SAINT-GOBAIN
SEKURIT

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Cool Car Standards and Test Procedures

The threatening danger of a climate change due to an increasing concentration of carbon dioxide in the atmosphere is a global problem, which has to be faced accordingly. Especially road traffic needs to contribute to CO_2-reduction in an adequate way, which means that Original Equipment Manufacturers (OEM) as well as suppliers have to face this challenge.

Therefore, Saint-Gobain Sekurit appreciates the initiative of the ARB for climate protection. In its integrated approach the consideration of the CO_2-reduction potential of air conditioning (MVAC) equipment through anti-heat glazing is an important point. We believe that systematic combination of anti-heat glazing with MVAC equipments would significantly contribute to the reduction of CO_2 emissions. Additionally thermal comfort is greatly improved.

With respect to the May-08, 2009 version of the "Cool Cars Standard and Test Procedures", we would like to make the following comments and suggestions regarding §95603 (a).

1. **Windshields with 50% Tts starting MY2012:**
   SAINT-GOBAIN Sekurit is selling such products already today, i.e. this can be implemented provided that the car manufacturers start the corresponding model-specific development projects early enough.
2. **Windshields with 40% Tts starting MY2014:**
   SAINT-GOBAIN Sekurit has started the development of a product fulfilling this requirement, and even though it is an ambitious target, we are convinced that this product cannot be made available until 2014. We would like to point out once more that the time until 2014 is really needed to allow a complete product validation by SAINT-GOBAIN Sekurit and by the car manufacturer. As a consequence, the entry date for 40% Tts windshields should not be brought forward before 2014, but 2014 is achievable.

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3. **Referencing to 4mm for rooflites, sidelites and backlites:**
   We understand that the purpose of this referencing to 4mm is basically to specify the performance of the raw glass, and then to allow the use of this glass material in various thicknesses. This approach is very good and pragmatic.
   It turns out, however, that for a given vehicle glazing with a thickness different from 4mm it is not straightforward to prove that it fulfills the maximum Tts as it is specified for 4mm, since the mathematical equations are very complex. As a consequence, SAINT-GOBAIN Sekurit suggests using simple limit-value curves which specify for each glass thickness the maximum Tts, and which for 4mm coincide with the definitions of the Cool Cars Standard. Details of these limit value curves are given in the appendix A.

4. **Rooflites with 30% Tts at 4mm starting MY 2012**
   According to our current understanding, it is possible to reach this requirement only with laminated glazing comprising a heatreflecting coating and dark glass. CARB should be aware that forcing car manufacturers to move from today's tempered rooflites to laminated rooflites will have a significant cost impact.
   If CARB desires to give car manufacturers also in the future the possibility to use tempered rooflites, then the target value has to be increased. SAINT-GOBAIN Sekurit suggests a target value of 34% Tts at 4mm, since this is only a minor modification in the total CO_2 emission, and it will be possible to fulfill this requirement with available glass material.

5. **70% TL sidelites and backlites with 60% Tts at 4mm starting MY2012**
   SAINT-GOBAIN Sekurit is selling such products already today, i.e. this can be implemented without any problem. There is just one exception, and this is 4.85mm thick glasses. Such glasses are still in the market in significant volumes, and due to the 70% light transmission requirement a glass material with relatively weak absorption has to be used. Consequently, at 4mm this material does not reach the 60% Tts requirement but only 66%.
   The problem is directly coming from the referencing principle, i.e. it cannot be solved easily. Consequently we suggest that a specific tradeoff possibility is formulated which allows car manufacturers to use this glass in 4.85mm, provided that they employ better performance on other body openings.

6. **Dark sidelites and backlites with 40% Tts at 4mm starting MY2012**
   So-called darktail glazing is a very cost-efficient means to reduce CO_2 emissions at least for those cars where federal laws allow their application. Therefore we think that it was important to incorporate this potential in the Standard. The requirement can be met without any problem, since SAINT-GOBAIN Sekurit is selling products with 40% Tts at 4mm already today.

Best regards

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Appendix A:
Limit-value curves for Tts depending on glass thickness

The general idea of a limit-value curve is to predict for a given glass material, which at 4mm thickness results in a given Tts (e.g. 60%), the Tts value which this material will have if produced in other thicknesses. In a first step the transmission of a glass depending on glass thickness is appoximated by the Lambert-Beer-Law:

$$T(\lambda) = \left(1 - R(\lambda)\right)^2 \cdot \exp(-\alpha(\lambda) \cdot d)$$

where $\alpha(\lambda)$ is the absorption coefficient of the glass. In good approximation the Reflectivity $R(\lambda)$ is constant over the investigated range, and consequently for every wavelength there is a simple mathematical relation between the transmission $T(\lambda)$ for the true glass thickness and the transmission $T(\lambda)$ at the reference thickness $d_0 = 4mm$. Unfortunately this simple relation does not exist anymore for integral values like Tds or Tts, and therefore some approximations have to be made. It turns out that a good and simple approximation for $Tts(d)$ can be achieved if a simple exponential decay similar to the Lambert-Beer law is assumed:

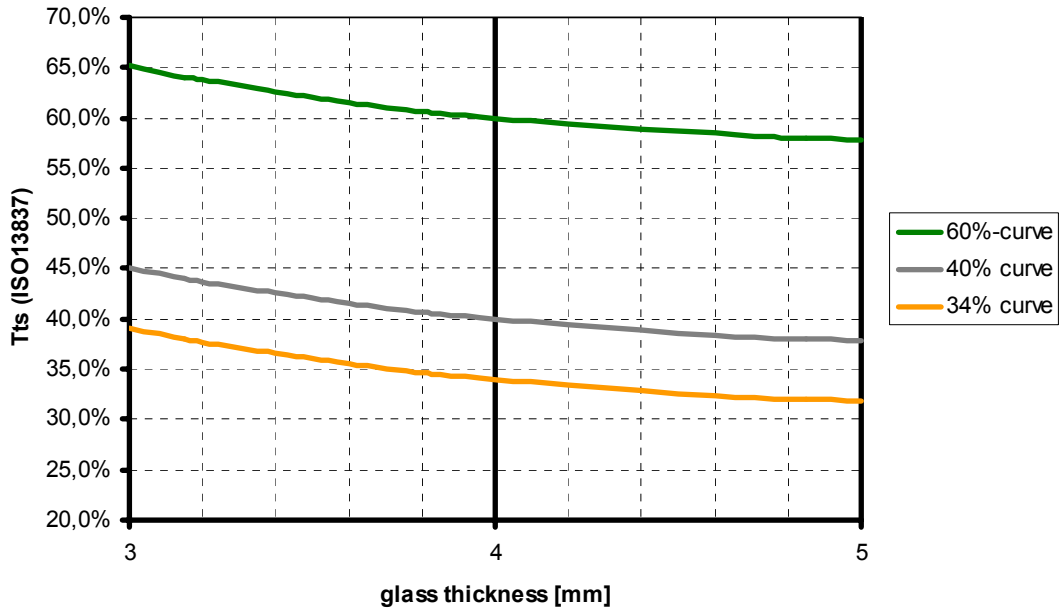
$$Tts(d) = A \cdot \exp(-k \cdot d) + B$$

and experience shows that the experimental data of various glass materials can be represented with sufficient precision if the parameters A and k are fixed to $A = 1.1$ and $k = 0.83mm^{-1}$. Taking this approximation into account, the remaining unknown B can be calculated directly from the desired Tts at 4mm.

This results finally in the following parameters for the limit-value curves:

	A	k	B
Tts = 60% at 4mm	1.10	0.83	0.555
Tts = 40% at 4mm	1.10	0.83	0.355
Tts = 34% at 4mm	1.10	0.83	0.300

The resulting limit value curves are shown in the following graph.



The final process to evaluate whether a certain glazing fulfils the requirements of the Cool Cars Standard is then simply the following:

1. measure thickness and Tts of the real glazing which is used in the vehicle
2. identify the Tts limit value curve to be applied (60% for sidelites/backlites with TL>70%, 40% for sidelites/backlites with TL<70%, and 34% for roofs).
3. the Cool Cars Standard requirement is fulfilled if the measured Tts is equal or lower than the Tts on the limit-value curve for the measured glass thickness