SS-EN 352-1:2002

Prepared	Date	Distribution
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Title

Test report for 3M Peltor X4A in accordance with EN 352-1:2002

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Document history

Issue	Date	Comment	Author
-	2012-09-13	First edition	IKB/Pierre Hagström

1 Summary

3M Peltor X4A ear-muffs have been tested according to SS-EN 352-1:2002.

Test result: The ear-muffs passed the tests.

Comment: The initial submission made for the purpose of testing against the requirements of EN352-1:2002 contained products featuring incorrect colour. Representative samples of the final colour version were received from 3M and are shown in Fig. 2). The product design is identical to the initial submission.

Fig. 1) X4A (test sample)

Fig. 2) X4A (final colour version)

2 Identification

Order number: 14262-12003

Company/Customer: 3M Svenska AB

Manufacturer: 3M Svenska AB

Type, designation: 3M Peltor X4A

Type of hearing protector: Passive headband ear-muff

Date of submission: 2012-02-20

Date of test: 2012-03-30 - 2012-05-29

Tester(s): IKB/Pierre Hagström

3 Validity of Test Report

- The test results apply to the tested objects only

4 Tests and test results

4.1 Issue verification of standard

The test has been performed according to EN 352-1:2002.

4.2 Unpacking and conditioning

(EN 13819-1 para 4.1.3.2; 4.1.3.5)
≥ 4 h in 22±5 °C, and ≤85 % relative humidity.

Test result: Pass

4.3 Weight

(EN 13819-1 para 4.1.3.6)

Specimen No.	Weight in grams	Comment
No. 1	233	-
No. 2	234	-
No. 3	234	-
No. 4	234	-
No. 5	235	-
No. 6	234	-
No. 7	234	-
No. 8	234	-
No. 9	234	-
No. 10	234	-
Mean	**234**	-

Test result: Pass

4.4 Sizing and adjustability

(EN 352-1 para 4.1; 4.3.2) (EN 13819-1 para 4.1.3.7a; 4.2)
("Small size range", "Medium size range", "Large size range")

For each of the combinations of dimensions of width and height respectively, check whether the ranges of adjustment of the cups/ headband and of the width between the cushions enable the ear-muffs to be fitted so that:

a) the internal apex of the headband touches the headband support pad.

b) the contact between the cushions and the plates of the fixture is continuous insofar as it provides an unbroken barrier between the inside and outside perimeters of the cushions.

The "x" marks where the ear-muff fulfils the requirement. In order to approve a size, the table must be complete in every column where the specific size is mentioned.

Speci-men	H 115 W 125 S	H 115 W 145 S/M	H 130 W 125 S/M	H 130 W145 S/M/L	H 130 W 155 M/L	H 140 W 145 M/L	H 140 W 155 L
No. 1	x	x	x	x	x	x	x
No. 2	x	x	x	x	x	x	x
No. 3	x	x	x	x	x	x	x
No. 4	x	x	x	x	x	x	x
No. 5	x	x	x	x	x	x	x
No. 6	x	x	x	x	x	x	x

Test result: X4A complies with small, medium and large size range.

4.5 Cup rotation

(EN 352-1 para 4.3.3; EN 13819-1 para 4.1.3.7a; 4.3)

When tested in accordance with EN 13819-1:2002, 4.3, the contact between the cushions and the plates of the fixture shall be continuous insofar as it provides an unbroken barrier between the inside and outside perimeter of the cushions.

The “x” marks where the ear-muff fulfils the requirement.

Specimen	H 122 W 135 S	H 130 W 145 M	H 135 W 150 L	Comment
No. 1	x	x	x	-
No. 2	x	x	x	-
No. 3	x	x	x	-
No. 4	x	x	x	-
No. 5	x	x	x	-
No. 6	x	x	x	-

Test result: Pass. The safety requirement is satisfied.

4.6 Headband force

(EN 352-1 para 4.3.4; EN 13819-1 para 4.1.3.7a; 4.4)

When tested in accordance with EN 13819-1:2002, 4.4, the headband force of each specimen shall not be greater than 14 N.

Speci-men	Size S Force in N	Size M Force in N	Size L Force in N	Comment
No. 1	11,5	11,2	11,1	-
No. 2	11,7	11,8	11,6	-
No. 3	11,7	11,9	11,4	-
No. 4	11,8	11,8	11,6	-
No. 5	11,7	11,7	11,5	-
No. 6	11,8	11,8	11,3	-
Mean	**11,7**	**11,7**	**11,4**	-

Test result: Pass. The safety requirement is satisfied.

4.7 Cushion Pressure

(EN 352-1 para 4.3.5; EN 13819-1 para 4.1.3.7a; 4.5)

When tested in accordance with EN 13819-1:2002, 4.5, the cushion pressure of each specimen shall be not greater than 4500 Pa.

Speci-men	Size S Pressure in Pa	Size M Pressure in Pa	Size L Pressure in Pa	Comment
No. 1	2334	2278	2365	-
No. 2	2214	2362	2300	-
No. 3	2391	2403	2306	-
No. 4	2411	2436	2313	-
No. 5	2283	2299	2410	-
No. 6	2462	2343	2278	-
Mean	**2349**	**2354**	**2329**	-

Test result: Pass. The safety requirement is satisfied.

4.8 Resistance to damage when dropped at low temperature (optional)

(EN 352-1 para 4.3.7; EN 13819-1 para 4.1.3.7b; 4.7)

The ear-muffs are conditioned at -20 °C and dropped from a specified height on to a steel plate. The ear-muffs (except for replaceable cushions) shall not crack when tested in accordance with EN 13819-1:2002, 4.7. Neither shall any part of the ear-muffs become detached, such that correct re-assembly requires the use of either a tool or a replacement part.

Test result: Pass. None of the six ear-muffs cracked. No parts of the six ear-muffs were detached.

4.9 Headband flexing

(EN 351-1 para 4.3.8; EN 13819-1 para 4.1.3.7d; 4.8)

The ear-muffs are set at a given adjustment and the headbands are flexed between the minimum (free state or 25 mm) and maximum (200 ± 5 mm) separations for 1000 cycles.

Test result: Pass. No signs of changes or damage.

4.10 Water immersion

(EN 352-1 para 4.3.8; EN 13819-1 para 4.1.3.7d; 4.8; 4.1.3.7e-i; 4.10-11; 4.4)
For plastic headband only.

The ear muffs shall be conditioned in water with a maintained constant temperature of (50 ± 2) °C for (24 ± 1) h.

Test result: N/A

4.11 Change in headband force

(EN 352-1 para 4.3.8; EN 13819-1 para 4.1.3.7b; 4.6)

The headband force of each specimen shall not change by more than ± 15 % from that reported at EN 352-1, 4.3.4 after the ear-muffs have been subjected to the appropriate conditioning and tests specified in EN 13819-1:2002, 4.1.3.7 a) to 4.1.3.7 i).

Specimen No.	Force in N M-size	Change in %	Comment
No. 1	10,8	-3,5 %	-
No. 2	11,6	-1,7 %	-
No. 3	11,8	-0,8 %	-
No. 4	11,2	-5,0 %	-
No. 5	11,6	-0,8 %	-
No. 6	11,4	-3,3 %	-

Test result: Pass. The safety requirement is satisfied.

4.12 Insertion loss

(EN 352-1 para 4.3.9; EN 13819-2 para 4.1.3.8; EN-24869-3 para 4.1)

The standard deviations reported in accordance with EN 13819-2:2002, 4.1 shall be not greater than 4,0 dB in four or more adjacent one-third octave bands, and not greater than 7,0 dB in any individual one-third octave band.

Test result: Pass. The complete test results from the insertion loss measurement for all 20 cups are shown in Appendix 1.

4.13 Resistance to leakage (fluid filled cushions only)

(EN 352-1 para 4.3.10; EN 13819-2 para 4.1.3.9a; 4.12)
Specimen No. 5 and No.6

In the case of fluid filled cushions, they shall not leak when the ear-muffs are tested in accordance with EN 13819- 1:2002, 4.12.

Test result: N/A

4.14 Materials, and construction

(En 13819-1 para 4.1.3.9b; EN 352-1 para 4.2.1 and 4.2.2)
Specimen No. 5 and No.6

Materials (4.2.1)

a) Those parts of the ear-muffs that may come into contact with the skin shall be non-staining, soft, pliable and not known to be likely to cause skin irritation, allergic reaction or any other adverse effect on health
.
b) All materials shall be visibly unimpaired after cleaning and disinfection by the methods specified by the manufacturer.

Test result: Pass. Statements from the manufacturer of the ear-muffs have been reviewed. The material satisfies the requirements.

All materials are visibly unimpaired after cleaning and disinfection by the methods specified by the manufacturer.

Construction (4.2.2)

a) All parts of the ear-muffs shall be rounded, finished smooth and be free from sharp edges.

b) Ear-muffs whose cushions and/or liners are intended by the manufacturer to be replaced by the wearer shall not require the use of tools for this purpose.

c) All universal ear-muffs that have a mass in excess of 150 g shall be provided with a headstrap.

d) Ear-muffs that are suitable for wearing only in the behind-the-head or under-the-chin modes, and that have a mass in excess of 150 g, shall be provided with a headstrap.

Test result: Pass. The ear-muffs are not liable to cause physical damage to the user when fitted and used according to the manufacturer's instructions. No tools are required when replacing cushions and liners.

4.15 Ignitability

(EN 352-1 para 4.3.11; EN 13819 4.1.3.9c; 4.13)

When tested in accordance with EN 13819-1:2002, 4.13, no part of the ear-muffs shall ignite upon application of the heated rod nor continue to glow after removal of the heated rod.

Test result: Pass. None of the two tested ear-muffs ignite upon application of the heated rod. The ear-muffs do not glow after removal of the heated rod.

4.16 Sound attenuation

(EN 352-1 para 4.3.12; EN 13819-1 para 4.1.3.10; EN 13819-2 para 4.2).

Specimen No. 1 to No.4

The assumed protection values, APV (=M_f-s_f), of the ear-muffs shall be not less than the values given in Table 1 of EN 352-1, also presented below.
M_f are the mean attenuation data and s_f the standard deviations as measured in accordance with EN 13819-2:2002.

Frequency in Hz	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
(M_f – s_f) in dB	5	8	10	12	12	12	12

Frequency in Hz	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Mean att	19,6	17,8	22,1	30,6	39,5	37,3	43,8	42,1
Stand dev	4,1	2,3	2,5	1,8	2,9	4,1	2,8	4,0
APV	15,5	15,5	19,6	28,8	36,6	33,2	41,1	38,2

HML and SNR values

H	**M**	**L**	**SNR**
36	30	22	33

The complete test results from the Sound Attenuation measurement are shown in Appendix 2.

Test result: Pass. The safety requirements are satisfied.

4.17 Marking

(En 352-1 para 5)

EN 352-1 requirement, paragraph 5	**Comment**
The ear-muffs shall be durably marked with the following information:	
a) the name, trade mark or other identification of the manufacturer or his authorised representative	Pass
b) the model designation	Pass
c) the number of this EN Standard, i.e. the generic mark "EN 352" NOTE A product can also meet other parts of the EN 352 series simultaneously	Pass
d) In the case of ear-muffs intended by the manufacturer to be worn in a particular orientation, an indication of the FRONT and/or TOP of the cups, and/or an indication of LEFT and RIGHT cup.	N/A

4.18 Information supplied by the manufacturer

(En 352-1 para 6)

EN 352-1 requirement, paragraph 6	**Comment**
6.1 General Information in accordance with 6.2 and 6.3 shall be provided at least in the official language(s) of the European state of destination.	Pass
6.2 Wearer information The following information for the wearer shall be supplied with the ear-muffs (as appropriate):	
a) the number of this European standard, i.e. EN 352-1:2002;	Pass
b) the name, trade mark or other means of identification of the manufacturer or his authorised representative;	Pass
c) the model designation;	Pass
d) as appropriate the statement(s): "This model of ear-muffs has satisfied the optional requirements at +50 °C." "This model of ear-muffs has satisfied the optional requirements at –20 °C." NOTE These statements may be combined.	Pass
e) materials of the headband (see 3.5) and of the cushions (see 3.2);	Pass

EN 352-1 requirement, paragraph 6	Comment
f) method of fitting/adjustment, including instructions regarding the setting of any means to adjust the headband force;	Pass
g) the size range(s) of the ear-muffs for each mode of wearing, as determined in 4.1, on both the packaging/box and in wearer information: for 'small size range' and 'large size range' (but not for 'medium size range') ear-muffs, the statements: On packaging/box **"Warning**: Small size range or large size range (as appropriate) ear-muffs. Refer to wearer information." In wearer information **"Warning**: These ear-muffs are of 'small size range' or 'large size range' (as appropriate). Ear-muffs complying with EN 352-1 are of 'medium size range' or 'small size range' or 'large size range'. 'Medium size range' ear-muffs will fit the majority of wearers. 'Small size range' or 'large size range' ear-muffs are designed to fit wearers for whom 'medium size range' ear-muffs are not suitable."	N/A
h) for each mode of wearing (as defined in 3.4), the following sound attenuation values: 1) mean value and standard deviation at each test frequency; 2) APV-value at each test frequency in accordance with EN ISO 4869-2 with the parameter α = 1; 3) H-, M- and L- value in accordance with EN ISO 4869-2 with the parameter α = 1; 4) SNR-value in accordance with EN ISO 4869-2 with the parameter α = 1; Each set of values shall be given equal prominence.	Pass
i) recommendation that the wearer should ensure that: 1) the ear-muffs are fitted, adjusted and maintained in accordance with the manufacturer's instructions; 2) the ear-muffs are worn at all times in noisy surroundings; 3) the ear-muffs are regularly inspected for serviceability;	Pass
j) a warning that, if the recommendations given in 6.2 i) are not adhered to, the protection afforded by the ear-muffs will be severely impaired;	Pass
k) methods of cleaning and disinfection which shall specify, and require the use of, agents that are not known to be harmful to the wearer;	Pass
l) the statement "This product may be adversely affected by certain chemical substances. Further information should be sought from the manufacturer";	Pass
m) the statement " Ear-muffs, and in particular cushions, may deteriorate with use and should be examined at frequent intervals for cracking and leakage, for example";	Pass

EN 352-1 requirement, paragraph 6	Comment
n) the statement ”The fitting of hygiene covers to the cushions may affect the acoustic performance of the ear-muffs”;	Pass
o) recommended storage conditions before and after use;	Pass
p) the designation/reference and other information required when ordering replacement cushions;	Pass
q) if appropriate, the method of cushion replacement;	Pass
r) the mean mass of the ear-muffs to the nearest gram;	Pass
s) the address from which additional information can be obtained.	Pass
6.3 Additional information The following information shall be available from the manufacturer on request:	
a) range of head sizes fitted;	Pass
b) information as specified in 6.2;	Pass
c) results of tests performed in accordance with this standard;	Pass
d) the name and country of the test laboratory which performed the tests specified in 6.3 c) and the date of the tests.	Pass

5 Measurement uncertainty

(EN 352-1 Annex A)

Information given in the document AcuLab/2006:0009C

Combitech AB

……..…..

Pär Säterlid
Laboratory manager

Date .....

……

Pierre Hagström
Testing officer

Date .....

6 Appendix 1: Insertion loss

The test results from the Insertion loss measurement for all 20 cups can be viewed in Table 1.

Table 1 Insertion loss

Freq (Hz)	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000
1	21,2	24,8	28,3	31,7	38,4	44,2	55,3	47,9	39,9	42,3	45,7	44,4	46,3	49,9	47,8	47,8
2	20,7	24,5	28,2	31,7	38,6	44,4	55,0	47,6	39,6	42,9	46,0	44,6	46,3	47,9	48,8	51,0
3	19,8	23,9	27,7	31,5	38,2	43,6	54,6	45,9	38,9	43,4	46,4	44,9	45,3	44,7	43,5	46,3
4	21,3	25,4	28,8	32,8	39,6	45,5	56,3	47,9	40,1	42,0	45,6	44,4	46,6	50,9	48,6	49,1
5	21,3	24,9	28,5	32,4	39,2	45,1	55,6	47,9	40,1	42,0	45,6	44,2	46,7	50,0	47,0	48,3
6	20,4	24,0	28,1	32,2	38,4	44,1	55,3	45,8	39,0	43,9	46,1	45,4	47,7	47,8	47,0	50,4
7	20,6	24,9	28,5	32,8	39,6	45,6	55,9	45,9	38,7	43,5	46,1	44,7	47,0	48,6	47,6	47,2
8	20,8	24,5	28,4	32,3	38,5	43,8	54,8	46,4	39,1	43,6	46,3	45,5	46,6	48,7	47,9	48,3
9	20,9	25,3	29,2	32,6	39,7	45,6	57,0	47,8	39,6	42,2	45,9	44,9	47,1	50,1	46,1	47,1
10	19,2	23,6	27,3	31,7	38,4	43,7	52,9	43,3	38,2	45,2	45,5	44,5	38,7	43,9	47,3	46,9
11	20,1	24,2	27,9	31,8	38,6	44,1	54,4	44,8	38,4	44,4	45,7	44,7	46,7	48,8	48,0	49,7
12	20,8	24,9	28,5	32,4	39,2	44,8	56,2	48,6	40,5	43,1	46,4	45,4	46,0	47,7	47,7	48,7
13	20,8	24,2	28,0	32,0	38,3	43,9	55,0	46,7	39,2	42,8	45,7	44,4	46,6	48,9	47,8	49,5
14	20,7	25,3	29,0	33,1	39,7	45,6	57,7	46,9	39,4	42,8	45,5	44,7	47,4	48,7	46,8	48,7
15	19,9	23,4	27,6	31,6	37,6	42,5	50,6	42,9	37,3	44,5	46,5	45,3	45,4	48,2	47,3	51,0
16	20,4	23,8	27,5	31,4	38,1	43,7	54,5	45,1	38,4	44,0	46,3	45,0	46,3	47,5	47,9	51,4
17	20,0	24,2	28,1	32,1	38,6	44,3	53,4	42,8	38,3	45,3	45,8	44,7	41,1	48,2	49,2	49,5
18	19,7	23,7	27,8	31,8	38,5	44,0	52,8	43,5	38,2	45,3	45,7	44,9	44,7	48,4	48,3	48,2
19	20,4	24,0	28,0	31,8	37,9	43,3	54,7	46,5	39,6	44,3	45,8	44,6	44,7	46,7	48,0	48,4
20	19,8	23,5	27,1	31,2	37,4	42,8	53,0	44,2	38,4	44,5	45,3	44,2	44,0	46,7	47,4	46,9
Mean	**20,4**	**24,3**	**28,1**	**32,0**	**38,6**	**44,2**	**54,7**	**45,9**	**39,0**	**43,6**	**45,9**	**44,8**	**45,6**	**48,1**	**47,5**	**48,7**
Std. Dev.	**0,6**	**0,6**	**0,6**	**0,5**	**0,7**	**0,9**	**1,6**	**1,8**	**0,8**	**1,1**	**0,3**	**0,4**	**2,2**	**1,7**	**1,2**	**1,5**

7 Appendix 2: Sound attenuation

The measured sound attenuation per person, mean and standard deviation can be viewed in Table 2.

Table 2 Sound Attenuation

Freq(Hz)	63	125	250	500	1000	2000	4000	8000
Subject 16	16,8	18,45	21,7	28,58	34,98	30,43	44,22	39,68
Subject 15	14,55	16,2	20,85	31,67	37,65	37,2	43,65	46,3
Subject 14	15,87	16,34	17,92	29,33	39,62	36,97	44,67	40,7
Subject 13	17,43	17,2	22,37	30	42,27	40,85	47,1	47,87
Subject 12	20,5	18,48	20,28	28,55	40,15	37,17	44,75	39,6
Subject 11	18,93	16,8	20,72	29,55	40,49	33,82	41,48	39,77
Subject 10	16,24	20,14	26,15	32,73	41,35	36	39,8	47,53
Subject 9	17,59	15,15	22,53	32,45	42,88	40,05	42,63	34,58
Subject 8	19,5	18,65	24,48	27,39	39,48	34	43,8	42,97
Subject 7	19,9	13,65	21,55	30,84	40,75	38,59	41,8	44,6
Subject 6	21,62	17,13	20,83	28,98	37,75	45,92	46,98	39,17
Subject 5	17,65	16,42	18,28	30,77	32,02	30,73	39	39
Subject 4	17,3	17,35	21,72	31,83	40,32	35,14	40,98	37,82
Subject 3	22,91	19,5	22,7	33	44,02	37,68	45,32	42,3
Subject 2	29,82	23,37	27,45	33,09	39,8	42,27	46,55	47,15
Subject 1	26,61	19,84	24,02	30,3	39,22	40,02	48,67	45,2
Mean Att.	**19,6**	**17,8**	**22,1**	**30,6**	**39,5**	**37,3**	**43,8**	**42,1**
Std. Dev.	**4,1**	**2,3**	**2,5**	**1,8**	**2,9**	**4,1**	**2,8**	**4,0**