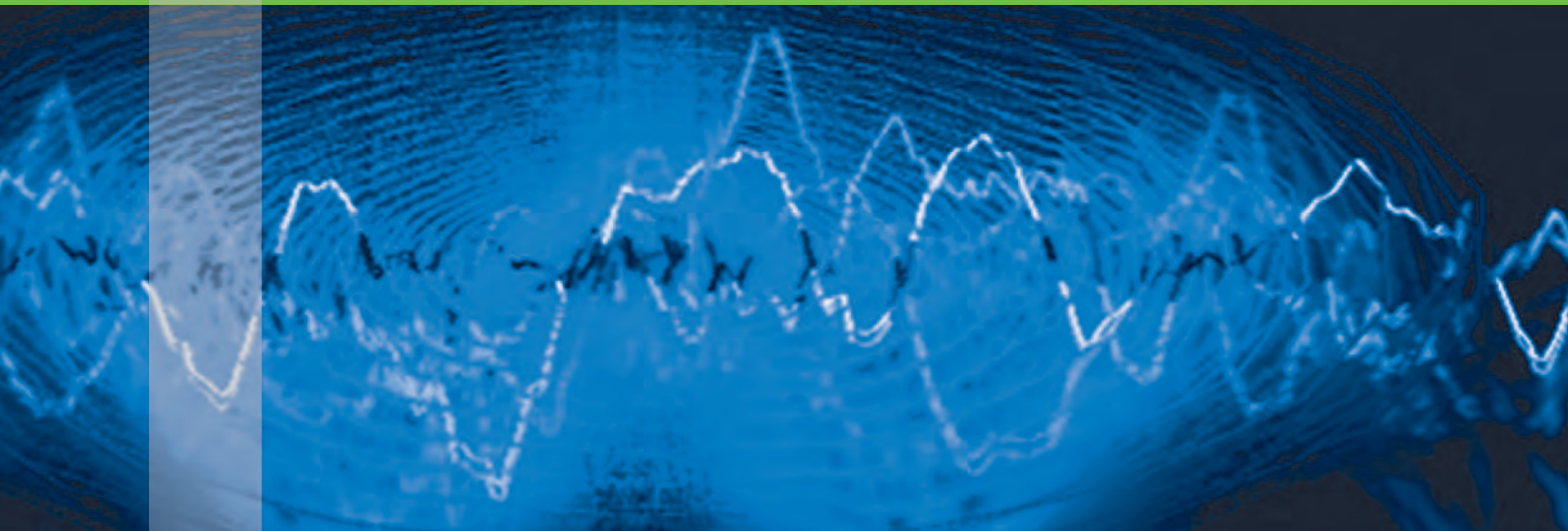


Measurement and vibration analysis

Measurement of vibrations and shocks using state of the art instruments – FFT analyzer and analysis software



Assignment

Due to our decades of experience in the field of vibration technology and isolation, we guarantee you technically and economically reliable problem solutions. The on site measurement and analysis of vibration is an essential part of our consulting services with regard to vibration and vibration isolation. Based on the measurement results, we develop vibration technical measures to comply with legally prescribed limits.

The assessment of periodic and non-periodic vibrations in the frequency range from 1 Hz to 80 Hz is e.g. based on the DIN 4150 "Vibrations in buildings; Effects on persons in buildings". Requirements and reference values are stated herein, in general the considerable disturbance of people in domestic properties and similar premises is to be avoided in order to comply with these regulations.

Procedure

In the first step the maximum value of the vibration levels for the three directional components x, y and z are determined. The largest of these three values KBF_{\max} is compared with the reference values A_U and A_O according to Table 1

- If KBF_{\max} is less than or equal to the (lower) reference value of A_U , then the requirements of this standard are met.
- If KBF_{\max} is more than the (upper) reference value of A_U , then the requirements of this standard are not met.
- For short-term impacts and those that do not occur often, the requirement of the standard is met if KBF_{\max} is less than or equal to A_O .

Another current example of the requirement for a vibration analysis is the storage of high-precision 3D-measurement machines, as well as other testing, measuring or grinding machines. Typically measurements must be carried out by such machines at the planned site, to ensure that existing ground vibrations do not exceed the permitted values (see Chart 1). To do this, the vibration acceleration is

determined within a given frequency spectrum (1–100 Hz), as a simple sum value measurement would provide insufficient information about the exact environmental conditions. The analysis, of the acceleration time signals is carried out using a fast-fourier-analyzer, which indicates the corresponding measurement value (vibration acceleration in g) for each frequency of the spectrum. If the disturbances (vibration interference) are out of the allowable range, the appropriate isolation can be determined with the help of our PC calculation program.

Very accurate vibration analysis in the lower frequency range are carried out with highly sensitive Geophones. Vibration speeds from below 0.01 $\mu\text{m/s}$ in the range from 0.2 to 30 Hz can be recorded with the Geophones. Extremely precise measurements of vibration are necessary for an optimal and customer-specific design, particularly in the semiconductor and Nanotech industry as well as for high-precision 3D-measurement machines.

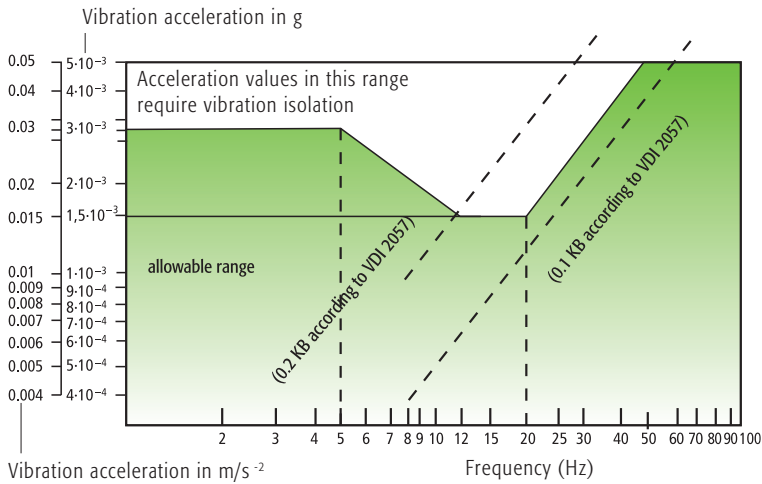


Chart 1: Example CMM limit curve

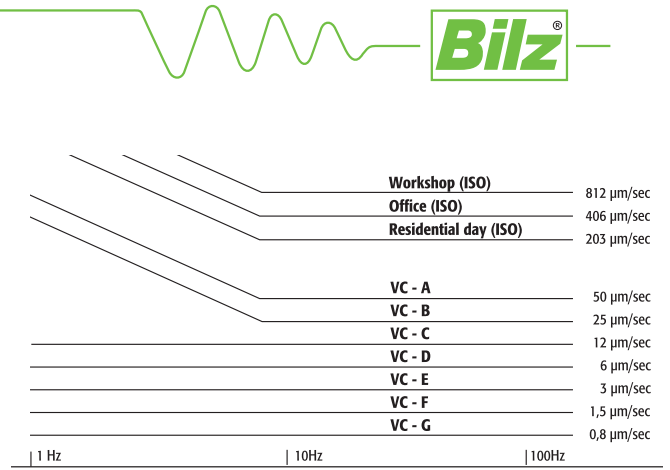


Chart 2: Vibration Criteria VC



FFT Analyzer



Geophone

REFERENCE VALUES A, FOR THE ASSESSMENT OF EXPOSURE TO VIBRATIONS

in homes and comparably used spaces

Line	Impact site	daytime			nighttime		
		A _U	A ₀	A _R	A _U	A ₀	A _R
1	Impact sites, in whose vicinity only commercial facilities and where appropriate are housed with the exception of where the owner and manager of operations, as well as supervisory and stand-by persons are housed (see Industrial estates § 9 BauNVO))	0.4	6	0.2	0.3	0.6	0.15
2	Impact sites, in whose vicinity mainly commercial facilities are housed (see Industrial estates § 8 BauNVO)	0.3	6	0.15	0.2	0.4	0.1
3	Impact sites, where neither predominantly commercial facilities nor predominantly domestic property are housed (see Core areas § 7 BauNVO, mixed areas § 6 BauNVO, village areas § 5 BauNVO)	0.2	5	0.1	0.1	0.2	0.15
4	Impact sites, in whose vicinity predominantly or exclusively domestic property is housed (see Pure residential areas § 3 BauNVO, General residential areas § 4 BauNVO, Small housing estates § 2 BauNVO)	0.15	3	0.07	0.1	0.2	0.3
5	Particularly vulnerable impact sites, for example in hospitals, sanatoriums, in so far as the are situated in those areas specially designated for them.	0.1	3	0.05	0.1	0.15	0.07

In brackets the areas of the Federal Land Utilisation Ordinance = BauNVO are specified, usually represented by the designations under line 1 to 4. A schematic equation is not possible because the designations under line 1 to 4 are only made after the grounds have been established to protect against exposure to vibration, the zoning of the area in the BauNVO takes into account however also other planning requirements.