



TECHNICAL INFORMATION

Slip resistance

Slip-resistance of floor tiles



The EU Construction Products Regulation No. 305/2011 requires floor coverings to be safe to use. This imposes the observance of special requirements pertaining to slip resistance in areas where a danger of accidents is to be assumed. The corresponding standards were drawn up by the Committee for workplaces (ASTA) and published in form of technical regulations.

These standards include requirements pertaining to slip resistance - leaflet "ASR A1.5/1,2 - Technical Regulations for workplaces - Floors" (previously BGR 181 for commercial areas) and, for barefoot areas, leaflet "DGUV Information 207-006 - Floor coverings for wet barefoot areas" (previously BGI/GUV-I 8527, updated June 2015), published by the German Statutory Accident Insurance (DGUV).

Areas subject to a danger of slipping (e.g. circulation areas in public buildings, retail and wholesale premises, swimming pools, sanitary rooms) require slip-resistant floor coverings, e.g. consisting of glazed or unglazed vitreous or porcelain stoneware tiles with a slightly

rough, rough or profiled surface. When small-format tiles are used, the high proportion of joints has a positive effect on the degree of slip resistance.

Slip-resistant coverings in publicly accessible areas are distinguished according to those that are walked over barefoot or in footwear. No regulations apply as yet in the area of private use, e.g. private bathrooms or kitchens.

The requirements stipulated by the slip resistance are defined in the regulations mentioned below. With our slip-resistant tiles, you will find the symbols  slip resistance in commercial areas,  slip resistance in barefoot areas and information about the relevant classification groups.

Slip-resistance properties in commercial applications

Responsible institutions:

Federal Institute for Occupational Health and Safety,
Friedrich-Henkel-Weg 1-25, D-44149 Dortmund
- www.baua.de

Main Association of Employers' Liability Insurance
Associations, Alte Heerstraße 111,
D-53757 Sankt Augustin - www.dguv.de

Area of application:

Floors in work rooms and work areas where there is a risk of slipping

Regulations:

„BGV Professional Association regulations for occupational safety and health“ (Published by: Main Association of Employers' Liability Insurance Associations) Leaflet „ASR A1.5/1,2 - Technical Regulations for workplaces - Floors“ (Published by: Federal Institute for Occupational Health and Safety, Committee for workplaces - ASTA)

Test method:

DIN 51130 – Testing of floor coverings; determination of slip resistance; work rooms and work areas subject to higher risk of slipping.

Walking method:

Inclined plane

Assessment groups:

	Angle of inclination	
	Lower limit value	Upper limit value
R9	6°	10°
R10	> 10°	19°
R11	> 19°	27°
R12	> 27°	35°
R13	> 35°	



R9: 6° – 10° **R10:** 10° – 19° **R11:** 19° – 27° **R12:** 27° – 35° **R13:** > 35°

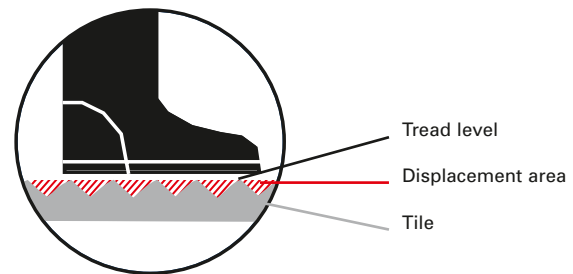
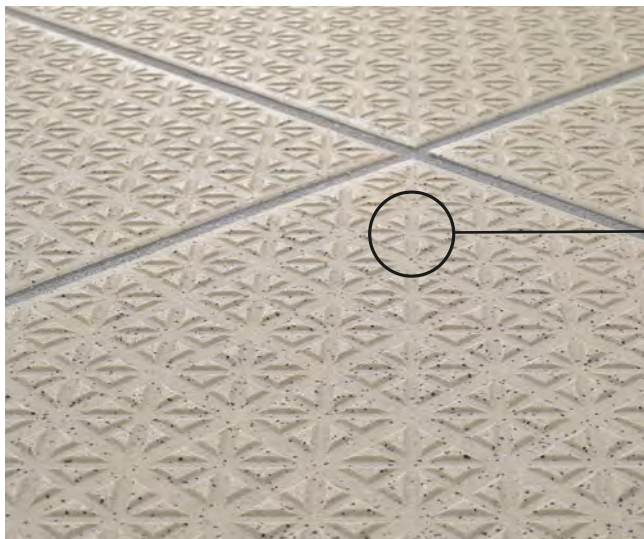
The slip resistance of tiles is tested on an inclined plane with a pre-determined angle of inclination and classified according to rating groups R9 to R13.

Slip resistance

Working rooms and areas with risk of slipping in accordance with ASR A1.5/1,2 (Technical Regulations for Workplaces, February 2013 issue, previously BGR 181)

Working rooms and areas are classified according to five assessment groups on the basis of size and the risk of slipping. Coverings in group R9 are subject to the lowest requirements, while the most stringent requirements apply to group R13 coverings. Working rooms and areas where a displacement space is necessary under the tread level in order to discharge substances that are particularly conducive to slipping are indicated by a „V“ in conjunction with a number specifying the minimum volume of the displacement space.

Designation of displacement space	Minimum volume of the displacement space below the walking area
V4	4 cm ³ /dm ²
V6	6 cm ³ /dm ²
V8	8 cm ³ /dm ²
V10	10 cm ³ /dm ²



The displacement area is the cavity (marked red) between the raised sections of the tile beneath the tread level.

Working rooms and areas with risk of slipping in accordance with ASR A1.5/1,2

No.	Working rooms and traffic routes	Slipping risk assessment group (standard guideline)	Displacement area with number specifying minimum volume
0	General working rooms and areas *)		
0.1	Entrance areas, indoors **)	R9	
0.2	Entrance areas, outdoors	R11 or R10	V4
0.3	Stairs, indoors ***)	R9	
0.4	Stairs, outdoors	R11 or R10	V4
0.5	Sloping ramps, inside ***) (e.g. for wheelchairs, levelling slopes, transport paths)	One R-group higher necessary for the entrance covering	V-value of entrance, covering, where applicable
0.6	Sanitary rooms		
0.6.1	Toilets	R9	
0.6.2	Changing or washrooms	R10	
0.7	Break rooms (e.g. day rooms, canteens)	R9	
0.8	First aid rooms and similar facilities (see ASR A4.3)	R9	
1	Manufacture of margarine, edible fats and oils		
1.1	Fat melting	R13	V6
1.2	Edible-oil refinery	R13	V4
1.3	Manufacture and packing of margarine	R12	
1.4	Manufacture and packing of edible fat, bottling of edible oil	R12	
2	Milk treatment and processing, cheese production		
2.1	Processing of fresh milk, including buttery	R12	
2.2	Cheese production, storage and packing	R11	
2.3	Ice cream manufacture	R12	
3	Manufacture of chocolates and confectionery		
3.1	Sugar boiling plant	R12	
3.2	Cocoa production	R12	
3.3	Preparation of raw mass	R11	
3.4	Production of slabs, hollow moulded forms and chocolates	R11	
4	Manufacture of breads and pastries (bakeries, cake and biscuit manufacturers)		
4.1	Preparation of dough	R11	
4.2	Areas where fats and liquid mixtures are processed	R12	
4.3	Washing-up rooms	R12	V4
5	Slaughtering, meat handling, meat processing		
5.1	Abattoir	R13	V10
5.2	Gut cleaning areas	R13	V10
5.3	Meat jointing	R13	V8
5.4	Sausage and cold meats kitchen	R13	V8
5.5	Boiled sausage area	R13	V8
5.6	Preserved sausage area	R13	V6
5.7	Sausage drying room	R12	
5.8	Gut storage	R12	
5.9	Curing, smoking room	R12	
5.10	Poultry processing	R12	V6
5.11	Slicing and packing area	R12	
5.12	Butchery with shop	R12	V8****)

Slip resistance

Working rooms and areas with risk of slipping in accordance with ASR A1.5/1,2

No.	Working rooms and traffic routes	Slipping risk assessment group (standard guideline)	Displacement area with number specifying minimum volume
6	Handling and processing of fish, manufacture of delicatessen products		
6.1	Handling and processing of fish	R13	V10
6.2	Manufacture of delicatessen products	R13	V6
6.3	Manufacture of mayonnaise	R13	V4
7	Preparation and processing of vegetables		
7.1	Manufacture of sauerkraut	R13	V6
7.2	Manufacture of canned vegetables	R13	V6
7.3	Sterilisation areas	R11	
7.4	Rooms in which vegetables are prepared for processing.	R12	V4
8	Wet areas in food and drink manufacture (if not specifically mentioned)		
8.1	Storage and fermenting cellar	R10	
8.2	Bottling, fruit juice manufacture	R11	
9	Kitchens, dining rooms		
9.1	Gastronomic kitchens (restaurant and hotel kitchens)	R12	
9.2	Commercial kitchens in homes, schools, day nurseries, sanatoriums	R11	
9.3	Commercial kitchens in hospitals and clinics	R12	
9.4	Large-scale commercial kitchens in canteens, district kitchens	R12	V4
9.5	Fast food and snack bar kitchens	R12	
9.6	Defrosting and re-heating kitchens	R10	
9.7	Tea and coffee kitchens, B+B kitchens, ward kitchens	R10	
9.8	Washing-up areas		
9.8.1	Washing-up areas for 9.1, 9.4, 9.5	R12	V4
9.8.2	Washing-up areas for 9.2	R11	
9.8.3	Washing-up areas for 9.3	R12	
9.9	Dining rooms, guest rooms, canteens incl. serving areas	R9	
10	Cold storage rooms, deep freeze rooms and depots		
10.1	For non-packaged goods	R12	
10.2	For packaged goods	R11	
11	Sales areas and shops		
11.1	Receiving room for meats		
11.1.1	For non-packaged goods	R11	
11.1.2	For packaged goods	R10	
11.2	Receiving room for fish	R11	
11.3	Serving area for meats and cold cuts		
11.3.1	For non-packaged goods	R11	
11.3.2	For packaged goods	R10	
11.4	Serving area for breads and pastries, non-packaged goods	R10	
11.5	Serving area for dairy and delicatessen products, non-packaged goods	R10	
11.6	Serving area for fish		
11.6.1	For non-packaged goods	R12	
11.6.2	For packaged goods	R11	
11.7	Serving areas other than 11.3 – 11.6	R9	
11.8	Meat preparation room		
11.8.1	For meat preparation other than covered in 5.	R12	V8
11.8.2	For meat processing other than covered in 5.	R11	
11.9	Flower arranging rooms and areas	R11	
11.10	Sales areas with fixed ovens		
11.10.1	For the production of breads and pastries	R11	
11.10.2	For the baking of prepared breads and pastries	R10	
11.11	Sales areas with fixed deep-fat fryers or grills	R12	V4
11.12	Sales areas, customer-frequented areas	R9	
11.13	Preparation areas for food for self-service sale	R10	
11.14	Cash till, packing areas	R9	
11.15	Sales areas outdoors	R11 or R10	V4
12	Public health service rooms		
12.1	Disinfection areas (wet)	R11	
12.2	Sterilisation areas	R10	
12.3	Excrement areas, sink rooms, unclean nursing rooms	R10	
12.4	Pathology rooms	R10	
12.5	Rooms for medicinal baths, hydrotherapy, fango preparation	R11	
12.6	Washrooms for operating theatres, plaster casting rooms	R10	
12.7	Sanitary rooms, ward bathrooms	R10	
12.8	Rooms for medical diagnosis and therapy, massaging rooms	R9	
12.9	Operating theatres	R9	
12.10	Wards with hospital rooms and corridors	R9	
12.11	Medical practices, day clinics	R9	
12.12	Dispensing chemist's	R9	
12.13	Laboratories	R9	
12.14	Hairdresser's	R9	
13	Laundries		
13.1	Rooms with continuous-run washing machines or centrifugal washing machines	R9	
13.2	Rooms in which the laundry is removed from the machine dripping wet	R11	
13.3	Rooms for ironing and pressing	R9	
14	Feed concentrate production		
14.1	Dry feed production	R11	
14.2	Feed concentrate production using fat and water	R11	V4
15	Manufacture of leather goods, textiles		
15.1	Water workshops in tanneries	R13	
15.2	Areas with fleshing machines	R13	V10
15.3	Areas where glued leather occurs	R13	V10
15.4	Grease room for the manufacture of seals	R12	
15.5	Dye works for textiles	R11	
16	Paint-shops		
16.1	Wet rubbing down areas	R12	V10
16.2	Powder coating	R11	
16.3	Paint finish	R10	
17	Ceramics industry		
17.1	Wet-grinding (for ceramic material)	R11	
17.2	Mixers, working with materials such as tar, pitch, graphite, synthetic resins	R11	V6
17.3	Presses (Forming), working with materials such as tar, pitch, graphite, synthetic resin	R11	V6
17.4	Casting / die Casting areas	R12	
17.5	Glazing areas	R12	

Slip resistance

Working rooms and areas with risk of slipping in accordance with ASR A1.5/1,2

No.	Working rooms and traffic routes	Slipping risk assessment group (standard guideline)	Displacement area with number specifying minimum volume
18	Treatment and processing of glass and stone		
18.1	Stone cutting, stone grinding areas	R11	
18.2	Glass moulding of hollow glass, container glass, structural glass	R11	
18.3	Grinding areas for hollow glass, sheet glass	R11	
18.4	Processing of insulating glass Working with desiccants	R11	V6
18.5	Packaging, dispatch of sheet glass, Working with anti-blocking agents	R11	V6
18.6	Etching and acid polishing units for glass	R11	
19	Cement works		
19.1	Cement washing area	R11	
20	Storage rooms		
20.1	Storage rooms for oils and fats	R12	V6
20.2	Storage rooms for packaged foods	R10	
20.3	Storage rooms outdoors	R11 or R10	V4
21	Chemical and thermal treatment of iron, metal and glass		
21.1	Pickling shops	R12	
21.2	Hardening shops	R12	
21.3	Laboratories	R11	
22	Metal workshops		
22.1	Electroplating rooms	R12	
22.2	Grey iron processing	R11	V4
22.3	Mechanical processing areas (e.g. lathe shop, milling shop), punching department, pressroom, drawing mill (pipes, wires) and areas with increased use of oil and lubricating materials	R11	V4
22.4	Part cleaning areas, steaming areas	R12	
23	Vehicle maintenance workshop		
23.1	Repair and maintenance shop	R11	
23.2	Repair and inspection pit	R12	V4
23.3	Car wash, washing areas	R11	V4
24	Aircraft maintenance workshops		
24.1	Hangars	R11	
24.2	Repair hangars	R12	
24.3	Washing areas	R11	V4
25	Sewage works		
25.1	Pumping rooms	R12	
25.2	Rooms for sludge de-watering facilities	R12	
25.3	Rooms for raking facilities	R12	
25.4	Standing areas of workplaces, working and maintenance platforms	R12	
26	Fire stations		
26.1	Vehicle standing areas	R12	
26.2	Rooms for hose servicing equipment	R12	
27	Functional rooms in the breathing apparatus training facility		
27.1	Preparation room	R10	
27.2	Conditioning room	R10	
27.3	Training room	R11	
27.4	Air lock	R10	
27.5	Mock-up dwelling	R11	
27.6	Heat acclimatisation room	R11	
27.7	Control station	R9	
28	Schools and day nurseries		
28.1	Entrance areas, corridors, recreation halls	R9	
28.2	Classrooms, group rooms	R9	
28.3	Stairs	R9	
28.4	Toilets, washrooms	R10	
28.5	Cookery rooms in schools (See no. 9, too)	R10	
28.6	Kitchens in day nurseries (See no. 9, too)	R10	
28.7	Machine rooms for woodwork	R10	
28.8	Special rooms for woodwork etc.	R10	
28.9	Playgrounds	R11 or R10	V4
29	Banks		
29.1	Bank counter areas	R9	
30	Outside traffic routes		
30.1	Paths	R11 or R10	V4
30.2	Loading ramps		
30.2.1	covered	R11 or R10	V4
30.2.2	not covered	R12 or R11	V4
30.3	Sloping ramps (e.g. for wheelchairs, loading bridges)	R12 or R11	
30.4	Refuelling areas		
30.4.1	covered	R11	
30.4.2	not covered	R12	
31	Parking areas		
31.1	Garages, multi-storey and underground car parks not subject to the effects of the weather *****)	R10	
31.2	Garages, multi-storey and underground car parks subject to the effects of the weather	R11 or R10	V4
31.3	Parking areas outdoors	R11 or R10	V4

*) For floors in wet barefoot areas see „DGUV Information 207-006 - Floor coverings for wet barefoot areas“ (previously BGI/GUV-I 8527, updated version of October 2010)
 **) Entrance areas in accordance with number 0.1 are areas accessed directly from outside and that may be wet if conditions are wet outside (see also point 6.3, The use of mats to take up dirt and moisture). For adjoining or other large areas, see point 4.10.
 ***) Stairs, ramps in accordance with number 0.3 and 0.5 are those that may be wet if it is wet outside. For adjoining areas, see point 4.10.
 *****) If a uniform floor covering has been installed everywhere, on the basis of a assessment (taking account of the cleaning method, the work flows and the amount of substances on the floor that are particularly conducive to slipping), the displacement area can be reduced to V4.
 *****) Those pedestrian areas that are not affected by the risk of slipping as a result of the effects of the weather, such as driving rain or water that has been brought in from outside.

Slip resistance

Working rooms and areas with risk of slipping

Requirements for the safe installation of floors in workplaces are described in the "Technical Regulations for Workplaces (ASR)" ASR A1.5/1,2. They specify:

"Those areas that are normally in constant use should have a relatively homogenous slip resistance to prevent the risk of tripping or slipping. This could be the case if the slip resistance of the surfaces differs by more than one R group within a single floor (e.g. with coverings, markings or adhesive films) or adjacent floors".

We also recommend observing the following excerpts from the BGR/GUV-R 181, published by the German Statutory Accident Insurance (DGUV):

In connected work places with differing slip risks, where employees move from one work place to the other, the same floor covering of the higher classification group should be used for the entire area. Floors must not have any trip hazards.

To facilitate cleaning, smooth, non-profiled floor coverings can be used in areas that cannot be walked on.

Such areas include, for example, along the walls up to a distance of 15 cm, in corners and under machines and installations which are firmly fixed to the floor.

A rounded edge between the walls and floor e.g. cove skirting is easier to clean than a rectangular edge.

Slip resistance in private areas

With regard to slip resistance, floor coverings in private areas are not subject to standard regulations. Independent of that, however, it is recommended to choose slip-resistant tiles according to your personal safety requirements.

Slip resistance

Slip-resistance properties in barefoot areas

Responsible institutions:

German Statutory Accident Insurance (DGUV), Glinkastraße 40, D-10117 Berlin - www.dguv.de

Area of application:

Wet barefoot areas, e.g. in swimming pools, hospitals, as well as changing rooms, washrooms and showers in sports centres and workplaces for which the statutory accident insurance agencies are responsible.

Regulations:

Leaflet „DGUV Information 207-006 - Floor coverings for wet barefoot areas“ (previously BGI GUV-I 8527, updated version of June 2015)

Published by: German Statutory Accident Insurance (DGUV)

Test method:

DIN 51097; Testing of floor coverings; determination of slip resistance; barefoot areas exposed to wet.




Walking method:

Inclined plane.

The slip resistance of tiles is tested on an inclined surface with a pre-determined angle of inclination and classified according to rating groups **A** to **C**.

If barefoot areas are also to be walked over in footwear, the requirements of ASR A1.5/1.2 must also be observed.

Classification groups and areas of application:

Classification group	Lower limit value	Upper limit value	Areas
A 	12°	18°	Barefoot hallways and sanitary areas (mainly dry) Individual and group changing rooms with lockers Pool floors in the non-swimmer areas, where the water level exceeds 80 cm Sauna and relaxation areas (mainly dry)
B 	> 18°	24°	barefoot hallways and sanitary areas, if not classified in A Showers and shower areas Steam baths Area surrounding the disinfectant sprayers Pool surrounds Pool floor in the non-swimmer areas, where the water level is less than 80 cm Pool floor in the non-swimmer areas in the tide effect pool Lift slab floors Paddling pools Steps and ladders outside the pool area provided these are not assigned to C Accessible surfaces of diving platforms and diving board installations which are not allocated to C. Sauna and relaxation area, provided they are not assigned to A
C 	> 24°		Steps and ladders leading into the water Stairways leading to diving boards and water slides Surfaces of diving platforms and diving boards in the length which is reserved for the diver (the slip-resistant surface of the diving platforms and diving boards must lead around the front edge where it is gripped by users' hands and toes) Foot basins Inclined pool borders Kneipp pool, foot pool Ramps in the pool rim area with an inclination of > 6%

Product groups | Slip resistance

	Nonvitreous	Glazed vitreous	Porcelain stoneware	Glazed Porcelain stoneware	R9	R10	R11	R12	R12-V4	A	B	C
	Product group				Slip resistance							
System ranges												
PRO ARCHITECTURA		•	•	•	•	•				•	•	•
COLORVISION	•											
GRANIFLOOR			•		•	•	•	•	•	•	•	
Functional ranges												
UNIT ONE		•	•		•	•				•	•	
UNIT TWO	•											
UNIT THREE			•			•	•	•	•	•	•	
UNIT FOUR			•	•		•				•	•	
UNIT FOUR WALL	•			•								
Residential construction												
MINERAL SPRING	•		•	•	•	•					•	
GROUND LINE			•		•	•					•	
MOOD LINE	•											
URBAN LINE	•		•									
WHITE & CREAM	•											
Variety and function												
BERNINA			•		•	•				•	•	
CÁDIZ	•		•		•	•				•	•	
CROSSOVER			•		•	•	•			•	•	
EAST END			•		•					•		
LODGE			•		•	•	•				•	
LODGE WALL	•										•	
MY EARTH			•		•		•				•	
OUTSTANDING			•			•				•	•	
PLACE			•		•	•					•	
PURE LINE			•			•					•	
SPOTLIGHT	•		•	•	•					•		
TUXEDO	•		•		•	•				•		
URBANTONES	•		•		•	•					•	
WAREHOUSE			•	•	•	•					•	
XENTRIC			•		•	•					•	
X-PLANE			•			•	•				•	
Interior and design												
CENTURY UNLIMITED	•		•	•	•	•					•	
CREATIVE SYSTEM 4.0	•											
MONOCHROME MAGIC	•											

This is a very general allocation of ranges to product groups and slip resistance. Individual articles may vary slightly. Exact information is provided in the details for each article.

Index basic tiles by slip resistance

R9

Anti-slip R9 (in workshop areas)

Ranges		Art.-Nr.	Format	Page
BERNINA	vilbostone unglazed porcelain stoneware, EN 14411Bla	2411	3,2 x 7,5 cm	118
		2386	3 x 30 cm	120
		2408	10 x 30 cm	117
		2393	30 x 30 cm	117
		2415	30 x 30 cm	120
		2650	30 x 50 cm	121
		2410	7,5 x 60 cm	117
		2409	15 x 60 cm	117
		2414	15 x 60 cm	120
		2394	30 x 60 cm	117
		2660	60 x 60 cm	117
		2180	35 x 70 cm	117
		2365	75 x 75 cm	118
		2390	45 x 90 cm	118
		2732	30 x 120 cm	118
		2730	60 x 120 cm	118
CÁDIZ	vilbostone unglazed porcelain stoneware, EN 14411Bla	2496	10 x 20 cm	129
		2572	30 x 60 cm	129
		2570	60 x 60 cm	129
CENTURY UNLIMITED	vilbostone unglazed porcelain stoneware, EN 14411Bla	2634	20 x 20 cm	256
		2631	20 x 60 cm	256
		2395	30 x 60 cm	256
		2664	60 x 60 cm	256
		2634	20 x 20 cm	258
CROSSOVER	vilbostone unglazed porcelain stoneware, EN 14411Bla	2625	7,5 x 7,5 cm	136
		2617	7,5 x 60 cm	136
EAST END	vilbostone unglazed porcelain stoneware, EN 14411Bla	2620	15 x 60 cm	136
		2610	30 x 60 cm	136
		2623	30 x 60 cm	136
		2615	60 x 60 cm	136
		2621	45 x 90 cm	136
		2305	7,5 x 7,5 cm	145
		2304	7,5 x 60 cm	145
GRANIFLOOR	vilbostone unglazed porcelain stoneware, EN 14411Bla	2303	15 x 60 cm	145
		2301	30 x 60 cm	145
		2307	30 x 60 cm	145
		2302	60 x 60 cm	145
		2214	30 x 30 cm	58
		2216	30 x 60 cm	58
GROUND LINE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2014	60 x 60 cm	58
		2347	30 x 60 cm	102
LODGE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2654	30 x 50 cm	153, 154
		2381	11,25 x 90 cm	152
		2380	22,5 x 90 cm	152, 154
		2741	10 x 120 cm	152
		2742	20 x 120 cm	152, 154
		2743	30 x 120 cm	152
MINERAL SPRING	vilbostone unglazed porcelain stoneware, EN 14411Bla	2056	45 x 45 cm	94
		2085	30 x 60 cm	94
		2090	30 x 60 cm	94
		2349	60 x 60 cm	94
MY EARTH	vilbostone unglazed porcelain stoneware, EN 14411Bla	2642	30 x 30 cm	164
		2650	30 x 50 cm	165
		2646	10 x 60 cm	164
		2647	20 x 60 cm	164
		2641	30 x 60 cm	164
		2640	60 x 60 cm	164
		2333	75 x 75 cm	164
PLACE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2484	7,5 x 60 cm	179
		2482	15 x 60 cm	179
		2494	30 x 60 cm	179
		2488	30 x 60 cm	179
		2480	60 x 60 cm	179
PRO ARCHITECTURA	vilbostone glazed porcelain stoneware, EN 14411Bla	3753	2,5 x 2,5 cm	34
		3709	5 x 5 cm	34
UNIT ONE	Glazed vitreous, EN 14411Blb	3709	5 x 5 cm	63
		3130	30 x 30 cm	64

Slip resistance

Index basic tiles by slip resistance



Anti-slip R9 (in workshop areas)

Ranges		Art.-Nr.	Format	Page	
UNIT THREE	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2020	20 x 20 cm	75	
SPOTLIGHT	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2030	5 x 5 cm	202	
		2919	2,5 x 15 cm	203	
		2394	30 x 60 cm	202	
		2660	60 x 60 cm	202	
		2840	40 x 80 cm	202	
		2810	80 x 80 cm	202	
TUXEDO	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2762	20 x 120 cm	211	
		2763	30 x 120 cm	211	
WAREHOUSE	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2410	7,5 x 60 cm	230	
		2409	15 x 60 cm	230	
		2394	30 x 60 cm	230	
		2648	30 x 60 cm	231	
		2660	60 x 60 cm	230	
		2732	30 x 120 cm	230	
		2730	60 x 120 cm	230	
		<i>vilbostone</i> glazed porcelain stoneware, EN 14411Bla	2660	60 x 60 cm	231
		2730	60 x 120 cm	231	
XENTRIC	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2394	30 x 60 cm	237	
		2831	30 x 60 cm	237	
		2660	60 x 60 cm	237	



Anti-slip R10 (in workshop areas)

Ranges		Art.-Nr.	Format	Page
BERNINA	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2392	30 x 60 cm	117
		2685	30 x 60 cm	117
CÁDIZ	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2037	5 x 10 cm	128
		2496	10 x 20 cm	128
		2572	30 x 60 cm	128
		2685	30 x 60 cm	128
		2570	60 x 60 cm	128
CENTURY UNLIMITED	<i>Vilbostone</i> glazed porcelain stoneware, EN 14411Bla	2030	5 x 5 cm	259
	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2030	5 x 5 cm	256
CROSSOVER	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2636	15 x 15 cm	136
		2628	30 x 30 cm	136
		2630	30 x 60 cm	136
		2685	30 x 60 cm	137
GRANIFLOOR	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2706	5 x 5 cm	57
		2200	10 x 10 cm	57
		2072	10 x 10 cm	58
		2607	10 x 10 cm	59
		2609	10 x 10 cm	59
		2263	10 x 15 cm	59
		2215	15 x 15 cm	57
		2602	15 x 15 cm	59
		2603	15 x 15 cm	59
		2495	10 x 20 cm	59
		2600	20 x 20 cm	57
		2232	7,5 x 30 cm	58
		2213	30 x 30 cm	58
		2234	30 x 30 cm	58
		GROUND LINE	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2026
LODGE	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2031	5 x 5 cm	155
		2362	7,5 x 7,5 cm	153
MINERAL SPRING	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2706	5 x 5 cm	94
OUTSTANDING	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2625	7,5 x 7,5 cm	172
		2617	7,5 x 60 cm	171
		2622	15 x 60 cm	171
		2650	30 x 50 cm	172
		2324	30 x 60 cm	171
		2668	60 x 60 cm	171
		2732	30 x 120 cm	172
		2735	60 x 120 cm	171
		PLACE	<i>vilbostone</i> unglazed porcelain stoneware, EN 14411Bla	2486
2492	30 x 60 cm			179
2489	30 x 60 cm			179

Index basic tiles by slip resistance

 R10

Anti-slip R10 (in workshop areas)

Ranges		Art.-Nr.	Format	Page
PRO ARCHITECTURA	Glazed vitreous, EN 14411Bib	3845	5 x 5 cm	34
		3245	10 x 10 cm	34
		3007	10 x 10 cm	38
		3009	10 x 10 cm	38
		3945	2,5 x 2,5 cm	34
	Vilbostone glazed porcelain stoneware, EN 14411Bla vilbostone unglazed porcelain stoneware, EN 14411Bla	2702	2,5 x 2,5 cm	38
		2706	5 x 5 cm	38
		2731	5 x 5 cm	40
		2765	5 x 5 cm	40
		2772	5 x 5 cm	40
		2200	10 x 10 cm	38
		2607	10 x 10 cm	40
		2609	10 x 10 cm	40
		2072	10 x 10 cm	40
		2498	10 x 15 cm	40
		2404	15 x 15 cm	38
		2405	15 x 15 cm	38
		2495	10 x 20 cm	40
		2604	20 x 20 cm	39
		2248	20 x 20 cm	39
		2213	30 x 30 cm	39
PURE LINE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2699	7,5 x 7,5 cm	194
		2688	30 x 50 cm	195
		2697	5 x 60 cm	192
		2691	10 x 60 cm	192
		2692	15 x 60 cm	192
		2689	20 x 60 cm	192
		2694	30 x 60 cm	192
		2686	30 x 60 cm	193
		2693	60 x 60 cm	193
		2695	30 x 120 cm	193
		2698	30 x 120 cm	194
2690	60 x 120 cm	193		
TUXEDO	vilbostone unglazed porcelain stoneware, EN 14411Bla	2035	5 x 5 cm	211
		2036	30 x 30 cm	211
UNIT ONE	Glazed vitreous, EN 14411Bib	3244	10 x 10 cm	63
		3245	10 x 10 cm	63
		3105	15 x 15 cm	63
		3177	20 x 20 cm	64
	vilbostone unglazed porcelain stoneware, EN 14411Bla	2706	5 x 5 cm	65
		2200	10 x 10 cm	65
		2072	10 x 10 cm	65
		2495	10 x 20 cm	65
		2248	20 x 20 cm	65
UNIT THREE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2200	10 x 10 cm	75
		2072	10 x 10 cm	76
		2011	15 x 15 cm	75
		2265	15 x 15 cm	77
		2004	10 x 20 cm	76
		2001	20 x 20 cm	75
		2009	7,5 x 30 cm	76
		2007	30 x 30 cm	76
		2008	30 x 30 cm	76
		2010	30 x 30 cm	77
UNIT FOUR	vilbostone unglazed porcelain stoneware, EN 14411Bla	2363	5 x 5 cm	87
		2706	5 x 5 cm	86
		2369	30 x 30 cm	86
		2360	30 x 60 cm	86
		2874	30 x 60 cm	87
		2680	30 x 60 cm	86
		2361	60 x 60 cm	87

Slip resistance

Index basic tiles by slip resistance

R10

Anti-slip R10 (in workshop areas)

Ranges		Art.-Nr.	Format	Page
URBANTONES	vilbostone unglazed porcelain stoneware, EN 14411Bla	2699	5 x 5 cm	219
		2218	15 x 15 cm	218
		2017	30 x 30 cm	218
		2679	7,5 x 60 cm	218
		2692	15 x 60 cm	218
		2694	30 x 60 cm	218
		2678	30 x 60 cm	219
		2686	30 x 60 cm	220
		2693	60 x 60 cm	219
		2453	45 x 90 cm	219
		WAREHOUSE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2626
2680	30 x 60 cm			230
2310	60 x 60 cm			230
XENTRIC	vilbostone unglazed porcelain stoneware, EN 14411Bla	2626	7,5 x 7,5 cm	237
		2685	30 x 60 cm	237
X-PLANE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2362	7,5 x 7,5 cm	247
		2354	2,5 x 15 cm	247
		2359	30 x 30 cm	245
		2351	7,5 x 60 cm	245
		2352	15 x 60 cm	245
		2392	30 x 60 cm	245
		2680	30 x 60 cm	245
		2349	60 x 60 cm	246
		2356	30 x 120 cm	246
		2358	30 x 120 cm	247
		2357	60 x 120 cm	246

R11

Anti-slip R11 (in workshop areas)

Ranges		Art.-Nr.	Format	Page
BERNINA	vilbostone unglazed porcelain stoneware, EN 14411Bla	2800	60 x 60 cm	117
CROSSOVER	vilbostone unglazed porcelain stoneware, EN 14411Bla	2627	7,5 x 7,5 cm	138
		2635	15 x 15 cm	137
		2633	30 x 30 cm	137
		2619	7,5 x 60 cm	137
		2622	15 x 60 cm	137
		2612	30 x 60 cm	138
		2624	30 x 60 cm	138
		2614	60 x 60 cm	138
GRANIFLOOR	vilbostone unglazed porcelain stoneware, EN 14411Bla	2119	15 x 15 cm	57
		2121	20 x 20 cm	57
		2118	30 x 30 cm	58
		2123	30 x 30 cm	58
		2225	30 x 30 cm	59
		2226	30 x 30 cm	59
LODGE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2801	60 x 60 cm	153
MY EARTH	vilbostone unglazed porcelain stoneware, EN 14411Bla	2649	3,2 x 7,5 cm	164
		2645	30 x 30 cm	165
		2644	30 x 60 cm	165
		2643	60 x 60 cm	165
		2802	60 x 60 cm	165
UNIT THREE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2119	15 x 15 cm	75
		2121	20 x 20 cm	75
		2118	30 x 30 cm	76
X-PLANE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2353	30 x 60 cm	246
		2800	60 x 60 cm	246

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R12

Anti-slip R12 (in workshop areas)

Ranges		Art.-Nr.	Format	Page
GRANIFLOOR	vilbostone unglazed porcelain stoneware, EN 14411Bla	2120	15 x 15 cm	57
		2122	20 x 20 cm	57
UNIT THREE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2120	15 x 15 cm	75
		2122	20 x 20 cm	75

R12-V4

Anti-slip R12-V4 (in workshop areas)

Ranges		Art.-Nr.	Format	Page
GRANIFLOOR	vilbostone unglazed porcelain stoneware, EN 14411Bla	2219	15 x 15 cm	57
		2253	20 x 20 cm	57
UNIT THREE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2219	15 x 15 cm	75
		2003	20 x 20 cm	75

A

Anti-slip A (in barefoot areas)

Ranges		Art.-Nr.	Format	Page
BERNINA	vilbostone unglazed porcelain stoneware, EN 14411Bla	2411	3,2 x 7,5 cm	118
		2386	3 x 30 cm	120
CÁDIZ	vilbostone unglazed porcelain stoneware, EN 14411Bla	2496	10 x 20 cm	128
		2572	30 x 60 cm	128
		2570	60 x 60 cm	128
CROSSOVER	vilbostone unglazed porcelain stoneware, EN 14411Bla	2630	30 x 60 cm	136
EAST END	vilbostone unglazed porcelain stoneware, EN 14411Bla	2305	7,5 x 7,5 cm	145
GRANIFLOOR	vilbostone unglazed porcelain stoneware, EN 14411Bla	2232	7,5 x 30 cm	58
		2234	30 x 30 cm	58
		2213	30 x 30 cm	58
OUTSTANDING	vilbostone glazed porcelain stoneware, EN 14411Bla	2650	30 x 50 cm	172
		2617	7,5 x 60 cm	171
		2622	15 x 60 cm	171
		2324	30 x 60 cm	171
		2668	60 x 60 cm	171
		2732	30 x 120 cm	172
2735	60 x 120 cm	171		
PRO ARCHITECTURA	vilbostone unglazed porcelain stoneware, EN 14411Bla	2213	30 x 30 cm	39
SPOTLIGHT	vilbostone unglazed porcelain stoneware, EN 14411Bla	2030	5 x 5 cm	202
		2919	2,5 x 15 cm	203
TUXEDO	vilbostone unglazed porcelain stoneware, EN 14411Bla	2035	5 x 5 cm	211
		2036	30 x 30 cm	211
UNIT ONE	Glazed vitreous, EN 14411Bib	3244	10 x 10 cm	63
		3105	15 x 15 cm	63
		3177	20 x 20 cm	64
UNIT THREE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2011	15 x 15 cm	75
		2001	20 x 20 cm	75
		2009	7,5 x 30 cm	76
		2007	30 x 30 cm	76
		2008	30 x 30 cm	76
UNIT FOUR	vilbostone unglazed porcelain stoneware, EN 14411Bla	2010	30 x 30 cm	77
		2369	30 x 30 cm	86
		2360	30 x 60 cm	86
		2874	30 x 60 cm	87
		2361	60 x 60 cm	87

Index basic tiles by slip resistance

B		Anti-slip B (in barefoot areas)		
Ranges		Art.-Nr.	Format	Page
BERNINA	vilbostone unglazed porcelain stoneware, EN 14411Bla	2685	30 x 60 cm	117
		2800	60 x 60 cm	117
CÁDIZ	vilbostone unglazed porcelain stoneware, EN 14411Bla	2037	5 x 10 cm	128
		2685	30 x 60 cm	128
CENTURY UNLIMITED	vilbostone glazed porcelain stoneware, EN 14411Bla vilbostone unglazed porcelain stoneware, EN 14411Bla	2030	5 x 5 cm	259
		2030	5 x 5 cm	256
CROSSOVER	vilbostone unglazed porcelain stoneware, EN 14411Bla	2627	7,5 x 7,5 cm	138
		2635	15 x 15 cm	137
		2633	30 x 30 cm	137
		2619	7,5 x 60 cm	137
		2622	15 x 60 cm	137
		2685	30 x 60 cm	137
		2612	30 x 60 cm	138
		2624	30 x 60 cm	138
		2614	60 x 60 cm	138
GRANIFLOOR	vilbostone unglazed porcelain stoneware, EN 14411Bla	2706	5 x 5 cm	57
		2200	10 x 10 cm	57
		2072	10 x 10 cm	58
		2607	10 x 10 cm	59
		2609	10 x 10 cm	59
		2263	10 x 15 cm	59
		2215	15 x 15 cm	57
		2119	15 x 15 cm	57
		2219	15 x 15 cm	57
		2602	15 x 15 cm	59
		2603	15 x 15 cm	59
		2495	10 x 20 cm	59
		2600	20 x 20 cm	57
		2121	20 x 20 cm	57
		2253	20 x 20 cm	57
		2118	30 x 30 cm	58
		2123	30 x 30 cm	58
		2225	30 x 30 cm	59
		2226	30 x 30 cm	59
GROUND LINE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2026	5 x 5 cm	102
LODGE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2031	5 x 5 cm	155
		2362	7,5 x 7,5 cm	153
		2801	60 x 60 cm	153
MINERAL SPRING	vilbostone unglazed porcelain stoneware, EN 14411Bla	2706	5 x 5 cm	94
MY EARTH	vilbostone unglazed porcelain stoneware, EN 14411Bla	2649	3,2 x 7,5 cm	164
		2645	30 x 30 cm	165
		2644	30 x 60 cm	165
		2643	60 x 60 cm	165
		2802	60 x 60 cm	165
OUTSTANDING	vilbostone unglazed porcelain stoneware, EN 14411Bla	2625	7,5 x 7,5 cm	172
PLACE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2486	7,5 x 7,5 cm	179
		2492	30 x 60 cm	179
		2489	30 x 60 cm	179
PRO ARCHITECTURA	Glazed vitreous, EN 14411Blb	3845	5 x 5 cm	34
		3593	5 x 10 cm	36
		3245	10 x 10 cm	34
		3007	10 x 10 cm	38
		3009	10 x 10 cm	38
		3592	10 x 10 cm	36
		3594	10 x 10 cm	36
		3213	10 x 20 cm	34
		3217	20 x 20 cm	35
		vilbostone glazed porcelain stoneware, EN 14411Bla vilbostone unglazed porcelain stoneware, EN 14411Bla	3945	2,5 x 2,5 cm
	2706		5 x 5 cm	38
	2772		5 x 5 cm	40
	2731		5 x 5 cm	40
	2765		5 x 5 cm	40
	2200		10 x 10 cm	38
	2607		10 x 10 cm	40
	2609		10 x 10 cm	40
	2072		10 x 10 cm	40
	2498		10 x 15 cm	40
	2495	10 x 20 cm	40	
2404	15 x 15 cm	38		
2405	15 x 15 cm	38		
2604	20 x 20 cm	39		
2248	20 x 20 cm	39		

Index basic tiles by slip resistance



Anti-slip B (in barefoot areas)

Ranges		Art.-Nr.	Format	Page
PURE LINE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2699	7,5 x 7,5 cm	194
		2686	30 x 60 cm	193
UNIT ONE	Glazed vitreous, EN 14411BIb vilbostone unglazed porcelain stoneware, EN 14411Bla	3245	10 x 10 cm	63
		2706	5 x 5 cm	65
		2200	10 x 10 cm	65
		2072	10 x 10 cm	65
		2495	10 x 20 cm	65
		2248	20 x 20 cm	65
UNIT THREE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2200	10 x 10 cm	75
		2072	10 x 10 cm	76
		2119	15 x 15 cm	75
		2219	15 x 15 cm	75
		2265	15 x 15 cm	77
		2004	10 x 20 cm	76
		2121	20 x 20 cm	75
		2003	20 x 20 cm	75
UNIT FOUR	vilbostone unglazed porcelain stoneware, EN 14411Bla	2363	5 x 5 cm	87
		2680	30 x 60 cm	86
		2706	5 x 5 cm	87
URBANTONES	vilbostone unglazed porcelain stoneware, EN 14411Bla	2699	5 x 5 cm	219
		2686	30 x 60 cm	220
WAREHOUSE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2626	7,5 x 7,5 cm	230
		2680	30 x 60 cm	230
		2310	60 x 60 cm	230
XENTRIC	vilbostone unglazed porcelain stoneware, EN 14411Bla	2626	7,5 x 7,5 cm	237
		2685	30 x 60 cm	237
X-PLANE	vilbostone unglazed porcelain stoneware, EN 14411Bla	2362	7,5 x 7,5 cm	247
		2680	30 x 60 cm	245
		2353	30 x 60 cm	246
		2800	60 x 60 cm	246



Anti-slip C (in barefoot areas)

Ranges		Art.-Nr.	Format	Page
PRO ARCHITECTURA	Glazed vitreous, EN 14411BIb vilbostone unglazed porcelain stoneware, EN 14411Bla	3246	10 x 10 cm	34
		3214	10 x 20 cm	34
		2702	2,5 x 2,5 cm	38

Chemical resistance

General

Ceramic tiles from Villeroy & Boch comply with the quality requirements of the European quality standards in accordance with DIN EN 14411 Ceramic tiles and slabs – terminology, classification, quality characteristics and markings.

Group Bla Dry-pressed ceramic tiles and slabs with low water absorption $E \leq 0.5\%$

Group Blb Dry-pressed ceramic tiles and slabs with low water absorption $0.5\% < E \leq 3\%$

Group BIII Dry-pressed ceramic tiles and slabs with high water absorption $E > 10\%$

Inspection standard DIN EN ISO 10545-13 – Chemical resistance – established test solutions:

Medium	Concentration	Reaction time		
		Porcelain stoneware EN 14411 Group Bla	Glazed vitreous EN 14411 Group Blb	Nonvitreous EN 14411 Group BIII
1 Aqueous test solutions				
1.1 Household chemicals / swimming pool additives				
Ammonium-chloride solution Sodium hypochlorite solution	100 g/l 20 mg/l	12 days 12 days	24 hours 24 hours	24 hours 24 hours
Classification groups		UA/UB/UC*	GA/GB/GC*	GA/GB/GC*
1.2 Acids and alkalis				
1.2.1 Low concentrations (L)				
Hydrochloric acid	3 %	12 days	4 days	4 days Testing method available
Citric acid	100 g/l	12 days	24 hours	24 hours Testing method available
Kaliumhydroxid	30 g/l	12 days	4 days	4 days Testing method available
Potassium hydroxide		ULA//ULB/ULC*	GLA/GLB/GLC*	GLA/GLB/GLC*
1.2.2 High concentrations (H)				
Hydrochloric acid	18 %	12 days Testing method available	4 days Testing method available	4 days Testing method available
Lactic acid	5 %	12 days Testing method available	4 days Testing method available	4 days Testing method available
Potassium hydroxide	100 g/l	12 days Testing method available	4 days Testing method available	4 days Testing method available
Classification groups		UHA/UHB/UHC*	GHA/GHB/GHC*	GHA/GHB/GHC*

*) Classification group A = no visible effect that declines after C

Inspection standard DIN EN ISO 10545-14 – Stain resistance – established testing solutions:

Medium (reaction time 24 h)

1. Stain-forming substances, leaving traces

Green stain forming substances in oil

Red stain forming substances in oil

2. Chemical / oxidising stain forming substances

Iodine, 13 g/l solution in alcohol

Stain-forming substances, leaving film

Olive oil

Cleaning stain-forming substances

a) Cleaning agents

Hot water ($55 \pm 5^\circ\text{C}$)

Weak cleaning agent (pH value 6.5-7.5)

Strong cleaning agent (pH value 9-10)

b) Solvent

Hydrochloric acid solution 3%

Potassium hydroxide 200g/l

Acetone

Classification groups: Cl. 5 / 4 / 3 / 2 / 1**

***) Classification group 5 = maximum stain resistance (all stains removed), which deteriorates after 1
Minor colour variations do not indicate chemical attack. Impairment due to solvents is to be excluded.

High-stress ceramic floor coverings

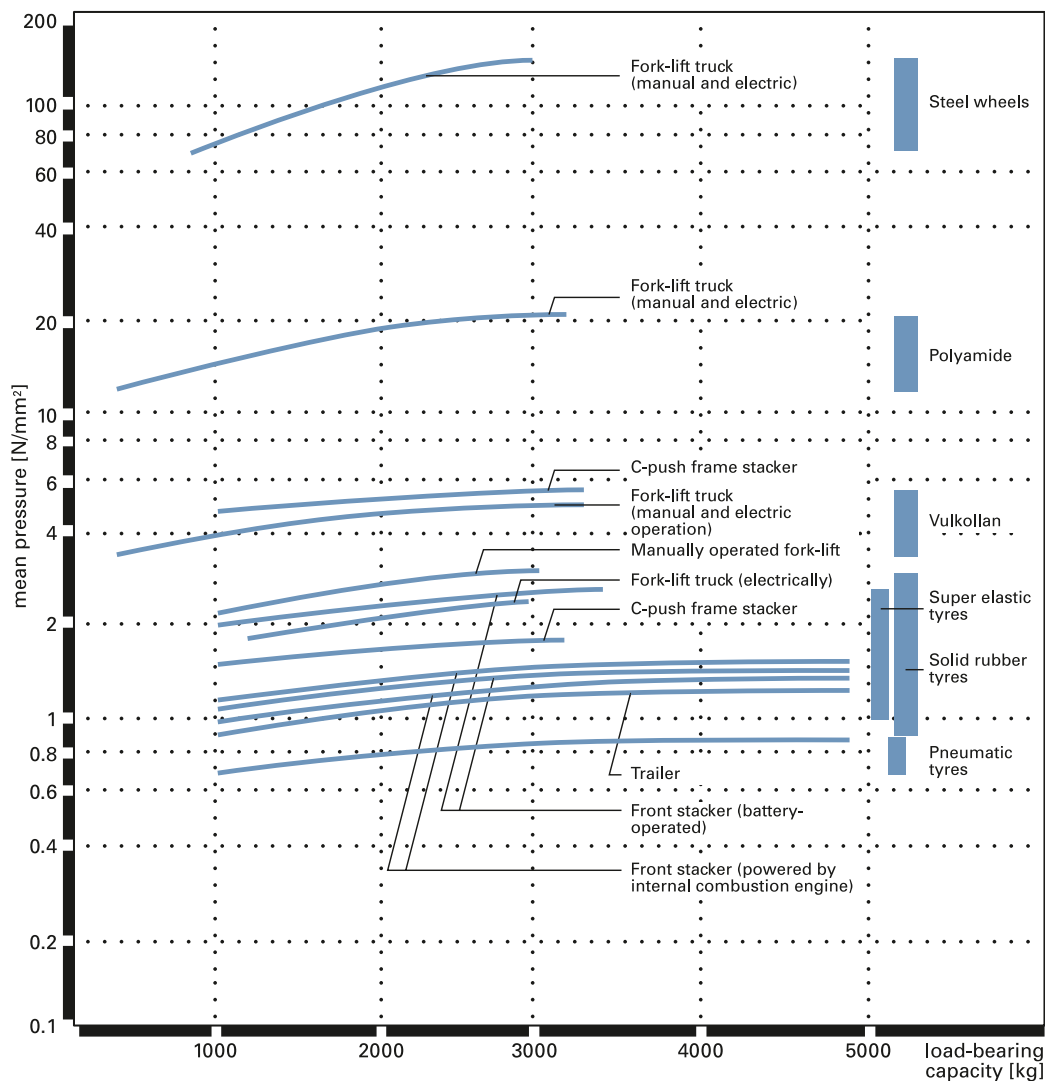


Figure 1: Mean pressure in N/mm² imposed by transport vehicles as a function of load-bearing capacity and type of roller material⁷

1. Introduction

The physical properties of ceramic tiles and slabs make them ideal for areas which are subject to severe mechanical or abrasive stress.

2. Stress factors and requirements

2.1 Stress factors

Floor coverings are subject to mechanical stress resulting from stationary loads caused of furniture, machines, etc. or from nonstationary loads induced by walking or driving over the floor surfaces. While stationary mechanical stress is not generally problematic and doesn't impose special requirements on the ceramic surface, nonstationary loads resulting from moving vehicles must receive due consideration during the planning stage.

Floor coverings which are exposed to stress as a result of transport operations with industrial trucks or vehicles imposing a similar load, such as occur at food retail stores or wholesale centres, do-it-yourself stores, other commercial premises, canteens, production plants, etc. are to be regarded as being subject to high levels of mechanical stress.

The traffic frequency does not constitute a key criterion here (a vehicle passing over a floor only once may be sufficient to cause damage, if the floor covering was not designed for the imposed load).

Regulations and guidelines for floor coverings subject to high levels of mechanical stress are contained in specifications issued by the „Fachverband des Deutschen Fliesengewerbes“ („German tiling association“) at the central association of the German building industry (ZDB), the industrial association „Keramische Fliesen und Platten“ e.V. („Ceramic tiles and slabs“) and the „Arbeitsgemeinschaft für Industriebau“ („Study group for industrial construction“).

The pressures imposed on floor coverings by industrial transport vehicles depend on the type of vehicle, the wheel forces and the roller materials.

Depending on these factors, pressures within a range from 0.7 to 150 N/mm² apply.

Steel and polyamide rollers should be avoided as a general principle. This restricts the pressures to the range < 6 N/mm², with a corresponding reduction in the risk of damage.

High-stress ceramic floor coverings

2.2 Requirements for ceramic coverings

Ceramic coverings in areas subject to high levels of mechanical stress are to be planned with due consideration to the attendant requirements and the expected stress levels. According to the ZDB specification [8], the following are suitable as ceramic covering materials:

- Dry-pressed ceramic tiles and slabs in accordance with EN 14411³ - Group B
- Extruded ceramic tiles and slabs in accordance with EN 14411³ - Group A

They should fulfil the following conditions:

- Side length of tiles and slabs between 8 and 30 cm
- Breaking force, F, in accordance with the stress group

The breaking force, F, of a tile or slab, which is defined as a measured quantity when determining the flexural strength in accordance with DIN EN ISO 10545-4¹, incorporates the most important influencing factors of flexural tensile strength and thickness and is:

- linearly dependent on the flexural tensile strength, β , in N/mm²;
- dependent on the square of the thickness, h, in mm;
- independent of the format when square formats apply.

When the flexural tensile strength of the tiles or slabs is known, the breaking force can be established by means of the following formula:

$$\text{Breaking force } F \text{ (N)} = 2 \times \beta \times h^2 \times b / 3 \times L$$

In which:

β flexural tensile strength of the tile or slab in N/mm²

Minimum flexural tensile strengths:

Split tiles in acc. with EN 14411 – Group A I ≥ 23 N/mm²

Tiles in acc. with EN 14411 – Group BIa ≥ 35 N/mm²

Tiles in acc. with EN 14411 – Group BIb ≥ 30 N/mm²

h Tile or slab thickness in mm;

b Tile or slab width in mm;

L Tile or slab length in mm (-20 mm)

Figure 3 shows the breaking force, F, as a function of the tile and slab thicknesses and the actual flexural tensile strengths. Tiles or slabs with a greater breaking force, F, reduce the risk of damage.

3. Installation

The tiles and slabs are laid according to the thin-bed method in accordance with DIN 18157⁵, Part 1, generally with hydraulic thin-bed mortars in acc. with EN 12004² Class C2TE - on a previously produced cement floor of strength class CT-C25-F4 at least.

Stress group	Breaking force F (N) EN ISO 10545-4	Areas of application Mechanical stress
I	< 1.500	Private homes and floor coverings subject to similar mechanical stress, e.g. hotel bathrooms, health-sector premises
II	1.500 – 3.000	Administrative, commercial and industrial premises (suitable for pneumatic-tired vehicles), e.g. industrial kitchens, canteens, traffic zones, car showrooms and maintenance rooms, sales rooms, in each case without industrial trucks Pressure up to 2 N/mm²
III	3.000 – 5.000	Commercial and industrial premises (industrial trucks with Superlastik, solid rubber and Vulkolan tyres), e.g. in the food retail and wholesale sector, non-food, general retailing and wholesale, shopping arcades Pressures of 2 to 6 N/mm²
IV	5.000 – 8.000	Commercial and industrial premises; areas of application as for group III, but traversable with polyamide rollers Pressures of 6 to 20 N/mm²
V	> 8.000	Commercial and industrial premises; heavy-duty areas used by industrial trucks with polyamide rollers. Rolling of metal parts, e.g. production, assembly and storage facilities, repair workshops for machinery and heavy-duty equipment Pressures > 20 N/mm²

Figure 2: Classification of groups according to mechanical stress

High-stress ceramic floor coverings

Cavities should be largely avoided when laying tiles and slabs. This can be achieved by means of the „combined method“ in accordance with DIN 18157⁵, Part 1, point 7.3.3, or by using the so-called „floating method“. In order to produce composite flooring and coverings on separating or insulating layers, tiles may also be laid according to the thick-bed or „vibration method“ AK-QR⁹. With due regard to the tolerances of the tiles or slabs, the minimum possible joint widths are recommended. Height offsets and „projecting teeth“ should be avoided.

Jointing is generally carried out with hydraulic jointing mortar; in the case of floor coverings which are additionally subject to chemical stress, e.g. in canteens or plants in the food industry, it may be necessary to carry out jointing with cold-curing resin jointing compounds, e.g. epoxy resin-based compounds.

Stress group	Thickness (mm)	Breaking force F (N)								
		Porcelain stoneware tiles in acc. with EN 14411								
		Group Bla – E ≤ 0,5% (square format)								
Flexural strength in N/mm ²										
		27	32	37	42	47	52	57	62	69
I	6.00	722	855	989	1,123	1,256	1,390	1,523	1,657	1,844
	7.00	982	1,164	1,346	1,528	1,710	1,892	2,074	2,255	2,417
	8.00	1,283	1,520	1,758	1,996	2,233	2,471	2,708	2,946	3,157
	8.50	1,448	1,716	1,985	2,253	2,521	2,789	3,057	3,326	3,564
II	9.00	1,624	1,924	2,225	2,526	2,826	3,127	3,428	3,728	3,996
	9.50	1,809	2,144	2,479	2,814	3,149	3,484	3,819	4,154	4,452
	10.00	2,005	2,376	2,747	3,118	3,489	3,861	4,232	4,603	4,933
	10.50	2,210	2,619	3,029	3,438	3,847	4,256	4,666	5,075	5,439
	11.00	2,426	2,875	3,324	3,773	4,222	4,671	5,121	5,570	5,969
	11.50	2,651	3,142	3,633	4,124	4,615	5,106	5,597	6,088	6,524
	12.00	2,887	3,421	3,956	4,490	5,025	5,559	6,094	6,628	7,104
III	12.50	3,132	3,712	4,292	4,872	5,452	6,032	6,612	7,192	7,708
	13.00	3,388	4,015	4,642	5,270	5,897	6,524	7,152	7,779	8,337
	13.50	3,653	4,330	5,006	5,683	6,359	7,036	7,712	8,389	8,991
	14.00	3,929	4,656	5,384	6,112	6,839	7,567	8,294	9,022	9,669
IV	16.00	5,132	6,082	7,032	7,983	8,933	9,883	10,833	11,784	12,629
	18.00	6,495	7,697	8,900	10,103	11,306	-	-	-	-
V	20.00	8,018	9,503	10,988	12,473	-	-	-	-	-
	9,702	11,499	13,295	15,092	15,092	-	-	-	-	-
	24.00	11,546	13,684	15,823	17,961	-	-	-	-	-

Figure 3: Breaking force, F, of tiles according to thickness and flexural strength

References:

- ¹ DIN-EN ISO 10545-4 Ceramic tiles – Determination of modulus of rupture and breaking strength
- ² EN 12004 Adhesives for tiles – Definitions and specifications
- ³ EN 14411 Ceramic tiles - Definitions, classification, characteristics and marking
- ⁴ AGI Arbeitsblatt A70 Industrieböden: Bodenbeläge aus Fliesen und Platten - Planung und Ausführung (Industrial floors: Floor coverings consisting of tiles and slabs – Planning and installation)
- ⁵ DIN 18157 „Ausführung keramischer Bekleidungen im Dünnbettverfahren“ Teil 1: „Hydraulisch erhärtende Dünnbettmörtel“ / Teil 3: „Epoxidharzklebstoffe“ (Production of ceramic coverings according to the thin-bed method Part 1: „Hydraulically setting thin-bed mortars“ / Part 3: „Epoxy resin adhesives“)
- ⁶ DIN 18560 Estriche im Bauwesen (Screeds for construction applications)
- ⁷ Autenrieth Bestimmung der Widerstandsfähigkeit von Industrie-Estrichen gegen mechanische Beanspruchung durch Flurfördermittel („Determination of the resistance of industrial screeds to mechanical stress imposed by industrial trucks“)
- ⁸ ZDB-Merkblatt Mechanisch hoch belastbare keramische Beläge („Hard-wearing ceramic coverings“)
- ⁹ AK-QR Verarbeitungsrichtlinien – Herstellung keramischer Bodenbeläge im Rüttelverfahren (Guidelines – Production of ceramic floor coverings according to the vibration method)

Wear resistance

Wear-resistance properties of glazed vitreous and porcelain stoneware tiles in accordance with EN ISO 10545-7

All floor coverings are exposed to wear.

The extent of wear is primarily dependent on the following factors:

- Frequency of use
- Degree of soiling and cleaning conditions
- Type of mechanical stress through manner in which the floor is walked, driven upon
- The hardness of the glaze
- The thickness of the glaze layer
- The glaze finish (matt, semi-matt, gloss)
- The colour and brightness of the glaze

As a rule, floor covering material is worn down by sand and dirt particles that adhere to the soles of shoes and act like sandpaper high pressure during walking and turning movements.

Glazed vitreous and porcelain stoneware tiles are characterised by a particularly easy-care finish. Glazed vitreous or porcelain stoneware tiles which are selected according to the area of application concerned and cleaned on a regular basis are highly durable.

If abrasive materials, such as dirt contained in quartz sand, are allowed to act on the glaze for long periods of time, a loss of gloss and gradual increase in roughness of the surface may result. However, as the serviceability of the floor covering remains unimpaired, this does not constitute a justifiable ground for complaints.

Scratches in the glaze are caused by materials of at least equal hardness, such as quartz grains, sand, dirt or similar in conjunction with a load and movements over the covering. They can, for example, be caused when moving heavy items (including pieces of furniture).

To prevent premature surface wear, it is recommended that large cleaning zones be provided at all entrances.

Wear resistance

Wear-resistance groups

Wear-resistance group 0 lightest stress

Unsuitable for the floor area. Villeroy & Boch does not manufacture products in wear-resistance group 0!

Wear-resistance group 1 very light stress

For floors in areas subject to very infrequent use, (soft-soled shoes) and no abrasive contamination.

Examples: Bedrooms and bathrooms in private homes.

Wear-resistance group 2 light stress

For floors in areas subject to infrequent use, (normal street shoes) and small amounts of abrasive contamination.

Examples: Private homes, with the exception of kitchens, stairs, terraces, loggias.

Wear-resistance group 3 medium stress

For floors in areas subject to frequent use, (normal street shoes) and abrasive contamination.

Examples: all rooms in the home, including bathrooms, hallways, corridors, balconies, loggias, apart from kitchens; hotel rooms and bathrooms; sanitary and therapy rooms in hospitals.

Wear-resistance group 4 medium-heavy stress

For floors in areas subject to frequent use (normal street shoes) and frequent, intense soiling.

Examples: private entrances and kitchens, terraces, sales rooms and utility rooms, offices, hotels etc.; floors in schools, administration buildings, hospitals etc.

Wear-resistance group 5 heavy stress

The tiles of the wear-resistance group 5, which provide a very high wear resistance, are available for areas subjected to intense public use.

Examples: bakeries, snack bars, entrance halls of hotels and banks, restaurants.

Maximum stress

For heavily frequented application areas or those subjected to extreme surface wear, for example, in the areas surrounding cash tills or entrance areas to passage ways, we recommend the use of unglazed porcelain stoneware, which has an unusually high degree of wear resistance.

At points that are subject to extreme wear – and this applies to all areas of application – deviations from the overall appearance of the surface are possible. In borderline cases, it is therefore recommendable to choose the next-highest wear-resistance group.

Tiles belonging to higher wear-resistance groups can, of course, be used in areas subject to lower requirements.

Wear-resistance properties of unglazed porcelain stoneware tiles

Unglazed porcelain stoneware tiles, as described in standard EN 14411, Group B1a water absorption $E \leq 0.5\%$, are considered to have some of the highest wear-resistance properties (deep abrasion) of all floor covering materials.

This homogeneous material reveals virtually no signs of wear, even after decades of intensive use.

Deep abrasion is the name for the wear of unglazed porcelain stoneware tiles as a result of grinding and abrasive stress.

The permissible tolerances are specified as minimum requirements in the relevant standard (DIN EN ISO 10545-6 – resistance to the deep abrasion of unglazed tiles and slabs, volume loss – max 175 mm³).

At points that are subject to extreme wear – and this applies to all areas of application – deviations from the overall appearance of the surface are possible.

UPEC – classification of ceramic floor coverings

General explanation

The UPEC classification for floor tiles is a usage- and function-related categorisation of floor coverings and applies in France.

The UPEC classification is performed by the CSTB (Centre Scientifique et Technique du Bâtiment, Scientific and Technical Building Centre) in Paris and is primarily aimed at intensively frequented rooms. Certification and classification is carried out in accordance with the CSTB Heft/ Cahier 3735: 2013.

The four letters U, P, E and C stand for:

U: Step-related wear

P: Impressions made by furniture and other fixed or mobile units (objects)

E: Behaviour in relation to water

C: Behaviour in relation to chemicals

Both the rooms and the floor coverings are UPEC-classified and the floor covering should comply at least with the UPEC classification of the room. The rooms and floor coverings are characterised using a combination of these four indexed letters, whereby a larger numeric value of the indices corresponds to higher toughness. The data sheet "Dünne Bodenbeläge."

It applies the leaflet "Thin floor coverings. Datasheet on the UPEC classification and the UPEC classification of rooms".

U: Step-related wear

"U" specifies the wear resistance and corresponds to the wear groups as per EN ISO 10545-7 (see chapter "Technical information: wear resistance"):

U2 corresponds to wear-resistance group PEI 2 for glazed tiles

U2s corresponds to wear-resistance group PEI 3 for glazed tiles

U3 corresponds to wear-resistance group PEI 4 for glazed tiles

U3s corresponds to wear-resistance group PEI 5 for glazed tiles

U4 applies to unglazed porcelain stoneware which does not have a corresponding wear-resistance group. These data are provided for information purposes only. In no way do they replace the official result of the CSTB. Index 1 is insignificant due to the minimal toughness in regular building practice.

P: Impressions made by furniture and other fixed or mobile units (objects)

"P" covers mechanical effects following the installation and use of furniture or other fixed (= impression-causing) or moveable objects (= that cause roller and scub marks) or as a consequence of objects of various weights being handled or falling down. It is also defined using the bending (tensile) strength.

In practice the five indices **2, 3, 4, 4+** and **4s** (highest toughness) are assigned.

As with the "U", index 1 is not used here either due to its insufficient toughness.

UPEC – classification of ceramic floor coverings

E: Behaviour in relation to water

E describes the covering's behaviour in relation to water.

The highest index 3 is always assigned to ceramic tiles.

C: Behaviour in relation to chemicals

"C" takes into account the consequences of the chemical or photochemical effect of substances that have a negative effect on the durability of the covering (stains, attacks that penetrate to various depths etc.).

Indices **0, 1, 2** and in exceptional cases **3** are assigned.

A floor covering will only be awarded index 3, which is assigned to certain rooms (laboratories, work-

shops etc.), after special tests dependent on the description of these rooms (for example laboratories for medical analyses, hairdressing salons) have been conducted.

All tiles from Villeroy & Boch are **C2**-classified and thus offer a very high chemical resistance, in particular as regards acids, lyes and stains.

Villeroy & Boch Tiles – certified manufacturer

Only certified manufacturers have the right to stipulate the UPEC classification of tested tiles. These tiles display the NF-UPEC logo on the packaging and the UPEC classification is indicated.

V&B Fliesen GmbH has been assigned the following number:

121

for its Merzig factory.

This certification guarantees

- that the tiles comply with the DIN EN 14411 standard
- that the tiles actually possess the specified wear-resistance characteristics, as defined by the UPEC classification (regular checking by an independent laboratory)
- and that the tiles originate from a production line which is continuously subject to extremely strict rules and regulations.



- Very easy to clean
- Dirt-repellent, less cleaning necessary
- Environment-friendly, saves on cleaning agents
- Water and a soft cloth are all that's needed, a mild cleaning agent is sufficient for more stubborn dirt
- Resistance proven 10-year simulation to verify the material's durability, subject to compliance with the care instructions
- Hygienic, poses no health or environmental risks: confirmed by independent institutes

Surface finish for nonvitreous wall tiles

The easy-care **ceramicplus** finish was developed in the Villeroy & Boch laboratories according to the latest findings from the field of materials research. **ceramicplus** provides the ceramic surface with a permanent finish by means of a special process.

On nonvitreous wall tiles treated in this way, dirt particles are virtually unable to obtain a hold and flow off with water droplets.

Water and a soft cloth are all that's needed for routine cleaning. Mild, environment-friendly cleaning agents are sufficient to remove more stubborn dirt – no need for

aggressive detergents. The highly effective and sustained hygienic properties of **ceramicplus** have been confirmed by means of extensive testing carried out at independent external testing institutes, such as the Institut für Medizinische Mikrobiologie und Hygiene at the University of Lübeck. Institutes such as the Fresenius Institut in Taunusstein have further confirmed that **ceramicplus** does not pose any health or environmental risks.

You will find detailed information on cleaning in the chapter "Technical information: Cleaning and care".



- In private and public areas
- For floors, walls, stairs and terraces
- Robust and durable
- Full-body colouring
- Variety of designs
- Various surface finishes
- Various classes of slip resistance
- Ideal for underfloor heating
- Exact colour and design planning possible
- Colour- and light-fast
- Chemical-resistant
- Resistant to stains and soiling
- Frost-resistant

***vilbostone* porcelain stoneware** permits a wealth of different surface designs featuring unusual colour and sheen effects. *vilbostone* porcelain stoneware is available both glazed and unglazed, with a matt, polished, rough-polished or relief surface finish and in various classes of slip-resistance.

vilbostone porcelain stoneware tiles are coloured throughout. Unglazed *vilbostone* porcelain stoneware with a matt or rough-polished surface finish have the ***vilbostoneplus*** seal, which renders the tiles particularly resistant to dirt and stains. During the manufacturing process, the structure of the tile surface is sealed in order to further increase the tiles' resistance to staining and

dirt, as a result of which subsequent treatment with impregnating agents is no longer necessary. Unglazed *vilbostone* porcelain stoneware is particularly suitable for heavily-used floors in public areas. It offers a high level of resistance to frost and chemicals and is colour- and light-fast.

You will find detailed information on cleaning in the chapter "Technical information: Cleaning and care".

Tiling / Installation

Non-vitreous tiles and non-vitreous tiles with a ceramicplus finish

EN 14411 Group BIII - dry-pressed ceramic tiles and slabs with high water absorption $E > 10\%$

Installation

Usually laid according to the thin-bed method in compliance with DIN 18157 with a C1 or C2 adhesive used in accordance with DIN EN 12004.

Joints

In order to compensate for the tolerances resulting from the manufacturing process, we recommend including corresponding joints when laying the tiles, depending on the size of the tiles and the desired appearance. Information on joint widths is to be found in DIN 18157 part 1 - 3 – edge length up to 150 mm, joint width of 2 - 3 mm, 2 - 8 mm for tiles wider than 150 mm. In general, the joint width is the result of the difference between the nominal size and the work size.

Villeroy & Boch recommends a minimum joint width of approx. 3 mm (from format 10 x 10 cm).

In addition to compensating for the above-mentioned tolerances, the joint also prevents water and dirt from penetrating into the tile covering. A cement-based joint prevents the penetration of bacteria, mould, etc.; the alkaline cement-based environment impedes growth in the joint.

The joint is part of the covering, which is why the nominal tile dimension (including joint) is the basis for calculating the material requirement.

Cutting

Dry cutting is generally possible by scoring with a Widia wheel, applying even pressure. We recommend running and slightly blunting new cutting wheels prior to actual use by carrying out a number of test cuts. Should splintering occur, so-called fine cutting wheels are available from dealers for dry cutting purposes. Special diamond-tipped wet tile cutters are recommended to ensure a clean cut in critical cutting work.

Visible cutting edges should be broken. As there are no standards regulating the subsequent processing of ceramic tiles, specialist companies are responsible for determining the cutting properties of the tile before laying.

Cut-outs

To create cutouts, a small cutout grinder and a special tile diamond-cutting disk should be used to make a cross-cut on the reverse. The centre of the tile is carefully knocked out using the tip of a tile hammer. When the hole is large

enough, we recommend that the rest be removed with a pair of parrot nippers.

The water-jet technique is recommended for complex cut-out work.

Drilling

Possible using carbide drills in dry state. To this end, a hardened pointed punch is used to pick away a little material at the centre point of the hole and a carbide drill or a glass ceramics drill is then used.

Exact drill holes can be produced in all substrates using a hollow drill with a diamond bit in dry and wet drilling processes.

When drilling in particular, care must be taken to ensure that the tile is laid professionally on a non-elastic base without any cavities, otherwise tiles could break or crack.

Tiling / Installation

vilbostone - porcelain stoneware and glazed vitreous and porcelain stoneware tiles

EN 14411 Group Bla - Dry-pressed ceramic tiles and slabs with low water absorption $E \leq 0.5\%$

EN 14411 Group Blb - Dry-pressed ceramic tiles and slabs with low water absorption $0.5\% < E \leq 3\%$

Laying

The tiles are usually laid according to the thin-bed method in compliance with DIN 18157 with plastic-modified C2 adhesives used in accordance with DIN EN 12004.

In keeping with the ZDB leaflet "Outdoor flooring", when tiling outdoors, a suitable method of laying should be

chosen to avoid cavities forming, e.g. the combined method (buttering – floating method) with a suitable plastic-modified C2 adhesive used in accordance with DIN EN 12004 or using special porcelain stoneware flow-bed mortar in the simple floating method.

Joints

In order to compensate for the tolerances resulting from the manufacturing process, we recommend including corresponding joints when laying the tiles, depending on the size of the tiles and the desired appearance. Information on joint widths is to be found in DIN 18157 part 1 - 3 – edge length up to 150 mm, joint width of 2 - 3 mm, 2 - 8 mm for tiles wider than 150 mm. In general, the joint width is the result of the difference between the nominal size and the work size.

Villeroy & Boch recommends a minimum joint width of approx. 3 mm (from format 10 x 10 cm).

In addition to compensating for the above-mentioned tolerances, the joint also prevents water and dirt from penetrating into the tile covering. A cement-based joint prevents the penetration of bacteria, mould, etc.; the alkaline cement-based environment impedes growth in

the joint. If there are any slight differences in height in the tile covering, the joint minimises the risk of the edges or corners chipping during use (e.g. when moving heavy suitcases with wheels or other heavy loads over the covering).

In special areas, such as rooms exposed to chemicals, industrial kitchens, swimming pools, etc. special purpose adhesives / grouting materials may be required. In such cases, it is best to contact the Deutsche Bauchemie organisation first.

The joint is part of the covering, which is why the nominal tile dimension (including joint) is the basis for calculating the material requirement.

Cutting

Dry cutting is generally possible by scoring with a Widia wheel, applying even pressure. We recommend running and slightly blunting new cutting wheels prior to actual use by carrying out a number of test cuts. Should splintering occur, so-called fine cutting wheels are available from dealers for dry cutting purposes. Special diamond-tipped wet tile cutters are recommended to ensure a clean cut in critical cutting work. Visible cutting edges should be broken.

As there are no standards regulating the subsequent processing of ceramic tiles, specialist companies are responsible for determining the cutting properties of the tile before laying.

Special features:

Glazed vitreous tiles are high-glaze products whose dry cutting properties may vary. Hard glazes possess varying stress curves. Consequently, when scoring the tile, particularly with a new Widia wheel, splintering of the glaze may occur; this can generally be avoided by changing the amount of pressure applied during cutting.

Tiling / Installation

vilbostone - porcelain stoneware and glazed vitreous and porcelain stoneware tiles

Cut-outs

To create cut-outs, a small cut-out grinder with a special diamond-cutting disk should be used to make the cut on the front of the tile.

We recommend drilling the corners with a diamond drill. We recommend the water-jet technique for complex cut-out work.

Drilling

Exact drill holes can be produced in all substrates using a hollow drill with a diamond bit in dry and wet drilling processes.

When drilling in particular, care must be taken to ensure that the tile is laid professionally on a non-elastic base without any cavities, otherwise tiles could break or crack.

Drills recommended by Villeroy & Boch Tiles:

1. Wet drill (hollow drill with diamond bit) for permanent professional use

1.1 Marcryst Diamantwerkzeuge - www.marcryst.com

Karl-Benz-Straße 8 · D-79761 Waldshut-Tiengen · Tel: +49(0)7741/96672-0 · Fax: +49(0)7741/96672-99

1.2 Karl Dahm & Partner GmbH - www.karldahm.com

Ludwigstraße 5 · D-83358 Seebruck · Tel: 49(0)8667/8780 · Fax: 49(0)8667/878200

1.3 Seelbach International GmbH - www.seelbach-international.com

Hauptstraße 20 · D-56477 Rennerod · Tel: 49(0)2664/9128-0 · Fax: 49(0)2664/9128-10

1.4 RUBI Deutschland GmbH - www.rubi.com

Mollsfeld 5 · D-40670 Meerbusch · Tel: 49(0)2159/81449-29 · Fax: 49(0)2159/81449-31

2. Wet drill (hollow drill with diamond bit) for private use

2.1 Marcryst Diamantwerkzeuge - www.marcryst.com

Karl-Benz-Straße 8 · D-79761 Waldshut-Tiengen · Tel: 49(0)7741/96672-0 · Fax: 49(0)7741/96672-99

2.2 Alpen-Maykestag GmbH - www.alpenmaykestag.com

Hansaallee 201 · D-40549 Düsseldorf · Tel: 49(0)211/537550-0 · Fax: 49(0)211/593573

3. Dry drill

3.1 Marcryst Diamantwerkzeuge - www.marcryst.com

Karl-Benz-Straße 8 · 79761 Waldshut-Tiengen · Tel: 49(0)7741-96672-0 · Fax: 49(0)7741-96672-99

3.2 Keil Werkzeugfabrik - Karl Eischeid GmbH - www.keil.eu

Im Auel 42 · D-51766 Engelskirchen · Tel: 49(0)2263/807-0 · Fax: 49(0)2263/807-333

3.3 Albert Berner Deutschland GmbH - www.berner.de


Bernerstraße 4 · D-74653 Künzelsau · Tel: 49(0)800/6633-123 · Fax: 49(0)800/6633-124

3.4 RUBI Deutschland GmbH

Mollsfeld 5 · D-40670 Meerbusch · Tel: 49(0)2159-8144929 · Fax: 49(0)2159-8144931

Technical Properties


Nonvitreous

In acc. with DIN EN 14411, Group BIII (Water Absorption E > 10%)						
Classification:	Table ZA.1.2 Walls inside		Requirements of the nominal dimension N			Tested in acc. with DIN EN ISO
			7 cm ≤ N < 15 cm	N ≥ 15 cm		
			mm	%	mm	
Length and width:						
Permissible deviation of the average side length of each tile/slab (2 or 4 sides) from the work size (W)			± 0.75	± 0.5	± 2.0	10545-2
Thickness:						
Deviation of the average thickness of each tile from the work size			± 0.5	± 10	± 0.5	10545-2
Straightness of sides:						
Max. deviation in relation to the corresponding work size			± 0.5	± 0.3	± 1.5	10545-2
Rectangularity:						
Max. deviation in relation to the corresponding work size			± 0.75	± 0.5	± 2.0	10545-2
Surface flatness:						
Max. deviation						
a) Central dome, in relation to the diagonal calculated from the work size			+ 0.75 / - 0.50	+ 0.5 / - 0.3	+ 2.0 / - 1.5	10545-2
b) Edge dome, in relation to the work size			+ 0.75 / - 0.50	+ 0.5 / - 0.3	+ 2.0 / - 1.5	10545-2
c) Skew, in relation to the diagonal calculated from the work size			± 0.75	± 0.5	± 2.0	10545-2
Surface quality:						
≤ 95% of tiles shall be free from visible defects that would impair the appearance of a major area of tiles			Achieved	Achieved	Achieved	10545-2
Water absorption in %:						
Average 10%. If the value exceeds 20%, this must be declared by the manufacturer. Individual min. 9%			Achieved	Achieved	Achieved	10545-3
Breaking strength in N: min. 600N (thickness ≤ 7.5mm) / min. 200N (thickness < 7.5mm)			Achieved	Achieved	Achieved	10545-4
Flexural strength in N/mm²: min. 12N/mm ² (thicknesses ≥ 7.5mm) / min. 15N/mm ² (thickness < 7.5 mm)			Achieved	Achieved	Achieved	10545-4
Coefficient of linear thermal expansion at ambient temperature of up to 100 °C in K⁻¹			Testing method available			10545-8
Thermal shock resistance			Achieved	Achieved	Achieved	10545-9
Moisture expansion			Testing method available			10545-10
Crazing resistance			Achieved	Achieved	Achieved	10545-11
Minor colour deviations			Testing method available			10545-16
Resistance to staining of glazed tiles (class 1 to 5)			Testing method available			10545-14
a) Glazed tiles and slabs min. class 3						
Resistance to acids and alkalis – low concentration			According to the class indicated by the manufacturer			10545-13
a) Glazed tiles and slabs; class GLA to GLC						
Resistance to acids and alkalis – high concentration			Testing method available			10545-13
a) Glazed tiles and slabs; class GHA to GHC						
Resistance to household chemicals and bath water additives (for swimming pools)						
a) Glazed tiles and slabs; class GA to GC – min. GB			Achieved	Achieved	Achieved	10545-13
Lead and cadmium release			Testing method available			10545-15

Technical Properties

Glazed vitreous


In acc. with DIN EN 14411, Group B_{1b} (Water Absorption $0.5 < E \leq 3\%$)

Classification:	Table ZA.1.1 Floors inside and / or outside				Requirements of the nominal dimension N	Tested in acc. with DIN EN ISO
	Table ZA.1.2 Walls inside					
		mm	%	mm		
Length and width: Permissible deviation of the average side length of each tile/slab (2 or 4 sides) from the work size (W)		± 0.9	± 0.6	± 2.0	10545-2 10545-2	
Thickness: Deviation of the average thickness of each tile from the work size		± 0.5	± 5%	± 0.5	10545-2	
Straightness of sides: Max. deviation in relation to the corresponding work size		± 0.75	± 0.5%	± 1.5	10545-2	
Rectangularity: Max. deviation in relation to the corresponding work size		± 0,75	± 0,5%	± 2,0	10545-2	
Surface flatness: Max. deviation						
a) Central dome, in relation to the diagonal calculated from the work size		± 0,75	± 0,5%	± 2,0	10545-2	
b) Edge dome, in relation to the work size		± 0,75	± 0,5%	± 2,0	10545-2	
c) Skew, in relation to the diagonal calculated from the work size		± 0,75	± 0,5%	± 2,0	10545-2	
Surface quality: ≥ 95% of tiles shall be free from visible defects that would impair the appearance of a major area of tiles		Achieved	Achieved	Achieved	10545-2	
Water absorption in %: $0.5 < E_b \leq 3.0\%$ / individual max. 3.3%		Achieved	Achieved	Achieved	10545-3	
Breaking strength in N: min. 1100N (thickness ≥ 7.5mm / min. 700N (thickness < 7.5mm)		Achieved	Achieved	Achieved	10545-4	
Flexural strength in N/mm²: min. 30N/mm ² / individual min. 27N/mm ²		Achieved	Achieved	Achieved	10545-4	
Resistance to deep abrasion		Achieved			10545-6	
a) Deep abrasion of unglazed tiles and slabs- volume loss max. 175 mm ³		The abrasion class is indicated by the manufacturer			10545-7	
b) Surface wear of glazed tiles and slabs – (class 1 to 5)		Testing method available			10545-8	
Coefficient of linear thermal expansion at ambient temperature of up to 100°C in K⁻¹		Achieved	Achieved	Achieved	10545-9	
Thermal shock resistance		Achieved	Achieved	Achieved	10545-12	
Frost resistance		Testing method available			10545-10	
Moisture expansion		Testing method available			10545-16	
Minor colour deviations		Testing method available			10545-5	
Impact resistance (measurement of coefficient of restitution)		Testing method available			10545-14	
Resistance to staining of glazed tiles (class 1 to 5)		According to the class indicated by the manufacturer			10545-13	
a) Glazed tiles and slabs min. class 3		Testing method available			10545-13	
b) unglazed tiles and slabs – testing method available		Testing method available			10545-13	
Resistance to acids and alkalis – low concentration		Testing method available			10545-13	
a) Glazed tiles and slabs; class GLA to GLC		Testing method available			10545-13	
b) unglazed tiles and slabs; class ULA to ULC		Testing method available			10545-13	
Resistance to acids and alkalis – high concentration		Testing method available			10545-13	
a) Glazed tiles and slabs; class GHA to GHC		Testing method available			10545-13	
b) unglazed tiles and slabs; class UHA to UHC		Testing method available			10545-13	
Resistance to household chemicals and bath water additives (for swimming pools)		Achieved	Achieved	Achieved	10545-13	
a) Glazed tiles and slabs; class GA to GC – min. GB		Testing method available			10545-15	
b) unglazed tiles and slabs; class UA to UC – min. UB		Testing method available			10545-15	
Lead and cadmium release		The application group is specified by the manufacturer			DIN 51130	
Determination of slip-resistance – commercial area		The application group is specified by the manufacturer			DIN 51097	
Determination of slip-resistance – barefoot area		Testing method available			DIN 51131	
Determination of slip-resistance – method to measure the coefficient of sliding friction		Testing method available			DIN 51131	

Technical Properties

vilbostone glazed and unglazed porcelain stoneware

In acc. with DIN EN 14411, Group BI_a (Water Absorption E ≤ 0.5%)

Classification:	Table ZA.1.1 Floors inside and / or outside Table ZA.1.2 Walls inside	Requirements of the nominal dimension N			Tested in acc. with DIN EN ISO
		7 cm ≤ N < 15 cm mm	N ≥ 15 cm %		
	 1-5				
Length and width: Permissible deviation of the average side length of each tile/slab (2 or 4 sides) from the work size (W)		± 0.9	± 0.6	± 2.0	10545-2 10545-2
Thickness: Deviation of the average thickness of each tile from the work size		± 0.5	± 5%	± 0.5	10545-2
Straightness of sides: Max. deviation in relation to the corresponding work size		± 0.75	± 0.5%	± 1.5	10545-2
Rectangularity: Max. deviation in relation to the corresponding work size		± 0,75	± 0,5%	± 2,0	10545-2
Surface flatness: Max. deviation					
a) Central dome, in relation to the diagonal calculated from the work size		± 0,75	± 0,5%	± 2,0	10545-2
b) Edge dome, in relation to the work size		± 0,75	± 0,5%	± 2,0	10545-2
c) Skew, in relation to the diagonal calculated from the work size		± 0,75	± 0,5%	± 2,0	10545-2
Surface quality: ≥ 95% of tiles shall be free from visible defects that would impair the appearance of a major area of tiles		Achieved	Achieved	Achieved	10545-2
Water absorption in %: Eb ≤ 0.5%, individual max. 0.6%		Achieved	Achieved	Achieved	10545-3
Breaking strength in N: min. 1300N (thickness ≥ 7.5mm / min. 700N (thickness < 7.5mm)		Achieved	Achieved	Achieved	10545-4
Flexural strength in N/mm²: min. 35N/mm ² / individual min. 32N/mm ²		Achieved	Achieved	Achieved	10545-4
Resistance to deep abrasion a) Deep abrasion of unglazed tiles and slabs- volume loss max. 175 mm ³ b) Surface wear of glazed tiles and slabs – (class 1 to 5)		Achieved The abrasion class is indicated by the manufacturer			10545-6 10545-7
Coefficient of linear thermal expansion at ambient temperature of up to 100 °C in K⁻¹		Testing method available			10545-8
Thermal shock resistance		Achieved	Achieved	Achieved	10545-9
Frost resistance		Achieved	Achieved	Achieved	10545-12
Moisture expansion		Testing method available			10545-10
Minor colour deviations		Testing method available			10545-16
Impact resistance (measurement of coefficient of restitution)		Testing method available			10545-5
Resistance to staining of glazed tiles (class 1 to 5) a) Glazed tiles and slabs min. class 3 b) unglazed tiles and slabs – testing method available		Testing method available			10545-14
Resistance to acids and alkalis – low concentration a) Glazed tiles and slabs; class GLA to GLC b) unglazed tiles and slabs; class ULA to ULC		According to the class indicated by the manufacturer			10545-13
Resistance to acids and alkalis – high concentration a) Glazed tiles and slabs; class GHA to GHC b) unglazed tiles and slabs; class UHA to UHC		Testing method available			10545-13
Resistance to household chemicals and bath water additives (for swimming pools) a) Glazed tiles and slabs; class GA to GC – min. GB b) unglazed tiles and slabs; class UA to UC – min. UB		Achieved	Achieved	Achieved	10545-13
Lead and cadmium release		Testing method available			10545-15
Determination of slip-resistance – commercial area		The application group is specified by the manufacturer			DIN 51130
Determination of slip-resistance – barefoot area		The application group is specified by the manufacturer			DIN 51097
Determination of slip-resistance – method to measure the coefficient of sliding friction		Testing method available			DIN 51131

Cleaning and care

General information on cleaning and care

With ceramic floors a distinction should be made between post-installation, maintenance and basic cleaning.

Post-installation cleaning

On completion of the tiling work building dirt and cement film must be removed with a suitable cleaning agent.

The application of suitable stain-removing cleaning agents may be necessary for other types of soiling at the construction site, such as paint stains.

Maintenance cleaning

The tiles can be swept, vacuumed or wiped with a damp cloth, using a suitable cleaning agent.

Basic cleaning

Serves to remove heavy soiling that accumulated during day-to-day use and cannot be removed through maintenance cleaning.

Cleaning methods

Two methods are customarily used:

- Manual cleaning using a broom, scrubbing brush, rubber squeegee or wiping mop.
- Machine cleaning using a single-disc machine, scrubbing suction machine or high-pressure cleaner with spray injection.

The procedure to be used will depend on the space available, the size of the area to be cleaned, the type of dirt and the surfaces to be cleaned (e.g. slip-resistant and textured surfaces) and on the chemical properties of the cleaning agent.

Manual cleaning is advisable where there is only little dirt. When machines are used, single-disc, three-disc machines or brush/scrubber suction machines have proved most effective for this purpose.

When using disc machines, suitable pads must be used, particularly on slip-resistant tile coverings in order to prevent cleaning from impairing the slip-resistance.

High-pressure cleaners with spray injection are particularly suitable for very dirty slip-resistant surfaces.

With high-pressure cleaners there is a slight danger of washing out and destroying cement joints if the machine is not used correctly (pressure too high because water jet is too close to surface). This effect is exacerbated through the use of unsuitable cleaning agents, e.g. acidic cleaners for maintenance cleaning.

Irrespective of the method chosen, care must be taken that the dirt is removed and not simply allowed to dry onto the surface. The most economical and reliable method is to use a powerful water suction machine.

The tiled surface should be dry after completing the cleaning process.

Cleaning and care

Cleaning agents

The type and chemical composition of the appropriate cleaning agent is determined by the type of soiling to be removed and the type of surface to be cleaned (material).

The pH value of the cleaning agent is of particular importance as it reveals whether it is alkaline, neutral or acidic.

The pH scale ranges from 0-14 (see the following table).

Values of individual types of cleaning agent	pH-value of concentrate in the range of
Strongly alkaline cleaner, e.g. with sodium or potassium hydroxide solution base	> 10,5
Weakly alkaline cleaner	8,0 to ≤ 10,5
So-called neutral cleaners	6,0 to ≤ 8,0
Weakly acidic cleaner, e.g. with citric acid base	3,0 to ≤ 6,0
Strongly acidic cleaner, e.g. with hydrochloric, phosphoric or sulphuric acid base	< 3,0

The concentration specified on the container in which the agents are supplied must be observed precisely!

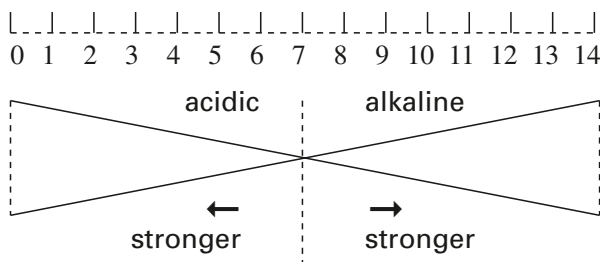


Fig. 1: pH values of cleaning agent groups in accordance with the information leaflet „Hygiene, cleaning and disinfection in pools“ by the German Association for the Recreational and Medicinal Bath Industry.

Strong alkaline cleaning agents are not used for regular cleaning. If such cleaners are left for long periods on aluminium, glass or plastics, they may attack and destroy the surfaces. Painted surfaces are attacked even more quickly; such surfaces or inserts must be masked.

Weak alkaline cleaning agents

These are mainly employed for cleaning sanitary areas, showers, etc.. Correctly diluted with water, they will remove body fats, cosmetics, grease and dirt deposits.

Neutral cleaning agents, are suitable for regular cleaning of dry areas (standard use ceramic floors, WC installations, changing rooms, etc.). Their grease-removing potential is limited.

Weak acidic cleaning agents remove limescale deposits (e.g. calcium scale), urine deposits and other mineral precipitates and deposits. They are also used for basic cleaning to remove cement film remaining after grouting. If used over long periods they will attack cement joints. To prevent this, the surfaces should be thoroughly wetted before cleaning in order to reduce absorption by the joints. The effectiveness of weak acidic cleaning agents also depends on the hardness of the water.

Strong acidic cleaning agents are only recommended for basic cleaning where there is a lot of cement film; the surfaces should be covered with water beforehand and neutralised after cleaning with a weak alkaline product.

Cleaning agents containing hydrofluoric acid must not be used as ceramic materials, are attacked rapidly and massively and will be permanently damaged!

Film-forming cleaning agents should not be used as they can considerably reduce or even neutralise the slip resistance of ceramic coverings, and can also produce unsightly effects (e.g. smearing) or cause cleaning problems.

Please observe the manufacturers' instructions carefully, as incorrect application of cleaning agents may attack and damage the tile covering, joints and elastic sealants.

Where underfloor heating systems are installed, it is particularly important to ensure that the detached dirt (dirty water) is removed before it is able to dry again.

A continuously updated and extended list of suitable tested cleaning agents for ceramic surfaces in swimming pools, the so-called "Liste RK", is provided by the German Association for the Recreational and Medicinal Bath Industry.

Cleaning and care

Nonvitreous tiles and nonvitreous tiles with ceramicplus

Group BIII - Dry-pressed ceramic tiles and slabs with high water absorption $E > 10\%$

The composition of the **ceramicplus** surface makes it much easier to clean. This, however, does not remove the need for cleaning.

Post-installation cleaning / basic cleaning

The cement film is reduced on **ceramicplus** tiles due to the reduced surface energy and the associated hydrophobic (water repellent) property.

Directly after jointing, cement film can be generally removed from nonvitreous and **ceramicplus** tiles with water. More stubborn residues of cement film can be removed using a weakly acidic cement film remover and a sponge

or cloth. The cleaning agent should then be rinsed off with enough clear water until all traces of the basic cleaning agent have been completely removed.

Tiles bearing the symbol “▲” precious metal plating, not scratchproof” should be cleaned with water and a neutral cleaning agent.

Routine cleaning

Final cleaning after tiling / Basic cleaning	Product and dosage	Cleaning equipment
It is generally sufficient to clean with water and a soft or non-scratch sponge or cloth		
Normal dirt, such as dust, light dirt	Neutral cleaning agents (available from specialist retailers)	Microfibre cloth or sponge
Limescale deposits and cement film	Weakly acidic cleaning agent (available from specialist retailers)	Microfibre cloth or sponge
Grease, oils, waxes, cosmetics, shoe marks	Weakly alkaline cleaning agent (available from specialist retailers)	Microfibre cloth or sponge

Please note: All of the information we provide about cleaning, care and removing stains from ceramic tiles is based on the latest knowledge and material research. It is, however, of a general nature and cannot cover every single eventuality. Therefore, please observe the instructions provided by the cleaning agent manufacturer.

Details relating to cleaning agent manufacturers are provided on page 387.

Strongly alkaline or strongly acidic cleaning agents can attack or destroy the surface of nonvitreous tiles and joints and must therefore not be used!

Abrasive cleaning agents and sponges can impair the surface properties and damage the glaze.

Cleaning and care

vilbostone - porcelain stoneware (also polished and rough-polished surface) glazed vitreous and porcelain stoneware tiles

General

On account of their properties, tiles are considered to be easy to clean. The cleaning methods and cleaning agents must, however, be adapted to the type of floor and local conditions.

It should be noted that hydrofluoric acid and related substances are able to attack or destroy the surface of porcelain stoneware tiles and glazed vitreous and porcelain stoneware tiles.

Consequently, no cleaning agents containing hydrofluoric acid are to be used!

vilbostoneplus

A sealant is applied to the surfaces of the matt and rough-polished vitreous tiles at the factory, leading to a marked improvement in resistance to staining and soiling.

ling; Villeroy & Boch does not recommend subsequent treatment with impregnating agents!

Sealing – for polished porcelain stoneware tiles only!

The polished porcelain stoneware tiles are to be sealed with a suitable anti-staining agent after basic cleaning.

Cleaning

Final cleaning after tiling / Basic cleaning	Product and dosage	Cleaning equipment
Loose dirt	-	Broom and vacuum cleaner
Cement film, mineral soiling, such as limescale deposits, soap residue	Acidic cleaner (available from specialist retailers)	Sponge, scrubbing brush, brush, cloth, microfibre cloth
Grease, oils, waxes, cosmetics, shoe marks	Alkaline cleaner (available from specialist retailers)	Sponge, scrubbing brush, brush, cloth, microfibre cloth
Routine cleaning		
Normal dirt, such as dust, light dirt, street dirt	Neutral cleaning agents (available from specialist retailers)	Broom and vacuum cleaner Sponge, scrubbing brush, brush, cloth, microfibre cloth

Please note: All of the information we provide about cleaning, care and removing stains from ceramic tiles is based on the latest knowledge and material research. It is, however, of a general nature and cannot cover every single eventuality. Therefore, please observe the instructions provided by the cleaning agent manufacturer.

Details relating to cleaning agent manufacturers are provided on page 387.

Cleaning and care

Slip-resistant tiles for commercially used and barefoot rooms

General

On account of their properties, tiles are considered to be easy to clean. The cleaning methods and cleaning agents must, however, be adapted to the type of floor and local conditions.

Owing to their high resistance to chemicals and their pronounced wear resistance, porcelain stoneware tiles are predominantly used in areas subject to high levels of stress. Only hydrofluoric acid and related substances are able to attack or destroy the surface of porcelain

stoneware tiles and they may thus not be used on these surfaces!

The slip-resistant properties are achieved through the roughness of the tile's surface or by means of relief-type profiling. More extensive cleaning is thus required than for smooth, glazed surfaces.

vibstoneplus

A sealant is applied to the surfaces of the matt and rough-polished vitreous tiles at the factory, leading to a marked improvement in resistance to staining and soiling;

Villeroy & Boch Tiles does not recommend subsequent treatment with impregnating agents!

Post-installation / basic cleaning

Tiles: R9 – R11 / Barefoot A – C	Dry area: incl. showroom, entrance, sanitary area		Wet area: incl. Sanitary and changing# areas / shower cubicles / swimming pools
Mineral dirt: cement film, lime scale, lime soap, rust	Acidic cleaner (available from specialist retailers)		Acidic cleaner (available from specialist retailers)
Fett- und Ölverschmutzungen EiweiÙe		Alkaline cleaner (available from specialist retailers)	
Procedure:	Wet covering (joints!) Apply cleaning agent and wipe with a micro-fibre pad and single-disc machine. Suck up dirty water Rinse tiles with lots of water.	Apply cleaning agent and wipe with a micro-fibre pad and single-disc machine. Suck up dirty water Rinse tiles with lots of water.	Wet covering (joints!) Apply cleaning agent and wipe with a micro-fibre pad and single-disc machine. Suck up dirty water Rinse tiles with lots of water.

Tiles: R9 – R13 / V4 – V8	Food area: large kitchens, food industry		Industry: workshops, working pits, wash rooms, grinding shops	
Mineral dirt: cement film, lime scale, lime soap, rust	Acidic cleaner (available from specialist retailers)		Acidic cleaner (available from specialist retailers)	
Grease and oil dirt, proteins		Alkaline cleaner (available from specialist retailers)		Alkaline cleaner (available from specialist retailers)
Procedure:	Wet covering (joints!) Apply cleaning agent and wipe with a micro-fibre pad and single-disc machine. Suck up dirty water Rinse tiles with lots of water.	Reinigungslösung aufbringen und mit Mikrofaserpap und Einscheibenmaschine reinigen. Schmutzflotte aufsaugen. Fliesen mit viel Wasser nachspülen	Apply cleaning agent and wipe with a micro-fibre pad and single-disc machine. Suck up dirty water Rinse tiles with lots of water.	Wet covering (joints!) Apply cleaning agent and wipe with a micro-fibre pad and single-disc machine. Suck up dirty water Rinse tiles with lots of water.

Cleaning and care

Slip-resistant tiles for commercially used and barefoot rooms

Routine cleaning

Normal surface soiling: incl. dust	Neutral cleaner (im Fachhandel erhältlich)
Lime scale deposits	Acidic cleaner (available from specialist retailers)
Grease and oil dirt	Alkaline cleaner (available from specialist retailers)
Procedure:	Clean floor covering using a cleaning agent in a two-stage mopping process with a microfibre short-hair mop. With larger areas, a cleaning machine with microfibre pad is recommended.

Note – swimming-pool area

The information in the leaflet „DGUV Information 207-006 - Floor coverings for wet barefoot areas“ (previously BGI/GUV-I 8527, updated version of October 2010), published by the German Statutory Accident Insurance (DGUV). The information in the leaflet „Hygiene, cleaning and disinfection in baths“ published by the German

Association for the Recreational and Medicinal Bath Industry.

Cleaning agents from the list „Approved cleaning agents for ceramic swimming pools“, the so-called „RK list“.

Manufacturers of cleaning agents:

The cleaning industry offers suitable cleaning agents for post-installation, basic and maintenance cleaning – the manufacturers' instructions must be observed.

For example:

Alpin Chemie GmbH · Hindelanger Straße 29 · D-87527 Sonthofen
Tel. +49(0)8321/66890 · www.alpin-chemie.com

BUZIL-Werk Wagner GmbH & Co.KG · Fraunhoferstraße 17 · D-87700 Memmingen
Tel. +49(0)8331/9306 · www.buzil.com

CC-Dr. Schutz GmbH · Holbeinstrasse 17 · D-53175 Bonn
Tel. +49(0)5152-9779/0 · www.dr-schutz.com

Eco-Nova Deutschland GmbH · Textilstraße 14 · D-48465 Schüttorf
Tel. +49(0)5923/99360 · www.eco-nova.de

Firma Ecolab Deutschland GmbH · Ecolab-Allee 1 · D-40789 Mohnheim am Rhein
Tel. +49(0)2173/5590 · www.ecolab.com

Lithofin AG · Heinrich-Otto-Straße 42 · D-73240 Wendlingen
Tel. +49(0)7024/9403-0 · www.lithofin.com

Tana Chemie GmbH · Rheinallee 96 · D-55120 Mainz
Tel. +49(0)6131/96403 · www.tana.de

Fila Deutschland Vertriebs GmbH · Augsburgener Straße 17 · D-89312 Günzburg
Tel. +49(0)8221/2068314 · www.filachim.com

Colour codes in accordance with RAL

In order to help architects and interior designers with colour matching during their planning work, we have allocated standardised codes to the colours of the ranges contained in the Catalogue for Architectural Design.

Codes for the RAL CLASSIC (4-digit) and RAL DESIGN (7-digit) colour lines are employed. The allocations are to be found in the table next to the respective Villeroy & Boch colour codes.

With regard to the virtually plain-coloured tile ranges, the allocated stars indicate the degree to which the tile colour matches the corresponding RAL colour.


With regard to the structured tile ranges, the allocated shade variation indicates the degree to which the tile colour matches the corresponding RAL colour. As a general principle, it is to be noted that the stated RAL colours for these ranges represent an average assessment.


*** stars = The colours are very similar in terms of shade (nuance), colour saturation and brightness, and are in some instances identical.


** stars = Similar in terms of shade (nuance), but differences with regard to colour saturation and brightness.


* star = Similar in terms of colour, but pronounced differences with regard to nuance, colour saturation and brightness.

Shade variation






 1 = The colours are virtually identical. The RAL colour corresponds to the overall impression of the covering.

 2 = The colours are largely similar. The RAL colour largely corresponds to the overall impression of the covering.












 3 = The colours are similar. The RAL colour partially corresponds to the overall impression of the covering.

 4 = The basic colour is similar. The RAL colour corresponds to a mean assessment based on the colour shades contained in the covering.













BERNINA

Colour code	Shade variation	RAL	
RT1L/RT1M	 2	075 70 20	
RT2L/RT2M	 2	280 30 05	
RT4L/RT4M	 2	075 70 10	
RT5L/RT5M	 2	080 70 05	
RT7L/RT7M	 2	075 60 10	























CÁDIZ

Colour code	Shade variation	RAL	
BU00	 2	075 92 05	
BU0L	 3	000 80 00	
BU0M	 3	080 80 05	
BU1L	 3	060 70 05	
BU1M	 3	060 70 05	
BU2L	 3	060 70 10	
BU2M	 3	060 70 10	
BU7L	 4	080 60 05	
BU7M	 4	080 60 05	
BU9L	 3	000 45 00	
BU9M	 3	000 45 00	

CENTURY UNLIMITED

Colour code	Shade variation	RAL	
CF10	 2	080 80 05	
CF15	 2	075 92 05	
CF16	 2	075 92 05	
CF20	 3	060 70 10	
CF30	 3	050 50 30	
CF60	 2	000 80 00	
CF61	 3	000 70 00	
CF62	 3	280 40 05	
CF65	 2	000 90 00	
CF80	 3	080 30 05	
CF90	 3	260 30 10	
CF91	 3	000 25 00	

COLORVISION

Colour code	Shade variation	RAL	
M100	 1	9003	***
M101	 1	100 80 05	***
M102	 1	250 80 15	***
M103	 1	140 80 10	***
M104	 1	085 90 20	***
M105	 1	070 90 20	**
M106	 1	070 90 10	***
B200	 1	9003	***
B201	 1	100 80 05	***
B202	 1	250 80 15	***
B203	 1	140 80 10	***
B204	 1	085 90 20	***
B205	 1	070 90 20	**
B206	 1	070 90 10	***
B301	 1	000 75 00	***
B302	 1	260 60 20	**
B303	 1	150 70 20	**
B304	 1	075 80 30	***
B305	 1	070 80 30	**
B306	 1	050 80 10	***
B401	 1	000 50 00	***
B402	 1	270 50 30	

Colour codes in accordance with RAL

COLORVISION

Colour code	Shade variation	RAL	
B403	1	160 70 20	***
B404	1	075 80 40	**
B405	1	060 70 40	**
B406	1	050 60 10	***
B501	1	000 15 00	***
B502	1	280 30 40	***
B503	1	170 60 40	***
B504	1	090 80 90	***
B505	1	060 60 60	**
B506	1	040 40 67	**
M150	1	9003	***
M151	1	100 80 05	***
M152	1	000 55 00	**

CREATIVE SYSTEM 4.0

Colour code	Shade variation	RAL	
CR00	1	9003	***
CR01	1	220 80 05	*
CR10	1	095 90 10	**
CR11	1	085 90 20	**
CR20	1	070 80 10	*
CR21	1	120 80 10	**
CR30	1	060 80 20	*
CR31	1	040 40 40	***
CR32	1	030 30 30	***
CR33	1	030 40 40	***
CR40	1	260 70 20	***
CR41	1	270 30 35	**
CR42	1	260 30 10	**
CR43	1	280 30 40	**
CR50	1	160 80 10	***
CR51	1	140 40 10	**
CR52	1	160 30 10	**
CR53	1	130 60 40	***
CR60	1	110 90 05	*
CR61	1	100 70 05	*
CR70	1	090 90 05	*
CR71	1	060 70 05	*
CR80	1	060 60 65	***
CR81	1	080 30 05	**
CR82	1	020 20 05	***
CR83	1	010 20 25	**
CR90	1	120 60 05	**
CR91	1	000 45 00	**
CR92	1	000 15 00	**
CR93	1	330 20 15	***

CROSSOVER

Colour code	Shade variation	RAL	
OS1L/OS1M/OS1R	1	080 80 10	
OS6L/OS6M/OS6R	1	100 60 05	
OS9L/OS9M/OS9R	1	000 30 00	

EAST END

Colour code	Shade variation	RAL	
SI0M	1	090 90 05	
SI1M	1	060 80 10	
SI2M	1	060 60 10	

GRANIFLOOR

Colour code	Shade variation	RAL	
911H	1	100 90 05	**
913H	1	000 75 00	***
913M	1	000 65 00	***
913D	1	240 40 05	***
919H	1	075 70 10	**
919D	1	050 40 10	**
920H	1	070 70 20	**
920D	1	070 40 40	**
921H	1	250 60 10	***
921D	1	250 40 15	***

GROUND LINE

Colour code	Shade variation	RAL	
BN10	1	075 80 10	
BN60	1	000 60 00	
BN70	1	070 60 10	
BN90	1	280 30 05	

LODGE

Colour code	Shade variation	RAL	
HW10	3	060 50 20	
HW20	3	070 70 20	
HW60	3	060 60 05	
HW70	3	050 60 10	
HW80	3	050 50 30	
HW90	3	060 40 05	

LODGE WALL

Colour code	Shade variation	RAL	
HW00	1	000 90 00	
HW10	1	90 90 05	
HW60	1	000 85 00	

MINERAL SPRING

Colour code	Shade variation	RAL	
MI00	2	080 80 05	
MI01	2	060 90 05	
MI02	2	090 90 05	
MI20	2	075 80 10	
MI21	2	080 90 05	
MI22	2	075 92 05	
MI60	2	000 55 00	
MI70	3	060 60 05	

MONOCHROME MAGIC

Colour code	Shade variation	RAL	
BL00	1	9003	
BL01	1	9003	
BL90	1	000 15 00	
BL91	1	000 15 00	

Colour codes in accordance with RAL

MOOD LINE

Colour code	Shade variation	RAL	
NG00	☐☐☐1	000 90 00	
NG10	☐☐☐1	075 92 05	
NG70	☐☐☐1	090 90 05	

MY EARTH

Colour code	Shade variation	RAL	
RU10	☐☐☐3	080 80 10	
RU20	☐☐☐3	070 70 20	
RU60	☐☐☐3	060 60 05	
RU90	☐☐☐3	000 40 00	

OUTSTANDING

Colour code	Shade variation	RAL	
TZ10	☐☐☐2	060 70 05	
TZ60	☐☐☐2	000 60 00	
TZ80	☐☐☐2	280 50 05	
TZ90	☐☐☐2	000 40 00	

PLACE

Colour code	Shade variation	RAL	
SL10	☐☐☐1	060 80 10	
SL60	☐☐☐1	060 60 10	
SL90	☐☐☐1	000 25 00	

PRO ARCHITECTURA

Colour code	Shade variation	RAL	
PN00	☐☐☐1	9003	★★
PN01	☐☐☐1	160 60 25	★★★
PN02	☐☐☐1	170 40 20	★★★
PN03	☐☐☐1	260 50 30	★★★
PN04	☐☐☐1	270 30 30	★★★
PN05	☐☐☐1	085 80 85	★★★
PN06	☐☐☐1	060 60 60	★★★
PN07	☐☐☐1	040 50 60	★★
PN08	☐☐☐1	030 30 40	★★★
PN09	☐☐☐1	000 85 00	★★
PN10	☐☐☐1	000 55 00	★★
PN11	☐☐☐1	000 45 00	★★
PN12	☐☐☐1	000 15 00	★★★
PN13	☐☐☐1	260 70 10	★★
PN14	☐☐☐1	260 60 15	★★
PN15	☐☐☐1	260 50 20	★★
PN16	☐☐☐1	230 70 10	★★
PN17	☐☐☐1	230 60 15	★★
PN18	☐☐☐1	230 50 20	★★
PN19	☐☐☐1	190 70 10	★★
PN20	☐☐☐1	190 70 20	★★★
PN21	☐☐☐1	190 60 25	★★★
PN22	☐☐☐1	150 70 20	★★★
PN23	☐☐☐1	150 60 20	★★★
PN24	☐☐☐1	160 50 25	★★
PN25	☐☐☐1	120 70 30	★★★
PN26	☐☐☐1	120 60 30	★★★
PN27	☐☐☐1	120 60 40	★★★
PN28	☐☐☐1	095 80 30	★★★
PN29	☐☐☐1	095 80 40	★★★

PRO ARCHITECTURA

Colour code	Shade variation	RAL	
PN30	☐☐☐1	090 80 60	★★★
PN31	☐☐☐1	080 90 20	★★
PN32	☐☐☐1	070 80 20	★★★
PN33	☐☐☐1	070 70 40	★★★
PN34	☐☐☐1	070 90 20	★★
PN35	☐☐☐1	060 70 30	★★
PN36	☐☐☐1	060 70 40	★★
PN37	☐☐☐1	040 70 20	★★★
PN38	☐☐☐1	030 60 20	★★★
PN39	☐☐☐1	030 50 20	★★★
PN50	☐☐☐1	100 90 05	★★
PN80	☐☐☐1	100 90 05	★★
PN81	☐☐☐1	000 85 00	★★★
PN82	☐☐☐1	000 65 00	★★
PN83	☐☐☐1	000 45 00	★★★
PN84	☐☐☐1	000 25 00	★★★
PN85	☐☐☐1	260 60 15	★★
PN86	☐☐☐1	230 60 10	★★
PN87	☐☐☐1	190 60 20	★★
PN88	☐☐☐1	150 60 20	★★
PN89	☐☐☐1	120 60 30	★★★
PN90	☐☐☐1	090 70 50	★★★
PN91	☐☐☐1	070 70 30	★★★
PN92	☐☐☐1	070 80 30	★★
PN93	☐☐☐1	030 40 20	★★★

PURE LINE

Colour code	Shade variation	RAL	
PL01	☐☐☐2	075 80 10	
PL06	☐☐☐2	000 75 00	
PL10	☐☐☐2	070 70 10	
PL11	☐☐☐2	060 50 10	
PL60	☐☐☐2	000 65 00	
PL61	☐☐☐2	000 50 00	
PL80	☐☐☐2	060 40 05	
PL81	☐☐☐2	040 30 05	
PL90	☐☐☐2	000 45 00	
PL91	☐☐☐2	000 30 00	

SPOTLIGHT

Colour code	Shade variation	RAL	
CM00	☐☐☐2	000 90 00	
CM60	☐☐☐2	270 90 05	
CM0L	☐☐☐2	000 85 00	
CM0M	☐☐☐2	000 85 00	
CM6L	☐☐☐2	000 70 00	
CM6M	☐☐☐2	000 70 00	
CM7L	☐☐☐2	100 80 00	
CM7M	☐☐☐2	000 80 00	
CM9L	☐☐☐2	000 45 00	
CM9M	☐☐☐2	000 35 00	

Colour codes in accordance with RAL

TUXEDO

Colour code	Shade variation	RAL	
TX10	3	000 80 00	
TX20	3	060 80 10	
TX30	3	060 70 20	
TX60	3	000 60 00	
TX70	3	060 40 20	
TX80	3	060 40 05	

UNIT ONE

Colour code	Shade variation	RAL	
UT01	1	000 90 00	***
UT02	1	000 75 00	***
UT03	1	075 92 05	**
UT21	1	9010	**
UT22	1	000 75 00	***
UT23	1	075 92 05	**
UT41	1	075 80 10	**
UT42	1	6500	***

UNIT TWO

Colour code	Shade variation	RAL	
TW01	1	9010	**
TW02	1	9010	**
TW03	1	9001	***
TW04	1	9001	***

UNIT THREE

Colour code	Shade variation	RAL	
GT10 / GK10	1	110 90 05	**
GT20 / GK20	1	070 60 10	**
GT30 / GK30	1	070 50 10	**
GT50 / GK50	1	120 50 05	**

UNIT FOUR

Colour code	Shade variation	RAL	
CT10	2	075 80 10	
CT60	2	040 70 05	
CT61	2	080 50 05	
CT62	2	000 40 00	
CT70	2	070 70 10	
CT80	2	060 40 05	

UNIT FOUR WALL

Colour code	Shade variation	RAL	
CT10	1	070 90 05	
CT60	1	000 85 00	

URBAN LINE

Colour code	Shade variation	RAL	
KA00	1	000 90 00	
KA10	1	090 90 05	
KA70	1	075 92 05	

URBANTONES

Colour code	Shade variation	RAL	
LI00/LI01	1	9003	
LI10/LI11	1	9001	
LI1L/LI1M	2	060 80 05	
LI30/LI31	1	7047	
LI4L/LI4M	2	100 70 05	
LI5L/LI5M	2	120 60 05	
LI60/LI61	1	100 70 05	
LI6L/LI6M	2	000 50 00	
LI8L/LI8M	2	080 30 05	
LI9L/LI9M	2	000 30 00	

WAREHOUSE

Colour code	Shade variation	RAL	
IN10	2	000 85 00	
IN60	2	000 75 00	
IN90	2	000 55 00	

WHITE & CREAM

Colour code	Shade variation	RAL	
SW00/SW01/SW02	1	9003	***
SW10/SW11/SW12	1	090 90 05	***

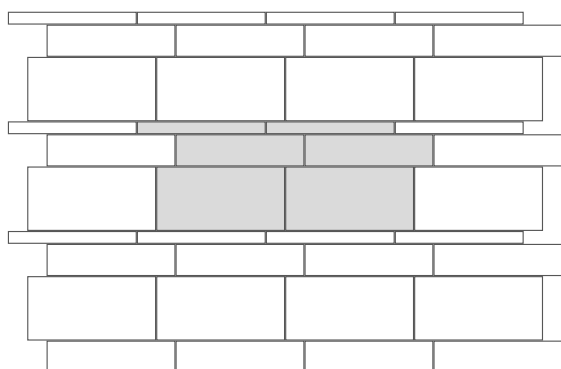
XENTRIC

Colour code	Shade variation	RAL	
XI20	2	080 80 05	
XI60	2	080 60 05	
XI80	2	060 40 05	
XI90	2	000 35 00	

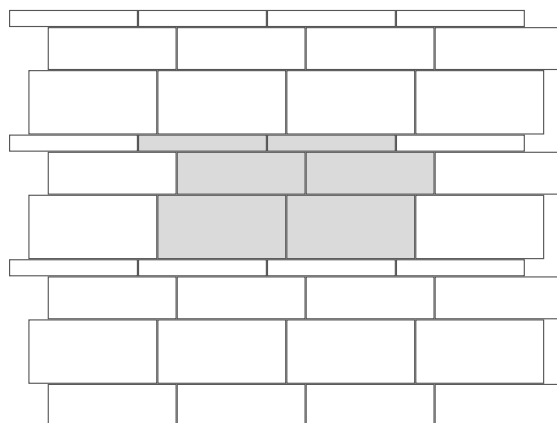
X-PLANE

Colour code	Shade variation	RAL	
ZM00	1	000 85 00	
ZM10	1	070 80 10	
ZM20	1	075 80 10	
ZM60	1	000 55 00	
ZM70	1	060 60 05	
ZM90	1	000 40 00	
ZM91	1	000 35 00	

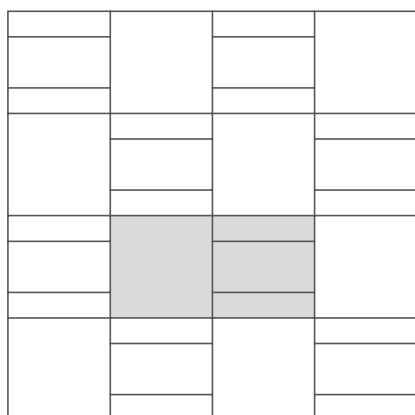
Calculation aids



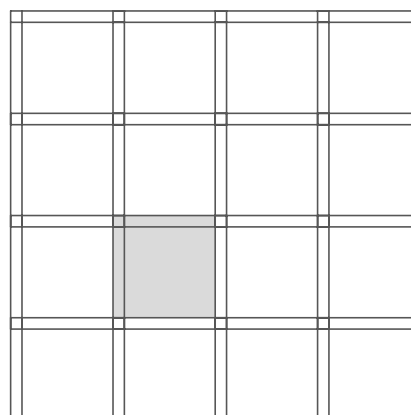
Size(cm)	Percent (%)
30 x 60	57,14
15 x 60	28,57
7,5 x 60	14,29



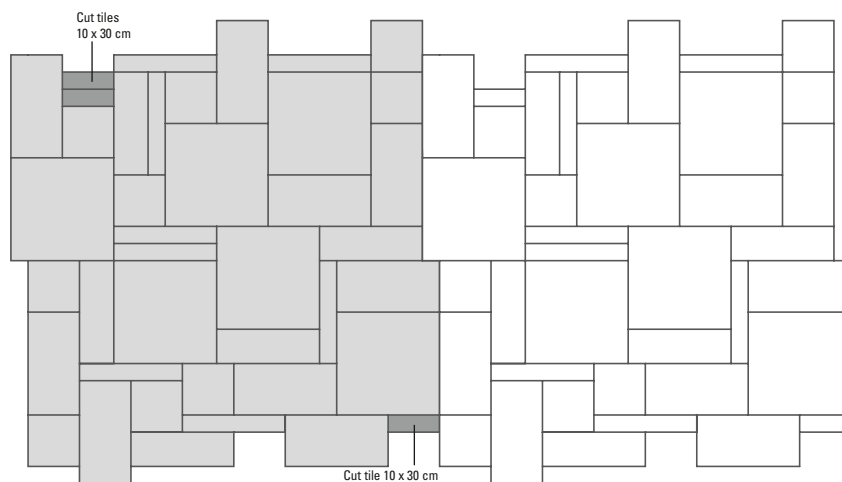
Size(cm)	Percent (%)
30 x 60	50,00
20 x 60	37,50
10 x 60	12,50



Size(cm)	Percent (%)
60 x 60	44,44
30 x 60	44,44
30 x 30	11,12

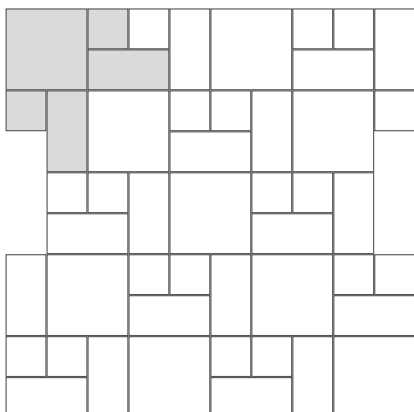


Size(cm)	Percent (%)
60 x 60	79,01
7,5 x 60	19,75
7,5 x 7,5	1,24

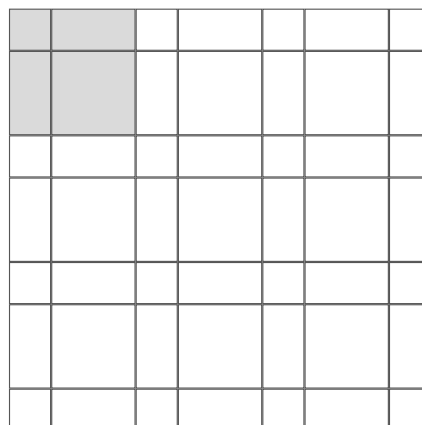


Size(cm)	Percent (%)
30 x 30	19,00
30 x 60	29,00
60 x 60	37,50
20 x 60	10,50
10 x 60	8,40

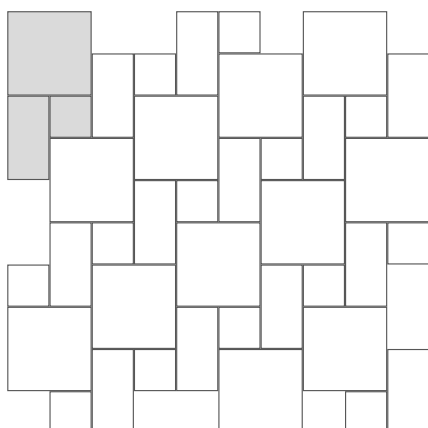
Calculation aids



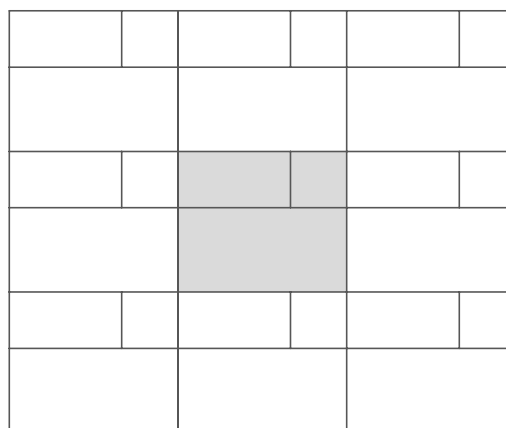
Size (cm)	Percent (%)
60 x 60	40,00
30 x 60	40,00
30 x 30	20,00



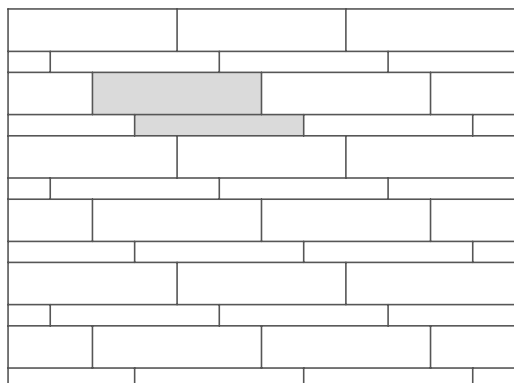
Size (cm)	Percent (%)
60 x 60	44,44
30 x 60	44,44
30 x 30	11,12



Size (cm)	Percent (%)
60 x 60	57,14
30 x 60	28,57
30 x 30	14,29



Size (cm)	Percent (%)
45 x 90	60,00
30 x 60	26,66
15 x 60	13,33



Size (cm)	Percent (%)
22,5 x 90	66,66
11,25 x 90	33,33

(1 inch = 2.54 cm

A to Z of tiles

Abrasion

Floor coverings are subject to surface wear through friction and rubbing, which can cause the surface appearance of glazed tiles to change.

See → “Technical information: Wear resistance”

Application areas for tiles

are walls and floors in residential and non-residential buildings.

Product	Product standard	Areas of application
Nonvitreous tiles	EN 14411 Group BIII	Walls in residential and non-residential buildings
Glazed tiles	EN 14411 Group Blb; BIIa; BIIb	Inside walls in residential and non-residential buildings according to the required abrasion classification (indoor and outdoor coverings) container tiling (drinking water tanks, swimming pools)
Porcelain stoneware	EN 14411 Group BIa	Preferably wall and floor coverings in residential and non-residential buildings

In compliance with EN 14411, these application areas and technical properties can be indicated by symbols which are, for example, to be found on the packaging. Symbols frequently used are:



Tile suitable for use on walls.



Tile suitable for use on floors.



Wear-resistance group in compliance with EN ISO 10545-7, see → Wear resistance



Frost resistance in compliance with EN 10545-12

ARTEFACTUR

A studio of Villeroy & Boch Tiles which is specialised in manual craftsmanship and individual tile design.

Accessible planning and construction

means planning and building residential and non-residential buildings, as well as public places, so that they can be used by all people without assistance and without restriction. This is based on various standards and statutory regulations (DIN 18040-1 Construction of accessible buildings – “Publicly accessible buildings”. DIN 18040-2 Construction of accessible buildings – “Dwellings”).

Slip-resistant properties are required in public areas. Ceramic tiles are particularly suitable for these applications. Such coverings are also increasingly required for floors in shower trays in private bathrooms.


Biscuit

Tile body. The glaze is applied to the biscuit for glazed tiles.

Buttering

Procedure using the thin-bed method described in DIN 18157 Part 1 Number 7.3.2 with glue applied to the back of the tiles. This procedure is to be preferred when laying tiles of different thicknesses, e.g. small format tiles inserted in larger areas made up of other formats/thicknesses.

Calibrated / Rectified tiles

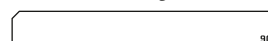
After manufacture, the edges of calibrated tiles, marked with the symbol , are additionally ground so that the sides are at an angle of 90° to the surface. Calibrated tiles are particularly true to dimension. As such, they allow tiling arrangements with narrow joints. The upper edge of calibrated tiles has a naturally ground contour. If this upper edge is angled, it is referred to as a bevelled edge.

This bevelled edge may vary within a standard fluctuation range relating to the production process or as a result of the structure on tiles with a surface structure. Bevelled edges can make joints look wider.

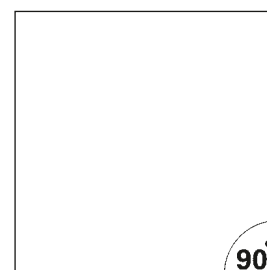
Calibrated tile



Calibrated tile with bevelled edges



View from side



View from above

Calibre

See → Tile sizes

Care

See → Technical information: “Cleaning and care”

Chemical resistance in compliance with ISO 10545-13

Nonvitreous and glazed vitreous tiles are resistant to household chemicals and swimming pool water additives (except for cleaning agents containing hydrofluoric acid and its compounds) (minimum requirements class GB - DIN EN ISO 10545-13), Resistance to acids and alkalis depends on their composition and concentration and must be tested with respect to the specific tile.

Unglazed porcelain stoneware tiles are resistant to chemicals except for hydrofluoric acids and its compounds (testing in accordance with EN 10545-13). Minor colour variations do not indicate chemical attack.

See → "Technical information: Chemical resistance"

CE marking

The CE mark indicates that the product complies with the requirements of the corresponding EU directive – in particular with regard to health protection and the safety of users and consumers – and may thus be freely circulated within the European Community.

Cement/sand bedding

Also referred to as conventional tiling. Used less and less frequently, a method of attaching tiles to walls and floors with mortar made of cement and sand, which is mixed on site.

Tiling Standards: VOB Part C: ATV-DIN 18352
"Tiles and slab work"

Ceramic digital printing

Ink-jet printers specialised in the field of tiles work with special ceramic inks. The reproducible colour space is attained in the 4-colour system through combined printing of the colours cyan, brown, yellow and black. An additional, fifth print head works with the contrasting colour white. The high printing rates of over 40 m/min mean that integrating a digital printer into a tile glazing line poses no problems. The method offers a number of advantages over conventional application processes: The non-contact nature of the printing process enables the decoration of surfaces with pronounced reliefs.

Direct printing without an additional printing form provides for maximum design variability while also facilitating direct product changes. The very high resolution ensures that even the finest and most intricate designs are rendered with a faithful attention to detail.

ceramicplus

ceramicplus is a surface finish for nonvitreous tiles from Villeroy & Boch. A special manufacturing process modifies the surface energy of the ceramic material surface energy by means of a chemico-physical process. As a result of this, water which comes into contact with the ceramic surface displays a stronger tendency to form droplets than on conventional surfaces, thus minimising the area of contact with the tile. **ceramicplus** tiles thus offer enhanced easy-care properties.

See → "Technical information: **ceramicplus**".

Cleaning – of ceramic tiles

One differentiates between the basic, initial cleaning and maintenance or everyday cleaning.

See → "Technical information: cleaning and care".

Coefficient of thermal expansion in compliance with EN ISO 10545-8

The coefficient of thermal linear expansion of tiles in accordance with DIN EN 14411 (at temperatures up to 100 °C: 0.007 mm/mK).

Coefficient of thermal conductivity

Specific properties of a material in respect to its ability to conduct heat. The calculation value for the coefficient of thermal conductivity of tiles in accordance with DIN 4108 ("Heat protection") - Part 4 is 1 W/(m x K).

Cold-curing resin adhesives

Normally two-component adhesives (resin and hardener) that cure through chemical reaction. For laying or jointing of ceramic coverings. (in compliance with EN 12004 Mortars and adhesives for tiles and slabs - Cold-curing resin adhesives [R]). We differentiate between: Cold-curing epoxy resin or polyurethane adhesive. Epoxy resin adhesives can be used on all bases. They are particularly suitable for chemically or mechanically high-stressed coverings or for tiling on steel. Polyurethane adhesives are not standardised. They are notable for their high elasticity and are particularly suitable for laying on bases likely to undergo considerable changes in form.

Colour coding

The colours of the ranges from the architecture programme are coded in accordance with RAL Classic (four-digit) and RAL Design (seven-digit).

See → "Technical information: colour codes".

Colourfastness

Ceramic tiles are unaffected by light and are colourfast. Thus, without a mechanical or chemical load, the surface of a tile only changes under extremely high temperatures.

Colour nuances and coloration

Ceramic tiles are made from natural raw materials and therefore vary in terms of surface finish to a certain extent within standard tolerances. Minor differences in colour, décor, structure, gloss or surface roughness may occur. However, many tile ranges require an even visual effect and differences in nuance would adversely affect the overall appearance. The tiles are therefore sorted by “nuance” (only Grade 1), and labeled and boxed separately.

The nuance is identified by a code of two figures followed by a letter, e.g. 45 X. Tiles with different nuances should not be used together. To compensate for any remaining differences of shading within one nuance, the contents of the boxes should be checked before tiling and the tiles mixed as necessary, i.e. tiles from several boxes laid alternately.

In some tile ranges, floor tiles in particular, the colour-play is an integral part of the character of the range and intentional. That is to say, based on an average colour shade and brightness (nuance code), tiles of differing colour shades, structures and brightness are intentionally chosen for combination. In such cases, differences in colour shading are intentional and not reason for complaint. For a varied, yet balanced overall effect, we recommend checking boxes from these tile ranges, too, and mixing the tiles when laying.

Where basic tiles and decor tiles from the same range are used together it is essential that the nuance codes match. The first two figures should always be identical. Not always a letter is indicated for decor tiles. In the case, there is a letter than it has to be identical to that of the basic tiles.

Combined tiling method



Thin-bed method described in DIN 18157 Part 1 Number 7.3.3 combining buttering and floating with adhesive application to both the base and the back of the tile.

This method is used to virtually prevent the formation of cavities when laying tiles. This is necessary, for example, with coverings that are subjected to high mechanical loads and for coverings laid outdoors or in swimming pools.

Combustibility

Ceramic tiles are non-combustible (Inflammability class A1 - DIN 4102).

Craquelé formation / Crazing

Craquelé refers to the fine hairline cracks to be found in the glaze of nonvitreous tiles and glass plating. On many articles the hairline cracks are a desired and intentional effect and not a cause for complaint. Articles which may develop hairline cracks in the glaze are indicated by  .

Crazing

Fine shallow cracks on nonvitreous tiles. They can be caused by the properties of the ceramic materials (crazing susceptibility) or, much more commonly, by changes in the form of the ground below. Crazing resistance is required for tiles (testing in accordance with DIN-EN ISO 10545-11). Glazes susceptible to crazing must be indicated as such by the manufacturer.

See also → Craquelé formation / Crazing

Discharge resistance

The discharge resistance, also known as the resistance to earth, is the electrical resistance of an object to earth potential. Ceramic tiles and slabs generally have a discharge resistance of $> 10^{10}$ Ohms and are thus anti-static and insulating. They are regarded as electrically conductive if their discharge resistance does not exceed 10^8 Ohms. A floor covering discharge resistance of $\leq 10^6$ Ohms can place particular requirements on the safety of use.

Dispersion adhesives

Adhesives with a high synthetic component for tile laying using the thin-bed method (in compliance with EN 12004 Mortars and adhesives for tiles and slabs - Dispersion adhesives [D]). Usually ready for use. Dispersion adhesives are only water-resistant to a limited extent, if at all, and are suitable solely for indoor coverings with low exposure to moisture. Manufacturers' instructions should be observed.

Displacement area

The displacement area is the area between the walking and the drainage level with raised surfaces (application, for example, in large kitchens).

See → “Technical information: Slip resistance”

Disposal

Disposal or waste disposal is the generic term for all methods and activities that serve the removal or recycling of waste. At the end of their useful life, ceramic tiles may be disposed of as building waste.

EMAS

V&B Fliesen GmbH was the first German tile manufacturer to participate in the EMAS (Eco-Management and Audit Scheme), currently the strictest test system for environmental criteria, at Merzig, Mettlach and La Ferté-Gaucher. It calls for a continuous, performance-oriented and regularly measurable optimisation process in which employees must also be involved.

Flexural tensile strength in compliance with EN ISO 10545-4

Building elements (e.g. tiles) are subject to flexural tensile stress - compressive stress on the face and tensile stress on the lower side, whereby the latter is generally the more significant. Flexural tensile strength (unit: N/mm²) is laid down as a minimum value in the relevant material standards (table 1).

Floor coverings are subject to flexural stress as a result of being walked or driven on and through the way the tiles are laid in the mortar bed in the case of soft substrates or floating floors. While stress through walking is negligible, the stress caused to coverings by being driven on, particularly by industrial trucks, should be allowed for by selecting tiles of appropriate thickness and/or minimum pressure load.

See also → "Technical information: High-stress ceramic floor coverings"

Product	Material standard	Flexural tensile strength in N/mm ²
Nonvitreous tiles	EN 14411 Group BIII	Thickness ≥ 7.5 mm min. 12 < 7.5 mm min. 15
Porcelain stoneware tiles	EN 14411 Group BIa	minimum 35
Glazed vitreous tiles	EN 14411 Group BIb	minimum 30

Table 1: Minimum values of flexural tensile strength

Floating

Type of thin-bed method described in DIN 18157 Part 1 Number 7.3.1 with adhesive applied to the laying surface.

Floating bed mortars

Special thin-bed mortars for laying floor tiles. They enable the tiles to be fixed cavity-free thin bed according to the floating method.

Floor coverings subjected to high mechanical loads

These are floor coverings subjected to stress through industrial trucks, e.g. hand-driven forklift trucks, and other vehicles.

Tiles used for such floor coverings must comply with the data sheet „Floor coverings subjected to high mechanical loads“ issued by the Zentralverband des Deutschen Baugewerbes (ZDB – Central association of the German building industry).

See also → "Technical information: High-stress ceramic floor coverings"

Frost resistance in compliance with EN ISO 10545-12



Most important criterion for using tiles outdoors. Required, according to EN 14411 Group BIa for porcelain stoneware and EN 14411 Group BIb for vitreous tiles. Tiles must be laid correctly to prevent frost damage.

Glaze

Coating applied of sintered, coloured and possibly decorated ceramic layer to a nonvitreous or vitreous tile.

Glazed edge

Tiling a wall with basic tiles with glazed edges has various advantages in terms of hygiene and aesthetic edges and corners. Villeroy & Boch produces basic tiles with one glazed edge for the entire nonvitreous range (except for a few of the large formats and rectified tiles).

The relevant articles are indicated by the symbol . In addition, certain tile ranges can be produced with two glazed edges. In the case of rectangular formats, one long and one short edge is glazed. These articles are indicated by the symbol .

Each box of tiles contains approx. 20% of such tiles.

Small format, glazed vitreous tiles in the formats 5 x 5 cm and 10 x 10 cm, which are often used for tiling walls, are also produced with a glazed edge. Every 5th box on a pallet contains sheets with glazed short edges. These boxes are marked accordingly.

Health and ceramic tiles

Tiles do not emit any emissions or odours and are easy-care. Thanks to these advantages, tile coverings are very hygienic and do not create an environment in which pathogens can flourish.

With regular care, they do not allow the development of any factors that could be harmful to health.

Villeroy & Boch does not use any toxic materials that could pose a danger to health in the manufacture of its tiles.

Heat storage capacity

The heat storage capacity of vitreous tiles is approx. 0.8 kJ / Kg x K

Impact sound

To reduce impact sound transmission, ceramic coverings are isolated from the substrate. As a rule, the impact sound insulation is fitted below the floor; however, it can also be isolated by fitting it below the tile covering.

Impregnation

Subsequent treatment of polished (lustro, rough polished) porcelain stoneware tiles to improve stain resistance.

See also → "Technical information: cleaning and care / vilbostone – porcelain stoneware."

Joints

Used to compensate material-related tolerances as well as substrate and applicator tolerances. More-over, the joint prevents the ingress of dirt. The width of the joints is normally the difference between the nominal and manufacturing dimensions. Information on joint widths is to be found in DIN 18 157, Part 1 - 3.

- Edge length up to 150 mm Joint width of 1.5 - 5 mm.
- Edge length greater than 150 mm
Joint width of 2 - 8 mm.

Villeroy & Boch recommends a minimum joint width of approx. 3mm.

see also → Laying / Tile sizes / Modular tiling

Lapped surface

See → Polished / lapped surface

Laser suitability

Statutory requirements stipulate that, in all rooms where lasers are used (e.g. in operating theatres), accident prevention regulation VBG 93 "Laser Irradiation" of the "Hauptverband der gewerblichen Berufsgenossenschaften" (Confederation of Industrial Employers' Liability Insurance Associations) must be observed. According to the "Hauptverband der Berufsgenossenschaften", these requirements are met by tiles with matt glazes (irrespective of the type of laser used). This includes all matt glazed tiles from the Villeroy & Boch range.

Laying

Method for the production of ceramic wall and floor coverings.

There is a difference between thin-bed and conventional laying. (See: "Thin-bed method" and "Thick-bed method"). In the thin-bed mortar method, there is a difference between "buttering", "floating" or the "combined method" (See appropriate entry). Tiling in compliance with the "medium-bed method" (See entry) is a version of the thin-bed mortar method using a thicker layer of mortar (from approx. 5 mm).

Lightness value

The lightness value of tiles can be determined from single-coloured surfaces. The lightness value is the reflectance of a certain colour hue between black Y = 0 and white Y = 100.

The lightness value indicates to what extent the relevant hue differs from black or white in terms of brightness.

Luminance contrast

The luminance contrast is the difference between the brightness of an object and its background or surrounding. If the object is brighter than the background or surrounding, the contrast value is positive. Negative contrast values indicate that the background or surrounding is brighter than the object.

The luminance contrast is important in tile coverings that are used as guidance systems for the visually impaired (see → "tactile tiles"). According to DIN 32984, the luminance contrast of the guidance system tiles against the remaining floor covering must be at least 0.4. See also table with possible combinations for the tactile tiles on page 374.

See also → "Technical information: Design of stair treads"

Medium amber ("LA")

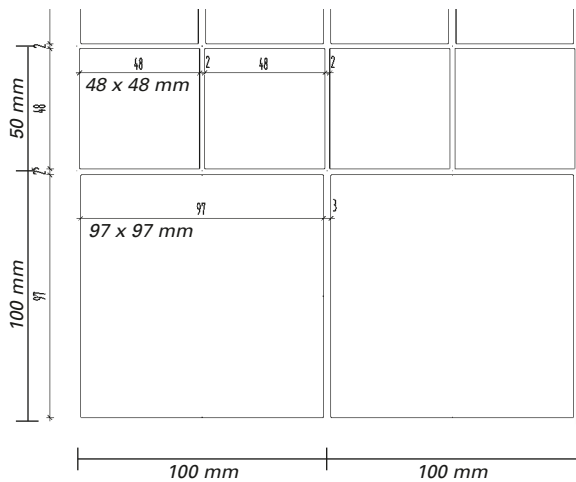
Method of laying large tiles (nominal dimensions > 40 x 40 cm) on floors or uneven laying surfaces that have to be evened. The adhesive (usually special hydraulic medium-bed cement) is applied with a coarse serrated trowel in a thickness of 5 - 15 mm.

A to Z of tiles

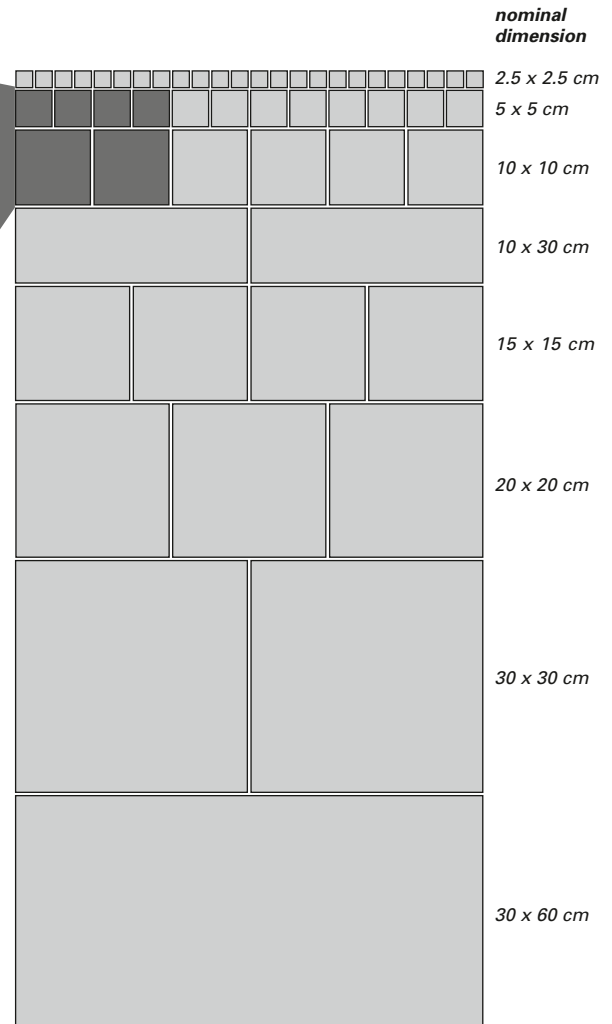
Modular tiling

Villeroy & Boch tile ranges are normally modular, i.e. tiles of different formats can be laid together in a modular format, if the nominal dimension is taken into account. Tiles of the same calibre can be laid with a uniform joint width. Wall and floor tiles of different calibres

can be laid in line with different joint widths if the nominal dimension is taken into account. Tiles of different thicknesses can normally be combined. We recommend that differences in tile thickness of more than 1 mm be compensated.



Combination of tiles, nominal dimension 5 x 5 cm, calibre 8, with tiles, nominal dimension 10 x 10 cm, calibre 7



Moisture expansion in compliance with EN ISO 10545-10

Moisture expansion in compliance of vitreous tiles is negligible and very low for nonvitreous tiles with high water absorption. The latter should not be used for applications under water (swimming pool or container tiling) or in humid industrial rooms with strongly varying water loads however, due to the danger of crazing of the glaze.

Monocalibre

Calibrated / Rectified tiles are only available in a single calibre – monocalibre.

see also → Calibrated / Rectified tiles

Mosaics

Mosaics are small-format tiles less than $\leq 10 \times 10$ cm.

Nominal size

Dimension to describe the product; as a rule, the nominal size is calculated from the work size and the joint width.

Nonvitreous

Traditional term for fine ceramic tiles with high water absorption $E > 10\%$ - DIN EN 14411 group BIII.

Plating and inserts

See → Precious metal, glass, natural stone and HPL

Polished / lapped surface

The surface of an unglazed vitreous or porcelain stoneware tile that, after firing, is rough-polished via a mechanical polishing procedure, which produces a polished appearance.

Porcelain stoneware

For porcelain stoneware tiles, there is a differentiation between glazed and unglazed. The advantage of unglazed porcelain stoneware is the full-body colouring. The surface of unglazed porcelain stoneware is not subject to wear and it is thus suitable for highly frequented areas.

According to EN 14411 Group Bla, water absorption $E \leq 0.5\%$.

Precious metal, glass, natural stone and HPL as plating and inserts

Precious metal, glass, natural stone and highpressure laminate with an imitation wood surface finish are not scratchproof and have special characteristics that differ from those of ceramics. Use only fine-grain mortar with low quartz content for jointing, and water with a neutral cleaning agent for cleaning. Borders, mosaics and inserts made of glass or high-pressure laminate with an imitation wood surface should only be used on walls and not on the floor. As far as precious metals and natural stone are concerned, changes in the appearance of the surface as a result of subsequent use are possible and in some cases desired.

The desired effect on the surface of floor tiles with metal inserts in particular (matt gloss) is only achieved through use. Please refer to information on product groups and materials. Precious metal plating is indicated by the symbol ▲. Glass-plating by the symbol ■.

Processing

Tiles are generally dry-cut but, depending on the material (with some surfaces), they are also wet-cut. With particularly complex inlay work, water-jet cutting may be necessary

Radioactivity

The radiation emitted by tiles corresponds to the natural radiation exposure of raw materials – clays, kaolin, quartz, feldspar and chalk – and is of a comparable level to other building materials, such as concrete, mortar, bricks, etc.

Reflectance

The reflectance describes the relationship between incident and reflected light. Glazed, matt and coloured tiles have different degrees of reflectance and this must be taken into account when deciding the layout of room lighting.

Resistance

See → Chemical resistance

Rough-polished surface

The surface of an unglazed vitreous or porcelain stoneware tile that, after firing, is rough-polished via a mechanical polishing process. In the case of tiles with a structured surface or surface relief, the higher zones have a glossy and the lower zones a matt appearance.


Sealants

In addition to the use of sealing strips in compliance with DIN 18195, composite seals have proven effective when working with tiles and slabs. The information leaflet "Composite seals - Instructions on producing liquid-processed composite seals with linings and coverings consisting of tiles and slabs for indoor and outdoor applications" (8/2012) issued by the Fachverband Deutsches Fliesengewerbe (German Tiling Association) is an important basis for correct planning and execution. Waterproofing standard DIN 18195 is currently being revised and will cover bonded waterproofing for indoor areas.


Shade variation

vilbostone porcelain stoneware tiles are natural-like products in a wide range of colours and structures. Thanks to innovative manufacturing processes they are available today in a variety known otherwise only with genuinely natural products such as stone, earth and wood. This variety is a particular design hallmark of the individual tiles and ranges. As with natural products the colour and structure can vary considerably. This natural variation in design is appreciated as such and should be taken into account when selecting a tile range.


We have four groups with different variation intensity, which influences the overall effect of the layout.

 1 – low


Almost identical appearance of the tiles with minor to barely perceptible deviations in colour and structure for a uniform effect.

 2 – medium

Minor variations in colour and structure for a restful, natural effect.

 3 – high

Greater variations in colour and structure for a lively natural effect.

 4 – strong

Strong variations in colour and structure for a colourful and/or structurally intense and varied effect.

A to Z of tiles

Sheet-mounting

Small-format tiles up to a format of 10 x 10 cm are mounted on sheets in the relevant tile grid. There are two variations of this:

- Sheet-mounted with lattice paper on the back (adhesion 5) for essentially dry areas (Standard)
- Sheet-mounted with lattice paper on the front (adhesion 4) for wet areas

As a rule, the provision of loose tiles or sheet-mounting from the front has to be agreed in advance.

Sheet-mounted tiles should always be stored in a dry place. For coverings that are exposed to wetness, frost or the like, we recommend using only sheet-mounted tiles with lattice paper on the front.

Shower board

Base element made of, amongst other things, extruded polystyrene rigid foam, with integrated slope and floor inlet, to produce flush-mounted shower trays.

See also → "Accessible planning and construction"

Shower tray construction systems

Complete system for the manufacture of flush-fitted shower trays with matching base elements and corresponding mouldings.

See also → "Accessible planning and construction, SINUS system"

Slabs

Ceramic tiles and slabs are classified by groups and product standards in DIN EN 14411.

The classification is based on the forming process (extrusion or dry pressing) and water absorption E

Design	B Dry pressed ceramic tiles and slabs				
Group	Bla	B1b	B1a	B1b	B111
Water absorption	E ≤ 0,5%	0,5% < E ≤ 3%	3% < E ≤ 6%	6% < E ≤ 10%	E > 10%
Annex (standard)	G	H	J	K	L

Classification of ceramic tiles and slabs in compliance with DIN EN 14411

Villeroy & Boch Tiles manufactures products in group Bla (porcelain stoneware tiles), B1b (vitreous tiles) and B111 (nonvitreous tiles).

Slip resistance

Special tiles with profiled or rough surface used to prevent accidents through slipping. Accident insurers (professional association or BAGUV) demand slip-resistant coverings for floors in work rooms and areas with high risk of slipping (e.g. in swimming pools). The tiles used in these areas must have the required slip resistant properties (as demonstrated by manufacturer). They are tested in accordance with the accident insurers guidelines together with DIN 51087 and DIN 51130.

Slip-resistant tiles are increasingly used in shower areas, particular in conjunction with accessible buildings.

See → Chapter "Slip resistance"

Sound insulation

DIN 4109 regulates measures for protection against airborne and footfall sound transmission from other's living and working areas, external noise and noise from technical installations in adjacent buildings. The latest sound insulation regulations set down in

- DIN 4109 Supplement 2

- VDI Guideline 4100

must be observed.

Stain resistance in compliance with DIN EN ISO 10545-14

To determine stain resistance, the surface of the tile is tested with specific test solutions over a suitable period of time. Unglazed porcelain stoneware from Villeroy & Boch is sealed with the **vilbostoneplus** ceramic seal finish. However, this surface protection is not applied to polished porcelain stoneware tiles. To improve stain resistance on these surfaces, impregnation with a suitable impregnating agent is recommended.

A to Z of tiles

Surface finish

The surface finish of a tile specifies the appearance and structure of the tile and/or the natural material that it imitates, e.g. plain, graniti, marble, slate. Together with the surface properties (e.g. plane, relieved) and the gloss level (e.g. matt, silk matt, rough-polished, gloss), the finish describes the visual impression of the tile irrespective of the colour.

Tactile tiles

Within the context of "accessible construction" in compliance with DIN 18040, floor coverings are subject to "sensory / tactile requirements" for the first time. These ground surface indicators are described in detail in DIN 32984. The aim is to establish a uniform orientation system so that the blind and the severely visually impaired are given the same safety information throughout Germany. Other European countries are working with similar principles, however, these can differ from country to country.

The DIN standard applies to new buildings and modernisations of publically accessible buildings and their outdoor areas, in particular, cultural and educational institutions, swimming pools, sports and leisure facilities, healthcare facilities, office and administrative facilities and court houses, shops and restaurants, toilet facilities, etc.

As ground surface indicators, Villeroy & Boch offers relevant tiles with various surface structures (grooves and studs) in the GRANIFLOOR series, which fulfil the relevant requirements.

See → chapter "Accessible planning and construction"

Thermal shock resistance in compliance with EN ISO 10545-9

Resistance to thermal shock as required by the relevant product standards such as DIN EN 14411 (testing in accordance with DIN-EN 10545-9).

Thin-bed method

Method of attaching tiles to walls and floors with a thin bed of mortar.

Tiling Standards:

DIN 18157: "Materials for ceramic coverings using the thin-bed method"

Part 1: Hydraulically hardening adhesives

Part 2: Dispersion adhesives

Part 3: Epoxy-based adhesives

The mortar bed thickness depends on the tile format.

Thin-bed mortar (hydraulic)

Cement-based, hydraulically hardening tile adhesives (in compliance with EN 12004 Mortars and adhesives for tiles and slabs - cementitious adhesives [C]) for attaching tiles using the thin-bed mortar method. Mostly used for non-combustible surfaces such as concrete, cement/sand screeds and renders for inside and outside.

Tile sizes

The tile format is given as a nominal dimension, which is made up of the work size (actual size) plus the recommended joint width. In the industrial manufacture of tiles, variations in the size (calibre) of the tiles are inevitable. The sizes are sorted, labelled and boxed separately. The calibre code is stated on every package next to the shade code and specifies the actual size of the tile.

Example: For a tile in format 30 x 30 cm with work size 296 x 296 mm, the following general calibre data will be stated on every package:

Calibre	Code
295 x 295 mm	5
296 x 296 mm	6
297 x 297 mm	7

Examples for actual tile size:

Nominal dimension:
30 x 30 cm
Work size: 296 x 296 mm
Calibre 7
Actual size:
297 x 297 mm
Joint width: 3 mm

Printing on the box



Nominal dimension:
30 x 30 cm
Work size: 296 x 296 mm
Calibre 6
Actual size:
296 x 296 mm
Joint width: 4 mm

Printing on the box



See also → Modular tiling / Calibrated / Rectified tiles

A to Z of tiles

Tolerances

Tiles are made of natural raw materials and are subject to material and production related tolerances. Permissible tolerances are laid down as minimum requirements in the product standard EN 14411.

See → “Technical information”

Underfloor heating

Underfloor heating is part of the surface heating group. Due to their very good thermal conductivity and heat storage capacity, ceramic tiles are the ideal covering in conjunction with underfloor heating.

UPEC

The UPEC classification for floor tiles applies in France. It can also be referred to in other countries, however.

See also → “Technical information: UPEC classification”

Vapour diffusion resistance

According to DIN EN ISO 12572, for vitreous (B1b) and porcelain stoneware tiles (B1a), the vapour diffusion resistance is approx. μ 120,000 and, for nonvitreous tiles, approx. μ 100,000 (without joints).

Joints do not permit diffusion.

Vitreous

Traditional term for fine ceramic tiles with low water absorption (DIN EN 14411 group B I b ; B II a ; B II b). Villeroy & Boch only supplies glazed vitreous tiles in compliance with EN 14411, Group B1b, water absorption $0.5\% < E < 3\%$.

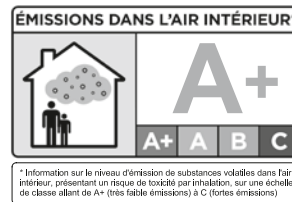
See also → “Porcelain stoneware tiles”.

VOC

Volatile organic compounds are substances that can form under certain conditions, such as great heat or excessively high pressure. The boiling range is between 50 – 100 °C and 240 – 260 °C; benzene is an example of a VOC.

VOCs are emitted from building products and furnishings at room temperature in lower concentrations as VVOCs (very volatile organic compounds) and in higher concentrations as SSOVs (semi-volatile organic compounds).

As ceramic tiles have to be manufactured at temperatures in excess of 1100 degrees, the product no longer contains VOC substances. Since 1 September 2012 in France, all building products – and consequently also ceramic tiles – have to be labelled with an emissions classification on the basis of VOC emissions tests. As emission-neutral products, they are classified as A+.



Water absorption (WA) in compliance with EN ISO 10545-3

The weight gain in % of the tile and slab sample saturated in water compared to the dry weigh.

See → “Technical properties”.

Wearing properties / deep-abrasion resistance in compliance with EN ISO 10545-6

Abrasion of the biscuit on unglazed porcelain stoneware tiles as a result of wear.

Resistance to deep abrasion: Maximum volume loss of 175 mm³.

See → “Wear-resistance” / → “Wear-resistance groups”

Wear-resistance groups

The wear-resistance class defines the wearing properties of tiles in glazed vitreous and provides a basis on which to choose floor tiles.

see → “Technical information: Wear-resistance”

Work size

The dimension of a tile determined during manufacture that has to agree with the actual production size within the specified permissible tolerances.

See → “Tile size”