

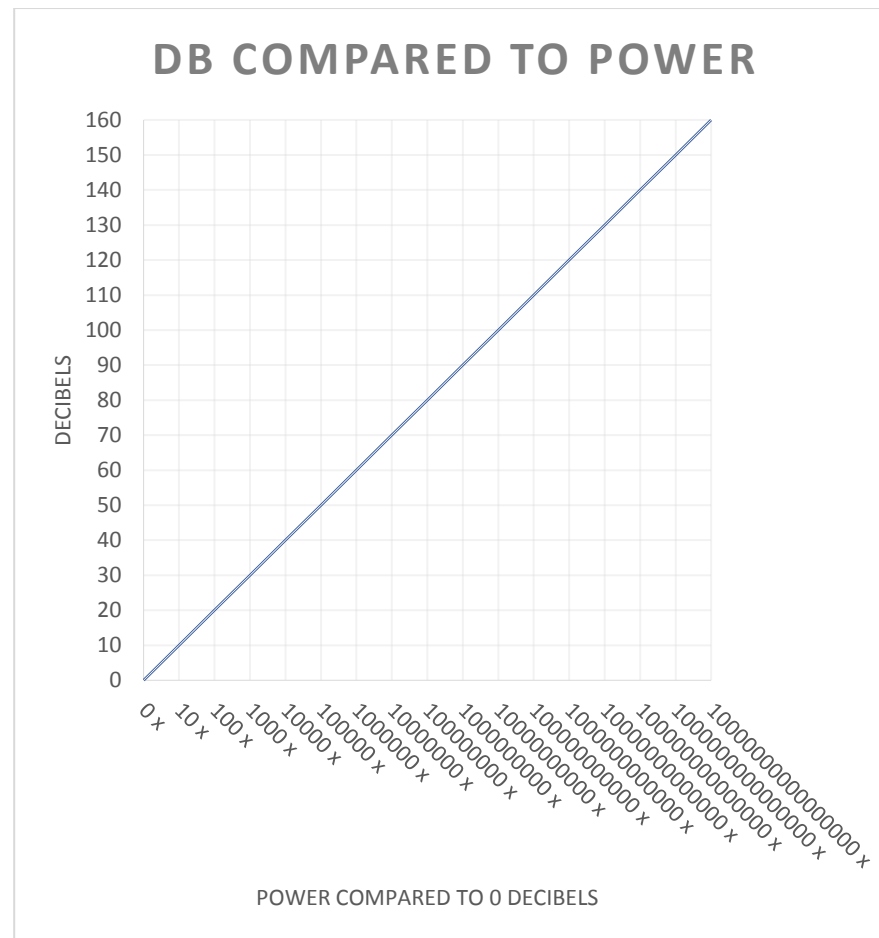
Decibels

What are Decibels?

The decibel (abbreviated dB) is the unit used to measure the intensity of a sound. The decibel scale is a little odd because the human ear is incredibly sensitive. Your ears can hear everything from your fingertip brushing lightly over your skin to a loud jet engine.

In terms of power, the sound of the jet engine is about 1,000,000,000,000 times more powerful than the smallest audible sound. That's a big difference!

On the decibel scale, the smallest audible sound (near total silence) is 0 dB. A sound 10 times more powerful is 10 dB. A sound 100 times more powerful than near total silence is 20 dB. A sound 1,000 times more powerful than near total silence is 30 dB.



.357 magnum revolver

a pin dropping

air conditioner

air raid siren

alarm clock

arc welder

babbling brook

balloon popping

belt sander

cap gun

computer

conversational speech

dishwasher

emergency vehicle siren

fighter jet launch

“Everyday” Sounds

firecracker

food processor

garbage disposal

handheld drill

healthy hearing threshold

howitzer cannon

inside subway car

jackhammer

jet engine at takeoff

lawn mower

light traffic

motorcycle (riding)

oxygen torch

passing diesel truck

peak stadium crowd noise

refrigerator

riveter

rock band

rocket launch

rustling leaves

safety airbag

shotgun

shower

snow blower

sporting event

squeeze toy

table saw

thunderclap

toilet flushing

vacuum cleaner

whisper

Adding Decibels

As we know, decibels work on a logarithmic scale, meaning we cannot simply add two decibel values together.

35dB + 35dB **does not equal** 70dB

We can use the following formulae to accurately calculate the addition of decibels.

$$L = 10 \log_{10} \left(10^{\frac{a}{10}} + 10^{\frac{b}{10}} \right)$$

Fortunately, there is an easier method that will give approximate values.

If the difference between the two values you are adding together is:

0 – 1 dB, add 3dB to the original highest value

2 – 3 dB, add 2dB to the original highest value

4 – 9 dB, add 1 dB to the original highest value

10+ dB, the highest original value remains unchanged

HOW LOUD IS TOO LOUD?

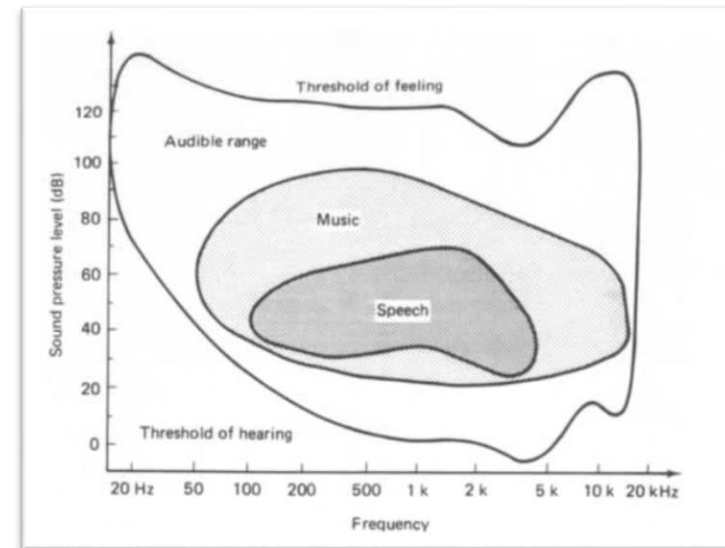
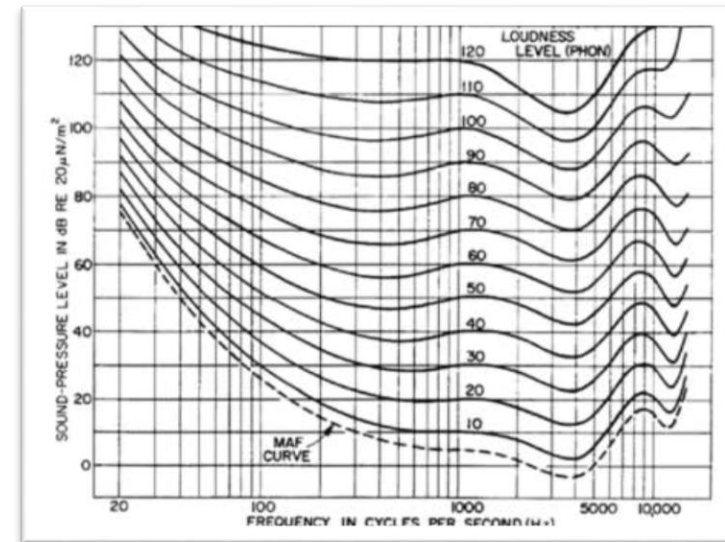
	Noise Source	dB	Safe Exposure Time
	Gunshot	165	0 seconds
	Firecrackers	140	0 seconds
	Ambulance Siren	130	0 seconds
	Jackhammer	120	15 seconds
	Chainsaw	110	2 minutes
	Power Tools	100	15 minutes
	Lawnmower	90	2 hours
	Car Traffic	85	8 hours
	Washing Machine	80	Infinite
	Food Mixer	70	Infinite
	Dishwasher	60	Infinite
	Rain	50	Infinite
	Whisper	30	Infinite

[Is there a noise loud enough to kill you?](#)

Loudness Levels

Sound pressure levels are highly objective and are measured by the decibel scale. Loudness however, is a subjective quantity – and must therefore be measured by a scale that is subjective (requiring human judgement). Loudness is measured in a unit called the phon. One phon is equal to the perceived loudness of a 1 dB sound at 1,000Hz. Hence we can see that loudness is frequency dependent, as the human ear is more sensitive to some frequencies than others. For all other frequencies the loudness in phons is decided by comparison with sound at 1,000Hz.

It is found that the threshold of hearing, which is assigned to be 0dB at 1,000Hz, is much higher in the lower frequency ranges. For example a 100Hz sound must have a sound pressure level of 40dB before it is audible. Regardless of the intensity for the threshold of hearing for a particular frequency, that loudness value is assigned to 0 phon. This allows a graph to be plotted showing the equal loudness contour for different sound frequencies. This graph also shows us which regions of the sound spectrum to which the human ear is most sensitive. This is generally 2,000 – 5,000Hz. Figure 1.7 shows an equal loudness contour graph. Sounds below the bottom (MAF) line cannot be heard, whilst those above can. MAF stands for minimum audible field.



dBA	Example	Home & Yard Appliances	Workshop & Construction
0	healthy hearing threshold		
10	a pin dropping		
20	rustling leaves		
30	whisper		
40	babbling brook	computer	
50	light traffic	refrigerator	
60	conversational speech	air conditioner	
70	shower	dishwasher	
75	toilet flushing	vacuum cleaner	
80	alarm clock	garbage disposal	
85	passing diesel truck	snow blower	
90	squeeze toy	lawn mower	arc welder
95	inside subway car	food processor	belt sander
100	motorcycle (riding)		handheld drill
105	sporting event		table saw
110	rock band		jackhammer
115	emergency vehicle siren		riveter
120	thunderclap		oxygen torch
125	balloon popping		
130	peak stadium crowd noise		
135	air raid siren		
140	jet engine at takeoff		
145	firecracker		
150	fighter jet launch		
155	cap gun		
160	shotgun		
165	.357 magnum revolver		
170	safety airbag		
175	howitzer cannon		
180	rocket launch		