



Auto Glass and Body Shop Tools

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VIBRATION LEVELS OF AUTO GLASS REMOVAL TOOLS

The following BTB report compares the Hand Arm Vibration (HAV) levels of a number of popular electric and air powered auto glass removal tools and is not to be utilised in any official capacity or reproduced in any way without prior written consent from BTB Automotive P/L.

This report is based on the results of independent testing carried out on major competitor tools in 1999 and 2004 by 2 internationally recognised testing authorities, the US National Institute for Occupational Safety and Health (NIOSH), and the Canadian Workers Compensation Board (WCB) of British Columbia.

These tests were conducted under actual workshop conditions, using both left and right hand operation during the removal of automotive glass.

BTB has additionally used these results to calculate (as per Ref.4) allowable operating times with respect to European Directive 2002/44/EC of 25 June 2002. This directive specifies the vibration exposure limits to which workers may be subjected, and the actions which employers must take when those limits are reached or exceeded.

Additional information used in this report has been sourced from third parties listed at the end of this document.

These reports conclude that the BTB tool can be used over a significantly longer period than major competitor tools with considerably lower risk of contracting Raynaud's Disease.

Raynaud's Disease is due to the effects of Hand Arm Vibration, particularly in colder climates, and is an existing problem with hand tools with excessive vibration levels. It is also an increasingly important consideration in the auto repair and insurance industries.

NIOSH (US)

The NIOSH Report provides the following recommended maximum operating times per day for each tool, based on the measured Overall Weighted Acceleration for these tools, and American Conference of Governmental Industrial Hygienists (ACGIH) recommendations on exposure to Hand Arm Vibration.

Table 1

Tool	Recommended Operating Time per Day (ACGIH)
BTB WK10 HD Air Tool	2-4 hrs
Competitor 1 Tool (Electric)	1-2 hrs / 2-4 hrs
Competitor 2 Tool (Electric)	Less than 1 hour

NIOSH also states “Both electric-powered tools had maximum vibrational energy in the Z-Axis which travels along the worker’s forearm. The BTB tool was measured with maximum energy in the Y-axis which runs parallel to the handle of the tool.”

WCB (CANADA)

Further to the above results, the Canadian Workers Compensation Board has conducted its own tests using a range of tools. This testing was carried out during actual auto glass removal on a variety of vehicles. The maximum acceleration levels measured in the axis of worst vibration are listed in Table 2.

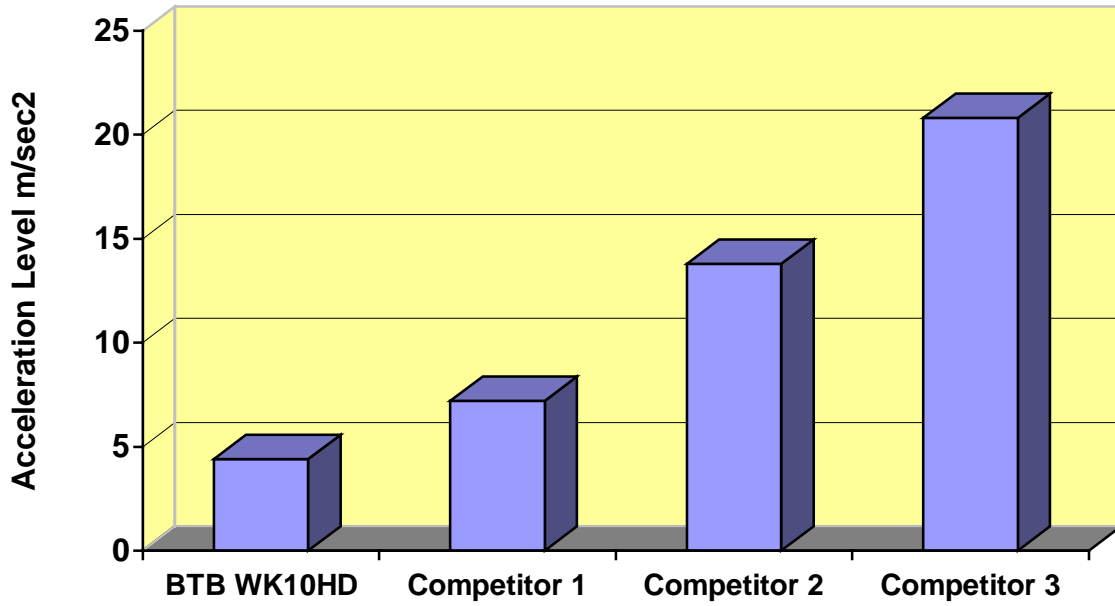
Table 2

Tool	Acceleration (m/s², worst axis)
BTB	4.4
Competitor 1 Tool	7.2
Competitor 2 Tool	13.8
Competitor 3 Tool	20.8

Table 2 results are illustrated in Chart 1.

In its conclusion, the WCB states that “the BTB tool vibrates noticeably less than the “Competitor 1” knife based on the data available (The BTB vibrates at 61% the acceleration of the “Competitor 1” knife). Both tools would be acceptable under the ACGIH guidelines.”

Chart 1 Maximum Acceleration Levels

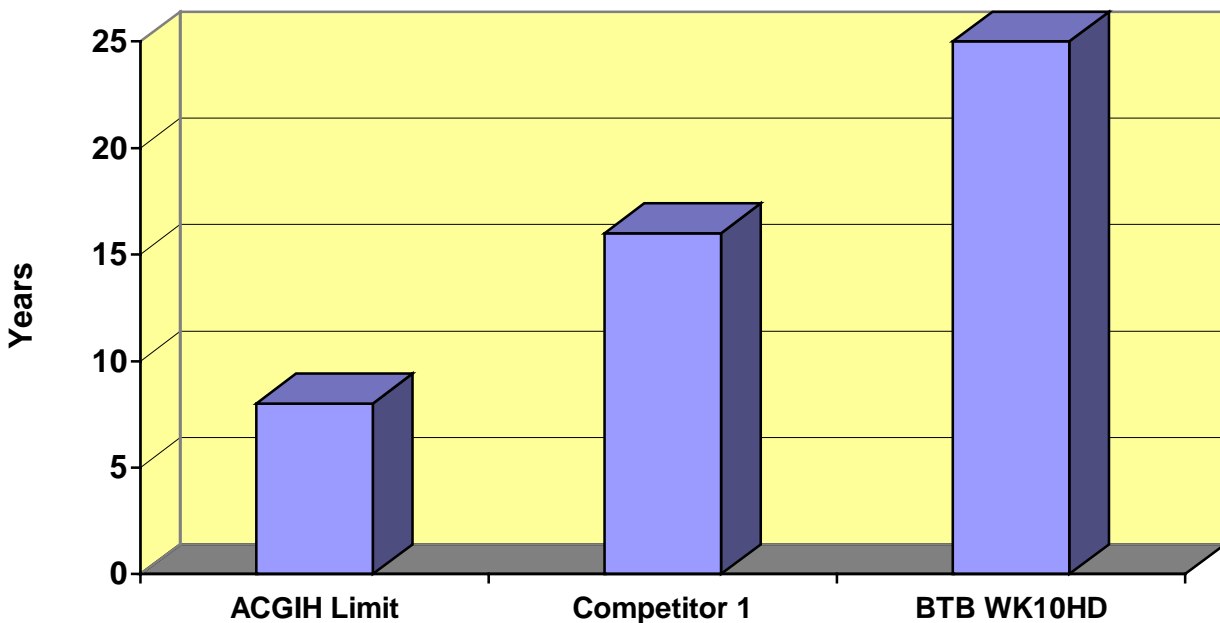


Furthermore, the WCB report also quantifies the above results by stating that approximately 10% of operators will attain Stage 1 of Raynaud's disease (caused by HAV exposure) within the following time scales, based upon the ACGIH daily guideline acceleration exposure A(8) value of 4 m/s²:

- 8 years with A(8) = 4 m/s² (ACGIH)
- 16 years with A(8) = 1.9 m/s² (Competitor 1 Tool and 5 cars/day)
- 25 years with A(8) = 1.2 m/s² (BTB and 5 cars/day)

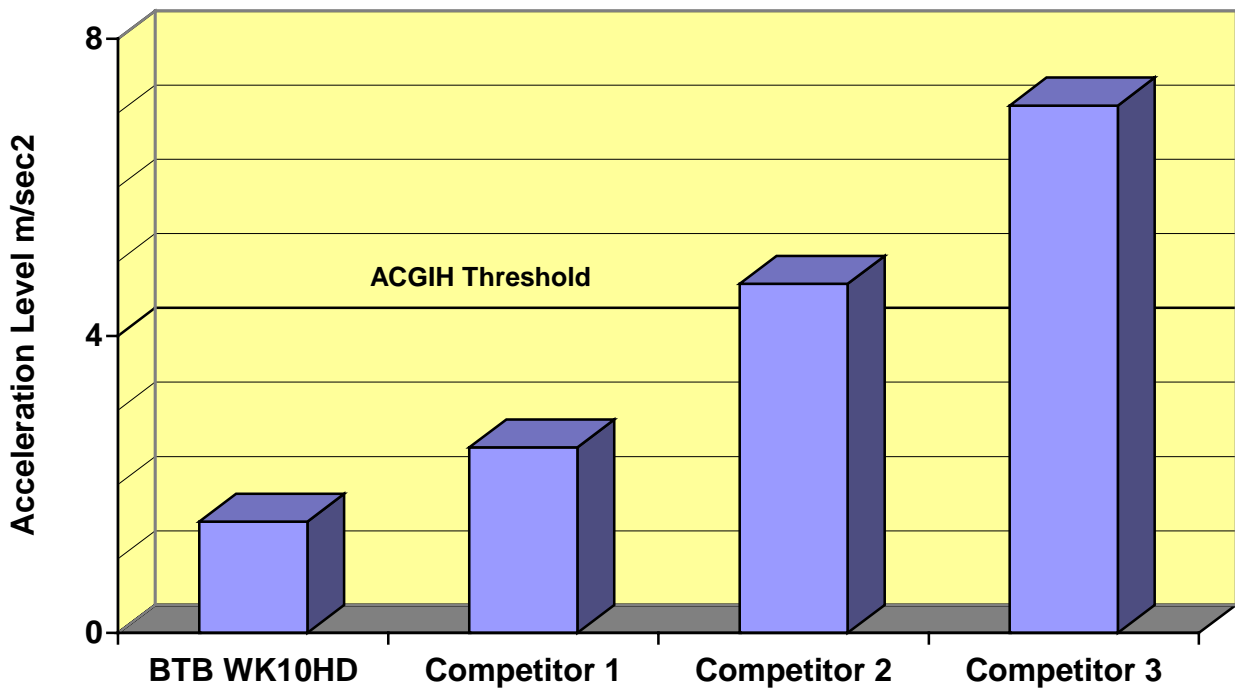
This is illustrated in Chart 2.

Chart 2 Years for 10% Probability of Acquiring Raynaud's Disease Due to Hand Arm Vibration Exposure



Again referring to the WCB report, and based on an operator removing 8 windscreens per day, the vibration exposure levels (A(8) standardised over an 8 hour day) for each of the tools can be compared as shown in Chart 3. The ACGIH daily guideline A(8) of 4 m/s² is shown as a threshold value in the chart.

Chart 3 Acceleration Exposure A(8) After 8 Windscreens



European Directive 2002/44/EC

More significantly, legislation introduced in 2002 by the European Parliament (Directive 2002/44/EC) regarding “...minimum requirements for the protection of workers from risks to their health and safety arising or likely to arise from exposure to mechanical vibration.” specifies limits on operating times for vibrating equipment.

This legislation is currently in force and applies to all member countries of the European Union, and will also be mandatory in the UK in 2005.

The directive specifies two basic limits on operating times, based on the vibration levels to which the worker is exposed during an 8 hour working day:

1. The EAV or Exposure Action Value, which is the operating time beyond which the employer must implement measures to reduce the exposure of the employee to mechanical vibration to a minimum.
2. The ELV or Exposure Limit Value, which is the operating time which **must not** be exceeded. Using the test results from the Canadian WCB report and applying the requirements of 2002/44/EC provides the following allowable average operating times.

Table 3

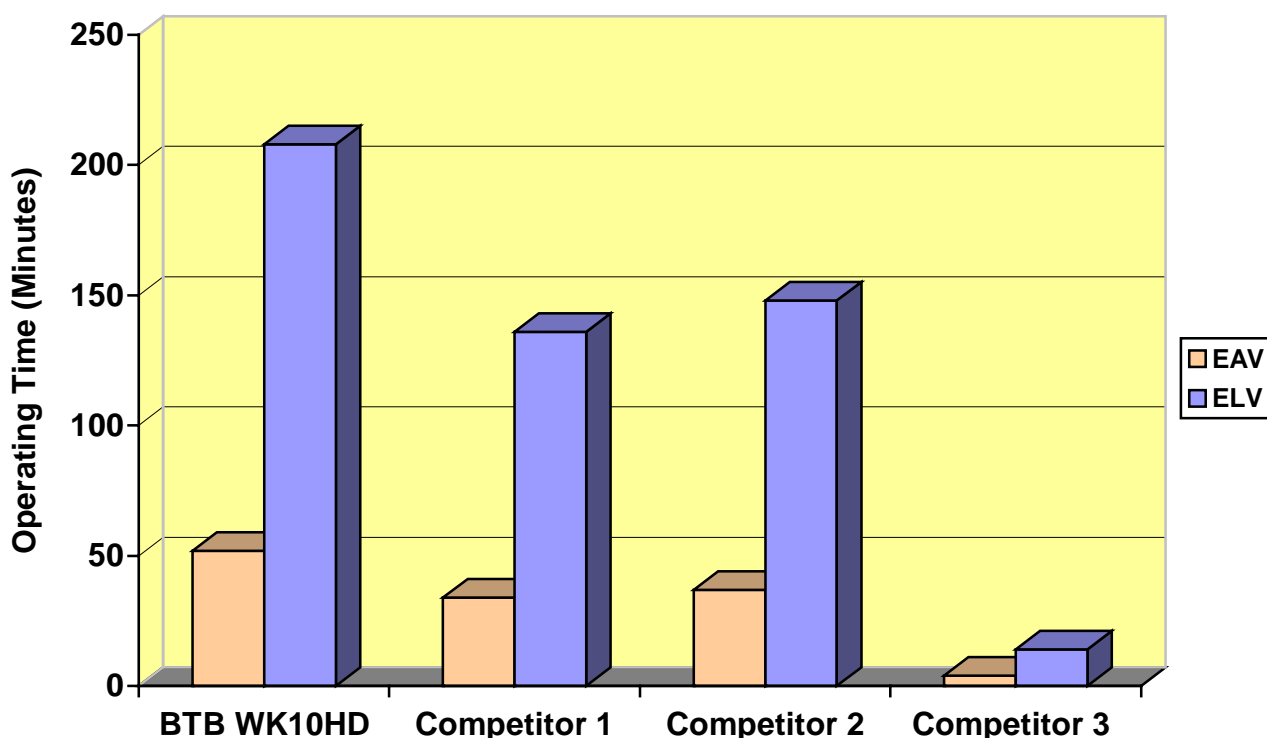
Tool	Acceleration (m/s², vector sum of axes*)	Exposure Action Value (hr:min)	Exposure Limit Value (hr:min)
BTB	7.6	0:52	3:28
Competitor 1 Tool	9.4	0:34	2:16
Competitor 2 Tool	9.0 (single result)	0:37	2:28
Competitor 3 Tool	29	0:04	0:14

* Also defined as Square Root of Sum of Squares (RSS) or Vector Sum, based on frequency weighted (rms) acceleration measurements for each individual axis.

Based on the above results, the BTB tool is the only tool which can be used by an operator all day (based on 8 windscreens per day at 6.5 minutes per screen) without requiring the employer to take exposure reduction measures (such as taking the operator off the job).

The relative operating times for all tools are shown in Chart 4.

Chart 4 Directive 2002/44/EC Operating Limit Values



Anti Vibration Gloves

The UK Health and Safety Executive (Ref. 6) has found that “At present, anti vibration gloves generally provide negligible attenuation of vibration ...” i.e. these types of gloves cannot generally be relied upon to convert a hazardous level of vibration to a safe level.

Summary

Based on the test results obtained by both NIOSH and WCB, it can be concluded that the BTB WK10HD precision pneumatic auto glass and panel removal tool presents significantly less risk to operator health and safety due to the effects of Hand Arm Vibration Syndrome.

This in turn should translate into less downtime due to fewer injuries, fewer injury claims and lower insurance premiums.

Importantly, the BTB tool can be used for significantly (over 40%) longer periods before allowable (EU) operation time limits are reached, translating into greater productivity and reduced need for employers to analyse and implement time consuming and costly vibration exposure reduction measures.

This feature is further reinforced by the BTB tool's variable speed control, which provides the ability to operate the tool at significantly reduced speed and attendant vibration level. The BTB cutting blade can also be used manually by fitting it to a proprietary manual handle thereby allowing finishing operations to a pre-cut glass to be made with no vibration effect at all.

The inherently low vibration and simple design of the BTB tool - with its reciprocating floating piston, variable speed and stroke which self adjust according to cutting conditions - in combination with the total absence of any rotating parts or drive mechanism, means that the BTB tool sets the standard in smoothness of operation and reliability.

The in-line configuration of the BTB tool, combined with low weight provides the added benefits of good ergonomic design with consequent reductions in operator fatigue and physical stress.

These benefits are due to BTB's specific aim of manufacturing a power tool that exceeds international safety standards for vibration and noise applicable to hand operated power tools, combined with superior ergonomic design.

Disclaimer

The above report has been produced on the basis of information provided by independent and reputable third party testing authorities. While BTB believes that the information provided is accurate and true in every respect, BTB cannot independently verify the accuracy of this information and cannot therefore guarantee that the data presented in this report and the conclusions reached therein are 100% accurate.

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References

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2. Workers Compensation Board Report 7.24-04057 “Hand Arm Vibration of Power Tools”, February 2004.
3. European Directive 2002/44/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration), 25 June 2002.
4. UK Health & Safety Executive, Hand Arm Vibration Calculation Tool
5. UK Health & Safety Executive Information Document HSE 246/31, “Reducing Risk of Hand-Arm Vibration Injury From Hand-Held Power Tools”
6. American Conference of Governmental Industrial Hygienists (ACGIH)