EZ METROLOGY

Application Notes:
Frameless Door Application

Innovation for Frameless Doors

Frameless windows have gained in popularity for a wide variety of reasons; lighter door design, removable roof segments, aesthetic aspect... Because of the structural limitations of glass, a number of design criteria need to be taken into account and observed during the life cycle of the vehicle. EZMetrology has been following the market trends and has been actively working with manufacturers to improve their understanding and quantify the performance of their solution. Today EZMetrology offers a range of products applicable or dedicated for frameless door systems.

Our Technologies & Solutions analyze & quantify all aspects of Frameless Doors:

- **EZMotion** Dynamic Deformations
- **EZSlam** Door Characteristics
- **SealScan** Seal System Applications
- **EZPinch** Pinch Safety Systems
- **EZ3D** Window Pre-Loads
- **WindowPod** Opening Vibrations
- **EZDoorKit** Minimum Closing Efforts

Frameless windows on car door.

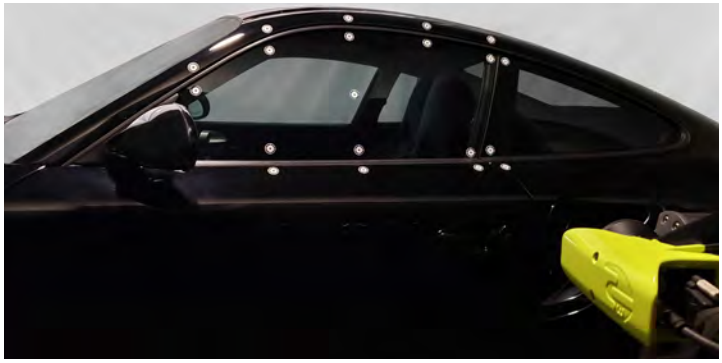
EZSlam placed on frameless car door.

Door Characteristics - with EZSlam

EZSlam, a top-of-the-line analysis tool, captures the full operation of the door systems. While this technology platform is applicable on standard doors, it is equally performant on frameless designs. In the latter situation, the advantage of extra air extraction from the cabin, mechanism of the window drop, and the different weight distribution will all play a role in the final sensation and performance of the door system. EZSlam captures that sensation and assists in setting or reaching the desired door sensation.

Dynamic Deformation - with EZMotion

To ensure performance of the door and sealing system at driving speeds, wind tunnel testing comes to mind. To quantify dependency of force actions and seal characteristics, EZMotion platform can provide the precise absolute or relative deformation from body, door, window, or trim components. The system can be used for quasi static test to dynamic vibration testing in the form of position of a collection of optical targets placed at strategic locations of the vehicle. The data will provide a path to defining the required specification for the door, window setting and window regulator settings.



EZMotion measuring frameless door on car.

CLA708

730 Welch Road
Commerce, MI 48390 - USA
Office: +1 248 861 2600

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42 Avenue de la Gare
L-1610 Luxembourg - EU
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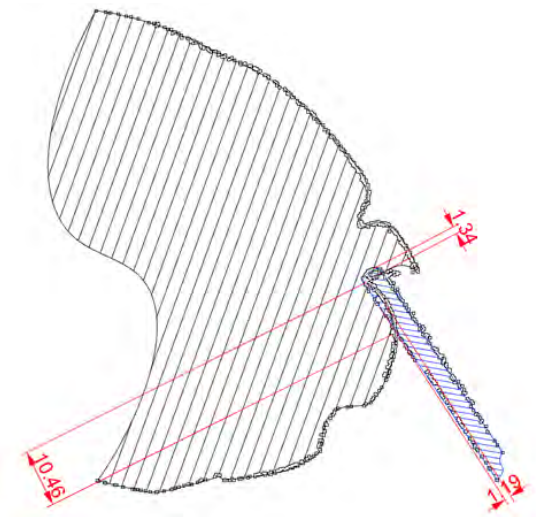
Seal System - with SealScan

The requirements on the window setting and the expected interaction with the seal system is part of what makes a frameless door a particular challenge. To capture this assembly, with the right level of detail and in a non-destructive way, SealScan technology has been developed to measure and dimension this window-seal-body cross section to quantify window penetration, seal compression, etc.

"The requirements of the window setting and the expected interaction with the seal system is part of what makes a frameless door a particular challenge."



Scan of seal from frameless car door.

Pinch Safety - with EZPinch

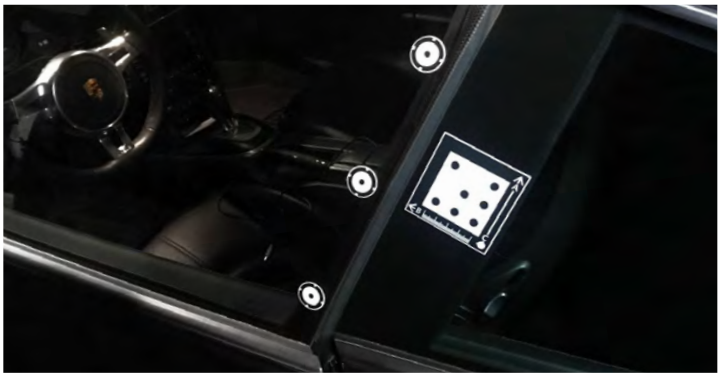
Powered windows have always been subject to the obvious concern to avoid pinching any fingers. While safety systems are in place to control the window regulator when such an event is detected. Our accurate and easy-to-install gauge can quickly evaluate the correct performance of these safety routines. The tendency to automate the doors now broadens the application field to the pinch detection on doors, trunks, liftgates and other electrical drive systems that can cause a pinch situation at any point during the travel.

EZPinch on car door.

"Our accurate and easy-to-install gauge can quickly evaluate the correct performance of these safety routines."

Window Pre Load - with EZ3D

Almost every design will include a preload on the window to ensure proper seal compression. While this is often an adjustable setting, we have created an easy-to-use device in order to study and quantify this adjustment and the correlation to the outcome. A handy optical, tablet based, measurement system can accurately define this preload condition and at the same time, capture the dimensional characteristic of the window drop.



EZ3D targets placed on frameless car door.

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Opening Vibrations - with WindowPod

A frameless window, with sufficient contact force might be subject to excessive vibrations when opening the door. The vibration is due to mechanical aspects from the latch and seal as well as electrical aspects from handle and window regulator. All aspects need to be in tolerance and sync to avoid this excessive and visual vibration. WindowPod allows for a rapid inspection of these window vibrations and reports the amplitude of the vibration in function of the opening speed. The unique metric allows to analyze, document the characteristic and in combination with the software can be used as a go/no-go gauge.

"WindowPod allows for a rapid inspection of these window vibrations and reports the amplitude of the vibration in function of the opening speed."

WindowPod placed on window of frameless car door.

EZSpeed and EZPressure devices utilized on frameless car door.

Minimum Closing Effort - EZDoorKit

Even though frameless doors are a different technology, the same level of comfort or better is still expected. EZMetrology offers a set of devices that allow quick data gathering, benchmarking, and production quality testing. **EZSpeed**, **EZEnergy,** and **EZPressure** devices are quick and simple-to-use gauges that take speed, energy, force, and pressure data of any door on the vehicle. These devices can further integrate wirelessly with Audit or PLS softwares to download, manage, and view the collected data. The collected data allows a greater understanding of the door design and allows for a history of changes and an assurance of meeting quality standards.

For more information about our products, please visit our website at www.ezmetrology.com.

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