



Designation: C 911 – 99<sup>e1</sup>

# Standard Specification for Quicklime, Hydrated Lime, and Limestone for Chemical Uses<sup>1</sup>

This standard is issued under the fixed designation C 911; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

<sup>e1</sup> NOTE—Note 9, Note 10, and Note 11 were editorially re-inserted February 2002.

## 1. Scope

1.1 This specification covers lime and limestone products suitable for chemical uses as shown in Table 1. The type designations signify the following:

Limestone, high-calcium—CL  
Limestone, dolomitic—DL  
Limestone, magnesian—ML  
Quicklime, high-calcium—CQ  
Quicklime, dolomitic—DQ  
Quicklime, magnesian—MQ  
Hydrated lime, high-calcium—CH  
Hydrated lime, dolomitic—DH  
Hydrated lime, magnesian—MH  
Hydrated lime, by-product—BH

NOTE 1—Lime is used in environmental systems when the control of factors influencing the environment such as gases, liquids and solids is required.

1.2 The buyer shall designate the use, as listed in Table 1, and may specify one or more of the type designations in 1.1.

## 2. Referenced Documents

### 2.1 ASTM Standards:

- C 25 Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime<sup>2</sup>
- C 50 Methods of Sampling, Inspection, Packing, and Marking of Lime and Limestone Products<sup>2</sup>
- C 51 Terminology Relating to Lime and Limestone (as Used by the Industry)<sup>2</sup>
- C 110 Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone<sup>2</sup>
- C 400 Test Method for Quicklime and Hydrated Lime for Neutralization of Waste Acid<sup>2</sup>

## 3. Chemical Composition and Physical Properties

3.1 The requirements for quicklime, hydrated lime, and limestone for the designated end uses are as shown in Table 1,

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C07 on Lime and is the direct responsibility of Subcommittee C07.03 on Industrial Uses.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 04.01.

and are on the basis of the weight of sample taken at the place of manufacture, except as noted in footnote B after the requirement. In this case, the requirement is on a moisture and carbon dioxide-free basis.

## 4. General Requirements

4.1 Quicklime shall be reasonably free of unslakable residues and shall be capable of disintegrating in water to form a suspension of finely divided material. Rapidity of slaking is generally a desirable quality.

4.2 The amount of residue shall not exceed that stated in the physical requirements of Table 1 or as agreed upon between the manufacturer and the purchaser (the residue is the amount of material retained on the screen).

## 5. Sampling and Inspection

5.1 Conduct the sampling, inspection, rejection, retesting, packing, and marking in accordance with Methods C 50.

NOTE 2—Rags are cooked for the manufacture of paper in a digester under steam pressure with lime or with lime and soda ash. They are then washed to eliminate as much of the noncellulose material as possible. A standard composition without rejection limits is specified for the reason that lime of either higher or lower total oxides, available lime, calcium oxide, or calcium hydroxide than the standard, may safely be used under suitable conditions for the purpose herein specified, depending primarily upon economic considerations. In the present state of the art, it is believed that the more serviceable type of specification for the product herein specified is that which defines a reasonable standard rather than one that fixes actual rejection limits. It is generally recognized that, other things being equal, lime meeting this standard is preferable to lime that does not, and lime surpassing the standard should be considered of premium quality.

NOTE 3—Lime is used in the “milk of lime” or “tank” system of sulfite pulp manufacture for making the cooking liquor. The milk of lime is held in solution or suspension in a series of tanks equipped with suitable agitators. The sulfur dioxide (SO<sub>2</sub>) is forced or drawn through these tanks successively. In some cases, the tanks are built on top of each other in the form of a tower. The contents of the first tank are drawn off when the liquor has reached a certain strength (3.5 to 6 % total SO<sub>2</sub>) and the contents of the second and third tanks progress to the first and second tanks respectively. The third tank is again charged with fresh milk of lime. There are other systems of absorption that provide for continuous instead of intermittent operation. The function of the lime is to furnish the base for the formation of the bisulfites of calcium and magnesium.

**TABLE 1 Limes and Limestones for Chemical Uses**

Use	ASTM Specification <sup>A</sup>	Notes Referenced	Approved Types of Lime or Stone	Chemical Requirements, %									
				CaO min	CaO, +MgO min	SiO <sub>2</sub> +Fe <sub>2</sub> O <sub>3</sub> , +Al <sub>2</sub> O <sub>3</sub> , max	MgO, max	CO <sub>2</sub> , max	SiO <sub>2</sub> + insoluble matter, max	Al <sub>2</sub> O <sub>3</sub> + Fe <sub>2</sub> O <sub>3</sub> , max	Available CaO, min	Fe <sub>2</sub> O <sub>3</sub> , max	Chemical Other
Cooking rags	C 45	2	CH	...	...	...	...	...	...	...	64.3 <sup>B</sup>	...	...
Cooking rags	C 45	2	CQ	...	...	...	...	...	...	...	90.0 <sup>B</sup>	...	...
Sulfite pulp	C 46	3	CQ, MQ	...	95.0 <sup>C</sup>	3.0 <sup>C</sup>	...	...	...	...	...	...	...
Sulfite pulp	C 46	3	CL, ML	...	95.0 <sup>C</sup>	3.0 <sup>C</sup>	...	...	...	...	...	...	...
Silica brick	C 49	4	CH	90 <sup>C</sup>	...	...	2.5 <sup>C</sup>	2.5	3.0 <sup>C</sup>	1.5 <sup>C</sup>	...	...	{ Free CaO ≤1.5
Silica brick	C 49	4	CQ	90 <sup>C</sup>	...	...	2.5 <sup>C</sup>	2.5	3.0 <sup>C</sup>	1.5 <sup>C</sup>	...	...	...
Water softening	C 53	5	CQ	...	...	...	...	...	...	...	90	...	...
Water softening	C 53	5	CH	...	...	...	...	...	...	...	68.1	...	...
Other water treatment uses	C 53	6	CQ, DQ, MQ	...	93.0	...	...	...	...	...	...	...	...
Other water treatment uses	C 53	6	CH, DH, MH	...	93.0 <sup>C</sup>	...	...	...	...	...	...	...	...
Carbide	C 258		CQ	92 <sup>C</sup>	...	...	1.75 <sup>C</sup>	4.0	2.0 <sup>C</sup>	1.0 <sup>C</sup>	...	0.5	P ≤ 0.02 <sup>C</sup> { S 0.2 <sup>C</sup> available
Grease	C 259		CH	...	...	...	1.5	...	1.0	...	...	0.5	{ Ca (OH) <sub>2</sub> ≥90
Calcium silicate product	C 415		CH	90 <sup>C</sup>	...	...	1.3 <sup>C</sup>	2.5	3.0 <sup>C</sup>	1.5 <sup>C</sup>	...	...	...
Calcium silicate product	C 415		CQ	90 <sup>C</sup>	...	...	1.3 <sup>C</sup>	2.5	3.0 <sup>C</sup>	1.5 <sup>C</sup>	...	...	...
Hypochlorite (bleach)	C 433	7	CH	...	...	...	...	...	...	...	68	0.3 <sup>C</sup>	...
Hypochlorite (bleach)	C 433	7	CQ	...	...	...	...	...	...	...	90	...	...
Industrial waste treatment	C 826	8	CH DH MH	...	{ 95.0 <sup>C</sup>	...	...	{ 5.0	...	...	...	...	BF > 0.72 <sup>D</sup> BF > 0.81 <sup>D</sup> BF > 0.74 <sup>D</sup>
Industrial waste treatment	C 826	8, 9	BH	...	90.0 <sup>C</sup>	...	...	...	...	...	...	...	...
Industrial waste treatment	C 826	8	CQ DQ MQ	...	} 90.0	...	...	...	...	...	...	...	BF > 0.93 <sup>D</sup> BF > 1.06 <sup>D</sup> BF > 0.93 <sup>D</sup>
Industrial waste treatment	C 826	8, 10	CL DL ML	...	} 90 <sup>C</sup>	...	...	...	...	...	...	...	BF > 0.45 <sup>D</sup> BF > 0.56 <sup>D</sup> BF > 0.48 <sup>D</sup>

<sup>A</sup> These specifications have all been incorporated into the current issue of this specification and are now discontinued. The discontinued specifications are available through Global Engineering Documents, 15 Inverness Way, East Englewood, CO 80112-5704.

- C 45 Specification for Quicklime and Hydrated Lime for Cooking of Rags in Paper Manufacture
- C 46 Specification for Quicklime and Limestone for Sulfite Brick Manufacture
- C 49 Specification for Quicklime and Hydrated Lime for Silica Brick Manufacture
- C 53 Specification for Quicklime and Hydrated Lime for Water Treatment
- C 258 Specification for Quicklime for Calcium Carbide Manufacture
- C 259 Specification for Hydrated Lime for Grease Manufacture
- C 415 Specification for Quicklime and Hydrated Lime for Calcium Silicate Products
- C 433 Specification for Quicklime and Hydrated Lime for Hypochlorite Bleach Manufacture
- C 826 Specification for Lime and Limestone Products for Industrial Waste Treatment

<sup>B</sup> Standard composition.

<sup>C</sup> On a nonvolatile basis.

<sup>D</sup> BF means Basicity Factor.

NOTE 4—In the manufacture of silica brick, silica in the form of massive quartzite or quartz conglomerate is ground until the particles are less than ¼ in. (6 mm) in size. Lime in the form of either slaked or hydrated lime is then added in quantities varying from 1.5 to 3.0 % calcium oxide (CaO), with sufficient water to produce about 5 to 7 % moisture content, and the shapes are molded and dried. They are then burned in downdraft or tunnel kilns until most of the quartzite has been converted into tridymite or cristobalite.

NOTE 5—In the softening of water for municipal and industrial supplies, lime is used alone or with coagulant aids to produce a precipitate that assists in the clarification of water, removal of bacteria, and removal of hardness. Lime and soda ash may be used together for softening water. The lime serves as a chemical reagent in water softening. The only useful

constituent of the lime is the calcium oxide content of the quicklime or hydrated lime capable of reacting with the other chemicals in the water or added to it. Inert material, besides reducing the value in proportion to its amount, also makes more sludge to be disposed of for a given amount of chemical action and thus reduces the capacity of the equipment in which it is used.

NOTE 6—In addition to water softening, lime is also used for silica removal from boiler feed-water, and for color removal and clarification of water for municipal and industrial supplies, for most such applications, high-calcium lime is preferred. However, for silica removal from boiler feedwater, dolomitic lime should be employed.

NOTE 7—In manufacture of calcium hypochlorite bleach, lime hydrate in water suspension is reacted with chlorine. Lime hydrate suitable for this