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SPRI Wind Design Seminar
ANSI/SPRI WD-1

SPRI
SINGLE PLY ROOFING INDUSTRY

ANSI/SPRI Standards

ANSI/SPRI Standards

- ANSI/SPRI WD-1 Design Standard Practices for Roofing Assemblies
- ANSI/SPRI RP-4*
- ANSI/SPRI RP-14
- ANSI/SPRI IA-1
- ANSI/SPRI FX-1

*referenced in the International Building Code

ANSI/SPRI WD-1 - Wind Design Standard Practice for Roofing Assemblies

Document assists in verifying the process to meet the building code associated to uplift pressures for roofing:

ASCE 7 Design Load (PSF) ≤ Tested Load (PSF)

Includes rational analysis methods for determining enhancement of perimeter and corner fastening (if necessary)

Rationale Analysis Method for Perimeters and Corners of Adhered Assemblies

Rationale analysis method is not necessary, when tested load capacity (not factored) is greater than the design load

Example:

Tested Load pressures is 90-psf. Zone 3 Design Load pressures have been calculated to -64.6-psf.

Since 90-psf > -64.6-psf, no enhancements would be necessary.

Select an appropriate roofing system

Chapter 15, Section 1504.4.1 IBC

Assemblies are tested by following one of the following:

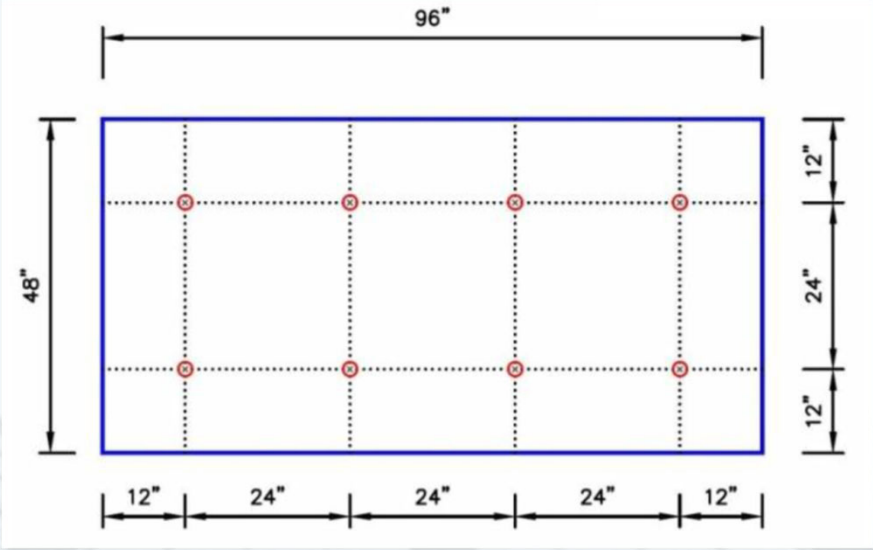
- ANSI/FM 4474 (12’x24’ or 5’x9’ size tables)
- UL 580 (10’x10’ size table)
- UL 1897 (10’x10’ or 12’x24’)

Results are Tested Loaded Assemblies in lbs/sqft.

Rationale Analysis Method for Perimeters and Corners of Adhered Assemblies

Rationale analysis method can be used when:

- Insulation secured with fasteners or adhesive ribbons
- Securement pattern can be converted to a sqft area.



Adhered Membrane Assemblies with Insulation Secured with Insulation Fasteners and Plates

Fastened Insulation

Increase fasteners per the following formula:

Fn = (Ft x Ld)/Lt

Where:

- Fn = # of fasteners to meet design load
- Ft = # of fasteners used to achieve tested load
- Ld = Design load for perimeter or corner
- Lt = Tested load

Adhered assembly with mechanically attached insulation

Roof Assembly Tested Load is 90-psf

Assembly uses 2-inch foam plastic insulation secured to the deck using 1 fastener every 4 ft² [8 fasteners per 4'x8' size board]

Design Loads in lbs/sqft				
Bldg. Ht., ft.	Zone 1'	Zone 1	Zone 2	Zone 3
60	**-40.8**	**-71.0**	**-93.7**	**-127.7**

Adhered Membrane Assembly with fastened insulation

$F_n = (F_t \times L_d)/L_t$

Zone 2

- $F_n = (F_t \times L_d)/L_t$
- F_n = (8 fasteners x 93.7-psf) ÷ 90-psf
- = 9 fasteners per board (rounded up)

Zone 3

- $F_n = (F_t \times L_d)/L_t$
- F_n = (8 fasteners x 127.7-psf) ÷ 90-psf
- = 12 fasteners per board (rounded up)

Rational Analysis Method
Adhered assembly with Ribbon/Bead Adhesive Attached Insulation

Ribbons/beads of an adhesive spacing equation:

Rn = Rt/(Ld/Lt):

Where:

- Rn = Adhesive spacing to meet the design load
- Rt = Adhesive spacing to achieve the tested load
- Ld = Design Load for the perimeter or corner
- Lt = Tested Load

Adhered assembly with ribbon/bead adhesive attached insulation

Roof Assembly Tested Load is 90-psf

System uses 2-inch foam plastic insulation adhered using ribbon/bead adhesive spaced 12-inches

Design Loads in lbs/sqft				
Bldg. Ht., ft.	Zone 1'	Zone 1	Zone 2	Zone 3
60	**-40.8**	**-71.0**	**-93.7**	**-127.7**

Adhered assembly with ribbon/bead adhesive attached insulation

Rn = Rt / (Ld/Lt)

Zone 2:

- $R_n = R_t / (L_d / L_t)$
- R_n = 12-inches/(93.7 psf ÷ 90 psf)
- = 11-inches (rounded down)

Zone 3:

- $R_n = R_t / (L_d / L_t)$
- R_n = 12-inches/(127.7 psf ÷ 90 psf)
- = 8-inches (rounded down)

Rationale Analysis Method Mechanically Attached Membranes Linear Securement (Rows Spacing)

$$RS_n = (L_t / L_d) \times RS_t$$

Where Fastener Spacing stays the same:

- RS_n = Fastening Row Spacing (ft)
- L_t = Tested load capacity
- RS_t = Tested Row Spacing (ft)
- L_d = Design load for the Zone 1, 2 and 3

Mechanically Attached Membrane with Linear Securement

Roof Assembly “Tested Load Capacity” is 90-psf

Membrane mechanically attached with 9.5-ft* rows at a rate of 12-inches

Design Loads in lbs/sqft				
Bldg. Ht., ft.	Zone 1’	Zone 1	Zone 2	Zone 3
60	**-40.8**	**-71.0**	**-93.7**	**-127.7**

*10-ft sheet – 0.5 seam = 9.5-ft

Mechanically Attached Membrane (Linear)

$$RS_n = (L_t / L_d) \times RS_t$$

Zone 2

- $RS_n = (L_t / L_d) \times RS_t$
- RS_n = (90-psf / 93.7-psf) x 9.5-ft
- = 9-ft rows (round down)

Zone 3

- $RS_n = (L_t / L_d) \times RS_t$
- RS_n = (90-psf / 127.7-psf) x 9.5-ft
- = 6-ft rows (round down)

Rationale Analysis Method Mechanically Attached Membranes Linear Securement (Fastening Spacing)

$$FS_n = ((L_t \times FS_t) / L_d) \times 12\text{-inches}$$

Where Fastener Spacing stays the same:

- FS_n = Fastening Spacing in seam (ft)
- L_t = Tested load capacity
- FS_t = Tested Fastening Spacing in seam (ft)
- L_d = Design load for the perimeter or corner

Mechanically Attached Membrane with Linear Securement

Roof Assembly Tested Load is 90-psf

Membrane mechanically attached with 9.5-ft* rows at a rate of 12-inches

Design Loads in lbs/sqft				
Bldg. Ht., ft.	Zone 1’	Zone 1	Zone 2	Zone 3
60	**-40.8**	**-71.0**	**-93.7**	**-127.7**

*10-ft sheet – 0.5 seam = 9.5-ft

Mechanically Attached Membranes Linear Securement (Fastening Spacing)

$$\mathbf{FS_n = ((L_t \times FS_t)/ L_d) \times 12\text{-inches})}$$

Zone 2:

- $FS_n = ((L_t \times FS_t) / L_d) \times 12\text{-inches}$
- $FS_n = ((90\text{-psf} \times 1\text{-ft}) / 93.7\text{-psf}) \times 12\text{-inches}$
- = <u>11-inches (round down)</u>

Zone 3:

- $FS_n = ((L_t \times FS_t) / L_d) \times 12\text{-inches}$
- $FS_n = ((90\text{-psf} \times 1\text{-ft}) / 127.7\text{-psf}) \times 12\text{-inches}$
- = <u>8-inches (round down)</u>

Rationale Analysis Method for Induction Welded Membranes

Induction Plates and Fasteners:

Increase Induction Plates & fasteners per the following formula:

$$Fn = (Ft \times Ld)/Lt$$

Where:

- Fn = # of plates & fasteners to meet design load
- Ft = # of plates & fasteners used to achieve tested load
- Ld = Design load for perimeter or corner
- Lt = Tested load

Induction Welded Membrane

Roof Assembly Tested Load is 90-psf

Membrane induction welded to 6 plates and fasteners per 4’x8’ size board

Design Loads in lbs/sqft				
Bldg. Ht., ft.	Zone 1’	Zone 1	Zone 2	Zone 3
60	**-40.8**	**-71.0**	**-93.7**	**-127.7**

Induction Welded Plates and Fasteners attaching insulation

Fn = (Ft x Ld)/Lt

Zone 2

- $F_n = (F_t \times L_d)/L_t$
- F_n = (6 fasteners x 93.7-psf) ÷ 90-psf
- = 7 fasteners per board (rounded up)

Zone 3

- $F_n = (F_t \times L_d)/L_t$
- F_n = (6 fasteners x 127.7-psf) ÷ 90-psf
- = 9 fasteners per board (rounded up)