



# Floor.

## Construction and requirements.

The function and productivity of a narrow aisle warehouse is decisively influenced by the floor, and in particular by its flatness. The sub-base and floor plate must be dimensioned in such a way that permitted tolerances are not exceeded under load conditions.

### Construction

As a rule, industrial floors consist of a sub-base, a concrete layer and surfacing (screed). Layers underneath the concrete layer serve, for example, as subsoil compression, moisture protection or heat insulation.

### Requirements

With regard to strength, the surface layer (screed) must conform to loading group II of DIN 18560, part 7, table 1. The floor must not deform under load. Shafts, channels or similar breaks in the floor must be arranged with a minimum distance of 200 mm from the tracks of the truck. Such installations in the working aisle should generally be avoided.

The floor must be resistant to oil and grease. The track covering should be non-abrasive and must not be susceptible to dust developing.

The resistance to earth according to IEC 1340-4-1 EN 1081, should not exceed  $10^6$  Ohm. This needs to be a large 10 with a small 6 higher up next to the 0. The frictional coefficient of the floor should permit the observance of ISO 6292 (Empirical value: approx. 0.5  $\mu$ ).



### **Standardisation**

National standards are applied. The load-bearing surface must comply with the relevant standards (e. g. Concrete society TR34 Chapter 4). Taking into consideration possible settling, the load-bearing surface must be prepared in such a way that the angular tolerances of the finished floor do not exceed 15 mm.

The tolerances based on DIN 18202 (see table 1) and similar to BS5606 apply for all areas of the warehouse floor. In the narrow aisle area, the tolerances stipulated in the VDMA guideline apply: Floors for use with VNA trucks ([www.VDMA.org](http://www.VDMA.org) → Sectors → Materials Handling and Logistic Technology).

The requirements of this VDMA guideline can be met if due care is taken.

### **Floor quality**

Today's high bay warehouses are technologically very advanced systems allowing the user to realise high throughput rates with substantial volume utilisation. This not only results in increased technological requirements with regard to the fork lift trucks, but also means that vehicle-related systems, for example the floor, need to meet certain minimum requirements. Compliance with the requirements of the VDMA guideline "Floors for use with VNA trucks" is mandatory in order to realise the full potential of the equipment.

The VDMA guideline focuses on three areas:

- Levelness requirements
- Evaluation of waviness
- Definition of a measurement method for waviness

### **Adjusted levelness requirements**

The VDMA guideline defines levelness requirements both along and across the wheel tracks. The basic principle for measurement of these criteria is contained in existing standards and widely applied in industry.

### **Evaluation of waviness**

This formulation of the floor requirements is based on the definition of a figure ( $F_x$ ) arrived at by static methods (standard deviation) by examining a series of height differences from adjacent measuring points. Lower  $F_x$  values mean greater waviness with greater amplitudes and thus poorer floor levelness. The guideline describes in detail how to calculate the figure. The guideline and the calculation tool for automatic calculation of the figure from raw data are available for download on the VDMA website.

### **Definition of the measurement method for waviness**

The VDMA guideline also gives a clear definition of the measurement method and offers a schematic drawing of the set-up for measurement. This ensures that the readings are reproducible and comparable. See the VDMA guideline (Section 4.2.3) for the requirements with regard to the waviness of the floor.



EKX 515, lifting height 16.5 m

### Finished floor outside the narrow aisle area (apron)

Spacing of the measuring points up to	0.1 m	1 m	4 m	10 m	from 15 m
Max. permissible variation from levelness (pitch)	2 mm	4 mm	10 mm	12 mm	15 mm

Table 1

### Height differences lateral to the direction of travel based on the VDMA guideline

The guideline is available for download on the VDMA website.

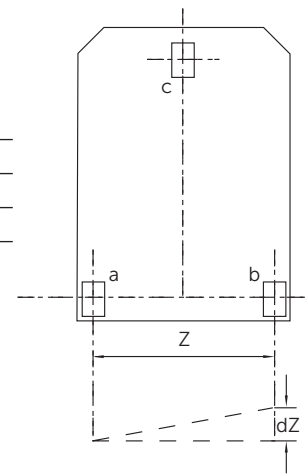
See Appendix B1 for an example calculation.

Top racking level (m)	$Z_{SLOPE}$ (mm/m)	$dZ = Z \times Z_{SLOPE}$
15	1.0	$Z \times 1.0$ mm/m
10	1.5	$Z \times 1.5$ mm/m
up to 6	2.0	$Z \times 2.0$ mm/m

Note: Interpolation is required for rack heights > 6 m.

Z is the dimension between the centre of the fork lift truck load wheels (a, b) in m and  $Z_{SLOPE}$  is the permissible slope across the aisle between the centre of the fork lift truck load wheels (a, b) in mm/m.

Parameter dZ is the height difference between the centres of the fork lift truck load wheels (a, b). dZ is specified as shown.



### Levelness tolerances along the direction of travel for all heights, based on the VDMA guideline

Spacing of the measuring points	1.0 m	2.0 m	3.0 m	4.0 m
Max. permissible variation from levelness, pitch as limit value in the tracks	2.0 mm	3.0 mm	4.0 mm	5.0 mm

Table 2

See the VDMA guideline (Section 4.2.3) for the requirements with regard to the waviness of the floor.