Sheet piling sections // Range of products

Overview of hot- and cold-rolled sections

ThyssenKrupp Infrastructure

Contents

ThyssenKrupp Infrastructure
Integrated solutions for civil and foundation engineering

Individually, ThyssenKrupp Bautechnik, ThyssenKrupp Tiefbautechnik, and ThyssenKrupp Bauservice have already achieved success in the market in their own right. Now the three are merging to form one single company: ThyssenKrupp Infrastructure. In the future our combined strength will create even more sustainable value for our customers.

Whether it's about mobility, urbanization, climate change, or resource efficiency: As a leading supplier of civil, marine, and foundation engineering solutions, we cover the full range of services for global infrastructure projects. Our portfolio is organized into four divisions: steel sections, machinery, trench shoring, and scaffolding systems.

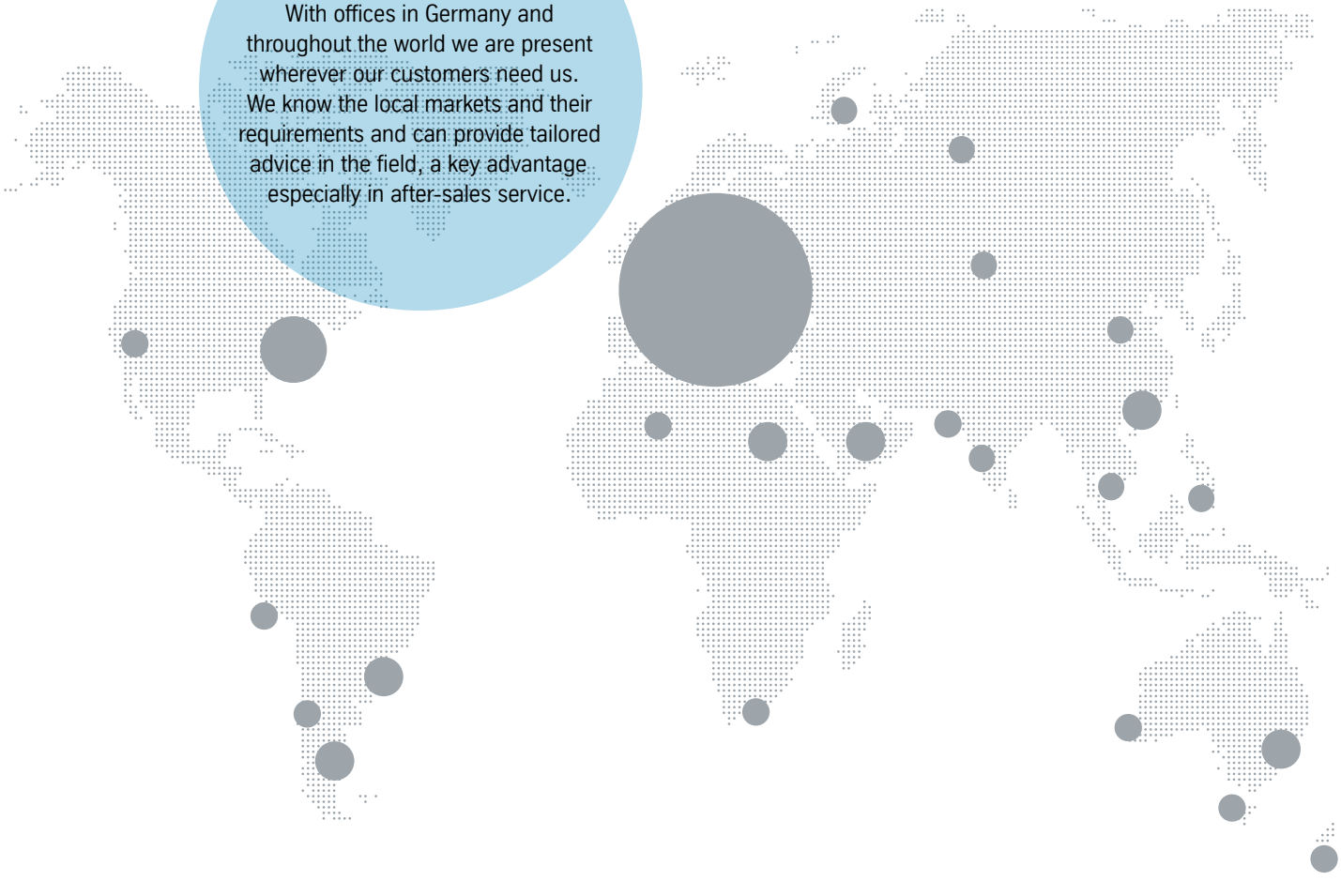
We see ourselves as a full-service supplier to the construction industry. We support and advise our customers all the way, developing solutions precisely tailored to the job in hand. For this we can rely on the expert support of our own consulting engineers.

We provide our customers with all the products they need to execute their projects. Most of these products come from our own production, such as MÜLLER pile driving and extracting equipment and TKL cold-formed sections. We are the exclusive distributors of TK-ASF anchor equipment and Emunds + Staudinger | KRINGS trench shoring systems.

We place great emphasis on sustainability. Our steel products meet the highest environmental performance standards: They are produced with minimum energy consumption, are eco-friendly in use, straightforward to dismantle, and virtually 100% recyclable. Our driving and extracting equipment is quiet and low on CO_2 emissions.

Global presence

With offices in Germany and throughout the world we are present wherever our customers need us. We know the local markets and their requirements and can provide tailored advice in the field, a key advantage especially in after-sales service.



ThyssenKrupp Infrastructure
Steel sections

Key elements of our integrated range of system solutions are the sale and hire of steel sheet piling, anchor equipment, and flood protection systems. As a multi-supplier we provide a broad range of products from various manufacturers, supplemented by a comprehensive service package of consulting, technical support, logistics, and leasing.

Steel sections

Sheet piling has a diverse range of uses, extending from water, road, and civil engineering to environmental protection. Our portfolio of products and services is just as diverse.

Hot-rolled sheet steel sections
- U-sections
- Z-sections
- Combined steel sheet piling
- Steel box piles
- Heavy-duty wall sections
- Intermediate piles

Cold-rolled sheet steel sections
- Trench sheeting
- Lightweight sections

Sealing systems
- TK interlock sealing system HOESCH
- Bitumen-based interlock sealants
- Other sealing methods

Pipe piles

Beams

Special and regular services
- Corrosion protection
- Fabrication
- Custom sections

Anchor equipment

We provide a comprehensive range of anchors and accessories to meet a wide range of challenges (quay structures, onshore and offshore wind turbine foundations, tunnels, excavations, retaining walls, and slope stabilization).

- TK-ASF drilled injection piles
- Micropiles
- Soil nails
- Anchor piles
- Round steel tie rods
- Anchor drilling rigs
- Accessories

Flood protection

As an end-to-end service provider with a high level of expertise in marine and foundation engineering we offer our customers a broad spectrum of highly efficient flood protection systems for both permanent and temporary use.

Permanent flood protection systems
- Steel sheet pile walls
- Sheet piling modules
- TKR glass wall system

Temporary flood protection systems
- TKR aluminum stop log system
- Fold-up flood protection system
- Stop panel system
- Building protection – gates and doors
- Aqua-Stop dam

Sheet piling adviser app

The entire sheet piling range on your smartphone. Simply scan the code.

iOS Android

ThyssenKrupp Infrastructure
Machinery

The right machinery and equipment is the key to cost-effective execution of marine and foundation projects. We therefore supply not only driving equipment, machinery, and accessories, but also the right technical solutions in one precisely tailored, complete package, matched to suit even the most diverse on-site requirements.

Machinery

We provide a full range of equipment for driving sheet piling, pipes, beams, and other sections in light- to heavy-duty operations to ensure the economical implementation of your construction project. Together with MÜLLER driving and extracting equipment and KRUPP drilling equipment we also use our own products.

Vibratory equipment

- MÜLLER vibrators (onshore and offshore)
- MÜLLER excavator-mounted vibrators
- MÜLLER power packs
- MÜLLER leader-mounted vibrators
- MÜLLER clamping devices

Leader mast equipment

- ABI MOBILRAM systems[1]
- BANUT fixed leader masts
- DELMAG drilling rigs
- Presses and special equipment

Drilling equipment

- MÜLLER drill drives
- KRUPP hydraulic hammer drills
- KRUPP double-head drilling systems
- KRUPP VibroDrills
- HUETTE anchor drilling rigs[2]

Driving equipment

- DELMAG diesel hammers
- MENCK freefall hammers
- GIKEN Silent Pilers[3]

Jack-up docks and platforms

[1] Exclusive distributors in Germany, Brazil, Australia
[2] Exclusive distributors in Eastern Europe, Russia, Kazakhstan
[3] Exclusive distributors in Germany

Applications for steel sheet piles
Functions and aesthetics

Steel sheet piles are high-tech products that can perform a huge variety of finely graduated functions, and also satisfy even the highest architectural demands. Good reasons for their popularity in many branches of the building industry.

Hot-rolled pile sections

Hot-rolled steel sheet piles are mainly used for construction engineering projects, because of the high rigidity and very good driving characteristics including a high section modulus. Hot-rolled piling sections are rolled at a temperature of more than 1,200° Celsius. Consequently the steel has a high plasticity and enables multiple profile shapes.

Our range of products:

- U-sections
- Z-sections on request
- Combined steel sheet piles
- Steel box piles
- Heavy-duty wall sections
- Standard rolled products
- Welded structures

Cold-rolled pile sections

Cold-rolled sections are formed from steel sheet in its cold state. Such sections are primarily used in trench shoring and for strengthening dikes because they combine a high structural stiffness with a low weight.

Our range of products:

- Trench sheeting
- Lightweight sections

Bespoke and other services

Additional, individual services extend the great diversity of this range of products even further. Those services include welded structures, impact strengthening, interlock sealing, and factory-applied finished coatings to prolong the service life.

Applications in construction

Hydraulic engineering

Ports

- Quay walls
- Dock structures
- Dolphins
- Ro-Ro facilities

Waterways

- Extensions and upgrades
- Diaphragm/slurry walls
- Embankment protection
- Berths
- Scour protection

Structures for waterways and watercourses

- Locks
- Weirs
- Bridge abutments
- Culverts
- Flood protection walls
- Pier foundations
- Intakes and outfalls

Transport infrastructure

Road and rail

- Retaining walls
- Noise barriers
- Bridge abutments
- Ramps
- Cuttings and tanking
- Tunnels

Civil engineering

- Foundations
- Footings
- Trench shoring
- Underground car parks
- Excavations

Environmental protection

Landfill, legacy pollution, encapsulation

- Vertical diaphragm/slurry walls
- Excavations for soil replacement
- Tank farm bund walls
- Waste-tipping ramps

Noise abatement

- Noise barriers

Water protection

- Pumping stations
- Sewage works
- Stormwater overflow basins
- Stormwater retention basins
- Dike protection

Hot-rolled sheet piling sections

Hot-rolled sheet piling sections
Overview

Section	Section modulus	Section modulus	Weight	Weight	Moment of inertia	Flange thickness	Web thickness	Height	Width
	W_y[1)3)]	W_y[1)3)]			I_y	t	s	h	b
	cm^3/m	cm^3	kg/m^2	kg/m	cm^4/m	mm	mm	mm	mm
	Wall	Single pile	Wall	Single pile	Wall				
TKL									
TKL 601	744	864	77.2	46.3	11,530	7.5	6.4	310	600
TKL 602	842	984	89.0	53.4	13,046	8.4	7.6	310	600
TKL 603	1,200	1,338	107.0	64.2	19,199	9.6	8.2	320	600
TKL 603C	1,300	1,464	120.2	72.1	20,930	10.0	10.0	322	600
TKL 604	1,618	1,830	121.8	73.1	31,548	10.0	9.0	390	600
TKL 604C	1,672	1,890	125.3	75.2	32,600	10.4	9.2	390	600
TKL 605	2,021	2,286	136.8	82.1	42,433	12.3	9.2	420	600
TKL 605C	2,068	2,352	142.8	85.7	43,435	12.4	10.0	420	600
TKL 606L	2,205	2,487	142.3	85.4	47,402	13.4	9.0	430	600
TKL 606	2,502	2,812	156.5	93.9	53,785	15.8	9.3	430	600
TKL 504L	1,423	1,619	127.0	63.5	24,198	11.2	8.7	340	500
TKL 504K	1,602	1,816	140.6	70.3	27,233	13.0	9.3	340	500
Asia									
Type IV W	2,700	539	177.0	106.0	56,700	18.0	–	420	600
Type III W	1,800	376	136.0	81.6	32,400	13.4	–	360	600
Type II W	1,000	203	103.0	61.8	13,000	10.3	–	260	600
Type VI L	3,820	680	240.0	120.0	86,000	27.6	–	450	500
Type V L	3,150	520	210.0	105.0	63,000	24.3	–	400	500
Type IV	2,270	362	190.0	76.1	38,600	15.5	–	340	400
Type III	1,340	223	150.0	60.0	16,800	13.0	–	250	400
Type II	874	152	120.0	48.0	8,740	10.5	–	200	400
NSP-10H	902	812	96.0	86.4	10,500	10.8	–	230	900
NSP-25H	1,610	1,450	126.0	113.0	24,400	13.2	–	300	900

Changing of section description TKL 504 to TKL 504K, starting from 01/2015.

For explanation of footnotes, see page 50.

Typical applications: low-water lock – hot-rolled pile sections

Hot-rolled sheet piling sections
Overview

Section	Section modulus	Section modulus	Weight	Weight	Moment of inertia	Flange thickness	Web thickness	Height	Width
	W_y[1)3)]	W_y[1)3)]			I_y	t	s	h	b
	cm^3/m	cm^3	kg/m^2	kg/m	cm^4/m	mm	mm	mm	mm
	Wall	Single pile	Wall	Single pile	Wall				
Gerdau/ball-and-socket interlock									
PZC 13	1,300	920	106.0	75.1	20,760	9.5	9.5	319	708
PZC 14	1,400	990	115.5	81.8	22,440	10.7	10.7	320	708
PZC 18	1,800	1,145	118.2	75.1	34,890	9.5	9.5	387	635
PZC 19	1,945	1,235	128.8	81.8	37,780	10.7	10.7	388	635
PZC 25	2,455	1,740	145.9	103.3	55,190	14.2	12.3	449	708
PZC 26	2,600	1,840	155.4	110.0	58,460	15.2	13.3	450	708
PZC 28	2,755	1,950	166.1	117.6	62,150	16.4	14.5	457	708
PZC 37	3,680	2,100	181.2	103.6	98,270	14.3	12.4	534	572
PZC 39	3,890	2,220	192.8	110.2	104,100	15.2	13.3	535	572
PZC 41	4,090	2,340	204.1	116.6	109,700	16.2	14.2	536	572

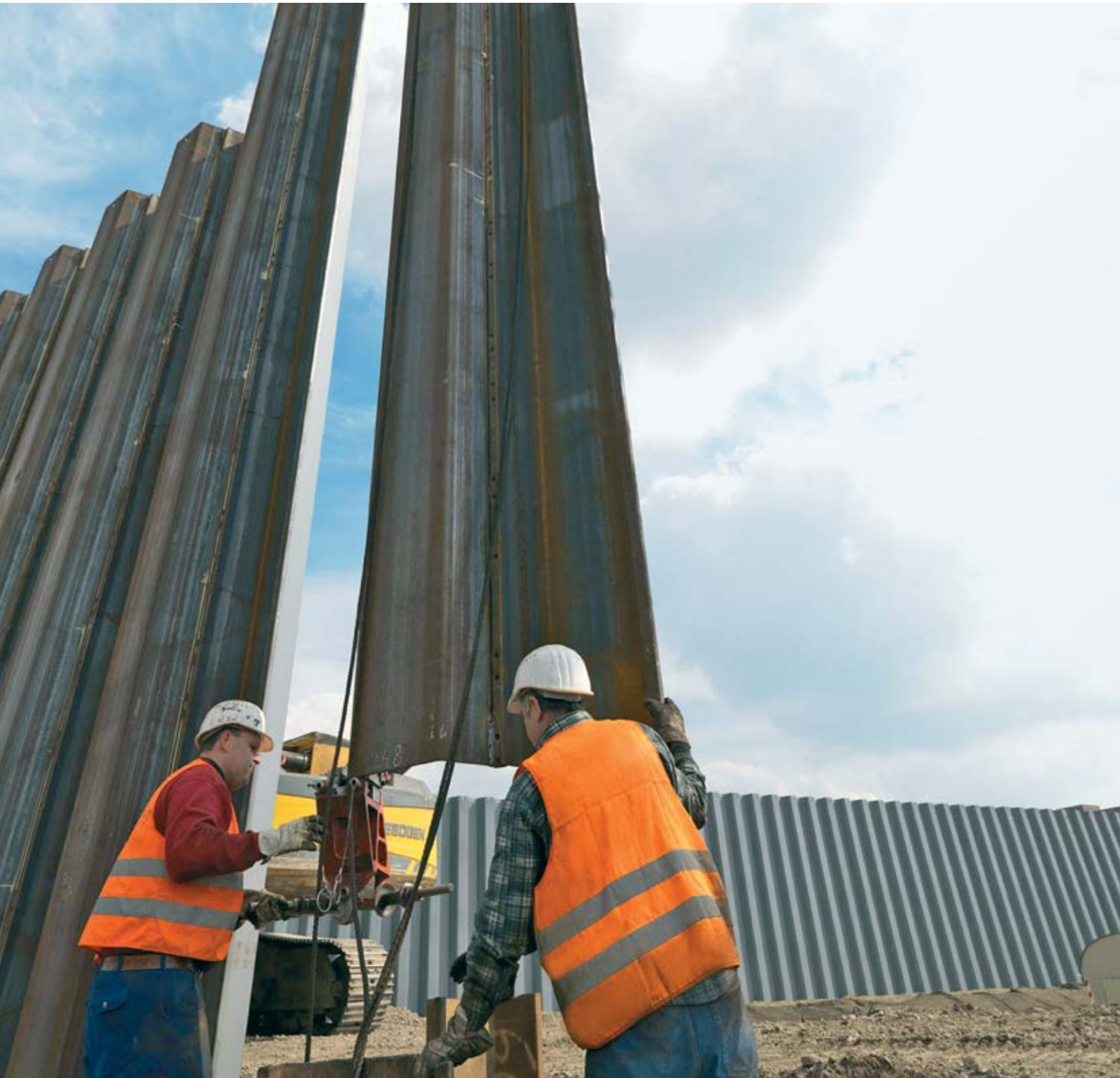
U-, Z- and straight-web sections in lengths from 30 m to 36 m on request. Basis for invoicing is the weight of the single pile (kg/m).

For explanation of footnotes, see page 50.

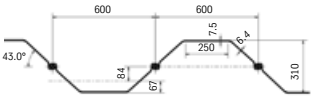
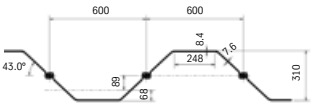
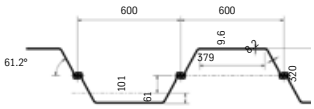
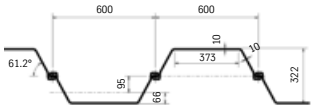
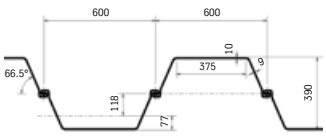
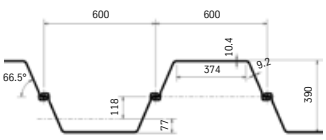
U-sections

Advantages

- Diverse range of sections for the most diverse applications
- Outstanding structural properties
- Optimum reuse options
- Good driving performance, good quality
- Easy installation of anchor systems and hinged connections, even underwater
- Good corrosion protection

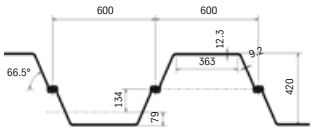
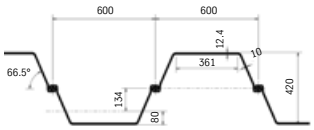
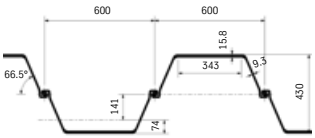
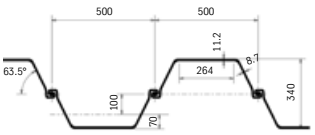
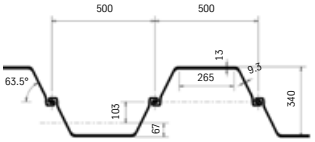


U-sections
Details

Section E = single pile D = double pile Dr = triple pile		Elastic section modulus[1) 3)]	Plastic section modulus[1) 3)]	Weight	Cross-sectional area	Perim-eter[4)]	Coating area[5)]	Static moment	Moment of inertia	Radius of gyration	Classification to ENV 1993-5	
		W_y	W_y					S_y	I_y	i_y	Steel grade	
		cm³	cm³	kg/m	cm²	cm	m²/m	cm³	cm⁴	cm	S 270 GP	S 355 GP
TKL												
TKL 601	per m wall	744	864	77.20	98.30	245	2.45	432	11,530	10.83	2	3
	per E	221	–	46.20	59.00	172	1.60	–	2,390	6.36	–	–
	per D	893	–	92.60	118.00	319	3.07	–	13,830	10.83	–	–
	per Dr	1,036	–	138.90	177.00	466	4.54	–	19,070	10.38	–	–
TKL 602	per m wall	842	984	89.00	113.30	245	2.45	492	13,046	10.73	2	2
	per E	252	–	53.40	68.00	172	1.60	–	2,700	6.30	–	–
	per D	1,010	–	106.80	136.00	319	3.07	–	15,660	10.73	–	–
	per Dr	1,172	–	160.20	204.00	466	4.54	–	21,550	10.28	–	–
TKL 603	per m wall	1,200	1,338	107.00	136.30	263	2.63	669	19,199	11.87	3	3
	per E	304	–	64.20	81.80	185	1.70	–	3,650	6.68	–	–
	per D	1,440	–	128.40	163.60	341	3.30	–	23,040	11.87	–	–
	per Dr	1,653	–	192.60	245.40	497	4.85	–	31,860	11.39	–	–
TKL 603C	per m wall	1,300	1,464	120.20	153.10	263	2.63	732	20,930	11.69	3	3
	per E	360	–	72.10	91.90	185	1.70	–	4,220	6.78	–	–
	per D	1,560	–	144.20	183.80	341	3.30	–	25,110	11.69	–	–
	per Dr	1,797	–	216.30	275.70	497	4.85	–	34,600	11.20	–	–
TKL 604	per m wall	1,618	1,830	121.80	155.20	283	2.83	915	31,548	14.26	3	3
	per E	431	–	73.10	93.10	197	1.84	–	5,990	8.02	–	–
	per D	1,942	–	146.20	186.20	365	3.53	–	37,860	14.26	–	–
	per Dr	2,217	–	219.30	279.30	535	5.23	–	51,890	13.63	–	–
TKL 604C	per m wall	1,672	1,890	125.30	159.70	283	2.83	945	32,600	14.29	3	3
	per E	435	–	75.20	95.80	197	1.84	–	6,080	7.97	–	–
	per D	2,006	–	150.40	191.60	365	3.53	–	39,120	14.29	–	–
	per Dr	2,270	–	225.60	287.40	535	5.23	–	53,240	13.61	–	–

For explanation of footnotes, see page 50.

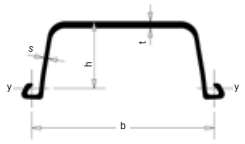
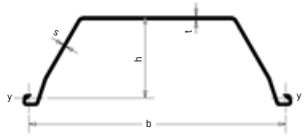
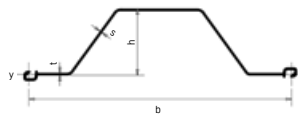
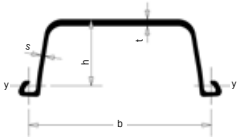
U-sections
Details

Section E = single pile D = double pile Dr = triple pile		Elastic section modulus[1) 3)]	Plastic section modulus[1) 3)]	Weight	Cross-sectional area	Perim-eter[4)]	Coating area[5)]	Static moment	Moment of inertia	Radius of gyration	Classification to ENV 1993-5	
		Wy	Wy					Sy	Iy	iy	Steel grade	
		cm³	cm³	kg/m	cm²	cm	m²/m	cm³	cm⁴	cm	S 270 GP	S 355 GP
TKL 605	per m wall	2,021	2,286	136.80	174.20	290	2.90	1,143	42,433	15.61	2	2
	per E	491	–	82.10	104.50	200	1.88	–	7,525	8.49	–	–
	per D	2,425	–	164.20	209.00	374	3.62	–	50,920	15.61	–	–
	per Dr	2,751	–	246.30	313.50	548	5.36	–	69,720	14.91	–	–
TKL 605C	per m wall	2,068	2,352	142.80	182.00	290.00	2.90	1,176	43,435	15.45	2	2
	per E	511	–	85.70	109.20	200.00	1.88	–	7,765	8.43	–	–
	per D	2,482	–	171.40	218.40	374.00	3.62	–	52,122	15.45	–	–
	per Dr	2,824	–	257.10	327.60	548.00	5.36	–	71,440	14.77	–	–
TKL 606L	per m wall	2,205	2,487	142.30	181.30	292.00	2.92	1,243	47,402	16.17	2	2
	per E	504	–	85.40	108.80	201.00	1.89	–	8,020	8.59	–	–
	per D	2,646	–	170.80	217.60	377.00	3.65	–	56,883	16.17	–	–
	per Dr	2,991	–	256.20	326.40	552.00	5.4	–	77,913	15.45	–	–
TKL 606	per m wall	2,502	2,812	156.50	199.30	292.00	2.92	1,406	53,785	16.43	2	2
	per E	517	–	93.90	119.60	201.00	1.89	–	8,455	8.41	–	–
	per D	3,002	–	187.80	239.20	377.00	3.65	–	64,542	16.43	–	–
	per Dr	3,370	–	281.70	358.80	552.00	5.4	–	88,220	15.68	–	–
TKL 504L	per m wall	1,423	1,619	127.00	161.70	282.00	2.82	810	24,198	12.23	2	2
	per E	334	–	63.50	80.90	167.20	1.55	–	4,052	7.08	–	–
	per D	1,423	–	127.00	161.80	308.00	2.95	–	24,198	12.23	–	–
	per Dr	1,654	–	190.50	242.70	450.00	4.36	–	33,602	11.77	–	–
TKL 504K	per m wall	1,602	1,816	140.60	179.10	282.00	2.82	908	27,233	12.44	2	2
	per E	346	–	70.30	89.60	167.20	1.55	–	4,300	6.93	–	–
	per D	1,602	–	140.60	179.20	308.00	2.95	–	27,233	12.33	–	–
	per Dr	1,849	–	210.90	268.80	450.00	4.36	–	37,736	11.85	–	–

Changing of section description TKL 504 to TKL 504K, starting from 01/2015.

For explanation of footnotes, see page 50.

U-sections
Details

Section E = single pile		Elastic section modulus[1) 3)]	Weight	Cross-sectional area	Moment of inertia	Flange thickness	Web thickness	Height	Width
		W_y			I_y	t	s	h	b
		cm³	kg/m	cm²	cm⁴	mm	mm	mm	mm
Asian sections									
Type II	per m wall	874	120.0	153.0	8,740	10.5	–	200	–
	per E	152	48.0	61.2	–	–	–	100	400
Type III	per m wall	1,340	150.0	191.0	16,800	13.0	–	250	–
	per E	223	60.0	76.4	–	–	–	125	400
Type IV	per m wall	2,270	190.0	242.5	38,600	15.5	–	340	–
	per E	362	76.1	96.9	–	–	–	170	400
Type VL	per m wall	3,150	210.0	267.7	63,000	24.3	–	400	–
	per E	520	105.0	133.8	–	–	–	200	500
Type VI L	per m wall	3,820	240.0	306.0	86,000	27.6	–	450	–
	per E	680	120.0	152.9	–	–	–	225	500
									
Type II W	per m wall	1,000	103	131.2	13,000	10.3	–	260	–
	per E	203	61.8	78.7	–	–	–	130	600
Type III W	per m wall	1,800	136.0	173.2	32,400	13.4	–	360	–
	per E	376	81.6	103.9	–	–	–	180	600
Type IV W	per m wall	2,700	177.0	225.5	56,700	18.0	–	420	–
	per E	539	106.0	135.0	–	–	–	210	600
									
NSP-10H	per m wall	902	96.0	122.2	10,500	10.8	10.8	230	–
	per E	812	86.4	110.1	–	–	–	230	900
NSP-25H	per m wall	1,610	126.0	160.4	24,400	13.2	13.2	300	–
	per E	1,450	113.0	143.9	–	–	–	300	900
									
Russian sections									
L 4	per m wall	2,200	195.0	235.7	37,837	14.8	9.5	344	–
	per E	405	74.0	94.3	–	–	–	172	400
L 5	per m wall	2,962	238.1	303.3	50,943	21.0	11.0	344	–
	per E	461	100.0	127.4	–	–	–	172	420
L 5UM	per m wall	3,555	227.2	289.4	76,430	23.0	11.0	430	–
	per E	–	113.6	144.7	–	–	–	215	500
									

For explanation of footnotes, see page 50.

Interlock forms, forms of supply, handling holes and interlocking

Interlocks

U-section (LARSSEN interlock)
Interlock form to DIN EN 10248-2 and EAU 2012 (Recommendations of Committee for Waterfront Structures, Harbours & Waterways) R 67

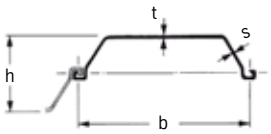
NSP section
Interlock form to DIN EN 10248-2 and EAU 2012 (Recommendations of Committee for Waterfront Structures, Harbours & Waterways) R 67

Handling holes and interlocking

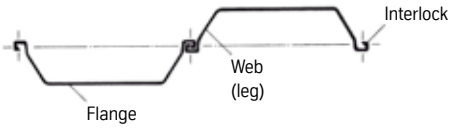
Handling holes can be drilled on request. They are drilled in every pile flange according to the drawing below. The distance of the hole from the top edge is 75 or 300 mm and must be specified with the order. Factory crimping, factory shear-resistant welding, or site welding of the interlocks is required to achieve the section moduli of the U-sections specified in this publication. The crimped double piles will be delivered with triple press points with an interval of 0.6 m. Other dimensions can be specified for crimping points, handling holes, and interlocking on request. The load-bearing capacity of each crimping point is min. 75 kN for a mutual displacement of 5 mm.

Forms of supply

E



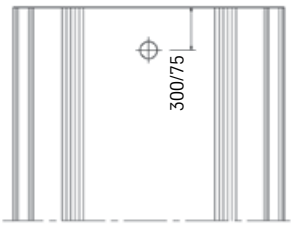
D
(S-form)

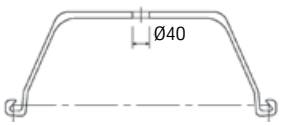


Dz
(Z-form is non-standard)

Dr

Triple piles on request



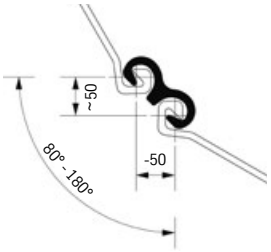


Corner and junction piles, Steelwall connectors

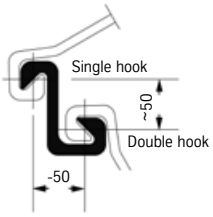
Corner and junction piles

U-section connectors for corners and junctions
for sheet piling sections with LARSSEN interlock.

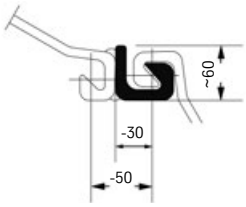
Omega 17
Weight: 17.3 kg/m



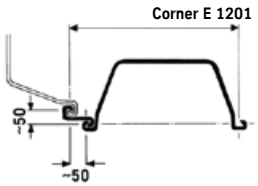
Corner section 20
Weight: 16.5 kg/m

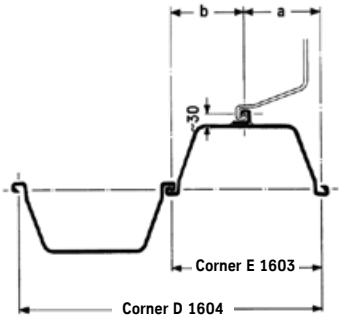


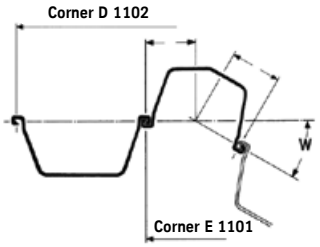
Corner section 22
Weight: 10.6 kg/m

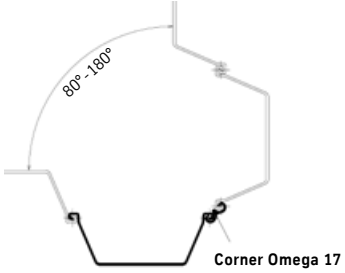


Examples









A wide range of applications

Hot-rolled Z-sections

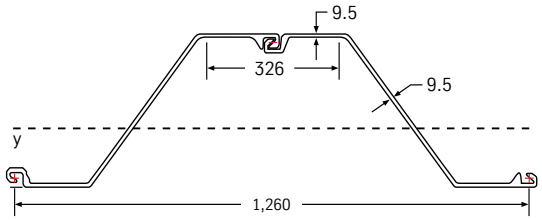
The continuous web of sheet piling and the specific location of the interlocks symmetrical to the neutral axis are the essential features of Z-sections. Both factors have a positive effect on the section modulus in the sheet pile – and do so at a relatively low weight. That results in great economic value.

Important advantages

- Increased moment of inertia to limit deflection and permit the use of higher-quality steels for economic solutions
- Better protection against corrosion by using greater material thicknesses at endangered points

As a high-tech product, steel sheet piling can handle a wide range of functions and applications. Among other things, it is used in hydraulic engineering, transportation infrastructure construction, or for retaining walls and noise barriers.

In addition to steel sheet piling, the portfolio of ThyssenKrupp Infrastructure also encompasses machinery for installation of sheet piling as well as services, such as steel fabrication, cutting, etc., and also we can provide anchor technology for project requirements.



Section	Single pile					Per m of wall				Classification under DIN EN 1093-5	
	Width	Height	Thicknesses		Mass	Mass	Selectional area	Moment of inertia	Elastic modulus	Steel grade	
	b	h	t	s	G	M	A	y	y		
	mm	mm	mm	mm	kg/m	kg/m	cm²/m	cm⁴/m	cm³/m	S 270 GP	S 355 GP
TKZ 17-630***	630	374	8.5	8.5	69.8	110.8	141.2	31,300	1,670	2	3
TKZ 18-630	630	375	9.5	9.5	76.0	120.7	153.7	33,850	1,805	2	2
TKZ 19-630***	630	376	10.5	10.5	82.2	130.5	166.3	36,410	1,940	2	2
TKZ 20-630***	630	377	11.0	11.0	85.4	135.6	172.7	37,734	2,004	2	2

*** At time of printing. TKZ 17. 19 and 20 are subject to final confirmation after production tests.
Hot-rolled sheet piles are supplied according to EN 10248.

Other steel products

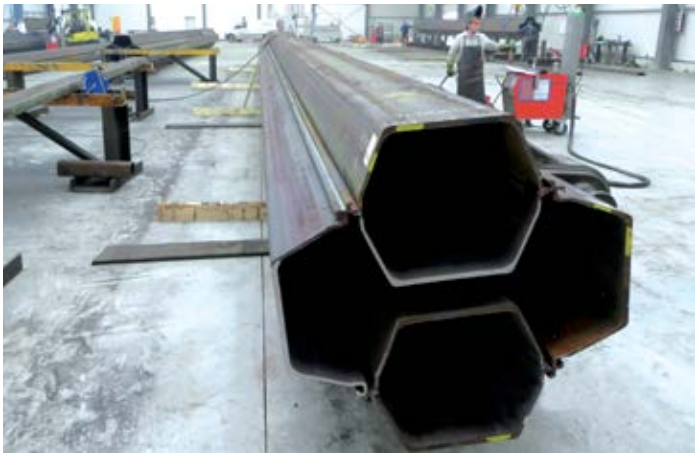
Steel box piles

A selection from the complete range	Pile section[7)]	Section modulus	Section modulus	Weight	Dimensions				Circum-ference	Area steel cross-section	Moment of inertia	Moment of inertia	Radius of gyration
		W_y	W_z		b	h	t	s			I_y	I_z	i_y
		cm³	cm³	kg/m	mm	mm	mm	mm	cm	cm²	cm⁴	cm⁴	cm
TKLP	TKLP 601	1,030	1,530	92.6	634	351	7.5	6.4	188	118.0	18,200	48,500	12.4
	TKLP 602	1,190	1,760	106.8	634	351	8.4	7.6	188	136.0	20,800	55,800	12.4
	TKLP 603	1,700	2,210	128.4	638	364	9.6	8.2	202	163.6	30,900	70,500	13.7
	TKLP 603C	1,850	2,580	144.2	638	368	10.0	10.0	202	183.8	34,000	82,300	13.4
	TKLP 604	2,210	2,590	146.2	638	434	10.0	9.0	214	186.2	48,000	82,600	16.0
	TKLP 604C	2,280	2,610	150.4	638	434	10.4	9.2	214	191.6	49,200	83,200	16.0
	TKLP 605	2,730	2,730	164.2	638	466	12.3	9.2	218	209.0	63,300	87,100	17.4
	TKLP 605C	2,830	2,870	171.4	638	466	12.4	10.0	218	218.4	66,000	91,500	17.4
	TKLP 606	3,400	2,860	187.8	635	475	15.8	9.3	218	239.2	80,500	90,800	18.3
	TKLP 606L	2,970	2,740	170.8	635	475	13.4	9.0	218	217.6	70,400	87,000	18.0
	TKLP 504K	1,870	1,870	140.6	536	384	13.0	9.3	184	179.2	35,700	50,100	14.1
	TKLP 504L	1,640	1,780	127.0	536	384	11.2	8.7	184	161.8	31,400	47,700	13.9
TKLD	TKLD 601	3,170	3,010	138.9	747	728	7.5	6.4	284	177.0	112,400	112,600	25.2
	TKLD 602	3,640	3,470	204.0	747	728	8.4	7.6	284	204.0	128,900	129,500	25.1
	TKLD 603	4,660	4,110	192.6	821	739	9.6	8.2	300	245.4	168,800	168,500	26.2
	TKLD 603C	5,220	4,600	216.3	821	739	10.0	10.0	300	275.7	188,900	189,000	26.2
	TKLD 604	5,360	4,840	219.3	880	774	10.0	9.0	317	279.3	212,700	212,700	27.6
	TKLD 604C	5,510	4,970	225.6	880	774	10.4	9.2	317	287.4	218,700	218,600	27.6
	TKLD 605	6,180	5,570	246.3	902	790	12.3	9.2	324	313.5	262,100	248,200	28.9
	TKLD 605C	6,440	5,810	257.1	902	790	12.4	10.0	324	327.6	273,400	259,000	28.9
	TKLD 606	6,990	6,280	281.7	905	792	15.8	9.3	324	358.8	290,600	286,100	28.5
	TKLD 606L	6,320	5,660	256.2	905	792	13.4	9.0	324	326.4	263,000	257,800	28.4
	TKLD 504K	4,160	4,030	210.9	737	659	13.0	9.3	272	268.8	138,700	149,000	22.7
	TKLD 504L	3,760	3,650	190.5	737	659	11.2	8.7	272	242.7	125,200	135,100	22.7

Weld seam form: external, continuous; weld seam thickness: min. a = 5 mm.
The pile sections shown here are just a selection from the total range. Further types can be supplied on request.

Changing of section description TKL 504 to TKL 504K, starting from 01/2015.
Changing of section description TKLD 504 to TKLD 504K, starting from 01/2015.

For explanation of footnotes, see page 50.



Steel box piles

A selection from the complete range	Pile section[7)]	Section modulus	Section modulus	Weight	Dimensions				Circum-ference	Area steel cross-section	Moment of inertia	Moment of inertia	Radius of gyration
		W_y	W_z		b	h	t	s			I_y	I_z	i_y
		cm³	cm³	kg/m	mm	mm	mm	mm	cm	cm²	cm⁴	cm⁴	cm
TKLV	TKLV 601	5,330		185.2	970	970	7.5	6.4	368	236.0	258,500		33.1
	TKLV 602	6,110		213.6	970	970	8.4	7.6	368	272.0	296,600		33.0
	TKLV 603	7,770		256.8	990	990	9.6	8.2	395	327.2	384,600		34.3
	TKLV 603C	8,670		288.4	990	990	10.0	10.0	395	367.6	429,000		34.2
	TKLV 604	8,960		292.4	1,060	1,060	10.0	9.0	418	372.4	474,900		35.7
	TKLV 604C	9,220		300.8	1,060	1,060	10.4	9.2	418	383.2	488,600		35.7
	TKLV 605	10,170		328.4	1,090	1,090	12.3	9.2	428	418.0	554,100		36.4
	TKLV 605C	10,590		342.8	1,090	1,090	12.4	10.0	428	436.8	577,300		36.4
	TKLV 606	11,810		375.6	1,100	1,100	15.8	9.3	428	478.4	649,700		36.9
	TKLV 606L	10,650		341.6	1,100	1,100	13.4	9.0	428	435.2	585,800		36.7
	TKLV 504K	7,150		281.2	905	905	13.0	9.3	360	358.4	323,700		30.1
	TKLV 504L	6,440		254.0	905	905	11.2	8.7	360	323.6	291,300		30.0
TKLF	TKLF 604	13,520	12,970	365.5	1,352	1,290	10.0	9.0	524	465.5	879,600	876,800	43.5
	TKLF 604C	13,920	13,680	376.0	1,352	1,290	10.4	9.2	524	479.0	905,600	906,600	43.4
	TKLF 605	15,380	14,820	410.5	1,379	1,315	12.3	9.2	535	522.5	1,024,600	1,022,300	44.3
	TKLF 605C	16,040	15,460	428.5	1,379	1,315	12.4	10.0	535	546.0	1,067,700	1,066,200	44.2
	TKLF 606	17,810	17,220	469.5	1,382	1,318	15.8	9.3	535	598.0	1,191,600	1,189,600	44.6
	TKLF 606L	16,070	15,510	427.0	1,382	1,318	13.4	9.0	535	544.0	1,074,700	1,071,700	44.5
	TKLF 504K	10,870	10,530	351.5	1,140	1,088	13.0	9.3	450	448.0	602,100	600,600	36.7
	TKLF 504L	9,780	9,480	317.5	1,140	1,088	11.2	8.7	450	404.5	541,800	540,700	36.6
TKLS	TKLS 604	18,590	19,480	438.6	1,504	1,535	10.0	9.0	632	558.6	1,427,300	1,464,600	50.6
	TKLS 604C	19,610	20,050	451.2	1,504	1,535	10.0	9.0	632	574.8	1,470,600	1,508,000	50.6
	TKLS 605	21,230	22,200	492.6	1,524	1,569	12.3	9.2	646	627.0	1,665,000	1,691,500	51.5
	TKLS 605C	22,100	23,150	514.2	1,524	1,569	12.4	10.0	646	655.2	1,734,000	1,763,200	51.4
	TKLS 606	24,630	25,690	563.4	1,524	1,573	15.8	9.3	646	717.6	1,936,700	1,958,200	52.0
	TKLS 606L	22,160	23,190	512.4	1,524	1,573	13.4	9.0	646	652.8	1,742,900	1,767,200	51.7
	TKLS 504K	15,050	15,850	421.8	1,257	1,308	13.0	9.3	544	537.6	984,100	995,900	42.8
	TKLS 504L	13,520	14,260	381.0	1,257	1,308	11.2	8.7	544	485.4	884,100	896,400	42.7

Weld seam form: external, continuous; weld seam thickness: min. a = 5 mm.
The pile sections shown here are just a selection from the total range. Further types can be supplied on request.
Changing of section description TKL 504 to TKL 504K, starting from 01/2015.

For explanation of footnotes, see page 50.

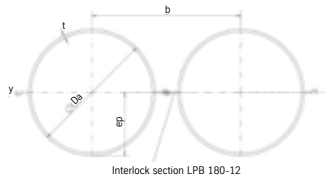
Heavy-duty wall sections

Advantages

- Modular system, which provides options for combined sheet piling plus optimum adaptation to suit structural and constructional requirements
- Secure, structural connections
- Good driving characteristics thanks to essentially symmetrical arrangement of pile sections

Combined steel sheet piling

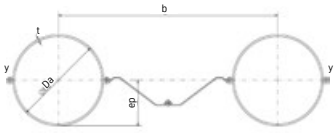
Combined wall with LPB180-12 connector



Interlock section LPB 180-12

Pipe diameter	Wall thickness	Width	Moment of inertia	Section modulus	Edge distance	Dead load related to pipe length. Length of connector LPB 180 in % related to length of pipe			Coating area
Da	t	b	I_y	W_y	ep	60%	80%	100%	Water side
mm	mm	m	cm⁴/m	cm³/m	cm	kg/m²	kg/m²	kg/m²	m²/m
813	10.00	0.993	204,797	5,038	40.65	216.95	222.79	228.63	1.50
813	12.00	0.993	243,942	6,001	40.65	256.24	262.08	267.92	1.50
813	14.00	0.993	282,496	6,949	40.65	295.33	301.17	307.01	1.50
914	10.00	1.094	265,217	5,803	45.70	219.69	224.99	230.29	1.50
914	12.00	1.094	316,170	6,918	45.70	259.91	265.21	270.51	1.50
914	14.00	1.094	366,440	8,018	45.70	299.94	305.24	310.54	1.50
1,016	10.00	1.196	334,322	6,581	50.80	221.99	226.84	231.68	1.51
1,016	12.00	1.196	398,817	7,851	50.80	262.98	267.83	272.68	1.51
1,016	14.00	1.196	462,535	9,105	50.80	303.81	308.66	313.50	1.51
1,220	14.00	1.400	688,907	11,294	61.00	309.85	313.99	318.13	1.52
1,220	16.00	1.400	783,444	12,843	61.00	351.77	355.91	360.06	1.52
1,420	14.00	1.600	955,140	13,453	71.00	314.27	317.90	321.52	1.53
1,420	16.00	1.600	1,086,970	15,309	71.00	357.12	360.75	364.37	1.53
1,420	18.00	1.600	1,217,666	17,150	71.00	399.85	403.47	407.10	1.53
1,620	16.00	1.800	1,440,667	17,786	81.00	361.28	364.51	367.73	1.53
1,620	18.00	1.800	1,614,739	19,935	81.00	404.74	407.97	411.19	1.53
1,620	20.00	1.800	1,787,496	22,068	81.00	448.09	451.32	454.54	1.53
1,820	18.00	2.000	2,068,284	22,728	91.00	408.66	411.56	414.46	1.53
1,820	20.00	2.000	2,290,504	25,170	91.00	452.61	455.51	458.41	1.53
1,820	22.00	2.000	2,511,231	27,596	91.00	496.46	499.36	502.26	1.53
1,820	25.00	2.000	2,839,537	31,204	91.00	562.04	564.94	567.84	1.53

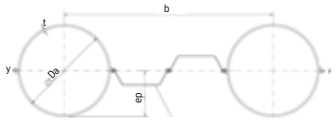
Pipe / sheet pile wall with PZi 675/12 intermediate piles



Pipe diameter	Wall thickness	Width	Including intermediate piles: Moment of inertia	Including intermediate piles: Section modulus	Excluding intermediate piles: Moment of inertia	Excluding intermediate piles: Section modulus	Edge distance	Dead load related to pipe length. Length of connector PZi in % related to length of pipe			Coating area
Da	t	b	I_y	W_y	I_y	W_y	ep	60%	80%	100%	Water side
mm	mm	m	cm⁴/m	cm³/m	cm⁴/m	cm³/m	cm	kg/m²	kg/m²	kg/m²	m²/m
813	10.00	2.228	103,557	2,548	91,276	2,245	40.65	144.74	163.35	181.97	1.37
813	12.00	2.228	121,003	2,977	108,723	2,675	40.65	162.25	180.86	199.48	1.37
813	14.00	2.228	138,186	3,399	125,906	3,097	40.65	179.67	198.29	216.90	1.37
914	10.00	2.329	136,328	2,983	124,580	2,726	45.70	149.15	166.96	184.77	1.37
914	12.00	2.329	160,262	3,507	148,514	3,250	45.70	168.04	185.85	203.67	1.37
914	14.00	2.329	183,875	4,024	172,128	3,766	45.70	186.85	204.66	222.47	1.37
1,016	10.00	2.431	175,734	3,459	164,480	3,238	50.80	153.24	170.31	187.37	1.38
1,016	12.00	2.431	207,464	4,084	196,209	3,862	50.80	173.41	190.47	207.54	1.38
1,016	14.00	2.431	238,812	4,701	227,557	4,479	50.80	193.50	210.56	227.62	1.38
1,220	12.00	2.635	325,669	5,339	315,286	5,169	61.00	182.90	198.64	214.38	1.40
1,220	14.00	2.635	376,406	6,171	366,022	6,000	61.00	205.25	220.99	236.73	1.40
1,220	16.00	2.635	426,634	6,994	416,251	6,824	61.00	227.52	243.26	259.01	1.40
1,420	14.00	2.835	548,707	7,728	539,056	7,592	71.00	215.12	229.76	244.39	1.41
1,420	16.00	2.835	623,108	8,776	613,458	8,640	71.00	239.31	253.94	268.57	1.41
1,420	18.00	2.835	696,869	9,815	687,219	9,679	71.00	263.42	278.05	292.68	1.41
1,620	16.00	3.035	863,447	10,660	854,432	10,549	81.00	249.54	263.21	276.87	1.42
1,620	18.00	3.035	966,685	11,934	957,670	11,823	81.00	275.31	288.98	302.65	1.42
1,620	20.00	3.035	1,069,144	13,199	1,060,130	13,088	81.00	301.02	314.69	328.36	1.42
1,820	18.00	3.235	1,287,149	14,144	1,278,692	14,052	91.00	285.74	298.56	311.38	1.43
1,820	20.00	3.235	1,424,534	15,654	1,416,077	15,561	91.00	312.91	325.73	338.55	1.43
1,820	22.00	3.235	1,560,996	17,154	1,552,538	17,061	91.00	340.02	352.84	365.66	1.43
1,820	25.00	3.235	1,763,967	19,384	1,755,510	19,291	91.00	380.56	393.39	406.21	1.43

Combined steel sheet piling

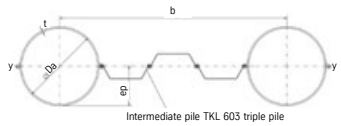
Pipe / sheet pile wall with TKL 603 DB intermediate pile



Intermediate pile TKL 603 double pile

Pipe diameter	Wall thickness	Width	Including intermediate piles		Excluding intermediate piles		Edge distance	Dead load related to pipe length. Length of connector TKL 603 in % related to length of pipe			Coating area
			Moment of inertia	Section modulus	Moment of inertia	Section modulus					
Da	t	b	I_y	W_y	I_y	W_y	ep	60%	80%	100%	Water side
mm	mm	m	cm⁴/m	cm³/m	cm⁴/m	cm³/m	cm	kg/m²	kg/m²	kg/m²	m²/m
813	10.00	2.073	109,216	2,687	98,101	2,413	40.65	138.83	153.26	167.70	1.41
813	12.00	2.073	127,967	3,148	116,852	2,875	40.65	157.65	172.08	186.52	1.41
813	14.00	2.073	146,434	3,602	135,320	3,329	40.65	176.37	190.81	205.24	1.41
914	10.00	2.174	144,060	3,152	133,462	2,920	45.70	143.84	157.60	171.36	1.42
914	12.00	2.174	169,701	3,713	159,103	3,481	45.70	164.07	177.84	191.60	1.42
914	14.00	2.174	194,998	4,267	184,400	4,035	45.70	184.22	197.98	211.75	1.42
1,016	10.00	2.276	185,804	3,658	175,681	3,458	50.80	148.44	161.59	174.73	1.43
1,016	12.00	2.276	219,694	4,325	209,571	4,125	50.80	169.98	183.13	196.27	1.43
1,016	14.00	2.276	253,177	4,984	243,054	4,785	50.80	191.44	204.58	217.73	1.43
1,220	12.00	2.480	344,281	5,644	334,991	5,492	61.00	180.34	192.41	204.47	1.44
1,220	14.00	2.480	398,189	6,528	388,899	6,375	61.00	204.09	216.16	228.22	1.44
1,220	16.00	2.480	451,557	7,403	442,267	7,250	61.00	227.76	239.82	251.89	1.44
1,420	14.00	2.680	578,830	8,153	570,233	8,031	71.00	214.63	225.79	236.95	1.45
1,420	16.00	2.680	657,534	9,261	648,937	9,140	71.00	240.21	251.37	262.54	1.45
1,420	18.00	2.680	735,562	10,360	726,965	10,239	71.00	265.72	276.88	288.04	1.45
1,620	16.00	2.880	908,417	11,215	900,417	11,116	81.00	250.93	261.32	271.71	1.46
1,620	18.00	2.880	1,017,212	12,558	1,009,212	12,459	81.00	278.09	288.48	298.87	1.46
1,620	20.00	2.880	1,125,185	13,891	1,117,185	13,792	81.00	305.18	315.57	325.96	1.46
1,820	18.00	3.080	1,350,522	14,841	1,343,041	14,759	91.00	288.86	298.57	308.29	1.46
1,820	20.00	3.080	1,494,821	16,427	1,487,340	16,344	91.00	317.39	327.11	336.82	1.46
1,820	22.00	3.080	1,638,150	18,002	1,630,669	17,919	91.00	345.87	355.58	365.30	1.46
1,820	25.00	3.080	1,851,336	20,344	1,843,855	20,262	91.00	388.46	398.17	407.88	1.46

Pipe / sheet pile wall with TKL 603 Dr intermediate pile

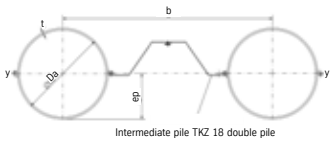


Intermediate pile TKL 603 triple pile

Pipe diameter	Wall thickness	Width	Including intermediate piles		Excluding intermediate piles		Edge distance	Dead load related to pipe length. Length of connector TKL 603 in % related to length of pipe			Coating area
			Moment of inertia	Section modulus	Moment of inertia	Section modulus					
Da	t	b	I_y	W_y	I_y	W_y	ep	60%	80%	100%	Water side
mm	mm	m	cm⁴/m	cm³/m	cm⁴/m	cm³/m	cm	kg/m²	kg/m²	kg/m²	m²/m
813	10.00	2.673	88,000	2,165	76,081	1,872	40.65	122.08	138.07	154.07	1.38
813	12.00	2.673	102,542	2,523	90,623	2,229	40.65	136.67	152.67	168.67	1.38
813	14.00	2.673	116,864	2,875	104,945	2,582	40.65	151.19	167.19	183.19	1.38
914	10.00	2.774	116,080	2,540	104,595	2,289	45.70	126.61	142.03	157.44	1.39
914	12.00	2.774	136,175	2,980	124,690	2,728	45.70	142.47	157.89	173.30	1.39
914	14.00	2.774	156,001	3,414	144,515	3,162	45.70	158.26	173.68	189.09	1.39
1,016	10.00	2.876	150,108	2,955	139,030	2,737	50.80	130.87	145.74	160.60	1.40
1,016	12.00	2.876	176,928	3,483	165,850	3,265	50.80	147.91	162.78	177.65	1.40
1,016	14.00	2.876	203,426	4,004	192,348	3,786	50.80	164.89	179.76	194.63	1.40
1,220	12.00	3.080	280,077	4,591	269,733	4,422	61.00	157.72	171.60	185.48	1.41
1,220	14.00	3.080	323,484	5,303	313,139	5,133	61.00	176.84	190.72	204.61	1.41
1,220	16.00	3.080	366,455	6,007	356,111	5,838	61.00	195.90	209.78	223.66	1.41
1,420	14.00	3.280	475,635	6,699	465,922	6,562	71.00	187.11	200.15	213.18	1.42
1,420	16.00	3.280	539,943	7,605	530,229	7,468	71.00	208.01	221.05	234.08	1.42
1,420	18.00	3.280	603,697	8,503	593,983	8,366	71.00	228.85	241.89	254.93	1.42
1,620	16.00	3.480	754,328	9,313	745,173	9,200	81.00	218.73	231.02	243.31	1.43
1,620	18.00	3.480	844,365	10,424	835,210	10,311	81.00	241.21	253.50	265.79	1.43
1,620	20.00	3.480	933,722	11,527	924,567	11,414	81.00	263.63	275.92	288.21	1.43
1,820	18.00	3.680	1,132,725	12,448	1,124,067	12,352	91.00	252.23	263.85	275.47	1.44
1,820	20.00	3.680	1,253,497	13,775	1,244,839	13,680	91.00	276.11	287.73	299.35	1.44
1,820	22.00	3.680	1,373,457	15,093	1,364,799	14,998	91.00	299.94	311.56	323.18	1.44
1,820	25.00	3.680	1,551,884	17,054	1,543,226	16,959	91.00	335.59	347.21	358.83	1.44

Combined steel sheet piling

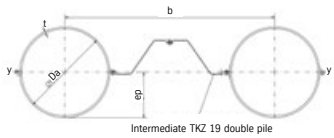
Pipe / sheet pile wall with TKZ 18 DB intermediate pile



Intermediate pile TKZ 18 double pile

Pipe diameter	Wall thickness	Width	Including intermediate piles: Moment of inertia	Including intermediate piles: Section modulus	Excluding intermediate piles: Moment of inertia	Excluding intermediate piles: Section modulus	Edge distance	Dead load related to pipe length. Length of connector TKZ 18 in % related to length of pipe			Coating area
Da	t	b	I_y	W_y	I_y	W_y	ep	60%	80%	100%	Water side
mm	mm	m	cm⁴/m	cm³/m	cm⁴/m	cm³/m	cm	kg/m²	kg/m²	kg/m²	m²/m
813	10.00	2.133	115,338	2,837	95,342	2,345	40.65	153.29	173.44	193.59	1.40
813	12.00	2.133	133,561	3,286	113,565	2,794	40.65	171.58	191.73	211.88	1.40
813	14.00	2.133	151,509	3,727	131,514	3,235	40.65	189.78	209.93	230.08	1.40
914	10.00	2.234	148,970	3,260	129,878	2,842	45.70	157.51	176.75	195.99	1.40
914	12.00	2.234	173,922	3,806	154,830	3,388	45.70	177.21	196.44	215.68	1.40
914	14.00	2.234	198,539	4,344	179,447	3,927	45.70	196.81	216.05	235.29	1.40
1,016	10.00	2.336	189,427	3,729	171,169	3,369	50.80	161.40	179.80	198.20	1.41
1,016	12.00	2.336	222,447	4,379	204,189	4,019	50.80	182.39	200.79	219.19	1.41
1,016	14.00	2.336	255,070	5,021	236,812	4,662	50.80	203.29	221.69	240.09	1.41
1,220	12.00	2.540	343,870	5,637	327,078	5,362	61.00	191.51	208.43	225.35	1.42
1,220	14.00	2.540	396,504	6,500	379,712	6,225	61.00	214.69	231.62	248.54	1.42
1,220	16.00	2.540	448,611	7,354	431,820	7,079	61.00	237.80	254.72	271.65	1.42
1,420	14.00	2.740	573,312	8,075	557,746	7,856	71.00	224.23	239.91	255.60	1.43
1,420	16.00	2.740	650,293	9,159	634,727	8,940	71.00	249.25	264.93	280.62	1.43
1,420	18.00	2.740	726,612	10,234	711,046	10,015	71.00	274.20	289.88	305.57	1.43
1,620	16.00	2.940	896,548	11,068	882,041	10,889	81.00	259.13	273.75	288.37	1.44
1,620	18.00	2.940	1,003,123	12,384	988,616	12,205	81.00	285.74	300.36	314.98	1.44
1,620	20.00	2.940	1,108,893	13,690	1,094,386	13,511	81.00	312.28	326.90	341.52	1.44
1,820	18.00	3.140	1,330,961	14,626	1,317,378	14,477	91.00	295.82	309.50	323.19	1.45
1,820	20.00	3.140	1,472,503	16,181	1,458,920	16,032	91.00	323.81	337.49	351.18	1.45
1,820	22.00	3.140	1,613,093	17,726	1,599,510	17,577	91.00	351.74	365.42	379.11	1.45
1,820	25.00	3.140	1,822,205	20,024	1,808,622	19,875	91.00	393.51	407.20	420.89	1.45

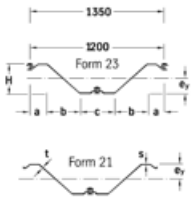
Pipe / sheet pile wall with TKZ 19 DB intermediate pile

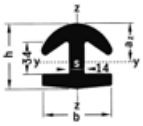


Intermediate TKZ 19 double pile

Pipe diameter	Wall thickness	Width	Including intermediate piles: Moment of inertia	Including intermediate piles: Section modulus	Excluding intermediate piles: Moment of inertia	Excluding intermediate piles: Section modulus	Edge distance	Dead load related to pipe length. Length of connector TKZ 19 in % related to length of pipe			Coating area
Da	t	b	I_y	W_y	I_y	W_y	ep	60%	80%	100%	Water side
mm	mm	m	cm⁴/m	cm³/m	cm⁴/m	cm³/m	cm	kg/m²	kg/m²	kg/m²	m²/m
813	10.00	2.133	116,850	2,875	95,342	2,345	40.65	157.74	179.37	201.00	1.40
813	12.00	2.133	135,073	3,323	113,565	2,794	40.65	176.03	197.66	219.29	1.40
813	14.00	2.133	153,022	3,764	131,514	3,235	40.65	194.23	215.86	237.49	1.40
914	10.00	2.234	150,414	3,291	129,878	2,842	45.70	161.75	182.41	203.06	1.40
914	12.00	2.234	175,366	3,837	154,830	3,388	45.70	181.45	202.10	222.76	1.40
914	14.00	2.234	199,983	4,376	179,447	3,927	45.70	201.05	221.71	242.36	1.40
1,016	10.00	2.336	190,808	3,756	171,169	3,369	50.80	165.46	185.21	204.96	1.41
1,016	12.00	2.336	223,828	4,406	204,189	4,019	50.80	186.45	206.20	225.95	1.41
1,016	14.00	2.336	256,451	5,048	236,812	4,662	50.80	207.35	227.10	246.85	1.41
1,220	12.00	2.540	345,140	5,658	327,078	5,362	61.00	195.24	213.41	231.57	1.42
1,220	14.00	2.540	397,774	6,521	379,712	6,225	61.00	218.43	236.59	254.76	1.42
1,220	16.00	2.540	449,881	7,375	431,820	7,079	61.00	241.54	259.70	277.87	1.42
1,420	14.00	2.740	574,489	8,091	557,746	7,856	71.00	227.69	244.52	261.36	1.43
1,420	16.00	2.740	651,471	9,176	634,727	8,940	71.00	252.71	269.55	286.39	1.43
1,420	18.00	2.740	727,789	10,251	711,046	10,015	71.00	277.66	294.50	311.33	1.43
1,620	16.00	2.940	897,646	11,082	882,041	10,889	81.00	262.36	278.05	293.75	1.44
1,620	18.00	2.940	1,004,220	12,398	988,616	12,205	81.00	288.97	304.66	320.35	1.44
1,620	20.00	2.940	1,109,990	13,704	1,094,386	13,511	81.00	315.51	331.20	346.89	1.44
1,820	18.00	3.140	1,331,989	14,637	1,317,378	14,477	91.00	298.83	313.53	328.22	1.45
1,820	20.00	3.140	1,473,530	16,193	1,458,920	16,032	91.00	326.83	341.52	356.21	1.45
1,820	22.00	3.140	1,614,121	17,738	1,599,510	17,577	91.00	354.75	369.45	384.14	1.45
1,820	25.00	3.140	1,823,233	20,036	1,808,622	19,875	91.00	396.53	411.22	425.92	1.45

Intermediate piles, interlock form

PZ intermediate piles	Section PZ	Form	Weight	Dimensions a	b	c	t/s	h	Perimeter developed	Section A	Coating area[10]	Moment of inertia I_y	Edge distance e_y
PZi 675-12			kg/m	mm	mm	mm	mm	mm	m	cm²	m²/m	cm⁴	cm
	675-12	23	209	142	480	246	12	312	3.70	266	3.53	34,640	16.8
	675-12	21	172	142	410	246	12	312	3.27	219	3.29	27,360	16.8

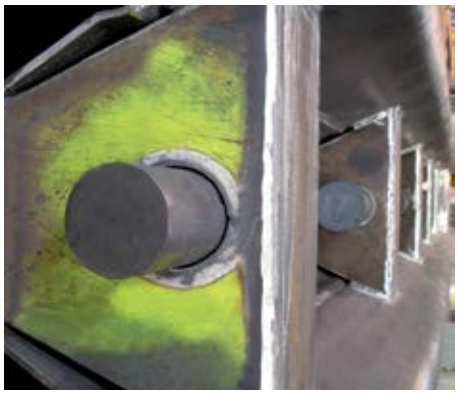
P locking bar	Section modulus W_y	W_z	Weight	Dimensions h	b	s	Perimeter developed	Cross-sectional area	Moment of inertia I_y	Moment of inertia I_z	Edge distance a_z
	cm³	cm³	kg/m	mm	mm	mm	cm	cm²	cm⁴	cm⁴	mm
	28	19.3	18.4	63.8	67	14	35.4	23.5	91.7	65.2	32.8

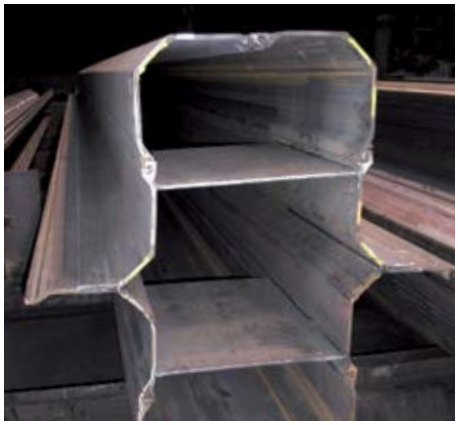
For explanation of footnotes, see page 50.

Welded structures

Our plants have been fabricating welded structures from steel piles for many decades. All our sheet piling steel grades are suitable for arc welding in compliance with general welding regulations.

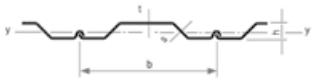
Foundation piles, dolphins plus fittings, box piles, structural piles such as corner and junction piles, piles with impact strengthening, piles with interlocks sealed by welding, and custom piles to suit special requirements are all fabricated to proven quality standards. Our plants conform to DIN 18800 Part 7 (changeover to DIN EN 1090 Part 1) and hence comply with all the requirements that must be met by modern welding operations. General and specific quality assurance procedures, e.g. non-destructive weld seam testing, are carried out by an independent institute according to German or, if required, international regulations.



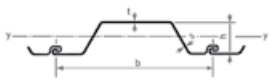
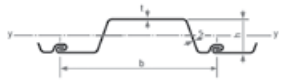
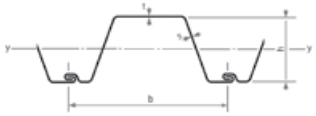
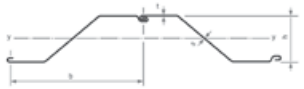
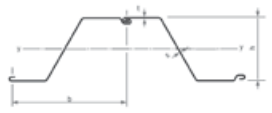


Cold-rolled sheet piling sections

Cold-rolled sheet piling sections
Overview

Trench sheeting	Section	Section modulus	Weight	Weight	Moment of inertia	Width	Height	Flange thickness	Web thickness
		W_y cm³/m	kg/m²	kg/m	I_y cm⁴/m	b	h	t	s
		Wall	Wall	Single pile	Wall	mm	mm	mm	mm
KD VI/6 and KD VI/8	KD VI/6	182	62.5	37.5	726	600	78	6.0	6.0
	KD VI/8	242	83.3	50.0	968	600	80	8.0	8.0
KD 4L	KD 4L	99	53.3	21.3	245	400	49	5.8	5.8
									

KD VI/6 and KD VI/8 Longer lengths on request, stocked lengths: from 3 m to 8 m.
KD 4L Longer lengths on request, stocked lengths: 3 m and 4 m.

Lightweight sections	Section	Section modulus	Weight	Weight	Moment of inertia	Width	Height	Flange thickness	Web thickness
		W_y cm³/m	kg/m²	kg/m	I_y cm⁴/m	b	h	t	s
		Wall	Wall	Single pile	Wall	mm	mm	mm	mm
KL 3/4 to KL 3/8	KL 3/4*	276	45.2	31.6	2,042	700	146	4.0	4.0
	KL 3/5*	339	55.8	39.1	2,502	700	147	5.0	5.0
	KL 3/6	410	66.0	46.2	3,080	700	148	6.0	6.0
	KL 3/7*	460	78.0	54.6	3,500	700	149	7.0	7.0
	KL 3/8	540	88.0	61.5	4,050	700	150	8.0	8.0
TKL 3/9	TKL 3/9*	680	106.9	74.8	5,120	700	160	9.0	9.0
									
HP 290S	HP 290S-5*	774	69.7	49.5	10,920	710	294	5.0	5.0
	HP 290S-6	933	83.7	59.4	13,530	710	296	6.0	6.0
	HP 290S-7	1,080	97.6	69.3	15,701	710	298	7.0	7.0
	HP 290S-8*	1,230	111.5	79.2	17,896	710	300	8.0	8.0
	HP 290S-9*	1,380	125.6	89.2	20,896	710	300	9.0	9.0
ZK 785	ZK 785-5	605	53.4	41.9	8,395	785	276	5.0	5.0
	ZK 785-6	724	64.2	50.4	10,053	785	277	6.0	6.0
	ZK 785-7	836	74.4	58.4	11,657	785	278	7.0	7.0
	ZK 785-8	951	84.8	66.6	13,302	785	279	8.0	8.0
	ZK 785-9	1,067	95.3	74.8	14,944	785	280	9.0	9.0
ZK 675	ZK 675-5	972	62.1	41.9	18,500	675	376	5.0	5.0
	ZK 675-6	1,164	74.7	50.4	22,131	675	377	6.0	6.0
	ZK 675-7	1,350	86.5	58.4	25,698	675	378	7.0	7.0
	ZK 675-8	1,540	98.7	66.6	29,332	675	379	8.0	8.0
	ZK 675-9	1,728	110.8	74.8	32,914	675	380	9.0	9.0

* Not available ex stock

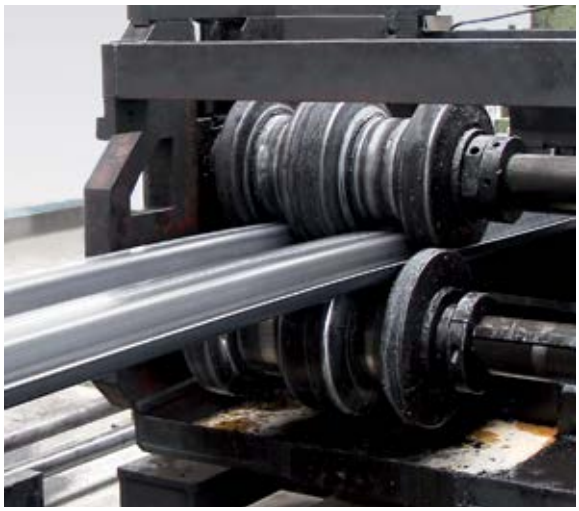
KL 3/4 to KL 3/8 and TKL 3/9 Lengths available: up to 12 m (from 12 m to 14 m on request), stocked lengths: from 3 m to 8 m.
HP 290S-5 to HP 290S-9 Lengths available: up to 17 m, stocked lengths: from 8 m to 12 m.
ZK 785-5 to ZK 785-9 and ZK 675-5 to ZK 675-9 Lengths available: up to 12 m.

Basis for invoicing is the weight of the single pile (kg/m).

Cold-rolled sheet piling sections
Safe, economical, dependable

We can supply a range of trench sheeting and lightweight sections to suit the market directly from our own production via our cold-rolling mill in Dessau. We have optimized our product portfolio even further by adding top-hat (HP) and Z-sections (ZK).

As a supplier of services to the construction industry, we ensure solutions that are cost-effective and tailored to your project. Solutions that are characterized by fast, on-time deliveries and trouble-free procedures.



Trench sheeting

Trench sheets are used for the reliable shoring of trenches, shafts, and excavations. Such sections are used when sealed interlocks are not necessary. To suit the conditions of driving and the typical applications, the form that has become established for trench sheets is one that is highly stable and suitable for repeated use. Their special shape makes them easy to install and stack.

These high-quality sections are produced in our cold-rolling mill and are stocked in lengths of up to 8 m. Longer lengths can be rolled on request.

Lightweight sections

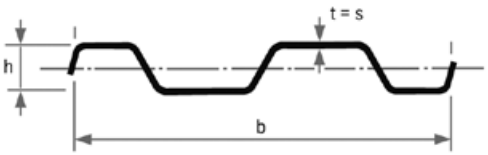
Lightweight sections are mainly used for trench shoring in inner-city applications, for protecting banks, and upgrading dikes. The interlock of the lightweight section serves as a reliable hook in such applications. The sections are manufactured in lengths of up to 17 m. For structures requiring greater watertightness, e.g. flood protection, we can supply the sections with an interlock filling made from a durable, pliable bitumen compound. It is also possible to fit a profiled TK HOESCH sealing system into the interlocks of the lightweight sections.

The sections undergo material testing and quality inspections in accordance with DIN standards and guarantee safety and reliability combined with optimum drivability.

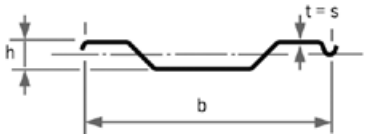
Trench sheeting
Technical data

Forms of supply for trench sheeting

E
KD VI/6
KD VI/8

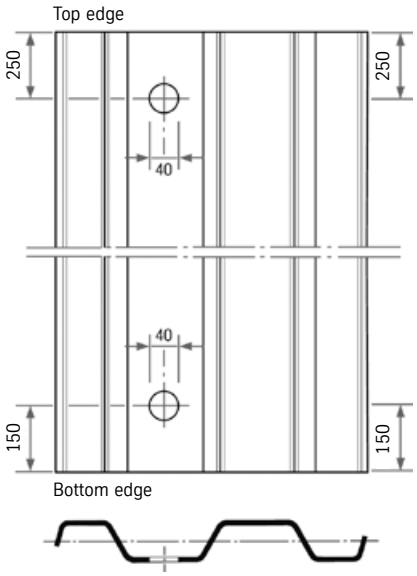


E
KD 4L



Trench sheeting is only supplied as single sheets **(E)** with handling holes.

Handling holes, KD VI/6 and KD VI/8 trench sheets



Handling holes, KD sections

- 250 mm from top edge
- 150 mm from bottom edge, standard form

Handling holes, KD 4L trench sheets

Handling holes are provided at both ends according to the above drawing.

Typical application: dike protection – lightweight sections

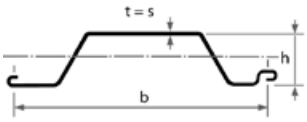
Lightweight sections
Technical data

Forms of supply for KL, TKL, and HP lightweight sections

Ea

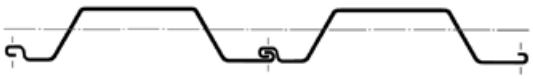
Single sheet in A-position (non-standard form).

Eb



Single sheet in B-position (standard form).

Da

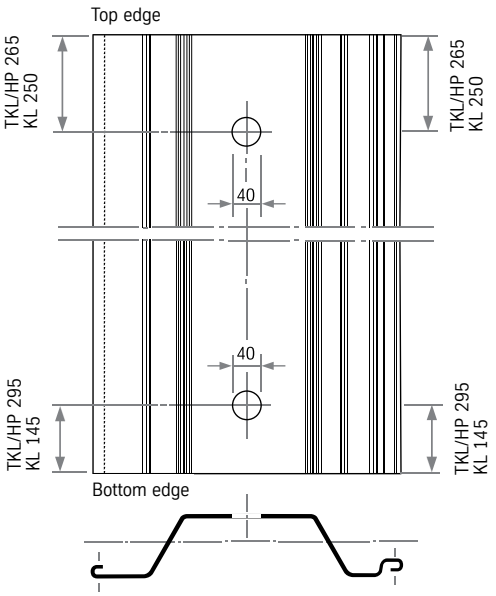


Double piles (**Da**) to special order only.

Db

Double piles **(Db)** to special order only.

Handling holes, KL, TKL, and HP lightweight sections



The KL, TKL, and top-hat (HP) lightweight sections are supplied with handling holes. Handling holes are provided at both ends according to the above drawing.

Handling holes, HP and TKL sections

- 265 mm top edge
- 295 mm from bottom edge, standard form

Handling holes, KL sections

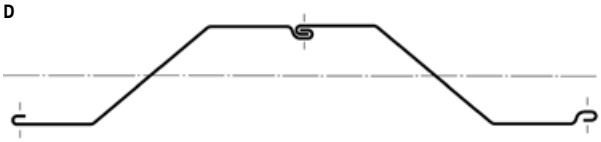
- 250 mm from top edge
- 145 mm from bottom edge, standard form

Lightweight sections
Technical data

Forms of supply for ZK lightweight sections

E

D



Double piles (**D**) to special order only.
Double piles are welded on one side in the interlock.

Welding of ZK lightweight sections

Double piles, which are supplied to special order only, can be welded on one side in the interlock at the top, bottom, and middle part of the pile. The length of weld at the top and bottom of the pile is 15 cm. Further welds 10 cm long are provided at intervals of 1.50 m.

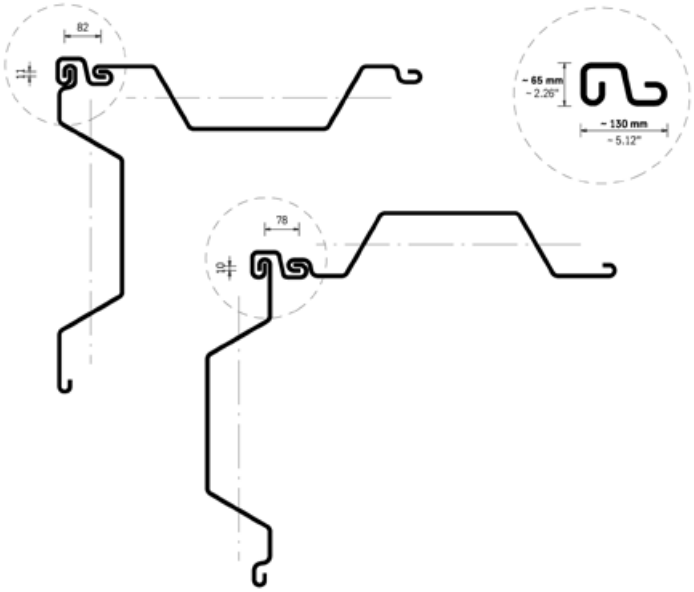
Handling holes, ZK lightweight sections

The ZK lightweight sections are supplied without handling holes.

Typical applications: dike protection – lightweight sections

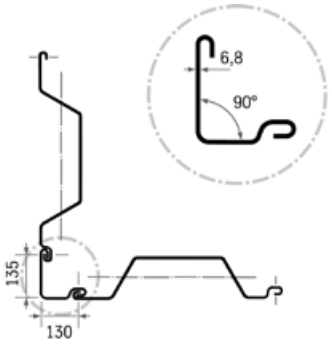
Lightweight sections
KRINGS corner sections, Steelwall connectors

Corner piles with Steelwall CF 90 connectors

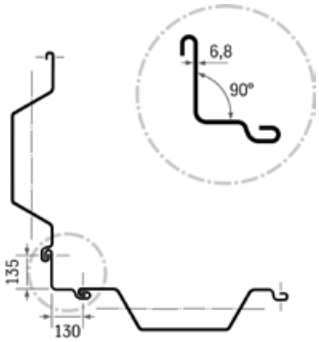


Corner piles with KRINGS KEP 90 corner sections

Variant A



Variant B



KRINGS KEP corner sections are available in variants A and B for 90° corners. An angular adjustment of ±20° is possible within the interlock and ±10° within the hook, which means that variant A covers a total angle of 80–120° and variant B a total angle of 60–100°.

Further variants available on request.

Sealing systems

Sheet piling as sealing system
Reliable sealing – for landfill and legacy pollution

Our steel sheet piling has proved to be highly effective in terms of both its structural and sealing properties. We use sealing systems very successfully in excavations as well as hydraulic and port engineering projects. In addition, those systems can be used in landfill and for containing legacy pollution. Whether as stand-alone solution or additional sealing component in various wall systems, production in accordance with DIN EN ISO 9001 plus sheet piling's special mode of construction limits the transport of pollutants through the interlock.

One special aspect of unsealed steel sheet piling is that water and other substances can initially pass through the interlocks. However, this applies for a short time only because the interlocks of the sheet piling include several bends and therefore have a relatively long seepage path. In soils with a significant proportion of fine particles this quickly leads to the seepage path becoming blocked and hence to a "self-sealing" effect.

In soils with a very low proportion of fine particles, and especially where high imperviousness is required, special interlock seals can be used. Depending on the level of imperviousness required, in addition to welding the interlocks, various sealing systems are available, e.g. TK HOESCH interlock sealing system (DBP 44 27561; EP 0 695 832), which is also particularly suitable for aggressive media in contaminated soils, for instance. For temporary works in which the sheet piling is to be used more than once, bitumen-based interlock sealants have proved worthwhile.

Applications for TK HOESCH interlock sealing system and bitumen-based interlock sealants:

The TK HOESCH interlock sealing system is primarily used for permanent structures (e.g. flood protection, legacy pollution, etc.).

Bitumen-based interlock sealants are preferred for temporary works (e.g. excavations) where the maximum hydrostatic pressure does not exceed 100 kPa.

Coated and sealed retaining wall, Essen

General remarks on soil properties
The soil: the foundation for every design

A reliable sealing effect is always the result of the interaction between the sealing system and the soil properties. As the latter can vary from one site to the next, they must be taken into account when planning pile driving.

The water permeability of a soil type depends on many factors, including the sizes of the soil particles, their structure, and the compactness of the stratum. As the proportion of fine particles increases, so the permeability decreases. The permeability is indicated by the k-value (see table below).

To suit the demands of construction projects, civil engineers have a number of options at their disposal for reducing the permeability of a soil, either temporarily or permanently. The three main methods are as follows:

a) Compacting the existing soil and installing a sealing material
b) Excavating the existing soil and installing a sealing material
c) Reducing the permeability of the existing soil

Whether merely a sealing effect is to be achieved, or loads are to be carried in the horizontal or vertical directions, this must be established at the design stage. Besides the structural and installation requirements, it is also important to specify the admissible permeability exactly according to the German Construction Contract Procedures (VOB) Part C – General technical specifications in construction contracts (ATV) – Piling – DIN 18304 section 0.2.10 or DIN EN 12063 section 11.

Landfill site, Asslar

Special care should be taken to ensure that the requirements regarding imperviousness are specified in the tender documents as follows: maximum permissible quantity of water per unit of time and wetted wall area in m^2 for a given hydrostatic pressure. Imprecise expressions such as “approximately watertight” can lead to undesirable, unscheduled works.

Permeability coefficient k

Type of soil	k	Classification
	m/s	
Clay; loam	$< 10^{-8}$	very low permeability
Silt; loamy, silty sand	10^{-8} to 10^{-6}	low permeability
Fine sand; medium sand	10^{-6} to 10^{-4}	moderate permeability
Coarse sand; medium gravel; fine gravel	10^{-4} to 10^{-2}	high permeability
Coarse gravel	$> 10^{-2}$	very high permeability

Soils are classified into five permeability ranges for construction purposes.

The k-value defines the calculated form of a physical velocity at which water at a temperature of 10°C and with a hydraulic gradient of i = 1 flows into a soil sample fitted in a test rig. The calculation of k-values for various soil types is governed by DIN 18130. The theory is based on Darcy’s law.

TK HOESCH interlock sealing system (DBP 44 27561; EP 0 695 832)
Two lines of defense

The TK HOESCH interlock sealing system is protected by patents and is resistant to the typical substances and fluids encountered in landfill and legacy pollution. It has two lip seals, which gives it two dependable lines of defense.

The TK HOESCH interlock sealing system is installed in the pile interlocks at the works. It consists of a profiled seal in the threading interlock, plus, for double piles, an injected seal in the middle interlock that adapts perfectly to the interlock slot. A primer ensures dependable adhesion and prevents rust forming underneath.

The seal in the threading interlock is designed in such a way that restoring forces are activated in the sealing material during pile driving which then seal off the interlock slot in the areas required (compression sealing). Providing two lip seals in the interlock ensures that the sealing system has two lines of defense. The driving interlock into which the next pile with its profiled seal is threaded is fabricated with a bevel to ease the threading process. The direction of driving must be specified in advance and adhered to.

Material properties
The sealant is made from polyurethane, which remains permanently elastic and resists ageing and weathering. In addition, polyurethane is also resistant to water, seawater, normal waste water, mineral oils, and numerous acids and caustic solutions. On request we can supply appropriate test certificates for environmental compatibility.

Product data for TK HOESCH interlock sealing system	
Base	polyurethane
Solvents	none
Color	reddish brown
Elongation at failure	approx. 100%
Flash point	100°C

Driving advice
Pile sections fitted with the TK HOESCH interlock sealing system should preferably be impact-driven. However, vibratory methods can be used in certain circumstances provided the soil is suitable for such methods. The pile section should be driven continuously into the ground, although penetration rates slower than 20 seconds per meter are not permitted. If the penetration rate is less than this or driving comes to a standstill, impact driving should be used for the remainder of the installation. Cooling the threading interlock seal with water during vibratory driving has proved useful.

The suitability of interlock seals for pressing methods should be checked with ThyssenKrupp Infrastructure prior to driving. During the winter, care should be taken to ensure that the pile temperature does not drop below –5°C because the formation of ice crystals in the threading interlocks can damage profiled seals. Sealed interlocks must be kept free from ice and snow.

Seal lubrication
Interlock seals must be coated with GM lubricant prior to driving. The lubricant is to be brushed evenly over the full length of the profiled seal (approx. 100 g per meter of seal). Owing to its biodegradability, GM lubricant is also suitable for use in areas from which drinking water is sourced. The lubricant is water-resistant, remains stable down to a temperature of –5°C, and has good adhesive properties.

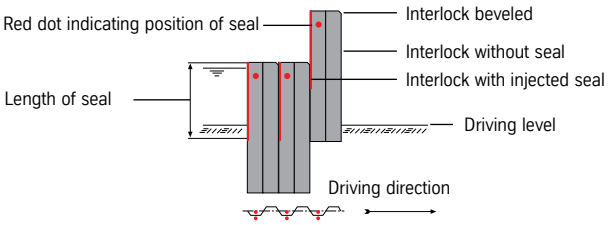
TK HOESCH interlock sealing system (DBP 44 27561; EP 0 695 832)
Two lines of defense

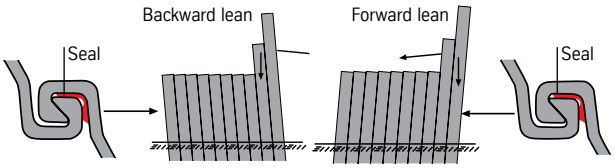
Any corrective measures applied must not cause any narrowing of any interlock slots containing profiled seals. DIN EN 12063 and EAU (Recommendations of Committee for Waterfront Structures, Harbours & Waterways) R 118 contain useful advice.

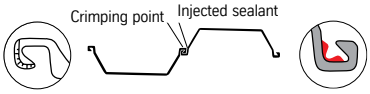
Driving direction

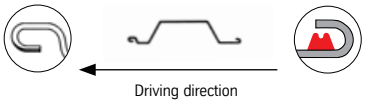
When installing sections with sealed interlocks, the direction of driving must be specified prior to starting work. When pitching double piles on-site, make sure that the free interlock is driven first and the interlock with the seal is threaded into this.

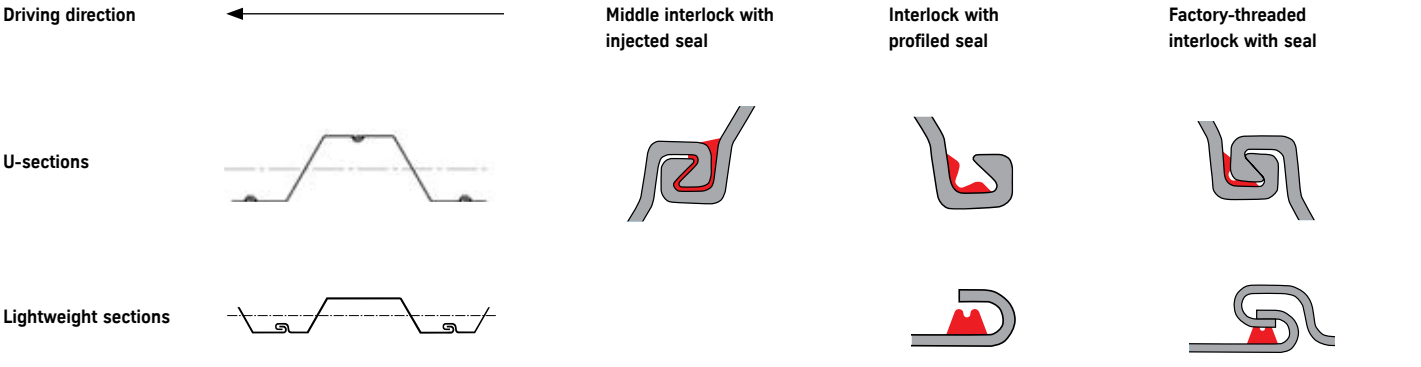
For threading, the pile must be turned so that the unsealed interlock points in the direction of driving. The side with the sealant is to be indicated by a colored dot at the top of the pile. Sheet piling should normally be driven continuously. However, a staggered installation is also possible. The method used should be chosen on the basis of the overall driving conditions.











Bitumen-based interlock sealants
Watertight and environmentally compatible

Bituminous materials can be used to reduce the permeability of the interlocks substantially. Two options are available, their use depending on the type of driving: SIRO 88 and a bitumen compound. Both materials can be applied in the factory or on-site.

The hot-poured bitumen SIRO 88 sealant has proved ideal for vibratory driving. A bituminous compound is recommended for impact driving. When factory-applied, both systems consist of a paste-like sealant in the driving interlock and a poured sealant in the factory-threaded middle interlock. Since the materials adhere well to the steel surface, it is not necessary to apply a primer to the interlocks beforehand. Certificates declaring the environmental compatibility of these sealants are available.

Material properties of SIRO 88

SIRO 88 is a hot-poured elastomeric bitumen sealant. After application and cooling, this material may be anything from soft to stiff depending on the ambient temperature. It adheres well to the steel surface.

Bitumen sealing compound

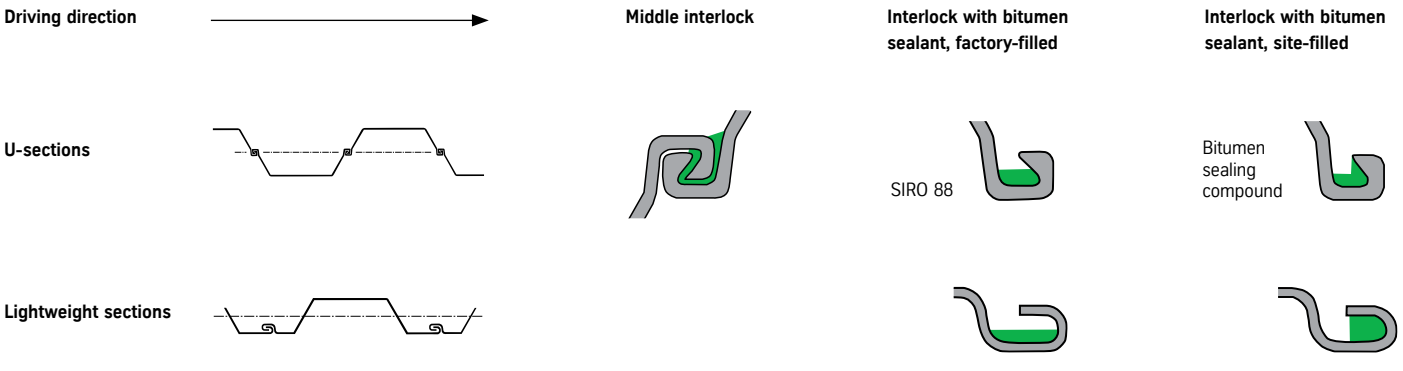
The sealant used for filling and sealing the interlocks of steel sheet piling is a pliable bitumen compound. It is a one-part material, is enhanced with synthetic additives and exhibits excellent adhesion in the interlock, and even withstands the acceleration forces of the driving process. It retains its pliability even at low temperatures and so can be applied on-site down to temperatures of –20°C. A study by the Gelsenkirchen Hygiene Institute has discovered that the bitumen compound and SIRO 88 can also be used as lubricants and sealants in sheet piling interlocks in areas in which drinking water is sourced.

Direction of driving

The direction of driving must be specified prior to installation when sealed interlocks are involved. For threading, the pile must be turned so that the sealed interlock points in the direction of driving.

Product data, SIRO 88	
Base	bitumen
Color	black
Pouring temperature	max. 180°C
Melting point	max. 200°C
Flash point	250°C
Solubility in water	none

Product data, bitumen sealing compound	
Base	bitumen
Color	black
Consistency	paste-like
Density	approx. 1.0 kg/dm^3
Method of application	spatula, jointer
Flash point	approx. 36°C
Temperature resistance	up to 90°C
Solubility in water	none



Other sealing methods and installation advice
Tailored solutions

Other sealing and installation methods may be necessary depending on the requirements of the particular project. It is therefore essential to investigate and establish the methods to be used in advance.

The following additional sealing methods are available for interlocks that must be sealed after driving:

- Where sealing requirements are not excessive, interlocks can be sealed subsequently, e.g. with timber wedges (swelling effect), rubber, or plastic cords.

- If total watertightness is required, welding the interlocks is the only solution. As a rule, this concerns the threading interlocks only because factory-threaded interlocks can be welded prior to driving. It is important to note that the interlock can only be welded when the surfaces are dry and clean. The weld seam must be applied to the side of the sheet piling that faces the base of the structure to be erected. Open interlocks can be covered with, for instance, steel flats or steel sections attached to the sheet piling with fillet welds.

Pitching the piles

Owing to increased interlock friction, sheet pile sections cannot reach their full embedment depth as a result of their self-weight alone. Therefore, suitable driving equipment must be available on the site. We can supply a specially fabricated starter weight that is used in conjunction with a carrier and free-fall equipment.

Effect of high temperatures

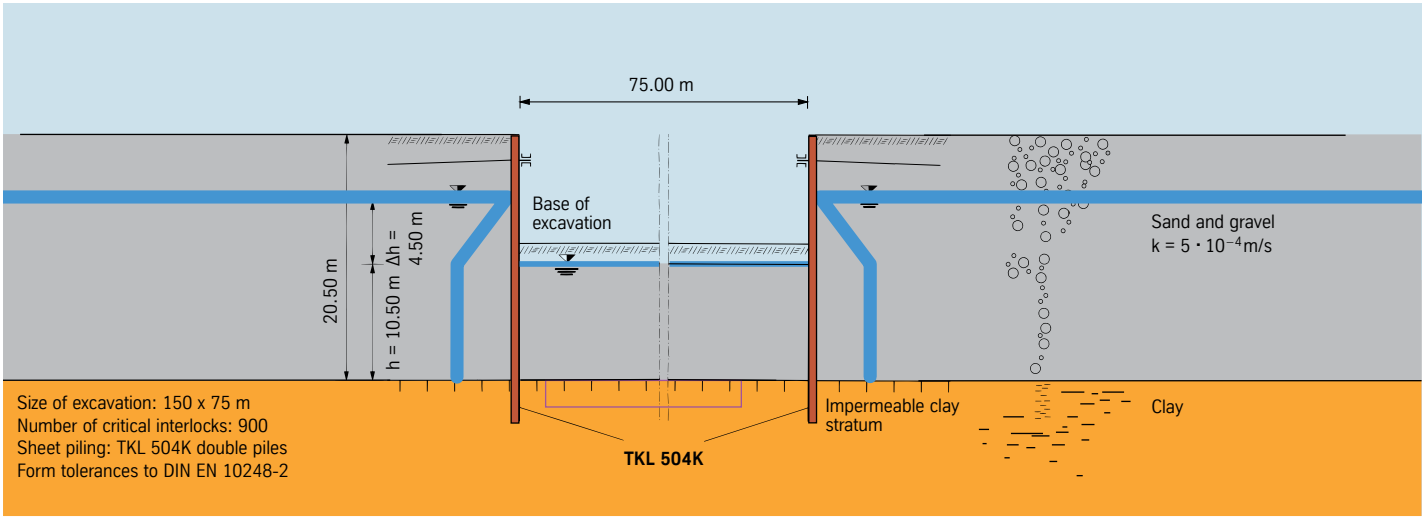
Welding carried out near seals or sealants can be expected to have an adverse, local effect on these materials. If subsequent welding cannot be avoided, resealing will be necessary.

Flame-cutting

If sheet piles fitted with the TK HOESCH interlock sealing system have to be cut or straightened on-site with flame-cutting equipment, the interlock of the driven pile must be beveled by grinding before pitching the next sheet pile. Otherwise the sealing can be damaged during the threading procedure. It is also necessary to check whether a bituminous sealant is flammable. Such a sealant must be cooled with water if necessary. Suitable fire extinguishers must be available on the building site.

> Please refer to the information on site operations on p. 41.

Water ingress into an excavation – comparison of soldier pile wall with groundwater lowering and steel sheet piling with various interlock sealing methods.



Changing of section description TKL 504 to TKL 504K, starting from 01/2015.

Criteria for selecting a suitable interlock sealing system
Spot-on selection

Which interlock seal is suitable for which project? This question has to be considered for every new project, and the answer depends on the project specification and the boundary conditions. We can provide you with the information you need so that you can specify “your” system spot-on.

Let’s look at an example to illustrate this. A vertical wall 10.5 m deep is required to encapsulate a contaminated site. Investigations have revealed that the soil is contaminated with the following hazardous substances: chlorinated dioxins and furans, chlorobenzenes, chlorophenols, oils, mineral oils, polycyclic aromatics, aliphatic and aromatic solvents.

From this it follows that the wall required must be resistant to all of the aforementioned substances. The permeability required is $k \leq 1.0 \cdot 10^{-9}$ m/s for a notional thickness of d = 60 cm. In light of the quality requirements, only factory-sealed sheet piles are permissible. The section modulus required is $W_y \geq 1{,}100$ cm³/m. A suitable sealing system can now be determined based on the following parameters:

Permeability criteria

The interlock seepage resistance ρ required is:
reqd. $\rho \leq k \cdot b/d$

The result is that to achieve the equivalent of a 60 cm thick diaphragm wall with $k \leq 1.0 \cdot 10^{-9}$ m/s, the minimum requirement is single piles with a TK HOESCH interlock sealing system in the threading interlock (critical pile width ≥ 0.50 m).

Typical applications
Top left: lock, Magdeburg
Bottom left: stormwater retention basin, Düsseldorf-Lörick
Right: retaining wall, Essen

Criteria for selecting a suitable interlock sealing system
Spot-on selection

The following calculation models are based on DIN EN 12063:

Seepage resistance ρ (m/s)

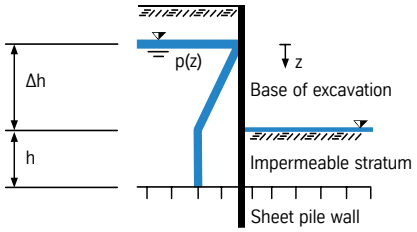
$$\rho = \frac{q(z) \cdot \gamma}{\Delta p(z)}$$

where:
q(z) = discharge rate over time related to interlock length ($m^3/m \cdot s$)
γ = specific gravity of fluid (kN/m^3)
$\Delta p(z)$ = hydrostatic pressure (kN/m^2)

Seepage rate Q ($m^3/s \cdot$ interlock)
The seepage rate Q through one interlock can be calculated thus:

$$Q = \int_0^{\Delta h+h} q(z) \cdot dz = (\rho/\gamma) \cdot \int_0^{\Delta h+h} \Delta p(z) \cdot dz$$

$$Q = \rho \cdot \Delta h \cdot (0{,}5 \cdot \Delta h + h)$$



To compare the imperviousness with that of a diaphragm wall, the permeability coefficient k to DIN 18130 Part 1 for soils (porous media) can be taken into account:

$$k = \frac{Q}{i \cdot A} \rightarrow Q = \frac{k \cdot \Delta p(z)}{\gamma \quad d} \cdot A$$

where:
k = permeability coefficient (m/s)
Q = measured flow rate (m^3/s)
i = hydraulic gradient (-)
A = cross-sectional area, wall area (m^2)

Considering these fundamental relationships and the number of critical interlocks per m^2 of wall area results in this relationship for a constant seepage rate Q:

$$\frac{k \cdot \Delta p(z)}{\gamma \cdot d} = \frac{k \cdot \Delta p(z)}{\gamma \cdot b}$$

$$\rightarrow \quad \frac{k}{d} = \frac{\rho}{b}$$

where:
d = thickness of diaphragm wall (m)
b = critical element width for designing seepage rate (m)

The sections given in the table below can be used:

Section	Critical element width	Comparable k-value for 60 cm thick diaphragm wall	Imperviousness requirement satisfied	Resistance requirement satisfied
	m	m/s		
EB (500 series)	0.50	$2.2 \cdot 10^{-10}$	yes	yes
DB (500 series)	1.00	$1.1 \cdot 10^{-10}$	yes	yes
EB (600 series)	0.60	$1.8 \cdot 10^{-10}$	yes	yes
DB (600 series)	1.20	$9.0 \cdot 10^{-11}$	yes	yes

A double pile (600 series) with $W_y \geq 1{,}100$ cm^3/m is selected for economic reasons. Its imperviousness therefore compares with that of a 60 cm thick diaphragm wall with a k-value of $9.0 \cdot 10^{-11}$ m/s, or for an 80 cm thick diaphragm wall a k-value of $1.2 \cdot 10^{-10}$ m/s.

On account of its being thinner, a slurry wall must exhibit a k-value of $1.2 \cdot 10^{-11}$ m/s in order to achieve the imperviousness of the sheet piling solution.

Resistance criteria

When selecting a suitable interlock sealing system to surround a contaminated site, resistance to the pollutants involved is just as important as the imperviousness. Conventional bituminous interlock sealants are not resistant to pollutants such as aliphatic and aromatic solvents, oils, or mineral oils. However, the TK HOESCH interlock sealing system has proven to be resistant to these pollutants.

Comparison of k-values

Sealing system	Critical element width	ρ	k-value required for diaphragm wall		Slurry wall
	b (m)	m/s	d = 0.60 m	d = 0.80 m	d = 0.080 m
Single piles with bitumen compound in every interlock	0.50	$6.0 \cdot 10^{-9}$	$7.2 \cdot 10^{-8}$	$9.6 \cdot 10^{-8}$	$9.6 \cdot 10^{-9}$
	0.60		$6.0 \cdot 10^{-8}$	$8.0 \cdot 10^{-8}$	$8.0 \cdot 10^{-9}$
Double piles with bitumen compound in driving interlock and poured compound in middle interlock	1.00	$6.0 \cdot 10^{-8}$	$3.6 \cdot 10^{-8}$	$4.8 \cdot 10^{-8}$	$4.8 \cdot 10^{-9}$
	1.20		$3.0 \cdot 10^{-8}$	$4.0 \cdot 10^{-8}$	$4.0 \cdot 10^{-9}$
Single piles with TK HOESCH interlock sealing system in every interlock	0.50	$1.8 \cdot 10^{-10}$	$2.2 \cdot 10^{-10}$	$2.9 \cdot 10^{-10}$	$2.9 \cdot 10^{-11}$
	0.60		$1.8 \cdot 10^{-10}$	$2.4 \cdot 10^{-10}$	$2.4 \cdot 10^{-11}$
Double piles with TK HOESCH interlock sealing system in threading interlock and injected sealant in middle interlock	1.00	$1.8 \cdot 10^{-10}$	$1.1 \cdot 10^{-10}$	$1.4 \cdot 10^{-10}$	$1.4 \cdot 10^{-11}$
	1.20		$9.0 \cdot 10^{-11}$	$1.2 \cdot 10^{-10}$	$1.2 \cdot 10^{-11}$
Triple piles with TK HOESCH interlock sealing system in threading interlock and injected sealant in middle interlocks	1.50	$1.8 \cdot 10^{-10}$	$7.2 \cdot 10^{-11}$	$9.6 \cdot 10^{-11}$	$9.6 \cdot 10^{-12}$
	1.80		$6.0 \cdot 10^{-11}$	$8.0 \cdot 10^{-11}$	$8.0 \cdot 10^{-12}$

System	ρ	Critical element width for TKL 504K double pile	No. of interlocks with possibly limited seepage	Ingress into excavation		Reduction in quantity of water to be pumped
	m/s	m		l/s	%	%
Groundwater lowering with soldier pile wall				~ 115	100	–
Sheet piling without interlock sealing[11)]	0.5	0.5	900	~ 41	36	64
Sheet piling with site-applied bitumen compound in every interlock	$8 \cdot 10^{-4}$ x k_{soil}/b	0.5	900	~ 3.1	3	97
Sheet piling with factory-applied bitumen compound in driving interlock and poured compound in middle interlock	$6 \cdot 10^{-8}$	1	450	~ 1.5	1.3	99
Sheet piling with TK HOESCH interlock sealing system in threading interlock and injected sealant in middle interlock	$1{,}8 \cdot 10^{-10}$	1	450	~ 0.005	0.004	999

Changing of section description TKL 504 to TKL 504K, starting from 01/2015.

For explanation of footnotes, see page 50.

Bespoke and other services
The extra for our customers

Successful corrosion protection
Stable, durable, safe

Two forms of corrosion protection are available to enhance the durability of sheet piling – and hence increase the chances of success for your project: coating and hot-dip galvanizing.

Coatings

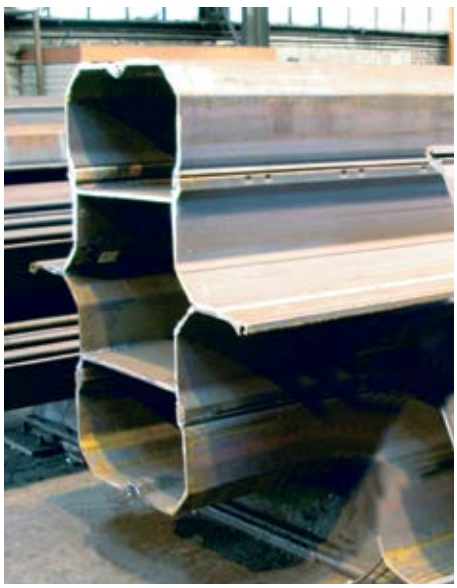
The choice of coating system depends on the corrosion loads expected and the design life (see also DIN EN ISO 12944).

Owing to the high loads to which steel sheet piling is usually exposed, epoxy resin or polyurethane coatings are normally used. Such coatings are also compatible with the TK HOESCH interlock sealing system.

These systems are highly stable and so the complete coating system can be factory-applied because with proper handling, damage during transport and installation is unlikely. However, factory-coating is also recommended for environmental reasons because it avoids the problems of blast-cleaning and spraying on the building site. To prevent rust stains on the coated sections, any existing interlock gaps must be grouted on-site. Coating interlocks filled with bitumen-based materials is not recommended because some of the material can be forced out of the interlocks during threading, which soils the sheet piling. Subsequent cleaning of these areas is complicated and expensive.

Hot-dip galvanizing

Hot-dip galvanizing is another method of corrosion protection and is also compatible with the TK HOESCH interlock sealing system. It can also be combined with a coating (duplex system) to yield additional benefits. The requirements of DIN EN ISO 1461 must be adhered to. An analysis of the steel must be carried out prior to hot-dip galvanizing in order to determine the properties of the surface. Special marking is also necessary. Therefore, if hot-dip galvanizing is planned, this must be specified prior to rolling. As with coating, filling interlocks with bituminous materials is not recommended with hot-dip galvanizing.



Terms of delivery
Steel grades

Terms of delivery

The terms of delivery and tolerances for hot-rolled steel sheet piles are in accordance with DIN EN 10248. Cold-rolled sheet piles are supplied in steel grade S 275 JR to DIN EN 10249-1.

Steel grades

The steel grades used for our hot-rolled steel sheet piles comply with DIN EN 10248-1. Steels complying with DIN EN 10025 (structural steels), DIN EN 10155 (weathering steels) or other specifications can be supplied on request. High-strength, weldable sheet piling steels with a minimum yield strength of max. 500 N/mm² can be supplied to works standards.

Sheet pile steel grades

Hot-rolled sheet piling sections to DIN EN 10248-1

Steel grade	Tensile strength	Minimum yield strength	Minimum elongation
	N/mm²	N/mm²	%
S 270 GP	410	270	24
S 355 GP	480	355	22

Steel grades for cold-rolled trench sheeting and lightweight sections to DIN EN 10249-1

Steel grade	Tensile strength	Minimum yield strength	Minimum elongation
	N/mm²	N/mm²	%
S 275 JR	410	275	22

Excerpt from the tolerances for form and dimensions for hot-rolled sheet piling made from unalloyed steels to DIN EN 10248-2

Wall thickness, U-sections	t: ≤ 8.5 mm = ±0.5 mm; > 8.5 mm = ±6% t s: ≤ 8.5 mm = –0.5 mm; > 8.5 mm = –6% s*
Wall thickness, Z-sections and straight-web sections	t, s: ≤ 8.5 mm = ±0.5 mm; > 8.5 mm = ±6% s, t
Section width	single pile ±2%, double pile ±3%
Section length	lengths of sections may deviate by ±200 mm from ordered lengths
Section height, U-sections	≤ 200 mm = ±4 mm; > 200 mm = ±5 mm
Section height, Z-sections	≤ 200 mm = ±5 mm; from 200 to 300 mm = ±6 mm; > 300 mm = ±7 mm
Weight	max. ±5% margin between calculated weight (according to section tables) and measured weight of total delivery

* Positive tolerances are usually a matter for the manufacturer's discretion. Positive tolerances can be agreed upon placing an order. In this case the following values should be used: +0.5 mm for s < 8.5 mm and +6% of s for s > 8.5 mm.

Standardized steels for combined sheet piling

Steel grade	Standard
General structural steels	EN 10025
Fine-grain structural steels	EN 10113
Weathering steels	EN 10155
Steels for sheet piling	EN 10248
Special steels, PT series	PT material standard
	Special works steels with minimum yield strengths of 355 to 460 N/mm²
Further steels on request	e.g. BS, NF, ASTM, JIS, CSAG, GOST, UNI

All section dimensions can be supplied to current national and international standards, also to customer specification if required. A selection can be found in the "steel grades" table.

Excerpt from the tolerances for form and dimensions for cold-rolled sheet piling made from unalloyed steels to DIN EN 10249-2

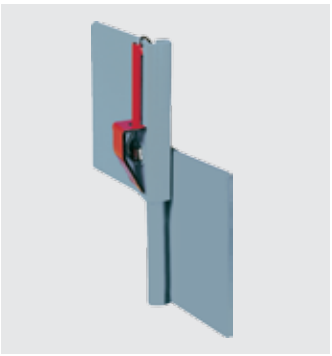
Wall thickness for nominal width up to 1,200 mm	from 4.00 to 5.00 mm = ±0.24 mm; from 5.00 to 6.00 mm = ±0.26 mm; from 6.00 to 8.00 mm = ±0.29 mm
Wall thickness for nominal width 1,200 to 1,500 mm	from 4.00 to 5.00 mm = ±0.26 mm; from 5.00 to 6.00 mm = ±0.28 mm; from 6.00 to 8.00 mm = ±0.30 mm
Section width	single pile ±2%, double pile ±3%
Section length	lengths of sections may deviate by ±50 mm from ordered lengths
Section height	≤ 200 mm section height ±4 mm
Weight	max. ±7% margin between calculated weight (according to section tables) and measured weight of total delivery

Special services
For every situation

Special requirements and unexpected developments can arise in any project.
We offer effective bespoke services to cover all eventualities.

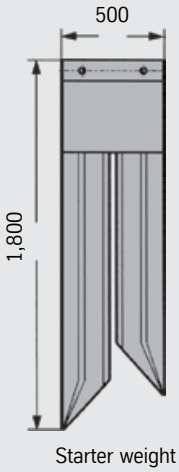
Anchors and fittings
We can supply all the anchor equipment to suit your requirements from one source. The range includes:
- Anchors and anchor components
- Anchor connecting elements
- Walings and waling fixings
- Sheet pile cappings
- Recesses, ladders, grab bars
- Bollards
- Custom components

Knife-edge bearing
This system, with a German national technical approval, transfers static and dynamic vertical loads directly, i.e. without intermediate fittings, from the reinforced concrete support to the sheet pile cross-section.



Signal transmitters
This system helps to prevent declutching in difficult soil conditions. The signal transmitter, fitted securely to the base of the section to be threaded, indicates declutching instantly so that effective measures can be taken in good time.

Piling helmets
Whatever the type of piling helmet (single, double, triple, or quadruple), we can supply standard timber dollies or laminated steel/polymer dollies for heavy-duty driving.



Starter weight

Starter weight
This is ideal for overcoming the friction resistance when installing sheet piles that only have to be threaded. The starter weight is recommended for:
- threading sheet piles in bentonite-supported deep trenches
- retaining walls with TK HOESCH interlock sealing system
- pitching piles installed with hydraulic pressing equipment

Suspended from a crane, a starter weight can also be used as a drop hammer for light-duty impact driving.

Vibration forecasts
Installing piles by impact or vibratory driving causes noise and also vibrations in the ground. We can prepare forecasts in order to identify any environmental impact.

The fine print
Explanation of footnotes

1) The section modulus values of the U-sections may only be used in structural analyses if at least every second interlock in the wall is interlocked such that it can accommodate shear forces.

2) Rolled and supplied on request.

3) The section modulus refers to:
E and Dr – the centroid axis of the respective element
D and per m wall – the y-y axis of the wall

4) Including the inside surfaces of the free interlocks for E, D and Dr.

5) Excluding the inside surfaces of the interlocks. Coating on both sides.

6) Including the inside surfaces of the free interlocks.

7) Can also be supplied with 250 x 20 mm welded plates.
Weld seam: external, continuous
Weld seam thickness: min. a = 5 mm

8) Excluding the inside surfaces of the free interlocks.

9) Including steel surface. The outline area is that contained by the straight-line contour connecting all outer, projecting edges.

10) According to the ENV 1993-5 classification, all PSp sections can be assigned to class 2.

11) Excluding the inside surfaces of the free interlocks. Coating on both sides.

Weights and section modulus values of combined steel sheet piling

Weights
The ratio of the different lengths has to be taken into account when calculating the weight per square meter of combined sheet piling. The true weight per square meter of the wall related to the length of the PSp bearing piles required for structural reasons can be read off the tables for the lengths given in percentages. Intermediate values can be obtained by linear interpolation.

Section modulus
The load-bearing capacity of each individual pile section is taken into account according to its moment of inertia value when calculating the structural values for combined sheet piling:

$$I_y = \frac{I_\rho + I_{Zw}}{a}$$

$$W_y = \frac{I_\rho + I_{Zw}}{a \cdot e_p}$$

$$W_y^I = \frac{I_\rho + I_{Zw}}{a \cdot e_p^I}$$

I_ρ = moment of inertia of PSp pile in cm^4
I_{Zw} = moment of inertia of PZ pile in cm^4
a = spacing of PSp piles in m
e_p/e_p^I = distance of edge from neutral axis in cm (related to outer edge of pile/interlock)

The section modulus values W_y, W_y^I and the moment of inertia value I_y are specified in the tables for combined sheet piling.

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