



Nova 2000 Noise
Attenuation Study – Rev 2



Prepared by:
Will Hamill (BE Mech Hons, Canterbury)
Development Manager
RPB Respiratory Limited

April 2010

Nova 2000 Noise Attenuation

Table of Contents

1.0	Introduction.....	3
1.1	Noise Attenuation Data	3
2.0	Sand blasting Noise.....	4
3.0	Nova 2000 Test Results	5
4.0	Noise inside the Nova 2000	6
4.1	Bone Conduction.....	6
4.2	Additional Protection	7
5.0	Conclusions.....	7

Nova 2000 Noise Attenuation

1.0 Introduction

The report summarizes the noise attenuation characteristics of the Nova 2000 Abrasive Blasting Helmet manufactured by RPB[®] Respiratory (Herein RPB, Where RPB is a registered trade mark of RPB Limited).

Although the Nova 2000 incorporates integrated noise attenuation by means of its dual density foam padding, RPB recommends users should always wear additional hearing protection whilst abrasive blasting due to the intrinsically high noise levels associated. This report utilizes theoretical calculations based upon field and laboratory tests to illustrate the combined noise attenuation of earplugs and the Nova 2000.

1.1 Noise Attenuation Data

Noise attenuation data of the Nova 2000 was gathered from experiments conducted by Prof. John Pearce and Dr. Jeffery Mahn of the University of Canterbury. The University of Canterbury was commissioned to conduct several independent tests on the acoustical properties of the Nova 2000 Abrasive Blasting Helmet. The data within this report has been extracted from their findings.

The sound pressure levels inside the Nova 2000 were measured using RPB's own *Briuel & Kjaer* Type 4100 Sound Quality Head and Torso Simulator and *Briuel & Kjaer* PULSE 4100 Analyzer with Type7700 software analysis package. The helmet, complete with cape, was fitted to the simulator. The simulator was located in a reverberant chamber where the specialised loud speaker system was used to generate the harvested abrasive blasting noise. The sound pressures in the right and left ears of the Simulator were measured using Bruel & Kjaer Type 4189 microphones and a Bruel & Kjaer Type 4100 Pulse System. The equipment used is shown in Figure 1, below. Sample noise used for testing was gathered using a variety of nozzles blasting at Euroblast, Christchurch in May 2007 using calibrated equipment.



Figure 1 - Measuring Equipment

Nova 2000 Noise Attenuation

2.0 Sand blasting Noise

A multitude of studies have been performed on the abrasive blasting industry, each collecting its own frequency response of the noise. A selection of these is shown in Table 1, ordered loudest through quietest, whereas, a graphical representation is subsequently shown in Figure 2.

Table 1 - Sandblasting Noise Comparison [dBA]

Octave Band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Log Sum
1: Health and Safety Executive, 1997.	85	91	100	109	118	123	126	120	128.9
2: Patel & Irving 1999.	78	79	83	90	98	107	114	120	121.2
3: Pearse, RPB Study	52	63	74	87	98	108	115	119	120.7
4: Price and Whitaker, 1986.	98	97	101	101	106	112	115	116	119.8
5: Pearse, Unpublished	75	76	74	81	88	97	102	117	117.2
6: Environmental medicine unit report, 1998	73	82	89	97	107	111	111	107	115.5

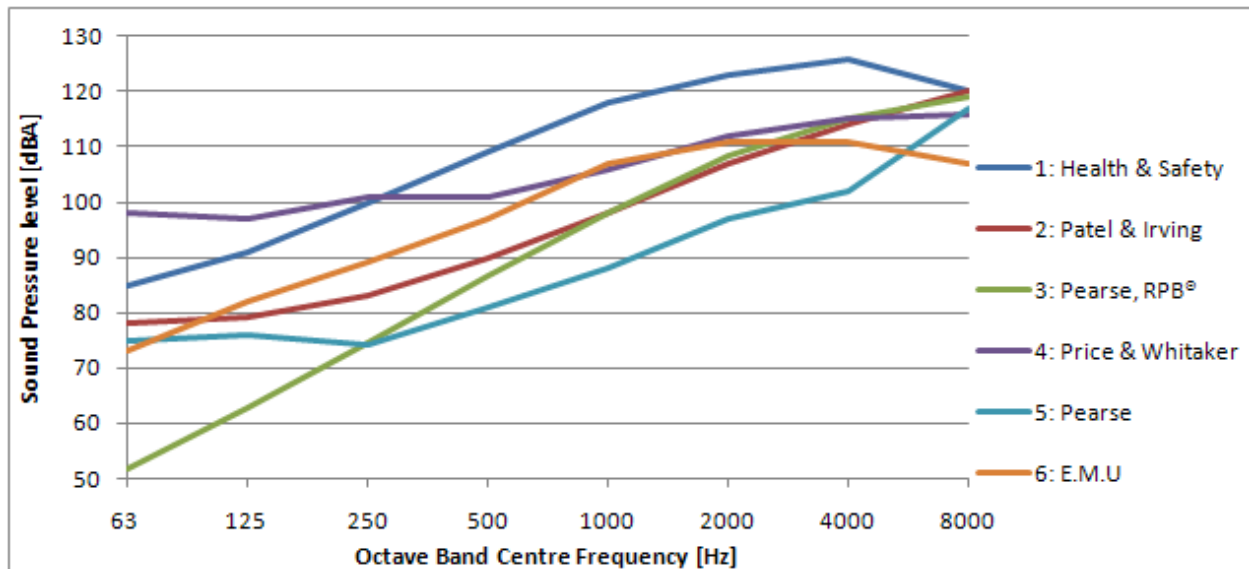


Figure 2 - Blasting noise recorded in various studies

Nova 2000 Noise Attenuation

3.0 Nova 2000 Test Results

Tables 1 & 2 below show the calculation of the noise attenuation of the Nova 2000.

Table 2 - Nova 2000 Results (With A-Weightings)

Octave Band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Log Sum
Abrasive blasting noise (dBA)	51.8	62.9	74.4	86.8	98.0	108.2	115.0	118.9	120.7
Noise in Nova 2000 at ear (dBA)	52.3	65.0	72.1	81.2	90.3	90.8	86.1	85.6	95.1

Therefore the **Nova 2000** attenuates abrasive blasting noise by **25.6 dBA**.

Figure 3 shows a graphical representation of the environmental noise caused by abrasive blasting and the resultant noise experienced inside the Nova 2000 when wearing no additional hearing protection.

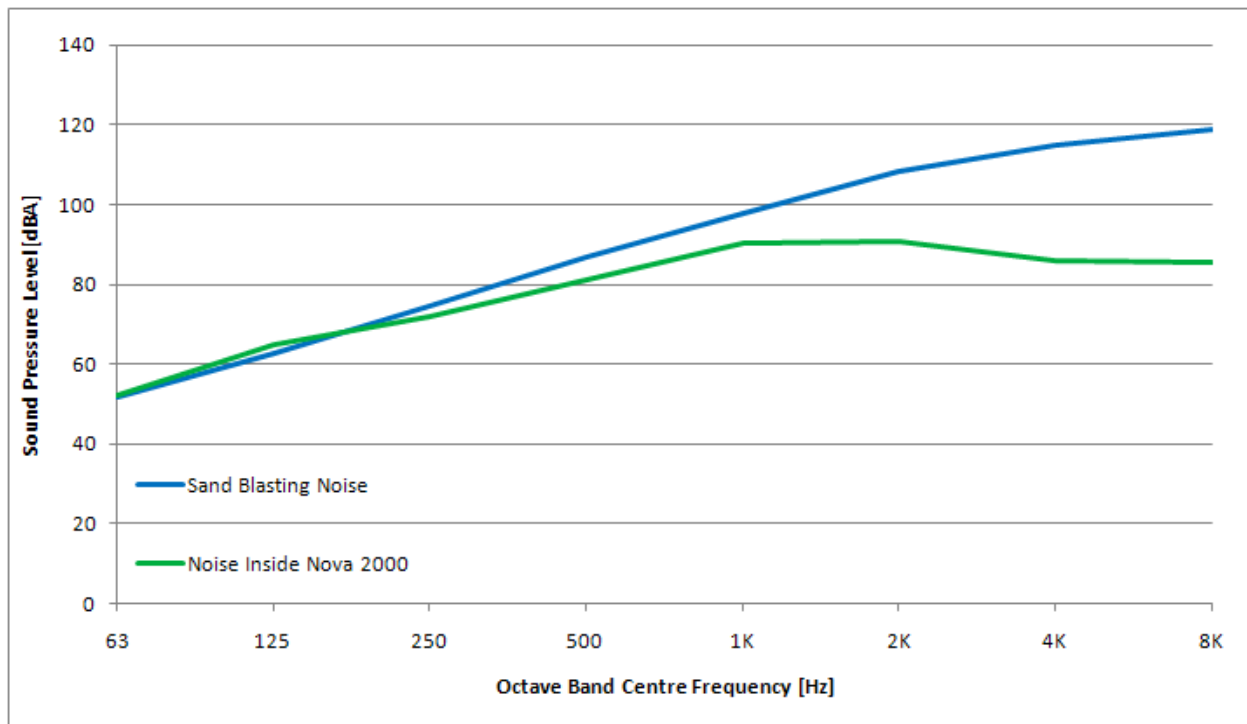


Figure 3 - Sound Pressure Levels of Nova 2000 Test

Therefore, by simple arithmetic, the Nova 2000 provides the following Octave band protection:

Table 3 - Nova 2000 Octave Band Noise Attenuation

Octave Band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Noise Reduction (dB)	-0.5	-2.1	2.3	5.6	7.7	17.4	28.9	33.3

Nova 2000 Noise Attenuation

4.0 Noise inside the Nova 2000

Figure 4, below, shows the noise experienced inside the Nova 2000 with no additional hearing protection. This is determined by applying the attenuation of the Nova 2000 to the data shown in Table 1, on page 4.

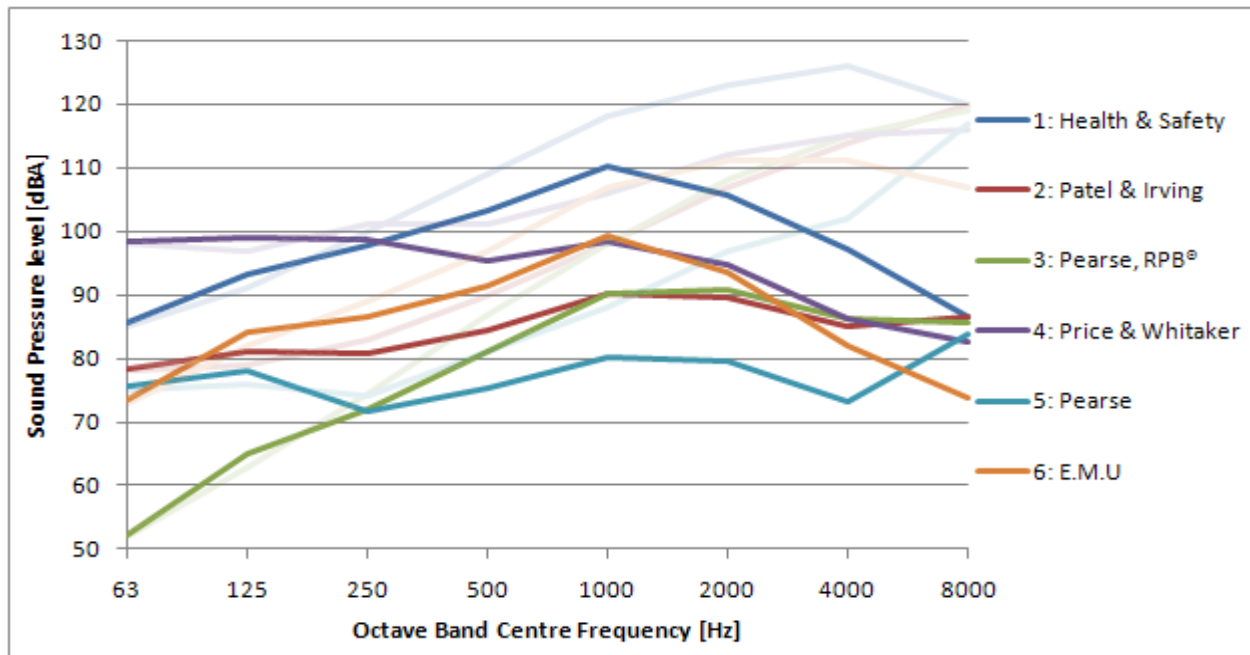


Figure 4 - Noise level inside Nova 2000 for the various input cases.

Table 4 - Attenuation provided by Nova 2000

Study	Initial Volume [dBA]	Attenuated Volume [dBA]	Attenuation [dBA]
1: Health and Safety Executive, 1997.	129	113	16
2: Patel & Irving 1999.	121	95	26
3: Pearse, RPB Study	121	95	26
4: Price and Whitaker, 1986.	120	106	14
5: Pearse, Unpublished	117	88	29
6: Environmental medicine unit report, 1998	116	101	14
Average	121	100	21

4.1 Bone Conduction

The effect of bone conduction (noise transmitted through the skull to the ears) performs a significant role in the effectiveness of hearing protection. It is hypothesized that the Nova 2000 adds further noise attenuation over alternative products by reducing bone conduction. Although yet to be scientifically proven, this is achieved because no rigid connections are formed between the helmet shell and the user's skull. Instead, the user is insulated by a minimum of two densities of foam in at all contact points. Conversely, alternative products rigidly connect the wearer's skull to the helmet shell in the form of a plastic head harness.

Nova 2000 Noise Attenuation

4.2 Additional Protection

Although the Nova 2000 provides significant hearing protection from sandblasting noise, this is still insufficient to protect users from hearing damage. Therefore, RPB recommends operators should always wear additional hearing protection in the form of foam earplugs. Foam earplugs are recommended because they:

- Provide the highest attenuation
- Fit comfortably next to the Nova 2000's pads
- Readily available
- Relatively cost effective compared with ear defenders and custom ear plugs.

It should be noted, the individual attenuations of earplugs and products like the Nova 2000 or ear defenders cannot be combined using simple addition. The process to combine the protection is outside the scope of this document and requires complicated experimentation that considers the affects of bone conduction.

Two examples of suitable ear plugs are:

“Max” by Howard Leight

Octave Band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Mean Attenuation [dBA]	34.6	37.1	37.4	38.8	38.2	37.9	47.3	44.8
Standard Deviation [dBA]	3.0	4.5	4.3	3.7	3.5	4.0	3.5	7.2
Assumed Protection (98%) [dBA]	28.6	28.1	28.8	31.4	31.2	29.9	40.3	30.4

“Soft FX” by E.A.R

Octave Band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Mean Attenuation [dBA]	34.6	37.5	38.5	40.4	38.6	39.6	48.9	47.8
Standard Deviation [dBA]	5.7	6.0	5.4	5.0	4.2	2.5	3.8	3.9
Assumed Protection (98%) [dBA]	23.2	25.5	27.7	30.4	30.2	34.6	41.3	40.0

Table 5 shows the average attenuation provided by the earplugs alone. Because the blasting noise varies across all the studies, the earplugs are compared to the mean sound pressure level volume of each study shown in Table 1 on page 4 across each octave band.

Table 5 - Attenuation provided by sample earplugs only

Octave Band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Log Sum
Average Sandblasting Noise [dBA]	77	81	87	94	103	110	114	116	119
Noise with Howard Leight, Max [dBA]	48	53	58	63	71	80	74	86	87
Noise with E.A.R, Soft FX [dBA]	54	56	59	64	72	75	73	76	81

Note: RPB Respiratory is in no way affiliated with E.A.R or Howard Leight.

5.0 Conclusions

The noise produced by the process of sandblasting is well in excess of that safe for human exposure, as it reaches levels in excess of 120 dBA. Even when a user is wearing earplugs, the exposure can still be in excess of 85 dBA, the maximum recommended 8 hour exposure level in most countries including (USA, UK, Australia and New Zealand). Thus additional hearing protection is always required.

Upon inspection of the Octave band frequency response, additional protection is required predominantly against frequencies greater than 1 kHz. Coincidentally, the Nova 2000 provides its greatest protection to these frequencies. Because not all operators obey safety instructions, supervisors can be assured of at least 14 to 29 dBA of protection provided by the Nova 2000 alone.

RPB Respiratory intends to perform future calculations and testing of the protection provided by the Nova 2000 combined with suitable ear plugs. It is expected that these tests will conclude the resulting sound pressure will be well below 85 dBA.