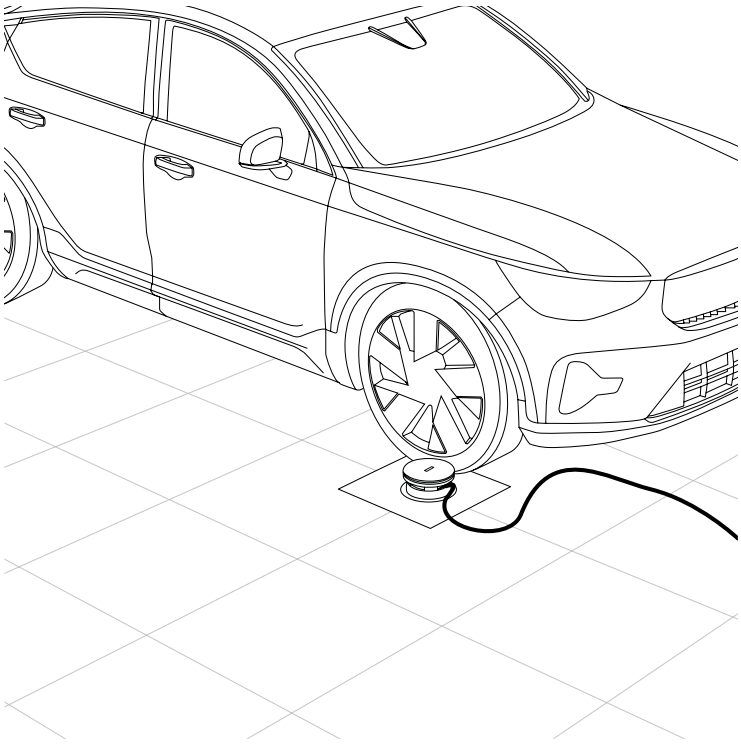
Technical information

Floor installation systems Mechanical stress



Planning aid, taking the load capacity requirements into account
Floor installation systems and installation units

hager

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01 Introduction

This technical information is dedicated to loads and load types to which floor installation systems are exposed and which they must withstand. It helps planners to determine the load type relevant for the construction project and to determine the suitable floor installation system using the relevant indicators.

02 Load areas

The load capacity specifications, as defined in the relevant standards, differ depending on the type of construction project. The use of the rooms defines the perpendicular payload (building engineering) and/or the break load (system floors), according to which the ceiling construction must be designed.

02.01 Building engineering

DIN EN 1991-1 defines, amongst other things, the payloads in building engineering:

Category	Use	qk = Perpendicular payload [kN/m²]	Qk = Individual load [kN]
A	Living accommodation	1.0 ... 2.0	1.0
B	Office areas and hallway	2.0 ... 5.0	2.0 ... 4.0
C	Meeting rooms	3.0 ... 7.5	4.0 ... 10.0
D	Sales areas	2.0 ... 5.0	2.0 ... 7.0
E	Warehouses, factories and workshops	5.0 ... 7.5	4.0 ... 10.0

Tab 1: Values according to DIN EN 1991-1

02.02 System floors

So-called break loads are defined for system floors, such as raised floors (DIN EN 12825) and hollow floors (DIN EN 13213). From these break loads, nominal loads with a 2x to 3x safety factor are derived. The individual loads are defined from these.

Class	Use types	Break load [kN]	Nominal load [kN] with safety factor 2
1	Offices without public business	≥4	2
2	Office areas with public business	≥6	3
3	Rooms with increased static loads, areas with fixed seating, construction offices	≥8	4
5	Exhibition areas, workshops with light operations, storage rooms, libraries	≥10	5
6	Industrial and workshop areas	≥12	6

Tab 2: Extract from DIN EN 12825 (for raised floors) and DIN EN 13213 (for cavity floors)

03 Load types

03.01 Payload and individual load

Even with a short-time or continuous load on floor installation products, their functionality must remain intact.
Using the characteristic data named in DIN EN 1991-1, DIN EN 12825 and DIN EN 13213, it is possible to determine the right systems for the appropriate use type.

The resulting loads exert a force directly on floors and ceiling constructions and thus also on floor installation systems. This load is defined by payload and individual load according to the standards listed above.

Payload

Also called

Distributed load, traffic load

Calculated as

qk in [kN/m²]

Presentation

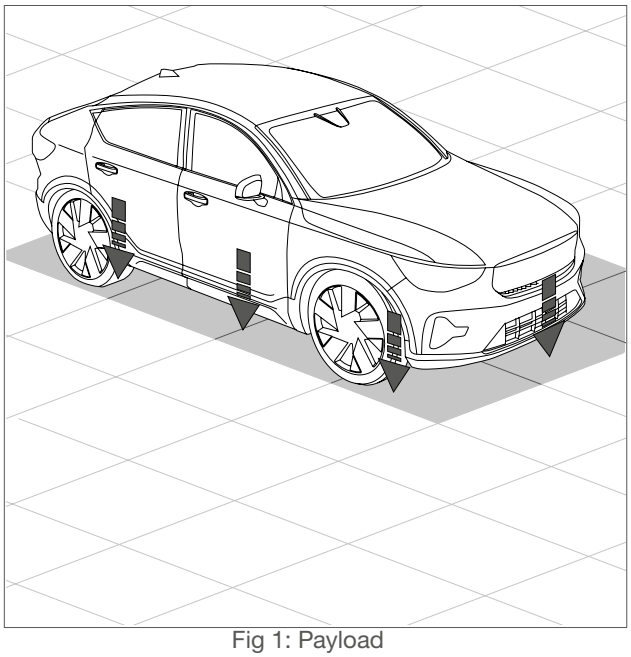


Fig 1: Payload

Explanation

The payload is a changing or moving impact on the component (e.g. weight of people, furniture, vehicles, etc.).

This is always stated with reference to a specific area (e.g. load per m^2).
These payloads are defined for ceiling constructions, system floors or floor structures, for example.

Individual load

Also called

Spot load, nominal load

Calculated as

Qk in [kN]

Presentation

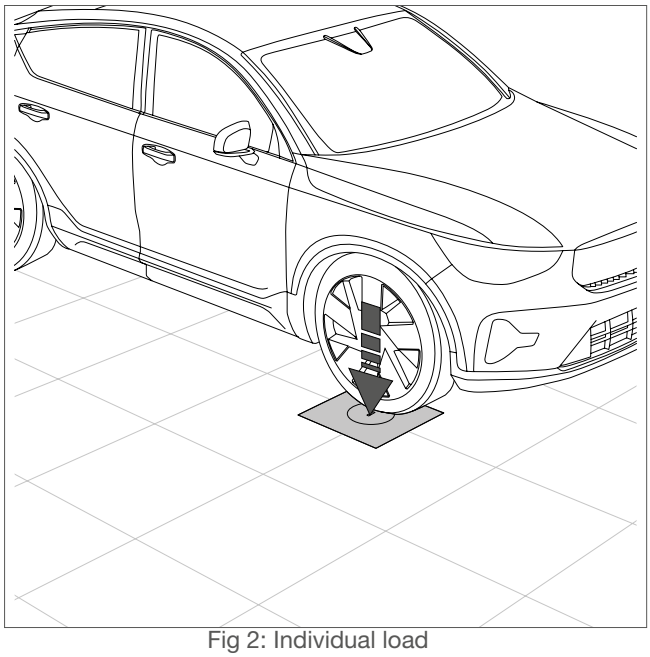


Fig 2: Individual load

Explanation

The individual load always relates to a specific point or an individual part and its impact on the floor space.

This is always stated as a spot load and occurs, for example, under the wheels of a parked vehicle or supporting columns of floors.

Payload

Example calculation:

A vehicle has a weight of 2000 kg, a length of 4.7 m and a width of 1.9 m.

This results in:
Load = Weight x earth acceleration
= 2000 kg x 9.81 m/s^2
= 19.6 kN

Area = Length x Width
= 4.7 m x 1.9 m
= 8.93 m^2

Payload = Load / area
= 19.6 kN / 8.93 m^2
qk = 2.19 kN/m^2

Individual load

Example calculation:

With the individual load, the weight of the vehicle is divided across
four tyres. The weight is only transferred to the ground via the four floor areas of the tyres.

This results in:
Individual load = Weight / 4 tyres x earth acceleration
= 2000 kg / 4 x 9.81 m/s^2
= 500 kg / 9.81 m/s^2
QK = 4.9 kN

Tab 3: Payload and individual load

Important

The choice of suitable floor installation systems or installation units is restricted using the individual load.

04 Testing of the load capacity

04.01 Individual loads with reference to floor installation systems

As already described, the individual loads of the planned room are relevant to the selection of the floor installation system.
If an office space is planned, then, for example, the standard DIN EN 1991-1 describes, according to use, an individual load of 2 ... 4 kN.
The floor installation system must now be selected so that it can withstand these loads, without losing its function. Two different types may apply: On the one hand, the standard load, in which the floor installation system is subjected to a load temporary through a small area (e.g. the foot of an office chair, Fig 3). On the other hand, the increased load or heavy load, which can occur through a large area (e.g. a car tyre, Fig 4).

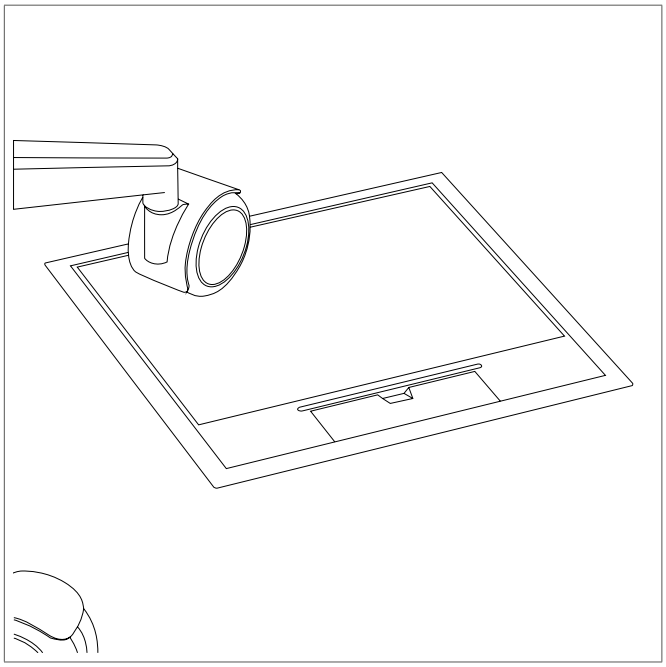


Fig 3: Standard supply unit VQxx

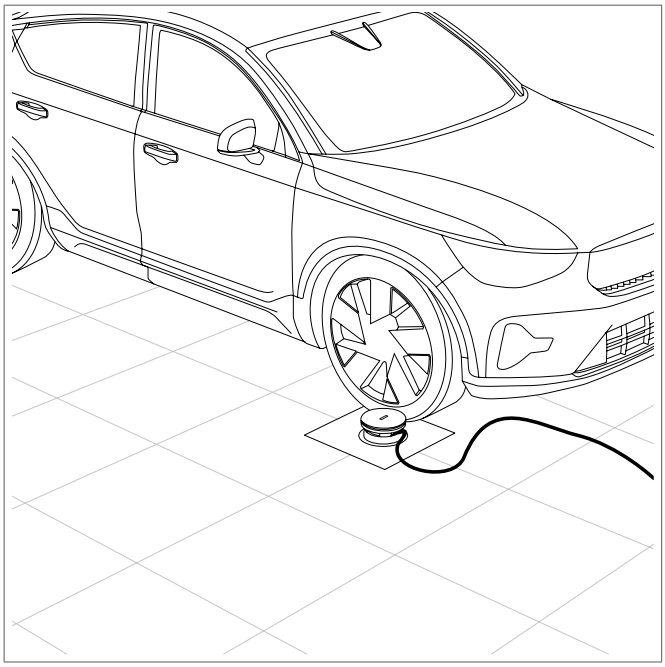


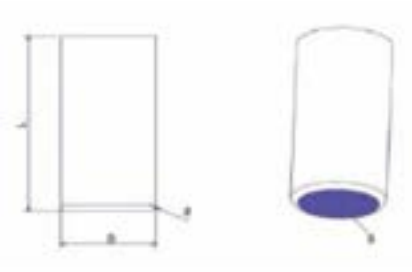
Fig 4: Heavy duty cassettes EKSQxxTMxx

04.02 Load classes according to the product standard DIN EN 50085-2-2

Duct systems and installation units for electrical installations must conform with the standard (DIN) EN 50085-2-2. This standard states that floor installation systems must have sufficient mechanical stability.

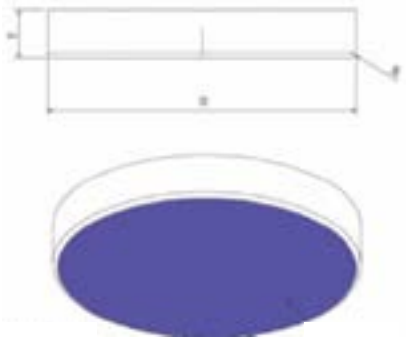
Load capacity for screed-flush duct systems (BKFx, BKWx, BKBx and BKGx) and installation units
(DIN) EN 50085-2-2 defines load classes for two applications (see 04.01).
The following are tested:

– 6.102 with a die (Ø 13 mm) for standard applications (Fig 5).
  The testing die simulates the area of a chair leg (Fig 3).
– 6.103 with a plate (Ø 130 mm) for high loads (Fig 6).
  The testing die simulates the area of a car tyre (Fig 4).



D - Diameter: 13.3 ± 0.1 mm

Fig 5: Testing die



D - Diameter: 130 ± 0.5 mm

Fig 6: Testing plate

Load class	(DIN) EN 50085	Load class	DIN EN 50085 2-2
Test, standard application (testing die Ø 13 mm)		**Optional testing of high loads (testing plate Ø 130 mm)**	
6.102.1	500 N	6.103.1	2000 N
6.102.2	750 N	6.103.2	3000 N
6.102.3	1000 N	6.103.3	5000 N
6.102.4	1500 N	6.103.4	10000 N
6.102.5	2000 N	6.103.5	15000 N
6.102.6	2500 N		
6.102.7	3000 N		

Tab 4: Load classes according to (DIN) EN 50085-2-2

Information

The values named in Tab 4 are values using which the product is declared. This means that, for example, the VANRx is classified according to 6.103.3, although it can withstand a load of 7500 N. This load class is not provided for in the standard, meaning that the product is classified downwards. This can be tested and confirmed through an internal test.

Information

The testing of the floor installation systems with high load requirements may be dealt with in the standard (DIN) EN 50085-2-2, but the bending during the test (6 mm) permitted in the standard and that after the test (≤ 3 mm) is not practical. Bending of this magnitude inevitably leads to damage to hard floor coverings (e.g. tiles).

04.03 Testing according to the standard

The testing for standard applications (with small area) is carried out in a testing institute and is a part of the certification of the products. Should higher loads be tested with a larger area, then the manufacturer must explicitly inform the testing institute of this.

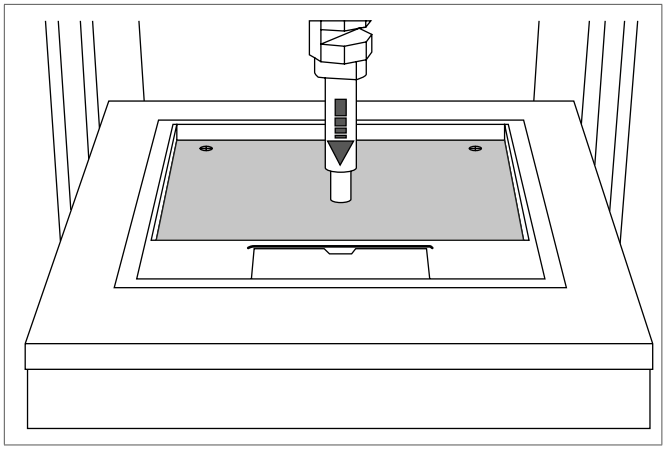


Fig 7: Pressure test with small area VQxx

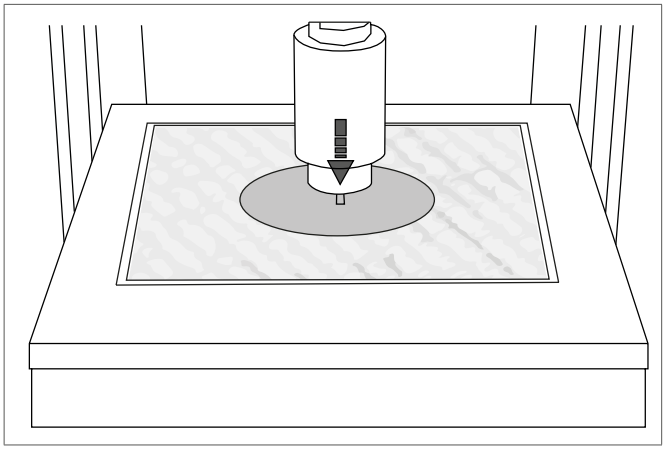


Fig 8: Pressure test with large area EKQxxTMxx

Load capacity of screed-covered floor installation systems

Screed-covered duct systems are only subjected to a load during the installation phase. After the floors have been completed, ducts are protected by the screed layer. The traffic loads are distributed over the screed, which is the carrying layer and which fully comply with the required payload.
This means that all screed-covered duct systems must be constructed in such a way so as to be stable enough to withstand the loads occurring on the construction site during storage, transport and processing.

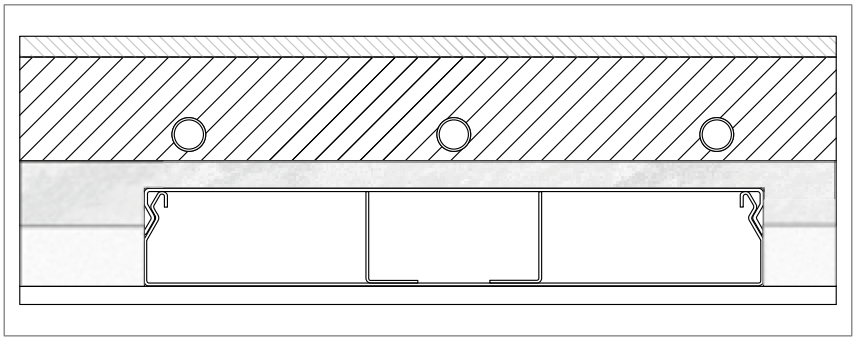


Fig 9: UK screed-covered floor installation duct system

05 Heavy duty application

Heavy equipment (e.g. industrial kitchens, fork lift trucks) are not taken into account in the standard DIN EN 1991-1, DIN EN 12825 and DIN EN 13213. These must be viewed specially as payloads or individual loads.

Heavy duty applications must be defined with the appropriate clients and/or authorities, in order to avoid overloads of the floor construction and the floor installation systems.

Example:
A fork lift truck of 2.8 t and a permitted carrying load of 2 t can achieve a maximum weight of 4.8 t. To simplify the calculation, it is assumed that the weight is evenly distributed.

Load = Weight x acceleration
= 4800 kg x 9.81 m/s^2
= 47.1 kN

Individual load = Load / number of surfaces
= 47.1 kN / 4 wheels
Qk = 11.78 kN

This means that, according to 6.103, the selected product must withstand a load of at least 11.78 kN, in order to be suitable for this application.

06 Product selection

06.01 Application example

How do the load areas and types connect to the requirements from the standard and product testing and how do I, as a planner, find the right floor installation system for load requirements/my construction project?

When evaluating the load capacity of floor installation systems, the individual loads of the planned rooms are relevant (see, for example, DIN EN 1991-1). When planning an office space, depending on the use, an individual load of 2 ... 4 kN is specified (see Tab 2).
Based on this data, it is now possible to choose the floor installation system so that it can withstand the loads without losing its function (see Tab 5).

Example
In the example in Tab 3, a requirement of 4.9 kN was calculated as an individual load. This is an increased load and is tested, according to the standard, according to 6.103. A suitable product for this application is an installation unit with at least 5 kN on a wide area. In this case, the EKQ stainless steel cassette is suitable.

Individual load in [N]	6.102.							6.103.				
	1	...2	...3	...4	...5	...6	...7	...1	...2	...3	...4	...5
BKFD					•				•			
BKWD					•				•			
KDE				•								
KDQ				•								
BDE				•								
BDQ				•								
UK				•								
VANR	$•_1$						$•_2$			$•_1$	$•_2$	
VQ/VDQ							•			•		
VR/VDR							•			•		
VE / VDE							•			•		
UDKQ06xx							•			•		
AKA							•					•
SLA							•				•	
SL 18075						•				•		
BKB							•			•		
BKG							•			•		
EKQ /MKQ							•			•		
EKR /MKR							•			•		
EKSQ							•					•
EKSR							•					•
UDKQ02E							•			•		
UDKQxxE							•			•		
BSR02D01 BSR02MKxx LAR02MKxx							•					
BSR02D02 BSR02MTxx LAR02MTxx							•					•
BSR02D03 BSR02KKxx LAR02KKxx	•									•		
LAR02KBxx					•					•		

Tab 5: Product selection

$•_1$: With polyamide cone outlet
$•_2$: With aluminium cone outlet

Tehalit GmbH
Seebergstrasse 37
67716 Heltersberg
GERMANY

T +49 63339920
F +49 H 63339927666
info@hager.de

hager.com

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