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Chaux de construction - Partie 1: Définitions, spécifications et critères de conformité

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Building lime - Part 1: Definitions, specifications and conformity criteria

Chaux de construction - Partie 1: Définitions, spécifications et critères de conformité

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 51 "Cement and building limes", the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2002, and conflicting national standards shall be withdrawn at the latest by July 2003.

This European Standard supersedes ENV 459-1:1994.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

The European Standard EN 459 for building lime consists of the following parts:

Part 1: Definitions, specifications and conformity criteria;

Part 2: Test methods;

Part 3: Conformity evaluation.

The requirements in EN 459-1:2001 are based on the results of tests on building lime according to EN 459-2:2001.

Annex A and C are informative. Annex B is normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The preparation of a European Standard for building lime was initiated by Resolution No 107 taken by CEN/TC 51 "Cement and building limes" in 1988.

Different sources of raw materials and different climatic conditions have led to different developments in building practices and materials and therefore to different kinds of building lime in different regions of Europe.

An attempt has been made to include all the different types of building lime which exist in Europe in this European Standard. To this end, it was necessary to establish a number of classes.

When mixed with water, building limes form a paste that improves the workability (values of flow and penetration) and water retention of mortars. The carbonation of hydrates in contact with atmospheric carbon dioxide provides the strength and durability of masonry mortars containing building lime. In lime mortars a recrystallisation of calcium carbonate occurs (this property is called "self healing").

The previous national standards for building limes generally also formed the basis for other areas of application (see Annex A (informative)). The classification chosen therefore also attempts to take into consideration these circumstances as far as possible.

1 Scope

This European Standard applies to building limes used as binders for preparation of mortar (for masonry, rendering and plastering) and production of other construction products.

It gives definitions for the different types of building limes and their classification. It also gives requirements for their chemical and physical properties which depend on the type of building lime and specifies the conformity criteria.

Terms of delivery or other contractual conditions, normally included in documents exchanged between the supplier and the purchaser of lime, are outside the scope of this European Standard.

NOTE Additional requirements are needed in special applications e. g. civil engineering.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 196-1, *Methods of testing cement – Part 1: Determination of strength.*

EN 196-2, *Methods of testing cement – Part 2: Chemical analysis of cement.*

EN 196-3, *Methods of testing cement - Part 3: Determination of setting time and soundness.*

EN 196-7, *Method of testing cement – Part 7: Methods of taking and preparing samples of cement.*

EN 459-2:2001, *Building lime – Part 2: Test methods*.

EN 459-3:2001, *Building lime – Part 3: Conformity evaluation.*

3 Terms and definitions

For the purposes of this European Standard the following definitions and abbreviations apply. (Further information see annex A (informative)).

3.1
lime
material comprising any physical and chemical forms under which calcium and/or magnesium oxide (CaO and MgO) and/or hydroxide ($Ca(OH)_2$ and $Mg(OH)_2$) can appear

3.2
building limes
limes used in building construction and civil engineering. It includes all the types given in Table 1

3.3
air limes[1])
limes mainly consisting of calcium oxide or hydroxide which slowly harden in air by reacting with atmospheric carbon dioxide. Generally they do not harden under water as they have no hydraulic properties. They may be either quicklimes (3.4) or hydrated limes (3.5)

3.4
quicklimes (Q)
air limes mainly consisting of calcium oxide and magnesium oxide produced by calcination of limestone and/or dolomite rock. They have an exothermic reaction when in contact with water. They are offered in varying sizes ranging from lumps to ground powder materials. They include calcium limes (3.6) and dolomitic limes (3.7)

3.5
hydrated limes (S)
air limes, calcium limes or dolomitic limes, resulting from the controlled slaking of quicklimes. They are produced in the form of a dry powder or putty or as a slurry (milk of lime)

3.6
calcium limes (CL)
limes mainly consisting of calcium oxide or calcium hydroxide without any additions of hydraulic or pozzolanic materials

NOTE Shell limes are hydrated calcium limes produced by calcination of shells followed by slaking. Carbide limes are hydrated calcium limes which are a by-product of the manufacture of acetylene from calcium carbide.

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[1]) Translation of a term used in most European countries.

3.7
dolomitic limes (DL)
limes mainly consisting of calcium oxide and magnesium oxide or calcium hydroxide and magnesium hydroxide without any additions of hydraulic or pozzolanic materials

3.8
semi-hydrated dolomitic limes
hydrated dolomitic limes mainly consisting of calcium hydroxide and magnesium oxide

3.9
completely hydrated dolomitic limes
hydrated dolomitic limes mainly consisting of calcium hydroxide and magnesium hydroxide

3.10
natural hydraulic limes (NHL)

3.10.1
natural hydraulic limes
limes produced by burning of more or less argillaceous or siliceous limestones with reduction to powder by slaking with or without grinding. All NHL have the property of setting and hardening under water. Atmospheric carbon dioxide contributes to the hardening process

3.10.2
natural hydraulic limes with additional material (Z)
NHL see 3.10.1. Special products may contain added suitable pozzolanic or hydraulic materials, up to 20 % by mass, are additionally designated by "Z"

3.11
hydraulic limes (HL)
limes mainly consisting of calcium hydroxide, calcium silicates and calcium aluminates produced by mixing of suitable materials. They have the property of setting and hardening under water. Atmospheric carbon dioxide contributes to the hardening process

4 Types of building lime

4.1 Classification

Air limes shall be classified according to their (CaO + MgO) content and hydraulic limes according to their compressive strength given in Table 1 (see annex A).

Table 1 – Types of building lime[a]

Designation	Notation
Calcium lime 90	CL 90
Calcium lime 80	CL 80
Calcium lime 70	CL 70
Dolomitic limes 85	DL 85
Dolomitic limes 80	DL 80
Hydraulic lime 2	HL 2
Hydraulic lime 3,5	HL 3,5
Hydraulic lime 5	HL 5
Natural hydraulic lime 2	NHL 2
Natural hydraulic lime 3,5	NHL 3,5
Natural hydraulic lime 5	NHL 5

[a] In addition, air limes are classified according to their conditions of delivery, quicklime (Q) or hydrated lime (S). In the particular case of hydrated dolomitic limes, the degree of hydration is identified S1: semi hydrated; S2: completely hydrated.

This classification refers to minimum requirements for each type (see Tables 2 and 3). Compliance with these requirements is assessed by means of statistical quality control as described in clause 5 of this European Standard.

4.2 Standard designation

Building limes shall be identified by their type specified in Table 1. Aditionally air limes shall also be identified by their conditions of delivery (quicklime or hydrated lime, see examples below).

EXAMPLE 1
Calcium lime 90 in the form of quicklimes is identified by

EN 459-1 CL 90-Q

EXAMPLE 2
Calcium lime 80 in the form of hydrated lime (slaked) is identified by

EN 459-1 CL 80-S

EXAMPLE 3
Dolomitic lime 85 in the form of semi hydrated lime is identified by

EN 459-1 DL 85-S1

EXAMPLE 4
Hydraulic lime 5 is identified by

EN 459-1 HL 5

EXAMPLE 5
Natural hydraulic lime 3,5 with pozzolanic addition is identified by

EN 459-1 NHL 3,5-Z

4.3 Chemical requirements

The composition of the building lime shall comply with the values in Table 2 when tested in accordance with EN 459-2:2001. All types of lime listed in Table 2 may contain additives in small quantities to improve the manufacture or properties of building lime. When the content exceeds 0,1 %, the actual amount and types shall be declared.

Table 2 – Chemical requirements of lime[a]

	Type of building lime	CaO + MgO	MgO	CO_2	SO_3	Available lime
1	CL 90	≥ 90	≤ 5[c]	≤ 4	≤ 2	–
2	CL 80	≥ 80	≤ 5[c]	≤ 7	≤ 2	–
3	CL 70	≥ 70	≤ 5	≤ 12	≤ 2	–
4	DL 85	≥ 85	≥ 30	≤ 7	≤ 2	–
5	DL 80	≥ 80	≥ 5	≤ 7	≤ 2	–
6	HL 2	–	–	–	≤ 3[b]	≥ 8
7	HL 3,5	–	–	–	≤ 3[b]	≥ 6
8	HL 5	–	–	–	≤ 3[b]	≥ 3
9	NHL 2	–	–	–	≤ 3[b]	≥ 15
10	NHL 3,5	–	–	–	≤ 3[b]	≥ 9
11	NHL 5	–	–	–	≤ 3[b]	≥ 3

NOTE The values are applicable to all kinds of lime. For quicklime these values correspond to the finished product; for all other kinds of lime (hydrated lime, lime putty and hydraulic limes) the values are based on the product after subtraction of its free water and bound water content.

[a] Values given in percent by mass.

[b] SO_3 content of more than 3 % and up to 7 % is permissible, if soundness is demonstrated at 28 days of water curing using a test given in EN 196-2.

[c] MgO content up to 7 % is acceptable if a soundness test given in 5.3 of EN 459-2:2001 is passed.

4.4 Standard strength requirements and other physical properties

4.4.1 Standard strength requirements for hydraulic lime

The standard strengths of the types of hydraulic lime and natural hydraulic lime are the compressive strengths determined in accordance with EN 459-2:2001 after 28 days and shall have the values given in Table 3.

Table 3 – Compressive strength of hydraulic lime and natural hydraulic lime

Type of building lime	Compressive strength MPa	
	7 days	28 days
HL 2 and NHL 2	-	≥ 2 to ≤ 7
HL 3,5 and NHL 3,5	-	≥ 3,5 to ≤ 10
HL 5 and NHL 5	≥ 2	≥ 5 to ≤ 15[a]

[a] HL 5 and NHL 5 with a bulk density lower than 0,90 kg/dm³ is allowed to have a strength up to 20 MPa.

NOTE It is known, that mortars containing lime binders also acquire compressive strength which increase slowly with carbonation.

4.4.2 Other physical properties for quicklimes and hydrated Limes

Physical properties in Table 4 and 5 of building limes shall comply with the relevant values given therein when tested in accordance with EN 459-2:2001.

Table 4 – Physical requirements of quicklime

	Type of building lime	Soundness after slaking[a] in accordance with 5.3.3 of EN 459-2:2001[b]	Yield in accordance with 5.9 of EN 459-2:2001[b] dm³/10 kg
1	CL 90	pass	≥ 26
2	CL 80		
3	CL 70		
4	DL 85	pass	–
5	DL 80	pass	–

[a] Slaking according to instructions of the lime producer.
[b] These requirements apply to building lime for masonry mortar, plastering and rendering.

4.4.3 Additional properties

Other properties, also determined in accordance with EN 459-2:2001, may be subject either to requirements in execution standards dealing with the use of limes or to queries from the users. These properties are given in the informative annex C.

4.5 Durability requirements

In many applications, particularly in severe environmental conditions, the choice of building limes has an influence on the durability of mortar and other construction products, e. g. frost resistance and chemical resistance.

The choice of building lime, from this European Standard, particularly as regards type and strength class for different applications and exposure classes shall follow the appropriate standards and/or regulations for mortar and other construction products valid in the place of use.

Table 5 – Physical requirements of hydrated calcium and dolomitic limes, lime putty, hydraulic lime and natural hydraulic limes[g]

	Type of building lime	Fineness[f]		Free water content[a]	Soundness[b d]			Mortar tests[e f]		Setting times	
					For building limes other than lime putty and hydrated dolomitic limes[c]		For lime putty and hydrated dolomitic limes	Penetration	Air content	initial	final[h]
		in accordance with 5.2 of EN 459-2:2001		in accordance with 5.11 of EN 459-2:2001	Reference method in accordance with 5.3.2.1 of EN 459-2:2001	Alternative method in accordance with 5.3.2.2 of EN 459-2:2001	in accordance with 5.3.3 of EN 459-2:2001	in accordance with 5.5 of EN 459-2:2001	in accordance with 5.7 of EN 459-2:2001	in accordance with 5.4 of EN 459-2:2001	
		% residue by mass									
		0,09 mm	0,2 mm	%	mm	mm		mm	%	h	
1	CL 90	≤ 7	≤ 2	≤ 2	≤ 2	≤ 20	pass	> 10 and < 50	≤ 12	—	
2	CL 80										
3	CL 70										
4	DL 85					—					
5	DL 80										
6	HL 2	≤ 15	≤ 5	≤ 2	≤ 2	≤ 20	—		≤ 20	> 1	≤ 15
7	HL 3,5										
8	HL 5										
9	NHL 2										
10	NHL 3,5										
11	NHL 5										

[a] For lime putty: free water content ≤ 70 % and ≥ 45 %.
[b] See 5.3 of EN 459-2:2001.
[c] For hydraulic limes and natural hydraulic limes with a SO_3 content of more than 3 % and up to 7 %, soundness is tested additionally in accordance with 5.3.2.3 of EN 459-2:2001.
[d] Additionally hydrated calcium limes, calcium lime putties and hydrated dolomitic limes which include grains larger than 0,2 mm shall be sound when tested in accordance with 5.3.4 of EN 459-2:2001.
[e] Using standard mortar in accordance with 5.5.1 of EN 459-2:2001.
[f] Not for lime putty.
[g] Fineness and free water content apply to building lime for all applications. Soundness, penetration, air content and setting time apply only to building lime for masonry mortar, plastering and rendering.
[h] Does not apply to HL 2 and NHL 2.