TKB-Technical Briefing Note 4

Installation of Linoleum Flooring

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- Manufactures of linoleum floor coverings
- Bundesverband Estrich und Belag
- Zentralverband Raum und Ausstattung
- Zentralverband Parkett- und Fußbodentechnik
- Bundesverband der vereidigten Sachverständigen für Raum und Ausstattung

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1. Introduction

This technical briefing note advises the installer on selection of installation materials for linoleum flooring. It contains information on the different types of linoleum flooring, classified according to the relevant European standards. When installing linoleum flooring, the specific characteristics of the floor covering must be taken into consideration. Linoleum flooring comes in form of sheets or tiles and is fully bonded during installation.

This briefing note does not deal with bonding of linoleum flooring on special constructions, such as sport floor constructions, industrial floors, bonding of linoleum with corkment or foam backing or conductive installation.

Linoleum flooring is mostly made from renewable raw materials such as oxidized linseed oil, resin, cork and/or wood flour which are fused to a carrier after appropriate mixing in a calendaring process. The sheets produced in this manner then mature in heated drying chambers until requirements specified in the respective standards are met. Linoleum flooring has a number of characteristic properties which must be taken into consideration during installation.

During installation/bonding, linoleum flooring might react to moisture from air, substrate or adhesive resulting in dimensional changes of the flooring material.

General note:
Residual indentations visible under a spotlight, caused by high punctual loads, can never be completely avoided with resilient floor coverings. 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). This also includes that future use must comply with floor construction.

2. Classification of Linoleum Flooring

2.1 DIN EN 548 Resilient Floor Coverings – Specification for plain and decorative Linoleum

2.2 DIN EN 686 Resilient Floor Coverings – Specification for plain and decorative Linoleum on a Foam Backing

2.3 DIN EN 687 Resilient Floor Coverings – Specification for plain and decorative Linoleum on a Corkment Backing

2.4 DIN EN 688 Resilient floor coverings – specification for cork linoleum

3. Adhesives for Linoleum Floor Coverings

The different types of adhesives are classified relative to composition, type of processing, setting behaviour and requirements for substrate.

3.1 Types of Adhesives

It is recommended to preferably use very low emission adhesives with EMICODE EC1/EC1 R classification. Only use adhesives specifically approved by flooring manufacturer for bonding of linoleum floor covering. Always carefully observe instructions regarding required application quantity or trowel notch size.

Linoleum floor coverings are preferably bonded using solvent-free, very low emission EMICODE EC1 dispersion adhesives with one-sided application. Alternatively, contact or dry adhesives (e.g. for pedestal formation), 2 component dispersion-cement adhesives or reaction resin adhesives (e.g. on non-absorbent substrates or with high traffic loads) are used.

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 bonding of linoleum floor coverings, only dispersion adhesives are used with wet bed application. This requires an absorbent substrate. The adhesives are applied to the prepared substrate using the specified TKB-notched trowel. Dispersion adhesives have a limited open time during which the linoleum floor covering shall be placed in the adhesive bed. If open time is exceeded, wetting is insufficient and consequently the bond lacks strength (e.g. hollow areas).

3.1.2 Contact Adhesives

Solvent-based contact adhesives consist of dissolved organic binding materials, highly volatile solvents (up to 80 %), inorganic fillers and additives. Dispersion contact adhesives mainly consist of dispersions of natural and synthetic rubbers with inorganic fillers and additives.

Contact adhesives are only processed with the contact bonding process. They are applied to both sides, i.e. the prepared substrate and floor covering backing and shall be sufficiently aired before floor covering is installed. They are mostly used for small area installations such as for bonding of baseboards and flooring on stairs.

Note:
The German Gefahrstoffverordnung (GefStoffV) (Ordinance on Hazardous Substances) and Technische Regel Gefahrstoffe (TRGS) (Technical Rules for Hazardous Substances) 610 severely restrict use of adhesives with high solvent content for occupational health and safety reasons. For all situations of linoleum flooring bonding, solvent-free adhesives are available.

3.1.3 Other adhesives

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

2-component dispersion/cement powder adhesives consist of a liquid component based on organic binders dispersed in water, a cement and/or gypsum based powder component as well as fillers and additives. In addition to physical drying, a major part of the water contained in the adhesive is bound chemically by reaction with the powder component. On account of this chemical water-binding, less water is given off to the environment (here floor covering and substrate) and the curing process is sped up. Consequently, these adhesives can also be used on non-absorbent or poorly absorbent substrates. The chemical reaction starts immediately after mixing. These products have a limited pot life and open time.

Dry adhesives are strips which are self-adhesive on both sides and come in rolls of varying width. Dry adhesives are delivered pre-dried by the manufacturer and therefore do not require airing, setting or drying time. After proper installation, they

are immediately load-bearing. Use for baseboards and stairs must be coordinated with the manufacturers of dry adhesive and linoleum floor covering.

4. Installation of Linoleum Floor Coverings

4.1 Substrate

TKB Technical briefing note 8 “Assessment and Preparation of Substrates for Installation of Floor Coverings and Parquet” as well as BEB Technical briefing note “Beurteilen und Vorbereiten von Untergründen. Verlegen von elastischen und textilen Bodenbelägen, Schichtstoffelementen (Laminat), Parkett und Holzpflaster. 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.

Linoleum floor coverings shall be bonded in a professional manner over the entire surface on a substrate conforming to standards, i.e. assessed and properly prepared (see ATV DIN 18365 “Bodenbelagsarbeiten (Floor covering work)”, section 3.1.1, 3.3 and 3.4.3).

When installing baseboards, walls must also be sufficiently dry and even.

4.2. Storage and Conditioning

Linoleum flooring shall be stored in a dry place, rolls in standing position. After rolls are unpacked following the roll numbers, the sheets are pre-cut with approx. 1 cm/meter or max. 10 cm extra length than needed for installation. Then, before bonding, the sheets – wear side on the outside, loosely rolled up and standing – shall be stored for at least 24 hours in the installation room to adjust to room climate. The room shall have a temperature of min.18 ºC. Humidity shall preferably be between 40 – 65 %.

Linoleum flooring in tiles shall only be conditioned on a level surface according to manufacturer's instructions.

4.3 Installation Conditions

The following threshold values for temperature and relative humidity shall be adhered to:

- relative humidity between 40 – 65 %
- room temperature min. 18 ºC
- temperature of materials used, e.g. flooring, adhesive min. 18 ºC
- substrate temperature min. 15 ºC, for heated construction max. 22 ºC

On the basis of required 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. Until adhesive has completely cured, the installed area shall be protected from direct sunlight or other thermal effects. Customer shall ensure that these essential measures have been taken, if necessary after installer has requested the measures or has voiced reservations.

Laid out sheets shall be bonded over the entire surface immediately. Dense, non-absorbent substrates, e.g. flow asphalts or sealed screeds must be levelled with sufficient layer thickness (recommendation: 2 - 3 mm dry layer thickness) before dispersion adhesives are applied.

4.4 Installation

4.4.1 Installation of Linoleum Floor Covering in Sheets

As a rule, linoleum floor coverings shall never be bent since they may break. When folding back sheets, e.g. before bonding, always maintain a sufficiently large radius in the fold back area.

4.4.1.1 Cutting of Linoleum Sheets

When cutting the sheets, always take into consideration that material-specific dimensional changes of the flooring can occur especially in the seam and hygienic skirting board area.

During bonding, linoleum floor coverings contract lengthwise and expand in width, especially when dispersion-based adhesives are used.

4.4.1.2 Cutting of Heads

For heads, length variations on vertical building sections must be prevented for tight cuts. In these cases, with sheet lengths of more than 6 meters, the sheet is bonded up to a remaining length of 1.5 meters. Once the adhesive has achieved sufficient initial strength and the sheet is locked in place, the remaining length is bonded and fitted into the adhesive bed.

For short lengths and heads of long sheets, when no direct joint will follow, the linoleum sheets are folded back over one half of the room. Then, the dispersion adhesive is applied, the sheet is placed in the adhesive bed and rubbed down. Only then is a clean cut performed at the heads. The sheets are then installed in the second half of the room as specified.

End seams are only fitted and cut after sheet has been placed in adhesive bed.

4.4.1.3 Edge Cutting

Both edges of the sheet shall be cut. The first edge (always the same side of the sheets) shall be cut by a minimum of 1.5 - 2 cm, even if later the joint is sealed using a welding cord. After cutting, the sheet edge must rest completely and evenly on substrate. If this is not the case, edge must be re-cut. The first edge cut is performed before adhesive is applied, e.g. using the appropriate linoleum edge cutter. Cutting of the second sheet edge (seam cut) is performed after sheet has been placed in adhesive bed (see 4.4.1.4).


Figure 1: Edge cut

4.4.1.4 Bonding

Sheet halves which must be closely fitted to adjoining building sections, e.g. thresholds and door cases, shall be bonded as described in first section of chapter 4.4.1.2. For long and narrow hallways which require lengthwise bonding, the sheets may also be folded back crosswise. After applying the adhesive (generally using TKB notched trowel size B1), the sheets are immediately placed in the adhesive bed free of tension. Heads must be rolled down (decurled). Only apply adhesive to an area which can be processed and rolled down during open time of adhesive. Backing of the flooring must be fully wetted after placing in adhesive bed. Replace toothed strip in time. Regularly check proper wetting during entire installation.

When cutting the second sheet edge, the upper sheet is scribed along the lower and already cut sheets and is then cut using a hooked blade. The blade must be designed in a way as not to push aside the adhesive. Using special seam or strip cutters, this process can be performed in one step. In order to prevent seam compression (peaked seams), the sheet edges shall be cut to 0.5 mm joints. The seam cut is done slightly angled from top to bottom (undercut) so that the seam is slightly wider at the bottom. The seam area shall be rolled down again with a seam roller or pressing hammer after cutting.

Always observe open time of the adhesive. If open time is exceeded, the backing of the floor covering might not be sufficiently wetted. Make sure there are no air pockets. In order to achieve complete wetting of the flooring backing, it must be rubbed and then rolled down over the entire area. When rolling/rubbing the flooring down, start along the width, then work lengthwise in order to remove air pockets on the most direct way. Then, the area must be examined with the handle of a hammer to detect possible hollow areas (air pockets) and to remove them. If needed, re-rub seams, heads and sags 5 - 20 minutes later or weigh them down. For rubbing down, it is recommended to use a smoother made from cork or carpet-covered wood, for rolling the flooring down use a multi-sectional roller with a weight of at least 65 kg and a width of approx. 40 cm.

The exact same steps also apply when joint sealing will follow.

Sags
A sag is an area of the sheet which is under constant wrap tension and therefore causes hollow areas. Sags are caused when during the maturing process the material is suspended in big loops in the drying chamber. Most often, they are found in the middle of each full flooring roll and can be more or less distinctive depending on thickness of the flooring or temperature (always observe manufacturer's instructions regarding bonding of these areas).

4.4.2 Installation of Linoleum Flooring in Tiles

Linoleum flooring in tiles is manufactured with jute or polyester/glass fleece backing. Please take this into consideration when selecting the adhesive and application quantity (appropriate notched trowel).

Normally, installation is performed with cross joints in alternating directions (chessboard). When installing tiles, first lay down a parallel to the main front of the room using a reference line and the starting point for installation of the first row of tiles so that in the edge area the size of the edge tiles does not fall under 10 cm. Only use white chalk for the reference line. In order to prevent any offset, a stepped installation it is recommended, preferably in a chessboard pattern.

4.4.3 Bonding of Profiles

Dry adhesives or dispersion contact adhesives approved by flooring manufacturer are recommended for bonding of profiles. Restrict the use of contact adhesives with a high level of solvents to the absolute minimum technically necessary (see item 3.1.3).

When using dry adhesives or dispersion contact adhesives, the elements to be bonded 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.

4.5 Seam Sealing

4.5.1 Thermal Seam Sealing

It is recommended to seal the joints of linoleum flooring in the commercial sector, in particular in hygiene areas. For substrates sensitive to moisture (e.g. wood particle-based panels, calcium sulfate-bound substrates) as well as in rooms where frequent wet cleaning must be performed, as a rule seam sealing shall always be performed.

Thermal sealing shall only be performed after adhesive has fully cured, as a rule after 24 hours at the earliest, but better yet after 2 - 3 days (see manufacturer's instructions). The joints are opened using a special miller or groover over a width of approx. 3.5 mm and up to 2/3 of the flooring thickness. The joint shall be carefully cleaned (vacuumed). The welding cord can either be processed using an automatic fuse machine (cord must pass the machine tension-free) or a hand welder with attached quick-weld nozzle (with a welding cord passage of 5 mm). In order to avoid damage to the surface of the flooring, select a welding nozzle with a narrow air outlet. Absolutely avoid exceeding or falling short of specified processing temperature. Work at a pace that allows melted cord to easily run into mill groove (2.5 – 3.0 meters/min) by applying only light pressure and to completely fill the groove. Excess material is removed in two steps:

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

Note:
As an alternative to the quarter moon knife, we recommend the Mozart utility blade (Mozart AG, Solingen, www.mozart-blades.de). This blade is designed so it only takes off excess in the joint area, thus minimizing or even avoiding damage to the flooring surface.

4.5.2 Seam Sealing using 2-Component joint Sealers

Special requirements for seam sealing, e.g. in laboratory areas or in the healthcare sector, are met by using 1- or 2-component joint sealers (e.g. on polyurethane basis). Always observe the relevant recommendations issued by flooring manufacturer.

4.6 Special Floor Covering Constructions

When installing linoleum floor coverings on corkment, for composite flooring with corkment or foam backing, on suitable impact sound insulation layers and for conductive linoleum floor coverings, always observe instructions issued by flooring and adhesive manufacturers.

4.7 Cleaning and Maintenance

The installer shall hand over to customer written care instructions for the floor covering together with order confirmation, at the latest before completion of installation according to VOB DIN 18365, Part C.

System cleaning and maintenance products shall be used and shall not adversely affect the floor covering properties.

5. Relevant Standards and Technical Briefing Notes

In the following, please find the relevant applicable standards and technical briefing notes. The current versions apply.

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

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

TRGS 900
Arbeitsplatzgrenzwerte (January 2006); Ausschuss für Gefahrstoffe (AGS); BArbBl. issue 1/2006 last supplemented and amended GMBl 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

GISCODE für Verlegewerkstoffe
Gefahrstoffinformationssystem der Berufs-genossenschaften der Bauindustrie, Frankfurt

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

5.2 Standards for Linoleum Flooring

Validity of the standards needs to be checked if required (e.g. www.beuth.de)

DIN EN 685
Resilient, textile and laminate floor coverings – Classification
November 2007

DIN EN 548
Resilient floor coverings – specification for plain and decorative linoleum
November 2004

DIN EN 687
Resilient floor coverings – specification for plain and decorative linoleum on a corkment backing
September 1997

DIN EN 686
Resilient floor coverings – specification for plain and decorative linoleum on a foam backing
September 1997

DIN EN 688
Resilient floor coverings – specification for cork linoleum
September 1997

5.3 Standards for Linoleum Flooring Adhesives

DIN EN 14259
Adhesives for floor coverings – requirements for mechanical and electrical performance
July 2004

5.4 Standards for Floor Installation Work

DIN 18299
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

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

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

5.6. 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