



Solar Reflection and Heat Distortion

Distortion of materials and products due to the concentrated reflection of sunlight from a neighboring surface is infrequent and occurs only with an unusual combination of conditions. In this document, the Vinyl Siding Institute (VSI) has outlined the currently available information related to this phenomenon and its effect on vinyl siding in particular.

Introduction

- Temperatures necessary to cause significant distortion of vinyl siding are not routinely achieved, even when siding is exposed to both direct sunlight and the reflection from normal, flat window glass. In cases where distortion has occurred, mechanisms that tend to increase the intensity of the reflected sunlight above natural levels are usually found.
- The issue is complex and is affected by product characteristics, environmental and climate factors, and circumstances unique to each occurrence, and is not limited to vinyl siding. Other building materials may suffer blistering or other forms of surface degradation, discoloration, or reduced service life. There are reports that outdoor items such as solar collectors, painted surfaces, wood products, and automobile parts have been damaged by abnormally reflected sunlight. Cases also have been reported in buildings under construction where the weather resistant barrier has been damaged by solar reflection before the cladding was applied. It can be expected that the lifetime of other building materials, including paints, other finishes, and wood products will be adversely affected by long term exposure to high-intensity reflected sunlight.

Contributing Factors

- Insulating glass Low-E windows and vinyl siding bring proven performance and substantial environmental benefits to a home. However, certain unusual combinations of environmental conditions and product characteristics can cause abnormally high temperatures to develop on vinyl siding and other products. The phenomenon is partially the result of desirable innovations in both windows and siding.
- Energy efficient Low-E windows work by reflecting a greater percentage of sunlight, especially in the infrared "heat" wavelengths. Insulating glass units are made of two or more panes of glass that are hermetically sealed at the edge, trapping an insulating layer of air or other gas in between. When the pressure between the panes of glass is different from the atmospheric pressure, the glass is designed to bend slightly. When the glass deflects inward, this creates a concave reflective surface that concentrates the reflected beam of sunlight. Objects in the path of the beam may be subjected to temperatures well in excess of those from normal exposure to the sun.

- The severity of the exposure depends on a number of factors, including climatic conditions and the relative positions of the sun, the window, and the siding or other products; and the size of the window, curvature of the glass and absorption characteristics of the products. Where the conditions come together in a specific manner, siding and other products that are struck by this narrowed beam of sunlight will be at greater risk of being raised to their heat deflection temperatures. It must be emphasized that both the windows and the siding are functioning normally, and that unless a particular combination of environmental circumstances occurs, both products serve their intended purposes without incident.

Remediation Strategies

- The National Association of Home Builders (NAHB) Building Products Issues Committee has conducted a review of the issue. They formed a task group to collect and evaluate available information on the issue and in February 2010 released a report of their findings titled *The Effect of Reflected Sunlight from Low-e and other Double Paned Window Glass on Vinyl Siding*. The NAHB report helps to provide a clear understanding of this issue from a third party and outlines how siding distortion from reflected sunlight might be remedied, or even avoided, in the future.
- Certain steps can be taken to reduce the potential effects of concentrated sunlight. Anything that blocks the path of sunlight, either to the window or between the window and the siding or other products, will eliminate or reduce the problem. This includes the strategic placement of trees, bushes, or other landscaping elements and the use of sunshades above windows. Screening applied to windows may reduce the total amount of reflected energy sufficiently to avoid the problem. Homeowners also can contact the builder, contractor, or manufacturers of the windows and the siding to address their specific situation.

Additional Information

- While the vast majority of vinyl siding is made primarily of polyvinyl chloride (PVC), it can also be made of chlorinated polyvinyl chloride (CPVC), which has a higher softening temperature. However, the formulation and manufacturing of CPVC-based vinyl siding is different from that of PVC-based siding, which means that it may not function as an appropriate replacement for regular siding in all cases. The higher cost of CPVC siding may also not be justified for the vast majority of homes that are not subject to conditions likely to result in distortion.
- Concentrated sunlight reflected from multiple-pane windows has been found to create temperatures on surfaces well into the mid-200° F range; well above those found under normal environmental conditions. While CPVC has a higher softening temperature, it is not immune to the conditions that can be created by abnormal solar reflection. It has been suggested that CPVC be used in all vinyl siding. CPVC-based siding may be useful for

addressing the circumstances in specific cases, but should not be assumed to be a universal solution.

- Siding made from PVC already meets high quality standards. In fact, vinyl siding is the only exterior cladding with both third-party product certification and certified installer programs, both of which are administered by an accredited, independent quality control agency to ensure that products and colors meet or exceed ASTM standards and that installers demonstrate knowledge of ASTM-accepted application techniques.
- Through the *VSI Product Certification Program*, certified vinyl siding is verified to meet or exceed *ASTM D3679*, the standard for vinyl siding quality, in areas such as weathering performance, color, gloss, windload resistance (withstanding wind pressures of at least 110 mph), surface distortion, impact resistance, flammability, heat shrinkage, linear expansion, camber, length, width and thickness.