

DuPont™ Thermax™ Wall System

Installation Procedures

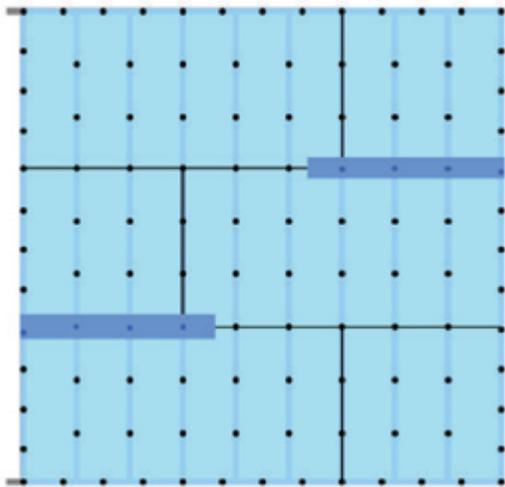
SEQUENCING OVERVIEW

Installation of the DuPont™ Thermax™ Wall System can begin once the structural steel and exterior wall steel studs have been installed and braced.

By using the all-steel bracing design, a layer of exterior gypsum drywall will not be necessary so the drywall or masonry contractor can begin immediately installing boards of **DuPont™ Thermax™ XARMOR™ (ci) Exterior Insulation** directly on the exterior of the steel studs (insulation can be left exposed for 180 days). As the contractor applies additional boards, **DuPont™ LiquidArmor™ Flashing and Sealant** is adhered to adjoining board joints and at pre-determined thru-wall penetrations. Windows and other openings are flashed following the removal of excess **Thermax™ XARMOR™ (ci)** in the window opening areas of the envelope.

With the building closed in, the structure has an insulated and weatherized envelope, which will allow for work to progress quickly on the interior of the structure. By completing this step, a building can begin to be conditioned, which can speed up the work of other trades beyond the exterior walls.

Figure 1: Fastening Pattern for Thermax XARMOR™ (CI) Exterior Insulation



8' Thermax XARMOR™ (ci) Board with 16" o.c. Stud Spacing
LiquidArmor™ Flashing and Sealant on all board joints, on top of fasteners

Once sections of insulation boards and flashing are in place, a contractor can begin installing veneer ties. Install barrel type veneer ties with a sealing washer mechanism with the Thermax™ Wall System to ensure a tight seal forms between the foam facer and veneer tie systems.

When a veneer tie is near a board joint, cover the jointed area with **LiquidArmor™ Flashing and Sealant** before inserting the brick tie. When a veneer tie is located in the field of the board, the veneer tie with a sealing washer mechanism will typically provide adequate protection from air infiltration and water intrusion and no flashing treatment is required behind the veneer tie. Flashing may be applied prior to inserting the veneer tie insertion, though, if extra protection from air and water is desired.

After the ties are secured to the steel studs on the interior, it is important to ensure that, if necessary, a floor-line firestop is installed in the stud cavity. **DuPont™ Styrofoam™ Brand Spray Polyurethane Foam "SPF" Insulation (CM Series)** can now be applied in the stud cavity, covering the fire-stop (if installed) back to the floor edge to complete the air barrier, to further seal and insulate the envelope. **Styrofoam™ Brand SPF Insulation (CM Series)** should be applied after the chosen veneer ties are in place. This allows free access for proper attachment of the tie. However, once the ties are in place, bricks can be laid on the exterior while a **Styrofoam™ Brand SPF Insulation (CM Series)** contractor foams a similar portion of the wall on the interior side.

This system of products provides scheduling overlaps that can save significant time on a project, minimizing negative impacts and providing an opportunity for multiple contractors to engage in finishing the exterior wall throughout the project.

CONTINUOUS INSULATION/DRAINAGE PLANE

Installation Recommendations

1. With printed side facing to the exterior, install **Thermax™ XARMOR™ (ci) Exterior Insulation** horizontally with the shiplap edge up (for boards that contact the steel studs).
2. Use maximum board lengths to minimize number of joints. Locate edge joints parallel to and on framing flange. Center end joints over supports. Common practice is to stagger but it is not required.
3. Anchor to exterior face of exterior metal stud wall framing with appropriate fastener. Abut insulation boards tightly together around openings and penetrations.

4. Fasten boards of **DuPont™ Thermax™ XARMOR (ci)** to each support with fasteners spaced 12" o.c. at perimeter and 16" o.c. in the field. Fasteners designed specifically for rigid foam sheathing may be used. Also, use fasteners or washer systems that have passed ASTM E330 wind testing and ASTM E331 water testing. Other fasteners designed specifically for rigid foam sheathing may be used, including those listed in Tech Solutions 513.0: Thermax™ Wall System, which is available at www.thermaxwallsystem.com. See Figure 1 for recommended fastening pattern. Set back perimeter fasteners 3/8" from board edges and ends. One approved fastener/washer can be placed to bridge a maximum of two board edges. Drive fasteners to bear washer tight and flush with surface of insulated sheathing.
5. For optimum performance and to create a water-resistive barrier, seal all end and edge joints, and thru-wall penetrations, such as window and door openings, with **DuPont™ LiquidArmor™ Flashing and Sealant**. Visit our website at building.dupont.com to download detailed installation guides for each of our flashing options.
6. When using **LiquidArmor™**, it is critical to apply at the recommended 50 ±5 wet mils application thickness. At Thermax™ board joints, apply 3 inches (±1 inch) over the joint, making sure that a minimum of 1 inch of LiquidArmor™ covers each side of the joint. Fasteners and washers along the board joints should also be completely covered with LiquidArmor™. Brick anchors can be installed after the application of **LiquidArmor™**. Please refer to *Installation Procedures for LiquidArmor™ Flashing and Sealant* for additional details.
7. **Thermax™ XARMOR™ (ci)** boards should be properly repaired if damaged during installation. Repairs may include applying flashing over a small hole or filling a large hole with a piece of the insulation board and then sealing with flashing.
8. Once sections of insulation boards and flashing are in place, a contractor can begin installing veneer ties. Install barrel type veneer ties with a sealing washer mechanism with the Thermax™ Wall System to ensure a tight seal forms between the foam facer and veneer tie systems. When a veneer tie is near a board joint, cover the jointed area with **LiquidArmor™** or before inserting the brick tie. When a veneer tie is located in the field of the board, the veneer tie with a sealing washer mechanism will typically provide adequate protection from air infiltration and water intrusion and no flashing treatment is required behind the veneer tie. Flashing may be applied prior to inserting the veneer tie insertion, though, if extra protection from air and water is desired.
9. If necessary due to stud placement, the floor line fire-stop should already be installed. Finally, **DuPont™ Styrofoam™ Brand Spray Polyurethane Foam "SPF" (CM Series)** can be applied to the interior of the stud cavity by a qualified SPF applicator.

AIR BARRIER COMPONENT

Installation

The performance of **Styrofoam™ Brand SPF ICC ESR-2670** can be affected by all the component parts of a structure, atmospheric conditions inside and outside the structure, equipment capabilities, and maintenance quality and frequency. Only personnel trained in spray polyurethane foam application should install per DuPont's qualification program.

Safety and Conditions of Use

- Read the instructions and (Material) Safety Data Sheets carefully before use. (M)SDSs for **Styrofoam™ Brand Spray Polyurethane Foam** products are available at www.building.dupont.com. Visit www.spraypolyurethane.com for further details and supporting information covering a wide range of topics including an overview of SPF health and safety guidelines, suggested personal protective equipment (PPE), typical first-aid treatment, and regulations and information about "green" marketing.
- **Styrofoam™ Brand SPF** contains isocyanate, hydrofluorocarbon blowing agent and polyol. Do not breathe vapor or spray. Use only with a NIOSH-approved supplied air respirator (SAR) in accordance with your company's respiratory protection program. Supplied air respirator or an approved air purifying respirator equipped with an organic vapor sorbent and a particle filter (P100) is required to maintain exposure levels below ACGIH, OSHA, WEEL or other applicable limits. For situations where the atmospheric levels may exceed the level for which an air purifying respirator is effective, use a positive-pressure, air-supplying respirator (air line or self-contained breathing apparatus).
- Isocyanate is irritating to the eyes, skin and respiratory system, and may cause sensitization by inhalation or skin contact. Sensitization, or the development of asthma, can lead to permanent respiratory problems.
- **Styrofoam™ Brand SPF** will adhere to most surfaces and skin. Do not get foam on skin. When spraying polyurethane foam, wear MDI-resistant (e.g., nitrile) or fabric gloves coated in nitrile, neoprene, butyl or PVC. Spray applicators and anyone in the spray zone should wear chemically resistant coveralls or full body suits with hoods and MDI-resistant fitted boots or booties. Professional judgment is necessary to determine the appropriate PPE necessary for secondary activities such as cleaning and trimming of the cured foam. Cured foam must be mechanically removed or allowed to wear off in time.
- Proper spray area ventilation and re-entry times must be followed to ensure site safety. Trained applicators may obtain more information by contacting our technical support team.
- **Styrofoam™ Brand SPF** should be installed by a trained SPF applicator.
- Contents are under pressure.

SPF Equipment Guidelines

- The DuPont™ Styrofoam™ Brand SPF (CM Series) drum contents are under pressure. Keep the drums out of sunlight and never use heating devices to warm drums. If the drums should cool below 60°F, allow drums to warm naturally to 60°F-90°F prior to application.
- Position drums to be used in a ventilated area out of rain or sunlight. The use of a sealable drum transfer pump is recommended. A transfer pump long enough for totes will rest on the bottom of the drum. If the extra-long drum transfer pump cavitates as the drum empties, the pump can bounce against the bottom of the drum, leading to damage and subsequent leakage of the contents.
- Open the bung with the proper tool to minimize damage to the bung cap. Open slowly until gas pressure (warm weather) or vacuum (cool weather) is released and then remove the bung cap completely.
- Never leave drums open for longer than 10 minutes. To prevent cavitation of the drum transfer pump, install a desiccated air dryer on the vent cap to keep the drums at atmospheric pressure. If the drum is not kept well sealed, moisture in the air will lead to solids formation in the isocyanate drums (A component), which can plug filters and pump check valves. Open polyol drums (B side) will allow the blowing agent to evaporate, which dramatically reduces foam yield.
- Empty isocyanate drums should be left uncapped prior to cleaning and disposal per local regulations. Ambient air contains moisture, which can combine with the residual isocyanate generating pressure in the drum.
- Keep the drums out of direct sunlight and out of the weather while applying the foam.
- Spray equipment must be capable of delivering the proper ratio (1:1 by volume) of polymeric isocyanate and polyol blend at the recommended temperatures and spray pressures (Table 1). To minimize the potential for off-ratio product, the use of a common drive on the positive displacement pumps of the proportioner is recommended.
- Follow the spray equipment manufacturer's guidelines for all spray operations. Spray units and guns come in a variety of capacities and styles and will require adjustments to achieve the desired spray pattern.

Ambient and Substrate Conditions

Substrate must be at least 5 degrees above dew point, with best processing results when the relative humidity is below

80 percent (<18 percent substrate moisture content if wood or concrete is the substrate). To minimize potential for moisture interference with adhesion of Styrofoam™ Brand SPF (CM Series) to the substrate, spray only when the relative humidity is below 70 percent (<12 percent substrate moisture content if wood or concrete is the substrate).

Surface Preparation

- The steel stud and DuPont™ Thermax™ XARMOR™ (ci) Exterior Insulation substrates must be free of moisture (dew or frost), grease, oil, solvents and other materials that would adversely affect the adhesion of the foam. Poor adhesion will result in stud line cracking of the foam.
- Thermax™ XARMOR™ (ci) and the steel studs do not need to be primed unless the studs are weathered or previously painted. If priming is desired, clean the surface per primer manufacturer's recommendations and use a primer known to be compatible with Styrofoam™ Brand SPF.
- Most untreated and unpainted wood does not need to be primed.
- Substrate temperatures should not exceed 100°F for Styrofoam™ Brand SPF CM 2045 and 60°F for Styrofoam™ Brand SPF CM 2030. Excessive temperatures will lead to fast gel times and low yield.

Application Guidelines

Due to the exothermic reaction of the isocyanate and polyol blend, Styrofoam™ Brand SPF (CM Series) should be applied in layers 1/2" to 1-1/2" thick. Application of one layer of 1-1/2" thick is recommended for optimum yield and performance. Allow the foam to cool completely before applying successive layers. If spraying to full cavity depth, maximum thickness per layer is 2". Excessive thicknesses can lead to void formation and even internal char, reducing the thermal and mechanical quality of the foam.

To minimize void formation where the sheathing is attached to the steel studs, apply foam in the cavity where the steel stud and sheathing meet (picture framing technique) prior to filling the cavity. Allow the foam to fully cool and then spray to the desired thickness by filling in the area between the previously applied foam using a side-to-side motion within each cavity.

Styrofoam™ Brand SPF should be covered as soon as feasible during the construction process. There is no need to wait for any off-gassing of the foam as this happens immediately during application.

TABLE 1: Recommended Processing Parameters – CM 2030, CM 2045

Recommended Equipment • Graco/Gusmer A-20, E20/30, H25/40 proportioner or equivalent • Graco/Gusmer Fusion AP, MP, CS, Probler P2 gun or equivalent • #0.01-0.03 mix chamber or equivalent	Relative Humidity %: <80	Substrate Temp (°F) CM 2030: 30-60 CM 2045: 45-100	Ambient Temp (°F) CM 2030: 30-70 CM 2045: 45-95
Difference Between Ambient and Dew Point Temperatures (°F): >5	Primary Heater Temp (°F): 115-130 ⁽¹⁾	Hose Temp (°F): 115-130 ⁽¹⁾	
Dynamic Pressure "A" (psi): 600-1200 (800 ⁽²⁾)	Dynamic Pressure "B" (psi): 600-1200 (800 ⁽²⁾)	SPF max.: 1.5" thick	Mixing Ratio A/B: 1:1

⁽¹⁾ To minimize potential for stud line cracking, Styrofoam™ Brand SPF CM 2030 should be applied at the higher end of temperature and pressure ranges.

⁽²⁾ Recommended initial pressure.

Cold Weather Application

Applying DuPont™ Styrofoam™ Brand SPF CM 2030 to the interior stud cavity side of DuPont™ Thermax™ XARMOR™ (ci) when outside temperatures are below 30°F can be accomplished with the following precautions:

- Heat the area to be sprayed to ≥30°F for a minimum of 2 hours prior to spraying for both the ambient air and substrate temperature. This is best done with window and doorway areas closed to improve even heating. Dry off any areas that might have formed moisture on the surface before spraying.

- Check the substrates (sheathing and studs) and ensure no moisture condensation is present. After applying the spray foam, maintain the temperature at ≥30°F for 48 hours.

SPF Troubleshooting Tips (see Table 2)

Reduced yield and excessive shrinkage leading to stud line cracking are the more common issues that SPF applicators face. The best rule of thumb is to stop applying foam to the walls if the foam looks different. “Different” would include color changes, color swirls, faster/slower than normal cream, non-circular or smaller/larger than usual spray pattern, foam reversion and poor wetting of the substrate.

TABLE 2: Styrofoam™ Brand SPF Troubleshooting Tips ⁽¹⁾⁽²⁾

Observation	Cause	Potential Issues	Potential Solutions
Color changes	A/B off-ratio	<ul style="list-style-type: none"> • Poor foam properties • Excessive shrinkage • Stud line cracking 	<ol style="list-style-type: none"> 1. Ensure drum transfer pumps are working properly (steady static pressures). 2. Ensure that chemical filters are not plugged and the check valves in the displacement pumps are operating correctly (steady dynamic pressures). A low polyol level will produce foam that is brittle and amber colored. A low isocyanate level will produce foam that is spongy and dark blue in color.
Color swirls	Poor mixing	<ul style="list-style-type: none"> • Poor foam properties • Excessive shrinkage • Stud line cracking 	<ol style="list-style-type: none"> 1. Check the drum chemical temperatures and determine if between 60°F and 90°F. 2. Determine if the dynamic pressures are approximately 800 psi or higher. 3. Determine if the chemical temperatures are between 115°F and 130°F.
Faster/slower than normal cream	High/low chemical temperatures; high/low chemical pressures	<ul style="list-style-type: none"> • Poor yield • Poor foam properties • Excessive shrinkage • Stud line cracking 	<ol style="list-style-type: none"> 1. Verify that drum temperatures are at the appropriate temperature. 2. Determine whether the heater block has the capacity to heat the chemicals to the temperature for spraying at the desired rate. 3. Ensure the line temperatures are operating properly. 4. Ensure that the dynamic pressures are in the recommended ranges. 5. Minimize exposure of the line to direct sunlight or severe cold.
Non-circular or smaller/larger than usual spray pattern	Plugging; high/low chemical temperatures or high/low pressures	<ul style="list-style-type: none"> • Poor yield • Poor foam properties • Excessive shrinkage • Stud line cracking 	<ol style="list-style-type: none"> 1. Check the drum chemical temperatures and determine if between 60°F and 90°F. 2. Determine if the dynamic pressures are approximately 800 psi or higher. 3. Determine if the chemical temperatures are between 115°F and 130°F. 4. Clean gun tip or remove and soak gun's mixing chamber. If mixing chamber cannot be cleaned with solvents, a burn-out oven may be required.
Foam reversion	High chemical temperatures	<ul style="list-style-type: none"> • Poor yield • Poor foam properties • Excessive shrinkage • Stud line cracking 	Foam reversion occurs when the mixing chemicals exit the gun as a froth or foam and then collapse. This is often due to excessively high temperature leading to boiling of the blowing agent in the mixing chamber.
Poor wetting of the substrate	Dirty substrate	Poor adhesion	Clean the substrate.
	Substrate incompatible with SPF	Poor adhesion	Prime the substrate.

⁽¹⁾ Contact equipment supplier if you are unfamiliar with equipment maintenance or these troubleshooting tips.

⁽²⁾ Ensure compliance with all safety recommendations during cleanup of uncured, off-ratio foams including ventilation requirements and restricted site access to those with proper personal protective equipment.



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WARNING: Rigid foam insulation does not constitute a working walkable surface or qualify as a fall protection product.

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