MULTILAYER MODULAR FLOORING ASSOCIATION
VERBAND DER MEHRSCHICHTIG MODULAREN FUSSBODENBELÄGE E.V.

Technical Bulletin

TB 1

Underlay Materials under Multilayer Modular Floor Coverings (MMF) - Test Standards and Performance Indicators

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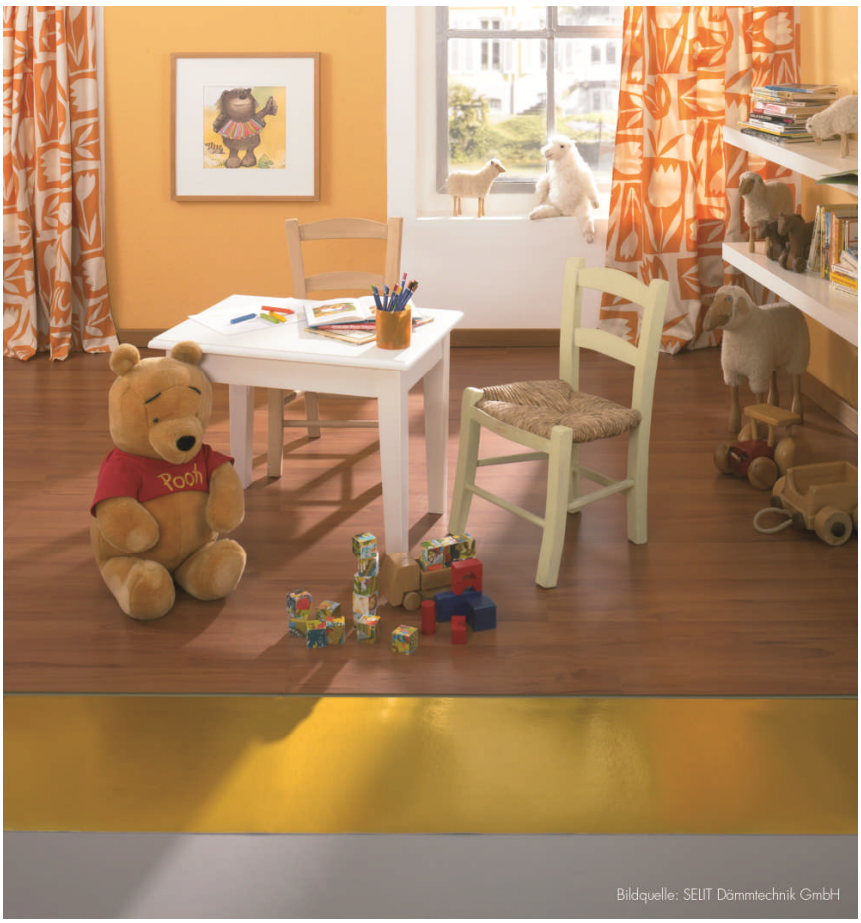

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1. Introduction

1.1. Scope

This technical bulletin provides general advice and application-based recommendations for underlays laid loose under floating multilayer modular floor coverings. It does not refer to products with “pre-attached underlays”, and also not to areas with special requirements and specifications for use.

The legal requirements in the country or area of purchase are to be observed at all times.

The explanations and data provided in this Technical bulletin conform to the state-of-the-art technology and the relevant recognized regulations at the time of publication.

1.2. References

All relevant references are mentioned in Annex B of this document.

2. Definitions

Multilayer modular floor covering:	Floor covering as described in EN 16511:2014, as well as other semi-rigid multilayer modular floor coverings for floating installation (e. g. “LVT, design flooring” etc.).
Modular:	Elements supplied in single sheets or tiles with worked edges that allow the product to be joint together to form a layer integral floor covering unit.
Underlay:	Resilient layer between the substrate and floor covering, added to obtain specific properties. As underlays, it is also possible to have combinations of the above mentioned underlays with films or coatings (e.g. vapor barriers).
Floor covering system:	Combination of multilayer modular floor covering element and the underlay.
Substrate:	Structural layer on which the flooring system is installed.

Abbreviations:

PC ..... **P**unctual **C**onformability
SD ..... Water vapor diffusion resistance (**Sd**-value)
R..... Thermal **R**esistance
DL..... **D**ynamic **L**oad
CS ..... **C**ompressive **S**trength
CC ..... **C**ompressive **C**reep
IS ..... **I**mpact **S**ound Reduction

3. General information

This technical bulletin highlights application-oriented requirements and the technical performance indicators for assessing if the underlay meets the intended purpose of the floorcovering system.

In general, the entire flooring system – in other words, the combination of multilayer modular floor covering with underlay – has to be chosen to meet the required needs of the use application.

By following the minimum recommendations for the underlays as specified in this technical bulletin, you will reduce the risk of product damage (e.g. damage to the joining system) of the floorcovering. These recommendations are based on the current level of knowledge. They will be able to minimize potential complaints within the warranty period for the flooring system.

3.1. Background information

When floating multilayer modular floor coverings are installed, an underlay may be placed between the substrate and the floor covering. This underlay offers various additional benefits to the floorcovering system. The underlay not only reduces the need for extensive subfloor preparations but also offers protection for the floorcovering, resulting in a satisfactory long lasting service life.

Any country-specific legal requirements are binding and are to be observed at all times.

Please note that the information provided by your floor manufacturer or supplier regarding the requirements for the use of their underlay is binding.

All minimum requirements were developed for assumed normal domestic use over a period of 20 years, covering 95 % of this type of floor coverings.

3.2. Test methods

The test methods described in this document are able to demonstrate the application-specific properties of an underlay.

The test methods are described in Annex A of this technical bulletin.

3.3. Underlay groups

Floating multilayer modular floor coverings are currently classified by MMFA as:

1. HDF substrate with polymer layer (excl. lacquer only)
2. Polymer or polyme-composite substrate with polymere layer and / or lacquer
3. All products which are not covered by (1) or (2), or external standards

These different floor coverings need specific underlays (depending e. g. on rigidity, elasticity etc. of the floor covering).

Currently there are 2 underlay groups. Typically, underlay group 1 can be used under coverings with HDF core, and underlay group 2 can be used under all other floor coverings.

The underlay group required shall be specified by the floor covering supplier. If no underlay group is specified by the supplier, group 2 is recommended.

4. Performance characteristics of underlays

In chapter 5, minimum requirements are given for each of the below mentioned performance characteristics in order to guarantee the durability of the technical performance, in respectively light and heavier areas of use (e.g. living rooms, halls, kitchens, etc….) during the whole lifetime of the flooring. They are meant as a rough indication to make it easier for consumers to choose the underlay for their specific area of application and to identify and determine the suitable floor covering/underlay combinations.

4.1. Performance in relation to the substrate/construction

PC: (punctual conformability)

Performance relating to unevenness of the subfloor

The substrate must conform to DIN 18202.

Smaller local imperfections like grains of screed can be leveled out by using appropriate underlays. It is essential that large-scale unevenness is leveled out by using appropriate measures (e.g. with a levelling compound or similar). For type 1 floor coverings, hollow spaces below the floor covering must be avoided in respect to reflection walking sound. Type 2 floorcoverings (cf. 3.3.) will be more critical in respect to imperfections of the subfloor. For example, larger gaps between tiles or cracks may show on the surface after some time. Unevenness may also put too much stress on the connection systems.

The capacity to level out the above mentioned imperfections is expressed using the PC value. This value is always given in mm and indicates an underlay's capacity to "absorb" local unevenness.

The higher the PC value, the better the underlay will be suited for for leveling out localized uneven areas.

SD: (water vapor diffusion resistance)

Moisture-sensitive flooring systems such as floor coverings with MDF/HDF core) require a permanently dry subfloor. In case of mineral substrates (e.g. concrete, screed, etc.), a water vapor diffusion control layer in the form of a moisture-proofing film is recommended for use on mineral substrates as a general principle in order to protect the floor covering from damages caused by rising residual moisture from the substrate.

Water vapor control layers can be either integrated into the underlay or be installed separately. The thickness of the water vapor control layer on its own is not significant in this respect, but the type and quality of the water vapor control layer are important.

The capacity to hold back the diffusion of water vapor is expressed using the s_d value (SD).

The higher the SD value, the better the film or underlay will protect the floor covering against damage caused by rising damp.

Based on practical experience, this value should be at least 75 m.

Transparent polyethylene (PE) films with a thickness of 150 µm will most probably achieve s_d values of > 75 m. The same applies for metalized plastic films with a thickness of >10 µm.

The requirement of 75 m is valid for substrates in equilibrium moisture content. When the substrate has a higher level of residual moisture, appropriate measures must be taken to dry the subfloor prior to the installation of the floor covering. It is absolutely necessary to consult and respect the relevant requirements of the floorcovering supplier.

R: (thermal resistance)

Case 1: Underfloor heating

With underfloor heating systems, the floorcovering system must not affect the heating function. The floor covering system must not be an excessive barrier to the effective

transfer of heat into the room. According to the BVF (Bundesverband Flächenheizungen und Flächenkühlungen or: German Association of underfloor heating and cooling) and the European standard for underfloor-heating dimensioning (EN 1264-3), the level of thermal resistance Rλ,B **for the entire floor covering system** must not exceed **0.15 m²K/W.**

Case 2: Underfloor cooling

In case of installation where cold water can be pumped through the underfloor heating system to provide cooling during the summer, additional requirements are needed. Under the floor covering, an automatic control for dew point (condensation) detection should be installed. This requires dew point sensors (i.e. probes) to be fitted under the floor covering, They will switch off the cooling system before condensation appears. Any condensation might result in damage to the flooring system. This could potentially lead to deformation, swelling, bubbles, formation of cracks, etc. The recommended thermal resistance Rλ,B for **the entire flooring system** for underfloor cooling systems should not exceed **0.10 m²K/W.**

The lower the $R_{\lambda,B}$ value of the flooring system, the better suited the flooring system will be for use on a heated/cooled substrate.

The $R_{\lambda,B}$ value for the entire flooring system has to be calculated as the sum of the thermal resistances of all the layers (typically: moisture barrier + underlay + floor covering).

Example of a suitable floor-mounted superstructure:

MMF Floor covering	0.07 $\frac{m^2 \times K}{W}$
Underlay	0.04 $\frac{m^2 \times K}{W}$ (= **R**)
Moisture barrier	0.005 $\frac{m^2 \times K}{W}$
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Total $R_{\lambda,B}$:	0.115 $\frac{m^2 \times K}{W}$ (≤ 0.15 and therefore suitable for heated floors)

Case 3: Looking for thermal insulation

In case of installation on uninsulated subfloors on ground floor or basement level, or above unheated areas like garages, a better living comfort can be achieved with a good thermal insulation of the floor covering. This can help provide higher floor temperatures and a more comfortable feeling when walking barefoot on the floor covering.

The higher the $R_{\lambda,B}$ value of the flooring system, the better the flooring system will be suited for use on an uninsulated subfloor.

4.2. Performance in relation to the use of the floor covering

Floors are subject to different loads in different classes of use. The underlay must guarantee the integrity of the floor covering. On the other hand, the underlay itself must be able to withstand these loads without losing technical performance in the long term.

It is a general misconception that thicker underlays perform better in this respect. This is absolutely NOT the case. Instead the absolute deformation under load is important. It is generally assumed that a maximum deformation of 0.5 mm for type 1 floorcoverings, or less than that for type 2 types, are allowed in order to protect the connection between the modules. Thicker underlays may behave negatively in this respect. Therefore the following characteristics are important.

The technical characteristics that influence the integrity of the floorcovering are listed below.

DL: **(dynamic load)**

Dynamic load is the pressure generated on the floor covering system by foot traffic, castor chairs, trolleys, etc…The underlay needs to be able to "absorb" these repeated loads of short duration without losing its absorbing performance over time.

This capacity is expressed using the DL value. A defined load is applied on the underlay for a short time and then released. This cycle is repeated with a defined frequency. The DL value is the number of cycles to obtain a reduction of underlay thickness of 0.5mm.

The higher the DL value, the longer the underlay will withstand these dynamic loads.

Depending on the underlay group (see cf. 3.3.), different loads are applied, and therefore DL_{25} and/or DL_{75} have to be specified.

The floor covering has a significant effect on the load distribution. Depending on the floor covering, the underlay will be subject to different loads. Therefore, DL tests for group 1 underlays will be carried out applying a maximum pressure of 25 kPa, and for group 2 underlays with a maximum pressure of 75 kPa.

CS and CC: (compressive strength and compressive creep):

Performance in relation to static loads

Sustained static loads on the floorcovering such as the weight of the floorcovering itself or heavy furniture standing on the floor (e.g. cabinet, piano, aquarium, etc.) may cause the underlay to be reduced in thickness over time. Compressive strength (CS) is the force needed to compress the underlay 0.5mm in thickness. Compressive creep (CC) evaluates which load can be put on the flooring over a reference period of 10 years until 0.5 mm compression is reached.

Case 1 – CS

Severe deformations may cause irreparable damage to the joining system and/or the core layer. This test determines the load necessary to put on the joint between the floorcovering elements, so that the floorcovering will be pressed down 0.5 mm.

The higher the CS value, the better the underlay will protect the joining system and prevent gaps, height differences, squeaking, etc.

Case 2 – CC

When an underlay is compressed by the static load over time, all beneficial technical characteristics, such as acoustical and thermal insulation, levelling capacity, etc., might disappear.

The higher the CC value, the more static load – e.g. heavier furniture – can be placed on the flooring system for a long period of time without losing technical benefits.

4.3. Requirements based on acoustics

As a rule, underlays have an impact on the acoustic properties of floor covering modules.

IS: (impact sound reduction):

Performance relating to impact sound reduction

Impact sound is defined as the noise which is perceived in the room below or next to the floor covering system. The noise can be generated by footsteps, falling objects etc. The IS

value is the reduction of noise generated on the same subfloor with and without the floorcovering. The underlay must be tested in combination with the floorcovering as simple extrapolation of underlay and floorcovering is impossible.

The higher the IS value, the better the underlay – in combination with the floor covering – will reduce the transmission noise.

The floor covering has a significant influence on the IS value of the flooring system. It has to be declared if testing the system was done with reference to a group 1 floor, based on a HDF core, and/or if it was done with reference to a group 2 floor, using an LVT core. Therefore IS_{HDF} (see A1.7.1) and/or IS_{LVT} (see A.1.7.2) have to be declared.

5. Requirements for underlays

5.1. Overview of requirements for underlay group 1 (e.g. under floor coverings MMFA-class 1 – with HDF-core)

Property	Description	Minimum requirements	Higher requirements	Test method
PC	Leveling out of localized uneven areas	≥ 0,5 mm		A1.1.
SD	Protection of floor coverings against residual moisture in substrate	≥ 75 m		A1.2.
$R_{\lambda,B}$*	Suitable for underfloor heating (H) or cooling (C)	H: ≤ 0.15 m²K/W C: ≤ 0.10 m²K/W		A1.3.
R_{λ}	Thermal insulation	≥ 0.075 m²K/W		A1.3.
DL_{25}	Sustained load generated by walking etc.	≥ 10,000 cycles	≥ 100,000 cycles	A1.4.1.
CS	Compressive strength at a defined compression stress	≥ 10 kPa	≥ 60 kPa	A1.5.
CC	Sustained load generated by furniture etc.	≥ 2 kPa	≥ 20 kPa	A1.6.
IS_{HDF}*	Reduction of noise transmission	≥ 14 dB	≥ 18 dB	A1.7.1.

* The entire flooring system is tested

5.2. Overview of requirements for underlay group 2 (e.g. under floor coverings MMFA-class 2 and 3 – without HDF-core)

Property	Description	Minimum requirements	Higher requirements	Test method
PC	Leveling out of localized uneven areas	≥ 0,5 mm		A1.1.
SD	Protection of floor coverings against residual moisture in substrate	≥ 75 m		A1.2.
$R_{\lambda,B}$*	Suitable for underfloor heating (H) or cooling (C)	H: ≤ 0.15 m²K/W C: ≤ 0.10 m²K/W		A1.3.
R_{λ}	Thermal insulation	≥ 0.075 m²K/W		A1.3.
DL_{75}	Sustained load generated by walking etc.	≥ 10,000 cycles	≥ 100,000 cycles	A1.4.2.
CS	Compressive strength at a defined compression stress	≥ 200 kPa	≥ 400 kPa	A1.5.
CC	Sustained load generated by furniture etc.	≥ 10 kPa	≥ 35 kPa	A1.6.
IS_{LVT}*	Reduction of noise transmission	≥ 10 dB	≥ 18 dB	A1.7.2.

* The entire flooring system is tested

6. Environment and safety

The following properties may be of significance with respect to environmental and safety factors. A number of these properties are governed by national or EU legislation/building regulations.

For example, in Germany a “bauaufsichtliche Zulassung (abZ)” or “general building regulations approval” is currently required for underlays dealing with VOC emissions and reaction to fire, and in France underlays have to be labeled according to specific volatile emssion categories.

Relevant environmental and safety-related properties are:

- Emission of dangerous substances, content of dangerous substances
- Odor emission
- Fire class
- Waste management

These factors are currently under development to be included in the harmonized standard for floorcoverings EN 14041.

Annex A: Test methods and reference floor coverings

A1. Test methods

The performance values must be tested according the following test methods. The test methods are described in CEN/TS 16354:2013 and some are adapted to multilayer modular floor coverings as described below.

A1.1. Determination of PC - Punctual Conformability

Described in CEN/TS 16354:2013

A1.2. Determination of SD - Water vapor diffusion resistance (Sd-value)

Described in CEN/TS 16354:2013

A1.3. Determination of R - Thermal Resistance

Described in CEN/TS 16354:2013

A1.4. Determination of DL - Dynamic Load

A1.4.1. DL_{25} for underlays group 1

Described in CEN/TS 16354:2013

A1.4.2. DL_{75} for underlays group 2

Described in CEN/TS 16354:2013

For tests of underlays group 2 the applied sinusoidal load must vary between σ_{min} = 100 Pa and σ_{max} = 75 kPa.

A1.5. Determination of CS - Compressive Strength

Described in CEN/TS 16354:2013

A1.6. Determination of CC - Compressive Creep

Described in CEN/TS 16354:2013

A1.7. Determination of IS - Impact Sound Reduction

A1.7.1. IS_{HDF} for underlays group 1

Described in CEN/TS 16354:2013

For underlays group 1 the reference floor covering described in A2.1 must be used as floor covering.

A1.7.2. IS_{LVT} for underlays group 2

Described in CEN/TS 16354:2013

For underlays group 2 the reference floor covering described in A2.2 must be used as floor covering.

A2. Reference floor coverings for system tests

Particular properties have to be tested as a system test. In this case the entire flooring system has to be investigated. In order to be able to compare the performance of the underlay as such a reference floorcovering of the respective type of flooring should be used.

A2.1. Reference floor covering for group 1

When determining performance of an underlay of group 1 the system tests have to be executed with the following reference floor covering:

7,3 mm monolithic seamless panel (LVT-covering: 1,8 mm, core layer HDF: 5,5 mm, no stabilizing layer), Area weight: 8 kg/m², size: 92 ± 2 cm x 120 ± 2 cm

This reference floor covering can be provided at MMFA (http://www.mmfa.eu)

A2.2. Reference floor covering for group 2

When determining performance of an underlay of group 2 the system tests have to be executed with the following reference floor covering:

5 mm monolithic seamless LVT-slab (PU-Coating: 10 µm, wear layer: 300 µm, decor film: 70 µm, core layer PVC with glass fibre reinforced: 3,2 mm, stabilizing layer: 1,5 mm), Area weight: 8,5 kg/m², size 98±2 cm x 120±2 cm

This reference floor covering can be provided at MMFA (http://www.mmfa.eu)

Annex B: Bibliography

CEN/TS 16354:2013	Laminate floor coverings — Underlays — Specification, requirements and test methods
EN 16511:2014	Loose-laid panels - Multi-layer semi-rigid floor covering (MSF) panels with wear resistant top layer