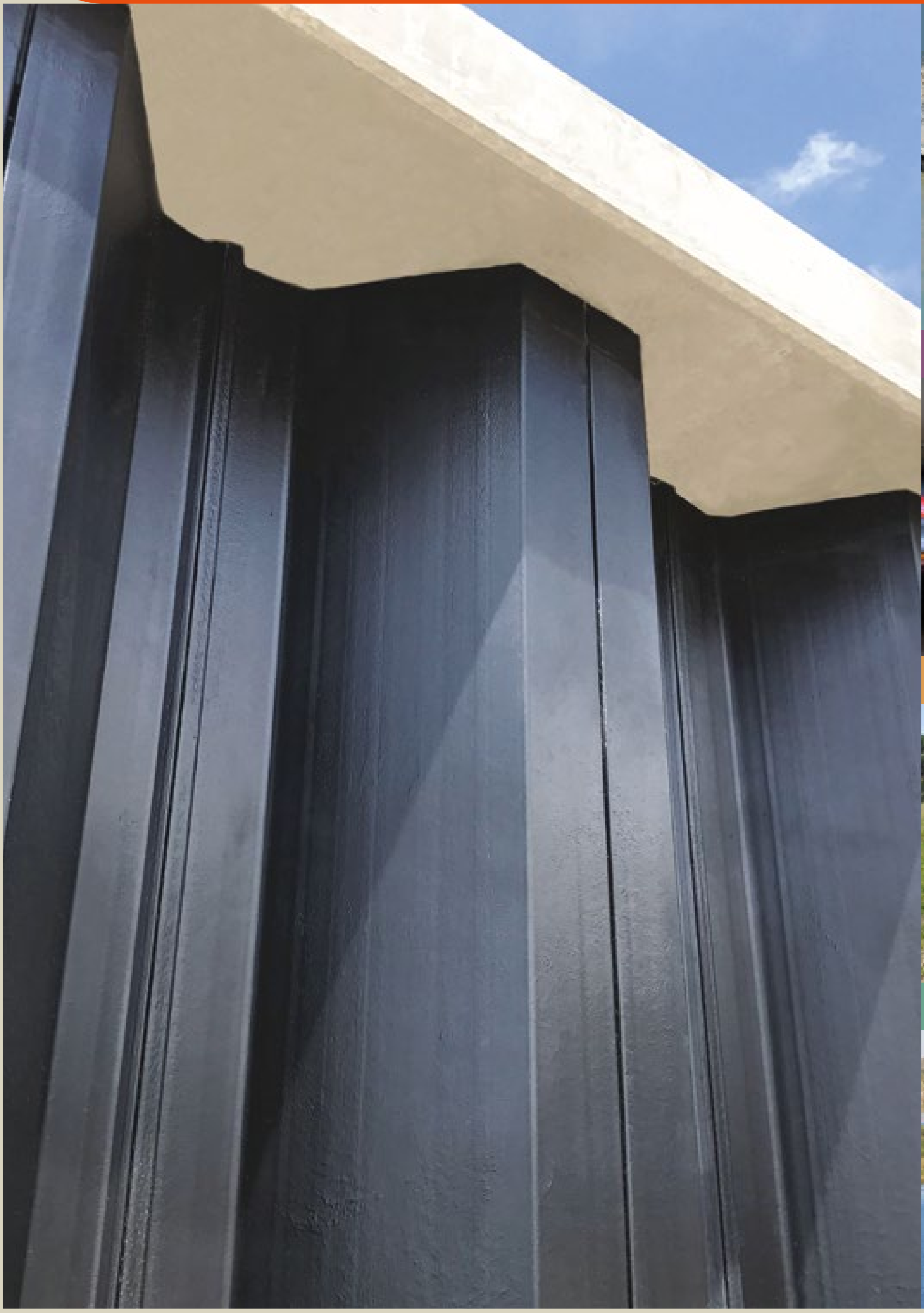
ArcelorMittal Sheet Piling

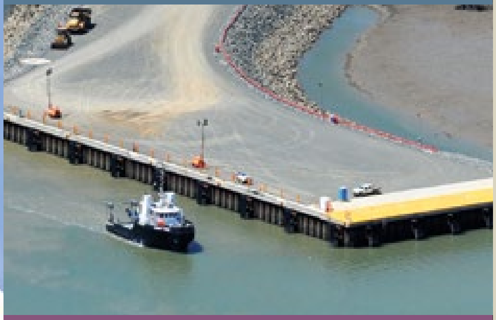
ArcelorMittal

Steel Foundation Solutions

General Catalogue 2019



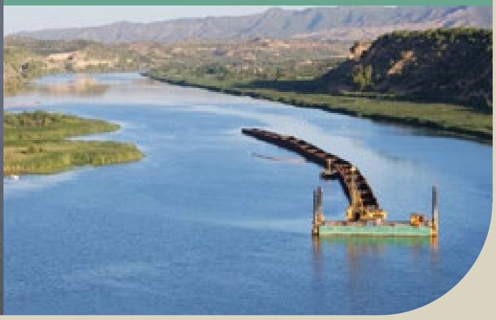
Water Transport Solutions



Mobility Infrastructure Solutions

Hazard Protection Solutions

Environmental Protection Solutions



Think steel first!

Water transport is essential to our global economy.

Breakwaters, quay walls, canals, embankments and locks, built with sustainable steel sheet piles, contribute to a reliable and safe water infrastructure network.

Water Transport Solutions

LNG port Gladstone, Queensland, Australia
© Waterway Constructions Pty Ltd

Mobility is central to our daily life.

Innovative use of steel sheet piles offer new options for building efficient underground car parks, bridges, road and railway infrastructures.

With shorter construction times and efficient driving techniques, projects are delivered faster, saving costs and minimizing the impact on the community.

Mobility Infrastructure Solutions

Underground car park, Hopmarkt, Aalst, Belgium

Dykes and flood protections made from steel sheet piles are one of the most efficient ways to protect against flooding and the consequences of climate change.

Hazard Protection Solutions

Flood protection, Niederaltdeich, Bavaria, Germany

Steel sheet pile walls retain polluted soils in impervious enclosures.

They allow remediation operations and preserve our environment.

Environmental Protection Solutions

Polluted soil remediation, Flix reservoir, Spain

Steel Foundation Solutions

ArcelorMittal Sheet Piling

General Catalogue 2019

EcoSheetPile™
100% recycled | recyclable
reusable steel

Disclaimer

Photo front cover: Marina Buena Ventura, Panama

Contents

Deepwater port, Northport, New Zealand

Introduction

Hot rolled steel sheet piles have been widely used worldwide for the construction of quay walls and breakwaters in harbours, of locks and of bank reinforcement on rivers and canals. Typical applications are also temporary cofferdams in land and in water, permanent bridge abutments, retaining walls for underpasses or underground car parks, impervious containment walls, etc.

ArcelorMittal is the largest steel and mining company in the world, created by the merger of Arcelor and Mittal Steel back in 2006. **ArcelorMittal is also the world's leading manufacturer of hot rolled steel sheet piles.**

ArcelorMittal Sheet Piling is in charge of the sales, marketing and promotion of foundation solutions produced by the following ArcelorMittal mills:

- hot rolled steel sheet piles: Belval and Differdange in Luxembourg, Dabrowa in Poland;
- cold formed steel sheet piles: "Palfroid" in Messempré, France;
- steel tubes (for foundations): Dintelmond, The Netherlands (for EU markets);
- steel bearing piles: Belval and Differdange in Luxembourg.

ArcelorMittal Sheet Piling can supply a complete solution package that can include accessories (such as anchoring material, walers, fabricated piles, driving caps, etc.), a full technical support from the conceptual design to the final installation process and additional features (such as special piles, coating, sealant material in the interlocks, etc.).

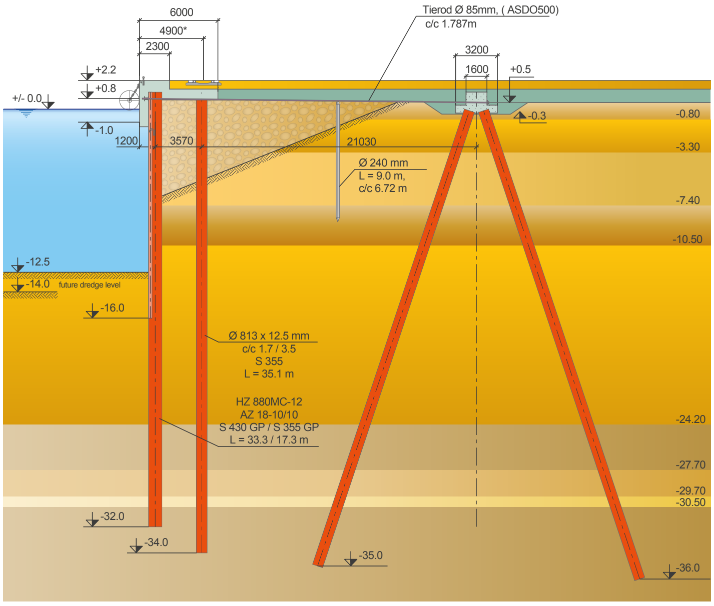
ArcelorMittal Belval is the world's largest rolling mill of hot rolled steel sheet piles and has been playing a leading role in the development of piling technology for over 100 years. The first steel sheet piles were rolled in 1911 and 1912: the "Ransome" and "Terre Rouge" piles. Since then, the production program of ArcelorMittal's mill in Belval has undergone constant improvement and development to include AZ® sections up to 800 mm wide and U-type sections up to 750 mm wide (AU). One rolling mill in Belval is dedicated to the sole production of steel sheet piles. ArcelorMittal introduced in the early 1990's the revolutionary, and yet unmatched AZ® profiles.

ArcelorMittal Differdange produces the biggest HZ®-M sections to form the most competitive HZ/AZ high section modulus combined wall system.

ArcelorMittal Dabrowa manufactures hot rolled U-type sheet piles.

ArcelorMittal's piling series are especially **suitable for building quickly and reliably cost-effective structures**. They are characterised by excellent section properties, for instance a high ratio section modulus to weight, as well as high moments of inertia. Steel sheet piles and foundation products are manufactured according to the European standards, but can also be supplied according to other international standards (e.g. ASTM).

The Technical Department offers comprehensive services throughout the world with customised support to all the parties involved in the design, specification and installation of sheet and bearing piles, e.g. consulting engineers, architects, regional authorities, contractors, academics and students.



Belval steel works, Luxembourg, 1930s

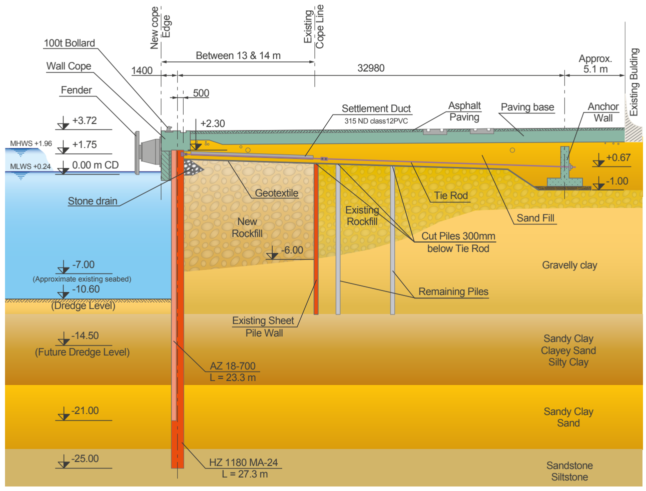
Sheet pile catalogues, 1912

In-house design team

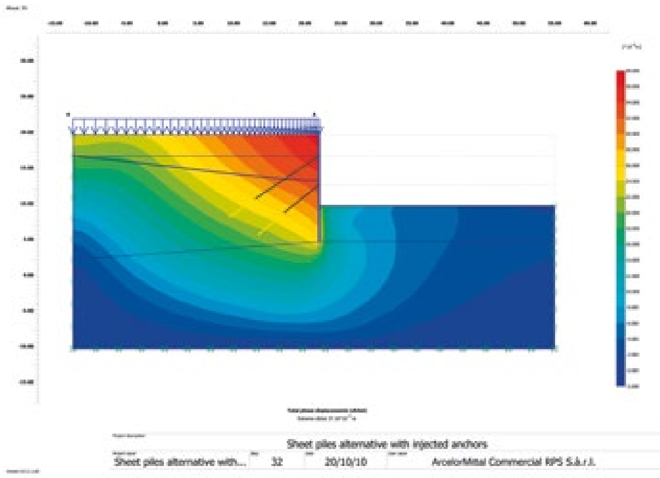
Services provided free of charge by ArcelorMittal's in-house design and support teams are:

- preliminary designs of complete solutions including anchorage systems and lifetime calculations;
- project optimizations offered to end-users to provide the most competitive piling package;
- elaboration of detailed project layouts and supply chains;
- assistance and recommendations on pile installation methods and driving equipment;
- Life Cycle Assessment (LCA) and carbon footprint for specific projects.

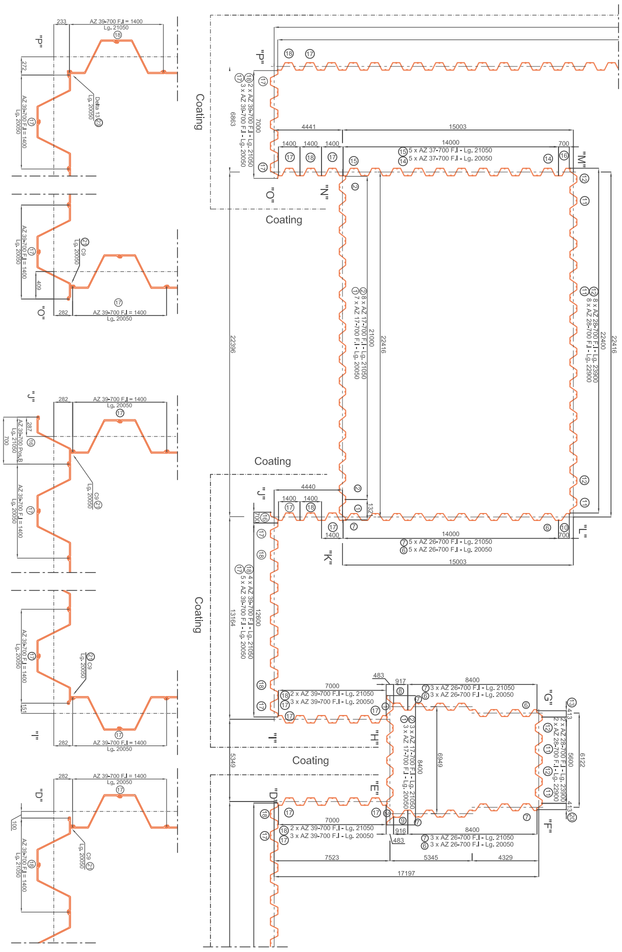
Please note that the legal responsibility for the final structure remains with the owner.



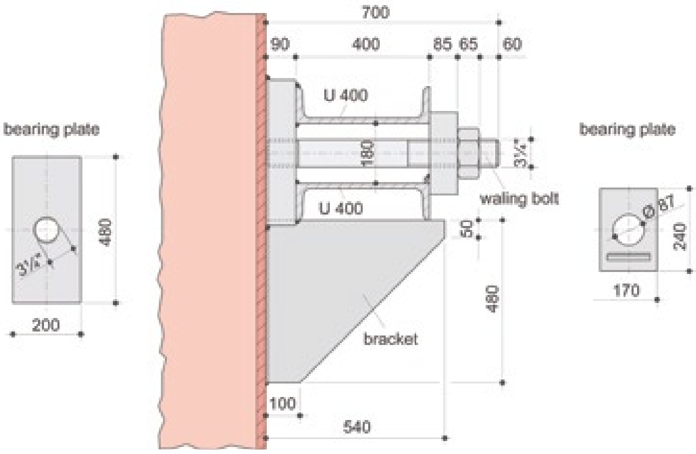
Feasibility studies



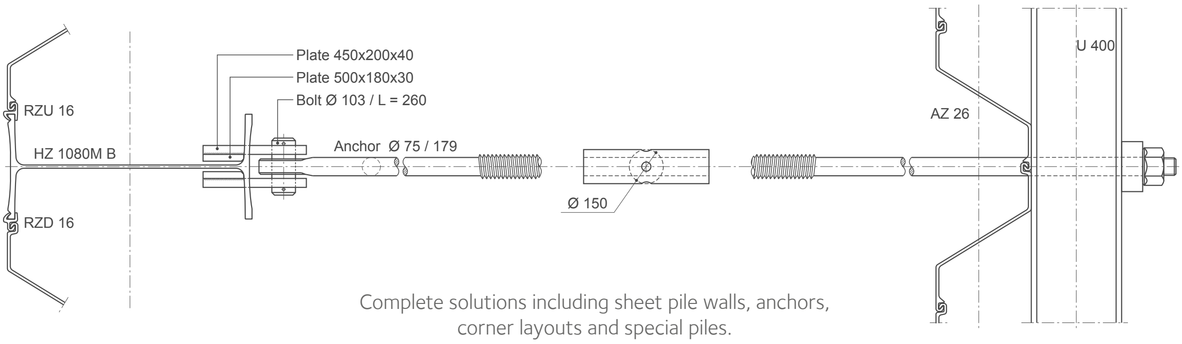
Preliminary designs



Sheet pile installation drawings

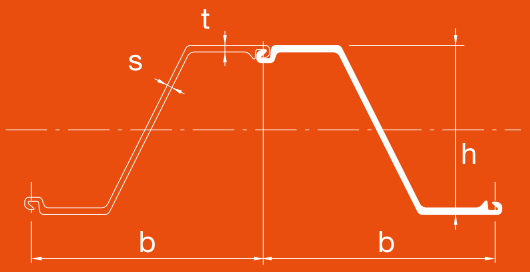


Solutions for execution details



Complete solutions including sheet pile walls, anchors, corner layouts and special piles.

Z-Sections



The essential characteristics of Z-sections are the continuous form of the web and the location of the interlock symmetrically on each side of the neutral axis.
Both aspects have a positive influence on the section modulus. The AZ® series, a section with extraordinary characteristics and the proven qualities of the Larssen interlock, has the following advantages:

– extremely competitive section-modulus-to-mass ratio;
– increased inertia for reduced deflection;
– large width, resulting in good installation performance;
– good corrosion resistance, the steel being thickest at the critical corrosion points.

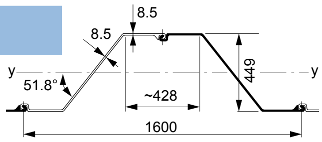
Section	Width	Height	Thickness		Sectional area	Mass		Moment of inertia	Elastic section modulus	Static moment	Plastic section modulus	Class[1]						
	b mm	h mm	t mm	s mm	cm²/m	single pile kg/m	wall kg/m²	cm⁴/m	cm³/m	cm³/m	cm³/m	S 240 GP	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 AP
AZ®-800																		
AZ 18-800	800	449	8.5	8.5	129	80.7	**101**	41320	**1840**	1065	2135	3	3	3	3	3	4	4
AZ 20-800	800	450	9.5	9.5	141	88.6	**111**	45050	**2000**	1165	2330	3	3	3	3	3	3	3
AZ 22-800	800	451	10.5	10.5	153	96.4	**120**	48790	**2165**	1260	2525	2	2	3	3	3	3	3
AZ 23-800	800	474	11.5	9.0	151	94.6	**118**	55260	**2330**	1340	2680	2	2	2	3	3	3	3
AZ 25-800	800	475	12.5	10.0	163	102.6	**128**	59410	**2500**	1445	2890	2	2	2	2	2	3	3
AZ 27-800	800	476	13.5	11.0	176	110.5	**138**	63570	**2670**	1550	3100	2	2	2	2	2	2	2
AZ®-750																		
AZ 28-750	750	509	12.0	10.0	171	100.8	**134**	71540	**2810**	1620	3245	2	2	2	2	3	3	3
AZ 30-750	750	510	13.0	11.0	185	108.8	**145**	76670	**3005**	1740	3485	2	2	2	2	2	2	3
AZ 32-750	750	511	14.0	12.0	198	116.7	**156**	81800	**3200**	1860	3720	2	2	2	2	2	2	2
AZ®-700 and AZ®-770																		
AZ 12-770	770	344	8.5	8.5	120	72.6	**94**	21430	**1245**	740	1480	2	2	3	3	3	3	3
AZ 13-770	770	344	9.0	9.0	126	76.1	**99**	22360	**1300**	775	1546	2	2	3	3	3	3	3
AZ 14-770	770	345	9.5	9.5	132	79.5	**103**	23300	**1355**	805	1611	2	2	2	2	3	3	3
AZ 14-770-10/10	770	345	10.0	10.0	137	82.9	**108**	24240	**1405**	840	1677	2	2	2	2	2	3	3
AZ 12-700	700	314	8.5	8.5	123	67.7	**97**	18880	**1205**	710	1415	2	2	3	3	3	3	3
AZ 13-700	700	315	9.5	9.5	135	74.0	**106**	20540	**1305**	770	1540	2	2	2	3	3	3	3
AZ 13-700-10/10	700	316	10.0	10.0	140	77.2	**110**	21370	**1355**	800	1600	2	2	2	2	3	3	3
AZ 14-700	700	316	10.5	10.5	146	80.3	**115**	22190	**1405**	835	1665	2	2	2	2	2	3	3
AZ 17-700	700	420	8.5	8.5	133	73.1	**104**	36230	**1730**	1015	2027	2	2	3	3	3	3	3
AZ 18-700	700	420	9.0	9.0	139	76.5	**109**	37800	**1800**	1060	2116	2	2	3	3	3	3	3
AZ 19-700	700	421	9.5	9.5	146	80.0	**114**	39380	**1870**	1105	2206	2	2	2	3	3	3	3
AZ 20-700	700	421	10.0	10.0	152	83.5	**119**	40960	**1945**	1150	2296	2	2	2	2	2	3	3
AZ 24-700	700	459	11.2	11.2	174	95.7	**137**	55820	**2430**	1435	2867	2	2	2	2	2	2	3
AZ 26-700	700	460	12.2	12.2	187	102.9	**147**	59720	**2600**	1535	3070	2	2	2	2	2	2	2
AZ 28-700	700	461	13.2	13.2	200	110.0	**157**	63620	**2760**	1635	3273	2	2	2	2	2	2	2

Section	Width b mm	Height h mm	Thickness t mm	Thickness s mm	Sectional area cm²/m	Mass single pile kg/m	Mass wall kg/m²	Moment of inertia cm⁴/m	Elastic section modulus cm³/m	Static moment cm³/m	Plastic section modulus cm³/m	Class[1] S 240 GP	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 AP
AZ®-700 and AZ®-770																		
AZ 36-700N	700	499	15.0	11.2	216	118.6	**169**	89610	**3590**	2055	4110	2	2	2	2	2	2	2
AZ 38-700N	700	500	16.0	12.2	230	126.4	**181**	94840	**3795**	2180	4360	2	2	2	2	2	2	2
AZ 40-700N	700	501	17.0	13.2	244	134.2	**192**	100080	**3995**	2305	4605	2	2	2	2	2	2	2
AZ 42-700N	700	499	18.0	14.0	259	142.1	**203**	104930	**4205**	2425	4855	2	2	2	2	2	2	2
AZ 44-700N	700	500	19.0	15.0	273	149.9	**214**	110150	**4405**	2550	5105	2	2	2	2	2	2	2
AZ 46-700N	700	501	20.0	16.0	287	157.7	**225**	115370	**4605**	2675	5350	2	2	2	2	2	2	2
AZ 48-700	700	503	22.0	15.0	288	158.5	**226**	119650	**4755**	2745	5490	2	2	2	2	2	2	2
AZ 50-700	700	504	23.0	16.0	303	166.3	**238**	124890	**4955**	2870	5735	2	2	2	2	2	2	2
AZ 52-700	700	505	24.0	17.0	317	174.1	**249**	130140	**5155**	2990	5985	2	2	2	2	2	2	2
AZ®																		
AZ 18[2]	630	380	9.5	9.5	150	74.4	**118**	34200	**1800**	1050	2104	2	2	2	3	3	3	3
AZ 18-10/10	630	381	10.0	10.0	157	77.8	**123**	35540	**1870**	1095	2189	2	2	2	2	3	3	3
AZ 26[2]	630	427	13.0	12.2	198	97.8	**155**	55510	**2600**	1530	3059	2	2	2	2	2	2	2
AZ 46	580	481	18.0	14.0	291	132.6	**229**	110450	**4595**	2650	5295	2	2	2	2	2	2	2
AZ 48	580	482	19.0	15.0	307	139.6	**241**	115670	**4800**	2775	5553	2	2	2	2	2	2	2
AZ 50	580	483	20.0	16.0	322	146.7	**253**	121060	**5015**	2910	5816	2	2	2	2	2	2	2

[1] Classification according to EN 1993-5. Class 1 is obtained by verification of the rotation capacity for a class-2 cross-section.
A set of tables with all the data required for design in accordance with EN 1993-5 is available from our Technical Department.
[2] These AZ® sections can be rolled-up or down by 0.5 mm and 1.0 mm on request.

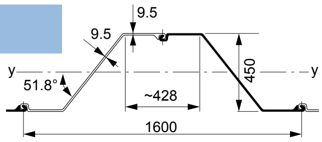
AZ®-800

AZ 18-800



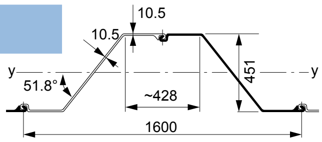
Section	S = Single pile / D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
AZ 18-800	Per S	102.9	**80.7**	33055	**1470**	17.93	1.04
	Per D	205.7	**161.5**	66110	**2945**	17.93	2.08
	Per m of wall	128.6	**100.9**	41320	**1840**	17.93	1.30

AZ 20-800



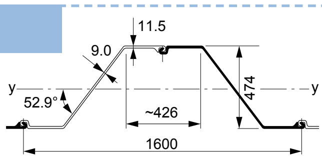
Section	S = Single pile / D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
AZ 20-800	Per S	112.8	**88.6**	36040	**1600**	17.87	1.04
	Per D	225.6	**177.1**	72070	**3205**	17.87	2.08
	Per m of wall	141.0	**110.7**	45050	**2000**	17.87	1.30

AZ 22-800



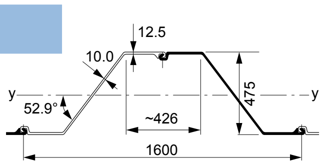
Section	S = Single pile / D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
AZ 22-800	Per S	122.8	**96.4**	39035	**1730**	17.83	1.04
	Per D	245.6	**192.8**	78070	**3460**	17.83	2.08
	Per m of wall	153.5	**120.5**	48790	**2165**	17.83	1.30

AZ 23-800



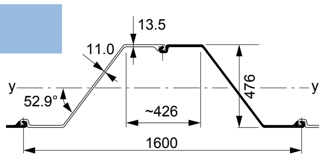
Section	S = Single pile / D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
AZ 23-800	Per S	120.5	**94.6**	44200	**1865**	19.15	1.06
	Per D	241.0	**189.2**	88410	**3730**	19.15	2.11
	Per m of wall	150.6	**118.2**	55260	**2330**	19.15	1.32

AZ 25-800



Section	S = Single pile / D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
AZ 25-800	Per S	130.6	**102.6**	47530	**2000**	19.07	1.06
	Per D	261.3	**205.1**	95060	**4005**	19.07	2.11
	Per m of wall	163.3	**128.2**	59410	**2500**	19.07	1.32

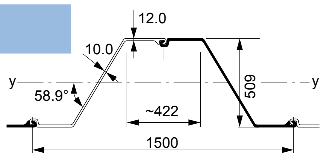
AZ 27-800



Section	S = Single pile / D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
AZ 27-800	Per S	140.8	**110.5**	50860	**2135**	19.01	1.06
	Per D	281.6	**221.0**	101720	**4275**	19.01	2.11
	Per m of wall	176.0	**138.1**	63570	**2670**	19.01	1.32

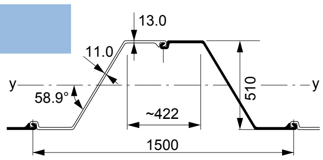
AZ®-750

AZ 28-750



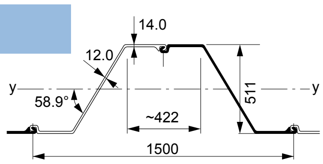
Section	S = Single pile / D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
AZ 28-750	Per S	128.4	**100.8**	53650	**2110**	20.44	1.06
	Per D	256.8	**201.6**	107310	**4215**	20.44	2.11
	Per m of wall	171.2	**134.4**	71540	**2810**	20.44	1.41

AZ 30-750



Section	S = Single pile / D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
AZ 30-750	Per S	138.5	**108.8**	57500	**2255**	20.37	1.06
	Per D	277.1	**217.5**	115000	**4510**	20.37	2.11
	Per m of wall	184.7	**145.0**	76670	**3005**	20.37	1.41

AZ 32-750

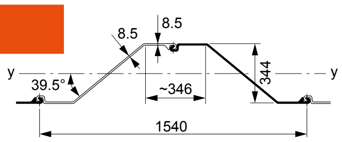


Section	S = Single pile / D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
AZ 32-750	Per S	148.7	**116.7**	61350	**2400**	20.31	1.06
	Per D	297.4	**233.5**	122710	**4805**	20.31	2.11
	Per m of wall	198.3	**155.6**	81800	**3200**	20.31	1.41

[1)] One side, excluding inside of interlocks.

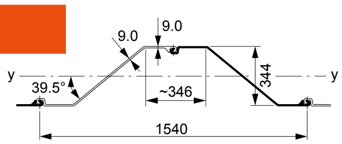
AZ®-700 and AZ®-770

AZ 12-770



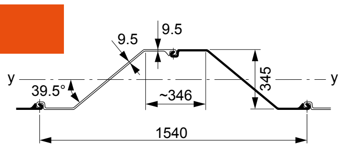
S = Single pile, D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
Per S	92.5	**72.6**	16500	**960**	13.36	0.93
Per D	185.0	**145.2**	33000	**1920**	13.36	1.85
Per m of wall	120.1	**94.3**	21430	**1245**	13.36	1.20

AZ 13-770



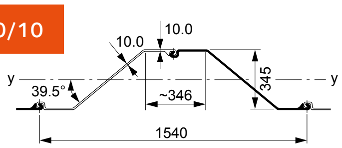
S = Single pile, D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
Per S	96.9	**76.1**	17220	**1000**	13.33	0.93
Per D	193.8	**152.1**	34440	**2000**	13.33	1.85
Per m of wall	125.8	**98.8**	22360	**1300**	13.33	1.20

AZ 14-770



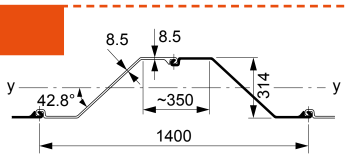
S = Single pile, D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
Per S	101.3	**79.5**	17940	**1040**	13.31	0.93
Per D	202.6	**159.0**	35890	**2085**	13.31	1.85
Per m of wall	131.5	**103.2**	23300	**1355**	13.31	1.20

AZ 14-770-10/10



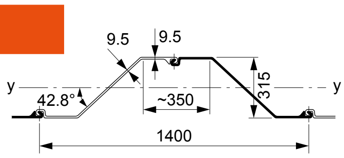
S = Single pile, D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
Per S	105.6	**82.9**	18670	**1085**	13.30	0.93
Per D	211.2	**165.8**	37330	**2165**	13.30	1.85
Per m of wall	137.2	**107.7**	24240	**1405**	13.30	1.20

AZ 12-700



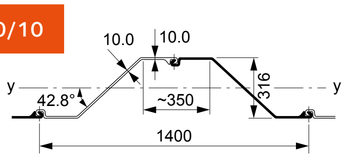
S = Single pile, D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
Per S	86.2	**67.7**	13220	**840**	12.38	0.86
Per D	172.5	**135.4**	26440	**1685**	12.38	1.71
Per m of wall	123.2	**96.7**	18880	**1205**	12.38	1.22

AZ 13-700



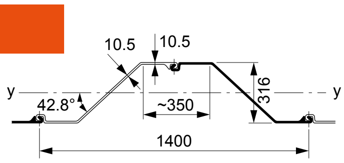
S = Single pile, D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
Per S	94.3	**74.0**	14370	**910**	12.35	0.86
Per D	188.5	**148.0**	28750	**1825**	12.35	1.71
Per m of wall	134.7	**105.7**	20540	**1305**	12.35	1.22

AZ 13-700-10/10



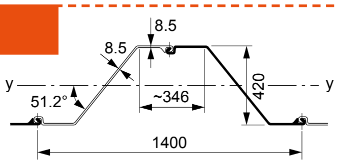
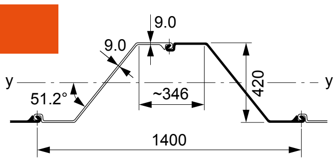
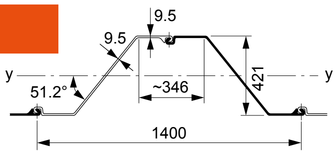
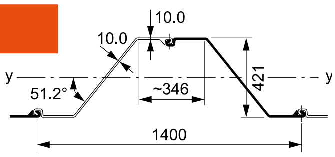
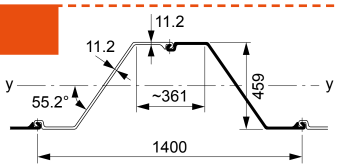
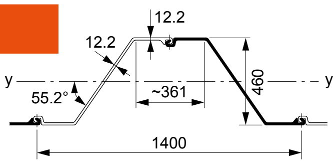
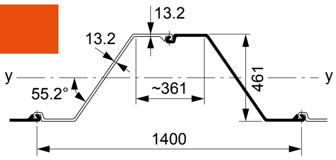
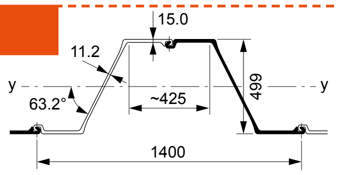
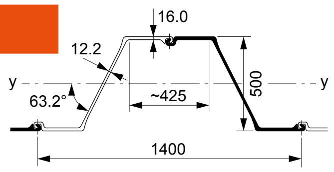
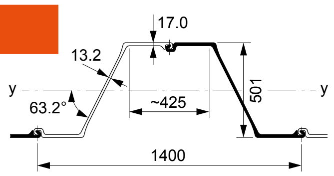
S = Single pile, D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
Per S	98.3	**77.2**	14960	**945**	12.33	0.86
Per D	196.6	**154.3**	29910	**1895**	12.33	1.71
Per m of wall	140.4	**110.2**	21370	**1355**	12.33	1.22

AZ 14-700

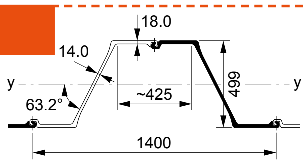
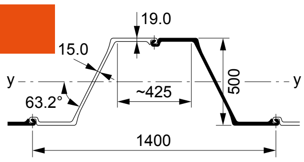
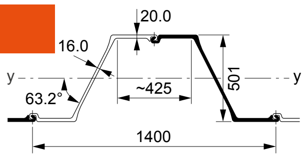
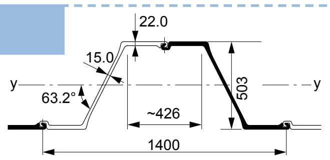
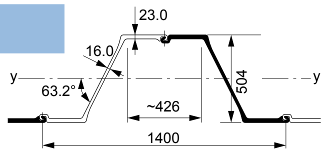
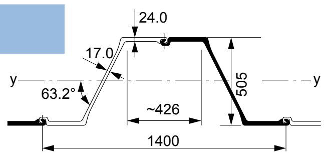


S = Single pile, D = Double pile	Sectional area (cm²)	Mass (kg/m)	Moment of inertia (cm⁴)	Elastic section modulus (cm³)	Radius of gyration (cm)	Coating area[1)] (m²/m)
Per S	102.3	**80.3**	15530	**980**	12.32	0.86
Per D	204.6	**160.6**	31060	**1965**	12.32	1.71
Per m of wall	146.1	**114.7**	22190	**1405**	12.32	1.22

[1)] One side, excluding inside of interlocks.

Section		S = Single pile D = Double pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1]
			cm²	kg/m	cm⁴	cm³	cm	m²/m
AZ 17-700		Per S	93.1	**73.1**	25360	**1210**	16.50	0.93
		Per D	186.2	**146.2**	50720	**2420**	16.50	1.86
		Per m of wall	133.0	**104.4**	36230	**1730**	16.50	1.33
AZ 18-700		Per S	97.5	**76.5**	26460	**1260**	16.47	0.93
		Per D	194.9	**153.0**	52920	**2520**	16.47	1.86
		Per m of wall	139.2	**109.3**	37800	**1800**	16.47	1.33
AZ 19-700		Per S	101.9	**80.0**	27560	**1310**	16.44	0.93
		Per D	203.8	**160.0**	55130	**2620**	16.44	1.86
		Per m of wall	145.6	**114.3**	39380	**1870**	16.44	1.33
AZ 20-700		Per S	106.4	**83.5**	28670	**1360**	16.42	0.93
		Per D	212.8	**167.0**	57340	**2725**	16.42	1.86
		Per m of wall	152.0	**119.3**	40960	**1945**	16.42	1.33
AZ 24-700		Per S	121.9	**95.7**	39080	**1700**	17.90	0.97
		Per D	243.8	**191.4**	78150	**3405**	17.90	1.93
		Per m of wall	174.1	**136.7**	55820	**2430**	17.90	1.38
AZ 26-700		Per S	131.0	**102.9**	41800	**1815**	17.86	0.97
		Per D	262.1	**205.7**	83610	**3635**	17.86	1.93
		Per m of wall	187.2	**146.9**	59720	**2600**	17.86	1.38
AZ 28-700		Per S	140.2	**110.0**	44530	**1930**	17.83	0.97
		Per D	280.3	**220.1**	89070	**3865**	17.83	1.93
		Per m of wall	200.2	**157.2**	63620	**2760**	17.83	1.38
AZ 36-700N		Per S	151.1	**118.6**	62730	**2510**	20.37	1.03
		Per D	302.2	**237.3**	125450	**5030**	20.37	2.05
		Per m of wall	215.9	**169.5**	89610	**3590**	20.37	1.47
AZ 38-700N		Per S	161.0	**126.4**	66390	**2655**	20.31	1.03
		Per D	322.0	**252.8**	132780	**5310**	20.31	2.05
		Per m of wall	230.0	**180.6**	94840	**3795**	20.31	1.47
AZ 40-700N		Per S	170.9	**134.2**	70060	**2795**	20.25	1.03
		Per D	341.9	**268.4**	140110	**5595**	20.25	2.05
		Per m of wall	244.2	**191.7**	100080	**3995**	20.25	1.47

[1] One side, excluding inside of interlocks.

Section		S = Single pile D = Double pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
AZ 42-700N		Per S	181.1	**142.1**	73450	**2945**	20.14	1.03
		Per D	362.1	**284.3**	146900	**5890**	20.14	2.06
		Per m of wall	258.7	**203.1**	104930	**4205**	20.14	1.47
AZ 44-700N		Per S	191.0	**149.9**	77100	**3085**	20.09	1.03
		Per D	382.0	**299.8**	154210	**6170**	20.09	2.06
		Per m of wall	272.8	**214.2**	110150	**4405**	20.09	1.47
AZ 46-700N		Per S	200.9	**157.7**	80760	**3220**	20.05	1.03
		Per D	401.8	**315.4**	161520	**6450**	20.05	2.06
		Per m of wall	287.0	**225.3**	115370	**4605**	20.05	1.47
AZ 48-700		Per S	201.9	**158.5**	83760	**3330**	20.37	1.02
		Per D	403.8	**317.0**	167510	**6660**	20.37	2.04
		Per m of wall	288.4	**226.4**	119650	**4755**	20.37	1.46
AZ 50-700		Per S	211.8	**166.3**	87430	**3470**	20.32	1.02
		Per D	423.6	**332.5**	174850	**6940**	20.32	2.04
		Per m of wall	302.6	**237.5**	124890	**4955**	20.32	1.46
AZ 52-700		Per S	221.7	**174.1**	91100	**3610**	20.27	1.02
		Per D	443.5	**348.1**	182200	**7215**	20.27	2.04
		Per m of wall	316.8	**248.7**	130140	**5155**	20.27	1.46

1) One side, excluding inside of interlocks.

Costal defense project, Colwyn Bay, UK

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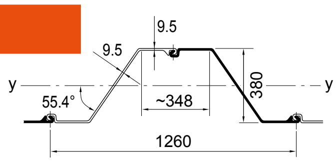
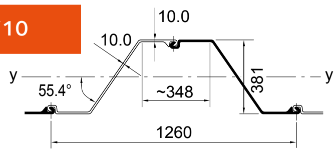
AZ®

AZ 18



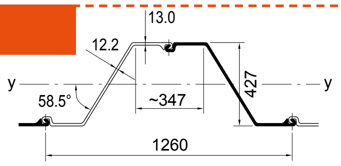
Section	S = Single pile D = Double pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1] m²/m
AZ 18	Per S	94.8	**74.4**	21540	**1135**	15.07	0.86
	Per D	189.6	**148.8**	43080	**2270**	15.07	1.71
	Per m of wall	150.4	**118.1**	34200	**1800**	15.07	1.35

AZ 18-10/10



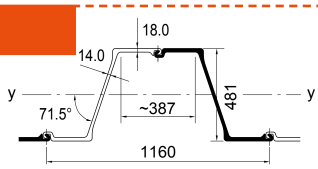
Section	S = Single pile D = Double pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1] m²/m
AZ 18-10/10	Per S	99.1	**77.8**	22390	**1175**	15.04	0.86
	Per D	198.1	**155.5**	44790	**2355**	15.04	1.71
	Per m of wall	157.2	**123.4**	35540	**1870**	15.04	1.35

AZ 26



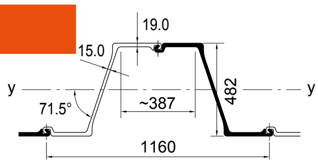
Section	S = Single pile D = Double pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1] m²/m
AZ 26	Per S	124.6	**97.8**	34970	**1640**	16.75	0.90
	Per D	249.2	**195.6**	69940	**3280**	16.75	1.78
	Per m of wall	197.8	**155.2**	55510	**2600**	16.75	1.41

AZ 46



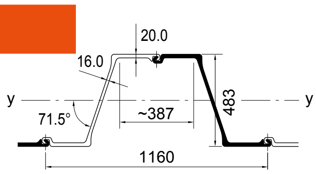
Section	S = Single pile D = Double pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1] m²/m
AZ 46	Per S	168.9	**132.6**	64060	**2665**	19.48	0.95
	Per D	337.8	**265.2**	128120	**5330**	19.48	1.89
	Per m of wall	291.2	**228.6**	110450	**4595**	19.48	1.63

AZ 48



Section	S = Single pile D = Double pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1] m²/m
AZ 48	Per S	177.8	**139.6**	67090	**2785**	19.43	0.95
	Per D	355.6	**279.2**	134180	**5570**	19.43	1.89
	Per m of wall	306.5	**240.6**	115670	**4800**	19.43	1.63

AZ 50

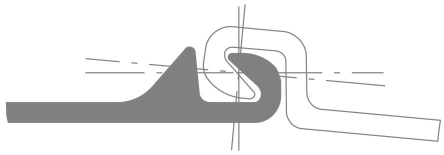


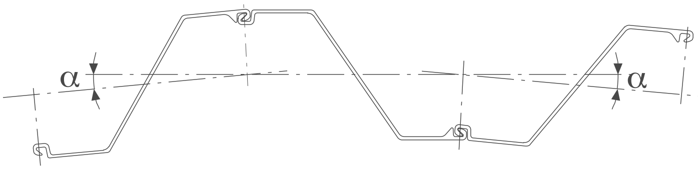
Section	S = Single pile D = Double pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1] m²/m
AZ 50	Per S	186.9	**146.7**	70215	**2910**	19.38	0.95
	Per D	373.8	**293.4**	140430	**5815**	19.38	1.89
	Per m of wall	322.2	**252.9**	121060	**5015**	19.38	1.63

[1] One side, excluding inside of interlocks.

Boardwalk, Aarschot, Belgium

Interlock

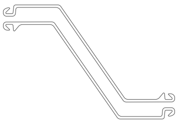




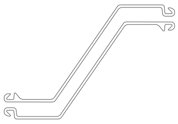
AZ® Larssen interlock in accordance with EN 10248.
All available AZ sheet piles can be interlocked.
Theoretical interlock swing: $\alpha_{max} = 5°$.

Delivery form

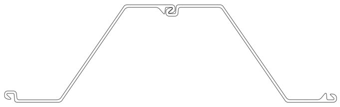
Single Pile
Position A



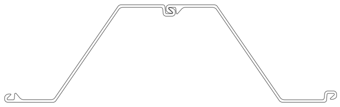
Single Pile
Position B



Double Pile
Form I (standard)

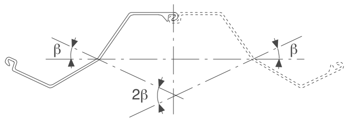


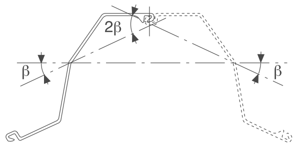
Double Pile
Form II (on request)



Bent piles

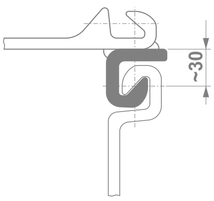
Maximum bending angle: β = 25°. Z-piles are bent in the middle of the web. They are generally delivered as single piles. Double piles are available upon request.



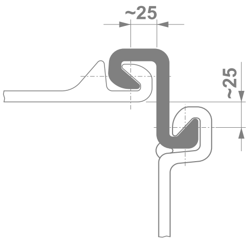


Corner sections

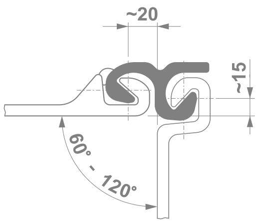
C 9
Mass ~ 9.3 kg/m



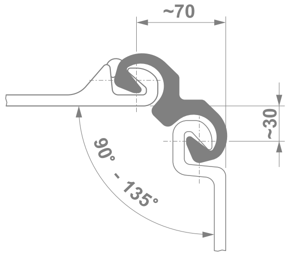
C 14
Mass ~ 14.4 kg/m



DELTA 13
Mass ~ 13.1 kg/m



OMEGA 18
Mass ~ 18.0 kg/m

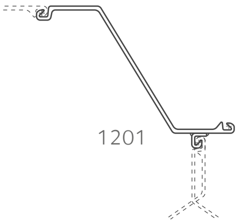


Special corner sections interlocking with Z-sections make it possible to form corner or junction piles without using fabricated special piles. Corner sections are fixed to the sheet pile in accordance with EN 12063.

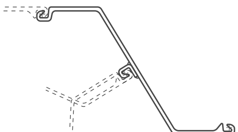
Different welding specifications are available on request. The corner sections are threaded and welded with a 200 mm setback from the top of the piles.

Corner and junction piles

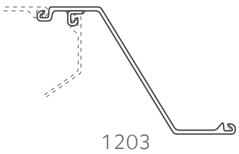
The following special piles, among others, are available as single and double piles on request.



1201



1202



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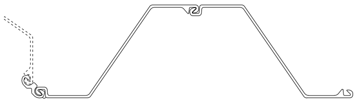
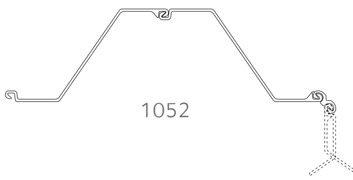


1051



1052

Crimping

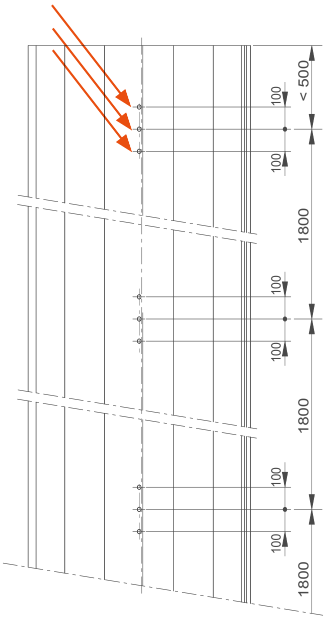
Threaded AZ® double piles are recommended for facilitating the installation process. Although crimping of AZ double piles is not required for structural design reasons, most customers demand crimping according to our standard specification for handling and driving.

[1)] Amount and layout of crimping points may differ at both ends. Special crimping on request.

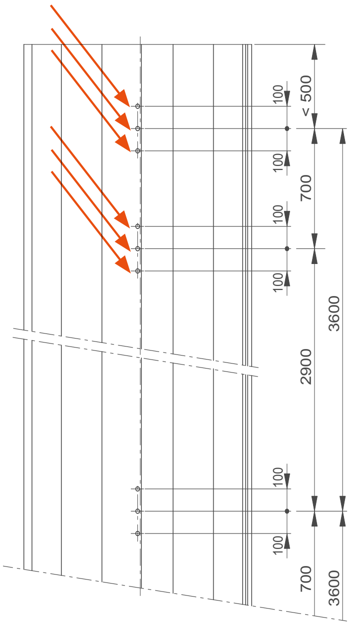
Pile length < 6 m:
3 crimping points per 1.8 m
= 1.7 crimping points per m[1)]

Pile length ≥ 6 m:
6 crimping points per 3.6 m
= 1.7 crimping points per m[1)]

3 crimping points



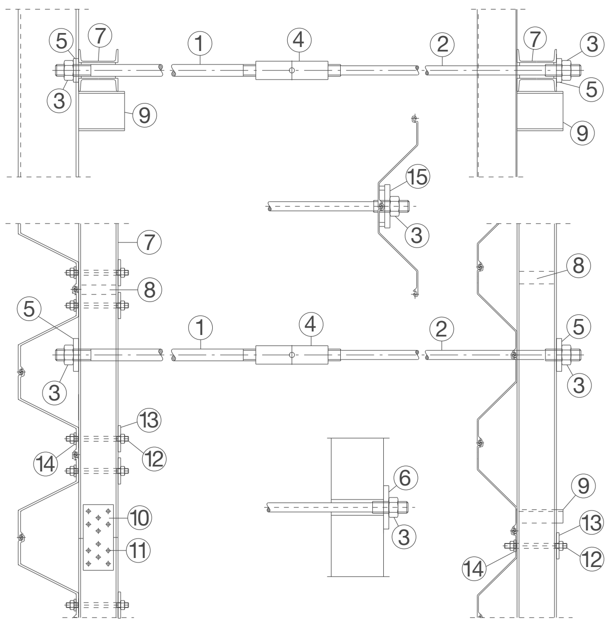
6 crimping points



Tie back system

Most sheet pile retaining walls need supplementary support at the top, in addition to embedment in the soil. Temporary cofferdams generally use waler and strut bracing inside the excavation. Permanent or large retaining walls are often tied back to an anchor wall installed at a certain distance behind the main wall. Other anchor systems, like injection anchors or anchor piles are also common practice. The drawing shows a typical horizontal tie-rod connection for sheet pile walls. The following components can be seen:

1 Plain tie-rod
2 Upset end tie-rod
3 Nut
4 Turnbuckle
5 Bearing plate
6 Bearing plate on concrete
7 Waling
8 Spacer
9 Supporting bracket
10 Splicing plate
11 Splicing bolt
12 Fixing bolt
13, 14, 15 – Fixing plate

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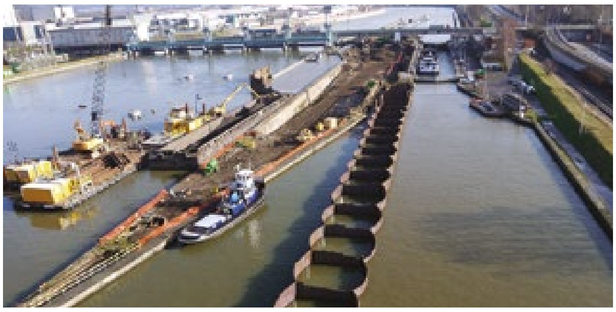
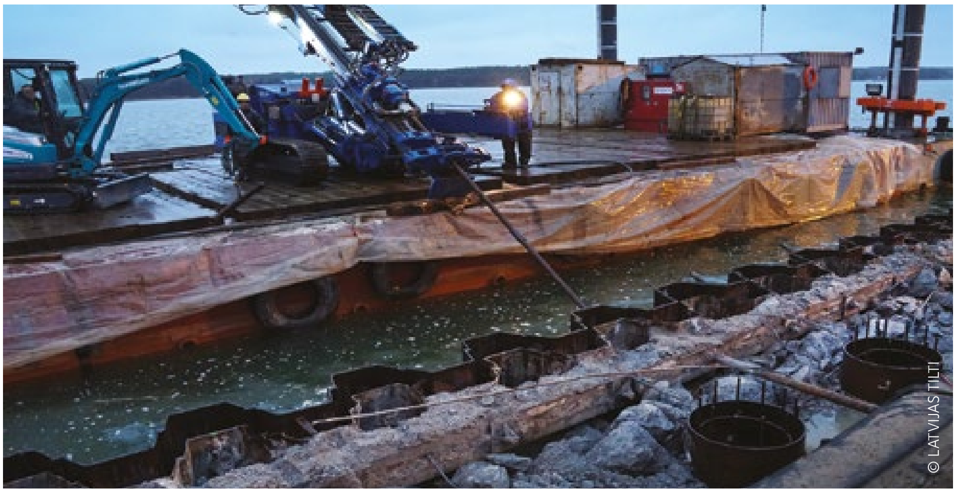
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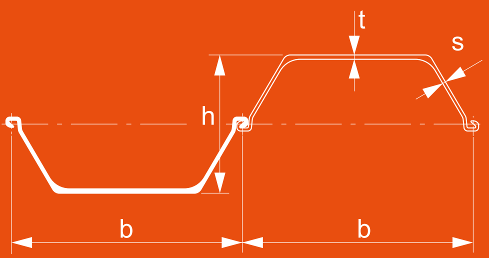
U-Sections



The advantages of U-sections are multiple:

- a wide range of sections forming several series with various geometrical characteristics, allowing a technically and economically optimum choice for each specific project;
- combination of great profile depth with large flange thickness giving excellent mechanical properties;
- the symmetrical form of the single element has made these sheet piles particularly convenient for re-use;
- the possibility of assembling and crimping the piles into pairs at the mill improves installation quality and performance;
- easy fixing of tie-rods and swivelling attachments, even under water;
- good corrosion resistance, the steel being thickest at the critical corrosion points.

Section	Width	Height	Thickness		Sectional area	Mass		Moment of inertia	Elastic section modulus	Static moment	Plastic section modulus	Class[1)]						
	b mm	h mm	t mm	s mm	cm²/m	single pile kg/m	wall kg/m²	cm⁴/m	cm³/m	cm³/m	cm³/m	S 240 GP	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 AP
AU™ sections																		
AU 14	750	408	10.0	8.3	132	77.9	**104**	28680	**1405**	820	1663	2	2	3	3	3	3	3
AU 16	750	411	11.5	9.3	147	86.3	**115**	32850	**1600**	935	1891	2	2	2	2	2	3	3
AU 18	750	441	10.5	9.1	150	88.5	**118**	39300	**1780**	1030	2082	2	3	3	3	3	3	3
AU 20	750	444	12.0	10.0	165	96.9	**129**	44440	**2000**	1155	2339	2	2	2	3	3	3	3
AU 23	750	447	13.0	9.5	173	102.1	**136**	50700	**2270**	1285	2600	2	2	2	3	3	3	3
AU 25	750	450	14.5	10.2	188	110.4	**147**	56240	**2500**	1420	2866	2	2	2	2	2	3	3
PU® sections																		
PU 12	600	360	9.8	9.0	140	66.1	**110**	21600	**1200**	715	1457	-	-	-	2	2	2	3
PU 12S	600	360	10.0	10.0	151	71.0	**118**	22660	**1260**	755	1543	-	-	-	2	2	2	2
PU 18^{-1}	600	430	10.2	8.4	154	72.6	**121**	35950	**1670**	980	1988	2	2	2	2	2	3	3
PU 18	600	430	11.2	9.0	163	76.9	**128**	38650	**1800**	1055	2134	2	2	2	2	2	2	2
PU 18^{+1}	600	430	12.2	9.5	172	81.1	**135**	41320	**1920**	1125	2280	2	2	2	2	2	2	2
PU 22^{-1}	600	450	11.1	9.0	174	81.9	**137**	46380	**2060**	1195	2422	2	2	2	2	2	3	3
PU 22	600	450	12.1	9.5	183	86.1	**144**	49460	**2200**	1275	2580	2	2	2	2	2	2	2
PU 22^{+1}	600	450	13.1	10.0	192	90.4	**151**	52510	**2335**	1355	2735	2	2	2	2	2	2	2
PU 28^{-1}	600	452	14.2	9.7	207	97.4	**162**	60580	**2680**	1525	3087	2	2	2	2	2	2	2
PU 28	600	454	15.2	10.1	216	101.8	**170**	64460	**2840**	1620	3269	2	2	2	2	2	2	2
PU 28^{+1}	600	456	16.2	10.5	226	106.2	**177**	68380	**3000**	1710	3450	2	2	2	2	2	2	2
PU 32^{-1}	600	452	18.5	10.6	233	109.9	**183**	69210	**3065**	1745	3525	2	2	2	2	2	2	2
PU 32	600	452	19.5	11.0	242	114.1	**190**	72320	**3200**	1825	3687	2	2	2	2	2	2	2
PU 32^{+1}	600	452	20.5	11.4	251	118.4	**197**	75410	**3340**	1905	3845	2	2	2	2	2	2	2
GU® sections																		
GU 6N	600	309	6.0	6.0	89	41.9	**70**	9670	**625**	375	765	3	3	3	4	4	4	4
GU 7N	600	310	6.5	6.4	94	44.1	**74**	10450	**675**	400	825	3	3	3	3	3	4	4
GU 7S	600	311	7.2	6.9	98	46.3	**77**	11540	**740**	440	900	2	2	3	3	3	3	3
GU 7HWS	600	312	7.3	6.9	101	47.4	**79**	11620	**745**	445	910	2	2	3	3	3	3	3
GU 8N	600	312	7.5	7.1	103	48.5	**81**	12010	**770**	460	935	2	2	3	3	3	3	3
GU 8S	600	313	8.0	7.5	108	50.8	**85**	12800	**820**	490	995	2	2	2	3	3	3	3

Section	Width	Height	Thickness		Sectional area	Mass		Moment of inertia	Elastic section modulus	Static moment	Plastic section modulus	Class[1)]						
	b mm	h mm	t mm	s mm	cm²/m	single pile kg/m	wall kg/m²	cm⁴/m	cm³/m	cm³/m	cm³/m	S 240 GP	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 AP
GU® sections																		
GU 10N	600	316	9.0	6.8	118	55.8	**93**	15700	**995**	565	1160	2	2	3	3	3	3	3
GU 11N	600	318	10.0	7.4	128	60.2	**100**	17450	**1095**	630	1280	2	2	2	2	3	3	3
GU 12N	600	320	11.0	8.0	137	64.6	**108**	19220	**1200**	690	1400	2	2	2	2	2	2	3
GU 13N	600	418	9.0	7.4	127	59.9	**100**	26590	**1270**	755	1535	2	2	2	2	2	3	3
GU 14N	600	420	10.0	8.0	136	64.3	**107**	29410	**1400**	830	1685	2	2	2	2	2	2	2
GU 15N	600	422	11.0	8.6	146	68.7	**115**	32260	**1530**	910	1840	2	2	2	2	2	2	2
GU 16N	600	430	10.2	8.4	154	72.6	**121**	35950	**1670**	980	1988	2	2	2	2	2	3	3
GU 18N	600	430	11.2	9.0	163	76.9	**128**	38650	**1800**	1055	2134	2	2	2	2	2	2	2
GU 20N	600	430	12.2	9.5	172	81.1	**135**	41320	**1920**	1125	2280	2	2	2	2	2	2	2
GU 21N	600	450	11.1	9.0	174	81.9	**137**	46380	**2060**	1195	2422	2	2	2	2	2	3	3
GU 22N	600	450	12.1	9.5	183	86.1	**144**	49460	**2200**	1275	2580	2	2	2	2	2	2	2
GU 23N	600	450	13.1	10.0	192	90.4	**151**	52510	**2335**	1355	2735	2	2	2	2	2	2	2
GU 27N	600	452	14.2	9.7	207	97.4	**162**	60580	**2680**	1525	3087	2	2	2	2	2	2	2
GU 28N	600	454	15.2	10.1	216	101.8	**170**	64460	**2840**	1620	3269	2	2	2	2	2	2	2
GU 30N	600	456	16.2	10.5	226	106.2	**177**	68380	**3000**	1710	3450	2	2	2	2	2	2	2
GU 31N	600	452	18.5	10.6	233	109.9	**183**	69210	**3065**	1745	3525	2	2	2	2	2	2	2
GU 32N	600	452	19.5	11.0	242	114.1	**190**	72320	**3200**	1825	3687	2	2	2	2	2	2	2
GU 33N	600	452	20.5	11.4	251	118.4	**197**	75410	**3340**	1905	3845	2	2	2	2	2	2	2
GU 16-400	400	290	12.7	9.4	197	62.0	**155**	22580	**1560**	885	1815	2	2	2	2	2	2	–
GU 18-400	400	292	15.0	9.7	221	69.3	**173**	26090	**1785**	1015	2080	2	2	2	2	2	2	–

The moment of inertia and section moduli values given assume correct shear transfer across the interlock.

1) Classification according to EN 1993-5. Class 1 is obtained by verification of the rotation capacity for a class 2 cross-section.
A set of tables with all the data required for design in accordance with EN 1993-5 is available from our Technical Department.
All PU® sections can be rolled-up or -down by 0.5 mm and 1.0 mm. Other sections on request.

Characteristics – AU™ sections

A weight reduction of about 10% compared to the 600 mm PU series has been achieved by optimising the geometric dimensions. The increased width **allows faster installation,** reduces the amount of coating required, due to the smaller perimeter, and increases watertightness thanks to fewer interlocks per metre of wall. Despite their greater width, the driving energy required for AU piles is not higher, thanks to their smooth and open shape and the patented radii at the web/flange connection.

Characteristics – PU® sections

PU sections are 600 mm wide U-piles manufactured in Belval. The shape of the **PU 18, PU 22** and **PU 28** has been engineered with "reinforced shoulders’ yielding the optimum section geometry **for hard driving conditions** as well as for **multiple re-use**. Re-using steel sheet piles improves drastically the environmental impact of a steel solution.

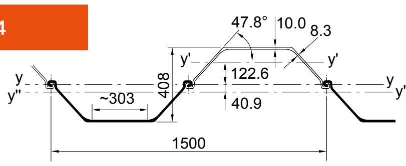
Characteristics – GU® sections

ArcelorMittal’s rolling mill in Dabrowa, Poland, produces hot rolled U-shaped steel sheet piles. The rolling mill has extended their portfolio during the last years with following sections: GU 7N, GU 14N, GU 18N, GU 28N, GU 32N and, in 2017, the GU 11N range.

Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1]
		cm²	kg/m	cm⁴	cm³	cm	m²/m

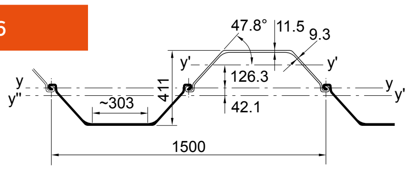
AU™ sections

AU 14



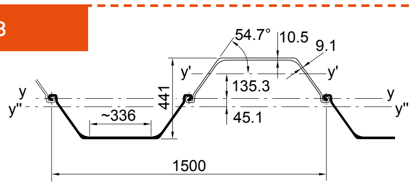
AU 14	Per S	99.2	**77.9**	6590	**457**	8.15	0.96
	Per D	198.5	**155.8**	43020	**2110**	14.73	1.91
	Per T	297.7	**233.7**	59550	**2435**	14.15	2.86
	Per m of wall	132.3	**103.8**	28680	**1405**	14.73	1.27

AU 16



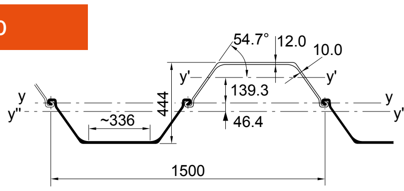
AU 16	Per S	109.9	**86.3**	7110	**481**	8.04	0.96
	Per D	219.7	**172.5**	49280	**2400**	14.98	1.91
	Per T	329.6	**258.7**	68080	**2750**	14.37	2.86
	Per m of wall	146.5	**115.0**	32850	**1600**	14.98	1.27

AU 18



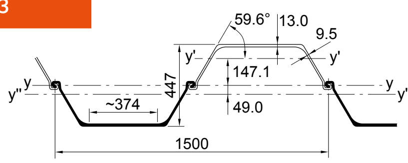
AU 18	Per S	112.7	**88.5**	8760	**554**	8.82	1.01
	Per D	225.5	**177.0**	58950	**2670**	16.17	2.00
	Per T	338.2	**265.5**	81520	**3065**	15.53	2.99
	Per m of wall	150.3	**118.0**	39300	**1780**	16.17	1.33

AU 20



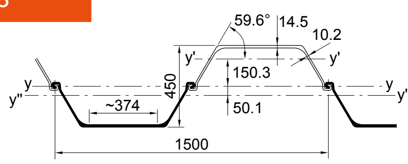
AU 20	Per S	123.4	**96.9**	9380	**579**	8.72	1.01
	Per D	246.9	**193.8**	66660	**3000**	16.43	2.00
	Per T	370.3	**290.7**	92010	**3425**	15.76	2.99
	Per m of wall	164.6	**129.2**	44440	**2000**	16.43	1.33

AU 23



AU 23	Per S	130.1	**102.1**	9830	**579**	8.69	1.03
	Per D	260.1	**204.2**	76050	**3405**	17.10	2.04
	Per T	390.2	**306.3**	104680	**3840**	16.38	3.05
	Per m of wall	173.4	**136.1**	50700	**2270**	17.10	1.36

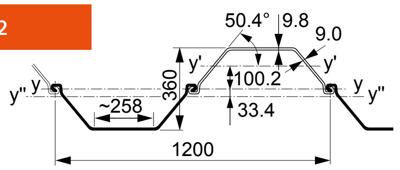
AU 25



AU 25	Per S	140.6	**110.4**	10390	**601**	8.60	1.03
	Per D	281.3	**220.8**	84370	**3750**	17.32	2.04
	Per T	422.0	**331.3**	115950	**4215**	16.58	3.05
	Per m of wall	187.5	**147.2**	56240	**2500**	17.32	1.36

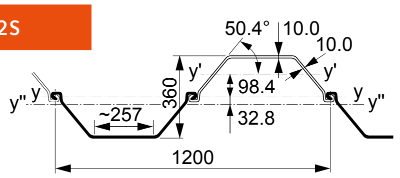
PU® sections

PU 12



PU 12	Per S	84.2	**66.1**	4500	**370**	7.31	0.80
	Per D	168.4	**132.2**	25920	**1440**	12.41	1.59
	Per T	252.6	**198.3**	36060	**1690**	11.95	2.38
	Per m of wall	140.0	**110.1**	21600	**1200**	12.41	1.32

PU 12S



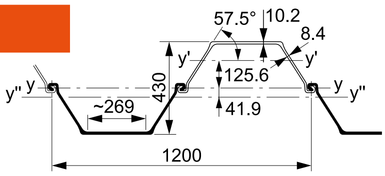
PU 12S	Per S	90.5	**71.0**	4830	**400**	7.30	0.80
	Per D	181.0	**142.1**	27190	**1510**	12.26	1.59
	Per T	271.5	**213.1**	37860	**1780**	11.81	2.38
	Per m of wall	150.8	**118.4**	22660	**1260**	12.26	1.32

[1] One side, excluding inside of interlocks.

PU® sections

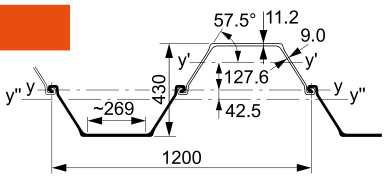
Section | S = Single pile, D = Double pile, T = Triple pile | Sectional area (cm²) | Mass (kg/m) | Moment of inertia (cm⁴) | Elastic section modulus (cm³) | Radius of gyration (cm) | Coating area[1)] (m²/m)

PU 18^{-1}



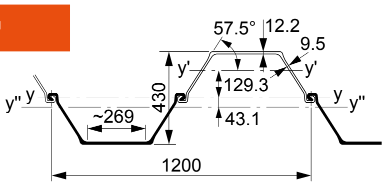
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
PU 18^{-1}	Per S	92.5	**72.6**	6960	**475**	8.67	0.87
	Per D	185.0	**145.2**	43140	**2005**	15.30	1.72
	Per T	277.5	**217.8**	59840	**2330**	14.69	2.58
	Per m of wall	154.2	**121.0**	35950	**1670**	15.30	1.43

PU 18



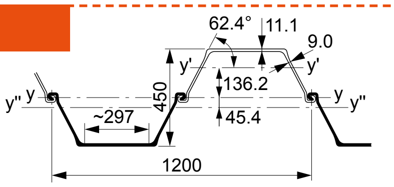
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
PU 18	Per S	98.0	**76.9**	7220	**485**	8.58	0.87
	Per D	196.0	**153.8**	46380	**2160**	15.38	1.72
	Per T	294.0	**230.7**	64240	**2495**	14.78	2.58
	Per m of wall	163.3	**128.2**	38650	**1800**	15.38	1.43

PU 18^{+1}



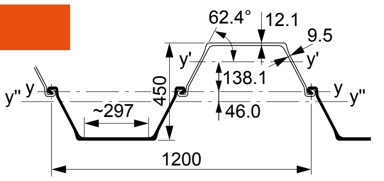
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
PU 18^{+1}	Per S	103.4	**81.1**	7480	**495**	8.51	0.87
	Per D	206.8	**162.3**	49580	**2305**	15.49	1.72
	Per T	310.2	**243.5**	68600	**2655**	14.87	2.58
	Per m of wall	172.3	**135.2**	41320	**1920**	15.49	1.43

PU 22^{-1}



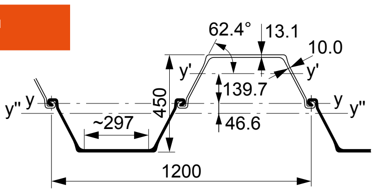
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
PU 22^{-1}	Per S	104.3	**81.9**	8460	**535**	9.01	0.90
	Per D	208.7	**163.8**	55650	**2475**	16.33	1.79
	Per T	313.0	**245.7**	77020	**2850**	15.69	2.68
	Per m of wall	173.9	**136.5**	46380	**2060**	16.33	1.49

PU 22



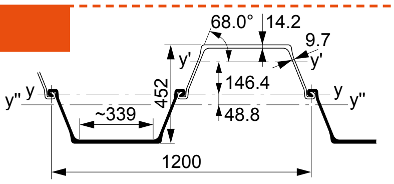
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
PU 22	Per S	109.7	**86.1**	8740	**546**	8.93	0.90
	Per D	219.5	**172.3**	59360	**2640**	16.45	1.79
	Per T	329.2	**258.4**	82060	**3025**	15.79	2.68
	Per m of wall	182.9	**143.6**	49460	**2200**	16.45	1.49

PU 22^{+1}



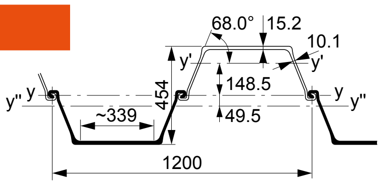
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
PU 22^{+1}	Per S	115.2	**90.4**	9020	**555**	8.85	0.90
	Per D	230.4	**180.9**	63010	**2800**	16.54	1.79
	Per T	345.6	**271.3**	87020	**3205**	15.87	2.68
	Per m of wall	192.0	**150.7**	52510	**2335**	16.54	1.49

PU 28^{-1}



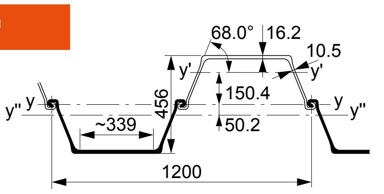
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
PU 28^{-1}	Per S	124.1	**97.4**	9740	**576**	8.86	0.93
	Per D	248.2	**194.8**	72700	**3215**	17.12	1.85
	Per T	372.3	**292.2**	100170	**3645**	16.40	2.77
	Per m of wall	206.8	**162.3**	60580	**2680**	17.12	1.54

PU 28



Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
PU 28	Per S	129.7	**101.8**	10070	**589**	8.81	0.93
	Per D	259.4	**203.6**	77350	**3405**	17.27	1.85
	Per T	389.0	**305.4**	106490	**3850**	16.55	2.77
	Per m of wall	216.1	**169.6**	64460	**2840**	17.27	1.54

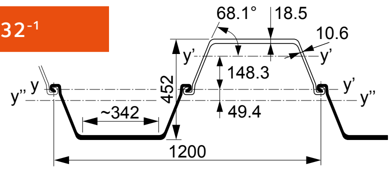
PU 28^{+1}

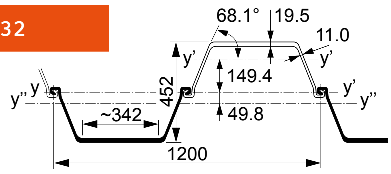


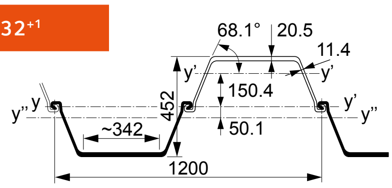
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
PU 28^{+1}	Per S	135.3	**106.2**	10400	**600**	8.77	0.93
	Per D	270.7	**212.5**	82060	**3600**	17.41	1.85
	Per T	406.0	**318.7**	112870	**4060**	16.67	2.77
	Per m of wall	225.6	**177.1**	68380	**3000**	17.41	1.54

[1)] One side, excluding inside of interlocks.

PU® sections







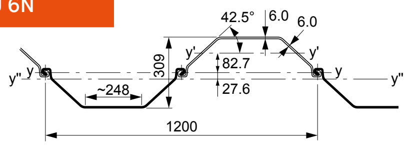
Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
		cm^2	kg/m	cm^4	cm^3	cm	m^2/m
PU 32^{-1}	Per S	140.0	**109.9**	10740	**625**	8.76	0.92
	Per D	280.0	**219.8**	83050	**3675**	17.22	1.83
	Per T	420.0	**329.7**	114310	**4150**	16.50	2.74
	Per m of wall	233.3	**183.2**	69210	**3065**	17.22	1.52
PU 32	Per S	145.4	**114.1**	10950	**633**	8.68	0.92
	Per D	290.8	**228.3**	86790	**3840**	17.28	1.83
	Per T	436.2	**342.4**	119370	**4330**	16.54	2.74
	Per m of wall	242.3	**190.2**	72320	**3200**	17.28	1.52
PU 32^{+1}	Per S	150.8	**118.4**	11150	**640**	8.60	0.92
	Per D	301.6	**236.8**	90490	**4005**	17.32	1.83
	Per T	452.4	**355.2**	124370	**4505**	16.58	2.74
	Per m of wall	251.3	**197.3**	75410	**3340**	17.32	1.52

1) One side, excluding inside of interlocks.

Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1]
		cm²	kg/m	cm⁴	cm³	cm	m²/m

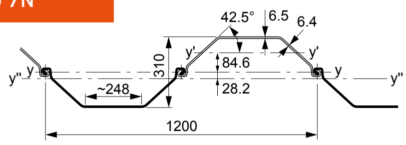
GU® sections

GU 6N



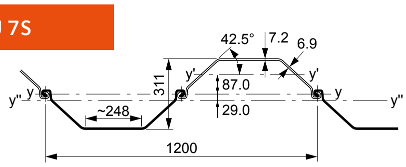
GU 6N	Per S	53.4	**41.9**	2160	**215**	6.36	0.76
	Per D	106.8	**83.8**	11610	**750**	10.43	1.51
	Per T	160.2	**125.7**	16200	**890**	10.06	2.26
	Per m of wall	89.0	**69.9**	9670	**625**	10.43	1.26

GU 7N



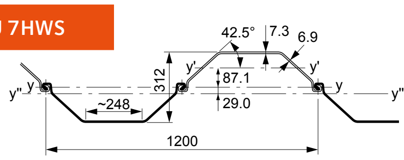
GU 7N	Per S	56.2	**44.1**	2250	**220**	6.33	0.76
	Per D	112.4	**88.2**	12540	**810**	10.56	1.51
	Per T	168.6	**132.4**	17470	**955**	10.18	2.26
	Per m of wall	93.7	**73.5**	10450	**675**	10.56	1.26

GU 7S



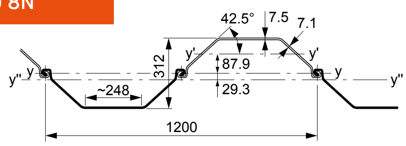
GU 7S	Per S	58.9	**46.3**	2370	**225**	6.35	0.76
	Per D	117.9	**92.5**	13850	**890**	10.84	1.51
	Per T	176.8	**138.8**	19260	**1045**	10.44	2.26
	Per m of wall	98.2	**77.1**	11540	**740**	10.84	1.26

GU 7HWS



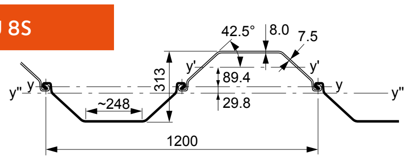
GU 7HWS	Per S	60.4	**47.4**	2380	**225**	6.28	0.76
	Per D	120.9	**94.9**	13940	**895**	10.74	1.51
	Per T	181.3	**142.3**	19390	**1050**	10.34	2.26
	Per m of wall	100.7	**79.1**	11620	**745**	10.74	1.26

GU 8N



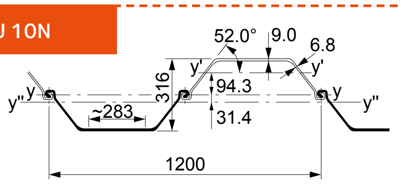
GU 8N	Per S	61.8	**48.5**	2420	**225**	6.26	0.76
	Per D	123.7	**97.1**	14420	**925**	10.80	1.51
	Per T	185.5	**145.6**	20030	**1080**	10.39	2.26
	Per m of wall	103.1	**80.9**	12010	**770**	10.80	1.26

GU 8S



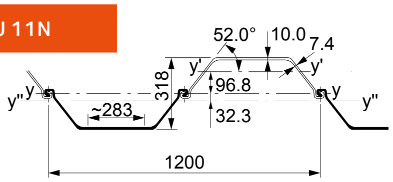
GU 8S	Per S	64.7	**50.8**	2510	**230**	6.23	0.76
	Per D	129.3	**101.5**	15360	**980**	10.90	1.51
	Per T	194.0	**152.3**	21320	**1145**	10.48	2.26
	Per m of wall	107.8	**84.6**	12800	**820**	10.90	1.26

GU 10N



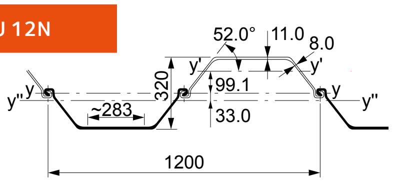
GU 10N	Per S	71.1	**55.8**	3100	**270**	6.60	0.78
	Per D	142.2	**111.6**	18840	**1190**	11.51	1.55
	Per T	213.3	**167.4**	26150	**1380**	11.07	2.32
	Per m of wall	118.5	**93.0**	15700	**995**	11.51	1.29

GU 11N



GU 11N	Per S	76.7	**60.2**	3280	**280**	6.53	0.78
	Per D	153.4	**120.4**	20930	**1315**	11.68	1.55
	Per T	230.1	**180.7**	29010	**1515**	11.23	2.32
	Per m of wall	127.9	**100.4**	17450	**1095**	11.68	1.29

GU 12N

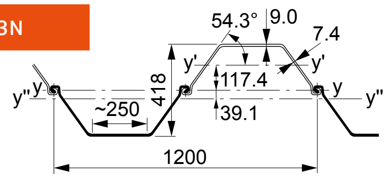


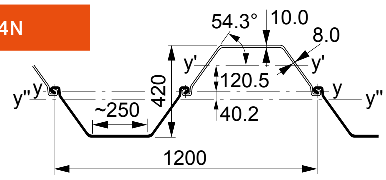
GU 12N	Per S	82.3	**64.6**	3450	**290**	6.47	0.78
	Per D	164.7	**129.3**	23060	**1440**	11.83	1.55
	Per T	247.0	**193.9**	31890	**1650**	11.36	2.32
	Per m of wall	137.2	**107.7**	19220	**1200**	11.83	1.29

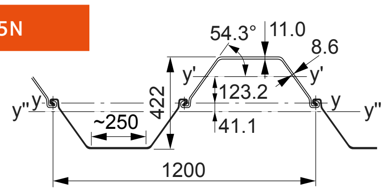
[1] One side, excluding inside of interlocks.

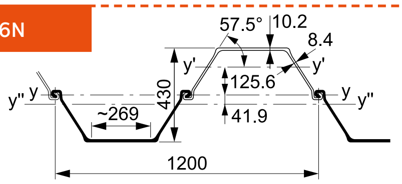
GU® sections

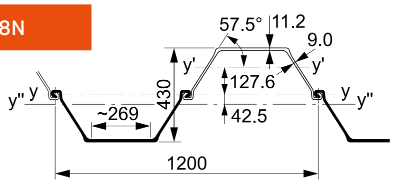
Section	S = Single pile D = Double pile T = Triple pile	Sectional area cm²	Mass kg/m	Moment of inertia cm⁴	Elastic section modulus cm³	Radius of gyration cm	Coating area[1)] m²/m
GU 13N	Per S	76.3	**59.9**	5440	**395**	8.44	0.85
	Per D	152.6	**119.8**	31900	**1525**	14.46	1.69
	Per T	228.9	**179.7**	44350	**1785**	13.92	2.53
	Per m of wall	127.2	**99.8**	26590	**1270**	14.46	1.41
GU 14N	Per S	81.9	**64.3**	5750	**410**	8.38	0.85
	Per D	163.8	**128.6**	35290	**1680**	14.68	1.69
	Per T	245.6	**192.8**	48970	**1955**	14.12	2.53
	Per m of wall	136.5	**107.1**	29410	**1400**	14.68	1.41
GU 15N	Per S	87.5	**68.7**	6070	**425**	8.33	0.85
	Per D	175.1	**137.4**	38710	**1835**	14.87	1.69
	Per T	262.6	**206.2**	53640	**2130**	14.29	2.53
	Per m of wall	145.9	**114.5**	32260	**1530**	14.87	1.41
GU 16N	Per S	92.5	**72.6**	6960	**475**	8.67	0.87
	Per D	185.0	**145.2**	43140	**2005**	15.30	1.72
	Per T	277.5	**217.8**	59840	**2330**	14.69	2.58
	Per m of wall	154.2	**121.0**	35950	**1670**	15.30	1.43
GU 18N	Per S	98.0	**76.9**	7220	**485**	8.58	0.87
	Per D	196.0	**153.8**	46380	**2160**	15.38	1.72
	Per T	294.0	**230.7**	64240	**2495**	14.78	2.58
	Per m of wall	163.3	**128.2**	38650	**1800**	15.38	1.43
GU 20N	Per S	103.4	**81.1**	7480	**495**	8.51	0.87
	Per D	206.8	**162.3**	49580	**2305**	15.49	1.72
	Per T	310.2	**243.5**	68600	**2655**	14.87	2.58
	Per m of wall	172.3	**135.2**	41320	**1920**	15.49	1.43
GU 21N	Per S	104.3	**81.9**	8460	**535**	9.01	0.90
	Per D	208.7	**163.8**	55650	**2475**	16.33	1.79
	Per T	313.0	**245.7**	77020	**2850**	15.69	2.68
	Per m of wall	173.9	**136.5**	46380	**2060**	16.33	1.49
GU 22N	Per S	109.7	**86.1**	8740	**546**	8.93	0.90
	Per D	219.5	**172.3**	59360	**2640**	16.45	1.79
	Per T	329.2	**258.4**	82060	**3025**	15.79	2.68
	Per m of wall	182.9	**143.6**	49460	**2200**	16.45	1.49
GU 23N	Per S	115.2	**90.4**	9020	**555**	8.85	0.90
	Per D	230.4	**180.9**	63010	**2800**	16.54	1.79
	Per T	345.6	**271.3**	87020	**3205**	15.87	2.68
	Per m of wall	192.0	**150.7**	52510	**2335**	16.54	1.49

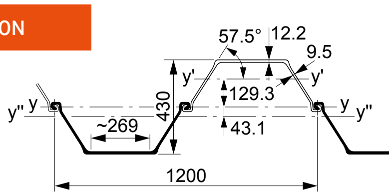


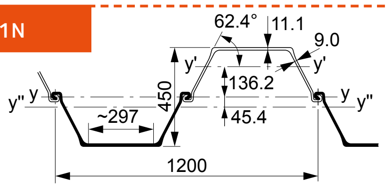


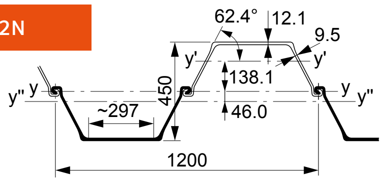


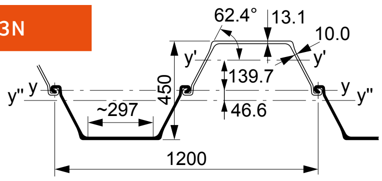










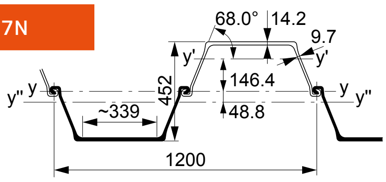


[1)] One side, excluding inside of interlocks.

Section | S = Single pile, D = Double pile, T = Triple pile | Sectional area | Mass | Moment of inertia | Elastic section modulus | Radius of gyration | Coating area[1)]

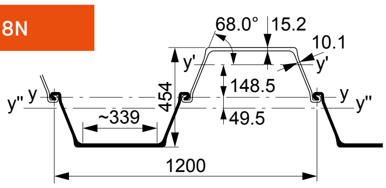
GU® sections

GU 27N



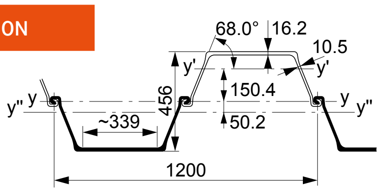
Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
		cm²	kg/m	cm⁴	cm³	cm	m²/m
GU 27N	Per S	124.1	**97.4**	9740	**576**	8.86	0.93
	Per D	248.2	**194.8**	72700	**3215**	17.12	1.85
	Per T	372.3	**292.2**	100170	**3645**	16.40	2.77
	Per m of wall	206.8	**162.3**	60580	**2680**	17.12	1.54

GU 28N



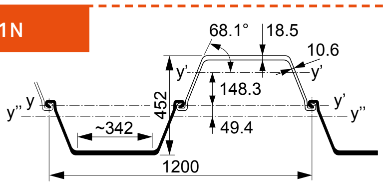
Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
GU 28N	Per S	129.7	**101.8**	10070	**589**	8.81	0.93
	Per D	259.4	**203.6**	77350	**3405**	17.27	1.85
	Per T	389.0	**305.4**	106490	**3850**	16.55	2.77
	Per m of wall	216.1	**169.6**	64460	**2840**	17.27	1.54

GU 30N



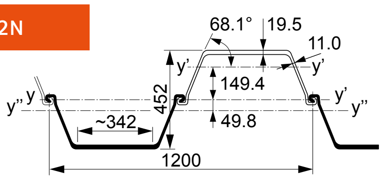
Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
GU 30N	Per S	135.3	**106.2**	10400	**600**	8.77	0.93
	Per D	270.7	**212.5**	82060	**3600**	17.41	1.85
	Per T	406.0	**318.7**	112870	**4060**	16.67	2.77
	Per m of wall	225.6	**177.1**	68380	**3000**	17.41	1.54

GU 31N



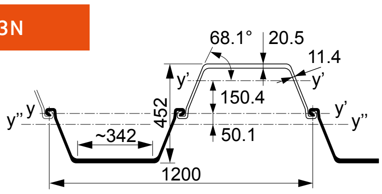
Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
GU 31N	Per S	140.0	**109.9**	10740	**625**	8.76	0.92
	Per D	280.0	**219.8**	83050	**3675**	17.22	1.83
	Per T	420.0	**329.7**	114310	**4150**	16.50	2.74
	Per m of wall	233.3	**183.2**	69210	**3065**	17.22	1.52

GU 32N



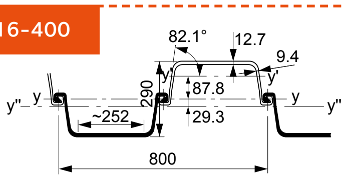
Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
GU 32N	Per S	145.4	**114.1**	10950	**633**	8.68	0.92
	Per D	290.8	**228.3**	86790	**3840**	17.28	1.83
	Per T	436.2	**342.4**	119370	**4330**	16.54	2.74
	Per m of wall	242.3	**190.2**	72320	**3200**	17.28	1.52

GU 33N



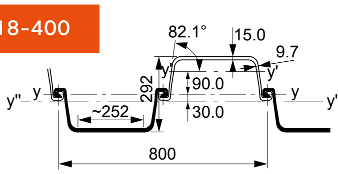
Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
GU 33N	Per S	150.8	**118.4**	11150	**640**	8.60	0.92
	Per D	301.6	**236.8**	90490	**4005**	17.32	1.83
	Per T	452.4	**355.2**	124370	**4505**	16.58	2.74
	Per m of wall	251.3	**197.3**	75410	**3340**	17.32	1.52

GU 16-400



Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
GU 16-400	Per S	78.9	**62.0**	2950	**265**	6.11	0.65
	Per D	157.9	**123.9**	18060	**1245**	10.70	1.28
	Per T	236.8	**185.9**	25060	**1440**	10.29	1.92
	Per m of wall	197.3	**154.9**	22580	**1560**	10.70	1.60

GU 18-400

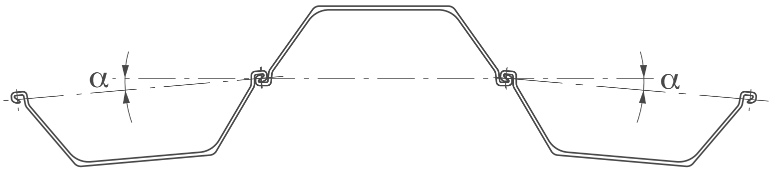


Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
GU 18-400	Per S	88.3	**69.3**	3290	**290**	6.10	0.65
	Per D	176.7	**138.7**	20870	**1430**	10.87	1.28
	Per T	265.0	**208.0**	28920	**1645**	10.45	1.92
	Per m of wall	220.8	**173.3**	26090	**1785**	10.87	1.60

[1)] One side, excluding inside of interlocks.

Interlock

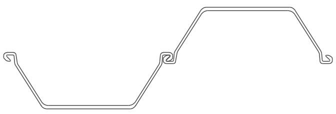
All AU™, PU® and GU® sheet piles feature Larssen interlocks in accordance with EN 10248. AU, PU and GU-N (exception: GU-400 range) sheet piles can be interlocked with each other.
Theoretical interlock swing: $\alpha_{max} = 5°$



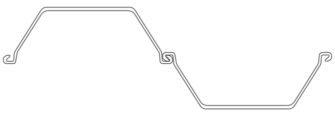
Delivery form

Single Pile

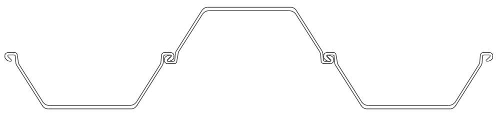
Double Pile
S-Form (standard)



Double Pile
Z-Form (on request)

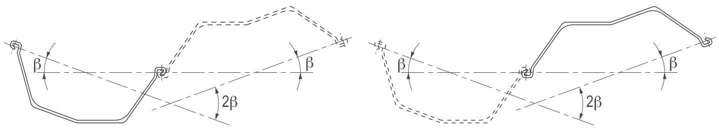


Triple Pile



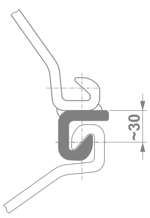
Bent piles

Maximum bending angle: $\beta = 25°$. U-piles are bent in the middle of the flange. They are generally delivered as single piles. Double piles are available upon request.

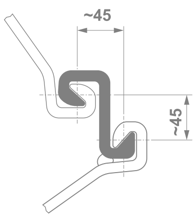


Corner sections

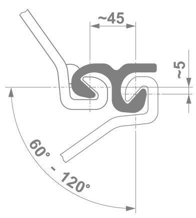
C 9
Mass ~ 9.3 kg/m



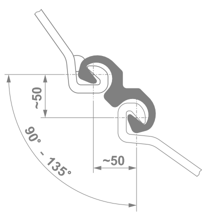
C 14
Mass ~ 14.4 kg/m



DELTA 13
Mass ~ 13.1 kg/m



OMEGA 18
Mass ~ 18.0 kg/m



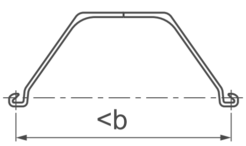
Special corner sections interlocking with U-sections make it possible to form corner or junction piles without using fabricated special piles. Corner sections are fixed to the sheet pile in accordance with EN 12063.

Different welding specifications are available on request. The corner sections are threaded and welded with a 200 mm setback from the top of the piles.

Fabricated piles, corner and junction piles

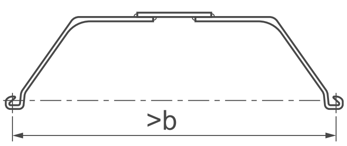
On request, arrangements can be made for widened or narrowed fabricated piles. The following special piles, among others, are available on request as single and double piles.

Narrowed pile



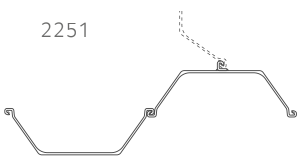
2501

Widened pile

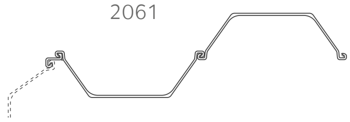


2511

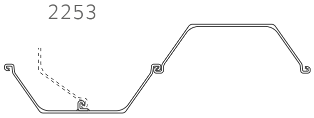
2251



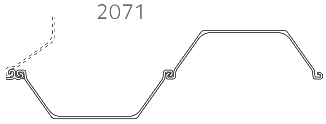
2061



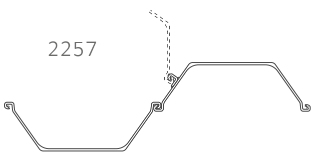
2253



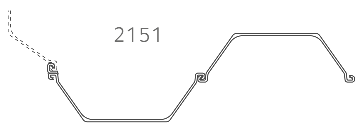
2071



2257



2151

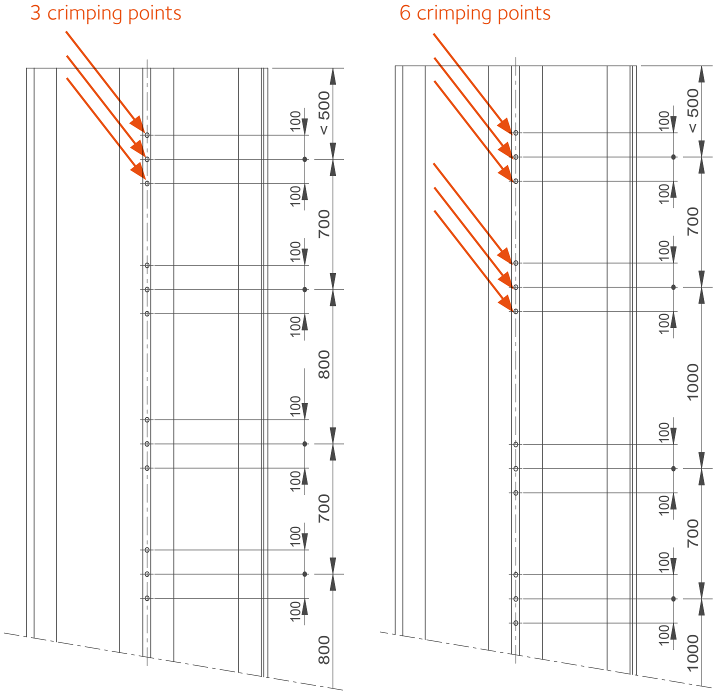


Crimping

Contrary to Z-piles, the interlocks of U-piles have to transmit shear forces. To guarantee proper shear force transmission, ArcelorMittal's U-sections can be delivered as double piles with crimped interlocks.
See sketch for ArcelorMittal's standard crimping pattern.
The allowable shear force per crimping point depends on the section and steel grade. **A resistance per crimp of minimum 75 kN at a displacement of up to 5 mm can be achieved**. The theoretical section properties of a continuous wall may have to be reduced even for double piles crimped[2].

AU standard crimping:
3 crimping points per 0.75 m
= 4 crimping points per m[1]

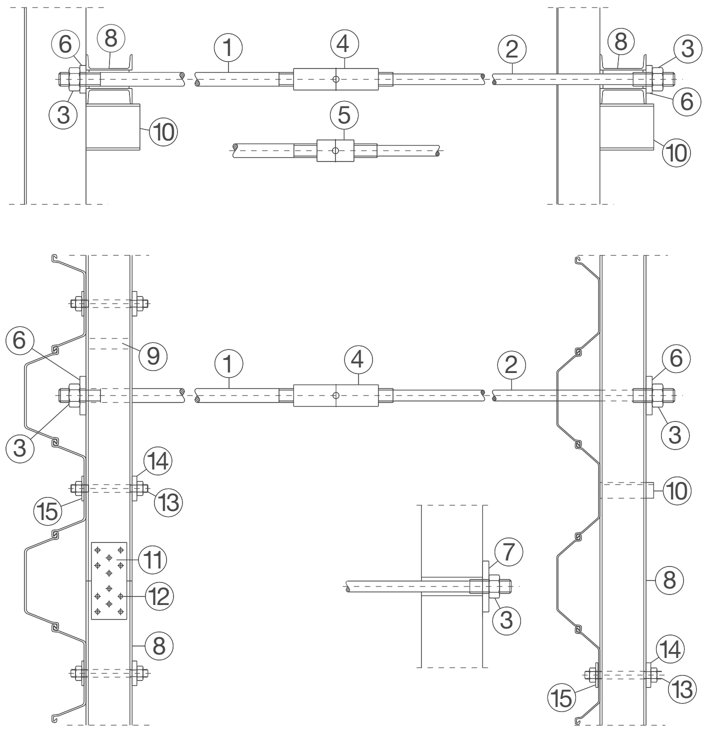
PU/GU standard crimping:
6 crimping points per 1.7 m
= 3.5 crimping points per m[1]



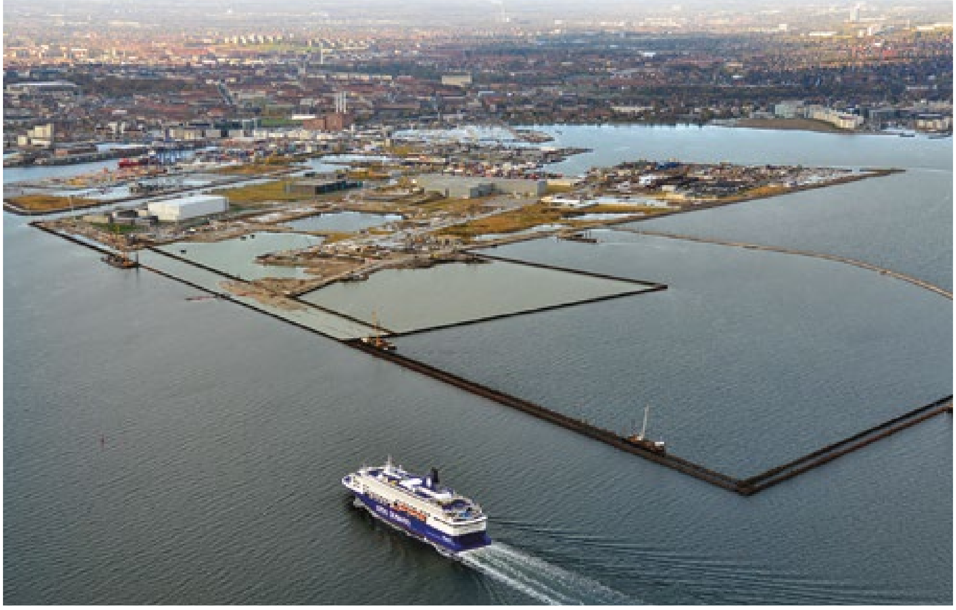
[1] Amount and layout of crimping points may differ at both ends.
Special crimping on request.
[2] Based on EN1993-5. Please consult our Technical Department for more information.

Tie back system

Most sheet pile retaining walls need supplementary support at the top, in addition to embedment in the soil. Temporary cofferdams generally use walers and struts (fixed or hydraulic) for cross-bracing inside the excavation. Permanent or large retaining walls are often tied back to an anchor wall installed at a certain distance behind the main wall. Injection anchors and anchor piles can also be used.
The drawing shows a typical horizontal tie-rod connection for U-section sheet pile walls.



1 Plain tie-rod
2 Upset end tie-rod
3 Nut
4 Turnbuckle
5 Coupling sleeve
6 Bearing plate
7 Bearing plate on concrete
8 Waling
9 Spacer
10 Supporting bracket
11 Splicing plate
12 Splicing bolt
13 Fixing bolt
14 Fixing plate
15 Fixing plate

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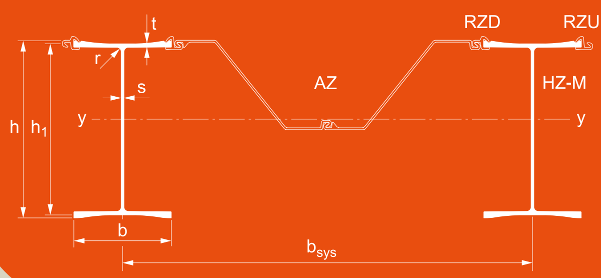
HZ® / AZ® combined wall system

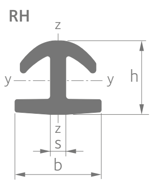


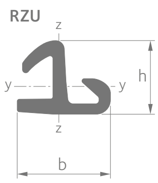
The HZ®-M combined wall is a revolutionary system, an extremely cost effective combined wall solution launched in 2008 to replace the former HZ/AZ system, and consists of:
- HZ®-M king piles;
- a pair of AZ® sheet piles as intermediary elements;
- special connectors (RH, RZD, RZU).

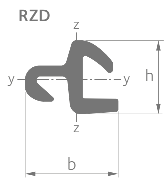
The HZ-M king piles, with milled grooves on the flanges and thicknesses up to 40 mm, fulfill two different structural functions:
- retaining members for soil and hydrostatic pressures;
- bearing piles for vertical loads.

The combinations are based on the same principle: structural supports comprising 1 or 2 HZ-M king pile sections alternating with or without intermediary double AZ sheet pile sections. The intermediary sheet piles have a soil-retaining and load-transferring function and are generally shorter than the HZ-M king piles. Depending on the combinations and steel grades adopted, the achievable bending moment capacity lies above 21 000 kNm/m (**W_x up to 46 500 cm³/m**).

Section (Sol. 102)	Dimensions							Torsional constant	Warping constant	Sectional area	Mass	Moment of inertia	Elastic section modulus	Coating area	Connector set
	h	h_1	b	t_{max}	t	s	r					y-y	y-y		
	mm	mm	mm	mm	mm	mm	mm	cm⁴	10³cm⁶	cm²	kg/m	cm⁴	cm³	m²/m	
HZ 680M LT	631.8	599.9	460	29.0	16.9	14.0	20	289.3	31110	257.8	**202.4**	177370	**5840**	3.052	A
HZ 880M A	831.3	803.4	458	29.0	18.9	13.0	20	347.2	58780	292.4	**229.5**	351350	**8650**	3.443	A
HZ 880M B	831.3	807.4	460	29.0	20.9	15.0	20	455.9	63190	324.7	**254.9**	386810	**9480**	3.448	A
HZ 880M C	831.3	811.4	460	29.0	22.9	15.0	20	531.9	66090	339.2	**266.3**	410830	**10025**	3.448	A
HZ 1080M A	1075.3	1047.4	454	29.0	19.6	16.0	30	525.9	98560	368.7	**289.4**	690560	**13075**	3.877	A
HZ 1080M B	1075.3	1053.4	454	29.0	22.6	16.0	30	656.5	106800	391.7	**307.5**	754830	**14205**	3.878	A
HZ 1080M C	1075.3	1059.4	456	29.0	25.7	18.0	30	876.2	114500	433.7	**340.5**	833250	**15605**	3.881	A
HZ 1080M D	1075.3	1067.4	457	30.7	29.7	19.0	30	1129.1	121000	467.7	**367.2**	909650	**16920**	3.882	A
HZ 1180M A	1075.4	-	458	34.7	31.0	20.0	30	1352.9	124600	494.9	**388.5**	967270	**17865**	3.884	A
HZ 1180M B	1079.4	-	458	36.7	33.0	20.0	30	1544.3	132400	512.1	**402.0**	1017000	**18675**	3.895	A
HZ 1180M C	1083.4	-	459	38.7	35.0	21.0	30	1817.9	142600	541.2	**424.9**	1081070	**19790**	3.905	B
HZ 1180M D	1087.4	-	460	40.7	37.0	22.0	30	2110.2	150000	568.1	**445.9**	1138630	**20690**	3.919	B
Connectors															
RH 16	61.8		68.2			12.2				20.1	**15.8**	83	**25**		A
RZD 16	61.8		80.5							20.7	**16.2**	57	**18**		
RZU 16	61.8		80.5							20.4	**16.0**	68	**18**		
RH 20	67.3		79.2			14.2				25.2	**19.8**	122	**33**		B
RZD 18	67.3		85.0							23.0	**18.0**	78	**22**		
RZU 18	67.3		85.0							22.6	**17.8**	92	**22**		







The outstanding feature of the HZ/AZ combined wall system is the extensive range of possible combinations using the entire AZ sheet pile offer, including the latest wide AZ-800 range, as well as all rolled-up and rolled-down AZ sections. The table below contains but a small sample of the available systems. **Please refer to our brochure "The HZ®-M Steel Wall System" for detailed information on the entire HZ®/AZ® range.**

Denomination of the HZ/AZ system:

2 connectors
1 RZD + 1RZU

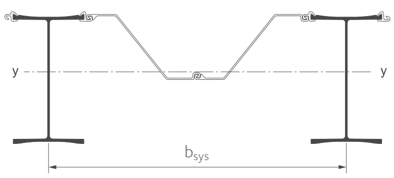
HZ 880M A – **1 2** / **AZ 25-800**

- HZ 880M A → King pile
- 1 → 1 king pile HZ 880M A
- 2 → 2 connectors: 1 RZD + 1RZU
- AZ 25-800 → Intermediary AZ 25-800 double pile


Taipei Port, Taiwan


CT, JadeWeserPort, Germany

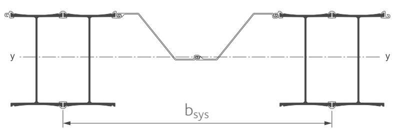
Combination HZ ... M – 12 / AZ 25-800



b_{sys} = 2.127 m

Section	Sectional area cm²/m	Moment of inertia cm⁴/m	Elastic[1)] section modulus cm³/m	Elastic[2)] section modulus cm³/m	Mass[3)] Mass100 kg/m²	Mass[3)] Mass60 kg/m²	Coating area[4)] Water side m²/m
HZ 680M LT	263.0	143460	**4245**	4810	**206**	162	2.73
HZ 880M A	279.5	237700	**5315**	6085	**219**	175	2.73
HZ 880M B	294.4	254470	**5720**	6445	**231**	187	2.74
HZ 880M C	301.2	265850	**5970**	6705	**236**	192	2.74
HZ 1080M A	316.0	418410	**7315**	8205	**248**	203	2.73
HZ 1080M B	326.8	449000	**7850**	8755	**257**	212	2.73
HZ 1080M C	346.3	485830	**8510**	9400	**272**	227	2.73
HZ 1080M D	362.1	521780	**9120**	10045	**284**	240	2.73
HZ 1180M A	374.7	548790	**9560**	10525	**294**	250	2.73
HZ 1180M B	382.8	572490	**9970**	10935	**300**	256	2.74
HZ 1180M C	398.4	607290	**10505**	11575	**313**	267	2.75
HZ 1180M D	410.8	634670	**11015**	12010	**322**	277	2.75

Combination HZ ... M – 24 / AZ 25-800



b_{sys} = 2.598 m

Section	Sectional area cm²/m	Moment of inertia cm⁴/m	Elastic[1)] section modulus cm³/m	Elastic[2)] section modulus cm³/m	Mass[3)] Mass100 kg/m²	Mass[3)] Mass60 kg/m²	Coating area[4)] Water side m²/m
HZ 680M LT	327.2	198160	**6175**	5545	**257**	220	3.26
HZ 880M A	354.3	351950	**8250**	7630	**278**	242	3.26
HZ 880M B	378.3	378400	**8875**	8245	**297**	261	3.26
HZ 880M C	389.5	396910	**9280**	8665	**306**	269	3.26
HZ 1080M A	414.3	646970	**11760**	11065	**325**	289	3.25
HZ 1080M B	431.8	695900	**12610**	11935	**339**	302	3.25
HZ 1080M C	463.5	755430	**13670**	13005	**364**	327	3.26
HZ 1080M D	489.3	813780	**14665**	14045	**384**	348	3.26
HZ 1180M A	509.8	857500	**15370**	14825	**400**	364	3.26
HZ 1180M B	522.1	893300	**15970**	15460	**410**	373	3.26
HZ 1180M C	549.4	955970	**17010**	16445	**431**	394	3.28
HZ 1180M D	567.7	994160	**17650**	17125	**446**	409	3.29

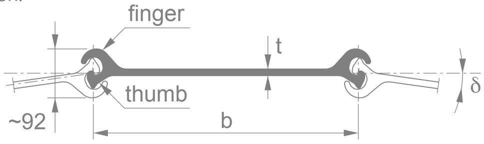
1) Referring outside of HZ-M flange.
2) Referring outside of RH / RZ.
3) $L_{RH} = L_{HZ}$; $L_{RZU} = L_{RZD} = L_{AZ}$; $Mass_{100}$: $L_{AZ} = 100\% \, L_{HZ}$; $Mass_{60}$: $L_{AZ} = 60\% \, L_{HZ}$.
4) Excluding inside of interlocks, per system width.

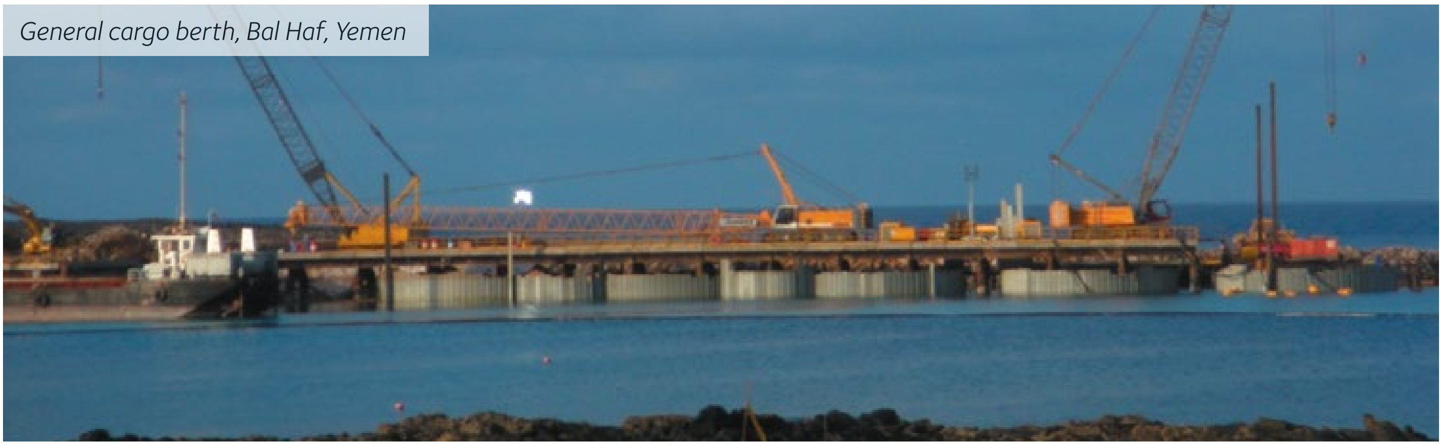
AS 500® straight web sections

AS 500 straight web sheet piles are designed to form closed cylindrical structures retaining a soil fill. The stability of the cells consisting of a steel envelope and an internal body of soil is guaranteed by their own weight. Straight web sheet piles are mostly used on projects where rock layers are close to ground level or where anchoring would be difficult or impossible. Straight web sheet pile structures are made of circular cells or diaphragm cells, depending on the site characteristics or the particular requirements of the project. The forces developing in these sheet pile sections are essentially horizontal tensile forces requiring an interlock resistance corresponding to the horizontal force in the web of the pile. AS 500 interlocks comply with EN 10248. **Please refer to our brochure "AS 500® Straight web steel sheet piles - design & execution manual" for further details.**

Section	Nominal width[1] b	Web thickness t	Deviation angle[2] δ	Perimeter (single pile)	Sectional area (single pile)	Mass (single pile)	Mass per m² of wall	Moment of inertia (single pile)	Section modulus (single pile)	Coating area[3]
	mm	mm	°	cm	cm²	kg/m	kg/m²	cm⁴	cm³	m²/m
AS 500 - 9.5	500	9.5	4.5	138	81.3	63.8	**128**	168	46	0.58
AS 500 - 11.0	500	11.0	4.5	139	89.4	70.2	**140**	186	49	0.58
AS 500 - 12.0	500	12.0	4.5	139	94.6	74.3	**149**	196	51	0.58
AS 500 - 12.5	500	12.5	4.5	139	97.2	76.3	**153**	201	51	0.58
AS 500 - 12.7	500	12.7	4.5	139	98.2	77.1	**154**	204	51	0.58
AS 500 - 13.0[4]	500	13.0	4.5	140	100.6	79.0	**158**	213	54	0.58

[1] The effective width to be taken into account for design purposes (layout) is 503 mm for all AS 500 sheet piles.
[2] Max. deviation angle 4.0° for pile length > 20 m.
[3] One side, excluding inside of interlocks.
[4] Please contact ArcelorMittal Sheet Piling for further information.




General cargo berth, Bal Haf, Yemen

The following characteristic interlock resistance can be guaranteed:

Section	$R_{k,s}$ [kN/m][5]
AS 500 - 9.5	3500
AS 500 - 11.0	4000
AS 500 - 12.0	5000
AS 500 - 12.5	5500
AS 500 - 12.7	5500
AS 500 - 13.0	6000

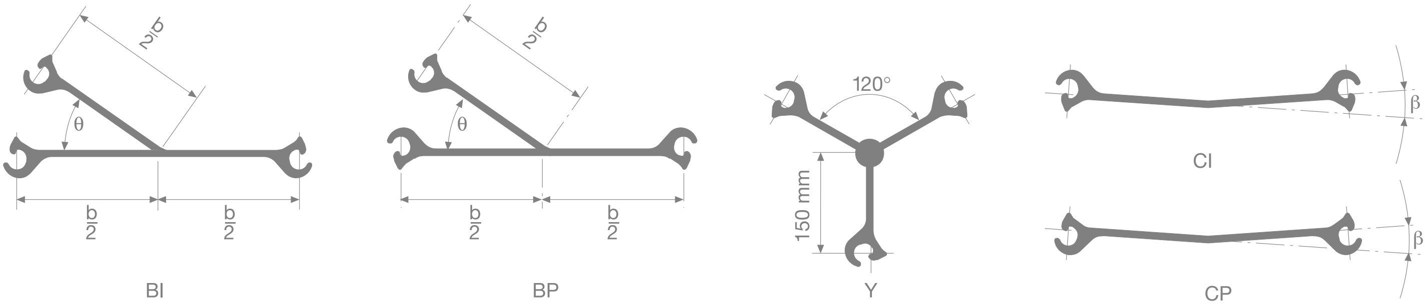
[5] For the related steel grade and further information, please contact ArcelorMittal Sheet Piling.

For AS 500 pile verification both, yield resistance of the web and ultimate resistance of the interlock, should be checked.

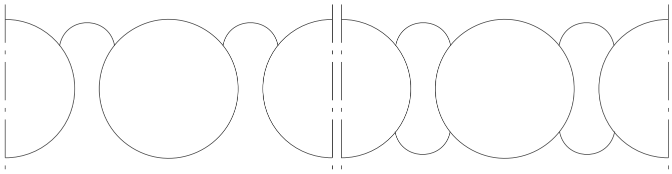

Bridge construction, South Korea

Junction piles and bent piles

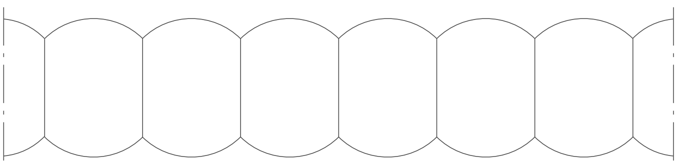
Junction piles that join circular cells and intermediary arcs can be provided. Bent piles are pre-bent at the mill. If the deviation angle exceeds 4.5° (4.0° if L > 20 m), bent piles can be used to set up structures with small radii.



Types of cells



Circular cells with 35° junction piles and one or two connecting arcs.



Diaphragm cells with 120° junction piles.

Hissmofors, Sweden

Lock, Arkansas, USA

Circular cell construction

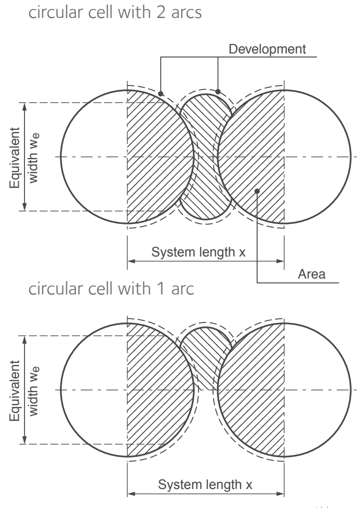
1. Installation of template

2. Threading until cell closure

3. Driving

Equivalent width

The equivalent width w_e which is required for stability verification determines the geometry of the chosen cellular construction.



• **for circular cells**

The equivalent width w_e is defined as:

$$w_e = \frac{\textit{Area within 1 cell + Area within 1 (or 2) arc(s)}}{\textit{System length x}}$$

The ratio R_a indicates how economical the chosen circular cell will be.

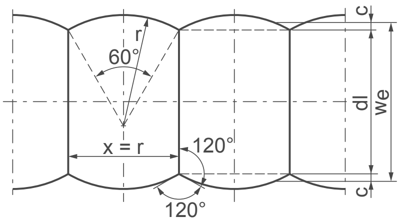
It is defined as follows

$$R_a = \frac{\textit{Development 1 cell + Development 1 (or 2) arc(s)}}{\textit{System length x}}$$

• **for diaphragm cells**

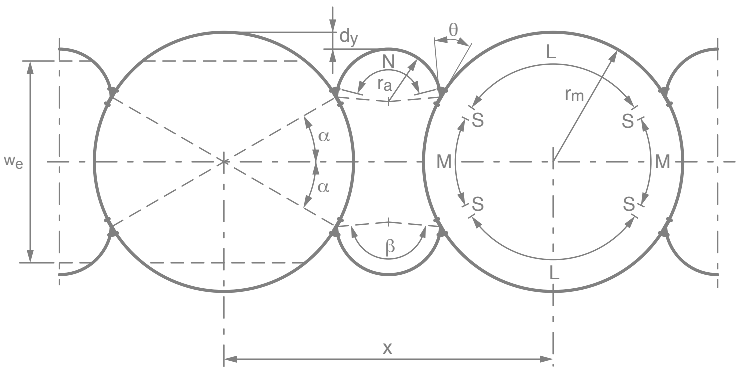
The equivalent width w_e is defined as:

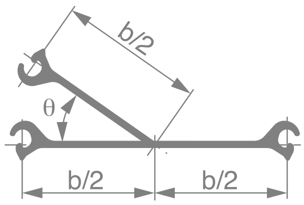
w_e = diaphragm wall length (dl) + 2 · c



Geometry of circular cells

Once the equivalent width has been determined, the geometry of the cells can be defined. This can be done with the help of tables or with computer programs.





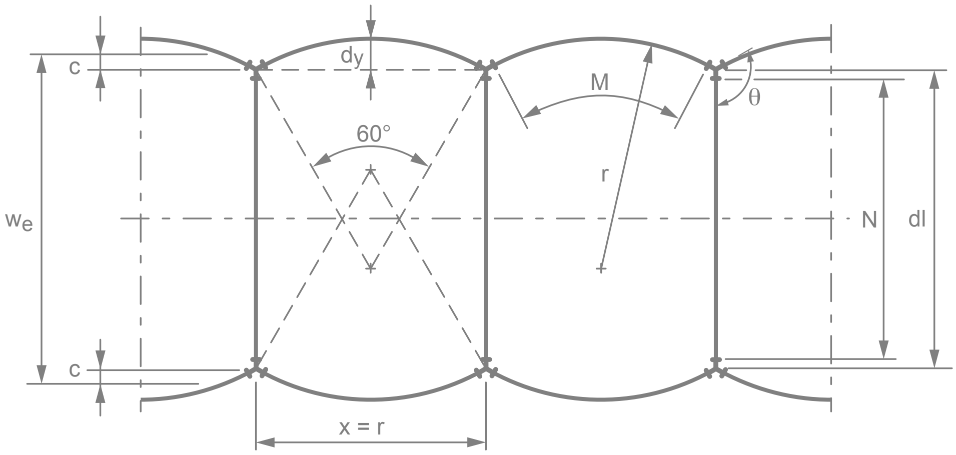
r_m = radius of the main cell
r_a = radius of the connecting arcs
θ = angle between the main cell and the connecting arc
x = system length
d_y = positive or negative offset between the connecting arcs and the tangent planes of the main cells
w_e = equivalent width

Junction piles with angles θ between 30° and 45°, as well as θ = 90°, are available on request.

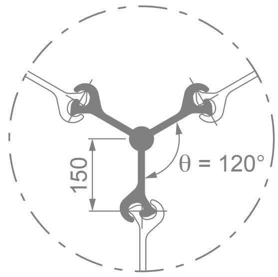
The table below shows a short selection of circular cells with 2 arcs and standard junction piles with θ = 35°.

Nb. of piles per						Geometrical values						Interlock deviation		Design values	
Cell				Arc	System							Cell	Arc	2 Arcs	
Total pcs.	L pcs.	M pcs.	S pcs.	N pcs.	pcs.	d = 2·r_m m	r_a m	x m	d_y m	α °	β °	δ_m °	δ_a °	w_e m	R_a
100	33	15	1	25	150	16.01	4.47	22.92	0.16	28.80	167.60	3.60	6.45	13.69	3.34
104	35	15	1	27	158	16.65	4.88	24.42	0.20	27.69	165.38	3.46	5.91	14.14	3.30
108	37	15	1	27	162	17.29	4.94	25.23	0.54	26.67	163.33	3.33	5.83	14.41	3.27
112	37	17	1	27	166	17.93	4.81	25.25	0.33	28.93	167.86	3.21	6.00	15.25	3.35
116	37	19	1	27	170	18.57	4.69	25.27	0.13	31.03	172.07	3.10	6.15	16.08	3.42
120	39	19	1	29	178	19.21	5.08	26.77	0.16	30.00	170.00	3.00	5.67	16.54	3.38
124	41	19	1	29	182	19.85	5.14	27.59	0.50	29.03	168.06	2.90	5.60	16.82	3.35
128	43	19	1	31	190	20.49	5.55	29.09	0.53	28.13	166.25	2.81	5.20	17.27	3.32
132	43	21	1	31	194	21.13	5.42	29.11	0.33	30.00	170.00	2.73	5.31	18.10	3.39
136	45	21	1	33	202	21.77	5.82	30.61	0.36	29.12	168.24	2.65	4.95	18.56	3.35
140	45	23	1	33	206	22.42	5.71	30.62	0.17	30.86	171.71	2.57	5.05	19.39	3.42
144	47	23	1	33	210	23.06	5.76	31.45	0.50	30.00	170.00	2.50	5.00	19.67	3.39
148	47	25	1	35	218	23.70	5.99	32.13	0.00	31.62	173.24	2.43	4.81	20.67	3.44
152	49	25	1	35	222	24.31	6.05	32.97	0.34	30.79	171.58	2.37	4.77	20.95	3.42

Geometry of diaphragm cells



Standard solution



r = radius
θ = angle between the arc and the diaphragm
w_e = equivalent width, with $w_e = dl + 2 \cdot c$
d_y = arc height
dl = diaphragm wall length
x = system length
c = equivalent arc height

Tugboat berth, Panama Canal, Panama

Marina breakwater, Costa Rica

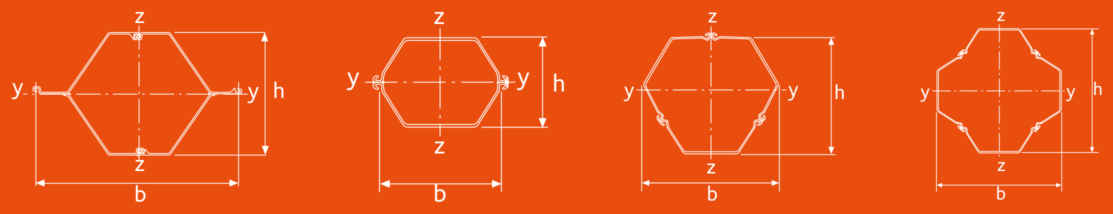
Geometry diaphragm wall

Number of piles N pcs.	Wall length dl m
11	5.83
13	6.84
15	7.85
17	8.85
19	9.86
21	10.86
23	11.87
25	12.88
27	13.88
29	14.89
31	15.89
33	16.90
35	17.91
37	18.91
39	19.92
41	20.92
43	21.93
45	22.94
47	23.94
49	24.95
51	25.95
53	26.96
55	27.97
57	28.97
59	29.98

Geometry arc (Standard solution)

Number of piles M pcs.	Radius System length x = r m	Arc height d_y m	Equivalent arc height c m	Interlock deviation δ_a °
11	5.57	0.75	0.51	5.17
13	6.53	0.87	0.59	4.41
15	7.49	1.00	0.68	3.85
17	8.45	1.13	0.77	3.41
19	9.41	1.26	0.86	3.06
21	10.37	1.39	0.94	2.78
23	11.33	1.52	1.03	2.54
25	12.29	1.65	1.12	2.34
27	13.26	1.78	1.20	2.17
29	14.22	1.90	1.29	2.03
31	15.18	2.03	1.38	1.90
33	16.14	2.16	1.46	1.79
35	17.10	2.29	1.55	1.69
37	18.06	2.42	1.64	1.60
39	19.02	2.55	1.73	1.52
41	19.98	2.68	1.81	1.44
43	20.94	2.81	1.90	1.38

Box piles



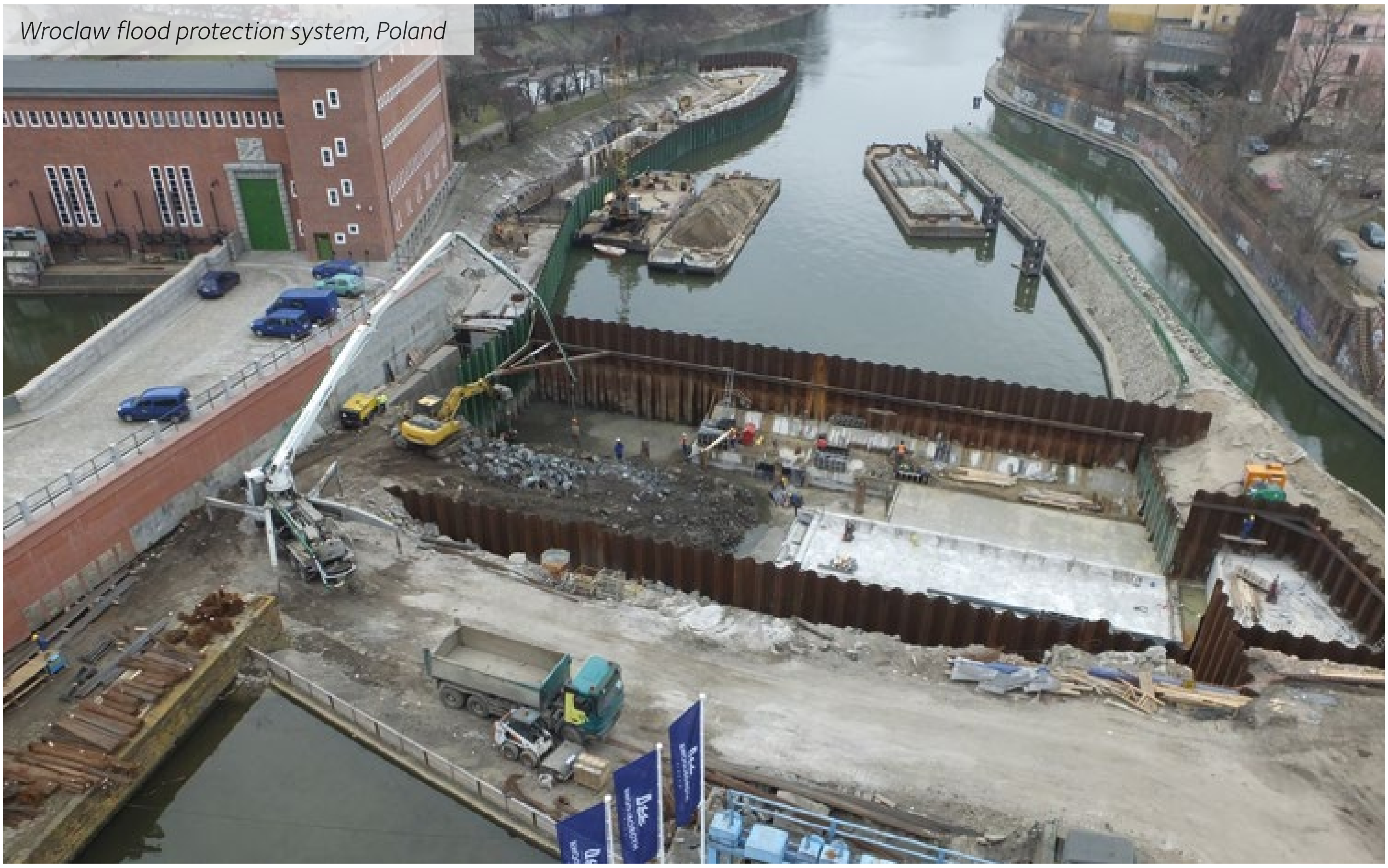
Z-box pile — Double U box pile — Triple U box pile — Quadruple U box pile

Section	Width	Height	Perimeter	Sectional area	Total section	Mass[1]	Moment of inertia		Elastic section modulus		Min. radius of gyration	Coating area[2]
	b	h					y-y	z-z	y-y	z-z		
	mm	mm	cm	cm^2	cm^2	kg/m	cm^4	cm^4	cm^3	cm^3	cm	m^2/m
CAZ-800 box piles												
CAZ 18-800	1600	898	438	363	7340	**285**	339470	650340	**7535**	**7915**	30.6	4.16
CAZ 20-800	1600	900	438	400	7372	**314**	372430	713410	**8250**	**8690**	30.5	4.16
CAZ 22-800	1600	902	439	436	7404	**342**	405710	776690	**8965**	**9465**	30.5	4.16
CAZ 23-800	1600	948	445	423	7764	**332**	447370	756450	**9405**	**9170**	32.5	4.24
CAZ 25-800	1600	950	446	460	7796	**361**	484690	820800	**10170**	**9990**	32.5	4.24
CAZ 27-800	1600	952	446	497	7829	**390**	522220	885310	**10930**	**10750**	32.4	4.24
CAZ-750 box piles												
CAZ 28-750	1500	1018	445	453	7829	**356**	547100	702950	**10715**	**9080**	34.8	4.23
CAZ 30-750	1500	1020	446	490	7861	**385**	590180	758880	**11535**	**9840**	34.7	4.23
CAZ 32-750	1500	1022	446	527	7892	**414**	633500	815060	**12360**	**10535**	34.7	4.23
CAZ-700 and CAZ-770 box piles												
CAZ 12-770	1540	687	389	328	5431	**257**	175060	557990	**5075**	**6985**	23.1	3.67
CAZ 13-770	1540	688	389	344	5446	**270**	183440	584640	**5310**	**7320**	23.1	3.67
CAZ 14-770	1540	689	390	360	5461	**283**	191840	611300	**5545**	**7655**	23.1	3.67
CAZ 14-770 -10/10	1540	690	390	376	5476	**295**	200280	637960	**5780**	**7995**	23.1	3.67
CAZ 12-700	1400	628	360	303	4524	**238**	137770	421600	**4365**	**5785**	21.3	3.39
CAZ 13-700	1400	630	361	332	4552	**261**	150890	461210	**4765**	**6335**	21.3	3.39
CAZ 13-700-10/10	1400	631	361	347	4565	**272**	157530	481090	**4965**	**6610**	21.3	3.39
CAZ 14-700	1400	632	361	362	4579	**284**	164130	500820	**5165**	**6885**	21.3	3.39
CAZ 17-700	1400	839	391	330	6015	**259**	265280	457950	**6300**	**6285**	28.3	3.69
CAZ 18-700	1400	840	391	347	6029	**272**	277840	479790	**6590**	**6590**	28.3	3.69
CAZ 20-700	1400	842	392	379	6058	**297**	303090	523460	**7170**	**7195**	28.3	3.69
CAZ 24-700	1400	918	407	436	6616	**342**	412960	596900	**8965**	**8260**	30.8	3.85
CAZ 26-700	1400	920	407	469	6645	**368**	444300	641850	**9625**	**8900**	30.8	3.85
CAZ 28-700	1400	922	408	503	6674	**395**	475810	686880	**10285**	**9510**	30.8	3.85

[1] The mass of the welds is not taken into account.
[2] Outside surface, excluding inside of interlocks.

Section	Width	Height	Perimeter	Sectional area	Total section	Mass[1)]	Moment of inertia		Elastic section modulus		Min. radius of gyration	Coating area[2)]
	b mm	h mm	cm	cm²	cm²	kg/m	y-y cm⁴	z-z cm⁴	y-y cm³	z-z cm³	cm	m²/m
CAZ-700 and CAZ-770 box piles												
CAZ 36-700N	1400	998	434	534	7215	**419**	627000	710770	**12525**	**9895**	34.3	4.12
CAZ 38-700N	1400	1000	435	570	7245	**447**	667900	757530	**13315**	**10550**	34.2	4.12
CAZ 40-700N	1400	1002	436	606	7275	**476**	709010	804300	**14105**	**11205**	34.2	4.12
CAZ 42-700N	1400	998	433	646	7267	**507**	744440	855860	**14870**	**11915**	34.0	4.11
CAZ 44-700N	1400	1000	434	682	7298	**535**	785620	902800	**15660**	**12570**	33.9	4.11
CAZ 46-700N	1400	1002	434	718	7328	**564**	827030	949760	**16455**	**13225**	33.9	4.11
CAZ 48-700	1400	1006	435	710	7346	**558**	845530	931330	**16745**	**12965**	34.5	4.13
CAZ 50-700	1400	1008	435	746	7376	**586**	887420	977550	**17540**	**13620**	34.5	4.13
CAZ 52-700	1400	1010	436	782	7406	**614**	929550	1023800	**18335**	**14255**	34.5	4.13
CAZ box piles												
CAZ 18	1260	760	361	333	4925	**261**	222930	365500	**5840**	**5560**	25.9	3.41
CAZ 26	1260	854	377	440	5566	**346**	366820	480410	**8555**	**7385**	28.9	3.57
CAZ 46	1160	962	401	595	5831	**467**	645940	527590	**13380**	**8825**	32.9	3.81
CAZ 48	1160	964	402	628	5858	**493**	681190	556070	**14080**	**9300**	32.9	3.81
CAZ 50	1160	966	402	661	5884	**519**	716620	584560	**14780**	**9780**	32.9	3.81

1) The mass of the welds is not taken into account.
2) Outside surface, excluding inside of interlocks.


Wroclaw flood protection system, Poland

Section	Width	Height	Perimeter	Sectional area	Total section	Mass[1)]	Moment of inertia		Elastic section modulus		Min. radius of gyration	Coating area[2)]
	b	h					y-y	z-z	y-y	z-z		
	mm	mm	cm	cm^2	cm^2	kg/m	cm^4	cm^4	cm^3	cm^3	cm	m^2/m
CAU double box piles												
CAU 14-2	750	451	230	198	2598	**155.8**	54400	121490	**2415**	**3095**	16.6	2.04
CAU 16-2	750	454	231	220	2620	**172.5**	62240	130380	**2745**	**3325**	16.8	2.04
CAU 18-2	750	486	239	225	2888	**177.0**	73770	142380	**3035**	**3625**	18.1	2.14
CAU 20-2	750	489	240	247	2910	**193.8**	83370	151220	**3405**	**3850**	18.4	2.14
CAU 23-2	750	492	244	260	3013	**204.2**	94540	157900	**3845**	**4020**	19.1	2.19
CAU 25-2	750	495	245	281	3034	**220.8**	104810	166600	**4235**	**4240**	19.3	2.19
CU double box piles												
CU 12-2	600	403	198	168	1850	**132.2**	34000	70000	**1685**	**2205**	14.2	1.72
CU 12S-2	600	405	198	181	1867	**142.1**	36120	76410	**1785**	**2410**	14.1	1.72
CU 18-2	600	473	212	196	2184	**153.8**	58020	78300	**2455**	**2470**	17.2	1.86
CU 22-2	600	494	220	219	2347	**172.3**	73740	88960	**2985**	**2800**	18.3	1.94
CU 28-2	600	499	226	259	2468	**203.6**	96000	103560	**3850**	**3260**	19.2	2.00
CU 32-2	600	499	223	291	2461	**228.3**	108800	109200	**4360**	**3435**	19.3	1.97
CGU double box piles												
CGU 7N-2	600	348	187	112	1596	**88.2**	16510	48530	**950**	**1535**	12.1	1.62
CGU 7S-2	600	349	188	118	1604	**92.5**	18210	50630	**1045**	**1605**	12.3	1.62
CGU 11N-2	600	359	193	153	1707	**120.4**	27670	60590	**1540**	**1915**	13.4	1.67
CGU 14N-2	600	461	205	164	2079	**128.6**	44070	65550	**1910**	**2075**	16.4	1.79
CGU 18N-2	600	473	212	196	2184	**153.8**	58020	78300	**2455**	**2470**	17.2	1.86
CGU 22N-2	600	494	220	219	2347	**172.3**	73740	88960	**2985**	**2800**	18.3	1.94
CGU 28N-2	600	499	226	259	2468	**203.6**	96000	103560	**3850**	**3260**	19.2	2.00
CGU 32N-2	600	499	223	291	2461	**228.3**	108800	109200	**4360**	**3435**	19.3	1.97
CGU 16-400	400	336	169	158	1170	**123.9**	25270	31900	**1505**	**1465**	12.7	1.40

[1)] The mass of the welds is not taken into account.
[2)] Outside surface, excluding inside of interlocks.

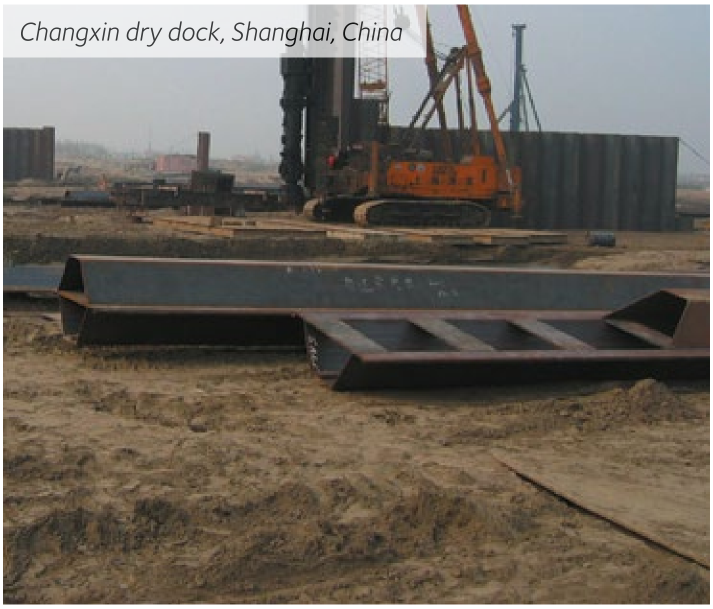
Section	Width	Height	Perimeter	Sectional area	Total section	Mass[1]	Moment of inertia		Elastic section modulus		Min. radius of gyration	Coating area[2]
	b	h					y-y	z-z	y-y	z-z		
	mm	mm	cm	cm^2	cm^2	kg/m	cm^4	cm^4	cm^3	cm^3	cm	m^2/m
CAU triple box piles												
CAU 14-3	957	908	341	298	6454	**233.7**	300330		**6510**	**6275**	31.7	3.03
CAU 16-3	960	910	342	330	6486	**258.7**	333640		**7235**	**6955**	31.8	3.03
CAU 18-3	1009	927	355	338	6886	**265.5**	363690		**7825**	**7205**	32.8	3.17
CAU 20-3	1012	928	356	370	6919	**290.7**	399780		**8570**	**7900**	32.9	3.17
CAU 23-3	1036	930	361	390	7073	**306.3**	431940		**9235**	**8340**	33.3	3.24
CAU 25-3	1038	931	364	422	7106	**331.3**	469030		**9995**	**9035**	33.3	3.24
CU triple box piles												
CU 12-3	800	755	293	253	4431	**198.3**	173100		**4555**	**4325**	26.2	2.54
CU 12S-3	802	756	294	271	4457	**213.1**	186260		**4890**	**4645**	26.2	2.54
CU 18-3	877	790	315	294	4931	**230.7**	227330		**5475**	**5185**	27.8	2.76
CU 22-3	912	801	326	329	5174	**258.4**	268440		**6310**	**5890**	28.6	2.87
CU 28-3	938	817	336	389	5356	**305.4**	330290		**7720**	**7040**	29.1	2.96
CU 32-3	926	809	331	436	5345	**342.4**	367400		**8585**	**7935**	29.0	2.92
CGU triple box piles												
CGU 11N-3	781	730	285	230	4206	**180.7**	150670		**4040**	**3860**	25.6	2.47
CGU 14N-3	844	781	305	246	4763	**192.8**	182730		**4475**	**4330**	27.3	2.65
CGU 18N-3	877	790	315	294	4931	**230.7**	227330		**5475**	**5185**	27.8	2.76
CGU 22N-3	912	801	326	329	5174	**258.4**	268440		**6310**	**5890**	28.6	2.87
CGU 28N-3	938	817	336	389	5356	**305.4**	330290		**7720**	**7040**	29.1	2.96
CGU 32N-3	926	809	331	436	5345	**342.4**	367400		**8585**	**7935**	29.0	2.92

[1] The mass of the welds is not taken into account.
[2] Outside surface, excluding inside of interlocks.


Vilanova, Barcelona, Spain

Section	Width	Height	Perimeter	Sectional area	Total section	Mass[1]	Moment of inertia		Elastic section modulus		Min. radius of gyration	Coating area[2]
	b	h					y-y	z-z	y-y	z-z		
	mm	mm	cm	cm^2	cm^2	kg/m	cm^4	cm^4	cm^3	cm^3	cm	m^2/m
CAU quadruple box piles												
CAU 14-4	1222	1222	453	397	11150	**311.6**	692030		**11325**		41.7	4.02
CAU 16-4	1225	1225	454	440	11193	**345.0**	770370		**12575**		41.8	4.02
CAU 18-4	1258	1258	471	451	11728	**354.0**	826550		**13140**		42.8	4.20
CAU 20-4	1261	1261	472	494	11771	**387.6**	910010		**14430**		42.9	4.20
CAU 23-4	1263	1263	481	520	11977	**408.4**	979870		**15510**		43.4	4.30
CAU 25-4	1266	1266	482	563	12020	**441.6**	1064910		**16820**		43.5	4.30
CU quadruple box piles												
CU 12-4	1025	1025	388	337	7565	**264.4**	394000		**7690**		34.2	3.36
CU 12S-4	1027	1027	389	362	7598	**284.1**	423410		**8250**		34.2	3.36
CU 18-4	1095	1095	417	392	8231	**307.6**	507240		**9270**		36.0	3.65
CU 22-4	1115	1115	432	439	8556	**344.6**	593030		**10635**		36.8	3.80
CU 28-4	1120	1120	445	519	8799	**407.2**	725730		**12955**		37.4	3.93
CU 32-4	1120	1120	440	582	8782	**456.6**	811100		**14480**		37.3	3.87
CGU quadruple box piles												
CGU 11N-4	979	979	379	307	7254	**240.9**	347050		**7095**		33.6	3.27
CGU 14N-4	1081	1081	404	328	7997	**257.1**	409870		**7585**		35.4	3.51
CGU 18N-4	1095	1095	417	392	8231	**307.6**	507240		**9270**		36.0	3.65
CGU 22N-4	1115	1115	432	439	8556	**344.6**	593030		**10635**		36.8	3.80
CGU 28N-4	1120	1120	445	519	8799	**407.2**	725730		**12955**		37.4	3.93
CGU 32N-4	1120	1120	440	582	8782	**456.6**	811100		**14480**		37.3	3.87

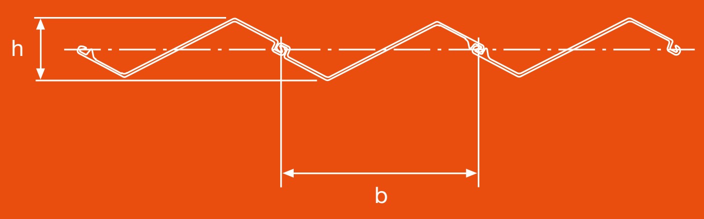
[1] The mass of the welds is not taken into account.
[2] Outside surface, excluding inside of interlocks.



Changxin dry dock, Shanghai, China

Vilanova, Barcelona, Spain

Jagged wall



AZ® jagged wall: AZ® sections threaded in reverse may form arrangements for special applications. The jagged wall arrangement represents a very economical solution for sealing screens (reduced height, reliable thickness, low driving resistance).

AZ® jagged wall

Section	Width	Height	Sectional area	Mass	Moment of inertia	Elastic section modulus	Coating area[1)]
	b	h					
	mm	mm	cm²/m	kg/m²	cm⁴/m	cm³/m	m²/m²
AZ-800							
AZ 18-800	897	242	115	**90**	4780	**395**	1.16
AZ 20-800	897	243	126	**99**	5340	**440**	1.16
AZ 22-800	897	244	137	**107**	5900	**485**	1.16
AZ 23-800	907	255	133	**104**	6070	**475**	1.17
AZ 25-800	907	257	144	**113**	6670	**520**	1.17
AZ 27-800	907	258	155	**122**	7260	**565**	1.17
AZ-750							
AZ 28-750	881	278	146	**114**	7970	**575**	1.20
AZ 30-750	881	280	157	**123**	8690	**620**	1.20
AZ 32-750	881	281	169	**132**	9420	**670**	1.20
AZ-700 and AZ-770							
AZ 12-770	826	181	112	**88**	2320	**255**	1.12
AZ 13-770	826	182	117	**92**	2450	**270**	1.12
AZ 14-770	826	182	123	**96**	2590	**285**	1.12
AZ 14-770-10/10	826	183	128	**100**	2720	**295**	1.12
AZ 12-700	751	182	115	**90**	2400	**265**	1.13
AZ 13-700	751	183	126	**99**	2680	**295**	1.13
AZ 13-700-10/10	751	183	131	**103**	2820	**305**	1.13
AZ 14-700	751	184	136	**107**	2960	**320**	1.13
AZ 17-700	795	224	117	**92**	3690	**330**	1.16
AZ 18-700	795	224	123	**96**	3910	**350**	1.16
AZ 19-700	795	225	128	**101**	4120	**365**	1.16
AZ 20-700	795	225	134	**105**	4340	**385**	1.16
AZ 24-700	813	241	150	**118**	5970	**495**	1.19
AZ 26-700	813	242	161	**127**	6490	**535**	1.19
AZ 28-700	813	243	172	**135**	7020	**580**	1.19

1) One side, excluding inside of interlocks.

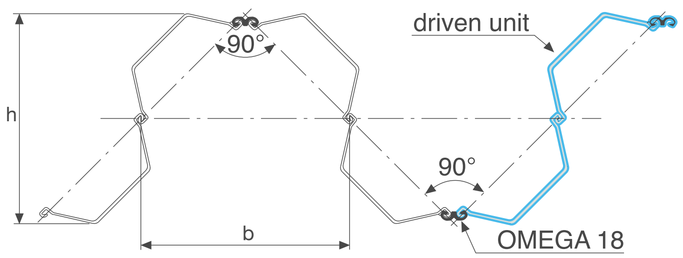
AZ® jagged wall

Section	Width	Height	Sectional area	Mass	Moment of inertia	Elastic section modulus	Coating area[1]
	b	h					
	mm	mm	cm^2/m	kg/m^2	cm^4/m	cm^3/m	m^2/m^2
AZ-700 and AZ-770							
AZ 36-700N	834	296	181	**142**	11900	**805**	1.23
AZ 38-700N	834	298	193	**152**	12710	**855**	1.23
AZ 40-700N	834	299	205	**161**	13530	**905**	1.23
AZ 42-700N	834	301	217	**170**	14730	**975**	1.24
AZ 44-700N	834	303	229	**180**	15550	**1025**	1.24
AZ 46-700N	834	304	241	**189**	16370	**1075**	1.24
AZ 48-700	836	303	242	**190**	16290	**1075**	1.23
AZ 50-700	836	303	253	**199**	17100	**1130**	1.23
AZ 52-700	836	305	265	**208**	17900	**1175**	1.23
AZ							
AZ 18	714	225	133	**104**	4280	**380**	1.19
AZ 18-10/10	714	225	139	**109**	4500	**400**	1.19
AZ 26	736	238	169	**133**	6590	**555**	1.21
AZ 46	725	309	233	**183**	16550	**1070**	1.30
AZ 48	725	310	245	**193**	17450	**1125**	1.30
AZ 50	725	312	258	**202**	18370	**1180**	1.30

[1] One side, excluding inside of interlocks.

Temporary trench, Brenner railway, Austria

U jagged wall



An arrangement of U-sheet piles forming a jagged wall offers economic solutions where high inertia and section modulus are needed. The final choice of section has to include drivability criteria. The mechanical values given below assume that the driven unit is crimped or welded. The OMEGA 18 section is normally threaded and welded at the mill, either by tack weld (no contribution to the section modulus of the jagged wall) or by an appropriately designed weld (full contribution to the section modulus). For walls with an anchorage or strut system, stiffeners have to be provided at the support levels.

Section	Width	Height	Mass	Moment of inertia[1)]		Elastic section modulus[1)]		Static moment	
	b	h		without Omega 18	with Omega 18	without Omega 18	with Omega 18	without Omega 18	with Omega 18
	mm	mm	kg/m²	cm⁴/m	cm⁴/m	cm³/m	cm³/m	cm³/m	cm³/m
AU™ jagged wall									
AU 14	1135	1115	**153**	275920	334450	**5080**	**5995**	3080	3625
AU 16	1135	1115	**168**	307090	365630	**5650**	**6555**	3435	3980
AU 18	1135	1136	**172**	329420	387960	**5800**	**6830**	3595	4135
AU 20	1135	1139	**187**	362620	421160	**6370**	**7400**	3960	4505
AU 23	1135	1171	**196**	390770	449300	**6675**	**7675**	4235	4780
AU 25	1135	1173	**210**	424630	483170	**7240**	**8240**	4610	5150
PU® jagged wall									
PU 12	923	903	**163**	188980	235400	**4275**	**5210**	2590	3125
PU 12S	923	903	**174**	202370	248810	**4570**	**5510**	2770	3305
PU 18	923	955	**186**	244470	290890	**5120**	**6095**	3215	3755
PU 22	923	993	**206**	286030	332460	**5760**	**6695**	3690	4230
PU 28	923	1027	**240**	349890	396310	**6810**	**7715**	4465	5000
PU 32	923	1011	**267**	389310	435740	**7705**	**8625**	5015	5550
GU® jagged wall									
GU 11N	923	903	**150**	167340	213770	**3790**	**4735**	2335	2875
GU 14N	923	920	**159**	198710	245140	**4320**	**5330**	2645	3180
GU 18N	923	955	**186**	244470	290890	**5120**	**6095**	3215	3755
GU 22N	923	993	**206**	286030	332460	**5760**	**6695**	3690	4230
GU 28N	923	1027	**240**	349890	396310	**6810**	**7715**	4465	5000
GU 32N	923	1011	**267**	389310	435740	**7705**	**8625**	5015	5550

[1)] The moment of inertia and elastic section moduli assume correct shear force transfer across the interlock on the neutral axis.

Combined walls

Steel sheet piles can easily be combined to form special arrangements and create systems with large bending resistance:
- box piles / sheet piles;
- HZ king piles / sheet piles;
- tubular king piles / sheet piles.

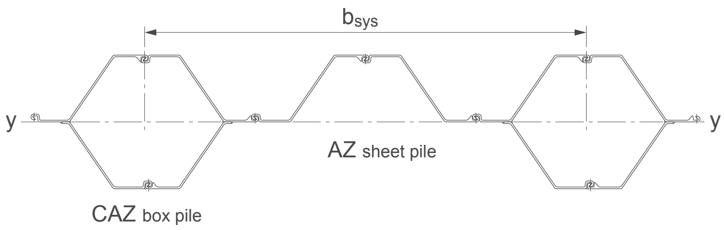
The primary piles or “king piles” of combined walls can also be used as bearing piles submitted to high vertical loads, e.g. crane loads. The intermediary sheet piles act mainly as soil-retaining and load-transferring elements.

Equivalent elastic section modulus

The equivalent elastic section modulus W_{sys} per linear metre of combined wall is based on the assumption that the deflections of king piles and intermediary steel sheet piles are the same, leading to the following formulas:

$$I_{sys} = \frac{I_{king\ pile} + I_{ssp}}{b_{sys}}$$

$$W_{sys} = \frac{W_{king\ pile}}{b_{sys}} \cdot \left(\frac{I_{king\ pile} + I_{ssp}}{I_{king\ pile}} \right)$$



I_{sys}	[cm⁴/m]:	Moment of inertia of combined wall
W_{sys}	[cm³/m]:	Elastic section modulus of combined wall
$I_{king\ pile}$	[cm⁴]:	Moment of inertia of king pile
I_{ssp}	[cm⁴]:	Moment of inertia of intermediary sheet pile
$W_{king\ pile}$	[cm³]:	Elastic section modulus of king pile
b_{sys}	[m]:	System width

CAZ box piles – AZ® sheet piles

Combination	System width b_{sys} mm	Mass$_{100}$ 1) kg/m²	Mass$_{60}$ 1) kg/m²	Moment of inertia I_{sys} cm⁴/m	Elastic section modulus W_{sys} cm³/m
AZ-800					
CAZ 20-800 / AZ 13-770	3140	148	129	129580	2870
CAZ 20-800 / AZ 18-700	3000	156	135	141780	3140
CAZ 20-800 / AZ 20-800	3200	153	131	138910	3075
CAZ 25-800 / AZ 13-770	3140	163	144	165330	3470
CAZ 25-800 / AZ 18-700	3000	171	151	179200	3760
CAZ 25-800 / AZ 20-800	3200	168	146	173990	3650
AZ-750					
CAZ 30-750 / AZ 13-770	3040	177	157	205470	4015
CAZ 30-750 / AZ 18-700	2900	185	164	221760	4335
CAZ 30-750 / AZ 20-800	3100	181	158	213630	4175
AZ-700 and AZ-770					
CAZ 13-770 / AZ 13-770	3080	137	117	70740	2045
CAZ 13-700 / AZ 13-700	2800	146	125	64160	2025
CAZ 18-700 / AZ 13-770	2940	144	124	106220	2520
CAZ 18-700 / AZ 13-700	2800	150	129	109500	2595
CAZ 18-700 / AZ 18-700	2800	152	130	118130	2800

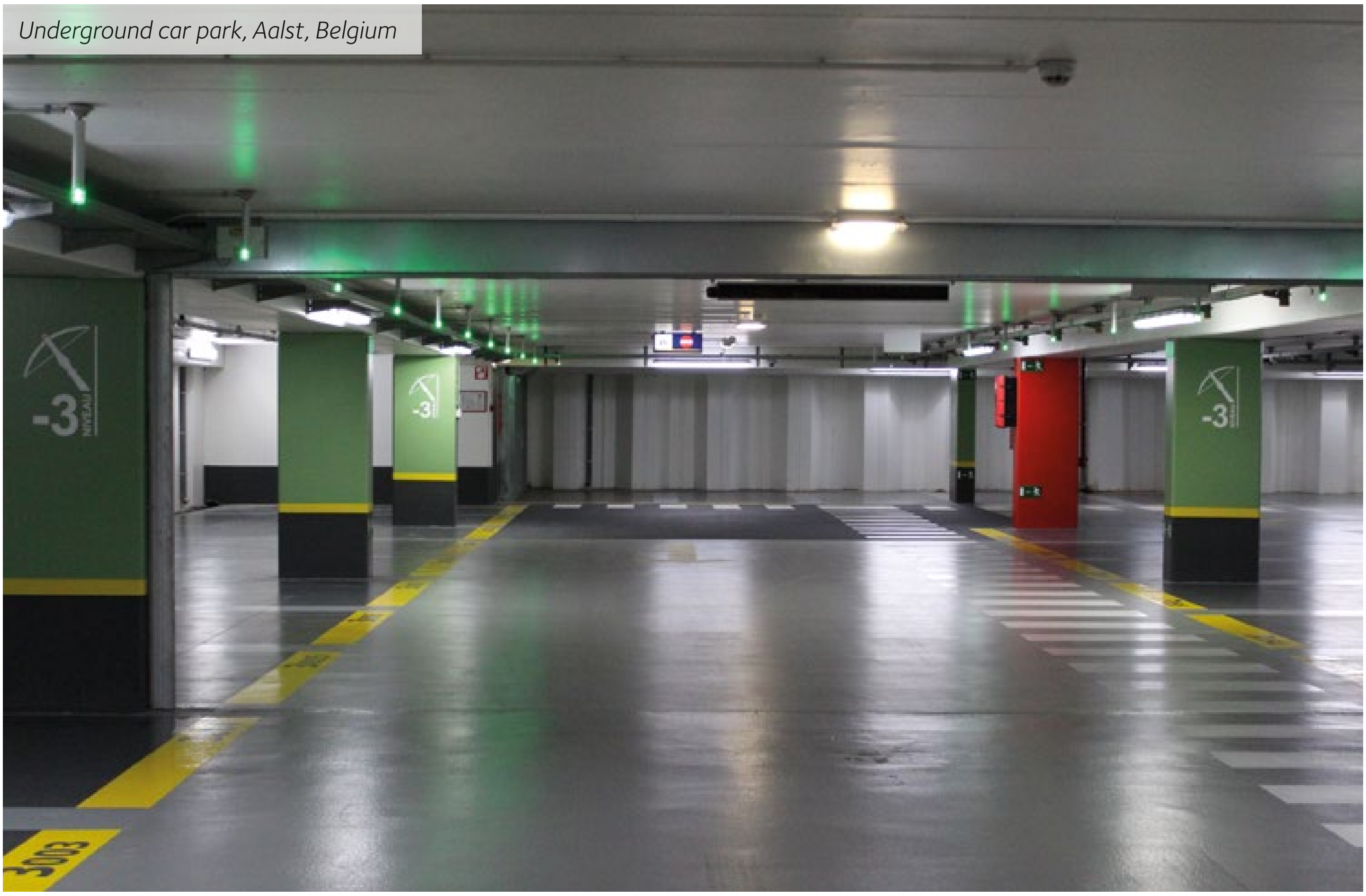
1) $Mass_{100}$: L_{AZ} = 100% $L_{box\ pile}$; $Mass_{60}$: L_{AZ} = 60% $L_{box\ pile}$.

CAZ box piles – AZ® sheet piles

Combination	System width b_{sys}	$Mass_{100}$ [1)]	$Mass_{60}$ [1)]	Moment of inertia I_{sys}	Elastic section modulus W_{sys}
	mm	kg/m²	kg/m²	cm⁴/m	cm³/m
AZ-700 and AZ-770					
CAZ 26-700 / AZ 13-770	2940	177	156	162840	3530
CAZ 26-700 / AZ 13-700	2800	185	163	168950	3660
CAZ 26-700 / AZ 18-700	2800	186	164	177580	3845
CAZ 38-700N / AZ 13-770	2940	204	183	238890	4760
CAZ 38-700N / AZ 13-700	2800	213	192	248800	4960
CAZ 38-700N / AZ 18-700	2800	214	193	257440	5130
CAZ 44-700N / AZ 13-770	2940	234	213	278930	5560
CAZ 44-700N / AZ 13-700	2800	244	223	290850	5800
CAZ 44-700N / AZ 18-700	2800	246	224	299480	5970
CAZ 50-700 / AZ 13-770	2940	251	230	313560	6200
CAZ 50-700 / AZ 18-700	2800	264	242	335840	6640
CAZ 50-700 / AZ 20-800	3000	254	231	319830	6320
AZ					
CAZ 18 / AZ 18	2520	163	139	105560	2765
CAZ 26 / AZ 18	2520	196	173	162660	3795
CAZ 48 / AZ 18	2420	265	241	299290	6190

[1)] $Mass_{100}$: L_{AZ} = 100% $L_{box\ pile}$; $Mass_{60}$: L_{AZ} = 60% $L_{box\ pile}$.

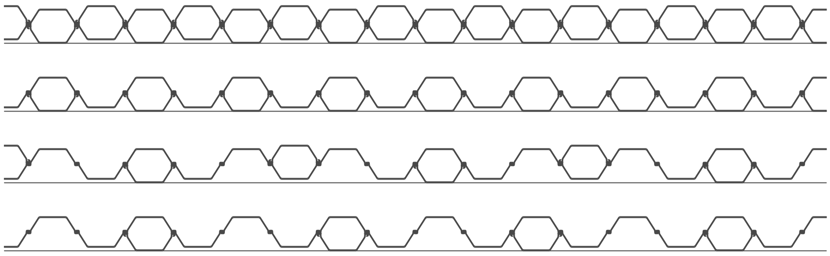
Underground car park, Aalst, Belgium



U box piles – U sheet piles

Type of reinforcement:
- Heightwise: full or partial height;
- Lengthwise: total length 1/1 or partial length 1/2, 1/3, 1/4.

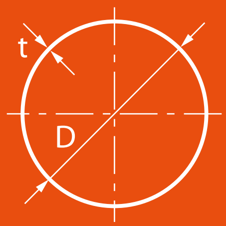
Please contact our Technical Department for other combinations (e.g. 2/4).



1/1
1/2
1/3
1/4

Section	1 / 1			1 / 2			1 / 3			1 / 4		
	Mass	Moment of inertia	Elastic section modulus	Mass	Moment of inertia	Elastic section modulus	Mass	Moment of inertia	Elastic section modulus	Mass	Moment of inertia	Elastic section modulus
	kg/m²	cm⁴/m	cm³/m	kg/m²	cm⁴/m	cm³/m	kg/m²	cm⁴/m	cm³/m	kg/m²	cm⁴/m	cm³/m
CAU box piles / AU™ sheet piles												
AU 14	208	72530	3220	156	40660	1805	139	43300	1920	130	37980	1550
AU 16	230	82990	3660	173	46230	2035	153	49560	2185	144	43440	1755
AU 18	236	98360	4045	177	55020	2260	157	58990	2425	148	51760	1950
AU 20	258	111160	4545	194	61830	2525	172	66680	2725	162	58460	2180
AU 23	272	126050	5125	204	69580	2830	182	75820	3080	170	66410	2435
AU 25	294	139750	5645	221	76800	3105	196	84080	3395	184	73590	2675
CU box piles / PU® sheet piles												
PU 12	220	56670	2810	165	32080	1590	147	33290	1650	138	29190	1370
PU 12S	237	60200	2975	178	34120	1685	158	35170	1735	148	30830	1450
PU 18	256	96700	4090	192	54370	2300	171	58000	2450	160	50940	1980
PU 22	287	122900	4975	215	68730	2785	192	73940	2995	180	64920	2395
PU 28	339	160000	6415	255	88390	3545	226	96310	3860	212	84370	3050
PU 32	381	181330	7270	285	99790	4000	254	108660	4355	238	95070	3445
CGU box piles / GU® sheet piles												
GU 7N	147	27520	1585	110	15630	900	98	16140	930	92	14160	775
GU 7S	154	30350	1740	116	17150	985	103	17810	1020	96	15610	845
GU 11N	201	46120	2570	151	25790	1435	134	27000	1505	125	23610	1235
GU 14N	214	73440	3185	161	41520	1800	143	44090	1915	134	38760	1550
GU 18N	256	96700	4090	192	54370	2300	171	58000	2450	160	50940	1980
GU 22N	287	122900	4975	215	68730	2785	192	73940	2995	180	64920	2395
GU 28N	339	160000	6415	255	88390	3545	226	96310	3860	212	84370	3050
GU 32N	381	181330	7270	285	99790	4000	254	108660	4355	238	95070	3445
GU 16-400	310	63180	3760	232	35270	2100	207	36110	2150	194	31460	1805

Steel tubes for foundations



ArcelorMittal manufactures spirally welded tubular foundation piles in its mill located in Dintelmond, The Netherlands, with diameters up to 3000 mm, wall thicknesses up to 25 mm, and lengths up to 53 m (without butt-welding). The mill is located on the waterfront and owns a deep-water quay wall.
Tubular piles are available in numerous European and US steel grades thanks to ArcelorMittal's worldwide network of coil producers. Tubes can be coated on the premises on request. The table below gives an overview of steel tubes used in foundations (bearing piles, combined walls, etc). Other dimensions on request.

Steel tubes can also be provided with C9 connectors welded on the tube to form combined wall systems[1)]. Tubular piles are the main retaining elements of the combined wall, carrying horizontal loads from soil and water pressures, and vertical loads from the anchors and superstructure. The intermediary sheet piles (preferably AZ sheet piles) transfer horizontal loads to the tubular piles. Please refer to our brochure "**AZ® sheet piles in combined walls**" for more information on the infill sheet piles.
Please refer to our brochure "**Spirally welded steel pipes**" for further details on steel tubes.

Diameter	Thickness	Moment of inertia	Elastic section modulus	Sectional area	Mass
D	t	I	W	A	G
mm	mm	cm^4	cm^3	cm^2	kg/m
864	10.0	244620	**5665**	268.3	**210.6**
864	12.0	291510	**6750**	321.2	**252.1**
864	14.0	337720	**7820**	373.8	**293.5**
914	10.0	290150	**6350**	284.0	**222.9**
914	12.0	345890	**7570**	340.0	**266.9**
914	14.0	400890	**8770**	395.8	**310.7**
1016	12.0	476980	**9390**	378.5	**297.1**
1016	14.0	553190	**10890**	440.7	**346.0**
1016	16.0	628480	**12370**	502.7	**394.6**
1219	14.0	962070	**15785**	530.0	**416.0**
1219	16.0	1094090	**17950**	604.7	**474.7**
1219	18.0	1224780	**20095**	679.1	**533.1**
1422	16.0	1746590	**24565**	706.7	**554.8**
1422	18.0	1956610	**27520**	793.9	**623.2**
1422	20.0	2164820	**30450**	880.9	**691.5**
1524	16.0	2154930	**28280**	758.0	**595.0**
1524	18.0	2414730	**31690**	851.6	**668.5**
1524	20.0	2672450	**35070**	945.0	**741.8**
1626	18.0	2939310	**36155**	909.3	**713.8**
1626	20.0	3253820	**40020**	1009.1	**792.1**
1626	22.0	3565970	**43860**	1108.6	**870.3**
1829	18.0	4198850	**45915**	1024.1	**803.9**
1829	20.0	4650060	**50850**	1136.6	**892.3**
1829	22.0	5098250	**55750**	1248.9	**980.4**
2032	20.0	6397590	**62970**	1264.2	**992.4**
2032	22.0	7016540	**69060**	1389.2	**1090.5**
2032	24.0	7631750	**75115**	1514.0	**1188.5**
2540	21.0	13182380	**103800**	1661.9	**1304.6**
2540	23.0	14403690	**113415**	1818.7	**1427.7**
2540	25.0	15619130	**122985**	1975.3	**1550.6**
2997	21.0	21737000	**145060**	1963.4	**1541.2**
2997	23.0	23759460	**158555**	2148.9	**1686.9**
2997	25.0	25773720	**171995**	2334.2	**1832.3**

1) Disclaimer: ArcelorMittal Sheet Piling highly recommends that Z or U sections used in tube combined walls as infill sheet piles are threaded with C9 connectors. Infill sheet piles threaded to C9 connectors are a proven solution with respect to optimum interlock fitting. In the event of use of a connector other than the C9, ArcelorMittal Commercial RPS S.à r.l. cannot be held liable for any related failure during construction such as and not limited to, increased friction during driving or declutching.

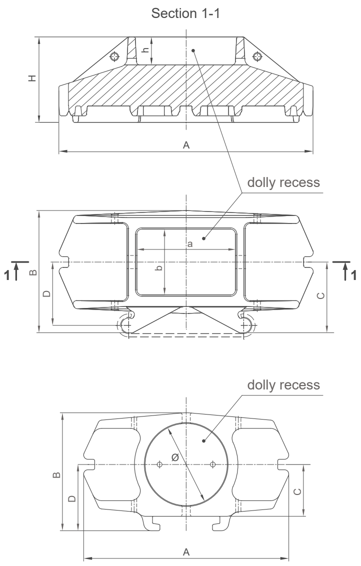
Driving caps

A driving cap is a very important accessory, providing good energy transfer between the hammer and the sheet pile section, thus preventing damage to the pile. Impact hammers need special driving caps. Driving caps for diesel hammers are generally made of cast steel, with an arrangement of guiding grooves for the different sheet pile sections on its lower side. A dolly is fitted into a recess on the top of the driving cap. Dollies are normally made of wooden or plastic components or a combination of several different elements. Each driving cap fits for several sheet pile sections, thus the number of required driving caps for a given sheet pile range is reduced.

Driving cap dimensions

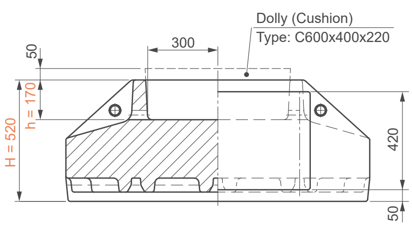
Driving caps	A	B	H	C	D	Mass	Dimensions of dolly recess	Corresponding sliding guide
	mm	mm	mm	mm	mm	kg	a/b/h or ø/h	
AUS 14-26	740	580	370	350	305	650	500/300/120	500/90
AUD 12-16	1540	750	520	430	385	1900	600/400/170	700/90
AUD 20-32	1570	750	520	430	385	2100	600/400/170	700/90
PUS	680	600	320	290	265	300	380/380/120	330/50
US-B	680	600	320	290	265	300	380/380/120	330/50
UD 1	1250	610	420	260	350	1000	ø 400/170	30
UD 2	1250	720	420	315	405	1250	ø 500/170	30
PUD 17-33	1250	720	420	315	405	1250	ø 500/170	30
A 18/26	1160	660	420	390	345	1150	600/400/170	500/90
A 48	1080	730	470	430	385	1400	600/400/170	500/90
AZD 12-14	1300	590	520	360	315	1700	600/300/170	700/90
AZD 12-14 L	1440	590	520	360	315	1750	600/300/170	700/90
UZD 14-28	1300	705	520	420	375	1900	600/400/170	700/90
AZD 36-40	1320	750	520	440	395	2050	600/400/170	700/90
ZD 800 A	1500	955	420	495	450	2450	ø 600/170	700/90
ZD 800 B	1360	1065	540	560	515	3000	ø 600/170	700/90
ZD 800 A-weld[1]	1510	702	400	420	375	1500	600/400/120	500/90
ZD 800 B-weld[1]	1400	738	430	438	393	1650	600/400/120	500/90
HS 8 -11	720	1270	430	710	665	1250	ø 600/170	500/90
HD 6 -11	840	1410	470	770	725	2350	ø 600/170	700/90

[1] Availability to be checked with technical department.

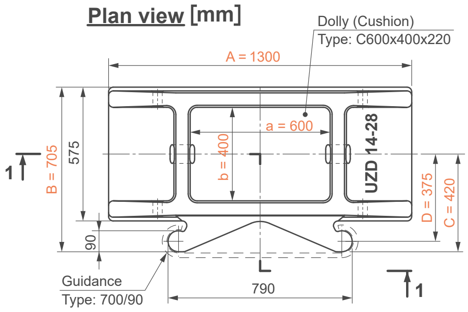


Driving caps – Examples

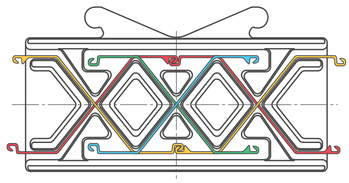
Section 1-1 (UZD 14-28) [mm]



Plan view [mm]

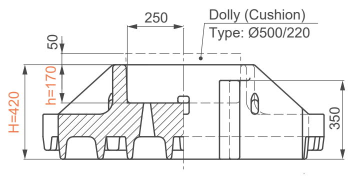


Bottom view

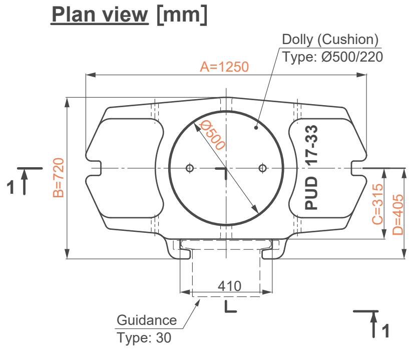


Position of section AZ 17-700... AZ 28-700 as single and double pile

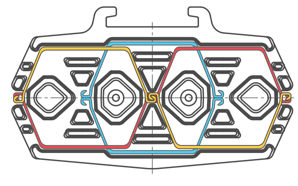
Section 1-1 (PUD 17-33) [mm]



Plan view [mm]



Bottom view



Position of section PU18...PU32 and GU13N...GU33N as single, double and box pile

Sheet pile sections and corresponding driving caps

Sections / Driving caps	AZD 12-14	AZD 12-14 L	UZD 14-28	AZD 36-40	A 18/26	A 48	ZD 800 A	ZD 800 B
Arrangement	D	D	D	D	D	D	D	D
AZ®-800								
AZ 18-800							✓	
AZ 20-800							✓	
AZ 22-800							✓	
AZ 23-800							✓	✓
AZ 25-800							✓	✓
AZ 27-800							✓	✓
AZ®-750								
AZ 28-750								✓
AZ 30-750								✓
AZ 32-750								✓
AZ®-700 and AZ®-770								
AZ 12-770		✓						
AZ 13-770		✓						
AZ 14-770		✓						
AZ 14-770-10/10		✓						
AZ 12-700	✓							
AZ 13-700	✓							
AZ 13-700-10/10	✓							
AZ 14-700	✓							
AZ 17-700			✓					
AZ 18-700			✓					
AZ 19-700			✓					
AZ 20-700			✓					
AZ 24-700			✓					
AZ 26-700			✓					
AZ 28-700			✓					
AZ 36-700N				✓				
AZ 38-700N				✓				
AZ 40-700N				✓				
AZ 42-700N				✓				
AZ 44-700N				✓				
AZ 46-700N				✓				
AZ 48-700				✓				
AZ 50-700				✓				
AZ 52-700				✓				
AZ®								
AZ 18					✓			
AZ 18-10/10					✓			
AZ 26					✓			
AZ 46						✓		
AZ 48						✓		
AZ 50						✓		

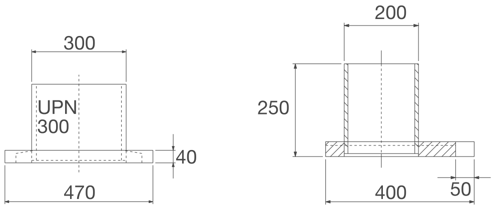
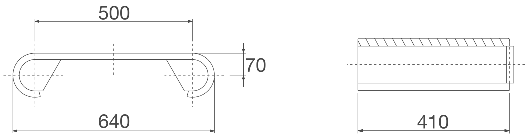
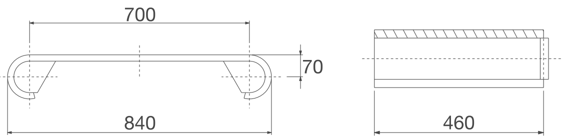
Sections / Driving caps	AUS 14-26	AUD 12-16	AUD 20-32	PUS	US-B	UD 1	UD 2	PUD 17-33	HS 8-11	HD 6-11
Arrangement	S	D/B	D/B	S	S	D/T/B	D/T/B	D/B	S	D
AU™										
AU 14	✓	✓								
AU 16	✓	✓								
AU 18	✓		✓							
AU 20	✓		✓							
AU 23	✓		✓							
AU 25	✓		✓		✓					
PU®										
PU 12				✓	✓	✓				
PU 12S				✓	✓	✓				
PU 18^{-1}				✓			✓	✓		
PU 18				✓			✓	✓		
PU 18^{+1}				✓			✓	✓		
PU 22^{-1}				✓			✓	✓		
PU 22				✓			✓	✓		
PU 22^{+1}				✓			✓	✓		
PU 28^{-1}				✓	✓			✓		
PU 28				✓	✓			✓		
PU 28^{+1}				✓	✓			✓		
PU 32^{-1}				✓	✓		✓	✓		
PU 32				✓	✓		✓	✓		
PU 32^{+1}				✓	✓		✓	✓		
GU®										
GU 6N				✓	✓	✓[1]				
GU 7N				✓	✓	✓[1]				
GU 7S				✓	✓	✓[1]				
GU 7HWS				✓	✓	✓[1]				
GU 8N				✓	✓	✓[1]				
GU 8S				✓	✓	✓[1]				
GU 10N						✓				
GU 11N						✓				
GU 12N						✓				
GU 13N				✓			✓	✓		
GU 14N				✓			✓	✓		
GU 15N				✓			✓	✓		
GU 16N				✓			✓	✓		
GU 18N				✓			✓	✓		
GU 20N				✓			✓	✓		
GU 21N				✓			✓	✓		
GU 22N				✓			✓	✓		
GU 23N				✓			✓	✓		
GU 27N				✓				✓		
GU 28N				✓				✓		
GU 30N				✓				✓		
GU 31N				✓	✓		✓	✓		
GU 32N				✓	✓		✓	✓		
GU 33N				✓	✓		✓	✓		
HZ®-M										
HZ 680M									✓[2]	✓[2]
HZ 880M									✓	✓
HZ 1080M									✓	✓
HZ 1180M									✓	✓

[1] Not fitting for box piles.
[2] On request.

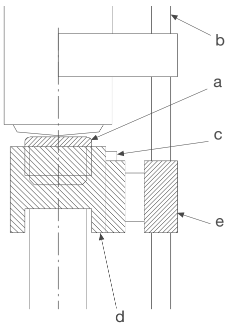
S = Single pile
D = Double pile
T = Triple pile
B = Box pile

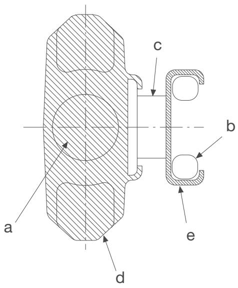
Sliding guides

Sliding guides are designed to guide the driving cap along the leader, thus guaranteeing proper alignment of the hammer in the centre of the driving cap. Their adaptation to the leader is normally carried out on-site.

Dimensions	Designation	Corresponding driving caps
	330/50	PUS US-B
	30	UD PUD
	500/90	A AUS ZD 800 A-weld ZD 800 B-weld HS 8-11
	700/90	AUD AZD ZD 800 A ZD 800 B UZD HD 6-11

Arrangement of driving caps





a = dolly/cushion
b = leader
c = sliding guide
d = driving cap
e = leader slide

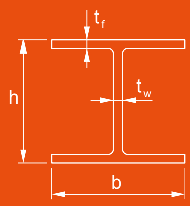
The leader slide (e) is not provided by ArcelorMittal.

HP piles

HP piles are special H-shaped bearing piles with webs and flanges of the same thickness. They are used as bearing piles for foundation projects such as bridges and industrial facilities or as anchoring piles for quay or excavation walls.

HP piles have the following common characteristics:

- guaranteed pile integrity after installation. No length limitations due to trimming or splicing;
- easy to store, handle and install. Easy connection to superstructure;
- bearing capacity available right after installation, capacity can be determined during installation;
- excellent durability. Corrosion rates of embedded HP piles are extremely low;
- HP piles are able to take high tensile and bending forces.



HP bearing piles range from HP 200 to HP 400. They are available in structural steel grades (yield strength 235 – 355 MPa) as well as in high-strength steel grades (yield strength 355 – 460 MPa) including HISTAR quality.

Rolling tolerances on dimensions, shape, weight and length are fixed in accordance with EN 10034.

Minimum delivery length is 8 m, maximum delivery length is 24.1 m for HP 200/220/260 and 33.0 m for HP 305/320/360/400.

The table below shows a selection of available piles. **Please refer to the brochure "Wide flange bearing piles" for detailed information on the entire HP range.**

Section	Mass	Dimensions				Sectional area	Total area $A_{tot} = h \cdot b$	Perimeter	Moment of inertia		Elastic section modulus	
		h	b	t_w	t_f				y-y	z-z	y-y	z-z
	kg/m	mm	mm	mm	mm	cm^2	cm^2	m	cm^4	cm^4	cm^3	cm^3
HP 200 x 43	42.5	200	205	9.0	9.0	54.1	410	1.18	3888	1294	389	126
HP 220 x 57	57.2	210	225	11.0	11.0	72.9	472	1.27	5729	2079	546	185
HP 260 x 75	75.0	249	265	12.0	12.0	95.5	660	1.49	10650	3733	855	282
HP 305 x 110	110	308	311	15.3	15.4	140	955	1.80	23560	7709	1531	496
HP 320 x 117	117	311	308	16.0	16.0	150	958	1.78	25480	7815	1638	508
HP 360 x 152	152	356	376	17.8	17.9	194	1338	2.15	43970	15880	2468	845
HP 400 x 213	213	368	400	24.0	24.0	271	1472	2.26	63920	25640	3474	1282

$t_w = t_{web}$ = web thickness $t_f = t_{flange}$ = flange thickness

Deurganckdock CT, Antwerp, Belgium

Durability of steel sheet piles

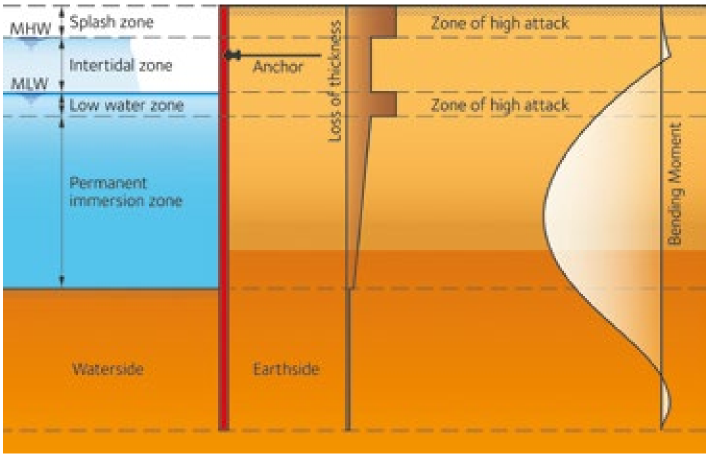
Unprotected steel in the atmosphere, water or soil is subject to corrosion that may lead to damage. Local weakening and rusting-through are normally considered to be maintenance problems that can be remedied locally. Depending on life-time requirements and accessibility to the structure, the service life of a steel structure can be achieved by one or a combination of following methods:

- protection by coating (typically only in high corrosion zones);
- use of a stronger section or a higher steel grade to create a "structural design reserve";
- use of Marine Grade Steel ASTM A690 (splash zone);
- avoiding important bending moments in the high corrosion zones;
- extension of the concrete capping beam below the low-water level;
- cathodic protection by impressed current or by sacrificial anodes (protects the surface constantly in contact with water);
- use of AMLoCor® steel grade (permanent immersion zone and low water zone).

Corrosion rates

The maximum steel stress in most maritime sheet pile structures is situated within the permanent immersion zone. The loss of thickness in this zone is considerably lower than in the high corrosion zones. Steel stress is generally very low in the maximum corrosion zones: splash zone & low water zone. These locations are therefore not the critical part of the structure despite their negative appearance if unprotected.

Typical loss of thickness due to corrosion and moment distribution for anchored sheet pile wall in marine environment:



Please refer to EC 3 Part 5 (EN 1993-5) for details on loss of steel thickness as a result of exposure in different media.
The use of the steel grade AMLoCor® significantly increases the design life of marine structures.

Surface coating

The classical corrosion protection for steel sheet piling is surface coating. EN ISO 12944 deals with protection by paint systems and its various parts cover all the features that are important in achieving adequate corrosion protection. It is essential that the steel surface is properly prepared before applying a coating system: removal of millscale by abrasive blasting (cf. ISO 8501-1). Most systems consist of one or two primers, an intermediate coat and a topcoat. Zinc primers are used frequently due to their good corrosion-inhibiting properties.

Intermediate coats increase the total thickness and thus increase the distance for moisture diffusion to the surface. Topcoats are chosen for colour and gloss retention, for chemical resistance, or for additional resistance to mechanical damage. Epoxies are generally used for seawater immersion and chemical resistance, polyurethanes for colour and gloss retention. Below, paint systems are proposed for different environments according to classifications of EN ISO 12944.

Metro Copenhagen, Denmark

Atmospheric exposure

Some applications require a stronger aesthetic component, where the steel sheet pile wall appearance is very relevant. In those cases, polyurethane finishes - which are easy to apply and maintain - are the preferred choice, mainly due to their good gloss and colour retention characteristics.

Proposal (EN ISO 12944 – Table A4, corrosivity category C4):

Epoxy primer
Recoatable epoxy intermediate coating
Aliphatic polyurethane topcoat

Nominal dry-film thickness of the system: 240 μm

Flood protection wall, Hamburg, Germany

Sea water & fresh water immersion Im1 / Im2

For long-term performance of steel structures immersed in sea water and in fresh water there should be no compromise on quality of the coating system, particularly as it may be damaged due to abrasion and impact. The application must be properly carried out and inspected on a regular basis. Cathodic protection is sometimes specified in combination with a (fully compatible) coating system.

Proposal (EN ISO 12944 – Table A6, corrosivity category Im2)
Epoxy primer Solvent-free epoxy coating or epoxy glass flake
Nominal dry-film thickness of the system: 500-550 µm

Lock, Venice, Italy

Landfills and contaminated soils

Excellent protection is essential due to exposure to highly aggressive substances. The coating system must have outstanding resistance to mineral and organic acids and other chemicals as well as capacity to withstand abrasion and impacts.

Proposal
Micaceous iron oxide pigmented polyamide cured epoxy primer Polyamide-cured-epoxy coating with increased chemical resistance
Nominal dry-film thickness of the system: 480 µm

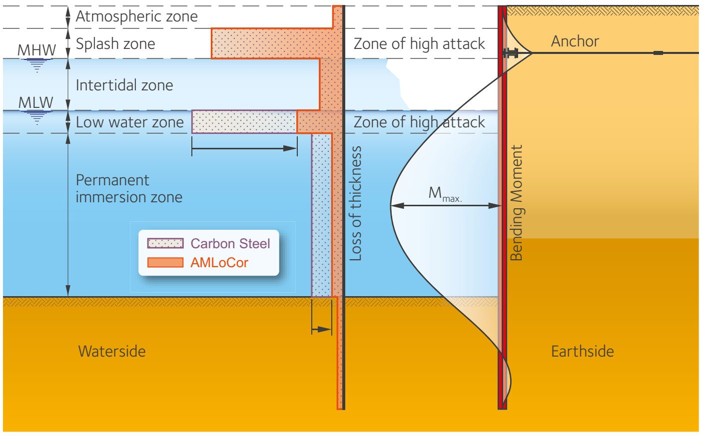
Waste disposal, Horn, Austria

AMLoCor®

New corrosion resistant steel grade for marine applications

AMLoCor® is ArcelorMittal's **"low corrosion" steel grade** that will revolutionize the design of port structures in the future.

The **key advantage of AMLoCor® is a significant reduction of the corrosion rates in the "Low Water Zone" (LWZ) and in the "Permanent Immersion Zone" (PIZ)**, which is normally the location of the maximum bending moments and consequently highest steel stresses. This steel grade is the solution to address the major concern of designers and port authorities: **durability of marine structures** like quay walls, breakwaters and jetties.

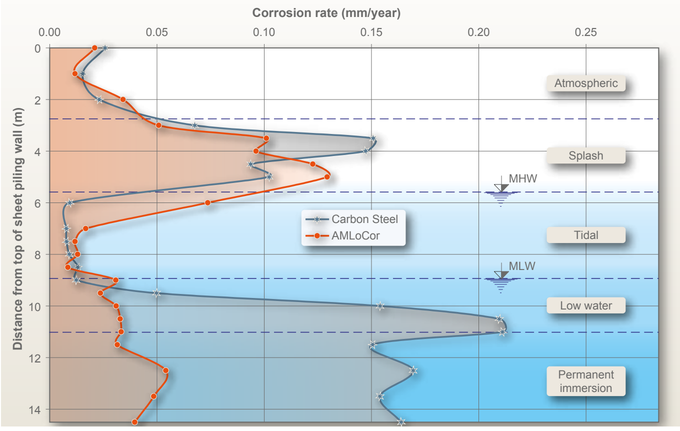


Typical loss of steel thickness in a marine environment: regular carbon steel vs. AMLoCor®.

Eurocode 3 Part 5 contains reference tables with typical corrosion rates valid for standard carbon steel in northern European countries. In-situ tests have proven that the **loss of steel thickness of AMLoCor is reduced by a factor 3 (PIZ) to 5 (LWZ) compared to standard structural steel** in the critical zones.

AMLoCor leads to considerable savings in steel weight compared to the unprotected carbon steel piling solution, as soon as loss of steel thickness due to corrosion in the immersion zone is significant. Cathodic protection or coatings can be used to increase the service life of the sheet pile structure. However, **AMLoCor® will in many cases yield the most cost-effective solution in the long-term.** AMLoCor is compatible with cathodic protection and coatings.

In addition AMLoCor protects the structures from "ALWC" (Accelerated Low Water Corrosion) which is related to biological activity enhancing degradation of steel in the low water zone.



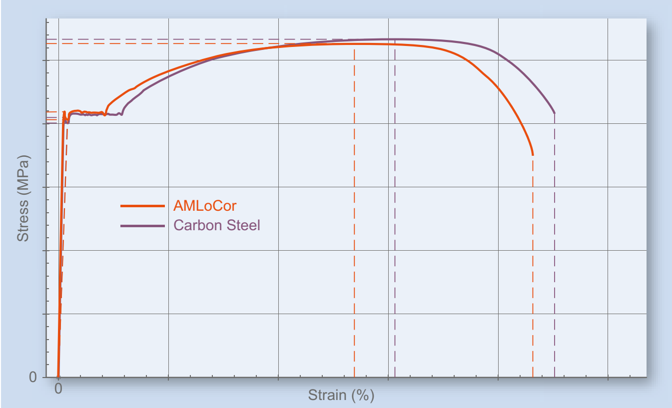
Steel grades of AMLoCor Blue for piling products are covered by the German National Technical Approval Z-30.10-55 of the Deutsche Institut für Bautechnik (DIBt).

The mechanical properties of AMLoCor steel are fully equivalent to standard piling grades, so that structural resistance can be determined according to all relevant design codes used for steel sheet piling structures, like EN 1993-5:2007 in European countries.

Some AZ sections are already available in AMLoCor steel grades, ranging from **AMLoCor Blue 320 to Blue 390** (yield strength 320 MPa up to 390 MPa). Please check our website for regular updates on available sections.

A driving test was performed in very compact soil in Denmark. Sheet piles in S 355 GP and AMLoCor Blue 355 were driven into very hard soils with some boulders. The sheet piles were monitored during driving, then pulled out and inspected. This test has demonstrated that the behaviour of AMLoCor sheet piles is equivalent to regular carbon steel sheet piles.

For more detailed information (e.g. on welding) please check our **brochure "AMLoCor®"**.



Typical Stress – Strain diagram of carbon steel & AMLoCor®.

Watertightness

Steel sheet piles are completely impervious. The only possibility of water infiltrating through a sheet pile wall is by penetration through the interlock. Due to its shape, the Larssen interlock naturally provides high seepage resistance. Sealing systems are therefore not necessary for applications such as temporary retaining walls where moderate rates of seepage are acceptable. If medium to high seepage resistance is required, e.g. cut-off walls for contaminated sites, retaining structures for bridge abutments or tunnels, double sheet piles with sealed or welded joints are recommended. **Please refer to our brochure "The impervious sheet pile walls" for further details.**

The following sealing systems are used to increase the watertightness of sheet pile walls:
– bituminous filler: **Beltan® Plus**, maximal water pressure: 100 kPa;
– wax & mineral-oil-based filler: **Arcoseal™**, maximal water pressure: 100 kPa;
– water-swelling product: **ROXAN® Plus** System, maximal water pressure: 200 kPa;
– **AKILA®** System, maximal water pressure: 300 kPa;
– welding: 100% watertight.

As Darcy's law for discharge through homogenous structures is not applicable to leakage phenomenon through sheet pile interlocks, a new concept of "joint resistance" has been developed by GeoDelft (Deltares).

$$q(z) = \rho \cdot \Delta p(z) / \gamma_W$$

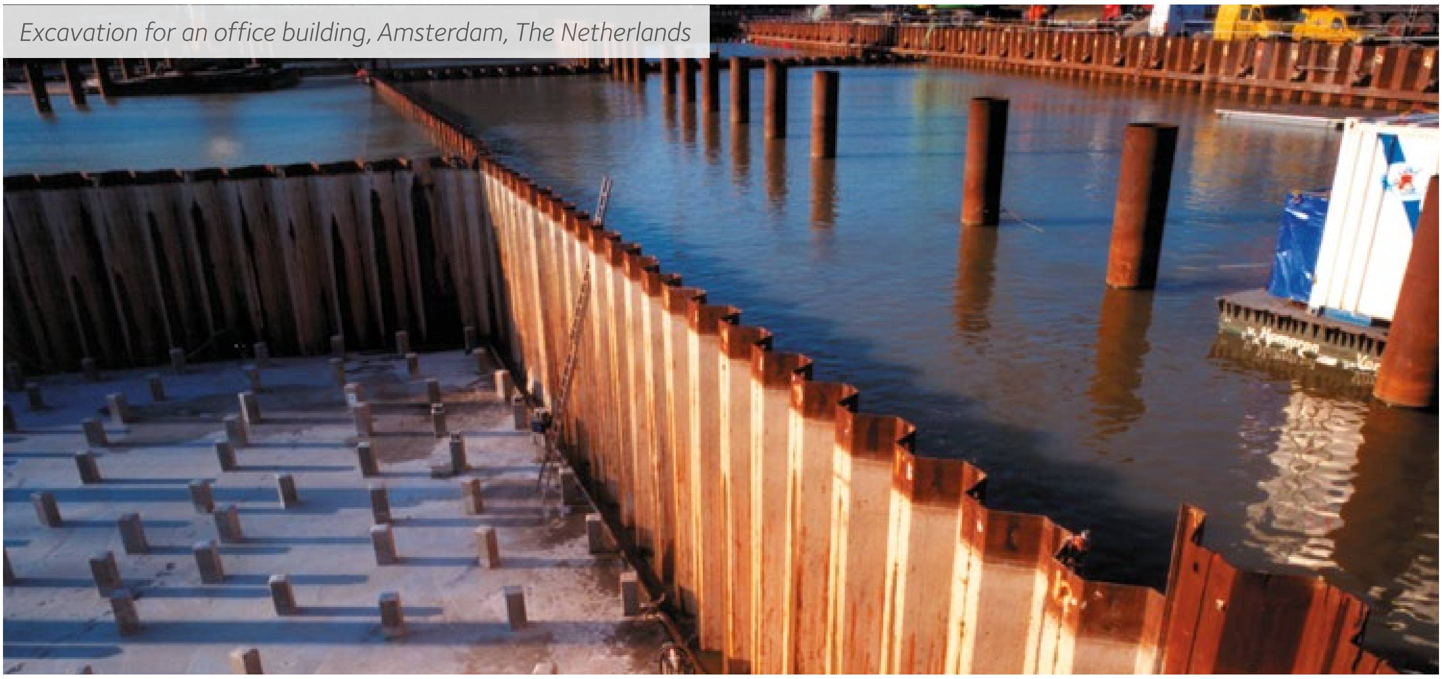
$q(z)$	water discharge [m³/s/m]
ρ	inverse joint resistance [m/s]
$\Delta p(z)$	pressure drop at level z [kPa]
γ_W	unit weight of water [kN/m³]

Sealing system/method	ρ [10^{-10} m/s]			Application of the system	Cost ratio[1)]
	100 kPa	200 kPa	300 kPa		
No sealant	> 1000	-	-	-	0
Beltan® Plus	< 600	not recommended	-	easy	1.0
Arcoseal™	< 600	not recommended	-	easy	1.2
ROXAN® Plus	0.5	0.5	-	with care	1.8
AKILA®	0.3	0.3	0.5	with care	2.1
Welded interlocks	0	0	0	2)	5.0

1) Cost ratio = $\frac{\text{Cost of sealing system}}{\text{Cost of Beltan® Plus Solution}}$

2) After excavation for the interlock to be threaded on jobsite.

Excavation for an office building, Amsterdam, The Netherlands

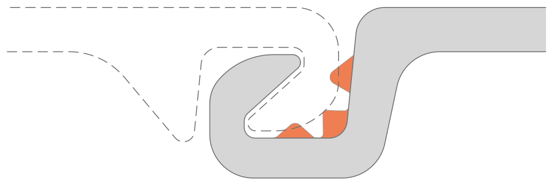


AKILA® sealing system

AKILA® is an **environmentally friendly high performance sealing system** for ArcelorMittal steel sheet piles. The system is based on three sealing "lips" mechanically extruded into the free interlocks using a product called MSP-1. The common interlock of double piles is sealed with a second product called MSP-2.

MSP-1 and MSP-2 belong to the family of **silane modified polymers** (MS-Polymers). Both products resist to humidity and weathering. Their main characteristics are:

- **single component elastic sealants** with a density of
  - 1.41 g/cm³ for MSP-1;
  - 1.48 g/cm³ for MSP-2;
- UV-stable;
- **excellent adhesion to steel;**
- resist to temperatures between -40°C and +90°C (up to 120°C for short periods);
- elongation at break > 380%;
- Shore A hardness after complete polymerization
  - 58 for MSP-1;
  - 44 for MSP-2 (after 14 days);
- durable in contact with freshwater, seawater as well as various hydrocarbons, bases and acids (depending on concentration – a complete list is available on request).



Sketch of MSP-1 product extruded into the free interlock.

MS-Polymers are solvent free and do not contain isocyanates. They can be considered as environmentally friendly products. AKILA® is certified by the "Hygiene-Institut des Ruhrgebiets" in Germany as suitable for use in contact with groundwater.
The free interlocks have to be chamfered at the top (see sketch). Penetration of soil into the interlocks during driving should be prevented, for instance by inserting a bolt at the bottom of the interlock (bolt tack welded).
The ambient temperature during installation must be above 0°C. Additionally, to improve the sliding of the interlocks, an environmentally friendly lubricant must be applied to the sealant in the interlocks prior to driving.
The layout and driving direction of the sheet pile wall shall be determined before ordering the sheet piles (delivery form of double piles, chamfering of interlocks, etc.).

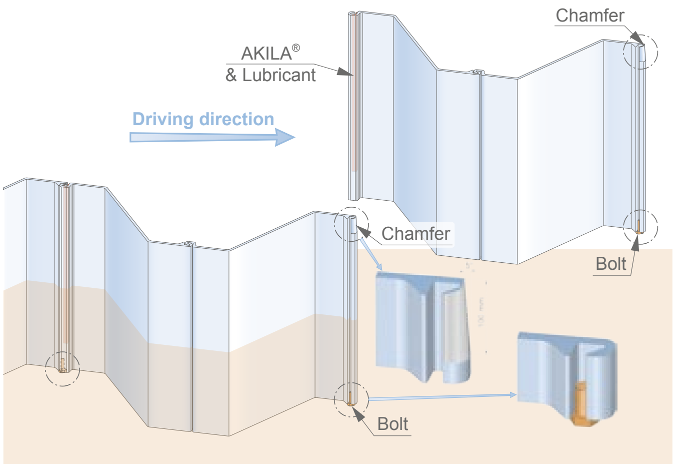
Inverse joint resistance ρ_m

A series of in-situ tests were carried out in stiff clays and in soft sandy soils. Single and crimped double sheet piles, fitted out with the AKILA® system, were driven into the ground using an impact hammer as well as a vibratory hammer.

In case of vibrodriving, sheet piles were driven continuously at a minimum penetration rate of 3 meters per minute. After installation, watertightness was tested at **water pressures of 2 and 3 bar**, according to a procedure developed by Delft Geotechnics (Deltares) and ArcelorMittal. The testing and the results were witnessed and certified by "Germanischer Lloyd", an independent third party.

The average **inverse joint resistance** ρ_m was determined according to EN 12063, see table below.

	ρ_m (m/s)	
Water pressure	200 kPa	300 kPa
Single piles (MSP-1)	4.9 x 10^{-11}	8.6 x 10^{-11}
Double piles (MSP-1 & MSP-2)	3.3 x 10^{-11}	4.7 x 10^{-11}



Installation recommendations (driving direction, chamfer, etc.).

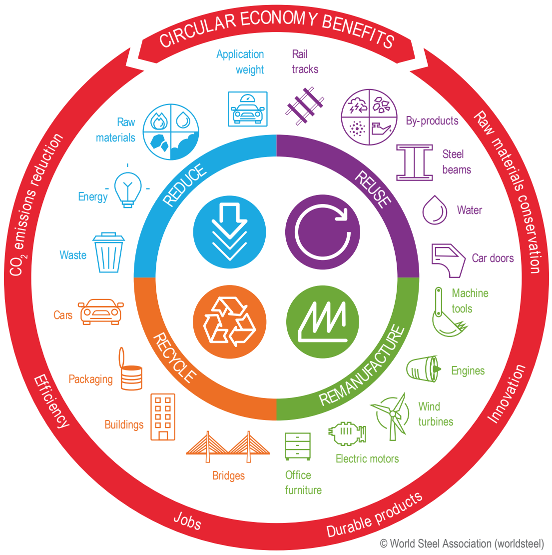
For more information contact our technical department.

Sustainability & Environmental Product Declaration (EPD)

ArcelorMittal is committed to lead the way in which the world views steel and champion steel's role in creating high quality, sustainable lifestyles for people all over the world. In 2010, it was the first steel manufacturer that performed a Life Cycle Assessment (LCA) dedicated to sheet piling products. Since 2016, ArcelorMittal's hot rolled steel sheet piles are covered by an Environmental Product Declaration.

ArcelorMittal's steel sheet piles are an environmentally friendly construction product. Along with other European steel products, they are produced in facilities that report transparent indicators for their environmental performance, which have certified quality management systems and protect their working force through Health & Safety policies. The environmental impact of ArcelorMittal's hot rolled steel sheet piles is documented in an Environmental Product Declaration (EPD), registered at the Institut Bauen und Umwelt e.V. (IBU), Germany.

Circular economy



ArcelorMittal Sheet Piling is also a major actor in the circular economy, promoting greater resource productivity aiming to reduce waste, avoid pollution, and monitor the material flows. This is in contrast to linear take-make-dispose economy, which wastes large amounts of embedded materials, energy, and labour.

Circular economy has the objective to reduce the creation of waste systematically throughout the different life cycles of a product.

Steel is a permanent material: never consumed, but continuously transformed; the use of natural resources for producing steel the first time is therefore a transformative process, making iron available in a more "practical form" for subsequent uses (life cycles) and thereby reducing the medium/long term pressure on natural resources.

Health & Safety

ArcelorMittal's core philosophy is to produce safe, sustainable steel, making health and safety the priority for the company. In the words of the group's chairman and CEO, Lakshmi Mittal:

"Everyone has the right to good health and safety. Equally, everyone has the responsibility to make this happen at home and at work. Leaders, machinery operators, office workers, contractors – we all need to believe that Journey to Zero is achievable and to feel responsible for health and safety".

The Journey to Zero Campaign is one of the strongest commitments of ArcelorMittal. It is founded on three pillars that are vital for a safer company: leadership from the top, workforce engagement that leads to shared vigilance, and evolution in practices as well as equipment through benchmarking and support from our Research & Development department.

Other certifications

ArcelorMittal brand values are sustainability, quality and leadership. ArcelorMittal Sheet Piling understands how the world is evolving, not only from an economic and market perspective, but also in terms of the social and environmental trends that will shape our future. Our strategic thinking is shaped to ensure a competitive cost position versus the competition, but also taking into account society's expectations for a more circular and lower carbon economy.

In order to demonstrate this full commitment, ArcelorMittal is certified by independent third bodies in accordance with international standards ISO 9001, ISO 14001, ISO 50001, BES 6001 and OHSAS 18001. This is essential to ensure continued success and to maintain the long-term leadership in the steel sheet piling sector.

ArcelorMittal Sheet Piling - Our commitment to sustainability

ArcelorMittal Sheet Piling's commitment to sustainability, environmental responsible steel production and circular economy is documented by the EcoSheetPile™ initiative.

This label certifies steel sheet pile ranges as 100% recycled, 100% recyclable, and reusable.

Environmental Product Declaration

ArcelorMittal is producing hot rolled steel sheet piling products in its European plants: Dabrowa in Poland, Belval and Differdange in Luxembourg. These sheet piling products are covered by an Environmental Product Declaration (EPD), registered by IBU, in accordance with the current European standards, and accepted by the ECO PLATFORM.
An EPD is a verified and registered document that communicates transparent and comparable information about the life cycle environmental impact of products.
It is created by the manufacturer, peer reviewed by independent bodies on the basis of ISO 14025 and EN 15804 standards as well as published by an environmental labelling organisation. Thus, EPDs are suitable as proof of environmental requirements in public procurement processes.

In order to develop this document, ArcelorMittal Sheet Piling has analysed the full production process and performed a Life Cycle Assessment of its steel sheet piling products.

Life Cycle Assessment

Developed in the 1990's, the Life Cycle Assessment (LCA) is a standardised methodology that analyses the potential environmental impacts of a product or a service during its production, use phase and end-of-life (ISO 14040). It has become an important tool to the steel industry as a way to assess and quantify the potential environmental footprint of steel products along their entire life cycle, from creation in a steel plant, to its end-of-life and recycling.
When performing an LCA it is also important to define the frame in which the assessment is made. In our case, the type of the EPD is a cradle-to-gate analysis, determining the different steps of steel making process, with options accouting for the following boundary conditions:

- resources: provision of resources, additives, and energy;
- transportation of resources and additives to the production site;
- steel making process analysis on site, including energy, production of additives, disposal and valorisation of production residues, and consideration of related emissions;
- waste processing (after-use);
- end-of-life scenarios (reuse and recycling).

All the data used in the LCA is collected through recommended templates developed by World Steel Association and its experts for Life Cycle Inventories (LCI) purpose.
For ArcelorMittal Sheet Piling, the data for the different sites was cross-checked with one another as well as with the previous years' data to identify potential inconsistencies and no processes, materials or emissions that are known to make a significant contribution to the environmental impact have been omitted.
Even though the period of time in which the steel sheet piles are being used in their different applications is not considered in the LCA, it is important to define the life span of sheet piles to highlight their durability as a construction material. On a conservative average sheet piles have an approximate life span of 50 years, but there are documented cases of sheet pile walls from the early decades of the 20th century that still work as they were designed.

Details about the EPD for ArcelorMittal steel sheet piles

ArcelorMittal has elaborated the Environmental Product Declaration (EPD) for the functional unit of 1 metric ton of hot rolled steel sheet piles (Z-piles, U-piles, AS 500®, and HZ®-M) produced by ArcelorMittal in the plants: Dabrowa, Belval and Differdange. It is based on a cradle-to-gate – LCA considering the options of:
- Module A1-A3: structural steel production;
- Module C3: sorting and shredding of after-use steel, non-recovered scrap due to sorting efficiency;
- Module D: End-of-Life scenarios, including reuse and recycling.

All information from the data collection process has been considered, covering all used and registered materials, thermal energy, electrical energy and fuel consumption. Measurement of on-site emissions took place and those emissions were considered. It is based on 100% of the annual production from 2015. For more information, please check our website: sheetpiling.arcelormittal.com.

Delivery conditions

Tolerances on shape and dimensions of hot rolled steel sheet piles according to EN 10248
(reduced tolerances on request)

Tolerances	AU™, PU®, GU®	AZ®	AS 500®	HZ®-M
Mass[1]	± 5%	± 5%	± 5%	±5%
Length (L)[2]	± 200 mm	± 200 mm	± 200 mm	± 200 mm
Height (h)[2]	h ≤ 200 mm: ± 4 mm h > 200 mm: ± 5 mm	h ≥ 300 mm: ± 7 mm	-	h ≥ 500 mm: ± 7 mm
Thicknesses (t,s)	t, s ≤ 8.5 mm: ± 0.5 mm t, s > 8.5 mm: ± 6%	t, s ≤ 8.5 mm: ± 0.5 mm t, s > 8.5 mm: ± 6%	t > 8.5 mm: ± 6%	t, s > 12.5 mm: –1.5 mm / +2.5 mm
Width single pile (b)	± 2% b	± 2% b	± 2% b	± 2% b
Width double pile (2b)	± 3% (2b)	± 3% (2b)	± 3% (2b)	± 3% (2b)
Straightness (q)	≤ 0.2% L	≤ 0.2% L	≤ 0.2% L	≤ 0.2% L
Ends out of square	± 2% b	± 2% b	± 2% b	± 2% b

[1] From the mass of the total delivery. [2] Of single pile.

Maximum rolling lengths (longer sections available on request)

Section	AZ	AU, PU	GU[1]	AS 500	HZ-M	RH / RZ	OMEGA 18	C9 / C14	DELTA 13
Length [m]	31	31	28	31	33	24	16	18	17

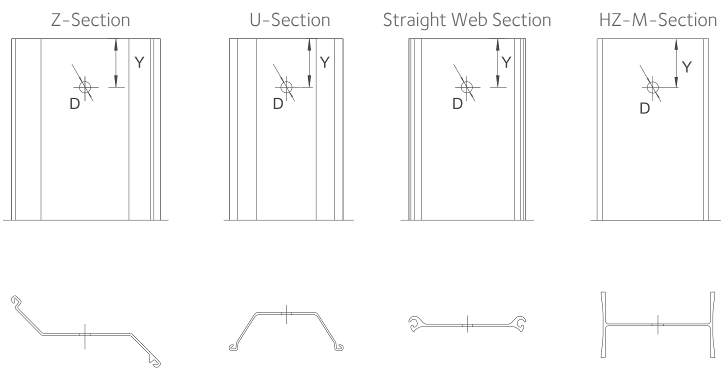
[1] Contact us for detailed information.

Handling holes

Sheet pile sections are normally supplied without handling holes. If requested, they can be provided with handling holes in the centerline of the section. The standard handling hole dimensions are as follows:

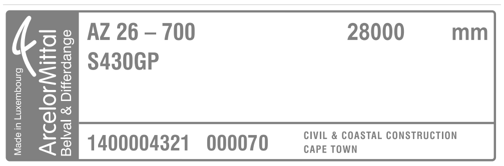
Diameter D [mm]	40	40	50	50	63.5	40
Distance Y [mm]	75	300	200	250	230	150

Diameter D [in]	2.5
Distance Y [in]	9



Markings

The following markings can be supplied on request:
- colour marks defining section, length and steel grade;
- adhesive stickers showing the customer's name, destination, order and item number, type and length of profile and steel grade.



Steel grades of sheet pile sections

Steel grade EN 10248	Min. yield strength R_{eH} MPa	Min. tensile strength R_m MPa	Min. elongation $L_o=5.65\sqrt{S_o}$ %	Chemical composition[1] (% max) C	Mn	Si	P	S	N[2), 3)]
S 240 GP	**240**	340	26	0.25	–	–	0.055	0.055	0.011
S 270 GP	**270**	410	24	0.27	–	–	0.055	0.055	0.011
S 320 GP	**320**	440	23	0.27	1.70	0.60	0.055	0.055	0.011
S 355 GP	**355**	480	22	0.27	1.70	0.60	0.055	0.055	0.011
S 390 GP	**390**	490	20	0.27	1.70	0.60	0.050	0.050	0.011
S 430 GP	**430**	510	19	0.27	1.70	0.60	0.050	0.050	0.011
ArcelorMittal mill specification									
S 460 AP	**460**	550	17	0.27	1.70	0.60	0.050	0.050	0.011

AMLoCor®	Min. yield strength R_{eH} MPa	Min. tensile strength R_m MPa	Min. elongation $L_o=5.65\sqrt{S_o}$ %	Chemical composition[1] (% weight) (% max.) C	Mn	Si	P	S	N[2), 3)]	(% min.) Cr	Al
Blue 320	**320**	440	23	0.27	1.70	0.60	0.05	0.05	0.011	0.75	0.40
Blue 355	**355**	480	22	0.27	1.70	0.60	0.05	0.05	0.011	0.75	0.40
Blue 390	**390**	490	20	0.27	1.70	0.60	0.05	0.05	0.011	0.75	0.40

All the sections can be delivered in steel grades according to EN 10248-1, but not all sections are available in all steel grades. Below table summarizes the current possibilities. Special steel grades like **S 460 AP**, American **ASTM A 572** steel grades, steels with improved corrosion resistance like **AMLoCor** and **ASTM A 690**, or steels with copper addition in accordance with EN 10248 Part 1 Chapter 10.4 can be supplied on request. A modified steel grade A 690 with higher yield strength is also available upon request.

Please contact us for information.
Galvanisation has an influence on the required chemical composition of the steel and must therefore be specified in the purchase orders.
We strongly recommend informing us of all surface treatment to be applied to the product when placing orders.
ArcelorMittal can also provide steel grades complying with other standards (see table below).

Europe	EN 10248	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 AP
USA	ASTM	A 328	-	A 572 Gr. 50; A 690	A 572 Gr. 55	A 572 Gr. 60	A 572 Gr. 65
Canada	CSA	Gr. 260 W	Gr. 300 W	Gr. 350 W	Gr. 400 W	-	-
Japan	JIS	SY 295	-	-	SY 390	-	-

Section \ Steel Grade	EN 10248 S 240 GP	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 AP	ASTM A 572	A 690
AZ-700 to 800	✓	✓	✓	✓	✓	✓	✓	✓	✓
AZ	✓	✓	✓	✓	✓	✓	✓	✓	✓
AU	✓	✓	✓	✓	✓	✓	✓	✓	✓
PU	✓[4)]	✓[4)]	✓[4)]	✓	✓	✓[5)]	✓[5)]	✓	✓[5)]
GU-N/S	✓	✓	✓	✓	✓	✓	✓[6)]	❖	×
GU-400	✓	✓	✓	✓	✓	❖	❖	❖	×
HZ-M	✓	✓	✓	✓	✓	✓	✓[7)]	✓	✓
RH / RZD / RZU	×	×	×	×	×	✓	✓	×	✓
C 9	×	×	×	✓	×	×	×	✓	×
C 14	×	×	×	✓	×	×	×	×	×
Delta 13	×	×	×	✓	×	×	×	×	×
Omega 18	×	×	×	×	×	✓	✓	×	×

Section	AMLoCor® Blue 320	Blue 355	Blue 390
AZ 20-800	✓	✓	✓
AZ 19-700	✓	✓	✓
AZ 20-700	✓	✓	✓
AZ 26-700	✓	✓	✓
AZ 28-700	✓	✓	✓
AZ 38-700N	✓	✓	×
AZ 40-700N	✓	✓	×
AZ 44-700N	✓	✓	×
AZ 46-700N	✓	✓	×
AZ 26	✓	✓	✓
C 9	×	✓	×

1) Product analysis. Maximum copper content of 0.6% for non-alloyed steel.
2) It is permissible to exceed the specific values provided that for each increase of 0.001% N, the P max content will be reduced by 0,005%. However, the N content shall not exceed 0.012% on the ladle analysis and 0.014% on the product analysis.
3) The maximum value for nitrogen does not apply if the chemical composition shows a minimum total Al content of 0.020% or if sufficient other N binding elements are present.
4) Except PU 12 & derivates.
5) PU 12 & derivates on request.
6) GU 11N & derivates on request.
7) HZ 1180M C and HZ 1180M D on request.

✓ Available.
❖ On request.
× Currently unavailable.

Geometric tolerances of tubular piles

Tolerance on pile length: +/- 200 mm

Standard	Outside diameter D		Wall thickness t	Straightness	Out-of-roundness		Mass	Maximum weld bead height[1]
EN 10219-2	+/- 1% +/- 10.0		+/- 10% +/- 2.0	0.20% of total length	+/- 2%		+/- 6%	t ≤ 14.2: 3.5 t > 14.2: 4.8
API 5L ISO 3183	≤ 1422	+/- 0.5% ≤ 4.0	< 15.0: +/- 10% ≥ 15.0: +/- 1.5	0.20% of total length	D/t ≤ 75 D < 1422	+/- 1.5% ≤ 15.0	+ 10% - 3.5%	t ≤ 13.0: 3.5 t > 13.0: 4.5
	> 1422	as agreed			else	as agreed		

[1] Tolerance on height of internal and external weld bead for submerged arc-welded hollow sections.
Note: values in "mm" except where specified.

Steel grades of tubular pile

Steel grade EN 10219-1	Min. yield strength R_{eH} (t ≤ 16 mm) MPa	Min. yield strength R_{eH} (16 < t ≤ 40 mm) MPa	Min. tensile strength R_m (3 ≤ t ≤ 40 mm) MPa	Min. elongation L_o (t ≤ 40 mm) %	Chemical composition (% max) C	Mn	P	S	Si	N	CEV (t ≤ 20 mm)
S 235 JRH	**235**	225	340-470	24	0.17	1.40	0.040	0.040	-	0.009	0.35
S 275 J0H	**275**	265	410-560	20	0.20	1.50	0.035	0.035	-	0.009	0.40
S 355 J0H	**355**	345	490-630	20	0.22	1.60	0.035	0.035	0.55	0.009	0.45
S 420 MH	**420**	400	500-660	19	0.16	1.70	0.035	0.030	0.50	0.020	0.43
S 460 MH	**460**	440	530-720	17	0.16	1.70	0.035	0.030	0.60	0.025	-

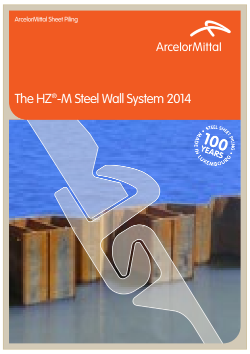
Steel grade API 5L[1] ISO 3183	Min. yield strength R_{eH} MPa	Min. tensile strength R_m MPa	Min. elongation[2] %	Chemical composition for PSL 1 pipe with t ≤ 25.0 mm[4] (% max) C[3]	Mn[3]	P	S
L 245 or **B**	**245**	415	23	0.26	1.20	0.030	0.030
L 290 or **X 42**	**290**	415	23	0.26	1.30	0.030	0.030
L 320 or **X 46**	**320**	435	22	0.26	1.40	0.030	0.030
L 360 or **X 52**	**360**	460	21	0.26	1.40	0.030	0.030
L 390 or **X 56**	**390**	490	19	0.26	1.40	0.030	0.030
L 415 or **X 60**	**415**	520	18	0.26[5]	1.40[5]	0.030	0.030
L 450 or **X 65**	**450**	535	18	0.26[5]	1.45[5]	0.030	0.030
L 485 or **X 70**	**485**	570	17	0.26[5]	1.65[5]	0.030	0.030

[1] API 5L (2007): American Petroleum Institute / ISO 3183 (2007). PSL: Product Specification Level.
[2] Minimum elongation: depends on tensile test piece cross-sectional area.
[3] For each reduction of 0.01 % below the specified max C concentration, an increase of 0.05 % above the specified max Mn concentration is permissible, up to a max of 1.65 % for grades L245/B to L360/X52, 1.75 % for L390/X56 to L450/X65 and 2.00 % for L485/X70.
[4] 0.50 % max for Cu, 0.50 % max for Ni, 0.50 % max for Cr, 0.15 % max for Mb.
[5] Unless otherwise agreed.

Tubular pile mill, Dintelmond, The Netherlands

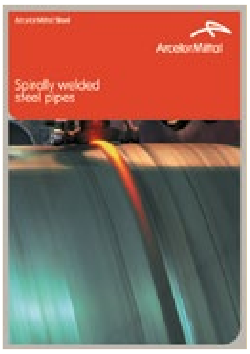
Documentation

Please refer to our website to download all our documentation: **sheetpiling.arcelormittal.com**
or contact us via E-mail: **sheetpiling@arcelormittal.com**

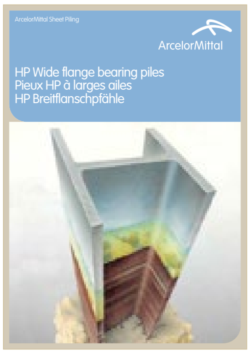


The HZ®-M Steel Wall System
GB, DE, FR, US, IT, SP, PT

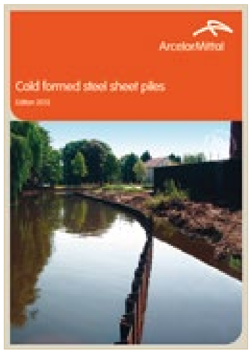
AS 500® Straight web steel sheet piles. Design and and Execution.
GB



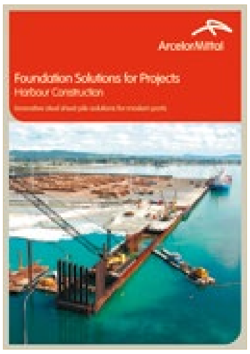
Spirally welded steel pipes
GB



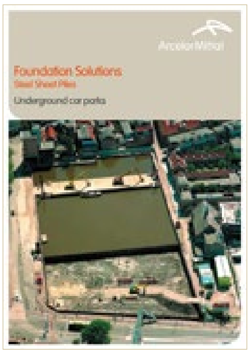
HP bearing piles
GB, DE, FR, SP



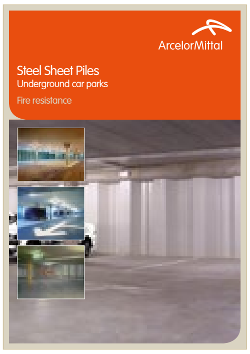
Cold formed steel sheet piles
GB, DE, FR, NL



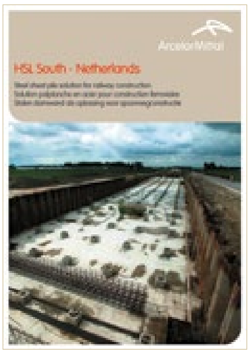
Harbour construction
GB



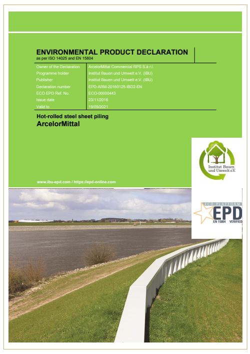
Underground car parks
GB, PT



Underground car parks
Fire resistance
GB

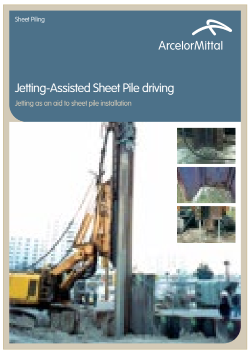


High speed line south – NL
GB, FR, NL

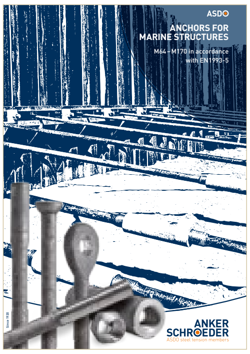


Environmental
Product Declaration
GB

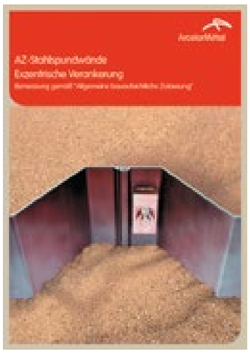
Installation of sheet piles
GB, DE, FR



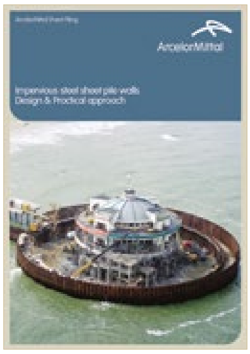
Jetting-assisted sheet pile driving
GB, DE, FR



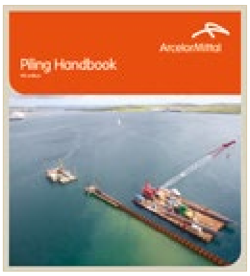
Anchoring of sheet piles
GB, DE



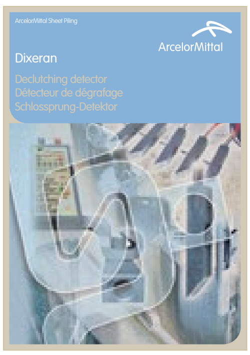
Off-centre anchoring
GB, DE, FR



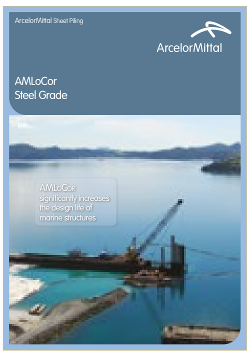
Impervious steel sheet pile walls
GB, DE, FR



Piling Handbook
GB

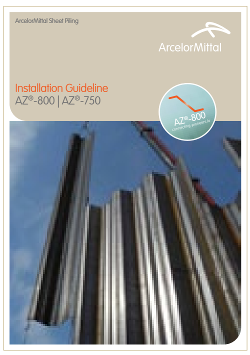


Declutching detector
GB, DE, FR

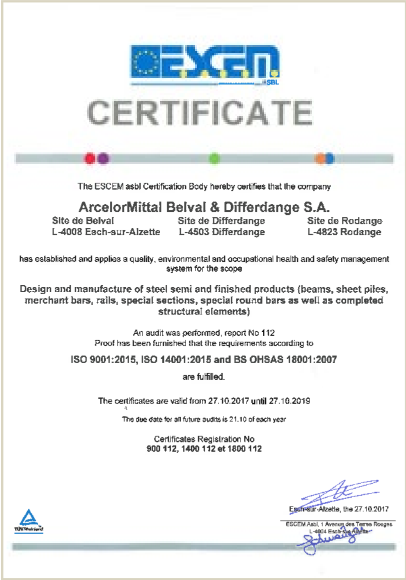


AMLoCor Steel Grade
GB, DE, RU

AZ sheet piles in combined walls
GB, DE, FR



Installation Guideline
AZ®-800 | AZ®-750
GB, DE



CERTIFICATE

The ESCEM asbl Certification Body hereby certifies that the company

ArcelorMittal Belval & Differdange S.A.

Site de Belval	Site de Differdange	Site de Rodange
L-4008 Esch-sur-Alzette	L-4503 Differdange	L-4823 Rodange

has established and applies a quality, environmental and occupational health and safety management system for the scope

Design and manufacture of steel semi and finished products (beams, sheet piles, merchant bars, rails, special sections, special round bars as well as completed structural elements)

An audit was performed, report No 112
Proof has been furnished that the requirements according to

ISO 9001:2015, ISO 14001:2015 and BS OHSAS 18001:2007

are fulfilled.

The certificates are valid from 27.10.2017 until 27.10.2019

The due date for all future audits is 21.10 of each year

Certificates Registration No
900 112, 1400 112 et 1800 112

Esch-sur-Alzette, the 27.10.2017

ESCEM Asbl, 1 Avenue des Terres Rouges
L-4004 Esch-sur-Alzette

Certificate

Standard	**ISO 50001:2011**
Certificate Registr. No.	01 407 125095
Certificate Holder:	**ArcelorMittal Belval & Differdange S.A.** Site d'Esch-Belval • L - 4008 Esch-sur-Alzette Including the locations **Site de Differdange** Rue Emile Mark • L – 4503 Differdange **Site de Rodange** 2 rue de l'Indutrie • L – 4823 Rodange
Scope:	Design and manufacture of steel semi and finished products (beams, sheet piles, merchant bars, rails, special sections, special round bars as well as completed structural elements) Proof has been furnished by means of an audit that the requirements of ISO 50001:2011 are met.
Validity:	The certificate is valid from 2016-11-05 until 2019-11-04. First certification 2013

2016-10-24

TÜV Rheinland Cert GmbH
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