ArcelorMittal Sheet Piling

ArcelorMittal

Steel Foundation Solutions

General Catalogue 2016










Cover:
Port of Ibiza, Spain

Steel Foundation Solutions

Steel Sheet Piling

General Catalogue 2016

EcoSheetPile™

100% recycled | recyclable

reusable steel

Trademarks

ArcelorMittal is the owner of following trademark applications or registered trademarks:
“AS 500”, “AU”, “AZ”, “GU”, “HZ”, “PU”, “AMLoCor”, “AKILA”, “Beltan”, “ROXAN”, “Arcoseal”.

In communications and documents the symbol ™ or ® must follow the trademark on its first or most prominent instance, for example:
AZ®, AU™

Credit lines must be used on all communications and documents where a trademark is used, for example:
AZ is a trademark of ArcelorMittal group
AU, AZ and HZ are trademarks of ArcelorMittal group
AZ 26-700 is a steel sheet pile manufactured by ArcelorMittal group

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ArcelorMittal Sheet Piling (group)

New
AZ 20-800
AZ 25-800
AZ 30-750
AZ 50-700
AS 500-13.0

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

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

Additionally, ArcelorMittal Sheet Piling can supply a complete package and accessories, including anchorage material, walers, fabricated piles, coated piles, driving caps, etc.

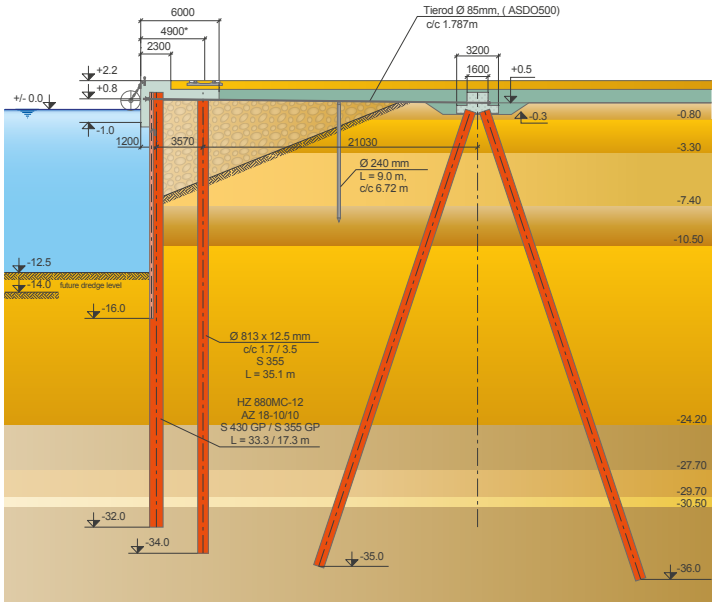
ArcelorMittal Belval is the world's largest rolling mill of hot rolled steel sheet piles and has been playing a leading role in the development of piling technology for over 100 years. The first steel sheet piles were rolled in 1911 and 1912: the "Ransome" and "Terre Rouge" piles. Since then the production 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® 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 some 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

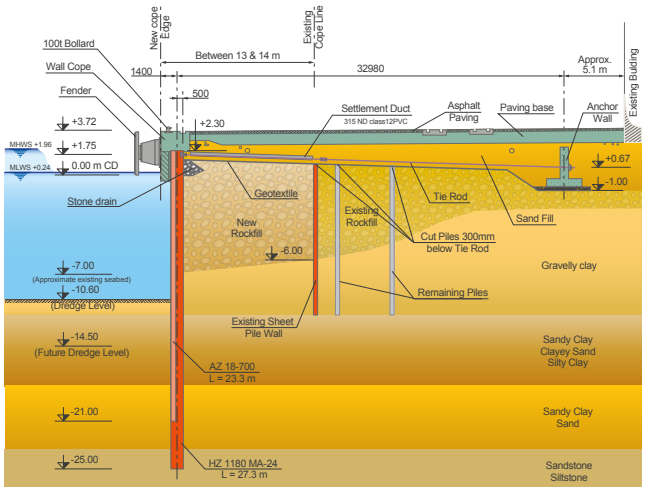
Sheet pile catalogues, 1912

In-house design team

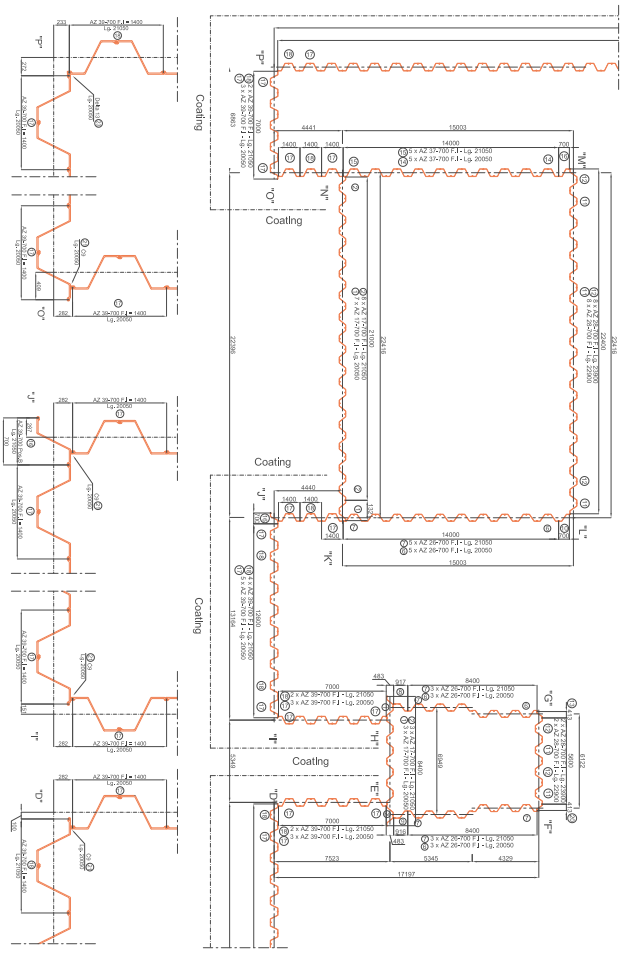
Services provided free of charge by ArcelorMittal's in-house design and support teams are:

- 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;
- promotion of "green sheet piles", including Life Cycle Assessment (LCA).

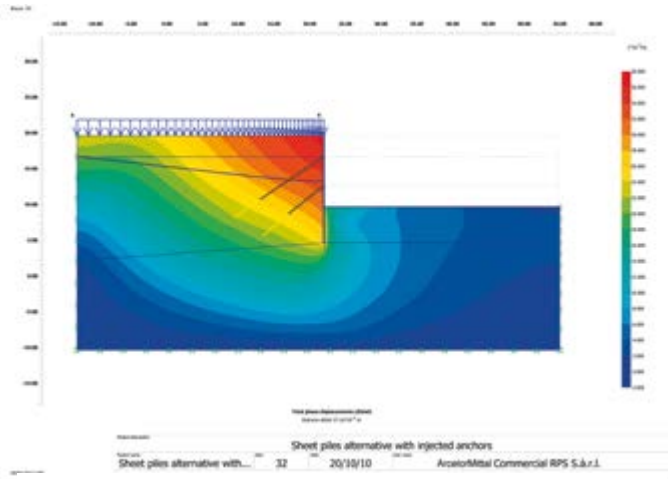
Please note that the legal responsibility for the final structure remains with the owner.



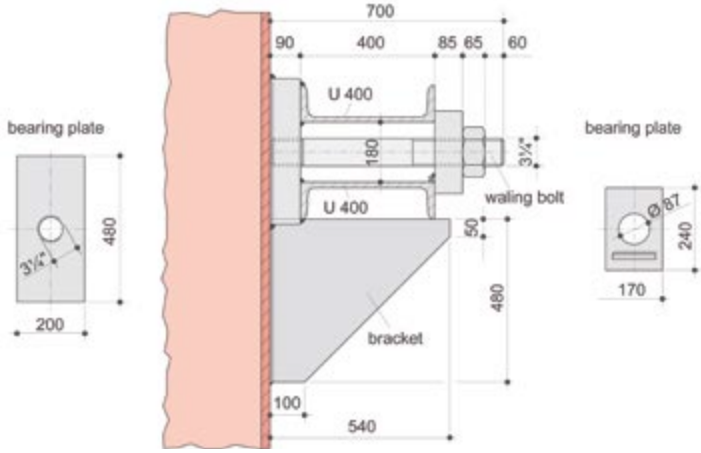
Feasibility studies



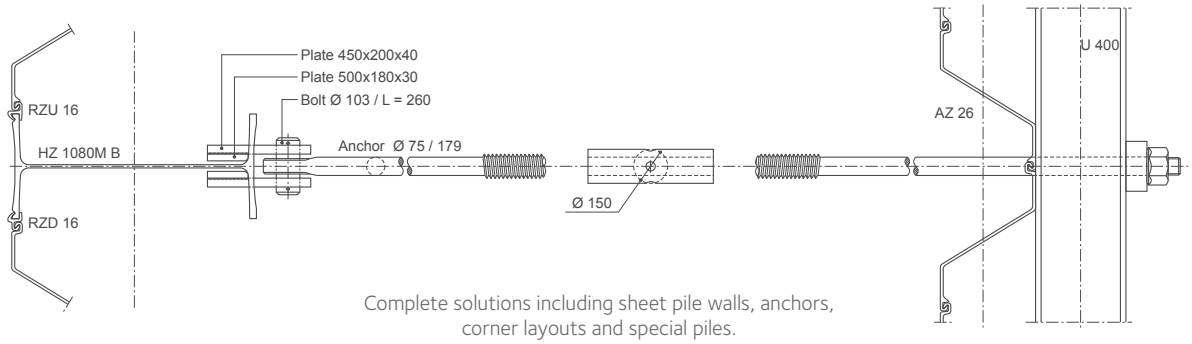
Sheet pile installation drawings



Preliminary designs

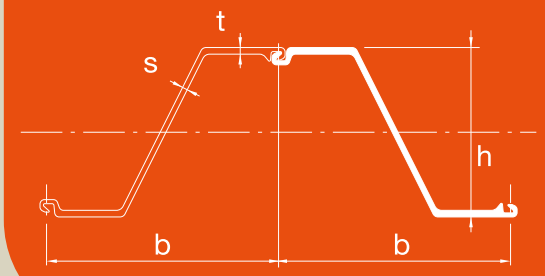


Solutions for execution details



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:

New
AZ 20-800
AZ 25-800
AZ 30-750
AZ 50-700

– 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	cm^2/m	single pile kg/m	wall kg/m^2	cm^4/m	cm^3/m	cm^3/m	cm^3/m	S 240 GP	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 AP
AZ®-800																		
New 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																		
New 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

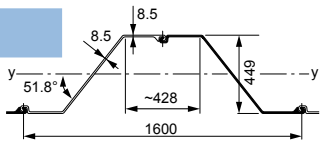
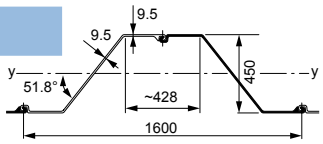
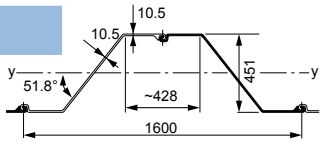
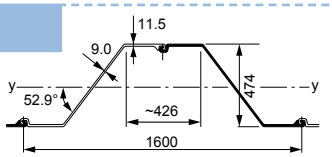
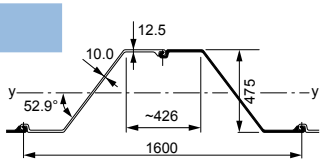
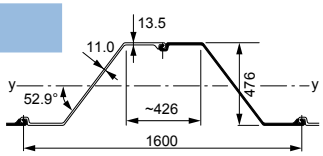
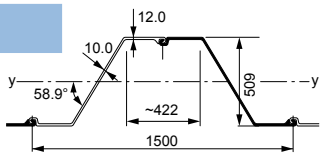
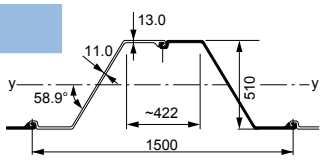
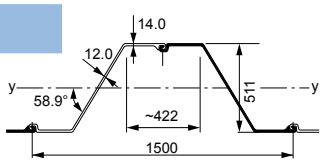
Section	Width	Height	Thickness		Sectional area	Mass		Moment of inertia	Elastic section modulus	Static moment	Plastic section modulus	Class[1]						
	b	h	t	s		single pile	wall					S 240 GP	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 AP
	mm	mm	mm	mm	cm^2/m	kg/m	kg/m^2	cm^4/m	cm^3/m	cm^3/m	cm^3/m							
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
New **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.
Steel grade S 460 AP following specifications of the mill is available on request.
[2] AZ® sections can be rolled-up or down by 0.5 mm and 1.0 mm on request.

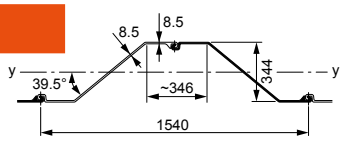
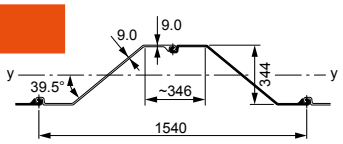
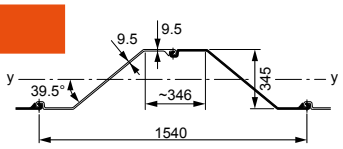
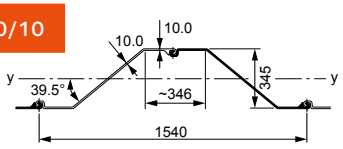
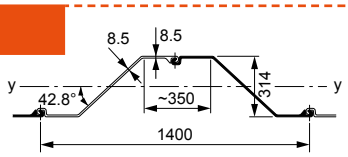
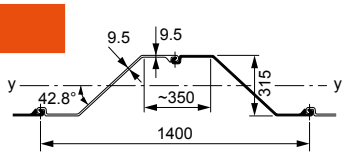
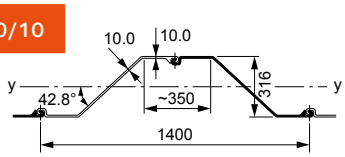
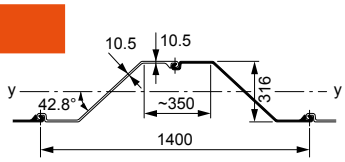
The new AZ series are available for shipment since:

- AZ 25-800 & AZ 30-750: 4th quarter of 2015
- AZ 20-800 & AZ 50-700: 1st semester of 2016

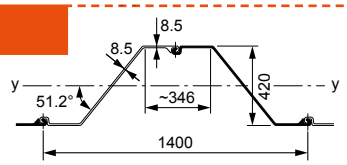
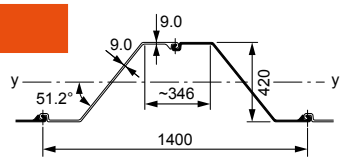
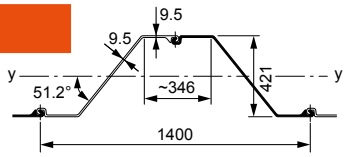
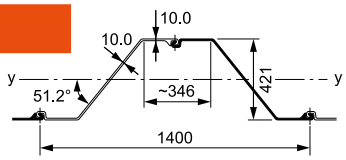
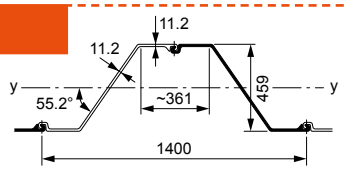
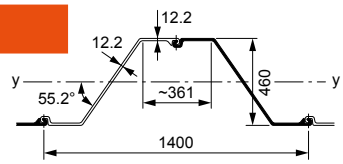
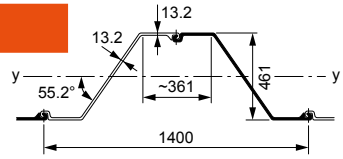
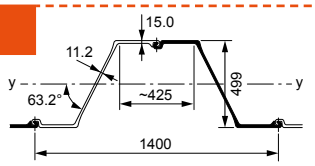
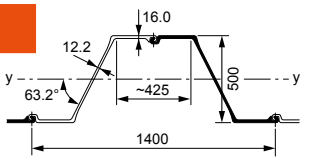
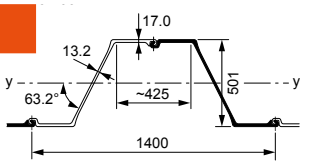
Please contact us for more detailed information.

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®-800							
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 	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 	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 	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 	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 	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 	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 	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 	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

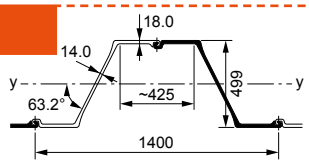
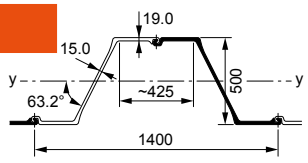
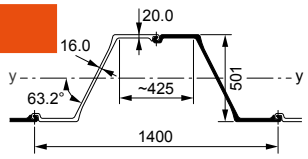
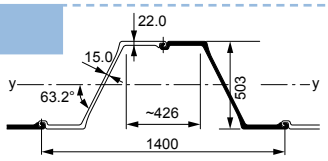
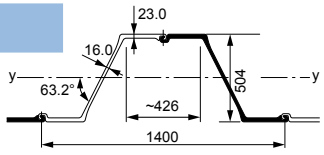
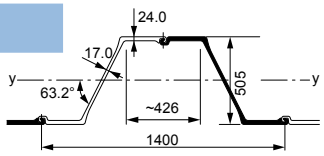
[1)] One side, excluding inside of interlocks.

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®-700 and AZ®-770							
AZ 12-770 	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 	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 	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 	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 	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 	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 	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 	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.

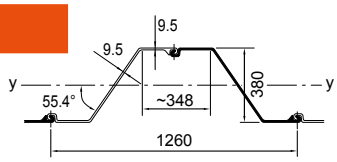
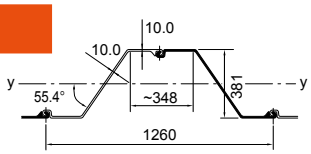
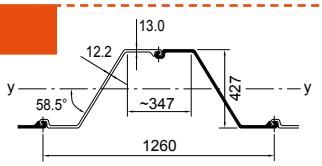
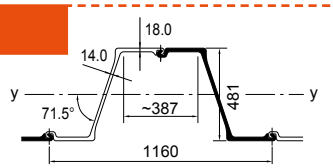
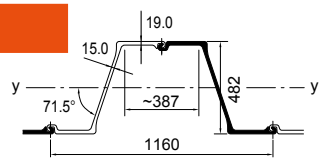
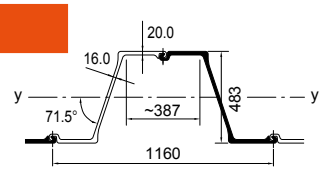
Section	S = Single pile D = Double pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
		cm²	kg/m	cm⁴	cm³	cm	m²/m
AZ 17-700 	Per S	93.1	**73.1**	25360	**1210**	16.50	0.93
	Per D	186.2	**146.2**	50720	**2420**	16.50	1.86
	Per m of wall	133.0	**104.4**	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	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
		cm²	kg/m	cm⁴	cm³	cm	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
New **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

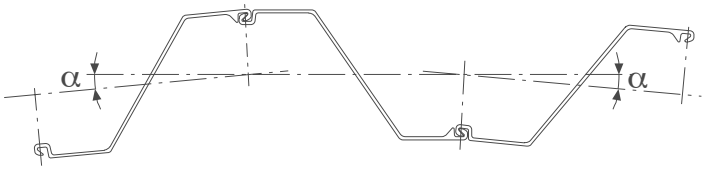
Section	S = Single pile D = Double pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
		cm²	kg/m	cm⁴	cm³	cm	m²/m
AZ®							
AZ 18 	Per S	94.8	**74.4**	21540	**1135**	15.07	0.86
	Per D	189.6	**148.8**	43080	**2270**	15.07	1.71
	Per m of wall	150.4	**118.1**	34200	**1800**	15.07	1.35
AZ 18-10/10 	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 	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 	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 	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 	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

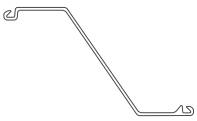
Interlock

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

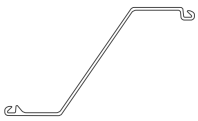


Delivery form

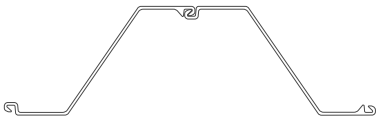
Single Pile
Position A



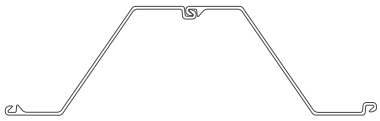
Single Pile
Position B



Double Pile
Form I (standard)

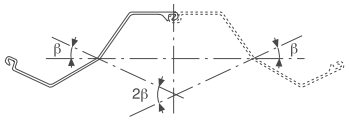


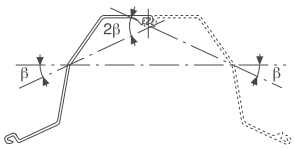
Double Pile
Form II (on request)



Bent piles

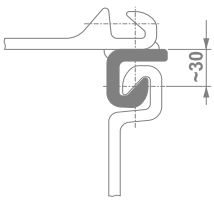
Maximum bending angle: $\beta = 25°$. Z-piles are bent in the middle of the web. They are generally delivered as single piles. Double piles are available upon request.



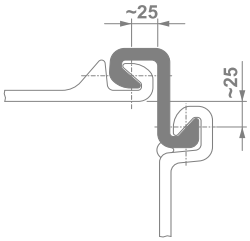


Corner sections

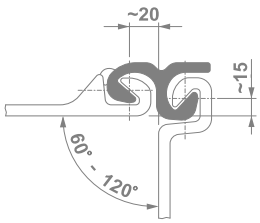
C 9
Mass ~ 9.3 kg/m



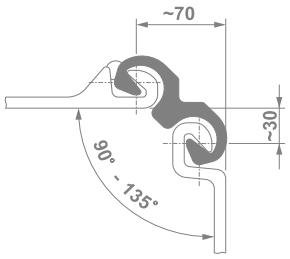
C 14
Mass ~ 14.4 kg/m



DELTA 13
Mass ~ 13.1 kg/m



OMEGA 18
Mass ~ 18.0 kg/m

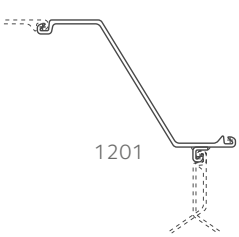


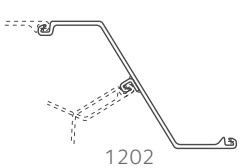
Special corner sections interlocking with Z-sections make it possible to form corner or junction piles without using fabricated special piles. Corner sections are fixed to the sheet pile in accordance with EN 12063.

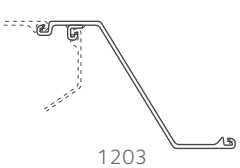
Different welding specifications are available on request. The corner sections are threaded and welded with a 200 mm setback from the top of the piles.

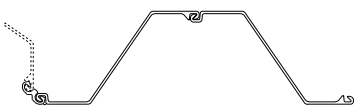
Corner and junction piles

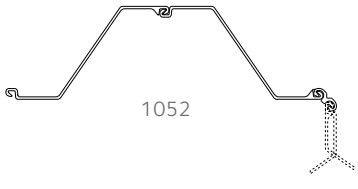
The following special piles, among others, are available as single and double piles on request.











Crimping

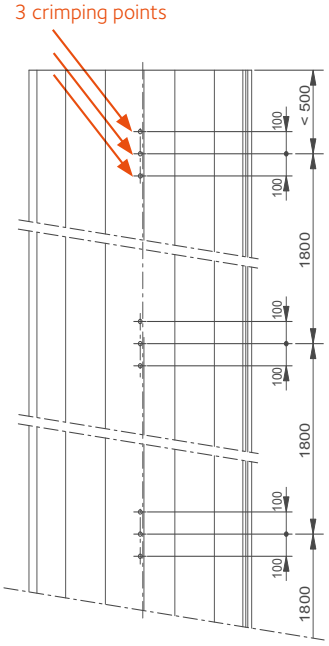
Threaded AZ® double piles are recommended for facilitating the installation process. AZ double piles are not crimped for statical reasons. However, due to customer demand, most of our AZ piles are crimped according to our standard specification, for the following reasons:

- Single piles easily bend around the weak axis under driving;
- Faster installation progress with double piles.

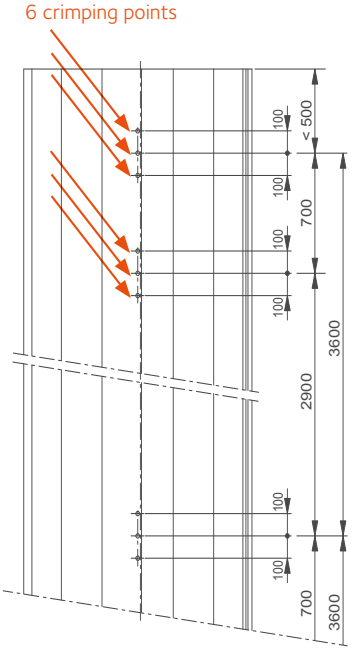
Pile length < 6 m:
3 crimping points per 1.8 m
= 1.7 crimping points per m[1)]

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

3 crimping points



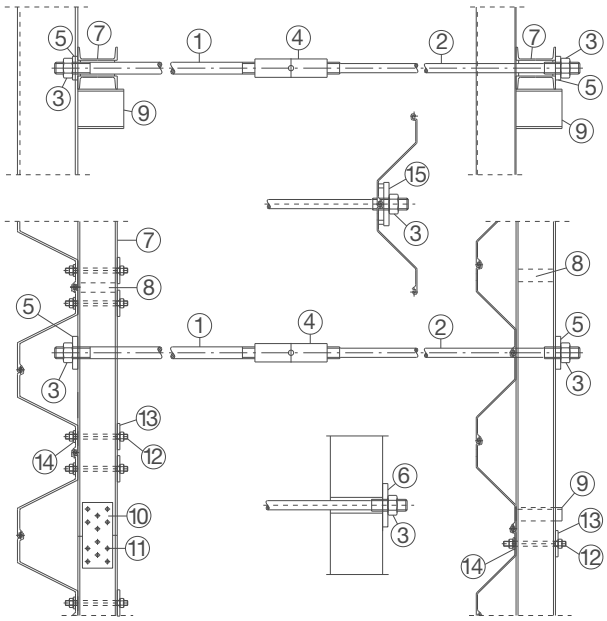
6 crimping points



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

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 a certain distance behind the main wall. Other anchor systems, like injection anchors or anchor piles, can also be used. The drawing shows a typical horizontal tie-rod connection for sheet pile walls. The following components can be seen:

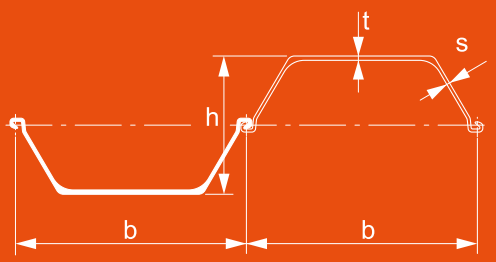


1 Plain tie-rod
2 Upset end tie-rod
3 Nut
4 Turnbuckle
5 Bearing plate
6 Bearing plate on concrete
7 Waling
8 Spacer
9 Supporting bracket
10 Splicing plate
11 Splicing bolt
12 Fixing bolt
13, 14, 15 Fixing plate


© Ebsary


© Hayward Baker

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 statical 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	cm^2/m	single pile kg/m	wall kg/m^2	cm^4/m	cm^3/m	cm^3/m	cm^3/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	2	2	2	3
PU 12-10/10	600	360	10.0	10.0	148	69.6	**116**	22580	**1255**	755	1535	2	2	2	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	100	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[2]
GU® sections																		
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.

[2] The steel grade S 460 AP according to mill specification of ArcelorMittal is available on request.
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 and AU™ sections can be rolled-up or -down by 0.5 mm and 1.0 mm. Other sections on request.

Characteristics – AU™ sections

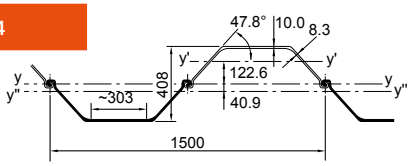
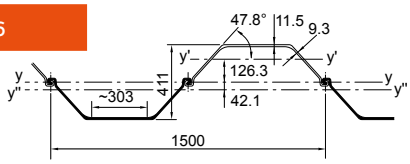
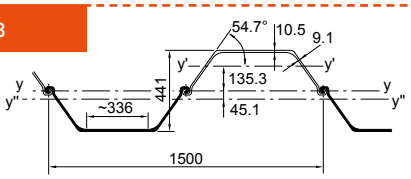
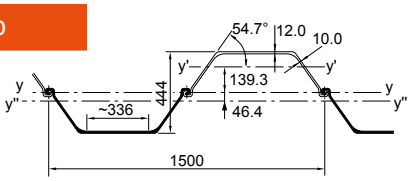
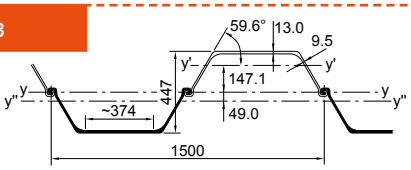
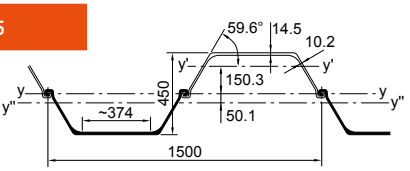
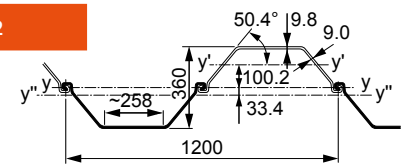
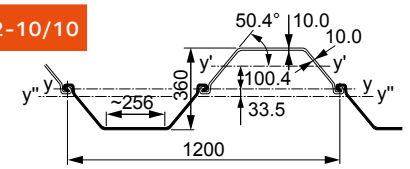
A weight reduction of about 10% compared to the 600 mm PU series has been achieved by optimising the geometric dimensions. The increased width **allows faster installation,** reduces the amount of coating required, due to the smaller perimeter, and increases watertightness thanks to fewer interlocks per metre of wall. Despite their greater width, the driving energy required for AU piles is no 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.

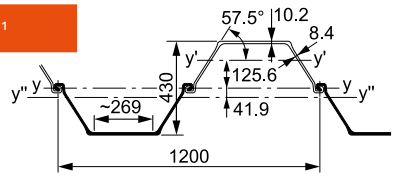
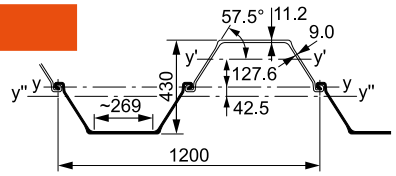
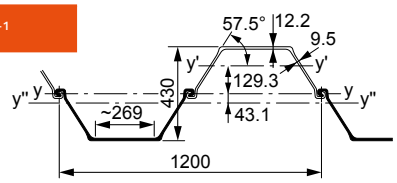
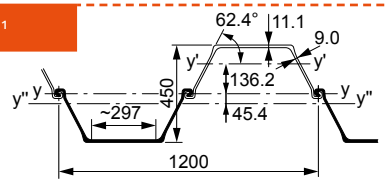
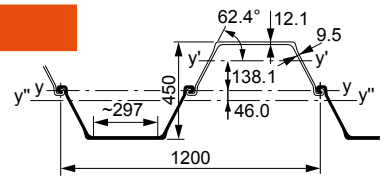
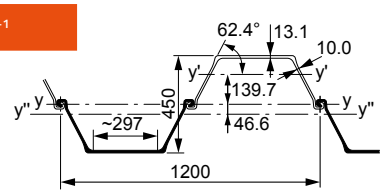
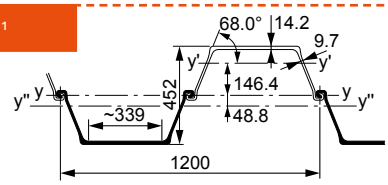
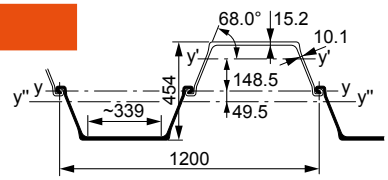
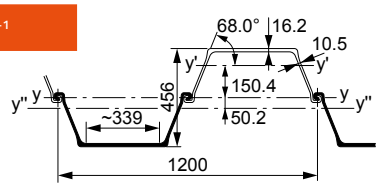
Characteristics – GU® sections

ArcelorMittal's rolling mill in Dabrowa, Poland, produces hot rolled U-shaped steel sheet piles. The rolling mill added during the last years new sections to their portfolio: GU 7N, GU 14N, GU 18N, and in 2014 the **GU 28N** and **GU 32N** range.

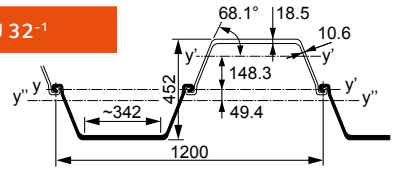
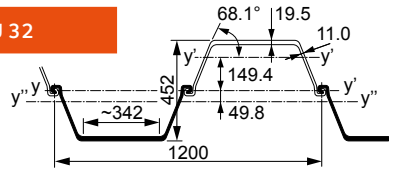
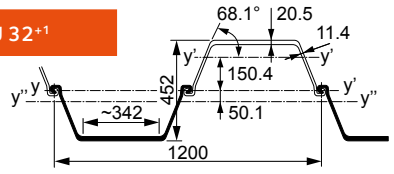
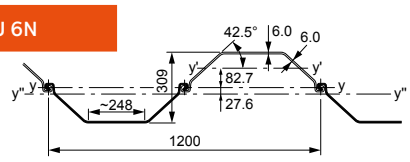
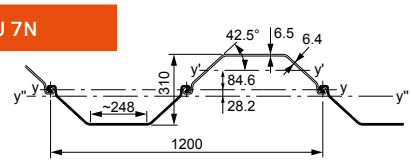
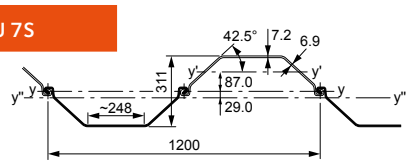
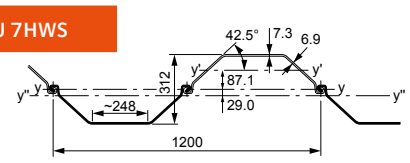
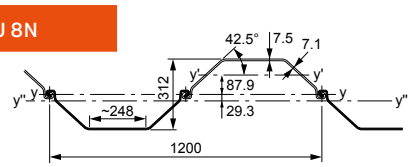
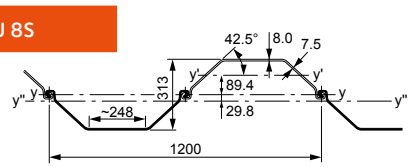
Section	S = Single pile D = Double pile T = Triple pile	Sectional area	Mass	Moment of inertia	Elastic section modulus	Radius of gyration	Coating area[1)]
		cm²	kg/m	cm⁴	cm³	cm	m²/m
AU™ sections							
AU 14 	Per S	99.2	**77.9**	6590	**457**	8.15	0.96
	Per D	198.5	**155.8**	43020	**2110**	14.73	1.91
	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 	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 	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 	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 	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 	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 	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 12-10/10 	Per S	88.7	**69.6**	4600	**377**	7.20	0.80
	Per D	177.3	**139.2**	27100	**1505**	12.36	1.59
	Per T	266.0	**208.8**	37670	**1765**	11.90	2.38
	Per m of wall	147.8	**116.0**	22580	**1255**	12.36	1.32

[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)]
		cm²	kg/m	cm⁴	cm³	cm	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 	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 	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 	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 	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 	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 	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 	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 	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

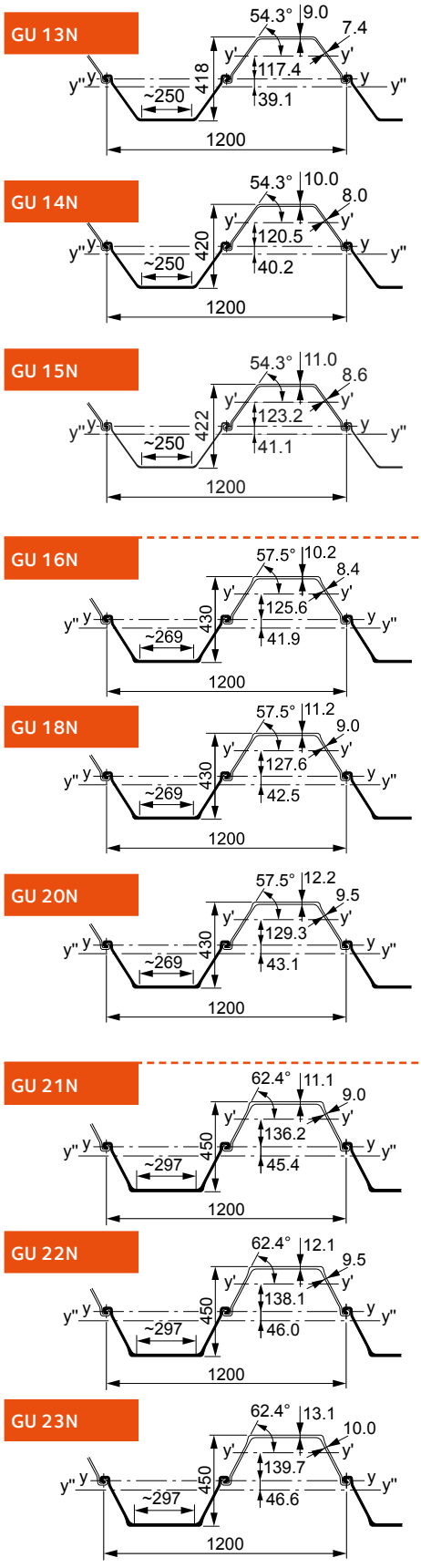
[1)] One side, excluding inside of interlocks.

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
PU® sections							
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
GU® sections							
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 	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 	Per S	60.2	**46.3**	2370	**225**	6.28	0.76
	Per D	120.3	**92.5**	13850	**890**	10.73	1.51
	Per T	180.5	**138.8**	19260	**1045**	10.33	2.26
	Per m of wall	100.3	**77.1**	11540	**740**	10.73	1.26
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 	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 	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

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

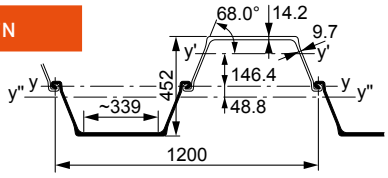
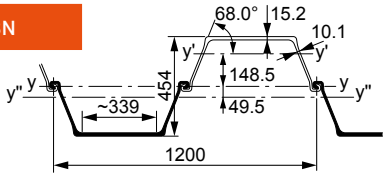
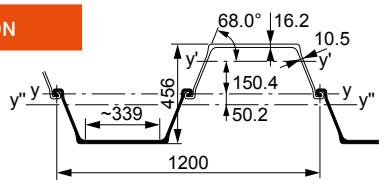
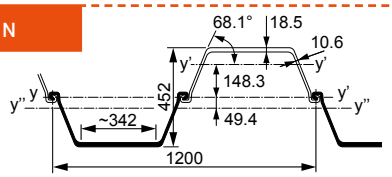
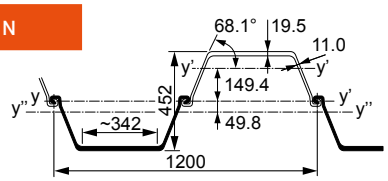
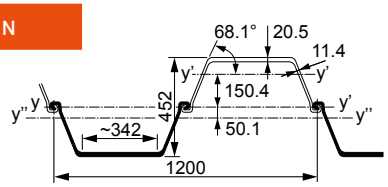
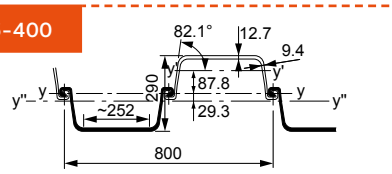
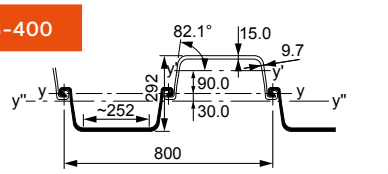
GU® sections

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]
		cm²	kg/m	cm⁴	cm³	cm	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.

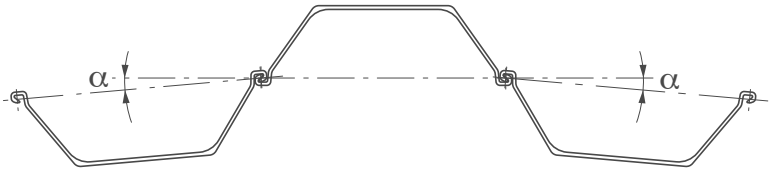
GU® sections

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
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 	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 	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 	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 	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 	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 	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 	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: $\alpha_{max} = 5°$

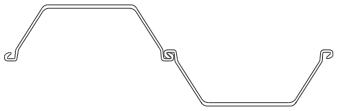


Delivery form

Single Pile

Double Pile
S-Form (standard)

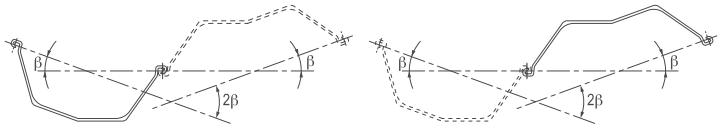
Double Pile
Z-Form (on request)



Triple Pile

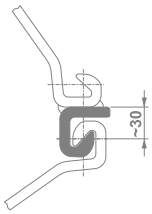
Bent piles

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.

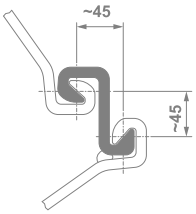


Corner sections

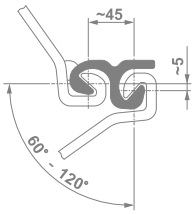
C 9
Mass ~ 9.3 kg/m



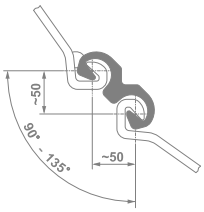
C 14
Mass ~ 14.4 kg/m



DELTA 13
Mass ~ 13.1 kg/m



OMEGA 18
Mass ~ 18.0 kg/m



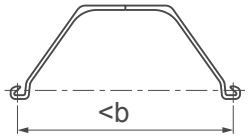
Special corner sections interlocking with U-sections make it possible to form corner or junction piles without using fabricated special piles. Corner sections are fixed to the sheet pile in accordance with EN 12063.

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

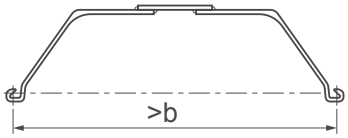
On request, arrangements can be made for widened or narrowed fabricated piles. The following special piles, among others, are available on request as single and double piles.

Narrowed pile



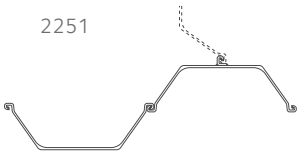
2501

Widened pile

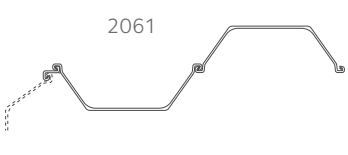


2511

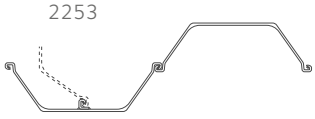
2251



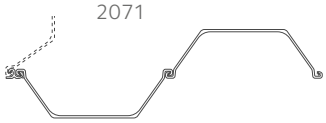
2061



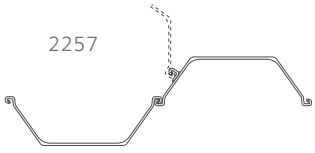
2253



2071



2257



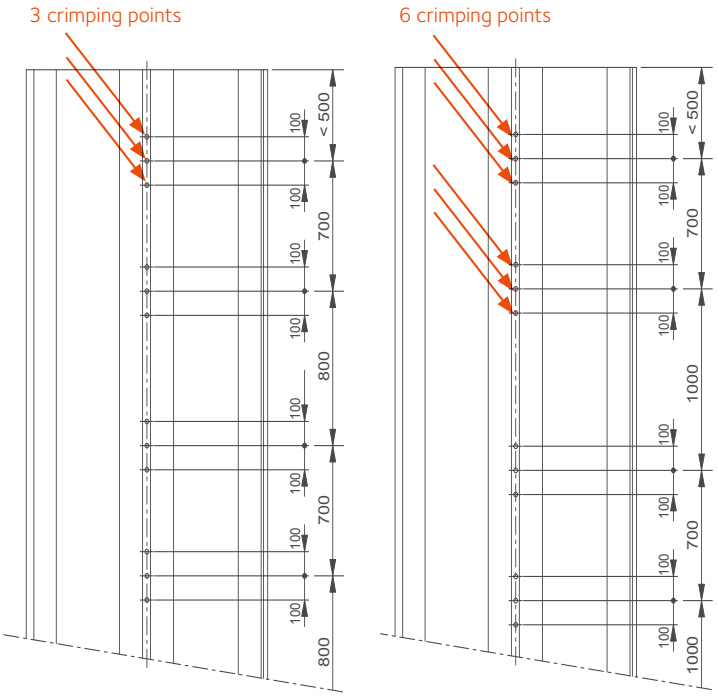
2151

Crimping

Contrary to Z-piles, the interlocks of U-piles have to transmit shear forces. To guarantee proper shear force transmisson, the interlocks of ArcelorMittal's U-sections can be delivered as crimped double piles. 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 for most sections**. 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)]

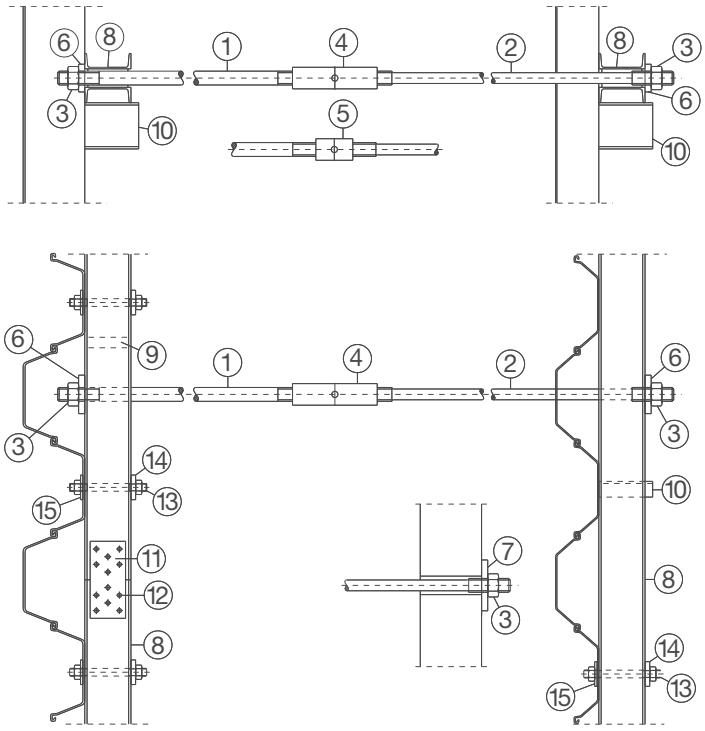
PU/GU standard crimping:
6 crimping points per 1.7 m
= 3.5 crimping points per m[1)]



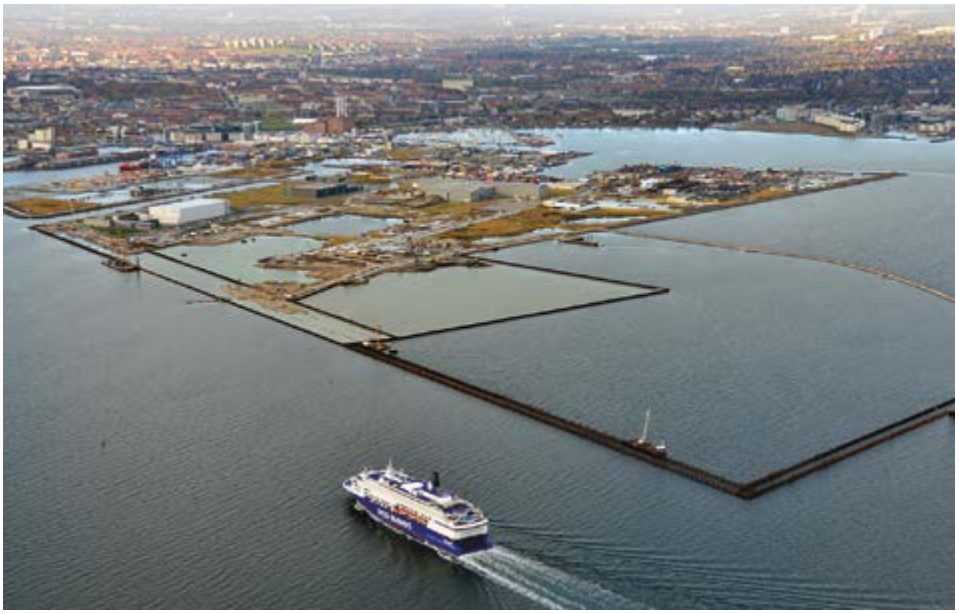
[1)] Amount and layout of crimping points may differ at both ends. Special crimping on request.
[2)] based on EN1993-5. Please consult our Technical Department for more information.

Tie back system

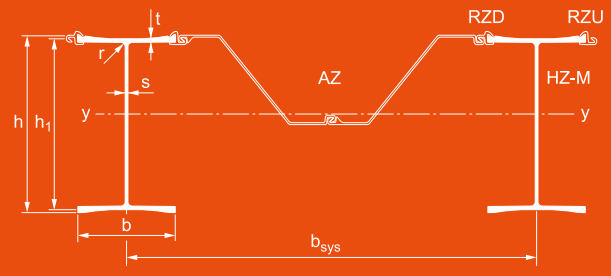
Most sheet pile retaining walls need supplementary support at the top, in addition to embedment in the soil. Temporary cofferdams generally use walers and struts for cross-bracing inside the excavation. Permanent or large retaining walls are often tied back to an anchor wall installed a certain distance 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



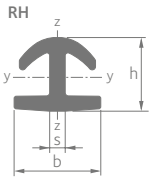
HZ® / AZ® combined wall system

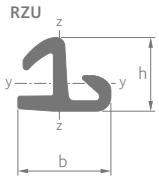


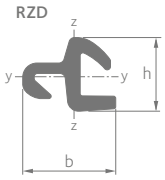
The revolutionary HZ®-M wall is an extremely economical combined wall system launched in 2008 to replace the former HZ/AZ system, and consists of:
– HZ®-M king piles;
– a pair of AZ® sheet piles as intermediary elements;
– special connectors (RH, RZD, RZU).

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							Sectional area	Mass	Moment of inertia	Elastic section modulus	Coating area	Connectors
	h	h_1	b	t_{max}	t	s	r			y-y	y-y		
	mm	mm	mm	mm	mm	mm	mm	cm²	kg/m	cm⁴	cm³	m²/m	
HZ 680M LT	631.8	599.9	460	29.0	16.9	14.0	20	257.8	**202.4**	177370	**5840**	3.05	A
HZ 880M A	831.3	803.4	458	29.0	18.9	13.0	20	292.4	**229.5**	351350	**8650**	3.44	A
HZ 880M B	831.3	807.4	460	29.0	20.9	15.0	20	324.7	**254.9**	386810	**9480**	3.45	A
HZ 880M C	831.3	811.4	460	29.0	22.9	15.0	20	339.2	**266.3**	410830	**10025**	3.45	A
HZ 1080M A	1075.3	1047.4	454	29.0	19.6	16.0	35	371.1	**291.3**	696340	**13185**	3.87	A
HZ 1080M B	1075.3	1053.4	454	29.0	22.6	16.0	35	394.1	**309.4**	760600	**14315**	3.87	A
HZ 1080M C	1075.3	1059.4	456	29.0	25.7	18.0	35	436.1	**342.4**	839020	**15715**	3.87	A
HZ 1080M D	1075.3	1067.4	457	30.7	29.7	19.0	35	470.1	**369.0**	915420	**17025**	3.87	A
HZ 1180M A	1075.4	-	458	34.7	31.0	20.0	35	497.3	**390.4**	973040	**17970**	3.88	A
HZ 1180M B	1079.4	-	458	36.7	33.0	20.0	35	514.5	**403.9**	1022780	**18785**	3.89	A
HZ 1180M C	1083.4	-	459	38.7	35.0	21.0	35	543.6	**426.8**	1086840	**19895**	3.90	B
HZ 1180M D	1087.4	-	460	40.7	37.0	22.0	35	570.5	**447.8**	1144400	**20795**	3.91	B
Connectors													
RH 16	61.8		68.2			12.2		20.1	**15.8**	83	**25**		
RZD 16	61.8		80.5					20.7	**16.2**	57	**18**		A
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**		
RZD 18	67.3		85.0					23.0	**18.0**	78	**22**		B
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 - 2014" for detailed information on the entire HZ®/AZ® range.**

Denomination of the HZ/AZ system:

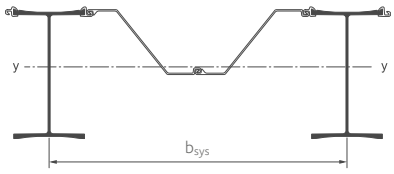
2 connectors
1 RZD + 1RZU

HZ 880M A – **1 2** / **AZ 25-800**

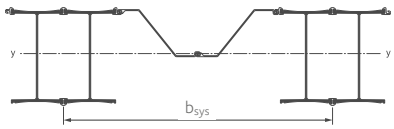
- HZ 880M A: King pile
- 1 2: 1 king pile HZ 880M A
- AZ 25-800: Intermediary AZ 25-800 double pile

Taipei Port, Taiwan

CT, JadeWeserPort, Germany



b_{sys} = 2.127 m



b_{sys} = 2.598 m

	Section	Sectional area	Moment of inertia	Elastic[1] section modulus	Elastic[2] section modulus	Mass[3]		Coating area[4]
						$Mass_{100}$	$Mass_{60}$	Water side
		cm^2/m	cm^4/m	cm^3/m	cm^3/m	kg/m^2	kg/m^2	m^2/m
Combination HZ ... M - 12 / AZ 25-800	**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	317.1	421160	**7365**	8260	249	204	2.73
	HZ 1080M B	327.9	451740	**7900**	8810	257	213	2.73
	HZ 1080M C	347.4	488570	**8560**	9455	273	228	2.73
	HZ 1080M D	363.2	524500	**9165**	10095	285	240	2.73
	HZ 1180M A	375.8	551520	**9605**	10575	295	250	2.73
	HZ 1180M B	383.9	575220	**10020**	10980	301	257	2.74
	HZ 1180M C	399.5	610010	**10555**	11625	314	268	2.75
	HZ 1180M D	411.9	637390	**11065**	12060	323	278	2.75
Combination HZ ... M - 24 / AZ 25-800	**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	416.1	651440	**11845**	11145	327	290	3.25
	HZ 1080M B	433.6	700360	**12695**	12010	340	304	3.25
	HZ 1080M C	465.3	759880	**13755**	13080	365	329	3.26
	HZ 1080M D	491.1	818230	**14745**	14125	386	349	3.26
	HZ 1180M A	511.7	861950	**15450**	14905	402	365	3.26
	HZ 1180M B	524.0	897750	**16055**	15540	411	375	3.26
	HZ 1180M C	551.2	960410	**17090**	16525	433	396	3.28
	HZ 1180M D	569.5	998600	**17730**	17205	447	410	3.29

[1] Referring outside of HZ-flange.

[2] Referring outside of RH / RZ.

[3] $L_{RH} = L_{HZ}$; $L_{RZU} = L_{RZD} = L_{AZ}$; $Mass_{100}$: $L_{AZ} = 100\,\% L_{HZ}$; $Mass_{60}$: $L_{AZ} = 60\,\% L_{HZ}$

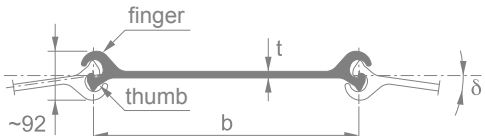
[4] Excluding inside of interlocks, per system width.

AS 500® straight web sections

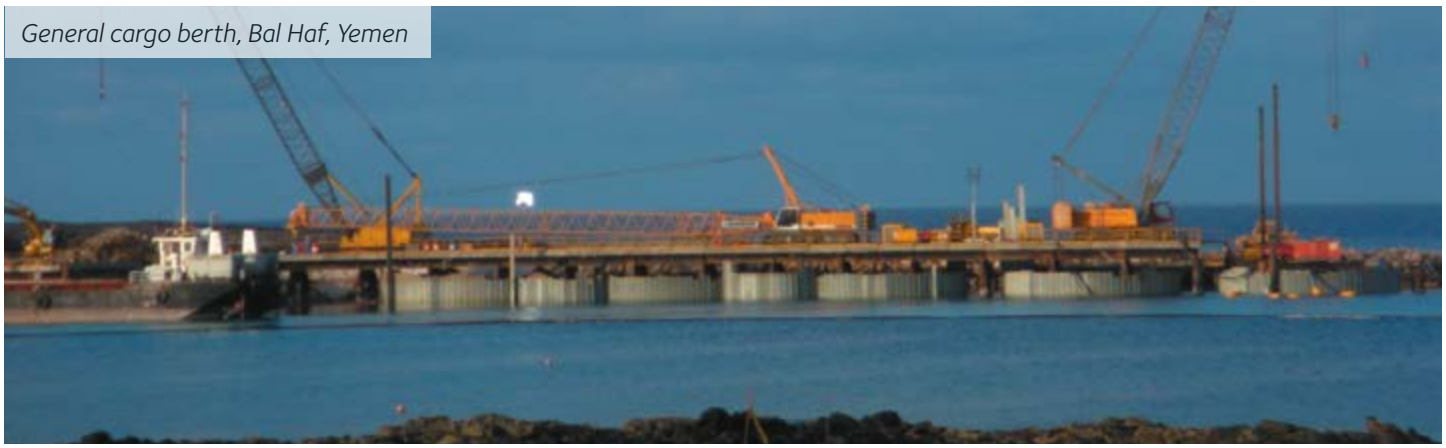
AS 500 straight web sheet piles are designed to form closed cylindrical structures retaining a soil fill. The stability of the cells consisting of a steel envelope and an internal body of soil is guaranteed by their own weight. Straight web sheet piles are mostly used on projects where rock layers are 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 strength 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	Steel section (single pile)	Mass	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	90.0	70.6	**141**	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
New **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 (lay-out) 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 maximum interlock strengths can be guaranteed:

Section	$R_{k,s}$ [kN/m]
AS 500 - 9.5	3000
AS 500 - 11.0	3500
AS 500 - 12.0	5000
AS 500 - 12.5	5500
AS 500 - 12.7	5500
AS 500 - 13.0	6000

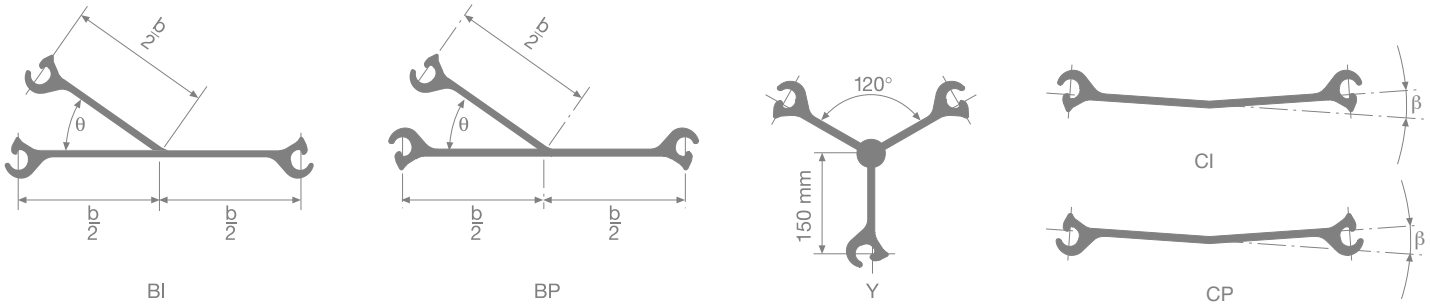
For the related steel grade please contact ArcelorMittal Sheet Piling.

For verification of the strength of piles, both yielding of the web and failure of the interlock should be considered.

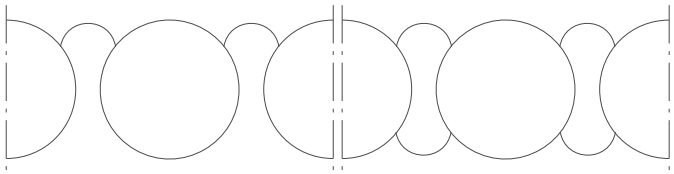
Bridge construction, South Korea

Junction piles and bent piles

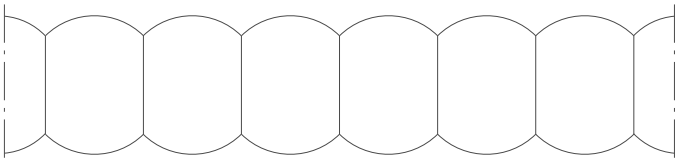
Junction piles that join circular cells and intermediary arcs can be provided. Bent piles are pre-bent at the mill. If the deviation angle exceeds 4.5° (4.0° if L > 20 m), bent piles can be used to set up structures with small radii.



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.

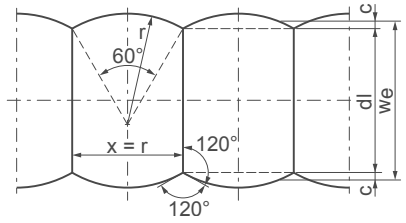
It is defined as follows

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

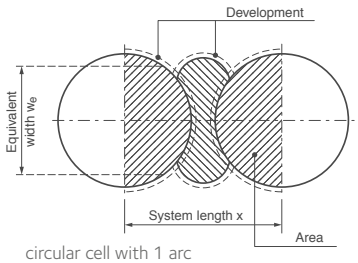
• for diaphragm cells

The equivalent width w_e is defined as:

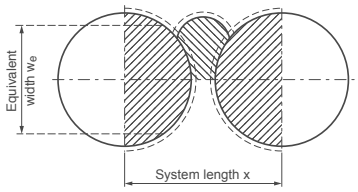
w_e = diaphragm wall length (dl) + 2 · c



circular cell with 2 arcs

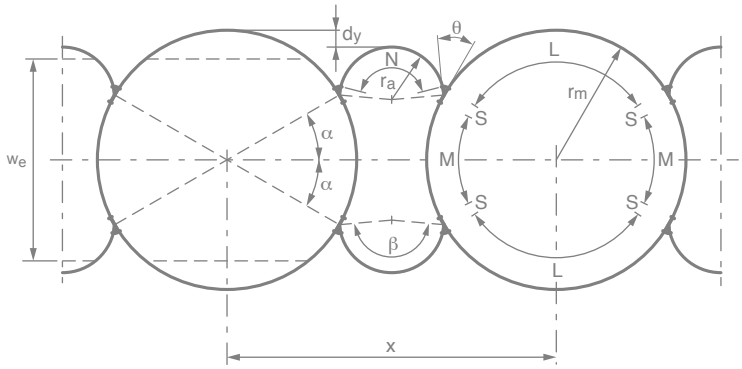


circular cell with 1 arc

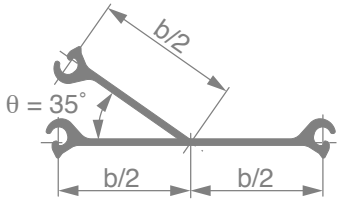


Geometry of circular cells

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.



Standard solution



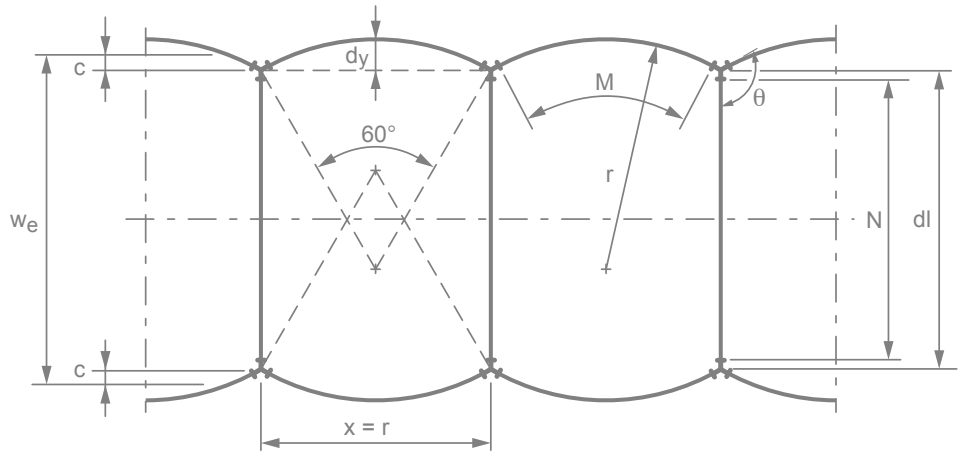
r_m = radius of the main cell
r_a = radius of the connecting arcs
θ = angle between the main cell and the connecting arc
x = system length
d_y = positive or negative offset between the connecting arcs and the tangent planes of the main cells
w_e = equivalent width

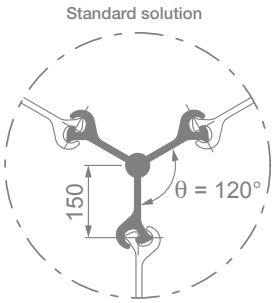
Junction piles with angles θ between 30° and 45°, as well as θ = 90°, are available on request.

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





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

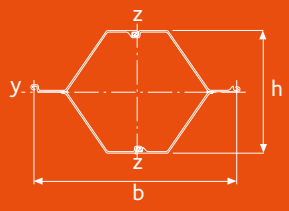
Geometry diaphragm wall

Number of piles	Wall length
N pcs.	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

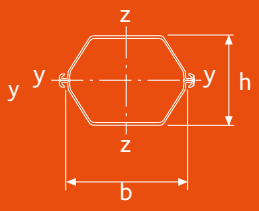
Geometry arc (Standard solution)

Number of piles	Radius System length	Arc height	Equivalent arc height	Interlock deviation
M pcs.	x=r m	d_y m	c m	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

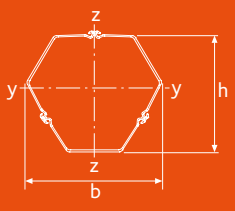
Box piles



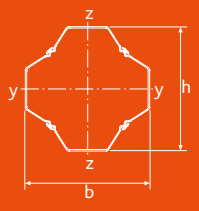
Z-box pile



Double U box pile



Triple U box pile



Quadruple U box pile

New
AZ 20-800
AZ 25-800
AZ 30-750
AZ 50-700

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	cm²	cm²	kg/m	cm⁴	cm⁴	cm³	cm³	cm	m²/m
New **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
New **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	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-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
New **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 12 -10/10-2	600	403	198	177	1850	**139.2**	35580	73460	**1765**	**2315**	14.2	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	120	1604	**92.5**	18210	50630	**1045**	**1605**	12.3	1.62
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.

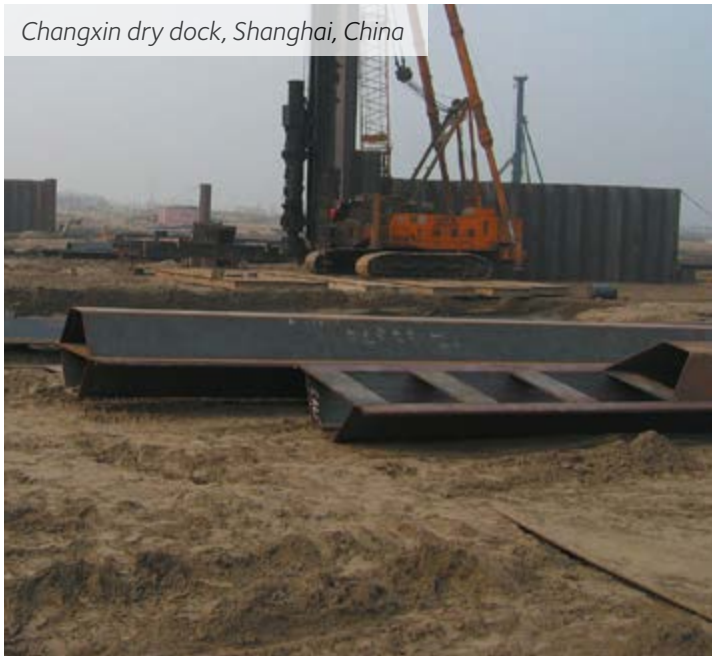
Section	Width	Height	Perimeter	Sectional area	Total section	Mass[1]	Moment of inertia		Elastic section modulus		Min. radius of gyration	Coating area[2]
	b	h					y-y	z-z	y-y	z-z		
	mm	mm	cm	cm^2	cm^2	kg/m	cm^4	cm^4	cm^3	cm^3	cm	m^2/m
CAU triple box piles												
CAU 14-3	957	908	341	298	6454	**233.7**	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 12-10/10-3	800	755	293	266	4432	**208.8**	182100		**4790**	**4555**	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 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.

Rheinhafen Neuss, Germany

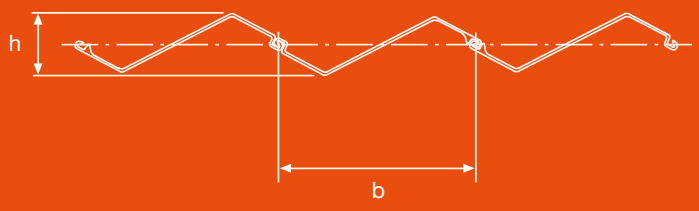
Section	Width	Height	Perimeter	Sectional area	Total section	Mass[1]	Moment of inertia		Elastic section modulus		Min. radius of gyration	Coating area[2]
	b	h					y-y	z-z	y-y	z-z		
	mm	mm	cm	cm^2	cm^2	kg/m	cm^4	cm^4	cm^3	cm^3	cm	m^2/m
CAU quadruple box piles												
CAU 14-4	1222	1222	453	397	11150	**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 12-10/10-4	1025	1025	388	355	7565	**278.4**	414830		**8095**		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 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

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).

New
AZ 20-800
AZ 25-800
AZ 30-750
AZ 50-700

AZ® jagged wall

Section	Width b mm	Height h mm	Sectional area cm²/m	Mass kg/m²	Moment of inertia cm⁴/m	Elastic section modulus cm³/m	Coating area[1] m²/m²
New 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
New AZ-750							
AZ 28-750	881	278	146	**114**	7970	**575**	1.20
AZ 30-750	881	280	157	**123**	8700	**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**	2330	**255**	1.12
AZ 13-770	826	182	117	**92**	2460	**270**	1.12
AZ 14-770	826	182	123	**96**	2600	**285**	1.12
AZ 14-770-10/10	826	183	128	**100**	2730	**300**	1.12
AZ 12-700	751	182	115	**90**	2410	**265**	1.13
AZ 13-700	751	183	126	**99**	2690	**295**	1.13
AZ 13-700-10/10	751	183	131	**103**	2830	**310**	1.13
AZ 14-700	751	184	136	**107**	2970	**325**	1.13
AZ 17-700	795	212	117	**92**	3690	**330**	1.16
AZ 18-700	795	212	123	**96**	3910	**350**	1.16
AZ 19-700	795	213	128	**101**	4120	**365**	1.16
AZ 20-700	795	214	134	**105**	4330	**385**	1.16
AZ 24-700	813	241	150	**118**	5970	**495**	1.19
AZ 26-700	813	242	161	**127**	6500	**535**	1.19
AZ 28-700	813	243	172	**135**	7030	**580**	1.19

[1] One side, excluding inside of interlocks.

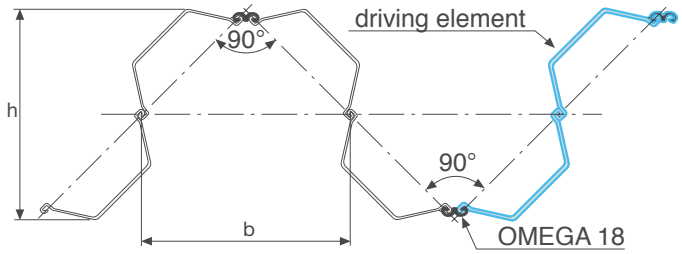
AZ® jagged wall

Section	Width b mm	Height h mm	Sectional area cm^2/m	Mass kg/m^2	Moment of inertia cm^4/m	Elastic section modulus cm^3/m	Coating area[1] 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	300	217	**170**	14650	**975**	1.24
AZ 44-700N	834	301	229	**180**	15460	**1025**	1.24
AZ 46-700N	834	302	241	**189**	16280	**1075**	1.24
New AZ 48-700	836	303	241	**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	308	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 motorway 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 statical values given below assume the solidarisation of the driving element, i.e. double pile. 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]		Plastic section modulus	
	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**	275830	334350	**5075**	**5995**	6160	7250
AU 16	1135	1115	**168**	307000	365520	**5650**	**6555**	6870	7960
AU 18	1135	1136	**172**	329320	387840	**5795**	**6825**	7180	8270
AU 20	1135	1139	**187**	362510	421030	**6365**	**7395**	7920	9005
AU 23	1135	1171	**196**	390650	449160	**6675**	**7675**	8470	9560
AU 25	1135	1173	**211**	424510	483020	**7240**	**8235**	9215	10300
PU® jagged wall									
PU 12	923	903	**163**	189000	229900	**4275**	**5090**	5175	6245
PU 12-10/10	923	903	**170**	198850	245250	**4495**	**5430**	5450	6525
PU 18	923	955	**186**	244340	290750	**5120**	**6090**	6430	7500
PU 22	923	993	**206**	285880	332290	**5760**	**6690**	7380	8450
PU 28	923	1028	**240**	349710	396110	**6805**	**7710**	8925	10000
PU 32	923	1011	**267**	389300	432400	**7705**	**8560**	10025	11095
GU® jagged wall									
GU 14N	923	920	**159**	198710	245140	**4320**	**5330**	5285	6360
GU 18N	923	955	**186**	244340	290750	**5120**	**6090**	6430	7500
GU 22N	923	993	**206**	285880	332290	**5760**	**6690**	7380	8450
GU 28N	923	1028	**240**	349710	396110	**6805**	**7710**	8925	10000
GU 32N	923	1011	**267**	389300	432400	**7705**	**8560**	10025	11095

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

Combined walls

New
AZ 20-800
AZ 25-800
AZ 30-750
AZ 50-700

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.

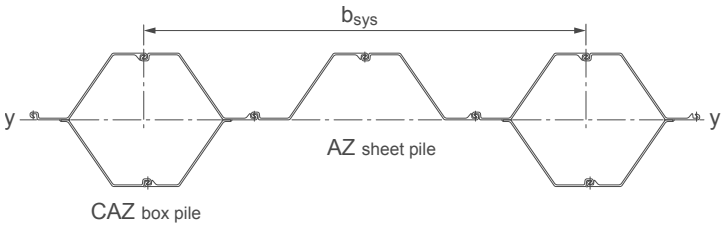
The primary piles or "king piles" of combined walls can also be used as bearing piles submitted to high vertical loads, e.g. crane loads. The intermediary sheet piles act mainly as soil-retaining and load-transferring elements.

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:

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

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



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					
New 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					
New 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

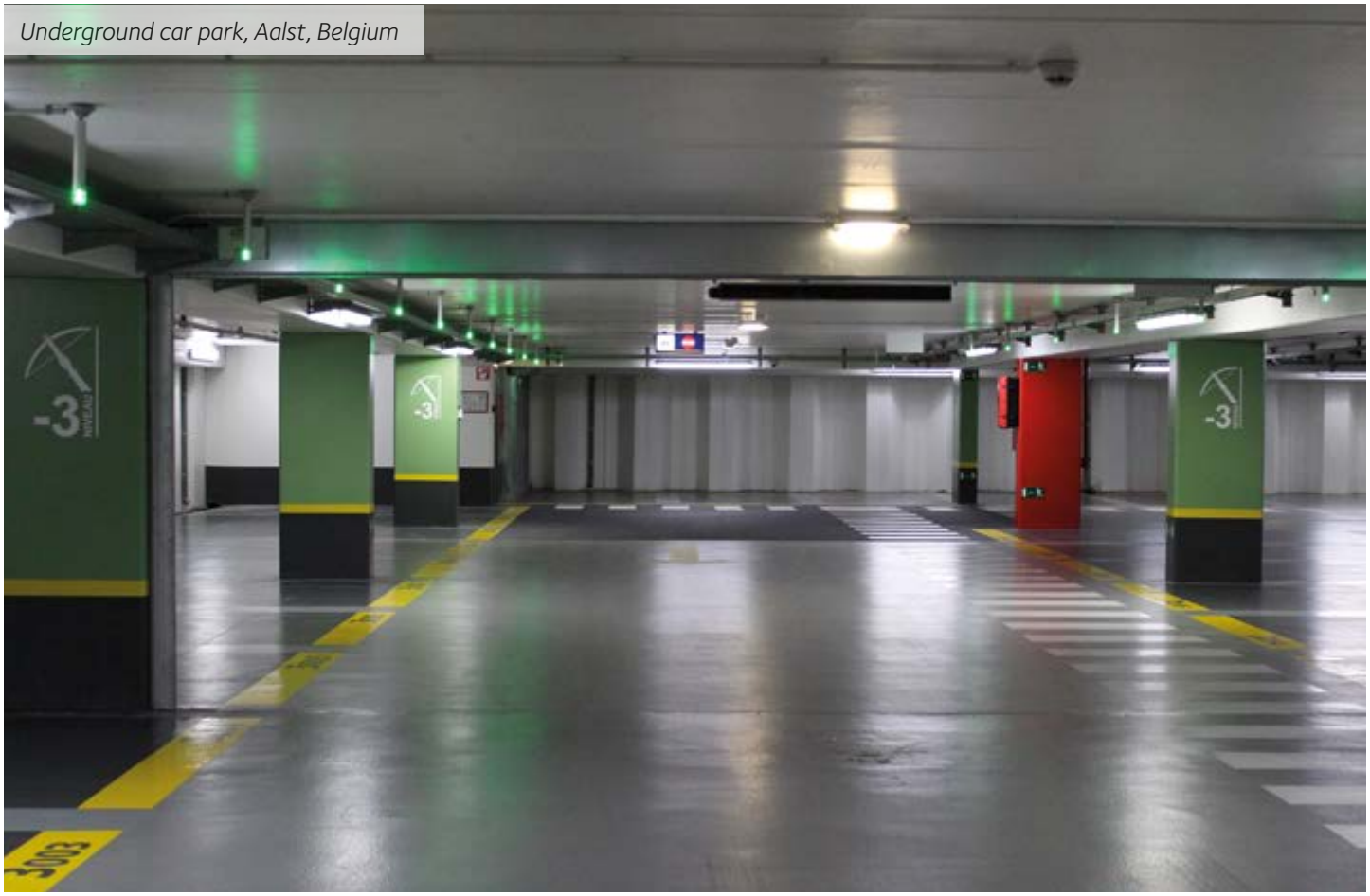
[1] Mass$_{100}$: L_{AZ} = 100% $L_{box\ pile}$; Mass$_{60}$: L_{AZ} = 60% $L_{box\ pile}$

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**
New 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

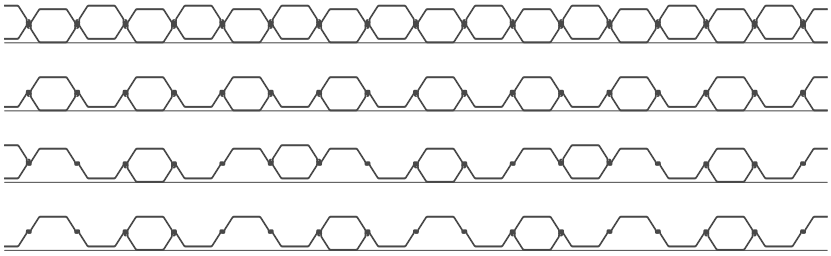


U box piles – U sheet piles

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).



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 12-10/10	232	59300	2945	174	33480	1660	155	34820	1730	145	30520	1430
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 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, and can produce tubes with diameters up to 3 000 mm, wall thicknesses up to 25 mm, and lengths up to 53 m (without butt-welding). Additionally, it 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. 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.

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**

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 generally fits several sheet pile sections, thus reducing the number of required driving caps for a given sheet pile range.

Sheet pile sections and corresponding driving caps

Section	Arrangement	Driving caps
AU 14/16/18/20/23/25	single	AUS 14-26
AU 14/16	double/box pile	AUD 12-16
AU 18/20/23/25	double/box pile	AUD 20-32
PU 12/18/22/28/32, GU 18N/22N/28N/32N	single	PUS
PU 12/28/32, GU 28N/32N	single	US-B
PU 12	double/triple/box pile	UD 1
PU 18/22/32, GU 18N/22N/32N	double/triple/box pile	UD 2
PU 18/22/28/32, GU 18N/22N/28N/32N	double/box pile	PUD 17-33
AZ 12-700 to AZ 14-700	double	AZD 12-14
AZ 12-770 to AZ 14-770-10/10	double	AZD 12-14 L
AZ 17-700 to AZ 20-700/AZ 24-700 to AZ 28-700	double	UZD 14-28
AZ 36-700N to AZ 46-700N/AZ 48-700 to AZ 52-700	double	AZD 36-40
AZ 18/26	double	A 18/26
AZ 46/48/50	double	A 48

Single and box piles can be driven to the top of the neighbouring pile when using UD driving caps.

For other driving elements (HZ, built-up box piles, triple piles, etc.) please contact our Technical Department.

Driving cap dimensions

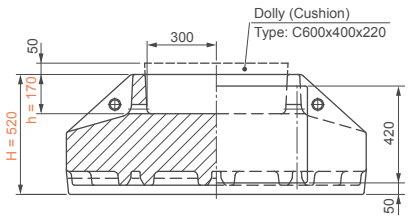
Driving caps	AUS 14-26	AUD 12-16	AUD 20-32	PUS	US-B	UD 1	UD 2
A/B/H	740/580/370	1540/750/520	1570/750/520	680/600/320	680/600/320	1250/610/420	1250/720/420
C	350	430	430	290	290	260	315
Mass [kg]	650	1900	2100	300	300	1000	1250
a/b (or Ø) / h[1)]	500/300/120	600/400/170	600/400/170	380/380/120	380/380/120	Ø400/170	Ø500/170

Driving caps	PUD 17-33	A 18/26	A 48	AZD 12-14 L	UZD 14-28	AZD 36-40
A/B/H	1250/720/420	1160/660/420	1080/730/470	1440/590/520	1300/705/520	1320/750/520
C	315	390	430	360	420	440
Mass [kg]	1250	1150	1400	1750	1900	2050
a/b (or Ø) / h[1)]	Ø500/170	600/400/170	600/400/170	600/300/170	600/400/170	600/400/170

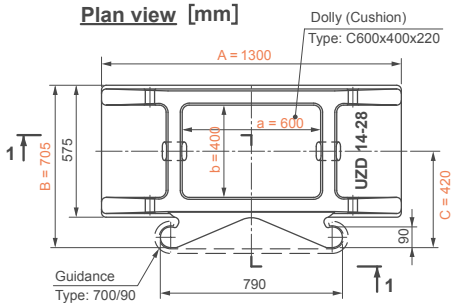
[1)] Dimensions of the dolly recess.

Driving caps - Examples

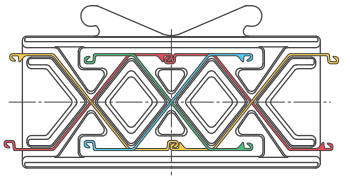
Section 1-1 (UZD 14-28) [mm]



Plan view [mm]

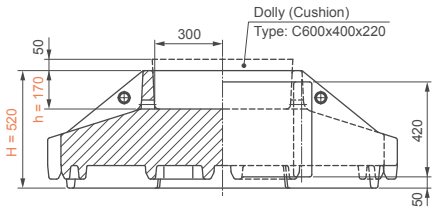


Bottom view

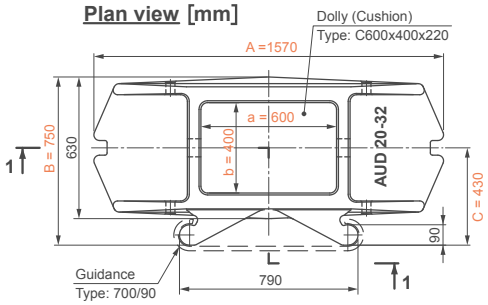


Position of section AZ 17-700 .... AZ 28-700
as double and single pile

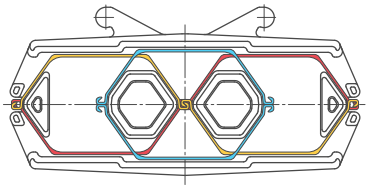
Section 1-1 (AUD 20-32) [mm]



Plan view [mm]

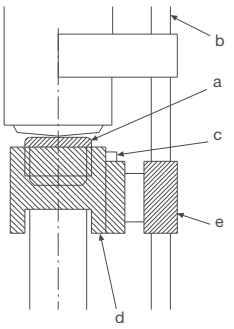


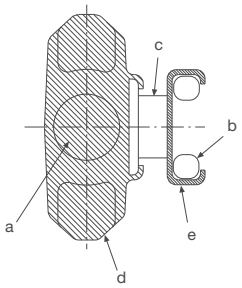
Bottom view



Position of section AU 18 / 20 / 23 / 25
as double, single and box pile

Arrangement of driving caps



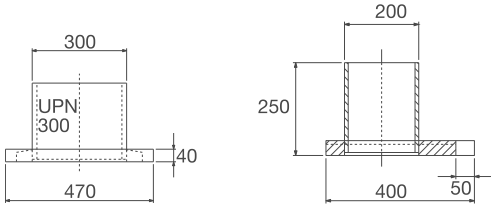
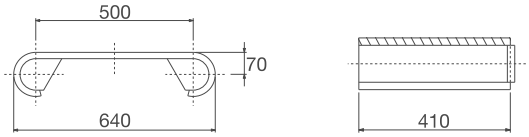
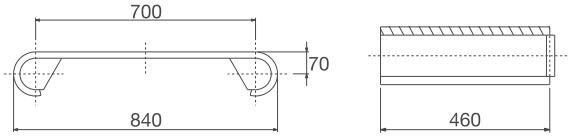


a = dolly/cushion
b = leader
c = sliding guide
d = driving cap
e = leader slide

The leader slide is not provided by ArcelorMittal.

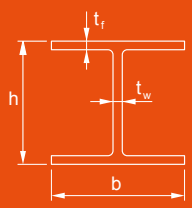
Sliding guides

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

Dimensions	Designation	Corresponding driving caps
	330/50	PUS and US-B
	30	UD
	500/90	A and AUS
	700/90	AUD and AZD

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 contains but a small extract of the 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} = hxb	Perimeter	Moment of inertia		Elastic section modulus	
		h	b	t_w	t_f			P	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

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


Deurganckdock CT, Antwerp, Belgium

Durability of steel sheet piles

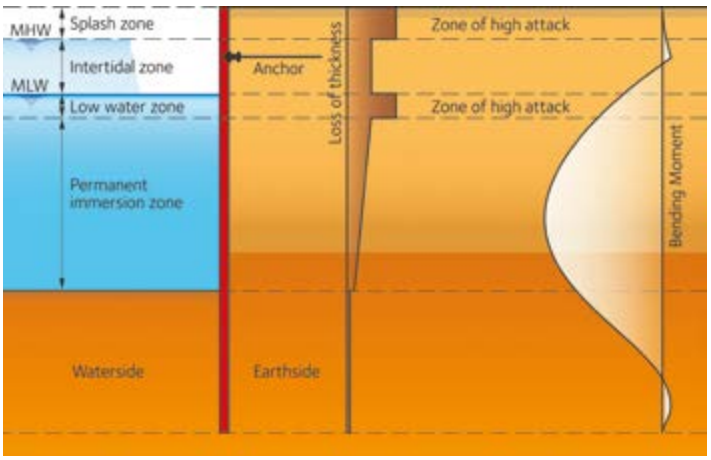
Unprotected steel in the atmosphere, water or soil is subject to corrosion that may lead to damage. Local weakening and rusting-through are normally considered to be maintenance problems that can be remedied locally. Depending on life-time requirements and accessibility of the structure, the service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



The use of a new steel grade AMLoCor® significantly increases the design life of marine structures.
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.

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: removal of millscale by abrasive blasting (cf. ISO 8501-1) before applying a coating system. 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.
In the following, paint systems are proposed for different environments according to classifications of EN ISO 12944.

Metro Copenhagen, Denmark

Atmospheric exposure

In applications such as retaining walls, the aesthetic and functional look of the sheet piles is important, so polyurethane finishes - which are easy to apply and maintain - are the most common choice 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 as abrasion and impact may damage the coating system. 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

Waste disposal

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

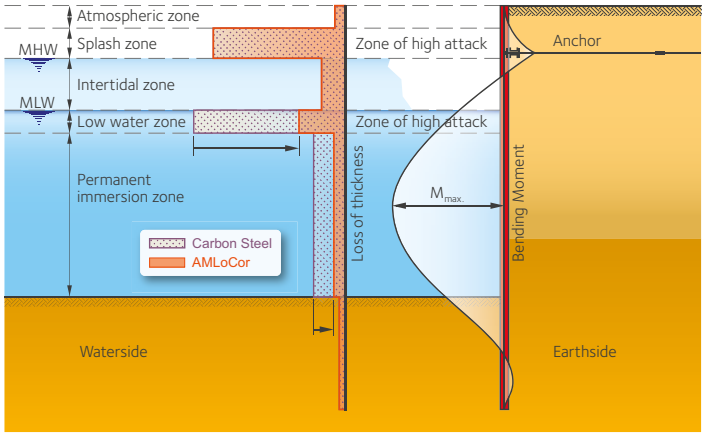
Waste disposal, Horn, Austria

AMLoCor®

New corrosion resistant steel grade for marine applications

AMLoCor® is ArcelorMittal's **new "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 new steel grade is the solution from our R&D department to address the major concern of designers and port authorities: **durability of marine structures** like quay walls, breakwaters, jetties.

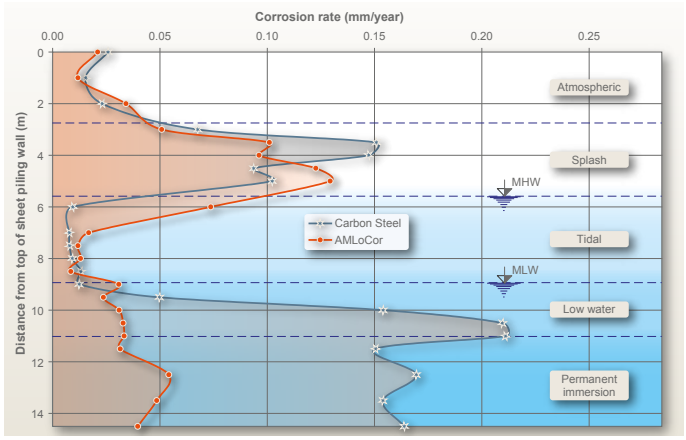


Typical loss of steel thickness in a marine environment: regular carbon steel vs. AMLoCor®

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

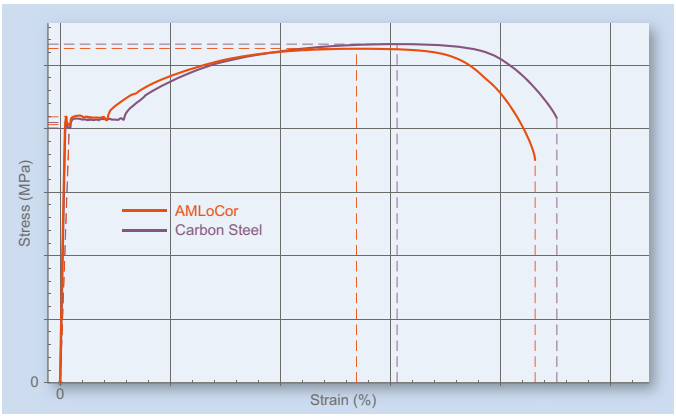


The mechanical properties of AMLoCor steel are fully equivalent to standard piling grades, so that structural resistance can be determined according to all relevant design codes used for steel sheet piling structures, like EN 1993-5:2007 in European countries.

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 as good as regular carbon steel sheet piles.

For more detailed information (e.g. on welding) please check our **brochure "AMLoCor®"**, part 1 to 3**.**



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 flowing 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).

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

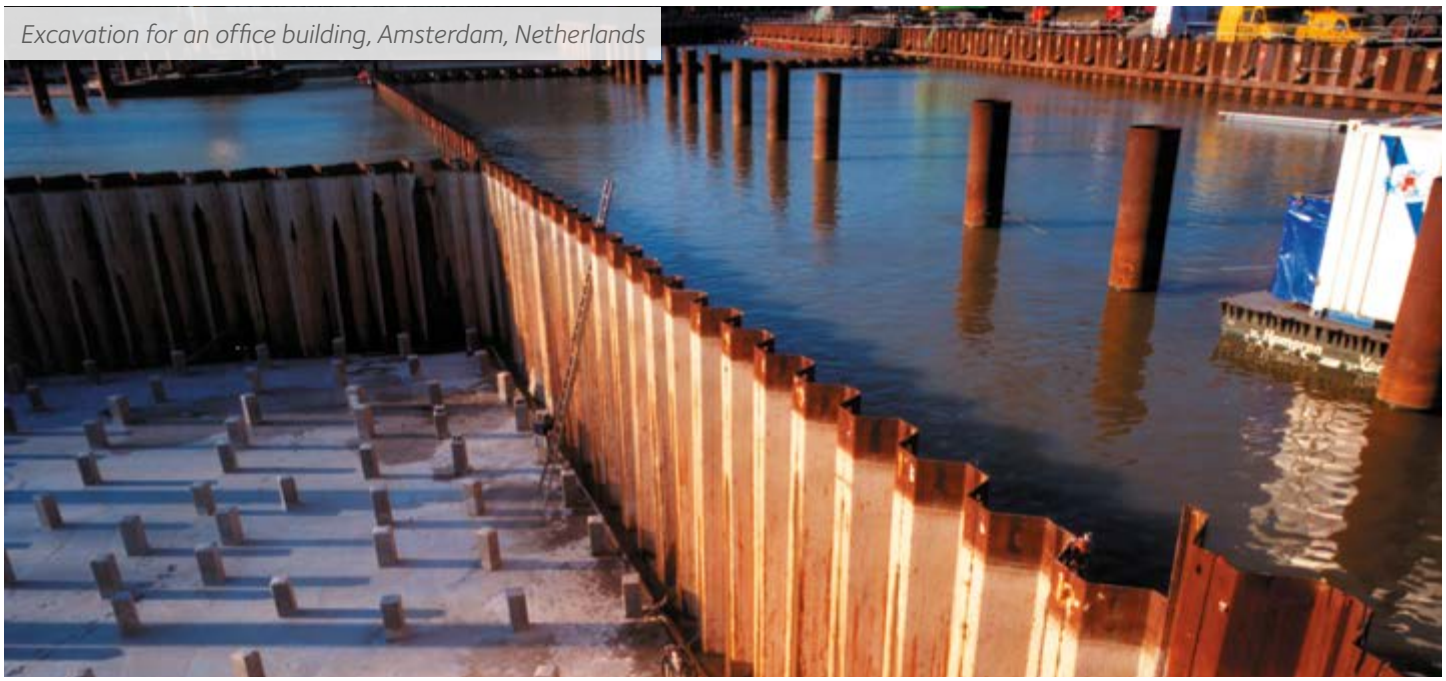
$q(z)$	water discharge [$m^3/s/m$]
ρ	inverse joint resistance [m/s]
$\Delta p(z)$	pressure drop at level z [kPa]
γ_w	unit weight of water [kN/m^3]

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 = $\frac{\text{Cost of sealing system}}{\text{Cost of bituminous Beltan Plus}}$

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

Excavation for an office building, Amsterdam, Netherlands

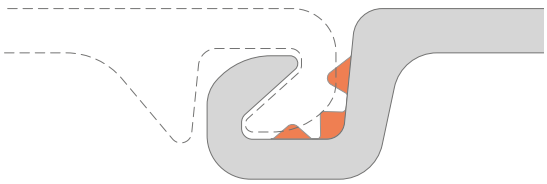


AKILA® sealing system

AKILA® is a **brand new 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 interlocks of 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).

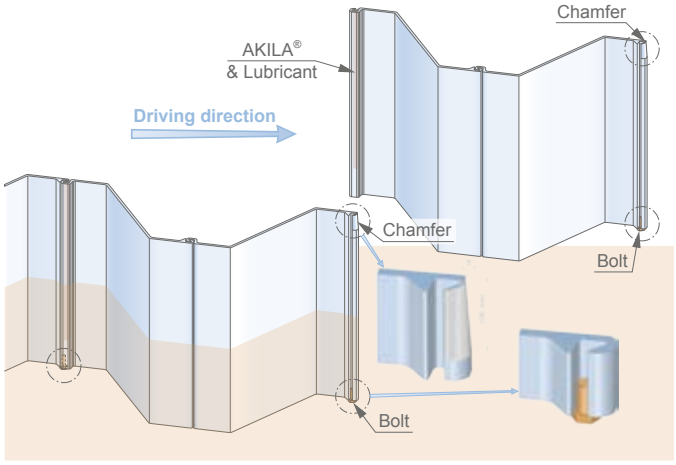
Inverse joint resistance ρ_m

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.

	ρ_m (m/s)	
water pressure	200 kPa	300 kPa
single piles (MSP-1)	4.9×10^{-11}	8.6×10^{-11}
double piles (MSP-1 & MSP-2)	3.3×10^{-11}	4.7×10^{-11}



Installation recommendations (driving direction, chamfer, etc.)

For more information contact our technical department.

Environmental product declaration

ArcelorMittal is the first steel manufacturer in the world that has performed a **Life Cycle Assessment (LCA) study dedicated to steel sheet piles**[i], which has been peer reviewed to be in compliance with the ISO standards 14 040 and 14 044.

For detailed information, please consult our **brochure "Environmental product declaration for Steel Sheet Piling structures".**

Environment has become a major focus in the construction industry. Public authorities and private investors are seeking more environmentally-friendly construction methods and products. Environmental factors already influence the choice of the construction solution in some countries.
The results of a LCA are related to a feature representative of the product and the service being expected from it.
The **functional unit** is used to describe the primary functions to be fulfilled by a product system. When comparing several products, it is necessary to consider an identical functional unit for both products.
The major benefit of steel sheet piles versus alternative solutions is the fact that **besides being 100% recyclable, steel sheet piles can be reused multiple times, hence decreasing its environmental burden.**

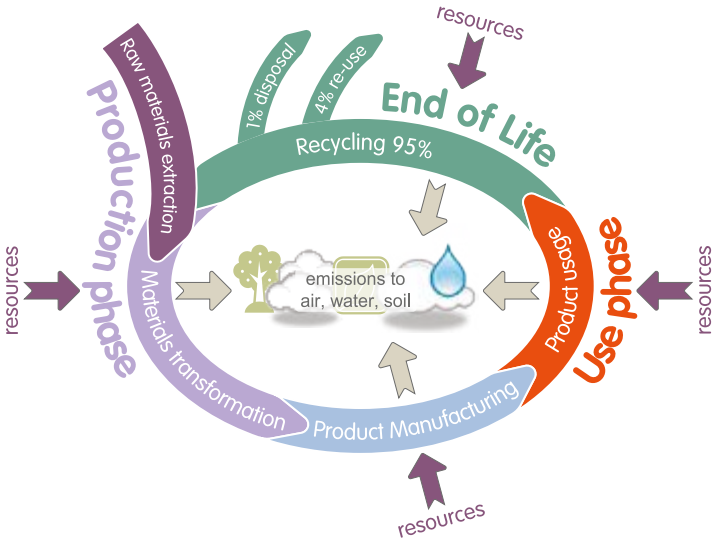
Environmental indicators

LCA practitioners usually assess some common **environmental indicators**. Generally, several substances contribute to a given environmental impact. For example, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and some other components all contribute to greenhouse gases emissions, respectively with different weights according to academic models, and the resulting impact is expressed as "CO_2 equivalent" emissions because CO_2 is the major contributor. This is a way to illustrate one simple aggregated value for the impact. The main environmental indicators are:

- Primary Energy Consumption (MJ)
- Global Warming Potential (CO_2-equivalent)
- Acidification (acidification of rain, SO_2-eq)
- Ozone formation at low altitude (summer smog, C_2H_4–eq)
- Eutrophication (PO_4–eq)
- Water (kg of water used).

Environmental profile of steel sheet piles

The functional unit selected is a 100 m retaining wall structure. Results are aggregated as the sum of the impacts of the production and end of life stage. During the use phase, impacts are negligible. Certified data used for the environmental profile calculations of the steel structure comes from the "World Steel Association" and it represents European average values for "sections" and World average values for "rebars". They are dated from 2010. According to the LCA approach, all elements such as transportation, as well as installation and extraction of the sheet piles are taken into account. Usually wall and wailing parts are recovered and therefore recycled. The distribution of impacts is equivalent for all indicators: **steel production is the main contributor** (between 93% to 98% of the impacts).



Environmental burdens of steel products used for sheet piling structures

The official World Steel Association formula used to calculate the environmental burden E is:

$$E = E' - (RR - RC) \cdot LCI_{scrap} \quad \text{and} \quad LCI_{scrap} = y \cdot (X_{pr} - X_{re})$$

With:

E'	"cradle to gate" environmental burden due to the production phase
RR	Recycling Rate at the end of life
RC	Recycled Content = amount of scrap used to produce steel
LCI_{scrap}	represents the environmental value of scrap (**environmental burden avoided by using scrap** as raw material)
y	efficiency of the electrical arc furnace in converting scrap into steel
X_{pr}	LCI for primary steel production (BOF: 100% iron ore)
X_{re}	LCI for secondary steel production (EAF: 100% scrap)

This **formula allows taking into account the benefit of the end of life recycling**, penalizing steel if the recycling rate is lower than the recycled content. Two LCI among the 16 life cycle inventories (LCI) of steel products provided by World Steel Association were used for this LCA.

[i] Hettinger, A.L.; Bourdouxhe, M.P.; Schmitt, A. "Comparative Environmental evaluation of retaining structures made of steel sheet piling or reinforced concrete". ArcelorMittal, 2010.

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)	± 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: –1.0 mm /+2.0 mm 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

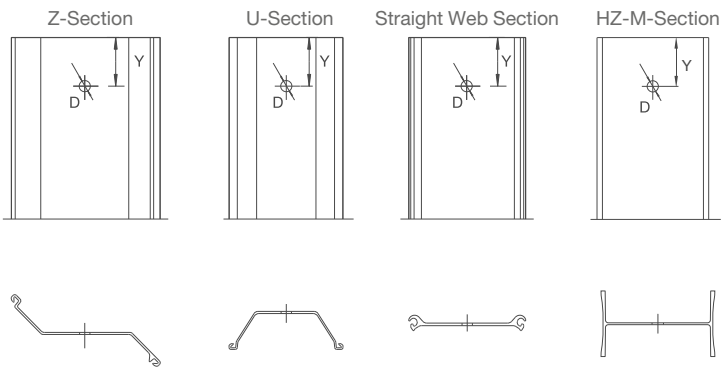
[1)] Contact us for detailed information.

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:

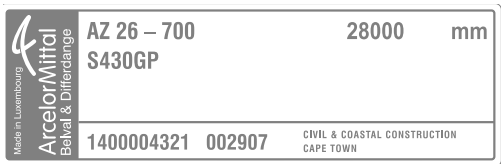
Diameter D [mm]	40	40	50	50	63.5	40
Distance Y [mm]	75	300	200	250	230	150

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 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 (% max)					
				C	Mn	Si	P	S	N
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 (% max)							
				C	Mn	Si	P	S	N	Cr	Al
Blue 320	**320**	440	23	0.27	1.70	0.60	0.05	0.05	0.011	1.50	0.65
Blue 355	**355**	480	22	0.27	1.70	0.60	0.05	0.05	0.011	1.50	0.65
Blue 390	**390**	490	20	0.27	1.70	0.60	0.05	0.05	0.011	1.50	0.65

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 updated 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[1)]
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	-	-

[1)] ArcelorMittal mill specification.

Section \ Steel Grade	EN 10248							ASTM	
	S 240 GP	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 AP[1)]	A 572	A 690
AZ-700 to 800	✓	✓	✓	✓	✓	✓	✓	✓	✓
AZ	✓	✓	✓	✓	✓	✓	✓	✓	✓
AU	✓	✓	✓	✓	✓	✓	✓	✓	✓
PU	✓	✓	✓	✓	✓	✓	✓	✓	✓
GU-N/S	✓	✓	✓	✓	✓	✓	✓	❖	×
GU-400	✓	✓	✓	✓	✓	❖	❖	❖	×
HZ-M	✓	✓	✓	✓	✓	✓	✓	✓	✓
RH / RZD / RZU	×	×	×	×	×	✓	✓	×	✓
C 9	×	×	×	✓	×	×	×	✓	×
C 14	×	×	×	✓	×	×	×	×	×
Delta 13	×	×	×	✓	×	×	×	×	×
Omega 18	×	×	×	×	×	✓	✓	×	×

	AMLoCor®		
	Blue 320	Blue 355	Blue 390
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	✓	✓	✓
AZ 28	✓	✓	×
C 9	×	✓	×

[1)] ArcelorMittal mill specification

✓ 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 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	-

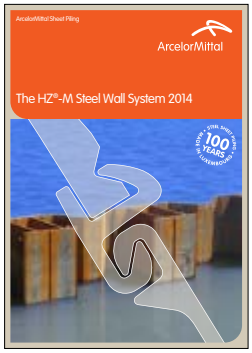
Steel grade API 5L[1] ISO 3183	Min. yield strength R_{eH} MPa	Min. tensile strength R_m MPa	Min. elongation[2] %	Chemical composition for PSL 1 pipe with t ≤ 25.0 mm[4] (% max) C[3]	Mn[3]	P	S
L 245 or **B**	**245**	415	23	0.26	1.20	0.030	0.030
L 290 or **X 42**	**290**	415	23	0.26	1.30	0.030	0.030
L 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, Netherlands

Documentation

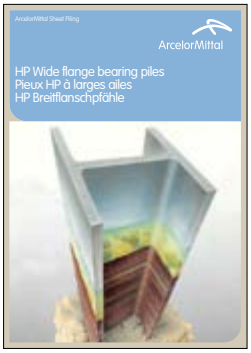
Please refer to our website to download all our documentation: **sheetpiling.arcelormittal.com**
or contact us via E-mail: **sheetpiling@arcelormittal.com**



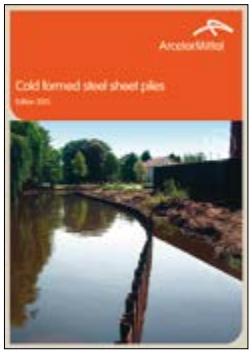
The HZ®-M Steel Wall System
GB (2014), DE, FR, US, IT, SP, PT

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

Spirally welded steel pipes
GB



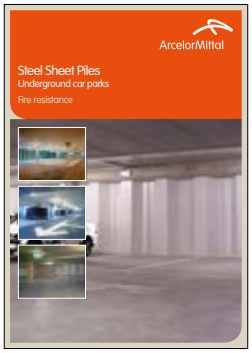
HP bearing piles
GB, DE, FR, SP



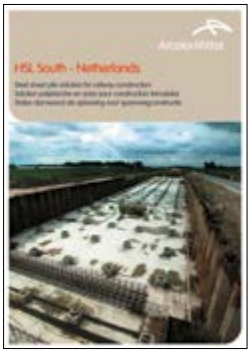
Cold formed steel piles
GB, DE, FR, NL

Harbour construction
GB

Underground car parks
GB, PT



Underground car parks – fire resistance
GB



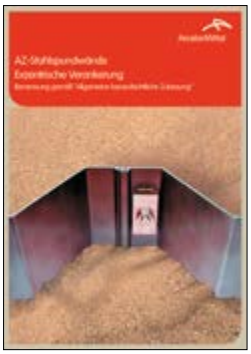
High speed line south – NL
GB, FR, NL

Environmental Product Declaration
GB

Installation of sheet piles
GB, DE, FR

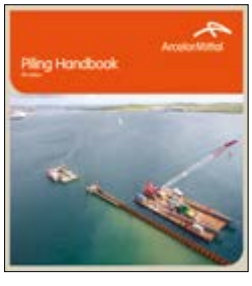
Jetting-assisted sheet pile driving
GB, DE, FR

Anchoring of sheet piles
GB, DE

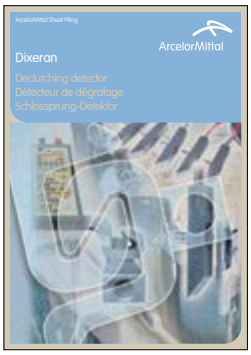


Off-centre anchoring
GB, DE, FR

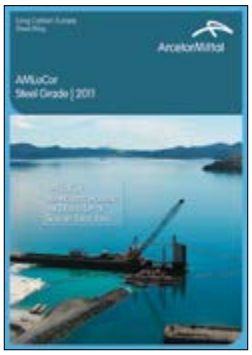
Impervious steel sheet pile walls
GB, DE, FR



Piling Handbook
GB



Declutching detector
GB, DE, FR



AMLoCor Steel Grade
AMLoCor 1A
GB, DE, RU

AZ sheet piles in combined walls
GB, DE, FR

Waste disposal
GB, DE, FR

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