DIVISION 07 - THERMAL AND MOISTURE PROTECTION

General: In addition to specific design and installation guidelines for construction projects involving alterations to building exteriors, the following standards are written to ensure the safety and wellbeing of both students and staff. Deviations may be considered from these requirements if the result provides a safe, adequate and quality design and installation. However, any deviation must be approved in writing by the Portland Public Schools project manager and Risk Management.

District roofs are regularly utilized by PPS employees, including custodial and maintenance staff who check and clear gutters; remove balls; service drains and equipment as needed. Roofs are also frequently accessed (without approval) by students and sometimes vandalized. Therefore, durability and safety is of high importance to protect the roof and staff members who access them.

Provide OSHA compliant fall protection systems on all roofs; these systems shall be selected based on those who must access the roofs as part of their job description, including both custodial and maintenance staff and in consideration of the *hierarchy of fall hazard controls* which include:

1) elimination of fall hazards
2) prevention of falls
3) control of falls

Anchor points - considered a form of fall control - is the last line of defense and is no longer the exclusive fall protection system for PPS district roofs. Selection of an appropriate fall protection system shall be made in consideration of specific roof design/layout and staff exposure to fall hazards.

Provide OSHA compliant access hatches and ladders to all roofs. Roof hatches and access ladder retrofits and/or new construction and installation must take into consideration the needs of custodial and maintenance staff as well as the roof's specific layout and design.

Selection of materials for new building exteriors should provide high quality, low long-term maintenance costs, be resistant to vandalism and moisture intrusion.

The District encourages simple systems with limited transitions between materials.

Moisture barrier, air barrier, thermal barrier and vapor retarders are to be continuous though they may be provided by a variety of materials and assemblies.

All products are to be installed per manufacturer specifications.

E.I.F.S is not allowed.

Roof system warranty 20 year minimum required. Coordinate warranty with Owner. All warranties to be non-pro-rated, full replacement warranties. They shall include material and installation, removal and replacement, and shall be inclusive of consequential damages.

Existing: Adding thermal insulation to existing buildings requires an analysis to ensure the new dew point is not inside the wall.

Historic: Historic requirements sometimes mandate historic envelope systems that have proven to not perform well. For example, contemporary wood windows made of pine do not perform the same as old growth fir windows. Review by an envelope consultant is recommended.

Reference Appendix for the SHPO Programmatic Agreement for Energy Efficiency, Weatherization, Rehabilitation and Interior Retrofit Projects, February 2012, Stipulation II D - Wall Insulation and Stipulation II E - Roofing, to determine what activities are allowed at Historic Register eligible schools without prior SHPO review.

Follow the Secretary of the Interior's Guidelines for the Rehabilitation of Historic Buildings (Roofs).

Sustainability: All finishes should meet high indoor air-quality standards to help create a healthy learning environment.

Division 07 sections should meet the requirements of LEED for Schools: Low emitting materials.

Finishes containing re-used, recycled and recyclable materials are preferred to the extent possible.

Finishes should be locally or regionally sourced, if possible.

07-11-13 Dampproofing

A. Hot or cold asphalt emulsion.
B. Recommended for foundation walls not adjacent to habitable space
C. Do not use at below grade walls with occupied/habitable space
D. Do not use in moist conditions and areas subject to hydrostatic pressure.
E. Installation: 2 coat system fully dried between applications.
F. Performance standards: Hot-applied asphalt, spray or brush applied, meets ASTM D 449. Cold applied, spray, brush, or trowel applied, meets ASTM 4479, 4586, 1227.
G. In compliance with LEED for Schools, Low emitting materials.Example product: Henry 789, MasterSeal 615 manufactured by Master Builders Solutions by BASF or equal.

07-13-26 Self-Adhering Sheet Waterproofing

A. Self-adhering, positive side modified bituminous sheet waterproofing sufficiently thick and flexible to bridge minor joints and cracks in the substrate. 60-75 mil thickness with 4 mil polyethylene facer and release liner on adhesive side. Seams are adhesively lapped.
B. For concealed substrates, cast in place, below grade walls, not subject to constant hydrostatic pressure.
C. Must be protected from UV light.
D. Performance Standards: Resistance to deterioration when immersed in standing water, must bond to substrates and adhere at laps, provide elongation and crack-bridging capabilities, elasticity under freeze thaw conditions, low water vapor permeability and chemical resistance to soil conditions
E. Warranty: specify minimum five years on material defects, up to two years on installation.
F. Provide manufacturer's recommended primer for full adhesion.
G. Accessories: drainage mat required to relieve hydrostatic pressure.

H. In compliance with LEED for Schools, Low emitting materials. Example product: WR Grace Bituthene 4000 or equal

07-14-13 Hot Fluid-Applied Rubberized Asphalt Waterproofing

A. 215 mil hot rubber reinforced between two applications.

B. Recommended for concealed horizontal substrates such as plaza decks or below roof-top tennis courts where subject to hydrostatic pressure. Recommended where waterproofing is not easily accessible for replacement.

C. Not self-healing.

D. Performance Standards: CAN/CGSB-37.50, no equivalent ASTM standard

E. Warranty: 10-20 years. See above for specifics.

F. Accessories: Protection board, drainage mat.

G. In compliance with LEED for Schools, Low emitting materials. Example products: Hydrotech 6125 or equal

07-14-16 Cold Fluid-Applied Waterproofing

A. 90-120 mil (dry film thickness) modified polyurethane installed in two applications with reinforcing at joints.

B. For concealed horizontal plaza deck over non-habitable space and for positive waterproofing of cast-in-place below grade walls which may be waterproofed prior to backfill. Not considered as robust as hot fluid applied rubber.

C. Good for use where there are many penetrations that a sheet waterproofing product would have difficulty with.

D. Recommended for use on green concrete

E. Not recommended over lightweight insulating concrete or parged walls where cracking can telegraph through waterproofing.

F. Not recommended in tight spaces due to fume build-up.

G. Crack and joint treatment required.

H. Not self-healing

I. Performance Standards: ASTM C 836/C 836M, ASTM D 5385 if available

J. Design Standards: ASTM C898/C 898M and C 1471

K. Dry film thickness can be half the wet film thickness. Specified desired dry film thickness that can be tested after installation.

L. Warranty: 10-15 years.

M. Accessories: Protection board or drainage mat required

N. In compliance with LEED for Schools Low emitting materials. Example product: Tremco 250GC or equal

07-16-13 Cementitious Waterproofing

A. Intended for rehabilitation applications at interior side of existing below grade concrete or masonry walls to stop moisture ingress.

B. May or may not stop water because it is installed on the negative side. Chemical grout injection should be used to stop liquid water.

07-17-00 Bentonite Waterproofing

A. For waterproofing below grade blind-side walls and below slab on grade, as well as positive side foundation walls and elevator and orchestra pits, as applicable.

B. Not for use at podium/plaza decks
C. Not for use under shallow soils.
D. Must be constrained to function (Product has bentonite clay encapsulated in mesh. Expands in the presence of water to block water flow).
E. Warranty: 5-15 years on material defects, up to two years on installation. Due to location cannot be replaced if leaks occur.
F. Performance Standards: ASTM D412and ASTM D4833
G. Accessories: Drainage mat, bentonite waterstop, bentonite mastic
H. In compliance with LEED for Schools. Example products: Cetco Voltex DS, Tremco Paraseal LG or equal

07-18-00 Traffic Coatings

A. Avoid use due to 5-7 year replacement cycle.
B. Maximum VOC: 100 g/L. In compliance with LEED for Schools. All

07-19-00 Water Repellent and Anti-Graffiti Coatings

General: Water repellents may be desirable to limit water absorption, staining and bio-growth on masonry walls. However, it may have deleterious impacts on new or existing brick. Water repellents must be reviewed with the District in a project specific manner. Provide product data, samples and application extents for District approval.

Historic: Water repellent and anti-graffiti coatings are to be avoided on historic masonry surfaces. Such coatings: impede the evaporative qualities of the building envelope system; change the color of the substrate; do not bridge cracks or voids in either the masonry unit or mortar; and require abrasive cleaning techniques when removed as a result of graffiti damage. They are recommended for use in new construction, cavity wall and rain screen design. See transparent coatings in National Park Service Brief http://www.nps.gov/tps/how-to-preserve/briefs/38-remove-graffiti.htm#barrier

A. Above grade concrete and masonry surfaces, clear water-repellent finishes, containing no silicone, wax or paraffin. (Must be breathable)
B. Provide a single product that provides both water repellant and anti-graffiti. Follow manufacturer's requirements for installation and number of coats to achieve both requirements.
C. Test compatibility with existing coatings.
D. Example Products include:
    1. "Prosoco",
    2. Fabrikem
E. Water-based coatings have not been as durable.
F. Provide a sample test area (20 SF) for Owner approval before proceeding with work. (demonstrate sealer and anti-graffiti)
G. Establish guidelines for location, height and extent of coating.
H. Anti-Graffiti and water-repellent coatings shall comply with LEED for Schools requirements for low-emitting materials.
    1. All paints and coatings installed inside of the weatherproofing system and applied on-site shall meet:
        a. The testing and product requirements of the California Department of Public Health (CDPH) Standard Method v1.1–2010 using the applicable exposure scenario. Product certifications that demonstrate compliance include

GREENGUARD (GG) Gold, Collaborative for High Performance Schools (CHPS) (excluding CHPS approved third-party certifications), and SCS Indoor Advantage Gold.

b. All paints and coatings wet-applied on site must meet the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.
   i. Concrete/Masonry Sealers: 100 VOC g/L
   ii. Industrial Maintenance (Anti-Graffiti) Coatings: 250 g/L

2. Exterior applied coatings applied on-site shall meet:
   a. The VOC limits of California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings.
      i. Industrial Maintenance (Anti-Graffiti) Coatings: 250 g/L
      ii. Concrete/Masonry Sealers: 100 g/L
3. Low Emitting Materials, materials wet applied on site must meet the VOC limits of California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, and South Coast Air Management District (SCAQMD), Rule 1168, effective July 1, 2005.

07-21-00 Thermal Insulation

Note: IBC 2015 standards will require fire testing of exterior wall assemblies when impacted by upgrades for energy or other code requirements.

A. Existing buildings: When exterior envelope upgrades such as siding replacement occurs, consider feasibility and payback to add insulation. Provide proper moisture protection/WRB and ensure the new dew point is not within the wall.
B. Meet minimum R values required by current code.
C. Continuous exterior insulation is recommended.
   1. Required by building code via prescriptive path
   2. Limits thermal bridging through cladding
   3. Keeps building frame and sheathing warm
   4. Semi-rigid mineral wool is fireproof. R-4.3 per inch
   5. Rigid foam (R-5 per inch) may be used if assembly has been tested to meet NFPA 285. 2” maximum thickness of insulation per layer.
   6. Note: It may not be feasible to retrofit existing structures with continuous exterior insulation due to complication of detailing and existing mullion depths.
D. Insulation: Batts, Blankets and Blown-in
   1. These products are appropriate for use in ceilings, exterior walls and floors over unheated spaces.
   2. Blown-in cellulose insulation is recommended due to higher insulation value, recycled content, reduced carbon footprint, and more air tightness. However, maintenance requirements must be considered, particularly in attic spaces, and batts or blankets may be more practical where access is needed.
   3. In existing buildings that are replacing roofs or siding, the District goal is to raise insulation levels to a minimum of current code. An analysis should be done to assess whether going beyond code is a good use of District resources and feasible within each project, and includes viable payback analysis. Consider alternative funding sources that may help bridge the gap.
   4. Meet minimum R-values required by current codes.

5. In compliance with LEED for Schools v4 Low Emitting Materials, meet the testing and product requirements of the California Department of Public Health (CDPH) Standard Method v1.1–2010 using the applicable exposure scenario. Product certifications that demonstrate compliance include GREENGUARD (GG) Gold , Collaborative for High Performance Schools (CHPS) (excluding CHPS approved third-party certifications), and SCS Indoor Advantage Gold.
6. Insulation products may not contain added formaldehyde, including urea formaldehyde, phenol formaldehyde, and urea-extended phenol formaldehyde in compliance with LEED for Schools Low Emitting Materials.

07-25-00 Weather Resistive Barriers (WRB)

A. Prefer self-adhesive, vapor permeable WRB for insulated stud cavity walls on new construction and rehabilitations.
   1. Example products are Wrapshield SA by Vaproshield and Henry Blueskin VP 160.
   2. Loose laid non-perforated, non-woven, non-absorbing, vapor-permeable membrane made of spun-bonded olefin or polypropylene is acceptable.
B. Fluid applied vapor permeable WRB recommended for new construction.
   1. Performance requirements: ASTM E 96//E 96M
   2. Example products: Tremco 220 or equal
C. Design the WRB to serve also as an air barrier.
D. WRBs are water-resistive, not water-proof, so flashing membranes are required.
E. Rubberized asphalt or butyl rubber Self-Adhered Membrane (SAM) recommended for exterior insulated walls (walls with insulation fully located outboard of WRB)
F. Foil faced SAM (membrane flashings) excels at sealant adhesion and is recommended in rough openings at windows.

07-26-00 Vapor Retarders

A. Install per code on warm, high humidity side of insulation
B. Under-slab vapor retarders to be minimum 15 mil thick minimum for durability during placement of rebar. See 03-10-00.
C. Provide a separate sheet vapor retarder over batt insulation:
   1. Examples: JM Commercial Facing 35TL and Lamtec R-3035HD

07-27-00 Air Barriers

A. Limits heat loss from wind moving through the cladding
B. Performance requirement: ASTM E 1677 air leakage rate of 0.004 cfm/sf
C. WRB can double as the air barrier if properly detailed (taped or sealed at joints)
D. Design the WRB to serve also as an air barrier to limit heat loss from wind.

07-31-00 Shingle and Shake Roofing

Historic: Competency of Bidder Clauses should be included. Pre-design documents should identify historic roofing systems

Reference Secretary of Interior Standards for Rehabilitation. Historic roofing systems (copper, slate, or other metal) may be a character defining feature of the school. Retaining, repairing or replacing in kind historic architectural features and components is

preferred. Repairing systems and components should be evaluated with maintenance requirements.

A. The District encourages replacing shingled roofs with pre-formed metal when budget allows. No wood shake roofing due to maintenance requirements. See 07-61-00.
B. The district discourages shingle roofs on new buildings.
C. Provide asphalt saturated underlayment: #30 felt paper. Comply with the physical requirements of current ASTM standards for Type II materials. Meet or exceed the performance criteria of current ASTM D226 and D4869.
D. Asphalt shingles: 3-tab metric or standard mineral surfaced, self-sealing asphalt shingles. Provide shingles with a UL Class A fire test response classification.
E. For repairs and additions, styles, textures, patterns and colors to closely match existing. At historic buildings, verify requirements of roofing material.
F. Nail Fasteners: Hot dip galvanized or aluminum, .120 inch (3mm) diameter barbed shank nails with 3/8" heads long enough to penetrate a minimum 3/4" into the roof deck, or at least 1/8" through the bottom of the deck.
G. No ridge vents on roofs with pitch less than 5 in 12.
H. Minimum slope recommended 3.5:12. Ensure slope meets manufacturer's requirements.
I. Provide Ice Protection Shield
    1. Example: Grace Ice and Water Shield
J. Valley flashing to be 22 gage, shop formed, pre-painted, 70% PVDF (example: Kynar) to match shingle color. Lengths not to exceed 10-foot with 1-inch high inverted V-profile at center of valley and equal flange widths of 12-inches. The length is limited to reduce heat expansion and buckling. Overlap is 8" minimum.
K. Solar Reflectance Index (SRI) targets for asphalt shingles to be greater than 20%

07-33-00 Natural Roof Coverings

A. Eco-roofs extend the life of the roof membrane due to UV protection, minimization of temperature flux and impacts from foot traffic.
B. Under stormwater manual regulations, an ecoroof is not counted as impervious area and can result in avoided stormwater charges.
C. Replacement can be more expensive and time consuming due to the organic material removal and replacement. Trays can be used to help mitigate this issue.
D. Provide systems such as the red cinder ecoroof with low maintenance which does not require irrigation.
    1. See Red Cinder Ecoroof Design Guidelines (See Appendix) Environmental Services City of Portland.
E. When eco-roofs are accessible either visually or physically to the students they are a health, well-being and educational asset. Access requires roof access with safety/guardrail provisions.

07-46-00 Siding

A. New Buildings: All siding products are to be installed over a ventilated air cavity (i.e. rain screen) to increase drying and durability and longevity of cladding materials.
B. Existing Buildings: Provide a ventilated air cavity if possible given scope. This may not be possible due to window and door frames and detailing needed. Consider addition of insulation and WRB; see 07-21-00 and 07-25-00.

C. Acceptable siding: Painted fiber cement (Hardie orAllura), monolithic factory colored fiber cement, factory finished aluminum panel, or factory finished steel panel.

D. Consider material aging properties with respect to aesthetics. Ensure proper detailing to avoid moisture stains and moss or fungal growth.

E. For all siding work, provide details for District approval including details at joints, intersections of materials, inner and outer corners, top and bottom, and at window and door frames. Limit opportunities for failure due to water/vapor and vandalism.

07-50-00 Low-Slope Roofing - General

A. Warranty:
   1. Provide manufacturer's 20-year unlimited penal sum (No Dollar Limit warranty covering entire system for workmanship and material, and damage to work resulting from roofing failure) material and labor warranty from the date of Acceptance. Warrant that all surfaces exposed to the weather are water-tight and free from defective materials and workmanship and that warranty includes furnishing all labor and material for correction or replacing any portion of the work that fails in the performance of its purpose. Guarantee is to include base flashings, roofing materials, insulation materials, installation of the materials, and related systems.
   2. Contractor (Installer's) Warranty. Include all components of roofing system such as roofing membrane, base flashing, fasteners, cover boards, insulation, walkway products, and other components of the installed system. Warranty period shall be two (2) years from date of Final Acceptance.

B. Design Criteria:
   1. The District prefers ½" per foot roof slope for all new school's roofs, with ¼" per foot slope allowed in areas that do not require crickets or roof valleys to direct water to drain collectors. For retrofit roof replacements, meet code minimum requirements due to existing clerestory windows, rooftop equipment and/or other conflicts.
   2. Oregon code requires 1/4" per foot minimum at roofs, with no exception for valleys.
   3. When reroofing, add overflow drains or scuppers if they do not already exist.
   4. Provide fall protection systems that are specific to low-slope roofs per Oregon-OSHA's revised Walking-Working Surfaces, OAR 437 Division 2/D, 1910.28 regulations, including Oregon's definition of low-slope which is a roof that has as slope less than or equal to a ratio of 2 in 12 (vertical to horizontal). .
   5. Provide access hatches and ladders that meet OSHA regulations, see section 07-72-33, "Roof Hatches".

C. Membrane Roofing Assembly:
   1. Plywood Substrate Insulation Fasteners: Standard duty roofing screw that is pre-assembled with a 3" metal plate. Provide length as required by the roofing material manufacturer.
      a. Example product: Parafast PA Roofing Fastener or District approved equal.
   2. Vapor barrier: required at deck level to prevent humidity from reaching cold roof surfaces

D. Rigid Roof Insulation:
   1. Rigid closed cell Polyisocyanurate foam core insulation boards with glass fiber faces, installed in a minimum of two layers. First layer mechanically fastened and second layer adhered. Layered to achieve desired R-Value. 2" maximum thickness of insulation per layer.

2. Provide insulation as required per Oregon Energy Efficiency Specialty Code. New building construction should be designed to exceed current code by 10%. Consider higher insulation values pending payback analysis.
3. Adhesive for bonding top layer of rigid insulation to base layer of insulation shall consist of Type IV asphalt or 2-part low-rise polyurethane foam insulation adhesive.

E. Rigid Cover Boards
1. Rigid cover boards 4' x 4' maximum size. Cold applied for new installations. Hot mopped applications for repair and maintenance only. Hot mopped roof surface and face of the cover boards or factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 447.
2. Possible options for cover boards:
   a. *½" or 5/8"* " glass-mat, water-resistant gypsum substrate that meets ASTM C 1177/C 1177M.
   b. Example product: Dens Deck Prime by Georgia Pacific.
   c. Silicone Treated Fiberglass-Reinforced Board: ½" and 5/8".
   d. ¾" Perlite.

F. Roofing Membrane: Minimum 2-ply SBS (Styrene Butadiene Styrene) modified bitumen roof membrane with granule-surfaced top ply (cap) sheet. Base Ply and Top Ply shall be glass fiber mat and glass fiber scrim reinforced. Base flashings shall be foil-faced.
1. In compliance with LEED for Schools.
2. Example products:
   a. "Siplast"
   b. "Soprema"
   c. "Firestone"
   d. "John Mansville"
3. Roof Membrane Materials at Structural Concrete Decks:
   a. Perforated Base Sheet: 20 pounds per 100 square feet.
   b. Base Ply Sheet: Random glass mat reinforced SBS modified asphalt sheet, minimum thickness 87 mils, minimum weight 62 pounds per 100 square feet, smooth surface.
   c. Top Ply Sheet: Random glass mat reinforced, 100% SBS modified bitumen, minimum thickness 126 mils at selvage edge, minimum weight 115 pounds per 100 square feet, mineral granule surfaced, color gray/white, fire rated.
      i. At slopes greater than 2:12, provide a foil-faced top ply sheet to obtain a class A fire rating as required by manufacturer.
4. Roof Membrane Materials at Lightweight Insulating Concrete Decks:
   a. Vapor retarder:
   b. Base Ply Sheet; Random glass mat reinforced SBS modified asphalt sheet, minimum thickness 87 mils, minimum weight 62 pounds per 100 square feet, smooth surface or approved.
   c. Top Ply Sheet: Random glass mat reinforced SBS modified bitumen, minimum thickness 94 mils at selvage edge, minimum weight 90 pounds per 100 square feet, mineral granule surfaced, Color gray/white, fire rated or approved.
   d. Reinforcing Sheet: Random glass mat reinforced SBS modified bitumen, minimum weight 60 pounds per 100 square feet or approved.
   e. Flashing Sheet: Polyester mat and woven glass mat reinforced SBS modified bitumen; minimum weight 110 pounds per 100 square feet.
5. Cold Adhesive:

a. A blend of special adhesive asphalts and safe, high-flash, quick drying solvents that meets or exceeds current ASTM D4479, Type II requirements.
b. Example: Siplast PA-311 M Adhesive

6. Method of Installation:
    i. Base Ply sheets shall be installed in full coverage of hot Type IV or Type III asphalt, manufacturer-approved adhesive, or self-adhered.
    ii. Top Ply sheets shall be installed in manufacturer-approved adhesive. Only cold-weather applications will be allowed to utilize hot asphalt for installation of the Top Ply sheet.
    iii. Flashing sheets shall be installed utilizing manufacturer-approved adhesive.
    iv. Open-flame torch-applied application – for any component for the roof assembly - is not allowed by the District.

G. Single Ply:
1. The use of single ply membranes is strongly discouraged by the District as the risk of damage due to rooftop access (both authorized and unauthorized) increases the risk of damage and resulting moisture intrusion. Exceptions may be granted under special circumstances on an individual project basis and at the District's discretion; Approval is required by COO. Exceptions may include:
    a. Slopes that exceed 2:12 (and under 4:12) where the use of an SBS modified bitumen system is cost-prohibitive and a Class A fire rating is required (some PVC assemblies can acquire Class A at steeper slopes).
    b. Non-occupied spaces.
    c. Buildings or structures with a service life of less than 20 years.
    d. Roofs that have controlled access.
    e. Roof areas with difficult access for conventional roof systems.
    f. Roof areas with weight limitations.
2. In the event that single ply roofing systems are authorized by the District, the following systems may be considered:
    a. Fully-adhered EPDM membrane over ½" gypsum-based cover board. Membrane thickness shall be 90 mils (0.090-inch); membrane color: dark gray. Low-VOC or no VOC (water based) bonding adhesive shall be used to adhere membrane to cover board. Ballast will prevent shrinking, hold in place, prolongs life span and protects from UV degradation.
        i. Example Products: Firestone, Carlisle, JM.
    b. Fully-adhered PVC or KEE membrane over ½" gypsum-based cover board. Membrane thickness shall be 80 mils (0.080-inch); color: white. Low-VOC or no VOC (water based) bonding adhesive shall be used to adhere membrane to cover board. PVC or KEE will hold up better with foot traffic. Reinforcement recommended.
        i. Example Products: Sarnafil, Carlisle, JM.
    c. Insulation assembly and securement shall be in accordance with Part D of this Section.
    d. Mechanically-attached systems shall not be considered acceptable.

H. Accessories:
1. Fasteners: Corrosion resistant and cut resistant.
2. Tapered Edge Strip at Crickets and Drains: Polyisocyanurate, or accepted substitute, providing for a roof slope and layout sufficient to achieve prompt and complete removal of water through the drainage system.
3. Provide walking pads from roof access to frequently maintained equipment.
4. Sealant: A moisture-cured, non-slump elastomeric sealant designed for roofing applications. The sealant shall be approved by the membrane manufacturer for use in conjunction with the roof membrane materials.

a. In compliance with LEED for Schools Low emitting materials, exterior applied adhesives, sealants, coatings, roofing, and waterproofing materials applied on site must meet the VOC limits of California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, and South Coast Air Quality Management District (SCAQMD), Rule 1168, effective July 1, 2005.

I. Execution:
   1. Precipitation: Do not apply roofing materials during precipitation or in the event there is a probability of precipitation during application. Take adequate precautions to ensure materials, applied roofing, and building interiors are protected from possible moisture damage or contamination.
   2. Take necessary precautions to prevent roofing material vapors and odors from entering the building air intake systems. Air intakes may receive temporary coverings.
   3. Building fans may be turned off to control dust and odor infiltration.
   4. Kettles are not to be placed within 6 feet of a roof overhang. Kettles to be monitored by a designated employee during all times of operation.
   5. Discuss maintenance and permanent fall protection with District Representative.
   6. Contractor is responsible for identifying preexisting conditions that may impact the performance of the new roof prior to commencement of work, including but not limited to:
      a. Structural deflection
      b. Water ponding
      c. Overhanging trees
      d. Unauthorized roof access and vandalism
      e. Roof drains are considered to be free and clear of blockage.
      f. Protect drains from demo debris and liquid asphalt.
      g. Require daily cleanup of all debris.

J. Storage and Protection
   1. Protect roofing materials at all times from wetting and moisture absorption. Store rolls on end and on pallets in a dry area, protected from ground moisture.
   2. Dry felts and insulation applied as a roofing system.
   3. Roof maintenance and means of extending life cycle
   4. Contractor is fully responsible for protection of the building from moisture during construction.

K. Spray-on asphalt emulsions with fiberglass rovings may be used for repairing existing roof systems: example: “Westcoat System” or District approved equal.

07-60-00 Sheet Metal Flashing

Warranty: Include a 2-year installer's weather tight guarantee against leakage of sheet metal copings, roof related flashings and sealants.

A. Provide 3-D Detail drawings of scuppers, crickets, curbs, roof jacks and complex flashing during the design and development phase. Provide all sheet metal to meet SMACNA standards.

B. Exposed locations:
   1. Pre-coated galvanized steel per current ASTM A653/A653M, G90; 24 gauge minimum core steel, shop pre-coated with Two-coat fluoropolymer finish containing not less than 70% PVDF resin by weight in color-coat.
   2. Example product: “Kynar 500” or “Hylar 5000”.

3. 26 gauge dead soft flashing grade stainless steel is acceptable when embedded in masonry
4. Concealed locations - provide minimum 24 gauge galvanized steel.
5. Joints in wall and cap flashing, standing seam only.
6. For window flashing, maintain single piece of sill flashing, where possible.
7. Provide drip flashing at head flashings, base flashings, parapets, roof trim, etc.
8. Provide 3-D of window wrap sequence showing air seal and water drainage path.
9. Detail flashings with dimensions of legs, hems, drips. Etc.

07-61-00 Sheet Metal Roofing

A. The district requests sloped metal roofs with 4:12 or greater slope whenever feasible. Also preferred at lower sloped roofs.
   1. Pre-formed Metal Roofing
   2. Standing seam. No substitutes.
   3. Provide 3-D detail drawings of scuppers, crickets, curbs, roof jacks and complex flashings.
   4. Ridge vents preferred on metal roofs.
   5. Joint Sealants – see section 07-92-00.

B. Material
   1. Pre-finished galvanized steel sheet
      a. 24-gauge minimum, hot-dipped galvanized steel.
   2. Finish:
      a. Factory applied
      b. Minimum thickness 0.70 mil over 0.25-mil prime coat
      c. Example: “Kynar 500 Fluorocarbon coating”.
   3. Coating warranty, not less than 20 years.

C. Testing
   1. For low-slope metal roofs, comply with ASTM E2140

D. Example products:
   1. “AEP SPAN Klip Rib” with integral self-locking standing seam (1-5/8 high) with 8” rib spacing and 16” panel width, or approved equal.
   2. Low Slope:
      a. Architectural Metal Solutions: AMS Armor Lock; www.ams-wa.com
      b. Bryer Company: TBC-Superseam: www.thebryercompany.com
      c. Fabral: PowerSeam: www.fabral.com

07-62-00 Custom Rain Gutters

A. Exposed gutters, seamless continuous (maximum 50’) x 6” K style. Provide all sheet metal to meet SMACNA standards.
   1. Provide sheet metal thickness per SMACNA chapter 1.
   2. Gutter expansion joints: allow gutter movement without disturbing roof system.
   3. Commercial quality gutter hanger
      a. Examples include: Hangtite by Raytec Manufacturing.
      b. Use galv. steel #12, screws, 1 1/2" long with a 5/16" head. Spacing to be a maximum of 30”. Screws to provide 350-lb capacity in both pullout and shear with a 100% safety factor. At each screw penetration use a silyl-terminated polyether sealant to seal penetration.

4. Drip flashing separate from gutter.
5. Exposed downspouts - pre-coated galvanized steel.
6. Concealed gutters are discouraged for new construction. Provide details for approval of primary and secondary waterproofing, metal expansion, water overflow and ice migration..

07-65-00 Flexible Flashing

A. Under roof copings and other horizontal sheet metal: Provide SBS modified asphalt. Examples include:
   1. Carlisle CCW WIP 300HT
   2. Henry Blueskin PE 200HT
   3. Owens Corning WeatherLock Metal High Temperature Underlayment
   4. Protecto Wrap RainProof – 40.

B. If a reinforced SBS sheet is required, examples include:
   1. Polyglass Polystick MTS or Tamko Moisture Guard Plus

C. Where not exposed to heat or excessive air flow: 40-mil, self-adhering, regular temp rubberized asphalt membrane flashing may be used.
   1. Examples:
      a. WR Grace “Perm-A-barrier Wall Flashing.”
      b. Advanced Strip-N-Flash
      c. Carlisle CCW-705-TWF
      d. Henry Blueskin TWF
      e. Hohmann & Bernard
      f. Textroflash

D. Flexible flashing shall be used under window and door sill to create a membrane pan. Foil faced membrane excel at sealant adhesion and are recommended in rough openings at windows.

07-71-00 Manufactured Roofing Specialties

A. Pitch pockets and pitch pan are not allowed.

B. Provide penetration seals that comply with the roofing system manufacturer’s warranty.

C. In compliance with LEED for Schools Low emitting materials, exterior applied adhesives, sealants, coatings, roofing, and waterproofing materials applied on site must meet the VOC limits of California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, and South Coast Air Quality Management District (SCAQMD), Rule 1168, effective July 1, 2005.

07-72-00 Roof Accessories

A. Include access to attics and roofs within the scope of roofing replacement.

B. Transitions between roof levels to receive OSHA compliant ladders installed per code.

C. Provide permanent fall protection on all roofs for maintenance and custodial activities. Determine appropriate fall protection system for specific roof configuration including location of drains and exposure to leading edges.
   1. Coordinate design with PPS Maintenance and custodial FOM managers.

D. Within scope of roof replacement and when possible, roof parapets shall be raised to meet OSHA guardrail requirements of 42” (+/-) 3".

E. Risk Management is required to verify and sign off that a Qualified Person shall oversee the design and installation of horizontal lifelines and anchorages. OSHA

defines a *Qualified Person* as, “a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.”

07-72-33 Roof Hatches & Guardrail

A. Provide OSHA compliant roof access hatches and doors. Consider ability to move maintenance materials and tools to and from roof as well as transition from fixed ladder to roof.

B. Provide Fire Rated Access Panels as required by code, meeting OSHA and IBC Regulations.

C. Provide OSHA compliant roof hatch guardrail systems with self-closing and latching swing gate for any new building construction and replacement roofs. New roof hatches to provide safe egress and ingress through roof type access hatches and to meet OSHA Fall Protection Regulations.

D. Guardrail System

1. All roof hatches shall have a guardrail system and toeboards on all exposed sides, except at entrance to the hatch, where a self-closing gate is required (1910.28(b)(3)(iv).The self-closing gate shall swing away from the hole.
    a. Guardrail system: top edge of top rail is 42 inches, plus or minus 3 inches, above the walking-working surface. Midrails shall be installed between the walking-working surface and the top edge of the guardrail system when there is not a wall or parapet that is at least 21” high (1910.29 (b)(2)). Examples of guardrail system manufacturers include but are not limited to:
        i. “Kee Safety” KeeHatch Railing System, Model RHSR-SS (Standard System) roof hatch railing system.
        ii. Bilco RL-NB safety rail system

E. Roof Hatch

1. Provide size appropriate for hatch access. A 3’-0” x 4’-0” min. hatch is preferred at vertical ladders. A ships ladder may require a longer hatch.
2. Example: Bilco Roof Hatch
3. When a fixed ladder terminates at a hatch, the hatch cover must open with sufficient clearance to provide easy access to or from the ladder and opens at least 70 degrees from horizontal if the hatch is counterbalanced (1910.23 (d)(8)0.

F. Grab Bars

1. Grab bar assemblies attached to fixed ladder rungs are not allowed.
2. Grab bars shall extend 42 inches (1.1 m) above the access level or landing platforms served by the ladder (1910.23(d)(7)).
3. The minimum size (cross-section) of grab bars is the same size as the rungs of the ladder (1910.23(d)(8)).

G. Location: When possible, located roof access in areas not accessible by students such as custodian and storage rooms. Ensure ladders cannot be accessed by students. When access must be provided in a student area, provide a locking cover to prevent climbing. Ensure required and adequate clearances are provided at base of ladders.

07-92-00 Joint Sealants

A. Sealants shall comply with LEED for Schools Low emitting materials / consist of low-emitting materials. Silicone sealants with 20 year warranty where possible at exterior. Verify compatibility with existing sealants. Field pull tests required

1. All sealants installed inside of the weatherproofing system and applied on-site shall meet:
    a. The testing and product requirements of the California Department of Public Health (CDPH) Standard Method v1.1–2010 using the applicable exposure scenario. Product certifications that demonstrate compliance include GREENGUARD (GG) Gold, Collaborative for High Performance Schools (CHPS) (excluding CHPS approved third-party certifications), and SCS Indoor Advantage Gold.
    b. All sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168.
        i. Architectural sealants: 250 VOC g/L
        ii. Architectural sealant primers, non-porous: 250 VOC g/L
2. Exterior applied sealants applied on-site shall meet:
    a. The VOC limits of California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, and South Coast Air Quality Management District (SCAQMD), Rule 1168, effective July 1, 2005.
        i. Architectural sealants: 250 VOC g/L
        ii. Architectural sealant primers, non-porous: 250 VOC g/L