

Technical Bulletin

## **Load tests for underfloor installation systems and service outlets**

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This technical bulletin provides you with information on specific technical subjects. It is based on the current rules and regulations and on our current test results. The content of this document is not legally binding.

### 1 Load capacities for installation systems

Underfloor electrical installation systems are subjected to loads. They must be able to resist normal loads occurring at the place of installation, whilst continuing to function. The loads may be of different kinds, either from people just walking over the top, from the feet of furniture right up to loads from vehicles and transportation aids.

#### 1.1 What is the effect of these loads?

The influence of loads on floors (ceiling constructions) – and thus on the installation systems installed there – is direct. The weight of the load creates a force on a certain area of the ground. If we consider this force on a specific area, e.g. on one m<sup>2</sup>, then we talk about a **load capacity**, taken from the viewpoint of subconstruction. Load capacities are defined for ceiling constructions, floor superstructures, system bases, etc. (see Appendix).

$$\text{Load capacity} = \text{load} / \text{surface area}$$

If we consider the weight of just a single section and its effect on the floor area, then we term this a **single load**.

Load capacities and single loads should always be considered separately. This can be seen clearly using the example of a vehicle:

A car weighs 2,000 kg.  
The axle base is 3.5 m and the wheelbase 1.8 m.

The loads can be calculated as follows:

$$\begin{aligned} \text{load} &= \text{weight} \times 9.81 \text{ m/s}^2 = 2,000 \text{ kg} \times 9.81 \text{ m/s}^2 = 19.6 \text{ kN} \\ \text{surface area} &= \text{axle base} \times \text{wheelbase} = 3.5 \text{ m} \times 1.8 \text{ m} = 6.3 \text{ m}^2 \\ \text{Load capacity} &= 19.6 \text{ kN} / 6.3 \text{ m}^2 = 3.1 \text{ kN/m}^2 \end{aligned}$$

The weight of the car is transferred to the ground through the four tyres. The **single load** is therefore 500 kg or 4.9 kN.

**When calculating and evaluating the load capacity of installation systems, only the effect of single loads should be taken into account.**

## 2 Permissible load on installation systems

Electrical installation systems for underfloor applications can either be according to DIN VDE 0634, Part 1 and Part 2 or EN 50085-2-2. The German standard DIN VDE 0634 is active until October 2011. The load tests of both standards differ so much, that we would like to inform you about the differences by this technical bulletin.

### 2.1 Specifications of standards

Regarding permissible loads both standard have the same objective:

Underfloor, flushfloor and onfloor electrical installation systems (CTS/CDS) shall have adequate mechanical strength.

### 2.2 Permissible loads for CTS/CDS

**DIN VDE 0634** defines one test with a load of 1,500 N. Test probe is a roll.

**EN 50085-2-2** defines load classes for two applications. The test probe is:

- according to 6.102 a test cylinder with a „small surface“ (1 cm<sup>2</sup>) for standard applications
- according to 6.103 a load plate with „large surface“ (Ø 130 mm) for high loads.

Test	Class	EN 50085-2-2
Standard application (Test cylinder 1 cm <sup>2</sup> )	6.102.1	500 N
	6.102.2	750 N
	6.102.3	1,000 N
	6.102.4	1,500 N
	6.102.5	2,000 N
	6.102.6	2,500 N
	6.102.7	3,000 N
High load (Load plate Ø 130 mm)	6.103.1	2,000 N
	6.103.2	3,000 N
	6.103.3	5,000 N
	6.103.4	10,000 N
	6.103.5	15,000 N

### 2.3 Test description

As specified by DIN VDE 0634 Part 1 the following test is used for **flush mounted service outlets**:

The centre of the walkover areas are subjected to a vertical force of 1,500 N from a testing roller for two minutes. The testing roller has a diameter of 50 mm and a width of 18 - 22 mm.

Both during and after the test, the air and creep paths may not be undershot. In addition, the process may not damage testing items, and active parts may not become exposed. The protection type must remain intact. The testing item may not have any clearly visible cracks. There may be no lasting deformations on the testing items five minutes after the test has been completed. Any deformations of up to 1.5 mm are allowable.

**Screed flush or screed covered installation systems** are specified by DIN VDE 0634 Part 2 using the same test method as with service outlets however the deformations are varying.

During the test deformations up to 4 mm are allowed. There may be no lasting deformations on the testing items one minute after the test has been completed. Any deformations of up to 3 mm are allowable.

**Load tests of EN 50085-2-2** make no difference for CTS/CDS and service outlets. The test is performed as:

The test probe is placed in the most unfavourable position (length and width). The force is gradually increased over 15 seconds and maintained for 60 seconds. During the test the samples shall show no deflection greater than **6 mm**.

After the test the sample shall show no signs of disintegration, nor shall there be any crack visible. One min after the load has been removed, there shall be no permanent deformation exceeding 3 mm.

The protection type must remain intact.

### 2.4 Heavy-duty systems

**DIN VDE 0634** does not cover heavy-duty systems. Therefore Ackermann (now OBO BETTERMANN) developed a company load test for heavy-duty products. The load classes of 10 kN and 20 kN have set a quasi standard for this type of products in the market. The dimension of the load plate is 100 x 150 mm and is the typical equivalent of the contact area of a car tyre. Furthermore Ackermann/OBO included the floor coverings in the test procedures as the performance of a heavy-duty system cannot be seen singularly.

## Load tests for underfloor installation systems and service outlets

**EN 50085-2-2** covers electrical installation systems for high load applications but the test is not related to practice. The high deformation during the test (6 mm) and after the test ( $\leq 3$  mm) will definitely cause damage of hard floor coverings.

Therefore OBO will go a step ahead. We make use of the test procedure of EN 50085-2-2 but reduce the deformations in a way, that the combination of underfloor system and floor covering will resist the permissible load without any damage.

### 2.4.1 Load classes for heavy-duty systems

Practical applications have created two load classes:

- Load class 1 for static loads of up to 10 kN suitable for application like exhibition areas
- Load class 2 for static loads of up to 20 kN suitable for applications like public areas in airports and stations.

*For details, load capacities and dependencies, we would draw your attention to the Technical bulletin "Electrical installation systems for areas with high load requirements".*

## 3 Conclusion

Underfloor electrical installation systems have proved their capability to support loads over many decades. They are particularly suited to use in office and administration buildings.

Appropriate installation systems must be used for applications with high load capacity requirements.

A transfer of the load capacities by simple conversion of the effective areas is generally not permitted.

The load capacity must always be regarded together with the floor structure, floor covering and the craftsmanship of the installation.

**Underfloor electrical installation systems cannot accept higher loads than the surrounding floor constructions.**

## Appendix

### Load assumptions

The following load values for ceiling constructions were taken from DIN 1055 "Actions on structures":

Category	Use	Perpendicular load capacity [kN/m <sup>2</sup> ]	Single load [kN]
A	Living accommodation	1.0 - 2.0	1.0
B	Offices and corridors	2.0 - 5.0	2.0 - 4.0
C	Meeting rooms	3.0 - 5.0	4.0 - 7.0
D	Sales areas	2.0 - 5.0	2.0 - 7.0
E	Workshops and rooms for large gatherings of people	5.0 - 7.5	4.0 - 10.0
F	Traffic and parking areas	3.5 - 5.0	20.0
G	Perpendicular load capacities with counterweight stacker	26 - 170	12.5 - 20.0

Table 1: Extract from 1055-3; Testing of perpendicular load capacities on a testing item 50 x 50 mm

The same applies to system bases (hollow floor and raised floor). For these floor systems, so-called breaking loads are defined. Breaking loads comprise a double or a triple safety level, which is then related to the maximum possible single load.

Class	Breaking load [kN]	double safety	triple safety
1	≥ 4	2 kN	1.3 kN
2	≥ 6	3 kN	2 kN
3	≥ 8	4 kN	2.7 kN
4	≥ 9	4.5 kN	3 kN
5	≥ 10	5 kN	3.3 kN
6	≥ 12	6 kN	4 kN

Table 2: Extract from EN 13213; Testing of breaking load capacities on a testing item 25 x 25 mm

### Allocation of nominal loads and load classes for system bases

Class	Breaking load [kN]	Nominal load [kN]	Load tap	Use
1	≥ 4	2	2	Office areas without corridors
2	≥ 6	3	3	Office areas with corridors
3	≥ 8	4	4	Office areas with increased static loads
5	≥ 10	5	5	Industrial floors, with light usage, storage rooms, libraries
6	≥ 12	≥ 6	6	Industrial and workshop floors

Table 3: Extract from EN 12825