TECHNICAL INFORMATION ON BUILDING MATERIALS

TIBM - 25

FOR USE IN THE DESIGN OF LOW-COST HOUSING

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WALL PLASTER BASES AND FURRING

This is the first in a series of three sections of a digest of Circular No. 151, "Wall Plaster: Its Ingredients, Preparation and Properties", (January 9, 1924),[1] issued by the Bureau of Standards, and deals with the preparation of plaster bases.

The information in Circular No. 151 was originally compiled with the cooperation of the Bureau of Standards' Plastering Conference (1923).

Value and Properties of Plaster: The occupant of a building is constantly aware of the quality of plaster on walls and ceilings through daily impressions, made subconsciously upon his mind perhaps, by which he becomes cognizant of whatever faults or merits it may possess. To him, its obvious value is that of decoration, although it has other functions which though none the less important, are frequently lost sight of.

The ability of plaster to resist fire should be such as to allow sufficient time for fire apparatus to arrive before the fire can gain too much headway.

The acoustical properties of plaster are of obvious concern in theaters, churches, and apartments.

The resistance to the passage of heat, especially in conjunction with furring, has a measurable effect on the quantity of fuel required to maintain comfort in a building.

[1] Available from Superintendent of Documents, Washington, D. C. (Price 10 cents).

Definitions of Plaster and Plastering: When dry material is mixed with water to produce a plastic mass, which subsequently hardens to form the surface of an interior wall or ceiling, the term plaster is applied to the material in any of its three stages--dry powder, plastic mass, or hardened surface.

Plastering includes the plaster, the backing to which it is applied, the workmanship used in its application, and subsequent reference to the complete wall surface.

Furring

Furring is the term applied to a type of construction wherein an air space is provided between the inside face of a wall and the back of the plaster.

Reasons for using furring are as follows:

(a) To keep the plaster dry by interposing an air space in the path of any water which may come through a masonry wall.

(b) To increase thermal resistance by interposing an air space between the exterior wall and interior plaster.

(c) To lessen the possibility of condensation of moisture on the surface of the plaster when the exterior masonry wall cools below the dew point of the air in the building.

(d) To provide additional safeguard against cracks by separating the plaster from the masonry wall which is underground movements resulting from exposure to weather. going

Therefore, it is recommended that all exterior masonry walls be furred. The improved durability of the plaster and decorations, and the comfort of occupancy, amply justify such a recommendation.

Some attempts have been made to use bituminous coatings to accomplish the same results as furring. Except insofar as these coatings prevent actual flow of air through the wall, the added thermal resistance is so slight as to be negligible. Such coatings do not always prove effective as waterproofings and do not provide an ideal base for plaster.

The furring of a wall may be accomplished by the use of different types of materials--furring tile, furring strips, and self-furring lath.

Furring Tile: Furring tile is made of either gypsum or clay and should be not less than one and one-half inches thick over-all. It should be firmly secured at top and bottom to the masonry by means of metal ties embedded in the walls, spaced on centers not more than two feet apart vertically nor three feet apart horizontally. There should be no mortar bond between tile and masonry and, for absorptive types of tile, all contact surfaces should be given an effective coat of dampproofing. The vertical jointing should be staggered and the tile set so as to provide a firm, plumb, and true surface for plastering. At structural members, it is sometimes necessary to bond the tile firmly, bedding in mortar at the bottom and wedging at the top.

Furring Strips: Furring strips should provide an air space of not less than one-half inch nor more than one inch. Those of wood or metal should be firmly secured to the masonry by means of metal plugs, metal wall ties, or nails spaced not more than three feet apart along the length of the strips. It is recommended that wood stripping for wood lath be placed not more than sixteen inches on centers for walls and twelve inches for ceilings. The weights of metal lath are such that the distances between stripping may vary from these dimensions according to the weight of material used.

Self-Furring Lath: Furring strips or stiffeners, which form a part of the lath, should be secured to the masonry as though they were separate strips.

Suspended Ceilings

It is sometimes desirable to make use of the principle of furring in the construction of suspended ceilings. For this type of ceiling, metal stirrups of appropriate lengths should be spaced four feet apart each way and rigidly fastened to the ceiling structure. Runner-bars spaced four feet on centers should be fastened to the stirrups, and furring strips should be secured to the runner-bars to provide a rigid and plane ensemble for the plaster. In low-cost house construction, satisfactory results may be obtained by using wood members in lieu of metal where wood joists are used.

Preparation of a Masonry Wall to Receive Plaster

Although furring is distinctly recommended for all exterior masonry walls, in cases where plaster is to be applied directly, the wall must have certain characteristics.

Trueness: A masonry wall to which plaster is to be applied should be reasonably true, with all angles and corners sharp and straight.

Cleanliness: Foreign material on the surface should be removed to secure a good bond between masonry and plaster. When brick or tile walls have pieces of mortar loosely adhering to them, a wire brush is useful for removing these loose pieces as well as any dirt which may have collected. A concrete wall may be coated with laitance or spotted with grease from the forms. These should be removed. Grease spots may be burned out with a blow torch.

Roughness and Wetness: The manner in which a wall receives plaster indicates whether or not it is suitably wet or rough. If the plaster cannot be spread, but adheres to the wall in lumps, the wall is too dry and must be wetted. If the plaster tends to stick to the trowel rather than to the wall, or if it tends to slide off, the wall may be too wet, in which case, the plastering should be postponed until some of the water has evaporated. If the wall is not too wet and the plaster does not spread properly, then it must be too smooth, and should be roughened by some suitable means, resorting to furring if necessary. The degree of roughness required is a function of the absorptive properties of a wall--the more absorptive the wall, the smoother the surface.

The roughness of the surface must be increased in proportion as the pores in a wall are diminished in number.

Some water is necessary to the chemical reactions involved in the hardening of plaster, and if the wall is so dry as to absorb the water immediately, the hardening may be impeded or even prevented--resulting in a "dry out".

Lathing

Lath is a material designed to serve as a base to which plaster is applied and is secured to the walls and ceilings either directly or by means of furring strips or counter-lath. Lath provides rigidity to the plaster work; distributes strains on the plaster, thus reducing the tendency to crack; and in conjunction with plaster, increases the stiffness of the structure.

There are three types of lath in general use--wood, metal, and plaster board.[1]

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[1]Gypsum plasterboard only is discussed under this heading in this paper. For information on fibrous plaster bases, consult manufacturers. General technical data are given in Bureau of Standards' publication Commercial Standard, CS 42-35, "Board, Fibre Insulating", and Miscellaneous Publication, No. 132, "Properties of Fiber Building Boards", both available from the Superintendent of Documents, Washington, D. C. (Price 5 cents each).

Wood Lath and Its Erection: Care should be taken in the selection of wood lath, which may warp or buckle when wet, particularly if the grain is crooked. Inferior lath may be readily detected and discarded when thoroughly soaked. Lath with large "live" knots should be discarded because of resin as it may penetrate the plaster and discolor it. In accordance with these suggestions, either No. 1 or No. 2 grades should be specified although No. 2 grade will probably contain a greater number of unsatisfactory lath. Lath should be approximately one-fourth inch thick and one and one-half inches wide. Commercial lengths are thirty-two and forty-eight inches.

Supports for wood lath should not be spaced more than sixteen inches apart on centers and the face should not exceed four inches in width. Supporting members at angles and corners should be solid to prevent extension of lath through the angles. On ceilings, lath should be laid in one direction only. In small panels, lath may be laid not to exceed a 60 degree angle. Spaces between the lath should be three-eighths inch, and their abutting ends not less than one-fourth inch apart. The vertical line of joints should be broken at least every seven laths. Lath should be nailed securely to every support crossed and all joints should be made over a support.

Metal Plaster Base Specifications: Metal plaster base may be divided into three classes--perforated sheet, expanded metal, and woven or welded wire. These may be self-furred or plain, and may or may not have a backing of paper or other material. Since in the manufacture of metal bases the larger the mesh, the heavier the metal, it is now customary to specify the weight. The most recent recommended minimum weights of expanded and sheet metal lath are as follows:

Department of Commerce - Bureau of Standards Simplified Practice Recommendation R3-28 - Metal Lath[1]	Pounds Per Square Yard		
	Light	Medium	Heavy
Expanded lath, no ribs	2.2 to 2.5	3.0	3.4
Expanded lath, ribbed	2.75	3.0 to 3.4	4.0
Sheet lath	4.5	-	-

The weight of lath to be used is determined by the type of plastering.[2] All metal plaster base should be painted or galvanized.

[1]Available from Superintendent of Documents, Washington, D. C. (Price 5 cents).

[2]See TIBM - 27.

Supports for metal lath and wire lath are generally set sixteen inches apart on centers for walls and twelve inches apart on centers for ceilings. If these dimensions are greater, an extra heavy sheet or ribbed lath should be used. As in the case of wood lath, the stripping for metal lath should be not more than four inches on the face. If greater, it should be set back and an additional strip not more than two inches on the face applied to receive the lath. Sheets of lath should be laid with the longer dimension across the supports, with ends at least one support distant from corners and angles, and then bent around or into them. Wall lath should also overlap the ceiling lath about six inches on the ceiling surface. This will strengthen those places where cracks in the plaster are most likely to occur. Sheets of lath which are put on horizontally should be applied beginning at the top of the walls. The ends and sides of sheets should be overlapped one full mesh with end joints over supports where possible. The lath along the stripping should be secured every six inches and once or twice between stripping, according to the spacing. It is essential to have all surfaces true and plumb, and of equal thickness and strength.

Gypsum Plasterboards (Gypsum Lath):[1] Gypsum plasterboard should be applied over studs, rafters, joists or furring strips spaced twelve or sixteen inches apart on centers. The boards should be nailed at every support with one and one-half inch, thirteen gage, three-eighths inch head nails, spaced four inches apart.

Joints should be staggered between walls and ceilings so that joints on walls will not meet ceiling joints.

Vertical joints should be broken. Vertical and horizontal joints should not exceed one-fourth inch.

Metal corner beads should be securely placed on all vertical exterior angles, and cornerites in all interior angles.

When gypsum plasterboard is used on metal studs for solid or hollow partitions, or is attached to ceiling runners for suspended ceilings, it should be erected in accordance with the specifications for the system used.

Gypsum plasterboards should not be wetted prior to the application of plaster.

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[1]See Federal Specification SS-P-431a, "Gypsum Plaster-Board" (Available from Superintendent of Documents, Government Printing Office, Washington, D. C. Price 5 cents), also American Society for Testing Materials Standard Specifications for Gypsum Lath, Serial Designation C - 37.

Solid Partitions: This type of construction usually consists of three-fourths inch steel channel studs or their equivalent for a fourteen foot height or less, and one layer of lath plastered and back-plastered to form a finished surface on both sides.

Corner Beads and Cornerites: Corner beads are generally made of metal and are used on outside angles to increase the protection of the plaster from impacts and sometimes for reinforcement. Cornerites are also used in reentrant angles, secured to both surfaces, to absorb the concentrated stresses in the plaster at these places.