

# **TECHNICAL CATALOGUE**

## **2011**

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# 1. Basic Product Categories

## 1.1 LASSELSBERGER Ceramic Tiles for 2011

The offer of **LASSELSBERGER, s.r.o.** ceramic wall and floor tiles for 2011 is divided into two groups. The **RAKO** household line of ceramic products is intended for the end customer, and the **LB OBJECT** system solution for buildings is intended for designers and architects.

**RAKO household ceramics** represents integrated sets of wall and floor tiles, including a wide assortment of decorative accessories for bathrooms, kitchens and floors for the home interior and exterior. The household ceramics catalogue meets, in particular, the needs of customers with high requirements for both design and utility value.

This technical catalogue includes comprehensive information about price groups of ceramic wall and floor tiles, logistics information, and shows all products for bathrooms, kitchens, and floors.

For system solution of buildings, **LASSELSBERGER, s.r.o.** offers ceramic wall and floor tiles under the **LB OBJECT** brand. The offer of ceramic products for buildings is presented in the **LB OBJECT 2011** catalogue, which includes mutually complementary systems of wall and floor tiles designed particularly for design and capital investment projects in the domain of services, administration, industry, etc. Furthermore, the **POOL** catalogue presents all products applicable for pool solutions.

## 1.2 Building chemistry for laying of ceramic tiles

### – LASSELSBERGER CERAMIC SYSTEM (LBCS)

The complete offer of building chemistry products, which presents the optimum solution for laying of ceramic floor and wall tiles, from housing interiors to demanding applications for tiling of swimming pools, enclosed balconies, terraces or industrial floors.

The catalogue of products of building chemistry includes materials for preparation of the base (leveling compounds, penetration coatings), water-proofing stoppers, gluing and jointing materials (cement, epoxy), as well as fixtures for maintenance of tiled surfaces. We recommend consulting specific technologies with specialized LBCS dealers. For contacts and further information please visit [www.lbcs.cz](http://www.lbcs.cz).

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## 2. Identification System for Ceramic Products of LASSELSBERGER, s.r.o.

### 2.1 TYPES OF CERAMIC PRODUCTS OF LASSELSBERGER, s.r.o.

The offer includes four types of ceramic products:

**Fully vitrified unglazed tiles TAURUS, catalogue number: Txxxxxxx**

are sintered, unglazed ceramic frost-resistant tiles with very low water absorption below 0.5 %, manufactured to comply with EN 14411, Bla UGL, Annex G. The products are intended mainly for floor tiling in exteriors and interiors that are exposed to weather and high to extreme mechanical stress, abrasion and pollution. For this reason, they are particularly suitable for floors in restaurants, administrative buildings, automobile showrooms, food-processing and chemical plants, as well as outdoor horizontal surfaces of balconies, terraces, and passageways. They are characterized by high strength, resistance to frost and chemicals. Polished and unglazed tiles with satin finish are intended for exclusive interiors and facades. Sintered unglazed tiles TAURUS are made in mono- or polychrome designs, with embossed anti-slip, smooth (standard), or satin-finished and polished surface.

**Fully vitrified glazed tiles KENTAUR, catalogue number: Dxxxxxxx**

are highly sintered ceramic glazed frost resistant tiles with very low water absorption below 0.5%, manufactured to comply with EN 14411 Bla GL, Annex G. The products are of universal use as floor and wall tiles for interiors and exteriors, exposed to climatic effects, high mechanical stress and pollution. For this reason they are highly suitable for apartments and apartment buildings, also for the exterior in terraces and balconies. Ceramic tiles with the abrasion resistance PEI 5 and declared slip resistance must be used in public buildings (e.g. restaurants, hotels, offices, governmental buildings, automotive showrooms).

**Glazed tiles, catalogue number: Gxxxxxxx**

are ceramic glazed tiles with water absorption ranging from 0.5 to 3.0 %, manufactured to comply with EN 14411 Blb GL, Annex H; adherence to this specification guarantees the product to be resistant to frost. The tiles can be used for interior walls and floors, as well as exterior facades that are exposed to weather. Some examples of their universal use include floors and walls in bathrooms, kitchens, corridors, offices, exterior facades, swimming pools, saunas, freezing and food-processing plants, etc. These tiles are not intended for horizontal surfaces on balconies and terraces. The tiles are made in a wide range of colours with glossy or matte finish, decorated with various techniques (printing, dusting, spraying) or glazing; they are either of anti-slip or wear-resistant type. Tiles with the surface of gold, platinum and mother-of-pearl can be used only for interior walls!

**Wall tiles, catalogue number: Wxxxxxxx**

are ceramic glazed tiles with water absorption over 10 %, manufactured to comply with EN 14411 BIII, Annex L. They are designed for tiling of walls, which are not exposed to weather, frost, effects of ground water, acid pollutants, their vapours, and abrasives. That is why they are intended for tiling of walls in bathrooms, kitchens, laundries, and other interiors. The tile surface is smooth or slightly embossed, with glossy, semi-matte or matte glaze, mono- or polychrome or decorated in various techniques.

**Complementary non-ceramic materials – glass (catalogue number Vxxxxxxx) and natural aggregate (catalogue number Sxxxxxxx)**

are suitable and unique complementary products for ceramic tiles. The properties of these materials and characteristic differences in their colour, structure and other parameters are defined by their natural origin or by the technology of production.

## 2.2 IDENTIFICATION OF CERAMIC TILES IN THE CATALOGUE

Information on ceramic tiles in the LASSELSBERGER, s.r.o. product catalogue is provided, in a uniform format, as per below:

1. **Type and intended use of ceramic tile** – wall tiles, floor tiles, sintered tiles

2. **Catalogue number** – an eight-character code, e.g. **Txxyyzzz**, where:

– **the first position** defines the product type, e.g.:

T – sintered unglazed ceramic tiles TAURUS	with water absorption < 0.5 % gr. Bla
D – sintered glazed ceramic tiles KENTAUR	with water absorption < 0.5 % gr. Bla
G – glazed ceramic tiles	with water absorption 0.5-3 % gr. Blb
W – glazed ceramic wall tiles	with water absorption > 10 % gr. BIII

xx – **the second and third** positions identify the surface type and shape based on the code list

yy – **the fourth and fifth** positions identify the product size based on the code list

zzz – **the sixth to eighth** positions identify the specific decoration and color

3. **Icons of important properties** – symbols for frost resistance, abrasion resistance, etc.

4. **Size** – size of the tile in centimeters

5. **Description of decoration character** – description pointing to the original, intentionally irregular decoration of individual pieces in selected series. Individual tiles need to be mixed and used at random during laying.

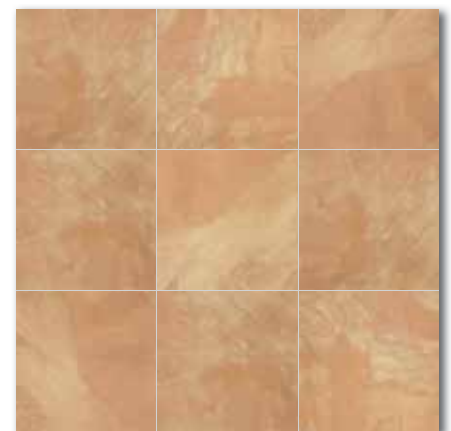
Variation of shades, embossing, or colours within one product:

**V1** – minimum differences

**V2** – small variation

**V3** – major variation

**V4** – major and completely randomized variation



Všechny výrobky celé série vykazují velké odchylky odstínové diference V3. / All products of the entire set show big deviations in shade difference V3. / Alle Produkte der ganzen Serie zeichnen sich durch ein breites Farbspiel V3 aus. / Wszystkie produkty w tej serii wykazują znaczne różnice odcieni V3. / Для всей плитки данной серии характерно значительное отличие оттенков V3.

## 2.3 IDENTIFICATION OF PRODUCTION BATCHES

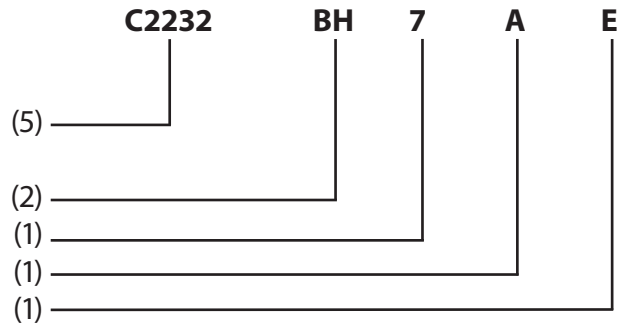
All ceramic tiles are manufactured in lots - batches which may vary in the color shade and size. Individual batches are identified in the accompanying documentation, on packaging, pallets, and delivery notes:

### Identification of a product batch – structure of a 10-character number:

Example:

whereas:

- a) country, production plant, line or supplier
- b) colour shade of the batch
- c) calibre – the last digit of the size in mm
- d) pallet: A – complete, B – incomplete
- e) identified with EAN code – E, no code – N



**Tiles from batches with different identification of the colour shade or caliber - size must not be used in the same area. Before laying work is commenced, it is necessary to verify the batch-related data specified on packaging. Any combination of tiling elements with different catalogue numbers in one surface must be discussed and ordered with the supplier or dealer in advance.**

## 3. Overview of Tile Properties

### 3.1 WATER ABSORPTION

Water absorption is the most important property to select the type of tiles for a particular environment. Water absorption of a ceramic tile is defined as increment of its weight in % after saturation with water. The water absorption test is performed using the procedure specified in the Czech Technical Standard ČSN EN ISO 10545-3.

First, the tiles are dried and weighed. After their saturation with water in vacuum or by boiling, the tiles are weighed again. The weight increment related to the dry weight is expressed in %.

Based on their water absorption, ceramic tiles are classified into several categories:

Water absorption	Type	Standard	Use
$E > 10 \%$	Wall tiles, catalogue numbers <b>W</b> .....	EN 14411 BIII GL, Annex L	Only for interior walls
$0.5 < E \leq 3 \%$	Glazed tiles, catalogue number <b>G</b> .....	EN 14411 BIb GL, Annex H	Universal use for frost-resistant tiling of floors and walls in the interior and facades
$E \leq 0.5 \%$	Fully vitrified tiles, catalogue numbers <b>T</b> ..... <b>D</b> .....	EN 14411 BIa GL and UGL Annex G	Highly resistant frost-resistant floors exposed to abrasion in the interior and exterior, facades, balconies, terraces

Ceramic tiles with high water absorption, i.e. wall tiles supplied under the European standard EN 14411 L, BIII GL, Annex L are intended for interior walls and they are not suitable for outdoor tiling and frost resistant applications.

Ceramic glazed tiles with low water absorption from 0.5 to 3 %, supplied under EN 14411 H, BIb GL, Annex H are frost resistant thanks to their low water absorption and are suitable for universal applications. Therefore they are suitable for wall and floor tiling in interiors and for exterior frost resistant wall tiling.

Fully sintered frost resistant ceramic tiles TAURUS and KENTAUR, with water absorption below 0.5 %, supplied according to EN 14411 G, BIa GL and UGL, Annex G are particularly suitable for horizontal exterior surfaces. They can be used universally. Selection of specific products for a particular application must take into account additional criteria, e.g. slip resistance, abrasion resistance of glazed tiles, etc. The product name and the respective standard are always provided on the cardboard packaging of the product.

## 3.2 FROST RESISTANCE



For exterior tiling, it is essential to use only frost resistant ceramic tiles, which can withstand long-term exposure to frost and weather. The prerequisite for **frost resistance** is low water absorption of ceramic tiles.

The frost resistance test according to ČSN EN ISO 10545-12 is relatively time-consuming. The tested tiles are saturated with water and exposed repeatedly to the temperatures of +5 °C and -5 °C. The tiles are exposed to the effects of 100 cycles of freezing and unfreezing from all sides.

**LASSELSBERGER, s.r.o.** ceramic tiles with water absorption below 3 % and fully sintered tiles with water absorption below 0.5 % remain intact even at temperatures lower than -30 °C, and for more than 100 cycles, a result better than required by ČSN EN ISO 10545-12.

Therefore, the mentioned compact tiles and sintered tiles are suitable for applications in damp premises, or on surfaces exposed to weather, including frost.

**Horizontal frost resistant surfaces of terraces and balconies require application of fully sintered ceramic tiles TAURUS and KENTAUR (EN 14411 B1a).** Glazed tiles COLOR TWO (EN 14411 B1b) are suitable for facades and wall tiling of cooling and freezing boxes. In the practical implementation of frost resistant tiling, the very important role is played by the quality of the base, adhesive and jointing materials, as the main objective is to prevent penetration of moisture under the tiled surface, especially on horizontal surfaces, facades and edges.

Nevertheless, it is also very important to observe the standards, recommended system solutions and laying procedures (see Chapter 5 – Tiling processing – 5.3.1 Frost resistant tiling).

**Each product, for which LASSELSBERGER, s.r.o. guarantees frost resistance, is identified with the following frost resistance symbol in the catalogue.**



### 3.3 STRENGTH

Strength of ceramic tiles is a very important property, particularly for floors, and it is determined according to ČSN EN ISO 10545-4 as bending strength, and is indicated in MPa, i.e. N/mm<sup>2</sup>. In addition, the breaking strength in N, according to ČSN EN ISO 10545-4, is determined after breaking a ceramic tile.

Strength is measured by gradual loading in the middle of an individual tile while its sides rest on supporting edges.

Bending strength  $P_o$  is calculated as follows:

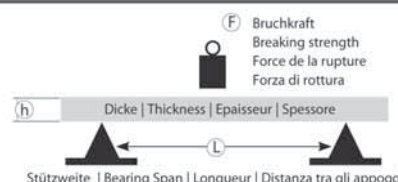
$$P_o = \frac{3 \cdot F \cdot L}{2 \cdot b \cdot h^2}$$

whereas: F – force at the moment of the sample breaking (N)  
 L – distance of the supporting edges (mm)  
 b – width of the tile being tested (mm)  
 h – minimum thickness of the fracture in (mm)

The strengths achieved by LASSELSBERGER ceramic tiles are significantly higher than the strengths required by the standards. The actual strength of the tiles is no less than 20 MPa, whilst the minimum of 15 MPa is required by the standard. The strengths of KENTAUR and TAURUS compact and sintered tiles are significantly higher than required by the standards (min. 27 to 35 MPa); refer to the catalogue for the technical parameters.

The force at the moment of tile fracture is e.g. 2000 N (200 kp) for common tile thickness of 9 mm. The thicker the tiles are the higher maximum load they can withstand. Tiles of common thicknesses 8 or 9 mm can be loaded with car tires up to the specified load (e.g. in automotive showrooms). Industrial floor tiles TAURUS with higher thickness of 13-15 mm (TAURUS INDUSTRIAL series) featuring high strength and breaking strength up to 5500 N (550 kp), see data in Table 1, are recommended for floors loaded with solid rubber wheels of fork-lift trucks or nylon wheels of handling carts. Special industrial-grade, non-ceramic tiles are required for floors loaded with steel wheels with no rubber cover

Tab. 1	Format Dimensions Format Format cm	Dicke Thickness Epaisseur Spessore cm	Bruchkraft Breaking strength Force à la rupture Forza di rottura N
Taurus	14,8 x 14,8	0,9	2 000
	19,8 x 19,8	0,9	1 900
	19,8 x 19,8	1,3	4 000
	19,8 x 19,8	1,5	5 500
	29,8 x 29,8	1,3	4 200
	29,8 x 29,8	1,5	5 000



The high strength is a significant advantage of LASSELSBERGER, s.r.o. products, enabling to apply the commonly manufactured sizes 30 x 30, 33.3 x 33.3, 40 x 40, 45 x 45, 60 x 30, and 60 x 60 cm, both on traditional floors and facades, as well as on modern assembled, ventilated and thermally insulated facade structures, which no more require material-consuming sticking into adhesives, and, at the same time, enable application of good thermal and acoustic insulation.

### 3.4 ABRASION RESISTANCE OF GLAZED FLOOR TILES – ABRASION RESISTANCE (PEI)

PEI

When selecting floor tiles from the viewpoint of expected intensity of foot traffic and pollution, the declared abrasion resistance of glazed tiles play an important role.

Abrasion resistance is the ability of the glaze to resist, more or less, to mechanical wear on the tile surface while the product is in use, depending on the foot traffic, type and level of floor pollution. Particularly hard dirt particles from streets or gardens gradually abrade the surface of tiles, and permanent changes in their appearance may occur.

The standard EN ISO 10545-7 classifies abrasion resistance in classes/degrees from 0 to 5. Products with the highest resistance class (PEI 5) are concentrated in the KENTAUR segment of tiles.

Abrasion resistance is determined by a laboratory method described in the above-mentioned standard. This method simulates and accelerates tile wear. A mixture of steel balls, corundum grains and water is vibrated on tile samples for a certain period of time until the vibration table with the samples performs the specified number of cycles. This method prepares samples which have been ground / exposed to the prescribed number of cycles ranging from 100 to 12 000. The **class of abrasion resistance** is then assigned by visual assessment of the damage in the glazed surface achieved under prescribed conditions in comparison with the original surface.

For floor application, it is recommended to pay attention to the declared **class of abrasion resistance**, and to use ceramic glazed tiles in agreement with the classification given below:

#### **Application of glazed tiles by their abrasion resistance:**

**Class PEI 1** – for floors without risks of scratching and soft-sole shoes, e.g. bathrooms, bedrooms and toilets in apartments, as well as tiled swimming pools and walls.

**Class PEI 2** – for floors rarely exposed to the pollution mentioned above and to regular shoes, e.g. living areas, except for house entrance and similar areas.

**Class PEI 3** – for floors exposed to frequent pollution, e.g. in apartments and family houses, corridors, except the house entrance. It is designed for entrance halls, enclosed balconies, balconies, corridors, home kitchens, hotel rooms, sanitary installations and therapeutic rooms in hospitals.

**Class PEI 4** – for busy foot traffic and stronger pollution, e.g. interiors of administration buildings, hotel corridors, business rooms, and offices.

**Class PEI 5** – for floors highly exposed to abrasion and pollution, e.g. shops, restaurants, and hotel staircases.

Note: Floor tiles with a higher class of abrasion resistance can also be used for applications requiring lower abrasion resistance (e.g. floor tiles with the abrasion resistance class 5 may be used for applications requiring the abrasion resistance class 3 – flats, family houses).

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Glazed and decorated sintered tiles from the KENTAUR product range mostly feature the abrasion resistance class of 4 or 5, depending on the type of decoration and colour intensity in the surface layer.

Abrasion resistance of stair shaped pieces corresponds to the abrasion resistance of basic tiles in the given series.

Ceramic glazed tiles with low abrasion resistance class of 1 and 2 are intended for floors not overtly exposed to abrasion, apartment bathrooms and bedrooms, for tiling of walls, facades etc.

For surfaces with busy traffic of persons, it is recommended to consult practical application of tiles with the manufacturer in advance. Based on practical experience, cleaning mats are recommended in entrance areas for shops and restaurants also where floor tiles of the highest abrasion resistance class are applied; this will significantly extend the service life of tiles and reduce the total amounts of dirt and dust carried into the shop or restaurant.

**Information on abrasion resistance** for individual types of glazed LASSELSBERGER tiles is provided in the catalogue by the abrasion resistance symbol and class: **PEI 4**.

Guaranteed classes of abrasion resistance in individual tile supplies are provided on delivery notes and they are also printed on the cardboard packaging and identification labels on the pallets.

### **Floors with extreme traffic**

For premises with extreme exposure to abrasion (supermarkets, entrances of administration buildings, public transport stations, passageways, street-side entries to restaurants and shops), it is recommended to use fully sintered, unglazed TAURUS tiles, which have practically no limitation in terms of surface wear.

### 3.5 ABRASION RESISTANCE OF UNGLAZED FLOOR TILES – DEEP ABRASION RESISTANCE OF TAURUS SERIES FLOOR TILES



Abrasion resistance of **unglazed tiles** in operation is best characterized by their **deep abrasion resistance** (resistance to deep wear).

Deep abrasion resistance of TAURUS unglazed floor tiles is verified according to ČSN EN ISO 10545-6, by abrasion of sample tiles with corundum sand under predefined conditions. Pursuant to the standard, the abraded volume must not exceed  $175 \text{ mm}^3$ . Fully sintered TAURUS tiles deliver very good resistance to deep abrasion; they only abrade by ca.  $130 \text{ mm}^3$ .

The high resistance to deep abrasion of fully sintered **TAURUS** tiles allows this product for application in floors with extremely high foot traffic, e.g. in supermarkets, public transport stations, underpasses and passageways, etc.

### 3.6 SLIP RESISTANCE OF FLOORS



When selecting tiles from the viewpoint of safe movement of persons on floors with increased slipping hazards, it is essential to know the anti-slip properties of individual floor materials. The requirements are specified by individual regulations in the List of Requirements given below.

Přehled požadavků na protiskluznost podlah					
předpis	požadovaná hodnota	země	oblast použití	hodnoty a označení Lasselsberger	
vyhl. 268/2009 Sb. ČSN 74 4505 Podlahy	součinitel smykového tření $\mu \geq 0,3$	ČR	podlahy bytových a pobytových místností	všechny dlaždice LASSELSBERGER	$\mu \geq 0,3$
vyhl. 268/2009 Sb. ČSN 74 4505 Podlahy	součinitel smykového tření $\mu \geq 0,5$	ČR	podlahy staveb užívaných veřejností	dlaždice LB označené ikonami viz Technický katalog www.rako.eu-servis-certifikáty	$\mu \geq 0,5$
vyhl. 369/2001 Sb. ČSN 73 4130 Schodiště	součinitel smykového tření $\mu \geq 0,6 + \tan \alpha$	ČR	pro osoby s omezenou schopností pohybu, schodiště a šikmé rampy	vybrané dlaždice viz Technický katalog www.rako.eu-servis-certifikáty	$\mu \geq 0,6$
ČSN EN 13451-1 Plavecké bazény	úhel kluzu $> 12^\circ$	EU, ČR	šatny, chodby pro chůzi na boso...	dlaždice označené ikonou	A
GUV 26.18 bezpečnostní předpis Německo	úhel kluzu $> 18^\circ$	EU, ČR	veřejné sprchy, ochozy bazénů, brouzdaliště, schody...	dlaždice označené ikonou	B
DIN 51 097	úhel kluzu $> 24^\circ$	EU, ČR	startovací bloky, schody do vody, šikmé okraje bazénů...	dlaždice označené ikonou	C
BGR 181 bezpečnostní předpis DIN 51 130	úhel kluzu 6 až 35°	Německo, EU doporučeno pro ČR	podlahy staveb užívaných veřejností	dlaždice označené ikonami viz katalog OBJECT str. 122	R9-R13



The slip-resistance requirements of floors indicated by Ministry of Local Development Regulation 268/2009 Coll. contains reference to respective standards, such as ČSN 74 4505 - Floors.

The standard specifies that horizontal floors of apartments have a friction coefficient of no less than 0.3. This is a value delivered by nearly all LASSELSBERGER tiles.

For areas accessible to the public, the standard requires that the surfaces and tiles have a friction coefficient of no less than 0.5. These applications require a choice of tiles with the defined anti-slip properties. The tiles are indicated in the catalogues with the anti-slip icons and their anti-slip values are shown in the tables attached to Chapter 3.6.

There exist specific requirements for anti-slip floors used by physically challenged persons, persons with partial or total sight impairment. Specific requirements are also in place for designs of staircases and wet floors in public pools, spa and rehabilitation centers, floors in public showers, bathrooms, areas around pools, paddling pools, as well as floors in working premises, e.g. big kitchens, cook-shops, warehouses, meat processing plants and shops, dairies, etc.

These applications need to choose tiles with the declared anti-slip properties in conformance to the relevant standards.

Anti-slip tiles for public buildings are indicated in the LB catalogues with the symbol of:  and .

Pursuant to the EN 14411 standard, the anti-slip properties of individual floor materials and the manner of declaring the anti-slip properties of tiles are specified by the manufacturer who typically uses the methodology in force to declare special anti-slip tiles for areas with high risk of slippage.

Methodology for evaluation of slip resistance of ceramic tiles is described in the European standard draft pr EN 13552 and in the Czech standard ČSN 72 5191, which offer several methods to describe anti-slip properties of tiles:

- a) Determination of the dynamic friction coefficient of tiles
- b) Determination of the static friction coefficient of tiles
- c) Determination of slipping properties for wet surfaces for barefoot walking pursuant to DIN 51 097 - (Bestimmung der rutschhemmenden Eigenschaft. Nassbelastete Barfussbereiche). Nassbelastete Barfussbereiche)  
 Determination of the slipping angle and of slipping properties for working premises and surfaces with increased slipping hazards pursuant to DIN 51 130 - (Bestimmung der rutschhemmenden Eigenschaft Arbeitsräume und Arbeits bereiche mit erhöhter Rutschgefahr Begehungsverfahren – Schiefe Ebene)
- d) Determination of slip resistance using the pendulum deflection method.

Determination of the dynamic and static friction coefficients is basically measurement of the friction coefficient between the subject tile and standard types of rubber materials. This methodology is applied especially in the Czech Republic, and in the countries of Central and South Europe

The friction coefficient is calculated as follows:

$$\mu_d = F_t / F_n$$

$F_t$  –drawing force

$F_n$  –vertical force

The friction coefficient is determined for dry and wet surfaces separately. Safety categories for anti-slip floors are established by ČSN 72 5191 as follows:

Slip resistance class according to CSN 72 5191	Friction coefficient $\mu$	Description
Class T1	$\mu < 0.20$	Extremely dangerous surface
Class T2	$0.20 \leq \mu \leq 0.40$	Insufficiently safe surface
Class T3	$0.40 \leq \mu \leq 0.75$	Safe surface
Class T4	$\mu > 0.75$	Very safe surface

Other methods currently used include the slip resistance determination as per ČSN 72 5191 and DIN 51 097, DIN 51 130 where the slip resistance of tiles is indicated by measurement of the slip angle on a sloped surface walked upon by the testing person. The sloped surface is fitted with the tiles being tested. The angle of the surface increases at the rate of 1° per minute until the testing person becomes unstable while walking and slips, thereby identifying the slipping angle. The bias of the assessment is eliminated by multiple repetitions of the determination process. The test is conducted by two independent persons whose individual correction coefficients have been assessed using a set of calibration tiles. A major advantage of the slip resistance determination applying this method is the possibility to evaluate significantly embossed tiles, as well as to systematically classify the tiles into individual, accurately defined user groups based on the ascertained slip angle. These user groups are applied especially in Germany and in West Europe (safety regulations of the Union of Tradesmen - BGR 181, refer to the OBJECT catalogue).



For **work floors** (DIN 51 130), the BGR 181 methodology defines the following anti-slip groups of tiles:

Slip angle	Identification	Recommended use
6–10°	R 9	interior and relaxation surfaces, canteens ...
10–19°	R10	warehouses, small kitchens, sanitary premises ...
19–27°	R11	school kitchens , washing lines, laundries, grinding shops, outdoor staircases...
27–35°	R12	large kitchens, working pits, dairies ...
over 35°	R13	fat refineries, leather works, and slaughter houses ...



The following groups have been specified for barefoot walking floors (ČSN EN 13 451-1, DIN 51 097, GUV 26.18):

Slip angle	Identification	Recommended use
> 12°	A	corridors for barefoot walking, changing rooms ...
> 18°	B	public showers, pool decks, paddling pools, stairs ...
> 24°	C	underwater stairs, inclined pool sides, starting blocks ..

Anti-slip tiles in the groups R10 through R13 are concentrated in the **TAURUS** line, and they are intended particularly for safe floors in public buildings, eating facilities, processing and food industry. For dressing rooms and changing rooms, the recommended types are **KENTAUR** and **TAURUS** tiles from the group with slip resistance A; **TAURUS** tiles with slip resistance B or C are intended for floors designed for barefoot walking with higher requirements for slip resistance.

The **POOL** program catalogue offers anti-slip products of groups A, B, and C for barefoot walking for public showers and pool surroundings as well as for applications defined by ČSN EN 13451-1.

When selecting anti-slip tiles, it is recommended to observe the Anti-slip Requirements for Floors given above, especially the preliminary requirement of ČSN 74 4505 – friction coefficient 0.3 and 0.5. The recommendations of the Safety Rules of the Union of Tradesmen BGR 181, as presented in the OBJECT catalogue, will promote the quality of floor designs and of public buildings in the Czech Republic.

Anti-slip properties of tiles are specified in the tables below. Detailed information is available on LAS-SELSBERGER, s.r.o. information lines:

**Phone: +420 800 303 333**

**e-mail: info@rako.cz**

**www.rako.cz – Services – Expert queries – Technical consultancy contacts**

## Anti-slip properties of LASSELSBERGER ceramic tiles OBJECT according to pr EN 13 552 and CSN 72 5191

Program Series	Method A Dynamic friction coefficient		Method B Static friction coefficient		Method C DIN 51 130, BGR 181		Method C DIN 51 097 (A,B,C)	Method D Pendulum deflection	
	$\mu$ dry	$\mu$ wet	$\mu$ dry	$\mu$ wet	R	V (cm <sup>3</sup> /dm <sup>2</sup> )		dry	wet
<b>OBJECT 2011 TAURUS</b>									
Surface S 10x10cm	≥ 0,6	≥ 0,6	≥ 0,7	≥ 0,6	R10		B	60	44
Surface S 15x15cm	≥ 0,7	≥ 0,6	≥ 0,7	≥ 0,6	R10		A	65	45
Surface S 20x20cm	≥ 0,6	≥ 0,6	≥ 0,6	≥ 0,6	R10		A	60	41
Surface S ≥ 30x30cm	≥ 0,6	≥ 0,6	≥ 0,6	≥ 0,6	R9		A	61	45
Surface SF	≥ 0,6	≥ 0,6	≥ 0,6	≥ 0,6	R9				
Surface SB	≥ 0,7	≥ 0,6	≥ 0,8	≥ 0,7	R10		A	70	54
Emboss SR1	≥ 0,7	≥ 0,6	≥ 0,8	≥ 0,7	R11		B	81	75
Emboss SR2	≥ 0,7	≥ 0,6	≥ 0,8	≥ 0,7	R12	V4	B	76	66
Emboss SR4	≥ 0,7	≥ 0,6	≥ 0,7	≥ 0,7	R12	V4	C	73	70
Emboss SR7	≥ 0,7	≥ 0,6	≥ 0,7	≥ 0,6	R11		B	62	41
Emboss SR20	≥ 0,7	≥ 0,6	≥ 0,7	≥ 0,6	R13	V8	C	80	75
Taurus step tile	≥ 0,6	≥ 0,6	≥ 0,8	≥ 0,7	R10		A		
Taurus step tile emboss SR7	≥ 0,6	≥ 0,6	≥ 0,7	≥ 0,6	R11		B	62	41
Taurus Double surface ST	≥ 0,5	≥ 0,3	≥ 0,6	≥ 0,4	R9		-	-	-
Shaped tiles for the sight impaired*	≥ 0,6	≥ 0,6	≥ 0,7	≥ 0,6	R11		A	74	52
<b>Color Two a POOL</b>									
Anti-slip emboss surface R10, cat. no. GRSxxxx	≥ 0,7	≥ 0,7	≥ 0,8	≥ 0,7	R10		B	75	67
Mosaic matte 4.7x4.7	≥ 0,6	≥ 0,5	≥ 0,6	≥ 0,5	R10		A		
Mosaic matte 2.3x2.3	≥ 0,6	≥ 0,6	≥ 0,6	≥ 0,6	R10		B		
Anti-slip emboss surface C, cat. no. GRHxxxx	≥ 0,9	≥ 0,8	≥ 0,9	≥ 0,8	-		C	88	82

"V" – free area in the embossed surface (cm<sup>3</sup>/dm<sup>2</sup>)

\* Products designed only for guiding and warning signage for the sight impaired

**(We advise customers that anti-slip surface of products requires more complex cleaning of the tile surface. See Chapter 6 – Maintenance of Tiled Surfaces)**

## Anti-slip Properties of LASSELSBERGER FLOOR Ceramic Tiles as per pr EN 13 552 and ČSN 72 5191

Program Series	Method B Static friction coefficient		Method C DIN 51 130	Method C DIN 51 097
	$\mu$ dry	$\mu$ wet	R	(A,B,C)
<b>Floors 2011</b>				
Andalusia	≥ 0,6	≥ 0,5	R9	-
Antik 90 - 95	≥ 0,6	≥ 0,5	R9	-
Antik 101 - 103	≥ 0,6	≥ 0,5	R10	-
Antik 108	≥ 0,7	≥ 0,6	R11	C
Arena	≥ 0,6	≥ 0,5	R10	A
Concept	≥ 0,6	≥ 0,5	R9	-
Defile	≥ 0,6	≥ 0,5	R9	-
Defile mosaic 4,7x4,7	≥ 0,7	≥ 0,6	R10	B
Diamond	≥ 0,6	≥ 0,4	R9	-
Essencia	≥ 0,6	≥ 0,5	R9	A
Fashion	≥ 0,6	≥ 0,5	R9	A
Fashion mosaic	≥ 0,6	≥ 0,5	R10	B
Galileo	≥ 0,6	≥ 0,5	R10	B
Geo	≥ 0,7	≥ 0,6	R10	A
Chateau	≥ 0,6	≥ 0,5	R10	A
Naturstone	≥ 0,6	≥ 0,5	R10	B
Noe	≥ 0,6	≥ 0,5	R9	-
Orion	≥ 0,6	≥ 0,5	R9	A
Riverberi	≥ 0,6	≥ 0,4	R9	-
Samba	≥ 0,6	≥ 0,5	R9	A
Sandstone Plus	≥ 0,6	≥ 0,5	R9	A
Sandstone Plus mosaic 4,7x4,7	≥ 0,7	≥ 0,6	R10	B
Sidney	≥ 0,6	≥ 0,4	R9	-
Spirit	≥ 0,6	≥ 0,4	R9	-
Terracotta	≥ 0,6	≥ 0,5	R9	-
Travertin	≥ 0,6	≥ 0,5	R10	A
Unistone (DAK...)	≥ 0,6	≥ 0,5	R9	-
Unistone (DAK...) and mosaic	≥ 0,6	≥ 0,5	R10	B
Venezia	≥ 0,6	≥ 0,5	R9	A
Wax	≥ 0,6	≥ 0,5	R9	-
Wood	≥ 0,6	≥ 0,5	R9	-
Wood mosaic	≥ 0,6	≥ 0,5	R10	B
Zircon	≥ 0,6	≥ 0,5	R9	A
Zircon mosaic	≥ 0,6	≥ 0,5	R10	B
Mosaic matte 2,3x2,3 (GDM02..)	≥ 0,6	≥ 0,6	R10	B

## 3.7 CHEMICAL PROPERTIES



Chemical properties that define the resistance of tiles against staining, exposure to household chemicals, pool chemicals and strong acids and alkali, are important aspects the architect or customer need to observe when selecting the suitable tile.

New methods for determination of chemical resistance are described in ČSN EN ISO 10545-13, and the method for determination of resistance to staining is described in ČSN EN ISO 10545-14

### 3.7.1 Resistance to Staining

Resistance to staining on the glaze is tested according to ČSN EN ISO 10545-14 by exposure to stain-forming substances – olive oil, iodine solution, chromic or ferric oxides, and it is expressed in terms of resistance classes:

- |   |                                                                  |
|---|------------------------------------------------------------------|
| 1 | Stains cannot be removed                                         |
| 2 | Stains can be removed by long-term application of cleaning agent |
| 3 | Stains can be removed with high-concentration cleaning agent     |
| 4 | Stains can be removed with low-concentration cleaning agent      |
| 5 | Stains can be removed with running water                         |

European standards require resistance	min. Class 3
LASSELSBERGER product guarantee	Class 5 and 4

Class 5 means the easiest removal of stains, Class 1 means that stains cannot be removed by any of the specified standard procedures.

Products of LASSELSBERGER, s.r.o. deliver very good resistance to stain-forming substances according to ČSN EN ISO 10545-14, and they can be easily cleaned with warm water (class 5).

### 3.7.2. Resistance against Household Chemicals, Strong Acids and Strong Alkali

CSN EN ISO 10545-13 requires that resistance of glazed ceramic products to defined solutions of household chemicals – ammonium chloride, sodium hypochlorite, and low concentrations of citric and hydrochloric acids, and potassium hydroxide be tested for a period of 4 days. Unglazed ceramic tiles are exposed to the chemicals for a period of 12 days. According to their resistance to household chemicals, tiles are classified as follows:

- |    |                                                  |
|----|--------------------------------------------------|
| GA | No changes visible                               |
| GB | Distinct changes of appearance                   |
| GC | Partial or complete loss of the original surface |

The European standards require resistance to household chemicals: min. Class GB  
Products of LASSELSBERGER, s.r.o. guarantee resistance to household chemicals: GA and GB.

CSN EN 14411 contains no specification for chemical resistance of tiles to low- and high-concentration acids and alkali. In general, ceramic tiles are not resistant to hydrofluoric acid. Resistance tests for lactic acid, hydrochloric acid, and potassium hydroxide in high concentrations are performed and evaluated also according to the methods specified in ČSN EN ISO 10545-13.

GLA, GHA, ULA, UHA	No change visible
GLB, GHB ULB, UHB,	Distinct change of appearance
GLC, GHC ULC, UHC	Partial or complete loss of the original surface*


Selected types of LASSELSBERGER, s.r.o. products, e.g. TAURUS and KENTAUR tiles, have very good resistance to such chemicals – see the enclosed table – and in combination with chemically resistant adhesives and jointing materials, these products are suitable for walls and floors in chemical production plants, accumulator maintenance shops, dairies, soft-drink factories, breweries, etc.

For these purposes, the traditional laying technique into cement and cement jointing is fully unsuitable. Chemically resistant materials must be used, e.g. epoxy penetration, epoxy damp proofing material, epoxy adhesive, and epoxy jointing materials.

Semi-vitreous wall tiles with water absorption over 10 % are not suitable for industrial applications requiring resistance against chemicals. They are resistant to common household chemicals and to mild cleaning agents (no abrasive effect, pH ranging from 6.5 to 7.5). For specific wall tiling (laboratories, etc.), white glossy wall tiles with a very good chemical resistance or tiling elements COLOR TWO can be used. Decorative tiling elements with gold, platinum, pearlescent, and metallic paint are not suitable for areas with chemical exposure; the maintenance procedure for these products is shown in Chapter 6 - Tiling Maintenance.

\* G...glazed, U...unglazed, L...low-concentrated, H...high-concentrated

## Recommended LASSELSBERGER, s.r.o. Products with High Chemical Resistance

Program / Series	Resistance to staining as per CSN EN ISO 10545-14	Resistance to acids and alkali as per CSN EN ISO 10545-13
<b>OBJECT 2011</b>		
<b>TAURUS</b> all standard surface series	Min. resistance Class 3	Resistance ULA
<b>TAURUS</b> Industrial	Min. resistance Class 3	Resistance ULA, UHA
<b>COLOR TWO</b>	Min. resistance Class 3	Resistance GLA
<b>POOL</b>	Min. resistance Class 3	Resistance GLA
<b>KENTAUR</b> select series bearing the icon 	Min. resistance Class 3	Resistance GLA

Other requirements for increased resistance against chemical agents must be discussed as specific requirement in the product order.

Products with high chemical resistance are identified in LASSELSBERGER, s.r.o. catalogues with the following symbol:



### 3.8 HYGIENIC PROPERTIES

LASSELSBERGER, s.r.o. products are regularly tested for **radiation-hygienic safety** as per the Decree by the State Office for Nuclear Safety 307/2002 Coll., as amended by Act 13/2002 Coll. Products of LASSELSBERGER, s.r.o. conform to the requirements mentioned above, and they are **safe**.

Ceramic products LASSELSBERGER, s.r.o. are regularly tested for release of lead (Pb) and cadmium (Cd) from glazes according to ČSN EN ISO 10545-15. The analyses performed confirm the health safety of ceramic tiles manufactured by LASSELSBERGER, s.r.o.

Certificates of health safety in contact with food, issued by an independent hygiene testing laboratory, are available for selected TAURUS products at **[www.rako.cz/servis/certifikaty](http://www.rako.cz/servis/certifikaty)**.

Wall and floor ceramic tiles, including accessories and shaped pieces, can be easily maintained, thus meeting the strict hygienic requirements for food-processing and healthcare facilities. They are suitable for all types of applications which require surfaces free of pathogenic germs, moulds, dust, and other pollutants.

Suitable application of ceramic tiles on floors and walls can also improve the home microclimate, e.g. reduce occurrence of dust, pollen and mites.

### 3.9 THERMAL PROPERTIES – FLOOR HEATING

Floor heating systems are becoming more and more popular in homes as they improve the comfort and heating ecology.

Their economic thermal properties make all tiles offered by LASSELSBERGER s.r.o. a perfect choice of surface for floor heating.

Thermal expansion coefficient in the 20 –100 °C is	6 to 8.10 <sup>-6</sup> K <sup>-1</sup>
Thermal conductivity of the materials is greater than	1 Wm <sup>-1</sup> K <sup>-1</sup>

Floor heating should be installed by a professional organization to ensure compliance with the prescribed requirements for dilatation joints, quality base, quality flexible adhesive and jointing material, etc. (see Chapter 5.3.2 Floor Heating and Chapter 5.4 Tile Jointing).

Although the thermal expansion coefficient in wall and floor tiles is very low, thermal expansion joints must be installed nonetheless. Ceramic tiling with thermal load, e.g. floor heating, terraces, balconies, and facades, needs to be fitted with thermal expansion joints every 3 meters. All other ceramic tiling must have thermal expansion joints every 6 meters (see Chapter 5.4 Tile Jointing).

### 3.10 GEOMETRIC PARAMETERS AND MODULE SIZES



Methods to determine geometric parameters of ceramic tiles are described in the Czech Technical Standard ČSN EN ISO 10545-2. An example of parameters prescribed by the standards and parameters achieved by LASSELSBERGER, s.r.o. sintered tiles Bla is shown in the table below:

Property	Tolerance permitted by CSN EN 14411 G,Bla KENTAUR, TAURUS	Value achieved by LASSELSBERGER, s.r.o. standard	calibrated
Dimensions	± 0.6 – 1.0 %	± 0.4 %	± 0.2 %
Thickness	± 5 – 10 %	± 5 %	± 5 %
Straightness of sides	± 0.5 %	± 0.3 %	± 0.2 %
Rectangularity	± 0.6 %	± 0.4 %	± 0.2 %
Surface flatness	± 0.5 %	± 0.3 %	± 0.3 %

Accurate values for all types of LASSELSBERGER, s.r.o. products are provided in the information annexes to catalogues.

#### Calibrated tiles:

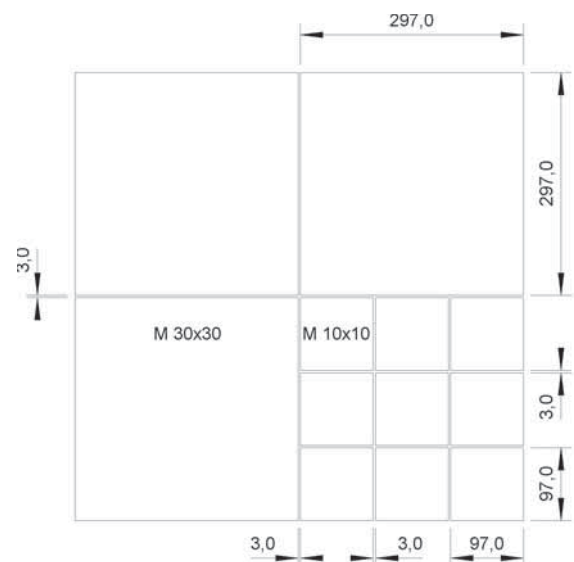
Floor and wall tiles in sizes of 45 cm and higher are usually offered with calibrated edges. They are ground to high precision and allow laying with a thin, elegant joint of approximately 2 mm. In the catalogue, they are always identified with the letter R icon. Polished sintered, unglazed TAURUS tiles and lapped or glazed sintered KENTAUR tiles are always calibrated for the declared sizes, i.e. their edges are ground to size. The **declared size** is specified on the packaging and delivery notes in millimeters (mm), refer to the Chapter 2.3, with sizes 5 and 8 being the most common. For a combination of polished (lapped) and standard surfaces, some series are already calibrated to size 5. In other cases, we recommend ordering calibration of standard ceramic tiles.

#### Modular sizes:

Ceramic tiles are manufactured in nominal sizes, e.g. 10x10, 20x20 cm and module sizes, e.g. M10x10, M20x20 cm. Module sizes are suitable for combinations of tiles of different formats on one surface while keeping running joints.

Ceramic products with module sizes consist of multiples of the basic sizes. The product size also includes the width of a uniform joint in order to achieve uniform joints on a surface consisting of different size tiles (see Fig. 1):

Fig. 1 – Example of modular composition of formats M10x10 and M30x30



Module sizes with caliber 7 are made in the POOL program and the COLOR TWO series from the OBJECT program; modules sizes of wall tiles with caliber 8 are made in the COLOR ONE series.

#### Mosaics

These products are offered in sizes 1.1x1.1, 2.3x2.3, 4.7x4.7, and 9.7x9.7 cm. Individual elements are pasted onto plastic or paper mesh (sets) in size 30x30 cm which facilitate and accelerate laying the mosaic on C2 class adhesive. If necessary, the mesh of the set may be cut into individual bands or listellos. The size of the sets and joints may be corrected to suit adjacent elements and large tiles.

---

## 4. Shopping Tips and Considerations before Laying

- When selecting ceramic tiles consider, apart from aesthetic aspects, also the conditions of their use. Discuss options available and select the suitable type of tiles.
- LASSELSBERGER wall tiles (**catalogue number W.....**) are suitable only for interior wall tiling
- Compact LASSELSBERGER tiles (**catalogue number G.....**) are frost resistant and suitable for exterior and interior applications for walls and floors, facades, pools, etc.
- Sintered **KENTAUR** and **TAURUS** ceramic tiles (**catalogue numbers T..... , D.....**) are highly frost resistant and are designed particularly for horizontal, frost-resistant tiling, e.g. on balconies and terraces. Selected types have the ultimate surface abrasion resistance. Unglazed products from the **TAURUS** program with a declared slip resistance are therefore suitable for floors with busy foot traffic, e.g. for supermarkets, public transport stations, administration buildings, etc.
- Measure carefully the required surface to be tiled, and always buy additional 10-15 % of the tiling material than theoretically calculated (waste at walls, particularly for oblique laying, unexpected adjustments and repairs, etc.).
- When buying tiles, always discuss the expected foot traffic in the building, and select tiles featuring suitable abrasion resistance.
- For applications in more demanding operation conditions in terms of slipping hazards (e.g. wet floors in public showers, pool surroundings, wet and greasy floors in big kitchens) always select suitable anti-slip floor tiles.
- Laying of tiles should be performed by a professional contractor. If you lay the tiles by yourself, carefully study the instruction manual provided by the manufacturers of ceramic tiles, cements, adhesives, and cutting instruments. For laying of wall and floor tiles in bathrooms, pools, balconies and terraces, we recommend system solutions using the procedures of base penetration, leveling, adhesive, damp-proofing, jointing and cleaning materials, e.g. the LB CERAMIC SYSTEM ([www.lbcs.cz](http://www.lbcs.cz)).
- Before starting the laying work, always check the delivered products by setting them on the surface, particularly for layouts with decoration and patterns. Also, check colour uniformity and marking of sizes and colour shades on the cardboard boxes. Never mix different shades or sizes.
- When laying tiles on large surfaces, make sure that expansion joints are made around supporting and expansion parts of construction, particularly on outdoor floors, facades and terraces.

## 5. Tile Processing

**Tile design and laying** should be performed by a professional contractor. If you are planning to lay the tiles by yourself, make sure you are well informed about the recommended use of particular tiles, their cementing and jointing, as well as about the importance of individual properties of ceramic tiles and cutting methods. For tile laying, it is necessary to adhere to the approved rules (refer to the new standard for floors – ČSN 74 4505), use system solutions and recommended construction chemical products of the LB CERAMIC SYSTEM ([www.lbcs.cz](http://www.lbcs.cz)).

### 5.1 PREPARATION OF THE BASE AND TILES BEFORE LAYING

Preparation of a stable base, which must be sufficiently strong and free of dust, grease and excess water, is a prerequisite for starting the laying work. Expanding bases/grounds, e.g. chipboards, must be provided with special expansion layers before laying. If necessary, damp-proofing and penetration coats are to be applied. Before laying the tiles, spread the ceramic tiles from several cardboards on at least 2 m<sup>2</sup> of the surface and check the general appearance and, in particular, setup of patterns combined from various types of products, various base colours and accessories, decorative strips - listellos, etc. It is recommended to have the designed layout approved by the owner, investor, or user of the building.

### 5.2 TILE CUTTING

LASSELSBERGER, s.r.o. wall tiles can be cut using common tile cutters. Compact and sintered tiles with embossed or glassy surfaces have very hard surfaces, therefore, it is recommended to use diamond tools – saws and jig saw diamond bits - for cutting, especially in embossed shaped pieces, corner joints, and cut out openings for fittings being connected (outlets, water and sewer pipes) - see Figures No. 2, 3, according to instructions for use provided by suppliers, [www.rako.cz](http://www.rako.cz) - **services - expert audience**.



Fig. 2 – Set for cutting of round openings in all types of ceramic tiles



Fig. 3 – Professional-grade diamond cutter for wet cutting of tiles

## 5.3 TILE STICKING AND IDENTIFICATION OF ADHESIVES

Recommended procedures are available for tiling of walls and floors (standards, for example, ČSN 74 4505, publications, e.g. Rostislav Drochytka & kol. „Keramicke obklady a dlazby“, company instructions, etc.). It is also necessary to select suitable types of gluing materials, which are characterised by the European standard EN 12 004.

### a) Classification and identification of adhesives according to EN 12 004

According to the material type, adhesives for ceramic tiles are divided as follows:

“C” – cement, “D” – dispersion, “R” – reactive from hardened resins.

Each type is available in two categories:

“1” – for common, standard use in interiors, with the minimum adhesion of 0.5 MPa

“2” – more demanding applications, e.g. non-absorbent bases and in exteriors with the minimum adhesion of 1.0 MPa.

Additional properties of adhesives are identified as follows:

“F” – quick-setting, “T” – with reduced slip, “E” – with extended open time.

Deformation properties (flexibility) of adhesives as per EN 12002

„S1” – deforming, deflection from 2.5 to 5 mm

„S2” – highly deforming, deflection over 5 mm.

### Examples of identification and recommended use of cement adhesives

“C1” – a standard cement adhesive for common use, gluing of ceramic tiles on stable bases in interiors (for example: LBCS – AD 501)

“C1 T” – a standard cement adhesive with reduced slip (for example LBCS - AD 505)

“C1 FT” – a quick-setting cement adhesive with reduced slip (for example LBCS - AD 580)

“C2 TE” – a flexible cement adhesive with reduced slip and extended open time for the interior (for example LBCS - AD 530).

### b) Methods of laying are selected mainly according to the type and quality of the base

b1) The traditional method of laying into a thick layer of mortar base is used wherever major unevenness of the base needs to be leveled. Tiling may start once the plaster has sufficiently hardened. Water absorbing tiles must be briefly soaked in water before laying to avoid quick absorption of water from the plaster. Compact and sintered tiles need not be soaked before laying. Apply a thin layer of fine mortar on a tile and press it evenly onto the wall. This method allows leveling of uneven wall surfaces, but it requires some skills and experience of the worker. At present, this method is replaced with thin-layer gluing.

b2) The method using gluing of tiles with a thin layer of adhesive is a modern, progressive technique suitable for quality level surfaces made of precision building blocks, plasterboards, etc. First, a thin, smooth layer of the adhesive is applied on the level surface to form the base. Then, this layer is to be spread with a suitable toothed smoother to ensure the adhesive forms an even layer. Individual tiles are to be placed on the surface prepared in this manner. Various spacing pieces can be used to ensure evenness of the joints. Tiles smeared with adhesive must be promptly cleaned.

When laying **large size ceramic elements and tiles** in the exterior, the C2 class adhesive must be applied both to the base and to the tile to deliver the required evenness of the tile surface and good adhesion to the base. When rectangular tiles are to be laid in the bond pattern, it is recommended that individual tiles be installed by an offset of one sixth or one quarter, not one half, of their length.

### 5.3.1 FROST RESISTANT TILING ON BALCONIES

Frost resistant tiling must be performed very carefully as the quality of the base, as well as the laying as such, strongly influence the service life of the completed tiled surface. The recommended procedure for laying of ceramic tiles on balconies is shown in Figures 4, 5, 6, and 7.

The base must be made of a frost-resistant mature material, without additional deformations, with a clean, smooth surface, free of dirt, dust or grease. All base horizontal surfaces must have a slope of at least 2 %. The banister structure must be anchored outside the ceramic surface.

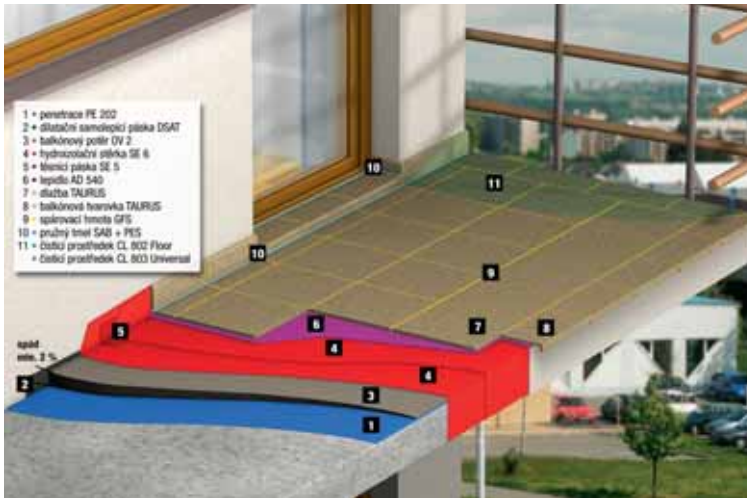


Fig. 4 – Balcony structure



Fig. 5 - Buttering- Floating glueing method

Apply two damp-proofing layers on a penetrated base using a liquid damp-proofing material (for example: SE6). The damp-proofing layer must be watertight around discharge fixtures, and applied at least 15 cm upwards on the adjoining vertical surfaces and walls, using a flexible sealing tape. Sintered ceramic tiles TAURUS and KENTAUR may be laid onto this quality damp-proof layer. It is best to use the Taurus Granit and Andalusia series with balcony shaped tiles or the Antik, Galileo, Travertin series into a C2TE S1 type frost-resistant cement adhesive (e.g. AD 530). Tiles are glued on the surface by applying the adhesive both on the base and tiles (Buttering-Floating); take care to remove the bubbles and hollows in the adhesive – see Fig. 5 – to prevent water collection under the tiles. A more suitable solution is available using a flowing adhesive, such as type C2E (for example AD 540) of liquid consistence. Prescribed dilatation joints must be observed and executed around the walls, structures, and on surfaces longer than 3 m. During laying and hardening of tiles, the temperature must not drop below +5 °C. After hardening, joints are to be filled with frost-resistant flexible jointing materials (such as GFS, CG2WA), dilatation joints filled with silicone (NSI) or, better, with polyurethane materials (such as SAB). Reliable results and long service life of tiled surfaces on balconies can be delivered by using the recommended LASSELSBERGER solutions [www.lbcscz-systemy-balkony](http://www.lbcscz-systemy-balkony), as shown in Fig. 6 and 7.

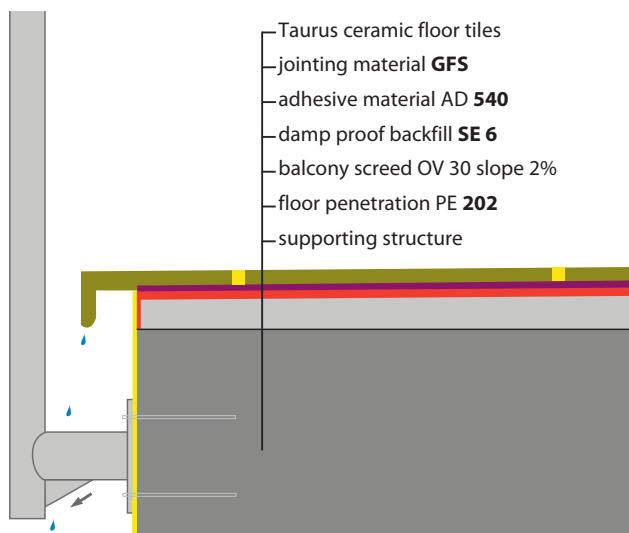


Fig. 6 – Balcony solution with a ceramic water bar

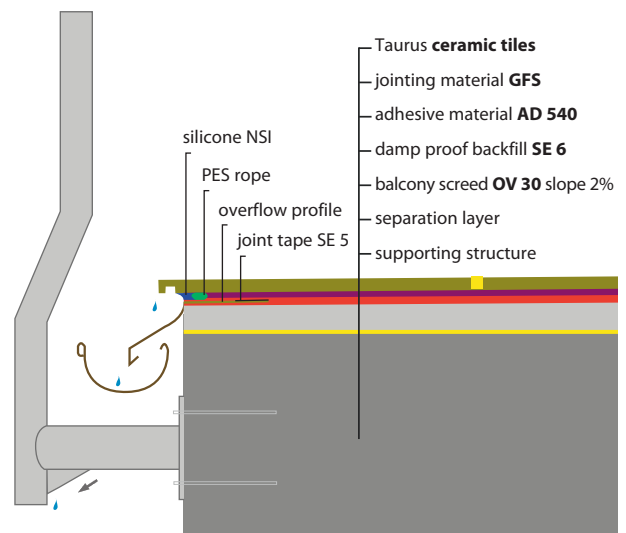


Fig. 7 – Balcony with metal sheathing

### 5.3.2 FLOOR HEATING

Floor heating has a number of advantages. It enables the nearly ideal distribution of temperature in the heated room. For heating with a stove or common central heating, the difference between air temperatures at the floor and at the ceiling is up to 8°C, with for floor heating the air temperatures throughout the space are nearly the same. Warm floor radiates heat to the people standing on it and to bottom parts of the walls, the air in the room is heated by convection, and the slow flow creates a pleasant environment. Radiation accounts for up to 60 % of the overall power output, and the thermal comfort can be achieved even at a lower air temperature in the heated room. This method reduces thermal loss due to heat passage through building structures, infiltration and ventilation. Thanks to good thermal conductivity (see the table of thermal conductivities),

Ceramics	1.00 W/(m.K)
Linoleum	0.17 W/(m.K)
Wood	0.20 W/(m.K)

siintered or compact ceramic tiles from the catalogues of home and building LASSELSBERGER ceramics, etc. are ideal materials for floor heating.

Additional energy savings can be achieved through floor heating operation. As the system uses heating water of temperatures lower than other heating systems, it is possible to use low-temperature heat sources. For gas-fuelled boilers it means that combustion gases can be cooled to a significantly lower temperature than in traditional systems. Well-designed floor heating cools combustion gases so that the condensation heat can be used and the efficiency of the heat sources may increase by up to 6 %.

Technical development has significantly improved properties of the employed materials and installation methods. The original steel pipes have been replaced with copper or plastic, welded and threaded joints have been replaced with moulded-on connectors. Fibre insulation materials have been replaced with polystyrene, and asphalt sheets were replaced with polyethylene foil. Distributors, mixing blocks with control valves, circular pumps and control automatics are serial-made products, which significantly reduces working times on site, and improves the quality of installation

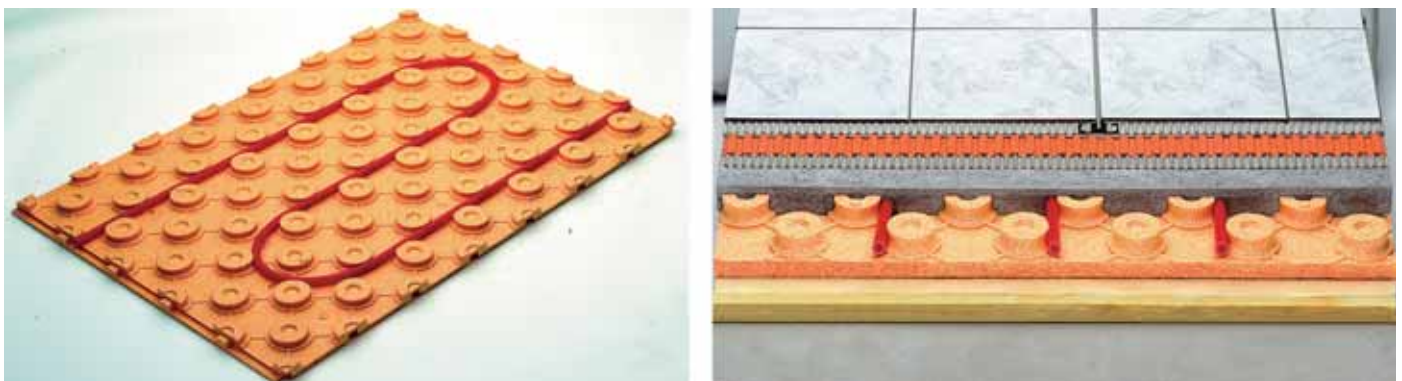


Fig. 8 – Example of water-based floor heating with the minimum thickness of screed

Owing to the mass of the concrete plate, the floor heating system offers high thermal inertia. Therefore, it is not capable of quick response to temperature changes. Rooms with floor heating should not be fitted with large windows.

The effect of cold surfaces and flow of cold air may be reduced by installing an edge border with higher frequency of pipes. This serves to promote the output and surface temperature of the floor which, for health concerns, should not be permanently higher than 28 °C. An even more suitable solution includes the installation of a supplementary floor convection unit with higher temperature of the heating water. This unit may include a fan for quick response to change of the weather.

It is a common notion that floor heating is associated with large investment costs. However, a more detailed analysis shows that the larger part of the costs is taken up by construction work, thermal insulation and structure of the floor. A quality design of the heating system guarantees a good return of the investment. We recommend that floor heating systems be built with any compact and sintered LASSELSBERGER floor tiles, including calibrated large tiles (TAURUS, KENTAUR).

### Electric floor heating

Floor heating cables and mats are effective for application in accumulation or direct heating of thin interior floors and in defrosting systems. Figure 9 shows a procedure which requires strict adherence to the instructions provided by the manufacturers. These thin-layer heating systems, too, are a good application of compact and sintered LASSELSBERGER tiles, for example KENTAUR, TAURUS, etc. and flexible C2 TE type adhesives and jointing materials of the LBCS system.

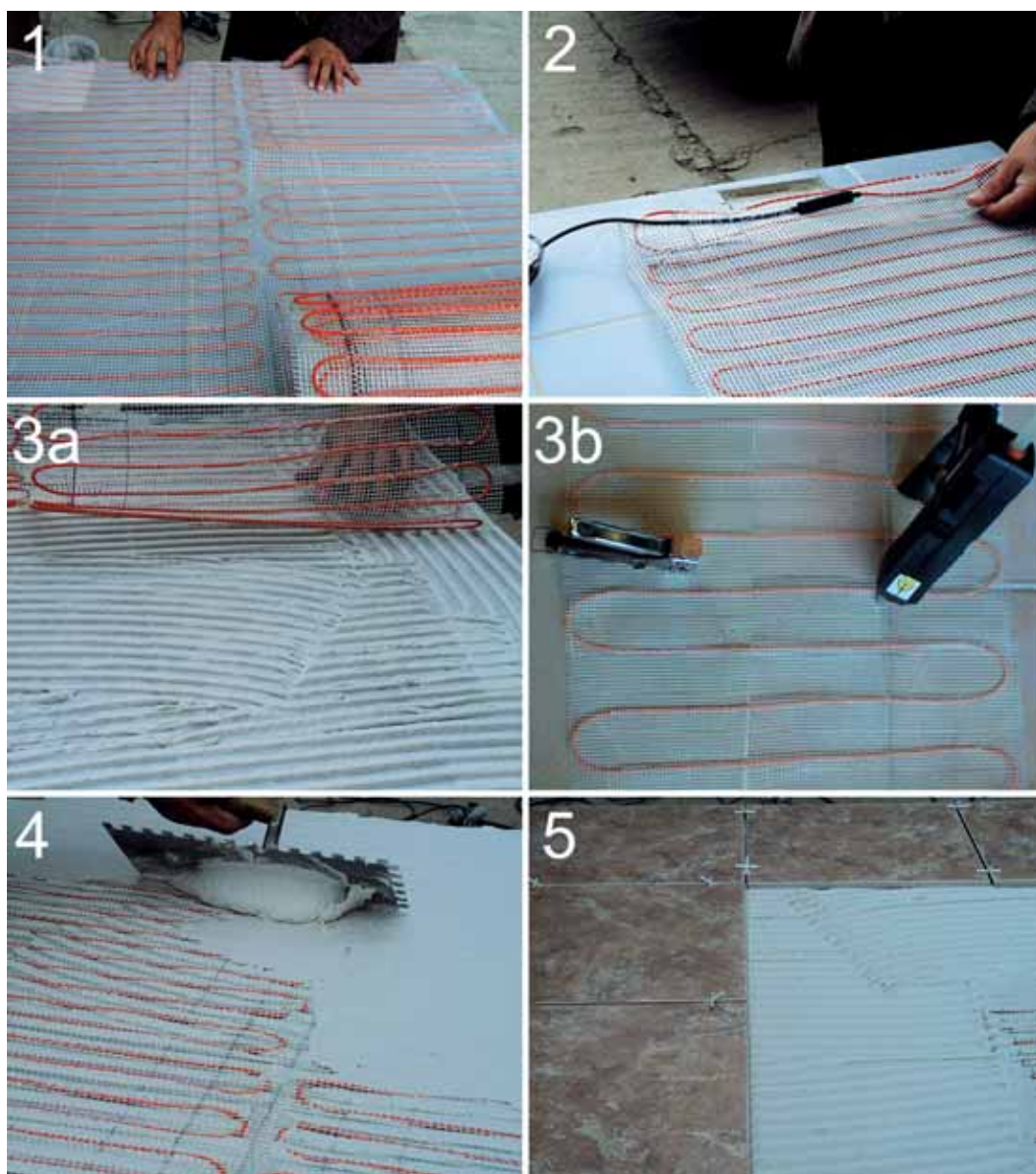


Fig. 9  
**Installation of electric floor heating**

- 1 – Roll out the heating mats
- 2 – Connect the heating mats
- 3a, 3b – Fix the mats to the penetrated base
- 4 – Carefully embed the heating mats with adhesive
- 5 – Lay the tiles

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## Designing of the Hot-Water Floor Heating

The theory for computation of radiating heating is very complicated. For the first fast orientation, power output tables can be used, as shown in all instruction manuals provided by floor heating suppliers. Observation of installation procedures must be documented in the site building log. For usual floor heating conditions the tables show, for example, for pipe space of 150 mm, the mean temperature of heating water is 40 °C, room temperature is 20 °C, and for tiled floors, the maximum power output is 100 W/m<sup>2</sup>. For carpet flooring, the output will reduce by 25 %. In addition, the change of the mean temperature of heating water by 5 °C will result in an increase or decrease of the power output by approximately 25 %. The temperature of heating elements should not permanently exceed 60 °C.

The heated area includes a base thermal insulation, supporting structure of heating pipes, concrete filler, and surface finish. Heating pipes may be set using various methods. The so-called system board consists of thermal insulation provided with a raster of lugs to position heating pipes at regular spacing distances. On a smooth insulation board, the pipes are fixed with clamps or on wire mesh stands with optional spacing, e.g. to create a peripheral zone with higher heating output. Thermal insulation can be also covered with a reflective layer or aluminium sheet to increase the output, and to achieve more even distribution of temperature in the floor.

Surfaces longer than 3 m must be provided with dilatation joints situated at the walls, doors and supporting structural and expansion elements (see Chapter 5.4 Tile Jointing). All electric and heating installations must conform to all related safety regulations.

Concrete or anhydrite filling must cover the heating pipes with a layer at least 45 mm thick. A plasticizer may be added into the concrete filler to ensure better contact with plastic pipes. The heating board, as well as the adjoining heating circuits, must be separated from the external walls with dilatation joints. A pressure test must be completed before concreting, and the pipes must be kept pressurized until the board is fully hardened (21 days for a cement slab). Also, the first heating must be gradual, the temperature in the system may grow only by 5 °C in 24 hours. After the operating temperature is achieved, its reduction must be also gradual, or else the pipes may separate from the concrete and thus reduce heat transfer and power output.

Tiles may be glued on the surface only after completion of the operations described above, using a flexible thin-layer adhesive LBCS- **AD530**, which ensures excellent heat transfer to the base slab with less than 2 % of water in concrete and less than 0.3 % of water in anhydrite (as measured by the carbide method). Tiles smeared with the adhesive must be promptly cleaned and covered with protective foil to prevent fast release of water from the hardening adhesive and potential pollution. After the time specified by the manufacturer of the adhesive, the tiles should be jointed with a flexible jointing material and immediately cleaned with a sponge and clean water.

### Literature:

Ing. Kotrba Vladimír: Podlahové vytápění, Materiály pro stavbu 6/2000, Bertelsmann Springer CZ

## 5.3.3 STAIRS

We recommend application of stair shaped tiles for installation of interior and exterior stairs. Stair tiles in size 60x30 cm from the Sandstone Plus, Essencia, Unistone, and Taurus Double, custom order Noe tiles 120x30 cm decorated with wood surface motives, and Defile stair tiles 42x45 cm are suitable for all apartments, family houses, and exclusive interiors.

Standard staircases in apartment buildings, family houses, public buildings, administration buildings, offices, schools, and shops offer good application of the 30x30 tiles from the Taurus, Andalusia, Antik, and Travertin series. A suitable solution are also the ceramic stair fillets that complement the Venezia, Antik, Andalusia, and Travertin series. Exterior installations in apartment buildings, offices, and schools require application of 30x30 com Taurus Granit stair tiles with SR7 embossed surface and sufficient anti-slip resistance class R11/B.

## 5.4 TILE JOINTING

Jointing can be performed once the mortar or adhesive has sufficiently hardened. Traditional jointing with cement has been replaced with modern jointing materials of various colors. Make sure to observe manufacturer's instructions and promptly clean tiles smeared with the material. **Joint width** (typically 2-6 mm) depends on the size, thickness and type of tiles. Calibrated tiles marked with the **R** icon have very small dimensional deviations and enable laying with the joint width of 1.5-2 mm. Recommended optimum width for LASSELSBERGER, s.r.o. module tiles is 3mm. It is vital that the jointing material fills the joints entirely, without any gaps or hollows.

### Selection of the Jointing Material

Jointing materials should be selected as per the purpose of the joint. The manufacturer recommends to use jointing materials from the LB CERAMIC SYSTEM ([www.lbcs.cz](http://www.lbcs.cz)). Other jointing materials, particularly those with distinct colours, should be first tested on a tile sample. The properties of the jointing material should be similar to those of the adhesive material. Jointing materials can be divided into several groups based on their chemical composition:

- Cement-based jointing materials (for example: GT, GW, GF, GF Bio, GFS)
- Silicone materials (for example: SI, NSI)
- Epoxy materials (for example: GE)
- Polyurethane materials (for example: SAB)

### Cement and Polymer-Cement Jointing Materials

Cement jointing materials LB CERAMIC SYSTEM (GT, GW) are used for common jointing of interior wall and floor tiling not exposed to mechanical and chemical effects, for wall and floor tiling in apartments, offices, etc. For more demanding applications, brittleness of common jointing materials can be reduced by addition of special polymers. In this manner prepared jointing materials are stronger and more flexible. The resulting materials are called polymer-cements. They are used for exterior and exposed surfaces, depending on the content of the additive. The manufacturer recommends flexible jointing materials (GF Bio, GF) for kitchen counters, laboratory tables, canteens, and floors exposed to mechanical and thermal effects, including floor heating. Joints of tiles for floor heating have standard widths determined by the size, thickness, and type of tiles, such as calibrated tiles with a joint of 1.5–2 mm. These must be complemented with expansion joints at a distance of no less than 3 m.

### Polymer Jointing Materials

These materials have been developed for special areas of application. They deliver good resistance to water, chemical agents, weather and mechanical stress. Thanks to their flexibility, silicone and polyurethane materials are used particularly as fills in thermal expansion joints. Epoxy materials (GE Easy, GE) feature high chemical and mechanical resistance; therefore, they are suitable for chemical and food-processing plants, e.g. breweries, slaughter houses, soft-drink factories, dairies, canneries, as well as for jointing of pools and tanks.

### Jointing of Glass Accessories

White or light color adhesives (Class C2) and jointing materials must be used for gluing and jointing of glass accessories.

### Expansion Joints

Ceramic tiling with thermal load, e.g. floor heating, terraces, balconies, and facades, needs to be fitted with thermal expansion joints every 3 meters. All other ceramic tiling must have thermal expansion joints every 6 meters; a corner joint must always be installed between wall and floor tiling. Expansion joints wider than 5 mm are filled with flexible silicone or polyurethane materials. These joints may also be installed in the form of special expansion boards.

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## 6. Maintenance of Tiled Surfaces

**Regular and correct cleaning** is an inherent part of tiling care. It is recommended to use the proven cleaning agents CL 802, CL 803, and CL 810 which are applied in professional floor and wall tiling; these products are offered by LASSELSBERGER. ([www.lbcs.cz](http://www.lbcs.cz))

During **normal maintenance of tiles**, it is recommended to wash ceramic tiles with a mixture of clean water and CL 803 agent (use 50-150 ml of agent in 10 liters of water) which delivers both cleaning and polishing functions. For cleaning after longer periods of time or cleaning of heavily polluted tiles, it is recommended to use the cleaning agents CL 802 (150-250 ml per 10 liters of water) and CL 810 (100-150 ml per 10 liters of water) to remove fatty dirt. Always wash the tiling surface with clean water after cleaning. Decorative elements ornamented with gold, platinum, pearlescent, or metallic surfaces can be washed with water and CL 803 cleaning agent free of abrasive elements.

During the **post-construction cleaning**, the contractor should carefully remove all remaining cement and cement jointing materials from the ceramic tiles. Even the slightest layer of cement binds dirt and has a negative effect on the appearance of the ceramic tiling. For post-construction cleaning, it is recommended to use CL 802, professional-grade remover of cement stains, at the dilution rates indicated above. Abundantly soak the surface, especially the joints, with water, then apply the cleaning solution with a mop or brush. Allow 10-15 minutes for application; always remember to wash the surface thoroughly with clean water.

**Maintenance of anti-slip floors** requires exceptional care and special agents corresponding to the type of pollution. For fatty surfaces, the use of alkaline cleaning agent CL 810 is recommended. Before and after the use of acidic or alkaline detergents, it is necessary to wash the floor thoroughly with plenty of clean water. For large surfaces, cleaning machines are recommended with gentle mechanical cleaning or pressurized water. Special tools are recommended to remove water from the surface of anti-slip floor tiles, e.g. on pool decks and large kitchens (rubber blades/spatulas, etc.). Apply CL 809 agent for easier maintenance of anti-slip tiles.

**CL 809 tiling penetration agent** facilitates maintenance work and reduces consumption of cleaning products. A thin layer of the CL 809 protective compound does not change the color of the surface nor the anti-slip properties of the tiles, yet it greatly reduces dirt accumulation on the surface. The product is applied in two very thin layers on carefully cleaned, dry tiles. The protective layer must be applied to polished sintered tiles after installation and after each cleaning. For common maintenance of thus treated polished tiles, mixture of water and CL 803 agent (see above) suffices.

**Winter maintenance.** Thanks to their solid resistance to chemicals and abrasion, sintered floor tiles in the exterior may be treated in winter with salt or inert material, depending on the need and weather.

To clean tiles from residues of organic materials, silicon, or epoxy, use agents with specific effects: CL 805 and CL 806, available from the LB CERAMIC SYSTEM ([www.lbcs.cz](http://www.lbcs.cz)). In practice, it is always necessary to follow the manufacturer's recommendations and safety instructions. In particular, be sure to protect your eyes.

Contact LBCS and RAKO technical consultancy ([www.lbcs.cz](http://www.lbcs.cz), [www.rako.cz](http://www.rako.cz) – services – expert audience – technical advisory contacts) for proper cleaning routine of a given area..

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## 7. Certification of Products and Quality Management System

**LASSELSBERGER, s.r.o.** pays systematic attention to the quality of its products. A **quality management system** for products and services has been developed in conformity to the international standard ISO 9001:2009. The management system has been regularly reviewed by the accredited organization of Technický a zkušební ústav stavební Praha (Technical and testing institute for constructions, Prague), which has also issued the certificate of QMS conformity with ČSN EN ISO 9001:2009.

**Products of LASSELSBERGER, s.r.o.** have been regularly tested by an independent accredited testing laboratory, the Technický a zkušební ústav stavební, Praha, to verify conformity of tile properties with the provisions of the European Council Directive 89/106/EEC.

The products manufactured and raw materials used are regularly tested for radiation-hygienic safety as per the State Office for Nuclear Safety Decree 307/2002 Coll., as amended by Act 13/2002 Coll. The testing organization has issued a certificate of safety for the products and materials of **LASSELSBERGER, s.r.o.**

Based on the mentioned supporting documents, the following declarations have been issued to meet the needs of customers and distributors, in agreement with the European Directive (EC):

**EC-Declaration of conformity for properties of ceramic tiles with water absorption over 10 %, EN 14411 BIII,** in reference to European Council Directive 89/106/EEC.

**EC-Declaration of conformity for properties of glazed ceramic tiles with low water absorption from 0.5 to 3 %, EN 14411 BIb,** in reference to European Council Directive 89/106/EEC.

**EC-Declaration of conformity for properties of unglazed and glazed ceramic tiles with low water absorption below 0.5%, EN 14411 BIa,** in reference to European Council Directive 89/106/EEC.

**Declaration of conformity of glass components for interior wall and floor tiling** to the Decree of the Government of the Czech Republic 163/2002 Coll., as amended by Decree 312/2005 Coll.

Copies of the declarations of conformity for properties of LASSELSBERGER, s.r.o. products with the requirements for building products and product certificates are available in the network of direct dealers of LASSELSBERGER, s.r.o. products and at the internet address **www.rako.cz – service – Declaration of conformity**. A certificate on the conformity of the products to the respective requirements is indicated in each delivery certificate issued by the manufacturer.

## CERTIFICATES OF TILING ELEMENTS MANUFACTURED BY LASSELSBERGER , s.r.o.

### A/ CZECH REPUBLIC CERTIFICATES

Conformity of properties found in ceramic tiles manufactured by LASSELSBERGER, s.r.o., Pilsen with the requirements of **CSN EN 14411** is attested by certificates issued by the accredited testing laboratory 204, TZÚS Pilsen, for these products:

**Ceramic tiles, dry pressed, with water absorption over 10 % declared according to CSN EN 14411, Group BIII, Annex L**

**Ceramic tiles, dry pressed, with water absorption 0.5-3 % declared according to CSN EN 14411, Group BIb, Annex H**

**Ceramic tiles, dry pressed, with water absorption below 0.5 % declared according to ČSN EN 14411, Group BIa, Annex G**

### B/ FOREIGN CERTIFICATES OF PRODUCTS

Compliance of properties of LASSELSBERGER, s.r.o. products with applicable standards on the respective territories has been also confirmed by certificates for the following countries:

**FRANCE  
RUSSIA  
UKRAINE**

### C/ QUALITY MANAGEMENT SYSTEM CERTIFICATES

The certificate of the quality management system attests to the conformity of the management, organizational and technical procedures used in LASSELSBERGER, s.r.o. for production of ceramic tiles with the requirements of internationally recognized rules for continuous improvement of quality and services specified in ČSN EN ISO 9001:2009. The certifying organization is the Certification Body for Quality Systems, CQS, in Prague.

**Certificate no.: CQS 2255 / 2010**

**Standard: CSN EN ISO 9001:2009**

Copies of these certificates are available for business partners in the corresponding language versions of the website **[www.rako.cz-servis-certifikaty](http://www.rako.cz-servis-certifikaty)** and in the following information lines:

**Phone: +420 800 303 333**

**Fax: +420 378 021 309**

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## 8. Warranty Conditions

The manufacturer LASSELSBERGER, s.r.o. Pilsen provides all its ceramic tiles with

### 2 years of warranty

for properties specified by the respective EN 14411 standard.

The warranty shall apply only whilst observing the manufacturer's recommendations, proper storage and handling, as well as proper execution of construction and laying work.

Should the customer receive a product the properties of which fail to meet the agreed quality, then the customer is entitled to claim these products. In doing so, the procedure specified herein must be observed. All claims must be made immediately in writing, and submitted to the direct supplier – dealer. For visible defects (size, flatness, glaze defects, shades, type confusion), the claim must be made **before commencement of the laying work** while the goods is in the original packaging.

Dear Customer,

Our employees are willing to answer any your questions and to discuss your comments and recommendations concerning LASSELSBERGER, s.r.o. ceramic tiles and their specific applications.

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## Notes

