



PRODUCT GUIDE

COMPOSITE FIBER TECHNOLOGIES

IMPERIAL VERSION 05, 2021

WAGNERS

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DISCLAIMER

The information provided in this publication, including any technical specification, is specific to pultruded fiber reinforced polymer (composite fiber) products supplied by Wagners CFT Manufacturing Pty Ltd (“Wagners”), is provided primarily for marketing purposes, and is subject to change without notice.

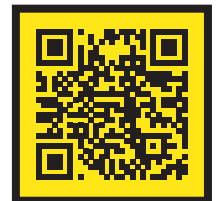
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PRODUCT AVAILABILITY AND OTHER INFORMATION

It is expected that the content of this Product Guide will change over time as a result of improvements to the materials, properties and finishes of products, and due to changes to the product range.

Therefore it is important to check that you are using the most up to date information by referring to the Wagners website.

VISIT WAGNERS CFT WEBSITE
BY SCANNING THE QR CODE





PINKENBA WHARF, BRISBANE, QLD, AU

WORLD'S FIRST MARINE INFRASTRUCTURE THAT IS MADE WITH GEOPOLYMER CONCRETE

LARGEST USE OF GFRP BARS (190 MILES) AND PULTRUDED FRP SECTIONS (330 TONS) IN A SINGLE JOB IN AUSTRALIA

PHOTOGRAPHY BY DJ MENGEL

PREFACE



This Product Guide is intended for all potential users of Wagners products, including project owners and managers, architects, engineers, project certifiers, and builders. It provides users of this publication with the general characteristics of Fiber Reinforced Polymers (FRP), and provides technical specifications for all of the Wagners pultruded products.

The vision of Wagners is not just to be a supplier of FRP structural products, but also to provide the market with innovative engineered structural solutions for many civil and structural applications where fiber composites have a distinct advantage. To support this vision, this Product Guide is part of a suite of publications that includes member design, connection design, and many pre-engineered application and building system designs.

The goal of this publication is to enable designers, certifiers and builders to specify and use Wagners products with ease and confidence in the quality and integrity of the data presented and the products supplied.

The product specifications and properties presented in this Product Guide are the result of the materials, manufacturing processes and fiber layups chosen by Wagners, and are therefore specific to these particular products. Other manufacturers will not necessarily use the same materials, manufacturing process and fiber layups, resulting in different mechanical properties. Therefore similar structural shapes produced by other manufacturers will not have identical properties and performance to Wagners' products.

INTRODUCTION



PRODUCTS AND SERVICES

Wagners is a diversified global construction materials and services provider and an innovative producer of New Generation Building Materials that reduce the impact of heavy construction materials on the environment.

Wagners are a producer of cement, concrete, aggregates, composite products and have developed innovative technology with its Earth Friendly Concrete product. Wagners are also providers of transport services, precast concrete and reinforcing steel.

A LONG AND STRONG HISTORY

Established in 1989 in Toowoomba, Queensland, Wagners is an ASX-listed company operating in domestic and international markets. Wagners started with three trading divisions – Wagners Concrete, Quarries and Transport and rapidly expanded to include cement, fly ash and lime, reinforcing steel, on-site concrete supply, contract crushing and bulk transport.

After many years of research and development, Wagners composite fiber products and an innovative concrete product that contains no cement, Earth Friendly Concrete, are now integral in reducing the worlds carbon emissions and impact on the environment caused by traditional building materials.



KEY AWARDS AND MILESTONES

2009: Winner Premier of Queensland's Regional Smart Business Award for having made the largest regional impact in the states 150 year history.

2016: Winner, Flatwork Category, American Concrete Institute (ACI) Excellence in Concrete Awards for the innovative use of Earth Friendly Concrete (EFC) geopolymer in pavements (Project: Toowoomba Wellcamp Airport).

2017: Listed on the Australian Stock Exchange (ASX).

2018: Inducted into the Queensland Business Leaders Hall of Fame in recognition of their intrepid entrepreneurship in successfully completing highly challenging infrastructure projects nationally and internationally.



We are committed to achieving and maintaining the highest possible standard of workplace health and safety across the entire business.

WAGNERS IS ISO 9001, ISO 14001 AND ISO 45001 CERTIFIED, ACCREDITED BY SAI GLOBAL.



WAGNERS COMPOSITE FIBER TECHNOLOGIES

COMPOSITE MATERIALS HAVE PROVEN TO BE A MATERIAL OF CHOICE INCREASINGLY USED BY CIVIL ENGINEERS IN RECENT YEARS.

As the use of composite materials becomes more common, their performance advantages have been well received by the aerospace and marine industries. Additional performance advantages such as high strength, low weight and a long service life are achieved as Wagners composite products do not corrode, rot or shrink. In certain applications, composite materials are superior to traditional construction materials such as steel and wood, ensuring a practical investment for the future of the asset.

Wagners has pioneered the use of composite materials around the world, exporting products from our US and Australian facilities to locations such as the United Kingdom, New Zealand, Russia, Middle East, Malaysia, Brazil and Canada. We are credited with the manufacture, design, and installation of the world's first composite road bridge on a public road network. Our continued research and development ensures we remain a leader in the design and implementation of this exciting building material.

In the past, our composites have been used in transportation, marine and electrical applications, amongst many others. However, it is not until recently that the ability to build large structures has been fully utilized by our experienced staff. Many years of research and development have resulted in the successful application of composite fiber technology to a number of products including wharves, road bridges, electrical crossarms and pedestrian structures.

PULTRUSION

Wagners use the 'pultrusion process' to fabricate the structural fiberglass sections. These sections are traditional in geometry and shape to that of rolled hollow section steel but are manufactured from fiberglass reinforcements and vinyl ester resins. The material combination has been chosen by Wagners to optimize the structural system as well as maximize cost efficiency.

Electrical-Corrosion Resistant (ECR) type glass has been selected as the initial building block for all Wagners FRP products. This high grade material has been selected for its impressive strength performance and workability. ECR type glass is also widely reported as having excellent chemical resistant characteristics.

To bind the glass fibers together, Wagners typically uses Vinyl Ester (VE) resin. VE resin has been selected over unsaturated polyester and epoxy resins because it provides strength and chemical resistant properties similar to epoxy resin to a significant cost advantage.





BOARDWALKS



PEDESTRIAN BRIDGES



ROAD BRIDGES



**TIMBER
REHABILITATION**



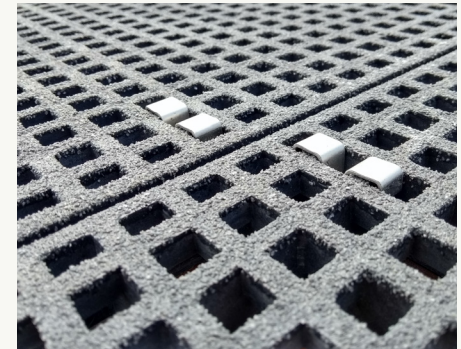
**REINFORCING
FRP REBAR**



**MARINE
STRUCTURES**



STAIRS



DECKING



**WATER
STRUCTURES**



**ELECTRICAL
CROSSARMS**



LIGHT POLES



UTILITY POLES

ENVIRONMENTAL PERFORMANCE

Wagners are committed to reducing waste and the consumption of resources and avoiding the pollution of land, air and water. This is achieved through recovering and recycling our waste products where possible, and by strict adherence to licensing conditions, industry codes and regulations.

Wagners' pultruded FRP products are currently used as substitutes for hardwood in marine and other corrosive environments offering a long-life asset with no detrimental impact on these environments. With hardwood forests in decline around the world, the use of FRP products in these applications will help preserve this important natural resource. The same benefits apply to the use of Wagners pultruded FRP products in place of steel, aluminum and reinforced concrete.

Key findings of a cradle-to-grave life cycle analysis by the Life Cycle Engineering and Management Research Group at The University of New South Wales by Kara and Manmek (2009) were:

"In general, the life cycle of the fiber reinforced polymer products have significantly lower embodied energy than the traditional products. As a conclusion, based on the defined scopes and assumptions of this analysis, it was found that composite products are estimated to perform better than the traditional products in terms of their embodied energy that incurred during their life cycle stages. At the material stage, they perform the best. Their outstanding material properties such as strength and lightness are genuinely an advantage over the traditional materials in this modern era."

More specifically, the report made the following conclusion regarding a power pole cross-arm produced by Wagners:

"A power-pole cross-arm that is made from the fiber composite has an environmental impact which is 77% less than that of a hardwood timber power-pole cross-arm. This equates to a lessening on the effects towards human health, the ecosystem quality and resource use during its life cycle."

The full report can be downloaded from the Wagners website at:
www.wagnerscft.com



**COOKTOWN FISHING PLATFORM
COOKTOWN, NORTH QLD, AU**

Today the end of life strategy for composites is disposal. Whilst this is not the preferred end of life strategy, it does no harm to the environment as the product once cured, is inert. It must not be disposed of in fire as toxic fumes may be released. The recycling options is also available to reuse the FRP products/constituent materials in various applications. Research is currently under way to make the process highly efficient.

Our environmental performance advantages includes:

- » Low embodied energy
- » Good thermal insulator - conserving energy while reducing operating costs
- » Durable - long life cycle reducing maintenance and replacement costs
- » Main ingredient is glass which is made from sand - an abundant resource

FRP STRUCTURES LIFE CYCLE



STEP ONE
PRODUCT OR PROJECT
DESIGNING STAGE

Appropriate FRP sections will be selected and certified designs will be developed for each project based on the application and strength/deflection requirements.

STEP TWO
MANUFACTURING STAGE
(PULTRUSION)

The selected profiles are manufactured following Wagners unique pultrusion process using high quality structural glass reinforcement and a resin matrix.

STEP THREE
FABRICATION STAGE
(POST PROCESSING)

The pultruded FRP profiles are assembled together using bonding or mechanical connections to fabricate the whole structure as per the approved design.

STEP FOUR
USAGE LIFE

FRP products perform significantly better than traditional products at this stage. This is due to their lightweight and corrosion resistance properties.

STEP FIVE
END-OF-LIFE
STAGE

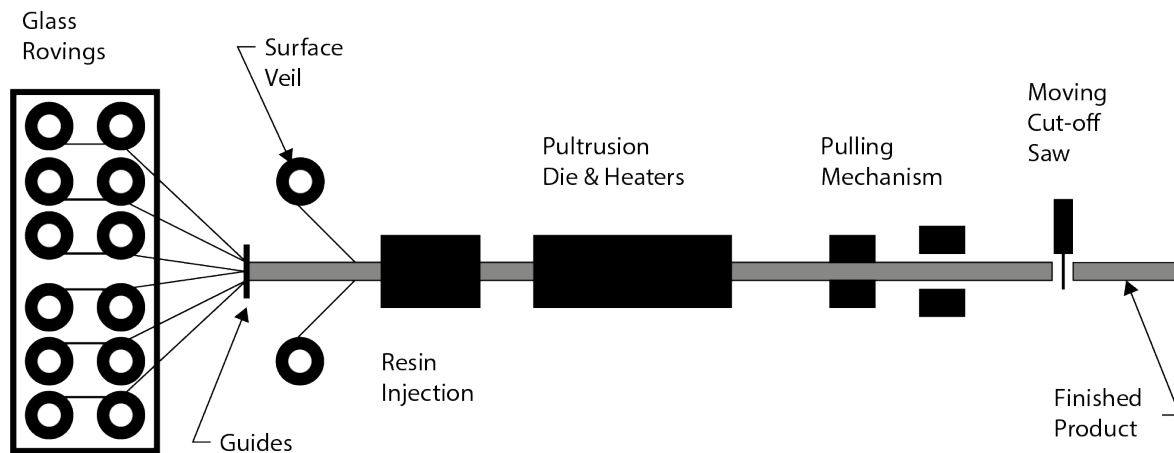
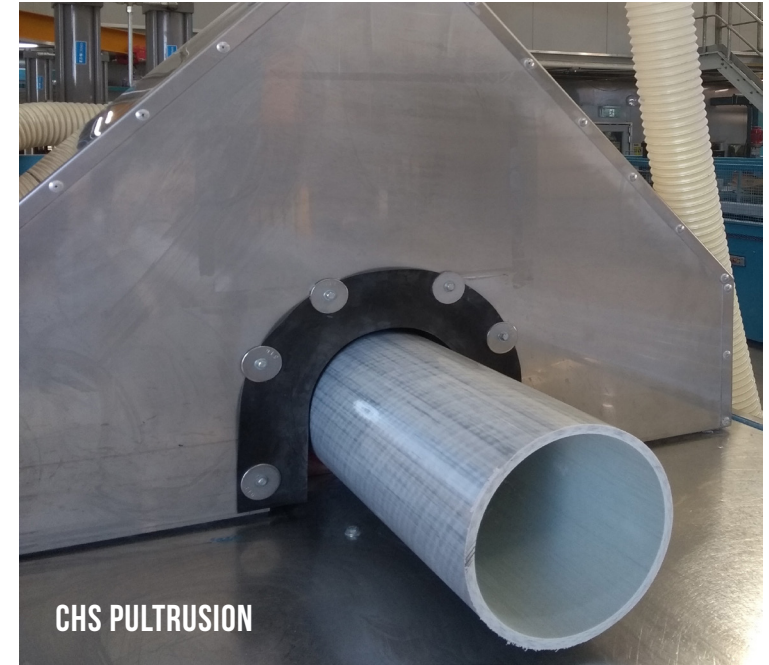
FRP products can be recycled where the glass can be retrieved and reused as reinforcements, while the resin part can be crushed into a fine powder and used as filler materials.

FIBER REINFORCED PRODUCT MANUFACTURING PROCESS (PULTRUSION PROCESS)

The term pultrusion combines the words “pull” and “extrusion”. Extrusion is the pushing of material, such as a billet of aluminum, through a shaped die, whereas pultrusion, is the pulling of material, such as fiber and resin, through a shaped die.

The pultrusion process starts with racks holding rolls of fiber glass roving. The fiber reinforcement used by Wagners is glass fiber. This raw fiber is pulled off the racks and is guided to the necessary shape, orientation and layers before entering a resin injection system. A surface veil is incorporated to improve surface finish and provide resistance to Ultra Violet (UV) degradation.

The fiber reinforcement becomes fully injected (wetted-out) with the catalyzed resin such that all the fiber filaments are thoroughly saturated with the resin mixture. This wetted fiber then enters the heated curing die. The heat initiates a chemical reaction in the resin which causes it to harden and the finished profile exits the die and is subsequently cooled.



PULTRUSION PROCESS

MERSEY RIVER FOOTBRIDGE
KEJIMKUJIK NATIONAL PARK,
NOVA SCOTIA, CA



PART TWO

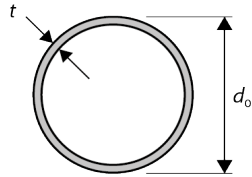
STRUCTURAL SECTIONS

STANDARD STRUCTURAL SECTIONS
BONDED STRUCTURAL SECTIONS



STANDARD STRUCTURAL SECTIONS

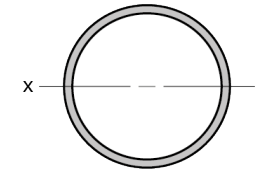
CIRCULAR HOLLOW SECTIONS



DIMENSIONS AND SECTION PROPERTIES

CIRCULAR HOLLOW SECTIONS

Fiber Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS					SECTION PROPERTIES					
	Nominal Designation d_o	Exact Dimensions		Mass per foot lb/ft	External Surface Area per ft ft ² /ft	Cross Section Area A_g in ²	About any axis			Torsion Constant J in ⁴	Torsion Modulus C in ³
		Outer Diameter d_o	Thick. t				I	Z	r		
		in	in								
WGN-C1000	3.5	3.50	0.236	2.13	0.92	2.422	3.24	1.9	1.2	6.5	3.7
WGN-C2000	6	6.06	0.228	3.70	1.59	4.186	17.84	5.9	2.1	35.7	11.8
WGN-C3000	9	9.06	0.382	9.31	2.37	10.410	98.17	21.7	3.1	196.3	43.3
WGN-C4000	11.5	11.54	0.374	11.71	3.02	13.115	204.45	35.4	3.9	408.9	70.9
WGN-C5000	12	11.85	0.531	16.89	3.10	18.900	303.34	51.2	4.0	606.7	102.4

SUPPLY CONDITIONS

Finish

The standard finish for the Circular Hollow Section (CHS) product is painted.

Length

The CHS profiles are typically manufactured up to 38ft. in length based on typical transport limitations. Longer lengths are available upon request

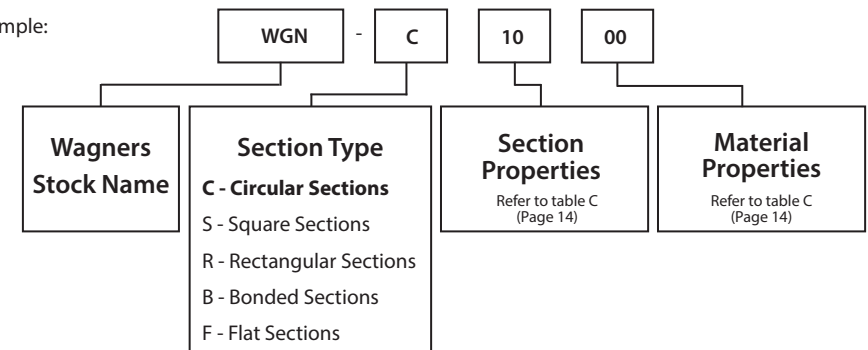
Post-Processing

Wagners can provide members cut to length with predrilled holes and inserts in accordance with client drawings. Contact Wagners for further details and pricing.

SDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the OSHA USA. Consult reference no: CET01115 for details at www.wagnerscft.com

Example:



MECHANICAL PROPERTIES

PROPERTY	RESULT						UOM	STANDARD
	C1000	C1010	C2000	C3000	C4000	C5000		
Tensile Strength – Longitudinal	52.4	44.5	88.5	92.1	92.1	92.1	ksi	ISO 527-4
Tensile Modulus of Elasticity – Longitudinal	5181	3324	5265	5135	5135	5135	ksi	
Compressive Strength – Longitudinal	38.7	42.8	57.3	57.3	57.3	57.3	ksi	ASTM D6641
Compressive Modulus of Elasticity – Longitudinal	5685	4238	4830	5972	5972	5972	ksi	
In-Plane Shear Strength – Longitudinal	13.2	13.3	12.2	13.5	13.5	13.5	ksi	ASTM D7078

*The values in the table are the characteristic values to be used for design in normal ambient conditions. It does not include adjustment factors to account for temperature, humidity, and chemical environments.

PHYSICAL PROPERTIES

PROPERTY	NOTATION	VALUE	UNIT	TEST METHOD
Density	r	127	lb/ft ³	ASTM D792
Barcol Hardness		60	-	ASTM D2583
Water Absorption		0.2	%	ISO 62
Glass Transition Temperature	T_g	266	°F	ASTM D7028
Fiber Mass Fraction	W_f	77.4	%	ISO 1172
Fiber Volume Fraction	V_f	57.7	%	
Coefficient of Thermal Expansion – Longitudinal	α_L	2.79E-06	/ °F	ISO 11359-2

The values in the table are mean values obtained from tests at ambient temperature and relative humidity.

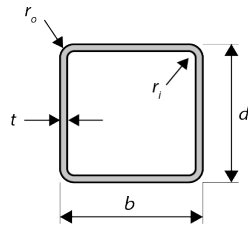
TABLE C

CIRCULAR HOLLOW SECTIONS (CHS)							
First digit: Dimension		Second digit: Wall Thickness		Third digit: Reinforcement		Fourth digit: Resin	
Value	Dimension, in	Value	Wall thickness, in	Value	Reinforcement Type	Value	Resin Type
1	3.5	0	0.2	0	ECR-glass rovings with 56° wound fibers	0	Vinyl Ester
				1	ECR-glass rovings with 71° wound fibers		
2	6	0	0.2	0	ECR-glass rovings with 50° wound fibers	0	Vinyl Ester
3	9	0	0.4	0	ECR-glass rovings with 50° wound fibers	0	Vinyl Ester
4	11.5	0	0.4	0	ECR-glass rovings with 30° wound fibers	0	Vinyl Ester
5	12	0	0.5	0	ECR-glass rovings with 30° wound fibers	0	Vinyl Ester

LIGHT POLES WELLCAMP BUSINESS PARK, QLD, AU



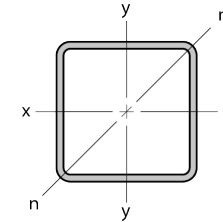
SQUARE HOLLOW SECTIONS



DIMENSIONS AND SECTION PROPERTIES

SQUARE HOLLOW SECTIONS

Fiber Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS							SECTION PROPERTIES								
	Nominal Designation b x d in x in	Exact Dimensions			Outside Corner Radius r_o in	Inside Corner Radius r_i in	Mass per ft lb/ft	External Surface Area per ft ft ² /ft	Cross Section Area A_g ft ²	About x- and y-axis			About n-axis		Torsion Constant J in ⁴	Torsion Modulus C in ³
		Depth d in	Width b in	Thick. t in						I_x in ⁴	Z_x in ³	r_x in	I_n in ⁴	Z_n in ³		
WGN-S1000	4 x 4	3.94	3.94	0.205	0.394	0.187	2.59	1.26	2.953	6.73	3.4	1.5	6.76	2.6	10.9	5.1
WGN-S3000	5 x 5	4.92	4.92	0.252	0.394	0.187	4.08	1.58	4.603	16.54	6.7	1.9	16.58	5.0	26.3	9.9

SUPPLY CONDITIONS

Finish

The standard finish for the Square Hollow Section (SHS) product is painted.

Length

The SHS profiles are typically manufactured up to 38ft. in length based on typical transport limitations. Longer lengths are available upon request.

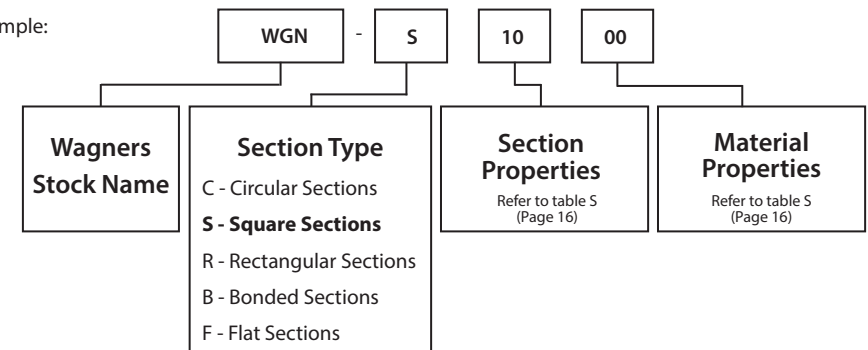
Post-Processing

Wagners can provide members cut to length with predrilled holes and inserts in accordance with client drawings. Contact Wagners for further details and pricing.

SDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the OSHA USA. Consult reference no: CET01115 for details at www.wagnerscft.com

Example:



MECHANICAL PROPERTIES

PROPERTY	RESULT		UOM	STANDARD
	WGN-S1000	WGN-S3000		
Tensile Strength – Longitudinal	88.5	88.5	ksi	ISO 527-4
Tensile Modulus of Elasticity – Longitudinal	5265	5265	ksi	
Poisson's Ratio – Longitudinal	0.28	0.28	-	
Tensile Strength – Transverse	8.0	8.0	ksi	ISO 527-4
Tensile Modulus of Elasticity – Transverse	1566	1566	ksi	
Poisson's Ratio – Transverse	0.09	0.09	-	
Compressive Strength – Longitudinal	70.3	70.3	ksi	ASTM D6641
Compressive Modulus of Elasticity – Longitudinal	4830	4830	ksi	
Compressive Strength – Transverse	17.4	17.4	ksi	ASTM D6641
Compressive Modulus of Elasticity – Transverse	1682	1682	ksi	
In-Plane Shear Strength – Longitudinal	12.2	12.2	ksi	ASTM D7078
In-Plane Shear Modulus of Elasticity – Longitudinal	621	621	ksi	
Interlaminar Shear Strength	6.4	6.4	ksi	ASTM D2344
Izod Pendulum Impact Resistance - Longitudinal**	60	60	ft-lbs/in	ASTM D256
Izod Pendulum Impact Resistance - Transverse	10	10	ft-lbs/in	

*The values in the table are the characteristic values to be used for design in normal ambient conditions. It does not include adjustment factors to account for temperature, humidity, and chemical environments.

**The test samples exceeded the test equipment capacity with 21.7J hammer, hence the true value is expected to be higher than the reported value.

PHYSICAL PROPERTIES

PROPERTY	NOTATION	VALUE	UNIT	TEST METHOD
Density	r	127	lb/ft ³	ASTM D792
Barcol Hardness		60	-	ASTM D2583
Water Absorption		0.2	%	ISO 62
Glass Transition Temperature	T_g	266	°F	ASTM D7028
Fiber Mass Fraction	W_f	77.4	%	ISO 1172
Fiber Volume Fraction	V_f	57.7	%	
Coefficient of Thermal Expansion – Longitudinal	α_L	2.79E-06	/ °F	ISO 11359-2

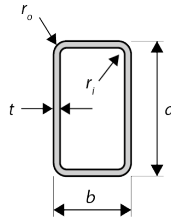
The values in the table are mean values obtained from tests at ambient temperature and relative humidity.



TABLE S

SQUARE HOLLOW SECTIONS (SHS)							
First digit: Dimension		Second digit: Wall Thickness		Third digit: Reinforcement		Fourth digit: Resin	
Value	Dimension, in	Value	Wall thickness, in	Value	Reinforcement Type	Value	Resin Type
1	4 x 4	0	0.2	0	ECR-glass rovings with 50° wound fibers	0	Vinyl Ester
3	5 x 5	0	0.3	0	ECR-glass rovings with 50° wound fibers	0	Vinyl Ester

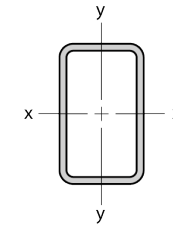
RECTANGULAR HOLLOW SECTIONS



DIMENSIONS AND SECTION PROPERTIES

RECTANGULAR HOLLOW SECTIONS

Fiber Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS							SECTION PROPERTIES									
	Nominal Designation b x d in x in	Exact Dimensions			Outside Corner Radius r_o in	Inside Corner Radius r_i in	Mass per ft lb/ft	External Surface Area per ft ft ² /ft	Cross Section Area A_g in ²	About x-axis			About y-axis			Torsion Constant J in ⁴	Torsion Modulus C in ³
		Depth	Width	Thick.						I_x	Z_x	r_x	I_y	Z_y	r_y		
		d	b	t						in ⁴	in ³	in	in ⁴	in ³	in		
WGN-R1000	3 x 4	3.94	2.95	0.205	0.394	0.187	2.59	1.09	2.550	5.33	2.7	1.4	3.40	2.3	1.2	6.85	3.7
WGN-R5000	4 x 10	9.84	3.94	0.319	0.197	0.315	7.88	2.27	8.434	99.37	20.2	3.4	22.60	11.5	1.6	58.04	19.7

SUPPLY CONDITIONS

Finish

The standard finish for the Rectangular Hollow Section (RHS) product is painted.

Length

The RHS profiles are typically manufactured up to 38ft. in length based on typical transport limitations. Longer lengths are available upon request.

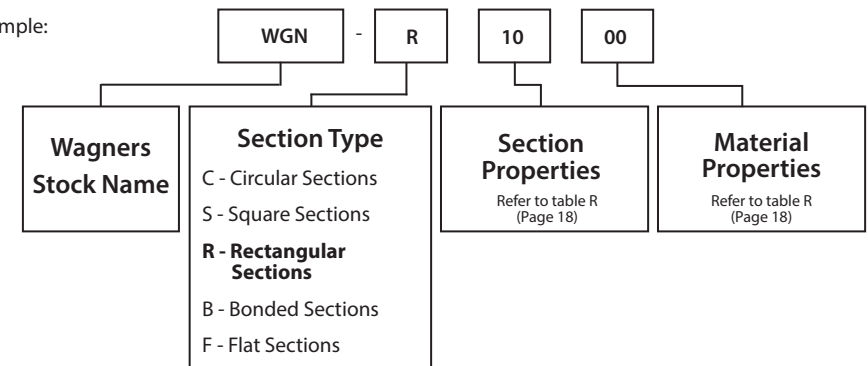
Post-Processing

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SDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the OSHA USA. Consult reference no: CET01115 for details at www.wagnerscft.com

Example:



MECHANICAL PROPERTIES

PROPERTY	RESULT		UOM	STANDARD
	WGN-R1000	WGN-R5000		
Tensile Strength – Longitudinal	82.7	88.5	ksi	ISO 527-4
Tensile Modulus of Elasticity – Longitudinal	5453	5265	ksi	
Poisson's Ratio – Longitudinal	0.3	0.28	-	
Tensile Strength – Transverse	5.1	8.0	ksi	ISO 527-4
Tensile Modulus of Elasticity – Transverse	1333	1566	ksi	
Poisson's Ratio – Transverse	0.07	0.09	-	
Compressive Strength – Longitudinal	61.6	70.3	ksi	ASTM D6641
Compressive Modulus of Elasticity – Longitudinal	4931	4830	ksi	
Compressive Strength – Transverse	15.7	17.4	ksi	ASTM D6641
Compressive Modulus of Elasticity – Transverse	1595	1682	ksi	
In-Plane Shear Strength – Longitudinal	7.4	12.2	ksi	ASTM D7078
In-Plane Shear Modulus of Elasticity – Longitudinal	680	621	ksi	
Interlaminar Shear Strength	6.1	6.4	ksi	ASTM D2344
Izod Pendulum Impact Resistance - Longitudinal**	60	60	ft-lbs/in	ASTM D256
Izod Pendulum Impact Resistance - Transverse	10	10	ft-lbs/in	

*The values in the table are the characteristic values to be used for design in normal ambient conditions. It does not include adjustment factors to account for temperature, humidity, and chemical environments.

**The test samples exceeded the test equipment capacity with 21.7J hammer, hence the true value is expected to be higher than the reported value.

PHYSICAL PROPERTIES

PROPERTY	NOTATION	VALUE	UNIT	TEST METHOD
Density	r	127	lb/ft ³	ASTM D792
Barcol Hardness		60	-	ASTM D2583
Water Absorption		0.2	%	ISO 62
Glass Transition Temperature	T_g	266	°F	ASTM D7028
Fiber Mass Fraction	W_f	77.4	%	ISO 1172
Fiber Volume Fraction	V_f	57.7	%	
Coefficient of Thermal Expansion – Longitudinal	α_L	2.79E-06	/°F	ISO 11359-2

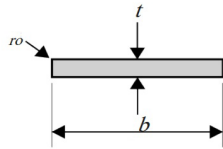
The values in the table are mean values obtained from tests at ambient temperature and relative humidity.



TABLE R

RECTANGULAR HOLLOW SECTIONS (RHS)						
First digit: Dimension		Second digit: Wall Thickness		Third digit: Reinforcement		Fourth digit: Resin
Value	Dimension, in	Value	Wall thickness, in	Value	Reinforcement Type	Value Resin Type
1	3 x 4	0	0.2	0	ECR-glass rovings with 50° wound fibers	0 Vinyl Ester
5	4 x 10	0	0.32	0	ECR-glass rovings with 39° wound fibers	0 Vinyl Ester

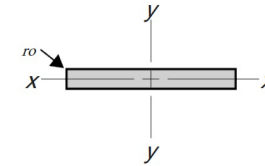
FLAT SECTIONS



DIMENSIONS AND SECTION PROPERTIES

FLAT SECTIONS

Fibre Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS							SECTION PROPERTIES							
	Nominal Designation b x t in x in	Exact Dimensions		Corner Radius r_o in	Corner Radius r_i in	Mass per m lb/ft	External Surface Area per m ft ² /ft	Cross Section Area A_g in ²	About x-axis			About y-axis			Torsion Constant J 10 ⁶ in ⁴
		Width	Thick.						I_x	Z_x	r_x	I_y	Z_y	r_y	
		b	t						10 ⁶ in ⁴	10 ³ in ³	in	10 ⁶ in ⁴	10 ³ in ³	in	
WGN-F1000	47 x 0.3	47.24	0.252			10.48	7.92	11.904	0.06	0.5	0.1	2214.15	93.7	13.6	0.25
WGN-F3000	12 x 1	11.81	0.945	0.394	0.079	9.79	2.10	11.123	0.82	1.7	0.3	128.47	21.8	3.4	3.32

SUPPLY CONDITIONS

Finish

The standard finish for the Flat Section (FS) product is painted.

Length

The FS profiles are typically manufactured up to 38ft. in length based on typical transport limitations. Longer lengths are available upon request.

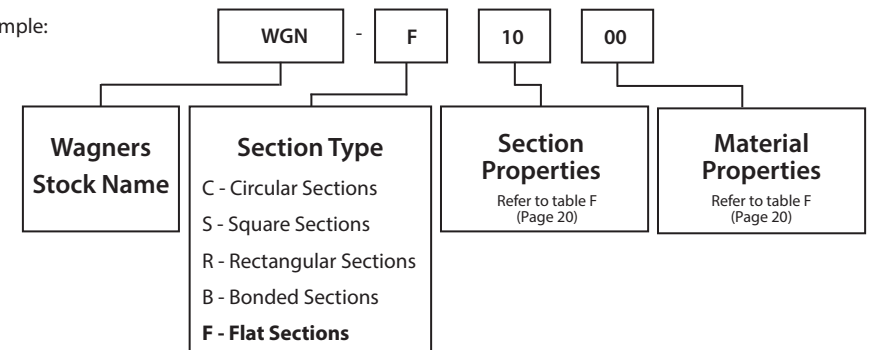
Post-Processing

Wagners can provide members cut to length with customised specifications in accordance with client drawings. Contact Wagners for further details and pricing.

SDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the OSHA USA. Consult reference no: CET01115 for details at www.wagnerscft.com

Example:



MECHANICAL PROPERTIES

PROPERTY	RESULT		UNIT	STANDARD
	F1000	F3000		
Tensile Strength – Longitudinal	54	79	ksi	ISO 527-4
Tensile Modulus of Elasticity – Longitudinal	3785	6058	ksi	
Compressive Strength – Longitudinal	38	73	ksi	ASTM D6641
Compressive Modulus of Elasticity – Longitudinal	3684	5305	ksi	

The values in the table are the characteristic values to be used for design in normal ambient conditions. It does not include adjustment factors to account for temperature, humidity, and chemical environments.

PHYSICAL PROPERTIES

PROPERTY	NOTATION	VALUE	UNIT	STANDARD
Density	r	124	lb/ft ³	ASTM D792
Barcol Hardness		60	-	ASTM D2583
Fiber Mass Fraction	W_f	75	%	ISO 1172
Fiber Volume Fraction	V_f	54	%	

The values in the table are the characteristic values to be used for design in normal ambient conditions. It does not include adjustment factors to account for temperature, humidity, and chemical environments.

TABLE F

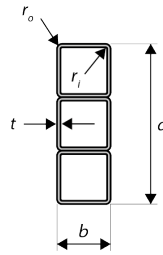
FLAT SECTIONS (FS)							
First digit: Dimension		Second digit: Wall Thickness		Third digit: Reinforcement		Fourth digit: Resin	
Value	Dimension, in	Value	Wall thickness, in	Value	Reinforcement Type	Value	Resin Type
1	47	0	0.3	0	ECR-glass rovings and E-CR multi-axial stitched fabric.	0	Vinyl Ester
3	12	0	1	0	ECR-glass rovings and E-CR multi-axial stitched fabric.	0	Vinyl Ester



BONDED I SECTIONS USING FRP FLATS,
GAMELIN CRESCENT FOOTBRIDGE, BRISBANE, QLD, AU

BONDED STRUCTURAL SECTIONS

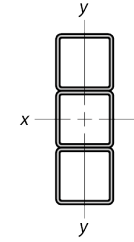
BONDED RECTANGULAR SECTIONS



DIMENSIONS AND SECTION PROPERTIES

BONDED RECTANGULAR SECTIONS

Fiber Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS								SECTION PROPERTIES							
	Nominal Designation b x d x t	Exact Dimensions			Outside Corner Radius r _o	Inside Corner Radius r _i	Mass per ft	External Surface Area per ft	Cross Section Area A _g	About x-axis			About y-axis			Torsion Constant J
		Depth d	Width b	Thick. t						I _x	Z _x	r _x	I _y	Z _y	r _y	
		in x in x in	in	in						in	in ⁴	in ³	in	in ⁴	in ³	
WGN-B1020	4 x 8 x 0.2	7.87	3.94	0.205	0.394	0.187	5.17	1.99	5.907	36.36	9.2	2.5	13.47	6.8	1.5	21.9
WGN-B1030	4 x 12 x 0.2	11.81	3.94	0.205	0.394	0.187	7.76	2.72	8.860	111.76	18.9	3.6	20.20	10.3	1.5	32.8
WGN-B1040	4 x 16 x 0.2	15.75	3.94	0.205	0.394	0.187	10.35	3.45	11.813	255.82	32.5	4.7	26.94	13.7	1.5	43.8
WGN-B1050	4 x 20 x 0.2	19.69	3.94	0.205	0.394	0.187	12.94	4.18	14.767	491.44	49.9	5.8	33.67	17.1	1.5	54.7
WGN-B1060	8 x 12 x 0.2	11.81	7.87	0.205	0.394	0.187	15.52	3.14	17.720	223.52	37.8	3.6	109.07	27.7	2.5	65.6
WGN-B1120	5 x 10 x 0.3	9.84	4.92	0.252	0.394	0.187	8.16	2.48	9.206	88.82	18.0	3.1	33.08	13.4	1.9	52.6
WGN-B1130	5 x 15 x 0.3	14.76	4.92	0.252	0.394	0.187	12.24	3.37	13.809	272.58	36.9	4.4	49.62	20.2	1.9	78.8
WGN-B1140	5 x 20 x 0.3	19.69	4.92	0.252	0.394	0.187	16.32	4.27	18.412	623.56	63.4	5.8	66.17	26.9	1.9	105.1
WGN-B1150	5 x 25 x 0.3	24.61	4.92	0.252	0.394	0.187	20.39	5.16	23.015	1197.50	97.3	7.2	82.71	33.6	1.9	131.4
WGN-B1160	10 x 15 x 0.3	14.76	9.84	0.252	0.394	0.187	24.47	3.96	27.618	545.17	73.9	4.4	266.47	54.1	3.1	157.7

SUPPLY CONDITIONS

Finish

The standard finish for the Bonded Rectangular Section (BRS) product is painted.

Length

The BRS profiles are typically manufactured up to 38ft. in length based on typical transport limitations. Longer lengths are available upon request

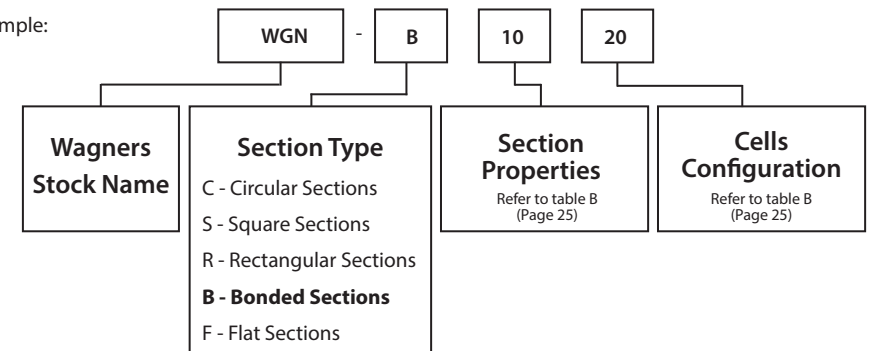
Post-Processing

Wagners can provide members cut to length with predrilled holes and inserts in accordance with client drawings. Contact Wagners for further details and pricing.

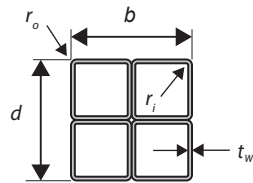
SDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the OSHA USA. Consult reference no: CET01115 for details at www.wagnerscft.com

Example:



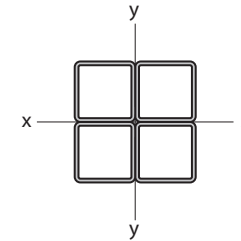
BONDED SQUARE SECTIONS



DIMENSIONS AND SECTION PROPERTIES

BONDED SQUARE SECTIONS

Fiber Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS							SECTION PROPERTIES							
	Nominal Designation b x d in x in	Exact Dimensions			Outside Corner Radius r_o in	Inside Corner Radius r_i in	Mass per ft lb/ft	External Surface Area per ft ft ² /ft	Cross Section Area A_g in ²	About x-axis and y-axis			About n-axis		Torsion Constant J in ⁴
		Depth d in	Width b in	Thick. t in						$I_{x,y}$ in ⁴	$Z_{x,y}$ in ³	$r_{x,y}$ in	I_n in ⁴	Z_n in ³	
WGN-B2020	8 x 8	7.87	7.87	0.205	0.394	0.187	10.35	2.51	11.813	72.72	18.5	2.5	72.56	13.4	43.8
WGN-B2120	10 x 10	9.84	9.84	0.252	0.394	0.187	14.46	2.62	18.412	177.65	36.1	3.1	175.86	26.0	105.1

SUPPLY CONDITIONS

Finish

The standard finish for the Bonded Square Section (BSS) product is painted.

Length

The BSS profiles are typically manufactured up to 38ft. in length based on typical transport limitations. Longer lengths are available upon request

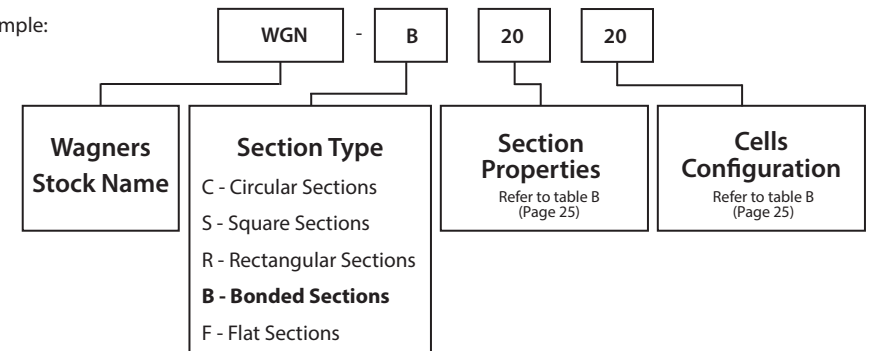
Post-Processing

Wagners can provide members cut to length with predrilled holes and inserts in accordance with client drawings. Contact Wagners for further details and pricing.

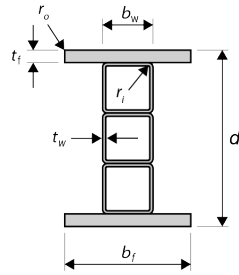
SDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the OSHA USA. Consult reference no: CET01115 for details at www.wagnerscft.com

Example:

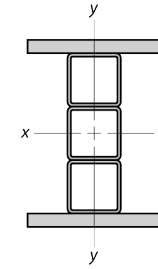


BONDED I SECTIONS



DIMENSIONS AND SECTION PROPERTIES

BONDED I-SECTIONS
Fiber Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS									SECTION PROPERTIES								
	Nominal Designation $b_f \times d \times b_w$	Depth d	Exact Dimensions			Outside Corner Radius r_o	Inside Corner Radius r_i	Mass per ft	External Surface Area per ft	Cross Section Area A_g	About x-axis			About y-axis			Torsion Constant J	
			Width b_f	b_w	Thick. t_f						t_w	I_x	Z_x	r_x	I_y	Z_y		r_y
in x in x in	in	in	in	in	in	in	in	in	in	in ⁴	in ³	in	in ⁴	in ³	in	in ⁴		
WGN-B3020	12 x 10 x 4	9.76	11.81	3.94	0.945	0.205	0.394	0.187	24.75	4.81	28.152	470.53	96.4	4.1	270.41	45.8	3.1	25.20
WGN-B3030	12 x 14 x 4	13.70	11.81	3.94	0.945	0.205	0.394	0.187	27.34	5.43	31.106	1018.32	148.7	5.7	277.15	46.9	3.0	36.14
WGN-B3040	12 x 18 x 4	17.64	11.81	3.94	0.945	0.205	0.394	0.187	29.93	6.06	34.059	1807.17	204.9	7.3	283.88	48.1	2.9	47.08
WGN-B3050	12 x 22 x 4	21.57	11.81	3.94	0.945	0.205	0.394	0.187	32.51	6.69	37.012	2859.98	265.1	8.8	290.62	49.2	2.8	58.01
WGN-B3120	12 x 12 x 5	11.73	11.81	4.92	0.945	0.252	0.394	0.187	27.74	4.97	31.452	737.64	125.7	4.8	290.03	49.1	3.0	55.87
WGN-B3130	12 x 17 x 5	16.65	11.81	4.92	0.945	0.252	0.394	0.187	31.81	5.76	36.055	1646.57	197.7	6.8	306.57	51.9	2.9	82.15
WGN-B3140	12 x 22 x 5	21.57	11.81	4.92	0.945	0.252	0.394	0.187	35.89	6.55	40.658	2992.10	277.4	8.6	323.11	54.7	2.8	108.43
WGN-B3150	12 x 27 x 5	26.50	11.81	4.92	0.945	0.252	0.394	0.187	39.97	7.35	45.261	4829.97	364.6	10.3	339.65	57.5	2.7	134.70

SUPPLY CONDITIONS

Finish

The standard finish for the Bonded I Section (BIS) product is painted.

Length

The BIS profiles are typically manufactured up to 38ft. in length based on typical transport limitations. Longer lengths are available upon request

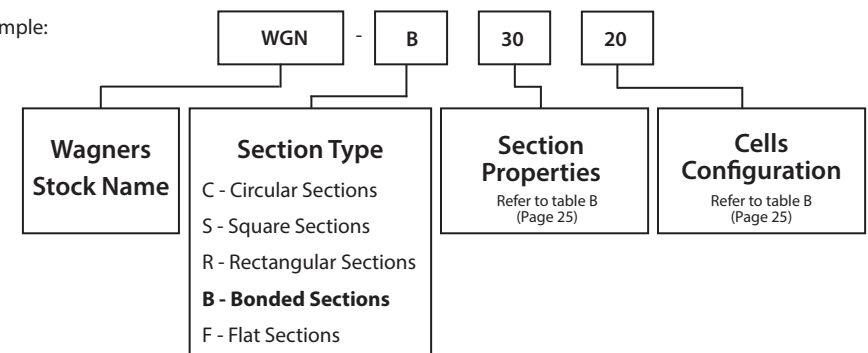
Post-Processing

Wagners can provide members cut to length with predrilled holes and inserts in accordance with client drawings. Contact Wagners for further details and pricing.

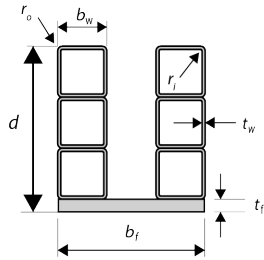
SDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the OSHA USA. Consult reference no: CET01115 for details at www.wagnerscft.com

Example:



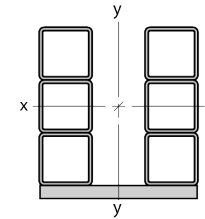
BONDED U SECTIONS



DIMENSIONS AND SECTION PROPERTIES

BONDED U-SECTIONS

Fiber Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS									SECTION PROPERTIES										
	Nominal Designation $b_f \times d \times b_w$ in x in x in	Depth d in	Exact Dimensions			Outside Corner Radius r_o in	Inside Corner Radius r_i in	Mass per ft lb/ft	External Surface Area per ft ft ² /ft	Cross Section Area A_g ft ²	About x-axis				About y-axis				Torsion Constant J in ⁴	
			Width b_f in	b_w in	Thick. t_f in						t_w in	I_x in ⁴	$Z_{x,max}$ in ³	$Z_{x,min}$ in ³	r_x in	I_y in ⁴	$Z_{y,max}$ in ³	$Z_{y,min}$ in ³		r_y in
WGN-B4120	24 x 11 x 5	10.79	23.62	4.92	0.945	0.252	0.394	0.187	35.89	7.37	40.658	472.92	169.7	59.1	3.4	2703.26	229.3	228.5	8.2	111.7
WGN-B4130	24 x 16 x 5	15.71	23.62	4.92	0.945	0.252	0.394	0.187	44.05	9.16	49.864	1307.25	277.1	118.9	5.1	3541.22	300.2	299.4	8.4	164.3
WGN-B4140	24 x 21 x 5	20.63	23.62	4.92	0.945	0.252	0.394	0.187	52.21	10.95	59.070	2724.43	399.8	197.2	6.8	4379.19	371.2	370.3	8.6	216.9
WGN-B4150	24 x 26 x 5	25.55	23.62	4.92	0.945	0.252	0.394	0.187	60.37	12.74	68.276	4844.44	537.7	292.8	8.4	5217.16	442.2	441.3	8.7	269.4

SUPPLY CONDITIONS

Finish

The standard finish for the Bonded U Section (BUS) product is painted.

Length

The BUS profiles are typically manufactured up to 38ft. in length based on typical transport limitations. Longer lengths are available upon request

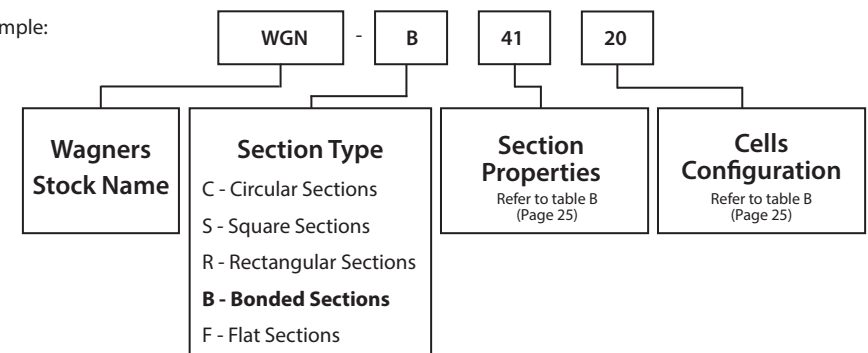
Post-Processing

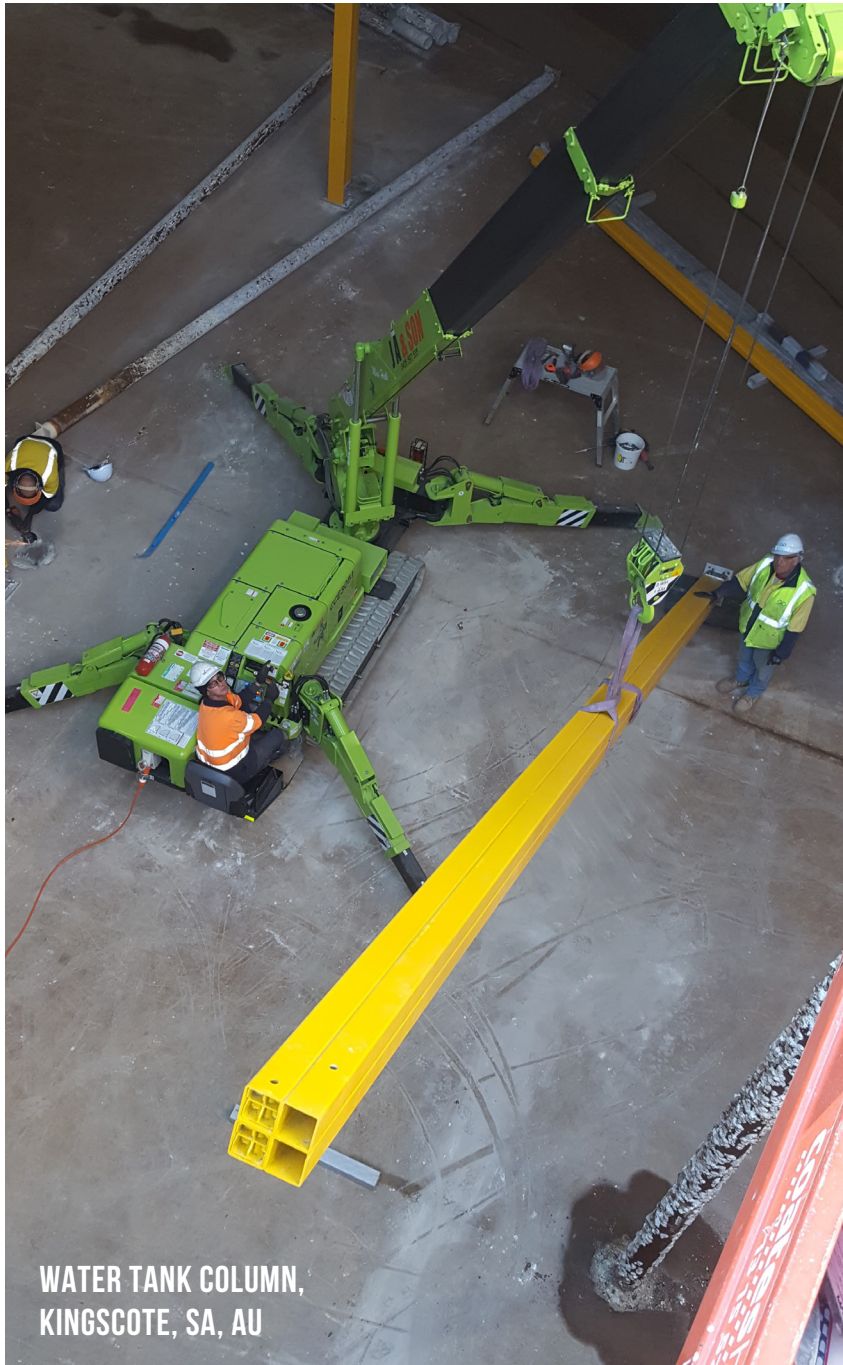
Wagners can provide members cut to length with predrilled holes and inserts in accordance with client drawings. Contact Wagners for further details and pricing.

SDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the OSHA USA. Consult reference no: CET01115 for details at www.wagnerscft.com

Example:





ADHESIVE PROPERTIES

The adhesive used for bonded beams is a proprietary thixotropic, solvent free, toughened epoxy resin. The adhesive has been specially formulated for composites and provides excellent peel strength of the bond.

PROPERTY	NOTATION	VALUE	UNIT	TEST METHOD
Tensile Strength	f_t	4.9	ksi	ISO 527-2
Tensile Modulus	E_t	349.4	ksi	ISO 527-2
Lap Shear Strength	f_v	1.7	ksi	ASTM D3163
Heat Deflection Temperature	HDT	185	°F	ISO 75

1. The properties in the table are as per the ATL Engineering Data sheet dated 23/9/09.
2. The values in the table are based on a cure schedule of 24 hours @ ambient + 8 hours @ 176 °F.
3. The values in the table are the design values to be used in normal ambient conditions. It does not include adjustment factor to account for temperature, humidity, and chemical environments.

TABLE B

BONDED SECTIONS							
First digit		Second digit		Third digit		Fourth digit	
Value	Section	Value	Components Profile	Value	Cells Configuration	Value	N/A
1	Bonded Rectangular Section	0	WGN-S1000	2	2	0	N/A
		1	WGN-S3000	3	3		
				4	4		
				5	5		
				6	2x3		
2	Bonded Square Section	0	WGN-S1000	2	2x2	0	N/A
		1	WGN-S3000				
3	Bonded I-Section	0	WGN-S1000 + WGN-F300	2	2	0	N/A
		1	WGN-S3000 + WGN-F300	3	3		
				4	4		
4	Bonded U-Section	0	WGN-S1000 + WGN-F300	2	2+2	0	N/A
		1	WGN-S3000 + WGN-F300	3	3+3		
				4	4+4		
				5	5+5		

DIMENSIONAL TOLERANCES

STANDARD STRUCTURAL SECTIONS

STANDARD STRUCTURAL SECTIONS					
Parameter	Tolerance	Illustration			
		CHS	SHS	RHS	FS
External Dimensions	$\pm 0.5\%$ with a maximum of $\pm 0.02''$				
Thickness, t	$\pm 0.02''$				
Outside corner radius, r_o	$\pm 0.02''$				
Out-of-flatness (Flat Section only)	$\pm b_f / 150$				
Concavity, x_1 Convexity, x_2	$\leq 0.4\%$				
Squareness of sides	$90^\circ \pm 1^\circ$				
Twist, v	$\leq 0.08'' + 0.006''$ per foot length				
Straightness, e (in any one plane)	$\leq 0.1\%$ of total length				
Mass of a section length	$\pm 4\%$				
Length of a member, L	$\pm 0.2''$				

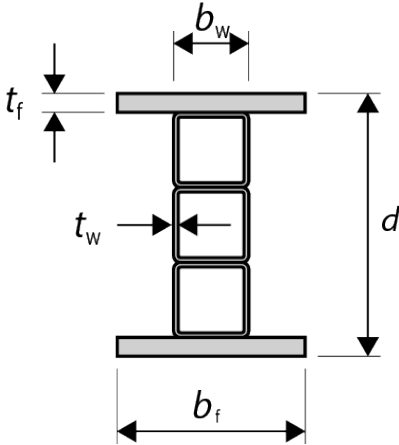
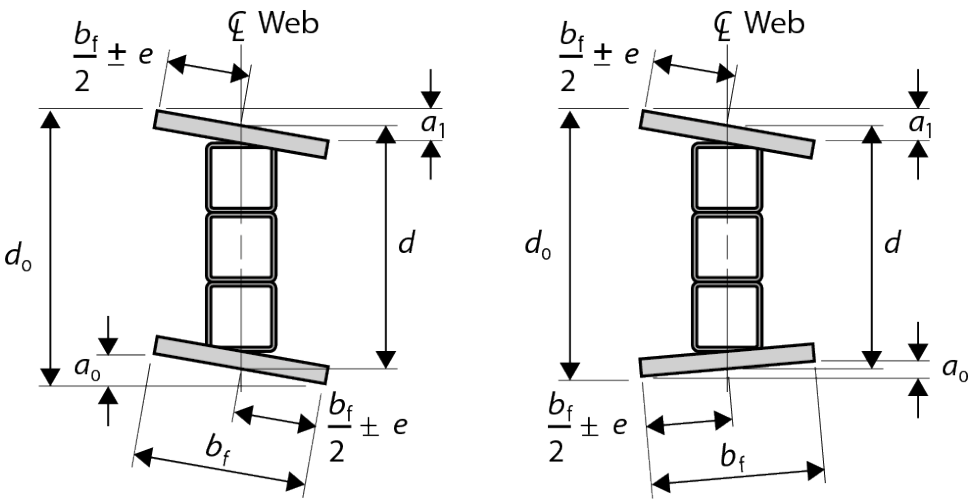
The tolerance on member length applies to manufactured product only. Tolerances on post-processed (fabricated) product are determined on a project by project basis.

BONDED STRUCTURAL SECTIONS

BONDED STRUCTURAL SECTIONS		
Parameter	Tolerance	Illustration
Deviation from verticality of a web, Δ_v	$\pm 0.08"$	<p>A side view of a bonded structural section showing a central web between two flanges. A vertical dashed line represents the intended vertical axis. A horizontal double-headed arrow labeled Δ_v indicates the deviation of the web from this vertical axis. A vertical double-headed arrow labeled d indicates the depth of the web.</p>
Off centre of a web, e	$\pm 0.08"$	<p>A side view of a bonded structural section showing a central web between two flanges. A vertical dashed line is labeled "Nominal web centre line". A horizontal double-headed arrow labeled e indicates the distance from the nominal web centre line to the actual center of the web.</p>
Out-of-flatness of a flange	$\pm b_f / 150$	<p>Two diagrams illustrating flange flatness. The left diagram shows a top view of a flange with a width b_f and a vertical double-headed arrow Δ_f indicating the out-of-flatness. The right diagram shows a side view of a flange with a vertical double-headed arrow Δ_f indicating the out-of-flatness. The label "Flange Edge" points to the outer edge of the flange.</p>
Straightness, e	0.1% of total length	<p>A side view of a curved member. A dashed line represents the intended straight axis. A vertical double-headed arrow labeled e indicates the maximum deviation from this axis. A horizontal double-headed arrow labeled L indicates the total length of the member.</p>
Mass of a section length	$\pm 4\%$	
Length of a member, L	$\pm 0.2"$	

NOTE: The tolerance on member length applies to manufactured product only. Tolerances on post-processed (fabricated) product are determined on a project by project basis. Contact Wagners for details.

BONDED STRUCTURAL SECTIONS

Parameter	Tolerance	Illustration
Depth, d	$\pm 0.5\%$ with a maximum of $\pm 0.02''$	
Flange width, b_f	$\pm 0.5\%$ with a maximum of $\pm 0.02''$	
Web width, b_w	$\pm 0.5\%$ with a maximum of $\pm 0.02''$	
Flange thickness, t_f	$\pm 3\%$	
Web thickness, t_w	$\pm 10\%$	
Out-of-square of an individual flange, a_0 or a_1	$\pm 0.08''$	
Total out-of-square of two flanges, a_0 or a_1	$\pm 0.16''$	

NOTE: The tolerance on member length applies to manufactured product only. Tolerances on post-processed (fabricated) product are determined on a project by project basis. Contact Wagners for details.

PART THREE

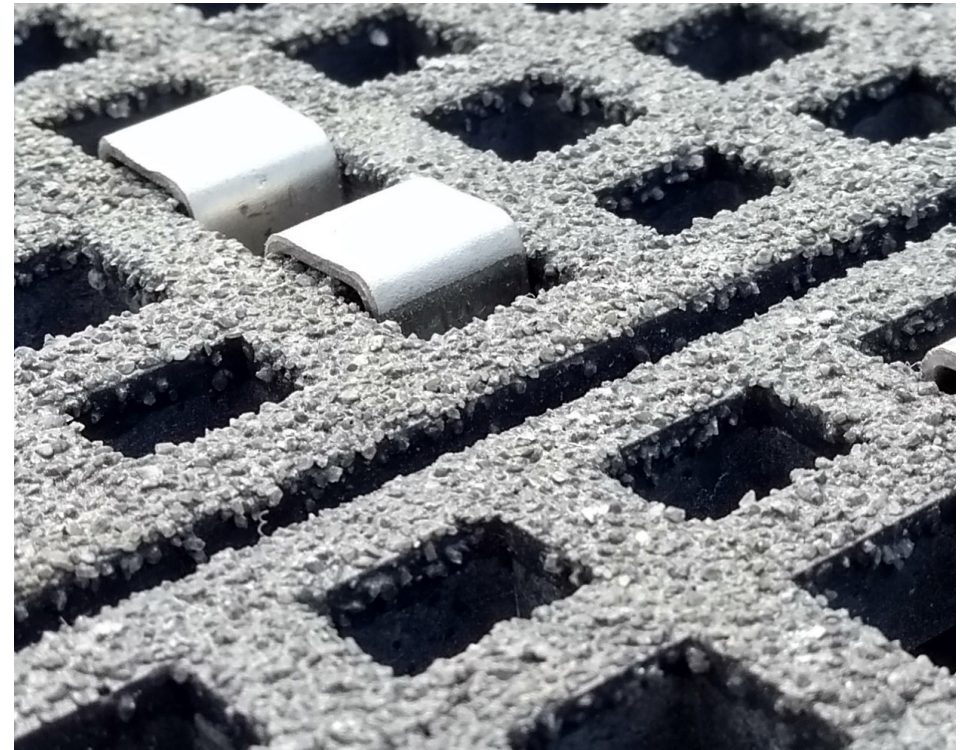
DECKING



WAGNERS HAVE SUPPLIED PEDESTRIAN STRUCTURAL FRP DECKING ELEMENTS SUCH AS GRATINGS, MESH AND COVERTOP ALL ACROSS THE WORLD.

Our products are uniquely suited to withstand the harshest environments while providing a low maintenance, long life asset to the local community. Wagners mesh, gratings and covertop are perfect for coastal, marine and environmentally sensitive areas. From tidal flood plains and protected mangrove swamps to alkaline desert and corrosive mining or oil/gas facilities.

Wagners products have proven time and time again their unique durability and strength. Possessing a full in-house test and certification team, Wagners will work hand in hand with the clients to ensure a robust, aesthetically pleasing pedestrian asset that will provide decades of service.



FRP DECKING

Molded grating is manufactured in an open, heated mold system. Continuous E-glass rovings are placed in the mold in alternating layers (on one side or two) and completely wetted out with resin. This continuous process produces an integral, one piece construction which provides excellent corrosion resistance as well as bi-directional strength for meshed deckings, covertsops and TredDeck.

Performance Advantages

- » Anti-fire, anti-corrosion and anti-aging
- » Anti-slippage
- » Light but high loaded strength
- » Long service life and maintenance free
- » Non-conduction or magnetic
- » Easy installation and rich color
- » Various sizes and colors available

THERE ARE A NUMBER OF DIFFERENT MOLDS AVAILABLE RESULTING IN A EXTENSIVE RANGE OF PANEL SIZES, THICKNESS AND MESH PATTERNS.

TredDeck is an advanced composite, high strength decking system have the same size of the structural FRP decking.

It consists of two layers, covertop substrate and a 0.4 in top layer of hard wearing stone, non-slip surface combined with thermoset UV stabilized Epoxy resin placed on to a variety of available decking materials.



GARDENVALE ACCESS COVERTOP DECKING

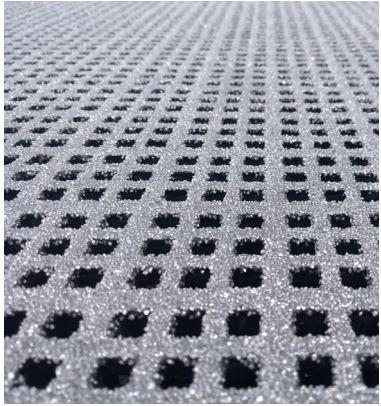
Functions

- » Anti-slip floor, stair tread, foot bridge
- » Operation platform, trench cover
- » Security and safety fence and handrails
- » Off-shore oil rig, moor shipyard, shipping deck, ceiling
- » Ramp ladder, scaffold, railway footpath
- » Decorative grid, man-made fountain pool grid
- » Non-conductive and non-magnetic

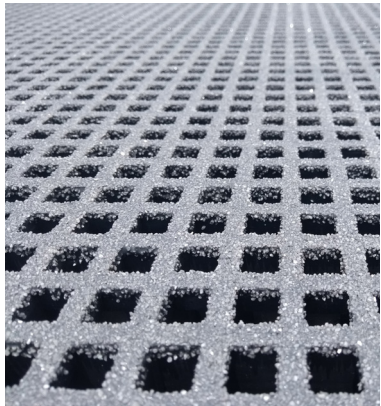
Industries

- » Chemical plant and metal finishing
- » Construction engineering
- » Traffic and transportation
- » Petrochemical engineering, ocean survey, water engineering
- » Food and beverage plants
- » Textile printing and dyeing
- » Electronics

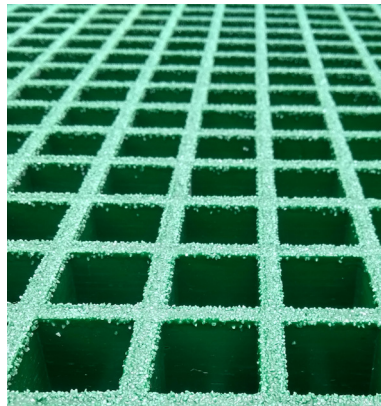
MESH DECKING CATEGORIES



MICRO-MESH DECKING*															
PRODUCT CODE	Thickness (in)	Bar Thickness (in)	Bar Spacing (Top/ Bottom) (in)	Aperture (in)	Open Rate (%)	Panel Size (in)	Weight (lb/ft ²)	Slip Rating (AS4586)	Pattern Loading	Allowable Design Load (lbf)					
										Max. Joist Clear Span (ft)					
										1.3	2	2.5	3.3	4	5
MIC30-XX	1.2	0.2	0.5x0.5 1.6x1.6	0.32x0.32	38	Standard Size: 50x145 Maximum Size: 60x160	3.9	P5	≤ 104 psf	1236	821	641	483	n/a	n/a
MIC38-XX	1.2	0.2	0.5x0.5 1.6x1.6	0.32x0.32	38	Standard Size: 50x145 Maximum Size: 60x160	5.1	P5	≤ 104 psf	1090*	1090	1057	787	686	n/a



MINI-MESH DECKING															
PRODUCT CODE	Thickness (in)	Bar Thickness (in)	Bar Spacing (Top/ Bottom) (in)	Aperture (in)	Open Rate (%)	Panel Size (in)	Weight (lb/ft ²)	Slip Rating (AS4586)	Pattern Loading	Allowable Design Load (lbf)					
										Max. Joist Clear Span (ft)					
										1.3	2	2.5	3.3	4	5
MIN30-XX	1.2	0.26	0.75x0.75 1.5x1.5	0.32x0.32	43	Standard Size: 48x144 Maximum Size: 60x160	3.9	P5	≤ 104 psf	1236	821	641	483	n/a	n/a
MIN38-XX	1.2	0.26	0.75x0.75 1.5x1.5	0.32x0.32	43	Standard Size: 48x144 Maximum Size: 48x160	4.8	P5	≤ 104 psf	1090*	1090	1057	787	686	n/a



OPEN-MESH DECKING															
PRODUCT CODE	Thickness (in)	Bar Thickness (in)	Bar Spacing (Top/ Bottom) (in)	Aperture (in)	Open Rate (%)	Panel Size (in)	Weight (lb/ft ²)	Slip Rating (AS4586)	Pattern Loading	Allowable Design Load (lbf)					
										Max. Joist Clear Span (ft)					
										1.3	2	2.5	3.3	4	5
MSH38-XX	1.2	0.28	1.5x1.5	1.2x1.2	67	Standard Size: 48x144 Maximum Size: 80x170	4.0	P5	≤ 104 psf	1236	821	641	483	n/a	n/a
MSH50-XX*	1.5	0.28	2x2	1.7x1.7	74	Standard Size: 48x144 Maximum Size: 60x160	4.7	P5	≤ 104 psf	1090*	1090	1057	787	686	n/a



COVERTOP DECKING															
PRODUCT CODE	Thickness (in)	Bar Thickness (in)	Bar Spacing (in)	Aperture (in)	Open Rate %	Panel Size (in)	Weight (lb/ft ²)	Slip Rating (AS4586)	Pattern Loading	Allowable Design Load (lb/ft)					
										Max. Joist Clear Span (ft)					
										1.3	2	2.5	3.3	4	5
COV25-XX	1	0.28	1.5x1.5	0	0	Standard Size: 48x144 Maximum Size: 60x160	4.3	P5	≤ 104 psf	1135	809	731	483	n/a	n/a
COV30-XX	1.2	0.28	1.5x1.5	0	0	Standard Size: 48x144 Maximum Size: 60x160	4.7	P5	≤ 104 psf	1383	989	753	595	651	n/a
COV43-XX	1.7	0.28	1.5x1.5	0	0	Standard Size: 48x144 Maximum Size: 87x167	5.9	P5	≤ 104 psf	1675*	1675*	1675	1450	1146	n/a
COV55-XX	2.2	0.28	2x2	0	0	Standard Size: 48x144 Maximum Size: 60x160	6.8	P5	≤ 104 psf	4496 [†]	4496 [†]	3259 [†]	2506	2090	1618

TREDDECK DECKING*															
PRODUCT CODE	Thickness (in)	Bar Thickness (in)	Bar Spacing (in)	Aperture (in)	Open Rate %	Panel Size (in)	Weight (lb/ft ²)	Slip Rating (AS4586)	Pattern Loading	Allowable Design Load (lb/ft)					
										Max. Joist Clear Span (ft)					
										1.3	2	2.5	3.3	4	5
TD35-FX	1.4	0.28	1.5x1.5	0	0	Standard Size: 48x144 Maximum Size: 60x160	9.2	P5	≤ 104 psf	1135	809	731	483	n/a	n/a
TD40-FX	1.2	0.28	1.5x1.5	0	0	Standard Size: 48x144 Maximum Size: 60x160	9.6	P5	≤ 104 psf	1383	989	753	595	651	n/a
TD53-FX	2.1	0.28	1.5x1.5	0	0	Standard Size: 48x144 Maximum Size: 82x167	10.9	P5	≤ 104 psf	1675*	1675*	1675	1450	1146	n/a
TD65-FX	2.6	0.28	2x2	0	0	Standard Size: 48x144 Maximum Size: 60x160	11.7	P5	≤ 104 psf	4496 [†]	4496 [†]	3259 [†]	2506	2090	1618

* Untested, conservative value based on the closest decking type/span
[^] 6x6" in loading plate

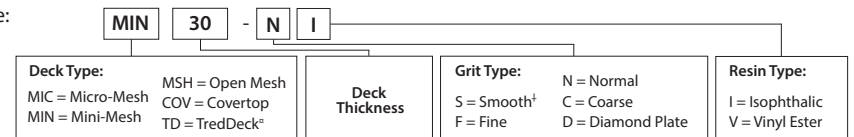
^x 8x8" in loading plate

[†] TredDeck comes with fine grit only

[‡] Smooth finish has low slip resistance

• Test load was applied over 4x4" in plate at mid-span and adjacent to the free edge of two-span decking Example:

• Design values are based on L/120 deflection limit with 0.6 SLS factor, and 1.5 ULS with relevant kt factor (AS1170)



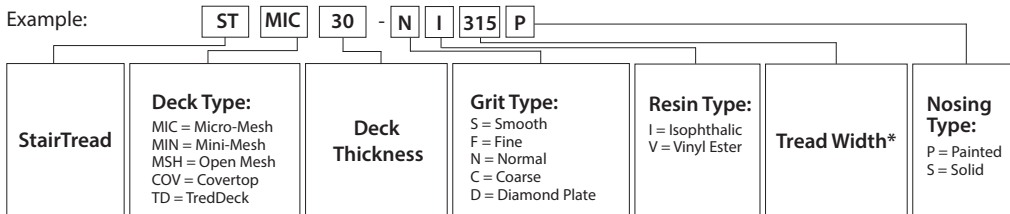
STAIRTREAD

FRP StairTreads are made in similar manner to the FRP decking, hence have the same sectional properties and strength capacities.

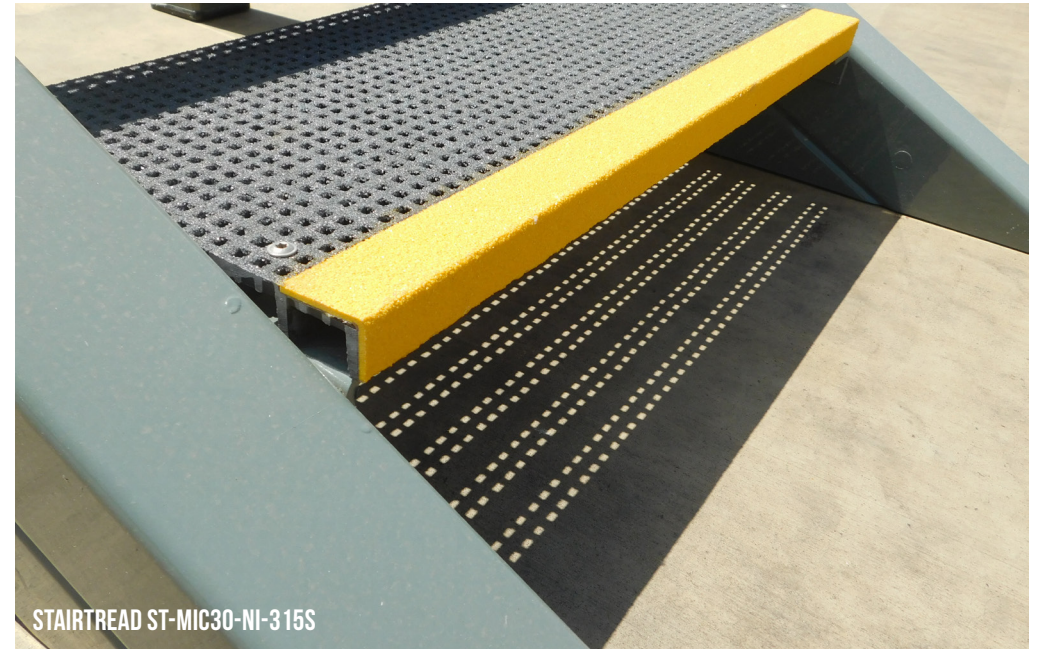
They are supplied with painted or solid nosing depending on the applications and/ or client preference.

STAIR TREAD					
PRODUCT CODE	Mesh Type (in)	Thickness (in)	Weight (lb/ft ²)	Standard Width (in)	Slip Rating AS 4586
ST-MIC30-XX-315X	Micro-Mesh	1.2	3.9	12.6	P5
ST-MIC38-XX-315X		1.5	4.9		
ST-MIN30-XX-315X	Mini-Mesh	1.2	3.9	12.6	P5
ST-MIN38-XX-315X		1.5	4.8		
ST-MSH38-XX-315X	Open-Mesh	1.5	4.0	12.6	P5
ST-MSH50-XX-315X		2	4.7		
ST-COV30-XX-315X	CoverTop	1.2	4.7	12.6	P5
ST-COV43-XX-315X		1.7	5.9		
ST-COV55-XX-315X		2.2	6.8		

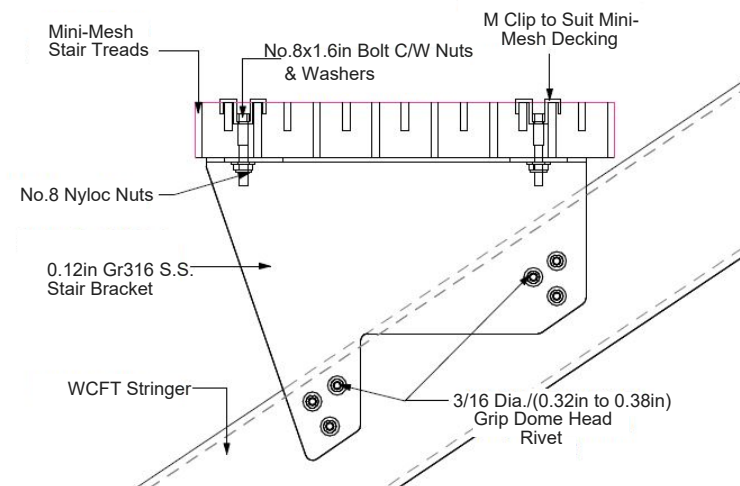
Example:



*The standard width of StairTread is 12.6in, custom width is also available.



STAIRTREAD ST-MIC30-NI-315S



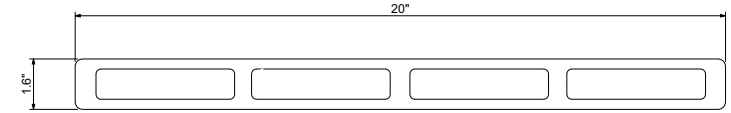
BRIDGEDECK

BridgeDeck is an innovative product solution that is commonly used for road bridges decking applications. It complies with the engineering and safety standards within United States and around the world including Australia, United Kingdom and Europe.

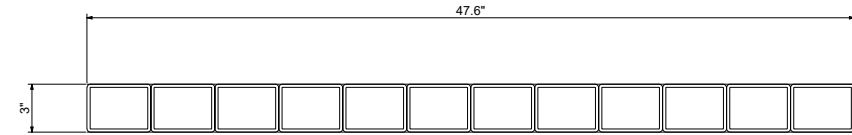
BRIDGEDECKS				
Product	Product Code	Dimensions (in) (W x H x T)	Weight (lb/ft ²)	Load Class
BridgeDeck 40	BD-040	20 x 1.6 x 0.32	7.7	< 2.5t
BridgeDeck 75	BD-075	47.6 x 3 x 0.2	8.1	H10
BridgeDeck 125	BD-125	49.6 x 5 x 0.4	10.2	HL-93

Performance Advantages

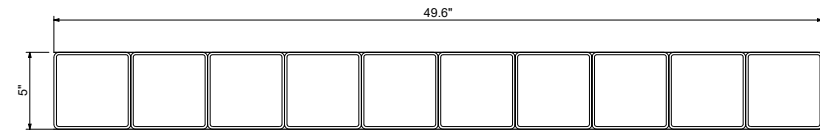
- » **Lightweight:** The high weight/strength ratio of WCFT BridgeDeck allow its utilization on existing timber and concrete bridge abutment, reducing the installation time and cost of the project
- » **Low Maintenance:** An ideal material in high risk environments near the sea or flood-prone areas, our bridgedeck will not rot, rust, corrode nor decay. Bridgedeck is not susceptible to freeze-thaw cycles, and has very low thermal expansion/contraction characteristics
- » **Low Cost Installation:** Prefabrication and experience allows bridgedeck to greatly reduce installation times over traditional procedures. In high traffic areas, Wagners will work closely with stakeholders to ensure a quick turnaround
- » **Robust Long-Life:** Bridgedeck is ideally suited for extended use in high fatigue structures. As a result of strenuous testing in partnership with local DOT's, our structures possess an extremely high strength reserve, allowing full load services for decades to come



BRIDGEDECK 40



BRIDGEDECK 75



BRIDGEDECK 125



BRIDGEDECK INSTALLATION
BIRKENHEAD ROAD BRIDGE, ADELAIDE, AU

PILES



FIBER ORIENTATION

Enormous design flexibility is available by utilizing different combinations of glass weight and orientation for different applications i.e. pier/wharf fender pile, a guide/mooring piling for floating structures such as marinas, and as a structural piling, either hollow or filled with concrete.

Depending on project requirements, axial loading requirements, transverse loading requirements, deflection limits, etc, we can design custom laminate configurations to maximize performance.

CONCRETE FILL

Filling with concrete is optional to match a desired stiffness, however, most new projects do not require it. The FRP wall is structural and sufficient on its own for the majority of applications.

PILE DRIVING AND SPLICING

Wagners FRP composite piles can either be vibratory or impact driven, and they are generally driven faster than solid timber and concrete piles. FRP pile splicing is possible in deep pile driving application using prefabricated FRP splices. The prefabricated FRP splices are provided by Wagners and can be installed into the piles on-site.

PILE CAPS

Customers can order standard Conical and Flat Top Caps or Custom Top Caps to accompany their order of Piles.

Conical and Flat Pile Caps fit over the pile, while Flat Insert Pile Caps fit within the pile. Insert Caps are useful for situations where lines are thrown over the pile which might catch on and damage a non-inset cap.

CONNECTION DETAILS

Various connection configurations can be utilized depending on the proposed application, and anti-crush inserts are used to provide superior connection capacities. More specific connection details are available in Part Seven of this document.

COATING

Piles can be coated in a variety of colors using fluoropolymer coating that has been engineered to resist direct UV exposure and other weathering effects in harsh marine environments. It comes with an extra long life warranty and at least 40 years of exterior exposure before the first recoat is required on the exposed parts. High-quality polyurethane coating is another option for structures in less aggressive environments.

PROPERTY	NOTATION	UOM	VALUE						
			WGN-C1000	WGN-C2000*	WGN-C3000	WGN-C4000*	WGN-C5000*	WGN-B2020	WGN-B2120
Nominal Profile Size			3.5" Circular Hollow Section	6" Circular Hollow Section	9" Circular Hollow Section	11.5" Circular Hollow Section	12" Circular Hollow Section	8" x 8" Bonded Square Hollow Sections	10" x 10" Bonded Square Hollow Sections
Outer Dimension	Do	in	3 1/2	6	9	11 1/2	11 6/7	7 14/16	9 13/16
Wall Thickness	t	in	-	2/9	3/8	3/8	1/2	13/64	16/64
Cross Sectional Area	A	in ²	2.42	4.19	10.41	13.12	18.90	11.81	18.41
Surface Area	SA	ft ² /ft	0.92	1.59	2.37	3.02	3.1	2.51	2.617
Moment of Inertia	I	in ⁴	3.24	17.84	98.17	204.45	303.34	72.72	177.65
Weight	w	lb/ft	2.13	3.70	9.31	11.71	16.89	10.35	14.46
Bending Moment Capacity	Mu	kip.ft	13	30	68	189	241	48	92
Tensile Strength (L)	F _{lt}	10 ⁴ psi	5.24	8.85	9.21	9.21	9.21	8.85	8.85
Tensile Modulus (L)	E _{lt}	10 ⁶ psi	5.18	5.26	5.14	5.14	5.14	5.26	5.26
Compressive Strength (L)	F _{lc}	10 ⁴ psi	3.87	7.03	5.73	5.73	5.73	7.03	7.03
Compressive Modulus (L)	E _{lc}	10 ⁶ psi	5.69	4.83	5.97	5.97	5.97	4.83	4.83
In Plane Shear Stress (L)	F _{Lv}	10 ⁴ psi	1.32	1.22	1.35	1.35	1.35	1.22	1.22

*Theoretical value as per ASCE Pre-Standard Design for Pultruded FRP structures (2010), and/or correlated from relevant mechanical tests.



GFRP REINFORCING BARS



BACKGROUND

Glass Fiber Reinforced Polymer (GFRP) also known as glass fiber reinforced polymer is a composite material weaving fiber E-glass and vinylester resin together.

While concrete has high compressive strength, it has limited tensile strength. To overcome these tensile limitations, reinforcing bars are used in the tension and compression side of concrete structures and steel has historically been used as an effective and cost-efficient reinforcement material.

Steel is susceptible to oxidation (rust), especially in coastal areas, locations where salt contaminated aggregates are used in the concrete mixture and sites where aggressive chemicals and ground conditions exist. Where corrosion of steel reinforcement occurs, the resulting materials have a larger volume (2-5 times) than the metal product from which they were originally derived, leading eventually to cracking and spalling and further deterioration of the steel.

The combination of ongoing deterioration and loss of reinforcement properties ultimately requires potentially significant and expensive outlays for repair and maintenance, and possibly the endangerment of the structure itself.

PERFORMANCE ADVANTAGES OF GFRP BARS

- » Corrosion resistance – will not rot or rust, impervious to the reaction of chemicals, salt ions and the alkalinity inherent in the concrete
- » Superior tensile strength – composite rebar offers a tensile strength more than two times higher than steel
- » Thermal expansion – GFRP rebar offers a level of thermal expansion comparable to concrete
- » Thermal insulation – highly efficient in resisting heat transfer, such as from building exteriors to interiors
- » Electrical and magnetic neutrality – contains no metal, and will not interfere with the operation of sensitive electronic devices such as medical MRI units or electronic testing devices
- » Lightweight – weighs approximately one-quarter the weight of an equivalent size steel bar, offering significant savings in both placement and use.

GLASS 'GFRP' REBAR TECHNICAL DATA

PROPERTIES OF GFRP REBAR								
Diameter (in)	ASTM No.	Equivalent Cross-Section Area (in ²)	Fiber Volume Fraction ASTM D2584	Tg (°F) ASTM E1640	Tensile Modulus (psi 10 ⁶) ASTM D7205	Guaranteed Tensile Strength (ksi) ASTM D7205	Ultimate Shear (ksi) ASTM D7617	Bond Strength (ksi) ACI 440.3R (Method B3)
1/4	#2	0.043	> 60%	≥ 212	6.67	131	22	1.2
1/3	-	0.078				123		
3/8	#3	0.121				120		
1/2	#4	0.202				110		
5/8	#5	0.310				105		
3/4	#6	0.434				100		
7/8	#7	0.589				95		
1	#8	0.760				90		
1 1/8	#9	0.953				86		
1 2/8	#10	1.240				80		



**HEADSTOCK GFRP REINFORCEMENT
PINKENBA WHARF, BRISBANE, QLD, AU**






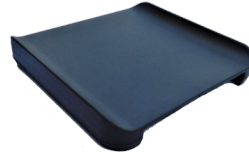
**GFRP REINFORCED BOAT RAMP
BUNDABERG, QLD, AU**

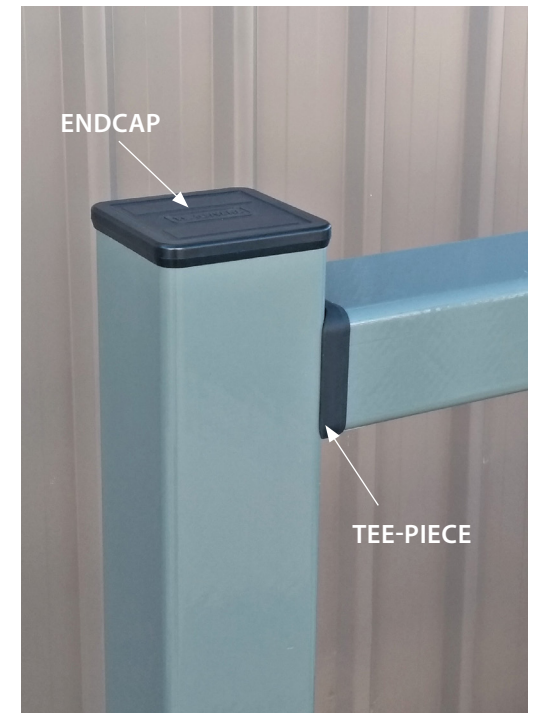
ACCESSORIES



ENDCAPS

Wagners can supply a range of custom manufactured plastic accessories to complement the composite structures. Made from lightweight and durable thermoplastic alloy, all endcap accessories are corrosion resistant and designed to match the long life of the composite asset.

NORMAL ENDCAP		FLUSH ENDCAP		RIVETED METAL ENDCAP		TEE-PIECE	
							
Part Numbers	Application	Part Numbers	Application	Part Numbers	Application	Part Numbers	Application
NCAP-S1000	WGN-S1000	FCAP-S1000	WGN-S1000	MCAP-S1000	WGN-S1000	TCAP-S1000	WGN-S1000
NCAP-S3000	WGN-S3000	FCAP-S3000	WGN-S3000	MCAP-S3000	WGN-S3000	TCAP-R1000	WGN-R1000
NCAP-R1000	WGN-R1000	FCAP-R1000	WGN-R1000	MCAP-R1000	WGN-R1000	-	-



INSERTS

The inserts are manufactured using the injection molding process and are made from lightweight and durable glass fiber-filled thermoplastic alloy which is corrosion and pest resistant.

They are provided at all bolt hole locations to improve the crushing resistance as well as bolted connection capacity.

ANTI-CRUSH INSERT DESCRIPTION



Part Numbers	Application
INST-S3000-Φ14	WGN-S3000-1/2" Bolt
INST-S3000-Φ18	WGN-S3000-5/8" Bolt
INST-S3000-Φ22	WGN-S3000-3/4" Bolt
INST-S3000-Φ26	WGN-S3000-1" Bolt
INST-S1000-Φ14	WGN-S1000-1/2" Bolt
INST-S1000-Φ18	WGN-S1000-5/8" Bolt
INST-S1000-Φ22	WGN-S1000-3/4" Bolt
INST-S1000-Φ26	WGN-S1000-1" Bolt
INST-R1000-Φ22	WGN-R1000-3/4" Bolt
INST-R1000-Φ26	WGN-R1000-1" Bolt

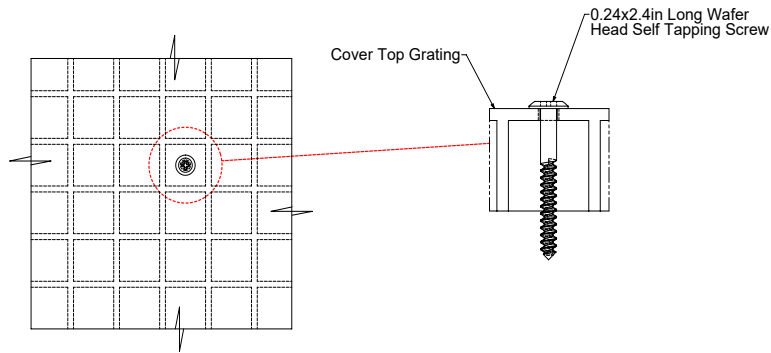
STAINLESS STEEL BRACKETS AND FASTENERS

Wagners also supply an extensive range of stainless steel connectors and fasteners to suit the use of the composite products in many applications, maintaining a high level of corrosion resistance as well as strength. These include stainless steel brackets, bolts, nuts and washers, steel screws and steel rivets.

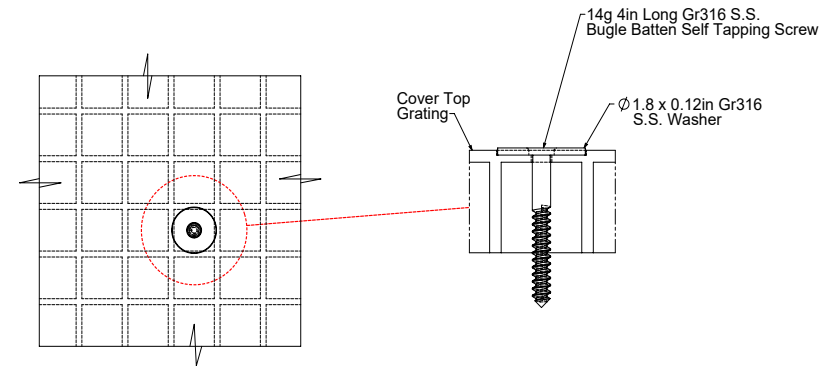
Refer to Wagners Installation Guide for further details about components available and refer to Wagners Design Guide for information on the connection capacities.

CONNECTIONS

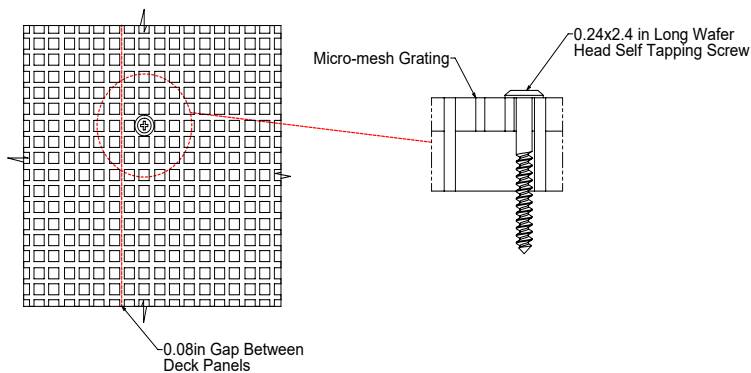
1. DECK TO JOIST



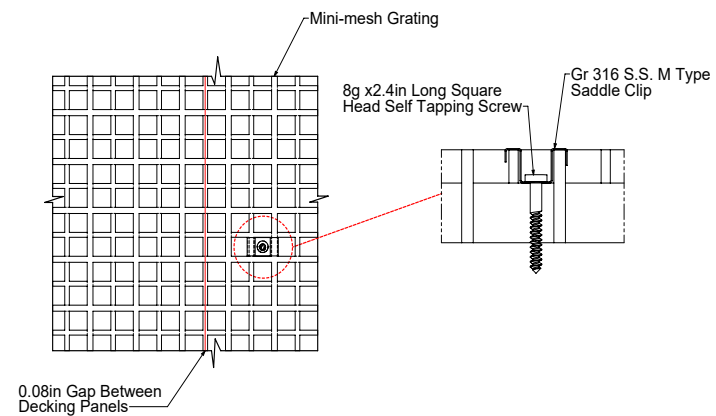
SELF TAPPING SCREW - COVERTOP



SELF TAPPING SCREW WITH OVERSIZE WASHER - COVERTOP

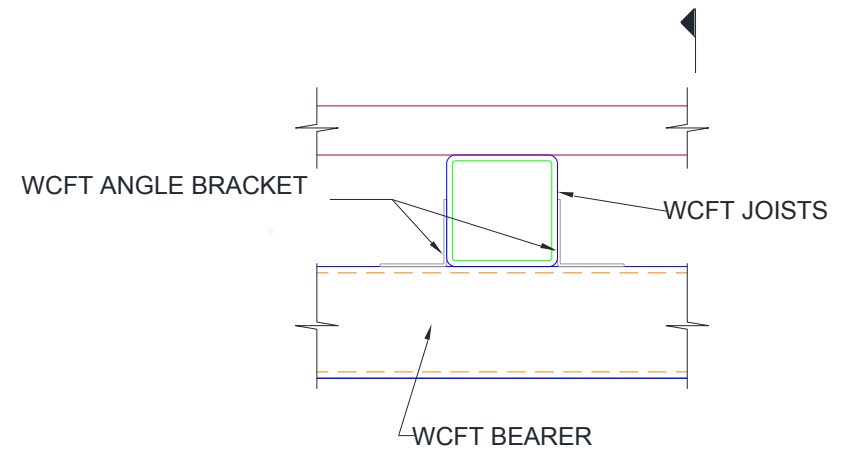
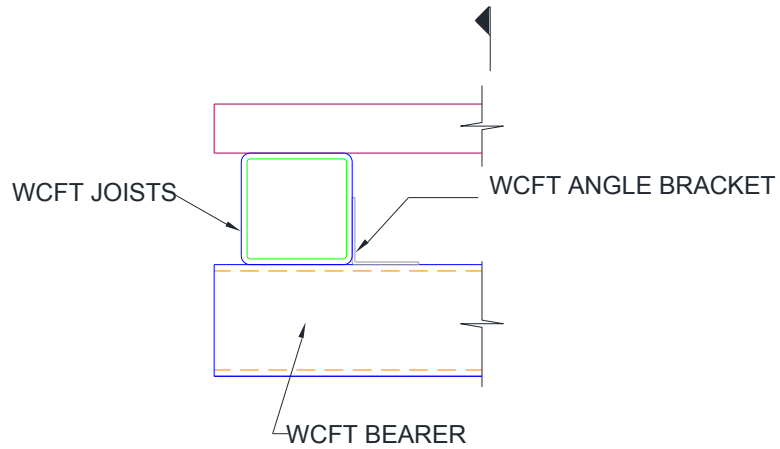


SELF TAPPING SCREW - MICRO-MESH

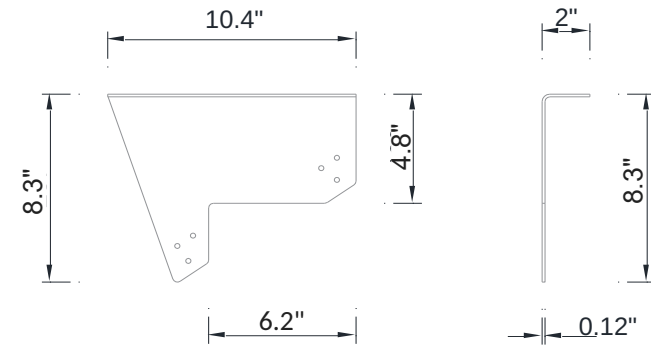
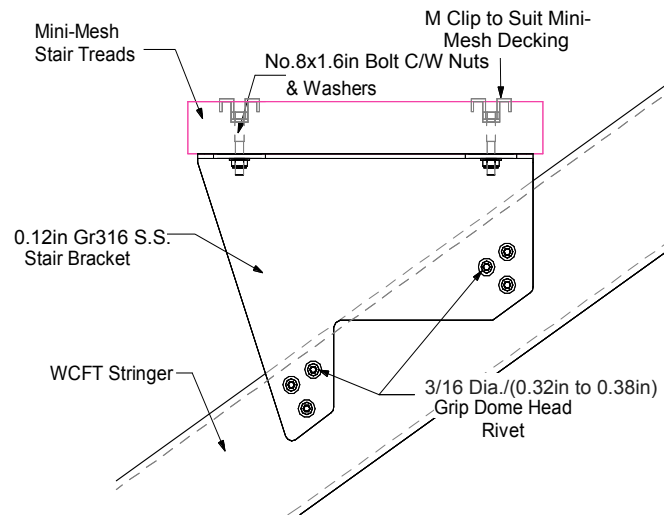


M-CLIP - MINI MESH

2. JOIST TO BEARER



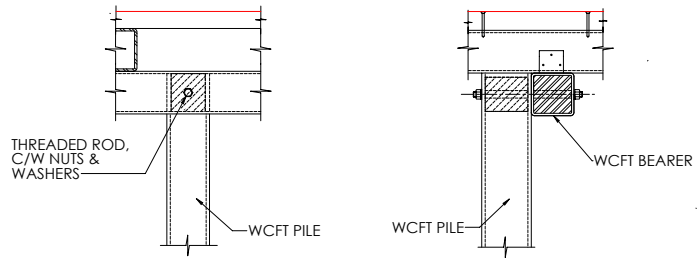
3. STAIR TREAD



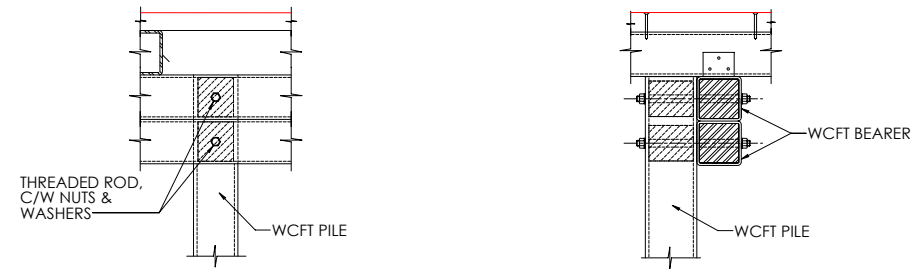
DIMENSION

4. BEARER TO PILE

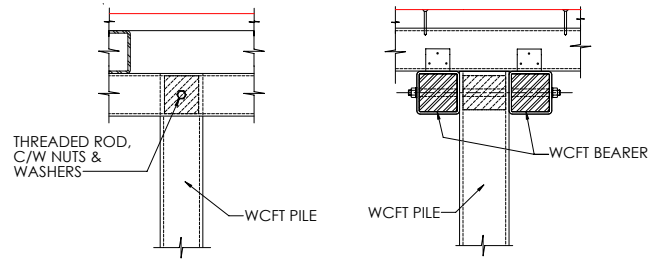
SINGLE SHEAR



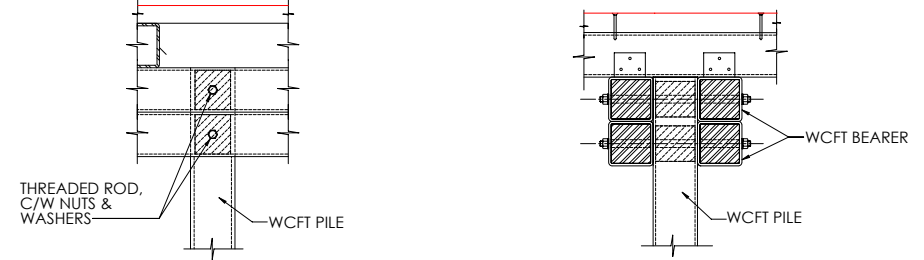
SINGLE SHEAR



DOUBLE SHEAR



DOUBLE SHEAR

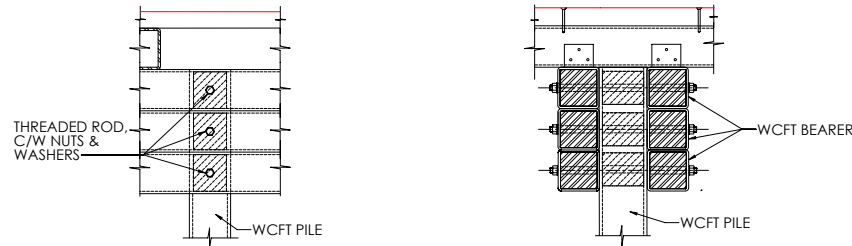


1 BOLT JOINTS

SINGLE SHEAR



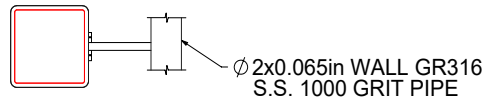
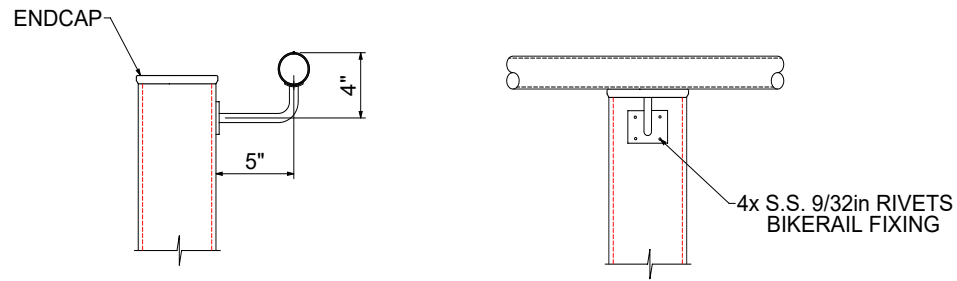
DOUBLE SHEAR



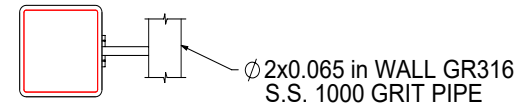
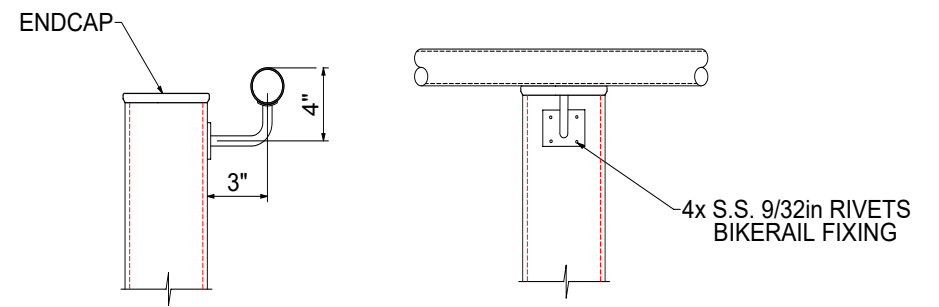
2 BOLT JOINTS

3 BOLT JOINTS

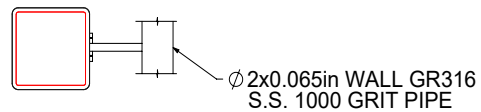
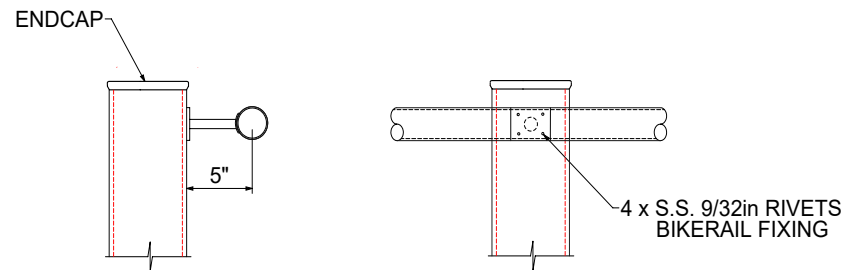
5. HANDRAIL CONNECTION



HANDRAIL 125



HANDRAIL 75



HANDRAIL STRAIGHT POST 125

GLOSSARY

Term	Description
Additives	Substances added to the polymer resin to aid in the processing of the FRP material.
Adhesive	A substance capable of holding materials together by surface attachment.
Composite	A combination of high modulus, high strength and high aspect ratio reinforcing material encapsulated by and acting in concert with a polymeric matrix.
Cure	To change the properties of a thermosetting resin irreversibly by chemical reaction, i.e. condensation, ring-closure, or addition. Cure may be accomplished by addition of curing (cross-linking) agents, with or without catalyst, and with or without heat.
Fiber Reinforced Polymer (FRP)	A Fiber Reinforced Polymer (or plastic) material consists of a polymer resin based matrix reinforced by fibers of either glass, carbon or aramid, and hybrid combinations of these fiber types.
Fiber	One or more filaments in the form of a continuous strand or roving in an FRP material.
Fiber mass fraction	The mass of reinforcement fiber in a cured composite divided by the mass of the composite section.
Fiber orientation	The orientation or alignment of the longitudinal axis of the fiber with respect to a stated reference axis.
Fiber volume fraction	The volume of reinforcement fiber in a cured composite divided by the volume of the composite section.
Filler	Non adhesive substance added in the matrix or adhesive material to alter its engineering properties, performance, and/or cost.
Glass fiber	A fiber spun from an inorganic product of fusion which has cooled to a rigid condition without crystallization.
Glass transition temperature	Temperature at which the polymer matrix changes from a glassy to a rubbery state as temperature increases.

Term	Description
Matrix	The continuous constituent of an FRP material that surrounds the fibers. It consists of a polymer resin with fillers and additives.
Orthotropic	Having three mutually perpendicular planes of elastic symmetry.
Plastic	A material that contains one or more organic polymers of large molecular weight, is a solid in its finished state and at some stage of its manufacture or processing into finished articles, can be shaped by flow.
Polymer	An organic material composed of molecules characterised by the repetition of one or more types of monomeric units.
Pultrusion	A continuous manufacturing process used to manufacture constant cross-section shapes of any length.
Release agent	An additive which promotes release from the manufacturing mold.
Resin	The polymeric material used to bind together the reinforcing fibers in FRP.
Resin content	The amount of matrix present in a composite either by percent weight or by percent volume.
Resin system	A mixture of resin, with ingredients such as catalyst, initiator (curing agent), diluents, etc. required for the intended processing and final product.
Roving / Tow	Large number of continuous parallel filaments or a group of untwisted parallel strands.
Thermoplastic	A plastic that repeatedly can be softened by heating and hardened by cooling through a temperature range characteristic of the plastic, and when in the softened stage, can be shaped by flow into articles by molding or extrusion.
Thermoset	A plastic that is substantially infusible and insoluble after being cured by heat or other means, e.g. polyester, epoxy, phenolic resin.
Veil	A thin layer of mat similar to a surface mat, often composed of organic fibers as well as glass fibers.
Vinyl ester resin	Thermosetting resins that consist of a polymer backbone with an acrylate or methacrylate termination.



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