

# Product Noise and Vibration Control



*Increased profits through innovative engineering noise and vibration control technology for designers, developers and suppliers of new or updated products ...*

## Designing-in Noise and Vibration Control at Source

Our approach is based on innovative engineering techniques that reduce noise at source, sidestepping the problems and costs associated with conventional technology. We have been extremely successful at applying a blend of engineering experience, intuition and technology transfer across a wide range of products and industries to develop elegant solutions to product noise and vibration problems.

### The Commercial Benefits

There are significant commercial advantages to be gained if your products are not only substantially quieter and smoother than those of your competitors, but also if the control measures used are dramatically cheaper. In many cases, incorporating our technology has substantially increased the profit margins on the product and even improved productivity.

### The Case Studies

#### Product Development - Compressor Noise Control

As part of a continuous product development programme to maintain their world-leading reputation, CompAir asked us whether it would be feasible to re-design the noise control package on one of their compressors. The initial target was to remove the existing silencer element to reduce the overall size of the unit - without any increase in noise or a reduction in the performance of the cooling system.



Source control modifications were developed for the cooling system which significantly reduced the overall noise from this element at source and also dramatically cut the tonal content (less "nuisance"). Coupled with modest flow and geometry changes, the new package reduced the overall "headline" noise from the compressor by 2 - 3dB(A), despite removing the standard silencer - and all without any cost or performance implications. [www.compair.com](http://www.compair.com)

#### Vacuum Cleaner Noise Control

And now for something completely different. During the re-design exercise for a new model, the noise from this vacuum cleaner was not only reduced by a factor of 10 (10dB(A)), but the subjective character of the noise was also substantially improved by eliminating the tonal components to make it sound "nicer" (a specialist technical term in acoustics!) and more powerful.



Sound:  before  after

The key to the success of the project was very accurate diagnosis and ranking of noise sources coupled with lateral thinking. The noise control techniques used included the re-design of the motor cooling fan, improving aerodynamics and isolation of the motor from the body. As these were all introduced as part of the design exercise, there were virtually no cost implications.

In another similar exercise, Dyson engineers spent a couple of days picking our brains over the options to design noise control features into new models.



#### Rear Axle Gear Noise

We were asked to design a test system for a production gear test machine to detect noisy gear pairs. However, we went a substantial step further by developing a vibration analysis algorithm for the ProTest system. This sought out the minimum noise "sweet spot" for each gear pair and specified the shimming required during installation in the differential so that each axle gear pair was assembled in its quietest configuration.

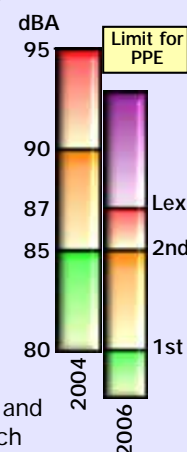


### Commercial Pressures

The new regulations reduce the noise level at which hearing protection is required by 5dB - which represents a 3 - fold reduction in noise energy. Consequently, the number of personnel using PPE has risen steeply - as have the costs (for 100 staff, this can result in a spend of over £20,000/annum on plugs alone). As a result, companies are under considerable and mounting pressure to buy low noise equipment.

We have developed the UK standard "Buy Quiet" purchasing policy complete with template documentation guidance notes, technical support and training, versions of which are widely used across industry.

Whilst the increased use and policing of Buy Quiet policies generates pressure on suppliers, it also represents a commercial opportunity. All else being reasonably equal, a quiet piece of plant attracts a substantial cost premium - and a higher margin.



Industrial Noise and Vibration Centre

### Cigarette Making Machines

These making machines had operator noise levels of 91 - 93dB(A) and had production requirements for instant access in the event of problems. Moreover, conventional acoustic materials were ruled-out due to the toxic combustion products should traces find their way into the tobacco



Various costly covers and guards had been tried in the past and rejected due to productivity and performance limitations. In one case, an entire production area had been lined with acoustic absorbent at a cost of £250000 - but with no effect on operator noise levels.

We designed a retro-fit engineering noise control package that controlled pneumatic noise, de-tuned gearbox resonances and damped key panels. Coupled with tolerance control on one gear-pair, this reduced noise levels by 4dB(A) to well below 90dB(A) at a cost of a few hundred pounds/machine and with no effect on normal operation or access. The kit was licensed by Molins for worldwide sale as a profitable product in its own right.

### Hi-Fidelity Engineering

We were asked to look at improving the acoustic design of Custom Design speaker stands for up-market Hi-Fi aficionados. As a result of vibration testing on the stands, we recommended replacing the top and bottom plates with laminated "dead-metal" versions from Acousteel. These reduced the vibration response of the stands by up to 40dB (a factor of x100).



According to the review in Hi-Fi Choice " .. switch to the Acoustic Steel plates and the sound is even better, with a deeper, quicker base and a more open mid-band. There's definitely a neutralising effect with the acoustic steel that zaps a lot of colouration, giving a far more neutral sound. Top value upgrade.. 5\*s."

### Eurostar HVAC

The noise produced by the Nightstock HVAC module was unacceptable both in terms of overall noise levels and tonal noise at the blade pass frequency of the fan and harmonics. Introducing conventional noise control techniques to reduce the tonal content had been unsuccessful. Maintaining the fan performance was critical and space within the HVAC module was severely limited.



The innovative solution was a combination of Quiet Fan technology (QFt - designing an aerodynamic insert that fits inside the fan volute) plus some minor additional modifications. These reduced the tonal content by 24dB and the overall noise by 8dB(A) with no significant effect on performance and at very low cost. The modifications were also contained entirely within unit (there were no space implications) and the whole project was completed within just a few days.

### Textile Machines

Detexomat machines (for making tights) were ordered subject to meeting the requirements of the INVC Buy Quiet policy used by the potential customer. The company consulted us as to the best way to reduce noise - previous attempts based on screens etc had been unsuccessful for operational reasons.



The solution involved noise control at source for both the pneumatic system and the high speed sewing machine. This reduced the operator noise from 90dB(A) down to 82dB(A) at a cost of just £250/machine and with no effect on normal operation.

### Vacuum Pump



The worldwide sales of a British vacuum pump based on a radical new principle had been affected by the high noise level. Previous attempts at noise control had met with only very limited success.

We used sophisticated analysis to identify and rank the sources and used the results in the re-design of the drive system and bed-plate. These measures added nothing to production costs but reduced the overall noise by 15dB(A) (down to 58dB(A)), well below the 60dB(A) target based on the noise levels of competing pumps. Moreover, as the tonal character of the pump had also been eliminated, it was virtually inaudible under most circumstances.

### Vibratory Sieves

The manufacturer of high performance vibratory sieves was increasingly under pressure from customers to provide quieter units. The issue was complicated by the fact that the machines are often used in high hygiene applications.



The conventional approach is based on variations on the theme of covers and full or partial enclosure - with obvious cost, access and hygiene implications. We developed and tested a set of engineering source control measures that could be built-in to the sieves (including an innovative component manufacturing process). The typical 5dB(A) noise reduction was achieved at little additional cost and with no effect on hygiene, maintenance or normal operation.

### Web Site Updates

Our web site gives you instant access to the latest developments in occupational and environmental Noise, Vibration, HAV, case studies (including sound), training, useful links, new products ....

[www.invc.co.uk](http://www.invc.co.uk)

Contact us for more information about product noise and vibration control technology, technical support and training programmes for engineers.