ArcelorMittal Sheet Piling

ArcelorMittal

The HZ®-M Steel Wall System 2020

The development of the HZ®-M Steel Wall System

The race to build larger vessels for the transport of containers and bulk cargo around the world has resulted in an increase of the draught of major ports, and consequently the need for more heavy-load berthing facilities has arisen. To cope with these deeper structures, conventional steel sheet piles have been replaced with "combined walls" which consist of two complementary elements: a primary element (king pile) and a secondary element (intermediary sheet pile).

Aware of this inescapable evolution in the main application field for the high range of conventional steel sheet piles, "Arbed" (ArcelorMittal since 2007) in Luxembourg started producing the **HZ-ZH** combined wall system in the 1970's. Quickly this system imposed itself as the first choice for the construction of new quay walls in major ports of Germany, Italy, the USA and many emerging economies.

Later in the 1990's, the development of the AZ steel sheet piles led to an improvement of the system: introduction of new HZ king piles that were available in different thicknesses, in combination with these AZ sheet piles as intermediary infill sheet piles. This **HZ/AZ** system encountered a matchless success and is still being used all over the world, in most large ports, in deep excavations, in deep watertight cofferdams, etc. Shipments of the HZ/AZ steel wall system during the last years confirmed this evolution.

At the beginning of the XXI century, trends continued evolving towards larger sea-going vessels. Loads on the future berths were expected to continue to increase. Several new mega-ports were on the planning stage, most existing ports were expanding their capacities. Those investments would have required the execution of a large amount of new quay walls and the deepening of existing ones. New types of applications required larger high-capacity retaining walls.

As a consequence, a shortage of production capacity of the HZ/AZ combined walls was predicted for the long-term. In order to continue to supply state-of-the-art and competitive foundation solutions, the new challenge faced by ArcelorMittal was developing deeper, hot rolled HZ sections with thicker flanges, and providing a substantial increase in productivity and production capacity, as well as being more cost-effective. For this development, an incredible amount of parameters and constraints had to be considered by our R&D.

In 2007, we launched the final research project. Many technical solutions were analysed, then several promising alternatives were investigated in detail in order to select the best choice: **a technically outstanding and proven system** based on existing experience and technology, and **economically a highly competitive solution** compared to existing systems and alternative construction methods and materials.

The HZ®-M Steel Wall concept consists in **hot rolling a wide flange beam, the HZ®-M, with variable thickness of the flange, and subsequently milling a groove into the flanges,** on which a connector is threaded. The finished product is quite similar to the previous HZ/AZ system.

This innovative system requires specialised milling equipment that was engineered and built for this high-precision task. The best suppliers were challenged to design and provide this exclusive milling instrument that would guarantee both a higher production capacity and productivity compared to the existing solution.

An additional advantage is that due to the tight milling tolerances which are achieved, a tighter and better mechanical connection between the flange of the king pile and the hot rolled connectors RH/RZ can be obtained.

Less than one year later, in 2008, ArcelorMittal was proud to supply just-in-time the first HZ®-M in a HZ®-M steel wall system for a huge project in Northern Germany. It proved to be a vast challenge mastered through excellent collaboration between several departments in Luxembourg: R&D, the rolling mill, the technical and the sales departments. The flexibility of the system has been further increased by extending the HZ-M range with the HZ 680M LT section in 2013.

Since 2015, with the introduction of the AZ-800 sections, new infill sheet piles are available which have further improved the competitiveness of the HZ®-M system. In 2019, the HZ 680M LT section was replaced by the new HZ 630M profile, to comply with the demand for stronger combined steel walls with construction height constraints.

We never doubted the success of this system and are confident that our customers will find within our large range of HZ/AZ combinations the most competitive solution for their project.

In 2019, ArcelorMittal has already delivered more than 1 million tonnes of the HZ/AZ system around the world: Brazil, Canada, France, Germany, Italy, Mexico, Nigeria, Poland, Russia, South Africa, The Netherlands, UK and USA, just to mention a few.

The HZ®-M Steel Wall System

The HZ-M Steel Wall System is one of the most preferred solutions for port structures and other deep excavations. It is an HZ/AZ combined wall system that comprises the following elements:

- HZ-M king pile elements, fulfilling two different structural functions: withstand soil and hydrostatic pressures as well as bear vertical loads;
- a pair of AZ sheet piles as an intermediary element that has a soil-retaining and load-transferring function and is generally shorter than the HZ-M king piles;
- special hot rolled connectors (RH, RZD, RZU) connecting infill sheet piles and HZ-M king piles to guarantee a continuous wall.

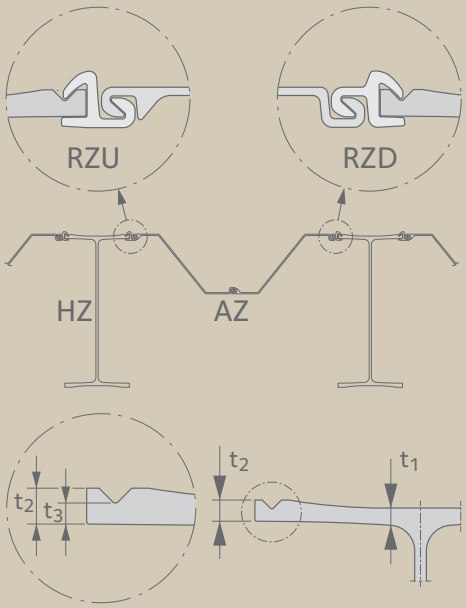
The general concept of the HZ®-M Steel Wall System is based on a stiff king pile with light intermediary sheet piles resulting in an overall safe and cost-effective high capacity retaining structure, with a high stiffness and high bending moment capacity.

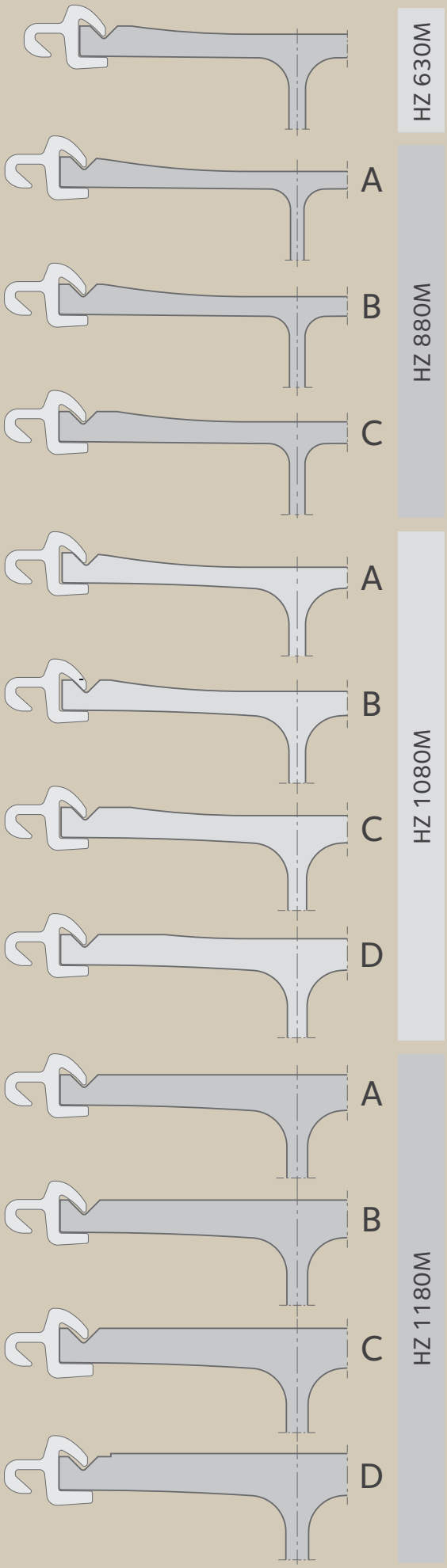
The main advantage of HZ-M king piles is the concave geometry of the flanges of the lighter sections, and the unmatched flange thickness of the heavier king pile sections with up to 40 mm.
To thread the RH/RZ connectors, a groove is milled into the flange. The milling equipment was designed to guarantee very tight tolerances of the groove, which improves interlocking of the connection and ensures sufficient residual steel thickness t_3. The groove is milled if required; flanges without connectors are not milled.

The connectors are threaded over the mill grooves of the HZ-M pile and partially welded, thus increasing the stiffness and the section modulus of the whole wall. Unlike other combined wall system, the geometry of the connectors ensures a "mechanical connection" between the two elements of the HZ/AZ system and guarantees the continuity of the wall without relying on the welding of the connectors.

Additionally, the HZ/AZ system presents advantages compared to equivalent tube-combiwalls:

- it forms an almost straight wall on the water side/excavation side;
- the depth of the HZ/AZ system is shallower, which is an advantage in tight situations (for instance, when installing a wall in front of an existing berthing facility);
- less impact of sea water corrosion on lifetime design (only front side flange of the HZ-M is exposed to sea water);
- the mechanical connection of RZ interlocks to the HZ-M beams provide additional safety, e.g. in case of corrosion of the fixation welding;
- the construction of the capping beam is easier and requires less concrete;
- anchoring of the HZ-M is more simple (see specific paragraph on page 30).

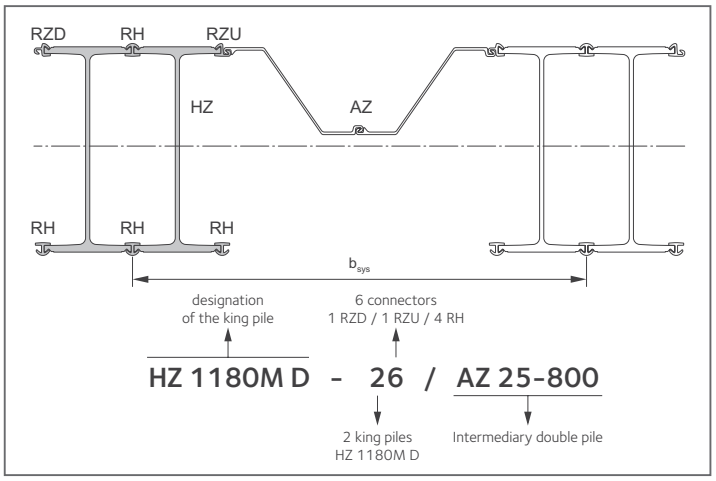




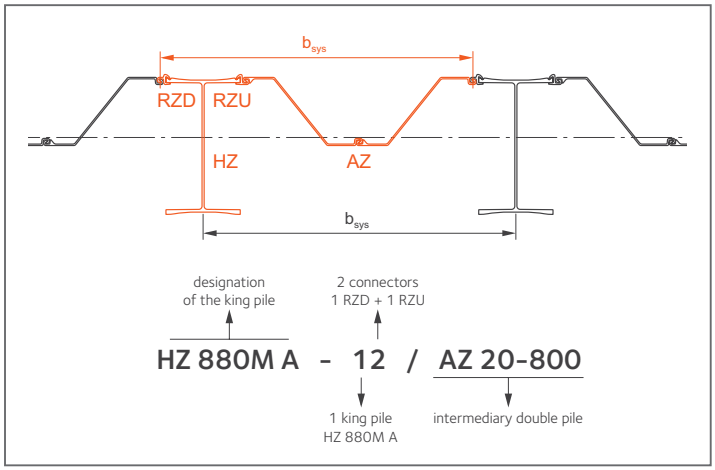
Definition of the HZ®-M Steel Wall System

The outstanding feature of the HZ/AZ combined wall system is the extensive collection of possible combinations using the entire AZ sheet pile range (6 solutions for each HZ-M section; AZ range including all rolled-up and rolled-down AZ sections). The combinations are based on the same principle: structural supports comprising 1 or 2 HZ-M king pile sections alternating with intermediary double AZ sheet pile sections, or as alternative without any infill sheet piles.

In this brochure, to limit the number of pages, the tables are restricted to the main infill sheet pile options from our AZ rolling program, but data for other combinations are available on request.



Denomination of the HZ-M Steel Wall System:



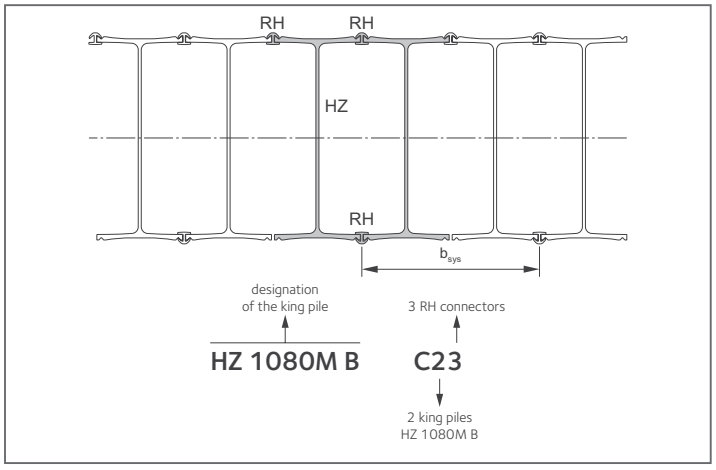
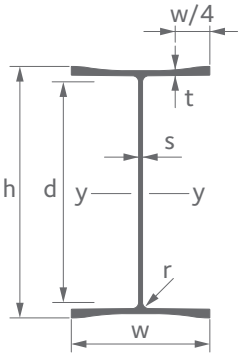
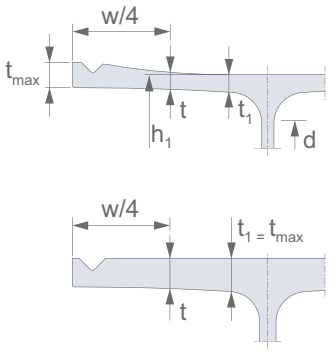


Fig.1. HZ/AZ steel wall system: definitions and designations.

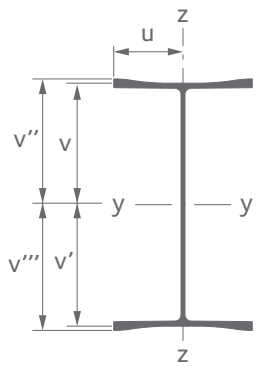
HZ®-M - King piles





Section	h mm	h_1 mm	d mm	w mm	t_1 mm	t_{max} mm	t mm	s mm	r mm	A_v cm^2	Suitable connectors	
HZ 630M	631.4	615.7	510.1	420	22.7	29.0	24.2	16.0	30	116.1	RZD/RZU 16	RH 16
HZ 880M A	831.3	803.4	729.4	458	17.0	29.0	18.9	13.0	20	112.4	RZD/RZU 16	RH 16
HZ 880M B	831.3	807.4	729.4	460	19.0	29.0	20.9	15.0	20	129.2	RZD/RZU 16	RH 16
HZ 880M C	831.3	811.4	729.4	460	21.0	29.0	22.9	15.0	20	130.3	RZD/RZU 16	RH 16
HZ 1080M A	1075.3	1047.4	936.3	454	20.7	29.0	19.6	16.0	30	188.2	RZD/RZU 16	RH 16
HZ 1080M B	1075.3	1053.4	936.3	454	23.7	29.0	22.6	16.0	30	190.7	RZD/RZU 16	RH 16
HZ 1080M C	1075.3	1059.4	936.3	456	26.7	29.0	25.7	18.0	30	213.8	RZD/RZU 16	RH 16
HZ 1080M D	1075.3	1067.4	936.3	457	30.7	30.7	29.7	19.0	30	227.5	RZD/RZU 16	RH 16
HZ 1180M A	1075.4	-	936.3	458	34.7	34.7	31.0	20.0	30	241.2	RZD/RZU 16	RH 16
HZ 1180M B	1079.4	-	936.3	458	36.7	36.7	33.0	20.0	30	243.0	RZD/RZU 16	RH 16
HZ 1180M C	1083.4	-	936.3	459	38.7	38.7	35.0	21.0	30	255.1	RZD/RZU 18	RH 20
HZ 1180M D	1087.4	-	936.3	460	40.7	40.7	37.0	22.0	30	267.3	RZD/RZU 18	RH 20

Solution 100



	Dimensions					Properties per solution										
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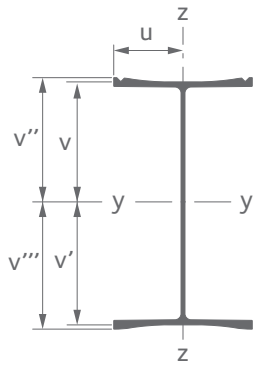
Section	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	307.9	307.9	315.7	315.7	210.0	312.0	**244.9**	220860	34220	598.3	29450	**7175**	-	1630	0.421	2.430
HZ 880M A	401.7	401.7	415.7	415.7	229.0	295.6	**232.0**	356770	39990	370.7	60820	**8880**	-	1745	0.459	2.966
HZ 880M B	403.7	403.7	415.7	415.7	230.0	328.2	**257.6**	392750	42770	482.6	65460	**9730**	-	1860	0.461	2.967
HZ 880M C	405.7	405.7	415.7	415.7	230.0	342.7	**269.0**	416760	44350	558.1	68370	**10275**	-	1930	0.461	2.967
HZ 1080M A	523.7	523.7	537.7	537.7	227.0	371.8	**291.9**	699490	39320	547.9	102000	**13355**	-	1730	0.455	3.403
HZ 1080M B	526.7	526.7	537.7	537.7	227.0	395.2	**310.2**	764780	42300	685.5	110600	**14520**	-	1865	0.455	3.403
HZ 1080M C	529.7	529.7	537.7	537.7	228.0	437.2	**343.2**	843200	44950	904.7	118400	**15920**	-	1970	0.457	3.405
HZ 1080M D	533.7	533.7	537.7	537.7	228.5	471.2	**369.9**	919590	46930	1156.9	124900	**17230**	-	2055	0.457	3.405
HZ 1180M A	537.7	537.7	537.7	537.7	229.0	498.4	**391.3**	977280	47940	1391.0	128600	**18175**	-	2095	0.458	3.406
HZ 1180M B	539.7	539.7	539.7	539.7	229.0	516.7	**405.6**	1030390	51140	1592.0	137800	**19090**	-	2235	0.458	3.414
HZ 1180M C	541.7	541.7	541.7	541.7	229.5	545.9	**428.5**	1094540	54720	1860.3	148000	**20205**	-	2385	0.459	3.423
HZ 1180M D	543.7	543.7	543.7	543.7	230.0	575.1	**451.5**	1159330	58340	2177.9	158300	**21325**	-	2535	0.460	3.432

Solution 102



	Dimensions					Properties per solution										
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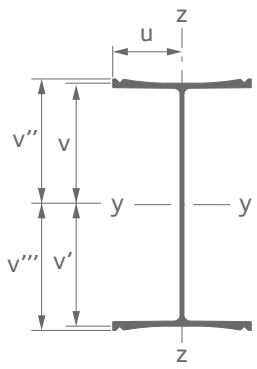
Section	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	311.4	304.4	319.2	312.2	210.0	308.6	**242.2**	217460	33010	569.2	28410	**6985**	-	1570	0.440	2.430
HZ 880M A	406.2	397.2	420.1	411.2	229.0	292.4	**229.5**	351350	38640	347.2	58780	**8650**	-	1685	0.478	2.966
HZ 880M B	408.1	399.3	420.0	411.3	230.0	324.7	**254.9**	386810	41280	455.9	63190	**9480**	-	1795	0.481	2.967
HZ 880M C	409.9	401.5	419.9	411.4	230.0	339.2	**266.3**	410830	42870	531.9	66090	**10025**	-	1865	0.480	2.967
HZ 1080M A	528.2	519.2	542.2	533.1	227.0	368.7	**289.4**	690560	38020	525.9	98560	**13075**	-	1675	0.473	3.403
HZ 1080M B	531.4	522.0	542.4	532.9	227.0	391.7	**307.5**	754830	40860	656.5	106800	**14205**	-	1800	0.475	3.403
HZ 1080M C	534.0	525.4	541.9	533.4	228.0	433.7	**340.5**	833250	43490	876.2	114500	**15605**	-	1910	0.476	3.405
HZ 1080M D	537.7	529.7	541.6	533.7	228.5	467.7	**367.2**	909650	45470	1129.1	121000	**16920**	-	1990	0.477	3.405
HZ 1180M A	541.5	533.9	541.5	533.9	229.0	494.9	**388.5**	967270	46460	1352.9	124600	**17865**	-	2030	0.477	3.406
HZ 1180M B	544.5	534.9	544.5	534.9	229.0	512.1	**402.0**	1017000	49170	1544.3	132400	**18675**	-	2145	0.481	3.414
HZ 1180M C	546.3	537.1	546.3	537.1	229.5	541.2	**424.9**	1081070	52740	1817.9	142600	**19790**	-	2300	0.482	3.423
HZ 1180M D	550.4	537.0	550.4	537.0	230.0	568.1	**445.9**	1138630	55340	2110.2	150000	**20690**	-	2405	0.487	3.432

Solution 104



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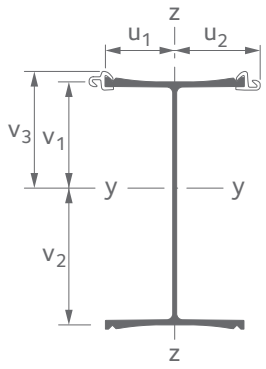
Section	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	307.9	307.9	315.7	315.7	210.0	305.1	**239.5**	214130	31800	543.5	27440	**6955**	-	1515	0.440	2.449
HZ 880M A	401.7	401.7	415.7	415.7	229.0	289.2	**227.0**	346040	37290	324.4	56870	**8615**	-	1630	0.478	2.984
HZ 880M B	403.7	403.7	415.7	415.7	230.0	321.3	**252.2**	381010	39800	429.6	61070	**9440**	-	1730	0.481	2.987
HZ 880M C	405.7	405.7	415.7	415.7	230.0	335.7	**263.6**	405030	41380	505.2	63950	**9985**	-	1800	0.480	2.987
HZ 1080M A	523.7	523.7	537.7	537.7	227.0	365.6	**287.0**	681790	36720	500.8	95400	**13020**	-	1620	0.473	3.421
HZ 1080M B	526.7	526.7	537.7	537.7	227.0	388.3	**304.8**	745050	39420	629.6	103200	**14145**	-	1735	0.475	3.423
HZ 1080M C	529.7	529.7	537.7	537.7	228.0	430.3	**337.8**	823460	42040	849.0	110900	**15545**	-	1845	0.476	3.424
HZ 1080M D	533.7	533.7	537.7	537.7	228.5	464.3	**364.4**	899860	44000	1102.0	117300	**16860**	-	1925	0.477	3.425
HZ 1180M A	537.7	537.7	537.7	537.7	229.0	491.4	**388.1**	957390	44980	1332.0	120900	**17805**	-	1965	0.477	3.426
HZ 1180M B	539.7	539.7	539.7	539.7	229.0	507.5	**398.4**	1003860	47210	1511.8	127500	**18600**	-	2060	0.481	3.437
HZ 1180M C	541.7	541.7	541.7	541.7	229.5	536.6	**421.2**	1067820	50760	1780.5	137600	**19710**	-	2210	0.482	3.446
HZ 1180M D	543.7	543.7	543.7	543.7	230.0	561.0	**440.4**	1118440	52340	2042.4	142500	**20570**	-	2275	0.487	3.447

Solution 124



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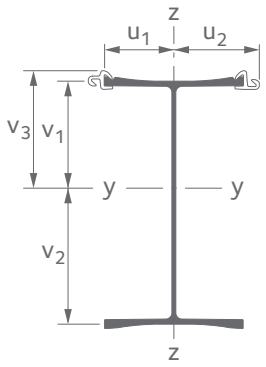
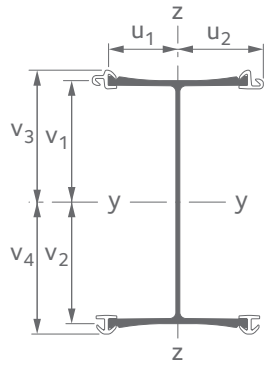
Section	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	272.1	343.6	300.3	209.9	263.9	346.2	**271.8**	247130	52190	702.2	38320	**7190**	8230	1980	0.582	2.546
HZ 880M A	351.8	451.6	386.1	228.8	282.9	330.3	**259.3**	404090	61290	476.1	79530	**8950**	10465	2165	0.621	3.035
HZ 880M B	358.2	449.2	390.5	229.9	283.9	362.4	**284.5**	439780	64000	584.1	84560	**9790**	11260	2255	0.624	3.039
HZ 880M C	361.9	449.5	392.3	229.9	283.9	376.8	**295.8**	464090	65580	659.8	87970	**10325**	11830	2310	0.624	3.038
HZ 1080M A	470.8	576.6	505.1	226.9	280.9	406.7	**319.3**	783040	60320	651.8	133500	**13580**	15500	2150	0.617	3.473
HZ 1080M B	476.6	576.8	507.9	226.9	280.9	429.4	**337.0**	846900	63020	781.7	142700	**14685**	16675	2245	0.618	3.474
HZ 1080M C	484.1	575.3	512.4	227.9	281.9	471.4	**370.0**	926280	65840	998.7	151900	**16100**	18080	2335	0.619	3.476
HZ 1080M D	491.2	576.3	515.5	228.4	282.4	505.4	**396.7**	1003330	67900	1252.3	159500	**17410**	19465	2405	0.620	3.476
HZ 1180M A	497.3	578.1	517.6	228.9	282.9	532.6	**418.1**	1061330	68980	1495.6	163800	**18360**	20505	2440	0.621	3.477
HZ 1180M B	500.5	578.9	518.8	228.9	282.9	548.6	**430.6**	1108050	71210	1677.6	171400	**19140**	21360	2515	0.622	3.484
HZ 1180M C	500.8	582.6	520.1	229.4	283.4	582.2	**457.0**	1182510	76990	2024.9	186200	**20300**	22735	2715	0.635	3.493
HZ 1180M D	504.5	582.9	521.8	229.9	283.9	606.6	**476.2**	1233510	78680	2290.7	192000	**21160**	23640	2770	0.641	3.497

Solution 12



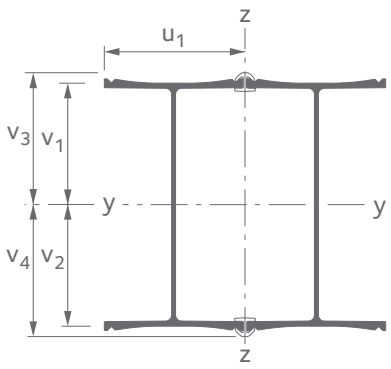
	Dimensions					Properties per solution										
	v_1	v_2	v_3	u_1	u_2	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$*	$W_{el,y}$**	$W_{el,z}$	A_{LW}	A_{LS}
Section	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	275.5	340.2	303.8	209.9	263.9	349.7	**274.5**	251260	53400	725.6	40250	**7385**	8270	2025	0.582	2.527
HZ 880M A	356.2	447.2	390.5	228.9	282.9	333.5	**261.8**	410770	62640	498.9	83350	**9185**	10520	2215	0.621	3.017
HZ 880M B	362.5	444.9	394.9	229.9	283.9	365.8	**287.2**	446960	65480	609.4	88710	**10045**	11320	2305	0.624	3.019
HZ 880M C	366.1	445.3	396.4	229.9	283.9	380.3	**298.5**	471210	67060	685.7	92100	**10580**	11885	2360	0.624	3.019
HZ 1080M A	475.6	571.8	509.9	226.9	280.9	409.8	**321.7**	793650	61620	674.8	139800	**13880**	15565	2195	0.617	3.455
HZ 1080M B	481.5	571.9	512.9	226.9	280.9	432.8	**339.8**	858610	64460	808.1	149600	**15015**	16740	2295	0.618	3.455
HZ 1080M C	488.5	570.9	516.8	227.9	281.9	474.8	**372.8**	937820	67290	1025.8	158800	**16430**	18145	2385	0.619	3.456
HZ 1080M D	495.3	572.1	519.6	228.4	282.4	508.8	**399.4**	1014760	69370	1279.6	166400	**17735**	19530	2455	0.620	3.457
HZ 1180M A	501.2	574.2	521.5	228.9	282.9	536.0	**420.8**	1072760	70460	1522.7	170900	**18685**	20570	2490	0.621	3.458
HZ 1180M B	505.3	574.1	523.6	228.9	282.9	553.2	**434.3**	1123200	73180	1717.8	180500	**19565**	21450	2585	0.622	3.462
HZ 1180M C	505.4	578.0	524.7	229.4	283.4	586.8	**460.7**	1197860	78970	2068.6	195500	**20725**	22830	2785	0.635	3.471
HZ 1180M D	511.2	576.2	528.5	229.9	283.9	613.7	**481.7**	1256780	81670	2358.7	205900	**21815**	23780	2875	0.641	3.476

Solution 14



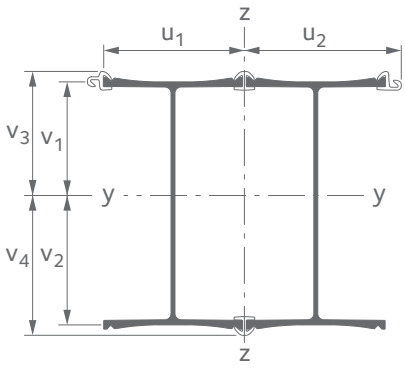
	Dimensions						Properties per solution										
	v_1	v_2	v_3	v_4	u_1	u_2	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$*	$W_{el,y}$**	$W_{el,z}$	A_{LW}	A_{LS}
Section	mm	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	307.5	308.3	335.7	336.6	209.9	263.9	386.5	**303.4**	288850	71250	865.8	62460	**9370**	8580	2700	0.582	2.808
HZ 880M A	401.1	402.4	435.4	436.8	228.9	282.9	370.6	**290.9**	478080	83810	635.9	129700	**11880**	10945	2965	0.621	3.253
HZ 880M B	403.1	404.3	435.4	436.8	229.9	283.9	402.6	**316.1**	513050	86710	743.8	135000	**12690**	11745	3055	0.624	3.256
HZ 880M C	405.1	406.3	435.5	436.7	229.9	283.9	417.1	**327.4**	537070	88290	820.1	138400	**13220**	12300	3110	0.624	3.255
HZ 1080M A	522.9	524.5	557.2	558.9	226.9	280.9	446.9	**350.9**	905800	82470	800.8	217700	**17270**	16205	2935	0.617	3.690
HZ 1080M B	526.0	527.4	557.3	558.9	226.9	280.9	469.6	**368.6**	969050	85170	930.9	226600	**18375**	17340	3030	0.618	3.691
HZ 1080M C	529.0	530.4	557.3	558.8	227.9	281.9	511.6	**401.6**	1047480	88170	1150.2	236400	**19750**	18745	3130	0.619	3.693
HZ 1080M D	533.1	534.3	557.4	558.8	228.4	282.4	545.6	**428.3**	1123870	90340	1402.1	244500	**21035**	20115	3200	0.620	3.693
HZ 1180M A	537.1	538.3	557.4	558.1	228.9	282.9	572.8	**449.6**	1181400	91500	1649.4	249500	**21945**	21170	3235	0.621	3.694
HZ 1180M B	539.1	540.3	557.4	558.7	228.9	282.8	588.8	**462.2**	1227870	93730	1832.0	257000	**22725**	21975	3315	0.622	3.696
HZ 1180M C	545.9	537.5	565.2	556.8	229.4	283.4	632.7	**496.7**	1331210	105640	2278.2	292200	**24385**	23550	3730	0.635	3.730
HZ 1180M D	547.8	539.6	565.1	556.9	229.9	283.9	657.1	**515.8**	1381830	107440	2534.5	298500	**25225**	24455	3785	0.641	3.736

Solution 22



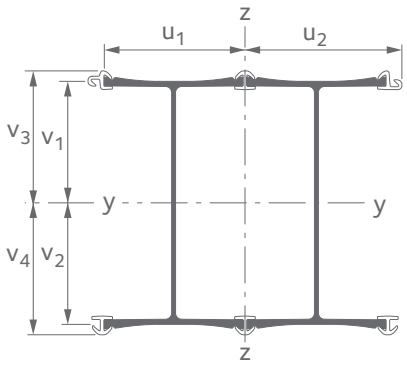
	Dimensions					Properties per solution										
	v_1	v_2	v_3	v_4	u_1	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$*	$W_{el,y}$**	$W_{el,z}$	A_{LW}	A_{LS}
Section	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	307.9	307.9	336.2	336.2	427.0	650.4	**510.6**	465570	351040	238756	70260	**15125**	13850	8220	0.925	2.934
HZ 880M A	401.7	401.7	436.2	436.2	465.0	618.7	**485.7**	757840	396870	324894	179300	**18865**	17375	8535	1.001	3.507
HZ 880M B	403.7	403.7	436.2	436.2	467.0	682.8	**536.0**	827780	440610	372106	183900	**20505**	18980	9435	1.007	3.513
HZ 880M C	405.7	405.7	436.2	436.2	467.0	711.7	**558.7**	875820	460030	381151	207500	**21590**	20080	9850	1.007	3.513
HZ 1080M A	523.7	523.7	558.1	558.1	461.0	771.4	**605.6**	1474960	473900	538547	371600	**28165**	26425	10280	0.993	3.941
HZ 1080M B	526.7	526.7	558.1	558.1	461.0	816.8	**641.2**	1601480	504130	555020	440200	**30405**	28695	10935	0.995	3.943
HZ 1080M C	529.7	529.7	558.1	558.1	463.0	900.8	**707.1**	1758320	559410	625885	468900	**33195**	31505	12080	0.998	3.946
HZ 1080M D	533.7	533.7	558.1	558.1	464.0	968.8	**760.5**	1911110	603080	670072	517400	**35810**	34240	12995	0.999	3.947
HZ 1180M A	537.7	537.7	558.1	558.1	465.0	1023.1	**803.2**	2026180	637490	709427	540700	**37680**	36305	13710	1.001	3.949
HZ 1180M B	539.7	539.7	558.1	558.1	465.0	1055.2	**828.3**	2119120	659790	696179	592500	**39265**	37970	14190	1.006	3.962
HZ 1180M C	541.7	541.7	561.0	561.0	467.0	1123.7	**882.1**	2274730	707070	745410	653200	**41990**	40550	15140	1.011	3.975
HZ 1180M D	543.7	543.7	561.0	561.0	468.0	1172.5	**920.4**	2375960	740430	781985	672700	**43700**	42350	15820	1.022	3.983

Solution 24



	Dimensions						Properties per solution										
	v_1	v_2	v_3	v_4	u_1	u_2	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$*	$W_{el,y}$**	$W_{el,z}$	A_{LW}	A_{LS}
Section	mm	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	290.0	325.8	318.3	354.1	426.9	480.9	691.5	**542.9**	500770	430330	253317	95210	**15370**	14140	8950	1.067	3.031
HZ 880M A	376.7	426.7	411.2	461.2	464.8	518.9	659.8	**518.0**	820000	490460	333657	238700	**19220**	17780	9450	1.144	3.559
HZ 880M B	380.9	426.5	413.4	458.9	466.9	520.9	723.9	**568.3**	890310	534990	382921	243200	**20875**	19400	10270	1.150	3.565
HZ 880M C	383.8	427.6	414.3	458.1	466.9	520.9	752.8	**591.0**	938480	554410	392187	270400	**21950**	20490	10645	1.150	3.565
HZ 1080M A	497.2	550.2	531.7	584.6	460.9	514.9	812.5	**637.8**	1581890	565930	539125	483600	**28755**	27060	10990	1.136	3.992
HZ 1080M B	501.6	551.8	533.1	583.2	460.9	514.9	857.9	**673.4**	1708720	596160	555194	560800	**30970**	29300	11580	1.138	3.995
HZ 1080M C	506.9	552.5	535.3	581.0	462.9	516.9	941.9	**739.4**	1866030	652220	625944	591700	**33770**	32120	12620	1.141	3.998
HZ 1080M D	512.4	555.0	536.8	579.4	463.9	517.9	1009.9	**792.8**	2019150	696280	670640	644900	**36380**	34850	13445	1.142	3.999
HZ 1180M A	517.5	557.9	537.9	578.3	464.9	518.9	1064.2	**835.4**	2134450	731080	717576	670400	**38260**	36905	14090	1.144	4.001
HZ 1180M B	520.1	559.3	538.5	577.7	464.9	518.9	1096.3	**860.6**	2227520	753380	719378	726200	**39825**	38555	14520	1.147	4.009
HZ 1180M C	521.3	562.1	540.6	581.4	466.9	520.9	1169.3	**917.9**	2394300	810730	745545	805400	**42600**	41185	15565	1.164	4.022
HZ 1180M D	524.2	563.2	541.5	580.5	467.9	521.9	1218.1	**956.2**	2495730	844530	783948	828700	**44310**	42990	16180	1.176	4.032

Solution 26

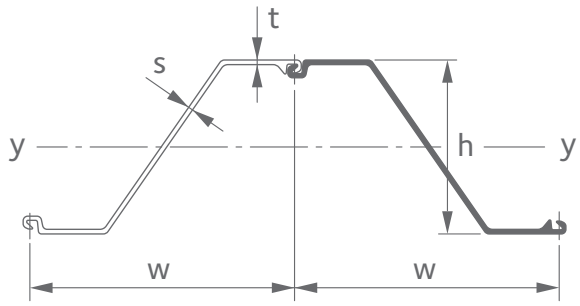


	Dimensions						Properties per solution										
	v_1	v_2	v_3	v_4	u_1	u_2	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$ *	$W_{el,y}$ **	$W_{el,z}$	A_{LW}	A_{LS}
Section	mm	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	307.6	308.1	336.0	336.4	426.9	480.9	731.8	**574.5**	540280	506260	253467	129710	**17535**	16060	10530	1.067	3.292
HZ 880M A	401.4	402.0	435.8	436.5	464.9	518.8	700.1	**549.6**	889890	580240	335001	322900	**22135**	20385	11185	1.144	3.776
HZ 880M B	403.4	404.0	435.8	436.5	467.0	520.8	764.1	**599.9**	959830	625530	382884	324800	**23755**	21990	12010	1.150	3.782
HZ 880M C	405.4	406.0	435.9	436.5	467.0	520.8	793.1	**622.6**	1007860	644950	392360	355800	**24825**	23090	12385	1.150	3.782
HZ 1080M A	523.3	524.1	557.7	558.5	460.9	514.9	852.8	**669.4**	1698970	654200	545166	633900	**32415**	30420	12705	1.136	4.209
HZ 1080M B	526.3	527.1	557.7	558.5	460.9	514.9	898.1	**705.0**	1825490	684420	555301	719800	**34635**	32685	13295	1.138	4.212
HZ 1080M C	529.4	530.1	557.8	558.5	462.9	516.9	982.1	**771.0**	1982330	741240	626147	749200	**37400**	35495	14340	1.141	4.215
HZ 1080M D	533.4	534.0	557.8	558.5	463.9	517.9	1050.1	**824.4**	2135120	785680	670660	805600	**39980**	38235	15170	1.142	4.216
HZ 1180M A	537.4	538.0	557.8	558.4	464.9	518.9	1104.5	**867.0**	2250190	820860	716260	830900	**41825**	40295	15820	1.144	4.217
HZ 1180M B	539.4	540.0	557.8	558.4	464.9	518.8	1136.5	**892.2**	2343130	843160	719557	891800	**43390**	41960	16250	1.147	4.221
HZ 1180M C	543.9	539.5	563.2	558.8	466.9	520.9	1219.8	**957.5**	2538170	924710	746792	1022600	**46665**	45070	17755	1.164	4.259
HZ 1180M D	545.8	541.6	563.1	558.9	467.9	521.9	1268.6	**995.9**	2639410	959080	783756	1042400	**48360**	46875	18380	1.176	4.271

Note: Alternative solutions are available on request.


Combined wall, combination 24

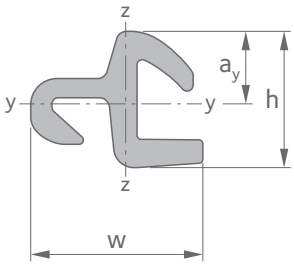
AZ® - Intermediary piles



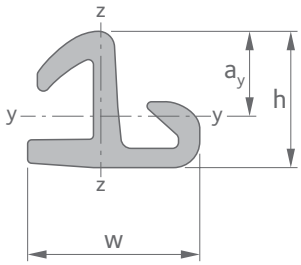
	Dimensions				Properties per double pile					
	h	w	t	s	A	G	I_y	$W_{el,y}$	i_y	A_{LW}
Section	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^3	cm	m^2/m
AZ 20-800	450	800	9.5	9.5	225.6	177.1	72070	3205	17.87	2.08
AZ 20-800-10/10	451	800	10.0	10.0	235.6	184.9	75070	3335	17.85	2.08
AZ 25-800	475	800	12.5	10.0	261.3	205.1	95060	4005	19.07	2.11
AZ 13-770	344	770	9.0	9.0	193.8	152.1	34440	2000	13.33	1.85
AZ 14-770-10/10	345	770	10.0	10.0	211.2	165.8	37330	2165	13.30	1.85
AZ 28-750	509	750	12.0	10.0	256.8	201.6	107310	4215	20.44	2.11
AZ 30-750	510	750	13.0	11.0	277.1	217.5	115000	4510	20.37	2.11
AZ 32-750	511	750	14.0	12.0	297.4	233.5	122710	4805	20.31	2.11
AZ 13-700	315	700	9.5	9.5	188.5	148.0	28750	1825	12.35	1.71
AZ 13-700-10/10	316	700	10.0	10.0	196.6	154.3	29910	1895	12.33	1.71
AZ 18-700	420	700	9.0	9.0	194.9	153.0	52920	2520	16.47	1.86
AZ 20-700	421	700	10.0	10.0	212.8	167.0	57340	2725	16.42	1.86
AZ 26-700	460	700	12.2	12.2	262.1	205.7	83610	3635	17.86	1.93
AZ 18-10/10	381	630	10.0	10.0	198.1	155.5	44790	2355	15.04	1.71
AZ 26	427	630	13.0	12.2	249.2	195.6	69940	3280	16.75	1.78

Connectors

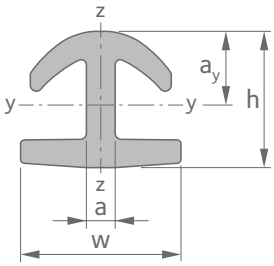
RZD



RZU



RH



	Dimensions				Properties							
	h	w	a	a_y	A	G	I_y	I_z	$W_{el,y}$	$W_{el,z}$	A_{LW}	A_{LS}
Section	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^3	cm^3	m^2/m	m^2/m
RZD 16	61.8	80.5	-	31.5	20.7	**16.2**	57	94	**18**	22	0.12	0.06
RZU 16	61.8	80.5	-	38.3	20.4	**16.0**	68	94	**18**	22	0.08	0.10
RH 16	61.8	68.2	12.2	32.5	20.1	**15.8**	83	54	**25**	16	0.10	0.09
RZD 18	67.3	85.0	-	35.9	23.0	**18.0**	78	110	**22**	25	0.12	0.07
RZU 18	67.3	85.0	-	42.1	22.6	**17.8**	92	110	**22**	25	0.09	0.10
RH 20	67.3	79.2	14.2	36.5	25.2	**19.8**	122	88	**33**	22	0.11	0.10

Note: For suitable combinations of connectors and HZ®-M king piles, see page 4.

Delivery conditions

Tolerances

Standard EN 10248	HZ®-M	AZ®
Mass[1]	± 5 %	± 5 %
Length (L)	± 200 mm	± 200 mm
Thicknesses (t,s)	t,s > 12.5 mm: + 2.5 mm / -1.5 mm	t,s > 8.5 mm: ± 6 %
Height (h)	h ≥ 500 mm: ± 7.0 mm	h ≥ 300 mm: ± 7.0 mm
Width single pile (w)	± 2 % w	± 2 % w
Width double piles (2w)	± 3 % (2w)	± 3 % (2w)
Straightness (q)	≤ 0.2 % L	≤ 0.2 % L
Ends out of square	± 2 % w	± 2 % w

[1] From the mass of the total delivery.

Maximum rolling length[2]

HZ	33 m
AZ	31 m
RZD / RZU / RH	24 m

[2] Longer sections may be supplied. Please contact us.

Section \ Steel grade	EN 10248 S 240 GP	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 AP[3]	ASTM A 572	A 690
HZ	✓	✓	✓	✓	✓	✓	✓[4]	✓	✓
AZ	✓[5]	✓	✓	✓	✓	✓	✓	✓	✓
RH / RZD / RZU	×	×	×	×	×	✓	✓	×	✓

[3] ArcelorMittal mill specification.
[4] HZ 1180M D on request.
[5] Please contact us as some limitations may apply.

✓ available × currently unavailable

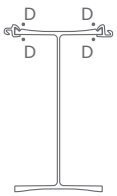
Steel grades

Standard EN 10248	Min. yield strength R_{eH} MPa	Min. tensile strength R_m MPa	Min. elongation $L_o = 5.65\sqrt{S_o}$ %
S 240 GP	240	340	26
S 270 GP	270	410	24
S 320 GP	320	440	23
S 355 GP	355	480	22
S 390 GP	390	490	20
S 430 GP	430	510	19
ArcelorMittal mill specification			
S 460 AP	460	550	17

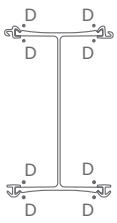
All the components of the HZ-M Steel Wall System are available in **ASTM A 690** steel grade.
ASTM A 690 with higher yield strength on request.

Standard welding configuration

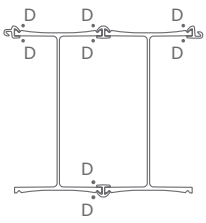
Sol. 12



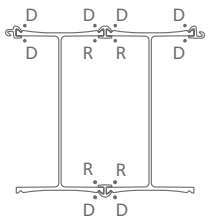
Sol. 14



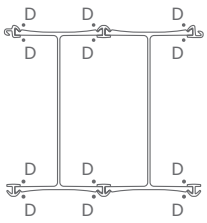
Sol. 24 - Form "a"



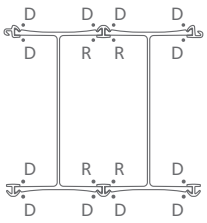
Sol. 24 - Form "b"



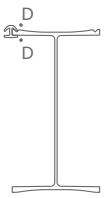
Sol. 26 - Form "a"



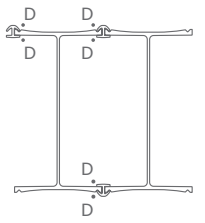
Sol. 26 - Form "b"



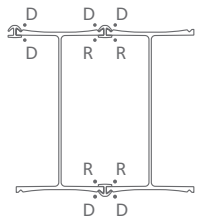
Sol. C1



Sol. C23 - Form "a"



Sol. C23 - Form "b"



D discontinuous weld, a = 6 mm: 10% of length (100 mm/m) over whole connector length and 500 mm continuous weld at top and toe of connector
R continuous weld, a = 6 mm: 500 mm at the top and toe of connector

In **Form "a"** the HZ-M king piles can be driven separately if necessary (for instance, in hard driving conditions).
Form "b" is the standard delivery form: the HZ-M king piles are welded together and can only be driven in one piece as a box pile.
If hard driving conditions are predicted, the length of the discontinuous weld "D" should be increased. Please contact our technical department for more details.

Combination HZ ... M - 12 / AZ 20-800

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm²/m	cm⁴/m	cm³/m	cm³/m	kg/m²	kg/m²	kg/m²	m²/m	m²/m	m
HZ 630M	275.2	154710	**4550**	5090	176	196	**216**	2.661	4.606	2.090
HZ 880M A	262.7	226900	**5075**	5810	167	187	**206**	2.700	5.097	2.127
HZ 880M B	277.7	243670	**5475**	6170	179	198	**218**	2.703	5.099	2.127
HZ 880M C	284.5	255060	**5730**	6435	184	204	**223**	2.703	5.098	2.127
HZ 1080M A	299.2	407590	**7130**	7995	195	215	**235**	2.696	5.534	2.127
HZ 1080M B	310.0	438170	**7660**	8545	204	224	**243**	2.697	5.534	2.127
HZ 1080M C	329.5	475020	**8320**	9190	219	239	**259**	2.699	5.536	2.127
HZ 1080M D	345.3	510970	**8930**	9835	232	251	**271**	2.699	5.536	2.127
HZ 1180M A	357.9	537990	**9370**	10315	242	261	**281**	2.700	5.537	2.127
HZ 1180M B	366.0	561690	**9785**	10725	248	268	**287**	2.702	5.541	2.127
HZ 1180M C	381.6	596490	**10320**	11370	260	280	**300**	2.714	5.550	2.127
HZ 1180M D	394.0	623870	**10830**	11805	269	289	**309**	2.720	5.555	2.127

Combination HZ ... M - 14 / AZ 20-800

HZ 630M	292.8	172690	**5600**	5130	184	207	**230**	2.661	4.887	2.090
HZ 880M A	280.2	258530	**6425**	5920	175	197	**220**	2.700	5.332	2.127
HZ 880M B	294.9	274710	**6795**	6290	186	209	**232**	2.703	5.335	2.127
HZ 880M C	301.7	285980	**7040**	6550	192	214	**237**	2.703	5.335	2.127
HZ 1080M A	316.6	460390	**8780**	8240	203	226	**249**	2.696	5.769	2.127
HZ 1080M B	327.3	490170	**9295**	8770	212	234	**257**	2.697	5.771	2.127
HZ 1080M C	346.8	526600	**9930**	9425	227	250	**272**	2.699	5.772	2.127
HZ 1080M D	362.6	562270	**10525**	10065	239	262	**285**	2.699	5.773	2.127
HZ 1180M A	375.2	589040	**10945**	10555	249	272	**295**	2.700	5.773	2.127
HZ 1180M B	382.7	610870	**11305**	10935	255	278	**300**	2.702	5.775	2.127
HZ 1180M C	403.1	659130	**12075**	11660	269	293	**316**	2.714	5.809	2.127
HZ 1180M D	414.4	682580	**12460**	12080	278	302	**325**	2.720	5.815	2.127

Combination HZ ... M - 24 / AZ 20-800

HZ 630M	363.4	226960	**6965**	6410	252	269	**285**	3.146	5.111	2.524
HZ 880M A	340.5	343110	**8040**	7440	235	251	**267**	3.224	5.638	2.598
HZ 880M B	364.6	369580	**8665**	8055	254	270	**286**	3.230	5.645	2.598
HZ 880M C	375.7	388080	**9075**	8470	263	279	**295**	3.229	5.644	2.598
HZ 1080M A	400.5	638100	**11600**	10915	282	298	**314**	3.215	6.072	2.598
HZ 1080M B	418.0	687030	**12450**	11780	296	312	**328**	3.218	6.074	2.598
HZ 1080M C	449.7	746570	**13510**	12850	321	337	**353**	3.221	6.077	2.598
HZ 1080M D	475.6	804940	**14505**	13890	341	357	**373**	3.222	6.078	2.598
HZ 1180M A	496.1	848660	**15210**	14675	357	373	**389**	3.223	6.080	2.598
HZ 1180M B	508.4	884460	**15815**	15310	367	383	**399**	3.227	6.089	2.598
HZ 1180M C	535.7	947150	**16850**	16290	388	404	**421**	3.243	6.102	2.598
HZ 1180M D	554.0	985340	**17495**	16975	402	419	**435**	3.256	6.111	2.598

Combination HZ ... M - 26 / AZ 20-800

HZ 630M	379.3	242610	**7875**	7210	260	279	**298**	3.146	5.372	2.524
HZ 880M A	356.0	369980	**9205**	8475	242	261	**279**	3.224	5.855	2.598
HZ 880M B	380.1	396270	**9810**	9080	261	280	**298**	3.230	5.862	2.598
HZ 880M C	391.2	414720	**10215**	9500	270	289	**307**	3.229	5.861	2.598
HZ 1080M A	416.0	683270	**13035**	12235	289	308	**327**	3.215	6.289	2.598
HZ 1080M B	433.5	732080	**13890**	13110	303	322	**340**	3.218	6.291	2.598
HZ 1080M C	465.2	791370	**14930**	14170	328	347	**365**	3.221	6.294	2.598
HZ 1080M D	491.0	849570	**15910**	15215	348	367	**385**	3.222	6.295	2.598
HZ 1180M A	511.6	893180	**16600**	15995	365	383	**402**	3.223	6.297	2.598
HZ 1180M B	523.9	928920	**17200**	16635	374	393	**411**	3.227	6.300	2.598
HZ 1180M C	555.1	1002400	**18430**	17800	397	416	**436**	3.243	6.338	2.598
HZ 1180M D	573.4	1040470	**19065**	18480	411	431	**450**	3.256	6.350	2.598

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 20-800-10/10

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm²/m	cm⁴/m	cm³/m	cm³/m	kg/m²	kg/m²	kg/m²	m²/m	m²/m	m
HZ 630M	280.0	156140	**4590**	5140	178	199	**220**	2.662	4.607	2.090
HZ 880M A	267.4	228310	**5105**	5845	169	190	**210**	2.701	5.097	2.127
HZ 880M B	282.4	245080	**5510**	6205	181	201	**222**	2.704	5.099	2.127
HZ 880M C	289.2	256470	**5760**	6470	186	207	**227**	2.704	5.099	2.127
HZ 1080M A	303.9	409000	**7150**	8020	198	218	**239**	2.697	5.535	2.127
HZ 1080M B	314.7	439590	**7685**	8570	206	227	**247**	2.698	5.535	2.127
HZ 1080M C	334.2	476430	**8345**	9220	221	242	**262**	2.699	5.536	2.127
HZ 1080M D	350.0	512380	**8955**	9860	234	254	**275**	2.700	5.537	2.127
HZ 1180M A	362.6	539390	**9395**	10340	244	264	**285**	2.701	5.538	2.127
HZ 1180M B	370.7	563100	**9810**	10755	250	271	**291**	2.702	5.542	2.127
HZ 1180M C	386.3	597900	**10345**	11395	262	283	**303**	2.715	5.551	2.127
HZ 1180M D	398.7	625280	**10850**	11830	272	292	**313**	2.721	5.556	2.127

Combination HZ ... M - 14 / AZ 20-800-10/10

HZ 630M	297.6	174120	**5650**	5175	186	210	**234**	2.662	4.888	2.090
HZ 880M A	284.9	259940	**6460**	5950	177	200	**224**	2.701	5.333	2.127
HZ 880M B	299.6	276110	**6830**	6320	188	212	**235**	2.704	5.336	2.127
HZ 880M C	306.4	287390	**7075**	6580	194	217	**241**	2.704	5.335	2.127
HZ 1080M A	321.3	461800	**8805**	8265	205	229	**252**	2.697	5.770	2.127
HZ 1080M B	332.0	491580	**9320**	8795	214	237	**261**	2.698	5.771	2.127
HZ 1080M C	351.5	528010	**9955**	9450	229	252	**276**	2.699	5.773	2.127
HZ 1080M D	367.3	563680	**10550**	10090	242	265	**288**	2.700	5.773	2.127
HZ 1180M A	379.9	590450	**10970**	10580	251	275	**298**	2.701	5.774	2.127
HZ 1180M B	387.4	612280	**11330**	10960	257	281	**304**	2.702	5.776	2.127
HZ 1180M C	407.8	660530	**12100**	11685	271	296	**320**	2.715	5.810	2.127
HZ 1180M D	419.1	683990	**12485**	12105	280	305	**329**	2.721	5.816	2.127

Combination HZ ... M - 24 / AZ 20-800-10/10

HZ 630M	367.3	228140	**7005**	6445	254	271	**288**	3.147	5.111	2.524
HZ 880M A	344.4	344260	**8070**	7465	237	254	**270**	3.224	5.639	2.598
HZ 880M B	368.5	370730	**8695**	8080	256	273	**289**	3.230	5.645	2.598
HZ 880M C	379.6	389230	**9105**	8495	265	281	**298**	3.230	5.645	2.598
HZ 1080M A	404.4	639260	**11620**	10935	284	301	**317**	3.216	6.072	2.598
HZ 1080M B	421.9	688190	**12470**	11800	298	314	**331**	3.218	6.075	2.598
HZ 1080M C	453.6	747730	**13535**	12870	323	339	**356**	3.221	6.078	2.598
HZ 1080M D	479.4	806090	**14525**	13910	343	360	**376**	3.222	6.079	2.598
HZ 1180M A	499.9	849820	**15230**	14695	359	376	**392**	3.224	6.080	2.598
HZ 1180M B	512.3	885610	**15835**	15330	369	385	**402**	3.227	6.089	2.598
HZ 1180M C	539.5	948300	**16870**	16310	390	407	**424**	3.244	6.102	2.598
HZ 1180M D	557.8	986490	**17515**	16995	404	421	**438**	3.256	6.112	2.598

Combination HZ ... M - 26 / AZ 20-800-10/10

HZ 630M	383.3	243800	**7915**	7245	261	281	**301**	3.147	5.372	2.524
HZ 880M A	359.9	371140	**9230**	8505	244	263	**283**	3.224	5.856	2.598
HZ 880M B	383.9	397420	**9835**	9105	263	282	**301**	3.230	5.862	2.598
HZ 880M C	395.0	415870	**10245**	9530	272	291	**310**	3.230	5.862	2.598
HZ 1080M A	419.9	684430	**13060**	12255	291	310	**330**	3.216	6.289	2.598
HZ 1080M B	437.4	733240	**13910**	13130	305	324	**343**	3.218	6.292	2.598
HZ 1080M C	469.1	792530	**14950**	14190	330	349	**368**	3.221	6.295	2.598
HZ 1080M D	494.9	850730	**15930**	15235	350	369	**388**	3.222	6.296	2.598
HZ 1180M A	515.4	894330	**16625**	16015	366	385	**405**	3.224	6.297	2.598
HZ 1180M B	527.7	930080	**17225**	16655	376	395	**414**	3.227	6.301	2.598
HZ 1180M C	558.9	1003550	**18450**	17820	399	419	**439**	3.244	6.339	2.598
HZ 1180M D	577.2	1041620	**19085**	18500	413	433	**453**	3.256	6.351	2.598

[1] Values taking the intermediary sheet piles into account.

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

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm²/m	cm⁴/m	cm³/m	cm³/m	kg/m²	kg/m²	kg/m²	m²/m	m²/m	m
HZ 630M	292.3	165710	**4870**	5455	184	207	**229**	2.696	4.641	2.090
HZ 880M A	279.5	237700	**5315**	6085	175	197	**219**	2.735	5.131	2.127
HZ 880M B	294.4	254470	**5720**	6445	187	209	**231**	2.738	5.133	2.127
HZ 880M C	301.2	265850	**5970**	6705	192	214	**236**	2.737	5.133	2.127
HZ 1080M A	316.0	418410	**7315**	8205	203	226	**248**	2.730	5.569	2.127
HZ 1080M B	326.8	449000	**7850**	8755	212	234	**257**	2.732	5.569	2.127
HZ 1080M C	346.3	485830	**8510**	9400	227	249	**272**	2.733	5.570	2.127
HZ 1080M D	362.1	521780	**9120**	10045	240	262	**284**	2.734	5.571	2.127
HZ 1180M A	374.7	548790	**9560**	10525	250	272	**294**	2.734	5.572	2.127
HZ 1180M B	382.8	572490	**9970**	10935	256	278	**300**	2.736	5.576	2.127
HZ 1180M C	398.4	607290	**10505**	11575	267	290	**313**	2.749	5.584	2.127
HZ 1180M D	410.8	634670	**11015**	12010	277	300	**322**	2.755	5.589	2.127

Combination HZ ... M - 14 / AZ 25-800

HZ 630M	309.9	183690	**5960**	5455	192	218	**243**	2.696	4.922	2.090
HZ 880M A	296.9	269340	**6695**	6165	183	208	**233**	2.735	5.366	2.127
HZ 880M B	311.7	285500	**7060**	6535	194	219	**245**	2.738	5.369	2.127
HZ 880M C	318.5	296770	**7305**	6795	200	225	**250**	2.737	5.369	2.127
HZ 1080M A	333.4	471210	**8985**	8430	211	236	**262**	2.730	5.804	2.127
HZ 1080M B	344.1	501000	**9500**	8965	219	245	**270**	2.732	5.805	2.127
HZ 1080M C	363.6	537410	**10135**	9615	235	260	**285**	2.733	5.807	2.127
HZ 1080M D	379.4	573070	**10725**	10255	247	273	**298**	2.734	5.807	2.127
HZ 1180M A	392.0	599840	**11145**	10750	257	282	**308**	2.734	5.808	2.127
HZ 1180M B	399.5	621680	**11505**	11125	263	288	**314**	2.736	5.810	2.127
HZ 1180M C	419.9	669920	**12270**	11850	277	303	**330**	2.749	5.843	2.127
HZ 1180M D	431.2	693380	**12660**	12270	286	312	**338**	2.755	5.850	2.127

Combination HZ ... M - 24 / AZ 25-800

HZ 630M	377.5	236070	**7245**	6665	259	278	**296**	3.180	5.145	2.524
HZ 880M A	354.3	351950	**8250**	7630	242	260	**278**	3.258	5.673	2.598
HZ 880M B	378.3	378400	**8875**	8245	261	279	**297**	3.264	5.679	2.598
HZ 880M C	389.5	396910	**9280**	8665	269	287	**306**	3.264	5.678	2.598
HZ 1080M A	414.3	646970	**11760**	11065	289	307	**325**	3.250	6.106	2.598
HZ 1080M B	431.8	695900	**12610**	11935	302	321	**339**	3.252	6.109	2.598
HZ 1080M C	463.5	755430	**13670**	13005	327	346	**364**	3.255	6.112	2.598
HZ 1080M D	489.3	813780	**14665**	14045	348	366	**384**	3.256	6.113	2.598
HZ 1180M A	509.8	857500	**15370**	14825	364	382	**400**	3.258	6.114	2.598
HZ 1180M B	522.1	893300	**15970**	15460	373	392	**410**	3.261	6.123	2.598
HZ 1180M C	549.4	955970	**17010**	16445	394	413	**431**	3.278	6.136	2.598
HZ 1180M D	567.7	994160	**17650**	17125	409	427	**446**	3.290	6.146	2.598

Combination HZ ... M - 26 / AZ 25-800

HZ 630M	393.5	251720	**8170**	7485	266	288	**309**	3.180	5.406	2.524
HZ 880M A	369.8	378830	**9425**	8680	249	270	**290**	3.258	5.890	2.598
HZ 880M B	393.8	405100	**10025**	9280	268	288	**309**	3.264	5.896	2.598
HZ 880M C	404.9	423550	**10430**	9705	277	297	**318**	3.264	5.896	2.598
HZ 1080M A	429.8	692140	**13205**	12390	296	317	**337**	3.250	6.323	2.598
HZ 1080M B	447.3	740950	**14060**	13265	310	330	**351**	3.252	6.326	2.598
HZ 1080M C	479.0	800230	**15095**	14330	335	355	**376**	3.255	6.329	2.598
HZ 1080M D	504.8	858420	**16075**	15370	355	376	**396**	3.256	6.330	2.598
HZ 1180M A	525.3	902020	**16765**	16155	371	392	**412**	3.258	6.331	2.598
HZ 1180M B	537.6	937760	**17365**	16795	381	401	**422**	3.261	6.335	2.598
HZ 1180M C	568.8	1011230	**18595**	17955	403	425	**446**	3.278	6.372	2.598
HZ 1180M D	587.1	1049300	**19225**	18635	418	439	**461**	3.290	6.385	2.598

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 13-770

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm²/m	cm⁴/m	cm³/m	cm³/m	kg/m²	kg/m²	kg/m²	m²/m	m²/m	m
HZ 630M	267.7	140740	**4135**	4635	174	192	**210**	2.427	4.372	2.030
HZ 880M A	255.0	215290	**4815**	5515	164	182	**200**	2.466	4.862	2.067
HZ 880M B	270.4	232560	**5230**	5890	177	194	**212**	2.469	4.864	2.067
HZ 880M C	277.4	244270	**5485**	6160	182	200	**218**	2.469	4.864	2.067
HZ 1080M A	292.4	401210	**7015**	7870	194	212	**230**	2.462	5.300	2.067
HZ 1080M B	303.6	432680	**7565**	8435	203	220	**238**	2.463	5.300	2.067
HZ 1080M C	323.6	470600	**8245**	9105	218	236	**254**	2.464	5.301	2.067
HZ 1080M D	339.9	507590	**8870**	9770	231	249	**267**	2.465	5.302	2.067
HZ 1180M A	352.9	535400	**9325**	10265	241	259	**277**	2.466	5.303	2.067
HZ 1180M B	361.2	559790	**9750**	10690	248	266	**284**	2.467	5.307	2.067
HZ 1180M C	377.3	595600	**10305**	11350	260	278	**296**	2.480	5.316	2.067
HZ 1180M D	390.1	623780	**10825**	11800	270	288	**306**	2.486	5.321	2.067

Combination HZ ... M - 14 / AZ 13-770

HZ 630M	285.8	159260	**5165**	4730	182	203	**224**	2.427	4.653	2.030
HZ 880M A	272.9	247840	**6160**	5675	172	193	**214**	2.466	5.098	2.067
HZ 880M B	288.1	264490	**6540**	6055	184	205	**226**	2.469	5.101	2.067
HZ 880M C	295.1	276090	**6795**	6320	190	211	**232**	2.469	5.100	2.067
HZ 1080M A	310.4	455540	**8685**	8150	202	223	**244**	2.462	5.535	2.067
HZ 1080M B	321.4	486190	**9220**	8700	210	231	**252**	2.463	5.536	2.067
HZ 1080M C	341.4	523680	**9875**	9370	226	247	**268**	2.464	5.538	2.067
HZ 1080M D	357.7	560380	**10490**	10030	239	260	**281**	2.465	5.538	2.067
HZ 1180M A	370.7	587930	**10920**	10535	249	270	**291**	2.466	5.539	2.067
HZ 1180M B	378.4	610400	**11300**	10925	255	276	**297**	2.467	5.541	2.067
HZ 1180M C	399.5	660050	**12090**	11680	270	292	**314**	2.480	5.575	2.067
HZ 1180M D	411.1	684190	**12490**	12110	279	301	**323**	2.486	5.581	2.067

Combination HZ ... M - 24 / AZ 13-770

HZ 630M	359.3	217210	**6665**	6135	252	267	**282**	2.912	4.876	2.464
HZ 880M A	336.1	336390	**7885**	7295	235	249	**264**	2.989	5.404	2.538
HZ 880M B	360.7	363500	**8525**	7920	254	269	**283**	2.995	5.410	2.538
HZ 880M C	372.1	382440	**8945**	8350	263	278	**292**	2.995	5.410	2.538
HZ 1080M A	397.4	638360	**11605**	10920	283	297	**312**	2.981	5.837	2.538
HZ 1080M B	415.4	688450	**12475**	11805	297	311	**326**	2.983	5.840	2.538
HZ 1080M C	447.8	749400	**13565**	12900	322	337	**352**	2.986	5.843	2.538
HZ 1080M D	474.3	809140	**14580**	13965	343	358	**372**	2.987	5.844	2.538
HZ 1180M A	495.3	853890	**15305**	14765	360	374	**389**	2.989	5.846	2.538
HZ 1180M B	507.9	890540	**15920**	15415	370	384	**399**	2.992	5.854	2.538
HZ 1180M C	535.8	954690	**16985**	16420	391	406	**421**	3.009	5.867	2.538
HZ 1180M D	554.6	993780	**17645**	17120	406	421	**435**	3.021	5.877	2.538

Combination HZ ... M - 26 / AZ 13-770

HZ 630M	375.6	233250	**7570**	6935	260	277	**295**	2.912	5.138	2.464
HZ 880M A	351.9	363910	**9050**	8335	242	259	**276**	2.989	5.621	2.538
HZ 880M B	376.5	390830	**9675**	8955	262	279	**296**	2.995	5.627	2.538
HZ 880M C	387.9	409710	**10090**	9385	271	288	**305**	2.995	5.627	2.538
HZ 1080M A	413.3	684600	**13060**	12255	290	307	**324**	2.981	6.054	2.538
HZ 1080M B	431.2	734570	**13935**	13150	304	321	**339**	2.983	6.057	2.538
HZ 1080M C	463.7	795260	**15005**	14240	330	347	**364**	2.986	6.060	2.538
HZ 1080M D	490.1	854830	**16005**	15305	351	368	**385**	2.987	6.061	2.538
HZ 1180M A	511.1	899460	**16720**	16105	367	384	**401**	2.989	6.062	2.538
HZ 1180M B	523.7	936050	**17335**	16760	377	394	**411**	2.992	6.066	2.538
HZ 1180M C	555.6	1011250	**18595**	17955	400	418	**436**	3.009	6.104	2.538
HZ 1180M D	574.4	1050210	**19240**	18650	415	433	**451**	3.021	6.116	2.538

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 14-770-10/10

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm^2/m	cm^4/m	cm^3/m	cm^3/m	kg/m^2	kg/m^2	kg/m^2	m^2/m	m^2/m	m
HZ 630M	276.3	142160	**4180**	4680	178	197	**217**	2.427	4.372	2.030
HZ 880M A	263.4	216680	**4845**	5550	168	188	**207**	2.466	4.862	2.067
HZ 880M B	278.8	233950	**5260**	5925	181	200	**219**	2.469	4.864	2.067
HZ 880M C	285.8	245670	**5515**	6195	186	205	**224**	2.469	4.864	2.067
HZ 1080M A	300.9	402610	**7040**	7895	198	217	**236**	2.462	5.300	2.067
HZ 1080M B	312.0	434080	**7590**	8465	207	226	**245**	2.463	5.300	2.067
HZ 1080M C	332.1	472000	**8270**	9135	222	241	**261**	2.464	5.301	2.067
HZ 1080M D	348.4	508990	**8895**	9795	235	254	**273**	2.465	5.302	2.067
HZ 1180M A	361.3	536800	**9350**	10295	245	264	**284**	2.466	5.303	2.067
HZ 1180M B	369.6	561190	**9775**	10720	252	271	**290**	2.467	5.307	2.067
HZ 1180M C	385.7	597000	**10330**	11380	264	283	**303**	2.480	5.316	2.067
HZ 1180M D	398.5	625170	**10850**	11830	274	293	**313**	2.486	5.321	2.067

Combination HZ ... M - 14 / AZ 14-770-10/10

HZ 630M	294.4	160680	**5210**	4775	186	208	**231**	2.427	4.653	2.030
HZ 880M A	281.3	249230	**6195**	5705	176	199	**221**	2.466	5.098	2.067
HZ 880M B	296.5	265880	**6575**	6090	188	211	**233**	2.469	5.101	2.067
HZ 880M C	303.5	277490	**6830**	6355	194	216	**238**	2.469	5.100	2.067
HZ 1080M A	318.9	456940	**8710**	8175	206	228	**250**	2.462	5.535	2.067
HZ 1080M B	329.9	487590	**9245**	8725	214	237	**259**	2.463	5.536	2.067
HZ 1080M C	349.9	525080	**9900**	9395	230	252	**275**	2.464	5.538	2.067
HZ 1080M D	366.1	561780	**10515**	10055	243	265	**287**	2.465	5.538	2.067
HZ 1180M A	379.1	589330	**10950**	10560	253	275	**298**	2.466	5.539	2.067
HZ 1180M B	386.9	611800	**11325**	10950	259	281	**304**	2.467	5.541	2.067
HZ 1180M C	407.9	661450	**12115**	11700	274	297	**320**	2.480	5.575	2.067
HZ 1180M D	419.5	685580	**12515**	12135	283	306	**329**	2.486	5.581	2.067

Combination HZ ... M - 24 / AZ 14-770-10/10

HZ 630M	366.4	218380	**6705**	6165	255	272	**288**	2.912	4.876	2.464
HZ 880M A	342.9	337530	**7910**	7320	238	254	**269**	2.989	5.404	2.538
HZ 880M B	367.6	364640	**8550**	7945	257	273	**289**	2.995	5.410	2.538
HZ 880M C	378.9	383570	**8970**	8375	266	282	**297**	2.995	5.410	2.538
HZ 1080M A	404.3	639500	**11625**	10940	286	302	**317**	2.981	5.837	2.538
HZ 1080M B	422.2	689590	**12500**	11825	300	316	**331**	2.983	5.840	2.538
HZ 1080M C	454.7	750540	**13585**	12920	326	341	**357**	2.986	5.843	2.538
HZ 1080M D	481.1	810280	**14600**	13985	346	362	**378**	2.987	5.844	2.538
HZ 1180M A	502.1	855030	**15325**	14785	363	379	**394**	2.989	5.846	2.538
HZ 1180M B	514.8	891670	**15940**	15435	373	388	**404**	2.992	5.854	2.538
HZ 1180M C	542.6	955830	**17005**	16440	394	410	**426**	3.009	5.867	2.538
HZ 1180M D	561.4	994920	**17665**	17140	409	425	**441**	3.021	5.877	2.538

Combination HZ ... M - 26 / AZ 14-770-10/10

HZ 630M	382.7	234420	**7610**	6970	263	282	**300**	2.912	5.138	2.464
HZ 880M A	358.8	365050	**9080**	8365	245	264	**282**	2.989	5.621	2.538
HZ 880M B	383.4	391960	**9700**	8980	265	283	**301**	2.995	5.627	2.538
HZ 880M C	394.8	410840	**10120**	9415	274	292	**310**	2.995	5.627	2.538
HZ 1080M A	420.2	685740	**13085**	12280	294	312	**330**	2.981	6.054	2.538
HZ 1080M B	438.1	735710	**13960**	13175	308	326	**344**	2.983	6.057	2.538
HZ 1080M C	470.6	796400	**15025**	14260	333	351	**369**	2.986	6.060	2.538
HZ 1080M D	497.0	855970	**16030**	15330	354	372	**390**	2.987	6.061	2.538
HZ 1180M A	518.0	900600	**16740**	16125	370	389	**407**	2.989	6.062	2.538
HZ 1180M B	530.6	937190	**17355**	16785	380	398	**417**	2.992	6.066	2.538
HZ 1180M C	562.5	1012380	**18615**	17975	404	423	**442**	3.009	6.104	2.538
HZ 1180M D	581.2	1051350	**19260**	18670	418	437	**456**	3.021	6.116	2.538

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 28-750

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm^2/m	cm^4/m	cm^3/m	cm^3/m	kg/m^2	kg/m^2	kg/m^2	m^2/m	m^2/m	m
HZ 630M	304.8	180190	**5295**	5930	192	216	**239**	2.693	4.638	1.990
HZ 880M A	291.1	255460	**5710**	6540	182	205	**229**	2.732	5.128	2.027
HZ 880M B	306.7	273040	**6135**	6915	195	218	**241**	2.735	5.130	2.027
HZ 880M C	313.8	284980	**6400**	7190	200	223	**246**	2.735	5.130	2.027
HZ 1080M A	329.4	445140	**7785**	8730	212	235	**259**	2.728	5.566	2.027
HZ 1080M B	340.7	477230	**8345**	9305	221	244	**267**	2.729	5.566	2.027
HZ 1080M C	361.1	515860	**9035**	9980	237	260	**283**	2.730	5.567	2.027
HZ 1080M D	377.7	553560	**9675**	10655	250	273	**297**	2.731	5.568	2.027
HZ 1180M A	390.9	581890	**10135**	11155	261	284	**307**	2.732	5.569	2.027
HZ 1180M B	399.4	606760	**10570**	11590	267	290	**314**	2.733	5.573	2.027
HZ 1180M C	415.8	643260	**11130**	12260	280	303	**326**	2.746	5.582	2.027
HZ 1180M D	428.8	671960	**11665**	12715	290	313	**337**	2.752	5.587	2.027

Combination HZ ... M - 14 / AZ 28-750

HZ 630M	323.2	199080	**6460**	5915	200	227	**254**	2.693	4.919	1.990
HZ 880M A	309.4	288660	**7175**	6610	190	217	**243**	2.732	5.364	2.027
HZ 880M B	324.8	305600	**7560**	6995	203	229	**255**	2.735	5.367	2.027
HZ 880M C	332.0	317430	**7815**	7270	208	234	**261**	2.735	5.367	2.027
HZ 1080M A	347.7	500550	**9545**	8955	220	247	**273**	2.728	5.801	2.027
HZ 1080M B	358.9	531800	**10085**	9515	229	256	**282**	2.729	5.802	2.027
HZ 1080M C	379.3	569980	**10745**	10200	245	272	**298**	2.730	5.804	2.027
HZ 1080M D	395.9	607390	**11365**	10870	258	285	**311**	2.731	5.804	2.027
HZ 1180M A	409.1	635460	**11805**	11385	269	295	**321**	2.732	5.805	2.027
HZ 1180M B	417.0	658370	**12185**	11785	275	301	**327**	2.733	5.807	2.027
HZ 1180M C	438.4	708980	**12985**	12545	290	317	**344**	2.746	5.841	2.027
HZ 1180M D	450.2	733570	**13390**	12980	299	326	**353**	2.752	5.847	2.027

Combination HZ ... M - 24 / AZ 28-750

HZ 630M	391.2	250860	**7700**	7085	269	288	**307**	3.178	5.142	2.424
HZ 880M A	366.6	370930	**8695**	8045	250	269	**288**	3.255	5.670	2.498
HZ 880M B	391.7	398410	**9340**	8680	270	289	**307**	3.262	5.676	2.498
HZ 880M C	403.2	417650	**9765**	9120	279	298	**317**	3.261	5.676	2.498
HZ 1080M A	429.1	677850	**12320**	11595	299	318	**337**	3.247	6.103	2.498
HZ 1080M B	447.3	728740	**13205**	12495	314	332	**351**	3.249	6.106	2.498
HZ 1080M C	480.2	790600	**14310**	13610	340	358	**377**	3.252	6.109	2.498
HZ 1080M D	507.1	851270	**15340**	14690	361	379	**398**	3.253	6.110	2.498
HZ 1180M A	528.4	896710	**16075**	15505	377	396	**415**	3.255	6.112	2.498
HZ 1180M B	541.2	933930	**16700**	16165	387	406	**425**	3.258	6.121	2.498
HZ 1180M C	569.5	999040	**17775**	17185	409	428	**447**	3.275	6.134	2.498
HZ 1180M D	588.6	1038720	**18440**	17895	424	443	**462**	3.287	6.143	2.498

Combination HZ ... M - 26 / AZ 28-750

HZ 630M	407.8	267160	**8670**	7940	276	298	**320**	3.178	5.404	2.424
HZ 880M A	382.7	398880	**9920**	9140	258	279	**300**	3.255	5.887	2.498
HZ 880M B	407.7	426170	**10550**	9765	278	299	**320**	3.262	5.893	2.498
HZ 880M C	419.3	445360	**10970**	10205	287	308	**329**	3.261	5.893	2.498
HZ 1080M A	445.3	724830	**13830**	12980	307	328	**350**	3.247	6.321	2.498
HZ 1080M B	463.5	775600	**14715**	13885	321	343	**364**	3.249	6.323	2.498
HZ 1080M C	496.4	837200	**15795**	14990	347	368	**390**	3.252	6.326	2.498
HZ 1080M D	523.2	897690	**16810**	16075	368	389	**411**	3.253	6.327	2.498
HZ 1180M A	544.5	943000	**17530**	16885	385	406	**427**	3.255	6.329	2.498
HZ 1180M B	557.3	980180	**18150**	17555	395	416	**438**	3.258	6.332	2.498
HZ 1180M C	589.7	1056500	**19425**	18760	419	441	**463**	3.275	6.370	2.498
HZ 1180M D	608.7	1096060	**20080**	19465	434	456	**478**	3.287	6.382	2.498

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 30-750

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm^2/m	cm^4/m	cm^3/m	cm^3/m	kg/m^2	kg/m^2	kg/m^2	m^2/m	m^2/m	m
HZ 630M	315.0	184050	**5410**	6060	197	222	**247**	2.694	4.639	1.990
HZ 880M A	301.1	259260	**5795**	6640	187	212	**236**	2.733	5.130	2.027
HZ 880M B	316.7	276830	**6225**	7010	199	224	**249**	2.736	5.132	2.027
HZ 880M C	323.8	288770	**6485**	7285	205	230	**254**	2.736	5.131	2.027
HZ 1080M A	339.4	448940	**7850**	8805	217	242	**266**	2.729	5.568	2.027
HZ 1080M B	350.8	481030	**8410**	9380	226	251	**275**	2.730	5.567	2.027
HZ 1080M C	371.1	519650	**9105**	10055	242	267	**291**	2.732	5.569	2.027
HZ 1080M D	387.7	557350	**9740**	10725	255	280	**304**	2.732	5.569	2.027
HZ 1180M A	401.0	585680	**10200**	11230	265	290	**315**	2.733	5.570	2.027
HZ 1180M B	409.4	610550	**10635**	11660	272	297	**321**	2.735	5.574	2.027
HZ 1180M C	425.8	647050	**11195**	12330	284	309	**334**	2.747	5.583	2.027
HZ 1180M D	438.8	675750	**11730**	12785	295	320	**344**	2.754	5.588	2.027

Combination HZ ... M - 14 / AZ 30-750

HZ 630M	333.4	202940	**6585**	6030	205	233	**262**	2.694	4.920	1.990
HZ 880M A	319.4	292450	**7270**	6695	195	223	**251**	2.733	5.365	2.027
HZ 880M B	334.8	309390	**7650**	7085	207	235	**263**	2.736	5.368	2.027
HZ 880M C	342.0	321220	**7905**	7355	213	241	**268**	2.736	5.368	2.027
HZ 1080M A	357.7	504350	**9615**	9025	225	253	**281**	2.729	5.803	2.027
HZ 1080M B	368.9	535600	**10155**	9585	234	262	**290**	2.730	5.804	2.027
HZ 1080M C	389.3	573780	**10820**	10270	250	278	**306**	2.732	5.805	2.027
HZ 1080M D	405.9	611180	**11440**	10940	263	291	**319**	2.732	5.806	2.027
HZ 1180M A	419.1	639250	**11875**	11455	273	301	**329**	2.733	5.806	2.027
HZ 1180M B	427.0	662170	**12255**	11850	280	307	**335**	2.735	5.808	2.027
HZ 1180M C	448.4	712770	**13055**	12610	294	323	**352**	2.747	5.842	2.027
HZ 1180M D	460.2	737350	**13460**	13050	304	332	**361**	2.754	5.848	2.027

Combination HZ ... M - 24 / AZ 30-750

HZ 630M	399.6	254030	**7800**	7175	272	293	**314**	3.179	5.144	2.424
HZ 880M A	374.8	374000	**8765**	8110	254	274	**294**	3.257	5.671	2.498
HZ 880M B	399.8	401480	**9415**	8750	274	294	**314**	3.263	5.678	2.498
HZ 880M C	411.3	420720	**9840**	9185	283	303	**323**	3.262	5.677	2.498
HZ 1080M A	437.3	680940	**12375**	11650	303	323	**343**	3.248	6.105	2.498
HZ 1080M B	455.4	731830	**13265**	12550	317	337	**358**	3.251	6.107	2.498
HZ 1080M C	488.4	793680	**14365**	13660	343	363	**383**	3.254	6.110	2.498
HZ 1080M D	515.2	854340	**15395**	14745	364	384	**404**	3.255	6.111	2.498
HZ 1180M A	536.5	899780	**16130**	15560	381	401	**421**	3.256	6.113	2.498
HZ 1180M B	549.3	937010	**16755**	16220	391	411	**431**	3.260	6.122	2.498
HZ 1180M C	577.6	1002120	**17830**	17240	413	433	**453**	3.276	6.135	2.498
HZ 1180M D	596.7	1041790	**18495**	17945	428	448	**468**	3.289	6.144	2.498

Combination HZ ... M - 26 / AZ 30-750

HZ 630M	416.2	270330	**8775**	8035	280	304	**327**	3.179	5.405	2.424
HZ 880M A	390.9	401960	**10000**	9210	262	284	**307**	3.257	5.888	2.498
HZ 880M B	415.8	429240	**10625**	9835	281	304	**326**	3.263	5.895	2.498
HZ 880M C	427.4	448430	**11045**	10275	291	313	**336**	3.262	5.894	2.498
HZ 1080M A	453.4	727920	**13890**	13035	311	333	**356**	3.248	6.322	2.498
HZ 1080M B	471.6	778690	**14775**	13940	325	348	**370**	3.251	6.324	2.498
HZ 1080M C	504.5	840280	**15855**	15045	351	373	**396**	3.254	6.327	2.498
HZ 1080M D	531.3	900770	**16865**	16130	372	395	**417**	3.255	6.328	2.498
HZ 1180M A	552.6	946070	**17585**	16940	389	411	**434**	3.256	6.330	2.498
HZ 1180M B	565.4	983250	**18210**	17610	399	421	**444**	3.260	6.333	2.498
HZ 1180M C	597.8	1059570	**19480**	18815	422	446	**469**	3.276	6.371	2.498
HZ 1180M D	616.8	1099120	**20135**	19520	437	461	**484**	3.289	6.383	2.498

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 32-750

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm^2/m	cm^4/m	cm^3/m	cm^3/m	kg/m^2	kg/m^2	kg/m^2	m^2/m	m^2/m	m
HZ 630M	325.2	187930	**5525**	6185	202	229	**255**	2.696	4.641	1.990
HZ 880M A	311.1	263060	**5880**	6735	192	218	**244**	2.734	5.131	2.027
HZ 880M B	326.7	280620	**6310**	7105	204	230	**256**	2.737	5.133	2.027
HZ 880M C	333.8	292570	**6570**	7380	210	236	**262**	2.737	5.133	2.027
HZ 1080M A	349.4	452750	**7915**	8880	222	248	**274**	2.730	5.569	2.027
HZ 1080M B	360.8	484840	**8480**	9455	231	257	**283**	2.731	5.568	2.027
HZ 1080M C	381.2	523460	**9170**	10130	247	273	**299**	2.733	5.570	2.027
HZ 1080M D	397.8	561160	**9810**	10800	260	286	**312**	2.733	5.571	2.027
HZ 1180M A	411.0	589480	**10265**	11305	270	296	**323**	2.734	5.571	2.027
HZ 1180M B	419.4	614360	**10700**	11735	277	303	**329**	2.736	5.575	2.027
HZ 1180M C	435.8	650850	**11260**	12405	289	316	**342**	2.749	5.584	2.027
HZ 1180M D	448.8	679550	**11795**	12855	299	326	**352**	2.755	5.589	2.027

Combination HZ ... M - 14 / AZ 32-750

HZ 630M	343.6	206820	**6710**	6145	210	240	**270**	2.696	4.921	1.990
HZ 880M A	329.4	296250	**7365**	6780	200	229	**259**	2.734	5.366	2.027
HZ 880M B	344.8	313180	**7745**	7170	212	241	**271**	2.737	5.369	2.027
HZ 880M C	352.0	325010	**8000**	7440	218	247	**276**	2.737	5.369	2.027
HZ 1080M A	367.8	508160	**9690**	9090	230	259	**289**	2.730	5.804	2.027
HZ 1080M B	379.0	539410	**10225**	9650	239	268	**297**	2.731	5.805	2.027
HZ 1080M C	399.3	577580	**10890**	10335	255	284	**313**	2.733	5.806	2.027
HZ 1080M D	415.9	614990	**11510**	11005	268	297	**326**	2.733	5.807	2.027
HZ 1180M A	429.1	643050	**11945**	11520	278	308	**337**	2.734	5.808	2.027
HZ 1180M B	437.0	665970	**12325**	11920	284	314	**343**	2.736	5.809	2.027
HZ 1180M C	458.4	716570	**13125**	12675	299	329	**360**	2.749	5.843	2.027
HZ 1180M D	470.2	741150	**13530**	13115	308	339	**369**	2.755	5.849	2.027

Combination HZ ... M - 24 / AZ 32-750

HZ 630M	408.0	257210	**7895**	7265	276	298	**320**	3.180	5.145	2.424
HZ 880M A	382.9	377090	**8840**	8175	258	279	**301**	3.258	5.673	2.498
HZ 880M B	407.9	404560	**9485**	8815	278	299	**320**	3.264	5.679	2.498
HZ 880M C	419.4	423800	**9910**	9250	287	308	**329**	3.264	5.678	2.498
HZ 1080M A	445.4	684030	**12435**	11700	307	328	**350**	3.250	6.106	2.498
HZ 1080M B	463.6	734920	**13320**	12600	321	343	**364**	3.252	6.108	2.498
HZ 1080M C	496.5	796770	**14420**	13715	347	368	**390**	3.255	6.111	2.498
HZ 1080M D	523.3	857430	**15450**	14800	368	390	**411**	3.256	6.112	2.498
HZ 1180M A	544.7	902870	**16185**	15610	385	406	**428**	3.258	6.114	2.498
HZ 1180M B	557.5	940090	**16810**	16270	395	416	**438**	3.261	6.123	2.498
HZ 1180M C	585.7	1005190	**17885**	17290	417	438	**460**	3.278	6.136	2.498
HZ 1180M D	604.8	1044870	**18550**	18000	432	453	**475**	3.290	6.146	2.498

Combination HZ ... M - 26 / AZ 32-750

HZ 630M	424.6	273510	**8880**	8130	284	309	**333**	3.180	5.406	2.424
HZ 880M A	399.0	405040	**10075**	9280	266	289	**313**	3.258	5.890	2.498
HZ 880M B	423.9	432320	**10700**	9905	285	309	**333**	3.264	5.896	2.498
HZ 880M C	435.5	451510	**11120**	10345	294	318	**342**	3.264	5.895	2.498
HZ 1080M A	461.5	731010	**13950**	13090	315	338	**362**	3.250	6.323	2.498
HZ 1080M B	479.7	781780	**14830**	14000	329	353	**377**	3.252	6.325	2.498
HZ 1080M C	512.6	843370	**15910**	15100	355	379	**402**	3.255	6.329	2.498
HZ 1080M D	539.4	903850	**16925**	16185	376	400	**423**	3.256	6.330	2.498
HZ 1180M A	560.8	949160	**17640**	16995	393	416	**440**	3.258	6.331	2.498
HZ 1180M B	573.6	986340	**18265**	17665	403	426	**450**	3.261	6.334	2.498
HZ 1180M C	605.9	1062650	**19540**	18870	426	451	**476**	3.278	6.372	2.498
HZ 1180M D	624.9	1102200	**20195**	19575	441	466	**491**	3.290	6.385	2.498

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 13-700

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm²/m	cm⁴/m	cm³/m	cm³/m	kg/m²	kg/m²	kg/m²	m²/m	m²/m	m
HZ 630M	284.8	148160	**4355**	4880	185	204	**224**	2.293	4.238	1.890
HZ 880M A	270.8	227970	**5095**	5840	175	194	**213**	2.332	4.728	1.927
HZ 880M B	287.2	246480	**5540**	6240	188	207	**225**	2.335	4.730	1.927
HZ 880M C	294.7	259050	**5815**	6535	194	213	**231**	2.335	4.730	1.927
HZ 1080M A	311.0	427440	**7475**	8385	207	225	**244**	2.328	5.166	1.927
HZ 1080M B	323.0	461210	**8065**	8995	216	235	**254**	2.329	5.166	1.927
HZ 1080M C	344.4	501850	**8790**	9710	233	252	**270**	2.330	5.167	1.927
HZ 1080M D	361.9	541520	**9465**	10425	247	265	**284**	2.331	5.168	1.927
HZ 1180M A	375.8	571320	**9950**	10955	258	276	**295**	2.332	5.169	1.927
HZ 1180M B	384.7	597490	**10410**	11410	265	283	**302**	2.333	5.173	1.927
HZ 1180M C	402.0	635880	**11000**	12120	277	296	**316**	2.346	5.182	1.927
HZ 1180M D	415.6	666080	**11560**	12605	288	307	**326**	2.352	5.187	1.927

Combination HZ ... M - 14 / AZ 13-700

HZ 630M	304.2	168040	**5450**	4990	194	216	**239**	2.293	4.519	1.890
HZ 880M A	290.0	262880	**6535**	6020	184	206	**228**	2.332	4.964	1.927
HZ 880M B	306.3	280730	**6945**	6430	197	218	**240**	2.335	4.967	1.927
HZ 880M C	313.8	293170	**7215**	6715	202	224	**246**	2.335	4.966	1.927
HZ 1080M A	330.3	485730	**9260**	8690	215	237	**259**	2.328	5.401	1.927
HZ 1080M B	342.1	518610	**9835**	9280	224	247	**269**	2.329	5.402	1.927
HZ 1080M C	363.5	558790	**10535**	10000	241	263	**285**	2.330	5.404	1.927
HZ 1080M D	381.0	598140	**11195**	10705	255	277	**299**	2.331	5.404	1.927
HZ 1180M A	394.9	627670	**11660**	11245	266	288	**310**	2.332	5.405	1.927
HZ 1180M B	403.2	651770	**12065**	11665	273	295	**317**	2.333	5.407	1.927
HZ 1180M C	425.7	705010	**12915**	12475	288	311	**334**	2.346	5.441	1.927
HZ 1180M D	438.1	730870	**13345**	12935	298	321	**344**	2.352	5.447	1.927

Combination HZ ... M - 24 / AZ 13-700

HZ 630M	378.7	227850	**6995**	6435	266	282	**297**	2.778	4.742	2.324
HZ 880M A	353.5	353650	**8290**	7670	247	262	**277**	2.855	5.270	2.398
HZ 880M B	379.5	382300	**8965**	8330	268	283	**298**	2.861	5.276	2.398
HZ 880M C	391.6	402340	**9410**	8785	277	292	**307**	2.861	5.276	2.398
HZ 1080M A	418.5	673350	**12240**	11520	298	313	**329**	2.847	5.703	2.398
HZ 1080M B	437.5	726370	**13165**	12455	313	328	**343**	2.849	5.706	2.398
HZ 1080M C	471.8	790810	**14315**	13610	340	355	**370**	2.852	5.709	2.398
HZ 1080M D	499.8	854000	**15390**	14740	362	377	**392**	2.853	5.710	2.398
HZ 1180M A	522.0	901330	**16155**	15585	380	395	**410**	2.855	5.712	2.398
HZ 1180M B	535.3	940110	**16810**	16270	390	405	**420**	2.858	5.720	2.398
HZ 1180M C	564.8	1007920	**17935**	17340	413	428	**443**	2.875	5.733	2.398
HZ 1180M D	584.6	1049240	**18630**	18075	428	444	**459**	2.887	5.743	2.398

Combination HZ ... M - 26 / AZ 13-700

HZ 630M	396.0	244850	**7945**	7280	274	293	**311**	2.778	5.003	2.324
HZ 880M A	370.3	382770	**9520**	8770	255	273	**291**	2.855	5.487	2.398
HZ 880M B	396.3	411220	**10180**	9420	276	293	**311**	2.861	5.493	2.398
HZ 880M C	408.3	431200	**10620**	9880	285	303	**321**	2.861	5.493	2.398
HZ 1080M A	435.3	722290	**13780**	12930	306	324	**342**	2.847	5.920	2.398
HZ 1080M B	454.3	775190	**14705**	13880	321	339	**357**	2.849	5.923	2.398
HZ 1080M C	488.6	839350	**15835**	15030	348	366	**384**	2.852	5.926	2.398
HZ 1080M D	516.5	902360	**16895**	16160	370	388	**405**	2.853	5.927	2.398
HZ 1180M A	538.8	949560	**17650**	17005	388	405	**423**	2.855	5.928	2.398
HZ 1180M B	552.1	988280	**18300**	17700	398	416	**433**	2.858	5.932	2.398
HZ 1180M C	585.8	1067770	**19630**	18960	423	441	**460**	2.875	5.970	2.398
HZ 1180M D	605.6	1108960	**20320**	19695	438	457	**475**	2.887	5.982	2.398

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 13-700-10/10

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm^2/m	cm^4/m	cm^3/m	cm^3/m	kg/m^2	kg/m^2	kg/m^2	m^2/m	m^2/m	m
HZ 630M	289.0	148770	**4375**	4900	187	207	**227**	2.293	4.238	1.890
HZ 880M A	275.0	228570	**5110**	5855	177	196	**216**	2.332	4.728	1.927
HZ 880M B	291.4	247080	**5555**	6255	190	209	**229**	2.335	4.730	1.927
HZ 880M C	298.9	259650	**5830**	6550	196	215	**235**	2.335	4.730	1.927
HZ 1080M A	315.2	428050	**7485**	8395	209	228	**247**	2.328	5.166	1.927
HZ 1080M B	327.1	461810	**8075**	9005	218	237	**257**	2.329	5.166	1.927
HZ 1080M C	348.6	502460	**8800**	9720	235	254	**274**	2.330	5.167	1.927
HZ 1080M D	366.1	542120	**9475**	10435	249	268	**287**	2.331	5.168	1.927
HZ 1180M A	380.0	571930	**9960**	10965	260	279	**298**	2.332	5.169	1.927
HZ 1180M B	388.9	598090	**10420**	11420	267	286	**305**	2.333	5.173	1.927
HZ 1180M C	406.1	636480	**11010**	12130	279	299	**319**	2.346	5.182	1.927
HZ 1180M D	419.8	666680	**11570**	12615	290	310	**330**	2.352	5.187	1.927

Combination HZ ... M - 14 / AZ 13-700-10/10

HZ 630M	308.5	168660	**5470**	5010	196	219	**242**	2.293	4.519	1.890
HZ 880M A	294.2	263480	**6550**	6030	186	208	**231**	2.332	4.964	1.927
HZ 880M B	310.5	281330	**6960**	6440	199	221	**244**	2.335	4.967	1.927
HZ 880M C	318.0	293770	**7230**	6725	204	227	**250**	2.335	4.966	1.927
HZ 1080M A	334.5	486340	**9275**	8700	217	240	**263**	2.328	5.401	1.927
HZ 1080M B	346.3	519210	**9845**	9290	226	249	**272**	2.329	5.402	1.927
HZ 1080M C	367.7	559390	**10545**	10010	243	266	**289**	2.330	5.404	1.927
HZ 1080M D	385.2	598750	**11205**	10715	257	280	**302**	2.331	5.404	1.927
HZ 1180M A	399.1	628280	**11670**	11255	268	291	**313**	2.332	5.405	1.927
HZ 1180M B	407.4	652380	**12075**	11675	275	297	**320**	2.333	5.407	1.927
HZ 1180M C	429.9	705610	**12925**	12485	290	314	**337**	2.346	5.441	1.927
HZ 1180M D	442.3	731470	**13355**	12945	300	323	**347**	2.352	5.447	1.927

Combination HZ ... M - 24 / AZ 13-700-10/10

HZ 630M	382.2	228350	**7010**	6450	268	284	**300**	2.778	4.742	2.324
HZ 880M A	356.8	354130	**8300**	7680	249	265	**280**	2.855	5.270	2.398
HZ 880M B	382.9	382790	**8975**	8340	270	285	**301**	2.861	5.276	2.398
HZ 880M C	394.9	402830	**9420**	8795	279	295	**310**	2.861	5.276	2.398
HZ 1080M A	421.9	673830	**12250**	11525	300	316	**331**	2.847	5.703	2.398
HZ 1080M B	440.8	726850	**13175**	12465	315	330	**346**	2.849	5.706	2.398
HZ 1080M C	475.2	791300	**14320**	13620	342	357	**373**	2.852	5.709	2.398
HZ 1080M D	503.1	854490	**15395**	14750	364	379	**395**	2.853	5.710	2.398
HZ 1180M A	525.4	901820	**16165**	15595	381	397	**412**	2.855	5.712	2.398
HZ 1180M B	538.7	940600	**16815**	16280	392	407	**423**	2.858	5.720	2.398
HZ 1180M C	568.2	1008410	**17940**	17345	414	430	**446**	2.875	5.733	2.398
HZ 1180M D	588.0	1049720	**18635**	18080	430	446	**462**	2.887	5.743	2.398

Combination HZ ... M - 26 / AZ 13-700-10/10

HZ 630M	399.5	245350	**7965**	7295	276	295	**314**	2.778	5.003	2.324
HZ 880M A	373.6	383250	**9535**	8780	257	275	**293**	2.855	5.487	2.398
HZ 880M B	399.6	411700	**10190**	9430	277	296	**314**	2.861	5.493	2.398
HZ 880M C	411.7	431690	**10635**	9890	287	305	**323**	2.861	5.493	2.398
HZ 1080M A	438.7	722780	**13790**	12940	308	326	**344**	2.847	5.920	2.398
HZ 1080M B	457.7	775670	**14715**	13890	323	341	**359**	2.849	5.923	2.398
HZ 1080M C	492.0	839830	**15845**	15040	350	368	**386**	2.852	5.926	2.398
HZ 1080M D	519.9	902850	**16905**	16165	372	390	**408**	2.853	5.927	2.398
HZ 1180M A	542.1	950040	**17660**	17015	389	407	**426**	2.855	5.928	2.398
HZ 1180M B	555.5	988770	**18310**	17705	400	418	**436**	2.858	5.932	2.398
HZ 1180M C	589.2	1068250	**19640**	18970	424	443	**462**	2.875	5.970	2.398
HZ 1180M D	609.0	1109440	**20325**	19700	440	459	**478**	2.887	5.982	2.398

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 18-700

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm²/m	cm⁴/m	cm³/m	cm³/m	kg/m²	kg/m²	kg/m²	m²/m	m²/m	m
HZ 630M	288.1	160940	**4730**	5300	187	207	**226**	2.438	4.383	1.890
HZ 880M A	274.1	240500	**5380**	6160	177	196	**215**	2.477	4.873	1.927
HZ 880M B	290.5	259000	**5820**	6560	190	209	**228**	2.480	4.875	1.927
HZ 880M C	298.0	271570	**6100**	6850	196	215	**234**	2.479	4.875	1.927
HZ 1080M A	314.3	440010	**7695**	8630	208	227	**247**	2.472	5.311	1.927
HZ 1080M B	326.3	473770	**8285**	9240	218	237	**256**	2.474	5.311	1.927
HZ 1080M C	347.7	514400	**9010**	9955	234	254	**273**	2.475	5.312	1.927
HZ 1080M D	365.2	554060	**9685**	10665	248	267	**287**	2.476	5.313	1.927
HZ 1180M A	379.1	583860	**10170**	11195	259	278	**298**	2.476	5.314	1.927
HZ 1180M B	388.0	610020	**10625**	11650	266	285	**305**	2.478	5.318	1.927
HZ 1180M C	405.3	648410	**11220**	12360	279	299	**318**	2.491	5.327	1.927
HZ 1180M D	418.9	678600	**11780**	12840	290	309	**329**	2.497	5.332	1.927

Combination HZ ... M - 14 / AZ 18-700

HZ 630M	307.6	180830	**5865**	5370	196	219	**241**	2.438	4.664	1.890
HZ 880M A	293.3	275420	**6845**	6305	185	208	**230**	2.477	5.108	1.927
HZ 880M B	309.6	293250	**7255**	6715	198	221	**243**	2.480	5.112	1.927
HZ 880M C	317.1	305690	**7525**	7000	204	226	**249**	2.479	5.111	1.927
HZ 1080M A	333.6	498290	**9500**	8915	217	239	**262**	2.472	5.546	1.927
HZ 1080M B	345.4	531170	**10070**	9505	226	249	**271**	2.474	5.547	1.927
HZ 1080M C	366.8	571340	**10770**	10225	243	265	**288**	2.475	5.549	1.927
HZ 1080M D	384.3	610680	**11430**	10930	257	279	**302**	2.476	5.549	1.927
HZ 1180M A	398.2	640210	**11895**	11470	268	290	**313**	2.476	5.550	1.927
HZ 1180M B	406.5	664310	**12295**	11890	274	297	**319**	2.478	5.552	1.927
HZ 1180M C	429.0	717540	**13145**	12695	289	313	**337**	2.491	5.585	1.927
HZ 1180M D	441.4	743390	**13570**	13155	299	323	**347**	2.497	5.592	1.927

Combination HZ ... M - 24 / AZ 18-700

HZ 630M	381.4	238250	**7315**	6730	268	283	**299**	2.923	4.887	2.324
HZ 880M A	356.1	363720	**8525**	7885	249	264	**280**	3.000	5.415	2.398
HZ 880M B	382.2	392360	**9200**	8550	269	285	**300**	3.006	5.421	2.398
HZ 880M C	394.2	412400	**9645**	9005	279	294	**309**	3.006	5.420	2.398
HZ 1080M A	421.2	683450	**12425**	11690	300	315	**331**	2.992	5.848	2.398
HZ 1080M B	440.1	736470	**13345**	12630	315	330	**345**	2.994	5.851	2.398
HZ 1080M C	474.5	800900	**14495**	13785	342	357	**372**	2.997	5.854	2.398
HZ 1080M D	502.4	864080	**15570**	14915	363	379	**394**	2.998	5.855	2.398
HZ 1180M A	524.6	911410	**16335**	15760	381	396	**412**	3.000	5.856	2.398
HZ 1180M B	538.0	950180	**16990**	16445	391	407	**422**	3.003	5.865	2.398
HZ 1180M C	567.5	1017980	**18110**	17510	414	430	**445**	3.020	5.878	2.398
HZ 1180M D	587.3	1059290	**18805**	18245	430	445	**461**	3.032	5.888	2.398

Combination HZ ... M - 26 / AZ 18-700

HZ 630M	398.8	255250	**8285**	7590	276	294	**313**	2.923	5.148	2.324
HZ 880M A	372.9	392840	**9770**	9000	257	275	**293**	3.000	5.632	2.398
HZ 880M B	398.9	421280	**10425**	9650	277	295	**313**	3.006	5.638	2.398
HZ 880M C	411.0	441260	**10870**	10110	287	305	**323**	3.006	5.638	2.398
HZ 1080M A	438.0	732400	**13975**	13115	308	326	**344**	2.992	6.065	2.398
HZ 1080M B	456.9	785290	**14900**	14060	322	341	**359**	2.994	6.068	2.398
HZ 1080M C	491.3	849440	**16025**	15210	349	368	**386**	2.997	6.071	2.398
HZ 1080M D	519.2	912440	**17085**	16340	371	389	**408**	2.998	6.072	2.398
HZ 1180M A	541.4	959630	**17835**	17185	389	407	**425**	3.000	6.073	2.398
HZ 1180M B	554.8	998350	**18490**	17880	399	417	**435**	3.003	6.077	2.398
HZ 1180M C	588.5	1077820	**19815**	19140	424	443	**462**	3.020	6.115	2.398
HZ 1180M D	608.3	1119010	**20500**	19870	440	459	**477**	3.032	6.127	2.398

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 20-700

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm²/m	cm⁴/m	cm³/m	cm³/m	kg/m²	kg/m²	kg/m²	m²/m	m²/m	m
HZ 630M	297.6	163280	**4800**	5375	191	213	**234**	2.438	4.383	1.890
HZ 880M A	283.4	242800	**5430**	6220	181	202	**222**	2.477	4.873	1.927
HZ 880M B	299.8	261290	**5875**	6615	194	215	**235**	2.480	4.875	1.927
HZ 880M C	307.3	273860	**6150**	6910	200	221	**241**	2.479	4.875	1.927
HZ 1080M A	323.6	442300	**7735**	8675	213	233	**254**	2.472	5.311	1.927
HZ 1080M B	335.6	476070	**8325**	9285	222	243	**263**	2.474	5.311	1.927
HZ 1080M C	357.0	516700	**9050**	10000	239	260	**280**	2.475	5.312	1.927
HZ 1080M D	374.5	556360	**9725**	10710	253	273	**294**	2.476	5.313	1.927
HZ 1180M A	388.4	586150	**10210**	11240	264	284	**305**	2.476	5.314	1.927
HZ 1180M B	397.3	612320	**10665**	11695	271	291	**312**	2.478	5.318	1.927
HZ 1180M C	414.5	650700	**11260**	12400	283	304	**325**	2.491	5.327	1.927
HZ 1180M D	428.2	680890	**11820**	12885	294	315	**336**	2.497	5.332	1.927

Combination HZ ... M - 14 / AZ 20-700

HZ 630M	317.1	183170	**5940**	5440	200	224	**249**	2.438	4.664	1.890
HZ 880M A	302.6	277710	**6900**	6360	190	214	**238**	2.477	5.108	1.927
HZ 880M B	318.9	295540	**7310**	6765	202	226	**250**	2.480	5.112	1.927
HZ 880M C	326.4	307980	**7580**	7050	208	232	**256**	2.479	5.111	1.927
HZ 1080M A	342.9	500590	**9545**	8955	221	245	**269**	2.472	5.546	1.927
HZ 1080M B	354.7	533470	**10115**	9545	230	254	**278**	2.474	5.547	1.927
HZ 1080M C	376.1	573630	**10815**	10265	247	271	**295**	2.475	5.549	1.927
HZ 1080M D	393.6	612980	**11470**	10970	261	285	**309**	2.476	5.549	1.927
HZ 1180M A	407.5	642500	**11935**	11510	272	296	**320**	2.476	5.550	1.927
HZ 1180M B	415.8	666600	**12340**	11930	278	302	**326**	2.478	5.552	1.927
HZ 1180M C	438.3	719830	**13185**	12735	294	319	**344**	2.491	5.585	1.927
HZ 1180M D	450.7	745680	**13615**	13195	304	329	**354**	2.497	5.592	1.927

Combination HZ ... M - 24 / AZ 20-700

HZ 630M	389.1	240150	**7370**	6780	271	288	**305**	2.923	4.887	2.324
HZ 880M A	363.6	365560	**8565**	7925	252	269	**285**	3.000	5.415	2.398
HZ 880M B	389.6	394200	**9245**	8590	273	289	**306**	3.006	5.421	2.398
HZ 880M C	401.7	414240	**9690**	9045	282	299	**315**	3.006	5.420	2.398
HZ 1080M A	428.6	685300	**12455**	11725	303	320	**336**	2.992	5.848	2.398
HZ 1080M B	447.6	738320	**13380**	12660	318	335	**351**	2.994	5.851	2.398
HZ 1080M C	481.9	802740	**14530**	13820	345	362	**378**	2.997	5.854	2.398
HZ 1080M D	509.9	865930	**15605**	14945	367	384	**400**	2.998	5.855	2.398
HZ 1180M A	532.1	913250	**16370**	15790	384	401	**418**	3.000	5.856	2.398
HZ 1180M B	545.4	952020	**17020**	16480	395	412	**428**	3.003	5.865	2.398
HZ 1180M C	574.9	1019820	**18145**	17540	418	434	**451**	3.020	5.878	2.398
HZ 1180M D	594.7	1061120	**18840**	18280	433	450	**467**	3.032	5.888	2.398

Combination HZ ... M - 26 / AZ 20-700

HZ 630M	406.5	257150	**8345**	7645	279	299	**319**	2.923	5.148	2.324
HZ 880M A	380.4	394680	**9815**	9040	260	279	**299**	3.000	5.632	2.398
HZ 880M B	406.4	423110	**10475**	9695	281	300	**319**	3.006	5.638	2.398
HZ 880M C	418.4	443090	**10915**	10150	290	309	**328**	3.006	5.638	2.398
HZ 1080M A	445.5	734240	**14010**	13145	311	330	**350**	2.992	6.065	2.398
HZ 1080M B	464.4	787140	**14935**	14095	326	345	**365**	2.994	6.068	2.398
HZ 1080M C	498.7	851280	**16060**	15245	353	372	**391**	2.997	6.071	2.398
HZ 1080M D	526.7	914290	**17120**	16370	375	394	**413**	2.998	6.072	2.398
HZ 1180M A	548.9	961470	**17870**	17215	392	412	**431**	3.000	6.073	2.398
HZ 1180M B	562.2	1000190	**18520**	17910	403	422	**441**	3.003	6.077	2.398
HZ 1180M C	595.9	1079660	**19850**	19170	427	448	**468**	3.020	6.115	2.398
HZ 1180M D	615.7	1120840	**20535**	19905	443	463	**483**	3.032	6.127	2.398

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 26-700

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm²/m	cm⁴/m	cm³/m	cm³/m	kg/m²	kg/m²	kg/m²	m²/m	m²/m	m
HZ 630M	323.7	177180	**5210**	5835	204	229	**254**	2.512	4.457	1.890
HZ 880M A	308.9	256420	**5735**	6565	193	218	**242**	2.551	4.948	1.927
HZ 880M B	325.3	274900	**6180**	6960	206	231	**255**	2.554	4.949	1.927
HZ 880M C	332.8	287470	**6455**	7250	212	237	**261**	2.554	4.949	1.927
HZ 1080M A	349.2	455960	**7975**	8945	225	249	**274**	2.547	5.385	1.927
HZ 1080M B	361.2	489720	**8565**	9550	234	259	**284**	2.548	5.385	1.927
HZ 1080M C	382.6	530340	**9290**	10260	251	276	**300**	2.549	5.387	1.927
HZ 1080M D	400.1	569990	**9960**	10970	265	289	**314**	2.550	5.387	1.927
HZ 1180M A	414.0	599780	**10445**	11500	276	300	**325**	2.551	5.388	1.927
HZ 1180M B	422.9	625940	**10905**	11955	283	307	**332**	2.552	5.392	1.927
HZ 1180M C	440.1	664320	**11495**	12660	295	320	**345**	2.565	5.401	1.927
HZ 1180M D	453.7	694500	**12055**	13140	306	331	**356**	2.571	5.406	1.927

Combination HZ ... M - 14 / AZ 26-700

HZ 630M	343.1	197070	**6395**	5855	212	241	**269**	2.512	4.738	1.890
HZ 880M A	328.1	291340	**7240**	6670	202	230	**258**	2.551	5.183	1.927
HZ 880M B	344.4	309150	**7645**	7080	214	242	**270**	2.554	5.186	1.927
HZ 880M C	351.9	321590	**7915**	7365	220	248	**276**	2.554	5.186	1.927
HZ 1080M A	368.5	514240	**9805**	9200	233	261	**289**	2.547	5.620	1.927
HZ 1080M B	380.3	547120	**10375**	9790	242	271	**299**	2.548	5.621	1.927
HZ 1080M C	401.7	587270	**11075**	10510	259	287	**315**	2.549	5.623	1.927
HZ 1080M D	419.1	626610	**11725**	11215	273	301	**329**	2.550	5.624	1.927
HZ 1180M A	433.0	656130	**12190**	11755	284	312	**340**	2.551	5.624	1.927
HZ 1180M B	441.3	680230	**12590**	12175	291	318	**346**	2.552	5.626	1.927
HZ 1180M C	463.8	733450	**13435**	12975	306	335	**364**	2.565	5.660	1.927
HZ 1180M D	476.2	759290	**13860**	13435	316	345	**374**	2.571	5.666	1.927

Combination HZ ... M - 24 / AZ 26-700

HZ 630M	410.3	251450	**7720**	7100	281	302	**322**	2.997	4.961	2.324
HZ 880M A	384.1	376510	**8825**	8165	262	282	**302**	3.074	5.489	2.398
HZ 880M B	410.1	405120	**9500**	8825	282	302	**322**	3.081	5.495	2.398
HZ 880M C	422.2	425160	**9945**	9280	292	312	**331**	3.080	5.495	2.398
HZ 1080M A	449.2	696280	**12655**	11910	313	333	**353**	3.066	5.923	2.398
HZ 1080M B	468.2	749300	**13580**	12850	328	348	**368**	3.068	5.925	2.398
HZ 1080M C	502.5	813710	**14725**	14005	355	375	**394**	3.072	5.928	2.398
HZ 1080M D	530.4	876880	**15800**	15135	377	397	**416**	3.073	5.929	2.398
HZ 1180M A	552.6	924190	**16565**	15980	394	414	**434**	3.074	5.931	2.398
HZ 1180M B	566.0	962970	**17215**	16670	405	424	**444**	3.077	5.940	2.398
HZ 1180M C	595.4	1030740	**18340**	17730	427	447	**467**	3.094	5.953	2.398
HZ 1180M D	615.2	1072040	**19035**	18465	443	463	**483**	3.107	5.962	2.398

Combination HZ ... M - 26 / AZ 26-700

HZ 630M	427.7	268460	**8715**	7980	289	313	**336**	2.997	5.223	2.324
HZ 880M A	400.9	405620	**10090**	9295	270	292	**315**	3.074	5.706	2.398
HZ 880M B	426.9	434040	**10745**	9945	290	313	**335**	3.081	5.713	2.398
HZ 880M C	438.9	454020	**11185**	10400	300	322	**345**	3.080	5.712	2.398
HZ 1080M A	466.1	745230	**14220**	13345	321	343	**366**	3.066	6.140	2.398
HZ 1080M B	485.0	798120	**15140**	14290	336	358	**381**	3.068	6.142	2.398
HZ 1080M C	519.3	862240	**16265**	15440	363	385	**408**	3.072	6.145	2.398
HZ 1080M D	547.2	925240	**17325**	16570	385	407	**430**	3.073	6.146	2.398
HZ 1180M A	569.4	972410	**18075**	17415	402	425	**447**	3.074	6.148	2.398
HZ 1180M B	582.7	1011140	**18725**	18105	413	435	**457**	3.077	6.151	2.398
HZ 1180M C	616.4	1090590	**20050**	19365	437	460	**484**	3.094	6.189	2.398
HZ 1180M D	636.2	1131760	**20735**	20100	453	476	**499**	3.107	6.201	2.398

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 18-10/10

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm^2/m	cm^4/m	cm^3/m	cm^3/m	kg/m^2	kg/m^2	kg/m^2	m^2/m	m^2/m	m
HZ 630M	313.1	169170	**4975**	5570	203	224	**246**	2.291	4.236	1.750
HZ 880M A	297.4	254790	**5695**	6525	191	212	**233**	2.330	4.726	1.787
HZ 880M B	315.1	274720	**6175**	6955	205	226	**247**	2.333	4.728	1.787
HZ 880M C	323.2	288270	**6475**	7270	212	233	**254**	2.333	4.728	1.787
HZ 1080M A	340.8	469980	**8220**	9220	225	246	**268**	2.326	5.164	1.787
HZ 1080M B	353.7	506390	**8855**	9875	236	257	**278**	2.327	5.164	1.787
HZ 1080M C	376.8	550170	**9635**	10645	254	275	**296**	2.328	5.165	1.787
HZ 1080M D	395.7	592920	**10365**	11410	269	290	**311**	2.329	5.166	1.787
HZ 1180M A	410.7	625030	**10885**	11985	280	301	**322**	2.330	5.167	1.787
HZ 1180M B	420.2	653240	**11380**	12475	288	309	**330**	2.331	5.171	1.787
HZ 1180M C	438.8	694600	**12015**	13240	302	323	**344**	2.344	5.180	1.787
HZ 1180M D	453.6	727130	**12620**	13760	313	335	**356**	2.350	5.185	1.787

Combination HZ ... M - 14 / AZ 18-10/10

HZ 630M	334.1	190650	**6185**	5665	212	237	**262**	2.291	4.517	1.750
HZ 880M A	318.1	292440	**7270**	6695	201	225	**250**	2.330	4.962	1.787
HZ 880M B	335.7	311640	**7710**	7135	214	239	**263**	2.333	4.965	1.787
HZ 880M C	343.7	325060	**8000**	7445	221	245	**270**	2.333	4.964	1.787
HZ 1080M A	361.6	532840	**10160**	9535	235	259	**284**	2.326	5.399	1.787
HZ 1080M B	374.3	568300	**10775**	10170	245	269	**294**	2.327	5.400	1.787
HZ 1080M C	397.4	611570	**11530**	10945	263	287	**312**	2.328	5.402	1.787
HZ 1080M D	416.2	653980	**12240**	11705	278	302	**327**	2.329	5.402	1.787
HZ 1180M A	431.2	685790	**12740**	12290	289	314	**338**	2.330	5.403	1.787
HZ 1180M B	440.2	711780	**13175**	12740	296	321	**346**	2.331	5.405	1.787
HZ 1180M C	464.4	769140	**14090**	13610	313	339	**365**	2.344	5.439	1.787
HZ 1180M D	477.8	796990	**14550**	14105	323	349	**375**	2.350	5.445	1.787

Combination HZ ... M - 24 / AZ 18-10/10

HZ 630M	407.4	249800	**7670**	7055	285	303	**320**	2.776	4.740	2.184
HZ 880M A	379.7	382650	**8970**	8300	265	281	**298**	2.853	5.268	2.258
HZ 880M B	407.3	413030	**9685**	9000	287	303	**320**	2.860	5.274	2.258
HZ 880M C	420.1	434310	**10155**	9480	297	313	**330**	2.859	5.274	2.258
HZ 1080M A	448.8	722330	**13130**	12355	319	336	**352**	2.845	5.701	2.258
HZ 1080M B	468.9	778640	**14110**	13350	335	351	**368**	2.847	5.704	2.258
HZ 1080M C	505.4	846990	**15330**	14580	363	380	**397**	2.850	5.707	2.258
HZ 1080M D	535.0	914060	**16470**	15775	387	403	**420**	2.851	5.708	2.258
HZ 1180M A	558.6	964270	**17285**	16675	405	422	**439**	2.853	5.710	2.258
HZ 1180M B	572.8	1005450	**17975**	17405	416	433	**450**	2.856	5.719	2.258
HZ 1180M C	604.0	1077340	**19170**	18530	440	457	**474**	2.873	5.732	2.258
HZ 1180M D	625.0	1121150	**19905**	19315	457	474	**491**	2.885	5.741	2.258

Combination HZ ... M - 26 / AZ 18-10/10

HZ 630M	425.8	267890	**8695**	7965	294	314	**334**	2.776	5.002	2.184
HZ 880M A	397.5	413570	**10285**	9475	273	293	**312**	2.853	5.485	2.258
HZ 880M B	425.1	443730	**10985**	10165	295	314	**334**	2.860	5.491	2.258
HZ 880M C	437.8	464950	**11450**	10655	305	324	**344**	2.859	5.491	2.258
HZ 1080M A	466.7	774320	**14775**	13865	327	347	**366**	2.845	5.919	2.258
HZ 1080M B	486.8	830500	**15755**	14870	343	363	**382**	2.847	5.921	2.258
HZ 1080M C	523.2	898550	**16950**	16090	372	391	**411**	2.850	5.924	2.258
HZ 1080M D	552.9	965420	**18080**	17285	395	415	**434**	2.851	5.925	2.258
HZ 1180M A	576.4	1015480	**18875**	18185	414	433	**452**	2.853	5.927	2.258
HZ 1180M B	590.6	1056600	**19565**	18920	425	444	**464**	2.856	5.930	2.258
HZ 1180M C	626.3	1140880	**20975**	20255	451	471	**492**	2.873	5.968	2.258
HZ 1180M D	647.3	1184550	**21705**	21035	467	488	**508**	2.885	5.980	2.258

[1] Values taking the intermediary sheet piles into account.

Combination HZ ... M - 12 / AZ 26

	Properties per meter of wall[1]							Per system		
	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
Section	cm^2/m	cm^4/m	cm^3/m	cm^3/m	kg/m^2	kg/m^2	kg/m^2	m^2/m	m^2/m	m
HZ 630M	342.2	183550	**5395**	6045	217	243	**269**	2.365	4.310	1.750
HZ 880M A	325.9	268850	**6010**	6885	205	230	**256**	2.403	4.800	1.787
HZ 880M B	343.6	288770	**6490**	7315	219	244	**270**	2.406	4.802	1.787
HZ 880M C	351.7	302320	**6790**	7625	225	251	**276**	2.406	4.801	1.787
HZ 1080M A	369.4	484080	**8465**	9495	239	264	**290**	2.399	5.238	1.787
HZ 1080M B	382.3	520490	**9100**	10150	249	275	**300**	2.400	5.237	1.787
HZ 1080M C	405.4	564250	**9885**	10920	267	293	**318**	2.402	5.239	1.787
HZ 1080M D	424.2	606990	**10610**	11685	282	307	**333**	2.402	5.239	1.787
HZ 1180M A	439.2	639100	**11130**	12255	294	319	**345**	2.403	5.240	1.787
HZ 1180M B	448.8	667310	**11625**	12745	301	327	**352**	2.405	5.244	1.787
HZ 1180M C	467.3	708660	**12260**	13505	315	341	**367**	2.418	5.253	1.787
HZ 1180M D	482.0	741180	**12865**	14025	327	353	**378**	2.424	5.258	1.787

Combination HZ ... M - 14 / AZ 26

HZ 630M	363.2	205020	**6650**	6090	226	255	**285**	2.365	4.590	1.750
HZ 880M A	346.6	306500	**7620**	7015	214	243	**272**	2.403	5.035	1.787
HZ 880M B	364.1	325690	**8055**	7455	228	257	**286**	2.406	5.038	1.787
HZ 880M C	372.2	339110	**8345**	7765	234	263	**292**	2.406	5.038	1.787
HZ 1080M A	390.2	546940	**10430**	9785	248	277	**306**	2.399	5.473	1.787
HZ 1080M B	402.9	582400	**11040**	10420	258	287	**316**	2.400	5.474	1.787
HZ 1080M C	426.0	625650	**11795**	11195	276	305	**334**	2.402	5.475	1.787
HZ 1080M D	444.8	668050	**12505**	11955	291	320	**349**	2.402	5.476	1.787
HZ 1180M A	459.7	699860	**13000**	12540	303	332	**361**	2.403	5.477	1.787
HZ 1180M B	468.7	725850	**13435**	12990	310	339	**368**	2.405	5.478	1.787
HZ 1180M C	492.9	783200	**14345**	13855	326	357	**387**	2.418	5.512	1.787
HZ 1180M D	506.3	811040	**14805**	14355	337	367	**397**	2.424	5.518	1.787

Combination HZ ... M - 24 / AZ 26

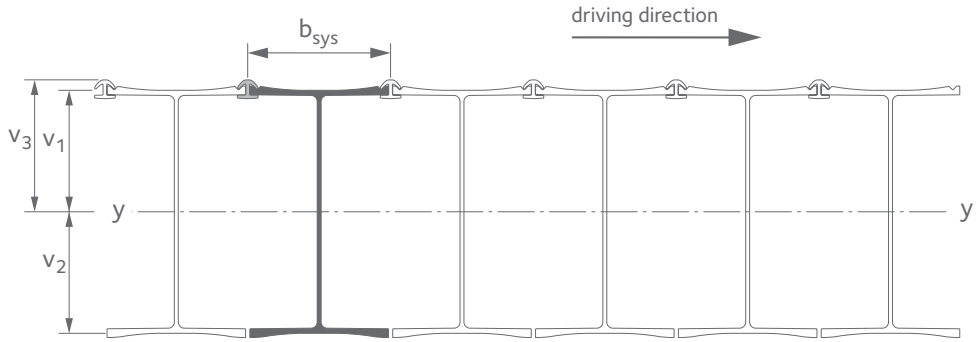
HZ 630M	430.7	261310	**8020**	7380	296	317	**338**	2.849	4.814	2.184
HZ 880M A	402.2	393780	**9230**	8540	275	296	**316**	2.927	5.342	2.258
HZ 880M B	429.8	424140	**9945**	9240	297	317	**337**	2.933	5.348	2.258
HZ 880M C	442.6	445420	**10415**	9725	307	327	**347**	2.932	5.347	2.258
HZ 1080M A	471.5	733500	**13330**	12545	330	350	**370**	2.919	5.775	2.258
HZ 1080M B	491.6	789810	**14315**	13545	345	366	**386**	2.921	5.777	2.258
HZ 1080M C	528.0	858140	**15530**	14770	374	394	**414**	2.924	5.780	2.258
HZ 1080M D	557.6	925200	**16670**	15970	397	418	**438**	2.925	5.781	2.258
HZ 1180M A	581.2	975400	**17485**	16865	416	436	**456**	2.926	5.783	2.258
HZ 1180M B	595.3	1016570	**18175**	17595	427	447	**467**	2.930	5.792	2.258
HZ 1180M C	626.5	1088440	**19365**	18725	451	471	**492**	2.947	5.805	2.258
HZ 1180M D	647.5	1132240	**20100**	19505	467	488	**508**	2.959	5.815	2.258

Combination HZ ... M - 26 / AZ 26

HZ 630M	449.2	279410	**9070**	8305	305	329	**353**	2.849	5.075	2.184
HZ 880M A	420.0	424700	**10565**	9730	284	307	**330**	2.927	5.559	2.258
HZ 880M B	447.6	454840	**11260**	10420	306	328	**351**	2.933	5.565	2.258
HZ 880M C	460.4	476060	**11725**	10905	316	338	**361**	2.932	5.564	2.258
HZ 1080M A	489.3	785490	**14985**	14065	338	361	**384**	2.919	5.992	2.258
HZ 1080M B	509.5	841670	**15970**	15070	354	377	**400**	2.921	5.994	2.258
HZ 1080M C	545.8	909690	**17160**	16290	382	405	**428**	2.924	5.997	2.258
HZ 1080M D	575.4	976550	**18285**	17485	406	429	**452**	2.925	5.998	2.258
HZ 1180M A	599.0	1026600	**19080**	18385	424	447	**470**	2.926	6.000	2.258
HZ 1180M B	613.2	1067730	**19775**	19120	435	458	**481**	2.930	6.003	2.258
HZ 1180M C	648.8	1151990	**21180**	20455	461	485	**509**	2.947	6.041	2.258
HZ 1180M D	669.8	1195650	**21905**	21235	478	502	**526**	2.959	6.054	2.258

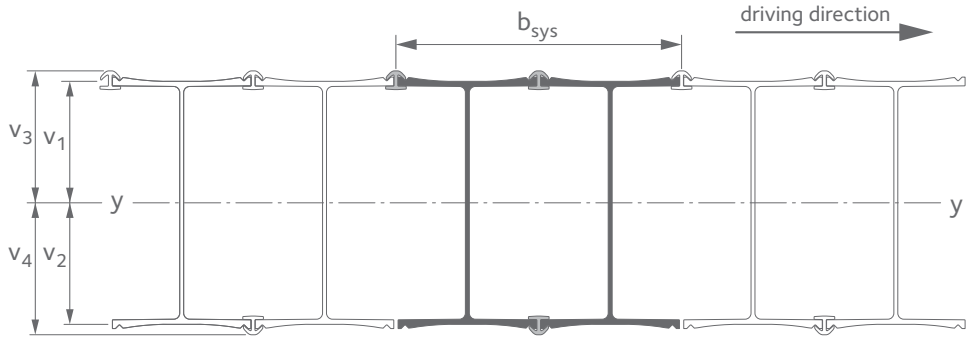
[1] Values taking the intermediary sheet piles into account.

Combination C 1



	Dimensions			Properties per meter of wall					Per system		
	v_1	v_2	v_3	A	G	I_y	$W_{el,y}$*	$W_{el,y}$**	A_{LW}	A_{LS}	b_{sys}
Section	mm	mm	mm	cm^2/m	kg/m^2	cm^4/m	cm^3/m	cm^3/m	m^2/m	m^2/m	m
HZ 630M	292.6	323.2	320.9	757.3	**594.5**	542340	**16780**	16900	0.513	2.500	0.434
HZ 880M A	379.9	423.5	414.3	662.1	**519.8**	811010	**19150**	19575	0.551	3.001	0.475
HZ 880M B	384.3	423.1	416.7	727.6	**571.1**	882820	**20865**	21185	0.554	3.003	0.475
HZ 880M C	387.1	424.3	417.5	758.1	**595.1**	933600	**22000**	22360	0.554	3.002	0.475
HZ 1080M A	500.8	546.6	535.2	830.8	**652.2**	1590360	**29095**	29715	0.547	3.439	0.470
HZ 1080M B	505.5	547.9	536.9	880.0	**690.8**	1728110	**31540**	32185	0.548	3.438	0.470
HZ 1080M C	510.5	548.9	538.9	965.7	**758.0**	1887970	**34395**	35035	0.549	3.440	0.470
HZ 1080M D	515.8	551.6	540.2	1035.8	**813.1**	2046410	**37100**	37880	0.550	3.440	0.470
HZ 1180M A	520.8	554.6	541.2	1091.2	**856.6**	2164320	**39025**	39990	0.551	3.441	0.475
HZ 1180M B	524.5	554.9	542.9	1127.6	**885.2**	2270310	**40910**	41820	0.553	3.447	0.475
HZ 1180M C	522.7	560.7	542.0	1192.6	**936.2**	2418290	**43130**	44615	0.558	3.465	0.475
HZ 1180M D	527.8	559.6	545.1	1246.5	**978.5**	2535560	**45310**	46515	0.564	3.472	0.475

Combination C 23



	Dimensions				Properties per meter of wall					Per system		
	v_1	v_2	v_3	v_4	A	G	I_y	$W_{el,y}$*	$W_{el,y}$**	A_{LW}	A_{LS}	b_{sys}
Section	mm	mm	mm	mm	cm^2/m	kg/m^2	cm^4/m	cm^3/m	cm^3/m	m^2/m	m^2/m	m
HZ 630M	298.7	317.0	327.1	345.3	772.5	**606.4**	557210	**17580**	16135	0.998	2.992	0.868
HZ 880M A	389.0	414.4	423.4	448.9	676.7	**531.2**	836540	**20185**	18635	1.074	3.542	0.950
HZ 880M B	392.1	415.3	424.6	447.7	741.5	**582.0**	906880	**21840**	20255	1.081	3.549	0.950
HZ 880M C	394.6	416.8	425.1	447.3	772.0	**606.0**	957590	**22975**	21410	1.080	3.548	0.950
HZ 1080M A	510.3	537.1	544.8	571.5	845.7	**663.8**	1633800	**30420**	28590	1.066	3.976	0.940
HZ 1080M B	514.1	539.3	545.5	570.8	894.1	**701.9**	1769060	**32800**	30995	1.068	3.978	0.940
HZ 1080M C	518.2	541.2	546.6	569.6	979.7	**769.1**	1928510	**35635**	33855	1.072	3.981	0.940
HZ 1080M D	523.0	544.4	547.4	568.8	1049.8	**824.1**	2086700	**38330**	36685	1.073	3.982	0.940
HZ 1180M A	527.6	547.8	548.0	568.3	1105.1	**867.5**	2204240	**40235**	38790	1.074	3.984	0.950
HZ 1180M B	529.9	549.5	548.3	568.0	1139.1	**894.2**	2302720	**41905**	40545	1.078	3.995	0.950
HZ 1180M C	530.2	553.2	549.5	572.5	1209.4	**949.4**	2466050	**44575**	43075	1.087	4.017	0.950
HZ 1180M D	532.7	554.8	549.9	572.0	1258.2	**987.7**	2567270	**46280**	44880	1.099	4.025	0.950

Designing an HZ®-M Steel Wall System

The design of a combined wall is similar to that of all standard sheet pile walls, but calculating the section properties of a combined HZ/AZ system is undertaken differently to conventional sheet piling.

The combined wall is a combination of different elements with the underlying assumption that the bending moments along the wall are distributed to the different elements proportionally to their stiffness.

Consequently:

- moment of inertia of one HZ/AZ system (one HZ®-M and one pair of AZ):

$$I_{sys} = I_{HZ} + I_{AZ} \qquad [m^4]$$

- moment of inertia of the HZ/AZ system per meter of wall:

$$I_{sys/m} = \frac{I_{HZ} + I_{AZ}}{b_{sys}} \qquad [m^4/m]$$

Hence, following formulas allow calculating the bending moment distribution to each single component.

Assuming that M_{sys} is the bending moment per meter of wall based on the geotechnical design:

- bending moment transmitted to the HZ-M king pile (including the connectors):

$$M_{HZ} = \left(\frac{I_{HZ}}{I_{sys}} M_{sys} \right) b_{sys} \qquad [Nm]$$

- bending moment transmitted to the intermediary AZ sheet pile:

$$M_{AZ} = \left(\frac{I_{AZ}}{I_{sys}} M_{sys} \right) b_{sys} \qquad [Nm]$$

Steel stress verification - Global safety approach

If only the effect of the bending moments is considered, steel stresses can be determined with the basic formula:

$$\sigma = \frac{M}{W}$$

For the HZ-M king piles:

$$\sigma_{HZ} = \frac{M_{HZ}}{W_{HZ}} = \left(\frac{1}{W_{HZ}} \right) \left(\frac{I_{HZ}}{I_{sys}} M_{sys} \right) b_{sys}$$

$$= \frac{1}{W_{HZ,\,eq}} M_{sys} \qquad [Pa]$$

where $$W_{HZ,\,eq} = \frac{I_{sys}}{b_{sys}\, max\,(v_1, v_2)} \qquad [m^3/m]$$

is the "equivalent section modulus" of the HZ-M king pile. This approach simplifies the task of the designer by using exclusively M_{sys} (no need to decompose M_{sys}).

Note: "$W_{HZ,eq}$" is labelled in the tables of this brochure as $W_{el,y}$*.

For the connectors RH / RZD / RZU:

$$\sigma_{RH/RZ} = \frac{M_{HZ}}{W_{RH/RZ}} = \left(\frac{1}{W_{RH/RZ}} \right) \left(\frac{I_{HZ}}{I_{sys}} M_{sys} \right) b_{sys}$$

$$= \frac{1}{W_{RH/RZ,\,eq}} M_{sys} \qquad [Pa]$$

where $$W_{RH/RZ,\,eq} = \frac{I_{sys}}{b_{sys}\, max\,(v_3, v_4)} \qquad [m^3/m]$$

Note: "$W_{RH/RZ,eq}$" is labelled in the tables of this brochure as $W_{el,y}$**.

For the AZ infill sheet piles:

$$\sigma_{AZ} = \frac{M_{AZ}}{W_{AZ}} = \frac{\frac{I_{AZ}}{I_{sys}} M_{sys}\, b_{sys}}{W_{AZ}} \qquad [Pa]$$

Based on the above formulas, the verification of the allowable stresses is straightforward:

$$\sigma_{allowable} = \frac{f_y}{S_F}$$

The steel stresses of each component must be checked individually:

$$\sigma_{HZ} \le \sigma_{allowable,\,HZ}$$

$$\sigma_{RH/RZ} \le \sigma_{allowable,\,RH/RZ}$$

$$\sigma_{AZ} \le \sigma_{allowable,\,AZ}$$

Notes:

- the yield stress of each component may be different. As a rule of thumb, stresses within the infill sheet piles are most often relatively small, allowing the use of a low steel grade for the AZ sections. This improves the cost efficiency of the system. However, driveability issues may trigger the choice of a higher steel grade than required by the design calculations.
- the yield strength of the connectors shall be equal or higher than that of the HZ-M, except for the combination 12. Hence, connectors are available exclusively with a yield strength of 460 MPa.
- the full range of HZ-M system are also available in ASTM A 690, with yield strengths of 345 MPa and above.

The HZ-M king piles are capable of transferring high vertical loads to the subsoil. In such cases, stress analysis should include vertical loads and additional bending moments induced by deflection. Vertical loads can also originate from battered anchor piles, struts, etc.

The basic formula changes to:

$$\sigma = \frac{M}{W_x} + \frac{N \cdot e}{W_x} + \frac{N}{A_{HZ}}$$

To summarize, the designer can calculate in an easy way the stresses in the different components of the HZ-M by using the bending moment M_{sys} of the combined wall and the two "equivalent" section moduli $W_{el,y}$* and $W_{el,y}$** which are shown in the tables of this brochure.

Steel stress verification - Partial safety approach

In Europe, the design of steel sheet pile walls has to be compliant with the Eurocodes. Please refer to EN 1993 - Part 5 [1] for the complete design method. Eurocodes are based on "partial safety factors" that are applied to the resistances (EN 1993-5) and the actions (geotechnical design based on EN 1997- Part1 [2]). Recommendations and advice for efficient design of combined steel walls according to the Eurocodes can be found in [11].

Practical aspects

The contribution of the infill sheet piles is relatively small for certain combinations so that in some cases, the designer neglects the contribution of the moment of inertia of the infill sheet piles. This is a safe-sided approach but might be over conservative in some cases.

Savings can be achieved by shortening the length of the intermediary sheet piles. In the ground, where there is earth support and embedment, the length of the intermediary sheet piles can be considerably optimized. In the infill role, the intermediary sheet pile is only required to resist active earth pressures down to the zero earth pressure level. For safety reasons, its length is extended below this level by at least 1 - 2 m (Figure 2). If the embedment of the infill sheet pile is quite small, special care must be taken during construction to make sure that the piles are driven to the design level. For cantilever walls, the maximum bending moment occurs in the embedded portion of the piles. Therefore, the length of the infill sheet piles must be checked. Furthermore, if groundwater pressures are high, the risk of seepage beneath the toe should be analysed when optimizing the length of the intermediary sheet piles.

The HZ-M king pile spacing should be limited so that full continuous earth resistance is safeguarded. When determining pile spacing, arching effects of the soil may be considered. If these properties are negligible (e.g. in soft mud or where groundwater pressure is high), the transverse load capacity of the intermediary sheet piles needs to be checked. Additionally, the development of the earth resistance in front of the wall may have to be checked. Experience shows that for the standard HZ/AZ combinations, this 3D effect on the passive resistance can be taken into account, and the design of the combined wall can be done as a continuous retaining wall. More detailed information can be found in Chapter 8.1.4 of the EAU 2012 [3]. The section modulus of the HZ-M king piles can be adapted to the resultant bending moment by adding RH connectors to the rear flanges. As a result, a lighter section can be selected and simply strengthened locally, where maximum bending occurs (Figure 3).

The HZ-M wall system, in which the full range of AZ sections can be used as intermediary sheet piles, offers maximum flexibility in terms of design. Heavier AZ sections can also be selected to enhance corrosion resistance or enhance driving behaviour. Generally speaking, the range of suitable sheet piles varies from 1 200 cm^3/m to 3 200 cm^3/m.

Driveability is an additional key factor that should be analysed when choosing the infill sheet piles. In normal driving conditions, infill sheet piles above 20 m should have a section modulus above 2 000 cm^3/m.

Local standards or regulations may call for specific features of the infill sheet piles. For instance, in some countries infill sheet piles used in marine structures shall have a minimum thickness of 10 - 12 mm.

Note: The application of design methods is to be reviewed in reference to each national standard governing (e.g. contribution of the infill sheet piles to bending resistance [1]).

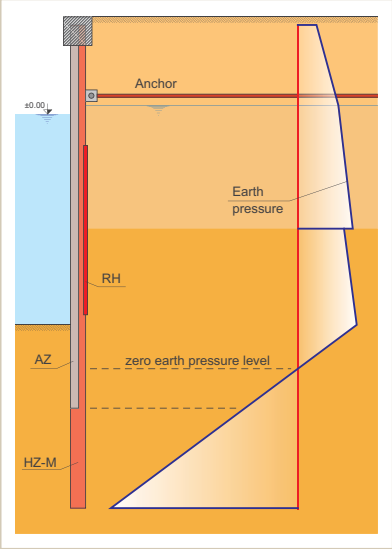


Fig. 2. Optimization of the length of the AZ infill sheet piles.

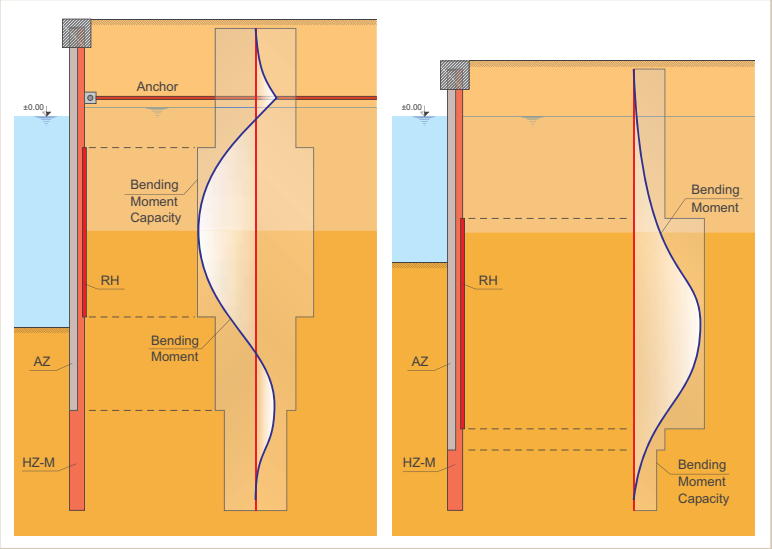


Fig. 3. Optimization of the bending moment capacity with additional RH connectors on the rear flange.

HZ®-M specific tie-back solution

Anchoring an HZ/AZ combined wall system can be simple and efficient: a tie-rod links each HZ-M pile or HZ-M box pile to a steel sheet pile anchor wall or isolated sheet pile panels - a particularly economical solution.

Because each king pile is anchored, a traditional waler system can be avoided. The tie-rod is simply linked to the HZ-M pile through two T-connectors and a pin. T-connectors are threaded through slots cut on jobsite in the rear flange of the HZ-M pile after driving. Loads are thereby applied close to the web.

HZ-M sections can be delivered with precut anchor slots on request, although this is not best practice as it is difficult to achieve the exact elevation of the slots due to driving tolerances. The figure below shows the slots cut in the HZ-M king pile. The dimensions "h" and "b" vary with the tie rod diameter.

Conventional anchoring, incorporating a waler system, is an alternative. The HZ-M system can also be anchored with battered steel HP-piles or with grouted anchors.

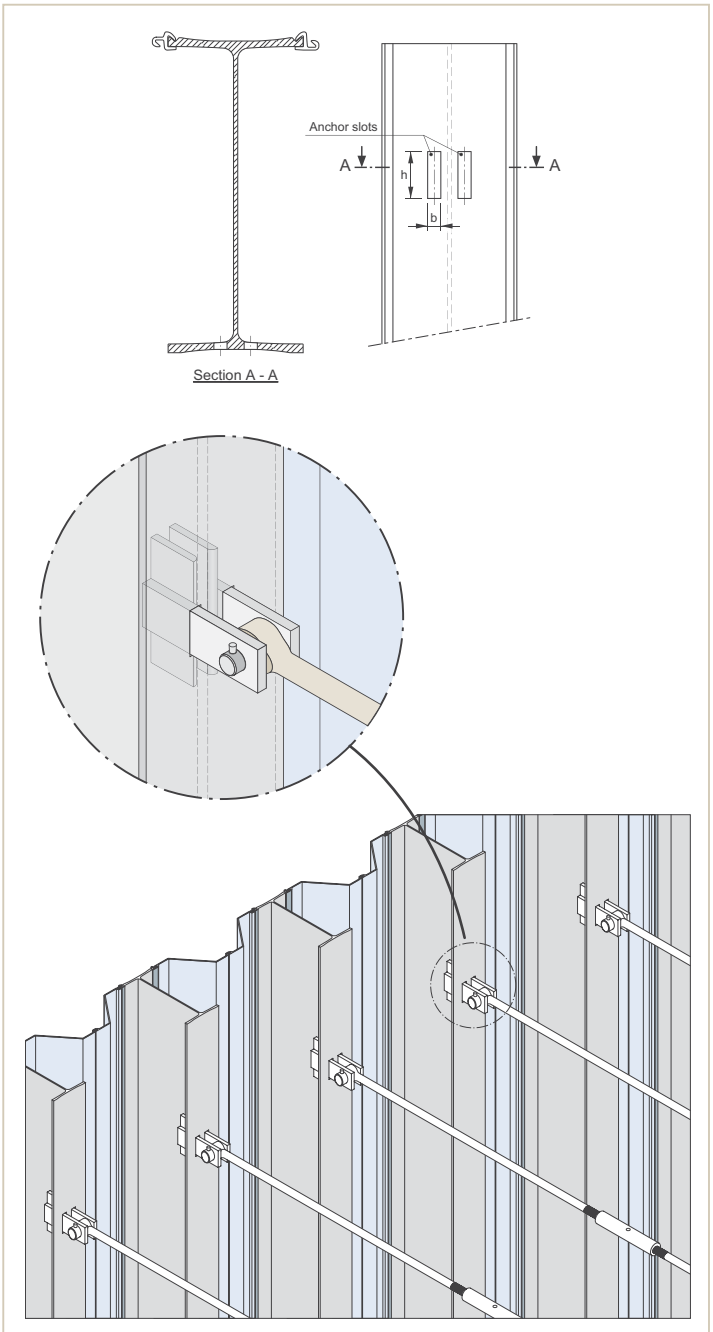


Fig. 4. Special tie-rod connection with T-connector for the HZ-M.

Fig. 5. Installation of the T-connectors at the job-site.

Fig. 6. Conventional anchor solution with tie-rods, walers, ...

Installation procedure

The HZ-M Steel Wall System can be installed on land or from water in a similar way. The key element for state-of-the-art installation is pile guiding. The guide can be a 2-level template frame or a leader mast attached to the pile driving machine.

First, the template frame is placed and secured to avoid any shifting during driving. Then a number of HZ-M king piles are pitched in the template. Afterwards, the king piles are driven into the ground (Figure 7 - Step 1), starting preferably with a vibratory hammer, adopting the "Pilgrim's step" driving sequence.

Depending on the soil conditions, the application and the geometry of the final structure, a second driving phase with a sufficiently powered impact hammer may be required (Figure 7 - Step 2): driving to final depth resumes after the removal of the driving template.

Generally, intermediary sheet piles are pitched and driven after the installation of the HZ-M piles is completed (Figure 7 - Step 3).

In case of difficult geotechnical conditions, the following may be necessary:

- Driving operation in stages: driving of king piles with vibratory hammer until refusal, then switch to impact hammer to reach final installation depth. The use of an impact hammer allows for an assessment of the final bearing capacity.
- Pre-drilling after placing the HZ-M piles may be considered to avoid damages of the infill sheet piles.
- In case vibrations on surrounding structures shall be avoided, placing of the HZ-M piles in a slurry trench may be considered.

It is recommended to use partially crimped pairs of AZ sheet piles: this specific crimping of the interlocks increases the stiffness at the top of the sheet pile and facilitates the installation process (Figure 8). At the bottom, the AZ sheet piles are still "flexible" enough to accommodate the driving tolerances of the king piles. For wide AZ-piles, the use of double clamps is recommended to achieve the best installation performance.

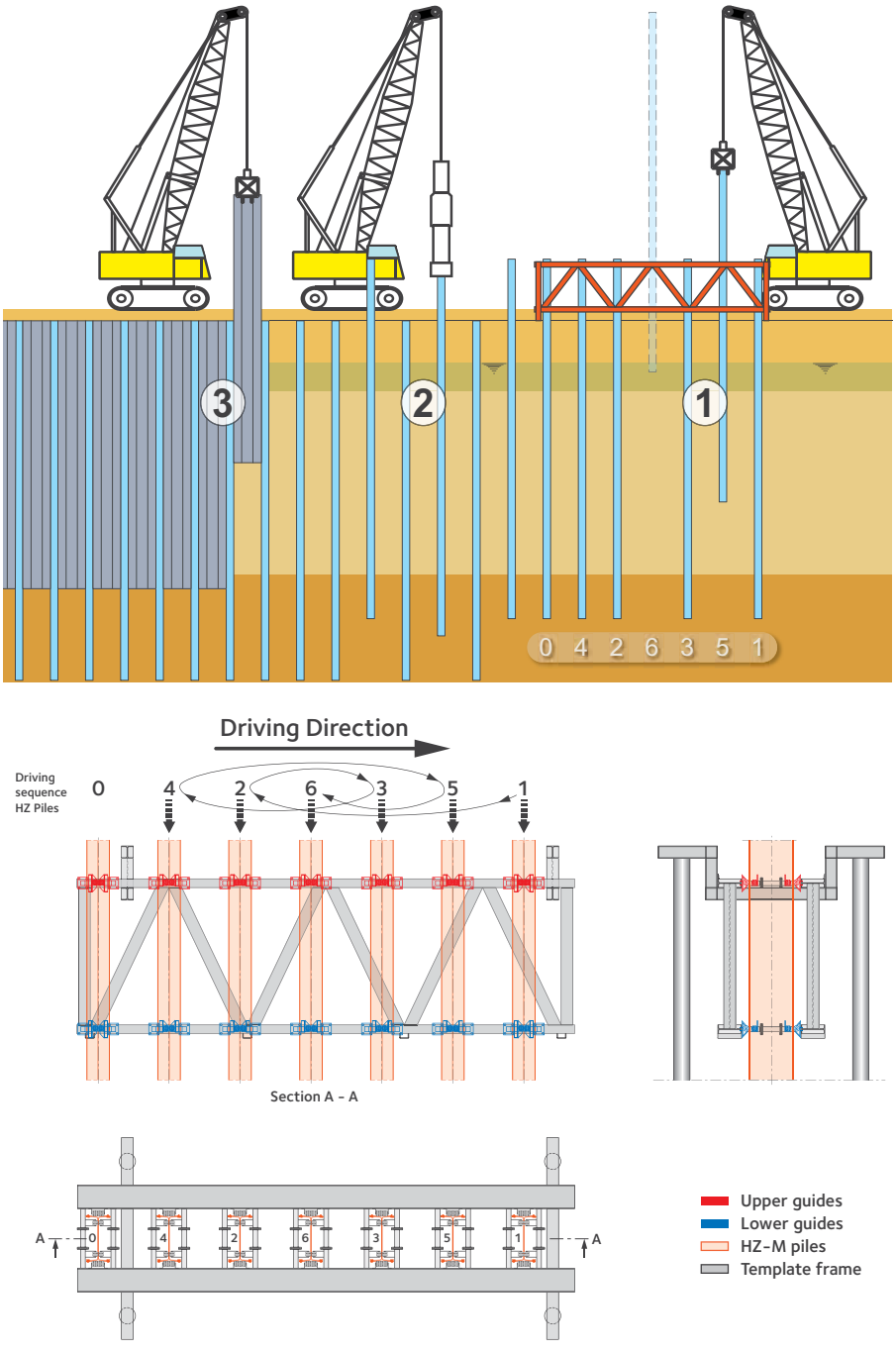


Fig. 7. Installation procedure: driving template and "Pilgrim's step" driving sequence.

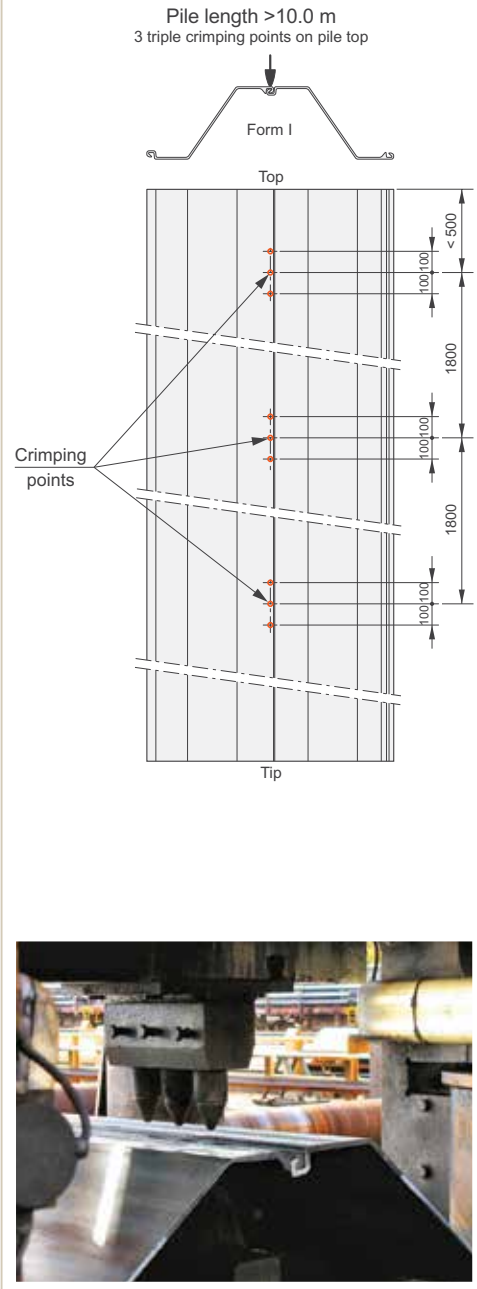


Fig. 8. Special crimping pattern for AZ infill sheet piles and crimping at the rolling mill.

It is essential that king piles are driven in the correct position as per driving plan. Greatest possible accuracy has to be guaranteed on verticality or prescribed batter. Two different methods can be used.

Method 1: Template with two guide levels

A rigid template with two guide levels is used in this method. The template has openings for the theoretical position of the king piles. (Figure 9). The vertical distance between the two levels should be 25% of the pile length, but in any case not less than 3 m.

The template should be placed as close to the ground as possible. On land, the template can rest on the ground, but it should be secured firmly against shifting. It is advisable to support the template on separate piles. When driving in water, the template should be supported on auxiliary piles just above the water level.

Depending on the design, templates usually have space for 5 to 9 king piles (Figure 7). These primary piles are driven using a free-hanging vibrator or an impact hammer, the vibrator being the most commonly used equipment. Inside the template, a proper HZ-M guiding system (Figure 10) should be designed to avoid damage to the coating on the sheet piles if applicable (for example, by using guiding rolls).

Fig. 9. Driving templates and their support.

After all the piles in one template are driven, the template is removed and repositioned. The last driven pile will serve as an anchor pile to guarantee the correct new position of the template. This will ensure proper alignment and distance between the next driven king piles. It may also serve as a support pile.

Later on, the intermediary sheet piles can be installed with the same driving equipment, or by a second pile driving team. For this operation, no template is necessary.

Method 2: Fixed leader system

The king piles are driven using piling equipment guided by a fixed leader (Figure 11). The specified verticality or inclination must be achieved by the leader and the correct positioning through a simple horizontal driving frame. When piling in water, the latter is secured above the water level on auxiliary piles. In all other cases, it is set down on the driving planum and fixed in its position.

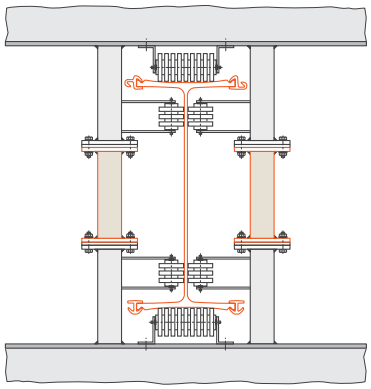


Fig. 10. Template and detail of guide.

Fig. 11. Template with a single level and piling equipment guided on a fixed leader.

Underwater installation

The rehabilitation of an existing deck-on-piles (Figure 12) or a gravity structure may be done with an underwater cantilever or anchored sheet pile wall installed in front of the existing structure. The installation of such a wall is more complex, but the procedure is similar to the driving methods described before. There is a need for a guiding system and the driving sequence follows the same principles, but the different phases have to be adapted to the local environment and tidal fluctuations. The driving equipment should be able to work under water, otherwise a vibratory hammer fitted with a "follower" (extension) can be used (Figure 12).

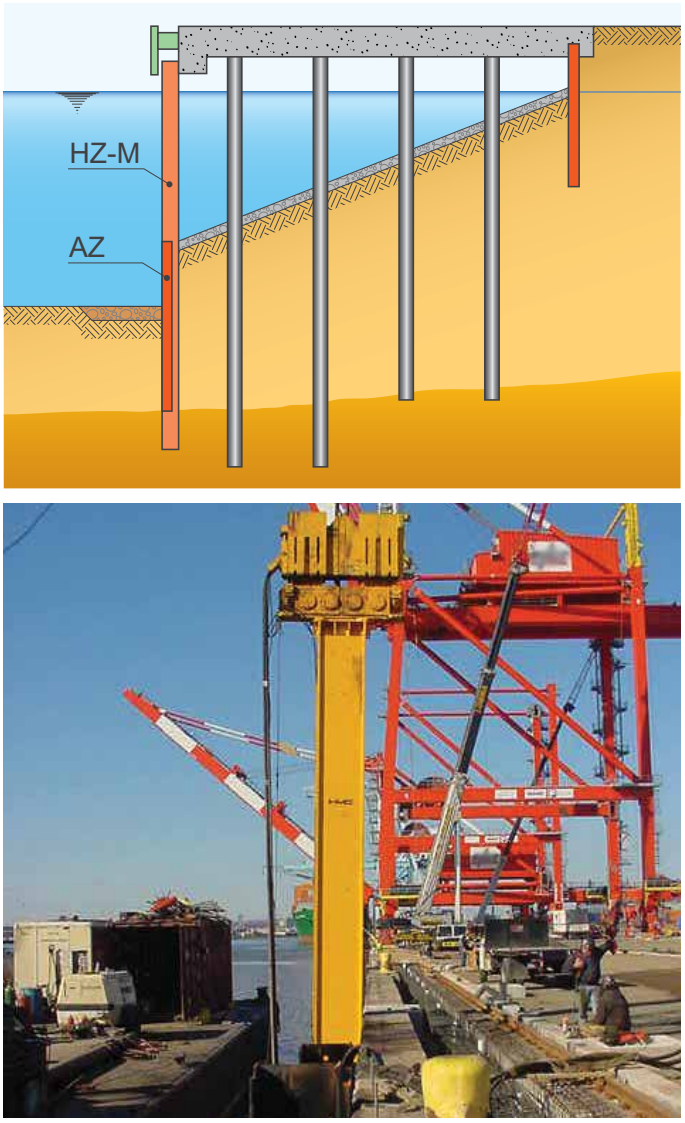


Fig. 12. Installation of AZ below water level with a follower on a vibratory hammer.

Additional recommendations

It is important to constantly check the position of the king piles and their verticality during the installation process. It should be as close as possible to the theoretical position. The intermediary sheet piles should be designed in the way, that they can compensate for installation tolerances of the king piles and their position without damage. The tolerance compensation can result from interlock rotation (only for AZ-piles), elastic deformation and plastic deformation.

In order to ensure an efficient and damage-free installation of AZ-type intermediary sheet piles, the distance between two adjacent king piles, at any position over the height of the infill sheet pile, should not exceed 200 mm and, in any case, the distance shall be less than the unfolded width of the intermediary sheet pile. In addition, compatibility with the rotation capacity of the interlocks should be considered. Producer information must be observed.

In case prescribed tolerances are not achieved, the king piles should be extracted and re-driven, or compatibility of the achieved driving tolerances should be proven. In special cases, the contractor can fabricate a special pile which takes into account the existing driving imperfection. It is to be noted that driving tolerances may have an impact on the water pressure resistance of the infill sheet piles and need to be accounted for in the design.

Under certain conditions, more specific attention to the choice of the intermediary sections is recommended. Please contact our Engineering Department for further information.

Generally, tolerances shall be agreed upon before the project starts.

Filling the interlocks of the free RZ connectors before installation with foam, Beltan®Plus or grease will significantly reduce the interlock resistance thus facilitates the pile driving. In case of non-cohesive soils, this procedure is strongly recommended as it prevents soil compacting inside of the interlocks.

Driving equipment

State-of-the-art driving technology allows for the use of impact or vibratory equipment to drive king piles and intermediary sheet piles. Vibratory equipment should be preferred whenever possible.
A combination of the two methods can be used for the driving of the king piles: the king piles are first driven using vibration techniques. The final depth is reached with an impact hammer, also to allow for a first assessment of the bearing capacity.

Intermediary sheet piles are generally installed with vibratory hammers. Vibratory hammers should be fitted with adequate clamps to ensure a correct energy transfer to the pile during the driving process. It is recommended to use double clamps for HZ-M box piles. For intermediary AZ sheet piles, single or double clamps can be considered (Figure 13). It is advisable to choose a vibrator with sufficient power reserve to allow for good driving speed and penetration, as well as to prevent damaging the interlocks through overheating. Vibratory hammers with variable moment are preferable. The different types of impact hammers are free-fall hammers, diesel hammers, and hydraulic hammers. A driving cap must be used with free-fall or diesel hammers (Figure 14). In the case of an hydraulic hammer, the manufacturer can provide special driving plates which fit the geometry of the pile head. Note that impact hammers should be powerful enough to avoid local deformation of the pile heads.

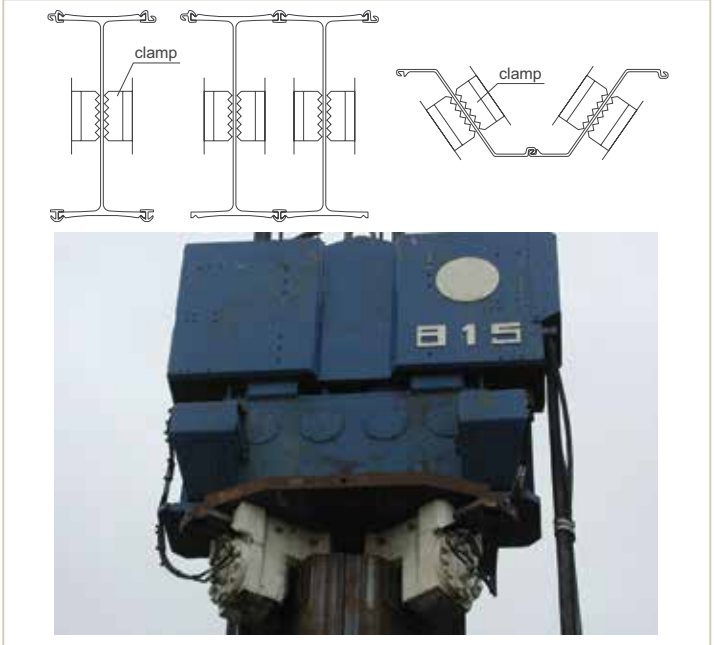


Fig. 13. Double clamps for a vibratory hammer.

If driving of the intermediary sheet piles shows no progress, is impossible or can only be achieved through excessive driving energy, the following is advised:

- check for obstructions in the soil. This can be done, for example, by extracting the intermediary sheet pile and re-driving it outside the interlocks.
- verify that the spacing and the positioning of the king piles is correct. This can be done, for example, by means of an inclinometer. A tube of the same diameter as the inclinometer is fitted with a corresponding connector and jetted down on the interlocks at the back flange of the king pile. The measurements taken by the inclinometer will give information on the actual position of the king pile at the relevant depths. In case the spacing between the king piles does not comply with the driving tolerances requirements, the king piles must be extracted and re-driven.

It is strongly advised to avoid forcing the driving of an intermediary sheet pile, as this might lead to interlock damage.

Driving aids

Whenever difficult driving is expected due to unfavourable geotechnical conditions, auxiliary techniques can help to smooth the progress of driving:

- water jetting: mainly in compact granular or slightly cohesive soils
- pre-drilling
- reinforcing the pile toe
- blasting
- installation in slurry trench

Water jetting in compact granular or slightly cohesive soil

Water jetting tubes attached to the intermediary sheet piles might facilitate the driving. A pressure of approximately 10 - 20 bars yields good results through minimizing the friction along the sheet pile surface and reducing toe resistance. Installation time, necessary driving energy, and vibrations are drastically reduced.

Position of section HZ 880M / 1080M / 1180M as solution 26

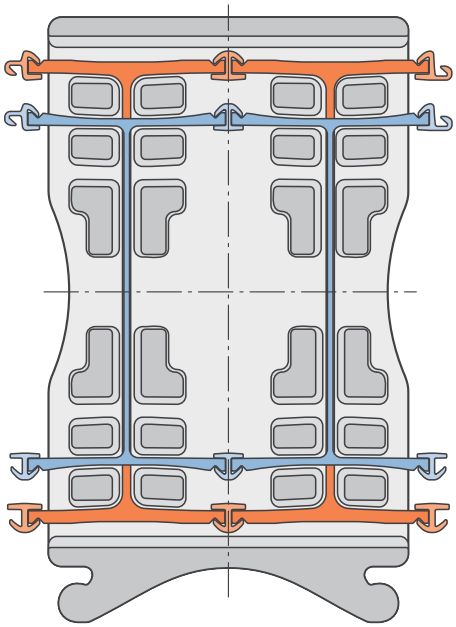


Fig. 14. Impact hammer driving cap.

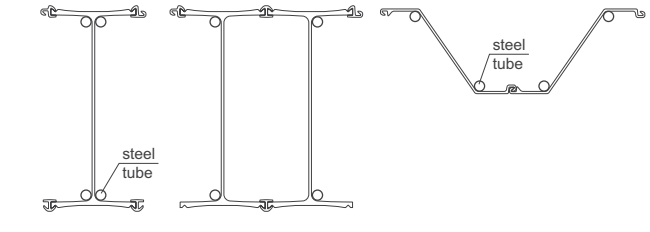
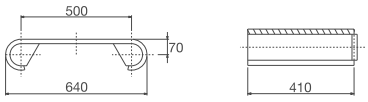
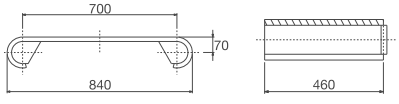


Fig. 15. Water jetting.

Sheet pile sections and corresponding driving caps

Arrangement	Single pile	Double pile
Driving caps	HS 8-11	HD 6-11
HZ®-M sections		
HZ 630M	✓[1)]	✓[1)]
HZ 880M	✓	✓
HZ 1080M	✓	✓
HZ 1180M	✓	✓

[1)] On request.

Dimensions of relevant sliding guides	Designation	Corresponding driving caps
	500/90	HS 8-11
	700/90	HD 6-11

Pre-drilling / Augering

Pre-drilling or augering is often used when sheet piles are to be driven into compact sands or stiff clays. The aim is to loosen the soil, in some cases even soil replacement can be foreseen, so that driving can be performed with standard piling equipment.

Pre-drilling can also be used when the combined wall has to penetrate rock layers. In this case, only the HZ-M king piles are driven into the drilled space in the soil layer (Figure 16).

Generally, pre-drilling is done only for the intermediary piles. The drilling diameter can be chosen in the range of 30%-40% of the sheet pile width.

Reinforcing of the pile toe

Piles can be strengthened by welding steel plates at the tip of the pile. This is used predominantly in cohesive soils with the aim of reducing skin friction (Figure 17).

Alternatively, the whole toe of the pile can be equipped with special cast elements also called “tip points” or “pile shoes”. This allows the pile to penetrate into rock, up to a few meters (for instance in sandstone or mudstone), without damage.

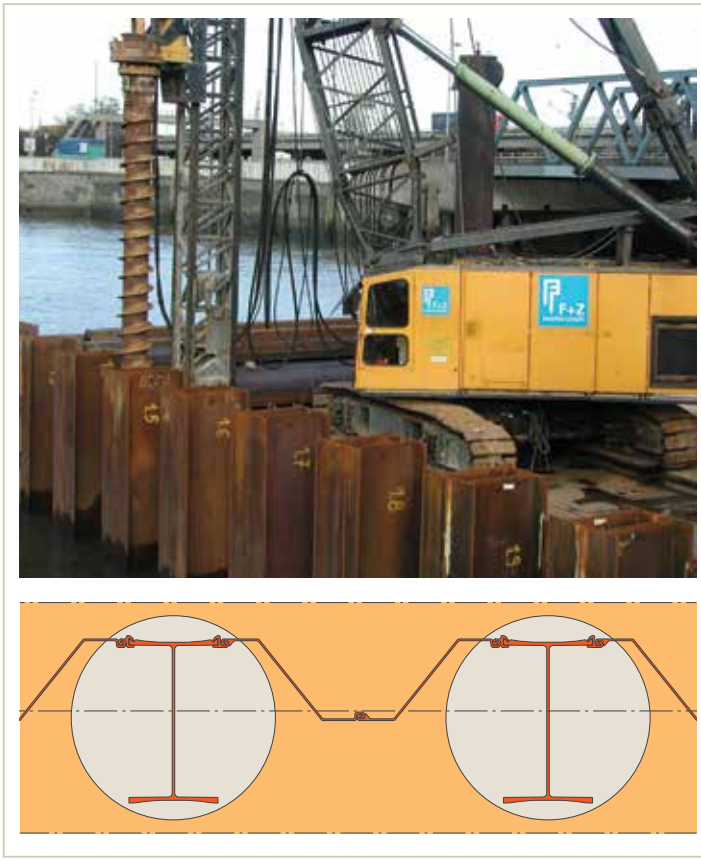


Fig. 16. Pre-drilling / augering for king piles.

For the HZ-M king piles, a special toe-cutting can be foreseen to concentrate the driving energy at the toe of the pile and cut through the hard soil layers (Figure 17). For AZ piles, simple plates can be sufficient as reinforcement.

Fig. 17. Reinforcing of the tip of the pile with steel plates / shoes welded on the king pile toe.

Rock bolting / Toe pinning into a rock layer

If the rock layer is higher than the required embedment depth of the combined wall, then the bottom of the wall can be secured by dowelling the king pile to the underlying rock (toe-pin, see Figure 18). Please consult the specific brochure for more information.

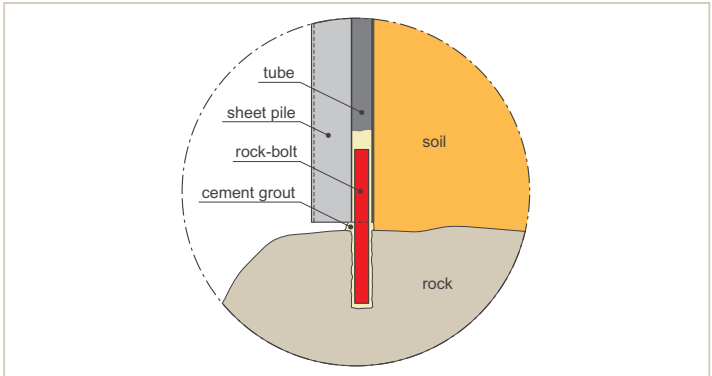


Fig. 18. Concept of a rock-bolt.

Durability

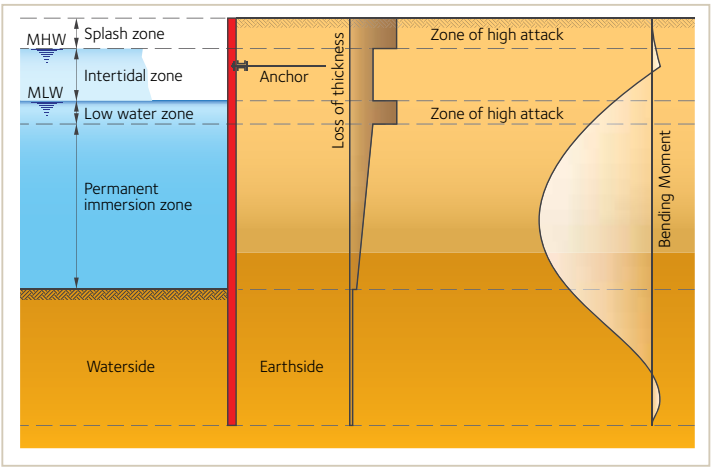
Generally, when designing temporary structures, corrosion does not have to be considered. For permanent structures, however, corrosion impact has to be analyzed for the service life. The loss of steel has an influence on the design of structures executed in marine environments. Atmospheric corrosion is quite small, and in most natural soils, steel resists quite well to the phenomenon of corrosion.

The determination of the residual section properties after corrosion of an HZ-M Steel Wall System is more complex than for standard sheet piles because corrosion is higher on the water side of the wall. Assumptions like proportionality to the initial thickness of the flange are too conservative and may lead to uneconomic solutions. Please contact our technical department if you need an assessment of the residual section properties.

Additional protection methods of the steel include surface coatings, cathodic protection (only in the zone which is permanently in contact with water), concrete capping beams, etc.

ArcelorMittal has developed a new steel grade **AMLoCor®** that is more resistant to corrosion in the "Permanent Immersion Zone" and in the "Low Water Zone". In the near future, all the elements of the HZ-M system will be available in AMLoCor steel grade with different yield strengths.

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



ArcelorMittal's technical department can assist with any queries.

Resistance to water pressure

The HZ-M system can be submitted to high hydraulic pressures, for instance, when used to build a cofferdam in the middle of a river. The performance of the system under water pressure depends on the chosen combination of HZ-M king pile and AZ infill sheet pile and their respective steel grades. This chapter aims to provide sufficient information to select the optimal HZ/AZ combination for this particular loading case.

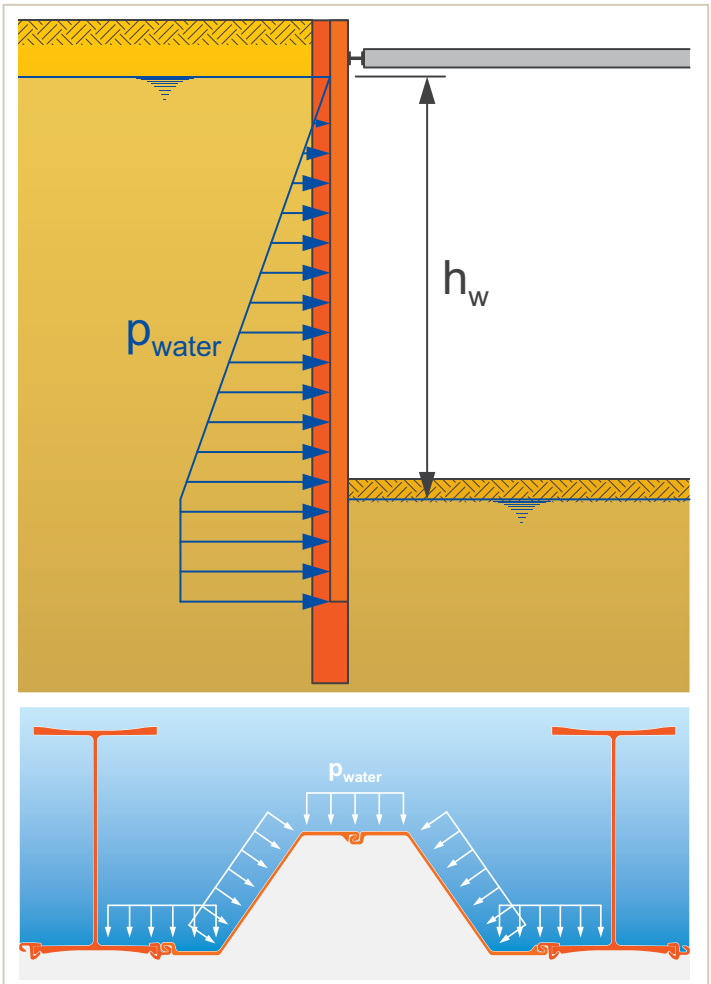


Fig. 19. HZ-M system under water pressure: assumptions.

Subsequent to former test series with sheet pile sections AZ 13, AZ 18 and AZ 26, a large number of mechanical laboratory testing and finite element simulations were performed for the series AZ-700, AZ-750, AZ-770 and AZ-800 at the Institute of Structural Design of the University of Stuttgart (Germany), to determine the resistance of the HZ-M system to hydraulic pressure. The mechanical tests used several hydraulic jacks applying progressive loads on the upper corners of the AZ piles (Fig. 20). Back-calculation of these tests allowed for calibration of a 2D FE model, considering conservative plane stress values, consistent with the 50 cm test samples.

The results confirm the excellent behaviour of the HZ-M Steel Wall System, which can resist water head differences up to 14 m for the AZ-700 profiles, and up to 10 m for the AZ-800 profiles. Declutching of the interlocks did not occur in any test, which confirms the outstanding reliability of the connectors and the "Larssen" interlocks of the AZ sheet piles.

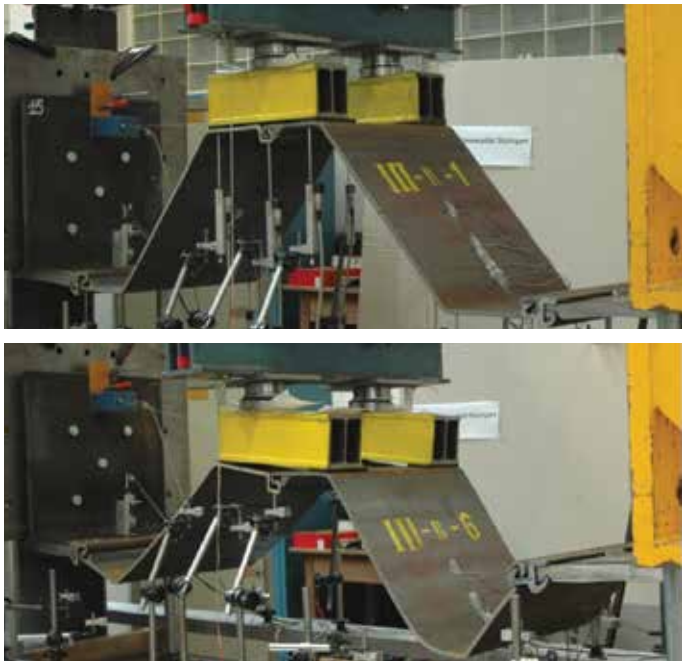


Fig. 20. Mechanical testing of the HZ-M system in the laboratory.

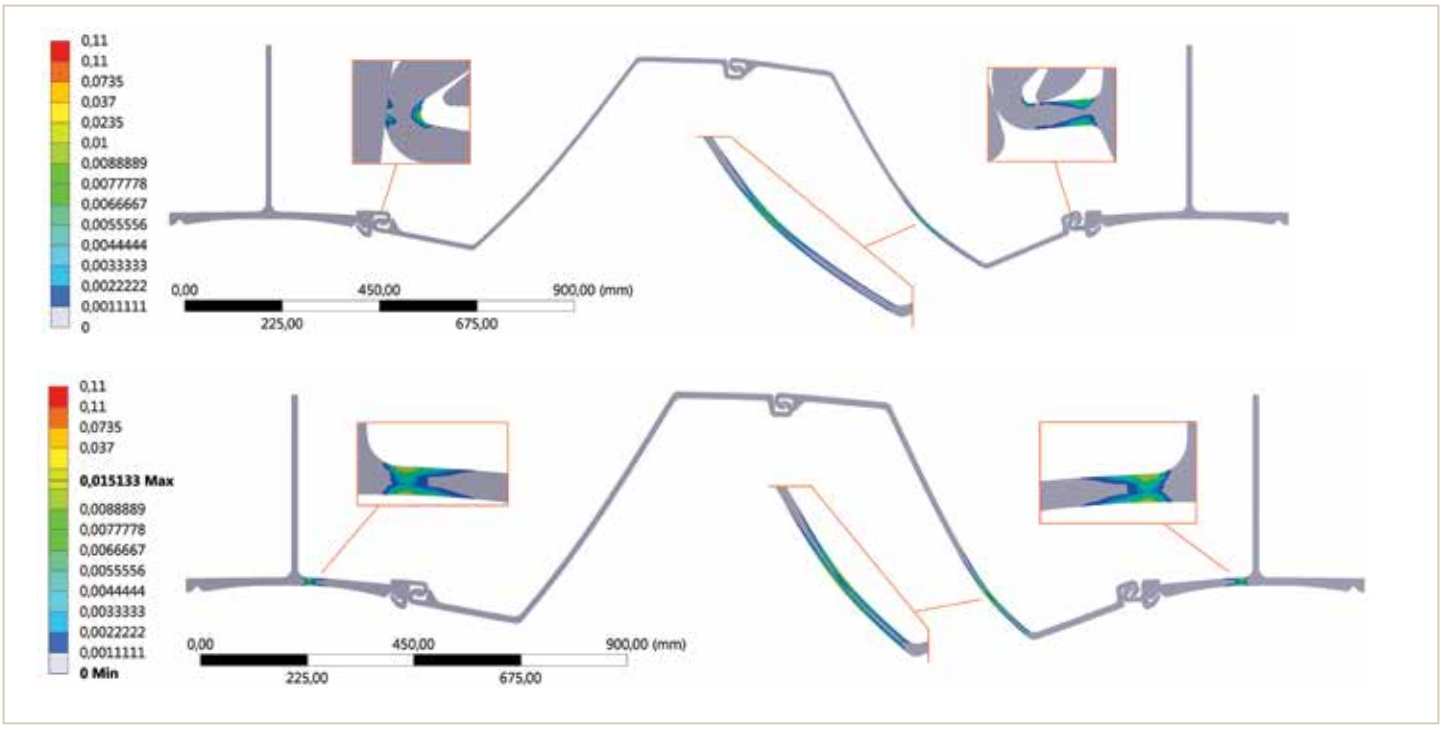


Fig. 21. Numerical simulation of an HZ/AZ combined wall under water pressure.

Characteristic values for maximum water pressures $p_{max,k}$ of the different AZ series (AZ-700, AZ-770, AZ-750 and AZ-800) result from a statistical evaluation of numerical test results from FEA, which have been validated to experimental test results ([9], [10]).

The required safety factors according to Eurocode EN 1993-1-5, Annex C [6], are included in the characteristic values.
The characteristic values of the water pressure are listed in the following table, and are valid for the following:

- steel grades
  - HZ-M S 430 GP & above $f_y \geq 430$ MPa
  - RZD/RZU S 460 AP[1)] $f_y \geq 460$ MPa
  - AZ S 240 GP, S 355 GP & S 430 GP
- the structure is submitted to pure water pressure. Eventual additional earth pressures are not considered.

The table is subdivided in three combinations of HZ-M king piles:

- HZ 880M A, S 430 GP & S 460 AP[1)]
- HZ 880M B, S 430 GP & S 460 AP[1)]
- HZ 880M C, HZ 1080M & HZ 1180M, S 430 GP & S 460 AP[1)]

Design values[2)] can be obtained by applying the partial safety factor γ_{M0}. Please refer to EN 1993 – Part 5 [1] and the relevant National Annex for γ_{M0} (EN 1993 – Part 5 recommends a value of $\gamma_{M0} = 1.0$).

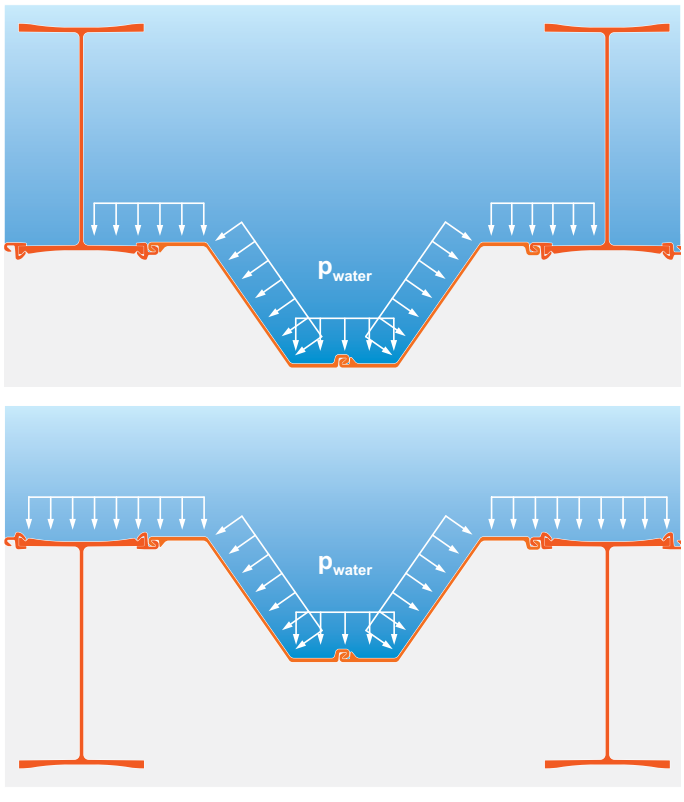


Fig. 22. AZ infill sheet piles under water pressure working in tension.

Notes

- As a rule of thumb, the resistance of AZ infill sheet piles increases with the yield strength.
- Failure can occur in the AZ infill sheet piles or in the flange of the HZ-M king pile, and consequently the minimum value of both resistances is chosen. Failure of the flange of the lighter HZ 880M series under high pressure governs the resistance in a few cases. Bold values in the table correspond to a failure within the HZ-M flange.
- For the HZ 630M, please contact our technical department.
- It is to be noted that driving tolerances and material thickness losses due to corrosion may have an impact on the water pressure resistance of the infill sheet piles and are not covered by the tabled values.

[1)] S 460 AP according to ArcelorMittal mill specification.
[2)] This procedure is only valid for a "Limit State" design approach as described in European Eurocodes. If the design of the sheet pile structure is based on an "Allowable Stress Design" (ASD) approach, the calculation using characteristic values of the table must be considered with an appropriate global safety factor based on local standards and design rules.

King pile	HZ 880M A						HZ 880M B						HZ 880M C / HZ 1080 M / HZ 1180 M					
HZ-M steel grade	S 430 GP			S 460 AP[1)]			S 430 GP			S 460 AP[1)]			S 430 GP			S 460 AP[1)]		
AZ steel grade	S 240 GP	S 355 GP	S 430 GP	S 240 GP	S 355 GP	S 430 GP	S 240 GP	S 355 GP	S 430 GP	S 240 GP	S 355 GP	S 430 GP	S 240 GP	S 355 GP	S 430 GP	S 240 GP	S 355 GP	S 430 GP
AZ infill sheet	Characteristic values of water pressure $p_{max.k}$ (kPa)																	
AZ 12-770	35.1	51.9	57.6	35.1	51.9	57.6	35.1	51.9	57.6	35.1	51.9	57.6	35.1	51.9	57.6	35.1	51.9	57.6
AZ 13-770	38.5	57.0	63.0	38.5	57.0	63.0	38.5	57.0	63.0	38.5	57.0	63.0	38.5	57.0	63.0	38.5	57.0	63.0
AZ 14-770	42.0	62.1	68.3	42.0	62.1	68.3	42.0	62.1	68.3	42.0	62.1	68.3	42.0	62.1	68.3	42.0	62.1	68.3
AZ 14-770-10/10	45.4	67.1	73.6	45.4	67.1	73.6	45.4	67.1	73.6	45.4	67.1	73.6	45.4	67.1	73.6	45.4	67.1	73.6
AZ 12-700	46.5	68.8	77.4	46.5	68.8	77.4	46.5	68.8	77.4	46.5	68.8	77.4	46.5	68.8	77.4	46.5	68.8	77.4
AZ 13-700	52.7	77.9	88.2	52.7	77.9	88.2	52.7	77.9	88.2	52.7	77.9	88.2	52.7	77.9	88.2	52.7	77.9	88.2
AZ 13-700-10/10	55.7	82.4	**92.4**	55.7	82.4	93.5	55.7	82.4	**92.4**	55.7	82.4	93.5	55.7	82.4	93.5	55.7	82.4	93.5
AZ 14-700	58.8	87.0	**92.4**	58.8	87.0	**98.3**	58.8	87.0	**92.4**	58.8	87.0	**98.3**	58.8	87.0	98.9	58.8	87.0	98.9
AZ 17-700	41.3	61.1	67.4	41.3	61.1	67.4	41.3	61.1	67.4	41.3	61.1	67.4	41.3	61.1	67.4	41.3	61.1	67.4
AZ 18-700	45.0	66.6	73.7	45.0	66.6	73.7	45.0	66.6	73.7	45.0	66.6	73.7	45.0	66.6	73.7	45.0	66.6	73.7
AZ 19-700	48.7	72.1	79.9	48.7	72.1	79.9	48.7	72.1	79.9	48.7	72.1	79.9	48.7	72.1	79.9	48.7	72.1	79.9
AZ 20-700	52.5	77.6	86.2	52.5	77.6	86.2	52.5	77.6	86.2	52.5	77.6	86.2	52.5	77.6	86.2	52.5	77.6	86.2
AZ 24-700	68.6	**92.4**	**92.4**	68.6	**98.3**	**98.3**	68.6	**92.4**	**92.4**	68.6	**98.3**	**98.3**	68.6	101.5	113.8	68.6	101.5	113.8
AZ 26-700	76.8	**92.4**	**92.4**	76.8	**98.3**	**98.3**	76.8	**92.4**	**92.4**	76.8	**98.3**	**98.3**	76.8	113.6	127.9	76.8	113.6	127.9
AZ 28-700	85.0	**92.4**	**92.4**	85.0	**98.3**	**98.3**	85.0	**92.4**	**92.4**	85.0	**98.3**	**98.3**	85.0	125.8	142.0	85.0	125.8	142.0
AZ 18-800	35.7	50.2	55.8	36.8	51.6	57.4	36.3	51.1	56.8	37.1	52.3	58.1	36.5	51.8	57.6	37.3	53.0	58.9
AZ 20-800	41.8	56.4	62.6	43.0	58.0	64.4	42.4	57.5	63.8	43.4	58.8	65.3	42.6	57.7	64.1	43.6	59.0	65.5
AZ 22-800	48.5	62.5	69.5	49.9	64.3	71.5	49.2	63.8	70.9	50.4	65.3	72.5	49.5	63.5	70.5	50.6	64.9	72.1
AZ 23-800	43.4	54.4	60.0	44.7	55.8	61.6	44.1	54.7	60.4	45.1	56.0	61.8	44.3	55.4	61.1	45.3	56.8	62.7
AZ 25-800	49.6	60.9	67.3	51.1	62.7	69.3	49.8	62.3	68.8	51.0	63.8	70.4	50.0	62.6	69.2	51.1	64.1	70.7
AZ 27-800	55.8	67.7	**73.2**	57.4	69.6	**76.0**	56.6	69.8	77.1	57.9	71.4	78.9	56.9	69.8	77.0	58.2	71.4	78.8
AZ 28-750	52.7	67.7	75.0	54.2	69.8	77.3	53.5	68.7	76.1	54.7	70.3	77.9	53.8	68.6	76.0	55.0	70.2	77.7
AZ 30-750	60.2	75.6	**80.8**	61.9	77.8	**84.3**	61.1	78.2	86.6	62.5	80.0	88.6	61.4	78.6	87.1	62.8	80.3	88.9
AZ 32-750	68.1	**81.0**	**86.4**	70.1	**84.3**	**89.8**	69.1	87.6	97.0	70.7	89.6	99.2	69.5	88.3	97.8	71.1	90.3	100.0

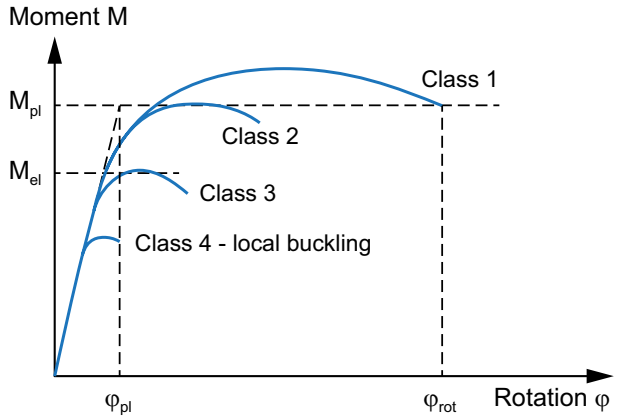
[1)] S 460 AP according to ArcelorMittal mill specification.

Cross-sectional classification of HZ®-M (Eurocode 3)

Standard case in pure bending[1)]

The design of steel sheet piles according to the European standards (Eurocode 3) requires the cross-sectional classification of profiles. The standard provides tables for the classification of the most common sections, like tubes, angles, H-beams, but does not deal with special sections like HZ-M with welded connectors on the extremities of the flanges, or sections with specific geometries as curved flanges with an increasing thickness towards its "free" ends. This is why a realistic classification was prepared to take into account the real geometry and the bending moment distribution for the HZ/AZ system.

A class 2 section may be designed using the plastic section modulus W_{pl} whereas for a class 3 section the designer only uses the elastic section modulus W_{el}. For a class 4 section, local buckling occurs before reaching the elastic bending moment capacity M_{el}.



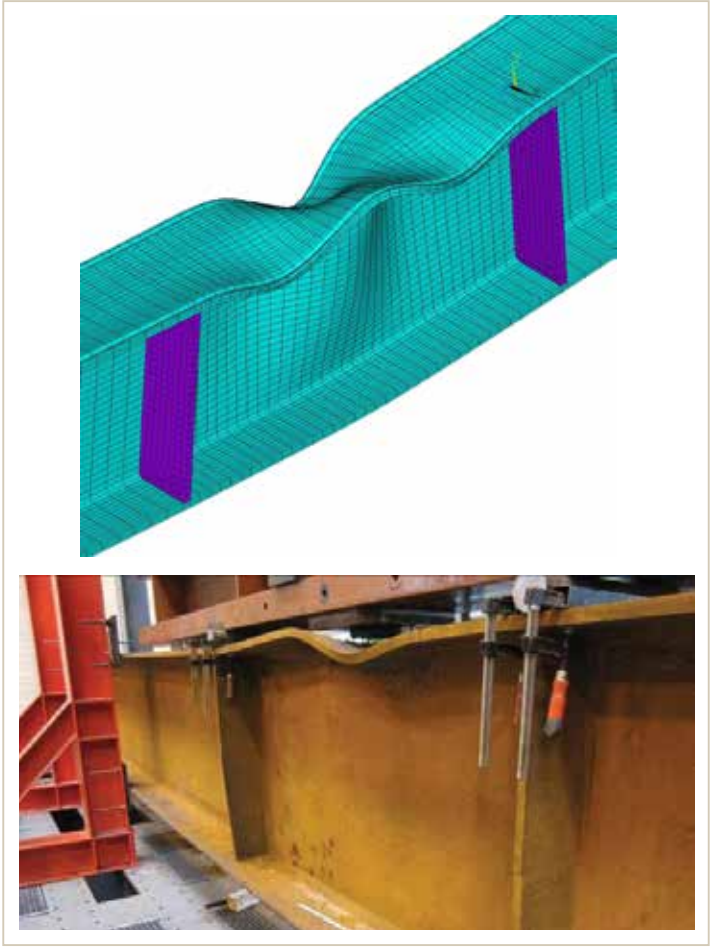
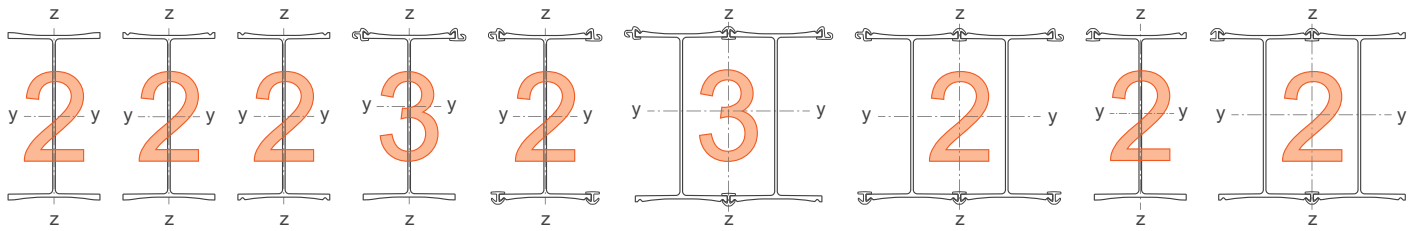


Fig. 23. Comparison between 4 point bending test and FEA simulation.



Cross section classes of HZ-M solutions, valid for the whole HZ-M range with nominal geometries and for steel grades from S 240 GP to S 460 AP

Fig. 24. Cross section classes for the HZ-M solutions.

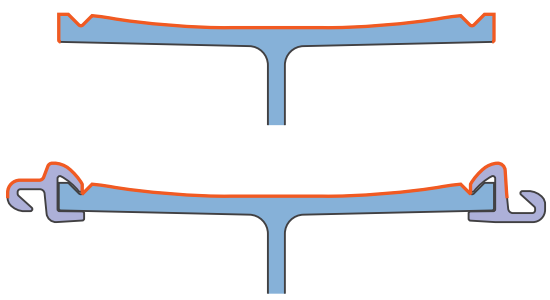


Fig. 25. Corrosion assumption: loss of steel thickness on outer flange.

In collaboration with the RWTH Aachen University, an experimental campaign on "4 points bending tests" (Figure 23), backed by numerical simulation using a finite element model developed by RWTH, has been performed [7].

The cross section's classes of HZ-M resulting from this campaign are summarized in Figure 24 and are valid for the whole HZ-M range and steel grades from S 240 GP to S 460 AP[2)].

From a safe-sided approach, all sections can be classified as cross-section class 2, for steel grades ranging from S 240 GP to S 460 AP, except for the solutions 12 and 24 (with connectors on the tensile flange or the compression flange) which are classified as class 3.

Influence of the loss of steel thickness of the flange

The corrosion phenomenon and its influence on the cross sectional classification was investigated. A parametric study [8] was carried out with the finite element model developed by RWTH considering a loss of steel thickness on one flange (outer face) up to 8 mm (see Figure 25).

The worst case was considered in this numerical study: the connectors are on the tension flange, and the flange thickness reduction is at the compression flange[3].

Typically, connectors and corrosion occur on the tension flange, and the cross section class can be chosen from the following table.

Section	Classification for loss of steel thickness 0 - 8 mm
HZ 880M A	3
HZ 880M B	3
HZ 880M C	3
HZ 1080M A	3
HZ 1080M B	3
HZ 1080M C	2
HZ 1080M D	2
HZ 1180M A	2
HZ 1180M B	2
HZ 1180M C	2
HZ 1180M D	2

Cross section classes with connectors on the tension flange and corrosion on the tension flange, valid for all HZ-M solutions, up to S 460 AP steel grade

Fig. 26. Cross section classes for corroded HZ-M solutions.

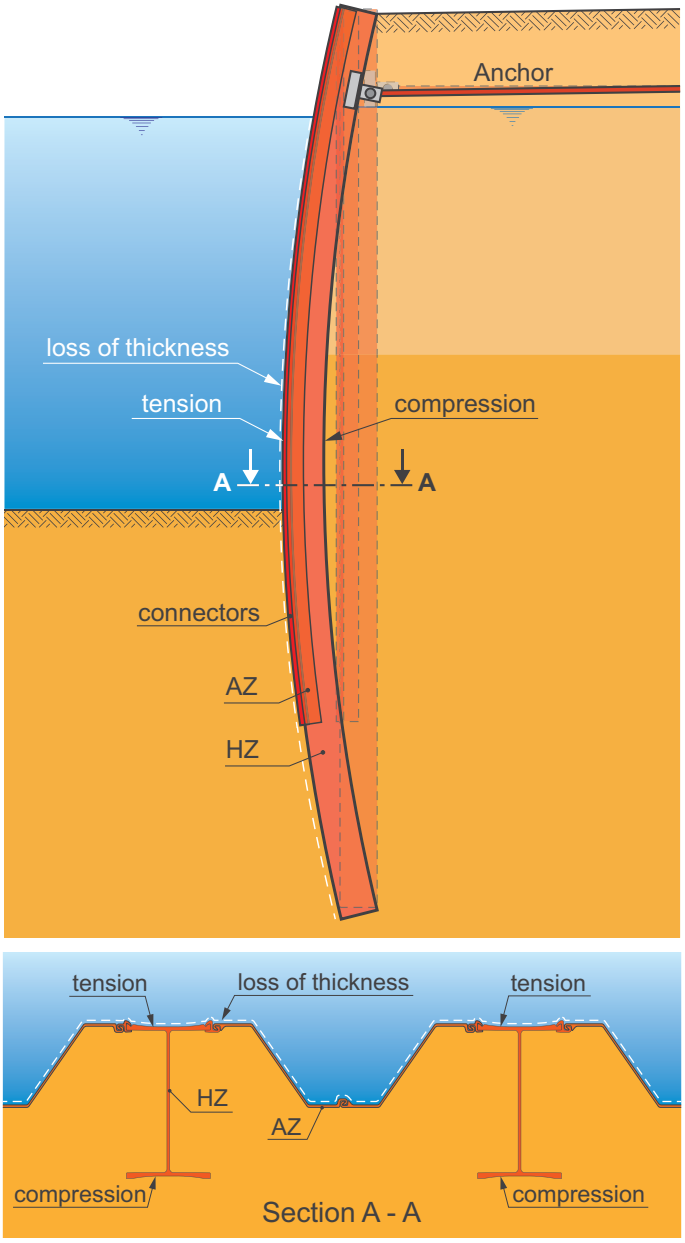


Fig. 27. Common configuration of an HZ/AZ combined wall system (typical cross section).

General conclusions

Combining the results from both research projects, the classification of the cross sections for the HZ-M king pile in pure bending can be summarized as follows:

- **Without corrosion**
  all the HZ-M king piles can be classified as class 2
  (except solutions 12 and 24: class 3)
- **With corrosion**
  for the most common configurations[4], the effect of the corrosion on the HZ-M classification is very limited.
  All the HZ-M solutions can be calculated in class 2 or 3 for up to 8 mm of loss of steel according to the table and the sketch above (Figure 26 & 27).

Above conclusions are valid for the whole HZ-M range from HZ 880M A to HZ 1180M D and steel grades S 240 GP up to S 460 AP. Please contact the technical department for the HZ 630M.

Remark: The classification of the HZ-M king piles in pure bending is allowable for king piles subject to combined bending and normal force as long as no interaction between bending and normal force needs to be considered in member design (EN 1993-5, 5.2.3). Classification of king piles subject to higher normal forces may combine classification of the flange according to the tests of HZ-M in pure bending and classification of the web according to EN 1993-1-1.

[1] In case of a combination of bending moments and significant compression loads, the design of the HZ-M section will generally be governed by the web slenderness (see formulas in EN 1993), except in the case of corrosion of flanges and web.
[2] For sheet pile applications, all HZ 1180M may be classified in class 1 with verification of the rotation capacity by appropriate calculation methods. Otherwise a class 2 should be chosen.
[3] "Solution 12" was chosen for all investigations as it is the most critical configuration (safe sided approach).
[4] Please contact our technical department in case the connectors are on the tension flange and corrosion occurs on the compression flange.

b_{sys}	width of one system (HZ/AZ combination) [m]
e	eccentricity [m]
f_y	yield strength of the steel [Pa]
h_i	height (depth) of the section [m]
d	depth of straight portion of web [m]
i_y	radius of gyration about the y-y axis [m]. $i_y = \sqrt{I_y / A}$
$p_{max,k}$	characteristic value of water pressure [Pa]
p_{water}	water pressure [Pa]
r	inner radius of the HZ-M profile, between web and flange [m]
s	thickness of the web [m]
t	thickness of the flange / thickness of the HZ-M flange at a distance w/4 from the edge [m]
t_1	thickness for flange bending [m]
t_2	thickness at the edge of the flange [m]
t_3	thickness in the groove [m]
t_{max}	maximum flange thickness [m]
v_1, v_2, u_1	distance of the neutral axis to the extreme fibre of the HZ-M flanges [m]
v_3, v_4, u_2	distance of the neutral axis to the extreme fibre of the connector RH/RZ [m]
w	nominal width of the element [m]
A	cross sectional area [m^2], [m^2/m]
A_v	shear area [m^2]
A_{HZ}	cross sectional area of the HZ-M king pile [m^2], [m^2/m]
A_{LS}	coating area on the soil side (back), excluding the inside of the interlocks, per element or system width, per unit length [m^2/m]
A_{LW}	coating area on the water side (front), excluding the inside of the interlocks, per element or system width, per unit length [m^2/m]
G	mass of the element / solution (with length RH/RZ = length HZ) per unit length [kg/m], [kg/m^2]
$G_{60\%}$	mass of the combination with length of the infill sheet piles AZ = 60% of the length of the HZ-M king piles [kg/m^2]
$G_{80\%}$	mass of the combination with length of the infill sheet piles AZ = 80% of the length of the HZ-M king piles [kg/m^2]
$G_{100\%}$	mass of the combination with length of the infill sheet piles AZ = 100% of the length of the HZ-M king piles [kg/m^2]
I_{AZ}	moment of inertia of one pair of AZ sheet pile [m^4]
I_{HZ}	moment of inertia of one HZ-M king pile [m^4]
I_{sys}	moment of inertia of one system (HZ/AZ combination) [m^4]
$I_{sys/m}$	moment of inertia of the wall per m of wall -M king pile [m^4/m]
I_y	moment of inertia about the main neutral axis y-y [m^4], [m^4/m]
I_t	torsional constant [m^4]
I_ω	warping constant [m^6]
I_z	moment of inertia about the neutral axis z-z (weak axis) [m^4]
M_{AZ}	bending moment transmitted to the intermediary AZ sheet pile [Nm/m]
M_{HZ}	bending moment transmitted to the HZ-M king pile [Nm/m]
M_{sys}	maximum bending moment per m of wall based on a design [Nm/m]
N	vertical load [N/m]
S_F	global safety factor applicable to steel
S_y	static moment of the HZ-M [m^3]
W_{AZ}	section modulus of a pair of AZ [m^3]
$W_{el,y}$*	equivalent elastic section modulus of the combination related to the extreme fiber of the flange of the HZ-M [m^3/m]
$W_{el,y}$**	equivalent elastic section modulus of the combination related to the extreme fiber of the connector RH/RZ [m^3/m]
$W_{el,z}$	elastic section modulus of the element related to neutral axis z-z (weak axis) [m^3]
$W_{HZ,\ eq.}$	= $W_{el,y}$*
$W_{pl,y}$	plastic section modulus of the HZ-M [m^3]
$W_{RH,\ RZ}$	= $W_{el,y}$**
σ_{AZ}	steel stresses in the intermediary AZ sheet pile [Pa]
σ_{HZ}	steel stresses in the HZ-M king pile [Pa]

Notes

- The nominal width of a combination b_{sys} has been rounded to a mean value valid for the whole range of a combination. However, the nominal width "w" of the "solutions" has been taken into account for the determination of the section properties. For installation purposes, the nominal system width of the combination "b_{sys}" should be used.
- All the data in the tables in this flyer has been determined with a CAD software. The main section properties have been rounded. Section properties determined in a different way may differ slightly.
- Mass of HZ/AZ combinations: $G_{60\%}$, $G_{80\%}$ & $G_{100\%}$ assume that the length of the connectors RZD/RZU and the RH on the back flange (Sol. 14 and Sol. 26) are the same as the length of the infill sheet piles AZ. The RH connecting two HZ-M king piles (Sol. 24 and Sol. 26) have the same length as the HZ-M king piles.
- Rounding of the mass of single elements of the combined system leads in some cases to slight discrepancies in the mass of the combinations / solutions.

References

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[2] EN 1997 - 1: Eurocode 7. Geotechnical design - Part 1: General rules. CEN.
[3] EAU 2012. Recommendations of the Committee for Waterfront Structures Harbours and Waterways. Ernst und Sohn.
[4] EN 10248 - 1: Hot-rolled steel sheet piling - Part 1: Technical delivery conditions. CEN.
[5] EN 1990: Eurocode: Basis of structural design. CEN.
[6] EN 1993-1-5: Eurocode 3: Design of steel structures - Part 1-5: Plated structural elements.
[7] Cross sectional classification of ArcelorMittal HZ range. RWTH Aachen. 2012.
[8] Cross sectional classification taking into account corrosion of ArcelorMittal HZ range. RWTH Aachen. 2012.
[9] Ulrike Kuhlmann and Adrian Just, Final Report – Expert Statement – Combined HZ-M/AZ Pile Walls Loaded with Water Pressure. Evaluation of Additional Tests and Statistical Re-evaluation of the Characteristic Resistance Values, Institute of Structural Design, University of Stuttgart, Germany, March 2019.
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HZ-M | Static moment & Plastic section modulus

Section	$W_{el,y}$ cm³	S_y cm³	$W_{pl,y}$ cm³	$W_{el,y}$ cm³	S_y cm³	$W_{pl,y}$ cm³	$W_{el,y}$ cm³	S_y cm³	$W_{pl,y}$ cm³
	Sol. 100			Sol. 12			Sol. 26		
HZ 630M	7175	3940	**7880**	7385	4450	**8785**	17535	9505	**19010**
HZ 880M A	8880	4840	**9675**	9185	5525	**10920**	22135	11865	**23730**
HZ 880M B	9730	5335	**10670**	10045	6025	**11940**	23755	12835	**25670**
HZ 880M C	10275	5630	**11260**	10580	6320	**12530**	24825	13425	**26850**
HZ 1080M A	13355	7475	**14950**	13880	8395	**16710**	32415	17810	**35615**
HZ 1080M B	14520	8090	**16185**	15015	9005	**17930**	34635	19005	**38010**
HZ 1080M C	15920	8925	**17850**	16430	9845	**19620**	37400	20670	**41345**
HZ 1080M D	17230	9690	**19380**	17735	10615	**21160**	39980	22200	**44400**
HZ 1180M A	18175	10275	**20550**	18685	11200	**22340**	41825	23370	**46740**
HZ 1180M B	19090	10770	**21535**	19565	11670	**23275**	43390	24230	**48465**
HZ 1180M C	20205	11410	**22820**	20725	12415	**24750**	46665	26160	**52320**
HZ 1180M D	21325	12055	**24110**	21815	13005	**25945**	48360	27190	**54380**
	Sol 102			Sol 14			Sol C1		
HZ 630M	6985	3885	**7770**	9370	5060	**10125**	7285	4180	**8340**
HZ 880M A	8650	4770	**9545**	11880	6345	**12690**	9040	5165	**10305**
HZ 880M B	9480	5265	**10525**	12690	6830	**13660**	9890	5655	**11295**
HZ 880M C	10025	5560	**11115**	13220	7125	**14250**	10430	5955	**11885**
HZ 1080M A	13075	7390	**14780**	17270	9440	**18885**	13615	7905	**15795**
HZ 1080M B	14205	8000	**16000**	18375	10040	**20080**	14760	8515	**17015**
HZ 1080M C	15605	8830	**17665**	19750	10875	**21745**	16165	9350	**18685**
HZ 1080M D	16920	9595	**19190**	21035	11635	**23275**	17475	10115	**20215**
HZ 1180M A	17865	10180	**20365**	21945	12220	**24445**	18420	10700	**21390**
HZ 1180M B	18675	10645	**21285**	22725	12655	**25305**	19310	11165	**22315**
HZ 1180M C	19790	11285	**22570**	24385	13675	**27345**	20490	11930	**23845**
HZ 1180M D	20690	11865	**23725**	25225	14190	**28380**	21565	12515	**25020**
	Sol 104			Sol 24			Sol C23		
HZ 630M	6955	3830	**7665**	15370	8860	**17655**	15260	8570	**17130**
HZ 880M A	8615	4710	**9415**	19220	11010	**21940**	19055	10625	**21230**
HZ 880M B	9440	5195	**10385**	20875	11985	**23905**	20705	11595	**23175**
HZ 880M C	9985	5490	**10975**	21950	12575	**25085**	21780	12185	**24355**
HZ 1080M A	13020	7310	**14615**	28755	16705	**33370**	28475	16195	**32375**
HZ 1080M B	14145	7905	**15815**	30970	17905	**35765**	30700	17390	**34770**
HZ 1080M C	15545	8740	**17480**	33770	19575	**39110**	33495	19060	**38105**
HZ 1080M D	16860	9505	**19010**	36380	21105	**42170**	36105	20585	**41165**
HZ 1180M A	17805	10090	**20180**	38260	22280	**44515**	37980	21755	**43505**
HZ 1180M B	18600	10520	**21040**	39825	23140	**46240**	39555	22620	**45230**
HZ 1180M C	19710	11160	**22325**	42600	24800	**49550**	42345	24295	**48580**
HZ 1180M D	20570	11675	**23355**	44310	25830	**51615**	44055	25330	**50640**

The plastic section modulus $W_{pl,y}$ applies only for steel stress verification of "class 1" and "class 2" sections according to EN 1993.

Table of combinations sorted by ascending Elastic section modulus

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
4135	210	HZ 630M	12/AZ 13-770
4180	217	HZ 630M	12/AZ 14-770-10/10
4355	224	HZ 630M	12/AZ 13-700
4375	227	HZ 630M	12/AZ 13-700-10/10
4465	209	HZ 630M	12/AZ 18-800
4550	216	HZ 630M	12/AZ 20-800
4590	220	HZ 630M	12/AZ 20-800-10/10
4730	226	HZ 630M	12/AZ 18-700
4800	234	HZ 630M	12/AZ 20-700
4815	200	HZ 880M A	12/AZ 13-770
4845	207	HZ 880M A	12/AZ 14-770-10/10
4870	229	HZ 630M	12/AZ 25-800
4975	246	HZ 630M	12/AZ 18-10/10
5010	199	HZ 880M A	12/AZ 18-800
5075	206	HZ 880M A	12/AZ 20-800
5095	213	HZ 880M A	12/AZ 13-700
5105	210	HZ 880M A	12/AZ 20-800-10/10
5110	216	HZ 880M A	12/AZ 13-700-10/10
5165	224	HZ 630M	14/AZ 13-770
5210	231	HZ 630M	14/AZ 14-770-10/10
5210	254	HZ 630M	12/AZ 26-700
5230	212	HZ 880M B	12/AZ 13-770
5260	219	HZ 880M B	12/AZ 14-770-10/10
5295	239	HZ 630M	12/AZ 28-750
5315	219	HZ 880M A	12/AZ 25-800
5380	215	HZ 880M A	12/AZ 18-700
5395	269	HZ 630M	12/AZ 26
5410	247	HZ 630M	12/AZ 30-750
5415	211	HZ 880M B	12/AZ 18-800
5430	222	HZ 880M A	12/AZ 20-700
5450	239	HZ 630M	14/AZ 13-700
5470	242	HZ 630M	14/AZ 13-700-10/10
5475	218	HZ 880M B	12/AZ 20-800
5485	218	HZ 880M C	12/AZ 13-770
5510	222	HZ 880M B	12/AZ 20-800-10/10
5510	222	HZ 630M	14/AZ 18-800
5515	224	HZ 880M C	12/AZ 14-770-10/10
5525	255	HZ 630M	12/AZ 32-750
5540	225	HZ 880M B	12/AZ 13-700
5555	229	HZ 880M B	12/AZ 13-700-10/10
5600	230	HZ 630M	14/AZ 20-800
5650	234	HZ 630M	14/AZ 20-800-10/10
5665	216	HZ 880M C	12/AZ 18-800
5695	233	HZ 880M A	12/AZ 18-10/10
5710	229	HZ 880M A	12/AZ 28-750
5720	231	HZ 880M B	12/AZ 25-800
5730	223	HZ 880M C	12/AZ 20-800
5735	242	HZ 880M A	12/AZ 26-700
5760	227	HZ 880M C	12/AZ 20-800-10/10
5795	236	HZ 880M A	12/AZ 30-750
5815	231	HZ 880M C	12/AZ 13-700
5820	228	HZ 880M B	12/AZ 18-700
5830	235	HZ 880M C	12/AZ 13-700-10/10
5865	241	HZ 630M	14/AZ 18-700
5875	235	HZ 880M B	12/AZ 20-700
5880	244	HZ 880M A	12/AZ 32-750
5940	249	HZ 630M	14/AZ 20-700
5960	243	HZ 630M	14/AZ 25-800
5970	236	HZ 880M C	12/AZ 25-800
6010	256	HZ 880M A	12/AZ 26
6100	234	HZ 880M C	12/AZ 18-700
6135	241	HZ 880M B	12/AZ 28-750
6150	241	HZ 880M C	12/AZ 20-700
6160	214	HZ 880M A	14/AZ 13-770
6175	247	HZ 880M B	12/AZ 18-10/10
6180	255	HZ 880M B	12/AZ 26-700
6185	262	HZ 630M	14/AZ 18-10/10
6195	221	HZ 880M A	14/AZ 14-770-10/10
6225	249	HZ 880M B	12/AZ 30-750
6310	256	HZ 880M B	12/AZ 32-750
6355	213	HZ 880M A	14/AZ 18-800
6395	269	HZ 630M	14/AZ 26-700
6400	246	HZ 880M C	12/AZ 28-750
6425	220	HZ 880M A	14/AZ 20-800
6455	261	HZ 880M C	12/AZ 26-700
6460	224	HZ 880M A	14/AZ 20-800-10/10
6460	254	HZ 630M	14/AZ 28-750
6475	254	HZ 880M C	12/AZ 18-10/10
6485	254	HZ 880M C	12/AZ 30-750
6490	270	HZ 880M B	12/AZ 26
6535	228	HZ 880M A	14/AZ 13-700
6540	226	HZ 880M B	14/AZ 13-770
6550	231	HZ 880M A	14/AZ 13-700-10/10
6570	262	HZ 880M C	12/AZ 32-750
6575	233	HZ 880M B	14/AZ 14-770-10/10
6585	262	HZ 630M	14/AZ 30-750
6650	285	HZ 630M	14/AZ 26
6670	282	HZ 630M	24/AZ 13-770
6695	233	HZ 880M A	14/AZ 25-800
6705	288	HZ 630M	24/AZ 14-770-10/10
6710	270	HZ 630M	14/AZ 32-750
6725	224	HZ 880M B	14/AZ 18-800
6790	276	HZ 880M C	12/AZ 26
6795	232	HZ 880M B	14/AZ 20-800
6795	232	HZ 880M C	14/AZ 13-770
6830	235	HZ 880M B	14/AZ 20-800-10/10
6830	238	HZ 880M C	14/AZ 14-770-10/10
6845	230	HZ 880M A	14/AZ 18-700
6895	279	HZ 630M	24/AZ 18-800
6900	238	HZ 880M A	14/AZ 20-700
6945	240	HZ 880M B	14/AZ 13-700
6960	244	HZ 880M B	14/AZ 13-700-10/10
6965	285	HZ 630M	24/AZ 20-800
6970	230	HZ 880M C	14/AZ 18-800
6995	297	HZ 630M	24/AZ 13-700
7005	288	HZ 630M	24/AZ 20-800-10/10
7010	300	HZ 630M	24/AZ 13-700-10/10
7015	230	HZ 1080M A	12/AZ 13-770
7040	236	HZ 1080M A	12/AZ 14-770-10/10
7040	237	HZ 880M C	14/AZ 20-800
7060	245	HZ 880M B	14/AZ 25-800
7075	241	HZ 880M C	14/AZ 20-800-10/10
7080	227	HZ 1080M A	12/AZ 18-800
7130	235	HZ 1080M A	12/AZ 20-800
7150	239	HZ 1080M A	12/AZ 20-800-10/10
7175	243	HZ 880M A	14/AZ 28-750
7215	246	HZ 880M C	14/AZ 13-700
7230	250	HZ 880M C	14/AZ 13-700-10/10
7240	258	HZ 880M A	14/AZ 26-700
7245	296	HZ 630M	24/AZ 25-800
7255	243	HZ 880M B	14/AZ 18-700
7270	250	HZ 880M A	14/AZ 18-10/10
7270	251	HZ 880M A	14/AZ 30-750
7305	250	HZ 880M C	14/AZ 25-800
7310	250	HZ 880M B	14/AZ 20-700
7315	248	HZ 1080M A	12/AZ 25-800
7315	299	HZ 630M	24/AZ 18-700
7365	259	HZ 880M A	14/AZ 32-750
7370	305	HZ 630M	24/AZ 20-700
7475	244	HZ 1080M A	12/AZ 13-700
7485	247	HZ 1080M A	12/AZ 13-700-10/10
7525	249	HZ 880M C	14/AZ 18-700
7560	255	HZ 880M B	14/AZ 28-750
7565	238	HZ 1080M B	12/AZ 13-770
7570	295	HZ 630M	26/AZ 13-770
7580	256	HZ 880M C	14/AZ 20-700
7590	245	HZ 1080M B	12/AZ 14-770-10/10
7610	300	HZ 630M	26/AZ 14-770-10/10
7615	236	HZ 1080M B	12/AZ 18-800
7620	272	HZ 880M A	14/AZ 26
7645	270	HZ 880M B	14/AZ 26-700
7650	263	HZ 880M B	14/AZ 30-750
7660	243	HZ 1080M B	12/AZ 20-800
7670	320	HZ 630M	24/AZ 18-10/10
7685	247	HZ 1080M B	12/AZ 20-800-10/10
7695	247	HZ 1080M A	12/AZ 18-700
7700	307	HZ 630M	24/AZ 28-750
7710	263	HZ 880M B	14/AZ 18-10/10
7720	322	HZ 630M	24/AZ 26-700
7735	254	HZ 1080M A	12/AZ 20-700
7745	271	HZ 880M B	14/AZ 32-750
7785	259	HZ 1080M A	12/AZ 28-750
7800	292	HZ 630M	26/AZ 18-800
7800	314	HZ 630M	24/AZ 30-750
7815	261	HZ 880M C	14/AZ 28-750
7850	257	HZ 1080M B	12/AZ 25-800

Table of combinations sorted by ascending Elastic section modulus

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
7850	266	HZ 1080M A	12/AZ 30-750
7875	298	HZ 630M	26/AZ 20-800
7885	264	HZ 880M A	24/AZ 13-770
7895	320	HZ 630M	24/AZ 32-750
7905	268	HZ 880M C	14/AZ 30-750
7910	269	HZ 880M A	24/AZ 14-770-10/10
7915	274	HZ 1080M A	12/AZ 32-750
7915	276	HZ 880M C	14/AZ 26-700
7915	301	HZ 630M	26/AZ 20-800-10/10
7950	311	HZ 630M	26/AZ 13-700
7965	314	HZ 630M	26/AZ 13-700-10/10
7975	274	HZ 1080M A	12/AZ 26-700
7985	261	HZ 880M A	24/AZ 18-800
8000	270	HZ 880M C	14/AZ 18-10/10
8000	276	HZ 880M C	14/AZ 32-750
8020	338	HZ 630M	24/AZ 26
8040	267	HZ 880M A	24/AZ 20-800
8055	286	HZ 880M B	14/AZ 26
8065	254	HZ 1080M B	12/AZ 13-700
8070	270	HZ 880M A	24/AZ 20-800-10/10
8075	257	HZ 1080M B	12/AZ 13-700-10/10
8170	309	HZ 630M	26/AZ 25-800
8220	268	HZ 1080M A	12/AZ 18-10/10
8245	254	HZ 1080M C	12/AZ 13-770
8250	278	HZ 880M A	24/AZ 25-800
8270	251	HZ 1080M C	12/AZ 18-800
8270	261	HZ 1080M C	12/AZ 14-770-10/10
8285	256	HZ 1080M B	12/AZ 18-700
8285	313	HZ 630M	26/AZ 18-700
8290	277	HZ 880M A	24/AZ 13-700
8300	280	HZ 880M A	24/AZ 13-700-10/10
8320	259	HZ 1080M C	12/AZ 20-800
8325	263	HZ 1080M B	12/AZ 20-700
8345	262	HZ 1080M C	12/AZ 20-800-10/10
8345	267	HZ 1080M B	12/AZ 28-750
8345	292	HZ 880M C	14/AZ 26
8345	319	HZ 630M	26/AZ 20-700
8410	275	HZ 1080M B	12/AZ 30-750
8465	290	HZ 1080M A	12/AZ 26
8480	283	HZ 1080M B	12/AZ 32-750
8510	272	HZ 1080M C	12/AZ 25-800
8525	280	HZ 880M A	24/AZ 18-700
8525	283	HZ 880M B	24/AZ 13-770
8550	289	HZ 880M B	24/AZ 14-770-10/10
8565	284	HZ 1080M B	12/AZ 26-700
8565	285	HZ 880M A	24/AZ 20-700
8610	280	HZ 880M B	24/AZ 18-800
8665	286	HZ 880M B	24/AZ 20-800
8670	320	HZ 630M	26/AZ 28-750
8685	244	HZ 1080M A	14/AZ 13-770
8695	288	HZ 880M A	24/AZ 28-750
8695	289	HZ 880M B	24/AZ 20-800-10/10
8695	334	HZ 630M	26/AZ 18-10/10
8710	250	HZ 1080M A	14/AZ 14-770-10/10
8715	336	HZ 630M	26/AZ 26-700
8725	241	HZ 1080M A	14/AZ 18-800
8765	294	HZ 880M A	24/AZ 30-750
8775	327	HZ 630M	26/AZ 30-750
8780	249	HZ 1080M A	14/AZ 20-800
8790	270	HZ 1080M C	12/AZ 13-700
8800	274	HZ 1080M C	12/AZ 13-700-10/10
8805	252	HZ 1080M A	14/AZ 20-800-10/10
8825	302	HZ 880M A	24/AZ 26-700
8840	301	HZ 880M A	24/AZ 32-750
8855	278	HZ 1080M B	12/AZ 18-10/10
8870	267	HZ 1080M D	12/AZ 13-770
8875	297	HZ 880M B	24/AZ 25-800
8880	264	HZ 1080M D	12/AZ 18-800
8880	333	HZ 630M	26/AZ 32-750
8895	273	HZ 1080M D	12/AZ 14-770-10/10
8930	271	HZ 1080M D	12/AZ 20-800
8945	292	HZ 880M C	24/AZ 13-770
8955	275	HZ 1080M D	12/AZ 20-800-10/10
8965	298	HZ 880M B	24/AZ 13-700
8970	297	HZ 880M C	24/AZ 14-770-10/10
8970	298	HZ 880M A	24/AZ 18-10/10
8975	301	HZ 880M B	24/AZ 13-700-10/10
8985	262	HZ 1080M A	14/AZ 25-800
9010	273	HZ 1080M C	12/AZ 18-700
9020	289	HZ 880M C	24/AZ 18-800
9035	283	HZ 1080M C	12/AZ 28-750
9050	276	HZ 880M A	26/AZ 13-770
9050	280	HZ 1080M C	12/AZ 20-700
9070	353	HZ 630M	26/AZ 26
9075	295	HZ 880M C	24/AZ 20-800
9080	282	HZ 880M A	26/AZ 14-770-10/10
9100	300	HZ 1080M B	12/AZ 26
9105	291	HZ 1080M C	12/AZ 30-750
9105	298	HZ 880M C	24/AZ 20-800-10/10
9120	284	HZ 1080M D	12/AZ 25-800
9145	273	HZ 880M A	26/AZ 18-800
9170	299	HZ 1080M C	12/AZ 32-750
9200	300	HZ 880M B	24/AZ 18-700
9205	279	HZ 880M A	26/AZ 20-800
9220	252	HZ 1080M B	14/AZ 13-770
9230	283	HZ 880M A	26/AZ 20-800-10/10
9230	316	HZ 880M A	24/AZ 26
9240	250	HZ 1080M B	14/AZ 18-800
9245	259	HZ 1080M B	14/AZ 14-770-10/10
9245	306	HZ 880M B	24/AZ 20-700
9260	259	HZ 1080M A	14/AZ 13-700
9275	263	HZ 1080M A	14/AZ 13-700-10/10
9280	306	HZ 880M C	24/AZ 25-800
9290	300	HZ 1080M C	12/AZ 26-700
9295	257	HZ 1080M B	14/AZ 20-800
9320	261	HZ 1080M B	14/AZ 20-800-10/10
9320	274	HZ 1180M A	12/AZ 18-800
9325	277	HZ 1180M A	12/AZ 13-770
9340	307	HZ 880M B	24/AZ 28-750
9350	284	HZ 1180M A	12/AZ 14-770-10/10
9370	281	HZ 1180M A	12/AZ 20-800
9395	285	HZ 1180M A	12/AZ 20-800-10/10
9410	307	HZ 880M C	24/AZ 13-700
9415	314	HZ 880M B	24/AZ 30-750
9420	310	HZ 880M C	24/AZ 13-700-10/10
9425	290	HZ 880M A	26/AZ 25-800
9465	284	HZ 1080M D	12/AZ 13-700
9475	287	HZ 1080M D	12/AZ 13-700-10/10
9485	320	HZ 880M B	24/AZ 32-750
9500	262	HZ 1080M A	14/AZ 18-700
9500	270	HZ 1080M B	14/AZ 25-800
9500	322	HZ 880M B	24/AZ 26-700
9520	291	HZ 880M A	26/AZ 13-700
9535	293	HZ 880M A	26/AZ 13-700-10/10
9545	269	HZ 1080M A	14/AZ 20-700
9545	273	HZ 1080M A	14/AZ 28-750
9560	294	HZ 1180M A	12/AZ 25-800
9615	281	HZ 1080M A	14/AZ 30-750
9635	296	HZ 1080M C	12/AZ 18-10/10
9645	309	HZ 880M C	24/AZ 18-700
9675	296	HZ 880M B	26/AZ 13-770
9675	297	HZ 1080M D	12/AZ 28-750
9685	287	HZ 1080M D	12/AZ 18-700
9685	320	HZ 880M B	24/AZ 18-10/10
9690	289	HZ 1080M A	14/AZ 32-750
9690	315	HZ 880M C	24/AZ 20-700
9700	301	HZ 880M B	26/AZ 14-770-10/10
9725	294	HZ 1080M D	12/AZ 20-700
9735	280	HZ 1180M B	12/AZ 18-800
9740	304	HZ 1080M D	12/AZ 30-750
9750	284	HZ 1180M B	12/AZ 13-770
9750	292	HZ 880M B	26/AZ 18-800
9765	317	HZ 880M C	24/AZ 28-750
9770	293	HZ 880M A	26/AZ 18-700
9775	290	HZ 1180M B	12/AZ 14-770-10/10
9785	287	HZ 1180M B	12/AZ 20-800
9805	289	HZ 1080M A	14/AZ 26-700
9810	291	HZ 1180M B	12/AZ 20-800-10/10
9810	298	HZ 880M B	26/AZ 20-800
9810	312	HZ 1080M D	12/AZ 32-750
9815	299	HZ 880M A	26/AZ 20-700
9835	269	HZ 1080M B	14/AZ 13-700
9835	301	HZ 880M B	26/AZ 20-800-10/10
9840	323	HZ 880M C	24/AZ 30-750
9845	272	HZ 1080M B	14/AZ 13-700-10/10
9875	265	HZ 1080M C	14/AZ 18-800

Table of combinations sorted by ascending Elastic section modulus

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
9875	268	HZ 1080M C	14/AZ 13-770
9885	318	HZ 1080M C	12/AZ 26
9900	275	HZ 1080M C	14/AZ 14-770-10/10
9910	329	HZ 880M C	24/AZ 32-750
9920	300	HZ 880M A	26/AZ 28-750
9930	272	HZ 1080M C	14/AZ 20-800
9945	331	HZ 880M C	24/AZ 26-700
9945	337	HZ 880M B	24/AZ 26
9950	295	HZ 1180M A	12/AZ 13-700
9955	276	HZ 1080M C	14/AZ 20-800-10/10
9960	298	HZ 1180M A	12/AZ 13-700-10/10
9960	314	HZ 1080M D	12/AZ 26-700
9970	300	HZ 1180M B	12/AZ 25-800
10000	307	HZ 880M A	26/AZ 30-750
10025	309	HZ 880M B	26/AZ 25-800
10070	271	HZ 1080M B	14/AZ 18-700
10075	313	HZ 880M A	26/AZ 32-750
10085	282	HZ 1080M B	14/AZ 28-750
10090	305	HZ 880M C	26/AZ 13-770
10090	315	HZ 880M A	26/AZ 26-700
10115	278	HZ 1080M B	14/AZ 20-700
10120	310	HZ 880M C	26/AZ 14-770-10/10
10135	285	HZ 1080M C	14/AZ 25-800
10135	307	HZ 1180M A	12/AZ 28-750
10155	290	HZ 1080M B	14/AZ 30-750
10155	330	HZ 880M C	24/AZ 18-10/10
10160	284	HZ 1080M A	14/AZ 18-10/10
10160	301	HZ 880M C	26/AZ 18-800
10170	298	HZ 1180M A	12/AZ 18-700
10180	311	HZ 880M B	26/AZ 13-700
10190	314	HZ 880M B	26/AZ 13-700-10/10
10200	315	HZ 1180M A	12/AZ 30-750
10210	305	HZ 1180M A	12/AZ 20-700
10215	307	HZ 880M C	26/AZ 20-800
10225	297	HZ 1080M B	14/AZ 32-750
10245	310	HZ 880M C	26/AZ 20-800-10/10
10265	323	HZ 1180M A	12/AZ 32-750
10270	292	HZ 1180M C	12/AZ 18-800
10285	312	HZ 880M A	26/AZ 18-10/10
10305	296	HZ 1180M C	12/AZ 13-770
10320	300	HZ 1180M C	12/AZ 20-800
10330	303	HZ 1180M C	12/AZ 14-770-10/10
10345	303	HZ 1180M C	12/AZ 20-800-10/10
10365	311	HZ 1080M D	12/AZ 18-10/10
10375	299	HZ 1080M B	14/AZ 26-700
10410	302	HZ 1180M B	12/AZ 13-700
10415	347	HZ 880M C	24/AZ 26
10420	305	HZ 1180M B	12/AZ 13-700-10/10
10425	313	HZ 880M B	26/AZ 18-700
10430	306	HZ 1080M A	14/AZ 26
10430	318	HZ 880M C	26/AZ 25-800
10445	325	HZ 1180M A	12/AZ 26-700
10470	277	HZ 1080M D	14/AZ 18-800
10475	319	HZ 880M B	26/AZ 20-700
10490	281	HZ 1080M D	14/AZ 13-770
10505	313	HZ 1180M C	12/AZ 25-800
10515	287	HZ 1080M D	14/AZ 14-770-10/10
10525	285	HZ 1080M D	14/AZ 20-800
10535	285	HZ 1080M C	14/AZ 13-700
10545	289	HZ 1080M C	14/AZ 13-700-10/10
10550	288	HZ 1080M D	14/AZ 20-800-10/10
10550	320	HZ 880M B	26/AZ 28-750
10565	330	HZ 880M A	26/AZ 26
10570	314	HZ 1180M B	12/AZ 28-750
10610	333	HZ 1080M D	12/AZ 26
10620	321	HZ 880M C	26/AZ 13-700
10625	305	HZ 1180M B	12/AZ 18-700
10625	326	HZ 880M B	26/AZ 30-750
10635	321	HZ 1180M B	12/AZ 30-750
10635	323	HZ 880M C	26/AZ 13-700-10/10
10665	312	HZ 1180M B	12/AZ 20-700
10700	329	HZ 1180M B	12/AZ 32-750
10700	333	HZ 880M B	26/AZ 32-750
10725	298	HZ 1080M D	14/AZ 25-800
10745	298	HZ 1080M C	14/AZ 28-750
10745	335	HZ 880M B	26/AZ 26-700
10770	288	HZ 1080M C	14/AZ 18-700
10775	294	HZ 1080M B	14/AZ 18-10/10
10780	302	HZ 1180M D	12/AZ 18-800
10815	295	HZ 1080M C	14/AZ 20-700
10820	306	HZ 1080M C	14/AZ 30-750
10825	306	HZ 1180M D	12/AZ 13-770
10830	309	HZ 1180M D	12/AZ 20-800
10850	313	HZ 1180M D	12/AZ 14-770-10/10
10850	313	HZ 1180M D	12/AZ 20-800-10/10
10870	323	HZ 880M C	26/AZ 18-700
10885	322	HZ 1180M A	12/AZ 18-10/10
10890	287	HZ 1180M A	14/AZ 18-800
10890	313	HZ 1080M C	14/AZ 32-750
10905	332	HZ 1180M B	12/AZ 26-700
10915	328	HZ 880M C	26/AZ 20-700
10920	291	HZ 1180M A	14/AZ 13-770
10945	295	HZ 1180M A	14/AZ 20-800
10950	298	HZ 1180M A	14/AZ 14-770-10/10
10970	298	HZ 1180M A	14/AZ 20-800-10/10
10970	329	HZ 880M C	26/AZ 28-750
10985	334	HZ 880M B	26/AZ 18-10/10
11000	316	HZ 1180M C	12/AZ 13-700
11010	319	HZ 1180M C	12/AZ 13-700-10/10
11015	322	HZ 1180M D	12/AZ 25-800
11040	316	HZ 1080M B	14/AZ 26
11045	336	HZ 880M C	26/AZ 30-750
11075	315	HZ 1080M C	14/AZ 26-700
11120	342	HZ 880M C	26/AZ 32-750
11130	326	HZ 1180M C	12/AZ 28-750
11130	345	HZ 1180M A	12/AZ 26
11145	308	HZ 1180M A	14/AZ 25-800
11185	345	HZ 880M C	26/AZ 26-700
11195	299	HZ 1080M D	14/AZ 13-700
11195	334	HZ 1180M C	12/AZ 30-750
11205	302	HZ 1080M D	14/AZ 13-700-10/10
11220	318	HZ 1180M C	12/AZ 18-700
11255	293	HZ 1180M B	14/AZ 18-800
11260	325	HZ 1180M C	12/AZ 20-700
11260	342	HZ 1180M C	12/AZ 32-750
11260	351	HZ 880M B	26/AZ 26
11300	297	HZ 1180M B	14/AZ 13-770
11305	300	HZ 1180M B	14/AZ 20-800
11325	304	HZ 1180M B	14/AZ 14-770-10/10
11330	304	HZ 1180M B	14/AZ 20-800-10/10
11365	311	HZ 1080M D	14/AZ 28-750
11380	330	HZ 1180M B	12/AZ 18-10/10
11430	302	HZ 1080M D	14/AZ 18-700
11440	319	HZ 1080M D	14/AZ 30-750
11450	344	HZ 880M C	26/AZ 18-10/10
11470	309	HZ 1080M D	14/AZ 20-700
11495	345	HZ 1180M C	12/AZ 26-700
11505	314	HZ 1180M B	14/AZ 25-800
11510	326	HZ 1080M D	14/AZ 32-750
11530	312	HZ 1080M C	14/AZ 18-10/10
11555	308	HZ 1080M A	24/AZ 18-800
11560	326	HZ 1180M D	12/AZ 13-700
11570	330	HZ 1180M D	12/AZ 13-700-10/10
11600	314	HZ 1080M A	24/AZ 20-800
11605	312	HZ 1080M A	24/AZ 13-770
11620	317	HZ 1080M A	24/AZ 20-800-10/10
11625	317	HZ 1080M A	24/AZ 14-770-10/10
11625	352	HZ 1180M B	12/AZ 26
11660	310	HZ 1180M A	14/AZ 13-700
11665	337	HZ 1180M D	12/AZ 28-750
11670	313	HZ 1180M A	14/AZ 13-700-10/10
11725	329	HZ 1080M D	14/AZ 26-700
11725	361	HZ 880M C	26/AZ 26
11730	344	HZ 1180M D	12/AZ 30-750
11760	325	HZ 1080M A	24/AZ 25-800
11780	329	HZ 1180M D	12/AZ 18-700
11795	334	HZ 1080M C	14/AZ 26
11795	352	HZ 1180M D	12/AZ 32-750
11805	321	HZ 1180M A	14/AZ 28-750
11820	336	HZ 1180M D	12/AZ 20-700
11875	329	HZ 1180M A	14/AZ 30-750
11895	313	HZ 1180M A	14/AZ 18-700
11935	320	HZ 1180M A	14/AZ 20-700
11945	337	HZ 1180M A	14/AZ 32-750
12015	344	HZ 1180M C	12/AZ 18-10/10
12020	309	HZ 1180M C	14/AZ 18-800

Table of combinations sorted by ascending Elastic section modulus

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
12055	356	HZ 1180M D	12/AZ 26-700
12065	317	HZ 1180M B	14/AZ 13-700
12075	316	HZ 1180M C	14/AZ 20-800
12075	320	HZ 1180M B	14/AZ 13-700-10/10
12090	314	HZ 1180M C	14/AZ 13-770
12100	320	HZ 1180M C	14/AZ 20-800-10/10
12115	320	HZ 1180M C	14/AZ 14-770-10/10
12185	327	HZ 1180M B	14/AZ 28-750
12190	340	HZ 1180M A	14/AZ 26-700
12240	327	HZ 1080M D	14/AZ 18-10/10
12240	329	HZ 1080M A	24/AZ 13-700
12250	331	HZ 1080M A	24/AZ 13-700-10/10
12255	335	HZ 1180M B	14/AZ 30-750
12260	367	HZ 1180M C	12/AZ 26
12270	330	HZ 1180M C	14/AZ 25-800
12295	319	HZ 1180M B	14/AZ 18-700
12320	337	HZ 1080M A	24/AZ 28-750
12325	343	HZ 1180M B	14/AZ 32-750
12340	326	HZ 1180M B	14/AZ 20-700
12375	343	HZ 1080M A	24/AZ 30-750
12410	318	HZ 1180M D	14/AZ 18-800
12410	322	HZ 1080M B	24/AZ 18-800
12425	331	HZ 1080M A	24/AZ 18-700
12435	350	HZ 1080M A	24/AZ 32-750
12450	328	HZ 1080M B	24/AZ 20-800
12455	336	HZ 1080M A	24/AZ 20-700
12460	325	HZ 1180M D	14/AZ 20-800
12470	331	HZ 1080M B	24/AZ 20-800-10/10
12475	326	HZ 1080M B	24/AZ 13-770
12485	329	HZ 1180M D	14/AZ 20-800-10/10
12490	323	HZ 1180M D	14/AZ 13-770
12500	331	HZ 1080M B	24/AZ 14-770-10/10
12505	349	HZ 1080M D	14/AZ 26
12515	329	HZ 1180M D	14/AZ 14-770-10/10
12590	346	HZ 1180M B	14/AZ 26-700
12610	339	HZ 1080M B	24/AZ 25-800
12620	356	HZ 1180M D	12/AZ 18-10/10
12655	353	HZ 1080M A	24/AZ 26-700
12660	338	HZ 1180M D	14/AZ 25-800
12740	338	HZ 1180M A	14/AZ 18-10/10
12865	378	HZ 1180M D	12/AZ 26
12915	334	HZ 1180M C	14/AZ 13-700
12925	337	HZ 1180M C	14/AZ 13-700-10/10
12985	344	HZ 1180M C	14/AZ 28-750
12995	321	HZ 1080M A	26/AZ 18-800
13000	361	HZ 1180M A	14/AZ 26
13035	327	HZ 1080M A	26/AZ 20-800
13055	352	HZ 1180M C	14/AZ 30-750
13060	324	HZ 1080M A	26/AZ 13-770
13060	330	HZ 1080M A	26/AZ 20-800-10/10
13085	330	HZ 1080M A	26/AZ 14-770-10/10
13125	360	HZ 1180M C	14/AZ 32-750
13130	352	HZ 1080M A	24/AZ 18-10/10
13145	337	HZ 1180M C	14/AZ 18-700
13165	343	HZ 1080M B	24/AZ 13-700
13175	346	HZ 1180M B	14/AZ 18-10/10
13175	346	HZ 1080M B	24/AZ 13-700-10/10
13185	344	HZ 1180M C	14/AZ 20-700
13205	337	HZ 1080M A	26/AZ 25-800
13205	351	HZ 1080M B	24/AZ 28-750
13265	358	HZ 1080M B	24/AZ 30-750
13320	364	HZ 1080M B	24/AZ 32-750
13330	370	HZ 1080M A	24/AZ 26
13345	344	HZ 1180M D	14/AZ 13-700
13345	345	HZ 1080M B	24/AZ 18-700
13355	347	HZ 1180M D	14/AZ 13-700-10/10
13380	351	HZ 1080M B	24/AZ 20-700
13390	353	HZ 1180M D	14/AZ 28-750
13435	364	HZ 1180M C	14/AZ 26-700
13435	368	HZ 1180M B	14/AZ 26
13460	361	HZ 1180M D	14/AZ 30-750
13470	347	HZ 1080M C	24/AZ 18-800
13510	353	HZ 1080M C	24/AZ 20-800
13530	369	HZ 1180M D	14/AZ 32-750
13535	356	HZ 1080M C	24/AZ 20-800-10/10
13565	352	HZ 1080M C	24/AZ 13-770
13570	347	HZ 1180M D	14/AZ 18-700
13580	368	HZ 1080M B	24/AZ 26-700
13585	357	HZ 1080M C	24/AZ 14-770-10/10
13615	354	HZ 1180M D	14/AZ 20-700
13670	364	HZ 1080M C	24/AZ 25-800
13780	342	HZ 1080M A	26/AZ 13-700
13790	344	HZ 1080M A	26/AZ 13-700-10/10
13830	350	HZ 1080M A	26/AZ 28-750
13845	334	HZ 1080M B	26/AZ 18-800
13860	374	HZ 1180M D	14/AZ 26-700
13890	340	HZ 1080M B	26/AZ 20-800
13890	356	HZ 1080M A	26/AZ 30-750
13910	343	HZ 1080M B	26/AZ 20-800-10/10
13935	339	HZ 1080M B	26/AZ 13-770
13950	362	HZ 1080M A	26/AZ 32-750
13960	344	HZ 1080M B	26/AZ 14-770-10/10
13975	344	HZ 1080M A	26/AZ 18-700
14010	350	HZ 1080M A	26/AZ 20-700
14060	351	HZ 1080M B	26/AZ 25-800
14090	365	HZ 1180M C	14/AZ 18-10/10
14110	368	HZ 1080M B	24/AZ 18-10/10
14220	366	HZ 1080M A	26/AZ 26-700
14310	377	HZ 1080M C	24/AZ 28-750
14315	370	HZ 1080M C	24/AZ 13-700
14315	386	HZ 1080M B	24/AZ 26
14320	373	HZ 1080M C	24/AZ 13-700-10/10
14345	387	HZ 1180M C	14/AZ 26
14365	383	HZ 1080M C	24/AZ 30-750
14420	390	HZ 1080M C	24/AZ 32-750
14460	367	HZ 1080M D	24/AZ 18-800
14495	372	HZ 1080M C	24/AZ 18-700
14505	373	HZ 1080M D	24/AZ 20-800
14525	376	HZ 1080M D	24/AZ 20-800-10/10
14530	378	HZ 1080M C	24/AZ 20-700
14550	375	HZ 1180M D	14/AZ 18-10/10
14580	372	HZ 1080M D	24/AZ 13-770
14600	378	HZ 1080M D	24/AZ 14-770-10/10
14665	384	HZ 1080M D	24/AZ 25-800
14705	357	HZ 1080M B	26/AZ 13-700
14715	359	HZ 1080M B	26/AZ 13-700-10/10
14715	364	HZ 1080M B	26/AZ 28-750
14725	394	HZ 1080M C	24/AZ 26-700
14775	366	HZ 1080M A	26/AZ 18-10/10
14775	370	HZ 1080M B	26/AZ 30-750
14805	397	HZ 1180M D	14/AZ 26
14830	377	HZ 1080M B	26/AZ 32-750
14885	359	HZ 1080M C	26/AZ 18-800
14900	359	HZ 1080M B	26/AZ 18-700
14930	365	HZ 1080M C	26/AZ 20-800
14935	365	HZ 1080M B	26/AZ 20-700
14950	368	HZ 1080M C	26/AZ 20-800-10/10
14985	384	HZ 1080M A	26/AZ 26
15005	364	HZ 1080M C	26/AZ 13-770
15025	369	HZ 1080M C	26/AZ 14-770-10/10
15095	376	HZ 1080M C	26/AZ 25-800
15140	381	HZ 1080M B	26/AZ 26-700
15170	383	HZ 1180M A	24/AZ 18-800
15210	389	HZ 1180M A	24/AZ 20-800
15230	392	HZ 1180M A	24/AZ 20-800-10/10
15305	389	HZ 1180M A	24/AZ 13-770
15325	394	HZ 1180M A	24/AZ 14-770-10/10
15330	397	HZ 1080M C	24/AZ 18-10/10
15340	398	HZ 1080M D	24/AZ 28-750
15370	400	HZ 1180M A	24/AZ 25-800
15390	392	HZ 1080M D	24/AZ 13-700
15395	395	HZ 1080M D	24/AZ 13-700-10/10
15395	404	HZ 1080M D	24/AZ 30-750
15450	411	HZ 1080M D	24/AZ 32-750
15530	414	HZ 1080M C	24/AZ 26
15570	394	HZ 1080M D	24/AZ 18-700
15605	400	HZ 1080M D	24/AZ 20-700
15755	382	HZ 1080M B	26/AZ 18-10/10
15770	393	HZ 1180M B	24/AZ 18-800
15795	390	HZ 1080M C	26/AZ 28-750
15800	416	HZ 1080M D	24/AZ 26-700
15815	399	HZ 1180M B	24/AZ 20-800
15835	384	HZ 1080M C	26/AZ 13-700
15835	402	HZ 1180M B	24/AZ 20-800-10/10
15845	386	HZ 1080M C	26/AZ 13-700-10/10
15855	396	HZ 1080M C	26/AZ 30-750

Table of combinations sorted by ascending Elastic section modulus

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
15865	379	HZ 1080M D	26/AZ 18-800
15910	385	HZ 1080M D	26/AZ 20-800
15910	402	HZ 1080M C	26/AZ 32-750
15920	399	HZ 1180M B	24/AZ 13-770
15930	388	HZ 1080M D	26/AZ 20-800-10/10
15940	404	HZ 1180M B	24/AZ 14-770-10/10
15970	400	HZ 1080M B	26/AZ 26
15970	410	HZ 1180M B	24/AZ 25-800
16005	385	HZ 1080M D	26/AZ 13-770
16025	386	HZ 1080M C	26/AZ 18-700
16030	390	HZ 1080M D	26/AZ 14-770-10/10
16060	391	HZ 1080M C	26/AZ 20-700
16075	396	HZ 1080M D	26/AZ 25-800
16075	415	HZ 1180M A	24/AZ 28-750
16130	421	HZ 1180M A	24/AZ 30-750
16155	410	HZ 1180M A	24/AZ 13-700
16165	412	HZ 1180M A	24/AZ 13-700-10/10
16185	428	HZ 1180M A	24/AZ 32-750
16265	408	HZ 1080M C	26/AZ 26-700
16335	412	HZ 1180M A	24/AZ 18-700
16370	418	HZ 1180M A	24/AZ 20-700
16470	420	HZ 1080M D	24/AZ 18-10/10
16560	396	HZ 1180M A	26/AZ 18-800
16565	434	HZ 1180M A	24/AZ 26-700
16600	402	HZ 1180M A	26/AZ 20-800
16625	405	HZ 1180M A	26/AZ 20-800-10/10
16670	438	HZ 1080M D	24/AZ 26
16700	425	HZ 1180M B	24/AZ 28-750
16720	401	HZ 1180M A	26/AZ 13-770
16740	407	HZ 1180M A	26/AZ 14-770-10/10
16755	431	HZ 1180M B	24/AZ 30-750
16765	412	HZ 1180M A	26/AZ 25-800
16810	411	HZ 1080M D	26/AZ 28-750
16810	415	HZ 1180M C	24/AZ 18-800
16810	420	HZ 1180M B	24/AZ 13-700
16810	438	HZ 1180M B	24/AZ 32-750
16815	423	HZ 1180M B	24/AZ 13-700-10/10
16850	421	HZ 1180M C	24/AZ 20-800
16865	417	HZ 1080M D	26/AZ 30-750
16870	424	HZ 1180M C	24/AZ 20-800-10/10
16895	405	HZ 1080M D	26/AZ 13-700
16905	408	HZ 1080M D	26/AZ 13-700-10/10
16925	423	HZ 1080M D	26/AZ 32-750
16950	411	HZ 1080M C	26/AZ 18-10/10
16985	421	HZ 1180M C	24/AZ 13-770
16990	422	HZ 1180M B	24/AZ 18-700
17005	426	HZ 1180M C	24/AZ 14-770-10/10
17010	431	HZ 1180M C	24/AZ 25-800
17020	428	HZ 1180M B	24/AZ 20-700
17085	408	HZ 1080M D	26/AZ 18-700
17120	413	HZ 1080M D	26/AZ 20-700
17160	405	HZ 1180M B	26/AZ 18-800
17160	428	HZ 1080M C	26/AZ 26
17200	411	HZ 1180M B	26/AZ 20-800
17215	444	HZ 1180M B	24/AZ 26-700
17225	414	HZ 1180M B	26/AZ 20-800-10/10
17285	439	HZ 1180M A	24/AZ 18-10/10
17325	430	HZ 1080M D	26/AZ 26-700
17335	411	HZ 1180M B	26/AZ 13-770
17355	417	HZ 1180M B	26/AZ 14-770-10/10
17365	422	HZ 1180M B	26/AZ 25-800
17455	429	HZ 1180M D	24/AZ 18-800
17485	456	HZ 1180M A	24/AZ 26
17495	435	HZ 1180M D	24/AZ 20-800
17515	438	HZ 1180M D	24/AZ 20-800-10/10
17530	427	HZ 1180M A	26/AZ 28-750
17585	434	HZ 1180M A	26/AZ 30-750
17640	440	HZ 1180M A	26/AZ 32-750
17645	435	HZ 1180M D	24/AZ 13-770
17650	423	HZ 1180M A	26/AZ 13-700
17650	446	HZ 1180M D	24/AZ 25-800
17660	426	HZ 1180M A	26/AZ 13-700-10/10
17665	441	HZ 1180M D	24/AZ 14-770-10/10
17775	447	HZ 1180M C	24/AZ 28-750
17830	453	HZ 1180M C	24/AZ 30-750
17835	425	HZ 1180M A	26/AZ 18-700
17870	431	HZ 1180M A	26/AZ 20-700
17885	460	HZ 1180M C	24/AZ 32-750
17935	443	HZ 1180M C	24/AZ 13-700
17940	446	HZ 1180M C	24/AZ 13-700-10/10
17975	450	HZ 1180M B	24/AZ 18-10/10
18075	447	HZ 1180M A	26/AZ 26-700
18080	434	HZ 1080M D	26/AZ 18-10/10
18110	445	HZ 1180M C	24/AZ 18-700
18145	451	HZ 1180M C	24/AZ 20-700
18150	438	HZ 1180M B	26/AZ 28-750
18175	467	HZ 1180M B	24/AZ 26
18210	444	HZ 1180M B	26/AZ 30-750
18265	450	HZ 1180M B	26/AZ 32-750
18285	452	HZ 1080M D	26/AZ 26
18300	433	HZ 1180M B	26/AZ 13-700
18310	436	HZ 1180M B	26/AZ 13-700-10/10
18340	467	HZ 1180M C	24/AZ 26-700
18390	430	HZ 1180M C	26/AZ 18-800
18430	436	HZ 1180M C	26/AZ 20-800
18440	462	HZ 1180M D	24/AZ 28-750
18450	439	HZ 1180M C	26/AZ 20-800-10/10
18490	435	HZ 1180M B	26/AZ 18-700
18495	468	HZ 1180M D	24/AZ 30-750
18520	441	HZ 1180M B	26/AZ 20-700
18550	475	HZ 1180M D	24/AZ 32-750
18595	436	HZ 1180M C	26/AZ 13-770
18595	446	HZ 1180M C	26/AZ 25-800
18615	442	HZ 1180M C	26/AZ 14-770-10/10
18630	459	HZ 1180M D	24/AZ 13-700
18635	462	HZ 1180M D	24/AZ 13-700-10/10
18725	457	HZ 1180M B	26/AZ 26-700
18805	461	HZ 1180M D	24/AZ 18-700
18840	467	HZ 1180M D	24/AZ 20-700
18875	452	HZ 1180M A	26/AZ 18-10/10
19020	444	HZ 1180M D	26/AZ 18-800
19035	483	HZ 1180M D	24/AZ 26-700
19065	450	HZ 1180M D	26/AZ 20-800
19080	470	HZ 1180M A	26/AZ 26
19085	453	HZ 1180M D	26/AZ 20-800-10/10
19170	474	HZ 1180M C	24/AZ 18-10/10
19225	461	HZ 1180M D	26/AZ 25-800
19240	451	HZ 1180M D	26/AZ 13-770
19260	456	HZ 1180M D	26/AZ 14-770-10/10
19365	492	HZ 1180M C	24/AZ 26
19425	463	HZ 1180M C	26/AZ 28-750
19480	469	HZ 1180M C	26/AZ 30-750
19540	476	HZ 1180M C	26/AZ 32-750
19565	464	HZ 1180M B	26/AZ 18-10/10
19630	460	HZ 1180M C	26/AZ 13-700
19640	462	HZ 1180M C	26/AZ 13-700-10/10
19775	481	HZ 1180M B	26/AZ 26
19815	462	HZ 1180M C	26/AZ 18-700
19850	468	HZ 1180M C	26/AZ 20-700
19905	491	HZ 1180M D	24/AZ 18-10/10
20050	484	HZ 1180M C	26/AZ 26-700
20080	478	HZ 1180M D	26/AZ 28-750
20100	508	HZ 1180M D	24/AZ 26
20135	484	HZ 1180M D	26/AZ 30-750
20195	491	HZ 1180M D	26/AZ 32-750
20320	475	HZ 1180M D	26/AZ 13-700
20325	478	HZ 1180M D	26/AZ 13-700-10/10
20500	477	HZ 1180M D	26/AZ 18-700
20535	483	HZ 1180M D	26/AZ 20-700
20735	499	HZ 1180M D	26/AZ 26-700
20975	492	HZ 1180M C	26/AZ 18-10/10
21180	509	HZ 1180M C	26/AZ 26
21705	508	HZ 1180M D	26/AZ 18-10/10
21905	526	HZ 1180M D	26/AZ 26

Trademarks

ArcelorMittal is the owner of following trademark applications or registered trademarks:
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