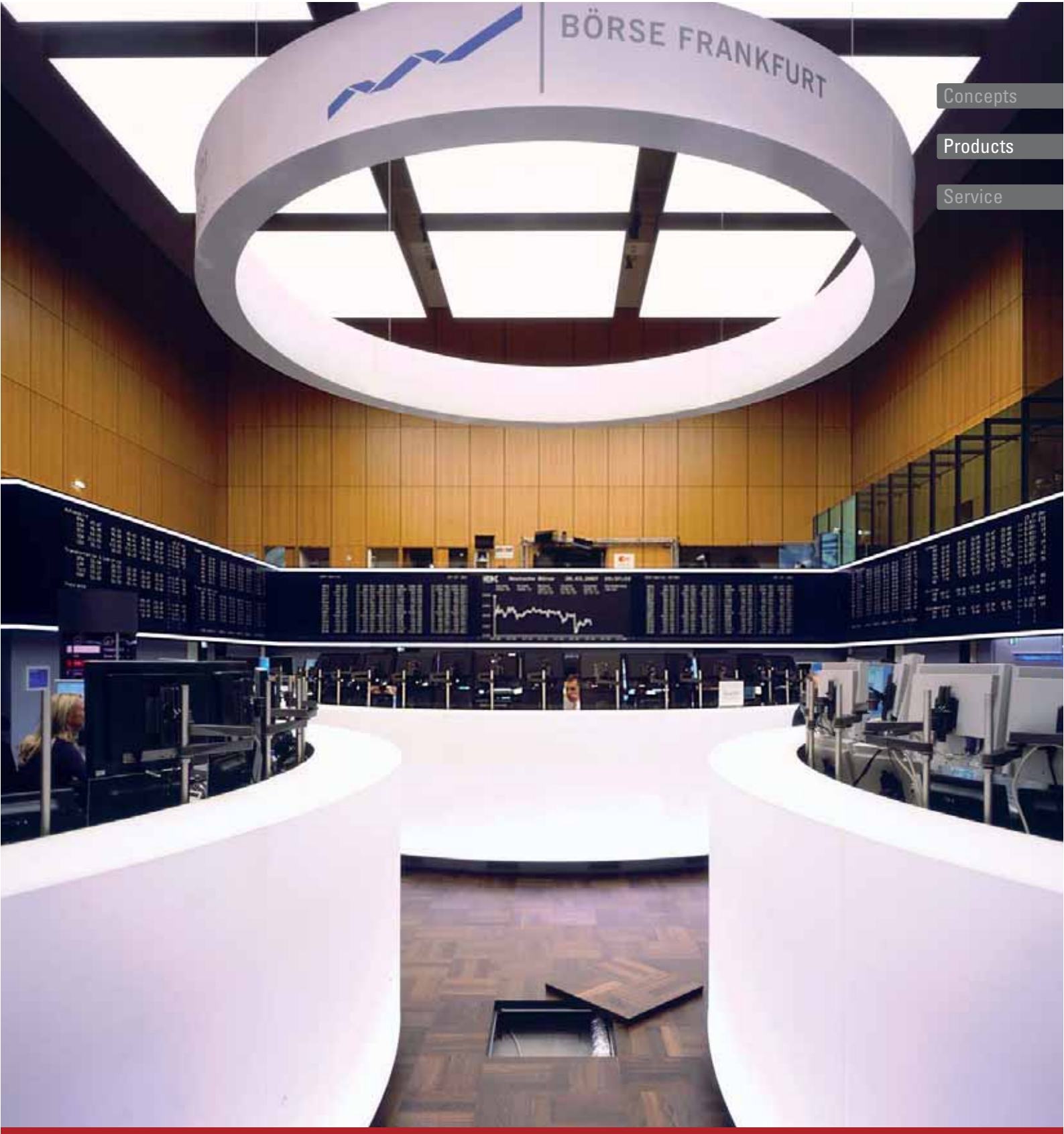



Concepts

Products

Service

# A true economic wonder.

LIGNA raised floor systems

Lindner | Building New Solutions

# Building new solutions.

Lindner undertakes major worldwide projects in all areas of interior finishes, insulation technology, industrial services and building facades. From pre-planning through to project completion Lindner is your partner of choice.

The Company's extensive manufacturing capability enables quality to be strictly maintained whilst allowing maximum flexibility to meet individual project requirements.

Environmental considerations are fundamental to all Lindner's business principles.

Through partnerships with clients Lindner turns concepts into reality.

## Choosing Lindner you have:

### Lindner Concepts:
Tailored solutions specifically geared to satisfy individual project requirements

### Lindner Products:
Quality materials and systems to the very highest industry standards

### Lindner Service:
Comprehensive project management services

# LIGNA raised floor systems

## Advantages, where you walk and stand.

**Your benefits at a glance**

- Minimal system weight
- Quick to install
- Excellent price-performance ratio
- Can be combined with other flooring systems
- Special formats available

# Contents



# A true economic wonder.

## Lindner LIGNA

The company has cutting-edge facilities and is one of the leading manufacturers worldwide. The highest accuracy in terms of tolerance is crucial for the quality of the finished raised floor; this is achieved through the highest technical standards.

### Environmentally-friendly quality.

Lindner's excellent quality is not left to chance, but is ensured by a sophisticated quality management system, demonstrated by our certification to ISO 9001:2000. Samples taken during production are tested against a full range of technical parameters such as stability, breaking load, dimensional accuracy, adhesive values, etc. (over 100 criteria in all). Our labs are equipped with ultra-modern test equipment, and constantly test edge trims, adhesives, zinc layer thickness etc. Independent institutes test all systems to the accepted standards for noise, fire safety and mechanical resistance. Tests meeting European standards and certification for almost all European countries are part of our portfolio.

### Eco-friendly.

Strategic environmental management is a top priority at Lindner. For this reason, we only use materials that are ecologically tested and approved. We also work continually to reduce our emissions and energy consumption. Before construction starts, we conduct surveys designed to reveal potential savings. Savings that we can pass on to you.

LIGNA raised floor panels are the first choice when the cost-effectiveness of your project is the focus – and a very good solution for office and technical areas.
This system is particularly attractive economically because of its excellent price-performance ratio. The light weight of the panels makes handling very easy. High accuracy in terms of tolerance also makes the panel extremely impermeable where air-tightness is required. Ease of forming rip cuts and cut outs is also an advantage.
The quality of the panels is of the highest standard. We can also cater for individual customer requests, such as special formats.
A well-established selection of raw materials ensures lowest possible emission levels.

## Fields of application

- Office and design areas
- Computer rooms and control centres
- Training and research rooms
- Industrial and working rooms

# System data – LIGNA

| | |
|---|---|
| Panel | High-density chipboard panel, classified in emission class E1, galvanised steel sheet or humidity protection at underside, surrounding edge protection against impact and humidity |
| Load-bearing capacity | 2 kN - 5 kN |
| Fire protection<br>Reaction to fire performance of the panel<br>Fire resistance performance | <br>Difficult to ignite<br>F 30, REI 30 |
| Resistance to earth | $\geq 10^6\ \Omega$ |
| System weight | 26 kg/sqm - 41 kg/sqm |
| Standard finished floor heights | 28 mm - 2,000 mm |
| Panel thickness | 30.5 mm - 38.5 mm |
| Pedestal spacing | 600 mm x 600 mm (other pedestal spacings are system-dependent) |
| Sound protection<br>Normalised flanking level difference $D_{n,f,w}$<br>Weighted sound reduction index $R_w$<br>Normalised flanking impact sound pressure level $L_{n,f,w}$<br>Reduction of impact sound pressure level $\Delta L_w$ | <br>45 dB - 54 dB<br>62 dB<br><br>66 dB - 47 dB<br>20 dB - 37 dB |
| Suitable floor coverings | Elastic coverings / textile coverings / HPL / WOODline / Loose-laid tiles |
| Accessories | - Expansion joints<br>- Stringers<br>- Electrical outlets<br>- Air ventilation outlets<br>- Cavity barriers<br>- Intermediate floors<br>- Facings<br>- Bridging profiles |

Please see the system data sheets for more detailed technical information on each system.

# System description – LIGNA

## Panel

The LIGNA raised floor panels are made of chipboard. The edges are tapered for easier laying and are protected by an edge trim.
High-density chipboard panels are used as a carrier. The panels comply with E1 requirements for formaldehyde emission. The panel edges slope downwards, facilitating easy removal and interchange. The impermeable foil on the underside of the panel on the AL version acts as humidity protection. Rigidity is increased by gluing a galvanised steel sheet to the ST version.

## Load-bearing capacity

A steel sheet can be applied underneath to increase load-bearing.

## Fire protection

LIGNA offers outstanding safety: the density of the panel allows us to achieve fire resistance of 30 minutes (Fire resistance performance F30, REI 30). The surrounding plastic edge trim ensures maximum sealing of joints thus providing fire protection.

## Resistance to earth

Chipboard panels can be produced with conductive properties. By using highly conductive components such as coverings, adhesives and edge trims, the electrostatic charge can be continually dispersed to earth. In such cases, it is important to choose a suitable floor covering.

## System weight

The weight of the system varies from 26 kg/sqm to 41 kg/sqm, depending on customer requests and load-bearing requirements.

## Installation height

For heights of 500 mm plus we recommend horizontal reinforcement with stringers.

## Pedestal

Pedestals are made from galvanised, yellow chromatised steel and are infinitely adjustable in height. They are equipped with a precision-engineered adjusting bolt.

## Sound dampening plates

Sound dampening gaskets are made of conductive /non-conductive plastics. They support optimum positioning of the floor panels and optimise sound as a result of their material properties.

## Gluing of pedestals

Pedestal base glued to subfloor. Adhesives of different qualities depending on the environmental requirements.

## Height fixing

A sealant varnish made from low-emission materials is used for this purpose.

## Wall connection

A permanent, pre-stressed wall connection with sealing tape works as a sound decoupling whilst also absorbing horizontal movements.

## Structural subfloor

As a rule, all structural subfloors are sealed to ensure lasting pedestal adherence to the subfloor. We recommend a 2-component finish for air-conducting system floors.

## Suitable floor coverings

Elastic or textile floor coverings are highly suitable for our raised floor panels. Loose-laid tiles are also suitable. WOODline creates a particularly pleasing feel.

# Lindner substructures

## Pedestals

The substructure is an important component of every system floor. The pedestals create the cavity needed to accommodate the services. Lindner metal pedestals can be adjusted to almost any height, therefore compensating for any uneveness in the subfloor. From design to manufacture – we produce our pedestal range entirely in-house.

We manufacture highly accurate pedestals for raised floors. Our many years of experience ensure high load-bearing capacity and excellent durability for all our products. Lindner systems can be combined with one another in many ways, and supplemented with different reinforcement profiles.

### Lindner pedestals

- Large adjustable range
- Corrosion resistant
- High load-bearing capacity
- Easy installation

# Reinforcement profiles

Even a standard Lindner floor system offers excellent load-bearing capacity. Should this prove insufficient, the system can be upgraded by reinforcement profiles, adjusted to the specific purpose.
Many options are available, from the lightest stringer which increases lateral rigidity through to a C-profile.

## Stringers

| | |
|---|---|
| **Type RO**<br>(Height: 7.5 mm) | The type RO stringer is made from cold-rolled galvanised steel sheet with clip function. Clipping (screwing optional) ensures a firm hold on the pedestal head, thus preventing any noise, for example rattling. The sole purpose of the stringer is to reinforce the system horizontally. |
| **Type RL**<br>(Height: 35 mm)<br><br>**Type RM**<br>(Height: 54 mm) | Type RL (light) and type RM (medium) stringers are made from cold-rolled galvanised steel sheet. Springs are inserted laterally on the ends of the stringers which are then clipped into the pedestal from above by pressing downwards (screwing optional). RL and RM stringer are used for horizontal and vertical system reinforcement. |

## C profiles

| | |
|---|---|
| Type CL (height: 41 mm) | Cold-rolled galvanised steel sheet, for use in switch room construction. Profiles are installed lengthwise in a continuous line underneath the floor using a hammerhead screw or a spring clip. A significant increase in load can be achieved depending on the dimension of the C-profile being used. |
| Type CS (height: 41 mm) | |
| Type CM (height: 84 mm) | |
| Type CH (height: 126 mm) | |

# System accessories

## Electrical outlets

As all electrical installations are fed under the raised flooring, electrical connections can be placed exactly where you want them by the installation of electrical outlets.


## Bridging profiles

For structural reasons bridging is required where pedestals cannot be installed. In such cases we offer special bridging profiles which are easy to install and yet improve dynamic and static load-bearing capacities.


## Expansion joints

Expansion joint profiles are used to absorb horizontal deflections and vertical weighing down constructively and invisibly.

## Air ventilation outlets

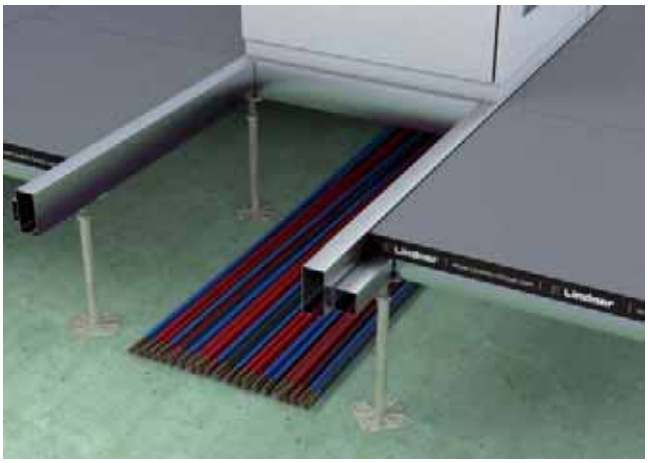
Air ventilation outlets allow the room to be air-conditioned and ventilated without creating draughts. A number of different systems are available:

- Open system
  Ventilation comes directly from the cavity, which is designed as a pressure floor, through the corresponding air ventilation outlets into the room.

- Closed system
  In a closed system, the air is fed through pipes or through cavity barriers with fixed connections to the air ventilation outlets.


## C-profile frames

For technical service rooms, we always recommend the use of stable switch room frames, as these provide the required lateral and vertical load-bearing capabilities. The combination of two C profiles with variable heights (CL and CM) provides sufficient stability for switch gear or server racks. Raised floor panels are not installed under the cabinets, so that cables can be connected more easily to the electrical components. Cold air is supplied through the opening in the floor, regulating the operating temperature of the components.

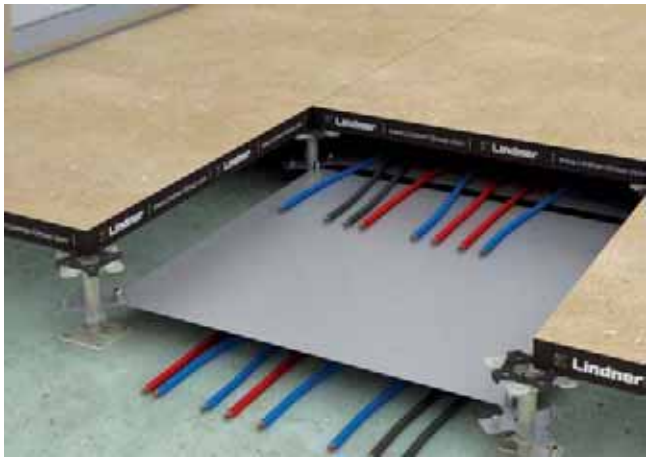



## Intermediate floor for cables

Where there is a lot of cabling, additional installation elements will be required. An intermediate floor should be installed to carry cables. It consists of a star-shaped carrier plate with welded threaded bolts into which a steel sheet cassette is hooked and screwed tight. Intermediate floors also enhance the horizontal stability of the system.

You can choose from two options:

- intermediate floors which can be walked on
- intermediate floors which cannot be walked on



# System accessories

## Facings

Staircases, platforms, etc. need to be finished with a front cladding (facing). Where features such as free-standing borders are required, the top edges of the facing will be protected with a stair edging profile. Angles screwed to the subfloor and bracings installed in the upper area of the facing ensure a stable structure.


## Cavity barriers

Three different types of cavity barriers can be installed to meet different requirements.

- Ventilation barriers
  made from coated chipboard panels
- Soundproofing barriers
  made from porous concrete (min. 100 mm)


# Joint permeability

Where open air ducting is installed under the raised floor, the impermeability of the system needs to be guaranteed.

The following specific values were confirmed by the "Institut für Systembodentechnik" with test report 04/535BS:

## Influencing factors

$V_L$ = volume of airflow per unit of length
a = joint permeability coefficient
$\Delta_p$ = test pressure difference

To optimise the air leakage coefficient of a raised floor system, we recommend the use of loose-laid tiles.

## Test results

- Wall connection with sealing tape;
  Test of wall connection $a_w$
  → Joint permeability coefficient
  $a_w$= 0.27 $m^3/(h \times m)$

- Wall connection with sealing tape and incorporated stringers;
  Test of wall connection $a_w$
  Joint length 6.0 m
  → Joint permeability coefficient
  $a_w$ = 0.27 $m^3/(h \times m)$

- Wall connection with airtight sealant; test of joints between the raised floor panels $a_D$
  Joint length 4.2 m
  → Joint permeability coefficient
  $a_D$ = 0.04 $m^3/(h \times m)$

# Load-bearing capacity

The permissible loading capacity is calculated and tested with the involvement of official bodies. The final results are substantiated by certificates of conformity to the application guideline for the standard DIN EN 12825.

The following key criteria are used:
a) Load value
b) Supporting surface of the load indentor
c) Positioning of the load on the test sample
d) Safety factor

The critical load for raised floors is the point load. Floor systems are assigned a load and deflection class on the basis of their static load-bearing properties and the related deflection levels. As a rule strip loads and distributed loads are not taken into account, as they are not applicable.

## Point loads

To determine the point load, a static load (such as a table leg) is simulated. On the basis of the permissible point load thus established, the system is generally assigned an appropriate load and deflection class. In accordance with standard practice, the load is applied with a 25 mm x 25 mm indentor.

## Dynamic loads

**To determine the permissible dynamic load (such as a forklift), the following must be taken into account:**

- Weight of the vehicle without load
- Total weight of the vehicle with load
- Max. wheel load
- Contact surface of the tyres or rollers
- Wheelbase
- Max. drive or tow speed
- Number, diameter, width and material of tyres or rollers
- Max. acceleration and deceleration during lifting
- Safety factor

A corresponding safety coefficient will be determined for the ascertained static load (permissible total weight of the vehicle) using the aforementioned factors and multiplied by the max. permissible static load. When selecting a floor covering, one must be sure that the floor covering and adhesive are suitable for these special requirements.

## Distributed loads

Like the point load, the distributed load is a static load. In contrast to the point load, the area of the indentor is 1 sqm. The term distribution load is commonly used in structural engineering. It is used to determine the strength of reinforced concrete floors. For raised floors, the specification or assessment of a distributed load is inappropriate.

For practical purposes, the indentor of 1 sqm spans the raised floor grid (60 cm x 60 cm) and thus the individual panel. The panel and pedestal acts here merely as an intermediate layer, transferring the load to the concrete subfloor.

# Load-bearing capacity

## Static values acc. to DIN EN 12825

The European raised floor standard EN 12825 describes a system test process for panels and pedestals (resp. substructure) to identify the maximum load and relevant classifications. The load is transferred onto the system using a test indentor of 25 mm x 25 mm (625 sqmm). The load points shown are to be checked. The failure criteria shown below for classification of the system is the breaking load and the deflection (vertical displacement) with nominal load and load class.

## Load classes

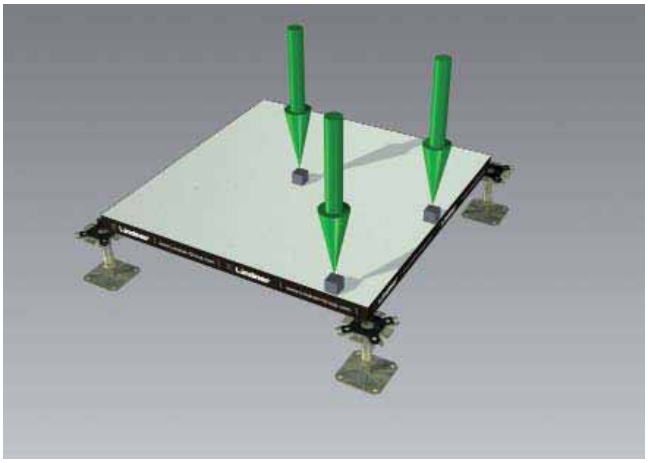
| Class [1] | Breaking load [2] | Nominal load [3] | Element class [4] | Applications and usage scenarios |
|---|---|---|---|---|
| 1 | ≥ 4,000 N | 2,000 N | 1 | Offices without public access and without heavy equipment |
| 2 | ≥ 6,000 N | 3,000 N | 2 | Office areas with public access |
| 3 | ≥ 8,000 N | 4,000 N | 3 | Rooms with increased static loads |
| 4 | ≥ 9,000 N | 4,500 N | - | Areas with fixed seating, design offices |
| 5 | ≥ 10,000 N | 5,000 N | 5 | Exhibition areas, workshops with light use, storage rooms, libraries |
| 6 | ≥ 12,000 N | 6,000 N | 6 [5] | As with load category 5,000 N, but with increased load requirements, industrial and workshop floors, vault rooms |
| - | ≥ 14,000 N | ≥ 7,000 N | | Heavy duty floors, production areas, such as clean rooms |

1) Classification of the load acc. to DIN EN 12825
2) To determine the breaking load, the load is applied to the weakest point of the panel (see illustration) using a 25 x 25 mm test indentor and is increased until the panel fails.
3) The nominal load or load class is determined from the breaking load divided by the safety factor $\nu = 2$
4) Load classification in accordance with the application guideline for raised floors
5) Higher breaking/nominal loads are required in individual cases for raised floors with high load-bearing requirements, see NORTEC power systems

## Deflection classes

For a load at the level of the nominal load (this is the breaking load divided by the safety factor), the vertical deflection measured must not exceed the values given in the table below.

| Class | Maximum deflection |
|---|---|
| A | 2.5 mm |
| B | 3.0 mm |
| C | 4.0 mm |



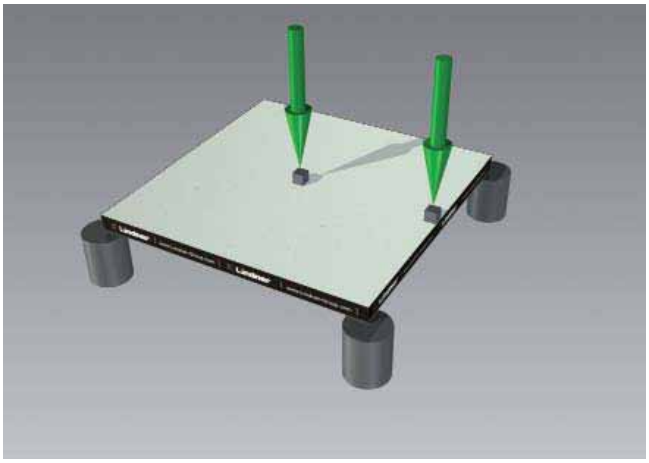
## Static values acc. to international standards

International standards describe the testing of components for the classification by load classes. Raised floor panels and pedestals are tested and classified individually. The maximum load is applied to the panel using a 25 mm x 25 mm (625 sqmm) test indentor. The load points shown are to be tested. The raised floor panel is supported on solid cylinders. The failure criterion is the breaking load and a maximum panel deflection of 2 mm (l/300).

## Load classes

| Class [1] | Breaking load [2] | Nominal load [3] | Deflection [4] | Applications and usage scenarios |
|---|---|---|---|---|
| 1 | ≥ 6,000 N | 3,000 N | max. 2 mm | Offices with a high proportion of communication equipment, telephone exchanges, engineering offices, auditoriums, training and treatment rooms |
| 2 | ≥ 8,000 N | 4,000 N | max. 2 mm | Computer rooms with more demanding requirements, print rooms, industrial floors with light traffic, storage rooms, workshops with light use and libraries |
| 3 | ≥ 10,000 N | 5,000 N | max. 2 mm | Computer rooms with more demanding requirements, print rooms, industrial floors with light traffic, storage rooms, workshops with light use and libraries |
| 4 | ≥ 10,000 N | > 5,000 N | max. 2 mm | Floors with forklift traffic, industrial and workshop floors, vault rooms |

1) Classification of load
2) To determine the breaking load, the load is applied to the weakest point of the panel (see illustration) using a 25 x 25 mm test indentor and is increased until the panel fails.
3) The nominal load is determined from the breaking load divided by the safety factor $\nu$ = min. 2
4) Where the panel is loaded with the nominal load, the maximum permissible deflection is l/300.



# Fire protection

Raised floors allow you to install all of the technical services such as cabling, supply and disposal systems, ventilation, heating, air-conditioning, etc. exactly where you want them.

Installations of this kind also have to comply with requirements in the case of fire. The following criteria must be considered:

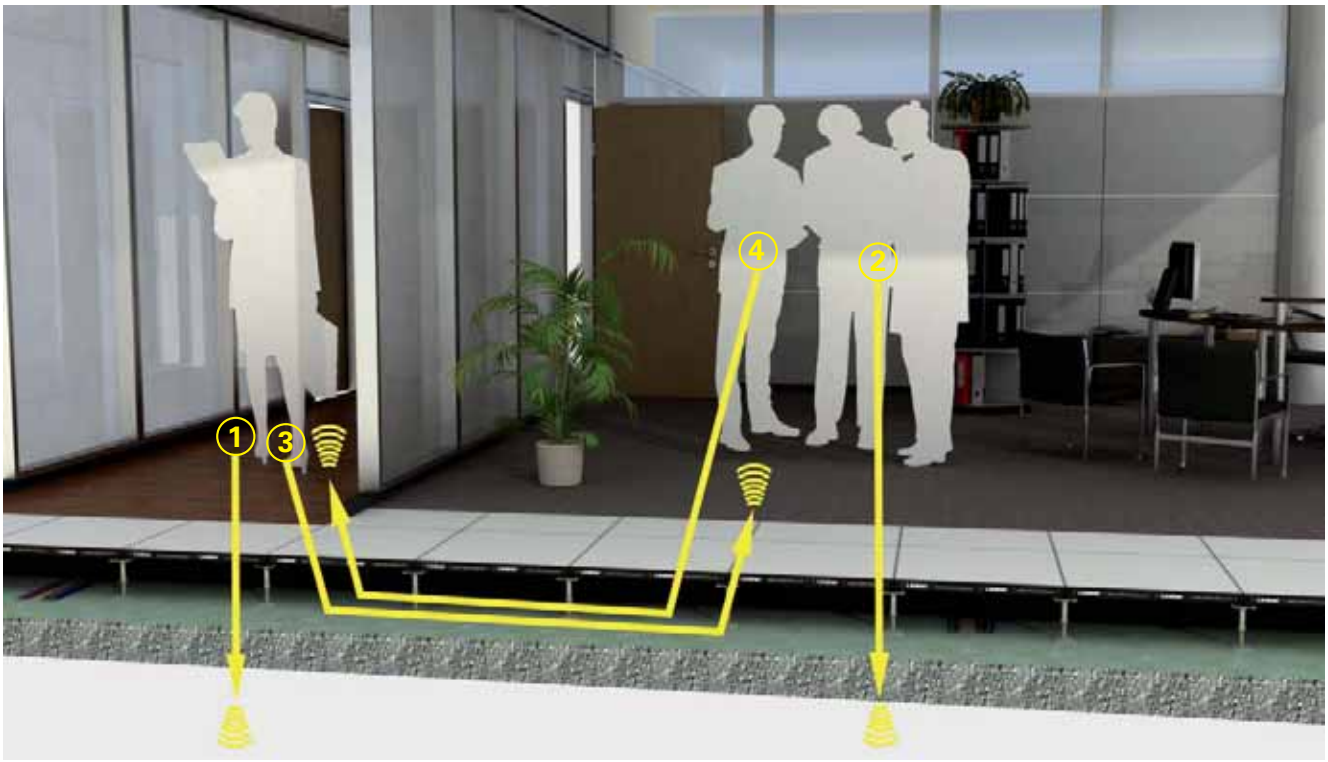
- Protection of adjacent escape routes
- Protection of neighbouring or other facilities
- Maintaining the stability of partition walls, with and without fire-resistance which are in contact with the flooring
- Fire-resistance of the structure
- Combustibility and reaction to fire performance
- Protection against a fire in the floor cavity

Further details and fire protection regulations can be found in Lindner documentations dealing with Fire Protection, the "Exemplary System Floor Directive" (MSysBöR) issue September 2005 and in the "Exemplary pipe work Directive" (MLAR) issue November 2005. Further information is also available in data sheet 11 of the BVS (Bundesverband Systemböden)

When operating cable and channel systems, fires resulting from incidents such as overheating cannot be ruled out. In this event the system floor structure must withstand this fire loading. In Germany fire testing to DIN 4102/2 is carried out to a temperature requirement as per ETK (standard temperature curve).

Fire resistance performance test of a system floor under load according to DIN 4102/2.

# Sound protection




## 1 Reduction of impact sound pressure level $\Delta L_w$ tested to DIN EN ISO 140-8

Laboratory test measurement is carried out vertically, i.e. from floor to floor with a standard ceiling, allowing comparison between different systems.
Higher values are favourable.

## 2 Weighted sound reduction index $R_w$ tested to DIN EN ISO 140-3

Laboratory test measurement is carried out vertically, i.e. from floor to floor, with a standard ceiling, allowing comparison between different systems.
Higher values are favourable.

## 3 Normalised flanking impact sound pressure level $L_{n,f,w}$ tested to DIN EN ISO 10848-2

Laboratory test measurement is carried out horizontally in combination with a highly sound-proofing partition which is suspended from the ceiling and touches the surface of the raised floor.
Lower values are favourable.

## 4 Normalised flanking level difference $D_{n,f,w}$ tested to DIN EN ISO 10848-2

Laboratory test measurement is carried out horizontally in combination with a highly sound-proofing partition which is suspended from the ceiling and touches the surface of the raised floor.
Higher values are favourable.

Consider the correction degree according to VDI 3762 to calculate the values on the construction site. Combinations of raised and hollow floors are to be assessed individually. The corrective allowance should be specified by the planner.

# Static electricity

## Preliminary remarks

Static electricity as a natural phenomenon is familiar to the public, for example when getting an electric shock from door handles after walking across carpets.

These electrical discharges are generally of no danger to the people themselves. People may however be startled and, as a result, make a mistake.

In addition to this, however, there are consequences of static electricity that must be prevented. These range from the destruction of electronic components to the explosion of complete factories.

## Brief description

**Static electricity builds up = electrical charge**
Static electricity always occurs from the movement of fixed insulators or liquid substances, strictly speaking from their separation. An extreme example is when dusty air passes a wall.

The resulting voltage depends on the air humidity. Dry air will cause higher charges to develop than humid air.

Electronic components are extremely sensitive to such events. Discharges of just 30 V can destroy them and/or trigger switching errors.

This results in unpredictable risks and thus incalculable costs. A fact which defuses the problem is to ensure that generally all electronic elements are shielded.

**Static electricity and conductivity**
At best the occurrence of static electricity can be reduced by choosing appropriate materials but it cannot be prevented entirely. However, ensuring that all electric charges are discharged immediately and smoothly, prevents any danger to people or objects. If static electricity is continually discharged when it occurs, the charge cannot become large enough to cause an electrical discharge (electric shock).

**Static and dynamic electricity**
Dynamic electricity is the electric power that is supplied by a power station, via electricity lines and is available as a voltage. Static electricity, in contrast, is not supplied by a voltage source, but rather is a one-off event, which is not immediately available again after discharge and has to be built up again.

## Test procedure for electrostatic properties

**Resistance measurements; measurement parameter Ω (ohm)**
Most tests are carried out in a prescribed test climate, which, however, is not uniform for the different standards.

Contact resistance
($R_1$ - Procedure A - DIN EN 1081)
Electrical resistance is measured on a sample between the tripod electrode placed on the surface of the floor covering and an electrode placed directly on the opposite underside.

Resistance to earth
($R_2$ - Procedure B - DIN EN 1081)
Electrical resistance is measured on an installed floor covering between a tripod electrode pressed onto the top of the floor and the earth potential.

Surface resistance
($R_3$ - Procedure C - DIN EN 1081)
Electrical resistance is measured on an installed floor covering between two tripod electrodes spaced 100 mm apart from one another.

Earth continuity
($R_{ST}$ DIN 57100 / VDE 0100 T-10)
Resistance is measured between the surface of the installed floor covering and the earth potential.

**Measurements of charge; measurement parameter kV (kilovolts)**

Walking test (DIN 54345, T2)
The charging voltage is measured by a test person shuffling across an installed floor covering wearing specific footwear.

Technical test (DIN 54345, T3)
The above mentioned walking test is simulated with a machine. This test can only be performed in a laboratory.

Terms
Antistatic
Elastic floor coverings are also antistatic if they are conductive.
Floor coverings are antistatic when they generally do not allow any disturbing electrostatic charges to develop; the charge needs to be less than or equal to 2.0 kV during the walking test.

Conductive
Floor coverings are conductive when their resistance to earth $R_2$ – Procedure B is less than or equal to $10^9\ \Omega$. However, lower resistances are also required in many cases.

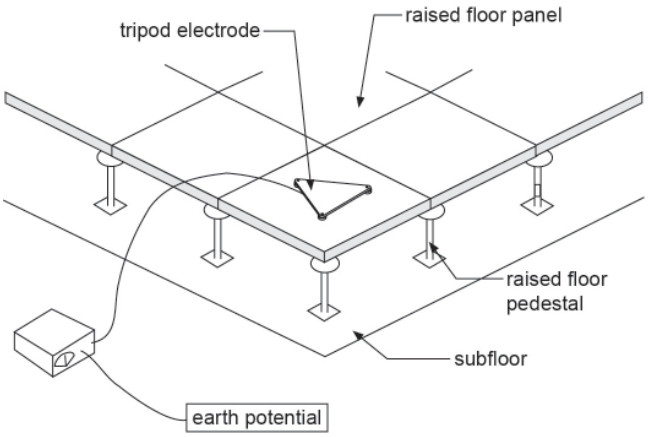
Insulation
A floor is insulating according to DIN 57100 / VDE 0100T410, Sec. 6.3.3 (against contact voltage from the mains) if the earth continuity $R_{ST}$ is not less than the following values:
50 kΩ = 5 x $10^4\ \Omega$ for installations with nominal voltages under 500 V
100 kΩ = 1 x $10^5\ \Omega$ for installations with higher nominal voltages

Note
As a result of different test conditions, the earth continuity can only be calculated approximately from the contact resistance (R1 – Procedure A – DIN EN 1081). However, from experience it is known that conductive floor coverings with less than $10^6\ \Omega$ do not meet the VDE requirements. Earth continuity for all types of floor coverings reduces where there is moisture in the flooring system.

# Resistance to earth

Resistance to earth $R_2$ – Procedure B – DIN EN 1081
Measurement of resistance to earth $R_2$ of the installed floor covering. The electrical resistance of an installed floor covering is measured between the earth potential and an electrode placed on the surface of the covering.
The tripod electrode is placed on the dry floor covering (48 hours after installation) and connected to the ohmmeter, just as is the earth connection. Load the tripod with at least 300 N before switching on the power.

Note
For values of $10^{10}\ \Omega$, static electricity can dissipate in about 1 second. Achieving less than $10^8\ \Omega$, a floor covering is sufficiently conductive to prevent a potential fire hazard from flammable dusts or gases created from electrostatic loading resulting from walking on the covering. With less than $10^6\ \Omega$, a covering is also suited for rooms for storage and production of explosives. The relevant requirements of the trade associations (e.g. ZH 1-200), electronics manufacturers and users have to be observed in each case.




| | |
|---|---|
| Tripod electrode: | Aluminium panel with rubber feet |
| Weight: | Equal to or greater than 300 N |
| Test voltage: | R less than or equal to $10^6\ \Omega$ with 100 V; R greater than $10^6\ \Omega$ with 500 V |
| Execution: | At least three measurements |

# Charge measurements

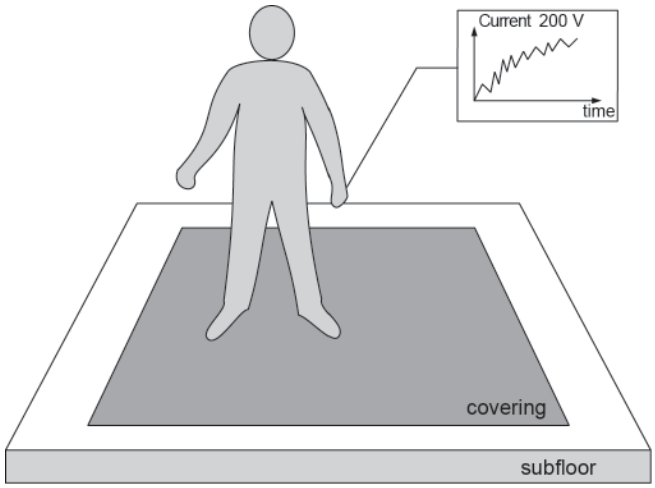
Charge measurements with the walking test,
DIN 54345 / Part 2
- Measurements of the tendency to electrostatic charge during the walking test

Duration of the walking test:
The charging voltage is measured when the person stands on the floor covering with both feet.

Floor coverings are considered to be antistatic if the charge voltage does not rise above 2,000 V (definition acc. to data sheet EDV 1, Issue 7/84 from the TFI Aachen for carpet flooring).

1 minute (shuffling gait) at 23 °C and at 25% relative air humidity.

A special rubber provided by the National Materials Testing Institute (BAM) is used for the sole material of the shoes. This material is slightly conductive and supplies a resistance of around $10^9$ Ω between the person and a conductive floor.

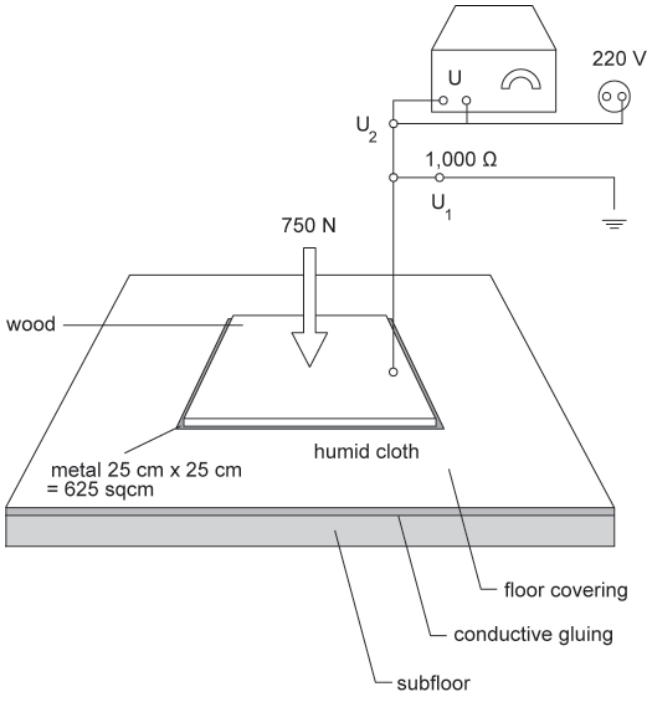



# Earth continuity

Earth continuity $R_{ST}$, DIN VDE 0100
- Measurement of the earth continuity between the surface of the installed floor covering and the earth potential

In workplaces handling components sensitive to static electricity and which regularly work with open voltages, e.g. in the test field, an electrically conductive floor covering must also be insulating acc. to DIN VDE 0100. The earth continuity measurement is used to assess the electrical insulating ability.

Note
VDE 0100 / Part 410 specifies a lower limit for the earth continuity $R_{ST}$ as applicable to the workplaces mentioned above. In workplaces where the nominal voltage does not exceed 500 volts of alternating current, the earth continuity must be at least 5 x $10^4$ Ω. If nominal voltage are between 500 and 1,000 volts of alternating current, the earth continuity must be at least 1 x $50^5$ Ω. Electrode surface: 625 sqcm.



# Examples of use

On the preceding pages we have clarified the meaning of the word electrostatic and the different measurements. What else must be taken into account where a raised floor is installed and what requirements are sensible?

The electrical resistance of individual areas are totalled which means in practice:

The resistance to earth $R_2$ can never be lower than the highest resistance of the individual element in the sequence: floor covering – adhesive – raised floor panels – gaskets – pedestals.

**The flooring systems must fulfil the following requirements:**

1. Office rooms with terminals, sale and exhibition rooms etc.

   In these areas, an antistatic floor covering which is equal to or less than 2 kV tested to DIN 54345.

2. Rooms with electronic equipment, such as data centres, computer operation rooms, office rooms with special equipment: earth resistance $R_2$ less than or equal to $10^9\ \Omega$ or charging voltage U maximum 2 kV.

3. Unprotected electronic assemblies or components with operator protection requirements, e.g. test fields in the electronic production area: Earth resistance $R_2$ less than $1 \times 10^8\ \Omega$, earth continuity acc. to VDE 0100, $R_{ST}$ operator $5 \times 10^4\ \Omega$ or $R_{st}$ greater $1 \times 10^5\ \Omega$ (depending on nominal voltage).

4. Unprotected electronic assemblies or components, e.g. fabrication or laboratory rooms for the production, repair and testing of electronic equipment, assemblies or components: Earth resistance $R_2$ less than $1 \times 10^8\ \Omega$.

5. Explosive atmospheres in general, e.g. laboratories with risk of explosion, gas pressure regulating facilities, accumulator rooms: Earth resistance $R_2$ less than $10^8\ \Omega$.

6. In newly built rooms used for medical purposes, $R_2$ less than $10^7\ \Omega$, after four years $R_2$ less than $10^8\ \Omega$, HF surgery $R_2$ greater $5 \times 10^4\ \Omega$.

7. Explosive substances, e.g. where explosives are produced and stored, munitions or pyrotechnical items: Earth resistance $R_2$ less than $10^6\ \Omega$.

Summary:
For most raised floor applications, a covering not exceeding the 2kV charge limit is usually sufficient. There is no requirement for earth resistance for the whole structure. Requirements for earth resistance as per the above list is usually only necessary in subareas e.g. central computer rooms.

Seen as a whole, the subject of static electricity is difficult to understand because of the many tests and requirements, a situation arising from excessive earth resistance requirements which were specified in the past.

Low conductivity of less than $10^8\ \Omega$ can only be achieved by raised floor manufacturers when using highly conductive coverings, panel materials and adhesives. With regard to construction costs, unnecessary excessive requirements should, therefore, be avoided. It should be mentioned here that corresponding user clothing (conductive footwear) is absolutely crucial. A technically perfect electrostatic floor construction is useless against non-conductive footwear. Damages due to electrostatic discharge in this instance are inevitable.

Source
Safety Guideline for Raised floors, AGI Worksheet, manufacturer´s recommendations, Carpet Research Institute.

# Floor coverings

## Standard coverings

Different floor coverings individualise your LIGNA raised floor. In general, all standard floor coverings are available. In addition to standard floor coverings Lindner offers floor panels with finished surfaces. Every floor system gets a covering as a finish. Factory-bonded coverings with tested and emission-free adhesives ensure the best quality and an extended life for your product. You can choose from a range of coverings including rubber, PVC, HPL or carpet.
For a top of the range floor covering select Lindner WOODline parquet floor.

### Possible floor coverings

- Elastic coverings
- Textile coverings
- HPL
- WOODline
- Steel sheet and aluminium foil
- Loose-laid tiles

## WOODline

The floor has always been an essential part of a highly specified room. Whether in a conference room or in the modern office, parquet floors make you feel good. Lindner parquet floors are manufactured from solid wood to the highest quality standards and are particularly durable and comfortable to walk on. The combination of a range of woods, designs and finishes means that all ideas are possible.

The edge trim is fitted to the top edge of the parquet, so that no moisture can penetrate into the parquet itself. The colour of the edge trim is supplied in the same colour as the parquet, making the joint between the panels and the edge trim itself barely visible.

# Floor coverings

## Types of wood

Maple, bamboo, steamed bamboo, steamed beech, light beech, oak, smoked oak, ash, olive ash, jatoba, cherry, merbau, walnut and teak. These wood types are only a small selection from our range. Other types of wood are available on request.



Maple

Bamboo

Steamed bamboo

Steamed beech

Light beech

Oak

Smoked oak

Ash

Olive ash

Jatoba

Cherry

Merbau

Walnut

Teak

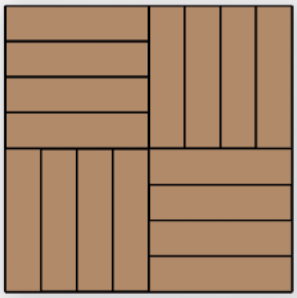
As with all natural products, wood differs in colour and structure. Print colours cannot reproduce the colour of the parquet exactly, therefore small differences might occur.

The wooden surfaces are offered oiled or varnished.

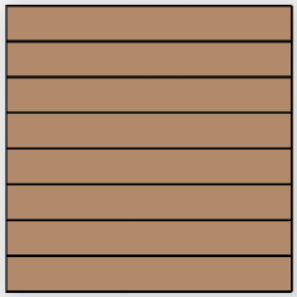
## Types of designs

3-strip

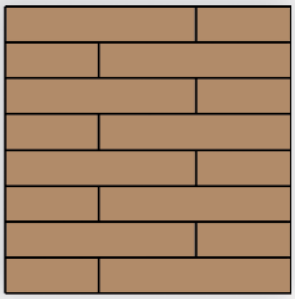
Cube, fourfold



Large baton

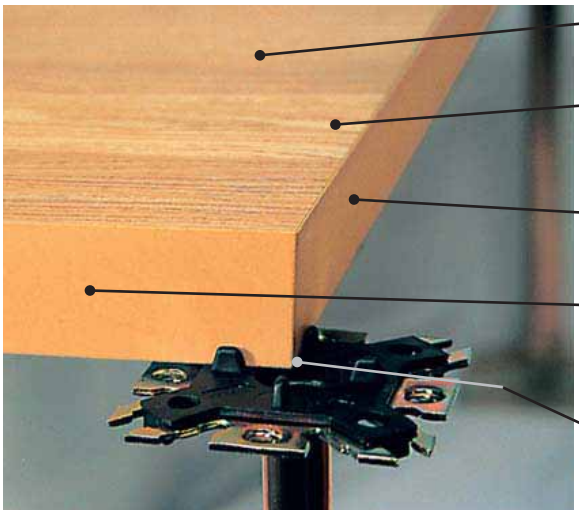


2-strip



Mosaic

Industrial parquet



Surface
Varnish, oil

Covering
High-quality wood panels in different designs and woods

Carrier panel
Raised floor panel from chipboard

Edge trim
Colour adjusted to the type of wood. To protect the edge of the panel, the edge trim reaches to the top edge of the parquet

Barrier
Impermeable foil as humidity barrier or steel sheet to increase load

### Advantages of varnished finishes:

- Extremely hard surface
- Highly wear resistant
- Low maintenance
- Resistant against bacteria and microorganisms
- Adjustable gloss level

### Advantages of oiled finishes:

- Low maintenance
- Damage through use is easy to resolve
- Ecologically friendly
- Maintains natural surface structure

# Standards and regulations

## Association of System Floors (Bundesverband Systemverband e.V.)

The comeing together of European countries and the creation of standards and laws to regulate this free market has resulted in medium-sized companies forming syndicates, so that they can increase their influence with public institutes and standardisation opposite their European counterparts.

This resulted in the Association of System Floors, founded on 1st January 1995 to represent the interests of medium-sized companies, such as the "Fachgemeinschaft Doppelboden" (Trade Community Raised Floors) or the "Fachverband Hohlraumboden" (Trade Association of Hollow Floors).

In addition to this synergy between associations, the Association of System Floors will also continue to support the European standardisation for raised floors in the CEN. This standardisation is intended to establish top-quality technical offers for raised floor products.

Please refer to the website of the "Bundesverband Systemböden e.V." (www.systemboden.de) for up-to-date information, particularly BVS data sheets on system floor specifications, the overview on standard certified system floors and the German system floor ABP (General Constructional Supervisory Test Certificate) central register.

Lindner AG is a member of the Association of System Floors.

## DIN EN 12825 Raised flooring

System floors, particularly raised floors, are used in every modern administrative and office building and as such are an everyday product for planners and architects.

System floors also fulfil many safety tasks. The planner has to deal with many building regulations, technical requirements and products.

The DIN EN 12825 standard has introduced standardised European testing procedures and load classes for system floors based on the Construction Product Directive. The corresponding application guidelines are based on European standards, whilst taking into account the German Building Regulations Act and the generally recognised regulations on the technology in nationally applicable requirements and regulations. At the same time, they also regulate procedures for certifying standards compliance.

The full set of DIN standards can be requested from Beuth Verlag GmbH, Burggrafenstraße 6, 10787 Berlin, Tel. (030) 26 01 – 22 60, www2.beuth.de.

DEUTSCHE NORM April 2002

Doppelböden
Deutsche Fassung EN 12825:2001

DIN
EN 12825

ICS 91.060.30

Raised access floors;
German version EN 12825:2001

Planchers surélevés;
Version allemande EN 12825:2001

**Die Europäische Norm EN 12825:2001 hat den Status einer Deutschen Norm.**

**Nationales Vorwort**

Das zuständige deutsche Normungsgremium für diese Europäische Norm ist der Normenausschuss NAEBM „Normenausschuss Eisen-, Blech- und Metallwaren (NAEBM)".

Fortsetzung 30 Seiten EN

Normenausschuss Eisen-, Blech- und Metallwaren (NAEBM) im DIN Deutsches Institut für Normung e. V.

# Standards and regulations

## Application guideline for DIN EN 12825 Raised Floors

In the application guideline for use, as part of the DIN EN 12825, essential requirements and features are specified regarding the suitability of a raised floor for use and traffic, setting a safety standard for the construction process.

System floors are being developed continually in both a technical and scientific sense. As a result, the application guideline needs to be adjusted regularly to the latest technology.

Only system floors that are produced in compliance with the standards, and which comply with the requirements of the application guideline in terms of construction, stability, materials, workmanship and life of product conformity are awarded the certificate for raised and hollow floors.


Monitoring of the safety standards is carried out by continual in-house monitoring and by regular external testing by neutral testing institutes and bodies in accordance with the application guideline.

Monitoring of safety standards guarantees adherence to the criteria required for suitability for use and traffic and so represents a reliable marker when choosing a floor system.

Installation of a certified raised floor is a guarantee for the users and owners that it complies with the latest technology in terms of safety, liability and industrial workplace regulations.

The guidelines for use are continuously added to and developed, to keep up to date with technical progress. The current version can be requested from the Association for System Floors.

# Standards and regulations

## Property Services Agency (PSA)

The Method of Building (MOB) standard for raised floors was introduced in 1982 by the Property Services Agency (PSA) and is the old standard for raised floors in the United Kingdom and is now being increasingly replaced by the EN 12825 standard.

## Ceilings & Interior Systems Construction Association (CISCA)

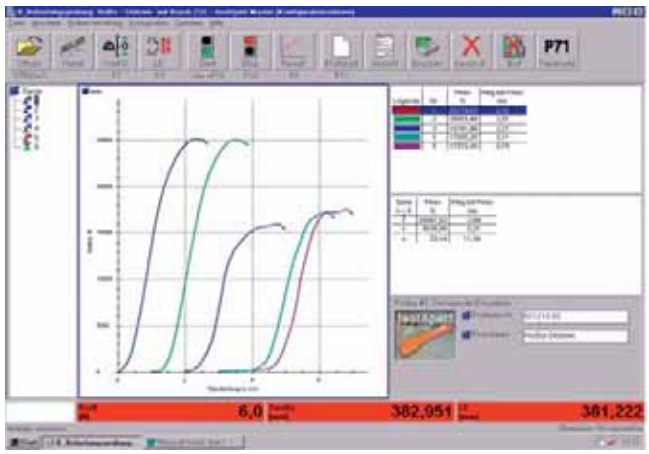
CISCA is an American standardisation institute for the interior industry. Its publications include test standards for the raised floor industry. The test standards were developed based on comments received from American and other international manufacturers.


The requirements for floor systems produced by CISCA and the MOB/PSA standard are overspecified for a normal application; this leads to oversized floor systems. The much newer EN is more applicable to loads that actually occur during usage, which leads to more cost-effective floor systems which are also easier to install and to use. The London-based STANHOPE PLC architects office has published a statement on this issue, which you can request from us.

## Workshop testing

As with all other rules and regulations, suitable test criteria for workshops (workshop test certificates) are specified for practical application, ensuring the smooth function of raised floors with a special requirement profile.

The type and validity of the tests were put together by the LGA (State Trade Agency) in Nuremberg.

# Notes

TU_B_LIG/E/1.2

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Lindner Concepts:

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- Clean Rooms and Laboratories
- Airports and Airlines
- Railways and Tunnels
- Studios and Concert Halls
- Interior Fit-out and Furnishings
- Cruise Liner and Ship Fit-out
- Hotels and Resorts
- General Contracting

Lindner Products:

- Facades
- Ceiling Systems
- Lights and Lighting Systems
- Partition Systems
- Doors
- Floor Systems
- Heating and Cooling Technologies
- Dry Lining Systems

Lindner Service:

- Green Building
- Deconstruction and Gutting
- Clearance of Harmful Substances
- Research and Development
- Delivery
- General Planning
- Installation
- Maintenance
- Public-Private Partnership (PPP)

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