Deutsches Institut für Bautechnik DIBt

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-21/0788 of 20 April 2022

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Injection System VME basic for rebar connections
Product family to which the construction product belongs	Systems for post-installed rebar connections with mortar
Manufacturer	MKT Metall-Kunststoff-Technik GmbH & Co. KG Auf dem Immel 2 67685 Weilerbach DEUTSCHLAND
Manufacturing plant	Werk 1,D und Werk 2,D
This European Technical Assessment contains	24 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330087-01-0601, Edition 06/2021

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European Technical Assessment

ETA-21/0787 of 21 January 2022

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General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Injection System VME basic for concrete
Product family to which the construction product belongs	Bonded fastener for use in concrete
Manufacturer	MKT Metall-Kunststoff-Technik GmbH & Co. KG Auf dem Immel 2 67685 Weilerbach DEUTSCHLAND
Manufacturing plant	Werk 1,D und Werk 2,D
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ICC-ES Evaluation Report

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

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EVALUATION SUBJECT:

MKT VME/VM-ME EPOXY ADHESIVE ANCHOR SYSTEM IN CRACKED AND UNCRACKED CONCRETE

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012, 2009 and 2006 *International Building Code®* (IBC)
- 2015, 2012, 2009 and 2006 *International Residential Code®* (IRC)

Property evaluated:

Structural

2.0 USES

General:

The MKT VME/VM-ME epoxy adhesive anchors are used to resist static, wind or earthquake (IBC Seismic Design Categories A through F) tension and shear loads in cracked and uncracked normal-weight concrete with $^1/_2$-, $^5/_8$-, $^3/_4$-, $^7/_8$-, 1-, and $1^1/_4$-inch-diameter (12.7, 15.9, 19.1, 22.2, 25.4 and 31.8 mm) threaded steel rods and No. 4 through No. 10 steel reinforcing bars in hammer-drilled holes.

The anchors are used to resist static, wind or earthquake (IBC Seismic Design Categories A and B only) tension and shear loads in uncracked normal-weight concrete only with $^3/_8$-inch-diameter (9.5 mm) threaded steel rods and No. 3 steel reinforcing bars in hammer-drilled holes and uncracked normal-weight concrete only with $^1/_2$-, $^5/_8$-, $^3/_4$-, $^7/_8$- and 1-inch-diameter (12.7, 15.9, 19.1, 22.2 and 25.4 mm) threaded steel rods and No. 4 through No. 8 steel reinforcing bars in core drilled holes. Use is limited to normal-weight concrete with a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

The anchor system complies with anchors as described in Section 1901.3 of the 2015 IBC, Section 1909 of the 2012 IBC, and is an alternative to cast-in-place anchors described in Section 1908 of the 2012 IBC, and Sections 1911 and 1912 of the 2009 and 2006 IBC. The anchor systems may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 General:

The MKT VME/VM-ME Epoxy Adhesive Anchor System is comprised of a two-component epoxy adhesive filled in cartridges, static mixing nozzles, dispensing tools, hole cleaning equipment and adhesive injection accessories.

MKT VME/VM-ME epoxy adhesive may be used with continuously threaded steel rods or deformed steel reinforcing bars. The primary components of the MKT VME/VM-ME Epoxy Adhesive Anchor System, including the epoxy adhesive cartridge, static mixing nozzle, the nozzle extension tube, dispensing tool and typical steel anchor elements, are shown in Figure 1 of this report. Manufacturer's printed installation instructions (MPII) and parameters, as included with each adhesive unit package, are replicated in Figure 2 of this report.

3.2 Materials:

3.2.1 MKT VME/VM-ME Epoxy Adhesive: MKT VME/VM-ME epoxy adhesive is an injectable two-component epoxy. The two components are separated by means of a labelled dual-cylinder cartridge. The two components combine and react when dispensed through a static mixing nozzle, supplied by, MKT which is attached to the cartridge. A nozzle extension tube is also packaged with the cartridge. The VME/VM-ME epoxy adhesive is available in 13-ounce (385 mL), 20-ounce (585 mL), and 47-ounce (1400 mL) cartridges. Each cartridge label is marked with the adhesive expiration date. The shelf life, as indicated by the expiration date, applies to an unopened cartridge when stored in accordance with the MPII, as illustrated in Figure 2 of this report.

3.2.2 Hole Cleaning Equipment: Hole cleaning equipment is comprised of steel wire brushes and air pump

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supplied by MKT, and a compressed air nozzle. The equipment is shown in Figure 2 of this report.

3.2.3 Dispensers: VME/VM-ME epoxy adhesive must be dispensed with manual, pneumatic dispensers, or electric powered dispensers supplied by MKT.

3.2.4 Steel Anchor Elements:

3.2.4.1 Threaded Steel Rods: Threaded steel rods must be clean and continuously threaded (all-thread) in diameters as described in Table 4 and Figure 2 of this report. Specifications for grades of threaded rod, including the mechanical properties and corresponding nuts and washers, are described in Table 2 of this report. Carbon steel threaded rods must be furnished with a minimum 0.0002-inch-thick (0.005 mm) zinc electroplated coating complying with ASTM B633, SC1; or a minimum 0.0021-inch-thick (0.053 mm) mechanically deposited zinc coating complying with ASTM B695, Class 55; or hot dip galvanized zinc coating complying with ASTM A153, Class C or D. The stainless steel threaded rods must comply with ASTM F593. Steel grades and material types (carbon, stainless) of the washers and nuts must be matched to the threaded rods. Threaded steel rods must be straight and free of indentations or other defects along their length. The embedded end may be either flat cut or cut on the bias to a chisel point.

3.2.4.2 Steel Reinforcing Bars: Steel reinforcing bars are deformed reinforcing bars (rebars), as described in Table 3 of this report. Table 4 and Figure 2 of this report summarize reinforcing bar size ranges. The embedded portions of reinforcing bars must be clean, straight, and free of mill scale, rust, mud, oil and other coatings (other than zinc) that may impair the bond with the adhesive. Reinforcing bars must not be bent after installation, except as set forth in ACI 318-14 Section 26.6.3.1(b) or ACI 318-11 Section 7.3.2 , as applicable, with the additional condition that the bars must be bent cold, and heating of the reinforcing bars to facilitate field bending is not permitted.

3.2.4.3 Ductility: In accordance with ACI 318-14 2.3 or ACI 318-11 D.1, as applicable, in order for a steel anchor element to be considered ductile, the tested elongation must be at least 14 percent and the reduction of area must be at least 30 percent. Steel elements with a tested elongation of less than 14 percent or a reduction of area less than 30 percent, or both, are considered brittle. Values for various steel materials are provided in Tables 2 and 3 of this report. Where values are nonconforming or unstated, the steel element must be considered brittle.

3.3 Concrete:

Normal-weight concrete must comply with Sections 1903 and 1905 of the IBC. The specified compressive strength of the concrete must be from 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

4.0 DESIGN AND INSTALLATION

4.1 Strength Design:

4.1.1 General: The design strength of anchors under the 2015 IBC, as well as the 2015 IRC, must be determined in accordance with ACI 318-14 and this report. The design strength of anchors under 2012, 2009 and 2006 IBC, as well as the 2012, 2009 and 2006 IRC, must be determined in accordance with ACI 318-11 (ACI 318) and this report.

The strength design of anchors must comply with ACI 318-14 17.3.1 or ACI 318-11 D.4.1, as applicable, except as required in ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable.

Design parameters are based on ACI 318-14 for use with the 2015 IBC and ACI 318-11 for use with the 2012, 2009 and 2006 IBC unless noted otherwise in Section 4.1.1 through 4.1.11 of this report.

Design parameters are provided in Tables 4 through Table 7. Strength reduction factors, ϕ, as given in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, must be used for load combinations calculated in accordance with Section 1605.2 IBC, ACI 318-15 5.3 or ACI 318-11 9.2, as applicable. Strength reduction factors, ϕ, as given in ACI 318-11 D.4.4 must be used for load combinations calculated in accordance with ACI 318-11 Appendix C.

4.1.2 Static Steel Strength in Tension: The nominal static steel strength of a single anchor in tension, N_{sa}, in accordance with ACI 318-14 17.4.1.2 or ACI 318-11 D.5.1.2, as applicable, and the associated strength reduction factors, ϕ, in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are provided in Table 4 of this report for the anchor element types included in this report. See Table 1.

4.1.3 Static Concrete Breakout Strength in Tension: The nominal static concrete breakout strength of a single anchor or group of anchors in tension, N_{cb} or N_{cbg}, must be calculated in accordance with ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, with the following addition:

The basic concrete breakout strength of a single anchor in tension, N_b, must be calculated in accordance with ACI 318-14 17.4.2.2 or ACI 318-11 D.5.2.2, as applicable, using the values of $k_{c,cr}$, and $k_{c,uncr}$ as given in the tables of this report. Where analysis indicates no cracking in accordance with ACI 318-14 17.4.2.6 or ACI 318-11 D.5.2.6, as applicable, N_b must be calculated using $k_{c,uncr}$ and $\Psi_{c,N}$ = 1.0. See Table 1. For anchors in lightweight concrete see ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable. The value of f'_c used for calculation must be limited to 8,000 psi (55 MPa) in accordance with ACI 318-14 17.2.7 or ACI 318-11 D.3.7, as applicable. Additional information for the determination of nominal bond strength in tension is given in Section 4.1.4 of this report.

4.1.4 Static Bond Strength in Tension: The nominal static bond strength of a single adhesive anchor or group of adhesive anchors in tension, N_a or N_{ag}, must be calculated in accordance with ACI 318-14 17.4.5 or ACI 318-11 D.5.5, as applicable. Bond strength values are a function of concrete compressive strength, concrete state (cracked, uncracked), drilling method (hammer-drill, core drilling) and installation conditions (dry concrete, water-saturated concrete, water-filled holes).

Bond strength values shall be multiplied by the associated strength reduction factor ϕ_{nn} and must be modified with the factor κ_{nn} for cases where holes are drilled in water-saturated concrete (κ_{ws}) or where the holes are water-filled at the time of anchor installation (κ_{wf}), as follows: