MPA Bau
Hannover

Materials Testing Institute for Building Construction
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Test Report No. 011662 – Mk / De -

First Execution

Applicant	F. von Müller GmbH & Co. KG Industriestraße 4 67304 Eisenberg
Date of Application:	12.09.2001 – Mi/Bu -
Subject of Application:	Testing the „ArGeTon"Clay tile – Cladding according to DIN 18516-1, Appendix C.

The test report contains 12 pages.

The test material has been consumed

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1. Delivery

On 12.09.2001 by the principal:

— one packet of blind rivets alu-stainless steel, 4,8 x 12; 10 mm head.

— 15 aluminium profiles T 110 x 45 x 2 mm „System Eisenberg", 1300 mm long

— 20 Argeton „U" clips (bottom), t = 2 mm

— 20 Argeton „O" clips (top), t = 2 mm

— 80 Argeton „M" clips (middle), t = 2 mm

— 50 angle brackets, t = 3 mm

— 12 Argeton joint profiles, 1300 mm long

— 110 Argeton cladding tiles, 400 x 200 mm, natural red.

Fig. 1 shows the construction of this cladding system as laid down by the manufacturer. Spaces of 60 cm between angle brackets were chosen by the principal.

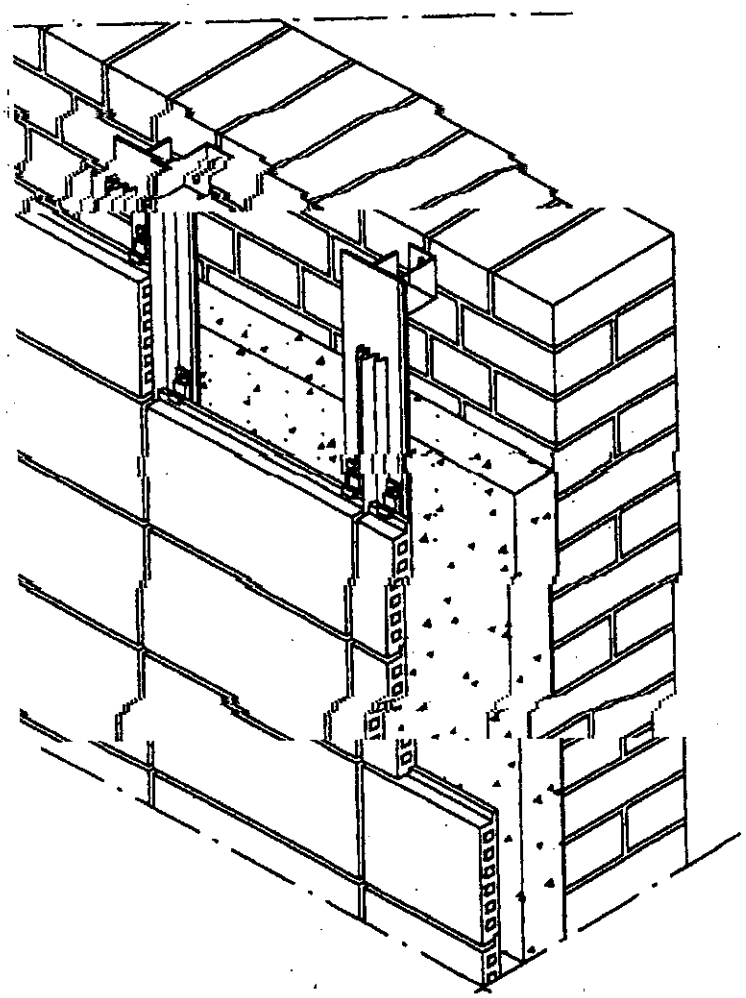

Fig. 1 Construction of the Argeton cladding system

2. Testing Order

The cladding material delivered was to be used to build three test rigs for the simulation af negative wind load. Complementary small-scale tests according to IN 18516-1, Appendix C were to be carried out with the cladding tiles and fixtures.

3. Method of rig test

For each rig, 18 small-sized cladding tiles were used. Horizontally 3 tiles were fixed lengthways and perperdiculary 6 tiles, thus producing a cladding surface of 1.2 m x 1.2 m = 1.44 m^2.

Between the substructure, three areas of equal size resulted and were filled with plastic bags. By filling these bags with compressed air a negative wind load could be simulated.

Gauges for measuring deflection were fixed to the central tile and to the two outside tiles of the middle row. The dimensions of the test rig are shown in our sketch (fig. 2).

The air pressure in the plastic bags between rear wall and clay tiles was increased gradually.It was measured with the help of a U-shaped manometer, which had been connected and partially filled with water. A water column difference of 10 cm corresponds to a surface load of 1 kN//m^2.

In order to calculate the actual surface load the load-free area of the substructure was allowed for, thus giving the following conversion equation:

$$k = \frac{1200\ \text{mm} - (3\ \text{x}\ 110\ \text{mm})}{1200\ \text{mm}} = 0.725$$

4. Results of the rig test

In all three attempts the maximum load was applied without any sign of damage to the cladding system. The maximum water column difference is 1800 mm. This value was reached three times and is equivalent to a surface load of 0.725 x 18 kN/m^2 = 13050 N/m^2.
The load applied to a single tile clip is thus

$$F_z = \frac{13050\ \text{N/m}^2\ \text{x}\ 1.44\ \text{m}^2}{36\ \text{clips}} = 522\ \text{N}$$

The maximum deflection was measured in the two outside perpendicular profiles; here the T-profiles were tilted as a result of the one-sided pull from the tiles. All measurements are shown in figures 3, 4 and 5.

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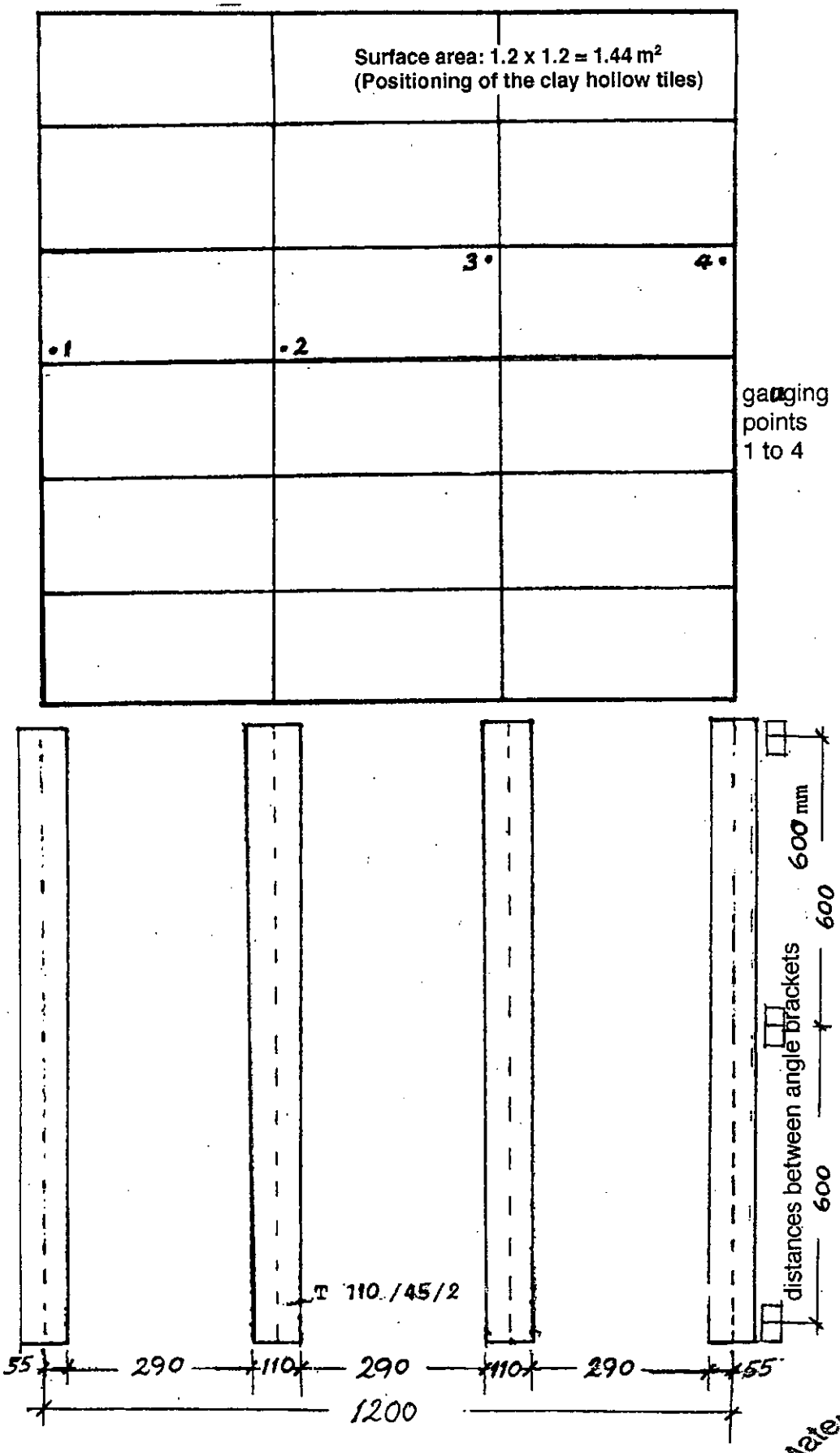

Fig 2 Dimension of test rig

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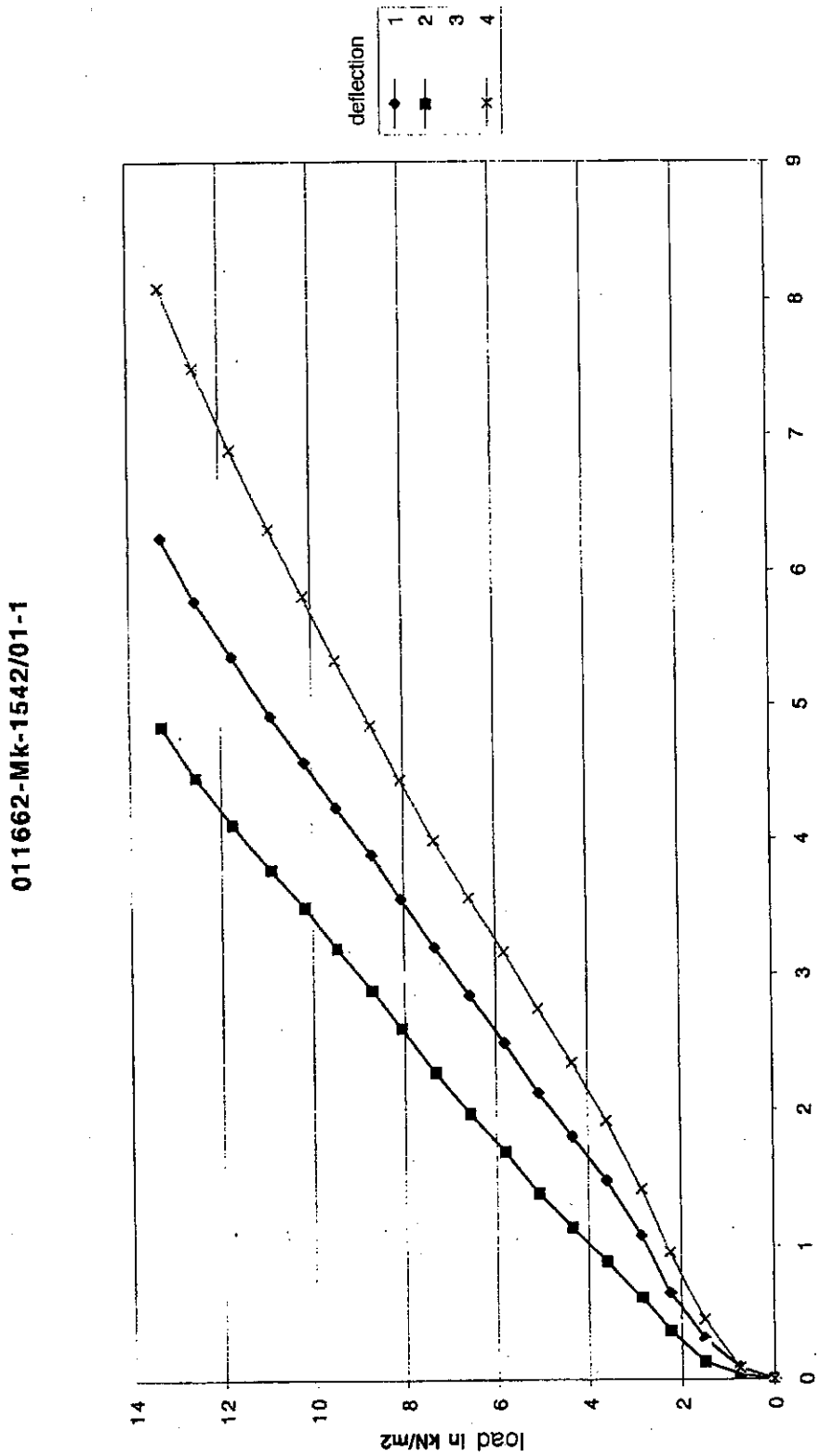

Fig. 3 Deflektion during the first rig test in relationship to the real surface load

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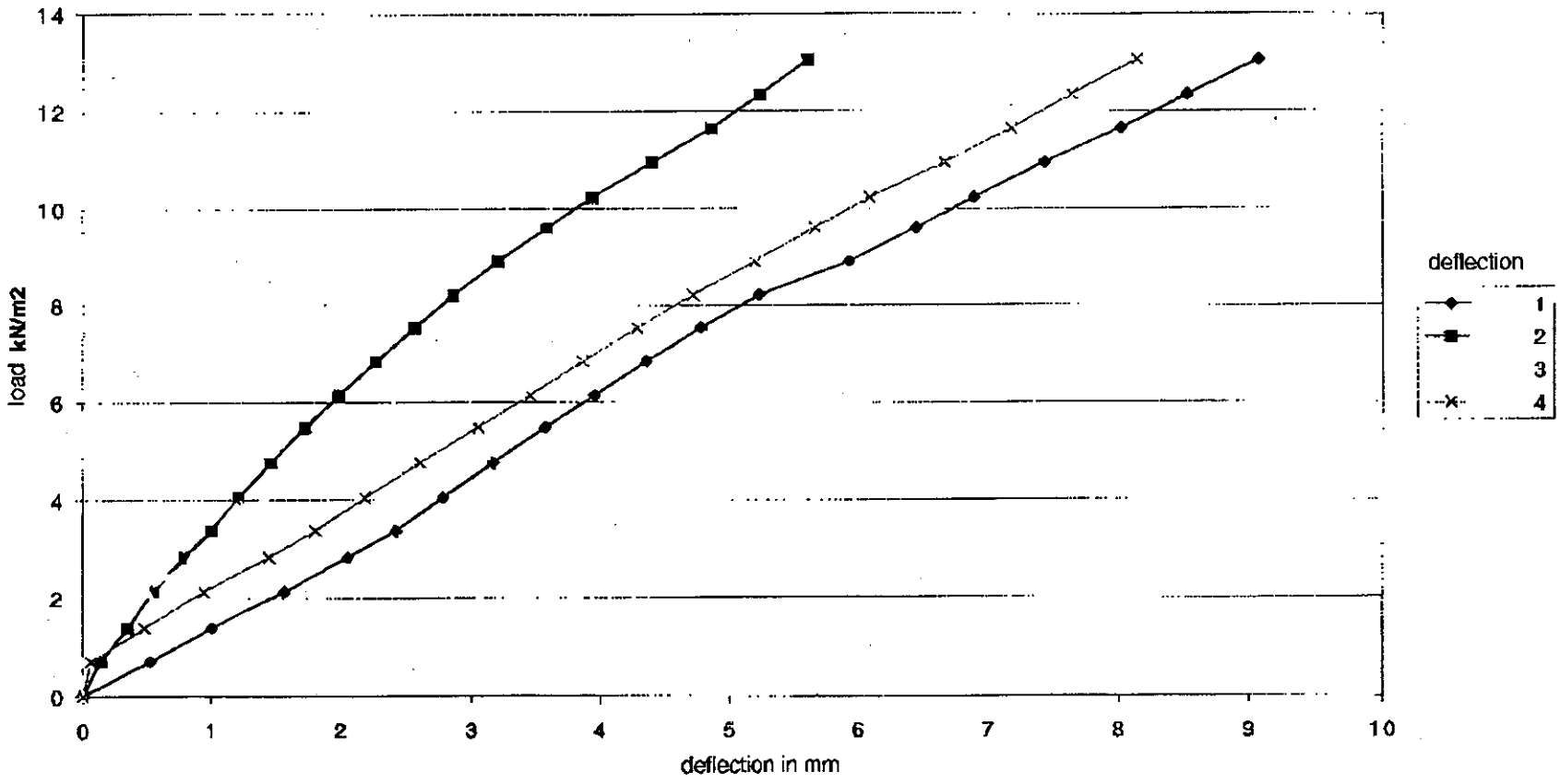

Fig. 4 Deflection during the second rig test in relationship to the real surface load

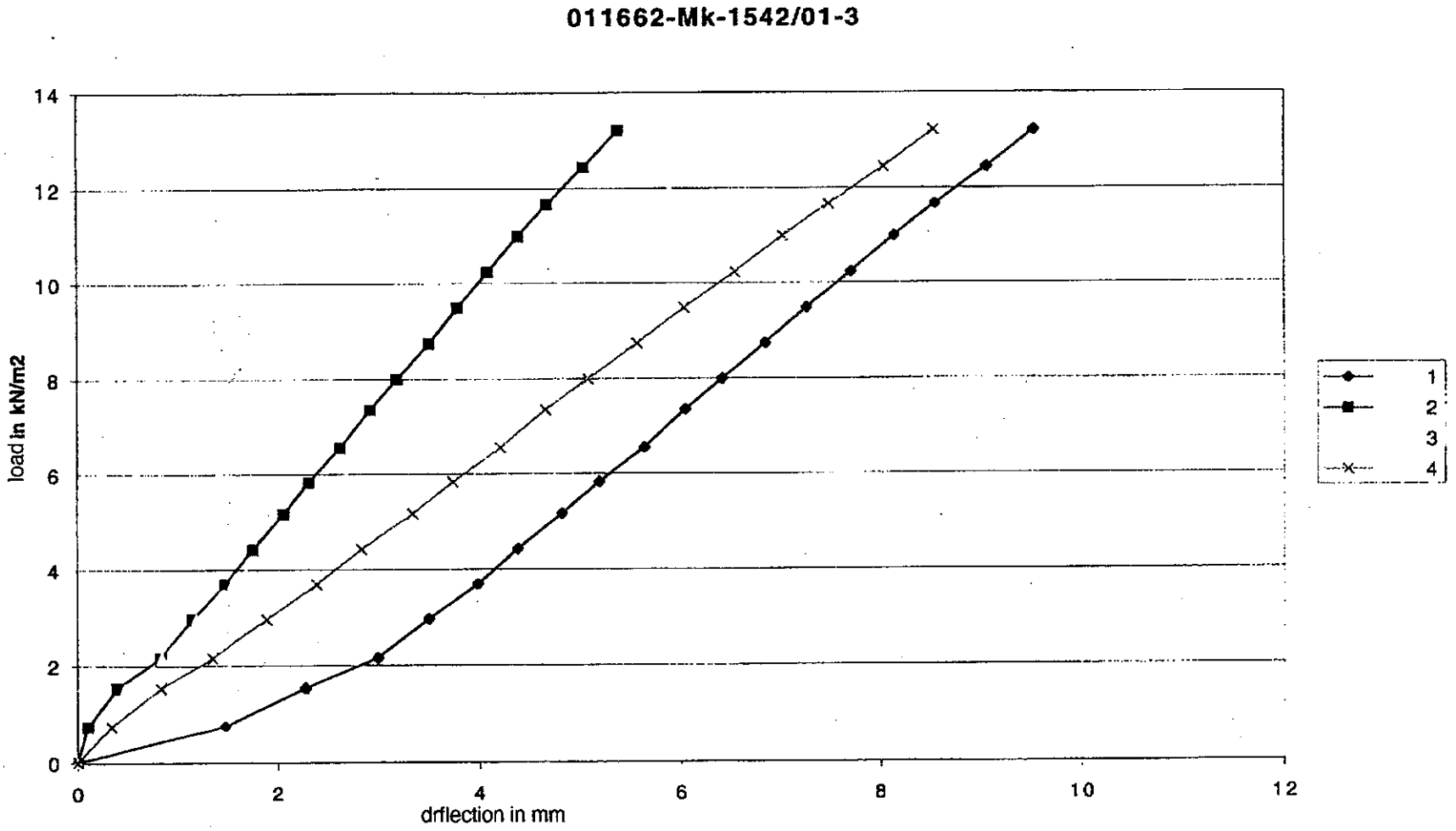

Fig 5 Deflection during the third rig test in relationship to the real surface load

5. Small-scale tests with the middle clip.

Ten small-scale tests were carried out and statistically analysed.The testing apparatus is shown in fig. 6, the results in table 1; in every case the head of the rivet was torn off. Fig 7 shows the typical deflection under increasing load. The irreversable deflection of the plate clip reached about 5 mm at the outermost point.

Table 1 Results of small-scale tests with the middle clip

Clip No.	Maximum loud N	Remarks
1	1254	Head of rivet torn off
2	1395	
3	1299	
4	1364	
5	1370	
6	1429	
7	1493	
8	1325	
9	1350	
10	1297	

Statistical analysis of tear off tests on clip with 75% probability

$\bar{x}$	1358
s	70
$x_{5\,\%}$	1216
xpermissible	405

with a safety factor of 3.

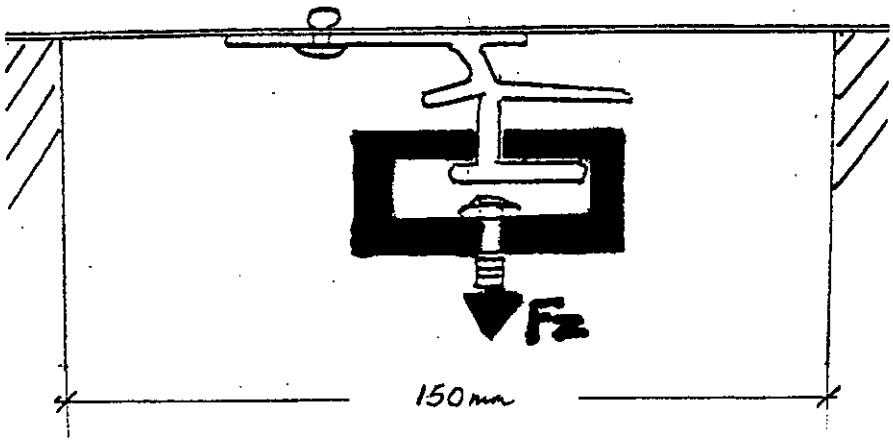

Fig. 6 Apparatus for tear off tests with middle clip

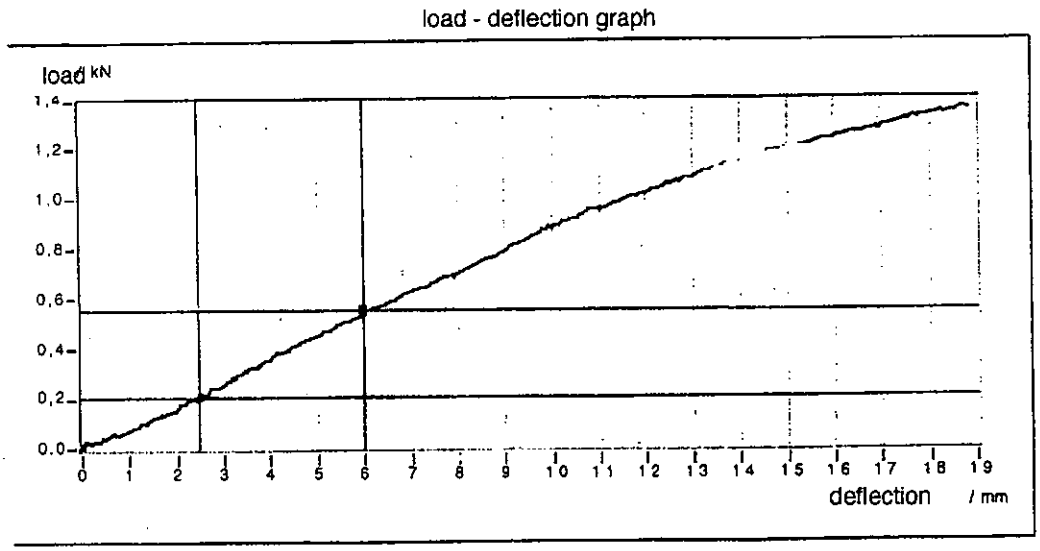

Fig. 7 Typical load - deflection graph

6. Loadbearing behaviour in the locality of the fixtures

Ten small-scale tests we carried out, as shown in figures 8a, b and c, each time using the middle clip. According to the principal, variations of ± 2 mm are to be anticipated in the region of the stop depth of clip in the groove of the tile. In order to investigate the influence of the stop depth the first series of tests was carried out with maximum stop depth; in the next series 4 mm play was given. In a third test series, the loadbearing behaviour of the groove along the bottom long side of the tile was determined. In all these cases the tongue of the tile was broken off at the point of loading (corner of the tile). The results are shown in table 2.

Table 2 Loadbearing behaviour in the locality of the fixtures

Test No.	Breaking load in the locality of the fixtures, testing method according to fig.		
	8 a	8 b	8 c
—	N	N	N
1	365	385	939
2	297	362	1013
3	468	485	992
4	430	413	1013
5	409	426	1011
6	441	445	1013
7	408	485	1028
8	416	428	1028
9	466	456	1005
10	455	460	960
$\bar{x}$	415	435	1000
s	52	40	Results not
$x_{5\,\%}$	309	354	relevant
F permissible	103	117	(tentative test)

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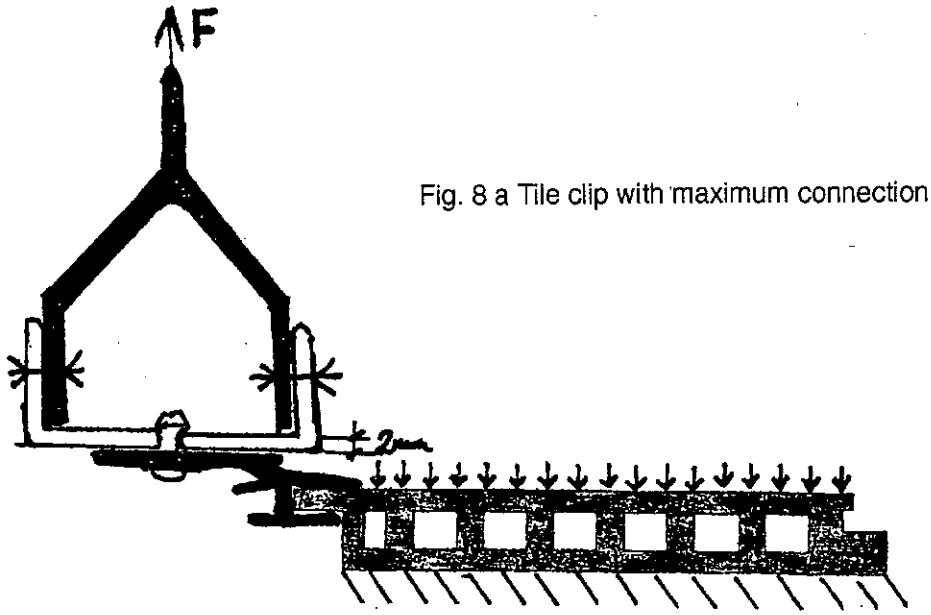

Fig. 8 a Tile clip with maximum connection

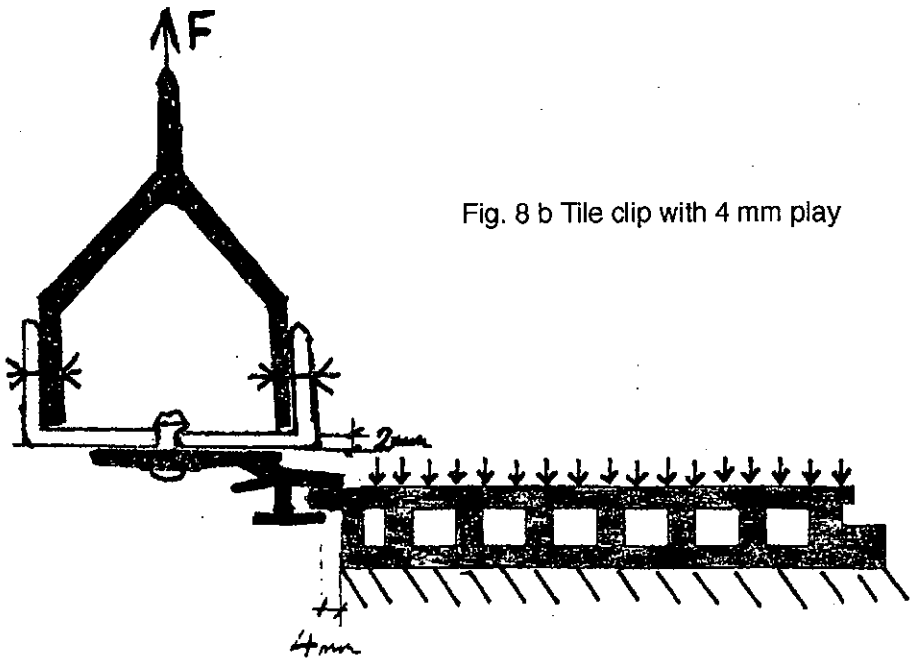

Fig. 8 b Tile clip with 4 mm play

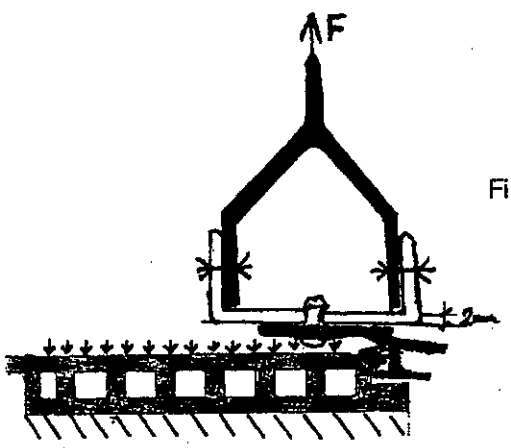

Fig. 8 c In the tongue of the bottom edge

Fig. 8 Loadbearing behaviour in the locality of the fixtures