

TPO MEMBRANE SYSTEMS



GreenShield

Heatshielding & Waterproofing Your Roof

Installation Methodology for Waterproofing RCC Roof and Façade Walls

Covers GreenShield™ TPO
membrane products:

GS TPO 1.2 RF BG (S)
GS TPO 1.5 RF BG (S)
GS TPO 1.2 RF BG (D)
GS TPO 1.5 RF BG (D)

www.greenshield.co.in

Introduction

This application guide provides standard procedures for application of GS TPO membranes of different areas of a RCC building – sloping roofs, green roofs, outer wall facades based on adhered and mechanically fastened in-situ system.

The step-by-step directions and illustrations provide solutions to your installation questions and assist you for top quality application of GreenShield™ TPO Membrane system.



GreenShield™ TPO Membrane Products, covered under this installation system:

- GS TPO 1.2 RF BG (S): 1.2 mm thick, single side backed TPO membrane, suitable for exposed systems
- GS TPO 1.5 RF BG (S): 1.2 mm thick, single side backed TPO membrane, suitable for exposed systems
- GS TPO 1.2 RF BG (D): 1.2 mm thick, double side backed TPO membrane, suitable for embedded systems
- GS TPO 1.5 RF BG (D): 1.5 mm thick, double side backed TPO membrane, suitable for embedded systems

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EQUIPMENT LIST

Below is a list of equipment that may be required for specific type of installation.

Handy Equipment & Tools

1. Gloves	10 .Scissors
2. Drill Bits (Carbide, Steel)	11. Silicone Rubber Roller
3. Measuring Tape	12. Utility Knives
4. Seam Probe	13. First Aid Kit / Box
5. Eye Protection	14. Rags
6. Brooms	15. Personal Protection Equipment (PPE)
7. Chalk Line	16. Lawn or Linoleum Roller
8. Wire Brush	17. Writing / Marking Instruments
9. Caulk Gun	18. Brushes & Trowels

Powered Equipment

1. Screw Guns	5. 10,000 – 20,000 watt generator
2. Robot Welder	6. Extension Cord
3. Electric Drill	7. Hand Held Hot Air Welder Machine
4. Hammer Drill	8. Automatic Roller Hot Air Welder Machine

Other Equipment

1. Rivet Gun	10. Screwdriver Set
2. Hammer	11. Aluminum Tape
3. Pull Out Tester	12. Adhesive Application Gun
4. T-Square	13. Metal Crimpers
5. Reciprocal & Circular Saw	14. Vice – Grip Pliers
6. Hand Saw	15. Stirring Sticks
7. Paddle Mixer	16. Ladder
8. Tongs	17. Shovels
9. Rubber Mallet	18. Mixing Vessels

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ROOF SUBSTRATE PREPARATION

Structural Requirement

A roof deck or wall is expected to be structurally sound to support and restraint the roofing system. It should also pose enough strength to withstand all anticipated loads, foot or construction traffic, rain and wind loads. It should also be able carry the weight of application workers and the equipment without showing signs of deflection at any point.

Here in this application guide, GreenShield is referring roof or wall as a supporting substrate to the GreenShield system; irrespective of the fact that the roof or wall may be built for furnishing or sound control purpose. To perform this application process, the roof or deck must be rigid.

Surface Requirement

For the application on RCC or brick wall substrate, the surface must be free of large cracks and should be as smooth as possible. There should be no large holes, undulations or sharp changes in elevation of the surface. If so, discuss the feasibility with GreenShield experts. Before system application is commenced, the substrate (roof or wall) should be inspected thoroughly by the applicator, the building contractor and the property owner's representative to identify if it fulfils the given conditions. Roof-mounted equipment should rest on structural framing of the building, not on the GreenShield roofing system. Any water seepage or leak resulting from rooftop mounted equipment are not covered under the GreenShield warranty.

For application on PEB roofs, the surface must free from cracks, holes and should be smooth. All roof mounted equipment must be removed prior to installation and must be re-installed on frame structure on not directly on the membrane. All sharp undulations from metal fasteners or ripped roof edges must be cleared and repaired, prior to installation.

Surface preparation includes, but not limited to, smoothening and filling all holes, irregularities and depressions before the system is applied. Post that, complete the moisture scan and make sure any wet surface or materials are clean and dry. Carefully sweep all roof surface to eliminate all dirt and debris. Grind and cut out large chunks or blisters on substrate. Repair cracks and holes in concrete especially larger than ¼" wide. Follow the same procedure until the application area is completely smooth and dry.

Slope Requirement

Providing a proper slope for water to drain off is a mandatory requirement of the site, before GS TPO systems can be installed. For RCC roofs, a screed based slope on top of mother slab is required, so that the subsequent installed layers, follow the slope into the drain off points. Such slopes must be properly verified and the entire roof must be free from any kind of water accumulation or ponding during testing.

GS TPO Relaxation Requirement

After the surface is fully prepared in accordance with the GreenShield™ guidelines, unpack and unroll GreenShield™ TPO Membrane and position without stretching. Let the membrane relax for up to 30 minutes and inspect for any damages.



In-Situ Embedded Monolithic System

Monolithic system, makes it possible to install the membrane on top of the substrate and then install tiles on top of it. Such a system also allows using insulation boards on top of slabs and waterproofing it, thus providing a system for roof insulation if required.

GS TPO RF BG (D) membrane has a special backing on both sides, sandwiching the TPO layer in the middle, enabling use of cementitious adhesives for anchoring with the slab as well as providing a adhering base for tiles above.

The system consists of mother slab, screed (for water slope), GS cementitious adhesive, GreenShield™ TPO RF BG (D) membrane, GS cementitious adhesive, mechanical anchoring, heat welded joints, tiles on top, enclosing the complete system. If required XPS insulation boards of upto 50 mm are used between the screed and the TPO layer, for additional roof thermal insulation.

After surface is fully prepared, apply a 2 mm thick layer of GS cementitious adhesive, and while tacky, lay the unrolled GS TPO membranes one by one, side by side considering overlaps as well as cover over the side parapet walls, on top of this and roll press the same for proper adhesion. This allows the underside of the membrane to adhere to the screed in a proper manner. Ensure all corners and joints are properly overlapped by 50 mm, for heat welding.

Once the entire area is covered, verify the joints using a seam probe to ensure no joints are left open. If any, close this using a hand heat welding machine.

Once verified, apply a 2 mm thick layer of GS cementitious adhesive on top of the TPO membrane, thereby sandwiching the membrane between the 2 layers of adhesive and fix tiles / stone, thus creating a monolithic substrate.

GS TPO membranes come in a standard size of 2 meters in width and 20 meters in length. Lay and orient sheets such that, it will form a uniform sheet covering entire roof area, working from lower slope to upper slope, ensuring the that flow of water is not hindered around the overlap welds.

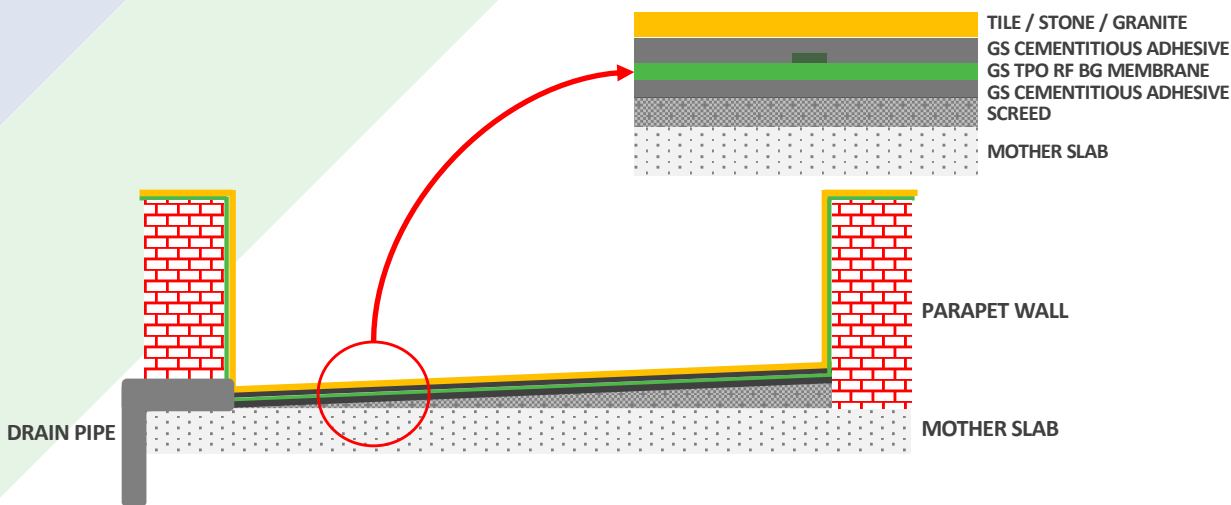


FIGURE 1: In-situ installation system

Membrane laying System – Fully Adhered

There are 2 ways to lay a membrane in an embedded system

- 1: Fully Adhered – using adhesives
- 2: Mechanically fastened using specially designed concrete fasteners.

In a fully adhered system, the membranes are sandwiched and fixed to the substrate using cementitious adhesives, thus fully bonding the membrane to the substrate. The pull strength achieved is higher than 5 N.

A 2 mm thick adhesive layer is applied on top of the screed slope. Care must be taken that the screed is not too porous and not very absorptive, else the adhesive layer will loose moisture soon and create a weaker bond with the membrane on top.

Once the adhesive is tacky, lay the membrane on it and press using rollers. Ensure the overlaps between two sheets for this system is 50 mm. The overlap then is heat welded with the help of heat gun. Refer **FIGURE 2**, below on membrane installing system. The welding temperature will vary according to the thickness of the membrane usually between 350 °C and 600°C. Do verify the exiting air temperature with a separate thermometer before the welding process to avoid damage due to excessive heat.

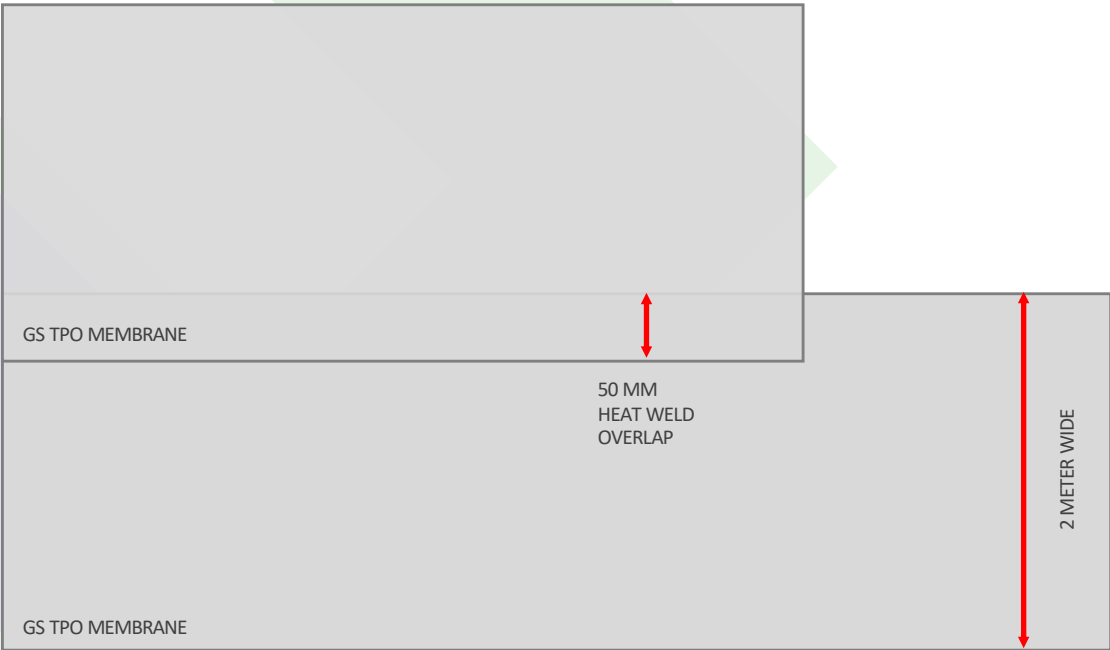


FIGURE 2: Membrane laying & heat welding system

Verify the heat welding using a probe (rounded tool) and ensure complete welding integrity. Pass the tester along the weld while applying little pressure to detect leaks, weak points, open joints.

This is an absolute necessary test and must be done by a qualified heat welder, when the joint has cooled, ideally after 6 hours of welding. Mark out any irregularities or weak joints or openings and then using a hand held welder, repair these joints using an additional piece of the membrane over the open joint.



FIGURE 3: Membrane weld joint verification

Membrane laying System –Mechanically Fastened

Mechanically fastened TPO membrane provides added protection against strong wind-uplift, while rain-coating a flat roof.

After surface is fully prepared, start positioning unrolled GS TPO membranes one by one, side by side considering overlaps as well as cover over the side parapet walls.

GS TPO membranes come in a standard size of 2 meters in width and 20 meters in length. Lay and orient sheets such that, it will form a uniform sheet covering entire roof area, working from lower slope to upper slope, ensuring the that flow of water is not hindered around the overlap welds.

One end of the membrane is fastened using fasteners and washers for concrete. The holes are drilled at distance of 2 meter from each other, 25 mm from the edge of the membrane, puncturing the membrane. 40 mm wide washers are placed on top and expansion anchored fasteners are hammered through the hole. As shown below in **FIGURE 3** The overlap of the sheet besides it, will be a total of 100 mm, covering the gap and washers, providing a 35 mm lip for heat welding. Follow heat welding & verification steps as described on **PAGE 6**.

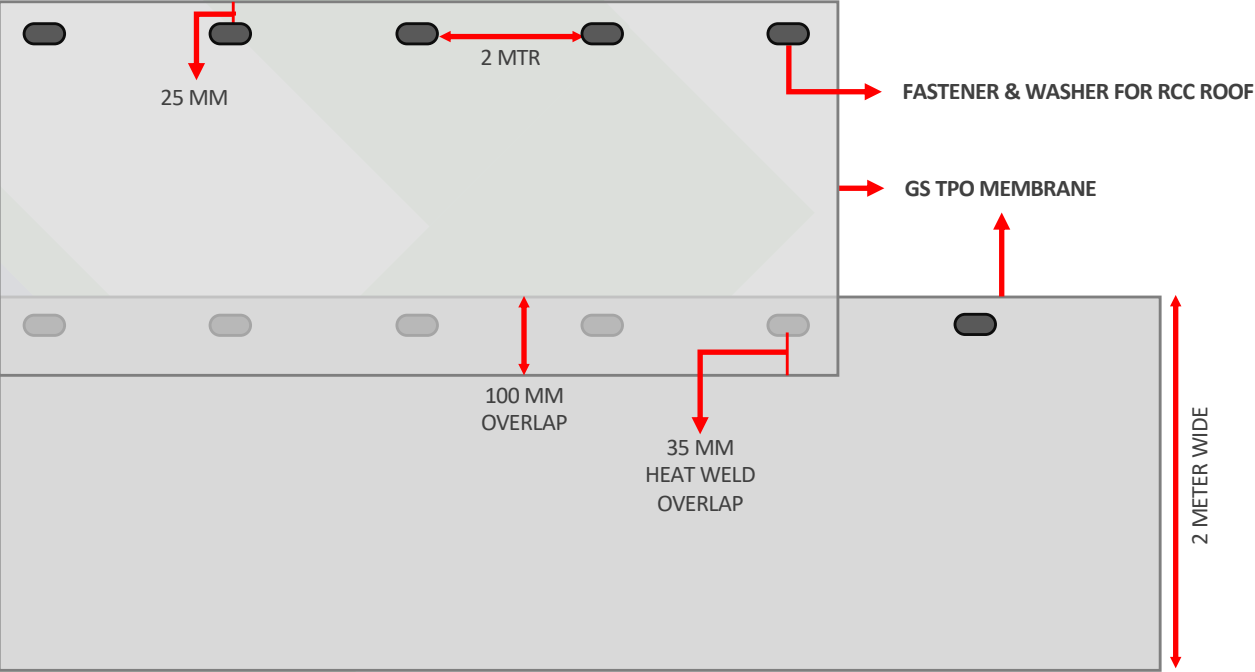


FIGURE 4: Mechanically fastened membrane installation & heat welding system

Washers and Fasteners:

These are critical accessories for securing membrane to the concrete substrate and ensuring high wind uplift resistance.

Fasteners are Hammer Fix Nylon Sleeve with Reverse Thread Nail
Ø: 8 mm | L: 80 mm

Washers are oval shaped Galvanized metal 60 x 40 mm, 1 mm thick, suitable for the fastener system, securing the membrane in place



FIGURE 5: Fastener & Washers

Insulation Foam Board Installation for In-Situ Monolithic System

For additional insulation on roofs, XPS insulation boards are preferred, providing significant amount of thermal insulation from heat transmission. 25 mm to 50 mm boards in 8ft X 4ft or 4ft X 2ft are installed over the roof. Compressive strength of these boards must not be lower than 120 kPa.

Each board kept side by side are attached either by tongue and lip mechanism or simple BOPP tape stuck on edges, covering the board gaps.

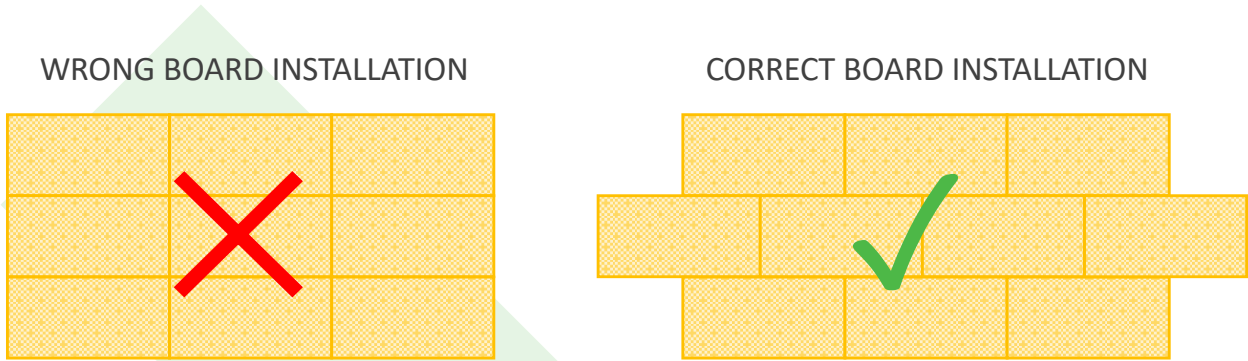


FIGURE 6: Insulation Board laying system

These boards are laid on top of sloped screed, followed by the in-situ system.

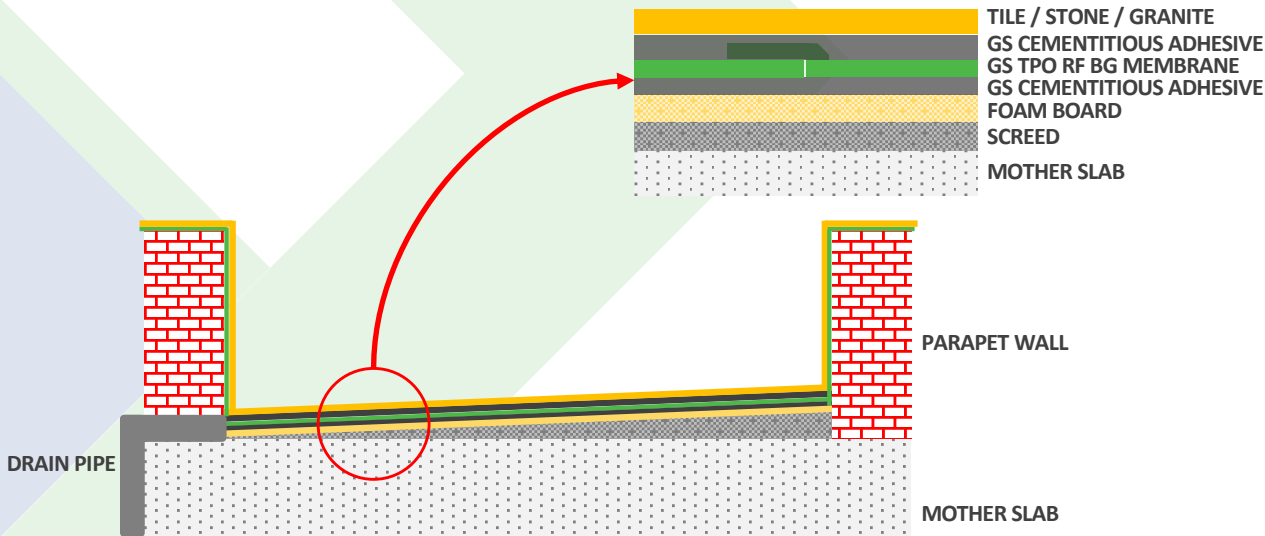


FIGURE 7: In-situ installation system with Insulation Boards

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APPLICATION ON FAÇADE WALLS

In-Situ Embedded Monolithic System

Monolithic system, makes it possible to install membrane on top of the brick wall masonry substrate and then install tiles on top of it. This ensures that a solid polymeric membrane of uniform thickness is that acts a barrier between the wall and exterior surface, waterproofing the building by enveloping it.

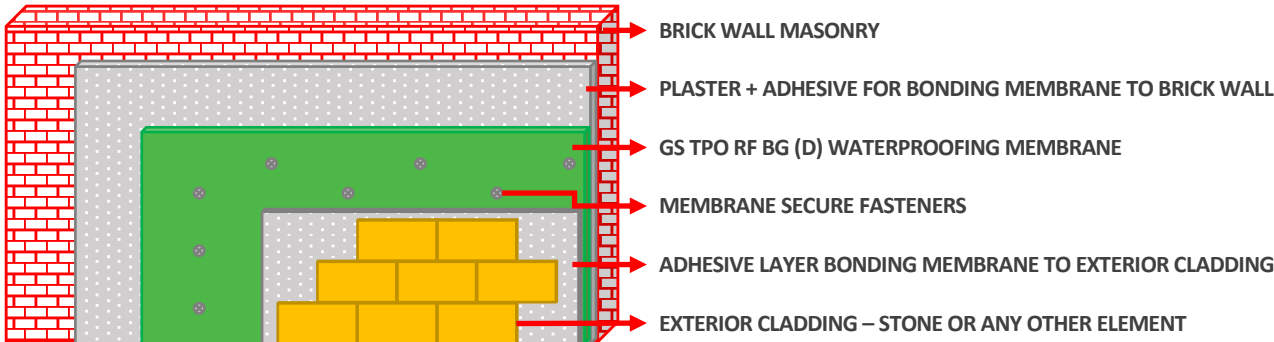


FIGURE 8: Façade Wall protection laying system

Once the brick wall masonry is completed, the surface on which waterproofing is to be done, must be levelled. All undulations, sharp edges, gaps etc must be filled up with proper plastering. Once substrate is properly prepared, a 1.5 mm thick layer of cementitious adhesive is applied and then GS TPO RF BG (D) membrane is laid on top of this tacky adhesive.

The GS TPO RF BG (D) is then further secured to the wall using a steel washer plate – raised / rounded and Hammer Fix Nylon Sleeve with Reverse Thread Nail or self tapping concrete screws.

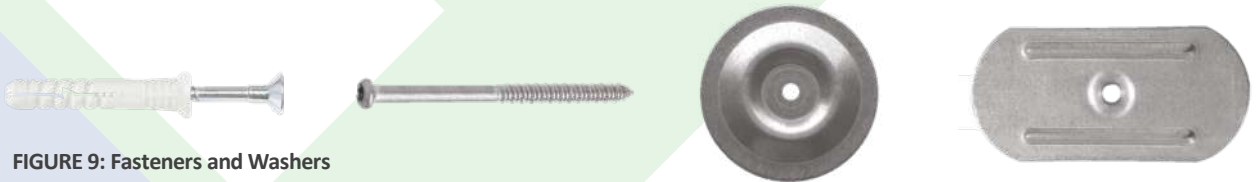


FIGURE 9: Fasteners and Washers

The fasteners are secured in a staggered grid of 2 mtr X 3 mtr with gaps of 1.5 mtr, as shown in **FIGURE 10** below. The fasteners are covered with a pre-sized membrane which is heat welded over the membrane, covering the fastener below, thus eliminating any chance of water seepage.

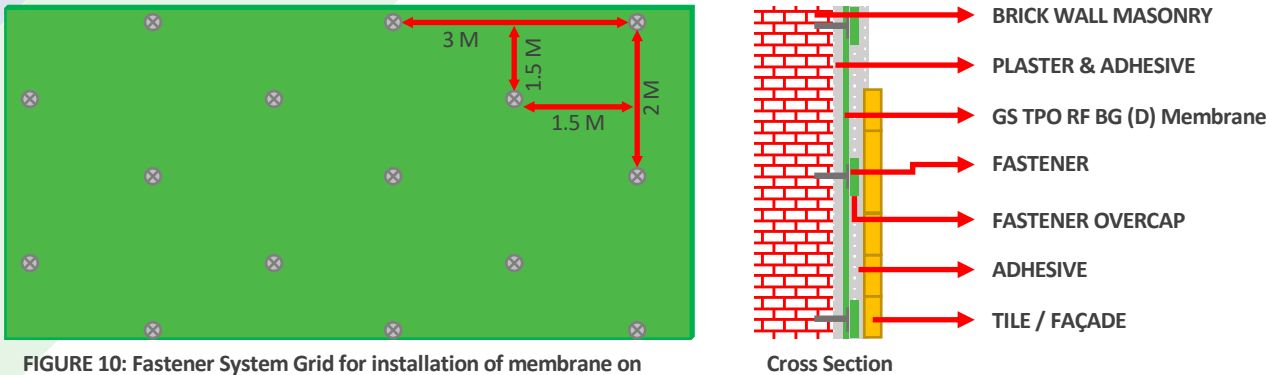


FIGURE 10: Fastener System Grid for installation of membrane on façade wall

Once the membrane is fastened to the wall substrate, a second layer of adhesive is applied for fixing tiles, thus providing a bond between tile and membrane below.

Corner and Joint Terminations

The GS TPO Membrane is flexible and easy to mould into shapes and corners. To ensure proper coverage of critical corners and joints, using an experienced applicator engineer is important.

Using hand-held hot air gun, heat up the membrane to make it malleable and then push into corners. On cooling the membrane will take shape. Further corners need to be cut, spliced and over welded to provide proper coverage and rain-coating of the substrate below. **FIGURE 11** below provides details of how membrane is installed around corners

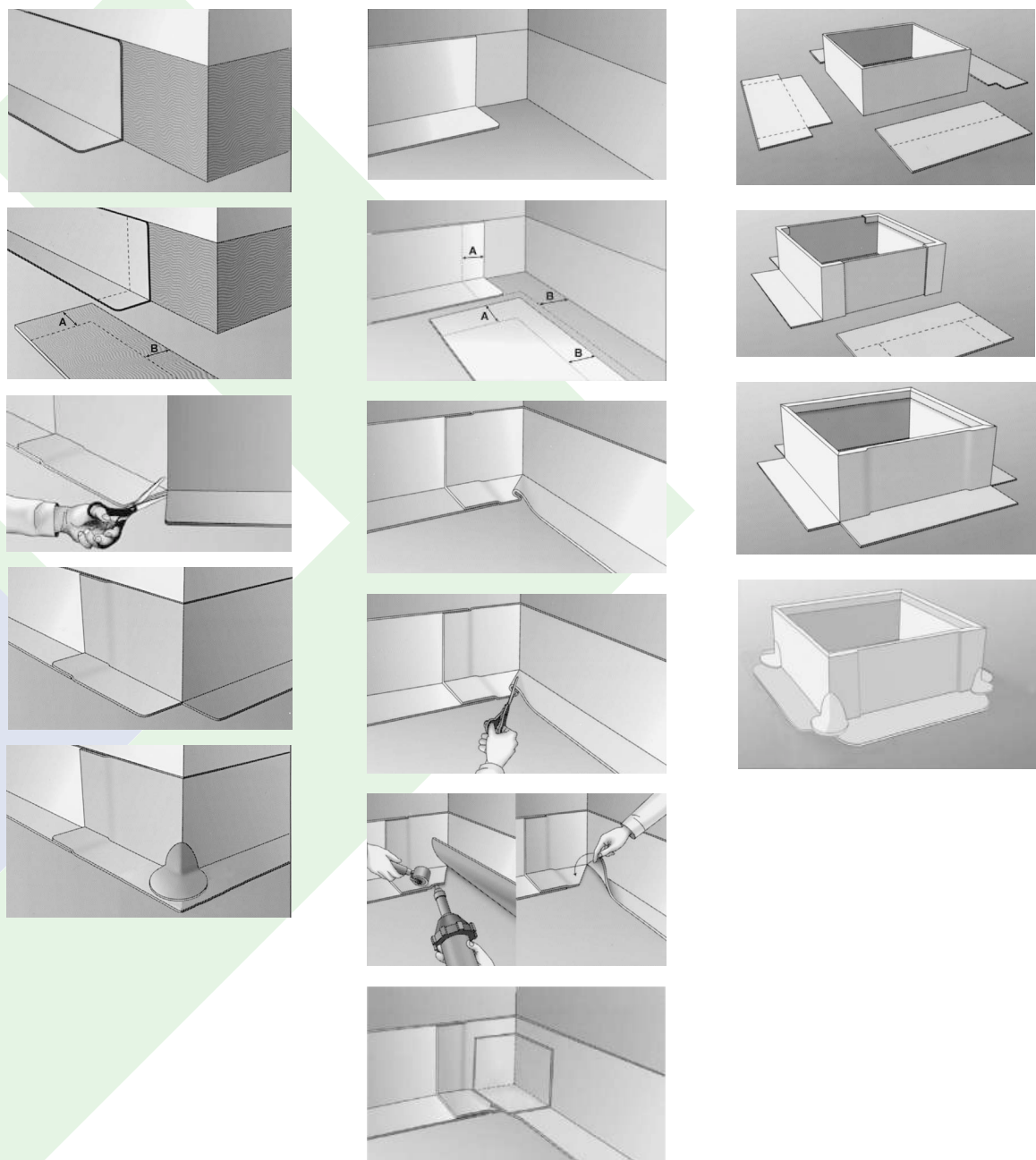


FIGURE 11: Corner and Joint terminations during TPO membrane installation

Corner and Joint Terminations

FIGURE 12 & 13 below provides cross sections diagrams around windows and doors.

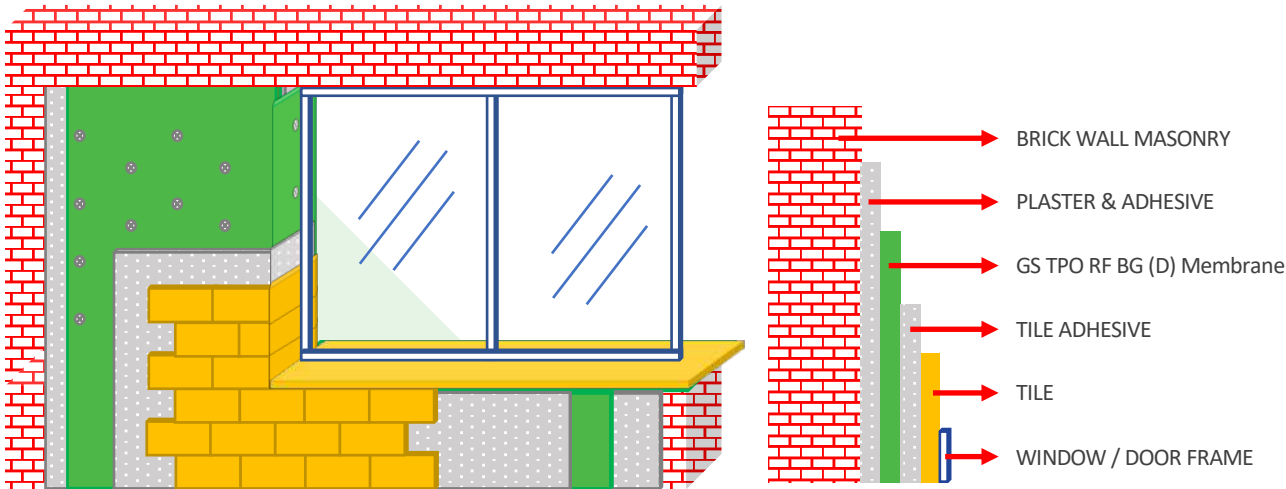
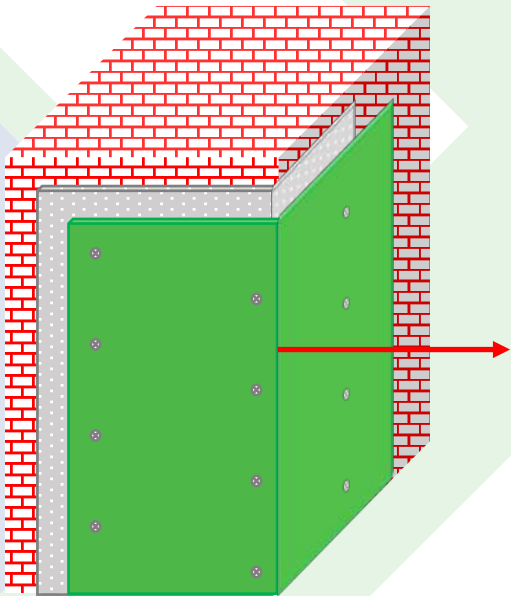


FIGURE 12: Cross sectional diagram of membrane installation around window, door frames and other such openings.



During installation, fold the membrane around the edge and fasten it on the other side, so as to hold the membrane in place.

Using a hand held hot air welding gun, blow over the edge, heating the membrane, and roller press the membrane on both sides of the edge so that the membrane takes the sharp shape of the edge.



FIGURE 13: Method to wrap membrane around corners and edges