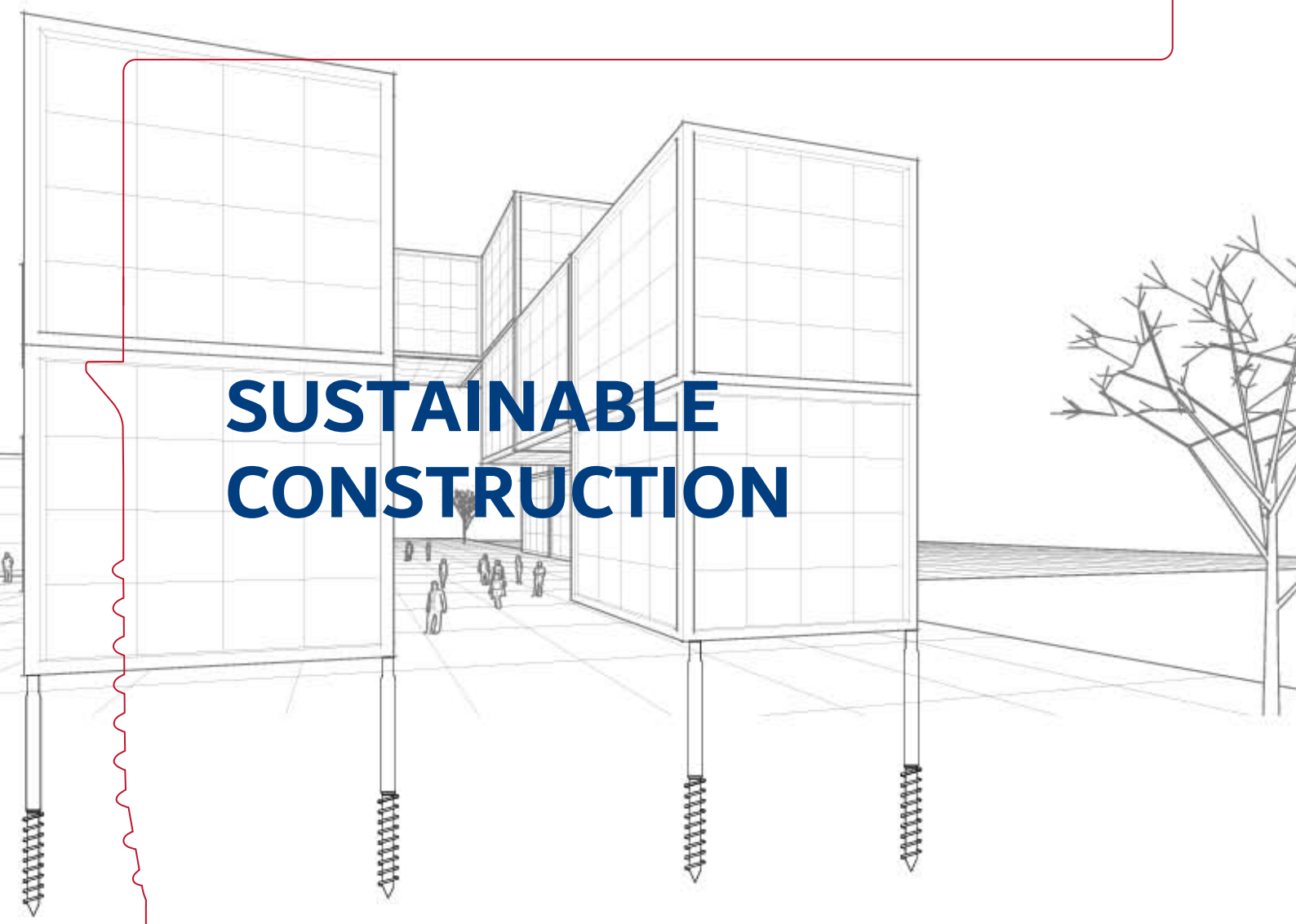
KRINNER

Deutsches Institut für Bautechnik DIBt



SUSTAINABLE CONSTRUCTION

The Pioneer in sustainable construction

THIRD-PARTY VERIFIED EPD ISO 14025 and EN 15804 Institut Bauen und Umwelt e.V.

GROUND SCREWS

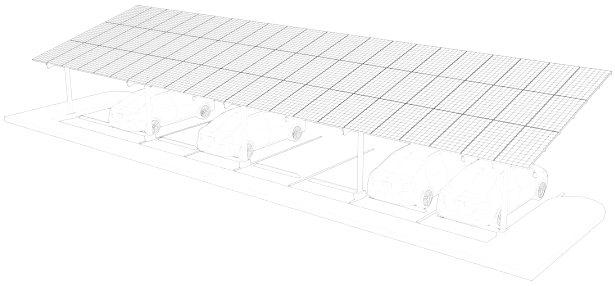
Pile foundations with KRINNER

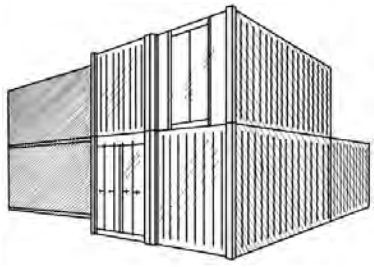
KRINNER Ground Screws are based on one of the oldest and most proven forms of foundation. The flexibly extendable pile made of hot-dip galvanized steel tubes is driven into the ground in a rotating, vibration-free and noise-reduced manner and is designed for vertical and horizontal load bearing.

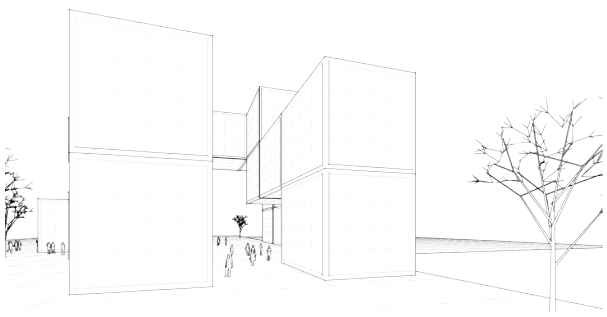
➨ **In principle KRINNER Ground Screws are suitable for use in any type of soil.**

VARIOUS APPLICATION POSSIBILITIES

as surface or deep foundations







SYSTEM DISPLAY

of KRINNER Ground Screws

Ground Screws are an excellent alternative for sustainable construction and offer clear advantages compared to a conventional concrete foundation.

Ecological

- No soil sealing
- Barely any crop damage
- Residue-free dismantling
- Circular building materials

Efficient

- Makes it possible to access hard to reach construction sites
- No need to move earth
- Quick installation
- Immediately loadable
- Simple deep foundation construction

Safe

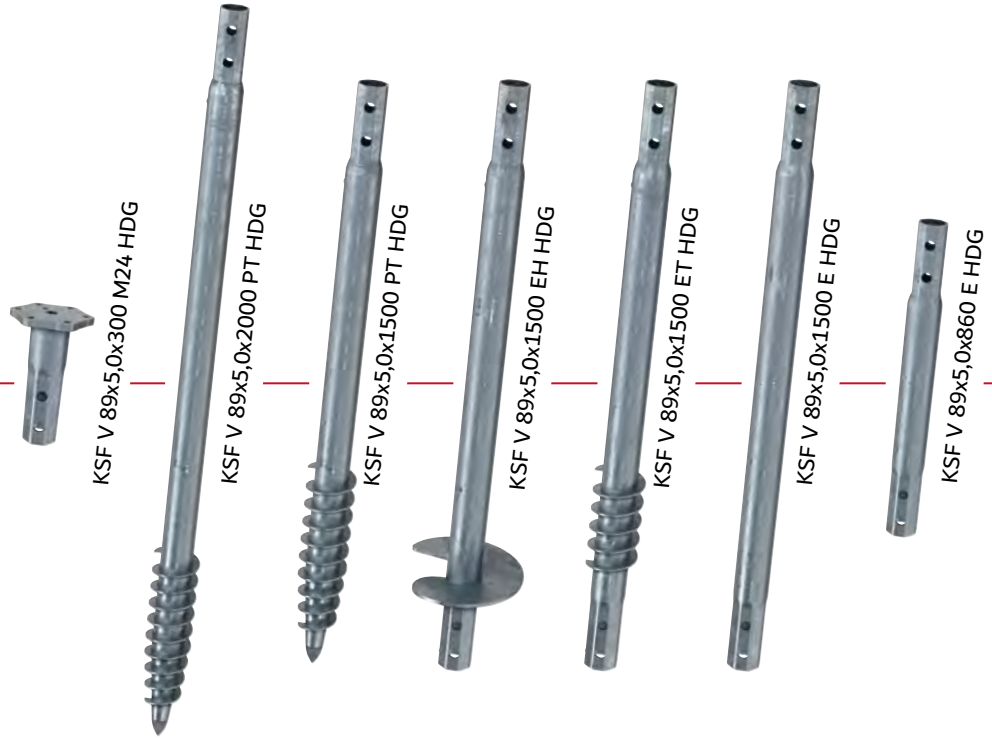
- Has been used for centuries
- Proven
- High load bearing capacity
- Highest quality standards

V-SERIES

The solution for economical surface and deep foundations

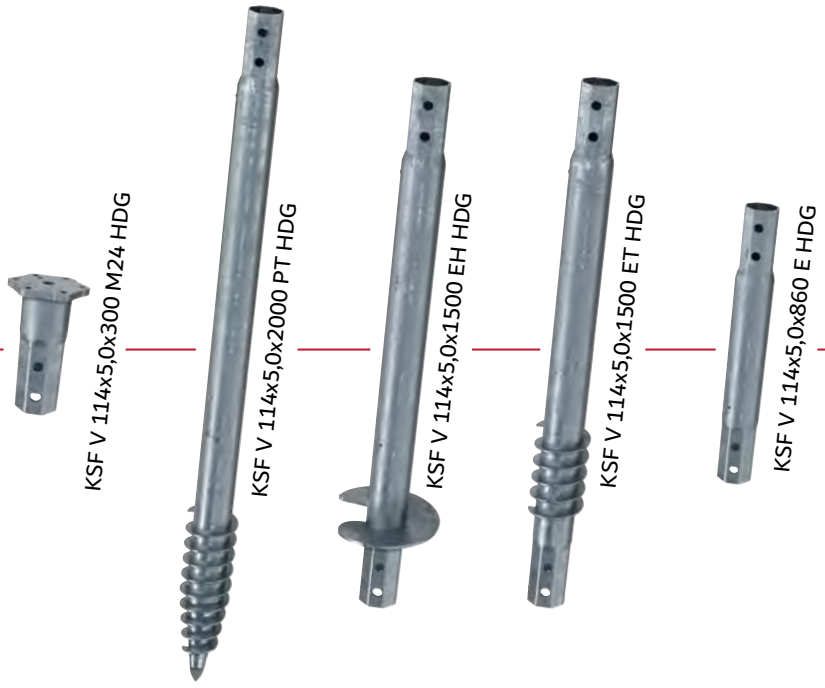
V89

DIBt-approved

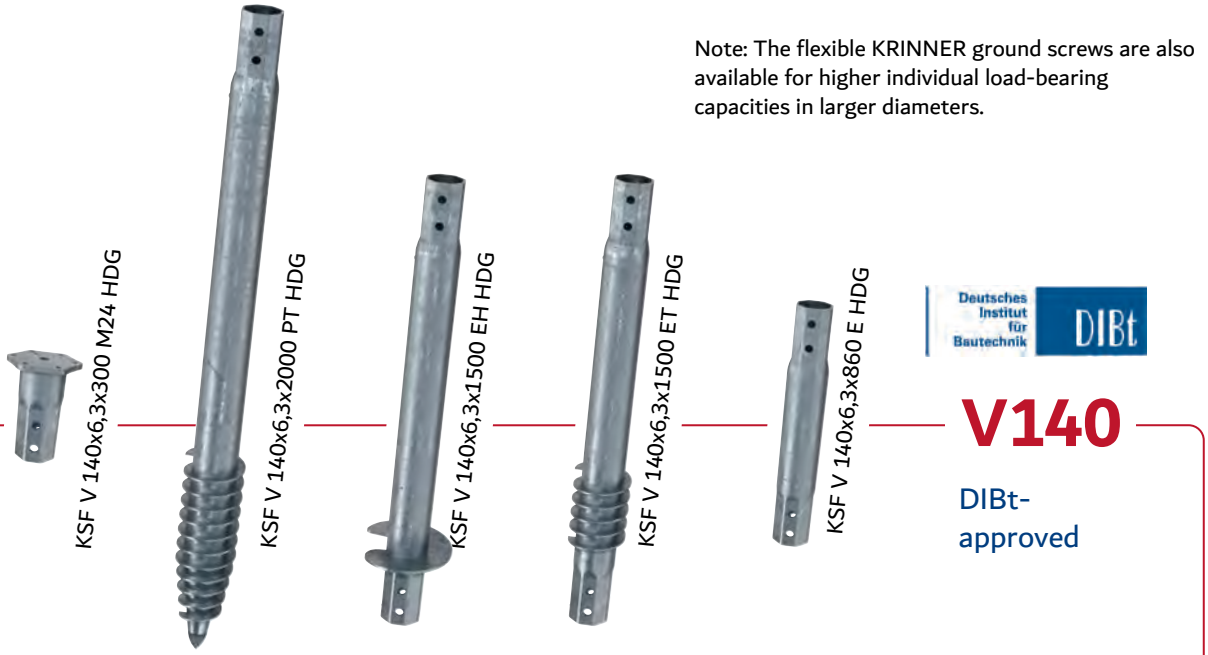


V114

DIBt-approved



Note: The flexible KRINNER ground screws are also available for higher individual load-bearing capacities in larger diameters.



Deutsches Institut für Bautechnik DIBt

V140

DIBt-approved

V168

according to DIN EN 12699:2015-07

PRODUCTS

CE

Base element – PT: The PT is the base element of the V-series and is always needed for the installation. The point and the thread help facilitate a quick feed into the soil. In addition, the thread ensures a higher load transfer into the ground compared to the pure surface friction on the pile shaft. Depending on the soil composition, an extension may be used. However, the PT may already be sufficient for a surface foundation if the soil composition is suitable. If this is the case, then only the head with the connecting flange needs to be installed afterwards.

Extension element with thread – ET: The ET is an extension element which can be used to penetrate through to deeper layers. With its thread, the ET supports the feed into the ground to prevent any “empty turning” of the ground screw element and on the other hand guarantees an even higher load transfer through the thread.

Extension element with plate – EH: An EH can be used as an extension when the ground screw has to carry even more additional load. The „plate“ on the ground screw increases the load-bearing capability of the screw thanks to its large surface area. The use of this extension is recommended in very soft and homogeneous soils.

E extension elements: The E extensions are levelling elements that can be used to level out any height differences. This can be useful for construction projects in sloping areas for example.

Head element – M24: The M24 is a head element which is needed as a connection part in the foundation construction.

EQUIPMENT

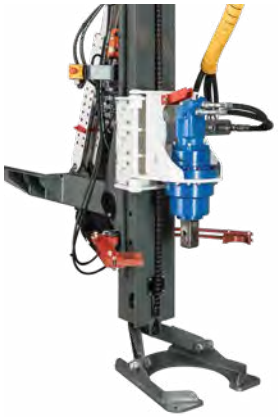
DIN

Related equipment for deep and system construction using Ground Screws

KRINNER sees itself as a system provider for sustainable foundation construction, so we offer the suitable test and installation equipment made by KRINNER.

KRP SYSTEM

- Equipped with 15.000 Nm or 25.000 Nm Auger-Torque drive
- Equipment for horizontal coupling of the KRINNER ground screws
- Use with KRINNER data acquisition management



KRL – LAFETTE

- In accordance with EN 16228-1
- Carrier vehicle wheel and telescopic loader with a lifting force at max. reach of 1.5
- Crawler or mobile excavator with a lifting force at max. reach of 1.5 t
- Mounting plate, quick-change device see operating instructions (depending on the carrier vehicle)

KRD 30 – CATERPILLAR

- Self-driving caterpillar, light and manoeuverable design
- Approx. 8,000 Nm tourque
- 2.4 m drill lift
- Only 1,1 t transport weight
- Precisely-defined feed force

LOAD TESTING EQUIPMENT

- Different designs for up to 500kN test load
- According to the applicable specifications of the standards in force

APPLICATION

V-series in the ground – with illustration
Dynamic probing and soil layers

1 M24 POST SUPPORT

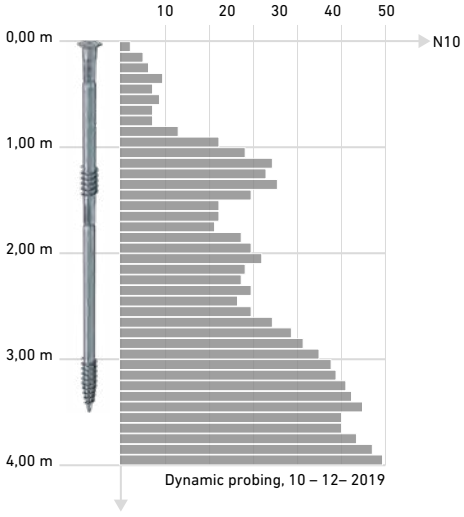
Head element to mount the foundation construction.

2 ET

Extension element to reach deeper soil layers. Thread supports the feed into the soil.

3 PT

Basic element, which is always used. Foundation point and thread help facilitate efficient and safe screwing in of foundation.



SOIL LAYER 1
COHESIVE SOIL

Humus layer, clayey and muddy, strongly rooted

SOIL LAYER 2
NON-COHESIVE SOIL

Very fine sand to slightly coarse-grained sand

SOIL LAYER 3
SLIGHTLY COHESIVE SOIL

Slightly muddy, fine sand to strongly coarse-grained sand

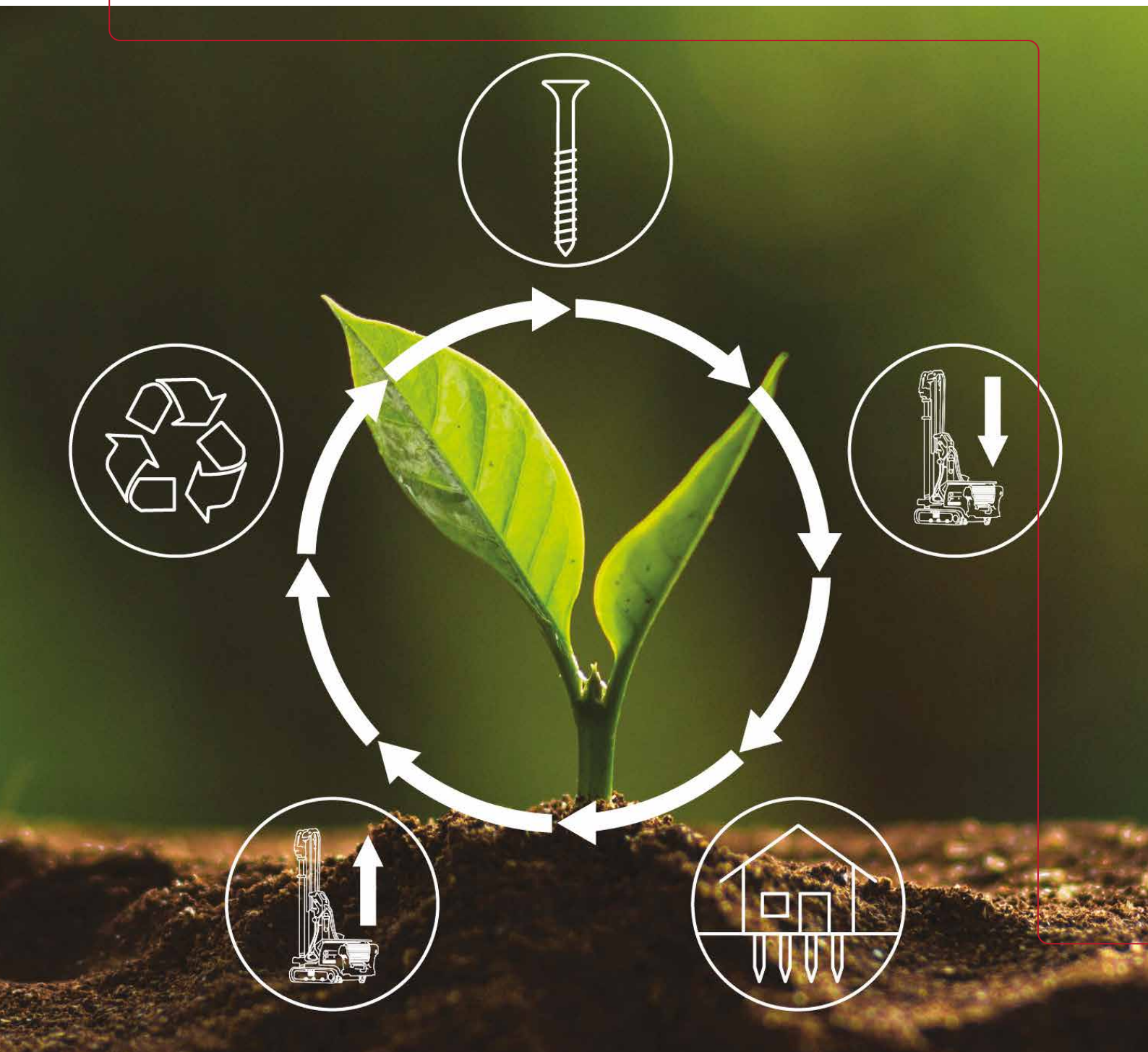
SOIL LAYER 4
NON-COHESIVE SOIL

Fine to coarse-grained sand

SUSTAINABILITY

EPD for KRINNER ground screws

With the EPD (Environmental Product Declaration), we create an important basis for the sustainability assessment of KRINNER ground screws. An EPD describes building materials or building components with regard to their environmental impact on the basis of life cycle assessments as well as their functional and technical properties. This quantitative, objective and verified information relates to the entire life cycle of the building product.



GENERAL TYPE APPROVAL

Deutsches Institut für Bautechnik

DIBt

Note: The complete DIBt-approval, including all associated drawings, can be viewed via the attached link or QR code. The following pages of this brochure contain only an excerpt of the approval content.

Link: https://www.dibt.de/de/service/zulassungsdownload/detail/z-3415-253

QR-Code:

Deutsches Institut für Bautechnik (DIBt)

Institute under Public Law sponsored by
the Federal Government and the Federal States

Technical Approval Body for Construction Products
and Construction Techniques

General Construction Permit

Date: 22/12/2023

Ref.: I 6-1.34.15-9/21

Number:
Z-34.15-253

Validity:
from: 22 December 2023
to : 22 December 2028

Applicant:
KRINNER Schraubfundamente GmbH
Passauer Straße 55
94342 Straßkirchen

Subject of notice::
KRINNER V-series screw piles as foundation element for structural works

Aforementioned subject matter is granted the general construction approval.
This notice consists of eight pages and six annexes.

I GENERAL PROVISIONS

1 This general construction permit serves as proof of the applicability of the subject matter in terms of the regional building regulations.

2 This notice does not replace any permits, approvals and certifications needed for the execution of construction projects.

3 This notice is issued notwithstanding any third-party rights (private protection rights, in particular).

4 Notwithstanding additional regulations contained in "General Provisions" copies of this notice shall be made available to subject matter users. Furthermore, subject matter users shall be informed that this notice must be available at the point of use. Copies shall be made available to authorities on request.

5 This notice shall be copied completely. An extracted publication requires the approval by Deutsches Institut für Bautechnik. Texts and drawings of advertising materials shall comply with this notice. Translations shall include the note "Translation of the original German version not checked by the German "Deutsches Institut für Bautechnik".

6 This notice is issued subject to revocation. Provisions may be amended and modified subsequently particularly in the light of new technical developments.

7 This notice refers to the subject matter facts and documents submitted by the Applicant in approval procedures. Any modification to these bases of approval are not covered by this notice and shall be submitted to Deutsches Institut für Bautechnik without delay.

I SPECIAL PROVISIONS

1 Subject matter and scope

(1) Subject matter is the planning, dimensioning and installation of foundations for structural facilities in the ground using "KRINNER V-series" screw piles made by "KRINNER Schraubfundament GmbH" (see Annex 1).

(2) Screw piles consist of:
- Base element with drive point
- Extensions
- Connecting bolts
- Pile head

(3) Screw piles are made of S 235 class and/or S 355 class steel. They are not zinc coated and/or galvanized according to DIN EN ISO 1461 and shall comply with Annexes 1-5.

(4) There are the following screw pile sizes: KSF V 89, KSF V 114 and KSF V 140.

(5) Elements are put together using a plug connection with connecting bolts thus attaining an installation depth of min. 1.7 m and 8 m in general. Screw piles are put into the ground in segments and in a ground--displacing way.

(6) Screw piles can be used as course or pressure stakes and for different loads for permanent use (more than 2 years). Generally, only axial loads are permitted.

2 Planning, dimensioning and installation regulations

2.1 General information

Unless otherwise provided for herein planning, dimensioning and installation of foundations for structural facilities using screw piles shall be in compliance with technical building regulations and, in particular, DIN EN 1997-1, DIN EN 1997-1/NA, DIN 1054 and DIN EN 14199 in conjunction with DIN SPEC 18539.

2.2 Planning

(1) Screw pile parameters relevant to planning are included in Annexes 1-5 and the declaration of conformity according to DIN EN 1090-1.

(2) Screw piles consist of a base element and extensions that are put together. Selection of the base element and the extensions is subject to pre-dimensioning and as specified by the manufacturer with the extension type depending on the soil conditions (see Annex 3).

(3) Plug connections and connecting bolts are used to ensure a frictional connection of individual components (see Annex 5). A min. tightening torque of 300 Nm shall be complied with. In case of alternating stress a locking as specified by the manufacturer shall be provided (e.g. Loctite 262).

(4) The corrosion protection system shall be used subject to the expected useful life and the soil class according to DIN 50929-3, par. 2.3.

(5) Adapters (if any) shall be provided by the manufacturer.

(6) There are the following drill point imperfections:

-	position deviation of head:	+/- 30 mm
-	height deviation of head:	+/- 5 mm
-	target inclination deviation	+/- 2 %

Above imperfections shall be taken into account when dimensioning the above-ground construction.

(7) Screw piles are exposed to axial traction and/or compression forces. Horizontal loads of up to 3% of vertical loads may be applied.

(8) In order to avoid bending loads of individual screw piles due to unwanted eccentric load screw piles shall be arranged in a way that such eccentricities are considered as causing no damage to an individual screw pile (e.g. min 3 screw piles carrying a single load or two lines carrying a line load or other constructive measures making sure that bending loads can be avoided).

(9) There shall be a flat and centred connection of the head to the above-ground component. Piles shall be secured against twisting.

(10) Connection of the pile head to the above-ground component as well as the pile head's resistance to corrosion under atmospheric conditions shall be proved separately.

(11) Final planning shall include the notes on the detail development based on planning. This includes, in particular, parts lists, details on execution and min. and max. torques.

2.3 Requirements for soil and/or corrosion probability in subsoil

(1) In order to determine corrosion probability of the in-situ soil the rating number sum B_0 and/or B_1 according to DIN 50929-3 shall be determined and the soil shall be assigned to the corresponding soil class according to DIN 50929-3, Table 3. Existence of an electroconductive or electrolytic connection to an external cathode (e.g. reinforced concrete part, copper earth electrodes or metal tubes) shall be excluded.

(2) There is a low corrosion load (soil class I), if the following conditions are met:

- Soils with elutriable components of less than 50% mass percentage
- No soil contaminations leading to rating number $Z_1 = 12$ according to DIN 50929-3, Table 2
- Soil resistance at representative points is more than 100 Ωm
- pH value: $6 \leq pH$
- No relevant admixture of corrosive substances such as sulfides, sulfates or salts

(3) Subject to the determined soil class a useful life of the pile as shown in Table 1, can be expected.

Table 1: Useful life of piles (years)

Thickness of galvanization according to DIN EN ISO 1461	Soil class			
	Ia	Ib	II	III
Zinc layer 70µm and/or 100 µm *	100	100	50	10
Not galvanized	100	50	25	10
* Planned useful life achieved by protective galvanization effect and a defined corrosion of 1.5 mm (inside and outside).				

2.4. Dimensioning

2.4.1 Proof of inner load-bearing capacity

(1) Screw pile parameters relevant to dimensioning are included in Annexes 1-5 and the declaration of conformity according to DIN EN 1090-1. A reduced nominal wall thicknesses (corrosion) of 1.5 mm is applied to prove the inner load-bearing capacity.

(2) The pile head's connection to the air layer boundary of the above-ground construction shall be proved separately in regard to corrosion resistance under atmospheric conditions.

2.4.2 Proof of outer load-bearing capacity

(1) For pre-dimensioning the size is determined on the basis of the expected impacts by the above-ground construction. Pile lengths result from the corresponding pull-out resistance and pressure resistance. According to the manufacturer such resistance should be based on experience. If pre-dimensioning values are not confirmed by proof load testing results, pile length shall be increased.

(2) An embedding depth of min 1.20 m into the load-bearing layer of the soil shall be provided.

(3) A group effect of anchors can only be excluded if there is an adequate distance (generally $\alpha \geq$ pile length). If the screw pile axial distance is smaller than the pile length, interaction shall be checked.

(4) The anchors' rated value of the pull-out resistance and/or pressure resistance shall be determined in situ for each size by way of proof load testing according to par. 2.5.

(5) The rated value of the pull-out resistance and/or pressure resistance applies to a mainly static load in axial direction. If there is no pressure resistance, the pull-out resistance value may also be used as the compressive force that can be absorbed.

(6) In case of alternating stress the cyclic load span shall be max. 20% of the characteristic pull-out resistance. In case of a fluctuating tensile stress involving a broader cyclic load range a corresponding proof load testing (pulsating stress) shall be performed.

2.5 Proof load testing

(1) Planning and performing proof load testing as well as analyzing the test results shall be the responsibility of KRINNER Schraubfundamente GmbH or structural engineers.

(2) Proof load testing shall be performed in accordance with DIN EN ISO 22477-1 and/or 2. In derogation thereof an accelerated loading cycle (see Annex 6) may be used.

(3) Testing forces F_p applied to the piles during proof load testing must not exceed the values in Table 2. In case of pressure tests in softer soils the permissible load may have to be reduced to avoid any stability failure.

Table 2: max. F_p per pile

Size as per Annex 1	max. F_p of absorbable tension force (kN)
KSF V 89	113
KSF V 113	197
KSF V 140	243

(4) The construction field shall be divided into areas with comparable foundation soil structures. Min. two test piles of the same size, inclination and anchoring depth shall be tested.

(5) The selection of the drill, the torque applied and the anchoring period as well as sub-soil preparation (e.g. pre-drilling or compacting) shall be documented and compared for each pile, as this may provide information about changed layer thicknesses and, therefore, a clearly different pull-out resistance.

(6) Installation torques that are required for or attained during installation shall be determined for the purpose of checking the screw pile type.

(7) In non-cohesive soils a combined proof load testing (tension and pressure) and a pile proof load testing (tension) may be performed. In cohesive soils it has to be checked whether plastic deformations allow for a combined testing.

(8) The following limiting criteria for pile resistance determination shall be complied with:

- Creep value $k_S \leq 2.0$ mm (pressure testing, tension testing)
- Pile head settlement $s \leq 0.1 * D$ (pressure testing)

  D = external diameter of foundation piles without metal strip thread / load plate

The value of the previous load stage where limiting criteria were complied with is the characteristic pile resistance.

(9) The group effect of the selected pile groups shall be tested in accordance with the planning.

2.6 Installation

2.6.1 Arrangement and installation of screw piles

(1) The key figures of the screw piles are included in Annexes 1-5 and the declaration of conformity according to DIN EN 1090-1. As regards installation attention shall be paid to the installation instructions issued by KRINNER Schraubfundamente GmbH.

(2) Screw pile sizes intended for installation shall be checked for completeness and integrity of all components on the basis of the implementation planning and the delivery notes.

(3) Screw piles are screwed in. Both machinery and performance configuration shall be in line with the specifications made during proof load testing.

(4) Points for drilling shall be measured in accordance with the planning documents. To ensure a more precise position a smaller diameter may be used for pre-punching.

(5) When screwing in screw piles shall be checked for straightness. The target inclination shall not deviate by +/- 2%.

(6) The plug connections shall be subject to implementation planning taking a min. tightening torque of the connecting bolts of 300 Nm into account. In case of alternating stress a locking specified by the manufacturer shall be provided (e.g. Loctite 262).

(7) When screwing in the installation torque shall be recorded and monitored. The max. permissible installation torque according to Table 3 must not be exceeded.

Size	Max. permissible installation torque (Nm)
KSF V 89x5	4.790
KSF V 114x5	10.330
KSF V 140x6.3	17.970

(8) If the max. tightening torque is attained prior to attaining the embedding depth of the load-bearing layer according to the implementation planning screwing shall be stopped. External load-bearing capacity of these screw piles shall be proved by way of additional proof load testing.

(9) If the attained installation torque does not attain the implementation planning target value, one or more additional extensions may be installed in order to attain the target value.

(10) After installation screw piles shall be protected permanently against twisting.

2.6.2 Acceptance test

(1) Testing shall be in accordance with par. 2.5.

(2) Acceptance shall take place upon attaining the test force to be determined on the basis of proof load testing and a structural analysis. Pull-out / pressure resistance does not have to be tested.

(3) 3% of the screw piles (min. 2 screw piles per area with comparable soil structures) shall be tested.

(4) Pile groups shall be tested analogously.

2.6.3 Construction supervision

(1) During installation the min. control measures defined in Table 4 shall be taken.

Test item	Testing	Min. frequency
Screw piles / components	Checking delivery notes and declaration of conformity for compliance of geometry and materials according to Annex 1 - 5 (EN 1090)	Each delivery
Screw piles	Visual integrity inspection	Each part
Corrosion protection (galvanizing)	Visual integrity inspection	Each part
Parameters and/or measuring values of insertion process	Check for use of proof load testing results Checking applied torque	Depending on test method.
Acceptance	Acceptance test according to par. 2.6.2	3% of piles per building site, min. 2 piles per homogenous site

(2) During installation of the piles proof of proper installation shall be recorded by the site manager or his / her representative.

(3) In case of poor test results installer shall immediately take measures to remedy the defect. After remedying the defect the respective test shall be repeated without delay to the extent technically feasible for the purpose of proving remedy of the defects.

2.6.4 Installer's declaration of conformity

(1) The installing company shall issue a declaration of conformity pursuant to Section 16a, para. 5 in conjunction with Section 21, para. 2, Model Building Regulations[1]

(2) The executing firm's declaration of conformity according to DIN EN 14199, Part 10, amended by DIN SPEC 18539, Part 3.8, shall be provided and include the following:

- Number of notice
- Details of construction project
- Date of execution
- Name and registered office of executing firm
- Confirmation of execution according to planning documents

[1] Model Building Regulations — Version: November 2002, last amended by resolution by the Conference of the Ministers of Construction dated 22/09/2022

- Documentation of basic materials and delivery notes
- Type of controls or inspection
- Date of control and/or inspection
- Results of control and inspection (if applicable) and comparison with requirements
- Features
- Name of company and signature of person in charge of controls and inspections

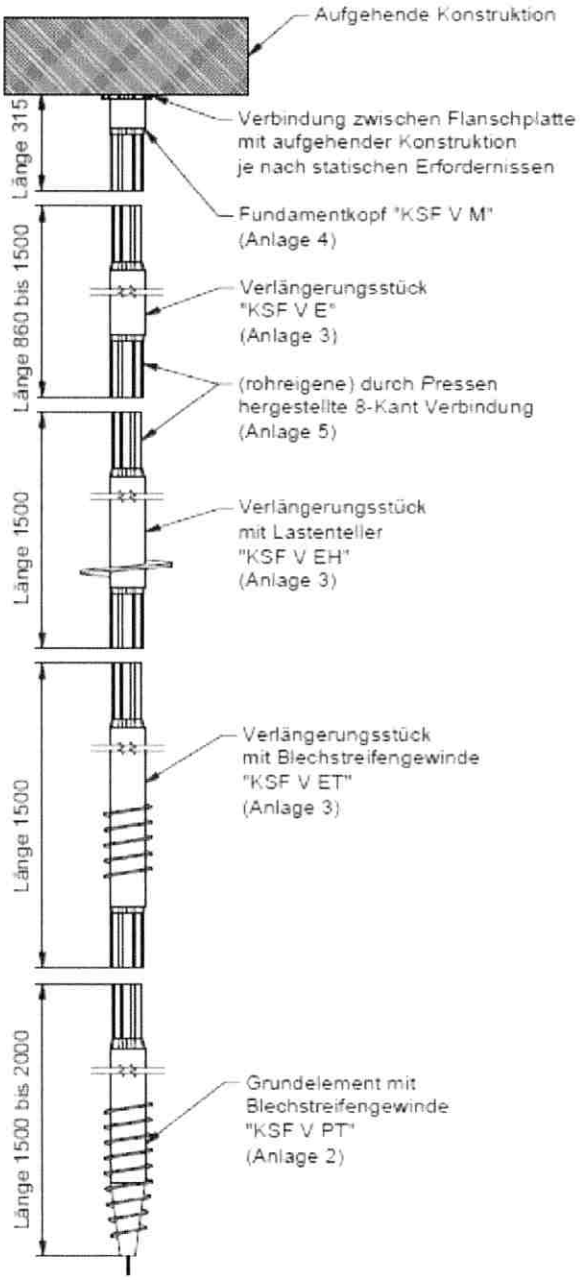
(3) The declaration of conformity shall be issued to client for the construction files and submitted to Deutsches Institut für Bautechnik and the supreme building authority on request.

Standard

DIN 1054:2021-04	Subsoil - Verification of the safety of earthworks and foundations - Supplementary rules to DIN EN 1997-1
EN 1090-1:2009+A1:2011	Execution of steel structures and aluminium structures - Part 1: Requirements for conformity assessment of structural components
DIN EN ISO 1461:2022-12	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods (ISO 1461:2022)
DIN EN 1997-1:2009-09	Eurocode 7: Geotechnical Design - Part 1: General Rules; German version EN 1997-1:2004 + AC:2009
DIN EN 1997-1NA:2010-12	National Annex - National parameters - Eurocode 7: Geotechnical Design - Part 1: General Rules
DIN EN 14199:2012-01	Execution of special geotechnical works - Micropiles; German version EN 14199:2005
DIN SPEC 18539:2012-02	Supplementary provisions to DIN EN 14199:2012-01, Execution of special geotechnical works - Micropiles
DIN 18196:2011-05	Earthworks and foundations - Soil classification for civil engineering purposes
DIN EN ISO 22477-1:2019-12	Geotechnical investigation and testing - Testing of geotechnical structures - Part 1: Testing of piles: static compression load testing
DIN EN ISO 22477-2:2024-01	Geotechnical investigation and testing - Testing of geotechnical structures - Part 2: Testing of piles: static tension load testing
DIN 50929-3:2018-03	Corrosion of metals - Corrosion likelihood of metallic materials when subject to corrosion from the outside - Part 3: Buried and underwater pipelines and structural components

LBD Dipl.-Ing. Andreas Kummerow
Department Head

Certified
Hemme



Fundamentrohr aus unlegiertem Baustahl			
Typ	Wanddicke	Außen-durchmesser	Material
KSF V 89	5	88,9	S235 JRH/1.0039
KSF V 114	5	114,3	S235 JRH/1.0039
KSF V 140	6,3	139,7	S235 JRH/1.0039

Maße in mm

KRINNER V-Serie - Schraubpfahl als Gründungselement für bauliche Anlagen	Anlage 1
Übersicht und Baugrößen	

NOTES

KRINNER

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