Quality test for tempered glass roller side

Keywords 1=scratch test 2=fabricating debris 3=defect 4=cleaning 5=scraper

Abstract

Roller side defects in tempered glass can usually be identified, isolated and resolved, but first they must be detected. The razor test provides timely feedback that can facilitate the resolution of roller side defects.

A common shop microscope is used to observe the result of simulated cleaning with a standard metal razor, such as those historically used by the glass and cleaning industries.

Consideration is given to effects of time and temperature. This simple surface quality test enables fabricators to predict the performance of both sides of tempered glass during future cleanings.

Introduction

Microscopic defects on a poor quality tempered glass surface may cause fine scratches to occur during cleaning. The ultimate visibility of these new scratches is not immediately apparent; tempered glass scratches become wider and more visible in a few hours after time delayed chipping occurs. [Figure 1]

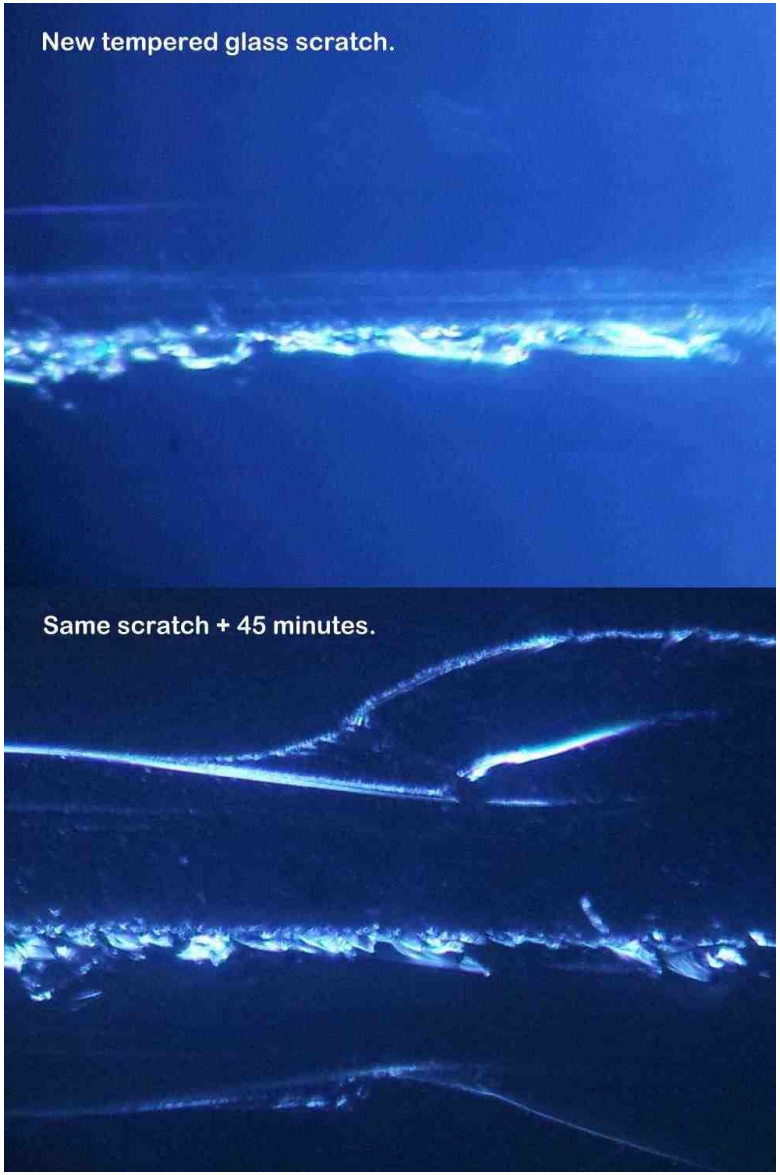


Figure 1 Dramatic, sudden crack growth was observed with a shop microscope by the author, about 45 minutes after the new scratch was photographed.

SOURCE: www.gpd.fi

When a moving scraper encounters a microscopic fabricating debris defect during cleaning, there are several possible outcomes. Often there is no scratch; a finer defect might be passed over without incident, or the defect might be dislodged, but suspended in cleaning solution.

A defect might be trapped under the blade in a way that causes only minor abrasion without indenting the surface. However, a fabricating debris defect may be trapped by the moving scraper in a way that will indent the surface, causing a deeper scratch with lateral chipping that will worsen with time.

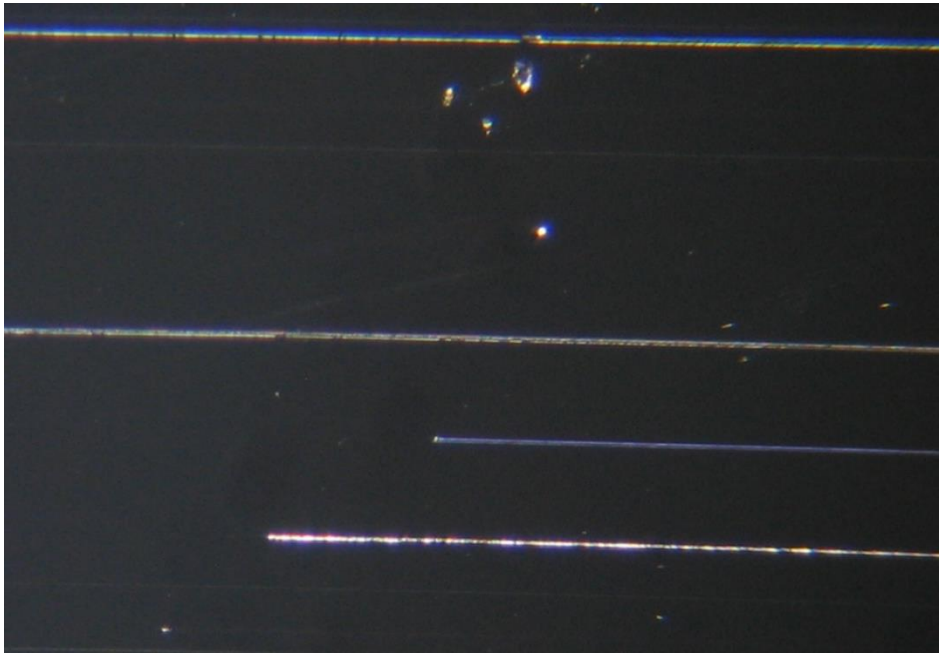


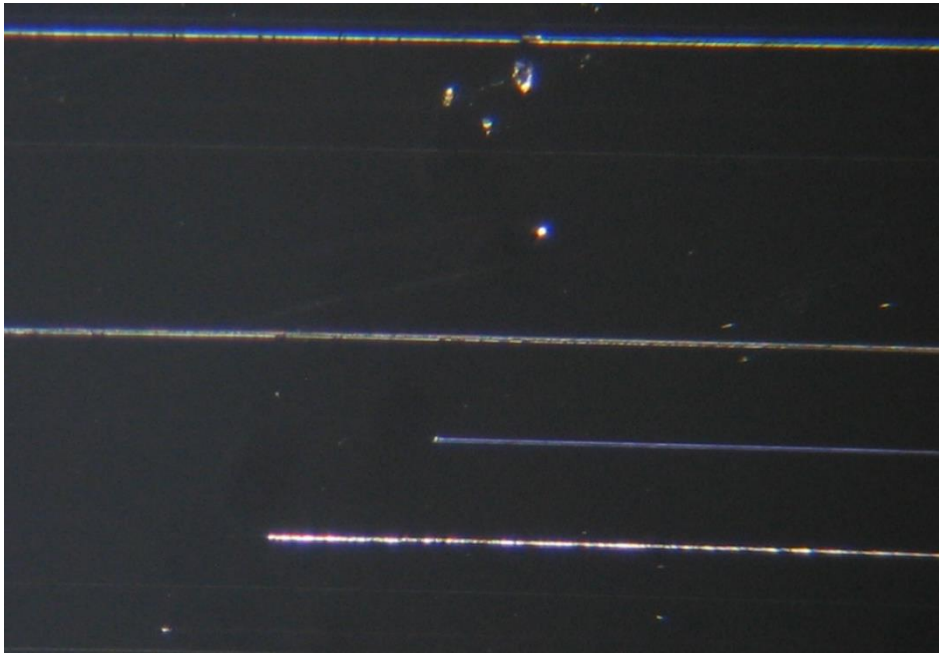
Figure 2 The roller side of this scratched tempered glass may have had over 500,000 microscopic roller side defects.

SOURCE: www.gpd.fi

The way to minimize scratched tempered glass issues is to minimize these defects.

Perfection is unnecessary; an isolated defect on a quality surface is unlikely to cause an objectionable scratch during cleaning. Unfortunately, poor quality surfaces are far from perfect. At least 11 microscopic defects are visible [Figure 2] - in a field of view smaller than 5mm square. For a tempered lite the size of a GPD poster (1m x 1.2m) this would project to 500,000 or more defects.

Excessive levels of roller side fabricating debris defects can result in an alarming number of randomly occurring scratches during cleaning. In large numbers, defects will cause costly issues for fabricators, their customers and end users.



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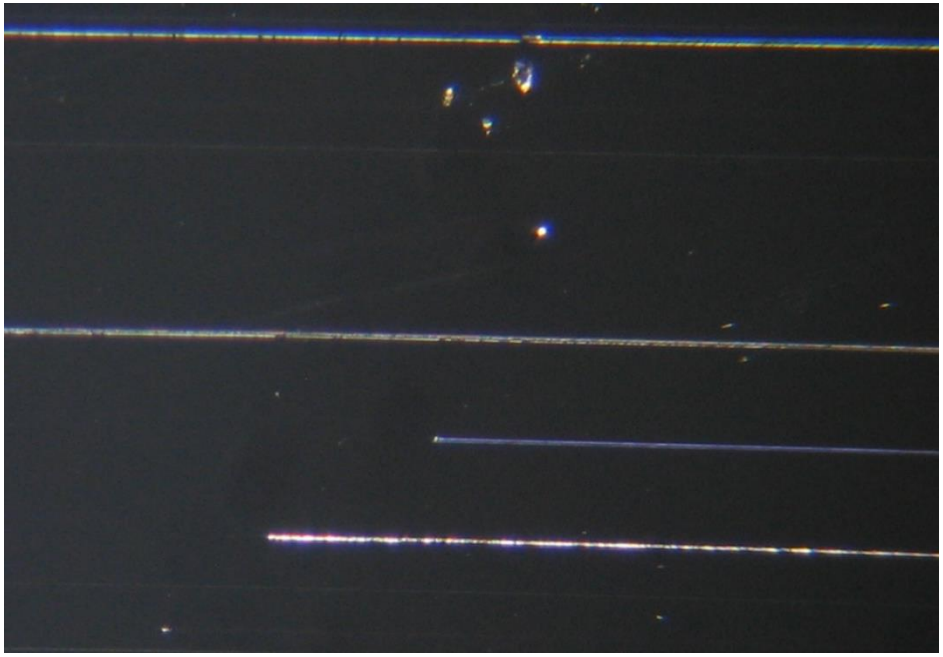
Objective

There is always room for improvement, but how can it be measured? How can managers, furnace operators and quality controllers monitor their own efforts to meet quality objectives?

We propose a very simple and realistic method; using a wide window cleaning scraper on tempered glass to simulate the effects of future cleaning to remove stickers, paint, and other common debris. This test attempts to cause fabricating debris scratches which can be observed with a common shop microscope. A log may be kept.



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Benefits of monitoring to maintain quality standards:

- Market the advantages of quality tempered glass surfaces
- Capitalize on demand for sustainable, durable, easily maintained products
- Capitalize on demand for green cleaning without use of toxic chemicals
- Help customers distinguish your brand.

Rationale for testing if tempered glass surface quality is questionable:

- Resolve surface quality issues internally
- Disputes consume management's time and energy
- Prevent litigation
- Avoid costly forensic investigations, (SEM, EDS).
- Organizational impact of rework – energy, transportation, etc.
- Customers have problems meeting deadlines
- Customers may be concerned about brand quality

SOURCE: www.gpd.fi

Equipment needed

- Felt tipped marker
- Straight edge
- Lighted shop microscope – 40x or 60x
- Conveniently located testing area
- User friendly worksheet or spreadsheet to log results.
- 6 inch glass cleaning scraper such as the Triumph MK3. [Figure 3]

Figure 3 Professional 6 inch window cleaning scraper (Triumph MK3 from JBF)

SOURCE: www.gpd.fi

Method

- Obtain test lites at furnace unload; label each with relevant information such as date and time
- Always test the roller side.
- Test promptly, while the glass is clean.
- Draw two parallel lines 6 inches apart with a felt tipped marker, from one edge to the other. .
- Place the scraper between the lines, near one edge.
- Apply firm pressure and push the scraper completely across the glass. [Figure 4]

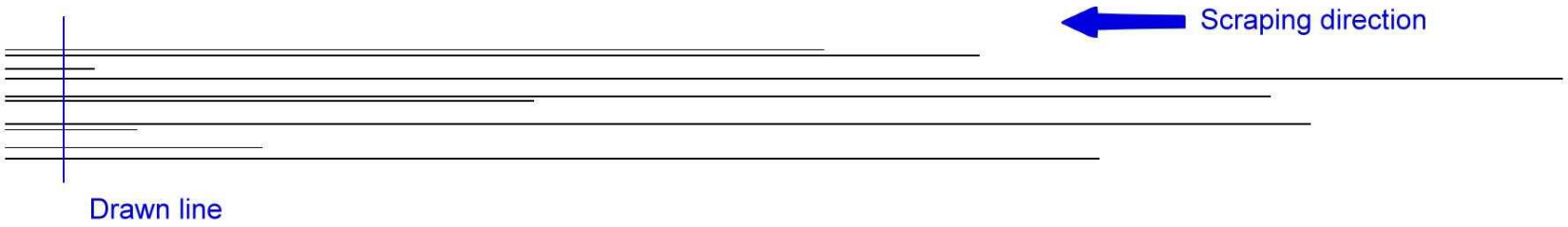


Figure 4 Fabricating debris defects cause fewer scratches near the beginning of the scraper's path. More scratches will be observed near the end.

SOURCE: www.gpd.fi

Observations

After scraping, use the shop microscope to observe the scraper's edge. Note whether any debris has accumulated. [Figure 5]

Scratches are best observed near the end of the scraper's path.

Use the marker to draw a perpendicular line across the path of the scraper, near the end.

Place the shop microscope on one end of that new line.

Turn on the light, and rotate the scope so light shines perpendicular to the path.

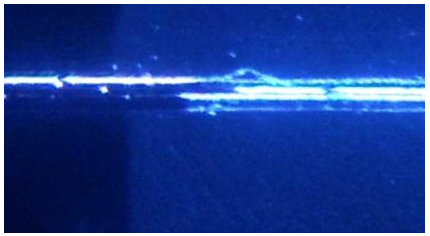
Focus the shop microscope on the line.

Move the shop microscope slowly along the line, from one end to the other.

Count every scratch that can be seen to intersect the line [Figure 6]. Enter result in a log, and report any unusual results promptly.

Figure 5 Debris may be observed on the edge of the scraper.

Figure 6 Count all scratches which intersect with the drawn line.



SOURCE: www.gpd.fi

Comments

Quality control personnel will find more defects than scratches, and more microscopic scratches than visible scratches. On quality surfaces, defects will be scarce, microscopic scratches will be rare and visible scratches rarer still.

Proper illumination is essential. Keep the light perpendicular to scratches. [Figure 7]

Test periodically - with frequencies subject to local conditions and after events that affect quality, such as equipment maintenance.

In some tempered glass scratch studies, visible crack growth is said to be affected by time and temperature. Consider using a heat source to stimulate crack growth and/or allowing extra time for scratches to develop.

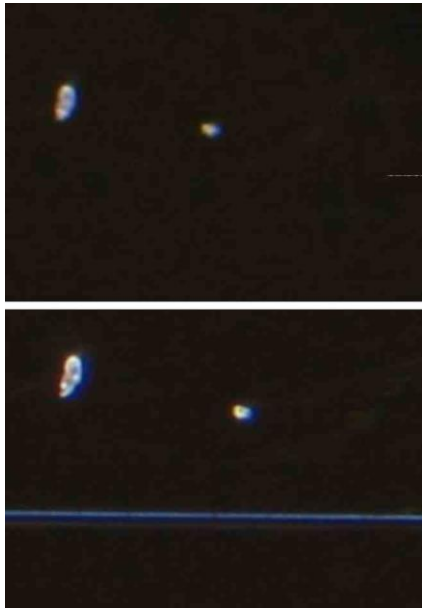


Figure 7 Light source must be perpendicular to the scratch, to assure visibility of new scratches.

SOURCE: www.gpd.fi

Program should be designed to monitor the entire usable width of rollers.

The shop microscope may be used to follow any scratch to the point of origin. [Figure 8]

If a poor quality tempered lite is not available for training purposes, or cannot be obtained from a competitor, a rock or sandpaper can be used to create observable scratches.

This is a practical shop test for the very reasons it is not practical as a field test. Glass is free and easily handled. Glass is already clean, lighting can be controlled, and batch testing is possible. A large area can be scraped and observed with a powerful shop microscope.

Results are much more reliable than mere visual inspection of a "small, inconspicuous area".

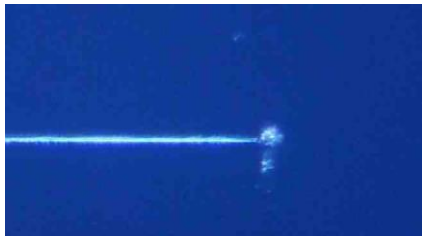


Figure 8 Follow any fabricating debris scratch to the point of origin.

SOURCE: www.gpd.fi

Conclusions

The wide metal window cleaning scraper is similar in hardness to glass, and will not scratch.

Any statistics obtained can help increase organizational awareness and end speculation about the relative quality of tempered glass surfaces.

Timely feedback will enable the fabricator to maintain - or improve, as the case may be – the quality of tempered glass surfaces, possibly without resorting to forensic methods such as scanning electron microscopy and energy dispersive spectroscopy. Cost per square foot for monitoring a batch of tempered glass will be minimal.

Where feedback results in a renewed emphasis on plant cleanliness, tempering practices, and equipment maintenance, the cost of monitoring would be recoverable through sustained productivity, extended useful life of equipment, and a general reduction in costs associated with scratched tempered glass.

There will always be demand for glass that can be cleaned with scrapers, just as there will be always be demand for safe, practical, effective cleaning methods.

SOURCE: www.gpd.fi

Gary Mauer

Director of the Window Cleaning Network, member of MWCoA, and a founding member of the International Window Cleaning Association.

His 35 year career in the window cleaning industry was preceded by 3 years experience with a glass fabricator.

Phone 1-262-490-1442 gmauer@window-cleaning.net http://www.scratched–glass.net

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