Expansion Characteristics of James Hardie® Siding Products

Technical Brief 05

Scope

As with all building materials, James Hardie fiber cement siding products can expand and contract with changes in temperature and relative humidity. James Hardie recommends designing for this type of movement on buildings with long runs of continuous siding.

Temperature Movement

The following expansion value should be used for considering this type of movement as a result temperature changes of the product in a given climatic environment.

Coefficient of Thermal Expansion (COTE) per ASTM E228 is:

- Longitudinal COTE = 6.7X10E-6 in/in°F
- Transverse COTE = 7.65X10E-6 in/in°F

Worked Example:

Consider the case, where HardiePlank® lap siding (8.25" wide by 12' long) is installed in January in Chicago, IL and there is approximately a 30°F daily temperature swing (18°F - 48°F) of the product. The linear expansion of the product that can be expected as a result of this temperature swing with the given COTE is calculated below. The longitudinal direction is the 12-ft (144-inches) direction of the product and the transverse direction is the 8.25-inch. The calculation will be done based on the longitudinal direction for this example.

Linear expansion equation: $\Delta L = L_0\, a(T_1 - T_0)$ *where,*
ΔL = *change in length (inches)*
L_0 = *initial product length (inches)*
a = *Coefficient of Thermal Expansion (in/in°F)*
T_0 = *initial temperature (°F)*
T_1 = *final temperature (°F)*

$\Delta L = (144\text{-in})^*(6.7\text{X}10\text{E-}6\ \text{in/in°F})^*(48°\text{F} - 18°\text{F})$
$\Delta L = (144\text{-in})^*(0.0000067\ \text{in/in°F})^*(30°\text{F})$
$\Delta L = 0.029\text{-in}$

This means that during the 30°F daily temperature swing, a piece of 8.25" wide x 12' long HardiePlank lap siding can be expected to move 0.029-inches, which in layman's terms is roughly 1/32th of an inch, in the longitudinal direction.

Relative Humidity/Moisture Movement

The following expansion value should be used for considering this type of movement as a result of the moisture content changes in the product due to the product equilibrating to the different Relative Humidity (RH) levels of a given climatic environment.

Moisture movement per ASTM C1185 (30% RH to 90% RH) is: 0.05% of length.

Worked Example:

For the purposes of this example, we will look at what this means for the long direction of a piece of HardiePlank™ lap siding (8.25-in wide by 12-ft long). The calculation for this is shown below:

Moisture Movement equation: $\Delta L = L_0\ 0.05\%$ *where,*
ΔL = *change in length (inches)*
L_0 = *initial product length at 30% RH (inches)*

$\Delta L = (144\text{-inches})^*(0.05\%)$
$\Delta L = (144\text{-inches})^*(0.0005)$
$\Delta L = 0.072\text{-inches}$

This means that the most a piece of 8.25-in wide x 12-ft long HardiePlank lap siding can be expected to move as a result of the moisture content changes in the product due to the product equilibrating at 30% RH then at 90%RH is 0.072-inches, which in layman's terms is roughly 1/16th of an inch, in the long direction.

It is the responsibility of the licensed design professional, when using our products as part of the wall assembly to:

- Adhere to all the installation requirements listed in the relevant product installation instructions.
- Design a wall assembly that actively manages moisture considering both interior and exterior environments of the building, particularly in buildings that have a high risk of wind driven rain penetration, that are artificially heated or cooled, or contain indoor pools/spas.
- Understand the interaction between system components with respect to expansion characteristics

Please be advised that James Hardie provides a limited product warranty covering the product only. James Hardie is not responsible for system design or installation.