



CREATIVE
COMPOSITES
GROUP

TECHNICAL SPECIFICATIONS

TUFFSPAN® FRP BUILDING PRODUCTS



ROOFING & SIDING • INSULATED COMPOSITE PANELS • ROOF DECK
FORM DECK • PURLINS & GIRTS • STRUCTURAL SHAPES
LOUVERS • RIDGE VENTS • GUTTER • BUILDINGS

TuffSpan®

Welcome to Creative Composites Group

TuffSpan building products from Enduro Composites (now a part of Creative Composites Group) provide a total, corrosion-resistant, structural solution including FRP building panels, beams, ventilation, and gutter systems. With its history of outstanding performance in the most challenging structural and environmental conditions, TuffSpan is the global leader for glass fiber reinforced plastic (FRP) building materials.

Within this guide, you will find information covering application, technical data and uses for our FRP building products.

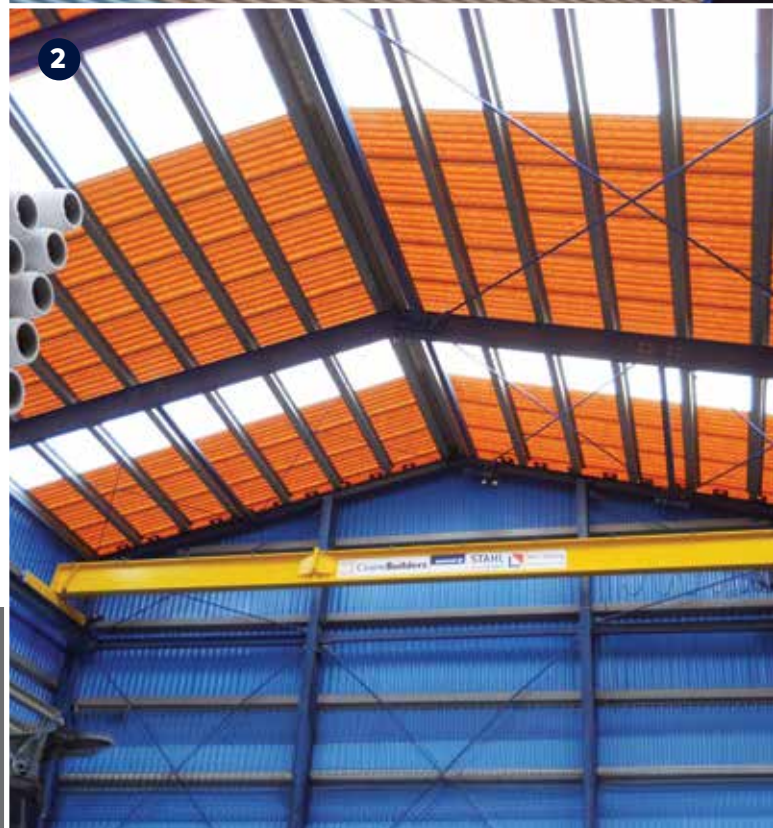
To reach our product specialists for assistance, please call (800) 231-7271, email us at BPsales@EnduroComposites.com, or visit our website: CreativeCompositesGroup.com.

We, at Enduro, appreciate your interest in TuffSpan FRP building systems and look forward to serving you.

***Thank you for your interest in our FRP solutions.
We look forward to working with you.***

◀ *Catalog Cover Photo: TuffSpan panels at cement plant designed by Industrial Architectural Alliance*

1. and 2. TuffSpan opaque and translucent cladding, beams, louvers and gutter at Desalination plant ▶



*TuffSpan panels & beams
at wastewater treatment plant*



*TuffSpan panels & beams
at pulp and paper mill*



*TuffSpan panels
at aluminum smelter*



Fiber Reinforced Polymer (FRP)

CORROSION RESISTANCE

For superior protection in chemical, wet or coastal environments, FRP material must include a premium resin system, either isophthalic polyester or vinyl ester. With good weathering properties, iso-polyester is recommended for most exterior applications and provides outstanding protection against caustics, acids, and continuous wet conditions. For higher temperature exposures, vinyl ester offers enhanced strength retention.

STRUCTURAL PROPERTIES

With FRP materials, strength and stiffness is determined by the alignment and amount of its glass fiber reinforcements. FRP building panels with higher glass content in straight, bidirectional alignment, such as TuffSpan, exhibit less panel deflection and provide better weather-tightness than alternative FRP materials.

UV PROTECTION

For high-quality, long-term performance, FRP cladding panels must be properly protected against UV rays. It is recommended that users and specifiers require a UV stabilized resin system plus an exterior protective coating for FRP cladding.

FIRE RETARDANCE

Fire retardant, FRP materials have self-extinguishing, low flame spread properties. It is recommended (at minimum) that users require materials with Class I flame spread rating of 25 or less per ASTM E84. To comply with FM Global guidelines, materials having passed FM Corner Fire Test per Standard 4880 must be specified.

NON-CONDUCTIVITY RF TRANSPARENT

FRP materials provide an appealing, safe option for utilities and other high voltage conditions and are ideal to enclose radar, microwave and communications equipment to reduce radio frequency interference.

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Facilities with TuffSpan FRP

- ▶ Aluminum
 - ▶ Battery Recycling
 - ▶ Chemical
 - ▶ Cement
 - ▶ Cooling Towers
 - ▶ Corn Processing
 - ▶ Desalination
- ▶ Electronics
 - ▶ Fertilizer
 - ▶ Food & Beverage
 - ▶ Galvanizing/Plating
 - ▶ Lithium Processing
 - ▶ Metal Processing
 - ▶ Marine/Port Facilities
- ▶ Mining
 - ▶ Military
 - ▶ Natatoriums
 - ▶ Pulp & Paper
 - ▶ Power
 - ▶ Radio Frequency Transparent
- ▶ Rendering
 - ▶ Salt
 - ▶ Solvent Extraction/ Electrowinning
 - ▶ Waste Treatment

TuffSpan FRP Roofing & Siding Panels

Outstanding Corrosion Resistance, Strength & UV Protection

For demanding structural and environmental applications, TuffSpan FRP building panels deliver unsurpassed performance as industrial roofing and siding. With its unique combination of corrosion resistance, high strength and UV protection, TuffSpan is the optimum building panel worldwide for challenging, tough conditions.

STRUCTURAL PERFORMANCE

TuffSpan has the highest strength and stiffness of any profiled FRP building panel and history of standing up to hurricane winds where aged metal, cementitious and other materials have failed. The TuffSpan material includes higher content (up to 50% of its weight) of reinforcing fibers that are strategically placed in straight and continuous, bidirectional alignment to optimize load transfer and reaction. Designers can use the same structural criteria for TuffSpan as they would specify for high-strength steel.

ROOFING PANELS SAFE FOR FOOT TRAFFIC

As the industry standard for walkable, fiberglass panels, TuffSpan Series 450 provides the strongest support for foot traffic of any fiberglass building panel designed for profiled roofing. The material's strength and stiffness offers installers and maintenance workers greater confidence and safer support when compared to other fiberglass roofing. This benefit is available for higher strength TuffSpan panels in specific profiles and Series classifications per Enduro's guidelines. Please see the Load/Span Tables in this guide and contact Enduro for assistance.

LONG SERVICE LIFE

Huge life-cycle cost savings and long-term aesthetics are provided by a combination of outstanding corrosion resistance, high strength and a 4-Level UV Protection System, which includes an exterior acrylic coating, UV stabilized resin, embossed resin-rich surface and interior mat or veil.

OPAQUE & TRANSLUCENT COLOR OPTIONS

TuffSpan panels are available in a number of standard opaque colors. TuffSpan panel color is integral throughout the material and will not rust, flake off or peel. For slightly added cost and minimum quantity requirements, custom colors are easily developed to match existing materials or color schemes.

TuffSpan panels are also available in translucent colors. These materials provide natural and soft, diffused lighting that dramatically enhances workplace environments while reducing utility bills.

Uses

- ▶ Roofing & Siding Panels
- ▶ Wall & Ceiling Liner
- ▶ Insulated Panel Assembly
- ▶ Cooling Tower Casing
- ▶ Tank Covers & Jacketing

Features

- ▶ Corrosion Resistance
- ▶ Strongest FRP Building Panel
- ▶ 4-level UV Protection
- ▶ Fire Retardant
- ▶ Opaque or Translucent Colors
- ▶ Walkable Roof Option
- ▶ Improved Facility Appearance

Benefits

- ▶ Lowest Total Cost of Ownership
- ▶ Maintenance-Free for Life
- ▶ Daylighting Panels Reduce Lighting Costs

1



2

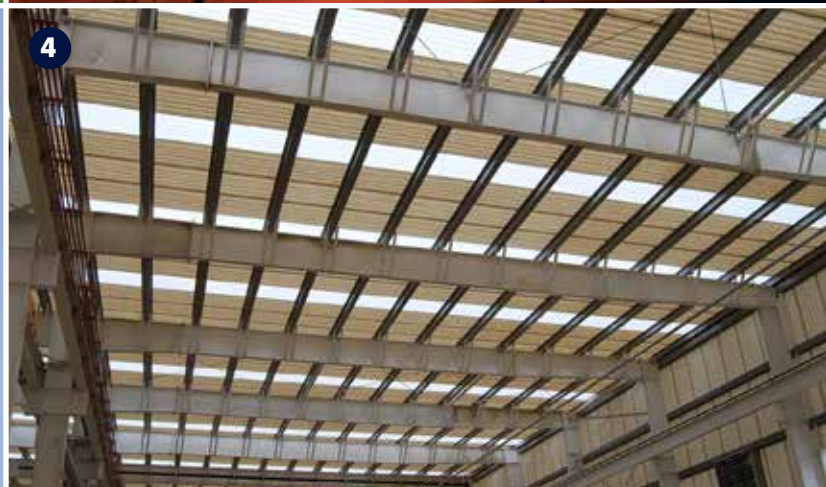
ROOFING & SIDING



3



4



5



1. At Waste to Energy facility, TuffSpan roofing and siding (on end wall) were undamaged by Hurricane Charlie's 145 mph winds. Corroded metal panels (on side wall) were damaged or blew off.
2. TuffSpan translucent roofing & siding at phosphate storage facility
3. TuffSpan FM siding on 130 foot tall recovery boiler at coastal location
4. TuffSpan roofing, siding and purlins at metal treatment plant
5. TuffSpan opaque & translucent cladding at fertilizer blending facility
6. TuffSpan roof deck installation at chemical plant
7. TuffSpan louvers, translucent roofing & siding at USA military base. Supported by External Truss Support System

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Properties & Certifications

The information on this page is a partial list of product descriptions and certifications.
For more information and certifications, please contact Enduro. Enduro is ISO 9001:2015 Certified.



Materials	PFR / VFR						FM		
	150	200	250	300	400	450	10	13	16
Nominal Weight, Oz/SF	8	9.5	10.5	12	14	16	10.5	13.5	16.5
Nominal Weight, Grams/M2	2440	2900	3200	3660	4270	4880	3200	4120	5035
Nominal Glass Content	48% by Wt.						30% by Wt.		
R-Value	0.042 to 0.077 hr-ft²-F / BTU depending on the series								

Standard Colors	Light Transmission	Notes
Gray, White, Beige, Stone White-R	Opaque	CC1 - FR materials Light transmission varies with thickness, color, and profile.
Translucent Clear	Up to 80%	
Translucent White	Up to 45%	
Translucent Gray, Beige, Stone White-R	Contact us	
Translucent Pearl (Off White)	Up to 27%	FM Approved

Contact us for additional opaque and translucent colors.

Fire and Smoke	FM	PFR / VFR	
	10, 13, 16	Series 150, 200, 250, 300	400, 450
Smoke Development, ASTM E-84	≤ 300	≤ 450 (PFR only)	> 450
Flame Spread Rating, ASTM E-84	15 (Class 1)	25 or less (Class 1)	
Fire Test for Roof Coverings, ASTM E-108	Class B: 3/12 max slope	Class C: 3/12 max slope	
Rate and Extent of Burning, ASTM D-635	N/A	CC1: ATB < 5, AFB 10 mm	
FM Approvals Standard 4880, Corner Fire Test	FM approval without sprinkler requirements or height limits		
Fire Test of Exterior Wall Assemblies, ULC-S134	FM 10/13 wall assembly meets Section 3.1.5.5 of NBC 2010		

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

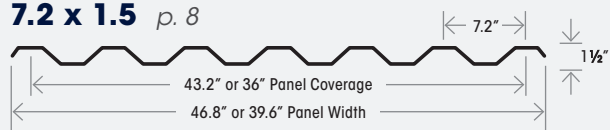
Wind Uplift	Series	Class	Span	Notes
4.2 x 1.06	FM 13, 16	FM I-60	5'6"	0.729" washer
7.2 x 1.5, 7.0 x 1.5, 7.2D x 1.75	FM 10, 13, 16	FM I-90	5'6"	1.125" washer
7.2 x 1.5, 7.0 x 1.5, 7.2D x 1.75	FM 13, 16	FM I-90	6'8"	1.125" washer
6.5 x 2 Roof Deck	VFR 500	UL Class 90	6'3"	UL Construction No. NM523
8.0 x 3.5 Roof Deck	VFR 700	UL Class 90	8'0"	UL Construction No. NM524
12 x 1.25R	LC2-150	UL Class 90	5'0"	UL Construction No. 580

Other Certifications	Series	Notes
FM Standard 4881 - Exterior Wall Systems	FM 10, 13, 16	Approvals for 19 profiles
Roof Diaphragm Loading, ASTM C455	4.2x1.06 PFR300, 7.2x1.5 PFR250	Contact us for diaphragm values
Coefficient of Thermal Expansion, ASTM D-696	TuffSpan Panels	Coefficient = 8 x 10 ⁻⁶ in/in°F
Florida Building Code	LC2-150	FL25568, FL25569
Florida Building Code	PFR-250	FL32006, FL32007
Texas (TDI) Windstorm	LC2-150	Translucent Wall & Roof Assembly
Solar Reflectance, ASTM C 1549	FM Opaque White	Average Reflectance = .750, SRI = .923
Thermal Emittance, ASTM C 1371	FM Opaque White	Average Emittance = .890
Solar Reflectance, ASTM C 1549	PFR 300, Translucent White	Average Reflectance = .449
Thermal Emittance, ASTM C 1371	PFR 300, Translucent White	Average Emittance = .905

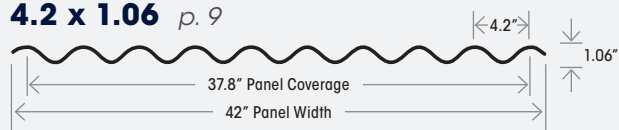
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STANDARD PROFILES

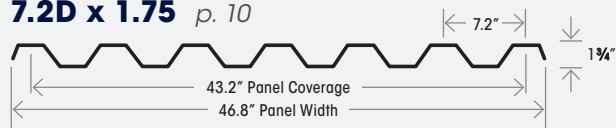
7.2 x 1.5 p. 8



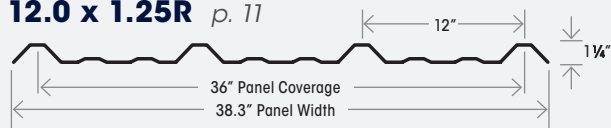
4.2 x 1.06 p. 9



7.2D x 1.75 p. 10

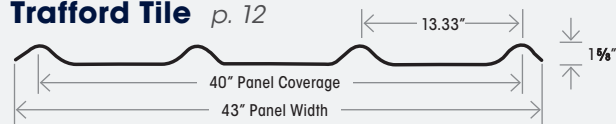


12.0 x 1.25R p. 11

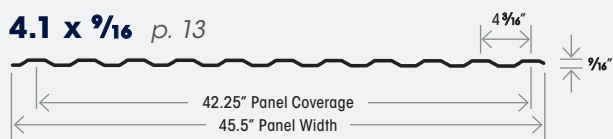


ADDITIONAL PROFILES

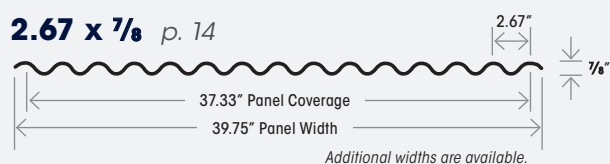
Trafford Tile p. 12



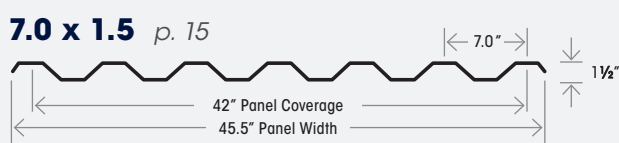
4.1 x 9/16 p. 13



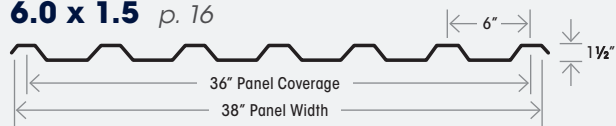
2.67 x 7/8 p. 14



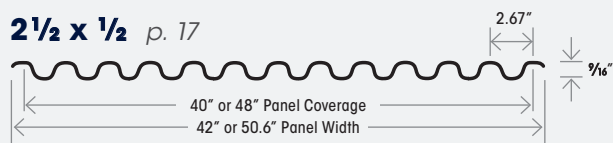
7.0 x 1.5 p. 15



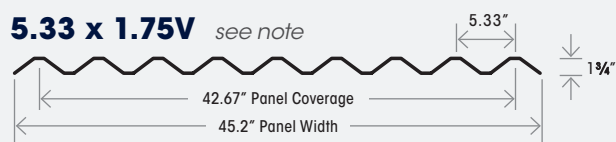
6.0 x 1.5 p. 16



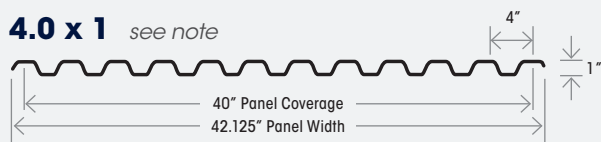
2 1/2 x 1/2 p. 17



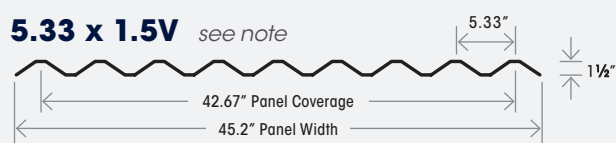
5.33 x 1.75V see note



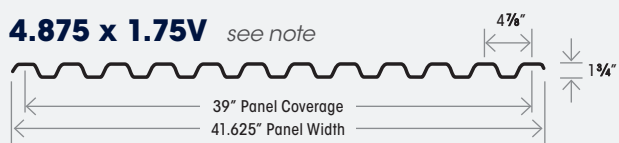
4.0 x 1 see note



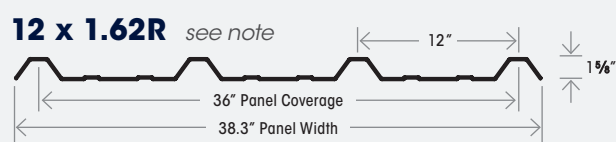
5.33 x 1.5V see note



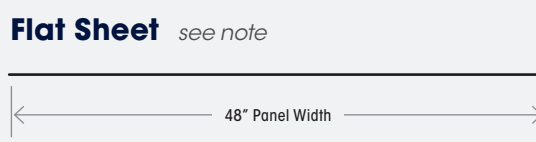
4.875 x 1.75V see note



12 x 1.62R see note



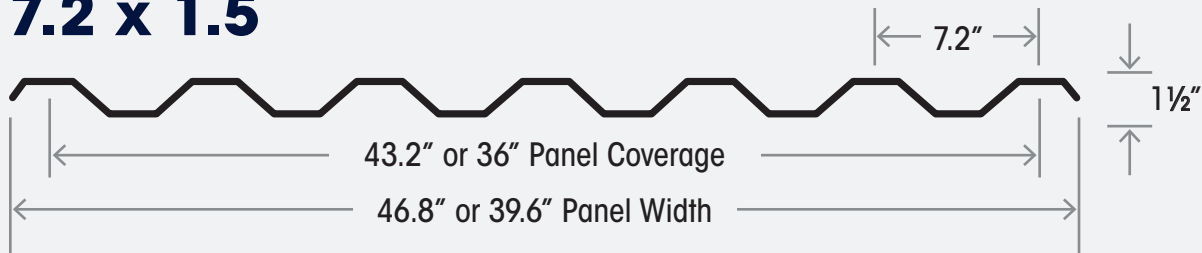
Flat Sheet see note



NOTE

Please contact us for load/span performance data.

7.2 x 1.5


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Personnel Load	Span	Defl @ 300 Lb. Load over 2.5 Ft. ² Area
TuffSpan Series 450	7' 6"	L/180 not to exceed 0.5"
TuffSpan Series 400	6' 0"	

With its high strength and stiffness, TuffSpan can provide safe support for normal installation and worker foot traffic with observance of standard, OSHA safety measures. The user is responsible for worker safety including requirements for harnesses, tie-off lines and safety shoes in addition to suitability of aged materials, slippery or sloped roofs. Single span conditions are not recommended for foot traffic.

Roofing: Positive Load

Deflection Limit = L/60 • Moment Factor of Safety = 2.5

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	7' 11"	10' 7"	9' 9"	6' 11"	9' 3"	8' 6"	6' 3"	8' 5"	7' 9"	5' 10"	7' 9"	7' 2"	5' 6"	7' 1"	6' 9"
	FR 400	7' 7"	10' 2"	9' 4"	6' 7"	8' 11"	8' 2"	6' 0"	8' 0"	7' 5"	5' 7"	7' 2"	6' 11"	5' 3"	6' 6"	6' 6"
	FR 300	7' 0"	9' 4"	8' 8"	6' 1"	7' 7"	7' 7"	5' 7"	6' 7"	6' 10"	5' 2"	5' 10"	6' 5"	4' 10"	5' 4"	6' 0"
	FR 250	6' 5"	7' 10"	7' 11"	5' 7"	6' 5"	6' 11"	5' 1"	5' 6"	6' 2"	4' 8"	4' 11"	5' 6"	4' 5"	4' 6"	5' 1"
	FR 200	5' 10"	7' 3"	7' 3"	5' 1"	5' 11"	6' 4"	4' 8"	5' 1"	5' 8"	4' 4"	4' 7"	5' 1"	4' 1"	4' 2"	4' 8"
	FR 150	5' 5"	5' 11"	6' 7"	4' 8"	4' 10"	5' 5"	4' 2"	4' 2"	4' 8"	3' 9"	3' 9"	4' 2"	3' 5"	3' 5"	3' 10"
	FM 16	7' 2"	9' 8"	8' 11"	6' 3"	8' 5"	7' 9"	5' 8"	7' 8"	7' 0"	5' 3"	7' 1"	6' 6"	5' 0"	6' 6"	6' 2"
	FM 13	6' 8"	8' 6"	8' 3"	5' 10"	6' 11"	7' 2"	5' 3"	6' 0"	6' 6"	4' 11"	5' 4"	6' 0"	4' 7"	4' 11"	5' 6"
	FM 10	6' 1"	7' 3"	7' 6"	5' 4"	5' 11"	6' 7"	4' 10"	5' 1"	5' 8"	4' 6"	4' 7"	5' 1"	4' 2"	4' 2"	4' 8"

Roofing: Negative Load

Deflection Limit = L/60 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	7' 11"	10' 7"	9' 9"	6' 11"	9' 3"	8' 6"	6' 3"	8' 5"	7' 9"	5' 10"	7' 10"	7' 2"	5' 6"	7' 4"	6' 9"
	FR 400	7' 7"	10' 2"	9' 4"	6' 7"	8' 10"	8' 2"	6' 0"	8' 1"	7' 5"	5' 7"	7' 6"	6' 11"	5' 3"	6' 7"	6' 6"
	FR 300	7' 0"	9' 5"	8' 8"	6' 1"	8' 3"	7' 7"	5' 7"	7' 5"	6' 10"	5' 2"	6' 8"	6' 5"	4' 10"	5' 7"	6' 0"
	FR 250	6' 5"	8' 7"	7' 11"	5' 7"	7' 4"	6' 11"	5' 1"	6' 5"	6' 3"	4' 8"	5' 8"	5' 10"	4' 5"	4' 8"	5' 4"
	FR 200	5' 10"	7' 10"	7' 3"	5' 1"	6' 9"	6' 4"	4' 8"	5' 10"	5' 9"	4' 4"	4' 8"	5' 3"	4' 1"	3' 10"	4' 5"
	FR 150	5' 5"	6' 10"	6' 8"	4' 8"	5' 7"	5' 10"	4' 3"	4' 10"	5' 3"	3' 11"	4' 1"	4' 8"	3' 9"	3' 5"	3' 10"
	FM 16	7' 2"	9' 8"	8' 11"	6' 3"	8' 5"	7' 9"	5' 8"	7' 8"	7' 0"	5' 3"	7' 1"	6' 6"	5' 0"	5' 10"	6' 2"
	FM 13	6' 8"	8' 11"	8' 3"	5' 10"	7' 9"	7' 2"	5' 3"	6' 11"	6' 6"	4' 11"	5' 11"	6' 1"	4' 7"	4' 11"	5' 7"
	FM 10	6' 1"	8' 2"	7' 6"	5' 4"	6' 9"	6' 7"	4' 10"	5' 11"	6' 0"	4' 6"	5' 1"	5' 6"	4' 2"	4' 3"	4' 10"

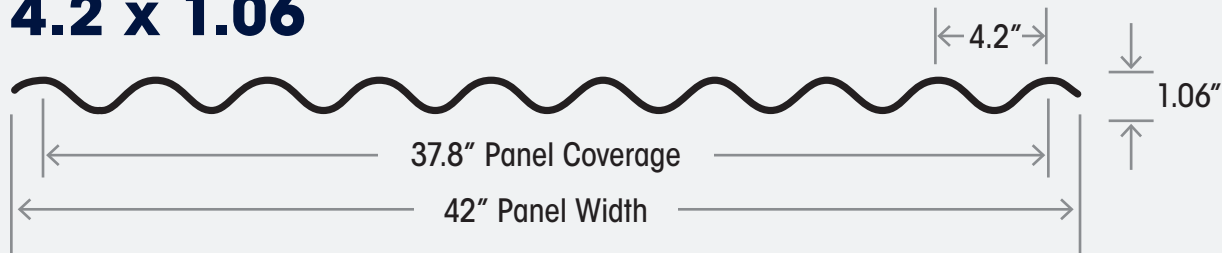
Siding: Wind Load

Deflection Limit = L/30 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	10' 0"	13' 4"	12' 4"	8' 8"	11' 6"	10' 9"	7' 11"	10' 0"	9' 9"	7' 4"	8' 11"	9' 1"	6' 11"	7' 9"	8' 6"
	FR 400	9' 7"	12' 10"	11' 10"	8' 4"	10' 8"	10' 4"	7' 7"	9' 3"	9' 4"	7' 0"	7' 11"	8' 8"	6' 7"	6' 7"	7' 6"
	FR 300	8' 10"	10' 9"	10' 11"	7' 9"	8' 9"	9' 7"	7' 0"	7' 7"	8' 6"	6' 6"	6' 8"	7' 7"	6' 1"	5' 7"	6' 4"
	FR 250	8' 1"	9' 0"	10' 0"	7' 1"	7' 4"	8' 3"	6' 5"	6' 5"	7' 2"	5' 8"	5' 8"	6' 5"	5' 2"	4' 8"	5' 4"
	FR 200	7' 5"	8' 4"	9' 2"	6' 5"	6' 9"	7' 7"	5' 10"	5' 10"	6' 7"	5' 3"	4' 8"	5' 3"	4' 9"	3' 10"	4' 5"
	FR 150	6' 9"	6' 10"	7' 8"	5' 7"	5' 7"	6' 3"	4' 10"	4' 10"	5' 5"	4' 4"	4' 1"	4' 8"	3' 11"	3' 5"	3' 10"
	FM 16	9' 1"	12' 2"	11' 2"	7' 11"	10' 7"	9' 9"	7' 2"	8' 10"	8' 11"	6' 8"	7' 1"	8' 0"	6' 3"	5' 10"	6' 8"
	FM 13	8' 5"	9' 9"	10' 4"	7' 4"	8' 0"	8' 11"	6' 8"	6' 11"	7' 9"	6' 2"	5' 11"	6' 9"	5' 8"	4' 11"	5' 7"
	FM 10	7' 8"	8' 4"	9' 4"	6' 8"	6' 9"	7' 7"	5' 11"	5' 11"	6' 7"	5' 3"	5' 1"	5' 9"	4' 9"	4' 3"	4' 10"

Maximum span for uniform load, PSF, is shown in lineal feet and based on panel fasteners with .729" diameter washer located 7.2" on center. Structural properties and maximum spans are based on large-scale tests that consider: bending moment at failure, flexural stiffness and pullover force per fastener.

4.2 x 1.06



Personnel Load	Span	Defl @ 300 Lb. Load over 2.5 Ft. ² Area
TuffSpan Series 450	6' 0"	L/150 not to exceed 0.5"
TuffSpan Series 400	6' 0"	

With its high strength and stiffness, TuffSpan can provide safe support for normal installation and worker foot traffic with observance of standard, OSHA safety measures. The user is responsible for worker safety including requirements for harnesses, tie-off lines, and safety shoes in addition to suitability of aged materials, slippery or sloped roofs. Single span conditions are not recommended for foot traffic.

Roofing: Positive Load

Deflection Limit = L/60 • Moment Factor of Safety = 2.5

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	6' 3"	8' 5"	7' 9"	5' 6"	7' 4"	6' 9"	5' 0"	6' 8"	6' 2"	4' 7"	6' 2"	5' 9"	4' 4"	5' 10"	5' 5"
	FR 400	6' 1"	8' 2"	7' 7"	5' 4"	7' 2"	6' 7"	4' 10"	6' 6"	6' 0"	4' 6"	6' 0"	5' 7"	4' 3"	5' 8"	5' 3"
	FR 300	5' 5"	7' 3"	6' 8"	4' 8"	6' 4"	5' 10"	4' 3"	5' 9"	5' 3"	3' 11"	5' 4"	4' 11"	3' 9"	5' 0"	4' 7"
	FR 250	5' 2"	7' 0"	6' 5"	4' 6"	6' 1"	5' 7"	4' 1"	5' 6"	5' 1"	3' 10"	5' 1"	4' 9"	3' 7"	4' 8"	4' 5"
	FR 200	4' 8"	6' 4"	5' 10"	4' 1"	5' 6"	5' 1"	3' 9"	5' 0"	4' 7"	3' 5"	4' 8"	4' 3"	3' 3"	4' 4"	4' 0"
	FR 150	4' 5"	5' 11"	5' 5"	3' 10"	5' 2"	4' 9"	3' 6"	4' 8"	4' 4"	3' 3"	4' 3"	4' 0"	3' 1"	3' 11"	3' 9"
	FM 16	5' 6"	7' 4"	6' 9"	4' 9"	6' 5"	5' 11"	4' 4"	5' 10"	5' 4"	4' 0"	5' 5"	5' 0"	3' 9"	5' 1"	4' 8"
	FM 13	5' 0"	6' 9"	6' 2"	4' 4"	5' 10"	5' 5"	3' 11"	5' 4"	4' 11"	3' 8"	4' 11"	4' 7"	3' 5"	4' 8"	4' 3"
	FM 10	4' 6"	6' 1"	5' 7"	3' 11"	5' 4"	4' 11"	3' 7"	4' 10"	4' 5"	3' 4"	4' 5"	4' 1"	3' 1"	4' 2"	3' 10"

Roofing: Negative Load

Deflection Limit = L/60 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	6' 3"	8' 5"	7' 9"	5' 6"	7' 4"	6' 9"	5' 0"	6' 8"	6' 2"	4' 7"	6' 2"	5' 9"	4' 4"	5' 10"	5' 5"
	FR 400	6' 1"	8' 2"	7' 7"	5' 4"	7' 2"	6' 7"	4' 10"	6' 6"	6' 0"	4' 6"	6' 0"	5' 7"	4' 3"	5' 8"	5' 3"
	FR 300	5' 5"	7' 3"	6' 8"	4' 8"	6' 4"	5' 10"	4' 3"	5' 9"	5' 3"	3' 11"	5' 4"	4' 11"	3' 9"	5' 0"	4' 7"
	FR 250	5' 2"	6' 11"	6' 5"	4' 6"	6' 1"	5' 7"	4' 1"	5' 6"	5' 1"	3' 10"	5' 1"	4' 9"	3' 7"	4' 6"	4' 5"
	FR 200	4' 8"	6' 4"	5' 10"	4' 1"	5' 6"	5' 1"	3' 9"	5' 0"	4' 7"	3' 5"	4' 8"	4' 3"	3' 3"	4' 4"	4' 0"
	FR 150	4' 5"	5' 11"	5' 5"	3' 10"	5' 2"	4' 9"	3' 6"	4' 8"	4' 4"	3' 3"	4' 4"	4' 0"	3' 1"	4' 0"	3' 9"
	FM 16	5' 5"	7' 4"	6' 9"	4' 9"	6' 5"	5' 11"	4' 4"	5' 10"	5' 4"	4' 0"	5' 5"	5' 0"	3' 9"	5' 1"	4' 8"
	FM 13	5' 0"	6' 9"	6' 2"	4' 4"	5' 10"	5' 5"	3' 11"	5' 4"	4' 11"	3' 8"	4' 11"	4' 7"	3' 5"	4' 6"	4' 3"
	FM 10	4' 6"	6' 1"	5' 7"	3' 11"	5' 3"	4' 11"	3' 7"	4' 10"	4' 5"	3' 4"	4' 5"	4' 1"	3' 1"	3' 6"	3' 10"

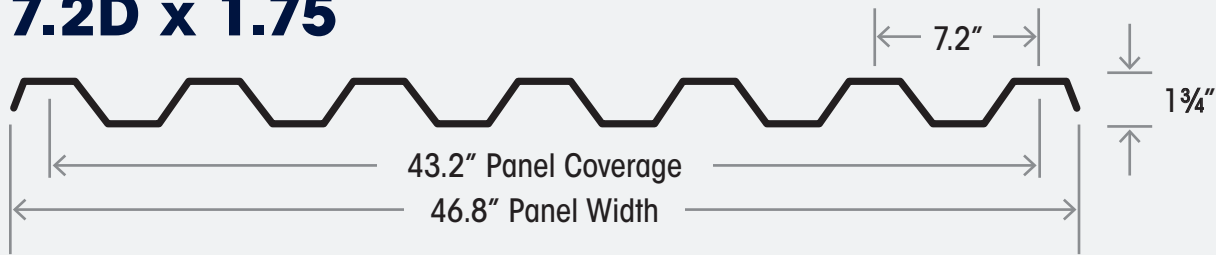
Siding: Wind Load

Deflection Limit = L/30 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	7' 11"	10' 8"	9' 10"	6' 11"	9' 3"	8' 7"	6' 3"	8' 5"	7' 9"	5' 10"	7' 10"	7' 3"	5' 6"	6' 7"	6' 9"
	FR 400	7' 8"	10' 4"	9' 6"	6' 9"	9' 0"	8' 4"	6' 1"	8' 2"	7' 7"	5' 8"	7' 7"	7' 0"	5' 4"	6' 5"	6' 7"
	FR 300	6' 9"	9' 1"	8' 5"	5' 11"	7' 11"	7' 4"	5' 5"	7' 2"	6' 8"	5' 0"	6' 5"	6' 2"	4' 8"	5' 10"	5' 10"
	FR 250	6' 6"	8' 9"	8' 1"	5' 8"	7' 7"	7' 1"	5' 2"	6' 7"	6' 5"	4' 10"	5' 5"	5' 11"	4' 6"	4' 6"	5' 2"
	FR 200	5' 11"	8' 0"	7' 4"	5' 2"	6' 11"	6' 5"	4' 8"	6' 2"	5' 10"	4' 4"	5' 2"	5' 5"	4' 1"	4' 4"	4' 11"
	FR 150	5' 7"	7' 6"	6' 11"	4' 10"	6' 4"	6' 0"	4' 5"	5' 6"	5' 5"	4' 1"	4' 10"	5' 1"	3' 10"	4' 0"	4' 7"
	FM 16	6' 11"	9' 3"	8' 6"	6' 0"	8' 1"	7' 5"	5' 5"	7' 4"	6' 9"	5' 1"	6' 8"	6' 3"	4' 9"	5' 6"	5' 11"
	FM 13	6' 4"	8' 6"	7' 10"	5' 6"	7' 5"	6' 10"	5' 0"	6' 9"	6' 2"	4' 8"	5' 5"	5' 9"	4' 4"	4' 6"	5' 2"
	FM 10	5' 8"	7' 8"	7' 1"	5' 0"	6' 8"	6' 2"	4' 6"	5' 3"	5' 7"	4' 2"	4' 3"	4' 10"	3' 11"	3' 6"	4' 0"

Maximum span for uniform load, PSF, is shown in lineal feet and based on panel fasteners with .729" diameter washer at every other corrugation over supports. Structural properties and maximum spans are based on large-scale tests that consider: bending moment at failure, flexural stiffness and pullover force per fastener.

7.2D x 1.75



Personnel Load	Span	Defl @ 300 Lb. Load over 2.5 Ft. ² Area
TuffSpan Series 450	7'6"	L/180 not to exceed 0.5"
TuffSpan Series 400	6'0"	

With its high strength and stiffness, TuffSpan can provide safe support for normal installation and worker foot traffic with observance of standard, OSHA safety measures. The user is responsible for worker safety including requirements for harnesses, tie-off lines, and safety shoes in addition to suitability of aged materials, slippery or sloped roofs. Single span conditions are not recommended for foot traffic.

Roofing: Positive Load

Deflection Limit = L/60 • Moment Factor of Safety = 2.5

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	8' 6"	11' 4"	10' 6"	7' 5"	9' 11"	9' 2"	6' 9"	9' 0"	8' 4"	6' 3"	8' 4"	7' 8"	5' 10"	7' 8"	7' 3"
	FR 400	8' 4"	11' 2"	10' 3"	7' 3"	9' 9"	9' 0"	6' 7"	8' 8"	8' 2"	6' 1"	7' 9"	7' 7"	5' 9"	7' 1"	7' 1"
	FR 300	7' 9"	10' 0"	9' 7"	6' 9"	8' 2"	8' 4"	6' 2"	7' 1"	7' 7"	5' 8"	6' 4"	7' 1"	5' 4"	5' 9"	6' 6"
	FR 250	7' 2"	9' 0"	8' 10"	6' 3"	7' 4"	7' 9"	5' 8"	6' 4"	7' 0"	5' 3"	5' 8"	6' 4"	4' 11"	5' 2"	5' 9"
	FR 200	6' 7"	7' 10"	8' 2"	5' 9"	6' 4"	7' 1"	5' 2"	5' 6"	6' 2"	4' 10"	4' 11"	5' 6"	4' 6"	4' 6"	5' 0"
	FR 150	6' 0"	6' 4"	7' 1"	5' 2"	5' 2"	5' 9"	4' 6"	4' 6"	5' 0"	4' 0"	4' 0"	4' 6"	3' 8"	3' 8"	4' 1"
	FM 16	8' 2"	11' 0"	10' 1"	7' 2"	9' 7"	8' 10"	6' 6"	8' 7"	8' 0"	6' 0"	7' 8"	7' 5"	5' 8"	7' 0"	7' 0"
	FM 13	7' 3"	9' 2"	9' 0"	6' 4"	7' 6"	7' 10"	5' 9"	6' 6"	7' 1"	5' 4"	5' 9"	6' 6"	5' 0"	5' 3"	5' 11"
	FM 10	6' 8"	7' 10"	8' 3"	5' 10"	6' 4"	7' 1"	5' 3"	5' 6"	6' 2"	4' 11"	4' 11"	5' 6"	4' 6"	4' 6"	5' 0"

Roofing: Negative Load

Deflection Limit = L/60 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	8' 6"	11' 4"	10' 6"	7' 5"	9' 11"	9' 2"	6' 9"	9' 0"	8' 4"	6' 3"	8' 4"	7' 8"	5' 10"	7' 10"	7' 3"
	FR 400	8' 4"	11' 2"	10' 3"	7' 3"	9' 9"	9' 0"	6' 7"	8' 10"	8' 2"	6' 1"	8' 3"	7' 7"	5' 9"	7' 2"	7' 1"
	FR 300	7' 9"	10' 5"	9' 7"	6' 9"	9' 1"	8' 4"	6' 2"	8' 2"	7' 7"	5' 8"	7' 2"	7' 1"	5' 4"	6' 0"	6' 8"
	FR 250	7' 2"	9' 7"	8' 10"	6' 3"	8' 5"	7' 9"	5' 8"	7' 4"	7' 0"	5' 3"	6' 6"	6' 6"	4' 11"	5' 8"	6' 2"
	FR 200	6' 7"	8' 10"	8' 2"	5' 9"	7' 4"	7' 1"	5' 2"	6' 4"	6' 5"	4' 10"	5' 3"	6' 0"	4' 7"	4' 5"	5' 0"
	FR 150	6' 0"	7' 4"	7' 5"	5' 3"	6' 0"	6' 6"	4' 9"	5' 2"	5' 9"	4' 5"	4' 7"	5' 2"	4' 2"	3' 10"	4' 4"
	FM 16	8' 2"	11' 0"	10' 1"	7' 2"	9' 7"	8' 10"	6' 6"	8' 8"	8' 0"	6' 0"	7' 7"	7' 5"	5' 8"	6' 4"	7' 0"
	FM 13	7' 3"	9' 9"	9' 0"	6' 4"	8' 6"	7' 10"	5' 9"	7' 6"	7' 1"	5' 4"	6' 4"	6' 7"	5' 0"	5' 3"	6' 0"
	FM 10	6' 8"	8' 11"	8' 3"	5' 10"	7' 4"	7' 2"	5' 3"	6' 4"	6' 6"	4' 11"	5' 6"	6' 1"	4' 7"	4' 7"	5' 2"

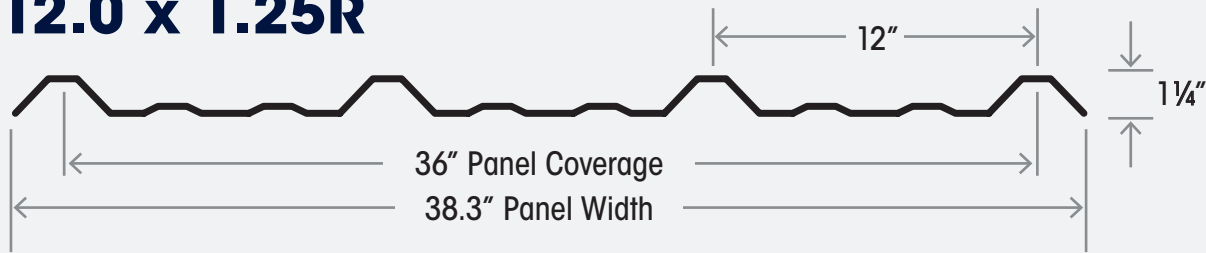
Siding: Wind Load

Deflection Limit = L/30 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	10' 8"	14' 4"	13' 3"	9' 4"	12' 6"	11' 6"	8' 6"	10' 10"	10' 6"	7' 10"	9' 8"	9' 9"	7' 5"	8' 6"	9' 2"
	FR 400	10' 6"	14' 1"	13' 0"	9' 2"	11' 6"	11' 4"	8' 4"	10' 0"	10' 3"	7' 9"	8' 7"	9' 7"	7' 3"	7' 2"	8' 2"
	FR 300	9' 9"	11' 7"	12' 1"	8' 6"	9' 5"	10' 7"	7' 9"	8' 2"	9' 2"	7' 2"	7' 2"	8' 2"	6' 8"	6' 0"	6' 10"
	FR 250	9' 0"	10' 4"	11' 2"	7' 11"	8' 5"	9' 5"	7' 2"	7' 4"	8' 2"	6' 6"	6' 6"	7' 4"	6' 0"	5' 8"	6' 5"
	FR 200	8' 3"	9' 0"	10' 1"	7' 3"	7' 4"	8' 2"	6' 4"	6' 4"	7' 1"	5' 8"	5' 3"	6' 0"	5' 2"	4' 5"	5' 0"
	FR 150	7' 4"	7' 4"	8' 2"	6' 0"	6' 0"	6' 8"	5' 2"	5' 2"	5' 9"	4' 7"	4' 7"	5' 2"	4' 2"	3' 10"	4' 4"
	FM 16	10' 4"	13' 10"	12' 9"	9' 0"	11' 6"	11' 2"	8' 2"	9' 6"	10' 1"	7' 7"	7' 7"	8' 8"	7' 2"	6' 4"	7' 3"
	FM 13	9' 2"	10' 7"	11' 4"	8' 0"	8' 7"	9' 8"	7' 3"	7' 6"	8' 4"	6' 8"	6' 4"	7' 3"	6' 1"	5' 3"	6' 0"
	FM 10	8' 4"	9' 0"	10' 1"	7' 4"	7' 4"	8' 2"	6' 4"	6' 4"	7' 1"	5' 8"	5' 6"	6' 3"	5' 2"	4' 7"	5' 2"

Maximum span for uniform load, PSF, is shown in lineal feet and based on panel fasteners with .729" diameter washer located 7.2" on center. Structural properties and maximum spans are based on large-scale tests that consider: bending moment at failure, flexural stiffness and pullover force per fastener.

12.0 x 1.25R



Roofing: Positive Load

Deflection Limit = L/60 • Moment Factor of Safety = 2.5

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	6' 1"	8' 2"	7' 6"	5' 3"	7' 1"	6' 6"	4' 10"	6' 5"	5' 11"	4' 5"	5' 10"	5' 6"	4' 2"	5' 4"	5' 2"
	FR 400	5' 10"	7' 10"	7' 2"	5' 1"	6' 10"	6' 3"	4' 7"	6' 1"	5' 8"	4' 3"	5' 5"	5' 3"	4' 0"	4' 11"	5' 0"
	FR 300	5' 4"	7' 0"	6' 8"	4' 8"	5' 9"	5' 10"	4' 3"	5' 0"	5' 3"	3' 11"	4' 5"	4' 11"	3' 9"	4' 1"	4' 6"
	FR 250	4' 11"	5' 11"	6' 1"	4' 3"	4' 10"	5' 4"	3' 11"	4' 2"	4' 8"	3' 7"	3' 9"	4' 2"	3' 5"	3' 5"	3' 10"
	FR 200	4' 6"	5' 5"	5' 7"	3' 11"	4' 5"	4' 10"	3' 7"	3' 10"	4' 3"	3' 3"	3' 5"	3' 10"	3' 1"	3' 1"	3' 6"
	FR 150	4' 1"	4' 5"	5' 0"	3' 7"	3' 7"	4' 1"	3' 1"	3' 1"	3' 6"	2' 9"	2' 9"	3' 1"	2' 6"	2' 6"	2' 10"
	FM 16	5' 6"	7' 5"	6' 10"	4' 10"	6' 5"	5' 11"	4' 4"	5' 10"	5' 5"	4' 0"	5' 5"	5' 0"	3' 10"	4' 11"	4' 8"
	FM 13	5' 1"	6' 5"	6' 4"	4' 5"	5' 3"	5' 6"	4' 0"	4' 7"	5' 0"	3' 9"	4' 1"	4' 7"	3' 6"	3' 8"	4' 2"
	FM 10	4' 8"	5' 5"	5' 9"	4' 1"	4' 5"	5' 0"	3' 8"	3' 10"	4' 3"	3' 5"	3' 5"	3' 10"	3' 1"	3' 1"	3' 6"

Roofing: Negative Load

Deflection Limit = L/60 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	6' 1"	8' 2"	7' 6"	5' 3"	7' 1"	6' 6"	4' 10"	6' 5"	5' 11"	4' 5"	6' 0"	5' 6"	4' 2"	5' 7"	5' 2"
	FR 400	5' 10"	7' 10"	7' 2"	5' 1"	6' 10"	6' 3"	4' 7"	6' 2"	5' 8"	4' 3"	5' 9"	5' 3"	4' 0"	5' 5"	5' 0"
	FR 300	5' 4"	7' 3"	6' 8"	4' 8"	6' 4"	5' 10"	4' 3"	5' 9"	5' 3"	3' 11"	5' 1"	4' 11"	3' 9"	4' 8"	4' 7"
	FR 250	4' 11"	6' 7"	6' 1"	4' 3"	5' 7"	5' 4"	3' 11"	4' 10"	4' 10"	3' 7"	4' 4"	4' 5"	3' 5"	3' 11"	4' 2"
	FR 200	4' 6"	6' 0"	5' 7"	3' 11"	5' 1"	4' 10"	3' 7"	4' 5"	4' 5"	3' 3"	3' 11"	4' 1"	3' 1"	3' 7"	3' 10"
	FR 150	4' 1"	5' 1"	5' 1"	3' 7"	4' 2"	4' 5"	3' 3"	3' 7"	4' 0"	3' 0"	3' 3"	3' 7"	2' 10"	2' 11"	3' 3"
	FM 16	5' 6"	7' 5"	6' 10"	4' 10"	6' 5"	5' 11"	4' 4"	5' 10"	5' 5"	4' 0"	5' 5"	5' 0"	3' 10"	5' 1"	4' 8"
	FM 13	5' 1"	6' 10"	6' 4"	4' 5"	6' 0"	5' 6"	4' 0"	5' 3"	5' 0"	3' 9"	4' 8"	4' 8"	3' 6"	4' 3"	4' 4"
	FM 10	4' 8"	6' 3"	5' 9"	4' 1"	5' 1"	5' 0"	3' 8"	4' 5"	4' 7"	3' 5"	3' 11"	4' 3"	3' 3"	3' 7"	4' 0"

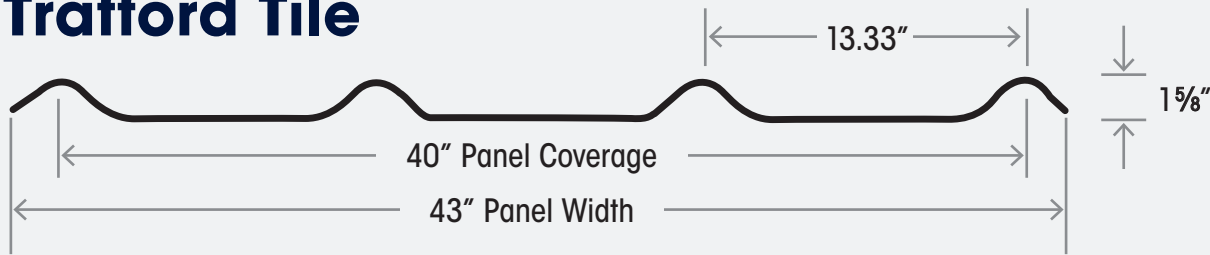
Siding: Wind Load

Deflection Limit = L/30 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	7' 8"	10' 3"	9' 5"	6' 8"	8' 9"	8' 3"	6' 1"	7' 7"	7' 6"	5' 7"	6' 9"	6' 11"	5' 3"	6' 2"	6' 6"
	FR 400	7' 4"	9' 10"	9' 1"	6' 5"	8' 1"	7' 11"	5' 10"	7' 0"	7' 2"	5' 5"	6' 3"	6' 8"	5' 1"	5' 9"	6' 3"
	FR 300	6' 9"	8' 1"	8' 5"	5' 11"	6' 7"	7' 4"	5' 4"	5' 9"	6' 5"	5' 0"	5' 1"	5' 9"	4' 8"	4' 8"	5' 3"
	FR 250	6' 2"	6' 10"	7' 8"	5' 5"	5' 7"	6' 3"	4' 10"	4' 10"	5' 5"	4' 4"	4' 4"	4' 10"	3' 11"	3' 11"	4' 5"
	FR 200	5' 8"	6' 3"	7' 0"	4' 11"	5' 1"	5' 9"	4' 5"	4' 5"	4' 11"	3' 11"	3' 11"	4' 5"	3' 7"	3' 7"	4' 0"
	FR 150	5' 1"	5' 1"	5' 9"	4' 2"	4' 2"	4' 8"	3' 7"	3' 7"	4' 0"	3' 3"	3' 3"	3' 7"	2' 11"	2' 11"	3' 3"
	FM 16	6' 11"	9' 4"	8' 7"	6' 1"	8' 1"	7' 6"	5' 6"	7' 0"	6' 10"	5' 1"	6' 3"	6' 4"	4' 10"	5' 8"	5' 11"
	FM 13	6' 5"	7' 5"	7' 11"	5' 7"	6' 1"	6' 9"	5' 1"	5' 3"	5' 10"	4' 8"	4' 8"	5' 3"	4' 3"	4' 3"	4' 9"
	FM 10	5' 11"	6' 3"	7' 0"	5' 1"	5' 1"	5' 9"	4' 5"	4' 5"	4' 11"	3' 11"	3' 11"	4' 5"	3' 7"	3' 7"	4' 0"

Maximum span for uniform load, PSF, is shown in lined feet and based on panel fasteners with .729" diameter washer on each side of every high rib over supports. Structural properties and maximum spans are based on large-scale tests that consider: bending moment at failure, flexural stiffness and pullover force per fastener.

Trafford Tile



Roofing: Positive Load

Deflection Limit = L/60 • Moment Factor of Safety = 2.5

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	6' 8"	9' 0"	8' 3"	5' 10"	7' 8"	7' 3"	5' 3"	6' 8"	6' 7"	4' 11"	5' 11"	6' 1"	4' 7"	5' 5"	5' 9"
	FR 400	6' 7"	8' 4"	8' 2"	5' 9"	6' 10"	7' 1"	5' 2"	5' 11"	6' 5"	4' 10"	5' 3"	5' 11"	4' 7"	4' 9"	5' 4"
	FR 300	6' 3"	7' 3"	7' 9"	5' 6"	5' 11"	6' 8"	5' 0"	5' 1"	5' 9"	4' 7"	4' 7"	5' 1"	4' 2"	4' 2"	4' 8"
	FR 250	5' 11"	6' 5"	7' 2"	5' 2"	5' 3"	5' 11"	4' 7"	4' 7"	5' 1"	4' 1"	4' 1"	4' 7"	3' 8"	3' 8"	4' 2"
	FR 200	5' 6"	5' 6"	6' 2"	4' 6"	4' 6"	5' 0"	3' 11"	3' 11"	4' 4"	3' 6"	3' 6"	3' 11"	3' 2"	3' 2"	3' 6"
	FR 150	4' 7"	4' 7"	5' 1"	3' 9"	3' 9"	4' 2"	3' 3"	3' 3"	3' 7"	2' 11"	2' 11"	3' 3"	2' 8"	2' 8"	2' 11"
	FM 16	6' 5"	8' 8"	8' 0"	5' 8"	7' 5"	7' 0"	5' 1"	6' 5"	6' 4"	4' 9"	5' 9"	5' 11"	4' 6"	5' 3"	5' 6"
	FM 13	6' 0"	6' 11"	7' 5"	5' 3"	5' 8"	6' 4"	4' 9"	4' 11"	5' 6"	4' 4"	4' 4"	4' 11"	4' 0"	4' 0"	4' 6"
	FM 10	5' 5"	6' 5"	6' 9"	4' 9"	5' 3"	5' 10"	4' 4"	4' 6"	5' 1"	4' 0"	4' 0"	4' 6"	3' 8"	3' 8"	4' 1"

Roofing: Negative Load

Deflection Limit = L/60 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	6' 8"	9' 0"	8' 3"	5' 10"	7' 10"	7' 3"	5' 3"	7' 1"	6' 7"	4' 11"	6' 1"	6' 1"	4' 7"	5' 1"	5' 9"
	FR 400	6' 7"	8' 10"	8' 2"	5' 9"	7' 8"	7' 1"	5' 2"	6' 9"	6' 5"	4' 10"	6' 1"	6' 0"	4' 7"	5' 1"	5' 8"
	FR 300	6' 3"	8' 5"	7' 9"	5' 6"	6' 10"	6' 9"	5' 0"	5' 11"	6' 2"	4' 7"	5' 3"	5' 8"	4' 4"	4' 5"	5' 0"
	FR 250	5' 11"	7' 5"	7' 3"	5' 2"	6' 1"	6' 4"	4' 8"	5' 3"	5' 9"	4' 4"	4' 5"	5' 0"	4' 1"	3' 8"	4' 2"
	FR 200	5' 8"	6' 4"	7' 0"	4' 11"	5' 2"	5' 9"	4' 6"	4' 6"	5' 0"	4' 0"	3' 9"	4' 4"	3' 8"	3' 2"	3' 7"
	FR 150	5' 3"	5' 3"	5' 11"	4' 4"	4' 4"	4' 10"	3' 9"	3' 9"	4' 2"	3' 4"	3' 2"	3' 7"	3' 0"	2' 8"	3' 0"
	FM 16	6' 5"	8' 8"	8' 0"	5' 8"	7' 7"	7' 0"	5' 1"	6' 10"	6' 4"	4' 9"	5' 11"	5' 11"	4' 6"	4' 11"	5' 6"
	FM 13	6' 0"	8' 0"	7' 5"	5' 3"	6' 6"	6' 6"	4' 9"	5' 8"	5' 10"	4' 5"	5' 0"	5' 5"	4' 2"	4' 2"	4' 9"
	FM 10	5' 5"	7' 4"	6' 9"	4' 9"	6' 0"	5' 11"	4' 4"	4' 11"	5' 4"	4' 0"	3' 11"	4' 6"	3' 9"	3' 3"	3' 9"

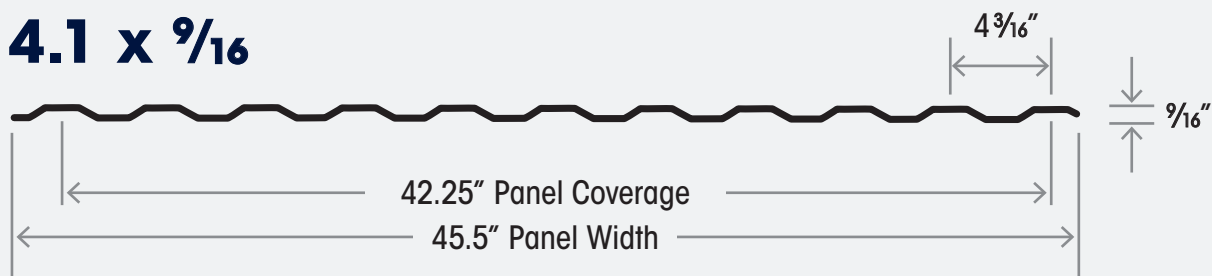
Siding: Wind Load

Deflection Limit = L/30 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	8' 5"	10' 10"	10' 5"	7' 4"	8' 10"	9' 1"	6' 8"	7' 8"	8' 3"	6' 2"	6' 1"	6' 11"	5' 10"	5' 1"	5' 9"
	FR 400	8' 3"	9' 7"	10' 3"	7' 3"	7' 10"	8' 9"	6' 7"	6' 9"	7' 7"	6' 1"	6' 1"	6' 9"	5' 6"	5' 1"	5' 9"
	FR 300	7' 11"	8' 5"	9' 5"	6' 10"	6' 10"	7' 8"	5' 11"	5' 11"	6' 7"	5' 3"	5' 3"	5' 11"	4' 10"	4' 5"	5' 1"
	FR 250	7' 5"	7' 5"	8' 4"	6' 1"	6' 1"	6' 9"	5' 3"	5' 3"	5' 10"	4' 8"	4' 5"	5' 0"	4' 3"	3' 8"	4' 2"
	FR 200	6' 4"	6' 4"	7' 1"	5' 2"	5' 2"	5' 9"	4' 6"	4' 6"	5' 0"	4' 0"	3' 10"	4' 4"	3' 8"	3' 2"	3' 7"
	FR 150	5' 3"	5' 3"	5' 11"	4' 4"	4' 4"	4' 10"	3' 9"	3' 9"	4' 2"	3' 4"	3' 2"	3' 7"	3' 0"	2' 8"	3' 0"
	FM 16	8' 2"	10' 5"	10' 1"	7' 1"	8' 6"	8' 10"	6' 5"	7' 4"	8' 0"	6' 0"	5' 11"	6' 9"	5' 8"	4' 11"	5' 8"
	FM 13	7' 7"	8' 0"	8' 11"	6' 6"	6' 6"	7' 4"	5' 8"	5' 8"	6' 4"	5' 1"	5' 0"	5' 8"	4' 7"	4' 2"	4' 9"
	FM 10	6' 10"	7' 4"	8' 3"	6' 0"	6' 0"	6' 9"	5' 2"	4' 11"	5' 8"	4' 8"	3' 11"	4' 6"	4' 3"	3' 3"	3' 9"

Maximum span for uniform load, PSF, is shown in lineal feet and based on panel fasteners with .729" diameter washer on each side of every high rib over supports. Structural properties and maximum spans are based on large-scale tests that consider: bending moment at failure, flexural stiffness and pullover force per fastener.

4.1 x 9/16



Roofing: Positive Load

Deflection Limit = L/60 • Moment Factor of Safety = 2.5

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	4' 5"	5' 11"	5' 5"	3' 10"	5' 2"	4' 9"	3' 6"	4' 8"	4' 4"	3' 3"	4' 4"	4' 0"	3' 0"	4' 1"	3' 9"
	FR 400	4' 3"	5' 8"	5' 3"	3' 8"	5' 0"	4' 7"	3' 4"	4' 6"	4' 2"	3' 1"	4' 2"	3' 10"	2' 11"	3' 11"	3' 7"
	FR 300	4' 0"	5' 5"	5' 0"	3' 6"	4' 9"	4' 4"	3' 2"	4' 3"	3' 11"	2' 11"	4' 0"	3' 8"	2' 9"	3' 9"	3' 5"
	FR 250	3' 9"	5' 1"	4' 8"	3' 4"	4' 5"	4' 1"	3' 0"	4' 0"	3' 8"	2' 9"	3' 9"	3' 5"	2' 7"	3' 6"	3' 3"
	FR 200	3' 8"	4' 11"	4' 6"	3' 2"	4' 3"	3' 11"	2' 11"	3' 11"	3' 7"	2' 8"	3' 7"	3' 4"	2' 6"	3' 5"	3' 1"
	FR 150	3' 4"	4' 6"	4' 2"	2' 11"	3' 11"	3' 7"	2' 8"	3' 7"	3' 3"	2' 5"	3' 4"	3' 1"	2' 4"	3' 1"	2' 10"
	FM 16	4' 0"	5' 4"	4' 11"	3' 6"	4' 8"	4' 4"	3' 2"	4' 3"	3' 11"	2' 11"	3' 11"	3' 7"	2' 9"	3' 8"	3' 5"
	FM 13	3' 8"	4' 11"	4' 7"	3' 3"	4' 4"	4' 0"	2' 11"	3' 11"	3' 7"	2' 8"	3' 8"	3' 4"	2' 6"	3' 5"	3' 2"
	FM 10	3' 4"	4' 6"	4' 2"	2' 11"	3' 11"	3' 8"	2' 8"	3' 7"	3' 4"	2' 6"	3' 4"	3' 1"	2' 4"	3' 2"	2' 11"

Roofing: Negative Load

Deflection Limit = L/60 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	4' 5"	5' 11"	5' 5"	3' 10"	5' 2"	4' 9"	3' 6"	4' 8"	4' 4"	3' 3"	4' 4"	4' 0"	3' 0"	4' 1"	3' 9"
	FR 400	4' 3"	5' 8"	5' 3"	3' 8"	4' 11"	4' 7"	3' 4"	4' 6"	4' 2"	3' 1"	4' 2"	3' 10"	2' 11"	3' 11"	3' 7"
	FR 300	4' 0"	5' 5"	5' 0"	3' 6"	4' 8"	4' 4"	3' 2"	4' 3"	3' 11"	2' 11"	4' 0"	3' 8"	2' 9"	3' 9"	3' 5"
	FR 250	3' 9"	5' 1"	4' 8"	3' 4"	4' 5"	4' 1"	3' 0"	4' 0"	3' 8"	2' 9"	3' 9"	3' 5"	2' 7"	3' 6"	3' 3"
	FR 200	3' 8"	4' 11"	4' 6"	3' 2"	4' 3"	3' 11"	2' 11"	3' 11"	3' 7"	2' 8"	3' 7"	3' 4"	2' 6"	3' 5"	3' 1"
	FR 150	3' 4"	4' 6"	4' 2"	2' 11"	3' 11"	3' 7"	2' 8"	3' 7"	3' 3"	2' 5"	3' 4"	3' 1"	2' 4"	3' 0"	2' 10"
	FM 16	4' 0"	5' 4"	4' 11"	3' 6"	4' 8"	4' 4"	3' 2"	4' 3"	3' 11"	2' 11"	3' 11"	3' 7"	2' 9"	3' 8"	3' 5"
	FM 13	3' 8"	4' 11"	4' 7"	3' 3"	4' 4"	4' 0"	2' 11"	3' 11"	3' 7"	2' 8"	3' 8"	3' 4"	2' 6"	3' 5"	3' 2"
	FM 10	3' 4"	4' 6"	4' 2"	2' 11"	3' 11"	3' 8"	2' 8"	3' 7"	3' 4"	2' 6"	3' 4"	3' 1"	2' 4"	3' 2"	2' 11"

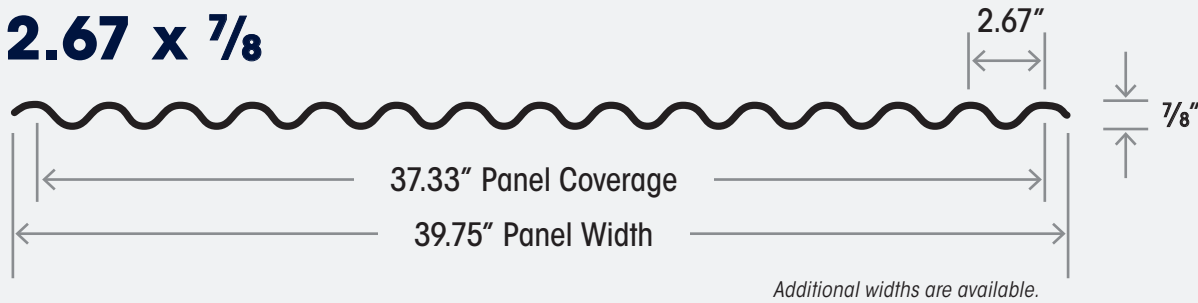
Siding: Wind Load

Deflection Limit = L/30 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	5' 6"	7' 5"	6' 10"	4' 10"	6' 6"	6' 0"	4' 5"	5' 11"	5' 5"	4' 1"	5' 6"	5' 0"	3' 10"	5' 2"	4' 9"
	FR 400	5' 4"	7' 2"	6' 7"	4' 8"	6' 3"	5' 9"	4' 3"	5' 8"	5' 3"	3' 11"	5' 3"	4' 10"	3' 8"	4' 11"	4' 7"
	FR 300	5' 1"	6' 10"	6' 3"	4' 5"	5' 11"	5' 6"	4' 0"	5' 5"	5' 0"	3' 9"	5' 0"	4' 7"	3' 6"	4' 8"	4' 4"
	FR 250	4' 9"	6' 5"	5' 11"	4' 2"	5' 7"	5' 2"	3' 9"	5' 1"	4' 8"	3' 6"	4' 8"	4' 4"	3' 4"	4' 3"	4' 1"
	FR 200	4' 7"	6' 2"	5' 8"	4' 0"	5' 5"	5' 0"	3' 8"	4' 11"	4' 6"	3' 5"	4' 3"	4' 2"	3' 2"	3' 6"	3' 11"
	FR 150	4' 3"	5' 8"	5' 3"	3' 8"	4' 11"	4' 7"	3' 4"	4' 6"	4' 2"	3' 1"	3' 7"	3' 10"	2' 11"	3' 0"	3' 5"
	FM 16	5' 0"	6' 9"	6' 3"	4' 5"	5' 11"	5' 5"	4' 0"	5' 4"	4' 11"	3' 8"	5' 0"	4' 7"	3' 6"	4' 8"	4' 4"
	FM 13	4' 8"	6' 3"	5' 9"	4' 1"	5' 5"	5' 0"	3' 8"	4' 11"	4' 7"	3' 5"	4' 7"	4' 3"	3' 3"	4' 4"	4' 0"
	FM 10	4' 3"	5' 9"	5' 3"	3' 9"	5' 0"	4' 7"	3' 4"	4' 6"	4' 2"	3' 1"	4' 2"	3' 10"	2' 11"	3' 10"	3' 8"

Maximum span for uniform load, PSF, is shown in lineal feet and based on panel fasteners with .729" diameter washer located 8.375" on center. Structural properties and maximum spans are based on large-scale tests that consider: bending moment at failure, flexural stiffness and pullover force per fastener.

2.67 x 7/8



Roofing: Positive Load

Deflection Limit = L/60 • Moment Factor of Safety = 2.5

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	4' 5"	5' 11"	5' 6"	3' 10"	5' 2"	4' 9"	3' 6"	4' 9"	4' 4"	3' 3"	4' 4"	4' 4"	3' 1"	4' 1"	3' 9"
	FR 400	4' 4"	5' 9"	5' 4"	3' 9"	5' 1"	4' 8"	3' 5"	4' 7"	4' 3"	3' 2"	4' 3"	3' 11"	3' 0"	4' 0"	3' 8"
	FR 300	4' 3"	5' 8"	5' 3"	3' 8"	5' 0"	4' 7"	3' 4"	4' 6"	4' 2"	3' 1"	4' 2"	3' 10"	2' 11"	3' 11"	3' 7"
	FR 250	4' 1"	5' 6"	5' 1"	3' 7"	4' 9"	4' 5"	3' 3"	4' 4"	4' 0"	3' 0"	4' 0"	3' 9"	2' 10"	3' 9"	3' 6"
	FR 200	3' 11"	5' 3"	4' 10"	3' 5"	4' 7"	4' 3"	3' 1"	4' 2"	3' 10"	2' 11"	3' 11"	3' 7"	2' 9"	3' 8"	3' 4"
	FR 150	3' 8"	4' 11"	4' 6"	3' 2"	4' 3"	3' 11"	2' 11"	3' 11"	3' 7"	2' 8"	3' 7"	3' 4"	2' 6"	3' 5"	3' 1"
	FM 16	3' 10"	5' 2"	4' 9"	3' 4"	4' 6"	4' 2"	3' 1"	4' 1"	3' 9"	2' 10"	3' 10"	3' 6"	2' 8"	3' 7"	3' 3"
	FM 13	3' 6"	4' 9"	4' 4"	3' 1"	4' 1"	3' 10"	2' 9"	3' 9"	3' 5"	2' 7"	3' 6"	3' 2"	2' 5"	3' 3"	3' 0"
	FM 10	3' 2"	4' 3"	3' 11"	2' 9"	3' 9"	3' 5"	2' 6"	3' 5"	3' 1"	2' 4"	3' 2"	2' 11"	2' 2"	2' 11"	2' 9"

Roofing: Negative Load

Deflection Limit = L/60 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	4' 5"	5' 11"	5' 6"	3' 10"	5' 2"	4' 9"	3' 6"	4' 8"	4' 4"	3' 3"	4' 4"	4' 0"	3' 1"	4' 1"	3' 9"
	FR 400	4' 4"	5' 9"	5' 4"	3' 9"	5' 0"	4' 8"	3' 5"	4' 7"	4' 3"	3' 2"	4' 3"	3' 11"	3' 0"	4' 0"	3' 8"
	FR 300	4' 3"	5' 8"	5' 3"	3' 8"	4' 11"	4' 7"	3' 4"	4' 6"	4' 2"	3' 1"	4' 2"	3' 10"	2' 11"	3' 11"	3' 7"
	FR 250	4' 1"	5' 6"	5' 1"	3' 7"	4' 9"	4' 5"	3' 3"	4' 4"	4' 0"	3' 0"	4' 0"	3' 9"	2' 10"	3' 9"	3' 6"
	FR 200	3' 11"	5' 3"	4' 10"	3' 5"	4' 7"	4' 3"	3' 1"	4' 2"	3' 10"	2' 11"	3' 6"	3' 7"	2' 9"	2' 11"	3' 4"
	FR 150	3' 8"	4' 11"	4' 6"	3' 2"	4' 3"	3' 11"	2' 11"	3' 11"	3' 7"	2' 8"	3' 2"	3' 4"	2' 6"	2' 7"	3' 0"
	FM 16	3' 10"	5' 2"	4' 9"	3' 4"	4' 6"	4' 2"	3' 1"	4' 1"	3' 9"	2' 10"	3' 10"	3' 6"	2' 8"	3' 7"	3' 3"
	FM 13	3' 6"	4' 9"	4' 4"	3' 1"	4' 1"	3' 10"	2' 9"	3' 9"	3' 5"	2' 7"	3' 6"	3' 2"	2' 5"	3' 3"	3' 0"
	FM 10	3' 2"	4' 3"	3' 11"	2' 9"	3' 9"	3' 5"	2' 6"	3' 5"	3' 1"	2' 4"	3' 2"	2' 11"	2' 2"	2' 11"	2' 9"

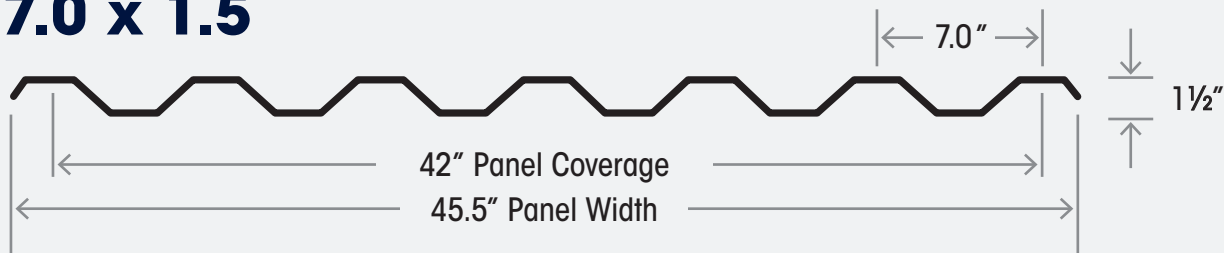
Siding: Wind Load

Deflection Limit = L/30 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	5' 7"	7' 6"	6' 11"	4' 10"	6' 7"	6' 0"	4' 5"	5' 11"	5' 6"	4' 1"	5' 6"	5' 1"	3' 10"	5' 2"	4' 9"
	FR 400	5' 5"	7' 3"	6' 9"	4' 9"	6' 4"	5' 10"	4' 4"	5' 9"	5' 4"	4' 0"	5' 4"	4' 11"	3' 9"	5' 0"	4' 8"
	FR 300	5' 4"	7' 2"	6' 7"	4' 8"	6' 3"	5' 9"	4' 3"	5' 8"	5' 3"	3' 11"	5' 2"	4' 10"	3' 8"	4' 4"	4' 7"
	FR 250	5' 2"	6' 11"	6' 4"	4' 6"	6' 0"	5' 7"	4' 1"	5' 6"	5' 1"	3' 9"	4' 8"	4' 8"	3' 7"	3' 11"	4' 5"
	FR 200	5' 0"	6' 8"	6' 2"	4' 4"	5' 10"	5' 4"	3' 11"	4' 5"	4' 10"	3' 8"	3' 6"	4' 0"	3' 5"	2' 11"	3' 4"
	FR 150	4' 7"	6' 2"	5' 8"	4' 0"	5' 3"	5' 0"	3' 8"	3' 11"	4' 6"	3' 5"	3' 2"	3' 7"	3' 2"	2' 7"	3' 0"
	FM 16	4' 10"	6' 6"	6' 0"	4' 3"	5' 8"	5' 3"	3' 10"	5' 2"	4' 9"	3' 7"	4' 10"	4' 5"	3' 4"	4' 6"	4' 2"
	FM 13	4' 5"	6' 0"	5' 6"	3' 10"	5' 2"	4' 10"	3' 6"	4' 9"	4' 4"	3' 3"	4' 5"	4' 0"	3' 1"	3' 9"	3' 10"
	FM 10	4' 0"	5' 5"	5' 0"	3' 6"	4' 8"	4' 4"	3' 2"	4' 3"	3' 11"	2' 11"	3' 6"	3' 8"	2' 9"	2' 11"	3' 4"

Maximum span for uniform load, PSF, is shown in lined feet and based on panel fasteners with .729" diameter washer located 8" on center. Structural properties and maximum spans are based on large-scale tests that consider: bending moment at failure, flexural stiffness and pullover force per fastener.

7.0 x 1.5



Personnel Load	Span	Defl @ 300 Lb. Load over 2.5 Ft. ² Area
TuffSpan Series 450	7' 6"	L/180 not to exceed 0.5"
TuffSpan Series 400	6' 0"	

With its high strength and stiffness, TuffSpan can provide safe support for normal installation and worker foot traffic with observance of standard, OSHA safety measures. The user is responsible for worker safety including requirements for harnesses, tie-off lines and safety shoes in addition to suitability of aged materials, slippery or sloped roofs. Single span conditions are not recommended for foot traffic.

Roofing: Positive Load

Deflection Limit = L/60 • Moment Factor of Safety = 2.5

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	7' 11"	10' 7"	9' 9"	6' 11"	9' 3"	8' 6"	6' 3"	8' 5"	7' 9"	5' 10"	7' 9"	7' 2"	5' 6"	7' 1"	6' 9"
	FR 400	7' 7"	10' 3"	9' 5"	6' 8"	8' 11"	8' 3"	6' 1"	8' 0"	7' 6"	5' 7"	7' 2"	6' 11"	5' 3"	6' 6"	6' 6"
	FR 300	7' 0"	9' 4"	8' 8"	6' 1"	7' 7"	7' 7"	5' 7"	6' 7"	6' 10"	5' 2"	5' 10"	6' 5"	4' 10"	5' 4"	6' 0"
	FR 250	6' 5"	7' 10"	7' 11"	5' 7"	6' 5"	6' 11"	5' 1"	5' 6"	6' 2"	4' 8"	4' 11"	5' 6"	4' 5"	4' 6"	5' 1"
	FR 200	5' 10"	7' 3"	7' 3"	5' 1"	5' 11"	6' 4"	4' 8"	5' 1"	5' 8"	4' 4"	4' 7"	5' 1"	4' 1"	4' 2"	4' 8"
	FR 150	5' 5"	5' 11"	6' 7"	4' 8"	4' 10"	5' 5"	4' 2"	4' 2"	4' 8"	3' 9"	3' 9"	4' 2"	3' 5"	3' 5"	3' 10"
	FM 16	7' 5"	9' 11"	9' 2"	6' 5"	8' 8"	8' 0"	5' 10"	7' 10"	7' 3"	5' 5"	7' 2"	6' 9"	5' 1"	6' 6"	6' 4"
	FM 13	6' 8"	8' 6"	8' 3"	5' 10"	6' 11"	7' 2"	5' 3"	6' 0"	6' 6"	4' 11"	5' 4"	6' 0"	4' 7"	4' 11"	5' 6"
	FM 10	6' 1"	7' 3"	7' 6"	5' 4"	5' 11"	6' 7"	4' 10"	5' 1"	5' 8"	4' 6"	4' 7"	5' 1"	4' 2"	4' 2"	4' 8"

Roofing: Negative Load

Deflection Limit = L/60 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	7' 11"	10' 7"	9' 9"	6' 11"	9' 3"	8' 6"	6' 3"	8' 5"	7' 9"	5' 10"	7' 10"	7' 2"	5' 6"	7' 4"	6' 9"
	FR 400	7' 7"	10' 3"	9' 5"	6' 8"	8' 11"	8' 3"	6' 0"	8' 1"	7' 6"	5' 7"	7' 6"	6' 11"	5' 3"	6' 9"	6' 6"
	FR 300	7' 0"	9' 5"	8' 8"	6' 1"	8' 3"	7' 7"	5' 7"	7' 5"	6' 10"	5' 2"	6' 9"	6' 5"	4' 10"	5' 9"	6' 0"
	FR 250	6' 5"	8' 7"	7' 11"	5' 7"	7' 4"	6' 11"	5' 1"	6' 5"	6' 3"	4' 8"	5' 8"	5' 10"	4' 5"	4' 10"	5' 6"
	FR 200	5' 10"	7' 10"	7' 3"	5' 1"	6' 9"	6' 4"	4' 8"	5' 11"	5' 9"	4' 4"	5' 1"	5' 4"	4' 1"	4' 3"	4' 10"
	FR 150	5' 5"	6' 10"	6' 8"	4' 8"	5' 7"	5' 10"	4' 3"	4' 10"	5' 3"	3' 11"	4' 4"	4' 10"	3' 9"	3' 7"	4' 1"
	FM 16	7' 5"	9' 11"	9' 2"	6' 5"	8' 8"	8' 0"	5' 10"	7' 10"	7' 3"	5' 5"	7' 3"	6' 9"	5' 1"	6' 0"	6' 4"
	FM 13	6' 8"	8' 11"	8' 3"	5' 10"	7' 9"	7' 2"	5' 3"	6' 11"	6' 6"	4' 11"	6' 1"	6' 1"	4' 7"	5' 1"	5' 8"
	FM 10	6' 1"	8' 2"	7' 6"	5' 4"	6' 9"	6' 7"	4' 10"	5' 11"	6' 0"	4' 6"	5' 3"	5' 6"	4' 2"	4' 4"	4' 11"

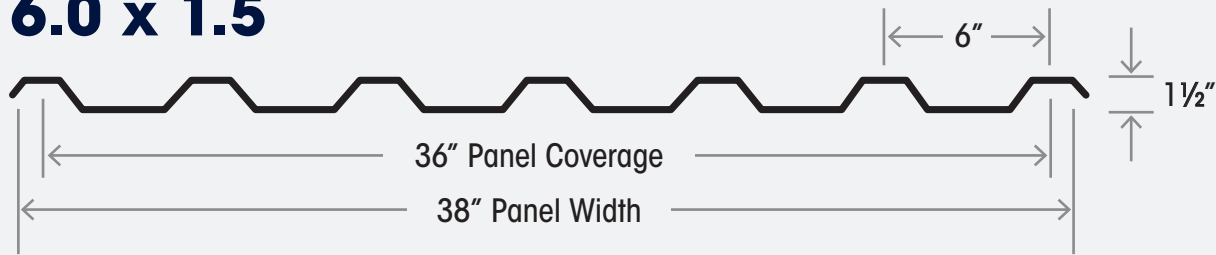
Siding: Wind Load

Deflection Limit = L/30 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	10' 0"	13' 4"	12' 4"	8' 8"	11' 6"	10' 9"	7' 11"	10' 0"	9' 9"	7' 4"	8' 11"	9' 1"	6' 11"	8' 0"	8' 6"
	FR 400	9' 7"	12' 11"	11' 11"	8' 5"	10' 8"	10' 5"	7' 7"	9' 3"	9' 5"	7' 1"	8' 2"	8' 9"	6' 8"	6' 9"	7' 8"
	FR 300	8' 10"	10' 9"	10' 11"	7' 9"	8' 9"	9' 7"	7' 0"	7' 7"	8' 6"	6' 6"	6' 9"	7' 7"	6' 1"	5' 9"	6' 6"
	FR 250	8' 1"	9' 0"	10' 0"	7' 1"	7' 4"	8' 3"	6' 5"	6' 5"	7' 2"	5' 8"	5' 8"	6' 5"	5' 2"	4' 10"	5' 6"
	FR 200	7' 5"	8' 4"	9' 2"	6' 5"	6' 9"	7' 7"	5' 10"	5' 11"	6' 7"	5' 3"	5' 1"	5' 9"	4' 9"	4' 3"	4' 10"
	FR 150	6' 9"	6' 10"	7' 8"	5' 7"	5' 7"	6' 3"	4' 10"	4' 10"	5' 5"	4' 4"	4' 4"	4' 10"	3' 11"	3' 7"	4' 1"
	FM 16	9' 4"	12' 6"	11' 7"	8' 2"	10' 8"	10' 1"	7' 5"	9' 1"	9' 2"	6' 10"	7' 3"	8' 3"	6' 5"	6' 0"	6' 10"
	FM 13	8' 5"	9' 9"	10' 4"	7' 4"	8' 0"	8' 11"	6' 8"	6' 11"	7' 9"	6' 2"	6' 1"	6' 11"	5' 8"	5' 1"	5' 9"
	FM 10	7' 8"	8' 4"	9' 4"	6' 8"	6' 9"	7' 7"	5' 11"	5' 11"	6' 7"	5' 3"	5' 3"	5' 11"	4' 9"	4' 4"	4' 11"

Maximum span for uniform load, PSF, is shown in lineal feet and based on panel fasteners with .729" diameter washer located 7" on center. Structural properties and maximum spans are based on large-scale tests that consider: bending moment at failure, flexural stiffness and pullover force per fastener.

6.0 x 1.5



Roofing: Positive Load

Deflection Limit = $L/60$ • Moment Factor of Safety = 2.5

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	7' 7"	10' 2"	9' 5"	6' 7"	8' 11"	8' 2"	6' 0"	8' 1"	7' 5"	5' 7"	7' 4"	6' 11"	5' 3"	6' 9"	6' 6"
	FR 400	7' 3"	9' 9"	9' 0"	6' 4"	8' 6"	7' 10"	5' 9"	7' 7"	7' 2"	5' 4"	6' 10"	6' 7"	5' 0"	6' 3"	6' 3"
	FR 300	6' 9"	8' 10"	8' 4"	5' 10"	7' 3"	7' 3"	5' 4"	6' 3"	6' 7"	4' 11"	5' 7"	6' 1"	4' 8"	5' 1"	5' 9"
	FR 250	6' 2"	7' 5"	7' 7"	5' 4"	6' 1"	6' 8"	4' 10"	5' 3"	5' 11"	4' 6"	4' 8"	5' 3"	4' 3"	4' 3"	4' 9"
	FR 200	5' 7"	6' 10"	6' 11"	4' 11"	5' 7"	6' 1"	4' 5"	4' 10"	5' 5"	4' 1"	4' 4"	4' 10"	3' 11"	3' 11"	4' 5"
	FR 150	5' 4"	6' 3"	6' 7"	4' 8"	5' 1"	5' 9"	4' 2"	4' 5"	5' 0"	3' 11"	4' 0"	4' 5"	3' 7"	3' 7"	4' 1"
	FM 16	6' 11"	9' 3"	8' 6"	6' 0"	8' 1"	7' 5"	5' 5"	7' 4"	6' 9"	5' 1"	6' 10"	6' 3"	4' 9"	6' 2"	5' 11"
	FM 13	6' 5"	8' 1"	7' 11"	5' 7"	6' 7"	6' 11"	5' 1"	5' 8"	6' 3"	4' 8"	5' 1"	5' 8"	4' 5"	4' 8"	5' 2"
	FM 10	5' 10"	6' 10"	7' 3"	5' 1"	5' 7"	6' 3"	4' 7"	4' 10"	5' 5"	4' 3"	4' 4"	4' 10"	3' 11"	3' 11"	4' 5"

Roofing: Negative Load

Deflection Limit = $L/60$ • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

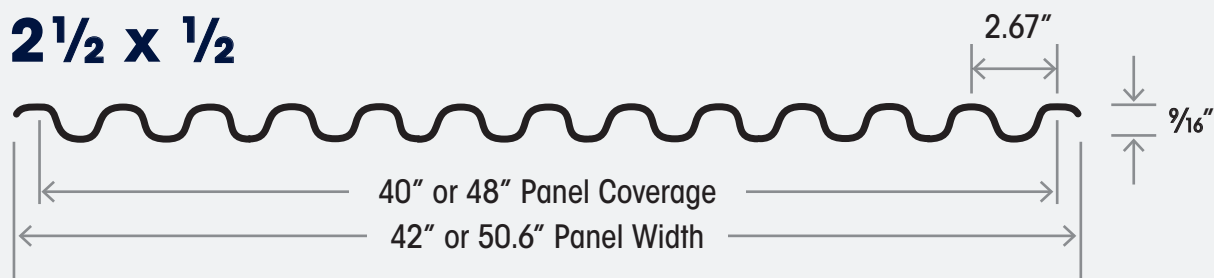
Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	7' 7"	10' 2"	9' 5"	6' 7"	8' 11"	8' 2"	6' 0"	8' 1"	7' 5"	5' 7"	7' 6"	6' 11"	5' 3"	7' 1"	6' 6"
	FR 400	7' 3"	9' 9"	9' 0"	6' 4"	8' 6"	7' 10"	5' 9"	7' 9"	7' 2"	5' 4"	7' 2"	6' 7"	5' 0"	6' 9"	6' 3"
	FR 300	6' 9"	9' 0"	8' 4"	5' 10"	7' 11"	7' 3"	5' 4"	7' 2"	6' 7"	4' 11"	6' 5"	6' 1"	4' 8"	5' 11"	5' 9"
	FR 250	6' 2"	8' 3"	7' 7"	5' 4"	7' 0"	6' 8"	4' 10"	6' 1"	6' 0"	4' 6"	5' 5"	5' 7"	4' 3"	4' 11"	5' 3"
	FR 200	5' 7"	7' 6"	6' 11"	4' 11"	6' 5"	6' 1"	4' 5"	5' 7"	5' 6"	4' 1"	5' 0"	5' 1"	3' 11"	4' 6"	4' 10"
	FR 150	5' 4"	7' 2"	6' 7"	4' 8"	5' 11"	5' 9"	4' 2"	5' 1"	5' 2"	3' 11"	4' 7"	4' 10"	3' 8"	4' 1"	4' 7"
	FM 16	6' 11"	9' 3"	8' 6"	6' 0"	8' 1"	7' 5"	5' 5"	7' 4"	6' 9"	5' 1"	6' 10"	6' 3"	4' 9"	6' 5"	5' 11"
	FM 13	6' 4"	8' 7"	7' 11"	5' 7"	7' 6"	6' 11"	5' 1"	6' 7"	6' 3"	4' 8"	5' 11"	5' 10"	4' 5"	5' 4"	5' 5"
	FM 10	5' 10"	7' 10"	7' 3"	5' 1"	6' 5"	6' 4"	4' 7"	5' 7"	5' 9"	4' 3"	5' 0"	5' 4"	4' 0"	4' 6"	5' 0"

Siding: Wind Load

Deflection Limit = $L/30$ • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	9' 7"	12' 10"	11' 10"	8' 4"	11' 0"	10' 4"	7' 7"	9' 6"	9' 5"	7' 0"	8' 6"	8' 8"	6' 7"	7' 9"	8' 2"
	FR 400	9' 2"	12' 4"	11' 4"	8' 0"	10' 2"	9' 11"	7' 3"	8' 9"	9' 0"	6' 9"	7' 10"	8' 4"	6' 4"	7' 2"	7' 10"
	FR 300	8' 6"	10' 3"	10' 6"	7' 5"	8' 4"	9' 2"	6' 9"	7' 3"	8' 1"	6' 3"	6' 5"	7' 3"	5' 10"	5' 11"	6' 7"
	FR 250	7' 9"	8' 7"	9' 7"	6' 9"	7' 0"	7' 10"	6' 1"	6' 1"	6' 9"	5' 5"	5' 5"	6' 1"	4' 11"	4' 11"	5' 6"
	FR 200	7' 1"	7' 11"	8' 9"	6' 2"	6' 5"	7' 2"	5' 7"	5' 7"	6' 3"	5' 0"	5' 0"	5' 7"	4' 6"	4' 6"	5' 1"
	FR 150	6' 8"	7' 3"	8' 1"	5' 10"	5' 11"	6' 7"	5' 1"	5' 1"	5' 9"	4' 7"	4' 7"	5' 1"	4' 2"	4' 1"	4' 8"
	FM 16	8' 8"	11' 8"	10' 9"	7' 7"	10' 2"	9' 5"	6' 11"	8' 9"	8' 6"	6' 5"	7' 10"	7' 11"	6' 0"	6' 9"	7' 5"
	FM 13	8' 0"	9' 4"	9' 11"	7' 0"	7' 7"	8' 6"	6' 4"	6' 7"	7' 4"	5' 11"	5' 11"	6' 7"	5' 4"	5' 4"	6' 0"
	FM 10	7' 4"	7' 11"	8' 10"	6' 5"	6' 5"	7' 2"	5' 7"	5' 7"	6' 3"	5' 0"	5' 0"	5' 7"	4' 6"	4' 6"	5' 1"

Maximum span for uniform load, PSF, is shown in lined feet and based on panel fasteners with .729" diameter washer located 6" on center. Structural properties and maximum spans are based on large-scale tests that consider: bending moment at failure, flexural stiffness and pullover force per fastener.

2½ x ½**Roofing: Positive Load**

Deflection Limit = L/60 • Moment Factor of Safety = 2.5

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	4' 3"	5' 8"	5' 3"	3' 8"	5' 0"	4' 7"	3' 4"	4' 6"	4' 2"	3' 1"	4' 2"	3' 10"	2' 11"	3' 11"	3' 7"
	FR 400	4' 1"	5' 6"	5' 1"	3' 7"	4' 9"	4' 5"	3' 3"	4' 4"	4' 0"	3' 0"	4' 0"	3' 9"	2' 10"	3' 9"	3' 6"
	FR 300	3' 10"	5' 3"	4' 10"	3' 5"	4' 7"	4' 2"	3' 1"	4' 2"	3' 10"	2' 10"	3' 10"	3' 6"	2' 8"	3' 7"	3' 4"
	FR 250	3' 8"	4' 11"	4' 6"	3' 2"	4' 3"	3' 11"	2' 11"	3' 10"	3' 7"	2' 8"	3' 7"	3' 4"	2' 6"	3' 5"	3' 1"
	FR 200	3' 6"	4' 9"	4' 4"	3' 1"	4' 1"	3' 10"	2' 9"	3' 9"	3' 5"	2' 7"	3' 6"	3' 2"	2' 5"	3' 3"	3' 0"
	FR 150	3' 3"	4' 4"	4' 0"	2' 10"	3' 9"	3' 6"	2' 7"	3' 5"	3' 2"	2' 4"	3' 2"	2' 11"	2' 3"	3' 0"	2' 9"
	FM 16	3' 10"	5' 2"	4' 9"	3' 4"	4' 6"	4' 2"	3' 0"	4' 1"	3' 9"	2' 10"	3' 9"	3' 6"	2' 8"	3' 7"	3' 3"
	FM 13	3' 7"	4' 9"	4' 5"	3' 1"	4' 2"	3' 10"	2' 10"	3' 9"	3' 6"	2' 7"	3' 6"	3' 3"	2' 5"	3' 4"	3' 0"
	FM 10	3' 3"	4' 4"	4' 0"	2' 10"	3' 10"	3' 6"	2' 7"	3' 6"	3' 2"	2' 5"	3' 2"	2' 11"	2' 3"	3' 0"	2' 9"

Roofing: Negative Load

Deflection Limit = L/60 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	4' 3"	5' 8"	5' 3"	3' 8"	4' 11"	4' 7"	3' 4"	4' 6"	4' 2"	3' 1"	4' 2"	3' 10"	2' 11"	3' 11"	3' 7"
	FR 400	4' 1"	5' 6"	5' 1"	3' 7"	4' 9"	4' 5"	3' 3"	4' 4"	4' 0"	3' 0"	4' 0"	3' 9"	2' 10"	3' 9"	3' 6"
	FR 300	3' 10"	5' 2"	4' 10"	3' 5"	4' 7"	4' 2"	3' 1"	4' 1"	3' 10"	2' 10"	3' 10"	3' 6"	2' 8"	3' 7"	3' 4"
	FR 250	3' 8"	4' 11"	4' 6"	3' 2"	4' 3"	3' 11"	2' 11"	3' 10"	3' 7"	2' 8"	3' 7"	3' 4"	2' 6"	3' 5"	3' 1"
	FR 200	3' 6"	4' 9"	4' 4"	3' 1"	4' 1"	3' 10"	2' 9"	3' 9"	3' 5"	2' 7"	3' 6"	3' 2"	2' 5"	3' 3"	3' 0"
	FR 150	3' 3"	4' 4"	4' 0"	2' 10"	3' 9"	3' 6"	2' 7"	3' 5"	3' 2"	2' 4"	3' 2"	2' 11"	2' 3"	2' 10"	2' 9"
	FM 16	3' 10"	5' 2"	4' 9"	3' 4"	4' 6"	4' 2"	3' 0"	4' 1"	3' 9"	2' 10"	3' 9"	3' 6"	2' 8"	3' 7"	3' 3"
	FM 13	3' 7"	4' 9"	4' 5"	3' 1"	4' 2"	3' 10"	2' 10"	3' 9"	3' 6"	2' 7"	3' 6"	3' 3"	2' 5"	3' 4"	3' 0"
	FM 10	3' 3"	4' 4"	4' 0"	2' 10"	3' 10"	3' 6"	2' 7"	3' 5"	3' 2"	2' 5"	3' 2"	2' 11"	2' 3"	3' 0"	2' 9"

Siding: Wind Load

Deflection Limit = L/30 • Moment Factor of Safety = 1.88 • Pullover Factor of Safety = 1.88

Load, PSF		20			30			40			50			60		
Span		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S E R I E S	FR 450	5' 4"	7' 2"	6' 7"	4' 8"	6' 3"	5' 9"	4' 3"	5' 8"	5' 3"	3' 11"	5' 3"	4' 10"	3' 8"	4' 11"	4' 7"
	FR 400	5' 2"	6' 11"	6' 4"	4' 6"	6' 0"	5' 7"	4' 1"	5' 6"	5' 1"	3' 9"	5' 1"	4' 8"	3' 7"	4' 9"	4' 5"
	FR 300	4' 11"	6' 7"	6' 1"	4' 3"	5' 9"	5' 3"	3' 10"	5' 2"	4' 10"	3' 7"	4' 10"	4' 5"	3' 5"	4' 7"	4' 2"
	FR 250	4' 7"	6' 2"	5' 8"	4' 0"	5' 5"	5' 0"	3' 8"	4' 11"	4' 6"	3' 4"	4' 6"	4' 2"	3' 2"	4' 0"	3' 11"
	FR 200	4' 5"	6' 0"	5' 6"	3' 10"	5' 2"	4' 10"	3' 6"	4' 9"	4' 4"	3' 3"	3' 11"	4' 0"	3' 1"	3' 3"	3' 8"
	FR 150	4' 1"	5' 6"	5' 0"	3' 7"	4' 9"	4' 5"	3' 3"	4' 3"	4' 0"	3' 0"	3' 5"	3' 8"	2' 10"	2' 10"	3' 3"
	FM 16	4' 10"	6' 6"	6' 0"	4' 3"	5' 8"	5' 3"	3' 10"	5' 2"	4' 9"	3' 7"	4' 9"	4' 5"	3' 4"	4' 6"	4' 2"
	FM 13	4' 6"	6' 0"	5' 7"	3' 11"	5' 3"	4' 10"	3' 7"	4' 9"	4' 5"	3' 3"	4' 5"	4' 1"	3' 1"	4' 1"	3' 10"
	FM 10	4' 1"	5' 6"	5' 1"	3' 7"	4' 10"	4' 5"	3' 3"	4' 4"	4' 0"	3' 0"	3' 11"	3' 9"	2' 10"	3' 7"	3' 6"

Maximum span for uniform load, PSF, is shown in lineal feet and based on panel fasteners with .729" diameter washer located 8" on center. Structural properties and maximum spans are based on large-scale tests that consider: bending moment at failure, flexural stiffness and pullover force per fastener.

Specification



PART ONE: GENERAL

1.01 Description of Work

The scope shall include roofing and/or siding panels and required accessories as shown on the drawings.

- A. FRP roofing and siding panels
- B. FRP trim and flashing
- C. Fasteners for panels and flashing
- D. Closures and sealants

1.02 Quality Assurance

- A. Materials shall comply with federal and local laws, applicable codes, and standards including:
 - 1. ASTM E72: Strength of Panels for Building Construction
 - 2. ASTM E84: Surface Burning Characteristics of Building Materials
 - 3. ASTM D696: Coefficient of Linear Thermal Expansion of Plastics
 - 4. ASTM D2583: Indentation Hardness of Plastics
 - 5. ASTM D1494: Diffused Light Transmission
- B. Roofing and siding panels shall meet the design criteria listed herein for the spans shown on the drawings.

1.03 Design Criteria

- A. Design Loads

Roofing: Positive _____ psf Negative Wind _____ psf

Siding: Positive _____ psf Negative Wind _____ psf

Positive load should be the higher of live or snow load or a minimum load of 20 psf.
- B. Deflection Limit

Roofing: L/D = _____ Siding: L/D = _____

Siding: Positive _____ psf Negative Wind _____ psf

IBC specifies L/60 as a minimum limit for deflection.
- C. Factor of Safety (FOS)

Roofing: Positive = 2.5 Negative Wind = 1.88

Siding: FOS = 1.88

1.04 Submittals

Submittals shall include, but not be limited to:

- A. Complete list and description of materials to be furnished
- B. Product literature
- C. Technical data demonstrating compliance with design criteria
- D. Layout drawings (if required)

PART TWO: PRODUCTS

2.01 Manufacturer(s)

The standard for design, characteristics and performance shall be TuffSpan roofing and siding as manufactured by Enduro Composites, Houston, Texas, CreativeCompositesGroup.com.

2.02 Materials

- A. Roof and siding panels shall conform to the following:
 - 1. Profile/Series shall be _____.
 - 2. Resin type shall be Isophthalic Polyester.
 - 3. Glass fiber reinforcements shall be continuous, straight and bi-directional along the length and width. Glass content shall be 48% by weight. *For FM approved materials revise to: Glass content shall be minimum of 33% by weight.*
 - 4. Materials shall be fire retardant with UL Class 1 Flame Spread Rating of 25 or less per ASTM E-84 test. *For FM materials add: Materials shall have FM approval per Standard 4880 (Corner Fire Test).*
 - 5. Materials shall be protected from UV rays by all of the following:
 - a. UV stabilized resin with neopentyl glycol and acrylic monomer
 - b. UV acrylic polymer exterior coating, factory-applied with minimum .4 mil dry film thickness
 - c. Surfacing mat or veil
 - d. Embossed resin-rich surface
 - 6. Finish shall be embossed top, smooth bottom.
 - 7. Color shall be Enduro standard or as selected by owner.
 - 8. Diffused light transmission (if applicable) shall be _____% per ASTM D 1494.
- B. FRP Flashing and trim shall be thickness, dimensions and profile required for a complete installation per drawings.
- C. Fasteners
 - 1. Structural fasteners shall be (304/316) stainless steel with seal washers installed per manufacturer's guidelines.
 - 2. Panel side lap and flashing fasteners shall be (316) stainless steel SB2 grommets and installed per manufacturer's guidelines.
- D. Closures and Sealants
 - 1. EPDM closures shall match unit profile.
 - 2. Sealant tape for roofing side and end laps shall be 3/32 x 1/2 in. thick non-shrink/non-hardening butyl tape.
 - 3. Sealant for translucent panels shall be Boss 380 Silicon or Silglaze II SCS 2800 caulk.

PART THREE: EXECUTION

3.01 Handling and Storage

- A. When handling materials, spreader bars shall be used when lifting FRP panels and surfaces protected from cuts, gouges, abrasions, and impacts. Wire slings shall not be used unless panel is protected.
- B. During storage, bundled panels shall be protected against standing water on top of and between sheets. Bundled panels shall be kept under cover (but ventilated) and dry. Materials shall be stored off the ground for air circulation and with one end elevated to permit water drainage.

3.02 Installation

Installer shall follow Manufacturer's Installation Instructions and Layout Drawings.

- A. For 304SS or 316SS Type A or B, self tapping crews, pilot holes must be drilled through the panel and support. Pilot holes are not required for stainless steel self-drilling screws, which have a carbon steel point.
- B. For SB2 Grommets used for side lap and flashing attachment, pilot holes must be drilled through flashing and panels.
- C. End laps shall be 6 inches minimum for roofing panels, and 4 inches minimum for siding panels.

HANDLING & STORAGE

When lifting FRP materials, spreader bars should be used. Wire slings should be avoided unless materials are protected. Material surfaces should be protected from cuts, impact and abrasions. FRP cannot be reshaped by external force such as hammering or extreme bending.

Bundled panels should be stored off the ground high enough to allow for air circulation under the bundle and to be above standing water. One end should be elevated for water drainage and moisture prevented between bundled panels.

INSTALLATION

Detailed, easy to follow, installation instructions are typically provided with panel shipments. Installation of panels, flashings, closures and sealants is similar to other profiled, roofing and siding panels.

For 304SS or 316SS, Type A or B (thread-forming) self-tapping fasteners, pilot holes are required. Pilot holes are also required for SB2 grommets for side lap and flashing attachment. Pilot holes are not required for SX5, SX14, and 12XS self-drilling screws, which are austenitic 304 or 316 stainless steel with a bi-metal welded carbon steel point. Fine-toothed saws, masonry or other abrasive type blades are suitable for field cutting of FRP materials.

FASTENER & SEALANT GUIDE

Profile	Structural Fasteners	Side Lap Fasteners / End & Side Laps
2.67 x 7/8, 2.5 x 1/2	Every 3rd high rib	For roofing or siding, allow 1 full rib (min.) for side laps. Roofing w/slope 3/12 or greater: Fasten side laps 18" o.c. Roofing w/slope less than 3/12: Fasten side laps 12" o.c. Siding: Fasten side laps 18" o.c. For roofing, end laps should be 6" minimum. For siding, end laps should be 4" minimum. For ridge, gable, transition and corner flashing overlap ends 4". For other flashings, butt ends unless noted otherwise. For fastening flashing to panels: Fasten to 7.2, 7.0, or 7.2D every other rib; 4.2 x 1.06, every 3rd rib; or 12" on center. Side lap Fastening: 6.5x2_18" o.c.; 8.0x3.5_24" o.c. Diaphragm Applications: 12" o.c. Butt or lap ends 3"
4.2 x 1.06 Roofing	Every other high rib	
4.2 x 1.06 Siding	Every other low rib	
4.1 x 9/16, 4.0 x 1, 4.875 x 1.75V	Every other low rib	
7.2 x 1.5, 7.2D x 1.75, 7.0 x 1.5, 5.3 x 1.75V	Every low rib	
12 x 1.25R, 12 x 1.62R, Trafford Tile	One on each side of every high rib	
6.5 x 2 Roof Deck, 8.0 x 3.5 Roof Deck	Every low rib	

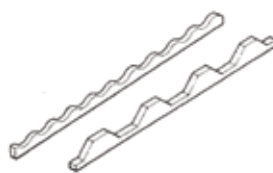
1. Sealant: Butyl tape sealant is required for roofing side and end laps. For translucent roofing, clear caulk may be used. Sealant is not required for siding or roof deck unless noted otherwise.
2. Fasteners: 304SS and 316SS Type A or B self-tapping screws require pilot holes before installation. SX5/SX14/12XS self-drilling fasteners are bi-metal screws with 304SS or 316SS head and clamping thread section. The drill point and lead thread are carbon steel. In some conditions, the carbon steel point, which is necessary for self-drilling installation, will exhibit rust or corrosion.
3. Washers, 0.729" diameter are typically required. Exceptions are 8.0 x 3.5 roof deck and FM ratings for 7.2" rib panels that require 1.125" diameter washers.

Structural Fastener	Beam Thickness	Drill Bit Size	Side Lap Fastener	Drill Bit Size
#14 Type B	.065-.085"	#8 (.199")	SB2 Grommet	3/8"
	.085-.115"	#7 (.201") or 13/64		
	.115-.375"	#1 (.228") or 7/32		
	.375-.500"	#1 (.228") or 7/32		
#14 Type A	.021-.026"	1/8 (.125")		
	.027-.050"	3/16 (.187")		
	.051-.075"	#8 (.199") or 13/64		
	Wood	5/32"		
	FRP	#22 (.157") or 11/64		
SX5 Self Driller	.075-.157"	Not required		
SX14 Self Driller	.158-.550"	Not required		
12XS Self Driller	FRP	Not required		



Butyl Tape

Tape is 3/32" thick x 1/2" wide non-shrinking, non-hardening, used for sealing side and end laps.



Closure Strips

Closure strips made from synthetic rubber (EDPM) are available for use with specific panel profiles.

Type A



Type B

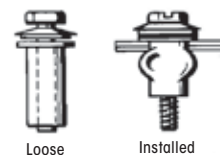


Self-Drillers



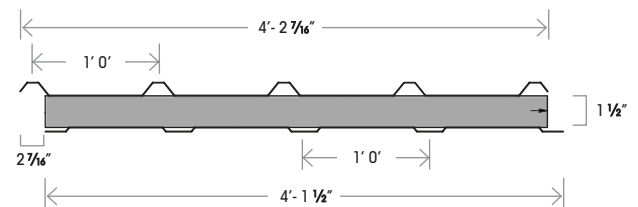
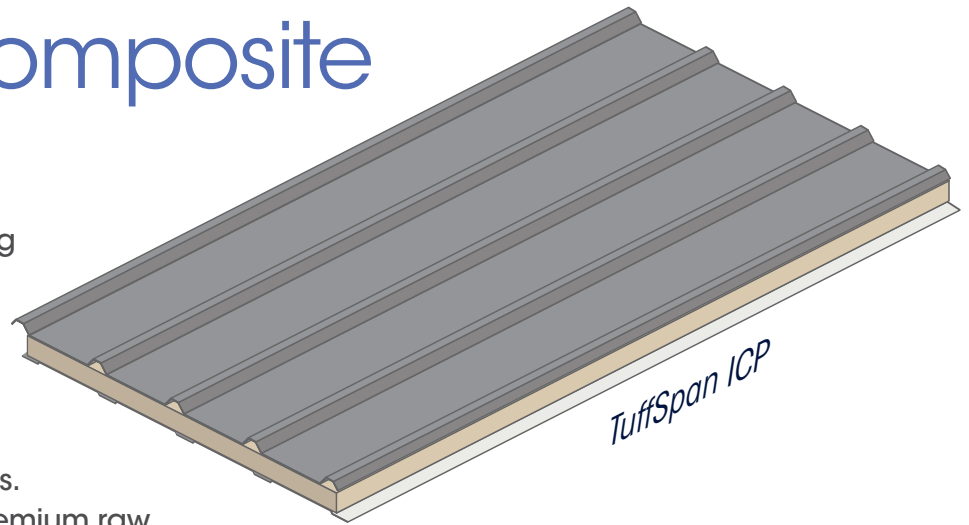
304SS
316SS
Carbon Steel

SB2 Grommet



Shop-assembled Insulated Composite Panel

With a proven history of outstanding product performance, TuffSpan FRP roofing and siding is the market leader providing safe, weathertight, long-term building solutions in the most chemically aggressive and harsh environments. The TuffSpan technology utilizes premium raw materials and constructability designed to achieve the highest performance.



Shop-Fabricated Insulated Panel **NEW!**

Introducing Enduro's next generation non-metallic insulated panel system, TuffSpan ICP (insulated composite panel) utilizes insulation board sandwiched between premium TuffSpan fiberglass exterior and interior panels. Now shop fabricated, the ICP significantly reduces total installed time and cost while providing excellent corrosion resistance and superior UV protection, extending a building's service life in the most chemically aggressive and harsh environments.

REDUCED INSTALLED COST

Shop-Fabricated • Modular Design • Lightweight

The shop fabricated TuffSpan ICP's enhanced modular design provides a more efficient installation method, greatly reducing installation time and costs. In addition to the installation cost savings from reduced man-hours, reducing the construction time onsite positions the facility to begin operations sooner. Utilizing fiberglass panels for both exterior and interior panels provides a lightweight insulated panel with better maneuverability and ease of installation.

EXCELLENT CORROSION RESISTANCE

Long Service Life • Maintenance-Free

Enduro's ICPs utilize TuffSpan for the exterior and interior panels, which do not corrode in facilities with continuous wet or tough chemical exposure. Its premium, isophthalic polyester, aliphatic or vinyl ester resin system ensures long, maintenance free service life and dramatically improves work conditions.

SUPERIOR UV PROTECTION

Extended Color Retention • Greater Aesthetics

TuffSpan panels utilize an acrylic polymer coating and UV stabilized resin system resulting in extended UV protection and retention of its aesthetic properties. The halogen-free, aliphatic resin offers the best weathering and color retention properties for structural, corrosion resistant cladding panels.

Roofing Positive Load

L/D = 60 • Moment FOS = 2.5

Uniform Load, PSF	20			30			40			50			60		
Span	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
ICP 450	6.08	8.16	7.50	5.25	7.08	6.50	4.83	6.41	5.91	4.41	5.83	5.50	4.16	5.33	5.33

Roofing Negative Load

L/D = 60 • Moment FOS = 1.88 • Pullover FOS = 1.88

Uniform Load, PSF	20			30			40			50			60		
Span	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
ICP 450	6.08	8.16	7.50	5.25	7.08	6.50	4.83	6.41	5.83	4.41	6.00	5.50	4.16	5.58	5.16

Siding Wind & Liner Load

L/D = 30 • Moment FOS = 1.88 • Pullover FOS = 1.88

Uniform Load, PSF	20			30			40			50			60		
Span	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
ICP 450	7.66	10.25	9.41	6.66	8.75	8.25	6.08	7.58	7.50	5.58	6.75	6.33	5.25	6.17	5.25

Maximum spans are shown in lineal feet and based on panel fasteners, w/.729" diameter washers, located 6" on center. Span limits and structural properties are determined from large-scale tests that consider bending moment at failure, flexural stiffness, and pullover force per fastener. Span conditions shown apply to all insulation thicknesses.

Material Characteristics & Test Certifications

Exterior and Interior Panels	TuffSpan fiberglass					
Panel Resin	PFR (Iso-polyester), VFR (Vinyl Ester)					
Insulation*	Polyisocyanurate Rigid Board (2" R-value of 13; 3" = R-value of 20)					
Panel Lengths	12 ft		14 ft		16 ft	
Panel Weights**	2": 107 lbs	3": 115 lbs	2": 125 lbs	3": 135 lbs	2": 143 lbs	3": 155 lbs
Standard Colors	Gray, White, Beige, Stone-white-R (Contact Enduro for others)					
Flame Spread Rating, ASTM E84	Class 1, 25 or less					

* Polyisocyanurate board insulation in 2" and 3" thicknesses are standard insulation type and thicknesses for TuffSpan ICP. For other type and thickness, please contact us.

** Panel weights are nominal. For comparison, ICP panels are 48" coverage width vs. industry standard 36" coverage width.



1. Insulated Panel System installed at wellhouse at salt facility
2. Insulated Panel System installed around bleach tank at a pulp & paper mill



Specification



PART ONE: GENERAL

1.1 Section Includes

- A. Insulated Composite Wall Panels with glass fiber reinforced plastic (FRP/GRP) face sheets and foam insulating core.
- B. Insulated Composite Roof Panels with glass fiber reinforced plastic (FRP/GRP) face sheets and foam insulating core.
- C. FRP/GRP trim and flashing for Insulated Composite Panels.
- D. Fasteners for panels and flashing.
- E. Closures and sealants.

1.2 Design Requirements

- A. The insulated composite panels with glass fiber reinforced plastic (FRP) face sheets and foam insulating core shall be factory laminated or foamed-in-place under a certified ISO 9001 Quality Control program.
- B. Design Requirements for Insulated Wall and Roof Panels:
 - a. Thermal Properties: The panel shall provide a nominal R-value of _____ per inch (minimum) of core insulation thickness. Reference Section 2.5 for R-value by insulation type.
 - b. Flame Spread: Rating of 25 or less, when tested in accordance with ASTM E84.
 - c. Smoke Development: Rating of 450 or less, when tested in accordance with ASTM E84.
- C. Design Requirements for Insulated Wall Panels:
 - I. The wall panels shall be designed and furnished by the manufacturer as a complete system.
 - II. Design loads shall be in accordance with local building code.
 - III. Wind loads shall be based on criteria in accordance with local building code or not less than 20 lbs. psf (.957 kPa).
 - IV. Deflection requirements shall be in accordance with the applicable building code and deflection limit of L/30.
 - V. Factor of safety of 1.88 shall apply for wind loads.
- VI. Accessories and fasteners shall be capable of resisting specified wind loads.
 - D. Design Requirements for Insulated Roof Panels:
 - I. The roof panels shall be designed and furnished by the manufacturer as a complete system.
 - II. Design loads shall be in accordance with local building code.
 - III. Dead load shall be the weight of the roof panels.
 - IV. Live load shall be a minimum of 20 lbs. PSF (.957 kPa).
 - V. Snow load shall be defined in accordance with local building code.
 - VI. Design positive load shall be the higher of the live+dead or snow+dead load or as defined by the local building code.
 - VII. Wind loads shall be based on wind criteria in accordance with local building code.
 - VIII. Collateral loads shall not be applied to the roof panels.
 - IX. Deflection requirements shall be in accordance with the applicable building code and deflection limit of L/60.
 - X. Factor of safety of 2.5 shall apply for positive loads. Factor of safety of 1.88 shall apply for wind loads.
 - XI. Accessories and fasteners shall be capable of resisting specified wind uplift loads.

PART TWO: PRODUCTS

2.1 Acceptable Manufacturer

- A. Enduro Composites, Inc., located at 16602 Central Green Blvd., Houston, TX 77032; Tel: 800-231-7271, 713-358-4000; BPSales@endurocomposites.com; CreativeCompositesGroup.com.

2.2 Insulated Composite Panels (ICP)

- A. Exterior face panel shall be TuffSpan glass fiber reinforced plastic (FRP) as manufactured by Enduro Composites, Inc. with ribs 12 in. (304.8 mm) on center with 1.25 in. (31.75 mm) depth and coverage of 48 inches (1219.2 mm).
- B. Exterior face panel shall be Series 450 and meet all specified Design Requirements.
- C. Surface of face panel exposed to outside environment shall have an embossed finish.
- D. Exterior face sheet shall have acrylic polymer exterior UV coating protection, factory-applied with minimum .4 mil dry film thickness.
- F. Color of exterior panel shall be Enduro standard Gray or as selected by owner.
- G. Interior liner panel shall be TuffSpan glass fiber reinforced plastic FRP Siding Panel as manufactured by Enduro Composites, Inc. with ribs 12 in. (304.8 mm) on center with maximum .375 in. (9.5 mm) depth and coverage of 48 in. (1219.2 mm).
- H. Interior liner panel shall be Series 300 at minimum and meet all specified Design Requirements.
- I. Color of interior panel shall be Enduro standard White or as selected by owner.
- J. Lengths of panels shall be +/- 1/4" with maximum length of 16'0".

2.3 Glass Fiber Reinforced Plastic Panel Material

- A. Material resin shall be premium grade, Isophthalic Polyester, UV stabilized with neopentyl glycol and acrylic monomer.
- B. Glass fiber reinforcements shall be continuous, straight and bi-directional along the length and width.
- C. Material shall be fire retardant with UL Class 1 Flame Spread Rating of 25 or less per ASTM E-84 test.
- D. Material shall have smoke development of 450 or less per ASTM E-84 test.

2.4 Foam Insulating Core

- A. Foam insulating core shall be 2 3/8" (select one) thick, polyisocyanurate foam insulation with minimum R-value of 6 per inch or 3 3/4" (select one) thick. The foam insulating core shall be factory laminated or foamed-in-place to face sheet and liner to develop finished insulated composite panel unit.
- B. Foam insulating core shall be tested to ASTM E84 and shall have these characteristics.
 - a. Flame spread index: 25 or less.
 - b. Smoke developed index: 450 or less.

2.5 Accessories

- A. Accessories shall include flashing, trim, closures, sealant, fasteners and other items as required for a complete installation.
- B. FRP/GRP flashing and trim shall be in thickness, dimensions and profile as required.
- C. Fasteners
 - a. Structural fasteners shall be 304/316 (select one) stainless steel with seal washers and installed per manufacturer's instructions.
 - b. Side lap and flashing fasteners shall be 316 stainless steel SB2 grommets and installed per manufacturer's instructions.
- D. Closures and Sealant
 - a. Closures shall be EPDM material and match panel profile.
 - b. Sealant shall be 3/32 x 1/2 inch, non-shrink/non-hardening butyl tape.

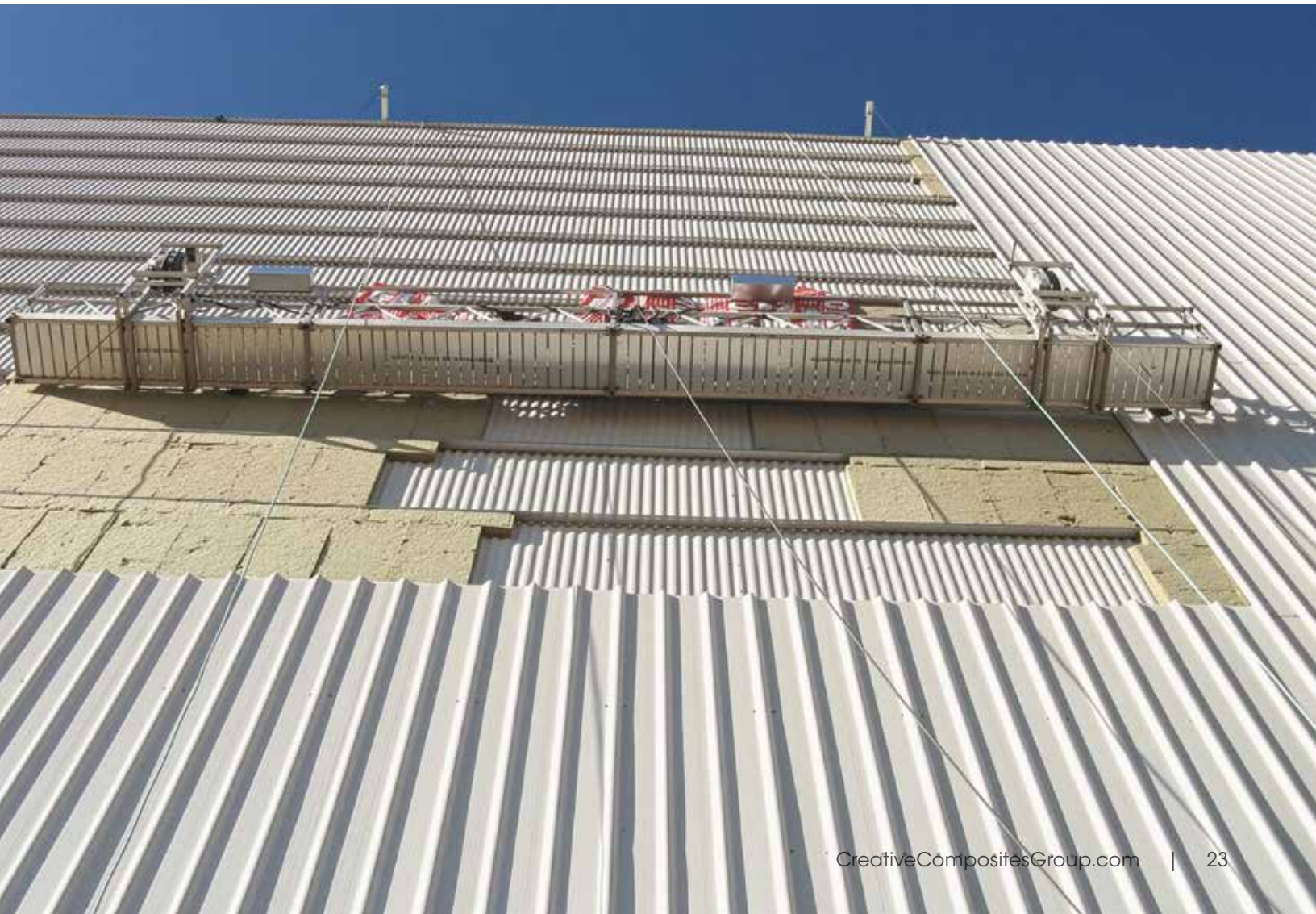
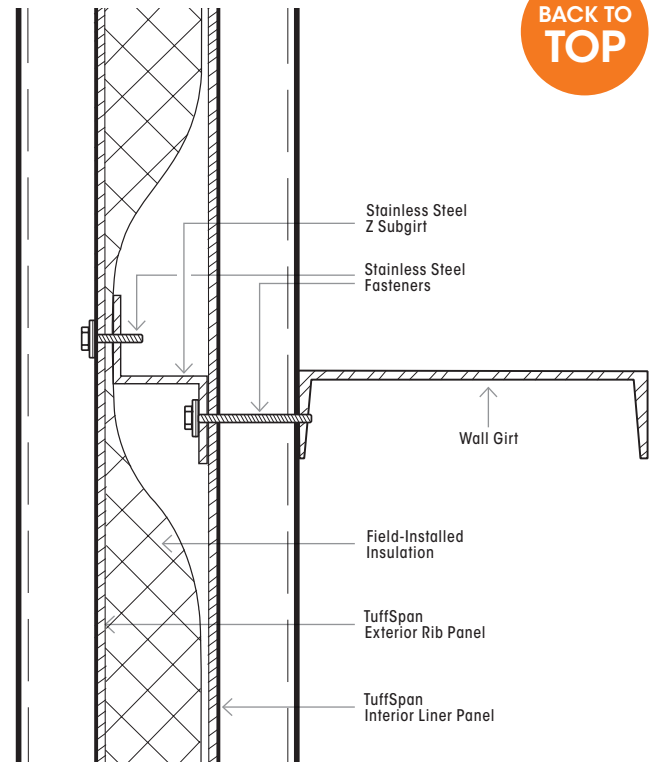
Field-assembled Insulated Panel System

In addition to the shop assembled ICP, TuffSpan panels are offered as a field-assembled insulated panel system. This assembly is approved by Factory Mutual for use as a wall and roof/ceiling with no height limitations or sprinklers.

A TuffSpan insulated panel assembly has passed ULC-S134, fire test for exterior cladding. Please contact us for additional information.

TuffSpan insulated panel system at potash operation. Assembly includes liner, stainless steel sub-girt, mineral wool insulation and exterior sheet.

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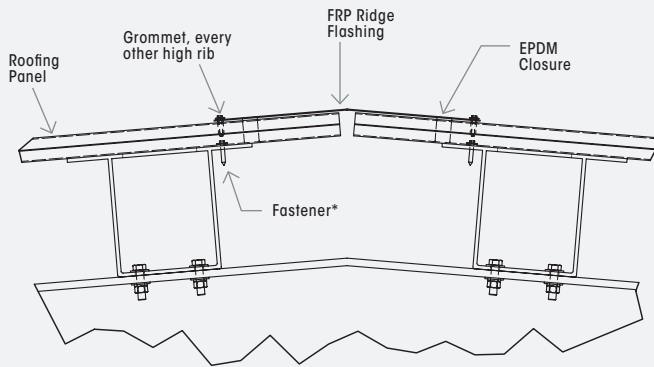


TUFFSPAN FRP ROOFING & SIDING PANELS

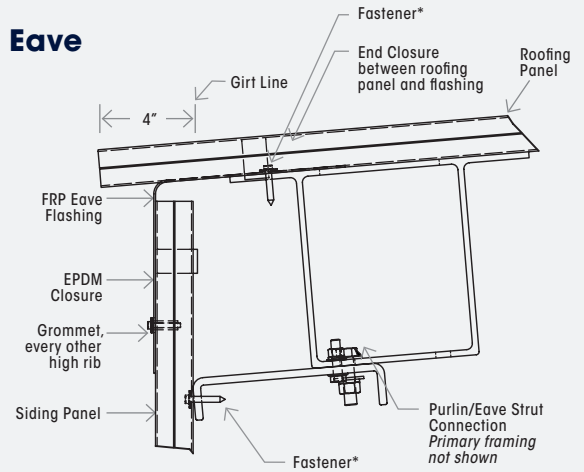
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Typical Details

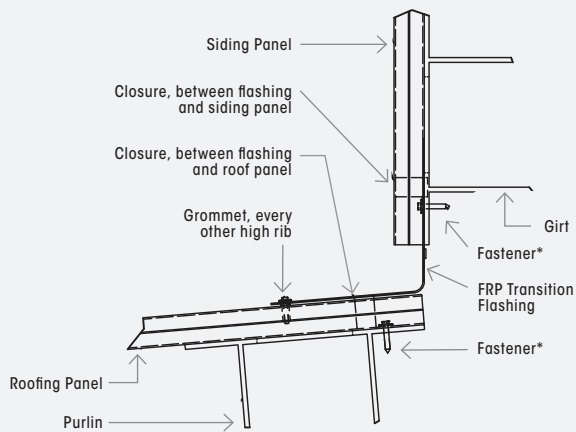
Ridge



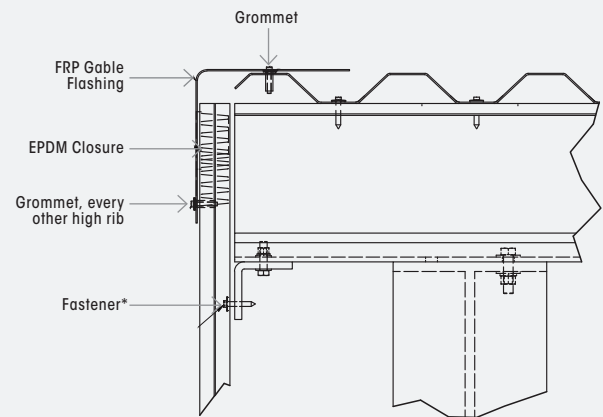
Eave



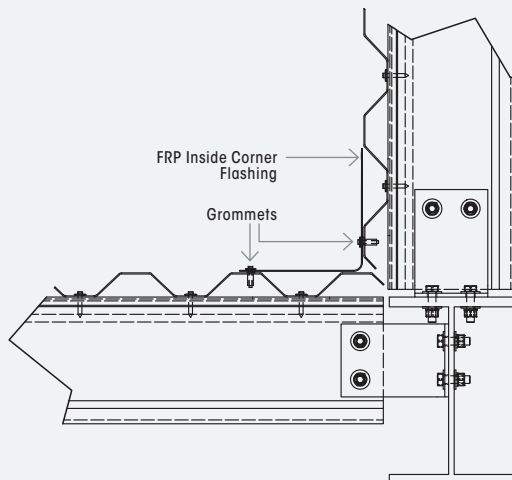
Transition



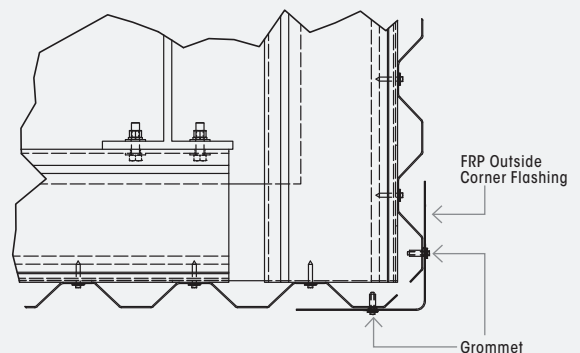
Gable



Inside Corner



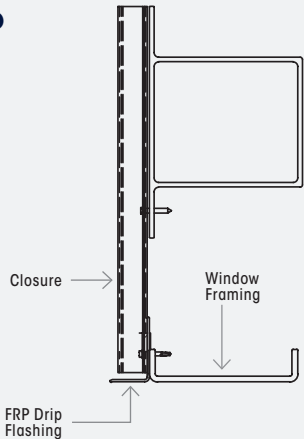
Outside Corner



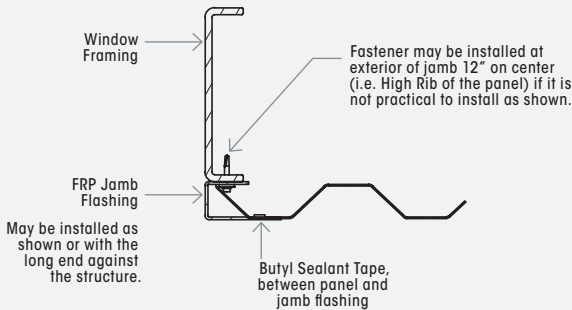
* See page 19 for installation guidelines.

Typical Details

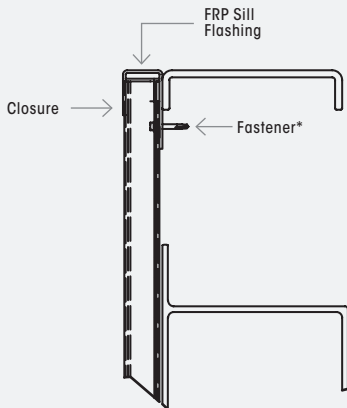
Drip



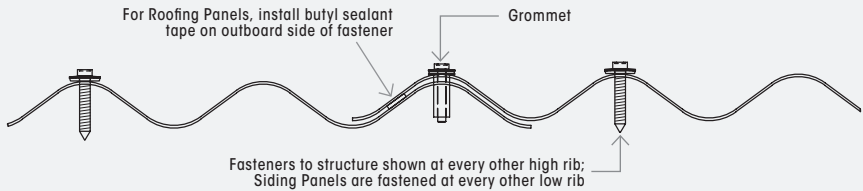
Jamb



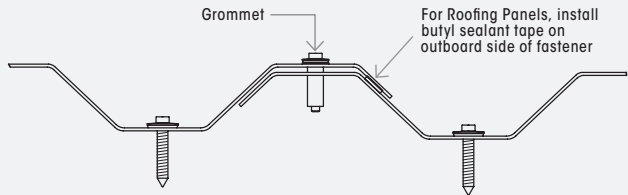
Sill



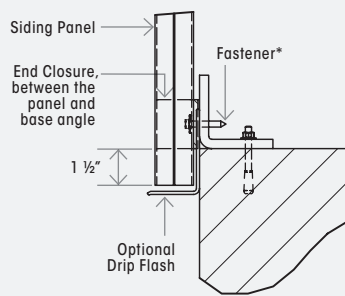
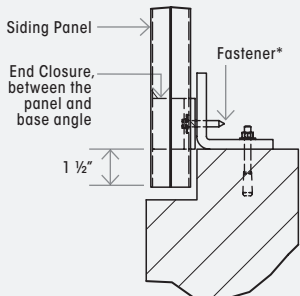
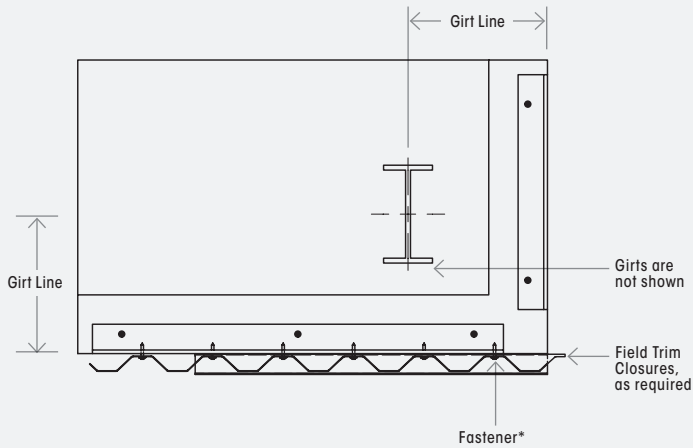
Corrugated Panel Side Lap



Rib Panel Side Lap



Base



* See page 19 for installation guidelines.

TuffSpan FRP Roof Deck

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Unsurpassed Strength & Corrosion Resistance

With outstanding corrosion resistance, TuffSpan fiberglass reinforced plastic Roof Deck provides long-term structural support for both built-up and single ply roofing materials.

As an alternative to metal or wood, TuffSpan Roof Deck does not rust, rot, peel or flake, thus eliminating the threat of falling deck particles that could damage equipment or contaminate product. As an alternative to concrete, TuffSpan offers an 11 lb. psf reduction in dead load on the building structure and huge installation cost and time savings. In addition, its bright white color can dramatically improve work conditions

STRUCTURAL PERFORMANCE

To optimize structural properties, TuffSpan material includes high (50% by weight) content of glass fiber reinforcements in bidirectional alignment. This provides the strength and stiffness necessary to withstand high wind uplift and support dead load of roofing materials. Available in two profiles, TuffSpan roof decks are designed to handle typical load and span conditions found in conventional building construction

The fiberglass reinforced plastic (FRP) decking delivers significant benefits for natatoriums, paper mills, food processing plants, industrial facilities with chemical exposures and other challenging conditions.



Corrosion resistant TuffSpan Roof Deck is a suitable substrate for either single-ply or built-up roofing

Uses

- ▶ Roof Deck for Membrane Roofing
- ▶ Roof Deck for Built Up Roofing

Benefits

- ▶ Life-Cycle Cost Savings
- ▶ Maintenance-Free Life
- ▶ No Rust, Rot, Peel or Flake
- ▶ Equipment & Product Safety
- ▶ Improved Work Conditions

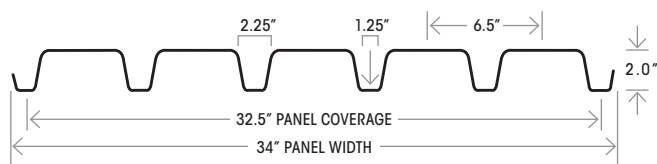
Features

- ▶ Corrosion Resistance
- ▶ Strongest FRP Building Panel
- ▶ Fire Retardant
- ▶ UL Listed
- ▶ Low Thermal Expansion
- ▶ White or Gray Color Options

Properties	6.5 x 2 Series 500	8.0 x 3.5 Series 700
Nominal Weight /SF	1.05 lb.	1.375 lb.
Nominal Glass Content, %	50	50
Resin System	Fire-Retardant Vinyl Ester	Fire-Retardant Vinyl Ester
Flame Spread Rating (ASTM E-84)	25 or less (Class 1)	25 or less (Class 1)
Moment Capacity/ft.	11,850 lbs. in.	12,400 lb. in.
Stiffness EI/ft.	2.32×10^6 lb. in. ²	5.85×10^6 lbs. in. ²
Fastener Pullover, per fastener	630 lb. (.729" diam. washer)	850 lb. (1.125" diam. washer)
Flextural Strength / ASTM D-790	55,000 psi	55,000 psi
Flexural Modulus / ASTM D-790	2.4×10^6 psi	2.4×10^6 psi
Tensile Strength / ASTM D-790	42,000 psi	42,000 psi
Coefficient of Thermal Expansion / ASTM D-696	8×10^{-6} in/in°F	8×10^{-6} in/in°F

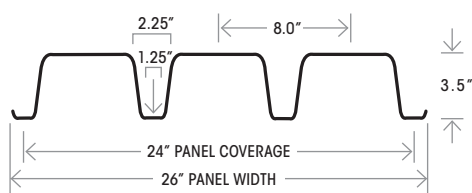
Load/Span Tables: Dead + Live / Uplift Loading

6.5 x 2 VFR 500



Uniform Loads, PSF	20	30	40	50	60	70	80
Single Span	7' 0"	6' 1"	5' 6"	5' 1"	4' 10"	4' 7"	4' 4"
Two Span	9' 4"	8' 2"	7' 5"	6' 11"	6' 6"	6' 2"	5' 10"
Three or More Spans	8' 7"	7' 6"	6' 10"	6' 4"	6' 0"	5' 8"	5' 5"

8.0 x 3.5 VFR 700



Uniform Loads, PSF	20	30	40	50	60	70	80
Single Span	9'6"	8'3"	7'6"	7'0"	6'7"	6'3"	6'0"
Two Span	12'9"	10'6"/11'1"	9'1"/10'1"	8'1"/9'4"	7'5"/8'6"	6'10"/7'9"	6'5"/6'9"
Three or More Spans	11'9"	10'3"	9'4"	8'8"	8'2"	7'8"	7'2"/7'5"

Roof Deck Design Parameters:

Span limits shown are based on roof deck being attached to each support at each low rib.

Deflection Limit = $L/180$ • Live Load - Factor of Safety = 2.5 (1st span listed) • Uplift Load - Factor of Safety = 1.88

Wind Uplift

Properties	6.5 x 2 Series 500	8.0 x 3.5 Series 700
Maximum Span	6'3"	8'0"
Fastener - Washer Diam. (1)	1-60: .729"; 1-90: 1.125"	1.125"
Fastener Spacing at Side Laps	18" o.c.	24" o.c.
Insulation Fasteners (2)	18 fasteners	18 fasteners
Poly-Iso Insulation Board	1.3" thick min.	1.3" thick min.
Wind Uplift Rating	CLASS 1-90	CLASS 1-90
Deflection Limit (3)	L/240	L/240

Notes:

- 1) Structural fasteners are required at each low rib of the deck unit.
- 2) Quantity is for each 4' x 8' insulation board panel.
- 3) With 300 lb. concentrated load.
- 4) Automatic sprinklers are required for Class 2 deck systems.

TuffSpan roof decks are UL Listed for Class 90 Uplift:
Construction #NM523 for 6.5; #NM524 for 8.0.

Specification

PART ONE: GENERAL

TuffSpan products establish the minimum quality standard.

PART TWO: PRODUCTS

FRP roof deck shall be TuffSpan as manufactured by Enduro Composites, Houston, Texas or approved equal.

- 2.01 Profile/Series shall be: _____ 6.5, Series 500 _____ 8.0, Series 700
- 2.02 Glass fiber reinforcements shall be continuous, straight and bi-directional (along the length and width of the unit). Glass content shall be a minimum of 50% by weight.
- 2.03 Resin type shall be premium grade vinyl ester.
- 2.04 Material shall have Class I Flame Spread of 25 or less per ASTM E 84
- 2.05 Color shall be: _____ White _____ Gray.

2.06 Design Criteria

- A. Dead + Live Load: $L/D = 180$, FOS = 2.5
- B. Wind Uplift Load: $L/D = 180$, FOS = 1.88
- C. Compliance with design criteria shall be established by large scale, vacuum box testing for live and uplift loads

PART THREE: EXECUTION

- 3.01 FRP roof deck units shall be installed in accordance with Manufacturer's Installation Guide.
- 3.02 Roofing insulation / membrane shall be attached by: _____ Mechanical (positive lock) fasteners: for example: TPR peel rivet.
_____ Cold adhesive: Olybond 500, Duro-Grip, or equal.
_____ Hot bituminous adhesive: Maximum temperature per NRCA Handbook of Accepted Roofing Knowledge.

TuffSpan FRP Form Deck

BACK TO
TOP

Permanent Form & Corrosion Protection for Concrete Slabs

Extending concrete life and improving plant safety, our TuffSpan Fiberglass Reinforced Plastic (FRP) Form Deck delivers important value for industrial plants.

In chemical exposure, corrosion can attack steel form deck, concrete slabs and its reinforcing bars. For these tough conditions, TuffSpan FRP Form Deck can provide a permanent form and corrosion protection for the underside of slabs. In addition, the corrosion resistant form deck can protect personnel and equipment located below by eliminating the threat of falling particles that can occur with a deteriorated steel deck.

Reinforced with high-tensile strength glass fibers consisting of 48% of its weight, TuffSpan has the strength

and stiffness needed for reliable support of heavy, wet concrete. Strategically placed in bidirectional alignment, the straight and continuous glass fiber reinforcements provide efficient load transfer within the section.

The reinforcements are embedded within a vinyl ester resin system that provides enhanced strength retention at high temperatures in addition to outstanding corrosion resistance. The fire retardant material has a Class I flame spread rating of 25 or less per ASTM E84 testing.

For worker safety and finished slab quality, deflection must be minimized during concrete pour and curing stage. For form deck applications, we recommend selection of one of its higher strength, TuffSpan panel products and maximum allowable deflection of $L/180$.

Uses

- ▶ Permanent Form for Concrete
- ▶ Protection for Underside of Slab

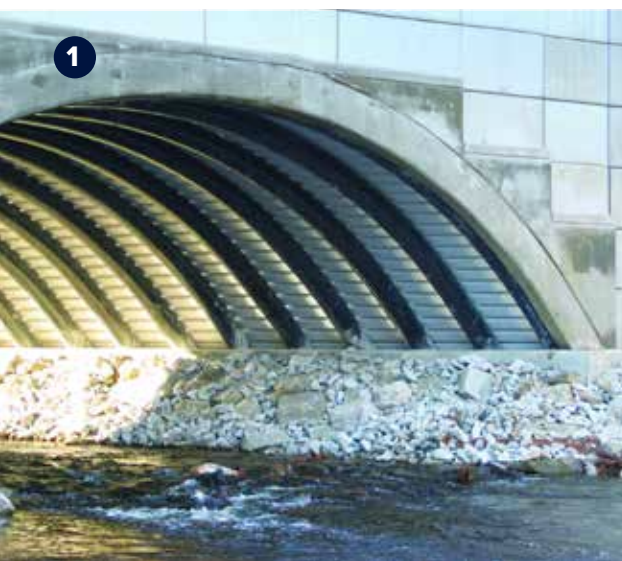
Features

- ▶ Corrosion Resistance
- ▶ Strongest FRP Building Panel
- ▶ Fire Retardant

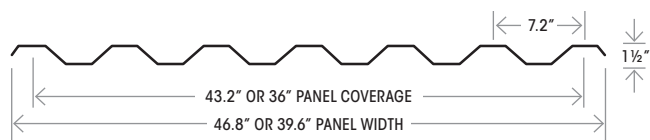
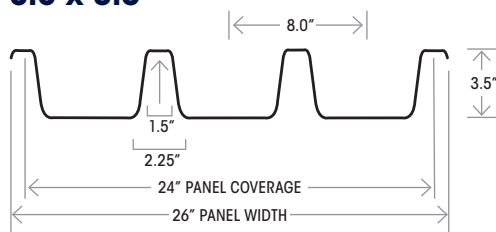
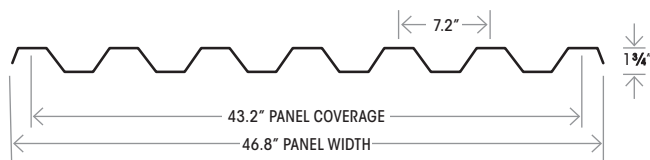
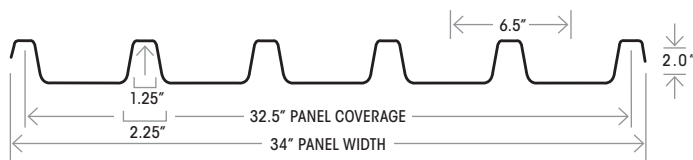
Benefits

- ▶ Longer Life for Concrete Slab
- ▶ Improved Plant Safety

Properties	7.2 x 1.5 VFR 450	7.2D x 1.75 VFR 450	6.5 x 2 VFR 500	8.0 x 3.5 VFR 700
Nominal Weight / SF	1.0 lb.	1.0 lb.	1.06 lb.	1.375 lb.
Nominal Glass Content	48% by Wt.	48% by Wt.	50% by Wt.	50% by Wt.
Moment Capacity / ft.	11,350 lb. in.	13,250 lb. in.	11,850 lb. in.	12,400 lb. in.
Stiffness EI / ft.	$1.12^6 \times 10^6$ lb. in. ²	1.385×10^6 lb. in. ²	2.32×10^6 lb. in. ²	5.85×10^6 lb. in. ²
Resin System	Fire-Retardant, Vinyl Ester (VFR)			
Flame Spread Rating (ASTM E-84)	25 or less (Class I)			
Standard Colors	White or Gray			



1. TuffSpan form deck for road bridge
2. TuffSpan form deck at food processing plant

7.2 x 1.5 RIB**8.0 x 3.5****7.2D x 1.75 RIB****6.5 x 2.0****DIAGRAM**

slab depth
Total slab depth is considered from bottom of deck to top of slab.

Maximum Unshored Spans: Normal Wt. Concrete, 145 PCF, Uniform Load

Slab Depth	TuffSpan Form		Load	L/D = 180, FOS = 2.5			L/D = 240, FOS = 2.5		
	Profile	Series		1 Span	2 Span	3 Span	1 Span	2 Span	3 Span
4.0"	7.2D x 1.75	450	39	4'9"	6'5"	5'11"	4'4"	5'10"	5'4"
	7.2 x 1.5	450	41	4'3"	5'9"	5'3"	3'10"	5'2"	4'10"
4.5"	7.2D x 1.75	450	45	4'7"	6'1"	5'8"	4'2"	5'7"	5'1"
	7.2 x 1.5	450	47	4'1"	5'6"	5'1"	3'8"	5'0"	4'7"
5.0"	6.5 x 2.0	500	56	4'11"	6'7"	6'1"	4'6"	6'0"	5'6"
	7.2D x 1.75	450	51	4'4"	5'10"	5'5"	3'11"	5'4"	4'11"
5.5"	6.5 x 2.0	500	62	4'9"	6'5"	5'11"	4'3"	5'10"	5'4"
	7.2D x 1.75	450	57	4'2"	5'8"	5'2"	3'10"	5'1"	4'9"
6.0"	8.0 x 3.5	700	65	6'5"	7'1"	7'11"	5'10"	7'1"	7'2"
	6.5 x 2.0	500	68	4'7"	6'2"	5'9"	4'2"	5'8"	5'2"
6.5"	8.0 x 3.5	700	71	6'3"	6'9"	7'7"	5'8"	6'9"	7'0"
	6.5 x 2.0	500	74	4'6"	6'0"	5'7"	4'1"	5'6"	5'1"
7.0"	8.0 x 3.5	700	77	6'1"	6'6"	7'3"	5'6"	6'6"	6'10"
	6.5 x 2.0	500	80	4'4"	5'11"	5'5"	4'0"	5'4"	4'11"
7.5"	8.0 x 3.5	700	83	5'11"	6'3"	7'0"	5'4"	6'3"	6'7"
	6.5 x 2.0	500	86	4'3"	5'9"	5'3"	3'10"	5'2"	4'10"
8.0"	8.0 x 3.5	700	89	5'9"	6'1"	6'9"	5'3"	6'1"	6'6"
	6.5 x 2.0	500	92	4'2"	5'7"	5'2"	3'9"	5'1"	4'8"

Notes:

- 1) Load, PSF = Uniform weight of concrete + Weight of form deck.
- 2) Maximum spans shown are based on:
 - Deflection not exceeding the more conservative value of L/180 or L/240 (as specified) or 1/2" under uniform concrete load.
 - Deflection, prior to concrete placement, not exceeding L/120 under 50 lbs/SF construction load.
 - Minimum factor of safety of 2.5 for Moment Capacity.
- 3) Form Deck panels must be fastened to structural supports in every low rib and to adjacent panels at side-laps, 18" on center.
- 4) The information in the tables is intended for use as a guideline only. Please contact us for assistance with material selection and information not covered such as maximum shored spans and other slab conditions.

TuffSpan FRP Louvers

Corrosion Resistant Ventilation Components

Our TuffSpan fiberglass reinforced plastic louvers provide effective air control and long service life for applications with demanding structural and environmental conditions. Servicing a range of needs, the louvers are available with either fixed or adjustable blades and openings.

With durable FRP components, TuffSpan louvers have a long history of standing up to tough chemical exposures and high windstorms. Having a glass fiber reinforcing

content of over 50% of its weight, the FRP frames and blades are extremely strong and stiff. Formulated with premium iso-polyester resin, the units are resistant to attack from aggressive chemicals.

The fire retardant FRP components have a Class I flame spread rating of 25 or less per ASTM E84. The units are available in opaque colors that match and blend with TuffSpan siding panels. In addition, as an option, the louver blades can be translucent to provide natural lighting for the facility

Uses

- ▶ FRP-6 Stationary Louvers
- ▶ FRP-6 Adjustable Louvers

Features

- ▶ Strong & Durable
- ▶ Strongest FRP Building Panel

- ▶ Fixed or Adjustable Blades
- ▶ Size Options
- ▶ Fire Retardant

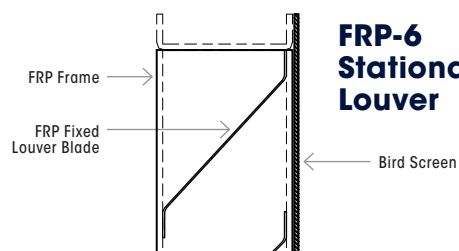
Benefits

- ▶ Life-Cycle Cost Savings
- ▶ Long, Maintenance-Free Life

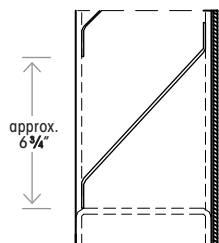
Product Description		
Size Range (Stationary)	FRP-6 Stationary Louvers	Height: 24" - 120" Width: 24" - 96" Depth: 6"
Size Range (Adjustable)	FRP-6 Adjustable Louvers	Height: 24" - 96" Width: 24" - 48" Depth: 6"
FRP Components	Frames: Pultruded Channel	Blades: TuffSpan Panel
Resin Systems	Isophthalic Polyester	
Flame Spread Rating	ASTM E-84	Class 1, 25 or less
Hardware	304 Stainless Steel	Optional Adder: Hardware: 316 Stainless Steel
Bird Screen	Black Plastic - 1/2" (12.7mm) Mesh	Optional Adder: Bird Screen: 304 or 316 SS: 1/2" mesh - 19ga Wire Optional Adder: Insect Screen: 304 or 316 SS: 18x18" Mesh - 33ga Wire Cloth
Standard Colors	Frame: Gray	Blades: Gray, White, Beige, Translucent Clear Custom colors are available for added cost & order minimums



1. TuffSpan Louvers & Windwall Panels at offshore platform
2. TuffSpan Louvers, Beams & Cladding at copper mine

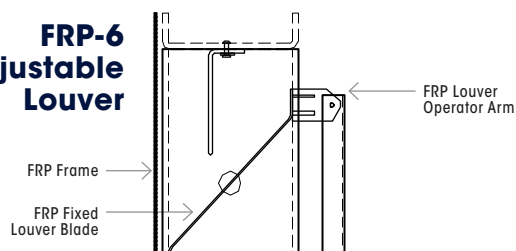


FRP-6 Stationary Louver



Louvers must be sized to allow 1/8" gap between outer edges of the unit(s) and louver opening.

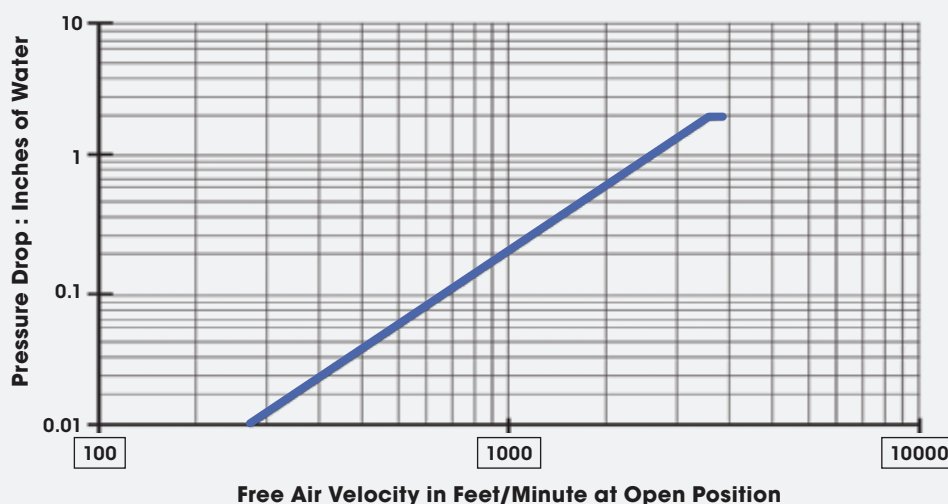
FRP-6 Adjustable Louver



Louver blades can be adjusted and locked in open or closed position.

Free Area Guide in SF

	24	30	36	42	48	54	60	66	72	78	84	90	96
24	1.10	1.42	1.73	2.05	2.37	2.69	3.00	3.32	3.64	3.96	4.28	4.59	4.91
30	1.65	2.12	2.60	3.08	3.55	4.03	4.51	4.98	5.46	5.94	6.41	6.89	7.37
36	2.20	2.83	3.47	4.10	4.74	5.37	6.01	6.65	7.28	7.92	8.55	9.19	9.82
42	2.75	3.54	4.34	5.13	5.92	6.72	7.51	8.31	9.10	9.90	10.69	11.48	12.28
48	3.30	4.25	5.20	6.16	7.11	8.06	9.01	9.97	10.92	11.87	12.83	13.78	14.73
54	3.85	4.96	6.07	7.18	8.29	9.41	10.52	11.63	12.74	13.85	14.97	16.08	17.19
60	3.85	4.96	6.07	7.18	8.29	9.41	10.52	11.63	12.74	13.85	14.97	16.08	17.19
66	4.39	5.67	6.94	8.21	9.48	10.75	12.02	13.29	14.56	15.83	17.1	18.37	19.64
72	4.94	6.37	7.80	9.23	10.66	12.09	13.52	14.95	16.38	17.81	19.24	20.67	22.10
78	5.49	7.08	8.67	10.26	11.85	13.44	15.02	Notes: 1) Free area calculations do not consider obstructed area created by bird or insect screen. 2) Contact us for open area of sizes not listed.					
84	6.04	7.79	9.54	11.29	13.03	14.78	16.53						
90	6.59	8.50	10.40	12.31	14.22	16.12	18.03						
96	7.14	9.21	11.27	13.34	15.40	17.47	19.53						
102	7.14	9.21	11.27	13.34	15.40	17.47	19.53						
108	7.69	9.92	12.14	14.36	16.59	18.81	21.03						
114	8.24	10.62	13.01	15.39	17.77	20.15	22.54						
120	8.79	11.33	13.87	16.41	18.96	21.50	24.04						



Free Air Velocity Chart

for Standard 6-inch Deep Louver

TuffSpan FRP Ridge Vents

Corrosion Resistant Ventilation Components

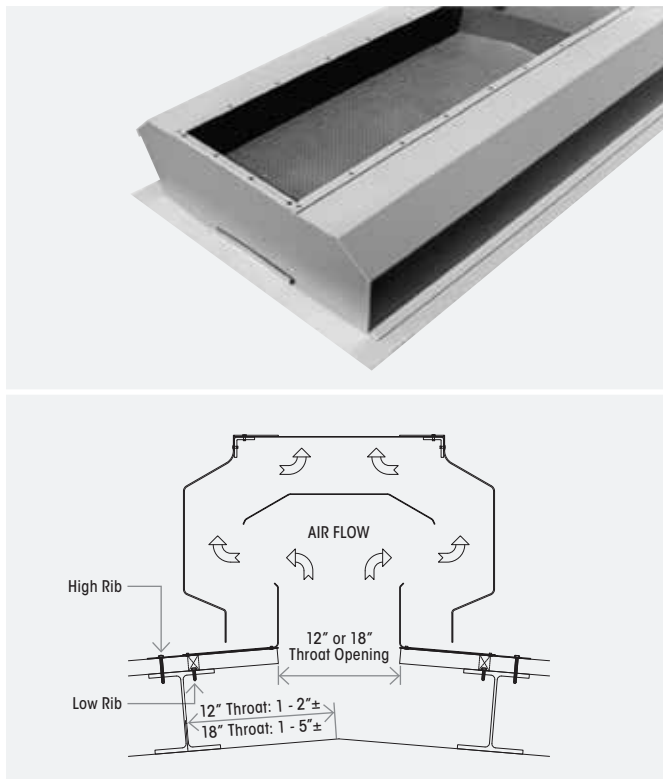
BACK TO
TOP

Our TuffSpan FRP ridge vents provide effective air flow and long, service life for applications with demanding structural and environmental conditions. The fiberglass reinforced plastic ventilators are designed for optimum air flow and moisture drainage plus high wind conditions.

Ridge vents with 12" and 18" throats are available with fixed dampers for stationary openings. These units are offered in factory-assembled, 10' sections for installation as individual units or in continuous, adjacent sections.

Large throat ventilators with 24" to 96" fixed openings include factory fabricated components, cut and pre-drilled, for easy field assembly and handling.

TuffSpan FRP Ridge Vents have a long, proven history of resistance to tough chemical exposures and structural conditions in addition to providing effective ventilation.



Features & Benefits

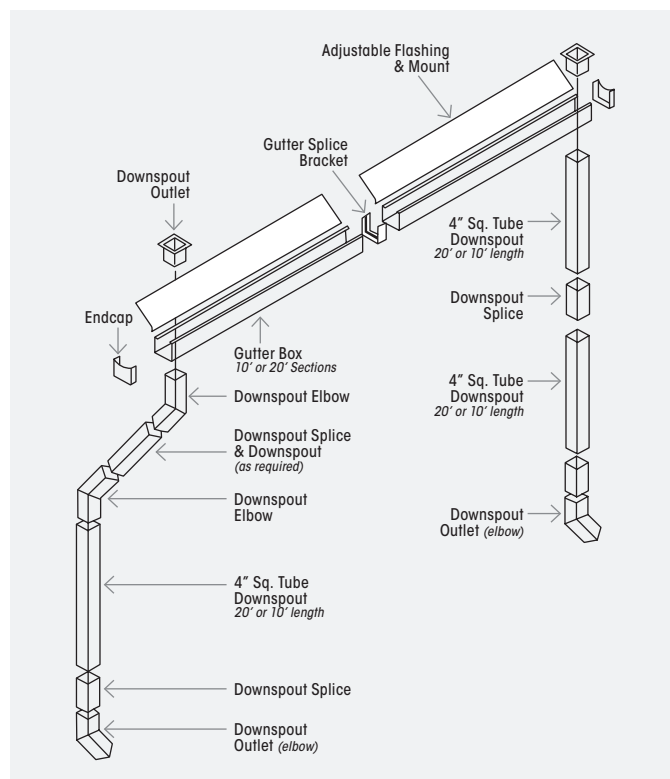
- ▶ Corrosion Resistance
- ▶ Strong & Durable
- ▶ Fire Retardant
- ▶ Size & Color Options
- ▶ Fixed Throat
- ▶ Long, Maintenance-Free Life

Product Description	
Size Options	12" to 18" Throat Opening, Fixed, Factory Assembled Units 24" to 96" Throat Opening, Fixed, Field Assembled Units
Colors	Gray, white, or beige exterior. Internal components are charcoal gray.
Bird Screen	Black Plastic-1/2" Mesh (12.7mm). <i>Stainless steel screen is available for added cost.</i>
Hardware	304 Stainless Steel. <i>316 stainless steel hardware is available for added cost.</i>
Resin System	Isophthalic Polyester
Flame Spread Rating	Class 1, 25 or less per ASTM E-84



TuffSpan FRP Gutter & Downspout

Corrosion Resistant Drainage Components



Our TuffSpan fiberglass reinforced plastic gutter systems from Enduro provide effective moisture drainage and long, service life for applications with demanding structural and environmental conditions. With gutter, downspout and accessories the system provides a complete corrosion resistant solution.

The gutter's continuously-hinged flange pivots to fit any roof pitch. This eliminates the need for individual hangers or brackets that may be required with other systems.

With high strength and outstanding corrosion resistance, the gutter system handles high loads and tough chemical exposures. Its pultruded FRP components are built with glass fiber reinforcements exceeding 50% of its weight that produce high structural properties. Formulated with premium iso-polyester resin, the units are resistant to attack from aggressive chemicals.

The fire retardant FRP components have a Class I flame spread rating of 25 or less per ASTM E84. The units are offered in colors and materials that blend with TuffSpan roofing and siding panels.

Products

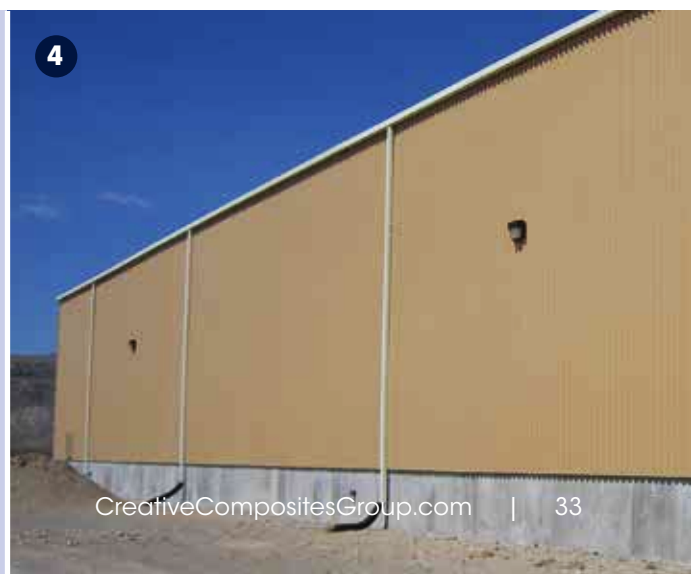
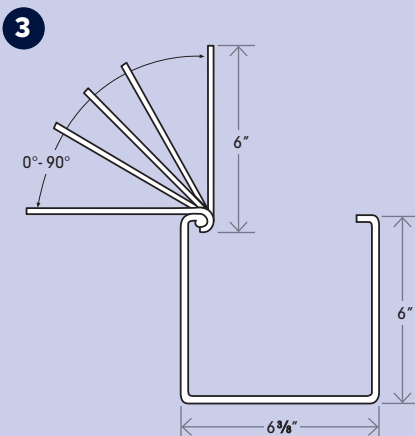
- ▶ 6" x 6 3/8" FRP Gutter
- ▶ Adjustable Mounting Flange
- ▶ 4" x 4" FRP Downspout
- ▶ End Caps, Elbows
- ▶ Accessories

Features & Benefits

- ▶ Corrosion Resistance
- ▶ Strong & Durable
- ▶ Fire Retardant
- ▶ Maintenance Free
- ▶ Life-Cycle Cost Savings

Product Description	
Gutter & Downspout	High Strength, Pultruded FRP Components
Resin System	Isophthalic Polyester
Flame Spread Rating, ASTM E-84	Class 1, 25 or less
Standard Colors	Gray, White, Beige

1. TuffSpan 12" Ridge Vent installed with FRP cladding, louvers, gutter
2. TuffSpan 48" Ridge Vent installed with FRP cladding, beams, louvers
3. Hinged gutter flange pivots to match any roof slope
4. TuffSpan gutter, downspout, roofing and siding at metal alloy processing plant



TuffSpan Purlins & Girts

BACK TO
TOP

Designed for High Load & Long Span Capability

TuffSpan® Flanged Tube Beams are developed specifically for applications that require high load and long span capability plus corrosion resistance. This includes building structures, baffle wall columns and support of tank cover decking. These sections utilize a custom design that optimizes structural properties and cost through innovative use of shape, glass fiber reinforcing and manufacturing process.

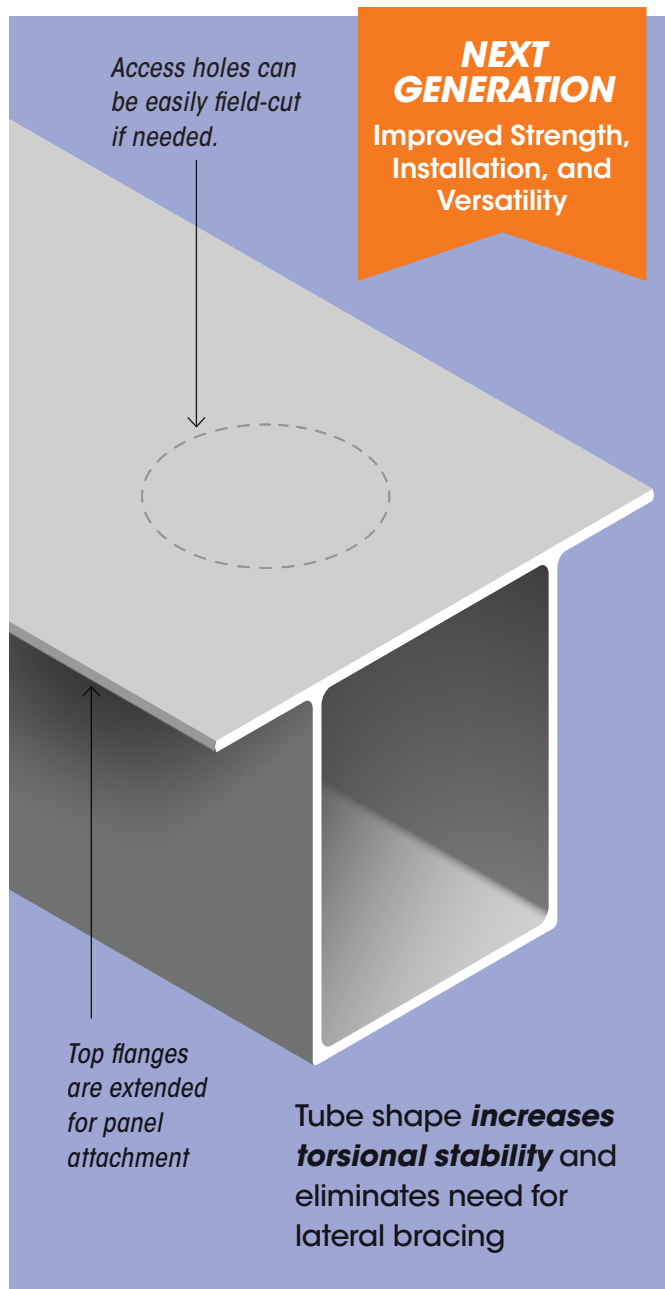
TuffSpan purlins & girts are designed for the harshest environments. Utilizing an iso-polyester or vinyl resin system provides outstanding corrosion protection and is fire retardant with a flame spread rating of 25 or less. The resulting combination of corrosion resistance, non-conductivity and long span capability delivers significant end user benefits and lifetime cost savings.

STRUCTURAL PERFORMANCE

As a result of efficient design, 8F7 Flanged Tube Beams, at lesser weight and without bracing, carry more load than heavier FRP I-Beams and WF-Beams. 8F7 Flanged Tube, at 15% and 30% less weight, has greater load capacity than heavier FRP I-beams and WF Beams with bracing for single span conditions. For two span conditions, the 8F7 capacity is even greater.

EASIER INSTALLATION

The flanged tube shape provides lateral stability eliminating the need for lateral bracing, plates or angles on primary framing or sag rods. FRP components are lighter in weight and far easier to drill and cut in the field than steel components while not requiring hot work permits. These features provide time and cost savings to facilities.



Uses

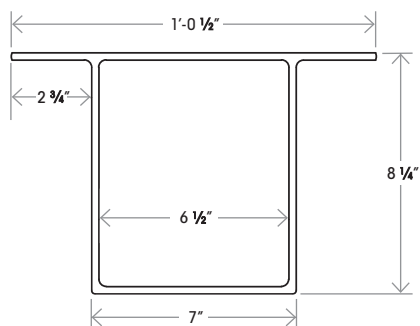
- ▶ Purlins
- ▶ Girts
- ▶ Penetration & Accessory Framing
- ▶ Walkway & Platform Framing

Features

- ▶ Corrosion Resistance
- ▶ Tubular Shape
- ▶ Fire Retardant
- ▶ Lightweight

Benefits

- ▶ Life-cycle Cost Savings
- ▶ Long Span Capability Without Lateral Bracing
- ▶ Maintenance-Free Life
- ▶ Reduced Installation Time & Costs

8F7 Purlin / Girt

Span (ft.)	Allowable Uniform Load (plf or lbs/ft)					
	L/D = 120			L/D = 180		
	1	2	3	1	2	3
16	380	475	594	253	475	469
17	318	421	526	212	421	393
18	269	375	469	179	375	333
19	229	337	421	153	337	285
20	197	304	368	131	304	245
21	171	276	319	114	266	212
22	149	251	278	99	232	185
23	130	230	244	87	204	163
24	115	211	215	77	180	143
25	102	195	191	68	160	127
26	91	180	170	60	143	113
27	81	167	152	54	128	101
28	73	155	136	49	115	91
29	66	145	123	44	103	82
30	59	135	111	40	94	74

1 - Single Span; 2 - Double Span; 3 - Triple Span

Assumes no bearing failure at the base. Assumes no local buckling.

Deflection limits based on average flexural modulus;
flexural capacity based on full scale testing.

W = 7 plf
A = 8.82 in²
I_{xx} = 94.8 in⁴
I_{yy} = 92.6 in⁴
E = 3,841,000 psi
G = 450,000 psi
M = 456,000 in.-lbs.

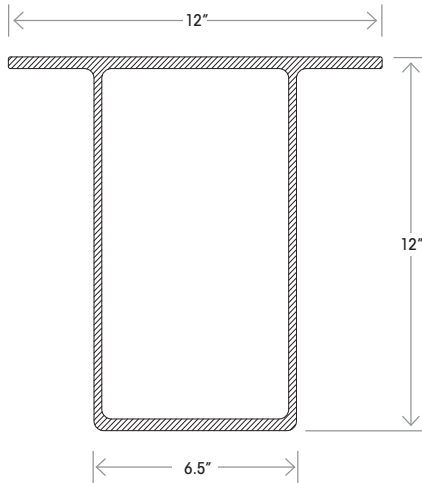
1. TuffSpan 8F7 girts on a chlor-alkali facility
2. TuffSpan 8F7 purlins and girts on a fertilizer storage facility



TuffSpan FRP Structural Shapes

BACK TO
TOP

12F12 Flanged Tube



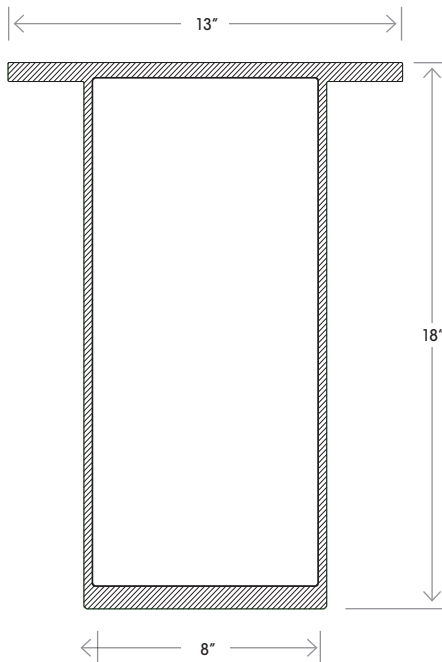
W	= 12 lb/ft	G	= 425,000 psi
A	= 12.64 in ²	M	= 1,225,000 lb-in
I _{xx}	= 284.26 in ⁴	r	= 3.0572 in
I _{yy}	= 118.31 in ⁴	Bf/Bt	= 32
E	= 3,800,000 psi	K	= 1

Allowable Uniform Load (lb/ft) - Unbraced							Column Load (lbs)	
Span (ft.)	L/D = 120		L/D = 180		L/D = 240		Lth (ft.)	Axial (lbs.)
	1	2	1	2	1	2		
21	518	741	346	741	259	624	6	55349
22	451	675	301	675	225	543	7	50850
23	395	618	263	618	197	475	8	47249
24	347	567	232	558	174	418	9	44285
25	307	523	205	493	154	370	10	41792
26	273	483	182	439	137	329	11	39658
27	244	448	163	392	122	294	12	37804
28	219	417	146	351	109	263	13	36176
29	197	388	131	316	98	237	14	34731
30	178	363	119	286	89	214	15	33438
31	161	340	107	259	81	194	16	32272
32	147	319	98	235	73	176	17	31214
33	134	300	89	215	67	161	18	30248
34	122	283	81	196	61	147	19	29361
35	112	267	75	180	56	135	20	28545

Beam FOS = 2.5 **1 - Single Span; 2 - Double Span**

Col. FOS = 3

18F17 Flanged Tube



W	= 16.75 lb/ft	G	= 425,000 psi
A	= 22.47 in ²	M	= 2,000,000 lb-in
I _{xx}	= 1197.3 in ⁴	r	= 3.53 in
I _{yy}	= 279.7 in ⁴	Bf/Bt	= 20.8
E	= 3,800,000 psi	K	= 1

Allowable Uniform Load (lb/ft) - Unbraced							Column Load (lbs)	
Span (ft.)	L/D = 120		L/D = 180		L/D = 240		Lth (ft.)	Axial (lbs.)
	1	2	1	2	1	2		
31	555	555	453	555	339	555	11	72396
32	521	521	411	521	309	521	12	69013
33	490	490	375	490	281	490	13	66041
34	461	461	343	461	257	461	14	63403
35	435	435	314	435	236	435	15	61042
36	412	412	289	412	217	412	16	58914
37	390	390	266	390	200	390	17	56982
38	369	369	246	369	184	369	18	55218
39	341	351	227	351	170	351	19	53600
40	316	333	211	333	158	333	20	52109
41	293	317	196	317	147	317	21	50730
42	273	302	182	302	136	302	22	49448
43	254	288	170	288	127	288	23	48254
44	237	275	158	275	119	275	24	47137
45	222	263	148	263	111	263	25	46091

Beam FOS = 2.5 **1 - Single Span; 2 - Double Span**

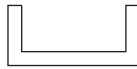
Col. FOS = 3

TuffSpan Standard Shapes

TuffSpan Standard Shapes include fiberglass reinforced plastic channel, angle, tube, wide flange and flat plate sections. The sections are manufactured by pultrusion process that provides consistent properties, close tolerances, good surface finish and optimum strength and stiffness with glass fiber reinforcements up to 60% of the material weight.

The material's iso-polyester or vinyl resin system provides outstanding corrosion protection and is fire retardant with a flame spread rating of 25 or less. The resulting combination of corrosion resistance, non-conductivity and long span capability delivers significant end user benefits and life cost savings.

CHANNEL



Size	Lbs/Ft
3" x 1" x 3/16"	0.68
4" x 1 1/8" x 1/4"	1.13
4 3/4" x 3 1/4" x 1/4"	2.06
6" x 1 5/8" x 1/4"	1.70
6" x 1 5/8" x 5/16"	2.10
6 7/8" x 5 3/8" x 1/4"	3.08
8" x 1 3/4" x 5/16"	2.90
10" x 2 3/4" x 3/8"	4.27

WIDE FLANGE BEAM



Size	Lbs/Ft
6" x 6" x 3/8"	5.30

SQUARE TUBE



Size	Lbs/Ft
1 5/8" x 1 5/8" x 1/8"	0.56
2" x 2" x 1/4"	1.40
3" x 3" x 1/4"	2.20
4" x 4" x 1/4"	3.25

ANGLE



Size	Lbs/Ft
2" x 2" x 1/4"	0.69
3" x 3" x 3/8"	1.53
4" x 4" x 3/8"	2.09
6" x 6" x 3/8"	3.35

FLAT SHEET



Size	Lbs/Ft
3' x 10' x 1/8" Thick	4.1
3' x 10' x 1/4" Thick	7.0
3' x 10' x 3/8" Thick	10.8
3' x 10' x 1/2" Thick	15.3

ROUND TUBE



Size	Lbs/Ft
2 3/8" x 1/4"	1.45

Please contact us for additional information and our Structural Shapes Technical Data Guide.

1. and 2.
TuffSpan flanged tube primary & secondary framing, and roofing panels at a chemical processing plant



Chemical Resistance Guide

BACK TO
TOP

It is important to consider the effects of chemical exposure to materials in the design stage. Many factors should be evaluated, including chemical type, concentration, duration of exposure and operating temperature. Enduro Composites should be contacted for material recommendations regarding specific applications and for information on chemical exposures not listed in this guide.

Enduro Composites offers panels in three standard resin systems, which provide outstanding corrosion protection for a broad range of applications. Premium grade isophthalic polyester and aliphatic hybrid are recommended for splash and spill chemical exposure and moderate operating temperatures. Having better strength retention at elevated temperatures, vinyl ester is recommended for certain higher temperatures and chemical exposures.

Chemical	Max. Cont. Temp. (°F)			
	%	Iso-Polyester	Aliphatic Hybrid	Vinyl Ester
Acetic Acid	10	150	150	210
Acetic Acid	50	125	125	180
Acetone	All	NR	NR	180
Alum	Vapor	150	150	210
Aluminum Potassium Sulfate	All	150	150	210
Aluminum Sulfate	All	150	150	210
Ammonia	-	-	-	100
Ammonium Hydroxide	10	90	90	160
Ammonium Nitrate	All	150	150	210
Benzene	All	90	90	NR
Benzenesulfonic Acid	30	150	150	210
Bromine (Dry & Wet Gases)	100	90	90	100
Calcium Chloride	All	150	150	210
Carbon Tetrachloride	Vapor	70	70	175
Chloride Dioxide	Fumes	90	90	210
Chlorine (Wet Gas)	All	90	90	210
Chlorine Cell Plant	10	-	-	150
Chromic Acid	10	-	-	150
Cooling Tower Water	-	130	130	170
Copper Sulfate	All	150	150	210
Diammonium Phosphate	Vapor	90	90	210
Dibutyl Phthalic	100	90	90	150
Ethylene Chlorohydrin	100	90	90	150
Ethylene Dichloride	All	NR	NR	100
Ethylene Glycol	All	150	150	210
Fatty Acids	100	150	150	210
Ferrous Sulfate	All	150	150	210
Fluosilicic Acid	10	100 (4)	100 (4)	180 (4)
Fungicides, Organic	100	90	90	-
Hydrochloric Acid	15	150	150	210
Hydrochloric Acid	32	100	100	180
Hydrochloric Acid	Vapor	150	150	210
Hydrofluoric Acid	10	100 (4)	100 (4)	150 (4)
Hydrogen Chloride (Gas)	100	120	120	210
Hydrogen Sulfide	All	150	150	210

Chemical	Max. Cont. Temp. (°F)			
	%	Iso-Polyester	Aliphatic Hybrid	Vinyl Ester
Kerosene/Fuel Oil	100	150	150	180
Magnesium Chloride	100	150	150	210
Methyl Alcohol	100	90	90	120
Mineral Oil	100	150	150	210
Naphtha	100	150	150	180
Nitric Acid	5	150	150	160
Nitric Acid	20	-	-	120
Nitric Acid Vapor	20	150	150	180
Phosphoric Acid	85	150	150	210
Potassium Aluminum Sulfate	Sat'd	150	150	210
Sodium Bicarbonate	10	140	140	180
Sodium Bisulfate	All	150	150	210
Sodium Carbonate	All	90	90	160
Sodium Chloride	Sat'd	150	150	210
Sodium Hydroxide	5	150	150	180
Sodium Hydroxide	Vapor	150	150	180
Sodium Hypochlorite	5	125	125	180
Sodium Hypochlorite	Vapor	150	150	180
Sodium Nitrate	All	150	150	210
Sodium Silicate	All	NR	NR	210
Sodium Sulfate	All	150	150	210
Soya Oil	100	130	130	210
Sulfite Liquors	-	120	120	210
Sulfur Dioxide	Dry/Wet	150	150	210
Sulfur Trioxide	100	90	90	210
Sulfuric Acid	50	150	150	210
Sulfuric Acid	70	150	150	180
Sulfuric Acid	Vapor	150	150	210
Tannic Acid	All	150	150	210
Trisodium Phosphate	25	-	-	210
Urea	Sat'd	90	90	180
Water Distilled	100	150	150	210
Water (city/sea)	100	150	150	210
Zinc Sulfate	All	150	150	210

Notes:

- Design engineers and plant personnel should use this guide to help with selecting the appropriate resin for their application. Since specific applications vary, this information should be used as a guide only and not considered as a guarantee of performance.
- The information shown is for standard Tuff Span iso-polyester and vinyl ester materials having a Class I Flame Spread rating.
- The resin system for Tuff Span FM approved panels is an iso-polyester with specific additives for enhanced fire retardance. The chemical resistance for Tuff Span FM Series panels is excellent but should not be considered the same as standard iso-polyester. Enduro Composites should be contacted for specific recommendations.
- A surfacing veil is recommended for this exposure.

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