SILVER LLC
McGEE
CONSULTING

Monday, February 13, 2017

[redacted]
[redacted]
[redacted] NY [redacted]

Re: Roofing system at [redacted] NY [redacted]

Dear [redacted],

At your request, I inspected the recent roof installation at the above address on 1/30/2017. My inspection focused on the cause of several leaks that occurred since the roof was installed.

The roof system on the house was recently replaced less than 18 months ago. The roof replacement consisted of installation of a new, single ply, TPO membrane roof on the first floor (deck level). A wood deck was then installed over this new TPO membrane. Three new, steep slope, metal panel pyramid roofs were installed over east second floor bedroom, the west second floor bedroom and the open-air gazebo on the deck.

The roof starting leaking soon after installation. Leaks occurred adjacent to the chimney and at the ceiling on the first floor below the deck at the west end of the house. Ceiling damage occurred in the garage at the east end of the house and moisture stains appeared on the cathedral ceiling in the second floor east bedroom.

I viewed several roof deficiencies due to substandard roof installation and design:

- There was no proper counter flashing installed at the exterior door of the west bedroom. The single ply roof membrane was extended up the wall to the door saddle and then terminated without proper securement or covering. This deficient condition required repair that was installed just prior to my visit. The repair consisted of securing the membrane to the wall with a termination bar and mechanical fasteners. The termination bar was then sealed with caulk. This is a standard method to secure the vertical flashing membrane to a wall. However, the height of the termination bar is only 5 inches. When a door saddle is less than 8” above the roof level, proper installation would require that a counter flashing pan is installed under the door saddle and over the vertical membrane. This door saddle pan can be constructed of either metal or TPO membrane. Proper installation of the counter flashing requires removal of the door and adjacent siding, then installation of the flashing pan, then re-installation of the door and siding.
- Along the entire perimeter of the new TPO membrane roof at the base of the parapet wall the membrane was not extended up behind the wood shingle wall siding. This resulted in the top edge of the membrane being 3” inches or less in height. There appeared to be no mechanical fasteners used to secure the vertical section of the


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com

membrane. There appeared to be no sealant used to prevent water from entering behind this top cut edge of the membrane. There was, in some locations, a 3-inch wide strip of aluminum slipped in under the wood siding and over the top edge of the roof membrane. This aluminum strip was a meager and insufficient attempt to construct a proper counter flashing. Single ply roof manufacturers typically require a minimum of 8 inches of membrane flashing up a wall (or a membrane height above anticipated water levels). The roof proposal included 'up to 12"' of flashing membrane on the walls. This would have been a proper flashing height for Northeast U.S. weather conditions. To extend the membrane properly up the wall would have required removing the wood shingles and then reinstalling wood shingles covering the top edge of the vertical wall membrane. This was not done. No wood shingles on the wall were impacted. The membrane was terminated too low and the small aluminum strip was insufficient as a counter flashing. Water seepage is likely occurring at numerous locations at the base of the parapet wall with excessive seepage occurring during the winter months and during heavy rain.

- The metal insulated flue (chimney) was flashed with excessive applications of sealant. This metal flue requires a proper pipe wrap flashing (see below Carlisle detail). The contractor apparently attempted to seal the flue penetration using only sealant. This sealant is not specified as a roof membrane or flashing and is to be use only to seal small openings and seams. Water leakage at the chimney (flue pipe) appears to be due to improper flashing of the flue penetration.
- The steep slope metal roof over the east bedroom has a ventilation system incorporated into the structure. This roof ventilation is required due to the cathedral ceiling below. Proper ventilation is required to prevent heat and moisture from being trapped in the cathedral ceiling. A proper vent in the wood soffit at the bottom of the steep roof slopes was installed when the house was constructed. The vent at the top of the roof slopes was constructed by cutting an opening in the roof sheathing, terminating the roof panels at the opening and then constructing a small raised roof section at the top of the pyramid overhanging the lower roof panels and opening in the roof sheathing. This is a standard and accepted venting detail for this type of roof system. However, because the opening in the sheathing is on the same plane as the roof panels, windblown precipitation can infiltrate into the opening in the roof sheathing. A proper ridge vent detail for a metal panel roof requires some sort of block against windblown precipitation. Often the panels are "boxed" at the tops by bending the top of the panel vertically or a separate metal closure is installed at the top of the panels under the ridge. This method prevents windblown precipitation from easily entering in the opening that is on the same plane as the panels. Air will still be able to vent up and over the closure or boxed end of the panels (see below detail for a similar ridge vent on metal panel roofs).
- The wood sleepers under the wood walkway deck planking is inhibiting drainage and creating ponding water in between the sleepers. Though a strip of TPO membrane


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com

was attached to the bottom of the sleepers (to protect the membrane), the narrow (2") side of the sleepers are resting directly on the roof. The narrow edge of the sleeper will now likely depress into the roof system creating troughs. Wood sleepers that are installed over an insulated single ply roof system require that wood blocking be installed under the wood sleepers in place of the insulation (see below, GAF TPO detail and Carlisle EPDM detail). This wood blocking below the membrane is to properly support the wood sleepers and prevent depression in the roof system. When installing overburden of this type on an insulated roof, the over burden must be designed to have its weight spread out to ensure the overburden does not depress into the roof system. This is especially necessary when the wood blocking under the membrane is not installed to support the overburden. Again, if wood blocking is installed under the membrane located directly under the overburden, the overburden will not depress into the roof system (as shown on the below details). The depression that will occur on this roof will now fill with ponding water. The water that does not drain from beneath the sleepers will now cause accelerated deterioration to the wood and roof system, with the worst damage due to the freeze and thaw of this water during the winter months.

- The continuous nature (from wall-to-wall) and the frequency of the wood sleepers has created a grievous impediment to proper water drainage. Ponding water is now occurring all over the roof at numerous locations. The trapped water between the sleepers will be subject to expansion when freezing. This excessive amount of trapped water will reduce the lifespan of the roof system. Typically, on roof designs such as this, a protection layer and drainage mat (see below Carlisle data sheets) are installed over the membrane and under the overburden to ensure that the membrane is protected and continuous drainage is provided over the entire roof area. The excessive amount of trapped water on this roof will likely be problematic over time.

I reviewed the proposal from [redacted] Roofing, the contractor that installed the roof. The proposal appears not to be complete. Omitted from the proposal is the method of adherence for the "isolation" (sic) board. "Isolation board" seems to be a misprint or error. Typically, there is a protection board or insulation board installed over the roof deck prior to the membrane adherence. It is possible that the term "Insulation board" should have been used in the proposal. "Iso" is an abbreviation of Isocyanate which is the most common form of ridged board roof insulation. The membrane does appear to be fully adhered; however, there are no visible fasteners and plates required to secure the insulation board to the wood deck. The membrane was not extended up the walls more than 3 inches; the proposal mentions a 12" dimension. However, it doesn't specify where that 12" of membrane is located. This 12" of membrane would not have been a counter flashing. The vertical membrane is the base flashing at the bottom of the wall. A counter flashing is a covering of the top edge of the vertical membrane. On this roof the wood shingle siding could have been used as a counter flashing. The contractor did install small strips of aluminum in an attempt to construct a counter flashing. This strip of aluminum is not a sufficient counter flashing due to its lack of elevation and lack of proper fastening.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com

It is likely that water will seep behind the membrane at the base of all the walls due to the lack of membrane height and lack of proper counter flashing. This seepage will increase over time as the adhesive holding the membrane to the wall deteriorates. Seepage will also increase due to ice and snow buildup as is typical in Northeast. Water that seeps behind the membrane will freeze, expand, contract, and separate the membrane from the wall. Water seepage at the walls will deteriorate the wood substrate. These conditions will only get worse over time. A proper repair would include removing the wood deck, removing a minimum of 18" of wood shingles up the wall, installing a new strip of TPO membrane heat-welded to the existing roof surface and extending up the walls a minimum of 12 inches, and then reinstalling wood shingles on the wall over the top of the vertical membrane leaving 4 to 6 inches of membrane exposed at the base of the walls and then replacing the wood deck.

Please feel free to contact me if you have any questions regarding this report.

Sincerely,

Ken Laibowitz
Senior Inspector


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


Ground view, front of house.


Overview of roof and deck from west to east taken from west end pyramid roof.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


Partial ground view of back of house, west end.


Partial view of back of house and pyramid roof at east end.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


Ground view, east end of house.


Leak, first floor ceiling, west end under deck and door above.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


Leak at chimney/flue.


Water damage to ceiling in garage, east end.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


Overview of roof from east to west.


Overview of wood deck and roof over leak at west end.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


Termination bar installed just prior to my inspection at door over west end leak.


View of drain in close proximity to west end leak. Drain has been elevated due to excessive layers of membrane.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


Insufficient membrane height at door jam, west end.


View of typical wall flashing. Wood shingles have not been removed for proper installation of membrane. Aluminum strips installed in an attempt to construct a counter flashing. Membrane height is less than 3". Water seepage is likely to increase with every winter. Drain poorly flashed to membrane.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


Aluminum strip is not fastened and does not provide adequate protection to the top of the membrane.


Membrane is less than 3” up wall over garage. This condition is typical at all walls.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


Flue over fireplace is not properly wrapped. Sealant was improperly spread all over base of flue in an attempt to prevent leakage. This sealant is not designed as a roof or flashing membrane and will not last, creating a maintenance condition. See attached detail for proper flue flashing technique.


Sealant was used behind flue. Again, a maintenance condition was created.

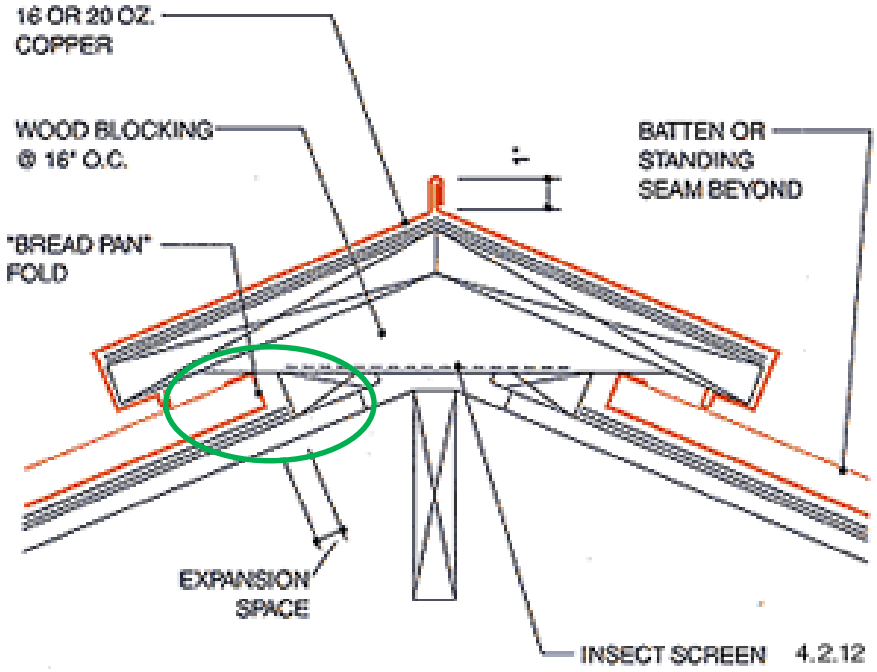

PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


Moisture stains on cathedral ceiling in east end bedroom.


Metal panel roof over east end bedroom. Peak vent system.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com


No protection from windblown precipitation at vent system. Top of pan was not boxed up as shown in detail below with a “bread pan” fold. No vertical closure was installed on panels below vent opening in the deck.




Typical venting system for the peaks of metal panel roofs. There are numerous designs similar to this detail that all have a vertical baffle of some sort to prevent windblown precipitation from entering the vent.


PO BOX 351 ◊ Garnerville ◊ New York 10923
845.947.5003 ◊ www.silvermcgee.com

We Do The Little Things That Mean A Lot!!

[redacted]

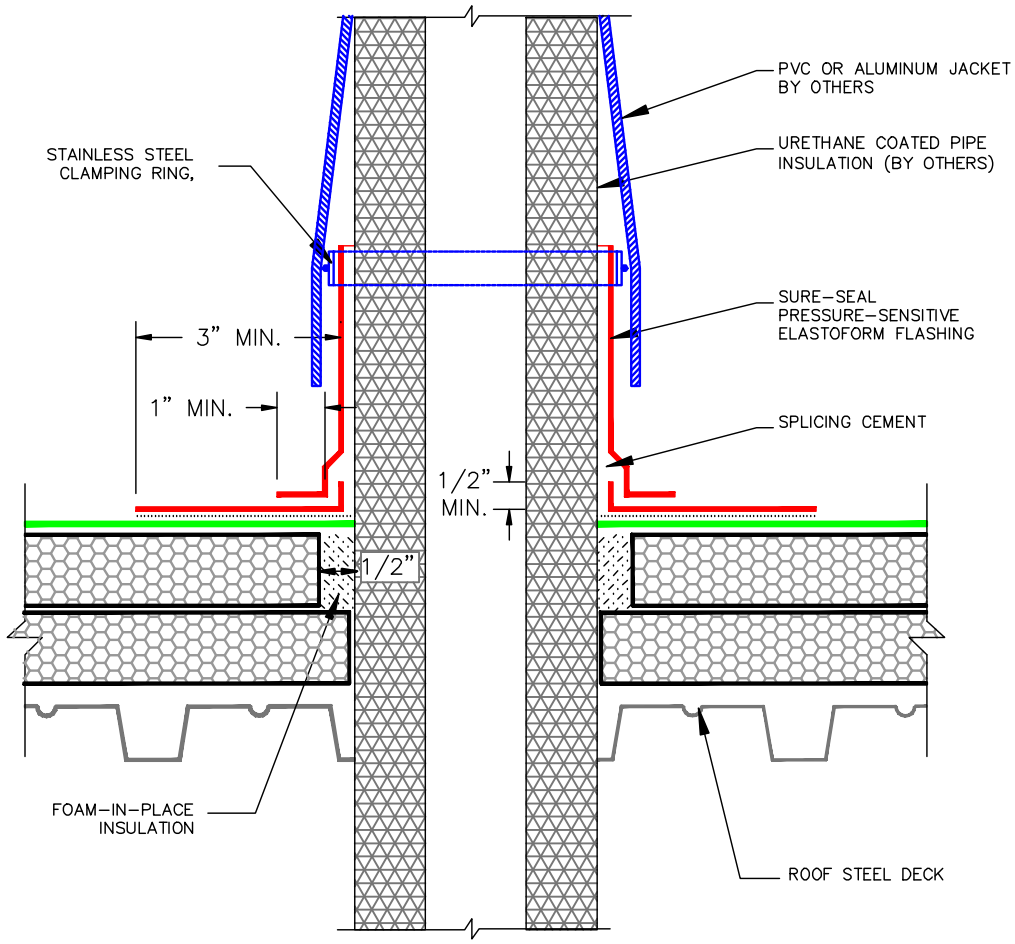
Date, 5/15/15

| CUSTOMER NAME & ADDRESS | PROJECT NAME & ADDRESS |
|---|---|
| [redacted] | [redacted] |

BID PROPOSAL

| TYPE | DESCRIPTION | TOTAL |
|---|---|---|
| MT/TPO<br>0120<br>0220 | • Remove Existing Roof System Down To Decking<br>• Fully Adhered A White 80 Mill Carlisle TPO Heat Weld Roof System Using Bonding Adhesives To Isolation Broad<br>• Install Up To 12" Of 80 Mill Wall Flashing On All Walls Counter Flashing<br>• Wood Work Billed Time And Material Only<br>• Refasten Existing Wood With Code Requirement And Specification<br>• Install New Standing-Seam Galvalume 26ga 16" Metal Striations Pan's<br>• Remove & Haul Away All Roofing Debris<br>• Includes A (10) Year Workmanship Warranty<br>• Includes A (20) Year Manufacture Warranty<br>• All Labor, Material, Equipment, Insurance & Inspections | $13,200.00<br>$35,200.00 |
| | | **Total: $48,400.00** |

[redacted]




FOAM–IN–PLACE INSULATION

DETAIL PROVIDED COURTESY OF
GROUP4 MATERIALS, INC.
BROOKFIELD, WISCONSIN

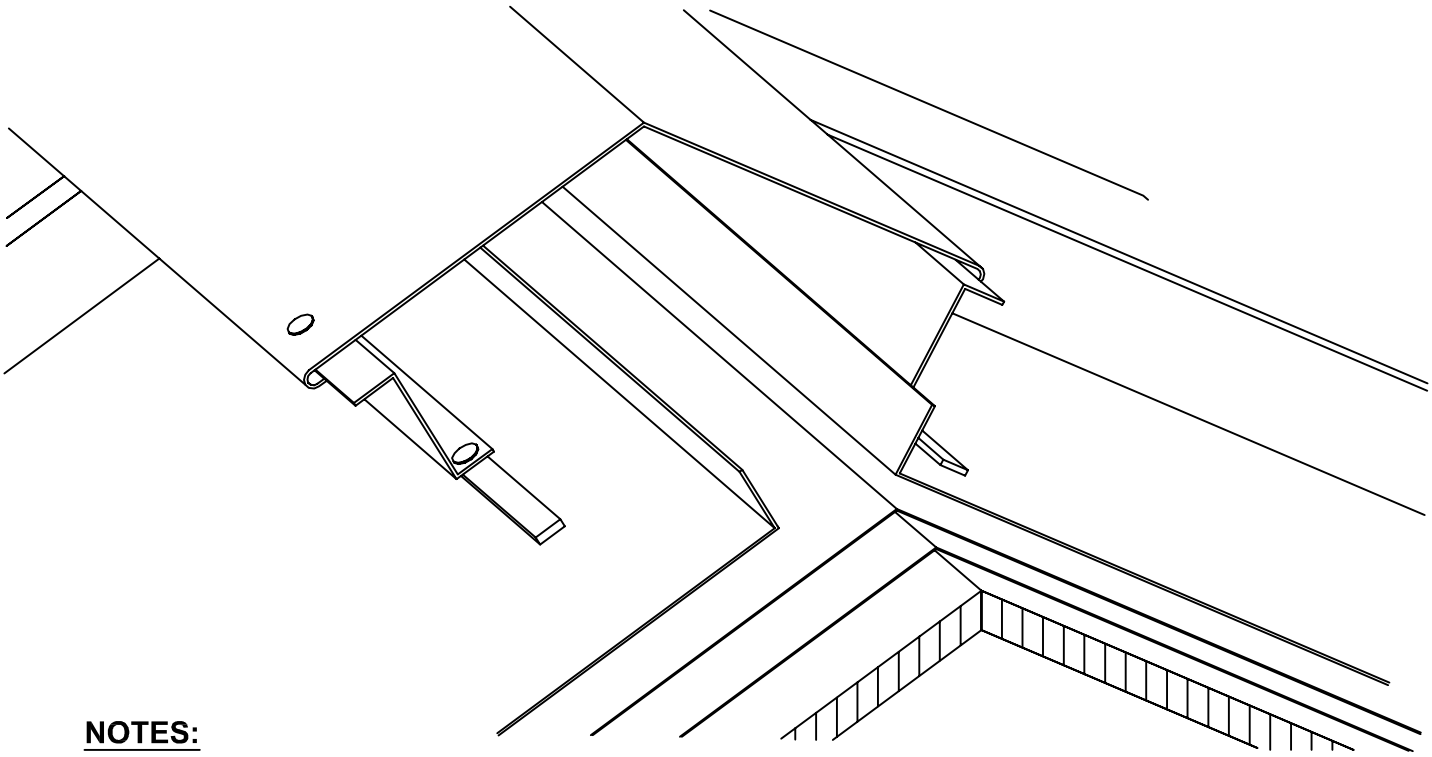
Carlisle SynTec Incorporated

# COLD STORAGE ENVELOPE
# INSULATED PIPE: FIELD FABRICATED FLASHING

COLD STORAGE DETAILS

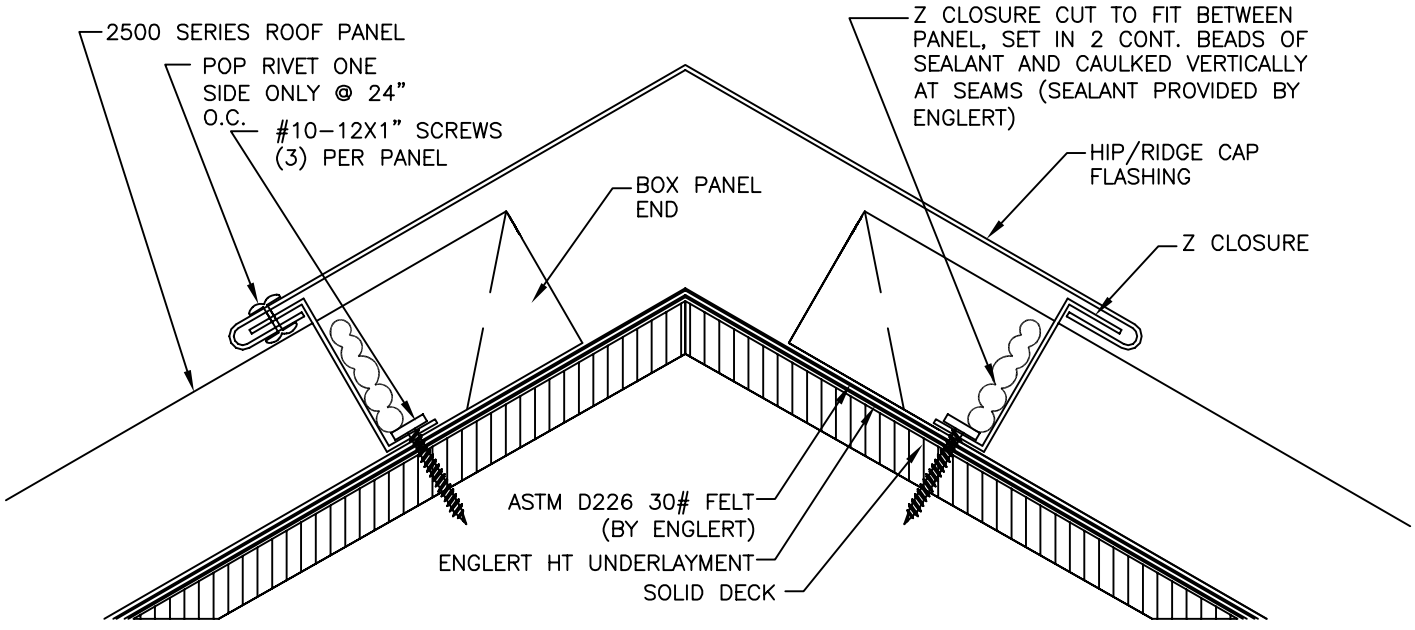
**CS 7.1.1**

# TYPICAL HIP / RIDGE DETAIL

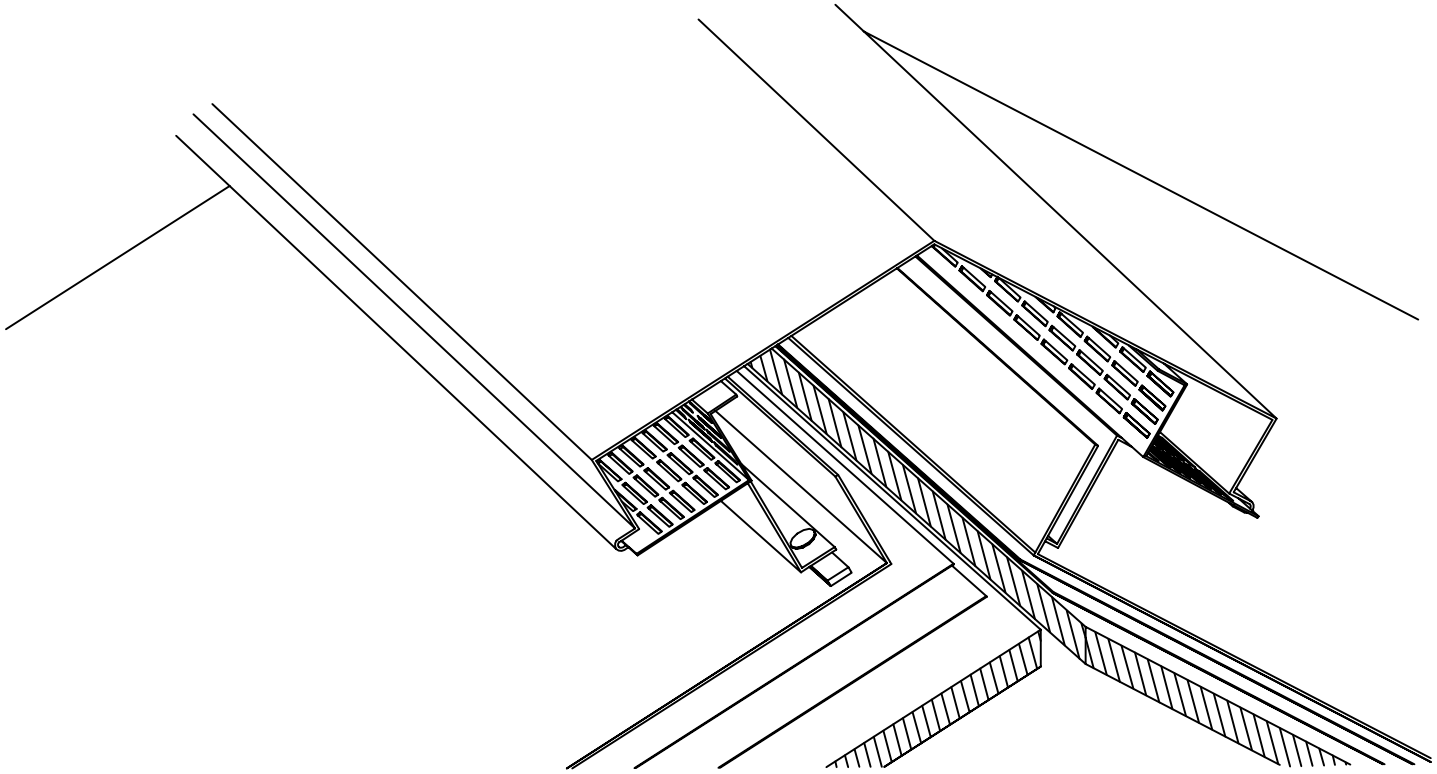


## NOTES:

1) BOX END OF PANELS.
2) FIELD CUT "Z" CLOSURES TO FIT BETWEEN PANEL RIBS.
3) SET "Z" CLOSURE IN TAPE SEALANT OR 2 CONT. BEADS OF SEALANT AND ATTACH TO PANEL WITH (3) #10-12X1" WOOD SCREWS.
4) APPLY SEALANT ON SIDE LEGS OF "Z" CLOSURE, FILLING ANY GAPS AROUND PANEL RIBS.
5) ATTACH RIDGE/HIP FLASHING TO "Z" CLOSURES WITH A POP RIVET ON ONE SIDE AT 24" O.C.
6) IF ADDITIONAL FLASHING LENGTHS ARE REQUIRED, APPLY SEALANT AND LAP THE FLASHING OVER THE INSTALLED FLASHING BY A MINIMUM OF 3" SECURING THE CONNECTION WITH POP RIVETS.

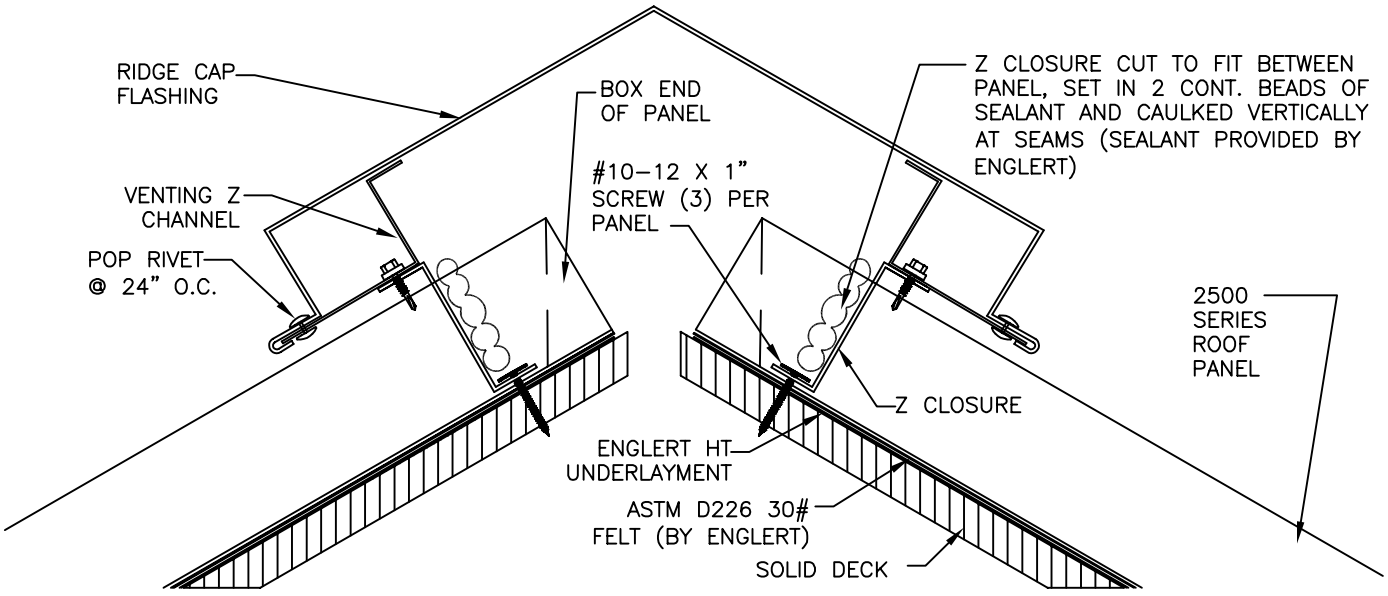


# METAL VENTED RIDGE DETAIL



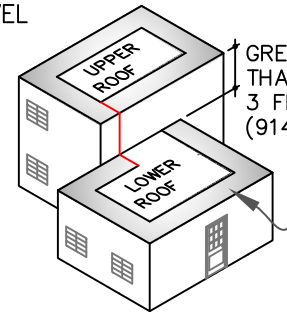
## NOTES:

1) BOX END OF PANELS.
2) SET "Z" CLOSURE IN TAPE SEALANT OR 2 CONT. BEADS OF SEALANT AND ATTACH TO PANEL WITH (3) #10-12X1" WOOD SCREWS.
3) ATTACH BOTTOM OF VENTED "Z" CLOSURE TO TOP OF "Z CLOSURE" WITH STITCH SCREWS @ 24" O.C.
4) HOOK OTHER HEM SIDE OF RIDGE CAP ONTO THE LONG END OF THE OTHER VENTED "Z" CLOSURE AND POP RIVET BOTH SIDES @ 24" O.C.
5) INSERT LONG END OF VENTED "Z" CLOSURE INTO AN OPEN HEM SIDE OF RIDGE CAP.

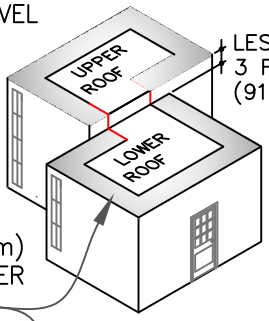


ROOF ZONES FOR MINIMUM ONE FASTENER PER 4 SQUARE FEET (1 FASTENER/0.372 SQUARE METER)

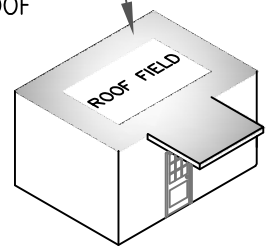
SPLIT LEVEL ROOFS




SPLIT LEVEL ROOFS

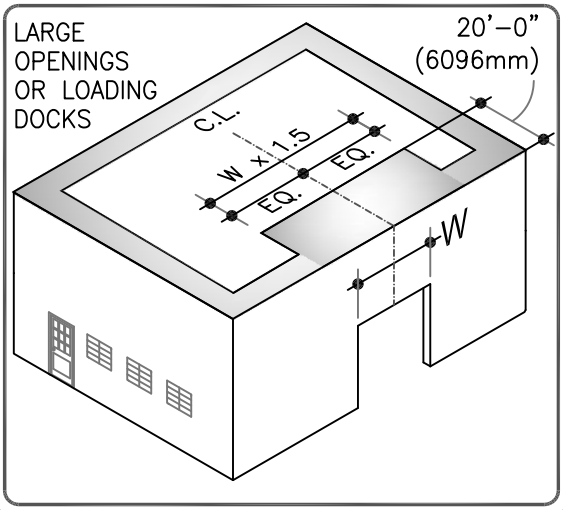


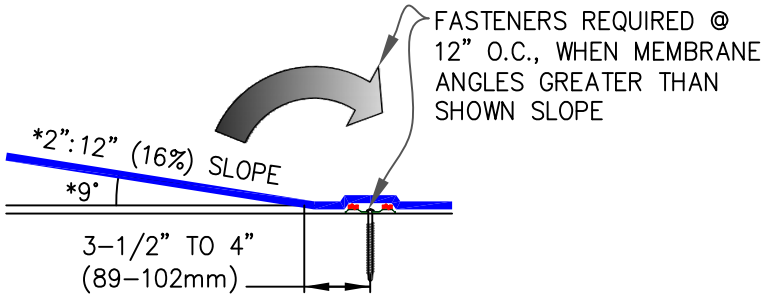

CANOPY ROOF



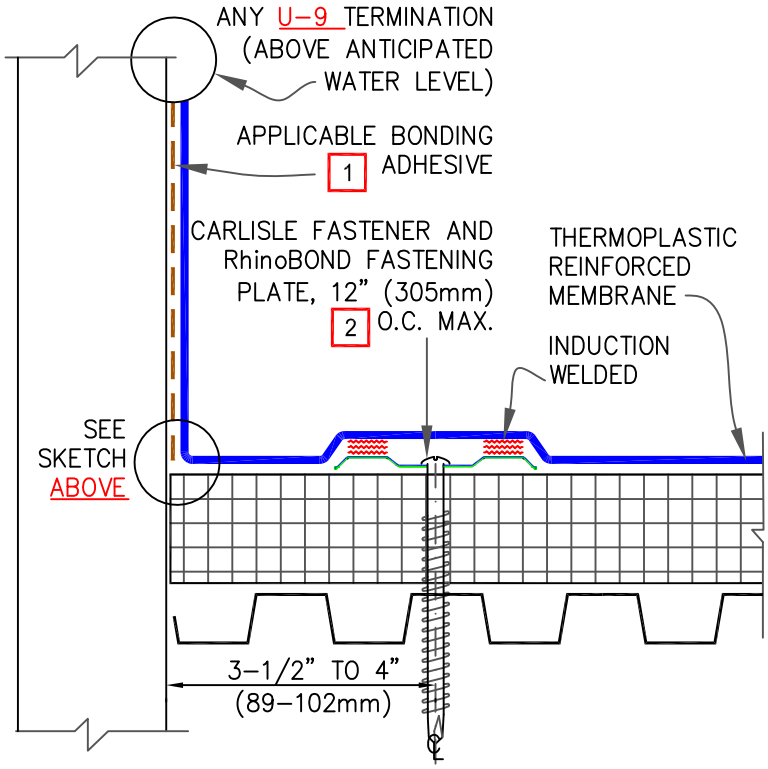

MAIN ROOF EXTENDING ON THE SAME LEVEL

LARGE OPENINGS OR LOADING DOCKS




*100mm HORIZONTAL:16mm VERTICAL




**ANGLE CHANGE SECUREMENT**

NOTES:

1. SURE–WELD MEMBRANE REQUIRES SURE–WELD BONDING ADHESIVE AND SURE–FLEX MEMBRANE REQUIRES SURE–FLEX BONDING ADHESIVE.
2. HP–X FASTENERS AND RhinoBOND PLATES ARE REQUIRED OVER STEEL AND WOOD DECKS.

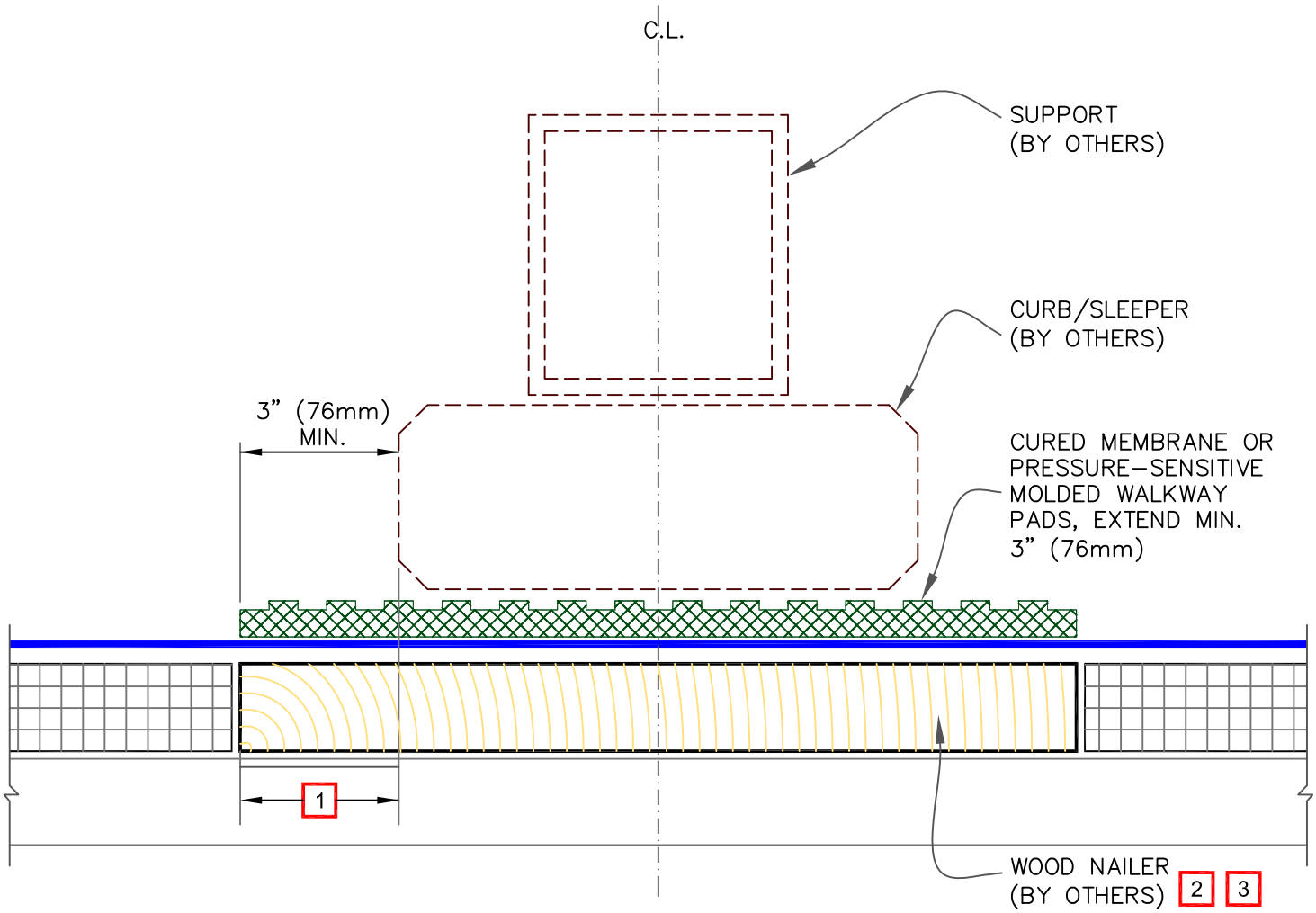
THERMOPLASTIC MEMBRANE
APPROVED SUBSTRATE
0 SEE NOTE(S)

**ANGLE CHANGE SECUREMENT METHOD WITH RhinoBond PLATES**

For additional information, refer to Specifications

DETAIL NO. RB-2

RhinoBond




NOTES:

1. SLEEPER MUST BE LARGE ENOUGH TO SUPPORT WEIGHT OF EQUIPMENT WITHOUT INDENTING INSULATION. EXTEND WOOD NAILER OUT AS REQUIRED BY STRUCTURAL ENGINEER TO DISTRIBUTE SUBJECT LOAD OR AT LEAST EXTEND OUT MIN. 3" (76mm).

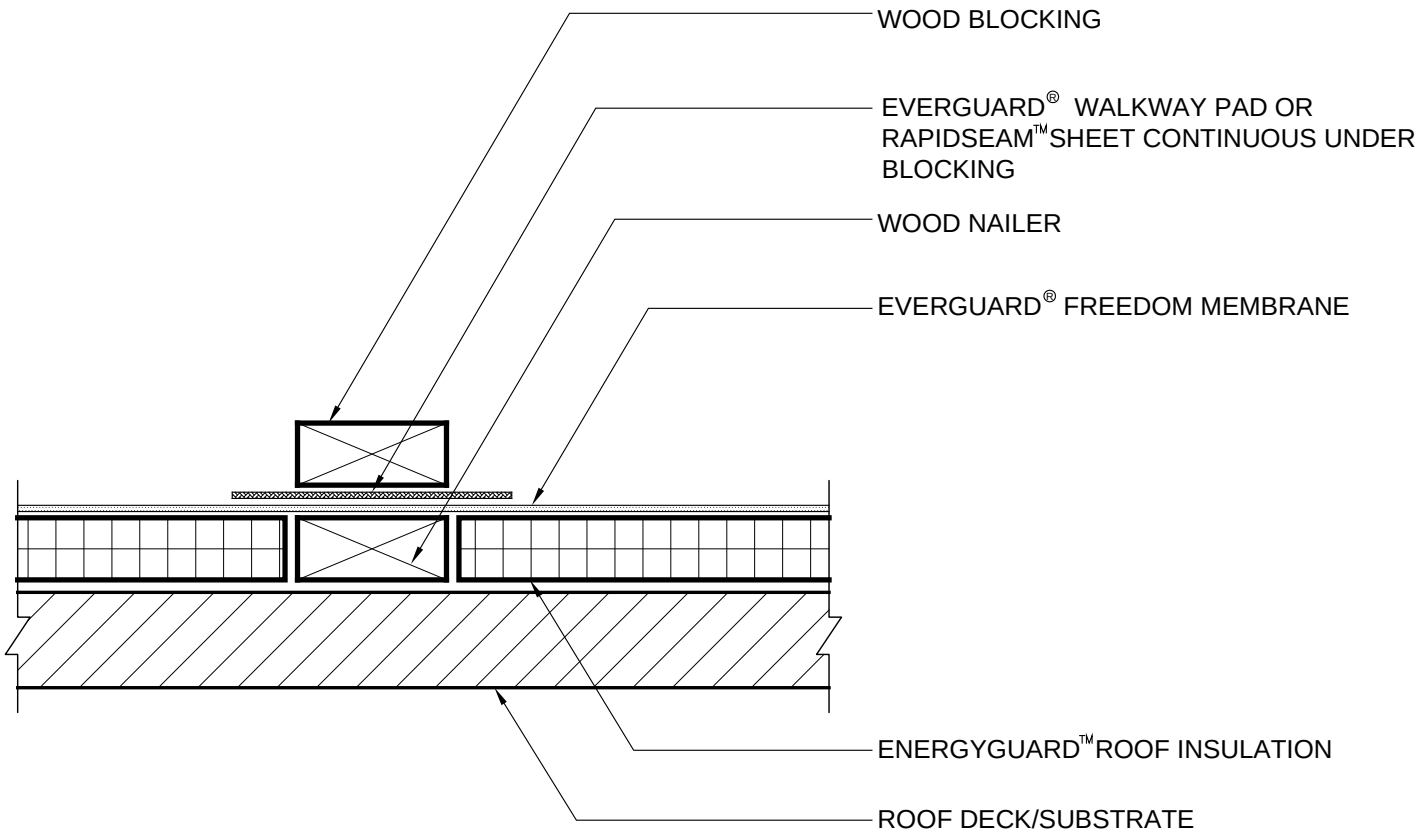
2. ENSURE SCREW/ANCHOR HEADS IN TOP SURFACE OF WOOD BLOCKING ARE RECESSED TO PROTECT MEMBRANE.

3. WOOD NAILERS NOT REQUIRED UNDER PIPE SUPPORTS.

4. CONSULT STRUCTURAL ENGINEER AND/OR SPECIFIER TO AVOID WATER PONDING DUE TO DECK DEFLECTION.

| | | |
|---|---|---|
| EPDM<br>APPROVED SUBSTRATE<br>0 SEE NOTE(S) | **SLEEPER**<br>For additional information, refer to Specifications | DETAIL NO.<br>U-24<br>THERMOSET UNIVERSAL |

**RAPID SEAM™ MAX 10 YR GUARANTEE**




NOTE:

1. IF THE INSULATION COMPRESSIVE STRENGTH IS INSUFFIENT FOR THE EQUIPMENT WEIGHT, INSTALL WOOD UNDER THE EQUIPMENT CARRYING SLEEPER, MATCHING THE HEIGHT OF THE INSULATION.

| | | | | |
|---|---|---|---|---|
| GAF MATERIALS CORPORATION www.gaf.com | EverGuard Freedom Self-Adhering Roofing System | EXPOSED WOOD EQUIPMENT SUPPORT SLEEPER | DRAWING # 511 | SYSTEM FD |
| | ROOF PENETRATION SERIES | HEATWELD & RAPIDSEAM | SCALE N.T.S. | ISSUE/ REVISION DATE 3-1-10 |

CARLISLE SYNTEC SYSTEMS

# ROOF GARDEN

## CCW 200V/300HV Protection Fabrics

### Overview

200V (12 oz/yd$^2$) and 300HV (16 oz/yd$^2$) Protection Fabrics are extremely tough non-woven polypropylene fabrics designed for use as protection course over Carlisle's Roof Garden waterproofing membranes and as filter fabrics used in conjunction with drainage gravel in "deep" intensive Roof Garden assemblies. 200V and 300HV Protection Fabrics exhibit excellent puncture strength and protect the waterproofing membrane from damage by construction traffic and debris. Additionally, they are non-biodegradable and stabilized to resist soil, chemicals and mildew, as well as acids and alkalis.

### Features and Benefits

- Available in 12 oz/yd$^2$ (200V) and 16 oz/yd$^2$ (300HV)
- Available in 2 different roll sizes
- Highly effective filter fabric
- May be left exposed for up to 30 days with no ill effect

### Installation

Unroll Carlisle 200V or 300HV directly over the waterproofing membrane. Position the next roll of protection fabric to overlap the first piece by a minimum of 2". Under windy conditions, secure the protection fabric with temporary ballast. For best results, proceed with placement of designated cover material as soon as possible.

*Review Carlisle specifications and details for complete installation information.*

### Precautions

200V/300HV must not be permanently exposed to sunlight. Limit exposure to sunlight to no more than 30 days prior to covering.

### Typical Properties and Characteristics

| Physical Property | Test Method | Typical 200V | Typical 300V |
|---|---|---|---|
| Puncture Resistance | ASTM D4833 | 130 lbs (0.58 kN | 235 lbs (1.05 kN) |
| Mullen Burst | ASTM D3786 | 400 psi (2,756 kPA) | 750 psi (5,167 kPA) |
| Elongation | ASTM D4682 | 50% | 50% |
| Thickness | ASTM D5199 | 90 mils (2.3 mm) | 150 mils (3.8 mm) |

Typical properties and characteristics are based on samples tested and are not guaranteed for all samples of this product. This data and information is intended as a guide and does not reflect the specification range for any particular property of this product.

### LEED® Information

| | |
|---|---|
| Pre-consumer Recycled Content | 0% |
| Post-consumer Recycled Content | 0% |
| Manufacturing Location | Pendergrass, GA |

### Packaging

| CCW 200V Protection Fabric | | |
|---|---|---|
| **Roll Size** | **Sheet Size** | **Weight** |
| 150" x 200' (3.81 m x 61 m) | 2500 ft$^2$ (232 m$^2$) | 140 lbs (64 kg) |
| 40" x 200' (1 m x 61 m) | 667 ft$^2$ (62 m$^2$) | 54 lbs (24 kg) |
| **CCW 300HV Protection Fabric** | | |
| **Roll Size** | **Sheet Size** | **Weight** |
| 150" x 200' (3.81 m x 61 m) | 2500 ft$^2$ (232 m$^2$) | 195 lbs (88 kg) |
| 40" x 200' (1 m x 61 m) | 667 ft$^2$ (62 m$^2$) | 58 lbs (26 kg) |

800-479-6832 | P.O. Box 7000 | Carlisle, PA 17013 | Fax: 717-245-7053 | **www.carlislesyntec.com**

CARLISLE'S

# MiraDrain GR9200

## Overview

Carlisle's MiraDrain GR9200 is a high performance retention/drainage composite consisting of a three-dimensional, high impact polystyrene core with pierced holes allowing water retention and drainage. GR9200 has a filter fabric bonded to the retention side of the molded core. This filter fabric prevents passage of particles into the water reservoirs while allowing excess water to pass freely into the drainage system. It is designed to retain moisture and provide drainage in Carlisle's Ballasted Stormwater Retention System.

## Intended Uses

The Ballasted Stormwater Retention System consists of Carlisle's 200V/300HV Protection Fabric, MiraDrain GR9200, and Carlisle's Moisture Retention Mat loose laid over an approved EPDM membrane.

The Ballasted Stormwater Retention System can contribute towards LEED® credit SS 6.1: Stormwater Design – Quantity Control.

## Features and Benefits

- Available in rolls 4' wide x 50' long (1.22 m x 15.24 m)
- Provides retention as well as drainage in Carlisle's Ballasted Stormwater Retention System
- Non-clogging drainage performance
- High compressive strength that withstands overburden stresses

## Installation

1. Carlisle's MiraDrain GR9200 Mat is installed on top of Carlisle's 200V/300HV Protection Fabric.
2. The filter fabric should be facing up. Overlap the filter fabric in the direction of water flow.
3. In windy conditions, provide temporary ballast to prevent wind disturbance.
4. Cover MiraDrain GR9200 with Carlisle's Moisture Retention Mat and then with round, river washed stone to meet the minimum weight/sq. ft. specification.

* REVIEW CURRENT CARLISLE SPECIFICATIONS AND DETAILS FOR SPECIFIC APPLICATION REQUIREMENTS.

## Precautions

1. Limit UV exposure by covering within 7 days of installation.
2. Any panels that are damaged during installation should be replaced by the installer.

| MiraDrain GR9200 | | |
|---|---|---|
| **Typical Properties and Characteristics*** | | |
| **Property** | **Test Method** | **Typical Value** |
| Thickness | ASTM D1777 | .040 in (10.2 mm) |
| Compressive Strength | ASTM D1621 | 15,000 psf (718 kPa) |
| Reservoir Capacity | TCM-0207 | 10 $in^3/ft^3$ (1,775 $cm^3/m^3$) |
| Percolation Flow Rate | TCM-G0163 | 0.237 gpm/$ft^2$ (0.844 lpm/$m^2$) |
| Retention Performance | TCM-G0163 | 17% |
| **MiraDrain GR9200 Filter Fabric** | | |
| Apparent Opening Size | ASTM D4751 | 40 US Std. Sieve (0.42 mm) |
| Water Flow Rate | ASTM D4491 | 145 gpm/$ft^2$ (5,907 l/min/$m^2$) |
| Grab Tensile Strength | ASTM D4632 | 365 lbs (4.62 kN) |

* Typical Properties and Characteristics are based upon an average of the available materials.



**800-479-6832** • P.O. Box 7000 • Carlisle, PA 17013 • Fax: 717-245-7053 • **www.carlisle-syntec.com**



Carlisle SynTec