GA-227-2017
RECOMMENDATIONS FOR THE PREVENTION OF CEILING CRACKING

Every building material undergoes dimensional change when exposed to changes in temperature (thermal coefficient of expansion) and/or moisture content (hygrometric coefficient of expansion). As a result, all building assemblies undergo dimensional changes (i.e., shrinkage and expansion) as the moisture content and temperature change over time. The thermal and hygrometric coefficients of expansion are not the same for all materials, so the amount of dimensional change will differ for each component of an assembly. When two materials with different coefficients of expansion, such as gypsum panels and wood framing, are rigidly attached to each other stress will build up between the materials as their moisture contents and/or temperatures change.

The amount of dimensional change, as a percent of a material's original dimension, is generally insignificant and uneventful. However, the total amount of dimensional change is a function of the sum of the individual elements and when framing spans approach or exceed 15 feet (5m), the difference between the expansion coefficients of gypsum panel and wood framing is significant. Typically, in ceilings, the result will be cracks at gypsum panel joints located near the mid-span of the ceiling.

There are two common methods to reduce the occurrence of centerline cracks in the ceiling—the use of resilient channels or the installation of control joints. Consider using one of these techniques when the following conditions occur:

- Large ceiling areas where framing members span more than 15 feet (5 m).
- Where ceiling framing members change direction.
- Adjacent parallel framing members within the same ceiling area have different span lengths or different stiffness or rigidity.
- Areas with large temperature and humidity variation such as garages, etc.
- Interior areas that may be left unconditioned over long periods of time.
- Improper placement of bottom chord splices of floor and ceiling joists. In-line bottom chord splices typically cause problems.

Resilient channels allow a less rigid attachment of the gypsum panel to wood framing. By structurally separating these two materials with resilient channels, each material is allowed to shrink or expand independently of the other thereby reducing stresses. When using resilient channels:

- Attach resilient channels perpendicular to the framing and then attach the gypsum panel perpendicular to the channels. This creates a ceiling system with isolation between the framing and gypsum panels. Movement inherent in the framing is decoupled by the metal leg of the channel, reducing stress on the panel joints.

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When the layout of the system does not allow perpendicular placement, cross bracing should be installed for attachment of the resilient channels. Perpendicular placement of resilient channels to framing serves to isolate structural movement and allows for optimal sound dissipation.

- Orienting resilient channel perpendicular to framing results in the taped edge joints of gypsum panels being oriented parallel to the long dimension of the ceiling framing where the joints are not subjected to the compressive and tensile forces created as the trusses or joists deflect.
- Spacing the resilient channels 16" (406 mm) o.c., versus 24" (610 mm) o.c. provides additional framing support for attachment of gypsum panels. This improves the strength of the system which minimizes the occurrence of ridging and cracking.
- Where trusses or joists change direction, the resilient channels should be installed to run in one direction. The addition of blocking will enable resilient channels to always be installed perpendicular to framing. The resulting gypsum panel joints will span truss direction changes and lead to a more uniform finish.

Unlike resilient channels, control joints allow for movement to occur in a specific location, the control joint itself. When utilizing control joints:

- Interior ceilings without perimeter relief: Control joints in direct applied or suspended ceilings without perimeter relief shall be installed so that linear dimensions between control joints does not exceed 30 ft. (9 m) and total area between control joints does not exceed 900 ft2 (81 m2).
- Interior ceilings with perimeter relief: Control joints in suspended ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50 ft. (15 m) and total area between control joints does not exceed 2500 ft2 (225 m2).
- A control joint or intermediate blocking should be installed where ceiling framing members change direction.

The use of either method will decrease the occurrence of centerline cracking. Typical dimensional stability values for gypsum panels is shown in Table 1, below:

Thermal Coefficient of Linear Expansion (typical) Unrestrained 38°- 90°F (3.3°- 32°C)
9.3×10^{-6} in./in.°F (16.7×10^{-6} mm/mm•°C)
Hygrometric Coefficient of Expansion (typical) Unrestrained (10% - 90% RH)
6.5×10^{-6} in./in./%RH (mm/mm/%RH)

Table 1: Typical Dimensional Stability Values of Gypsum Panels from GA-235 *Gypsum Board Typical Mechanical Physical Properties*

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