How North American Window Performance Evaluations Affect Glass Design

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Chevy Bolt EV has Longer Range in Europe
Triple Glass has Lower U in Europe
Different Conditions = Different Ratings

- European Driving Cycle vs. EPA Protocol
- NFRC/ASHRAE weather vs. CEN weather
ΔT Drives Convection in Gap

- NFRC/ASHRAE $\Delta = 70\text{ in} - 0\text{ out} = 70^\circ\text{F}$
- CEN $\Delta = 68\text{ in} - 32\text{ out} = 36^\circ\text{F}$
Duluth MN Annual Temperatures
U.S. Climate Zones
U.S. Heating Design Temperatures
About 2/3 U.S. is Colder than Frankfurt
What’s this mean for triple/quad glass?

- Volume(s) of gas act together
  - (2) 13mm gaps = 26 mm of volume
  - More expansion/contraction
  - Stress on edge seal
  - Depending on glass size/type Cardinal recommends max gap of 13mm
Narrow Glass can be Stress Problem
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• Distortion due to differential deflections
  – Cardinal recommends pressure equalization
Vented Center Pane

Cavities are at different temperatures.
Glass will deflect differently without center vent.
Potential for visible distortion.

• Small diameter (1.5mm)
• “Clean drill w/laser (no spall)
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- Potential for thermal stress breakage
  - Avoid low-E coating in center pane
  - Use high solar gain low-E on surface 5
Low-E Placement/Type

- Due to risk of trapped heat/thermal stress breakage, do not put low-E coating on center pane
- Use high solar gain low-E on surface #5
  - Minimizes thermal stress and potential for color problems
- Select high, medium, low solar gain for surface #2 depending on orientation and building design
Marketing says R9 Glass!
Thank you for your attention.

Any questions?