

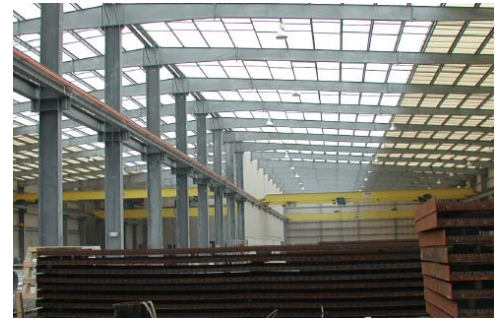
Tuff Span Roofing & Siding Panels

Unsurpassed Strength & Corrosion Resistance

For demanding structural and environmental conditions, Tuff Span GRP building panels deliver unsurpassed performance as industrial roofing and siding.

In GRP materials, strength and stiffness is determined by the alignment and amount of its glass fiber reinforcements. For effective reaction and transfer of loads, Tuff Span is constructed with high reinforcing content placed in straight and continuous, bidirectional alignment. As a result, Tuff Span has higher strength and stiffness of any profiled GRP building panel and history of standing up to hurricane winds where aged metal, cementitious, and other materials have failed. Providing personnel safety, Tuff Span series 450 is the standard for walkable, GRP roofing.

To resist attack from aggressive chemical exposure, Tuff Span is formulated with premium resin systems, Iso-Polyester or Vinyl Ester. Extended and superior UV protection is provided by an exterior acrylic coating, UV stabilized resin, embossed resin-rich surface, and interior mat or veil. A wide range of profiles are available in opaque colors or translucent for natural light transmission.



Tuff Span Roofing & Siding; Tuff Span Purlins over Pickling Line



Tuff Span Roofing & Siding - 44,594 SM; Tuff Span Monitor Ridge Vent - 366 LM

| Uses | Features | Benefits |
|---|---|---|
| <ul style="list-style-type: none"> > Roofing & Siding Panels > Roof & Form Deck > Insulated Panel Assembly > Tank Covers & Lagging > Cooling Tower Casing | <ul style="list-style-type: none"> > Corrosion Resistance > Strongest FRP Building Panel > 4-Level UV Protection > Fire Retardant > Low Thermal Expansion > Opaque/Translucent Colors | <ul style="list-style-type: none"> > Life-Cycle Cost Savings > Maintenance-Free Life > Light Transmission Option > Walkable Roof Option > Improved Appearance |

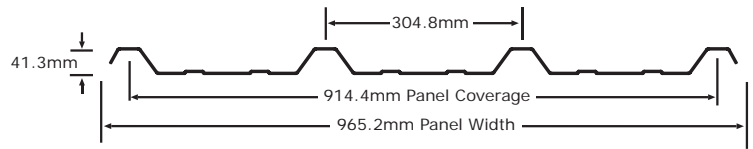
| Tuff Span Materials | PFR/VFR | | | | | | FM | | |
|--|----------------------------------|-----|-----|----------------|-----|-----|------------------------|-----|-----|
| | 150 | 200 | 250 | 300 | 400 | 450 | 10 | 13 | 16 |
| Nominal Weight, Oz/square meter | 2.4 | 2.7 | 3.2 | 3.7 | 4.3 | 4.9 | 3.2 | 4.1 | 5.0 |
| Nominal Glass Content | 48% by Wt. | | | | | | 30% by Wt. | | |
| Flame Spread Rating, ASTM E-84 | 25 or less (Class 1) | | | | | | 15 (Class 1) | | |
| Smoke Development, ASTM E-84 | ≤ 450 (PFR) | | | > 450, all VFR | | | ≤ 300 | | |
| Fire Test for Roof Coverings, ASTM E-108 | Class C: 14° max slope | | | | | | Class B: 14° max slope | | |
| Rate & Extent of Burning, ASTM D-635 | ATB < 5, AFB 10 mm (CC1) | | | | | | | | |
| Ignition Temperature, ASTM D-1929 | 343 - 426° C | | | | | | | | |
| Coefficient of Thermal Expansion, ASTM D-696 | 1.44 x 10 ⁻⁵ mm/mm° C | | | | | | | | |

PFR = Iso-Polyester Fire Retardant; VFR = Vinyl Ester Fire Retardant; FM = FM Approved Iso-Polyester

| Standard Colors | Light Transmission | Notes |
|---|--------------------|---|
| Gray, White, Beige, Shale, Stone White-R | Opaque | Contact Enduro for other colors |
| Translucent Clear | Up to 80% | % light transmission varies with panel thickness, color & profile |
| Translucent White | Up to 50% | |
| Translucent Gray, Beige, Shale, Stone White-R | Up to 40% | |

0610

12 x 1 5/8 R-Panel



Roofing Positive Load; L/D = 60; Moment FOS = 2.5

| Load, Pascals | | 957 | | | 1436 | | | 1915 | | | 2394 | | | 2872 | | |
|----------------------------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Span | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| S E R I E S | FR 450 | 2.06 | 2.74 | 2.54 | 1.78 | 2.29 | 2.21 | 1.62 | 1.98 | 2.01 | 1.50 | 1.78 | 1.85 | 1.42 | 1.62 | 1.75 |
| | FR 400 | 1.98 | 2.67 | 2.46 | 1.73 | 2.16 | 2.16 | 1.57 | 1.88 | 1.96 | 1.47 | 1.68 | 1.80 | 1.37 | 1.52 | 1.70 |
| | FR 300 | 1.90 | 2.44 | 2.36 | 1.68 | 1.98 | 2.06 | 1.52 | 1.70 | 1.88 | 1.40 | 1.52 | 1.70 | 1.32 | 1.40 | 1.55 |
| | FR 250 | 1.75 | 1.75 | 1.98 | 1.45 | 1.45 | 1.60 | 1.24 | 1.24 | 1.40 | 1.12 | 1.12 | 1.24 | 1.02 | 1.02 | 1.14 |
| | FR 200 | 1.65 | 1.70 | 1.90 | 1.40 | 1.40 | 1.55 | 1.22 | 1.22 | 1.35 | 1.07 | 1.07 | 1.22 | 0.99 | 0.99 | 1.09 |
| | FR 150 | 1.32 | 1.32 | 1.50 | 1.09 | 1.09 | 1.22 | 0.94 | 0.94 | 1.04 | 0.84 | 0.84 | 0.94 | 0.76 | 0.76 | 0.86 |
| | FM 16 | 1.85 | 2.49 | 2.31 | 1.62 | 2.11 | 2.01 | 1.47 | 1.83 | 1.83 | 1.37 | 1.62 | 1.70 | 1.29 | 1.47 | 1.60 |
| | FM 13 | 1.73 | 1.93 | 2.13 | 1.50 | 1.57 | 1.75 | 1.37 | 1.37 | 1.52 | 1.22 | 1.22 | 1.37 | 1.12 | 1.12 | 1.24 |
| | FM 10 | 1.57 | 1.65 | 1.83 | 1.35 | 1.35 | 1.50 | 1.14 | 1.14 | 1.29 | 1.04 | 1.04 | 1.14 | 0.94 | 0.94 | 1.04 |

Roofing Negative Load; L/D = 60; Moment FOS = 1.88; Pullover FOS = 1.88

| Load, Pascals | | 957 | | | 1436 | | | 1915 | | | 2394 | | | 2872 | | |
|----------------------------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Span | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| S E R I E S | FR 450 | 2.06 | 2.74 | 2.54 | 1.78 | 2.41 | 2.21 | 1.63 | 2.18 | 2.01 | 1.50 | 2.03 | 1.85 | 1.42 | 1.75 | 1.75 |
| | FR 400 | 1.98 | 2.67 | 2.46 | 1.73 | 2.34 | 2.16 | 1.57 | 2.11 | 1.96 | 1.47 | 1.80 | 1.80 | 1.37 | 1.50 | 1.70 |
| | FR 300 | 1.90 | 2.57 | 2.36 | 1.68 | 2.24 | 2.06 | 1.52 | 1.93 | 1.88 | 1.40 | 1.55 | 1.75 | 1.32 | 1.30 | 1.47 |
| | FR 250 | 1.90 | 2.03 | 2.29 | 1.65 | 1.65 | 1.85 | 1.45 | 1.45 | 1.60 | 1.30 | 1.17 | 1.35 | 1.17 | 0.99 | 1.12 |
| | FR 200 | 1.65 | 1.98 | 2.03 | 1.45 | 1.60 | 1.78 | 1.30 | 1.40 | 1.55 | 1.22 | 1.17 | 1.35 | 1.14 | 0.99 | 1.12 |
| | FR 150 | 1.40 | 1.52 | 1.73 | 1.22 | 1.24 | 1.40 | 1.09 | 1.09 | 1.22 | 0.97 | 0.91 | 1.04 | 0.89 | 0.76 | 0.86 |
| | FM 16 | 1.85 | 2.49 | 2.31 | 1.63 | 2.18 | 2.01 | 1.47 | 1.98 | 1.83 | 1.37 | 1.60 | 1.70 | 1.30 | 1.32 | 1.50 |
| | FM 13 | 1.73 | 2.24 | 2.13 | 1.50 | 1.83 | 1.85 | 1.37 | 1.57 | 1.70 | 1.27 | 1.35 | 1.52 | 1.19 | 1.12 | 1.27 |
| | FM 10 | 1.57 | 1.88 | 1.96 | 1.37 | 1.55 | 1.70 | 1.24 | 1.32 | 1.50 | 1.17 | 1.12 | 1.30 | 1.09 | 0.94 | 1.07 |

Siding: Wind Load; L/D = 30; Moment FOS = 1.88; Pullover FOS = 1.88

| Load, Pascals | | 957 | | | 1436 | | | 1915 | | | 2394 | | | 2872 | | |
|----------------------------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Span | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| S E R I E S | FR 450 | 2.59 | 3.23 | 3.20 | 2.26 | 2.64 | 2.79 | 2.06 | 2.29 | 2.54 | 1.90 | 2.03 | 2.29 | 1.78 | 1.75 | 2.01 |
| | FR 400 | 2.51 | 3.07 | 3.10 | 2.18 | 2.49 | 2.72 | 1.98 | 2.16 | 2.41 | 1.85 | 1.80 | 2.06 | 1.73 | 1.50 | 1.70 |
| | FR 300 | 2.41 | 2.79 | 3.00 | 2.11 | 2.29 | 2.57 | 1.90 | 1.93 | 2.21 | 1.78 | 1.55 | 1.75 | 1.60 | 1.30 | 1.47 |
| | FR 250 | 2.03 | 2.03 | 2.29 | 1.65 | 1.65 | 1.85 | 1.45 | 1.45 | 1.60 | 1.30 | 1.17 | 1.35 | 1.17 | 0.99 | 1.12 |
| | FR 200 | 1.98 | 1.98 | 2.21 | 1.60 | 1.60 | 1.80 | 1.40 | 1.40 | 1.55 | 1.24 | 1.17 | 1.35 | 1.14 | 0.99 | 1.12 |
| | FR 150 | 1.52 | 1.52 | 1.73 | 1.24 | 1.24 | 1.40 | 1.09 | 1.09 | 1.22 | 0.97 | 0.91 | 1.04 | 0.89 | 0.76 | 0.86 |
| | FM 16 | 2.34 | 2.97 | 2.90 | 2.06 | 2.41 | 2.54 | 1.85 | 2.01 | 2.26 | 1.73 | 1.60 | 1.80 | 1.63 | 1.32 | 1.50 |
| | FM 13 | 2.18 | 2.24 | 2.49 | 1.83 | 1.83 | 2.03 | 1.57 | 1.57 | 1.75 | 1.40 | 1.35 | 1.52 | 1.27 | 1.12 | 1.27 |
| | FM 10 | 1.88 | 1.88 | 2.11 | 1.55 | 1.55 | 1.73 | 1.32 | 1.32 | 1.50 | 1.19 | 1.12 | 1.30 | 1.09 | 0.94 | 1.07 |

1. Maximum spans are shown in lineal meters and based on Uniform Loading in Pascals and panel fasteners with 1.85 cm diameter washer at every low rib over supports.
2. Panel structural properties and maximum spans are based on large-scale tests that consider: Bending Moment at failure; Flexural Stiffness; Pullover Force per fastener.