



PRODUCT GUIDE

COMPOSITE FIBRE TECHNOLOGIES

VERSION 05, 2021

WAGNERS

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DISCLAIMER

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

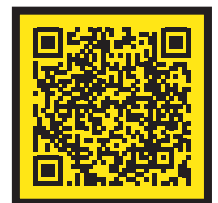
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PRODUCT AVAILABILITY AND OTHER INFORMATION

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 (305 KM) AND PULTRUDED FRP SECTIONS (330 TONNES) 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 Fibre 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 fibre 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 fibre layups chosen by Wagners, and are therefore specific to these particular products. Other manufacturers will not necessarily use the same materials, manufacturing process and fibre 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 Australian 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 fibre 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 FIBRE 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 both in Australia and internationally, exporting products from Toowoomba, Queensland to locations such as the United States, 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 utilised by our experienced staff. Many years of research and development have resulted in the successful application of composite fibre 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 fibreglass sections. These sections are traditional in geometry and shape to that of rolled hollow section steel but are manufactured from fibreglass reinforcements and vinyl ester resins. The material combination has been chosen by Wagners to optimise the structural system as well as maximise 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 fibres 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**



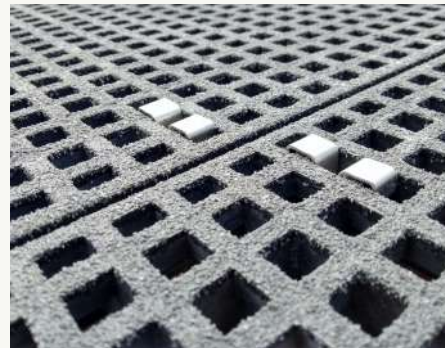
**REINFORCING
FRP REBAR**



**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 fibre 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 fibre 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.wagner.com.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

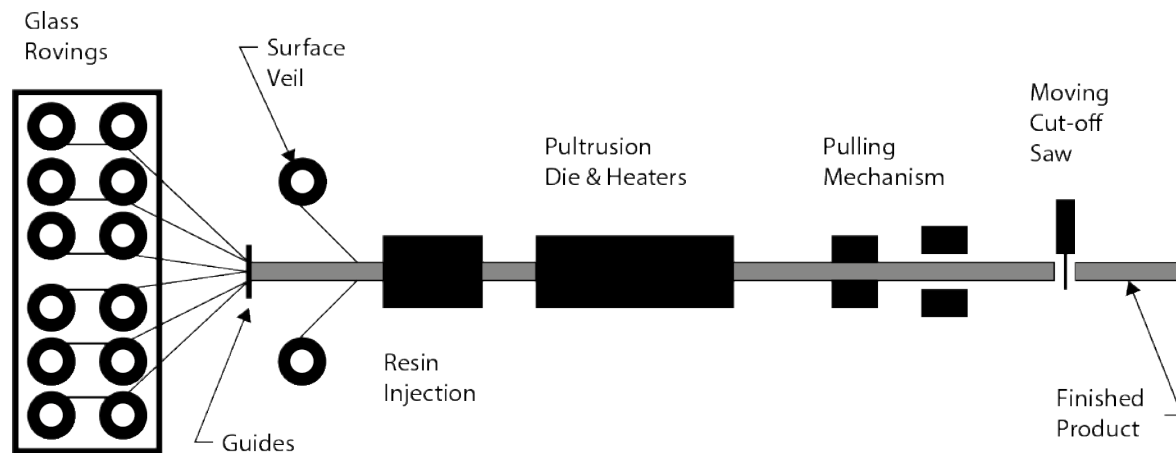
FRP products can be recycled where the glass can be retrieved and reused as reinforcements, while the resin part can be crushed into a fine powder and used as filler materials.

FIBRE 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 fibre and resin, through a shaped die.

The pultrusion process starts with racks holding rolls of fibre glass roving. The fibre reinforcement used by Wagners is glass fibre. This raw fibre 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 fibre reinforcement becomes fully injected (wetted-out) with the catalysed resin such that all the fibre filaments are thoroughly saturated with the resin mixture. This wetted fibre 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

COOKTOWN FISHING PLATFORM
COOKTOWN, NORTH QLD, AU



PART TWO

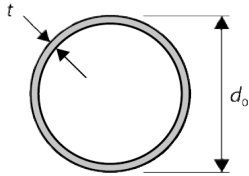
STRUCTURAL SECTIONS

STANDARD STRUCTURAL SECTIONS
BONDED STRUCTURAL SECTIONS



STANDARD STRUCTURAL SECTIONS

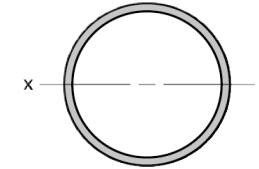
CIRCULAR HOLLOW SECTIONS



DIMENSIONS AND SECTION PROPERTIES

CIRCULAR HOLLOW SECTIONS

Fibre Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS				SECTION PROPERTIES					
	Designation		Mass per meter	External Surface Area per m	Cross Section Area A_g	About any axis			Torsion Constant J	Torsion Modulus C
	Outer Diameter d_o	Thick. t				I	Z	r		
mm	mm	kg/m	m ² /m	mm ²	10 ⁶ mm ⁴	10 ³ mm ³	mm	10 ⁶ mm ⁴	10 ³ mm ³	
WGN-C1000	88.9	6.0	3.17	0.279	1563	1.35	30.4	29.4	2.7	60.7
WGN-C2000	154.0	5.8	5.50	0.484	2700	7.43	96.4	52.4	14.9	192.9
WGN-C3000	230.1	9.7	13.86	0.723	6716	40.86	355.2	78.0	81.7	710.3
WGN-C4000	293.0	9.5	17.43	0.920	8461	85.10	580.9	100.3	170.2	1161.8
WGN-C5000	301.0	13.5	25.13	0.946	12193	126.26	838.9	101.8	252.5	1677.9

SUPPLY CONDITIONS

Finish

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

Length

The CHS profiles are typically manufactured up to 11.8m in length based on typical transport limitations. Longer lengths are available upon request

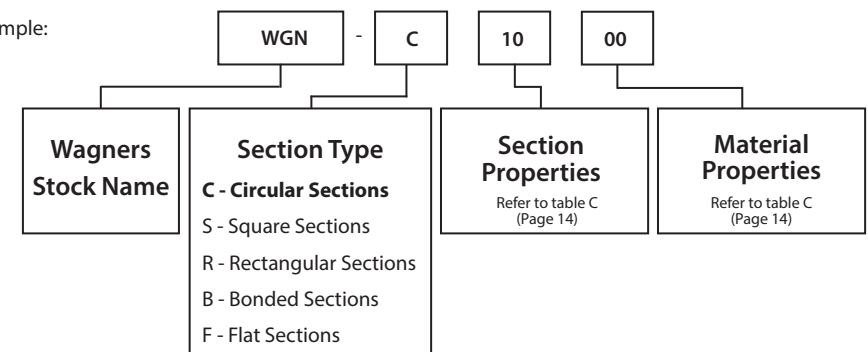
Post-Processing

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

MSDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the NOHSC Australia. Consult MSDS No. WCFT 1004 for details at www.wagner.com.au

Example:



MECHANICAL PROPERTIES

PROPERTY	RESULT						UOM	STANDARD
	C1000	C1010	C2000	C3000	C4000	C5000		
Tensile Strength – Longitudinal	361	307	610	635	635	635	MPa	ISO 527-4
Tensile Modulus of Elasticity – Longitudinal	35720	22920	36300	35405	35405	35405	MPa	
Compressive Strength – Longitudinal	267	295	395	395	395	395	MPa	ASTM D6641
Compressive Modulus of Elasticity – Longitudinal	39200	29220	33300	41178	41178	41178	MPa	
In-Plane Shear Strength – Longitudinal	91	92	84	93	93	93	MPa	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

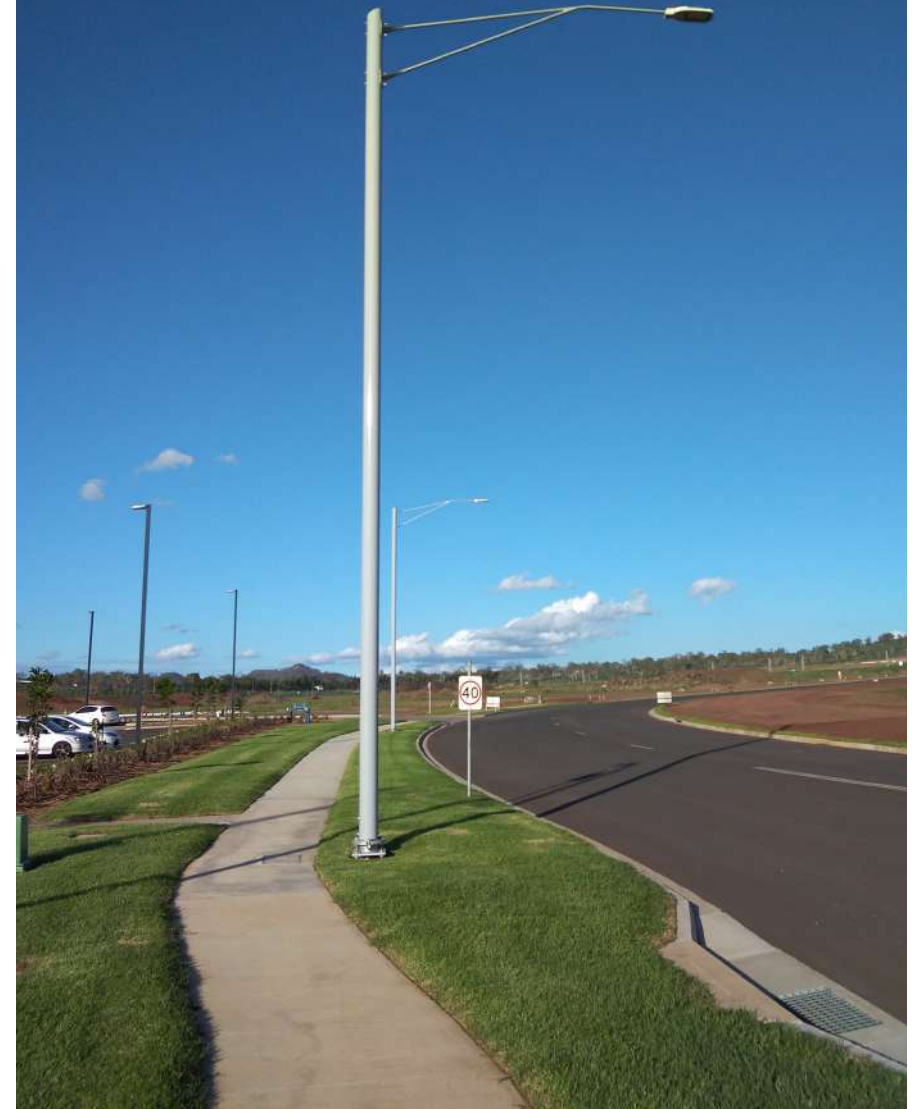
PROPERTY	NOTATION	VALUE	UNIT	TEST METHOD
Density	r	2,030	kg/m ³	ASTM D792
Barcol Hardness		60	-	ASTM D2583
Water Absorption		0.2	%	ISO 62
Glass Transition Temperature	T_g	130	°C	ASTM D7028
Fibre Mass Fraction	W_f	77.4	%	ISO 1172
Fibre Volume Fraction	V_f	57.7	%	
Coefficient of Thermal Expansion – Longitudinal	α_L	5.03x10 ⁻⁶	/°C	ISO 11359-2

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

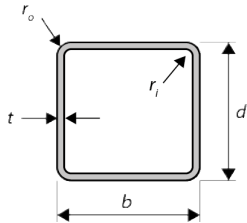
TABLE C

CIRCULAR HOLLOW SECTIONS (CHS)							
First digit: Dimension		Second digit: Wall Thickness		Third digit: Reinforcement		Fourth digit: Resin	
Value	Dimension, mm	Value	Wall thickness, mm	Value	Reinforcement Type	Value	Resin Type
1	88.9	0	6.0	0	ECR-glass rovings with 56° wound fibres	0	Vinyl Ester
				1	ECR-glass rovings with 71° wound fibres		
2	154.0	0	5.8	0	ECR-glass rovings with 30° wound fibres	0	Vinyl Ester
3	230.1	0	9.7	0	ECR-glass rovings with 50° wound fibres	0	Vinyl Ester
4	293.0	0	9.5	0	ECR-glass rovings with 30° wound fibres	0	Vinyl Ester
5	301.0	0	13.5	0	ECR-glass rovings with 30° wound fibres	0	Vinyl Ester

LIGHT POLES WELLCAMP BUSINESS PARK, QLD, AU



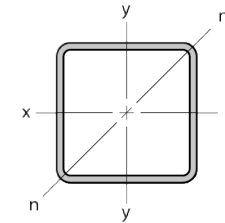
SQUARE HOLLOW SECTIONS



DIMENSIONS AND SECTION PROPERTIES

SQUARE HOLLOW SECTIONS

Fibre Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS							SECTION PROPERTIES							
	Depth	Width	Thick.	Outside Corner Radius	Inside Corner Radius	Mass	External Surface Area	Cross Section Area A_g	About x- and y-axis			About n-axis		Torsion Constant J	Torsion Modulus C
	d	b	t	r_o	r_i	per m	per m		I_x	Z_x	r_x	I_n	Z_n		
mm	mm	mm	mm	mm	kg/m	m ² /m	mm ²	10 ⁶ mm ⁴	10 ³ mm ³	mm	10 ⁶ mm ⁴	10 ³ mm ³	10 ⁶ mm ⁴	10 ³ mm ³	
WGN-S1000	100	100	5.2	10.0	4.75	3.85	0.383	1905	2.80	56.1	38.4	2.81	42.3	4.6	84.3
WGN-S2000	104	104	7.0	10.0	4.75	5.30	0.399	2650	4.11	79.0	39.4	4.12	59.3	6.6	115.7
WGN-S3000	125	125	6.4	10.0	4.75	6.07	0.483	2970	6.89	110.2	48.2	6.90	81.9	10.9	162.9

SUPPLY CONDITIONS

Finish

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

Length

The SHS profiles are typically manufactured up to 11.8m in length based on typical transport limitations. Longer lengths are available upon request.

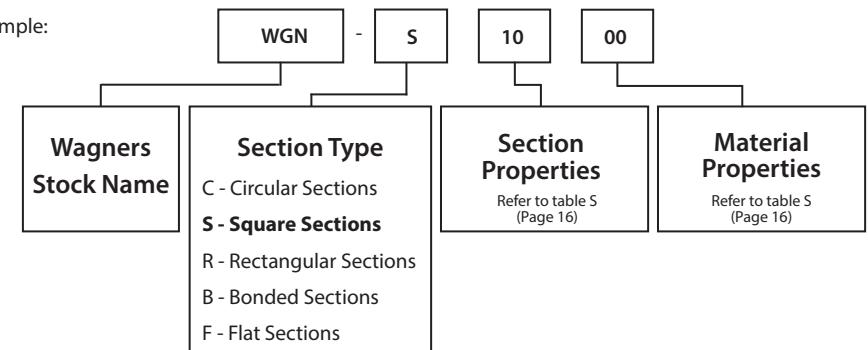
Post-Processing

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

MSDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the NOHSC Australia. Consult MSDS No. WCFT 1004 for details at www.wagner.com.au

Example:



MECHANICAL PROPERTIES

PROPERTY	RESULT			UOM	STANDARD
	WGN-S1000	WGN-S2000	WGN-S3000		
Tensile Strength – Longitudinal	610	595	610	MPa	ISO 527-4
Tensile Modulus of Elasticity – Longitudinal	36300	37680	36300	MPa	
Poisson's Ratio – Longitudinal	0.28	0.28	0.28	-	
Tensile Strength – Transverse	55	55	55	MPa	ISO 527-4
Tensile Modulus of Elasticity – Transverse	10800	10800	10800	MPa	
Poisson's Ratio – Transverse	0.09	0.09	0.09	-	
Compressive Strength – Longitudinal	485	405	485	MPa	ASTM D6641
Compressive Modulus of Elasticity – Longitudinal	33300	38240	33300	MPa	
Compressive Strength – Transverse	120	120	120	MPa	ASTM D6641
Compressive Modulus of Elasticity – Transverse	11600	11600	11600	MPa	
In-Plane Shear Strength – Longitudinal	84	71	84	MPa	ASTM D7078
In-Plane Shear Modulus of Elasticity – Longitudinal	4280	6040	4280	MPa	
Interlaminar Shear Strength	44	43	44	MPa	ASTM D2344
Izod Pendulum Impact Resistance - Longitudinal**	3204	3204	3204	J/m	ASTM D256
Izod Pendulum Impact Resistance - Transverse	554	554	554	J/m	

*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	2,030	kg/m ³	ASTM D792
Barcol Hardness		60	-	ASTM D2583
Water Absorption		0.2	%	ISO 62
Glass Transition Temperature	T_g	130	°C	ASTM D7028
Fibre Mass Fraction	W_f	77.4	%	ISO 1172
Fibre Volume Fraction	V_f	57.7	%	
Coefficient of Thermal Expansion – Longitudinal	α_L	5.03x10 ⁻⁶	/°C	ISO 11359-2

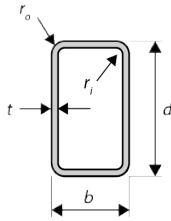
The values in the table are mean values obtained from tests at ambient temperature and relative humidity.



TABLE S

SQUARE HOLLOW SECTIONS (SHS)							
First digit: Dimension		Second digit: Wall Thickness		Third digit: Reinforcement		Fourth digit: Resin	
Value	Dimension, mm	Value	Wall thickness, mm	Value	Reinforcement Type	Value	Resin Type
1	100x100	0	5.2	0	ECR-glass rovings with 50° wound fibres	0	Vinyl Ester
2	104x104	0	7.0	0	ECR-glass rovings with 50° wound fibres	0	Vinyl Ester
3	125x125	0	6.4	0	ECR-glass rovings with 50° wound fibres	0	Vinyl Ester

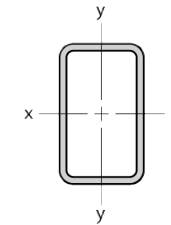
RECTANGULAR HOLLOW SECTIONS



DIMENSIONS AND SECTION PROPERTIES

RECTANGULAR HOLLOW SECTIONS

Fibre Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS							SECTION PROPERTIES								
	Depth d	Width b	Thick. t	Outside Corner Radius r _o	Inside Corner Radius r _i	Mass per m	External Surface Area per m	Cross Section Area A _g	About x-axis			About y-axis			Torsion Constant J	Torsion Modulus C
									I _x	Z _x	r _x	I _y	Z _y	r _y		
mm	mm	mm	mm	mm	kg/m	m ² /m	mm ²	10 ⁶ mm ⁴	10 ³ mm ³	mm	10 ⁶ mm ⁴	10 ³ mm ³	mm	10 ⁶ mm ⁴	10 ³ mm ³	
WGN-R1000	100	75	5.2	10.0	4.75	3.31	0.333	1645	2.22	44.4	36.7	1.41	37.7	29.3	2.9	61.0
WGN-R5000	250	100	8.1	5.0	8.0	11.72	0.691	5441	41.36	330.9	87.2	9.40	188.1	41.6	24.2	322.7

SUPPLY CONDITIONS

Finish

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

Length

The RHS profiles are typically manufactured up to 11.8m in length based on typical transport limitations. Longer lengths are available upon request.

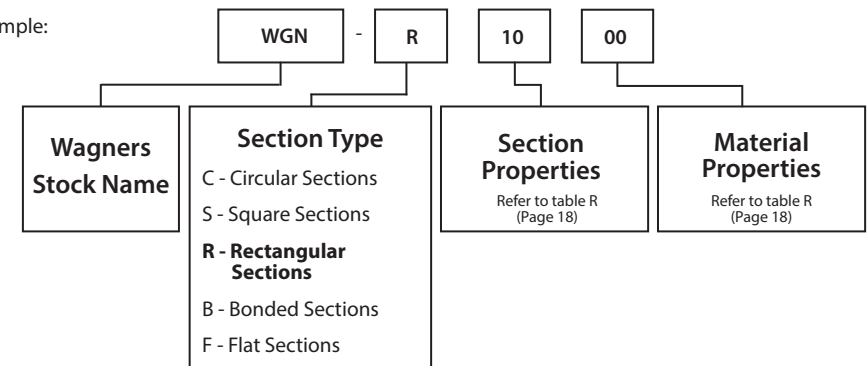
Post-Processing

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

MSDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the NOHSC Australia. Consult MSDS No. WCFT 1004 for details at www.wagner.com.au

Example:



MECHANICAL PROPERTIES

PROPERTY	RESULT		UOM	STANDARD
	WGN-R1000	WGN-R5000		
Tensile Strength – Longitudinal	570	610	MPa	ISO 527-4
Tensile Modulus of Elasticity – Longitudinal	37600	36300	MPa	
Poisson's Ratio – Longitudinal	0.3	0.28	-	
Tensile Strength – Transverse	35	55	MPa	ISO 527-4
Tensile Modulus of Elasticity – Transverse	9190	10800	MPa	
Poisson's Ratio – Transverse	0.07	0.09	-	
Compressive Strength – Longitudinal	425	485	MPa	ASTM D6641
Compressive Modulus of Elasticity – Longitudinal	34000	33300	MPa	
Compressive Strength – Transverse	108	120	MPa	ASTM D6641
Compressive Modulus of Elasticity – Transverse	11000	11600	MPa	
In-Plane Shear Strength – Longitudinal	51	84	MPa	ASTM D7078
In-Plane Shear Modulus of Elasticity – Longitudinal	4690	4280	MPa	
Interlaminar Shear Strength	42	44	MPa	ASTM D2344
Izod Pendulum Impact Resistance - Longitudinal**	3204	3204	J/m	ASTM D256
Izod Pendulum Impact Resistance - Transverse	554	554	J/m	

*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.



JAMES ST. JETTY,
ESPERANCE, WA, AU

PHYSICAL PROPERTIES

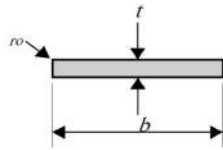
PROPERTY	NOTATION	VALUE	UNIT	TEST METHOD
Density	r	2,030	kg/m ³	ASTM D792
Barcol Hardness		60	-	ASTM D2583
Water Absorption		0.2	%	ISO 62
Glass Transition Temperature	T_g	130	°C	ASTM D7028
Fibre Mass Fraction	W_f	77.4	%	ISO 1172
Fibre Volume Fraction	V_f	57.7	%	
Coefficient of Thermal Expansion – Longitudinal	α_L	5.03x10 ⁻⁶	/°C	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, mm	Value	Wall thickness, mm	Value	Reinforcement Type	Value Resin Type
1	100x75	0	5.0	0	ECR-glass rovings with 50° wound fibres	0 Vinyl Ester
5	250x100	0	8.1	0	ECR-glass rovings with 39° wound fibres	0 Vinyl Ester

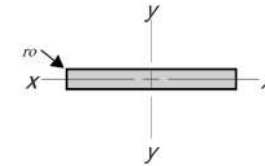
FLAT SECTIONS



DIMENSIONS AND SECTION PROPERTIES

FLAT SECTIONS

Fibre Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS					SECTION PROPERTIES							
	Designation		Corner Radius	Mass	External Surface Area	Cross Section Area	About x- axis			About y-axis			Torsion Constant
	Width	Thick.					I_x	Z_x	r_x	I_y	Z_y	r_y	
b	t	r_o	per m	per m	A_g	10^6mm^4	10^3mm^3	mm	10^6mm^4	10^3mm^3	mm	10^6mm^4	
WGN-F1000	1200	6.4	-	15.6	2.413	7680	0.026	8.2	1.85	921.6	1536	346.41	0.10
WGN-F3000	300	24.0	10	14.6	0.641	7176	0.343	28.6	6.91	53.5	356.5	86.32	1.38

SUPPLY CONDITIONS

Finish

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

Length

The FS profiles are typically manufactured up to 11.8m in length based on typical transport limitations. Longer lengths are available upon request.

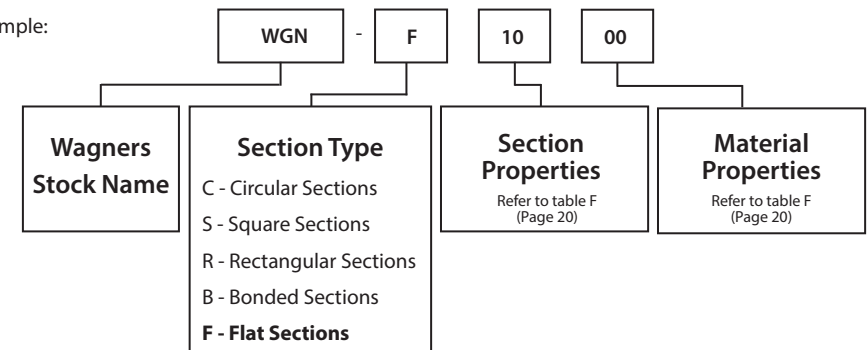
Post-Processing

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

MSDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the NOHSC Australia. Consult MSDS No. WCFT 1004 for details at www.wagner.com.au

Example:



MECHANICAL PROPERTIES

PROPERTY	RESULT		UNIT	STANDARD
	F1000	F3000		
Tensile Strength – Longitudinal	373	548	MPa	ISO 527-4
Tensile Modulus of Elasticity – Longitudinal	26100	41768	MPa	
Compressive Strength – Longitudinal	265	500	MPa	ASTM D6641
Compressive Modulus of Elasticity – Longitudinal	25400	36575	MPa	

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	1979	kg/m ³	ASTM D792
Barcol Hardness		60	-	ASTM D2583
Fibre Mass Fraction	W_f	75	%	ISO 1172
Fibre 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

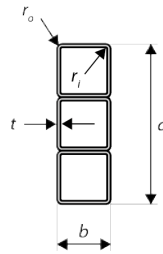
FLAT SECTIONS (FS)							
First digit: Dimension		Second digit: Wall Thickness		Third digit: Reinforcement		Fourth digit: Resin	
Value	Dimension, mm	Value	Wall thickness, mm	Value	Reinforcement Type	Value	Resin Type
1	1200x6.4	0	6.4	0	ECR-glass rovings and E-CR multi-axial stitched fabric.	0	Vinyl Ester
3	300x24.0	0	24.0	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

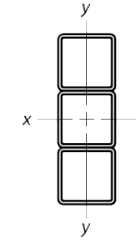
BONDED RECTANGULAR SECTIONS



DIMENSIONS AND SECTION PROPERTIES

BONDED RECTANGULAR SECTIONS

Fibre Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS							SECTION PROPERTIES							
	Designation			Outside Corner Radius r_o	Inside Corner Radius r_i	Mass per m	External Surface Area per m	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	
mm	mm	mm	mm	mm	kg/m	m ² /m	mm ²	10 ⁶ mm ⁴	10 ³ mm ³	mm	10 ⁶ mm ⁴	10 ³ mm ³	mm	10 ⁶ mm ⁴	
WGN-B1020	200	100	5.2	10.0	4.75	7.70	0.61	3811	15.1	151.3	63.0	5.6	112.1	38.4	9.1
WGN-B1030	300	100	5.2	10.0	4.75	11.55	0.83	5716	46.5	310.1	90.2	8.4	168.2	38.4	13.7
WGN-B1040	400	100	5.2	10.0	4.75	15.40	1.05	7621	106.5	532.4	118.2	11.2	224.3	38.4	18.2
WGN-B1050	500	100	5.2	10.0	4.75	19.25	1.27	9527	204.6	818.2	146.5	14.0	280.3	38.4	22.8
WGN-B1060	300	200	5.2	10.0	4.75	23.10	0.96	11432	93.0	620.2	90.2	45.4	454.0	63.0	27.3
WGN-B1120	250	125	6.4	10.0	4.75	12.14	0.76	5939	37.0	295.8	78.9	13.8	220.3	48.2	21.9
WGN-B1130	375	125	6.4	10.0	4.75	18.21	1.03	8909	113.5	605.1	112.8	20.7	330.5	48.2	32.8
WGN-B1140	500	125	6.4	10.0	4.75	24.28	1.30	11879	259.5	1038.2	147.8	27.5	440.6	48.2	43.7
WGN-B1150	625	125	6.4	10.0	4.75	30.35	1.57	14848	498.4	1595.0	183.2	34.4	550.8	48.2	54.7
WGN-B1160	375	250	6.4	10.0	4.75	36.42	1.21	17818	226.9	1210.2	112.8	110.9	887.3	78.9	65.6

SUPPLY CONDITIONS

Finish

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

Length

The BRS profiles are typically manufactured up to 11.8m in length based on typical transport limitations. Longer lengths are available upon request

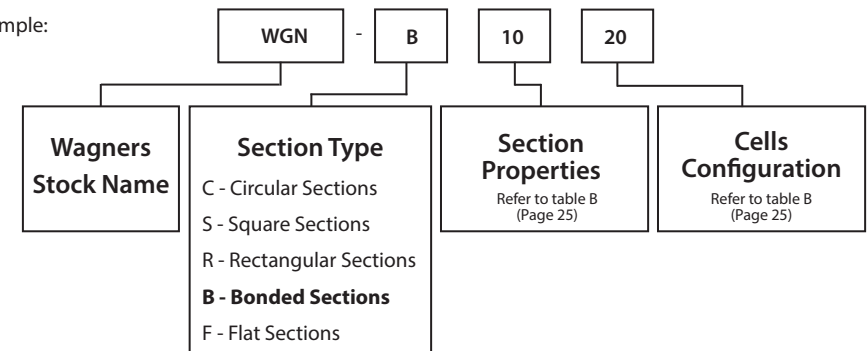
Post-Processing

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

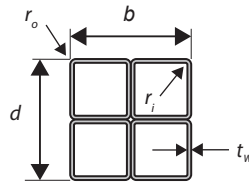
MSDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the NOHSC Australia. Consult MSDS No. WCFT 1004 for details at www.wagner.com.au

Example:



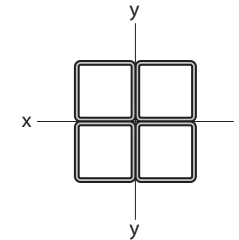
BONDED SQUARE SECTIONS



DIMENSIONS AND SECTION PROPERTIES

BONDED SQUARE SECTIONS

Fibre Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS							SECTION PROPERTIES						
	Designation			Outside Corner Radius	Inside Corner Radius	Mass	External Surface Area	Cross Section Area	About x-axis and y-axis			About n-axis		Torsion Constant
	Depth	Width	Thick.						$I_{x,y}$	$Z_{x,y}$	$r_{x,y}$	I_n	Z_n	
	d	b	t	r_o	r_i	per m	per m	A_g	10^6mm^4	10^3mm^3	mm	10^6mm^4	10^3mm^3	10^6mm^4
mm	mm	mm	mm	mm	kg/m	m ² /m	mm ²							
WGN-B2020	200	200	5.2	10.0	4.75	15.40	0.766	7621	30.3	302.7	63.0	30.2	220.4	18.2
WGN-B2120	250	250	6.4	10.0	4.75	24.28	0.966	11879	73.9	591.5	78.9	73.2	425.7	43.7

SUPPLY CONDITIONS

Finish

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

Length

The BSS profiles are typically manufactured up to 11.8m in length based on typical transport limitations. Longer lengths are available upon request

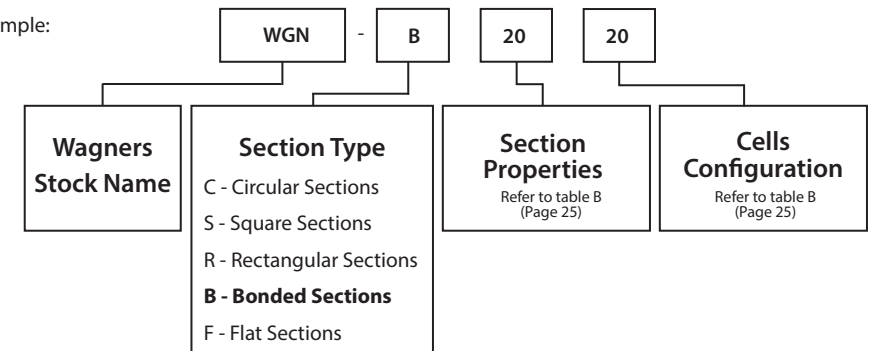
Post-Processing

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

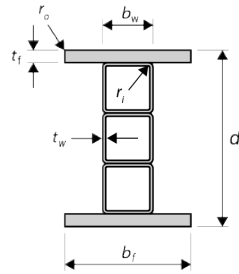
MSDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the NOHSC Australia. Consult MSDS No. WCFT 1004 for details at www.wagner.com.au

Example:



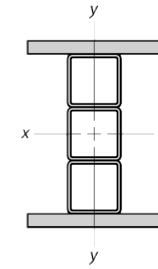
BONDED I SECTIONS



DIMENSIONS AND SECTION PROPERTIES

BONDED I-SECTIONS

Fibre Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS									SECTION PROPERTIES							
	Depth d	Designation Width		Thick.		Outside Corner Radius r _o	Inside Corner Radius r _i	Mass per m	External Surface Area per m	Cross Section Area A _g	About x-axis			About y-axis			Torsion Constant J
		b _f	b _w	t _f	t _w						I _x	Z _x	r _x	I _y	Z _y	r _y	
		mm	mm	mm	mm						10 ⁶ mm ⁴	10 ³ mm ³	mm	10 ⁶ mm ⁴	10 ⁶ mm ⁴	10 ³ mm ³	
WGN-B3020	248	300	100	24	5.2	10.0	4.75	36.38	1.47	18163	195.9	1579.4	103.8	112.6	750.4	78.7	10.5
WGN-B3030	348	300	100	24	5.2	10.0	4.75	40.68	1.66	20068	423.9	2436.0	145.3	115.4	769.0	75.8	15.0
WGN-B3040	448	300	100	24	5.2	10.0	4.75	44.53	1.85	21973	752.2	3358.0	185.0	118.2	787.7	73.3	19.6
WGN-B3050	548	300	100	24	5.2	10.0	4.75	48.38	2.04	23879	1190.4	4344.6	223.3	121.0	806.4	71.2	24.1
WGN-B3120	298	300	125	24	6.4	10.0	4.75	41.27	1.52	20291	307.0	2060.6	123.0	120.7	804.8	77.1	23.3
WGN-B3130	423	300	125	24	6.4	10.0	4.75	47.34	1.76	23261	685.4	3240.4	171.6	127.6	850.7	74.1	34.2
WGN-B3140	548	300	125	24	6.4	10.0	4.75	53.41	2.00	26231	1245.4	4545.3	217.9	134.5	896.6	71.6	45.1
WGN-B3150	673	300	125	24	6.4	10.0	4.75	59.48	2.24	29200	2010.4	5974.4	262.4	141.4	942.5	69.6	56.1

SUPPLY CONDITIONS

Finish

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

Length

The BIS profiles are typically manufactured up to 11.8m in length based on typical transport limitations. Longer lengths are available upon request

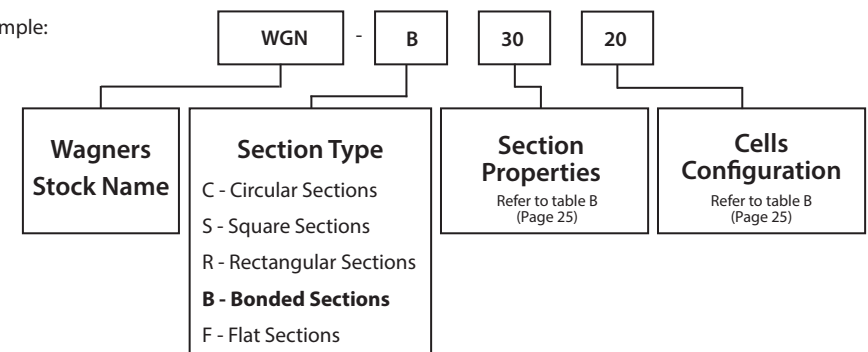
Post-Processing

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

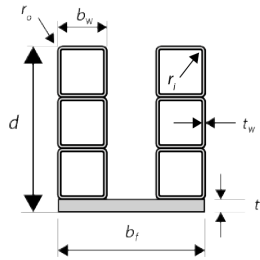
MSDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the NOHSC Australia. Consult MSDS No. WCFT 1004 for details at www.wagner.com.au

Example:



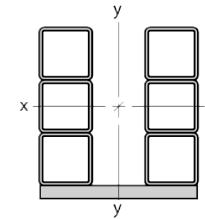
BONDED U SECTIONS



DIMENSIONS AND SECTION PROPERTIES

BONDED U-SECTIONS

Fibre Reinforced Polymer (FRP)



PRODUCT CODE	DIMENSIONS									SECTION PROPERTIES									
	Designation					Outside Corner Radius	Inside Corner Radius	Mass	External Surface Area	Cross Section Area	About x-axis				About y-axis				Torsion Constant
	Depth	Width		Thick.							per m	per m	A _g	I _x	Z _{x,max}	Z _{x,min}	r _x	I _y	
d	b _f	b _w	t _f	t _w	r _o	r _i	kg/m	m ² /m	mm ²	10 ⁶ mm ⁴	10 ³ mm ³	10 ³ mm ³	mm	10 ⁶ mm ⁴	10 ³ mm ³	10 ³ mm ³	mm	10 ⁶ mm ⁴	
WGN-B4120	274	600	125	24	6.4	10.0	4.75	53.4	2.25	26231	196.8	2781.6	968.6	86.6	1125.2	3756.9	3744.3	207.1	46.5
WGN-B4130	399	600	125	24	6.4	10.0	4.75	65.6	2.79	32170	544.1	4540.8	1949.0	130.1	1474.0	4920.0	4906.5	214.1	68.4
WGN-B4140	524	600	125	24	6.4	10.0	4.75	77.7	3.34	38109	1134.0	6552.0	3231.5	172.5	1822.8	6082.9	6068.8	218.7	90.3
WGN-B4150	649	600	125	24	6.4	10.0	4.75	89.8	3.88	44049	2016.4	8812.1	4798.9	214.0	2171.5	7245.8	7231.2	222.0	112.1

SUPPLY CONDITIONS

Finish

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

Length

The BUS profiles are typically manufactured up to 11.8m in length based on typical transport limitations. Longer lengths are available upon request

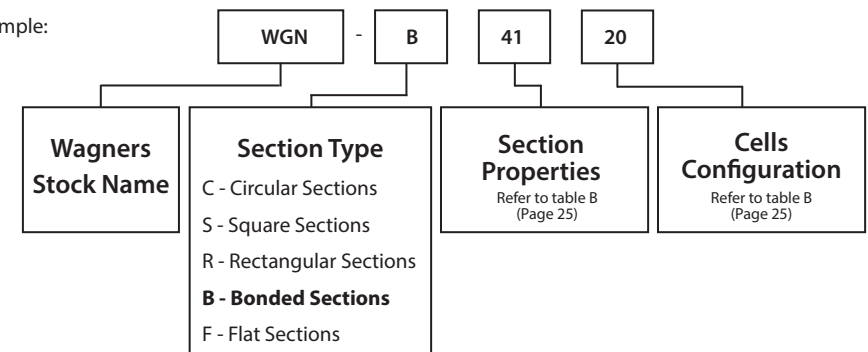
Post-Processing

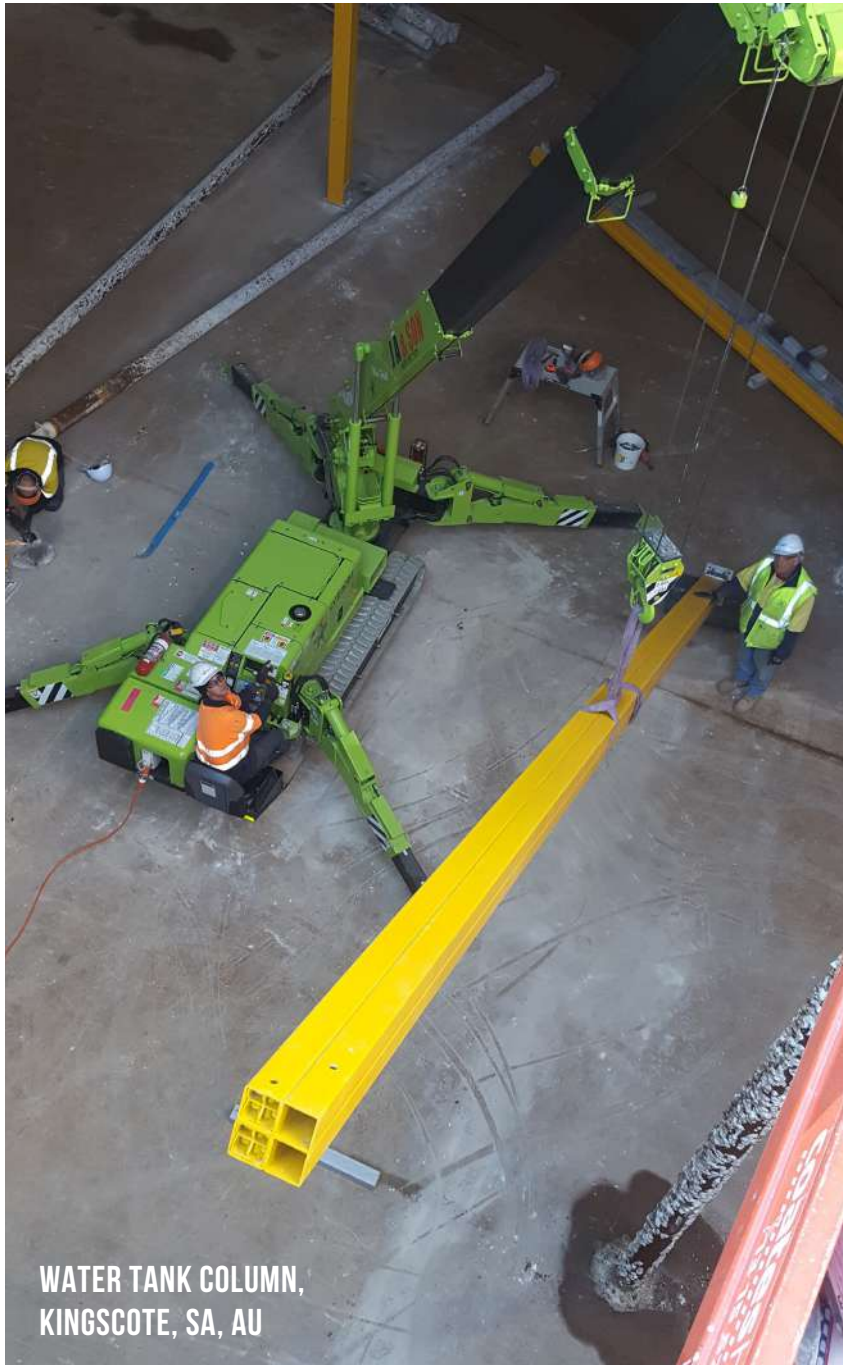
Wagners can provide members cut to length with predrilled holes and inserts in accordance with client drawings. Contact Wagners for further details and pricing.

MSDS - FRP Structural Section

This product is not classified as hazardous according to the criterion of the NOHSC Australia. Consult MSDS No. WCFT 1004 for details at www.wagner.com.au

Example:





WATER TANK COLUMN,
KINGSCOTE, SA, AU

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	34.1	MPa	ISO 527-2
Tensile Modulus	E_t	2409	MPa	ISO 527-2
Lap Shear Strength	f_v	11.9	MPa	ASTM D3163
Heat Deflection Temperature	HDT	85	°C	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 @ 80 °C.
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 ± 0.5 mm				
Thickness, t	± 0.5 mm				
Outside corner radius, r_o	± 0.5 mm				
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	≤ 2 mm + 0.5 mm per metre 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	± 5 mm				

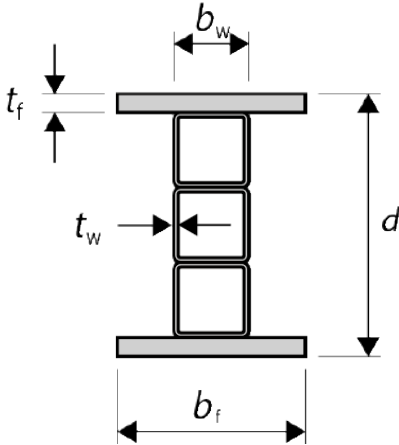
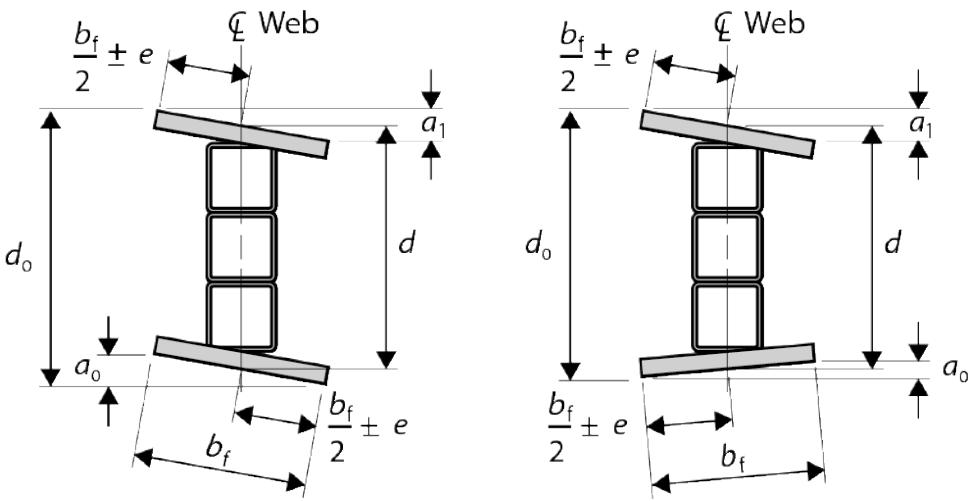
The tolerance on member length applies to manufactured product only. Tolerances on post-processed (fabricated) product are determined on a project by project basis.

BONDED STRUCTURAL SECTIONS

BONDED STRUCTURAL SECTIONS		
Parameter	Tolerance	Illustration
Deviation from verticality of a web, Δ_v	± 2 mm	<p>A side view of a bonded structural section showing a vertical web between two horizontal flanges. The web is slightly tilted. A dimension line with arrows indicates the vertical deviation Δ_v at the top flange. Another dimension line indicates the depth d of the web.</p>
Off centre of a web, e	± 2 mm	<p>A side view of a bonded structural section showing a vertical web between two horizontal flanges. A vertical dashed line represents the 'Nominal web centre line'. A dimension line with arrows indicates the offset e of the web from this line.</p>
Out-of-flatness of a flange	$\pm b_f / 150$	<p>Two diagrams showing the out-of-flatness of a flange. The left diagram shows a top view of a flange with width b_f and a vertical deviation Δ_f from a flat surface. The right diagram shows a side view of a flange with a vertical deviation Δ_f from a flat surface, labeled 'Flange Edge'.</p>
Straightness, e	0.1% of total length	<p>A diagram showing a curved member of length L. A dashed line represents the ideal straight member, and a solid line represents the actual curved member. The maximum deviation e is shown between the two lines.</p>
Mass of a section length	$\pm 4\%$	
Length of a member, L	± 5 mm	

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 $\pm 0.5\text{mm}$	
Flange width, b_f	$\pm 0.5\%$ with a maximum of $\pm 0.5\text{mm}$	
Web width, b_w	$\pm 0.5\%$ with a maximum of $\pm 0.5\text{mm}$	
Flange thickness, t_f	$\pm 3\%$	
Web thickness, t_w	$\pm 10\%$	
Out-of-square of an individual flange, a_0 or a_1	$\pm 2\text{mm}$	
Total out-of-square of two flanges, a_0 or a_1	$\pm 4\text{mm}$	

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

Moulded grating is manufactured in an open, heated mould system. Continuous E-glass rovings are placed in the mould in alternating layers (on one side or two) and completely wet 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.

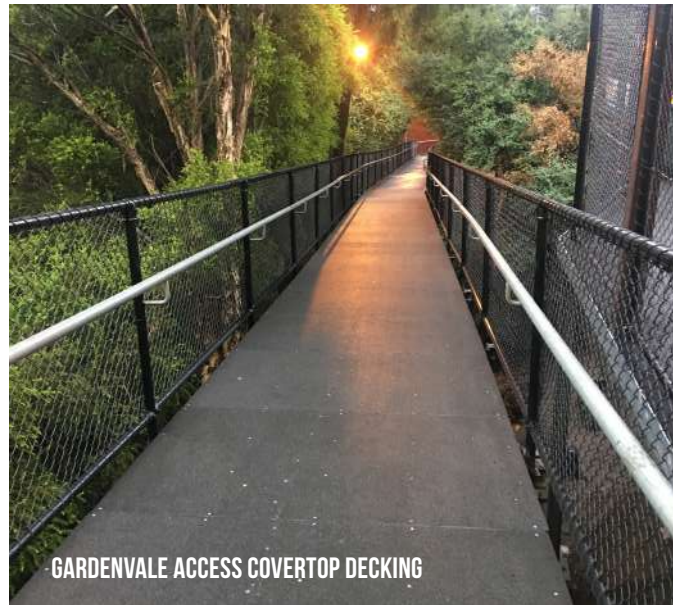
Performance Advantages

- » 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 colour
- » Various sizes and colours available

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

TredDeck is an advanced FRP composite and high-strength structural decking system that has similar geometry to covertsop deckings, but with an additional specifically engineered top layer.

It consists of two main components, covertsop decking substrate and a 10 mm top layer of hard-wearing stone and non-slip surface combined with thermoset UV stabilized epoxy resin as the binder and adhesive create a durable non-slip surface.



GARDENVALE ACCESS COVERTOP DECKING

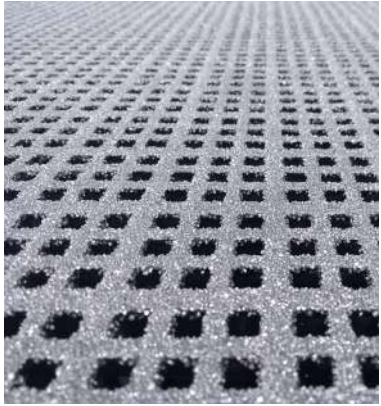
Functions

- » 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

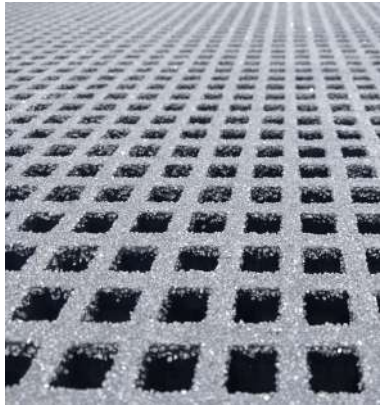
Industries

- » 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 (mm)	Bar Thickness (mm)	Bar Spacing (Top/Bottom) (mm)	Aperture (mm)	Open Rate (%)	Panel Size (mm)	Weight (kg/m ²)	Slip Rating (AS4586)	Pattern Loading	Allowable Design Load (kN)					
										Max. Joist Clear Span (mm)					
										400	600	750	1000	1200	1500
MIC30-XX	30	5.0	13x13 40x40	8x8	38	Standard Size: 1247x3687 Maximum Size: 1527x4047	19.1	P5	≤ 5 kPa	5.50	3.65	2.85	2.15	n/a	n/a
MIC38-XX	38	5.0	13x13 40x40	8x8	38	Standard Size: 1247x3687 Maximum Size: 1527x4047	25.0	P5	≤ 5 kPa	4.85*	4.85	4.70	3.50	3.05	n/a



MINI-MESH DECKING															
PRODUCT CODE	Thickness (mm)	Bar Thickness (mm)	Bar Spacing (Top/Bottom) (mm)	Aperture (mm)	Open Rate (%)	Panel Size (mm)	Weight (kg/m ²)	Slip Rating (AS4586)	Pattern Loading	Allowable Design Load (kN)					
										Max. Joist Clear Span (mm)					
										400	600	750	1000	1200	1500
MIN30-XX	30	6.5	19x19 38x38	12.5x 12.5	43	Standard Size: 1220x3660 Maximum Size: 1530x4047	18.8	P5	≤ 5 kPa	5.50	3.65	2.85	2.15	n/a	n/a
MIN38-XX	38	6.5	19x19 38x38	12.5x 12.5	43	Standard Size: 1225x3660 Maximum Size: 1225x4047	23.5	P5	≤ 5 kPa	4.85*	4.85	4.70	3.50	3.05	n/a



OPEN-MESH DECKING															
PRODUCT CODE	Thickness (mm)	Bar Thickness (mm)	Bar Spacing (Top/Bottom) (mm)	Aperture (mm)	Open Rate (%)	Panel Size (mm)	Weight (kg/m ²)	Slip Rating (AS4586)	Pattern Loading	Allowable Design Load (kN)					
										Max. Joist Clear Span (mm)					
										400	600	750	1000	1200	1500
MSH38-XX	38	7.0	38x38	31x31	67	Standard Size: 1220x3660 Maximum Size: 2100x4240	19.5	P5	≤ 5 kPa	3.55*	3.55	2.90	2.30	1.80	n/a
MSH50-XX*	50	7.0	50x50	43x43	74	Standard Size: 1220x3660 Maximum Size: 1527x4020	23.0	P5	≤ 5 kPa	3.55	3.55	2.90	2.30	1.80	n/a



COVERTOP DECKING															
PRODUCT CODE	Thickness (mm)	Bar Thickness (mm)	Bar Spacing (mm)	Aperture (mm)	Open Rate (%)	Panel Size mm	Weight (kg/m ²)	Slip Rating (AS4586)	Pattern Loading	Allowable Design Load (kN)					
										Max. Joist Clear Span (mm)					
										400	600	750	1000	1200	1500
COV25-XX	25	7.0	38x38	0	0	Standard Size: 1220x3660 Maximum Size: 1524x4010	21.0	P5	≤ 5 kPa	5.05	3.60	3.25	2.15	n/a	n/a
COV30-XX	30	7.0	38x38	0	0	Standard Size: 1220x3660 Maximum Size: 1530x4010	23.0	P5	≤ 5 kPa	6.15	4.40	3.35	2.65	2.90	n/a
COV43-XX	43	7.0	38x38	0	0	Standard Size: 1220x3660 Maximum Size: 2100x4240	29.0	P5	≤ 5 kPa	7.45*	7.45*	7.45	6.45	5.10	n/a
COV55-XX	55	7.0	50x50	0	0	Standard Size: 1220x3660 Maximum Size: 1527x4020	33.0	P5	≤ 5 kPa	20.00*	20.00*	14.50 [^]	11.15	9.30	7.20



TREDDECK DECKING*															
PRODUCT CODE	Thickness (mm)	Bar Thickness (mm)	Bar Spacing (mm)	Aperture (mm)	Open Rate (%)	Panel Size mm	Weight (kg/m ²)	Slip Rating (AS4586)	Pattern Loading	Allowable Design Load (kN)					
										Max. Joist Clear Span (mm)					
										400	600	750	1000	1200	1500
TD35-FX	35	7.0	38x38	0	0	Standard Size: 1220x3660 Maximum Size: 1524x4010	45.0	P5	≤ 5 kPa	5.05	3.60	3.25	2.15	n/a	n/a
TD40-FX	40	7.0	38x38	0	0	Standard Size: 1220x3660 Maximum Size: 1530x4010	47.0	P5	≤ 5 kPa	6.15	4.40	3.35	2.65	2.65	n/a
TD53-FX	53	7.0	38x38	0	0	Standard Size: 1220x3660 Maximum Size: 2100x4240	53.0	P5	≤ 5 kPa	7.45	7.45	7.45	6.45	5.10	n/a
TD65-FX	65	7.0	50x50	0	0	Standard Size: 1220x3660 Maximum Size: 1527x4020	57.0	P5	≤ 5 kPa	20.00	20.00	14.50	11.15	9.30	7.20

* Untested, conservative value based on the closest decking type/span

[^] 150x150mm loading plate

^x 200x200mm loading plate

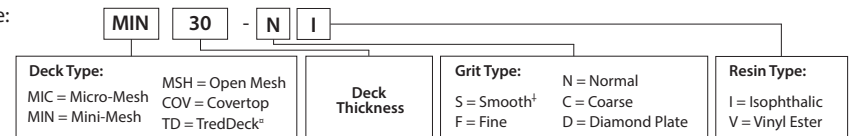
[^] TredDeck comes with fine grit only

[†] Smooth finish has low slip resistance

• Test load was applied over 100x100mm plate at mid-span and adjacent to the free edge of two-span decking

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

Example:



STAIRTREAD

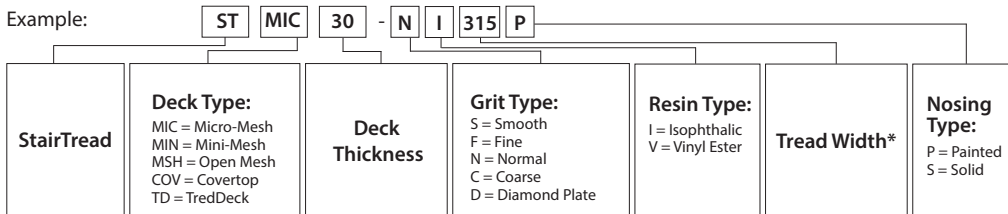
FRP StairTreads are made in similar manner to the FRP decking, hence have the same sectional properties and strength capacities.

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

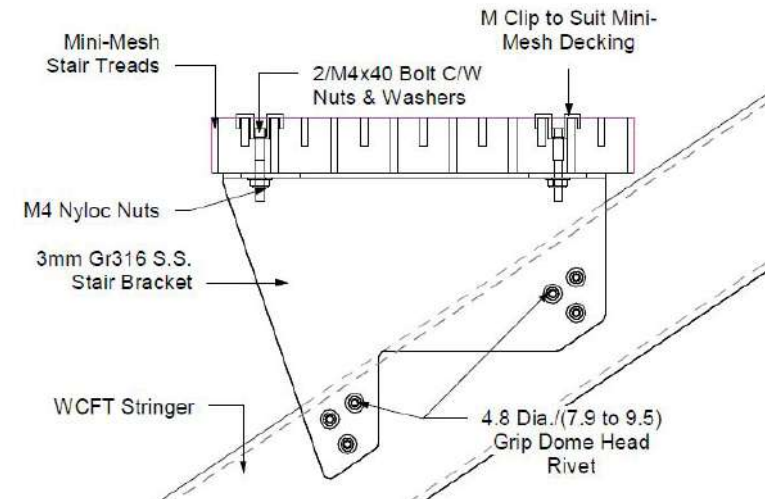
STAIR TREAD					
PRODUCT CODE	Mesh Type (mm)	Thickness (mm)	Weight (kg/m ²)	Standard Width (mm)	Slip Rating AS 4586
ST-MIC30-XX-315X	Micro-Mesh	30.0	18.8	315	P5
ST-MIC38-XX-315X		38.0	23.8		
ST-MIN30-XX-315X	Mini-Mesh	30.0	19.1	315	P5
ST-MIN38-XX-315X		38.0	23.5		
ST-MSH38-XX-315X	Open-Mesh	38.0	19.5	315	P5
ST-MSH50-XX-315X		50.0	23.0		
ST-COV30-XX-315X	CoverTop	30.0	23.0	315	P5
ST-COV43-XX-315X		43.0	29.0		
ST-COV55-XX-315X		55.0	33.0		



Example:



*The standard width of StairTread is 315mm, custom width is also available.



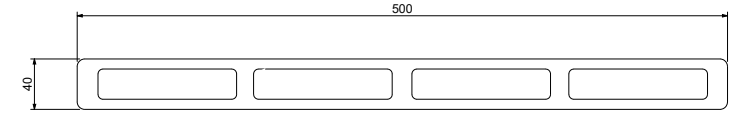
BRIDGEDECK

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

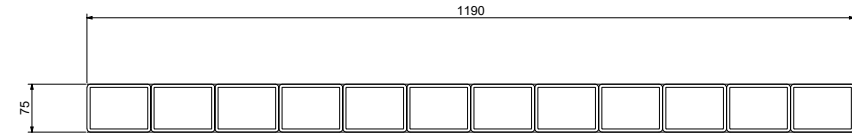
BRIDGEDECKS				
Product	Product Code	Dimensions (mm) (WxHxT)	Weight (kg/m ²)	Load Class
BridgeDeck 40	BD-040	500x40x8	37.6	Light Vehicle
BridgeDeck 75	BD-075	1190x75x5	39.7	Medium Vehicle
BridgeDeck 104	BD-104	1236x105x12	53.6	T44
BridgeDeck 125	BD-125	1240x126x10	50.0	SM1600

Performance Advantages

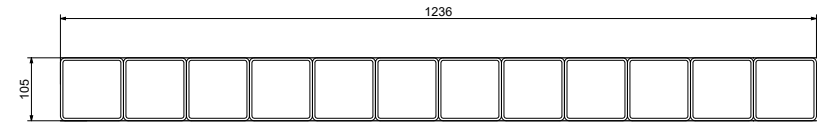
- » **Lightweight:** The high weight/strength ratio of WCFT BridgeDeck allow its utilisation on existing timber and concrete bridge abutment, reducing the installation time and cost of the project
- » **Low Maintenance:** An ideal material in high risk environments near the sea or flood-prone areas, 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 Main Roads Queensland, our structures possess an extremely high strength reserve, allowing full load services for decades to come



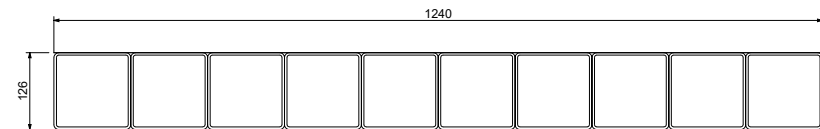
BRIDGEDECK 40



BRIDGEDECK 75



BRIDGEDECK 104



BRIDGEDECK 125



PILES



FIBRE 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

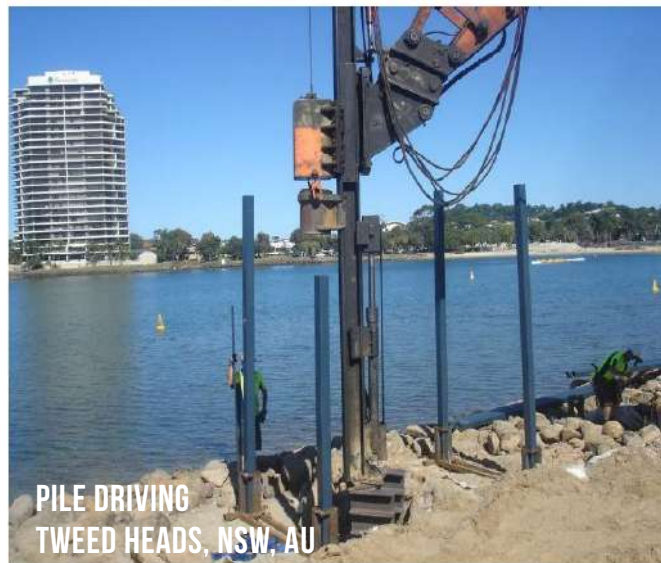
Various connection configurations can be utilised depending on the proposed application, and anti-crush inserts are used to provide superior connection capacities. More specific connection details are available in Part Seven of this document.

COATING

Piles can be coated in a variety of colours 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			89x6mm Circular Hollow Section	154x5.8mm Circular Hollow Section	230x9.7mm Circular Hollow Section	293x9.5mm Circular Hollow Section	301x13.5mm Circular Hollow Sections	200x200mm Bonded Square Hollow Sections	250x250mm Bonded Square Hollow Sections
Outer Dimension	Do	mm	88.9	154.0	230.1	293.0	301.0	200	250
Wall Thickness	t	mm	6.0	5.8	9.7	9.5	13.5	5.2	6.4
Cross Sectional Area	A	mm ²	1563	2700	6716	8461	12193	7621	11879
Surface Area	SA	m ² /m	0.28	0.48	0.72	0.92	0.95	0.77	0.97
Moment of Inertia	I	mm ⁴	1.35x10 ⁶	7.43x10 ⁶	40.89x10 ⁶	85.10x10 ⁶	126.26x10 ⁶	30.27x10 ⁶	73.94x10 ⁶
Weight	w	kg/m	3.17	5.50	13.86	17.43	25.13	15.40	24.28
Bending Moment Capacity	Mu	kN.m	17.4	41	92	256	327	65	125
Tensile Strength (L)	F _{lt}	MPa	361	610	635	635	635	610	610
Tensile Modulus (L)	E _{lt}	MPa	35720	36300	35405	35405	35405	36300	36300
Compressive Strength (L)	F _{lc}	MPa	267	485	395	395	395	485	485
Compressive Modulus (L)	E _{lc}	MPa	39200	33300	41178	41178	41178	33300	33300
In Plane Shear Stress (L)	F _{Lv}	MPa	91	84	93	93	93	84	84

*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 Fibre Reinforced Polymer (GFRP) also known as glass fibre reinforced polymer is a composite material weaving fibre 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 (mm)	ASTM No.	Equivalent Cross-Section Area (mm ²)	Fibre Volume Fraction ASTM D2584	Tg (°C) ASTM E1640	Tensile Modulus (GPa) ASTM D7205	Guaranteed Tensile Strength (MPa) ASTM D7205	Ultimate Shear (MPa) ASTM D7617	Bond Strength (MPa) ACI 440.3R (Method B3)
6	#2	28	> 60%	≥ 100	46	900	150	8
8	-	50				850		
10	#3	78				830		
13	#4	130				760		
16	#5	200				725		
19	#6	280				690		
22	#7	380				655		
25	#8	490				620		
28	#9	615				590		
32	#10	800				550		



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



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

PART SIX

HANDRAILS



INDUSTRIAL HANDRAILS

All pultruded profiles used in handrails are made of E-glass and premium grade isophthalic polyester or vinyl ester resin.

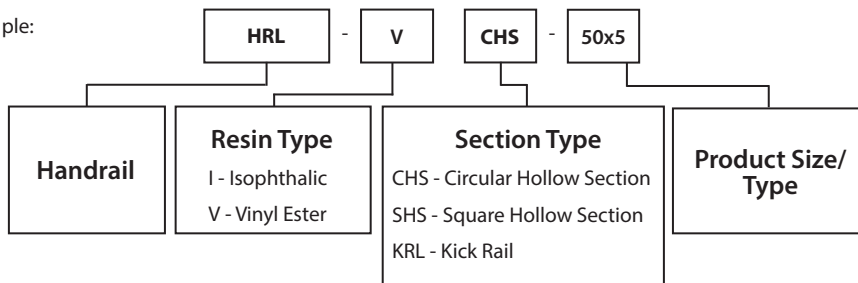
There are two types of handrail available:

Round tubes handrails consist of 50 x 5 mm for top/middle rail and post. Top and middle rails shall be connected using tee and cross connectors. Kickrails shall be 100 x 5 mm thickness and using side or base plate connectors.

Square tube handrail consists of 55 x 6 mm for post and rails. Top and middle shall be connected using 45 x 3 mm connectors. Kickrail shall be 100 x 5 mm thickness and using side or base plate connector.

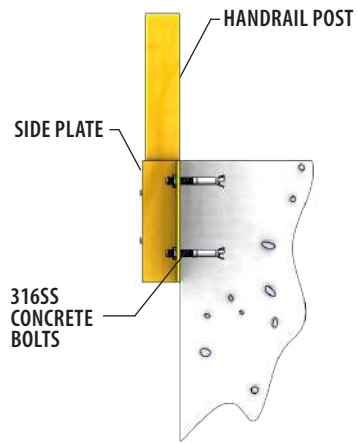
Type 316 SS bolts/nuts/washers shall be provided for handrail assembly and fixation.

Example:

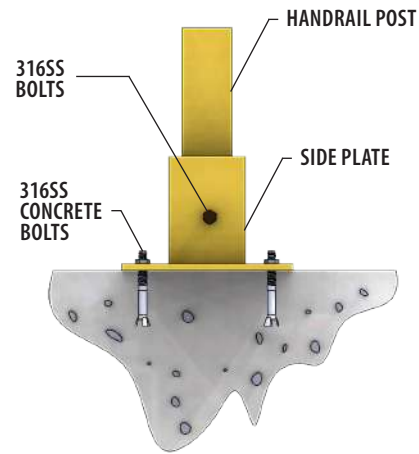


HANDRAILS	
Product Code	Part Details
HRL-VSHS-50x6	SHS 55x6
HRL-VCHS-50x4	CHS 50x4
HRL-VKRL-100x4	Kick Rail 100x4
HRL-VSHS-ELBOW	Elbow Connection for SHS
HRL-VSHS-3WAY	3 Way Connection for SHS
HRL-VSHS-4WAY	4 Way Connection for SHS
HRL-VSHS-Side Plate	Side Plate Connection for SHS
HRL-VSHS-BASE PLATE	Base Plate Connection for SHS
HRL-VCHS-ELBOW	Elbow Connection for CHS
HRL-VCHS-3WAY	3 Way Connection for CHS
HRL-VCHS-4WAY	4 Way Connection for CHS
HRL-VCHS-Side Plate	Side Plate Connection for CHS
HRL-VCHS-BASE PLATE	Base Plate Connection for CHS

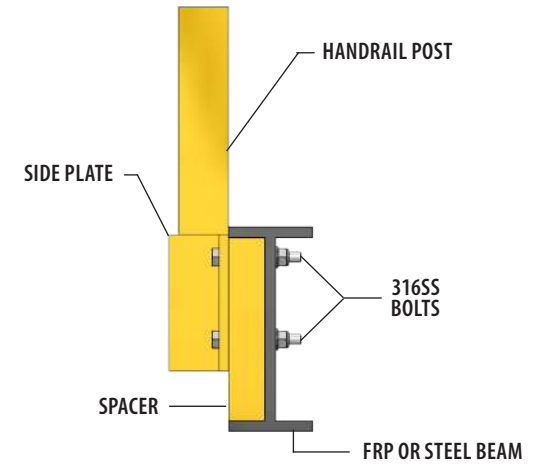
TYPES OF POST INSTALLATION DETAILS



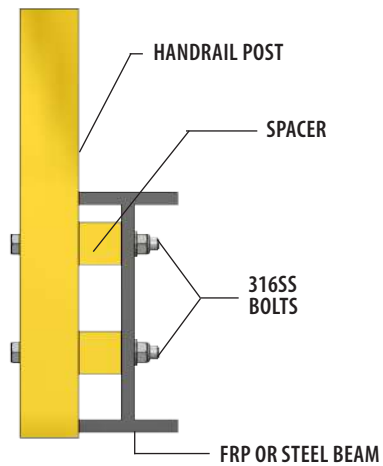
SIDE MOUNTED POST PLATE



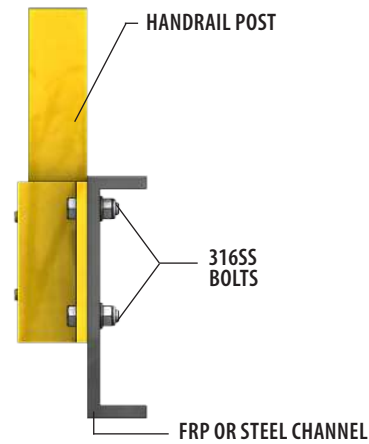
SURFACE MOUNTED POST PLATE



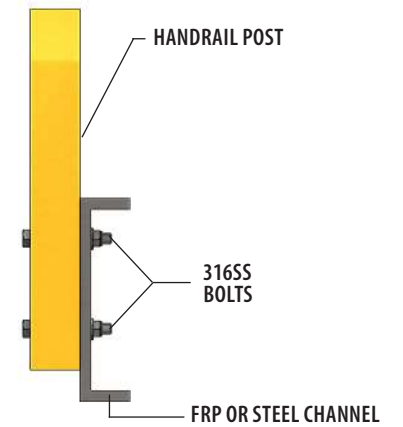
HANDRAIL POST PLATE TO FRP OR STEEL BEAM



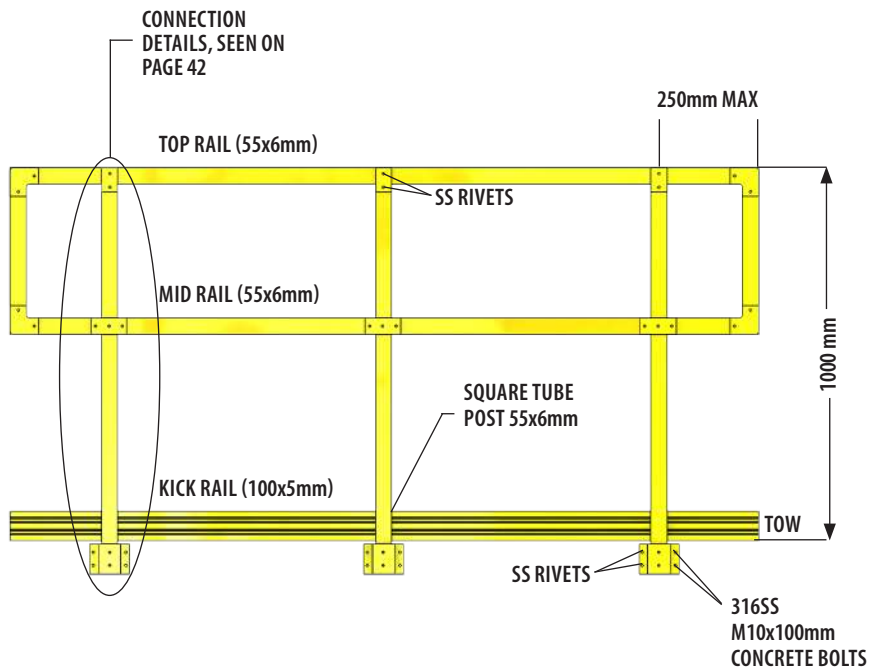
HANDRAIL POST PLATE TO FRP OR STEEL BEAM



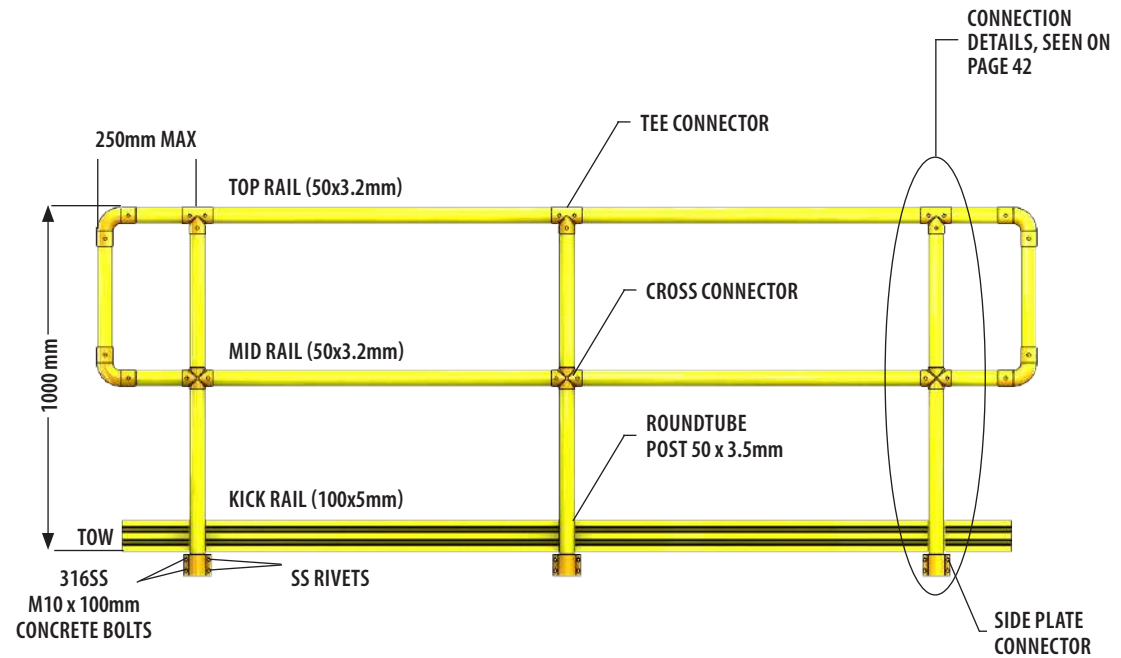
HANDRAIL POST PLATE TO FRP OR STEEL CHANNEL



HANDRAIL POST PLATE TO FRP OR STEEL CHANNEL



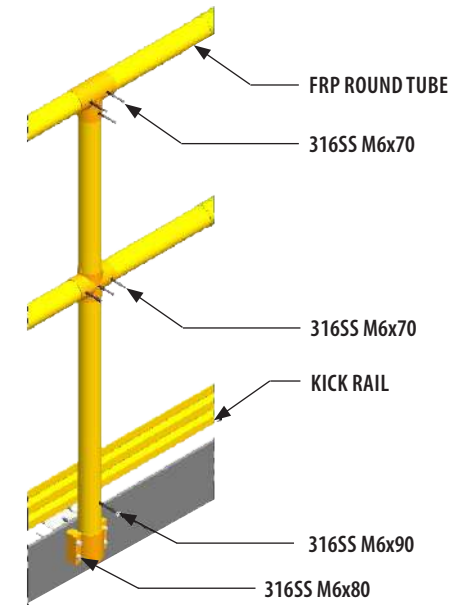
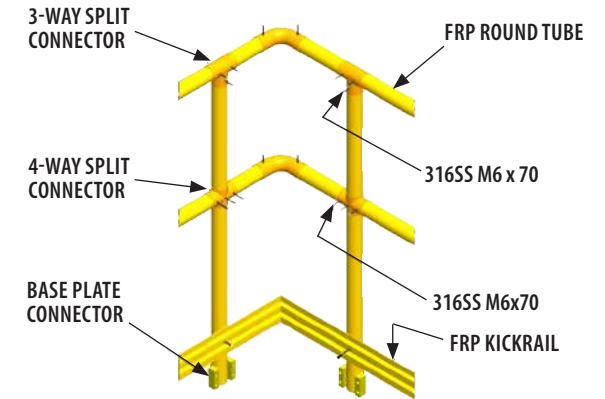
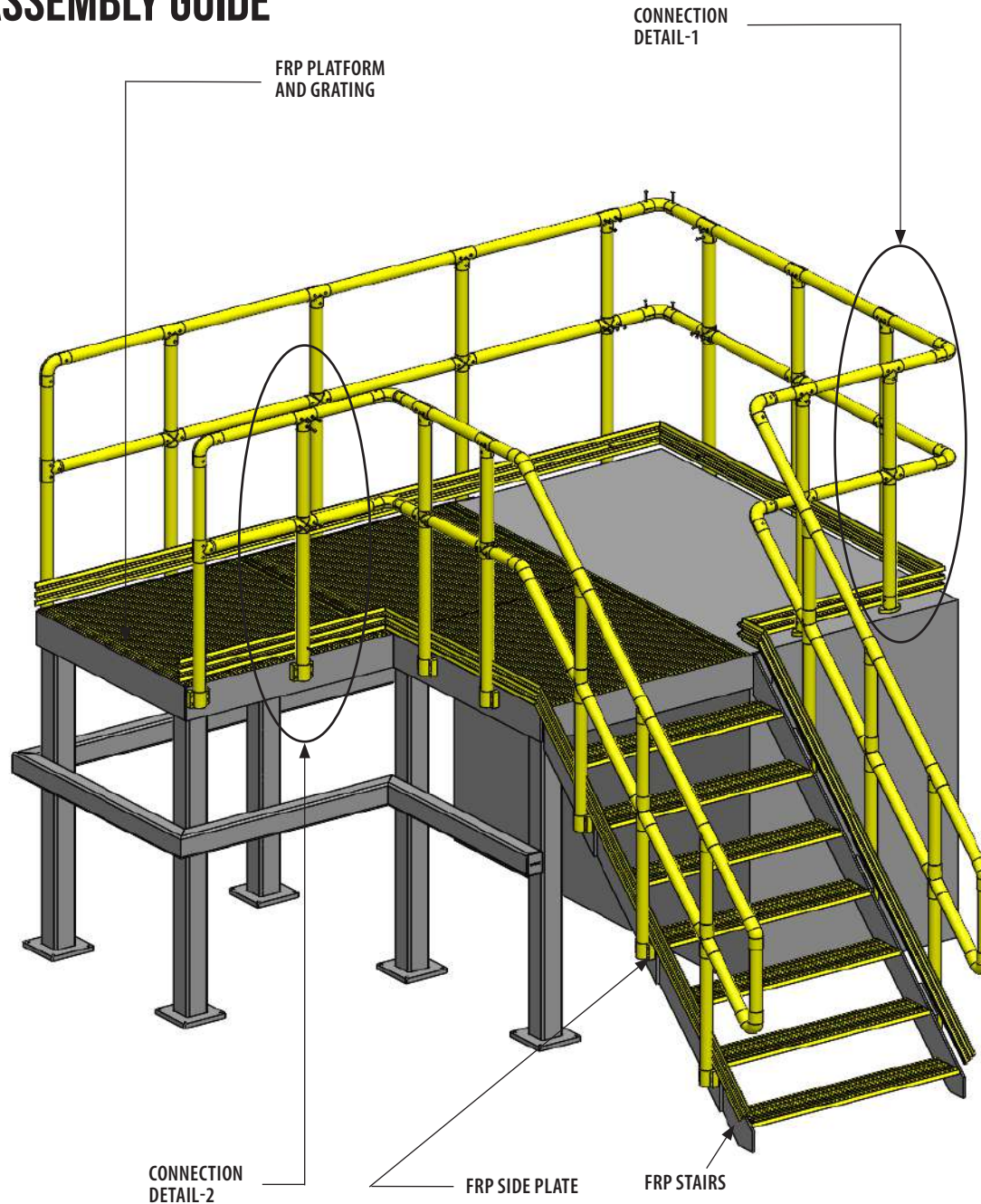
SQUARE HANDRAIL



ROUND HANDRAIL

HANDRAIL ASSEMBLY GUIDE

HANDRAIL DATA:
TUBE SIZE: 50mmx5mm
THICKNESS




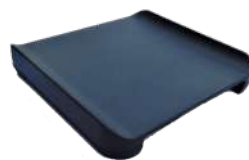


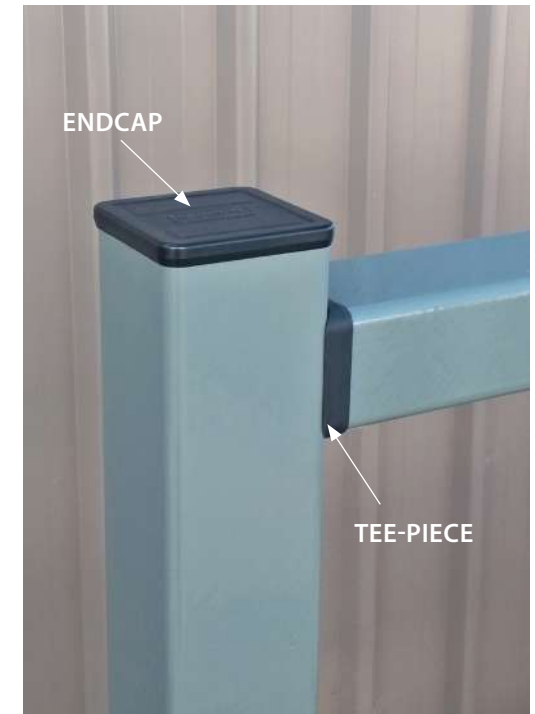
ACCESSORIES



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 fibre-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-M12 Bolt
INST-S3000-Φ18	WGN-S3000-M16 Bolt
INST-S3000-Φ22	WGN-S3000-M20 Bolt
INST-S3000-Φ26	WGN-S3000-M24 Bolt
INST-S1000-Φ14	WGN-S1000-M12 Bolt
INST-S1000-Φ18	WGN-S1000-M16 Bolt
INST-S1000-Φ22	WGN-S1000-M20 Bolt
INST-S1000-Φ26	WGN-S1000-M24 Bolt
INST-R1000-Φ22	WGN-R1000-M20 Bolt
INST-R1000-Φ26	WGN-R1000-M24 Bolt

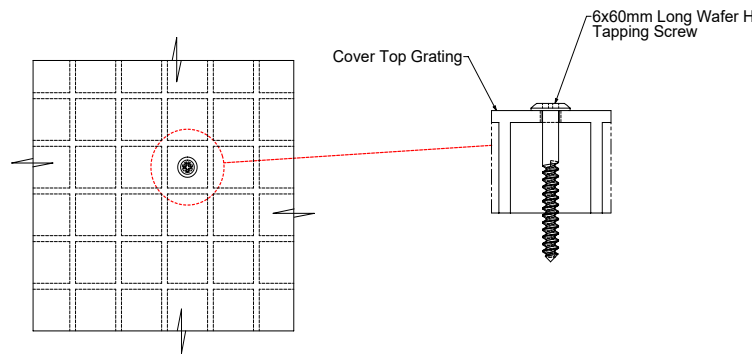
STAINLESS STEEL BRACKETS AND FASTENERS

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.

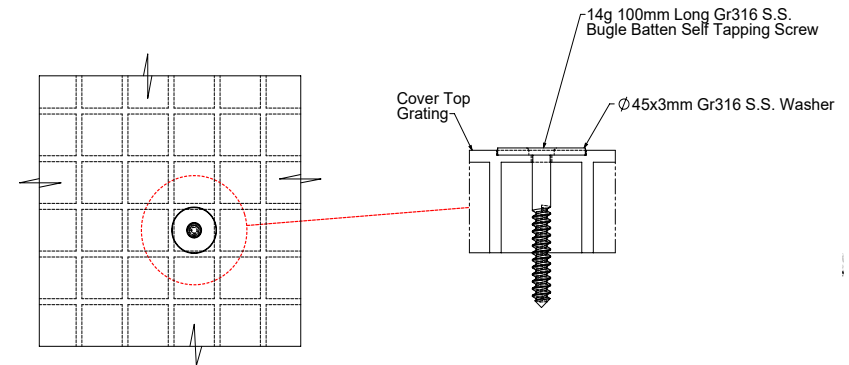
Refer to Wagners Installation Guide for further details about components available and refer to Wagners Design Guide for information on the connection capacities.

CONNECTIONS

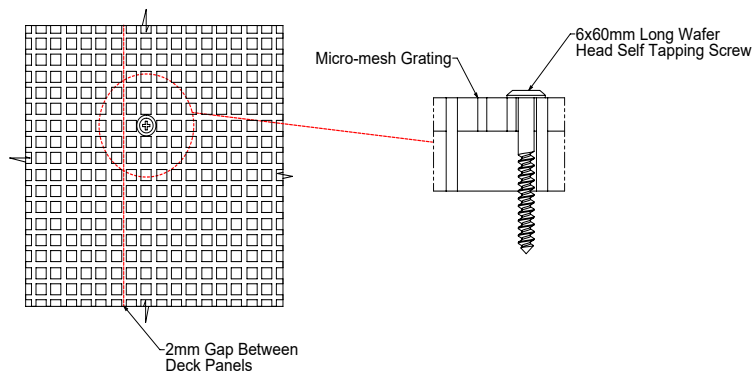
1. DECK TO JOIST



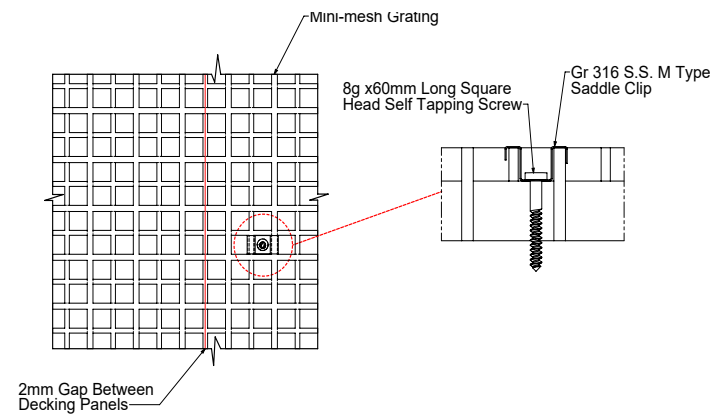
SELF TAPPING SCREW - COVERTOP



SELF TAPPING SCREW WITH OVERSIZE WASHER - COVERTOP

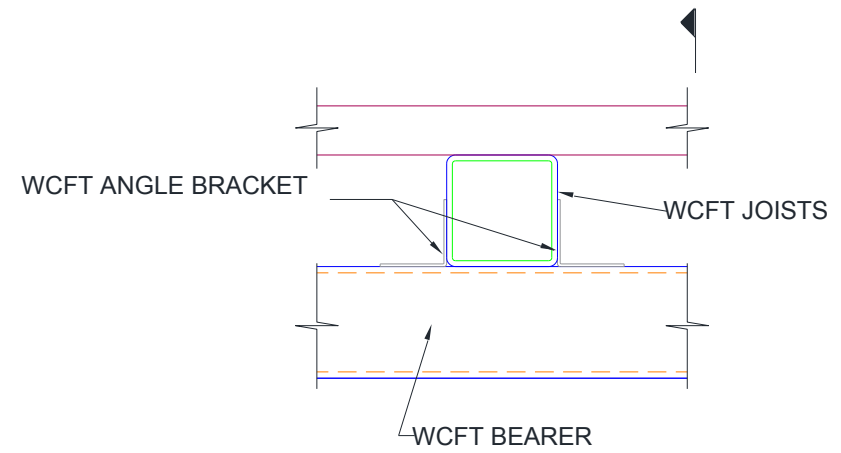
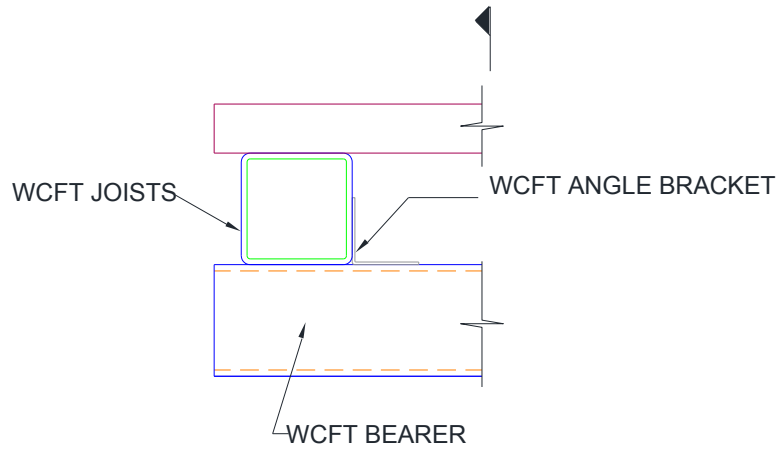


SELF TAPPING SCREW - MICRO-MESH

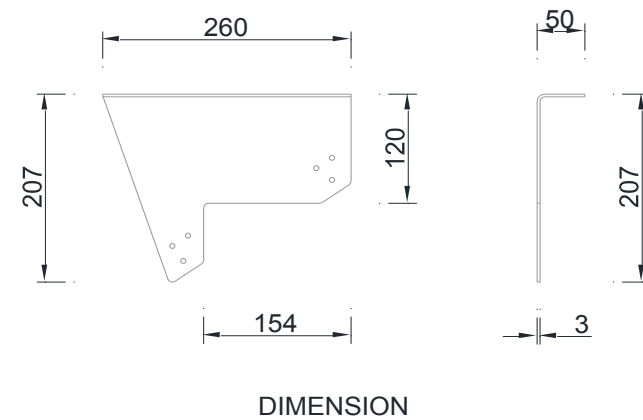
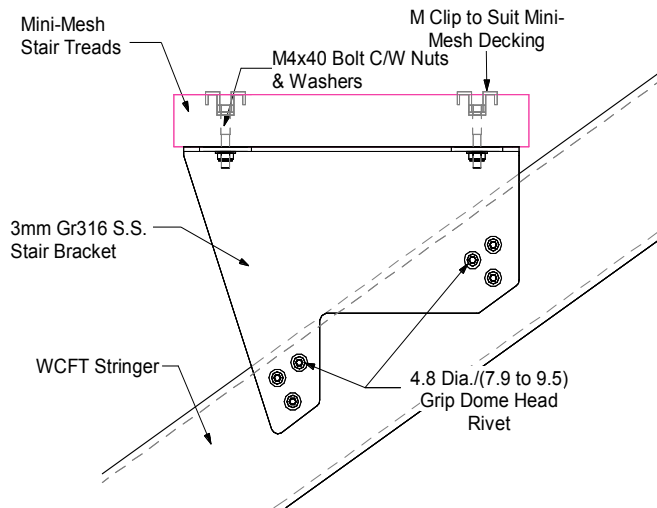


M-CLIP - MINI MESH

2. JOIST TO BEARER

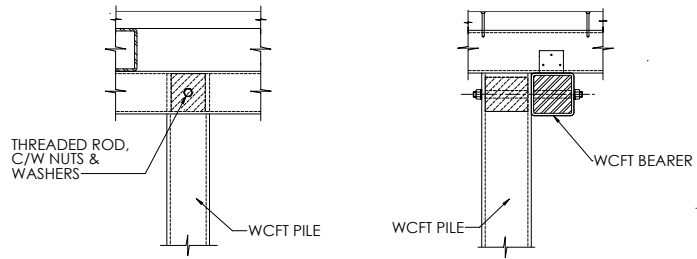


3. STAIR TREAD

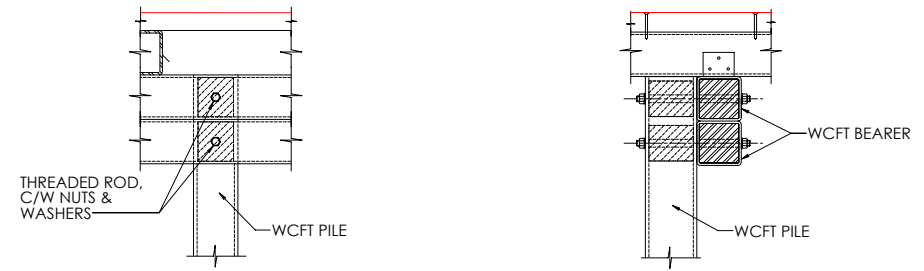


4. BEARER TO PILE

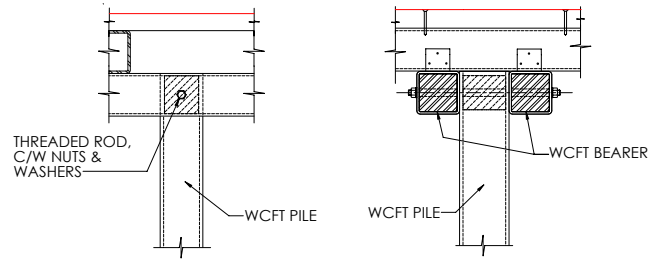
SINGLE SHEAR



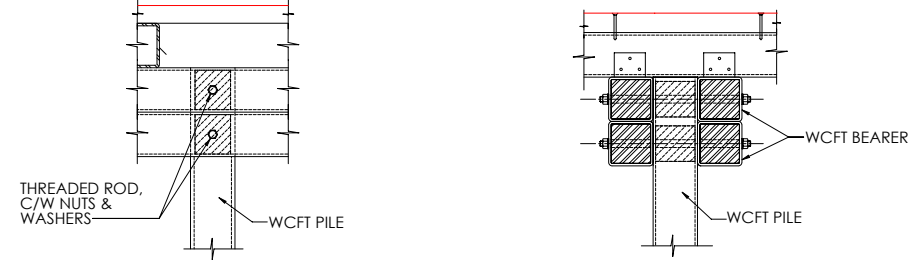
SINGLE SHEAR



DOUBLE SHEAR



DOUBLE SHEAR

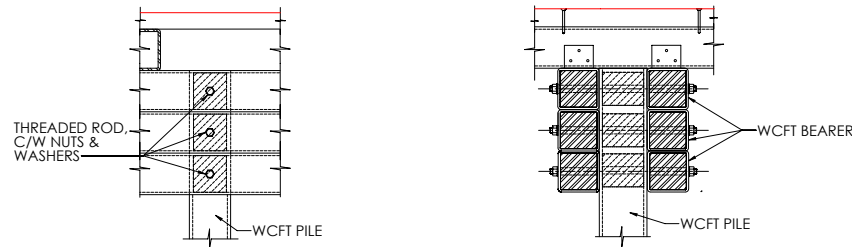


1 BOLT JOINTS

SINGLE SHEAR



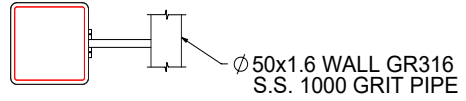
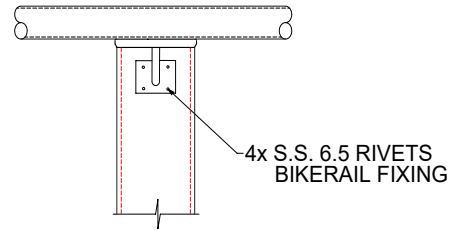
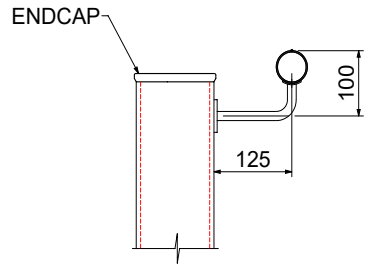
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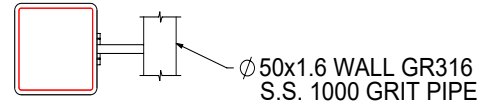
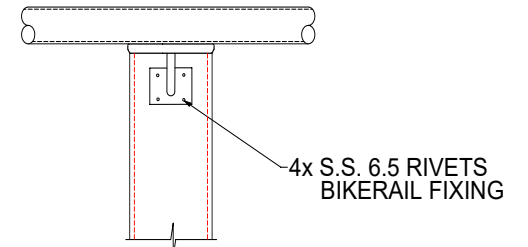
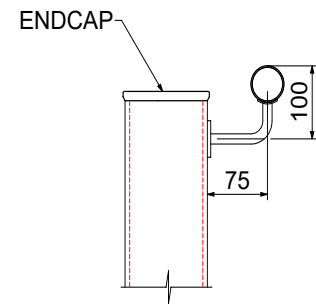
2 BOLT JOINTS

3 BOLT JOINTS

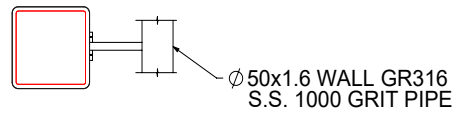
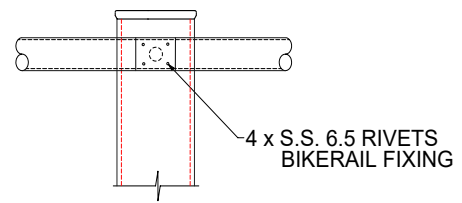
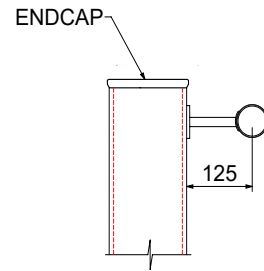
5. HANDRAIL CONNECTION



HANDRAIL 125



HANDRAIL 75



HANDRAIL STRAIGHT POST 125



MERSEY RIVER FOOTBRIDGE
KEJIMKUIK NATIONAL PARK,
NOVA SCOTIA, CA

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.
Fibre Reinforced Polymer (FRP)	A Fibre Reinforced Polymer (or plastic) material consists of a polymer resin based matrix reinforced by fibres of either glass, carbon or aramid, and hybrid combinations of these fibre types.
Fibre	One or more filaments in the form of a continuous strand or roving in an FRP material.
Fibre mass fraction	The mass of reinforcement fibre in a cured composite divided by the mass of the composite section.
Fibre orientation	The orientation or alignment of the longitudinal axis of the fibre with respect to a stated reference axis.
Fibre volume fraction	The volume of reinforcement fibre 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 fibre	A fibre spun from an inorganic product of fusion which has cooled to a rigid condition without crystallisation.
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 fibres. 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 mould.
Resin	The polymeric material used to bind together the reinforcing fibres 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 moulding 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 fibres as well as glass fibres.
Vinyl ester resin	Thermosetting resins that consist of a polymer backbone with an acrylate or methacrylate termination.

PRODUCT GUIDE

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