



Tapered DesignGroup

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TAPERED INSULATION DESIGN GUIDE

A Basic Understanding of Tapered Insulation Concepts, Layouts and Designs

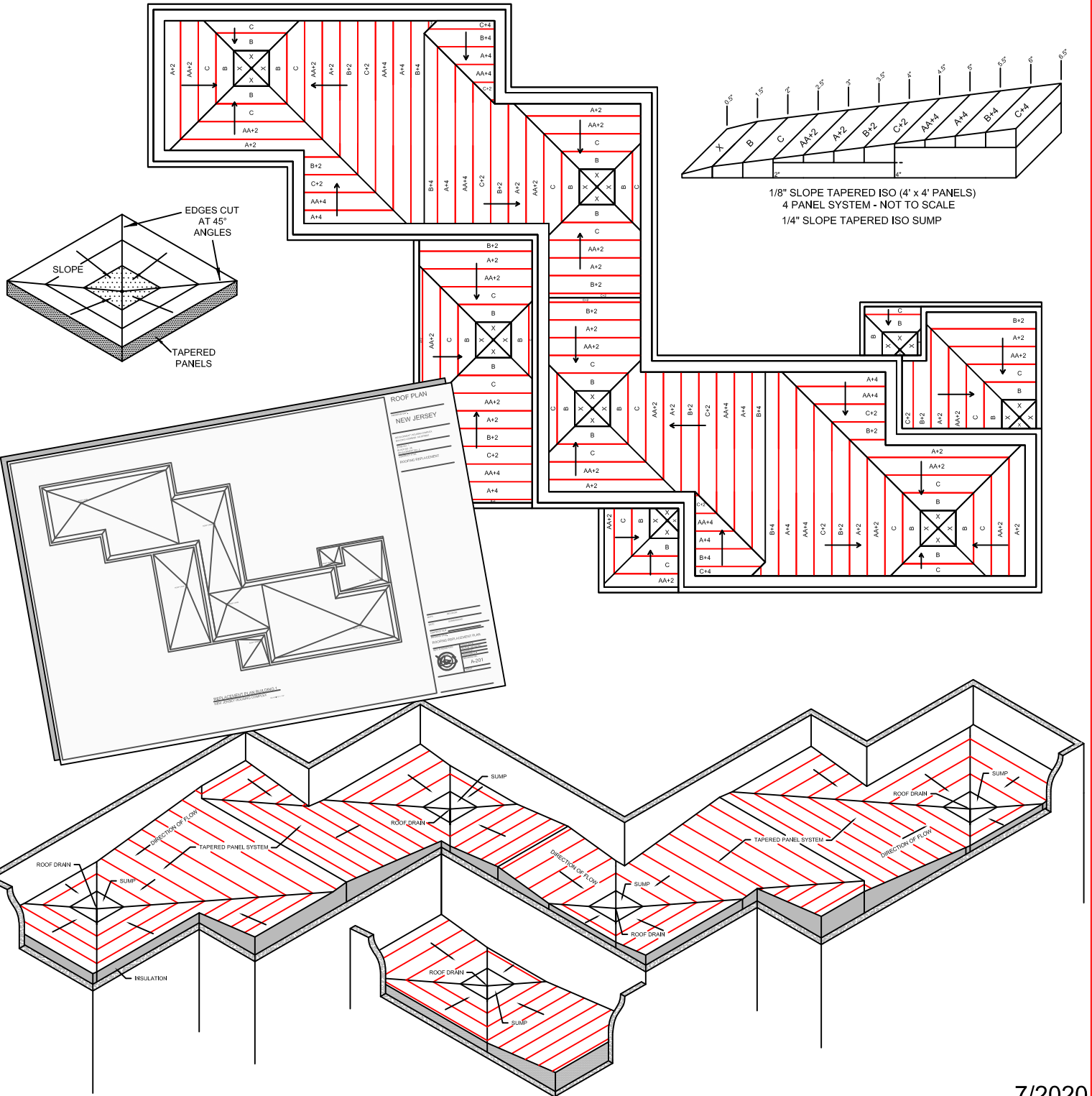


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We
protect
what
matters
most™

Welcome to the Tapered Design Group (TDG) ***Tapered Insulation Design Guide!***

GAF's Tapered Design Group provides tapered insulation take-offs for architects, contractors and distributors nationwide as part of the various services offered to our customers. The purpose of this guide is to showcase tapered insulation concepts and layouts and provide an overview of how tapered insulation can be used on a variety of roof applications.

We hope this guide will give you a basic understanding of what GAF's Tapered Design Group can offer and answer some basic questions regarding tapered design. Your business is appreciated, and our department looks forward to working with you in the future for all of your tapered insulation needs.

*GAF is a proven leader in the roofing industry and has been your best choice since 1886.
Let us earn your business!*

Thanks,

The TDG Team

Email: tdg@gaf.com



DISCLAIMER

PLEASE READ CAREFULLY

GAF Tapered Design Group does not practice architecture or engineering, and does not assume any responsibility or liability for the design or installation of the roofing system. The design responsibility remains with the architect, engineer, roofing contractor, or owner and construction details illustrated and described herein are furnished solely for guidance purposes.

These guidelines should not be construed as being all-inclusive, nor should they be considered. Acceptance of the building structure to receive a tapered panel system installation will be at the responsibility of an architect, engineer, or contractor. GAF reserves the right to decline designing and/or quoting any job where GAF feels that the information provided is inaccurate, incomplete or does not have enough information to make an informed recommendation regarding design. GAF's willingness to provide design information on a particular job cannot be construed or interpreted as confirmation that the building structure is appropriate to receive a tapered panel system installation.

GAF, as a material manufacturer, does not assume any responsibility for errors in quantities due to mistakes on submitted plans, drawings or differences in field conditions. The contractor shall remain responsible for verifying all drain locations, drain overflow locations (required by code), perimeter dimensions, roof surveys, materials, R-values and existing conditions prior to installation of insulation. The contractor is responsible for verifying layout(s) to ensure it meets job specifications.

Tapered insulation shop drawings must be approved by the architect, contractor or code official and returned to GAF's Tapered Design Group prior to shipment and installation of materials.

GAF is not responsible for the handling, storage or shortages of material. It is the responsibility of the roofing contractor to verify correct material counts when materials are delivered. GAF is to be notified of any discrepancies of delivered materials.

All cut insulation panels larger than a half panel in size are to be used elsewhere within the layout in order to prevent a shortage in material.

All coverboards, cant strips, edge strips, Gemini crickets, hinged sumps or crickets etc., not shown on GAF Tapered Design Group's shop drawings will be the responsibility of the roofing contractor to provide.

Code Compliance... *are you complying?*

TAPERED INSULATION

The majority of jurisdictions in the U.S. follow the 2012, 2015 or 2018 edition of International Energy Conservation Code (IECC). The thermal insulation code requirements were slightly re-organized and revised with each edition. The following are the commercial roofing-related requirements from the 2012, 2015 and 2018 editions of IECC:

2012 IECC

C402.2.1 Roof assembly. The minimum thermal resistance (*R-value*) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U-factor* is equivalent to the same assembly with the *R-value* specified in Table C402.2.
2. Unit skylight curbs included as a component of an NFRC 100 rated assembly shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

2015 IECC

C402.2.2 Roof assembly. The minimum thermal resistance (*R-value*) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.1.3, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U-factor* is equivalent to the same assembly with the *R-value* specified in Table C402.1.3.
2. Where tapered insulation is used with insulation entirely above deck, the *R-value* where the insulation thickness varies 1 inch (25 mm) or less from the minimum thickness of tapered insulation shall comply with the *R-value* specified in Table C402.1.3.
3. Unit skylight curbs included as a component of a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

2018 IECC

C402.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.1.3, based on construction materials used in the roof assembly. Insulation installed on a suspended ceiling having removable ceiling tiles shall not be considered as part of the minimum thermal resistance of the roof insulation. Continuous insulation board shall be installed in not less than 2 layers and the edge joints between each layer of insulation shall be staggered.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted U-factor is equivalent to the same assembly with the R-value specified in Table C402.1.3.
2. Where tapered insulation is used with insulation entirely above deck, the R-value where the insulation thickness varies 1 inch (25 mm) or less from the minimum thickness of tapered insulation shall comply with the R-value specified in Table C402.1.3.
3. Two layers of insulation are not required where insulation tapers to the roof deck, such as at roof drains.

C402.2.1.1 Skylight curbs. Skylight curbs shall be insulated to the level of roofs with insulation entirely above the deck or R-5, whichever is less.

Exception: Unit skylight curbs included as a component of a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

IECC Code and Commentary

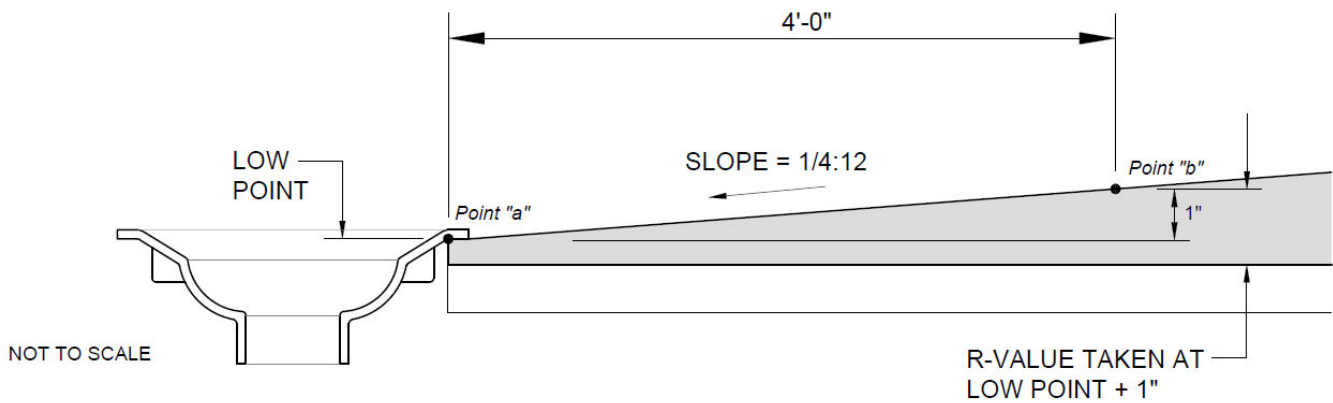
Tapered Insulation

“...it is important to notice that the variation in insulation thickness is limited to 1 inch (25 mm). This limitation on the thickness variation will help ensure more consistent insulation coverage and also reduce the number of roofs that qualify to use this exception.

This 1-inch (25 mm) limitation does not prevent the provisions from being applied to roofs that have a greater variation; it simply does not allow the additional thickness to be factored into the average insulation values. Where the variation exceeds 1 inch (25 mm), it would be permissible to go to the thinnest spot and measure the *R-value* at that point (for the example call this Point “a”). Then go to a point that is 1 inch (25 mm) thicker than Point “a” and measure the *R-value* there (for the example, call this Point “b”). The remaining portions of the roof that are thicker than the additional 1-inch (25 mm) portion (Point “b”) would simply be assumed to have the same *R-value* that Point “b” had. All portions of the roof that meet or exceed the Point “b” *R-value* would simply use the Point “b” *R-value* when determining the area weighted U-factor for the roof.”

Graphically Depicted

Example with a roof slope = 1/4:12



Code Compliance... are you complying?

SOURCE: IECC -International Energy Conservation Code

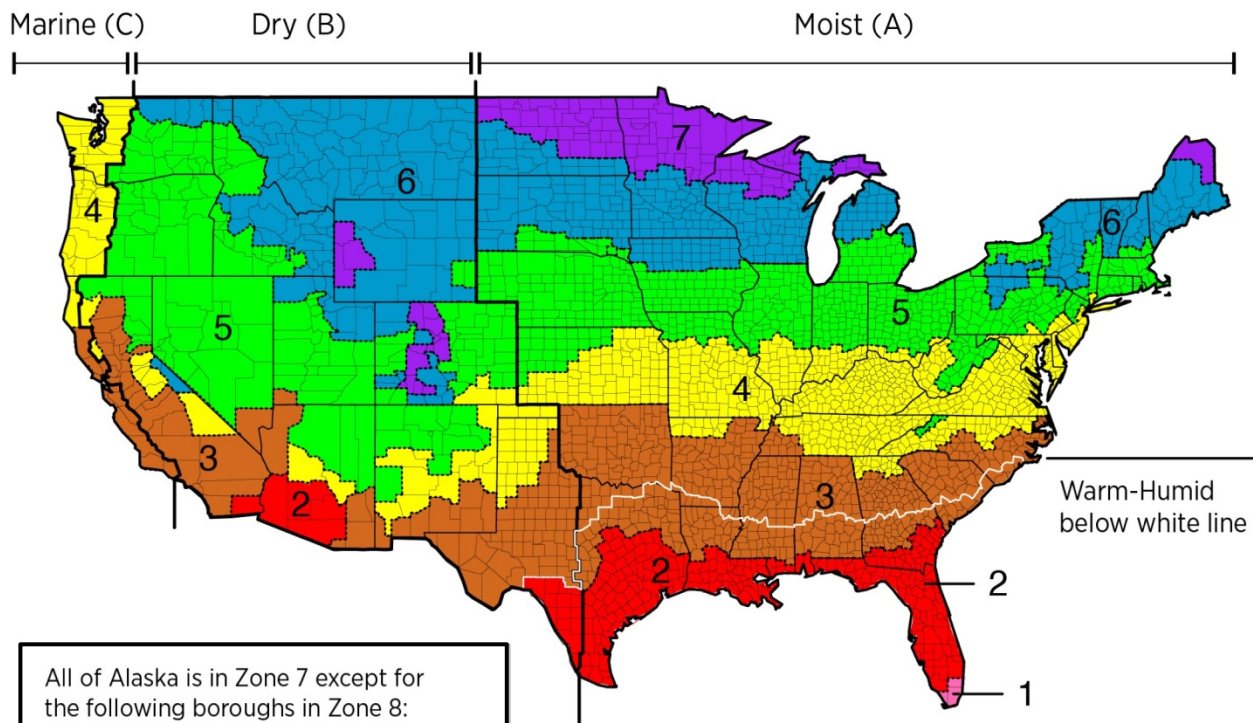
CLIMATE ZONE & R-VALUE

**Roofing-specific adaptation of
IECC 2012, Table C402.2 and
IECC 2015/IECC 2018, Table C402.1.3**
Minimum R-value requirements for
"Insulation entirely above deck"

Additional base layers of insulation may be required in order to meet applicable energy code requirements. The use of the average R-value method to show compliance may not be acceptable with the authority having jurisdiction (AHJ). This method is intended to be used for tapered insulation systems where the insulation thickness does not vary more than 1 inch. When the variation exceeds 1 inch, it is acceptable to use an R-value based on the thickness of the insulation where the insulation is 1 inch thicker than the tapered system's low point. Consult with the AHJ for further guidance.

Climate Zone	IECC 2012	IECC 2015	IECC 2018
1	R-20 ci	R-20 ci	R-20 ci
2		R-25 ci	R-25 ci
3			
4	R-25 ci	R-30 ci	R-30 ci
5			
6	R-30 ci	R-35 ci	R-35 ci
7	R-35 ci		
8	R-35 ci	R-35 ci	R-35 ci

ci = continuous insulation



All of Alaska is in Zone 7 except for the following boroughs in Zone 8:
Bethel, Northwest Arctic, Dellingham, Southeast Fairbanks, Fairbanks N. Star, Wade Hampton, Nome, Yukon-Koyukuk, North Slope

Zone 1 includes Hawaii, Guam, Puerto Rico, and the Virgin Islands

ASHRAE MAP

Code Compliance... *are you complying?*

SOURCE: IECC -International Energy Conservation Code

ROOF DRAINAGE

The following are the roof drainage-related requirements from the 2012, 2015 and 2018 IECC:

2012 IECC/2015 IECC

Section 1503—Weather Protection

[P] 1503.4 Roof drainage. Design and installation of roof drainage systems shall comply with Section 1503 of this code and Sections 1106 and 1108, as applicable, of and the *International Plumbing Code*.

[P] 1503.4.1 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.

2018 IECC

Section 1502—Roof Drainage

[P] 1502.1 General. Design and installation of roof drainage systems shall comply with Section 1502 of this code and Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.

[P] 1502.2 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.

Note: *GAF recommends, and building codes require, a minimum ¼" slope to help achieve positive drainage. Please consult with a design professional to address project specifications and requirements.*

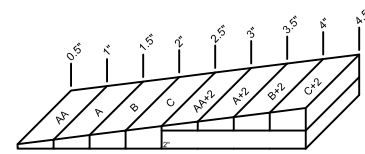
GAF TAPERED QUICK REFERENCE CHART

TAPERED PANELS - 4' X 4'

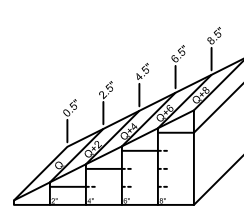
	BOARD STYLE	DIMENSIONS IN INCHES	AVERAGE THICKNESS	BD FEET PER PANEL
1/8	AA	0.5" - 1"	0.75"	12
	A	1" - 1.5"	1.25"	20
	B	1.5" - 2"	1.75"	28
	C	2" - 2.5"	2.25"	36
	* D	2.5" - 3"	2.75"	44
	* E	3" - 3.5"	3.25"	52
	* F	3.5" - 4"	3.75"	60
	* FF	4" - 4.5"	4.25"	68
1/4	X	0.5" - 1.5"	1"	16
	Y	1.5" - 2.5"	2"	32
	* Z	2.5" - 3.5"	3"	48
	* ZZ	3.5" - 4.5"	4"	64
	G	1" - 2"	1.5"	24
1/2	H	2" - 3"	2.5"	40
	* I	3" - 4"	3.5"	56
	Q	0.5" - 2.5"	1.5"	24
	* QQ	2.5" - 4.5"	3.5"	56
	* XX	1" - 3"	2"	32
	* JJ	0.5" - 1.25"	0.875"	14
	* KK	1.25" - 2"	1.625"	26
	* LL	2" - 2.75"	2.375"	38
	* MM	2.75" - 3.5"	3.125"	50
	* J	1" - 1.75"	1.375"	22
3/16	* K	1.75" - 2.5"	2.125"	34
	* L	2.5" - 3.25"	2.875"	46
	* M	3.25" - 4"	3.625"	58
	* SS	0.5" - 2"	1.25"	20
	* TT	2" - 3.5"	2.75"	44
	* S	1" - 2.5"	1.75"	28
	1	0.5" - .75"	0.625"	10
	2	.75" - 1"	0.875"	14
3/8	3	1" - 1.25"	1.125"	18
	4	1.25" - 1.5"	1.375"	22
	5	1.5" - 1.75"	1.625"	26
	6	1.75" - 2"	1.875"	30
	* 7	2" - 2.25"	2.125"	34
	* 8	2.25" - 2.5"	2.375"	38

TAPERED PANELS MATRIX

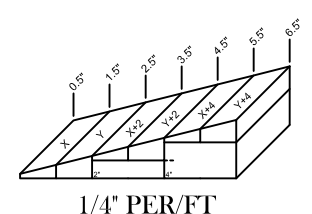
FT	1/8"	1/4"	1/2"	3/16"	3/8"	1/16"
4	1"	1.5"	2.5"	1.25"	2"	.75"
8	1.5"	2.5"	4.5"	2"	3.5"	1"
12	2"	3.5"	6.5"	2.75"	5"	1.25"
16	2.5"	4.5"	8.5"	3.5"	6.5"	1.5"
20	3"	5.5"	10.5"	4.25"	8"	1.75"
24	3.5"	6.5"	12.5"	5"	9.5"	2"
28	4"	7.5"	14.5"	5.75"	11"	2.25"
32	4.5"	8.5"	16.5"	6.5"	12.5"	2.5"
36	5"	9.5"	18.5"	7.25"	14"	2.75"
40	5.5"	10.5"	20.5"	8"	15.5"	3"
44	6"	11.5"	22.5"	8.75"	17"	3.25"
48	6.5"	12.5"	24.5"	9.5"	18.5"	3.5"
52	7"	13.5"	26.5"	10.25"	20"	3.75"
56	7.5"	14.5"	28.5"	11"	21.5"	4"
60	8"	15.5"	30.5"	11.75"	23"	4.25"
64	8.5"	16.5"	32.5"	12.5"	24.5"	4.5"
68	9"	17.5"	34.5"	13.25"	26"	4.75"
72	9.5"	18.5"	36.5"	14"	27.5"	5"
76	10"	19.5"	38.5"	14.75"	29"	5.25"
80	10.5"	20.5"	40.5"	15.5"	30.5"	5.5"



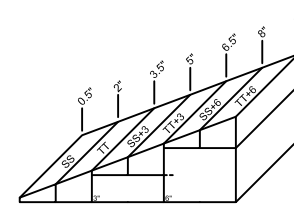
1/8" PER/FT



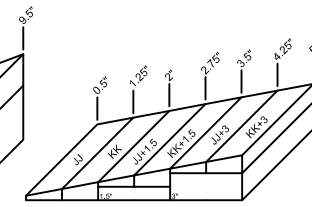
1/2" PER/FT



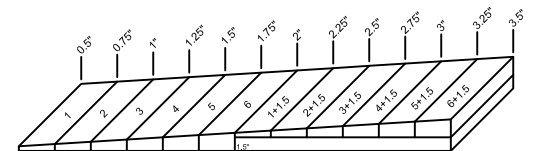
1/4" PER/FT



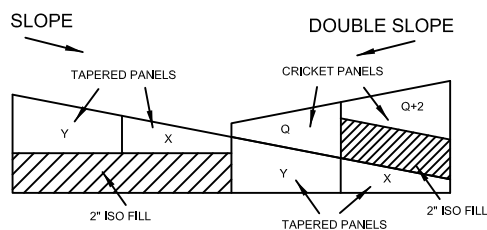
3/8" PER/FT



3/16" PER/FT



1/16" PER/FT



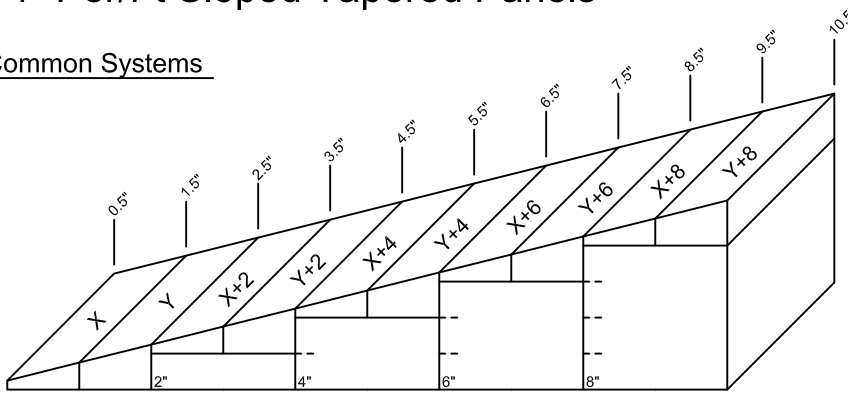
NOT TO SCALE
TAPERED EDGE STRIPS NOT SHOWN

NOTE: The use of 1/16" per/ft slope on a flat deck is not recommended. In order to use a 1/16" per/ft sloped tapered system on a flat deck, prior approval from the Regional Field Services Manager in your area is required, and is dependent upon the type of roof system on top of the insulation. The use of 1/16" per/ft tapered panels on a roof that has existing slope in order to enhance the slope is permitted; however, GAF does not guarantee that the ridges and valleys of the existing slope will match those of the tapered system.

Tapered Insulation Panels & Section Details

1/4" Per/Ft Sloped Tapered Panels

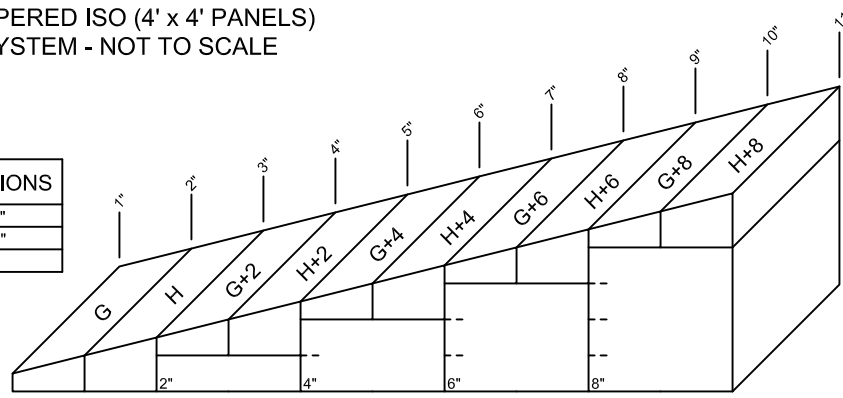
Common Systems



SLOPE	BOARD STYLE	DIMENSIONS
1/4" per/ft.	X	0.5" - 1.5"
1/4" per/ft.	Y	1.5" - 2.5"
NO SLOPE	2" ISO FILL	2"

1/4" SLOPE TAPERED ISO (4' x 4' PANELS)
2 PANEL SYSTEM - NOT TO SCALE

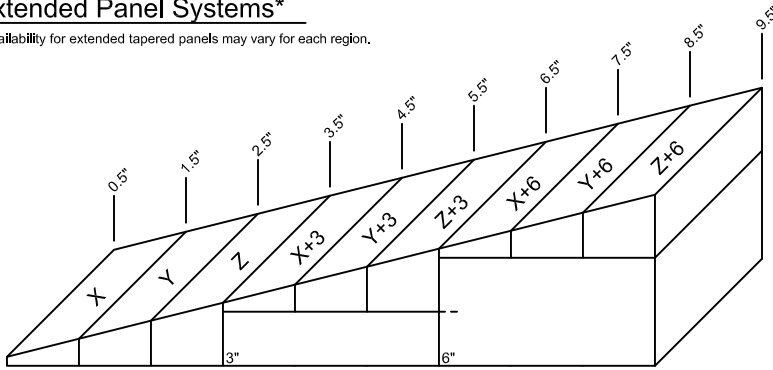
SLOPE	BOARD STYLE	DIMENSIONS
1/4" per/ft.	G	1" - 2"
1/4" per/ft.	H	2" - 3"
NO SLOPE	2" ISO FILL	2"



1/4" SLOPE TAPERED ISO (4' x 4' PANELS)
2 PANEL SYSTEM - NOT TO SCALE

Extended Panel Systems*

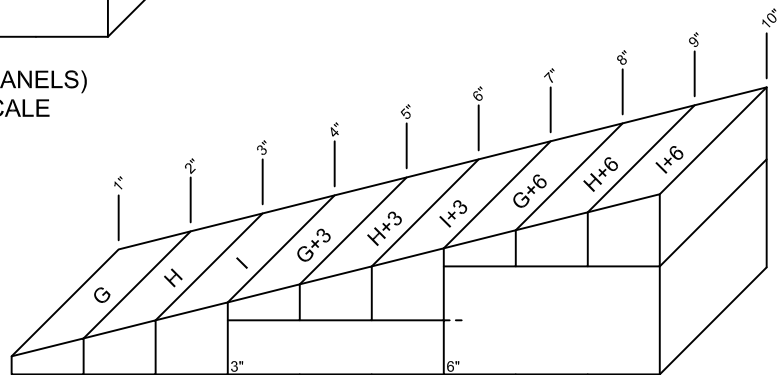
*Availability for extended tapered panels may vary for each region.



SLOPE	BOARD STYLE	DIMENSIONS
1/4" per/ft.	X	0.5" - 1.5"
1/4" per/ft.	Y	1.5" - 2.5"
1/4" per/ft.	Z	2.5" - 3.5"
NO SLOPE	3" ISO FILL	3"

1/4" SLOPE TAPERED ISO (4' x 4' PANELS)
3 PANEL SYSTEM - NOT TO SCALE

SLOPE	BOARD STYLE	DIMENSIONS
1/4" per/ft.	G	1" - 2"
1/4" per/ft.	H	2" - 3"
1/4" per/ft.	I	3" - 4"
NO SLOPE	3" ISO FILL	3"

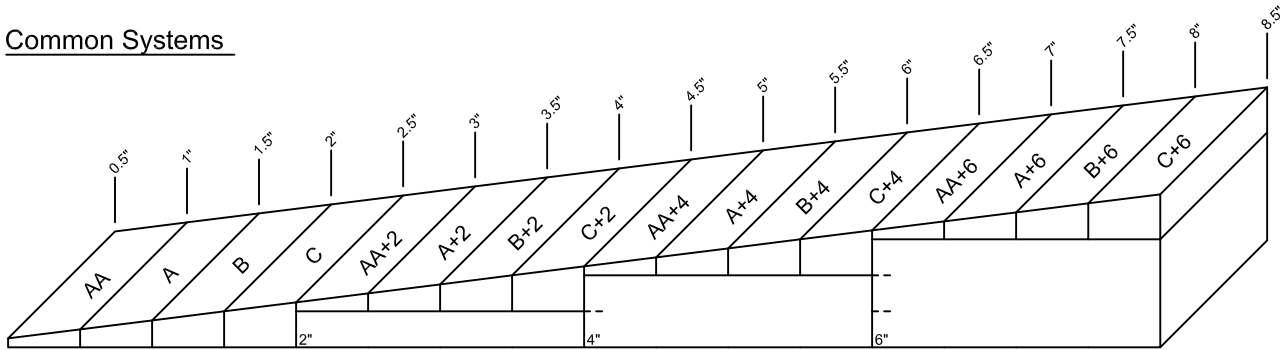


1/4" SLOPE TAPERED ISO (4' x 4' PANELS)
3 PANEL SYSTEM - NOT TO SCALE

Tapered Insulation Panels & Section Details

1/8" Per/Ft Sloped Tapered Panels

Common Systems

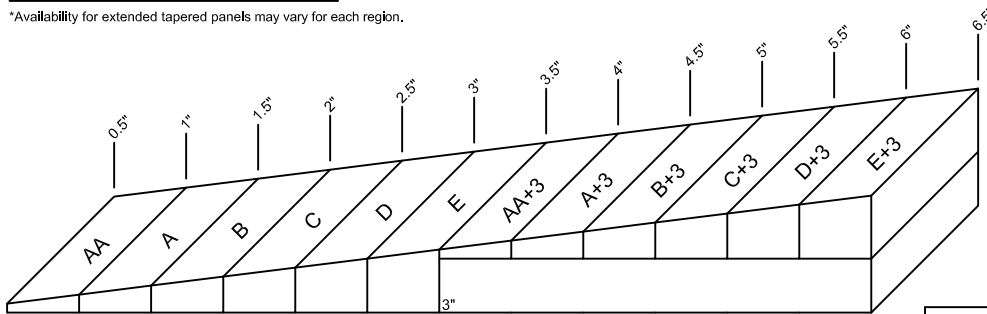


1/8" SLOPE TAPERED ISO (4' x 4' PANELS)
4 PANEL SYSTEM - NOT TO SCALE

SLOPE	BOARD STYLE	DIMENSIONS
1/8" per/ft.	AA	0.5" - 1"
1/8" per/ft.	A	1" - 1.5"
1/8" per/ft.	B	1.5" - 2"
1/8" per/ft.	C	2" - 2.5"
NO SLOPE	2" ISO FILL	2"

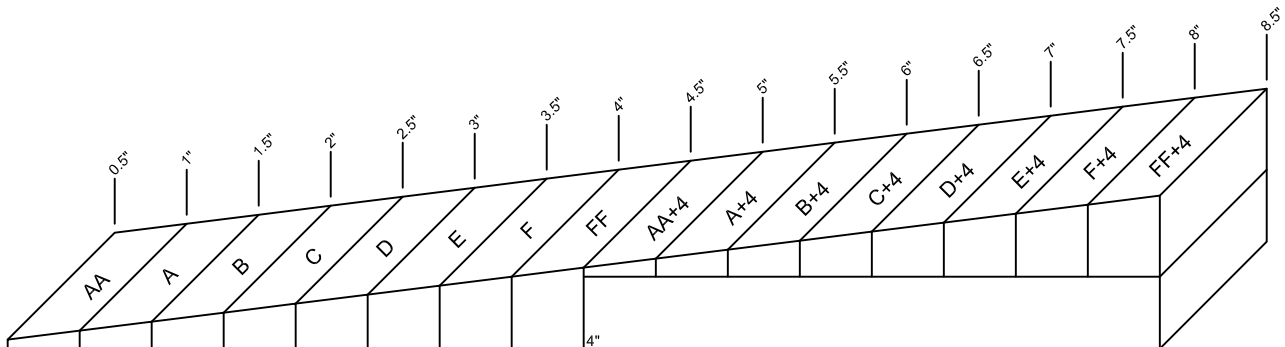
Extended Panel Systems*

*Availability for extended tapered panels may vary for each region.



1/8" SLOPE TAPERED ISO (4' x 4' PANELS)
6 PANEL SYSTEM - NOT TO SCALE

SLOPE	BOARD STYLE	DIMENSIONS
1/8" per/ft.	AA	0.5" - 1"
1/8" per/ft.	A	1" - 1.5"
1/8" per/ft.	B	1.5" - 2"
1/8" per/ft.	C	2" - 2.5"
1/8" per/ft.	D	2.5" - 3"
1/8" per/ft.	E	3" - 3.5"
NO SLOPE	3" ISO FILL	3"

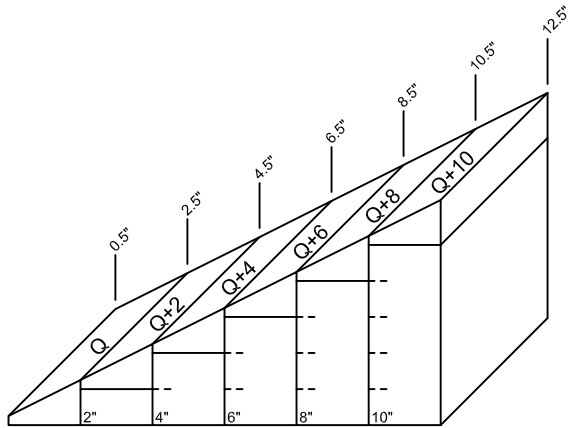


1/8" SLOPE TAPERED ISO (4' x 4' PANELS)
8 PANEL SYSTEM - NOT TO SCALE

SLOPE	BOARD STYLE	DIMENSIONS
1/8" per/ft.	AA	0.5" - 1"
1/8" per/ft.	A	1" - 1.5"
1/8" per/ft.	B	1.5" - 2"
1/8" per/ft.	C	2" - 2.5"
1/8" per/ft.	D	2.5" - 3"
1/8" per/ft.	E	3" - 3.5"
1/8" per/ft.	F	3.5" - 4"
1/8" per/ft.	FF	4" - 4.5"
NO SLOPE	4" ISO FILL	4"

Tapered Insulation Panels & Section Details

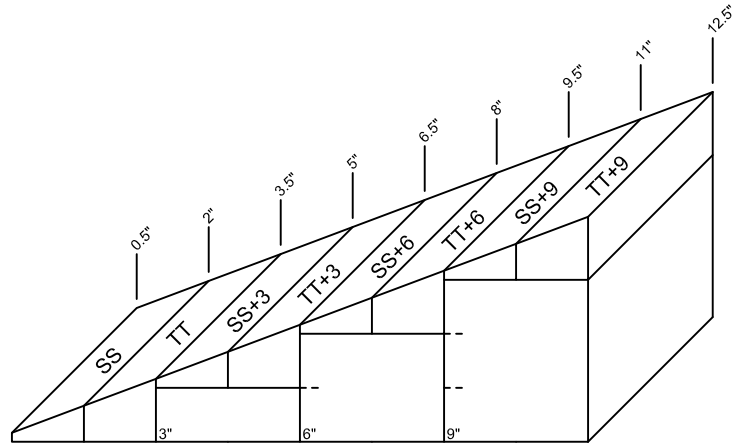
1/2" Per/Ft Sloped Tapered Panels



1/2" SLOPE TAPERED ISO (4' x 4' PANELS)
1 PANEL SYSTEM - NOT TO SCALE

SLOPE	BOARD STYLE	DIMENSIONS
1/2" per/ft.	Q	0.5" - 2.5"
NO SLOPE	2" ISO FILL	2"

3/8" Per/Ft Sloped Tapered Panels



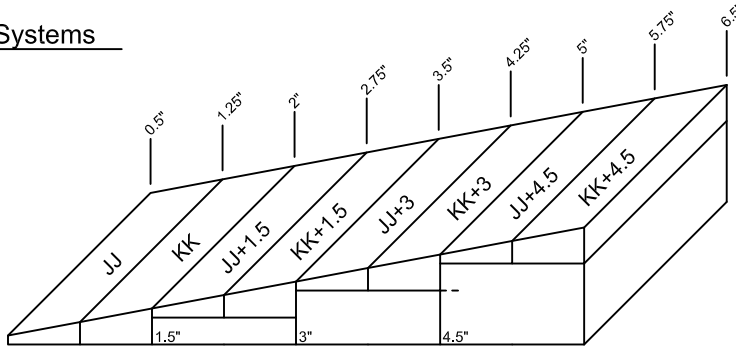
3/8" SLOPE TAPERED ISO (4' x 4' PANELS)
2 PANEL SYSTEM - NOT TO SCALE

SLOPE	BOARD STYLE	DIMENSIONS
3/8" per/ft.	SS	0.5" - 2"
3/8" per/ft.	TT	2" - 3.5"
NO SLOPE	3" ISO FILL	3"

3/16" Per/Ft Sloped Tapered Panels*

*3/16" per/ft tapered panels systems may not be available for all regions.

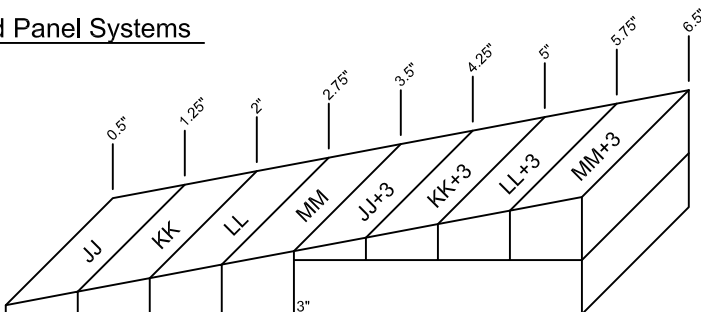
Regular Systems



3/16" SLOPE TAPERED ISO (4' x 4' PANELS)
2 PANEL SYSTEM - NOT TO SCALE

SLOPE	BOARD STYLE	DIMENSIONS
3/16" per/ft.	JJ	0.5" - 1.25"
3/16" per/ft.	KK	1.25" - 2"
NO SLOPE	1.5" ISO FILL	1.5"
NO SLOPE	3" ISO FILL	3"

Extended Panel Systems



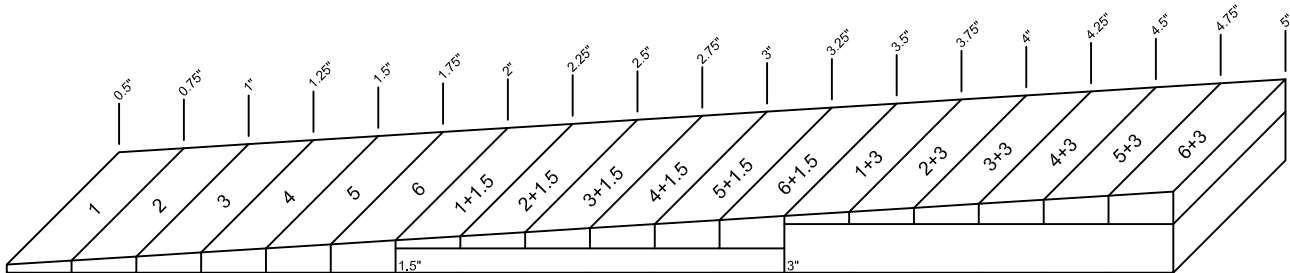
3/16" SLOPE TAPERED ISO (4' x 4' PANELS)
4 PANEL SYSTEM - NOT TO SCALE

SLOPE	BOARD STYLE	DIMENSIONS
3/16" per/ft.	JJ	0.5" - 1.25"
3/16" per/ft.	KK	1.25" - 2"
3/16" per/ft.	LL	2" - 2.75"
3/16" per/ft.	MM	2.75" - 3.5"
NO SLOPE	3" ISO FILL	3"

Tapered Insulation Panels & Section Details

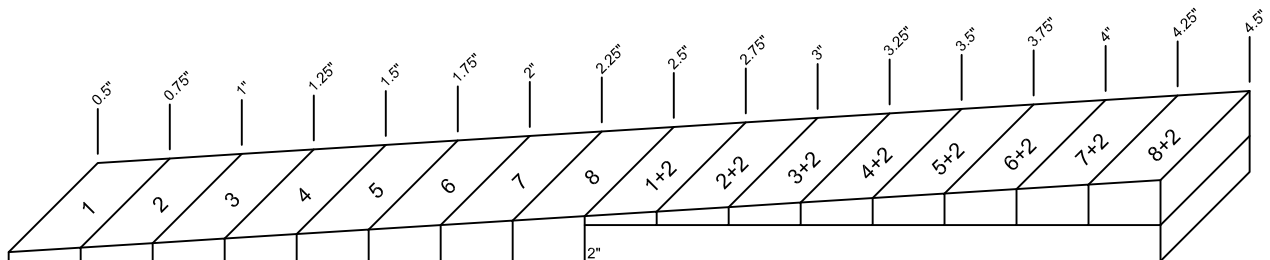
1/16" Per/Ft Sloped Tapered Panels

*Availability for 1/16" per/ft tapered panels may vary for each region.



1/16" SLOPE TAPERED ISO (4' x 4' PANELS)
6 PANEL SYSTEM - NOT TO SCALE

SLOPE	BOARD STYLE	DIMENSIONS
1/16" per/ft.	1	0.5" - .75"
1/16" per/ft.	2	.75" - 1"
1/16" per/ft.	3	1" - 1.25"
1/16" per/ft.	4	1.25" - 1.5"
1/16" per/ft.	5	1.5" - 1.75"
1/16" per/ft.	6	1.75" - 2"
NO SLOPE	1.5" ISO FILL	1.5"
NO SLOPE	3" ISO FILL	3"



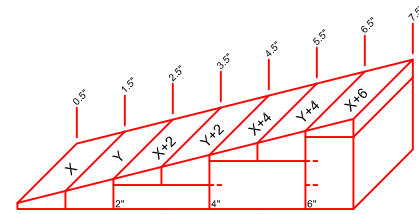
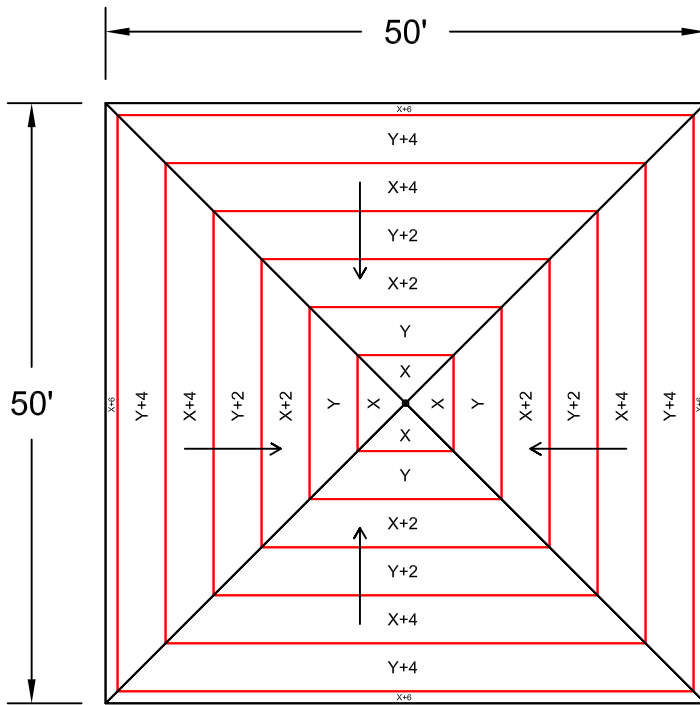
1/16" SLOPE TAPERED ISO (4' x 4' PANELS)
8 PANEL SYSTEM - NOT TO SCALE

SLOPE	BOARD STYLE	DIMENSIONS
1/16" per/ft.	1	0.5" - .75"
1/16" per/ft.	2	.75" - 1"
1/16" per/ft.	3	1" - 1.25"
1/16" per/ft.	4	1.25" - 1.5"
1/16" per/ft.	5	1.5" - 1.75"
1/16" per/ft.	6	1.75" - 2"
1/16" per/ft.	7	2" - 2.25"
1/16" per/ft.	8	2.25" - 2.5"
NO SLOPE	2" ISO FILL	2"

NOTE: The use of 1/16" per/ft slope on a flat deck is not recommended. In order to use a 1/16" per/ft sloped tapered system on a flat deck, prior approval from the Regional Field Services Manager in your area is required, and is dependent upon the type of roof system that is to be installed on top of the insulation. The use of 1/16" per/ft tapered panels on a roof that has existing slope in order to enhance the slope is permitted, however, GAF cannot guarantee that the ridges and valleys of the existing slope will match those of the tapered system.

Extended Panel Systems

A comparison using XY versus XYZ



EXAMPLE 1 (STANDARD)

SECTION TAPERED PANELS:		QTY
X	0.500 - 1.500	122
Y	1.500 - 2.500	96

SECTION FILL PANELS:		QTY
2"	2.000 flat	256

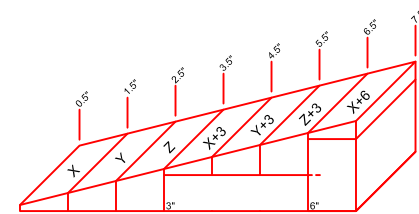
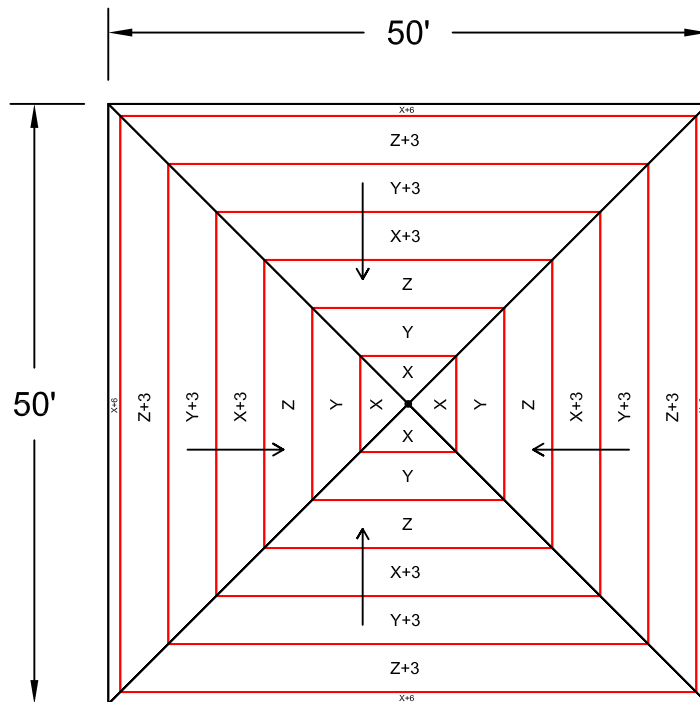
Average R-Value = 26.61
 Tapered Area: 25 Squares
 Total Squares of Material: 75.84
 Total Squares of Application: 64.16

APPROXIMATE PRICE: \$4,732*

* Taper .42 bd/ft, Flat .32 bd/ft

PROS: CHEAPER UP-FRONT COST
 PANELS NO LARGER THAN 2.5" THICK
 COMMON PANELS KEPT IN STOCK

CONS: MORE TOTAL SQUARES HANDLED AND APPLIED



EXAMPLE 2 (EXTENDED)

SECTION TAPERED PANELS:		QTY
X	0.500 - 1.500	90
Y	1.500 - 2.500	56
Z	2.500 - 3.500	72

SECTION FILL PANELS:		QTY
3"	3.000 flat	140

Average R-Value = 26.81
 Tapered Area: 25 Squares
 Total Squares of Material: 57.28
 Total Squares of Application: 46.20

APPROXIMATE PRICE: \$4,959*

* Taper .42 bd/ft, Flat .32 bd/ft

PROS: LESS TOTAL SQUARES HANDLED AND APPLIED
 LESS ADHESIVE USED (WHEN ADHERING)
 SLIGHTLY BETTER R-VALUE

CONS: MORE EXPENSIVE UP-FRONT COST
 SINGLE PANEL THICKNESS EXCEEDS 3"
 Z PANELS NOT COMMONLY STOCKED

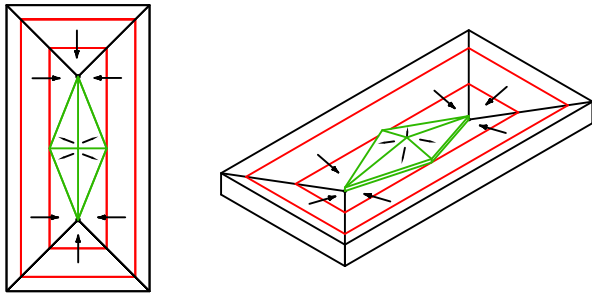
*Board/ft pricing used as example only - contact your local GAF Rep. for current bd/ft pricing in your area.

Layouts & Designs

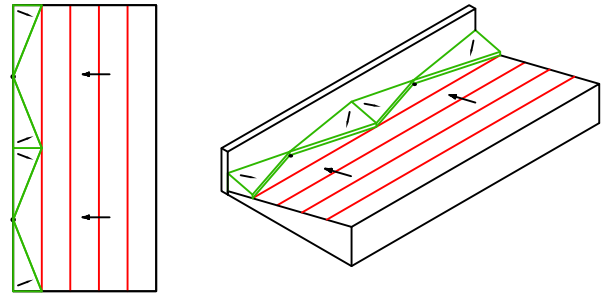
Typical tapered layouts shown in plan and isometric views

Designs not to scale

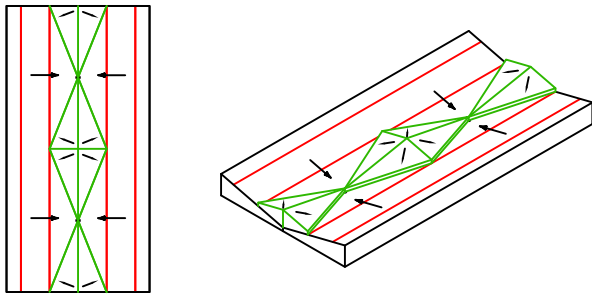
2-WAY/4-WAY COMBINATION SLOPE DESIGN



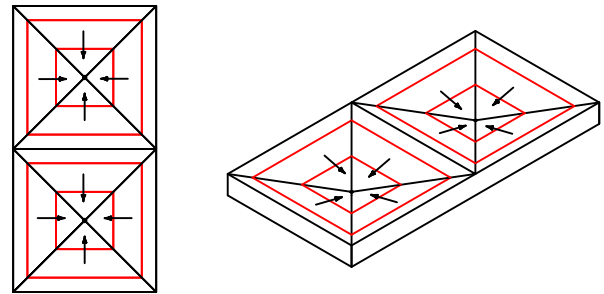
1-WAY SLOPE TO SCUPPERS/DRAINS



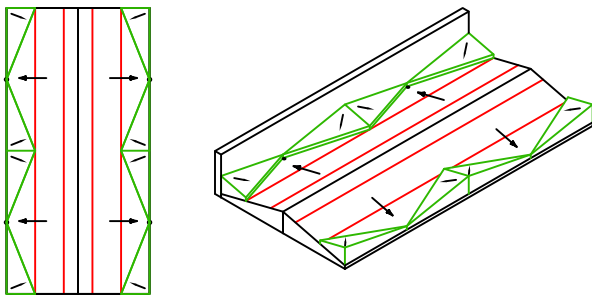
2-WAY SLOPE TO CENTER DRAINS



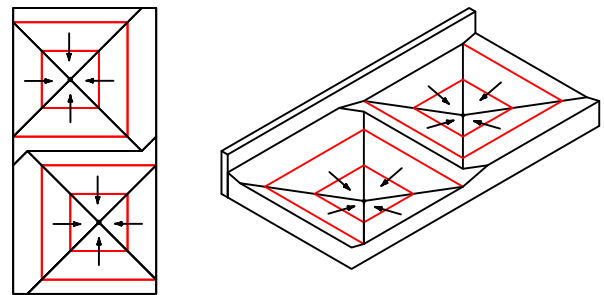
4-WAY SLOPE TO CENTER DRAINS



2-WAY SLOPE TO DRAINS/SCUPPERS



4-WAY SLOPE TO OFFSET DRAINS

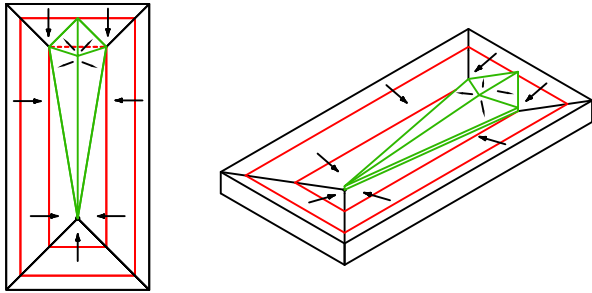


Layouts & Designs

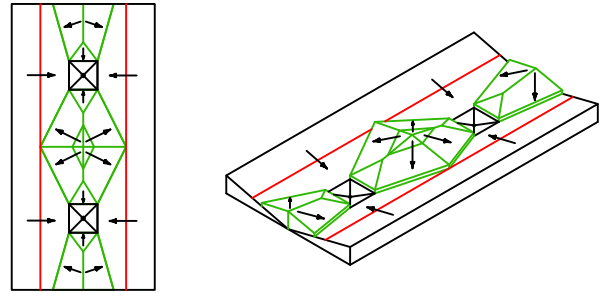
Typical tapered layouts shown in plan and isometric views

Designs not to scale

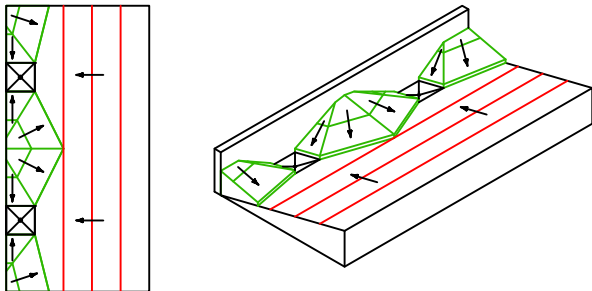
EXPANDED LOW WITH KITE CRICKET



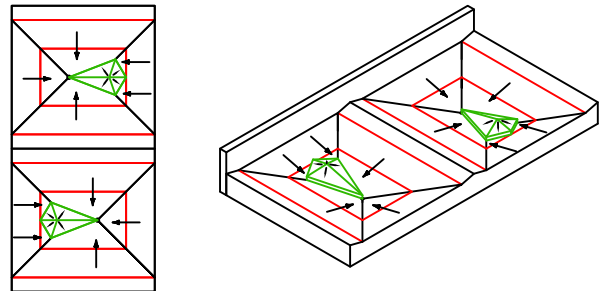
2-WAY TO SNUB NOSED CRICKETS / SUMPS



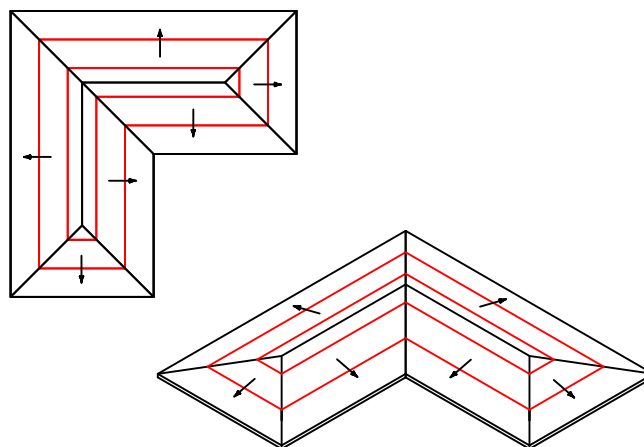
1-WAY TO SNUB-NOSED CRICKETS / SUMPS



COMBINATION SLOPE WITH KITE CRICKETS



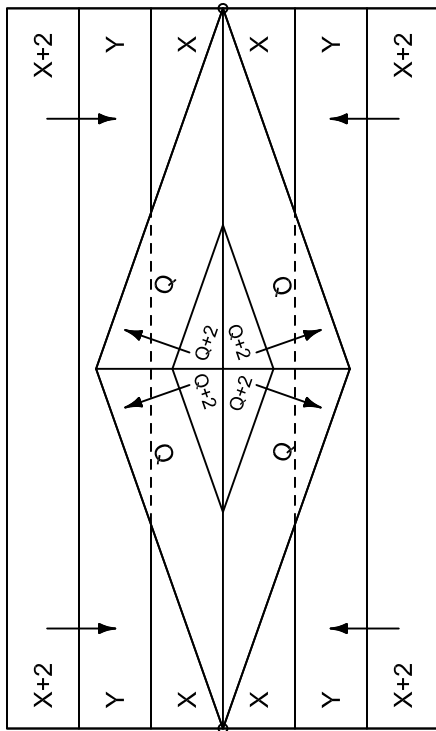
SLOPE TO PERIMETER EDGE



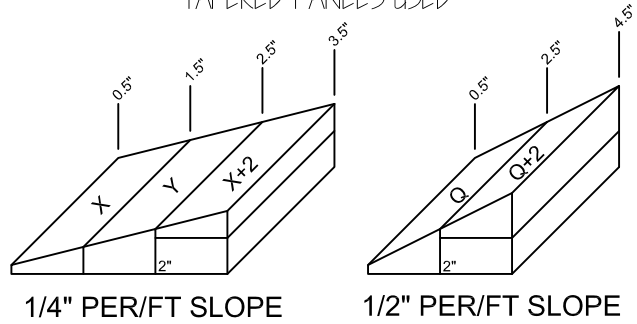
Understanding Cricket Structure

Designs not to scale

SAMPLE LAYOUT

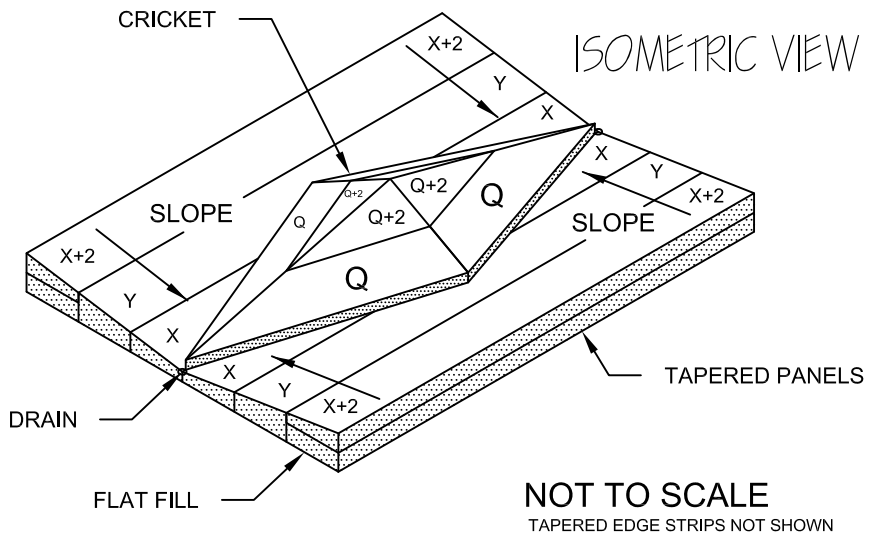


TAPERED PANELS USED



1/4" PER/FT SLOPE

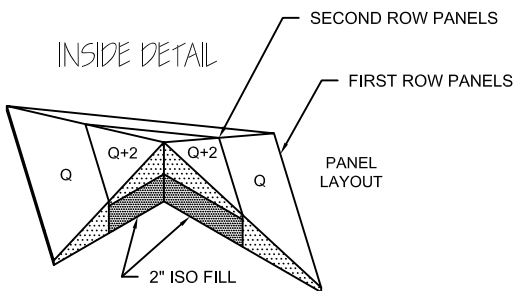
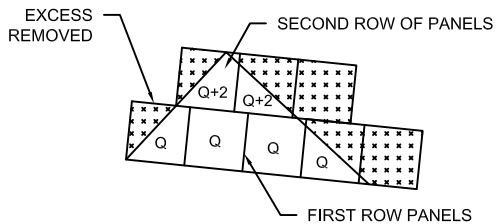
1/2" PER/FT SLOPE



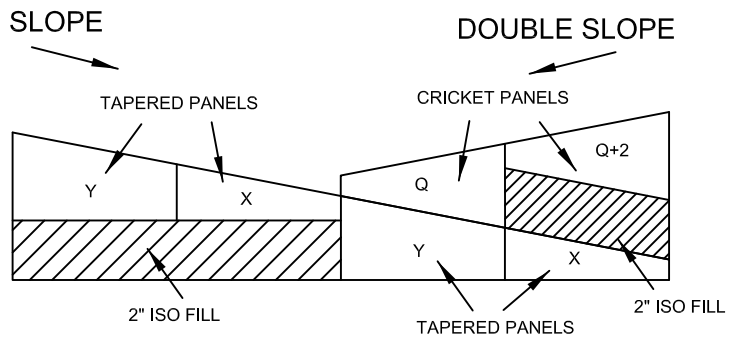
NOT TO SCALE

TAPERED EDGE STRIPS NOT SHOWN

CRICKET STRUCTURE



SLOPED PANELS DIAGRAM

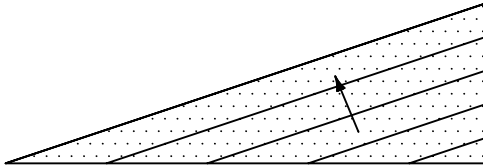


Notes:

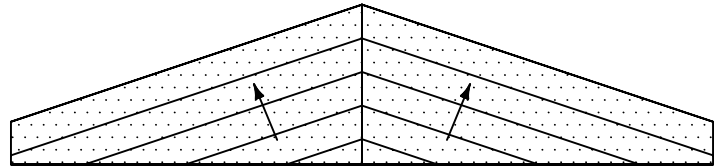
- 1) Industry standard: crickets are double the slope of the tapered system used.
- 2) Doubling the slope of the cricket ensures that proper drainage occurs. Anything less than double may result in ponding issues and/or slower drainage.

Types of Crickets

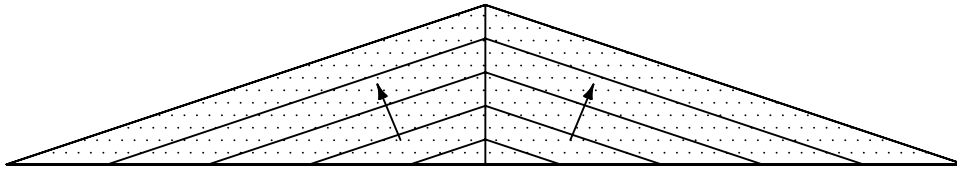
Designs not to scale



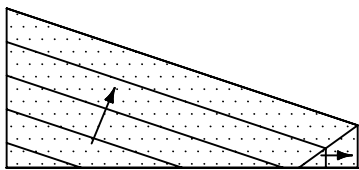
QUARTER/CORNER CRICKET



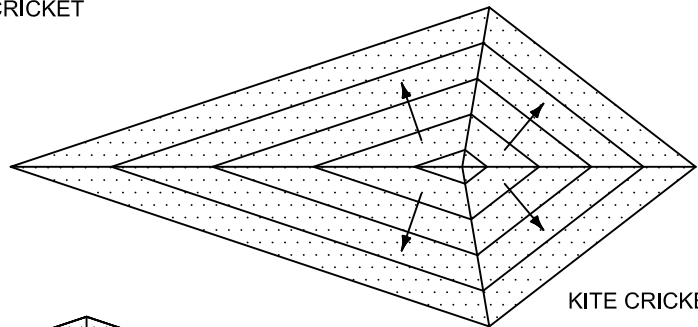
OFF-WALL CRICKET



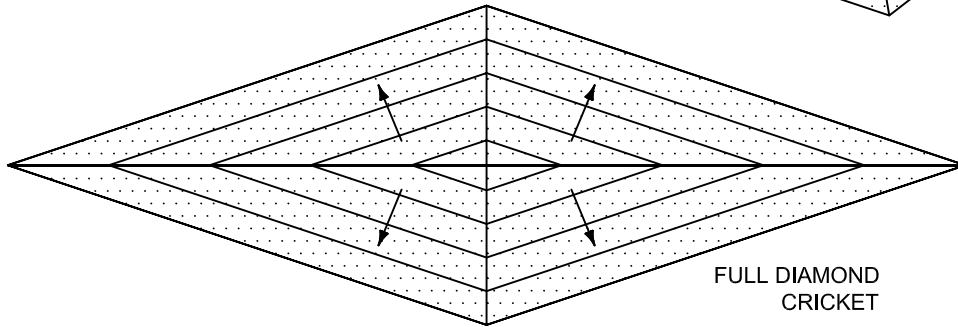
HALF-DIAMOND CRICKET



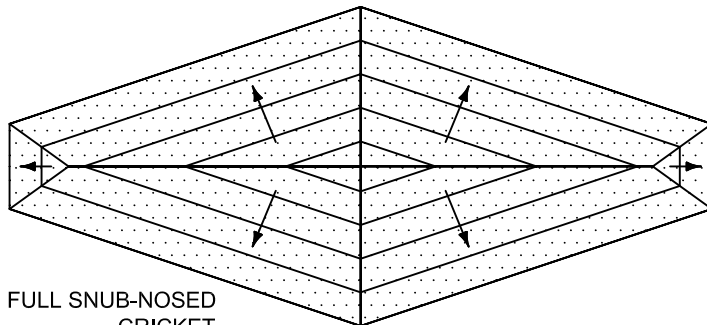
QUARTER SNUB-NOSED CRICKET



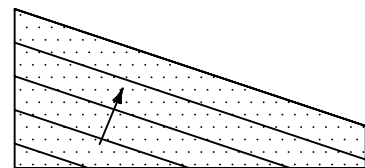
KITE CRICKET



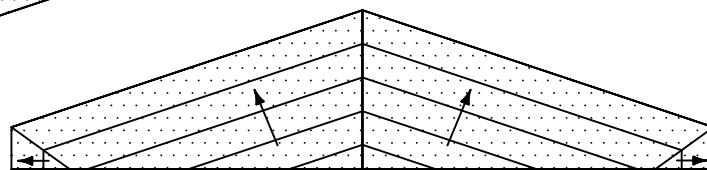
FULL DIAMOND CRICKET



FULL SNUB-NOSED CRICKET

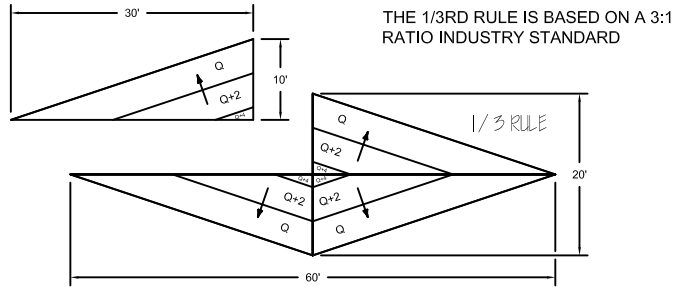
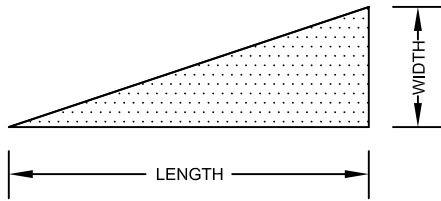


OFF-WALL CORNER CRICKET



HALF SNUB-NOSED CRICKET

1/3RD Cricket Rule



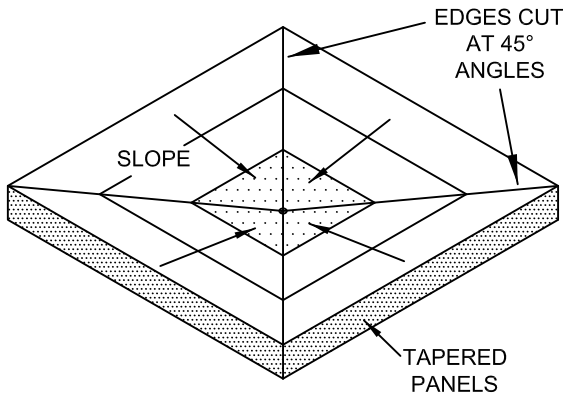
QUARTER		QUARTER		HALF		HALF		FULL		FULL	
LENGTH	WIDTH	LENGTH	WIDTH	LENGTH	WIDTH	LENGTH	WIDTH	LENGTH	WIDTH	LENGTH	WIDTH
3'	1'	41'	13'-8"	6'	1'	82'	13'-8"	3'	1'	41'	13'-8"
4'	1'-4"	42'	14'	8'	1'-4"	84'	14'	4'	1'-4"	42'	14'
5'	1'-8"	43'	14'-4"	10'	1'-8"	86'	14'-4"	5'	1'-8"	43'	14'-4"
6'	2'	44'	14'-8"	12'	2'	88'	14'-8"	6'	2'	44'	14'-8"
7'	2'-4"	45'	15'	14'	2'-4"	90'	15'	7'	2'-4"	45'	15'
8'	2'-8"	46'	15'-4"	16'	2'-8"	92'	15'-4"	8'	2'-8"	46'	15'-4"
9'	3'	47'	15'-8"	18'	3'	94'	15'-8"	9'	3'	47'	15'-8"
10'	3'-4"	48'	16'	20'	3'-4"	96'	16'	10'	3'-4"	48'	16'
11'	3'-8"	49'	16'-4"	22'	3'-8"	98'	16'-4"	11'	3'-8"	49'	16'-4"
12'	4'	50'	16'-8"	24'	4'	100'	16'-8"	12'	4'	50'	16'-8"
13'	4'-4"	51'	17'	26'	4'-4"	102'	17'	13'	4'-4"	51'	17'
14'	4'-8"	52'	17'-4"	28'	4'-8"	104'	17'-4"	14'	4'-8"	52'	17'-4"
15'	5'	53'	17'-8"	30'	5'	106'	17'-8"	15'	5'	53'	17'-8"
16'	5'-4"	54'	18'	32'	5'-4"	108'	18'	16'	5'-4"	54'	18'
17'	5'-8"	55'	18'-4"	34'	5'-8"	110'	18'-4"	17'	5'-8"	55'	18'-4"
18'	6'	56'	18'-8"	36'	6'	112'	18'-8"	18'	6'	56'	18'-8"
19'	6'-4"	57'	19'	38'	6'-4"	114'	19'	19'	6'-4"	57'	19'
20'	6'-8"	58'	19'-4"	40'	6'-8"	116'	19'-4"	20'	6'-8"	58'	19'-4"
21'	7'	59'	19'-8"	42'	7'	118'	19'-8"	21'	7'	59'	19'-8"
22'	7'-4"	60'	20'	44'	7'-4"	120'	20'	22'	7'-4"	60'	20'
23'	7'-8"	61'	20'-4"	46'	7'-8"	122'	20'-4"	23'	7'-8"	61'	20'-4"
24'	8'	62'	20'-8"	48'	8'	124'	20'-8"	24'	8'	62'	20'-8"
25'	8'-4"	63'	21'	50'	8'-4"	126'	21'	25'	8'-4"	63'	21'
26'	8'-8"	64'	21'-4"	52'	8'-8"	128'	21'-4"	26'	8'-8"	64'	21'-4"
27'	9'	65'	21'-8"	54'	9'	130'	21'-8"	27'	9'	65'	21'-8"
28'	9'-4"	66'	22'	56'	9'-4"	132'	22'	28'	9'-4"	66'	22'
29'	9'-8"	67'	22'-4"	58'	9'-8"	134'	22'-4"	29'	9'-8"	67'	22'-4"
30'	10'	68'	22'-8"	60'	10'	136'	22'-8"	30'	10'	68'	22'-8"
31'	10'-4"	69'	23'	62'	10'-4"	138'	23'	31'	10'-4"	69'	23'
32'	10'-8"	70'	23'-4"	64'	10'-8"	140'	23'-4"	32'	10'-8"	70'	23'-4"
33'	11'	71'	23'-8"	66'	11'	142'	23'-8"	33'	11'	71'	23'-8"
34'	11'-4"	72'	24'	68'	11'-4"	144'	24'	34'	11'-4"	72'	24'
35'	11'-8"	73'	24'-4"	70'	11'-8"	146'	24'-4"	35'	11'-8"	73'	24'-4"
36'	12'	74'	24'-8"	72'	12'	148'	24'-8"	36'	12'	74'	24'-8"
37'	12'-4"	75'	25'	74'	12'-4"	150'	25'	37'	12'-4"	75'	25'
38'	12'-8"			76'	12'-8"			38'	12'-8"		
39'	13'			78'	13'			39'	13'		
40'	13'-4"			80'	13'-4"			40'	13'-4"		

Tapered Insulation Sumps

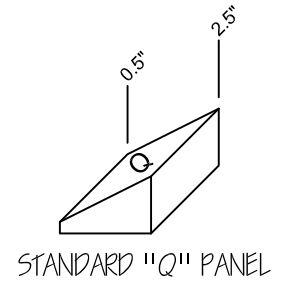
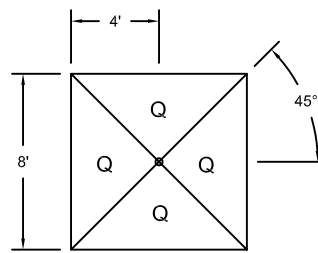
Tapered insulation sumps can be made with any tapered panel to any size needed. Pre-fabricated sumps are also available.

4-WAY SLOPE TO SUMP

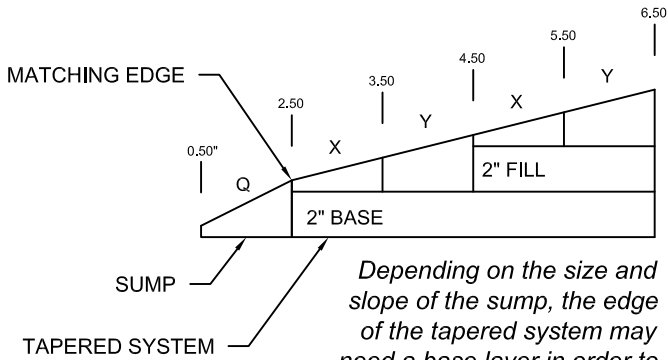
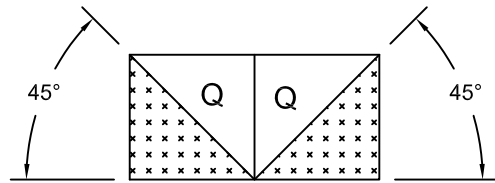
NOT TO SCALE



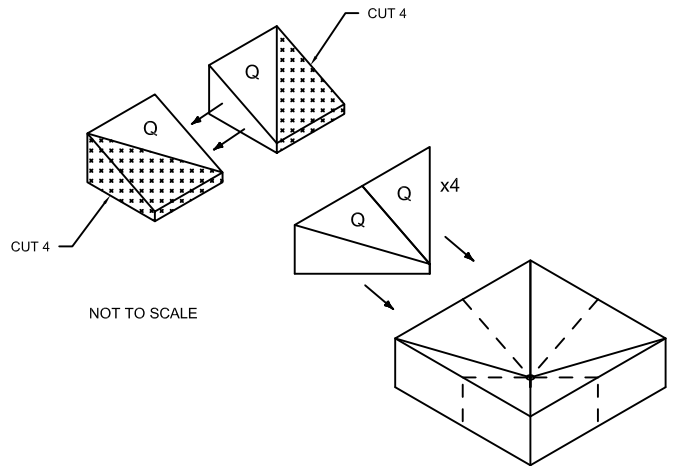
SUMP MADE OF "Q" PANELS



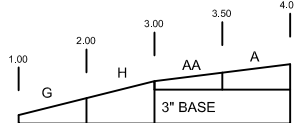
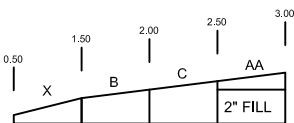
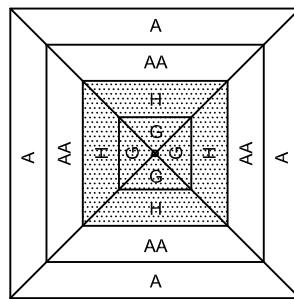
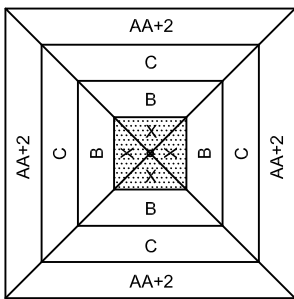
BUILDING A SUMP



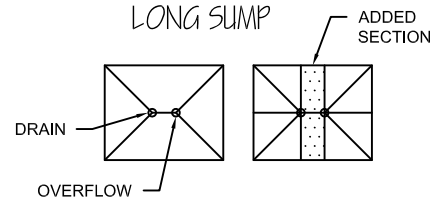
Depending on the size and slope of the sump, the edge of the tapered system may need a base layer in order to increase the height to match the edge of the sump.



EXAMPLES OF TAPERED SYSTEMS WITH SUMPS



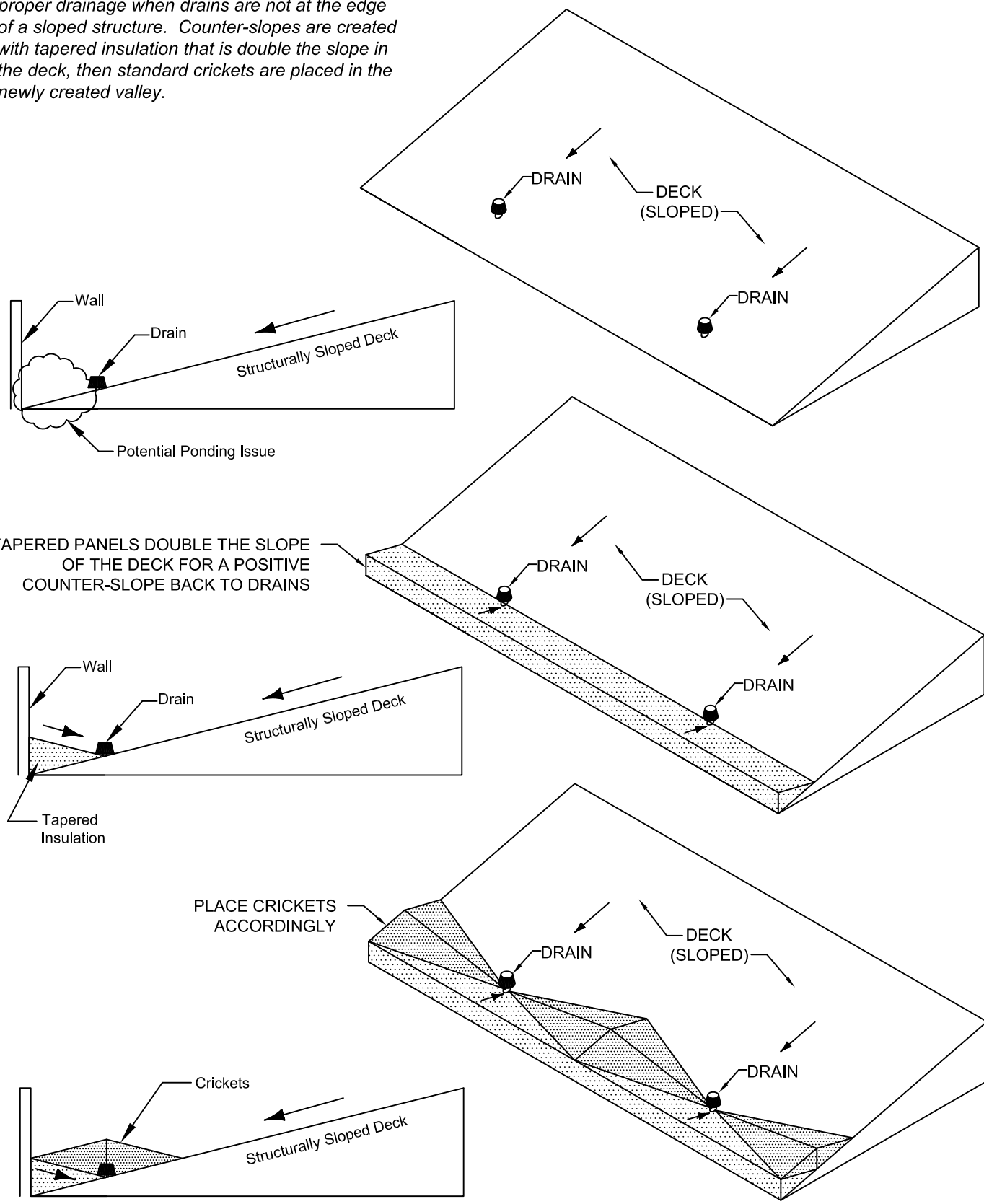
LONG SUMP



A long sump can accommodate a drain and an overflow. This is built like a standard sump with an added section between the drains.

Tapered Insulation as Counter-Slope

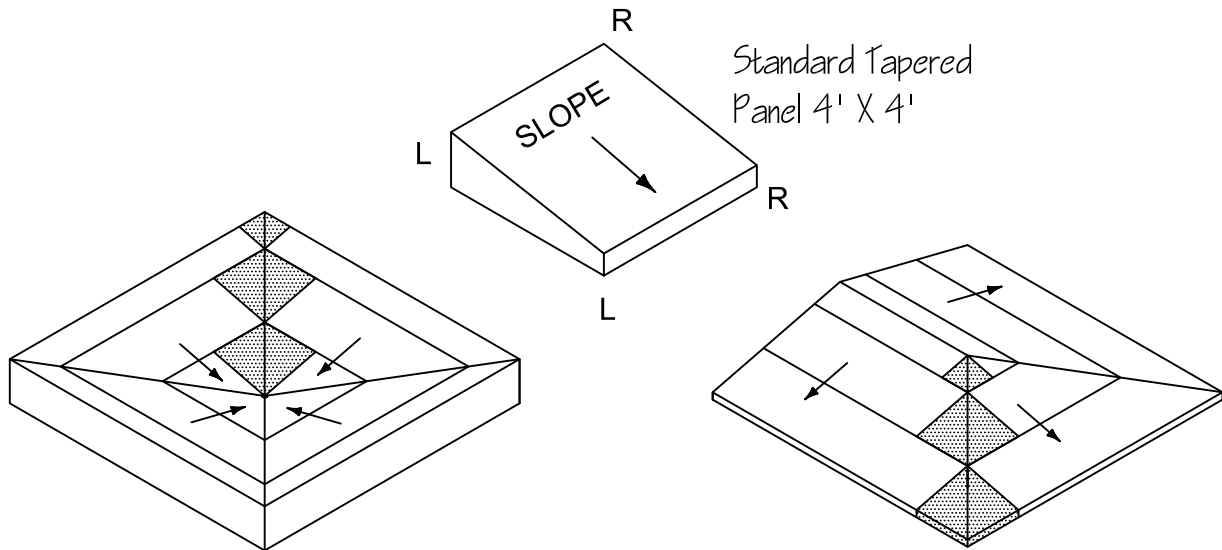
Counter-slopes, or back-slopes, are the solution to proper drainage when drains are not at the edge of a sloped structure. Counter-slopes are created with tapered insulation that is double the slope in the deck, then standard crickets are placed in the newly created valley.



Mitered Hips and Valleys in Tapered Insulation

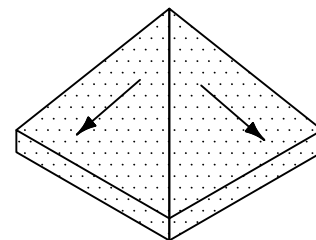
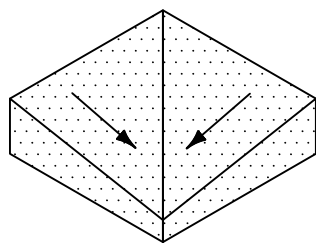
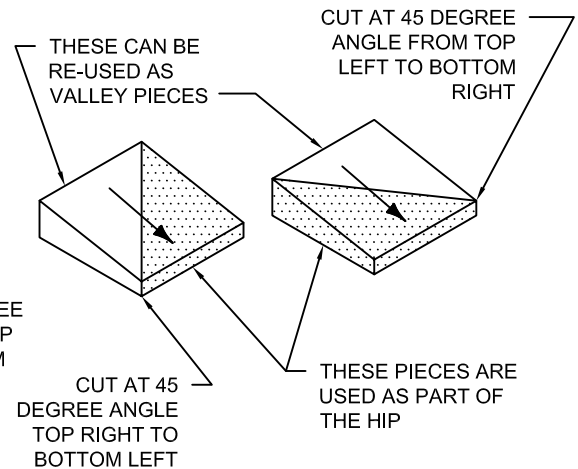
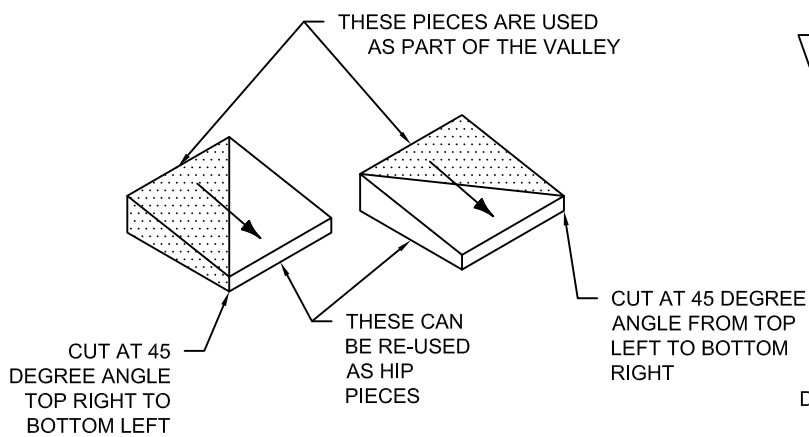
Cutting hips and valleys in tapered insulation is similar to that of cutting sumps (see section on sumps for more information). By cutting the panel in half, the leftover half can be re-used for the portion.

NOTE: DRAWINGS ARE NOT TO SCALE



MITERED VALLEY

MITERED HIP



FINISHED VALLEY

FINISHED HIP

FREQUENTLY ASKED QUESTIONS (FAQ'S)

Q: What is the process to obtain a quote?

A: Tapered requests should be emailed to tdg@gaf.com and will be completed in the order in which received. Using the latest taper software available, our Tapered Design Specialists will design and estimate the job, and the quote will be sent to the GAF Territory Manager for your region. Each quote will have a unique job number.

Q: What information should be provided when requesting a quote?

A: In order for us to complete a quote we need the following information:

- *Roof Plan(s) or Dodge & IsqFt number(s)*
- *Project Name and Location*
- *Roof Details and Building/Wall Sections*
- *Specifications/ Submittals*
- *Average or Minimum R value Requirements*
- *Required Slope of Tapered Insulation*
- *Minimum Starting Thickness*
- *Base Layer(s)*
- *Contact Information*

Q: What is the turn-around time for a quote?



A: The turn-around time depends on the complexity of the roof area and design. A minimum of 2 business days is strongly recommended to ensure the quote is completed in time.

Q: Do you accept paper blueprint drawings?

A: As of 2010, we no longer accept mailed full-size blueprint paper drawings. Have your local office supply store scan them as a full size pdf, then email us the electronic version. This saves you time & money!

Q: Do you accept hand-drawn roof plans?

A: Yes, we accept fully dimensioned hand drawn roof plans as long as they are legible. We recommend:

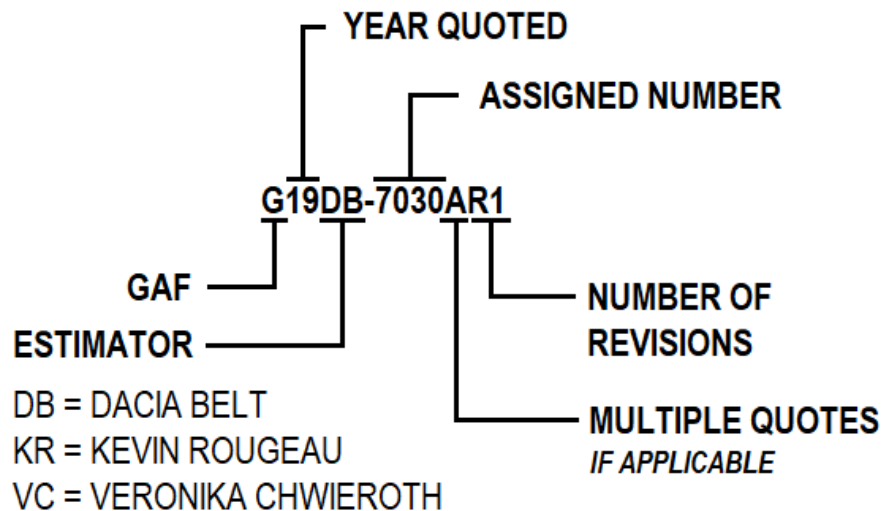
- Using a ruler when drawing straight lines
- Using graph paper for clean lines
- Drawing lines clearly
- Calculating the overall length, then checking to see if all side dimensions add up
- Providing a horizontal  and vertical  dimension to each roof drain and roof obstruction, as well as the size of the obstruction for proper placement
- Verifying that all roof drains, scuppers, RTU's, slopes, etc. are clearly shown

Q: Will I receive the piece count?

A: TDG does not provide piece counts. When the job has been ordered by the quote number through our customer service department, the piece count will be provided by the Regional Pricing Administrator.

Q: How do I interpret the GAF TDG job/quote number?

A: The GAF quote number can be broken down as follows...



Note: To find out if you have the latest version of the quote, contact us at tdg@gaf.com.

Q: How do I get a shop drawing?

A: A submittal or full size shop drawing can be requested for review by the contractor or architect by contacting us at tdg@gaf.com and providing the quote number as reference. It is strongly recommended that the drawings are approved and signed by the architect prior to shipment to ensure the accuracy of the tapered design. GAF does not assume any responsibility for the accuracy or appropriateness of the system design, which shall remain the sole responsibility of the architect, engineer or contractor.

Inform us immediately when the job has been ordered through customer service. The drawings will not arrive on the truck when the shipment is delivered at the jobsite. Full size printed drawings can be mailed upon request if a job has been ordered (limit 4).

Q: How do I contact the Tapered Design Group?

A: Email: tdg@gaf.com

Phone: Dacia: 972.851.0421 Kevin: 972.851.0489 Veronika: 973.628.4051

TERMS AND DEFINITIONS

1/3RD RULE	The industry standard for figuring the width of a cricket. It is a 3:1 ratio based on a standard diamond cricket, where the width is 1/3 rd the overall length.
2-WAY SLOPE	A roof with two roof planes coming together to form a "V" shaped depression down the center of the roof area. Most often used between a series of drains that have crickets/saddles between each drain.
4-WAY SLOPE	A roof with four roof planes coming together at a peak and four separate hips/valleys, most often at 45 degree angles, to a center drain. Sumps are created using 4-way slopes in tapered insulation.
AREA DIVIDER	Divides roofs into separate areas. An area division may be needed in order to create better tapered layouts when designs become complicated. Examples of area dividers are expansion joints, pony walls and parapets.
AVERAGE R-VALUE	In tapered insulation, the R-value that is calculated in the overall roof area based on the average thickness of the insulation.
COUNTER-SLOPE	Counter-slopes, or back-slopes, are the solution to proper drainage when drains are not at the edge of a sloped structure. Counter-slopes are created with tapered insulation that is double the slope in the deck facing the opposite direction of the field slope, and then standard crickets are placed in the newly created valley.
CRICKET	Tapered insulation that is usually double the tapered slope. Crickets help divert water around objects on a roof area, such as obstructions and roof penetrations, and direct water to drains and scuppers. Various types of crickets may be used throughout the roof area, such as: corner, snub-nosed, diamond, half-diamond and off-wall crickets.
DECK SLOPE	Otherwise known as structure slope. This is slope that is built into the deck, created by sloping trusses to a certain pitch. Most of these type decks require only flat ISO insulation and the only tapered panels are those of crickets.
DRAIN	The exit-point where rain water flows into a pipe fixture off of a roof area. Drains can have a variety of sizes and shapes and are installed at the low-point of the roof area.
DRAINAGE	The flow of water from one point to another. Ideally, positive drainage is achieved when water flows from the highest point to the lowest point. For example, a drain or scupper, where the water can exit off of the roof area without ponding.
EXPANSION JOINT	A separation between roof areas in order to relieve stress due to building movement or heat expansion/contraction.
HIP	The inclined external angle formed by the intersection of two sloping roof planes.

IECC	International Energy Conservation Code.
INSULATION	Material used on roof areas or in walls in order to reduce the transfer of heat.
LOW-SLOPE	Roof slopes less than 2:12 are considered low-sloped roofs. Generally, tapered insulation is used for slopes 1/2:12 or less to provide drainage where needed.
LTTR	Long Term Thermal Resistance (LTTR) is a scientifically supported method to calculate the 15-year, time-weighted average R-value of roof insulation. <i>Source: PIMA</i>
MINIMUM R-VALUE	In tapered insulation, the R-value at the lowest point of the roof area.
NRCA	National Roofing Contractors Association.
OBSTRUCTION	Any roof penetration or obstacle that can block the flow of water and potentially cause ponding. <i>See Void</i>
OVERFLOW DRAINAGE	Also known as secondary, or emergency, drains or scuppers. Where roof drains are required, secondary roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason.
PIMA	Polyisocyanurate Insulation Manufacturers Association.
POLYISOCYANURATE	Polyisocyanurate, often referred to as Polyiso (or ISO), is a closed-cell rigid foam board insulation consisting of a foam core sandwiched between two facers. The facers are composed of various organic and inorganic materials, usually paper and fiberglass. It is widely used in residential and commercial markets for both roof and side wall applications. <i>Source: PIMA</i>
PONDING	Standing water that does not drain or dissipate from the roof surface within 48 hours after precipitation ends. Ponding can also result from other water sources, including, but not limited to, improperly piped air conditioning condensate and steam condensate lines and/or leaks.
R-VALUE	The measure of thermal resistance in insulation. R-value requirements vary by region and may be specified as <i>Minimum</i> or <i>Average</i> R-value. Consult local code to determine the proper R-value for your area.
RIDGE	The high point where a roof area changes direction and creates a peak. In a tapered system, the ridge usually falls half the distance between the drains if a 4-way slope design is used.
RTU	Roof Top Unit. RTUs greater than 30" in length requires crickets in order to divert water. Most often the RTU is installed on a curb, and the tapered insulation is removed from the estimate and creates a "void" in the roof area. <i>See Void</i>

ROOF SYSTEM	Everything that is above the roof deck, including the type of membrane going over the tapered insulation system, such as TPO, PVC, BUR & Modified Bitumen.
SADDLE	Another term for a cricket, though most often referred to those between drains.
SCUPPER	An opening through a parapet wall that allows for water to drain off of the roof area. Most common designs for scuppers include a 2-way slope with crickets between a series of scuppers on a single wall.
SUMP	Sumps are used to help draw the water in towards the center drain, and can come in various sizes and slopes. Similar to a 4-way slope, sumps are usually a greater slope than the field slope of a tapered system.
TAPERED SLOPE	The slope on a roof area that is created by tapered insulation. Tapered slope may refer to the field slope or slope created by crickets/saddles. Most common on flat decks, however, may be used to enhance an existing slope of a structure.
TDG	Tapered Design Group. As part of the many services available to our customers to reduce their hassles, our Tapered Design Group (TDG) provides tapered insulation take-offs for architects, contractors, and distributors nationwide.
VALLEY	Area where two adjoining sloped roof planes intersect on a roof creating a "V" shaped depression. Can also be used to describe the "hip" created in tapered insulation that meet at 45 degree angles from a 4-way slope.
VOID	A void is any obstruction in the roof area that will not receive tapered insulation. Voids will not be calculated in the total squares of tapered insulation and most often need crickets in order to divert the water around the obstruction itself. Some examples of voids are RTUs, fans, curbs, roof hatches, skylights, chimneys or any other roof penetrations over 30" wide.