JIUDING FRP PULTRUSION PROFILES

Technical instructions

FRP pultrusion profiles composition and production process

1. Composition

Pultrusion profile is a kind of composite material, using fiber glass as reinforced component and thermosetting resin as bonding basis. Fiber roving gives profiles high longitudinal strength while fiberglass mat, including continuous mat, stitched mat. Etc. gives good transverse strength. Normally, the unsaturated polyester resin, vinyl resin is chosen to be the thermosetting resin basis, which could also be epoxy resin and phenolic resin. The resin base enable the product with good anti-corrosion property, different resin enables the product to be suitable for various corrosion environment, to add the ultraviolet inhibitor and fire retardant may enable the product to have the outstanding anti-aging property and the different rank anti-flammable property. Besides, add the nexus mat on the product surface could make it obtain best corrosion-resistance and anti-ageing properties. The fiberglass content in pultrusion profile is usually 45%-75% (weight ratio), the rest is resin and additive.

2. Production process

Pultrusion is a continuous process to produce the random length FRP profiles with uniform section. The fiberglass continuous roving and mat are well placed on creels, pulling by the machine to go through the resin bath under the traction of pultrusion machine, shaped through a pre-molding with a kind of section shape, and cured by heating die. The finished profiles will be self-cooling then be cut automatically.

Pultrusion process is an advanced mechanized compound materials molding process with less environmental pollution, high production efficiency, less cutting loss, without leftover material.

Properties of FRP pultrusion profiles

1、Properties of pultrusion profiles

1.1 Corrosion resistant

Pultrusion profiles are non-rusty with excellent anti-corrosion property, resisted various corrosion of gas and liquid medium, such as acid, alkali, organic solvent and salt. The choice of GP resin, ISO resin and VE resin depends on the medium type and temperature request at actual using situation, please refer to the corrosion-resistant table of pultrusion profiles.

1.2 Light weight and high strength

The fiberglass content of the pultrusion profile is higher than other composite material with different techniques, thus its longitudinal strength is extremely high as steels. But its density is only a quarter of the steels, so its ratio of strength is much higher than that of steels, while its modulus is lower than steels, which is only 1/7 to 1/10 of the steels.

1.3 Anti-ageing

Pultrusion profile is made by excellent thermosetting resin and fiberglass system, which is different from the common thermoplastic, its normal lifespan is over 20 years. Add the ultraviolet inhibitor and nexus mat could make it obtain the best anti-ageing effect.

1.4 Easy maintenance

There are multiple choices of pultrusion profiles color. The pigment is mixed with the resin during the pultrusion process which makes the color not easily to fade, the profiles without painting maintenance but self-clean function.

1.5 Excellent electromagnetism property

Pultrusion profiles have the excellent property of electric insulation, non-magnetism and non-electric light, which could be used in the equipment fields with the electric conductive danger and sensitive to the magnetism, as well as the place of flammability and burst.

1.6 Thermal property

Pultrusion profile is a type of heat-insulation materials, its thermal-expansion rate is much lower than that of common plastic, which with excellent mechanical property under the low temperature and no melting under the high temperature. But the strength and modulus will be reduced in a certain degree under the high temperature, its suitable temperature range is from -50 degree to 100 degree.

2、 Performance table

1) standard profiles

Property	Direction	Unit	Test method	Profiles	Rods
Tensile Strength	（LW）	MPa	ASTM D638/GB1447-83	210-350	500-700
	（CW）	MPa		30-60	
Tensile Modulus	（LW）	GPa	ASTM D638/GB1447-83	15-28	32-42
	（CW）	GPa		5-7	
Flexural Strength	（LW）	MPa	ASTM D790/GB1449-83	210-390	600-900
	（CW）	MPa		60-100	
Flexural Modulus	（LW）	GPa	ASTM D790/GB1449-83	15-24	32-42
	（CW）	GPa		5-7	
Compressive Strength	（LW）	MPa	ASTM D695/GB1448-83	220-350	400-450
	（CW）	MPa		60-100	
Compressive Modulus	（LW）	GPa	ASTM D695/GB1448-83	16-23	
	（CW）	GPa		5-10	
Short beam Shearing Strength	（LW）	MPa	ASTM D2344	25-35	
Breaks Shearing Strength	（PF）	MPa	ASTM D732	38-50	38-55
Impact Strength	LW	KJ/mm^2	ASTM D256	150-250	
Poisson Ratio	（LW）	mm/mm	ASTM D3039	0.3-0.4	
	（CW）	mm/mm		0.15-0.25	
Barcol Hardness		--	ASTM D2583	40-50	50
Relative Density		--	ASTM D792	1.7-1.9	1.85-1.95
Coefficient of Thermal expansion	（LW）	10^{-6}m/m/℃	ASTM D696/GB2572-82	4.5-8	3.0
Breakdown Strength	（PF）	KV/mm	ASTM D149/GB1408-78	7-8	
	（LW）	KV/mm		1.4-1.6	

Remarks:

LW=lengthwise CW=crosswise PF= perpendicular to laminate face

2）E23 standard profiles

Properties	Unit	Test standard	Requirements according to E23 standard
Lengthwise tensile modulus	Gpa	EN ISO527	23
Lengthwise tensile strength	Mpa	EN ISO 527	240
Transverse tensile strength	Mpa	EN ISO 527	50
Transverse tensile modulus	Gpa	EN ISO 527	7
Lengthwise flexural strength	Mpa	EN ISO 14125	240
Transverse flexural strength	Mpa	EN ISO 14125	100
Interlaminar shear strength	Mpa	EN ISO 14130	25

3) CTI-137 standard profiles

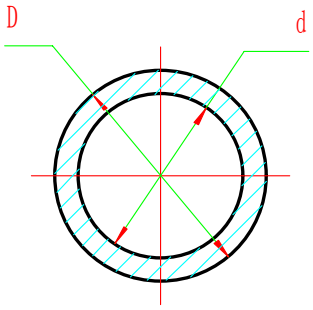
Properties	**Test method ASTM**	**Units**	**Polyester shapes**	**Vynil ester shapes**	**Rod &bar**	**Polyester plate**			**Vinyl ester plate**		
						1/8” 3.2mm	**3/16”-1/4” 4.8-6.4mm**	**3/8”-1” 9.5-25.4mm**	**1/8” 3.2mm**	**3/16”-1/4” 4.8-6.4mm**	**3/8”-1” 9.5-25.4mm**
Tensile stress LW	**D638**	**10^6 N/m2**	**206.8**	**206.8**	**689**	**137.9**	**137.9**	**137.9**	**137.9**	**137.9**	**137.9**
Tensile stress CW	**D638**	**10^6 N/m2**	**48.2**	**48.2**	**/**	**51.7**	**68.9**	**68.9**	**51.7**	**68.9**	**68.9**
Tensile modulus LW	**D638**	**10^6 N/m2**	**17.2**	**17.9**	**41.3**	**12.4**	**12.4**	**12.4**	**12.4**	**12.4**	**12.4**
Tensile modulus CW	**D638**	**10^6 N/m2**	**5.5**	**5.5**	**/**	**4.8**	**6.2**	**9.6**	**6.9**	**6.9**	**9.6**
Compressive stress LW	**D695**	**10^6 N/m2**	**206.8**	**206.8**	**413.6**	**165.4**	**165.4**	**165.4**	**165.4**	**165.4**	**165.4**
Compressive stress CW	**D695**	**10^6 N/m2**	**103.4**	**110.3**	**/**	**106.8**	**113.7**	**137.9**	**113.79**	**120.6**	**137.9**
Compressive modulus LW	**D695**	**10^6 N/m2**	**17.2**	**17.9**	**/**	**12.4**	**12.4**	**12.4**	**12.4**	**12.4**	**12.4**
Compressive modulus CW	**D695**	**10^6 N/m2**	**6.9**	**6.9**	**/**	**6.9**	**6.9**	**6.9**	**6.9**	**6.9**	**6.9**
Flexural stress LW	**D790**	**10^6 N/m2**	**206.8**	**206.8**	**689**	**241.3**	**241.3**	**206.8**	**241.3**	**24.3**	**206.8**
Flexural stress CW	**D790/**	10^6 N/m2	**68.9**	**68.9**	**/**	**69.6**	**103.4**	**124.1**	**89.6**	**103.4**	**124.1**
Flexural modulus LW	**D790**	10^6 N/m2	**13.8**	**15.1**	**41.9**	**12.4**	**13.8**	**13.8**	**12.4**	**13.8**	**13.8**
Flexural	**D790/**	10^6	**5.5**	**5.5**	**/**	**6.2**	**7.6**	**9.6**	**6.2**	**7.6**	**9.6**

modulus CW		N/m2									
Modulus of elasticity E	**Full section**	10^6 N/m2	**17.9**	**19.3**							
Shear modulus LW	**Full section**	10^6 N/m2	**2.9**	**2.9**							
Short beam shear LW	**D2344**	10^6 N/m2	**31**	**31**							
Bearing stress LW	**D953**	10^6 N/m2	**206.8**	**206.8**	**/**	**220.6**	**220.6**	**220.6**	**220.6**	**220.6**	**220.6**
Bearing stress CW	**D953**	10^6 N/m2	**206.8**	**206.8**	**/**	**220.6**	**220.6**	**220.6**	**220.6**	**220.6**	**220.6**
Poisson's ration LW	**D3039**	**CM/CM**	**0.31**	**0.31**	**/**	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**
Notched Izod impact LW	**D256**	**M-kg**	**1.28**	**1.28**	**2.04**	**0.94**	**1.02**	**1.02**	**0.94**	**1.02**	**1.02**
Notched Izod impact CW	**D256**	**M-kg**	**0.2**	**0.2**	**0.26**	**0.26**	**0.26**	**0.26**	**0.26**	**0.26**	**0.26**
Barcool Hardness	**D2583**	**/**	**45**	**45**	**50**	**40**	**40**	**40**	**40**	**40**	**40**
24HR water absorption	**D570**	**%max by wt.**	**0.6**	**0.6**	**0.25**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
Density	**D792**	**Kg/m2**	**1716-1938**	**1716-1938**	**1993-2103**	**1661-1882**		**1661-1882**	**1661-1882**	**1661-1882**	**1661-1882**
Thermal conductivity	**C177**	**W/MK**	**0.58**	**0.58**	**/**	**0.58**	**0.58**	**0.58**	**0.58**	**0.58**	**0.58**

Specification table for pultrusion profiles

1. Tube

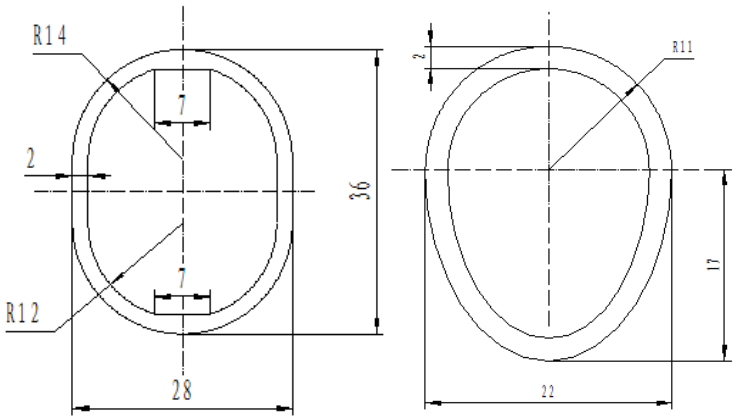
ROUND TUBE



No.	Specification D/d	Surface	D (mm)	d (mm)	Thickness (mm)
1	19/14	Stitched mat	19	14	2.5
2	22.2/18.4	Stitched mat	22.2	18.4	1.915
3	23.6/19.5	Stitched mat	23.6	19.5	2.05
4	23.8/19	CSM	23.8	19	2.4
5	24.5/17.9	Stitched mat	24.5	17.9	3.3
6	25.4/14	Stitched mat	25.4	14	5.7
7	25.4/21.2	CSM	25.4	21.2	2.1
8	25.4/20.5	CSM	25.4	20.5	2.45
9	25.4/19	CSM	25.4	19	3.2
10	25.4/18.4	CSM	25.4	18.4	3.5
11	25.6/19.2	CSM	25.7	19.2	3.25
12	27.25/22	CSM	27.25	22	2.625
13	28/24	CSM	28	24	2
14	28/23	CSM	28	23	2.5
15	30/24	CSM	30	24	3
16	31/25	CSM	31	25	3
17	31.7/26.75	CSM	31.7	26.75	2.475
18	31.7/26.15	CSM	31.7	26.15	2.775
19	31.7/25.6	CSM	31.7	25.6	3.05
20	32/27.5	CSM	32	27.5	2.25
21	32/26	Stitched mat	32	26	3
22	32.3/28.2	Stitched mat	32.3	28.2	2.05
23	32.3/27	Stitched mat	32.3	27	2.65
24	32.3/26	Stitched mat	32.3	26	3.15

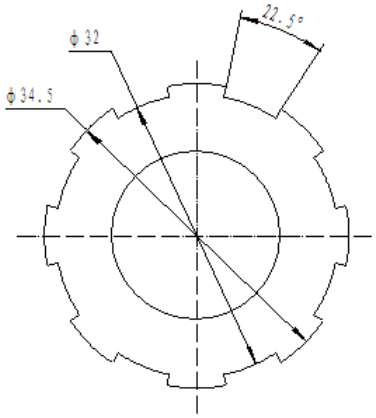
25	32.3/22	CSM	32.3	22	5.15
26	33.7/28.7	CSM	33.7	28.7	2.5
27	34/28	Stitched mat	34	28	3
28	34.7/30.2	Stitched mat	34.7	30.2	2.25
29	35/29	Stitched mat	35	29	3
30	39/34	CSM	39	34	2.5
31	45/35	CSM	45	35	5
32	50/42	Stitched mat	50	42	4
33	60/44	Stitched mat	60	44	8
34	75/67	Stitched mat	75	67	4
35	160/150	Stitched mat	160	150	5

OVAL TUBE



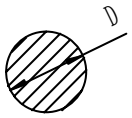
1	36/28	Stitched mat	36	28	2
2	28/22	Stitched mat	28	22	2

ANTI-SLIP TUBE

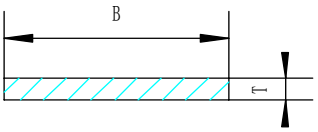


1	34/31/25.5	Stitched mat	34	31	1.5/4.25
2	34/31/19.2	Stitched mat	34	31	1.5/7.4

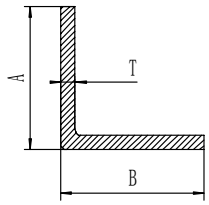
2. Rod

No.	D(mm)	Sectional area (mm^2)	Sectional drawing
1	7.9	48.992	
2	5	19.625	
3	6	28.260	
4	10	78.500	
5	12	113.040	
6	12.7	126.613	
7	14	153.860	
8	18	254.340	
9	19	283.385	
10	22	379.940	
11	23.7	440.927	
12	25	490.625	
13	28	615.440	
14	30	706.500	
15	32	803.840	

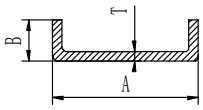
3. Plat sheet

No.	Width B(mm)	Thickness T(mm)	Sectional area (mm^2)	Sectional drawing
1	10	5	50	
2	12.7	3	38.1	
3	12.7	6.35	80.645	
4	40	4	160	
5	40	6	240	
6	50	3	150	
7	50	8	400	
8	64	6.4	409.6	
9	140	5	700	
10	200	12	2400	
11	100	12	1200	
12	75	6	450	
13	75	10	750	
14	80	12	960	
15	76.2	12.7	967.74	
16	101.6	12.7	1290.32	
17	101.6	6.35	645.16	

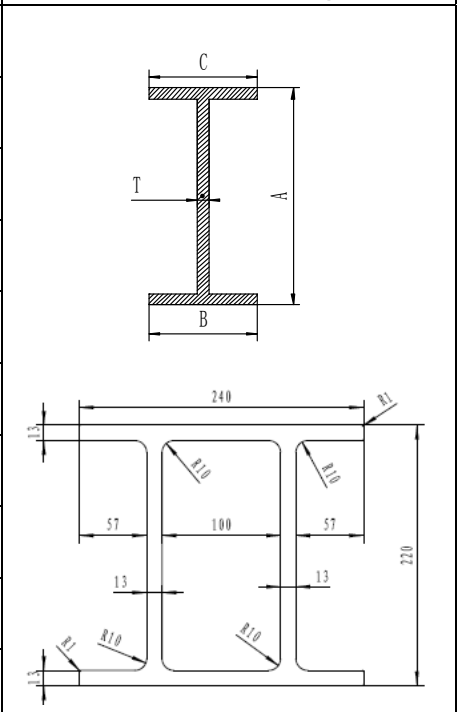
4. Equal Angles

No.	A(mm)	B(mm)	T(mm)	Sectional drawing
1	40	40	4	
2	29	29	4	
3	50	50	5	
4	50.8	50.8	6.35	
5	75	75	4	
6	75	75	6	
7	76	76	9.5	
8	75	75	8	
9	76.2	76.2	6.35	
10	150	150	5	
11	101.6	101.6	6.35	
12	152.4	152.4	9.5	

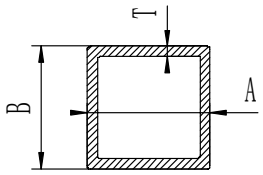
5. Channel

No.	A(mm)	B(mm)	T(mm)	Sectional drawing
1	50	30	5	
2	52	30	5	
3	60	50	5	
4	70	26	3/4	
5	79	28.5	3	
6	84	30	5.5	
7	88.9	38.1	4.76	
8	90	45	5	
9	92	52	5	
10	100	30	6	
11	100	35	5	
12	100	50	6	
13	101.6	35	4.8	
14	101.6	28.58	6.35	
15	110	60	10	
16	114.3	63.5	3.2	
17	139.7	38.1	4.76	
18	140	45	5	
19	150	40	10	
20	150	38	6	
21	150	50	6	
22	152.4	42	6.35	
23	152.4	42	9.5	
24	200	50	10	
25	203.2	56	9.5	
26	250	70	12	
27	340	70	10	

6、I beam

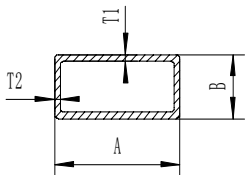
No.	A(mm)	B(mm)	C(mm)	T(mm)	Sectional drawing
1	25	15	15	4	
2	38	15	15	4	
3	50.8	15	25.4	4.2	
4	50.8	50.8	50.8	4.2	
5	101.6	50.8	6.35	6.35	
6	152.4	76.2	6.35	6.35	
7	152.4	76.2	9.525	9.525	
8	150	75	6	6	
9	202	101	100	10	
10	250	125	125	12	
11	240	220	220	13	

7、Square tube

No.	A(mm)	B(mm)	T(mm)	Sectional drawing
1	**25.4**	**25.4**	**2**	
2	**25.4**	**25.4**	**3.2**	
3	**36**	**36**	**3**	
4	**38**	**38**	**2.5**	
5	**38**	**38**	**4**	
6	**41.4**	**41.4**	**4.2**	
7	**50**	**50**	**4**	
8	**50**	**50**	**5**	
9	**50**	**50**	**6**	
10	**50.8**	**50.8**	**6.35**	
11	**62.2**	**62.2**	**6.4**	
12	**64**	**64**	**6.35**	
13	**75**	**75**	**6**	
14	**75**	**75**	**8**	
15	**75**	**75**	**9**	
16	**76**	**76**	**6.35**	

17	**80**	**80**	**6**	
18	**90**	**90**	**4**	
19	**100**	**100**	**8**	
20	**101.6**	**101.6**	**6.35**	
21	**120**	**120**	**8**	
22	**120**	**120**	**5**	
23	**150**	**150**	**8**	

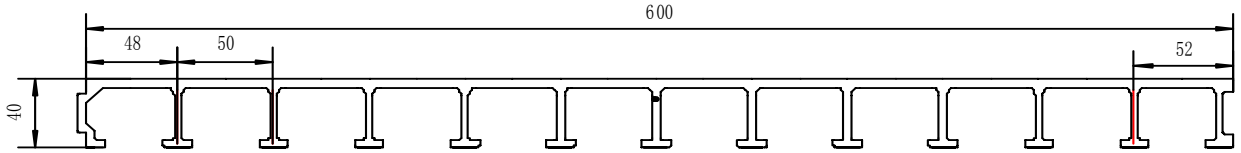
8、Rectangular tube

No.	A (mm)	B (mm)	T1 (mm)	T2 (mm)	Sectional drawing
1	42	20	2	2	
2	50	25	4	4	
3	70	26	3	3	
4	80	50	5	5	
5	85	25	4	4	
6	117.5	92.1	4.8	4.8	
7	117.5	92.1	9.5	9.5	
8	120	170	5	5	
9	150	100	6	6	
10	190.5	101.6	9.5	9.5	
11	228	152	6	6	

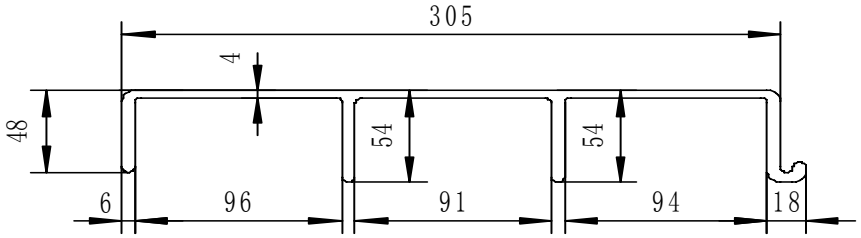
9. Special Profiles

Flat rod, kick plate, Flat sheet, survey and draw the meter, grating bar, T -profile, the large grating panel, the chair reed and so on.

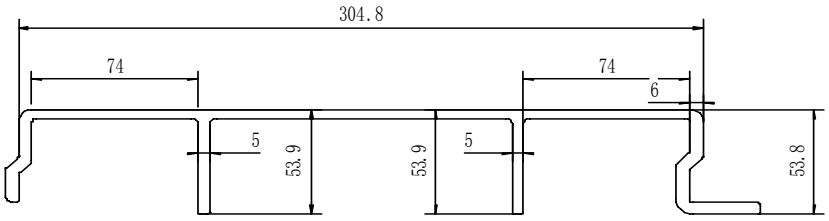
Deckplank 1：（12kg/M+）



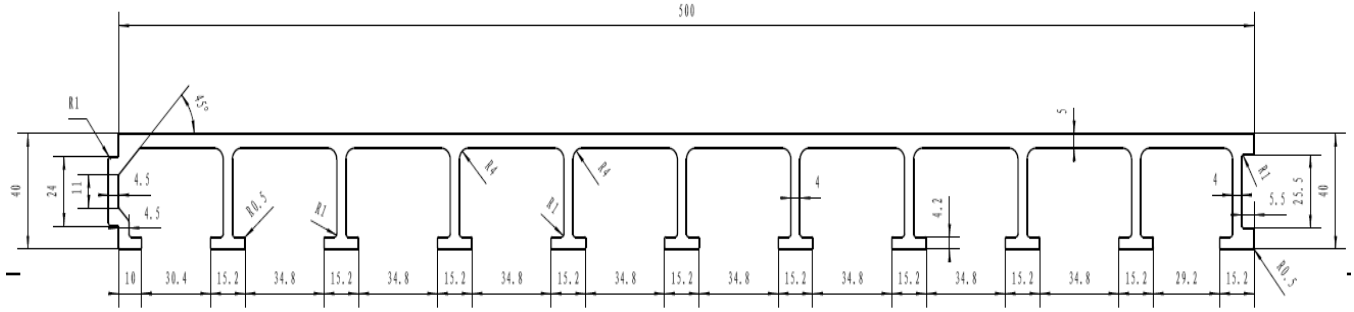
Deckplank 2：（5.0kg/M+）



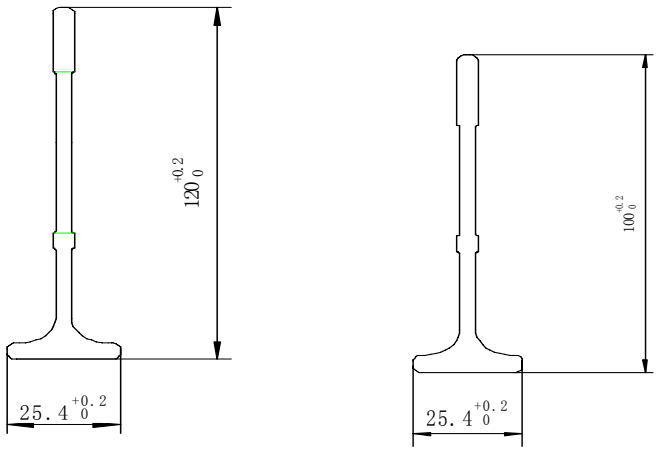
Deckplank 3：（5.0kg/M+）



Deckplank 4（500*40*5,8.92kg/m）

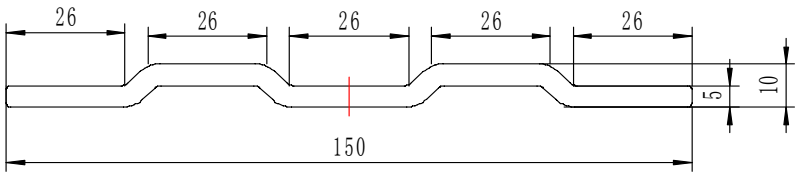


9.2 T Profile（1.03KG/M--100H，1.17KG/M--120H）

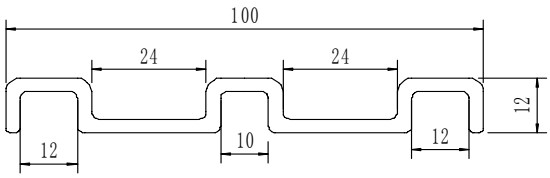


9.3 Kick plate

Kick plate 1：（1.49KG/M）



Kick plate 2：（0.84KG/M）



10. The custom profiles

With professional design and development team, we are capable to make special profiles according to customer’s request of various shapes.