

# Pultruded Phenolic Grating

SI Units

## Fibergrate

Composite Structures

HIGH PERFORMANCE COMPOSITE SOLUTIONS  
U.S. Coast Guard Approval  
No. 164.040/2/2



- Low Install Cost
- Impact Resistant
- Corrosion
- No Tools
- No Welding
- No Splicing
- No Drilling
- Hand Safe
- Fire Resistant
- Long Life

# Phenolic Grating Products



## Introduction

Safe-T-Span® pultruded phenolic grating manufactured by Fibergrate Composite Structures is an alternative to maintenance-intensive metallic grating for applications where conventional pultruded grating cannot be used. Safe-T-Span phenolic grating can withstand high temperatures and direct contact with flame while maintaining its structural integrity. This feature makes the grating and stair treads ideal for a wide range of offshore, marine, transportation and industrial applications. All Safe-T-Span phenolic grating requiring Coast Guard approval is inspected independently at the production stage to ensure quality control standards are followed. Safe-T-Span phenolic grating is available in a 38mm depth, "I" bar with a 60% or 40% open area (I6015P and I4015P series).

## Phenolic Pultruded Grating Benefits



### Superior Fire Safety Characteristics:

Best combination of flame resistance and low smoke/toxic emissions in industrial pultruded FRP grating. Able to withstand extended direct contact with flame without burning or incurring structural damage, providing a safe pathway for exit.



### Long Service Life:

FRP products provide outstanding durability and corrosion resistance in demanding applications, therefore providing improved product life over traditional materials.



### Low Maintenance:

Corrosion resistant properties of FRP grating and products reduce or eliminate the need for sandblasting, scraping and painting. Products are easily cleaned with a high pressure washer.



### High Strength to Weight Ratio:

Able to safely accommodate heavier weights over greater spans while being less than one-half the weight of steel grating.



### High Corrosion Resistance:

Safe-T-Span® pultruded fiberglass gratings are known for their ability to provide corrosion resistance in the harshest environments.



### Slip Resistance:

Safety is built-in with a grit top surface that provides outstanding adhesion and durability for safe footing, even in wet or oily conditions.



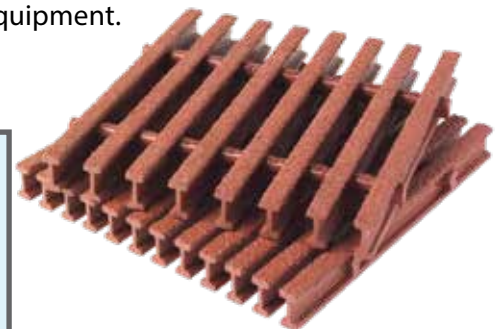
### Low Install Cost:

Due to ease of fabrication and lightweight, FRP pultruded phenolic grating eliminates the need for heavy lifting equipment.



## Phenolic Grating Applications

- Offshore Platforms
- Equipment Skids
- Workboats
- Marine Vessels
- Access & Wellhead Platforms
- Stairways
- Refineries
- Petroleum Processing

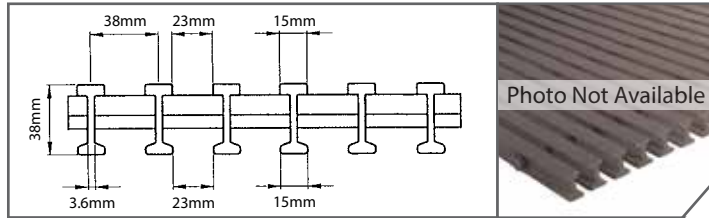


# Product Selection and Details

## Grating Details

### 38mm Deep I6015P

# of Bars/ m of Width	Load Bar Depth	Open Area	Load Bar Centers	Approximate Weight
26	38mm	60%	38mm	13.8 kg/m <sup>2</sup>

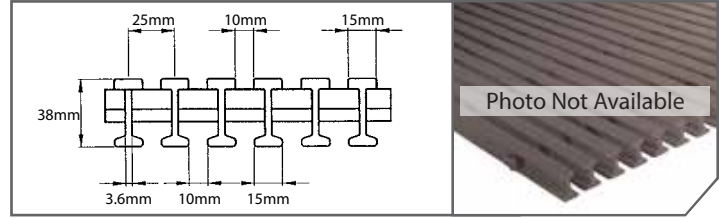


Section Properties per m of Width:  $A = 6.8 \times 10^3 \text{ mm}^2$   $I = 1.3 \times 10^6 \text{ mm}^4$   $S = 6.5 \times 10^4 \text{ mm}^3$   
Average EI = 43,862.4 kN-mm<sup>2</sup> (SPAN ≥ 610mm)

### 38mm Deep I4015P (ADA Compliant)



# of Bars/ m of Width	Load Bar Depth	Open Area	Load Bar Centers	Approximate Weight
39	38mm	40%	25mm	20.2 kg/m <sup>2</sup>

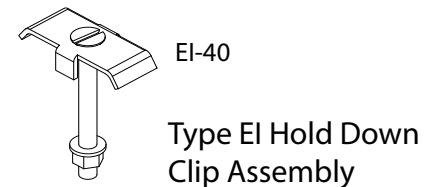
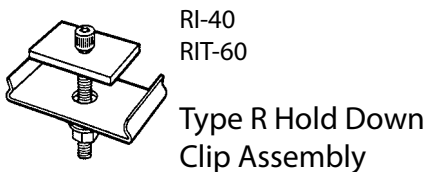


Section Properties per m of Width:  $A = 1.0 \times 10^4 \text{ mm}^2$   $I = 1.9 \times 10^6 \text{ mm}^4$   $S = 9.7 \times 10^4 \text{ mm}^3$   
Average EI = 65,035.7 kN-mm<sup>2</sup> (SPAN ≥ 610mm)

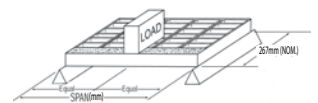
Series	Load Bar Spacing	Stocked Sizes		Load Bars/m	Wt./m <sup>2</sup>	Open Area
		Width (mm)	Length (m)			
I6015P	38mm	914, 1219	3.0, 3.7, 6.1, 7.3	26	13.8 kg	60%
I4015P	25mm	914, 1219	3.0, 3.7, 6.1, 7.3	39	20.2 kg	40%

## Clip Assemblies for Safe-T-Span® Phenolic Grating

Fibergate offers a number of 316 stainless steel clip assemblies for attaching panels of Safe-T-Span pultruded phenolic grating to structural supports.



## Safe-T-Span® Pultruded Phenolic Stair Treads



TREAD TYPE	Load (kN)	Span (mm)					
		400	600	800	1000	1200	
		SPAN/150	2.7	4.0	5.3	6.7	8.0
38mm Deep I6015P	1	Deflections in mm	0.1	0.5	1.0	1.8	2.8
	2		0.3	0.9	1.9	3.4	5.7
38mm Deep I4015P	1		0.2	0.3	0.7	1.2	2.0
	2		0.4	0.7	1.2	2.2	3.7

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## Performance Data

All tests were conducted on actual finished product.

### Fire Safety

Safe-T-Span® pultruded phenolic grating meets or exceeds the following fire safety standards.

Test	Performance
<b>ASTM E84*</b>	<b>Flame Spread Index:</b> <b>UV Coated:</b> 25 or less <b>Non-UV Coated:</b> 25 or less
<b>ASTM D635 Horizontal Burning Test</b>	The specimen meets the HB classification requirement because it did not burn past the 25mm reference mark.
<b>UL 94 Flamability Test</b>	Classification: 94V-0
<b>ASTM D2863 Oxygen Index Test</b>	The specimen did not ignite with the oxygen concentration set at 100%.

\*Reports available upon request.

### Smoke and Toxic Fume Emissions

Safe-T-Span® pultruded phenolic grating generates significantly less smoke and toxic fumes than conventional grating when exposed to fire.

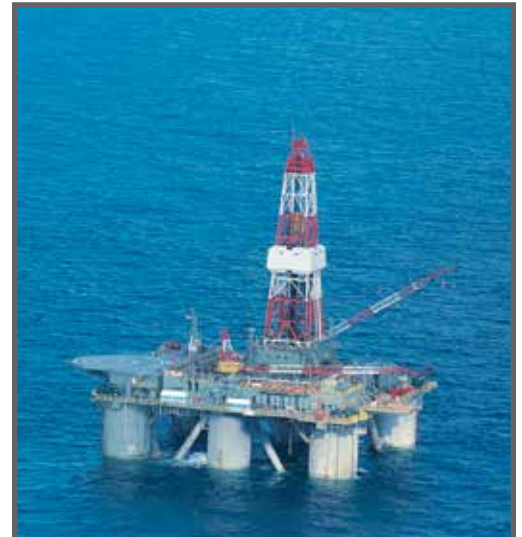
Test	Description	Performance	
		Max. Ds corrected	Ds@4 Min
<b>ASTM E662 (NFPA 268)</b>	<b>Non-Flaming</b>	1.8	.22
		2.7	.50
<b>ASTM E800 Products of Combustion</b>	<b>Carbon Monoxide</b>	300 ppm	
	<b>Carbon Dioxide</b>	5575 ppm	
	<b>Hydrogen Chloride</b>	None Detected	
	<b>Hydrogen Cyanide</b>	None Detected	
	<b>Hydrogen Fluoride</b>	None Detected	
	<b>Oxides of Nitrogen</b>	None Detected	
	<b>Sulfur Dioxide</b>	None Detected	

### Independent Fire Test

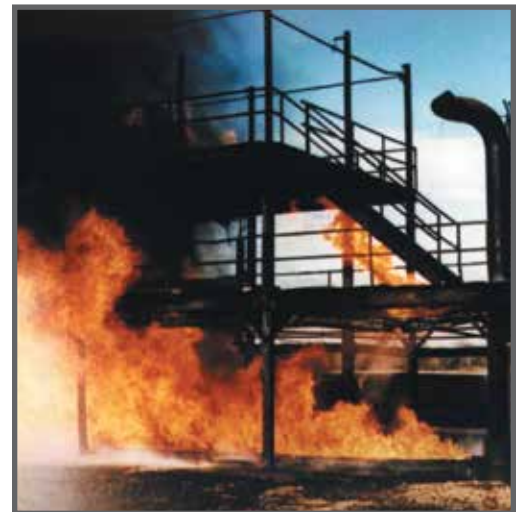
Independent Fire Exposure Test of pultruded grating as outlined in the U.S. Coast Guard Draft Memorandum: Policy File Memorandum on the use of Fiber Reinforced Plastic (FRP) Deck Grating (dated June of 2001).

The test consisted of exposing Safe-T-Span® pultruded phenolic grating to a 60-minute fire test at temperatures exceeding 926 degrees centigrade. The grating was tested at a clear span of 1118 mm and retained its structural integrity after 60 minutes in the furnace as evidenced by post-loading of 1.96 kN (greater than 4.5 kN/m<sup>2</sup>).

Test reports are available from Fibergrate Composite Structures at 1-800-527-4043.



U.S. Coast Guard Approval No: 164.040/2/2





# Test Data and Approvals

## Regulatory Information

Fibergrate's products are designed to comply with the regulations of many internationally recognized safety organizations. These products have undergone extensive independent testing and received numerous certifications, approvals and authorizations including the following:

### U.S. Coast Guard (USCG)

- **Pultruded Grating:** Phenolic Resin - USCG PFM 2-98, Level 2 & 3 USCG Approval No. 164.040/2/2
- **Molded Grating:** Authorized for use where Fire Integrity is not a concern yet requires a flame spread index of less than or equal to 25 (ASTM E84) (Marine Safety Manual, Volume II, Paragraph 5.C.6.d(2))

### ISO 9001:2008 Certified Facilities

- **Certificate No:** CERT-05835-2003-AQ-HOU-ANAB

### ABS Type Approval

- **Pultruded Grating:** Phenolic Resin Level 2 & 3 - Certificate Number: 01-HS172578-3-DUP
- **Molded Grating:** ASTM E84 less than or equal to 25 - Certificate Number: 01-HS34733-X

### DNV GL Type Approval

- **FRP Grating:** Certificate Number: TAF000003C



## Chemical Resistance

C - Constant Exposure    S - Frequent Exposure    I - Infrequent Exposure    N - Not Recommended

Chemical Environment	% Concentration	Rating	Chemical Environment	% Concentration	Rating
Acetic Acid	50	I	Hydrochloric Acid	1-10	I
Acetone	100	C	Hydrochloric Acid	11-37	I
Alcohols	100	C	Hydrofluoric Acid	1-100	N
Alum	100	C	Lime Slurry	Max	C
Benzene	100	C	Methylene Chloride	100	C
Carbon Tetrachloride	100	C	Nickel Salts	Sat	C
Chlorinated Hydrocarbons	100	C	Nitric Acid	1-100	N
Chlorine Dioxide	100	C	Phenol	All	C
Chlorobenzene	100	C	Phosphoric Acid	85	S
Chloroform	100	C	Sodium Hypochlorite	1-8	N
Chromic Acid	1-100	N	Sodium Hydroxide	All	N
Crude Oil	100	C	Sulfuric Acid	1-30	I
Dichlorobenzene	100	C	Sulfuric Acid	35-98	N
Ethers	100	C	Toluene	100	C
Formaldehyde	All	C	Trichloroethane	100	C
Fuel (gasoline, diesel)	100	C	Water (fresh, salt, waste)	Max	S

# Load Tables for I4015P & I6015P Grating

UNIFORM LOAD TABLE - Deflection in Millimeters												
Clear Span (mm)	Style	UNIFORM LOAD = kN/m <sup>2</sup>									Max Rec Load (kN/m <sup>2</sup> )	Ultimate Load (kN/m <sup>2</sup> )
		3	5	10	15	20	30	50	75	100		
400	I6015	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	0.4	0.5	328	657
	I4015	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	0.4	492	985
600	I6015	< 0.3	< 0.3	0.4	0.6	0.7	1.1	1.8	2.7	3.6	179	358
	I4015	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	0.4	0.6	0.9	1.2	268	537
800	I6015	0.4	0.7	1.3	1.9	2.6	3.9	6.5	9.7	---	110	220
	I4015	< 0.3	0.4	0.8	1.2	1.6	2.5	4.1	6.1	8.1	165	331
1000	I6015	0.9	1.5	3.0	4.6	6.1	9.1	---	---	---	81	162
	I4015	0.6	1.0	2.1	3.2	4.2	6.4	10.6	---	---	122	244
1200	I6015	1.8	3.0	6.0	9.0	12.0	---	---	---	---	65	131
	I4015	1.2	2.0	4.0	6.0	8.1	12.1	---	---	---	98	196
1400	I6015	3.2	5.4	10.7	---	---	---	---	---	---	49	99
	I4015	2.1	3.5	7.0	10.5	---	---	---	---	---	74	148
1600	I6015	5.4	9.0	---	---	---	---	---	---	---	33	66
	I4015	3.6	6.0	11.8	---	---	---	---	---	---	50	99
1800	I6015	8.7	---	---	---	---	---	---	---	---	30	61
	I4015	5.8	9.7	---	---	---	---	---	---	---	46	91

CONCENTRATED LINE LOAD TABLE - Deflection in Millimeters												
Clear Span (mm)	Style	LINE LOAD = kN per m of Panel Width (kN/m of width)									Max Rec Load (kN/m)	Ultimate Load (kN/m)
		0.7	1.5	3.0	5.0	10.0	15.0	20.0	25.0	30.0		
400	I6015	< 0.3	< 0.3	< 0.3	< 0.3	0.3	0.6	0.8	1.0	1.2	63	126
	I4015	< 0.3	< 0.3	< 0.3	< 0.3	0.4	0.6	0.8	1.0	1.1	95	190
600	I6015	< 0.3	< 0.3	0.4	0.6	1.1	1.7	2.2	2.8	3.3	54	108
	I4015	< 0.3	< 0.3	< 0.3	0.3	0.7	1.1	1.5	1.9	2.3	81	163
800	I6015	< 0.3	0.4	0.8	1.3	2.5	3.8	5.1	6.3	7.6	47	93
	I4015	< 0.3	< 0.3	0.5	0.8	1.7	2.5	3.4	4.2	5.1	70	140
1000	I6015	0.3	0.7	1.4	2.3	4.7	7.1	9.5	11.9	---	41	81
	I4015	< 0.3	0.4	0.9	1.6	3.2	4.7	6.3	7.9	9.5	61	122
1200	I6015	0.5	1.1	2.3	3.9	7.9	11.9	---	---	---	36	72
	I4015	0.4	0.8	1.6	2.6	5.3	7.9	10.6	---	---	54	109
1400	I6015	0.8	1.8	3.7	6.1	12.3	---	---	---	---	33	66
	I4015	0.6	1.2	2.5	4.1	8.2	12.3	---	---	---	50	99
1600	I6015	1.3	2.7	5.5	9.1	---	---	---	---	---	30	61
	I4015	0.8	1.8	3.6	6.0	12.1	---	---	---	---	46	91
1800	I6015	1.8	3.9	7.8	---	---	---	---	---	---	27	55
	I4015	1.2	2.6	5.2	8.6	---	---	---	---	---	41	82

1. The above gratings were tested in accordance with the procedure recommended by the Fiberglass Grating Manufacturers Council of the Composites Fabricators Association.
2. Deflections have been limited to approximately 12.7mm or Clear Span/100 as recommended by the Fiberglass Grating Manufacturers Council.
3. Walking loads, typically 2.4-3.1 kN/m<sup>2</sup> maximum are recommended for pedestrian traffic. Deflections for worker comfort are typically limited to the lesser of 9.5mm or CLEAR SPAN divided by 125, for a firmer feel, limit deflection to the lesser of 6.4mm or CLEAR SPAN divided by 200.
4. The designer should not exceed the MAX RECOMMENDED LOAD at any given span. MAX RECOMMENDED LOAD represents a 2.1 factor of safety on ULTIMATE CAPACITY.
5. ULTIMATE CAPACITY represents a complete and total failure of grating. Values are provided to illustrate the reserve strength of the grating at a given span and are NOT to be used for design. Functionality of grating is limited to MAX RECOMMENDED LOAD.
6. The allowable loads in this table are for STATIC LOAD CONDITIONS at ambient temperatures only. Allowable loads for impact or dynamic conditions should be a maximum of ONE-HALF the values shown. Long term loads will result in added deflection due to creep in the material and will also require higher safety factors to ensure acceptable performance.

For applications at elevated temperatures, consult the factory. The designer is further referenced to ASCE Structural Plastics Design Manual.

# Phenolic Projects

## Fibergrate's Phenolic Grating

Fibergrate has provided a Coast Guard approved pultruded phenolic grating to the market for more than a decade and has participated in a number of large projects requiring a product with the strenuous flame and smoke indexes found in phenolics. Both of Fibergrate's ISO 9001-2008 certified manufacturing facilities are also certified to provide Coast Guard approved phenolic products. Phenolics are heavily used in the offshore market, and Fibergrate has successfully supplied Safe-T-Span® phenolic gratings to Shell, Chevron Texaco, Unocal, Saudi Aramco, Woodside, BP, Norsk Hydro, Pemex, El Paso Energy, Exxon Mobil and Conoco Phillips. Fibergrate has supplied over 27,870 square meters of grating for high profile projects such as Shell's NaKika and Bonga, the Enfield FPSO and BP's Azerbaijan.

## Shell NaKika

Shell's NaKika Semi Submersible Drilling and Production Platform located in the Gulf of Mexico required 14,864 square meters of Fibergrate's I6015P coated phenolic pultruded grating. Phenolic grating and treads were used throughout the platform, including the internal maintenance spaces within the hull to the apron surrounding the pedestal cranes. During the final commissioning of the platform, while at a fabrication yard in Texas, Fibergrate's inspection of the installed gratings showed an estimated weight savings amounting to approximately 907 metric tons! This savings was achieved by the use of Fibergrate's I6015P Phenolic, over typical 32mm galvanized gratings.



## Chevron Tahiti and Blind Faith

Fibergrate successfully supplied 3,716 square meters of USCG approved Safe-T-Span® pultruded I6015P UV coated phenolic grating, fabricated per Chevron drawings, for both the Tahiti and Blind Faith offshore platforms. The grating was installed throughout the structure, including the crew's living quarters. These projects further confirm Fibergrate's commitment as a valued and trusted vendor to the offshore oil and gas industry.

# Structural Fire Integrity Matrix

Matrix from Det Norske Veritas (DNV-GL) Type Approval Certificate No. TAF000003C

Location	Service	Fire Integrity
<b>Service</b>	Walkways or areas which may be used for escape, or access for fire fighting, emergency operation or rescue	L1 <sub>A</sub>
	Fire Integrity	L3
<b>Cargo Pump Rooms</b>	All personnel walkways, catwalks, ladders, platforms or access areas	L1
<b>Cargo Holds</b>	Walkways or areas which may be used for escape, or access for fire fighting, emergency operation or rescue	L1
	Personnel walkways, catwalks, ladders, platforms or access areas other than those described above	L0
<b>Cargo Tanks</b>	All personnel walkways, catwalks, ladders, platforms or access areas	L0 <sub>B</sub>
<b>Fuel Oil Tanks</b>	All personnel walkways, catwalks, ladders, platforms or access areas	L0
<b>Ballast Water Tanks</b>	All personnel walkways, catwalks, ladders, platforms or access areas	L0
<b>Cofferdams, void spaces, double bottoms, pipe tunnels, etc.</b>	All personnel walkways, catwalks, ladders, platforms or access areas	L0
<b>Accommodation, service, and control spaces</b>	All personnel walkways, catwalks, ladders, platforms or access areas	NOT PERMITTED
<b>Lifeboat embarkation or temporary safe refuge stations in open deck areas</b>	All personnel walkways, catwalks, ladders, platforms or access areas	L2
<b>Open Decks or semi-enclosed areas</b>	Operational areas and access routes for deck foam firefighting systems on tank vessels	L2
	Walkways and areas that may be used for escape, or access for firefighting systems and AFFF hose reels, emergency operation, or rescue on MODUs and production platforms including safe access to tanker bows	L2 <sub>C</sub>
	Walkways or areas that may be used for escape or access for firefighting, emergency operation or rescue other than those used above	L3
	Personnel walkways, catwalks, ladders, platforms or access areas other than those described above	L3
	Gangway for safe access to bow on tankers according to IMO MSC.62(67)	L2 <sub>D</sub>

1. If machinery space does not contain any internal combustion machinery, other oil burning, oil heating or oil pumping units, fuel oil filling stations, or other potential hydrocarbon fire sources and has not more than 2.5 kg/m<sup>2</sup> of combustible storage, gratings of L3 integrity may be used in lieu of L1.
2. Gratings that are electrically conductive shall be required. Acceptance criteria for resistance per unit length and to earth is: < 0.1 M.Ω to earth. Test standard ASTM D257-91, ref. DNV GL-CP-0070 "Fibre reinforced thermosetting plastic piping systems - Non-metallic materials"
3. Tested with furnace temperature curve according to ASTM E119 (i.e. not tested for Hydrocarbon or Jet fire exposure).
4. IMO 2010.FTP.Code Part 5 and 2 to be separately documented.

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