Institut für Baustoffe, Massivbau und Brandschutz
Materialprüfanstalt für das Bauwesen
TU BRAUNSCHWEIG

# Test Report

This document is the translated version of Short report to Test Report No. 1101/505/18 – dated 06/06/2018. The legally binding text is the aforementioned German Short report to Test Report.

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|---|---|
| Document number: | (1101/505/18) - short – Bod of 06/06/2018 |
| Client: | medifa hygienic rooms GmbH<br>Heinrich-Hertz-Straße 4<br>76470 Ötigheim, Germany |
| Order date: | 26/01/2018 |
| Order ref.: | - |
| Order received: | 26/01/2018 |
| Subject of the order: | Testing a wall of 3.50 m x 3.60 m, type MediFa, Bending strength and fall protection pursuant to DIN 4103-1 and with reference to ETAG 003 |
| Test basis: | DIN 4103-1:2015, DIN 18183-1:2018<br>ETAG 003:2013 |
| Samples received: | Calendar week 20, 2018 |
| Sampling: | By the client |
| Test material marking: | By MPA Braunschweig |
| Test date: | Calendar week 20, 2018 |

Materialprüfanstalt f. d. Bauwesen Braunschweig MPA BS 1

This short test report consists of 8 pages including the cover sheet.

# 1 Procedure

medifa hygienic rooms GmbH with headquarters in Ötigheim, Germany commissioned the MPA Braunschweig on 26/01/2018 with the test of a lightweight inner shaft wall made of metal profiles (60x30x2) and a one-sided panelling with stainless steel sheet laminated panels (t = 19 mm), construction method medifa. To do this, tests were conducted on a wall structure measuring $h_{Wall}$ = 3.00 m high ($h_{Raw\ ceiling}$ = 3.50 m) under consideration of design loads pursuant to DIN 4103-1:2015 and ETAG 003.

The various partial tests were carried out on 15/05/2018 at MPA Braunschweig, cf. also test report no. 1101/505/18 of MPA Braunschweig. Other relevancies, for example, noise and fire protection properties, are not considered in the calculations of this assessment report.

# 2 Literature

[1] DIN 4103 Part 1, Internal non-loadbearing partitions, June 2015.

[2] ETAG 003, Guideline for European Technical Approval for internal partition wall kits for use as non-loadbearing walls, Berlin, August 2013.

[3] Struck, Limberger: Die Energieübertragung auf leichte, nichttragende Bauteile, Mitteilungen Ibt 9, 1978. (available in German only)

[4] Research Report 204, Struck, Limberger: Der Glaskugelsack als Prüfkörper für Beanspruchungen durch weichen Stoß – eine erweiterte Modellvorstellung, Berlin, 1994 (available in German only).

# 3 Wall tests

## 3.1 General

The test specimen was built by the client in calendar week 20 of 2018 in the wall test rig at the MPA Braunschweig.

The wall structure is an inner partition wall with a height of $h_{Wall}$ = 3.20 m ($h_{Raw\ ceiling}$ = 3.50 m) and a width of $w_{Wall}$ = 3.60 m with a stud construction made of four metal sections (60 mm x 30 mm x 2 mm) and with a single-layer panelling on each side, made of laminated gypsum board panels (GKB) $d_{Panel,\ GKB,}$ = 18.0 mm, $d_{medifa,\ Panel,\ GKB}$= 19.0 mm (construction method: medifa).

The steel sections (H101-0001-01, 60x30x2) were screwed into metal U-shaped bottom rails (H101-0022 02) t = 2.0 mm thick at a centre distance of $e_b$ = 1.20 m. The U-shaped bottom rails were fastened to the bottom wooden plank (#16/16) of the wall test bench at a distance of e = 50 cm, using hexagon head screws (H422-0730, 8 x 40). The steel sections were screwed to the U-shaped bottom rail on each side using a self-tapping screw (H422-0240, 3.5 x 13).

The coated gypsum board panels were mounted onto the steel sections at a distance of approx. 45 cm (H422-02403, 3.5 x 13) using bolted mounting brackets (H102-0007-02). At the upper edge, the panels were held in place using a steel ceiling rail (H101-0008 01, t = 3 mm).

At the top edge, the wall was not fastened directly to the upper wooden plank (# 16/16). The upper transverse U-shaped rail (H101-0001-01, 60x30x2) was mounted using three suspending brackets at an angle of 45° (H101-0001-01, 60x30x2). These three angled suspending brackets were bolted tension and compression-resistant to the upper wooden plank (H422-0730, 8 x 40) and the cross bar of the wall (H422-0220, 4 x 4.8 x 19) at a distance of e = 1.0 m. Image 1 shows this type of design.

Image 1: Tension and compression-resistant assembly of the wall at the upper edge, using two angles and a steel section attached to the cross strut of the test stand

Image 2: Front view of the partition wall, the panel height of the wall is h = 3.00 m

The vertical steel sections had a length of L = 3.20 m. At this height, angles were used to bolt the cross bar to the vertical sections (hexagon drill screws, H422-0220, 4.8x19). The panelling had a maximum height of $h_{Wall}$ = 3.00 m. In addition, a horizontal steel ceiling rail (H101-0008 01, t = 3 mm) was mounted at the upper edge in order to finish the panelling. A drill screw (H422-0220, 4.8x19) was used to connect the rail with the vertical sections. Image 2 illustrates the setup.

The upper edge of the wall structure was not covered with a plank. This is representative for the use of these walls when installing suspended ceiling structures. The same applies to the oblique suspending brackets which were mounted at a distance of e = 1.0 m (H422-0730, 8 x 40, angle 135°, H101-001801).

The panelling was installed on one side, using a single layer. The vertical distance of the fasteners was e = 45 cm for the large panels. The panelling was screwed to the steel sections using mounting brackets (H102-0007 02) and self-tapping screws. The vertical and horizontal joints were sealed using an elastic joint tape.

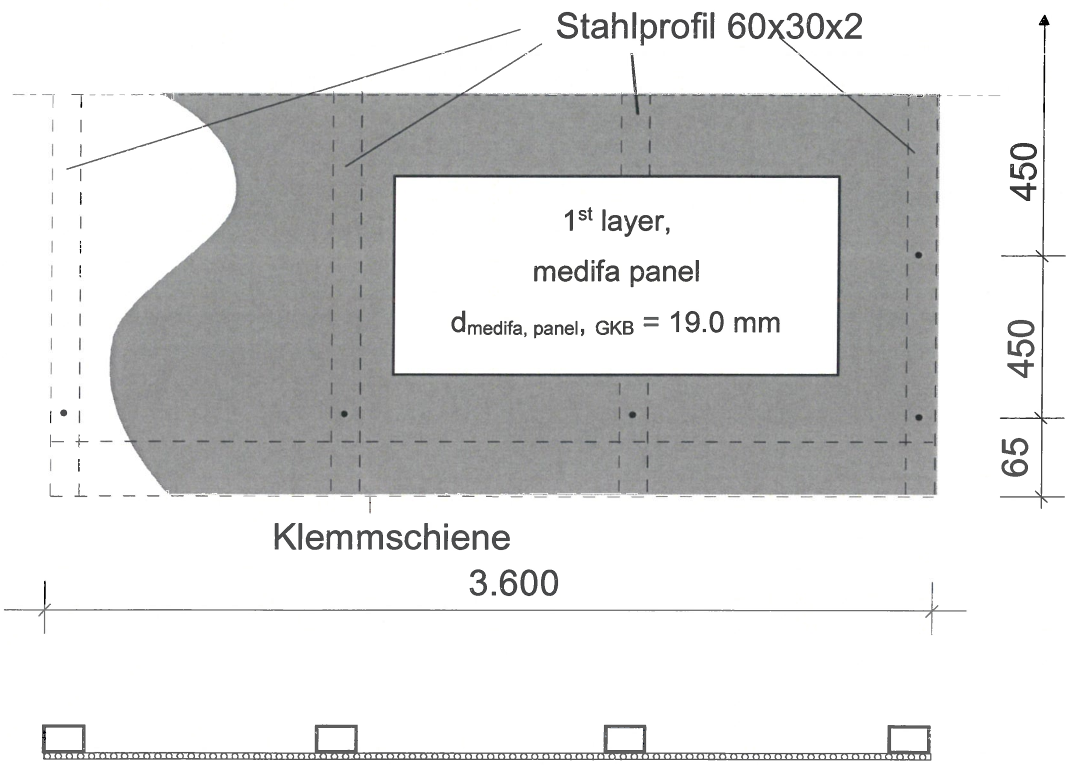


Image 3: Principle drawing and section of the wall structure's setup

## 3.2 Static test with strut load

The load was applied to the wall at $h_{Strut\ load}$ = 0.90 m. The maximum load was limited to $F_{Test}$ ≈ 5.4 kN. After reaching the maximum load of $F_{Test}$ ≈ 5.4 kN, the load was not increased any further. The load was introduced for a short period of time, after which the load applied to the test specimen was removed again. The test load of $F_{Test}$ ≈ 5.4 kN corresponds to the load pursuant to DIN 4103-1.

### 3.2.1 Testobservations

A bending test with a linear load application was conducted on the wall specimen (test name Roosy) pursuant to DIN 4103-1. The observations on the wall test were recorded during the experiment and photographed.

Table 1: Pressing forces, deformation and observations

| Test | Pressure [kN] | Displacement [mm] | Observations |
|---|---|---|---|
| **Roosy** | 1.8 | 6.1 | Load, installation area 1, no damage. |
| | 3.6 | 12.0 | Load, installation area 2, no damage. |
| | 5.57 | 19.2 | Load, load according to standard, no damage. |

## 3.3 Pendulum impact tests

Following the static pressure test, pendulum impact tests were also carried out on the same test specimen to demonstrate the soft impact on the panelling.

### 3.3.1 General

Pursuant to DIN 4103-1, sufficient resistance of the wall reacting to an impact load caused by a human body (soft impact) striking the wall must be demonstrated. Compliance with the following requirements is mandatory [1]:

a) the partition wall must not be torn apart from its attachments,
b) wall fragments that can cause serious physical injury must not fall to the ground,
c) the entire thickness of the partition wall must not be penetrated.

### 3.3.2 Wall tests using a soft impact

Following the partial test with the strut load, pendulum impact tests were subsequently carried out on the same partition wall in order to demonstrate the soft impact. The impact was carried out at a wall height of h = 1.50 m (with reference to ETAG 003).

During the first pendulum impact test, the drop height of the impactor (impactor's mass = 50 kg) used to test the partition wall – a single-ply was used on each side – was $h_{pendulum,1}$ = 0.24 m. The impacting pendulum energy in this experiment was $E_{Test,1}$ = 500 x 0.24 = 120 Nm.


Image 4: Test setup of the partition wall for the pendulum impact test, h = 1.50 m

Image 4 shows the test setup After the experiment, the wall structure was subject to a close visual inspection for damage. The test was repeated twice according to ETAG 003 using a pendulum energy of $E_{Test}$ = 120 Nm.

The pendulum height of the impactor (impact mass = 50 kg) at the next pendulum impact test was $h_{Pendulum,\ 2}$ = 40 cm. The acting pendulum energy in this experiment was $E_{Test,\ 2}$ = 500 x 0.40 = 200 Nm.

After the experiment, the wall structure was examined closely for damage. Subsequently, another pendulum impact test $h_{Pendulum,\ 3}$ = 1.15 m was carried out. In this experiment, the acting pendulum energy was $E_{test,\ 3}$ = 575 Nm. The implementation of the pendulum impact tests with indication of the impact points as well as the close visual inspection for damage after the test are shown in Table 2.

Table 2: Points of impact, drop heights and results for the pendulum impact tests

| Wall | Point of impact | Drop height [mm] | Result |
|---|---|---|---|
| Roosy | 1, h = 1.50 m, mullion no. 2 | 3 x 240 | No damage to the panelling and the metal sub-structure |
| | 1, h = 1.50 m, mullion no. 2 | 1 x 400 | No damage to the panelling and the metal sub-structure |
| | 2, h = 1.50 m, centre of panelling in area 1 | 3 x 240 | No damage to the panelling and the metal sub-structure |
| | 2, h = 1.50 m, centre of panelling in area 1 | 1 x 400 | In the upper panelling in area 1 on the left-hand side, 2 out of 5 mounting brackets are loosened. |

After each pendulum impact test, the wall was subject to a close visual inspection on the front and back. Any damage is listed in the 'Result' column.

The pendulum impact heights in Table 2 are taken from ETAG 003 for use class II.

The upper panelling in the first area was replaced. Further pendulum impact tests were carried out pursuant to DIN 4103-1. The implementation of the pendulum impact tests with details of the impact points as well as the close visual examination after the test are summarized in Table 3 below.

Table 3: Points of impact, drop heights and results for the pendulum impact tests

| Wall | Point of impact | Drop height [mm] | Result |
|---|---|---|---|
| Roosy | 3, h = 1.60 m, mullion no. 2 | 1 x 1,150 | No damage to the panelling and the metal sub-structure Permanent deformation in the metal mullion Δw = 3 mm. |
| | 4, h = 1.15 m, centre of panelling in area 1, installation panel | 1 x 700 | Breakage of the gypsum board panel (GKB) in the installation panel. Gypsum plasterboard pieces did not fall to the ground since the gypsum plasterboard is glued to the stainless steel panelling. Permanent deformation in the panelling Δw = 15 mm. |

After each pendulum impact test, the wall was subject to a close visual inspection on the front and back. Any damage is listed in the 'Result' column.

## 4 Summary

medifa hygienic rooms GmbH with headquarters in Ötigheim, Germany commissioned the MPA Braunschweig with the test of a lightweight inner shaft wall made of metal profiles (60 x 30 x 2) and a one-sided panelling with stainless steel sheet laminated panels (t = 19 mm), construction method medifa.

To do this, tests were carried out on a wall structure measuring $h_{Wall}$ = 3.20 m ($h_{Raw\ ceiling}$ = 3.50 m) under consideration of the design loads pursuant to DIN 4103-1:1984 and ETAG 003.

The tests were carried out by employees of MPA Braunschweig in the test hall of the MPA Braunschweig during calendar week 20, 2018.

During the test, the 1.5-fold strut load for installation area 2 could be sustained pursuant to DIN 4103-1.

$$F_{(Test\ Roosy\ 001)} = 5.57\ kN > 5.40\ kN.$$

The capacity of the bending limit load for installation areas 1 and 2 was verified under experimental conditions for the $h_{Wall}$ = 3.50 m high shaft wall with steel sections pursuant to DIN 4103-1:2015, Section 5.2.3.

The requirements for the verification of the soft impact on lightweight partition walls pursuant to DIN 4103-1:2015 were fulfilled. The structural integrity against soft impact loads for the $h_{Wall}$ = 3.50 m high wall structure can therefore be considered to be fulfilled.

In addition, with reference to ETAG 003, pendulum impact tests were carried out for use class A.II.

The requirements for the verification of soft body impact on lightweight partition walls pursuant to ETAG 003 were also fulfilled. The structural integrity against soft impact loads for the $h_{Wall}$ = 3.50 m high wall structure can therefore be considered to be fulfilled.

The proof of the bending limit load capacity for the installation areas 1 and 2 and the requirements for the proof of the soft impact on light partition walls could be fulfilled by the shaft wall construction in the experiment. A partition wall construction of the construction method medifa with a double-sided panelling was not tested. Experience has shown that a partition wall structure has a somewhat stiffer material or deformation behaviour and, in our opinion, also fulfils the requirements for verification of the soft impact and bending limit load capacity for installation area 1 and 2.

The sound and fire properties of the partition walls must be verified separately.

Braunschweig, 06/06/2018

Head of Testing Laboratory

Dr.-Ing. A.-W. Gutsch

Engineer/Official in Charge
i.A.

Dr.-Ing. P. Bodendiek

Materialprüfanstalt f. d. Bauwesen
MPA BS 1
Braunschweig