

HISTORICAL FILE

DO NOT DESTROY

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PLAINTIFF'S EXHIBIT

USG-1639

GYP SUM BOARD PRODUCTS

JOINT DEFORMATION - "RIDGING"

In 1940, only 10% of all new houses used gypsum wallboard dry wall construction, while today at least 50% use this method. This increase is due not only to the natural advantages of this type of construction but also, and to an even greater degree, to the marked improvement of workmanship during this period of time. The applicators who are today reinforcing and finishing joints have in general attained a quality of workmanship resulting in a degree of perfection of the completed job which five years ago was thought improbable.

The degree of perfection which is being reached on the better jobs has brought to light certain joint deformities which in the past were unnoticed and of little consequence because of overall mechanical irregularities. One of the principal deformities occasionally noted generally during cold or damp periods is that of the development of an apparent ridge running down the center of the joint. The ridge appears to develop some time after the joint finishing work has been completed. Our studies indicate that temperature and humidity changes are a major factor in the occurrence of this condition, particularly where such variations are substantial.

Temperature and humidity are climatic conditions which affect the performance of other common building materials. Expansion joints are used in concrete work to compensate for expansion and contraction due to temperature changes. Expansion and contraction of steel due to temperature changes are given consideration by designers of steel structures. Changes in humidity cause substantial dimensional changes in lumber. Dimensional changes can be, and many times are, extremely harmful to structures. Movement in steel, lumber or concrete has its effect on interior finishing materials. When the interior finishing material is plaster, cracks may result. It is also recognized that one of the principal causes of plaster cracking is thermal shock, which in reality is rapid changes in temperature. Further, great differences in temperature from one side of the wall to the other sometimes cracks plaster.

Architects and contractors have long recognized the effect of temperature and humidity conditions on building materials which have been widely used. Through experience they have learned that it is necessary to take certain precautions in order to minimize damage to their structures. Since joint ridging in dry wall construction is caused principally by changing temperatures and humidities, it is also necessary in this instance to take precautionary measures in order to get the best results.

When joints between gypsum wallboard panels are reinforced with tape and the tape concealed with cements in common use today, the cements, as they dry, set up a stress within themselves which tends to curl the gypsum wallboard at the edge. Under normal drying conditions and with relatively thin and narrow applications of cement over the joint, the gypsum wallboard can resist the stress without curling to the extent that it will not disfigure the job. However, under slow drying conditions, such as in cold or damp periods, the board has less resistance to this stress with the result that the board may curl and ridging may develop to the degree that it is objectionable.

Occurrence of ridging seems to be more prevalent in the fall, winter and spring months of the year when drying conditions are at their worst, and particularly when joint finishing is completed in unheated structures. We have observed during winter months, if joint treatment is applied in the normal manner in heated houses, the occurrence of ridging is practically negligible provided that ample drying time is allowed between coats of cement and that joints are finished relatively flat without undue crowning.

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During the past ten years our Research Department has made an exhaustive study of this problem. Based upon their work we have prepared the following recommendations designed to minimize the danger of ridging.

For best results we recommend the use of the job laminated SHEETROCK Double Wall System. Using this system, particular care should be taken in spreading the adhesive between the two layers out to the extreme ends and edges of the panels. Although ridging occurs on both side walls and ceilings, it is generally most noticeable in ceilings. Hence, if cost is a consideration, the principal objection can be minimized by using the two-layer system on the ceilings only.

Recognizing that not all jobs can afford the additional cost of the double wall system, our Research Department has developed a low cost method of reinforcing the back side of all ceiling joints. This method has been field tested and has proven a very effective method of minimizing ridging. The specifications and details covering this system are covered fully in the following pages. Applicators report the cost of installing the reinforcing strips at from \$7.50 to \$15.00 per house of average size. Applicators who have used this system extensively report uniformly good results and are outspoken in their praise of it.

The above described methods of minimizing the danger of ridging are the most positive means known to us.

The following are our recommendations to minimize ridging on jobs where neither of the two previously described methods can be justified from a cost standpoint.

1. Houses should be heated at least two days before joint treatment is started and fairly uniform temperatures maintained day and night until such time as the house is occupied. For best results the temperature within the house should be maintained at approximately 70°. However, we believe that temperatures in the neighborhood of 55° are satisfactory provided the humidity is not over 40. This requirement is in line with plastering recommendations.
2. Cements for embedding, fill and finish work should be used at their heaviest workable consistency.
3. Our recommended procedure for the embedding of tape should be followed; that is, to embed the tape and immediately follow up with a light covering coat which fills the channel formed by the two tapered edges relatively level with the adjoining surfaces.
4. At least two days' drying time should be allowed between the first and second coat of cement.
5. The fill and finish coats should be feathered out not wider than 10" except where additional feathering is necessary to compensate for board irregularities. In the case of butt joints, the extreme width of the cemented area under normal conditions should not be in excess of 20".
6. At least one days' drying time should be allowed between the second and third coats of cement.
7. At least four days' drying time should be allowed before sanding and decoration. The center

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of the finished joint should be sanded using a flat wood block backing the sandpaper to level off the finished area. If these practices are followed, it is our belief that job results will be uniformly as good during cold or damp periods as work completed during the dry summer periods, provided, of course, that the same skill in joint finishing is employed.

Our recommendations for correcting a ridging condition are as follows:

1. Let the ridge develop fully before repair is undertaken. It is almost impossible to tell how long it will take the ridges to develop, but usually under normal living conditions six months is sufficient time. If the ridge is repaired before it is completely developed it will continue to develop with the result that shortly after it is repaired it will again be visible and may be objectionable. It should be repaired under hot and dry conditions. By hot and dry we are referring to temperatures from 72° upwards and humidities below 40%.
2. Sand the ridge down to the reinforcing tape without cutting through the tape. Fill the concave areas on either side of the ridge with a light fill of thick mix cement. After this is dry, float a very thin film of cement over the entire area.
3. Examine the area with strong side lighting to make certain that the ridge has been concealed. If not, use additional coats of cement. If it has disappeared and casts no shadow, the area is ready for repainting.

Ridging, in its greater degrees of development, is easily identified in that all ceiling joints will probably be uniformly deformed. Generally, if only a few joints are visible, some other cause such as a twisted stud, starved joint or badly cupped recess may be responsible. Once ridging is noted the applicator and/or contractor, depending upon the circumstances, should be notified and advised of the precautions for minimizing ridging and the remedies.

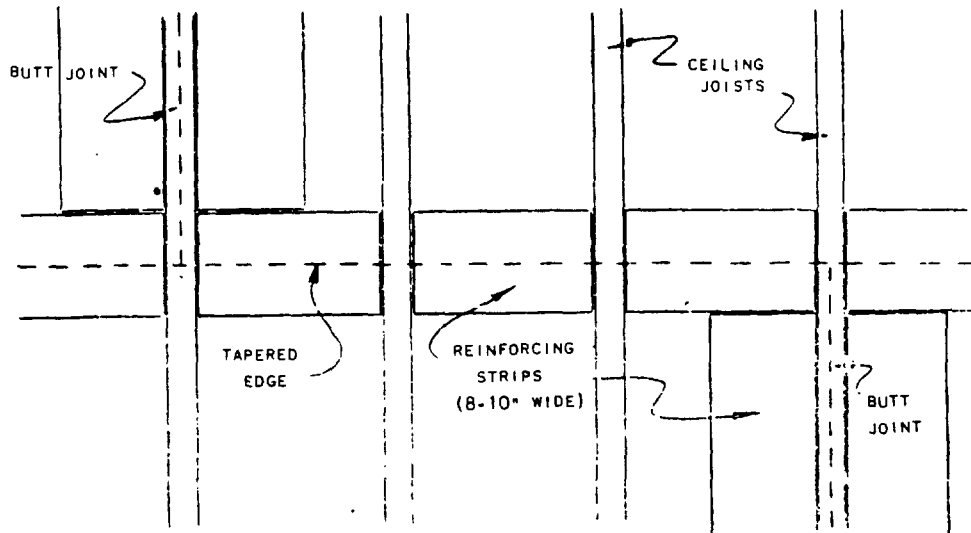
The recommendations which have been listed here are not unlike precautions which are cited for other standard wall and ceiling finishing materials. By following them, uniformly better jobs will be the result.

SUGGESTED REINFORCING SYSTEM DESIGNED TO MINIMIZE JOINT DEFORMATION IN SINGLE-LAYER GYPSUM WALLBOARD CEILING CONSTRUCTION.

Specifications

1. SHEETROCK shall be applied on ceilings with edges of panels perpendicular to joists, and nailed in accordance with USG specifications.
2. All joints at edges of panels shall be reinforced with strips of SHEETROCK cemented over the back of the joints in the spaces between joists, in such fashion that adjacent panels are "welded" together.
3. Reinforcing shall consist of SHEETROCK strips 8 to 10 inches wide, of suitable length to fit easily between joists without leaving more than 1 inch of joint uncovered in any space.

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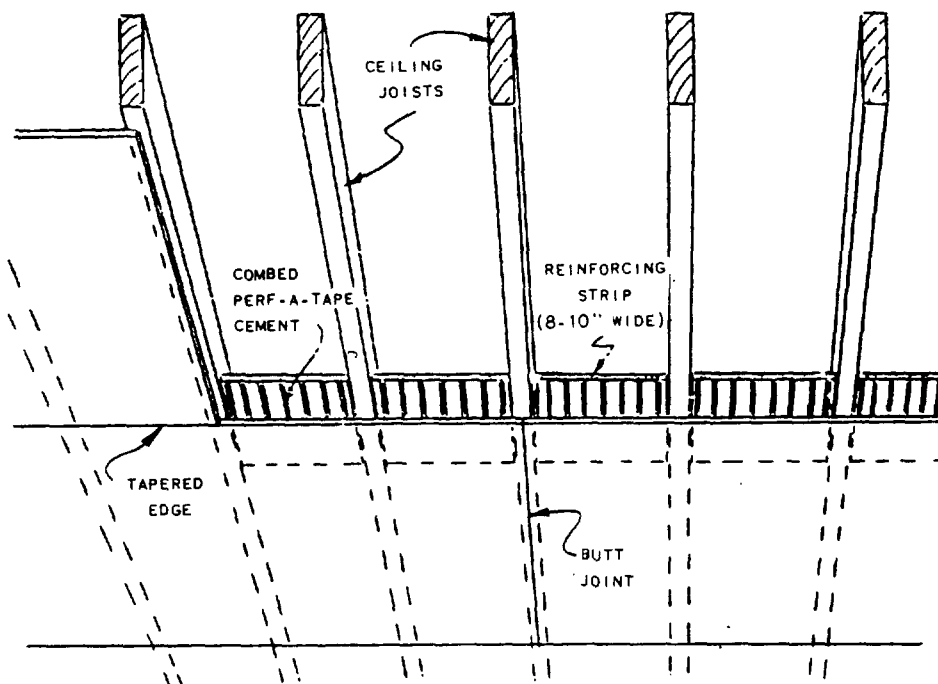
PLAN VIEW OF CEILING (As seen from above)

For reinforcing ceilings of 3/8" SHEETROCK strips of 3/8" or 1/2" SHEETROCK shall be used; for ceilings of 1/2" SHEETROCK, strips of 1/2" SHEETROCK only shall be used. Scrap SHEETROCK may be used for reinforcing, providing it is not cracked. (Note: Insulating SHEETROCK shall not be used for reinforcing).

4. Reinforcing strips shall be applied with PERF-A-TAPE cement, mixed in accordance with the manufacturer's directions, but to a slightly thinner consistency than is normally used for taping. The cement shall be applied to the strips using a notched spreader blade so that the lines of cement will extend across the joint, essentially at right angles thereto, when the strip is put in place. Cement shall be thus applied over the entire area of one side of each strip. The cement shall be used at a consistency permitting application of uniform and continuous adhesive lines, which do not appreciably slump or flatten out behind the spreader blade.
5. Immediately after application of adhesive, strips shall be installed in accordance with either (a) or (b) below:
 - (a) Reinforcing strips shall be installed from above after the SHEETROCK ceiling is applied. A strip is centered lengthwise over each joint between joists and pressed firmly down into place, using a slight sliding motion to obtain uniform adhesive contact and good bond.
 - (b) After each SHEETROCK panel is erected reinforcing strips with adhesive applied shall be put into place from below along the open edge of the panel in each joist space,

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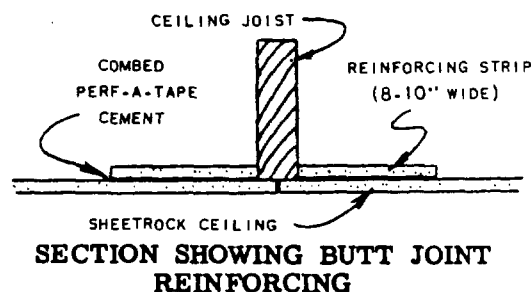
in such fashion that approximately one-half the width of the strip overhangs the edge of the panel.



VIEW SHOWING REINFORCING STRIPS INSERTED IN CEILING APPLICATION FROM BELOW

As soon as the strips have been so placed, the adjacent SHEETROCK panel is erected, exercising care to avoid excessive sidewise displacement of the reinforcing strips. Vibration from the nailing of this panel will create sufficient flow of the cement to bring the strips into good adhesive contact with both panels, across the joint. This operation shall be repeated until erection of the ceiling is complete.

6. After the cement is applied, installation of the strips shall be completed without delay, before the cement begins to stiffen appreciably by drying. (Note: If the cement is too thin or if the edges of the panels are loosely butted, cement may occasionally squeeze through the joint. Unless removed, this cement may cause difficulty in finishing the joint).
7. An essential similar procedure shall be followed for reinforcing end joints, except that strips shall be placed on each side of and as close as possible to the joist on which the end joint falls. Each reinforcing strip shall extend along the end joint as far as is permitted by the strips used for reinforcing the edge-joints. (Note: If the reinforcing is installed from above, after the SHEETROCK ceiling is erected, a single piece of appropriate



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size may be used in lieu of separate strips for reinforcement of adjacent end - and edge-joints). If reinforcing is installed after erection of SHEETROCK, the location of end joints shall be marked so that they can be readily identified from above.

8. Taping shall not be begun for at least 12 hours after the reinforcing has been applied.