

## Test Report -English Translation-

**Document number:** (3392/8845)-CM dated 03-03-2006

**Client:** Henkel KGaA  
Henkelstraße 67  
D 40589 Düsseldorf

**Order dated:** 01-08-2005

**Order reference:** Mr. Spratte

**Orders received:** 08-08-2005

**Subject:** Test and evaluation of Henkel injection adhesive anchors



### Henkel Injection Anchor Pattex CF900

(dimensions M8 to M20) in connection with anchor rods made of zinc-plated steel (strength class 5.8), set in the tension zone of reinforced concrete floor sections and subjected to centric applied tensile loads, of their fire behaviour to determine their fire resistance time

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

**Samples received:** 34th CW of 2001

**Sampling:** The Testing House does not have any information indicating official sampling.

**Marking:** none

**Tested on:** 34th and 35th CW of 2001

**Validity to:** 20-12-2007

This Test Report consists of 7 pages incl. cover and 6 annexes.

The Test Report No. (3392/8845)-CM dated 03-03-2006 does not replace a General Building Code Test Certificate (abZ, abP, ETA) according to the German Laender Building Regulations.

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## 1 General

As ordered a Test Report for the fire behaviour (concerning steel failure or pull-out) of centric tensile loaded Henkel Injection Anchor Pattex CF900 (dimensions M8 to M20) in connection with anchor rods made of zinc-plated steel (strength class 5.8) when exposed to one-side fire in accordance to DIN EN 1363-1 : 1999-10 to determine their fire resistance time, should be compiled.

basis:

- (1) DIN EN 1363-1 : 1999-10.
- (2) Henkel Injection Anchor Pattex CF900 with anchor rods, zinc-plated; european technical approval No. ETA 05-0133 dated 19-05-2005, issued by DIBt, Berlin.
- (3) The Test Report No. (3392/8845)-CM dated 03-03-2006 is a transfer of Test Report No. (3494/2601)-Nau dated 20-12-2001 and as per statement of the client is identical with the evaluated anchors.

## 2 Description of evaluated test arrangement

The Henkel Injection Anchor Pattex CF900 is a bonded anchor System (injection anchor) with anchor rods made of zinc-plated steel (strength class 5.8), that may be used for anchorages to static loadings in non-cracked reinforced and unreinforced normal weight concrete of strength class  $\geq C20/25$  and  $\leq C50/60$ .

The Henkel Injection Anchor Pattex CF900 consists of the two-component injection mortar an anchor rod with a hexagonal nut with washer. The injection mortar consists of styrene-free vinylester resin as well silica sand and hardener that are filled in a two camber cartridge and is only being merged in the mixing nozzle where it then reacts. The anchor rods, washers and nuts were made of zinc-plated steel (strength class 5.8).

The use of Henkel Injection Anchor Pattex CF900 is regulated by technical data sheets of the client.

Any other structural data of the Henkel Injection Anchor Pattex CF900 are to be seen at annex 1.3 of this Test Report.

A total of 15 Henkel Injection Anchors Pattex CF900 were placed into the tension zone of reinforced floor sections, strength class C20/25, that concurrently built the space enclosure of the furnace and tested under centric tension for their fire behaviour in accordance with DIN EN 1363-1 : 1999-10 to determine their fire resistance time.

The installation of Henkel Injection Anchors Pattex CF900 was made in accordance with technical data sheets of the client.

The centric tensile loading to the Henkel Injection Anchors Pattex CF900 was applied by external loading systems and encased steel elements (dead loads) of corresponding weight, which were suspended by unprotected steel adapters and tension rods (length of  $l \leq 500$  mm).

Any other constructive details concerning the installation situation of the Henkel Injection Anchors Pattex CF900 are to be seen at annex 1.2 of this Test Report.

### **3 Test arrangement and accomplishment**

The fire tests of Henkel Injection Anchors Pattex CF900 were carried out in a small-scale furnace with the interior dimensions  $w \times d \times h = 1000 \text{ mm} \times 1500 \text{ mm} \times 1500 \text{ mm}$ . The horizontal space enclosure was built by reinforced concrete slabs of strength class C20/25. In their tension zone (non-cracked concrete) the Henkel Injection Anchors Pattex CF900 were placed.

Fire exposure in the furnace was proceeded as to the standard temperature-time curve (ETK) as detailed in DIN EN 1363-1 : 1999-10, section 5.1.1. Two plate thermometers with measuring points made from Ni-Cr/Ni-Al wire (type K), 1.0 mm in diameter, as detailed in DIN EN 1363-1 : 1999-10, section 4.5.1.1, were used to measure the temperatures in the furnace. For a graphical representation of the temperatures measured in the furnace during the fire test, reference is made to annexes 2.1 to 2.3.

Deviant to TR 020 : 2004-05 the tests were carried out without air gap.

### **4 Tests results, evaluation and conclusions**

In the period of 34th and 35th CW of 2005 15 Henkel Injection Anchors Pattex CF900 (dimensions M8 to M20) with anchor rods made of zinc-plated steel (strength class 5.8) were placed into the tension zone of reinforced floor sections, strength class C20/25, and tested under centric tension for

their fire behaviour in accordance with DIN EN 1363-1 : 1999-10 to determine their fire resistance time.

The test results of the Henkel Injection Anchors Pattex CF900 are listed in table 4-1 below, which also show the causes of failure.

**table 4-1: Essential test results of Henkel Injection Anchors Pattex CF900 with anchor rods made of zinc-plated steel (strength class 5.8)**

| date of test | anchor size | Embedment depth<br>$h_{nom}^{1)}$<br>[ mm ] | load             |                 |                              |
|--------------|-------------|---|------------------|-----------------|------------------------------|
|              |             |   | act. N<br>[ kN ] | time<br>[ min ] | failure<br>cause             |
| 22-08-2001   | M8          | 80  | 0,80             | 97              | tear of thread <sup>2)</sup> |
|              |             |   | 1,50             | 49              | nut <sup>3)</sup>            |
| 27-08-2001   |             |   | 0,61             | 101             | pull-out <sup>4)</sup>       |
| 30-08-2001   |             |   | 0,40             | > 135           | w/o <sup>5)</sup>            |
| 22-08-2001   | M10         | 90  | 2,22             | 73              | tear of thread <sup>2)</sup> |
|              |             |   | 1,50             | 89              | tear of thread <sup>2)</sup> |
| 27-08-2001   |             |   | 4,50             | 38              | nut <sup>3)</sup>            |
| 30-08-2001   |             |   | 1,20             | 117             | tear of thread <sup>2)</sup> |
| 22-08-2001   | M12         | 110   | 5,00             | 47              | nut <sup>3)</sup>            |
| 27-08-2001   |             |   | 2,13             | 94              | tear of thread <sup>2)</sup> |
| 30-08-2001   |             |   | 1,61             | 126             | tear of thread <sup>2)</sup> |
| 22-08-2001   | M16         | 125   | 9,00             | 50              | nut <sup>3)</sup>            |
| 27-08-2001   |             |   | 4,50             | 126             | pull-out <sup>4)</sup>       |
| 30-08-2001   | M20         | 170   | 6,50             | 103             | nut <sup>3)</sup>            |
| 30-08-2001   |             |   | 11,00            | 57              | nut <sup>3)</sup>            |

1) The embedment depth  $h_{nom}$  is identical with the minimum embedment depth in the technical data sheets of the client.

2) The anchor rod tore near above the nut.

3) The nut was pulled off the thread.

4) The anchor rod was pulled out of base material.

5) The anchor was stuck after the test with act. N in the base material.

Based on the test results and the evaluation of the causes of failure the Henkel Injection Anchors Pattex CF900 (dimensions M8 to M20) in connection with anchor rods made of zinc-plated steel (strength class 5.8), set in normal weight concrete of strength class  $\geq C 20/25$ , can get fire resistance times against the maximum centric tensile loading, as seen in figure 4-1 and in table 4-2 below.

figure 4-1: graphic representation of test results of (dimensions M8 to M20) in connection with anchor rods made of zinc-plated steel (strength class 5.8).

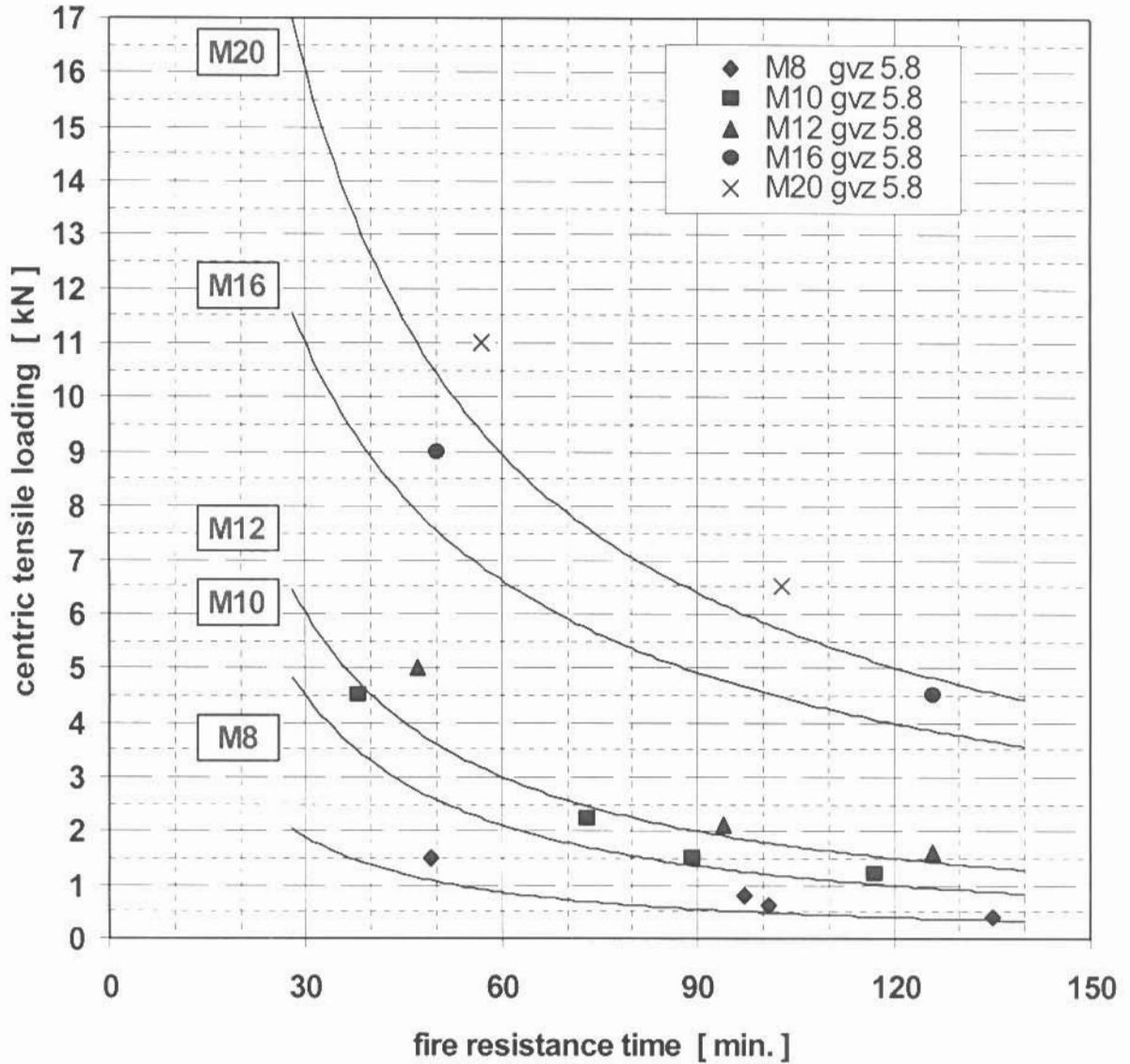


table 4-2: Design proposal for Henkel Injection Anchors Pattex CF900 with styrene-free vinyl ester in connection anchor rods (dimensions M8 to M20) made of zinc-plated steel (strength class 5.8) against tensile load

| Anchor size | fire resistance time / maximum tensile loading <sup>1)</sup> |                      |                      |                       |
|-------------|--|----------------------|----------------------|-----------------------|
|             | 30<br>max. F<br>[kN]   | 60<br>max. F<br>[kN] | 90<br>max. F<br>[kN] | 120<br>max. F<br>[kN] |
| M8          | ≤ 1,90   | ≤ 0,85               | ≤ 0,55               | ≤ 0,40                |
| M10         | ≤ 4,50   | ≤ 2,10               | ≤ 1,35               | ≤ 1,00                |
| M12         | ≤ 6,00   | ≤ 3,00               | ≤ 2,00               | ≤ 1,50                |
| M16         | ≤ 11,00  | ≤ 6,60               | ≤ 4,90               | ≤ 4,00                |
| M20         | ≤ 16,00  | ≤ 9,00               | ≤ 6,40               | ≤ 5,00                |

<sup>1)</sup> For the use loads resulting from the european technical approval No. ETA 05-0133 dated 19-05-2005 may be decisive.

## 5 Annotations

The Test Report No. (3392/8845)-CM dated 03-03-2006 does not replace a General Building Code Test Certificate (abZ, abP, ETA) acc. to the Laender Building Regulations. In particular is to be kept in mind that values of fire loads for injection adhesive anchors in the future could be regulated by European technical approvals.

The Henkel Injection Anchors Pattex CF900 may be used for anchorages to static loadings in non-cracked reinforced normal weight concrete of strength class  $\geq C20/25$  and  $\leq C50/60$ .

The preceding evaluation only applies to Henkel Injection Anchors Pattex CF900 (dimensions M8 to M20) made of zinc-plated steel (strength class 5.8) in consideration of the technical data sheets of the clients and the ancillary conditions of the european technical approval No. ETA 05-0133 dated 19-05-2005.

The assessment shall only apply to reinforced concrete members whose fire resistance rating shall as a minimum comply with the fire resistance time of the anchors.

The validity of the Test Report No. (3392/8845)-CM will expire on 20-12-2007.

*Rohling*

ORR Dr.-Ing. Rohling  
Head of the Testing House



*A. Maertins*

by order  
Dipl.-Ing. Maertins  
engineer in charge

Braunschweig, dated 03-03-2006

## **Index of annexes**

Index of 6 annexes to Test Report No. (3392/8845)-CM

Anlage 1.1 : design of test equipment

Anlage 1.2 : installation situation of the Henkel Injection Anchor Pattex CF900

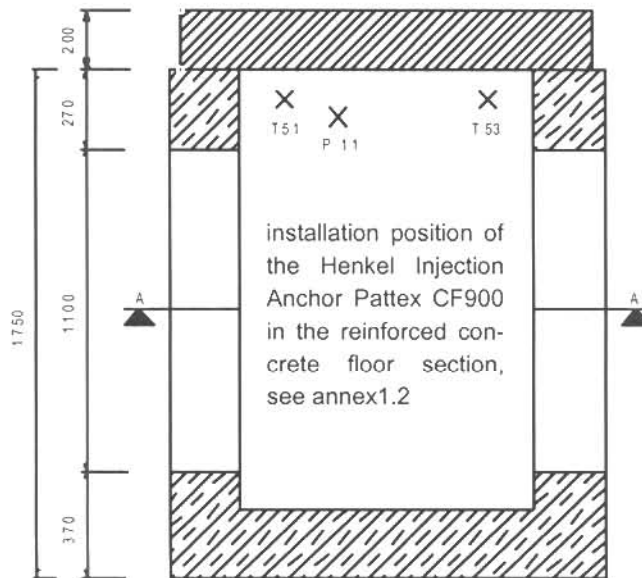
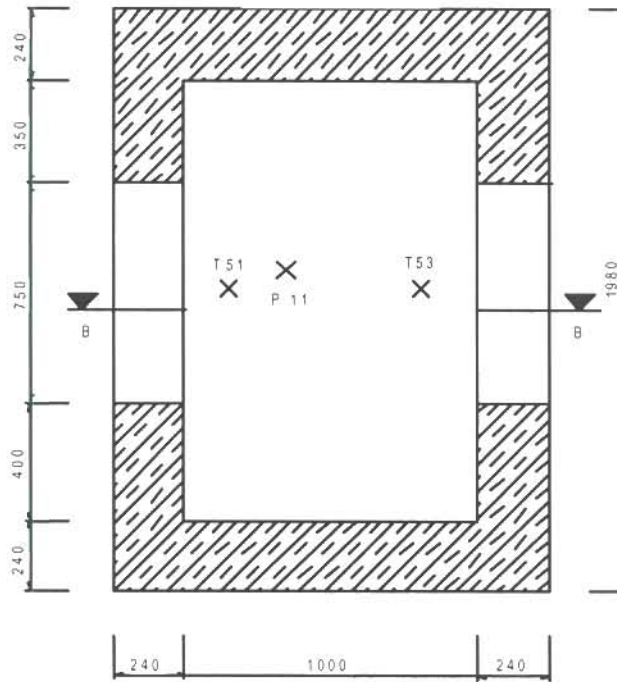
Anlage 1.3 : technical data of the Henkel Injection Anchor Pattex CF900

Anlage 2.1 : temperatures in the furnace, test 1

Anlage 2.2 : temperatures in the furnace, test 2

Anlage 2.3 : temperatures in the furnace, test 3

furnace: chamber 6



T 51 and T 53 measuring points of furnace temperature, thermocouples with measuring points made of Ni-Cr/Ni-Al-wires (type K)

dimensions in mm

**arrangement and test set-up**

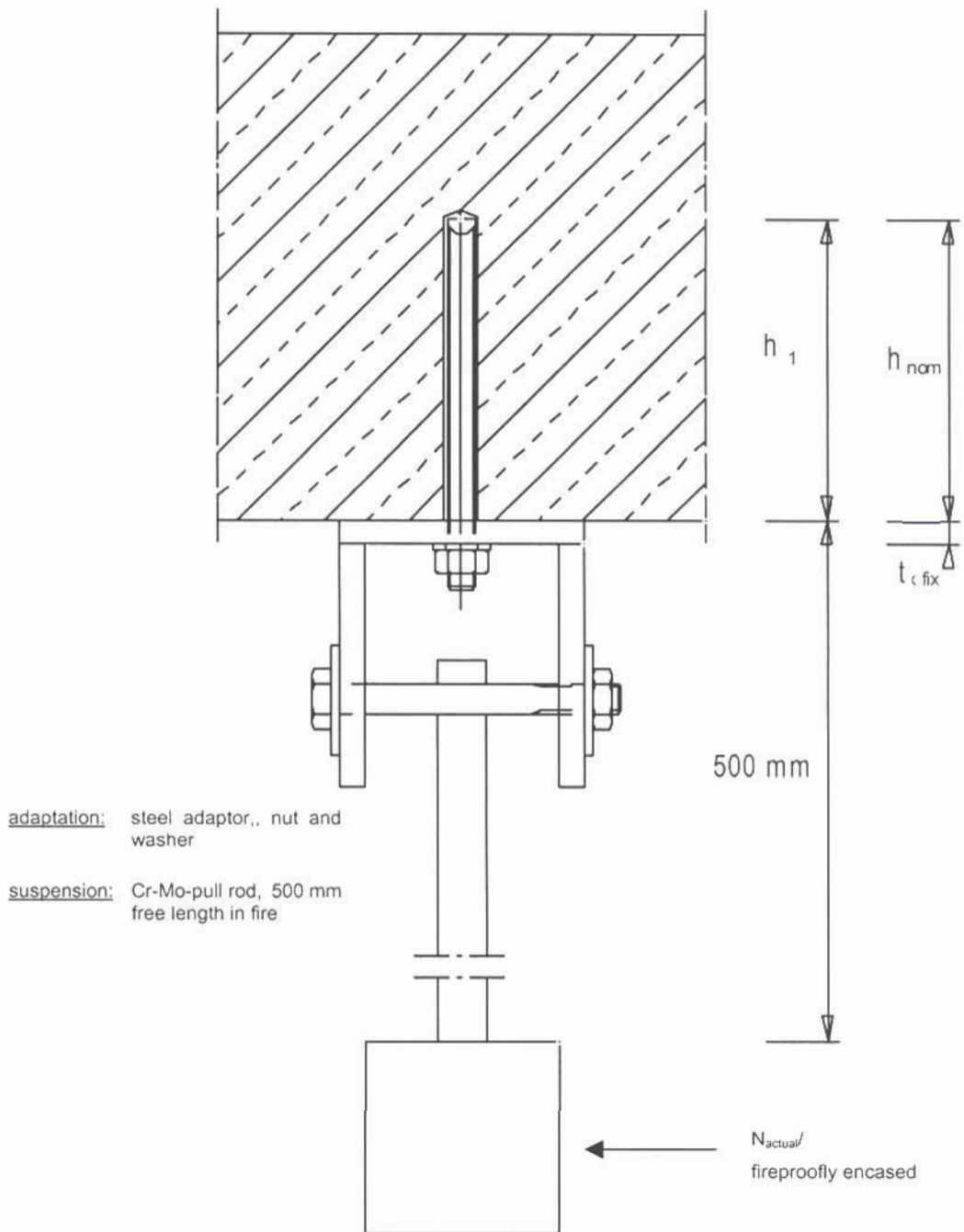
design of test equipment

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annex 1.1 to  
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Installation situation of the Henkel Injection Anchor Pattex CF900

Reinforced concrete slab /  $t \geq 160\text{mm}$  / C20/25

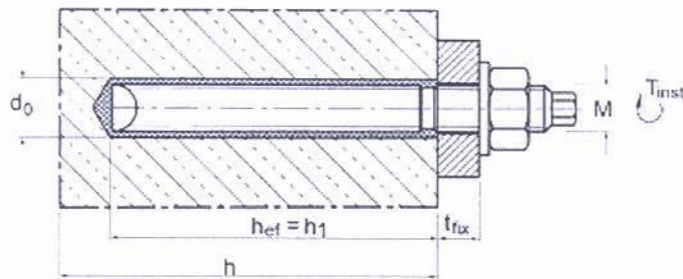


Installation situation of sample

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## Henkel Injection Anchor Pattex CF900



### materials

| description      | material   |
|------------------|--|
| injection mortar | silica sand, styrene-free vinylester resin and hardener        |
| anchor rod       | steel of strength class 5.8, zinc-plated, $\geq 5 \mu\text{m}$ |
| washer           | steel in acc. to DIN 50 961                                    |
| hexagonal nut    | steel of strength class 8 in acc. to DIN EN 20 898-2           |

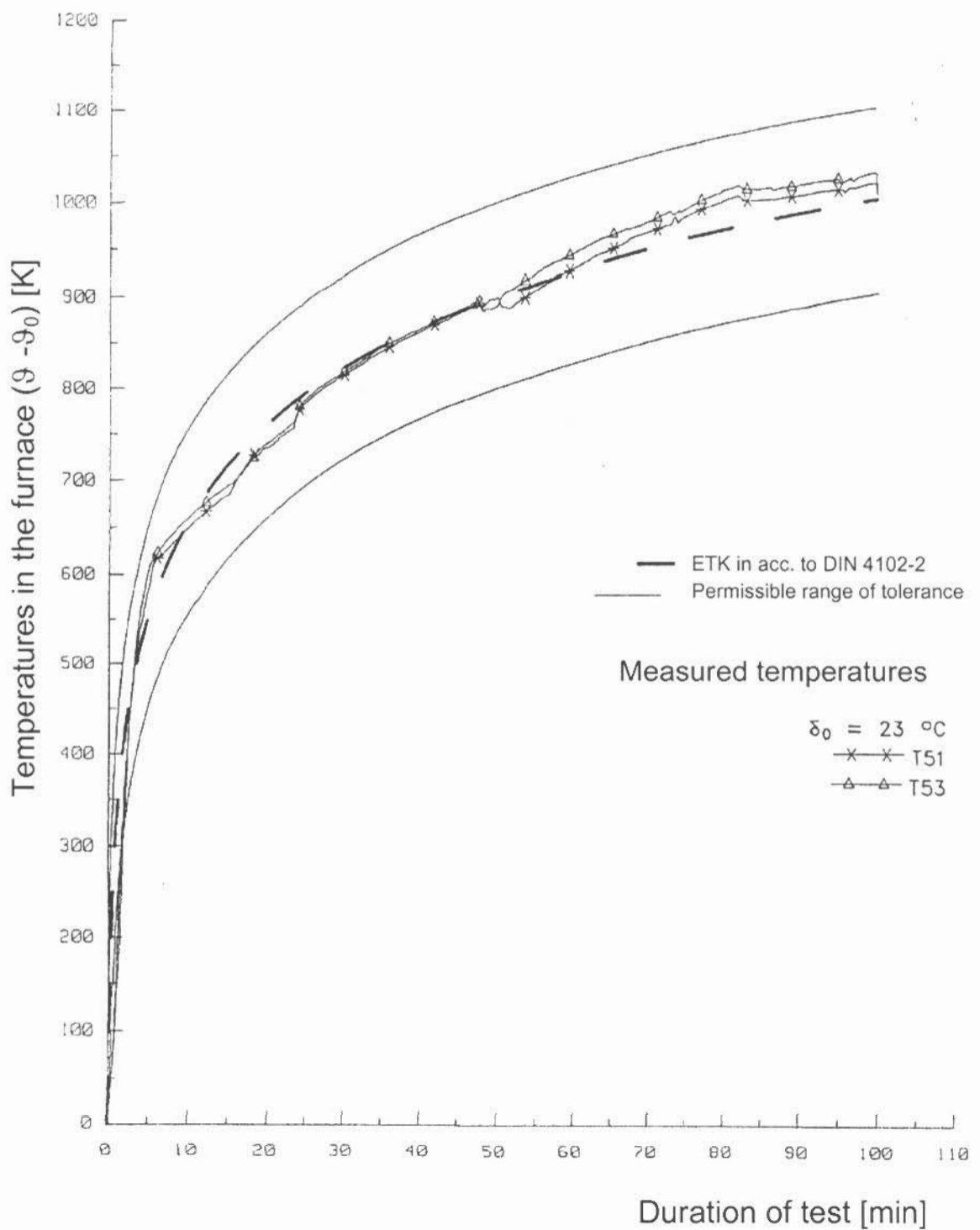
### mechanical properties

| description of anchor         |                          | Henkel Injection Anchor Pattex CF900<br>with styrene-free vinylester resin |     |     |     |     |
|-------------------------------|--------------------------|--|-----|-----|-----|-----|
|                               |                          | M8   | M10 | M12 | M16 | M20 |
| anchor size                   |                          |  |     |     |     |     |
| nominal diameter of drill bit | $d_0$ [ mm ]             | 10   | 12  | 14  | 18  | 24  |
| effective anchorage depth     | $h_1$ [ mm ]             | 80   | 90  | 110 | 125 | 170 |
| Min. hole depth               | $h_{\text{nom}}$ [ mm ]  | 80   | 90  | 110 | 125 | 170 |
| min. base material thickness  | $h_{\text{min}}$ [ mm ]  | 130  | 150 | 180 | 220 | 280 |
| max. tightening torque        | $T_{\text{inst}}$ [ Nm ] | 10   | 20  | 40  | 80  | 150 |

**Technical data**  
Henkel Injection Anchor Pattex CF900

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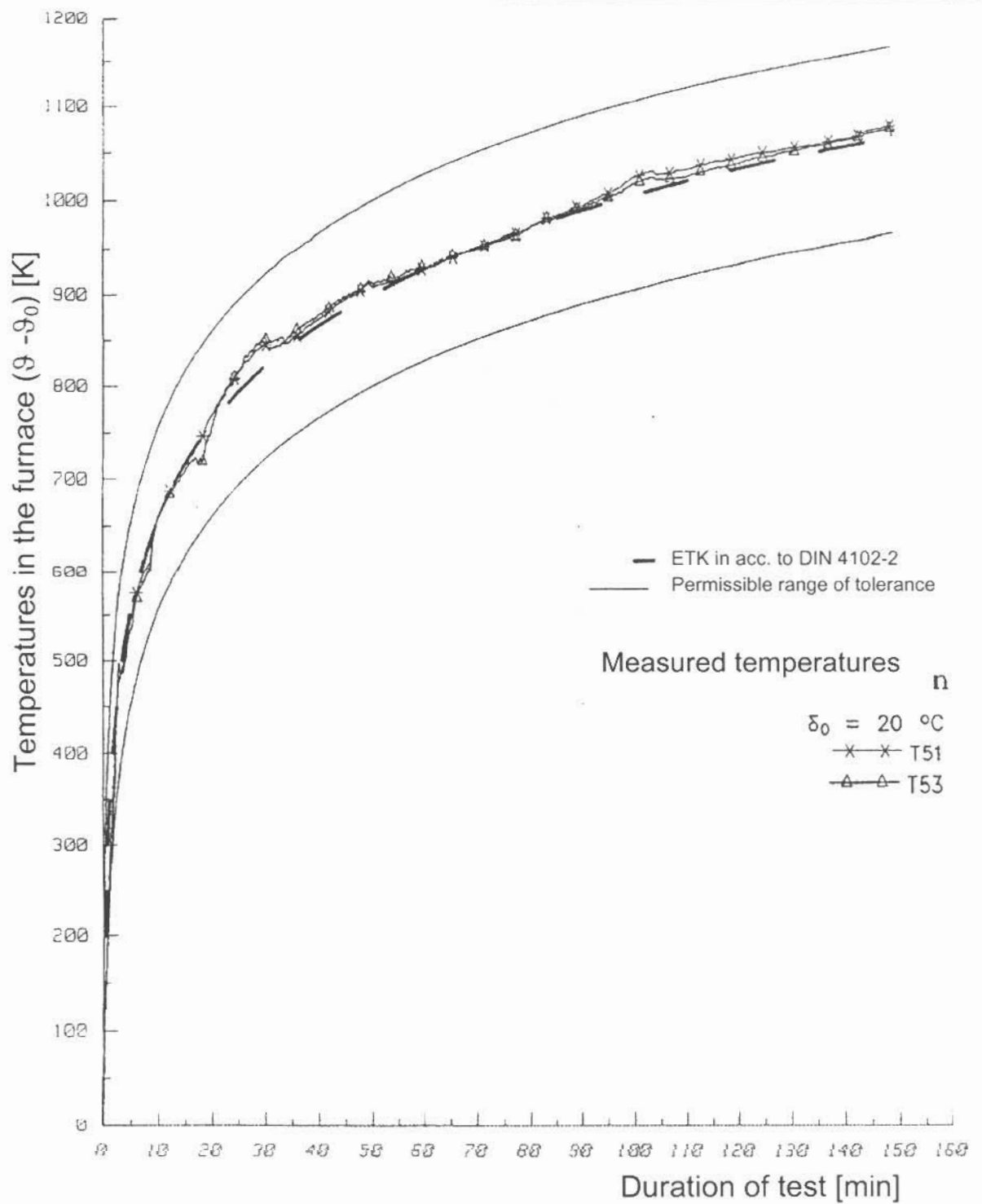
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**Temperatures in the furnace**  
 (test dated 08-22-2001)

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annex 2.1 to  
 Test Report  
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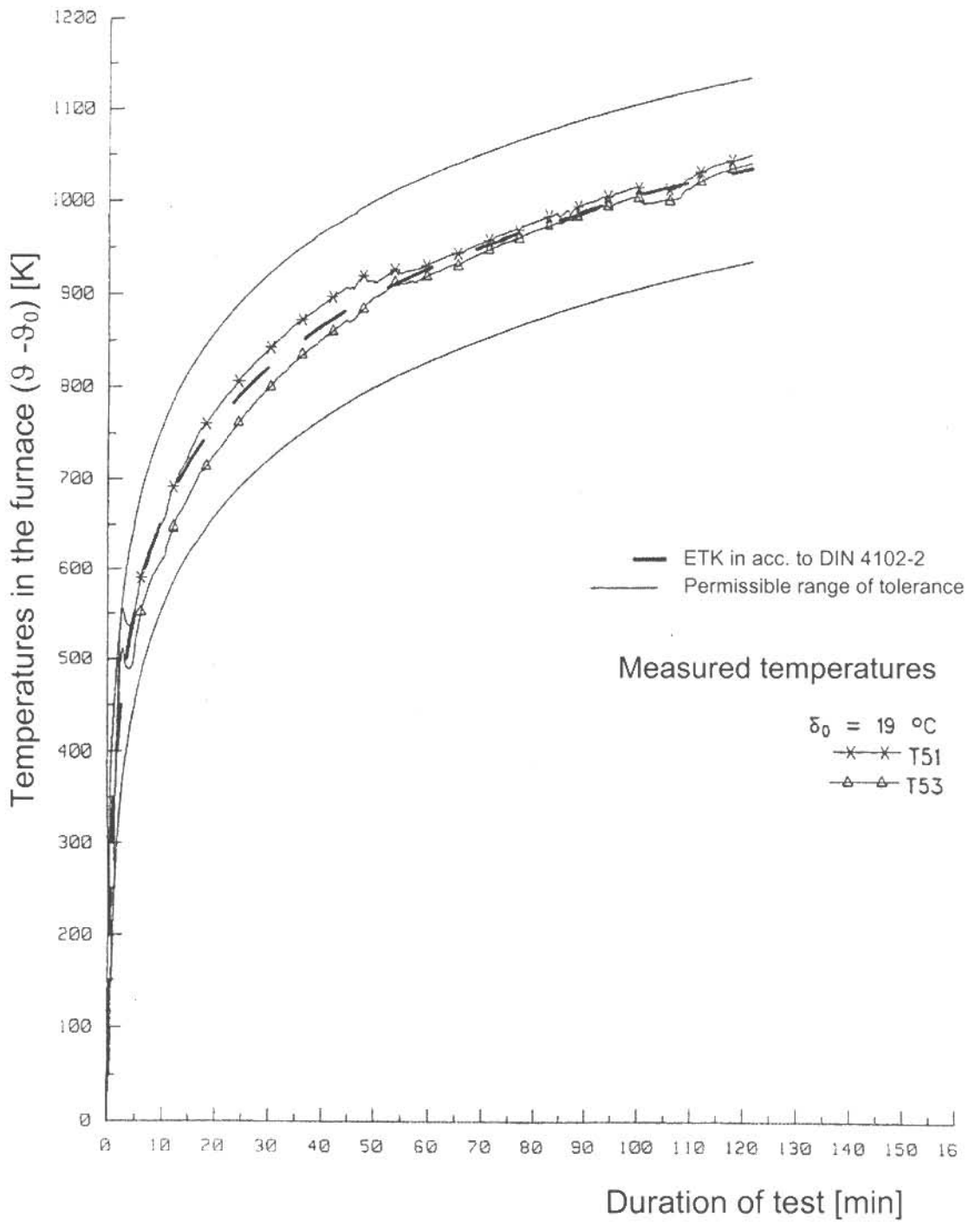


Temperatures in the furnace  
 (test dated 08-27-2001)

annex 2.2 to  
 Test Report

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No. (3392/8845)-CM



**Temperatures in the furnace**  
 (test dated 08-30-2001)

annex 2.3 to  
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