

**DIVISION 07 - THERMAL & MOISTURE PROTECTION**

Includes the following sections:

- 07 10 00 Dampproofing and Waterproofing
- 07 13 00 Sheet Waterproofing
- 07 19 00 Water Repellents
- 07 25 00 Water Resistive Barrier System
- 07 27 26 Fluid Applied Membrane Air Barriers
- 07 31 13 Composition Roofing
- 07 31 29 13 Wood Shingle Roofing
- 07 31 29 16 Wood Shake Roofing
- 07 32 00 Clay and Concrete Tile Roofing
- 07 40 00 Roofing and Siding Panels
- 07 41 13 Metal Panel Roofing
- 07 54 00 Single-Ply Membrane Roofing
- 07 62 00 Sheet Metal Flashing and Trim
- 07 70 00 Roof Specialties and Accessories
- 07 92 00 Joint Sealants

**DESIGN CRITERIA**

General Design Requirements:

1. Roof access ladders and stairways to roof shall not be alternating tread type.
2. Provide 18 gauge flashing at roof locations accessible to students or building occupants to prevent damage and vandalism.
3. All rooftop mounted equipment shall be mounted on platforms.
4. All platforms (curbs) shall be a minimum of 8 inches in height from the finished roof surface. Walk-pads shall be provided from roof access points to and around all rooftop equipment.
5. All conduits and piping shall have a 4 inch minimum height and all conduit and piping supports shall be made from DURA-BLOK as supplied by Cooper B-Line, Inc. Roof Topper by Arlington, Safety Yellow Pipeguard, or equal.

For renovation projects: When rooftop equipment is removed from roof, all associated components shall be removed as well. This includes: complete removal of any curbs, supports, piping, conduits, electrical lines, blocking, etc.

Fall Protection: All areas that expose workers to a fall of six feet or greater shall be protected by parapet walls or permanent guardrails that comply with Cal OSHA Title 8 section 3209. When guardrails or parapets are not feasible, provide one of the following:

1. Horizontal Lifelines as part of a complete fall arrest system that is compliant with Cal OSHA Title 8 section 1670 designed by a "Qualified Person" as defined by ANSI/ASSE Z359.0-2007-2.109.

2. Anchorages that comply with Cal OSHA Title 8 section 1670 as designed by a “Qualified Person” as defined by ANSI/ASSE Z359.0-2007-2.109.

<b>DAMPPROOFING AND WATERPROOFING</b>	<b>07 10 00</b>
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For more information, refer to the University’s Standard Specification Section 07 25 00 Water Resistive Barrier System.

<b>SHEET WATERPROOFING</b>	<b>07 13 00</b>
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On all below grade applications: Prior to installation of any product all areas shall be clean and have an approved primer applied per manufacturer’s specification. All non-exposed areas shall be a minimum of 40mil self-adhering sheet, composed of SBS modified rubberized asphalt based adhesive, backed by a layer of protection board separating it from contact with soil or other damaging substrates.

Grace Ice & Water Shield self-adhered underlayment; or equal. For special applications only, consult University’s Representative before applying.

<b>WATER REPELLENTS</b>	<b>07 19 00</b>
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All exterior exposed masonry and concrete (to receive no other finish) shall be treated with a clear penetrating waterproofing.

<b>WATER RESISTIVE BARRIER SYSTEM</b>	<b>07 25 00</b>
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**QUALITY ASSURANCE**

- A. Installer shall have 5 years of documented previous experience on at least 5 similar scope projects, using the specified or generically comparable materials.
- B. Follow recommendations of ASTM E2112 *Standard Practice for Installation of Exterior Windows and Doors*, and ASTM E 2266 *Standard Guide for Design and Construction of Low-Rise Frame Building Wall Systems to Resist Water Intrusion* for general guidance in assuring a watertight building enclosure.
- C. Mock-ups: Provide products, assemblies, and related materials for the composite mock-ups specified in Section 01 43 39 Mock-ups. Test completed mock-up assemblies following CBC 1403.2 to the code prescribed minimum pressure or building design pressure, whichever is greater.
- D. Hold Pre-Installation Conference in accordance with requirements of Section 01 31 19 – Project Meetings

**WARRANTY**

- A. Warrant sheathing paper to be free from defects in materials and workmanship for a period of ten (10) years from date of Substantial Completion. This warranty shall be in addition to

and not a limitation of other rights the University may have against the Contractor under the Contract Documents.

**PRODUCTS**

**WATER-RESISTIVE BARRIER (Water-Vapor Permeable)**

- A. 2-layer minimum installation. The water resistance of each layer shall be not less than 1 hour per ASTM D779 and water-vapor transmission shall be not less than 75 g/sq. m. x 24 hr. per ASTM E96

Note to Specifier: select one of the following options.

- 1. **Option 1:** 2 layers Building Paper: Federal Specification UUB-790a, Grade D, 60 minute (water-vapor-permeable, kraft building paper). Fortifiber Corp.'s "Super Jumbo Tex," asphalt-saturated kraft, permeable building paper, or equal.
- 2. **Option 2:** 1 layer (inner) WrapShield SA, self-adhered vapor permeable sheet, with manufacturers prefabricated corners, tapes and accessories, self-adhered, Vaproshield LLC or equal, plus 1 layer (outer) of Option 1 Building Paper product.

**WATER-RESISTIVE BARRIER (Water-Vapor Impermeable)**

Note to Specifier: Water Vapor Impermeable WRB's do not allow the wall to transmit water vapor from interior sources and should only be specified when a water vapor transmission analysis (WUFI) is performed to verify that the wall assembly and building ventilation rates are sufficient to prevent moisture vapor entrapment in the wall assembly.

- A. 2-layer minimum installation.

Note to Specifier: select one of the following options.

- 1. **Option 1:** 1 layer (inner) Perm A Barrier Wall Membrane, Grace Construction Products, or equal, plus 1 layer (outer) of Option 1 Building Paper product.
- 2. **Option 2:** Blueskin SA, Henrys, or equal, plus 1 layer (outer) of Option 1 Building Paper product

**SELF-ADHERED FLASHING**

- A. Self-adhered flashing (SAF1): SBS modified rubberized asphalt adhesive, 40-mil thickness, HDPE carrier sheet. Standard material.
  - 1. Vycor V-40, 36 mil. of rubberized asphalt integrally bonded to 4 mil 0.1mm (.004 inch), high density cross laminated polyethylene film. Grace Construction Products or equal.
- B. Self-adhered flashing (SAF2): SBS modified rubberized asphalt adhesive, 25-mil thickness, aluminum surfaced, HDPE carrier sheet. For use where sealant will be adhered, such as around window openings.
  - 1. Vycor Aluminum Flashing, rubberized asphalt integrally bonded to aluminum surfaced HDPE high density cross laminated polyethylene film. Grace Construction Products or equal.
- C. Self-adhered flashing (SAF3): Butyl adhesive, 30-mil thickness, HDPE carrier sheet. For use at high heat locations such as under sheet metal flashings exposed to the sun.
  - 1. Ultra Roofing Underlayment, butyl adhesive, Grace Construction Products or equal.
  - 2. Use manufacturer-approved butyl-based SAF when installing Wrapshield SA.

**ACCESSORIES**

- A. Primer for use over fiberglass-mat faced wall sheathings: WB primer, Grace Construction Products or equal.
- B. Sealant: Sealant compatible with adjacent self-adhered flashings, membranes and components:
  - 1. For use with HDPE carrier sheet self-adhered membranes and flashings. One part, neutral cure silicone sealant. Dow 758, Dow Corning or equal.
  - 2. For use with Henrys Blueskin, One-part, low-odor, moisture cure or equal. BES 925 sealant, or equal.

**EXAMINATION**

- A. Review definition of weather-exposed surfaces from CBC Chapter 2502: Weather-Exposed Surfaces. Surfaces of walls, ceilings, floors, roofs, soffits and similar surfaces exposed to the weather except the following:
  - 1. Ceilings and roof soffits enclosed by walls, fascia, bulkheads or beams that extend a minimum of 12 inches below such ceiling or roof soffits.
  - 2. Walls or portions of walls beneath an unenclosed roof area, where located a horizontal distance from an open exterior opening equal to at least twice the height of the opening.
  - 3. Ceiling and roof soffits located a minimum horizontal distance of 10 feet from the outer edges of the ceiling or roof soffits.
- B. Inspect wall surfaces for plumb and planarity. Verify planarity of wall surface is within 1/4 inch over 10 feet or less, and within 1/8th inch over 4 feet or less. Reject non-conforming Work.
- C. Surfaces to be covered shall be dry, and shall have dried in fair weather not less than 3-days following wetting by rain.

**FLUID-APPLIED MEMBRANE AIR BARRIERS****07 27 26****PERFORMANCE REQUIREMENTS**

The air barrier shall have the following characteristics:

- A. It must be continuous, with all joints made airtight.
- B. It shall have an air permeability not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water. (1.57 psf.) (equal to 0.02L/sq. m @ 75 Pa.).
- C. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
- D. It shall be durable or maintainable.
- E. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep.

- F. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

#### QUALITY ASSURANCE

- G. **Manufacturer:** Air barrier systems shall be manufactured and marketed by a firm with a minimum of 20 years' experience in the production and sales of waterproofing and air barriers. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- H. **Source Limitations:** Obtain primary air-barrier material, through wall flashing, components and accessories through one source from a single manufacturer. Should project require a vapor permeable and a vapor impermeable air barrier on same project, obtain vapor-permeable and vapor impermeable air barrier and through wall flashing from one source from a single manufacturer.
- I. **Applicator Qualifications:** A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is an approved applicator as determined by waterproofing system manufacturer.

#### WARRANTY

- A. **Material Warranty:** Manufacturer's standard form in which manufacturer agrees to replace fluid-applied air barrier membrane materials that fail within specified warranty period when installed and used in strict conformance with written manufacturer's instructions.
  - 1. Failures include, but are not limited to, the following:
    - a) Failure to maintain air permeance rating not to exceed .004 cfm/sq. ft (0.02 L/s/sq. m.) when tested per ASTM E2178, within specified warranty period.
    - b) Failure to maintain a vapor permeance rating greater than 10 perms when tested in accordance with ATM E96, Method B.
  - 2. Warranty Period: Five (5) years from date of Substantial Completion.
- B. **Installer Warranty:** Installer's workmanship warranty in which installer agrees to repair or replace components of weather barrier system including, but not limited to, weather barrier, flashings, sealants and other components that fail in materials or workmanship within the specified warranty period. Removal and reinstallation of materials and systems necessary to repair/replace defective work shall be included within the warranty.
  - 1. Warranty Period: Five (5) years from date of Substantial Completion.
  - 2. Warranty shall cover damage to building and contents resulting from failure to resist penetration of water.

#### PRODUCTS

##### VAPOR PERMEABLE AIR AND WATER BARRIER

- A. Fluid-Applied, Fully-Adhered, Vapor-Permeable Membrane Air and Water Barrier.
  - 1. Basis of Design: Subject to compliance with requirements, provide the following:
    - a) Perm-A-Barrier VP, as manufactured by Grace Construction Products.
  - 2. Acceptable Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
    - a) R-Guard Cat 5, as manufactured by Prosoco.
    - b) Equal.
- B. Physical and Performance Properties: Provide products with the following minimum properties:
  - 1. Membrane Air Permeance: Not to exceed 0.0009 cfm/sq. ft. of surface area (at specified thickness) at 1.57-lbf/sq. ft. pressure difference (0.002 L/s x sq. m of surface area at 75-Pa) when applied to CMU wall; when tested per ASTM E2178.
  - 2. Membrane Vapor Permeance: Not less than 11.2 perms (649.6 ng/Pa x s x sq. m); when tested per ASTM E96.
  - 3. Assembly Performance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.0008 cfm/sq. ft. of surface area under a pressure differential of 0.3 in. water (1.57 pounds per square foot) (0.004 L/s x sq. m of surface area at 75-Pa) when tested in accordance with ASTM E 2357.
  - 4. Nail Sealability: No water infiltration when tested in accordance with ASTM D 1970.
  - 5. Tensile Strength: 50 psi when tested per ASTM E412.
  - 6. Solids Content: 50% (approx.).
  - 7. UV Exposure Limit for AB-1: Not more than 180 calendar days; per ASTM D412 and ASTM E96-Method B.
    - a) AB-2 product shall be specifically designed for indirect and intermittent UV exposure, suitable for use behind open joint systems.

#### AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Liquid Membrane for Details and Terminations: Provide Bituthene Liquid Membrane as manufactured by Grace Construction Products or equal.
- C. Wall Primer (for Use with Throughwall Flashing and Tapes Applied to Substrate): Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.

1. Flash Point: No flash to boiling point
  2. Solvent Type: Water
  3. VOC Content: Not to exceed 10 g/l
  4. Application Temperature: -4°C (25°F) and above
  5. Freezing point (as packaged): -7°C (21°F)
  6. Product: Perm-A-Barrier WB Primer manufactured by Grace Construction Products or equal.
- D. Self-adhering Flashing (SAF): 36 mil (0.9 mm) of self-adhesive rubberized asphalt integrally bonded to 4 mil (0.1 mm) of cross-laminated, high-density polyethylene film to provide a min. 40 mil (1.0 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:
1. Water Vapor Transmission: ASTM E96, Method B: 0.05 perms (2.9 ng/Pa s. sq. m.) max.
  2. Air Permeance at 75 Pa (0.3 in. water) pressure difference: 0.0006 L/s. sq. m (0.00012 cfm/ sq. ft.) max.
  3. Puncture Resistance: ASTM E154: 178 N (40 lbs.) min.
  4. Lap Adhesion at -4°C (25°F): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
  5. Low Temperature Flexibility: ASTM D1970: Unaffected to -43°C (-45°F)
  6. Tensile Strength: ASTM D412, Die C Modified: min. 2.7 MPa (400 psi)
  7. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200%
  8. Product: Perm-A-Barrier Detail Membrane manufactured by Grace Construction Products or equal.
  9. Ripcord not permitted.
- E. Joint Reinforcing Strip: Air barrier manufacturer's approved tape.
- F. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
1. Product: Bituthene Liquid Membrane, manufactured by Grace Construction Products or equal.
- G. Self-Adhesive HDPE Waterproofing Membrane: Flexible, preformed waterproof membrane.
1. Product: Bituthene 4000, manufactured by Grace Construction Products or equal.
- H. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft (24 to 32 kg/cu. m) density; flame

spread index of 25 or less according to ASTM E162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

- I. Joint Sealant: ASTM C920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O.
  1. Product: S100 silicone sealant by Grace Construction Products or equal.
  2. Product (where sealant comes in contact with polyethylene side of self-adhering flashing): Dow 758 silicone sealant by Dow Construction Products or equal.

<b>COMPOSITION ROOFING</b>	<b>07 31 13</b>
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Composition roofing shall be installed in accordance with current NCRA guidelines for installation and shall have a minimum 40 year warranty. Composition roofing Systems shall meet the following standards:

1. UL 997
2. ASTM D3018 TYPE 1
3. ASTM D3161 TYPE 1, CLASS F
4. ASTM D3462

Fasteners shall be in accordance with the manufacturer's specifications for application.

Type 30 felt underlayment or better shall be used. For special applications consult University's Representative before applying.

<b>WOOD SHINGLE ROOFING</b>	<b>07 31 29.13</b>
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**FIRE-RETARDANT SHINGLES:** A fire-retardant roof covering that is at least Class C shall be installed.

**VALLEY FLASHING:** Flashing shall not be less than 26-gauge and shall extend 11-inches (8-inches for shingles) from the centerline each way. End laps shall not be less than 4-inches. A 36-inch-wide, 30-pound felt underlayment shall be placed under the metal flashing.

**WOOD SHINGLE APPLICATION:** Shingles shall be laid with a side lap of not less than 1-1/2-inch between joints in adjacent courses and not in direct alignment in alternate courses. Spacing between shingles shall be approximately 1/4-inch. Each shingle shall be fastened with two nails positioned approximately 3/4-inch from each edge and approximately 1-inch above the exposure line. Starter courses at the eaves shall be doubled. Fasteners shall be long enough to penetrate into the sheathing 3/4-inch or through the thickness of the sheathing, whichever is less.

**FASTENERS, TREATED SHINGLES:** Due to the corrosive nature of the treating material used for treated shakes or shingles, the fasteners used shall be hot-dipped galvanized, aluminum or stainless steel.



**WOOD SHAKE ROOFING**

**07 31 29.16**

**FIRE-RETARDANT SHINGLES:** A fire-retardant roof covering that is at least Class C shall be installed.

**WOOD SHAKE APPLICATION:** Shakes shall be laid with a side lap of not less than 1-1/2-inch between joints in adjacent courses. Spacing between shakes shall be not less than 3/8-inch or more than 5/8-inch except for treated shakes, which shall have a spacing of not less than 1/4-inch or more than 3/8-inch. Shakes shall be fastened with two nails only, positioned approximately 2-inches above the exposure line. The starter course at the eaves shall be doubled using shakes or shingles as the bottom course. Fasteners shall be long enough to penetrate into the sheathing 3/4-inch or through the thickness of the sheathing, whichever is less.

**VALLEY FLASHING:** Flashing shall not be less than 26-gauge and shall extend 11-inches from the centerline each way. End laps shall not be less than 4-inches. A 36-inch-wide, 30-pound felt underlayment shall be placed under the metal flashing.

**FASTENERS, TREATED SHAKES:** Due to the corrosive nature of the treating material used for treated shakes or shingles, the fasteners used shall be hot-dipped galvanized, aluminum or stainless steel.

**CLAY AND CONCRETE TILE ROOFING**

**07 32 00**

All roofing tile shall be installed in accordance with the manufacturer specifications. A minimum of two layers Type 30 Felt underlayment or better shall be installed. For special applications, consult University's Representative before applying.

Tiles shall be installed on an elevated battened system. For special applications, consult University's Representative before installing.

Fasteners shall be in accordance with the manufacturer specifications for the application used.

**ROOFING AND SIDING PANELS**

**07 40 00**

All metals used shall be prefinished Zinalume/Galvalume sheetmetal or G-90 galvanized steel in minimum 24 gauge as described in ASTM A792.

**METAL PANEL ROOFING**

**07 41 13**

Standing seam roofing system shall consist of integral self-locking seams with a minimum seam height of 1-3/4 inches. Standing seam roofing system shall have no exposed fasteners. Panels shall have clips designed to allow for thermal expansion and contraction.

Type 30 felt underlayment or better. For special applications, consult University's Representative before applying. Sealants shall be gunnable grade single component polyurethane caulk or gunnable grade butyl. Tape Sealant shall be Butyl.

Manufacturer shall provide a standard 35 year coating performance warranty. All installations shall be in accordance with specified manufacturer guidelines.

<b>SINGLE-PLY MEMBRANE ROOFING</b>	<b>07 54 00</b>
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Polyvinyl Chloride (PVC) Single-Ply Membrane Roofing System (SMR) is the standard thermoplastic membrane roofing system for low sloped applications. Thermoplastic Olefin (TPO) membranes are not approved for Campus installations. SMR systems shall be fully adhered or mechanically fastened qualifying for a UL Class A Roof Covering with Factory Mutual 1-90 Windstorm Classification as needed to meet the current code requirements for the ultimate design wind speed designated for the building classification. The SMR system shall be covered by the material manufacturer's 20-Year Total System Warranty covering all roofing components installed above the roof deck upon completion and acceptance of Work.

All roofing systems shall meet ASTM standards per their respective systems. Roofing materials shall meet ASTM D4434, minimum 60 mil thickness and have a Solar Reflectance Index (SRI) as required below for a minimum of 75 percent of the roof surface. (Product shall meet current CA Title 24 Requirements for reflectivity.)

Roof Type	Slope	SRI
Low-Sloped Roof	≤ 2:12	78
Steep-Sloped Roof	> 2:12	29

For special applications, consult University's Representative before applying. All installations shall be in accordance with manufacturer recommendations.

Products: The following SMR systems are listed to establish a standard of quality:

1. Plasticized Polyvinyl Chloride (PVC): Sarnafil S327, manufactured by Sarnafil, Inc.; EGSR-60 Roofing Membrane distributed by Everguard/GAF; or equal.

Emissions: The following maximum emissions are listed in grams per liter.

1. Trowelable Mastic and Pitch Pocket Sealant: 450
2. Sealant: Refer to Section 07 92 00 Water Resistive Barrier System
3. Adhesive: 250

<b>SHEET METAL FLASHING AND TRIM</b>	<b>07 62 00</b>
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The University has adopted a requirement to eliminate the use of lead in building materials. Items specified in Section 07 62 00 and any other section that contains lead material must be revised to lead-free products. Solder as specified in Sheet Metal Flashing and Trim sub-section 2.05 and Manufactured Roof Specialties are affected by this. The solder melting point temperatures and gauge of GSM must be evaluated. Lead-free Tin solder products are available through Johnson

Mfg. Co. and Lucas Milhaupt and nest used in combination with solder flux paste products. Please provide a submittal of materials required by this new requirement.

Solder:

1. Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, lead-free; Jotun “Galvanite”, or equal.
2. Other Metals: Grade as recommended by manufacturer of metal sheets for intended use.

<b>ROOF SPECIALTIES AND ACCESSORIES</b>	<b>07 70 00</b>
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Roof Hatches:

1. Standard Roof Hatch size is 30 inches by 36 inches. For special applications or sizes, consult the University’s Representative. Roof hatches that are larger than the standard size shall require hydraulic or spring loaded hinges.
2. Roof hatches shall be designed to comply with Cal OSHA Title 8 section 3212 and to provide safe egress and ingress through roof and access hatches
3. Roof hatches shall be designed such that opening and closing of the roof hatch can be done with three points of contact on the ladder at all times.
4. Where no roof hatch is provided, a fixed ladder shall be provided that complies with Cal OSHA Title 8 section 3277.
5. Consideration shall be given for the safe exit and approach to the hatch and ladder. The roof hatch shall be located such that there is a sufficient clear space directly in front of the ladder at the roof level.

<b>JOINT SEALANTS</b>	<b>07 92 00</b>
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Detail all special conditions. All materials used shall be top-of-the line available suited for the conditions being sealed and in compliance with the following VOC requirements.

<b>Sealants</b>	Max g/L
Architectural	250
Non-membrane Roof	300
Single Ply Roof Membrane	450
Other	420
<b>Sealant Primers</b>	
Architectural – nonporous	250
Architectural – porous	775
Modified Bituminous	500
Other	750
Requirements from South Coast Air Quality District Rule 1168 (01/07/05) except for aerosol adhesive requirements which come from Green Seal Standard GS 36 (10/19/00). Applicable definitions apply.	