NOISE CONTROL - PRECAUTIONS AT THE DESIGN STAGE

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ECONOMIC ASPECTS

The cost of producing a quiet factory or plant varies with the type of industry, but may be between 0.5 and 2% of capital cost for plant on existing sites in industrial areas.

Should the plant be on a green field site then the costs could be doubled.

Noise control costs money and must be allowed for when costing a project, failure to do so inevitably leads to either:

(a) over expenditure or
(b) excessive noise levels.

Noise control applied after commissioning inevitably costs more and in some cases becomes impracticable or uneconomic.

Works design staff should make provision for noise control at the design stage.

NOISE PROBLEMS DUE TO DEFAULT AT THE DESIGN STAGE

Design staff involved in new installations, should have a basic knowledge of noise control, be aware of impending legislation, and an appreciation of the precautions necessary to prevent noise problems arising at new installations.

Faults found at the commissioning stages of recent installations illustrate the type of problem arising through default at the design stage.

(a) Placing of machines in factories: i.e. machines installed close to highly reverberant surfaces, and placed where internal environmental problems have been created.

(b) Works air supply systems
Air supplied at 100 PSIG, 20 PSIG was sufficient for the particular duty of removing moisture from cast ingots. A specially designed system was designed delivering a low air pressure through an elongated slot. An attenuation of 10dB(A) was obtained and a power saving of £6000 per year.

In another case a reduction in Leq and power saving were made by interlocking an air supply to operate only when required by process.

(c) Fan manufacturer supplied data showing acceptable noise levels. Fan when installed on site produced dangerous noise levels due to badly designed pipework creating severe turbulence.

In another case, environmental complaints arose due to pure tones from the blade passing frequency emanating from the top of the fan exhaust stack. Due to the pipework geometry the fitting of a silencer was impractical.

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Where the installation of a fan could give rise to environmental complaints, consideration should be given at the ductwork design stage, for the provision of a flanged spool in the line. Should it be necessary to fit a silencer retrospectively, inexpensive fitting would follow.

It should be remembered that a large slow speed fan will generally be much quieter than a high speed small fan with the same throughput. It is usually cheaper to buy the quiet fan in the first place than try to silence the noisy one.

The tip speed of a quiet fan would usually be below 40m/sec.

Most environmental complaints arise due to pure tones from fans. It must be remembered that because the ear is able to disciminate between different frequencies of sound, a pure tone can be clearly audible in a general noise, when the level of the pure tone is 10 to 15dB below the sound pressure of the octave band which contains the pure tone.

(d) Blowers

Blowers fitted with silencers installed in blower house. Delivery pipework, after silencer unlagged, taking in noise generated in blower house and being conveyed beyond the room wall.

Be wary that manufacturers noise data are not for silenced blowers because blowers may be supplied unsilenced.

A reactive silencer designed for low-lobe passing frequency attenuation will be large. The size can be reduced by keeping the strict dB(A) objectives in mind i.e. it may be possible to ignore a heavily weighted fundamental frequency and size the silencer to attenuate the second harmonic frequency in preference.

(e) Electric Motors

Motor noise tends to be cooling fan turbulence and speed dependent only. Noise can start to be a hazard at 10kw for a 3000 RPM motor and 50kw for a 1500 RPM machine.

Consider reducing the turbulence noise by using a smaller and/or more efficient (uni-directional) fan rotor to replace the bi-directional type (refer to BS:4999: Part 51 "General requirements for rotating electrical machinery").

Inlet silencers can be used where a motor is mounted near to work stations.

Noise data supplied in accordance with the now obsolete BEAMA spec is at 3m and not at the customary 1m.

(f) Granule Conveying

Pneumatic conveying pipework is a regenerative line source - the noise does not decay appreciably with distance along the pipe, the breakout noise attenuation is only 3dB for every doubling of distance from the pipe surface. Noise can increase by as much as 10dB at bends, so position bends away from personnel work stations to protect employees.

(g) Drive Belts

Tooth belts are now being more widely used in industry because of their value in power savings. Tooth belts have given rise to noise problems. Consideration must be given to the replacement of mesh guards by solid acoustic lined guards.

(h) Vents

Steam, gas and air vents generate high noise levels when the gas speed exceeds 80m/sec. Silencers may be required above this speed. Consideration should be given to this when designing pressure relief devices for example.

(i) Pumps

It is usual where pumps are concerned to find that the motor noise is dominant or equal to the pump noise.

Suction pipework is noisier than delivery. Velocities should be kept down to 5m/sec. The usual faults with pump noise are due to:

(i) Undersize suction pipe-work leading to excessive velocity and cavitation.
(ii) Aeriation of fluid-reservoir - particularly location of outlet pipe.
(iii) Undersize filter in suction - starvation.

(j) Silencers

Check that the silencer construction and materials are adequate for the process conditions, flammability, internal pressure etc. Silencers can be heavy and often require support.

(k) Enclosures

Consider ventilation where there is possibility of a build up of flammable gases etc. Remember that enclosures will be removed for maintenance purposes and rarely put back efficiently. An enclosure designed to attenuate 30dB with a 1% hole reduces attenuation to 20dB and so on.

Enclosures should always be isolated from the floor with padding/felt etc.

Works design staff need access to noise expertise at an early stage in design if noise problems at the commissioning stage are to be avoided.