KSB®

self-drilling anchor

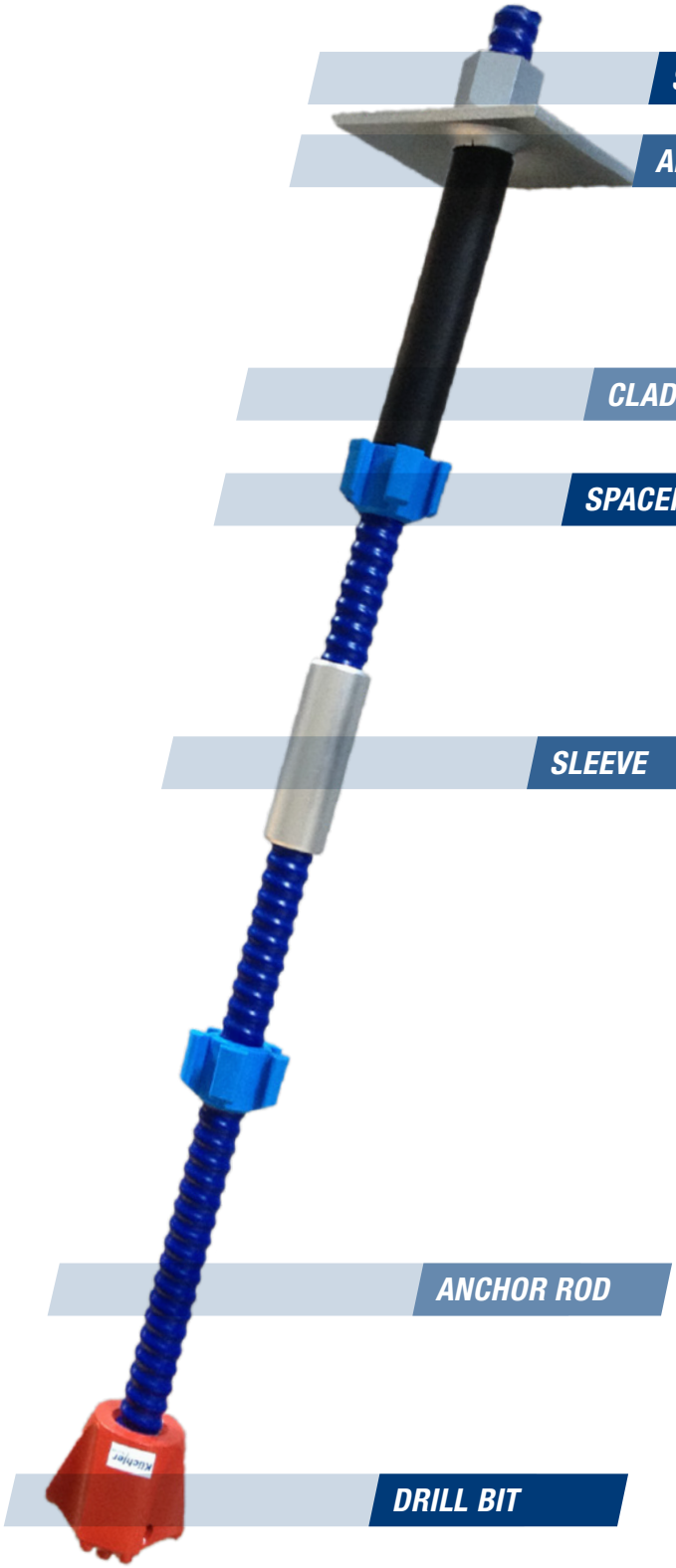
Küchler Technik

kuechler-technik.ch

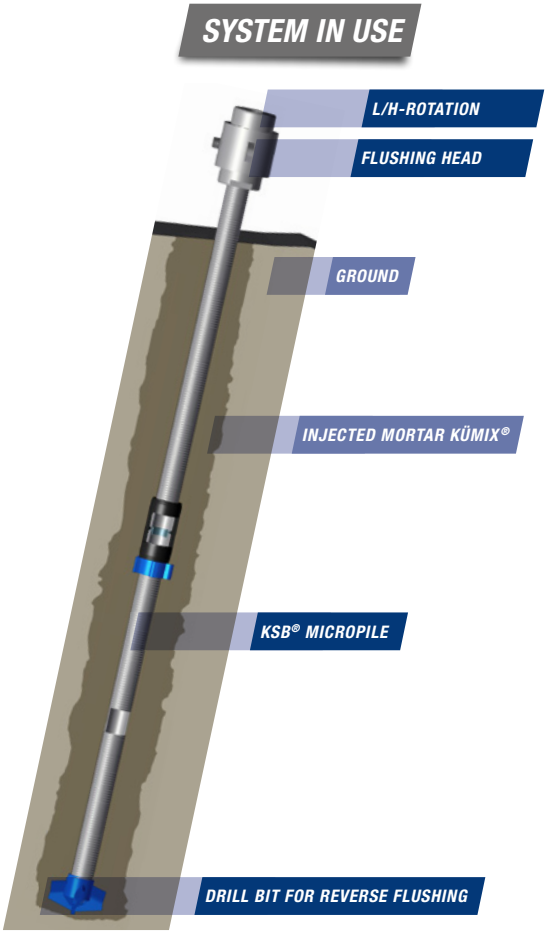
Anchoring | Drilling | Measurement | Injection

THE STRUCTURE OF THE KSB®

ANCHOR PILE



SYSTEM IN USE



KSB®
K = Küchler / **SB** = Self-drilling anchor

october 2022

KSB® KÜCHLER SELF-DRILLING ANCHOR

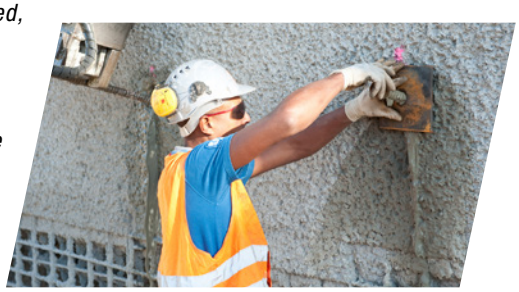
DESCRIBED

The KSB® is a self-drilling anchor system with continuous external thread that can be drilled without casing in loose soil and rock whilst grouting at the same time. The anchor also has a left-hand thread for conventional rotary percussion drilling.

The KSB® system is based on the conventional threaded drill rods R 32, R 38 and R 51. A variety of compatible system components guarantee a wide range of applications. The threads of the KSB®rods are cold rolled to the entire rod length. Through this vast cold forming not only is the steel is tempered and the yield strength increased, but each rod is also subjected to mechanical material testing.

The continuous outer thread of the KSB® rod ensures safe cuttings promotion and the great inner diameter of the KSB® rod guarantees an easy injection, even for very long drill holes. If necessary, a centering of the micropile can take place with spacers after completion of the bore.

The KSB® includes a complete range of accessories from drill bits, adapter pieces, couplings, bolts and anchor plates. In addition, the KSB® can be installed in a variety of types of drills thanks to the wide range of injection adapters and drilling tools.



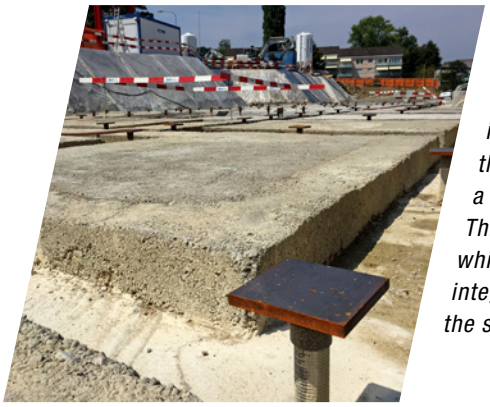
MAIN ADVANTAGES

No casing required

The anchor may be drilled without casing in loose or in ankerile floors. Casing is not required to anchor the drill hole.

Self-drilling system

Thanks to the self-drilling operation, the rods can be used for most types of soil. They can be used with tensile, compressive and alternating load and used as an injection tube.



Simultaneous drilling and injecting in one operation

During drilling operations, the Cement mortar is evenly distributed in the drill hole and penetrates into the surrounding soil or rock layers a (so-called filter cake effect). This causes a higher bond strength while at the same allowing a better integration of soil and hollow bar in the softer layers of soil.

High strength thread

Both the round thread and the trapezoidal thread enable a large and robust rod that is ideally suited for rotary percussion drilling and ensures a strong bond with the cement mortar in the drill hole.

Rotary percussion drilling.

A very efficient drilling technology, which ensures a fast drilling rate with good directional stability of the drill rod. At the same time it helps to compact the cement mortar in the drill hole interior.

Continuous thread of the drill rods

Thanks to the continuous thread, the drill rod can be reduced, sleeved or extended at any position.

KSB® SPECIFICATIONS

KSB® Standard B 500

weak / standard / strong / very strong

		Thread direction **left**											Thread direction **right**				
		 R32/22	 R32/20	 R32/17	 R32/15	 R38/17	 R38/15	 R51/35	 R51/28	 R51/25	 T64/42	 T64/36	 T76/59	 T76/55	 T76/51	 T76/41	 T114/92*
Failure load F_{tk}	kN	250	295	360	400	500	580	660	800	1 000	1 200	1 400	1 100	1 300	1 600	2 000	2 050
Yield strength F_{yk} [3]	kN	200	240	300	340	400	450	540	630	800	1 000	1 100	850	1 000	1 200	1 600	1 650
Tensile strength f_{tk} [3]	N/mm²	720	720	700	700	700	700	700	700	760	730	740	650	650	650	750	640
Yield point f_{yk}	N/mm²	580	580	600	600	600	600	600	600	600	600	580	520	520	520	580	520
Nominal outer diameter [2]	mm	32	32	32	32	38	38	51	51	51	64	64	76	76	76	76	114
Wall thickness	mm	5	6	7.5	9	8.5	9.5	8	9.5	12.5	11	13	8	10	12.5	16	10
Steel cross-section [1] **A**	mm²	360	420	530	580	740	800	950	1 150	1 370	1 710	1 920	1 620	2 000	2 400	2 800	3 280
Elongation after fracture Agt	%	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0	> 5.0
Ratio ft / fy		> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15
Weight G²	kg/m	2.90	3.40	4.20	4.55	5.80	6.30	7.45	9.10	10.70	13.45	15.05	12.73	15.75	18.86	21.95	25.80
Thread direction		left	left	left	left	left	left	left	left	left	left	left	right	right	right	right	right
Maximum test load (0.9 F_{yk}) F_p	kN	180	216	270	306	360	405	486	567	720	900	990	765	900	1 080	1 440	1 485
Torsional restistance T_{Rd}	Nm	1 826	2 032	2 333	2 467	3 833	3 999	7 266	8 479	9 602	16 013	16 939	16 614	19 564	22 638	28 855	48 578
Shear restistance Q_{Rd}	kN	118	134	175	191	244	264	313	379	452	564	612	509	606	715	890	940
Equivalent to approx. **KÜBOLT® B500** (Yield strenght)	mm	20	25	28	28	32	32	32	40	40	50	50	40	50	50	50	50
Equivalent to approx. **KÜBOLT® S670** (Yield strenght)	mm	18	18	22	25	28	28	30	30	35	43	43	35	43	43	43	43

Working loads according / applications

for piles

Service loads F_{yk}/1.75 F	kN	114	134	170	194	229	257	309	360	457	571	629	486	571	685	914	943

with nails in full composite

Defined force F_{yk}/1.75 F	kN	148	178	222	250	296	333	400	466	592	740	814	629	740	888	1 185	1 220

with prestressed anchor

Setting force ≤ 0.6 × Ftk/P0	kN	150	177	216	240	300	348	396	480	600	720	840	660	780	960	1 200	1 230
DUPLEX		o.r.	×	o.r.	×	×	o.r.	×	×	o.r.	o.r.	o.r.	o.r.	×	o.r.	o.r.	o.r.

KÜPS® Drill 2a/3a

Outer diameter	mm				60	76	76	89	89	89	o.r.	o.r.					
Inner covering	mm				10.5	16.1	16.1	15.8	15.8	15.8	12.3	12.3					

KÜPS® Bolt 2a/3a

Outer diameter	mm	60	60	60	60	76	76	89	89	89	89	89					
Inner covering	mm				10.5	16.1	16.1	15.8	15.8	15.8	12.3	12.3					

Caption

R32/22 — ISO 10208 Rounded threads; Nominal outer diameter in mm; Inner diameter

T76/55 — Trapezoidal thread; Nominal outer diameter in mm; Inner diameter

Application

Pressure; Tension; Pre-Tensioned; Pressure/Tension; Permanent; Jet

KSB® System options

 Raw 

 KÜPS® 2a 

[1] Calculated from the nominal mass with S0 = 106 x m / 7.850 (kg/m3)

[2] Permissible deviation: -3 bis +9 (%)

[3] Characteristic value (5 % fractile)

* Delivery on request (o.r. / delivery time min. 2 weeks)

– Corresponds to B 500 B according to SIA 262

– Values are subject to constant changes

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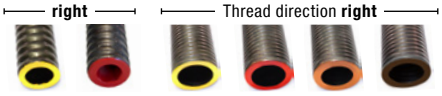
KSB® B 900

weak / standard / strong / very strong

right — Thread direction **right**



		R51/7T	R51/9T	T76/6T	T76/8T*	T76/10T	T76/12T
Failure load F_{tk}	kN	1 000	1 200	1 400	1 800	2 200	2 900
Yield strength F_{yk} [3]	kN	800	1 000	1 200	1 400	1 700	2 100
Tensile strength f_{tk} [3]	N/mm²	> 1 100	> 1 100	> 1 100	> 1 100	> 1 100	> 1 100
Yield point f_{yk}	N/mm²	> 900	> 900	> 900	> 900	> 900	> 900
Nominal outer diameter [2]	mm	51	51	76	76	76	76
Wall thickness	mm	7.1	9.4	6.3	8	10	12.5
Steel cross-section [1] A	mm²	1 000	1 200	1 500	1 800	2 200	2 900
Elongation after fracture Agt	%	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ratio ft / fy		> 1.15	> 1.15	> 1.15	> 1.15	> 1.15	> 1.15
Weight G²	kg/m	8.00	9.60	12.20	14.50	17.70	23.30
Thread direction		left	left	right	right	right	right
Maximum test load (0.9 F_{yk}) F_p	kN	720	900	1 080	1 260	1 530	1 890
Torsional restistance T_{Rd}	Nm	10 637	12 645	23 791	28 755	33 861	39 880
Shear restistance Q_{Rd}	kN	465	589	718	881	1 049	1 232
Equivalent to approx. KÜBOLT® B500 (Yield strenght)	mm	40	50	50	50	63.5	63.5
Equivalent to approx. KÜBOLT® S670 (Yield strenght)	mm	35	43	43	43	57.5	63.5

Working loads according / applications

for piles

Service loads F_{yk}/1.75 F	kN	457	571	685	800	971	1 200

with nails in full composite

Defined force F_{yk}/1.75 F	kN	592	740	888	1 037	1 259	1 555

with prestressed anchor

Setting force ≤ 0.6 × Ftk/P0	kN	not suitable					
DUPLEX		o.r.	o.r.	o.r.	o.r.	o.r.	o.r.

KÜPS® Drill 2a/3a

Outer diameter	mm	o.r.	o.r.

KÜPS® Bolt 2a/3a

Outer diameter	mm	o.r.	o.r.

KSB® INOX

Thread direction **left**

		R32 INOX	R38 INOX	R51 INOX	R38 INOX 3b
		2b			3b
Failure load F_{tk}	kN	360	630	950	630
Yield strength F_{yk} [3]	kN	300	460	760	460
Tensile strength f_{tk} [3]	N/mm²	800	800	800	800
Yield point f_{yk}	N/mm²	650	650	650	650
Nominal outer diameter [2]	mm	32	38	51	38
Wall thickness	mm	5.6	9.5	9.5	9.5
Steel cross-section [1] A	mm²	480	800	1 300	800
Elongation after fracture Agt	%	> 5.0	> 5.0	> 5.0	> 5.0
Ratio ft / fy		> 1.2	> 1.2	> 1.2	
Weight G²	kg/m	3.8	6.3	10.5	6.3
Thread direction		left	left	left	left
Maximum test load (0.9 F_{yk}) F_p	kN	270	414	684	414

Working loads according / applications

for piles

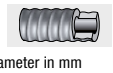
Service loads F_{yk}/1.75 F	kN	170	260	430	260

with nails in full composite

Defined force F_{yk}/1.35 F	kN	222	340	562	340

Caption

R32/22 — ISO 10208 Rounded threads; Nominal outer diameter in mm; Inner diameter



T76/55 — Trapezoidal thread; Nominal outer diameter in mm; Inner diameter

Application

Druck; Tension; Pre-tensioned; Pressure / Tension; Permanent; Jet

KSB® System options

Raw; KÜPS® 2a

- The support (top plate) must be positioned at 90° to the axis of the supporting element
- Values are subject to constant changes
- Anchor rod delivery lengths: 2, 3 or 4 meters

[1] Calculated from the nominal mass with $S_0 = 10^6 \times m / 7.850$ (kg/m³)

[2] Permissible deviation: -3 bis +9 (%)

[3] Characteristic value (fractile 5 %)

* Delivery on request (o.r. / delivery time min. 2 weeks)

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KSB® DRILL BITS

OPTIMAL USE

Soil type	Cohesive, clay, mixed soil	Sandy, mixed soil	Gravel with blocks > 3 meters hard metal
KSB® Drill bit type	 Speedy Jet	 Speedy Stepped cross drill bit	 Rocky Button drill bit
Anchor reduction  R32 / R38 R32 / R51 R38 / R51 R51 / T64			 Rocky Button drill bit hard metal
Special drill bits Custom-made drill bit types / sizes on request	 Clay drill bit welded  Jetting bit (Magnification factor 2-5)	 Cross drill bit	
Magnification factor (Core drill bit diameter x factor = ND) with rotational embedding by grouting Kümix®	1.3	1.5	2.0

Nominal outer diameter and Radiale KÜMIX® (=ND)	Drill bit diameter (D=mm)	ND	Covering	ND	Covering	ND	Covering
R32 left	51	66	17	77	22	102	35
	76	99	33	114	41	152	60
	90	117	43	135	52	180	74
R38 left	76	99	30	114	38	152	57
	90	117	40	135	49	180	71
	100	130	46	150	56	200	81
	115			173	67	230	96
	130	169	66	195	79	260	111
	150	195	79				
	180	234	98				
R51 left (T64)	90	117	33	135	42	180	65
	100	130	40	150	50	200	75
	115			173	61	230	90
	130	169	59	195	72	260	105
	150	195	72				
	180	234	92				
T76 right	130	169	47	195	60	260	92
	180	234	79	270	97	360	142
T114 right	175	228	57	263	93	350	118
	200	260	73	300	112		

ND= Nominal outer diameter

Available drill bits

Different design or with anchor reduction

Min. 40mm covering of KSB pile according to SIA 267

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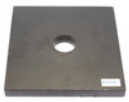
KSB® ACCESSORIES

ANCHOR PLATES

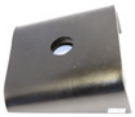
The right anchor plate for every rear anchoring. On request we can produce the perfect solution for you.
All anchor plates are also available galvanized.



ANCHOR PLATE STRAIGHT
0 – 2 ° (nut screw standard)

with KSB® angle plate 0 – 30°

CONVEX ANCHOR PLATE
0 – 15 ° (Domed anchor nut)



WEDGE PLATE
0 – 35 ° (calotte support)

NET SPRING PLATE

Further information in this document

SLEEVES

For uninterrupted connection of the anchor tubes.
All sleeves are also available galvanized.

KSB® SLEEVE
Standard

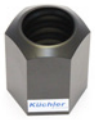
KSB® SLEEVE
with subsequent injection valve

KSB® SEAL
< 250 bar

SCREW NUTS

To fix the anchor plates on the anchor rod.
All screw nuts are also available galvanized.

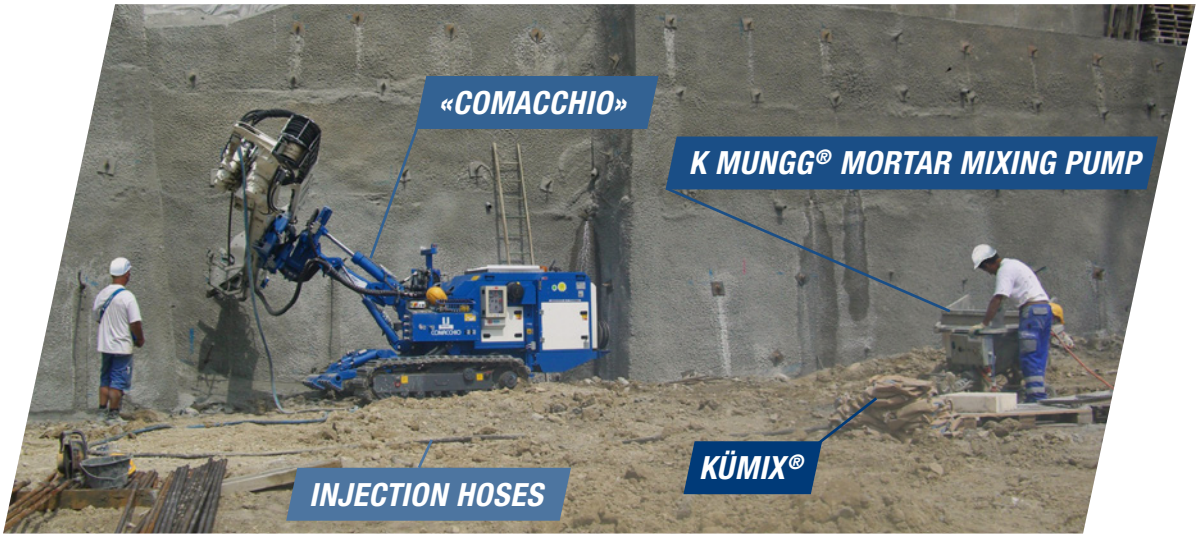
KSB® DOMED ANCHOR NUT



KSB® SCREW NUT
Standard

KSB® SCREW NUT WITH EYELET

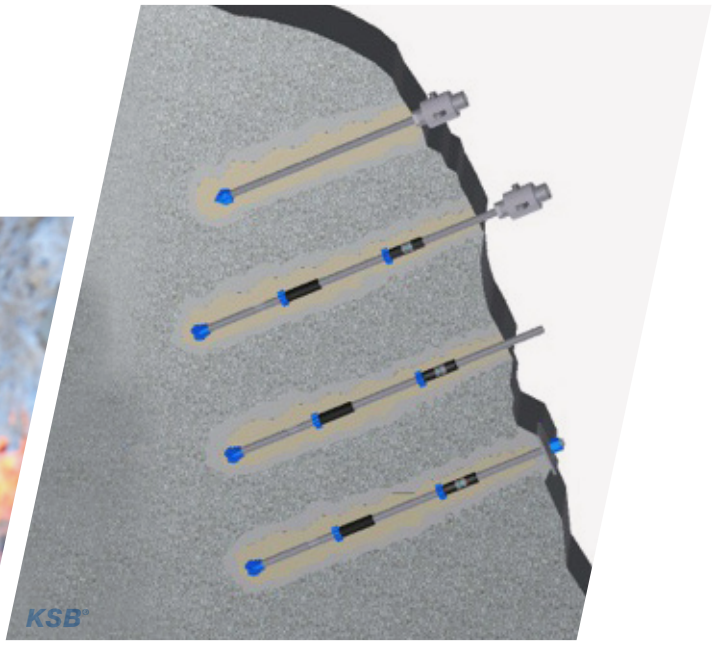
KSB® ANCHOR INSTALLATION



- Uniform process engineering in all soils
- The optimum integration with the existing soil
- Very high installation performance
- Work can be carried out with smaller drilling devices
- Vibration-free drilling
- Very flexible and efficient construction process
- Improved support and setting behavior
- Soil improvement through grout body by around 20%
- Installation with excavator drilling attachment 5 – 6 m possible from terrain without large scaffolding

Drilling and grouting in one operation. One worker can be saved due to the K MUNGG® Pump remote control.

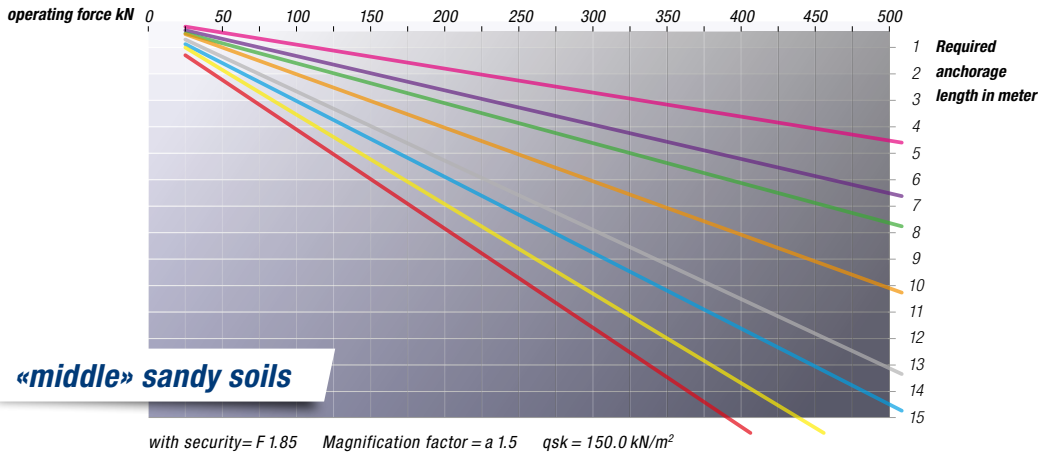
Injection material is constantly injected during the rotating and pulsing drilling process. It displaces and mixes with the existing soil. The KÜMIX® is continuously pressed by the drill bit to the drill hole mouth. Thus, the cuttings-promotion is accomplished and an entire sheathing is guaranteed. When sweeping out the drill hole before coupling every other anchor tube, the drill hole is swept to the stroke length of drilling attachment (pipe cleaning motion), thus the optimal formation of the grout body is achieved.

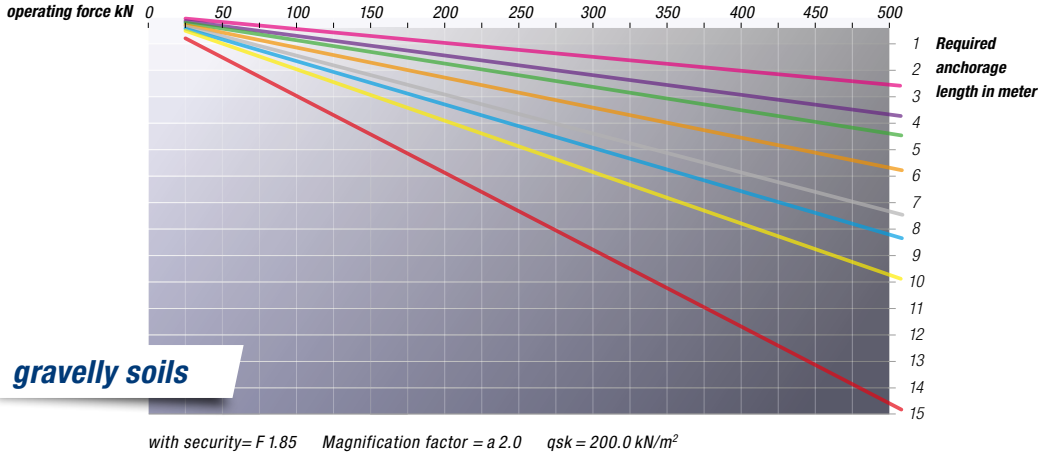


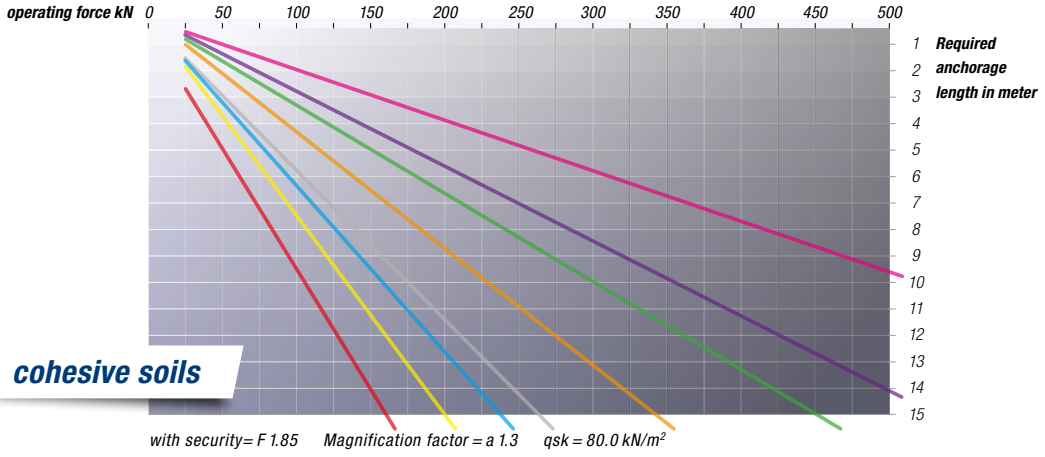
PRE-DIMENSIONING ANCHORAGE LENGTH

Drill head diameter

- Ø 51 mm
- Ø 76 mm
- Ø 90 mm
- Ø 100 mm
- Ø 130 mm
- Ø 170 mm
- Ø 200 mm
- Ø 300 mm







INJECTION USAGE KÜMIX® kg/m (W/F-VALUE 0.5)

Geology		Core drill bit diameter d (mm)							
		51 mm	76 mm	90 mm	100 mm	130 mm	150 mm	180 mm	200 mm
Cohesive soil a = 1.3	theoretical	7	15	20	25	42	55	79	98
	practical	9.1	20	25	35	55	75	105	130
Sand a = 1.5	theoretical	8	17	23	29	48	64	91	113
	practical	12	25	35	45	75	100	140	170
Kies a = 2	theoretical	10	22	31	39	64	85	113	150
	practical	20	45	65	80	130	170	225	300

The diameter of the grout body enlarges by grouting with cement suspension by a soil-dependant proportion a. The effective diameter is therefore calculated as follows:

$D_{eff} = d \times a$

D_{eff} = Effective diameter of the grout body
d = Diameter of the core drill bit
a = Engagement factor

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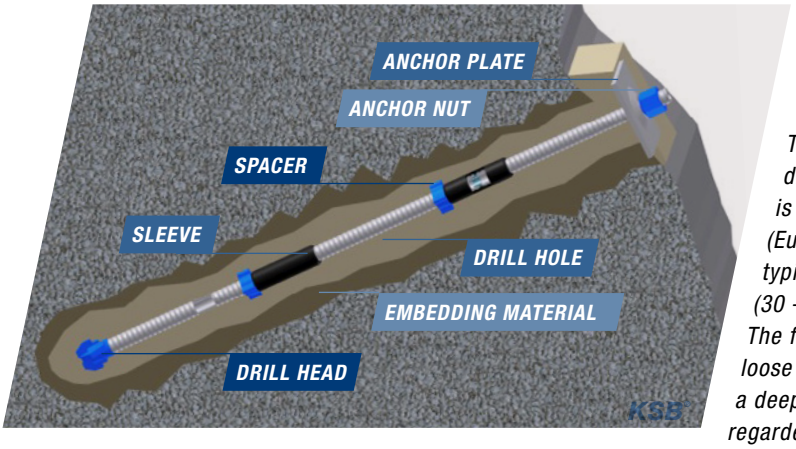
KSB® SOIL NAILS

B 500 B 900

NON-TENSIONED ANCHOR Anchor nails



KSB® Küchler self-drilling soil nails are ideal for loose or unstable soils, as they can be introduced without casing. The system is therefore often used in unstable soils.

The KSB® Küchler self-drilling anchor enables drilling and injecting in a single operation and is fully compliant with standard EN 14490 (European standard for soil nails). Soil nails are typically classified as lightly loaded (30 – 150 kN), passive installation elements. The full bond on the entire length enables the loose wedge at the surface to be tied into a deeper soil layer. Soil nails are generally regarded as low-risk installations.

Soil nailing should be planned in a rhombus-shaped grid, to ensure efficient distribution of the reinforcement. An appropriate drainage system should be secured within the nailed front, which cannot collect water inside the overhang. This would later form an uncontrolled load on the facing formwork.

AREAS OF APPLICATION

Embankment safety

Excavation safety

Securing roads

Network fixture

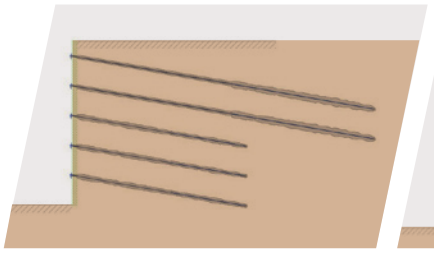
KSB® in tunneling

Rockfall shoring

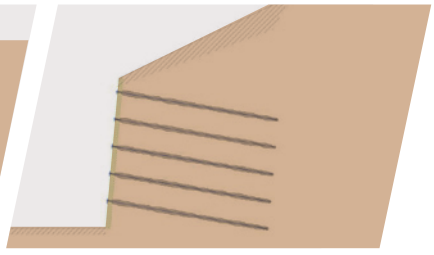
Securing roads

Rear anchored pile walls

Precut



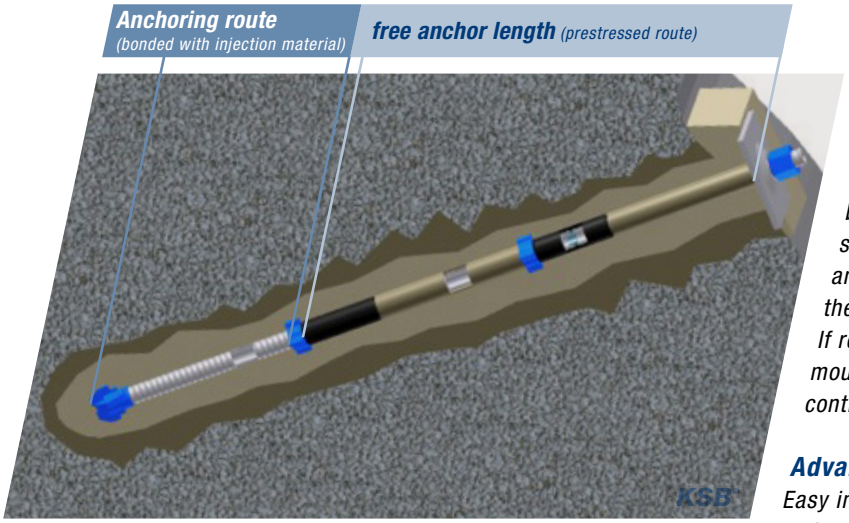
Excavation safety



Rear anchored sheet pile wall

KSB® PRESTRESSED ANCHOR

B 500



The KSB® prestressed anchors are formed in the region of the free anchor length with a PE cladding tube. This protects the anchor in the free anchor length (prestressed length) before bonding with the injection material and soil. The anchor has then free clearance (free anchor length), which can be prestressed after the injection material is set.
If required a Küchler load cell can also be mounted so that the force can always be controlled.

Advantages

Easy installation with stable geology, where casing drilling is not required - this saves the use of heavy drilling equipment and shortens the construction period.

IMPORTANT

- **The support (top plate) must be positioned at 90° to the axis of the supporting element (see installation instructions).**
- **Each KSB® must be inspected by Küchler Technik AG according to SIA 267 (see anchor technology).**
- **See installation instructions.**

AREAS OF APPLICATION

Excavation

Retaining wall / sheet pile wall

Pile / sheet pile wall

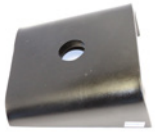
Sheet pile wall

Combination with nails

ACCESSORIES

CLADDING TUBE

For free anchor length



WEDGE PLATES

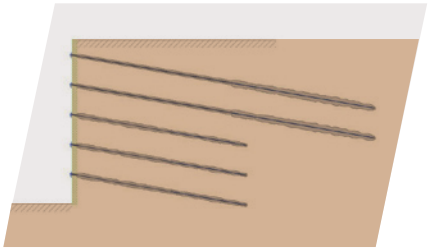
15°, 20°, 30°

or as required

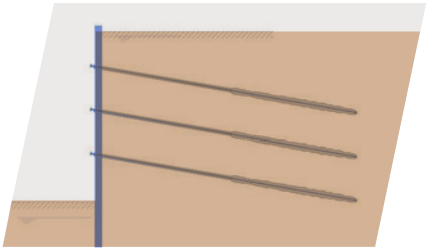
ANGEL PLATE

10°,15°, 20°, 30°

In the event of deviations greater than 5°, the use of an angle disc with standard KSB® screw nut is mandatory.



Excavation



Rear anchored sheet pile wall

Further information in this document

MEASUREMENT ANCHOR OR ANCHOR TEST ANCHORS

Installation of a Küchler load cell. The anchor is tested under tension for resistance. The load cell is used for periodic reading of the acting forces.

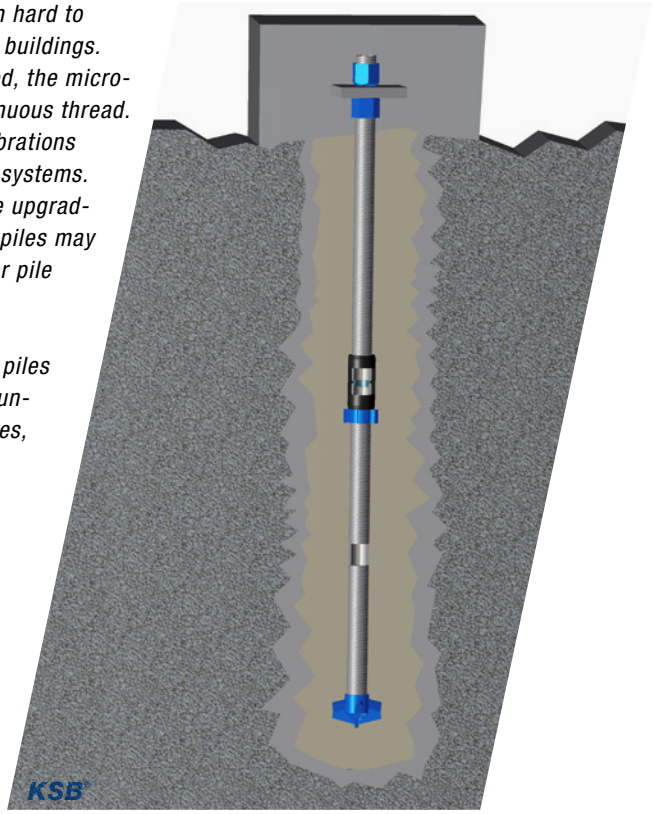
october 2022

KSB® MICRO-INJECTION PILE

KSB®Micro-injection piles can be installed in hard to reach areas and in the immediate vicinity of buildings. If the foundation level is deeper than expected, the micro-pile can be extended anytime due to its continuous thread. With rotary percussion drilling only minimal vibrations and impairments arise compared to driven pile systems. This way the foundations of old buildings can be upgraded without damage The buckling strength of the piles may be increased by applying a steel pipe in the upper pile area and the injecting of the annular space.

Possible application areas for KSB® Micro injection piles according to EN 14199: curtain wall foundations, foundation reinforcement, pylon foundations, wind turbines, renovation of old buildings and stand foundations for electric railways.

The buckling safety analysis for the slim KSB® Micro-injection pile is only to be administered, if the undrained shear strength of the soil is less than 10 kN/m².



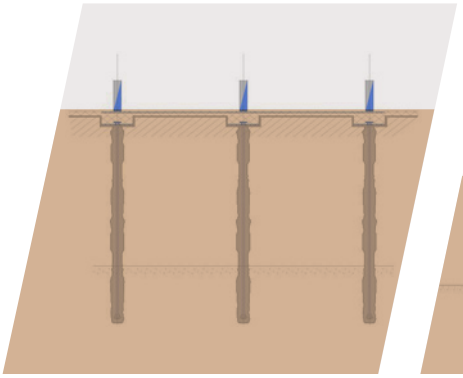
AREAS OF APPLICATION

Pile foundation

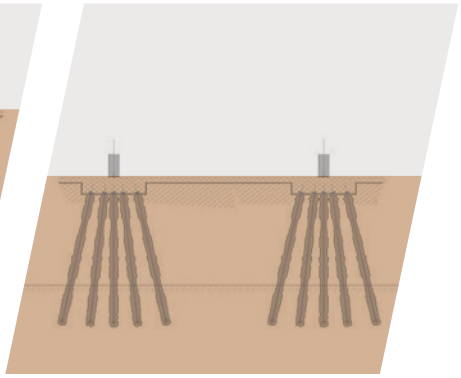
Foundation reinforcement

Embankment and road security

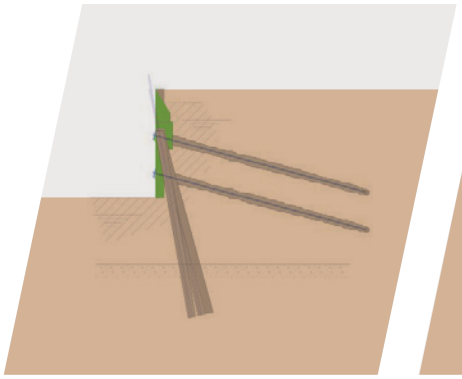
Bridge building I Noise barriers



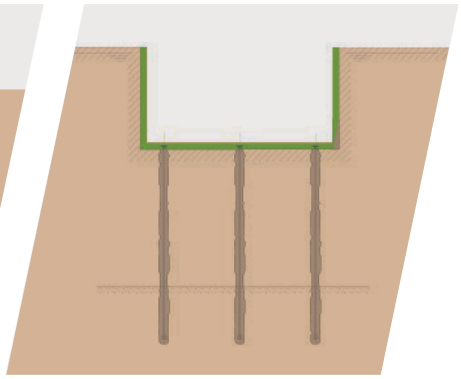
Independent, individual piles



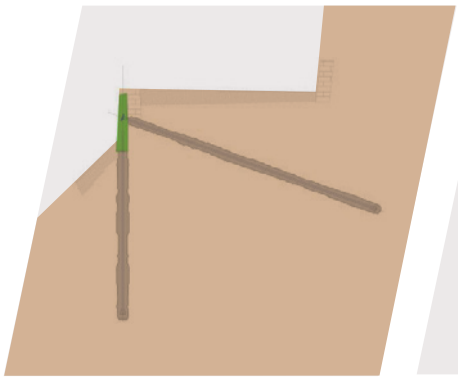
Pile group



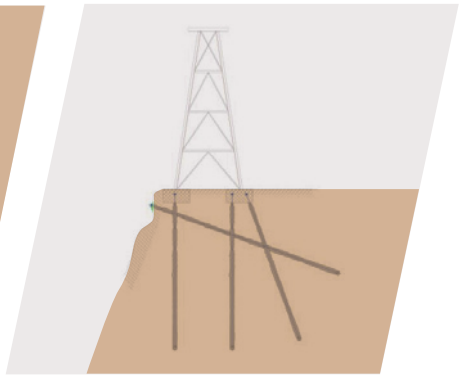
Under pinning pile



Uplift pile



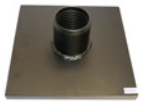
Hard shoulder stabilization



Mast foundation anchoring

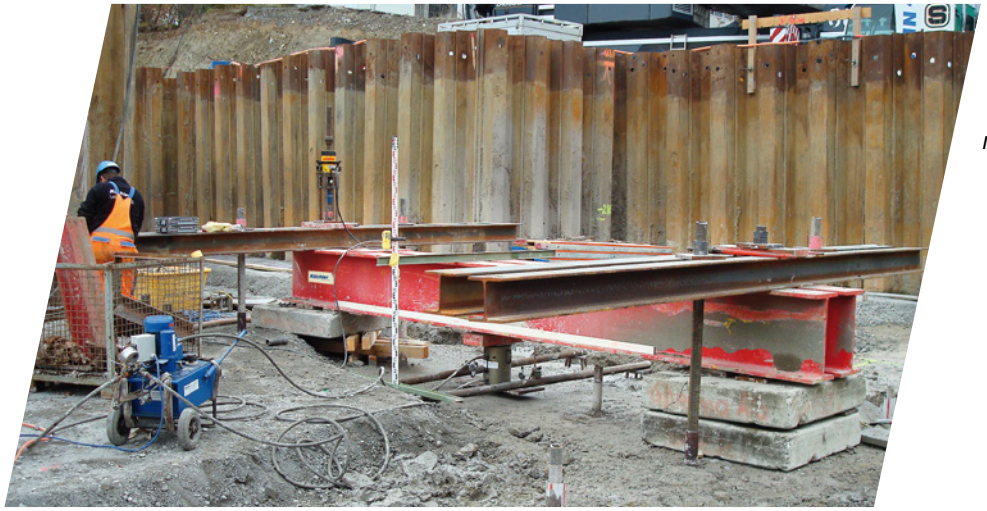
ACCESSORIES

DRILL BIT



PILE HEAD

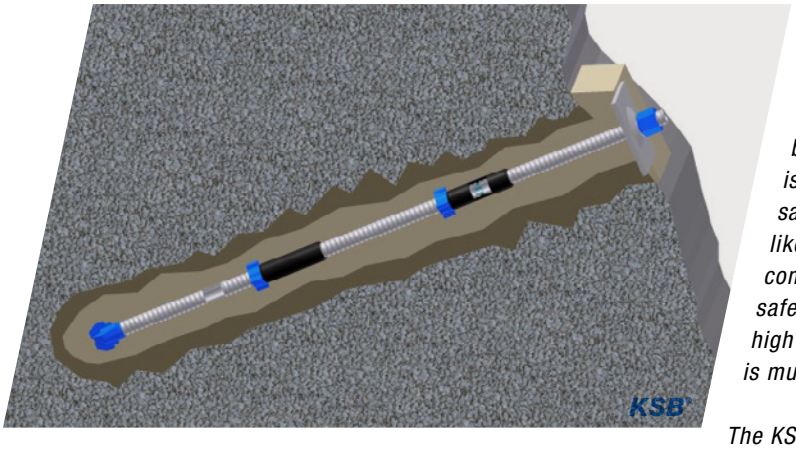
TESTS



Our test system is the most modern and has digital force measurement (1kN exact) and 2 gages (1/100 mm exact) for the deformation measurement.

KSB® DUPLEX-SYSTEM

KSB®DUPLEX - PERMANENT SYSTEM



The KSB®-Duplex system is injected with KÜ-MIX® thick flush during the drilling. Depending on the geology of the soil this is injected using an injection high pressure of up to 200 bar and a deep W/Z. The injection pressure is created through two built-in nozzles in the sacrificial KSB®Drill bit. The nozzles perform like a high-pressure cleaner, the soil is completely cut, compressed, toothed and a safe cement stone cladding is produced with high quality KÜMIX®. The friction in the soil is much improved.

The KSB® Drill bit is between 51 mm and 200 mm depending upon requirement, and is also available in hard metal and in different designs.

The patented KSB® Coupling system allows arbitrary lengthening of the system and ensures the tightness under high pressure. This also enables efficient work in small working lengths. The installation of the whole system is carried out in one and requires no additional lifting equipment

ACCESSORIES

SPACER

AREAS OF APPLICATION

Securing roads

Noise barriers

Excavation

THE 5 CORROSION PROTECTION LEVELS

1

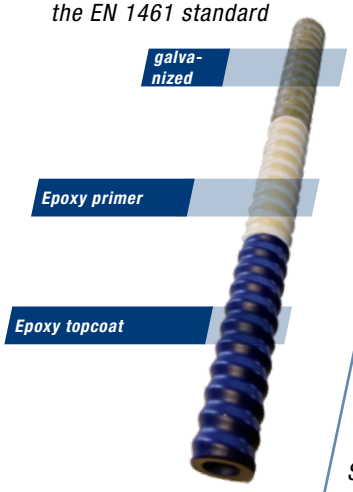
Corrosion allowance

The rust-rate of the steel diameter over the entire service life is determined with this method. This determines the remaining capacity of the anchor and its ability to meet the load requirements of the soil nail.

2

Protection by hot-dip galvanizing

Continuous Swiss galvanizing in accordance with the EN 1461 standard



3

Protection by epoxy coating

– waterproof

– electrical insulation

Toplex – Plus powder coating 60 – 80 my achieves the corrosive category C5-I long. This means that the coating withstands aggressive industrial atmospheres with high humidity.

The Toplex System offers the following advantages

– environmentally friendly, «meets the EU RoHS Directives»

– prevents the zinc reduction and therefore the load on the soil and water

– 100 % solvent-free

– high mechanical strength (impact and pressure-resistant)

– protected against infiltration

– very good aging and revision properties (restoration)

Electrical resistance measurements

40 – 50 my = 5500 V
60 – 65 my = 6500 V
80 my = 7000 V

Successfully used in many coated railings, noise barriers, bridges and highways.

4 KÜPS®

Also possible with K Support drill system, with an additional steel pipe.

5

Protection with KÜMIX®

– shrinkage-compensated

– waterproof

– no chemical additives

System advantages with KÜMIX® (Injection mortar)

The injection material (KÜMIX®) is waterproof and has been tested at 500 kPa for 72 h (max. depth 0.8 cm) = high corrosion protection at low cladding.

The KÜMIX® Injection mortar is shrinkage-compensated and demonstrates a thixotropic behavior. Less mortar consumption than when only cement would be used. The W/B (water-binder ratio) can easily be kept below 0.5, ensuring a high compressive strength and low shrinkage.

Advantages in introducing the KÜMIX® injection material using the KSB® Self-drilling anchor

– Smooth drilling with galvanized and epoxy-coated anchors by constant lubrication of the drill hole

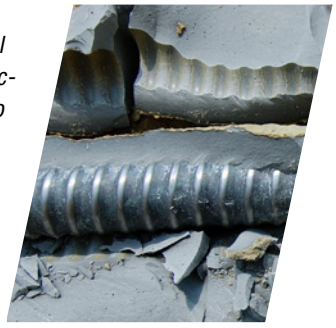
– No water flushing drilling, allowing only very little damage to the coating

– Filling the deepest part of the drill hole (from drill bit)

– Vibrating injection using rotary percussive drilling (excellent compression of injection material)

– An excellent mixing of the soil occurs due to the rotating injection (drill hole enlargement 2 to 3 times the drill diameter)

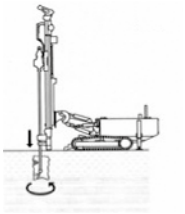
– Excellent injection material interlocking, 1.5 to 2 times higher sleeve friction than cased drilled systems (higher security of R_a)



KSB® MINI-JET-WORK

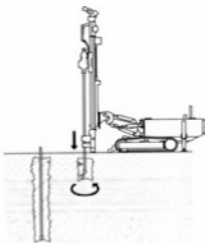
WORKING STEPS

With the mini-jet technology it is possible to produce columns of 30 - 60 cm in diameter. This depends on the purpose of the bore and the nature of the substrate.



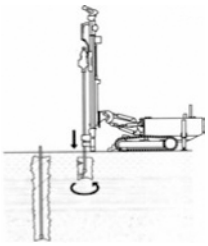
1

Start the hole with simultaneous injection of mortar under high pressure. The KÜMIX® is jetted into the ground at 100 to 250 bar through nozzles in the drill bit.



2

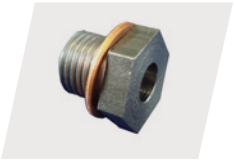
Due to the continuous penetration rate with high pressure injection a column of cemented material around the micropile is created.



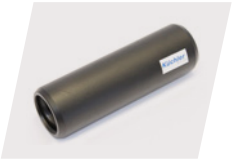
3

When the bore depth is reached the KSB®, used for the injection will remain in the drill hole. This acts as the reinforcement of a pile or as an anchor.

Jetting drill bit



Nozzle



Patented sleeve with seal

Seal

NOZZLE DIAMETER mm

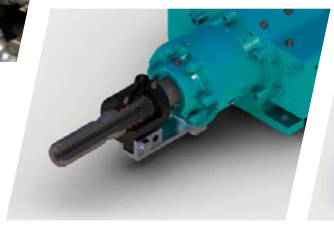
	1.4	1.6	1.8	2.0	2.2	2.4	3.0	3.2	3.5	4.0	5.0
Nozzle flow *(ℓ/min and nozzle) Kümix® W/F-Value 0.7*											
5 bar								12	14	19	29
10 bar							15	17	20	26	41
20 bar							21	24	28	37	58
30 bar							25	29	35	45	71
40 bar							29	33	40	52	82
50 bar						21	33	37	45	59	91
60 bar						23	36	41	49	64	
70 bar					21	25	39	44	53	69	
80 bar					22	27	42	47	57	74	
90 bar					24	28	44	50	60	79	
100 bar				21	25	30	47	53	63	83	
120 bar				23	27	33	51	58	69	91	
150 bar				25	31	36	57	65	78		
180 bar			22	28	34	40	62	71	85		
200 bar			24	29	35	42	66	75	90		
220 bar	16	20	25	31	37	44	69	79	94		
250 bar	17	22	26	33	40	47	74	84			

The flow rate depends on the diameter and the pressure, as well as the injection material. The flow rate for the most common diameters and pressures is depicted in the list. The injection material has a W/F value of 0.7 and a density of 1.66 kg/ℓ.

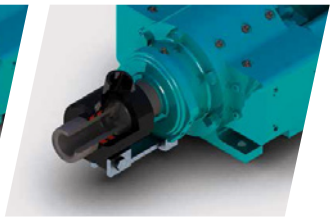
KSB® FLUSHING HEAD

DESCRIPTION

Using the KSB® flushing head cement mortar can be pumped through the cavity of a rotating anchor while drilling. In this simple way, it is ensured that during the drilling progress a simultaneous injection of the anchor cavity occurs. The injection adapter consists of three components - the flushing head shaft, the flushing head and sealing kit.



External thread



Internal thread

Further information in this document

PROCEDURE

For the connection between the adapter piece and the KSB® anchor the correct injection flushing shaft must be selected within the injection adapter unit. This ensures that the connection is strong enough to withstand the high demands of rotary percussion drilling. In addition, the sleeve joints can compensate for short-term eccentric loads occurring if obstructions are encountered during drilling.

The flushing shaft must be securely mounted and locked on the adapter to ensure that the joint remains tight during drilling and does not release during the replacement of the individual drill rods.

The seals within the mortar collar should be greased every 20 minutes.

Application up to max. 50 bar.

IG/IG

IG/AG

Transition adapter

Key

october 2022

KSB® OFFSET DEVICE

OVERVIEW

INSTALLATION UNIT	ANCHOR TYPE				
	R 32	R 38	R 51	T 76	T 89 / T 114
LIGHT DRILLING UNIT Pneumatic min 28 kg	 Hand hammer drill **< 32**	 Hammer drill on portable aluminum drilling attachment **< 38**			
DRILLING ATTACHMENTS Hydraulic 700 kg – 3 000 kg		 Hydraulic hammer drill 1001 on portable drilling attachment TMF 10 **< 51**	 Hammer drill on portable aluminum drilling attachment TMF 14 **< 76**		
			 Hammer drill to drill head TMF 15 **< 76**	 Hammer drill on excavator drilling attachment TMF 20 **< 114**	
DRILL DEVICE Hydraulic 5 000 kg – 8 000 kg					
			 Hammer drill to crawler drill rig MC 235 **< 76**	 MC 600 Eurodrill on Comacchio **< 114**	
			 Nextech Eurodrill HD 2004 incl. flushing head **< 76**		

Further information in this document

General representation

october 2022

K MUNGG® INJECTION SYSTEM

K MUNGG®

K VARIO MUNGG®

K SILO TRAILER

Automatically injecting at the push of a button with the Küchler system and the K MUNGG electric spiral pump.

Min. 40 bar delivery pressure (5-20 ℓ/min optimal performance)

RADIO CONTROL

INJECTION BOCK

GAGE

Further information in this document

GERTEC INJECTION STATIONS

IS-35-E

IS-60-EA

IS-80-EA

Plunger-, Piston- or Spiralpump, fully automatic and radio controlled with up to 200 lt and 200 bar working pressure.

KSB®INJECTION TECHNOLOGY

INJECTION MATERIAL

KÜMIX® / KÜMIX® S *(accelerated)*
KIM 500 / KIM 700 *(accelerated)*
K Injection mortar

BAGGED MATERIAL

Injecting with bagged material for smaller jobs

SILO

Further information in this document

We recommend using KÜMIX® as injection material. When compared to conventional cements, KÜMIX® impresses thanks to its high early and final strength. It is also thixotropic, which is a major advantage for processing as an injection material. Moreover, it is also sulfate-resistant and has low shrinkage.

At low temperatures under 5 °C, the injection material hardens much slower than at normal ground temperatures.

MIXING RATIO WATER / KÜMIX®

		W/S-value (water/solid value)			
Mixing ratio		0.4	0.5	0.6	0.7
Quantity KÜMIX® (kg/m³)		1 345	1 166	1 078	974
Quantity water (ℓ/m³)		538	582	647	682
Yield (ℓ/t)		743	840	928	1 025
Fresh mortar raw density (kg/ℓ)		1.89	1.78	1.73	1.66
Flow time (Marsh-hopper)	(sec)	–	–	–	76
Settlement (Vol. %)	nach 2 h	–	–	–	0.5
Compressive strength (N/mm²)	nach 1 d	9	5	2	1
	nach 2 d	19	9	5	2
	nach 7 d	39	24	14	9
	nach 28 d	52	38	24	19

Compressive strength test 4 x 4 x16 cm prisms

OUR TEST SYSTEM

DESCRIBED

Optimum measurement accuracy

Using modern and precise measuring instruments for optimum measurement results through digital gage (0001 mm) and digital force measurement (1 kN). We place great emphasis on compliance with the SIA standards.

The practice continues to surprise the theory

Due to our ongoing testing we are increasingly observing that the prescribed anchor lengths, respectively the systems, are not always optimally adapted to the geological conditions. By unforeseen ground conditions (injection losses, aquifers, not reaching the rock, etc.) more transparency on the anchor work can be achieved through previously built test anchors or by continuous sampling.

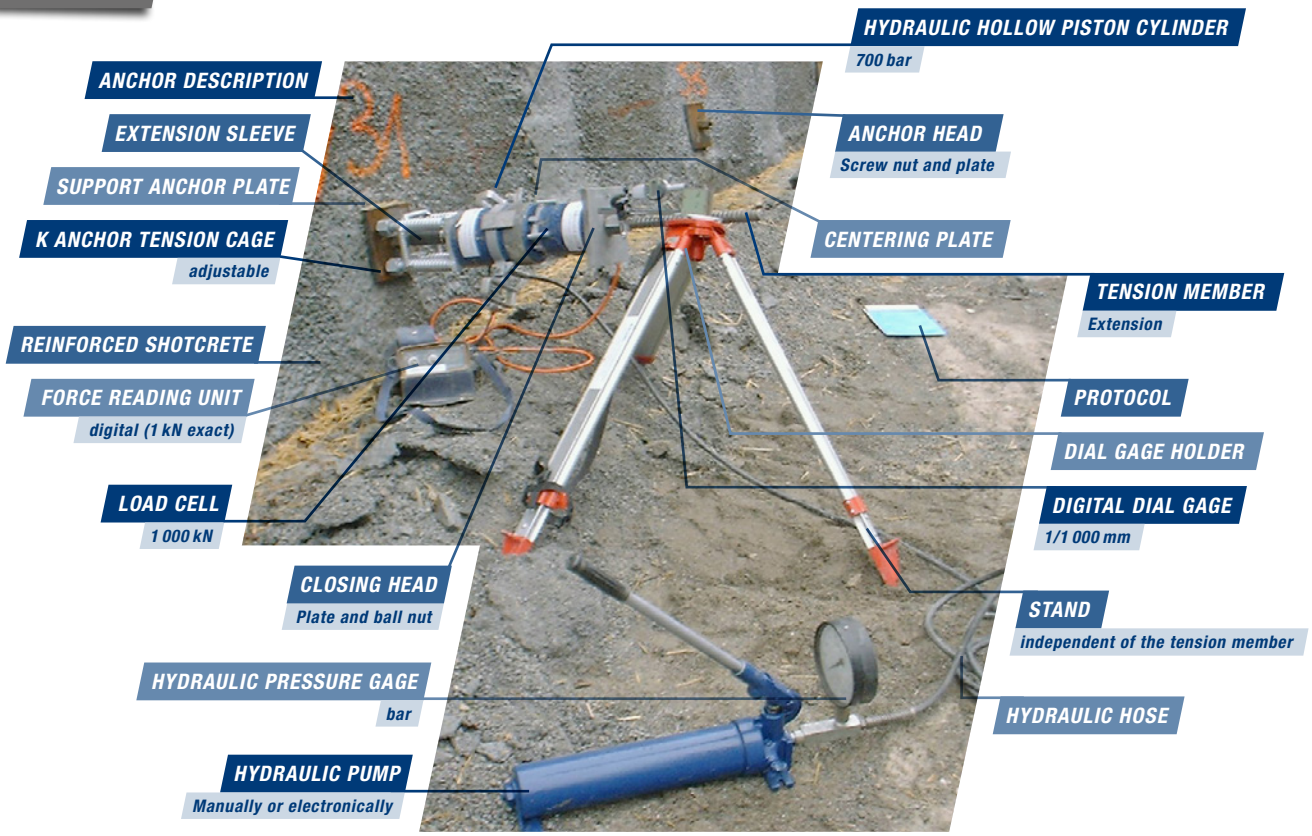
Self-developed test components

We place great value on smooth running test applications. Therefore, we developed an adjustable K anchor tension cage, which can set unevenness and the exact test angle with just a few hand movements.

Expertise to the end

From consulting and delivery of optimal system through to instruction and finally through our anchor testing, we provide additional quality assurance in construction and therefore also support the standards of the SIA, which stipulates testing of the anchor.

OVERVIEW



ANCHOR DATA DESIGNATION

FORCES	F	Tensile force in the anchor
	F_{sk}	characteristic value of the tensile force at the yield point of the tension member
	F_{tk}	characteristic value of the tensile strength of the tension member
	F_{pv}	Test load at anchor tests
	F_p	Test load at tensile tests
	F_a	Initial force at anchor tests and tensile tests
	F_o	Defined force
	ΔF	Force increments at anchor tests - tensile tests (force levels)
	V_{Rk}	characteristic value of the shear force at the yield point of the tension member
	M_{Rk}	characteristic value of the bending moment at the yield point of the tension member
RESISTANCES	R_i	inner load bearing resistance of the anchor (force at the yield point F_{yk})
	R_a	outer load bearing resistance of the anchor (max. force of the embedding in the base)
	R	standard load bearing resistance of the anchor (smaller value of R_i and R_a)
	R_d	Load bearing resistance
RATED VALUES	S_d	Load (general)
	F_d	acting tensile force
	V_d	acting shear force
	M_d	acting bending moment
GEOMETRIC DESIGNATIONS	l	Anchor length
	l_f	effective free anchor length
	l_{fr}	free anchor length tensile test (incl. tension member extension)
	l_v	Anchorage length
	$ß$	Anchor inclination with regard to the horizontal (ß > 0: anchor declining)
CHARACTERISTIC VALUES	f_{tk}	Test value of the tensile strength of the tension member (N/mm^2)
	F_y	Calculated value of the yield point of the tension member (N/mm^2)
	f_{yk}	Test value at the yield point of the tension member
	E	Tension member modulus of elasticity (kN/mm^2)
	A	Cross-sectional area of the tension member (mm^2)
	k	Creep rate
SHIFTS	Δl	Load (general)
	Δl_i	acting tensile force
	Δl_{el}	acting shear force
	Δl_{bl}	acting bending moment

TECHNICAL TERMS

Anchor	Structural element that transfers force into the subsoil via a tension member
Injection pile	Pile that is injected with mortar or cement as it is being established or after it has been established
Measuring anchor /control anchor	Anchor that is equipped with a force measuring device
Nail	Anchor that primarily transfers tensile forces or tensile and shear forces in the subsoil
Pile	Streamlined structural element to transmit loads and forces into the subsoil
Non-tensioned anchor	Anchor that primarily transmits tensile forces into the subsoil
Anchoring	The entire combination of anchoring measures that contribute to the load bearing capacity of the structure by introducing tensile forces in the subsoil.
Test anchor/Test pile	Anchor and piles on which loading tests are performed for assessment
Pre-tensioned anchor	Anchor which transmits size defined tensile forces into the subsoil via a tension member
Tension member	Part of the anchor that transmits the anchor force from the anchor head to the anchorage zone