



# Low Temperature Impact Performance of 3M™ VHB™ Structural Glazing Tapes

Technical Bulletin

February, 2012

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## Introduction

This bulletin summarizes a study to evaluate the low temperature impact performance of 3M™ VHB™ Structural Glazing Tape at an independent third party test institute. This testing was conducted to assess the suitability of 3M™ VHB™ Structural Glazing Tapes for cold weather applications where bonded assemblies may experience a short duration impact stress.

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## Background

3M™ VHB™ Structural Glazing Tapes have been successfully used since 1990 to bond glass panels to metal frames creating structural glazing facade elements. Successively, the 3M™ VHB™ Acrylic Foam Tapes technology has broadened its footprint in construction and architectural markets as a viable alternative to conventional structural silicones and mechanical fasteners. In thousands of applications around the world, 3M™ VHB™ Structural Glazing Tapes have proven their performance in real life conditions and many years of service. Exposure conditions vary from hot and humid environments in the Middle East and Africa to extreme cold conditions in Canada or Russia.

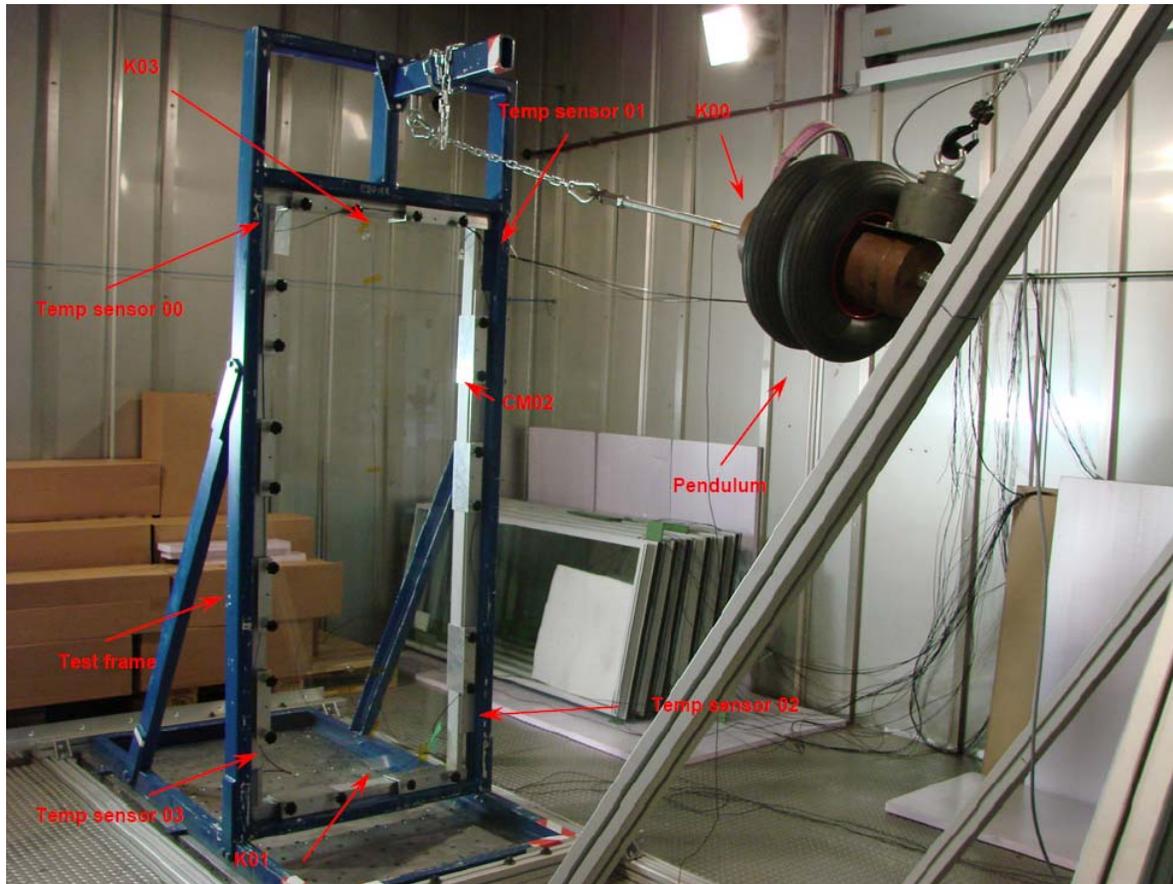
3M™ VHB™ Structural Glazing Tapes B23F and G23F were granted a European Technical Approval (ETA) and CE mark in 2009 which certifies fitness for use by the European building authorities. By striving to demonstrate the fitness for use beyond regulatory expectations, 3M appointed the independent test institute ATLAS-ELEKTRONIK with its acknowledged testing expertise in the field of climatic and vibration simulation to conduct a severe test scenario. ATLAS-ELEKTRONIK conducted a full scale impact test on a window unit or “Structural Glazing Kit” bonded with 3M™ VHB™ Structural Glazing Tape B23F. This was to simulate the impact of a person into a bonded glazing element at the lowest ETA temperature specification limit of -40°C (-40°F) which reflects an unlikely event and thus, severe scenario in service. The acknowledged test standard for impact simulation in facades in Europe is the Pendulum Impact test (EN 12600).

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## Test Procedure

A test rig was mounted on a supporting structure to provide a) adequate fixture and thus minimum impulse energy dissipation through movement and b) attachment of the pendulum to a remote electronic release mechanism (see Figure 1).

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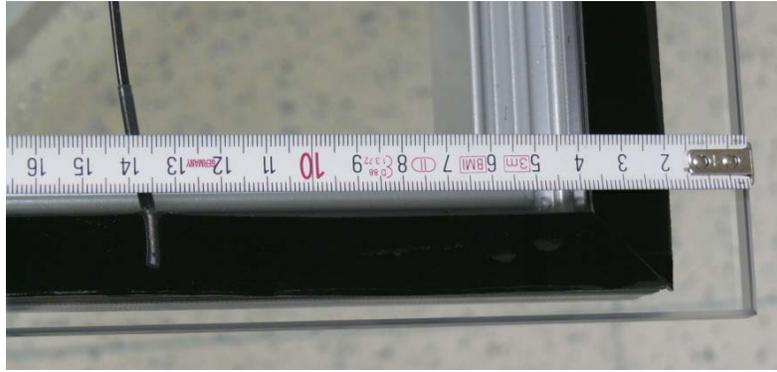


**Figure 1** - Set-up of the test rig with Structural Glazing Kit and location of temperature and acceleration sensors. *Courtesy ATLAS-ELEKTRONIK*

Three Structural Glazing Kit specimens were fabricated according to 3M process guidelines with 3M™ VHB™ Structural Glazing Tape B23F. These glazed assemblies consisted of an aluminum glazing frame system designed for compatibility with 3M™ VHB™ Structural Glazing Tape. The aluminum glazing frames were bonded to 10 mm (0.40") thick toughened safety glass panels with 18 mm (0.71") wide 3M™ VHB™ Structural Glazing Tape. The aluminum glazing frames measured 1900 mm tall x 800 mm wide (75" x 31.5") and were mounted onto the steel test frame shown in Figure 1 with the pendulum fixed at the required drop height. The electronic release mechanism for the pendulum was triggered when the desired test temperature was achieved. Temperature measurement was monitored permanently throughout all tests to ensure proper temperature in the tape was maintained at -40°C (-40°F).

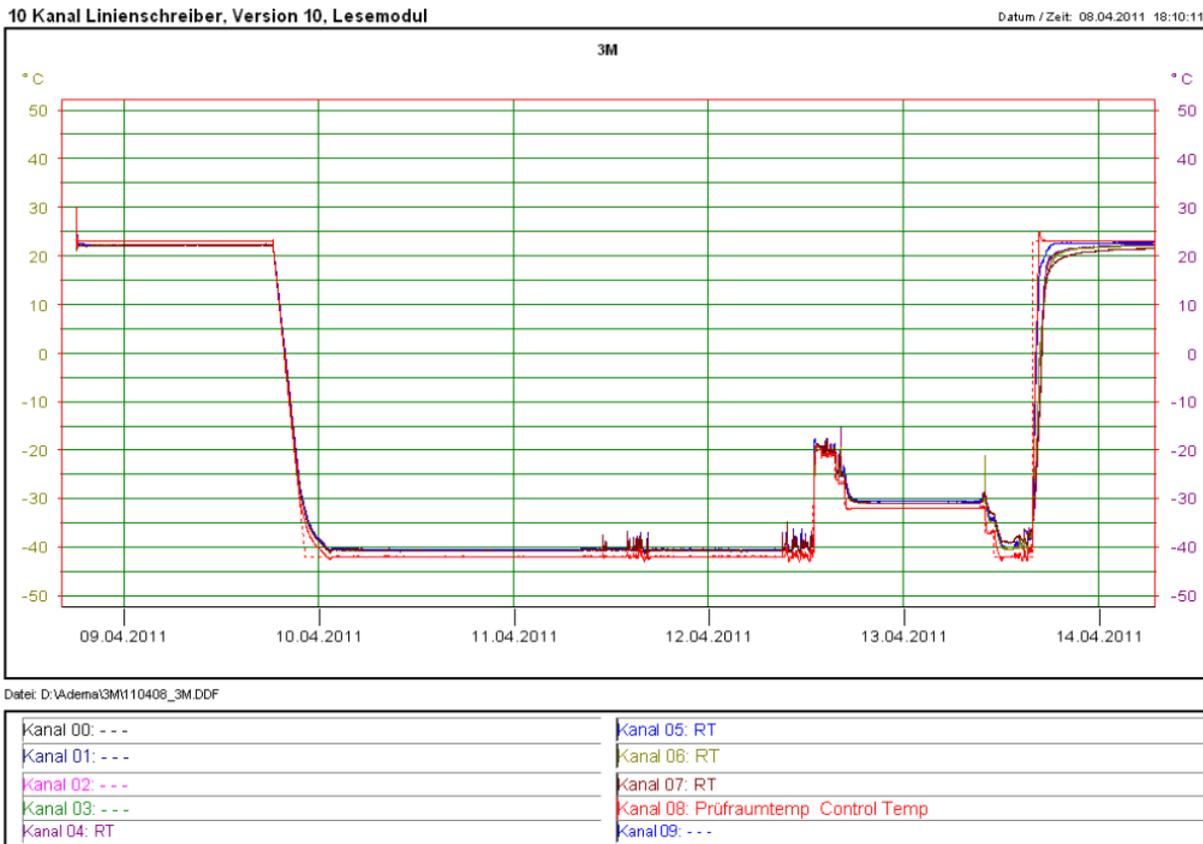
The locations of the temperature sensors are as shown in Figure 2. Sensors were placed inside the bond line; i.e., between the glass and 3M™ VHB™ Structural Glazing Tape with the cables routed outside the climatic chamber where the temperature measurement equipment was located. The pendulum was held in place by an electronic magnet coupled with a release mechanism outside the chamber. This set-up ensured maximum temperature stability during testing.

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**Figure 2** - Thermo couple sensor placed in the tape bond line.

The recorded temperature profile is given in Figure 3. Channel 08 (Kanal 08) shows the chamber temperature compared to the in situ tape temperature.



**Figure 3** - Temperature profile of test regime. *Courtesy ATLAS-ELEKTRONIK*

In accordance to EN 12600, a total of five test runs were conducted with multiple (four or two) impacts at each specific energy level. The only exception to this was for the first Structural Glazing Kit specimen which was only impacted once to allow for verification of the test and measurement equipment.

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The drop height was fixed at 1200 mm (47.2") whereas the impactor mass was varied from 50 kg (110 lbs) to 100 kg (220 lbs). The maximum impact energy as defined in EN 12600 is 589 J which corresponds to the 50 kg (110 lb) impactor mass.

All three Structural Glazing Kit specimens were tested at the required maximum energy level of 589 J according to EN 12600. As noted earlier, the first specimen was impacted only one time at this energy level. The second specimen was subjected to the same energy level and impacted four times in accordance with EN 12600. The third specimen was tested at three specific energy levels with successively increasing impactor masses of 50 kg (four impacts), 75 kg corresponding to 883 J (two impacts), and 100 kg corresponding to 1177 J (two impacts), exceeding twice the energy level required by EN 12600 (see Figure 4).

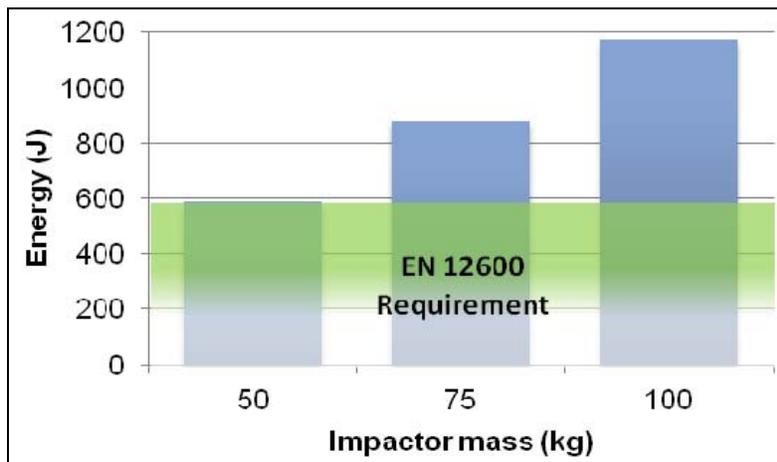


Figure 4 - 3M™ VHB™ Tape B23F passes the pendulum test at energy levels exceeding 2 times EN 12600 requirement.

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## Test Results

All three Structural Glazing Kit specimens passed the pendulum test according to EN 12600 conducted at -40°C (-40°F) including the tests beyond the required energy levels. No failures or issues were observed with the 3M™ VHB™ Structural Glazing Tapes after a total of 10 impacts at the extreme cold temperature. Bond line and glass integrity were intact and undamaged according to visual inspection conducted by all witnesses present during the test procedure.

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## Conclusion

The results of this extreme test regimen demonstrate the cold temperature impact performance of 3M™ VHB™ Structural Glazing Tapes in an appropriate glazing system as well as the safety factor beyond what is expected per industry standards. A copy of the test report from ATLAS-ELEKTRONIK is available for further review upon request.

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3M Industrial Adhesives and Tapes Division  
3M Center, Building 225-5S-06  
St. Paul, MN 55144-1000  
800-362-3550 (Fax) 877-369-2923  
[www.3m.com/vhb/structuralglazing](http://www.3m.com/vhb/structuralglazing)

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