

EINGEGANGEN 5. JUNI 2014

EINGEGANGEN AM 27. MAI 2014

**MPA**  
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Institute for Building Materials,  
Concrete Construction  
and Fire Protection

Braunschweig Civil  
Engineering Materials  
Testing Institute

Materialprüfanstalt (MPA) für das Bauwesen · Beethovenstr. 52 · D-38106 Braunschweig

Mungo Befestigungstechnik AG  
Bornfeldstrasse 2  
4603 Olten  
Schweiz

**Letter**

**9901/2014**

Our Ref.: (3333/394/14)-NB  
Customer-No.: 11893  
Official in Charge: Frau Bollmohr  
Dept.: BS  
Contact: 0531-391-5461  
n.bollmohr@ibmb.tu-bs.de

Your Ref.:  
Your message of:

Date: 08.01.2014

### Validity of Test Report No. (3589/342/09)-NB of 06/11/2009

Dear Sir or Madam,

In reply to your enquiry we wish to inform you that the statements made in the above Test Report No. (3589/342/09)-NB of 06/11/2009 regarding the reaction to fire of centrally tensioned "Mungo Injection system MIT 600 RE for concrete" bonded anchors, consisting of

"Mungo Injection system MIT 600 RE for concrete" anchors in connection with anchor rods (M8 to M30 made from electrogalvanised steel; strength class  $\geq 5.8$ ),

"Mungo Injection system MIT 600 RE for concrete" anchors in connection with anchor rods (M8 to M30 made from stainless steel; material No. 1.4401 (A4) or 1.4571 (A5); strength class  $\geq 70$ ),

"Mungo Injection system MIT 600 RE for concrete" anchors in connection with HCR anchor rods (M8 to M30 made from highly corrosion-resistant HCR steel (1.4529 or 1.4565; strength class  $\geq 70$ ),

which are set in uncracked reinforced concrete (strength class at least C20/25 and not higher than C50/60) and exposed to a fire in accordance with the DIN EN 1363-1 standard temperature-time curve (ETK), continue to apply until 7 January 2019.

This letter consists of 3 pages and contains an abstract of the above Test Report.



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Notified body (0761-CPD)  
MPA Braunschweig has been approved and notified as a civil engineering testing, inspection and certifying body. MPA Braunschweig has been accredited as a testing and calibration laboratory in compliance with ISO/IEC 17025, and as an inspection body in compliance with ISO/IEC 17020.

## 1 General information

In view of the results that were achieved in the fire test, the fire resistance times that are listed in the table in section 2 below can be assigned to the “Mungo Injection system MIT 600 RE for concrete” anchors for the given maximum tensile loads, due consideration being given to the notes in section 3 below. The edge and centre distances have to be selected, so the steel failure / the mortar failure (failure as a result of ETK temperature exposure) becomes decisive.

## 2 Evaluation of test results

Table 2-1: Fire resistance times for the “Mungo Injection system MIT 600 RE for concrete” anchors (dimensions M8 – M30) made from electrogalvanised steel, stainless steel and highly corrosion-resistant HCR steel, set in substrates made from uncracked reinforced concrete (strength class at least C20/25 and not higher than C50/60), as a function of stress  $\sigma_s$  under centric tensile load and the minimum placement depth

| Designation                            | “Mungo Injection system MIT 600 RE for concrete” anchor |        |        |        |         |         |         |         |
|--|---|--------|--------|--------|---------|---------|---------|---------|
|  | Maximum tensile load <sup>1)</sup>                      |        |        |        |         |         |         |         |
|  | F<br>[kN]   |        |        |        |         |         |         |         |
| Fire resistance time<br>$t_u$<br>[min] | M8  | M10    | M12    | M16    | M20     | M24     | M27     | M30     |
| Min. placement depth [mm]              | 80  | 90     | 110    | 125    | 170     | 210     | 250     | 280     |
| 30                                     | ≤ 0.90  | ≤ 3.20 | ≤ 4.20 | ≤ 8.25 | ≤ 17.25 | ≤ 24.85 | ≤ 32.30 | ≤ 39.50 |
| 60                                     | ≤ 0.50  | ≤ 1.80 | ≤ 2.30 | ≤ 5.30 | ≤ 10.20 | ≤ 14.75 | ≤ 19.15 | ≤ 23.40 |
| 90                                     | ≤ 0.30  | ≤ 1.10 | ≤ 1.40 | ≤ 3.80 | ≤ 6.70  | ≤ 9.70  | ≤ 12.60 | ≤ 15.40 |
| 120                                    | ≤ 0.20  | ≤ 0.75 | ≤ 0.90 | ≤ 3.00 | ≤ 5.00  | ≤ 7.20  | ≤ 9.30  | ≤ 11.35 |

1) For the normal intended use, loads resulting from the ETA-09/0340 European Technical Approval may be decisive

If the edge distance  $c$  is so large that steel failure becomes the failure mode, the load values in table 2-1 can also be applied to anchors that are subjected to shear loads.

### 3 Additional information

The above-mentioned Test Report does together with this letter not replace an approval (Building Code Test Certificate - abP, National Technical Approval - abZ, European Technical Approval - ETA) that is required under the German building code procedure. It should, in particular, be noted that fire load values for "Mungo Injection system MIT 600 RE for concrete" anchors may be regulated by a National Technical Approval (abZ) or a European Technical Approval (ETA).

The above assessment only applies to the tested "Mungo Injection system MIT 600 RE for concrete" anchors on the basis of the conditions that are set out in the Technical Data Sheets of Mungo Befestigungstechnik AG. In accordance with the specifications provided by Mungo Befestigungstechnik AG, the anchors must be installed in compliance with European Technical Approval No.ETA-09/0340 of 23/10/2009.

The assessment for the above "Mungo Injection system MIT 600 RE for concrete" anchors only applies in connection with substrates made from uncracked reinforced concrete (strength class at least C20/25 and not higher than C50/60) that can at least be classified under a fire resistance class that corresponds to that of the anchors. It must also be considered that the anchors have for the time being only been approved of for normal intended use in uncracked reinforced concrete.

The validity of Test Report No. (3589/342/09)-NB of 06/11/2009 will, together with this letter, expire on 7 January 2019.



Kind regards,

i. A.

ORR Dr.-Ing. Rohling  
Head of Department

i. A.

Dipl.-Ing. Bollmohr  
Official/engineer in charge

**Test Report**

- Translation -

Document No.: (3589/342/09) – NB dd. 06/11/2009

Client: Mungo Befestigungstechnik AG  
Bornfeldstrasse 2  
4603 Olten  
Schweiz

Order date: 04/08/2009

Order Ref.: -

Order received: 04/08/2009

Subject: "Mungo Injection system MIT 600 RE" bonded anchors,  
placed in non-cracked RC members and subjected to  
centric tension loads, to be tested and evaluated in  
connection with anchor rods (dimensions M8 to M30) for  
their reaction to fire to determine their fire resistance time  
for one-sided fire exposure

Test basis: DIN EN 1363-1 : 1999-10

Test material received: 11/06/2009

Sampling: Sampling information is not available to the Testing House.

Test material marking: None

Test date: 27/06/2008, 27/08/2008, 01/09/2008 and 30/09/2008

Valid until: 07 January 2014



This Test Report consist of 8 pages, incl. cover sheet and 8 annexes.

Test Report No. (3589/342/09) – NB dd. 06/11/2009 does not replace the building code attestation (General Building Code Test Certificate - abP; National Technical Approval - abZ, ETA) required under the German building code procedure.

This Test Report may not be copied unless as a complete text and without any changes. Excerpts and abridged versions of this document are subject to approval in writing of MPA Braunschweig. Documents that do not carry a signature and the official stamp are invalid. The first sheet of this document and the page carrying the signatures bear the official stamp of MPA Braunschweig. The test material has been fully used. Accreditations are valid for the testing methods specified in the current documents. A list showing fields for which accreditation has been obtained can be made available upon request.

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## 1 Background and general statement

Under the order placed with the Testing House, a Test Report was to be drawn up on the reaction to fire of "Mungo Injection system MIT 600 RE" bonded anchors, which are subjected to centric tension and tested for steel failure / bonding failure on the basis of section 2.3 of TR 020 : 2004-05, when exposed to a fire in compliance with DIN EN 1363-1 : 1999-10 to determine their fire resistance time.

### Related documents:

- (1) DIN EN 1363-1 : 1999-10, Fire resistance tests - Part 1: General requirements,
- (2) EOTA Technical Report TR 020 : 2004-05 - Evaluation of anchorages in concrete concerning resistance to fire,
- (3) "Mungo Injection system MIT 600 RE", European Technical Approval ETA-09/0340 of 23-10-2009, issued by DIBt, Berlin,
- (4) is a transfer of Test Report No. (3302/252/08)-NB dated 07-01-2009 (english translation, the german version of Test Report No. (3302/252/08)-NB dated 07-01-2009 is the only legally binding text). The injection adhesive anchors evaluated in the present Test Report

are per statement of the client identical with the anchors evaluated in the Test Report No. (3302/252/08)-NB.

Using the results achieved in the fire test, the “Mungo Injection system MIT 600 RE” bonded anchors were to be examined and evaluated respecting requirements (steel failure, pullout) specified in EOTA Technical Report TR 020 : 2004-05.

## **2 Description of system tested**

The “Mungo Injection system MIT 600 RE” bonded anchor is an injection system that uses the bonding effect between anchor rod, bonding mortar and concrete to become anchored in the substrate. According to the type approval for cold design of anchoring means primarily subjected to static loads, the “Mungo Injection system MIT 600 RE” bonded anchor may be used in reinforced and non-reinforced normal-weight concrete (strength class C20/25 as a minimum and C50/60 as a maximum) in the non-cracked concrete.

Main elements of the tested “Mungo Injection system MIT 600 RE” bonded anchor are a two-component mortar cartridge (injection mortar: based on epoxy resin with amine hardener and silica flour) and cold-formed anchor rods (dimensions M8 to M30), together with a hexagon nut and a washer. The anchor rods and the nuts and washers are made from electrogalvanised steel (strength class 5.6). Forces are transmitted by the bond stress between the anchor rod and the anchoring substrate. For the service conditions, the “Mungo Injection system MIT 600 RE” bonded anchor is regulated with the European Technical Approval ETA-09/0340.

As specified in the above type approval, the “Mungo Injection system MIT 600 RE” bonded anchors were installed with the installation tools (hammer drill and drill, cleaning device and injection device) defined in these documents.

Further structural details and details of the as-installed condition of the bonded anchors are shown annexes 1.1 to 1.4 of this Test Report.

## **3 Test set-up and testing**

The “Mungo Injection system MIT 600 RE” bonded anchors were fire tested in a small-sized furnace with the inside dimensions 1,000mm x 1,500mm x 1,500mm (WxDxH). RC slabs (strength class C20/25) formed the horizontal barrier, into the tension zones of which the “Mungo Injection system MIT 600 RE” bonded anchors were placed.

In compliance with TR 020 : 2004-05, section 2.3.1, external loading systems and protected steel elements (dead loads) of the required weight, which were suspended for an unsupported and

unprotected length of  $l \leq 500$  mm with tension rods and an additional steel adapter, were used for introducing the centric loads into the “Mungo Injection system MIT 600 RE” bonded anchors.

The furnace was exposed to a fire in compliance with the standard temperature-time curve (ETK) as specified in DIN EN 1363-1 : 1999-10, section 5.1.1. The temperatures in the furnace were measured with 2 plate thermometers made from Ni-Cr/Ni-Al  $\varnothing$  1.0mm wire (type K) in compliance with DIN EN 1363-1 : 1999-10, section 4.5.1.1.

The temperatures measured in the furnace during the fire tests are illustrated by the graphs in annexes 2.1, 3.1, 4.1, and 5.1.

## 4 Test results, evaluation and conclusions

### 4.1 Evaluation of test results respecting centric tension loading

On 27/06/2008, 27/08/2008, 01/09/2008 and 30/09/2008, a total of 26 “Mungo Injection system MIT 600 RE” bonded anchors were placed in the non-cracked tension zone of RC floor sections (strength class C20/25) and tested for their reaction to fire when subjected to centric tension loads in compliance with DIN EN 1363-1 : 1999-10 to determine their fire resistance time.

Tables 4-1 to 4-5 in Test Report No. (3302/252/08) – NB dated 07-01-2009 list the test results for the 26 “Mungo Injection system MIT 600 RE” bonded anchors in connection with anchor rods made from electrogalvanised steel (strength class 5.6) and make reference to the cause of failure.

### 4.2 Evaluation of test results respecting steel failure

#### 4.2.1 General

The basis used for evaluation was section 2.3.1 of EOTA Technical Report TR 020 : 2004-05:

$$\sigma_{s1} = c_1 + c_2 / t_u \quad \text{equation: regression curve}$$

$$\sigma_{s2} = c_3 (c_1 + c_2 / t_u) \quad \text{equation: design curve}$$

Equations for determination of the characteristic steel stress for fire resistance times of 60 min., 90 min. and 120 min:

$$\sigma_{Rk,s,f(60)} = c_3 (c_1 + c_2 / 60\text{min})$$

$$\sigma_{Rk,s,f(90)} = c_3 (c_1 + c_2 / 90\text{min})$$

$$\sigma_{Rk,s,f(120)} = c_3 (c_1 + c_2 / 120\text{min})$$

Equation for determination of the characteristic steel stress for fire resistance times of 30 min., using the equation of the straight line through points  $t_u = 60 \text{ min} / \sigma_{Rk,s,fi(60)}$  and  $t_u = 90 \text{ min} / \sigma_{Rk,s,fi(90)}$ :

$$\sigma_{Rk,s,fi(30)} = c_4 - c_5 \times 30 \text{ min}$$

To calculate the tensile stress, the stress cross section  $A_s$  of the corresponding diameter of the “Mungo Injection system MIT 600 RE” bonded anchors was entered in the computation. Separate assessments were made for dimensions M8 to M20. The assessments for dimensions M24 to M30 are based on the test results for diameter M20.

#### 4.2.2 Presentation of test results and evaluation

The graphs in Fig. 4.1 show the test results as a function of the stress  $\sigma_s$  of the “Mungo Injection system MIT 600 RE” bonded anchors made from electrogalvanised steel (strength class 5.6) when subjected to centric tensile loads.

The “Mungo Injection system MIT 600 RE” bonded anchors with the dimensions M24 to M30 are evaluated on the basis of the steel stress utilisation level in relation to the stress cross section.

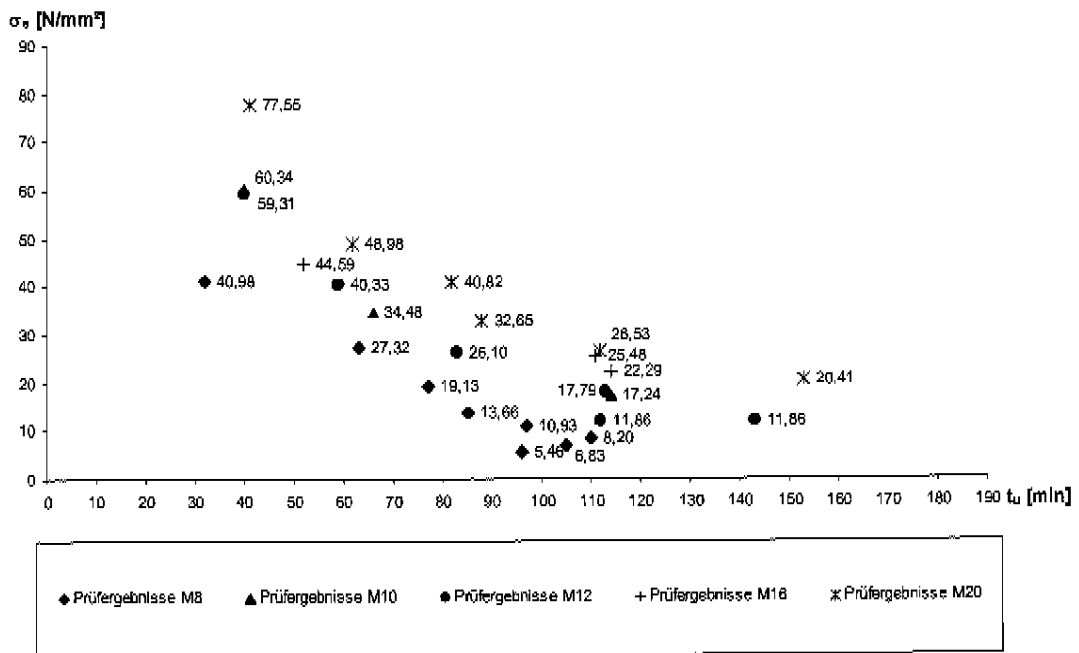


Fig. 4-1: Graphic representation of test results (steel failure, bonding failure) determined for the “Mungo Injection system MIT 600 RE” bonded anchors (dimensions M8 to M20) in connection with anchor rods made from electrogalvanised steel (strength class 5.6)



**4.2.3 Proposed rating for the “Mungo Injection system MIT 600 RE” bonded anchors (dimensions M8 to M30) in connection with anchor rods made from electrogalvanised steel (strength class 5.6)**

Using the test results achieved for “Mungo Injection system MIT 600 RE” bonded anchors made from electrogalvanised steel (strength class 5.6) as a basis, fire resistance periods are proposed for the “Mungo Injection system MIT 600 RE” bonded anchors (dimensions M8 to M30) made from electrogalvanised steel (strength class 5.6, 5.8 and 8.8) as a function of the maximum centric tensile load as shown in table 4-1 below.

Based on the results achieved in the tests, and departing from the evaluation specifications in TR 020 : 2004-05, the ratings for “Mungo Injection system MIT 600 RE” bonded anchors made from galvanised steel have been increased with regard to the 30-minute fire resistance time.

Table 4-1: Proposed rating for “Mungo Injection system MIT 600 RE” bonded anchors (dimensions M8 – M30) made from electrogalvanised steel, regarding their fire resistance times as a function of stress  $\sigma_s$  when exposed to centric tensile loads, and as a function of the minimum set depth

| Designation                            | “Mungo Injection system MIT 600 RE” bonded anchor |      |      |      |       |       |       |       |
|--|---|------|------|------|-------|-------|-------|-------|
|  | Maximum tensile load <sup>1)</sup>                |      |      |      |       |       |       |       |
|  | F<br>[kN]   |      |      |      |       |       |       |       |
| Fire resistance time<br>$t_u$<br>[min] | M8  | M10  | M12  | M16  | M20   | M24   | M27   | M30   |
| Minimum set depth [mm]                 | 80  | 90   | 110  | 125  | 170   | 210   | 250   | 280   |
| 30                                     | 0.90  | 3.20 | 4.20 | 8.25 | 17.25 | 24.85 | 32.30 | 39.50 |
| 60                                     | 0.50  | 1.80 | 2.30 | 5.30 | 10.20 | 14.75 | 19.15 | 23.40 |
| 90                                     | 0.30  | 1.10 | 1.40 | 3.80 | 6.70  | 9.70  | 12.60 | 15.40 |
| 120                                    | 0.20  | 0.75 | 0.90 | 3.00 | 5.00  | 7.20  | 9.30  | 11.35 |

<sup>1)</sup> Loads resulting from European Technical Approval ETA-09/0340 may be decisive for the service condition.

**4.2.4 Proposed rating for “Mungo Injection system MIT 600 RE” bonded anchors (dimensions M8 – M30) in connection with anchor rods made from stainless steel**

Starting from the results achieved in the tests, the same characteristic tensile stresses (cf. table 4-1) are recommended for the “Mungo Injection system MIT 600 RE” bonded anchors, when adequate anchor rods and nuts made from stainless steel (material No. 1.4401 (A4) and 1.4571 (A5), 1.4529 (HCR) strength class 50 and 70, respectively) are used.

## 5 Annotations

- 5.1** This Test Report does not replace the required building code attestation (General Building Code Test Certificate - abP; National Technical Approval - abZ, ETA). It should, in particular, be noted that the fire load density values of “Mungo Injection system MIT 600 RE” bonded anchors can be regulated by European Technical Approvals.
- 5.2** The above evaluation shall only apply to the tested “Mungo Injection system MIT 600 RE” bonded anchors, due consideration being given to the boundary conditions shown in the technical annexes attached to this Test Report and/or the technical data sheets of Mungo Befestigungstechnik AG.
- 5.3** The “Mungo Injection system MIT 600 RE” bonded anchors may be used for anchoring applications in non-cracked reinforced concrete (strength class C20/25 as a minimum and C50/60 as a maximum) when primarily subjected to static loads.
- 5.4** The evaluation shall only apply in connection with members made from reinforced concrete, which can as a minimum be classified under the same fire resistance class as that of the anchors.
- 5.5** The validity of the Test Report will expire on 07 January 2014.

*Rohling*  
ORR Dr.-Ing. Rohling  
Head of Testing Laboratory



i.A. *Bollmohr*  
Dipl.-Ing. Bollmohr  
Engineer in charge

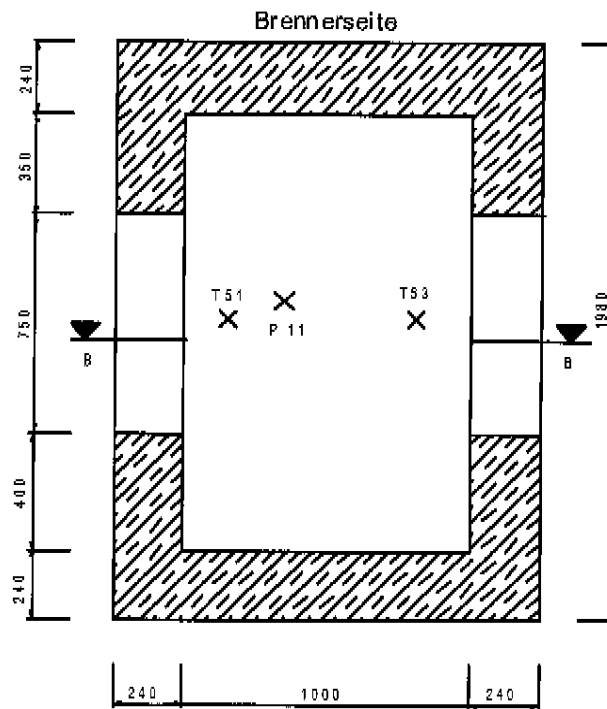
Braunschweig, dated 06 November 2009

## List of annexes

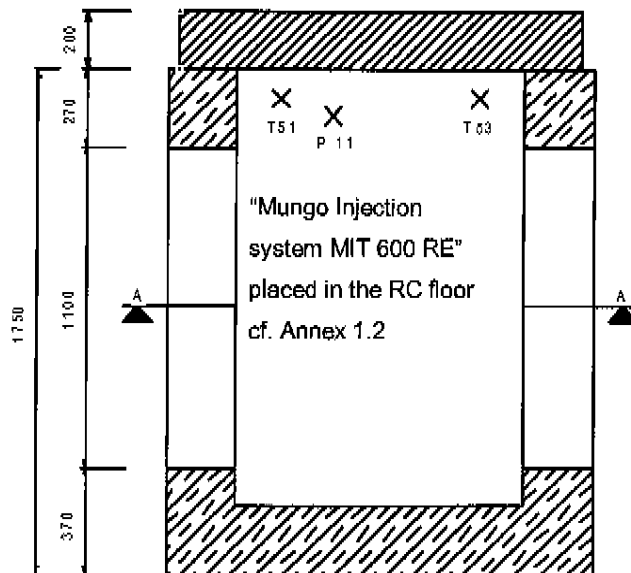
- Annex 1.1 : Structural design of the test installation
- Annex 1.2 : “Mungo Injection system MIT 600 RE” bonded anchors after installation
- Annex 1.3 : Technical details of the bonded anchors
- Annex 1.4 : Technical details of the bonded anchors
- Annex 2.1 : Furnace temperatures – test 1
- Annex 3.1 : Furnace temperatures – test 2
- Annex 4.1 : Furnace temperatures – test 3
- Annex 5.1 : Furnace temperatures – test 4

Furnace: chamber 6

Schnitt A-A



Schnitt B-B Deckenelement



T51 and T53 measuring points of furnace temperature, thermocouples with measuring points made of Ni-Cr/Ni-Al-wires (type K)  
P11 Pressure measuring head

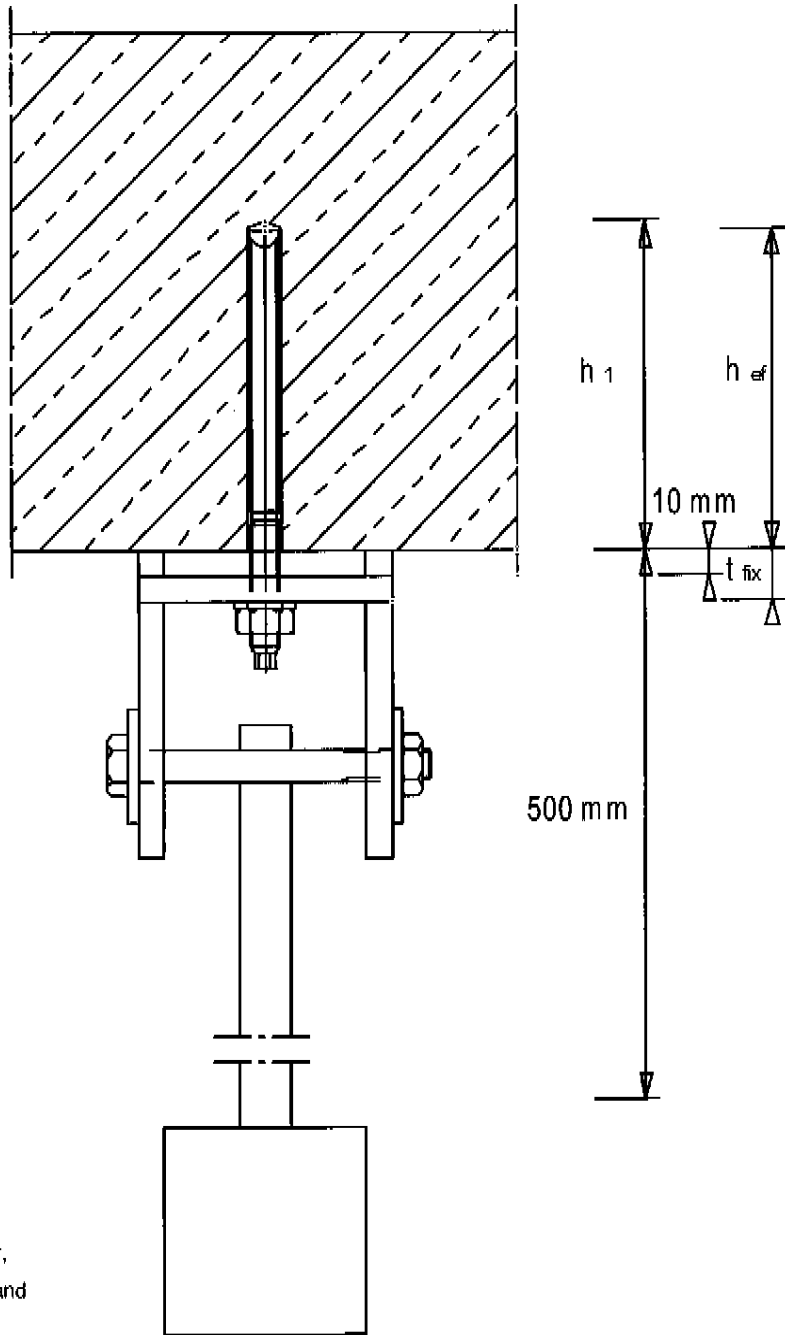
Dimensions in mm

**Structural design of the test installation**  
Installation of test chamber

**Materialprüfanstalt für das Bauwesen**  
Institut für Baustoffe, Massivbau und Brandschutz  
der Technischen Universität Braunschweig

Annex 1.1 of  
Test Report No.  
(3589/342/09)-NB

**"Mungo Injektion system MIT 600 RE" placed in RC slab**  
 $d \geq 200\text{mm} / C 20/25$



**Adapter:** Steel adapter,  
genuine nut and  
washer

**Suspender:** Cr-Mo-tension  
rod, 500 mm  
w/o protection in  
the fire

**Installation situation of sample**  
 "Mungo Injektion system MIT 600 RE"

**Materialprüfanstalt für das Bauwesen**  
 Institut für Baustoffe, Massivbau und Brandschutz  
 der Technischen Universität Braunschweig

Annex 1.2 of  
 Test Report No.  
 (3589/342/09)-NB

**"Mungo Injektion system MIT 600 RE"**

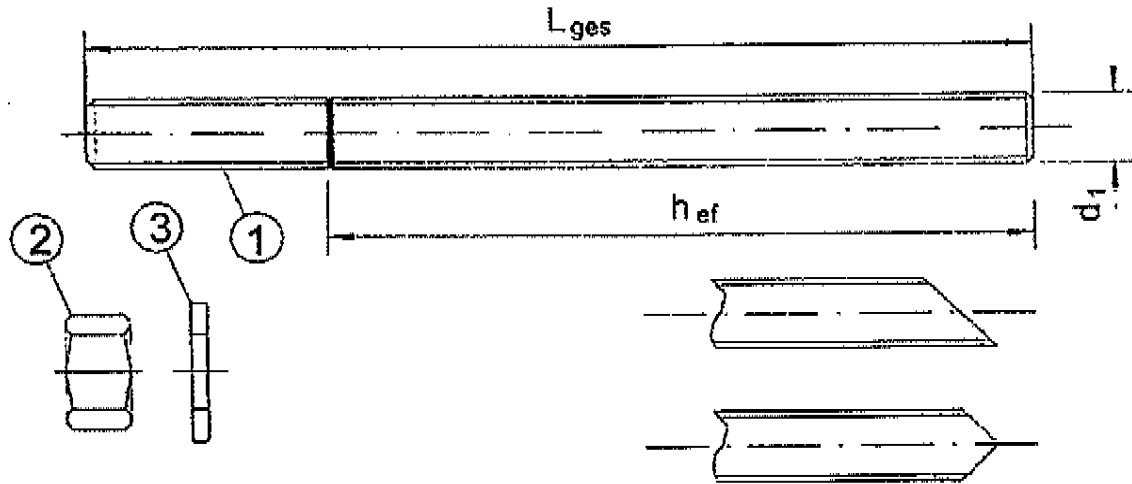


Table: Materials

| Teil  | Benennung   | Material  |
|---|---|---|
| <b>Stahlteile, verzinkter Stahl <math>\geq 5 \mu\text{m}</math> gemäß EN ISO 4042 oder Stahlteile, feuerverzinkt <math>\geq 40 \mu\text{m}</math> gemäß EN ISO 1461</b> |   |   |
| 1   | Ankerstange   | Stahl gemäß EN 10087 oder EN 10263<br>Festigkeitsklasse 5.8, 8.8 gemäß EN ISO 898-1:1999  |
| 2   | Sechskantmutter gemäß EN 24032                                  | Festigkeitsklasse 5 (für Ankerstangen der Klasse 5.8) EN 20898-2,<br>Festigkeitsklasse 8 (für Ankerstangen der Klasse 8.8) EN 20898-2 |
| 3   | Unterlegscheibe gemäß EN ISO 7089, EN ISO 7093 oder EN ISO 7094 | Stahl, verzinkt   |
| <b>Nichtrostender Stahl</b>   |   |   |
| 1   | Ankerstange   | Werkstoff 1.4401 / 1.4571, EN 10088-1:2005,<br>> M24: Festigkeitsklasse 50 EN ISO 3506<br>≤ M24: Festigkeitsklasse 70 EN ISO 3506     |
| 2   | Sechskantmutter, EN 24032                                       | Werkstoff 1.4401 / 1.4571 EN 10088,<br>> M24: Festigkeitsklasse 50 EN ISO 3506<br>≤ M24: Festigkeitsklasse 70 EN ISO 3506             |
| 3   | Unterlegscheibe EN ISO 7089, EN ISO 7093 oder EN ISO 7094       | Werkstoff 1.4401 oder 1.4571, EN 10088  |
| <b>Stahlteile aus hochkorrosionsbeständigem Stahl</b>   |   |   |
| 1   | Ankerstange   | Werkstoff 1.4529 / 1.4565, EN 10088-1:2005,<br>> M24: Festigkeitsklasse 50 EN ISO 3506<br>≤ M24: Festigkeitsklasse 70 EN ISO 3506     |
| 2   | Sechskantmutter, EN 24032                                       | Werkstoff 1.4529 / 1.4565 EN 10088,<br>> M24: Festigkeitsklasse 50 EN ISO 3506<br>≤ M24: Festigkeitsklasse 70 EN ISO 3506             |
| 3   | Unterlegscheibe EN ISO 7089, EN ISO 7093 oder EN ISO 7094       | Werkstoff 1.4529 / 1.4565 gemäß EN 10088  |

**Technical data**

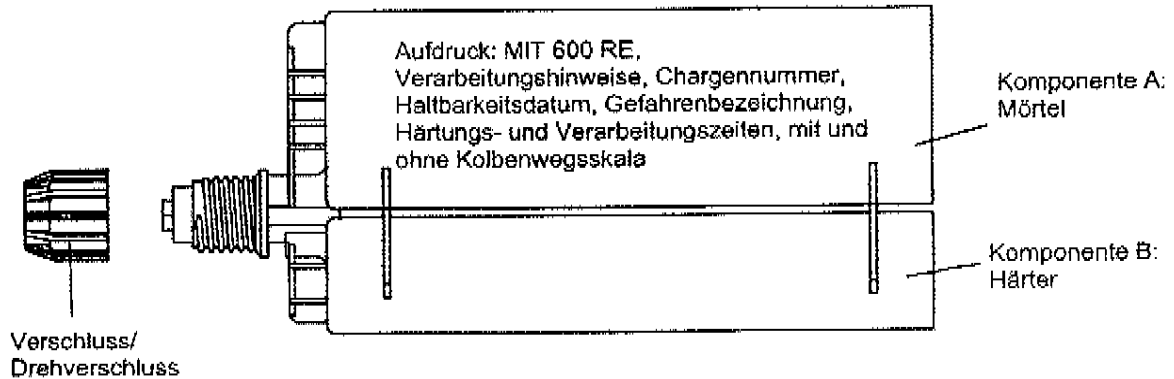
"Mungo Injektion system MIT 600 RE"

**Materialprüfanstalt für das Bauwesen**  
Institut für Baustoffe, Massivbau und Brandschutz  
der Technischen Universität Braunschweig

Annex 1.3 of  
Test Report No.  
(3589/342/09)-NB

## "Mungo Injektion system MIT 600 RE"

Cartridge: Mungo Injektion system MIT 600 RE



Static mixer:

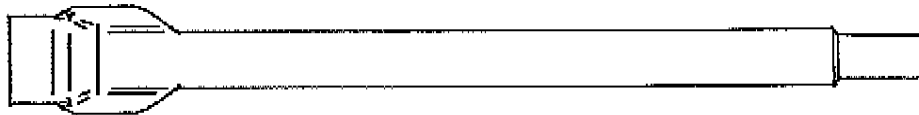


Table: installation details

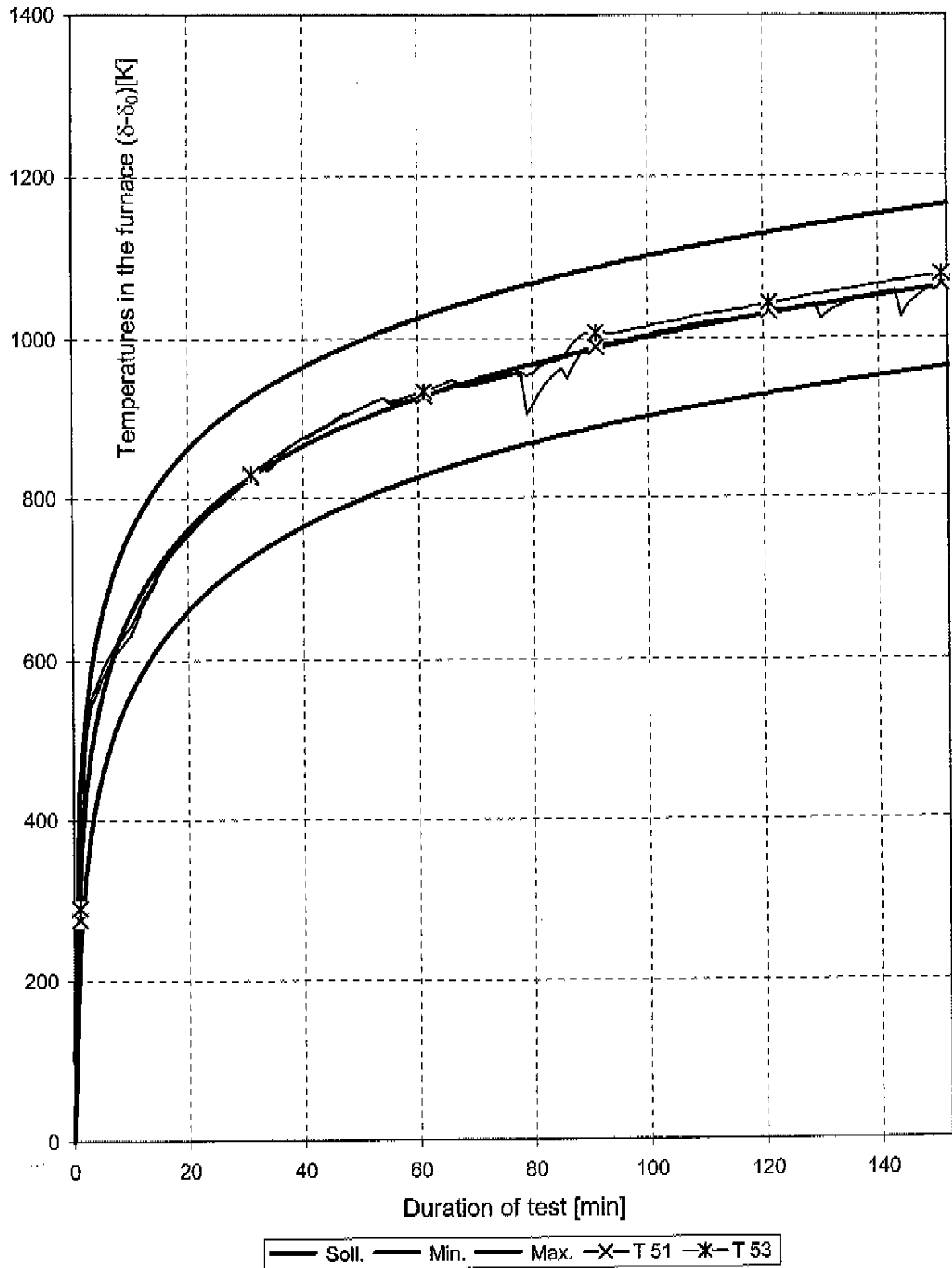
| Anchor name            |                   | "Mungo Injektion system MIT 600 RE" |     |     |     |     |     |     |     |
|------------------------|-------------------|-------------------------------------|-----|-----|-----|-----|-----|-----|-----|
|                        |                   | M8                                  | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
| Nominal drill diameter | $d_0$ [ mm ]      | 10                                  | 12  | 14  | 18  | 24  | 28  | 32  | 35  |
| Depth of borehole      | $h_0$ [ mm ]      | 80                                  | 90  | 110 | 125 | 170 | 210 | 250 | 280 |
| Minimum set depth      | $h_{ef}$ [ mm ]   | 80                                  | 90  | 110 | 125 | 170 | 210 | 250 | 280 |
| Min. member thickness  | $h_{min}$ [ mm ]  | 110                                 | 120 | 140 | 160 | 220 | 260 | 304 | 340 |
| Torque                 | $T_{inst}$ [ Nm ] | 10                                  | 20  | 40  | 80  | 120 | 160 | 180 | 200 |

### Technical data

"Mungo Injektion system MIT 600 RE"

**Materialprüfanstalt für das Bauwesen**  
 Institut für Baustoffe, Massivbau und Brandschutz  
 der Technischen Universität Braunschweig

Annex 1.4 of  
 Test Report No.  
 (3589/342/09)-NB



$\delta_0 = 24 \text{ }^\circ\text{C}$

test date: 27.06.08

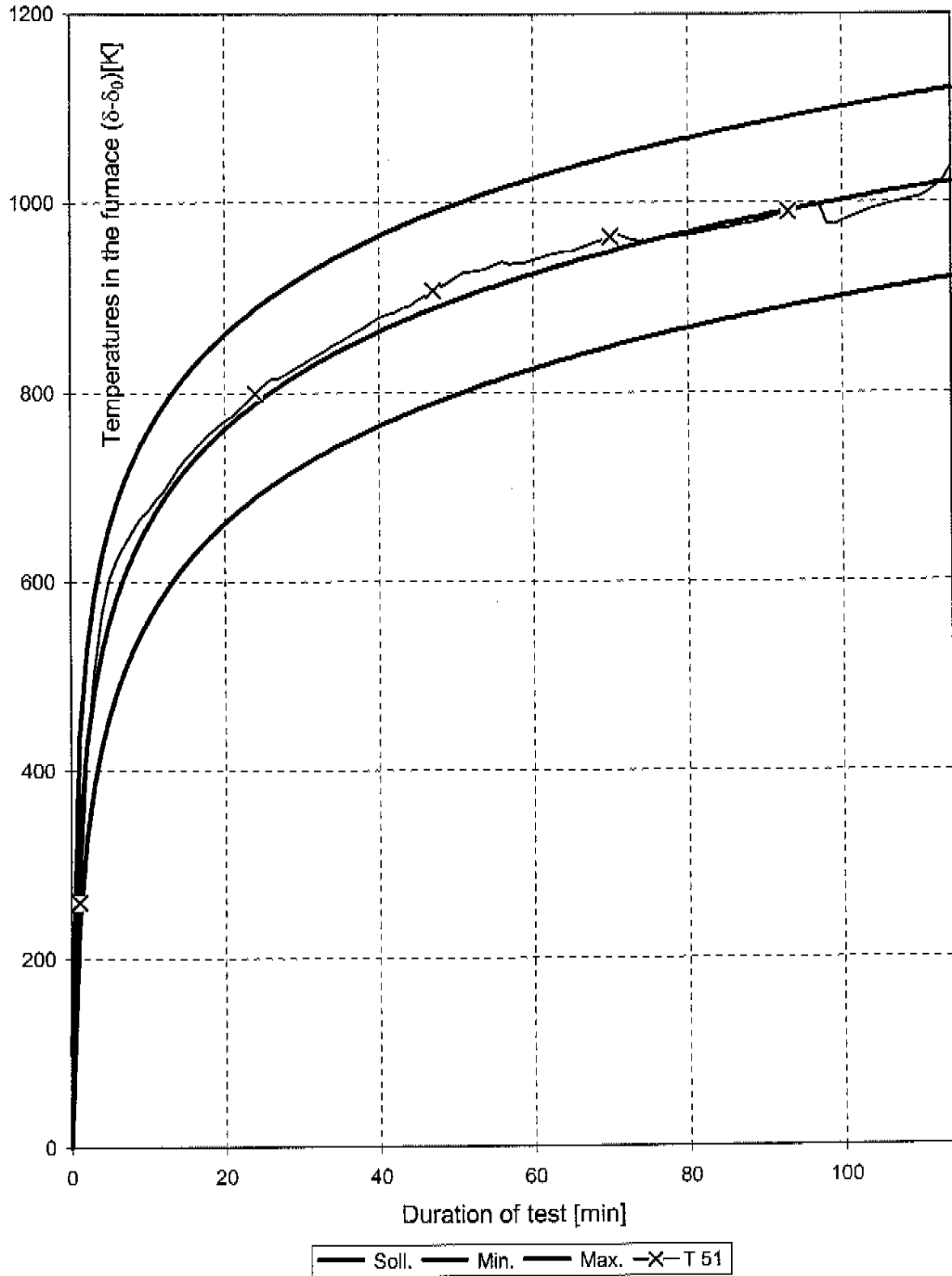
Temperatures in the furnace  
test 1

Materialprüfanstalt für das Bauwesen  
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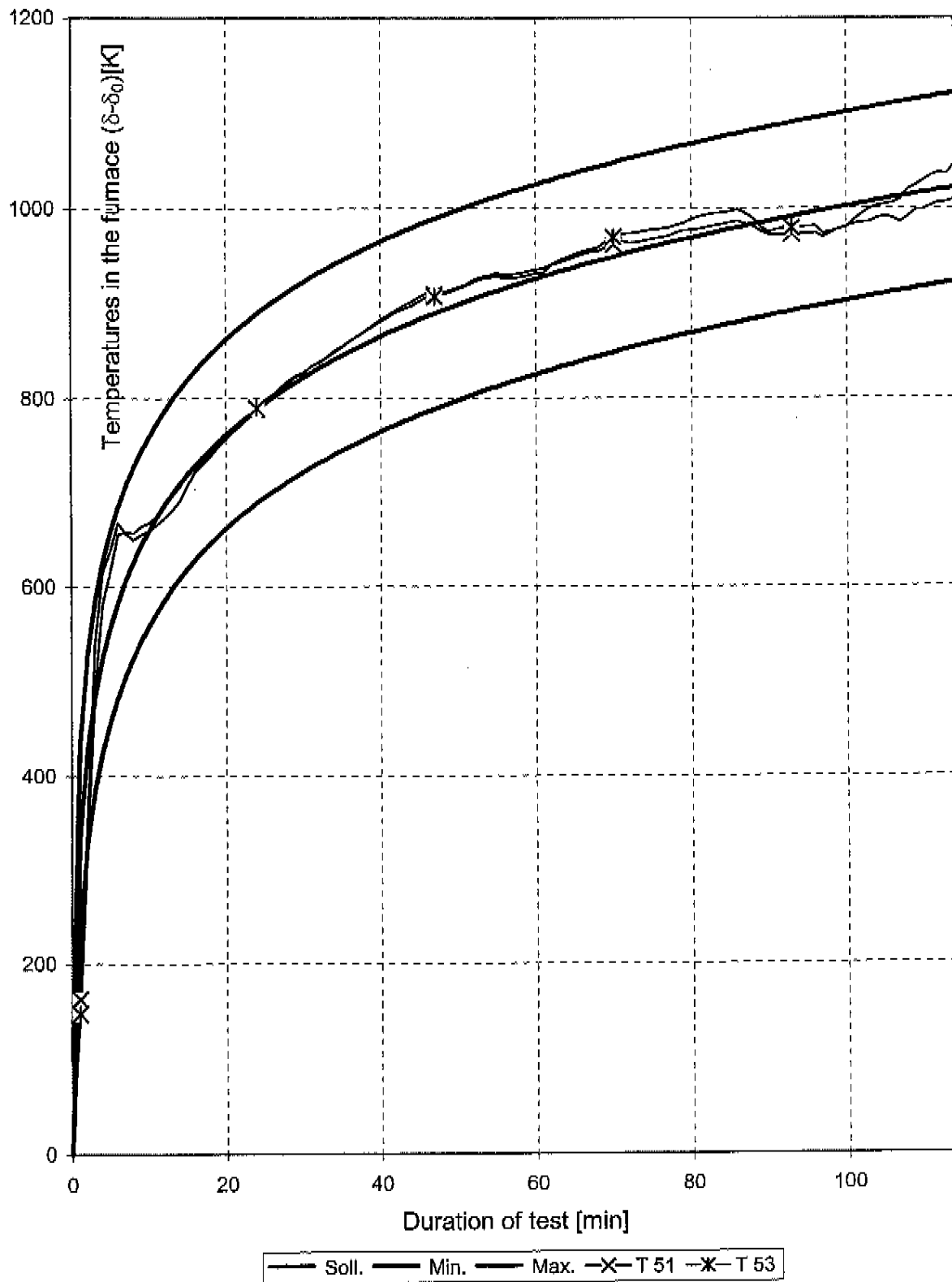
$\delta_0 = 21 \text{ }^\circ\text{C}$

test date: 27.08.08

Temperatures in the furnace  
test 2

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der Technischen Universität Braunschweig

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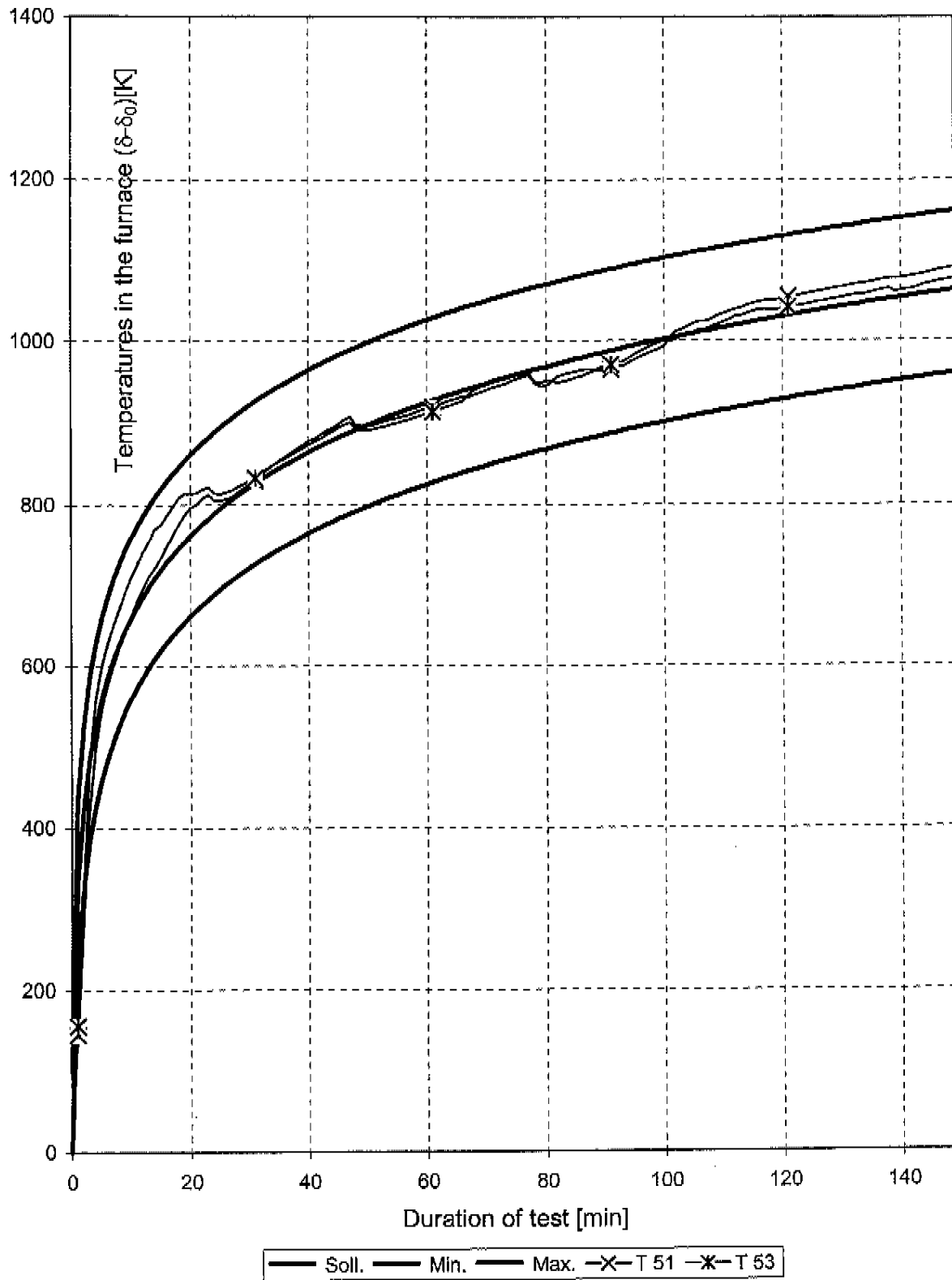
$\delta_0 = 21 \text{ }^\circ\text{C}$

test date: 01.09.08

Temperatures in the furnace  
test 3

Materialprüfanstalt für das Bauwesen  
Institut für Baustoffe, Massivbau und Brandschutz  
der Technischen Universität Braunschweig

Annex 4.1 of  
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$\delta_0 = 18 \text{ }^\circ\text{C}$

test date: 30.09.08

Temperatures in the furnace  
test 4

Materialprüfanstalt für das Bauwesen  
Institut für Baustoffe, Massivbau und Brandschutz  
der Technischen Universität Braunschweig

Annex 5.1 of  
Test Report  
No. (3589/342/09)-NB

**Companion Sheet to Test Report****- Translation -**

Document No.: (3589/342/09) – NB dd. 06/11/2009

Client: Mungo Befestigungstechnik AG  
Bornfeldstrasse 2  
4603 Olten  
Schweiz

Order date: 04/08/2009

Order Ref.: -

Order received: 04/08/2009

Subject: "Mungo Injection system MIT 600 RE" bonded anchors,  
placed in non-cracked RC members and subjected to  
centric tension loads, to be tested and evaluated in  
connection with anchor rods (dimensions M8 to M30) for  
their reaction to fire to determine their fire resistance time  
for one-sided fire exposure

Test basis: DIN EN 1363-1 : 1999-10

Test material received: 11/06/2009

Sampling: Sampling information is not available to the Testing  
House.

Test material marking: None

Test date: 27/06/2008, 27/08/2008, 01/09/2008 and 30/09/2008

Valid until: 07 January 2014



This Companion Sheet consist of 4 pages, incl. cover sheet.

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## **1 Background and general statement**

Under the order placed with the Testing House, a Test Report was to be drawn up on the reaction to fire of “Mungo Injection system MIT 600 RE” bonded anchors, which are subjected to centric tension and tested for steel failure / bonding failure on the basis of section 2.3 of TR 020 : 2004-05, when exposed to a fire in compliance with DIN EN 1363-1 : 1999-10 to determine their fire resistance time.

Related documents:

- (1) DIN EN 1363-1 : 1999-10, Fire resistance tests - Part 1: General requirements,
- (2) EOTA Technical Report TR 020 : 2004-05 - Evaluation of anchorages in concrete concerning resistance to fire,
- (3) “Mungo Injection system MIT 600 RE”, European Technical Approval ETA-09/0340 of 23-10-2009, issued by DIBt, Berlin.

Using the results achieved in the fire test, the “Mungo Injection system MIT 600 RE” bonded anchors were to be examined and evaluated respecting requirements (steel failure, pullout) specified in EOTA Technical Report TR 020 : 2004-05.

## **2 Proposed rating for the “Mungo Injection system MIT 600 RE” bonded anchors (dimensions M8 to M30) in connection with anchor rods made from electrogalvanised steel (strength class 5.6)**

Using the test results achieved for “Mungo Injection system MIT 600 RE” bonded anchors made from electrogalvanised steel (strength class 5.6) as a basis, fire resistance periods are proposed for the “Mungo Injection system MIT 600 RE” bonded anchors (dimensions M8 to M30) made from electrogalvanised steel (strength class 5.6, 5.8 and 8.8) as a function of the maximum centric tensile load as shown in table 2-1 below.

Based on the results achieved in the tests, and departing from the evaluation specifications in TR 020 : 2004-05, the ratings for “Mungo Injection system MIT 600 RE” bonded anchors made from galvanised steel have been increased with regard to the 30-minute fire resistance time.

Table 2-1-: Proposed rating for “Mungo Injection system MIT 600 RE” bonded anchors (dimensions M8 – M30) made from electrogalvanised steel, regarding their fire resistance times as a function of stress  $\sigma_s$  when exposed to centric tensile loads, and as a function of the minimum set depth

| Designation                            | “Mungo Injection system MIT 600 RE” bonded anchors |      |      |      |       |       |       |       |
|--|--|------|------|------|-------|-------|-------|-------|
| Fire resistance time<br>$t_u$<br>[min] | Maximum tensile load <sup>1)</sup>                 |      |      |      |       |       |       |       |
|  | F<br>[kN]  |      |      |      |       |       |       |       |
|  | M8   | M10  | M12  | M16  | M20   | M24   | M27   | M30   |
| Minimum set depth [mm]                 | 80   | 90   | 110  | 125  | 170   | 210   | 250   | 280   |
| 30                                     | 0.90   | 3.20 | 4.20 | 8.25 | 17.25 | 24.85 | 32.30 | 39.50 |
| 60                                     | 0.50   | 1.80 | 2.30 | 5.30 | 10.20 | 14.75 | 19.15 | 23.40 |
| 90                                     | 0.30   | 1.10 | 1.40 | 3.80 | 6.70  | 9.70  | 12.60 | 15.40 |
| 120                                    | 0.20   | 0.75 | 0.90 | 3.00 | 5.00  | 7.20  | 9.30  | 11.35 |

<sup>1)</sup> Loads resulting from European Technical Approval ETA-09/0340 may be decisive for the service condition.

### 3 Proposed rating for “Mungo Injection system MIT 600 RE” bonded anchors (dimensions M8 – M30) in connection with anchor rods made from stainless steel

Starting from the results achieved in the tests, the same characteristic tensile stresses (cf. table 2-1) are recommended for the “Mungo Injection system MIT 600 RE” bonded anchors, when adequate anchor rods and nuts made from stainless steel (material No. 1.4401 (A4) and 1.4571 (A5), 1.4529 (HCR) strength class 50 and 70, respectively) are used.

## 4 Annotations

- 4.1** This Test Report does not replace the required building code attestation (General Building Code Test Certificate - abP; National Technical Approval - abZ, ETA). It should, in particular, be noted that the fire load density values of "Mungo Injection system MIT 600 RE" bonded anchors can be regulated by European Technical Approvals.
- 4.2** The above evaluation shall only apply to the tested "Mungo Injection system MIT 600 RE" bonded anchors, due consideration being given to the boundary conditions shown in the technical annexes attached to this Test Report and/or the technical data sheets of Mungo Befestigungstechnik AG.
- 4.3** The "Mungo Injection system MIT 600 RE" bonded anchors may be used for anchoring applications in non-cracked reinforced concrete (strength class C20/25 as a minimum and C50/60 as a maximum) when primarily subjected to static loads.
- 4.4** The evaluation shall only apply in connection with members made from reinforced concrete, which can as a minimum be classified under the same fire resistance class as that of the anchors.
- 4.5** The validity of the Test Report will expire on 07 January 2014.

*Rohling*  
ORR Dr.-Ing. Rohling  
Head of Testing Laboratory



*i.A. Bollmohr*  
Dipl.-Ing. Bollmohr  
Engineer in charge

Braunschweig, dated 06 November 2009