AV CONSULTING B.V.
Calibration Laboratory

CERTIFICATE OF CALIBRATION AVC16104

CUSTOMER

Name:	AV-Consulting
Address:	Benedenberg 100A
Zip code & City :	2861 LH Bergambacht
Country:	Netherlands

CALIBRATION OF

Device:	Pisthonphone 4228	Class:	LS
Brand & type:	Bruel & Kjaer		4228
Serial number:	1943250		
Customers Instrument tag	N/A		

SPECIFICATIONS

Calibrated in accordance with:	IEC 60942:2003-01	Class:	LS
	Microphone method, sound calibration comparison method		
Method used:	IEC-60942 Annex B, Periodic tests		
Traceability:	The results are traceability to the international units system SI.		

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23° [C] ± 3° [C]

Environmental conditions:

Pressure	Unit	Humidity	Unit	Temperature	Unit
1014,50	[hPa]	55,0	[%]	24,0	[°C]

UNCERTAINTY OF MEASUREMENT

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, which for a normal distribution provides a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from standards, calibration method, effects of environmental conditions and any short time contribution from the device under calibration.

RESULT

PASS

DATE

Date of calibration :		*Date of issue :*	
Calibration Engineer:		*Approved Signatory:*	
A.Vreeswijk	November 10, 2017		November 10, 2017

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VISUAL INSPECTION

	Yes	No
The equipment / device is in serviceable condition.	x	
There is no visible damage.	x	
The appropriate documentation accompanied the equipment.	x	
Calibration tags / CE tags are present and correct.	x	
The equipment is suitable to use for official testing and/or calibration.	x	

COMMENTS

The sound calibrator has been shown to conform to the class LS requirements for periodic testing, described in Annex B of IEC 60942:2003 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed. However, as public evidence was not available, from a testing organization responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the sound calibrator to the requirements of IEC 60942:2003.'

CALIBRATION EQUIPMENT

Device	Type	Brand	Serial no.
Digital Voltmeter 6½ digits	34465A	Keysight	MY54502281
Conditioning Amplifier	2691	Bruel & Kjaer	2079137
Electroacoustical Calibrator	4231	Bruel & Kjaer	1000577
Band Pass Filter	1618	Bruel & Kjaer	823142
Pistonphone	4228	Bruel & Kjaer	1943250
Laboratory Standad Microfoon	4160	Bruel & Kjaer	2402417
Plus system	3560C	Bruel & Kjaer	2336739
Audio FFT Analyzer	XL2	NTI	A2A06359EO

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DEVICE UNDER TEST

Device	Type	Brand	Serial no.
Calibrator	4228	Bruel & Kjaer	1943250
Pattern Approval	N/A	-	
Barometer	UZ0004	Bruel & Kjaer	-

MEASUREMENTS

0. PRELIMINARY INSPECTION

Annex B2 Prior to any measurements, the sound calibrator and all accessories shall be visually inspected, and any controls operated to ensure that they are in working order. It shall be established that the power supply of the instrument is within the operating limits specified in the instruction manual, by using the method specified in the instruction manual.

	Adaptor	Coupler Clean	Controls	Battery comp.	Acces-sories	Other elements
Visual inspection / Proper working order	Ok	Ok	Ok	Ok	Ok	Ok

1. ENVIRONMENTAL CONDITIONS PRIOR TO CALIBRATION

Annex B.3.2.1 All tests in Clause B.3 shall be carried out within the following ranges of environmental conditions: 80 kPa to 105 kPa, 20 °C to 26 °C and 25 % to 70 % relative humidity

	Measured	Unit
Barometric pressure	1014,5	[hPa]
Relative humidity	55,0	[%]
Air temperature	24,0	[°C]

2. REFERENCE INFORMATION

Annex B.3.3. If a barometer is provided with the sound calibrator, prior to making any measurements of the sound pressure level generated by the sound calibrator, the indication of the barometer shall be checked by comparison with that of a calibrated precision barometer at the prevailing static pressure. The reading of the barometer under test shall be recorded, and the tolerances for the indicated static pressure shall be within the limits of the tolerances given in the instruction manual.

	Expected	Measured	Accept -Limit	Accept +limit	Deviation	Uncertainty
Barometric pres-sure, barometer	[hPa]	[hPa]	[hPa]	[hPa]	[hPa]	[hPa]
	1014,40	1014,00	-20,29	20,29	-0,40	5,00

3. MEASURED RESULT VALUES

The stated result values are valid at the following environmental reference conditions:

	Measured	Unit
Barometric pressure	101,3	[kPa]
Relative humidity	50,0	[%]
Air temperature	23,0	[°C]

4. SOUND PRESSURE LEVEL

Annex B.3.4.1 Following coupling of the microphone to the sound calibrator, the time specified in the instruction manual shall be allowed for the microphone and sound calibrator to stabilize. The sound pressure level generated by the sound calibrator shall then be measured, as an average over 20 s of operation, at the principal sound pressure level and principal frequency. For class LS sound calibrators the microphone shall be a laboratory standard microphone as specified in IEC 61094-1. For class 1 and class 2 sound calibrators the microphone shall be a working standard microphone as specified in IEC 61094-4 (or IEC-61094-1).

The sound pressure level generated by the sound calibrator under test shall be measured using a calibrated microphone or microphone system (comparison method). Limits include uncertainty.

Nominal Level stated on calibration chart	Accept limit lower Class-LS	Accept limit upper Class-LS	Accept limit lower Class 1	Accept limit upper Class 1	Measured level actual conditions	Corrections reference conditions	Result at rererence conditions §3	Measurement uncertainty
[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
124,12	124,01	124,23	123,81	124,43	124,53	0,4435	124,09	0,09

5. FREQUENCY

Annex B.3.5. The frequency of the sound generated by the sound calibrator coupled to the microphone used in B.3.4 shall be measured, at the principal sound pressure level, for each frequency setting of the sound calibrator for which the instruction manual states that the instrument conforms to the requirements of this standard. Limits include uncertainty.

Nominal Level stated on calibration chart	Accept limit lower Class-LS	Accept limit upper Class-LS	Accept limit lower Class 1	Accept limit upper Class 1	Measured level	Measurement uncertainty
[Hz]	[Hz]	[Hz]	[Hz]	[Hz]	[Hz]	[Hz]
251,2	241,27	261,13	241,27	261,13	251,17	0,07

6. TOTAL DISTORTION

Annex B.3.5.The frequency of the sound generated by the sound calibrator coupled to the microphone used in B.3.4 shall be measured, at the principal sound pressure level, for each frequency setting of requirements of this standard. Limits include uncertainty.

Calibration level	Frequency	Total distortion	Accept limit Class LS	Accept limit Class 1	Measurement uncertainty
[dB]	[Hz]	[%]	[%]	[%]	[%]
124,12	251,20	1,20	2,25	2,75	0,25

Note : Accept limits are reduced by measurement uncertainty to assure result value, expanded by the actual expanded uncertainty does not exceed the specified limits as stated in the standard IEC-61094.

Note: Nominal Level for LS calibrator is defined as the value as stated on the calibration chart delivered by the manufacturer.

7. ENVIRONMENTAL CONDITIONS FOLLOWING THE CALIBRATION

Actual environmental conditions following calibration

	Measured	Unit
Barometric pressure	1014,5	[hPa]
Relative humidity	55,0	[%]
Air temperature	24,0	[°C]

8. SUMMARY

0. PRELIMINARY INSPECTION	☑ PASS	☐ FAIL
1. ENVIRONMENTAL CONDITIONS PRIOR TO CALIBRATION	☑ PASS	☐ FAIL
2. REFERENCE INFORMATION	☑ PASS	☐ FAIL
4. SOUND PRESSURE LEVEL	☑ PASS	☐ FAIL
5. FREQUENCY	☑ PASS	☐ FAIL
6. TOTAL DISTORTION	☑ PASS	☐ FAIL
7. ENVIRONMENTAL CONDITIONS FOLLOWING THE CALIBRATION	☑ PASS	☐ FAIL