

# DOCKET

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**Before the California Energy Commission  
Docket No. 12-BSTD-01  
2013 Building Energy Efficiency Standards**

**Comments of Cardinal Glass Industries on the 15-Day Language:  
2013 Proposed Building Energy Efficiency Standards**

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Cardinal Glass Industries\* submits the following comments on the fenestration requirements, both residential and nonresidential, in the Staff Proposed Draft 2013 Building Energy Efficiency Standards (15-Day Language). Cardinal has participated in multiple Staff workshops for the 2013 Rulemaking, through WebEx and in person, and attended and testified at the Commission's hearing on the 45-Day Language. These written comments follow-up on the remarks we have made previously, both in writing and at the workshops.

**I. Cardinal Supports the Proposed Window Prescriptive Path Values**

Through written comments and testimony, Cardinal has consistently supported the prescriptive compliance approach window requirements that are included in the 15-Day Language. We firmly believe that the analysis presented during the workshops, as well as our own considerable experience, demonstrates that the proposed new prescriptive compliance approach requirements for residential and nonresidential windows are cost-effective and will generate substantial additional energy and peak demand savings for California. The proposed prescriptive window values are equal to, or better than, the requirements of the recently published newest edition of the national residential model energy code, the 2012 International Energy Conservation Code (IECC), and are the proper step forward to carry the state until its next Standards update.

Cardinal appreciates the opportunity to actively participate in the development of these new Standards. Throughout this process, we have offered numerous comments and recommendations with the ultimate goal of developing the best, most cost-effective window and door Standards for California. Staff agreed with many of our suggestions, and has made changes along the way to improve the Standards. While we may not

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\* Cardinal Glass is the national leader in manufacturing high performance low-E coatings and insulating glass units used in fenestration. Cardinal is a management-owned corporation headquartered in Minnesota with 5,500 employees and 27 manufacturing facilities nationwide. Cardinal has two facilities in California that produce the type of coated glass products currently required by California Standards, as well as products that would meet the new standards proposed during the Staff Workshop. Cardinal also has facilities that produce float glass, tempered glass and insulating glass units on the West Coast. Over the past two decades, Cardinal has actively participated during California's standards updates and has participated nationally in the model code development process.

agree with every aspect of the 15-Day Language, we believe the 2013 Rulemaking is an enormous improvement over the current Standards, and we support and recommend adoption of the 15-Day Language.

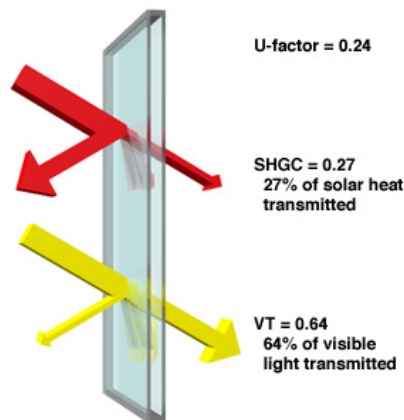
**In our August 5, 2011 and October 31, 2011 written comments (both residential and nonresidential), we provided significant data and supporting reasons for setting baseline window U-factor and SHGC criteria that encourage the use of high performing low solar/high VT low-E glazing, which is both cost-effective and widely available. We intend our comments below to be cumulative to our August 5<sup>th</sup> and October 31<sup>st</sup> comments and therefore have not repeated all of that information here, but instead incorporate our prior comments by reference.**

Specifically, Cardinal fully supports the proposed maximum U-Factor, maximum SHGC and minimum VT requirements that will become the prescriptive compliance approach for residential and nonresidential windows. California will be taking a tremendous step forward by requiring the best available, cost-effective low solar gain low-emissivity glazing capable of providing cooling, heating and lighting energy savings through the combination of improved U-Factor, SHGC and VT requirements in the new Standards. By establishing a minimum VT requirement for nonresidential windows, California has also set a new benchmark for lighting savings beyond what would be achieved through adoption of either of the model codes. Both ASHRAE and the IECC have included far more complicated and less effective visible light requirements through ratios and effective apertures. The prescriptive minimum VT requirements in the 15-Day Language are the simplest, most effective visible light standards we have observed in our code development efforts, and we support Staff's initiative in incorporating such a measure.

**A. The Proper Targets for Establishing Prescriptive Requirements in California Are Performance Levels Achievable with Low SHGC/High VT ("Triple Silver") Low-E Glass**

Cardinal's comments throughout the rulemaking process have emphasized the importance of setting appropriate "technology point" metrics to achieve the desired savings. Cardinal is the national leader in manufacturing low SHGC/high VT low-E coatings, specifically what the Staff and CASE authors have termed "triple silver" (referring to the type of low-e coating) or "low-E with a low SHGC." Cardinal supports the requirements in the 15-Day Language that require reasonably low SHGCs and high VTs as the optimal, cost-effective approach to fenestration in all buildings in California. This glazing will also produce reasonably robust U-factors as well. We agree that low SHGC/high VT low-E glazing should be the prescriptive standard and performance baseline, and we support requiring this type of glazing across the board in the prescriptive path (all climate zones; all product types; all window areas).

Low SHGC/high VT (triple silver) glazing represents a significant opportunity for increased energy efficiency by saving energy/energy cost, particularly high-priced on-peak energy; reducing electric utility system peak demand and the sizing of cooling systems; and improving the overall occupant comfort levels. The graph below from the Efficient Windows Collaborative (EWC) website illustrates the unique properties of low SHGC/high VT low-E glazing in blocking unwanted solar gain, while transmitting high visible light and producing low glazing U-factors.



[www.efficientwindows.org](http://www.efficientwindows.org)

*The EWC is a collaborative effort of Lawrence Berkeley National Laboratory, University of Minnesota Center for Sustainable Building Research and the Alliance to Save Energy and is funded, at least in part, by the US Department of Energy.*

Since windows are rated by the National Fenestration Rating Council (“NFRC”) inclusive of the frame, the glass values shown above must be converted to whole-product values with frames – for example, a 0.27 SHGC glass typically translates to a whole product SHGC well below 0.25 and a whole product VT generally above 0.40 (at least for fixed frames). Ultimately the whole product values for U-factor, SHGC and VT vary depending on the type of frame, whether the frame is fixed or operable, and the percentage of frame to glass.

#### **B. Establishing a Reasonable Minimum Visible Transmittance (VT) for Nonresidential Fenestration Is Well Justified Based upon the Record**

Windows are the source of significant solar heat gain, particularly in commercial structures, which have significant internal and external heat gains. Even in colder climates, cooling energy use is typically the most significant load for commercial structures. Because of this fact, most commercial energy codes have appropriately focused on establishing low SHGCs to offset cooling energy use and lower peak demand. However, traditional solutions to blocking solar gain sacrificed visible light by using much darker glazing. The benefit of a product like low SHGC/high VT low-E glazing is

that it provides excellent solar heat gain reduction without losing nearly as much visible light as other glazing types. This glass technology point currently represents the best available combination of low SHGC, low U-factor and high VT. To ensure maximum natural light is available (or at least the energy savings associated with it), a minimum VT makes the most sense as the simplest and most effective metric in the context of a prescriptive compliance approach. We agree with the conclusion of the CASE study and support setting a minimum VT to help ensure daylighting associated savings.

Setting a prescriptive minimum VT ensures maximum natural lighting and minimum artificial lighting in the energy baseline. As the CASE authors' analysis bears out, the more daylighting that is provided, the more likely internal electric lighting and resulting electric loads are reduced at peak times during the day, which provides a series of benefits beyond the obvious lighting electricity reductions, such as reduced cooling loads due to lower internal heat generated from lighting and, therefore, reduced cooling energy use to offset the lighting "heat" load and associated lower peak demand.

**C. The Low U-Factor, Low Solar Gain and High Visible Light Glazing Required by the Standards Is Widely Available**

Early on in the proceedings, we observed a few comments filed in the BSTD Docket Log and witnessed some discussion during the workshops questioning the availability in California of low solar gain/high VT low-E glazing capable of meeting the maximum SHGC and minimum VT requirements. Through this process, sufficient data has been presented both in comments and at the workshops to prove that the low solar low-emissivity glazing capable of meeting the proposed Standards (residential and nonresidential) is both cost-effective and readily available to window manufacturers. Windows and doors with this glazing are already available to and in use by the building industry. Multiple workshop participants, in addition to Cardinal, correctly pointed out that this glazing is readily available to all window manufacturers from most of the major U.S. glass manufacturers (including Cardinal, which currently manufactures this product in its California facilities) in a wide array of window products, including the most challenging frame types. We provided examples of such products in our prior comments.

We have also noted in our comments and during the workshops, but it bears repeating, that as early as 2009, 51% of the millions of window products listed in the NFRC Certified Products Directory had SHGCs of 0.25 or better. Product research shows that conforming windows are already sold in California from numerous window manufacturers. Moreover, our experience tells us that adoption of the proposed new Standards will only increase the availability of these products.

## **II. Important Revisions that the Commission Should Consider in the Next Standards Update**

As stated at the outset, Cardinal fully supports the 15-Day Language and recognizes the significant improvements the 2013 Rulemaking will produce over the current Standards. In no way intending to detract from Cardinal's solid support for the 15-Day Language, we would like the Commission to be aware that there still are opportunities to improve the Standards beyond the 2013 Rulemaking. Cardinal has commented in writing and in public testimony during workshops and at the 45-Day hearing explaining these specific opportunities. Mindful of Staff's and the Commission's desire to complete the 2013 Rulemaking, we are proposing the following suggested improvements for Staff's and the Commission's consideration in any future revision to the Standards (of course, if the Commission chooses to make further changes to the proposed Standards after the upcoming public hearing, we recommend these proposed changes for consideration). We are hopeful that the Commission can act now to identify these items as priorities for the next round of the Standards.

### **Residential:**

#### **1. Set a Lower Mandatory Maximum U-factor**

To ensure peak demand savings, optimal equipment sizing and occupant comfort, the IECC has included mandatory maximum U-factor and SHGC requirements since its 2004 version. We fully support the Commission's establishment of a similar mandatory fenestration U-factor requirement in the 15-Day Language, in Section 150.0(q). However, we think the Standards' 0.58 U-factor should be much lower to make it more effective and beneficial to occupants. The proposed 0.58 U-factor window is capable of being met by most average double-pane clear glass units. Because much of the California market has already transformed to double-pane products, and most with low-E glazing, the proposed 0.58 mandatory maximum U-factor will have little implication in practice, and we recommend lowering the value to create a proper backstop and require some form of low-emissivity glazing be used throughout the state. A mandatory maximum 0.40 U-factor would be sufficiently low enough to ensure low-e coatings were used, but also would leave sufficient room above the prescriptive U-factor requirements for flexibility in the performance compliance approach.

There is no reason why California should continue to allow the use of excess amounts of clear glass in homes, even in passive solar designs, which could benefit from lower U-factors (and SHGCs on the appropriate orientations).

- **We recommend that the Commission lower the mandatory maximum U-factor to 0.40 for all California climate zones in the next Standards update.**

## **2. Establish a Mandatory Maximum SHGC**

We recommend that the Commission institute a mandatory maximum SHGC requirement, which seems to have been excluded due to some concerns over limitations on passive solar design. It was apparent during the October 14th workshop that many stakeholders saw the clear value and benefit in establishing a mandatory maximum SHGC. At the same time, we acknowledge that a few stakeholders commented it was important to protect the ability to build passive solar designs. There was discussion during the workshop about establishing a mandatory maximum SHGC in conjunction with a workable passive solar design exception; however, no action was taken on this front in the proposed Standards. While we believe that the weighted-average compliance option satisfies this concern (high SHGC windows can be used on the appropriate exposures while using low SHGC windows for the remainder of the home and still meet a weighted average maximum SHGC), we can also support exempting south-oriented glazing from the SHGC mandatory requirement. These simple approaches would remove any hindrance to passive solar designs. Moreover, if meaningful maximum U-factors and SHGCs are established, occupants of passive solar design will have the benefit of lower SHGC windows on the non-southern orientations.

- **We recommend that the Commission establish a mandatory maximum 0.40 SHGC (while exempting south-oriented glazing, if deemed necessary) for all California climate zones in the next Standards update.**

## **Nonresidential:**

### **3. Delete Equation 140.3-B Regarding Vertical Fenestration Minimum VT**

The 15-Day Language includes a window-to-wall ratio (WWR) formula exception (Equation 140.3-B) to the prescriptive minimum VT requirement for nonresidential glazing. We understand that a few commenters believe that this WWR equation is a necessary exception to the prescriptive VT requirement. We strongly disagree. First, the VT requirement is already an area-weighted average, which allows for the design flexibility that was cited as a primary reason why this equation was included. Second, this type of issue should be addressed through the performance path, not through a prescriptive formula. The result, when

using a formula like this one, which is not equivalent to the prescriptive values, is that users will have an incentive to game the system by using whichever option produces the least stringent requirement. The WWR equation also undercuts the purpose of a simplified prescriptive path. Prescriptive paths are designed to be straightforward and easy to follow, giving users and manufacturers a clear indication of the required values for ease of compliance and market transformation. The WWR equation adds an unnecessary layer of complexity and confusion. In addition, the WWR equation will allow users to install darker glazing and fail to achieve the lighting energy efficiency savings that were forecast by the CASE authors.

During the hearing on the 45-Day Language, Staff commented that they view the WWR equation as a temporary measure, and they will seek to delete the exception in the next Standards update cycle. We support this commitment.

- **We recommend that the Commission delete Equation 140.3-B and eliminate any WWR exception in the next Standards update.**

#### **4. Ensure that Equation 140.3-B Cannot Be Used for the Performance Compliance Approach**

To follow-up our immediately preceding comment in opposition to the WWR exception in Equation 140.3-B, we believe the Commission must clearly state that the WWR equation cannot be used to avoid the minimum VT requirements through the performance compliance approach. In other words, the baseline reference design must be based upon the minimum prescriptive VT requirements in Tables 140.3-B & C, and not be based upon the WWR equation. Allowing the baseline VT to be set by the WWR equation could allow users to trade-off from a lower baseline, thereby significantly undercutting the expected daylighting savings from the minimum VT requirement.

We have been informed by Staff that the Nonresidential Alternative Calculation Method (NACM) Reference Manual is currently being prepared. Staff has acknowledged our concern and indicated the NACM Reference Manual will clearly state that Equation 140.3-B cannot be used in the performance compliance approach.

- **We recommend that the Commission eliminate Equation 140.3-B from the NACM Reference Manual and take all other appropriate actions necessary to ensure that Equation**

**140.3-B cannot be used as the baseline for the performance compliance approach.**

**5. Convert from the RSHGC approach to SHGC.**

We believe the approach in the nonresidential Standards that references a maximum Relative Solar Heat Gain Coefficient (RSHGC) for glazing is too complicated and should be abandoned for a simple maximum SHGC approach, just like the approach used in the Standards for residential glazing. Setting a straight SHGC requirement would tie the prescribed values to product ratings that can be easily matched to the tables, rather than requiring a complicated formula to comply prescriptively. Other residential and nonresidential building efficiency standards (IECC, ASHRAE, etc.) all use whole product SHGC values and not RSHGC as the standard.

We understand that the RSHGC formula is an attempt to account for the use of projections/overhangs. We prefer no adjustment for projection factor in the prescriptive path (this does not preclude overhangs; it just does not give them extra credit) and that any credit for overhangs be left to the performance compliance approach. However, if California wishes to allow adjustments for overhangs in the prescriptive path, then we suggest an approach like the model codes that starts with a baseline set of prescriptive SHGC requirements assuming no overhang and then establishes a simplified adjustment methodology (or alternate values) to account for overhangs. For example, the 2012 IECC includes simplified SHGC adjustment multipliers based on ASHRAE values (IECC Table C402.3.3.1) which can be applied to the prescriptive SHGC criteria.

- **We recommend that the Commission eliminate RSHGC and replace it with SHGC for nonresidential buildings in the next Standards update.**

**6. Delete the 1,000 square feet Exemption to NFRC**

We have commented previously, during the workshops and in writing, in full support of deleting Appendix NA6 and the 2008 Standard's 10,000 square feet exemption from NFRC ratings for U-factor, SHGC and VT. We were pleased to see in earlier drafts of the 2013 Rulemaking that the 10,000 square feet exemption was deleted entirely. However, against our recommendation, the NFRC exemption was reinstated as exceptions to Section 110.6(a)2, 3 and 4, albeit at a much lower level of 1,000 square feet.



While we believe that the much lower square footage limitation on the exception is an important improvement, we think it is a mistake to retain this exemption in any form. We feel even 1,000 square feet is still a high amount of exempt glazing that will deter full market transformation to NFRC in California. Retaining exemptions like these in the Standards only makes it harder to fully transition to NFRC ratings in nonresidential applications. The 2013 Rulemaking already has default tables and does not also need this exemption.

- **We recommend that the Commission eliminate Exception 1 to Section 110.6(a) (the 1,000 square feet NFRC exemption) in the next Standards update.**

#### **7. Delete Table 141.0-A for Windows in Nonresidential Alterations**

The simple and straightforward compliance approach for all windows (for new buildings, additions, replacements and alterations) is to simply reference the values in the prescriptive compliance tables as the baseline requirements for all. The lone exception in the proposed Standards to this straightforward approach is for windows used in nonresidential alterations through Table 141.0-A. It is not clear why this nuance exists.

This new alterations-only table creates a number of concerns. First, it is not clear why windows in nonresidential alterations require a customized table. Second, the values in Table 141.0-A are much less stringent than the prescriptive values for glazing in new buildings. Third, the new table is different from the other nonresidential window requirements because it reintroduces different window requirements for different climate zones for nonresidential building alterations. The glazing requirements for new nonresidential buildings and windows in additions and as replacements are not climate zone dependent.

The first draft of Table 141.0-A mistakenly did not include a minimum VT requirement, but this problem has since been corrected so the table now requires windows in nonresidential alterations to meet the same minimum VT requirements as new nonresidential windows, which we support. This approach of simply referencing for nonresidential alterations the same requirements for U-factor and SHGC that are in place for new windows should be implemented in the next Standards update.

- **We recommend that the Commission eliminate Table 141.0-A in the next Standards update.**

### **III. The New Requirements in the 2013 Rulemaking Will Create Quality Jobs in California**

Low solar gain/high VT low-emissivity glass that will meet the new Standards is already manufactured in California. For example, Cardinal has a coated glass facility located in Galt (about 30 minutes south of Sacramento), and other manufacturers also produce this type of glass. Cardinal's Galt facility has capacity to ramp up production to supply the coating needs for windows to meet the new Standards, and this increased production will translate directly into quality jobs for California.

We believe that improvements in the Standards will have similar positive impacts on other industries in the state and region. The Commission's vote to adopt the 15-Day Language will not only provide meaningful demand and energy savings for homeowners and businesses, but because of the local manufacturing presence, the new Standards will also spur more investment and production by California manufacturers. The new Standards will mean more jobs and help improve the California economy.

### **IV. Conclusion**

In summary, Cardinal fully supports the 15-Day Language for the 2013 Rulemaking of the Title 24 Building Energy Efficiency Standards as they pertain to windows. These changes will improve the Standards to be equal to or better than the 2012 IECC, a key benchmark. The Standards have set the appropriate technology targets for high performance glazing that will generate significant cooling, heating and lighting energy savings, while creating and maintaining good jobs right here in California. We thank you for the opportunity to provide these comments.

Respectfully submitted,



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On Behalf of Cardinal Glass Industries

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