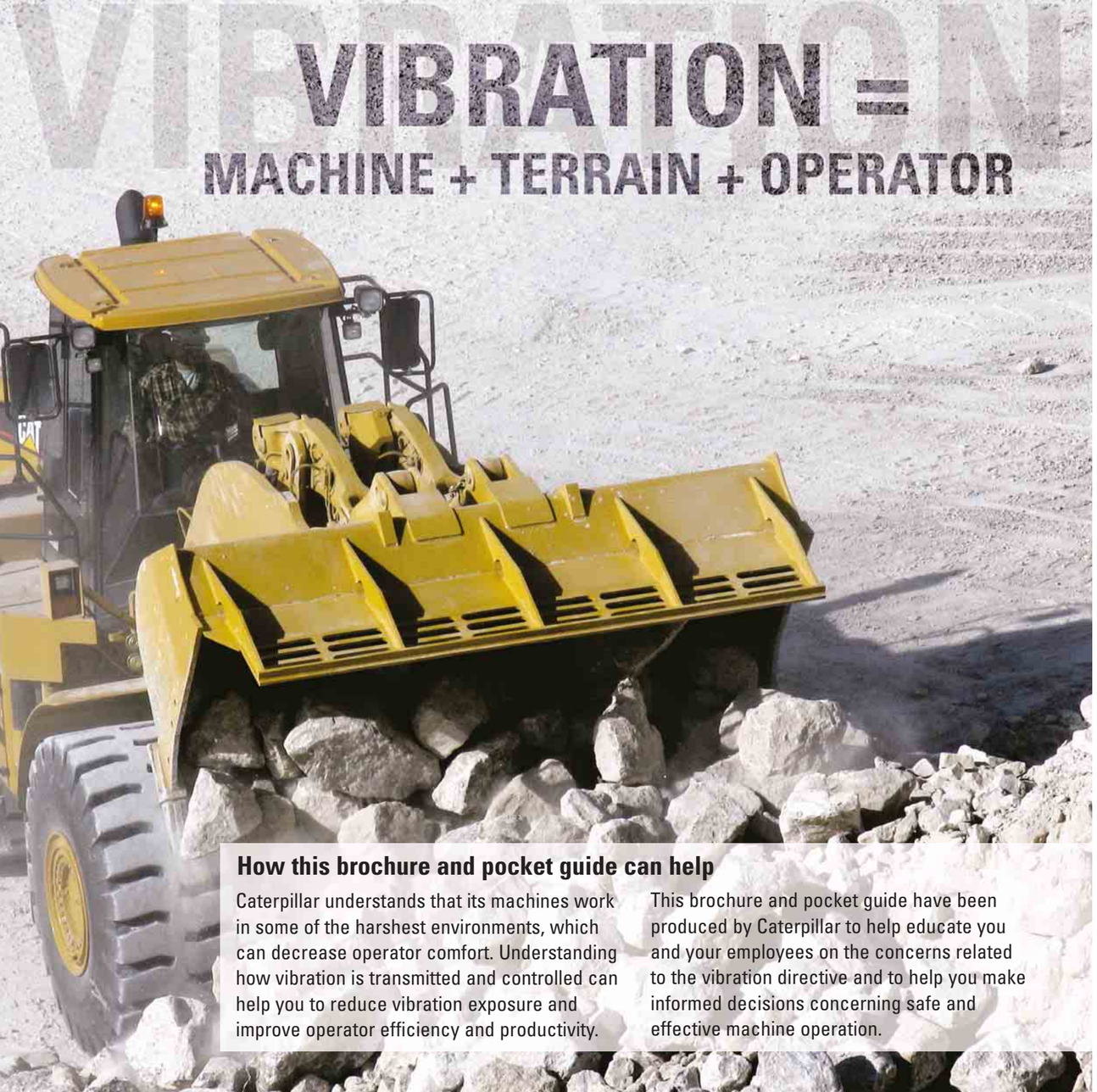
DRIVING DOWN VIBRATION

The European Union Physical Agents (Vibration) Directive 2002/44/EC

Your crucial role in ensuring compliance



How this brochure and pocket guide can help

Caterpillar understands that its machines work in some of the harshest environments, which can decrease operator comfort. Understanding how vibration is transmitted and controlled can help you to reduce vibration exposure and improve operator efficiency and productivity.

This brochure and pocket guide have been produced by Caterpillar to help educate you and your employees on the concerns related to the vibration directive and to help you make informed decisions concerning safe and effective machine operation.

WHY YOU NEED TO TAKE ACTION NOW

EU member states have to comply the European Union Physical Agents (Vibration) Directive 2002/44/EC, and transpose it no later than July 6, 2005.

Unlike previous directives on machine sound levels and engine emissions, you have an important role to play because the effective control of vibration exposure is not just a function of the manufacturer's machine.

Vibration exposure results primarily from these three factors - the machine, operator technique and ground conditions - and you have a responsibility to influence all three.

Your responsibilities

The directive places responsibilities on employers to:

- assess the levels of vibration experienced by employees and decide if they are likely to be exposed to limits laid out in the directive
- where necessary, take steps to reduce employees' exposure to vibration
- provide employees with information and training on how to operate machines to reduce the risk of exposure to vibration
- keep a record of your risk assessment and control actions
- review and update your risk assessment regularly

VIBRATION EXPLAINED

Exposure to vibration at work happens in two main ways:

- **whole-body vibration, or WBV**
- **hand-arm vibration, or HAV**

Hand-arm vibration levels in earth-moving machines with a ride-on operator are, in general, below the legal thresholds where you need to take action. Consequently, this brochure deals only with the action you should take to reduce whole-body vibration.

Your role in meeting the directive

The following pages provide an overview of how you can drive down whole-body vibration in your business. The pocket guide provides more detailed lists of the issues raised by the directive and practical help with the steps you should be taking.

The complete text of The European Union Physical Agents (Vibration) Directive 2002/44/EC can be found by accessing the European Union law website (EUR-Lex) at: http://europa.eu.int/eur-lex

Our responsibilities as manufacturers

Directive 98/37/EC encourages manufacturers to make their machines as safe as possible and to provide you with adequate information to help you use them safely.

CE labels and the Certificate of Conformity show that our machines comply with 98/37/EC and other relevant directives.

Different tasks produce different levels of vibration, and we have a duty to point out activities likely to create the greatest levels of whole-body vibration and advise on ways of minimising those levels.

Machine vibration levels will primarily depend upon the machine task, the operator technique and the terrain conditions. Vibration levels can be minimised by following the guidelines in this brochure and pocket guide.

ASSESSING THE EFFECT OF WHOLE-BODY VIBRATION ON YOUR EMPLOYEES

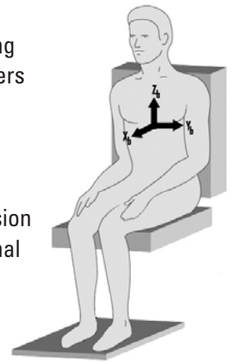
All operators are exposed to some degree of whole-body vibration which passes through the seat or floor into the body. The longer an operator is exposed to vibration, the higher the accumulated level of whole-body vibration exposure.

The most common causes of whole-body vibration are:

- **driving off-road too fast**
- **driving over rough routes**
- **poorly adjusted seat suspension**

Assessing vibration levels

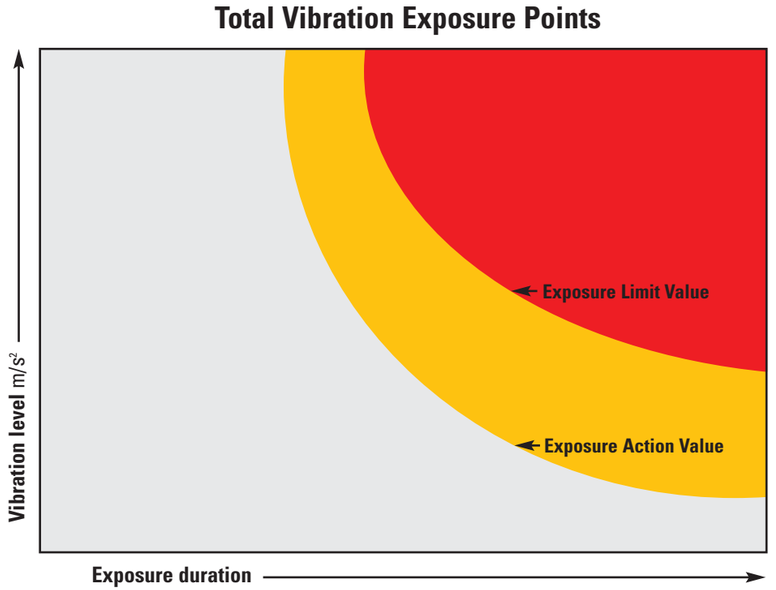
Your first step should be to complete a risk assessment by collecting basic information, observing work tasks and talking to your managers and employees.



Use this information, along with vibration information provided by international institutes, to assess the vibration levels for operators. If vibration exposure information is not available, you may commission a vibration expert to measure the WBV levels. You may get additional guidance on how to proceed from your local safety organisation or trade association.

Once you have the results, you can determine a course of action.

A SIMPLE GUIDE TO VIBRATION LIMITS



The chart above is a simple representation of the detailed chart in the pocket guide. It shows how Total Vibration Exposure is based on both vibration levels and exposure duration.

If Total Vibration Exposure is above the Exposure Limit Value (in the red area), you should stop the activity and implement new procedures to bring the level of exposure within safe limits.

If the Total Vibration Exposure is between the Exposure Limit Value and the Exposure Action Value (in the yellow area), you should take action to reduce vibration exposure to more acceptable levels and develop a programme to reduce the risk of exposure to vibration.

If the Total Vibration Exposure is below the Exposure Action Value (in the grey area), no action is needed.

PRACTICAL STEPS TO REDUCING EMPLOYEE WBV

These are some of the steps you can take to reduce WBV. A more comprehensive list can be found in the pocket guide at the back of this brochure.

- **ensure machines are adequately maintained, particularly the suspension**
- **choose the right machine for the ground surface and task**
- **check that machines have the right tyres, inflated to the correct pressure for the ground surface**
- **Check the operator's seat is in good repair, and gives good support**
- **use a suspension seat that meets ISO 7096. If a suspension seat is fitted, make sure it is correctly adjusted to the operator's weight according to the manufacturer's instructions**
- **ensure equipment in machine cabs is set to suit the size and reach of the operator**
- **identify the machines and work situations with the highest levels of vibration and arrange a rotation to reduce individual exposures**
- **plan work site routes over the smoothest terrain**
- **if possible, improve the route surface. For example, repair pot-holes, clear debris, or level out the surface**

Employee training

Arrange training to tell employees about whole-body vibration, and what they can do to reduce the level of exposure. In particular, cover the importance of:

- **sitting and posture**
- **adjusting the seat for good seating position and posture and, where a suspension seat is fitted, for the operators weight, especially when different people drive the machine**
- **correct tyre pressures**
- **keeping speed low on uneven terrain**
- **avoiding debris and potholes**
- **varying work patterns to reduce exposure**
- **reporting operator discomfort, as early as possible**

ALWAYS DRIVING DOWN VIBRATION

Caterpillar has always used state-of-the-art technology to ensure a socially responsible approach to safety and operator working conditions.

1940s

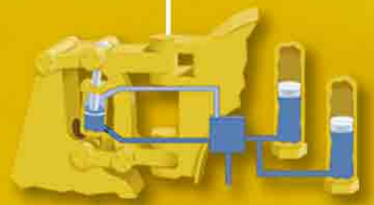
1940: Tandem rear axels on motor graders reduce bump input by 50%

1950s

1955: Scraper cab suspension systems tested.

1960s

1963: Air/Oil strut suspension for dumpers.



1968: Cushion hitch suspension systems on scrapers.

1970s

1978: Suspended undercarriage system for track type tractors.

1980s

1987: Caterpillar has a dedicated team with 20 years' experience of isolating operators from vibration, particularly in demanding applications involving vibratory compactors.

1990s

1991: Lift–arm suspension introduced on wheel loaders

1999: Lift–arm suspension introduced on backhoe loaders.

2000+

Caterpillar is curently working to reduce vibration still further across its whole product range. Here are three innovative examples.

Seat suspension systems
The Cat toggle link suspension system helps compensate for the operator's weight, ensuring the most comfortable ride over rough ground. The unique ride zone indicator allows the operator to adjust the seat for the most comfortable positioning and ride. All Cat suspension seats meet ISO 7096.

Cab suspension systems
Every Cat cab is attached to the frame with resilient mounts to reduce vibration and sound. Most Cat hydraulic excavators use viscous mounts, made of rubber filled with silicon oil. These significantly reduce low-frequency vibrations, cut noise and increase operator comfort.

Frame suspension systems
The Cat 700 range of articulated trucks has a 3-point front suspension system with independent cylinder action. The trailing frame rear suspension has resilient mounted mechanical walking beams. The result is a smooth ride over rough terrain and faster haul speeds.

Sources

The vibration information and calculation procedure shown in this brochure and pocket guide is based on *ISO/TR 25398 Mechanical vibration - Guideline for the assessment of exposure to whole-body vibration of ride on operated earth-moving machines - using harmonised data measured by international institutes, organisations and manufacturers.*

This brochure and pocket guide provide information on how to assess the whole-body vibration exposure of operators of earth-moving machines. The method is based on measured vibration emission under real working conditions for all manufacturers' machines, not just Caterpillar machines.

You should check the original directive, as this document only summarises part of the content of the applicable law, and is not meant to substitute taking reference from original sources. Other parts of these documents are based on information from the United Kingdom Health and Safety Executive.

Contact your local Caterpillar dealer for more information on how to select machine features to minimise operator vibration and operate your Caterpillar machines safely.

Visit www.cat.com to find your local dealer

YOUR NEXT OPTIONS

- use these guidelines to assess whole-body vibration levels and develop a programme of action.
- if you have a local safety organisation or trade association, contact them to get additional guidance about the vibration directive.
- check the original directive by assessing the European Union law website (EUR-Lex) at **http://europa.eu.int/eur-lex**

Contact your local Caterpillar dealer for more information about selecting machine features to minimise operator vibration and operating your Caterpillar machines safely.

Visit **www.cat.com** to find your local dealer

HEGQ3338 (10/2005) hr