Facts on sound and noise, energy and safety

Silvent's safety products fully comply with the noise limitations of the EU Machine Directive as well as OSHA's safety regulations.

The effect of noise on humans

Man has five senses: sight, hearing, taste, smell, and touch. The most essential of the senses is, without question, the sense of sight. It is crucial to our managing our education and work.
After sight, the sense generally considered as the second most important is the sense of hearing. It is primarily through speech and hearing that we communicate with one another. Hearing is also our most sensitive and important warning mechanism. It receives impressions from every direction and is open for impulses when a person is awake as well as asleep.

Modern society has created an environment in which the ear is the sensory organ most frequently and most easily damaged. The human ear is not designed to endure or exclude much of the sound and noise that exist in the industrial society of today. Therefore, the ear can be seriously injured by loud and repetitive noise.

Loss of hearing can result in a person being partially or completely isolated from his surroundings. Such a loss can never be restored.

In the past, a noisy machine was a symbol of strength, power, and wealth. People accustomed themselves to the noise, i.e., they accepted it as the noisy machine meant income and existence. The fact that those exposed to the noise became hard of hearing or practically deaf was considered a natural part of the occupation.
Today, we no longer need to accept this rationalization. There are possibilities to reduce or eliminate noise, both in the workplace and in our private lives. It is simply a matter of making people aware of the dangers and the possibilities so that we can take action against noise.

Many experts and researchers view noise pollution as one of the most major of today's environmental problems.

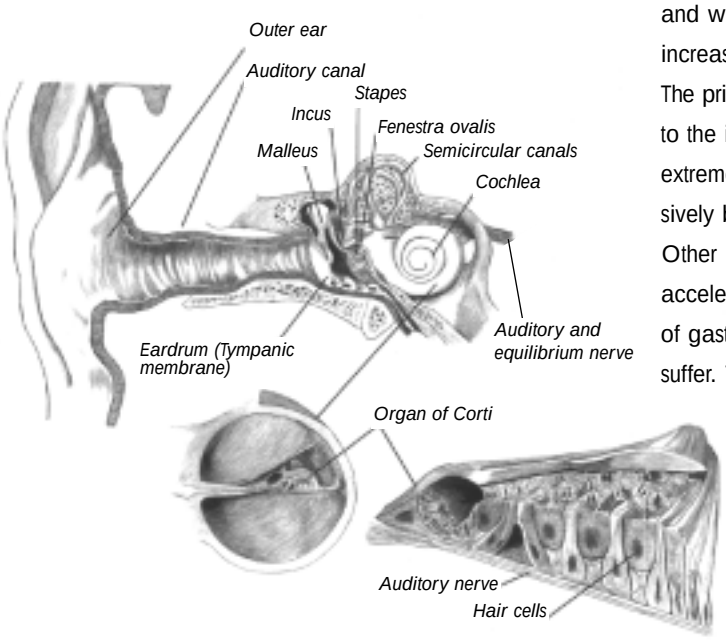
70-80% of all hearing loss within the manufacturing industry today is associated with compressed air noise.

The structure of the ear

When sound waves reach the ear, they are transformed into signals to the brain in the three different parts of the ear:

- The outer ear and the auditory canal
- The middle ear
- The inner ear

The outer ear and auditory canal are designed to amplify incoming sound waves. These then affect the eardrum, setting it into motion. Vibrations in the eardrum are transmitted to the hearing ossicles: the hammer, the anvil, and the stirrup, or malleus, incus and stapes. These tiny bones are in turn connected to the fenestra ovalis, which leads to the inner ear. As the eardrum is some 20 times larger than the fenestra ovalis, the vibrations are amplified. The fenestra passes sound waves on to the cochlea of the inner ear. Fluid contained in the snail shaped cochlea transmits the vibrations to the actual hearing organ, the organ of Corti. This organ contains more than 30,000 sensory cells, known as hair cells as they are equipped with "feelers". When these are agitated, the auditory nerve is affected, sending electrical impulses via nerve synapses to the hearing center of the brain.



How are we affected by noise?

The difference between sound and noise is usually defined as noise being undesirable sound. Whether a sound is considered to be noise or not is, in other words, a purely subjective evaluation, determined by one's attitude towards the noise source.

Three types of effects are often mentioned in connection with noise:

- Psychological
- Masking
- Physical

Psychological effects consist of irritation caused by continuous or repeated noise. In this type of disturbance the intensity of the noise need not be particularly great, especially in conjunction with relaxation or sleep. A dripping faucet or the dull sound of traffic can be sufficient.

Irritating noise in the workplace decreases work capacity and performance. Generally speaking, irritation increases in direct proportion to the volume of the noise, and noise containing distinct high-pitched tones is particularly disturbing.

Noise is said to be masking when it prevents the ear from interpreting other sound signals, e.g. conversation and warning signals, Masking noise can therefore increase the risk of accident in the workplace.

The primary physical effect of noise on humans is damage to the inner ear. The ear may be damaged acutely by extremely intensive noise such as a rifle shot, or successively by continuous exposure to, say, industrial noise.

Other physical effects are elevated blood pressure, an accelerated rate of breathing, and increased production of gastric juices. Blood circulation, sleep, and digestion suffer. This may lead to headache, nausea, muscular tension, and mental and physical fatigue, which, in turn, can result in inattentiveness.

What characterizes impaired hearing?

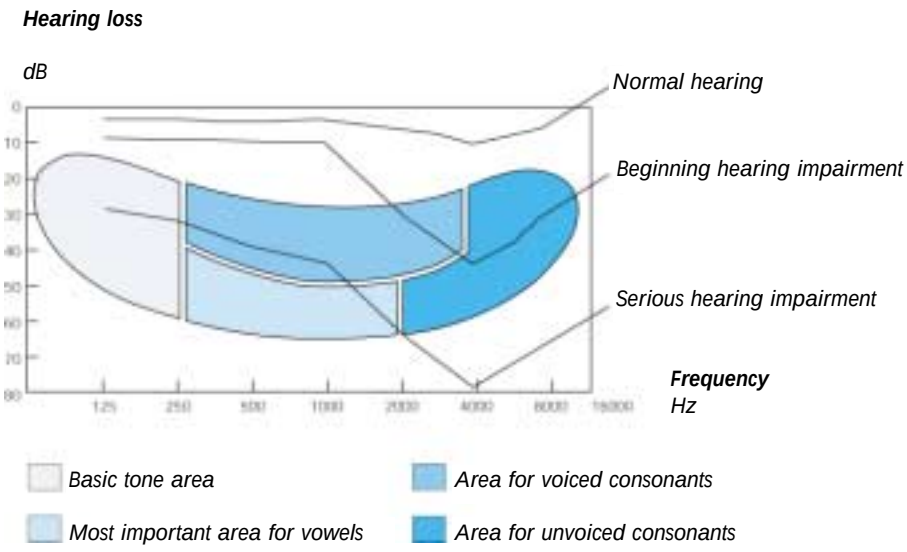
A common but erroneous conception is that people become accustomed to noise. A positive attitude towards a source of noise does reduce some of the body's physical reactions, but damage to the ear is inevitable. Certain hair cells are, in a sense, exhausted and paralyzed. What a person experiences as "getting used to" a noise is actually an impairment of the ability to perceive those frequencies where the noise is strongest. The "accustomed" person may even be insensitive to all the frequencies that comprise the noise.
As has previously been mentioned, sound is interpreted when waves of pressure affect the cochlea in the inner ear. The membrane in the cochlea vibrates and affects the sensory hairs, which are bent for precisely the frequency that corresponds to that of the sound wave. Extreme stimulation of the same hair cells for a prolonged period of time disrupts the cells' metabolism, putting them temporarily out of order. One becomes hard of hearing. If the cells are permitted to "rest" a while after exposure to noise that is neither too extreme nor too prolonged, the cells recuperate and function is restored. If this stress occurs day after day and the hair cells do not have time to return to normal between exposures, the cells' blood supply and metabolism permanently change so that they can no longer function.

The frightening thing about hearing loss is that, in its initial stages, it goes unnoticed. The frequencies that lie above the range of speech disappear first. One no longer hears the chirping of birds and the song of crickets. Eventually, the range of speech is affected as well. Consonants vanish first, then the vowels, and the effect can come surprisingly quickly and be devastating.

The areas marked in the diagram below illustrate approximately the sound levels at different frequencies that comprise normal speech measured at a distance of one meter.

Hearing impairment caused by exposure to noise often involves the generation of nerve impulses that are experienced as a ringing or buzzing, consisting of pure tones or complexes of tones within a certain frequency zone. In other words, one suffers from auditory hallucinations arising without stimulation. This phenomenon can lead to psychological complications as grave as the physical damage itself.
It is possible to "adapt" oneself to noise, but sooner or later, the harsh truth must be faced.

Hearing loss resulting from exposure to noise can never be restored.



Tinnitus cannot be shut off

Ringing in the ears

Tinnitus, formerly often referred to as ringing in the ears, is perceiving sound when no actual physical stimulation of the inner ear occurs. Sometimes it may sound like a swarm of mosquitoes, sometimes like a chain saw. Imagine a swarm of mosquitoes in your bedroom on a summer's night. You can't see it. You can't reach it. You can't make it stop. Your only recourse is to pull the pillow over your head and try to ignore it. Having tinnitus is a similar situation; only worse for you have no pillow. The sound is inescapable – there is no avoiding it, muffling it or switching it off. In most cases tinnitus is a temporary problem, but for some it can be a permanent condition, equivalent to chronic pain, and in such cases it is important to seek professional help. Tinnitus cannot be cured with medicine or surgery but there is treatment available that provides relief and support.

What is tinnitus?

Tinnitus results from your hearing being damaged so that you experience a disturbing noise ringing in your head. It is a sound that does not actually exist and that nobody else can hear. This may partially explain the fact that it has taken so long for tinnitus to be recognized as a form of hearing impairment. For years the problem was dismissed as a figment of the imagination. Moreover, tinnitus is often exacerbated when a person is stressed, exhausted or depressed, which has further fed the fires of prejudice.

Tinnitus can be a temporary or permanent condition. If the peeping, buzzing or roaring sound disappears the following morning, you are lucky. If it does not disappear, you may be a victim of permanent hearing impairment.

Why do you hear this ringing?

It is not fully understood what causes tinnitus. One theory is that auditory cells have been damaged so that they send false signals to the brain. This may be analogous to the cells being "chocked" by excessive noise and locking in a position where they send out signals even when no actual noise is present.

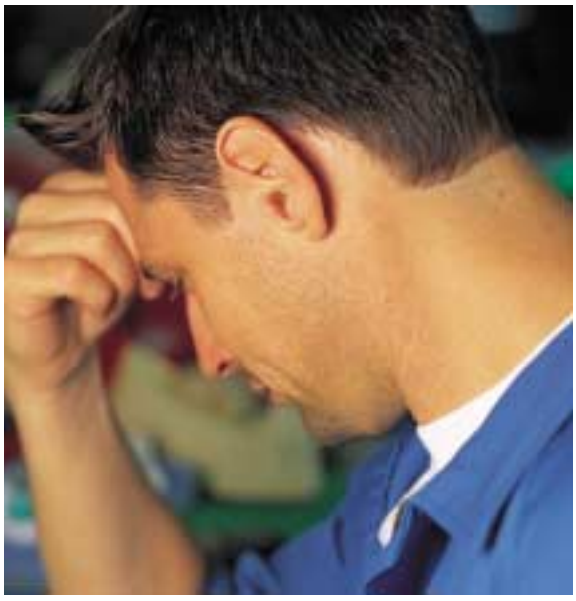
Tinnitus can be avoided

It is estimated that approximately 20% of the population of industrialized nations suffers from some form of tinnitus. Approximately 5 % of these people experience symptoms so severe that their daily lives are affected. Some suffer socially, for example they cannot go to the cinema or attend concerts because they cannot stand the sound level. Some can no longer work because the tinnitus sound makes it impossible for them to concentrate. Even though there is no general cure for tinnitus, there are ways to avoid being stricken.

Warning!

If you experience a ringing sensation or if your ears feel blocked after a day at work, this constitutes a serious warning. You may have tinnitus.

Implement a thorough noise control program at your place of work. Be especially observant of any unsilenced opening in your compressed air system.



Basic facts on sound

In acoustics, the study of sound, there are many special expressions and terms. Here some of the most common of them are briefly discussed.

Sound

Sound is a wave motion that arises when a sound source sets the surrounding air particles into motion. The motion then spreads to other air particles further from the source. Sound waves propagate at a speed of 340 m/s. In liquids and solids the propagation rate is greater: 1500 m/s in water and 5000 m/s in steel.

Noise and tones

Sound that is not desirable is normally called noise. Sound may consist of a single pure tone, but more often it is composed of many tones of various volumes.
The amount of irritation a sound causes is not solely a function of the volume of the different tones. Their frequencies also play a major role, with high tones being more irritating than lower ones. Pure tones create more discomfort than sound consisting of a number of tones.

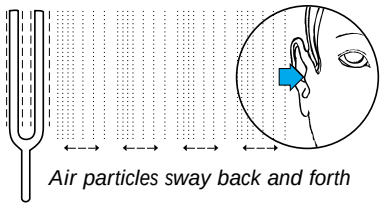
Frequency, Hz

The number of oscillations per second determines the frequency of a sound wave. The unit of measurement for frequency is the hertz (Hz). Sound exists within a very broad frequency range; the audible range for young people is normally between 20 Hz and 20,000 Hz. Low tones, or base tones, are created by slow oscillations of the air particles. High tones provide treble. Usually tones above 500 Hz are considered to be high tones.

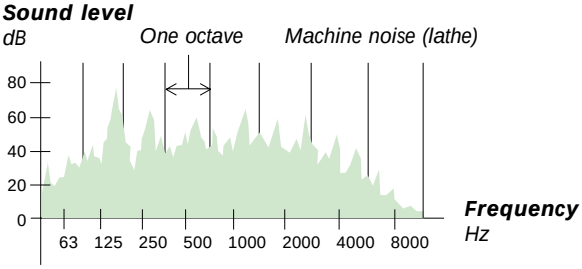
Infrasound and ultrasound

Sound with frequencies of less than 20 Hz is known as infrasound. If a sound has a frequency that exceeds 22,000 Hz it is called ultrasound.

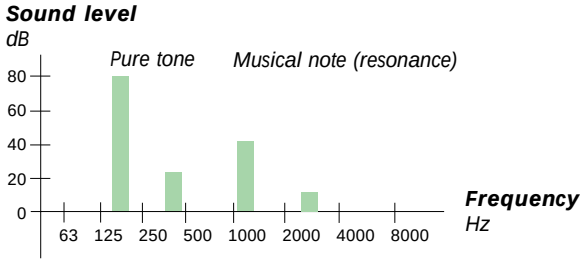
Tuning fork

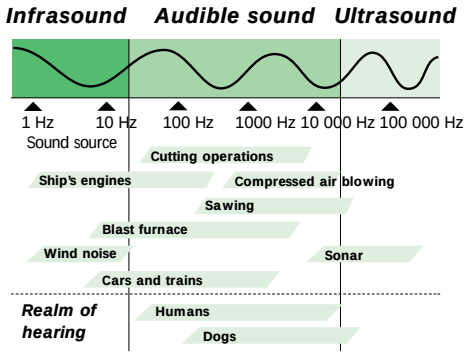


Sound level



Sound level





Decibel, dB

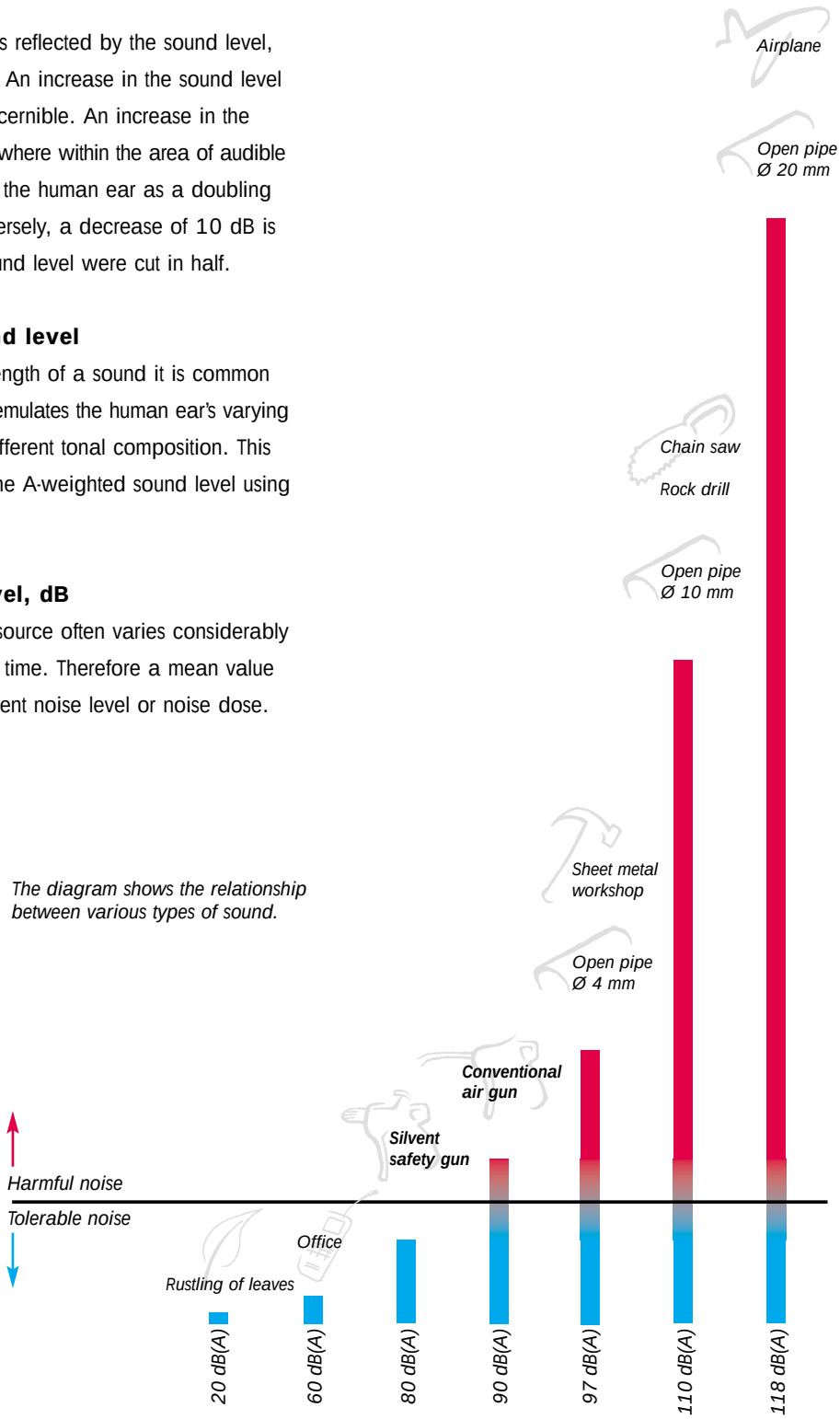
The strength of a sound is reflected by the sound level, expressed in the unit dB. An increase in the sound level of 1 dB is just barely discernible. An increase in the sound level of 10 dB anywhere within the area of audible sound is experienced by the human ear as a doubling of the sound volume. Inversely, a decrease of 10 dB is experienced as if the sound level were cut in half.

Measuring the sound level

When measuring the strength of a sound it is common to use an instrument that emulates the human ear's varying sensitivity to sounds of different tonal composition. This is known as measuring the A-weighted sound level using the unit dB(A).

Equivalent noise level, dB

The sound from a noise source often varies considerably during a given period of time. Therefore a mean value is measured - the equivalent noise level or noise dose.



The diagram shows the relationship between various types of sound.

Noise abatement

Compressed air noise

Consideration should be taken to the noise problem when designing a new machine or planning a new factory. Formerly not much thought was given to limiting the noise a machine generates at the design phase but today the sound level has become a strong sales argument for machine makers in many countries.

The EU Machine Directive states the following regarding noise:

"Machines shall be designed and constructed so that the risks associated with the emission of airborne noise are reduced to the lowest level possible with consideration to technological advances and existing devices designed to reduce noise, particularly at its source."

In other words, open pipe blowing should be replaced with noise reducing air nozzles.

Noise in the form of rushing air from pneumatic systems is common in most industrial environments. This noise is of two types: in part impulse noise, which results from the evacuation of valves and cylinders, and the type of noise that is generated when compressed air is used for cleaning, cooling, transporting or sorting.

Often these noise sources have been allowed to propagate freely. In the best of cases, personal hearing protection has been provided to prevent hearing loss.

Comparison table for open pipe and Silvent nozzles at 500 kPa (71.5 psi).

PIPE Inside Ø		SOUND LEVEL	AIR CONSUMPTION		REPLACE WITH SILVENT NOZZLE	NOISE LEVEL REDUCTION		AIR SAVINGS		
mm	"	dB(A)	Nm³/h	scfm		dB(A)	%	Nm³/h	scfm	%
2	5/64	84	8	4.7	MJ4	8	43	4	2.4	50
2.5	3/32	87	12	7.1	MJ5	8	43	2	1.2	17
3	1/8	90	17	10.0	MJ6	8	43	3	1.8	18
4	5/32	95	30	17.7	* 511, 011, 209, 701, 921, 971, 811	16	67	11	6.5	37
5	3/16	99	47	27.7	* 1011, 700-mini	15	65	22	13.0	47
6	1/4	102	67	39.5	920	21	77	37	21.8	55
7	9/32	105	92	54.2	973, 703	19	73	34	20.0	37
8	5/16	108	118	69.5	404	22	78	42	24.7	36
10	3/8	112	185	109.0	* 705, 2005	20	75	90	53.0	49
12	1/2	116	266	156.7	* 707C, 407	23	80	146	86.0	55
14	9/16	119	363	213.8	710	20	75	147	86.6	40
16	5/8	122	474	279.2	412	30	88	246	144.9	52
17	11/16	123	536	315.7	715C	23	80	225	132.5	42
18	23/32	124	599	352.8	715L	21	77	287	169.0	48
20	3/4	126	740	435.9	720	22	78	320	188.5	43
25	1	131	1159	682.7	730C	26	84	523	308.0	45

* Values may vary slightly depending on choice of nozzle.

Effective noise abatement

A better solution to the problem is not to let this noise spread throughout the workplace unimpeded. In most cases it is possible to halve the noise of pneumatic systems by using specially designed silencers and air nozzles. Silvent has specialized on these types of products and offers a unique and patented product range designed to eliminate noise at its source.

Compressed air nozzles can cut noise levels in half and, at the same time, maintain or enhance the blowing force, in comparison with open pipe.

Safety guns fitted with noise suppressing air nozzles halve the noise level while saving considerable amounts of energy compared with conventional air guns without nozzles.

Silencers, whether hose or central silencers, provide noise reduction of up to 30 dB(A).

SILVENT®℗

Noise control programs

Authorities around the world have imposed strict restrictions regarding noise levels in the workplace. Measures must be taken to reduce noise to the lowest level that is practically possible. Among other things a noise control program must be implemented if noise levels exceed existing limits. Personnel must not be exposed to noise that will damage their hearing. Employees who suspect that noise levels at their place of work are too high should turn to their employers for help.

The equivalent noise level, i.e. the mean noise level during a working day, must not be greater than 85 dB(A). No continuous noise source may exceed 115 dB(A) and any short duration impulse noise may not be more than 140 dB(C).

Noise in the workplace must be measured whenever there is a risk that it is too high, i.e. stipulated noise limitations are exceeded. The results must be registered and archived. Measurement and mapping of noise is also necessary when a noise control program is to be conducted.

Machines should be designed to generate as little noise as possible. When a new machine, tool or other sort of equipment is purchased, it is important to choose alternatives that are as quiet as possible. Machinery and equipment must be serviced and maintained to prevent it from becoming noisy in the course of time. Workplaces must be acoustically designed so that noise is absorbed and kept to an absolute minimum.

Information about noise

Wherever noise levels may damage hearing, signs saying "risk of hearing impairment – use hearing protection" must be posted. These warnings must be visible when entering the area as well as at the machines themselves. Employees should be made aware of the fact that noise level limitations are being exceeded and provided with information on the measures the company has taken. They must also be required to wear hearing protection. This protection should be adequate for the prevailing conditions and chosen in consultation with the employees. Any personnel that are exposed to a noise level that exceeds existing limitations must undergo regular hearing examinations and be informed of the results.

What is a noise control program?

Authorities in most countries now require that measures be taken to reduce noise employees are exposed to if it exceeds the stipulated limitations. A noise control program is a clear description of the measures that must be taken to reduce noise to a level that is not injurious to hearing. The program should also include a schedule for implementation and specify who is responsible for seeing to it that the various measures are carried out accordingly. The scope, design and timeframe of the control program may vary depending on the size of the company.

Mapping the noise

Step 1. The individual employee

Start by measuring the noise that the individual employees are exposed to. The general noise level must be measured as well but remember that it is important that measurement takes place in representative working conditions. Compare the results with the limitations stipulated in the noise exposure regulations. You should also review any history of hearing impairment among personnel.

Step 2. Recommendations for procedures

1. Map the way the noise level varies throughout the workplace. The results are best presented using so called noise maps.
2. Determine the amount of noise the various noise sources contribute to the total noise level employees are exposed to. Here it is important to consider the nature of the noise sources, the strength of the noise they generate and their duration.
3. Perform more extensive analysis, e.g. frequency analysis. This is normally necessary to be able to choose the proper steps to take.

Step 3. Study the acoustics in the workplace

The acoustics in the workplace have a great effect on the noise level employees are exposed to. Noise is often amplified by the way it is reflected by walls, ceiling and floor. The sound absorbing characteristics of these surfaces determine to what extent noise is reflected. Their properties can be measured or calculated.

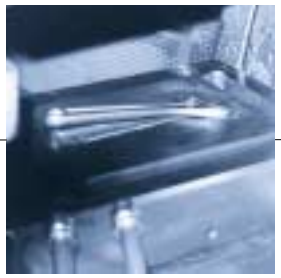
Proposing measures

After carefully mapping the noise and evaluating the acoustics of the workplace it is time to propose actual measures. It is important that employees and safety representatives are also permitted to make suggestions and express their views. Normally a combination of measures is required. This may include:

- Measures directly at the machine or noise source
- Enclosing the noise source
- Replacing machines or equipment with quieter models
- Replacing or altering work routines
- Measures in the workplace itself such as installing sound absorbing materials or screens
- Soundproofed control or monitoring rooms
- Rotation of personnel

Examples of effective measures provided by Silvent

The picture shows a 1 kg crescent wrench being lifted off a press by the air stream generated by two SILVENT 705s. Previously conventional blowing methods were employed using a 10 mm (3/8") open pipe. At an operating pressure of 500 kPa (71.5 psi), this meant that each pipe created a noise level of approximately 110 dB(A). Air consumption was 185 Nm^3/hr. (109 scfm) and pipe. Installing the Silvent nozzles cut the noise level in half and decreased air consumption by 49%!



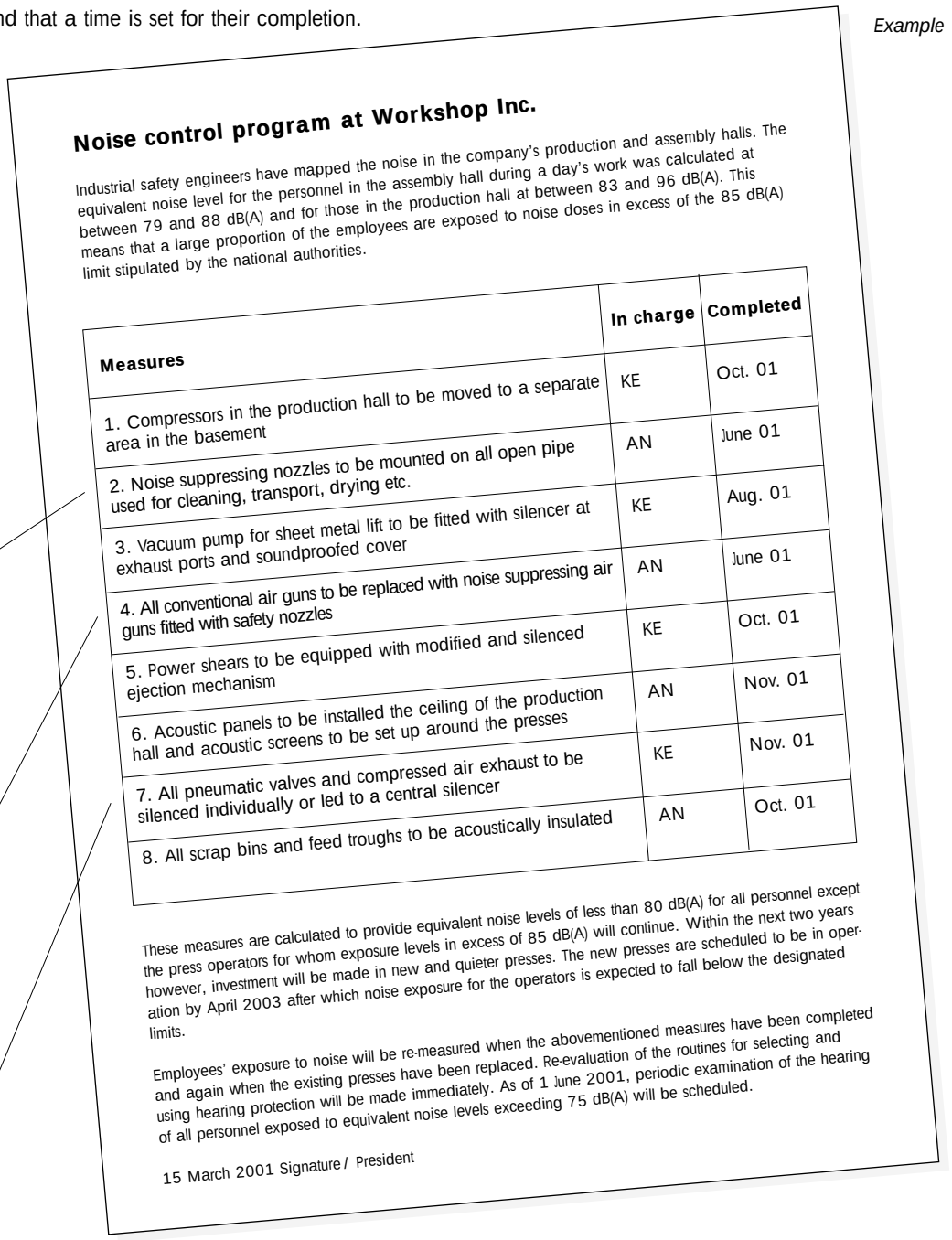
Here a SILVENT 007 safety gun with its unique two-step system reduces both the noise level and energy consumption. The noise suppressing safety nozzle on the 007 grip normally halves the noise level in comparison with conventional air guns without nozzles.

PLM's plastics division has conducted a noise control program in their production facilities. The company has installed more than 50 CD central silencers in their molding machines. They have succeeded in effectively solving their noise problem and have eliminated a previous problem with clogged silencers at the same time.

A scheduled noise control program

When the noise has been mapped and appropriate measures have been decided upon, a detailed noise control program should be scheduled for implementation. It is important that someone be made responsible for making certain that the respective measures are properly carried out and that a time is set for their completion.

Example



Noise control program at Workshop Inc.

Industrial safety engineers have mapped the noise in the company's production and assembly halls. The equivalent noise level for the personnel in the assembly hall during a day's work was calculated at between 79 and 88 dB(A) and for those in the production hall at between 83 and 96 dB(A). This means that a large proportion of the employees are exposed to noise doses in excess of the 85 dB(A) limit stipulated by the national authorities.

Measures	In charge	Completed
1. Compressors in the production hall to be moved to a separate area in the basement	KE	Oct. 01
2. Noise suppressing nozzles to be mounted on all open pipe used for cleaning, transport, drying etc.	AN	June 01
3. Vacuum pump for sheet metal lift to be fitted with silencer at exhaust ports and soundproofed cover	KE	Aug. 01
4. All conventional air guns to be replaced with noise suppressing air guns fitted with safety nozzles	AN	June 01
5. Power shears to be equipped with modified and silenced ejection mechanism	KE	Oct. 01
6. Acoustic panels to be installed the ceiling of the production hall and acoustic screens to be set up around the presses	AN	Nov. 01
7. All pneumatic valves and compressed air exhaust to be silenced individually or led to a central silencer	KE	Nov. 01
8. All scrap bins and feed troughs to be acoustically insulated	AN	Oct. 01

These measures are calculated to provide equivalent noise levels of less than 80 dB(A) for all personnel except the press operators for whom exposure levels in excess of 85 dB(A) will continue. Within the next two years however, investment will be made in new and quieter presses. The new presses are scheduled to be in operation by April 2003 after which noise exposure for the operators is expected to fall below the designated limits.

Employees' exposure to noise will be re-measured when the abovementioned measures have been completed and again when the existing presses have been replaced. Re-evaluation of the routines for selecting and using hearing protection will be made immediately. As of 1 June 2001, periodic examination of the hearing of all personnel exposed to equivalent noise levels exceeding 75 dB(A) will be scheduled.

15 March 2001 Signature / President

Energy conservation

Energy conservation

Within every company there is an ongoing aspiration to reduce costs. Every expense is scrutinized, including energy costs.

There are numerous possibilities to conserve energy used in association with compressed air, in part by getting rid of leaks but primarily through more efficient use of the compressed air.

At least as important as saving money is investing in energy saving measures that provide increased comfort and quality of life. More and more people have understood the connection between job satisfaction and human performance. A good example is using properly dimensioned air nozzles when cleaning with compressed air. In addition to reducing energy costs, you also get considerably lower noise levels.

Clearly the cost of energy is a key factor when dimensioning a compressed air installation. Therefore it is important to find a solution that not only meets the requirements for performance and quality, but requirements for efficient use of energy as well. The additional cost that may arise when purchasing equipment that fulfills both criteria may well be a good investment in the long run.

Blowing with compressed air

When compressed air is used for cleaning, sorting, or drying, most people rely on the use of an open pipe. As a rule not much thought has been given to the dimensioning of the pipe - rather a "suitable pipe" is used. People normally choose a pipe that is big enough to guarantee that the blowing operation is adequately performed. In the vast majority of cases this has resulted in an over-dimensioning of the blowing force.

Properly conducted technical dimensioning that results in the correct choice of nozzle, distance, and blowing angle often results in an energy savings of 30-50%.

Energy cost and power consumption reductions with Silvent nozzles

Working hours/year:
1760

Degree of Utilization:
40%

Cost for 1 Nm³ (35.3 scf) at 500 kPa (71.5 psi):
1.5 cents (USD)

PIPE INSIDE Ø		PRESSURE 500 kPa (71.5 psi)			REPLACE WITH SILVENT NOZZLE	AIR SAVINGS WITH SILVENT			ENERGY SAVINGS WITH SILVENT	REDUCED POWER REQUIREMENT FOR COMPRESSION	
		Consumption		Annual							
mm	"	Nm³/h	scfm	cost USD		Nm³/h	scfm	%	USD	kW	%
2	5/64	8	4.7	84	MJ4	4	2.4	50	42	0.3	50
2.5	3/32	12	7.1	127	MJ5	2	1.2	17	21	0.2	17
3	1/8	17	10.0	180	MJ6	3	1.8	18	32	0.3	18
4	5/32	30	17.7	317	*511, 011, 209, 701 921, 971, 811	11	6.5	37	116	0.9	37
5	3/16	47	27.7	496	*1011, 700-mini	22	13.0	47	232	1.8	47
6	1/4	67	39.5	708	920	37	21.8	55	391	3.0	55
7	9/32	92	54.2	972	973, 703	34	20.0	37	359	2.8	37
8	5/16	118	69.5	1246	404	42	24.7	36	444	3.4	36
10	3/8	185	109.0	1954	*705, 2005	90	53.0	49	950	7.3	49
12	1/2	266	156.7	2809	*707C, 407	146	86.0	55	1542	11.9	55
14	9/16	363	213.8	3833	710	147	86.6	40	1552	12.0	41
16	5/8	474	279.2	5005	412	246	144.9	52	2598	20.0	52
17	11/16	536	315.7	5660	715C	225	132.5	42	2376	18.3	42
18	23/32	599	352.8	6325	715L	287	169.0	48	3031	23.3	48
20	3/4	740	435.9	7814	720	320	188.5	43	3379	26.0	43
25	1	1159	682.7	12239	730C	523	308.0	45	5523	42.5	45

* Values may vary slightly depending on choice of nozzle.

Lower the pressure

Silvent's patented air guns and safety nozzles allow more efficient utilization of the compressed air. This permits you to lower the pressure at your workstations and still perform the same job. Lower pressure means an even lower sound level as well as lower energy consumption. You should always strive to have the right pressure in the right place – neither too high nor too low. The operating pressure directly affects the requirement for power. Higher pressure of course means higher energy consumption. Raising the operating pressure to compensate for pressure drop always means higher operating costs. An equivalent reduction results in an equally large increase of profit.

Raising the pressure by one bar means an approximately 8% increase in energy consumption.

A study of conservation of energy and the environment

The environmental department in Great Britain recently conducted a study of how compressed air consumption might be reduced by using safety guns. Silvent's safety nozzles were compared with conventional open pipe blowing. The test was performed by Van Leer Ltd., who manufacture steel drums. Compressed air is used at a number of stations throughout the entire production process. After testing Silvent's nozzles, the following conclusions were drawn:

- A 25% reduction of energy costs
- Payback time on the investment was nine months
- Potential for substantial savings
- Extremely simple measures necessary

Operating costs

The major expense associated with a blowing operation is the operating cost for producing the compressed air. Calculated for a five-year period, the investment and financing costs for purchasing air nozzles are negligible. Installing an open pipe is only an expense. A properly installed Silvent nozzle represents an investment in cost reduction.

The right equipment and knowledge decrease your operating costs.

A report made by the environmental department in Great Britain shows how compressed air can be saved by using the right air nozzles.

Compressed air safety

When you choose to work with compressed air, you choose an energy source that is capable of storing large amounts of energy. Therefore, certain precautions must be taken to prevent accidents from occurring. Indications of maximum operating pressure, temperature, load, etc. must be respected and must not be exceeded. Compressed air must not be allowed to come into direct contact with skin (the human body). Safety regulations regarding the use of compressed air are being reviewed in a number of countries.

At present two countries, the USA and Switzerland, have implemented restrictions on the amount of compressed air pressure that skin may be directly exposed to.

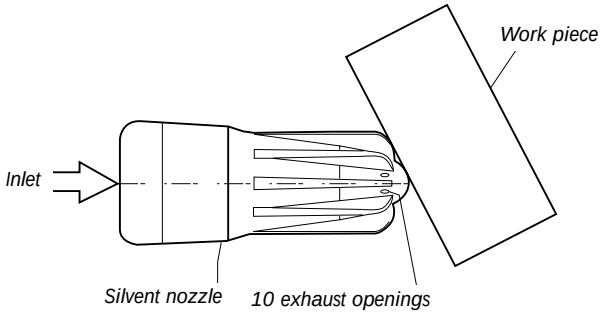
Operators often use air guns to clean themselves of dust and grime during and after the working day. Using compressed air in this manner clearly involves the risk of air being pressed through the skin and entering the blood and creating a blood clot.

A number of fatal accidents lie behind the restrictions that have been imposed.

In the United States, safety in the workplace is regulated by the OSHA. OSHA is an acronym for the Occupational Safety and Health Administration. The use of compressed air is covered in §1910.242 b, wherein it is stipulated that the pressure of compressed air that comes into direct contact with skin must not exceed 210 kPa (30 psi).

In Switzerland SUVA, Schweizerische Unfallsversicherungsanstalt, has imposed similar restrictions. Every Silvent nozzle is designed to comply with these safety standards. The figure below illustrates that the nozzle cannot be blocked in a manner that closes off the entire opening (dead ending). Thus, the pressure that can be amassed will never exceed 210 kPa (30 psi). Furthermore §1910.242 b states that some method or equipment must be provided to prevent a chip or particle, regardless of size, from blowing into the eye or against the skin of the operator or a fellow worker. This chip guarding may be separate from the nozzle, as in the case where shields or barriers are used. Generally speaking, the use of protective air cones provides adequate protection for the operator, but screens, baffles or shields may be necessary to protect fellow workers from exposure to flying chips or particles.

All of Silvent's safety guns are designed to comply with these regulations.



EU Machine Directive

Within the EU, the regulations expressed in the Machine Directives 89/392/EEC, 91/368/EEC and 93/44/EEC apply.

The directives set important health and safety standards regarding the design and manufacture of machine and safety components.

Even though compressed air nozzles are used in systems and machines governed by the Machine Directive, air nozzles are not specifically dealt with.

Pneumatic components need not be individually CE approved according to the Machine Directive; in fact it is illegal to do so.

For machine makers who must certify that their products comply with the Machine Directives, the specifications included in the catalog regarding temperature, pressure and voltage are sufficient for machine components.

Silvent will gladly answer additional questions regarding the Machine Directive.

Noise regulations

Regulations governing the amount of noise that is permissible in places of work are stipulated in, among other places, EU directive 86/188, "Noise at work" and OSHA 1910.95, Occupational noise exposure".

A few countries have even stricter standards than those found in the EU directive.

According to EU regulations, the follow applies to the noise level:

The emission of airborne noise must be reduced to the lowest level, taking into account technical progress and the availability of means of reducing noise.

In Sweden the stipulated equivalent noise exposure is 85 dB(A), 5 dB(A) lower than the demands of the EU directive.

In the event that the designated exposure limit is exceeded, an investigation of the cause must be conducted. Corrective measures must be devised, scheduled and implemented. Exposure shall be reduced as much as is practically possible under the designated limit.

Satisfactory information regarding the violation of the noise exposure limit must be provided to all affected personnel, including information on the measures to be taken. They shall be made aware of the risk to their hearing the exposure entails, as well as their obligation to use hearing protection.

Machines and technical devices shall be designed to utilize the possibilities the latest technological advances afford to reduce noise.

In other words, it is important to keep abreast of technological advances regarding noise abatement. Noise abatement at the source of the noise is generally the most effective and the most economical method. When determining the least practically possible noise exposure, it is necessary to take the latest technological development and possibilities to limit noise exposure into consideration. The EU directive means the former reference to the economic feasibility of noise control measures is no longer valid. The purpose of the EU directive is, among other things, to assure that companies and countries shall not be allowed to improve their competitive position at the expense of a healthy working environment.

Silvent offers you the opportunity to make use of the latest technological advances in the field of noise abatement and thereby meet the requirements of the EU directive as well as the OSHA regulations.