EG / Enola Gaye manufacture a range of pyrotechnics that produce noise effects i.e. Mk5 Thunderflash, Mk7 Thunderflash, EG67 Ball grenade, Wire Pull® Flash 1.0, Wire Pull® Flash Grenade 3.0 and Wire Pull® Paint Grenade. Each product has been labelled with the safety distance and noise information to ensure that you can use these products safely.

To this extent, we have produced this basic guide about noise to help understand the noise information on the product labelling so our products can be used safely and to their fullest extent.

What is noise or sound?

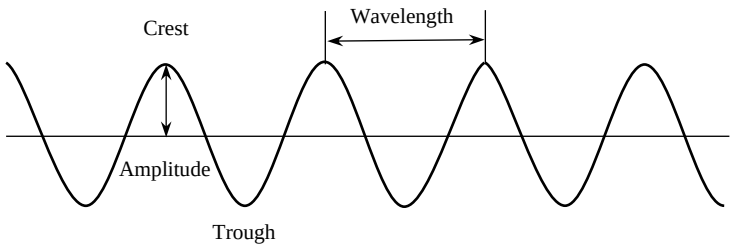
When a balloon pops, a twig snaps, a glass brakes, hands are clapped or an EG67 goes off we hear the noise produced by these actions. The noise or sound we hear is our brains interpretation of the soundwaves produced when these actions occur. When a balloon pops, the sudden release of energy from the stretched rubber contracting produces the sound waves.

Soundwaves

Soundwaves can be likened to the ripples made when you drop a pebble into a still pond. Except in the case of soundwaves, the pebbles are actions like a balloon popping and the pond is the air. When you drop a big stone into a pond the ripples will be bigger than if you drop a small pebble into the pond, the same is with soundwaves, bomb going off will make big ripples in the air compared to an EG67 going off where the ripples will be smaller and we hear a much smaller noise compared to the bomb.

Soundwave Structure

Throwing a pebble into a pond produces ripples (transverse wave), the ripples will have crests which are the highest points of the ripples and troughs which are the lowest points. The distance between one crest and the next is called the wavelength and the distance from the midpoint of the wave and a crest is called the amplitude.



The number of wavelengths within a period of time is called the frequency.

The amplitude corresponds to the power of the wave and the frequency corresponds to the pitch of a sound. A sound that has a high amplitude will sound louder than a sound with low amplitude. A sound where the wavelength is long will have a low frequency and the sound will have low pitch (more bass) than a sound with a short wavelength or high frequency.

This guide will use the transverse wave (above picture) as a pictorial explanation; however, sound waves are in actually longitudinal waves which act a bit like a Slinky with areas of high pressure and low pressure along the wave (Slinky).

Measurement of sound

Sound and Surfaces

Sound will be heightened or lessened depending on the surface(s) that the sound is made on and that the sound wave travels over. Noises made on hard flat surfaces e.g. concrete will appear louder than those made on soft surfaces e.g. grass. This is because on hard surfaces the sound wave is

reflected along the surface, just as a ping pong ball will bounce along a road. On hard surfaces most of the sound energy will reach the person hearing it. On soft surfaces the sound energy is absorbed just as a ping pong ball wont bounce on grass. This means that on soft surfaces less of the sound energy will reach the person hearing it and the sound will appear quieter.

When measuring sound, we need to measure the maximum volume produced, we need to reduce the amount of sound absorbed by the ground. For this reason, when recording the sound level, it is best to produce the sound on hard surfaces and have a hard surface between the device making the sound and the sound meter recording it.

Sound Filters
Sound is measured using a sound meter placed at a measured distance from the sound (this is important). The sound meter is set to measure using a range of filters denoted by the letters A, C and Z. Each filter "sifts" the sound wave only allowing through certain parts of the sound wave. Filter "A" mimics the human ear so the sound that is measured is close to what the human ear will hear filtering out very high and very low frequency sounds. Filter "C" attenuates the sound wave less than "A" and is commonly used for very high pressure (loud) sounds or sounds with a very low frequency or bass element. Filter "Z" doesn't filter the curve and is the measurement of the raw sound wave.

Sound is measured in decibels (dB) and to identify which filter has been used to measure a sound the filter letter is put in brackets after the letters "dB".

- Filter A – dB(A)
- Filter C – dB(C)
- Filter Z – dB(Z)

Sounds or noises recorded using different filters cannot be compared directly.

Sound and Time
There are many different types of sounds and noise that we hear. There are long low noises e.g. tumble drying, there are longer louder noises e.g. music at parties, there are shorter louder sounds e.g. a jack hammer or a jet taking off and there are very quick sounds e.g. popping a balloon or a gun going off.

To accurately measure or record these sounds and noises, the way they are measured is different.

- Time Weighted Average - e.g. music concert or working in a noisy environment. The noise or sound is measured over a period of time (usually 8hours) and the average sound recording is taken. As an example, laws and regulations may specify that to prevent hearing damage the sound or noise cannot be more than 85 dB(A) over a period of 8 hours.
- Max Impulse - e.g. gun going off. The maximum amplitude over a very short time (less than 1 second) is recorded. This ensures the sound or noise that is measured is more accurate for those very quick sudden sounds.

Sound and Distance.
Think of the situation your standing next to a runway and a plane takes off, the noise will be very loud. You're now standing in your garden watching a plane fly over showing the white trails, the noise of the plane will be much lower. This is an extreme example and you'll probably be thinking "well that's obvious" but it highlights that distance matters.

So, a noise measured at a distance of 10m will have a lower sound measurement (sound quieter) than the same noise measured at a distance of 1m. In the same way, an EG67 Ball grenade will sound much louder if you are standing 10 metre away than if you are standing 20 metres away.

If we compare two different products that produce a noise:
Device A – produces a noise recorded at 115 dB(A) measured at 5 metres.
Device B – produces a noise recorded at 115 dB(A) measured at 10 metres.

If you are standing the 5 metres from device A and 10 metres from device B, the two devices will sound the same.

If you are standing 5 metres from both devices, then device B will sound much louder than device A.

Therefore, when quoting the sound level a device produces, the distance that a sound measurement was recorded at should always be stated, otherwise the measurement is meaningless.

e.g. 115 dB(A) measured at 10m
e.g. 115 dB(A) @10m

Quoting Sound and Noise levels
So that someone can clearly understand a noise measurement all of the following information needs to be stated.

- Sound level measurement (numerical value)
- Sound filter used.
- Distance the sound was recorded at.
- Impulse (I) or time weighted average.

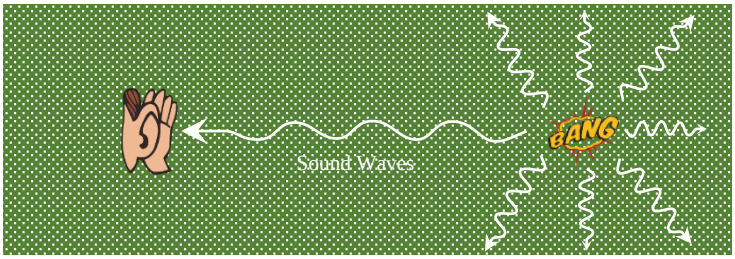
e.g. 112 dB(A)I @ 5m – 112 decibels measured as an impulse using “A” filter at a distance of 5 metres.

If a sound measurement is quoted without this information, it is meaningless.

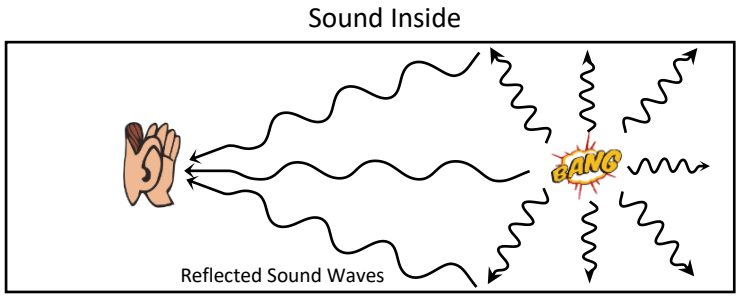
Sound inside and outside
Popping a balloon outside in the garden will be a lot quieter than popping the balloon inside the house which will sound much louder.

When a sound is created outside the noise energy is projected in all directions so when the sound wave reaches you, you are only hearing a small part of total sound energy that was produced.

Sound Outside

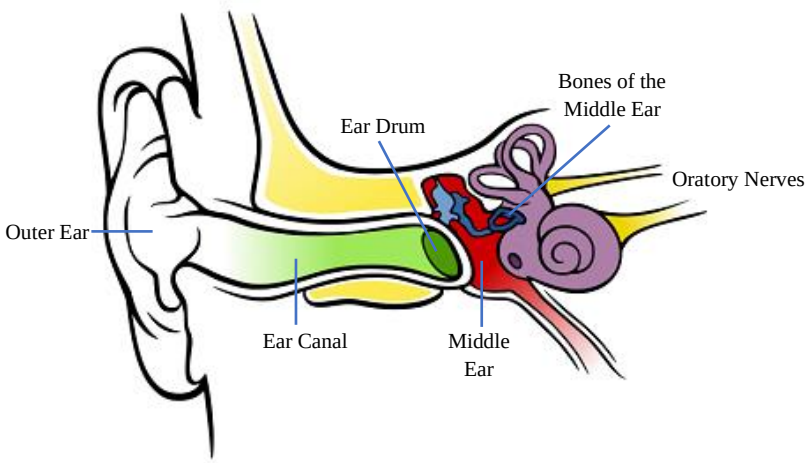


When a sound is created inside the sound is projected in all directions, when the sound waves hit a hard surface e.g. a wall then the sound wave is reflected back into the room. If you are standing inside the room, the sound waves are reflected back towards you and you receive more of the sound energy produced by the device and so it appears much louder.



If a device is used in a confined space e.g. an alley way, where it is essentially outside but enclosed in some directions (e.g. walls on 2 sides of the area); then the noise produced by a device will sound louder than if it were in an open space but lower than if it were inside (totally enclosed).

How do we hear sound?



Sound waves are collected by the outer ear and funnelled through the ear canal toward the ear drum. The sound waves cause the ear drum to vibrate which in turn vibrates the small bones in the inner ear. These bones transmit and amplify the vibrations through the fluid in the middle ear. The middle ear fluid stimulates small nerve cells called hair cells which send electrical impulses along the oratory nerve to the brain. We perceive these electrical signals as sound.

Reduced Hearing and Hearing Damage

Reduced hearing

There are many ways in which we can suffer reduced hearing. Blockages in the ear canal, holes in the ear drum (burst ear drum), excess fluid in the middle, thickening of the middle ear fluid can all affect the how sounds are transmitted through the ear to the oratory nerve and brain, resulting in a reduced sense of hearing.

Hearing Damage

Very loud noises or exposure to repeated loud noises without the use of hearing protection can damage the hair cells leading to tinnitus (constant ringing in the ears), and in some cases significant damage to the hair cells that can lead to hearing loss. The tiny hair cells cannot repair themselves or re-grow, so once damaged they cannot recover.

Hazardous Sound Levels

If the sound reaching your ears is above a daily or weekly average of 85 dB(A) based on an 8hr day or 135 dB(A) instantaneous sound, then hearing protection must be supplied and worn.

If the sound reaching your ears is above a daily or weekly average of 87 dB(A) based on an 8hr day or 137 dB(A) instantaneous sound, the hair cells in your ear can be permanently damaged and thus hearing can be permanently impaired.

Enola Gaye / EG Noise Products and Safe Use.

All Enola Gaye / EG pyrotechnics that produce a bang or other loud noise reports are thoroughly tested when designed and then regularly though the entire manufacturing process. The noise levels are measured outside on a flat concrete surface so that the maximum noise level is recorded.

Because the noise testing is carried out outside, we state that the products must be used outside in order to protect the users and their fellow players or training colleagues.

Following the guidance on the product labels and the advice given on the product safety sheets will ensure that Enola Gaye / EG noise products can be both fun to use and safe.

For More Information

Health and Safety Executive Noise at Work Regulations

https://www.hse.gov.uk/noise/index.htm