BSD Technical Standard
Division 7: Roofing & Thermal Envelope Systems

1. PURPOSE

This Technical Standard is a narrative describing Beaverton School District's (BSD's) Basis of Design for roofing and thermal envelope systems. The information contained herein is to be used by the Project Design Team to develop a sustainable, integrated roofing and thermal envelope system that is air-tight and weather-tight, economical to maintain, and minimizes building operation costs. This Technical Standard shall be used as part of the BSD's General Design Standards (comprised of the BSD Educational Specifications and the BSD Technical Standards).

2. GENERAL

Manufacturer's recommendations for best practices shall be followed during installation or application of roofing and/or thermal envelope products.

2.1. MOCKUPS

2.1.1. Adequate mock-ups shall be constructed to be representative of each unique interface between substrate and window system or between substrate and opening.

2.1.2. Contractor shall coordinate with the Owner's Building Envelop Consultant, Special Inspection and Testing agencies, and waterproofing manufacturers. BSD representative to provide copies of all reports and inspections to the Contractor for review and remediation as required.

2.2. TESTING

2.2.1. At least 1% of all windows (include at least one of each specific type of installation) shall be subjected to a pressurized test for moisture intrusion of at least four cycles of five minutes each in compliance with ASTM e1105 Procedure B. Refer to 2.1.2. above.

2.3. DRAWINGS AND SPECIFICATIONS

2.3.1. All designs shall comply with current Oregon Structural Specialty Code (OSSC).

2.3.2. Architects shall produce a detailed set of drawings and specifications for the roof assembly. Drawings shall show the location of all roof drains, gutters, scuppers, rooftop equipment, penthouses, walkway pads, expansion joints, area separators, drainage patterns, tapered insulation, and any other items which affect the roof assembly.

2.3.3. Drawings shall include details of curbs and supports, flashings, drains, gutters, scuppers, expansion joints, area dividers, and all other membrane penetrations and terminations, along with details of unique situations.

2.3.4. Details shall be consistent with the industry standards established by the National Roofing Contractors Association (NRCA). Rooftop piping, conduits, and equipment shall be mounted on supports specifically manufactured for roofing. Wood blocking may be used as a means of support when provided with sacrificial membrane layer between blocking and roofing surface.

2.4. SHOP DRAWINGS AND SUBMITTALS

2.4.1. Provide, to the BSD Representative, the Architect and the Building Envelope Consultant, shop drawings detailing installation of the actual product. Include flashings, terminations, expansion joints, penetrations, drains, base tie-ins, fall protection, and roof edges.

2.5. CLOSE-OUT

2.5.1. Project Record Documentation for as-builts shall include the following as a minimum:

2.5.1.1. Documentation of all deviations from the design and/or shop drawing submittals, including products that were changed and the reason for the change.

2.5.1.2. Copies of final test reports and any deficiency lists.

2.5.1.3. Documentation of all deviations in Operation and Maintenance (O&M) information from that provided with original equipment submittals.

3. ROOFING, WALKING PATHS, RIGID ROOF INSULATION

3.1. ROOFING

3.1.1. Prohibited Roof Systems: No torch applied roofing materials or roofing bitumen adhesives such as asphalt, coal tar pitch or modified bitumen asphalt blends requiring heating in kettles are permitted. Vegetative roof systems are not permitted.

3.1.2. All new and replacement roofs shall be covered by a single source warranty provided by the Roofing Manufacturer, a 30-year minimum total system warranty including flashings and sheet metal counter flashing.

3.1.3. Installing contractor’s warranty shall be for two (2) years.

3.1.4. New construction roof systems shall be designed to provide a ¼” per foot slope as required by current Oregon Structural Specialty Code (OSSC). Additional tapered insulation should be used at strategic locations to create saddles, crickets, and additional taper around equipment, perimeter areas, curbs, valleys and other potential problem areas. Provide secondary drainage systems as required by code.

3.1.5. On re-roofing projects, drainage should be assessed, and provisions should be made to create positive drainage if the existing roof systems do not drain well.

3.1.6. Windstorm design: Roof systems that have been successfully tested by a qualified testing and inspecting agency to resist field, perimeter and corner uplift pressure calculated according to ASCE 7.

3.1.7. Fire Rating Design: Roof systems shall conform to “Class A” roof coverings as listed in Building Materials Directory of Underwriters Laboratories (UL). All roofing systems shall have an ASTM E-108/UL790 Class A fire rating.

3.1.8. Roof warranty shall cover all components of the entire roofing system including but not limited to the insulation substrate, field membrane, membrane surfacing, base flashing, embedded sheet metal, attachment clips and closures, miscellaneous sheet metal flashing and counterflashing, detail penetrations, and drainage flashing systems. Manufacturer shall repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

3.1.9. Fully adhered vapor retarders should be installed on all concrete deck roof applications.

3.1.10. Where multiple roof system types are selected for a project (i.e. low slope, steep slope, plaza deck applications), and single manufacturer shall provide all roof system warranties for the entire project whenever possible.

3.1.11. Occupational Safety and Health Administration (OSHA) compliant ladders shall be installed at roof elevation changes that exceed 19” (per OSHA 1926.1051(a), Standard 29 CFR). Permanent fall protection system that complies with current OSHA standards shall be incorporated into the roof design.

3.1.12. Roof/ceiling insulation systems shall provide thermal resistance as required by current Oregon Energy Code, or greater.

3.1.13. Access shall be limited to construction areas. Fences will be constructed as necessary to prevent student and all other unauthorized access to the construction area. Adequate measures shall be taken by the Contractor to protect bystanders and pedestrian traffic from the possibility of being hit by objects falling or being dropped from above.

3.1.14. BSD’s buildings are considered to be well-maintained and in good condition. The Contractor is responsible for identifying and documenting pre-existing conditions prior to commencement of work. The Contractor will be held accountable for undocumented damage such as, but not limited to:

3.1.14.1. Ceiling damage

3.1.14.2. Water stains

3.1.14.3. Damaged landscaping

3.1.14.4. Exterior façade damage

3.1.14.5. Blocked or plugged roof drains

3.1.14.6. Damage to curbing and sidewalks

3.1.15. Daily clean-up of the jobsite is required. Clean-up shall include magnetic sweep of jobsite to pick up all nails and metallic debris. Drains shall be protected from debris and liquid asphalt during construction and installation; dams or other means of

blocking drains shall be removed daily as part of the clean-up. Construction waste shall be recycled or disposed of in approved manner on a regular basis.

3.1.15.1. Roofing materials must be clean and dry when installed. Protect all roofing and insulation materials from moisture and construction debris during storage, handling, and installation. Wet or damaged materials shall be removed from the project site. The installation shall be inspected by the Manufacturer's Representative and by a Moisture Intrusion Consultant.

3.1.15.2. Application of roofing compounds and adhesives must be done in a manner that limits odors and release of Volatile Organic Compounds (VOCs) to the atmosphere or into the interior environment of the building. Do not apply roofing materials with the building ventilation system operating. Ensure ventilation system is turned off and air intakes are covered as necessary to prevent infiltration of construction dust, debris, odors, and VOCs into the building.

3.1.16. Recoat

3.1.16.1. Recoat is acceptable for built-up roofs only. Recoat built-up roofs as required to prevent leaks and moisture infiltration and to maintain integrity of roofing system. Recoat with aluminum or white reflective coatings. As an emergency stop-gap measure, recoating may be considered for other types of roofs; Maintenance Services Administrator approval is required for recoat on other than built-up roofs.

3.1.17. Restoration

3.1.17.1. Restoration is acceptable only if life-cycle analysis over a 30-year period shows restoration to be more cost-effective than replacement. Approval from the Maintenance Services Administrator is required.

3.1.18. Removal

3.1.18.1. Removal is required if more than one roof is in place. No more than "two roofs" will be allowed on any BSD building. Remove to bare deck if no insulation on deck or if moisture infiltration is detected in the existing insulation. Only re-use insulation if no moisture infiltration is detected by thermal scan and surface of insulation has not been disturbed or penetrated.

3.1.19. Replacement

3.1.19.1. Roofs to be covered by a single source warranty provided by the Roofing Manufacturer. Class A fire rating and a 30-year minimum total system warranty including flashings is required.

3.1.20. Built-up

3.1.20.1. Minimum 30-year warranty

3.1.20.2. Cold applied only

3.1.20.3. No torch applied roof system

3.1.20.4. Rock ballast < 2:12 < reflective coating. Use ¼" minus rock ballast

3.1.20.5. Rock ballast < 2:12 < reflective coating. Use ¼" minus rock ballast

3.1.21. Hybrid Single-Ply

3.1.21.1. Minimum 30-year warranty

3.1.21.2. Provide a minimum of 1 ply of a polyester/glass scrim/glass mat trilaminate reinforcement coated with waterproofing asphalt set in an adhesive as recommended by the roofing manufacturer.

3.1.21.3. Continuously wrapped and fully adhered over top of curbs and parapet walls, set metal cap on top

3.1.21.4. Mechanically attached Thermoplastic Polyolefin (TPO) or Ethylene Propylene Diene Monomer (EPDM) (use of EPDM systems will be considered upon recommendation by the Architect/Engineer (A/E) and approved by Maintenance Services Administrator), 0.060" minimum thickness; rated for 70-mph wind shear.

3.1.21.5. Cover board to be glass mat faced gypsum board, DensDeck, or equal

3.1.22. Composition

3.1.22.1. Minimum 30-year warranty

3.1.22.2. Rubber modified shingles (glass mat acceptable for portables)

3.1.22.3. 15-lb felt underlayment

3.1.22.4. No staples, nail only

3.1.22.5. Metal W-valleys, 24-gauge minimum

3.1.22.6. Acceptable ridge venting manufactures and product: Cor-a-vent, or approved by the BSD Representative

3.1.23. Metal

3.1.23.1. Use of metal roofing is discouraged for safety reasons. When metal roof is approved:

3.1.23.1.1. 1½" standing seam

3.1.23.1.2. Ice and water shields as underlayment with required venting to avoid trapping moisture

3.1.23.1.3. Pre-finished, 24-gauge, hot-dipped galvanized steel sheet

3.1.23.1.4. Metal roof panel shall be continuing from the eave to ridge, with no field laps.

3.1.23.1.5. Stainless steel crickets, blank out panels and/or transvers panels must be installed uphill of all roof curbs.

3.1.23.1.6. Panel shall have a symmetric design that will allow for replacement of a single panel without disturbing adjacent panels.

3.1.23.1.7. Factory applied Kynar 500 fluorocarbon coating finish, minimum thickness 0.70-mil over 0.25-mil prime coat, or equal

3.1.23.1.8. Bottom of roof panels prime coat only

3.1.23.1.9. Coating warranty, not less than 20 years

3.2. WALK PATHS

3.2.1. Walk paths are required around all hatches, rooftop mounted equipment, and in areas subject to traffic on hybrid single-ply and rock ballasted roofs.

3.2.2. Provide roofing membrane manufacturer approved walkway.

3.2.3. Provide roof protection provisions for window washing equipment and any other high traffic roof areas.

3.3. RIGID ROOF INSULATION

3.3.1. Rigid insulation board to be mechanically fastened. Georgia Pacific DensDeck, or equal, cover board mechanically attached per manufacturer's recommendations and to meet wind shear rating.

3.3.2. No hot mopped roof surfaces. Taper insulation and crickets toward drains to prevent ponding.

3.3.3. ASTM C 1289, minimum 20 psi polyisocyanurate is the preferred roof insulation material. Insulation thickness shall not exceed 2.5" per layer. Both the short and long joints should be staggered a minimum of 6 inches in each direction.

3.3.4. ASTM C 1177 gypsum sheathing recovery boards shall be installed over all Polyisocyanurate insulation installations. All fastened insulation layers shall receive an additional adhered recovery board layer to prevent fastener backout. R values shall be determined by LTTR and shall meet minimum energy code requirements with an emphasis toward exceeding minimum energy standards.

3.3.5. Provide cost-benefit analysis of upgrading to R-30, or better, deck insulation for major remodels, additions, and all new construction. Cost/benefit analysis required as part of mechanical design, no later than 50% Design Development (DD). Cost benefit to include operational savings and first-cost savings from downsizing of mechanical equipment.

4. FLASHING

4.1. SYSTEMS

4.1.1. Mechanically fasten the top edge of base flashing. Cover metal flashing flanges at roof edges with single-ply. Use concealed fasteners where possible.

4.1.2. Flashing systems to be fabricated and installed in compliance with the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) standards and the Architectural Sheet Metal Manual.

4.1.3. Visible surfaces must have factory finish, be uniform in color, and match color design scheme.

4.2. ACCEPTABLE FASTENERS

4.2.1. Concealed fasteners: Hot-dipped galvanized nails, cadmium plated screws

4.2.2. Exposed fasteners: Neoprene gasketed screws

4.2.3. Fasteners are not to be installed on horizontal services.

4.3. GALVANIZED STEEL

4.3.1. 24-gauge hot-dipped galvanized steel with baked enamel finish

4.3.2. 20-year warranty on finish

4.3.3. 24-gauge pre-finished, factory applied Kynar 500 fluorocarbon coating, or equal

4.3.4. Finish: Minimum thickness 0.70-mil over 0.25-mil prime coat

4.4. STAINLESS STEEL

4.4.1. 26-gauge dead soft flashing grade stainless steel

4.4.2. Concealed locations: 24-gauge galvanized steel

4.4.3. Joints in wall and cap flashing: Standing seam only

4.4.4. Fasteners: Hexagon head equipped with neoprene washers

4.4.5. Drive pins or similar hammer/expanding fasteners are prohibited

4.5. CURB AND PARAPET FLASHING, PARAPET CAPS

4.5.1. 24-gauge pre-finished, factory applied Kynar 500 fluorocarbon coating, or equal

4.5.2. Fasteners: Use fastening clip, no screws through the top

4.5.3. Seal at corners with Dow Corning 795, or equal

4.5.4. Cap to extend a minimum of 3” over edge, with felts tucked underneath or single-ply to extend over top of curb or parapet wall

4.6. FLASHINGS

4.6.1. Use 4-lb lead flashings around roof drains. Lead flashing to extend a minimum of 2’-0” from the centerline of the drain. Copper is also an acceptable material for flashings. Contractor shall use and apply materials in accordance with best industry practice and manufacturers recommendations (which may include liquid applied flashing using PMMA products).

4.6.2. Taper insulation and crickets toward drains to prevent ponding.

4.7. PITCH POCKETS

4.7.1. The use of pitch pockets is not permitted.

5. GUTTERS, DOWNSPOUTS, ROOF DRAINS

5.1. GENERAL

5.1.1. Concealed gutters are prohibited on new construction. No internal gutters.

5.1.2. Drip edge flashings are required. Drip flashing shall be separate from gutter.

5.2. GUTTERS

5.2.1. Seamless continuous bracketed gutters only. One piece K-style, 5” minimum, hot-dipped galvanized steel with baked enamel finish gutter expansion joints allowing gutter movement without disturbing roof system are required. A leaf and debris protection system is required.

5.3. DOWNSPOUTS

5.3.1. Schedule 40 galvanized steel downspouts to be schedule 40 to minimum of 10’-0” above grade. Transition to sheet metal downspout is allowed above 10’-0”.

5.3.2. Internal drain preferred, no collector boxes through parapet walls.

5.3.3. External downspouts must be mounted flush to the building to prevent climbing. All securing brackets must be removable without removing siding.

5.4. INTERIOR ROOF DRAINS

5.4.1. Clamping ring to be lower than surrounding roof surface, minimizing water ponding.

5.4.2. Insulated roofs provide at least 3’-0” square depression at drain. Depression to be formed with tapered insulation board. Interior roof drain flashing, 4-lb, 99% pure lead, 36” square, flashing cement between roofing system and lead flashing.

5.4.3. Extend lead flashing and roofing plys into clamping ring. Overflow drains should be interior piped.

5.4.4. Sump receivers: A.O. Smith, or equal. Roof drain piping and fittings: refer to BSD Division 22: Plumbing Technical Standards.

5.5. DRAIN SCUPPERS

5.5.1. Perimeter Scuppers shall not be used as primary water drain on any roof that is higher than 16 feet above grade. Use of scupper drains for overflow protection is acceptable.

6. ROOF OPENINGS

6.1. HATCHES

6.1.1. Roof openings must be located so that a person entering or exiting through the hatch will not, at any time, come within 10’-0” of the edge of the roof.

6.1.2. Access to the roof shall be by fixed ship’s ladder (vertical ladders require approval). No “disappearing” attic ladders will be accepted. Provide a roof hatch with an extendable safety post for all vertical ladders.

6.1.3. Provide latch operated with interior tee handle and with flush or recessed exterior keyed cylinder (dead bolt). (Exterior handles are prone to vandalism and are not secure.)

6.1.4. Dead bolt shall be keyed to match building locks: Schlage Interchangeable Core (IC) cylinder.

6.1.5. Roof mounted safety rails to be provided at roof level at all roof hatch locations.

6.2. SKYLIGHTS

6.2.1. Skylights shall meet OSHA Standard 29 CFR 1926.502(i). No operable skylights allowed. Twenty-five square foot maximum area of skylight roof penetration.

6.2.2. Fall-rated fiberglass skylights are the only acceptable flat skylight. Glass may be used for pyramid and ridge skylights only.

7. FALL PROTECTION

7.1. DESIGN CRITERIA

7.1.1. The preferred design shall meet Federal and Oregon OSHA fall protection requirements.

7.1.2. Roofs shall have minimal slope and designs are preferred to incorporate parapet walls at all roof edges with an elevation difference of greater than 6’-0” from grade.

7.1.3. The combined dimension of parapet walls from adding height above roofline and width at top of the wall shall be a minimum of 48”.

7.1.4. Oregon OSHA requires a minimum height of 30” (thus width at top 18”) while Federal OSHA requires a minimum height of 39” (thus width at top 9”).

7.1.5. New construction shall not have mechanical or other equipment requiring regular maintenance within 10’-0” of the roof edge.

7.1.6. The following guidelines apply to existing construction and new construction with sloped roofs and all roofs without parapet walls:

Provide fully engineered fall protection system with anchor point loads and attachments designed by a Fall Protection Consultant, approved by the Structural Engineer, with installation approved and inspected by Manufacturer’s Representative. Provide supporting documentation in close-out documents.

7.2. ENGINEERED FALL PROTECTION SYSTEM TO INCLUDE:

7.2.1. Permanent anchor points

7.2.1.1. Need to be installed no more than 35’-0” from leading edges and no more than 70’-0” apart when anchor points can be accessed without entering a demarcated fall hazard area.

7.2.1.2. Anchor points must not exceed 45’-0” when employees have to enter a demarcated fall hazard area to attach to the anchor point. Horizontal pendulum swings must not exceed 30 °.

7.2.1.3. Anchor points need to sustain 5,000 lbs of force for fall arrest. Guardian CB-12, or equal. No horizontal static cable systems allowed.

7.2.2. Self-retracting life lines

7.2.2.1. Personal Fall Arrest System (PFAS) not to exceed 50’-0”.

7.2.3. Demarcation lines

7.2.3.1. Demarcation lines must be placed in accordance with OSHA standards and at least 6’-0” from the roof edge.

7.2.4. Permanent guardrails

7.2.4.1. Permanent guardrails must be in place for mechanical equipment within 10’-0” of the edge of the building.

7.2.5. Fixed ladders

7.2.5.1. Provide fixed ladders to allow safe access between flat roofs with elevation changes of more than 19”. Ladders shall provide hand support that extends 3’-0” above the access point. Ladders shall be permanently attached to the wall. Do not attach to roof deck.

7.2.6. Permanent covers

7.2.6.1. Skylights that meet OSHA Standard 29 CFR 1926.502(i) are considered “fall rated” and do not require covers.

7.2.7. Existing skylights

7.2.7.1. Fall hazard warning stickers need to be installed over any skylight that is not “fall rated” or protected with a permanent cover.

7.2.7.2. Existing buildings may require temporary guardrails (stored on roof surface), and/or temporary safety nets for use when working within 10’-0” of a demarcated fall hazard area (leading edge or skylight).

8. WATERPROOFING, DAMPPROOFING, AND WATER REPELLANT COATINGS

8.1. WATERPROOFING

8.1.1. Foundations and Below Grade Walls

8.1.1.1. Provide for water management and waterproofing on all foundations and below grade walls. Adequate drainage shall be provided. Avoid direct soil contact with below grade building surfaces.

8.1.1.2. All penetrations are to be water-tight under all conditions. Provide details for penetration, drains, joints, sumps, and moisture collection systems.

8.1.1.3. All below grade exterior applications use asphalt emulsion (two coat system).

8.2. WATER REPELLANT COATINGS

8.2.1. Contractor to notify BSD Representative prior to applying sealant. Test compatibility with existing coatings prior to application. Contractor to document purchase and demonstrate, for District inspector, application on at least 1% of work.

8.2.2. The weatherproofing, graffiti sealants, and joint sealant products listed below have proved to be durable and to reliably meet the District’s needs. However, the District encourages input from the Designer to bring to the District’s attention any superior products that are developed for these purposes and any products of equal performance and that are more cost-effective.

8.2.2.1. Weatherproofing: Sure Klean Weather Seal, Blok-Guard by Prosoco, or approved equal.

8.2.2.2. Graffiti Sealant: Evonik Protectosil, or equal. Apply full strength to lower 10'-0" of wall surface as anti-graffiti sealant. Above 10'-0", apply at 15:1 mix for brick sealing.

8.2.2.3. Joint Sealants

8.2.2.3.1. Paintable Surfaces: Vulkem 921, Sikaflex-1a, or approved equal. Install with proper backer rod

8.2.2.3.2. Non-paintable Surfaces: Dow Corning 795, or approved equal

9. INSULATION AND WALL SYSTEMS

9.1. SYSTEMS

9.1.1. Provide complete weather barrier, air barrier, insulation system, and vapor retarder per current OSSC requirements for exterior walls on all conditioned spaces. Provide weather, air, and vapor retarder that is appropriate for the type of insulation used.

9.1.2. Weather and vapor retarder shall be installed per manufacturer's recommendations with all joints taped (or lapped as appropriate) and shall be sealed at all interfaces. No "paper" tape allowed for exterior joints.

9.1.3. Installation and permeability rating of weather and vapor retarders shall also meet the insulation manufacturer's recommendations. All insulation systems shall meet or exceed Oregon Energy Code and be installed to fill all gaps, provide continuity of thermal resistance, and avoid thermal bridging.

9.1.4. Seal building envelope to provide complete air barrier. Air barrier to be inspected by BSD Representative prior to installing siding or cladding. Contractor to provide mock-ups as indicated by 2.1 GENERAL - MOCKUPS Section.

9.1.5. Insulation to be placed at the roof/parapet level to ensure a thermal break and to prevent a "cold sink" within the wall below parapet.

9.1.6. "Rain screen" wall system (sometimes referred to as "cavity wall" or "drained wall" system) is required for all block and brick exterior walls and is preferred for all cladding systems. Flashings and drainage to be provided at every floor (10'-0" elevation change).

9.1.7. Mock-up of rain screen wall system including flashings and drainage system to be provided on-site. Breathable weather barrier to be provided between the cladding and the concealed space of the wall system. A/E to evaluate the feasibility and cost implications of using outside of the cavity insulation system.

9.1.8. Shop drawings and details of wall systems at all openings, joints, transitions, and penetrations shall be provided for the BSD Representative approval prior to installation.

9.1.9. No stucco or Exterior Insulation and Finishing System (EIFS) type products allowed. These products are not acceptable for exterior cladding in the Beaverton School District.

REVISION HISTORY

Rev 1: 5/2025

Section	Section Title	Revision
All	All	Renumbered all sections of the Technical Standard; included other minor formatting and edits for clarity.