Effective noise control in large companies

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The Volkswagen noise policy

- Place noise control as early as possible in the purchasing/planning process
  …inform/be informed
  …the early dB is the cheapest
  …leave amendments to the supplier
- Define proper noise values
  …make sensible requirements
  …speak the same language
  …train your supplier
- Benchmark is state of the art
  …do more than limit value compliance
  …don’t quieten without sense

Content of BV 1.01

Unless the supplier is given different values, the following values are to be met.

The 1m-surface-sound pressure level $L_{pA,1m}$ (averaged sound pressure level in 1 m distance) and the emission sound pressure levels (workplace) according EN ISO 11200ff must not exceed **L_{pA}= 75 dB(A)**.

At devices with frequencies above 16 kHz a level of **L_{pZmax}= 110 dB(Z)** must not be exceeded.

The supplier has to give information if sophisticated measures has to be carried out to keep the guaranteed values.

Only non inflammable materials are to be used.

Emission and immission

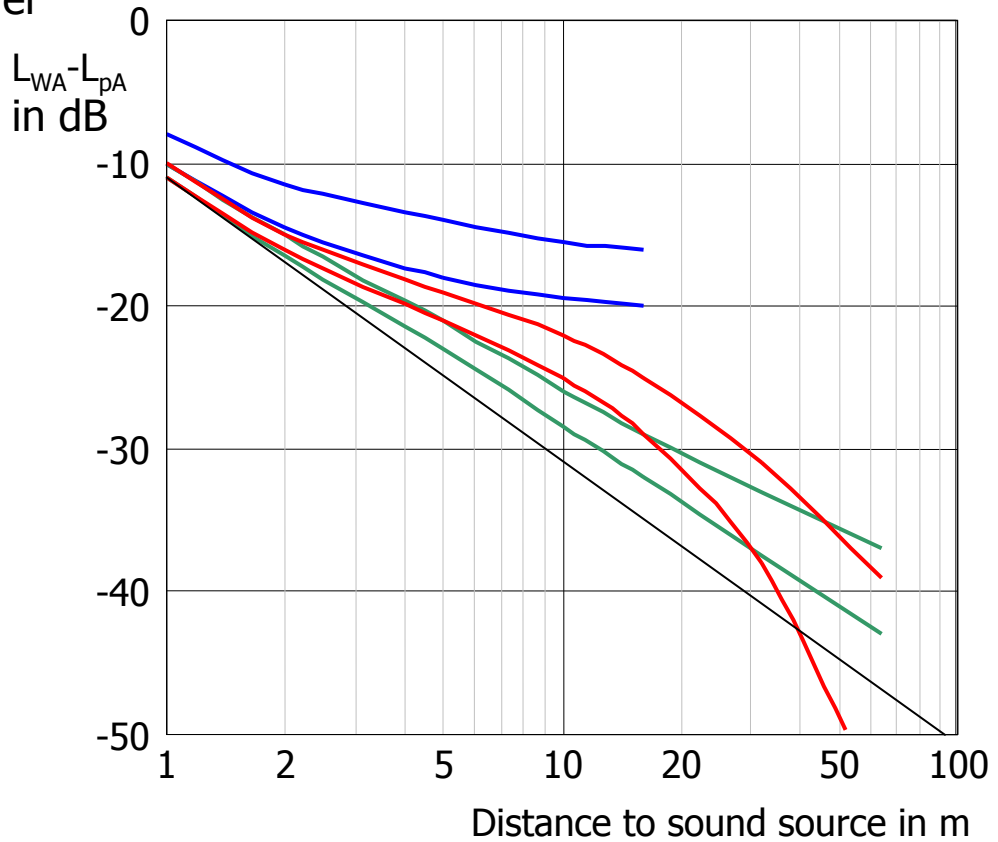
Suppliers seldom know the difference between emission and immission:

- Only the definition of emission values ensures correct acceptance procedures.
- The emission sound pressure level defined LpA belong to the machine only. Influence of background noise and room reflections must be eliminated
- Background noise is corrected by using K1 (ISO 3740ff)
- Room influence K2 is more complicated:
  - Sabine formula is not applicable in low-ceiling rooms !
  - Sound distribution curve (EN ISO 14257) is used for correction
  - The curve depends only on absorbing materials and ceiling height
- K1+K2 may reach 10dB in worst-case situations:
  => emission ≤ 75 dB(A) leads to immission ≤ 85dB(A)

The sound distribution curve

The sound distribution curve displays the difference between sound power and sound pressure level

- blue: cubic room
- red: low ceiling, full
- green: low ceiling, empty
- upper curves: absorbing ceiling
- lower curves: reflecting ceiling
- black: free field
  (6dB / distance doubling)
- At Volkswagen:
  upper green curve,
  approx. 4dB / distance doubling



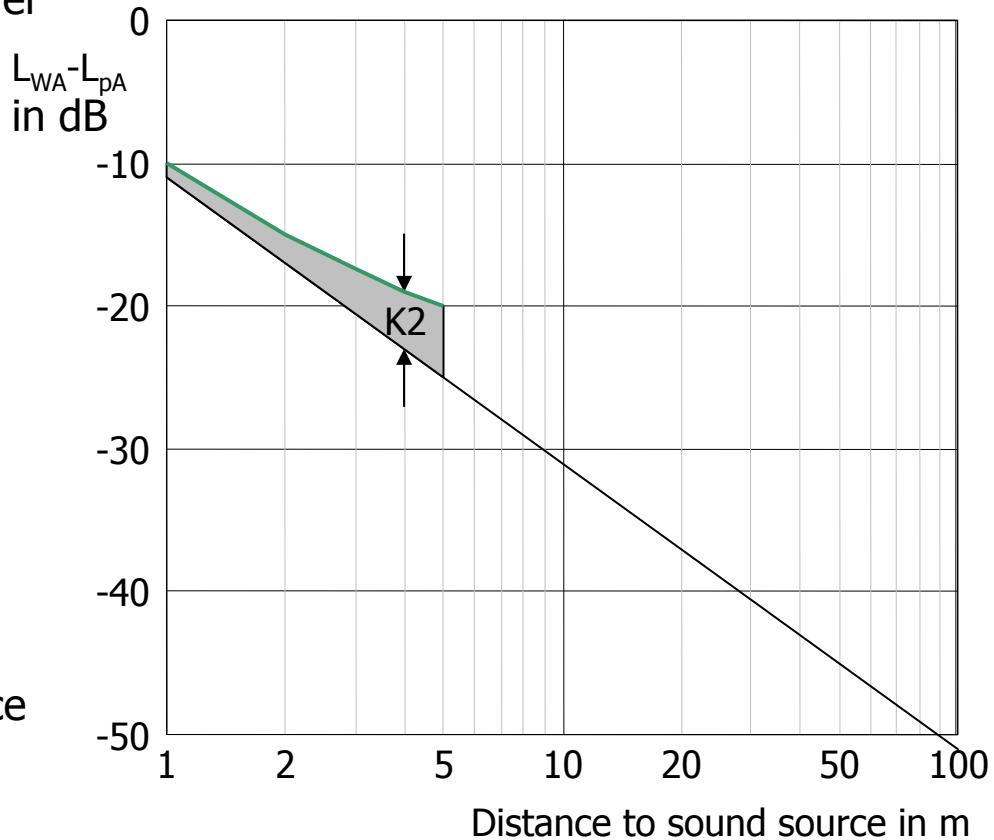
The sound distribution curve

The sound distribution curve displays the difference between sound power and sound pressure level

- Difference between curve and free field curve equals the room reflection K2
- Typical Volkswagen workroom:

Distance	K2
1m	1dB
2m	2dB
3m	3dB
4m	4dB

- distance to the main sound source (<5m) equals K2 in dB



Noise Measurements

Calculation of emission values (Excel-Sheet)

Calculation of noise emission levels		1	2	3	4	5	6	7	8
Background noise	LAm/dB	73	77	77	76	76	75	76	
Machine noise (workplaces)	LAm/dB	77	80						
Machine noise (1m-surface)	LAm/dB			80	80	81	79	79	
Distance main sound source	R/m	1	2	2	2	3	3	3	
Background noise correction	K1/dB	2	3	3	2	2	2	3	
Room reflection correction	K2/dB	1	2	2	2	3	3	2	
sound pressure levels (workplace)	LpA/dB	74	75						
sound pressure level (1m-surface)	LpAi,1m/dB			75	76	76	74	74	
do., averaged	LpA,1m/dB	75							

Ultrasonic noise

Some devices use ultrasonic sound to weld/clean parts

- The A weighting curve eliminates ultrasonic frequency contents
- The AU weighting curve extends the A curve up to ultrasonic frequencies
- The Z weighting curve is zero for all frequencies (with definite uncertainties)
- A level of 110dB(Z) may cause ear pressure, nausea, etc.
- Higher levels may cause hearing losses at high frequencies (>8kHz), which are not considered as occupational disease (ISO 1999 ends at 6kHz)

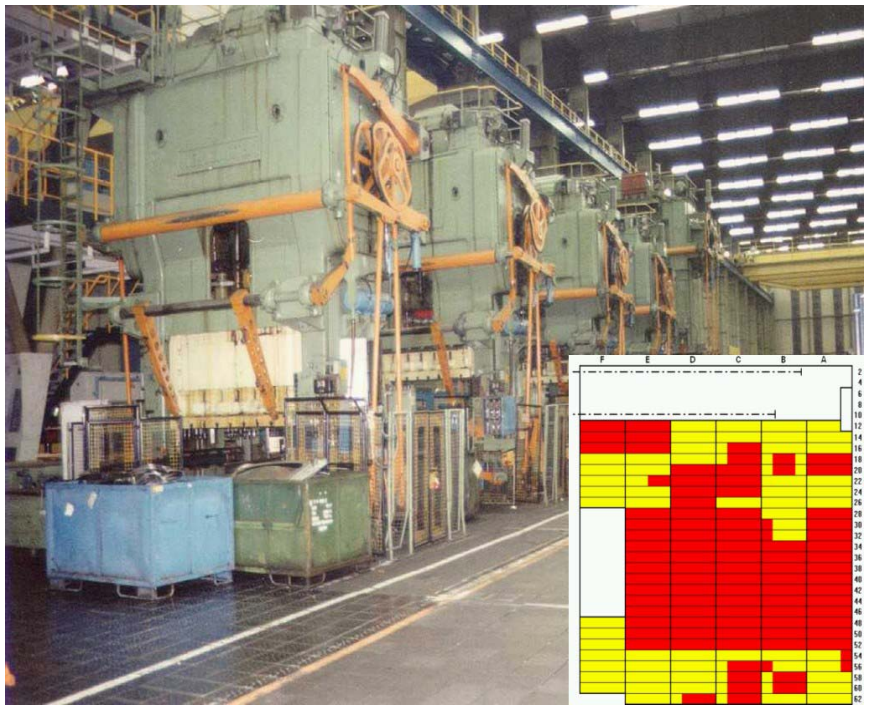
Problems

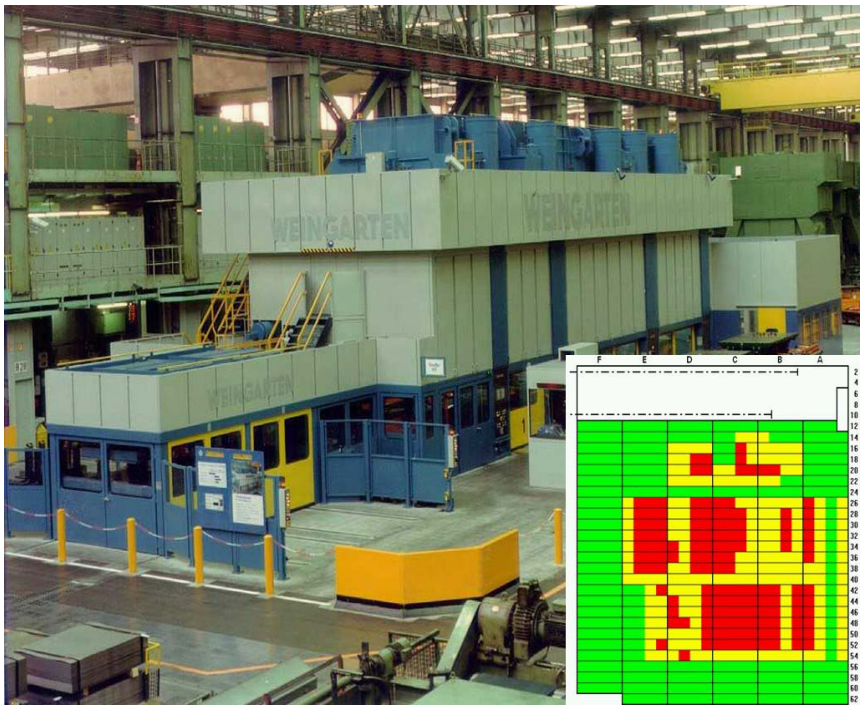
Using a purchasing directive does not solve every noise problem:

- Definition of a machine:
  connected machines of different suppliers: what is machine/background noise
- Working conditions:
  supplier declares standard condition values, machine under normal load is louder/normal load is changing
- User induced noise:
  throwing parts in a container, putting parts in retainer under time pressure, misuse of machines

Results

Press shop 1985-2005





Results

Body shop 1985-2005