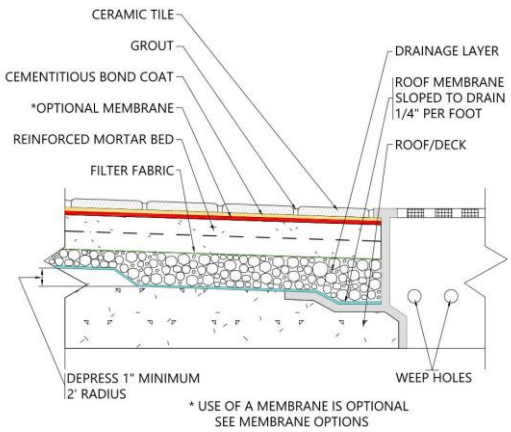
Exterior Tile & Natural Stone Installations over Primary Waterproofing Membranes

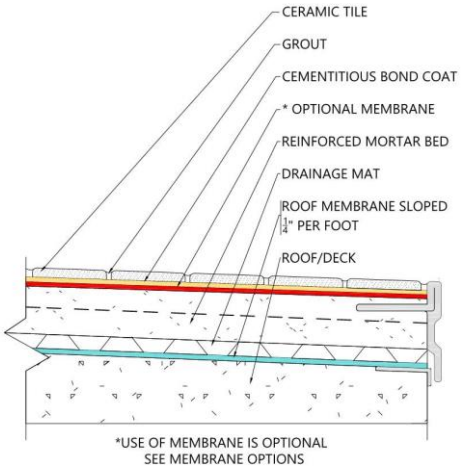
Primary liquid waterproofing membranes of various compositions are specified on rooftops, exterior balconies and plaza decks. Chosen for their ease in conforming to substrates, superior elongation properties and resistance to the severe weather conditions, these membranes serve as primary protection against water damage under occupied living spaces. These membranes are also designed to assist with water evacuation to drains or to ground away from a structure or from a walkway.

For tile or natural stone installations over these membranes, the traditional assemblies would be based on Tile Council of North America's F103 Details below:

F103 Roof Deck or Balcony (Drainage Layer)



F103 Roof Deck or Balcony (Drainage Mat)



As shown, these details incorporate a wire reinforced, non-bonded mortar bed with either a layer of crushed stone or a mat to assist drainage over a primary membrane. These methods are very effective as the mortar bed is floated by the tile installer to create a smooth and continuous overall slope to provide the tiled surface's pitch to drains. This method is especially useful when installing ungauged natural stone as it can be "wet set" into a fresh mortar bed to accommodate variations in thickness and leave the surface relatively flat and in-plane.

Additionally, these non-bonded methods separate the tile assembly from the substrate below, thereby reducing movement stress effects from minor dimensional mass changes, deflection or concrete slab shrinkage.

There are many projects however, that cannot allow for these assemblies as they can add 20-30lbs/SF (97-146 kg/m^2) and up to 2-1/2" (6.35cm) in height to the design of a rooftop, deck or balcony. In these cases, care is to be shown in specifying the correct membranes for direct bonding that are compatible in a tile assembly.

While most ANSI A118.10 Bonded Liquid Waterproofing Membranes are not recommended as primary membranes directly over occupied space, CUSTOM® RedGard® Waterproofing and Crack Prevention Membrane has been successfully used for decades over substrates such as concrete slabs, masonry shotcrete and cement-based mortar beds in a primary waterproofing application over occupied space. *(Primary membranes are not recommended for direct bonding over plywood decks.)*

RedGard was specifically formulated to be compatible for bonding ceramic and natural stone tiles with cement-based adhesive mortars (Modified and Improved Modified Dry-set Mortars – ANSI A118.4 & A118.15) and other ANSI - approved tile installation product systems. When cured, the membrane resembles a monolithic vinyl pan without seams and the potential for leakage.

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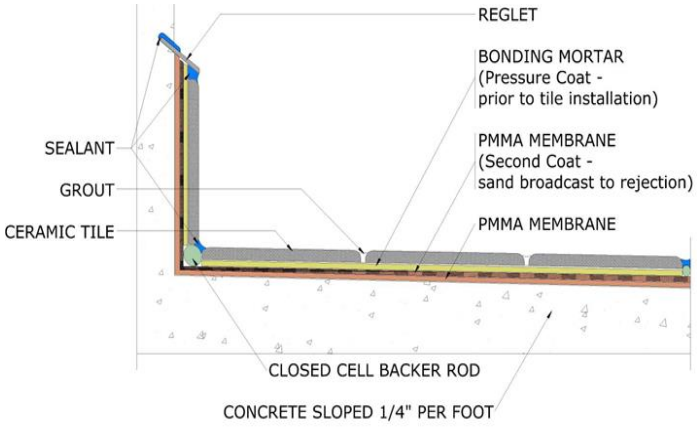
However, there may be project specifications that call for specific roofing membranes under certain conditions such as increased anticipated movement or the need to leave coving treatment or additional areas exposed to the elements. These circumstances could lead to the use of alternative primary membranes, unclassified by an ANSI product standard. While many compositions are available, successful tile and stone assemblies have been designed using cold-applied, polymethyl methacrylate (PMMA) and polyurethane methacrylate (PUMA)-based products. Similar to the use of RedGard in a bonded method as the primary membrane, a thinset or thickset application is possible. A bonded, thickset application does not require a minimum 1-1/4" (3cm) thickness as does the non-bonded method, but to accommodate movement, the assembly is to be designed with 100 SF maximum sections with movement joints on suspended concrete slabs.

To bond tile assemblies to PUMA and PMMA products, the membranes are placed using a two-coat method with the upper coat filled with clean, coarse sand broadcasted to rejection (sand bonded and exposed). Although embedding sand is a common practice with these membranes, the manufacturer must confirm that this method is acceptable. Additionally, the membrane thickness is to be minimal so as not to contribute to failure from point loading in extra-heavy service conditions.

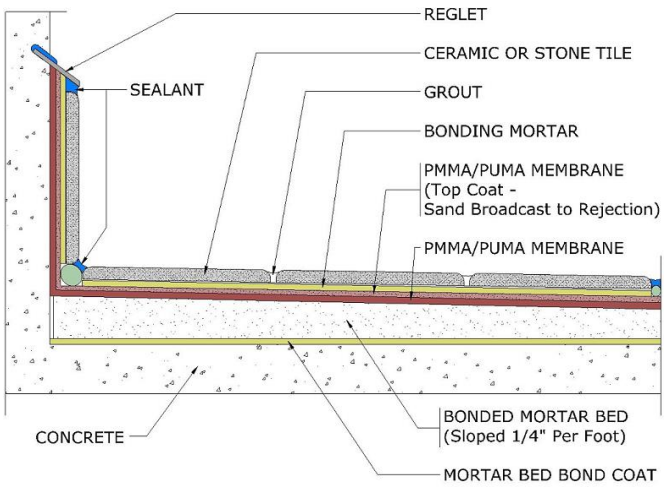
PUMA Cold-Applied Waterproofing Application with Sand Broadcast to Rejection

Once the excess sand is removed, the options for assemblies are similar to the traditional TCNA thinset method (F104) and thickset bonded mortar bed method (F101).

CF104 Direct Bond – Thinset Method



***CF101 Bonded* Mortar Bed – Thickset Method**



When using any membranes in exterior tile or natural stone applications, attention to the substrate's flatness and providing adequate pitch is required to properly evacuate water. Divots in the plane, commonly referred to as "birdbaths," will trap water leading to expansive efflorescence and/or tile delamination from the effects of thermal growth and freeze-thaw expansion.

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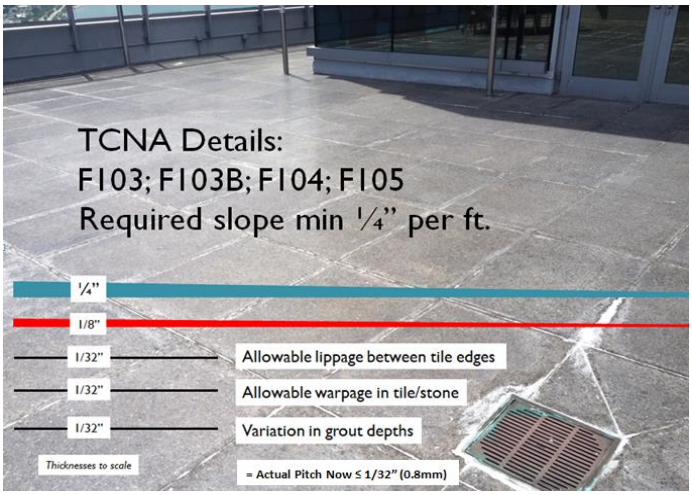
Although a minimum of ¼" per linear ft. pitch is required by code, installation material manufacturers and industry standards, 1/8" per linear ft. pitch is often specified with unacceptable results that are beyond the tile installer's control. As shown below, accepted variables affect the flow of water and when compounded, severely slow water flow. Running bond or Versailles patterns further exacerbate these conditions.



Other very important considerations for a successful installation to either reduce or eliminate efflorescence and the effects of freeze-thaw include the following:

1. Mortars and grouts that are OPC-based (ordinary Portland cement) contain minerals that are more susceptible to effloresce through grout and sealant joints. Rapid-setting/curing products with high concentrations of calcium aluminate cement can significantly reduce or eliminate these issues. Additionally, the faster cure reduces the risk of issues related to inclement weather conditions. Mortars such as MegaLite® RS Rapid Setting Crack Prevention Mortar or ProLite® RS Rapid Setting Large Format Tile Mortar are in this category. Prism® Ultimate Performance® Grout is the choice for grouting.

2. In Bonded Mortar Bed–Thickset Method applications, the option of using RedGard as a secondary membrane (as shown in the F103 details), also provides valuable performance enhancements. In addition to directing water to drains or away from the structure, the membrane helps blocks mineral migration(efflorescence) from the mortar bed and is a crack isolation/prevention membrane.

3. Achieving adequate mortar coverage, required by ANSI A108.5 as ≥95%, is critical for a successful installation. A common misconception is if the substrate and tile are flat troweled, that "mortar coverage is at 100%!" even when troweled ridges are not collapsed! As described in the National Tile Contractors Association's Trowel & Error Video (available in English, Spanish and Russian,) troweled mortar ridges are to be collapsed with less than 5% voids so that the mortar is at a continuous thickness. It's also good practice to strike the mortar around edges of the tile to fill voids.

4. Requirements for site drainage locations should minimize distances between receptors within horizontal spaces in conjunction with height elevations to accommodate adequate water evacuation.

5. **And last and certainly not least, the leading cause of exterior tile installation failures is the lack of adequate movement joints!** Movement joints are to be placed with proper widths and frequencies in locations to accommodate structural movement and the assembly's thermal growth. All tiles expand to some degree. The Tile Council of North America's Handbook provides valuable information for design professionals to calculate and specify joints for movement. Membranes such as RedGard pass performances required by ANSI A118.12 crack isolation standards to accommodate >1/8" in-plane movement. PUMA membranes may pass ASTM C1305 crack bridging standards, but without adequate and correctly placed "soft" joints, the tile assembly can experience severe compression.

With advanced planning and effective communication between trades, tiled, exterior assemblies can be performed successfully and last for decades. Be sure to include your CUSTOM® Representatives in your project's planning, mockup and execution stages. For information about exterior tile applications, also contact the CUSTOM Technical Services Department at **800.282.8786**.

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