

Technical Bulletin

## **Electrical installation systems for areas with high load requirements**

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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 contents of this document is not legally binding.

### 1 Underfloor electrical installation systems

Electrical installation systems in floors have been used successfully for many years. As far back as 1960, underfloor duct systems were used in office and administrative buildings, thus allowing the installation of all necessary connections for power, telephones and lighting close to workstations.

The electrical installation systems continued to be developed, and now fulfil almost every requirement with regard to use, size, design and lifespan.

Typical applications are found in office environments, conference rooms and high-quality living accommodation.

The installation systems are naturally subjected to loads, so-called "live loads/traffic loads", which are compensated for through the design, appropriate materials and used material thicknesses.

Current standardisation has created a basis for the standard loads in offices and administration buildings, which provides planners, construction engineers and users with the necessary safety.

### 2 Use in heavy load areas

The necessity of running cables and lines from Point A to Point B is not just limited to the relatively "lightweight" office environment. A whole range of other applications require such solutions: exhibition areas in museums and car showrooms, sales areas, concourses in airports and stations, workshops, etc.

These areas are commonly referred to as heavy load areas, as here the traffic loads place additional requirements on the floors and the installation systems. Besides static forces, dynamic forces may also have an impact, which should be taken into account in individual cases.

### 3 Installation systems and floor coverings – a need for harmony

The floor structure, screed type, covering thickness and the floor covering type – these are all key factors in the selection of the installation systems. Stone or hard coverings are often used in heavy load areas, on account of the applications involved. These can be cleaned easily and are very resistant to the live loads.

The type of the cleaning required for the floor covering has an impact on the selection of the installation systems. If floor washing is required, then the covering must offer moisture protection for the cables and resources installed in the floor.

With regard to the covering thickness, the type and thickness of the floor coverings are of major importance. Covering thicknesses of 10 mm to 40 mm or even more must be considered. The smallest of bends can cause thin, hard floor coverings to break. Thick floor coverings have a positive effect on the load capacity of systems, as the load is distributed over a wide area.

As the thickness of the floor covering and the load capacity increase, the weight of the covers of the installation system also increases. As these may require "handling" in some cases, agreement is required from all involved parties at an early stage. In the case of smooth floor covering surfaces, vacuum lifters are a suitable aid for opening covers/cassettes. If the coverings are uneven or porous, then additional opening aids, such as threaded sleeves in the cassettes for installation keys, can be used.

### 4 Standardisation

In the current standard, DIN VDE 0634, load requirements for electrical installation systems are specified only for office applications. Although these requirements are relatively stringent, no products can be tested for the so-called heavy load sector. Currently, an international standardisation committee is working on a European standard for underfloor electrical installation systems, which will also contain the so-called heavy load sector. Dynamic forces are not considered by the current standard. The state of standardisation has not yet reached a stage at which a publication date can be specified for the short or medium term. Current applications thus require detailed requirements from planners and construction engineers, and appropriate product testing by manufacturers.

### 5 Ackermann – systems for the heavy load sector

In recent years, Ackermann has worked closely with planners and construction engineers to develop a wide range of individual solutions for sectors with increased load requirements. As far as possible, these solutions are based on standard products, and tailor-made solutions are only created for the points at which the heavy loads impact.

Based on the experience gained, there are now system solutions available for screed-flush and screed-covered installation. Flexibility and safety are at the heart of the development process.

The moisture protection offered by the system corresponds to DIN VDE 0634.

#### 5.1 Screed-covered solution

In the two system sizes, 250 and 350, the duct sections S2 and S3 are used in the standard version, along with the UZD junction and branch box. Additional supports in the box ensure the necessary stiffness and load capacity.

To provide a cover above the electrical installation, square or round heavy-load cassettes are used along with the GRAF9 service unit in combination with the installation cover with heavy-load supports.

The GESRM 2 unit insert is employed together with a strengthened outlet box.

#### 5.2 Screed-flush solution

For screed-flush heavy-load applications the OKU trunking system is used. The wide side profiles provide good load distribution on the base, and a connection to the screed, along with the necessary moisture protection. The covers consist of 8 mm stud plate. The side profiles and trunking covers have flush ends and protrude approximately 4 mm over the screed. In practice, this is not a problem, as a sealant is applied to the screed, which reaches to the floor covering application profile.

Past experience has shown that applications in these areas often contain special requirements for the installation systems. For this reason, there are no plans for a catalogue solution.

### 5.3 Load classes

The system solution "Heavy load, screed-covered" is available in two versions:

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

For proof of the load capacity, see Point 9 and the Appendix.

Product	Load class	Note
Cassette solutions, square	1 and 2	Only in conjunction with heavy-load supports.
Cassette solutions, round	2	Only in conjunction with installation cover with heavy-load support for use in screed-covered duct systems.
GESRM2	2	In conjunction with the heavy load version of the underfloor outlet box.
GRAF9	7.5 kN	Only in conjunction with installation cover with heavy load support for use in screed-covered duct systems.

Table 1: Overview of products and their approved loads

## 6 Basic information on the installation of screed-covered duct systems for heavy loads

The following points should be observed to ensure a continued load capacity for the installation systems:

- It is not possible to lay the UZD underfloor box on the insulation layer.
- The UZD underfloor box must sit entirely on the concrete floor. The load capacity is severely impaired by cavities under the box, particularly in the corner, i.e. under the levelling screws.
- Additional cover supports must have a solid base, i.e. if the floor plates acts as springs on the underfloor box, then the areas under the supports must be rebored.
- The UZD underfloor box must have a direct connection to the screed. Separation strips between the underfloor box and the screed reduce the load capacity and will cause damage to the floor covering.
- Floor coverings must extend right up to the opening of the UZD underfloor box, e.g. for the GRAF9  $\varnothing$  305 mm <sup>+1</sup>.
- The tiles must be fully and firmly adhered to the box surface. The surface should be prepared with a suitable primer. We cannot recommend the use of soft plastic adhesives or silicone.

## 7 Square cassettes in screed-covered duct systems

Cassettes, both "blind" and with a height adjustable outlet (tube) are used to cover inspection openings and for outletting cables.

The permissible load of the products should always be considered together with the floor covering (see Point 3).

## 8 Round cassettes in screed-covered duct systems, false and cavity floors

Its design means that the round cassette can be used both in screed-covered duct systems and in false and cavity floors.

An important factor is the permissible load of the surrounding floor construction.

## 9 Proof of permissible loads

All the heavy-load products are subjected to a comprehensive range of tests. The subconstruction was an underfloor junction box cast in screed. The cassettes were covered with a granite plate (thickness 20 mm). To give an accurate simulation of a live load, a square test die with the dimensions W/H/D in mm = 100 x 20 x 150 was used.

The size of the test die roughly corresponds to the contact area of a car tyre, the foot of a lifting platform, or the tyre of a mobile cleaning unit, thus producing realistic test results.

In a similar way to the load test prescribed by DIN VDE 0634, the bends occurring during the load are measured during the test along with any bends remaining afterwards. The load was centred on the item on test.

## 10 Summary

Ackermann heavy-load systems can offer a system solution for many applications. They have shown themselves to be able to accept loads, offer flexible usage and safe operation.

The permissible load should always be considered together with the floor covering. Consider the following rule:

When the covering gets thicker, then the load is distributed better, and the products can be subjected to slightly greater loads. The floor covering is unlikely to be damaged by any bending.

When the covering gets thinner, then the level of bending of system components increases. It is likely that the floor covering will be damaged.

### Conclusion

**Heavy-load systems and the floor structure/floor covering forming a functional unit.**

**The load values to be expected must be clarified before planning.**

**It is essential that planners, suppliers and construction engineers consult each other in good time.**

**The installation instructions for the installation systems should be complied with.**

**Appendix**

**Test report for square and round cassettes**

The square cassette was installed on an underfloor junction box of size 350-2. The cassette was covered with a granite plate of 20 mm thickness.

The size of the round cassette was R9 and it was positioned on a granite plate of 20 mm thickness.

The tests of the cassette, in both the "blind" and "with tube" forms lead to the same results. They lead on to the conclusion that cassettes of smaller sizes can lead to increased permissible loads.

Product	Steel insert	Load			
		6 kN	12 kN	15 kN	20 kN
Square cassette on UZD 350-2 with heavy-load support	4 mm	1.25 / -	1.8 / 0.1	2.2 / 0.2	-
	8 mm	0.75 / -	1.2 / 0.1	1.45 / 0.15	1.65 / 0.2
Round cassette	8 mm	0.6 / -	1.12 / 0.3	1.25 / 0.4	1.72 / 0.6

Table 2: Test duration: 2 minutes per test step, thickness of the floor covering: 20 mm  
Bending in mm during the test/lasting deformation (after testing)

**Test report: GESRM2 and GRAF9**

Product	Load in [kN]						
	5	7.5	10	12.5	15	17.5	20
GESRM2	0.6 / -		0.65 / < 0.1				0.9 / 0.1
GRAF9	2.8 / 0.2	3.7 / 0.5					

Table 3: Test duration: 2 minutes per test step  
Bending in mm during the test/lasting deformation (after testing)

**OKU test report**

The flush floor OKU trunking system was tested with a nominal width of 300 mm. The top cover consisted of corrugated plate. The distance between the cover butt supports was 400 mm.

Product	Load in [kN]						
	5	7.5	10	12.5	15	17.5	20
OKU	1.0 / -	1.5 / 0.1	1.85 / 0.17	2.2 / 0.2	2.6 / 0.25	2.8 / 0.3	3.0 / 0.3

Table 4: Test duration: 2 minutes per test step  
Bending in mm during the test/lasting deformation (after testing)

