

Comparative Testing of Clarvista Shower Glass

Abstract

Clarvista glass showed no signs of corrosion after rigorous internal testing developed by PPG, nor after industry-standard accelerated environmental testing. Moreover, in comparative testing with the leading competitive coated shower glass products, *Clarvista* glass was equal or superior in durability, clarity retention and corrosion resistance. Identical testing of *uncoated* shower glass products generated significant signs of corrosion.

PPG testing also showed that *Clarvista* glass products can be cleaned and maintained with most non-abrasive, off-the-shelf cleaning products.

Introduction

In 2009, PPG introduced *Clarvista* glass for shower doors, and bath and shower enclosures that, with regular maintenance, looks newer, longer than competing clear glass products. *Clarvista* glass is available in a conventional clear glass substrate or an ultra-clear *Starphire* glass substrate.

Clarvista glass products maintain clarity through a proven, reliable manufacturing method that fuses the coating to the glass surface, which makes it resistant to the corrosive action of moisture, humidity and the chemicals found in many household cleaners. This coating process has been used in the industry for more than 20 years.

This document reviews performance testing of *Clarvista* glass compared to competitive *uncoated* and *coated* shower glass products.

Testing Parameters

There are no industry-standard qualification tests for coated bath/shower enclosure glass. The purpose of the PPG testing was to simulate the bath/shower enclosure environment to validate the performance of several commonly specified products according to the following factors:

1. Heat/humidity exposure (bath/shower environment)
2. Mechanical/physical durability (compounded by exposure to heat/humidity¹)
3. Chemical durability (compounded by exposure to heat/humidity²)

Products

PPG performed a battery of accelerated and industry-standard tests on *Clarvista* glass and other common shower glass products to gauge their physical and chemical durability, and their ability to withstand the corrosive effects of heat and humidity (environmental durability). All products were thermally tempered (strengthened) to accurately represent how they would be used in a bath/shower environment. They were:

- *Clarvista* glass
- *Uncoated* clear glass
- Leading competitive coated *clear* glass

Clarvista glass was tested in both conventional clear glass and ultra-clear *Starphire* glass substrates.

PPG “Jungle Box” Test

To measure durability, PPG devised an accelerated high-temperature, high-humidity corrosion test to exaggerate the environmental conditions each glass would face over time in an everyday bath and shower environment. This “jungle box” test subjected each glass type to 1,000 continuous hours of 140°F temperatures, 90 percent relative humidity and a minimum 7.0 pH factor.

PPG created the jungle box test to definitively validate *Clarvista* glass and to ensure a high-performance product that would deliver real-world benefits to the final consumer. PPG had three goals for *Clarvista* glass:

- Improved performance compared to uncoated shower glass
- Change in post-test haze readings of less than 1 percent
- Performance equal to or better than competitive products tested.

¹ To replicate repeated cleaning/wiping of bath/shower glass in a hot/humid environment

² To replicate repeated exposure of bath/shower glass to household cleaners in a hot/humid environment

“...in comparative testing with the leading competitive coated shower glass products, *Clarvista* glass was equal or superior in durability, clarity retention and corrosion resistance. Identical testing of uncoated shower glass products generated significant signs of corrosion.”

Industry-Standard Tests

PPG conducted four industry-standard tests on each glass sample, as follows:

- *Cleveland Condensation* (reference ASTM D4585) for heat/water condensation resistance
- *Salt Fog* (reference ASTM B117) for corrosion resistance
- *Taber Abrasion* Test (reference ASTM D1044) for physical durability
- *pH Testing* (reference ASTM D5146) for chemical durability (including exposure to a variety of industrial chemicals and household cleaners).

Testing Reference Chart

| Property Tested | Tests Performed | Relevant Details |
|---|------------------------|--|
| Hot/Humid Environment* | PPG Jungle Box | 140°F / 90% RH Glass packs w/ acrylic beads |
| | Cleveland Condensation | 140°F / 95% RH |
| | Salt Fog | 95°F/5 wt.% salt spray |
| Mechanical Durability** | Taber Abrasion | 10 cycles / 500g weight |
| Chemical Durability** pH range 0.9 – 12.6 | Cleaning Agents | 24 hr. soak, then 10 wipes |
| | Industrial Chemicals | Tests chemical dependent |

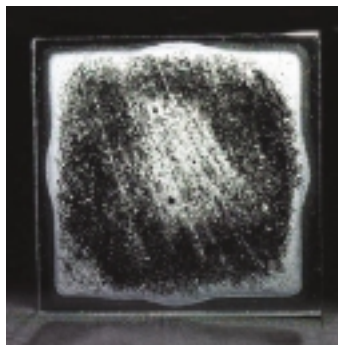
*Exposed 1,000 hours **Followed by 1,000 hours exposure in PPG Jungle Box

RESULTS:

The following photos depict the performance of each product as measured by post-test haze¹ readings, according to prescribed testing:

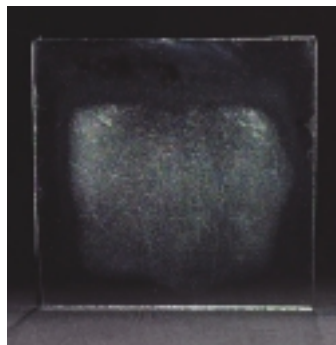
PPG “Jungle Box” Test

Uncoated clear glass



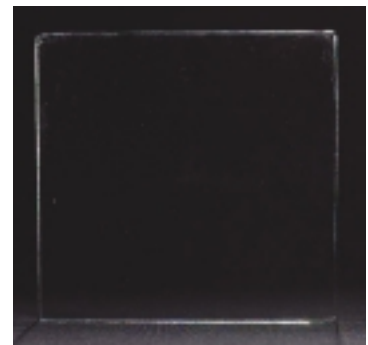
After the PPG jungle box test, the uncoated clear shower glass had a haze measurement of 77 percent.

Leading competitive coated shower glass



The leading competitive coated clear glass had a haze reading of 12 percent after the PPG jungle box test.

Clarvista glass



The haze reading for Clarvista glass in a clear glass substrate was less than 1 percent after the PPG jungle box test.

¹ Haze is a scientific measure of glass clarity. The lower the haze measure, the clearer the glass appears.

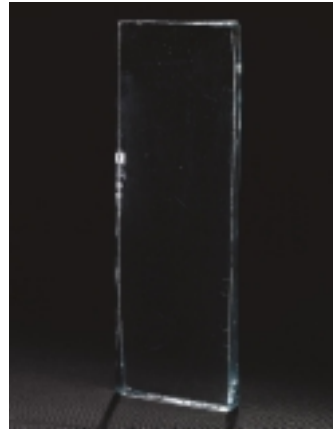
Cleveland Condensation Test (Heat and Water Condensation Resistance)

Purpose:

This test examines the ability of glass to resist damage from continuous exposure to condensation by exposing one side of a sample to a heated, saturated mix of air and water vapor. The reverse side is exposed to air at room temperature. The performance of the glass is measured by the effects condensation has on color change, blistering, loss of adhesion, and softening or hardening of the glass and/or coating.



After testing in the Cleveland Condensation chamber, uncoated clear glass had a hazing reading of less than 1 percent.



The leading competitive coated clear glass had a hazing reading of 1 percent.

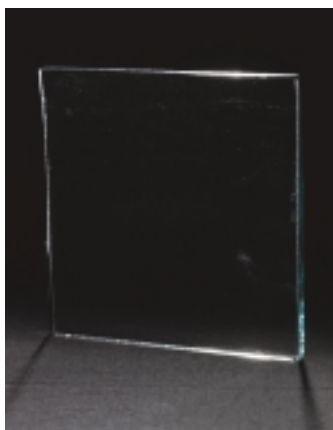


The haze reading for Clarvista glass in a clear glass substrate was less than 1 percent after Cleveland Condensation testing.

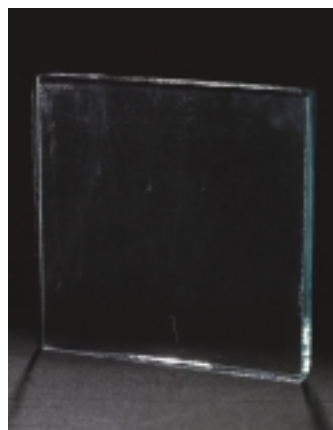
Salt Fog Test (Corrosion Resistance)

Purpose:

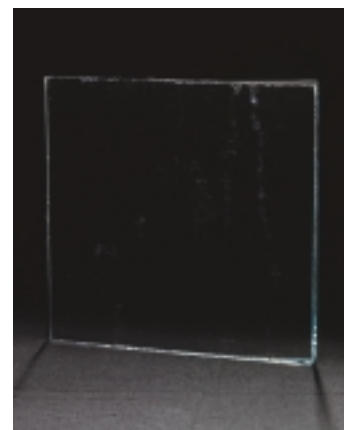
Salt fog testing takes place in a closed chamber where glass samples are exposed to a 5 percent sodium chloride (salt) mist for 1,000 hours at a minimum temperature of 95°F. The performance of the glass/coating is measured by its ability to resist the chamber's corrosive environment.



After salt fog exposure, uncoated clear glass had a haze reading of 1 percent.



After salt fog testing, the leading competitive coated clear glass had a haze reading of 2 percent.



After salt fog testing, Clarvista glass in a clear glass substrate had a haze reading of 1 percent.

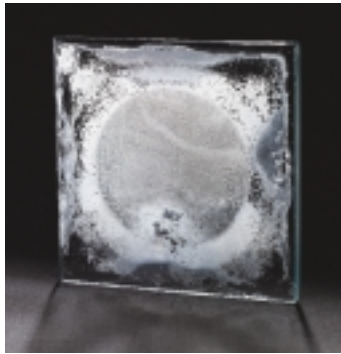
Taber Abrasion Test (Physical Durability)

Purpose:

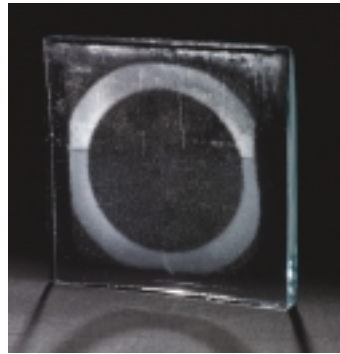
In the Taber abrasion test, two rollers covered with gritted paper are rotated over the surface of the glass/coating with varying levels of pressure to simulate the physical effects of abrasion. This is immediately followed by 1,000 hours of exposure in the PPG “jungle box.”

The purpose of this test is two-fold: First, to gauge the susceptibility of the glass surface to scratches during handling and fabrication and, second, to assess its ability to withstand the repeated mechanical action of cleaning in the home shower environment.

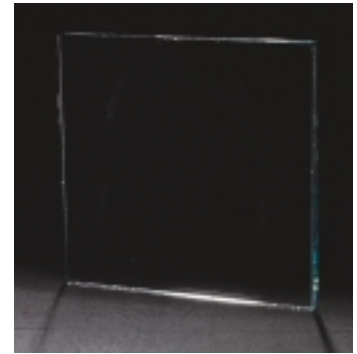
The performance of the glass/coating is measured by its ability to resist surface wear and maintain its appearance and protective properties.



Taber/jungle box testing of uncoated clear glass produced a haze measurement of 83 percent.



On the leading competitive coated clear glass the Taber/jungle box test produced a haze reading of 42 percent.



Clarvista glass in a clear glass substrate had a haze reading of less than 1 percent after Taber/jungle box testing.

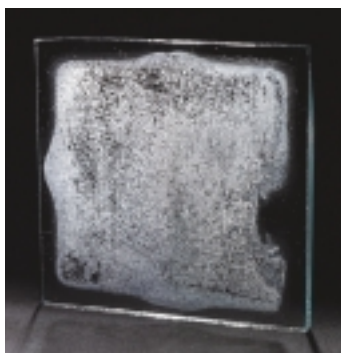
pH Testing (Chemical Durability)

Purpose:

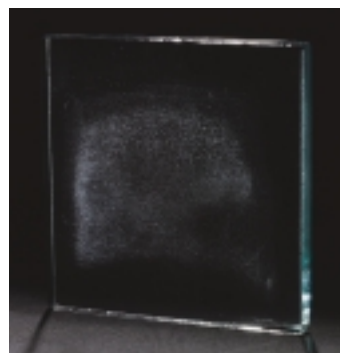
For pH testing, each glass sample is cleaned with a paper wipe 10 times after 24-hour immersion in the selected cleaning product/formula. After pH testing, the samples are further exposed to 1,000 hours of heat and humidity in the PPG jungle box. The purpose of the test is to gauge the effects of repeated chemical exposure from cleaning in the home shower environment. PPG tested more than a dozen common household cleaning products/formulas with pH factors ranging from 0.9 to 12.6. The following photographs show results from four cleaning products:

- Calcium-Lime Rust Remover
- Ammonia-Based Glass Cleaner
- Baking Soda
- Bath/Shower Stain Remover

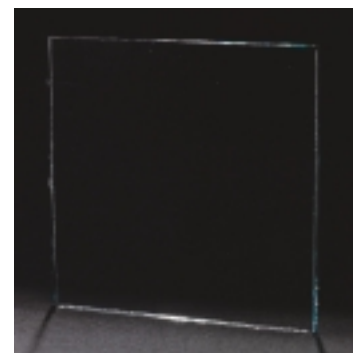
Calcium-Lime Rust Remover



pH/jungle box testing with calcium-lime rust remover produced a haze reading of 58 percent on uncoated clear glass.

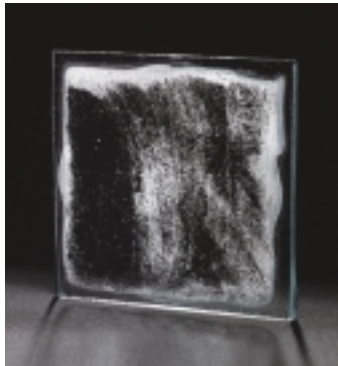


On the leading competitive coated clear glass, pH/jungle box testing with calcium-lime rust remover produced a haze reading of 6 percent.

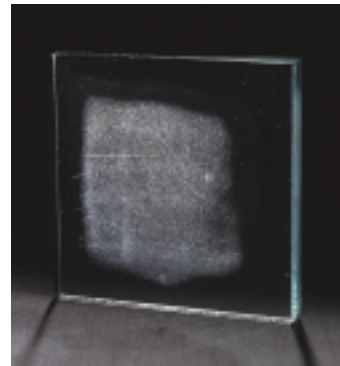


After pH/jungle box testing with a calcium-lime rust remover, Clarvista glass in a clear glass substrate had a haze reading of less than 1 percent.

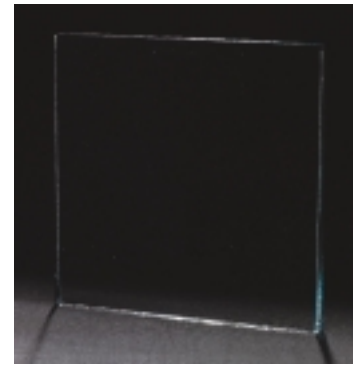
Baking Soda



pH/jungle box testing with baking soda generated a haze reading of 61 percent for uncoated clear glass.

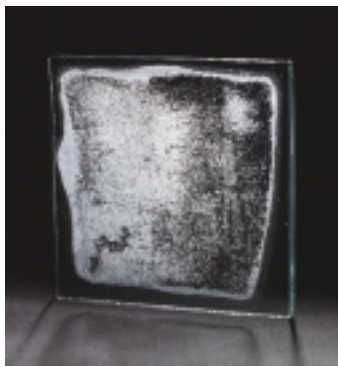


On the leading competitive coated clear glass, pH/jungle box testing with baking soda produced a haze reading of 22 percent.

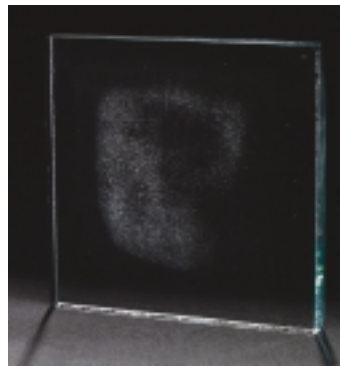


After pH/jungle box testing with baking soda, Clarvista glass in a clear glass substrate had a haze reading of less than 1 percent.

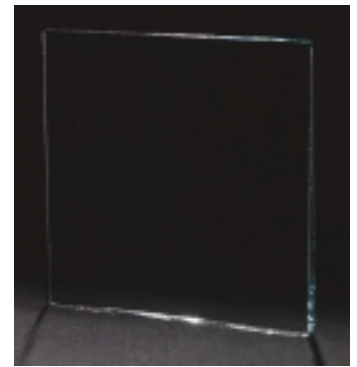
Ammonia-Based Glass Cleaner



pH/jungle box testing with the ammonia-based glass cleaner created a haze reading of 87 percent on uncoated clear glass.

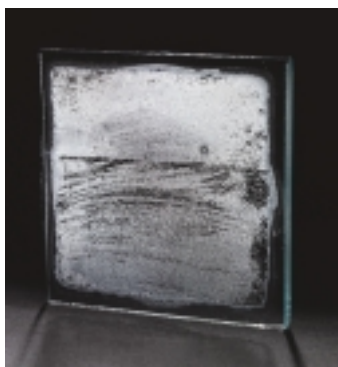


The leading competitive coated clear glass sample had a haze reading of 3 percent after pH/jungle box testing with the ammonia-based glass cleaner.

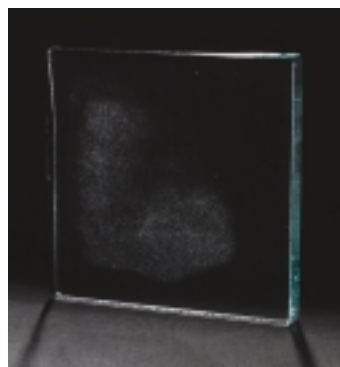


The haze reading for Clarvista glass in a clear glass substrate was less than 1 percent after pH/jungle box testing with the ammonia-based glass cleaner.

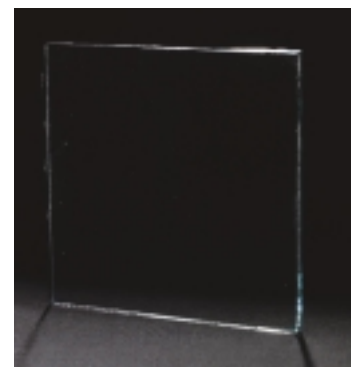
Bath/Shower Stain Remover



pH/jungle box testing with the bath/shower stain remover produced a haze reading of 70 percent for uncoated clear glass.



pH/jungle box testing with the bath/shower stain remover resulted in a haze reading of 4 percent for the leading competitive coated clear glass.



The haze reading for Clarvista glass in a clear glass substrate after pH/jungle box testing with the bath/shower stain remover was less than 1 percent.

| Product | Heat/Humidity ONLY (PPG Jungle Box) | Mechanical + Heat/Humidity | Chemical + Heat/Humidity |
|---------------------------------------|--|----------------------------|--------------------------|
| Clarvista Glass | ■ | ■ | ■ |
| Competitor's Coated Bath/Shower Glass | ■ | ■ | ■ |
| Uncoated Glass | ■ | ■ | ■ |

KEY: ■ = No Corrosion ■ = Moderate Corrosion ■ = Severe Corrosion

Summary

Test data demonstrate that coated shower glasses offer consistently better performance and a longer service life than uncoated products.

Testing also reveals that the coating applied to *Clarvista* glass enables it to maintain clarity and resist corrosion longer than the leading competitive coated shower glass. As a consequence, consumers can expect *Clarvista* glass to retain its original clarity longer than the leading competitive products in a true shower environment.

Conclusions

- After internal PPG and industry-standard testing, *Clarvista* glass showed no signs of hazing or corrosion.
- *Clarvista* glass was tested with both conventional clear and ultra-clear *Starphire* glass substrates. The test results were equal for both substrates.
- After the same testing, uncoated glass showed significant signs of corrosion.
- Depending on the test, *Clarvista* glass showed better or comparable performance to competitor products.
- *Clarvista* glass showed better mechanical durability than competing products.
- Most non-abrasive, off-the-shelf cleaners can be used on *Clarvista* glass without diminishing its long-term appearance and performance.

Note to Fabricators

- During the tempering (strengthening) process, *Clarvista* glass does not require furnace modifications or equipment that is often needed for other coated glass. As a point of departure, the standard furnace heat cycle for the same uncoated glass thickness and substrate is recommended.

Clarvista glass is available in conventional clear glass and *Starphire* ultra-clear, low-iron glass substrates in thicknesses of 6mm (1/4"), 10mm (3/8") and 12mm (1/2").

For more information, call **1-888-PPG-GLAS (774-4527)**, or visit **www.ppgclarvistaglass.com**

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