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GRIFFOLYN® REINFORCED VAPOR RETARDERS

UNDER SLAB   WALLS   ROOF DECKS

Protect Your Building Envelope From The Destructive Forces Of Nature

Assured System Performance

About Reef Industries

Does your structure require special consideration in terms of vapor control? Does your vapor control system require high performance materials and the expertise to properly implement them? If so, no company is better able to support your efforts than Reef Industries, the pioneer and industry leader in reinforced laminates and composites for vapor retarder applications.

Founded as the original division of Reef Industries in 1957, Griffolyn introduced a newly patented process to manufacture internally reinforced film laminates. The result was high strength, lightweight and ruggedly durable materials that offered easy to use and cost effective solutions to vapor control problems. The heavier and more tedious to install materials then in use, were rapidly replaced as Griffolyn systems became recognized as the state of the art technology.

Over the years, new technologies and innovations spawned a variety of new manufacturing techniques and product lines. The increasing scope and range of production capability encompassed additional product offerings and in 1976, the corporate identity of Reef Industries, Inc. was adopted.

Reef Industries is headquartered in Houston, Texas and operates six product divisions including Griffolyn. A state-of-the-art manufacturing facility and two fabrication plants support a worldwide sales network. Technical support and research groups, staffed by knowledgeable engineers and chemists, work closely with the most experienced sales department in the industry. This team is uniquely qualified to provide extensive support services to Griffolyn specifiers and customers.

CONTACT INFORMATION

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CONSIDERATIONS FOR DESIGNERS AND SPECIFIERS

Moisture Problems in Buildings

Each year, countless building owners suffer the problems associated with material and systems failures due to moisture. Anyone who has faced a shutdown or limited use of their facility due to a wall system, roof assembly or flooring failure can attest to the cost and inconveniences involved. There is much to motivate design professionals to utilize every available means to avoid and minimize the potential for these problems:

- Inconvenience to the owner/client
- Monetary loss from disrupted operations
- Bad publicity
- High repair costs
- Adverse effects on indoor air quality
- Design liability exposure and litigation
- Potential impact on “Errors and Omissions” insurance premiums

Water Vapor Migration

One of the primary functions of the building thermal envelope is to maintain desirable temperature and humidity for occupant comfort. Within the range of temperatures encountered in buildings, water may exist as a vapor, liquid or solid.

Moisture-related problems in buildings may arise from:

1. The presence of too much moisture
2. Changes in moisture content
3. Effects of a change of state, such as freezing within wall cavities
4. Deterioration of materials due to corrosion of metals, or rotting of wood framing

In the design, specification and construction of the building envelope, the behavior of moisture must be considered, particularly the occurrence of condensation. Problems may arise when moisture comes into contact with a cold surface such as a window, or within outdoor walls or roof-ceiling assemblies. Condensation within walls that enclose air conditioned spaces must be considered in warm humid climates.

Moisture moves in air due to differences in vapor pressure, but also with movement of the air itself. The causes of air motion through construction assemblies must be considered, especially infiltration and exfiltration at windows, doors and other penetrations of the building envelope.

Vapor Retarders and Air Barriers

Most building materials are permeable to moisture. Porous materials that become saturated with moisture lose their insulating ability and may not regain it when dry. Walls are particularly susceptible, and moisture migration should be prevented or minimized by use of low permeance membranes, called vapor retarders (formerly referred to as vapor barriers). A vapor retarder is a material that has a flow rating of one perm or less (1 perm = 1 grain/hr·ft^2·in Hg vapor pressure difference). Permeability of one perm is often still too high for a vapor retarder to be effective in most building applications. A lower permeability rating is generally required. As a general rule, vapor retarders should be installed as close as possible to the side of the assembly through which moisture enters. Air barriers are designed to stop the movement of air, which can cause not only convective heat flow, but movement of large volumes of moisture along with the air.

Permeability, Strength, Durability, Fire Retardancy

Low permeability, high strength, and durability are the primary selection and specification criteria. Additionally, building code provisions may sometimes require use of materials which are fire retardant. Vapor retarders should be selected according to their intended performance, as determined by recognized, industry standard test methods.

The investment made in selecting and specifying an effective vapor retarder system during the design and construction process are only pennies per square foot. The cost of corrective measures required by improperly installing a vapor retarder, installing the wrong vapor retarder, or not installing one at all, has proven to be many dollars per square foot.

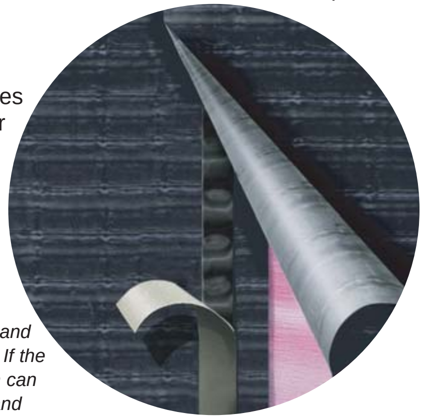
NOTES TO SPECIFIER: *Careful placement and sealing of vapor retarder materials is essential to ensure effective moisture vapor control. Perforation of the membrane for any reason will limit its effectiveness and can be responsible for failure at the time of installation. The use and placement of vapor retarders should be determined by a qualified design professional familiar with their use, and with local climatic conditions. In no case should two non-permeable materials be used in the same assembly since moisture could be trapped between them, resulting in extensive damage. By design, Griffolyn Vapor Retarders are not "breathable" (vapor permeable) and are not appropriate for use where breathable materials are required.*

THE GRIFFOLYN® SYSTEM

Griffolyn® Vapor Retarder Materials

The main components of the Griffolyn system are several grades of high performance polyethylene vapor retarder material made of HDPE (high density polyethylene), LDPE (low density polyethylene), or LLDPE (linear low density polyethylene). They are reinforced with a heavy-duty polyester cord grid for high strength and durability. Vapor retarders can be manufactured in sizes to meet project requirements up to 200 feet x 200 feet (61 m x 61 m), greatly reducing the number of in-field seams and the potential for failure.

Fab Tape™



Fab Tape is an asphaltic mastic which creates a durable field seam between multiple vapor retarder sections and for sealing around penetrations. Proper installation is imperative to ensure optimal bonding and sealing.

Fab Tape Application

Both Griffolyn surfaces must be clean and dry. *On a dirty surface the tape will adhere to sand and dust instead of the Griffolyn Vapor Retarder Material. If the surface is wet, pockets of moisture are created which can thermally expand and contract, degrading adhesion and destroying the seal.*

Warm temperatures promote better initial adhesion. *Fab Tape will reach maximum bond strength in about 24 hours when ambient temperatures exceed 60°F (15°C). In ambient temperatures below 60°F (15°C), longer bonding times should be expected, unless supplemental heat is applied.*

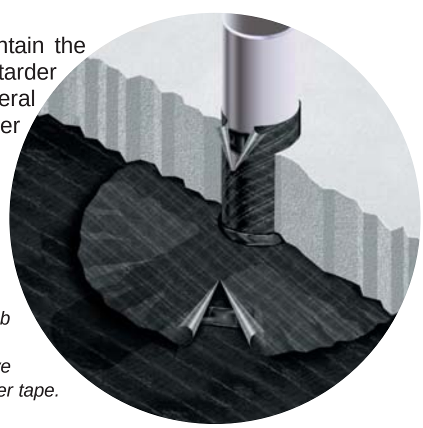
Proper grading of the subgrade beneath the vapor retarder is essential for optimal sealing. *A rough, rutted or lumpy sub-grade can cause wrinkles and gaps which make it difficult to achieve an effective bond.*

Placement of Fab Tape during installation.
Lay both vapor retarder sections over a smooth surface with a 6 inch (150 mm) overlap. Fold the top section back and apply the Fab Tape 4 inches (100 mm) back and parallel to the edge of the bottom section. Smooth out any gaps or voids while applying the tape. Remove the release paper and firmly press the top section to the bottom while maintaining even tension to avoid gaps which could cause leaks. Allow adequate time for complete bonding before subjecting the seam to substantial stress.

Griff Tape ™

Griff Tape is a self-adhesive tape used to repair holes in the vapor retarder caused by jobsite damage. The tape helps to assure an effective seal around the building envelope.

Pipe Boots



The application of pipe boots helps to maintain the integrity and performance of the vapor retarder system. Pipe boots are available in several sizes compatible with Griffolyn Vapor Retarder Materials.

Installation of pipe boots. *Attach Fab Tape around perimeter of the boot and remove the backing paper. Be sure the ends of the tape overlap each other. Lower the boot over the pipe and press the boot material firmly to the vapor retarder material around the pipe. Lower the tube section and wrap Fab Tape around the pipe. Place the tape to allow some slack when the boot is raised above the tape. Remove backing paper. Raise the tube section and secure over tape. (See special instructions for Type-65G.)*

Transguard® 4000

The American Concrete Institute (ACI) recommends maintaining satisfactory moisture content during concrete curing for best results. Lack of sufficient moisture may cause cracking, dusting, scaling and crazing. Transguard 4000 is a strong, lightweight, re-usable, wet-cure cover with a high water retention rate that helps maintain appropriate moisture levels during the concrete curing process. Transguard 4000 is totally synthetic to avoid concrete staining common to other covers.

NEW ENVIRONMENTAL CONSIDERATIONS

Indoor Air Quality

An important issue receiving a lot of attention lately is the subject of so-called "sick building syndrome". It can have many causes including dangerous molds, bacteria, mildew, gasses given off by building materials, and inadequate ventilation. Indoor air quality (IAQ) problems don't just make a building "sick"; they also carry with them a high degree of human health risk. There is growing evidence that many of these problems are made worse, if not caused by, unwanted moisture in buildings. Much of this moisture enters through exterior walls and floor slabs. Mold, mildew, and other organisms feed on organic materials in the building. They often flourish in wall cavities and in the dark, moist environment under flooring materials and carpeting.

Radon Control

Radon gas is a naturally occurring by-product of the decay of uranium in the soil. It can enter buildings through cracks in foundation walls and floor slabs. High levels of radon in buildings have been linked to increased risk of lung cancer. The use of vapor retarders can effectively reduce the amount of radon entering a building when used as part of a complete radon control system.

Increased Energy Efficiency

Energy conservation efforts over the past decade have seen advances in the understanding of building performance. The use of blower doors, pressure diagnostics, and targeted air sealing has helped with energy conservation. Since water vapor contains a large amount of heat energy (latent heat of vaporization), a major component of any energy efficiency program is the control of airborne movement of moisture.

Non-solvent Flooring Adhesives

Effective Jan. 1, 1996 chlorinated solvents that have been a part of flooring adhesives for many years could no longer be manufactured in the United States. Adhesive manufacturers now use either water-based or "100% solids" formulations. A disadvantage of these formulations is that they may re-emulsify in the presence of water penetrating the floor slab from below, causing the floor system to fail prematurely.

Flooring materials have changed, too. Materials such as vinyl asbestos tile (VAT) which were "breathable" have been replaced by vinyl composition tile (VCT) which is not vapor permeable. These materials are highly susceptible to failure from condensation forming underneath the floor covering. An effective vapor retarder below concrete slabs is now more important than ever.

SOURCES OF VAPOR RETARDER PROBLEMS

By understanding some of the pitfalls surrounding the effective installation of vapor retarders, specifiers can head off potential problems and failures. Contractors must install vapor retarder systems correctly by following the project specifications and the manufacturer's installation recommendations. Some of the most common problems of vapor retarder systems include:

1. Placing concrete on a vapor retarder rather than an absorptive base such as sand or gravel increases the water "bleeding" period. Concrete finishers sometimes poke holes in the vapor retarder to allow water to disperse so they can start work sooner.

2. Workers often puncture the vapor retarder with stakes while placing edge forms and reinforcing bar supports.

3. Vehicular traffic before and during concrete placement can rip thin, non-reinforced plastic sheets or cause underlying sharp aggregate to make thousands of tiny perforations in the vapor retarder material.

4. Unsealed openings may occur along lapped edges of the vapor retarder, at intentional penetrations for pipes, conduits, outlet boxes and at the floor-wall intersection. The vapor retarder should be pulled up and sealed to the footing or foundation wall.

UNDER SLAB APPLICATIONS

Natural soil capillarity can allow large volumes of moisture to contact the underside of a slab. Properly formed capillary breaks within the soil foundation system, combined with a high performance vapor retarder, are the first lines of defense. Without an under slab vapor retarder, moisture can be forced upwards under pressure into habitable space. Mineral salts from the ground and from the concrete itself can be transported through the slab to the underside of the flooring system causing visible efflorescence and staining.

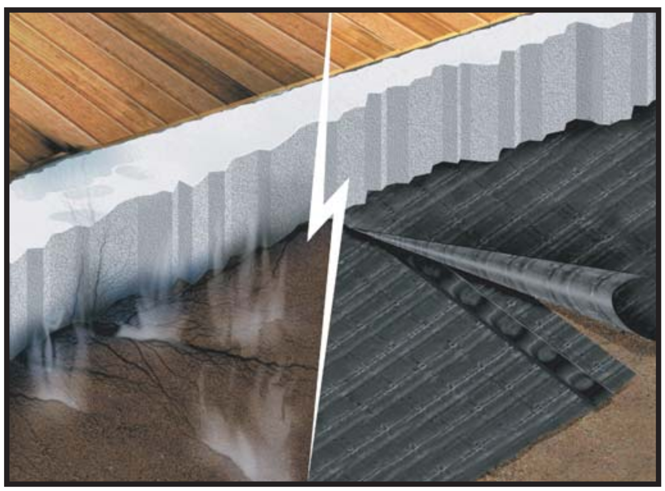
Some of the problems commonly associated with moisture migration through the slab include:

- Deterioration of flooring adhesive
- Bumps, ridges or bubbles under flooring
- Color changes
- Mold, mildew and bacteria growth
- Peaking, curling, or warping of flooring
- Efflorescence (build-up of mineral salts)

The majority of flooring failures result directly from a high emission of moisture from the concrete slab. It is said that moisture is the largest single problem in the flooring and coated surfaces industries today.

Many of the vapor retarders installed under building slabs do not perform adequately due to improper placement or puncturing. Ineffective vapor retarders will not reduce permeability enough to control even the small amount of moisture it takes to interfere with the bond integrity of modern flooring systems.

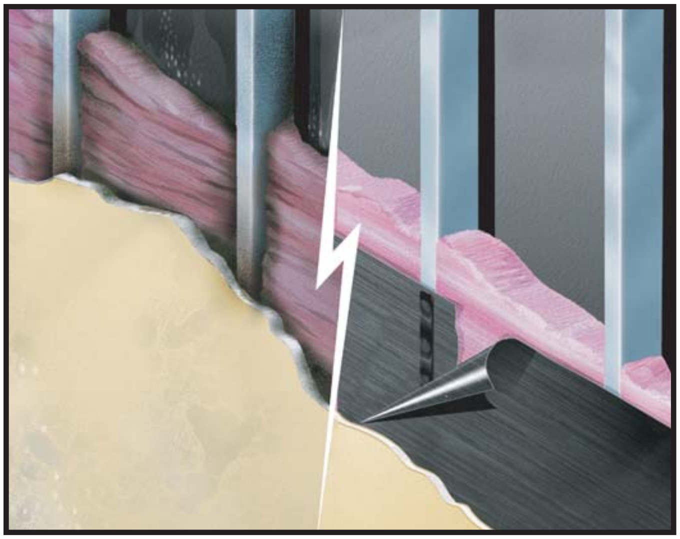
The need for an under slab vapor retarder in high humidity areas with high water tables is well understood. However buildings in arid climates also need vapor retarders. Air conditioning the interior of the structure creates a significant difference in vapor pressure which can cause moisture to be drawn out of the ground (an area of relatively high vapor pressure) through the slab and into the space above (an area of low vapor pressure). Landscape irrigation systems, planters, broken plumbing pipes and other water sources can lead to moisture problems, even in arid regions.



The majority of flooring failures result directly from a high emission of moisture from the concrete slab. Slab moisture is the largest single problem in the flooring and coated surface industries today. The low permeance and high strength of Griffolyn under slab vapor retarders effectively control under slab moisture infiltration, preventing expensive flooring failures.

All major flooring manufacturers have specifications requiring moisture tests before installation of their flooring materials. Even if new concrete is allowed to dry to the point where flooring can safely be installed, the absence or improper installation of a vapor retarder can lead to expensive failures later. Research into moisture-related flooring failures has shown a high correlation between the severity of the failure and the absence of a vapor retarder. Buildings without a vapor retarder will not necessarily have moisture problems. However, buildings with vapor emission problems are usually found to have inadequate vapor retarders.

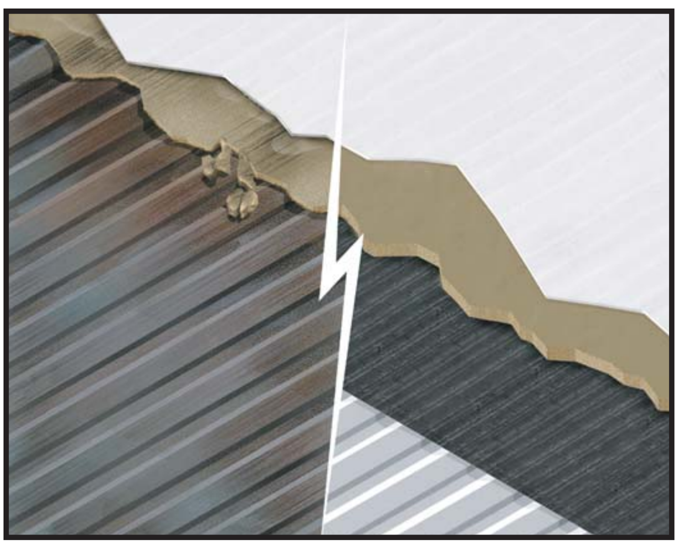
There are two ASTM standards for vapor retarders under concrete slabs, ASTM E-1745-97 "Standard Specifications for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs". ASTM E-1745-97 list three classifications which may be used to specify vapor retarders. The second standard is ASTM E-1643-98 "Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs". (See the Product Description & Application Selector Guide)



Moisture Infiltration in wall cavities can result in mold and decay problems. Damaging moisture is introduced into wall cavities through air leaks and vapor diffusion. Griffolyn vapor retarders effectively control moisture infiltration into the building envelope.

"Caution: Do not rely on sheet polyethylene as a primary vapor retarder. During temperature cycling and exposure to air, polyethylene deteriorates and cracks resulting in an ineffective seal."

SpecGUIDE 07190 - Vapor Retarders
The Construction Specification Institute (CSI)



Moisture in the roof assembly can cause structural corrosion, staining, mold and mildew growth and saturated insulation. A Griffolyn vapor retarder system can stop water vapor from causing loss of insulation performance, structural damage and other moisture-related problems.

Fire retardant vapor retarder materials may be required by building codes. Consult the building code authority having jurisdiction for more information.

WALL APPLICATIONS

Properly protecting the building envelope from mold and degradation caused by moisture infiltration usually requires the use of a vapor retarder in wall assemblies. This is especially true in regions where there is a substantial difference between inside and outside moisture levels, which can create a large vapor pressure differential.

Moisture is introduced into walls through both air leaks (convection) and vapor diffusion. Of these two methods, air leaks present a greater potential for causing moisture damage. It is estimated that air leakage through a hole of less than one square inch can allow passage of up to nearly eight gallons of water into the building envelope over the course of a single heating season. A high quality vapor retarder might be able to eliminate condensation caused by diffusion, but even an excellent vapor retarder is of little use if it can be bypassed by convective currents.

Griffolyn vapor retarders effectively control air leaks and vapor diffusion to reduce the amount of moisture infiltration into the building. The effectiveness of the vapor retarder will be greatly affected by the number of penetrations through the material made during installation. All penetrations should be sealed with a pipe boot, Fab Tape, or Griff Tape before finishing the wall.

The location of a Griffolyn vapor retarder in the structure depends upon whether the building is to be located in a predominantly heating climate or cooling climate. The concept is to keep the vapor retarder on the warm side of the dew point to prevent condensation on cold surfaces inside the wall. The same consideration applies when placing vapor retarders in roof deck assemblies. For design standards and more information, consult the ASHRAE "Handbook of Fundamentals" published by The American Society of Heating, Refrigeration and Air Conditioning Engineers.

ROOF APPLICATIONS

Some buildings generate large amounts of moisture as a result of activities or processes they contain. Examples include natatoriums, manufacturing facilities, certain industrial processes and food plants. As a result of condensation which can occur within the roof assembly, these buildings may experience problems with saturated insulation, structural corrosion, staining, mildew growth, and other moisture-related problems.

An effective vapor retarder system located on the warm side of the dew point can stop water vapor from reaching a temperature or location where it can cause loss of insulation performance or serious damage. For many years the National Roofing Contractors Association (NRCA) has maintained that vapor retarders should be considered for use in low-slope membrane roof assemblies where:

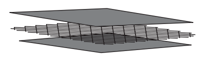
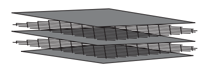
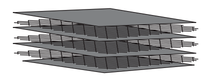
- *The outside average January temperature is below 40 degrees F (4°C), and the expected interior winter humidity is 45% or greater.*

ASHRAE has also developed design criteria for low sloped roofs. Consult their "Handbook of Fundamentals" for methodology on use of vapor retarders. NRCA recommends that when ASHRAE guidelines are followed, the vapor retarder:

- *permeability rating should approach 0 perm*
- *should be completely sealed at side and end laps*
- *should be sealed and flashed at all roof perimeters and penetrations*
- *should envelope the vertical edges of insulation boards*
- *must be able to resist damage from hot asphalt or specified adhesives*
- *should be chemically compatible with conventional roofing materials*
- *may need to have good adhesion and shear properties*

PRODUCT DESCRIPTIONS

Vapor Retarder Products

Griffolyn® Type-65	Griffolyn® Type-85	Griffolyn® Type-105
Type-65 is a reinforced 3-ply polyethylene, general purpose vapor retarder which meets the strength and permeance requirements for most applications.	Type-85 is a reinforced 5-ply vapor retarder which offers greater strength and lower permeance for a higher level of integrity in under slab and roofing applications.	Type-105 is a reinforced 7-ply vapor retarder which is engineered to deliver the extra strength and extra low permeance needed to meet the additional requirements of wood flooring, special coatings and special flooring systems.
		

		Type-65	Type-85	Type-105
07220	Roof & Deck Insulation	■	■	■
07410	Metal Roof & Wall Panels	■	■	■
07420	Plastic Roof & Wall Panels	■	■	■
07460	Siding	■	■	■
07500	Membrane Roofing	■	■	■
07610	Metal Roofing	■	■	■
09250	Gypsum Board	■	■	■
09500	Ceilings	■	■	■
09620	Specialty Flooring	■	■	■
09640	Wood Flooring	■	■	■
09650	Resilient Flooring	■	■	
09660	Static Control Flooring	■	■	■
09670	Fluid Applied Flooring	■	■	■
09680	Carpet	■	■	
09950	Wall Coverings	■	■	

NEW PRODUCTS!

Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

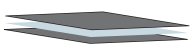
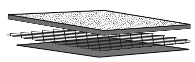
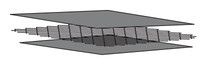
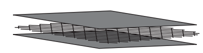
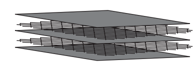
"ASTM E-1745-97 REQUIREMENTS"

Criteria	Test Method	Class A	Class B	Class C
Water Vapor Permeance	ASTM E-96	0.3 perms	0.3 perms	0.3 perms
Tensile Strength	ASTM D-882	45.0 lbf/in	30.0 lbf/in	13.6 lbf/in
Puncture Resistance	ASTM D-1709 Method B	2200 grams	1700 grams	475 grams

"GRIFFOLYN VAPOR RETARDER PERFORMANCE"

Criteria	Test Method	15 mil GREEN	10 mil GREEN
Classification		Class A	Class A&B
Water Vapor Permeance	ASTM E-96	0.018 perms	0.027 perms
Tensile Strength	ASTM D-882	58 lbf	45 lbf
Puncture Resistance	ASTM D-1709 Method B	3100 gm	2270 gm

Fire Retardant Products

Griffolyn® VAPORguard®	Griffolyn® Type-65G	Transguard® 4000	Griffolyn® Type-55 FR	Griffolyn® TX-1200® FR	Griffolyn® Type-90 FR
VAPORguard is specifically engineered to combine high density polyethylene and aluminum to provide an extremely low permeance for special applications such as radon protection, cold storage, museums, and computer rooms.	Type-65G combines the high performance of Griffolyn high density reinforced polyethylene with a non-woven geotextile for an under slab vapor retarder with superior puncture resistance.	Transguard 4000 Concrete Curing Covers have a higher moisture retention than burlap, requiring less frequent re-wetting which helps to maintain the correct moisture level for proper concrete curing.	Type-55 FR is a reinforced 3-ply general purpose fire retardant vapor retarder for use in walls, ceilings and roof assemblies.	TX-1200 FR is a reinforced 3-ply vapor retarder which offers greater strength and lower permeance. Qualifies as a Class I building product for a higher level of integrity in walls, ceilings and roof assemblies.	Type-90 FR is a reinforced 5-ply vapor retarder which is engineered to deliver the extra strength and extra low permeance required in applications with extreme temperature variation.
					

NOTES TO SPECIFIER: *When specifying products from the above CSI Master Format sections, please consult the specific product manufacturer regarding their requirements for vapor retarders. Some manufacturers require the presence of a vapor retarder before they will warrant their product.*

"SURFACE BURNING CHARACTERISTICS"

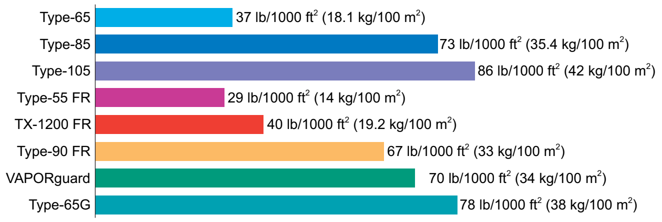
Griffolyn Type-55 FR, TX-1200 FR and Type-90 FR pass NFPA 701 Large Scale "Standard Methods of Fire Tests for Flame-Resistant Textiles and Films." They have a Class I / Class A Flame Spread Rating per UBC-42 and ASTM E-84.

Product	Flame Spread	Smoke Developed
Type-55 FR	10	70
TX-1200 FR	10	45
Type-90 FR*	5	135

* Class II / Class B

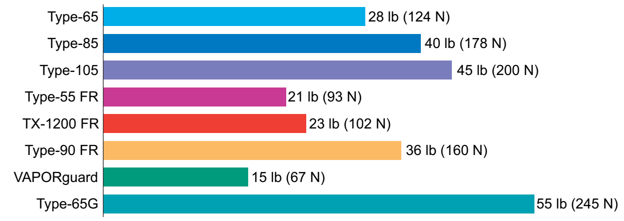
Physical Properties & Typical Values

ASTM D-3776 / Weight



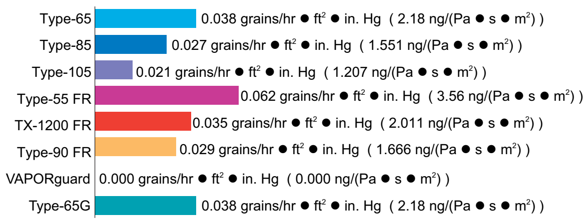
D-3776 is the procedure used for calculating the weight of the material.

ASTM D-2582 / Puncture Propagation Tear



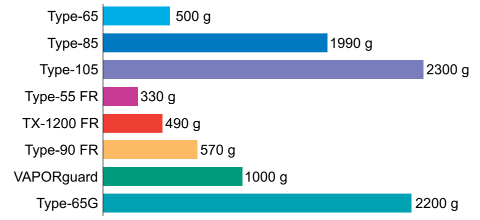
D-2582 determines the dynamic tear resistance of the material when subjected to end-use snagging-type hazards.

ASTM E-96 / Permeance (PERM)



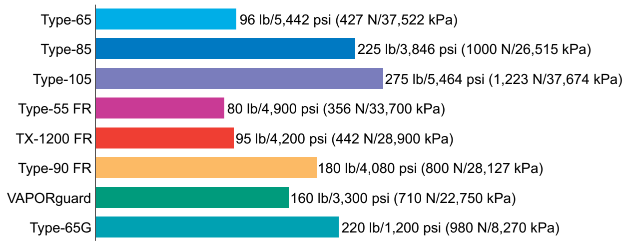
E-96 determines the rate at which water vapor passes through a material 73.4° F, 50% RH

ASTM D-1709 / Puncture Resistance



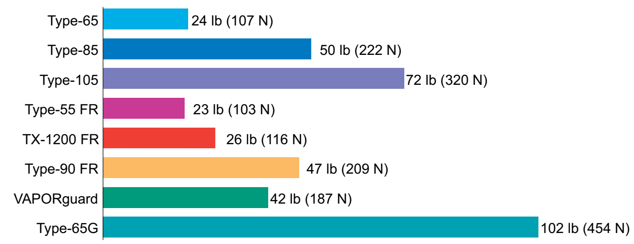
D-1709 determines the performance of the material when impacted by an object.

ASTM D-882 / 3" Tensile Strength



D-882 measures the ability of the material to resist a tensile-type load.

ASTM D-4833 / Puncture Strength



D-4833 measures the ability of the material to resist punctures.

Units in parentheses are metric for compliance on government projects.

Call Today for Samples and Specification Guide

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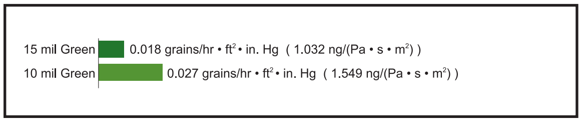
email: ri@reefindustries.com

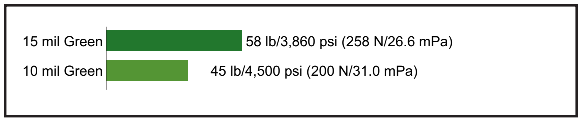
Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

ASTM E-1745-97

Permeance
ASTM E-96 (B)
(ASTM E-154 Section 7)



Tensile Strength
ASTM D-882
(ASTM E-154 Section 9)



Puncture Resistance
ASTM D-1709
Method B