



INSTA-MOLD EAR PROTECTORS ATTENUATION TEST REPORT

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Cabot Safety Corporation's E•A•RCALSM Acoustical Laboratory is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program*, for hearing protection device attenuation testing per ANSI S3.19-1974 and ANSI S12.6-1984.

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This report contains 6 pages:

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- 1) summary test data
- 2) individual subject data
- 3) extreme range test
- 4) extreme mean value test
- 5) computation of the NRR
- 6) subject characteristics

For a complete description of the testing procedures involved in generating this report, see the following Cabot Safety Corporation Technical Reports:

E-A-R 90-32/HP Manual for Calibration of the Cabot Safety Corporation
E•A•RCAL Acoustical Laboratory re ANSI S3.19-1974
and ANSI S12.6-1984

E-A-R 91-41/HP Policies and Procedures Manual for the Cabot Safety
Corporation E•A•RCAL Acoustical Laboratory re ANSI
S3.19-1974 and ANSI S12.6-1984

* This report, which pertains only to the samples and subjects tested, cannot be used to claim product endorsement by NVLAP, or any other agency of the U. S. Government.

E•A•RCAL ATTENUATION TEST REPORT



PER ANSI S3.19-1974

DEVICE: Insta-Mold Customized Ear Protectors

DEVICE TYPE: Custom earmold

MANUFACTURER: Insta-Mold Prosthetics, Inc.

TEST DATE: January 6, 1993

TEST ID#: C37401

SUBJECTS/SAMPLES: 10/10

NRR (per EPA-1979): 27.1

BAND FORCE (N): NA

POSITION: NA

FITTING PROCEDURE: EPA/Experimenter Fit

Test Frequency (Hz)	Mean Attenuation (dB)	Standard Deviation (dB)
125	34.1	5.9
250	33.9	5.4
500	35.4	4.7
1000	32.8	2.8
2000	36.4	3.9
3150	44.6	3.5
4000	45.1	3.7
6300	46.4	4.1
8000	46.9	4.7

Performed by: Ronald W. Kieper
 Ronald W. Kieper
 Sr. Acoustical Technician

Reviewed by: Elliott H. Berger
 Elliott H. Berger
 Manager, Acoustical Engineering

COMMENTS: This product tested with two coatings of Insta-Seal Plus liquid. TLS failed the Outlier Test for Extreme Ranges at 125 and 1000 Hz. She was retested. The original NRR was 25.2.

INDIVIDUAL SUBJECT DATA

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Test ID: C37401

Device: Insta-Mold Customized Ear Protectors

Date: 1/5/93

Samples: 10

Position: NA

Comfort:

3.8

Comments: Tested with Tasco Ultimuff [158602]. TLS retest data. Impressions, made using syringe and foam dam, extending past the first bend, but not past second bend. Two coats of Insta-Seal Plus applied prior to testing.

Subj.	Trial	1/3 Octave-Band Frequency										Canal Size	NRR*
		125	250	500	1000	2000	3150	4000	6300	8000	125	Comf.	
DVF	1	34	37	41	33	33	44	48	52	50	37		S/S 29.4
	2	31	33	36	32	32	41	43	51	43	28		
	3	29	28	34	31	35	45	46	49	47	26	4	
KAF	1	24	28	29	32	30	42	45	44	40	22		MM+ 25.6
	2	20	23	29	28	33	42	46	41	45	17		
	3	25	26	36	33	32	44	44	42	42	24	5	
GWG	1	33	31	37	34	38	42	45	49	49	33		L/L 30.9
	2	36	36	38	32	34	45	45	50	50	36		
	3	38	35	35	31	38	44	41	50	50	36	1	
MG	1	40	35	35	32	36	45	50	49	52	38		M/M 30.1
	2	36	35	36	31	39	50	49	46	53	36		
	3	32	33	34	30	33	46	44	47	52	35	2	
BAK	1	40	36	36	35	45	52	52	50	46	39		XL/XL 35.0
	2	42	43	42	36	43	47	46	46	41	41		
	3	44	38	40	36	41	48	49	48	40	43	10	
JRM	1	37	35	36	34	32	42	41	42	43	38		XS/XS+ 31.5
	2	34	34	35	33	32	40	42	44	43	34		
	3	36	35	33	32	32	43	42	42	42	36	5	
DLP	1	39	38	43	36	42	48	55	53	52	39		L/L+ 25.9
	2	32	30	27	31	38	40	44	51	54	32		
	3	33	34	36	36	39	52	48	54	57	38	4	
CRR	1	30	29	31	30	37	42	40	40	44	31		M/M 30.1
	2	30	30	32	30	35	42	42	40	44	35		
	3	33	33	32	32	36	41	44	39	40	34	2	
EAS	1	42	45	48	39	43	51	49	48	52	40		M/M 33.5
	2	38	42	41	38	37	47	42	44	50	35		
	3	44	46	38	37	38	44	46	46	49	38	3	
TLS	1	29	29	33	31	36	45	44	44	45	33		M/M 27.8
	2	34	32	31	30	34	41	42	45	45	29		
	3	27	29	28	28	39	43	38	47	46	30	2	
Mean		34.1	33.9	35.4	32.8	36.4	44.6	45.1	46.4	46.9	33.8		
sd(30)		5.9	5.4	4.7	2.8	3.9	3.5	3.7	4.1	4.7	5.9		
sd(10)		5.6	5.1	3.7	2.6	3.6	2.6	2.9	4.1	4.5			
Q-Value		38.4	31.7	29.2	27.1	27.5		36.7		38.9			

NRR (2sd) = 27.1 (1sd) = 30.9 (0sd) = 34.6

NRR* - Individual 2sd NRR

DIXON'S OUTLIER TEST: EXTREME RANGES

Test ID: C37401

Device: Insta-Mold Customized Ear Protectors

Subj.	1/3 Octave-Band Frequency								
	125	250	500	1000	2000	3150	4000	6300	8000
DVF	5	9	7	2	3	4	5	3	7
KAF	5	5	7	5	3	2	2	3	5
GWG	5	5	3	3	4	3	4	1	1
MG	8	2	2	2	6	5	6	3	1
BAK	4	7	6	1	4	5	6	4	6
JRM	3	1	3	2	0	3	1	2	1
DLP	7	8	16	5	4	12	11	3	5
CRR	3	4	1	2	2	1	4	1	4
EAS	6	4	10	2	6	7	7	4	3
TLS	7	3	5	3	5	4	6	3	1
Mean	5.3	4.8	6.0	2.7	3.7	4.6	5.2	2.7	3.4
Max.	8	9	16	5	6	12	11	4	7
r	0.200	0.143	0.429	0.000	0.000	0.500	0.444	0.000	0.167

Extreme value rejected if $r > 0.477$. One-sided test of significance at $p < 0.05$.

Rejected values are shaded.

DIXON'S OUTLIER TEST: EXTREME MEANS

Test ID: C37401

Device: Insta-Mold Customized Ear Protectors

Subj.	1/3 Octave-Band Frequency								
	125	250	500	1000	2000	3150	4000	6300	8000
DVF	31.3	32.7	37.0	32.0	33.3	43.3	45.7	50.7	46.7
KAF	23.0	25.7	31.3	31.0	31.7	42.7	45.0	42.3	42.3
GWG	35.7	34.0	36.7	32.3	36.7	43.7	43.7	49.7	49.7
MG	36.0	34.3	35.0	31.0	36.0	47.0	47.7	47.3	52.3
BAK	42.0	39.0	39.3	35.7	43.0	49.0	49.0	48.0	42.3
JRM	35.7	34.7	34.7	33.0	32.0	41.7	41.7	42.7	42.7
DLP	34.7	34.0	35.3	34.3	39.7	46.7	49.0	52.7	54.3
CRR	31.0	30.7	31.7	30.7	36.0	41.7	42.0	39.7	42.7
EAS	41.3	44.3	42.3	38.0	39.3	47.3	45.7	46.0	50.3
TLS	30.0	30.0	30.7	29.7	36.3	43.0	41.3	45.3	45.3
Mean	34.1	33.9	35.4	32.8	36.4	44.6	45.1	46.4	46.9
Min.	23.0	25.7	30.7	29.7	31.7	41.7	41.3	39.7	42.3
Max.	42.0	44.3	42.3	38.0	43.0	49.0	49.0	52.7	54.3
Low r	0.382	0.325	0.077	0.167	0.042	0.000	0.043	0.242	0.000
High r	0.056	0.372	0.273	0.318	0.303	0.227	0.000	0.194	0.167

Extreme value rejected if $r > 0.551$. Two-sided test of significance at $p < 0.05$.

Rejected values are shaded.

Calculation of the Noise Reduction Rating (NRR)*

Test ID: C37401

Device: Insta-Mold Customized Ear Protectors

1/3 Octave Band Center Frequency (Hz)	125	250	500	1000	2000	4000	8000	
1. Assumed pink noise	100	100	100	100	100	100	100	
2. C-weighting values	-0.2	0.0	0.0	0.0	-0.2	-0.8	-3.0	
3. Unprotected C-weighted levels (step 1 + step 2)	99.8	100	100	100	99.8	99.2	97.0	107.95 dBC***
4. A-weighting values	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	
5. Unprotected A-weighted levels (step 1 + step 4)	83.9	91.4	96.8	100.0	101.2	101.0	98.9	
6. Mean attenuation at frequency**	34.1	33.9	35.4	32.8	36.4	44.8	46.7	
7. Standard deviation at frequency (x2)**	11.8	10.8	9.4	5.6	7.7	7.2	8.8	
8. Protected A-weighted sound levels (step 5 - step 6 + step 7)	61.6	68.3	70.8	72.9	72.5	63.3	61.1	77.85 dBA***
9. NRR = (step 3 log sum) - (step 8 log sum) - (3 dB correction factor) NRR = 27.1 ****								

* Computations per EPA (1979). Computations are done with 15 significant digits in the computer. If NRR is computed from rounded values in rows 6 and 7 of this table, errors of up to 0.1 dB may occur. All values in dB.

**4000-Hz values are mean of 3150 Hz and 4000 Hz data.
8000-Hz values are mean of 6300 Hz and 8000 Hz data.

*** Logarithmic sum. All logarithms to base 10.

**** Values shown to 0.1 dB. However, labeled NRRs are to be rounded to integer values, with values ending in 0.5 rounded to the next lower whole number.

Age, Gender, and Anatomical Data for Test Subjects

Test ID: C37401

Device: Insta-Mold Customized Ear Protectors

Subjects	Sex	Canal	Size	Age	Bitragus Breadth	Head Height	R. Ear Breadth	R. Ear Length	R. Pinna Protr.
		L	R						
DVF	F	S	S	43	136	126	32	62	19
KAF	F	M	M+	38	135	141	27	52	23
GWG	M	L	L	37	144	132	31	63	23
MG	F	M	M	30	136	118	31	61	23
BAK	M	XL	XL	42	150	143	39	68	20
JRM	M	XS	XS+	37	141	133	35	64	23
DLP	M	L	L+	27	145	149	34	68	26
CRR	M	M	M	20	132	146	29	60	26
EAS	M	M	M	22	148	146	39	71	22
TLS	F	M	M	31	132	130	31	65	23
	4-F	Mean		32.7	139.9	136.4	32.8	63.4	22.8
	6-M			8.0	6.6	10.1	4.0	5.3	2.2

Age in years. Dimensions in millimeters.

Subjects for this test were selected from the E-A-RCAL Laboratory panel of experienced listeners so as to obtain a 50/50 (+/-10%) gender balance. A subject's availability was a factor in the selection process.