

CNBOP-PIB STANDARDS

FIRE PROTECTION

Laboratory Tests of Voice Alarm Loudspeakers According EN 54-24:2008

CNBOP-PIB-BA-01E:2014

Revision 1, 2014



CENTRUM NAUKOWO-BADAWCZE
OCHRONY PRZECIWPOŻAROWEJ
im. Józefa Tuliszkowskiego
PAŃSTWOWY INSTYTUT BADAWCZY



**Centrum Naukowo – Badawcze Ochrony Przeciwpożarowej
im. Józefa Tuliszkowskiego
Państwowy Instytut Badawczy**

CNBOP-PIB-BA-01E:2014

Revision 1, February 2014

**CNBOP-PIB Standard
Fire Protection**

**Laboratory Tests of Voice Alarm Loudspeakers
According EN 54-24:2008**

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Revision I

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1. Information about BA laboratory

The Department-Laboratory of Fire Alarm Systems and Fire Automation (BA) operates in accordance with requirements specified in the Quality Book. The organizational structure, division of responsibility, system and research procedures, processes and resources are consistent with the implemented quality system in accordance with requirements of EN 17025. The Department-Laboratory has been accredited since 07.10.1998, Accreditation Certificate of Research Laboratory No. AB 207 (see Annex 2). The scope of the Department-Laboratory activities includes variety of issues connected with fire detection systems, activating fire alarm devices and fire alarm systems and alarm signal transmission.

The Department-Laboratory tests all types of loudspeakers to voice alarm systems:

- ceiling loudspeakers,
- horn loudspeakers,
- projector loudspeakers,
- cabinet loudspeakers,
- column loudspeakers etc.

The procedure of the laboratory tests (please remember that below procedure includes only laboratory tests, not the whole certification process):

1. Send us an order letter (see the annex 1).
2. We prepare an agreement and send it to you to sign (one version by e-mail and two by post).
3. Sign the agreements and send one copy back to our company.
4. Pay the advance money (it is 40% of the total contract value).
5. Deliver us the samples with complete documentation, documentation should be signed and dated.
6. When we receive the advance money, samples and documentation we will start test the loudspeakers. It takes about 2 months to test type A loudspeakers, and about 3 months to test type B loudspeakers.
7. We will inform the customer immediately and stop doing tests, if the loudspeaker fails any of the tests.
8. If anything goes wrong, the client decide what he want to do (stop testing, continue testing or make modifications).
9. If a loudspeaker pass the tests, we prepare testing report in three Polish versions and two English versions.
10. We inform the client that tests are over, and we send him an invoice.
11. The client pay the rest of money.
12. We send the test report by post.
13. The contract is completed.

2. General information

The EN 54-24 standard specifies requirements and test methods for loudspeakers which are dedicated to use in voice alarm systems. The EN 54-24 do not contain requirements for loudspeakers for special application (e.g. explosion danger areas), addressable loudspeakers and loudspeakers with active components.

3. Measurement equipment

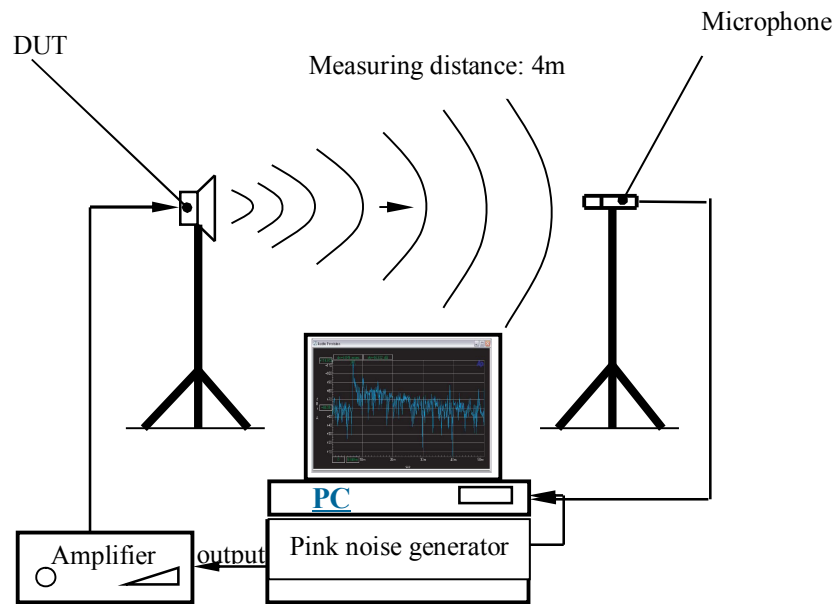


Fig. 1. Measuring equipment

The audio measurements of voice alarm loudspeakers are made in an anechoic chamber (free-field conditions) by the use of equipment shown in Fig. 1. Flush mounted loudspeakers (ceiling and wall speakers) should be mounted in the standard baffle during audio tests in the anechoic chamber. The sample shall be mounted according to the instructions of manufacturer during the test. The SPL is measured in the 1/3 octave bands from 100 Hz to 10 kHz, when the loudspeaker is supplied with pink noise and noise power equals 1W.

4. Frequency response limits

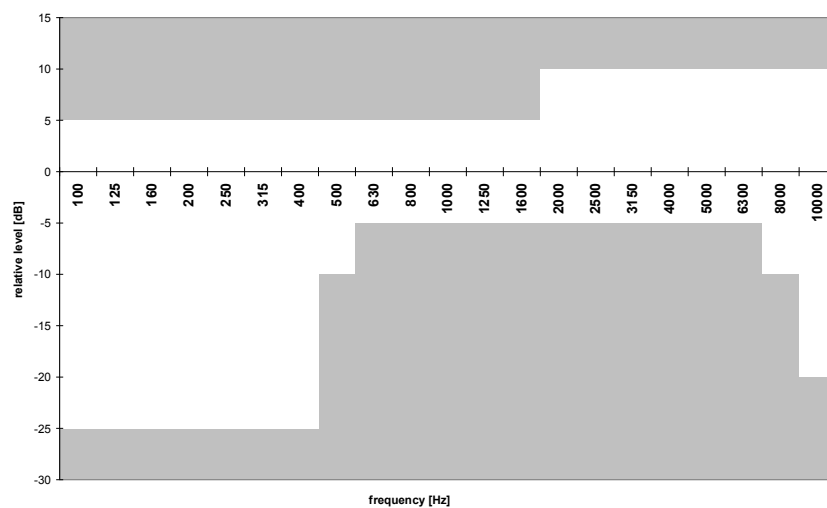


Fig. 2. Frequency response limits

The curve of sound pressure levels vs. frequency shall be in white area shown in Fig. 2. The 0 dB reference axis shall be adjusted to give the best fit with the frequency response curve. There is possibility that the specific types of loudspeakers (e.g. horn speakers) shall be

tested together with the dedicated equalizer. In that case manufacturer shall specify what type of equalizer shall be used and what type of settings it should have.

5. Construction requirements

There should be possible to connect external conductors to the loudspeaker and terminals shall be designed the way that an external conductor is clamped between metal surfaces without being damaged (cross-sectional area: 0,8 – 2,5 mm²). The material of connection box is not specified, it can be ceramic or plastic. Our laboratory suggest to use ceramic connection boxes but it is not obligatory. It mustn't be possible to remove any part or the whole loudspeaker or make any adjustments (e.g. change of power settings) without the use of special tools, codes, seals etc.

Enclosure material

The loudspeakers made of plastic shall conform to the below flammability requirements:

- a) voltage: $\leq 30V$ RMS, power: $>15W$ – class V-2 according EN 60695-11-10:1999 amended by EN 60695-11-10:1999/A1:2003
- b) voltage: $>30V$ RMS, power: $>15W$ – class 5VB according EN 60695-11-20:1999 amended by EN 60695-11-20:1999/A1:2003.

Enclosure protection degree:

Type A (indoor application): IP21C

Type B (outdoor application): IP33C

Explanation:

IP2x - protection against solid objects over 12,5 mm, during this test force of 30N is used;

IP3x - protection against solid objects over 2.5 mm (tools and wires), during this test force of 3N is used;

IPx1 - protection against vertically falling drops of water;

IPx3 - protection against direct sprays of water up to 60° from the vertical,

IPxxC - protection against touch of dangerous parts, solid objects with diameter of 2.5 mm can penetrate the enclosure but can't touch dangerous parts.

6. Marking of the loudspeakers

The loudspeakers should have marking labels with the following information:

- EN 54-24,
- type A or type B,
- name or trademark of the manufacturer or supplier,
- model designation,
- terminal designation,
- rated noise voltage,
- rated impedance for loudspeakers without transformers,
- rated noise power,
- power settings,
- marks by which it is possible to identify the place and date of manufacture.

7. Data sheet

The manufacturer of the product shall supply the following documentation:

- mechanical drawings of the device,
- description of the acoustical measurement environment used during tests,

- frequency response curve and sensitivity results,
- filled parameter card (see Table 1);
- reference axis, reference plane and horizontal plane;
- specification of dedicated equalizer (if applicable);
- installation manual.

Table 1. The parameter card of the voice alarm system loudspeakers for laboratory tests according EN 54-24:2008

1.	Name of a loudspeaker	
2.	Manufacturer (name and address)	
3.	Customer (name and address)	
4.	Type of loudspeaker (ceiling, horn, wall, projector)	
5.	The loudspeaker has got „fire dome” enclosure (Yes/No/Not applicable)	
6.	Mounting method to the wall or to the ceiling, description of the mounting method	
7.	Material of the bracket	
8.	Type of the dedicated equalizer (if applicable)	
9.	Rated noise power, [W]	
10.	Rated noise power for 100V line, transformer tapping options [W]	
11.	Rated noise power for another lines, transformer tapping options [W]	
12.	Rated impedance for each transformer tapping options [Ω],	
13.	Coil impedance, [Ω]	
14.	Sensitivity, [dB]	
15.	S.P.L. (rated noise power / 4m), [dB]	
16.	Coverage angle 500 Hz, [$^{\circ}$] [$^{\circ}$]	
17.	Coverage angle 1kHz,, [$^{\circ}$]	
18.	Coverage angle 2kHz, [$^{\circ}$]	
19.	Coverage angle 4kHz, [$^{\circ}$]	
20.	Range of the supply voltage [V]	
21.	Type of a terminal block (material, quantity of terminals)	
22.	Type of fuse (overload, thermal), range of work temperatures [$^{\circ}$ C]	
23.	Type of entry holes for conductors or cables	
24.	Quantity of entry holes for cables	
25.	Min. and max. cross-sectional of the connected conductors [mm ²]	
26.	Work temperatures [$^{\circ}$ C]	
27.	Enclosure protection degree (IP)	
28.	Environmental type (A or B)	
29.	Dimensions (length x width x depth) of the loudspeaker with its enclosure [mm]	
30.	Diameter of the diaphragm [mm]	
31.	Weight [kg]	
32.	Colour– if there are several options, please write all	
33.	Enclosure material (e.g.: ABS, steel- type and sign)	
34.	Mark(s) and code(s) (for example, a serial number or batch code), by which the manufacturer can identify at least, the date or batch. Where any marking on the device uses symbols or abbreviations not in common use then these shall be explained.	

For testing compliance with EN 54-24 the manufacturer shall provide:

- Type A: 7 specimens,
- Type B: 9 specimens.

The samples shall be provided with all necessary accessories. It is possible to deliver less specimens but the manufacturer shall be aware that this will increase the test time and exposes the specimen to a more severe test regime. This solution is usually used for expensive types of loudspeakers.

8. Test program

Table 2. Specifications and test methods

No.	Product characteristic tested	Test method according to PN-EN 54-24	Test method according to ISO 7240-24	Test apparatus and procedure according:
1.	Requirements	p.4	p.4	NA
2.	Reproducibility (frequency response/sensitivity)	p. 5.2	p. 5.2	NA
3.	Rated impedance	p. 5.3	p. 5.3	NA
4.	Horizontal and vertical coverage angles	p. 5.4	p. 5.4	NA
5.	Maximum sound pressure level	p. 5.5	p. 5.5	NA
6.	Rated noise power – durability	p. 5.6	p. 5.6	NA
7.	Dry heat (operational)	p. 5.7	p. 5.7	EN 60068-2-2
8.	Dry heat (endurance)	p. 5.8	p. 5.8	EN 60068-2-2
9.	Cold (operational)	p. 5.9	p. 5.9	EN 60068-2-1
10.	Damp heat, cyclic (operational)	p. 5.10	p. 5.10	EN 60068-2-30
11.	Damp heat, steady state (endurance)	p. 5.11	p. 5.11	EN 60068-2-78
12.	Damp heat, cyclic (endurance)	p. 5.12	p. 5.12	EN 60068-2-30
13.	SO ₂ –corrosion (endurance)	p. 5.13	p. 5.13	EN 60068-2-42
14.	Shock (operational)	p. 5.14	p. 5.14	EN 60068-2-27
15.	Impact (operational)	p. 5.15	p. 5.15	EN 60068-2-75
16.	Vibration sinusoidal (operational)	p. 5.16	p. 5.16	EN 60068-2-6
17.	Vibration sinusoidal (endurance)	p. 5.17	p. 5.17	EN 60068-2-6
18.	Enclosure protection	p. 5.18	p. 5.18	EN 60529

9. Tests

- reproducibility – to show that the acoustical performance of the loudspeaker does not vary unduly from specimen to specimen,
- rated impedance – the lowest impedance modulus is not lower than 0,8 of the rated impedance specified by the manufacturer for each tap setting (loudspeakers with transformers),

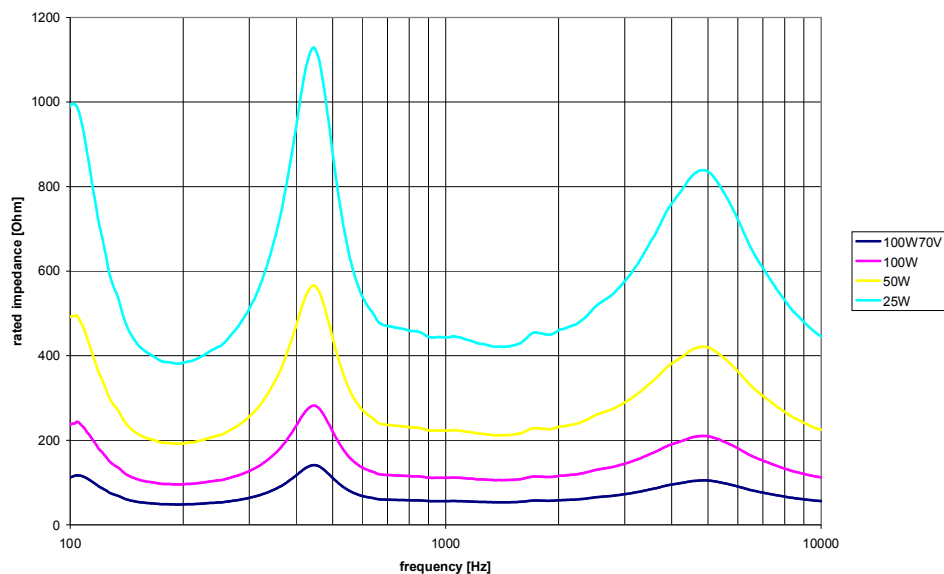


Fig. 3. Impedance graph

- horizontal and vertical coverage angles – measured coverage angles for the octave band filters centred on 500Hz, 1kHz, 2kHz and 4kHz are equal to the values specified by the manufacturer within $\pm 5^\circ$,

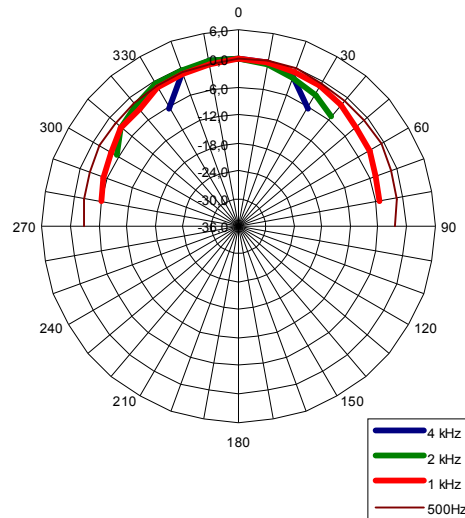


Fig. 4. Coverage angles graph

- maximum SPL – the results are equal or greater than value specified by the manufacturer,
- rated noise power – 100h of simulated signal at rated noise voltage,
- dry heat (operational) – to demonstrate the ability to function correctly at high temperatures,

Table 3. Dry heat (operational)

Type	Temperature [°C]	Duration [h]
A	55 ± 2	16
B	70 ± 2	16

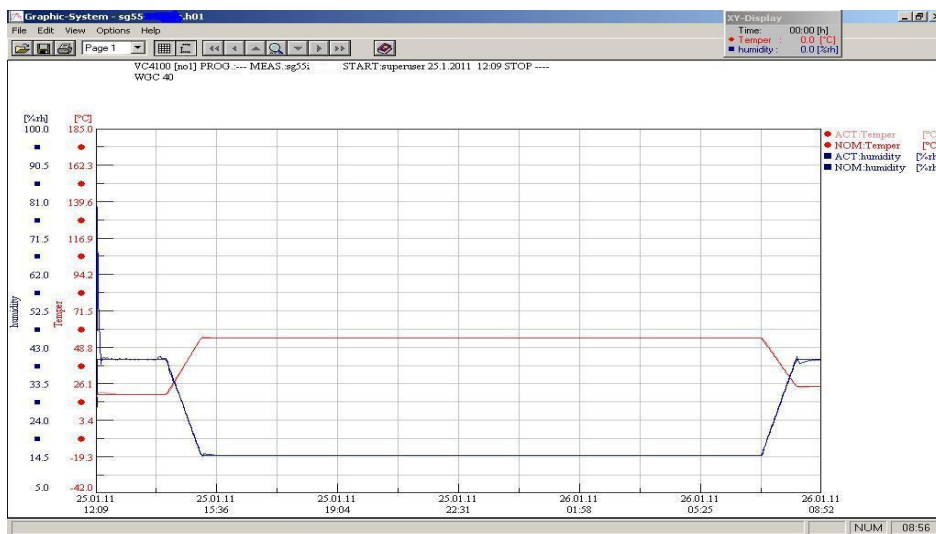


Fig. 5. Test results of resistance for dry heat

- dry heat (endurance) - to demonstrate the ability to withstand long term ageing effects,

Table 4. Dry heat (endurance)

Type	Temperature [°C]	Duration [h]
A	Not applicable	
B	70 ± 2	16

- cold (operational) - to demonstrate the ability to function correctly at low temperatures,

Table 5. Cold (operational)

Type	Temperature [°C]	Duration [h]
A	-10 ± 2	16h
B	-25 ± 2	16h

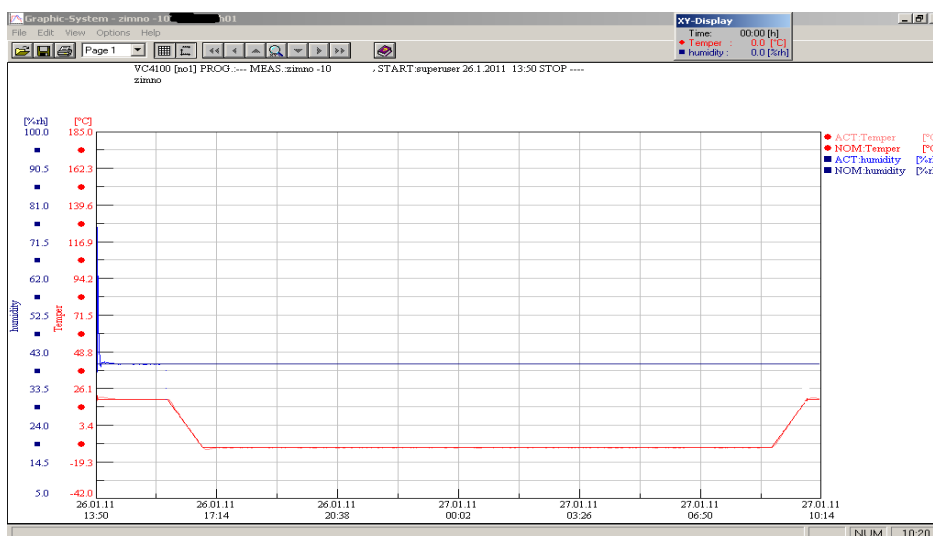


Fig. 6. Test results of resistance for cold

- damp heat, cyclic (operational) – to demonstrate the immunity to an environment with high relative humidity, where condensation can occur on the device,

Table 6. Damp heat, cyclic (operational)

Type	Lower value of temperature [°C]	Relative humidity [%]	Upper value of temperature [°C]	Relative humidity [%]	Number of cycles
A	+ 25 ± 2	≥95	+40 ± 2	93 ± 3	2
B	+ 25 ± 2	≥ 95	+55 ± 2	93 ± 3	2

- damp heat, cyclic (endurance) - to demonstrate the ability to withstand long term effects of high humidity and condensation,

Table 7. Damp heat, cyclic (endurance)

Type	Lower value of temperature [°C]	Relative humidity [%]	Upper value of temperature [°C]	Relative humidity [%]	Number of cycles
A	Not applicable				
B	+ 25 ± 2	≥ 95	+55 ± 2	93 ± 3	6

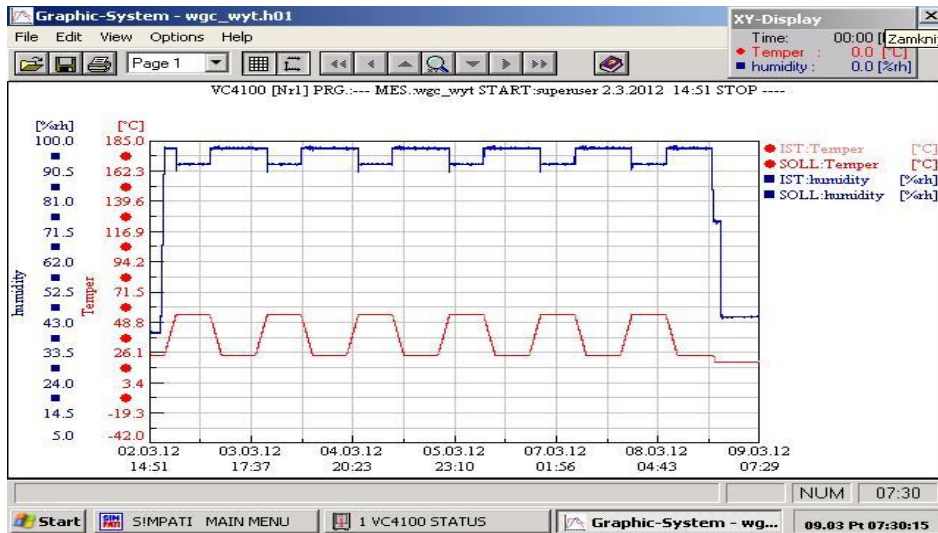


Fig. 7. Endurance test of damp heat, cyclic

- damp heat, steady state (endurance) - to demonstrate the ability to withstand long terms of humidity,

Table 8. Damp heat, steady state (endurance)

Type	Temperature [°C]	Relative humidity [%]	Duration [days]
A	+ 40 ± 2	93 ± 3	21
B	+ 40 ± 2	93 ± 3	21

- corrosion (endurance) - to demonstrate the ability to withstand the corrosive effect of sulphur dioxide as an atmospheric pollutant,

Table 9. Corrosion (endurance)

Type	Temperature [°C]	Relative humidity [%]	SO ₂ concentration	Duration [days]
A	+ 25 ± 2	93 ± 3	25 ± 5 ppm	21
B	+ 25 ± 2	93 ± 3	25± 5 ppm	21

- shock (operational) - to demonstrate the immunity to mechanical shocks, this test is only applicable for samples of weight equal or lower than 4,75kg,
- impact (operational) - to demonstrate the immunity to mechanical impacts upon its surface,
- vibration, sinusoidal (operational) - to demonstrate the immunity to vibration at levels considered appropriate to the normal service environment,

Table 10. Vibration, sinusoidal (operational)

Type	Frequency range	Acceleration amplitude	Number of axis	Sweep cycles
A	10-150 Hz	0,5 g	3	1
B	10-150 Hz	0,5 g	3	1

- vibration, sinusoidal (endurance) - to demonstrate the ability to withstand the long term effects of vibration,

Table 11. Vibration, sinusoidal (endurance)

Type	Frequency range	Acceleration amplitude	Number of axis	Sweep cycles
A	10-150 Hz	0,5 g	3	20
B	10-150 Hz	0,5 g	3	20

- enclosure protection – to demonstrate that the degree of protection of the enclosure with regard to the ingress of solid foreign objects and the harmful effects due to the ingress of water.

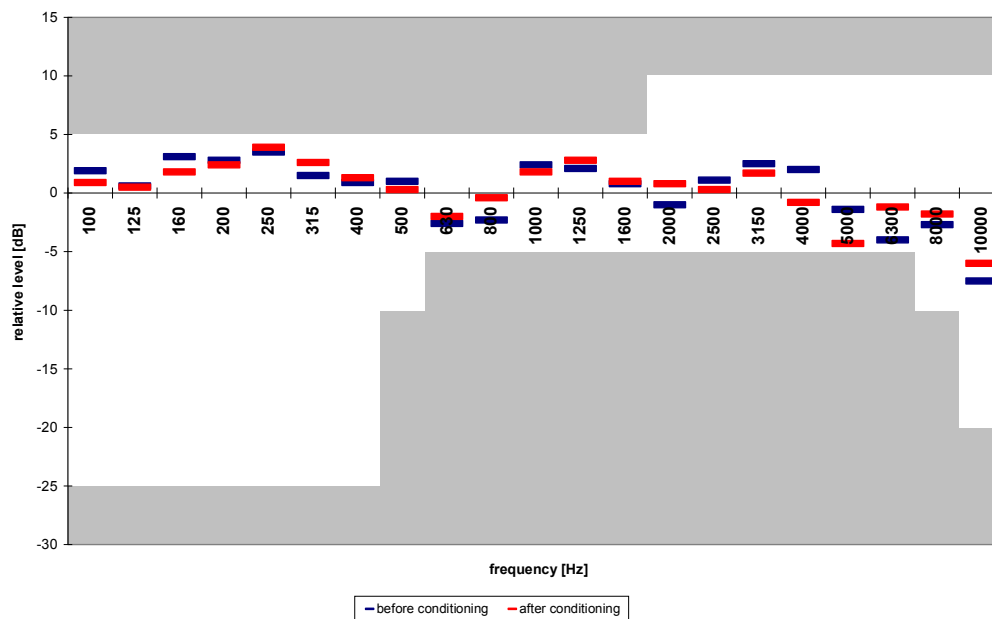


Fig. 8. Frequency response curve

The sample after most of the tests should be checked if the frequency response curve does not deviate by more than 3dB from the results measured during the reproducibility test (see Fig. 6). The products tested according EN 54-24:2008 are assumed to enter the alarm conditions before the fire becomes so large to affect their functioning, this is why there are not any requirements to function when exposed to direct attack of fire.

10.Contact

If you have any questions regarding laboratory tests please feel free to contact us:

M. Eng. Tomasz Sowa
 phone: +48 22 769 32 09
 e-mail: tsowa@cnbop.pl

M. Eng. Tomasz Popielarczyk
 phone: +48 22 769 32 09
 e-mail: tpopielarczyk@cnbop.pl

The order letter¹

.....
*(place and date)*²

To
Department Laboratory of Fire Alarm Systems
and Fire Automation
CNBOP
ul. Nadwislanska 213
05-420 Jozefow/k.Otwocka
Poland
fax: 0-22 769 33 56
pstepien@cnbop.pl
tsowa@cnbop.pl

Our company would like to make qualification tests of *(name of device)* type *(type of device)* according to:

- European standard EN 54-24:2008,
- The Regulation of the Minister of the Interior and Administration of April 27, 2007 on the list of products used for ensuring public safety or protecting health, life and property, and the principles of issuing admittance to use these products (Polish O.J. dated 2007, No. 143 position 1002) introduced by the amending regulation of July 20, 2010 (Polish O.J. dated 2010, No. 85 position 553); points:*,
- Attached test program *(please write on the attached document: "I accept above test program" and sign it)*.*

Please prepare all necessary documents and send to the address given below:

Name of the company:

Address of the company:

Mailing address (if another than company address):

VAT number:

Contact person:

With kind regards

*** cross out if not applicable**

¹ The order letter can be sent by e-mail, mail or fax.

² After filling the form all annotations in italics should be removed

The accreditation certificate of testing laboratory

POLSKIE CENTRUM AKREDYTACJI
POLISH CENTRE FOR ACCREDITATION



Sygnatariusz EA MLA
EA MLA Signatory

CERTYFIKAT AKREDYTACJI
LABORATORIUM BADAWCZEGO
ACCREDITATION CERTIFICATE OF TESTING LABORATORY
Nr AB 207

Potwierdza się, że: / This is to confirm that:

**CENTRUM NAUKOWO-BADAWCZE OCHRONY
PRZECIWOPOŻAROWEJ im. Józefa Tuliszkowskiego
- PAŃSTWOWY INSTYTUT BADAWCZY
ZESPÓŁ LABORATORIÓW SYGNALIZACJI ALARMU POŻARU
I AUTOMATYKI POŻARNICZEJ BA
ul. Nadwiślańska 213, 05-420 Józefów k/Otwocka**

spełnia wymagania normy PN-EN ISO/IEC 17025:2005
meets requirements of the PN-EN ISO/IEC 17025:2005 standard

Akredytowana działalność jest określona w Zakresie Akredytacji Nr AB 207
Accredited activity is defined in the Scope of Accreditation No AB 207

Akredytacja pozostaje w mocy pod warunkiem przestrzegania
wymagań jednostki akredytującej określonych w kontrakcie Nr AB 207
This accreditation remains in force provided the Laboratory observes
the requirements of Accreditation Body defined in the Contract No AB 207

Certyfikat akredytacji ważny do dnia 11.10.2017 r.
The certificate of accreditation is valid until 11.10.2017

Akredytacji udzielono dnia 07.10.1998 r.
Accreditation was granted on 07.10.1998



ZASTĘPCA DYREKTORA
POLSKIEGO CENTRUM AKREDYTACJI



LUCYNA OLBORSKA

Warszawa, dnia 27 września 2013 roku