Loose Applied Membranes with Protected Membrane over Monolithic Concrete Decks

Building codes often require a specific slope. Some existing decks will require tapered insulation to achieve the code mandated slope or to overcome a negative drainage situation. A cost effective solution is to use a loose applied single-ply membrane with tapered insulation over the concrete deck.

When this solution is proposed, T. Clear Corp. will provide a 10-year Total Performance Warranty, if the system is installed by a T. Clear Authorized Contractor; and the following conditions are met:

1. The membrane is currently approved and is installed in accordance with T. Clear Corp. Specifications for EPDM or Thermoplastic membranes.
2. A peel and stick or other adhered asphalt-based vapor barrier,* with a thickness of 20 mil or greater, is bonded to the concrete deck prior to the application of the tapered or other insulation. (See T. Clear Specification C-MB-1-AD)
3. Total average insulation R-Value beneath the membrane is no more than 50% of the total R-Value of the system. (Note: for high humidity applications a specific analysis of the system is required to determine R-Values that bring the dew point above the membrane.)
4. All deck penetrations shall be sealed to prevent air infiltration. (See T. Clear Tech Note #20 for details)

Exceptions to No. 2 and No. 3 will be considered where there is limited vapor drive and/or mild climatic conditions. T. Clear Corp. does not approve dead level decks with loose applied membranes.

* Currently acceptable vapor barriers are W.R. Grace Ice & Water shield, Hyload PMVB, Tamko Moisture Guard, Malarkey Artic Seal, Jiffy Seal, any modified bitumen self-adhering membrane, any one/two-ply BUR vapor barrier. Check membrane manufacturer for compatibility.

Securement Details for HEAVY**GUARD**® Ballasted Roof Insulation Jobs

The increased weight of HEAVY**GUARD**® provides increased win stability. The securement requirements for HEAVY**GUARD** remain the same as LIGHT**GUARD**®. Therefore, always follow the current published strapping requirements for LIGHT**GUARD**.

This note will address differences that using HEAVY**GUARD** instead of LIGHT**GUARD**, will entail. The main differences in the two products are: 1) its finished thickness and 2) its increased board weight.

1) Consideration must be given to the increased thickness where clearance heights are critical. The finished product thicknesses are listed below. The use of HEAVY**GUARD** over the membrane surface may require that access doors will have different threshold heights than those normally designed for LIGHT**GUARD**.

2" HEAVYGUARD [1] ~ 3" finished
3" HEAVYGUARD [1] ~ 4" finished

The increased thickness of the latex modified concrete topping of the HEAVY**GUARD** changes the dimensions of our normal fasteners. Corrosion-resistant curling fasteners that lock beneath the concrete surface are the present fastener of choice. The TPR-2 fastener is acceptable for this application. The TPR Peel Rivet is available from SFS Stadler, 800-648-6032.

2) The dead-load/live-load issue is one of great importance whether in new construction or retrofit. T. Clear LIGHT**GUARD** weighs 4.5 psf and the HEAVY**GUARD** weighs approximately 11psf. This weight factor must be considered when in the design stage of construction.

[1] All HEAVY**GUARD** products are special orders. Please contact T. Clear Corp. for availability and lead time.

Recover Systems:
LIGHT**GUARD**® Recover Over Existing Mechanically Attached Single Ply Membranes

General
Codes allow only two roofs. This system, therefore, is designed to go over an existing, mechanically attached system. Prior to construction, the roof shall be surveyed for moisture; all saturated* insulation shall be removed and replaced with the same type of insulation as in the original installation. The deck shall be surveyed by others and declared sound. Record of the moisture and deck survey shall be provided by the contractor of record.

Wood or Steel Decks
The primary assumption with mechanically attached systems on wood and steel decks is that there is no air barrier under the membrane, but the membrane can be made into an air barrier.

The old, mechanically attached membrane will become the air barrier in the new system. Therefore, the existing membrane must be intact and reasonably watertight. Any existing splits and tears should be repaired with standard repair techniques for the existing membrane. If the existing membrane has shattered or is otherwise permeable, the system or the area of damage must be covered with minimum 6mil polyethylene sheet.

Over the existing or repaired system, mechanically attach a rigid insulation board to the structure deck. Minimum requirement is installation to the uplift requirements of Factory Mutual 1-60. Table 1 specifies the number of fasteners required. Figure 1 shows fastener placement. Fasteners must be corrosion resistant and exceed the minimum corrosion requirements of Factory Mutual. Table 2 shows approved recovery boards and insulations.

Note: Before specifying extruded polystyrene over steel deck, determine if a fire classified system exists below the existing membrane. Some classified systems include: minimum 0.5 inch gypsum board, 0.25 inch Dens Deck, 1.2 inch polyisocyanurate foam, 1 inch wood fiber, and 1 inch perlite.

The new membrane must be installed loose laid or fully adhered over the new rigid insulation. LIGHTGUARD® is installed over the membrane according to current T. Clear specifications for systems over loose laid membranes.

Concrete, Lightweight Concrete, Concrete T's, or Poured Gypsum Decks
The primary assumption is that the deck serves as an air barrier. Therefore, all perimeters and penetrations shall be made airtight, before proceeding with the re-cover.

After determining that all penetrations are airtight, proceed with installation of an approved insulation over the existing membrane system. The insulation shall not be mechanically fastened; it must be loose laid over the membranes.

Warranties
Re-cover systems, installed according to T. Clear Specifications, are eligible for T. Clear's Total Performance Warranty (10 year maximum).

* The insulation shall have greater than 80% of its original R-Value as defined by New Wetting Curves for Common Roof Insulation's: Tobiasson et. al.; Published in Third International Symposium on Roofing Technology. Alternatively drying curves developed and provided to T. Clear Corp. at Notice of Award must show the insulation completely drying in less than two years.

TABLE 1: FASTENERS REQUIRED

Exposure B: City, Suburban								
3 Second Gust ASCE 7-02	**Fasteners, per 8 square feet**							
Basic Wind Speed	**85**	**90**	**100**	**110**	**120**	**130**	**140**	**150**
Building Height (ft.)								
0 – 15	2	2	2	2	2	*2*	*2*	**N**
>15 – 30	2	2	2	2	*2*	*2*	*2*	**N**
>30 – 45	2	2	2	2	*2*	*2*	*2*	**N**
>45 – 60	2	2	2	2	*2*	*2*	*2*	**N**
>60 – 75	2	2	2	*2*	*2*	*2*	**S**	**N**
>75 – 90	*2*	*2*	*2*	*2*	*2*	*2*	**S**	**N**
>90 – 120	*2*	*2*	*2*	*2*	*2*	*2*	**S**	**N**
>120 - 150	*2*	*2*	*2*	*2*	*2*	**S**	**S**	**N**
Exposure C: Open, Flat								
3 Second Gust ASCE 7-02	**Fasteners, per 8 square feet**							
Basic Wind Speed	**85**	**90**	**100**	**110**	**120**	**130**	**140**	**150**
Building Height (ft.)								
0 – 15	2	2	2	2	*2*	*2*	*2*	**N**
>15 – 30	2	2	2	**2**	*2*	*2*	**N**	**N**
>30 – 45	2	2	2	**2**	*2*	**S**	**N**	**N**
>45 – 60	2	2	2	**2**	*2*	**S**	**N**	**N**
>60 – 75	2	2	**2**	*2*	*2*	**S**	**N**	**N**
>75 – 90	*2*	*2*	*2*	*2*	**S**	**S**	**N**	**N**
>90 – 120	*2*	*2*	*2*	*2*	**S**	**S**	**N**	**N**
>120 - 150	*2*	*2*	*2*	*2*	**S**	**S**	**N**	**N**

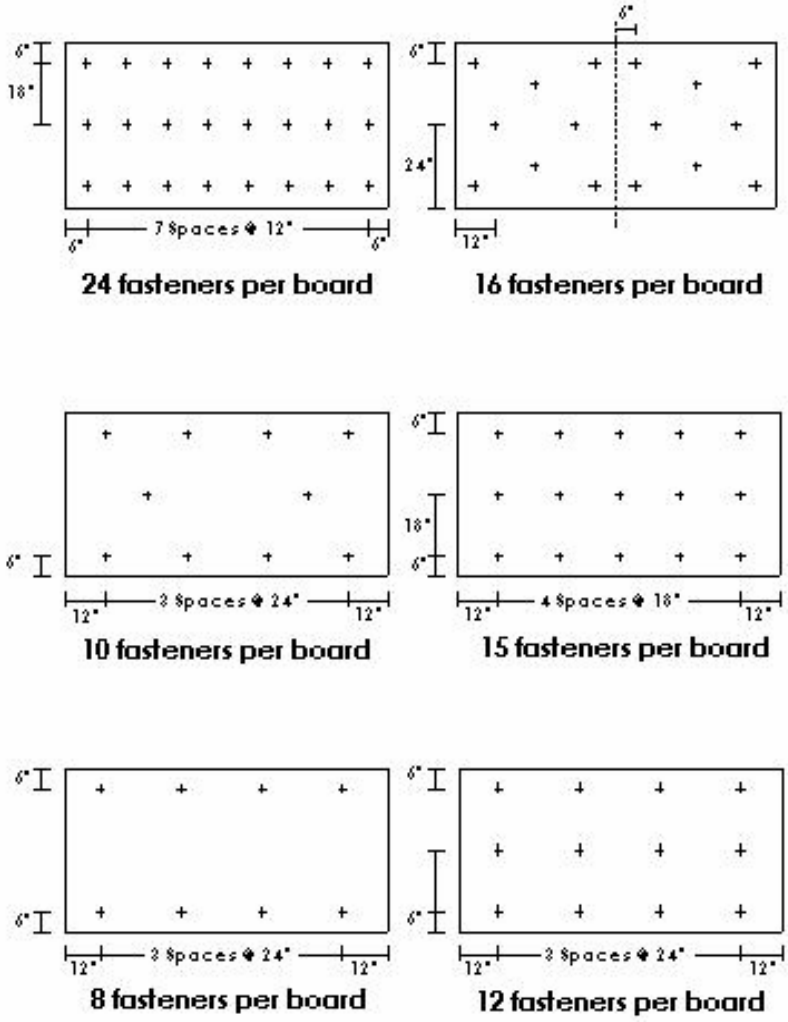
TABLE 1 KEY		
	2	50% more fasteners in corners.
	2	Double fasteners in corner area, 50% more within 8 feet of perimeter.
	2	Do not install LIGHT**GUARD** if parapet height is less than 3 feet in this wind zone.
	S	Do not install LIGHT**GUARD** if parapet height is less than 3 feet in this wind zone. Fastener pattern determined by latest FM wind load approval for 1-135 or higher requirements.
	N	Do not install LIGHT**GUARD** in this wind zone.

TABLE 2: APPROVED RECOVER INSULATION

Insulation	Minimum Thickness	Type
Extruded Polystyrene	1”	ASTM D578 Type 4
Dens Deck & Gypsum Board	.5”	
Iso Board	1.2”	

FIGURE 1

Fastener Placement 4 x 8 ft. (1.2 x 2.4m) boards.



REPAIR OF DAMAGED CONCRETE SURFACE ON LIGHT**GUARD**® / HEAVY**GUARD**® ROOFING

LIGHT**GUARD** / HEAVY**GUARD** Protected Membrane Roof Systems will frequently develop micro cracks in the concrete surface during shipping and handling. These cracks are cosmetic only and do not affect the long-term performance of the roofing material. Most cracks are only visible during drying periods after a rain or snowfall. When the boards are totally dried, the cracks disappear. If, however, the boards are broken during installation, we recommend that they be replaced.

It is not unusual to encounter broken corners or edges of the concrete surface. Cracking and chipping are natural and cannot be entirely eliminated from cement products. The appropriate repair of chips should ensure the long life of the LIGHT**GUARD** / HEAVY**GUARD** Roof Insulation. These damaged areas should be repaired as soon as possible in order to protect the exposed Styrofoam brand plastic foam from degradation is due to prolonged exposure to sunlight. If the foam is not damaged, coat with an outdoor latex paint.

The broken or damaged area of the concrete may separate cleanly from the surface of the Styrofoam or it may break away, tearing the foam and causing a portion of the foam to be removed while still bonded to the broken piece of concrete. In either case, the broken piece should be replaced and/or the damaged area be repaired as soon as possible.

If the broken piece can be retrieved, the repair technique can be simply a matter of bonding the piece back into place using VULKEN 116 SEALANT, by Mameco International as the adhesive. This repair technique can be simply accomplished during most seasons of the year following manufacturer's instructions.

Before bonding the broken piece back into place, clean both surfaces to be bonded and be sure that they are dry. The preferred method for adhesion application is by using a cartridge of VULKEM 116 SEALANT, extruding a ¼" bead around the perimeter of broken area, and immediately placing the broken piece into position using firm pressure to assure adhesive transfer and good fit. If the broken area is larger than a nominal 8" x 8", then it is advisable to also extrude a bead of mastic in the center portion of the damaged area before replacing the broken piece.

The recommendation for repairing broken concrete areas when the broken piece cannot be found or is not usable is to use a latex modified mortar mix. The most popular and easily attainable admixture for concrete is Acryl* 60, produced by Standard Dry Wall Products. However, any good acrylic latex admixture having 20% used to dilute the latex. Use straight Acryl* 60 as purchased to mix the cement/sand mixture into a workable slurry for easy application. A recommended dry mix proportion is 3 parts of concrete sand (ASTM C-144) and 1 part of Type 1 Portland Cement ASTM C-150 (do not use air entrained cement). Place with a flat metal towel and float or texture finish with a wood float. Do not make repairs if temperatures are below 45°F for a minimum of 72 hours to ensure good initial curing. Cover and adequately protect repaired area if temperatures are expected to drop near freezing point within the first few days of repair.

VEGETATION CONTROL ON PROTECTED MEMBRANE ROOFING SYSTEMS

Protected Membrane Roof Insulation systems require periodic inspection and maintenance to assure optimum performance and appearance. It is extremely important to keep the roof and drains free of debris. The media necessary for the germination of ugly vegetation, with rotting of leaves and constant barrage of blowing grit on the roof surface, can be abundant in the cracks and crevices of the surface. The two herbicides that are recognized to control the unsightly vegetation on the surface are:

1) SURFLAN® is a pre-emergent herbicide (applied to seed) for the control of annual grass and broadleaf weeds that germinate from seed. The mixture to be sprayed should consist of a mixture of 1.5 – 2.0 ounces of herbicide per gallon of water. All instructions and cautions on the manufacturer's label should be followed.

2) ROUNDUP® is a herbicide that is sprayed directly on the leaves. Spraying should be done in a manner to ensure uniform and complete coverage. Plants should not be sprayed so that the spray solution runs off. The mixture to be sprayed should consist of a mixture of 2.0 – 2.5 ounces of herbicide per gallon of water. All instructions and cautions on the manufacturer's label should be followed.

Application suggestions are:

1) In the spring (April or May), Surflan should be applied to the areas where growth is expected. (i.e.: perimeter of roof, penetration, drains and valleys.)
2) In the summer (June or July), a Surflan / Roundup mix can be used in areas of growth. This mixture is a 1:1 mixture of the two herbicides diluted as described above.
3) In the fall (August or September), Roundup should be applied to plant leaves to kill residual growth.

If vegetation control has not been a part your roof maintenance program, the above regimen may have to be followed. Once growth has been observed to be under control, spring and fall treatment may be all that is necessary to uphold the appearance of your roof.

STRESS RELIEVING OF LIGHT**GUARD**® / HEAVY**GUARD**® PANELS TO ACCOMMODATE SLIGHT IMPERFECTIONS IN THE MEMBRANE OR DECK

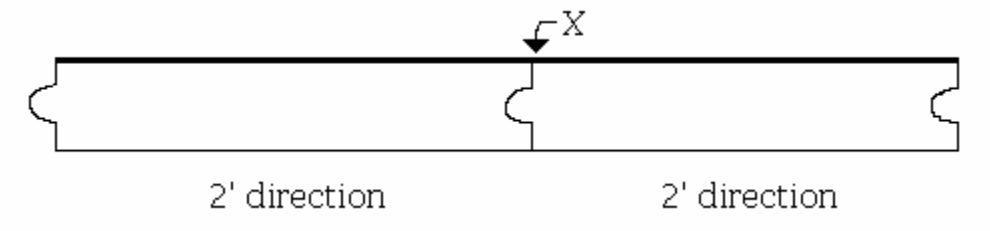
LIGHT**GUARD** / HEAVY**GUARD** panels are by nature a rigid walk-able surfaced membrane overlay board composed of a 2' x 4' extruded Styrofoam board with a 3/8" and 15/16" thick concrete top. On some applications, cracking has been observed as the board is asked to span humps in the deck substrate or thick seams of certain membranes and stay intact while traffic is applied to its surface. In reality, the concrete cracks and the foam contours itself around the imperfection without breaking. Over time, the crack collects dirt and becomes visible. The crack in the concrete does not pose a product integrity problem, only an aesthetic one.

The LIGHT**GUARD** and HEAVY**GUARD** panels are able to span imperfections of 1/8"x 1". Larger areas may have to be corrected for by alleviating the foam side of the board using a rasp, wood-carving head for a small electric grinder, or hot knife. To accomplish this, the LIGHT**GUARD** board can be placed in position and imperfection etched into the foam bottom by applying slight foot pressure directly over the raised area. Remove the LIGHT**GUARD** board, and remove the etched area in the foam using the above described instruments. Replace the LIGHT**GUARD** board and check that the LIGHT**GUARD** is sitting flat. This procedure should allow the board to sit flat on the membrane surface and will help prevent cracking due to uneven deck/substrate.

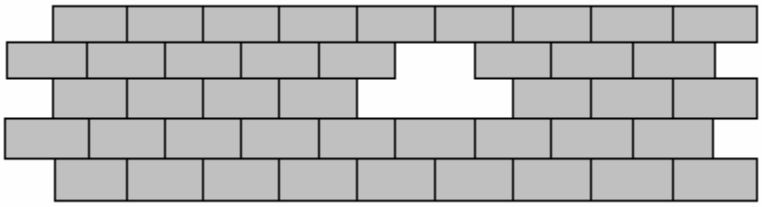
Rasps can be purchased at auto-finishing or woodworking stores. These are manual instruments and come in assorted sized and shapes and are self cleaning by design. The wood-carving attachment for the small rotary grinder is available through EIFS dealers or through Demand Products (800-325-7540). Care must be taken with the grinder wood carving instrument as there is rapid removal of the foam surface and sharp blades. Appropriate hand and eye protection should be used.

How Do I Get That LIGHT**GUARD**®/HEAVY**GUARD**® Replaced and Resecured Without All That Extra Strapping?

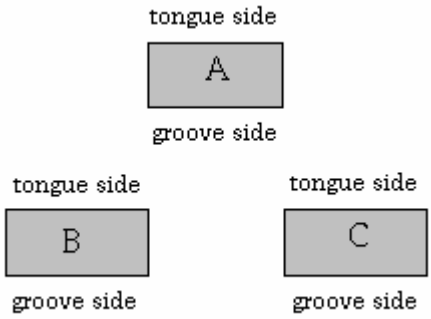
Damaged LIGHT**GUARD** or HEAVY**GUARD** boards exist in an area of the roof array. Using a sharp knife, remove a damaged board's tongue along the four foot direction as illustrated below at "X". Care must be taken so that the knife blade does not puncture the membrane. The damaged board can now be removed from the array using a pry tool.



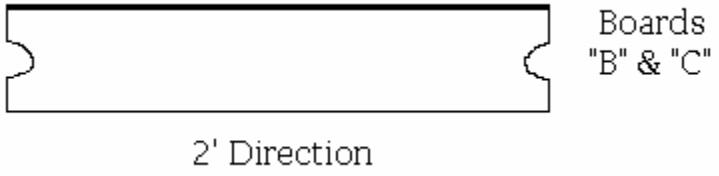
The system array can now be disassembled in order to remove any other damaged LIGHT**GUARD** / HEAVY**GUARD** boards by lifting out the surrounding boards. The system can now be reassembled with undamaged units until there are three boards left to be replaced and the opening resembles the illustration below.



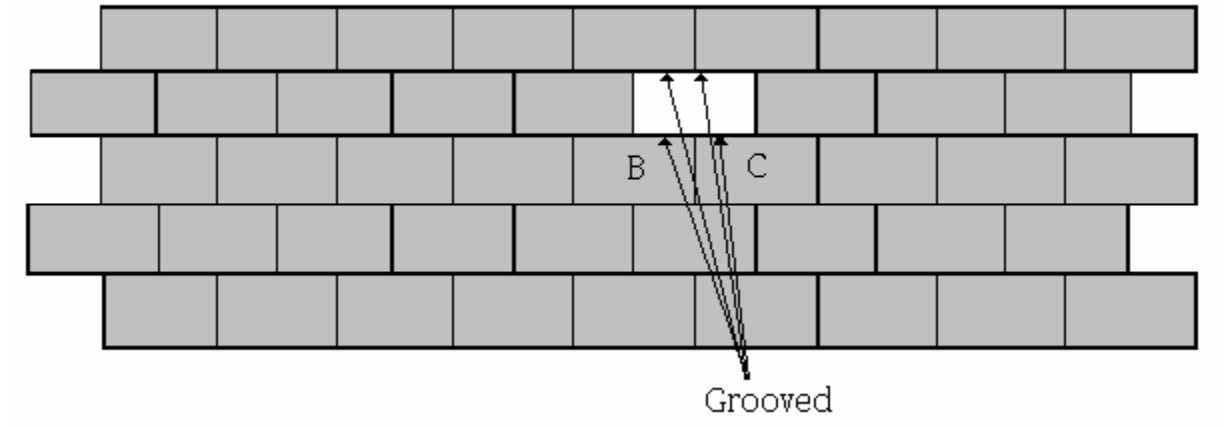
The final three good boards in the replacement array must have the tongues facing in this direction.



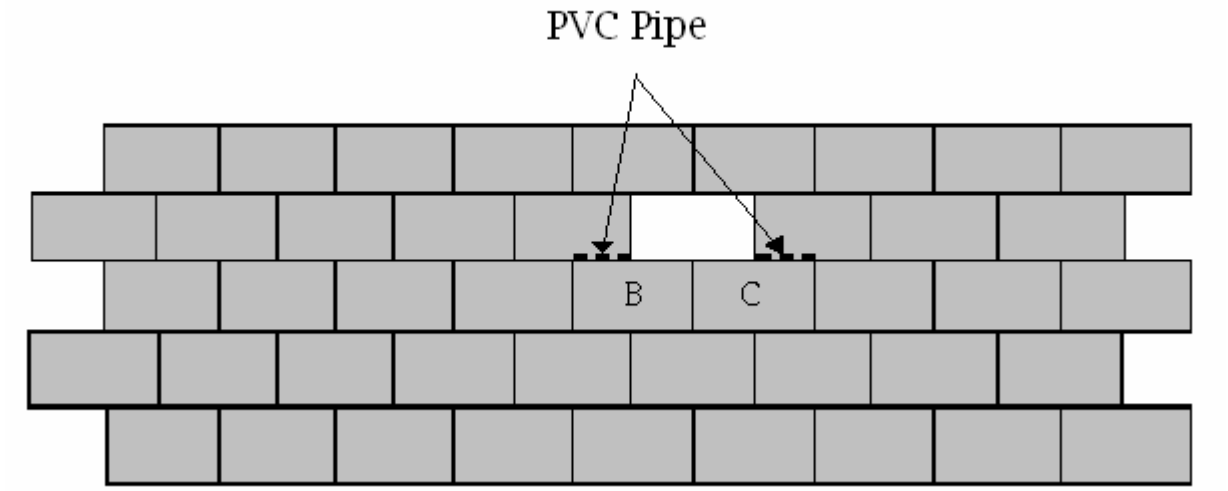
Two of the remaining boards (B & C) have their tongues removed and corresponding grooves inserted in the foam part of the LIGHT**GUARD** / HEAVY**GUARD** so that both the 4' long edges are grooved on both sides. This can easily be done with a handheld hot knife containing a long blade bent to conform to our factory groove. Boards "B" & "C" should have a cross-sectional profile as shown below.



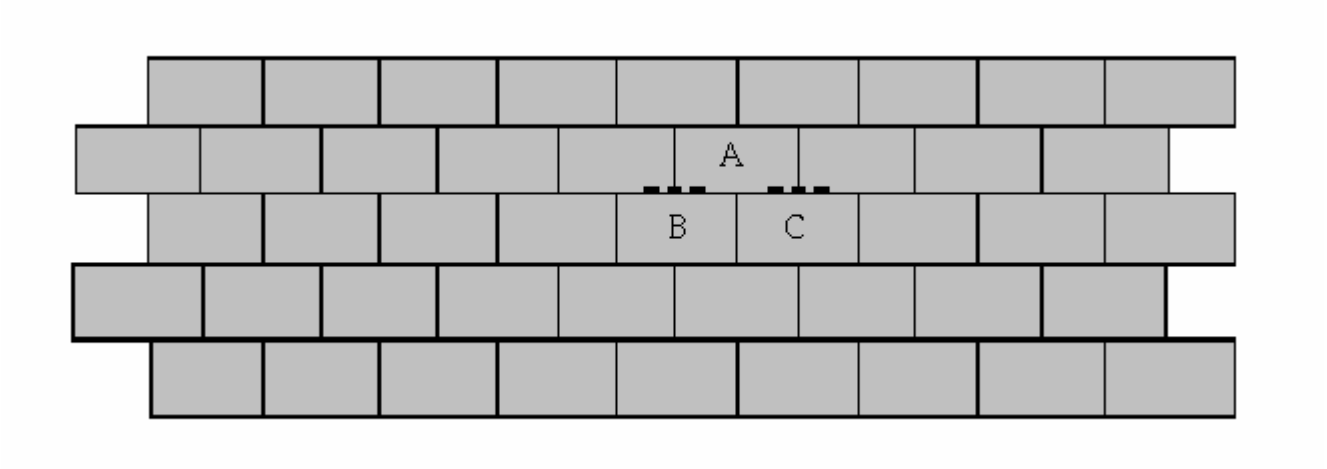
Boards "B" & "C" are placed into the system and the remaining hole for "A" will have grooves on both its 4' long edges.



Two pieces of ¾" plumbing PVC pipe are cut 24" in length. These pieces of pipe are the replacements for the missing tongues in the system. The 24" pieces are slid in the holes formed by the removed tongue/fabricated groove openings of "B" & "C" above, as indicated by the illustration below.



Finally, board “A” is installed into the hole with the tongue in its normal position. Using a knife blade, the PVC pipes are slid 12” laterally forming a partial tongue that will prevent the system from coming apart. This securement replacement is to be used for replacement boards in the field of the roof and is not intended as a possible replacement for normal securement as described in Technical Data Sheet 4.4.



**Note:* In perimeter replacements (within 20’ from an exterior wall), on applications having wind ranges in excess of 110 mph, or on applications having System 3 securement, consult T. Clear Technical support (800-544-7398) before using this technique.

LIGHT**GUARD**®/HEAVY**GUARD**® Roofing On Coal Tar Roof Membranes

Necessity is the mother of invention. The protected membrane roof was invented because the coal tar was leaking through deck openings into a building and damaging product stored there. In 1952, John Best of The Dow Chemical Co. created the first experimental LIGHT**GUARD**® Roof when he placed Styrofoam® coated with mortar over the coal tar on the roof and stopped this drip of the coal tar. Twenty-one years later, the roof coated with Styrofoam was still performing like new.

Today, 56 years after John Best's experiment, LIGHT**GUARD** still performs the same function of keeping coal tar from moving on the roof and leaking into the building or drains.

LIGHT**GUARD** can be placed directly over old or new coal tar membranes. A coal tar BUR membrane covered with LIGHT**GUARD** is one of the most trouble free systems available. Several older coal tar roofs had insulation up-grades by covering the roof with LIGHT**GUARD** in the late 70's and are still performing today. Many new roofs were built with coal tar BUR and LIGHT**GUARD** top covering during the same era, that have had no problems. The coal tar BUR and LIGHT**GUARD** roof has been the only roof specification of several architects, because their customers have no problems with this roof.

Coal tar is a substitute for Type 3 asphalt in all of our BUR specifications. There are a few unique requirements for coal tar:

1. Coal Tar BUR. Slope is limited to ¼" per foot.
2. The membrane must be covered with a minimum 4mil polyethylene bond breaker sheet, and LIGHT**GUARD** should not be placed over recently re-saturated coal tar without these precautions.
3. If the existing insulation beneath the coal tar BUR membrane is greater that R-10 have the T. Clear Tech department check the amount of insulation required over the membrane to achieve membrane temperature stabilization.

T CLEAR CORPORATION
LIGHTGUARD®
Protected Membrane Roofing Systems

TECH NOTES

Adhesives for use with STYROFOAM® brand plastic foam 11/07

The question regarding what adhesives should be used with STYROFOAM in any given application is a question that is often asked by customers, architects, and suppliers. It is a question that must be addressed from many points of view.

T Clear Corporation recognizes that there is a vast array of high quality adhesives suitable for use with expanded polystyrene foam. Many of these adhesives are formulated to perform as a general purpose adhesive in many different applications with a variety of substrates. Others are for very specialized purposes. It is our belief at T Clear that the ability to make a recommendation for one of these adhesives over the other would require more information than is reasonably available to us. The continuous performance quality of an adhesive is the responsibility of the manufacturer. Therefore, the only recommendation we can rightfully make is to use an adhesive that the manufacturer claims as compatible with polystyrene foam.

The user needs to be aware of a few basic considerations when selecting an adhesive. Foremost on this list is the adhesive's chemical compatibility with the polystyrene foam. The adhesive must not attack and cause cavitations of the polystyrene foam during the curing process. Open time and cure are other areas of consideration. Open time is the amount of time the user has from adhesive application to assembly completion. Cure time refers to the time period from the assembly to when the bond reaches optimum strength. The user should also consider the environment of the bond after it is cured. Does it need to withstand freeze/thaw cycles that would be common in the outdoors during the winter? Will water or high moisture levels affect the adhesive during or after it is cured? Will the adhesive need to remain pliable after cure to allow for slight movement in the assembly? The manufacturer generally considers these variables plus many others when formulating an adhesive. It is the responsibility of the user to determine if the adhesive chosen is suitable for the intended application.

T Clear does not recommend a particular adhesive for the use with STYROFOAM brand plastics. However, previous laboratory evaluations have shown certain adhesives to perform well with STYROFOAM. These adhesives demonstrated little or no cavitations to polystyrene foam at cure temperatures below 100˚F. The bond strength of these adhesives after cure was greater than the tensile strength of the foam.

The following is a list of these adhesives and their manufacturers:

DAP BEATS the NAIL	DAP Inc.	(800) 543-3840
DAXCEL 161D Foamastik	Dacar Products Co., Inc	(412) 922-2536
DAXCEL Foamgrab PS Adhesive	Dacar Products Co., Inc	
Henry #117	W. W. Henry Co.	(800) 232-4832
Henry #317	W. W. Henry Co.	
INSTA-STICK	The Dow Chemical Co.	(888) 868-1183
LN 601, 901 and 915	MACCO Adhesives SCM Corp.	(800) 634-0015
QB-300	Ohio Sealants, Inc.	(800) 321-3578
PL Premium	Ohio Sealants, Inc.	
PL300	Ohio Sealants, Inc.	
OLYBOND	OMG	(800) 633-3800
Pliodeck	Ashland Chemical	(800) 322-6580
Sonneborn 200	ChemRex, Inc.	(800) 433-9517
Titebond	Franklin International	(800) 347-4583

Latex-base, non-flammable adhesives.
One-part urethane-based nonflammable adhesive.