

ROOFING APPLICATION STANDARD (RAS) No. 127

PROCEDURE FOR DETERMINING THE MOMENT OF RESISTANCE AND MINIMUM CHARACTERISTIC RESISTANCE LOAD TO INSTALL A TILE SYSTEM ON A BUILDING OF A SPECIFIED ROOF SLOPE AND HEIGHT

1. Scope

This standard covers the procedure for determining the Moment of Resistance (M_r) and Minimum Characteristic Resistance Load (F') to install a tile system on buildings of a specified roof slope and height. Compliance with the requirements and procedures herein specified, where the pressures (P_{asd}) have been determined based on Table 1 or Table 2 of this standard, as applicable, do not require additional signed and sealed engineering design calculation. All other calculations must be prepared, signed and sealed by a professional engineer or registered architect. Table 1 is applicable to a wind speed of 175 mph, risk category II buildings, and exposure category C. Table 2 is applicable to a wind speed of 175 mph, risk category II buildings, and exposure category D.

2. How to determine the Moment Resistance (M_r) (Moment Based Systems)

2.1 Determine the minimum design wind pressures for the field, perimeter and corner areas (P_{asd1} , P_{asd2} and P_{asd3} , respectively) using the values given in Table 1 or Table 2, as applicable, or those obtained by engineering analysis prepared, signed and sealed by a professional engineer or registered architect based on ASCE 7.

2.2 Locate the aerodynamic multiplier (λ) in tile Product Approval.

2.3 Determine the restoring moment due to gravity (M_g) per Product Approval.

2.4 Determine the attachment resistance (M_p) per Product Approval.

2.5 Determine the Moment of Resistance (M_r) per following formula:

$$M_r = (P_{asd} \times \lambda) - M_g$$

2.6 Compare the values for M_r with the values for M_p , noted in the Product Approval. If the M_r values are greater than or equal to the M_p values, for each area of the roof [i.e., field $P_{asd}(1)$, perimeter $P_{asd}(2)$ and corner $P_{asd}(3)$ areas], then the tile attachment method is acceptable.

3. How to determine the Minimum Characteristic Resistance Load (F') (Uplift Based System)

3.1 Determine the minimum design pressures for the field, perimeter and corner areas [$P_{asd}(1)$, $P_{asd}(2)$ and $P_{asd}(3)$, respectively] using the values given in Table 1 or Table 2, as applicable, or those obtained by engineering analysis prepared, signed and sealed by a professional engineer or registered architect based on the criteria set forth in ASCE 7.

3.2 Determine the angle (θ) of roof slope, from Table 1 or Table 2, as applicable.

3.3 Determine the length (l), width (w) and average tile weight (W) of tile, per Product Approval.

3.4 Determine the required uplift resistance (F_r) per following formula:

$$F_r = [(P_{asd} \times l \times w) - W] \times \cos \theta$$

3.5 Compare the values for F_r with the values for F' noted in the Product Approval. If the F_r values are greater than or equal to the F' values, for each area of roof [i.e., field $P_{asd}(1)$ perimeter ($P_{asd}(2)$ and corner $P_{asd}(3)$ areas], then the tile attachment method is acceptable.

ROOF SLOPE	> 2:12 to ≤ 6:12			> 6:12 to ≤ 12:12	
	$P_{asd}(1)$	$P_{asd}(2)$	$P_{asd}(3)^2$	$P_{asd}(1)$	$P_{asd}(2)$ & $P_{asd}(3)$
Roof mean height					
≤ 20'	-39.1	-68.1	-100.7	-42.8	-50.0
>20' to ≤ 25'	-40.9	-71.3	-105.4	-44.8	-52.3
>25' to ≤ 30'	-42.4	-73.9	-109.3	-46.4	-54.3
>30' to ≤ 35'	-43.9	-76.6	-113.2	-48.1	-56.2
>35' to ≤ 40'	-45.1	-78.7	-116.3	-49.4	-57.8

¹ Calculated in accordance with ASCE.

² For Hip Roofs with slope ≤ 5.5:12, $P_{asd}(3)$ shall be treated as $P_{asd}(2)$.

³ $P_{asd} = 0.6P_{ult}$

ROOF SLOPE	> 2:12 to ≤ 6:12			> 6:12 to ≤ 12:12	
	$P_{asd}(1)$	$P_{asd}(2)$	$P_{asd}(3)^2$	$P_{asd}(1)$	$P_{asd}(2)$ & $P_{asd}(3)$
Roof mean height					
≤ 20'	-47.0	-81.9	-121.0	-51.4	-60.1
>20' to ≤ 25'	-48.8	-85.0	-125.7	-53.4	-62.4
>25' to ≤ 30'	-50.3	-87.7	-129.6	-55.0	-64.4
>30' to ≤ 35'	-51.5	-89.9	-132.7	-56.4	-65.9
>35' to ≤ 40'	-52.7	-91.9	-135.8	-57.7	-67.9

¹ Calculated in accordance with ASCE 7.

² For Hip Roofs with slope ≤ 5.5:12, $P_{asd}(3)$ shall be treated as $P_{asd}(2)$.

³ $P_{asd} = 0.6P_{ult}$

TABLE 3 WHERE TO OBTAIN INFORMATION		
Description	Symbol	Where to find
Design Pressure	$P_{asd}(1)$ or $P_{asd}(2)$ or $P_{asd}(3)$	Table 1 or Table 2, as applicable, or by an engineer analysis prepared, signed and sealed by a professional engineer based on ASCE 7
Mean Roof Height	H	Job Site
Roof Slope	θ	Job Site
Aerodynamic Multiplier	λ	Product Approval
Restoring Moment due to Gravity	M_g	Product Approval
Attachment Resistance	M_f	Product Approval
Required Moment Resistance	M_r	Calculated
Minimum Characteristic Resistance Load	F'	Product Approval
Required Uplift Resistance	F_r	Calculated
Average Tile Weight	W	Product Approval
Tile Dimensions	l=length w=width	Product Approval

All calculations must be submitted to the building official at the time of permitting.

