Consulting Structural &
Forensic Engineers
3600 E University Dr, Suite 1400, Phoenix, AZ 85034
(602) 438-2500 www.smleng.com

Roof Tech, Inc.
10620 Treena Street, Suite 230
San Diego, CA 92131

July 11, 2025

Attn: Mr. Yoichi Shimokobe, CEO

Subject: Roof Tech RT-PLUS with or without RT-Rail (1.6 or 2.3)

SML Job No.: 471-22

Dear Mr. Shimokobe:

We have analyzed the Roof Tech RT-PLUS (RT-PLUS) with or without Roof Tech RT-Rail (RT-Rail) for its use in supporting photovoltaic (PV) panels flush mount on enclosed or partially enclosed building roofs or walls and determined that, for the configurations and criteria described below, it is in compliance with the applicable sections of the following reference documents:

Code/References:

- International Building Code 2018 & 2021 Editions
- International Residential Building Code 2018 & 2021 Editions
- ASCE/SEI 7-16 Min. Design Loads for Buildings & Other Structures
- Aluminum Design Manual, ADM-2015 & 2020 Editions

This letter is to address the use and allowable loads for the Roof Tech RT-PLUS with or without RT-Rail and is intended to be a standalone letter.

Roof Tech, Inc. – RT-PLUS Mount

We have reviewed the test report for the RT-PLUS prepared by IAPMO Institute of Building Technology (IAPMO), report number 2426-25013-002 dated March 5, 2025.

The IAPMO report indicates the primary failure modes for the RT-PLUS are screw withdrawal for shear loading, sheathing failure for compression and tension loading (OSB and Plywood Only), and screw withdrawal for shear and tension loading (Rafter). Please note that allowable loads for the RT-PLUS for Rafter compression are not presented as the roof framing will control for these conditions and shall be evaluated "by others" as noted later in this letter. The allowable load values provided below were developed by taking the average of six tests divided by a factor of safety of 3.0 for screw withdrawal and 2.0 for sheathing failure. The shear test loads were applied with the bolt located at the RT-PLUS slot top. Any adverse effects due to additional height or eccentricity of connected components shall be considered by the end user of this letter.

The Roof Tech RT-PLUS photovoltaic (PV) panel roof mount system is comprised of a 6000 series aluminum RT-PLUS base. The RT-PLUS comes in two versions, one with a 5/16" wide rail mounting slot and one with a 3/8" wide rail mounting slot, the allowable loads presented here use the lesser values of the two versions so that the same allowable loads are used for both versions.

RT-Rail system or an appropriately load-rated 3rd party rail, by others, may be attached to the RT-PLUS base per the rail manufacturer's installation instructions. The installation of the RT-PLUS must be with the long direction parallel to the roof framing and in accordance with Roof Tech's Installation Manual. The system is attached to the roof wood substrate with either SS304 5.0 mm x 60 mm or SS304 5.0 mm x 90 mm wood screws.

Three wood substrates were tested with the fasteners also passing through two layers of composite asphalt roof shingles and 2 layers of building paper. The three (3) tested wood substrate consisted of 15/32" thick plywood sheathing over a 2x4 SPF #2 rafter (2x truss top chord OK by inspection), 7/16" thick OSB only, and 15/32" thick plywood only, See Exhibits 'A1' & 'A2'. **Two (60mm or 90mm long) wood screws are required at the rafter installations, six (60mm long) wood screws are required at the rafter offset installations, and five (60mm long) wood screws are required at the OSB only and plywood only installations.**

Testing Standards/Testing Lab Compliance:

- ASTM D7147-21, Standard Specification for Testing and Establishing Allowable Loads of Joist Hangers
- Miami Dade County Cert. No. 22-0707.02
- ANSI ANAB Cert. No. AT-1479
- ISO/IEC 17025:2017

7/16" OSB: The allowable load for tension (uplift), compression (downward), and lateral shear for anchorage in 7/16" thick OSB only is 200.6 lb, 241.5 lb, and 140.1 lb respectively.

15/32" Plywood: The allowable load for tension (uplift), compression (downward), and lateral shear for anchorage in 15/32" thick plywood only is 216.2 lb, 236.5 lb, and 234.1 lb respectively.

Rafter

- **60mm:** The allowable load for tension (uplift) and lateral shear for anchorage in wood with specific gravity of 0.42 or greater is 459.9 lb and 339.7 lb respectively.
- **90mm:** The allowable load for tension (uplift) and lateral shear for anchorage in wood with specific gravity of 0.42 or greater is 644.3 lb and 538.6 lb respectively.
- **Offset:** The allowable load for tension (uplift) and lateral shear for anchorage in wood with specific gravity of 0.42 or greater is 566.5 lb and 499.7 lb respectively.
    - The minimum size rafter/truss top chord is 2x4.
    - The listed specific gravity is per NDS Table 12.3.3A
    - Values are based on securing the wood screws with a minimum embedment of 1.5 inches for 60mm screw and 2.68 inches for the 90mm screw, with a minimum edge distance of 1.5D = 0.295 inches which allows for the wood screws to be installed approximately within the middle half of the rafter/top chord width (0.91 inches) and minimum end distance of 2.5" laterally loaded parallel to grain downslope.
    - Compression loads are limited by the roof framing and shall be evaluated for each roof installation by a qualified professional and is outside the scope of this letter.

This letter only addresses the maximum spacing of the Roof Tech RT-PLUS mounting system with and without RT-Rail. If utilizing a 3rd party rail system, please see the applicable rail manufacturer's roof mount installation manuals and span tables for the maximum rail spans, and other limits to their use. The lesser of these tables and the applicable rail manufacturer's span tables shall control the installed spacing of the RT-PLUS and spans of the rails. The maximum rail cantilever shall be limited to the smaller of 40% of the maximum mount spacing in the tables below and the rail manufacturer's specified maximum cantilever. RT-PLUS mounts shall be skip loaded on the roof where possible and provide thermal expansion splices along the rail at intervals not to exceed manufacturer's recommendations (refer to the rail manufacturer's thermal expansion splice detailing for proper installation), or 14 ft o.c. maximum.

Roof Tech, Inc. – RT-Rail System (when used)

RT-Rail System has 2 rail options which are comprised of a 6000 series extruded aluminum sections with an overall depth of 1.65 in. and a cross-sectional net area of 0.356sq.in for the 1.6 version, and an overall depth of 2.3 in. and a net area of 0.444sq.in for the 2.3 version, and 6000 series aluminum parts as follows. The rails are used to support solar PV modules on the roof of a building, see Roof Tech installation manual. The PV modules are attached to the rails by the mounting clamps. The rails are mounted with a small clearance (flush mounting) and are installed at the same slope as the underlying roof structure. The rail mount adapter locks the rail to the RT-PLUS mount.

- The testing data provided by the rail manufacturer, dated February 19th, 2019, was performed at the rail manufacturer's facilities and tests were third party observed on site by SML. The failure modes for the tests are as follows:
  - Mid and end clamps - aluminum base material ultimate rupture failure with ADM safety factor of 1.95 applied.
  - Rail adapter - aluminum base material ultimate rupture failure with ADM safety factor of 1.95 applied.
  - Rail splice - proof loaded to 2.0 times design load with no residual deformation after load removed.

- We have also reviewed testing data provided by the rail manufacturer, dated October 29th, 2020, which was performed at the rail manufacturer's facilities under SML direction. The failure criteria was rail permanent deformation, which was determined by removing the target load and measuring resultant deformation. The failure mode was rail yielding at permanent deformation onset. Maximum allowable values for these failure conditions were derived using a safety factor of 1.65 per ADM for aluminum yielding failure.

- The testing report number 20231207 provided by Roof Tech, was performed at the Roof Tech's facility and the tests were third party observed via Zoom conference video call by SML. The failure mode for the lateral test was L-Foot rupture, with the lowest of three tests divided by an ADM rupture safety factor of 1.95.

The following conversion chart has been created to help clarify the ASCE 7-16 roof zones, which vary from gable to hip and for various roof pitches, while also keeping the spacing tables in as simple a form as possible.

For each ASCE figure 30.3-2A to 30.3-2H (See Appendix, which each have up to six (6) roof zones, we have converted those to three (3) "Roof Areas" based on their GCp value.) The GCp value ranges shown below have been reduced where applicable based on ASCE 7-16 procedures and effective tributary areas for each component evaluated.

Conversion Chart - SML Table Roof Areas to ASCE 7-16 Roof Zones

Roof Type	Roof Slopes, (deg)	Roof Areas Per SML Tables	Roof Zones Per ASCE 7-16	Effective Wind Area and GCp Range for Leeward Wind, (ft^2)		Effective Wind Area and GCp Range for Windward Wind, (ft^2)	
Gable Roof	0 to 7	1	1`, 1	10 to 500	-1.7 to -1	10 to 100	0.3 to 0.2
		2	2	10 to 500	-2.3 to -1.4	10 to 100	0.3 to 0.2
		3	3	10 to 500	-3.2 to -1.4	10 to 100	0.3 to 0.2
	7 to 20	1	1, 2e	20 to 100	-2 to -0.5	2 to 100	0.7 to 0.3
		2	2n, 2r, 3e	10 to 250	-3 to -1	2 to 100	0.7 to 0.3
		3	3r	10 to 100	-3.6 to -1.8	2 to 100	0.7 to 0.3
	20 to 27	1	1, 2e	20 to 300	-1.5 to -0.8	2 to 100	0.7 to 0.3
		2	2n, 2r, 3e	10 to 150	-2.5 to -1.2	2 to 100	0.7 to 0.3
		3	3r	4 to 50	-3.6 to -1.8	2 to 100	0.7 to 0.3
	27 to 45	1	1, 2e, 2r	10 to 100	-1.8 to -0.8	10 to 100	0.9 to 0.5
		2	2n, 3r	10 to 200	-2 to -1	10 to 100	0.9 to 0.5
		3	3e	2 to 300	-3.2 to -1	10 to 100	0.9 to 0.5
Hip Roof	0 to 7	NA	NA	NA	NA	NA	NA
	7 to 20	1	1	20 to 100	-1.8 to -1	10 to 100	0.7 to 0.3
		2	2r	10 to 200	-2.4 to -1.3	10 to 100	0.7 to 0.3
		3	2e, 3	10 to 200	-2.6 to -1.4	10 to 100	0.7 to 0.3
	20 to 27	1	1	10 to 100	-1.4 to -0.8	10 to 100	0.7 to 0.3
		2	2e, 2r, 3	10 to 200	-2 to -1	10 to 100	0.7 to 0.3
		3	NA	NA	NA	NA	NA
	27 to 45	1	1	10 to 200	-1.5 to -0.7	3 to 100	0.9 to 0.3
		2	2e, 2r	7 to 100	-2.8 to -1	3 to 100	0.9 to 0.3
		3	3	5 to 50	-3.6 to -1	3 to 100	0.9 to 0.3

The tables accompanying this letter show the maximum allowable spans for the RT-PLUS Mount System with and without RT-Rail for each associated wind speed, wind exposure category, roof/panel angle, roof area, array zone and ground snow load for gable and hip roofs in the landscape and portrait orientations for 30-foot maximum mean roof heights. The effect of seismic loads (for all design categories A-E) has been determined to be less than the effect due to wind loads in all load conditions and combinations. The assumed topography is flat with a $K_{zt} = 1.0$. Therefore, the maximum allowable spacing for common load cases due to dead, wind and snow loads are the controlling load cases.

Table Index:

RT-PLUS Mount (Used with 3rd Party Rail):

7/16" OSB (5-60mm screws):

Landscape:

- Gable – Panel Width = 40in
- Hip – Panel Width = 40in
- Gable – Panel Width = 45in
- Hip – Panel Width = 45in

Portrait:

- Gable – Panel Length = 68in
- Hip – Panel Length = 68in
- Gable – Panel Length = 80in
- Hip – Panel Length = 80in
- Gable – Panel Length = 96in
- Hip – Panel Length = 96in

15/32" Plywood (5-60mm screws):

Landscape:

- Gable – Panel Width = 40in
- Hip – Panel Width = 40in
- Gable – Panel Width = 45in
- Hip – Panel Width = 45in

Portrait:

- Gable – Panel Length = 68in
- Hip – Panel Length = 68in
- Gable – Panel Length = 80in
- Hip – Panel Length = 80in
- Gable – Panel Length = 96in
- Hip – Panel Length = 96in

Rafter – 60mm (2-60mm screws):

Landscape:

- Gable – Panel Width = 40in
- Hip – Panel Width = 40in
- Gable – Panel Width = 45in
- Hip – Panel Width = 45in

Portrait:

- Gable – Panel Length = 68in
- Hip – Panel Length = 68in
- Gable – Panel Length = 80in
- Hip – Panel Length = 80in
- Gable – Panel Length = 96in
- Hip – Panel Length = 96in

Rafter – 90mm (2-60mm screws):

Landscape:

- Gable – Panel Width = 40in
- Hip – Panel Width = 40in
- Gable – Panel Width = 45in
- Hip – Panel Width = 45in

Portrait:

- Gable – Panel Length = 68in
- Hip – Panel Length = 68in
- Gable – Panel Length = 80in
- Hip – Panel Length = 80in
- Gable – Panel Length = 96in
- Hip – Panel Length = 96in

Rafter – Offset (6-60mm screws):

Landscape:

- Gable – Panel Width = 40in
- Hip – Panel Width = 40in
- Gable – Panel Width = 45in
- Hip – Panel Width = 45in

Rafter – Offset (6-60mm screws):

Portrait:

- Gable – Panel Length = 68in
- Hip – Panel Length = 68in
- Gable – Panel Length = 80in
- Hip – Panel Length = 80in
- Gable – Panel Length = 96in
- Hip – Panel Length = 96in

RT-PLUS Mount with RT-Rail 1.6:

7/16" OSB (5-60mm screws):

Landscape:

- **Gable – Panel Width = 40in**
- **Hip – Panel Width = 40in**
- **Gable – Panel Width = 45in**
- **Hip – Panel Width = 45in**

Portrait:

- **Gable – Panel Length = 68in**
- **Hip – Panel Length = 68in**
- **Gable – Panel Length = 80in**
- **Hip – Panel Length = 80in**
- **Gable – Panel Length = 96in**
- **Hip – Panel Length = 96in**

Rafter – 60mm (2-60mm screws):

Landscape:

- **Gable – Panel Width = 40in**
- **Hip – Panel Width = 40in**
- **Gable – Panel Width = 45in**
- **Hip – Panel Width = 45in**

Portrait:

- **Gable – Panel Length = 68in**
- **Hip – Panel Length = 68in**
- **Gable – Panel Length = 80in**
- **Hip – Panel Length = 80in**
- **Gable – Panel Length = 96in**
- **Hip – Panel Length = 96in**

Rafter – Offset (6-60mm screws):

Landscape:

- **Gable – Panel Width = 40in**
- **Hip – Panel Width = 40in**
- **Gable – Panel Width = 45in**
- **Hip – Panel Width = 45in**

15/32" Plywood (5-60mm screws):

Landscape:

- **Gable – Panel Width = 40in**
- **Hip – Panel Width = 40in**
- **Gable – Panel Width = 45in**
- **Hip – Panel Width = 45in**

Portrait:

- **Gable – Panel Length = 68in**
- **Hip – Panel Length = 68in**
- **Gable – Panel Length = 80in**
- **Hip – Panel Length = 80in**
- **Gable – Panel Length = 96in**
- **Hip – Panel Length = 96in**

Rafter – 90mm (2-60mm screws):

Landscape:

- **Gable – Panel Width = 40in**
- **Hip – Panel Width = 40in**
- **Gable – Panel Width = 45in**
- **Hip – Panel Width = 45in**

Portrait:

- **Gable – Panel Length = 68in**
- **Hip – Panel Length = 68in**
- **Gable – Panel Length = 80in**
- **Hip – Panel Length = 80in**
- **Gable – Panel Length = 96in**
- **Hip – Panel Length = 96in**

Rafter – Offset (6-60mm screws):

Portrait:

- **Gable – Panel Length = 68in**
- **Hip – Panel Length = 68in**
- **Gable – Panel Length = 80in**
- **Hip – Panel Length = 80in**
- **Gable – Panel Length = 96in**
- **Hip – Panel Length = 96in**

RT-PLUS Mount with RT-Rail 2.3:

7/16" OSB (5-60mm screws):

Landscape:

- **Gable – Panel Width = 40in**
- **Hip – Panel Width = 40in**
- **Gable – Panel Width = 45in**
- **Hip – Panel Width = 45in**

Portrait:

- **Gable – Panel Length = 68in**
- **Hip – Panel Length = 68in**
- **Gable – Panel Length = 80in**
- **Hip – Panel Length = 80in**
- **Gable – Panel Length = 96in**
- **Hip – Panel Length = 96in**

Rafter – 60mm (2-60mm screws):

Landscape:

- **Gable – Panel Width = 40in**
- **Hip – Panel Width = 40in**
- **Gable – Panel Width = 45in**
- **Hip – Panel Width = 45in**

Portrait:

- **Gable – Panel Length = 68in**
- **Hip – Panel Length = 68in**
- **Gable – Panel Length = 80in**
- **Hip – Panel Length = 80in**
- **Gable – Panel Length = 96in**
- **Hip – Panel Length = 96in**

Rafter – Offset (6-60mm screws):

Landscape:

- **Gable – Panel Width = 40in**
- **Hip – Panel Width = 40in**
- **Gable – Panel Width = 45in**
- **Hip – Panel Width = 45in**

15/32" Plywood (5-60mm screws):

Landscape:

- **Gable – Panel Width = 40in**
- **Hip – Panel Width = 40in**
- **Gable – Panel Width = 45in**
- **Hip – Panel Width = 45in**

Portrait:

- **Gable – Panel Length = 68in**
- **Hip – Panel Length = 68in**
- **Gable – Panel Length = 80in**
- **Hip – Panel Length = 80in**
- **Gable – Panel Length = 96in**
- **Hip – Panel Length = 96in**

Rafter – 90mm (2-60mm screws):

Landscape:

- **Gable – Panel Width = 40in**
- **Hip – Panel Width = 40in**
- **Gable – Panel Width = 45in**
- **Hip – Panel Width = 45in**

Portrait:

- **Gable – Panel Length = 68in**
- **Hip – Panel Length = 68in**
- **Gable – Panel Length = 80in**
- **Hip – Panel Length = 80in**
- **Gable – Panel Length = 96in**
- **Hip – Panel Length = 96in**

Rafter – Offset (6-60mm screws):

Portrait:

- **Gable – Panel Length = 68in**
- **Hip – Panel Length = 68in**
- **Gable – Panel Length = 80in**
- **Hip – Panel Length = 80in**
- **Gable – Panel Length = 96in**
- **Hip – Panel Length = 96in**

There are two "Landscape" sizes, 40in and 45in and these dimensions indicate the width of your PV panel or the upslope dimension to determine which table you need to use. There are three "Portrait" sizes, 68in, 80in and 96in. These dimensions indicate the length of your PV panel or the upslope dimension to determine which table you need to use.

Combining Rafter and Deck-Only Mounts:
It is permissible to combine rafter and deck-only mounting as shown at the end of this letter in Exhibits 'B1' & 'B2'. In summary, the rafter-to-deck spacing shall be the average of the rafter spacing and deck-only (OSB or Plywood Only) spacing. When using combined rafter and deck-only mounting the maximum panel height from top of roof to top of panel shall be either 5" with an average PV panel gap of 0.5" or 7" with an average PV panel gap of 0.7".

It is acceptable to use alternate size panels and to adjust the allowable spans when the actual upslope tributary dimension fall between those shown in the tables by **linearly extrapolation/interpolation** between table values using the following formula, with the exception that linear interpolation cannot accurately be done where any table value is 98 inches as this value has likely been truncated from a higher value.
Y = Y1 + (Y2 - Y1) / (X2 – X1) * (X – X1); where

Landscape, Portrait or Mixed:
Y = "New Span"; Y1 = "Span from Table Corresponding to X1"
Y2 = "Span from Table Corresponding to X2"
X = "Actual Upslope Tributary Dimension to Rail"
X1 = "Rail Trib from Table Corresponding to Y1"
X2 = "Rail Trib from Table Corresponding to Y2"

Also note that linear extrapolation/interpolation can be done using any of the Gable Tables or Hip Tables, but these cannot be combined. IE. linear extrapolation/interpolation using Gable Landscape and/or Gable Portrait or Hip Landscape and/or Hip Portrait Hip is acceptable, but any combination of Gable and Hip tables is not allowed.

Linear Extrapolation/Interpolation Example – Gable Roof using Landscape or Portrait Example Givens:

- 7/16" OSB
- 68"x 42" module
- 115 MPH wind speed
- wind exposure 'C'
- 30 ft mean roof height
- RT-Plus Only
- ground snow load 15 psf
- 3:12 roof pitch (14.0 degrees)
- non-exposed panels
- roof zone 1
    - Actual upslope tributary dimension to rail X = 42 inches; using the gable tables with the next lower and higher tributary dimension
- X1 = 40"
- X2 = 45"
- Y1 = 84"
- Y2 = 75"

→ Y = 75" + (84" – 75") / (45" – 40") * (42" – 40") = 80.4" (Interpolated Span)

The following link is a tool that may help: https://x-engineer.org/linear-interpolation-extrapolation-calculator/

Additionally, mixing data from any combination of the 3 versions of tables is not allowed. IE. You cannot mix data from RT-PLUS Mount (Used with 3rd Party Rail), RT-PLUS Mount with RT-Rail 1.6, or RT-PLUS Mount with RT-Rail 2.3 tables.

Table Notes for Gable & Hip Roof Tables – Tabulated values are based on the following criteria:

1. Building mean roof height = 30 ft maximum; Risk Category = II.
2. Solar panel & rail dead load = approximately 2.5 psf.
3. ASCE 7-16; Figures 30.3-2A to 30.3-2H. The assumed topography is flat with a $K_{zt} = 1.0$
4. Ground elevation factor (K_e) = 1.0
5. γ_E = edge array factor, has been taken as 1.5 for Exposed and 1.0 for Non-Exposed spans as defined in ASCE 7-16 section 29.4.4.
6. γ_a = solar panel pressure equalization factor, has been reduced to 0.65 for tributary areas to the mount of 10 ft. sq. assuming the minimum average PV module gap of 0.4 inch and a maximum h_2 dimension of 6.5 inch, or minimum average PV module gap of 0.5 inch and a maximum h_2 dimension of 4.5 inch based on SEAOC PV2 2017, and further reduced as the tributary area to the mount increases as outlined in ASCE 7-16. Other combinations of average PV module gap and h_2 dimensions are acceptable provided they also result in a 0.65 pressure equalization factor or less for a 10 ft. sq tributary area to the mount per SEAOC PV2 2017 and shall be determined by the end user.
7. The snow load stated on the tables is ground snow load and has been reduced as allowed within the building code. If the local jurisdiction governing the installation specifies a minimum roof snow load it shall be converted to a ground snow load following the local building code and any applicable amendments prior to application of the attached tables. No special snow conditions are considered within the tables including unbalanced, drifting, sliding, retention, ponding snow, or rain-on snow surcharge loading. Span tables do not apply to buildings which are intentionally kept below freezing, just above freezing or unheated.
8. PV panels must be supported per the manufacturer's required orientation, location and/or spacing, with the rails in the across roof slope direction. Verification of PV module capacity to support the loads associated with the given array shall be the responsibility of the Contractor or Owner and not Roof-Tech or SML.
9. OSB shall be 24/16 APA rated sheathing minimum (7/16" thick).
10. Plywood shall be 32/16 APA rated sheathing minimum (15/32" thick).
11. PV panel must comply with mechanical load requirements of UL 1703 OR 2703.
12. Sheathing shall be free of defects including, but not limited to water damage and delamination and must be evaluated by the project Engineer of Record (EOR).
13. The mounts may be installed through a maximum of 2 layers of composite asphalt roof shingles or maximum 20 gage metal decking provided the metal is predrilled as deck screws are not designed to penetrate the metal decking.
14. The roof rafters or trusses shall be evaluated by the project EOR for structural integrity and capacity as required by the governing jurisdiction, and roof rafters or trusses shall be spaced at 24" on center maximum.
15. These values do include NDS load factor reductions, and further reductions by the end user are prohibited.

Our analysis assumes that the connections and associated hardware are installed in a workmanlike manner in accordance with the Roof-Tech installation manual for Roof-Tech – RT-PLUS, and Roof Tech RT-Rail or the 3rd party rail manufacturer's installation manuals, and generally accepted standards of construction practice.

It is the responsibility of the contractor to verify that the strength of the roof framing meets the minimum properties used in the tests and can safely support the maximum imposed loads stated within this document.

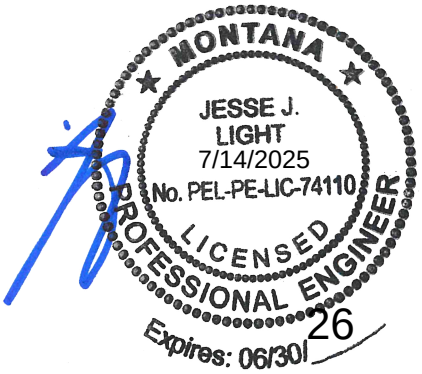
When using a 3rd party rail: The bolted connection of the rail to the Roof-Tech RT-PLUS used in the testing was a 5/16" diameter bolt torqued at 12 ft-lb for the 5/16" slot version and 3/8" diameter bolt torqued at 18 ft-lb for the 3/8" slot version, any other bolt size or torque is outside the scope of this report and has not been considered in the above allowable loads or maximum span tables. It is the responsibility of the contractor to determine the capacity of an alternate bolted connection and take appropriate reductions if applicable.

For the purposes of this document, 'non-expired signature sheet' refers to this signature sheet bearing a digital signature and a professional seal that is still within the validity period recognized by the appropriate licensing authority or regulatory body. The signature sheet must remain in good standing and unrevoked for the duration of its intended use.

SML and Roof-Tech, Inc. assume no liability beyond what is specifically shown in this letter. Additional information is available at the Roof tech, Inc. web site, https://roof-tech.us/

Please feel free to contact me at your convenience if you have any questions.

Respectfully yours,



Jesse Light, SE, PE

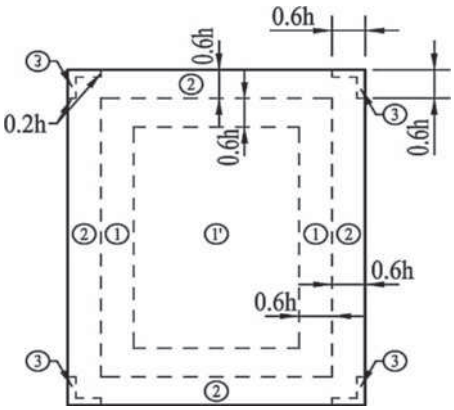
Digitally signed by Jesse Light, SE, PE
DN: C=US, OU=DBA: SML - Consulting Structural & Forensic Engineers, O="Starling Madison Lofquist, Inc.", CN="Jesse Light, SE, PE", E=jlight@smleng.com
Reason: Authority Having Jurisdiction: CLICK HERE. If no Signature Validation dialog appears, email me. A status of "The document has not been modified since this signature was applied" or "The revision covered by this signature is unaltered despite subsequent changes" is valid—but review any later changes.
Location: Phoenix, AZ
Date: 2025-07-14 13:01:15
Foxit PhantomPDF Version: 9.7.5

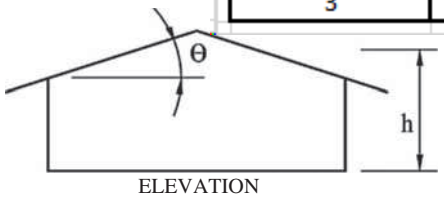
Jesse Light, S.E., P.E.
Principal / President / Sr. Structural Engineer

Andrew Huseman, P.E.
Principal / Professional Engineer

Roof Areas Per SML Tables	Roof Zones Per ASCE 7-16
1	1`, 1
2	2
3	3

Diagrams

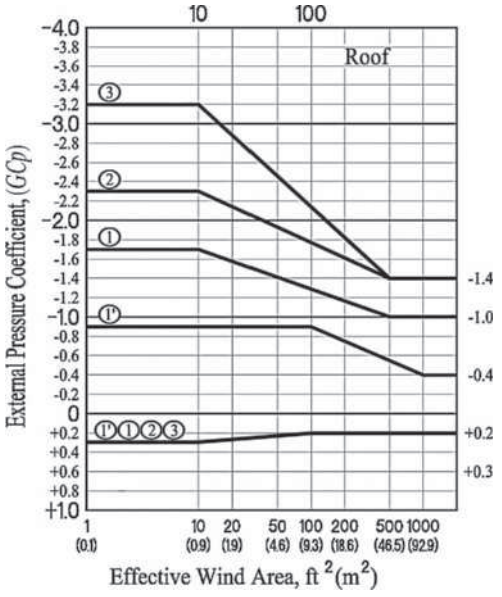


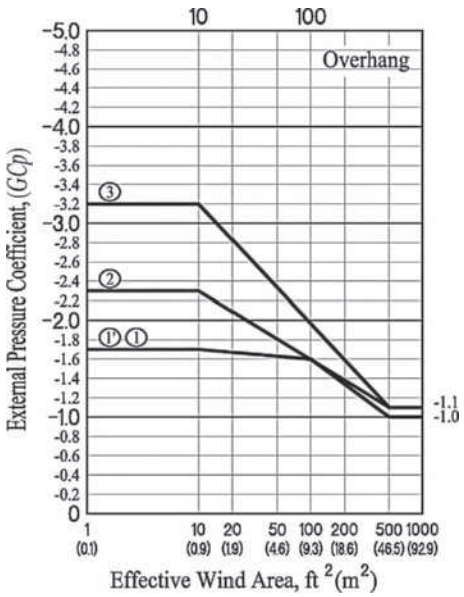


Notation

B = Horizontal dimension of building measured normal to wind direction, in ft (m).
h = Eave height shall be used for $\theta = 10°$.
θ = Angle of plane of roof from horizontal, in degrees.

External Pressure Coefficients





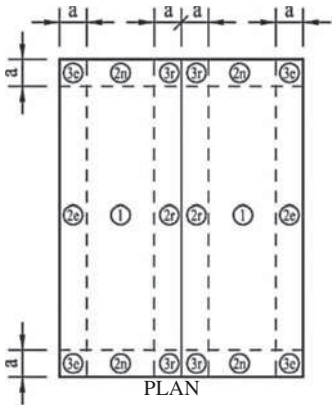
Notes

1. Vertical scale denotes (GC_p) to be used with q_h.
2. Horizontal scale denotes effective wind area, in ft^2 (m^2).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. If a parapet equal to or higher than 3 ft (0.9 m) is provided around the perimeter of the roof with $\theta \le 7°$, the negative values of (GC_p) in Zone 3 shall be equal to those for Zone 2, and positive values of (GC_p) in Zones 2 and 3 shall be set equal to those for wall Zones 4 and 5, respectively, in Fig. 30.3-1.
6. Values of (GC_p) for roof overhangs include pressure contributions from both upper and lower surfaces.
7. If overhangs exist, the lesser horizontal dimension of the building shall not include any overhang dimension, but the edge distance, a, shall be measured from the outside edge of the overhang.

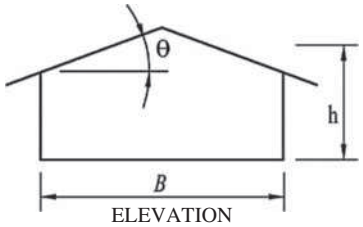
FIGURE 30.3-2A Components and Cladding [$h \le 60$ ft ($h \le 18.3$ m)]: External Pressure Coefficients, (GC_p), for Enclosed and Partially Enclosed Buildings—Gable Roofs, $\theta \le 7°$

Roof Areas Per SML Tables	Roof Zones Per ASCE 7-16
1	1, 2e
2	2n, 2r, 3e
3	3r

Diagrams



PLAN



ELEVATION

Notation

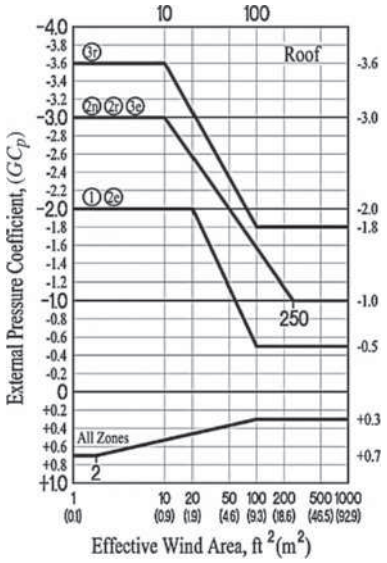
a = 10% of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m). If an overhang exists, the edge distance shall be measured from the outside edge of the overhang. The horizontal dimensions used to compute the edge distance shall not include any overhang distances.

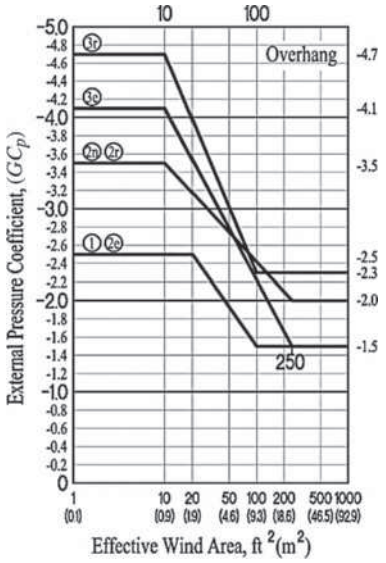
B = Horizontal dimension of building measured normal to wind direction, in ft (m).

h = Mean roof height, in ft (m), except that eave height shall be used for $\theta \le 10°$.

θ = Angle of plane of roof from horizontal, in degrees.

External Pressure Coefficients





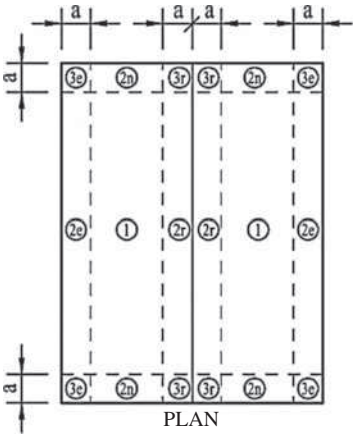
Notes

1. Vertical scale denotes (GC_p) to be used with q_h.
2. Horizontal scale denotes effective wind area, in ft^2 (m^2).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. Values of (GC_p) for roof overhangs include pressure contributions from both upper and lower surfaces.
6. If overhangs exist, the lesser horizontal dimension of the building shall not include any overhang dimension, but the edge distance, a, shall be measured from the outside edge of the overhang.

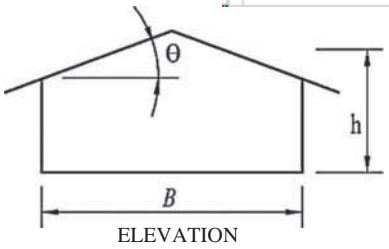
FIGURE 30.3-2B Components and Cladding [$h \le 60$ ft ($h \le 18.3$ m)]: External Pressure Coefficients, (GC_p), for Enclosed and Partially Enclosed Buildings—Gable Roofs, $7° < \theta \le 20°$

Roof Areas Per SML Tables	Roof Zones Per ASCE 7-16
1	1, 2e
2	2n, 2r, 3e
3	3r

Diagrams



PLAN



ELEVATION

Notation

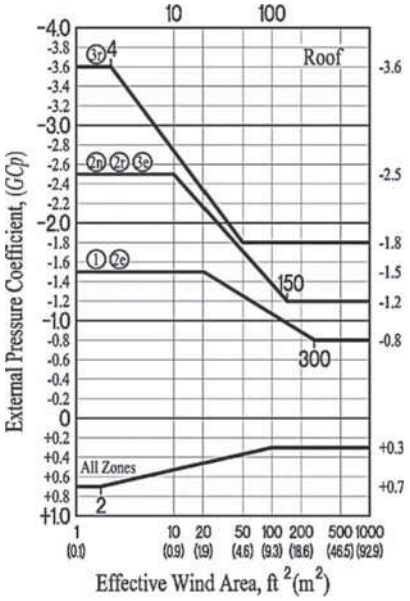
a = 10% of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m). If an overhang exists, the edge distance shall be measured from the outside edge of the overhang. The horizontal dimensions used to compute the edge distance shall not include any overhang distances.

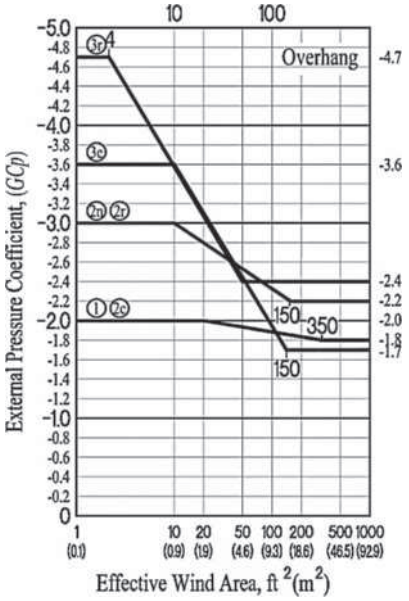
B = Horizontal dimension of building measured normal to wind direction, in ft (m).

h = Mean roof height, in ft (m).

θ = Angle of plane of roof from horizontal, in degrees.

External Pressure Coefficients





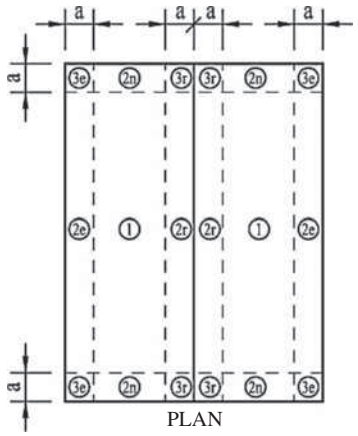
Notes

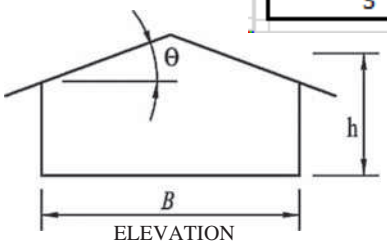
1. Vertical scale denotes (GC_p) to be used with q_h.
2. Horizontal scale denotes effective wind area, in ft^2 (m^2).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. Values of (GC_p) for roof overhangs include pressure contributions from both upper and lower surfaces.
6. If overhangs exist, the lesser horizontal dimension of the building shall not include any overhang dimension, but the edge distance, a, shall be measured from the outside edge of the overhang.

FIGURE 30.3-2C Components and Cladding [$h \le 60$ ft ($h \le 18.3$ m)]: External Pressure Coefficients, (GC_p), for Enclosed and Partially Enclosed Buildings—Gable Roofs, $20° < \theta \le 27°$

Roof Areas Per SML Tables	Roof Zones Per ASCE 7-16
1	1, 2e, 2r
2	2n, 3r
3	3e

Diagrams





Notation

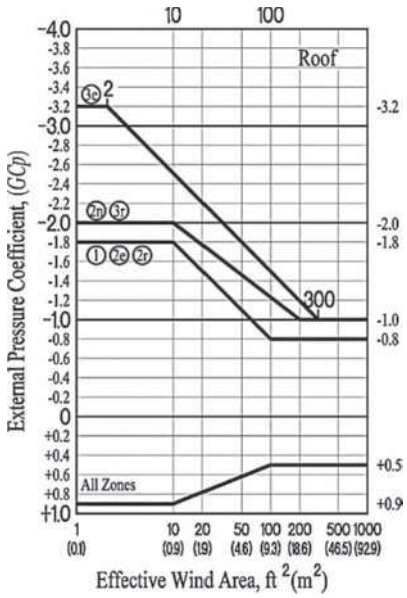
a = 10% of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m). If an overhang exists, the edge distance shall be measured from the outside edge of the overhang. The horizontal dimensions used to compute the edge distance shall not include any overhang distances.

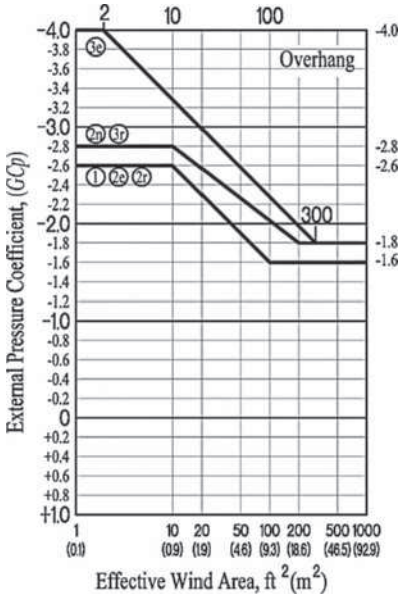
B = Horizontal dimension of building measured normal to wind direction, in ft (m).

h = Mean roof height, in ft (m).

θ = Angle of plane of roof from horizontal, in degrees.

External Pressure Coefficients





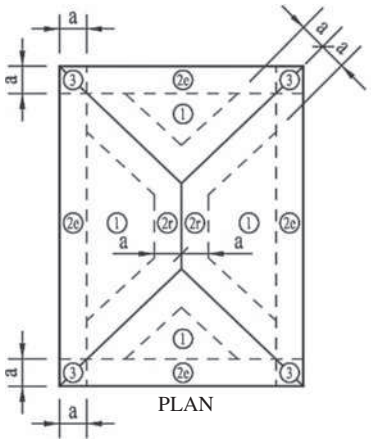
Notes

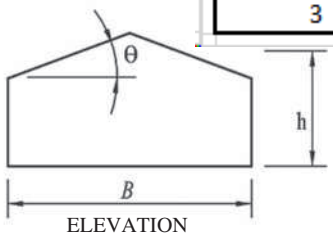
1. Vertical scale denotes (GC_p) to be used with q_h.
2. Horizontal scale denotes effective wind area, in ft^2 (m^2).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. Values of (GC_p) for roof overhangs include pressure contributions from both upper and lower surfaces.
6. If overhangs exist, the lesser horizontal dimension of the building shall not include any overhang dimension, but the edge distance, a, shall be measured from the outside edge of the overhang.

FIGURE 30.3-2D Components and Cladding [$h \le 60$ ft ($h \le 18.3$ m)]: External Pressure Coefficients, (GC_p), for Enclosed and Partially Enclosed Buildings—Gable Roofs, $27° < \theta \le 45°$

Roof Areas Per SML Tables	Roof Zones Per ASCE 7-16
1	1
2	2r
3	2e, 3

Diagrams





Notation

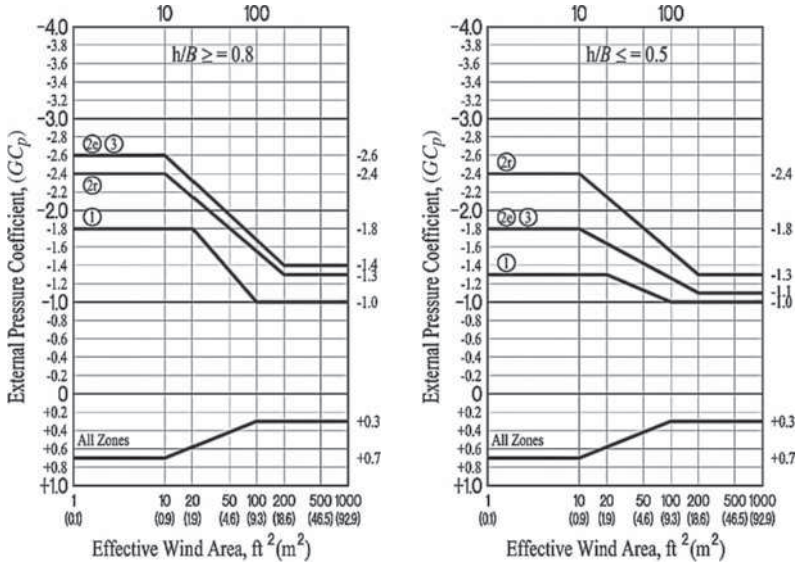
a = 10% of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m). If an overhang exists, the edge distance shall be measured from the outside edge of the overhang. The horizontal dimensions used to compute the edge distance shall not include any overhang distances.

h = Mean roof height, in ft (m), except that eave height shall be used for $\theta \le 10°$.

B = Horizontal dimension of building measured normal to wind direction, in ft (m).

θ = Angle of plane of roof from horizontal, in degrees.

External Pressure Coefficients



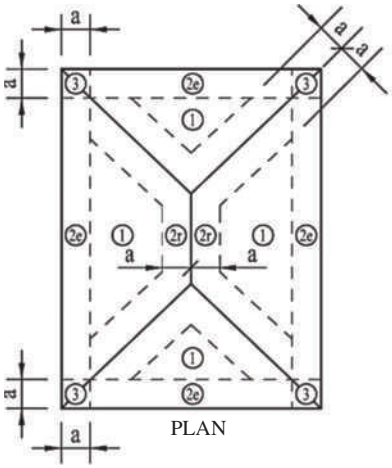
Notes

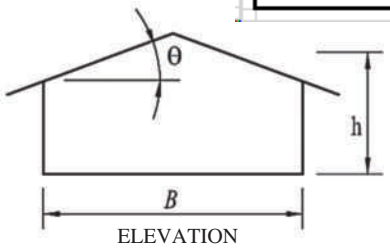
1. Vertical scale denotes (GC_p) to be used with q_h.
2. Horizontal scale denotes effective wind area, in ft^2 (m^2).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. If overhangs exist, the lesser horizontal dimension of the building shall not include any overhang dimension, but the edge distance, a, shall be measured from the outside edge of the overhang.
6. Interpolation of (GC_p) between the two different h/B values is required for $0.5 < h/B < 0.8$.
7. B for Zone 3 is the least horizontal dimension. B for Zones 1 and 2e is normal to the building width and normal to the eave defining Zone 2e.

FIGURE 30.3-2E Components and Cladding [$h \le 60$ ft ($h \le 18.3$ m)]: External Pressure Coefficients, (GC_p), for Enclosed and Partially Enclosed Buildings—Hip Roofs, $7° < \theta \le 20°$ (Roof)

Roof Areas Per SML Tables	Roof Zones Per ASCE 7-16
1	1
2	2e, 2r, 3
3	NA

Diagrams





Notation

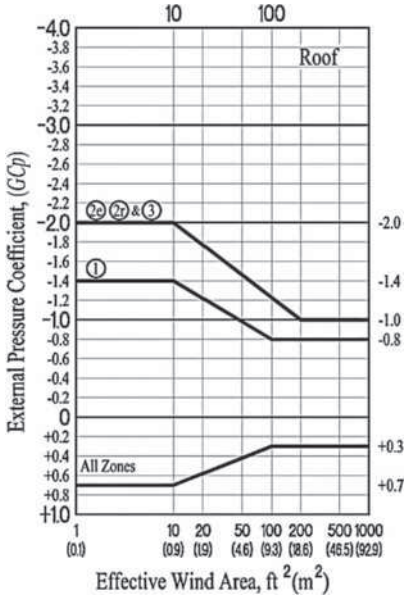
a = 10% of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m). If an overhang exists, the edge distance shall be measured from the outside edge of the overhang. The horizontal dimensions used to compute the edge distance shall not include any overhang distances.

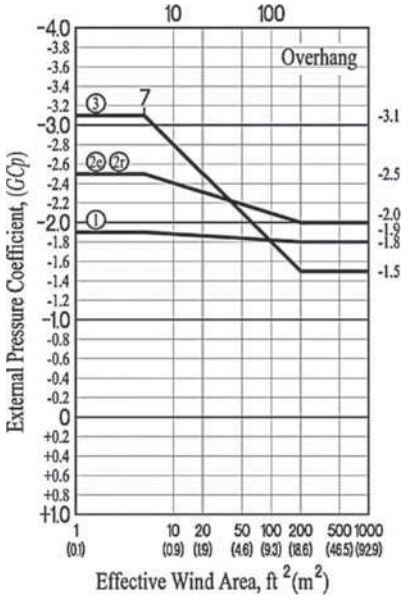
B = Horizontal dimension of building measured normal to wind direction, in ft (m).

h = Mean roof height, in ft (m).

θ = Angle of plane of roof from horizontal, in degrees.

External Pressure Coefficients





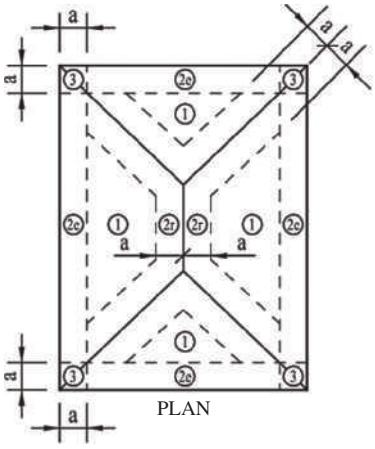
Notes

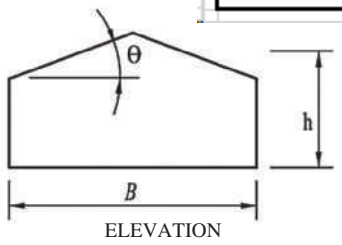
1. Vertical scale denotes (GC_p) to be used with q_h.
2. Horizontal scale denotes effective wind area, in ft^2 (m^2).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. Values of (GC_p) for roof overhangs include pressure contributions from both upper and lower surfaces.
6. If overhangs exist, the lesser horizontal dimension of the building shall not include any overhang dimension, but the edge distance, a, shall be measured from the outside edge of the overhang.

FIGURE 30.3-2G Components and Cladding [$h \le 60$ ft ($h \le 18.3$ m)]: External Pressure Coefficients, (GC_p), for Enclosed and Partially Enclosed Buildings—Hip Roofs, $20° < \theta \le 27°$ (Roof and Overhang)

Roof Areas Per SML Tables	Roof Zones Per ASCE 7-16
1	1
2	2e, 2r
3	3

Diagrams





Notation

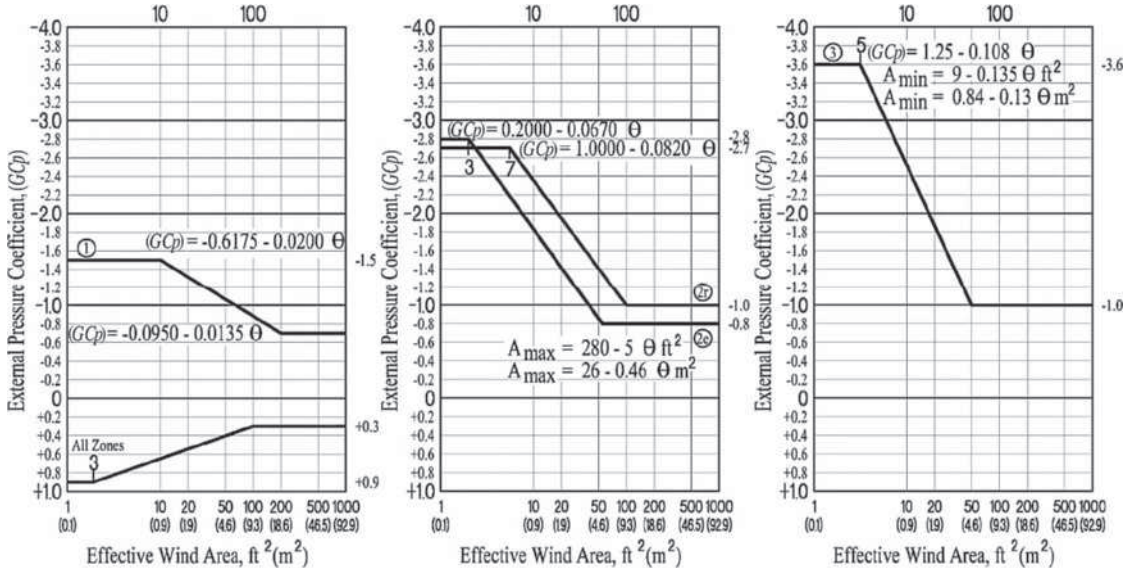
a = 10% of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m). If an overhang exists, the edge distance shall be measured from the outside edge of the overhang. The horizontal dimensions used to compute the edge distance shall not include any overhang distances.

B = Horizontal dimension of building measured normal to wind direction, in ft (m).

h = Mean roof height, in ft (m).

θ = Angle of plane of roof from horizontal, in degrees.

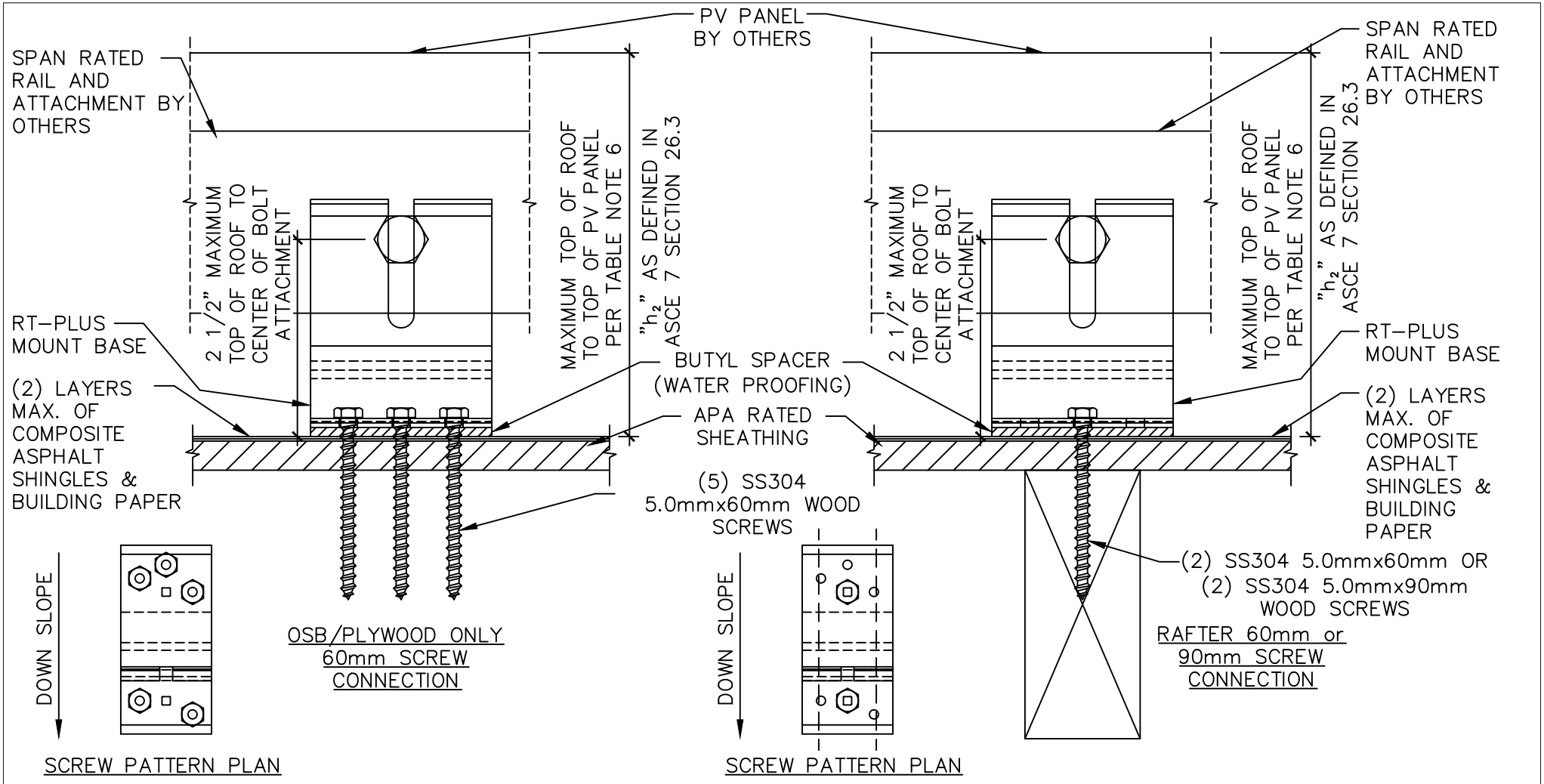
External Pressure Coefficients



Notes

1. Vertical scale denotes (GCp) to be used with q_h.
2. Horizontal scale denotes effective wind area, in ft^2 (m^2).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. If overhangs exist, the lesser horizontal dimension of the building shall not include any overhang dimension, but the edge distance, a, shall be measured from the outside edge of the overhang.
7. A_{min} = the minimum tributary area (i.e., areas less than A_{min} are to use (GCp) value for A_{min}).
8. A_{max} = the maximum tributary area (i.e., areas greater than A_{max} are to use (GCp) value for A_{max}).
9. (GCp) values given for roof slope, θ = 45°; for other slopes use the equations.

FIGURE 30.3-2H Components and Cladding [$h \le 60$ ft ($h \le 18.3$ m)]: External Pressure Coefficients, (GC_p), for Enclosed and Partially Enclosed Buildings—Hip Roofs, 27° < θ ≤ 45° (Roof)



1 RAIL ORIENTATION

SCALE: N.T.S.

Consulting Structural and Forensic Engineers

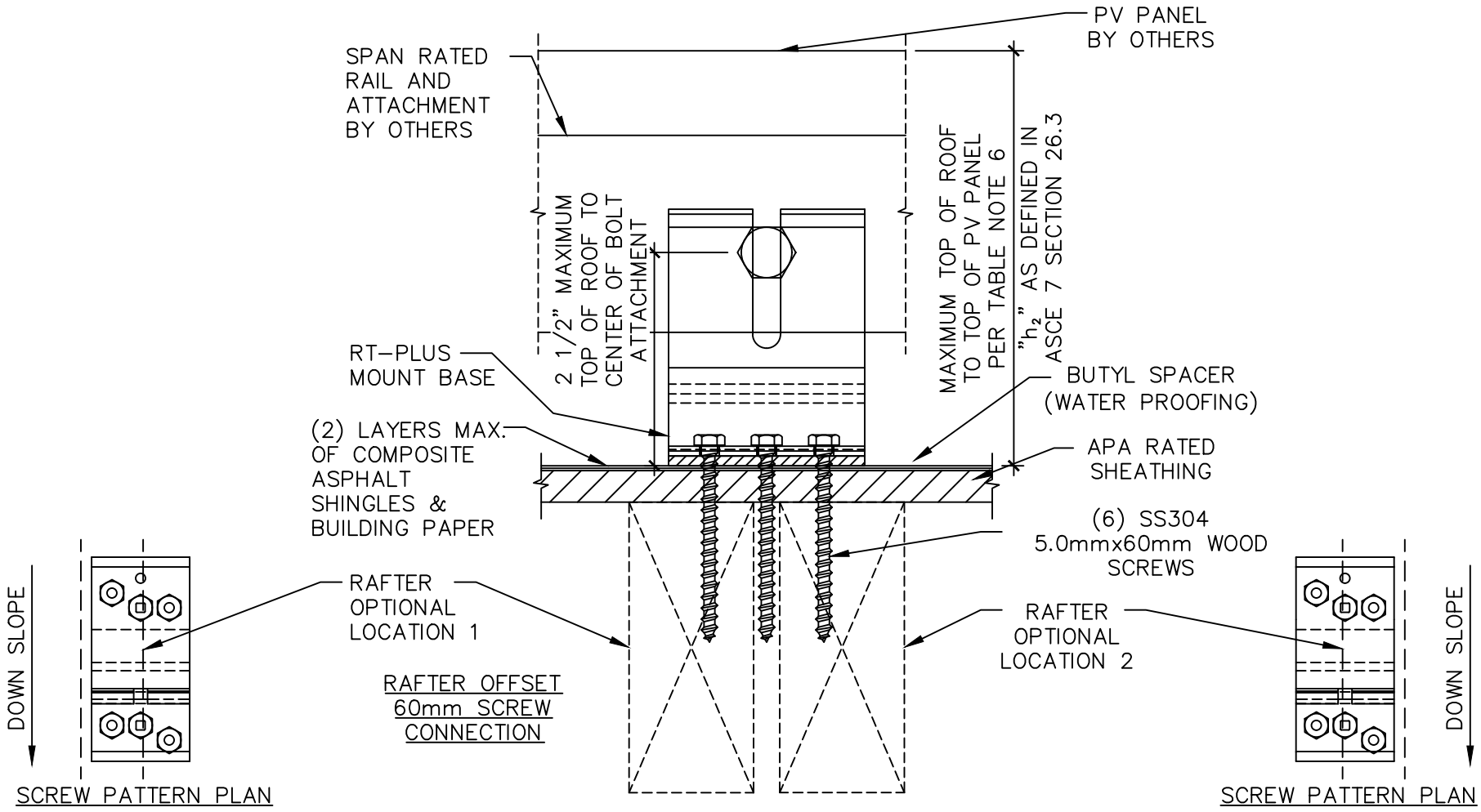
3600 East University Drive
Suite 1400
Phoenix, Arizona 85034
(602) 438-2500
fax. (602) 438-2505
www.smleng.com

DRAWN BY: J.S.	DATE: 3-31-25
DESIGNED BY: J.L.	JOB NO: 471-22

ROOF TECH
RT-PLUS MOUNT
WITH RAILS & PV PANELS
BY OTHERS

ROOF TECH, INC.
10620 TREENA ST., SUITE 230
SAN DIEGO, CA 92131

EXHIBIT A1



2 RAIL ORIENTATION

SCALE: N.T.S.

Consulting Structural and Forensic Engineers

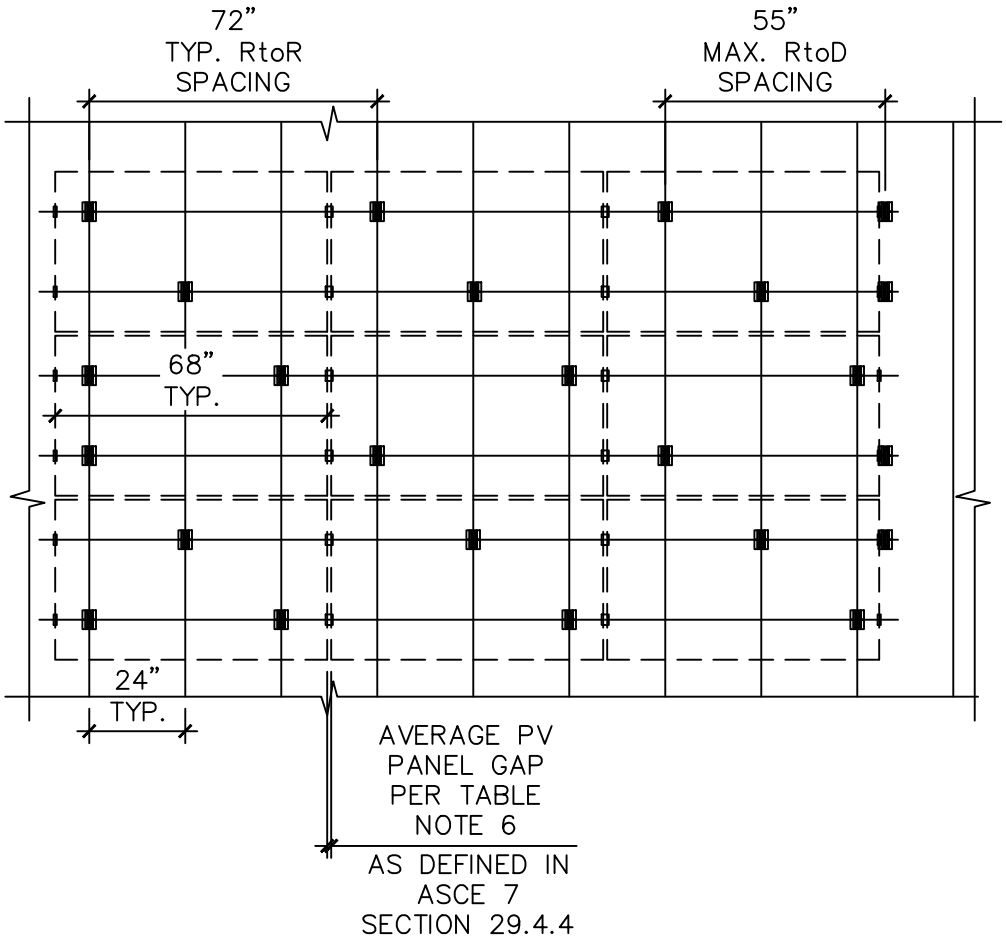
3600 East University Drive
Suite 1400
Phoenix, Arizona 85034
(602) 438-2500
fax. (602) 438-2505
www.smleng.com

DRAWN BY: J.S.	DATE: 3-31-25
DESIGNED BY: J.L.	JOB NO: 471-22

ROOF TECH
RT-PLUS MOUNT
WITH RAILS & PV PANELS
BY OTHERS

ROOF TECH, INC.
10620 TREENA ST., SUITE 230
SAN DIEGO, CA 92131

EXHIBIT A2



LANDSCAPE EXAMPLE:

DESIGN CRITERIA;

- ASCE 7-16 GABLE ROOF
- 30 ft MEAN ROOF HEIGHT
- 100 PSF GROUND SNOW LOAD
- 140 MPH WIND SPEED
- 6:12 ROOF PITCH (26.6 DEGREE ROOF ANGLE)
- WIND EXPOSURE 'C'
- ROOF ZONE 2; NON-EXPOSED PV PANELS
- PANEL WIDTH = 40"
- RAFTER (60mm) AND OSB DECKING (60mm) ONLY COMBINED INSTALLATION
  NOTE: SIMILAR PROCEDURE FOR PLYWOOD DECKING ONLY

RAFTER-TO-RAFTER (RtoR) = 95 in (72 in ACTUAL)
DECKING-TO-DECKING (DtoD) = 19 in

RtoD = RAFTER-TO-DECKING = [(RtoR)+(DtoD)]/2

RtoD = [95in+19in]/2=57in MAX > 55in THEREFORE OK

PLEASE NOTE: CHECK WITH PV PANEL MANUFACTURER FOR ALLOWABLE SUPPORT LOCATIONS FOR THE PROJECT SPECIFIC DESIGN LOADS. SUPPORT LOCATIONS SHOWN MAY NOT BE ALLOWED FOR ALL PV PANELS.

1 PARTIAL FRAMING PLAN AND EXAMPLE CALCULATION (COMBINED RAFTER-TO-DECKING ONLY LANDSCAPE INSTALL)

SCALE: 1/4"=1'-0"

SML
Consulting Structural and Forensic Engineers
3600 East University Drive
Suite 1400
Phoenix, Arizona 85034
(602) 438-2500
fax. (602) 438-2505
www.smleng.com

DRAWN BY:	J.S.	DATE:	3-31-25
DESIGNED BY:	J.L.	JOB NO:	471-22

ROOF TECH
RT-PLUS MOUNT
WITH RAILS & PV PANELS
BY OTHERS

ROOF TECH, INC.
10620 TREENA ST., SUITE 230
SAN DIEGO, CA 92131

EXHIBIT B1

PORTRAIT EXAMPLE:

DESIGN CRITERIA;

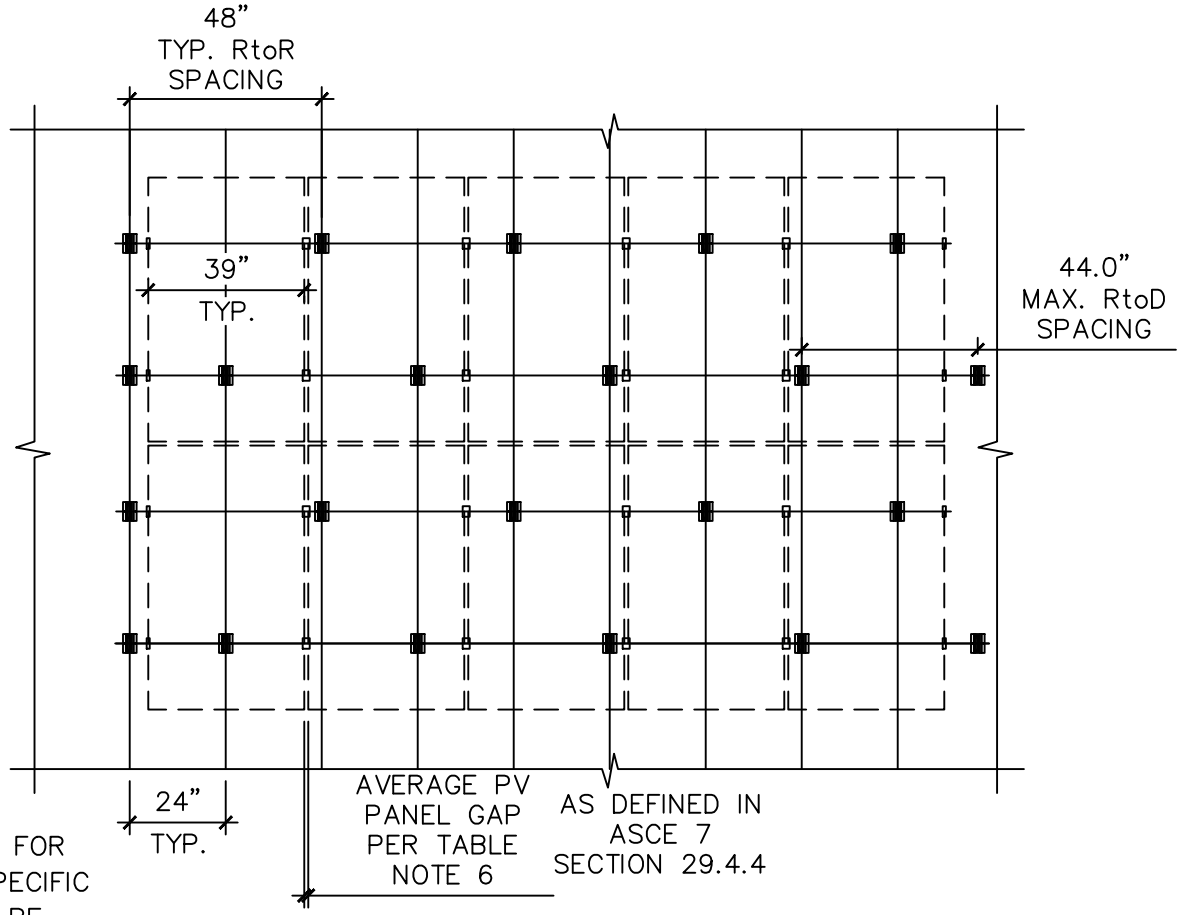
- ASCE 7-16 HIP ROOF
- 30 ft MEAN ROOF HEIGHT
- 55 PSF GROUND SNOW LOAD
- 170 MPH WIND SPEED
- 5:12 ROOF PITCH (22.6 DEGREE ROOF ANGLE)
- WIND EXPOSURE 'C'
- ROOF ZONE 2; NON-EXPOSED PV PANELS
- PANEL WIDTH = 80"
- RAFTER (60mm) AND OSB DECKING (60mm)
  ONLY COMBINED INSTALLATION
  NOTE: SIMILAR PROCEDURE FOR
  PLYWOOD DECKING ONLY

RAFTER-TO-RAFTER (RtoR) = 71 in (48 in ACTUAL)
DECKING-TO-DECKING (DtoD) = 16 in

RtoD = RAFTER-TO-DECKING = [(RtoR)+(DtoD)]/2

RtoD = [71in+16in]/2=44in MAX.

PLEASE NOTE: CHECK WITH PV PANEL MANUFACTURER FOR ALLOWABLE SUPPORT LOCATIONS FOR THE PROJECT SPECIFIC DESIGN LOADS. SUPPORT LOCATIONS SHOWN MAY NOT BE ALLOWED FOR ALL PV PANELS.



2 PARTIAL FRAMING PLAN AND EXAMPLE CALCULATION (COMBINED RAFTER-TO-DECKING ONLY PORTRAIT INSTALL)

SCALE: 1/4"=1'-0"

SML
Consulting Structural and Forensic Engineers

3600 East University Drive
Suite 1400
Phoenix, Arizona 85034
(602) 438-2500
fax. (602) 438-2505
www.smleng.com

DRAWN BY:	J.S.
DESIGNED BY:	J.L.
DATE:	3-31-25
JOB NO:	471-22

ROOF TECH
RT-PLUS MOUNT
WITH RAILS & PV PANELS
BY OTHERS

ROOF TECH, INC.
10620 TREENA ST., SUITE 230
SAN DIEGO, CA 92131

EXHIBIT B2