

GUIDES TO GOOD BUILDING

MINISTRY OF WORKS ADVISORY LEAFLETS

This Series is designed mainly to meet the need of the small builder, clerk of works, foreman and craftsman for information in a practical and convenient form about the results of research and the latest developments in building practice.

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These leaflets are published at intervals of approximately one month and are obtainable from His Majesty's Stationery Office at the addresses shown below, or through any bookseller, with either of whom you may place a standing order.

Single copies 2d. each.*

In quantities at the following rates (including postage):
25 for 3s. 0d., 50 for 5s. 0d.,
100 for 8s. 0d., 1,000 for £3 15s. 0d.

*Postage on quantities less than 25 is as follows:
Up to 4 copies 1d., up to 14 copies 2d., over 14 copies 3d.

NEW ISSUES ARE ADVERTISED IN H.M.S.O. DAILY LIST

LONDON:

PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

York House, Kingsway, London, W.C.2; 429 Oxford Street, London, W.1 (Post Orders, P.O. Box No. 369, London, S.E.1);
13a Castle Street, Edinburgh, 3; 39 King Street, Manchester, 2; 2 Edmund Street, Birmingham, 3;
1 St. Andrew's Crescent, Cardiff; Tower Lane, Bristol, 1; 80 Chichester Street, Belfast.

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Limes for Mortar

MINISTRY OF WORKS
ADVISORY LEAFLET No. 6

1950

Price 2d. net

HOW TO USE LIME WHEN MIXING MORTAR

THE KINDS OF LIME

All limes start as lump lime, or quicklime, which is obtained by burning chalk or limestone in a kiln.

BLUE LIAS, and similar limes, which come from limestone containing clay, have the property of setting hard under water soon after slaking; they are therefore known as hydraulic limes, and are used mainly for mortar.

GREYSTONE LIMES come from chalk containing only a little scattered clay minerals—not enough to make them fully hydraulic—but they will harden under water or when moist in two or three weeks after slaking. These limes are classed as semi-hydraulic; they can be used for both mortar and plastering.

WHITE LIMES (mountain lime, chalk lime, etc.) come from rocks which are practically pure limestone or chalk. They do not set hard under water, and are therefore classed as non-hydraulic limes. They are used for plastering and for making cement-lime mortar.

MAGNESIAN LIMES are made from dolomitic limestone. They are in a class by themselves and are used mainly for mortar, but they must not be used with bricks containing sulphates. They are mostly non-hydraulic.

The various types of lime are classified in a table at the end of this leaflet.

LIME PUTTY

Quicklime must be slaked before it can be used. In the old days all builders used to slake their own lime, running it to a paste known as lime putty.

Lime putty run from quicklime is still used in some parts of the country and for special jobs, since one of its chief characteristics is good workability.

Slaked non-hydraulic limes improve with keeping, so they should stand for at least two weeks to fatten up before use. They should be kept moist and undisturbed until they are needed. Semi-hydraulic quicklimes are usually slaked as non-hydraulic limes, but the wet putty must not be stored.

Slaked hydraulic limes do not keep—the quicklime is usually slaked on the building site by spraying it with water on a clean wooden platform until thoroughly moist; it is then heaped together, covered with sand and left for about 36 hours. The material is then put through a sieve before use, to remove any unslaked particles which might slake later in the hardened mortar and cause unsoundness or even cracking. Magnesian limes are also slaked in a heap.

DRY HYDRATED LIME

Nowadays most lime used in building is dry hydrated lime—a ready-made form of slaked lime, which is a white or greyish powder supplied in paper bags like cement. It is usually manufactured either from white lime or from greystone lime, and is therefore non-hydraulic or semi-hydraulic. Hydraulic limes are also available in dry hydrated form—they set in the same way as cement, but not quite so quickly.

Quicklime, too, has sometimes been sold in a finely ground form. Don't confuse ground quicklime with dry hydrated lime. Ground quicklime constitutes a serious fire risk if put in a damp place, whilst dry hydrated lime obviously does not.

LIME PUTTY FROM DRY HYDRATED LIME: Dry hydrated lime is often mixed and used at once as a mortar or plaster. If it is not of the quick hardening or hydraulic type, it is better to soak it in water for 24 hours before adding the sand. This will give a much more workable mix. Stir the hydrated lime into the water until a putty-like mixture is obtained. Don't add the water to the lime or you will get a lumpy putty.

LIME MORTARS

Lime mortars are usually of a 1 : 3 lime : sand composition. For external brickwork it is usually best to use hydraulic lime mortars because other lime mortars do not stand up well to frost. Semi-hydraulic and non-hydraulic lime mortars, however, are used for bedding limestone and sandstone.

MIXING LIME MORTARS : To make mortar from non-hydraulic lime putty or soaked hydrated lime, mix the sand and lime putty on a clean platform until an even consistency is reached. Round off this "coarse stuff" into a heap, smooth the sides and leave undisturbed until required for use, but don't let it dry out if you keep it for any length of time. This coarse stuff will stiffen up on standing, but with vigorous beating and stirring it can be knocked up to its original plastic state. If possible, don't add any water when knocking up—working the mortar vigorously will give a better material than the addition of water.

Semi-hydraulic putties are mixed with sand in the same way—but when using them don't make up more mortar than is sufficient for one day.

To make mortar from hydraulic quicklime which has been slaked on site, mix the sand and the lime thoroughly, adding more sand and/or water if necessary to get the right proportions and consistency. Magnesian lime mortar is also prepared in this way. Hydrated hydraulic lime must not be soaked overnight. Mix it dry with the sand, then add water, and use within four hours.

CEMENT-LIME MORTARS : Lime gives a mortar good working properties. The more lime in the mix, the better the workability. A fat lime slaked to a putty gives the best working properties, and an unsoaked hydrated lime the poorest.

Cement gives a mortar strength and durability. Not only is the hardened mortar strong, but it hardens quite quickly. Without lime, a high proportion of cement to sand is needed to make a workable mix, but this is wasteful and may easily cause cracking due to too much shrinkage. Unlike a lime mortar, a cement mortar will readily lose water to a thirsty brick and thus give loss of adhesion.

A mortar containing both lime and cement will normally possess a desirable combination of properties. It will be workable, will set reasonably quickly, and is adequately strong for all purposes in small housebuilding. Hydraulic limes should be used with sand alone and not with cement. High alumina cement is not suitable for use with lime.

For normal types of brickwork under normal conditions use a 1 : 2 : 8-9 cement : lime : sand mortar. If however the brickwork has to withstand severe weather, or for bricklaying during winter where earlier strength may be demanded use a 1 : 1 : 5-6 mix ; a 1 : 3 : 10-12 mix is only suitable for internal work when there is no danger of frost affecting it.

Cement-lime-sand mixes are also very good for external renderings ; a 1 : 2 : 8-9 mix is suitable for normal use, but where a wall has to stand up to severe weather conditions a 1 : 1 : 5-6 mix is better.

MIXING CEMENT-LIME MORTAR : These are usually prepared by first making up a wet mix of lime and sand usually known as coarse stuff. If the lime is added as putty the coarse stuff may be used immediately, but if you use dry hydrated lime, mix up enough coarse stuff for the day's work and let it stand overnight to improve its properties. Immediately before use, mix the cement thoroughly into the coarse stuff, adding more water if necessary. Don't mix up all the mortar at once. Do it in batches so that each batch can be used up within two hours of adding the cement ; throw away any left after this.

Cement-lime mortar may also be prepared by mixing dry hydrated lime, cement and sand, then adding the water, and using straight away. This is often speedy and convenient, but remember that such a mortar does not have good working properties.

PROPORTIONING : When you are making the coarse stuff, remember that the lime only fills up the spaces between the sand grains, giving you the same volume of coarse stuff as the sand you started with ; for instance, 1 volume of lime and 6 volumes of sand give you only 6 volumes of coarse stuff, not 7. Therefore to prepare a 1 : 1 : 6 mix use 1 part of lime and 6 parts of sand to get 6 parts of coarse stuff. Then add 1 part of cement to these 6 parts of coarse stuff. Similarly to prepare a 1 : 2 : 9 mix use 2 parts of lime and 9 parts of sand. This gives 9 parts of 2 : 9 coarse stuff, which will need 1 part of cement to bring it to the right proportions for a 1 : 2 : 9 mix.

If you are using a ready mixed lime-sand mortar as the basis of a cement-lime mortar, the sand and lime may not be in the right proportions for the final mix. For instance you may have a 1 : 3 lime : sand mix from which to prepare a 1 : 2 : 9 cement : lime : sand mix. The first thing to do is to get the lime : sand proportions right ; a 1 : 3 mix is the same as a 2 : 6 mix, so that if you add 3 parts of sand to 6 parts of the 1 : 3 mix, it will give you 9 parts of a 2 : 9 mix. Then, as before, adding 1 part of cement to 9 parts of a 2 : 9 coarse stuff will give you the required 1 : 2 : 9 mix.

MORTAR	PROPORTIONS BY VOLUME			USES
	Cement	Lime	Aggregate	
CEMENT MORTAR	1	0-1	3	For brickwork where extra strength is needed Normal brickwork below the damp proof course Granite masonry
CEMENT-LIME MORTAR	1	1	5-6	Normal brickwork in winter Rubble masonry in winter Dense sandstone masonry
CEMENT-LIME MORTAR	1	2	8-9	Normal brickwork in spring and summer Rubble masonry in spring and summer Tall chimneys
CEMENT-LIME MORTAR	1	3	10-12	Internal brickwork only in summer Limestone or porous sandstone masonry where rapid hardening is necessary
HYDRAULIC LIME MORTAR	0	1	2-3	Normal brickwork Tall chimneys
SEMI-HYDRAULIC OR NON-HYDRAULIC LIME MORTAR	0	1	2-3	Limestone or porous sandstone masonry

THE DIFFERENT KINDS OF LIME

TYPE OF LIME	OTHER NAMES	SOURCE	TYPE OF SLAKING	EXPANSION ON SLAKING	METHOD OF SLAKING	MATURING TIME	MIXING MORTAR	WHEN TO USE MORTAR	KNOCKING UP	USE OF HYDRATED LIME
NON-HYDRAULIC LIMES	Fat lime High-calcium lime Mountain lime Chalk lime Stone lime Limestone lime White lime White chalk lime	Chalk, mountain limestone, and other almost pure limestones	Rapid, with much heat	Considerable	Stir into excess water gradually. Sieve	At least two weeks, but as long as possible	Mix putty thoroughly with sand	Must be kept moist if not used at once	Can be knocked up if it stiffens	Stir into water and leave for 24 hours, then use as lime putty
MAGNESIAN LIMES	Dolomitic lime	Dolomitic limestone	Very slow	Variable	Slake as hydraulic lime or add (hot) water to the lime. Sieve	36 hours	Mix putty thoroughly with sand	Within 24 hours	Can be knocked up if it stiffens	Stir into water and leave for 24 hours, then use as lime putty
SEMI-HYDRAULIC LIMES	Grey lime Greystone lime	Grey chalk	Slow	Moderate	For putty, stir into excess water. For mortar soak with water and cover with sand. Sieve	36 hours	Mix putty thoroughly with sand	Within 24 hours	Can be knocked up within 24 hours	Stir into water and leave for 24 hours, then use as lime putty
HYDRAULIC LIMES	Blue lias lime	Blue lias limestones	Very slow, requires fine grinding	Small	Spray with water and cover with sand. Sieve	36 hours	Mix covering sand with the slaked lime, adding more if required	Within 4 hours	Should not be knocked up after it stiffens	Mix dry with sand, add water and continue mixing. Use within 4 hours

