GYPSUM ASSOCIATION
201 NO. WELLS ST., CHICAGO 6, ILLINOIS
1350 N. HIGHLAND, HOLLYWOOD 28, CALIF.

Special Recommendations

NAILING GYPSUM WALLBOARD
SINGLE AND TWO-PLY APPLICATION
(SINGLE AND DOUBLE NAILING METHODS)

PLAINTIFF'S EXHIBIT
GP-1105

AIA FILE NUMBER 23-L

RECOMMENDED NAILS AND SPACING

THICKNESS OR TYPE	DESCRIPTION OF NAIL	NAIL SPACING
SINGLE LAYER		
1/4" thickness (for application over existing surfaces only)	Flat head, diamond point nail of such length as to give not less than 1" penetration into the framing member.	Nails spaced not less than 3/8" from ends and edges. At each support space nails a maximum of 7" for ceilings and a maximum of 8" for walls. Do not stagger nails on adjoining ends and edges. (See reverse side.)
3/8" thickness	1-1/8" or 1-1/4" long, annular ringed GWB-54 nail complying with ASTM Spec. C380-58T or 4d, 14 gage, 1-3/8" long, 7/32" flat head, diamond point, bright finish cooler.	(A) Nails spaced not less than 3/8" from ends and edges. At each support space nails a maximum of 7" for ceilings, a maximum of 8" for walls. Do not stagger nails on adjoining ends and edges (see reverse side), or double nailing method may be used (see reverse side).
1/2" thickness	1-1/4" long, annular ringed GWB-54 nail complying with ASTM Spec. C380-58T or 5d, 13-1/2" gage, 1-5/8" long, 15/64" flat head, diamond point, bright finish cooler. For exterior use, use GWB-54 nail only.	Same as (A) above or double nailing method may be used (see reverse side).
5/8" thickness	6d, 13 gage, 1-7/8" long, 1/4" flat head, diamond point. (Use for fire rated constructions). 1-3/8" long, annular ringed GWB-54 nail complying with ASTM C380-58T where fire rated construction is not required. For exterior use, use GWB-54 nail only.	Same as (A) above. Double nailing method may be used (see reverse side), except for fire rated constructions.
TWO-PLY		
(1) Adhesive between layers	(1) First layer – same as for single layer application of thickness used. (2) Face layer – long enough to penetrate at least 3/4" into framing member.	(1) Same as (A) above; drive nails flush with paper surface. (2) Use only enough nails to hold wallboard in place until adhesive develops adequate bond. Suggested spacing 12" on ceilings and 16" on walls.
(2) No adhesive used between layers.	(1) First layer – same as for single layer application. (2) Face layer – long enough to penetrate at least 1-1/8" into framing member.	(1) Same as (A) above, except nails may be spaced a maximum of 14". Drive nails flush with paper surface. (2) Same as for single layer application or double nailing method may be used (see reverse side).
(3) Staple application of first-layer only. (Face layer applied as described above)	(1) Staples shall meet the following minimum requirements: Wire – 16 U. S. Standard gage flattened galvanized wire. Staple Crown – Flat, 7/16" wide (outside measure). Staple Legs – For 3/8" thick board – 1" long with divergent points. For 1/2" thick board – 1-1/8" long with divergent points.	(1) Staples shall be driven with the crown at right angles to the paper bound edges of the wallboard except where the paper bound edges fall on the framing members, the staples shall be driven parallel to the edges. Staples shall be driven in such a manner that the crown bears tightly against the wallboard but does not cut into the face paper. The legs of the staple shall be no less than 3/8" from the ends and edges of the wallboard. Spacing of staples shall be 7" o.c. maximum on ceilings and 8" o.c. maximum on walls.

May, 1959

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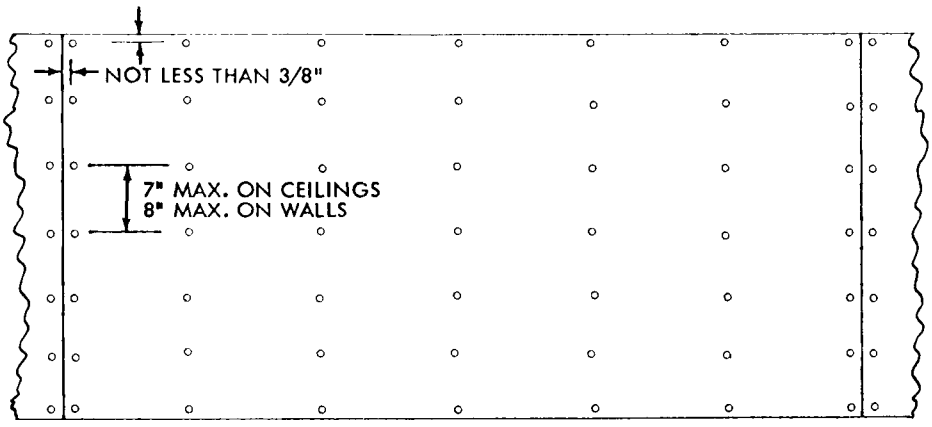
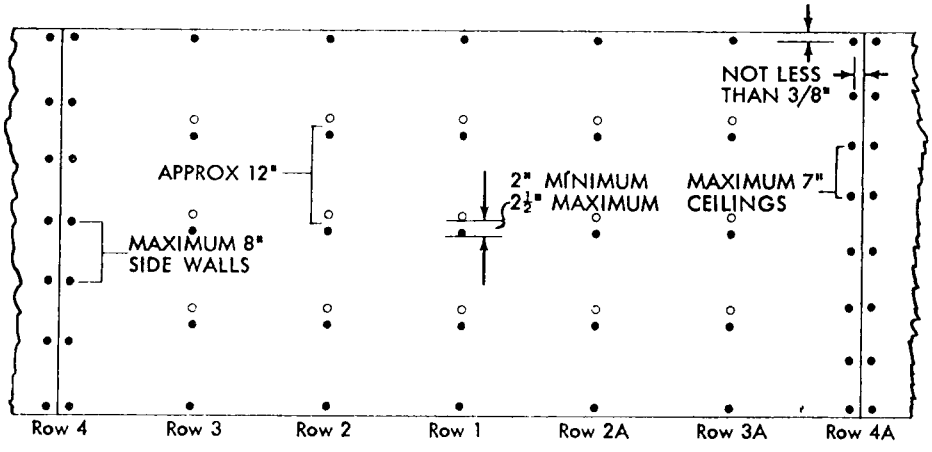
SINGLE NAILING



NAILS: (See Reverse Side)

"SINGLE NAILING" SYSTEM PROCEDURE: The wallboard shall be held in firm contact with the nailing member while the nails are being driven. Nailing preferably should proceed from the central portion of each piece of wallboard towards ends and edges. Nails shall not be staggered on adjoining edges or ends. Perimeter nailing at the top and bottom is not required.

DOUBLE NAILING



NAILS: (See Reverse Side)

"DOUBLE NAILING" SYSTEM PROCEDURE:

1. Two men are required to nail one ceiling board – one man nails rows 1, 2, 3 and 4; the other nails rows 2A, 3A and 4A.
2. Starting at center of board, nails shown by dot ● are applied in row 1, then rows 2 and 2A, 3 and 3A, 4 and 4A, etc., always nailing from center to edges of sheet.
3. Apply "double" nails shown by circle O in the same manner as first nails, also starting at row 1.
4. As alternate procedure, "double" nails may be applied immediately after nailing of first nails in each row is completed according to step "2" above.
5. Use single nails on perimeter of board.

IMPORTANT: All three field (first) nails in each row should be applied before the "double" (second) nails are applied. It may be necessary to "hit" the first nails in each row after the second nail is applied

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FOR RADIANT HEATING with Gypsum Wallboard

GENERAL

The purpose of these recommendations is to explain the proper use of gypsum wallboard when used with radiant heating. Gypsum wallboard or backing board can be satisfactorily used in conjunction with radiant heating installations, however, certain precautions must be taken to minimize the possibility of such things as cracking due to thermal shock, shadowing under the heating system due to unequal initial drying rates, or calcination of the gypsum wallboard due to over-heating. These recommendations are intended to provide information which should help avoid such difficulties.

TYPES OF RADIANT HEATING SYSTEMS

Electrical systems where cables are located between two layers of gypsum wallboard.

Hot water systems in which the heat conducting mediums, such as pipes, are located between two layers of gypsum wallboard.

Systems in which the heating elements are located behind the gypsum wallboard.

SPECIFICATIONS

Gypsum wallboard shall be applied in accordance with the requirements of ASA A97.1, "Standard Specifications for Gypsum Wallboard Finishes" except as herein modified.

Systems Using Two Layers of Gypsum Wallboard

The first layer of gypsum wallboard or backing board shall be applied horizontally to nailing members using nails as specified below. Nails shall be spaced a maximum of 14" o.c. for the first layer and 7" o.c. for the face layer.* Nails shall be driven flush with surrounding wallboard surfaces for application of the first ply.

*For exception see "Note", Electric Heating Systems.

Nails:

Gypsum Wallboard (Thickness)	Recommended Nails
First Ply	
3/8"	1-1/8" or 1-1/4" GWB-54 or 4d, 14 gage, 1-3/8" long, 7/32" flat head, diamond point, bright finish cooler.
1/2"	1-1/4" GWB-54 or 5d, 13-1/2 gage, 1-5/8" long, 15/64" flat head, diamond point, bright finish cooler.
5/8"	1-3/8" GWB-54 or 6d, 13 gage, 1-7/8" long, 1/4" flat head, diamond point, bright finish cooler.
Second Ply	
GWB-54 Type nails providing 3/4" penetration or "Cooler" nails providing 1" penetration.	

Staples:

The *first ply only* of two-ply construction may be attached by power driven staples. When staples are used, the following recommendations should be employed.

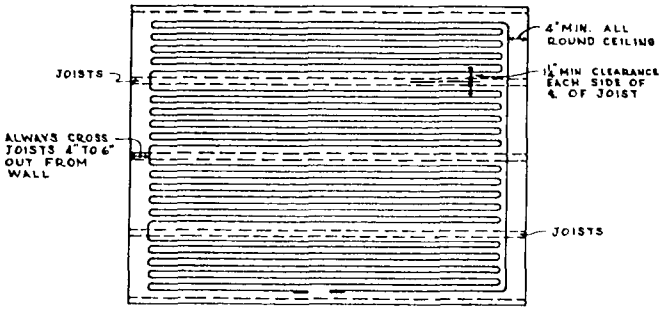
The staples shall meet the following minimum requirements: 16 U.S. Standard gage flattened galvanized wire, 7/16" wide crown, 1" long legs for 3/8" thick board, 1-1/8" long for 1/2"thick board and 1-1/4" long for 5/8" thick board, with divergent points.

The spacing of staples shall not exceed 7" on center on ceilings.

Staples shall be driven with the crown at right angles to the paper bound edges of the gypsum wallboard, except where the paper bound edges fall on the framing members, then the staples shall be driven parallel to the edges. Staples shall be driven in such a manner that the crown bears tightly against the wallboard, but does not cut into the face paper. The legs of the staples shall be no less than 3/8" from the ends and edges of the gypsum wallboard.

ELECTRIC HEATING SYSTEMS:

Electric heating cables shall be securely attached to the base or first layer of gypsum wallboard in accordance with cable manufacturer's recommendations, with cables parallel to and between nailing members. Cable shall be positioned at least 1-1/4" from center of nailing member on each side so that at least a 2-1/2" unobstructed channel is provided under each nailing member. This is necessary to prevent nails, used to subsequently attach the face layer of gypsum wallboard, from being driven into the cable. Cables shall cross nailing members only at ends of ceiling 4" to 6" from wall. There shall be at least a 4" space completely around the perimeter of each ceiling, which is clear of cables. Cables shall be kept at least 8" clear of all openings.



TYPICAL CEILING LAYOUT PATTERN

All inspections and testing of the heating system shall be completed before application of face layer of gypsum wallboard.

Heating cable spacing between joists shall be as re-

(OVER)

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commended by the heating cable manufacturer. *Under no operating conditions shall the gypsum board core exceed a temperature of 125°F.*

Complete embedding of the heating elements is necessary. The area between the heating elements shall be filled with a filler which shall be level so there is complete contact between the face layer and the back layer of gypsum wallboard. (Note: Where the filler serves as an adhesive to hold the face layer, nail spacing may be 7" o.c. for the first layer and 16" o.c. for the face layer.) When required to produce a uniform thickness of the filler and to provide a firm base for nailing, furring strips of a thickness equal to that of the layer of the filler, may be attached over the base layer to the ceiling joist at parallel relationship. The face layer shall be erected immediately after the filler has been spread. The last nails around the perimeter of the ceiling shall be spaced 8" to 10" away from the adjoining wall to prevent them from striking the electric cables where they cross the framing members.

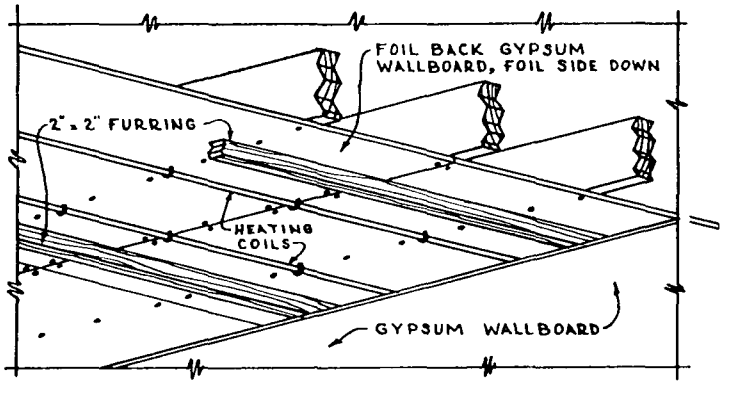
All joints and nail heads shall be finished according to the wallboard manufacturer's recommendations. *Allow a minimum of one week with good drying conditions and two weeks in the cold season before turning on the heating system.*

HOT WATER HEATING SYSTEMS:

Apply insulating gypsum wallboard for the first layer parallel to the joist with the aluminum foil facing downward to act as a reflector behind the heating elements. Nails shall be spaced not more than 8" o.c. They shall be driven flush with surrounding wallboard surfaces.

Nail 2" × 2" furring strips 16" o.c. over the insulating gypsum wallboard and at right angles to the joists.

The heating elements shall be suspended from and supported by the framing members and not from the gypsum wallboard.



TYPICAL HOT WATER SYSTEM

All inspections and testing of the heating system shall be completed before application of the face layer.

Under no operating conditions shall the gypsum board core exceed a temperature of 125°F.

Apply the final or face layer in the normal manner, at right angles to the furring strips. Nails shall be as specified for the first ply and shall be spaced not more than 7" o.c. Do not use insulating or foilback wallboard for face layer.

All joints and nail heads shall be finished according to the wallboard manufacturer's recommendations. *Allow a minimum of one week with good drying conditions and two weeks in the cold season before turning on the heating system.*

OTHER SYSTEMS:

Where the heating system is located behind the gypsum wallboard, the recommendations for the applicable system shall be complied with.

Under no operating conditions shall the gypsum board core exceed a temperature of 125°F.

All joints and nail heads shall be finished according to wallboard manufacturer's specifications. *Allow a minimum of one week good drying conditions and two weeks in the cold season before turning on the heating system.*

DESIGN DATA

It is the responsibility of the architect to prepare and correlate complete plans and specifications. The limitations and characteristics of the materials used for the structure shall be taken into consideration. It is responsibility of the heating engineer to properly design the radiant heating system to work effectively with these materials.

Be certain to follow the job specifications. *Substitutions in materials might change the rate of heat flow, which in turn might give results that would make the entire installation unsatisfactory.*

The following design data is recommended for use in calculating the heat transmission coefficients (U) for gypsum wallboard.

Thermal Conductivity Values:

Material	Conductance "C" (Thickness as stated)	Resistance "R" (1/C)
3/8" gypsum wallboard	3.73	0.27
1/2" gypsum wallboard	2.76	0.36
5/8" gypsum wallboard	2.42	0.41

DECORATION

Decoration of the finished work including sizing or sealing shall not proceed until the heating system has been test operated for a minimum of 24 hours. The system should then be turned off and decorating of the gypsum wallboard performed. Do not decorate the wallboard while the heating system is being tested, or is in operation. It is also recommended that where texture finishes are used, such finishes be allowed to thoroughly set or dry prior to the operation of the heating system.

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Application of
GYPSUM WALLBOARD ON EXTERIOR LOCATIONS

MATERIALS AND APPLICATION:

Gypsum wallboard (1/2 or 5/8 inches thick) may be used for carport and open porch ceilings and the soffits of eaves that are horizontal or incline downward away from the building.

Materials and application shall be in strict conformance with the requirements of American Standard for Gypsum Wallboard Interior Finishes A97, except as modified below:

Nails for 1/2 inch board shall be the annular ringed gypsum wallboard nail GWB-54, complying with the requirements of ASTM Designation C380-58T. Nails for 5/8 inch board shall meet the same requirements except that the length shall be 1-3/8 inches.

Suitable drips and mouldings shall be provided around the perimeter to protect from direct exposure to water. The edges of the board shall be placed not less than 1/4 inch from masonry.

The wallboard shall be applied horizontally on nailing members spaced not to exceed 24 inches on center.

Joints may be covered with battens or finished with joint treatment.

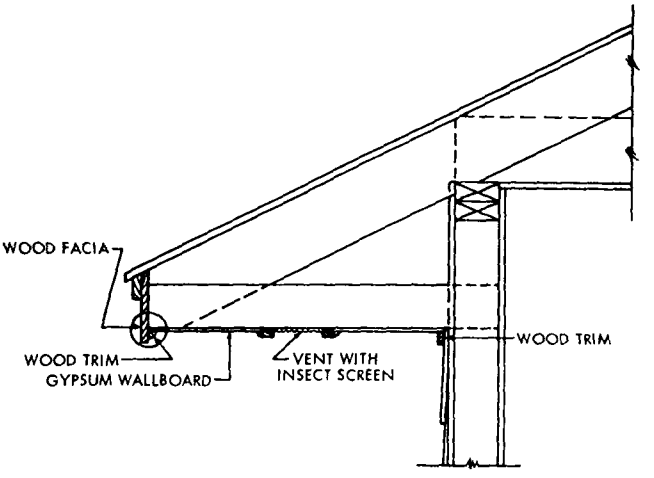
Nailheads shall receive joint treatment in the usual manner.

VENTILATION:

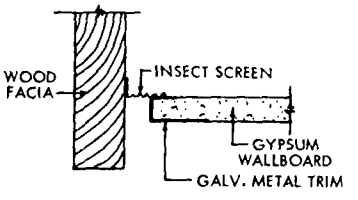
Adequate ventilation shall be provided for the space immediately above such installations. (Note: The minimum acceptable ventilation shall be as required in the current Minimum Property Requirements of the Federal Housing Administration.)

PAINTING:

The exposed surface of the board shall be painted with not less than two coats of exterior type oleoresinous or water-thinned emulsion paint.



FRAME WALL



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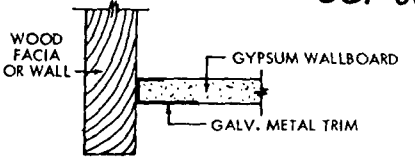
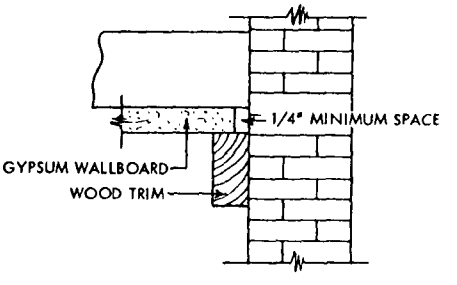


ALTERNATE FACIA DETAILS



MASONRY WALL

AIA FILE NUMBER 23-L

GYPSUM ASSOCIATION
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1350 N. HIGHLAND, HOLLYWOOD 28, CALIF.

Special Recommendations

"FLOATING" INTERIOR ANGLE METHOD of Application for Gypsum Wallboard

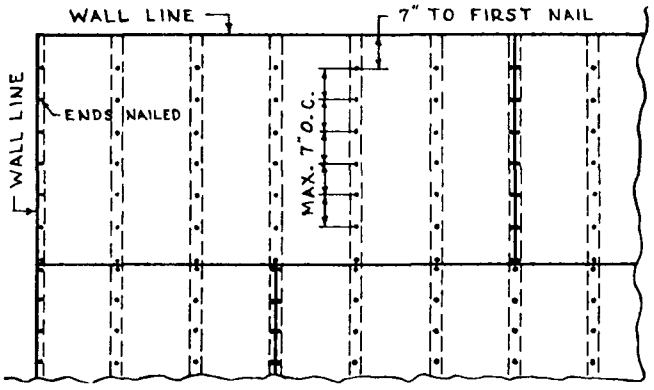
The "Floating Angle" method of application of gypsum wallboard was developed to reduce possible wallboard cracking caused by stress at intersections of framed walls and ceilings.

This method applies only to gypsum wallboard application when finished with tape and joint cement (an adhesive) treatment. Certain nails are eliminated in all interior angles, both at the horizontal angle where ceiling and sidewalls meet, and in the vertical angle where sidewalls intersect. The "Floating" interior angle application method may be used with (1) Conventional Nailing and (2) Double Nailing. The following changes apply to the above two nailing methods. When "floating" interior angles, changes apply only to nailing at angles. All other specifications remain the same. (Consult A.S.A. A97.1, 1958)

CONVENTIONAL NAILING METHOD

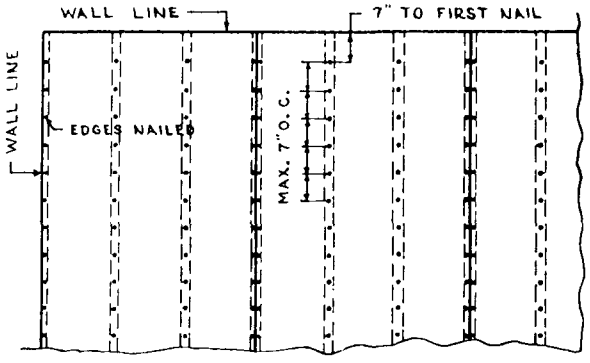
A. Ceilings – (Always apply ceilings first)

Horizontal Application. Use recommended framing practices for corner nailing. Wallboard must fit snugly into all corners. Conventional nailing shall be used where the ends of the boards abutt the wall intersection. At the wall-ceiling intersection where the long edges of the board parallel the intersection, the first nail shall be nominally 7 inches from the wall intersection. Conventional nail spacing shall be used in the remainder of the ceiling area.



CEILING – HORIZONTAL APPLICATION
(LOOKING UP)
CONVENTIONAL NAILING

Vertical Application. Conventional nailing shall be used where the long edges of the board abutt the wall intersection. At the wall and ceiling intersections where the ends of the board parallel the intersections, the first nail shall be nominally 7 inches from the wall intersection. Conventional nail spacing shall be used in the remainder of the ceiling area.



CEILING – VERTICAL APPLICATION
(LOOKING UP)
CONVENTIONAL NAILING

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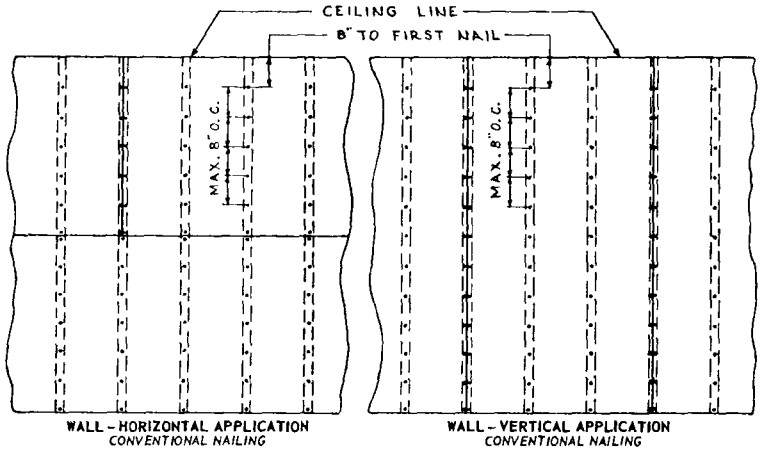
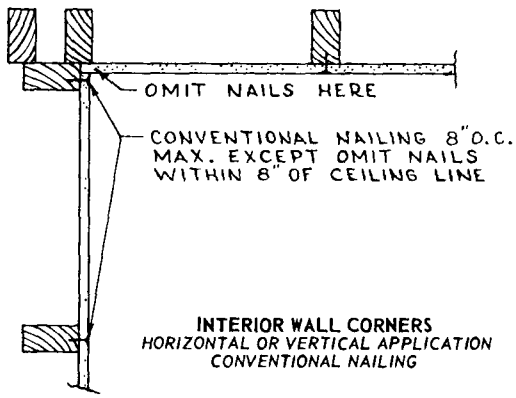
B. Sidewalls –

All wallboard must be applied to maintain firm contact at ceiling line, in order to support the ceiling boards previously applied. Along the ceiling intersection, omit nails directly at the ceiling angle. The first nail shall be nominally 8 inches from the ceiling intersection. At all vertical interior angles, omit only the corner nailing of the board first applied and to be overlapped in the angle. The overlapping board is to be nailed in the conventional manner, 8 inches on center. Conventional nail spacing shall be used in the remainder of the wall area.



WALL – HORIZONTAL APPLICATION
CONVENTIONAL NAILING

WALL – VERTICAL APPLICATION
CONVENTIONAL NAILING



INTERIOR WALL CORNERS
HORIZONTAL OR VERTICAL APPLICATION
CONVENTIONAL NAILING

DOUBLE NAILING METHOD

Refer to standard specifications for the "Double Nailing" method. Note that the perimeter nailing is the same as the "Conventional Nailing Method", but the field of the board is nailed in pairs (1-1/2" to 2" apart) approximately 12 inches on center on both sidewalls and ceilings. To adapt this method to "Floating Corners", follow the changes listed under Conventional Nailing Method as they apply to the perimeters of the gypsum board at the interior angles.

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RECOMMENDATIONS FOR USE OF WEDGE BLOCK IN HANDLING GYPSUM BOARD

A new wedge block has revolutionized the handling of gypsum board products. The wedge (Fig. 1 and 2) is simple in design and easy to use.

Before the advent of the wedge block, it was not unusual for two or even three men to fill orders. Now, the fork-lift truck operator can, by himself, handle any order. Stacking gypsum board is simplified too—with the added bonus of less dunnage.

The wedge blocks can be easily obtained from cabinet makers. Fig. 1 supplies all of the necessary specifications. Cost of the wedge is between $20 and $30. And, if the wedge is used with normal care, it will provide many years of satisfactory service . . . paying for itself over and again by reducing man-hours and damaged board.

A step-by-step procedure for using the wedge is shown on the reverse side of this bulletin.

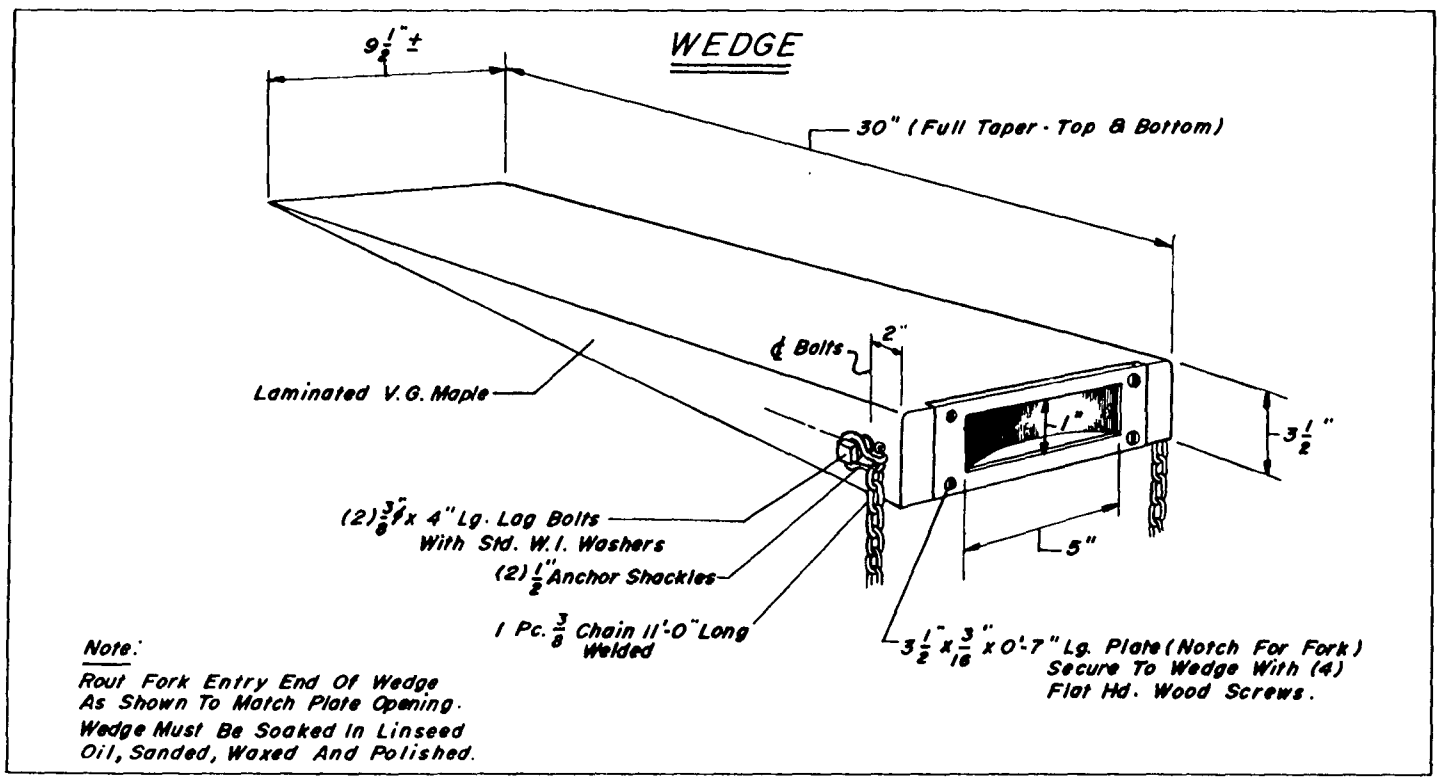

Fig. 1—These specifications can be used by a cabinet maker in your area to make the wedge block.

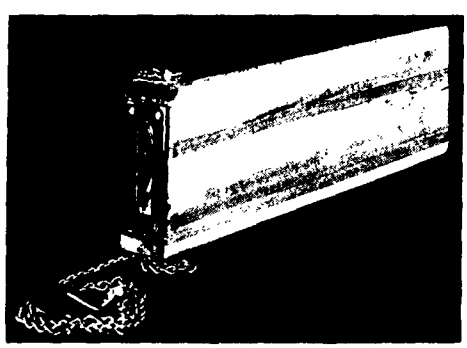

Fig. 2—
This photograph reveals the wedge block's laminated maple construction, notch for fork and chain for removing wedge.

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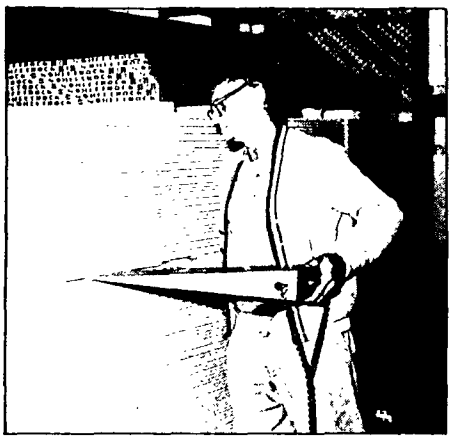
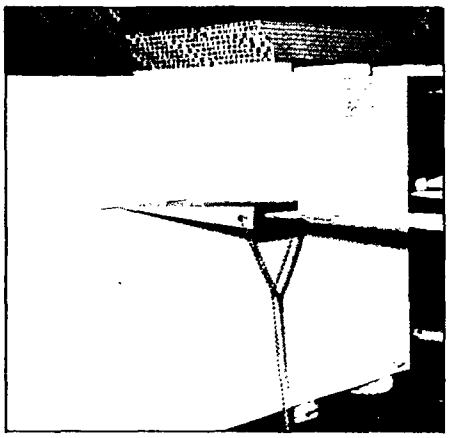
Procedure for Use of Wedge Block

Step 1

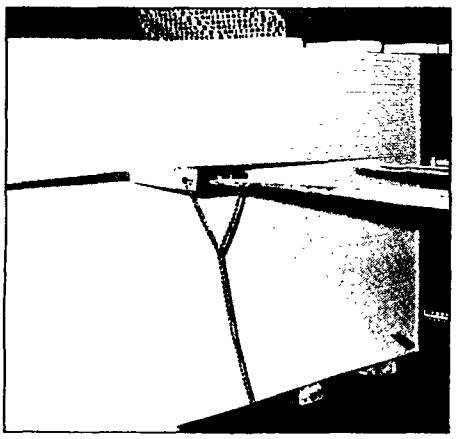


The fork-lift operator inserts the wedge by hand under the precise number of sheets required (left). He then mounts the truck and guides the fork into the special notch of the wedge block (right).

Step 2

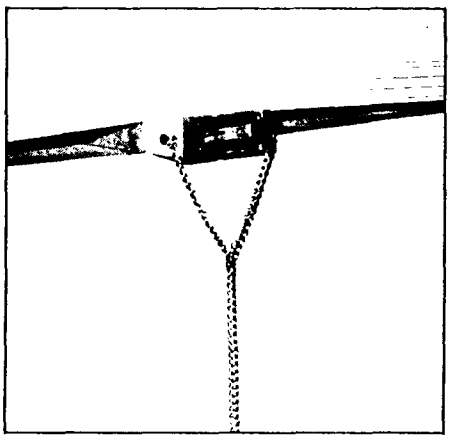


Step 3

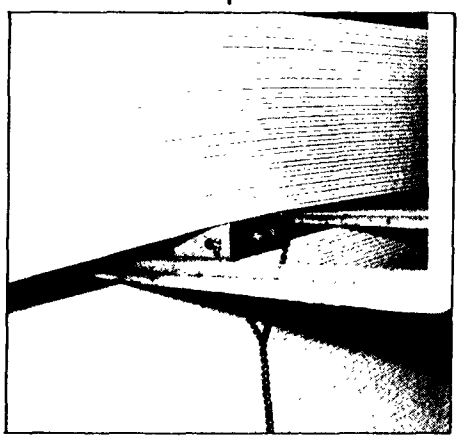


The fork-lift truck is then slowly moved forward, pushing the wedge block into the stack of board (left). When the wedge block is fully inserted, the truck is backed off—leaving ample space for insertion of forks (right).

Step 4

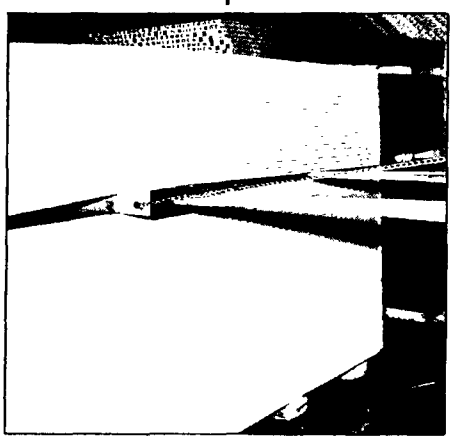


Step 5



The forks are inserted in space provided by the block and board is delivered to destination (left). Special feature of block (right) is chain which is fastened to truck for removing wedge after board has been stacked—eliminating dunnage.

Step 6



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