ArcelorMittal Sheet Piling

ArcelorMittal

The HZ®-M Steel Wall System

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.

Launched in 2021, the **EcoSheetPile™ Plus** label certifies that the steel sheet piles are **produced from 100% recycled steel and 100% certified renewable electricity.**
This is covered by an Environmental Product Declaration (EPD), based on dedicated life-cycle analysis. EcoSheetPile™ Plus is an essential part of ArcelorMittal's **XCarb™ recycled and renewably produced** initiative to reach carbon neutrality by 2050.

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.

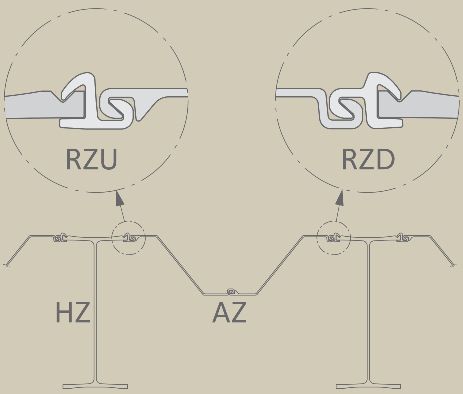
The general concept of the HZ®-M Steel Wall System is based on a stiff king pile with light intermediary sheet piles resulting in an overall safe and cost-effective high capacity retaining structure, with a high stiffness and high bending moment capacity.

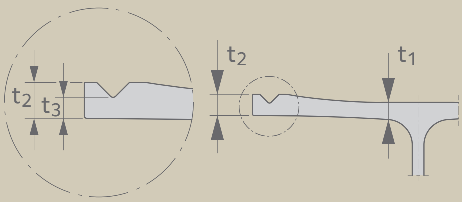
The main advantage of HZ-M king piles is the concave geometry of the flanges of the lighter sections, and the unmatched flange thickness of the heavier king pile sections with up to 40 mm.
To thread the RH/RZ connectors, a groove is milled into the flange. The milling equipment was designed to guarantee 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.

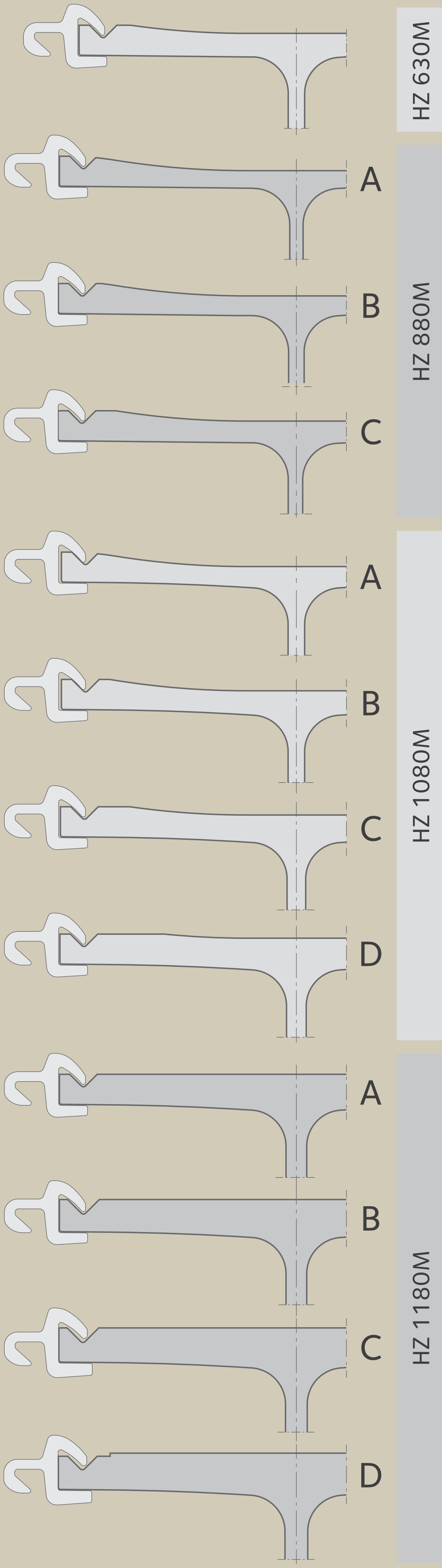
The connectors are threaded over the mill grooves of the HZ-M pile and partially welded, thus increasing the stiffness and the section modulus of the whole wall. Unlike other combined wall system, the geometry of the connectors ensures a "mechanical connection" between the two elements of the HZ/AZ system 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).



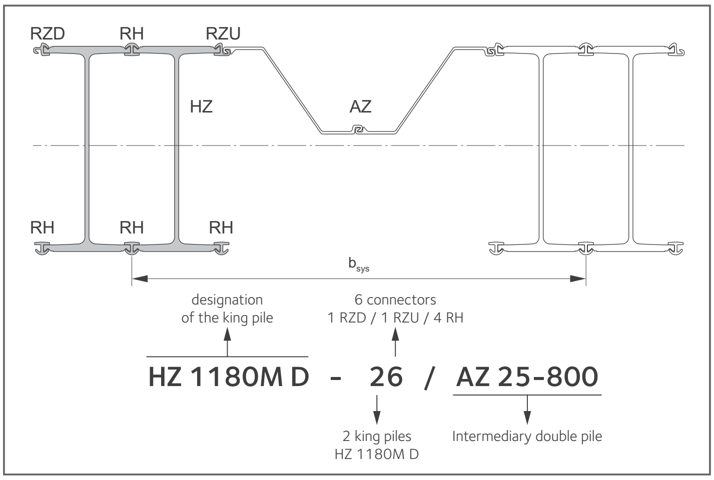




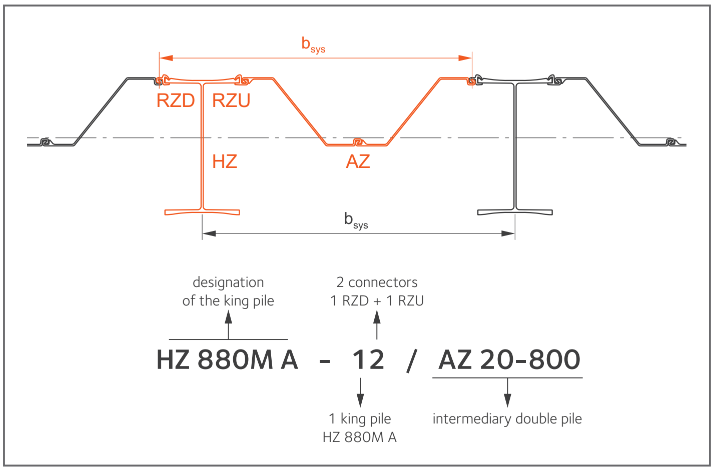
Definition of the HZ®-M Steel Wall System

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:



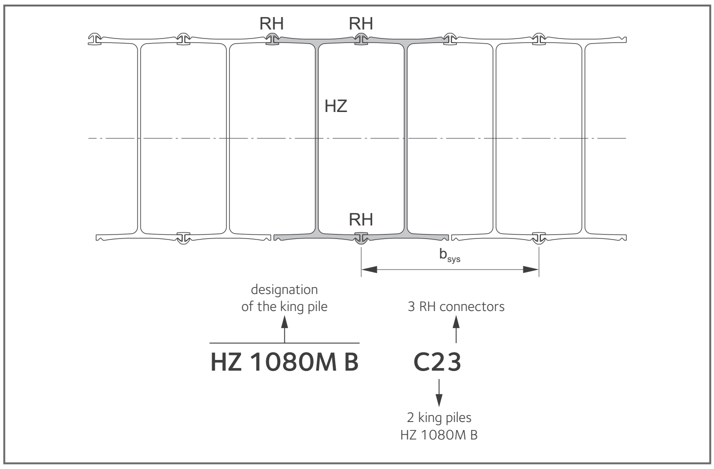
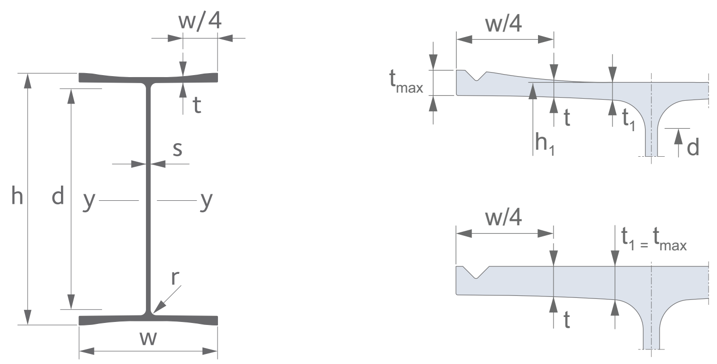


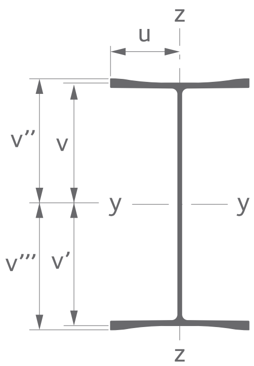
Fig.1. HZ/AZ steel wall system: definitions and designations.

HZ®-M - King piles



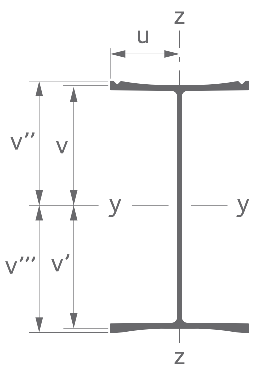
Section	h mm	h_1 mm	d mm	w mm	t_1 mm	t_{max} mm	t mm	s mm	r mm	A_v cm^2	Suitable connectors	
HZ 630M	631.4	615.7	510.1	420	22.7	29.0	24.2	16.0	30	116.1	RZD/RZU 16	RH 16
HZ 880M A	831.3	803.4	709.6	458	16.9	29.0	18.9	13.0	30	120.0	RZD/RZU 16	RH 16
HZ 880M B	831.3	807.4	709.6	460	18.9	29.0	20.9	15.0	30	137.2	RZD/RZU 16	RH 16
HZ 880M C	831.3	811.4	709.6	460	20.9	29.0	22.9	15.0	30	139.0	RZD/RZU 16	RH 16
HZ 1080M A	1075.3	1047.4	945.6	454	20.7	29.0	19.6	16.0	30	185.8	RZD/RZU 16	RH 16
HZ 1080M B	1075.3	1053.4	945.6	454	23.7	29.0	22.6	16.0	30	188.3	RZD/RZU 16	RH 16
HZ 1080M C	1075.3	1059.4	945.6	456	26.7	29.0	25.7	18.0	30	211.4	RZD/RZU 16	RH 16
HZ 1080M D	1075.3	1067.4	945.6	457	30.7	30.7	29.7	19.0	30	225.1	RZD/RZU 16	RH 16
HZ 1180M A	1075.4	-	945.6	458	34.7	34.7	31.0	20.0	30	238.9	RZD/RZU 16	RH 16
HZ 1180M B	1079.4	-	945.6	458	36.7	36.7	33.0	20.0	30	240.6	RZD/RZU 16	RH 16
HZ 1180M C	1083.4	-	945.6	459	38.7	38.7	35.0	21.0	30	252.7	RZD/RZU 18	RH 20
HZ 1180M D	1087.4	-	945.6	460	40.7	40.7	37.0	22.0	30	264.9	RZD/RZU 18	RH 20

Solution 100



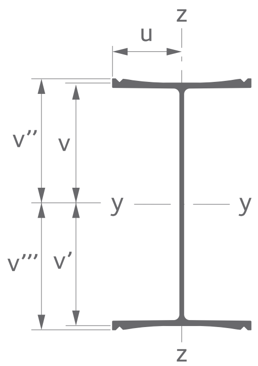
Section	v	v'	v''	v'''	u	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$*	$W_{el,y}$**	$W_{el,z}$	A_{LW}	A_{LS}
	Dimensions					Properties per solution										
	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	307.9	307.9	315.7	315.7	210.0	312.0	**244.9**	220860	34220	598.3	29450	**7175**	-	1630	0.421	2.430
HZ 880M A	401.7	401.7	415.7	415.7	229.0	299.8	**235.3**	362700	40000	399.0	60640	**9030**	-	1745	0.459	2.949
HZ 880M B	403.7	403.7	415.7	415.7	230.0	332.4	**260.9**	398680	42780	517.7	65270	**9875**	-	1860	0.461	2.951
HZ 880M C	405.7	405.7	415.7	415.7	230.0	346.9	**272.3**	422700	44360	597.7	68170	**10420**	-	1930	0.461	2.950
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



Section	v	v'	v''	v'''	u	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$*	$W_{el,y}$**	$W_{el,z}$	A_{LW}	A_{LS}
	Dimensions					Properties per solution										
	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	406.1	397.3	420.1	411.3	229.0	296.6	**232.8**	357280	38650	375.0	58600	**8800**	-	1690	0.478	2.949
HZ 880M B	408.0	399.4	420.0	411.3	230.0	328.9	**258.2**	392750	41300	490.1	63000	**9625**	-	1795	0.481	2.951
HZ 880M C	409.9	401.5	419.8	411.5	230.0	343.4	**269.6**	416770	42880	570.2	65890	**10170**	-	1865	0.480	2.950
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



Section	Dimensions					Properties per solution										
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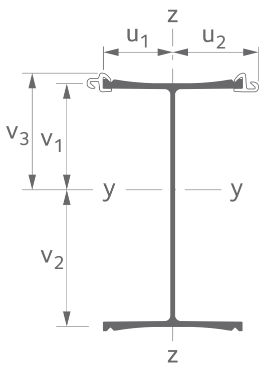
	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	307.9	307.9	315.7	315.7	210.0	305.1	**239.5**	214130	31800	543.5	27440	**6955**	-	1515	0.440	2.449
HZ 880M A	401.7	401.7	415.7	415.7	229.0	293.4	**230.3**	351980	37300	352.1	56690	**8760**	-	1630	0.478	2.967
HZ 880M B	403.7	403.7	415.7	415.7	230.0	325.5	**255.5**	386940	39810	463.4	60880	**9585**	-	1730	0.481	2.970
HZ 880M C	405.7	405.7	415.7	415.7	230.0	339.9	**266.8**	410960	41390	543.2	63760	**10130**	-	1800	0.480	2.970
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	**385.8**	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



Section	Dimensions					Properties per solution										
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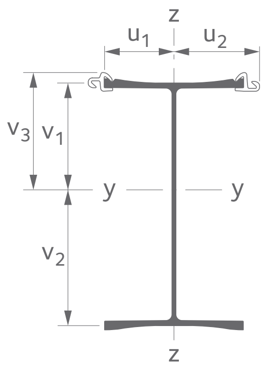
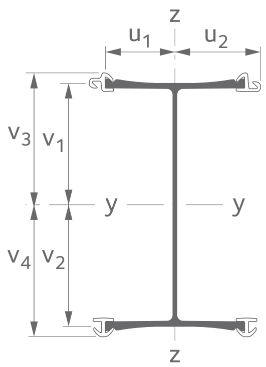
	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	272.1	343.6	300.3	209.9	263.9	346.2	**271.8**	247130	52190	702.2	38320	**7190**	8230	1980	0.582	2.546
HZ 880M A	352.4	451.0	386.8	228.8	282.9	334.5	**262.6**	410130	61300	503.4	79340	**9095**	10605	2165	0.621	3.019
HZ 880M B	358.7	448.7	391.1	229.9	283.9	366.6	**287.8**	445810	64010	614.6	84400	**9935**	11400	2255	0.624	3.022
HZ 880M C	362.4	449.0	392.8	229.9	283.9	381.0	**299.1**	470100	65590	695.0	87810	**10470**	11970	2310	0.624	3.021
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



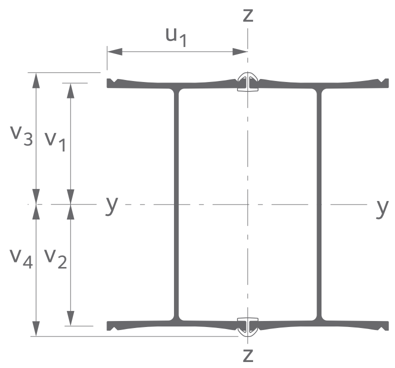
	Dimensions					Properties per solution										
	v_1	v_2	v_3	u_1	u_2	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$*	$W_{el,y}$**	$W_{el,z}$	A_{LW}	A_{LS}
Section	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^{3}cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	275.5	340.2	303.8	209.9	263.9	349.7	**274.5**	251260	53400	725.6	40250	**7385**	8270	2025	0.582	2.527
HZ 880M A	356.7	446.7	391.1	228.8	282.9	337.7	**265.1**	416790	62650	526.1	83160	**9330**	10660	2215	0.621	3.001
HZ 880M B	363.0	444.4	395.3	229.9	283.9	370.0	**290.5**	452960	65490	641.1	88550	**10190**	11460	2305	0.624	3.002
HZ 880M C	366.5	444.9	396.9	229.9	283.9	384.5	**301.8**	477210	67070	721.3	91940	**10725**	12025	2365	0.624	3.002
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



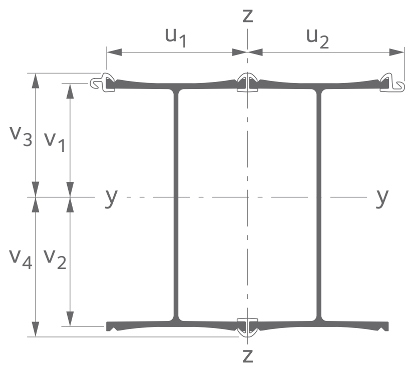
	Dimensions						Properties per solution										
	v_1	v_2	v_3	v_4	u_1	u_2	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$*	$W_{el.y}$**	$W_{el,z}$	A_{LW}	A_{LS}
Section	mm	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^{3}cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	307.5	308.3	335.7	336.6	209.9	263.9	386.5	**303.4**	288850	71250	865.8	62460	**9370**	8580	2700	0.582	2.808
HZ 880M A	401.1	402.3	435.4	436.8	228.9	282.9	374.8	**294.2**	484020	83820	656.6	129300	**12030**	11080	2965	0.621	3.236
HZ 880M B	403.1	404.3	435.5	436.8	229.9	283.9	406.8	**319.4**	518990	86730	766.1	134700	**12835**	11885	3055	0.624	3.239
HZ 880M C	405.1	406.3	435.5	436.7	229.9	283.9	421.3	**330.7**	543000	88310	847.1	138100	**13365**	12435	3110	0.624	3.239
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



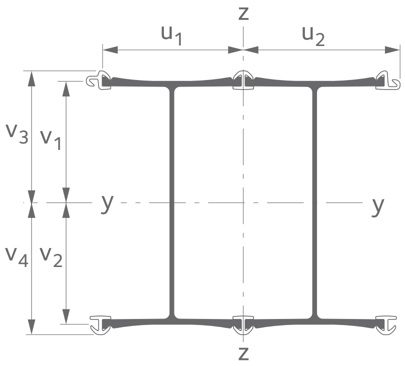
	Dimensions					Properties per solution										
	v_1	v_2	v_3	v_4	u_1	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$*	$W_{el,y}$**	$W_{el,z}$	A_{LW}	A_{LS}
Section	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	307.9	307.9	336.2	336.2	427.0	650.4	**510.6**	465570	351040	238756	70260	**15125**	13850	8220	0.925	2.934
HZ 880M A	401.7	401.7	436.2	436.2	465.0	627.1	**492.3**	769720	401560	330960	181100	**19160**	17650	8635	1.001	3.490
HZ 880M B	403.7	403.7	436.2	436.2	467.0	691.2	**542.6**	839650	445350	378656	185300	**20800**	19250	9535	1.007	3.497
HZ 880M C	405.7	405.7	436.2	436.2	467.0	720.1	**565.3**	887690	464770	387367	208900	**21880**	20355	9950	1.007	3.496
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	377.0	426.4	411.5	460.8	464.8	518.9	668.2	**524.5**	831930	495150	331071	240600	**19510**	18055	9540	1.144	3.542
HZ 880M B	381.2	426.2	413.6	458.7	466.9	520.9	732.3	**574.8**	902220	539720	378374	244700	**21170**	19670	10360	1.150	3.548
HZ 880M C	384.0	427.4	414.5	457.8	466.9	520.9	761.2	**597.6**	950390	559140	392241	271700	**22240**	20760	10735	1.150	3.548
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

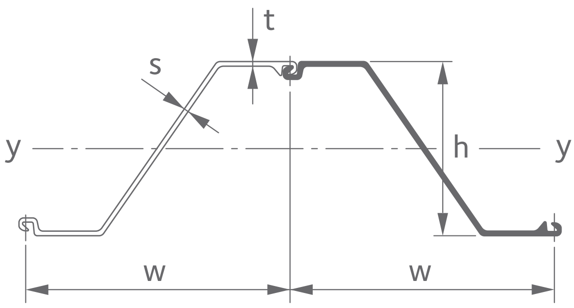


	Dimensions						Properties per solution										
	v_1	v_2	v_3	v_4	u_1	u_2	A	G	I_y	I_z	I_t	I_ω	$W_{el,y}$*	$W_{el,y}$**	$W_{el,z}$	A_{LW}	A_{LS}
Section	mm	mm	mm	mm	mm	mm	cm^2	kg/m	cm^4	cm^4	cm^4	10^3cm^6	cm^3	cm^3	cm^3	m^2/m	m^2/m
HZ 630M	307.6	308.1	336.0	336.4	426.9	480.9	731.8	**574.5**	540280	506260	253467	129710	**17535**	16060	10530	1.067	3.292
HZ 880M A	401.4	402.0	435.8	436.5	464.9	518.9	708.5	**556.1**	901760	584930	331236	324481	**22430**	20660	11275	1.144	3.759
HZ 880M B	403.4	404.0	435.8	436.5	466.9	520.9	772.5	**606.4**	971700	630270	378596	325708	**24050**	22265	12100	1.150	3.766
HZ 880M C	405.4	406.0	435.9	436.5	466.9	520.9	801.5	**629.2**	1019730	649680	392302	356525	**25115**	23365	12475	1.150	3.765
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.

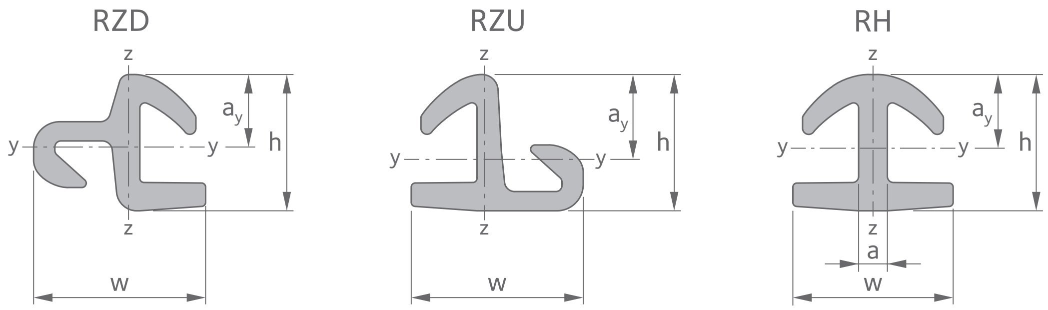
Combined wall, combination 24

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



	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

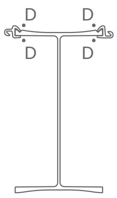
Steel grades

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

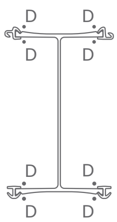
All the components of the HZ-M Steel Wall System are available in **ASTM A 690** steel grade.
ASTM A 690 with higher yield strength on request.

Standard welding configuration

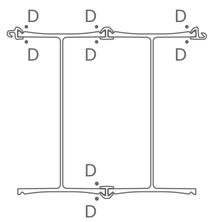
Sol. 12



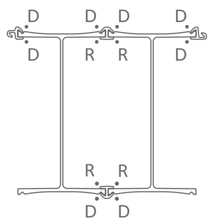
Sol. 14



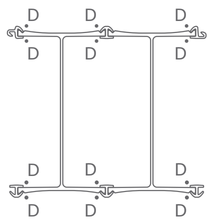
Sol. 24 - Form "a"



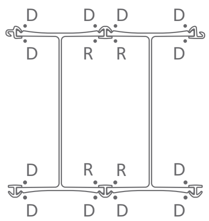
Sol. 24 - Form "b"



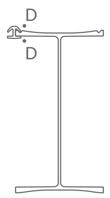
Sol. 26 - Form "a"



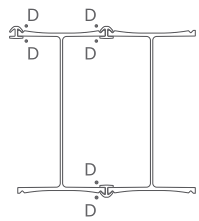
Sol. 26 - Form "b"



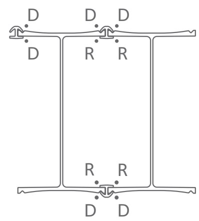
Sol. C1



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	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	275.2	154710	**4550**	5090	176	196	**216**	2.661	4.606	2.090
HZ 880M A	264.7	229730	**5145**	5875	168	188	**208**	2.700	5.080	2.127
HZ 880M B	279.6	246490	**5545**	6235	180	200	**220**	2.703	5.082	2.127
HZ 880M C	286.4	257880	**5795**	6500	186	205	**225**	2.703	5.081	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

Section	A	I_y	$W_{el.y}$*	$W_{el.y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	292.8	172690	**5600**	5130	184	207	**230**	2.661	4.887	2.090
HZ 880M A	282.1	261320	**6495**	5985	176	199	**221**	2.700	5.315	2.127
HZ 880M B	296.9	277490	**6865**	6355	188	210	**233**	2.703	5.318	2.127
HZ 880M C	303.7	288770	**7110**	6610	193	216	**238**	2.703	5.318	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

Section	A	I_y	$W_{el.y}$*	$W_{el.y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	363.4	226960	**6965**	6410	252	269	**285**	3.146	5.111	2.524
HZ 880M A	343.8	347690	**8155**	7545	238	254	**270**	3.224	5.621	2.598
HZ 880M B	367.8	374150	**8780**	8155	257	273	**289**	3.230	5.628	2.598
HZ 880M C	379.0	392650	**9190**	8575	265	281	**297**	3.229	5.627	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

Section	A	I_y	$W_{el.y}$*	$W_{el.y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	379.3	242610	**7875**	7210	260	279	**298**	3.146	5.372	2.524
HZ 880M A	359.3	374550	**9315**	8580	245	263	**282**	3.224	5.839	2.598
HZ 880M B	383.3	400830	**9920**	9185	264	282	**301**	3.230	5.845	2.598
HZ 880M C	394.4	419280	**10325**	9605	273	291	**310**	3.229	5.844	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	269.4	231140	**5175**	5910	171	191	**211**	2.701	5.081	2.127
HZ 880M B	284.3	247900	**5580**	6270	182	203	**223**	2.704	5.082	2.127
HZ 880M C	291.1	259290	**5830**	6535	188	208	**229**	2.704	5.082	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	297.6	174120	**5650**	5175	186	210	**234**	2.662	4.888	2.090
HZ 880M A	286.8	262730	**6530**	6015	178	202	**225**	2.701	5.316	2.127
HZ 880M B	301.6	278900	**6900**	6385	190	213	**237**	2.704	5.319	2.127
HZ 880M C	308.4	290180	**7140**	6645	195	219	**242**	2.704	5.319	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	367.3	228140	**7005**	6445	254	271	**288**	3.147	5.111	2.524
HZ 880M A	347.6	348840	**8180**	7570	239	256	**273**	3.224	5.622	2.598
HZ 880M B	371.7	375300	**8805**	8180	258	275	**292**	3.230	5.628	2.598
HZ 880M C	382.8	393800	**9215**	8600	267	284	**301**	3.230	5.628	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	383.3	243800	**7915**	7245	261	281	**301**	3.147	5.372	2.524
HZ 880M A	363.1	375700	**9345**	8605	247	266	**285**	3.224	5.839	2.598
HZ 880M B	387.1	401980	**9950**	9210	266	285	**304**	3.230	5.845	2.598
HZ 880M C	398.3	420430	**10355**	9635	274	294	**313**	3.230	5.845	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	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	292.3	165710	**4870**	5455	184	207	**229**	2.696	4.641	2.090
HZ 880M A	281.5	240530	**5385**	6150	176	199	**221**	2.735	5.114	2.127
HZ 880M B	296.4	257290	**5790**	6510	188	210	**233**	2.738	5.116	2.127
HZ 880M C	303.2	268670	**6040**	6770	193	216	**238**	2.737	5.116	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	298.9	272120	**6765**	6230	184	209	**235**	2.735	5.350	2.127
HZ 880M B	313.7	288290	**7130**	6600	196	221	**246**	2.738	5.353	2.127
HZ 880M C	320.5	299560	**7375**	6860	201	226	**252**	2.737	5.352	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	357.5	356530	**8360**	7735	244	262	**281**	3.258	5.656	2.598
HZ 880M B	381.6	382980	**8985**	8350	263	281	**300**	3.264	5.662	2.598
HZ 880M C	392.7	401480	**9395**	8770	272	290	**308**	3.264	5.662	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	373.0	383390	**9535**	8785	251	272	**293**	3.258	5.873	2.598
HZ 880M B	397.0	409660	**10140**	9385	270	291	**312**	3.264	5.879	2.598
HZ 880M C	408.1	428110	**10545**	9810	279	300	**320**	3.264	5.879	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
	Properties per meter of wall[1]							Per system		
	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	267.7	140740	**4135**	4635	174	192	**210**	2.427	4.372	2.030
HZ 880M A	257.0	218200	**4885**	5580	166	184	**202**	2.466	4.846	2.067
HZ 880M B	272.4	235460	**5300**	5955	178	196	**214**	2.469	4.847	2.067
HZ 880M C	279.4	247170	**5555**	6230	184	201	**219**	2.469	4.847	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	285.8	159260	**5165**	4730	182	203	**224**	2.427	4.653	2.030
HZ 880M A	274.9	250710	**6230**	5740	174	195	**216**	2.466	5.081	2.067
HZ 880M B	290.2	267360	**6615**	6120	186	207	**228**	2.469	5.084	2.067
HZ 880M C	297.1	278960	**6865**	6385	192	212	**233**	2.469	5.084	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	359.3	217210	**6665**	6135	252	267	**282**	2.912	4.876	2.464
HZ 880M A	339.4	341090	**8000**	7400	237	252	**266**	2.989	5.387	2.538
HZ 880M B	364.0	368180	**8640**	8025	257	271	**286**	2.995	5.393	2.538
HZ 880M C	375.4	387120	**9060**	8455	266	280	**295**	2.995	5.393	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	375.6	233250	**7570**	6935	260	277	**295**	2.912	5.138	2.464
HZ 880M A	355.2	368580	**9170**	8445	245	262	**279**	2.989	5.604	2.538
HZ 880M B	379.8	395490	**9790**	9060	264	281	**298**	2.995	5.611	2.538
HZ 880M C	391.2	414380	**10205**	9495	273	290	**307**	2.995	5.610	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	265.4	219590	**4915**	5615	170	189	**208**	2.466	4.846	2.067
HZ 880M B	280.8	236860	**5330**	5990	182	201	**220**	2.469	4.847	2.067
HZ 880M C	287.8	248570	**5585**	6265	188	207	**226**	2.469	4.847	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

Section	A	I_y	$W_{el.y}$ *	$W_{el.y}$ **	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	294.4	160680	**5210**	4775	186	208	**231**	2.427	4.653	2.030
HZ 880M A	283.4	252100	**6265**	5770	178	200	**222**	2.466	5.081	2.067
HZ 880M B	298.6	268750	**6650**	6155	190	212	**234**	2.469	5.084	2.067
HZ 880M C	305.6	280350	**6900**	6420	195	218	**240**	2.469	5.084	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

Section	A	I_y	$W_{el.y}$ *	$W_{el.y}$ **	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	366.4	218380	**6705**	6165	255	272	**288**	2.912	4.876	2.464
HZ 880M A	346.2	342230	**8025**	7425	241	256	**272**	2.989	5.387	2.538
HZ 880M B	370.9	369320	**8665**	8050	260	276	**291**	2.995	5.393	2.538
HZ 880M C	382.2	388260	**9085**	8480	269	284	**300**	2.995	5.393	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

Section	A	I_y	$W_{el.y}$ *	$W_{el.y}$ **	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	382.7	234420	**7610**	6970	263	282	**300**	2.912	5.138	2.464
HZ 880M A	362.1	369720	**9195**	8470	248	266	**284**	2.989	5.604	2.538
HZ 880M B	386.7	396630	**9815**	9085	267	285	**304**	2.995	5.611	2.538
HZ 880M C	398.1	415510	**10235**	9520	276	294	**312**	2.995	5.610	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	293.2	258430	**5785**	6610	184	207	**230**	2.732	5.112	2.027
HZ 880M B	308.8	276000	**6210**	6980	196	219	**242**	2.735	5.114	2.027
HZ 880M C	315.9	287940	**6470**	7255	202	225	**248**	2.735	5.113	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	311.4	291580	**7245**	6675	192	218	**244**	2.732	5.347	2.027
HZ 880M B	326.9	308520	**7630**	7065	204	230	**257**	2.735	5.350	2.027
HZ 880M C	334.0	320350	**7885**	7335	210	236	**262**	2.735	5.350	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	370.0	375690	**8810**	8155	253	272	**290**	3.255	5.653	2.498
HZ 880M B	395.0	403170	**9460**	8790	273	291	**310**	3.262	5.659	2.498
HZ 880M C	406.6	422410	**9885**	9225	282	300	**319**	3.261	5.659	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	386.1	403630	**10040**	9245	261	282	**303**	3.255	5.870	2.498
HZ 880M B	411.1	430910	**10665**	9875	280	301	**323**	3.262	5.877	2.498
HZ 880M C	422.6	450100	**11085**	10310	289	311	**332**	3.261	5.876	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	303.2	262220	**5870**	6705	189	213	**238**	2.733	5.113	2.027
HZ 880M B	318.8	279780	**6295**	7075	201	226	**250**	2.736	5.115	2.027
HZ 880M C	325.9	291730	**6555**	7350	207	231	**256**	2.736	5.115	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

Section	A	Iy	Wel.y*	Wel.y**	G60%	G80%	G100%	ALW	ALS	bsys
HZ 630M	333.4	202940	**6585**	6030	205	233	**262**	2.694	4.920	1.990
HZ 880M A	321.4	295380	**7340**	6760	197	225	**252**	2.733	5.348	2.027
HZ 880M B	336.9	312310	**7725**	7150	209	237	**264**	2.736	5.351	2.027
HZ 880M C	344.0	324140	**7980**	7420	215	242	**270**	2.736	5.351	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

Section	A	Iy	Wel.y*	Wel.y**	G60%	G80%	G100%	ALW	ALS	bsys
HZ 630M	399.6	254030	**7800**	7175	272	293	**314**	3.179	5.144	2.424
HZ 880M A	378.1	378770	**8885**	8220	257	277	**297**	3.257	5.655	2.498
HZ 880M B	403.1	406240	**9530**	8855	277	296	**316**	3.263	5.661	2.498
HZ 880M C	414.7	425480	**9955**	9295	286	306	**326**	3.262	5.660	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

Section	A	Iy	Wel.y*	Wel.y**	G60%	G80%	G100%	ALW	ALS	bsys
HZ 630M	416.2	270330	**8775**	8035	280	304	**327**	3.179	5.405	2.424
HZ 880M A	394.2	406700	**10115**	9315	264	287	**309**	3.257	5.872	2.498
HZ 880M B	419.2	433980	**10740**	9945	284	307	**329**	3.263	5.878	2.498
HZ 880M C	430.7	453170	**11160**	10385	293	316	**338**	3.262	5.877	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

Section	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}
	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	313.2	266030	5955	6805	193	220	246	2.734	5.114	2.027
HZ 880M B	328.8	283580	6380	7175	206	232	258	2.737	5.116	2.027
HZ 880M C	335.9	295530	6645	7445	211	238	264	2.737	5.116	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	331.5	299180	7435	6850	202	231	260	2.734	5.349	2.027
HZ 880M B	346.9	316110	7820	7240	214	243	272	2.737	5.353	2.027
HZ 880M C	354.0	327940	8070	7510	219	249	278	2.737	5.352	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	386.2	381850	8955	8285	261	282	303	3.258	5.656	2.498
HZ 880M B	411.2	409320	9605	8925	280	302	323	3.264	5.662	2.498
HZ 880M C	422.8	428560	10030	9360	289	311	332	3.264	5.661	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	402.3	409790	10195	9390	268	292	316	3.258	5.873	2.498
HZ 880M B	427.3	437060	10820	10015	288	312	335	3.264	5.879	2.498
HZ 880M C	438.8	456250	11240	10455	297	321	344	3.264	5.879	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	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	284.8	148160	4355	4880	185	204	224	2.293	4.238	1.890
HZ 880M A	272.9	231090	5175	5910	177	196	214	2.332	4.712	1.927
HZ 880M B	289.4	249590	5615	6315	190	209	227	2.335	4.713	1.927
HZ 880M C	296.9	262150	5895	6605	196	214	233	2.335	4.713	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	12600	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	292.2	265960	6610	6090	185	207	229	2.332	4.947	1.927
HZ 880M B	308.5	283800	7020	6500	198	220	242	2.335	4.950	1.927
HZ 880M C	316.0	296250	7290	6785	204	226	248	2.335	4.950	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	357.0	358610	8410	7780	250	265	280	2.855	5.253	2.398
HZ 880M B	383.0	387260	9085	8445	271	286	301	2.861	5.259	2.398
HZ 880M C	395.1	407300	9530	8895	280	295	310	2.861	5.259	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	373.7	387710	9645	8880	258	276	293	2.855	5.470	2.398
HZ 880M B	399.8	416160	10300	9535	279	296	314	2.861	5.477	2.398
HZ 880M C	411.8	436140	10740	9995	288	306	323	2.861	5.476	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
	Properties per meter of wall[1]							Per system		
	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	277.1	231690	5185	5925	179	198	218	2.332	4.712	1.927
HZ 880M B	293.6	250190	5630	6330	192	211	230	2.335	4.713	1.927
HZ 880M C	301.1	262760	5905	6620	198	217	236	2.335	4.713	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	308.5	168660	5470	5010	196	219	242	2.293	4.519	1.890
HZ 880M A	296.4	266560	6625	6105	187	210	233	2.332	4.947	1.927
HZ 880M B	312.7	284400	7035	6510	200	223	245	2.335	4.950	1.927
HZ 880M C	320.2	296850	7305	6795	206	229	251	2.335	4.950	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	382.2	228350	7010	6450	268	284	300	2.778	4.742	2.324
HZ 880M A	360.3	359100	8420	7790	252	267	283	2.855	5.253	2.398
HZ 880M B	386.4	387740	9095	8455	272	288	303	2.861	5.259	2.398
HZ 880M C	398.4	407780	9540	8905	282	297	313	2.861	5.259	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	399.5	245350	7965	7295	276	295	314	2.778	5.003	2.324
HZ 880M A	377.1	388200	9655	8895	260	278	296	2.855	5.470	2.398
HZ 880M B	403.1	416640	10315	9545	280	298	316	2.861	5.477	2.398
HZ 880M C	415.2	436620	10755	10005	290	308	326	2.861	5.476	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

Section	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}
	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	276.2	243630	**5455**	6230	178	198	**217**	2.477	4.856	1.927
HZ 880M B	292.7	262110	**5900**	6630	191	211	**230**	2.480	4.858	1.927
HZ 880M C	300.2	274680	**6175**	6920	197	216	**236**	2.479	4.858	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	307.6	180830	**5865**	5370	196	219	**241**	2.438	4.664	1.890
HZ 880M A	295.5	278500	**6920**	6375	187	209	**232**	2.477	5.092	1.927
HZ 880M B	311.8	296330	**7330**	6785	200	222	**245**	2.480	5.095	1.927
HZ 880M C	319.3	308770	**7600**	7070	206	228	**251**	2.479	5.095	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	381.4	238250	**7315**	6730	268	283	**299**	2.923	4.887	2.324
HZ 880M A	359.6	368690	**8645**	8000	251	267	**282**	3.000	5.398	2.398
HZ 880M B	385.7	397310	**9320**	8660	272	287	**303**	3.006	5.404	2.398
HZ 880M C	397.7	417350	**9765**	9115	281	297	**312**	3.006	5.404	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	398.8	255250	**8285**	7590	276	294	**313**	2.923	5.148	2.324
HZ 880M A	376.4	397780	**9895**	9115	259	277	**295**	3.000	5.615	2.398
HZ 880M B	402.4	426210	**10550**	9765	280	298	**316**	3.006	5.621	2.398
HZ 880M C	414.5	446190	**10990**	10225	289	307	**325**	3.006	5.621	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	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	297.6	163280	**4800**	5375	191	213	**234**	2.438	4.383	1.890
HZ 880M A	285.5	245920	**5505**	6290	183	203	**224**	2.477	4.856	1.927
HZ 880M B	302.0	264400	**5950**	6690	196	216	**237**	2.480	4.858	1.927
HZ 880M C	309.5	276970	**6225**	6980	202	222	**243**	2.479	4.858	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	304.8	280790	**6980**	6430	191	215	**239**	2.477	5.092	1.927
HZ 880M B	321.0	298620	**7385**	6835	204	228	**252**	2.480	5.095	1.927
HZ 880M C	328.5	311060	**7655**	7120	210	234	**258**	2.479	5.095	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	367.1	370530	**8690**	8040	255	272	**288**	3.000	5.398	2.398
HZ 880M B	393.1	399150	**9365**	8700	275	292	**309**	3.006	5.404	2.398
HZ 880M C	405.2	419190	**9810**	9155	285	301	**318**	3.006	5.404	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	383.9	399620	**9940**	9155	263	282	**301**	3.000	5.615	2.398
HZ 880M B	409.9	428050	**10595**	9805	283	303	**322**	3.006	5.621	2.398
HZ 880M C	421.9	448030	**11035**	10265	293	312	**331**	3.006	5.621	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	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	323.7	177180	**5210**	5835	204	229	**254**	2.512	4.457	1.890
HZ 880M A	311.1	259540	**5810**	6635	195	220	**244**	2.551	4.931	1.927
HZ 880M B	327.5	278020	**6255**	7030	208	232	**257**	2.554	4.933	1.927
HZ 880M C	335.0	290580	**6530**	7320	214	238	**263**	2.554	4.932	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	343.1	197070	**6395**	5855	212	241	**269**	2.512	4.738	1.890
HZ 880M A	330.3	294410	**7320**	6740	203	231	**259**	2.551	5.166	1.927
HZ 880M B	346.6	312230	**7725**	7150	216	244	**272**	2.554	5.169	1.927
HZ 880M C	354.1	324670	**7990**	7435	222	250	**278**	2.554	5.169	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	410.3	251450	**7720**	7100	281	302	**322**	2.997	4.961	2.324
HZ 880M A	387.6	381470	**8945**	8280	265	284	**304**	3.074	5.472	2.398
HZ 880M B	413.6	410080	**9620**	8940	285	305	**325**	3.081	5.479	2.398
HZ 880M C	425.7	430120	**10065**	9395	295	314	**334**	3.080	5.478	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	427.7	268460	**8715**	7980	289	313	**336**	2.997	5.223	2.324
HZ 880M A	404.4	410570	**10210**	9405	273	295	**317**	3.074	5.690	2.398
HZ 880M B	430.4	438980	**10865**	10055	293	315	**338**	3.081	5.696	2.398
HZ 880M C	442.4	458960	**11305**	10515	302	325	**347**	3.080	5.695	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	cm²/m	cm⁴/m	cm³/m	cm³/m	kg/m²	kg/m²	kg/m²	m²/m	m²/m	m
HZ 630M	313.1	169170	**4975**	5570	203	224	**246**	2.291	4.236	1.750
HZ 880M A	299.7	258160	**5780**	6600	193	214	**235**	2.330	4.710	1.787
HZ 880M B	317.5	278070	**6255**	7035	207	228	**249**	2.333	4.712	1.787
HZ 880M C	325.5	291620	**6555**	7350	214	235	**256**	2.333	4.711	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	334.1	190650	**6185**	5665	212	237	**262**	2.291	4.517	1.750
HZ 880M A	320.5	295760	**7350**	6770	202	227	**252**	2.330	4.945	1.787
HZ 880M B	338.0	314960	**7790**	7210	216	241	**265**	2.333	4.948	1.787
HZ 880M C	346.1	328380	**8085**	7520	223	247	**272**	2.333	4.948	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	407.4	249800	**7670**	7055	285	303	**320**	2.776	4.740	2.184
HZ 880M A	383.4	387930	**9100**	8420	268	284	**301**	2.853	5.251	2.258
HZ 880M B	411.0	418290	**9815**	9120	289	306	**323**	2.860	5.257	2.258
HZ 880M C	423.8	439570	**10285**	9600	299	316	**333**	2.859	5.257	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

Section	A	I_y	$W_{el,y}$*	$W_{el,y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	425.8	267890	**8695**	7965	294	314	**334**	2.776	5.002	2.184
HZ 880M A	401.2	418830	**10420**	9595	276	296	**315**	2.853	5.468	2.258
HZ 880M B	428.8	448980	**11115**	10285	298	317	**337**	2.860	5.475	2.258
HZ 880M C	441.6	470190	**11580**	10775	308	327	**347**	2.859	5.474	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	328.2	272220	**6095**	6960	207	232	**258**	2.403	4.783	1.787
HZ 880M B	345.9	292120	**6575**	7390	221	246	**272**	2.406	4.785	1.787
HZ 880M C	354.0	305670	**6870**	7700	227	252	**278**	2.406	4.785	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

Section	A	I_y	$W_{el.y}$*	$W_{el.y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	363.2	205020	**6650**	6090	226	255	**285**	2.365	4.590	1.750
HZ 880M A	349.0	309820	**7700**	7095	216	245	**274**	2.403	5.018	1.787
HZ 880M B	366.5	329010	**8140**	7535	230	259	**288**	2.406	5.022	1.787
HZ 880M C	374.6	342430	**8430**	7840	236	265	**294**	2.406	5.021	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

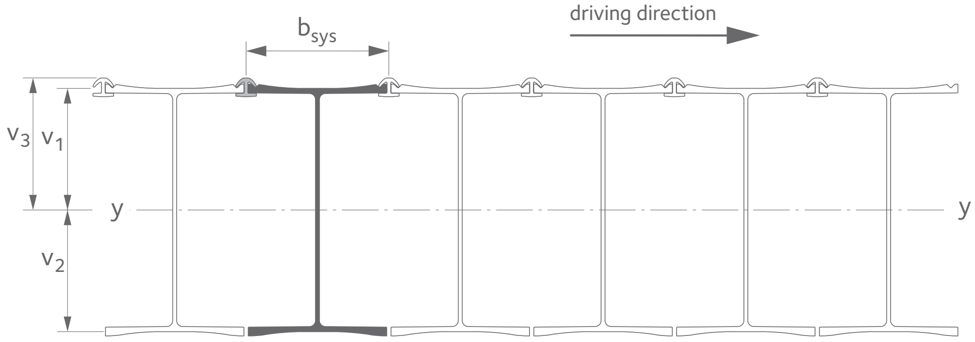
Section	A	I_y	$W_{el.y}$*	$W_{el.y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	430.7	261310	**8020**	7380	296	317	**338**	2.849	4.814	2.184
HZ 880M A	405.9	399060	**9360**	8660	278	298	**319**	2.927	5.325	2.258
HZ 880M B	433.5	429400	**10075**	9360	300	320	**340**	2.933	5.331	2.258
HZ 880M C	446.3	450680	**10545**	9845	310	330	**350**	2.932	5.330	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

Section	A	I_y	$W_{el.y}$*	$W_{el.y}$**	$G_{60\%}$	$G_{80\%}$	$G_{100\%}$	A_{LW}	A_{LS}	b_{sys}
HZ 630M	449.2	279410	**9070**	8305	305	329	**353**	2.849	5.075	2.184
HZ 880M A	423.7	429960	**10695**	9850	287	310	**333**	2.927	5.542	2.258
HZ 880M B	451.3	460090	**11390**	10540	308	331	**354**	2.933	5.548	2.258
HZ 880M C	464.1	481300	**11855**	11025	318	341	**364**	2.932	5.548	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

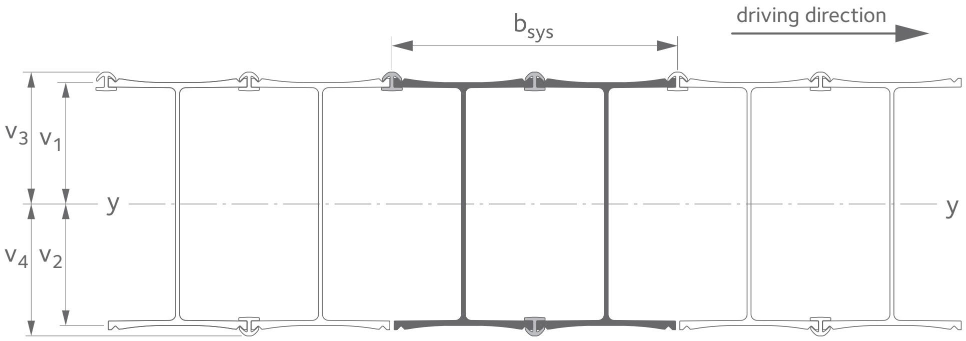
[1] Values taking the intermediary sheet piles into account.

Combination C 1



Section	Dimensions v_1	v_2	v_3	Properties per meter of wall A	G	I_y	$W_{el,y}$*	$W_{el,y}$**	Per system A_{LW}	A_{LS}	b_{sys}
	mm	mm	mm	cm²/m	kg/m²	cm⁴/m	cm³/m	cm³/m	m²/m	m²/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	380.2	423.2	414.6	671.0	**526.8**	823630	**19460**	19865	0.551	2.984	0.475
HZ 880M B	384.5	422.9	417.0	736.4	**578.1**	895380	**21175**	21475	0.554	2.986	0.475
HZ 880M C	387.3	424.1	417.7	766.9	**602.0**	946160	**22310**	22650	0.554	2.986	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



Section	Dimensions v_1	v_2	v_3	v_4	Properties per meter of wall A	G	I_y	$W_{el,y}$*	$W_{el,y}$**	Per system A_{LW}	A_{LS}	b_{sys}
	mm	mm	mm	mm	cm²/m	kg/m²	cm⁴/m	cm³/m	cm³/m	m²/m	m²/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	389.1	414.3	423.6	448.7	685.6	**538.2**	849130	**20500**	18925	1.074	3.526	0.950
HZ 880M B	392.3	415.1	424.7	447.6	750.3	**589.0**	919420	**22150**	20540	1.081	3.532	0.950
HZ 880M C	394.7	416.7	425.2	447.1	780.8	**613.0**	970120	**23285**	21695	1.080	3.531	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	532.6	554.7	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:

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

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

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

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 20m 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]).

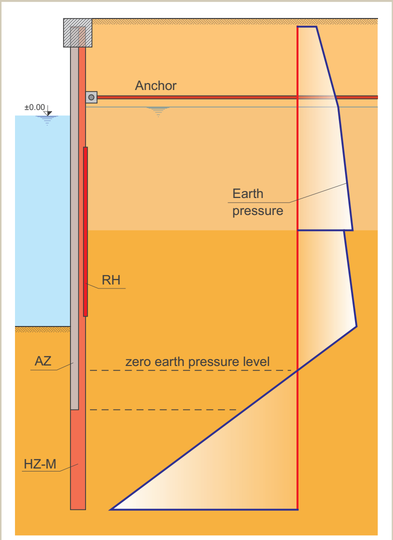


Fig. 2. Optimization of the length of the AZ infill sheet piles.

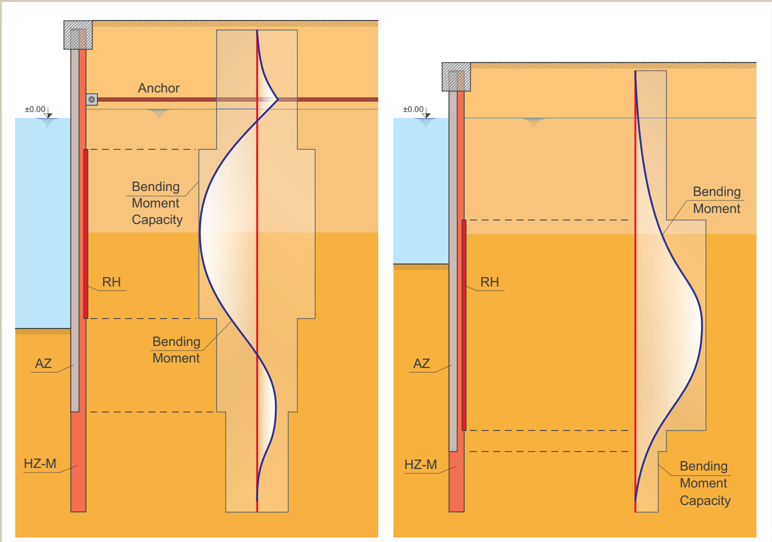


Fig. 3. Optimization of the bending moment capacity with additional RH connectors on the rear flange.

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.

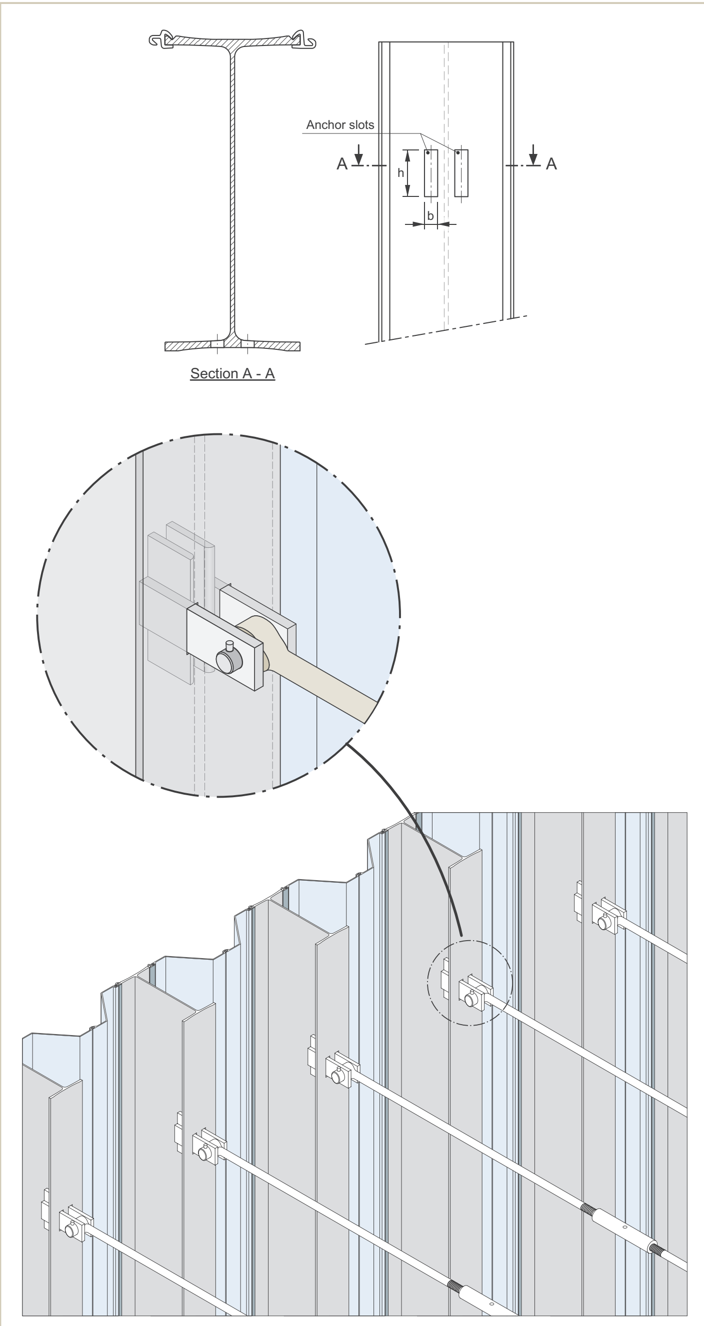


Fig. 4. Special tie-rod connection with T-connector for the HZ-M.

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.

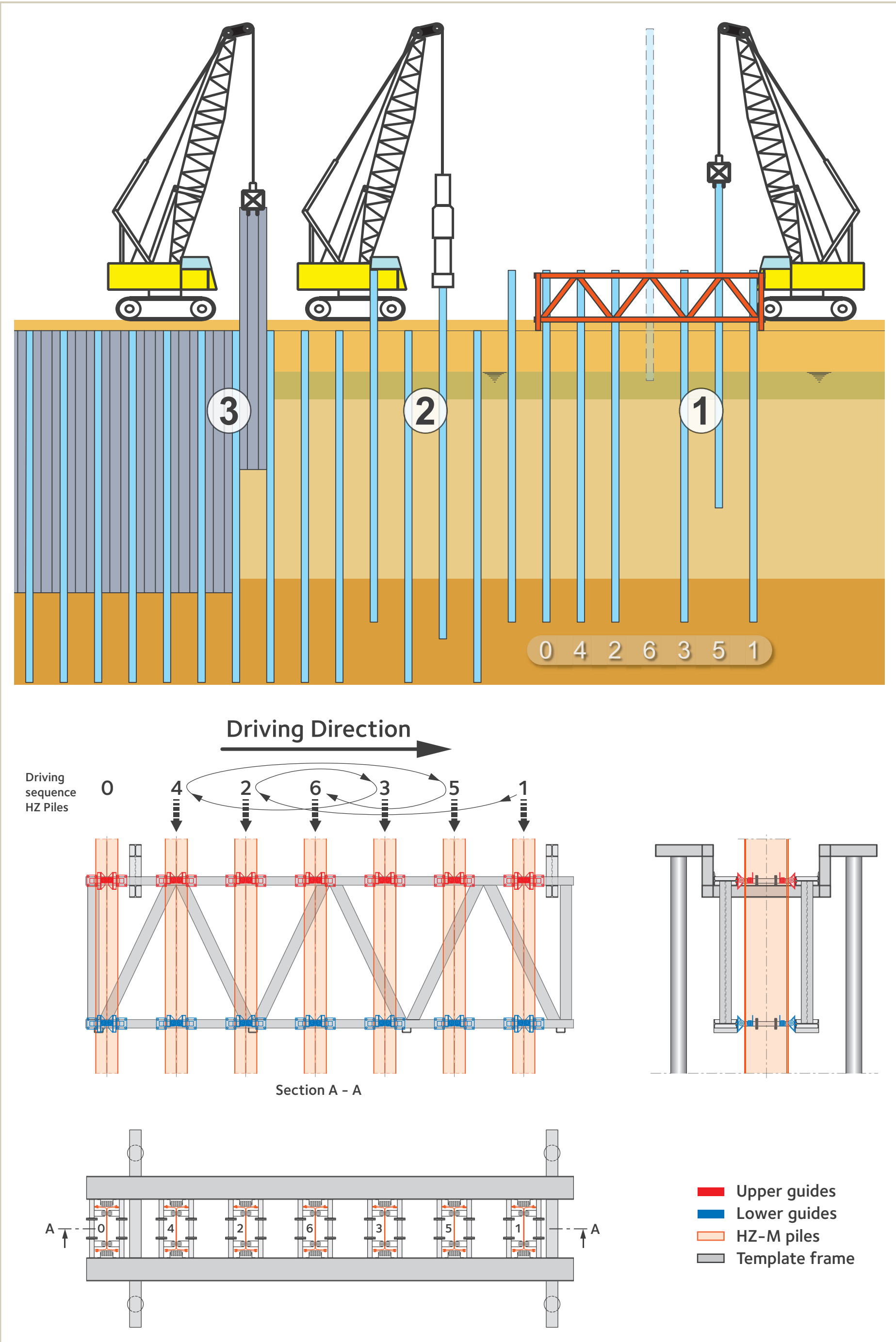


Fig. 7. Installation procedure: driving template and "Pilgrim's step" driving sequence.

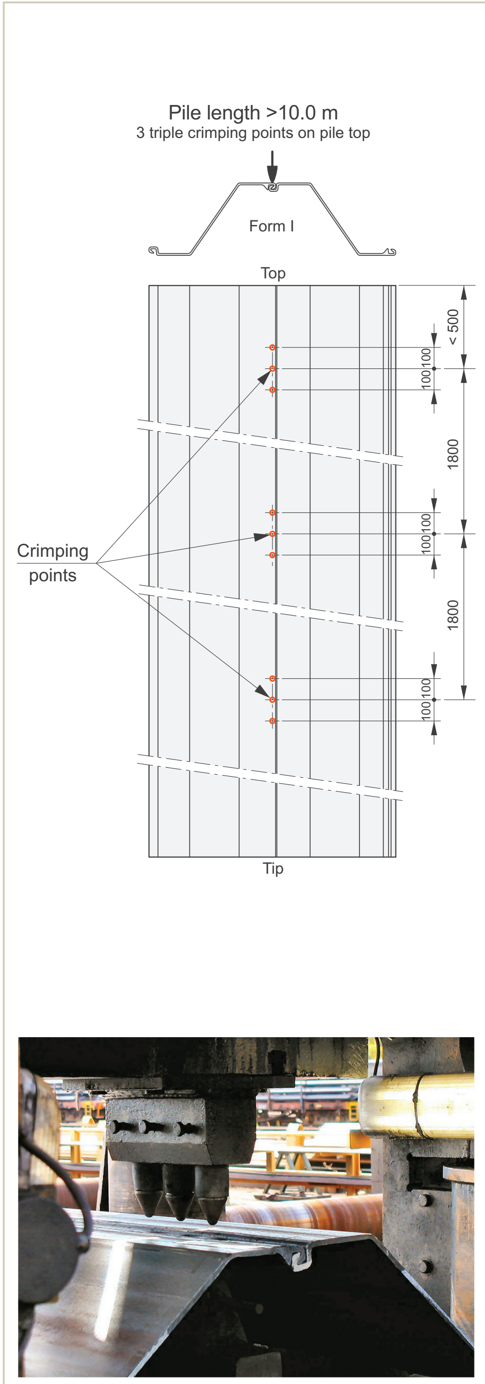


Fig. 8. Special crimping pattern for AZ infill sheet piles and crimping at the rolling mill.

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).

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. 9. Driving templates and their support.

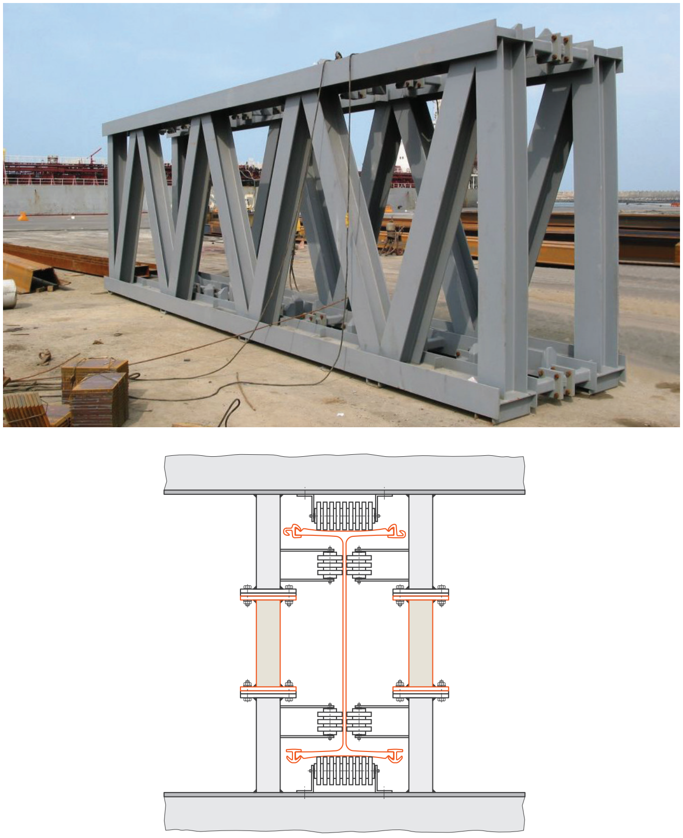


Fig. 10. Template and detail of guide.

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).

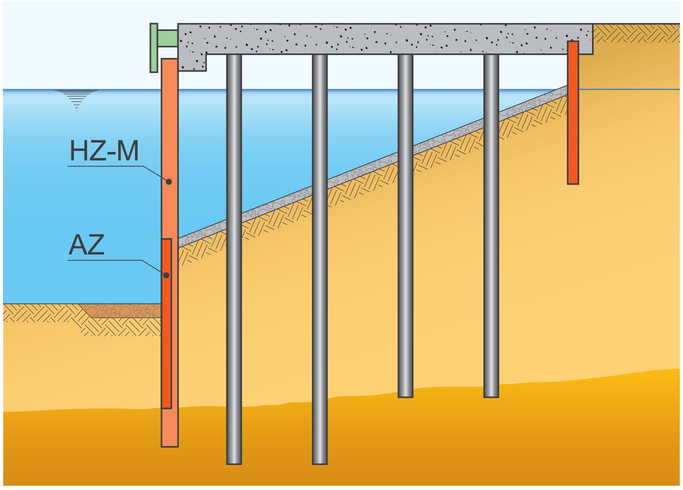


Fig. 12. Installation of AZ below water level with a follower on a vibratory hammer.

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.

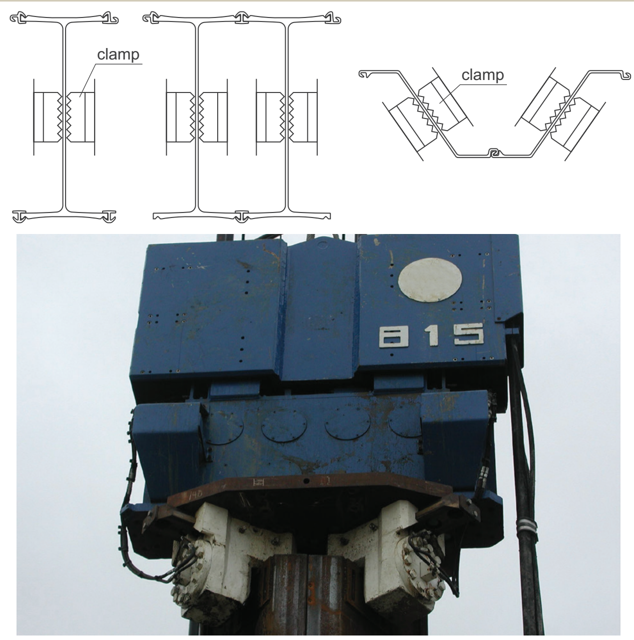


Fig. 13. Double clamps for a vibratory hammer.

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.

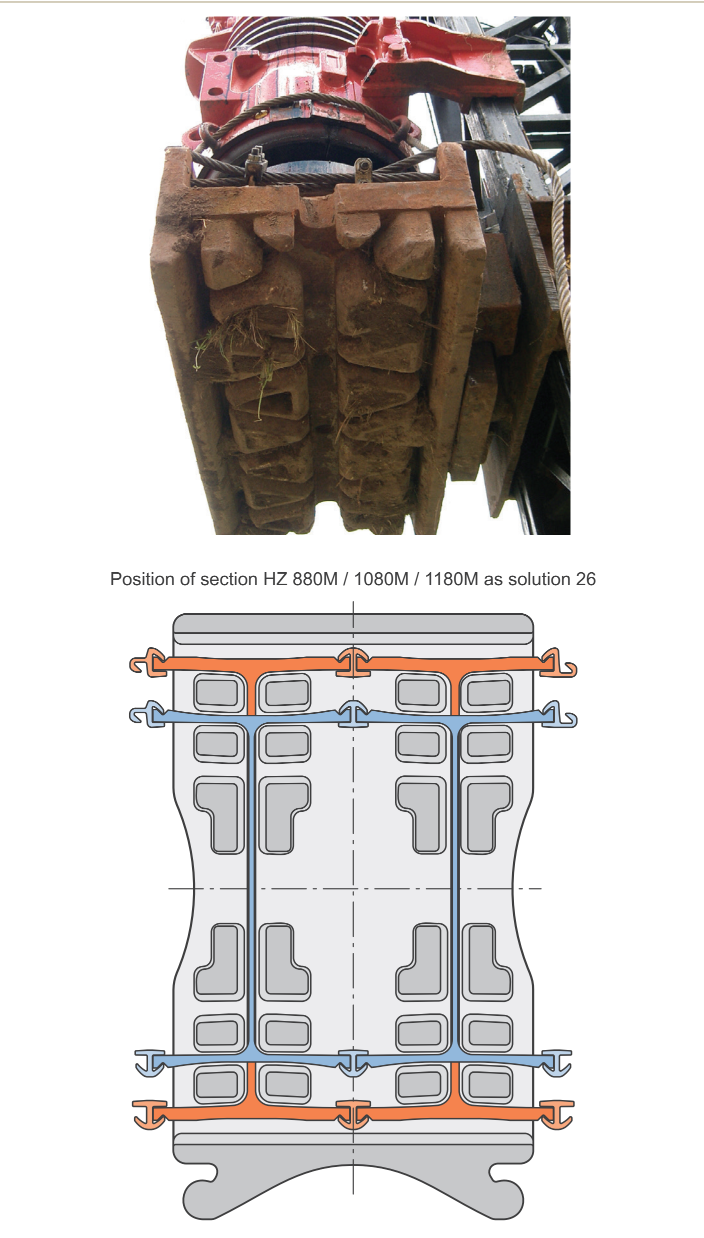


Fig. 14. Impact hammer driving cap.

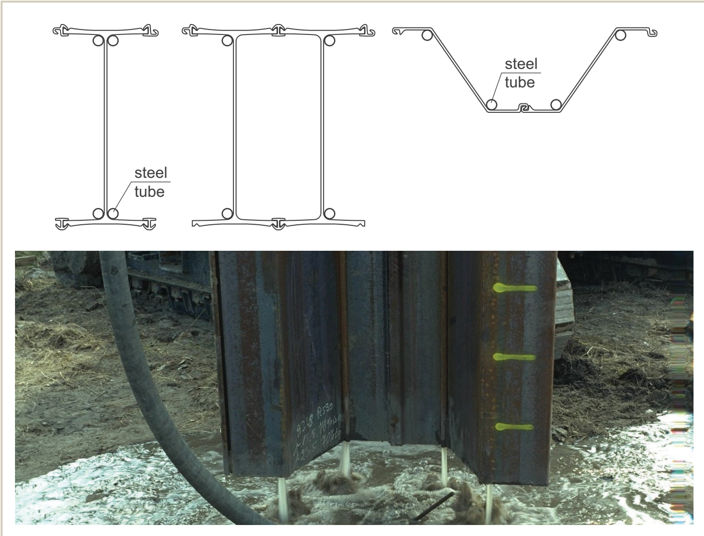
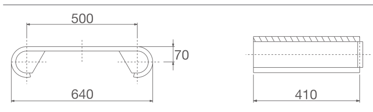
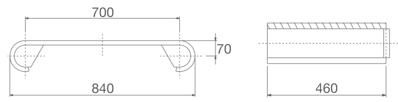


Fig. 15. Water jetting.

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.

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.

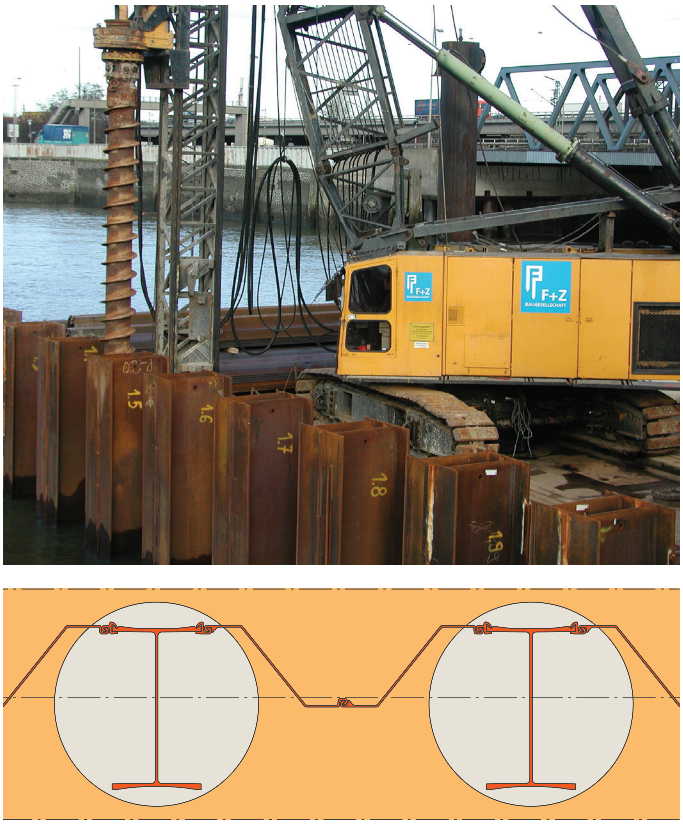


Fig. 16. Pre-drilling / augering for king piles.

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.

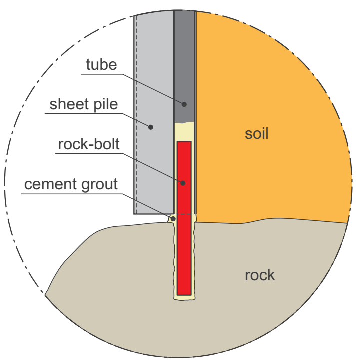


Fig. 18. Concept of a rock-bolt.

Durability

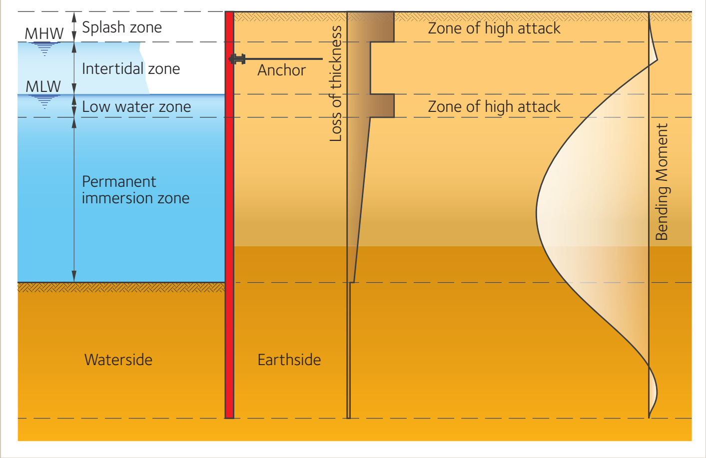
Generally, when designing temporary structures, corrosion does not have to be considered. For permanent structures, however, corrosion impact has to be analyzed for the service life. The loss of steel has an influence on the design of structures executed in marine environments. Atmospheric corrosion 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.

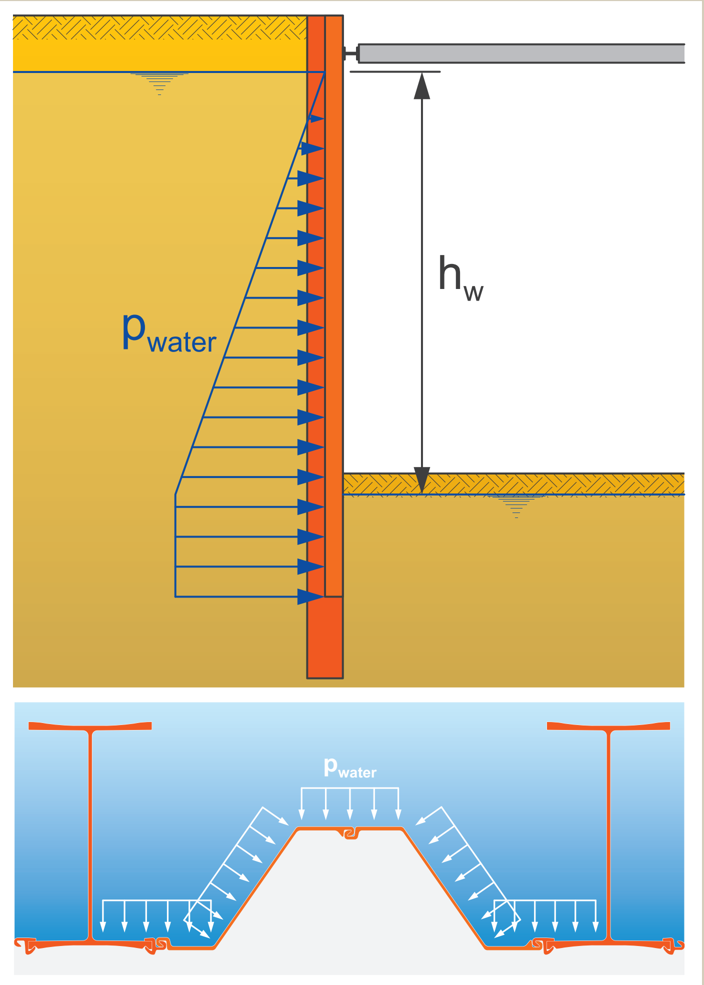


Fig. 19. HZ-M system under water pressure: assumptions.

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.

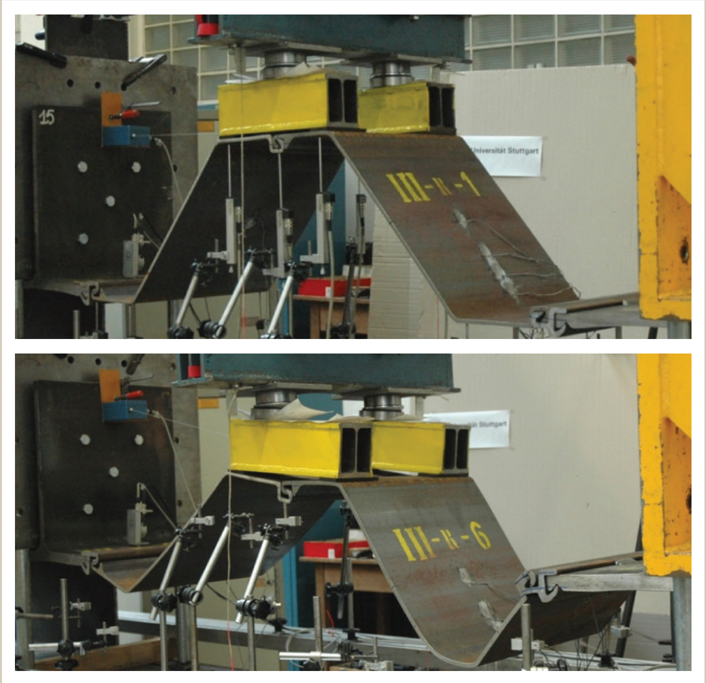


Fig. 20. Mechanical testing of the HZ-M system in the laboratory.

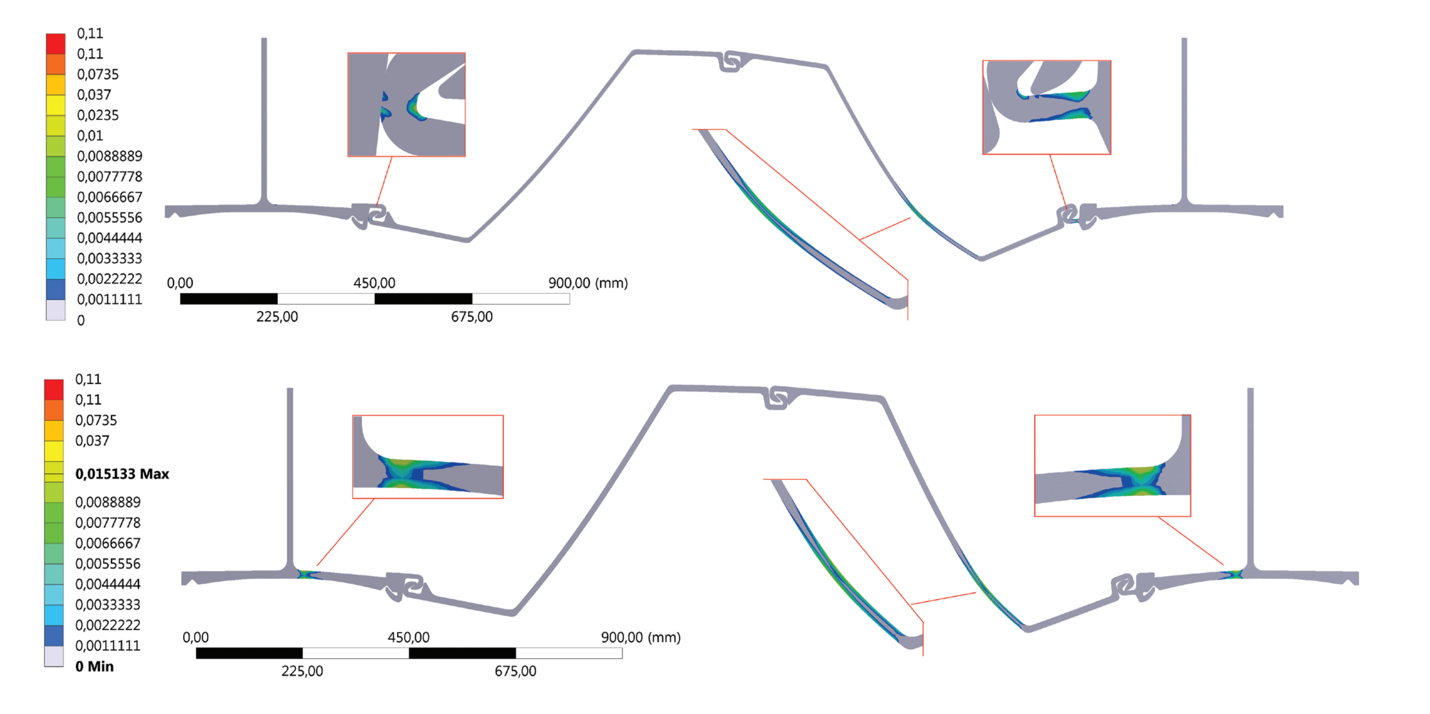


Fig. 21. Numerical simulation of an HZ/AZ combined wall under water pressure.

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 $\gamma_{M0} = 1.0$).

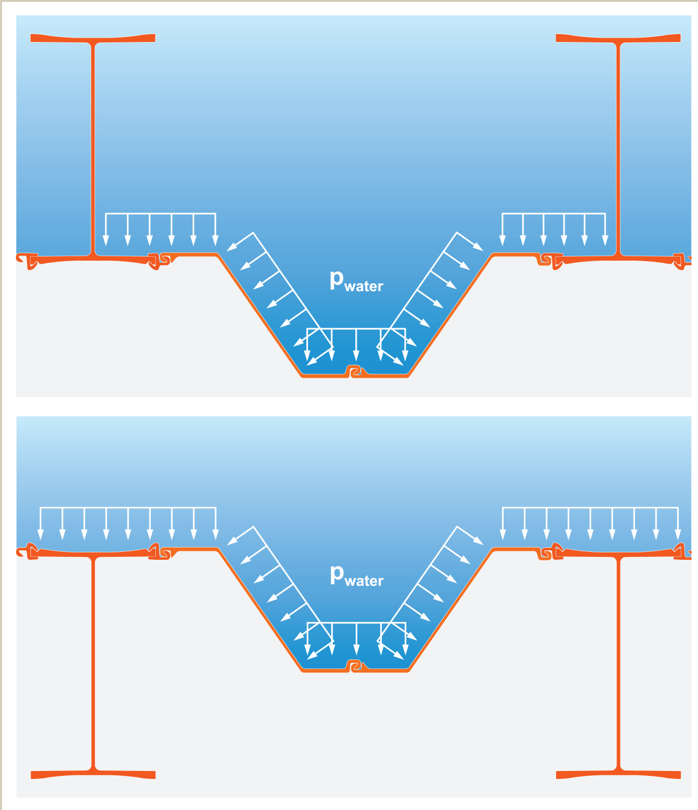


Fig. 22. AZ infill sheet piles under water pressure working in tension.

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

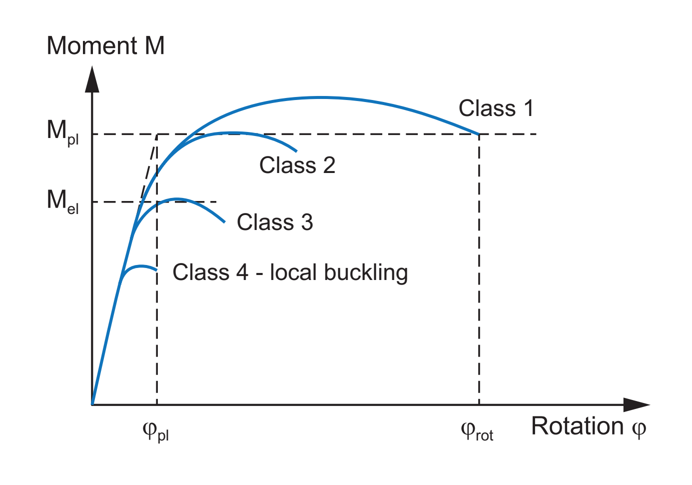
[1)] S 460 AP according to ArcelorMittal mill specification.

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}.



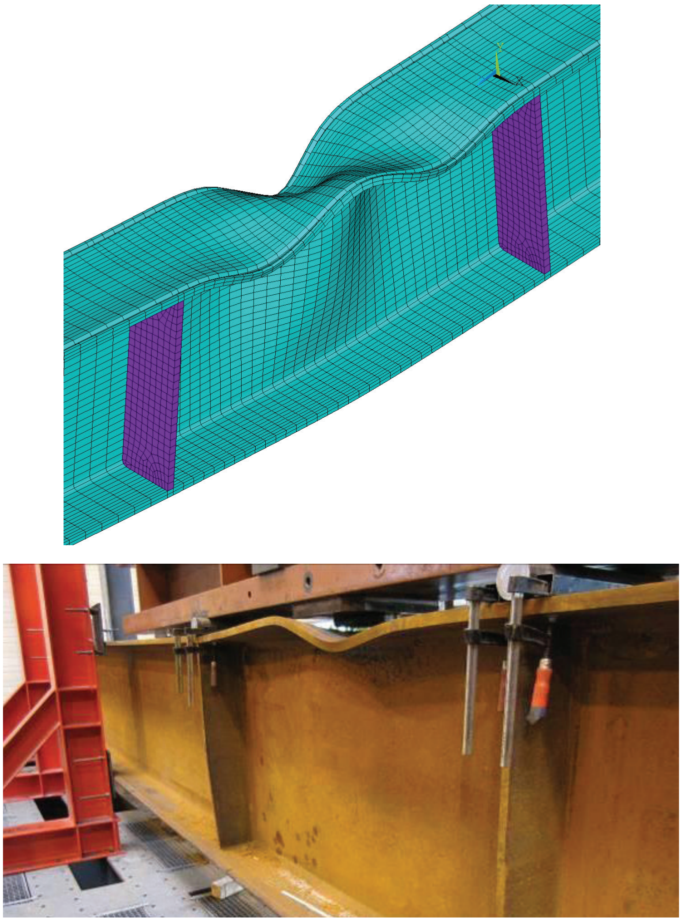
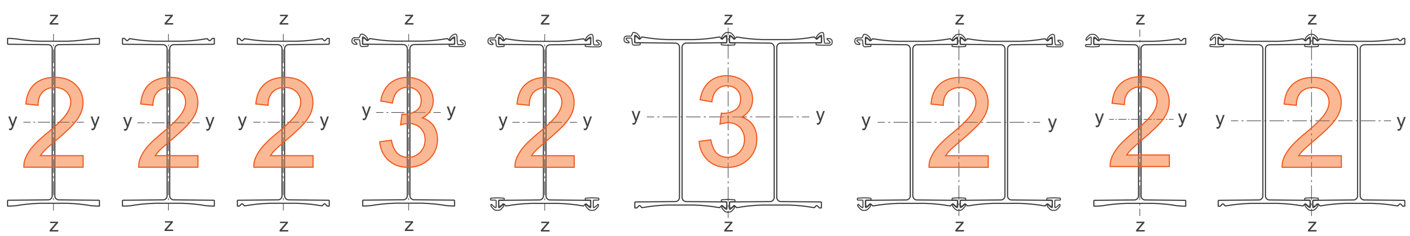


Fig. 23. Comparison between 4 point bending test and FEA simulation.



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.

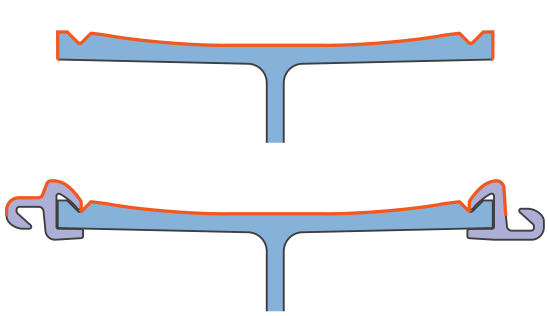


Fig. 25. Corrosion assumption: loss of steel thickness on outer flange.

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.

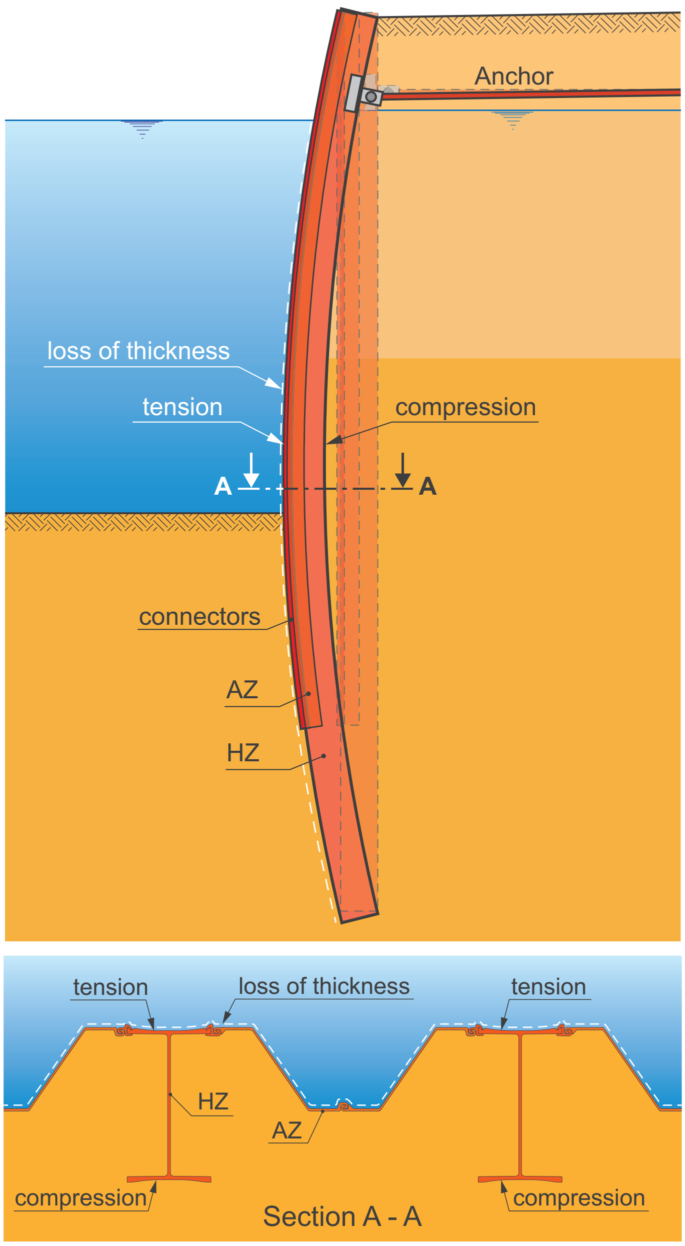


Fig. 27. Common configuration of an HZ/AZ combined wall system (typical cross section).

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.

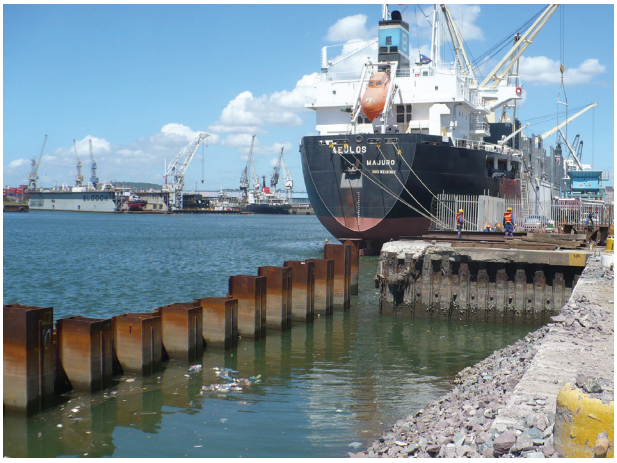
[2] For sheet pile applications, all HZ 1180M may be classified in class 1 with verification of the rotation capacity by appropriate calculation methods. Otherwise a class 2 should be chosen.

[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.

Conventions and Symbols

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.

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[1] EN 1993 - 5: Eurocode 3. Design of steel structures - Part 5: Piling. CEN.
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[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.
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HZ-M | Static moment & Plastic section modulus

Section	$W_{el,y}$	S_y	$W_{pl,y}$	$W_{el,y}$	S_y	$W_{pl,y}$	$W_{el,y}$	S_y	$W_{pl,y}$
	cm^3	cm^3	cm^3	cm^3	cm^3	cm^3	cm^3	cm^3	cm^3
	Sol. 100			Sol. 12			Sol. 26		
HZ 630M	7175	3940	**7880**	7385	4450	**8785**	17535	9505	**19010**
HZ 880M A	9030	4915	**9835**	9330	5605	**11075**	22430	12020	**24045**
HZ 880M B	9875	5415	**10830**	10190	6105	**12100**	24050	12995	**25985**
HZ 880M C	10420	5710	**11420**	10725	6400	**12690**	25115	13585	**27165**
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	8800	4850	**9700**	12030	6425	**12845**	9185	5245	**10460**
HZ 880M B	9625	5345	**10685**	12835	6910	**13820**	10035	5735	**11455**
HZ 880M C	10170	5640	**11275**	13365	7205	**14405**	10575	6030	**12040**
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	8760	4785	**9575**	19510	11165	**22260**	19350	10780	**21545**
HZ 880M B	9585	5270	**10545**	21170	12125	**24220**	20995	11755	**23490**
HZ 880M C	10130	5565	**11135**	22240	12735	**25400**	22070	12345	**24670**
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
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
4870	229	HZ 630M	12/AZ 25-800
4885	202	HZ 880M A	12/AZ 13-770
4915	208	HZ 880M A	12/AZ 14-770-10/10
4975	246	HZ 630M	12/AZ 18-10/10
5145	208	HZ 880M A	12/AZ 20-800
5165	224	HZ 630M	14/AZ 13-770
5175	211	HZ 880M A	12/AZ 20-800-10/10
5175	214	HZ 880M A	12/AZ 13-700
5185	218	HZ 880M A	12/AZ 13-700-10/10
5210	231	HZ 630M	14/AZ 14-770-10/10
5210	254	HZ 630M	12/AZ 26-700
5295	239	HZ 630M	12/AZ 28-750
5300	214	HZ 880M B	12/AZ 13-770
5330	220	HZ 880M B	12/AZ 14-770-10/10
5385	221	HZ 880M A	12/AZ 25-800
5395	269	HZ 630M	12/AZ 26
5410	247	HZ 630M	12/AZ 30-750
5450	239	HZ 630M	14/AZ 13-700
5455	217	HZ 880M A	12/AZ 18-700
5470	242	HZ 630M	14/AZ 13-700-10/10
5505	224	HZ 880M A	12/AZ 20-700
5525	255	HZ 630M	12/AZ 32-750
5545	220	HZ 880M B	12/AZ 20-800
5555	219	HZ 880M C	12/AZ 13-770
5580	223	HZ 880M B	12/AZ 20-800-10/10
5585	226	HZ 880M C	12/AZ 14-770-10/10
5600	230	HZ 630M	14/AZ 20-800
5615	227	HZ 880M B	12/AZ 13-700
5630	230	HZ 880M B	12/AZ 13-700-10/10
5650	234	HZ 630M	14/AZ 20-800-10/10
5780	235	HZ 880M A	12/AZ 18-10/10
5785	230	HZ 880M A	12/AZ 28-750
5790	233	HZ 880M B	12/AZ 25-800
5795	225	HZ 880M C	12/AZ 20-800
5810	244	HZ 880M A	12/AZ 26-700
5830	229	HZ 880M C	12/AZ 20-800-10/10
5865	241	HZ 630M	14/AZ 18-700
5870	238	HZ 880M A	12/AZ 30-750
5895	233	HZ 880M C	12/AZ 13-700
5900	230	HZ 880M B	12/AZ 18-700
5905	236	HZ 880M C	12/AZ 13-700-10/10
5940	249	HZ 630M	14/AZ 20-700
5950	237	HZ 880M B	12/AZ 20-700
5955	246	HZ 880M A	12/AZ 32-750
5960	243	HZ 630M	14/AZ 25-800
6040	238	HZ 880M C	12/AZ 25-800
6095	258	HZ 880M A	12/AZ 26
6175	236	HZ 880M C	12/AZ 18-700
6185	262	HZ 630M	14/AZ 18-10/10
6210	242	HZ 880M B	12/AZ 28-750
6225	243	HZ 880M C	12/AZ 20-700
6230	216	HZ 880M A	14/AZ 13-770
6255	249	HZ 880M B	12/AZ 18-10/10
6255	257	HZ 880M B	12/AZ 26-700
6265	222	HZ 880M A	14/AZ 14-770-10/10
6295	250	HZ 880M B	12/AZ 30-750
6380	258	HZ 880M B	12/AZ 32-750
6395	269	HZ 630M	14/AZ 26-700
6460	254	HZ 630M	14/AZ 28-750
6470	248	HZ 880M C	12/AZ 28-750
6495	221	HZ 880M A	14/AZ 20-800
6530	225	HZ 880M A	14/AZ 20-800-10/10
6530	263	HZ 880M C	12/AZ 26-700
6555	256	HZ 880M C	12/AZ 18-10/10
6555	256	HZ 880M C	12/AZ 30-750
6575	272	HZ 880M B	12/AZ 26
6585	262	HZ 630M	14/AZ 30-750
6610	229	HZ 880M A	14/AZ 13-700
6615	228	HZ 880M B	14/AZ 13-770
6625	233	HZ 880M A	14/AZ 13-700-10/10
6645	264	HZ 880M C	12/AZ 32-750
6650	234	HZ 880M B	14/AZ 14-770-10/10
6650	285	HZ 630M	14/AZ 26
6670	282	HZ 630M	24/AZ 13-770
6705	288	HZ 630M	24/AZ 14-770-10/10
6710	270	HZ 630M	14/AZ 32-750
6765	235	HZ 880M A	14/AZ 25-800
6865	233	HZ 880M B	14/AZ 20-800
6865	233	HZ 880M C	14/AZ 13-770
6870	278	HZ 880M C	12/AZ 26
6900	237	HZ 880M B	14/AZ 20-800-10/10
6900	240	HZ 880M C	14/AZ 14-770-10/10
6920	232	HZ 880M A	14/AZ 18-700
6965	285	HZ 630M	24/AZ 20-800
6980	239	HZ 880M A	14/AZ 20-700
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
7020	242	HZ 880M B	14/AZ 13-700
7035	245	HZ 880M B	14/AZ 13-700-10/10
7040	236	HZ 1080M A	12/AZ 14-770-10/10
7110	238	HZ 880M C	14/AZ 20-800
7130	235	HZ 1080M A	12/AZ 20-800
7130	246	HZ 880M B	14/AZ 25-800
7140	242	HZ 880M C	14/AZ 20-800-10/10
7150	239	HZ 1080M A	12/AZ 20-800-10/10
7245	244	HZ 880M A	14/AZ 28-750
7245	296	HZ 630M	24/AZ 25-800
7290	248	HZ 880M C	14/AZ 13-700
7305	251	HZ 880M C	14/AZ 13-700-10/10
7315	248	HZ 1080M A	12/AZ 25-800
7315	299	HZ 630M	24/AZ 18-700
7320	259	HZ 880M A	14/AZ 26-700
7330	245	HZ 880M B	14/AZ 18-700
7340	252	HZ 880M A	14/AZ 30-750
7350	252	HZ 880M A	14/AZ 18-10/10
7370	305	HZ 630M	24/AZ 20-700
7375	252	HZ 880M C	14/AZ 25-800
7385	252	HZ 880M B	14/AZ 20-700
7435	260	HZ 880M A	14/AZ 32-750
7475	244	HZ 1080M A	12/AZ 13-700
7485	247	HZ 1080M A	12/AZ 13-700-10/10
7565	238	HZ 1080M B	12/AZ 13-770
7570	295	HZ 630M	26/AZ 13-770
7590	245	HZ 1080M B	12/AZ 14-770-10/10
7600	251	HZ 880M C	14/AZ 18-700
7610	300	HZ 630M	26/AZ 14-770-10/10
7630	257	HZ 880M B	14/AZ 28-750
7655	258	HZ 880M C	14/AZ 20-700
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	274	HZ 880M A	14/AZ 26
7700	307	HZ 630M	24/AZ 28-750
7720	322	HZ 630M	24/AZ 26-700
7725	264	HZ 880M B	14/AZ 30-750
7725	272	HZ 880M B	14/AZ 26-700
7735	254	HZ 1080M A	12/AZ 20-700
7785	259	HZ 1080M A	12/AZ 28-750
7790	265	HZ 880M B	14/AZ 18-10/10
7800	314	HZ 630M	24/AZ 30-750
7820	272	HZ 880M B	14/AZ 32-750
7850	257	HZ 1080M B	12/AZ 25-800
7850	266	HZ 1080M A	12/AZ 30-750
7875	298	HZ 630M	26/AZ 20-800
7885	262	HZ 880M C	14/AZ 28-750
7895	320	HZ 630M	24/AZ 32-750
7915	274	HZ 1080M A	12/AZ 32-750
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
7980	270	HZ 880M C	14/AZ 30-750
7990	278	HZ 880M C	14/AZ 26-700
8000	266	HZ 880M A	24/AZ 13-770
8020	338	HZ 630M	24/AZ 26

Table of combinations sorted by ascending Elastic section modulus

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
8025	272	HZ 880M A	24/AZ 14-770-10/10
8065	254	HZ 1080M B	12/AZ 13-700
8070	278	HZ 880M C	14/AZ 32-750
8075	257	HZ 1080M B	12/AZ 13-700-10/10
8085	272	HZ 880M C	14/AZ 18-10/10
8140	288	HZ 880M B	14/AZ 26
8155	270	HZ 880M A	24/AZ 20-800
8170	309	HZ 630M	26/AZ 25-800
8180	273	HZ 880M A	24/AZ 20-800-10/10
8220	268	HZ 1080M A	12/AZ 18-10/10
8245	254	HZ 1080M C	12/AZ 13-770
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
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	319	HZ 630M	26/AZ 20-700
8360	281	HZ 880M A	24/AZ 25-800
8410	275	HZ 1080M B	12/AZ 30-750
8410	280	HZ 880M A	24/AZ 13-700
8420	283	HZ 880M A	24/AZ 13-700-10/10
8430	294	HZ 880M C	14/AZ 26
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
8565	284	HZ 1080M B	12/AZ 26-700
8640	286	HZ 880M B	24/AZ 13-770
8645	282	HZ 880M A	24/AZ 18-700
8665	291	HZ 880M B	24/AZ 14-770-10/10
8670	320	HZ 630M	26/AZ 28-750
8685	244	HZ 1080M A	14/AZ 13-770
8690	288	HZ 880M A	24/AZ 20-700
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
8775	327	HZ 630M	26/AZ 30-750
8780	249	HZ 1080M A	14/AZ 20-800
8780	289	HZ 880M B	24/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
8805	292	HZ 880M B	24/AZ 20-800-10/10
8810	290	HZ 880M A	24/AZ 28-750
8855	278	HZ 1080M B	12/AZ 18-10/10
8870	267	HZ 1080M D	12/AZ 13-770
8880	333	HZ 630M	26/AZ 32-750
8885	297	HZ 880M A	24/AZ 30-750
8895	273	HZ 1080M D	12/AZ 14-770-10/10
8930	271	HZ 1080M D	12/AZ 20-800
8945	304	HZ 880M A	24/AZ 26-700

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
8955	275	HZ 1080M D	12/AZ 20-800-10/10
8955	303	HZ 880M A	24/AZ 32-750
8985	262	HZ 1080M A	14/AZ 25-800
8985	300	HZ 880M B	24/AZ 25-800
9010	273	HZ 1080M C	12/AZ 18-700
9035	283	HZ 1080M C	12/AZ 28-750
9050	280	HZ 1080M C	12/AZ 20-700
9060	295	HZ 880M C	24/AZ 13-770
9070	353	HZ 630M	26/AZ 26
9085	300	HZ 880M C	24/AZ 14-770-10/10
9085	301	HZ 880M B	24/AZ 13-700
9095	303	HZ 880M B	24/AZ 13-700-10/10
9100	300	HZ 1080M B	12/AZ 26
9100	301	HZ 880M A	24/AZ 18-10/10
9105	291	HZ 1080M C	12/AZ 30-750
9120	284	HZ 1080M D	12/AZ 25-800
9170	279	HZ 880M A	26/AZ 13-770
9170	299	HZ 1080M C	12/AZ 32-750
9190	297	HZ 880M C	24/AZ 20-800
9195	284	HZ 880M A	26/AZ 14-770-10/10
9215	301	HZ 880M C	24/AZ 20-800-10/10
9220	252	HZ 1080M B	14/AZ 13-770
9245	259	HZ 1080M B	14/AZ 14-770-10/10
9260	259	HZ 1080M A	14/AZ 13-700
9275	263	HZ 1080M A	14/AZ 13-700-10/10
9290	300	HZ 1080M C	12/AZ 26-700
9295	257	HZ 1080M B	14/AZ 20-800
9315	282	HZ 880M A	26/AZ 20-800
9320	261	HZ 1080M B	14/AZ 20-800-10/10
9320	303	HZ 880M B	24/AZ 18-700
9325	277	HZ 1180M A	12/AZ 13-770
9345	285	HZ 880M A	26/AZ 20-800-10/10
9350	284	HZ 1180M A	12/AZ 14-770-10/10
9360	319	HZ 880M A	24/AZ 26
9365	309	HZ 880M B	24/AZ 20-700
9370	281	HZ 1180M A	12/AZ 20-800
9395	285	HZ 1180M A	12/AZ 20-800-10/10
9395	308	HZ 880M C	24/AZ 25-800
9460	310	HZ 880M B	24/AZ 28-750
9465	284	HZ 1080M D	12/AZ 13-700
9475	287	HZ 1080M D	12/AZ 13-700-10/10
9500	262	HZ 1080M A	14/AZ 18-700
9500	270	HZ 1080M B	14/AZ 25-800
9530	310	HZ 880M C	24/AZ 13-700
9530	316	HZ 880M B	24/AZ 30-750
9535	293	HZ 880M A	26/AZ 25-800
9540	313	HZ 880M C	24/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
9605	323	HZ 880M B	24/AZ 32-750
9615	281	HZ 1080M A	14/AZ 30-750

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
9620	325	HZ 880M B	24/AZ 26-700
9635	296	HZ 1080M C	12/AZ 18-10/10
9645	293	HZ 880M A	26/AZ 13-700
9655	296	HZ 880M A	26/AZ 13-700-10/10
9675	297	HZ 1080M D	12/AZ 28-750
9685	287	HZ 1080M D	12/AZ 18-700
9690	289	HZ 1080M A	14/AZ 32-750
9725	294	HZ 1080M D	12/AZ 20-700
9740	304	HZ 1080M D	12/AZ 30-750
9750	284	HZ 1180M B	12/AZ 13-770
9765	312	HZ 880M C	24/AZ 18-700
9775	290	HZ 1180M B	12/AZ 14-770-10/10
9785	287	HZ 1180M B	12/AZ 20-800
9790	298	HZ 880M B	26/AZ 13-770
9805	289	HZ 1080M A	14/AZ 26-700
9810	291	HZ 1180M B	12/AZ 20-800-10/10
9810	312	HZ 1080M D	12/AZ 32-750
9810	318	HZ 880M C	24/AZ 20-700
9815	304	HZ 880M B	26/AZ 14-770-10/10
9815	323	HZ 880M B	24/AZ 18-10/10
9835	269	HZ 1080M B	14/AZ 13-700
9845	272	HZ 1080M B	14/AZ 13-700-10/10
9875	268	HZ 1080M C	14/AZ 13-770
9885	318	HZ 1080M C	12/AZ 26
9885	319	HZ 880M C	24/AZ 28-750
9895	295	HZ 880M A	26/AZ 18-700
9900	275	HZ 1080M C	14/AZ 14-770-10/10
9920	301	HZ 880M B	26/AZ 20-800
9930	272	HZ 1080M C	14/AZ 20-800
9940	301	HZ 880M A	26/AZ 20-700
9950	295	HZ 1180M A	12/AZ 13-700
9950	304	HZ 880M B	26/AZ 20-800-10/10
9955	276	HZ 1080M C	14/AZ 20-800-10/10
9955	326	HZ 880M C	24/AZ 30-750
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
10030	332	HZ 880M C	24/AZ 32-750
10040	303	HZ 880M A	26/AZ 28-750
10065	334	HZ 880M C	24/AZ 26-700
10070	271	HZ 1080M B	14/AZ 18-700
10075	340	HZ 880M B	24/AZ 26
10085	282	HZ 1080M B	14/AZ 28-750
10115	278	HZ 1080M B	14/AZ 20-700
10115	309	HZ 880M A	26/AZ 30-750
10135	285	HZ 1080M C	14/AZ 25-800
10135	307	HZ 1180M A	12/AZ 28-750
10140	312	HZ 880M B	26/AZ 25-800
10155	290	HZ 1080M B	14/AZ 30-750
10160	284	HZ 1080M A	14/AZ 18-10/10
10170	298	HZ 1180M A	12/AZ 18-700
10195	316	HZ 880M A	26/AZ 32-750

Table of combinations sorted by ascending Elastic section modulus

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
10200	315	HZ 1180M A	12/AZ 30-750
10205	307	HZ 880M C	26/AZ 13-770
10210	305	HZ 1180M A	12/AZ 20-700
10210	317	HZ 880M A	26/AZ 26-700
10225	297	HZ 1080M B	14/AZ 32-750
10235	312	HZ 880M C	26/AZ 14-770-10/10
10265	323	HZ 1180M A	12/AZ 32-750
10285	333	HZ 880M C	24/AZ 18-10/10
10300	314	HZ 880M B	26/AZ 13-700
10305	296	HZ 1180M C	12/AZ 13-770
10315	316	HZ 880M B	26/AZ 13-700-10/10
10320	300	HZ 1180M C	12/AZ 20-800
10325	310	HZ 880M C	26/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
10355	313	HZ 880M C	26/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
10420	305	HZ 1180M B	12/AZ 13-700-10/10
10420	315	HZ 880M A	26/AZ 18-10/10
10430	306	HZ 1080M A	14/AZ 26
10445	325	HZ 1180M A	12/AZ 26-700
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
10545	320	HZ 880M C	26/AZ 25-800
10545	350	HZ 880M C	24/AZ 26
10550	288	HZ 1080M D	14/AZ 20-800-10/10
10550	316	HZ 880M B	26/AZ 18-700
10570	314	HZ 1180M B	12/AZ 28-750
10595	322	HZ 880M B	26/AZ 20-700
10610	333	HZ 1080M D	12/AZ 26
10625	305	HZ 1180M B	12/AZ 18-700
10635	321	HZ 1180M B	12/AZ 30-750
10665	312	HZ 1180M B	12/AZ 20-700
10665	323	HZ 880M B	26/AZ 28-750
10695	333	HZ 880M A	26/AZ 26
10700	329	HZ 1180M B	12/AZ 32-750
10725	298	HZ 1080M D	14/AZ 25-800
10740	323	HZ 880M C	26/AZ 13-700
10740	329	HZ 880M B	26/AZ 30-750
10745	298	HZ 1080M C	14/AZ 28-750
10755	326	HZ 880M C	26/AZ 13-700-10/10
10770	288	HZ 1080M C	14/AZ 18-700
10775	294	HZ 1080M B	14/AZ 18-10/10
10815	295	HZ 1080M C	14/AZ 20-700
10820	306	HZ 1080M C	14/AZ 30-750
10820	335	HZ 880M B	26/AZ 32-750
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
10865	338	HZ 880M B	26/AZ 26-700
10885	322	HZ 1180M A	12/AZ 18-10/10
10890	313	HZ 1080M C	14/AZ 32-750
10905	332	HZ 1180M B	12/AZ 26-700
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
10990	325	HZ 880M C	26/AZ 18-700
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
11035	331	HZ 880M C	26/AZ 20-700
11040	316	HZ 1080M B	14/AZ 26
11075	315	HZ 1080M C	14/AZ 26-700
11085	332	HZ 880M C	26/AZ 28-750
11115	337	HZ 880M B	26/AZ 18-10/10
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
11160	338	HZ 880M C	26/AZ 30-750
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
11240	344	HZ 880M C	26/AZ 32-750
11260	325	HZ 1180M C	12/AZ 20-700
11260	342	HZ 1180M C	12/AZ 32-750
11300	297	HZ 1180M B	14/AZ 13-770
11305	300	HZ 1180M B	14/AZ 20-800
11305	347	HZ 880M C	26/AZ 26-700
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
11390	354	HZ 880M B	26/AZ 26
11430	302	HZ 1080M D	14/AZ 18-700
11440	319	HZ 1080M D	14/AZ 30-750
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
11560	326	HZ 1180M D	12/AZ 13-700
11570	330	HZ 1180M D	12/AZ 13-700-10/10
11580	347	HZ 880M C	26/AZ 18-10/10
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
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
11855	364	HZ 880M C	26/AZ 26
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
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
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

Table of combinations sorted by ascending Elastic section modulus

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
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
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
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
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

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
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
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
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
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

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
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
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
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
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	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

Table of combinations sorted by ascending Elastic section modulus

$W_{el,y}$* cm³/m	$G_{100\%}$ kg/m²	Section	Combination
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	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
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
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
18590	446	HZ 1180M C	26/AZ 25-800
18595	436	HZ 1180M C	26/AZ 13-770
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
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

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