

SECTION 23 - METRIC DESIGN INFORMATION

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SECTION 23

METRIC DESIGN INFORMATION



Look for this blue line in the left margin of the Design Manual documents. This line shows you where the latest update has been made.

NOTE:

*The **METRIC DESIGN INFORMATION** is structured to be used in conjunction with the information in the Strongwell Design Manual. This is **not** stand alone data and should not be treated as such.*



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METRIC SYSTEM CONVERSIONS AND ABBREVIATIONS

ABBREVIATIONS

mm	=	millimeters
cm	=	centimeters
m	=	meter
in	=	inch
ft	=	foot (feet)
yd	=	yard
psi	=	pounds per square inch
N	=	unit of force; Newton
Pa	=	Pascal; N/m ² (one Newton per square meter)
N/mm ²	=	Newton per millimeter squared
lb	=	pound
dyne	=	unit of force
g	=	gram
kg	=	kilogram
ml	=	milliliter
cc	=	cubic centimeter

CONVERSIONS

1 ft	=	12 in
1 ft	=	0.3048 m
1 in	=	25.4 mm
1 in	=	2.54 cm
1 in ³	=	16.4 ml
1 Pa	=	10 dynes/cm ²
1 Pa	=	1 N/m ²
1 lb	=	0.4536 kg
1 kg	=	2.206 lb
1 yd	=	0.914 m
1 psi	=	6.895 x 10 ³ N/m ²
1 psi	=	6.895 x 10 ⁻³ N/mm ²
1 N/mm ²	=	145 psi
1 kg/cm ²	=	14.2 psi
1 ft-lb/in	=	5.35 N-m/m
1 dyne	=	10 ⁻⁵ Newtons
1 lb/in ³	=	2.768 kg/m ³
1 kgf/mm ²	=	1.42 ksi
1 ft-lb	=	1.36 N-m


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
See "Weights and Measures" and "SI Conversion Factors" in the **APPENDIX** of the Strongwell Design Manual for more complete information.


EXTREN® AVAILABILITY LIST


STOCKED **NONSTOCKED**


Measurements are in millimeters (mm) unless otherwise noted.


 Equal Leg Angles	Series 500	Series 525	Series 625
25.4 x 3.18	S	S	S
31.8 x 3.18	N	N	N
31.8 x 4.76	S	S	N
38.1 x 4.76	S	S	S
38.1 x 3.18	N	S	N
38.1 x 6.35	S	S	S
50.8 x 3.18	N	N	N
50.8 x 4.76	S	S	N
50.8 x 6.35	S	S	S
76.2 x 6.35	S	S	S
76.2 x 9.53	S	S	S
101.6 x 6.35	S	S	S
101.6 x 9.53	S	S	S
101.6 x 12.7	S	S	S
127 x 12.7	N	N	N
152.4 x 6.35	N	S	N
152.4 x 9.53	N	N	N
152.4 x 12.7	S	S	S

 Channels	Series 500	Series 525	Series 625
38.1 x 25.4 x 4.76	N	N	N
38.1 x 38.1 x 6.35	N	S	N
50.8 x 14.3 x 3.18	S	S	N
50.8 x 22.2 x 6.35	N	N	N
66.7 x 3.18 x 31.8 x 4.76	N	N	N
76.2 x 25.4 x 4.76	N	N	N
76.2 x 38.1 x 6.35	N	S	N
76.2 x 22.2 x 6.35	S	S	S
88.9 x 38.1 x 4.76	N	S	N
101.6 x 27.0 x 3.18	N	N	N
101.6 x 34.9 x 4.76	S	S	S
101.6 x 28.6 x 6.35*	S	S	S
127 x 34.9 x 6.35	S	S	N
139.7 x 38.1 x 4.76	N	S	N
152.4 x 41.3 x 6.35	S	S	S
152.4 x 42.9 x 9.53	N	S	N
203.2 x 55.6 x 6.35	N	S	N
203.2 x 55.6 x 9.53	S	S	S
254 x 69.9 x 12.7**	N	S	S
304.8 x 76.2 x 12.7***	N	S	N
355.6 x 88.9 x 19.1	N	N	N
457.2 x 55.6 x 4.76	N	N	N
609.6 x 76.2 x .260	N	N	N


 Wide Flange Beams	Series 500	Series 525	Series 625
50.8 x 3.18	N	N	N
76.2 x 6.35	S	S	N
101.6 x 6.35	S	S	S
152.4 x 6.35	S	S	S
152.4 x 9.53	S	S	S
203.2 x 9.53	S	S	S
203.2 x 12.7	N	N	N
254 x 9.53***	N	S	N
254 x 12.7	N	N	N
304.8 x 12.7	N	N	N


 I-Beams	Series 500	Series 525	Series 625
50.8 x 25.4 x 3.18	N	N	N
76.2 x 38.1 x 6.35	S	S	S
101.6 x 50.8 x 6.35	S	S	S
140 x 63.5 x 6.35	N	S	N
152.4 x 76.2 x 6.35	N	S	N
152.4 x 76.2 x 9.53	N	N	N
152.4 x 101.6 x 6.35	N	N	N
203.2 x 101.6 x 9.53	S	S	N
203.2 x 101.6 x 12.7	N	N	N
254 x 127 x 9.53	N	N	N
254 x 127 x 12.7	N	N	N
304.8 x 152.4 x 12.7	N	S**	S**
457.2 x 9.53 x 114.3 x 12.7	N	N	N
609.6 x 9.53 x 190.5 x 19.1	N	N	N

 Square Tube	Series 500	Series 525	Series 625
25.4 x 3.18	S	S	N
31.8 x 3.18	N	N	N
38.1 x 3.18	S	S	N
38.1 x 6.35	N	N	N
44.5 x 3.18	N	N	N
44.5 x 6.35	N	N	N
50.8 x 3.18	S	S	N
50.8 x 6.35*	S	S	S
63.5 x 6.35****	N	S	N
76.2 x 3.18	N	N	N
76.2 x 6.35	S	S	S
76.2 x 9.53	N	S	N
88.9 x 6.35	N	S	S
101.6 x 6.35	S	S	S
101.6 x 9.53	N	N	N
152.4 x 9.53	N	N	N


 Round Tube	Series 500	Series 525	Series 625
25.4 x 3.18	S	S	S
31.8 x 3.18	S	S	N
38.1 x 3.18	S	S	N
38.1 x 6.35	S	S	N
44.5 x 3.18	N	N	N
44.5 x 6.35	N	S	N
50.8 x 3.18	S	S	N
50.8 x 6.35	S	S	N
63.5 x 6.35	S	S	N
76.2 x 6.35	N	N	N
88.9 x .140	N	N	N
101.6 x 6.35	N	N	N
127 x 6.35	N	N	N
152.4 x 3.18	N	N	N
152.4 x 6.35	N	N	N


* Also stocked in 525 yellow
 ** Stocked in 7.32 m only
 *** Stocked in 9.75 m only
 **** Stocked in 525 yellow only

 Rectangular Tube	Series 500	Series 525	Series 625
63.5 x 41.3 x 3.18	N	N	N
101.6 x 3.18 x 50.8 x 6.35	S	S	N
165.1 x 6.35 x 50.8 x 12.7	N	N	N
177.8 x 101.6 x 6.35	N	N	N
228.6 x 152.4 x 7.94	N	N	N
228.6 x 152.4 x 11.12	N	N	N

 Plate	Series 500	Series 525	Series 625
3.17	S	S	S
4.76	S	S	N
6.35	S	S	S
9.53	S	S	S
12.7	S	S	S
15.9	N	N	N
19.1	N	S	N
25.4	N	N	N

NOTE: USDA approved plate available (non-stocked) in all sizes except 12.7 mm and 9.25 mm. EXTREN® plate is stocked in 1.22 m x 2.44 m sheets.

 Round Rod - Thermal Cure ¹	
12.7	S
7.94	N
9.53	S
12.7	S
15.88	S
19.05	S
20.64	N
20.64	N
25.4	S
28.58	N
31.75	S
38.1	S
50.8	N

 Square Bar - Thermal Cure ¹	
12.7	S
15.88	S
19.05	S
25.4	S
31.75	N
38.1	S

¹ Special Composite Design - Not EXTREN® Composites; Thermal cure bars and rods were not designed to be machined.

FIBREBOLT® Studs and Nuts	
9.53	S
12.7	S
47.63	S
19.05	S
25.4	S



NOTE: All FIBREBOLT® is stocked in 1.22 m lengths.

NOTES: All sizes are metric conversions of standard Imperial dimensions (inches to millimeters). Parts are sold in standard Imperial dimensions only.

Unless otherwise noted, all dimensions are in inches and stocked lengths are 6.1 m long.








All EXTREN® Series 500 products can be produced to meet NSF potable water standards in minimum mill run quantities. Only products bearing the NSF logo are certified.









EXTREN® AVAILABILITY LIST

STOCKED **NONSTOCKED**

Measurements are in millimeters (mm) unless otherwise noted.

Special Pultruded Shapes*

	PE	PE/FR	VE/FR
Channel 			
88.9 x 50.8 x 5.56	N	S	N
266.7 x 38.1 x 19.1 x 4.8	N	N	N
Channel (Ladder Rail)** 			
43.2 x 2.54 x 27.9 x 2.54	N		
47.63 x 3.18 x 28.58 x 4.78	N		
80.0 x 3.05 x 29.85 x 3.05	N		
83.57 x 3.25 x 29.97 x 4.83	N		
84.07 x 3.43 x 30.15 x 5.33	N		
101.6 x 3.175 x 44.45 x 4.75	N		
Corner Post 			
82.55 x 161.29	N	N	N
Curb Angle*** 			
25.4 x 38.1	N	N	N
38.1 x 38.1	N	N	N
50.8 x 38.1	N	N	N
F-Section 			
139.7 x 25.4 x 6.35	N	N	N
152.4 x 38.1 x 6.35	N	N	N
Flat Strips 			
50.8 x 4.76****	N	S	S
50.8 x 6.35	N	N	N
76.2 x 4.76	N	N	N
76.2 x 6.35	N	S	N
76.2 x 9.53	N	N	N
76.2 x 12.7	N	S	N
101.6 x 12.7	N	N	N
152.4 x 6.35	N	N	N
Flight Channel 			
139.7 x 3.18 x 63.5 x 4.76	N		
181.0 x 3.18 x 63.5 x 4.76	N		

	PE	PE/FR	VE/FR
Fluted Tube 			
31.75 (Stock Yellow - 6.15 m lengths)			N
Rectangular Tubes 			
330.2 x 215.9 x 9.53	N	N	N
381 x 152.4 x 9.53	N	N	N
406.4 x 215.9 x 9.53	N	N	N
457.2 x 152.4 x 9.53	N	N	N
523.9 x 152.4 x 6.35	N	N	N
574.7 x 152.4 x 9.53	N	N	N
Slide Guide 			
63.5 x 57.15 x 6.35 (Stock White)	S		
Square Tube w/ Rd. Hole 			
25.4 sq. with 19.05 rd. hole	N	N	N
Strut 			
41.3 x 41.3 x 3.97 (Stock Gray)	N	S	N
Top Rail 			
50.8 x 6.35 modified rd. tube	N	N	N
Unequal Leg Angles 			
44.5 x 31.75 x 6.35	N	N	N
Z-Section 			
31.75 x 63.5 x 3.18	N	N	N

* Not necessarily EXTREN® specifications.

** Standard color - orange

*** Stocked at Chatfield Division

**** Stocked in 7.32 m only

Custom Pultrusions

Strongwell produces custom pultrusions in many shapes and materials for hundreds of customers. The special pultruded shapes listed on this page are only a partial listing of dies owned by Strongwell.

NOTES: All sizes are metric conversions of standard Imperial dimensions. Parts are sold in standard Imperial dimensions only.

Unless otherwise noted, all dimensions are in inches and stocked lengths are 6.1 m long.

All EXTREN® Series 500 products can be produced to meet NSF potable water standards in minimum mill run quantities. Only products bearing the NSF logo are certified.

**EXTREN® VS. TRADITIONAL MATERIALS
(PROPERTY COMPARISON)**

		EXTREN 500/525 SHAPES ^①	EXTREN 625 SHAPES ^①	THERMAL CURE ROD & BAR ^①	CARBON STEEL (M1020)	316 STAINLESS STEEL	HASTELLOY C-276 (ANNLD.) ^②
MECHANICAL							
Tensile Strength (N/mm ²)	LW	207	207	689	414	552	689
	CW	48.3	48.3	—	414	552	689
Tensile Modulus (x 10 ³ N/mm ²)	LW	17.2	17.9	41.4	207	193	179
	CW	5.52	6.89	—	207	193	179
Flexural Strength (N/mm ²)	LW	207	207	689	414	552	689
	CW	68.9	68.9	—	414	552	—
Flexural Modulus (x 10 ³ N/mm ²)	LW	13.8	15.2	41.4	207	193	179
	CW	5.52	5.52	—	207	193	179
Izod Impact (J/mm)	LW	1.33	1.33	2.14	N/A	.454-.587	—
	CW	0.214	0.214	—	N/A	—	—
Specific Gravity		1.7	1.7	2.0	7.8	7.92	8.96
PHYSICAL							
Density (x 10 ⁻³ g/mm ³)		1.72-1.94	1.72-1.94	1.99-2.10	7.86	8.03	8.97
Thermal Conductivity (W-m/m ² /C°)		83.1	83.1	104	5400-9554	1994-3842	1475
Coefficient of Thermal Expansion (x 10 ⁻⁵ mm/mm/C°)		1.2	1.2	0.9	10.9-14.5	16.4-18.2	

① Values Are Minimum Ultimate Properties From Coupons.

**FIBERGLASS PULTRUSION THICKNESS
RELATIVE TO STEEL, ALUMINUM OR WOOD^②**

FIBERGLASS PULTRUSION CONSTRUCTION	*STEEL		
	Tensile Strength	Rigidity	Flexural Strength
50% Mat & Roving (EXTREN®)	2.5	2.15	1.82
70% Roving only (Thermal Cure Rod & Bar)	1.0	1.71	1.12

* Copied from *Engineered Materials Handbook*, Vol. 1, "Composites", pg. 541

② As an example, a 50% mat & roving fiberglass pultrusion would need to be 1.16 times as thick as an aluminum part to achieve the same 'flexural strength'.

**EXTREN® VS. TRADITIONAL MATERIALS
(PROPERTY COMPARISON)**

		ALUMINUM 6061-T61 T651	PONDEROSA PINE	RIGID PVC RIGID PVC	RIGID PVC 10% GLASS	FIBERGLASS COMPRESSION MOLDING (SMC)	SPRAY-UP (30-50% GLASS)
MECHANICAL							
Tensile Strength (N/mm ²)	LW	310	2.90	42.7	53.8	55.2-138	62.1-124
	CW	310	—	42.7	53.8	55.2-138	62.1-124
Tensile Modulus (x 10 ³ N/mm ²)	LW	68.9	—	2.69	3.10	11.0-17.2	5.52-12.4
	CW	68.9	—	2.69	3.10	11.0-17.2	5.52-12.4
Flexural Strength (N/mm ²)	LW	310	106	75.8	80.7	124-207	110-193
	CW	310	64.8	75.8	80.7	124-207	110-193
Flexural Modulus (x 10 ³ N/mm ²)	LW	68.9	6.89	2.41	3.10	9.02-12.4	6.89-8.30
	CW	68.9	—	2.41	3.10	9.02-12.4	6.89-8.30
Izod Impact (J/mm)	LW	—	—	0.085	0.085	.534-1.07	.214-.641
	CW	—	—	0.085	0.085	.534-1.07	.214-.641
Specific Gravity		2.50	0.520	1.38	1.39	1.5-1.7	1.4-1.6
PHYSICAL							
Density (x 10 ⁻³ g/mm ³)		2.55	0.526	1.44	1.44	1.49-1.69	1.39-1.63
Thermal Conductivity (W-m/m ² /C°)		24923	1.66	27.0	—	1.12-1.27	1.04-1.23
Coefficient of Linear Expansion (x 10 ⁻⁶ mm/mm/C°)		24.5	3.09	67.3	41.8	18.2-32.7	21.8-36.4

**FIBERGLASS PULTRUSION THICKNESS
RELATIVE TO STEEL, ALUMINUM OR WOOD^②**

FIBERGLASS PULTRUSION CONSTRUCTION	*ALUMINUM			*WOOD		
	Tensile Strength	Rigidity	Flexural Strength	Tensile Strength	Rigidity	Flexural Strength
50% Mat & Roving (EXTREN®)	1.0	1.49	1.16	.25	.79	.45
70% Roving only (Thermal Cure Rod & Bar)	.4	1.19	.71	.10	.63	.27

* Copied from *Engineered Materials Handbook*, Vol. 1, "Composites", pg. 541

② As an example, a 50% mat & roving fiberglass pultrusion would need to be 1.16 times as thick as an aluminum part to achieve the same 'flexural strength'.