DYWIDAG

GEOTECHNICAL SYSTEMS

DYWIDAG *GEWI*® Piles (Micropiles [Composite Piles] with a Load-Carrying Element made of Steel Bar with Thread Ribs S 555/700, Ø 63.5mm)

Approval Number Z-32.1-9
Validity 02nd January 2019 - 02nd April 2021

**General Construction Supervisory Authority Approval/
General Design-Type Approval
No. Z-32.1-9 from February 20, 2019**

Deutsches Institut für Bautechnik DIBt
(German Institute for Building Technology)

Approval Body for Building Products and Building Methods
Constructional Testing Authority
A statutory body jointly sponsored by the German national government and the German Länder
Member of EOTA, UEAtc and WFTAO

General Construction Supervisory Authority Approval/General Design-Type Approval

Date:
02/20/2019

Reference No.:
I 64-1.34.14-19/18

Approval No.:
Z-32.1-9

Period of validity:
from: **January 2, 2019**
to: **April 2, 2021**

Applicant:
DYWIDAG-Systems International GmbH
Destouchesstrasse 68
80796 München

Subject of approval:
DYWIDAG GEWI Piles (Micropiles [Composite Piles] with a Load-Carrying Element made of Steel Bar with Thread Ribs S 555/700, 63.5mm dia.)

The above-mentioned subject matter is hereby granted general construction supervisory authority accreditation/approval.
This notice comprises 12 pages and 4 annexes.
The subject matter was granted a general construction supervisory authority approval on April 11, 1995 for the first time.

Important Note
This general construction supervisory authority approval/general design-type approval is the translation of a document originally prepared in the German language which has not been verified and officially authorized by "Deutsches Institut für Bautechnik" (German Institute for Civil Engineering). In case of doubt in respect to the wording and interpretation of this notice, the original German version hereof shall prevail exclusively. Therefore, no liability is assumed for translation errors or inaccuracies.

I GENERAL PROVISIONS

1 This notice verifies the applicability or fitness for the intended purpose of the subject matter of approval within the meaning of the *Land* building codes ["*Landesbauordnungen*"].

2 This notice does not replace the permissions, approvals and certificates required by law for the realization of building projects.

3 This notice is issued without prejudice to the rights of third parties, especially private property rights.

4 Copies of this notice must be made available to the user or installer of the subject matter of approval without prejudice to more detailed provisions under "Special Provisions". In addition, it must be pointed out to the user or installer of the subject matter of approval that this notice must be available at the site of use or installation. Copies hereof must also be made available to the authorities involved on request.

5 This notice may only be reproduced in its entirety. A publication of excerpts is subject to the approval of DIBt. Texts and drawings included in promotional material may not contradict this notice, and translations must include the note "Translation of the German original version not verified by DIBt".

6 This notice 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 notice refers to the information and documents provided by the applicant. Any amendment of such information and documents is not covered by this notice and must be promptly disclosed to DIBt.

8 The general design-type approval covered by this notice is deemed to be a general construction supervisory authority approval of the design at the same time.

II SPECIAL PROVISIONS

1 Subject matter of approval and applicability

(1) Subject matter of this approval are DYWIDAG GEWI piles of company DYWIDAG-Systems International GmbH with a load-bearing element made from steel bar with thread ribs S 555/700 with a nominal diameter of 63.5mm.
(2) These piles are micropiles (composite piles) for which the stipulations set out in DIN EN 14199[1] in conjunction with DIN SPEC 18539[2] must be observed, unless otherwise stated below. In accordance with Annex 1 or 2, the micropiles must be made from a continuous load-bearing steel element and uniformly surrounded with cement stone over their entire length. The load-bearing steel element can be provided with a corrugated plastic sheathing injected with inner cement grout (see Annex 2).
(3) The micropiles may be used as tension or compression piles for permanent and temporary (≤ 2 years) installations.
(4) The micropiles are designed for loading by axial loads only.
(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 (e.g. organic substances).
(6) The micropiles 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[3], Table 7, with $W_0 < -8$, can be expected unless the load-bearing steel element is protected by a corrugated plastic sheathing over its entire length.

2 Regulations covering the construction product

2.1 Properties and composition

2.1.1 Load-bearing steel element

2.1.1.1 Steel grade and dimensions

Only general construction supervisory authority approved steel bar with thread ribs S 555/700, nominal diameter of 63.5mm, may be used.

2.1.1.2 Mechanical splice formation

(1) The steel bar with thread ribs may be spliced by couplers according to the general construction supervisory authority approval No. Z-1.5-2 for threaded coupler connections and anchorages of steel bar with thread ribs S 555/700, nominal diameter 63.5mm (see Annexes 1 through 3).
(2) For tensile loads, the couplers must be locked with nuts. In the case of non-dynamic actions, the lock nuts can be omitted if a fixed or corrosion protection heat shrink sleeve (see Section 2.1.5) is arranged in accordance with Annex 3.
(3) If, in the case of compression piles, the coupler is not secured with a heat shrink sleeve or with lock nuts, then it must either be glued to the load-carrying element or prevented from unscrewing by means of pins.

[1]	DIN EN 14199:2012-01	Execution of special geotechnical works - Micropiles; German version EN 14199:2005
[2]	DIN SPEC 18539:2012-02	Supplementary provisions to DIN EN 14199:2012-01, Execution of special geotechnical works - Micropiles
[3]	DIN 50929-3:1985-09	Corrosion of metals; probability of corrosion of metallic materials when subject to corrosion from the outside; buried and underwater pipelines

(4) Irrespective of the specifications in this section, locking with nuts is always required in the case of alternating loads and dynamic actions in accordance with DIN EN 1991-1-1[4], Section 2.2 (see Annex 3).

2.1.2 Pile connection in the foundation body, pile neck

(1) The load-bearing steel element must be anchored with anchorages in accordance with the general construction supervisory authority approval No. Z-1.5-2 for screwed coupler connections and anchorages of steel bar with thread ribs S 555/700. The additional reinforcement in the pile head must be positioned in accordance with this general construction supervisory authority approval.

(2) In the transition area from the pile shaft to the foundation body, a constructional protection of the pile neck must be ensured by arranging a corrugated PE or PVC duct injected with cement grout (see Annexes 1 and 2). The minimum 1mm thick corrugated plastic sheathing must have a distance of ≥ 5mm to the load-carrying element and must be surrounded by at least 10mm cement stone.

(3) In the case of load-carrying elements already embedded in in plastic corrugated shethings injected with inner cement grout (see Section 2.1.3 and Annex 2), an additional corrugated plastic sheathing is not required. As pile neck protection, the existing corrugated plastic sheathing with the bond length t must be integrated in the entire structure (see Annex 2).

(4) Alternatively to (2), also an additional reinforcement made from N 94 reinforcing steel mesh (or a reinforcement cage identical in the cross section and in the spacing between the wires), which surrounds the load-bearing steel element annularly, can be arranged in the pile neck. The longitudinal wires must be on the outside; the overlap length in the direction of the bar circumference must be ≥ 180°. The additional reinforcement must be located in the cross section as far to the outside as possible, and the longitudinal wires must be covered with cement stone in accordance with DIN SPEC 18539, A Annex C. The inner diameter of the longitudinal wires of the additional reinforcement must be ≥ 89mm. The welded steel mesh must be positioned concentrically to the steel tendon to meet the aforementioned conditions and centered in the borehole by suitable spacers.

(5) If the piles are installed only temporarily (service life ≤ 2 years) for the transfer of loads, then the constructional protection of the pile neck can be omitted.

[4] DIN EN 1991-1-1:2010-12 Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings; German version EN 1991-1-1:2002+ AC:2009

2.1.3 Plastic ribbed pipe

(1) The load-carrying element can be embedded, except for possible joints, in a corrugated plastic sheathing injected with inner cement grout over its entire length (see Annex 2). In this case, a sheathing, which must consist either of PVC-U in accordance with DIN EN ISO 1163-1[5], of polyethylene with a molding compound ISO 17855-PE-HD,,E,44-T022 pursuant to DIN EN IS0 17855-1[6] or of polypropylene with the molding compounds ISO 19069-PP-B„EAGC,10-16-003 or ISO 19069-PP-H,,E,06-35-012/022 in accordance with DIN EN ISO 19069-1[7], must be slipped over the load-bearing element. It must be ensured that only straight ducts are installed. The sheathing must have a uniform wall thickness of ≥ 1mm; only ducts may be installed which do not show any trapped bubbles and the pigmentation of which is uniform.

(2) The possibly required individual segments of the PVC-U sheathings must be screwed together and carefully glued with a specific PVC adhesive. Unspliced ducts must be used as the PE or PP sheathings.

(3) At the earth-side end, an end cap (injection cap) made from steel or PE must be connected to the sheathing using cams and glued. The ventilation cap must be glued to the sheathing at the air-side end of the ribbed pipe.

2.1.4 Inner cement grout

(1) Inner cement grout as prescribed by DIN EN 447[8] must be used. In addition, DIN EN 445[9] and DIN EN 446[10] must be observed.

(2) For the injection of the corrugated plastic sheathing with inner cement grout in the plant, the prepared load-bearing element must be positioned on an inclined plane, so that injection from the lowest point (injection cap) and ventilation at the highest point (ventilation cap) are ensured.

2.1.5 Additional components

(1) Fix shrink sleeves and corrosion protection heat shrink sleeves must be used as the heat shrink sleeves. The material properties and dimensions of the heat shrink sleeves must correspond to the specifications deposited at DIBt. The heat shrink sleeves must be shrunk on with hot air, infrared radiation, or the soft flame of a gas burner; the wall thickness in the shrunk condition must be ≥ 1.5mm.

(2) To maintain the distance of ≥ 5mm between the load-carrying element and the corrugated plastic sheathing, the load-carrying element must be provided with spacers every 1.0m, or a polyethylene helix 6mm dia. with a pitch of 0.5m must be arranged.

5	DIN EN ISO 1163-1:1999-10	Plastics - Unplasticized poly(vinyl chloride) (PVC-U) molding and extrusion materials - Part 1: Designation system and basis for specifications (ISO 1163-1:1995) - German version EN ISO 1163-1:1999
6	DIN EN ISO 17855-1:2015-0	Plastics - Polyethylene (PE) moulding and extrusion materials - Part 1: Designation system and basis for specifications (ISO 17855-1:2014) - German version EN ISO 17855-1:2014
7	DIN EN ISO 19069-1:2015-06	Plastics - Polypropylene (PP) molding and extrusion materials - Part 1: Designation system and basis for specifications (ISO 19069-1:2015) - German version EN ISO 19069-1:2015
8	DIN EN 447:1996-07	Grout for prestressing tendons - Specification for common grout; German version EN 447:1996
9	DIN EN 445:1996-07	Grout for prestressing tendons - Test methods; German version EN 445:1996
10	DIN EN 446:1996-07	Grout for prestressing tendons - Grouting procedures; German version EN 446:1996

(3) For centering the load-bearing elements in the borehole and for ensuring sufficient cement stone covering, spring basket spacers are arranged in accordance with Annexes 1 and 2 and with the specifications deposited at DIBt. For load-bearing elements embedded in corrugated plastic sheathing injected with inner cement grout, alternatively, segment spacers in accordance with Annex 2 and the specifications deposited at DIBt can be arranged. The spacers must be arranged in accordance with Section 3.3.3, Table 1.

2.2 Manufacture, packaging, transport, storage and marking

2.2.1 Corrosion protection and manufacture of the prefabricated pile construction for installation and grouting

(1) The cement stone covering of the load-bearing steel element as specified in Section 3.3.3 must be ensured by the measures required therein.

(2) If a corrugated plastic sheathing as defined in Section 2.1.3 is slipped over the load-bearing steel element, the annulus between the load-bearing element and the corrugated plastic sheathing must be injected with inner cement grout as set out in Section 2.1.4 from the bottom to the top, while the load-bearing element is stored on an inclined plane. To ensure complete injection, the ventilation cap must be connected to a 0.5m long filling tube or to a grout cone. To maintain the distance of ≥ 5mm between the load-carrying element and the plastic ribbed pipe, spacers as defined in Section 2.1.5 must be arranged. The above work must be carried out in a plant.

2.2.2 Packaging, transport and storage

(1) The effectiveness of the corrosion protection depends on the integrity of the corrosion protection components. Therefore, special care must be taken during the transport, storage and installation of the readily assembled pile construction that the corrosion protection components, in particular, the plastic ribbed pipe, are not damaged due to improper handling. If transported by a crane hook, the assembled pile construction must be carried at its pile head-side end directly on the steel or with carrying straps or must be placed in ducts. The pile construction must be stored on the ground; contamination of the corrugated plastic sheathing must be excluded.

(2) Depending on the temperatures, the prefabricated pile sections may not be removed from the assembly bench earlier than one day after the injection of the inner cement grout has taken place in the plant. The further transport and the installation may only be carried out 2 days (48 hrs) after the inner cement grout has been injected in the plant.

(3) If in the case of a cased borehole, the projecting end of the drill set has an edged internal thread or rather a sharp-edged tube end, the steel load-carrying elements prepared in accordance with Section 2.2.1 may only be inserted into the borehole if an edge-free inserting trumpet or a tube nipple fully covering the internal thread of the casing has been placed onto the projecting end of the drill set. Care must be taken that the corrosion protection is not damaged when the load-carrying element is inserted.

2.2.3 Marking

(1) The delivery note for the prefabricated pile construction must be marked by the manufacturer with the mark of conformity (Ü-Zeichen) in accordance with the conformity mark regulations issued by the German Länder. The marking may only be performed if the requirements pursuant to Section 2.3 have been met.

(2) The delivery note must, among other things, state for which piles the prefabricated pile constructions are designated and in which plant they have been manufactured. Only components for one micropile type to be specified may be delivered on a delivery note.

2.3 Certificate of conformity

2.3.1 General

(1) The conformity of the pile components and of the pile construction prefabricated for installation and grouting with the provisions of the general construction supervisory authority approval covered by this notice must be confirmed for every manufacturing plant with a declaration of conformity (Ü-Zeichen) issued by the manufacturer based on its factory production control system and on a certificate of conformity issued by a notified product certification body, as well as regular external surveillance by a external surveillance agency in accordance with the following provisions: The manufacturer of the pile components and of the prefabricated pile construction must commission a notified product certification body and a external surveillance authority to issue the certificate of conformity (Ü-Zeichen) and perform the external surveillance, including the product testing to be carried out in this process.

(2) The manufacturer shall show that a certificate of compliance has been issued by marking the construction products with the compliance mark (Ü- Zeichen) including a reference to the designated use.

(3) The notified product certification body must send a copy of the certificate of conformity issued to the DIBt.

(4) In addition, DIBt must be provided with a copy of the report on the first testing for information.

2.3.2 Factory production control system

(1) Each manufacturer and each supplier must set up and also carry out their own factory production control. Factory production control is understood to be the continual monitoring of production by the manufacturer or supplier who thus ensures that the construction products manufactured meet the requirements of this general construction supervisory authority approval.

(2) The internal production control system should at least include the measures listed in Annex 4 regarding the incoming goods inspection and the control during the production.

(3) The results of the internal production control must be recorded and evaluated. The records must at least contain the following information:

- The description of the building product or of the basic material and of its components,
- the nature of the control or inspection,
- the date of manufacture and the date of inspection of the building product or of the basic material or of its components,
- the results of the controls and inspections and, if applicable, a comparison with the relevant requirements,
- the signature of the person in charge of the internal production control system.

(4) The records must be kept for a minimum of five years and submitted to the notified product certification body involved in continuous surveillance. They must be submitted to DIBt and to the competent highest construction supervisory authority on request.

(5) If the test results are unsatisfactory, the manufacturer must immediately take the measures necessary to eliminate the identified deficiency. Construction products which do not meet the requirements must be handled in such a manner that they cannot be mistaken for conforming products. Once the deficiency has been eliminated, the test in question must be immediately repeated, provided that this is technically feasible and also required to verify the elimination of the deficiency.

2.3.3 External monitoring

(1) The facilities and the internal factory production control system in all manufacturing plants must be reviewed by a notified product certification body on a regular basis, but at least twice a year.

(2) An initial test must be carried out as part of the external monitoring. In this process, samples must be taken for sample checks, and the testing tools must be inspected. Both sampling and testing are incumbent on the external surveillance authority.

(3) The results of the certification and of the external surveillance must be kept for a minimum of five years. They must be presented to DIBt and to the competent highest construction supervisory authority by the notified product certification body on request.

3 Regulations for planing and design of micropiles

3.1 Planning

Unless otherwise stated in the following text, the technical construction standards, in particular, DIN EN 1997-1[11], DIN EN 1997-1/NA[12], DIN 1054[13], DIN 1054/A1[14] and DIN 1054/A2[15], apply.

(2) In the case of dynamic actions according to DIN EN 1991-1-1, Section 2.2, in conjunction with DIN EN 1991-1-1/NA, it must be verified that the fatigue strengths of the steel load-carrying element or of the coupler splices and the anchorages are not exceeded. The fatigue strengths must be taken from the relevant general construction supervisory authority approvals for steel bar with thread ribs or for screwed coupler connections and anchorages of steel bar with thread ribs (general construction supervisory authority approval No. Z-1.5-2).

(3) As the partial safety factor γ_M for the material resistance of the steel load-carrying element, γ_M = 1.15 must be used in the design situations BS-P, BS-T and BS-A.

3.2 Design

3.2.1 Tensile piles

For piles as described in Annex 1, the load-bearing steel element of which is not embedded in coruggated plastic sheathing injected with inner cement grout and which are intended for permanent installation (longer than 2 years), it must be verified that the tensile stresses or marginal stresses do not exceed the value of 230N/mm² in the case of unintended bending stresses in steel based on the design values of impacts in the design situation BS-P.

3.2.2 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 steel load-carrying element to the cement stone.

(2) To verify the transfer length, the design value of the bond strength must be determined in accordance with DIN EN 1992-1-1, Section 8.4.2, in conjunction with DIN EN 1992-1-1/NA. In this process, the coefficient to consider the bar diameter can be set at η_2 = 0.9.

[11]	DIN EN 1997-1:2009-09	Eurocode 7: Geotechnical design - Part 1: General rules; German version EN 1997-1:2004 + AC:2009
[12]	DIN EN 1997-1/NA:2010-12	National Annex - Nationally determined parameters - Eurocode 7: Geotechnical design - Part 1: General rules
[13]	DIN 1054:2010-12	Subsoil - Verification of the safety of earthworks and foundations - Supplementary rules to DIN EN 1997-1
[14]	DIN 1054/A1:2012-08	Subsoil - Verification of the safety of earthworks and foundations - Supplementary rules to DIN EN 1997-1:2010; amendment A1:2012
[15]	DIN 1054/A2:2015-11	Subsoil - Verification of the safety of earthworks and foundations - Supplementary rules to DIN EN 1997-1:2010; amendment 2

3.2.3 Entire structure

If required, the slip (see details in Annex 3) occurring in tensile stressed coupler splices without the use of lock nuts must be taken into account for the design of the entire structure.

3.3 Installation

DIN EN 14199 in conjunction with DIN SPEC 18539 applies to the installation of the DYWIDAG GEWI piles (micropiles), unless otherwise stated in the text below.

3.3.1 Contractor

(1) The DYWIDAG GEWI piles may only be installed under the responsible technical supervision of DYWIDAG-Systems International GmbH.

(2) The DYWIDAG GEWI piles may also be installed by companies which can present a certificate issued by DYWIDAG-Systems International GmbH that they have been comprehensively trained in the installation of the DYWIDAG GEWI piles in accordance with the general design-type approval covered by this notice.

3.3.2 Coupler splices

(1) If couplers are required, then the general requirements as defined in Section 2.1.2.2 apply to the splice formation of the load-bearing steel element.

(2) The distance between the joints in the longitudinal direction of a steel bar with thread ribs must be ≥ 1m.

(3) For piles intended for permanent installation, the free bar ends as well as the internal thread of the coupler and nuts must be coated with an anti-corrosion compound (e.g. Denso-Jet, Petro-Plast, Nontribos) before joining them.

(4) For load-bearing elements embedded in corrugated plastic sheathing injected with inner cement grout (see Sections 2.1.3 and 2.1.4), the site of coupling must be protected with a corrosion-protection heat shrink sleeve (see Section 2.1.5) in accordance with Annex 3. The hollow space between the grout column and the splice must, as required by DIN 30672[16], be completely filled with the plastic sealing tape "Densoplast Petrolatum" on both sides of the splice, before the heat shrink sleeve is shrunk on. The petrolatum must be melted on through heating.

3.3.3 Pile shaft

For the production of the grout body of the DYWIDAG GEWI piles, cement grout is to be used.

[16] DIN 30672:2000-12 External organic coatings for the corrosion protection of buried and immersed pipelines for continuous operating temperatures up to 50°C - Tapes and shrinkable materials

3.3.3.1 Cement grout

(1) The basic materials for the cement grout are cements with particular properties in accordance with DIN 1164-10[17] and cements in line with DIN EN 197-1[18], taking into consideration the present exposition classes as defined by DIN EN 206-1[19] in conjunction with DIN 1045-2[20] (Tables 1, F.3.1 and F.3.2), water as stipulated by DIN EN 1008[21] and, where required, additives in accordance with DIN EN 934-2[22] in conjunction with DIN EN 206-1/DIN 1045-2 or subject to a general construction supervisory authority approval, and natural aggregates for concrete in compliance with DIN EN 12620[23], taking into account DIN EN 206-1/DIN 1045-2.

(2) For the verification of the compressive strength of the grout body (cement grout), two series of 3 specimens per 7 manufacturing days on which piles are fabricated or per construction site are to be produced.

3.3.3.2 Post-grouting

Post-grouting is to be performed by means of the GEWI post-grouting system (see Annexes 1 and 2) optionally arranged during the installation of the load-bearing steel element. Piles subject to load may not be post-grouted.

3.3.3.3 Centering and covering of the steel load-carrying element

(1) The load-bearing steel element must be centered within the borehole in such a manner that an adequate cement stone covering is provided at all sites, including over the couplers. For load-bearing elements in accordance with Annex 1, which are not embedded in corrugated plastic sheathings injected with inner cement grout, the minimum dimensions of the covering pursuant to DIN SPEC 18539, A Annex C, apply.

(2) Piles with corrugated plastic sheathings as shown in Annex 2 must have a cement stone covering of at least 10mm over the ribbed pipes.

(3) The cement stone covering must be secured by means of spring basket spacers (see Annexes 1 and 2) or segment spacers (see Annex 2), also in combination with the GEWI post-grouting system, solely by means of the casing (only in the case of non-cohesive soils; cf. DIN EN 1997-1 in conjunction with DIN EN 1997-1/NA and DIN 1054, Section 3.1) or in combination with the aforementioned spacers. Segment spacers may only be used for load-bearing elements as shown in Annex 2, which are embedded in corrugated plastic sheathings injected with inner cement grout.

[17]	DIN 1164-10:2004-08	Special cement - Part 10: Composition, requirements and conformity evaluation for special common cement
	DIN 1164-10 Ber. 1:2005-01	Corrections to DIN 1164-10:2004-08
[18]	DIN EN 197-1:2004-08	Cement - Part 1: Composition, specifications and conformity criteria of common cements; German version EN 197-1:2000 + A1:2004
	DIN EN 197-1 Ber. 1:2004-11	Corrections to DIN EN 197-1:2004-08
	DIN EN 197-1/A3:2007-09	Cement - Part 1: Composition, specifications and conformity criteria of common cements; German version EN 197-1:2000/A3:2007
[19]	DIN EN 206-1:2001-07	Concrete - Part 1: Specification, performance, production and conformity
	DIN EN 206-1/A1:2004-10	Concrete - Part 1: Specification, performance, production and conformity; German version EN 206-1/A1:2004
	DIN EN 206-1/A2:2005-09	Concrete - Part 1: Specification, performance, production and conformity; German version EN 206-1:2000/A2:2005
[20]	DIN 1045-2:2008-08	Concrete, reinforced and prestressed concrete structures - Part 2: Concrete - Specification, properties, production and conformity - Application rules for DIN EN 206-1
[21]	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
[22]	DIN EN 934-2:2009-09	Admixtures for concrete, mortar and grout - Part 2: Concrete admixtures - Definitions, requirements, conformity, marking and labelling; German version EN 934-2:2009
[23]	DIN EN 12620:2008-07	Aggregates for concrete; German version EN 12620:2002+A1:2008

(4) The distances between the spacers depend on the particular inclination and can be taken from Table 1 and Annexes 1 and 2; the distances from the first spacer on the pile base are continuously indicated. The first spacer on the pile base must be arranged ≤ 1.50m from the earth-side end of the steel load-carrying element.

Table 1: Inclination of the piles and distance between the spacers

Spacer	Steel load-carrying element	Inclination of the piles	Distance between the spacers[1]	Remarks
Spring basket or segment spacer[2]	63.5mm dia.	0° (vertical) to 15°	≤ 3.0m	Dimensions of the spacers, cf. Annexes 1 and 2
		16° to 45°	≤ 2.6 m	
		46° to 80°	≤ 2.2m	

[1] a minimum of 3 spacers in each case

[2] If the wall thickness of the starter pipe of the casing equals or exceeds the cement stone covering c, then spacers may be omitted in non-cohesive soils in accordance with DIN EN 1997-1 in conjunction with DIN EN 1997-1/NA and DIN 1054, Section 3.1.

3.3.4 Integration in the entire structure

In the area of the pile neck, the constructional measures as defined in Section 2.1.2 must be observed.

3.3.5 Declaration of conformity regarding the manufacture

(1) The contractor must issue a declaration of conformity in accordance with Section 16a(5), Section 21(2) MBO[24] that the DYWIDAG GEWI piles manufactured correspond to the provisions of this general design-type approval.

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

- notice number,
- designation of the building project,
- the date of installation,
- contractor's name and registered office,
- confirmation that the installation is in compliance with the design documents,
- documentation of the basic materials and delivery notes,
- the nature of the controls or inspections,
- the date of the control or inspection,
- the 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) The declaration of conformity must be handed over to the client for incorporation into the construction file and presented to DIBt and to the competent highest construction supervisory authority on request.

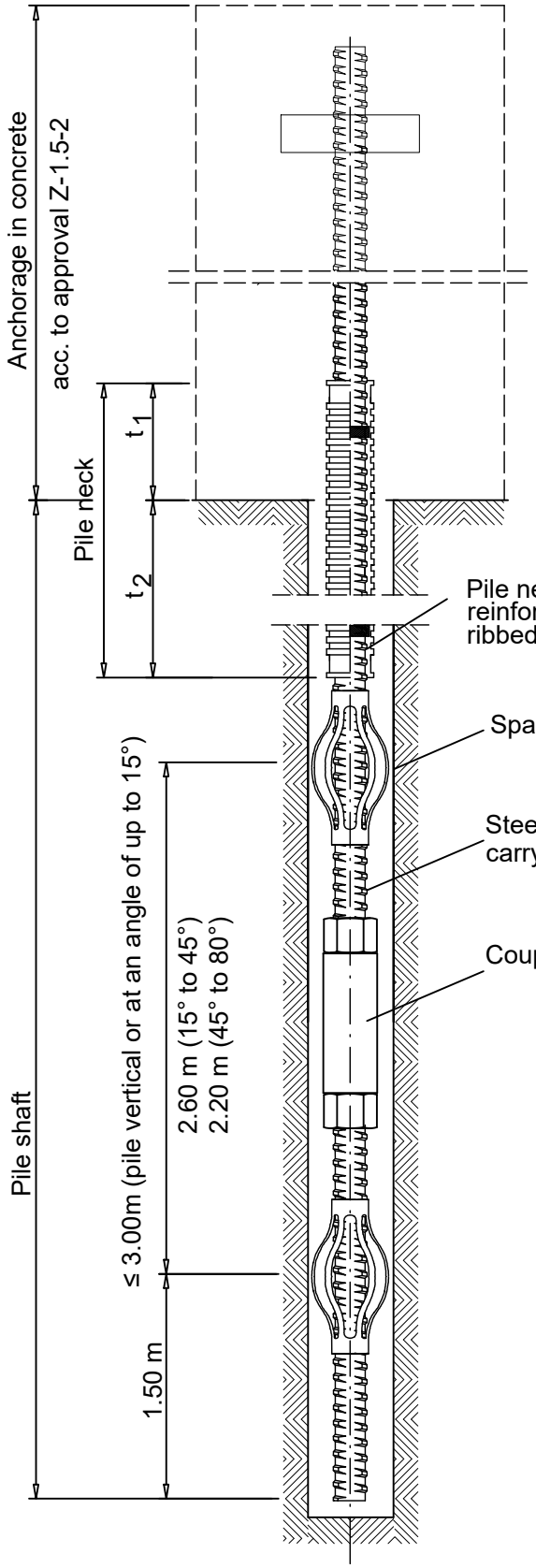
[24] Musterbauordnung (MBO, German Model Building Code) Version of November 2002, last amended by the resolution adopted by the conference of the ministers of construction of 05/13/2016

Bettina Hemme
Section Head

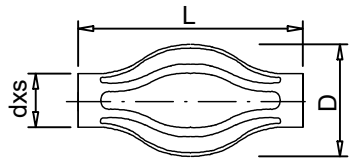
Certified

/Illegible signature/

/Stamp mark:/
/Bear emblem/
Deutsches Institut
für Bautechnik
11



Spring basket spacer



dxs	L	min. D*
75x3,6	285	110

Dimensions in mm

*min. dia. must be increased by compression, dependent on the covering required in accordance with DIN SPEC 18539 A Annex C

Pile neck:

Plastic ribbed pipe

- $t_1 \geq 200$ mm, $t_2 \geq 600$ mm
- $a_{Ri} \geq 79$ mm [inner ribbed pipe diameter]

Alternatively:

a) Reinforcement cage made from N94 welded steel mesh

- $t_1 \geq 300$ mm, $t_2 \geq 600$ mm
- $a_{Bi} \geq 89$ mm (inner reinforcement cage diameter)

b) Helix

- $t_1 \geq 300$ mm, $t_2 \geq 600$ mm
- $a_{Wi} \geq 89$ mm, $Ø_W = 4$ mm, $c_W = 75$ mm
- Distance protection: 6 longitudinal bars Ø 8 mm

a_{Wi} - inner helix diameter

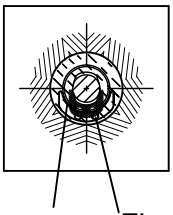
$Ø_W$ - bar diameter

c_W - pitch

Pile shaft:

For post-grouting, arrangement of the GEWI post-grouting system with grout valves and grout tubes

GEWI post-grouting system

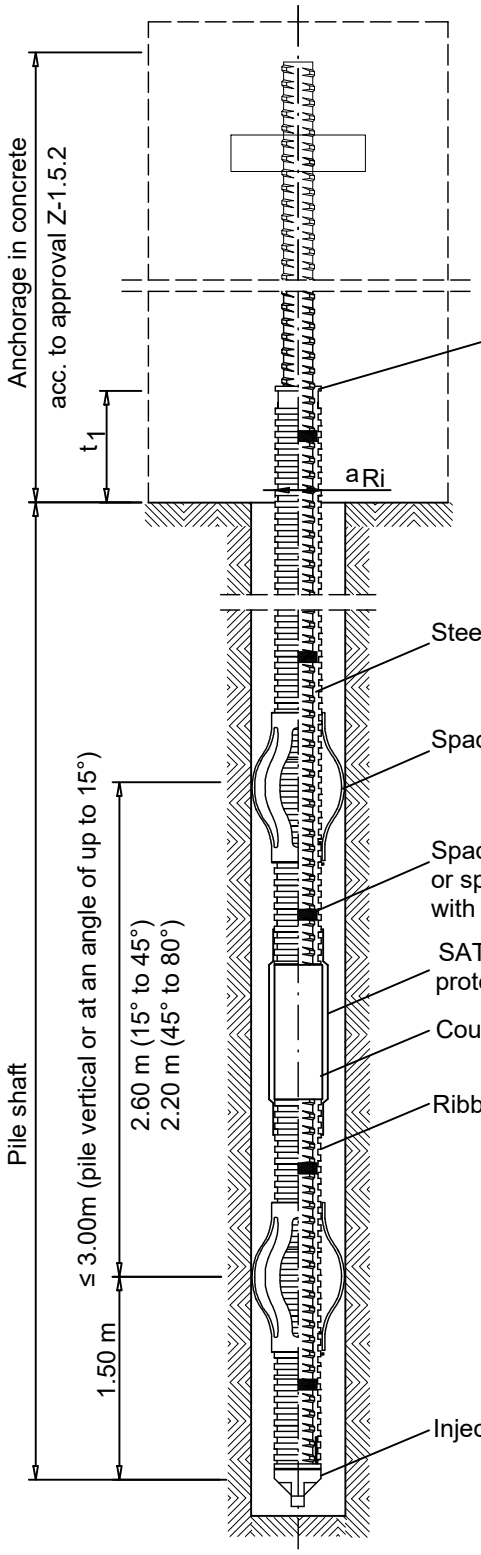


Grout valve Flushing and grout tube

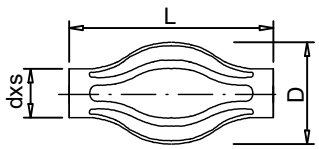
DYWIDAG GEWI Piles (Micropiles [Composite Piles] with a Load-Carrying Element made of Steel Bar with Thread Ribs S 555/700, Ø63.5mm)

Annex 1

GEWI Single-bar Pile (SKS)



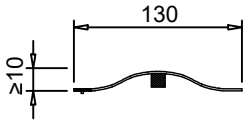
Spring basket spacer



dxs	L	min. D*
110x3,2	285	130

Dimensions in mm

Alternatively: Segment spacer



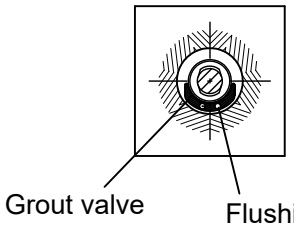
Pile neck:

Plastic ribbed pipe
- $t_1 \geq 200$ mm
- $a_{Ri} \geq 79$ mm [inner ribbed pipe diameter]

Pile shaft:

For post-grouting, arrangement of the GEWI post-grouting system with grout valves and grout tubes

GEWI post-grouting system



DYWIDAG GEWI Piles (Micropiles [Composite Piles] with a Load-Carrying Element made of Steel Bar with Thread Ribs S 555/700, Ø63.5mm)

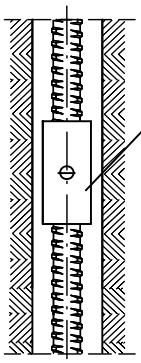
Annex 2

GEWI Single-bar Pile (SKS)

GEWI pile (SKS)

Compression splice (contact splice)

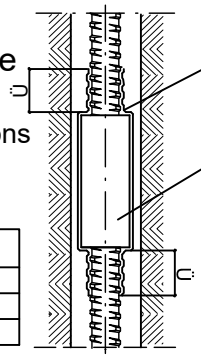
for non-dynamic actions



Bars hand-tightened

Tension or compression splice

for non-dynamic actions

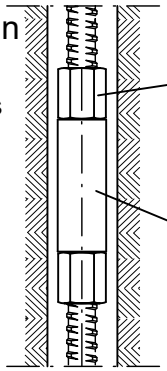


For tension splice	
Load (N_{Ed}/A) [N/mm²]	Slip [mm]
230	2

Bars hand-tightened

Tension/compression splice

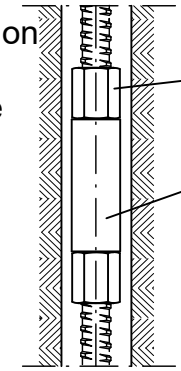
for non-dynamic actions



locked acc. to Z-1.5-2

Tension,compression splice and tension/ compression splice

for dynamic loads

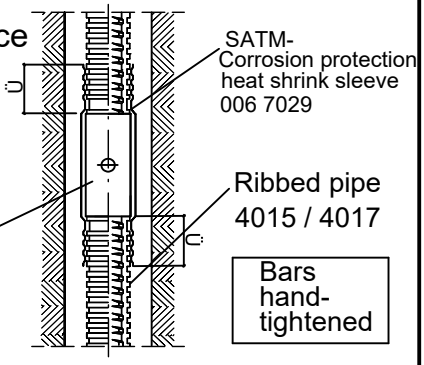


locked acc. to Z-1.5-2

GEWI pile with plastic ribbed pipe (double corrosion protection)

Compression splice (contact splice)

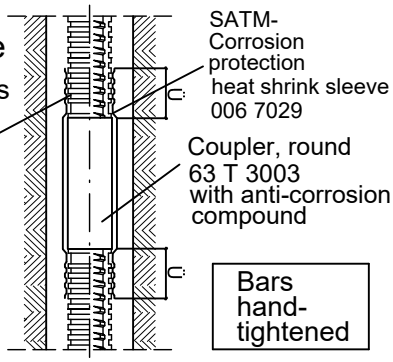
for non-dynamic actions



Bars hand-tightened

Tension or compression splice

for non-dynamic actions

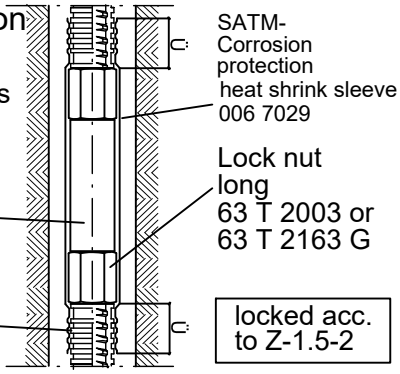


For tension splice	
Load (N_{Ed}/A) [N/mm²]	Slip [mm]
445	3

Bars hand-tightened

Tension/compression splice

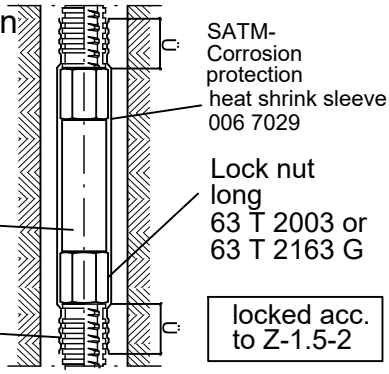
for non-dynamic actions



locked acc. to Z-1.5-2

Tension,compression splice and tension/ compression splice

for dynamic loads



locked acc. to Z-1.5-2

Ü ≥ Ø steel load-carrying element or Ø plastic ribbed pipe

DYWIDAG GEWI Piles (Micropiles [Composite Piles] with a Load-Carrying Element made of Steel Bar with Thread Ribs S 555/700, Ø63.5mm)

GEWI Single-bar Pile, Couplers

Annex 3

Inspection		Inspection method	FPCS[1]	IP/EM[2] value	
1. Incoming goods inspection					
1.1	Steel bar with threaded ribs	Delivery note	every delivery	X	Mark of conformity acc. to the GCSA approval for steel bar with thread ribs S 555/700, 63.5mm dia.
1.2	Anchoring and connecting means	Delivery note	every delivery	X	Mark of conformity acc. to Z-1.5-2
1.3	Thickness/diameter of the inner spacers	Measurement	every delivery	X*	≥ 5mm
1.4	Plastic ribbed pipes, injection caps, ventilation cap				
	Molding compound	DIN EN 10204	every delivery	X	Inspection certificate "2.1"
	Wall thickness of plastic ribbed pipes (at the inner and outer rib and flank)	Measurement	1 per 100 pcs.	X*	Shop drawings
	Inner and outer diameter	Measurement	1 per 100 pcs.	X*	Shop drawings
1.5	Shrink sleeves				
	Molding compound	DIN EN 10204	every delivery	X	Inspection certificate "2.1"
	Wall thickness (at 3 sites on the basic material), application of glue	Measurement	1 per 100 pcs.	X*	Data sheet, shop drawings
2. Control during manufacture					
2.1	Shrink sleeves				
	Wall thickness at 3 sites in the shrunk condition	Sample and measurement	1 per 100 pcs.	X*	≥ 1.5 mm
2.2	Totality of the factory-applied corrosion protection measures	visually	every load-carrying element	X	Work instructions
2.3	Inner cement grout	DIN EN 445	DIN EN 446	X	DIN EN 447

* Inspection plan:
If each individual measured value equals or exceeds the minimum value stipulated, the batch must be accepted. Otherwise, additional samples can be taken. The same measurements as those on the first sample must be carried out on these additional samples. The measuring results must be merged with the previous measurements. The mean value x and the standard deviation s must be derived from all values. If the test value (numerical value)

$$z = x - 1.64\ s$$

derived therefrom equals or exceeds the minimum value required, the batch must be accepted, otherwise rejected.

[1] Internal Production Control System
[2] Initial testing/external monitoring (twice a year)

DYWIDAG GEWI Piles (Micropiles [Composite Piles] with a Load-Carrying Element made of Steel Bar with Thread Ribs S 555/700, Ø63.5mm)

Minimum Requirements for the Internal Production Control System

Annex 4

BELGIUM AND LUXEMBOURG

DYWIDAG-Systems International N.V.
Philipssite 5, bus 15
Ubicenter, 3001 Leuven, Belgium
Phone +32-16-60 77 60
Fax +32-16-60 77 66
E-mail info.be@dywidag-systems.com

FRANCE

DSI France SAS
Rue de la Craz
Z.I. des Chartinières
01120 Dagneux, France
Phone +33-4-78 79 27 82
Fax +33-4-78 79 01 56
E-mail dsi.france@dywidag-systems.fr

GERMANY

DYWIDAG-Systems International GmbH
Germanenstrasse 8
86343 Koenigsbrunn, Germany
Phone +49-8231-96 07 0
Fax +49-8231-96 07 40
E-mail geotechnik@dywidag-systems.com

DYWIDAG-Systems International GmbH
Max-Planck-Ring 1
40764 Langenfeld, Germany
Phone +49-2173-79 02 0
Fax +49-2173-79 02 20
E-mail suspa@dywidag-systems.com

DYWIDAG-Systems International GmbH
Schuetzenstrasse 20
14641 Nauen, Germany
Phone +49-3321-44 18 0
Fax +49-3321-44 18 18
E-mail suspa@dywidag-systems.com

ITALY

DYWIDAG Systems S.r.l.
Viale Europa 72 Strada A 7/9
20090 Cusago (MI), Italy
Phone +39-02-901 65 71
Fax +39-02-901 65 73 01
E-mail info@dywit.it

NETHERLANDS

DYWIDAG-Systems International B.V.
Veilingweg 2
5301 KM Zaltbommel
Netherlands
Phone +31-418-57 89 22
Fax +31-418-51 30 12
E-mail email.nl@dywidag-systems.com

POLAND

DYWIDAG-Systems International Sp. z o.o.
ul. Bojowników o Wolność i Demokrację 38/121
41-506 Chorzów, Poland
Phone +48-32-241 09 98
Fax +48-32-241 09 28
E-mail dsi-polska@dywidag-systems.com

SPAIN

DYWIDAG Sistemas Constructivos, S.A.
Avd/de la Industria, 4
Pol. Ind. la Cantuena
28947 Fuenlabrada (Madrid), Spain
Phone +34-91-642 20 72
Fax +34-91-642 27 10
E-mail dywidag@dywidag-sistemas.com

UNITED KINGDOM

DYWIDAG-Systems International Ltd.
Northfield Road, Southam, Warwickshire
CV47 0FG, Great Britain
Phone +44-1926-81 39 80
Fax +44-1926-81 38 17
E-mail sales@dywidag.co.uk

www.dywidaggroup.com

04616-1/05.20-web ca