



The HZ[®]-M Steel Wall System

New standard
EN 10248 - Part 1: 2023



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.

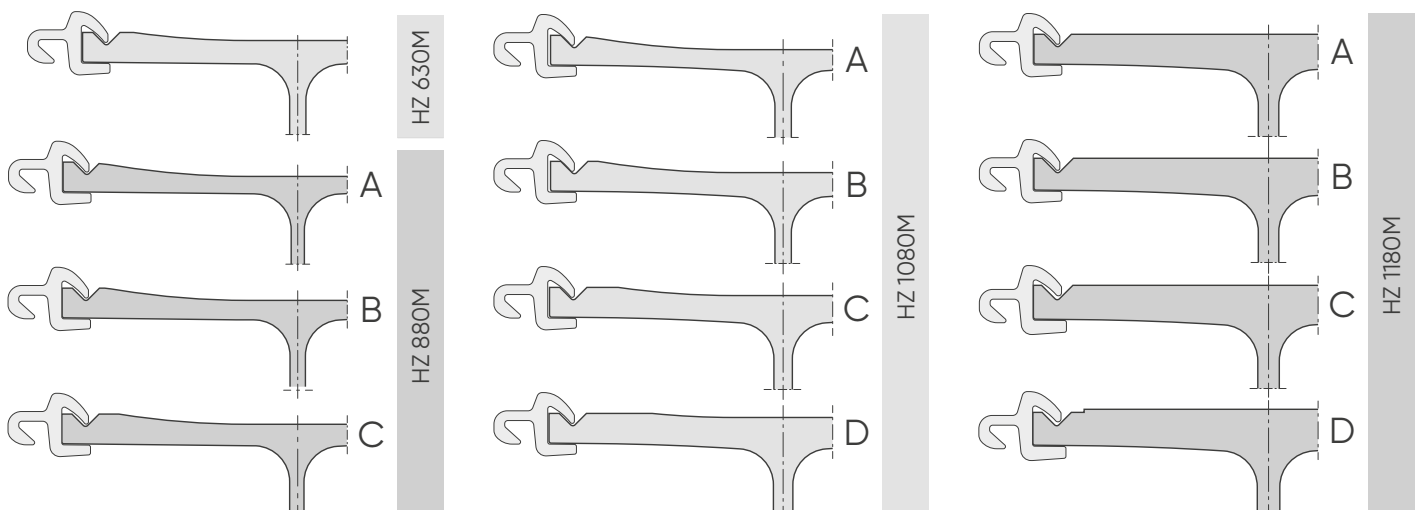
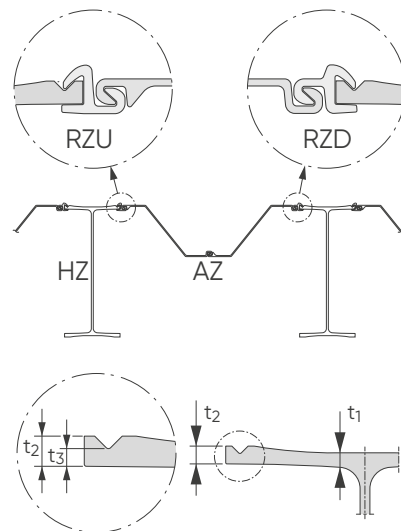
The main advantage of HZ-M king piles is the concave geometry of the flanges of the lighter sections, and the unmatched flange thickness of the heavier king pile sections with up to 40 mm.

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:

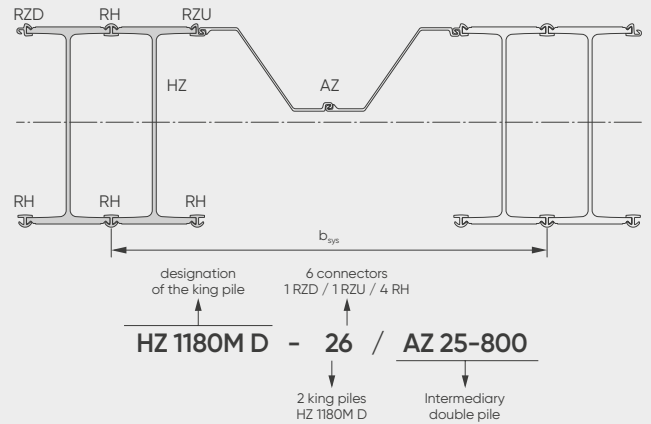
- it forms an almost straight wall on the water side/ excavation side;
- the depth of the HZ/AZ system is shallower, which is an advantage in tight situations (for instance, when installing a wall in front of an existing berthing facility);
- less impact of sea water corrosion on lifetime design (only 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 31).



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:

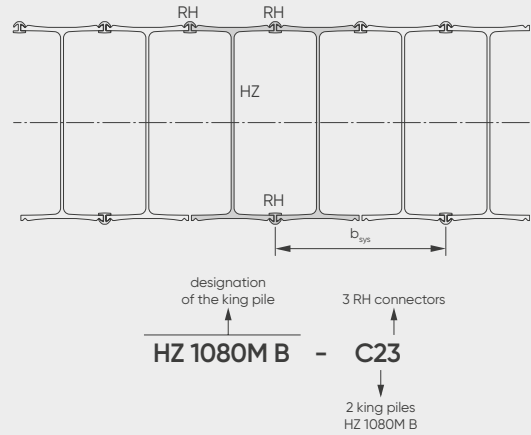
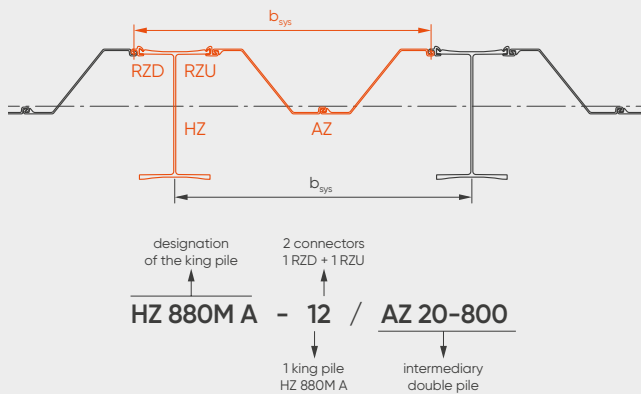
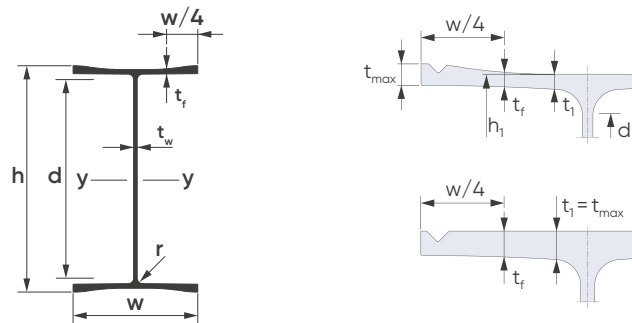


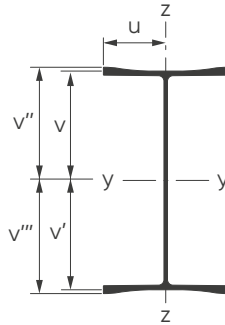
Fig.1. HZ/AZ steel wall system: definitions and designations.

HZ[®]-M - King piles



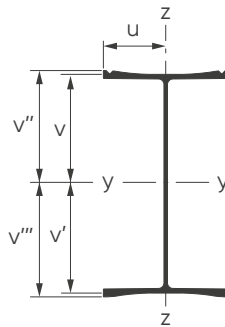
Section	h mm	h_1 mm	d mm	w mm	t_1 mm	t_{max} mm	t_f mm	t_w mm	r mm	A_v cm ²	Suitable connectors
HZ 630M	631.4	615.7	510.1	420	22.7	29.0	24.2	16.0	30	116.1	RZD/RZU 16 RH 16
HZ 880M A	831.3	803.4	709.6	458	16.9	29.0	18.9	13.0	30	120.0	RZD/RZU 16 RH 16
HZ 880M B	831.3	807.4	709.6	460	18.9	29.0	20.9	15.0	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



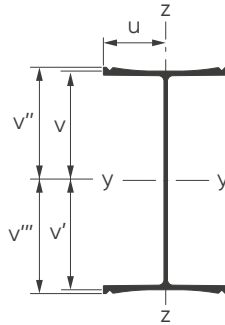
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	mm	mm	mm	mm	mm	cm ²	kg/m	cm ⁴	cm ⁴	cm ⁴	10 ³ cm ⁶	cm ³	cm ³	cm ³	m ² /m	m ² /m
HZ 630M	307.9	307.9	315.7	315.7	210.0	312.0	244.9	220860	34220	598.3	29450	7175	-	1630	0.421	2.430
HZ 880M A	401.7	401.7	415.7	415.7	229.0	299.8	235.3	362700	40000	399.0	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



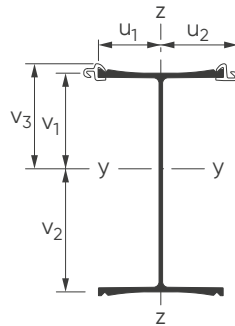
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	mm	mm	mm	mm	mm	cm ²	kg/m	cm ⁴	cm ⁴	cm ⁴	10 ³ cm ⁶	cm ³	cm ³	cm ³	m ² /m	m ² /m
HZ 630M	311.4	304.4	319.2	312.2	210.0	308.6	242.2	217460	33010	569.2	28410	6985	-	1570	0.440	2.430
HZ 880M A	406.1	397.3	420.1	411.3	229.0	296.6	232.8	357280	38650	375.0	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



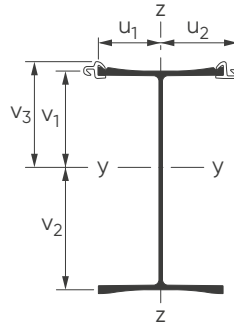
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	mm	mm	mm	mm	mm	cm ²	kg/m	cm ⁴	cm ⁴	cm ⁴	10 ³ cm ⁶	cm ³	cm ³	cm ³	m ² /m	m ² /m
HZ 630M	307.9	307.9	315.7	315.7	210.0	305.1	239.5	214130	31800	543.5	27440	6955	-	1515	0.440	2.449
HZ 880M A	401.7	401.7	415.7	415.7	229.0	293.4	230.3	351980	37300	352.1	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



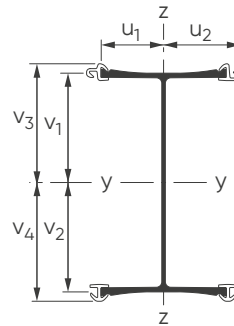
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	mm	mm	mm	mm	mm	cm ²	kg/m	cm ⁴	cm ⁴	cm ⁴	10 ³ cm ⁶	cm ³	cm ³	cm ³	m ² /m	m ² /m
HZ 630M	272.1	343.6	300.3	209.9	263.9	346.2	271.8	247130	52190	702.2	38320	7190	8230	1980	0.582	2.546
HZ 880M A	352.4	451.0	386.8	228.8	282.9	334.5	262.6	410130	61300	503.4	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



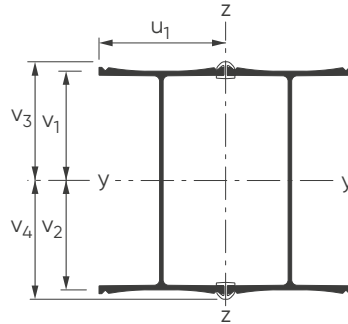
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	mm	mm	mm	mm	mm	cm ²	kg/m	cm ⁴	cm ⁴	cm ⁴	10 ³ cm ⁶	cm ³	cm ³	cm ³	m ² /m	m ² /m
HZ 630M	275.5	340.2	303.8	209.9	263.9	349.7	274.5	251260	53400	725.6	40250	7385	8270	2025	0.582	2.527
HZ 880M A	356.7	446.7	391.1	228.8	282.9	337.7	265.1	416790	62650	526.1	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



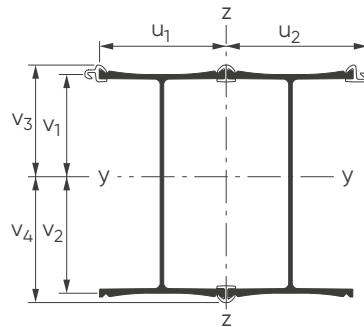
Section	Dimensions						Properties per solution										
	v ₁	v ₂	v ₃	v ₄	u ₁	u ₂	A	G	I _y	I _z	I _t	I _ω	W _{el,y} *	W _{el,y} **	W _{el,z}	A _{LW}	A _{LS}
	mm	mm	mm	mm	mm	mm	cm ²	kg/m	cm ⁴	cm ⁴	cm ⁴	10 ³ cm ⁶	cm ³	cm ³	cm ³	m ² /m	m ² /m
HZ 630M	307.5	308.3	335.7	336.6	209.9	263.9	386.5	303.4	288850	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



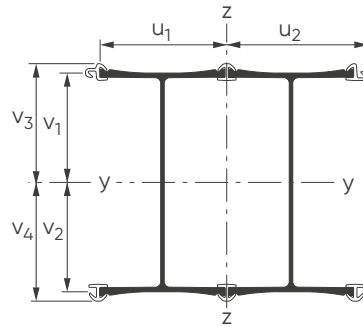
Section	Dimensions					Properties per solution										
	v ₁	v ₂	v ₃	v ₄	u ₁	A	G	I _y	I _z	I _t	I _ω	W _{el,y} *	W _{el,y} **	W _{el,z}	A _{LW}	A _{LS}
	mm	mm	mm	mm	mm	cm ²	kg/m	cm ⁴	cm ⁴	cm ⁴	10 ³ cm ⁶	cm ³	cm ³	cm ³	m ² /m	m ² /m
HZ 630M	307.9	307.9	336.2	336.2	427.0	650.4	510.6	465570	351040	238756	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



Section	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}
	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	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



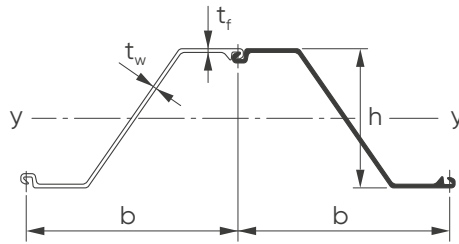
Section	Dimensions						Properties per solution										
	v_1	v_2	v_3	v_4	u_1	u_2	A	G	I_y	I_z	I_t	I_w	$W_{el,y}^*$	$W_{el,y}^{**}$	$W_{el,z}$	A_{LW}	A_{LS}
	mm	mm	mm	mm	mm	mm	cm ²	kg/m	cm ⁴	cm ⁴	cm ⁴	10 ³ cm ⁶	cm ³	cm ³	cm ³	m ² /m	m ² /m
HZ 630M	307.6	308.1	336.0	336.4	426.9	480.9	731.8	574.5	540280	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

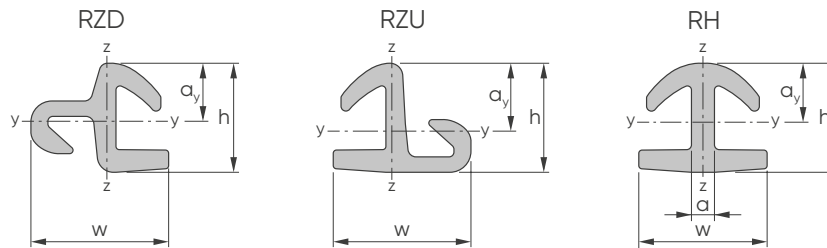


AZ[®] - Intermediary piles



Section	Dimensions				Properties per double pile					
	h	b	t _f	t _w	A	G	I _y	W _{el,y}	i _y	A _{LW}
	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



Section	Dimensions				Properties							
	h	w	a	a _y	A	G	I _y	I _z	W _{el,y}	W _{el,z}	A _{LW}	A _{LS}
	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.

Tolerances

Standard EN 10248-2	HZ [®] -M	AZ [®]
Mass ¹⁾	± 5 %	± 5 %
Length (L)	± 200 mm	± 200 mm
Thicknesses (t _f , t _w)	t _f , t _w > 12.5 mm: + 2.5 mm / - 1.5 mm	t _f , t _w > 8.5 mm: ± 6 %
Height (h)	h ≥ 500 mm: ± 7 mm	h ≥ 300 mm: ± 7 mm
Width single pile	± 2 % w	± 2 % b
Width double piles	-	± 3 % (2b)
Straightness (q)	≤ 0.2 % L	≤ 0.2 % L
Ends out of square	± 2 % w	± 2 % b

¹⁾ From the mass of the total delivery.

Maximum rolling length²⁾

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

²⁾ Longer sections may be supplied. Please contact us.

Section	EN 10248-1							ASTM	
	S 240 GP	S 270 GP	S 320 GP	S 355 GP	S 390 GP	S 430 GP	S 460 GP	A 572	A 690
HZ	✓ ³⁾	✓	✓	✓	✓	✓	✓	✓	✓
AZ	✓ ³⁾	✓	✓	✓	✓	✓	✓	✓	✓ ³⁾
RH / RZD / RZU	✗	✗	✗	✗	✗	✓	✓	✗	✓

³⁾ Please contact us as some limitations may apply. ✓ available ✗ currently unavailable

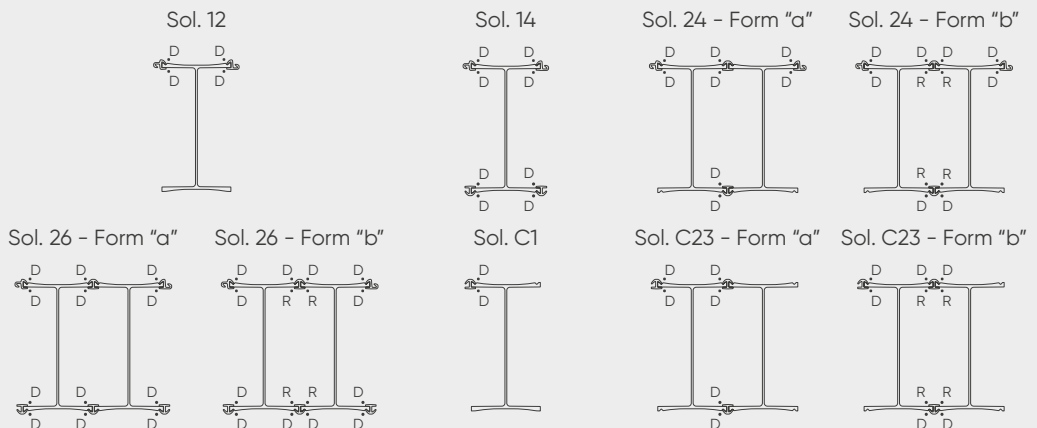
Steel grades

Standard EN 10248-1	Min. yield strength		Min. tensile strength		Min. elongation L ₀ = 5.65 √s ₀	Minimum impact energy KV ₂	
	R _{eH}	R _m	Testing temperature			Joules	
	MPa	MPa	°C	J			
S 240 GP	240	340	20	27			
S 270 GP	270	410	20	27			
S 320 GP	320	440	20	27			
S 355 GP	355	480	0	27			
S 390 GP	390	490	0	27			
S 430 GP	430	510	0	27			
S 460 GP	460	530	0	27			

Contact us for enquiries on S 500 GP steel grade.

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



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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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

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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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

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

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

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.

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Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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

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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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
Combination HZ ... M - 12 / AZ 14-770-10/10										
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										
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										
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										
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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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

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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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

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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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

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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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

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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

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

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

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

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

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.

Section	Properties per meter of wall ¹⁾						Per system			
	A	I _y	W _{ely} *	W _{ely} **	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

Combination HZ ... M - 12 / AZ 26

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

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

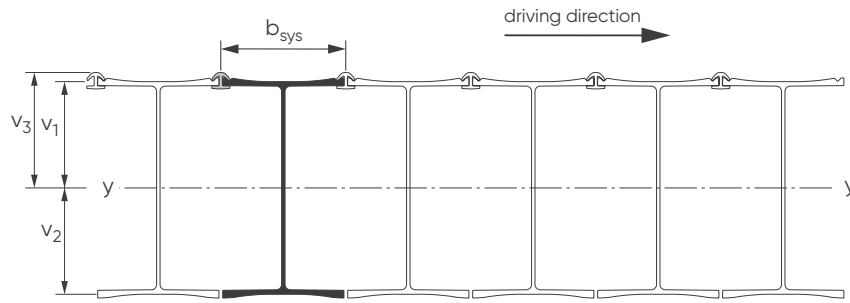
HZ 630M	430.7	261310	8020	7380	296	317	338	2.849	4.814	2.184
HZ 880M A	405.9	399060	9360	8660	278	298	319	2.927	5.325	2.258
HZ 880M B	433.5	429400	10075	9360	300	320	340	2.933	5.331	2.258
HZ 880M C	446.3	450680	10545	9845	310	330	350	2.932	5.330	2.258
HZ 1080M A	471.5	733500	13330	12545	330	350	370	2.919	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

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

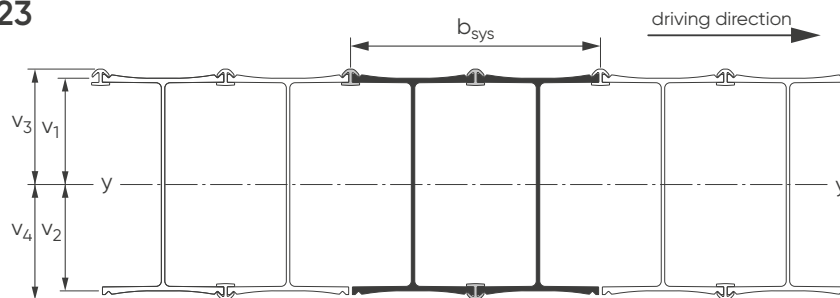
¹⁾ Values taking the intermediary sheet piles into account.

Combination C 1



Section	Dimensions			Properties per meter of wall					Per system		
	v_1	v_2	v_3	A	G	I_y	$W_{el,y}^*$	$W_{el,y}^{**}$	A_{LW}	A_{LS}	b_{sys}
	mm	mm	mm	cm ² /m	kg/m ²	cm ⁴ /m	cm ³ /m	cm ³ /m	m ² /m	m ² /m	m
HZ 630M	292.6	323.2	320.9	757.3	594.5	542340	16780	16900	0.513	2.500	0.434
HZ 880M A	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				Properties per meter of wall					Per system		
	v_1	v_2	v_3	v_4	A	G	I_y	$W_{el,y}^*$	$W_{el,y}^{**}$	A_{LW}	A_{LS}	b_{sys}
	mm	mm	mm	mm	cm ² /m	kg/m ²	cm ⁴ /m	cm ³ /m	cm ³ /m	m ² /m	m ² /m	m
HZ 630M	298.7	317.0	327.1	345.3	772.5	606.4	557210	17580	16135	0.998	2.992	0.868
HZ 880M A	389.1	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):

$$I_{sys} = I_{HZ} + I_{AZ}$$

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

$$I_{sys/m} = \frac{I_{HZ} + I_{AZ}}{b_{sys}}$$

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):

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

- bending moment transmitted to the intermediary AZ sheet pile:

$$M_{AZ} = \left(\frac{I_{AZ}}{I_{sys}} M_{sys} \right) b_{sys}$$

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:

$$\begin{aligned} \sigma_{HZ} &= \frac{M_{HZ}}{W_{HZ}} = \left(\frac{1}{W_{HZ}} \right) \left(\frac{I_{HZ}}{I_{sys}} M_{sys} \right) b_{sys} \\ &= \frac{1}{W_{HZ,eq}} M_{sys} \end{aligned}$$

where $W_{HZ,eq} = \frac{I_{sys}}{b_{sys} \max(v_1, v_2)}$

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_{ely} .

For the connectors RH / RZD / RZU:

$$\begin{aligned} \sigma_{RH/RZ} &= \frac{M_{HZ}}{W_{RH/RZ}} = \left(\frac{1}{W_{RH/RZ}} \right) \left(\frac{I_{HZ}}{I_{sys}} M_{sys} \right) b_{sys} \\ &= \frac{1}{W_{RH/RZ,eq}} M_{sys} \end{aligned}$$

where $W_{RH/RZ,eq} = \frac{I_{sys}}{b_{sys} \max(v_3, v_4)}$

Note:

" $W_{RH/RZ,eq}$ " is labelled in the tables of this brochure as W_{ely} .

For the AZ infill sheet piles:

$$\sigma_{AZ} = \frac{M_{AZ}}{W_{AZ}} = \frac{\frac{I_{AZ}}{I_{sys}} M_{sys} b_{sys}}{W_{AZ}}$$

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 A690, 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_{ely}^* and W_{ely}^{**} 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- Part 1 [2]). Recommendations and advice for efficient design of combined steel walls according to the Eurocodes can be found in [12].



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

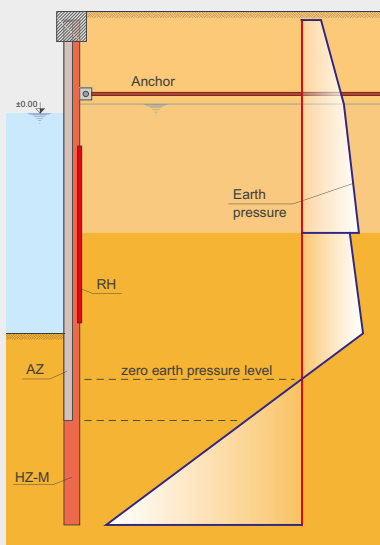


Fig. 2. Optimization of the length of the AZ infill sheet piles.

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 cm³/m to 3 200 cm³/m.

Driveability is an additional key factor that should be analysed when choosing the infill sheet piles. In normal driving conditions, infill sheet piles above 20 m should have a section modulus above 2 000 cm³/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]).

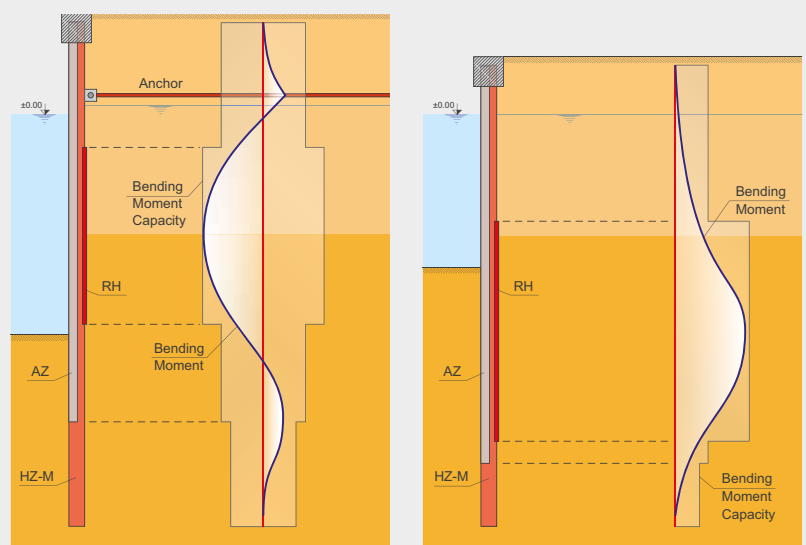


Fig. 3. Optimization of the bending moment capacity with additional RH connectors on the rear flange.

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.

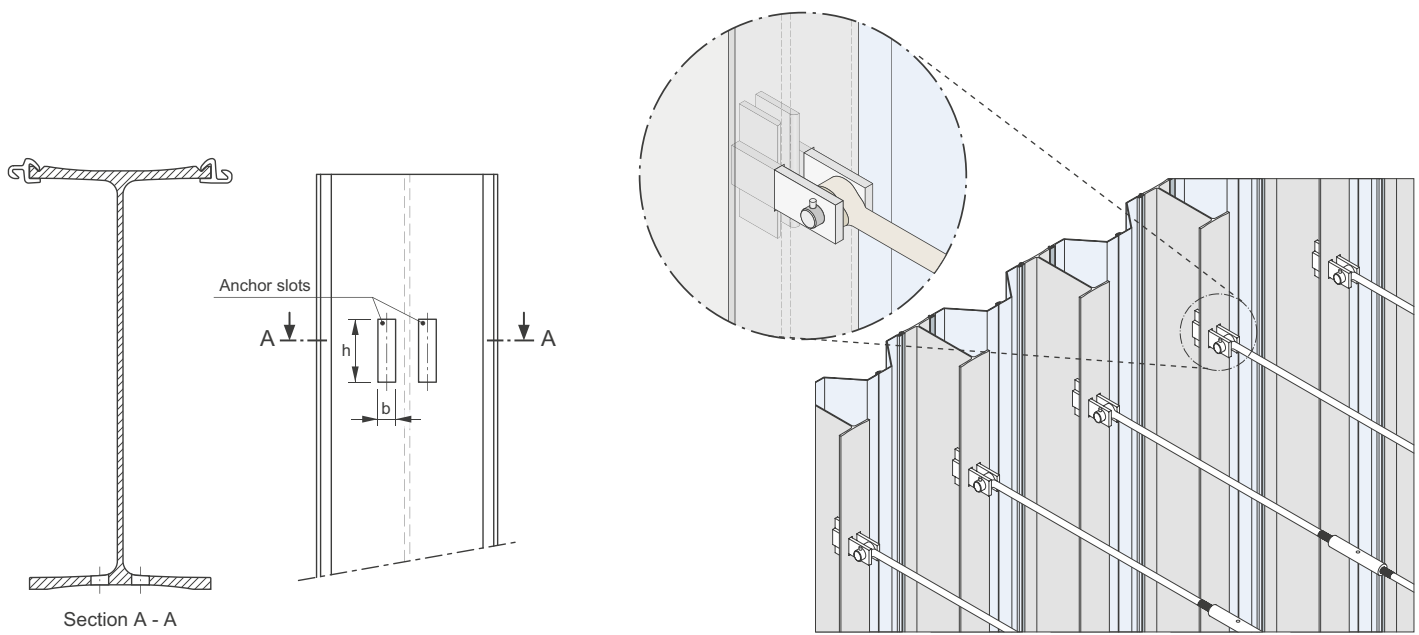


Fig. 4. Special tie-rod connection with T-connector for the HZ-M.



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).

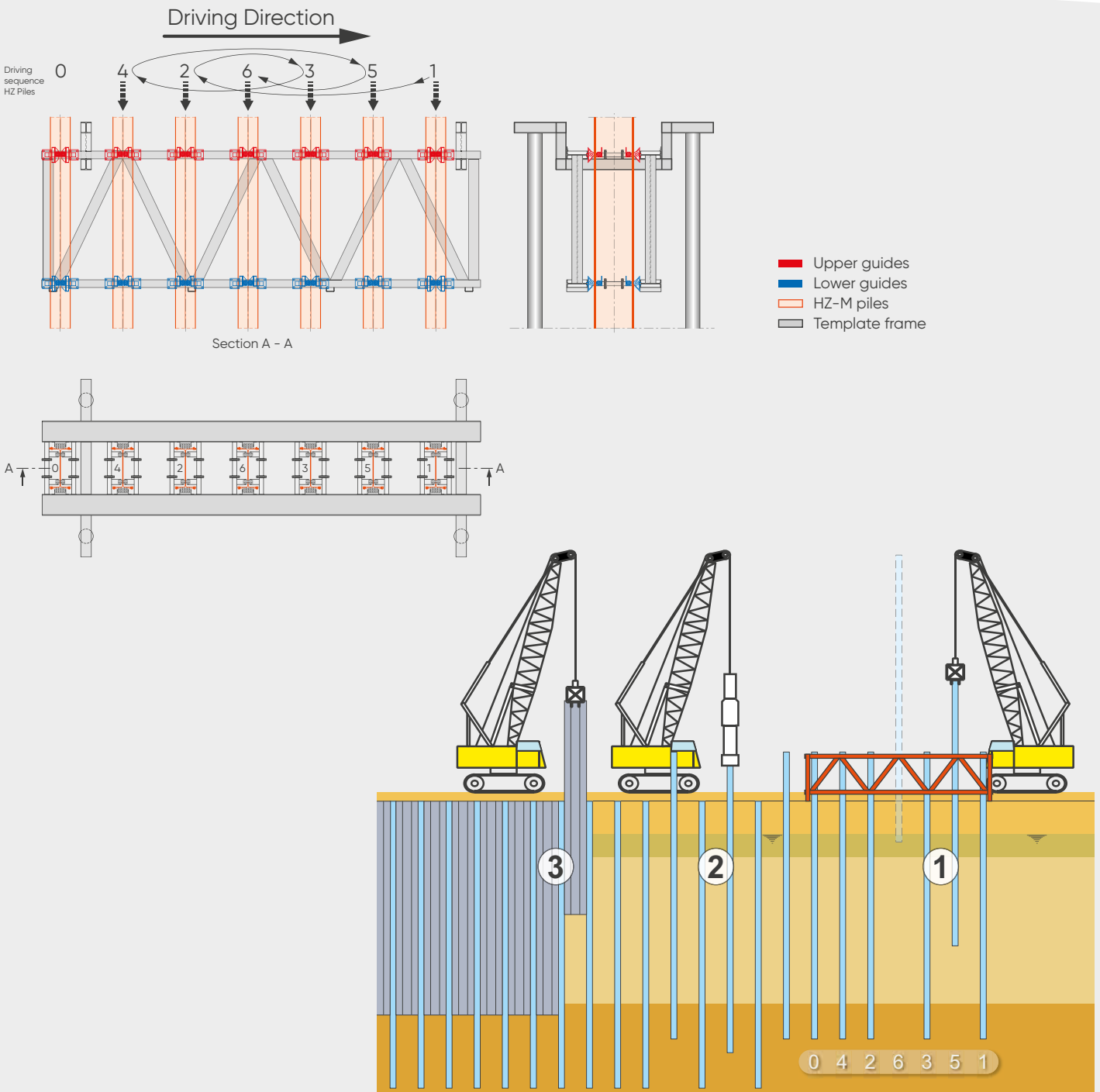


Fig. 7. Installation procedure: driving template and "Pilgrim's step" driving sequence.

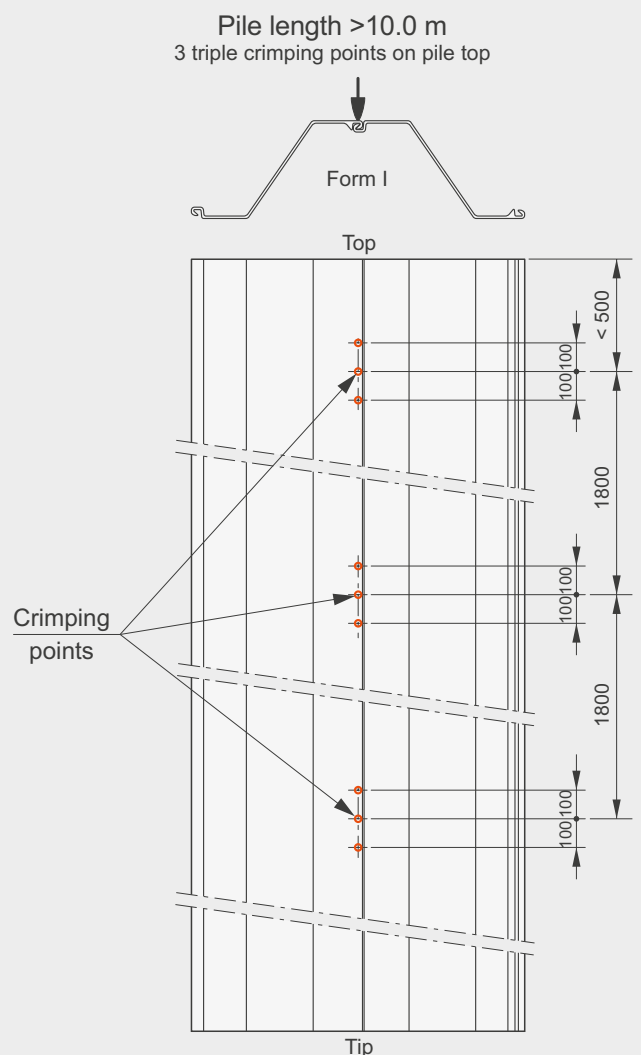
In case of difficult geotechnical conditions, the following may be necessary:

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



Installation methods

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.



Fig. 9. Driving templates and their support.

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.

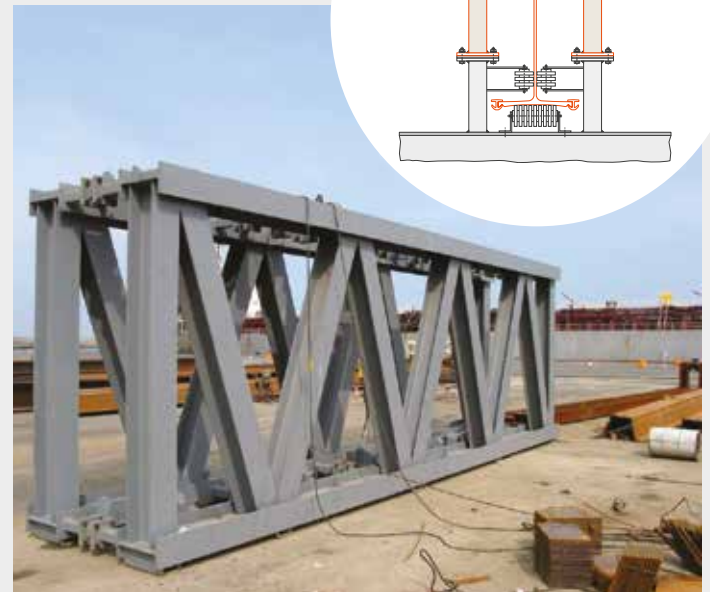
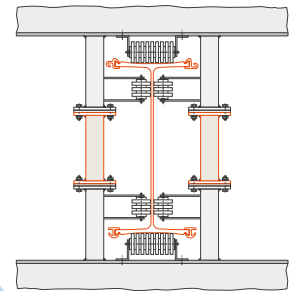


Fig. 10. Template and detail of guide.



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

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.

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).

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.

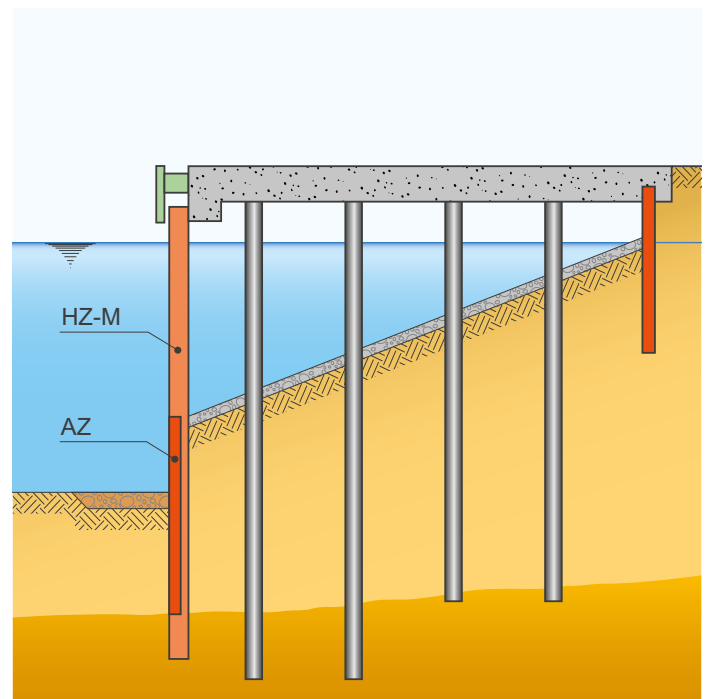


Fig. 12. Installation of AZ below water level with a follower on a vibratory hammer.

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.

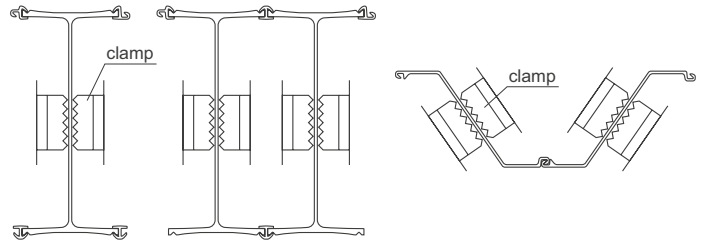


Fig. 13. Double clamps for a vibratory hammer.

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

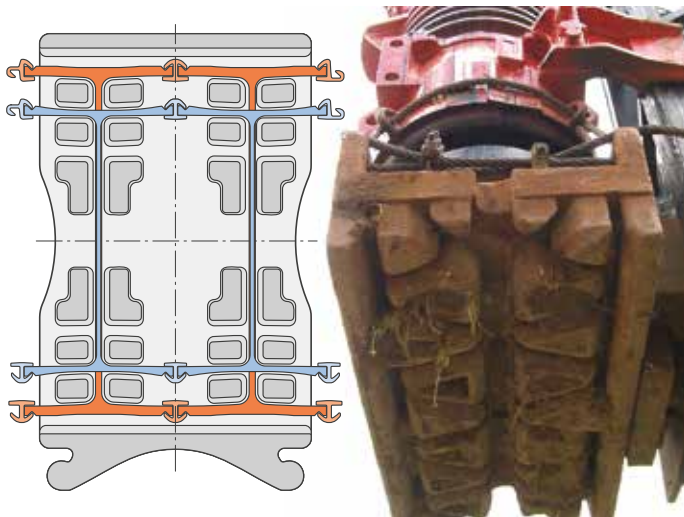


Fig. 14. Impact hammer driving cap.

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.

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

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.

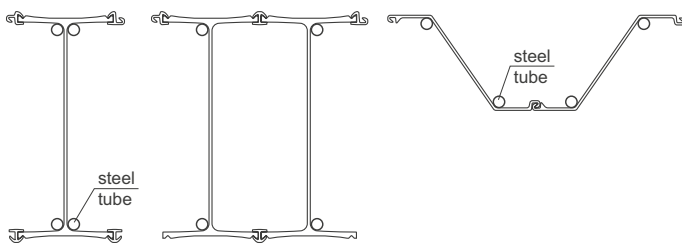


Fig. 15. Water jetting.

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.

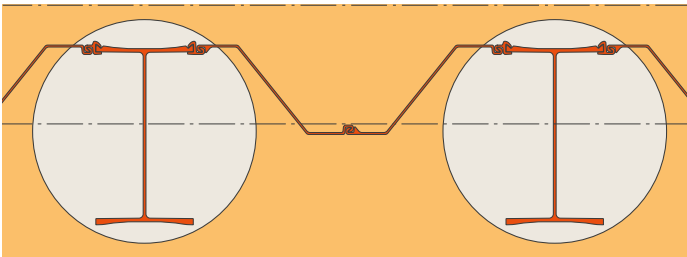


Fig. 16. Pre-drilling / augering for king piles.



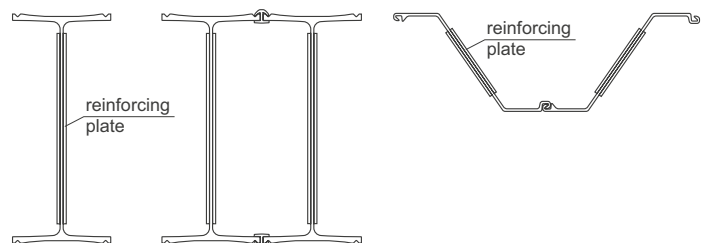
Fig. 17. Reinforcing of the tip of the pile with steel plates / shoes welded on the king pile toe.

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.



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.

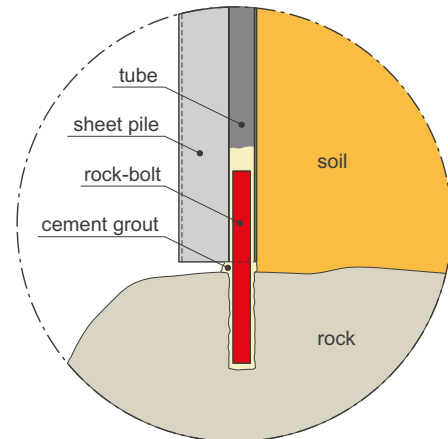


Fig. 18. Concept of a rock-bolt.

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.

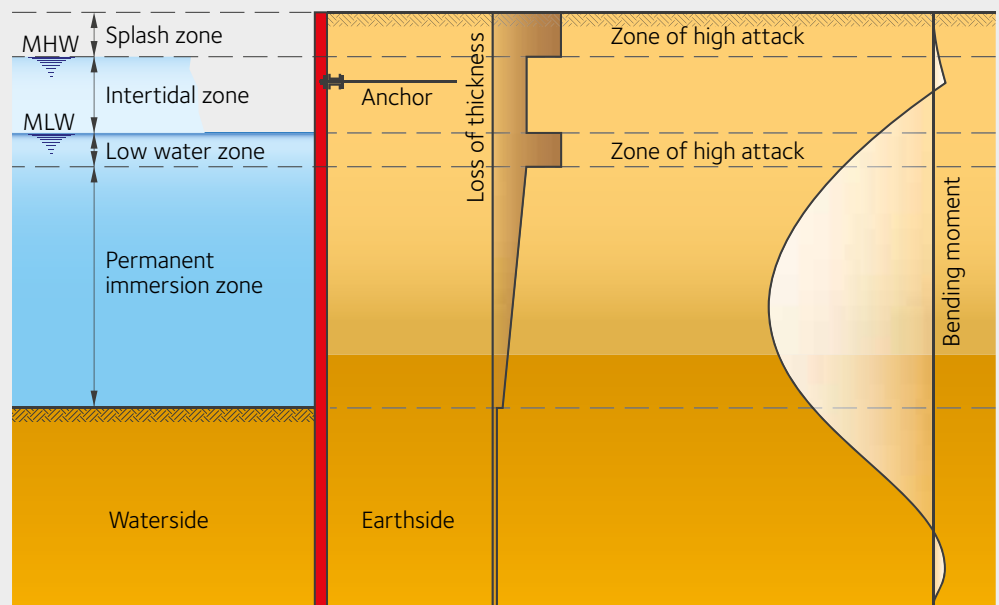
The determination of the residual section properties after corrosion of an HZ-M Steel Wall System is more complex than for standard sheet piles because corrosion is higher on the water side of the wall. Assumptions like proportionality to the initial thickness of the flange are too conservative and may 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.

ArcelorMittal's technical department can assist with any queries.

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



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.

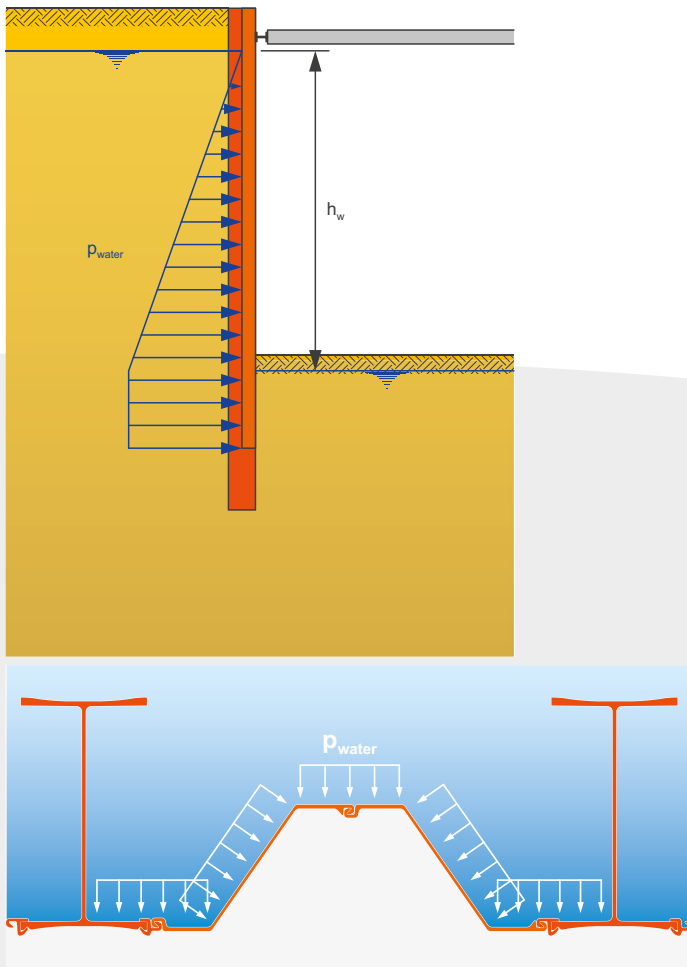


Fig. 19. HZ-M system under water pressure: assumptions.

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 (Figure 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 13 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 "Larsen" interlocks of the AZ sheet piles.

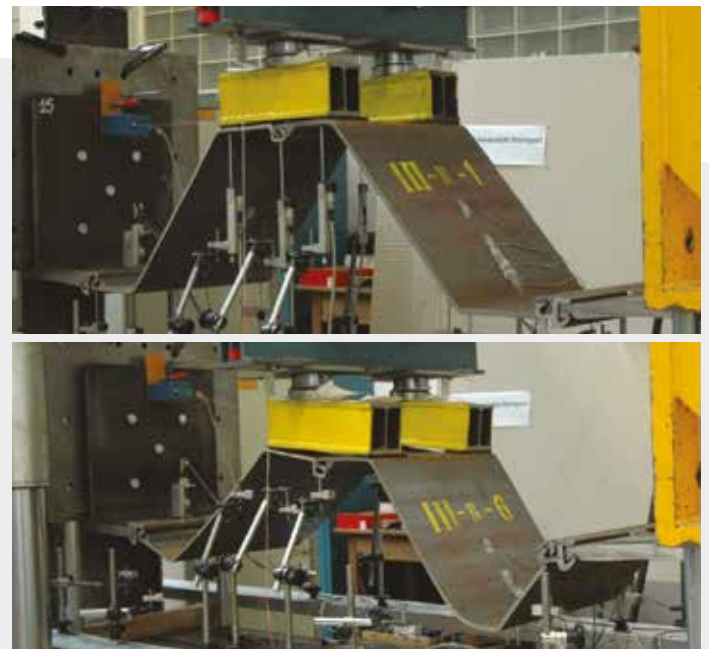


Fig. 20. Mechanical testing of the HZ-M system in the laboratory.

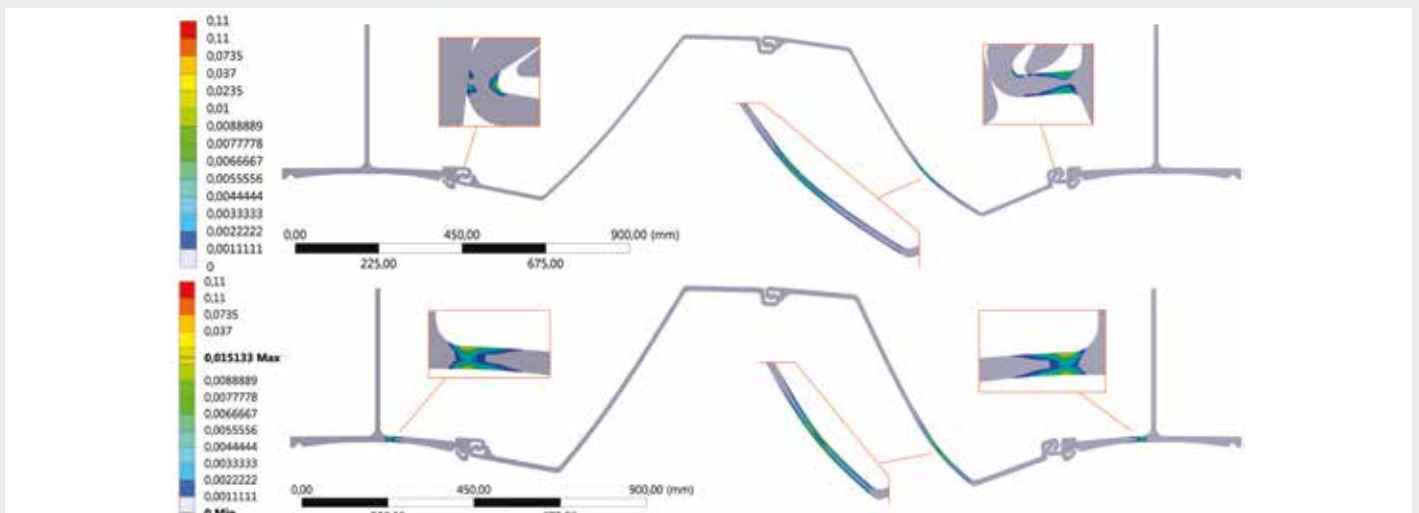


Fig. 21. Numerical simulation of an HZ/AZ combined wall under water pressure.

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 ([10], [11]).

The required safety factors according to Eurocode EN 1993-1-5, Annex C [7], 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 GP	$f_y \geq 460$ 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 GP
- HZ 880M B, S 430 GP & S 460 GP
- HZ 880M C, HZ 1080M & HZ 1180M, S 430 GP & S 460 GP

Design values¹⁾ 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 $\gamma_{M0} = 1.0$).

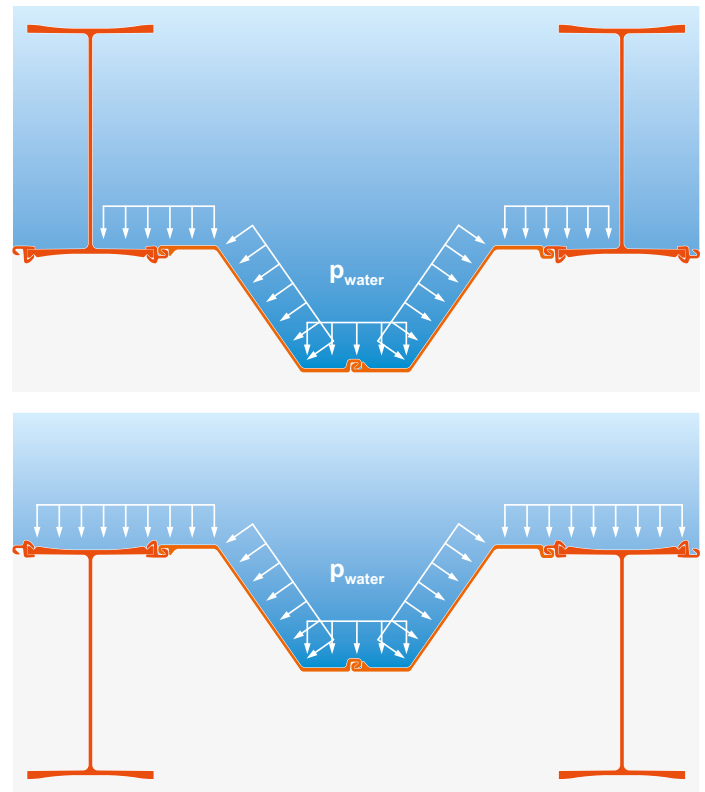


Fig. 22. AZ infill sheet piles under water pressure working in tension.

Impact of driving imperfections :

The impact of driving imperfections of the HZ-M combined wall on the resistance to water pressure was investigated. The range of imperfections considered was $\pm 5^\circ$ for rotation and ± 100 mm for horizontal displacement (Fig. 23).

The study conducted showed a **reduction limited to 20%** in the water pressure resistance for the range of imperfections and the

profiles considered (AZ 18-10/10, AZ 26, AZ 18-700, AZ 20-700, AZ 26-700, AZ 20-800, AZ 22-800, AZ 25-800, AZ 27-800, AZ 30-750, AZ 32-750).

For further information, please contact ArcelorMittal Sheet Piling.

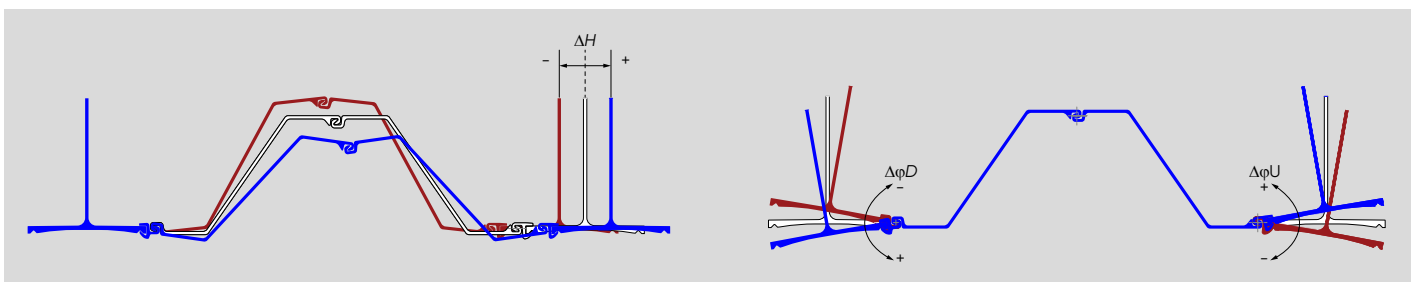


Fig. 23. Considered driving imperfections ($\pm 5^\circ$ for rotation and ± 100 mm for horizontal displacement).

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⁾ 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.

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

Standard case in pure bending¹⁾

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.

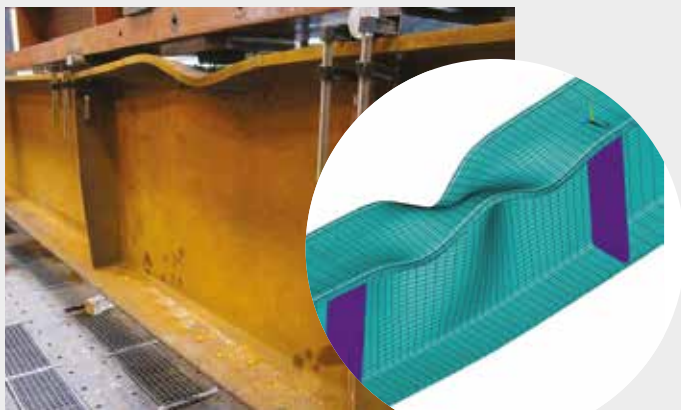
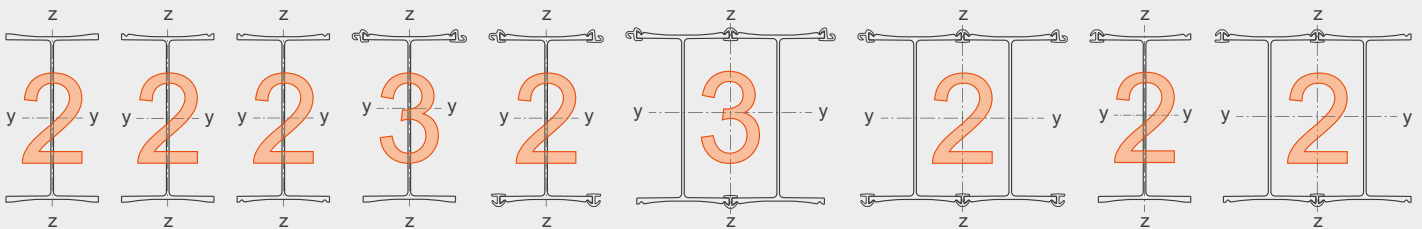
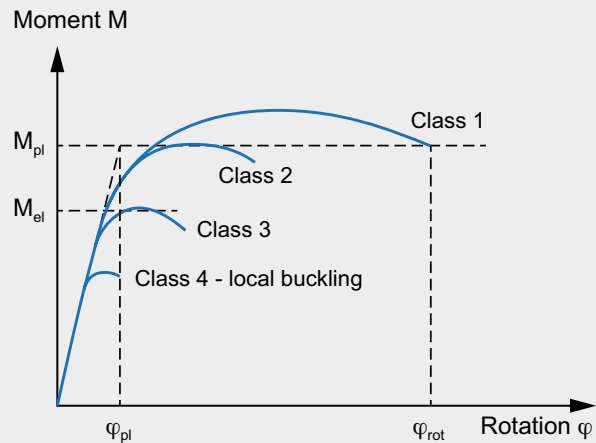


Fig. 24. Comparison between 4 point bending test and FEA simulation.

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} .



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 GP.

Fig. 25. Cross section classes for the HZ-M solutions.

In collaboration with the RWTH Aachen University, an experimental campaign on "4 points bending tests" (Figure 24), backed by numerical simulation using a finite element model developed by RWTH, has been performed [8].

The cross section's classes of HZ-M resulting from this campaign are summarized in Figure 25 and are valid for the whole HZ-M range and steel grades from S 240 GP to S 460 GP²⁾.

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 GP, except for the solutions 12 and 24 (with connectors on the tensile flange or the compression flange) which are classified as class 3.

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.

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 [9] 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 26).

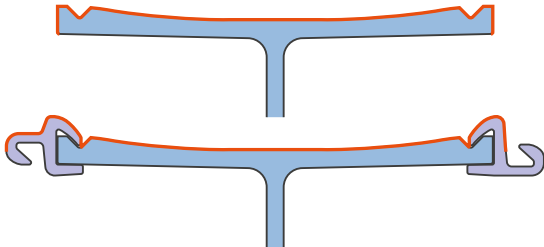


Fig. 26. Corrosion assumption: loss of steel thickness on outer flange.

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 flange¹⁾.

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 GP steel grade.

Fig. 27. Cross section classes for corroded HZ-M solutions.

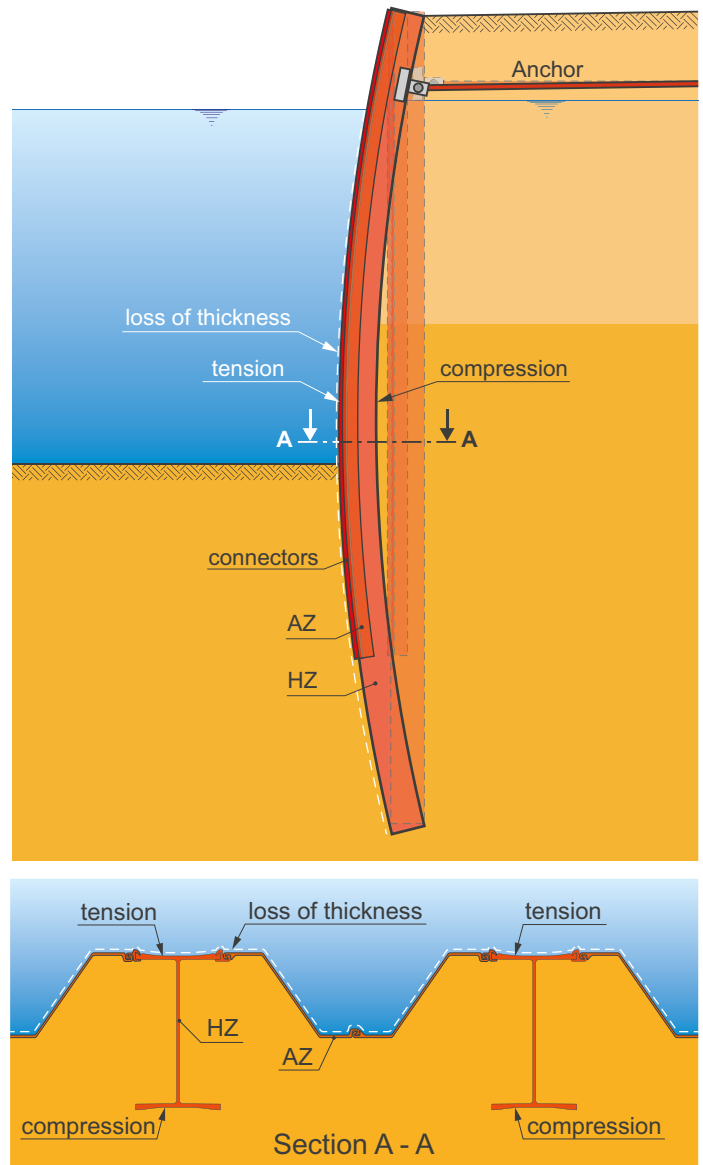


Fig. 28. Common configuration of an HZ/AZ combined wall system (typical cross section).

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 configurations²⁾, 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 27 & 28).

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 GP. 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⁾ "Solution 12" was chosen for all investigations as it is the most critical configuration (safe sided approach).

²⁾ 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	nominal width of the AZ element	$G_{80\%}$	mass of the combination with length of the infill sheet piles AZ = 80% of the length of the HZ-M king piles
b_{sys}	width of one system (HZ/AZ combination)	$G_{100\%}$	mass of the combination with length of the infill sheet piles AZ = 100% of the length of the HZ-M king piles
d	depth of straight portion of web	I_{AZ}	moment of inertia of one pair of AZ sheet pile
e	eccentricity	I_{HZ}	moment of inertia of one HZ-M king pile
f_y	yield strength of the steel	I_{sys}	moment of inertia of one system (HZ/AZ combination)
h_i	height (depth) of the section	$I_{sys/m}$	moment of inertia of the wall per m of wall
i_y	radius of gyration about the y-y axis. $i_y = \sqrt{I_y/A}$	I_y	moment of inertia about the main neutral axis y-y
$p_{max,k}$	characteristic value of water pressure	I_t	torsional constant
p_{water}	water pressure	I_w	warping constant
r	inner radius of the HZ-M profile, between web and flange	I_z	moment of inertia about the neutral axis z-z (weak axis)
t_f	thickness of the flange / thickness of the HZ-M flange at a distance w/4 from the edge	M_{AZ}	bending moment transmitted to the intermediary AZ sheet pile
t_1	thickness for flange bending	M_{HZ}	bending moment transmitted to the HZ-M king pile
t_2	thickness at the edge of the flange	M_{sys}	maximum bending moment per m of wall based on a design
t_3	thickness in the groove	N	vertical load
t_{max}	maximum flange thickness	S_F	global safety factor applicable to steel
t_w	thickness of the web	S_y	static moment of the HZ-M
V_1, V_2, U_1	distance of the neutral axis to the extreme fibre of the HZ-M flanges	W_{AZ}	section modulus of a pair of AZ
V_3, V_4, U_2	distance of the neutral axis to the extreme fibre of the connector RH/RZ	$W_{el,y}^*$	equivalent elastic section modulus of the combination related to the extreme fiber of the flange of the HZ-M
w	nominal width of HZ-M element	$W_{el,y}^{**}$	equivalent elastic section modulus of the combination related to the extreme fiber of the connector RH/RZ
A	cross sectional area	$W_{el,z}$	elastic section modulus of the element related to neutral axis z-z (weak axis)
A_v	shear area	$W_{HZ,eq.} = W_{el,y}^*$	
A_{HZ}	cross sectional area of the HZ-M king pile	$W_{pl,y}$	plastic section modulus of the HZ-M
A_{LS}	coating area on the soil side (back), excluding the inside of the interlocks, per element or system width, per unit length	$W_{RH/RZ,eq.} = W_{el,y}^{**}$	
A_{LW}	coating area on the water side (front), excluding the inside of the interlocks, per element or system width, per unit length	σ_{AZ}	steel stresses in the intermediary AZ sheet pile
G	mass of the element / solution (with length RH/RZ = length HZ) per unit length	σ_{HZ}	steel stresses in the HZ-M king pile
$G_{60\%}$	mass of the combination with length of the infill sheet piles AZ = 60% of the length of the HZ-M king piles		



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 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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- [6] EN 1990: Eurocode: Basis of structural design. CEN.
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- [8] Cross sectional classification of ArcelorMittal HZ range. RWTH Aachen. 2012.
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- [11] Ulrike Kuhlmann and Alexander Enders, Final Report – Investigations on combined sheet pile walls (HZ/AZ system) under water pressure loading. Test back-calculation of experimental investigations with five AZ/HZ combinations in reverse setup position (b), Institute of Structural Design, University of Stuttgart, Germany, May 2019.
- [12] U. Kuhlmann, J. Grabe, B. Froschmeier, C. Schallück, A. Just: Entwicklung von effizienten Dimensionierungsgrundlagen für die Tragbohlen von kombinierten Stahlpundwänden. Forschung für die Praxis P 813. Forschungsvereinigung Stahlanwendung e.V. (FOSTA), Verlag und Vertriebsgesellschaft mbH, Düsseldorf, 2012.

HZ-M | Static moment & Plastic section modulus

Section	$W_{el,y}$	S_y	W_{ply}	$W_{el,y}$	S_y	W_{ply}	$W_{el,y}$	S_y	W_{ply}
	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_{ply} 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_{ely}^*	$G_{100\%}$	Section	Combination	W_{ely}^*	$G_{100\%}$	Section	Combination	W_{ely}^*	$G_{100\%}$	Section	Combination
cm ³ /m	kg/m ²			cm ³ /m	kg/m ²			cm ³ /m	kg/m ²		
4135	210	HZ 630M	12/AZ 13-770	5960	243	HZ 630M	14/AZ 25-800	7150	239	HZ 1080M A	12/AZ 20-800-10/10
4180	217	HZ 630M	12/AZ 14-770-10/10	6040	238	HZ 880M C	12/AZ 25-800	7245	244	HZ 880M A	14/AZ 28-750
4355	224	HZ 630M	12/AZ 13-700	6095	258	HZ 880M A	12/AZ 26	7245	296	HZ 630M	24/AZ 25-800
4375	227	HZ 630M	12/AZ 13-700-10/10	6175	236	HZ 880M C	12/AZ 18-700	7290	248	HZ 880M C	14/AZ 13-700
4550	216	HZ 630M	12/AZ 20-800	6185	262	HZ 630M	14/AZ 18-10/10	7305	251	HZ 880M C	14/AZ 13-700-10/10
4590	220	HZ 630M	12/AZ 20-800-10/10	6210	242	HZ 880M B	12/AZ 28-750	7315	248	HZ 1080M A	12/AZ 25-800
4730	226	HZ 630M	12/AZ 18-700	6225	243	HZ 880M C	12/AZ 20-700	7315	299	HZ 630M	24/AZ 18-700
4800	234	HZ 630M	12/AZ 20-700	6230	216	HZ 880M A	14/AZ 13-770	7320	259	HZ 880M A	14/AZ 26-700
4870	229	HZ 630M	12/AZ 25-800	6255	249	HZ 880M B	12/AZ 18-10/10	7330	245	HZ 880M B	14/AZ 18-700
4885	202	HZ 880M A	12/AZ 13-770	6255	257	HZ 880M B	12/AZ 26-700	7340	252	HZ 880M A	14/AZ 30-750
4915	208	HZ 880M A	12/AZ 14-770-10/10	6265	222	HZ 880M A	14/AZ 14-770-10/10	7350	252	HZ 880M A	14/AZ 18-10/10
4975	246	HZ 630M	12/AZ 18-10/10	6295	250	HZ 880M B	12/AZ 30-750	7370	305	HZ 630M	24/AZ 20-700
5145	208	HZ 880M A	12/AZ 20-800	6380	258	HZ 880M B	12/AZ 32-750	7375	252	HZ 880M C	14/AZ 25-800
5165	224	HZ 630M	14/AZ 13-770	6395	269	HZ 630M	14/AZ 26-700	7385	252	HZ 880M B	14/AZ 20-700
5175	211	HZ 880M A	12/AZ 20-800-10/10	6460	254	HZ 630M	14/AZ 28-750	7435	260	HZ 880M A	14/AZ 32-750
5175	214	HZ 880M A	12/AZ 13-700	6470	248	HZ 880M C	12/AZ 28-750	7475	244	HZ 1080M A	12/AZ 13-700
5185	218	HZ 880M A	12/AZ 13-700-10/10	6495	221	HZ 880M A	14/AZ 20-800	7485	247	HZ 1080M A	12/AZ 13-700-10/10
5210	231	HZ 630M	14/AZ 14-770-10/10	6530	225	HZ 880M A	14/AZ 20-800-10/10	7565	238	HZ 1080M B	12/AZ 13-770
5210	254	HZ 630M	12/AZ 26-700	6530	263	HZ 880M C	12/AZ 26-700	7570	295	HZ 630M	26/AZ 13-770
5295	239	HZ 630M	12/AZ 28-750	6555	256	HZ 880M C	12/AZ 18-10/10	7590	245	HZ 1080M B	12/AZ 14-770-10/10
5300	214	HZ 880M B	12/AZ 13-770	6555	256	HZ 880M C	12/AZ 30-750	7600	251	HZ 880M C	14/AZ 18-700
5330	220	HZ 880M B	12/AZ 14-770-10/10	6575	272	HZ 880M B	12/AZ 26	7610	300	HZ 630M	26/AZ 14-770-10/10
5385	221	HZ 880M A	12/AZ 25-800	6585	262	HZ 630M	14/AZ 30-750	7630	257	HZ 880M B	14/AZ 28-750
5395	269	HZ 630M	12/AZ 26	6610	229	HZ 880M A	14/AZ 13-700	7655	258	HZ 880M C	14/AZ 20-700
5410	247	HZ 630M	12/AZ 30-750	6615	228	HZ 880M B	14/AZ 13-770	7660	243	HZ 1080M B	12/AZ 20-800
5450	239	HZ 630M	14/AZ 13-700	6625	233	HZ 880M A	14/AZ 13-700-10/10	7670	320	HZ 630M	24/AZ 18-10/10
5455	217	HZ 880M A	12/AZ 18-700	6645	264	HZ 880M C	12/AZ 32-750	7685	247	HZ 1080M B	12/AZ 20-800-10/10
5470	242	HZ 630M	14/AZ 13-700-10/10	6650	234	HZ 880M B	14/AZ 14-770-10/10	7695	247	HZ 1080M A	12/AZ 18-700
5505	224	HZ 880M A	12/AZ 20-700	6650	285	HZ 630M	14/AZ 26	7700	274	HZ 880M A	14/AZ 26
5525	255	HZ 630M	12/AZ 32-750	6670	282	HZ 630M	24/AZ 13-770	7700	307	HZ 630M	24/AZ 28-750
5545	220	HZ 880M B	12/AZ 20-800	6705	288	HZ 630M	24/AZ 14-770-10/10	7720	322	HZ 630M	24/AZ 26-700
5555	219	HZ 880M C	12/AZ 13-770	6710	270	HZ 630M	14/AZ 32-750	7725	264	HZ 880M B	14/AZ 30-750
5580	223	HZ 880M B	12/AZ 20-800-10/10	6765	235	HZ 880M A	14/AZ 25-800	7725	272	HZ 880M B	14/AZ 26-700
5585	226	HZ 880M C	12/AZ 14-770-10/10	6865	233	HZ 880M B	14/AZ 20-800	7735	254	HZ 1080M A	12/AZ 20-700
5600	230	HZ 630M	14/AZ 20-800	6865	233	HZ 880M C	14/AZ 13-770	7785	259	HZ 1080M A	12/AZ 28-750
5615	227	HZ 880M B	12/AZ 13-700	6870	278	HZ 880M C	12/AZ 26	7790	265	HZ 880M B	14/AZ 18-10/10
5630	230	HZ 880M B	12/AZ 13-700-10/10	6900	237	HZ 880M B	14/AZ 20-800-10/10	7800	314	HZ 630M	24/AZ 30-750
5650	234	HZ 630M	14/AZ 20-800-10/10	6900	240	HZ 880M C	14/AZ 14-770-10/10	7820	272	HZ 880M B	14/AZ 32-750
5780	235	HZ 880M A	12/AZ 18-10/10	6920	232	HZ 880M A	14/AZ 18-700	7850	257	HZ 1080M B	12/AZ 25-800
5785	230	HZ 880M A	12/AZ 28-750	6965	285	HZ 630M	24/AZ 20-800	7850	266	HZ 1080M A	12/AZ 30-750
5790	233	HZ 880M B	12/AZ 25-800	6980	239	HZ 880M A	14/AZ 20-700	7875	298	HZ 630M	26/AZ 20-800
5795	225	HZ 880M C	12/AZ 20-800	6995	297	HZ 630M	24/AZ 13-700	7885	262	HZ 880M C	14/AZ 28-750
5810	244	HZ 880M A	12/AZ 26-700	7005	288	HZ 630M	24/AZ 20-800-10/10	7895	320	HZ 630M	24/AZ 32-750
5830	229	HZ 880M C	12/AZ 20-800-10/10	7010	300	HZ 630M	24/AZ 13-700-10/10	7915	274	HZ 1080M A	12/AZ 32-750
5865	241	HZ 630M	14/AZ 18-700	7015	230	HZ 1080M A	12/AZ 13-770	7915	301	HZ 630M	26/AZ 20-800-10/10
5870	238	HZ 880M A	12/AZ 30-750	7020	242	HZ 880M B	14/AZ 13-700	7950	311	HZ 630M	26/AZ 13-700
5895	233	HZ 880M C	12/AZ 13-700	7035	245	HZ 880M B	14/AZ 13-700-10/10	7965	314	HZ 630M	26/AZ 13-700-10/10
5900	230	HZ 880M B	12/AZ 18-700	7040	236	HZ 1080M A	12/AZ 14-770-10/10	7975	274	HZ 1080M A	12/AZ 26-700
5905	236	HZ 880M C	12/AZ 13-700-10/10	7110	238	HZ 880M C	14/AZ 20-800	7980	270	HZ 880M C	14/AZ 30-750
5940	249	HZ 630M	14/AZ 20-700	7130	235	HZ 1080M A	12/AZ 20-800	7990	278	HZ 880M C	14/AZ 26-700
5950	237	HZ 880M B	12/AZ 20-700	7130	246	HZ 880M B	14/AZ 25-800	8000	266	HZ 880M A	24/AZ 13-770
5955	246	HZ 880M A	12/AZ 32-750	7140	242	HZ 880M C	14/AZ 20-800-10/10	8020	338	HZ 630M	24/AZ 26

W _{ely} *	G _{100%}	Section	Combination	W _{ely} *	G _{100%}	Section	Combination	W _{ely} *	G _{100%}	Section	Combination
cm ³ /m	kg/m ²			cm ³ /m	kg/m ²			cm ³ /m	kg/m ²		
8025	272	HZ 880M A	24/AZ 14-770-10/10	8955	275	HZ 1080M D	12/AZ 20-800-10/10	9620	325	HZ 880M B	24/AZ 26-700
8065	254	HZ 1080M B	12/AZ 13-700	8955	303	HZ 880M A	24/AZ 32-750	9635	296	HZ 1080M C	12/AZ 18-10/10
8070	278	HZ 880M C	14/AZ 32-750	8985	262	HZ 1080M A	14/AZ 25-800	9645	293	HZ 880M A	26/AZ 13-700
8075	257	HZ 1080M B	12/AZ 13-700-10/10	8985	300	HZ 880M B	24/AZ 25-800	9655	296	HZ 880M A	26/AZ 13-700-10/10
8085	272	HZ 880M C	14/AZ 18-10/10	9010	273	HZ 1080M C	12/AZ 18-700	9675	297	HZ 1080M D	12/AZ 28-750
8140	288	HZ 880M B	14/AZ 26	9035	283	HZ 1080M C	12/AZ 28-750	9685	287	HZ 1080M D	12/AZ 18-700
8155	270	HZ 880M A	24/AZ 20-800	9050	280	HZ 1080M C	12/AZ 20-700	9690	289	HZ 1080M A	14/AZ 32-750
8170	309	HZ 630M	26/AZ 25-800	9060	295	HZ 880M C	24/AZ 13-770	9725	294	HZ 1080M D	12/AZ 20-700
8180	273	HZ 880M A	24/AZ 20-800-10/10	9070	353	HZ 630M	26/AZ 26	9740	304	HZ 1080M D	12/AZ 30-750
8220	268	HZ 1080M A	12/AZ 18-10/10	9085	300	HZ 880M C	24/AZ 14-770-10/10	9750	284	HZ 1180M B	12/AZ 13-770
8245	254	HZ 1080M C	12/AZ 13-770	9085	301	HZ 880M B	24/AZ 13-700	9765	312	HZ 880M C	24/AZ 18-700
8270	261	HZ 1080M C	12/AZ 14-770-10/10	9095	303	HZ 880M B	24/AZ 13-700-10/10	9775	290	HZ 1180M B	12/AZ 14-770-10/10
8285	256	HZ 1080M B	12/AZ 18-700	9100	300	HZ 1080M B	12/AZ 26	9785	287	HZ 1180M B	12/AZ 20-800
8285	313	HZ 630M	26/AZ 18-700	9100	301	HZ 880M A	24/AZ 18-10/10	9790	298	HZ 880M B	26/AZ 13-770
8320	259	HZ 1080M C	12/AZ 20-800	9105	291	HZ 1080M C	12/AZ 30-750	9805	289	HZ 1080M A	14/AZ 26-700
8325	263	HZ 1080M B	12/AZ 20-700	9120	284	HZ 1080M D	12/AZ 25-800	9810	291	HZ 1180M B	12/AZ 20-800-10/10
8345	262	HZ 1080M C	12/AZ 20-800-10/10	9170	279	HZ 880M A	26/AZ 13-770	9810	312	HZ 1080M D	12/AZ 32-750
8345	267	HZ 1080M B	12/AZ 28-750	9170	299	HZ 1080M C	12/AZ 32-750	9810	318	HZ 880M C	24/AZ 20-700
8345	319	HZ 630M	26/AZ 20-700	9190	297	HZ 880M C	24/AZ 20-800	9815	304	HZ 880M B	26/AZ 14-770-10/10
8360	281	HZ 880M A	24/AZ 25-800	9195	284	HZ 880M A	26/AZ 14-770-10/10	9815	323	HZ 880M B	24/AZ 18-10/10
8410	275	HZ 1080M B	12/AZ 30-750	9215	301	HZ 880M C	24/AZ 20-800-10/10	9835	269	HZ 1080M B	14/AZ 13-700
8410	280	HZ 880M A	24/AZ 13-700	9220	252	HZ 1080M B	14/AZ 13-770	9845	272	HZ 1080M B	14/AZ 13-700-10/10
8420	283	HZ 880M A	24/AZ 13-700-10/10	9245	259	HZ 1080M B	14/AZ 14-770-10/10	9875	268	HZ 1080M C	14/AZ 13-770
8430	294	HZ 880M C	14/AZ 26	9260	259	HZ 1080M A	14/AZ 13-700	9885	318	HZ 1080M C	12/AZ 26
8465	290	HZ 1080M A	12/AZ 26	9275	263	HZ 1080M A	14/AZ 13-700-10/10	9885	319	HZ 880M C	24/AZ 28-750
8480	283	HZ 1080M B	12/AZ 32-750	9290	300	HZ 1080M C	12/AZ 26-700	9895	295	HZ 880M A	26/AZ 18-700
8510	272	HZ 1080M C	12/AZ 25-800	9295	257	HZ 1080M B	14/AZ 20-800	9900	275	HZ 1080M C	14/AZ 14-770-10/10
8565	284	HZ 1080M B	12/AZ 26-700	9315	282	HZ 880M A	26/AZ 20-800	9920	301	HZ 880M B	26/AZ 20-800
8640	286	HZ 880M B	24/AZ 13-770	9320	261	HZ 1080M B	14/AZ 20-800-10/10	9930	272	HZ 1080M C	14/AZ 20-800
8645	282	HZ 880M A	24/AZ 18-700	9320	303	HZ 880M B	24/AZ 18-700	9940	301	HZ 880M A	26/AZ 20-700
8665	291	HZ 880M B	24/AZ 14-770-10/10	9325	277	HZ 1180M A	12/AZ 13-770	9950	295	HZ 1180M A	12/AZ 13-700
8670	320	HZ 630M	26/AZ 28-750	9345	285	HZ 880M A	26/AZ 20-800-10/10	9950	304	HZ 880M B	26/AZ 20-800-10/10
8685	244	HZ 1080M A	14/AZ 13-770	9350	284	HZ 1180M A	12/AZ 14-770-10/10	9955	276	HZ 1080M C	14/AZ 20-800-10/10
8690	288	HZ 880M A	24/AZ 20-700	9360	319	HZ 880M A	24/AZ 26	9955	326	HZ 880M C	24/AZ 30-750
8695	334	HZ 630M	26/AZ 18-10/10	9365	309	HZ 880M B	24/AZ 20-700	9960	298	HZ 1180M A	12/AZ 13-700-10/10
8710	250	HZ 1080M A	14/AZ 14-770-10/10	9370	281	HZ 1180M A	12/AZ 20-800	9960	314	HZ 1080M D	12/AZ 26-700
8715	336	HZ 630M	26/AZ 26-700	9395	285	HZ 1180M A	12/AZ 20-800-10/10	9970	300	HZ 1180M B	12/AZ 25-800
8775	327	HZ 630M	26/AZ 30-750	9395	308	HZ 880M C	24/AZ 25-800	10030	332	HZ 880M C	24/AZ 32-750
8780	249	HZ 1080M A	14/AZ 20-800	9460	310	HZ 880M B	24/AZ 28-750	10040	303	HZ 880M A	26/AZ 28-750
8780	289	HZ 880M B	24/AZ 20-800	9465	284	HZ 1080M D	12/AZ 13-700	10065	334	HZ 880M C	24/AZ 26-700
8790	270	HZ 1080M C	12/AZ 13-700	9475	287	HZ 1080M D	12/AZ 13-700-10/10	10070	271	HZ 1080M B	14/AZ 18-700
8800	274	HZ 1080M C	12/AZ 13-700-10/10	9500	262	HZ 1080M A	14/AZ 18-700	10075	340	HZ 880M B	24/AZ 26
8805	252	HZ 1080M A	14/AZ 20-800-10/10	9500	270	HZ 1080M B	14/AZ 25-800	10085	282	HZ 1080M B	14/AZ 28-750
8805	292	HZ 880M B	24/AZ 20-800-10/10	9530	310	HZ 880M C	24/AZ 13-700	10115	278	HZ 1080M B	14/AZ 20-700
8810	290	HZ 880M A	24/AZ 28-750	9530	316	HZ 880M B	24/AZ 30-750	10115	309	HZ 880M A	26/AZ 30-750
8855	278	HZ 1080M B	12/AZ 18-10/10	9535	293	HZ 880M A	26/AZ 25-800	10135	285	HZ 1080M C	14/AZ 25-800
8870	267	HZ 1080M D	12/AZ 13-770	9540	313	HZ 880M C	24/AZ 13-700-10/10	10135	307	HZ 1180M A	12/AZ 28-750
8880	333	HZ 630M	26/AZ 32-750	9545	269	HZ 1080M A	14/AZ 20-700	10140	312	HZ 880M B	26/AZ 25-800
8885	297	HZ 880M A	24/AZ 30-750	9545	273	HZ 1080M A	14/AZ 28-750	10155	290	HZ 1080M B	14/AZ 30-750
8895	273	HZ 1080M D	12/AZ 14-770-10/10	9560	294	HZ 1180M A	12/AZ 25-800	10160	284	HZ 1080M A	14/AZ 18-10/10
8930	271	HZ 1080M D	12/AZ 20-800	9605	323	HZ 880M B	24/AZ 32-750	10170	298	HZ 1180M A	12/AZ 18-700
8945	304	HZ 880M A	24/AZ 26-700	9615	281	HZ 1080M A	14/AZ 30-750	10195	316	HZ 880M A	26/AZ 32-750

W _{ely} *	G _{100%}	Section	Combination	W _{ely} *	G _{100%}	Section	Combination	W _{ely} *	G _{100%}	Section	Combination
cm ³ /m	kg/m ²			cm ³ /m	kg/m ²			cm ³ /m	kg/m ²		
10200	315	HZ 1180M A	12/AZ 30-750	10825	306	HZ 1180M D	12/AZ 13-770	11620	317	HZ 1080M A	24/AZ 20-800-10/10
10205	307	HZ 880M C	26/AZ 13-770	10830	309	HZ 1180M D	12/AZ 20-800	11625	317	HZ 1080M A	24/AZ 14-770-10/10
10210	305	HZ 1180M A	12/AZ 20-700	10850	313	HZ 1180M D	12/AZ 14-770-10/10	11625	352	HZ 1180M B	12/AZ 26
10210	317	HZ 880M A	26/AZ 26-700	10850	313	HZ 1180M D	12/AZ 20-800-10/10	11660	310	HZ 1180M A	14/AZ 13-700
10225	297	HZ 1080M B	14/AZ 32-750	10865	338	HZ 880M B	26/AZ 26-700	11665	337	HZ 1180M D	12/AZ 28-750
10235	312	HZ 880M C	26/AZ 14-770-10/10	10885	322	HZ 1180M A	12/AZ 18-10/10	11670	313	HZ 1180M A	14/AZ 13-700-10/10
10265	323	HZ 1180M A	12/AZ 32-750	10890	313	HZ 1080M C	14/AZ 32-750	11725	329	HZ 1080M D	14/AZ 26-700
10285	333	HZ 880M C	24/AZ 18-10/10	10905	332	HZ 1180M B	12/AZ 26-700	11730	344	HZ 1180M D	12/AZ 30-750
10300	314	HZ 880M B	26/AZ 13-700	10920	291	HZ 1180M A	14/AZ 13-770	11760	325	HZ 1080M A	24/AZ 25-800
10305	296	HZ 1180M C	12/AZ 13-770	10945	295	HZ 1180M A	14/AZ 20-800	11780	329	HZ 1180M D	12/AZ 18-700
10315	316	HZ 880M B	26/AZ 13-700-10/10	10950	298	HZ 1180M A	14/AZ 14-770-10/10	11795	334	HZ 1080M C	14/AZ 26
10320	300	HZ 1180M C	12/AZ 20-800	10970	298	HZ 1180M A	14/AZ 20-800-10/10	11795	352	HZ 1180M D	12/AZ 32-750
10325	310	HZ 880M C	26/AZ 20-800	10990	325	HZ 880M C	26/AZ 18-700	11805	321	HZ 1180M A	14/AZ 28-750
10330	303	HZ 1180M C	12/AZ 14-770-10/10	11000	316	HZ 1180M C	12/AZ 13-700	11820	336	HZ 1180M D	12/AZ 20-700
10345	303	HZ 1180M C	12/AZ 20-800-10/10	11010	319	HZ 1180M C	12/AZ 13-700-10/10	11855	364	HZ 880M C	26/AZ 26
10355	313	HZ 880M C	26/AZ 20-800-10/10	11015	322	HZ 1180M D	12/AZ 25-800	11875	329	HZ 1180M A	14/AZ 30-750
10365	311	HZ 1080M D	12/AZ 18-10/10	11035	331	HZ 880M C	26/AZ 20-700	11895	313	HZ 1180M A	14/AZ 18-700
10375	299	HZ 1080M B	14/AZ 26-700	11040	316	HZ 1080M B	14/AZ 26	11935	320	HZ 1180M A	14/AZ 20-700
10410	302	HZ 1180M B	12/AZ 13-700	11075	315	HZ 1080M C	14/AZ 26-700	11945	337	HZ 1180M A	14/AZ 32-750
10420	305	HZ 1180M B	12/AZ 13-700-10/10	11085	332	HZ 880M C	26/AZ 28-750	12015	344	HZ 1180M C	12/AZ 18-10/10
10420	315	HZ 880M A	26/AZ 18-10/10	11115	337	HZ 880M B	26/AZ 18-10/10	12055	356	HZ 1180M D	12/AZ 26-700
10430	306	HZ 1080M A	14/AZ 26	11130	326	HZ 1180M C	12/AZ 28-750	12065	317	HZ 1180M B	14/AZ 13-700
10445	325	HZ 1180M A	12/AZ 26-700	11130	345	HZ 1180M A	12/AZ 26	12075	316	HZ 1180M C	14/AZ 20-800
10490	281	HZ 1080M D	14/AZ 13-770	11145	308	HZ 1180M A	14/AZ 25-800	12075	320	HZ 1180M B	14/AZ 13-700-10/10
10505	313	HZ 1180M C	12/AZ 25-800	11160	338	HZ 880M C	26/AZ 30-750	12090	314	HZ 1180M C	14/AZ 13-770
10515	287	HZ 1080M D	14/AZ 14-770-10/10	11195	299	HZ 1080M D	14/AZ 13-700	12100	320	HZ 1180M C	14/AZ 20-800-10/10
10525	285	HZ 1080M D	14/AZ 20-800	11195	334	HZ 1180M C	12/AZ 30-750	12115	320	HZ 1180M C	14/AZ 14-770-10/10
10535	285	HZ 1080M C	14/AZ 13-700	11205	302	HZ 1080M D	14/AZ 13-700-10/10	12185	327	HZ 1180M B	14/AZ 28-750
10545	289	HZ 1080M C	14/AZ 13-700-10/10	11220	318	HZ 1180M C	12/AZ 18-700	12190	340	HZ 1180M A	14/AZ 26-700
10545	320	HZ 880M C	26/AZ 25-800	11240	344	HZ 880M C	26/AZ 32-750	12240	327	HZ 1080M D	14/AZ 18-10/10
10545	350	HZ 880M C	24/AZ 26	11260	325	HZ 1180M C	12/AZ 20-700	12240	329	HZ 1080M A	24/AZ 13-700
10550	288	HZ 1080M D	14/AZ 20-800-10/10	11260	342	HZ 1180M C	12/AZ 32-750	12250	331	HZ 1080M A	24/AZ 13-700-10/10
10550	316	HZ 880M B	26/AZ 18-700	11300	297	HZ 1180M B	14/AZ 13-770	12255	335	HZ 1180M B	14/AZ 30-750
10570	314	HZ 1180M B	12/AZ 28-750	11305	300	HZ 1180M B	14/AZ 20-800	12260	367	HZ 1180M C	12/AZ 26
10595	322	HZ 880M B	26/AZ 20-700	11305	347	HZ 880M C	26/AZ 26-700	12270	330	HZ 1180M C	14/AZ 25-800
10610	333	HZ 1080M D	12/AZ 26	11325	304	HZ 1180M B	14/AZ 14-770-10/10	12295	319	HZ 1180M B	14/AZ 18-700
10625	305	HZ 1180M B	12/AZ 18-700	11330	304	HZ 1180M B	14/AZ 20-800-10/10	12320	337	HZ 1080M A	24/AZ 28-750
10635	321	HZ 1180M B	12/AZ 30-750	11365	311	HZ 1080M D	14/AZ 28-750	12325	343	HZ 1180M B	14/AZ 32-750
10665	312	HZ 1180M B	12/AZ 20-700	11380	330	HZ 1180M B	12/AZ 18-10/10	12340	326	HZ 1180M B	14/AZ 20-700
10665	323	HZ 880M B	26/AZ 28-750	11390	354	HZ 880M B	26/AZ 26	12375	343	HZ 1080M A	24/AZ 30-750
10695	333	HZ 880M A	26/AZ 26	11430	302	HZ 1080M D	14/AZ 18-700	12425	331	HZ 1080M A	24/AZ 18-700
10700	329	HZ 1180M B	12/AZ 32-750	11440	319	HZ 1080M D	14/AZ 30-750	12435	350	HZ 1080M A	24/AZ 32-750
10725	298	HZ 1080M D	14/AZ 25-800	11470	309	HZ 1080M D	14/AZ 20-700	12450	328	HZ 1080M B	24/AZ 20-800
10740	323	HZ 880M C	26/AZ 13-700	11495	345	HZ 1180M C	12/AZ 26-700	12455	336	HZ 1080M A	24/AZ 20-700
10740	329	HZ 880M B	26/AZ 30-750	11505	314	HZ 1180M B	14/AZ 25-800	12460	325	HZ 1180M D	14/AZ 20-800
10745	298	HZ 1080M C	14/AZ 28-750	11510	326	HZ 1080M D	14/AZ 32-750	12470	331	HZ 1080M B	24/AZ 20-800-10/10
10755	326	HZ 880M C	26/AZ 13-700-10/10	11530	312	HZ 1080M C	14/AZ 18-10/10	12475	326	HZ 1080M B	24/AZ 13-770
10770	288	HZ 1080M C	14/AZ 18-700	11560	326	HZ 1180M D	12/AZ 13-700	12485	329	HZ 1180M D	14/AZ 20-800-10/10
10775	294	HZ 1080M B	14/AZ 18-10/10	11570	330	HZ 1180M D	12/AZ 13-700-10/10	12490	323	HZ 1180M D	14/AZ 13-770
10815	295	HZ 1080M C	14/AZ 20-700	11580	347	HZ 880M C	26/AZ 18-10/10	12500	331	HZ 1080M B	24/AZ 14-770-10/10
10820	306	HZ 1080M C	14/AZ 30-750	11600	314	HZ 1080M A	24/AZ 20-800	12505	349	HZ 1080M D	14/AZ 26
10820	335	HZ 880M B	26/AZ 32-750	11605	312	HZ 1080M A	24/AZ 13-770	12515	329	HZ 1180M D	14/AZ 14-770-10/10

W_{ely}^*	$G_{100\%}$	Section	Combination	W_{ely}^*	$G_{100\%}$	Section	Combination	W_{ely}^*	$G_{100\%}$	Section	Combination
cm ³ /m	kg/m ²			cm ³ /m	kg/m ²			cm ³ /m	kg/m ²		
12590	346	HZ 1180M B	14/AZ 26-700	13935	339	HZ 1080M B	26/AZ 13-770	15530	414	HZ 1080M C	24/AZ 26
12610	339	HZ 1080M B	24/AZ 25-800	13950	362	HZ 1080M A	26/AZ 32-750	15570	394	HZ 1080M D	24/AZ 18-700
12620	356	HZ 1180M D	12/AZ 18-10/10	13960	344	HZ 1080M B	26/AZ 14-770-10/10	15605	400	HZ 1080M D	24/AZ 20-700
12655	353	HZ 1080M A	24/AZ 26-700	13975	344	HZ 1080M A	26/AZ 18-700	15755	382	HZ 1080M B	26/AZ 18-10/10
12660	338	HZ 1180M D	14/AZ 25-800	14010	350	HZ 1080M A	26/AZ 20-700	15795	390	HZ 1080M C	26/AZ 28-750
12740	338	HZ 1180M A	14/AZ 18-10/10	14060	351	HZ 1080M B	26/AZ 25-800	15800	416	HZ 1080M D	24/AZ 26-700
12865	378	HZ 1180M D	12/AZ 26	14090	365	HZ 1180M C	14/AZ 18-10/10	15815	399	HZ 1180M B	24/AZ 20-800
12915	334	HZ 1180M C	14/AZ 13-700	14110	368	HZ 1080M B	24/AZ 18-10/10	15835	384	HZ 1080M C	26/AZ 13-700
12925	337	HZ 1180M C	14/AZ 13-700-10/10	14220	366	HZ 1080M A	26/AZ 26-700	15835	402	HZ 1180M B	24/AZ 20-800-10/10
12985	344	HZ 1180M C	14/AZ 28-750	14310	377	HZ 1080M C	24/AZ 28-750	15845	386	HZ 1080M C	26/AZ 13-700-10/10
13000	361	HZ 1180M A	14/AZ 26	14315	370	HZ 1080M C	24/AZ 13-700	15855	396	HZ 1080M C	26/AZ 30-750
13035	327	HZ 1080M A	26/AZ 20-800	14315	386	HZ 1080M B	24/AZ 26	15910	385	HZ 1080M D	26/AZ 20-800
13055	352	HZ 1180M C	14/AZ 30-750	14320	373	HZ 1080M C	24/AZ 13-700-10/10	15910	402	HZ 1080M C	26/AZ 32-750
13060	324	HZ 1080M A	26/AZ 13-770	14345	387	HZ 1180M C	14/AZ 26	15920	399	HZ 1180M B	24/AZ 13-770
13060	330	HZ 1080M A	26/AZ 20-800-10/10	14365	383	HZ 1080M C	24/AZ 30-750	15930	388	HZ 1080M D	26/AZ 20-800-10/10
13085	330	HZ 1080M A	26/AZ 14-770-10/10	14420	390	HZ 1080M C	24/AZ 32-750	15940	404	HZ 1180M B	24/AZ 14-770-10/10
13125	360	HZ 1180M C	14/AZ 32-750	14495	372	HZ 1080M C	24/AZ 18-700	15970	400	HZ 1080M B	26/AZ 26
13130	352	HZ 1080M A	24/AZ 18-10/10	14505	373	HZ 1080M D	24/AZ 20-800	15970	410	HZ 1180M B	24/AZ 25-800
13145	337	HZ 1180M C	14/AZ 18-700	14525	376	HZ 1080M D	24/AZ 20-800-10/10	16005	385	HZ 1080M D	26/AZ 13-770
13165	343	HZ 1080M B	24/AZ 13-700	14530	378	HZ 1080M C	24/AZ 20-700	16025	386	HZ 1080M C	26/AZ 18-700
13175	346	HZ 1180M B	14/AZ 18-10/10	14550	375	HZ 1180M D	14/AZ 18-10/10	16030	390	HZ 1080M D	26/AZ 14-770-10/10
13175	346	HZ 1080M B	24/AZ 13-700-10/10	14580	372	HZ 1080M D	24/AZ 13-770	16060	391	HZ 1080M C	26/AZ 20-700
13185	344	HZ 1180M C	14/AZ 20-700	14600	378	HZ 1080M D	24/AZ 14-770-10/10	16075	396	HZ 1080M D	26/AZ 25-800
13205	337	HZ 1080M A	26/AZ 25-800	14665	384	HZ 1080M D	24/AZ 25-800	16075	415	HZ 1180M A	24/AZ 28-750
13205	351	HZ 1080M B	24/AZ 28-750	14705	357	HZ 1080M B	26/AZ 13-700	16130	421	HZ 1180M A	24/AZ 30-750
13265	358	HZ 1080M B	24/AZ 30-750	14715	359	HZ 1080M B	26/AZ 13-700-10/10	16155	410	HZ 1180M A	24/AZ 13-700
13320	364	HZ 1080M B	24/AZ 32-750	14715	364	HZ 1080M B	26/AZ 28-750	16165	412	HZ 1180M A	24/AZ 13-700-10/10
13330	370	HZ 1080M A	24/AZ 26	14725	394	HZ 1080M C	24/AZ 26-700	16185	428	HZ 1180M A	24/AZ 32-750
13345	344	HZ 1180M D	14/AZ 13-700	14775	366	HZ 1080M A	26/AZ 18-10/10	16265	408	HZ 1080M C	26/AZ 26-700
13345	345	HZ 1080M B	24/AZ 18-700	14775	370	HZ 1080M B	26/AZ 30-750	16335	412	HZ 1180M A	24/AZ 18-700
13355	347	HZ 1180M D	14/AZ 13-700-10/10	14805	397	HZ 1180M D	14/AZ 26	16370	418	HZ 1180M A	24/AZ 20-700
13380	351	HZ 1080M B	24/AZ 20-700	14830	377	HZ 1080M B	26/AZ 32-750	16470	420	HZ 1080M D	24/AZ 18-10/10
13390	353	HZ 1180M D	14/AZ 28-750	14900	359	HZ 1080M B	26/AZ 18-700	16565	434	HZ 1180M A	24/AZ 26-700
13435	364	HZ 1180M C	14/AZ 26-700	14930	365	HZ 1080M C	26/AZ 20-800	16600	402	HZ 1180M A	26/AZ 20-800
13435	368	HZ 1180M B	14/AZ 26	14935	365	HZ 1080M B	26/AZ 20-700	16625	405	HZ 1180M A	26/AZ 20-800-10/10
13460	361	HZ 1180M D	14/AZ 30-750	14950	368	HZ 1080M C	26/AZ 20-800-10/10	16670	438	HZ 1080M D	24/AZ 26
13510	353	HZ 1080M C	24/AZ 20-800	14985	384	HZ 1080M A	26/AZ 26	16700	425	HZ 1180M B	24/AZ 28-750
13530	369	HZ 1180M D	14/AZ 32-750	15005	364	HZ 1080M C	26/AZ 13-770	16720	401	HZ 1180M A	26/AZ 13-770
13535	356	HZ 1080M C	24/AZ 20-800-10/10	15025	369	HZ 1080M C	26/AZ 14-770-10/10	16740	407	HZ 1180M A	26/AZ 14-770-10/10
13565	352	HZ 1080M C	24/AZ 13-770	15095	376	HZ 1080M C	26/AZ 25-800	16755	431	HZ 1180M B	24/AZ 30-750
13570	347	HZ 1180M D	14/AZ 18-700	15140	381	HZ 1080M B	26/AZ 26-700	16765	412	HZ 1180M A	26/AZ 25-800
13580	368	HZ 1080M B	24/AZ 26-700	15210	389	HZ 1180M A	24/AZ 20-800	16810	411	HZ 1080M D	26/AZ 28-750
13585	357	HZ 1080M C	24/AZ 14-770-10/10	15230	392	HZ 1180M A	24/AZ 20-800-10/10	16810	420	HZ 1180M B	24/AZ 13-700
13615	354	HZ 1180M D	14/AZ 20-700	15305	389	HZ 1180M A	24/AZ 13-770	16810	438	HZ 1180M B	24/AZ 32-750
13670	364	HZ 1080M C	24/AZ 25-800	15325	394	HZ 1180M A	24/AZ 14-770-10/10	16815	423	HZ 1180M B	24/AZ 13-700-10/10
13780	342	HZ 1080M A	26/AZ 13-700	15330	397	HZ 1080M C	24/AZ 18-10/10	16850	421	HZ 1180M C	24/AZ 20-800
13790	344	HZ 1080M A	26/AZ 13-700-10/10	15340	398	HZ 1080M D	24/AZ 28-750	16865	417	HZ 1080M D	26/AZ 30-750
13830	350	HZ 1080M A	26/AZ 28-750	15370	400	HZ 1180M A	24/AZ 25-800	16870	424	HZ 1180M C	24/AZ 20-800-10/10
13860	374	HZ 1180M D	14/AZ 26-700	15390	392	HZ 1080M D	24/AZ 13-700	16895	405	HZ 1080M D	26/AZ 13-700
13890	340	HZ 1080M B	26/AZ 20-800	15395	395	HZ 1080M D	24/AZ 13-700-10/10	16905	408	HZ 1080M D	26/AZ 13-700-10/10
13890	356	HZ 1080M A	26/AZ 30-750	15395	404	HZ 1080M D	24/AZ 30-750	16925	423	HZ 1080M D	26/AZ 32-750
13910	343	HZ 1080M B	26/AZ 20-800-10/10	15450	411	HZ 1080M D	24/AZ 32-750	16950	411	HZ 1080M C	26/AZ 18-10/10

$W_{el,y}^*$	$G_{100\%}$	Section	Combination	$W_{el,y}^*$	$G_{100\%}$	Section	Combination
cm ³ /m	kg/m ²			cm ³ /m	kg/m ²		
16985	421	HZ 1180M C	24/AZ 13-770	18520	441	HZ 1180M B	26/AZ 20-700
16990	422	HZ 1180M B	24/AZ 18-700	18550	475	HZ 1180M D	24/AZ 32-750
17005	426	HZ 1180M C	24/AZ 14-770-10/10	18590	446	HZ 1180M C	26/AZ 25-800
17010	431	HZ 1180M C	24/AZ 25-800	18595	436	HZ 1180M C	26/AZ 13-770
17020	428	HZ 1180M B	24/AZ 20-700	18615	442	HZ 1180M C	26/AZ 14-770-10/10
17085	408	HZ 1080M D	26/AZ 18-700	18630	459	HZ 1180M D	24/AZ 13-700
17120	413	HZ 1080M D	26/AZ 20-700	18635	462	HZ 1180M D	24/AZ 13-700-10/10
17160	428	HZ 1080M C	26/AZ 26	18725	457	HZ 1180M B	26/AZ 26-700
17200	411	HZ 1180M B	26/AZ 20-800	18805	461	HZ 1180M D	24/AZ 18-700
17215	444	HZ 1180M B	24/AZ 26-700	18840	467	HZ 1180M D	24/AZ 20-700
17225	414	HZ 1180M B	26/AZ 20-800-10/10	18875	452	HZ 1180M A	26/AZ 18-10/10
17285	439	HZ 1180M A	24/AZ 18-10/10	19035	483	HZ 1180M D	24/AZ 26-700
17325	430	HZ 1080M D	26/AZ 26-700	19065	450	HZ 1180M D	26/AZ 20-800
17335	411	HZ 1180M B	26/AZ 13-770	19080	470	HZ 1180M A	26/AZ 26
17355	417	HZ 1180M B	26/AZ 14-770-10/10	19085	453	HZ 1180M D	26/AZ 20-800-10/10
17365	422	HZ 1180M B	26/AZ 25-800	19170	474	HZ 1180M C	24/AZ 18-10/10
17485	456	HZ 1180M A	24/AZ 26	19225	461	HZ 1180M D	26/AZ 25-800
17495	435	HZ 1180M D	24/AZ 20-800	19240	451	HZ 1180M D	26/AZ 13-770
17515	438	HZ 1180M D	24/AZ 20-800-10/10	19260	456	HZ 1180M D	26/AZ 14-770-10/10
17530	427	HZ 1180M A	26/AZ 28-750	19365	492	HZ 1180M C	24/AZ 26
17585	434	HZ 1180M A	26/AZ 30-750	19425	463	HZ 1180M C	26/AZ 28-750
17640	440	HZ 1180M A	26/AZ 32-750	19480	469	HZ 1180M C	26/AZ 30-750
17645	435	HZ 1180M D	24/AZ 13-770	19540	476	HZ 1180M C	26/AZ 32-750
17650	423	HZ 1180M A	26/AZ 13-700	19565	464	HZ 1180M B	26/AZ 18-10/10
17650	446	HZ 1180M D	24/AZ 25-800	19630	460	HZ 1180M C	26/AZ 13-700
17660	426	HZ 1180M A	26/AZ 13-700-10/10	19640	462	HZ 1180M C	26/AZ 13-700-10/10
17665	441	HZ 1180M D	24/AZ 14-770-10/10	19775	481	HZ 1180M B	26/AZ 26
17775	447	HZ 1180M C	24/AZ 28-750	19815	462	HZ 1180M C	26/AZ 18-700
17830	453	HZ 1180M C	24/AZ 30-750	19850	468	HZ 1180M C	26/AZ 20-700
17835	425	HZ 1180M A	26/AZ 18-700	19905	491	HZ 1180M D	24/AZ 18-10/10
17870	431	HZ 1180M A	26/AZ 20-700	20050	484	HZ 1180M C	26/AZ 26-700
17885	460	HZ 1180M C	24/AZ 32-750	20080	478	HZ 1180M D	26/AZ 28-750
17935	443	HZ 1180M C	24/AZ 13-700	20100	508	HZ 1180M D	24/AZ 26
17940	446	HZ 1180M C	24/AZ 13-700-10/10	20135	484	HZ 1180M D	26/AZ 30-750
17975	450	HZ 1180M B	24/AZ 18-10/10	20195	491	HZ 1180M D	26/AZ 32-750
18075	447	HZ 1180M A	26/AZ 26-700	20320	475	HZ 1180M D	26/AZ 13-700
18080	434	HZ 1080M D	26/AZ 18-10/10	20325	478	HZ 1180M D	26/AZ 13-700-10/10
18110	445	HZ 1180M C	24/AZ 18-700	20500	477	HZ 1180M D	26/AZ 18-700
18145	451	HZ 1180M C	24/AZ 20-700	20535	483	HZ 1180M D	26/AZ 20-700
18150	438	HZ 1180M B	26/AZ 28-750	20735	499	HZ 1180M D	26/AZ 26-700
18175	467	HZ 1180M B	24/AZ 26	20975	492	HZ 1180M C	26/AZ 18-10/10
18210	444	HZ 1180M B	26/AZ 30-750	21180	509	HZ 1180M C	26/AZ 26
18265	450	HZ 1180M B	26/AZ 32-750	21705	508	HZ 1180M D	26/AZ 18-10/10
18285	452	HZ 1080M D	26/AZ 26	21905	526	HZ 1180M 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				





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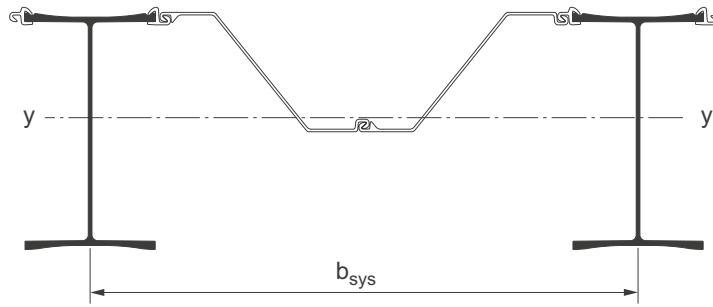
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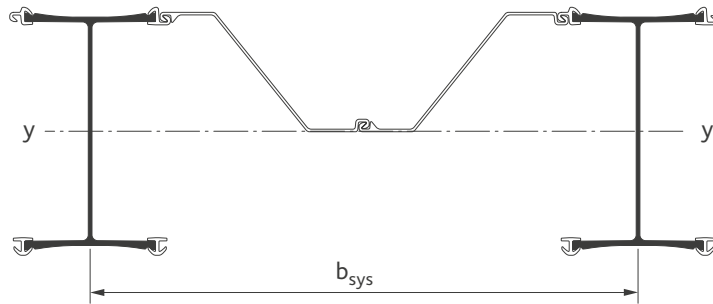
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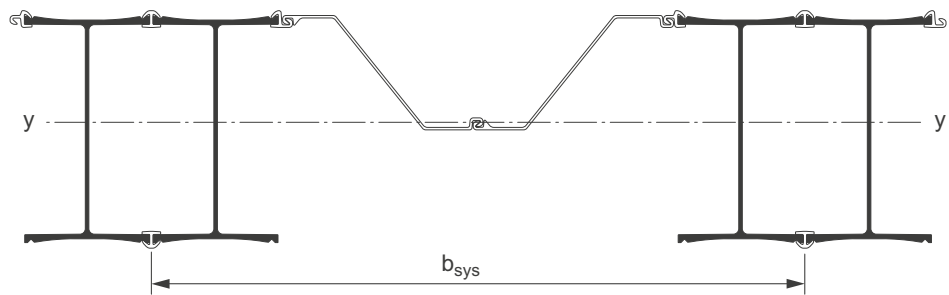
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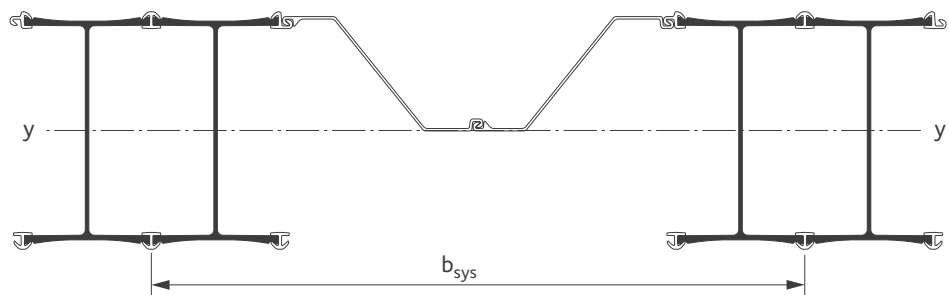
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