



DOW™-KNIGHT CI-SYSTEM INSTALLATION PROCEDURES

OVERVIEW

Installation of the THERMAX™ Wall System and DOW™-KNIGHT CI-SYSTEM can begin once structural steel and exterior wall steel studs are installed and braced.

By using the all-steel bracing design, a drywall, masonry or siding contractor can begin immediately installing boards of THERMAX™ (ci) Exterior Insulation to the exterior of the building envelope (insulation can be left exposed for up to 180 days). As the contractor applies successive boards, WEATHERMATE™ Flashing 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™ (ci) Exterior Insulation in these areas of the envelope.

Once sections of insulation board and flashing are in place, a strip of WEATHERMATE™ Flashing is adhered to the face of the THERMAX™ (ci) Exterior Insulation in continuous vertical runs at each stud location where a Knight CI-Girt™ will be installed.

Installation of CI-Girt™ can begin as soon as a portion of the THERMAX™ (ci) Exterior Installation is correctly installed and flashed. The building exterior does not need to be entirely covered with exterior insulation prior to commencing installation of CI-Girt™.

CI-Girt™ is then mounted vertically at these locations, fastened through the insulation to the steel studs. Depending on individual contractor productivity rates, installation of the Knight CI-System™ should only lag minimally behind installation of the THERMAX™ (ci) Exterior Insulation. Ensure thru-wall penetrations and openings where excess THERMAX™ (ci) Exterior Insulation has been removed are properly flashed prior to installing CI-Girt™.

Once closed in, the structure has an insulated and weatherized envelope that will allow work to progress quickly on the interior of the structure. Interior conditioning of the building can also begin, which can speed up the work of other trades beyond the exterior walls. Installation of the façade can begin once vertical girts are in place.

If required, a floor-line fire stop can be installed in the stud

cavity after vertical girts are in place. Spray foam can then be applied in the stud cavity (covering the fire stop, if installed) back to the floor edge to complete the air barrier and to further seal and insulate the envelope. Apply spray foam after the CI-System™ is in place to achieve air barrier performance.

Interior spray foam application and exterior façade installation can happen at the same time, starting as soon as girts are in place. This provides scheduling overlaps during which multiple contractors can be engaged in finishing of the exterior wall, providing potentially significant time savings and minimizing negative impacts.

PRODUCT STORAGE RECOMMENDATIONS

THERMAX™ (ci) Exterior Insulation

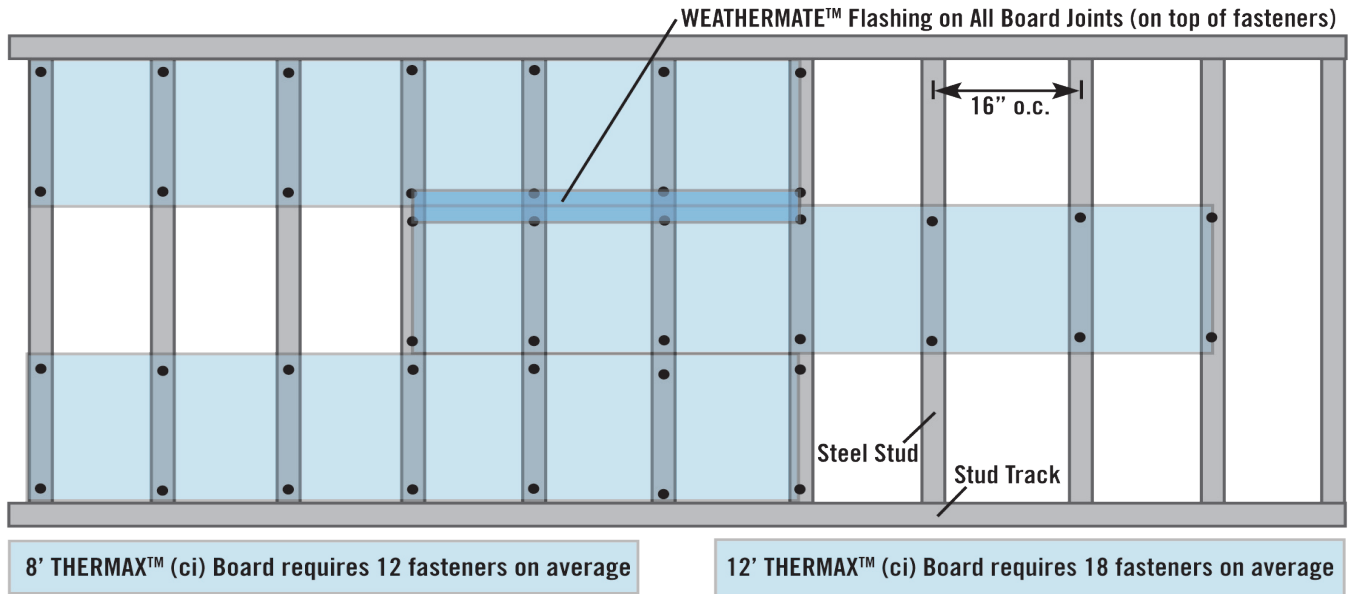
- Do not leave THERMAX™ (ci) Exterior Insulation exposed to direct sunlight for more than 180 days.
- Store above standing water.
- If possible, store insulation boards indoors. If stored outdoors, keep insulation boards tarped or covered to protect from weather.
- If insulation boards get wet, ensure they are fully air dried before covering.
- Insulation boards are lightweight and can be blown around by wind. Weigh down loose boards until they are securely attached to the structure.
- For both indoor and outdoor storage, adhere to all local building and fire codes (references include NFPA 230 "Standard for the Fire Protection of Storage," NFPA 13 "Standard for the Installation of Sprinkler Systems" and applicable ICC or local building codes).

CI-System™ Framing

- Store in a dry location.
- If possible, store exterior framing components and pieces indoors. If stored outdoors, keep components tarped or covered to protect from weather.

Figure 1: Temporary Fastening Pattern for THERMAX™ (ci) Exterior Insulation

TEMPORARY FASTENING: 8' THERMAX™ (ci) Board with 16" o.c. Stud Spacing



NOTE: Please contact Dow for additional temporary fastening requirements if exterior CI-Girt framing will not be installed same day or when unusually high winds or extreme weather conditions are expected.

STYROFOAM™ Brand SPF

STYROFOAM™ Brand SPF (CM Series) has a shelf life of 6 months when stored dry between 60°F and 90°F. Avoid direct sunlight during shipping and storage on the job site. Protect from the weather to prevent moisture from entering drums. Store drums in compliance with local fire and safety requirements.

Exercise caution when opening containers, as pressure may be present when material has been exposed to elevated temperatures. Empty drums are nonreturnable and should be disposed of using current industrial practices in accordance with federal, state or local regulations.

CONTINUOUS INSULATION/DRAINAGE PLANE

Installation Recommendations

1. With printed side facing outwards to building exterior, install THERMAX™ (ci) Exterior Insulation horizontally, with the shiplap edge up (for boards in contact with steel studs).
2. Use maximum board lengths wherever possible to minimize number of joints. Locate edge joints parallel to and on framing flange. Center end joints over supports and stagger each course. Abut insulation boards tightly together around openings and penetrations.
3. Temporarily fasten THERMAX™ (ci) Exterior Insulation boards to exterior face of exterior metal stud wall framing with one Rodenhouse Plasti-Grip (CBW) Washer and appropriate coated fastener at each corner and at top and bottom of board at each stud

location (two fasteners per board per stud - see Figure 1 for recommended fastening pattern). Set back 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. Do not countersink. Other fasteners designed specifically for rigid foam sheathing may be used upon CI-SYSTEM™ manufacturer's written approval only.

4. Do not install more THERMAX™ insulation boards than can be permanently fastened with vertical CI-Girts in the same day. Do not leave insulation overnight or for extended periods that is not permanently fastened to building substructure with vertical girts.
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 WEATHERMATE™ Flashing.
6. **It is critical that flashing be attached in shingle fashion on the face of THERMAX™ (ci) Exterior Insulation and that all thru-wall penetrations are properly flashed to achieve a continuous drainage plane.** A minimum overlap the width of the flashing is recommended. For example, if using 4" wide WEATHERMATE™ Flashing, overlap by at least 4".
7. THERMAX™ (ci) Exterior Insulation boards should be properly repaired if damaged during installation. Repairs may include applying a strip of flashing over a small hole or filling a large hole with a piece of insulation board and sealing with flashing.

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7. If necessary due to stud placement, the floor line fire-stop should already be installed. Finally, STYROFOAM™ Brand Spray Polyurethane Foam (CM Series) can be applied to the interior of the stud cavity by a qualified SPF applicator.

CI-GIRT RAIN SCREEN FRAMING SYSTEM

Framing Component Preparation

1. Use shearing instruments (i.e. snips, nibbler, etc.) for cutting metal framing components. Saws are not recommended, as the sparks produced during cutting will damage the anti-corrosion coating.
2. Minimum length of installed cut CI-Girt is 24”.
3. Minimum length of installed cut RS-Rail is 24” (or 1.5 stud bays). Unsupported span of installed RS-Rail that extends past closest CI-Girt must not exceed 12” in length

Installation Recommendations

NOTE: These recommendations are supplementary to and do not replace project-specific shop drawings. Framing system should always be installed in accordance with shop drawings.

1. Use a laser level or chalk line to mark starting height of CI-Girt. Align bottom edges of all CI-Girts to this line to ensure proper alignment of threaded holes for level installation of horizontal members. The CI-Girt is a symmetrical component, where pre-punched holes are evenly spaced and centered upon the girt.
2. Mount CI-Girts, with 3/4” pre-punched slots and pre-threaded holes facing outward, no greater than 24” on center (at each stud location) over installed THERMAX (ci) Exterior Insulation.
3. Check plumb of CI-Girts parallel and perpendicular to the structure. Adjust using slots in girt to ensure parallel alignment of face of framing.
4. Place ThermaStop thermal isolation washer and stainless steel washer onto self-tapping screws of sufficient length to penetrate through insulation and engage framing stud behind.
5. Using self-tapping screws with washers, attach CI-Girt to stud through very bottom and very top attachment holes (3/4” pre-punched slots).
6. Tighten screws to between 90 and 100 in. lbs. of torque. If installed using a power drill, verify for each installer at beginning of project the proper torque setting of each drill.
7. Engage stud with one self-tapping screw and washer at each remaining intermediate attachment hole (3/4” pre-punched slot), and tighten to between 90 and 100 in. lbs. torque.
8. Where vertical obstructions are present and unavoidable

(i.e. window openings), use laser or chalk line to restart CI-Girt, aligning screw holes to ensure horizontal members will be level.

9. Once first row of CI-Girts is installed, proceed with installation of next level of CI-Girts directly above. Install successive courses of CI-Girts with a 1/4” expansion gap between girt ends, using a plastic shim for spacing. Remove shims below as each successive level of CI-Girts is fully and properly installed.
10. With M8 screws, mount lowest (first) RS-Rail to lowest holes in CI-Girt. Tighten M8 fasteners to between 90 and 100 in/lbs torque. If installed using power drill, verify for each installer at beginning of project the proper torque setting of each drill.
11. Install next RS-Rail, spaced appropriately above the lowest (first) RS-Rail, as indicated on shop drawings or as required for the panel veneer, tightening M8 fasteners to between 90 and 100 in. lbs. of torque.
12. Install successive RS-Rails as indicated on shop drawings or as required for proper panel alignment, tightening M8 fasteners to between 90 and 100 in. lbs. of torque.
13. At windows and other openings mount RS-Rail so that fastening points are as close to the lower and upper edges of the windows and openings as possible.

AIR BARRIER COMPONENT

Installation

The performance of STYROFOAM™ Brand Spray Polyurethane Foam (CM Series) ICC ESR-2670 can be affected by all of a structure’s components, atmospheric conditions inside and outside, equipment capabilities, and maintenance quality and frequency. Only personnel trained in spray polyurethane foam application should install STYROFOAM™ Brand SPF (CM Series) per Dow Building Solution’s qualification program.

Safety and Conditions of Use

- Before use, read the instructions and Material Safety Data Sheets carefully. MSDS for STYROFOAM™ Brand SPF products are available for download at dowbuildingsolutions.com.
Visit 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 Spray Polyurethane Foam contains isocyanate, hydrofluorocarbon blowing agent and polyol. Do not breathe vapor or spray. Use only with a NIOSH-

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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 and other applicable limits. Where 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 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 over time.
- Contents are under pressure.
- STYROFOAM™ Brand SPF should be installed by a trained SPF applicator.

Equipment Guidelines

- Drum contents are under pressure. Keep drums out of sunlight and never use heating devices to warm drums. If drums should cool below 60°F, ensure drums 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, then remove bung cap completely.
- Never leave drums open for longer than 10 minutes. To prevent drum transfer pump cavitation, install a desiccated air dryer on the vent cap to keep drums at atmospheric pressure. If

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 and generate pressure in the drum.
- Keep 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 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 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 relative humidity is below 70 percent (<12 percent substrate moisture content if wood or concrete is the substrate).

Surface Preparation

- Steel studs and THERMAX™ (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 polyurethane foam. Poor adhesion will result in stud line cracking of the SPF.
- THERMAX™ (ci) Exterior Insulation and steel studs do not need to be primed unless studs are weathered or previously painted. If priming is desired, clean surface per primer manufacturer's recommendations and use a primer known to be compatible with spray polyurethane foam.
- Most untreated and unpainted wood does not need to be primed.

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- Substrate temperatures should not exceed 120°F for STYROFOAM™ Brand SPF CM 2060, 100°F for CM 2045 and 60°F for 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 sheathing is attached to the steel studs, apply foam in the cavity where 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 (CM Series) 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.

Overspray Notes

Overspray can lead to several problems on the job site if not controlled properly. Overspray will coat all surfaces in a room and if windows and doorways are left open, the overspray can reach other rooms and vehicles outside the building.

Cover objects near the application area that might be coated with overspray. Excessive overspray can accumulate on areas

that are intended for spray foam application. Overspray can be brittle and may affect the adhesion of the spray foam on oversprayed substrates. When spray foam is applied to an area coated with excessive overspray, delamination can result.

To minimize overspray, do not apply STYROFOAM™ Brand SPF (CM Series) if there is air movement in the room from wind or fans. Point the gun perpendicular to the surface being sprayed and as close as possible without causing spattering or a popcorn pattern.

Cold Weather Application

Applying STYROFOAM™ Brand SPF CM 2030 to the interior stud cavity side of THERMAX™ (ci) Exterior Insulation 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 1: RECOMMENDED PROCESSING PARAMETERS – CM 2030, CM 2045 AND CM 2060

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 CM 2060: 60-120	Ambient Temp (°F) CM 2030: 30-70 CM 2045: 45-95 CM 2060: 60-100
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

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TABLE 2: STYROFOAM™ BRAND SPF TROUBLESHOOTING TIPS⁽¹⁾

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"> Ensure drum transfer pumps are working properly (steady static pressures). Ensure chemical filters are not plugged and check valves in displacement pumps are operating correctly (steady dynamic pressures). Low polyol level will produce brittle and amber-colored foam. Low isocyanate level will produce spongy and dark-blue colored foam.
Color swirls	Poor mixing	<ul style="list-style-type: none"> Poor foam properties Excessive shrinkage Stud line cracking 	<ol style="list-style-type: none"> Check drum chemical temperatures and determine if between 60°F and 90°F. Ensure dynamic pressures are approx. 800 psi or higher. Ensure chemical temperatures are between 115°F & 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"> Verify drums are at appropriate temperatures. Determine whether heater block has capacity to heat chemicals to temperature required to spray at desired rate. Ensure line temperatures are operating properly. Ensure dynamic pressures are in recommended ranges. Minimize exposure of 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"> Check drum chemical temperatures and determine if between 60°F & 90°F. Ensure dynamic pressures are approx. 800 psi or higher. Ensure chemical temperatures are between 115°F & 130°F. Clean gun tip or remove and soak gun mixing chamber. If gun 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 OR Substrate incompatible with SPF	Poor adhesion	<ol style="list-style-type: none"> Ensure substrate is clean. Prime incompatible substrates appropriately.

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Dow Polyisocyanurate Insulation

CAUTION: This product is combustible and shall only be used as specified by the local building code with respect to flame spread classification and to the use of a suitable thermal barrier. For more information, consult MSDS, call Dow at 1-866-583-BLUE (2583) or contact your local building inspector. In an emergency, call 1-989-636-4400.

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

STYROFOAM™ Brand Spray Polyurethane Foam contains isocyanate, hydrofluorocarbon blowing agent and polyol. Read the instructions and Material Safety Data Sheets carefully before use. Wear protective clothing, gloves, goggles and proper respiratory protection. Supplied air or an approved air-purifying respirator equipped with an organic vapor sorbent and a particle filter is required to maintain exposure levels below ACGIH, OSHA, WEEL or other applicable limits. Provide adequate ventilation. Contents under pressure. STYROFOAM™ Brand SPF should be installed by a trained SPF applicator.

Building and/or construction practices unrelated to building materials could greatly affect moisture and the potential for mold formation. No materials supplier, including Dow and Knight Wall Systems, can give assurance that mold will not develop in any specific system.



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