Laboratory Attenuation Data for 3M™ Hearing Protection Products (Tested in Accordance with ANSI S3.19-1974)

*3M recommends fit testing of hearing protectors. If the NRR is used to estimate typical workplace protection, 3M recommends that the NRR be reduced by 50% or in accordance with applicable regulations.

Disposable Roll Down Earplugs

Device	NRR*	CSA Class	Frequency (Hz)	Octave Band Attenuation Data (dB) 125	250	500	1000	2000	3150	4000	6300	8000
E•A•R™ Classic™	29 dB	AL	Mean Attenuation	37.4	40.9	44.8	43.8	36.3	41.9	42.6	46.1	47.3
			Standard Deviation	5.7	5.0	3.3	3.6	4.9	3.0	3.1	3.5	2.7
E•A•R™ Classic™ Small	29 dB	AL	Mean Attenuation	32.9	37.5	41.4	40.0	36.4	43.9	45.2	48.2	48.1
			Standard Deviation	4.2	4.4	4.2	4.3	4.0	3.0	2.5	2.6	4.4
E•A•R™ Classic™ Plus	33 dB	AL	Mean Attenuation	37.7	43.0	47.0	43.7	38.2	44.5	45.4	49.1	48.4
			Standard Deviation	4.9	4.7	3.3	3.4	3.6	2.8	3.6	4.4	4.4
E•A•R™ Classic™ Plus Metal Detectable	33 dB	AL	Mean Attenuation	37.7	43.0	47.0	43.7	38.2	44.5	45.4	49.1	48.4
			Standard Deviation	4.9	4.7	3.3	3.4	3.6	2.8	3.6	4.4	4.4
E•A•R™ Classic Soft ™	31 dB	AL	Mean Attenuation	35.7	41.5	46.2	42.4	37.7	42.5	44.7	47.2	46.4
			Standard Deviation	7.4	8.5	6.2	5.3	2.4	3.7	3.5	5.4	4.5
E•A•R™ E-Z-Fit™	28 dB	AL	Mean Attenuation	35.6	36.9	39.0	37.5	35.1	42.3	44.9	47.7	48.7
			Standard Deviation	5.8	5.0	4.6	5.9	3.0	2.6	3.3	3.4	4.5
E•A•R™ TaperFit™ 2 (2 size earplug)	32 dB	AL	Mean Attenuation	36.4	39.1	41.7	40.7	38.1	44.5	45.9	48.4	48.1
			Standard Deviation	3.6	2.9	3.4	3.5	2.8	2.0	2.3	3.2	3.7
E•A•R™ Classic™ SuperFit™ 30	30 dB	AL	Mean Attenuation	32.9	37.5	41.4	40.0	36.4	43.9	45.2	48.2	48.1
			Standard Deviation	4.2	4.4	4.2	4.3	4.0	3.0	2.5	2.6	4.4
E•A•R™ Classic™ SuperFit™ 33	33 dB	AL	Mean Attenuation	37.7	43.0	47.0	43.7	38.2	44.5	45.4	49.1	48.4
			Standard Deviation	4.9	4.7	3.3	3.4	3.6	2.8	3.6	4.4	4.4
3M™ 1100 and 1110	29 dB	AL	Mean Attenuation	33.9	37.7	39.8	38.5	37.0	41.9	42.7	45.5	44.6
			Standard Deviation	4.7	5.5	5.6	4.8	3.1	3.8	3.4	4.0	3.4
E•A•Rsoft™ Yellow Neons™ (2 size earplug)	33 dB	AL	Mean Attenuation	38.4	40.3	43.2	41.8	38.6	45.0	45.7	49.6	47.3
			Standard Deviation	4.8	4.8	5.0	4.0	2.6	3.3	3.3	4.0	3.5
E•A•Rsoft™ Yellow Neon™ Blasts (2 size earplug)	33 dB	AL	Mean Attenuation	38.4	40.3	43.2	41.8	38.6	45.0	45.7	49.6	47.3
			Standard Deviation	4.8	4.8	5.0	4.0	2.6	3.3	3.3	4.0	3.5
E•A•Rsoft™ SuperFit™ (2 size earplug)	33 dB	AL	Mean Attenuation	38.4	40.3	43.2	41.8	38.6	45.0	45.7	49.6	47.3
			Standard Deviation	4.8	4.8	5.0	4.0	2.6	3.3	3.3	4.0	3.5
E•A•Rsoft™ Yellow Neons™ Metal Detectable Regular size only	32 dB	AL	Mean Attenuation	36.1	37.4	39.7	38.6	38.5	44.6	45.4	47.4	48.0
			Standard Deviation	3.6	4.9	4.3	3.1	2.7	3.2	4.1	3.2	3.2
3M™ Nitro™	32 dB	AL	Mean Attenuation	36.1	37.4	39.7	38.6	38.5	44.6	45.4	47.4	48.0
			Standard Deviation	3.6	4.9	4.3	3.1	2.7	3.2	4.1	3.2	3.2
3M™ Tattoo™	32 dB	AL	Mean Attenuation	36.1	37.4	39.7	38.6	38.5	44.6	45.4	47.4	48.0
			Standard Deviation	3.6	4.9	4.3	3.1	2.7	3.2	4.1	3.2	3.2
E•A•Rsoft™ Grippers ™	31 dB	AL	Mean Attenuation	38.9	38.7	42.9	41.9	39.2	45.6	47.4	50.9	48.2
			Standard Deviation	4.6	5.4	5.7	5.3	3.4	3.8	3.8	5.3	5.2
E•A•Rsoft™ FX ™	33 dB	AL	Mean Attenuation	40.8	40.8	43.6	41.8	37.9	45.2	47.6	49.0	46.8
			Standard Deviation	2.9	3.5	4.0	3.8	2.6	2.8	3.5	3.8	4.3

NOTE: The Noise Reduction Rating (NRR) shown for 2 size products are based on laboratory testing of regular and large sizes of the earplug.

Push-to-Fit Earplugs

Device	NRR*	CSA Class	Frequency (Hz)	Octave Band Attenuation Data (dB) 125	250	500	1000	2000	3150	4000	6300	8000
E•A•R™ EXPRESS™ Pod Plugs™	25 dB	AL	Mean Attenuation	31.6	32.1	32.2	36.9	35.7	37.0	35.7	38.7	40.5
			Standard Deviation	4.3	4.6	4.8	4.0	3.3	3.3	4.2	5.1	3.4
E•A•R™ EXPRESS™ Pod Plugs™ Metal Detectable	25 dB	AL	Mean Attenuation	31.6	32.1	32.2	36.9	35.7	37.0	35.7	38.7	40.5
			Standard Deviation	4.3	4.6	4.8	4.0	3.3	3.3	4.2	5.1	3.4
E-A-R™ Push-Ins™	28 dB	AL	Mean Attenuation	37.8	37.2	39.8	38.8	35.0	40.0	37.7	38.7	41.1
			Standard Deviation	4.9	5.0	4.8	3.4	3.0	3.5	3.6	4.3	4.1
E-A-R™ Push-Ins™ Metal Detectable	28 dB	AL	Mean Attenuation	37.8	37.2	39.8	38.8	35.0	40.0	37.7	38.7	41.1
			Standard Deviation	4.9	5.0	4.8	3.4	3.0	3.5	3.6	4.3	4.1
E-A-R™ Push-Ins™ with Grip Rings	30 dB	AL	Mean Attenuation	40.2	39.4	41.0	41.0	37.4	41.1	44.0	48.3	47.3
			Standard Deviation	5.8	4.4	4.0	4.8	3.0	5.3	4.5	3.5	3.6
E-A-R™ Push-Ins™ SofTouch™	31 dB	AL	Mean Attenuation	37.1	38.3	40.1	40.1	38.5	46.7	48.1	46.4	47.2
			Standard Deviation	5.2	5.8	3.3	4.3	3.4	3.8	2.5	3.6	3.1
3M™ E-A-R™ Skull Screws™	32 dB	AL	Mean Attenuation	38.2	37.7	39.9	40.2	38.1	45.0	46.9	48.3	45.6
			Standard Deviation	3.1	3.1	3.0	4.3	2.6	4.0	3.9	5.1	4.6
3M™ Pistonz™	29 dB	AL	Mean Attenuation	37.2	37.7	39.5	40.1	34.3	42.3	41.4	46.2	46.1
			Standard Deviation	5.4	5.2	5.0	3.4	2.8	2.9	3.3	4.7	3.4
3M™ No-Touch™	29 dB	AL	Mean Attenuation	36.9	36.7	39.4	40.4	35.9	42.9	45.5	48.8	45.9
			Standard Deviation	4.9	4.8	4.5	5.9	2.5	3.6	4.0	4.9	4.3

NOTE: The Noise Reduction Rating (NRR) shown for 2 size products are based on laboratory testing of regular and large sizes of the earplug.

Reusable Earplugs

Device	NRR*	CSA Class	Frequency (Hz)	Octave Band Attenuation Data (dB) 125	250	500	1000	2000	3150	4000	6300	8000
E•A•R™UltraFit™	25 dB	AL	Mean Attenuation	28.5	30.0	32.9	33.5	34.9	40.4	41.9	42.7	44.6
			Standard Deviation	4.7	4.6	4.6	4.0	3.6	5.4	5.1	3.3	4.1
E•A•R™ UltraFit™ Metal Detectable	25 dB	AL	Mean Attenuation	28.5	30.0	32.9	33.5	34.9	40.4	41.9	42.7	44.6
			Standard Deviation	4.7	4.6	4.6	4.0	3.6	5.4	5.1	3.3	4.1
E•A•R™ UltraFit Plus™	26 dB	AL	Mean Attenuation	32.3	33.2	34.1	36.0	36.4	40.8	39.7	43.2	44.1
			Standard Deviation	5.1	4.3	4.9	4.6	3.4	3.9	5.5	5.4	3.3
3M™ Tri-Flange ™	26 dB	AL	Mean Attenuation	32.3	33.2	34.1	36.0	36.4	40.8	39.7	43.2	44.1
			Standard Deviation	5.1	4.3	4.9	4.6	3.4	3.9	5.5	5.4	3.3
E•A•R™ UltraFit™ 27	27 dB	AL	Mean Attenuation	35.2	35.3	36.2	36.9	36.2	43.4	42.7	43.7	44.3
			Standard Deviation	4.7	5.5	4.7	3.9	3.8	4.9	5.3	5.3	4.8
E-A-R™ HiFi™	12 dB	C	Mean Attenuation	14.5	15.3	16.9	18.9	22.5	23.0	19.8	22.3	24.6
			Standard Deviation	3.8	2.8	2.5	3.0	3.4	3.0	2.8	2.9	2.6
E-A-R™ Arc Plug™ (dual end) level dependent	0 dB	-	Mean Attenuation	4.7	4.2	6.0	9.5	16.7	18.6	16.3	16.7	17.2
			Standard Deviation	4.0	4.3	5.0	6.7	4.9	5.7	5.8	6.1	6.8
E-A-R™ Arc Plug™ (dual end) steady state	22 dB	AL	Mean Attenuation	32.7	31.8	33.0	32.0	34.5	37.3	38.9	43.8	43.3
			Standard Deviation	5.9	6.1	6.5	5.5	4.1	5.3	6.1	6.7	6.9
3M™ Combat Arms™ Earplug (dual end) level dependent	0 dB	-	Mean Attenuation	4.7	4.2	6.0	9.5	16.7	18.6	16.3	16.7	17.2
			Standard Deviation	4.0	4.3	5.0	6.7	4.9	5.7	5.8	6.1	6.8
3M™ Combat Arms™ Earplug (dual end) steady state	22 dB	AL	Mean Attenuation	32.7	31.8	33.0	32.0	34.5	37.3	38.9	43.8	43.3
			Standard Deviation	5.9	6.1	6.5	5.5	4.1	5.3	6.1	6.7	6.9
3M™ Combat Arms™ Single Tip Earplug (3 size product) level dependent	7 dB	C	Mean Attenuation	4.1	4.5	11.0	18.7	24.9	29.8	25.8	18.7	26.5
			Standard Deviation	2.7	2.8	3.9	3.2	3.3	2.7	3.3	3.6	3.3
3M™ Combat Arms™ Single Tip Earplug (3 size product) steady state	23 dB	BL	Mean Attenuation	30.3	28.7	32.2	31.9	31.7	38.0	35.1	31.9	37.8
			Standard Deviation	3.4	3.9	3.4	3.8	3.0	4.4	4.8	5.4	4.3

NOTE: The Noise Reduction Rating (NRR) shown for 3 size products are based on laboratory testing of the small, medium and large sizes of the earplug.

Banded Hearing Protectors

Device	NRR*	CSA	(Hz)	Octave Band Attenuation Data (dB) 125	250	500	1000	2000	3150	4000	6300	8000
E-A-R™ Caboflex™ Under the Chin Position	20 dB	BL	Mean Attenuation	28.7	28.3	28.0	28.6	32.2	42.1	44.3	47.2	44.6
			Standard Deviation	6.8	6.3	5.8	4.9	3.7	3.2	3.8	3.9	5.7
E-A-R™ Caboflex™ Behind the Head Position	17 dB	BL	Mean Attenuation	25.8	24.9	25.8	27.3	31.7	40.7	42.1	43.0	41.5
			Standard Deviation	7.6	7.5	6.1	5.5	4.0	4.3	3.7	4.0	6.1
E•A•R Caps™ Under the Chin Position	17 dB	BL	Mean Attenuation	22.7	21.1	19.4	21.1	31.1	37.7	38.1	40.1	39.2
			Standard Deviation	4.4	4.1	3.3	2.5	3.1	2.4	2.5	3.8	4.2
E•A•Rflex™ 28 Under the Chin Position	28 dB	AL	Mean Attenuation	35.3	34.5	36.4	34.0	36.4	43.2	45.5	47.9	46.3
			Standard Deviation	6.3	5.2	3.9	3.5	3.2	3.6	3.1	4.4	4.4
E•A•Rflex™ Foam Tips Under the Chin Position	25 dB	AL	Mean Attenuation	32.7	32.8	34.2	35.2	38.2	45.5	45.5	49.0	48.2
			Standard Deviation	4.2	5.5	5.7	5.7	3.3	3.4	3.4	3.7	4.1
E•A•Rflex™ Foam Tips Behind the Head Position	25 dB	AL	Mean Attenuation	32.5	32.9	34.1	36.3	37.8	44.7	45.1	46.2	46.3
			Standard Deviation	4.6	5.1	5.6	5.9	4.5	4.0	3.4	3.2	3.6
E•A•Rflex™ Foam Tips Over the Head Position	25 dB	AL	Mean Attenuation	32.6	31.2	31.8	35.0	36.9	44.1	44.6	47.3	46.7
			Standard Deviation	4.6	5.2	5.4	5.4	3.4	4.3	3.9	4.2	3.7
E•A•Rflex™ Premolded Tips Under the Chin Position	27 dB	AL	Mean Attenuation	40.0	41.3	43.6	39.4	37.3	39.2	39.6	44.0	46.2
			Standard Deviation	5.7	6.2	6.6	5.4	4.0	4.7	6.2	6.1	5.6
E•A•Rflex™ Premolded Tips Behind the Head Position	24 dB	AL	Mean Attenuation	39.7	40.1	43.8	40.1	37.6	39.4	39.8	44.8	47.2
			Standard Deviation	8.8	8.9	8.9	7.5	6.3	5.9	6.4	5.7	3.8
E•A•Rflex™ Premolded Tips Over the Head Position	24 dB	AL	Mean Attenuation	38.6	39.3	42.0	38.0	36.5	37.4	36.9	43.0	45.8
			Standard Deviation	6.8	7.4	7.1	6.5	4.0	6.2	7.3	6.2	4.3
E-A-R™ Swerve™ Comfort Pods Behind the Head Position	19 dB	BL	Mean Attenuation	26.3	23.8	22.0	24.6	32.9	37.2	38.7	45.0	40.6
			Standard Deviation	3.6	3.6	3.7	2.8	3.2	3.9	2.7	3.0	3.4
E-A-R™ Swerve™ Flex 28 Tips Behind the Head Position	28 dB	AL	Mean Attenuation	35.7	35.1	37.6	38.2	36.7	45.6	46.7	47.4	44.9
			Standard Deviation	5.5	4.9	5.7	5.2	3.8	3.9	4.3	5.4	3.7

NOTE: The Noise Reduction Rating (NRR) shown for 2 size products are based on laboratory testing of regular and large sizes of the earplug.

Laboratory Attenuation Data for 3M™ Hearing Protection Products (Tested in Accordance with ANSI S3.19-1974)

*3M recommends fit testing of hearing protectors. If the NRR is used to estimate typical workplace protection, 3M recommends that the NRR be reduced by 50% or in accordance with applicable regulations.

3M™ E-A-R™ Earmuffs

Device	NRR*	CSA Class	Octave Band Attenuation Data (dB)									
			Frequency (Hz)	125	250	500	1000	2000	3150	4000	6300	8000
Model 1000	20 dB	B	Mean Attenuation	11.7	16.2	26.5	31.6	32.5	35.0	38.1	41.8	41.8
Over the Head Position			Standard Deviation	3.3	2.7	2.7	2.6	3.0	2.8	2.5	4.7	3.8
Model 1000	22 dB	B	Mean Attenuation	14.8	17.1	27.7	35.2	34.0	36.8	39.1	44.0	43.3
Behind the Head Position			Standard Deviation	3.2	3.1	2.3	3.5	3.0	3.2	3.3	3.0	3.1
Model 1000	22 dB	A	Mean Attenuation	14.4	18.4	28.0	34.8	34.3	36.5	38.8	43.7	43.2
Under the Chin Position			Standard Deviation	3.7	3.4	2.5	2.8	3.4	2.6	2.9	2.9	3.0
Model 2000H	21 dB	B	Mean Attenuation	13.0	17.7	25.6	30.1	32.8	35.9	33.5	36.4	37.2
Hard Hat Attached			Standard Deviation	3.6	2.7	2.4	2.5	3.4	2.4	2.0	3.3	3.7
Model 3000	25 dB	A	Mean Attenuation	16.5	21.8	33.8	40.4	35.1	36.2	38.4	38.3	39.7
Over the Head Position			Standard Deviation	2.5	2.7	3.0	3.9	3.4	3.4	3.2	2.2	2.8
Model 3000	26 dB	AL	Mean Attenuation	21.2	22.3	33.1	41.2	34.7	36.1	38.3	37.9	38.7
Behind the Head Position			Standard Deviation	2.4	2.9	2.3	2.7	3.2	2.7	1.9	2.7	4.2
Model 3000	26 dB	AL	Mean Attenuation	20.5	22.7	32.6	41.2	34.6	37.3	38.9	37.3	39.5
Under the Chin Position			Standard Deviation	4.3	2.6	2.6	2.9	3.5	2.5	2.9	2.1	4.0

3M™ PELTOR™ Earmuffs

Device	NRR*	CSA Class	Octave Band Attenuation Data (dB)									
			Frequency (Hz)	125	250	500	1000	2000	3150	4000	6300	8000
Optime™ 105 - H10A	30 dB	AL	Mean Attenuation	21.0	26.0	36.6	40.6	38.0	41.8	42.7	41.7	41.3
Over the Head Position			Standard Deviation	1.9	2.3	2.3	2.4	2.5	2.7	1.8	2.1	2.5
Optime™ 105 - H10B	29 dB	AL	Mean Attenuation	21.0	26.4	37.1	40.0	36.9	40.4	42.1	41.6	42.2
Behind the Head Position			Standard Deviation	2.7	2.6	3.0	3.6	2.4	3.4	2.8	2.9	2.5
Optime™ 105 - H10P3	27 dB	AL	Mean Attenuation	20.7	25.5	36.2	38.3	35.7	39.3	41.3	42.1	41.3
Hard Hat Attached			Standard Deviation	3.0	3.3	3.9	3.4	2.9	3.5	3.4	2.5	3.1
Optime™ 101 - H7A	27 dB	A	Mean Attenuation	15.5	24.5	35.3	40.0	36.9	39.9	37.5	37.7	38.1
Over the Head Position			Standard Deviation	3.0	2.0	2.4	2.8	2.6	2.8	3.2	2.7	3.9
Optime™ 101 - H7B	26 dB	A	Mean Attenuation	16.8	23.5	34.8	39.7	36.5	35.8	36.2	40.1	40.1
Behind the Head Position			Standard Deviation	3.4	2.6	2.1	2.6	2.3	2.2	2.4	2.4	3.0
Optime™ 101 - H7P3*	24 dB	A	Mean Attenuation	15.3	21.8	33.7	40.0	36.2	35.5	34.7	37.2	35.5
Hard Hat Attached			Standard Deviation	2.6	2.5	2.6	3.3	3.8	3.0	2.7	3.1	3.2
Optime™ 98 - H9A	25 dB	A	Mean Attenuation	15.5	22.0	33.7	39.7	36.5	42.7	40.1	39.8	40.6
Over the Head Position			Standard Deviation	2.7	3.5	2.6	2.4	2.6	2.6	2.8	2.7	2.5
Food Industry Earmuff - H9A-02	26 dB	A	Mean Attenuation	15.1	21.7	31.2	38.6	35.6	40.5	43.0	40.9	41.8
Over the Head Position			Standard Deviation	2.8	1.9	2.7	2.0	3.0	3.5	3.2	2.0	2.7
Optime™ 98 - H9P3*	23 dB	A	Mean Attenuation	14.8	20.2	30.5	38.7	36.4	38.9	36.3	39.4	38.3
Hard Hat Attached			Standard Deviation	2.5	3.1	3.4	2.6	3.0	2.9	3.0	3.7	2.9
Optime™ 95 - H6A	21 dB	B	Mean Attenuation	12.4	15.0	26.2	35.2	35.2	30.9	33.3	36.0	37.5
Over the Head Position			Standard Deviation	2.6	1.8	2.5	3.2	2.5	3.0	2.0	4.5	3.2
Optime™ 95 - H6B	21 dB	B	Mean Attenuation	13.2	14.2	25.1	34.2	35.4	30.4	35.1	37.0	38.5
Behind the Head Position			Standard Deviation	2.9	1.6	2.6	2.6	3.0	2.8	2.1	4.0	2.8
Optime™ 95 - H6F	21 dB	B	Mean Attenuation	12.4	15.0	26.2	35.2	35.2	30.9	33.3	36.0	37.5
Over the Head Position			Standard Deviation	2.6	1.8	2.5	3.2	2.5	3.0	2.0	4.5	3.2
Optime™ 95 - H6P3E	21 dB	B	Mean Attenuation	12.3	17.2	27.8	32.8	33.9	36.5	36.0	36.5	36.8
Hard Hat Attached			Standard Deviation	2.7	3.0	2.5	2.8	2.9	4.1	3.0	4.3	4.6
H31A	24 dB	A	Mean Attenuation	13.2	20.4	30.8	35.8	37.0	41.3	37.1	34.1	35.5
Over the Head Position			Standard Deviation	2.6	2.5	2.7	2.6	3.2	2.5	2.5	2.9	2.2
H31P3*	23 dB	A	Mean Attenuation	12.2	18.9	29.7	34.8	37.2	37.0	35.8	35.0	37.4
Hard Hat Attached			Standard Deviation	2.1	2.6	2.3	2.7	3.6	2.9	2.4	4.0	3.9
H505B Welding Helmet Earmuff	17 dB	B	Mean Attenuation	12.7	13.2	22.9	21.6	31.9	40.2	39.5	37.6	38.6
Behind the Head Position			Standard Deviation	5.5	2.1	2.6	2.3	2.5	3.4	3.5	3.6	3.5
X1A	22 dB	A	Mean Attenuation	16.0	18.3	27.7	37.6	35.1	42.2	41.4	39.4	39.3
Over the Head Position			Standard Deviation	5.2	3.1	3.0	3.5	2.8	2.8	2.6	2.6	3.8
X1P3E	21 dB	B	Mean Attenuation	13.8	17.3	27.4	35.6	34.5	41.8	40.1	36.8	36.1
Hard Hat Attached			Standard Deviation	4.5	3.2	2.9	2.8	2.9	2.9	2.9	3.7	4.1
X2A	24 dB	A	Mean Attenuation	14.9	21.6	31.8	41.0	36.7	39.1	38.5	39.0	39.0
Over the Head Position			Standard Deviation	4.2	3.3	2.3	2.5	3.0	2.4	2.0	2.8	3.4
X2P3E	24 dB	A	Mean Attenuation	15.2	21.3	32.6	39.2	35.9	37.7	37.1	38.6	37.3
Hard Hat Attached			Standard Deviation	4.2	3.1	2.8	3.2	3.3	2.8	2.1	2.5	3.0
X3A	28 dB	AL	Mean Attenuation	23.4	27.7	29.4	42.5	38.8	39.3	42.3	39.5	39.5
Over the Head Position			Standard Deviation	3.0	2.1	3.1	2.6	2.7	4.0	3.3	2.6	2.8
X3P3E	25 dB	AL	Mean Attenuation	19.6	24.1	29.7	39.1	35.7	38.2	40.3	37.1	35.4
Hard Hat Attached			Standard Deviation	3.3	3.1	2.5	3.9	3.1	4.7	3.5	4.4	4.9
X4A	27 dB	AL	Mean Attenuation	20.5	24.1	32.8	40.7	37.6	44.5	45.4	42.4	42.3
Over the Head Position			Standard Deviation	4.6	3.4	1.9	2.8	2.9	3.1	2.5	3.1	3.0
X4P3E	25 dB	A	Mean Attenuation	18.1	21.6	32.4	40.1	36.5	44.2	46.2	43.7	43.3
Hard Hat Attached			Standard Deviation	4.9	2.6	2.0	2.3	3.2	3.9	2.7	2.4	3.0
X5A	31 dB	AL	Mean Attenuation	23.9	30.5	41.1	43.0	38.0	43.1	44.0	41.1	40.3
Over the Head Position			Standard Deviation	4.1	2.2	2.8	2.9	2.7	2.9	2.4	2.6	2.2
X5P3E	31 dB	AL	Mean Attenuation	21.6	29.3	41.0	42.4	37.5	41.7	42.5	40.6	40.5
Hard Hat Attached			Standard Deviation	3.2	2.5	2.8	3.1	2.2	2.3	2.5	2.9	2.6

Laboratory Attenuation Data for 3M™ Hearing Protection Products (Tested in Accordance with ANSI S3.19-1974)

*3M recommends fit testing of hearing protectors. If the NRR is used to estimate typical workplace protection, 3M recommends that the NRR be reduced by 50% or in accordance with applicable regulations.

3M™ PELTOR™ Communications Eartips

Device	NRR*	CSA Class	Octave Band Attenuation Data (dB)									
			Frequency (Hz)	125	250	500	1000	2000	3150	4000	6300	8000
ORA TAC - Classic ™ Eartip	31 dB	AL	Mean Attenuation	37.3	38.1	42.6	40.8	36.7	42.6	43.5	48.1	45.9
			Standard Deviation	4.8	3.5	3.6	2.7	3.3	3.6	4.3	5.2	3.8
ORA TAC - Skull Screw™ Eartip	29 dB	AL	Mean Attenuation	38.0	36.8	39.2	44.8	37.7	43.1	42.6	46.4	45.2
			Standard Deviation	5.0	5.1	5.8	5.2	4.2	5.3	5.6	5.4	2.7
ORA TAC - UltraFit™ Eartip	20 dB	AL	Mean Attenuation	35.1	35.1	36.3	32.3	33.7	37.0	37.7	39.1	39.1
			Standard Deviation	9.3	7.3	8.1	6.5	5.5	7.4	6.5	6.9	5.6
ORA TAC - CCC-GRM-25 Eartip	26 dB	AL	Mean Attenuation	34.1	30.2	34.7	34.7	35.4	38.4	36.7	42.9	43.8
			Standard Deviation	3.4	4.1	3.7	3.9	3.7	4.0	4.3	4.1	4.2
TEP-100 Tactical Earplug - Skull Screw™ Eartip	30 dB	AL	Mean Attenuation	36.3	35.7	39.8	41.4	40.4	43.0	41.9	48.2	46.0
			Standard Deviation	5.3	5.5	5.5	4.2	3.4	4.6	3.5	4.6	4.2
TEP-100 Tactical Earplug - UltraFit™ Eartip (3 size product)	23 dB	AL	Mean Attenuation	36.2	33.7	34.7	32.0	34.5	37.4	35.6	38.0	37.5
			Standard Deviation	5.1	5.2	5.5	3.9	3.4	5.3	6.5	4.4	5.4
TEP-100 Tactical Earplug - CCC-GRM-25 Eartip	27 dB	AL	Mean Attenuation	34.5	30.6	36.3	35.2	35.5	38.6	37.6	44.6	45.7
			Standard Deviation	4.2	3.9	4.1	3.0	3.5	3.3	3.8	3.6	4.3
E-A-R buds™ - Skull Screw ™ Eartip	29 dB	AL	Mean Attenuation	38.0	36.8	39.2	44.8	37.7	43.1	42.6	46.4	45.2
			Standard Deviation	5.0	5.1	5.8	5.2	4.2	5.3	5.6	5.4	2.7
E-A-R buds™ - UltraFit™ Eartip	20 dB	AL	Mean Attenuation	35.1	35.1	36.3	32.3	33.7	37.0	37.7	39.1	39.1
			Standard Deviation	9.3	7.3	8.1	6.5	5.5	7.4	6.5	6.9	5.6
E-A-R buds™ - CCC-GRM-25 Eartip	27 dB	AL	Mean Attenuation	34.5	30.6	36.3	35.2	35.5	38.6	37.6	44.6	45.7
			Standard Deviation	4.2	3.9	4.1	3.0	3.5	3.3	3.8	3.6	4.3

NOTE: The Noise Reduction Rating (NRR) shown for 3 size products are based on laboratory testing of the small, medium and large sizes of the eartip

How to Use the Noise Reduction Rating (NRR)

The NRR describes the average sound level reduction (attenuation) provided by a hearing protection device (HPD) in a laboratory test. Since the NRR is based on laboratory testing, it does not take into account the loss of protection that occurs when hearing protectors are not fit properly or when they are not worn for the entire time that the wearer is exposed to noise

For most wearers, the NRR identified on the current EPA label (shown here) significantly overestimates the protection of the hearing protector in the workplace. This rating is based on an "experimenter fit" method of measuring HPD attenuation.

Using the EPA Noise Reduction Rating (Experimenter Fit)

The NRR on the EPA label shown to the right is based on the *average* amount of attenuation provided by an HPD when it is worn by 10 different people during a laboratory test. During this test, the person conducting the test fits the hearing protector on each person. This "experimenter fit" method results in ratings as high as 33 dB. Since research indicates that these ratings overestimate the protection that many wearers will receive in the real world, 3M RECOMMENDS REDUCING THE NRR before attempting to estimate the effectiveness of an HPD as follows:

1. Subtract 7 dB from the NRR if noise is measured on the A-weighted decibel scale (dBA). (Skip this step if noise is measured on the C-weighted dB scale)
2. Divide the result of step 1 (NRR-7) by 2. This is known as "derating".

An Example of Reducing the NRR

8-hour TWA noise exposure:	93 dBA
NRR of hearing protectors:	29 dB
Subtract 7 dB from the NRR:	29 dB - 7 dB = 22 dB
Divide by 2:	22 ÷ 2 = 11 dB
Subtract 11 dB from the 8-hour TWA noise exposure:	93 dBA - 11 dB = 82 dB

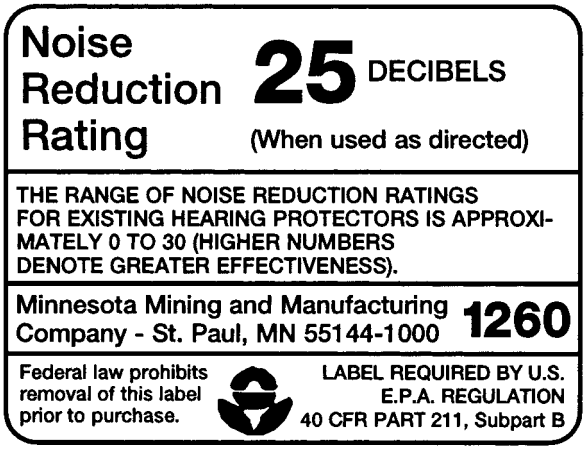
Decide if 82 dB (known as the "Protected Exposure") is below the PEL for noise

A New Rating: NRR (SF)

A new "subject fit" method of measuring HPD attenuation will be used in the future to calculate a different rating; the NRR (SF). The people (subjects) in this laboratory test fit their own protector according to the manufacturer's instructions without the help of the person conducting the test. Compared to the NRR shown on the current EPA label, the NRR (SF) is usually a lower rating that may be closer to the performance of the hearing protector in the real world. For more information about the NRR (SF), contact 3M Technical Service at 800 243-4630.

Estimating Noise Reduction for Individual Users

The labeled values of noise reduction are based on laboratory tests. It is not possible to use these data to reliably predict levels of protection achieved by a given individual in a particular environment. To ensure protection, those wearing hearing protectors for occupational exposures must be enrolled in a hearing conservation program. Non-occupational users should have a hearing evaluation by an audiologist, physician, or other qualified professional, on a regular basis.



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Technical Data Bulletin
3M Personal Safety Division

#234 Hearing Protection for Impulse Noise Published July 2015

Impulse noises are generally defined as sounds with short duration (less than 1 second) such as gunfire, explosions or the "pop" of a pneumatic nail gun. These sounds typically have an extremely fast onset and often reach very high sound pressure levels (SPL). In figure 1, for example, the sound of gunfire reaches a peak SPL of 164 decibels (dB) in the first few tenths of a millisecond then decays rapidly.

By comparison, *continuous* noises are generally defined as sounds that have a longer duration (more than 1 second) such as most typical industrial noises, noises from vehicles and aircraft, and noise from operating power tools at work or at home.

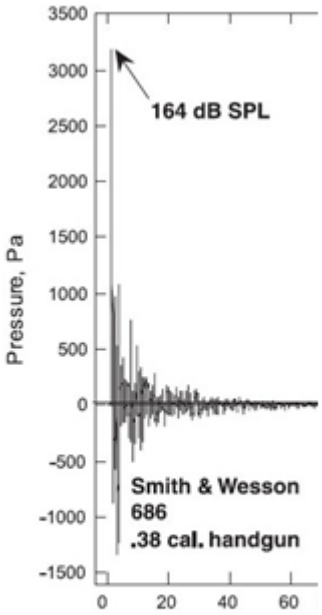

Figure 1. Example of impulse waveform from handgun. Flamme, et al 2009.

What are the Risks Associated with Impulse Noise?

One commonly accepted approach to assessing the health risks for people exposed to impulse noise is to measure the instantaneous *peak* sound pressure level (L_{pk}) rather than the *average* sound pressure level (L_{avg}). When peak sound levels exceed 135 dB, the risk of damage to the auditory system and other adverse health effects increases significantly. Common health effects associated with impulse noise include hearing loss, tinnitus, hyperacusis (abnormal sensitivity to loud sounds) as well as non-auditory effects such as hypertension, fatigue and other conditions related to stress.

Are Hearing Protectors Effective Against Impulse Noise?

When properly selected and worn according to the user instructions, hearing protection devices (HPDs) help reduce exposure to both continuous noises as well as impulse noises. However, it is difficult to predict the required and/or actual hearing protection obtained during exposure to impulse noises. For gunfire, the weapon type, number of rounds fired, proper selection, fit and use of hearing protection, the proper care and condition of the hearing protectors, and other variables will impact hearing protector performance.

Traditional Passive Hearing Protectors

Passive hearing protectors are devices without electronic components. Traditional passive HPDs, such as roll-down foam earplugs, push-to-fit foam earplugs and earmuffs, create a physical barrier that reduces (attenuates) the sound level that reaches the wearers' ears by a certain amount regardless of the sound level to which the wearer is exposed. For example, someone who selects and wears 3M™ E-A-Rsoft™ FX™ Earplugs correctly and obtains 33 dB of noise reduction overall would be expected to

obtain that amount of noise reduction for an 85-dB SPL exposure and at least that much or more noise reduction for a 150-dB SPL exposure. These devices are sometimes referred to as “conventional” or “non-level-dependent” hearing protectors.

Passive Level-Dependent Hearing Protectors

HPDs that incorporate specialized acoustic filters are often referred to as “level-dependent” or “nonlinear.” Unlike traditional passive hearing protectors, these devices create a relatively transparent barrier at low sound levels, using a tiny orifice or a thin diaphragm. The intention is for the amount of noise reduction to increase in proportion to the sound level to which the wearer is exposed.

At low sound levels, below 110 dB SPL for example, these devices provide little or no attenuation, allowing the wearer to maintain better hearing ability*. However, when the wearer is exposed to very high level, short-duration impulse noises, the acoustic filters instantaneously restrict the transmission of sound into the ear by a greater amount that increases as sound level increases, to help boost the attenuation of the peak sound pressure wave, L_{pk}, and reduce the exposure of the wearer.

Some level-dependent HPDs, such as the 3M™ Combat Arms™ Earplugs, allow the wearer to switch from the impulse noise protection mode to a continuous noise protection mode by sealing the acoustic filter, thus causing the device to function as a traditional hearing protector. This can be useful when the wearer is exposed to impulse noise at certain times and continuous noise at other times.

Electronic Level-Dependent Hearing Protectors

These HPDs use electronic technology to maintain, and in some cases enhance, hearing ability when sound levels are low. They are often referred to as “active” hearing protectors. Environmental microphones (also referred to as tactical, surround, or situational-awareness microphones) on the device pick up the low-level (non-hazardous) sounds in the area around the wearer and reproduce them inside the hearing protector. Typically the wearer can control the loudness using a volume control on the device. The amount of sound that is electronically reproduced inside the HPD decreases proportionally as the sound level outside the device increases. Electronic compression is used to limit the level of the reproduced sound inside the headset to non-hazardous levels.

Since the maximum attenuation provided (in the absence of electronic reproduction) is based on the physical properties of the earmuff cups or earplugs that create the acoustic seal around the ear or in the ear, these devices provide protection against both impulse and continuous noises in the same way as traditional HPDs. The big difference is the ability of electronic level-dependent HPDs to allow the wearer to hear more effectively during periods of low noise without the need to remove the device.

All 3M™ PELTOR™ electronic level-dependent hearing protectors limit the sound reproduced from the environmental microphones to 82 dB SPL. In the absence of the reproduced signal (even if the active circuitry is powered off), some sound will continue to be transmitted into the ear since the barrier created by the earmuff cups or earplugs themselves has the same limitations as does a traditional HPD. In other words, even electronic level-dependent hearing protectors eventually depend on the non-electronic components to help protect the wearer’s hearing.

**Hearing ability is a general term to describe various factors related to auditory situational awareness such as sound detection, recognition, identification, localization and communication.*

Hearing Protector Guidance

A variety of factors affect the hazardousness of the impulse noises and the degree of hearing protection required, especially the number of exposures and overall peak level, L_{pk}, of each impulse. For example, the sound made by a weapon fired in an indoor firing range may have a greater intensity due to reverberation than the same weapon fired at an outdoor range where there is rapid sound decay. The caliber and type of weapon (handgun versus rifle) can also have a significant effect on L_{pk} .

The following guidance is to be considered general in nature since the actual hazard associated with exposure to gunfire and other impulse noises and the protection obtained when hearing protectors are worn is influenced by the variables described above.

Regardless of the hearing protector being worn, the user should be alert to his or her own hearing. If during or after an exposure, tinnitus (ringing or buzzing in the ears) is heard or the user's hearing seems muffled or dulled, or for any other reason the user suspects a hearing problem, the fit, condition or adequacy of the protector should be carefully checked and/or a more protective device or combination of devices (such as earmuffs and earplugs together) should be worn. For those exposed to weapons fire on a regular basis, periodic hearing evaluations are advised.

For highest noise reduction: wear dual protection (earmuffs worn over high attenuation earplugs fit deeply in the ear). This configuration will significantly boost the noise reduction but will reduce the user's hearing ability.

For high noise reduction: wear a good quality single hearing protector, such as foam earplugs fit deeply in the ear or high attenuation earmuffs. This approach may also reduce hearing ability.

For better hearing ability: consider level-dependent hearing protectors, either passive or active. Possible configurations include the following, with the dual-protection option being the more protective.

- Single hearing protection
    - Electronic level-dependent earplugs such as the 3M™ PELTOR™ Tactical 100, or
    - Electronic level-dependent earmuffs such as 3M™ PELTOR™ Tactical Sport, or
    - Passive level-dependent earplugs such as the 3M™ Combat Arms™ Earplugs
- Dual hearing protection
    - Passive level-dependent earplugs worn together with electronic level-dependent earmuffs, or
    - Electronic level-dependent earplugs worn together with traditional passive earmuffs, or
    - Traditional passive earplugs worn together with electronic level-dependent earmuffs, or
    - Electronic level-dependent earplugs worn together with electronic level-dependent earmuffs.

Hunters may choose level-dependent HPDs to balance the need for protection with the ability to detect and locate nearby game animals. Likewise, target shooters may opt to combine electronic level-dependent devices with passive HPDs (dual protection) to allow better audibility of range commands without sacrificing hearing protection.

For more information on hearing protection for indoor firing ranges and other shooting sports, read:

- Preventing Occupational Exposures To Lead and Noise At Indoor Firing Ranges. NIOSH publication 2009-136. Available online at http://www.cdc.gov/niosh/docs/2009-136/
- Hearing Protection & the Shooting Sports. Published by the National Hearing Conservation Association (NHCA) and the National Shooting Sports Foundation (NSSF). Available online at https://nhca.site-ym.com/store/ViewProduct.aspx?id=1945533

The importance of proper fit

The noise reduction of earmuff-style hearing protectors may be lower when eyeglasses, goggles or respirator straps are worn between the sealing surface of the earmuff cushions and the sides of the wearer's head. For best noise reduction, select eyeglasses or goggles that have thin, flat temples or straps that will minimize interference with the seal of the earmuff cushions. Pull long hair back to the extent possible and remove other items that may degrade the earmuff seal such as pencils, hats, jewelry or earbuds. Do not bend and reshape the headband as this will cause a loose fit and allow sound leakage.

Earplugs should be used in accordance with the manufacturer's instructions with special emphasis on selection of proper size and proper depth of insertion. If using disposable foam earplugs such as the 3M™ E-A-R™ Classic™ Earplugs, it's important to ensure that the proper technique for rolling and compressing the plug is used to avoid creating a crease along the length of the earplug that can degrade the noise reduction properties of the plug.

3M recommends fit testing of hearing protectors to provide a better estimate of the noise reduction obtained by the wearer. Proper care and maintenance of hearing protectors is critical in ensuring the device's protective capabilities can be maximized. To learn more about fitting, care and use of hearing protectors visit 3M online at www.3M.com/Hearing.

Flamme GA, Wong A, Liebe K, Lynd J. (2009) Estimates of auditory risk from outdoor impulse noise II: Civilian firearms. *Noise Health* 11: 231-42.

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