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**Approval Body for Building Products and
Building Methods**

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General design-type approval

Number:
Z-34.14-225

Period of validity
from: **3 September 2025**
until: **3 September 2030**

Ordering party
DYWIDAG-Systems International GmbH
Neuhofweg 5
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Subject of Approval:

"DYWI Drill" micropiles

The above mentioned subject of the regulation is hereby granted general construction supervisory authority approval. This approval comprises twelve pages and six annexes.

I GENERAL PROVISIONS

- 1 This general design-type approval verifies the applicability or fitness for the intended purpose of the subject of the regulation within the meaning of the Laender construction regulations.
- 2 This Approval does not replace any permits, approvals or certificates required by law for the implementation of construction projects.
- 3 This approval is issued without prejudice to the rights of third parties, especially private property rights.
- 4 Copies of this Approval shall be made available to the user of the subject of the regulation irrespective of further regulations provided under the "Special Provisions" section. In addition, it must be pointed out to the user of the subject of the regulation that this notice must be available at the site of installation. Copies must also be made available to any relevant authorities upon request.
- 5 This approval may only be reproduced in its entirety. Publication of excerpts requires the approval of the German Institute for Building Technology. Texts and drawings included in any advertising leaflets may not contradict this Approval; translations must contain the note "Translation of the German original version not verified by the German Institute for Building Technology".
- 6 This approval is issued subject to revocation. The provisions herein can be subsequently amended or modified, especially if the latest technical findings give reason for this.
- 7 This Approval refers to the information and documents provided by the applicant regarding the subject of the regulation during the approval proceedings. Any change to these principles is not covered by this Approval and must be immediately reported to DIBt.

II SPECIAL PROVISIONS

1 Subject of the regulation, scope of application

(1) This approval covers the planning, measurements and execution of "DYWI Drill" micropiles according to DIN EN 14199 in combination with DIN SPEC 18539.

(2) The "DYWI Drill" micropiles are equipped with:

- hollow bars made of steel from the R32, R38, R51 and T76 series as well as connecting and anchoring components made of steel in accordance with the general technical approval/general type approval Z-14.4-674,
- steel anchor plates and other steel/plastic accessory components,
- cement mortar as grouting mortar.

For details, see Annex 1. As part of this process, the hollow bars may be used as drill rods when drilling the borehole and then left in the borehole as a continuous load-bearing element, which is surrounded by grouting mortar along its entire length.

(3) The micropiles may be used as tension piles or compression piles, even under alternating loads, for permanent use (>2 years), and are designed for loading by axial loads only.

2 Provisions for planning, design and installation

2.1 General

The micropiles must be planned, dimensioned and executed in accordance with the technical building specifications - in particular DIN EN 14199 in conjunction with DIN SPEC 18539, DIN EN 1997-1, DIN EN 1997-1/NA and DIN 1054 - unless otherwise specified below.

2.2 Planning

2.2.1 General

(1) Micropiles may only be used for predominantly static loads in non-cohesive soils (see DIN EN 1997-1 in conjunction with DIN EN 1997-1/NA and DIN 1054, Section 3.1).

(2) Micropiles may be used in cohesive soils (see DIN EN 1997-1 in conjunction with DIN EN 1997-1/NA and DIN 1054, Section 3.1) and exclusively under predominantly static loading, provided that the execution is accompanied and verified in accordance with the test plan filed with German Institute for Building Technology and with the participation of a geotechnical expert, see also Section 2.4.3 (2).

(3) Load-bearing elements must be installed using rotary percussive drilling. Depending on the hollow bar type (DYWI Drill series), the maximum permissible value pairs regarding impact energy and torque are to be taken from the characteristic curves in Annex 6 and specified in the execution planning.

(4) Load-bearing elements must be protected against corrosion by covering them with cement grout. Minimum cement grout cover thickness must adhere to the specifications according to DIN SPEC 18539, A Annex C.

(5) An expert in geotechnical engineering must be consulted if the soil contains elements which may weaken the corrosion protection in case they intrude into the grout body (cement grout covering the hollow bar; e.g. organic substances).

(6) The piles may not be installed if the subsoil contains ground water or seepage water from waste heaps and/or landfills, so that a high corrosion probability for shallow pitting and pitting corrosion of the steel according to DIN 50929-3, Table 8, with $W_0 < -8$, can be expected.

(7) Inclination of the micropiles, in relation to the vertical, may be up to 70° , see also Table 1.

(8) The maximum permissible length of the micropiles, depending on the hollow bar type (DYWI Drill series) and the inclination of the micropiles (against the vertical), can be found in Table 1.

Table 1: Maximum micropile length [m]

Pile inclination (against the vertical)	DYWI Drill Series			
	R32	R38	R51	T76
0° to $\leq 20^\circ$	18 m	24 m	27 m	
20° to $\leq 45^\circ$	15 m	21 m	24 m	
45° to $\leq 70^\circ$	12 m	18 m	21 m	

(9) The execution planning documentation must include information resulting from the details implementation planning. This includes information on the manufacturing of any required coupling points by means of couplers, cement mortar composition, cement mortar coverage and centering of the load-bearing elements, as well as pile head embedded in the planned structure.

2.2.2 Load-bearing element

(1) Longitudinally welded hollow bars made of quenched and tempered steel with continuous rolled round or trapezoidal thread in accordance with approval Z-14.4-674 of the following hollow bar types are to be used as load-bearing elements:

DYWI Drill Series R32

- R32-210, R32-250, R32-280, R32-320, R32-360, R32-400

DYWI Drill Series R38

- R38-420, R38-500, R38-550

DYWI Drill Series R51

- R51-550, R51-660, R51-800

DYWI Drill Series T76

- T76-1300

Where:

R rolled round thread

T rolled trapezoidal thread

32, 38, 51, 76 nominal outer diameter of the load-carrying element in [mm]

210 – 1300 nominal value of the tensile strength of the load-carrying element in [kN]

(2) Further geometric and mechanical properties of the load-bearing elements can be found in the approval Z-14.4-674, Annex 1 to 4. The section lengths of the hollow bars can be 1.00 m – 3.00 m, the standard length is 3.00 m.

2.2.2.1 Couplings of the load-bearing elements

(1) Section lengths of the hollow bars can be adjusted by means of couplers according to approval Z-14.4-674 (steel or cast couplers) to the individually required total length of the load-bearing element. The geometric properties of the couplers comply with the approval Z-14.4-674, Annex 5.

(2) The distance between the joints must be at least 1.00 m and may not exceed 3.00 m. Below the joints, spacers must be arranged at a maximum distance of 3.00 m from each other in accordance with Annex 2.

(3) Both hollow bar ends must be tensioned against each other in the coupler with a torque moment M in accordance with Table 2; the torque moments must be specified in the execution planning records. Slip values ≤ 0.1 mm may be assumed for the couplings of all hollow bar types tensioned in this manner (counter-torqued).

Table 2: Coupling M torque moment values

Torque moment	DYWI Drill series/ hollow bar type						
	R32		R38		R51		T76
	-210, -250, -280, -320, -360	-400	-420, -500	-550	-550, -660	-800	-1300
M [Nm]	800	1300	2000	2300	3800	4900	13500

2.2.3 Pile shaft

2.2.3.1 Cement grout

(1) Cement mortar (grouting mortar) must be used for the cement grout layer covering the load-bearing element. The starting materials for the cement grout are cements with special properties according to DIN 1164-10 and cements according to DIN EN 197-1 – taking into account the existing exposure classes as per DIN EN 1045-2 (Tables 1, F.3 and F.4), water as per DIN EN 1008 and, if necessary, additives as per EN 934-2 in conjunction with DIN 1045-2 or with general construction supervisory authority approval are to be applied.

(2) The water/cement ratio of the cement mortar must be in the range $w/c = 0.4$ to 0.5 . Compressive strength must be determined in accordance with DIN EN 445. Cylindrical compressive strength of the cement mortar must be at least $f_{ck} = 35$ N/mm² after 28 days. If the compressive strength is tested earlier than after 28 days, the micropiles may be loaded if at least a cylindrical compressive strength of $f_{ck} = 32$ N/mm² is confirmed.

(3) While drilling in, a cement mortar with a water/cement ratio of $w/c = 0.5$ to 0.7 may be used as a flushing and supporting fluid, which must be completely replaced with cement mortar with a water/cement ratio of $w/c = 0.4$ to 0.5 once the target depth has been reached.

2.2.3.2 Centering and covering of the load-bearing element

(1) Boreholes are drilled without casing, using a lost drill bit screwed onto the ground end of the first load-carrying element (see also Annex 1). Spacers must be arranged over the entire length of the micropile to be drilled in accordance with Annex 2. The design of spacers (spacers or pipe spacers) can be selected freely according to the required cement grout layer; it is recommended to use the same type over the entire length of a micropile. The diameter of the drill bit and the spacer must be selected so that the minimum required cement stone layer in accordance with DIN SPEC 18539, A Annex C is maintained.

(2) Spacers in accordance with Annex 2 must be arranged at a distance of ≤ 3.00 m below the couplers, regardless of the inclination. While sinking the connected hollow bar, the drilling process helps to achieve a friction-locked bracing of the spacer over the coupler, so that primary fastening of the spacer can be omitted during the arrangement.

2.2.3.3 Transition pipe on the pile collar

(1) A transition pipe in accordance with Annex 3 must be arranged at the pile collar depending on the type of load. Once grouting work is complete, the transition pipe must be arranged concentrically around the hollow bar in the fresh grouting mortar at the pile collar; the minimum embedment length in the rising structure is 100 mm.

(2) In the case of tension piles, the transition pipe is made of plastic (PE-HD, minimum wall thickness $t = 2.5$ mm), the embedment length in the pile shaft is specified in Annex 3 according to the strength class of the cement grout of the grouting mortar. Grouting mortar cover within the transition pipe is 50 mm for all hollow bar types and does not depend on the minimum required cement grout cover for the pile shaft in accordance with DIN SPEC 18539, A Annex C. The minimum required outer diameter of the transition pipe is specified in Annex 3.

(3) In the case of piles exposed to compression and alternating loads, transition pipes must be arranged as follows in the load application area (pile head/rising structure) according to the installation case:

- Installation case A - Full force transfer and load bearing joint between the pile head and rising structure:

Transition pipe made of plastic (PE-HD, minimum wall thickness $t = 2.5$ mm), embedment length in the pile shaft is specified in Annex 3 according to the strength class of the cement grout of the grouting mortar and the cover of the hollow bar according to Annex 3.

- Installation case B - No full force transfer and no load bearing joint between the pile head and rising structure (load transfer onto the pile via the hollow bar):

Transition pipe made of steel (S235) with minimum wall thickness and embedment length in the pile shaft as specified in Annex 3 according to the strength class of the cement grout of the grouting mortar and the cover of the hollow bar according to Annex 3.

(4) The dimensions of the transition pipe and the respective embedment lengths must be specified in the execution planning records. In case of a concentric arrangement of the transition pipe, spacers (e.g. spring basket spacers, see Annex 3) must be arranged on the hollow bar on site in the required number and dimensions according to the size of the transition pipe.

(5) In case of micropiles that are intended as test piles for compression loads testing and then used as structural piles, a steel transition pipe must always be installed as pile collar protection in accordance with the installation case B, Annex 3, irrespective of the type of stress/installation case.

2.2.4 Pile connection in the foundation body

(1) Hollow bars are to be anchored in the foundation body using end anchors consisting of steel nuts and lock nuts in accordance with the approval Z-14.4-674, as well as anchor plates made of steel (S355JR) in accordance with Annexes 4 and 5. The design of the end anchoring depends on the type of load, see Appendix 4 and 5. The respective nuts must be tightened against the anchor plate with a torque (counter torque) of at least 500 Nm; the value must be specified in the execution planning records.

(2) When anchoring without additional reinforcement, square anchor plates with the dimensions according to Annex 4 and the specified minimum center and edge distances must be used. Within the center distances specified in Annex 4, a minimum structural reinforcement of 25 kg/m^3 is required around the pile head. Dimensions of the anchor plates were verified as part of the approval process using component tests for the minimum foundation concrete strength class C20/25. Depending on the type of load, the minimum distance $a_{\min}$ in accordance with Annex 4 must be maintained for load transfer via the anchor plate into the pile.

(3) When anchoring with additional reinforcement, anchor plates with the dimensions according to Annex 5 and the specified minimum center and edge distances must be used. Minimum foundation concrete strength class C20/25 specifications in Annex 5 were verified as part of the approval procedure. The additional reinforcement must be arranged as follows in addition to the structurally required reinforcement:

- to ensure additional reinforcement in the area of the anchoring at the pile head, ribbed reinforcing steel B500B in accordance with DIN 488-1 or in accordance with a general building authority approval must be used.

- The provisions of DIN EN 1992-1-1, Section 4.4.1 in conjunction with DIN EN 1992-1-1/NA, NDP Ad. 4.4.1.2 (5) apply for the concrete cover "c".
- Depending on the type of load, the number of stirrups specified in Annex 5 must be arranged above and/or below the anchor plate within a_{min} and starting from the anchor plate.

2.3 Design

2.3.1 General

(1) $\gamma_M = 1.15$ must be used in the design situations BS-P, BS-T and BS-A as the partial safety factor γ_M for the material resistance of the hollow bar.

(2) For deformation calculations, the calculation values according to Table 3 are to be used for the hollow bar.

Table 3: Calculated deformation parameters for the DYWI Drill series

DYWI Drill Series	Cross-sectional area A [mm ²]	Axial stiffness $A \cdot E$ [kN]	Bending stiffness $E \cdot I$ [kN·mm ²]
R32-210	340	$68 \cdot 10^3$	$5.5 \cdot 10^6$
R32-250	370	$74 \cdot 10^3$	$5.9 \cdot 10^6$
R32-280	410	$82 \cdot 10^3$	$6.2 \cdot 10^6$
R32-320	470	$94 \cdot 10^3$	$6.6 \cdot 10^6$
R32-360	510	$102 \cdot 10^3$	$6.9 \cdot 10^6$
R32-400	560	$112 \cdot 10^3$	$7.2 \cdot 10^6$
R38-420	660	$132 \cdot 10^3$	$14.6 \cdot 10^6$
R38-500	750	$150 \cdot 10^3$	$15.6 \cdot 10^6$
R38-550	800	$160 \cdot 10^3$	$16.0 \cdot 10^6$
R51-550	890	$178 \cdot 10^3$	$38.3 \cdot 10^6$
R51-660	970	$194 \cdot 10^3$	$41.3 \cdot 10^6$
R51-800	1150	$230 \cdot 10^3$	$46.0 \cdot 10^6$
T76-1300	1590	$318 \cdot 10^3$	$182.2 \cdot 10^6$

(3) Provisions of the approval Z-14.4-674, Section 3.2 shall apply to the load-bearing capacity of the coupler and the end anchoring. Slip values of ≤ 0.1 mm for the counter-torqued coupling according to Table 2 (see Section 2.2.2.1) were verified as part of the approval procedure. With regards to end anchoring according to Section 2.2.4 (1), countered and embedded in concrete as a pile connection in the foundation body, relevant slip values can be excluded.

2.3.2 Internal dimensioning of micropiles

2.3.2.1 Tension loads

(1) The minimum dimensions of the cement grout cover for the hollow bar according to DIN SPEC 18539, A Annex C apply. The characteristic load-bearing capacities of the hollow bar depending on the respective cement grout cover are given in Table 4.

Table 4: Characteristic load-bearing capacity R_k [kN] of the hollow bars as a function of the cement grout cover c [mm]

DYWI Drill Series	Cement grout cover c [mm]		
	30	40	50
R32-210	160	160	160
R32-250	189	190	190
R32-280	210	213	215
R32-320	240	245	246
R32-360	261	265	267
R32-400	286	291	293
R38-420	332	339	342
R38-500	377	385	389
R38-550	402	411	414
R51-550	434	446	450
R51-660	473	486	492
R51-800	561	576	584
T76-1300	924	964	987

(2) Intermediate values may be interpolated. R_k values greater than the maximum values given in Table 4 must not be used, even if a value greater than 50 mm is selected for the cement grout cover c .

2.3.2.2 Compression loads

(1) The minimum dimensions of the cement grout cover for the hollow bar according to DIN SPEC 18539, A Annex C apply. The characteristic load-bearing capacities of the hollow bars depending on the respective cement grout cover are given in Table 5a and 5b.

Table 5a: Characteristic load-bearing capacity R_k [kN] of the DYWI Drill series R32 as a function of the cement grout cover c [mm]

DYWI Drill Series	R32-210	R32-250	R32-280	R32-320	R32-360	R32-400
c [mm]	25	25	25	25	25	25
R_k [kN]	160	190	220	250	280	330
c [mm]	20	20	20	20	20	20
$0.75 \cdot R_k$ [kN]	120	143	165	188	210	248

Table 5b: Characteristic load-bearing capacity R_k [kN] of the DYWI Drill series R38, R51 and T76 as a function of the cement grout cover c [mm]

DYWI Drill Series	R38-420	R38-500	R38-550	R51-550	R51-660	R51-800	T76-1300
c [mm]	30	30	30	40	40	40	60
R_k [kN]	350	400	450	450	540	640	1000
c [mm]	20	20	20	30	30	30	40
$0.75 \cdot R_k$ [kN]	263	300	338	338	405	480	750
c [mm]	-	-	-	25	25	25	25
$0.50 \cdot R_k$ [kN]	-	-	-	225	270	320	500

(2) Intermediate values may be interpolated. R_k values greater than the maximum values given in Table 5a and 5b must not be used, even if a value greater than that in the top row of Tables 5a and 5b is selected for the cement grout cover c .

2.3.2.3 Alternating loads

The minimum dimensions of the cement grout cover for the hollow bar according to DIN SPEC 18539, A Annex C apply. The characteristic load-bearing capacities of the hollow bar, dependent on the respective cement grout cover, are specified according to the type of stress in Tables 4, 5a, and 5b; the smaller value is decisive.

2.3.3 Verification of anchoring in the foundation body

(1) Force is applied in accordance with Section 2.2.4 and Annexes 4 and 5. Application of the full pile load via the anchor plate must be verified.

(2) Transfer of the respective pile forces into the foundation body must be verified in accordance with the applicable technical building regulations (e.g. DIN EN 1992-1-1 in conjunction with DIN EN 1992-1-1/NA). Load introduction not occurring in the compression zone must be considered when verifying the punching shear.

(3) The reinforced concrete foundation must be designed according to the theory of elasticity in accordance with DIN EN 1992-1-1, Sections 5.4 and 5.5, in conjunction with DIN EN 1992-1-1/NA.

2.3.4 Proof of the transfer length (force transmission length) in soil

(1) It must be ensured that the force transmission length into the soil is greater than the required transfer length from the hollow bar to the cement stone.

(2) Between the cement mortar and the hollow bar, a characteristic bond strength $T_{b,k} = 3.0$ N/mm² can be assumed for all hollow bar types and a minimum cylinder compressive strength of the cement mortar $f_{ck} = 35$ N/mm².

2.4 Installation

2.4.1 General

(1) The contractor must inspect the micropile "DYWI Drill" to confirm completeness of all required components on the basis of the execution planning records and delivery bills.

(2) Works must be carried out in accordance with the work instructions from DYWIDAG-Systems International GmbH submitted to the DIBt and must be available at the construction site.

2.4.2 Micropile execution

(1) The boreholes are made without casing in accordance with the execution planning documentation. Rinsing with water is not permitted.

(2) If the drill hole tends to cave at the borehole mouth during drilling/flushing, it must be stabilized with a temporary guide casing. The transition pipe to be arranged on the pile collar in accordance with Section 2.2.3.3 and Annex 3 can also be used as a guide casing. After completion of drilling, the transition pipe must be positioned concentrically to the hollow bar in accordance with the execution planning records on the pile collar, using the spacers to be arranged subsequently.

(3) During the preparation of each micropile, a pile record must be created in accordance with DIN EN 14199, Section 10, in conjunction with DIN SPEC 18539. DYWIDAG-Systems International GmbH has submitted a template pile record to the German Institute for Building Technology as part of the process description.

(4) Any necessary couplings for the hollow bar must be provided using couplers in accordance with the execution planning records. The required torque moments according to the execution planning records (see also Table 2) must be applied by the rotary head of the drilling device and monitored based on the working pressure of the hydraulics.

(5) Spacers must be arranged below the coupling in accordance with the specifications of the execution planning records. After completing the coupling and before continuing to lower the load-bearing element, ensure that the spacer is positioned directly below the coupler.

(6) After reaching the target depth, grouting must be carried out with a cement grout in accordance with the execution planning documentation. The grouting mortar must be machine-mixed. Before grouting, no demixing or formation of lumps may occur. The volume to be grouted must be at least large enough to completely displace the mud and support fluid. Grout must be introduced through the hollow bar at least until it emerges bubble-free from the annular space at the mouth of the drill borehole. During grouting, the grouting mortar storage tank must not be pumped empty so that air is not introduced into the grouting mortar.

(7) Grouting may be omitted if cement mortar for grouting has already been applied as a supporting and flushing liquid in accordance with the execution planning records. In this case, after reaching the final depth, it must be ensured that the flushing and support fluid is completely cleaned of drill cuttings.

(8) For the verification of the compressive strength of the grouting mortar (cement grout), two series of three specimens per seven manufacturing days on which piles are fabricated or per construction site are to be collected. The collection must be noted in the pile record.

(9) After introducing the hollow bar into the borehole and grouting, a transition pipe must be inserted into the still flowing grout at the pile collar in accordance with the execution planning records, if this has not already been arranged as guide casing (see paragraph (2)). Appropriate spacers (e.g. spring basket spacers) must be used to ensure the concentric arrangement of the transition pipe to the hollow bar in accordance with the execution planning records.

(10) When arranging the anchoring elements at the pile head, it must be ensured that the anchor plate cannot twist or shift when the foundation concrete is poured. For this purpose, the respective nuts must be screwed against the anchor plate with a torque (counter torque) in accordance with the execution planning records.

2.4.3 Execution checks, test load

(1) Execution of the micropiles must be supervised by a geotechnical expert. The expert can request special monitoring measures in connection with the construction project, e.g. whether a test pile should be excavated. In the case of pile inclinations between 45° and 70° against the vertical, at least one pile per construction site must be excavated and assessed by the expert. As a rule, only the upper area, between 1.5 m and 2.0 m into the ground, needs to be exposed. A pile does not need to be excavated if the results for piles with the same or greater inclination against the vertical are available in comparable soils and have been approved by a geotechnical expert.

(2) In cohesive soils (see DIN EN 1997-1 in conjunction with DIN EN 1997-1/NA and DIN 1054, Section 3.1), the installation of micropiles must be accompanied and verified by a geotechnical expert in accordance with the test plan filed with the German Institute for Building Technology.

(3) Test piles that have successfully undergone a compression load test may only be used as structural piles if a transition pipe made of steel according to Annex 3, Installation Case B, was arranged at the pile head during the load test. The upper edge of the steel pipe must be at least at the same height as the transition pipe in the resulting structure.

2.4.4 Declaration of conformity of the installation

(1) A declaration of conformity in accordance with paragraph 16a section 5 in conjunction with paragraph 21 section 2 of the MBO¹ must be submitted by the contractor to confirm the conformity of the type of construction with the general design-type approval.

(2) The executing company's declaration of conformity must be drafted in accordance with DIN EN 14199, Section 10, supplemented by DIN SPEC 18539, Section 3.8. It must at least contain the following information:

- approval number Z-34.14-255,
- designation of the building project,
- installation date,
- contractor's name and registered office,
- confirmation that the installation is in compliance with the design documents,
- documentation of the basic materials and delivery documents,
- nature of the controls or inspections,
- date of the control or inspection,
- results of the controls and inspections and, if applicable, a comparison with the relevant requirements,
- particularities,
- name, company and signature of the person in charge of the controls and inspections.

(3) Copies of the records must be handed over to the client for incorporation into the construction file and presented to the German Institute for Building Technology and to the competent highest construction supervisory authority on request.

The following technical specifications have been referenced:

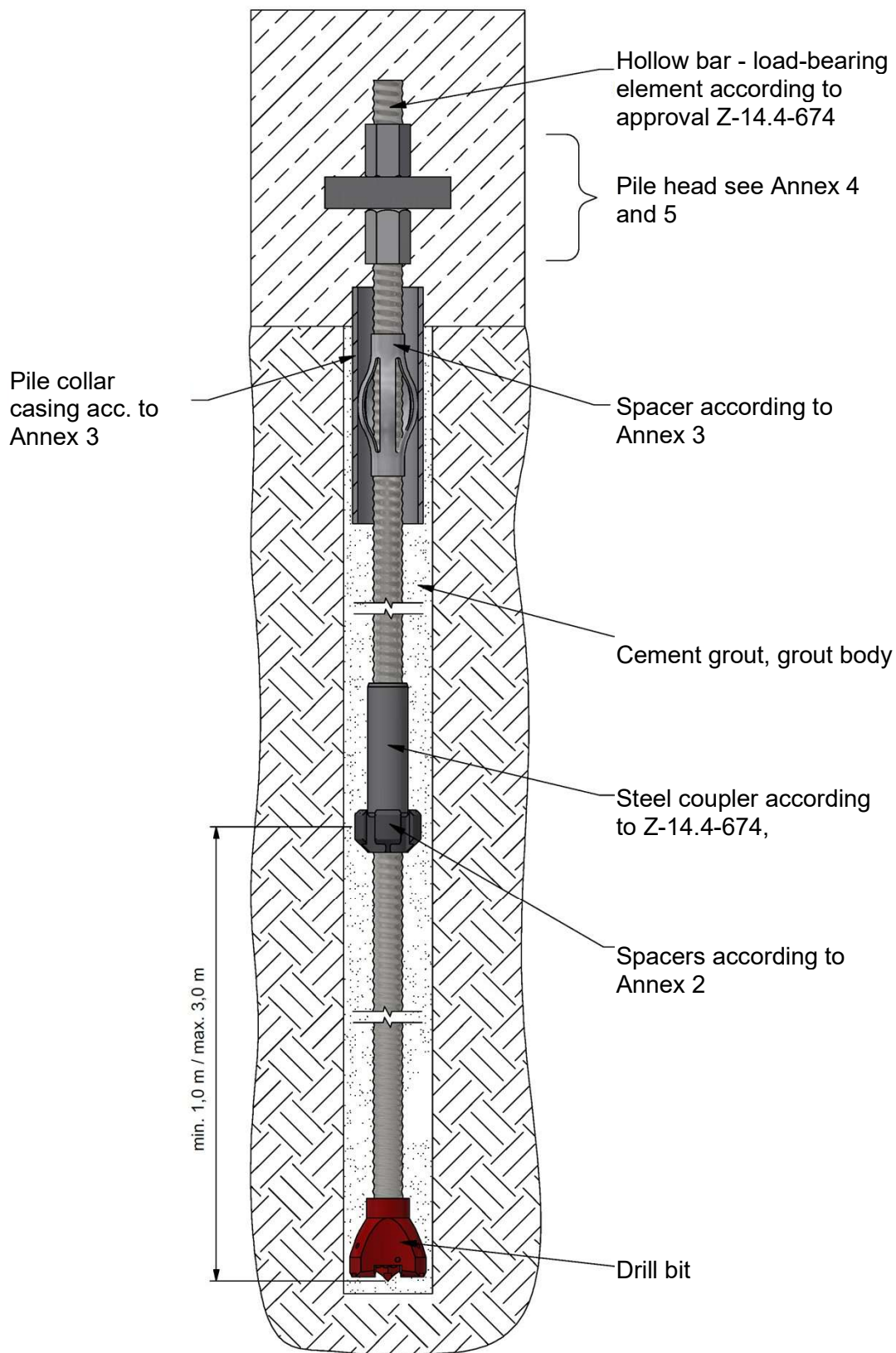
Z-14.4-674 dated 31 May 2023	General Construction Supervisory Authority Approval/ General Design-Type Approval: DYWI® Drill Hollow Bars with Connections and Anchoring as Load-Carrying Element in Geotechnical Engineering – types R32-210, R32-250, R32-280, R32-320, R32-360, R32-400, R38-420, R38-500, R38-550, R51-550, R51-660, R51-800, T76-1300, T76-1650 and T76-1900; Period of validity: 12 June 2023 - 12 June 2028
DIN EN 197-1:2011-11	Cement – Part 1: Composition, specifications and conformity criteria of common cements; German version EN 197-1:2011
DIN EN 445:1996-07	Grout for prestressing tendons - Test methods; German version EN 445:1996
DIN 488-1:2009-08	Reinforcing steel - Part 1: Steel grades, properties, marking

¹ Model Building Code (Musterbauordnung, MBO) Version of November 2002, last changed by the decision of the conference of the minister of construction of 26/27 September 2024

DIN EN 934-2:2012-08	Admixtures for concrete, mortar and grout – Part 2: Concrete admixtures – Definitions, requirements, conformity, marking and labelling; German version EN EN 934-2:2009+A1:2012
DIN EN 1008:2002-10	Mixing water for concrete - Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete; German version EN 1008:2002
DIN 1045-2:2023-08	Concrete, reinforced and prestressed concrete structures – Part 2: Concrete
DIN 1054:2021-04	Subsoil - Verification of the safety of earthworks and foundations - Supplementary rules to DIN EN 1997-1
DIN 1164-10:2023-02	Special cement – Part 10: Cement with low effective alkali content – Composition and requirements
DIN EN 1992-1-1:2011-01	Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings, German version EN 1992-1-1:2004 + AC:2010
DIN EN 1992-1-1/NA:2013-04	National Annex – Nationally determined parameters – Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings
DIN EN 1997-1:2009-09	Eurocode 7: Geotechnical design - Part 1: General rules; German version EN 1997-1:2004 + AC:2009
DIN EN 1997-1/NA:2010-12	National Annex - Nationally determined 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 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

Bettina Hemme
Section Head

Certified
Jendryschik



"DYWI Drill" micropiles

Overview

Annex 1

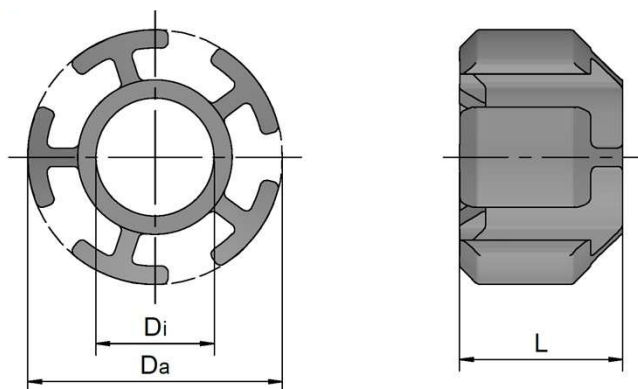
Spacer

Material:

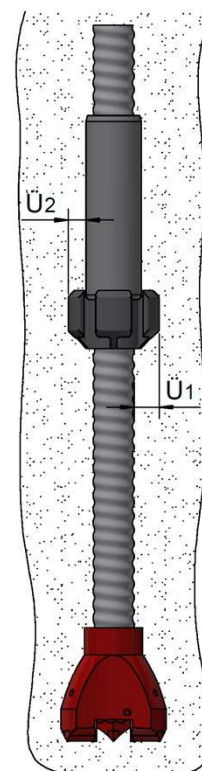
G34CrMo4 after EN 10293

G42CrMo4 after EN 10293

G40Cr



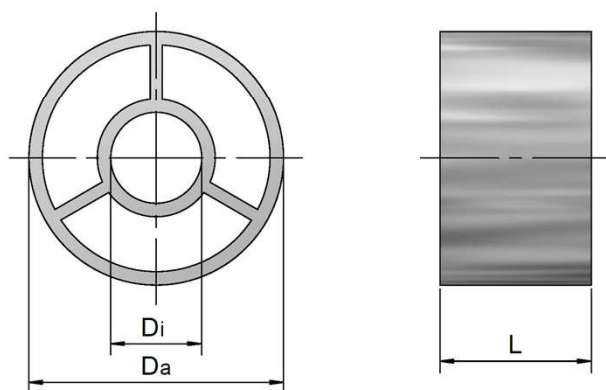
	DYWI Drill series / hollow bar type											
	R32			R38			R51			T76		
Di [mm]	33			39			51			78		
L [mm]	40			45			60			60		
Da [mm]	73	102	132	84	111	141	95	123	153	136	155	185
Ü1 [mm]	21	35	50	23	37	52	23	37	52	30	40	55
Ü2 [mm]	16	30	45	17	30	45	16	30	45	21	30	45



Pipe spacer

Material:

EN 10025-2 S235JR



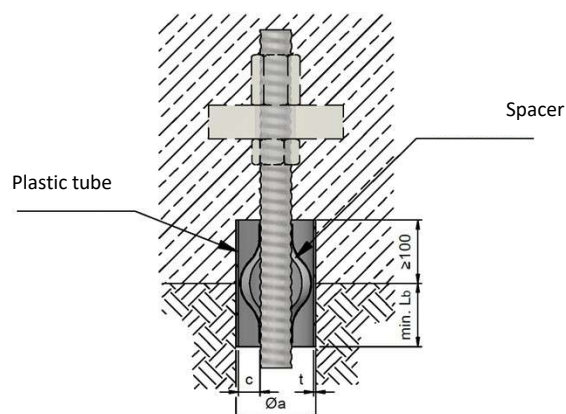
	DYWI Drill series / hollow bar type											
	R32			R38			R51			T76		
Di [mm]	37			42			51			81		
L [mm]	90			90			90			90		
Da [mm]	89	102	133	102	114	152	108	127	152	140	159	194
Ü1 [mm]	29	35	51	32	38	57	29	39	51	32	42	59
Ü2 [mm]	23	30	46	25	32	51	23	32	45	22	32	49

"DYWI Drill" micropiles

Spacer

Annex 2

Tension pile



Spacer (spring basket spacer)



	R32		R38		R51	T76
ØD*	100	155	100	155	175	225
Ød	40	40	40	40	55	75

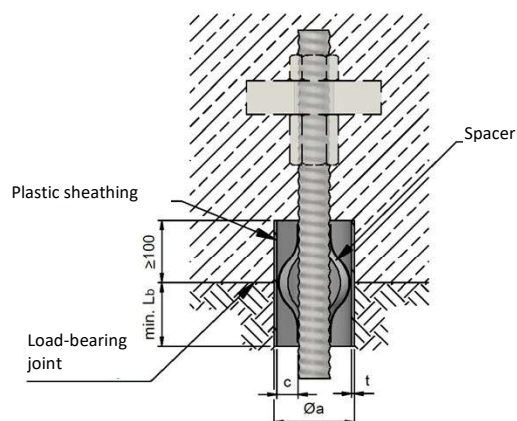
* D must be adapted by compressing/stretching to the required cover c in the pile collar casing.

Tension pile

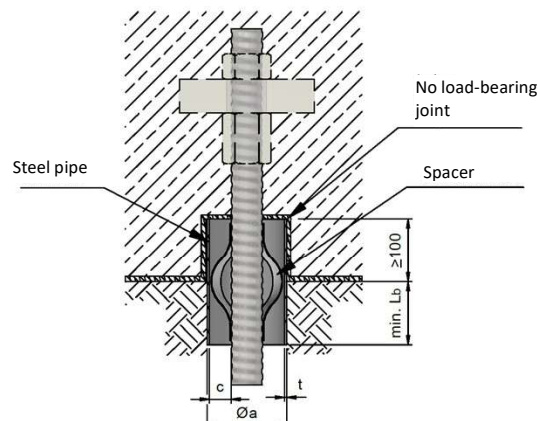
Tension pile														
		R32-210	R32-250	R32-280	R32-320	R32-360	R32-400	R38-420	R38-500	R38-550	R51-550	R51-660	R51-800	T76-1300
Minimum cement grout layer in plastic tube	c [mm]	50												
Min. pipe length f_{ck} 32.5	L_b [mm]	481	547	608	660	714	805	694	751	815	641	729	795	642
Min. pipe length f_{ck} 42.5	L_b [mm]	371	421	467	507	548	616	532	575	624	492	558	609	492
Outer diameter plastic tube	min. $\varnothing a$ [mm]	137						143			156			181
Min. wall thickness of plastic tube (structural)	t [mm]	2,5												

Compression pile

Installation case A



Installation case B



Compression pile

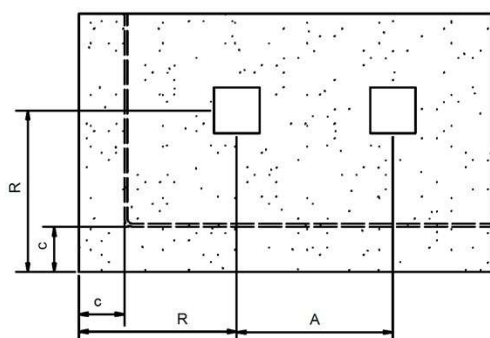
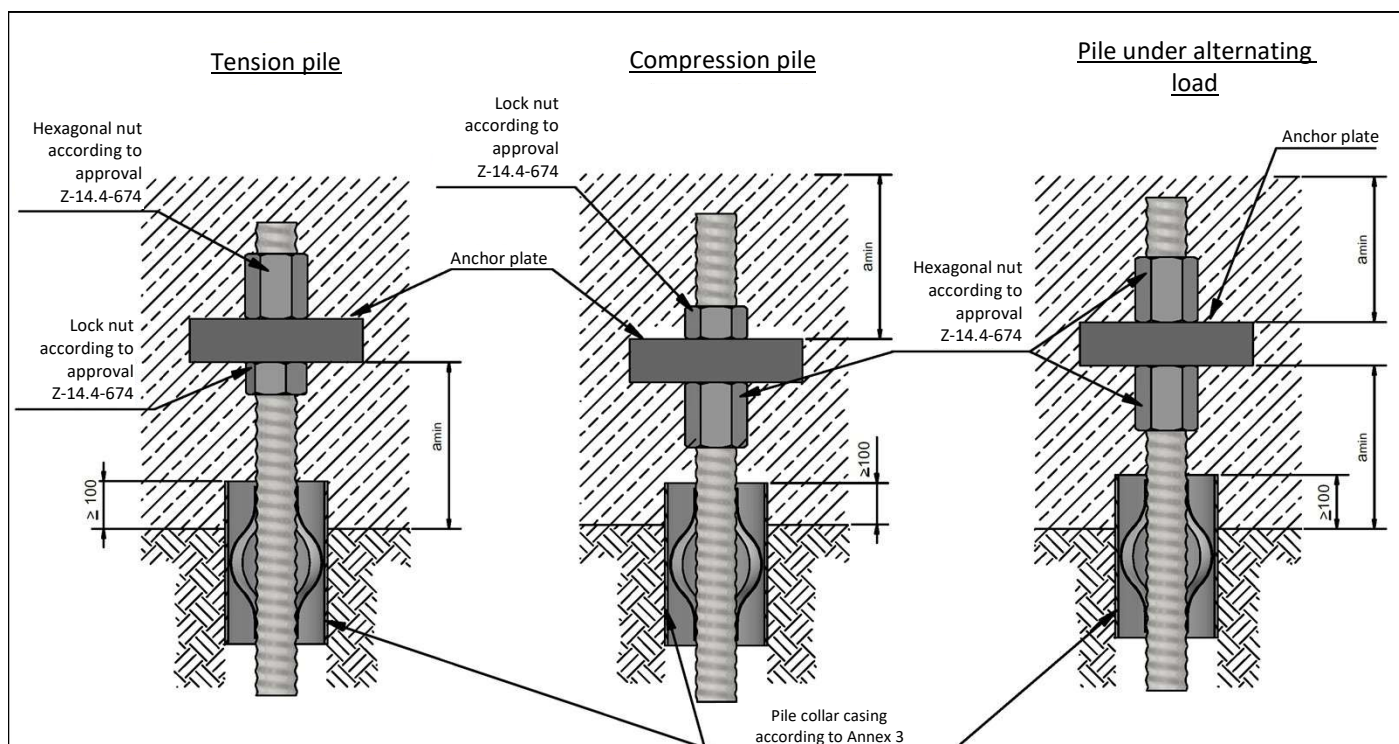
Compression pile														
		R32-210	R32-250	R32-280	R32-320	R32-360	R32-400	R38-420	R38-500	R38-550	R51-550	R51-660	R51-800	T76-1300
Minimum cement grout layer in plastic tube	c [mm]	25						30			40			60
Min. pipe length f_{ck} 32.5	L_b [mm]	341	381	412	433	459	504	501	530	567	560	632	680	718
Min. pipe length f_{ck} 42.5	L_b [mm]	265	294	318	334	354	388	386	407	436	431	485	522	550
Outer diameter steel tube	min. $\varnothing a$ [mm]	89						105			140			208
Min. wall thickness of steel pipe*	t [mm]	3,1						3,5			4,4			6,0
Outer diameter of plastic pipe*	min. $\varnothing a$ [mm]	87						103			136			201
Outer diameter of plastic pipe*	t [mm]	2,5												

* considering 2mm corrosion loss on diameter

"DYWI Drill" micropiles

Transition pipe on the pile collar

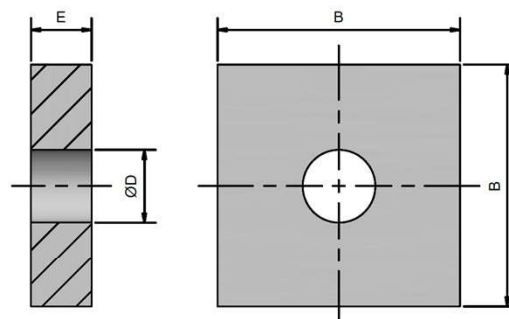
Annex 3



Anchoring without additional reinforcement
Minimum concrete quality $\geq C20/25$

c - concrete cover of the structural reinforcement

Square anchor plate
Material: S355JR according to DIN EN 10025

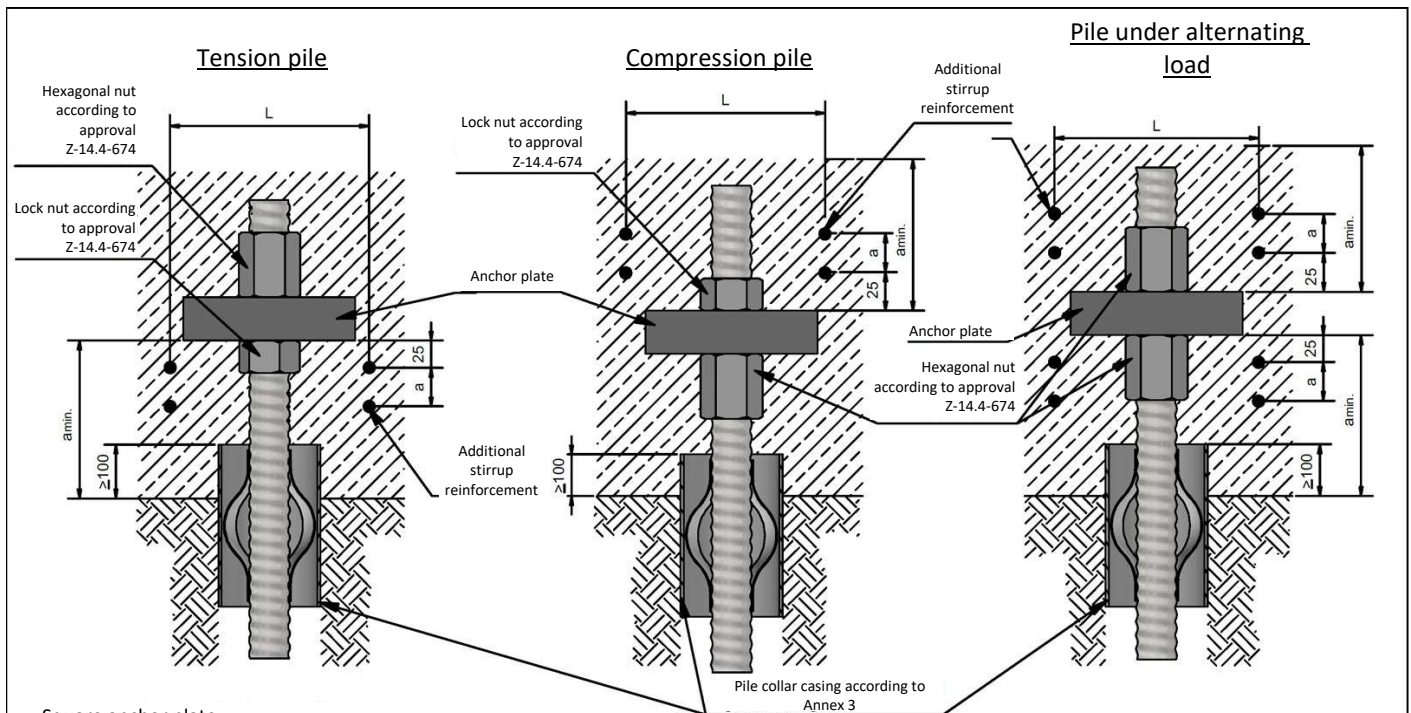


	DYWI Drill series / hollow bar type												
	R32-210	R32-250	R32-280	R32-320	R32-360	R32-400	R38-420	R38-500	R38-550	R51-550	R51-660	R51-800	T76-1300
Min. center distance A [mm]	260	260	260	260	260	260	290	290	290	320	320	320	480
Min. edge distance A [mm]	$120 + c$	$120 + c$	$120 + c$	$120 + c$	$120 + c$	$120 + c$	$135 + c$	$135 + c$	$135 + c$	$150 + c$	$150 + c$	$150 + c$	$230 + c$
A min [mm]	520	520	520	520	520	520	580	580	580	640	640	640	960
B - plate width [mm]	100	100	100	100	120	120	140	140	140	160	160	180	200
E - plate thickness [mm]	25	25	30	30	30	30	35	35	35	40	40	40	50
D - Loch $\varnothing$ [mm]	35	35	35	35	35	35	41	41	41	60	60	60	80

"DYWI Drill" micropiles

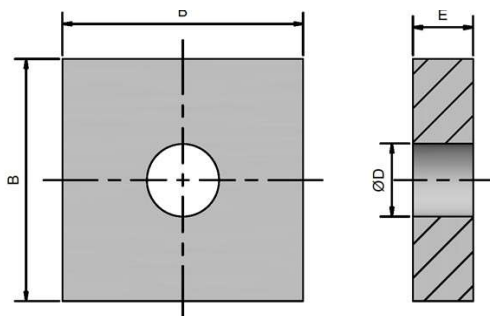
Pile head embedment without additional reinforcement for minimum concrete quality C20/25

Annex 4

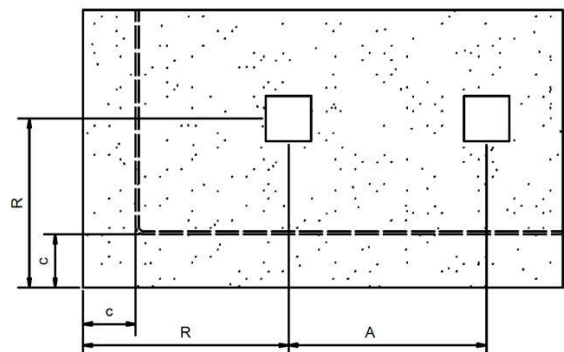


Square anchor plate

Material: S355JR according to DIN EN 10025



Minimum concrete class: $\geq C20/25$



c - concrete cover of the structural reinforcement

	DYWI Drill series / hollow bar type												
	R32-210	R32-250	R32-280	R32-320	R32-360	R32-400	R38-420	R38-500	R38-550	R51-550	R51-660	R51-800	T76-1300
Min. center distance A [mm]	200	200	200	210	200	230	230	230	260	310	310	310	460
Min. edge distance R [mm]	90 + c	90 + c	90 + c	95 + c	90 + c	105 + c	105 + c	105 + c	120 + c	145 + c	145 + c	145 + c	245 + c
a min [mm]	100 + c	100 + c	100 + c	110 + c	80 + c	110 + c	90 + c	90 + c	120 + c	150 + c	150 + c	130 + c	260 + c
Additional reinforcement n x d x L x a [mm]	2 x 8 x 180 x 40						2 x 8 x 210 x 45			2 x 10 x 290 x 50			3 x 12 x 440 x 55
B - Plate width [mm]	100	100	100	100	120	120	140	140	140	160	160	180	200
E - Plate thickness [mm]	20	20	20	20	25	25	25	25	25	30	30	30	35
D - Hole diameter Ø [mm]	35	35	35	35	35	35	41	41	41	60	60	60	80

Exposure classes according to DIN 1045-2 must be observed

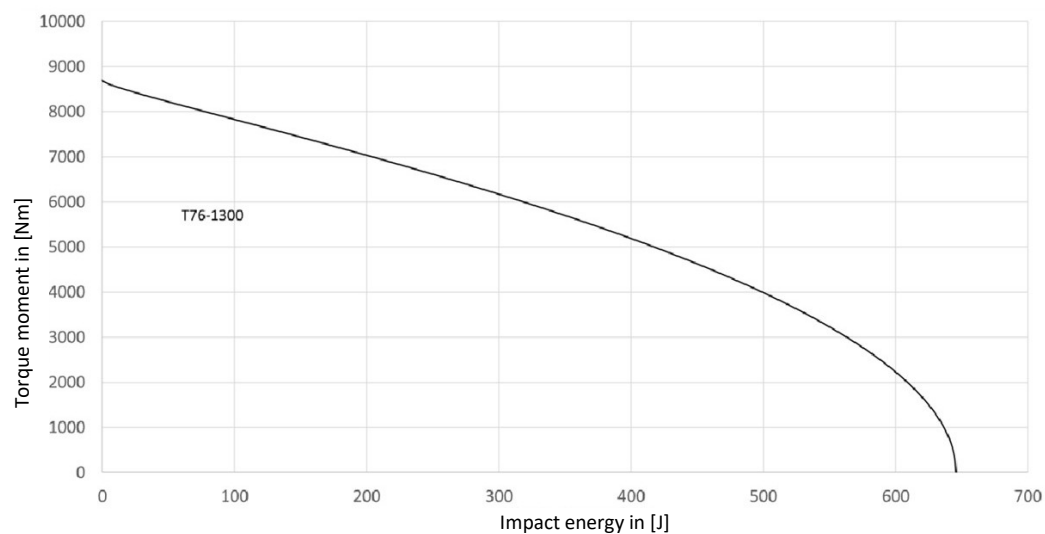
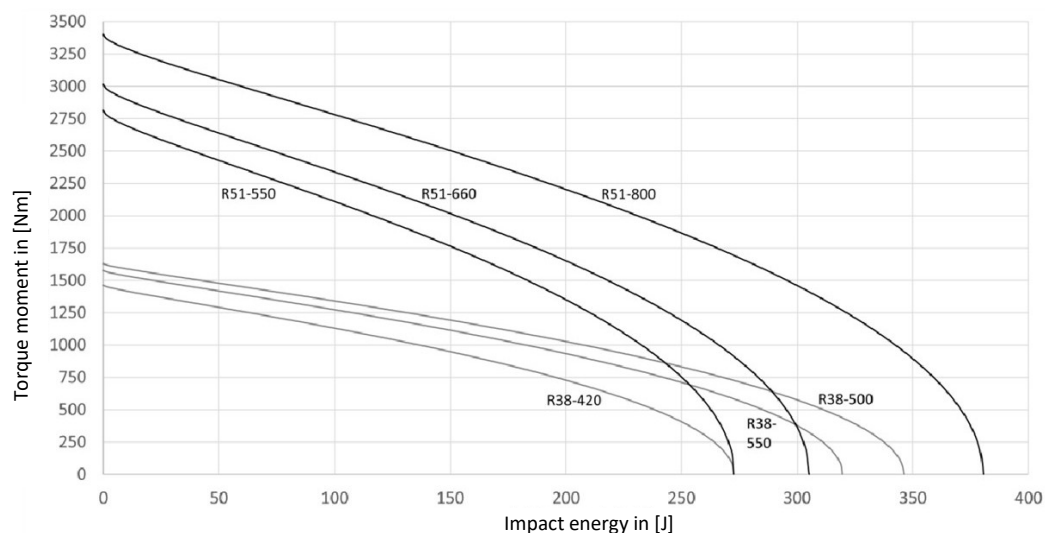
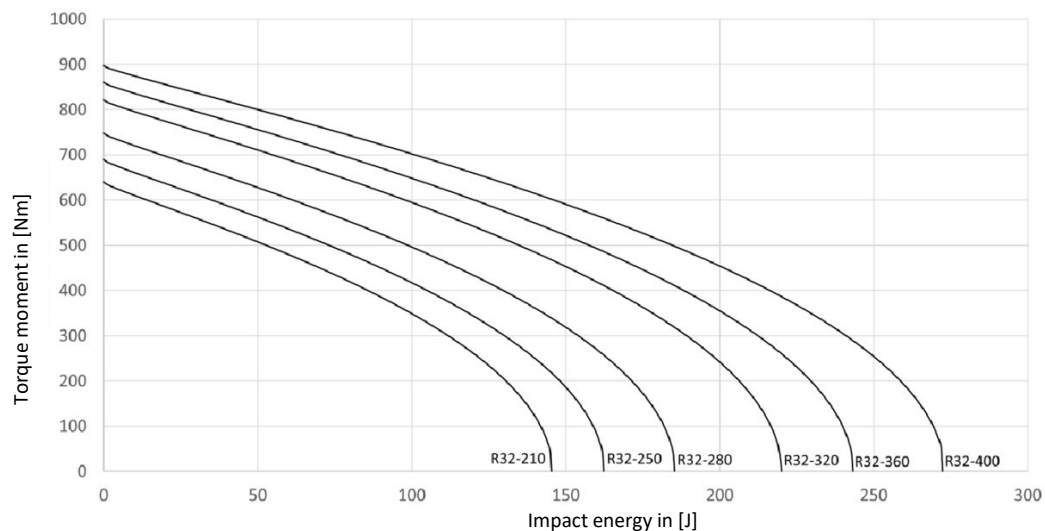
n - number of stirrups

d - stirrup reinforcement diameter

"DYWI Drill" micropiles

Pile head embedment with additional reinforcement for minimum concrete quality C20/25

Annex 5



"DYWI Drill" micropiles

Characteristic curves for impact energy and torque value pairs

Annex 6