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STANDARD SPECIFICATIONS FOR GYPSUM PLASTERING

INCLUDING REQUIREMENTS FOR LATHING AND FURRING

Approved as
AMERICAN STANDARD
by the American Standards Association
September 26, 1946

Sponsor Organizations
THE AMERICAN INSTITUTE *of* ARCHITECTS
1741 New York Avenue, N. W., Washington 6, D. C.

AMERICAN SOCIETY *for* TESTING MATERIALS
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STANDARD SPECIFICATIONS FOR GYPSUM PLASTERING

INCLUDING REQUIREMENTS FOR LATHING AND FURRING

CHAPTER I

NOTE.—These specifications are intended to describe minimum requirements. The use of equivalents, or better, is permissible.

GENERAL PROVISIONS

1. **(a)** The work includes all labor, materials, services, equipment, and scaffolding required to complete the lathing and plastering of the project in accordance with the drawings and specifications.

(b) Scaffolding shall be constructed and maintained in strict conformity with applicable laws and ordinances, and so as not to interfere with and obstruct the work of others.

(c) The work shall be properly co-ordinated with the work of other trades.

SCOPE OF WORK

2. **(a)** The following work shall be included:

.....

.....

.....

(b) The following work shall not be included:

.....

.....

.....

MATERIALS

3. **(a)** The materials shall conform to the following specifications of the American Society for Testing Materials:

MATERIALS		A.S.T.M. DESIGNATIONS[1]
SAND FOR USE IN PLASTER[a]		C 35 – 39[2]
LIME	Special Finishing Hydrated Lime[b,c,d]	C 206 – 46 T
	Quicklime for Structural Purposes[e,f]	C 5 – 26
GYPSUM PLASTERS	Ready-sanded	C 28 – 40
	Neat	
	Wood-fibered	
	Calcined gypsum for finishing coat	
MOLDING PLASTER		C 59 – 40
KEENE'S CEMENT		C 61 – 40

VERMICULITE . . . . when used as an aggregate with plaster shall conform in particle size to the requirements of the Standard Specifications for Sand for Use in Plaster (A.S.T.M. Designation: C 35 – 39).[2] The weight shall be not less than 7½ nor more than 10 lb. per cu. ft., as determined by measurement in a cubic foot box, using the shoveling procedure as outlined in the Standard Method of Test for Unit Weight of Aggregate (A.S.T.M. Designation: C 29 – 42).[1]

WATER[g] . . . . . shall be clean, fresh, suitable for domestic consumption, and free from such amounts of mineral and organic substances as would affect the set of the plaster.

[a] Fine sand, having rounded particles, uniform in size (frequently called "quicksand") shall not be used. It can be easily detected since it settles in the bottom of the mixing box, gives the mixture a watery appearance and causes it to work "short," and produces a weak plaster.

[b] A.S.T.M. Specifications C 206 cover both dolomitic and high-calcium finishing hydrated limes.

[c] The requirements for popping and pitting prescribed in A.S.T.M. Specifications C 206 shall be replaced by an autoclave method for "soundness" (popping and pitting) as described in Appendix I. In this test, if the specimen shows the presence of pops or pits the sample shall be reported "unsound" and the shipment shall be rejected.

Since this autoclave method for the determination of "soundness" may be equally applicable to quicklime, provided a properly prepared lime putty is used, the quicklime shall be slaked in accordance with the directions given in Appendix I under Section A2 and the same requirement for popping and pitting as defined above shall be added to and made applicable to A.S.T.M. Specifications C 5.

[d] The requirements for plasticity prescribed in A.S.T.M. Specifications C 206 shall apply to hydrated lime and quicklime used for lime putty in finishes, and all lime used shall be suitable for finish coat plastering. The total free (unhydrated) calcium oxide (CaO) and magnesium oxide (MgO) in the hydrated product shall not exceed 8 per cent by weight calculated on the as-received basis in accordance with the 1945 tentative revision of the Standard Methods of Chemical Analysis of Limestone, Quicklime, and Hydrated Lime (A.S.T.M. Designation: C 25 – 44).[1]

[e] Water containing salt or alum, or water in which tools have been washed, accelerates the "set." Water from stagnant pools and wells frequently contains organic or vegetable matter which may retard the "set."

(b) All manufactured materials shall be delivered in the original packages, containers, or bundles bearing the name of the manufacturer and the brand.

[1] These specifications and methods of the American Society for Testing Materials are published in the 1946 Book of A.S.T.M. Standards, Part II.

[2] See p. 14.

(c) Plaster and all cementitious materials shall be kept dry until ready to be used; they shall be kept off the ground, under cover, and away from sweating walls and other damp surfaces.

(d) Metal goods shall be protected against rusting.

BASE COAT PROPORTIONS

4. Base coat plaster shall be proportioned as follows:

(a) Gypsum Neat Plaster:

NOTE.—The term "neat" as applied to gypsum plaster means that the material, as shipped by the manufacturer, does not contain aggregate. Aggregate must be added at the job. Neat plaster may be fibered or unfibered.

First coat on all types of lath shall be mixed in the proportions of 1 part of gypsum neat plaster to not more than 2 parts of sand, by weight. When vermiculite is used as an aggregate, the first coat on all types of lath shall be mixed in the proportions of 100 lb. of gypsum neat plaster to not more than 2 cu. ft. of vermiculite.

First coat on masonry surfaces (except monolithic concrete) and second (brown) coat in all three-coat work shall be mixed in the proportions of 1 part of gypsum neat plaster to not more than 3 parts of sand, by weight. When vermiculite is used as an aggregate, the first coat on masonry surfaces (except monolithic concrete) and second (brown) coat in all three-coat work shall be mixed in the proportions of 100 lb. of gypsum neat plaster to not more than 3 cu. ft. of vermiculite.

(b) Gypsum Ready-Sanded Plaster:

Gypsum ready-sanded plaster shall be used without the addition of aggregate.

For first coat on all types of lath, scratch-coat gypsum ready-sanded plaster shall be used.

For application to masonry surfaces (except monolithic concrete) and for second (brown) coat in all three-coat work, either scratch-coat or brown-coat gypsum ready-sanded plaster may be used.

(c) Gypsum Wood-Fiber Plaster:

For two- and three-coat work on all types of lath, gypsum wood-fiber plaster shall be used without the addition of aggregate.

For two- and three-coat work on masonry surfaces (except monolithic concrete), gypsum wood-fiber plaster shall be mixed in the proportions of 1 part of plaster to 1 part of sand, by weight.

HAND MIXING

5. Material that has partially set shall not be retempered or used. Frozen, caked, or lumpy material shall not be used. The mixing boxes shall be watertight and thoroughly cleaned of all set or hardened material. If mixing is done in the building, waterproof protection shall be provided under the mixing boxes and water barrels. Tools shall be cleaned after mixing each batch.

(a) Gypsum Neat Plaster.—Aggregate shall be added at the job. Plaster and aggregate shall be mixed dry to a uniform color at one end of the box, hoed into water at the other end, and thoroughly mixed to the proper consistency.

(b) Gypsum Ready-Sanded Plaster.—Aggregate shall not be added. Plaster shall be placed at one end of the box, hoed into water at the other end, and thoroughly mixed to the proper consistency.

(c) Gypsum Wood-Fiber Plaster.—When used without aggregate, the plaster shall be placed at one end of the box, hoed into water at the other end, and thoroughly mixed to the proper consistency. When sand is added, the plaster and sand shall be mixed dry to a uniform color at one end of the box, hoed into water at the other end, and thoroughly mixed to the proper consistency.

MECHANICAL MIXING

6. Material that has partially set shall not be retempered or used. Frozen, caked, or lumpy material shall not be used. The mixer shall be cleaned of all set or hardened material before materials for a new batch are loaded. Each batch shall be mixed separately.

(a) Gypsum Neat Plaster.—Aggregate shall be added at the job. The following cycle of operations shall be followed while the mixer is in continuous operation (Note 1):

Put in the approximate amount of water,
Add approximately half the amount of aggregate,
Add all the plaster,
Add the remainder of the aggregate,
Mix to the proper consistency, adding water if necessary, and
Dump the entire batch and use.

NOTE 1.—When the mixer is used intermittently, small amounts of sand and water shall be added after dumping each batch and the mixer run for a few minutes. After dumping the sand and water, the mixer will be clean and ready for a new batch.

(b) Gypsum Ready-Sanded Plaster.—Aggregate shall not be added. The following cycle of operations shall be followed while the mixer is in continuous operation (Note 2):

Put in the approximate amount of water,
Add the plaster,
Mix to the proper consistency, adding water, or plaster, if necessary, and
Dump the entire batch and use.

NOTE 2.—When the mixer is used intermittently, a small amount of water shall be added after dumping each batch and the mixer run for a few minutes. After dumping the water, the mixer will be clean and ready for a new batch.

(c) Gypsum Wood-Fiber Plaster.—When used without aggregate, the plaster shall be mixed as prescribed in Paragraph (b) for gypsum ready-sanded plaster. When sand is added, the plaster and sand shall be mixed as prescribed in Paragraph (a) for gypsum neat plaster.

LIME PUTTY

7. (a) Hydrated Lime shall be mixed with the amount of water called for in the printed directions of the manufacturer. The hydrated lime may be sifted into the water, or the putty may be screened or punched through a sieve or treated in any other manner so as to obtain a smooth, lump-free putty. The putty may be used immediately after mixing, or following a 12- to 24-hr. soaking period, as recommended by the manufacturer.

(b) Pulverized Quicklime shall be slaked by sifting it into the amount of water called for in the printed directions of the manufacturer and then allowing it to become cold before using.

(c) Lump Quicklime shall be thoroughly slaked, run through a No. 8 sieve made of 16-gage steel wire, and allowed to stand at least two weeks before using.

FINISH COAT PROPORTIONS

8. (a) Gypsum - Lime Putty Trowel Finish shall be mixed in the proportions of 3 parts of lime putty to 1 part of gaging plaster (calcined gypsum), by volume.

(b) Prepared Gypsum Trowel Finish shall be mixed with water to the proper consistency in accordance with the manufacturer's directions.

(c) Keene's Cement Finish:

MEDIUM HARD FINISH shall be mixed in the proportions (Note) of 1 part of lime putty to 1½ parts of Keene's cement, by volume.

NOTE.—If mixed mechanically, the proportions shall be 2 cu. ft. of lime putty, 1.5 cu. ft. of Keene's cement, and 10 lb. of fine, white, washed sand, mixed as follows:

Put in approximately 24 qt. of water,
Add lime, sand, and Keene's cement,
Mix for not less than 15 min. nor more than 20 min., and
Dump entire batch and use.

HARD FINISH shall be mixed in the proportions of 1 part of lime putty to 3 parts of Keene's cement, by volume.

(d) Prepared Gypsum - Sand Float Finish shall be mixed with water to the proper consistency in accordance with the manufacturer's directions.

(e) Gypsum - Sand Float Finish shall be mixed in the proportions of 1 part of gypsum neat unfibered plaster to not more than 2 parts of sand, by weight. Sand shall pass a No. 12, 16, or 20 sieve, depending on the texture of the surface desired.

(f) Keene's Cement - Lime - Sand Float Finish shall be mixed in the proportions of 2 parts of lime putty, 1½ parts of Keene's cement, and 4½ parts of sand, by volume.

(g) Colored Finishes for Float and Texture Work shall be mixed with water to the proper consistency in accordance with the manufacturer's directions.

THICKNESS OF PLASTER

9. (a) Grounds shall be installed so as to provide for the following thicknesses of plaster, from face of plaster base to finished plaster surfaces:

	THICKNESS OF PLASTER
LATH { Metal Lath, Wire Lath, and Wire Fabric	⅝ in., min.
LATH { All other types	½ in., min.
UNIT MASONRY AND CONCRETE WALLS	⅝ in., min.
MONOLITHIC CONCRETE CEILINGS[a]	⅛ in., min. to ⅜ in., max.

[a] If monolithic concrete ceiling surfaces require more than ⅜ in. of plaster to produce desired lines or surfaces, metal lath or wire lath shall be attached thereto. In extreme cases metal furring may be required.

(b) Wood Grounds will be furnished and installed by others.

(c) Metal Grounds shall be furnished and installed by the plastering contractor.

PREPARATIONS FOR PLASTERING

10. (a) Temperature and Ventilation.—Plaster shall not be applied to surfaces that contain frost. A minimum temperature of 40 F. shall be maintained in the building for an adequate period prior to the application of the plaster, while the plastering is being done, and

until it is completely dry. If the maintenance of this minimum temperature requires the furnishing of heat, it shall be provided by.....[3] Salamanders shall be piped out through an opening and shall be placed as near the center of the room as practicable. Adequate, properly regulated ventilation shall be provided.

In cold, damp, or rainy weather, properly regulated heat shall be provided, but precautions shall be taken against too rapid drying before set has occurred (Note 1). As soon as the plaster has set, free circulation of air shall be provided to avoid sweat-outs. After the plaster has set, heating shall be continued to insure as rapid drying as possible. Plaster shall not be allowed to freeze before it has set. Alternate freezing and thawing shall be avoided.

NOTE 1.—A portion of the water used for mixing gypsum plaster is necessary for the chemical reaction which sets and hardens plaster. Therefore, gypsum plaster must not be permitted to dry out before setting has taken place. It must be protected from blasts of wind and from drying unevenly or too rapidly. If glazed sash are not in place, and it is necessary to enclose the building, exterior openings of the building shall be screened with cheesecloth, or similar material.

(b) Masonry Surfaces (Note 2) on which suction must be reduced shall be properly wet down immediately before the plaster is applied (Note 3).

NOTE 2.—Because bituminous compounds do not provide ideal bases for plaster, the application of plaster to masonry or concrete which has been coated with such compounds should be discouraged.

NOTE 3.—This is particularly important if wood-fiber plaster is used.

(c) Wood Lath shall be thoroughly wet down from 12 to 24 hr., and in very dry weather again from 1 to 3 hr., before the plaster is applied.

(d) Gypsum and Fiber Insulation Lath shall not be wet down.

(e) Monolithic Concrete Surfaces shall be cleaned of all dust, loose particles, and other foreign matter. Laitance and efflorescence shall be removed by washing first with a 10 per cent solution of commercial muriatic acid and water and then with clean water to remove all traces of acid. Grease and oil shall be completely removed (Note 4).

Concrete surfaces shall have sufficient roughness to provide proper bonds (Note 5); if necessary the surface shall be evenly wetted, but not saturated, to provide proper suction. If surfaces are not rough, they shall be hacked or bush-hammered, or a dash-coat of portland-cement grout, composed of 1 part of cement to 1½ parts of fine sand mixed to a mushy consistency, shall be applied. The portland-cement grout shall be forcibly dashed on the concrete surface, using a stiff fiber brush, with a whipping motion. This coat shall be kept damp for at least two days immediately following its application and then allowed to dry. Before application of plaster, the surface shall be evenly dampened if necessary to provide proper suction.

NOTE 4.—Because bituminous compounds do not provide ideal bases for plaster, the application of plaster to masonry or concrete which has been coated with such compounds should be discouraged.

NOTE 5.—The use of dressed (smooth) lumber, metal, and plywood forms, oiling or greasing of such forms, and the vibrating of concrete produces concrete surfaces which are so smooth that mechanical bond necessary for plaster is absent.

(f) Surfaces shall be carefully examined before the plaster is applied thereto, and the proper authorities notified of any and all unsatisfactory conditions. Application of the plaster then shall not proceed until such unsatisfactory conditions have been satisfactorily remedied or adjusted.

(g) Metal Grounds and other accessories, such as corner beads, screeds, picture molds, etc., shall be carefully examined to see that they are straight, curved, plumb, level, square, or true to the required angles, as the case may require, before the plaster is applied.

APPLICATION OF BASE COATS

11. (a) Two-Coat Work.—Base (first) coat shall be applied with sufficient material and pressure to form good full keys on wood lath, and good bond on gypsum or fiber insulation lath or masonry, as the case may be, and to cover well, and then be doubled back with the same mix to bring the plaster out to grounds, straightened to true surface with rod and darby, and left rough, ready to receive the finish (second) coat.

(b) Three-Coat Work.—Scratch (first) coat shall be applied with sufficient material and pressure to form good full keys on wood and metal lath, wire lath, and wire fabric, and good bond on gypsum or fiber insulation lath or masonry, as the case may be, and to cover well, and then be scratched to rough surface (Note 1).

Brown (second) coat shall be applied, after the scratch (first) coat has set firm and hard, brought out to grounds and straightened to a true surface with rod and darby, and left rough, ready to receive the finish (third) coat.

[3] The name of the party who is to furnish heat shall be inserted here.

NOTE 1.—For best results, plaster screeds should be applied to the scratch coat prior to the application of the brown coat. First coat on fiber insulation lath should be a quick-setting gypsum plaster.

(c) Solid Plaster Partitions With Steel Studs shall be not less than 2 in. in thickness and shall have scratch, back-up, brown, and finish coats.

Scratch coat shall be applied on the lath side with sufficient material and pressure to form good keys and to cover well, and then be scratched to a rough surface. Temporary bracing of studs shall be furnished on the channel side of the partition and maintained until the scratch coat on the lath side has set.

Back-up coat shall be applied on the channel side, after the scratch coat on the lath side has set firm and hard, in not less than two operations, the first to adequately cover the keys of the scratch coat, and the other coat or coats to bring the plaster out to grounds. It shall then be straightened to true surface with rod and darby and left rough, ready to receive the finish coat.

Brown coat on the lath side shall be applied over the scratch coat, after the back-up coat on the channel side has set, and shall be rodded, darbied, and left rough, as specified for the back-up coat.

Plaster shall extend to the floor. All spaces between grounds shall be filled. Hollow metal bucks shall be filled solid. Wherever possible, plastering shall be commenced at the bottom of the partitions.

(d) Studless Solid Partitions (Metal Lath and Plaster) shall be not less than 2 in. in thickness and plaster shall be applied in the same number of coats and in the same manner as for solid partitions with studs, except that where rib metal lath is used, the scratch coat shall be applied on the flat side and the temporary bracing on the rib side, and where flat expanded metal lath is used, the temporary bracing may be attached to either side and the scratch coat shall be applied on the opposite side. Back-up coats shall then be applied on the rib side of the metal lath, or on the back side of the scratch coat, and shall be followed by the brown coat applied over the scratch coat.

(e) Studless Solid Partitions (Gypsum Lath and Plaster, Single-Thickness $\frac{3}{8}$ in. or $\frac{1}{2}$ in. Lath) shall be not less than 2 in. in thickness and shall have scratch, brown, and finish coats on both sides.

Scratch coat (Note 2) approximately $\frac{3}{8}$ in. in thickness shall be applied first to the side opposite the temporary bracing with sufficient pressure to form a good bond, followed by a $\frac{3}{8}$ in. thick scratch coat applied to the side on which the bracing occurs. Scratch coats shall be scratched to form a rough surface.

Brown coat shall be applied to the side opposite the bracing after the scratch coat has set firm and hard and is partially dry. When this brown coat has set firm and hard and is partially dry, temporary bracing shall be removed and brown coat applied to bracing side. Brown coat shall be straightened to a true surface with rod and darby and left rough, ready to receive the finish coat, allowing $\frac{1}{16}$ to $\frac{1}{8}$ in. on each side for finish coat to bring over-all partition thickness to not less than 2 in.

NOTE 2.—It is important that a rich scratch coat be used. The scratch coat should contain not more than 2 parts of sand to 1 part of plaster by weight.

(f) Studless Solid Partitions (Gypsum Lath and Plaster, Multiple-Thickness Lath) shall be not less than 2 in. in thickness and the combined thickness of the scratch, brown, and finish coats on each side shall be not less than $\frac{1}{2}$ in. The thickness of the separate coats, and the sequence of plastering on each side depending on whether bracing is used, shall be in accordance with the proprietary specifications for the system employed.

The scratch coat shall be applied with sufficient pressure to form a good bond and shall be scratched to form a rough surface.

The brown coat shall be applied after the scratch coat has set firm and hard and is partially dry. Brown coat shall be straightened to a true surface with rod and darby and left rough, ready to receive the finish coat, allowing $\frac{1}{16}$ to $\frac{1}{8}$ in. on each side for finish coat to bring over-all partition thickness to not less than 2 in.

(g) Plastering on Monolithic Concrete.—Plaster shall be a specially prepared bond plaster for use on concrete. Aggregate shall not be added.

Surfaces of walls and columns shall have a scratch coat of bond plaster, followed by a brown coat of gypsum plaster (in the proportions of 1 part of gypsum neat plaster to not more than 3 parts of sand, by weight, or 100 lb. of gypsum neat plaster to not more than 3 cu. ft. of vermiculite) troweled into the scratch coat before it has set. The brown coat shall be brought out to grounds, straightened to a true surface with rod and darby, and left rough, ready to receive the finish coat.

Surfaces of ceilings shall have a coat of bond plaster scratched in thoroughly, double back, and filled out to a true, even surface and left rough, ready to receive the finish coat.

APPLICATION OF FINISHES

12. In the application of finishes, the use of excessive water shall be avoided; however, when applying a finish coat to a base coat composed of gypsum plaster and vermiculite aggregate, it is necessary to have the base coat in a semi-green condition. If the base coat is dry, it should be evenly wetted, but not saturated, just before the application of the finish coat.

(a) Trowel Finishes:

GYPSUM - LIME PUTTY TROWEL FINISH shall be applied over a base coat which has set and is surface-dry, scratched in thoroughly, laid on well, doubled back and filled out to a true, even surface. The thickness shall be from $\frac{1}{16}$ to $\frac{1}{8}$ in. The finish shall be allowed to draw a few minutes and then it shall be well troweled with water to a smooth finish, free from cat faces and other blemishes.

PREPARED GYPSUM TROWEL FINISH shall be applied in accordance with the manufacturer's directions.

KEENE'S CEMENT FINISH shall be applied over a thoroughly set base coat which is nearly but not quite dry (Note 1), scratched in thoroughly, laid on well, doubled back, and filled out to a true, even surface. The thickness shall be from $\frac{1}{16}$ to $\frac{1}{8}$ in., unless the finish coat is marked off or jointed, in which case the thickness may be increased as required by the depth of marking or jointing. The finish shall be allowed to draw a few minutes and then it shall be well troweled with water to a smooth finish, free from cat faces and other blemishes.

NOTE 1.—If the base coat has dried out, it shall be sprayed with water, but not soaked, before the finishing coat is applied.

(b) Float Finishes.—The following float finishes shall be applied over a thoroughly set base coat which is nearly but not quite dry (Note 2), laid on with a trowel to an even surface, and then floated (with wood, carpet, cork, rubber, or other type float, depending on the texture desired) to a true, even surface, free from slick spots and other blemishes:

Prepared gypsum sand float finish,
Gypsum sand float finish, and
Keene's cement-lime sand float finish.

NOTE 2.—If the base coat has dried out, it shall be sprayed with water, but not soaked, before the finishing coat is applied.

(c) Colored Finishes for Float and Texture Work shall be applied in accordance with the manufacturer's directions.

(d) Acoustical and Other Special Purpose Plasters shall be applied in accordance with the manufacturer's directions.

CHAPTER II

SPECIFICATIONS FOR LATHING AND FURRING

NOTE.—These specifications are intended to describe minimum requirements. The use of equivalents, or better, is permissible. For some types of structures it may be desirable to use metal lath and supporting members heavier than the minima listed in these standard specifications. Cornerite is required only where specified and is not called for on masonry bases.

DESCRIPTION OF TERMS

13. (a) The term "attached" or "furred" as applied to ceiling construction, means that the furring members are attached directly to the structural members of the building.

(b) The term "suspended," as applied to ceiling construction, means that the furring members are suspended below the structural members of the building.

(c) The term "main runners," as applied to metal construction, means the runners which are attached to or suspended from construction above for the support of cross furring.

(d) The term "cross furring," as applied to metal construction, means the furring members which are attached at right angles to the underside of main runners or other structural supports.

MATERIALS

14. (a) Gypsum Lath shall conform to the Standard Specifications for Gypsum Lath (A.S.T.M. Designation: C 37 - 42) of the American Society for Testing Materials.[1]

Gypsum lath shall conform to the following dimensional requirements:

Thickness	$\frac{5}{16}$, $\frac{3}{8}$, or $\frac{1}{2}$ in.
Width	16 in.
Length	32 or 48 in.

(b) Wood Lath shall be No. 1 grade, reasonably clear, evenly manufactured, and free of detrimental defects.

A few worm holes, small pitch pockets, well set or firm knots, not more than $\frac{3}{4}$ in. in diameter and not bunched, and wane not more than one third the thickness and one third the width for one third the length on one side of the lath, or its equivalent otherwise located, when not in combination with any other defect, shall be permitted.

[1] 1946 Book of A.S.T.M. Standards, Part II.

Wood lath shall conform to the following dimensional requirements:

	Minimum	Maximum
Thickness	$\frac{5}{16}$ in.	$\frac{3}{8}$ in.
Width	$1\frac{5}{16}$ in.	$1\frac{5}{8}$ in.
Length	$47\frac{1}{2}$ in.	48 in.
	$31\frac{1}{2}$ in.	32 in.

(c) Fiber Insulation Lath shall conform to Class B of the Federal Specification for Insulating Fiberboard (LLL-F-321b).

Fiber insulation lath shall conform to the following dimensional requirements:

	Dimension	Permissible Variations
Thickness	$\frac{1}{2}$ in., $\frac{3}{4}$ in., and multiples of $\frac{1}{2}$ in.	$\pm\frac{1}{16}$ in.
Width	16, 18, or 24 in.	$-\frac{1}{4}$ in.
Length	48 in.	$-\frac{1}{4}$ in.

Fiber insulation lath may be either single or multiple ply board. The individual plies shall be joined in such manner as to prevent separation under normal use.

(d) Metal Lath, Expanded, Ribbed, and Sheet, shall be of copper-bearing steel, coated with rust-inhibitive paint after cutting, or cut from zinc-coated steel sheets.

(e) Wire Lath shall be not lighter than No. 19 W. & M. gage wire, $2\frac{1}{2}$ meshes per inch, coated with zinc or rust-inhibitive paint.

(f) V-Stiffened Wire Lath shall be not lighter than No. 20 W. & M. gage wire, $2\frac{1}{2}$ meshes per inch, with No. 24 U. S. gage V-rib stiffeners spaced not to exceed 8 in. apart, coated with zinc or rust-inhibitive paint.

(g) Paper-Backed Wire Fabric shall be not lighter than No. 16 W. & M. gage, zinc-coated wire, with not to exceed 2 by 2-in. mesh, with stiffening ribs spaced not to exceed 5 in. center to center, and absorptive paper backing securely attached to metal by not less than No. 17 W. & M. gage stitch wires 2 in. on centers in such a manner as to provide full embedment of at least $\frac{1}{8}$ in. of plaster for at least one half of

the total length of the strands and one half of the total weight of the metal. The design shall be such as to provide a mechanical bond and continuous metallic reinforcement, in both directions, for plaster.

(h) Metal Accessories such as corner beads, base screeds, concealed picture molds, etc., shall be not lighter than No. 26 U. S. gage steel, zinc-coated, with perforated or expanded flanges or clips shaped so as to permit complete embedment in the plaster.

(i) Channels shall be hot-rolled or cold-rolled steel, free of rust, of the following minimum weights per thousand lineal feet:

SIZE	HOT-ROLLED	COLD-ROLLED
¾ in.	300 lb.	300 lb.
1 in.	410 lb.	....
1½ in.	850 lb.	475 lb.
2 in.	1260 lb.	....

NOTE.—Coating with rust-inhibitive paint is recommended.

LATHING

15. All lath shall be applied with the long dimension at right angles to the supports, except that furnished in rolls which may be applied with the long dimension parallel to the supports.

APPLICATION OF GYPSUM LATH

16. (a) Gypsum lath shall be securely nailed to wood supports (spaced not to exceed 16 in. on center), at intervals not to exceed 4 in., with No. 13 gage, 1⅛-in., ⅜-in. flat head, blued nails. The nails shall be driven with under side of the head flush with the face of the lath.

(b) Joints between walls and ceilings shall be staggered. Lath shall be applied with the long dimension at right angles to the framing members, with joints broken in each course. Lath shall not be butted tightly together, nor be more than ¼ in. apart.

(c) Cornerite shall be provided at all interior angles and shall be fastened only sufficiently to retain position during plastering.

(d) Gypsum lath shall be attached to horizontal or vertical metal supports by means of special clips.

(e) Special erection systems, on either wood or metal supports, which afford equal carrying strength may be used, in which event lath shall be erected in accordance with the specifications therefor.

NOTE.—On ceilings and other large unbroken areas it is recommended that lath be applied in rectangular herringbone fashion.

STUDLESS SOLID PARTITIONS (GYPSUM LATH AND PLASTER, SINGLE-THICKNESS ⅜- OR ½-IN. LATH)

17. (a) Gypsum lath shall be plain, ⅜ or ½ in. in thickness, 16 or 24 in. in width, and in ceiling-height lengths.

(b) Floor and ceiling runners of wood or metal shall be firmly secured to floor and ceiling construction. Sides of grooves in runners shall overlap both faces of lath not less than ½ in.

(c) Gypsum lath shall be of such length to allow ¼-in. top clearance in the ceiling runner, and shall be erected vertically, engaging the ends in the slots of floor and ceiling runners.

(d) In erecting lath, the vertical edges shall be aligned in accordance with the lath manufacturer's directions. (This will vary somewhat depending upon whether clips are used or not used and will vary with the type of clip.)

(e) Temporary bracing members shall consist of 2 by 4-in. wood braces, or equivalent, erected horizontally and spaced not more than 3 ft. on centers. The braces shall extend the full length of the partition and shall be anchored rigidly at ends. Where partitions are longer than 10 ft., the temporary braces shall be reinforced with 2 by 4-in. vertical braces rigidly held at top and bottom and securely fastened to the horizontal braces. The vertical braces shall not exceed 10 ft. on centers.

(f) The method of attaching lath to the braces shall be done strictly in accordance with the recommendations of the lath manufacturer.

STUDLESS SOLID PARTITIONS (GYPSUM LATH AND PLASTER, MULTIPLE-THICKNESS LATH)

18. (a) Gypsum lath shall be plain or perforated, ⅜ or ½-in. in thickness or a combination of the two types and thicknesses, 16 or 24 in. in width, and in ceiling height or 48 in. in length depending upon the system employed.

(b) Floor or ceiling runners of wood or metal shall be firmly secured to floor and ceiling construction. Sides of grooves in runners shall overlap both faces of lath not less than ½ in.

(c) When erecting ceiling height lath, the length shall be such as to allow ¼ in. top clearance in the ceiling runner.

(d) The lath, including the clips and additional reinforcing, if any, shall be erected

strictly in accordance with the proprietary specifications for the system employed.

(e) If temporary bracing is required, it, together with the method of attaching the lath to the braces, shall be done strictly in accordance with the proprietary specifications for the system employed.

APPLICATION OF WOOD LATH

19. (a) Wood lath shall be spaced $\frac{3}{8}$ in. apart at the edges, $\frac{1}{4}$ in. apart at the ends, and shall be nailed securely at right angles to wood supports (spaced not to exceed 16 in. on center) with 3d fine, No. 16 gage, blued nails, full driven.

(b) Joints shall be broken every seventh lath.

(c) Lath shall not run through from one room to another.

(d) Cornerite shall be provided at all interior angles and shall be fastened only sufficiently to retain position during plastering.

APPLICATION OF FIBER INSULATION LATH

20. (a) Fiber insulation lath shall be nailed securely to wood supports (spaced not to exceed 16 in. on center) at intervals of not more than $4\frac{1}{2}$ in., with blued or bright nails of the following sizes:

For $\frac{1}{2}$-in. lath.....$1\frac{1}{8}$-in. blued fiberboard nails or 4d box nails.
For 1-in. lath.....$1\frac{3}{4}$-in. blued fiberboard nails or 6d box nails.

(b) Nails shall be placed not less than $\frac{3}{8}$ in. from the ends and not less than $\frac{1}{2}$ in. from shiplapped, tongued-and-grooved, or interlocking edges.

(c) End joints (except interlocking type) shall be approximately $\frac{3}{16}$ to $\frac{1}{4}$ in. Shiplapped, tongued-and-grooved, or interlocking edges shall be fitted to moderate contact.

(d) Cornerite shall be provided at all interior angles and shall be fastened only sufficiently to retain position during plastering.

APPLICATION OF METAL LATH, WIRE LATH, AND WIRE FABRIC

21. (a) The weight of metal lath, wire lath, and wire fabric shall conform to the requirements prescribed in Table I.

(b) Metal lath (except ribbed), wire lath, and wire fabric shall be attached to horizontal wood supports with not less than $1\frac{1}{2}$-in., No. 11 gage, $\frac{7}{16}$-in. head, barbed, bright or blued, roofing nails driven home; and shall be attached to vertical wood supports with not less than 4d common nails or 1-in. roofing nails driven to a penetration of at least $\frac{3}{4}$ in., or 1-in., No. 14 W. & M. gage wire staples driven home. The $\frac{3}{8}$-in. rib lath, stiffened wire lath, and sheet lath shall be attached to horizontal and vertical wood supports with nails or staples $\frac{3}{8}$ in. longer than required for the aforementioned bases, unless attachments are through the ribs, in which event nails or staples shall be of such length as to provide at least $1\frac{3}{8}$-in. penetration in horizontal wood supports and $\frac{3}{4}$-in. penetration in vertical wood supports. Common nails shall be bent over to engage at least three strands of lath. Other methods of attachment which afford equal carrying strength may be used.

(c) For rib lath attached directly to the underside of concrete joists, not less than 2 strands of No. 14 gage wire shall be used, and for rib lath attached directly to the underside of open-web steel joists, not less than either 2 strands of No. 16 gage or 4 strands of 18 gage wire shall be used.

TABLE I.—TYPES AND WEIGHTS OF METAL LATH, WIRE LATH, AND WIRE FABRIC AND SPACING, CENTER TO CENTER OF SUPPORTS.[a]

Type of Lath	Minimum Weight of Lath, lb. per sq. yd	Maximum Allowable Spacing of Supports, in.				
		Vertical Supports			Horizontal Supports	
			Metal			
		Wood	Solid Partitions	Others	Wood or Concrete	Metal
Flat expanded metal lath	2.5	16	16	12	0	0
	3.4	16	16	16	16	$13\frac{1}{2}$
Flat rib metal lath	2.75	16	16	16	16	12
	3.4	19	24	19	19	19
$\frac{3}{8}$-in. rib metal lath[b]	3.4	24	..	24	24	19
	4.0	24	..	24	24	24
Sheet metal lath	4.5	24	24	24	24	24
Wire lath	2.48	16	16	16	$13\frac{1}{2}$	$13\frac{1}{2}$
V-stiffened wire lath	3.3	24	24	24	19	19
Wire fabric	[c]	16	0	16	16	16

[a] Lath may be used on any spacings, center to center, up to the maximum shown for each type and weight.
[b] Rod-stiffened or V-stiffened flat expanded metal lath of equal rigidity and weight is permissible on the same spacings as $\frac{3}{8}$-in. rib metal lath.
[c] Paper-backed wire fabric, No. 16 gage wire, 2 by 2-in. mesh, with stiffener.

(d) Metal lath, wire lath, and wire fabric shall be securely attached to horizontal and vertical metal supports with No. 18 W. & M. gage, galvanized, soft-annealed wire ties.

(e) All attachments for securing metal lath, wire lath, and wire fabric shall be spaced not more than 6 in. apart.

(f) Side laps of metal lath, wire lath, and wire fabric shall be secured to supports and be tied between supports at not to exceed 9-in. intervals.

(g) Flat expanded metal lath and wire lath shall be lapped ½ in. at the sides and 1 in. at the ends. Ribbed lath shall be lapped at the sides by nesting, and 1 in. at the ends. Sheet lath shall be lapped at the sides and ends by nesting. Stiffened wire lath and fabric shall be lapped by nesting ribs or selvage 1 in. at the sides, and 1 in. at the ends.

(h) Special erection systems that afford equal carrying strength may be used, in which event lath shall be erected in accordance with the specifications therefor.

(i) Application of flat expanded metal lath shall be started one support away from a corner and be bent into or around the corner and carried on to the support on the abutting surface. Lath shall first be applied to ceilings and the sheets carried down 6 in. onto the walls and partitions. If lath is not used on ceilings, the lathing may be started at the top of the wall and may be bent and carried up 6 in. onto the ceiling joists. Wherever possible the ends of the sheets of lath shall be staggered. Ribbed and sheet lath, stiffened wire lath, and fabric shall be butted at internal corners.

(j) Cornerite shall be provided at all interior angles where ribbed or sheet lath, stiffened wire lath, or fabric is used. It shall be fastened only sufficiently to retain position during plastering.

STUDLESS SOLID PARTITIONS (METAL LATH AND PLASTER)

22. Where metal lath is used for studless solid partitions, the long dimension of the sheet shall be vertical and shall be one continuous sheet from floor to ceiling. Lath shall be secured to ceiling runners or to ceiling lath by wire ties spaced not more than 6 in. apart, and shall be suitably anchored to floor runners or base. Where the ceiling is to be plastered, flat expanded metal lath shall be returned 6 in. on the ceiling, and rib metal lath shall be butted against the ceiling and cornerite used, unless ceiling lath is returned on partition as specified in Section 21(i). At vertical corners, metal lath shall be bent and returned 6 in. on abutting surfaces. Flat expanded metal lath shall be lapped ½ in. at sides, and rib metal lath by nesting, and all side laps shall be wire tied at not to exceed 9-in. intervals.

ATTACHED, FURRED, AND SUSPENDED CEILINGS (METAL LATH CONSTRUCTION)

23. (a) Hangers and Inserts. — Hangers shall be of ample length. Hangers (without inserts) shall be secured to steel reinforcement in concrete with cinder aggregate and shall be either secured to steel reinforcement or looped and embedded 2 in. in concrete with other types of aggregates.

Inserts shall develop the full strength of the hangers which are attached to them. Inserts used in cinder concrete or tile arch construction shall be toggled with 7-in. cross pieces bearing on top of reinforcing steel in cinder concrete or on top of tile arch construction. In concrete with aggregates other than cinders, inserts shall be secured to steel reinforcement or looped and embedded 2 in. in the concrete.

Wire shall be zinc-coated (galvanized). Gage numbers specified are Washburn and Moen. Rods and flats shall be of mild steel. Gages and sizes specified are the minimum permissible.

Wire for attaching runners and furring directly to concrete beams and joists, to steel beams and joists, and to wood beams and joists shall be of the gage sizes prescribed in Table II.

TABLE II.—GAGE SIZES OF WIRE FOR ATTACHING RUNNERS AND FURRING DIRECTLY TO BEAMS AND JOISTS.[a,b]

For Supporting Runners			For Supporting Furring Without Runners		
Area Supported, max., sq. ft.	Single Strand	Two Strands	Two Strands		
			To Concrete	To Steel	To Wood
8	12 gage	14 gage	14 gage	16 gage	16 gage
12	10 gage	12 gage	.....	.....	.....
16	8 gage	11 gage	.....	.....	.....

[a] Inserts, special clips, or other devices of equal strength may be substituted for those prescribed in Table II. Two double-strands of No. 18 gage wire may be substituted for two strands of No. 16 gage wire for attaching steel furring to steel joists or to wood joists.

[b] Where one strand of wire is specified, it means that the runners or furring are secured to the structural supports in such manner that only one wire supports the runners or furring; where 2 strands of wire are specified, it means that two separate wires support the runners or furring and these wires are either saddle-tied to or twisted together under the runners or furring; where two double-strands are specified, it means that four separate wires support the runners or furring and these wires are either saddle-tied to or twisted together under the runners or furring.

Hangers for supporting main runners of suspended ceilings shall be of the following sizes:

AREA SUPPORTED, MAX., SQ. FT.	SIZE OF HANGERS
16	$\frac{3}{16}$-in. round rods[a] or No. 8 gage wire
25	1 by $\frac{3}{16}$-in. flats[a]

[a] It is highly recommended that all rod hangers be protected with a zinc or cadmium coating and that flat hangers be similarly coated or protected with a rust-inhibitive paint.

Where 1 by $\frac{3}{16}$-in. inserts are used, $\frac{7}{16}$-in. diameter holes shall be punched on the center line at the lower ends which shall project a sufficient distance below the bottom of the concrete or tile arch construction to permit the attachment of the hangers.

Flat steel hangers shall be bolted to 1 by $\frac{3}{16}$-in. inserts with $\frac{3}{8}$-in. diameter round-head stove bolts.

Wire or rod hangers shall be saddle-tied or wrapped around main runners so as to develop the full strength of the hangers.

Lower ends of flat hangers shall be bolted to main runners, or bent tightly around runners and bolted to the main part of the hanger; bolts to be $\frac{3}{8}$-in. diameter round-head stove bolts.

Holes in both inserts and hangers shall not be nearer to the ends than $\frac{3}{8}$ in.

The nuts of bolts shall be drawn up tight.

(b) Main Runners for the various spacings of hangers shall be of the following minimum sizes:

DISTANCE CENTER TO CENTER OF HANGERS	SIZE OF MAIN RUNNERS[a]
Up to 3 ft.	$1\frac{1}{2}$-in. cold-rolled channels
Up to 4 ft.	$1\frac{1}{2}$-in., 1.12-lb., hot-rolled channels
Up to 5 ft.	2-in. hot-rolled channels or $1\frac{1}{2}$ by $1\frac{1}{2}$ by $\frac{3}{16}$-in. angles

[a] Other shapes of hot-rolled or cold-rolled members of equal strength may be substituted for those prescribed in this tabulation.

(c) Cross Furring for various spacings of main runners shall be of the following minimum sizes, but the maximum spacings of cross furring for various types of lath shall not exceed those listed in Table I (Section 21(a)):

DISTANCE CENTER TO CENTER OF MAIN RUNNERS	SIZE OF CROSS FURRING[a]	MAXIMUM SPACING
Up to 2 ft.	$\frac{1}{4}$-in. pencil rods or $\frac{1}{4}$-in. channels	12 in.
Up to 2 ft.	$\frac{3}{8}$-in. pencil rods or $\frac{1}{4}$-in. channels	19 in.
Up to 2 ft. 6 in.	$\frac{3}{8}$-in. pencil rods or $\frac{3}{4}$-in. channels	12 in.
Up to 3 ft.	$\frac{3}{4}$-in. cold- or hot-rolled channels	24 in.
Up to 3 ft. 6 in.	$\frac{3}{4}$-in. cold- or hot-rolled channels	19 in.
Up to 4 ft.	$\frac{3}{4}$-in. cold- or hot-rolled channels	16 in.
Up to 4 ft.	1-in. hot-rolled channels	24 in
Up to 4 ft. 6 in.	1-in. hot-rolled channels	19 in.
Up to 5 ft.	1-in. hot-rolled channels	12 in.

[a] Other shapes of hot-rolled or cold-rolled members of equal strength may be substituted for those prescribed in this tabulation.

Cross furring shall be securely attached to the main runners by special clips or by not less than 2 strands of No. 16 W. & M. gage galvanized wire or equivalent attachments.

STEEL STUDS FOR SOLID PLASTER PARTITIONS

24. Steel studs for solid plaster partitions shall be of such size and number and so located as to provide solid backing at all corners. They shall be set to the required dimensions, properly aligned, made plumb and true, securely anchored to the floor and ceiling construction, and temporarily braced. Studs adjacent to openings shall be doubled and securely anchored to the frames or bucks. Heads of openings shall be adequately reinforced.

METAL FURRING FOR WALLS

25. (a) Attachments (Note 1) shall consist of nails driven securely into concrete or into masonry joints, or short pieces of $\frac{3}{4}$-in. channels used as anchors driven into masonry joints. They shall be spaced not to exceed 2 ft. on center, horizontally, and in accordance with the spacing of horizontal channels, vertically, and shall project a proper distance from the face of the wall to permit ties to be made (Note 2).

NOTE 1.—Special devices which are the equivalent of, or better than, the nail or channel attachments may be used in lieu thereof.

NOTE 2.—Where dampproofing has been damaged in installation of attachments, it shall be pointed with the same material before proceeding with the installation of the furring.

(b) Horizontal Members (Note 3) shall be not less than $\frac{3}{4}$-in. hot- or cold-rolled channels. They shall be spaced not to exceed 4 ft. 6 in. on center with the lower and upper channels not more than 6 in. from the floor and ceiling, respectively, and not less than $\frac{1}{4}$ in. from the face of the wall. They shall be securely tied to attachments with 3 strands of No. 18 W. & M. gage, galvanized, soft-annealed wire, or equivalent devices.

NOTE 3.—Special devices, securely attached to concrete or masonry, in lieu of horizontal members, may be used for support of vertical members.

(c) Vertical Members shall be not less than $\frac{3}{4}$-in. hot-rolled or cold-rolled channels. They shall be spaced in accordance with requirements for spacing of supports in Table I (Section 21 (a)). They shall be securely saddle-tied to horizontal members with 3 loops of

No. 18 W. & M. gage galvanized soft-annealed wire, or equivalent devices, at each crossing, and securely anchored to the floor and ceiling construction. Where furring is a considerable distance from the face of the wall, channel braces to the wall shall be provided approximately 2 ft. on center, and, where the height exceeds 16 ft., special truss bracing shall be provided to prevent concentration of load on the floor construction.

(d) Band-Iron Furring shall be $\frac{3}{4}$-in. or 1-in. crimped and painted band iron not lighter than No. 22 U. S. gage metal. Such furring shall be stapled to the wall with brick staples not more than 24 in. on centers. Spacing of band-iron furring shall not exceed 16 in. on centers. The wire or metal lath shall be stapled over such band-iron furring with staples providing a penetration of not less than $\frac{3}{4}$ in. into the masonry.

WORKMANSHIP

26. All metal construction and lathing shall be erected so that finished plaster surfaces may be true to line, level, plumb, square, curved, or as otherwise required, without excessive thickness of plaster.

APPENDIX I

METHOD FOR DETERMINING "SOUNDNESS" (POPPING OR PITTING) OF A LIME PUTTY MADE FROM EITHER A HYDRATED LIME OR QUICKLIME

HYDRATED LIME

A1. (a) To a 100-g. sample of hydrated lime, sufficient water shall be added to make a fairly stiff putty. This putty shall be aged in a covered vessel at room temperature for not less than 16 nor more than 24 hr.

(b) Two volumes of the aged putty prepared from the hydrated lime in accordance with Paragraph (*a*) shall be thoroughly mixed with 1 volume of unretarded calcined gypsum (Note) and sufficient water to form a paste. A layer of this aged paste of from $\frac{1}{16}$ to $\frac{1}{8}$ in. in uniform thickness shall be spread on a 4 by 4 in. glass plate and the specimen set aside for 2 hr., thus allowing the calcined gypsum to set.

NOTE.—The calcined gypsum shall be previously tested to assure soundness (absence of popping or pitting) by steaming a duplicate specimen of the set neat gypsum for 2 hr. in an autoclave at a pressure of 120 psi. as described in Paragraph (*c*).

(c) The specimen shall be placed on a rack in an autoclave to which water has been added equal to 1 or 2 per cent of the volume of the autoclave. The rack shall be provided with a cover that will prevent water from dripping on the specimen. The steam pressure shall be raised to 120 psi. and maintained for 2 hr., after which it shall be released through a valve at such a rate that atmospheric pressure is reached in about 5 min. The autoclave shall then be opened and the specimen examined for pops or pits.

QUICKLIME

A2. (a) Because of the variable slaking characteristics of different quicklimes, it is necessary to determine by preliminary experiment the amount of water required to hydrate the quicklime at or near the boiling point of water and produce a fairly stiff putty. It is essential that sufficient water be used to prevent "burning" of the lime and the possible production of a dry hydrate, as these unfavorable slaking conditions may, in themselves, cause an otherwise potentially sound quicklime to test unsound.

(b) A 200-g. sample of quicklime shall be slaked with the entire amount of water and in the manner previously determined to produce the desired stiffness of putty. The sample shall be stirred to insure even distribution of the water, thus avoiding local heating. The putty shall be aged in a covered vessel at room temperature for not less than 16 nor more than 24 hr.

(c) Two volumes of this aged putty prepared from the quicklime in accordance with Paragraph (*b*) of this section shall be thoroughly mixed with 1 volume of unretarded calcined gypsum and sufficient water to form a paste and tested in accordance with Section A1(*b*) and (*c*). The specimen shall then be examined for pops or pits.

APPENDIX II

Standard Specifications for
SAND FOR USE IN PLASTER[1]

A.S.T.M. Designation: C 35 - 39

ADOPTED, 1939.[2]

This Standard of the American Society for Testing Materials is issued under the fixed designation C 35; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Quality of Sand.—It is recognized that for certain purposes satisfactory results may be obtained with sands not conforming to these specifications. In such cases the use of sand not conforming to these specifications may be authorized only under special provisions based upon laboratory studies of the possibility of designing a mixture of materials to be used on the job that will yield plaster equivalent in quality to the specified mixture made with sand complying with these specifications in all respects.

Definition

1. Sand[3] for use in plaster shall consist of fine granular material composed of hard, strong, durable, uncoated particles which are free from injurious amounts of saline, alkaline, organic, or other deleterious substances.

Grading (Sieve Analysis)

2. (*a*) Sand for use in plaster shall be uniformly graded from fine to coarse within the following limits:

RETAINED ON SIEVE	PERCENTAGE RETAINED MAX.	MIN.
No. 4 (4760-micron)	0	..
No. 8 (2380-micron)	10	0
No. 30 (590-micron)	80	15
No. 50 (297-micron)	95	70
No. 100 (149-micron)	..	95

(*b*) The amount of material finer than a No. 200 (74-micron) sieve, shall not exceed 5 per cent.

(*c*) The sieves shall conform to the requirements of the Standard Specifications for Sieves for Testing Purposes (A.S.T.M. Designation: E 11) of the American Society for Testing Materials.[4]

Organic Impurities

3. The sand when subjected to the colorimetric test for organic impurities shall show a color not darker than the standard color, unless it is shown by adequate tests that the impurities causing the color are not harmful in plaster.

Methods of Testing

4. The properties enumerated in these specifications shall be determined in accordance with the following methods of test of the American Society for Testing Materials:

(*a*) *Sieve Analysis.*—Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates (A.S.T.M. Designation: C 136).[4]

(*b*) *Material Finer than No. 200 Sieve.*—Standard Method of Test for Amount of Material Finer than No. 200 Sieve in Aggregates (A.S.T.M. Designation: C 117).[4]

(*c*) *Organic Impurities.*—Standard Method of Test for Organic Impurities in Sands for Concrete (A.S.T.M. Designation: C 40).[4]

[1] Under the standardization procedure of the Society, these specifications are under the joint jurisdiction of the A.S.T.M. Committee C-7 on Lime and Committee C-11 on Gypsum.

[2] Prior to their present adoption as standard, these specifications were published as tentative from 1921 to 1925, being revised in 1924 and 1925. They were adopted in 1925, revised in 1930, but withdrawn and republished as tentative in 1936.

These specifications are in effect a revision and consolidation of, and replace the former Standard Specifications for Sand for Use in Gypsum Plaster (A.S.T.M. Designation: C 35) and the Tentative Specifications for Sand for Use in Lime Plaster (A.S.T.M. Designation: C 66 - 31 T), which specifications were accordingly discontinued in 1936.

[3] The term sand is defined in the Standard Definition of the Term Sand (A.S.T.M. Designation: C 58), 1946 Book of A.S.T.M. Standards, Part II.

[4] 1946 Book of A.S.T.M. Standards, Part II.

Presented by

CERTAIN-TEED PRODUCTS CORPORATION

120 S. LaSalle Street

CHICAGO 3, ILL.

TABLE OF COVERING CAPACITIES OF VARIOUS TYPES OF PLASTER

TYPE OF PLASTER	Approximate Square Yardage Per Ton For Various Types of Bases				
	Gypsum Lath	Metal Lath	Wood Lath	Gypsum Tile	Clay Tile
Neat†	225 to 240 Sanded 2 to 1	105 to 135 Sanded 2 to 1	180 to 210 Sanded 2 to 1	235 to 255 Sanded 3 to 1	165 to 200 Sanded 3 to 1
Wood Fibered	115 to 120 Mixed with water only No sand	55 to 65 Mixed with water only No sand	90 to 100 Mixed with water only No sand	90 to 105 Mixed with water only No sand	75 to 85 Mixed with water only No sand
Ready Sanded	75 to 80 Mixed with water only No sand	35 to 45 Mixed with water only No sand	60 to 70 Mixed with water only No sand	65 to 70 Mixed with water only No sand	45 to 55 Mixed with water only No sand
Prepared Trowel Finish	350 to 400 square yards per ton				
Sand Float Finish	250 to 275 square yards per ton				
Gauging Plaster	Will cover approximately 1600 square yards when proportioned: 2 tons hydrated lime to 1 ton of gauging plaster				
Keene's Cement	As hard finish--400 lbs. Keene's Cement mixed with 100 lbs lime putty will cover approximately 100 square yards				

† Neat plaster is either fibered, extra fibered, or unfibered plaster to which sand must be added on the job.

C. - PROPERTIES OF GYPSUM WALL PLASTERS

1. EFFECT OF AGGREGATES ON SETTING TIME ETC.

(a) Sand

1. A.S.T.M. Specifications for a Plastering Sand are as follows:

100% to pass a 4 mesh screen.
Not more than 10% to be retained on an 8 mesh screen.
Not more than 80% or less than 15% to be retained on a 30 mesh screen.
Not more than 95% or less than 70% to be retained on a 50 mesh screen.
Not more than 5% to pass a 100 mesh screen.
Not more than 5% to be removed by decantation.

2. Effect of Particle Size on the Strength and Workability:

A sand of fine particle size lowers the strength of plaster in two ways. First, such a sand presents an enormous surface area to be cemented together which requires much more plaster to surround the grains than will a properly coarse sand with its far lesser surface area. Second, the water carrying capacity of a fine grained sand or a sand containing excessive amounts of loam and silt is much greater than a coarse clean sand. This results in a less dense, softer and weaker plastering as the strength of any plaster is inversely proportional to the amount of mixing water used, the smaller the amount of water the stronger the set plaster. Inferior fine sands are used in many localities that will not come anywhere near passing A.S.T.M. specifications and even when specified amounts are used soft walls may result. In many cases this condition is blamed on the plaster. Of course most good plasterers realize this but there is plenty of room for further educational work along these lines. The problem is further complicated in that in many localities good sand is not available.

3. Amounts of Sand to be Used:

As noted before, standard specifications call for either two parts or three parts of sand to 1 part of plaster by weight which is the equivalent of about 12½ and 19 No. 2 square point shovels of damp or wet sand. We should not recommend the use of greater amounts of sand than called for by the specifications. However, if the sand is coarse and sharp many plasterers use 14 to 16 shovels of sand for scratch mortar (about 2½ to 1) and from 20 to 22 shovels (3½ to 1) for brown mortar, obtaining satisfactory results. It is also very common practice to use about 2½ parts of sand (15 to 16 shovels) for two coat doubled up work on gypsum lath with good results. In certain mid-western localities it is common practice to use from 4 to 6 parts of sand for the second or brown coat and get away with it although soft wall complaints are rather common. It is also true that 4 parts of coarse sharp sand will make a harder, stronger wall than will 3 parts of a dirty fine grained sand. Therefore if a good grade of sand is used in samples of set plastering that are sent to the laboratory for analysis we do not consider 2½ to 1 for scratch coat plastering or up to 3½ to

3. Amounts of Sand to be Used (Cont'd) 1 for brown coat plastering badly oversanded according to general practice. However, these amounts of sand leave little factor of safety such as the weakening effect of slow drying conditions and we are sure that the plastering industry would be much better off if everyone followed specifications. Plaster producers would also sell more plaster and receive fewer complaints.

4. Effect of Various Impurities on Setting Time:

Various sands have different effects upon the setting time of plaster. Unwashed bank sand often contains organic material leached down from the surface vegetation and will tend to make the plaster mix slow setting. A clean silica sand will be rather slow setting; a dirty fine sand may have an accelerating effect as will a sand containing certain salts and minerals. The set stabilized plasters developed in recent years reduce these variations in setting time to a marked degree.

(b) Vermiculite and Perlite

The lightweight aggregates (expanded Vermiculite and expanded Perlite) are now being used extensively in place of sand especially in Metropolitan markets. Vermiculite is a Mica like mineral which when heated expands to accordian like crystals many times its original volume. Perlite is a glassy rock of volcanic origin that when sized and heated to a high temperature expands or explodes like popcorn to very light weight porous particles.

1. A.S.A. specifications for Expanded Vermiculite

To be used as a plaster aggregate in place of sand are as follows:

Particle size -- Same as A.S.T.M. Specifications for Plastering Sand

Weight -- Not less than $7\frac{1}{2}$ or more than 10 lbs. per cu. ft.

A.S.A. Specifications for expanded Perlite to be used as a plaster aggregate in place of sand are as follows:

Particle size -- Same as A.S.T.M. specifications for plastering sand except that the minimum percentage retained on a #100 mesh sieve shall be decreased from 95 to 90%.

Weight -- Not less than $7\frac{1}{2}$ or more than 15 lbs. per. cu. ft.

2. Amounts of Light Weight Aggregates to be Used

When Vermiculite or Perlite is used, the first coat on all types of lath shall be mixed in the proportions of 100 lbs. of neat gypsum plaster to not more than two cubic feet of Vermiculite of Perlite.

For the first coat on Masonry surfaces (except monolithic concrete) and the second coat in all three-coat work, the

2. Amounts of Light Weight Aggregates to be Used (Cont'd)

proportions shall be 100 lbs. of neat gypsum plaster to not more than 3 cubic feet of Vermiculite or Perlite.

On all bases except wire, metal or wood lath and monolithic concrete, when double up or lay-on method is employed (except masonry) the proportions shall be 100 lbs. of neat gypsum plaster to not more than 2½ cubic feet of Vermiculite or Perlite.

For double up work on masonry, the proportions shall be 100 lbs. of neat gypsum plaster to not more than 3 cubic feet of Vermiculite or Perlite.

When Vermiculite or Perlite is used in ready-mixed plaster the proportions shall be 100 lbs. of neat gypsum plaster to not more than 3 cubic feet of Vermiculite or Perlite.

3. Effect on Setting Time

In general the light weight aggregates expanded Vermiculite and expanded Perlite- have little or no accelerating effect on the setting time consequently a rather slow set can be expected when these aggregates are used, set stabilized plasters now available eliminate the need for the dealer to carry two stocks of plaster - one for use with sand and the other for use with light weight aggregates.

2. EFFECT OF TEMPERATURE ON THE SET

Gypsum plaster will set quicker in cold weather than in hot weather. These differences in setting time are not great when using an impure plastering sand. However it is necessary that we retard plaster differently for different seasons, using the most retarder in the winter, less in the spring and a minimum amount during hot weather. There is an additional reason for using less retarder in the summer for, unless the plaster sets quite quickly on the job, hot winds may quickly dry out the plastering before it sets. This trouble is not met with in cold weather unless the plastering is exposed to excessive heat from steam pipes, radiators, stoves, etc.

3. EFFECT OF AGE AND DAMPNESS ON THE SET AND WORKING PROPERTIES

Under normal storage conditions retarded plaster will slow down in set to some extent during the first few months aging. As aging continues and moisture is absorbed in the plaster it slowly becomes quicker setting so that it may become to quick for satisfactory use without the addition of retarder on the job. In very damp storage conditions these changes take place more rapidly. If the plaster comes in contact with water, hard set lumps will form, only a few of which are necessary to contaminate the bag and make it unsatisfactory for use because of very quick setting time.

4. EFFECT OF DIRTY OR CLEAN MIXERS, TOOLS AND WATER ON THE SET

Water used for mixing plaster should be of a quality fit to drink. Tools and mixing box should be kept clean. The mixing box should be scraped out clean with the hoe between each mix and a machine mixer should be

4. EFFECT OF DIRTY OR CLEAN MIXERS, TOOLS AND WATER ON THE SET (Cont'd)

slushed out with water. Tools should not be washed off in the barrel containing the mixing water as the set plaster in the water will exert a marked accelerating effect on the set of the plaster. Machine mixers are difficult to clean and usually are lined with set plaster from previous mixes, Because of this and because of the more vigorous mixing a machine mixer has a marked accelerating effect on plaster. It is therefore recommended that when the salesman knows that a particular shipment is to be machine mixed he should so notify the mill on the order so that a slower setting plaster may be furnished. The longer a plaster is mixed the quicker it will set although in a retarded wall plaster the normal variations in mixing time occurring on jobs are not great enough to seriously affect the time of set.

D. GYPSUM PLASTERS FOR INDUSTRIAL USE

1. DENSITE

(a) Description:

This is a new plaster product suited primarily for industrial uses in which casts of great strength, hardness and density are required.

During 1949 a new addition to the Blue Rapids plant was completed and put into operation for the manufacture of this product. Since the process is entirely different from any other now used in producing gypsum plasters and patent applications are now being prosecuted, we are not at liberty to disclose the process.

(b) Properties:

Densite has the appearance of ordinary white molding plaster. Although it is chemically the same as molding plaster, a given volume of the dry powder weighs about twice as much as an equal volume of molding plaster. It is somewhat similar to U.S.G. Hydrocal but requires considerably less mixing water to obtain a given consistency, therefore, Densite casts are far harder, and stronger than Hydrocal casts.

To obtain plastering consistency only 22 parts of water to 100 parts of Densite by weight are required. Casts made at this water/plaster ratio develop a compressive strength in excess of 15,000 pounds per square inch when dry.

To obtain pouring consistency, only 33 parts of water are required as compared to 70 parts for Sunflower molding plaster. Casts made at this pouring consistency (33 water/plaster ratio) develop a compressive strength of approximately 9000 pounds per square inch when dry. This is approximately four times the strength of casts made from molding plaster at the same pouring consistency i.e., 70 water/plaster ratio.

Densite mixes with water like ordinary molding of casting plaster and the setting action is also similar to that of molding plaster. Ordinary it sets a little faster than molding plaster but the setting time can be regulated as required to suit a particular use.

Setting expansion at pouring consistency is approximately .26% but this can be reduced to as little as .04% or increased to as much as 1.5% by the addition of certain ingredients.

(c) Types and Uses:

Industrial Densite:

Industrial Densite is the strongest and hardest pure gypsum plaster available today. As such, it finds many applications in a wide variety of industries. It is ideally suited for any application where high strength and hardness are desirable in the finished cast. Typical uses include lamp bases, novelties, book ends, statuary, plaques, mirror frames, Portland Cement molds, metal casting investment mixtures, floor underlayment

Industrial Densite: (Cont'd)

and patching compounds, models, relief maps, plastic forming dies and plastic casting molds. Densite may also be used in admixture with other plasters to obtain various degrees of hardness and strength. The expansion of Industrial Densite is rather high (0.26%) compared with ordinary plasters (0.13% to 0.17%) and it should be used only where expansion is of no importance. Industrial Densite is available with any desired setting time.

Low Expansion Densite:

This product is especially designed for uses where the setting expansion of the plaster must be kept at a minimum. Such uses include case molds, models, block molds, patterns and dies. This material will find its biggest use in pattern shops. The aircraft and automotive industries annually use thousands of tons of low expansion plasters and most potteries use several tons of such material per month for case molds.

Several types of Low Expansion Densite are available depending upon the particular needs of the consumer. These various formulas and their uses are covered in Industrial Sales Bulletin #102.

Low Expansion Densite is the hardest and strongest low expansion plaster available. As such, it finds ready acceptance by pattern shops and machine shops using Keller or Gorton duplicating machines. In these machines, a plaster model and a steel block are set up and clamped in place. A stylus, moved mechanically, travels over the surface of the plaster model. This stylus actuates a milling cutter which cuts the same contour into the steel block. In this manner, the steel block is eventually milled to the exact size and shape of the plaster model, forming a duplicate model in steel which is used as a working die. Since the stylus pressure against the plaster model is rather high, ordinary plasters cannot be used for Keller or Gorton models. Low Expansion Densite has been found to be the best plaster available for such models because of its extreme hardness and dimensional stability. Duplicator models made with Low Expansion Densite may be used many times with no marring of the surface by the stylus.

High Expansion Densite:

A special formula Densite with unsually high expansion characteristics is available for special uses. High Expansion Densite is used in the pattern shop where an expanded pattern is wanted. The original (exact size) model is boxed up and High Expansion Densite is cast around it. Upon setting, this material expands away from the model reaching a maximum expansion of about 1.2% in 18 hours. The expanded mold thus formed is inverted, and molding plaster or Low Expansion Densite is cast into it. The resulting cast is an expanded duplicate of the original model. This expanded model or pattern is used to make an impression in foundry sand, into which the metal is cast. On cooling, the metal shrinks and the resulting casting is almost an exact

High Expansion Densite: (Cont'd)

duplicate of the original model. This process in extensively used by the aircraft industry for the production of Kirksite dies. The High Expansion cast is used as a mold when it has reached an expansion of 1/8 inch per foot. (about 3 hours after set). Since Kirksite has a shrinkage of 1/8 inch per foot after casting, the resulting dies require very little machining.

Dental Densite:

The dental industry annually uses large quantities of high strength gypsum plasters for the manufacture of Dental Models. Densite is the best material available for this purpose and has met with immediate acceptance in this field. For Dental uses our base Densite containing no additives should be recommended.

2. SUNFLOWER MOLDING AND CASTING PLASTERS

This well known and popular brand is made from gypsum rock of over 99% purity at Blue Rapids, Kansas and is also made at Acme, Texas from rock of over 98% purity. It is made by a special process which lowers the water carrying capacity to a minimum so that this plaster when mixed at plastering consistency with 50% water will give a tensile strength of over 500 lbs. per square inch and a compressive strength of over 3,000 lbs. per square inch on the set and dry casts. At pouring consistency when mixed with 70% water a tensile strength of over 300 lbs. and a compressive strength of over 2,000 lbs. results. A chemical treatment gives a slurry with few air bubbles and a cast unusually free from voids and pin holes. It contains no abrasive material.

After calcination and treatment in the kettle this plaster is reground to a fineness of 99.9% thru a 50 mesh screen and 98.0% thru a 100 mesh screen insuring a uniform fine texture and easy soaking and mixing properties. Its color is white. The setting time of this product is held within rigid specification limits at the plant so that it will set on the job in from 15 to 25 minutes depending on mixing conditions. For special uses the setting time can be made quicker or slower as desired. The heat developed as the plaster sets is generated slowly resulting in a cool working plaster that will not injure gelatin molds. The setting expansion when mixed with 50% water is 0.18% and when mixed with 70% water is 0.16%. Sunflower Molding is as fine a molding plaster as can be made from gypsum and is unexcelled in quality the world over.

Uses:

Sunflower Molding and Casting Plasters are used for shop cast ornamental work, run work, statuary, plaques, novelties, lamp bases, marble setting, Terra Cotta molds, refractory and Portland Cement molds. They may also be used as gauging plasters with the addition of lime putty, where a smooth working white coat is desired on walls and ceilings.

Corrective Shop Practices:

The most common difficulties with molding or casting plasters are (1) quick set and (2) slow set. Quick set is due to very old plaster, plaster which has been exposed to dampness, dirty mixing water, or mixing

Corrective Shop Practices: (Cont'd)

buckets which are encrusted with set-up plaster. This may be remedied by using a retarder with old plaster, using clean water, and keeping the mixing buckets free from pre-set plaster. Slow set plaster can be accelerated by the addition of small amounts of potassium sulfate (1 oz. per 100 lbs. of plaster) to the mixing water. A longer mixing time and the use of hot water will also accelerate the set. In hot weather, where injury to glue molds may result from the heat evolved by the setting plaster, the addition of ice to the mixing water is to be recommended. The addition of too much lime in run work may cause softness in the finished work. Not over 5% of lime should be added to the plaster for run work with a template in the production of moldings, beams, etc.

3. STATUARY CASTING PLASTER:

This plaster differs from Sunflower Molding Plaster in that it contains a special ingredient which "case hardens" the finished cast. Objects cast with this plaster will have an extremely hard surface, resistant to marring and dense enough to be painted without preliminary sizing. Statuary Casting Plaster was especially developed for use by casting shops desirous of producing superior merchandise. It is admirably suited to the production of high grade statuary, "piggy" banks, etc.

Uses:

For high grade statuary, plaques, and art novelties where a hard, abrasive resistant surface is desired.

Corrective Shop Practices:

Same as for Sunflower Molding. In drying statuary plaster care must be taken in removing the cast from a warm drying room to a cool or cold atmosphere as the quick shrinkage will cause small crazing cracks on the surface. If dried at too high temperatures or for too long a period casts made from either Statuary or Sunflower will calcine and soften. A temperature of 130°F. should be the maximum allowed in such dryers.

4. INDUSTRIAL STUCCO AND COMMON MOLDING PLASTER

These products made from light gray lower purity rock gypsums. They are usually treated to produce strong durable casts. Common Molding plaster is used for many of the same purposes as Sunflower where maximum strength, the whitest color and the most uniform texture are not necessary. It is commonly used for molds in the manufacture of terra cotta, refractory shapes for high temperature furnaces, cast Portland Cement, porous fire brick, marble setting stucco, etc. Its setting time is about the same as Sunflower Molding Plaster.

Industrial stucco is more or less a tailor made material manufactured to suit the requirements of the purchaser so that no specifications can be given as to its set, grind and water carrying capacity.

5. PLATE GLASS STUCCO (FIRST AND SECOND SIDE)

Is used to firmly cement the rough plate glass sheets to the grinding tables or machines so that the surfaces of the glass can be polished and ground. This is a continuous process in modern plants where the glass is cemented to a series of flat cars hooked together that pass slowly

5. PLATE GLASS STUCCO (FIRST AND SECOND SIDE) (Cont'd)

down a line on a track where the sheets are first ground by revolving cast iron shoe grinders fed with sand and then polished under large revolving felt polishers fed with rouge. When the glass, finished on the top side, emerges from the polishers it is turned over, the polished side cemented to the tables and again run thru the grinders and polishers.

For bedding the glass on continuous line machines a pure, strong accelerated, grit free calcined gypsum is used to which is added 2 to 5% hydrated lime. The lime causes the plaster to adhere more firmly to the glass. It is particularly important that the plaster used for the second side bedding shall be grit free so that the polished glass will not be scratched as it is bedded or if it slips under the grinders or polishers. A special patented formula of plate glass stucco is also available for plants that do not want to go to the expense and uncertainty of adding lime. This formula is now used successfully in several of the largest plate glass plants in the country. It is sold only in 100 lb. bags.

A rather coarse ground stucco is preferable as it does not stick to the glass when the plate is taken from the table. The plaster is usually mixed rapidly in machine mixer with from 110 to 180% water and the desired amount of lime forming a very thin watery slurry that is immediately thrown and spread over the table bed in a thin layer. The glass is then placed on the slurry and pressed down firmly by heavy rollers. The stucco is often accelerated at the gypsum mill so that it will set on the grinding and polishing line in from 5 to 8 minutes depending on the speed of the machine and the distance on the line from where the glass is bedded until it runs under the first grinders where it must be set and sufficiently hard to hold the glass firmly in place.

Large size window plate glass is polished on large round revolving tables 30 feet or so in diameter on which various sizes of glass are cemented with a slower setting stucco. These tables revolve with the top of the glass in contact with series of large grinding and polishing shoes that revolve in opposite direction to that of the table.

Plate glass stucco as made at our Blue Rapids plant is unexcelled for this purpose. It is grit free, exceptionally strong and of a very uniform set. While it is not absolutely necessary to use this grade of plaster for first bedding some large concerns use it for both sides due to its strength and uniformity of performance. As soon as the proper setting time is determined for a particular operation no trouble is experienced with Blue Rapids plate glass stucco.

Stuccos of somewhat lower purity, such as those produced at our Fort Dodge and Grand Rapids plants, are sometimes used for first bedding or "first side" purposes. However, they are not sufficiently grit free for use as second side stucco.

Corrective Plant Practices:

The usual difficulties experienced with plate glass stuccos are (1) slow set (2) quick set, and (3) lack of adhesion. The setting time of plate glass stucco is very important. If the stucco sets to quickly it may be difficult or impossible to bed the glass properly. If the stucco sets to slowly, it will not be strong enough to hold the glass on the table when the glass passes under the first grinders. The usual remedy for a slightly quick set is to lower the temperature of the mixing

Corrective Plant Practices: (Cont'd)

water. Conversely, a slow setting stucco may be accelerated by using warmer water. Most plate glass plants have a thermostatically controlled water supply and are able to vary water temperatures between about 60°F. and 110°F. With this water temperature range, it is possible to vary the set of the stucco about 3 minutes in either direction.

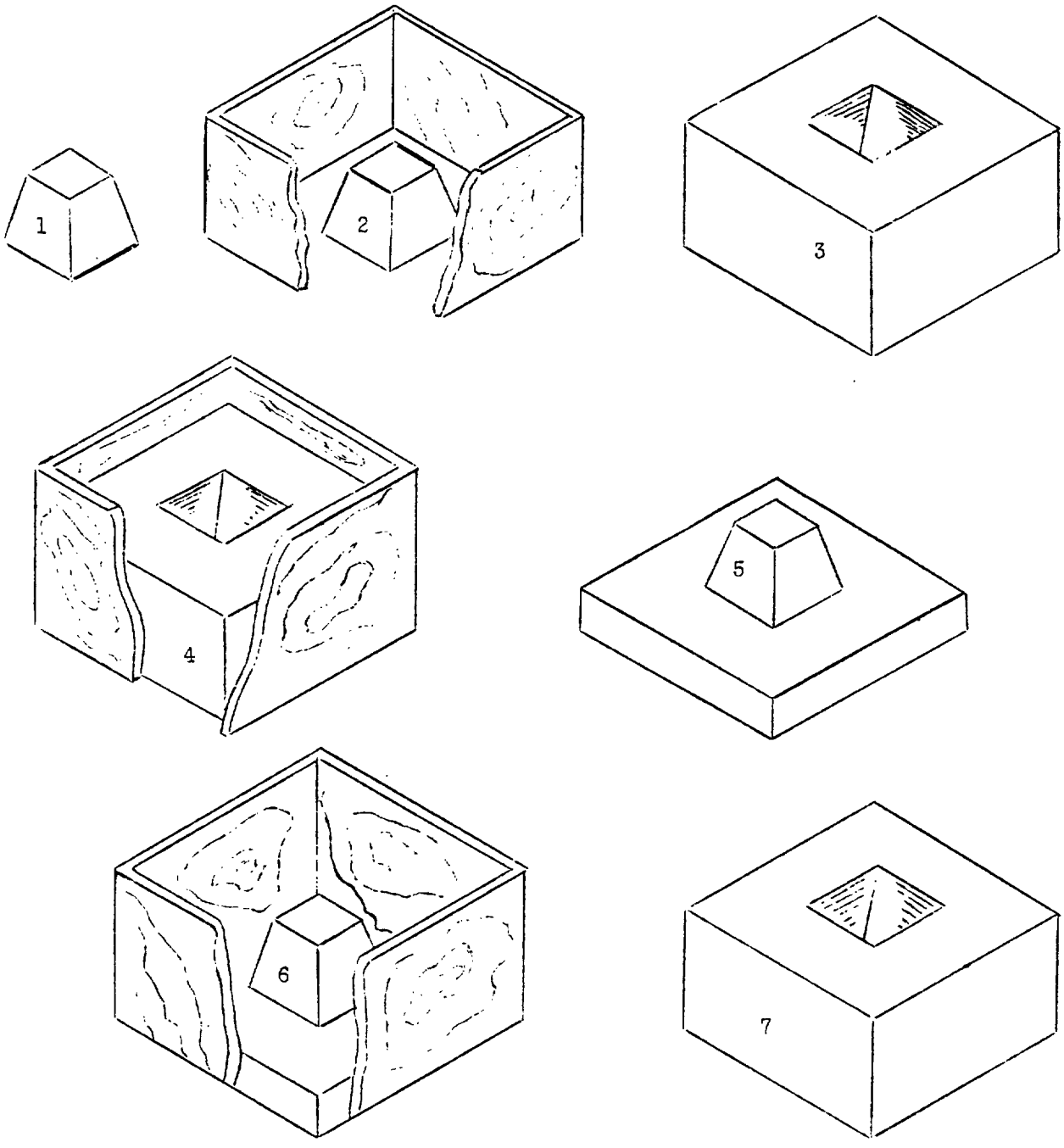
Difficulties with poor adhesion of the plaster to the glass may be caused by quick set, lack of sufficient lime in the mix, or too high a percentage of water in the mix. The remedy for quick set has been discussed above, and the preventive measures to be employed in the other cases are obvious.

6. POTTERY PLASTER

Pottery and sanitary ware plants in this country use thousands of tons of plaster products each year. The larger proportion of this is pottery plaster. This plaster is made into molds which are used in forming clay to produce dinner ware and other ceramic objects. A model of the object to be produced is made of clay or plaster (fig. 1). This model is then boxed-up as in figure 2 and a mold is cast from it using a low expanding, very hard plaster such as our Low Expansion Densite. In the case of the simple object shown this mold would appear as in figure 3. (More complicated objects often necessitate production of split molds.) The mold shown in figure 3 is called a "block mold". This mold is boxed-up and a cast is taken from it (fig.4.). The resulting cast, (fig. 5), is called a "case mold" and a number of these are made from block mold. The block mold is then stored together with the model for future reference. The case molds are used on the production line to form the actual working molds used in shaping the clay pieces. Figure 6 shows the case mold set up for pouring the working mold (fig. 7). Since the case mold must be used many times to produce new working molds, it should always be made of the strongest plaster available. Our Low Expansion Densite is probably the best material for case molds available today.

The working or production mold is always made of pottery plaster. Pottery plaster is a fine ground, white plaster containing set regulating chemicals. Casts made from pottery plaster are much more porous than Densite casts and are able to absorb considerable amounts of water. Working molds may be either jigger molds or casting molds. A jigger mold is a mold used to form clay having a consistency similar to modeling clay. A slug of this relatively stiff, moist clay is placed in the center of the jigger mold and the mold is rotated on a potters wheel or automatic machine. A metal template is pressed against the clay which is thereby forced to spread evenly over the mold surface, any excess being screeded off by the template. The mold, bearing the finished clay piece, is then placed in a dryer until the clay has dried enough to permit its removal from the mold. The mold is then used to form another piece, etc. Only round or oval pieces such as plates, cups and platters can be made by the jiggering process. A good jigger mold is expected to produce several hundred pieces of ware before it wears to the point where it must be replaced.

More complicated pottery objects such as pitchers, teapots, figurines, etc., are made in casting molds. Clay which has been thinned with water to a pourable slurry is poured into the casting mold and allowed to remain for a specified time. The casting mold, being porous, draws water from



(1) MODEL -- Low Expansion Densite or mix of L. E. Densite and Pottery Plaster.
(2) Model set up for casting Block Mold.
(3) BLOCK MOLD -- Same materials as Model.
(4) Block Mold set up for casting Case Mold.
(5) CASE MOLD -- Low Expansion Densite.
(6) Case Mold set up for casting working mold.
(7) WORKING MOLD - Pottery Plaster - this mold used on production line.

6. POTTERY PLASTER (Cont'd)

the slurry thus depositing a layer of clay on the face of the mold. The excess slurry is then poured out, leaving the surface of the mold lined with a layer of stiffened clay. After drying, the clay piece shrinks away from the plaster surface and may be removed. The mold is then dried and used again. All casting molds are hollow, while jigger molds may be either flat or hollow. Most casting molds are two or three piece molds which may be taken apart to release the clay piece.

The requirements for a good pottery plaster are, high purity, low water carrying capacity to develop maximum strength, fine grind to insure even texture and a minimum amount of voids on or near the surface of the mold. For best results, jigger molds should be made with a lower-plaster ratio than that used for casting molds, since the jigger mold need not have much absorption or porosity. Most modern potteries, however, use the same water-plaster ratio for both types and try to hit a mid point at which both types of mold will work satisfactorily. This is admittedly not good technique but is necessitated by local labor practices which stipulate that mold makers must make both types from a single mix. Each pottery has its own preferred water-plaster ratio and these will range from 65-100 to 85-100. It is therefore important to determine what water-plaster ratio, mixing time and setting time are desired, before submitting samples of our plaster to any pottery. Such data should be gathered on the salesman's initial call, and passed on to his district office together with the request for samples. The district office can then handle the sample order through the laboratory and plant, and make sure the sample will meet specifications.

In mixing plaster and water for pottery molds a machine mixer should be used as about a 20% increase in strength and durability is obtained as well as a mold practically free from small voids and pin holes. Plaster so mixed will give longer life to the mold and will result in better finished dishes than the old fashioned hand mixing method by which it is impossible to properly remove the air bubbles. In order to get best results with a mechanical mixer the double or triple bladed mixing propeller should be placed near the bottom of the mixing bucket and be large enough so that the ends of the blade are within two or three inches from the sides of the bucket. To insure uniform molds the weiged amount of plaster should be sprinkled into the weighed or measured amount of water, allowed to soak 3 or 4 minutes and then mixed in the mixer for 4 minutes if possible or until the slurry "draws" or slightly thickens due to the starting of the setting action when it should immediately be poured into the case molds which have previously been carefully lubricated with a good grade of soap paste such as English potters soap. The mixer should be run at a speed of approximately 300 r.p.m. and best results are obtained if a baffle plate extends out from the side of the bucket which aids in eliminating the air and prevents the contents from swirling over the edge. Most mold makers however do not use the baffle plate as it makes it more difficult to clean the bucket between batches. A thorough cleaning of both bucket and propeller between batches is necessary to avoid quick setting slurry which cannot be mixed the proper length of time and which results in inferior molds.

Corrective Shop Practices:

Pottery plaster may betoo quick setting for satisfactory use if it is very old, or if the bags have been wetted or stored in a damp place. Quick set can be caused by dirty mixing equipment, impure mixing water, water which is very warm or too long a mixing period. Slow set complaints may result from too short a mixing time or the use of very cold water. Some waters contaminated with organic material will also cause slow set. Another common complaint is on cracked molds. This is usually caused by poor drying facilities which overheat and calcine the molds, or to very rapid changes in temperature either at the entering or discharge ends of the drier. Poor wearing qualities of pottery plaster molds is sometimes the subject of a complaint and is usually the result of using too much mixing water. Wear can also result from too high a concentration of chemicals in the clay slurry. Uneven wearing qualities result from pouring the plaster before it has reached the "creaming" stage, the thin slurry tending to settle in the case and yield a mold denser in some spots than in others.

7. DENTAL PLASTERS, LABORATORY AND IMPRESSION

Made at both Acme, Texas and Blue Rapids, Kansas

(a) Dental Impression Plaster:

A fine ground white pure quick setting plaster made from carefully selected rock. It is mixed by the dentist to a rather thick consistency and placed in a small tray about the size of the jaw which is inserted in the patient's mouth. It hardens very quickly leaving a perfect impression of the entire upper or lower part of the mouth. This plaster is accelerated to set in from 3 to 5 minutes when shipped and is frequently accelerated with powdered potassium sulphate by the dentist. Such plaster must be free from voids, low in water carrying capacity to provide strength and must be of such density that it will break away from the casing easily with a clean break so that the broken pieces can be perfectly cemented together. Our impression plaster meets these requirements in all respects. It is purchased and resold in small containers by some of the largest dental supply dealers in the country.

If stored for several months under damp conditions impression plaster may become too quick setting to be used. If stored in the dental laboratory in metal containers with tight covers this trouble will not occur.

(b) Dental Laboratory Plaster:

Is the same high grade fine ground white plaster as dental impression plaster, the main difference being that it possesses a slower set of 10 to 12 minutes. The dentist uses this plaster for general laboratory work and for making models or casts over which vulcanizing can be done immediately. As considerable strength is desired the plaster should be mixed as thick as possible as both sections of the mold between which the rubber plate is vulcanized are subjected to considerable pressure.

No troubles are ordinarily experienced with dental laboratory plaster unless it becomes quick setting from age or extreme dampness.

8. ORTHOPEDIC PLASTER

A fine ground white plaster that will make a strong rigid cast. Ordinarily it is retarded to set in from 10 to 15 minutes but a quicker or slower set may be desired according to the particular technique employed. It is used to make a rigid cast over a broken bone by immersing bandages in a rather thin plaster mix and wrapping the bandage tightly around the injured part. Very often the bandage is impregnated with dry plaster after which the roll may be immersed in water and wound around the injury. If a quicker set is desired powdered potassium sulphate can be added to the water. Certain-teed orthopedic plaster is produced at both Acme and Blue Rapids.

9. METAL CASTING PLASTER

Calcined gypsum mixed with 20 to 30% of a fibrous talc is used as a mold in which is cast copper base alloys, silver or aluminum objects such as machine parts, carburetor parts, small art objects, silver ware, etc. Split molds of the plaster fiber mixture are usually cast in metal master molds after which they are dried and dead burned so that all the water of crystallization is removed leaving a soft punky cast which is held together largely by the interlocking fibers. The molten metal is then poured in the dead burned mold and when cooled the plaster is knocked off of the metal and destroyed. It is necessary that the plaster be dead burned or the molten metal coming in contact with the water of crystallization would immediately drive off the water in the form of steam which would cause pits, blibs and imperfections in the metal. This process is more expensive than the sand mold method but a better finish is obtained. Either Sunflower molding or Common molding is used for this purpose the fiber usually being added at the metal plant. It is very important that the amount of fiber, amount of mixing water and the dead burning process be carefully regulated or an undesirable shrinkage or warping of the mold will result. It has been found that potassium sulphate cannot be used to accelerate the plaster used for this purpose as it causes the plaster to stick to the metal. Ordinarily the regular set of 30 to 40 minutes gives the desired results, powdered raw gypsum accelerator being added at the metal plant. A high lime stone content in the plaster is also undesirable as carbon dioxide is released upon contact with the hot metal causing pits and imperfections in the metal casting.

10. FILLS FOR SAFES AND SAFE CABINETS

Large amounts of calcined gypsum are used in the lining of safes and safe cabinets as a protection against fire. Large safes may have a shell 3 or 4 inches thick of set plaster entirely surrounding the inner compartment. The plaster is mixed at pouring consistency, poured into the shell, allowed to set and the entire assembly placed in dryers until the plaster is completely dry. Fiber is sometimes added to decrease the weight and crystals of ammonium alum may be mixed in with the plaster to increase the amount of combined water present. The contents of such a safe or cabinet cannot burn as long as any combined water is left in the shell and even after the water is all expelled the dead burned gypsum is still an effective insulator. Vents are provided in the shell to permit the escape of steam. Safes so constructed will stand the heat of a burning building for several hours without destroying the contents of the inner compartment.

11. CRAYON PLASTERS

A fine ground pure and white calcined gypsum free from coarse particles and grit is used in the manufacture of ordinary black board crayons. Mixed with water and accelerator only, it is poured in a series of molds that automatically turn and discharge the chalk as soon as it is set. Very thin mixtures of water and plaster are used and the proportions are carefully regulated so that the chalk has the proper degree of softness to write properly and still have sufficient strength to handle.

Our Blue Rapids or Acme rock will make an ideal plaster for this purpose as it is white pure and grit free.

12. CERTROCK

An extremely dense, hard, strong gypsum plaster that when mixed with only 40% water will readily pour, filling the most minute details of a mold. When set and dry, casts made from Certrock will have a tensile strength of over 600 lbs. per square inch and a compressive strength of over 5,000 lbs. per square inch which is greater strength than is possessed by concrete as ordinarily made, (high grade concrete is usually designed for compression strength of 5,000 lbs. per square inch).

Certrock is used by automobile body builders for making tracer models for use with the so-called Keller machine which cuts out large dies used in pressing out fenders and other auto body parts. The Certrock model is sufficiently hard and strong to withstand the pressure of the tracer that works back and forth over its surface and which governs the cutting action of the Keller machine.

Certrock is also used mixed with pottery plaster to increase the hardness and strength of case molds and is frequently mixed equal parts with Sunflower Molding to make more durable molds on which to form hats and other objects. It is also used in making match plates in foundries and as a flooring compound when mixed with other materials. Large statues have been made from Certrock which after sizing with boiled linseed oil and painting have proven durable for several years when placed out of doors exposed to the weather.

Two precautions should be observed in using Certrock. The plaster and water should be accurately proportioned according to directions and mixing should be vigorous and rapid until all the lumps disappear and a perfectly smooth slurry results. It should then be immediately poured into the form and allowed to set. The setting time of Certrock on the average job will run between 20 and 35 minutes depending on job conditions.

13. POLISHING PLASTER

A fine ground regular set calcined gypsum is used in large amounts for filling the spaces between blocks or slabs of granite and marble while they are being ground and polished with steel shot, emery and rouge. The plaster is mixed to a pouring consistency and poured between the blocks which after the plaster has set presents a smooth surface on which the grinders and polishers can work without losing the grinding shot which is reclaimed and used over and over again. To give best results a fine ground grit free plaster should be used.

13. POLISHING PLASTER (Cont'd)

For sawing slabs a coarse ground calcined gypsum may be used. The plaster slurry, usually mixed with sawdust, is poured between the slabs to present a solid mass thru which the saw can cut and to prevent the loss of the sawing shot in the crevices.

14. MISCELLANEOUS USES OF CALCINED GYPSUM

Include the manufacture of dehydrating agents, paint fillers, face powder, the manufacture of rubber stamps, as a component part of match heads, patching plaster and plaster of paris for painters and paper-hangers use in filling small cracks.

E. THE CAUSES OF AND REMEDIES FOR TROUBLES MET WITH IN THE USE OF GYPSUM WALL PLASTER

1. SLOW SET

If plaster fails to set on the wall in 7 or 8 hours it may be considered slow setting especially in the summertime when dryouts more frequently occur.

Cause:
Impure sand containing organic matter. Mixing water that contains organic matter (city water rarely causes trouble). Insufficient sand used. The wrong kind of plaster used such as using fibred plaster without the addition of sand instead of neat wood fibred plaster. Using old plaster in hot weather that was retarded for winter use. Plastering in unusually hot weather. Using light weight aggregates (Vermiculite or Perlite) with slow setting plaster.

Remedy:

1. Add one handful of accelerator as furnished by the plants and thoroughly mix with each sack of plaster.

2. Place several pounds of quick set gauging or molding plaster into a barrel of water, allow to stand an hour or so, mix thoroughly and use this water with the plaster. The water in the barrel will cause quicker setting if the tools are washed in the barrel.

3. Add 5 or 6 handfuls of Portland Cement or hydrated lime per bag of plaster and mix thoroughly.

4. Add set plaster by either scraping the sides of the mixing box or screening set droppings and mixing several handfuls per bag of plaster.

5. Add either alum or zinc sulphate to the mixing water in proportions of 1 to 3 ounces per gallon of water.

6. Remember that the first few mixes may be slow setting if mixed in a new or very clean box or machine mixer. As the plastering progresses this condition will probably correct itself as the box or machine mixer becomes contaminated with set plaster. Also remember that a thorough mixing of all ingredients is necessary to obtain a uniform set. Box mixing of plaster retarded for a machine mixer will often result in a slow set.

2. DRY OUTS AND DRY OUT SPOTS

When soft white chalky spots or areas that can easily be rubbed into with the ball of the finger are found a dry out has occurred. This usually takes place within a few hours after the plaster is applied unless the plaster is unusually slow setting and is much more prevalent in the summer than in the winter.

Cause:

Plaster requires the presence of about 17% of water in order to set. If, because of hot winds or the presence of excessive artifical heat from stoves, radiators, etc., this water is all evaporated before time for the plaster to set, a dry out will occur. The insufficient mixing or retarder added on the job may result in dried out spots in places where there is a concentration of retarder.

Remedy:

To prevent this trouble accelerate the plaster to a 2 to 3 hour job set and screen all openings so that hot drying winds cannot strike the walls. In cold weather see that the walls are not dried out quickly due to the plastering being near heating units. To correct this trouble after it has occurred thoroughly wet down the dried out areas preferably with a spray. Repeat every two or three hours until the plaster sets. Be sure sufficient water is added to penetrate into the keys and set them up hard. If speedy action is necessary dissolve 2 or 3 lbs. of potassium sulphate, alum or zinc sulphate in a barrel of water and spray the walls with this solution. Make sure that this treatment does not harden the surface only, leaving the keys soft and weak which may happen if the plaster is not thoroughly soaked thru. The water must not be applied with a hose to wash away the plastering. Water dashed on with a white wash brush is usually sufficient to remedy small dried out areas.

3. QUICK SET

When plaster sets up in less than one hour after it is mixed it is too quick setting for normal job conditions as the plasterer usually figures that it will take at least this length of time to get all the mix out of the box, onto the wall and darbied.

Cause:

Probably some local condition such as very quick setting sand, mixing box lined with set plaster, mixing water contaminated with plaster, lumpy plaster that has been wetted with water or the use of excessive amounts of sand. Plaster and damp sand should not be allowed to stand dry mixed before adding water. Plaster retarded for use in hot weather may set too fast. Plaster retarded for a box mix may be too quick setting when mixed in a machine mixer. Water is not ordinarily a cause of this trouble unless it contains excessive amounts of alum or other salts.

Remedy:

Add retarder to the water or by sprinkling it over the top of the plaster at the rate of from $\frac{1}{2}$ to $1\frac{1}{2}$ ounces per bag depending upon how much slower set is desired. Mix very thoroughly both in the dry state and after water is added. If retarder is not available a glue solution may be used by dissolving about 5 lbs. of powdered glue in a barrel of water and adding from a pint to a quart of this solution for each bag of plaster in the mix. Citric acid and tartaric acid in small amounts will also retard the setting time of plaster. Plaster may be retarded incorrectly at the mill due to insufficient or inaccurate information regarding job conditions or the kind of sand used in some markets. The plant laboratory or the general gypsum laboratory should be immediately informed in such a case sending in samples of the sand used and if possible a sample of competitive plaster that is giving satisfaction. Troubles are usually caused by lack of sufficient information as to

Remedy: (Cont'd)

the kind of sand used or some unusual local practice or job condition. The use of set stabilized plaster has greatly reduced setting time troubles but will not eliminate them entirely if very old plaster is used or if unusual job or weather conditions prevail.

4. SWEAT OUTS

A sweat out is just the opposite of a dry out. The plastering will be dark in color, will be set but will still be damp or partly wet for several days or possibly weeks after it was applied. Sweat outs occur more frequently in winter than in summer.

Cause:

Excess water remaining in the plastering for abnormal lengths of time will cause a partial redissolving of the crystals resulting in soft or "rotten" plastering. This condition may be so bad that the plastering may have to be removed. Fine sand and clay or loam in the sand used increases this danger as mortar so made is slower in drying. When Vermiculite is used as the aggregate the plaster should be rather quick setting and after the set good drying conditions should prevail as such plastering dries slower than sanded plaster.

Remedy:

After the plaster has set the excess water should be removed as soon as possible by opening up doors and windows to secure good ventilation. In the winter or in very damp rainy weather provide artificial heat. If the sweat out condition is not too far advanced immediately drying the wall will preserve the remaining strength in the plaster and eliminate the necessity of replastering.

5. FROZEN PLASTER

When plaster is applied in freezing weather without artificial heat being provided it may become frozen before the set has taken place and will remain damp and dark in color. To prevent such a condition use artificial heat and provide ventilation. Freezing weather will not injure plaster after it is set and dry.

To remedy a frozen wall close up the building and supply artificial heat cautiously until the walls are thawed out and then ventilate until the walls are dry. If the plastering is partly thawed out and is then allowed to freeze again serious damage will be done. Never apply a finish coat to frozen plaster.

6. SOFT WALLS

If the plastering is not dried out, sweated out or frozen but is too soft for a good job the condition is probably due to the use of too much aggregate. A good test to determine the hardness of plaster is to take a stick of soft wood such as white pine and rub back and forth on the plaster surface with a pressure of 10 to 15 lbs. If the stick gouges into the plaster making a deep furrow it is soft plastering. If sand can easily be brushed off the surface with the hand, soft plastering is indicated.

There is no remedy for this trouble but to remove the soft plastering and replaster. To prevent, it is obvious that the proper amount of a good coarse clean sand or light weight aggregate must be used. Good plasterers will not use more than the proper amount of aggregate as such plaster is difficult to apply and will not give a good job. Plastering materials are usually cheaper than labor and the extra cost of labor when too much aggregate is used will more than offset the saving in material. The use of neat wood fiber plaster or premixed plaster prepared at the mill will of course remove such a danger. To accurately determine the amount of aggregate in set plaster send a representative sample to the general laboratory for analysis.

Caution: Vermiculite plastering, even when mixed with the specified amounts, is much softer than sanded plaster.

7. SHORT WORKING

Since the advent of plastisized plaster short working complaints are seldom encountered, for this plaster, after months of storage, will retain its easy working properties and ability to carry specified amounts of aggregate.

Short working plaster is plaster lacking in plasticity. With normal amounts of aggregate it will work tough under the trowel, will not form a good key back of the lath and will sag under the darby. When a handful of short working mortar is squeezed it will leave a core of aggregate. Such a plaster is not only hard to apply but will not give the customaryyardage due to excessive droppings and the smaller amount of aggregate used.

In case plaster is short working due to excessive age its working properties can be improved by mixing with the necessary amount of fresh plaster, by using less aggregate or adding one or two shovelsful of soaked hydrated lime putty, in which case retarder will probably have to be added due to the strong accelerating effect of the lime.

8. TOO RICH WORKING PLASTER

When plaster mixed with normal amounts of aggregate is sticky under the tools, or in the plasterers phaseology, is not "free"enough, it is too rich working. Very often such a condition is erroneously reported as short working. The remedy is easy - usually the addition of one to three extra shovels of sand or a little more light weight aggregate per bag of plaster will correct the condition. Some sands high in clay content contribute to this sticky working characteristic.

9. FALLING PLASTER

Plaster may fall from lath or other backings for one or more of the following reasons:

(a) Too much aggregate with resultant weak plastering and poor bond.

(b) Dry outs or sweat outs with resulting soft walls, poor bond and weak keys.

(c) Use of dry or poor quality wood lath that expands when wet and pinches off the keys or applying the lath too close together thus preventing proper key formation.

(d) Using plaster mixed with aggregate in place of bond plaster on concrete surfaces.

(e) Plastering on smooth surfaces not properly roughened or on surfaces treated with waterproof bituminous compounds.

(f) Calcination of the plaster especially the keys that are in close contact with heating pipes or ducts located back of the plastering.

(g) Exposure of plastering to continued high heats such as boiler houses, etc., or lighting units too close to the plaster.

(h) Exposure of plaster to continued steam or to a continued wetting from leaks in plumbing.

(i) Excessive vibration such as might occur on cat walks improperly supported over suspended ceilings.

10. SAGGING PLASTER

Usually due to expansion of the backing. Sometimes experienced on wood lath or fibre insulating lath. Plaster on large areas may bulge due to the expansion of the framing members. On ceilings the use of too light a metal lath or failure to properly stretch, staple or tie the lath.

11. EFFLORESCENCE

Any soluble salts in the plaster, aggregate or in the backing may work to the surface of the plaster as it drys especially under continued damp or wet conditions. If the salt is hygroscopic or draws water as is the case with sea salt, magnesium and calcium chlorides, damp or wet spots will persist on the plastered wall. Sea sand should not be used due to the presence of these salts. Usually the efflorescence is in the form of a white powder deposited on the surface and the condition will persist until all soluble salts are leached out.

Under unusually continued wet or damp conditions a reaction may occur between the dolomitic limestone impurity in the gypsum plaster and the gypsum itself forming the soluble magnesiun sulphate which may efflorescence on the surface of the plaster. The remedy is to dry out the plaster and rub off the efflorescence. If this is not done such an efflorescence will continue indefinitely until all the dolomite impurity is leached out of the plaster.

12. STAINED PLASTER

(a) On Wood Lath: Yellow or brown stains occasionally develop on the surface of plastering over wood lath due to the leaching out of sap and resins in the wood. This trouble rarely occurs on non-staining lath such as white pine or spruce but often occurs with green or inferior lath.

(b) On Masonry: Stains on the surface of plastering on masonry are usually due to soluble constituents of the masonry mortar or glazes on clay and terra cotta tile.

(c) Dust Marks over Wood Lath: Due tc a slight difference in temperature between the plaster directly over wood lath and the plaster directly over the spaces between the lath, more dust will collect on the cooler areas. When the air back of the lath is cooler than the air in the room the plaster over the lath is warmer, over the spaces it is cooler and the dust line is over the keys or the space between the lath. If the conditions are reversed and the air in the room is colder than the space back of the lath, the space directly over the lath will be cooler and will show the excess dust deposition. There seems to be no cure for the trouble as cleaning is only a temporary expedient. This trouble does not occur on metal lath, plain gypsum lath or insulating lath but has been known to occur on perforated gypsum lath because of the temperature difference directly over the perforations.

(d) From Impurities in Sand: Various soluble impurities in sand especially organic matter will occasionally stain the surface of plastering. Rusty tools, rust in the water or the use of non-galvanized lath or nails may cause rust spots in the finish. Bits of iron, if they get into the plaster or sand, will invariably cause rust spots as will certain iron minerals sometimes found in sand.

13. RETEMPERING

Plaster after it has set cannot be remixed with water for it will not again harden. Keene's Cement and lime can be re-tempered. Plasterers will sometimes add more water to mortar in the box or on the board that is starting to set and mix vigorously hoping to get the plaster on the wall before it is set hard. This is very bad practice as the newly forming crystals being broken down plus the weakening effect of the extra water will result in much weaker plastering.

14. FINISH COAT COMPLAINTS

(a) Setting Time: Occasionally, setting time complaints are reported on gauging plaster-lime putty finishes because the plasterer has a quick set finish when he expected a slow set or vice versa. A slow set complaint is usually caused by the use of such a small amount of gauging plaster that practically no set takes place. Quick set gauging troubles are easily remedied by the addition of retarder or retarded plaster to the mixing water and this is commonly done by plasterers even when using slow set gauging. Setting time troubles on prepared trowel finish or sand float finish can be remedied in the usual ways by some method of retarding or accelerating. Retarder must be thoroughly mixed into the mortar to avoid small dryout spots.

(b) Soft Finish: Insufficient gauging plaster is the common cause of a soft lime putty finish. An ideal mix for a hard finish is two parts of lime putty to one part of dry gauging by volume. There is some danger of mixing the mortar thru the set especially if a quick set gauging is used in insufficient amounts. Good ventailation should be provided or the lime will remain soft, as it will not carbonate or harden while wet. Prepared trowel

(b) Soft Finish: (Cont'd)

finish and sand float finish if not dried out will always be sufficiently hard although too much water used in the final troweling operation will kill the surface and leave a soft powder that can be brushed off with the fingers after the finish is dry.

(c) Finish Peeling off the Brown Coat:

This may be due to a dried out, frozen or over sanded base coat, failure to roughen the base coat by scratching or brooming, insufficient pressure in appling the scratch coat, or applying the finish in one thick coat.

The use of normal Hydrated Finishing Lime (Type N - A.S.T.M.) with gauging plaster as a finish coat has caused many peeling complaints which generally occur several years after erection. This type of Finishing lime contains large and varying amounts of unhydrated calcium and magnesium oxides. It has been proved that these unhydrated oxides hydrate slowly in the wall finish with a resultant expansion that weakens the bond between the finish coat and the base coats. To overcome this difficulty, a Special Hydrated Finishing Lime (Type S - A.S.T.M.) is now being produced and is specified for finish coat plastering. This "Special" type of Hydrated Finishing Lime is hydrated under pressure in an autoclave and must contain not more than 8% of unhydrated oxides of calcium and magnesium to conform to specifications. Autoclaved Finishing Lime is available for direct shipment from our lime supplier; it is not regularly carried in stock at all of our Gypsum Plants but if sufficient demand develops arrangements will be made to stock it along with the Normal type for shipment in mixed carloads with gypsum products.

There is little danger of prepared trowel or sand float finishes coming loose from the backing.

(d) Lack of Plasticity:

Complaints of lack of plasticity of a lime putty finish are sometimes blamed on the gauging plaster. Unless excessive amounts of gauging plaster are used, tough working properties are entirely the fault of the lime. Lime that has been aged for some time or insufficiently soaked will lack plasticity and there seem to be occasional variations in shipments from the same lime plant. In cold weather hydrated lime is a little less plastic than in warm weather and some manufacturers recommend soaking it for 48 hours in the winter. Trowel finish and sand float finish are given the desired degree of plasticity at the plant and tough working complaints are few. Finishing over dried out spots or areas in the base coat causes trouble as the dried out areas have a different suction than the set areas making it difficult to apply the finish evenly.

(e) Staining from Backing, Trowel Burns, Dirt, etc.

Stains from backings such as wood lath, masonry mortar, etc., which of course show up on the finish coat have already been discussed. A dark discoloration called a trowel burn results from excessive troweling on high spots. Poor workmanship is often seen where bits of sand and dirt from the brown coat are smeared over the face of the finish. Dirt from the mortar board very often

(e) Staining from Backing, Trowel Burns, Dirt, etc. (Cont'd)

discolors the finish. The use of common gauging will leave small dark specks in the finish and very often lime is contaminated with such spots. To obtain the whitest wall use the best grade of hydrated finishing lime and a white gauging plaster such as Blue Rapids or Satin Spar or Acme white brands. Streaks in the finish usually are due to a poor mixing of the putty and the gauging or the use of too much water in finishing.

(f) Paint Peeling from Finish:

Unless a lime putty-gauging plaster finish is well carbonated (changed to limestone) on the surface paint will peel off due to the action of free lime on linseed oil. It is necessary to wait from 3 months to a year depending on climatic conditions before it is safe to paint such a finish. After the finish is dry a sizing coat of 2 lbs. of zinc sulphate in a gallon of water will minimize the danger of paint peeling troubles. Prepared Trowel Finish and Sand Float Finishes containing no lime can be painted as soon as they are dry. Water seeping thru a wall from leaky roofs or faulty plumbing will also loosen and stain painted finishes.

(g) Blistering, Popping and Cracked Finishes:

In the application of lime putty and prepared trowel finishes blistering is always caused by applying the finish to a wet base. A dry or nearly dry base and proper handling of the trowel will eliminate this trouble. Sand float finish should be applied on a green or 50% dry base to prevent rolling up under the trowel. Excess water in the final troweling will also cause blisters which can sometimes be corrected by allowing the wall to stand until the water has left the surface and then troweling.

Popping or surface blistering occurs usually after the finishing job is completed and may be caused by improper slaking of the lime. To be sure that pops or blisters will not occur quick lime should be slaked for several weeks before it is used. A good insurance against this trouble is to use hydrated finishing lime.

Check, chip or map cracks in a lime putty finish are caused by shrinkage resulting from the use of insufficient gauging or insufficient troweling or applying plaster killed or partly killed in the mix. Chip cracking is common in slow drying weather due to the slowness of the base coat in drying. Very slow set finish of any kind may crack from shrinkage as the water is completely absorbed into the backing. Any finish that is dried out before the set will frequently crack.

15. CRACKED PLASTERING

Plaster properly mixed, applied set and dried will never crack of itself. When cracks occur, they may be:

(a) Settlement Cracks:

The framework of a building is often distorted by the foundation settling or by wind pressure. The resulting cracks in the plaster usually run from the corners diagonally across the walls. If cracks on opposite sides of a partition are in about the same relative position it is good evidence the cracks are caused by settlement.

(b) Structural Cracks:

The deflection of improperly designed ceiling joists is a common cause of ceiling cracks. It has been claimed that the deflection should not be greater than 1/360 of the span as this is the limit that plaster will bend without cracking. Swelling, shrinking, and twisting of wood studs, door bucks and window framing caused by the use of green lumber, poor construction, or from moisture and temperature changes, are a frequent cause of cracks. Careless wedging of the walls at the ceiling in masonry construction results in cracks at the wall and ceiling angle. Fireplace chimneys settling away from the walls cause cracks. Recent investigations have shown that marked differences in temperature and humidity between opposite sides of a wall or ceiling are a basic cause of cracks. The only known remedy is to eliminate such conditions.

(c) Cracks over Wood Lath:

Wood lath if not expanded by wetting before the plaster is applied will often expand when plaster is applied theron and cause cracks running parallel with the lath. Straight vertical cracks are sometimes caused by failure to break the joints at every seventh lath. Settlement and shrinkage cracks often follow the lath joints especially if not properly staggered.

(d) Cracks over Gypsum Lath:

Cracks on plaster applied over gypsum lath are common over the joints due to thin grounds. A full 1/2 inch of plaster should always be applied to strengthen the wall especially at the joints where vibration and strains are more likely to cause cracks. Settlement cracks, deflection of ceiling joists and improper application of the gypsum lath are other causes of trouble. Gypsum lath will not expand or contract of itself and if plaster is properly mixed and applied to the specified thickness cracking troubles (other than those caused by movement of the framework) will be eliminated.

(e) Cracks over Fibre Insulating Lath:

Fibre insulating lath will sometimes expand to an undesirable degree after excessive moisture absorption resulting in buckling and consequent cracking of the plaster. To minimize this trouble and to prevent cracks over joints apply a full 1/2 inch of plaster accelerated to set within 3 hours or before the lath can expand excessively. Cracks due to settlement, deflecting joists and twisting framework are also found on insulating lath. Lack of reinforced corners, and re-entrant angles and lack of reinforcing over the corners of door and window frames increases the danger of cracking. Some manufacturers recommend 6" strips of expanded metal lath be attached to all continuous ceiling joints.

(f) Cracks over Masonry Backing:

Check cracks in plastering on masonry backings are due to failure to wet the brick or tile to sufficiently reduce suction, to the use of insufficient sand (3 to 1 by weight should be used) or the lack of a second coat. Various structural cracks are common due to improper wedging of the wall at the ceiling and swelling of door and window framing.

(g) Miscellaneous Causes of Cracks:

Suspended ceilings of large areas with no breaks such as false beams are likely to crack from the thermal expansion or the expansion due to changes in humidity of the plaster itself as well as from the expansion of the backing of metal lath channel irons, etc. Architects are paying considerable attention to this problem and it is hoped that better design and better plastering practices will develop.

Running uninsulated heating ducts and pipes in or close to plaster- in some cases have caused bad cracking due to a very rapid drying of wet plastering. The heat of around 160°F. carried in these ducts will in time calcine and soften the plastering to a dangerous degree. In a dry atmosphere a tempurature above 115°F. may in time calcine, soften and crack the plastering.

16. SUBMITTING SAMPLES ON COMPLAINTS

Salesmen should observe the following rules in submitting samples on complaints.

1. On a setting time complaint send samples of the sand and plaster used. A sample of set plaster gives us no information concerning the set except in so far as it shows whether the plaster has dried out or not.

2. On a soft wall complaint send a sample of the set plastering which is representative of the material complained of.

3. In obtaining a plaster sample take it with a clean hand or scoop directly from a freshly opened bag. Plaster from the mixing box may be contaminated with water or dirt. Place sample in a clean metal can. A moisture resisting cardboard carton may be used if metal container is not available.

4. In obtaining a sand sample dig down into the sand pile in several different places to get an uncontaminated sample. Many of the sand samples we receive are contaminated with plaster splashings from the mixing box and are absolutely worthless as set plaster in the sand greatly accelerates the setting time.

5. Pack all samples securely in metal or heavy cardboard containers similar to ice cream cylinders. Clean metal containers such as pint paint cans with tight fitting covers are the best. We receive any number of samples of damp sand in a paper bag packed next to plaster also in a paper bag both of which have broken open and the contents mixed. Such samples are worthless and have to be thrown away without testing. Sometimes a sample of set plastering is included in the mixture of sand and plaster which makes the sample of no value.

6. Give us all the details of the trouble that you possibly can.

17. LABORATORY TESTS ON SAMPLES

The information that the General Laboratory can give you on samples submitted is as follows:

1. We can test for setting time under laboratory conditions, comparing the plaster with the job sand and standard testing sand.

2. We can test the sand for fineness, cleanliness and effect on the set and state whether it passes A.S.T.M. specifications.

3. We can test samples of set plaster to determine the amount of sand added and whether there are chemical indications of a dry out.

4. We can make analyses and strength tests on any sample of neat plaster.

5. We can comment on the thickness and hardness of the plastering, the adhesion of the finish coat and the adhesion to the backing if samples are submitted, and determine the cause of many stains.

6. On gypsum lath we can test for the absorption of the paper liner, the strenth of the lath, adhesion of the paper to the core, hardness of edges etc.

7. When the plastering is not badly over sanded but is softer than normal, we can only speculate whether the cause is slow drying conditions (sweat out) or frozen plaster, or plaster killed or partly killed in the mix. We know of no way to prove by laboratory tests which of these reasons caused the trouble.

8. We cannot always tell why plaster falls from the lath, especially in the case of perforated lath when there are no keys submitted with the sample. The keys may be dried out and the rest of the plastering fairly strong.

9. The man on the job reporting the complaint can help a lot by observing and telling us everything possible about the job as his observations may give us a clue towards discovering the cause of the trouble which we cannot find out from the samples alone.

18. PLASTERING PROBLEMS AND REMEDIES

THE HANDY REFERENCE CHART ON THIS AND THE PAGES FOLLOWING WILL PROVE HELPFUL IN TREATING PROBLEMS THAT ARISE DUE TO VARIOUS JOB CONDITIONS.

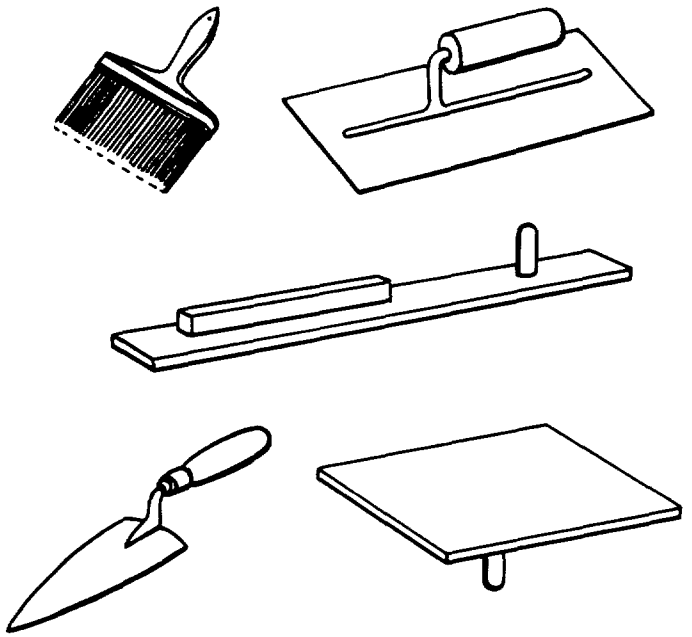
CONDITION	TROUBLE	CAUSE	REMEDY
PLASTER FAILS TO SET IN 5 TO 6 HOURS. SOFT, WHITE "DRY-OUT" SPOTS NEAR OPENING.	SLOW SETTING PLASTER.	IMPURE SAND. WRONG TYPE OF PLASTER USED. OLD PLASTER. TOO LITTLE SAND.	MIX MORE THOROUGHLY. ADD AN ACCELERATING MATERIAL TO QUICKEN THE SET.
PLASTER SETS UP IN MORTAR BOX OR IN LESS THAN 1½ HOURS ON THE WALLS.	QUICK SETTING PLASTER.	IMPURE WATER OR SAND. TOOLS AND MIXING BOX NOT FREE FROM SET PLASTER.	USE A RETARDING MATERIAL. CLEAN TOOLS AND MIXING BOX.
PLASTER CANNOT BE MADE A WORKABLE MORTAR WITH SPECIFIED AMOUNT OF SAND. WORKS HARD.	SHORT WORKING PLASTER.	PLASTER IN STORAGE TOO LONG. PLASTER PILED ON DAMP GROUND OR AGAINST GREEN WALLS.	ADD FRESH PLASTER. USE LESS SAND AND WATER. ADD SLAKED OR HYDRATED LIME.
SOFT CHALKY SPOTS NEAR OPENINGS. WALLS EASILY RUBBED OFF WITH FINGERS. USUALLY OCCURS IN HOT WEATHER.	DRY-OUTS.	PLASTER DRIED BEFORE SETTING. TOO RAPID DRYING. A TOO THIN COAT OVER DRY WOOD LATH. OPENINGS NOT SCREENED.	APPLY CLEAN WATER TO SPOTS WITH SPRAY OR BRUSH.
PLASTER REMAINS DAMP AND DARK-COLORED FOR SEVERAL DAYS AFTER APPLICATION. WALLS BECOME SOFTER AND WEAKER EACH DAY. CONDITION USUALLY OCCURS IN COLD WEATHER.	SWEAT-OUTS.	LACK OF GOOD DRYING CONDITIONS. WALL SOFTENS BEFORE WATER EVAPORATES. TOO FINE SAND.	OPEN DOORS AND WINDOWS. IN COLD WEATHER INTRODUCE ARTIFICAL HEAT. IF WALLS ARE TOO SOFT THERE IS NO REMEDY BUT TO RE-PLASTER.
PLASTER REMAINS DAMP AND DARK-COLORED. SIMILAR TO A "SWEAT-OUT". FREEZING TEMPERATURE PRESENT IN THE ROOM.	FROZEN PLASTER.	PLASTER APPLIED BELOW FREEZING POINT. FROZEN WALLS.	OPEN DOORS AND WINDOWS. PROVIDE GOOD VENTILATION. USE ARTIFICAL HEAT WHEN PLASTERING IN ROOMS THAT ARE BELOW FREEZING TEMPERATURE.
WALLS SOFT AND CRUMBLY. (NOT A QUICK-SET OR SLOW-SET OR SWEAT-OUT). WALLS EASILY SCRATCHED WITH FINGER OR COIN.	OVER-SANDING. SOFT WALLS.	TOO MUCH SAND USED. INFERIOR SAND USED.	THERE IS NO REMEDY FOR THIS CONDITION BUT TO RE-PLASTER. PREVENT BY CAREFULLY MEASURING SAND. FOLLOW STANDARD SPECIFICATIONS.
GYPSUM LATH AS BASE.	CRACKS AROUND JOINTS. PLASTER DOES NOT BOND. CRACKS IN CEILING.	INSUFFICIENT GROUNDS OVER SANDING. DRIED OUT PLASTER. SAGGING JOINTS.	USE CORRECT GROUNDS. APPLY SECOND COAT. MEASURE SAND CAREFULLY.

CONDITION	TROUBLE	CAUSE	REMEDY
FIBRE INSULATING LATH AS BASE.	CRACKS IN PLASTER COAT. PLASTER DOES NOT BOND.	IMPROPER NAILINGS OF LATH. TOO THIN PLASTER COAT. SLOW SET. SLOW DRYING OF PLASTER.	FOLLOW MANUFACTUREK'S NAILING DIRECTIONS. APPLY SECOND COAT. USE ONLY GYPSUM PLASTER.
METAL LATH AS A BASE.	CEILING CRACKS OR SAGS.	GAUGE LATH TOO LIGHT.	CORRECT DEFECTS MENTIONED USE CORRECT PLASTER.
	PLASTER DOES NOT BOND.	PLASTER NOT EXTRA FIBERED. PLASTER OVER-SANDED.	
WOOD LATH AS A BASE.	CRACKS AND BUCKLES RUNNING PARALLEL TO LATH.	EXPANSION OF DRY LATH.	REMOVE DEFECTIVE PARTS AND RE-PLASTER. USE ONLY NO. 1 GRADE LATH. FOLLOW STANDARD SPECIFICATIONS. WET LATH DAY BEFORE AND AGAIN AN HOUR OR TWO BEFORE PLASTERING.
	PLASTER SOUNDS HOLLOW.	KEYS PROBABLY BROKEN.	
	VERTICAL CRACKS.	IMPROPER STAGGERING OF JOINTS.	
	STAINED WALLS.	RESINS, OILS, GUMS HAVE LEACHED OUT OF LATH.	
MASONRY BACKINGS -- BRICK, CLAY, TILE OR TERRA COTTA TILE, USED AS A BASE.	NETWORK OF SMALL CRACKS.	TOO MUCH SUCTION. TOO LITTLE SAND.	WET BACKING BEFORE APPLYING PLASTER.
	LARGE CRACKS AROUND CEILING ANGLES.	SHRINKAGE DUE TO IMPROPER WEDGING OF WALL.	WEDGE WALLS CORRECTLY AT CEILING.
	CRACKS OVER DOOR OPENINGS.	SWELLING OF WOODEN DOOR BUCKS AND IMPROPER LAYING AND KEYING OF TILE.	FOLLOW MANUFACTURERS SPECIFICATIONS.
	PLASTER DOES NOT ADHERE.	SURFACE TOO SMOOTH OR GLOSSY. INSUFFICIENT SUCTION.	HACK SURFACE. DAMPEN SURFACE.
GYPSUM TILE OR BLOCK USED AS A BASE.	SHRINKAGE CRACKS.	TOO MUCH SUCTION.	DAMPEN TO REDUCE SUCTION.
	SMALL CRACKS.	INSUFFICIENT SAND.	USE CORRECT AMOUNT OF SAND.
	LARGE CRACKS.	SETTLEMENT OR DEFORMATION STRAINS.	
CONCRETE SURFACES USED AS BASE.	PLASTER CRACKS, CHECKS OR FAILS TO ADHERE.	USE OF PLASTER NOT SPECIALLY PREPARED FOR THE PURPOSE. SURFACE NOT CORRECTLY PREPARED TO RECEIVE PLASTER.	USE CONCRETE BOND PLASTER. ROUGHEN SURFACE BEFORE PLASTERING. DAMPEN TO KILL EXCESSIVE SUCTION.
STAINING OF PLASTER.	YELLOW OR BROWN STAINS.	YELLOW OR BROWN STAINS USUALLY CAUSED BY SAP OR RESIN LEACHING FROM WOOD LATH.	SANDPAPER, AND IF WALLS ARE DRY THE SPOTS WILL NOT REAPPEAR.

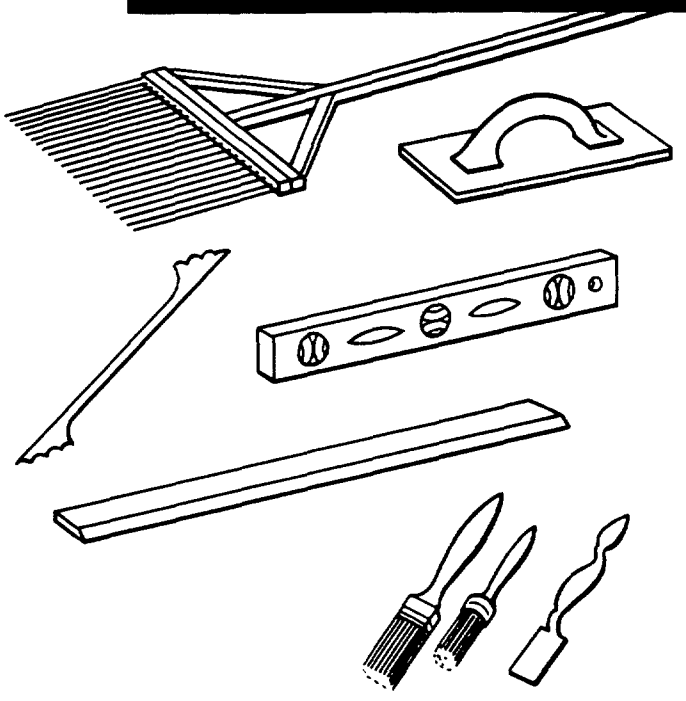
CONDITION	TROUBLE	CAUSE	REMEDY
STAINING OF PLASTER	YELLOW OR BROWN STAINS.	WOOD CHIPS USED AS A FILLER IN GYPSUM TILE.	AS ABOVE
	RUST SPOTS.	RUSTY TOOLS, RUST IN WATER OR USE OF NON-GALVANIZED METAL LATH OR NAILS.	HARD TO REMOVE.
WHITE POWDERY MATERIAL ON WALLS WHICH IS EASILY RUBBED OFF. NOT COMMON BUT SOMETIMES FOUND ON WALLS OVER CONCRETE, MASONRY BACKINGS, TILE, ETC.	EFFLORESCENCE.	SOLUBLE SALTS IN BACKING, IN THE CASE OF CONTINUED DAMP CONDITIONS, COME TO SURFACE OF WALL.	BEFORE PLASTERING OVER CONCRETE, IF EFFLORESCENCE IS PRESENT, WASH WITH A SOLUTION OF 1 PART MURIATIC ACID TO 4 PARTS OF WATER. THEN WASH AGAIN WITH WATER.
LIME PUTTY FINISH CHECK OR MAP CRACKS. CRACKS RUNNING IN ALL DIRECTIONS.	SHRINKAGE OF LIME PUTTY FINISH COAT.	INSUFFICIENT GYPSUM GAUGING WITH LIME. APPLICATION AFTER GAUGING PLASTER HAS SET. CHECK CRACKS IN SPOTS MAY BE DUE TO NON-UNIFORM BLENDING OF GAUGING PLASTER WITH LIME PUTTY.	USE AT LEAST ONE VOLUME OF DRY GYPSUM GAUGING PLASTER TO 3 VOLUMES OF LIME PUTTY. THICKNESS OF FINISH COAT SHOULD NOT BE LESS THAN 1/16" OR MORE THAN 1/8". IF CONDITION IS VERY BAD, THE ONLY REMEDY IS TO REMOVE FINISH AND THEN REFINISH.
DISCOLORED FINISH.	STREAKS OR DISCOLORATION.	LIME PUTTY AND GAUGING PLASTER NOT THOROUGHLY MIXED BEFORE APPLICATION. TOO MUCH WATER USED IN TROWELING.	FOLLOW STANDARD SPECIFICATIONS.
LOOSE FINISH COAT.	IF THE HARDENED FINISH COAT IS LOOSE FROM BASE COAT.	OVER-SANDED BROWN OR BASE COAT PLASTER. LEAVING BROWN OR BASE COAT TOO SMOOTH. APPLICATION OVER BASE COAT THAT WAS DRIED OUT OR CONTAINED FROST. APPLICATION OF FINISH IN ONE COAT. APPLICATION OF FINISH COAT WITHOUT SUFFICIENT PRESSURE TO PROMOTE PROPER BOND.	REMOVE THE LOOSE FINISH COAT AND REFINISH.
POPS IN LIME PUTTY FINISH.	POPS.	QUICKLIME NOT SUFFICIENTLY SLAKED BEFORE APPLICATION.	USE HYDRATED LIME.
PREPARED TROWEL FINISH.	POOR BOND.	BASE COAT DRIED OUT. BASE COAT OVER-SANDED. BASE COAT NOT ROUGH ENOUGH. BASE COAT TOO WET.	MIX WITH WATER ONLY. APPLY ON A BROOMED BASE THAT IS SET AND NEARLY DRY. APPLY IN 3 OPERATIONS. PROVIDE PROPER VENTILATION.

CONDITION	TROUBLE	CAUSE	REMEDY
PREPARED TROWEL FINISH.	BLISTERS.	APPLICATION ON A WET OR DAMP BASE COAT.	MIX WITH WATER ONLY. APPLY ON A BROOMED BASE THAT IS SET AND NEARLY DRY. APPLY IN 3 OPERATIONS. PROVIDE PROPER VENTILATION.
	SOFT WEAK FINISH.	SLOW SETTING FINISH RESULTING IN A DRY-OUT. POOR VENTILATION.	
SAND FLOAT FINISH.	FINISH WORKS HARD AND ROLLS UNDER THE TROWEL.	BASE COAT IS TOO DRY.	TO AVOID TROUBLE, BASE COAT SHOULD BE HARD, FIRM AND LIGHTLY BROOMED. BASE COAT MUST BE ABOUT 50% WET OR HALF GREEN. APPLY FINISH IN A THIN COAT. PROVIDE PROPER VENTILATION FOR DRYING.
	SMOOTH OR SCOURED SPOTS.	TOO MUCH WATER USED DURING FLOATING PROCESS.	

NOTES



DEFINITIONS of PLASTERING TERMS



ACCELERATOR—Material added to gypsum plaster to speed up the set.

ACOUSTICAL PLASTER—A special type finishing plaster which reduces noise and corrects sound reverberation.

AGGREGATE—The inert material used as a filler for mixing with cementing material. With plaster, usually sand, Vermiculite or Perlite is used.

ARCH—Any curved top of a wall opening. Designed structurally to rest the overhead load on the side members.

ARRIS—The sharp edge which forms an external corner where two surfaces join.

BASECOAT—All coats of plaster applied before the finish coat.

BED MOLD OR BED—Any flat area left in a cornice for later planting of enrichments.

BLISTERS—Bulges on the finish coat of plaster. Caused by applying finish coat before basecoat has dried, or by troweling too soon after application.

BOSS—A Gothic-style decoration planted at the intersection of moldings.

BRACKET—A projecting ornament carrying a cornice.

BREAK—Any interruption in the continuance of a plastered wall or cornice.

BROWN COAT—The coat of plaster underlying the finish coat. Synonymous with basecoat in two-coat work. Applied with a rough surface to receive the finish coat.

BUCKLES—Spots which raise away from the lath, eventually cracking to expose the lath underneath. Usually caused by applying plaster over dry, broken or improperly applied wood lath.

BULL NOSE—An external angle with corners rounded. Used mostly at window returns and door frames. A bull nose may be made by running with plaster or by using a bull nose corner bead with the proper radius.

BUTTERFLIES—Color imperfections in a lime putty finish wall or large variations of color which smear out under pressure of the trowel. Caused by lumps in unsifted lime or insufficient mixing and gauging of lime and plaster.

CAPITAL OR CAP—Decorative top part of a column or pilaster.

CASE MOLD—A shell of plaster used to hold parts of a plaster mold in position. Used with gelatin or wax molds to avoid distortions during pouring.

CASTS—The finished product of molding. Used largely as ornaments which are stuck in place.

CATFACE—A flaw, similar in appearance to a pock mark, found in the finish coat. The term is used in some regions to describe basecoat knobs which show through the finish.

CEMENT PLASTER—A type of gypsum plaster processed for mixing with sand for basecoats. Also known as neat or Hardwall plaster.

CHECK CRACKS—Surface cracks caused by the shrinkage of plaster which remains bonded to the base.

CHIP CRACKS—Cracks where the bond of the plaster is partially destroyed, causing egg-shelling. Also referred to as fire cracks, map cracks, crazing, fire checks and hair cracks.

COFFERED CEILINGS—Decorative ceilings composed of sunken or recessed panels.

DENTILS—An architectural term for the small blocks planted in series in the bed mold of cornice.

DOPE—A plasterer's term for additions which accelerate or retard the set of plaster.

DOUBLE-UP—Application of plaster in successive operations without a setting or drying interval between coats.

DRY OUT—Soft, crumbly plaster from which the water has evaporated before the plaster sets.

EFFLORESCENCE—A white, fleecy deposit caused by salt in the sand or backing of plaster. Occurs on the face of plastered walls. Also known as "Whiskering" or "Saltpetering."

EGG AND DART—A design used in molded cornices. Composed of an oval and a dart, spaced alternately. Supposedly, the egg represents life; the dart, death.

EGG-SHELLING—The concave form of chip-cracking in base or finish coat of plaster walls. This condition partially destroys the bond.

ENRICHMENT—A cast ornament which is not part of a running design.

EXPANDED METAL—"Metal Lath," made of sheets of metal which are slit and stretched in a direction perpendicular to the slit to form diamond shaped openings.

FAT—Plaster accumulated on the trowel during the finishing operation. Used to fill in small imperfections. "Fat" is also used to describe the working characteristics of plaster.

FENCE—A wall of plaster or clay which is placed around a model before pouring the material for the mold.

FIBER—Animal hair or the fibers of the sisal plant. Either is mixed with plaster to act as a binding agent until keys are set.

FISH EYES—Approximately ¼" spots in the finish coat of plastered walls. Caused by lime which is lumpy due to age or insufficient blending of material.

FRAMING—Studs, joists, headers or other wood or metal structural members to which lath is applied.

FURRING—Wood strips applied to masonry to support lathing. This allows free circulation of air behind the plaster and is especially suitable for damp walls. The term also applies to strips nailed on joists or rafters too far apart or crooked, and to the light weight metal grillage to which lath is attached for wall or ceiling construction.

GAUGING—A type of plaster used for mixing with lime putty as a finish coat for the purpose of obtaining a definite setting time, initial strength and elimination of shrinkage cracks. The term is also used to denote the method of mixing gauging plaster with lime putty.

GELATIN—An animal product which is used to make semi-rigid molds. Because of its flexibility, it is widely used for molds which have undercuts.

GREEN—Used to describe wet or damp plaster.

GROUNDS—A wood or metal strip attached to framing so the exposed surface can act as a gauge to govern the thickness of plaster. Used also by carpenters as a nailing base to support trim.

HARDWALL—Gypsum basecoat plaster. In some regions used to describe sanded plaster; in other regions, neat plaster.

JOINING—The meeting point on a surface of two different mixes of plaster.

KEENE'S CEMENT—Dead burned gypsum plaster which is exceptionally strong due to its processing. Used where extra strength and durability in plaster are required.

LATH—Any base for receiving plaster. The five major types—wood, gypsum, metal, insulating and wire—are all usually secured to framing or furring members.

LIME—Oxide of calcium (CaO) which results from burning limestone ($CaCO_3$). Heat drives out carbon dioxide (CO_2) from limestone, leaving oxide of calcium or "quicklime." Quicklime and water mixed cause chemical changes which yield hydrated or slaked lime.

MITRE—A joint at the angle of two moldings.

MODEL—Any object which serves as a pattern for a mold.

MOLD—The form in which copies of an object are cast. Plasterers' molds are of two types—running and casting. Running molds are for any type of decoration which is cast in place. Casting molds are for ornaments that are cast before putting in place, and planted in position later. Casting molds are made generally from wax, gelatin or plaster.

NEAT—Generally describes basecoat plaster to which sand is added on the job.

NICHE—A recess in a wall, either curved or square, depending on the architecture or the intended use. Used for housing statues, vases, door chimes, etc.

PERLITE—A volcanic rock. Expands to lightweight material when heated. Used as a lightweight plaster aggregate.

PINHOLE—A small hole in a cast sometimes caused by an excess of water in mix.

POLISH—To trowel a finish coat until it is smooth and glossy.

PULP—Wood fiber or wood-fiber plaster. A trade term.

PUTTY—Lime which is slaked, soaked or mixed with water.

RETARDER—Any material mixed with gypsum plaster to slow the natural set of the plaster.

RETURN—Term applied to the end of a cornice or molding which forms an external mitre and stops at the wall line.

REVEAL—The vertical face between the interior wall and frame in a window or door opening.

SCAGLIOLA—A precast imitation marble usually cast with Keene's Cement. The art of casting Scagliola is fast becoming lost.

SCRATCH COAT—The first of three coats of plaster.

SCREED—Long, narrow strips of plaster applied horizontally along a wall. They serve as thickness guides for plastering the wide intervals.

SISAL—(See Fiber).

SKIM COAT—A local designation of the final coat of plaster.

SLAKING—Hydration of quicklime by mixing with water to form a putty.

SOFFIT—The undersurface of an archway, bead, cornice, etc.

SPLAY ANGLE—Any angle of more than 90° formed by two surfaces meeting.

STAFF—A plaster cast which has been strengthened by the addition of fiber to the casting mix. Usually nailed, wired, or stuck in place.

SUCTION—The power of a plastered surface to absorb water. A highly important property of basecoat, which must absorb water from the finish coat.

SWEAT OUT—Areas of a wall that are soft and damp due to poor drying conditions.

TEMPER—To mix plasters to a proper working consistency.

TEMPLATE—A shaped metal pattern used in molding arches, curves and similar shapes.

VERMICULITE—A mineral having characteristics much like mica. On heating, it expands into a lighter weight material. Used as an aggregate for plaster because of its light weight and fire resistant qualities.

WADDING—In hanging staff, wadding refers to fastening wads of Plaster of Paris and excelsior or fiber to casts and winding around framing.

WAINSCOT—The lower three or four feet of a wall which is finished differently from the upper parts.

G. GYPSUM WALLBOARD, GYPSUM LATH, GYPSUM SHEATHING

Gypsum Wallboard, Lath and Sheathing are composed of a core of fibered, hydrated calcined gypsum and other ingredients surfaced on both sides with smooth, uniform, specially prepared paper forming the finished surfaces and serving as a reinforcement.

Each raw material used in the manufacture of these products is for a specific purpose, and only those that meet our rigid specifications are used. The quality and structural value of each board product depends upon its composition and fabrication during manufacture. To thoroughly understand the quality, properties, uses, etc., of each product their composition and manufacture should be known. Therefore, the manufacturing may best be followed by starting with the raw materials and following their course, step by step, thru the process.

1. RAW MATERIALS

(a) Paper:

Certain-teed manufacturers in its own paper plant much of the special paper used for surfacing wallboard, lath and sheathing. A different kind of paper is used for each finished product.

Due to high freight costs for shipping paper from our Thorold, Canada, plant to our Western Wallboard Plants, it is to our advantage to purchase some paper from outside manufacturers. This outside purchased paper is manufactured according to our own formulae and specifications.

The papers are manufactured on seven cylinder paper machines, which means that there are seven seperate layers of paper stock felted together to form the solid finished sheet. The finished sheet as formed consists of 3 parts which are known as the face liner, filler, and bond liner. By building up the solid sheet in this manner the composition of each part of the sheet can be controlled so as to produce a paper which will have the properties required by the finished gypsum board products made therefrom.

All papers used for wallboard, lath and sheathing have certain properties in common:

1. The bond liner in all cases is made from unsized stock and is designed to produce perfect bond to the gypsum core. The bond to the gypsum core is accomplished by the bond liner absorbing the saturated gypsum solution from the gypsum slurry used for forming the core. Gypsum crystals grow in this saturated solution that has been absorbed by the bond liner and interlace into the crystals of the core thereby producing the bond.

2. The filler of all our paper is made from a specially sized paper stock to render it waterproof. This waterproofing of the filler is very important and is one of the features of the paper which we use for all types of board, lath and sheathing. The waterproof properties of the filler prevent the free water present in the slurry and core, while the board is being manufactured, from percolating thru the face

2. (Cont'd)
and back papers to the surfaces, which would cause unsightly water marks, stains, etc. Also the waterproofed filler prevents the passage of free water present in gypsum plaster mortar applied on the surface of gypsum lath from passing thru the covering paper into the core. In the latter case if the water were not prevented from reaching the gypsum core in the lath it would dissolve a sufficient number of the crystals which bond the paper to the core and might cause the paper to loosen from the core.

3. The face liner used for wallboards is made from a special paper stock which is colored, highly sized, and treated to render it waterproof, scuff-proof and having a finished surface that is smooth, uniform, and non-absorptive. The face liner of lath paper is exactly the same as the bond liner as explained above, because its surfaces must have the properties of bonding to the gypsum plaster applied thereon. The face liner of gray wallboard back paper is made from stock that is slightly sized so as to render it scuffproof. The face liner of the paper used on sheathing is made from paper stock which is colored, highly sized, and treated to render it waterproof, scuff-proof, and having a finished surface that is smooth, uniform and non-absorptive.

(b) Stucco:
The stucco used for manufacturing the core is designed especially for this purpose. It is of proper fineness and is low in water carrying so as to produce a core which has the proper hardness and strength.

(c) Fine Sawdust:
This is not ordinary sawdust which is a waste product from saw mills, planing mills, etc., but is manufactured especially for us and must meet our specifications. It is manufactured by grinding certain kinds of soft wood, non-staining wood chips, etc. This type fine sawdust is of a very fibrous structure which bonds perfectly to the gypsum and gives certain properties to the gypsum board which are not available when ordinary sawdust or wood fibre is used. The fine sawdust is added to the core for the following reasons:

1. To give proper nailing properties to the core and eliminate chipping and shattering of the core at open edges of the board.

2. To reduce the brittleness of the core.

3. To produce a wallboard that has the required flexability and which can be handled without breakage.

4. To reduce the weight of the board.

(d) Adhesive:

The gypsum crystals which form the core, and bond it to the bond liner of the paper used, are very fine and brittle. To protect these crystals, and add to the bond between the core and the bond liner of the paper, a special adhesive is used. This adhesive, which is mixed into the ingredients in the core, is water-soluble and therefore concentrates between the crystals where the core is in contact with the bond liner, thereby reinforcing the crystalline structure and adding to the bond between the core and the paper covering. This concentration of the adhesive at the surfaces of the core is somewhat similar to the action of the soluble gum added to produce the case-hardened surfaces of statuary casting plaster.

(e) Accelerator:

To regulate the setting time of the slurry so that the gypsum core sets hard in sufficient time to enable the board to be cut into the required lengths when it reaches the cut-off knife, it is necessary that an accelerator be used. The accelerator which we use is ordinary pulverized gypsum rock but chemical accelerators such as potassium sulphate, ammonium sulphate, etc. may also be used.

(f) Foam:

The foam added to the slurry used for producing the core is made from a mixture of rosin soap and protein glue passed thru special equipment that beats it into a stable, uniform structured, small bubble foam. The foam is added to produce microscopic air voids throughout the gypsum core. The soap forms the bubbles and the protein glue reinforces or toughens their film structure so as to obtain maximum efficiency from the foam. After the foam is added to the slurry the protein content of the soap solution reacts with the gypsum, forming insoluble calcium salts which further reinforce the void structure of the gypsum core. The foam is added to the slurry for the following reasons:

1. To increase the thermal insulation value of the board.
2. To enhance the nailing properties of the board.
3. To reduce the brittleness of the core.
4. To add to the flexability of the board.
5. To reduce the weight of the board.

2. PROCESS OF MANUFACTURE

Each step in the process of manufacture in necessary to control the quality and uniformity of the board, lath or sheathing produced. The quality of the board depends upon the combination of the paper used and the structure of the core. The paper has been covered above. The structure of the core in combination with the paper controls rigidity, structural strngth and durability of the board, lath and sheathing. The required hardness and strength of the core can be obtained by proper formulation of the dry ingredients and control of the water plaster ratio.

2. PROCESS OF MANUFACTURE (Cont'd)

The proper mixing of the dry ingredients, soaking of the dry mixture, addition of the foam and proper wet mixing before the slurry is filled into the paper covering all are very important. Our system of inspection, testing and control is very rigid to make sure that the proper percentage of each raw material is incorporated and so that the mixture is thoroughly dry mixed and wet mixed before it is used for forming the core.

An illustration of what quality means in the composition of the core of gypsum board is the experience of some of our dealers in Pittsburgh and Johnstown, Pa., who had our Bestwall in stock during the 1936 flood. Bestwall and competitive wallboards in these dealers' warehouses were covered by the flood water for several days until the water receded. The Bestwall after drying, except for being soiled to a certain extent, was still in usable condition, whereas, the competitive wallboard disintegrated to such a degree that it was worthless.

Some of our competitors use high percentages of starch, paper pulp, etc., as fillers in the gypsum core of their gypsum boards and lath to reduce the weight, etc. These materials have a tendency to absorb moisture under high humidity conditions and tend to cause the core to become punky or soggy.

(a) Dry Mixing:

It is absolutely necessary to thoroughly mix the fine sawdust, accelerator, and adhesive into the dry stucco so that a uniform mixture is obtained. This dry mixing is accomplished in the conveying equipment as the material is delivered to the wet end of the machine. The dry mixture is delivered to a wide conveyor belt, known as the soak belt, and spread out to a uniform thickness on this belt.

(b) Wet Mixing:

The dry stucco mixture after being spread on the conveyor belt passes under a series of water sprays which cut grooves into the dry mix so that when it passes into the pool of water, known as the pond, the mixture will absorb the required amount of water to fully hydrate the Plaster of Paris and produce a slurry of the proper consistency for use in forming the core. After the wet mixture leaves the pond it is transferred from one conveyor belt to another while it is passing to the final mixing equipment. Before it reaches the mixer the required amount of foam is added and it is thoroughly and intimately mixed into the wet mixture or slurry in the final mixing equipment. The slurry is then discharged from the mixer directly onto the face paper as it travels to the forming roll.

(c) Drying Paper Before Using:

The paper used for the manufacture of board, lath and sheathing is shipped in large rolls. The cut edges of the paper in these rolls are exposed to atmospheric conditions and when in storage for a period of time may absorb a sufficient amount of moisture from the air to cause a slight expansion of the paper along the edges. This expansion causes the paper to have wavy edges when it is fed to the machine to form the board and is objectionable

(c) Drying Paper Before Using: (Cont'd)

as it causes wrinkles along the edges of the board if this condition is not remedied. This waviness is overcome by the use of electric edge heaters, which equipment dries the edges of the paper so that the sheet is free from waviness. This process is covered by a Certain-teed patent.

(d) Forming the Board:

The entire board machine from conveying the stucco and raw materials to the soak belt to the removal of the board lath or sheathing from the dryer is accurately syncronized for perfect control. We produce different types of closed edges when manufacturing board, lath and sheathing, depending upon the product. The different types of edges are square, recessed, tongue and groove, bevelled, and round, depending upon the product. These edges are formed by special folding mechanisms as the core is being formed and before the board passes thru the forming rolls. Wallboard, lath and sheathing are manufactured with the face paper down. This method of manufacturing the board simplifies the formation of the edges and the application of the back paper. As the face paper passes beneath the mixer, the required amount of slurry is fed thereon as it moves towards the forming roll. Two operators are present at all times to see that the proper amount of slurry is available and that a full and solid core is formed.

All of our products have the edges of the face and back paper glued together where they overlap on the back. Adhesive is applied to the edges of the back paper just before it comes in contact with the face paper and as the board passes thru the forming roll. A special type of adhesive is used to bond the edges of the face and back paper at this point.

The thickness of the products is controlled at the forming roll. The width is controlled by the setting of the folding mechanism and the forming roll and the core is still soft, it is transferred to a broad conveyor belt by which it is gradually conveyed (while the gypsum core is setting) to a point where it is cut into the required lengths. The distance from the forming rolls to the cut-off knife is 500 ft. or more. The speed of the board machine can be varied at will depending upon the type board being manufactured and the drying time required.

(e) Length of Machine:

The over-all length of the machine at the Akron Plant from the wet end to the dryer is about 650 ft. and from the forming roll to the cut-off knife, approximately 525 ft. Labelling or stencilling is done on the back of the board just before the board reaches the cut-off knife.

(f) Cut-Off Knife:

This is a moving knife which, at some of the Plants, travels with the board as it engages the board from above and below. At other of our Plants where the board machine operates at relatively high speeds, a rotary knife is used.

(g) Drying:

The board is then conveyed to the dryer by means of special equipment known as transfer table and tipple. The drying is accomplished by conveying the board thru an enclosed compartment about 260' long wherein a large volume of moderately heated and humidified air is circulated. Drying the board is a very important step in the manufacture and perfect control must be had at all times on the temperature and humidity of the air which acts as the drying medium.

(h) Take Off:

After the board is dried, it is discharged from the dryer and conveyed thru a cooling section to the discharge end where the board is taken off of the machine either manually or by mechanical means. At this point each piece of board, lath or sheathing is carefully inspected by the take-off men and any sub-standard material is segregated from the first grade material.

(i) Treating Cut Ends:

The cut ends of all board, lath or sheathing are treated after drying. This treatment produces cut edges that are equally as hard as the enclosed core. It adds to the quality of the board in that the cut ends may be nailed without chipping or crushing and the treatment also reduces the absorptive characteristics of the open ends.

(j) Twin Mounting and Bundling:

Wallboard panels of 1/2" and 3/8" thickness are then twin mounted. This consists of packing two pieces of board face to face and binding them together at the cut ends with paper tape. Twin mounting is done mechanically by a machine which was developed by Certain-teed. This machine automatically binds the ends together, cuts the tape, and discharges the finished bundle. Wallboard panels of 1/4" thickness are bundled in a similar fashion but there are three pieces to the bundle instead of two and the packing is described as triple mounting.

Gypsum lath are packed 32 sq. ft. (6 pieces) to the bundle by using paper tape to bind the lath together. This is accomplished by stacking the required number of pieces of lath to form a bundle on the conveyor belt which carries it to the taping device. The taper automatically applies the tape along the longitudinal edges of the bundle, cuts off the tape and discharges the finished bundle.

(k) Perforated Lath:

In some of the Plants, Lath is perforated after bundling. This is done by placing the bundle into a gang perforating machine which drills the holes. In other Plants, the perforating is done by a punching machine at the end of the board machine; the operation being performed on the wet lath before it is cut into 48" lengths, The perforations, in either case, are 3/4" in diameter and spaced 4" apart.

(l) Gypsum Insulating Board and Lath:

These products are made by laminating a sheet of bright aluminum foil on the back of regular wallboard or lath.

They should always be applied with the foil side against the studs. The principes of reflective insulation and vapor barrier properties of these products are expained in detail in section "K" of this manual

(m) Reclaiming:

Wallboard, lath and sheathing which have been damaged in the manufacturing process are delivered to the reclaiming department. In the reclaiming department re-cutting equipment is available so that the damaged goods can be cut into smaller sizes and reclaimed for shipment to the trade.

(n) Loading Cars:

Loading cars of wallboard, lath and sheathing is done under close supervision. And all precautions that are possible are taken to insure delivery of board to destination in good condition. To illustrate, the precautions which are taken in this department we will explain the routine which is followed in loading cars. All cars are carefully inspected before they are accepted for loading wallboard, lath and sheathing. Any cars with leaky roofs, broken floors, which are unusually dirty, etc., are rejected. All loose nails are withdrawn from the floors and sides and any loose boards are fastened to prevent damage to load. After the cars have been cleaned and prepared, the floors are covered with dunnage board and the walls covered with paper before starting to load. While loading the cars paper pads are attached to the side of the cars to protect the ends and edges of the piles of board, lath, or sheathing. Special care is used to brace, tie and protect all piles of board to prevent shifting or damage en route to destination.

3. INSPECTION

The entire process of manufacture and all raw materials used are under the supervision of compentent inspectors. An inspector is on duty at all times and on all shifts and is responsible for the quality of the products produced on that shift. Every step in the process is checked hourly or at fixed intervals as a matter of control. Finished boards are tested hourly or more often for thickness, width, length, bond, nailing properties, flexibility, strength, weight, appearance, resistance to moisture, etc. All tests and inspections are recorded on standard report forms made up in duplicate. These reports are watched by the board plant superintendent as the entries are made throughout the day. The reports when completed are signed by the inspectors and turned over to the board plant superintendent and plant manager for approval. One copy of the report is sent to the Chicago Laboratory. These reports are carefully analyzed by all concerned and then filed for reference.

4. SAMPLES

All samples of wallboard, lath and sheathing are cut from standard production.

5. BESTWALL GYPSUM WALLBOARD

(a) What it is:

Bestwall Gypsum Wallboard is the original gypsum wallboard. It was originated in 1909 and the product has been constantly improved since that time. It comes in large panels 4' wide, 6' to 12' in length, 1/4", 3/8", and 1/2" in thickness and with square, recessed and beveled edges. It consists of a fire-proof core of set gypsum plaster. A surfacing of tough, fibrous, multiple-ply paper is tightly and permantly bonded to the core. The core is toughened by the addition of a small amount of fiber. It is also aerated slightly to reduce its weight, to give it desirable nailing qualities and to increase its flexability and insulating value.

Bestwall is a closed-edge board. To protect the edges the ivory colored face paper is folded around the long edges of the board and is overlapped by the edges of the gray back paper. While still in the pulp stage, sizing and other ingredients are added to the paper to make it water-resistant and to increase resistance to scuffing.

(b) Where it is Used:

Bestwall is used to erect new walls and ceilings, to remodel or repair cracked walls and ceilings and to convert waste space, such as attics, into useful rooms. It is nailed directly to the studs and joists and provides a surface suitable to any type of decoration. In repair work it may be applied right over old cracked walls. Bestwall can be shaped to form curved walls and ceilings. There are numerous uses for Bestwall in almost every type of construction.

(c) Advantages of Bestwall:

1. Fire-proof

Every wall built of Bestwall is a fire-guard. The gypsum core of Bestwall is unique as a fire-retardant. It will not burn or support combustion, the fundamental property associated with all fire-proof materials, and it delays the passage of high temperatures. This means that wood members protected by Bestwall cannot be raised to a temperature that will char or ignite them so long as the Bestwall is intact. Wood stud bearing partitions faced with Bestwall, tested in accordance with the Standard Method of Fire Tests of Building Construction and Materials specified by the American Society for Testing Materials, have qualified for the following fire ratings:

Faced with 3/8" Bestwall - 25 minutes

Faced with 1/2" Bestwall - 40 minutes

2. Non-Warping

Atmospheric changes have practically no effect on Bestwall. It will not expand or contract appreciably nor will it warp or buckle when sujected to extreme changes in temperatures and relative humidity.

3. Structural Strength

A combination of the hard, strong resilent core with its tightly adhering envelope of tough, water-resistant paper, creates a versatile board of high structural strength. Its resistance to transverse stresses adds strength to walls and makes ceilings sag-proof. Yet it is amazingly pliable and it can be readily shaped to large radius curves for the construction of curved walls and ceilings.

4. Durable-Will Not Crack

Bestwall is permanent as well as strong. It is vermin-proof and it will not rot or decay. Because it will not crack, Bestwall preserves, intact, whatever surface treatment is used over it. Bestwall is able to withstand the effects of normal settling, jarring and other shocks without cracking, because of its strong, resilient gypsum core, and its tough paper surfacing.

5. Special Packaging

Bestwall is placed on the job unmarred, clean and unblemished by dirt or finger marks. This is assured by a special method of packaging. Two sheets of Bestwall 3/8" or 1/2" in thickness are placed face to face. A strong tape across both ends of the panels holds them closely together so they cannot slide across one another to cause marring. This also reduces to an absolute minimum the danger of broken corners, battered edges or soiled surfaces. Bestwall 1/4" thickness is packed 3 pieces to the bundle in a similar manner.

6. Easy to Decorate - Sanitary

Bestwall's smooth, moisture resistant paper surfacing forms an ideal base for any type of decoration which, if desired, may be applied the day after Bestwall is erected. It will not swell, shrink or soften when paint, enamel, calcimine or wallpaper is applied. For best painting results, however, it is recommended that the entire wall and ceiling areas first be given a coat of good quality pigmented varnish primer. Where calcimine or wallpaper is used, this recommendation should also be followed to assure easy removal of these finishes when redecoration is required.

Whether used with or without decoration, Bestwall is sanitary. It does not harbor germs or vermin and it is easy to keep clean.

7. Recessed, Square and Beveled Edges

Bestwall is available with square, recessed and beveled edges. Where paneled effects are desired, square edge panels are applied and the joints are simply covered with decorative wood or metal strips. If the paneling effect is not wanted, the joints of the square edge panels may be filled with Bestwall Joint Filler. Recessed edge panels in combination with the Bestwall Reinforcing Joint System are recommended for smooth walls without noticeable joints.

Where beveled edge panels are used, the joint with adjacent bevel edge forms a neat, decorative, V-shaped groove. This minimizes otherwise unsightly joints without the need of paneling or the use of the Bestwall Reinforcing Joint Systems.

(d) Economical - Easy to Apply

Bestwall comes in large sheets which are quickly and easily applied to wood frame construction. It may be sawed and nailed like lumber. Square Edge Bestwall is nail marked. This is an exclusive feature with Bestwall that reduces application time. One row of inconspicuous dots down the middle of the panel indicates the location of the middle stud for 24" stud spacing. The other rows 16" from each edge indicate the location of the studs for 16" stud spacing. Bestwall can be cleanly sawed with an ordinary handsaw to fit any space. It can also be cut to size by scoring with a sharp knife and breaking over a straight edge.

FACTS ABOUT BESTWALL

SIZES:	THICKNESS	WIDTH	LENGTH
Bevel Edge	3/8" and 1/2"	4'	6' to 12'
Square Edge	1/4", 3/8" and 1/2"	4'	6' to 12'
Recessed Edge	3/8" and 1/2"	4'	6' to 12'

PACKAGING

3 panels per bundle of 1/4"
2 panels per bundle of 3/8" and 1/2"

WEIGHT

1/4" - approximately 1 lb. per square foot
3/8" - approximately 1½ lbs.per square foot
1/2" - approximately 2 lbs.per square foot

(e) Application:

Bestwall may be applied with the long dimensions (edges) parallel with the studs and joists, known as "vertical"application, or it may be applied with the long dimension perpendicular to the studs and joists, known as "horizontal" application.

1. Horizontal Application

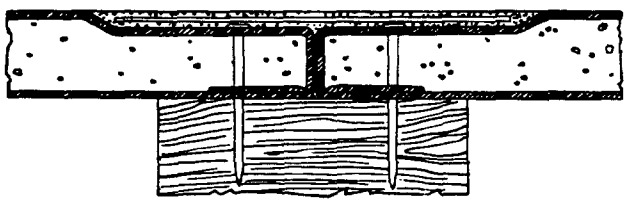
Horizontal application is recommended for Recessed Edge Bestwall. The directions on the following insert are for the application of Recessed Edge Bestwall.

HOW TO APPLY

Recessed Edge

BESTWALL

Recessed Edge Bestwall comes in two thicknesses, ⅜" and ½"—in a width of 4′ and in lengths from 6′ to 12′. Long edges of this type Bestwall are recessed on the face side. When the boards are butted, the two recessed edges



join and form a shallow depression at the joint (see illustration directly above). Into this depression Bestwall Fibre Tape is embedded in Bestwall Reinforcing Joint Finisher to form a smooth, strong joint.

APPLY RECESSED EDGE BESTWALL HORIZONTALLY

Horizontal application across the studding and at right angles to the ceiling joists is the proper method of application. This type construction furnishes additional bracing to the structure and provides greater strength to joints at all openings and corners. Each intermediate stud supports no more than 4′ of joint. ½" Recessed Edge Bestwall is the preferred thickness for this type of construction.

PLAN THE ENTIRE JOB BEFOREHAND

Before commencing the application of Recessed Edge Bestwall, all wall and ceiling measurements should be carefully checked, and the sizes of Recessed Edge Bestwall ordered so that you have the fewest possible joints to make. You will eliminate waste and save time and material if you plan the entire job before you start nailing Recessed Edge Bestwall.

Before nailing, rough carpentry should also be examined. Make sure that it is properly installed to receive Recessed Edge Bestwall and that all plumbing, lighting, and heating connections are in place and have been inspected. See, too, that all studding and joists are in line.

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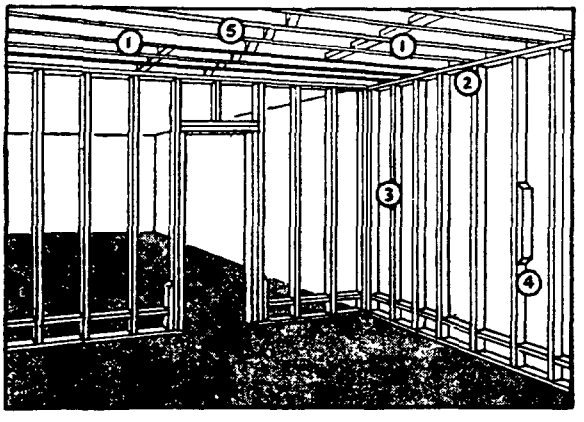
PREPARATION OF FRAMING

Best results are obtained when studding, joists and furring are spaced on 16" centers. These should be straight and true. Bowed or warped studs may be straightened by sawing the hollow sides at the middle of the bow and driving a wedge into the saw kerf until in line. Reinforce by nailing 1" x 4" strips on each side of the cut.

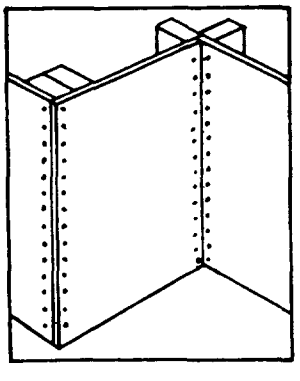


1. Headers; 2. Plate, ribbon or girt; 3. Double studding; 4. Splice to straighten stud that is bowed or out of line; 5. Bridging.

2" x 4" Headers should be placed wherever fixtures are to be installed. On jobs where base boards are used, it is recommended that headers be provided for nailing the base boards. No grounds are required.

CORNERS

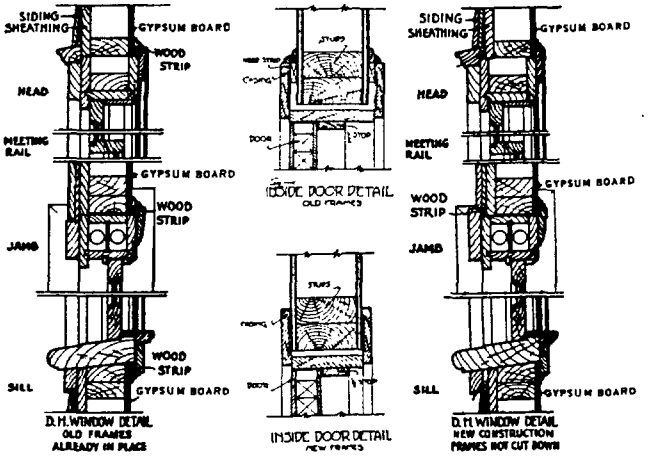
Corners are to be applied as shown in the illustration. On outside corners the edge of one board should overlap that of the other to obtain an even, true square corner. Double studs should be provided at corners of wall intersections as well as at exterior angles. (Refer to illustration.)



FRAMING AT OPENINGS

See that there is a backing for nailing of all ends of Recessed Edge Bestwall at openings. In new construction, order framing for 3/8" or 1/2" grounds, depending on which thickness of Recessed Edge Bestwall you are using on the job. Where window frames are not cut down to allow for the difference in thickness between boards and lath and plaster, wood lath should be nailed either on back of outside trim of window casing, or on covering boards. This saves building-out on the inside studs for proper clearance of standard frames. Door frames should be cut to size. If not, fillet strip must be used. (See framing details in illustration below.)

FRAMING DETAILS



FRAMING FOR CHIMNEYS

Do not nail furring direct to chimneys. Fur with 1" x 4" lumber to provide nailing surfaces for Recessed Edge Bestwall. Nail these furring strips together at the corners, to the floor and ceiling and to the wall, but do not nail to the chimney itself. This will allow free movement for the chimney.

BRICKWORK

To apply Recessed Edge Bestwall on new brick walls, set nailing strips in the mortar joints to

provide for nailing of furring strips. 1" x 3" lumber may be used for furring strips to furnish a nailing surface for Recessed Edge Bestwall. Furring strips should be placed on 16" centers.

CUTTING OR SAWING

To cut, score on the face side of Recessed Edge Bestwall with a knife or chisel, cutting the front liner. Then turn the board over, or up on edge, and give the back of the board a slight blow along the intended break, at the same time bending the board slightly backward away from the scored face. After scoring the back liner where the break has occurred, the board can be snapped in two and a smooth, clean cut obtained. Recessed Edge Bestwall may also be cut with a sharp hand saw.

TYPE OF NAILS

Use 5d cement-coated common nails for ½" Recessed Edge Bestwall, or 4d cement-coated common nails for ⅜" Recessed Edge Bestwall for new work. It is extremely important that the correct size and type of nail be used.

APPLICATION ON CEILING

Recessed Edge Bestwall should be applied to the ceiling first. Apply board at right angles to or across the joists. The board can be applied to the ceiling with the aid of a T buck and staging. The upright of the T buck should be 1" longer than the height of the ceiling. (See illustration.)

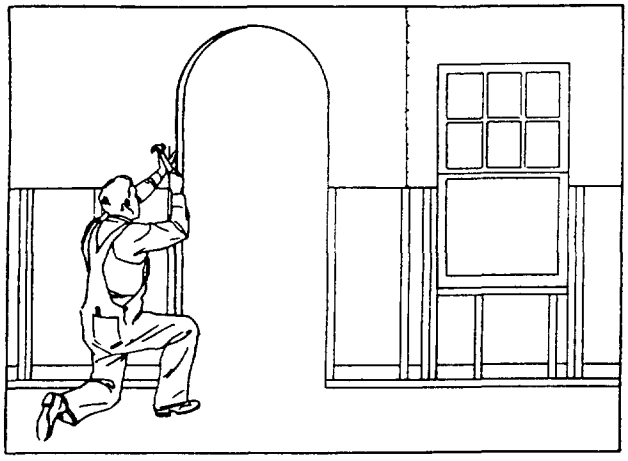
For staging use two ordinary saw horses and planking. Nail a 3' cross-piece across the studs about ¼" below the ceiling. Slide one end of Recessed Edge Bestwall on this crosspiece, and raise the other end into position by the use of the T buck. Stagger all end joints. Nail on intermediate joists first and from center to edges. Then nail ends.

Butt all edges together. Space nails 5" to 7" on centers on intermediate joists as well as on all edges. Drive nail heads home slightly below surface of Recessed Edge Bestwall, but do not use nail set as this may break the face paper surface of the board.

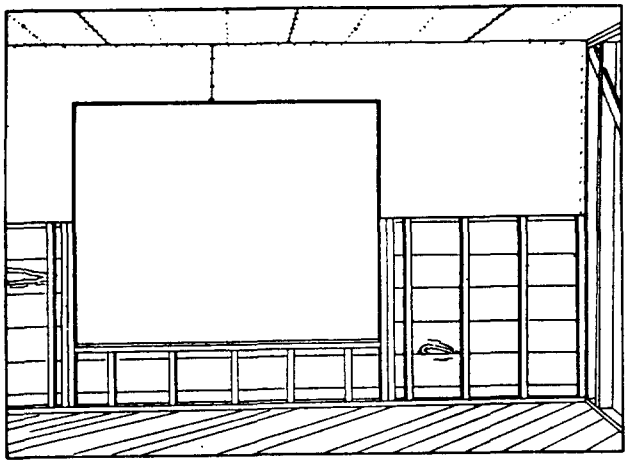
SIDE WALLS

Apply top boards first and work down to bottom. Do not have any vertical joints at corners of openings or above or below openings. To ac-

complish this, use full size sheets of Recessed Edge Bestwall and cut out openings as shown in the illustrations. In some rare cases where

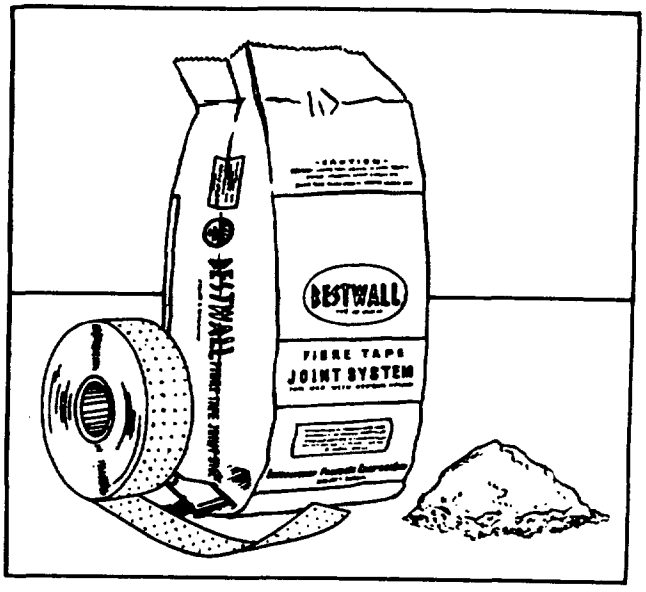


extra wide openings occur, it may be necessary to have a vertical joint above or below the opening. In this case such a vertical joint should occur as near the center of the opening as possible, but must be over a stud so the ends can be securely nailed. (See illustration below.)



Such joints can be eliminated in most cases by using a 12′ length of board. Space nails 6″ to 8″ apart on all supports.

Stagger all vertical joints. Be sure vertical joints on side walls do not meet ceiling joints at the juncture of side walls and ceiling.



JOINT APPLICATION

For proper joint application, follow the direction sheet included in the large carton of Bestwall Fibre Tape Joint System, or printed on the outside of the small carton.

FINISHING AND DECORATING SURFACE

Recessed Edge Bestwall will take any style of wall and ceiling decoration admirably — wall paper, texture paint, calcimine, oil base paint or enamel. Before starting to decorate, all joints should be thoroughly dry and the entire surface should be given a coat of high grade pigmented varnish primer.

The decoration of Recessed Edge Bestwall is to be applied in strict conformance with the specifications of the manufacturer of the paint, or decorating material to be used. Before wall paper is applied over Bestwall after the joints have been treated with Bestwall Fibre Tape Joint System, the entire surface should be sized with a pigmented varnish primer.

Recessed Edge BESTWALL

CERTAIN-TEED PRODUCTS CORPORATION - ARDMORE, PENNA.

FORM 1639 1-50 PRINTED IN U. S. A.

2. Vertical Application

The same general procedure in planning the job, preparing the framing, etc., should be followed as is recommended for horizontal application. Type, size, and spacing of nails are also the same. Headers should be provided for nailing the ends of the panels.

3. Except for the manner of treating joints, Square Edge Bestwall is applied in the same way as Recessed Edge Bestwall. Vertical application is most commonly used.

4. Bevel Edge Bestwall is applied as in (1) or (2) above but no joint treatment is needed because the bevelled edges form an attractive "V" joint which becomes a part of the decorative effect of the finished wall surface.

(f) Finishing of Joints and Nail Heads:

Two different systems of joint treatment are available. The most satisfactory and most commonly used system is one in which perforated paper tape is applied over the joints with a special finisher. It is most commonly used with recessed edge board but may also be used with square edge board.

The other system, which is the older of the two, consists of filling the joints with a plaster of Paris type of joint filler. It is not as satisfactory as the tape system but is sometimes used in "cheap" construction.

1. Bestwall Fiber Tape Joint System:

This system is available in the No. 1 package, consisting of 20 pounds of reinforcing finisher and a 250 ft. roll of perforated paper tape packed in a multiwall paper bag. The No. 2 case consisting of 12 cartons, each containing 4 pounds of reinforcing finisher and a 60 ft. roll of perforated paper tape, and the No. 3 case which is the same as the No. 2 case except that a plastic broad knife or applicator is supplied with each carton.

Directions for using the fiber tape joint system are printed on the package or on a direction sheet enclosed in the package. A brief resume of proper application procedure is given below:

First the joint is "buttered" with Bestwall Reinforcing Joint Finisher which has been mixed according to directions. The Reinforcing Fiber Tape is then embedded, using a flexible broadknife. After the tape is in place, sufficient additional Finisher is used to level off the joint and to make it flush with the entire wall surface. Any excess Finisher is then removed and nail heads are spotted.

Particular care should be taken to see that all joints are smooth and free from bumps and uneven places. Sandpaper should be used on the dry Bestwall Reinforcing Finisher to provide a smooth finish and to prevent the joints and rough spots from showing when the final decoration is applied.

For best results, the entire wallboard and reinforced joints should be given a coat of pigmented varnish primer. This is necessary when oil paints or lacquers are used, since it prevents possible staining of the paint or lacquer coat by foreign materials soluble in oil or lacquer which may be present in the paper surfacing.

This priming coat provides a surface of uniform suction from which wallpaper and calcimine can be removed.

Reasonably satisfactory results may be secured with some types of water-thinned paint by priming only the joints and filled nail heads with pigmented varnish primer prior to painting. When joints and filled nail heads only are primed, caution should be used to secure uniform appearance of the completed job, since there may be a difference in appearance of the primed areas as compared to the unprimed board, due to difference in suction.

It is recommended, however, that all joints and filled nail heads be primed with pigmented varnish primer in every case to prevent rewetting of the reinforcing tape and finisher and tend to eliminate unsatisfactory results due to so-called "burnouts," or changes in color of the paint applied over the finisher, especially where conditions of high humidity are present.

The manufacturers directions should be followed in applying the pigmented varnish primer and decorating materials.

2. Bestwall Joint Filler:

This is a Plaster of Paris type of filler. It is usually packed in 5 lb. cartons. Directions for using it are printed on the carton. The following directions are taken from the 5 lb. carton.

BESTWALL JOINT FILLER DIRECTIONS

In erecting Bestwall Gypsum Wallboard, drive nails straight, to leave heads slightly below the surface. Do not use nail set.

Smooth all rough spots on the surface with fine sandpaper.

Apply all trim before finishing the joints.

Cut away loose or damaged corners or edges with a knife leaving a solid basis for the filler. Repair damaged surfaces with filler.

Place about 1/4 of a pint of clean water in a clean flat bottom container. Add and stir enough filler to bring to the consistency of putty. ENTIRE MIXTURE MUST BE AGITATED CONSTANTLY DURING THE TIME IT IS BEING PREPARED. Keep container and mixing tools clean and free from hardened filler. Bestwall Joint Filler will remain in a workable state for approximately fifteen minutes. If it starts to stiffen before being applied do not add water. Throw the batch away and mix a new one.

With a semi-flexible scraping knife about 3" wide work enough Bestwall Joint Filler over the joints to build up to a smooth flush surface. Where necessary go over the joints twice to get a smooth, uniform finish.

Spot each nail head with a small amount of Bestwall Joint Filler, using a twisting motion. Allow filler to dry, then sandpaper with No. 1-1/2 sandpaper to remove any roughness and to obtain a smooth, even surface.

Ten pounds of Bestwall Joint Filler should fill joints and cover nail heads on 1000 square feet of Bestwall Gypsum Wallboard.

Contents manufactured under U.S. Letters Patent No. 1,960,538.

(g) Decorating the Surface:

Bestwall will take any kind of interior decoration - wallpaper, calcimine, water thinned paste paints, flat wall oil paints, enamels, etc.

Please note the recommendations for preparation of the surface for decoration given in the directions for Bestwall Fibre Tape Joint System. With reference to the application of a sizing coat of pigmented varnish primer as the first step in any kind of decoration. The reasons for this recommendation are as follows:

1. Wallpaper adheres satisfactorily to the primed surface but can be removed for redecorating when desired without damaging the paper surface of the board.

2. The priming coat kills the absorption, or "suction", of paper and joint finisher, thus equalizing the absorption characteristics over the entire surface thereby providing satisfactory conditions for subsequent application of oil paints, enamels and water mixed paints. Uneven color or sheen of the paint coat due to uneven suction are thereby eliminated.

3. The priming coat seals the surface of the finisher against penetration of water. If water thinned paint is applied over an unprimed taped joint, the water may soak into the finisher and soften it while at the same time rewetting the paper tape causing it to expand. Then as the joint again dries, shrinkage of the tape may occur resulting in cracking of the finisher and paint film along the edge of the tape. This may happen even though there are no cracks in the finished joint prior to the application of the water mixed paint. A properly applied priming coat of a good grade of pigmented varnish primer eliminates this trouble by sealing the joint against water penetration.

4. Wallboard papers usually contain particles of asphalt coated or asphalt laminated paper. These come from the waste paper used in the furnish for the filler or interior of the sheet. Bits of carbon paper are also present at times. These cannot be kept out of wallboard papers under present day

4. (Cont'd)
conditions and they are present in all manufacturer's board papers.

When oil paint or lacquer is applied to unprimed wallboard the thinners in the paint or lacquer soaks into the interior of the face paper. These thinners dissolve some of the asphalt. Then as the paint or lacquer dries the solvent comes to the surface by wick action, bringing with it the asphalt in solution. The solvent evaporates leaving the asphalt as stains in the paint film.

Priming with pigmented varnish primer positively prevents such bleeding of asphalt into the subsequent paint film. Of course, the varnish primer also contains asphalt solvents and asphalt spots will sometimes bleed into the priming coat but repeated tests have shown that, even though this happens, the stains are locked in the priming coat when it is dry and do not come on through into the subsequent oil paint or lacquer coat. Even when spots of asphalt are placed on the ivory paper surface and melted in with a hot iron, the pigmented varnish primer prevents them from bleeding into the subsequent oil paint or lacquer coat.

The one drawback to the use of pigmented varnish primer is that it tends to raise the fibers of the paper, particularly along the edge of the treated joints and around nail heads where the paper may have been roughened by the use of sand paper. This roughness can be eliminated by very light sanding with fine sand paper after the pigmented priming coat is dry.

Glue size tends to lay the fibers and leave a smooth surface but it does not provide the advantages of pigmented varnish primer enumerated above and is, therefore, not recommended unless followed by a subsequent priming coat of pigmented varnish primer.

In the areas where the paper surface has been roughened by sanding some operators apply a thin coat of joint finisher and immediately scrape it off clean. Enough of the casein glue is left on the surface to lay the fibers down and when the surface is again dry the application of the priming coat will not raise the fibers.

6. TILE BOARD

Gypsum Tile Board is similar to regular Bestwall except that the face of the board is embossed in the form of square tiles $4\frac{1}{4}$" x $4\frac{1}{4}$". The indentations are approximately 1/8" wide. Tile Board is supplied in 4 x 8 feet and 4 x 10 feet sizes, 3/8" in thickness and packed two boards to a bundle. The 4 x 8 feet is the standard size generally used.

Uses:

Gypsum Tile Board is used in kitchens, bathrooms, etc., where a tile effect is desired.

The method of erection is the same as that for Bestwall Gypsum Wallboard. After erection it may be painted or enameled to obtain any color effect desired.

7. WOOD GRAIN BOARD

(a) What it is:

Bestwall Grain Board is Bestwall which has been finished with an attractive reproduction of selected panels of Knotty Pine, Figured Aspen and Ribbon Mahogany. This finish has a durable transparent coating. The reproduction is so accurate in color and graining that it cannot be distinguished from the actual wood at a distance of a few inches.

(b) Where it is Used:

Bestwall Grain Board is used where the appearance of rich wood finishes is desired plus the fire protection and economy afforded by gypsum wallboard.

(c) Economical - Easy to Apply:

Bestwall Grain Board is applied like other Bestwall products. Nail heads are concealed with plastic wood, stick shellac or linseed oil putty mixed with stain to match the particular surface. The joints between the boards may be left unfinished or they may be arranged as panels, the joints being covered with matching wood strips or moldings.

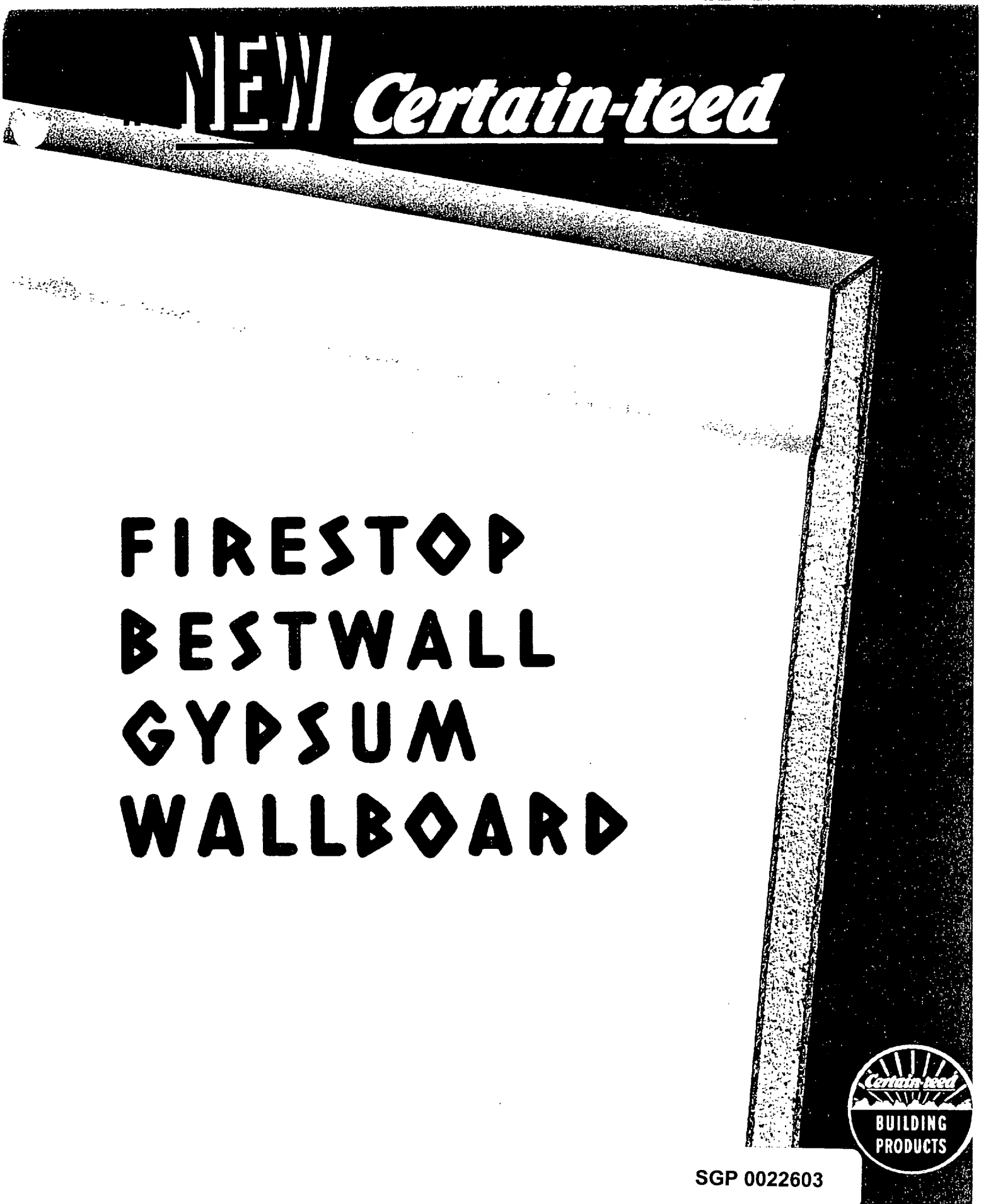
Many attractive installations have been made with metal moldings of various designs at the board or panel joints.

FACTS ABOUT BESTWALL GRAIN BOARD

FINISH	TYPE OF EDGE	*THICKNESS	WIDTH	LENGTHS
Figured Aspen	Beveled Edge	3/8"	48"	8' - 9' - 10'
Ribbon Mahogany	Beveled Edge	3/8"	48"	8' - 9' - 10'
Knotty Pine	Square Edge	3/8"	48"	8' - 9' - 10'

BRANDS: Bestwall Only. PACKAGING: Twin Mounted.

* 1/4" or 1/2" Thicknesses or other edges may be obtained on special orders if substantial quantities are involved. Consult General Sales Department for prices on such special orders.



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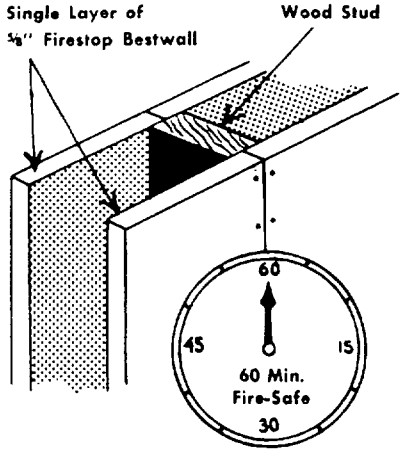
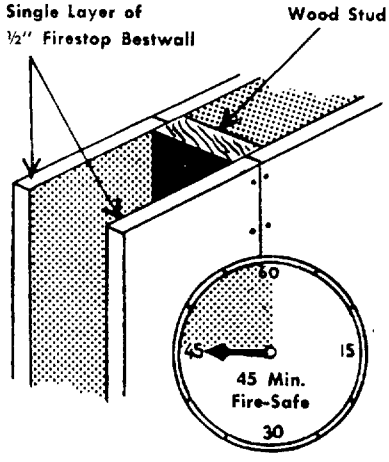
FIRESTOP BESTWALL

FIRESTOP BESTWALL is an entirely new type of gypsum wallboard, offering the first improvement in the fire-resistance properties of conventional gypsum wallboard since the introduction of **BESTWALL**, the Original Gypsum Wallboard, in 1912. A single layer of ⅝" **FIRESTOP BESTWALL** applied on both sides of a load-bearing wood stud partition has a fire-resistance rating of one hour. A single layer of ½" thickness on similar construction has a 45-minute rating. The above facts are substantiated by standard fire tests conducted by the Underwriters' Laboratories Inc.* This amazing new development in fire-safety is made possible by the addition of certain incombustible materials (exclusive with Certain-teed) to the gypsum core of **FIRESTOP BESTWALL**.





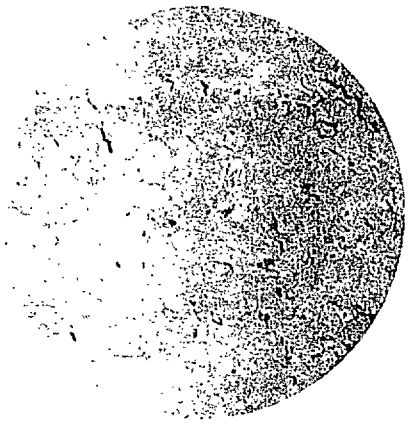
SGP 0022604

FIRESTOP BESTWALL serves the same construction purposes as regular gypsum wallboard, forming the finish and covering of all interior walls and ceilings. It is suitable for remodeling as well as new construction where greater fire-resistance is desired. In F.H.A. construction requiring 45-minute fire rating, the ½" thickness is particularly applicable. **FIRESTOP BESTWALL** has the same characteristics as regular **BESTWALL** wallboard including strength, rigidity and dimensional stability. Like regular **BESTWALL**, it is made with recessed edges, and is covered with the same tough gray back paper and smooth ivory face paper. **FIRESTOP BESTWALL** comes in large, easy-to-handle sheets 4 feet in width; 6 to 12 feet in length; ⅝" and ½" in thickness.

* Photostatic copies of Underwriters' Laboratories' conclusions and recommendations on these fire tests will be furnished upon request.

Below are photographic reproductions which show a section of regular gypsum wallboard, and a section of FIRESTOP BESTWALL Wallboard, both of which have been subjected to a fire temperature of 1700° F. for one hour.

Regular Gypsum Wallboard



FIRESTOP BESTWALL Wallboard

Note the shrinkage cracks in the regular gypsum board with the conventional gypsum core. As the gypsum is calcined this shrinkage of the core is inevitable due to the loss of water of crystallization. These cracks allow faster passage of heat through the board exposed to the fire thus lessening its fire-protective properties.

Now, note the surface of the FIRESTOP BESTWALL board with the gypsum core containing the special incombustible ingredients. Under the action of fire these ingredients expand, counteracting the natural contraction of the gypsum core in such manner as to minimize shrinkage cracks, thereby affording greater fire-protection.

ARCHITECTURAL SPECIFICATIONS

NOTE: These specifications are provided for the convenience of architects in writing specifications for projects where the added fire-resistive characteristics of 5/8" FIRESTOP BESTWALL are desired. When FIRESTOP BESTWALL ½" thick is to be used, the alternate specifications shown within parentheses ( ) are applicable. Explanatory notes are given in italics within brackets [ ].

SCOPE—Where so indicated on the plans, partitions and interior walls shall be finished with FIRESTOP BESTWALL Gypsum Wallboard.

MATERIALS—FIRESTOP BESTWALL shall be 5/8" (½") thick by 48" wide in varying lengths as required and with recessed longitudinal edges; manufactured by Certain-teed Products Corporation. It shall bear the label of the manufacturer and the indicia of the Underwriters' Laboratories. [*FIRESTOP BESTWALL conforms to Federal Specification SS-W-51a, Type A and Amendment 1 and or A.S.T.M. Specification C-36-42, due allowance being made with respect to weight of core and transverse strength on ¼" thickness since no provision is made for this thickness in either of the specifications named.*]

JOINT SYSTEM used for treatment of the joints between panels of FIRESTOP BESTWALL shall be "Bestwall Fibre Tape Joint System" consisting of a high quality fibre tape and a joint finisher to be used therewith manufactured by Certain-teed Products Corporation.

NAILS shall be 6-d, 1 7/8" long (5-d, 1 5/8" long) cement-coated, flat-head.

APPLICATION—Partitions and interior walls, bearing or non-bearing as indicated on plans shall consist of 2" x 4" wood studs spaced 16" on centers, effectively fire-stopped; finished on each face with 5/8" (½") FIRESTOP BESTWALL Gypsum Wallboard fastened at each stud with 6-d, 1 7/8" long (5-d, 1 5/8" long) cement-coated, flat-head nails spaced at 7" centers (7" centers for vertical application and 4" centers for horizontal application). [*Horizontal application is recommended but is not mandatory.*] The wallboard, in all other respects, shall be applied in accordance with the manufacturer's standard directions for the application of gypsum wallboard and in a first class, workmanlike manner.

All joints between panels of FIRESTOP BESTWALL shall be treated with Bestwall Fibre Tape Joint System applied in accordance with the manufacturer's printed instructions. Nail head depressions shall be filled with Joint System Finisher brought flush with the surface of the wallboard. When thoroughly dry the finish coat of finisher on joints and nail head depressions shall be sanded smooth and made ready to receive a coat of pigmented varnish primer which will be the base for subsequent paint, wall paper or other decorative treatment. [*Sanding of finisher and subsequent decoration are not required to obtain the fire-resistance ratings listed by Underwriters' Laboratories, Inc., for FIRESTOP BESTWALL.*]

The following table shows the gypsum wallboard partition constructions required to meet 45-minute and 1-hour fire-resistance classifications:

Fire-Resistance Ratings	FIRESTOP BESTWALL*	Regular GYPSUM WALLBOARD**
45 Minutes	Single layer ½" thickness on each side of wood stud partition	Double layer ½" thickness on each side of wood stud partition
1 Hour	Single layer 5/8" thickness on each side of wood stud partition	Double layer ½" thickness on each side of wood stud partition

SOURCES: * Tests conducted by the Underwriters' Laboratories
** Tests conducted by the U. S. Bureau of Standards

Look for this seal

SGP 0022605

on each board and bundle of FIRESTOP BESTWALL—it is your guarantee of continued top quality and performance by Certain-teed Products Corporation and by the Underwriters' Laboratories.

Certain-teed

MANUFACTURERS OF QUALITY BUILDING MATERIALS

ASPHALT ROOFING
SHINGLES AND SIDINGS

GYPSUM PLASTER
LATH AND WALLBOARD
ACOUSTICAL PRODUCTS

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DALLAS, TEXAS
Box 9098

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8004 Grand River Ave.

EAST ST. LOUIS, ILLINOIS
17th Street & Broadway

KANSAS CITY, MISSOURI
4722 Broadway

NIAGARA FALLS, N. Y.
Box No. 367

PHILADELPHIA, PENNA.
120 East Lancaster Avenue
Ardmore, Penna.

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1014 Chesley Avenue

ST. PAUL, MINNESOTA
2395 University Avenue

SGP 0022606

Form 5600

Printed in U.S.A.

SUPER FIREPROOF GYPSUM WALLBOARD — THE SUPER FIREPROOF GYPSUM WALLBOARD
FIRESTOP BESTWALL SUPER FIREPROOF UL FIRESTOP BESTWALL SUPER FIREPROOF
SUPER FIREPROOF TWIN MOUNTED SUPER FIREPROOF TWIN MOUNTED

8. FIRESTOP BESTWALL

(a) What it is:

Firestop Bestwall is a new type of gypsum wallboard with fire resisting qualities superior even to regular gypsum boards. It offers the first improvement in fire resistance properties of conventional gypsum boards since their introduction to the building trade. This amazing new development in fire-safety is made possible by the addition of small amounts of certain incombustible materials (exclusive with Certain-teed) to the gypsum core of Firestop Bestwall.

(b) What it Does:

Firestop Bestwall serves the same construction purposes as regular gypsum wallboards to form the finish and covering of interior walls and ceilings as well as for partitions. However, when attacked by fire, the special incombustible materials alter the characteristics of Firestop Bestwall in a manner which gives partitions built with this improved product higher fire resistance classifications than those given partitions built with equal thickness of regular gypsum boards.

(c) Where it is Used:

Firestop Bestwall is used where building specifications call for a higher degree of fire-resistance, meeting the most rigid requirements for certain conditions of construction and occupancy specified by an ever increasing number of building codes throughout the country.

(d) Advantages:

1. Extra Fire Resistance:
A single layer of Firestop Bestwall 5/8" in thickness applied in accordance with the instructions to both sides of a wood stud load-bearing partition will resist the spread of fire for one hour. This result cannot be obtained with any other single layer construction using regular gypsum wallboard of equal thickness. Similar Construction using 1/2" thickness of Firestop Bestwall will resist the spread of fire for 45 minutes. Tests conducted by the Underwriters' Laboratories (as set forth on page 23 of the Jan. 1949 Edition of the Underwriters' List of Inspected Fire Protection Equipment and Materials) show this extra fire resistance of Firestop Bestwall.

2. Economical:
Savings in time, materials and labor are effected when a single layer of 5/8" or 1/2" Firestop Bestwall is substituted for two layers of 1/2" regular gypsum wallboard on each side of a load-bearing partition to obtain a one hour or 45 minute fire resistance ratings, respectively. Single layer type of construction, of course, means single application cost.

(e) Recommended Method of Application:

Firestop Bestwall is applied in the same manner as regular gypsum wallboard except that the 5/8" thickness requires the use of 6-d, 1-7/8" long cement coated, flat-head nails spaced at 7" centers when panels are placed vertically and at 4" centers when panels are placed horizontally. Horizontal application is recommended but is not mandatory to obtain maximum fire resistance. All joints between panels should be treated with Bestwall Fibre Tape Joint System applied in the usual manner. Firestop Bestwall may be decorated by any method that is suitable for regular gypsum wallboard.

FACTS ABOUT FIRESTOP BESTWALL

Sizes: Thickness - 1/2" and 5/8"
Width - 48"
Lengths - 6' to 12'

Edges: Recessed

Packaging: 2 panels per bundle

Weight: 1/2" - approximately 2.2 lbs.per sq. ft.
5/8" - approximately 2.6 lbs.per sq. ft.

9. BESTWALL INSULATING GYPSUM WALLBOARD

(a) What it is:

Bestwall Insulating Gypsum Wallboard is regular Bestwall with a bright aluminum foil laminated to its reverse side. This foil, according to U.S. Bureau of Standards tests, reflects 90% of radiant heat thus providing effective thermal insulation. Also, it is a very efficient vapor barrier.

(b) Where it is Used:

Bestwall Insulating Gypsum Wallboard is designed for use on the interior side of exterior walls and on ceilings under cold attic spaces. It is applied with the foil side against the wall studs or ceiling joists.

(c) Advantages:

1. Thermal Insulation: 50% to 80% of heat transfer across air spaces in outside walls of a frame structure is by radiation; the remaining heat transfer occurs by correction and conduction. Aluminum foil reflects about 90% of the radiant heat striking it. This means that it ultimately emits approximately 10% of the radiant heat that reaches its surface. A more detailed explanation of the insulation principle is given in Section "K" of this Manual.

The insulating value of this product is equal to at least 1/2" of fiber insulation board.

Insulating gypsum wallboard is as effective in summer in resisting the heat flow into a building as it is in resisting the cut flow of heat in the winter.

2. Vapor Barrier: To prevent condensation within exterior wall construction (and in ceiling construction facing unheated attic spaces), a vapor barrier is essential. The aluminum foil on the back of Bestwall Insulating Gypsum Wallboard provides a highly efficient vapor barrier.

FACTS ABOUT BESTWALL INSULATING GYPSUM WALLBOARD

Sizes:	Thickness - 3/8" and 1/2" Width - 48" Length - 6' to 12'
Edges:	Square or Recessed
Packaging:	2 panels per bundle; face to face; completely wrapped to protect foil surfaces.
Weight:	3/8" - approximately 1½ lbs. per sq. ft. 1/2" - approximately 2 lbs. per sq. ft.

10. GYPSUM LATH

(a) Properties:

1. Braces the Building: A finish of gypsum lath and plaster adds material stiffness to the building frame and is much more capable or resisting the strains put upon it as a result of warping or settlement or by vibration than an ordinary lath and plaster finish. This was effectively demonstrated by tests made at Armour Institute of Technology, Chicago, to ascertain the relative lateral resistance to distortion of different types of lath, plastered with gypsum plaster.

The tests were made on large size panels, the frame consisting of 2 x 4 inch yellow pine studs, spaced 16 inches on centers. A series of panels was covered with gypsum lath and gypsum plaster, erected in accordance with standard construction methods. Another series was constructed using three other types of lath, each plastered with gypsum plaster. Each partition frame, when constructed, was rigidly anchored at the base. A testing machine then exerted a horizontal pull at the top of the frame in the direction of its length. The apparatus measured the resistance of the panel against movement in a lateral direction.

The maximum load at the end of the test and the deflection produced are shown in the following tabulation. Note that although a greater distorting force was applied to the gypsum lath panel, its deflection was the smallest of all the panels.

Designation of Panels	Maximum Load	Deflection
#1 Type Lath Panel	2,450 Lbs.	1.43 in.
#2 " " "	2,725	.22 "
#3 " " "	3,300	.20 "
Gypsum Lath Panel	3,375	.08 "

2. Resistance to Rough Usage: The resistance offered by ordinary lath and plaster and gypsum lath and plaster to heavy blows, such as accidental bumps from furniture and childrens toys, was also determined by test at Armour Institute of Technology upon panels similar to the ones used in the distortion tests.

Each of the panels was erected as a vertical wall, 8 feet high and 4 feet wide, being securely supported at each corner. All the panels were plastered with gypsum plaster.

The finished surface of a panel was then struck at the center, between two studs, with a fifty-pound bag of damp sand, which was suspended as a pendulum from a point thirteen feet above the center of the panel. The bag was swung and allowed to strike the face of the panel, the distance from the face to the panel to the center of the weight being recorded for each blow.

The first blow struck was from a distance of ten inches, the second from twenty inches, and the distance was then increased by increasments of four inches until failure of the panel.

The following table shows the number of blows struck, the distance and the total accumulated energy in foot-pounds required to crack each panel. Probably no series of blows as severe as those used in the test would, under normal conditions, be directed against an ordinary wall or partition, but the results show the resistance to cracking provided by gypsum lath and plaster.

Panels	Distance From Center Position When Panel Showed First Crack.	Total Number of Blows Before Panel Showed First Crack.	Total Accumulated Energy in Foot-Pounds Required to Crack Panel.
#1 Type Lath	5 Ft. 8 In.	14	391
#2 " "	6 " 8 "	17	640
#3 " "	8 " 0 "	21	1,120
Gypsum Lath	9 " 8 "	26	2,031

3. Bond Between Gypsum Lath and Plaster - United States Bureau of Standards Tests: The adhesion of plaster to lath or other plaster base determines the safety and durability of the construction and to a considerable degree its fire-resistance. With so much depending upon this factor, tests were made to determine the adhesion of gypsum plaster applied to various laths and bases commonly used in building construction. These tests were conducted at the United States Bureau of Standards in 1925.

Gypsum Plaster was applied to the specimens and after a seven-day aging period the specimens were put in a testing machine and pulled free of the laths and other plaster bases. Although the bond was found to be satisfactory in all cases, attention is called to the fact that the bond between gypsum lath and plaster was greater than the bond between plaster and any other type of lath tested. A pull of six pounds per square inch was required to separate the plaster from the gypsum lath, providing a factor of safety of 144. This is approximately three times the bond of plaster and ordinary lath, as shown by the tests.

With the lath and plaster saturated, as it might become due to a broken water pipe or a leaky roof, the bond was 2.09 pounds per square inch, which is a factor of safety of 72. Tests were then conducted on samples that had been saturated and were permitted to dry for 7, 14 and 28 days before testing, and it was found that the bond increased again to its original value upon drying. There was no decrease in bond. A good description of the bond between gypsum lath and gypsum plaster is contained in the United States Bureau of Mines Technical Paper No. 155, which reads:

"The binding material forming the outside of the plaster board (gypsum lath), gives an excellent bonding surface for gypsum plaster. Minute needle crystals of gypsum, formed as the plaster sets, penetrate the binding material and interlace with it and the plaster forming the lath (gypsum core), making a very strong bond."

Lime plaster and portland cement plaster should not be applied to gypsum lath, as they do not bond properly to it.

(b) Uses:

Gypsum lath is an ideal base upon which to apply gypsum plaster. Aside from this specific use for which the lath is designed, it is frequently used for lining garages, for temporary partitions, etc.

(c) Types:

There are three types of gypsum lath:

Regular or Plain Gypsum Lath
Perforated Gypsum Lath
Insulating Gypsum Lath

Basically, these different types are the same, i.e., they consist of a core of set gypsum plaster sandwiched between sheets of tough, fibrous paper. The paper is tightly bonded to the core and the exposed surfaces give proper suction for easy application of gypsum plaster and to insure maximum bonding strength. This basic form is known as "Regular" or "Plain" Gypsum Lath.

Perforated Gypsum Lath (Perfolath) is plain gypsum lath that has been perforated with circular holes to provide mechanical keys for plaster. The holes are 3/4" in diameter and they are spaced 4" center to center. As a result of these mechanical keys added to the high bonding strength of plaster to gypsum lath, extra fire protection is obtained.

Insulating Gypsum Lath is plain gypsum lath covered on one face with a sheet of bright aluminum foil to give extra thermal insulation and provide an efficient vapor barrier.

(d) Application:

Nailing edges shall have bearing not less than 5/8" on studs, joists, etc., with horizontal joints in walls and joints at right angles with ceiling joists broken at each board and with vertical joints on opposite sides of partitions not on the same studs. Lath shall be nailed at every support with nails spaced 4 inches apart. For 3/8" lath use 1-1/8", 13 gauge, 3/8" flat head nails. For 1/2" lath use 4d common nails. More detailed information on the application of Gypsum Lath is given on Page 8 of "Standard Specifications For Gypsum Plastering" inserted after Page 29 of this Manual.

(e) Advantages:

1. Crack Resistance: It does not swell, buckle or shrink, thereby eliminating the principle forces which cause plaster to crack or fall off walls and ceilings.

2. Stronger Plaster Bond: Tests made by U.S. Bureau of Standards indicate a wide range of values in the adhesion of gypsum plaster to various backings commonly employed. The strongest bond is obtained with gypsum lath. When perforated lath is used there is a two-way bond which develops increased fire resistance.

3. Fire Protection: Because the basic component of gypsum lath is gypsum which is incombustible and does not readily transmit heat, it protects combustible wood understructure from damage by fire. The fire resistance ratings, according to U.S. Bureau of Standards Tests, for wood stud, load-bearing partitions protected with gypsum lath and plaster are given on the following page.

	PARTITIONS	
GYPSUM LATH	PLASTER (1)	FIRE RATING
3/8" Perforated (2)	1 part gypsum to 2 parts sand, by weight	1 hr.
3/8" Plain	Fibered (3) gypsum - no sand	1 hr.
3/8" Plain	1 part gypsum plaster to 2 parts sand, by weight	3/4 hr.

NOTES: (1) Two-coat work - 1/2" thick over face of lath

(2) Perforated with holes 3/4" or larger, 1 hole for not more than 16 sq. in. of lath

(3) Fiber can be wood, sisal, asbestos or a mixture of these materials.

4. Adds Structural Strength: The strong, rock-like core of the closed edge lath panels provides exceptional structural value and support wherever used. This rigid lath ties the framing members together and increases resistance to distortion resulting from warping, settling, wind pressure and vibration. Such distortion is another cause of plaster cracking or falling.

5. Permanence: Gypsum lath has great durability. It does not decay or disintegrate and it is vermin-proof.

6. Insulation: Insulating Gypsum Lath applied with the reflective surface facing an air space of not less than 3/4" between studs, joists, or rafters, provides insulation equal in value to 1/2" thickness of fiber insulation lath. The aluminum foil retains its insulating efficiency over a long period of time.

7. Vapor Barrier: The aluminum foil on Benner Insulating Gypsum Lath is a highly efficient vapor barrier. When plastered with 3/8" thickness of plaster has an average vapor permeability of only 0.67 grains per square foot per hour per inch of mercury pressure difference across the wall. This is well below the limit of 1.25 grains of moisture which has been set by many authorities as the upper limit for good building construction.

8. Economical and Easy to Apply: Gypsum Lath comes in convenient bundles which are easy to carry and stack. Compared to wood lath, gypsum lath requires much less handling and approximately half the nailing. Cutting and nailing (or clipping) the lath to supporting studs or joists completes the operation. The lath cuts evenly and easily, without waste. It may be applied vertically in closets, corners, and pilasters.

   The convenient sizes of gypsum lath contribute to a saving in erection cost, since the dimensions of the lath are adaptable, without cutting to the spacing of studs, joists or other supports.

9. Sizes and Packaging:

Thickness	Width	Length	Packed
3/8"	16"	48"	6 pieces to bundle (32 sq. ft.)
1/2"	16"	48"	4 pieces to bundle (21-1/3 sq. ft.)

11. Sheathing Board:

(a) Properties:

Gypsum sheathing is a fire-proof sheet of gypsum enclosed in a fibrous covering. All surfaces are treated to make them water-repellent. Building paper is not required over these water-repellent panels. The tongued and grooved edges interlock and the ends meet over the studs thus providing protection against air infeltration.

(b) Uses:

Gypsum sheathing is an ideal sheathing for frame structures under siding, shingles, stucco and brick veneer.

(c) Application:

Gypsum sheathing is applied directly to the frame work and with the length at right angle to the supports, groove side down. The cut ends are to be butted tightly together over the supports; interlock the side edges. Stagger the vertical joints. Use 1-3/4" long, No. 10½ gauge galvanized flat head roofing nails. Space the nails 4 inches apart on each support and 3/8" from the edge on cut ends. Nail securely and drive nailheads flush with surface.

(d) Advantages:

Gypsum sheathing is convenient and economical to erect, because the units are easy to handle, cuts and nails easier than lumber and is adaptable to any building construction. Strength and rigidity test as compared to 7/8" thick wood sheathing show it to be suitable for structural sheathing purposes.

(e) Sizes:

Gypsum sheathing is manufactured in units of 1/2" thick, 24" wide, and 8' in length; designed to fit supports 16" on centers.

H. GYPSUM TILE

We do not manufacture gypsum partition and furring tile at the present time. They were formerly manufactured at our Acme, Akron, Fort Dodge and Grand Rapids plants and are still available from other manufacturers. Therefore, a brief description of the product is included here as a matter of information.

The standard size units are 12" x 30" in thickness of 2, 3, 4, and 6 inches. The two inch tile is solid. The 3 inch tile may be either "hollow" or solid. The 4 inch and 6 inch tile are "hollow".

The units are cast from a slurry composed of gypsum stucco, wood fiber, accelerator and water. Casting is usually done in automatic machines equipped with metal molds. The core poles which form the hollows may be round or of rectangular shape with rounded corners.

After the slurry has set the core poles are either withdrawn or the tiles are pushed off the poles. The sides of the form also open, permitting removal of the cast unit. The units are then put through a drying kiln to remove the free water. When dry they are ready for shipment.

They are used for furring masonry walls, for building fire resistant, non-load bearing partitions and for fireproofing steel columns, beams, etc.

The mortar used in laying is usually unfibered (or fibered) gypsum plaster mixed with 3 parts sand.

Gypsum tile partitions are usually plastered on both sides with ordinary sanded gypsum plaster although for factory and warehouse partitions and the like they are sometimes left unplastered. Lime plaster must not be used as it will not bond to the tile.

I. GYPSUM ROOF DECKS

(a) Poured in Place: (Metro-Mix)

Metro-Mix roof decks are formed by pouring gypsum concrete over steel wire reinforcing onto a gypsum board or any other suitable permanent material form such as insulation board or asbestos cement board. Metro-Mix roof decks are generally supported by standard steel framework, however, wood or other construction systems may be used. Due to its light weight, Metro-Mix roof decks save considerable steel required for the framework of the roof. The simplicity of design, high insulating value and speed of construction also make Metro-Mix roof decks very economical. Metro-Mix decks are also fire resistant and adaptable to flat, pitched, sawtooth and other types of roof design.

MATERIALS REQUIRED:

1. Bulb Tees or Rails: Standard structural tees or rails of the required strength shall be obtained by the fireproofing contractor. These materials should be specified for one coat of oil base paint and cut to size so that the ends will rest on the purlins or roof supports. The size, type and section modulus of steel required should be worked out by the fireproofing contractor in conjunction with the manufacturer of the steel. The Buffalo Steel Co., Tonawanda, N.Y. is one firm that supplies this material.

2. Steel Wire Reinforcing: Galvanized steel wire mesh of No. 12 gauge longitudinal wire 4" on center and No. 14 gauge transverse wire 8" on center are required for reinforcing. The effective cross sectional area of the reinforcing must be no less than .026 sq. in. per foot width. The American Steel & Wire Co., Cleveland, Ohio is one firm that supplies this material.

3. Forms: Specially designed Certain-teed roof deck board is available for Metro-Mix roof decks. This material is 1/2" thick, 32" wide and furnished in lengths required for purlin spacings. These roof deck boards are extra heavy for additional strength, fungi-treated for mold preventure and surfaced with ivory faced paper for excellent light reflection. Tee or rail spacing of 32-5/8" on center should be specified for a 32" width board.

4. Metro-Mix: Certain-teed Metro-Mix containing calcined gypsum and wood shavings should be specified for the gypsum concrete. This material is also used as fill for cants, saddles, curbs, etc., as required. This material is available in 80 lb. bags for easier handling and less breakage.

ERECTION OF METRO-MIX ROOF DECKS:

1. Placing of Tees or Rails: The steel tees are placed at right angles to the roof purlin members and spaced 32-5/8" on center. Each tee is welded to the roof purlin at each point of intersection. The welds should be placed to alternate on the sides of the purlin. Each weld should have a fillet length not less than 3/4". The ends of the tees should be placed to bear on the purlins.

2. Placing of Forms: The form boards are placed to rest on the lower flange of the tee. All boards should be placed to form a snug, tight and even joint with the adjoining boards. Special size boards for walls, curbs and openings shall be cut neatly to fit required area.

3. Placing of Reinforcing: Steel wire reinforcing is rolled over the tops of the tees and allowed to rest on the tops of the form board. Steel wire reinforcing must be placed wherever Metro-Mix will be poured. Cut the reinforcing from areas such as openings where Metro-Mix will not be poured. The rolls of wire reinforcing must overlap adjoining rolls not less than 6". It is very important to place the No. 12 gauge longitudinal wire at right angles to the tees.

4. Pouring Metro-Mix: Metro-Mix should be mixed with clean water to a rather thick pouring consistency. A water plaster ratio of 7-1/2 to 9 gallons of water to one 80 lb. bag of Metro-Mix is recommended. One ton of Metro-Mix at this water plaster ratio will give a 2" thick coverage of approximately 250 sq. ft. Metro-Mix should be poured to form an average thickness not less than 2". After pouring the Metro-Mix, trowel or screed to obtain an even surface. Metro-Mix saddles, cants and grades should be poured as indicated.

(b) Precast (Gypsteel Plank)

Gypsteel Plank is a precast gypsum slot, 2" x 15" x 10'0", reinforced with galvanized steel wire mesh, enclosed within an electrically welded steel frame. The exposed edges of the frame are tongued and grooved.

THE MANUFACTURE OF GYPSTEEL PLANK:

1. Raw Materials:

(a) Galvanized steel .032" thick is used to make the frames that form the tongued and grooved edges and ends of Gypsteel Plank.

(b) Reinforcing in the form of 16 gauge galvanized steel wire alternately spaced 4" and 6" on centers lengthwise and 4" on centers crosswise. All of the wires are spot welded together at the point where they cross each other.

(c) Stucco (calcined gypsum) used for manufacture of the plank is of a controlled water carrying capacity to regulate the consistency of the slurry produced and the strength and weight of the finished plank.

(d) Wood Fibre used is shredded or specially ground soft wood to eliminate excessive brittleness and help reduce the weight of the finished plank.

(e) Accelerator is necessary to regulate the setting time of the slurry, so that the plank will set hard in sufficient time to be removed from the machine. The accelerator used is pulverized set gypsum.

2. Manufacturing Process:

(a) The galvanized steel is purchased in large sheets which are run thru a slitter to form strips 4-9/16" x 135". The strips are then placed in a punch press where small sections of the metal are cut out, so that the finished frame members can be bent to form a rectangular frame. The punched strips, or blanks, are put through a rolling mill to form the tongued and grooved frame members.

The frame is formed by placing one tongued member and one grooved member into a jig, clamped true and straight; open corners are spot welded. The finished frame is 2" thick, 15" wide and 10' long.

(b) The finished frames are placed end to end on the conveyor belt of the continuous casting machine. They are held in contact with each other and with the conveyor belt by means of holding clamps. While the frames are being conveyed on the machine the reinforcing mats are put into place.

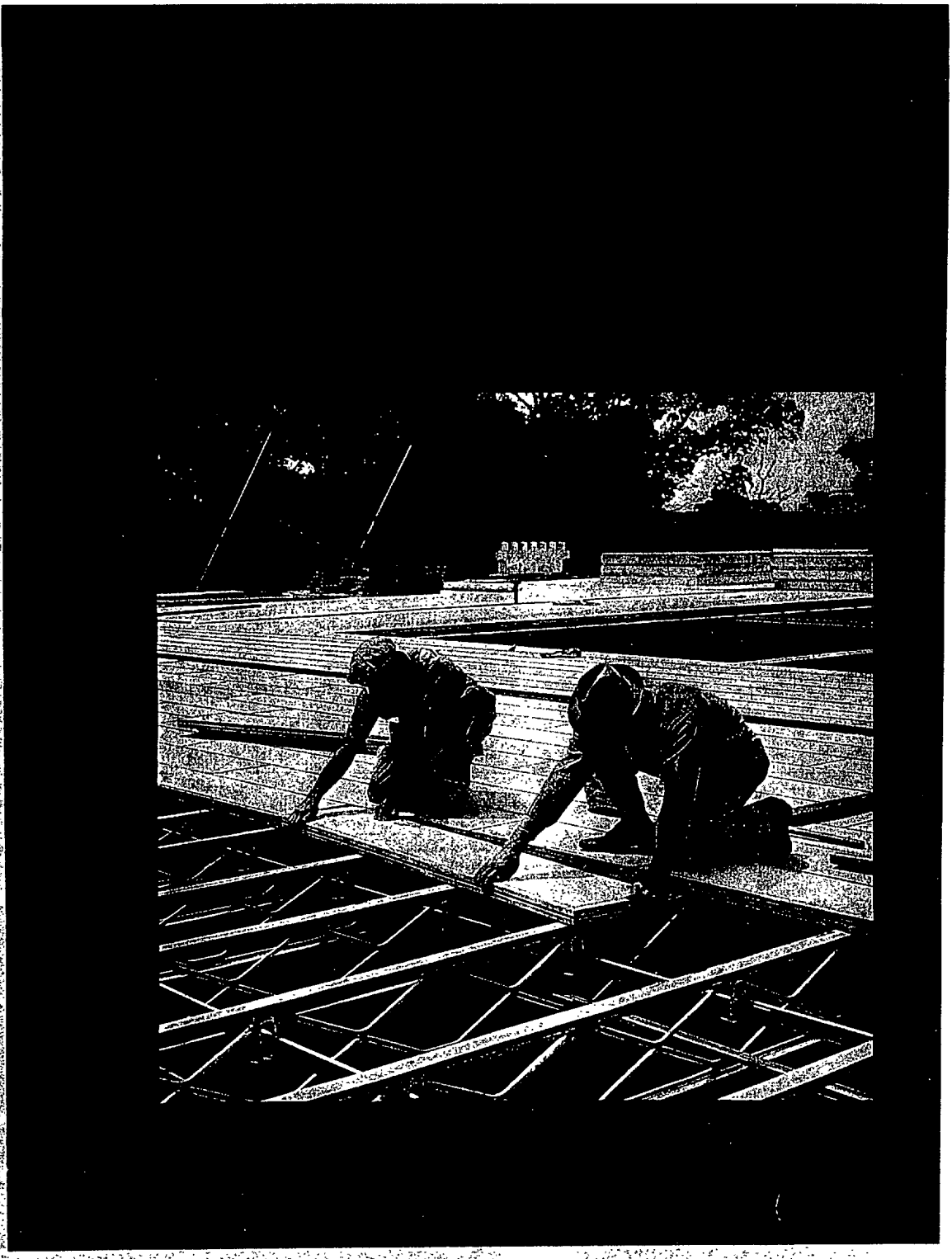
(c) The stucco is conveyed in a continuous stream by means of a screw conveyor from the storage bin to the mixer and the proper amounts of wood fibre and accelerator are added enroute and thoroughly mixed into the stucco. The dry stucco mixture with the proper amount of water are mixed in a continuous mixer to form the slurry.

(d) While the metal frames are moving on the conveyor of the casting machine, they are filled with slurry discharged from the mixer as they pass. The slurry sets hard while the plank are being conveyed to discharge end of the machine.

(e) The wet plank are then removed from the machine, placed onto kiln cars, and conveyed thru a kiln where they are dried by heated air.

CONSTRUCTION OF GYPSTEEL ROOF DECKS:

The insert following this page gives complete engineering design and technical data on Gypsteel Plank, helpful information about handling the Plank in storage and on the job, methods of installation etc. This literature is available for distribution to the Trade and is included here for reference purposes.



Certain-teed
BUILDING PRODUCTS

*Certain-teed** Gypsteel Plank* for Roof Decking

WHAT IT IS

Gypsteel Plank is a precast gypsum slab, 2″ x 15″ x 10′0″, reinforced with galvanized steel wire mesh, poured into a galvanized steel frame which is electrically welded at the corners. The exposed edges of the frame are tongued and grooved to insure a tight fit with adjoining planks.

The steel tongues and grooves mesh snugly so that adjacent units work together. Gypsteel Plank roof decks have high uniform strength.

WHERE IT IS USED

Gypsteel Plank is used as a roof decking in industrial buildings, theatres, garages, etc., and wherever a lightweight, fire-proof roof deck is required.

The bindings mesh to form a steel I-Beam that gives Plank its definitely calculable strength and permits the joints to be safely broken between supports. Yet both steel and gypsum are flexible enough to warp or bend within reasonable limits.

ADVANTAGES

LIGHT IN WEIGHT

The weight of Gypsteel Plank is approximately 12 pounds per square foot. This light weight creates a great saving in dead load which in turn promotes a great saving in the structural framework.

STRONG

Gypsteel Plank is recommended for roof decking for spans up to and including 7 feet. The safe load with a factor of safety of four is 75 pounds per square foot.

DIMENSIONAL STABILITY

Gypsteel is not affected by changes in temperature or atmospheric conditions and can withstand extremes of heat and cold. Where problems of unusually high degrees of heat or humidity are to be encountered, it is recommended that complete facts be referred to our General Office for discussion. Gypsteel Plank will not rot, decay or deteriorate, is vermin-proof and termite-proof, and is as permanent as the building itself.

THERMAL INSULATION

The heat conductivity of 2 inches of Plank is equal in insulating value to 9 to 10 inches of concrete or an 8 inch brick wall.

FIRE-RESISTANCE

Being made of gypsum, Gypsteel Plank is incombustible.

EASILY ERECTED

Gypsteel Plank comes ready for installation—no form work, no mixing or pouring is required. It handles like lumber and may be cut, sawed or bored by hand or power tools.

APPEARANCE

Gypsteel Plank makes a smooth, attractive ceiling which may be easily painted by following simple painting instructions. The Plank does not collect dust and dirt as do ceilings of ribbed or flanged materials.

ECONOMICAL

Simplicity of design keeps erection time and labor costs at a minimum; the lightness and strength of the Plank reduces the amount of structural steel required.

TECHNICAL DATA

Dimensions			Allowable Span	Allowable Load Per Square Foot	Weight Per Square Foot	Heat Transmission Loss "U"		
Thickness	Width	Length				No Insulation	½″ Insulation	1″ Insulation
2″	15″	10-′0″	7′-0″	75 Lbs.	12 Lbs.	.528	.287	.197

* Reg. U. S. Pat. Off.

SGP 0022620

ROOF APPLICATION INSTRUCTIONS

SUPPORTS

Plank is laid directly over wood or steel supports with uniform or variable spacing. End joints are staggered and need not come over the supports, thus reducing cutting and eliminating waste as small pieces may be used to start a new row of plank.

PITCHED ROOFS

All decks of steep pitch should have additional provision to take up the roof thrust by means of stop angles, bolting Plank to purlins, etc.

OVERHANG OPENINGS

Overhangs should not extend beyond supports more than 12 inches in Plank length or 6 inches in Plank width.

CURVED ROOFS

The minimum radius for curved surfaces is 90 feet and should preferably be limited to 120 feet. For short radii the support spacings should not exceed 5 feet.

WARPED SURFACE

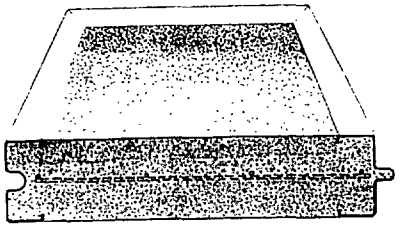
Plank will follow warped surfaces, if not too extre

ROOFING

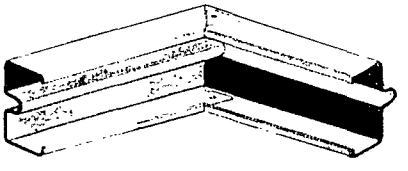
Any type of standard roofing may be applied over Pl For built-up roofs, nail the first layer of paper or fel the Plank and spot mop if desired. Do not mop entire area. Shingle, slate and other roofing material this type may be nailed direct to the Plank. Square nails, preferably hard copper, penetrating 1½" recommended. The steel Plank binding is easily punc for nail holes for shingles.

PAINTING

On buildings having exposed roof areas, the P ceilings may be painted to improve the appearanc the buildings and to add to the life of the roof de The steel binding should first be primed with a pr recommended for use over new galvanizing. For results the entire surface should then be covered wi primer and paint using a varnish vehicle. Alumi flake pigment mixed in the proportion of 1.5 pounc each gallon of varnish is excellent as a primer and be used for the finish as well. Dependence shoul placed upon a responsible manufacturer who has spe ized in paints for gypsum roofs.



The binding is clinched into the gypsum surface. Cross-section shows how steel and gypsum are flush and smooth, presenting a level, uniform surface.



Note the unique v which the steel b is welded at the to form a on frame. This assures er strength, a mor frame, and also nates damage in dling and shippin

SPECIFICATIONS

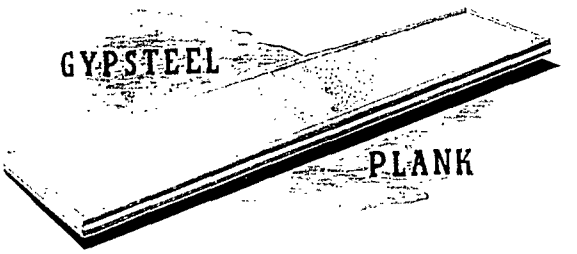
All roofs shall be constructed of steel bound Gypsteel Plank as manufactured by the Certain-teed Products Corporation. This Plank shall consist of factory molded units 2" thick by 15" wide by 10'0" long, bound and reinforced on the side and ends by "tongued and grooved" galvanized steel channels 2" deep. The gypsum core shall be reinforced with steel mesh.

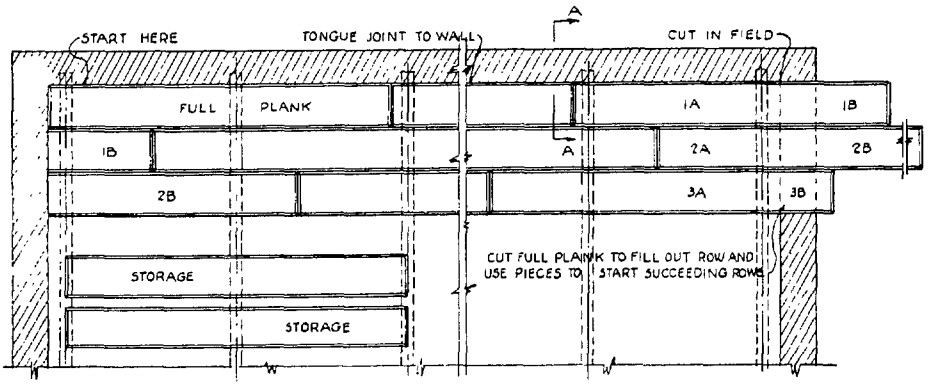
The Plank shall be laid directly over supporting purlins (joists or beams) to which they shall be fastened down by steel clips, furnished by the manufacturer, engaging their top flanges†, and securely nailed to the ends of the Plank with four penny slater's or plasterboard nails. Plank shall be laid with tongues meshing into grooves of adjoining units. End joints need not come over the supports, but shall be broken with the maximum practical distance between them.

NOTE: On Plank roofs of all types with more than 1½" pitch per foot, the thrust should be taken up at the eaves by a stop angle or other member of appropriate size and strength. On very steep pitches, the top flanges of every third or fourth row of purlins may be punched to permit the bolting of the Plank direct to the steel at such intervals as the engineer may recommend.

† When used over light steel joists, without bridging, insert the words: "alternately on opposite sides."

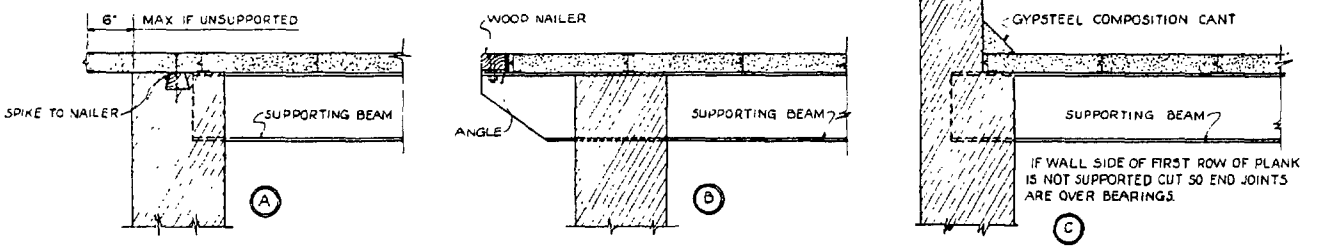
DETAILS OF DESIGN AND INSTALLATION



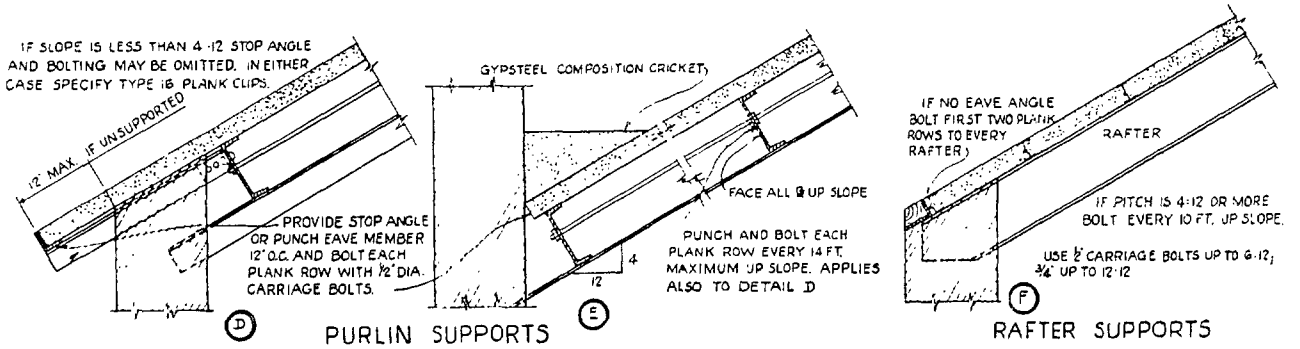


PART ROOF PLAN

TYPICAL ARRANGEMENT OF GYPSTEEL PLANK ROOFS. WHERE SLOPE PERMITS STORE AHEAD AS SHOWN FOR ECONOMICAL HANDLING.



TYPICAL SECTION A-A

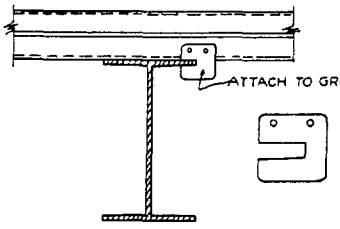


PURLIN SUPPORTS

RAFTER SUPPORTS

PITCHED ROOF DETAILS

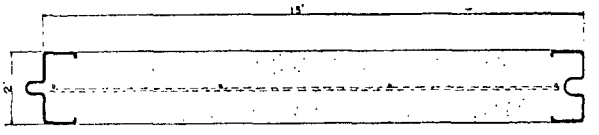
DETAILS OF DESIGN AND INSTALLATION



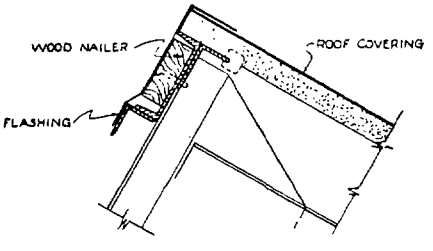
TYPICAL METHOD OF FASTENING GYPSTEEL PLANK TO SUPPORTS.

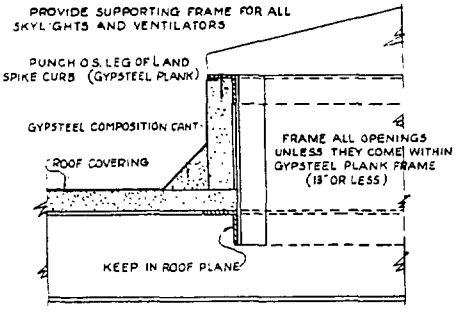
STANDARD CLIPS FURNISHED UNLESS OTHERWISE SPECIFIED HEAVY DUTY CLIPS AVAILABLE FOR PITCHED ROOFS; ALSO SPECIAL SIZES FOR MOST OPEN-WEB JOISTS.

THE TONGUED AND GROOVED STEEL BINDING, WHICH ENCLOSES THE ENDS AS WELL AS THE SIDES, IS A SINGLE PIECE FRAME LOCKED AT THE CORNERS. THE GYPSUM CORE IS ADDITIONALLY REINFORCED AGAINST IMPACT WITH GALVANIZED WELDED WIRE MESH.

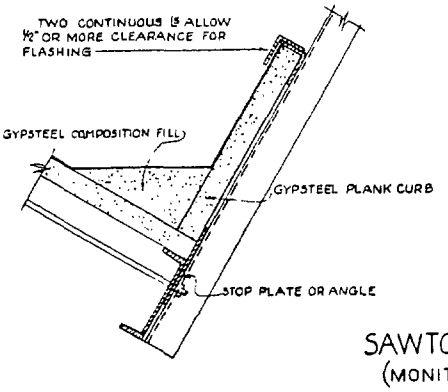


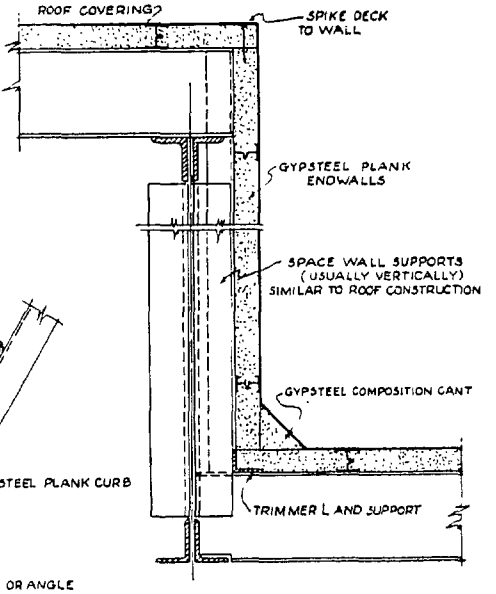
ALWAYS NAIL (DONT MOP) FIRST LAYER OF ROOFING FELT. WHEN SLATE, TILE, SHINGLE OR COPPER ROOFINGS, FLASHING, GUTTER HANGERS, ETC. ARE ATTACHED DIRECT TO GYPSTEEL PLANK ALWAYS USE SQUARE CUT COPPER NAILS PENETRATING 1¼" TO 1⅝" IN.
LAY USUAL FELT UNDER ROOFING. (SLATE, COPPER, ETC.)



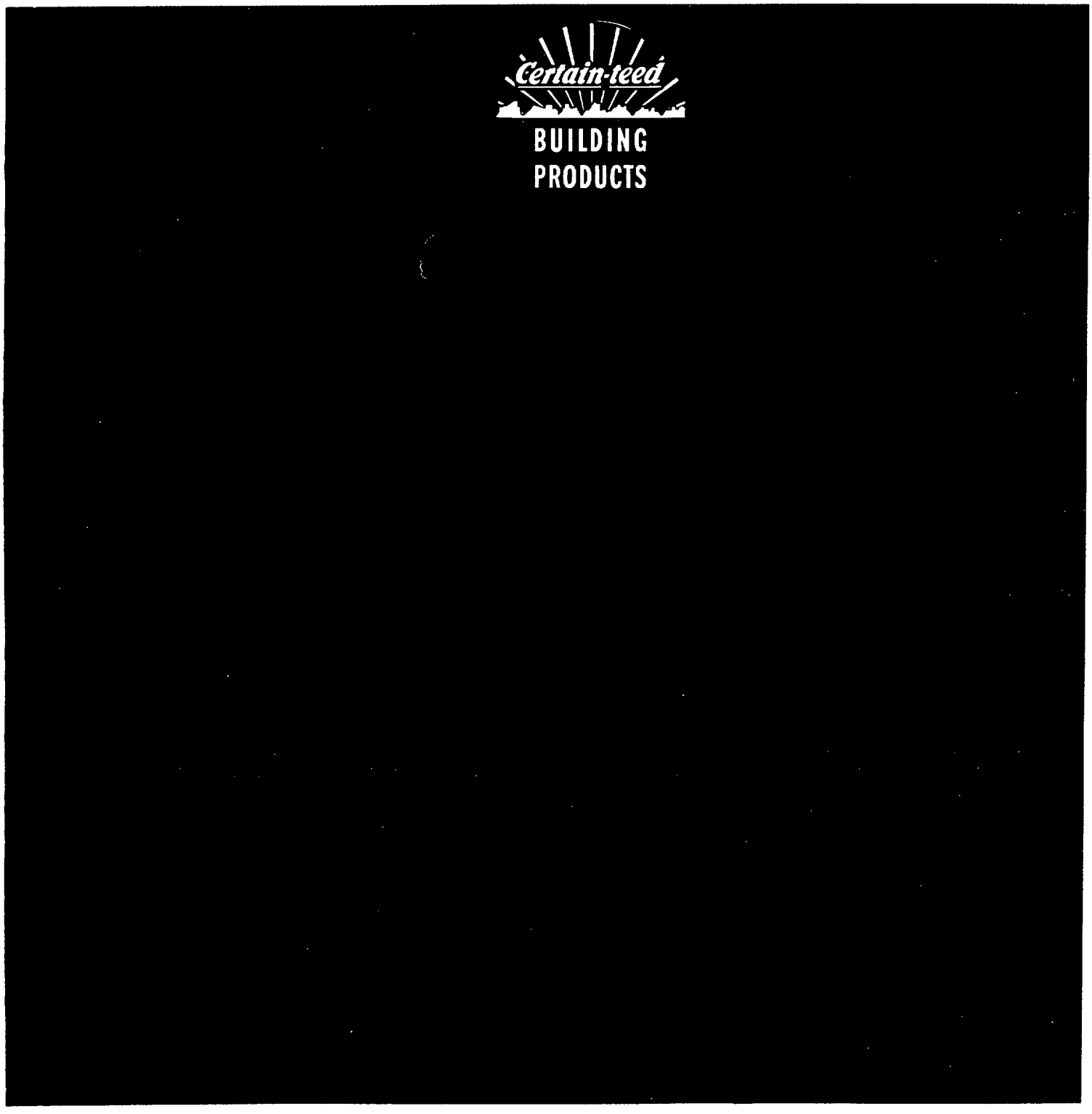


CURB DETAILS FOR OPENINGS
(MONITORS SIMILAR)





SAWTOOTH DETAILS
(MONITORS SIMILAR)



SGP 0022624

Form 4460—25M—7-49

Printed in U. S. A.

INSTRUCTIONS

FOR HANDLING AND ERECTING

Certain-teed

GYPSTEEL PLANK

FOR ROOF CONSTRUCTION

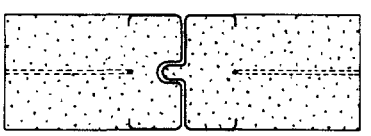
GYPSTEEL PLANK is manufactured in the standard size of 2" x 15" x 10' 0". Each PLANK is bound on both sides and ends with galvanized steel, tongued and grooved like wood plank, and is reinforced against impact with No. 16 gauge wire mesh.

↑↑ FLAT *or* ON EDGE ↑↑

UNLOADING. Remove loose spacer at center of one row of PLANK. Lift up and out on key PLANK at center. Balance of PLANK from this row can then be easily removed. Do not drag the PLANK as the sides or corners may be damaged. When hauling PLANK by truck, stack it on edge, placing supports at third points as illustrated above.

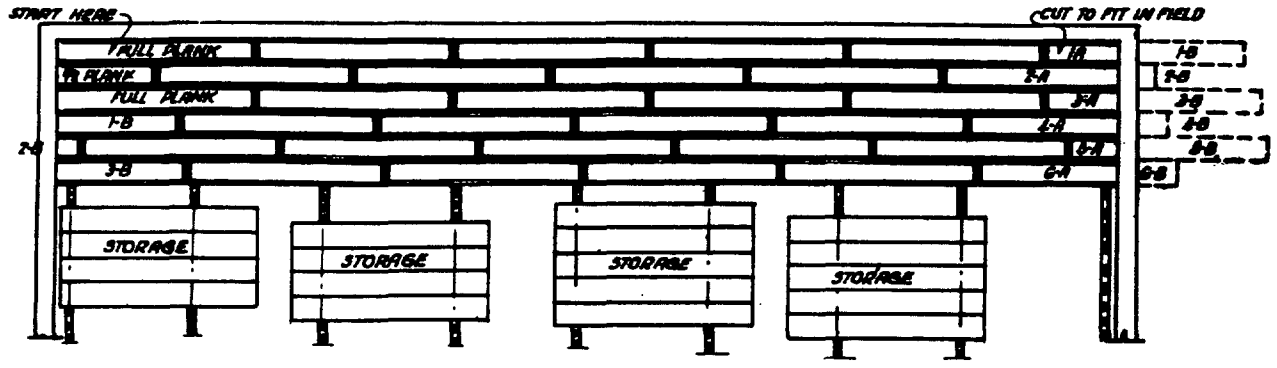
STORAGE. PLANK should be on level ground and protected from the weather. PLANK should be piled at least 4" above the ground and may be placed on edge (groove down) or flat, supported by two timbers, at third points. Do not pile flat over ten PLANKS high.

HOISTING. PLANK can be passed by hand to low roofs or hoisted on a regular cage hoist by standing PLANK on end against the head piece. When standing PLANK on end, keep the tongue up and the troweled side down to avoid damage to the binding or exposed "mat" face. If a free line and sling is used, provide two vertical lines of light wood skids to keep PLANK from swinging and thus avoid a tag line. For flat areas it is advisable to hoist a considerable amount of PLANK in place and store, one PLANK deep, before starting erection. In order to save rehandling, material should be stored so that tongues will engage grooves in the right direction. PLANK may be used as a runway when stored as shown in sketch on Page 2 with tongues engaging grooves.



ERECTION. The "mat" side of PLANK has a smooth finish while the reverse side has a "trowel" finish. The PLANK has the same strength with either side down. We recommend that the smooth finish be placed down if roof is exposed from underside. The strength of the PLANK is gained through the meshing side joints which form a continuous I-beam over supports. Always start PLANK at left hand corner of the building, where supports are at right angles to PLANK, laying the tongued side towards the exterior wall. The PLANK is simply laid over the supports in continuous rows similar to the method of laying a tongue and groove floor. Ends need not come over supports. Do not walk on first row of PLANK until after second row is laid. The strength of the slab will be greatly increased as succeeding rows are added. In general, start with a full PLANK in the first row, a half PLANK in the second row, and a full PLANK in the third row, and so on for each succeeding row. Side joints should be meshed as tightly as possible and PLANK may be driven tight with a light sledge, using a 2" x 4" or 2" x 6" wood block, preferably long enough to span over two supports.

Continued on other side



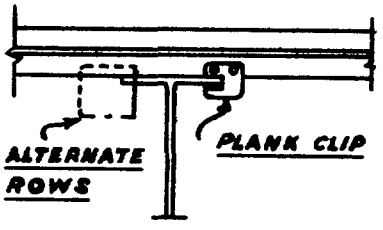
END JOINTS must be staggered, whether they come over supports or not. To accomplish this, the pieces which are left after cutting to fill out a row will be found convenient to use in starting the succeeding rows. As it is not necessary to have a piece long enough to span between two purlins to start a row, waste is eliminated.

In staggering end joints, it is advisable to leave a minimum of four feet between them. Nail the PLANK down direct to wood supports or fasten it to steel supports with special galvanized clips which we furnish. Attach the clips to groove side of the PLANK by nailing through metal binding with 1¼" or 1½" long galvanized flat headed roofers or 4d slaters nails. This size nail can be driven through the binding without pre-punching. The holes in the clip are smaller than the nail to obtain a drive fit. Place the clips on opposite edge of structural beam flange on alternate rows of PLANK, except on sloping roofs where the clips may help resist the roof thrust.

CUTTING of PLANK may be done as follows: Pile PLANK flat for a cutting table. Score both sides of the PLANK with a sharp instrument such as a chisel and cut the binding with a hack saw, then slide the PLANK until cut is at the end of the pile. Bend down and then up with a quick motion which will snap the gypsum and reinforcing. Any uneven gypsum can be trimmed with a sharp hatchet. If an electric saw is used, the following carborundum blades are recommended by their manufacturers:

Carborundum Co. — 205-C-4X Norton Co. — 37-30 P8T

Table saws can be used with a steel center carborundum blade manufactured by the Carborundum Co., number 163-C4VX5 in 12", 14" and 16" diameter.



TOOLS. The following equipment is recommended: lather's or carpenter's hatchet, sledge, hacksaw with 24 point blade (18 or 32 point blades can be used), 1¼" or 1½" flat headed galvanized roofers or 4d slaters nails, a sharp instrument for scoring the gypsum, and a carpenter's hammer for attaching clips.

SADDLES. To get the proper levels on roofs for drainage, saddles can be made from Gypsum Composition containing wood chips for aggregate, to which water is added. Properly mixed with water, Gypsum Composition will yield approximately 40 cubic feet per ton. Each 80 lb. bag of Gypsum Composition requires approximately 7 gallons of water. The mix starts to set immediately and will set hard in less than 30 minutes. Gypsum Composition should be mixed fast and thoroughly, not to exceed three minutes in a deep tray barrow or mortar box and should be placed at once where required. All mixing should be done at the exact location of the fill and ample water supply must be provided. Remember Gypsum cannot be retempered and the addition of water does not retard the setting. Set screed strips about 4' 0" O.C. for proper levels of grade. Pour alternate bays, remove screed strips and pour open bays, screed off level and trowel lightly.

Certain-teed PRODUCTS CORPORATION
120 EAST LANCASTER AVENUE • ARDMORE • PENNSYLVANIA

SGP 0022626

Form No. 4401 Printed in U.S.A.

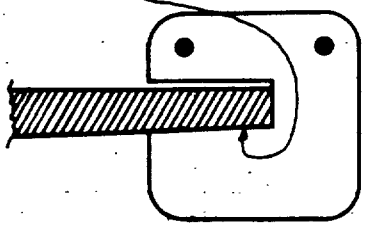
Certain-teed Products Corporation

120 SOUTH LASALLE STREET
CHICAGO 3, ILLINOIS

TYPES OF CLIPS AVAILABLE FOR GYPSTEEL [redacted] PLANK

ALL CLIPS ARE DRAWN TO 3/4 SCALE.

DRAW CLIP UP TIGHT TO UNDERSIDE OF STEEL.

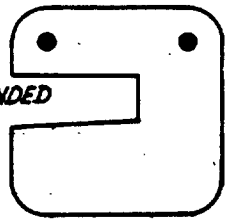


THIS STANDARD TYPE CLIP IS SHIPPED WITH EACH ORDER OF [redacted] PLANK UNLESS OTHERWISE SPECIFIED.

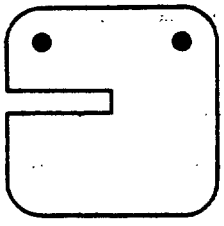
TYPE #20

STANDARD CLIPS ARE USED ON ALL STANDARD I-BEAMS AND CHANNELS.

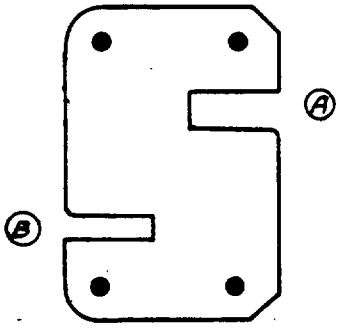
THIS CLIP IS SAME SIZE AS TYPE 20 CLIP BUT IS MADE OF HEAVIER MATERIAL AND IS RECOMMENDED FOR USE ON ALL ROOFS WHERE THE PLANK RUNS UP & DOWN THE SLOPE AND THE PITCH IS MORE THAN 3" IN 12".



TYPE #16



TYPE "M"



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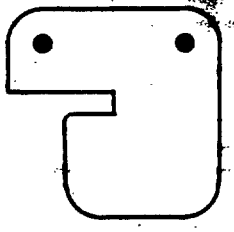
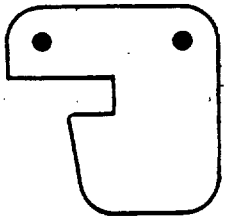
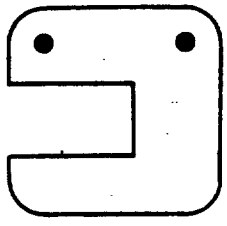


TYPE "HA"

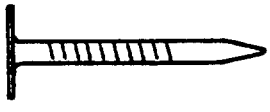


TYPE "HB"



TYPE B20 CLIP IS FOR USE ON HEAVY FLANGE BEAMS. (see table)
TYPE "B16" IS SIMILAR AND IS USED WHERE THE PLANK RUNS UP & DOWN THE SLOPE AND THE PITCH IS MORE THAN 3" IN 12".

TYPE B20
TYPE B16



SGP 0022627

FULL SIZE VIEW OF NAIL USED WITH PLANK CLIPS.
SHANK OF NAIL TO BE SLIGHTLY LARGER THAN HOLE IN CLIP

SEE REVERSE SIDE FOR TYPE CLIPS REQUIRED FOR VARIOUS SIZES OF STEEL BAR JOISTS & BEAMS.

Form #4455 6-1-46

TYPE CLIPS REQUIRED FOR VARIOUS SIZES OF STEEL BAR JOISTS & BEAMS

MANUFACTURER	JOIST TYPE													
	#81	#82	#102	#103	#104	#123	#124	#125	#126	#145	#146	#147	#166	#167
BATES	-	HA	HA	HA	T	T	T	T	T	T	T	T	T	-
BETHLEHEM expanded	-	T	T	T	T	T	T	T	T	T	T	-	T	-
BETHLEHEM welded	M	M	M	M	M	M	M	M	T	M	T	T	T	T
CECO	HA	M	M	M	M	M	M	M	T	M	T	T	T	T
CONSTEEL	HA	HA	HA	HB	HB	HB	HB	HA	HB	HB	HB	HB	HB	HB
GABRIEL	T	T	T	T	T	T	T	T	T	T	T	T	T	T
MACOMBER	M	M	M	T	T	T	T	T	T	T	T	T	T	T
TRUSCON	HA	T	T	HA	T	HA	T	T	T	T	T	STD	T	STD
WILSON	Joist Prefix (a, b, e, h = T clip) (L = STD clip) (p, s = T Clip) (v, w, = B clip)													

CHANNEL & I BEAM SIZES & WEIGHTS

TYPE of CLIP	5"	6"	7"	8"	9"	10"	11"	12"
TYPE "T"	JUNIOR & LIGHT I BEAMS							
		4.4# 12	5.5#	6.5# 13	7.5#	9# 15	10.3# 11.8 16.5	
TYPE 20	STANDARD I BEAMS							
	10.0# 12.25 14.75	12.5# 14.75 17.25	15.3# 17.5 20.0					
TYPE 16	WIDE FLANGE BEAMS							
	13.5# 16.0	15.5# 18.0 20.0		17.0# 19.0 21.0 24.0		21.0# 23.0		
TYPE B16 & B20				35.0 40.0		29.0 33.0 37.0 41.0 49.0		28.0# 32.0 36.0 40.0 45.0
TYPE "T"	CHANNELS							
	6.7# 9.0 11.5							
TYPE 16 & 20		8.2# 10.5 13.0 15.5	9.8# 12.25 14.75 17.25 19.75	11.5# 13.75 16.25 18.75 21.25				
TYPE B16 & B20					13.4# 15.0 20.0 25.0	15.3# 20.0 25.0 30.0 35.0		20.7# 25.0 30.0 35.0 40.0

J. KALITE ACOUSTIC PLASTER

(a) Types of Acoustic Plaster:

There are several different types of acoustic plasters now on the market; 1) Coarse particles held together at the points of contact by a thin cement with no fines to fill in the spaces. Such a plaster has an uncertain porosity and sound absorption, lacks plasticity and is difficult to apply, 2) Contains a large amount of asbestos or wood fiber held together with a gypsum plaster binder, the fibers swelling from the water and contracting when the plastering is dry, leaving air spaces or voids. The porosity in this type is sometimes increased by stippling with a stiff brush or making definite holes in the plastering with a multi-nail punch. This kind of plaster is usually soft, non-plastic and difficult to apply, 3) The porosity is obtained by chemical means usually by a mixture of an acid salt and a carbonate which when mixed with plaster and water releases carbon dioxide gas which fills the mass with small gas bubbles, the action being somewhat similar to bromo seltzer and water. In this type too much or too little mixing affects the number of voids formed so that an uncertain porosity and sound absorption results, 4) Porous aggregates combined with gypsum plaster and foaming agents to give a highly cellular plaster of ready workability without the objectionable characteristics enumerated above.

(b) Description of Kalit H Plaster:

Natural and buff colored Kalite "H" is composed of a pumice aggregate plus a binder of our plastisized gypsum plaster. Pumice is a volcanic rock which is very porous and full of small voids something like a fine grained sponge, so that the aggregate itself is an excellent sound absorber. It also contains certain frothing agents, that, by the mechanical action in mixing, form a heavy foam that disperses millions of tiny intercommunicating air voids throughout the plaster binder that do not work out when the plaster is mixed and applied but remain fixed throughout the mass after the Kalite has set. This results in a hard plaster thru which one can easily blow smoke and when this is possible you can be sure that you have a good sound absorbing plaster.

Kalite "H" is made at Fort Dodge, Iowa, Akron, New York and Acme, Texas in two different colors, natural color or light grey and a buff color. Physical tests on Kalite "H" are as follows:

Coefficient of sound absorption at 512 cycles, 1/2" thick = .46
" " " " " 512 " 3/4" " = .63

Bureau of Standards Test reported October 16th, 1935

Weight about one half as much as ordinary sanded, gypsum plaster mortar, or about 53 lb. per cu. ft.

(c) Properties and Advantages of Kalite "H" over other Acoustic Plasters:

Because of its plastisized gypsum binder Kalite is unusually easy to apply and results in plastering harder and stronger than other acoustic plasters. It can be painted with non-bridging lacquer or Mural-Tone paint without appreciable loss of its sound absorbing properties. No delay in application is necessary as is the case with some acoustic plasters. The second coat can be applied one hour after the first coat. These are excellent sales arguments for the use of Kalite as it speeds up the job and does away with the necessity of again placing the scaffolding. A smooth finish or a rough finish can be obtained giving excellent imitation stone effects.

(d) How to Mix Kalite "H":

Complete directions are given in our advertising literature and are sent out with every shipment. It is most important that it first be mixed to a "dry tamp" consistency by adding not more than 3 gallons of water per 80 lb. bag and mixing thoroughly until the mass is uniformly dampened. More water should then be added in small amounts mixing in each addition thoroughly until the mortar is light, fluffy, plastic and of the proper plastering consistency. It will take at least 5 minutes to obtain best results. Do not add too much water in the early stages as the mortar thins down to some extent on mixing.

(e) How to Apply Kalite "H" and what Backing to Use:

Kalite "H" should always be applied over standard scratch and brown coat gypsum plastering which means 1/2" of plaster over all lath except masonry which requires a 5/8" grounds or thickness of plaster. The brown coat of gypsum plastering should be left rough to secure good adhesion of the Kalite "H" to the backing. The base coat must be dry or only very slightly damp when the Kalite is applied.

For 1/2" thick trowel finish application scratch in a 3/8" coat using good pressure and rod to level surface (Use 5/8" darby coat for 3/4" total thickness). When this first coat has taken up or stiffened to a firm mass and the bubbles have broken which will require up to one hour's time, double back with the 1/8" finish coat which should be mixed to a slightly thinner consistency than the first coat. Lay on smooth and trowel as little as possible. When bubbles have broken and water has left the surface trowel in one direction to a smooth even surface. Do not use water in finishing and do not trowel too soon after finish coat is applied or the surface pores will be filled. The final troweling should be done when the surface remains dull behind the trowel showing that no water is being drawn to the surface.

If a float finish is desired the scratch or darby coat should be 1/4" thick and the finish coat 1/4" thick. A medium rough texture can be obtained by patting the finish coat with a wood or shingle float as soon as the bubbles have broken. A still smoother texture can be obtained by substituting a steel trowel for the float. If a rough texture is desired the surface can be floated with the shingle or wood float using a circular motion in one direction after the bubbles are all broken. Never sprinkle with water when

(e) How to Apply Kalite "H" and What Backing to Use: (Cont'd)

finishing. The floating process must be done uniformly or darker and lighter colored areas will be very noticeable due to a difference in light reflection.

There are no directions in our literature for applying Kalite 1" thick. This however can be done when necessary by first applying a 1/2" thickness and allowing to set and thoroughly dry which provides the necessary suction for the second half inch which should be applied in two coats exactly the same as if 1/2" were being applied on gypsum base coat plastering.

(f) How to Eliminate Discoloration or Joining Marks:

Practically all the complaints that we have had on Kalite "H" jobs have been caused by faulty and careless application. Sales Department General Bulletin No. 45 dated January 20th, 1938 covers special precautions and directions very thoroughly and should be read and thoroughly understood by everyone in the Gypsum Division. This paper was jointly prepared by various persons in the organization who have serviced these complaints. Following are quotations and abstracts of the most important parts of this report.

1. Kalite "h" must be mixed exactly according to directions to develop the proper plasticity, workability and porosity.

2. It must be applied over a dry base coat of Gypsum plaster sanded according to specifications and of the proper grounds.

3. It must not be applied over a white lime putty finish coat or over old plastering where the white finish coat has been only partially removed. Before applying Kalite over old plastering all the white coat must be removed and the revealed brown coat roughened.

4. The first or scratch coat must be scratched in tightly to avoid drop outs as it is very difficult to patch such areas and obtain a color match. Also the Kalite must be mixed sufficiently to develop its maximum plasticity to avoid drop outs.

5. The base coat of gypsum plaster over which Kalite is to be applied must be left rough and reasonably straight.

6. If the plaster base coat is partly wet or green certain areas will be wetter than others causing an unequal absorption which may result in an uneven color. "Dropouts" are also likely to occur.

7. When Kalite is applied directly adjoining mouldings made from moulding plaster, the molds should be dry, otherwise the water from the mold may wet the base coat plaster near the mold which may result in a different appearance of the Kalite plaster that is applied over the damp portions of the base coat.

8. To eliminate joining marks sufficient mechanics must be available so that the Kalite can be applied continuously across the entire surface. This is especially true when ceilings or side walls of a large area are to be plastered.

   If only part of an area is finished one day and part the next day it is almost impossible to avoid joining marks. If an insufficient number of plasterers are working with Kalite in such a fashion that fresh Kalite mortar has to be applied adjoining an area that was plastered with Kalite sometime before, a joining mark between the Kalite plaster that has lost considerable of its water from the suction of the base coat and the fresh Kalite plaster will be difficult to avoid.

   One or two plasterers working on a large area are quite likely to run into such trouble, whereas, a sufficient number should start at one end of the area and work side by side continuously to the other end until the entire area has been plastered with Kalite in one continuous operation without stopping the job.

   If this is not possible some provision should be made before the job is started to apply the Kalite in definite sized panels so that at least one whole panel can be plastered per day in order to avoid any such joining marks. This is a factor that must be straightened out by the plastering contractor with the general contractor and architect before starting to apply Kalite on very large areas that cannot be completed in one continuous operation.

9. Skilled mechanics must do the work.

10. The finish coat must be laid on straight and true so that there will be no low spots that would not be touched by the final troweling as such low spots will give the appearance of a different color or shade.

11. The final troweling should be done in one direction so as to prevent a difference in light reflection. It is difficult to make the average plasterer realize this.

12. If a float finish is desired, it is extremely important that the work be carefully done so than an even level uniform textured surface is obtained. A rougher finish in some areas or depressions in the surface will always have a darker appearance.

13. Floating should be done uniformly, all plasterers using the same circular motion in the same direction. This is most important.

14. It is extremely important that the finish coat should not receive the final troweling until the Kalite has taken up or when the water bubbles are broken and the water has left the surface. This point however is covered in our regular Kalite mixing and application specifications.

15. Kalite should not be applied to metal lath direct.

16. Kalite should not be applied to a concrete or Portland Cement plastered surface without an intermediate coat of gypsum bond plaster as failure to bond may result.

17. The hangers that suspend a plastered ceiling from a concrete arch must be strong and rigid also metal lath should be tightly fastened to furring strips and of sufficient strength to permit the additional thickness and weight of Kalite to be applied.

18. Cat walks installed over suspended ceilings especially in theatres to enable inspection of electrical equipment, etc., must not rest on any portion of the ceiling construction or the vibration may rupture the plaster keys.

(g) Trowel and Float finishes (see section (c) above).

(h) How to Patch Kalite Plastering:

If patching a drop out on a Kalite job is necessary we have been told by a competent plasterer that by mixing clean dry Kalite set plaster with a clear glue solution and applying this mixture in the patch, excellent results will be obtained.

(i) Decoration:

As mentioned in section "c" above set and dry Kalite plastering can be painted with a spray gun with either a non-bridging lacquer or Mural-Tone paint thus securing a variety of colors and shades without appreciably reducing the sound absorption value. Tests made on Kalite "H" at the Bureau of Standards painted with two coats of non-bridging lacquer showed no difference in scund absorption at 512 cycles and very little difference at the other cycles. Tests made at the same institution on Kalite Cast covered with 4 coats of Mural-Tone white paint showed practically no difference at the various frequencies (cycles) tested. One-half gallon of lacquer thinned with one-half gallon of lacquer thinner will cover from 150 to 200 square feet one coat depending on color and job conditions. One gallon of Mural-Tone paste mixed with the proper amount of water will cover one coat from 400 to 700 sq. ft.

(j) How to Clean Kalite Walls:

Kalite can be washed clean with soap and water and a sponge with no bad effects. A fine whisk broom may be used in some cases if brooming is done very lightly. A vacuum cleaner has been used successfully on some jobs.

(k) Coverage:

Coverage 1/2" thick = 115 yards per ton.
" 3/4" " = 77 " " "

(l) Light Reflection Factor:

The minimum light reflection factor of Kalite "H" buff is 65.3% according to tests made by the Curtiss Lighting Co. of Chicago.

KALITE SOUND ABSORBING PLASTER (TYPE "H")

DIRECTIONS FOR MIXING

Preparation of the Base Coat:

Kalite "H" Plaster is applied as a finish coat over standard scratch and brown coats of sanded gypsum plaster in lieu of the usual white finish. The brown coat shall be darbied as smooth and level as possible for reception of the Kalite "H" Plaster. Brooming or otherwise roughening the brown coat is not recommended. The base coat must be dry, or practically so, when the Kalite is applied. Kalite "H" Plaster is usually applied ½" thick but the thickness may be increased when increased sound absorption per unit area is desired.

Mixing:

Kalite "H" Plaster may be mixed either in a mortar box or machine mixer. Machine mixing is recommended whenever possible.

IMPORTANT: It is necessary to mix Kalite to "dry tamp" consistency, then add more water to obtain plastering consistency. Follow the directions carefully. Proper mixing insures good workability and ease of application.

The following proportions are based on one 80 pound sack of Kalite. The same proportions should be used for larger batches.

Machine Mixing:

Put sufficient clean water into the mixer to obtain "dry tamp" consistency (not more than 3 gallons of water per 80 pound bag of Kalite), add the Kalite and continue mixing until the mass is thoroughly and uniformly dampened, then add water in small quantities allowing each addition of water to be thoroughly mixed into the mortar before more is added. Continue this procedure until thin plastering consistency is obtained and the mortar is light and fluffy. Each batch should be mixed for at least 3 to 5 minutes.

Box Mixing:

Spread the dry Kalite in the raised end of a clean mortar box and add sufficient clean water to obtain "dry tamp" consistency (not more than 3 gallons of water per 80 pound bag of Kalite.) Mix vigorously and thoroughly, hoeing the material back and forth several times from end to end of the mortar box until thoroughly dampened and "dry tamp" consistency is obtained, then add more water in small amounts, thoroughly mixing in each addition of water by vigorous agitation with the hoe. Continue this procedure until thin plastering consistency is obtained and the mortar is light and fluffy.

Note: In the early stages of mixing, the mortar may appear to be too stiff. However, when turned over several times and vigorously mixed the consistency becomes thinner. For this reason any additional water which may be required should be added slowly and in small amounts.

All mixing equipment should be thoroughly cleaned between batches.

DIRECTIONS FOR APPLICATION

TROWEL FINISH (Use standard plastering tools)

For ½" Thickness:

The first application of Kalite should be laid on to a thickness of approximately ⅜" and rodded or darbied to a level surface. When this darby coat has "taken up" so that bubbles have broken and has stiffened sufficiently, double back with ⅛" of material of slightly thinner consistency to produce full ½" thickness. This application should be laid down as smooth as possible removing all heavy trowel welts, cat faces, etc. This application shall be laid on across the narrowest dimension of the area to be finished. All finish to be laid on in the same direction. A sufficient number of men should

be employed and so placed that all are working on wet ends of the finish. The usual trowel motions for removing cat faces, etc., are permissible while the finish is wet. Strict compliance with above instructions will insure absence of joining marks.

When the bubbles have broken and the water has left the surface over the entire area to be finished, start finish troweling across the direction in which the application has been laid on (along the long direction of the area). Make each trowel stroke continuous and all in the same direction. Start the troweling stroke at the beginning of one end of the area and carry on continuously to the other end returning to the point of beginning for each successive trowel stroke until the entire area has been firmly troweled in this one direction. Then the entire area should be troweled in the same manner using the same continuous trowel strokes across the direction of the first troweling.

When these trowelings have been completed slight depressions in the plaster which have not been contacted by the side of the trowel in either of the above trowelings may appear in the form of bright spots. These spots may be worked out to a uniform texture by firmly troweling them in the direction of the final troweling with the end of the trowel. It is extremely important that the trowel used in this finish troweling be kept clean and dry both front and back during the entire operation. To obtain the most satisfactory finish and uniform texture permit only one man to do the entire finish troweling because there are no two men who use exactly the same trowel pressure. Do not sprinkle the surface coat with water when finishing. Remember that the surface must be porous to obtain maximum sound absorption.

If the final troweling is done too soon after the finish coat is applied "fat" will be drawn to the surface and will partly fill the surface pores. This will reduce the sound absorption of the plaster and the surface may have a mottled appearance when dry. Final troweling should be delayed until the surface remains dull behind the trowel showing that no water is being drawn to the surface.

For ¾" Thickness:

Follow the same procedure as for ½" thickness except that the darby coat should be built up to ⅝" thickness.

FLOAT FINISH (Use standard plastering tools)

For ½" Thickness:

Follow the same procedure as described for trowel finish except that the darby coat is to be applied ¼" thick. After this darby coat has "taken up" and bubbles have broken, double back with an additional ¼" of the same material laid on as uniformly as possible. The surface should then be straightened and levelled with a shingle or wood float as soon as possible after application and before the water has left the surface. A medium rough texture may be obtained by allowing the surface to "take up" until the bubbles have practically all broken, then patting down the surface with the float. A somewhat smoother texture can be obtained by lightly trowelling the roughened surface with a steel trowel instead of patting it with the float. This trowelling should be done after all bubbles have broken and the plaster has become sufficiently firm so that trowel marks will not show. If a rough texture is desired, the surface may be floated with a shingle or wood float using the usual circular motion. This final floating should be done after practically all of the bubbles have broken. Do not sprinkle with water when finishing.

For ¾" Thickness:

Follow the same procedure as for ½" thickness except that the darby coat should be built up to ½" thickness.

DECORATION: If Kalite Sound Absorbing Plasters are to be decorated, consult the nearest Sales Office of the Certain-teed Products Corporation for recommendations.

CERTAIN-TEED PRODUCTS CORPORATION

GENERAL OFFICES: CHICAGO 3, ILL.

FORM 1561 — REV. 11-45
PRINTED IN U.S.A.

K. PRINCIPLES OF REFLECTIVE INSULATION

THIS SECTION WILL BE SENT TO YOU

WHEN COMPLETED.

L. LIME PRODUCTS & THERE USES

Certain-teed does not manufacture lime products. Arrangements have been made to obtain our requirements from a lime manufacturer who has a splendid reputation and long experience in the production of Finishing and Mason's Limes of the highest quality. These limes are produced from dolomitic limestone quarried in the famous Ohio fields. They are packed for us under "Cetain-teed" brand and must meet rigid quality specifications.

(a) Hydrated Finishing Lime:

1. What it is: This is a white, highly plastic, dolomitic hydrated lime. Two types are available: Normal and Special. The Normal type is quick lime which has been partially hydrated during the manufacturing process. The Special type is a quick lime that has been hydrated under pressure in an autoclave (hence, sometimes referred to as "Autoclaved" Lime) which results in a minimum of 92% hydration of the calcium and magnesium oxides. Both types conform to respective A.S.T.M. and Federal Specifications.

2. Where it is Used: Hydrated Finishing Lime is used primarily as one of the ingredients in "white coat" mortar for the finish coat on interior plastering. It is also mixed with molding plaster for running molds on the bench or in place on the wall.

3. Advantages: Hydrated Finishing Lime "white coat" plastering provides a beautiful and pleasing foundation for practically every decorative material. The gleaming white surface is completely devoid of any texture. For general purposes, when mixed with gauging plaster it is amply hard. When a harder finish is called for the lime putty is mixed with Keene's Cement instead of gypsum gauging plaster. Hydrated Finishing Lime is noted for its high plasticity and excellent workability. It yields an exceptionally high coverage. One ton of lime properly gauged with gypsum gauging plaster will cover 500 to 700 square yards as a finish coat. A lime putty-gauging plaster white coat is generally the lowest cost finish obtainable. The "Special" type (autoclaved) Finishing Lime overcomes finish coat peeling complaints which frequently occur several years after application of the finish coat. The expansion caused by the slow hydration (on the wall or ceiling) of the unhydrated calcium and magnesium oxides is considered to be the cause of this peeling. Since the "Special" type contains no more than 8% of these unhydrated oxides at time of application, the subsequent expansion is minimized.

4. Instructions for Use: For a plaster finish coat the lime is first mixed with water to form a putty. Normal type lime requires soaking for twelve to twenty-four hours prior to application. This long soaking or slaking period may be ommited when special-type lime is used.

The lime putty should be mixed in the proportion of three parts lime putty to one part of gauging plaster by volume. Water is added to form a mortar. This mortar, which is

4. Instructions for Use: (Cont'd) applied over the gypsum plaster brown coat in a layer 1/16" to 1/8" thick, is troweled to a smooth dense surface.

   For ornamental run molds, the lime putty is mixed with gypsum molding plaster and the mold is then formed by means of a template.

(b) Mason's Hydrated Lime:

1. What it is: Certain-teed Mason's Hydrated Lime is a white hydrated lime meeting A.S.T.M. requirements for Type "M" Hydrated Lime for masonry purposes.

2. Where it is Used: Certain-teed Mason's Hydrated Lime is mixed with sand to make mortar for interior plastering, laying up brick and other masonry. It may also be used as an addition to Portland Cement mortar to improve workability. This product is frequently used as a general purpose lime for improving sanitary conditions in poultry houses, animal barns and similar farm buildings.

(c) Packaging:

Both Hydrated Finishing and Mason's Hydrated Lime are packed in multi-wall paper bags of approximately 50 lbs. gross weight.

M. HUMMER SYSTEM

(a) What it is:

The Hummer System of Laminated Wall Construction is a patented method of dry wall construction, available to all builders upon application to the licensee.

Basically, this system consists of applying two layers of gypsum wallboard to the studding in place of lath and plaster. The first layer is nailed directly to the studding. The second layer is glued and nailed on top of the first in such a manner that joints do not coincide. Walls are then finished by having all joints filled to produce a smooth, unbroken neat appearing surface of exceptional strength and durability.

(b) Where it is Used:

The system may be used in all wall and ceiling construction in any type of building which requires decorated walls. It is especially suitable for dwellings because it can be applied on standard framing, cuts construction time and building costs and is easily decorated.

(c) Advantages:

The Hummer System is easily and inexpensively applied and furnishes exceptionally strong and durable walls and ceilings. Because of its lamination it is crack-proof and shatter-proof, and the two layers of gypsum board make it fireproof. It is impervious to rot and vermin. This patented system of construction assures walls and ceilings that will not sag. These walls and ceilings can be papered and painted easily by conventional methods.

(d) Application:

1. Nailing: 1-7/8" 13 gauge cement-coated nails with sinker type heads should be used for both layers. Do not nail boards to corner studs or within 6" of corner studs. Do not nail at window and door corners. Drive nails flush with the surface of the board.

2. First Layer: The first layer of 3/8" gypsum board should be nailed directly to the studs or ceiling joists. Cuttings, cut stock, liner board or standard size board may be used. Boards may be placed horizontally or vertically, using enough nails to hold them securely in position until the second layer is applied. The first layer boards may be butted or spaced slightly apart.

3. Second Layer: Boards for the second layer should have adhesive applied to the outside surface just before the boards are positioned and nailed. Adhesive should be used within 24 hours of mixing, and a "comb" type spreader is recommended for application. Joints of the second layer should not be closer than 6" to the joints of the first layer. Nails should be placed every 10-1/2" along the edges of the second layer boards and every 14" in the center field. Second layer boards should be spaced at least 1/8" apart.

4. Vertical Corners: To install a vertical corner, the back cover paper of the second layer board to be used as the corner piece should be scored, and adhesive applied to the back cover paper. A piece of reinforced asphalt laminated kraft paper as long as the corner piece and 6" wide should then be centered over the scoring and pressed into the adhesive, and another layer of adhesive applied. The board should then be carried to the corner and "cracked" over the knee, thus breaking the board at the scoring on the back without damaging the face. It may then be gradually bent into place in the corner.

   It is very important that neither the first nor the second layer of gypsum boards be nailed in the corners.

5. Broken Ceilings: The first layer of ceiling boards should be applied with back paper facing studs. It should be scored at the point where the corner will occur, and nailed in place, the nails being kept at least 6" from the angles. Care should be taken to avoid breaking the face paper. The second layer of gypsum board should then be scored on the back at the point where the corner will occur, and the adhesive applied. A piece of reinforced asphalt laminated kraft paper as long as the corner piece and 12" wide should then be centered over the scoring and pressed into the adhesive, and another layer of adhesive applied. The board should then be carefully "cracked" over the knee in order to avoid injuring the face paper, set in place and nailed, the nails being kept at least 6" from the angle.

6. Ceiling End Joints: Good strong adhesion between the first and second layers can be assured by clamping the ceiling end of the boards with a No. 14 1" wood screw wherever the ceiling end joints fall between joists. These screws should remain in place for at least twelve hours to allow the adhesive to attain full holding strength.

7. Preparation of Joints for Filling: All board should be inspected after application. Cut and broken edges or corners should be beveled or cut with a sharp knife. Crumbling gypsum or loose paper should be removed to present a smooth, firm edge and damaged surfaces should be hollowed smooth. A thin coat of white shellac or approved size should be applied to these spots.

8. Filler: Filler to be used for joints in the Hummer System of wall construction should be of fast-setting gypsum-containing type, supplied in the form of a dry powder that will mix readily with water. This is sold under trade name of "Hummer Filler".

9. Filling: Filler should be applied with a 5" broadknife. When the filler begins to set it should be forced tightly into all joints and broken surfaces and sheared off with the broadknife. Filler should be applied over all nail heads and sheared off in the same manner. A second coat of filler should be applied after the first has dried.

10. Finishing all Joints and Nail Heads: After the filler has thoroughly set a coat of Bestwall Finisher or other approved finisher should be spread over all joints, broken places and nail heads.

    The finisher should be sheared off with the 5" broadknife in the same manner as the filler. After this first coat of finisher has dried, a second coat should be applied, extending beyond the width of the joint to about 9". Application of the second coat of finisher is known as the "layback operation."

    Finisher should dry for at least 48 hours before the wall is painted or papered.

11. Decorating: A pigmented primer should be applied to all surfaces that are to be painted. A thin varnish size should be applied to the wall before papering to allow easy removal of wallpaper when redecorating.

(e) Specifications:

1. Gypsum Wallboard: All gypsum board used in the Hummer System shall conform to Federal Specification SS-W-51a.

2. Type of Board: The Gypsum board shall have recessed, beveled or "bull-nosed" edges.

3. Framing: The framing shall be in alignment with reasonable practical tolerance and nailing members shall be no less than 1-1/8" in thickness.

4. Adhesive: The adhesive used in this system shall be of cold-setting casein-containing type with mold inhibitor, supplied in the form of a dry, uncaked powder and in such condition that it can be readily mixed with water. The adhesive, when mixed with water, shall be of proper consistency for easy, uniform spreading with a "comb" type spreader. After being applied, the adhesive shall not flow when the surface on which it is spread is held in a vertical position.

5. Tests: Test samples, 3" x 12", cut from a typical wall section, shall show no more than 5% delamination between pieces of wallboard after soaking for one hour in water of room temperature.