RULES FOR SCREED MATERIALS ACCORDING TO EUROPEAN STANDARDS

REGELN FÜR ESTRICHMÖRTEL NACH EUROPÄISCHER NORMUNG

REGLEMENTATION POUR MORTIERS DE CHAPE SELON LES NORMES EUROPEENNES

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SUMMARY

About 8 years ago CEN decided that a standard for screed materials should be set up. Materials meeting this can be traded across borders in Europe. In the middle of the year 2002 a standard for screed materials, DIN EN 13813 (1) will be ready. This standard will contain new regulated screed materials together with new material properties.

After the publication of the european standard for screed materials there is a transition period in which screed materials can be used according to national standards, in Germany DIN 18560-1 (2). The manufacturers and layers of screed materials must however familiarise themselves with the new regulations The national standards – in Germany DIN 18560-2,3,4 and 7 (3,4,5,6) must be revised by the end of the transition period.

ZUSAMMENFASSUNG

Vor rund 8 Jahren entschied CEN, auch eine Estrichnorm erarbeiten zu lassen, nach deren Festlegungen dieses Produkt über die Grenzen Europas hinweg gehandelt werden kann. Mitte des Jahres 2002 wird eine Norm für Estrichmörtel und Estrichmassen vorliegen, die DIN EN 13813 [1], mit neu geregelten Estrichen und mit einigen neuen Material-Kennwerten.

Zwar gilt nach Erscheinen der europäischen Estrichmörtelnorm eine Übergangsfrist, nach der die Estrichmörtel und Estrichmassen auch noch nach nationalen Regelungen, in Deutschland nach DIN 18560-1 [2], verwendet werden dürfen, jedoch müssen sich die Mörtelhersteller bzw. die Estrichleger mit den

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neuen Festlegungen vertraut machen; die nationalen Anwendungsnormen - in Deutschland die DIN 18 560-2, 3, 4 und 7 - [3, 4, 5, 6] sind bis zum Ende der Übergangsfrist zu überarbeiten.

RESUME

Il y a environ 8 ans, le CEN a décidé de faire élaborer une norme sur les mor-tiers de chape. Les produits répondant à ces réglementations pourront être com-mercialisés au-delà des frontières nationales à l'intérieur de l'Europe. Au milieu de l'an 2002, une norme nationale, la DIN EN 13813 (1), sera disponible. Cette norme comprendra de nouveaux matériaux pour chapes et de nouvelles proprié-tés physiques.

Après la parution de la norme européenne, il y aura une période de transi-tion pendant laquelle les mortiers de chape pourront être utilisés selon les nor-mes nationales, en Allemagne la DIN 18560 (2). Néanmoins, les fabricants et po-seurs de chape devront se familiariser avec les nouvelles réglementations. Les normes d'application nationales, en Allemagne la DIN 18 560-2, 3, 4 et 7 [3, 4, 5, 6] devront être actualisées jusqu'à la fin de la période de transition.

KEYWORDS: European Standard for screed materials

1 INTRODUCTION

In future, construction materials can only be sold in other countries when according to european construction materials guide lines there are standardised rules, so called harmonised technical specifications and the materials fulfil the requirements of these technical specifications so that a CE symbol can be used.

8 years ago CEN decided that the technical standards for screed materials in civil engineering should be harmonised and commissioned Germany to act as co-ordinator of the technical committee No. 303.

From this technical committee 2 working groups (WG) and 5 task groups (TG) were formed. WG1 standardised the terminology, properties and require-ments of screed materials. Methods of testing screed materials were regulated by WG2. The 5 task groups for binder cement, calcium sulphate, magnesite, mastic asphalt and resin were consulted by the working groups when specific problems relating to the above mentioned materials occurred.

Half a year ago DIN 13318 (7) was published. In this standard the usual definitions in German English and French used in screed materials are compiled. This proved very useful when language problems and communication difficulties occurred at many meetings.

After the first request for opinions the new screed material standard prEN 13813(1) was sent to Brussels for a final opinion whereby had to be either yes or no. At the most slight editing changes were allowed. It is to be reckoned with that the DIN EN 18313 will be published by the middle of the year 2001. After a transition period of at least half a year all screed materials shall be treated according to the new rules and labelled with the CE symbol. From this time on the regulations in DIN 18560-1 (2) do not apply any more.

2 SCREED SORTS AND THEIR USES

The responsibility of a technical committee and especially its chairman is to see that all tried and tested products even from other european countries find a place in a european standard. As a result nearly all screed sorts and screed properties in DIN 18560-1 (2) are integrated in the new standard.

According to pr EN 13318 (7) a screed is one or more layers of screed mortar placed at the construction site on a base. It can either be bonded to the base or not or laid on a separating layer or on am insulating layer. Its purpose is to fulfil one or more of the following functions

- achieve a certain required height
- used as a base for flooring material
- used directly as a wearing surface

In order to eliminate communication difficulties it was necessary to define the term screed and to declare that in Germany the term screed includes screed mortar, screed materials and the finished product.

As well as screeds made of standardised cement binder, calcium sulphate, magnesite and mastic asphalt as mentioned in DIN 18560-1 (2) the pr EN 13813

Includes synthetic resin screeds even though synthetic resin binder alone will not be standardised in future. According to the type of binder and the initial letters in English screeds are characterised as follows,

CT cementitious screeds
CA calcium sulfate screeds
MA magnesite screeds
AS mastic asphalt screeds
SR synthetic resin screeds

The regulated requirements in pr EN 13813 apply only to screed materials used for floor construction indoors. Additional properties possibly required for the use of screeds outdoors are not included in the new standard. It is stated specifically that the application of the new standard applies only to the properties of the products which can be traded and not the manufacture of the screed materials themselves. It is also stated quite clearly that this standard applies to screed materials mixed on site by the same contractor. That is the screed layer who mixes and places it. In future it must be taken into consideration that the requirements of pr EN 1504-2 (8) should be heeded when cementitious and synthetic resin mortars are used for protective layers or repair of concrete components. According to the new standard screed mixtures cannot be used for load carrying components of structural systems.

3 ESSENTIAL PROPERTIES AND REQUIREMENTS

At the beginning of 1996 the european commission issued a so called mandate for the construction products for floors. In this mandate the essential properties

for which the responsible technical committee had to name minimum requirements were listed. The section for screed materials were included in this mandate in January 1999. The following properties were to be dealt with

- reaction to fire
- corrosion enhancing components
- harmful components
- water vapour- and water permeability
- resistance to mechanical use
- impact sound insulation, sound absorption
- thermal insulation

In the following then general valid regulated properties in pr EN 13813 are described. Afterwards requirements for the individual screed mortar types mentioned in pr EN 13813 (annex Z) will be gone into.

3.1 Materials

Only such binders, aggregates, admixtures, additives and water may be used in the production screed mortars that guarantee the properties that the manufacturer has named. If there are european standards for the source materials and the materials fulfil the requirements of these standards then it can be assumed that the usefulness of the screed mortar is guaranteed. Therefore the manufacturer can in addition to source materials which fulfil european or national standards also use materials which are not standardised, providing he can guarantee that the required properties such as strength, wear resistance and shrinkage limits can with certainty be achieved when the screed mortar is produced at the construction site.

3.2 Usual properties and classes

When describing a screed mortar with property values one must differentiate between those that must always be reported and those quoted when relevant.

The values always required (N = normative) and those when relevant (O = optional) are compiled dependent on mortar type and usage in table 1.

Table 1. Screed materials and tests which apply to each type

Screed materials based on:	compressive strength	flexural strength	wear resistance "Böhme"	wear resistance "BCA"	wear resistance to rolling wheel	surface hardness	resistance to indentation	resistance to rolling wheel with floor covering	setting time	shrinkage and swelling	consistency	pH value	modulus of elasticity	Impact resistance	bond strength
Cement	N	N	N* (one of three)			O	-	O	-	O	O	O	O	O*	O
Calcium sulfate	N	N	O	O	O	O	-	O	O	O	O	N	O	-	O
Magnesite	N	N	O	O	O	N*	-	O	-	O	O	O	O	-	O
Mastic asphalt	-	-	O	O	O	-	N	O	-	-	-	-	-	-	-
Synthetic resin	O	O	-	N* (one of two)		O	-	O	-	O	O	-	O	N*	N

N = Normative O = Optional, where relevant - = not relevant

* only for screed material intended for wearing surfaces

According to table 1 compressive and flexural strength after pr EN 13892-1 and –2 (9,10) must always be declared for cementitious-, calcium sulphate- and magnesite screed materials. For thicker layers of synthetic resin screed material it may be declared. If the surface of cementitious- or synthetic resin screeds are to be used directly the the wear resistance must be declared. With cementitious screed there is a choice of 3 test methods and with synthetic resin screed 2 test methods.

In Germany the abrasion test after Böhme according to pr EN 13892-3 (11) has been found to be the best in order to describe the surface strength of cementitious screeds with hard aggregates subject to impact, rolling and abrasive use. However for cementitious screeds with a high content of synthetic resin the BCA testing machine after pr EN 13892-4 (12) or the rolling wheel testing machine after pr EN 13892-5 (13) appear to be better.

For all mechanical values several classes have been established. The user can select the appropriate class according to the planned usage. The mortar manufacturer or layer can classify his work according to the results of a suitability test and mark it accordingly.

The suggested classes for the individual values are compiled in tables 2 to 8. The abbreviations used to describe the values are also given.

Table 2. Compressive strength classes for screed materials

Class	C5	C7	C12	C16	C20	C25	C30	C35	C40	C50	C60	C70	C80
Compressive strength in N/mm^2	5	7	12	16	20	25	30	35	40	50	60	70	80

[1)] C for **C**ompressive strength

Table 3. Flexural strength classes for screed materials

Class	F1	F2	F3	F4	F5	F6	F7	F10	F15	F20	F30	F40	F50
Flexural strength in N/mm^2	1	2	3	4	5	6	7	10	15	20	30	40	50

[1)] F for **F**lexural strength

Table 4. Wear resistance Böhme classes for cementitious and other screed materials

Class	A22	A15	A12	A9	A6	A3	A1,5
Abrasion quantity in $cm^3/50\ cm^2$	22	15	12	9	6	3	1,5

[1)] A for **A**brasion

Table 5. Wear resistance BCA classes for cementitious and other screed materials

Class	AR6	AR4	AR2	AR1	AR0,5
Maximum wear depth in µm	600	400	200	100	50

[1)] AR for **A**brasion **R**esistance

Table 6. Wear resistance to rolling wheel classes for cementitious and other screed materials

Class	RWA300	RWA100	RWA20	RWA10	RWA1
Abrasion quantity in cm³	300	100	20	10	1

[1)] RWA for **R**olling **W**heel **A**brasion

In test abrasion according to Böhme the surface of the screed is pressed on to a rotating steel plate. Between the screed and the steel plate is an abrasive sand. In the other two test the abrasion is produced by steel wheels or ball bearings under a defined load. In all cases the volume resp. Abrasion depth is used to judge the abrasion resistance.

Table 7. Surface hardness for mangnesite and other screed materials

Class	SH30	SH40	SH50	SH70	SH100	SH150	SH200
Surface hardness in N/mm²	30	40	50	70	100	150	200

[1)] SH for **S**urface **H**ardness

The surface hardness as tested after pr EN 13892-6 (14) is a value together with the compressive strength which has proofed itself over time as a good property for classifying magnesite screeds use directly. It can also be used to describe other screeds with aggregates whose largest grain is < 4mm

Table 8a. Hardness classes for mastic asphalt; on cubes – Load applied 525 N - Indentation in units of 0,1 mm

Hardness classes / Test conditions	ICH10	IC10	IC15	IC40	IC100
22 ± 1 °C, 100 mm², 5 h	≤ 10	≤ 10	≤ 15	--	--
40 ± 1 °C, 100 mm², 2 h	≤ 20	≤ 40	≤ 60	--	--
40 ± 1 °C, 500 mm², 0,5 h	--	--	--	> 15 - 40	> 40 - 100

[1)] IC for **I**ndentation **C**ubes

Table 8b. Hardness classes for mastic asphalt; on plates – Load applied 525 N – Indentation in units of 0,1 mm

Hardness classes / Test conditions	IP10	IP12	IP30	IP70
40 ± 1 °C, 100 mm^2, 31 minutes	≤ 10	≤ 12	10 - 30	≤ 70

[2)] IP for **I**ndentation **P**lates

Table 8c. Hardness classes for mastic asphalt; on plates – Load applied 317 N – Indentation in units of 0,1 mm

Hardness classes / Test conditions	IPI	IPII	IPIII	IPIV
45 °C, 31,7 mm^2, 1 minutes	≤ 11	--	--	--
35 °C, 31,7 mm^2. 1 minutes	--	≤ 9	≤ 8	≤ 30

[3)] IP for **I**dentation **P**lates

The hardness classes of mastic asphalt determined according to pr EN 12697-20 (15) or pr EN 12697-21 (16) can be determined on either cubes IC (IC for indentation cubes) or plates IP (IP for indentation plates.

For thin screed layers such as synthetic resin mortars or cementitious mortars with small diameter aggregate modified with synthetic resin other values are important for the durability. They are for example bond strength and impact resistance. For synthetic screeds classes of these values always have to be declared.

Table 9. Bond strength classes for cementitious, calcium sulfate, magnesite and synthetic resin screed material

Class	B0,2	B0,5	B1,0	B1,5	B2,0
Bond strength in N/mm^2	0,2	0,5	1,0	1,5	2,0

[1)] B for **B**ond strength

The bond strength is determined after pr EN 13892-8 (17). The impact resistance IR is determined on a layer of synthetic resin mortar applied to a defined concrete plate according to EN ISO 6272 (18) and is quoted in Nm

The values for the wearing resistance to rolling wheels, the time for laying, shrinkage and swelling, consistency and flexural modulus according to the latest european testing method standards can optionally be quoted by mortar manufacturers for screeds with coverings.

3.3 Special product properties

Values for the following material properties must be declared by the mortar manufacturer if there are legal requirements. The properties for there are different or unified requirements in european countries at present include

- electrical resistance
- chemical resistance
- reaction to fire
- release of corrosive substances
- or corrosiveness of screed materials
- water vapour- and water permeability
- thermal resistance, impact sound insulation and sound absorption

Whereas in pr EN 13813 only values and test methods used to describe the special material properties are mentioned threshold values which are to be kept in all european countries are laid down in appendix Z of pr EN 13813. Only when these threshold values are achieved resp. after checking whether a threshold value is necessary may the CE symbol be used.

4 DESCRIPTION OF SCREED MATERIALS

Screed materials according to this standard have been described by the binder and the guaranteed classes and properties by the manufacturer. Planers and users of screed materials also have to use these descriptions.

Cementitious screed material not used for wearing surfaces in strength classes C20 and F4

EN 13813 CT-C20-F4

Magnesiste screed material in strength classes C50 and F10 and surface hardness SH150

EN 13813 MA-C50-F10-SH150

Calcium sulfate screed material in strength classes C20 and F4

EN 13813 CA-C20-F4

Mastic asphalt material according to resistance to indentation class IC10

EN 13813 AS-IC10

or Synthetic screed material according to bond strength class B2,0, wear resistance class AR1 and impact resistance IR4

EN 13813 SR-B2,0-AR1-IR4

If materials such as hard aggregates, polymers, fibres, etc. are used to achieve special properties, these materials may be mentioned in the designation.

Cementitious screed material modified by polymer according to compressive strength class C40, flexural strength class F10 and bonding strength class B1,5

EN 13813 Polymer-modified CT-C40-F10-B1,5

Cementitious screed material with hard aggregates according to compressive strength class C60, flexural strength class F10 and wear resistance "Böhme" class A1,5

EN 13813 Hard aggregates CT-C60-F10-A1,5

5 CONFORMITY

The manufacturers and layers of screed materials have to prove the declared material properties through

- initial type test
- production control

The initial type test shall show before the use of the screed materials that with the source materials the properties guaranteed by the manufacturer can be achieved.

Initial type tests always have to be carried out when the source materials or the manufacturing process is changed. Production control includes

- control of manufacturing process
- testing of the screed materials

The control of the manufacturing process shall be carried out according to the principles of EN ISO 9000 and includes

- regular checking of machines and equipment used in the manufacture of the screed materials
- control of the source materials

- checking the manufacturing process

The testing of the screed materials shall be carried out according to the type of screed material and meaningfulness of the test results taking previous result into consideration.

Testing shall always be carried out

- about every 1000m² laid
- when a new section or site is started
- according to the rules in section 9 of pr EN 13813

Only screed materials for which the material properties are proved according to these rules may be describe according to pr EN 13813 as shown above. The conformity or correspondence can be established

through regular controls sing statistical evaluation of the results

or through individual results with a sufficiently high safety factor above the guaranteed value.

By correspondence using individual results the values for example with compressive and flexural strength should be at least 10% higher than the quoted properties.

REFERENCES

[1] pr EN 13813: Screed material and floor screeds – screed materials – Properties and requirements

[2] DIN 18560-1: Floor screeds in building constructions – General requirements, production, testing

[3] DIN 18560-2: Floor screeds in building constructions – Floor screeds and heating floor screeds on insulation layers

[4] DIN 18560-3: Floor screeds in building constructions – Base-bonded floor screeds

[5] DIN 18560-4: Floor screeds in building constructions – Floor screeds on separating layer

[6] DIN 18560-7: Floor screeds in building constructions – Heave duty floor screeds (industrial floor screeds)

[7] DIN EN 13318: Screed materials and floor screeds – Definitions

[8] prEN 1504-2:2000: Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity – Part 2: Surface protection systems.

[9] prEN 13892-1: Method of test for screed materials – Sampling, making and curing specimens for test.

[10] prEN 13892-2: Method of test for screed materials – Determination of flexural and compressive strength.

[11] prEN 13892-3: Method of test for screed materials – Determination of wear resistance - Böhme.

[12] prEN 13892-4: Method of test for screed materials – Part 4: Determination of wear resistance BCA.

[13] prEN 13892-5: Method of test for screed materials – Part 5: Determination of resistance to rolling wheel – Method for screed material for wearing layers.

[14] prEN 13892-6: Method of test for screed materials – Determination of surface hardness.

[15] prEN 12697-20: Bituminous mixtures – Test methods for hot mix asphalt – Part 20: Indentation using cube or marshall specimens.

[16] prEN 12697-21: Bituminous mixtures – Test methods for hot mix asphalt – Part 21: Indentation using plate specimens

[17] prEN 13892-8: Method of test for screed materials – Part 8: Determination of bond strength.

[18] EN ISO 6272: Paints and varnishes – Falling-weight test (ISO 6272:1993)