

Installation of Self-laying Carpet Tiles

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In collaboration with

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1 Introduction

This briefing note provides recommendations for installers regarding installation and removal of self-laying carpet tiles. The ISO 2424 standardized term for carpet tiles is the following: "Modular carpet. Textile floor covering of predetermined shape and size intended to be used in a modular mode." This briefing note exclusively deals with self-laying carpet tiles which manufacturers have approved for loose installation. For self-laying carpet tiles other terms are used as well depending on their format, e.g. SL (carpet) tiles, carpet panels, carpet plates or carpet planks. In the following, we shall use the term "SL carpet tile" which includes all terms mentioned above and shall be interpreted as a synonym for carpet tiles with different dimensions, suited for loose installation. In some instances, the term "tile" is used instead of "SL-carpet tile" to improve readability of the text.

In particular, these SL carpet tiles are preferably used in situations where installations in double or hollow floors must be easily accessible or where the floor covering shall be removed quickly and flexibly, either partially or over the whole surface. Information is provided on properties and

applications for loose-laying or removable SL carpet tiles and panels as well as regarding installation, removal and maintenance.

2 Substrates

Information regarding assessment and preparation of substrates can be found in TKB Technical Briefing Note 8 "Beurteilen und Vorbereiten von Untergründen für Bodenbelag- und Parkettarbeiten".

2.1 Screeds

The common screed types such as cement screed, calcium sulphate flow screed and magnesia screed are approved for installation of SL carpet tiles. However, readiness for installation and evenness of the screed are prerequisites for this type of installation. For mastic asphalt screeds a sufficiently thick levelling layer (2-3 mm with calcium sulphate or cement-based levelling compounds) is required to provide uniform absorbency and evenness. All screed mounting constructions (compound screed /screed on separating layer /screed on insulation / screed for under floor heating) are suited for installation of SL carpet tiles.

2.2 Prefabricated Screed Constructions

Prefabricated screeds, sometimes also confusingly described as dry screeds, are slab type substrates, installed on a load-bearing floor on which floor coverings can be immediately installed without drying time.

The possible constructions are the result of the elements' mechanical properties, directly related to their chemical composition.

The TKB briefing note 10 "Bodenbelags- und Parkettarbeiten auf Fertigteilelestrichen – Holzwerkstoff- und Gipsfaserplatten" gives descriptions of the materials used for prefabricated screed elements and the different installation constructions.

SL carpet tiles place no special demands on prefabricated screed constructions. However, it is important to remove all overhangs in the joint areas, if necessary smoothing down the joints with a suitable levelling compound. In some cases, a full surface levelling of the complete prefabricated screed area might be advisable using a self-levelling compound.

2.3 Hollow and Double Floors

The basis for hollow floors are formwork elements which are either placed on height-adjustable supporting legs or directly on the concrete floor. After applying a separating layer, the screed is installed on the formwork base, in most cases a calcium sulphate flow screed or a reinforced cement screed. The clear cavity height to be used for

electrical, water or computing installations etc, can be up to 200 mm.

Hollow floors are used where quick and easy access to the installations and supply lines is required. This is advantageous for offices, workrooms, training and research facilities. The installations are thus accessible through inspection openings in the framework and the screed. Vent holes and outlets can be installed in the framework, the screed can also be installed as heated screed. The term double floor stands for prefabricated floor panels placed on height-adjustable supporting legs. Each individual panel can be removed to gain access to the installation level. Double floors are used in computing rooms, control rooms, auditoriums and allow for clear heights of up to 1250 mm in the installation cavity. Different floor panels can be used:

- Steel tubs filled with calcium sulphate bound mortar on which then different floor coverings can be installed. By placing heating coils with quick release into the mortar, even under floor heating systems can be installed.
- Calcium sulphate bound mineral panels with fibre reinforcement and no steel tub.
- High density wood-based panels or particle boards with integrated aluminium laminate on the underside or counteracting sheet steel
- Steel panels.

SL carpet tiles are a particularly suitable and often used floor covering solution for double floors, since the tiles as well as the double floor panels can be quickly removed and so ensure easy access to the installation level. For installation, SL carpet tiles do not follow the joint grid of the double floor system.

2.4 Assessment of Substrate

The required substrate assessment procedures and their execution prior to installation of SL carpet tiles are specified in TKB briefing note 8 "Beurteilen und Vorbereiten von Untergründen für Bodenbelag- und Parkettarbeiten". In particular, the requirements of DIN 18365 must be observed, similar to installation of other textile or elastic floor coverings.

TKB briefing note 10 "Bodenbelags- und Parkettarbeiten auf Fertigteilstrichen – Holzwerkstoff- und Gipsfaserplatten" contains special information regarding assessment of prefabricated screed constructions.

2.5 Preparation of Substrate

The individual steps for the preparation of substrates are detailed in TKB briefing note 8 "Beurteilen und Vorbereiten von Untergründen für Bodenbelag- und Parkettarbeiten". In particular, it must be made sure that the substrate is clean, even and dry. For prefabricated screed components, overhangs in the joint area must be removed and for

double floors, height offsets between the panels are to be avoided.

TKB briefing note 10 "Bodenbelags- und Parkettarbeiten auf Fertigteilstrichen – Holzwerkstoff- und Gipsfaserplatten" contains special information regarding assessment of prefabricated screed constructions.

3 Loose and Removable SL carpet tiles

3.1 Structure

Like all textile floor coverings, SL carpet tiles are divided into textile floor coverings with pile and those without pile. For SL carpet tiles, like textile coverings with pile, a distinction is made between coverings with loop pile (Bouclé) and those with cut pile (Velours). Needle felt and twined yarn floor coverings are also available in tile form and are examples for textile coverings without pile.

In addition, SL carpet tiles are also manufactured using a weaving process, however only woven carpets with pile are offered as tiles. Woven carpets with pile are also manufactured with loop or cut pile.

For SL carpet tiles, the required high grammage is achieved through heavy coating, consisting of bitumen or PVC, today increasingly also of polyurethane (PUR), ethylene vinyl acetate copolymers (EVA) or polyolefins.

Given that the tiles shall be easily removable, it makes sense to check the bonding strength of the combination of backing construction and SL carpet tile fixation or to have manufacturers of the floor covering or the fixation confirm that the combination of backing construction and fixation is suitable for the intended purpose.

3.2 Properties

In particular, SL carpet tiles stand out on account of their dimensional stability and the ability to be installed level without the need for adhesives. Compared to other textile floor coverings, SL carpet tiles have a higher grammage, ensuring level laying.

In most cases, the tiles are installed on a special SL carpet tile fixation, preventing slippage during use.

The usual edge length of SL carpet tiles is 50 cm x 50 cm. However, there also exist non-square forms (e.g. rectangular) in order to be able to satisfy special design requirements.

SL carpet tiles are characterized by a number of parameters, such as edge length, grammage (DIN EN 1307; ISO 8543), overall thickness (DIN EN 1307; ISO 1765), the manufacturing process (ISO 2424), construction (ISO 2424), pile type, pile weight (ISO 2424), pile layer thickness (DIN EN 1307; ISO 1766), material of pile, carrier and

backing or pile, binding and filling warps, nap count (DIN EN 1307; ISO 1763), contact resistance (DIN EN 1307; ISO 10965), surface resistance (DIN EN 1307; ISO 10965), degree of impact sound attenuation (DIN EN 1307; DIN EN ISO 10140-3), sound reduction (DIN EN 1307; DIN EN ISO 354), heat transfer resistance (DIN EN 1307; ISO 8302), fire behaviour (EN 14041).

The dimensional tolerances for SL carpet tiles are determined in EN 1307. Within a batch, the dimensional accuracy shall not exceed a tolerance of $\pm 0,2\%$ (inspection according to EN 994). Regarding dimensional stability, examination of loose lay and removable bonded tiles according to EN 986 shall only allow shrinkage or expansion of max. 0.2% in both horizontal directions. When testing according to EN 986, the SL carpet tiles may only cup or bulge for not more than max. 2 mm. In practice however, vertical changes of this scale will lead to complaints.

3.3 Applications

SL carpet tiles are used in residential and industrial projects when a certain flexibility in floor construction is required, e.g.

- In offices for easy access to electrical installations under double and hollow floors.
- In hotels and restaurants for easy exchange of soiled or damaged tiles in heavy duty areas.
- In store or exhibition stand construction for easy and quick installation or renovation.
- In all projects where individuality, a wide range of designs and variability in floor design is required.

For installers, SL carpet tiles offer two important benefits compared to carpets on rolls: transport is much easier on account of the smaller dimensions as well as simple and reliable calculation of clippings of the floor covering with individual room geometries and unfavourable room layouts.

The SL carpet tiles are placed on a dried SL carpet tile fixation to prevent slipping. Consequently, they can later be taken up easily and without damage and if required, can be re-installed later without the need for renovation of the substrate.

For installation, this entails the following:

On the one hand, not only the floor covering, SL carpet tile fixation and substrate must be suited for the heavy duty demands of the project, but more importantly, the combination of the materials must stand up to these requirements and on the other hand, the flexible and non-destructive removal of SL carpet tiles must be ensured. This requires the use of specialized products and exact observance of

special parameters before, during and after installation.

4 Installation

4.1 Storage and Conditioning

SL carpet tiles must be stored in a dry place. If manufacturer has not issued different instructions, the SL carpet tiles must be unpacked and conditioned for a period of 1-2 days at temperatures between 18 – 22 °C and a relative air humidity of 45 – 65 %. In order to prevent excessive stress on lower tiles in stack, tiles shall not be stacked too high. This applies if flooring manufacturer has not issued other instructions.

4.2 Installation Conditions

During installation and for 7 days after installation, the following ambient conditions shall be observed:

- Substrate temperature: min. 15 °C
- Material temperature: mind. 18 °C
- Substrate temperature with under floor heating systems: 18 - 22 °C (3 days before and up to 7 days after installation)
- Air temperature: min. 18 °C
- Relative air humidity: preferably 40 – 65 %, max. 75 %

Since SL carpet tiles particularly react to changes in relative air humidity, always carefully observe above conditions.

More detailed information regarding room climate can be found in TKB Briefing Note 17 "Auswirkungen des Raumklimas auf Bodenbeläge und Verlegewerkstoffe während der Verlegung und der Nutzung". This briefing note outlines that responsibility for setting the required installation climate basically lies with the customer, the installer however is required to assess the conditions before start of installation. Should the installation conditions deviate from the required climate conditions, installation shall only take place after explicit agreement between customer and installer.

4.3 Application of fixation for SL Carpet Tiles

As their name implies, SL carpet tiles are self-laying and based on their structure and depending on their grammage, do not necessarily require to be glued down over the entire surface. One advantage of SL carpet tiles is that they can easily be taken up which makes them the ideal floor covering option for double and hollow floors.

Consequently, SL carpet tiles are only prevented from slipping by application of a special fixation. Based on this function, SL carpet tile fixations are often designated as anti-slip layers. SL carpet tile fixations are aqueous polymer dispersions which,

once dried, form an elastic film with specific, low adhesion to the SL carpet tiles. The low adhesion of the SL carpet tiles on the dried film of the fixation prevents slipping of the tiles and at the same time allows for easy and non-damaging removal and re-use of the tiles.

SL carpet tile fixations distinguish themselves by their composition, properties and function from other fixations with different designations and applications/functions, e.g. universal fixations with higher bonding strength, wide range of applications and use with wet or pressure-sensitive adhesive methods, fixation of textile coverings (for rolls) and dispersion fixations for (PVC) design and multilayer floor coverings.

If manufacturer has not issued other instructions, the fixation shall be applied with an appropriate fine-pored foam roller in a thin layer using a stripping grid. With double floor systems it shall be ensured that the liquid fixation does not enter between the individual floor panels, since panel edges might glue together and subsequently double floor panels are difficult to remove at a later date. To avoid leakage of fixation between panels, mask the joints or apply fixation panel by panel.

The applied SL carpet tile fixation must have dried out completely before carpet tiles are installed to avoid tiles to be glued down permanently. If tiles are placed on film too early, instead of an anti-slip effect, a full bond is achieved and SL carpet tiles can be damaged when taken up at a later date.

4.4 Installation of Floor Covering

Upon delivery, the pallets with SL carpet tiles are often numbered or the installation sequence of the individual pallets is specified. The boxes normally have batch numbers which must be followed on account of colour tolerances. The SL carpet tiles need to be conditioned before installation as described under 4.1.

The SL carpet tiles must lay flat, even without adhesion film applied. SL tiles with cupped edges or bulging centres must be discarded.

During installation, make sure there are no significant colour deviations from tile to tile. For this reason, always observe the numbering of the consignment as described above.

Direction of installation is normally indicated on the backside of the tile. Always observe manufacturer's instructions regarding installation direction.

After room has been measured, installation starts in the centre of the room. It has been proven helpful to install tiles along an exact rectangular reference line. First, 4 tiles are fixated and serve as starting point for the rest of the installation. Installation is then continued in a stepped manner, joint meeting

joint. Always make sure that protruding pile of velour tiles is not wedged in or bent.

When installing SL carpet tiles on double floor panels, make sure that the tile edges are offset to the edges of the double floor panels.

4.5 Conductive Installation

The surface and contact resistance of SL carpet tiles is typically approx. 10^8 to $10^9 \Omega$. For conductive installations, conductive fixations are used. Typically, a conductive agent is added to the regular SL carpet tile fixation. The surface conductivity of such conductive fixations is between 10^5 to $10^7 \Omega$. Conductive installation of anti-static SL carpet tiles normally results in an overall contact resistance of 10^8 to $10^9 \Omega$.

A defined grounding is achieved by placing a blank copper strip ($w = 10 \text{ mm}$, $t = 0.1 \text{ mm}$) into the fixation layer. The copper strip shall be installed circularly in the room with a wall clearance of 25 cm. For grounding of conductive floors, potential equalization (VDE 0107/3.68) is required for every 30 m^2 of surface. A copper strip with a length of min. 1 meter is placed in the fixation layer and shall overlap the copper strip which has been installed along the walls with 25 cm clearance. The copper strip shall jut out by 1 meter from installation surface to serve as terminal for the electrician to make potential equalization.

4.6 Taking up and Re-use

In order to ensure proper re-use of the SL carpet tiles, the tiles shall be removed by a professional installer. The tiles have to be taken up carefully, in particular not taken up diagonally starting with the edge since this might result in warping. They must then be properly stored in an air-conditioned room. When taking up the tiles, make sure the fixation layer is not contaminated by dust or other types of dirt.

The floor space with exposed anti-slip layer shall be protected from dust and dirt by appropriate measures, e.g. covering it with PE sheets.

When re-using the SL carpet tiles, it shall be made sure that each tile goes back to its initial position in order to maintain the original appearance. This ensures that the original colour variation pattern is restored.

5. Cleaning and Maintenance

SL carpet tiles shall only be cleaned with dry cleaning processes or using special cleaning pads. Wet cleaning methods, e.g. spray extraction or wet shampooing are not permitted to prevent damage to

floor covering and substrate. This applies when floor manufacturer has not issued other instructions.

6 Relevant Standards and Technical Briefing Notes

6.1 Industrial and Consumer Safety

Verordnung zum Schutz vor Gefahrstoffen
(Gefahrstoffverordnung – GefStoffV)
vom 26.11.2010 (BGBl. I S. 1643)
In der aktuellen Fassung vom 29.03.2017 (BGBl. I
S. 626)

TRGS 900
Arbeitsplatzgrenzwerte
Ausgabe: Januar 2006
BArBI Heft 1/2006, S. 41-55
Zuletzt geändert und ergänzt: GMBI 2017, S. 368-
370 v. 8.6.2017
Ausschuß für Gefahrstoffe (AGS)

GISCODE für Verlegewerkstoffe
aktuelle Fassung
(<http://www.bgbau.de/gisbau/giscodes>)
Gefahrstoff Informationssystem der
Berufsgenossenschaften der Bauindustrie;
Frankfurt

EMICODE für Verlegewerkstoffe
aktuelle Fassung (<http://www.emicode.com/de/>)
„Gemeinschaft Emissionskontrollierte
Verlegewerkstoffe, Klebstoffe und Bauprodukte
e.V.“ (GEV)

TRGS 600
Substitution
Ausgabe: August 2008
GMBI Nr. 46/47, S. 970-989 v. 22.09.2008
Ausschuß für Gefahrstoffe (AGS)

TRGS 610
Ersatzstoffe und Ersatzverfahren für stark
lösemittelhaltige Vorstriche und Klebstoffe für den
Bodenbereich
Ausgabe: Januar 2011
GMBI 2011 Nr. 8, S.163-165 v. 02.03.2011
Ausschuß für Gefahrstoffe (AGS)

6.2 TKB Technical Briefing Notes

TKB-Merkblatt 8
Beurteilen und Vorbereiten von Untergründen für
Bodenbelag- und Parkettarbeiten
Stand: April 2015
Technische Kommission Bauklebstoffe (TKB) im
Industrieverband Klebstoffe e.V. (IVK), Düsseldorf
Available at: www.klebstoffe.com.

TKB Technical Briefing Note 9
Technical Specification and Installation of Floor
Levelling Compounds
Version: April 2008
Technische Kommission Bauklebstoffe (TKB) im
Industrieverband Klebstoffe e.V. (IVK),
Düsseldorf.
Available at: www.klebstoffe.com

TKB-Merkblatt 10
Bodenbelags- und Parkettarbeiten auf
Fertigteilestrichen – Holzwerkstoff- und
Gipsfaserplatten
Stand: März 2016
Technische Kommission Bauklebstoffe (TKB) im
Industrieverband Klebstoffe e.V. (IVK),
Düsseldorf.
Available at: www.klebstoffe.com

TKB-Merkblatt 17
Auswirkungen des Raumklimas auf Bodenbeläge
und Verlegewerkstoffe während der Verlegung und
der Nutzung
Stand: März 2018
Technische Kommission Bauklebstoffe (TKB) im
Industrieverband Klebstoffe e.V. (IVK),
Düsseldorf.
Available at: www.klebstoffe.com

6.3 Standards for Floor Coverings

Norm DIN EN 1307:2016-05
Textile Bodenbeläge – Einstufung
Deutsche Fassung EN 1307:2014 + A1:2016
Berlin: Beuth Verlag GmbH. Mai 2016

Norm DIN ISO 2424:1999-01
Textile Bodenbeläge - Begriffe
Deutsche Fassung ISO 2424:1992
Berlin: Beuth Verlag GmbH. Januar 1999

Norm ISO 2424:2007-02
Textile floor coverings - Vocabulary
Berlin: Beuth Verlag GmbH. February 2010

Norm DIN CEN/TS 14472-1:2003-10
Elastische, textile und Laminatbodenbeläge -
Planung, Vorbereitung und Verlegung - Teil 1:
Allgemeines.
Deutsche Fassung CEN/TS 14472-1:2003
Berlin: Beuth Verlag GmbH. Oktober 2003

Norm DIN CEN/TS 14472-2:2003-10
Elastische, textile und Laminatbodenbeläge -
Planung, Vorbereitung und Verlegung - Teil 2:
Textile Bodenbeläge
Deutsche Fassung CEN/TS 14472-2:2003
Berlin: Beuth Verlag GmbH. Oktober 2003

Norm DIN EN 14041:2008-05
Elastische, textile und Laminat-Bodenbeläge -
Wesentliche Eigenschaften
Deutsche Fassung EN
14041:2004+AC:2005+AC:2006
Berlin: Beuth Verlag GmbH. Mai 2008

Norm E DIN EN 14041:2016-07
Elastische, textile und Laminat-Bodenbeläge -
Wesentliche Eigenschaften
Deutsche Fassung prEN 14041:2016
Berlin: Beuth Verlag GmbH. Juli 2016

Norm DIN EN 986:2006-03
Textile Bodenbeläge - Fliesen - Bestimmung der
Maßänderung infolge der Wirkungen wechselnder
Feuchte- und Temperaturbedingungen und
vertikale Flächenverformungen
Deutsche Fassung EN 986:2005
Berlin: Beuth Verlag GmbH. März 2006

Norm DIN EN 994:2012-03
Textile Bodenbeläge - Bestimmung der Länge und
Geradheit der Kanten und der Rechtwinkligkeit von
Fliesen
Deutsche Fassung EN 994:2012
Berlin: Beuth Verlag GmbH. März 2012

Norm ISO 1765:1986-11
Maschinell gefertigte textile Fußbodenbeläge -
Dickebestimmung
Berlin: Beuth Verlag GmbH. November 1986

Norm ISO 1766:1999-10
Textile Bodenbeläge - Bestimmung der Dicke über
der Grundschrift
Berlin: Beuth Verlag GmbH. Oktober 1999

Norm ISO 1763:1986-11
Teppiche - Bestimmung der Knoten- und/oder
Schlingenanzahl je Längen- und Flächeneinheit
Berlin: Beuth Verlag GmbH. November 1986

Norm ISO 10965:2011-07
Textile Bodenbeläge - Bestimmung des
elektrischen Widerstandes
Berlin: Beuth Verlag GmbH. Juli 2011

Norm DIN EN 14159:2015-03
Textile Bodenbeläge - Anforderungen für
Toleranzen der (linearen) Maße von abgepassten
Teppichen, Läufern, Teppichfliesen und Teppich-
Auslegeware und des Musterrapports
Deutsche Fassung EN 14159:2014
Berlin: Beuth Verlag GmbH. März 2015

Norm ISO 8543:1998-05
Textile Bodenbeläge - Verfahren für die
Gewichtsbestimmung
Berlin: Beuth Verlag GmbH. Mai 1998

6.4 Standards for Floor Covering Installation

Norm DIN 18365:2016-09
VOB Vergabe- und Vertragsordnung für
Bauleistungen - Teil C: Allgemeine Technische
Vertragsbedingungen für Bauleistungen (ATV) -
Bodenbelagarbeiten
Berlin: Beuth Verlag GmbH. September 2016

6.5 Standards for substrates

Norm DIN EN 12825:2002-04
Doppelböden
Deutsche Fassung EN 12825:2001
Berlin: Beuth Verlag GmbH. April 2002

Norm DIN EN 13213:2001-12
Hohlböden
Deutsche Fassung EN 13213:2001
Berlin: Beuth Verlag GmbH. Dezember 2001

6.6 Other Standards

Norm DIN 18202:2013-04
Toleranzen im Hochbau - Bauwerke
Berlin: Beuth Verlag GmbH. April 2013

Norm DIN 18299:2016-09
VOB Vergabe- und Vertragsordnung für
Bauleistungen - Teil C: Allgemeine Technische
Vertragsbedingungen für Bauleistungen (ATV) -
Allgemeine Regelungen für Bauarbeiten jeder Art.
Berlin: Beuth Verlag GmbH. September 2016

Norm DIN 18340:2016-09
VOB Vergabe- und Vertragsordnung für
Bauleistungen – Teil C: Allgemeine technische
Vertragsbedingungen für Bauleistungen (ATV) –
Trockenbauarbeiten
Berlin: Beuth Verlag GmbH. September 2016

Norm DIN 1960:2016-09
VOB Vergabe- und Vertragsordnung für
Bauleistungen - Teil A: Allgemeine Bestimmungen
für die Vergabe von Bauleistungen
Berlin: Beuth Verlag GmbH. September 2016

Norm DIN 1961:2016-09
VOB Vergabe- und Vertragsordnung für
Bauleistungen - Teil B: Allgemeine
Vertragsbedingungen für die Ausführung von
Bauleistungen
Berlin: Beuth Verlag GmbH. September 2016

Norm DIN EN ISO 10140-3:2015-11
Akustik - Messung der Schalldämmung von
Bauteilen im Prüfstand - Teil 3: Messung der
Trittschalldämmung
Deutsche Fassung EN ISO 10140-
3:2010+A1:2015
Berlin: Beuth Verlag GmbH. November 2015

Norm DIN EN ISO 354:2003-12
Akustik - Messung der Schallabsorption in
Hallräumen
Deutsche Fassung EN ISO 354:2003
Berlin: Beuth Verlag GmbH. Dezember 2003

Norm ISO 8302:1991-08
Wärmeschutz - Bestimmung des stationären
Wärmedurchlasswiderstandes und verwandter
Eigenschaften - Verfahren mit dem Plattengerät
Berlin: Beuth Verlag GmbH. August 1991

6.7 Commentaries for Standards

Verbände übergreifender Kommentar zur ATV DIN
18365
Hamburg: SN-Verlag Michael Steinert, 2017
ISBN 978-3-924883-16-4

6.8 Other Technical Briefing Notes

BEB-Arbeits- und Hinweisblatt
Beurteilen und Vorbereiten von Untergründen im
Alt- und Neubau, Verlegen von elastischen und
textilen Bodenbelägen, Laminat, mehrschichtig
modularen Fußbodenbelägen, Holzfußböden und
Holzpflaster, Beheizte und unbeheizte
Fußbodenkonstruktionen
Stand: März 2014
Bundesverband Estrich und Belag e.V., Troisdorf

ZVPF Technisches Hinweisblatt 02
Qualitätsanforderung an die Ebenheit von
Untergründen für Bodenbeläge und Parkett
Stand: 2016-07
Zentralverband Parkett und Fußbodentechnik,
53842 Troisdorf-Oberlar

6.9 Specialist Literature

Karl Remmert, Josef Heller, Horst Spang, Dr. Jörn
Haferkorn
Fachbuch für Bodenleger
2. Auflage 2010
Hamburg: SN-Verlag Michael Steinert, 2010
ISBN 978-3-924883-12-6