

# TKB-Technical Briefing Note 7

## Installation of PVC Flooring

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## 1. Introduction

This technical briefing note advises the installer on selection of installation materials for PVC flooring. It contains information on the different types of PVC flooring, classified according to the relevant European standards. When installing PVC flooring, the specific characteristics of the different flooring types must be taken into consideration. Adhesive types are classified relative to composition, type of processing and setting behaviour.

This technical briefing note does not deal with installation of PVC flooring on special constructions such as sports or industrial floors.

## 2. Classification of PVC Flooring according to European Standards

PVC flooring is made from polyvinyl chloride, mineral aggregates, pigments, plasticizers, stabilizers and other additives. It is available in sheets, tiles and flooring elements/planks and is glued down during installation. Other installation methods are not described in this technical briefing note.

PVC flooring is manufactured in many different forms and designs. Classification of the different PVC floorings is described in various European standards:

- Homogeneous and heterogeneous polyvinyl chloride floor coverings without underlay according to DIN EN 649
- PVC flooring with a backing made from either polyester felt or jute or a combination polyester felt/PVC according to DIN EN 650
- PVC flooring with foam layer according to DIN EN 651
- PVC flooring with cork backing according to DIN EN 652
- expanded (cushioned) polyvinyl chloride PVC flooring according to DIN EN 653
- flexible PVC tiles according to DIN EN 654
- PVC flooring with increased particle-based slip resistance according to DIN EN 13845

### 3. Adhesives for PVC Flooring

#### 3.1 Types of Adhesives

##### 3.1.1 Dispersion Adhesives

Dispersion adhesives consist of organic binding materials dispersed in water, inorganic fillers and additives. Setting takes place based on a physical process when the water contained in the adhesive evaporates. The setting properties of dispersion adhesives are mainly influenced by the climatic conditions of the installation environment. High temperatures and/or low humidity accelerate, low temperatures and/or high humidity delay the setting process.

For dispersion adhesives for one-sided application either wet or pressure sensitive (dry) bonding methods are applied to install PVC flooring. If the pressure sensitive (dry) bonding method shall be used, adhesives must be specifically approved for this process by the manufacturer. Wet bonding requires an absorbent substrate. If substrate is non-absorbent, a floor levelling compound must first be applied with a layer thickness of 2 mm to prepare an absorbent subfloor.

Dispersion contact adhesives are processed using the contact bonding method. They are applied to both sides – the prepared substrate and floor covering backing and must have sufficiently aired before installing the floor covering. They are mostly used for small area installations, e.g. installation of baseboards and flooring on stairs.

##### 3.1.2 Reaction Resin Adhesives

Reaction resin adhesives consist of chemically reactive organic binding materials, inorganic fillers and additives. Reaction resin adhesives for PVC flooring are mainly 2-component systems based on polyurethane or epoxy resins and set by chemical reaction. The curing speed of these adhesives is essentially influenced by the temperature of adhesive, substrate and floor covering. 2-component reaction resin adhesives require exact compliance with prescribed mixing ratio and careful mixing. They only have a limited pot life and open time.

##### 3.1.3 Solvent-based Contact Adhesives

Solvent-based contact adhesives consist of dissolved organic binding materials, highly volatile solvents (up to 80 %), inorganic fillers and additives. From a work safety, consumer and environmental protection perspective, use of these adhesives shall be reduced to the absolute minimum technically necessary. For all applications, dispersion contact adhesives or dry adhesives are an alternative.

#### Note:

The German "Gefahrstoffverordnung" (GefStoffV) (Ordinance on Hazardous Substances) and the German "Technische Regel für Gefahrstoffe (TRGS) (Technical Rules for Hazardous Substances) 610" massively restrict use of adhesives with high solvent contents for occupational health and safety reasons. The solvents used are highly volatile, flammable and harmful compounds. In case the existing threshold values can not be safely adhered to, measures prescribed in GefStoffV must be taken.

##### 3.1.4 Dry Adhesives

Dry adhesives are sheets or strips which are self-adhesive on both sides and come in rolls of varying width. Dry adhesives are delivered ready-for-use by the manufacturer and therefore do not require airing, setting or drying time. After proper installation, they are immediately load-bearing. Use must be coordinated with the respective manufacturer.

##### 3.2. Selection of Adhesive Type

Preferably, PVC flooring is installed using solvent-free, very low emission dispersion adhesives such as EMICODE EC 1 products with one-sided application (one side adhesives). In addition, dispersion contact adhesives (e.g. for stairs and baseboards), reaction resin adhesives (e.g. on non-absorbent substrates or for high traffic areas) or dry adhesives can be used.

Only use adhesives declared suitable for installation of PVC flooring. Always observe notes regarding required application quantity or TKB trowel notch sizes.

### 4. Installation of PVC Flooring

#### 4.1. Substrate

TKB Technical Briefing Note 8 "Assessment and Preparation of Substrates for Installation of Floor Coverings and Parquet" as well as BEB-Merkblatt (BEB-information sheet) "Beurteilen und Vorbereiten von Untergründen. Verlegen von elastischen und textilen Bodenbelägen, Schichtstoffelementen (Laminat), Parkett und Holzpfaster. Beheizte und unbeheizte Fußbodenkonstruktionen" (Assessment and preparation of substrates. Installation of elastic and textile floor coverings, laminate, parquet and wood paving. Heated and non-heated floor constructions) contain detailed instructions and specifications regarding required tests.

## 4.2. Storage and Conditioning

PVC flooring shall be stored in a dry place at a temperature between 15 °C and 25 °C. Store sheets in rolls in standing position and do not expose to sunlight. Tiles and flooring elements/planks are stored flat and stacked in boxes, maximum stacking height 8 boxes.

For conditioning before installation, store floor coverings for at least 24 hours at a room temperature of minimum 18 °C. Relative air humidity shall preferably be between 40 – 65 %, however shall not exceed 75 %. For panels, it has been proven beneficial to fan out the individual panels before installation.

## 4.3 Installation Conditions

The relative air humidity shall preferably be between 40 – 65 %, however it shall not exceed 75 %. Ambient air temperature as well as the temperature of the installation materials, e.g. floor covering and adhesive must be at least 18 °C, substrate must have a minimum temperature of 15 °C.

On the basis of curing, drying and reaction times of the installation materials, the above room climate conditions shall be maintained for 3 days before installation, during and for 7 days after completion of installation work.

If temperatures rise during curing phase of the adhesive, e.g. on account of direct sunlight, dimensional changes of the floor covering may occur. Consequently, flooring and installation materials shall be protected from direct sunlight or other thermal effects before, during and after installation until adhesive has completely cured. Only after adhesive is completely cured shall furniture of any kind be placed on flooring.

## 4.4 Bonding

### 4.4.1 Bonding of PVC Flooring

For bonding, the adhesives mentioned under item 3 shall be used. Guidelines of flooring and adhesive manufacturers shall always be observed.

One-side dispersion adhesives are applied to substrate using the recommended TKB trowel notch size. It is recommended to work with an 18 or 21 cm wide notched trowel. Using a 28 cm wide notched trowel might lead to the formation of adhesive pooling with resulting bubble-like convexities. PVC flooring can be installed with the wet or pressure sensitive (dry) bonding method depending on substrate and suitability of the adhesive.

Wet bonding method:

On absorbent substrates, the PVC flooring is placed in the still wet adhesive bed after short air drying time. Always observe open time, i.e. the period during which the back of the flooring can be fully wetted with adhesive.

Pressure sensitive (dry) bonding method:

The pressure sensitive (dry) bonding method can be used on absorbent as well as on non-absorbent substrates if manufacturer has not issued any restrictions. For non-absorbent substrates, preferably use TKB trowel notch sizes with low adhesive consumption to minimize risk of residual indentations. With this method, the flooring is placed in the adhesive bed which is fully air-dried. On dense, non-absorbent substrates check by finger testing if a dry and surface tacky adhesive film has formed (to avoid water ingress). When lightly touching the adhesive bed with the fingertip, no adhesive shall stick to finger. This “pressure sensitive bonding phase” is rather limited and is influenced by climatic conditions. Flooring must be placed in adhesive bed during pressure sensitive bonding period. With pressure sensitive bonding, the risk of unavoidable residual indentations is higher than with the wet bonding method.

For both methods, the time when flooring is placed in adhesive bed depends on the prevailing climatic conditions in installation room.

Irrespective of the chosen bonding method, immediately after flooring has been placed in adhesive bed, it is rubbed down from the middle to the outside using a carpet-covered cork panel to prevent air pockets. At the end of the waiting time specified by the adhesive manufacturer, the flooring is rolled down using a multi-sectional roller with a minimum weight of 50 kg. This ensures optimum wetting of the floor covering backing. Start the rolling process from the centre to the outside and repeat this process after 30 - 60 minutes.

#### General note:

Residual indentations caused by high punctual loads visible under a spotlight can never be completely avoided with resilient flooring. However, they can be minimized by selecting the right adhesive, application quantity (use of TKB recommended notched trowel with suitable notch sizes), proper processing and choice of appropriate chair/furniture sliders (large and level contact surface, no sharp edges) and/or use suitable pressure distribution underlays under movable furniture or rollers (type W according to EN 12529).

#### 4.4.2 Installation of flexible Tiles and PVC Flooring in Tiles

When installing tiles, always observe manufacturer's instructions concerning laying direction. For measurement, always make sure of even space distribution subject to offcuts. The first tiles are loosely positioned along the defined reference line (line out) and adhesive is then applied starting from here. For adjoining rooms, laying direction should be followed. To best prevent residual indentations during use, PVC design flooring shall be installed with the wet bed method. On non-absorbent substrates only reaction resin or dry adhesives or pressure sensitive bonding can be used according to manufacturer's instructions. After PVC floor covering has been laid, it must be rubbed down.

#### 4.4.3 Installation of PVC Flooring in Sheets including Seam Edge Cutting

The seam edges of the sheet lengths must be cut since only cleanly cut seams will guarantee clean joints. The first sheet edge is straightened using a strip cutter or edge cutter. For the second sheet there are two methods:

- (a) For small rooms (before application of the adhesive):

An already cut length of sheet is placed on top of another length which is then cut along the edge of the upper length. The resulting strip is then cut off in the opposite direction using a hooked blade.

- (b) For large rooms (after application of the adhesive):

The upper length of sheet is cut using a scribe or linocut along the edge of the lower sheet already placed in the adhesive bed, the resulting strip is cut off with hooked blade.

After the individual lengths have been cut, the so-called guidance length is folded back by half making sure of a big radius in order to prevent fold marks in the flooring. For the following sheet length, the course of the seam is marked on the substrate for orientation purposes. After the remaining lengths have been folded back, a straight line is marked with a line or steel ruler directly in front of the folding edge. It is recommended to put down masking tape along the line which is then removed immediately before adhesive is applied for the second half of the length. Starting at the tape, adhesive is evenly spread using the recommended TKB notched trowel size. The folded back lengths are then slid into the fresh adhesive over a length of approximately 10 cm. This offers the advantage that adhesive is still relatively fresh when the second length is processed and clearly visible marks of this area on flooring surface are mostly avoided.

After appropriate airing time the guidance length is lined up along the marking. All flooring lengths are then slid into adhesive bed avoiding air pockets. The top ends might have to be decurled and pulled down. Next, the flooring is rubbed and rolled down as described under item 4.4.1.

After waiting time specified by adhesive manufacturer, the flooring is rolled down over the entire area.

After the second half of the length has been folded back, adhesive is applied starting at the previously applied adhesive layer. Always avoid to apply two layers of adhesive in the same area since it may show after installation. The next steps are identical to those of the first half of the sheet.

#### 4.4.4 Bonding of Profiles

Dry or dispersion contact adhesives are recommended for bonding of profiles. When using these adhesives, the elements to be glued must be fitted exactly since subsequent corrections are almost impossible to perform. After installation, the elements must be immediately pressed and tapped down firmly over the entire length.

#### 4.4.5 Conductive Bonding of PVC Flooring

The requirements for the electrostatic behaviour of a floor can vary according to the intended use of the room. A distinction is made between insulating, anti-static and conductive PVC flooring. Conductive PVC flooring requires the use of a conductive adhesive.

PVC flooring and adhesive are installed on a conductive system, which subsequently must be properly grounded. Adequate connections must be available on site. Connection of the conductive system to ground is performed via a copper strip and shall only be executed by a qualified electrician.

##### **Note:**

The standards mentioned in chapter 5 are only test standards and do not describe the conductive systems.

##### 4.4.5.1 Conductive Bonding on Copper Strip Grid

Conduction is performed via a copper strip installed centred under each length or tile row. The ends of the copper strips shall be connected with each other. The position of the copper strips shall be marked using a line. The conductive adhesive is applied in a thin coat along the line using a Japan spreader, the strip is installed and covered with another thin layer of adhesive to avoid that edges will show later. Every 30 m<sup>2</sup>, a connection is



required for potential equalization (qualified electrician).

Next, the conductive PVC flooring is installed using a conductive adhesive.

#### 4.4.5.2 Conductive Bonding on a transverse conductive Layer

A transverse conductive layer is created by applying a conductive dispersion primer over the entire area. In this case, the copper strip grid described above is not required. Every approx. 30 m<sup>2</sup>, a connection with a 1 m long copper strip is required for potential equalization (qualified electrician). For large areas, the distance between the individual copper strips shall not exceed 8 - 10 m. Since a transverse conductive layer considerably reduces absorbency of the substrate, installation is normally performed with pressure sensitive (dry) bonding method.

#### 4.4.5.3 Conductive Bonding with double Requirements

For conductive bonding with an additional transition resistance RST according to VDE 0100, an electrical minimum resistance of 50,000 Ohm is required to protect users. In any case, instructions of flooring manufacturer must be observed. The crucial factor is to match conductivity of the flooring and the adhesive. The substrate shall be sufficiently dry, since moisture may result in minimum resistance not being met. Every 30 m<sup>2</sup> a connection with a 1 m long copper strip is required for potential equalization (qualified electrician).

#### 4.4.5.4 Conductive Flooring with conductive Backing

For conductive flooring in sheets with a conductive layer on the back, bonding and grounding can also be performed only at the top end of the sheet in overlap, perpendicular to the sheet direction depending on manufacturer's instructions. Every 30 m<sup>2</sup> a connection for potential equalization is required (qualified electrician). Tile flooring is basically bonded over the entire area using a conductive adhesive.

#### 4.4.6 Bonding of PVC Flooring on Underlays

Basically, a combination of flooring and underlay has different technical properties than the flooring alone.

The manufacturers of the PVC floor covering and the underlay must be contacted regarding functionality of the respective combination. During installation it shall be ensured that the edges of underlay and PVC sheet flooring are not congruent. Depending on manufacturer's instructions, the underlay shall be levelled using either dispersion floor levelling compounds or

2-component polyurethane floor levelling compounds.

Basically, all flooring must be welded.

#### 4.5. Seam Sealing

Sealing of the seams is always recommended in commercial areas or when floor covering is exposed to constantly changing temperatures (e.g. underfloor heating). With substrates sensitive to moisture (e.g. wood composite panels or calcium sulfate floors), in rooms where industrial wet cleaners are used (e.g. cleaning units), in hygiene areas and areas where moisture is brought in from the outside (entrances), seams must always be welded. Welding shall only take place after adhesive has completely cured. Depending on type of adhesive and room climate, this may take several days. Please always observe manufacturer's instructions.

The longer the waiting time, the lower the risk of damage and separation in joint area. Design flooring and semi-flexible polyvinyl chloride tiles are never welded.

##### 4.5.1 Thermal Welding

PVC flooring can be thermally welded using a PVC welding cord suited for the respective flooring type.

When using a 4 mm welding cord, the seam edges are cut using a 3.3 mm wide parabolic cutting blade to a depth of approx. 2/3 of the floor covering thickness. For flooring with foam backing cut only to the foam. In the area of the wall connection, open floor covering using a hand groover. Joint width shall not exceed 3.5 mm. Then clean the groove thoroughly (vacuum or clean with blow jet).

The welding cord can either be inserted into the joints with a welding machine or a hand welder with attached speed welding nozzle - with consistent pressure and speed. The connection between welding cord and flooring is only achieved when adhering to the welding temperature specified by flooring manufacturer. In order to minimize damage to flooring surface, e.g. with surface finishes, a welding nozzle with narrow air outlet shall be selected.

Excess material is removed in two steps:

- The first removal step is performed when welding cord has not yet cooled down using a sharp quarter moon knife with trim guide attached.
- The second step takes place only after joint has completely cooled down – excess is removed flush to flooring surface, also using a quarter moon knife.

If no quarter moon knife is at hand, an appropriate trimming knife can be used which will only work in the joint area when removing excess welding cord.

#### 4.5.2 Cold Welding

As an alternative to thermal welding, PVC flooring can also be welded using a cold welding agent.

One prerequisite for this method is that seams are densely cut and clean. To protect the flooring surface, the seam is covered with a thin adhesive tape. The adhesive tape is then carefully cut open right above the seam using a knife. The cold welding agent is pressed into the joint with an appropriate special nozzle and the adhesive tape is then immediately removed. For at least 3 hours, do not put any load on the freshly welded area.

## 5. Relevant Standards and Information Sheets

In the following, relevant standards and other technical briefing notes are listed. They represent the current versions at time of publication of this technical briefing note.

### 5.1 Industrial Safety

Gefahrstoffverordnung (GefStoffV), Published December 23, 2004 (BGBl. I S 3758), amended by article 2 of the ordinance of December 18, 2008 (BGBl. I S 2768)

TRGS 430  
Isocyanate – Gefährdungsbeurteilung und Schutzmaßnahmen (March 2009); Ausschuss für Gefahrstoffe (AGS); GMBI No. 18/19 (04.05.2009)

TRGS 610  
Ersatzstoffe und Ersatzverfahren für stark lösemittelhaltige Vorstriche und Klebstoffe für den Bodenbereich (March 1998); Ausschuss für Gefahrstoffe (AGS); BArbBl. issue 3/1998

TRGS 900  
Arbeitsplatzgrenzwerte (January 2006); Ausschuss für Gefahrstoffe (AGS); BArbBl. issue 1/2006 last supplemented and amended GMBI No. 12-14 (27.03.2009)

TRGS 907  
Verzeichnis sensibilisierender Stoffe (Notification BMA according to § 52 Abs. 3 Gefahrstoffverordnung (October 2002); Ausschuss für Gefahrstoffe (AGS); BArbBl. issue 10/2002

EMICODE  
Gemeinschaft Emissionskontrollierte Verlegetwerkstoffe, Klebstoffe und Bauprodukte e. V. (GEV), Düsseldorf

### 5.2 Standards for PVC Flooring

DIN EN 649  
Resilient floor coverings - Homogeneous and heterogeneous polyvinyl chloride floor coverings - Specification  
01-2004

DIN EN 650  
Resilient floor coverings - polyvinyl chloride floor coverings on jute backing or on polyester felt backing or on polyester felt with polyvinyl chloride backing - Specification  
01-1997

DIN EN 651  
Resilient floor coverings - polyvinyl chloride floor coverings with foam layer - Specification  
01-2004

DIN EN 652  
Resilient floor coverings - polyvinyl chloride floor coverings with cork-based backing - Specification  
01-1997

DIN EN 653  
Resilient floor coverings - expanded (cushioned) polyvinyl chloride floor coverings - Specification  
01-1997

DIN EN 654  
Resilient floor coverings - semi-flexible polyvinyl chloride tiles - Specification  
01-2004

DIN EN 12466  
Resilient floor coverings - Vocabulary  
06-1998

DIN EN 13845  
Resilient floor coverings - polyvinyl chloride floor coverings with particle-based enhanced slip resistance - Specification  
10-2005

DIN EN 14041  
Resilient, textile and laminate floor coverings – essential characteristics  
05-2008

### 5.3 Standards for Adhesives used in Installation of PVC Floor Coverings

DIN EN 14259  
Adhesives for floor coverings – requirements for mechanical and electrical behaviour  
07-2004

DIN EN 1372  
Adhesives - Test method for adhesives for floor and wall covering adhesives – Peel test  
October 1999

**DIN EN 1903**

Adhesives - Test method for adhesives for plastic or rubber floor coverings or wall coverings - Determination of dimensional changes after accelerated aging  
June 2008

**DIN EN 13415**

Test of adhesives for floor coverings - Determination of electrical resistance of adhesive films and composites  
August 2002

**5.4 Standards for Floor Installation Work****DIN 18365**

VOB Vergabe- und Vertragsordnung für Bauleistungen – Teil C: Allgemeine Technische Vertragsbedingungen für Bauleistungen (ATV) – Allgemeine Regelungen für Bauarbeiten aller Art - Bodenbelagsarbeiten  
October 2006

**5.5 TKB Technical Briefing Notes****TKB-Technical Briefing Note 6**

Trowel notch sizes for floor coverings, wood flooring and tiles  
May 2007

**TKB- Technical Briefing Note 8**

Assessment and preparation of substrates for installation of floor coverings and parquet  
June 2004

**TKB- Technical Briefing Note 9**

Technical specification and installation of floor levelling compounds  
April 2008

**5.6 Other Standards and Information Sheets****BEB-Merkblatt**

Beurteilen und Vorbereiten von Untergründen. Verlegen von elastischen und textilen Bodenbelägen, Schichtstoffelementen (Laminat), Parkett und Holzpflaster. Beheizte und unbeheizte Fußbodenkonstruktionen.  
October 2008

**DIN18299**

VOB Vergabe- und Vertragsordnung für Bauleistungen, - Teil C: Allgemeine Technische Vertragsbedingungen für Bauleistungen (ATV) - Allgemeine Regelungen für Bauarbeiten aller Art  
October 2006

**DIN 1960**

VOB Vergabe- und Vertragsordnung für Bauleistungen - Teil A: Allgemeine Bestimmungen für die Vergabe von Bauleistungen  
May 2006

**DIN 1961**

VOB Vergabe- und Vertragsordnung für Bauleistungen - Teil B: Allgemeine Vertragsbedingungen für die Ausführung von Bauleistungen  
October 2006

**5.7. Literature and Commentaries**

Harald Kaulen, Günter Hahn, Ortwin Baumann  
Erläuterungen zur DIN 18365 – Bodenbelagsarbeiten und DIN 18299, Ausgabe 2002, 6. Auflage 2004

Arbeitskreis Bodenbeläge im Bundesverband Estrich und Belag e. V.  
Kommentar zur DIN 18365 - Bodenbelagsarbeiten 1. Edition, 2006)