

DOCKET

10-BSTD-01

DATE OCT 31 2011

RECD. OCT 31 2011

**Before the California Energy Commission
Docket No. 10-BSTD-01
2013 Building Energy Efficiency Standards**

Comments of Cardinal Glass Industries on Nonresidential and High-Rise Residential/Hotel Fenestration Requirements in the Staff Proposed Draft Standards Discussed at the October 13, 2011 Workshop

Cardinal Glass Industries* submits the following comments on the nonresidential fenestration requirements, including high-rise residential and hotel/motel buildings, in the Staff Proposed Draft 2013 Building Energy Efficiency Standards. Cardinal's glass is used in fenestration in both residential and nonresidential structures in California and nationwide, both new and replacement, and because of this, we have participated in multiple workshops for the 2013 Rulemaking, through WebEx and in person at the October 13 – 14, 2011 Staff Workshops.

These written comments are intended to follow-up on the remarks we have made previously in general support of the direction of the proposed revisions to the nonresidential fenestration standards and in the establishment of a minimum Visible Transmittance (VT) requirement for windows.

Cardinal Generally Supports the Proposed Fenestration Standards

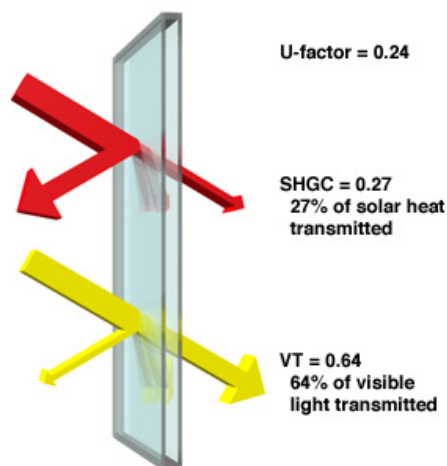
From the beginning of the 2013 Rulemaking process, Cardinal has supported, and continues to support, Staff and the CASE authors in their efforts to simplify and improve the nonresidential (including high-rise residential and hotel/motel buildings) fenestration provisions and their objective of establishing a minimum VT requirement. We are submitting these written comments to supplement our prior comments and testimony. Please note that our commentary is focused on vertical nonresidential fenestration only and does not address skylights.

* 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, we have actively participated during California's standards updates and have participated nationally in the model code development process.

The Proper Targets for Establishing Prescriptive Requirements in California Are Performance Levels Achievable with “Triple Silver” – Low-E Glass

Our comments during the rulemaking process have emphasized the importance of setting appropriate “technology point” metrics to achieve the desirable savings. As the national leader in manufacturing low SHGC low-E coatings, specifically what the Staff and CASE authors have termed “triple silver” or “low-E with a low SHGC,” Cardinal supports Staff’s proposal to require reasonably low SHGCs and high VTs as the most optimal, cost-effective approach to fenestration in nonresidential buildings in California. This glazing will also produce reasonably stringent U-factors as well. We agree that low SHGC low-E glazing should be the standard, and we support setting values (U-factors, SHGCs and VTs) achievable using this type of glazing across the board in the prescriptive path (all climate zones; all product types; all window areas).

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



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 NFRC with the frame, the glass values shown above must be converted to whole-product values with frames – for example, a 0.27 SHGC glass translates to a whole product SHGC typically 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.

Simplification Is an Important Objective to Be Achieved by the Proposed Revisions

We are of the same mind as Staff with their stated objective of improving the Standard while simplifying it to the degree possible. Simplification has enormous potential to improve code compliance and enforcement as well as market transformation by creating economies of scale when suppliers compete to produce the best product to meet the target at a competitive price. We have recently seen successful simplification efforts for nonresidential fenestration on the national code level too. We believe that the proposed methodology of identifying the optimal combination of low SHGC and U-factor and high VT values (for prescriptive and baseline purposes) based upon the best available, cost-effective window technology is the most reasonable approach to maximize fenestration-related energy savings. This approach balances summer and winter thermal envelope protection with daylighting potential.

We agree that the Standards should have one set of prescriptive values for a maximum window area (consistent with the approach used in the International Energy Conservation Code or "IECC"), should make no distinction in the requirements for types of framing materials (also consistent with the IECC), and should set the same values for all climate zones across the state. Additionally, we think there are further opportunities to simplify and improve the requirements even more, specifically:

1. Setting the same minimum VT (by operator type – e.g., fixed, operable, storefront, curtainwall) in Table 140.3-B for high-rise residential and hotels/motels that have been proposed for nonresidential in Table 140.3-A.
 - This would promote market transformation and one clear standard.
2. Similar to VT, setting the same maximum U-factors (by operator type – e.g., fixed, operable, storefront, curtainwall) in Table 140.3-B for high-rise residential and hotels/motels that have been proposed for nonresidential in Table 140.3-A.
3. Converting from the RSHG approach to specifying SHGC.
 - It is unnecessary to factor the effect of projections into the prescriptive or baseline values; if projection factors are to be recognized in the prescriptive path there should be a separate exception as in the 2012 IECC.

4. Clarifying the NFRC certification and labeling specifications in the Standards to appropriately reference VT ratings and the Component Modeling Approach (CMA).

We recommend that Staff carefully evaluate each of these suggested improvements. Although we understand that one of the improvements, the conversion to SHGC, may not be easily accomplished in this Standard revision, we hope it is at least on the agenda for the next revision. We think our other suggestions for standardized U-factors and VTs can be easily accomplished now.

The Proposed California Values Compare Well with U-factor and SHGC Values from the IECC

The Staff Proposed maximum prescriptive values are also in line with the direction energy efficient windows are heading in the national model energy code (IECC) and across the country. In most cases, the proposed prescriptive values are equal to, or better, than the IECC (ASHRAE 90.1-2010 fenestration values are typically less stringent than the 2012 IECC) and are the proper next step to carry the state until its subsequent Standards update in 2017. The table below shows the U-factors and SHGCs for certain IECC climate zones compared with the proposed California values (IECC climate zone 3 is the predominant California climate zone in the 2012 IECC):

Fenestration Type	IECC CZ # 3 U-factor/SHGC	IECC CZ #4 and 5 U-factor/SHGC	Proposed U-factor/RSHG for Nonresidential	Proposed U-factor/RSHG for HR - Res and Hotel/Motel
Fixed	0.46/0.25	0.38/0.40	0.36/0.25	0.36/0.25
Operable	0.60/0.25	0.45/0.40	0.45/0.22	0.47/0.22
Curtainwall/Storefront	0.46/0.25	0.38/0.40	0.40/0.26	0.41/0.26

As noted above, we recommend adjusting the proposed U-factors by using the same U-factors for HR-Residential and Hotel/Motel as used for Nonresidential, specifically: 0.36 for Fixed, 0.45 for Operable, and 0.40 Curtainwall. This recommendation would result in very slight changes and improved efficiency while standardizing the requirements across all three types of buildings.

Establishing a Reasonable Minimum Visible Transmittance (VT) for 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 factor for commercial structures. Because of this, establishing low SHGCs has been the appropriate focus of most commercial energy codes to offset cooling energy use and lower peak demand. However, traditional solutions to blocking solar gain included substantially darker glazing, which meant visible light was sacrificed. The benefit of a product like triple-silver low SHGC low-E glazing is that it provides excellent solar heat gain reduction without losing nearly as much visible light as other approaches; this glazing currently represents the best available combination of low SHGC, low U-factor and high VT. To ensure maximum natural light is provided (or at least the energy savings associated with it), a minimum VT makes the most sense as the simplest and most effective 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.

We reviewed comments in the transcript of the June 9th workshop, written comments in the rulemaking docket, and comments during the October 13th workshop that question the benefits of setting a minimum VT. We disagree with these comments that oppose a minimum VT requirement. 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 load and associated lower peak demand. There have been a number of comments made about glare being a problem associated with the proposed VT requirements. There was much discussion about the glare issue during the October 13th workshop, and also much evidence presented that higher VTs do not lead to increased glare. Instead, it was shown that glare could be present regardless of a fenestration product's VT rating, and it is something best addressed through design, not VT.

Minimum VT opponents have also suggested that effective aperture (EA) or a light-to-solar gain ratio (referred to as LSG or VT/SHGC) are better alternatives. We do not agree and fear that these recommendations would water down the requirements to the point where reasonable daylighting is lost in many cases. Focusing first on EA, most commenters agreed that EA is overly complicated and unnecessary. The CASE authors have also provided examples of technical loopholes in an EA approach that make it inferior to VT or VT/SHGC. An LSG or VT/SHGC ratio could be a simple prescriptive

option, because it relies on two readily available window performance metrics, but the same benefits with less complexity can be accomplished by simply setting a minimum VT. The comments we reviewed seemed to favor the VT/SHGC approach more because of the extremely weak 1.1 ratio that has been adopted in some other codes rather than the ratio approach itself. We do not view a 1.1 VT/SHGC ratio as a particularly effective daylighting saving target. Using Cardinal's triple silver low SHGC low-e glass to illustrate, its VT/SHGC ratio would exceed 2.0. As a result, a switch to the VT/SHGC ratio approach would require that the ratio be set to support values produced by the triple silver low SHGC low-E target established in the Staff Proposed Draft Standards and equivalent to the minimum VTs that have been proposed (likely a ratio of 1.5 or possibly greater).

For those commenters who argue the proposed minimum prescriptive VT requirements are too stringent, several allowances have been recommended to make the standards more flexible and to allow a greater array of products to qualify, while at the same time preserving the core of the VT requirement and associated daylighting savings. It is most important that the minimum VT remain in the prescriptive path baseline, because it sets the baseline energy use for the performance path. The prescriptive VT can be traded away in the performance path, so long as comparable energy savings are provided. Any glazing or combination of measures that deliver equivalent savings would be allowed. A greatly relaxed minimum VT (or EA or LSG ratio) would obviously reduce the potential savings estimated by the CASE authors.

Glazing That Meets the Proposed Standards Is Widely Available

A few comments filed in the BSTD Docket Log and made during the October 13th and 14th workshops question whether low SHGC low-E glazing that can meet both the proposed SHGC and VT requirements is available in California. A chart was presented by Mr. Thomas Zaremba at the October 13th workshop, which he used to suggest that there are very few products capable of meeting the Staff Proposed SHGC and VT values. We note that the chart Mr. Zaremba presented did not show whole product values and was not a tabulation of qualifying fenestration products. It was simply a scatter plot of combinations of the universe of center-of-glass values for SHGC and VT. Counter to Mr. Zaremba's claims, we think the chart he presented refuted his arguments and in fact helped verify that there are glazing combinations capable of meeting the Standards. As the above EWC graphic above illustrates, triple-silver low-E has the technical specifications capable of meeting the proposed Standards, and triple-silver is represented on the chart Mr. Zaremba showed.

From the discussions we have observed, it appears that sufficient data has been presented both in comments and at the workshops to dispel any concern over availability of triple-silver low-E. It has been shown that this type of glazing is not "proprietary" to a single glass manufacturer and is readily available to all window manufacturers. Multiple workshop participants have correctly pointed out that this

type of glazing is available to all window manufacturers from most of the major U.S. glass manufacturers (including Cardinal) and is currently available in a wide array of window products. We point to Cardinal's residential fenestration comments submitted in this Docket for additional details substantiating the availability of this glazing. Moreover, no one is required to use low SHGC low-E glazing, since there is always the ability to use virtually any fenestration under the performance compliance path – under the performance path, the values produced by these products merely set the energy budget.

Our Specific Recommended Revisions to the Standards for Nonresidential Fenestration Will Further Improve the Standards

- 1. To Further Simplify the Standards, the Same Prescriptive Minimum VT and Maximum U-factor Requirements Applicable to Nonresidential Should also Apply to High-Rise Residential Buildings and Hotels/Motels**

In reviewing Tables 140.3-A (Nonresidential) and 140.3-B (High-Rise Residential and Guest Rooms of Hotels/Motels), as noted above, we observed that different VT minimums and U-factor maximums are proposed between the two tables – but the proposed RSHG maximums are the same. We recognize it is appropriate to differentiate the requirements between fixed and operable fenestration products, due to fundamental differences in these products. However, putting the fixed and operable distinction aside, it is unclear why the proposed fenestration requirements should be different between nonresidential and high-rise residential/hotel/motel.

Practically speaking, the same glazing type will be used to meet the proposed RSHG, VT and U-factor requirements for all the building types covered by Section 140.3, and therefore the effective energy savings realized are expected to be the same regardless of slight variations in the prescriptive values set for the various commercial building types. For these reasons, we think the VT and U-factor requirements should, consistent with RSHG, be the same in both tables. Setting the same for both would establish one set of clear targets, which is optimal for market transformation, production and inventories.

We think the values are close enough and the expected savings equivalent to justify that the minimum VT and maximum U-factor values from Table 140.3-A (nonresidential) should also be used in Table 140.3-B. Using the nonresidential values from Table 140.3-A values would also be consistent with the flexibility allowances for VT recently added to the Staff Proposed Draft Standards.

2. RSHG Should Be Converted to SHGC Requirements

We have discussed with Staff and the CASE authors the use of the Relative Solar Heat Gain (RSHG) metric instead of simply referencing an SHGC. We believe the RSHG requirement in the prescriptive path is too complicated and should be abandoned for a simple maximum SHGC approach, like is the requirement for residential fenestration. Setting a straight SHGC requirement would tie the prescribed values to product ratings that can be easily matched to the tables, as opposed to a complicated formula. Other building efficiency standards (IECC, ASHRAE, etc.) all use whole product SHGC values as the standard.

We understand that the RSHG formula is an attempt to account for the use of projections/overhangs, but we do not believe the prescriptive standard should reflect the use of an overhang. We prefer no adjustment for projection factor in the prescriptive path and that such an adjustment be left to the performance path. However, if California wishes to allow adjustments for overhangs in the prescriptive path, then we suggest an approach like other codes that start with a baseline set of prescriptive SHGC requirements assuming no overhang and then establish 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) to apply to the prescriptive SHGC criteria.

We understand that the RSHG metric has not been identified for modification in the 2013 Rulemaking, but we ask that it still be considered. We note that switching from RSHG to SHGC is a simple energy-neutral revision, and ultimately an improvement to the Standards due to ease of implementation. We also note that this can be done without requiring modified energy calculations because the models are based upon the specified RSHG/SHGC, which will not change. That being said, if this is not an issue Staff wishes to address now, we hope it will be revisited during the next Standards update.

3. NFRC References for VT and the Component Modeling Approach (CMA) Can and Should Be Improved

There was discussion during the October 13 – 14 workshops questioning the accuracy of the Staff Proposed Draft Standards in referencing the NFRC Component Modeling Approach (CMA) for commercial fenestration. Cardinal has worked with NFRC for many years, including serving on its Board of Directors. Given our NFRC experience, we have reviewed the NFRC sections of the Standards and agree that revisions to the Standards are necessary to properly account for the definite distinction between CMAST – the NFRC component modeling software, and CMA – the NFRC component modeling approach.

In addition, we observed there is no certification and labeling requirement in the Standards for VT, despite it being proposed as a requirement. Because VT is now required for certain structures, it should be included in the Standard's certification and labeling requirements, along with U-factor and SHGC. VT is already included in NFRC 200 (the same rating procedure as SHGC), and NFRC product labels already include VT. For unrated products, there is a default VT equation in the proposed Standards (Equation 140.3-C), which can be used to establish a default VT label.

The corrections we believe are necessary are quite technical in nature, and we think it would be better to address them separate from these comments. We welcome the opportunity to work with Staff to craft appropriate revisions to the NFRC language of the Standards.

Conclusion

In summary, Cardinal fully supports the goal of increased energy savings and simplification. We support the proposed prescriptive U-factor and RSHG requirements, although our above comments suggest slight improvements. We also support establishing a minimum VT requirement, with the slight modifications mentioned above, as a simple and effective measure to capture daylighting savings. The glazing capable of meeting proposed requirements is presently available from a number of glass manufacturers, including Cardinal, and can be obtained by any window manufacturer for any window product. We thank you for the opportunity to provide these comments.

Respectfully submitted,



Eric M. DeVito
BRICKFIELD, BURCHETTE, RITTS & STONE, PC
1025 Thomas Jefferson Street, NW
Eighth Floor West Tower
Washington, DC 20007
(202) 342-0800
Eric.DeVito@bbrslaw.com

On Behalf of Cardinal Glass Industries

October 31, 2011