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When Humidity Makes Wallboard Swell

Q: After I painted a recently finished wall clad with gypsum panels, I noticed depressions at the fastener locations. I know the wall did not have these imperfections prior to painting it. Can you explain what is happening?

A: This issue has come up in the past to the point where an informal study was undertaken to determine the root cause of the phenomenon. The condition was occurring even after four or five coats of joint compound were applied over the fasteners, and was independent of the type of framing, that is, wood or cold-formed steel framing.

Various environmental chambers, which are rooms where the interior temperature and relative humidity are controlled, were used to observe the impact of varying the temperature and humidity conditions. The goal was to reveal what may occur when conditions exist that are significantly different during the application of the finishing materials compared to the final conditioned space. An example of this would be going from a relatively high humidity condition such as 40 degrees and 80 percent relative humidity, or 90 degrees with 90 percent relative humidity to the final occupied condition that is near 70 degrees with 50 percent relative humidity.

The results indicate that environmental conditions do affect paper faced gypsum panels. Further, it was learned that the issue can occur based on two differing scenarios. The first is through application, while the second is the result of a rapid change in room conditions between time of application and final conditioned space.

It was deduced that the moisture and water within paint can cause gypsum panel face paper to irreversibly swell. This swelling then induced what appeared to be a depression at the fastener location. The testing also revealed that the amount of swelling varied with the type of face paper that was on the panel. Moisture resistant papers exhibited less expansion than regular papers. The use of airless spray equipment allows for the application of 'heavy bodied' latex paints. This exacerbates the problem for it results in more water impacting the surface paper of the gypsum board.

In another instance, gypsum panels whose surfaces were completely sealed from water penetration by latex paint exhibited excessive depressions at the fasteners after the test specimen was exposed to high temperature, high humidity conditions (90 degrees with 90 percent relative humidity) for 24 hours.

Moving on to the second scenario, a rapid change in humidity levels, either up or down, will induce depressions or protrusions at the fastener locations. Depressions at fasteners were observed when the environmental conditions had low humidity compared to the final occupied state. That is, the room transitions from 95 degrees with10 percent relative humidity to 70 degrees and 50 percent relative humidity. Conversely, protrusions at the fasteners may occur when the application conditions have high humidity and the final occupied state is 70 degrees with 50 percent relative humidity.

The results indicate that rapid changes in environmental conditions may result in paper facing expansion or contraction. This can occur even after a Level 4 or 5 finish has been applied to the gypsum panel. Level 4 is defined in ASTM C840, *Standard Specification for Application and Finishing of Gypsum Board*, as "Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compounds shall be smooth and free of tool marks and ridges. Level five has the added application of "a thin skim coat of joint compound that shall be trowel applied to the entire surface." The point here is that a surface anomaly can occur even after the highest level of finishing has been accomplished.

Documents are available to assist the contractor. Both the Gypsum Association and the Drywall Finishing Council offer advice for minimizing the impact of this phenomenon. The following is taken from the Drywall Finishing Council document, "Method for Inspecting Interior Joint Treated Gypsum Panel Surfaces:"

"Environmental Control – Temperature, humidity and airflow should remain constant, and as close to occupancy conditions as possible. The potential for finishing and decorating problems is minimal when job environmental conditions match occupancy environmental conditions. Controlling and maintaining environmental conditions is key. Changes and/or fluctuations in temperature, humidity and airflow can have a profound adverse effect."

The Gypsum Association in GA 214, *Recommended Levels of Finish for Gypsum Board, Glass Mat and Fiber-Reinforced Gypsum Panels*, suggests that "the potential for finishing and decorating problems are minimized when temperature, humidity, and airflow remain constant and as close to occupancy environmental conditions as possible. A minimum temperature of 50°F (10°C) should be maintained continuously for 48 hours prior to and throughout the finishing process until applied materials are thoroughly dry."

When jobsite conditions fall outside these guidelines, the contractor should document the variances and alert all to the increased risk for a potentially unsatisfactory completed wall or ceiling surfaces. The project has a higher probability of a successful finish when environmental conditions are controlled throughout the project and are close to the final occupied conditions. •

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