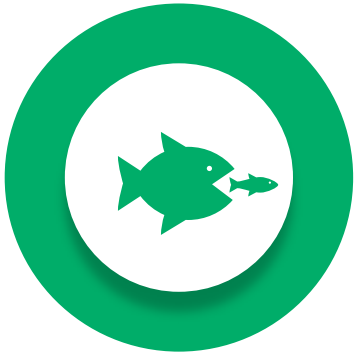
NOISE
QUALITY ASSURANCE
MASTER CLASS

MINERALS COUNCIL
SOUTH AFRICA

EMPEROR'S PALACE, JOHANNESBURG
21 JUNE 2023, 07:30-14:00

	Item	Presenter/ Facilitator	Time
1.	Registration and Networking	All	07:30-08:30
2.	Welcome	K Motseme	08:30-08:35
3.	Emergency Preparedness	Venue Representative	08:35-08:40
4.	Setting the Scene	K Motseme	08:40-08:50
5.	Check-In	All	08:50-09:10
	PART 1: LEGAL REQUIREMENTS AND APPLICABLE STANDARDS		
6.	Round Table Discussion	All	09:10-09:25
7.	Noise MCOP	B Mongoma	09:25-10:00
8.	Applicable Standards	M Naude	10:00-10:30
	TEA BREAK (10:30-11:00)		
	PART 2: INSTRUMENT CONSIDERATIONS		
9.	Round Table Discussion	All	11:00-11:15
10.	Instrument Considerations	M Naude	11:15-12:15
	COMFORT BREAK (12:15-12:30)		
	PART 3: CALIBRATION REQUIREMENTS		
11.	Calibration Requirements	M Naude	12:30-13:15
12.	Round Table Discussion	All	13:15-13:30
13.	Team Quiz Competition and Session Review	All	13:30-13:45
14.	Closing Remarks	K Motseme	13:45-14:00
	LUNCH		

Session Engagement Pointers



Conformance To The Competition Act Requiements

Not promote any supplier, discuss any particular instrument brand, including pricing, Competitively sensitive business information, etc.

Questions

Please ask questions verbally and via Mentimeter Link

Guidance Note

This is a Guidance Note, please do consult referenced Standards and Documents

Have Fun

Let's engage and share experiences, it's a session to engage

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PART 1: LEGAL REQUIREMENTS AND APPLICABLE STANDARDS

MOSH NOISE

DATE: 21 JUNE 2023

Department of Mineral Resources and Energy

QUALITY ASSURANCE

Presented by: Mr B Mongoma

mineral resources & energy
Department:
Mineral Resources and Energy
REPUBLIC OF SOUTH AFRICA

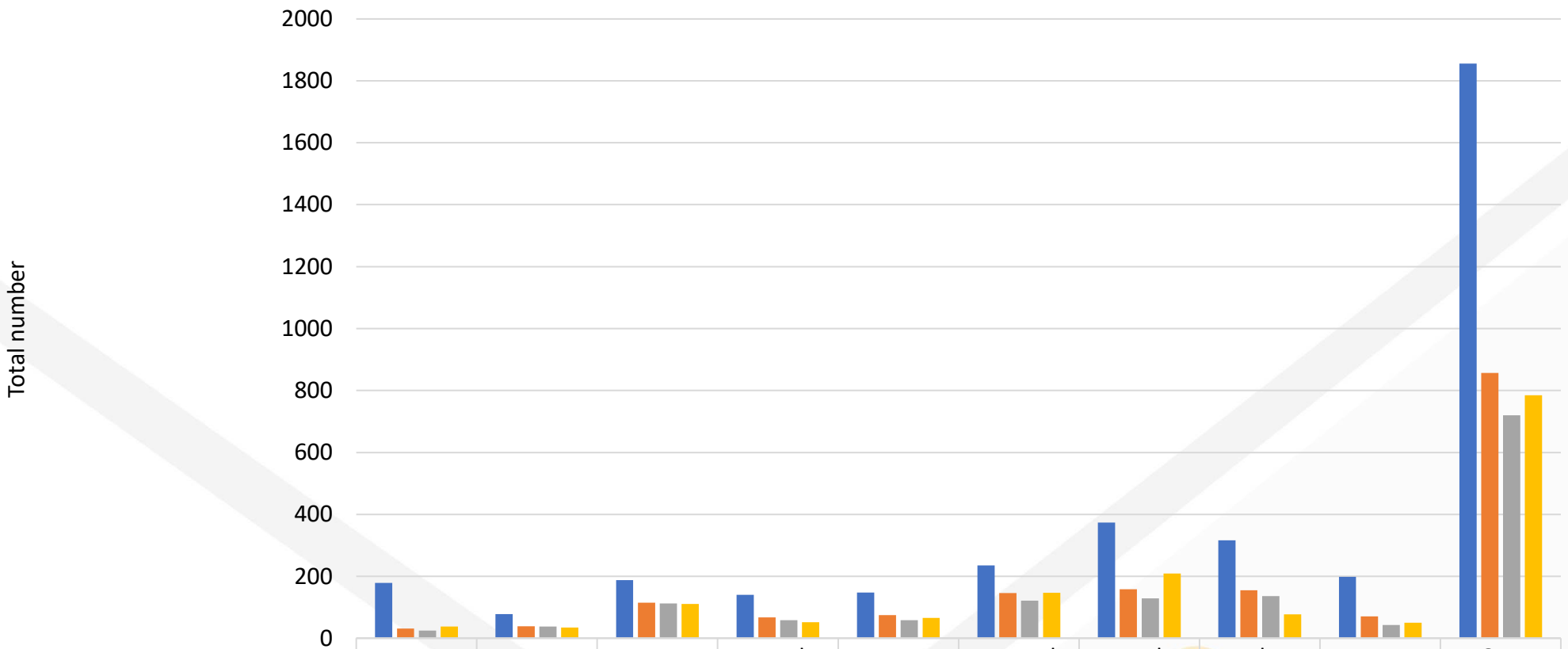
2030 NDP

PRESENTATION LAYOUT

1. NOISE EXPOSURE TRENDS
2. KEY CHALLENGES
3. MHS IMPROVEMENT INTERVENTIONS 2023/24

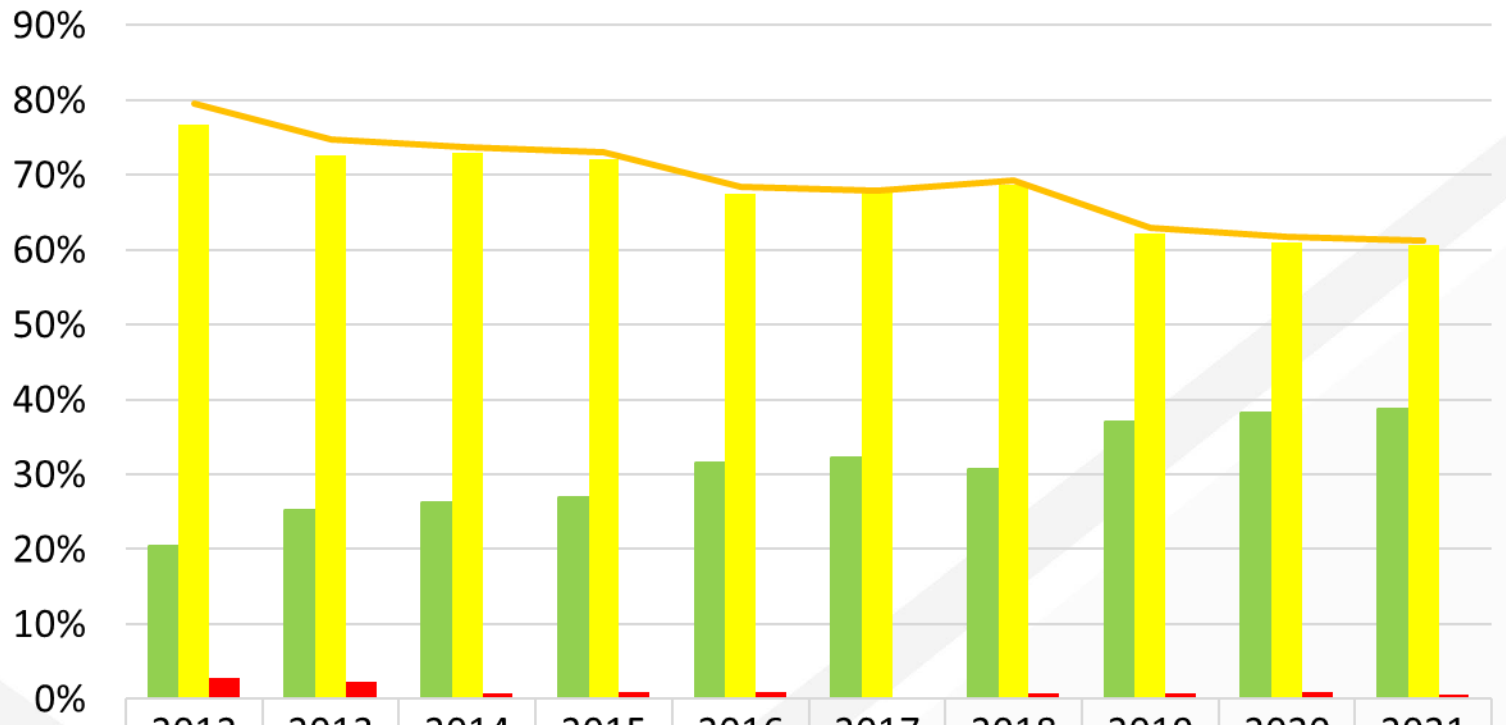
NOISE EXPOSURE TRENDS

NUMBER OF OPERATING MINES VS NUMBER OF REPORTS SUBMITTED



	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	North West	Northern Cape	Western Cape	TOTAL RSA
No. of operating mines 2023	179	78	188	140	148	235	374	316	198	1856
No. of reports submitted 2019	31	39	115	67	75	146	158	155	71	857
No. of reports submitted 2020	25	38	112	58	58	121	129	136	43	720
No. of reports submitted 2021	38	35	111	52	66	147	209	77	50	785

NOISE EXPOSURES TO LEVELS ABOVE 85 dB

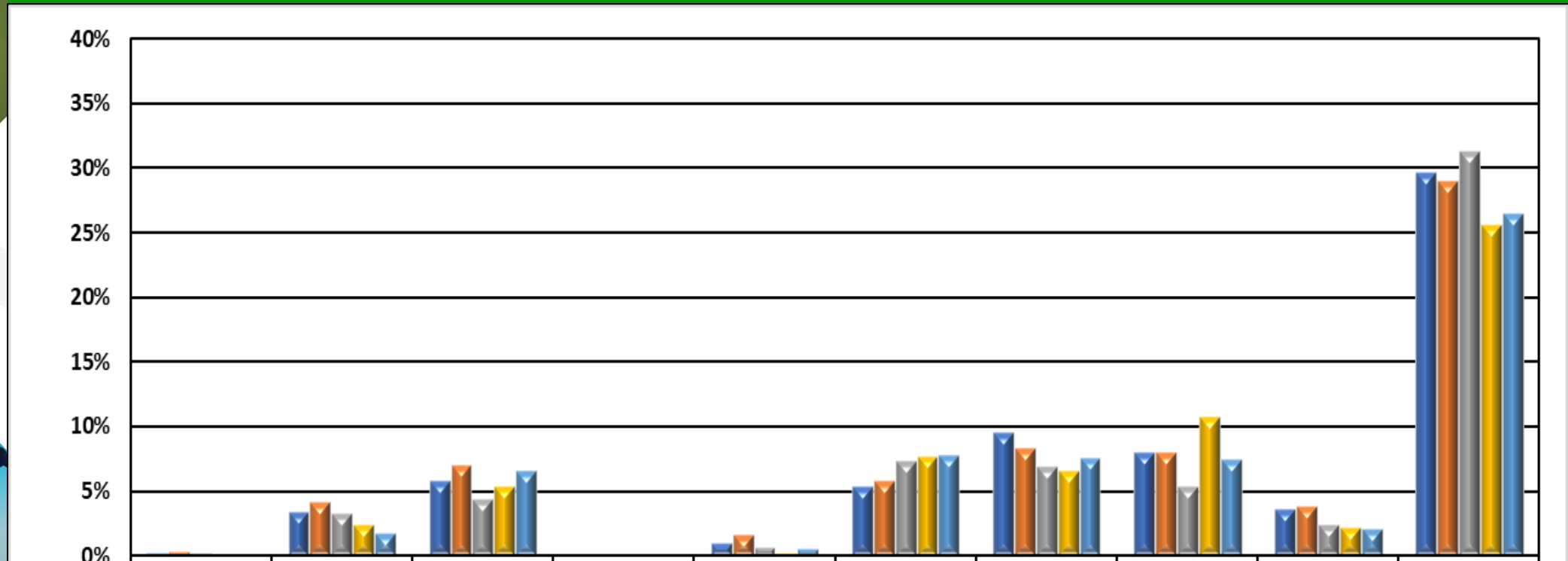


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
HEG C	20.47	25.17	26.25	26.89	31.61	32.15	30.66	37.08	38.24	38.8
HEG B	76.79	72.61	73.02	72.16	67.51	67.62	68.66	62.24	60.9	60.68
HEG A	2.74	2.22	0.74	0.96	0.87	0.22	0.67	0.68	0.87	0.51
% of employees at risk of noise exposure ≥ 85 (dB)A	79.53	74.83	73.76	73.12	68.38	67.84	69.33	62.92	61.77	61.19

mineral resources & energy
Department:
Mineral Resources and Energy
REPUBLIC OF SOUTH AFRICA

2030 NDP

NOISE EXPOSURES TO LEVELS ABOVE ≥ 85 dB PER REGION



	WC	NC	FS	EC	KZN	MP	LP	GP	NW(K)	NW(R)
2017	0.39	3.56	5.99	0.05	1.09	5.48	9.71	8.17	3.73	29.68
2018	0.42	4.30	7.16	0.06	1.81	5.95	8.46	8.11	3.99	29.08
2019	0.30	3.38	4.54	0.05	0.78	7.44	7.04	5.47	2.52	31.40
2020	0.07	2.59	5.45	0.02	0.37	7.81	6.68	10.83	2.30	25.64
2021	0.10	1.88	6.72	0.06	0.67	7.88	7.65	7.56	2.17	26.50

KEY CHALLENGES

AUDIT KEY CHALLENGES

- ❑ No document process/procedure on how the mine must undertake their risk assessment (non-compliance to OH-01-2022 Instruction (Fires on Conveyor belts).
- ❑ mine don't describe the team composition with their competency that will be required to undertake the risk assessment.
- ❑ Risk assessment conducted by an individual or competent people not included.
- ❑ Noise exposure impact "binnegoed" in the risk assessment report.
- ❑ Noise source monitoring not conducted in accordance with the noise guidance note.
- ❑ minimum number as required by Annexure F is not complied with.
- ❑ noise source data is not recorded using rolling log averages on a quarterly basis.

AUDIT KEY CHALLENGES

- ❑ Mine having one sampling area.
- ❑ HEGs not determined based on the risk assessment outcomes.
- ❑ Sampling schedule not planned to cover all occupations within a HEG.
- ❑ No calibration readings before and after on the sampling sheets.
- ❑ Statistical analysis/log average not conducted for the determination & evaluation of each HEG.
- ❑ Noise exposure measurements for a rock driller was recorded as 40.3 dB(A).
- ❑ Noise exposure measurements that were reported to the DMRE couldn't be traced back on how the log averages were calculated to classify a HEG into a category.
- ❑ Events or factors that influence the results not assessed and recorded, e.g., excessive winds.
- ❑ No training programme for a person conducting the noise measurements.

KEY NOISE CHALLENGES ON 2022 QUARTERLY REPORTS

- ✓ Late submissions e.g., 2022 Q1 report submitted on the 23rd of December 2022.
- ✓ HEGs classified on 90th percentile on quarterly basis (reporting template doesn't require that).
- ✓ HEG with log average that is above 85 dB(A) have been classified as "C".
- ✓ HEG with log average that is below 82 dB(A) have been classified as "C".
- ✓ HEG with log average that is below 82 dB(A) have been classified as "B".
- ✓ HEG with log average that is greater than 82 dB(A) have been classified as "D".

KEY NOISE CHALLENGES ON 2022 QUARTERLY REPORTS

- ✓ Incorrect HEG determinations e.g., mining manager with drill rig operator + bobcat driver + mine planner/surveyor + geologist + HAMV driver.
- ✓ All the mine supervisors have been classified in one HEG with the same noise exposure profile
- ✓ No average log reading; however, the HEG has been classified.
- ❖ A 12.1 appointee assigned to more different mines, and all the above challenges.
- ❖ No investigations on health threatening occurrences and corrective actions.

2023/24 INITIATIVES

MHS IMPROVEMENT INTERVENTIONS 2023/24

INITIATIVES FOR 2023/2024

- ✓ Promulgate and popularise the guideline on quality assurance programme for occupational hygiene and ventilation engineering measurements.
- ✓ Resuscitate and participate in regional health working groups , whilst continuing to engage with mining houses engagement as per their request/s or need identified.
- ✓ Ensure administrative fines are imposed on late submissions.
- ✓ Summon the employer/employer representative, mine engineer and 12.1 appointee to present their poor-quality reports.

MHS IMPROVEMENT INTERVENTIONS 2023/24

INITIATIVES FOR 2023/2024

- ✓ Combined Occupational Health- Focused Audits.
- ✓ Focused inspection and audits on maintenance strategies.
- ✓ Follow up on section 11.5 Investigations conducted by the mines.
- ✓ All mines with overexposures reported in 2022 to be inspected on monthly.
- ✓ Overexposures and under reporting (incorrect HEG determinations and classifications) will be investigated.

THANK YOU

APPLICABLE STANDARDS

Presented By: Marianka Naudé

21 June 2023

Emperor's Palace, Johannesburg

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PART 1
LEGAL REQUIREMENTS & APPLICABLE STANDARDS

- Purpose of the Guidance Note
- Legal Requirements
- Accredited Laboratory
- Applicable Standards

PURPOSE

To assist industry members in ensuring that all items of sound measuring equipment used are calibrated against the requirements of the specific IEC standards (by an accredited facility) by recommending and specifying certain set of tests for the periodic testing of sound level meters and accompanying instruments.

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Sound level pressure instruments are being used to classify and quantify the nature, magnitude and origin of noise and sound sources.

The instruments of interest are:

International Electrotechnical Commission Standards IEC

REASON?

This is done to ensure that all instruments conforming to these IEC standards are accepted to have the same capability in performing the same measurements and achieving the same results, and thus ensuring uniformity.

LEGAL ASPECTS

Mine Health and Safety Act No. 29 of 1996 requires the employer to:

- Protect the health and safety of employees
- To establish and maintain a system of occupational hygiene measurements.

SANS 10083

- “relevant national body” as described in SANS 10083

  means:

  South African National Accreditation System (SANAS)

- “relevant national legislation” means

  South African Qualifications Authority Act (No. 58 of 1995)

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GOVERNMENT GAZETTE, ACT NO: 19 OF 2006 INDICATES IN CLAUSE 4 THAT:

SANAS is recognized as the only national body responsible for carrying out accreditation in respect of conformity assessment, which incudes accreditation of:

- Calibration, testing and verification laboratories
- Certification Bodies
- Inspection Bodies
- Rating agencies
- Any other type of body that may be added to SANAS scope of activity.

SANAS is recognized as the national body to monitor Good Laboratory Practice (GLP) compliance with principles adopted by the Organization for Economic Co-operation and Development (OECD) for GLP facilities.

WHAT IS AN ACCREDITED LABORATORY?

- **Demonstrates its ongoing competence in the field of calibration/testing that meets the requirements of IEC 17025 General Requirements for competence of testing and calibration laboratories.**

- **Audited on a regular basis by an independent third party and**

- **Proven that it meets the management and technical systems requirements of the standard.**

WHAT IS AN ACCREDITED LABORATORY?

- **Prove the laboratory has adequate equipment to perform the tests/calibrations.**

- **Prove it has adequate technical competent personnel to perform the calibration and/or tests.**

BENEFIT

- **You are assured that the laboratory has been audited to an international standard based on demonstrating their competence in performing the calibration/tests.**

- **Accreditation provides assurance that a third party independently verified the laboratory processes**

DEFINITION OF QUALITY STANDARDS?

Documents that provide requirements, specifications, guidelines, or characteristics that can be used consistently to ensure that the measured results are repeated and accurate.

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WHAT IS AN IEC STANDARD?

Describes the number of tests that shall be performed on instruments to establish if the instrument conforms to the IEC requirements so that the instrument can be accepted as functioning correctly.

SABS ARP:0109

Is a standard specifically implemented for the main purpose to recommend the minimum set of parameters and ranges proposed for periodic testing of sound level meters, microphones used with sound level meters, sound calibrators, fractional octave band filters and personal sound exposure meters to state compliance to the relevant IEC standards.

Sound Level Meters	Integrating Sound Level Meters	Personal Noise Exposure Meters	Acoustic Calibrators
Latest Standard			
IEC 61672 consist of 3 Parts		**IEC 61252**	**IEC 60942**
Previously Published as			
IEC 60651 IEC 651	**IEC 60804 IEC 804**		**IEC 942**

Instruments according to the older standards are still compliant to their specific standards and can still be calibrated.

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PART 2: INSTRUMENTS CONSIDERATIONS

PART 2 :
EVERYTHING YOU NEED TO KNOW ABOUT NOISE MEASURING EQUIPMENT

1. **SOUND LEVEL METERS**
   INTEGRATING SOUND LEVEL METERS
2. **MICROPHONES**
3. **PERSONAL NOISE EXPOSURE METERS**
4. **ACOUSTIC CALIBRATOR**
5. **STORAGE AND HANDLING OF EQUIPMENT**
6. **PRE- AND POST CALIBRATION**
7. **UNCERTAINTY OF MEASUREMENT**

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SOUND LEVEL METERS OR INTEGRATING SOUND LEVEL METERS

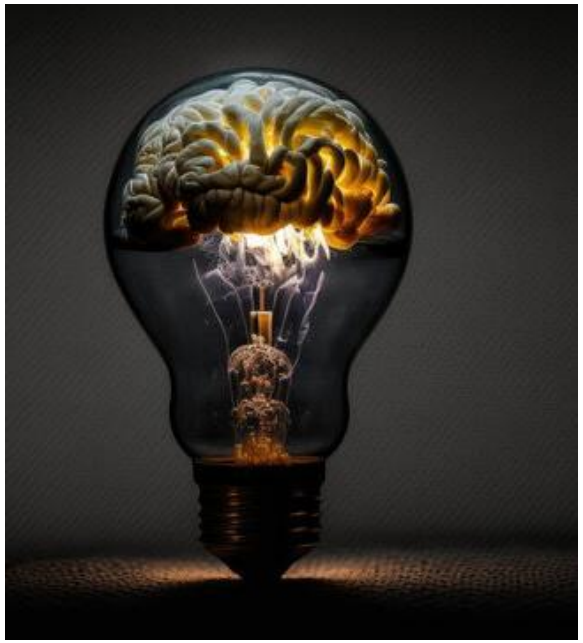
A Sound Level Meter which accumulates the total sound energy over a measurement period and calculates an equivalent average value, usually displayed as an L_{eq}, that complies at least with the accuracy requirements specified for a type 2 instrument in IEC 61672.

Sound Level Meters are used for the following type of measurements:

- **To spot check noise levels**
- **To identify noise sources**
- **To evaluate the effectiveness of noise controls**

SLM'S CURRENT STANDARD TO COMPLY TO IS IEC 61672 "ELECTROACOUSTICS – SOUND LEVEL METERS"

- **IEC 61672 Part 1: "Specifications" Identify the electro acoustical performance specifications.**
- **Sound Level Meters can be classified at a Class 1 or Class 2**
- **The class of a noise level meter describes its accuracy as defined by the relevant international standards.**



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SLM'S CURRENT STANDARD TO COMPLY TO IS IEC 61672 "ELECTROACOUSTICS – SOUND LEVEL METERS"

- **The Measurement Precision is reduced as the Class number increases, affecting manufacturer's cost also significantly.**
- **Sound level meters are defined by International Standards such as IEC 60651, IEC 60804, IEC 61672, within these standards there are 2 allowed levels of tolerance and these are known as Class 1 or Class 2.**
- **Class 1 instruments are also called "precision" instruments and are also more accurate than a Class 2 instrument also called a "general grade" meter.**

SLM'S CURRENT STANDARD TO COMPLY TO IS IEC 61672 "ELECTROACOUSTICS – SOUND LEVEL METERS"

- **Class 1 meter's tolerances are much smaller than a class 2 sound level meter which makes a Class 1 more accurate than a Class 2.**
- **Class 1 Sound Level Meters can measure sound over a wider frequency range than a Class 2 instrument and meet narrower tolerances for all performance criteria.**
- **Class 1 instruments are mandatory for conducting noise measurements for Noise Control Regulations.**

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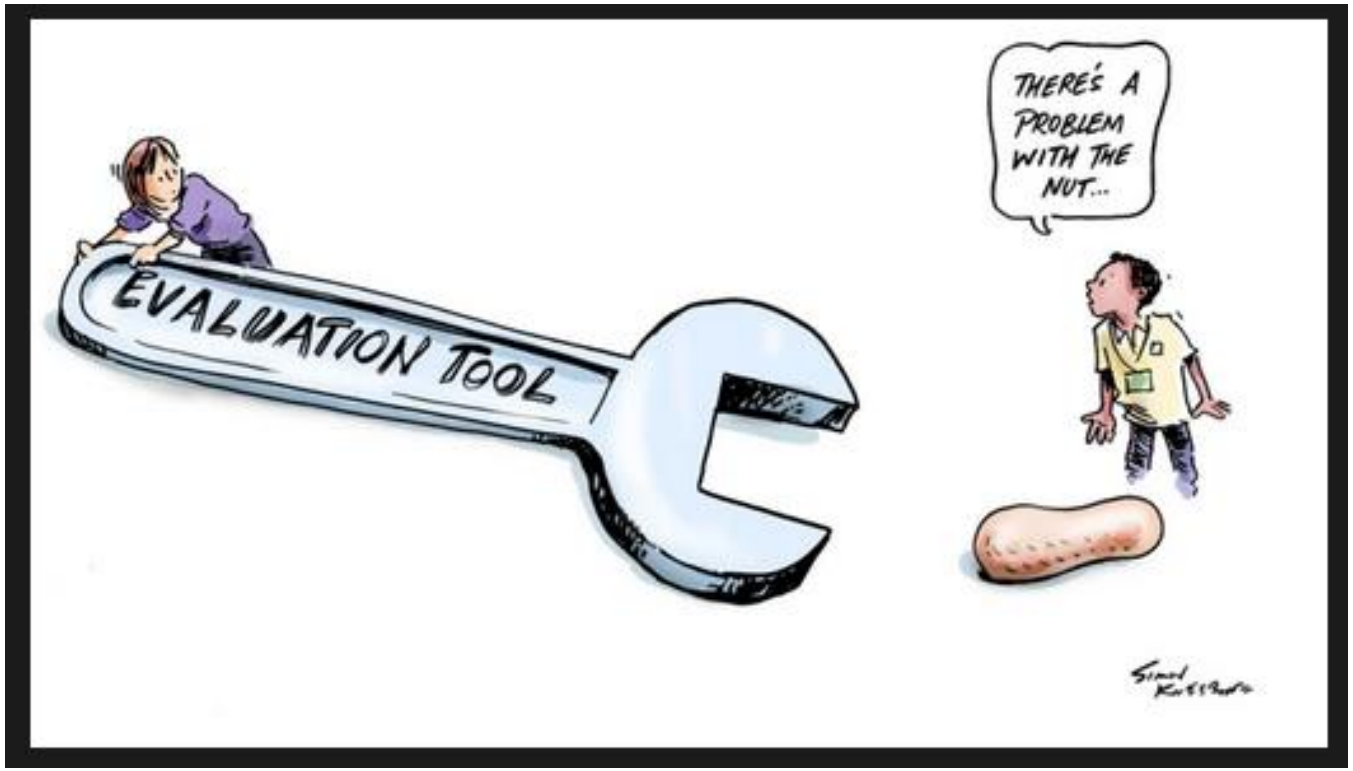
SLM'S CURRENT STANDARD TO COMPLY TO IS IEC 61672 "ELECTROACOUSTICS – SOUND LEVEL METERS"

- **Class 2 instruments are required according to SANS 10083 for "The measurement and assessment of occupational noise for hearing conservation purposes"**

- **The classification of the Microphone will determine the overall classification of the Sound Level Meter.**

- **For example, if you have a sound level meter as a Class 1 but the Microphone purchased with that instrument is a Class 2, the instrument will be converted to a Class 2 instrument.**

IEC 61672 PART 2: “PATTERN EVALUATION TEST”



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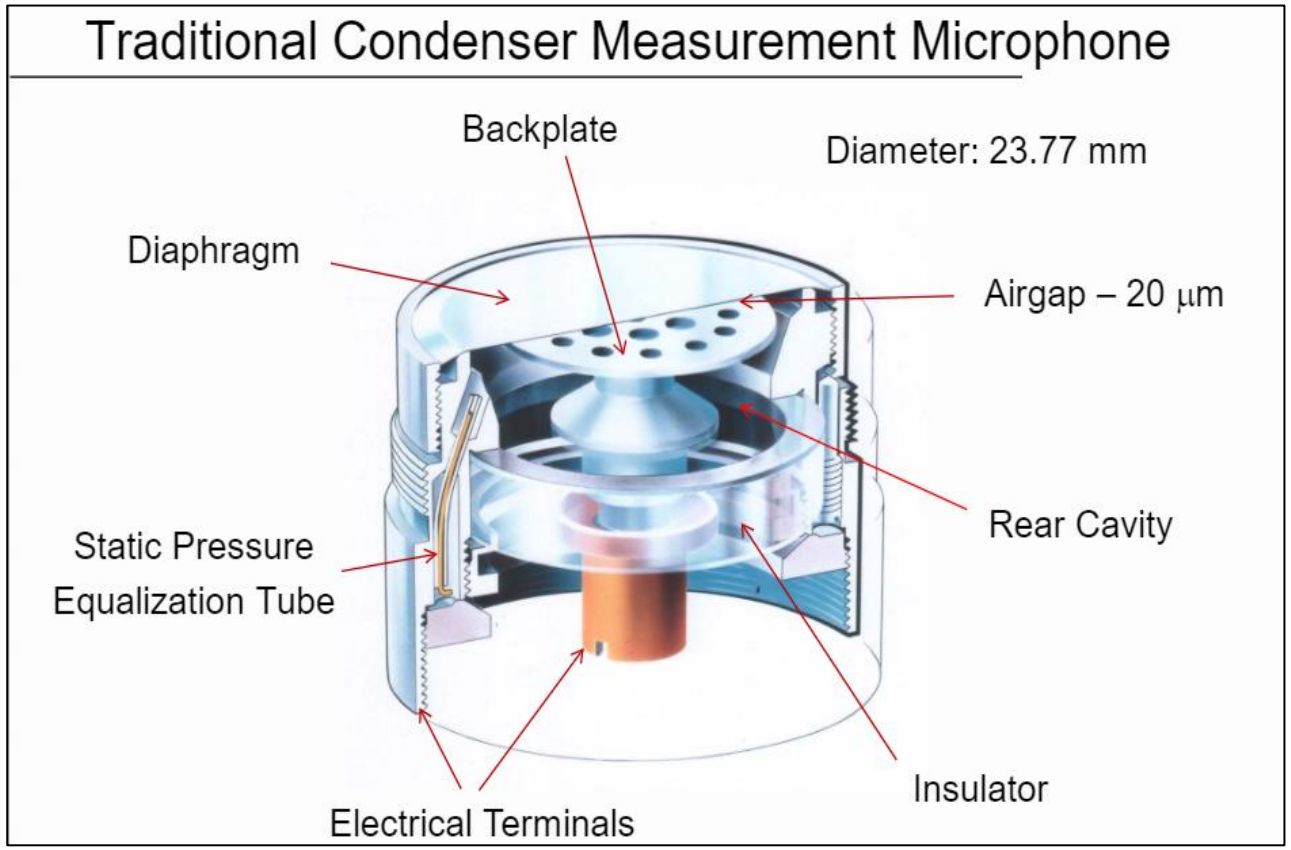
IEC 61672 PART 3: “PERIODIC TESTING”

- **The aim of the standard was to ensure that periodic testing is performed in consistent manner by ALL laboratories.**

- **The purpose of periodic testing is to assure the user that the performance of the SLM conforms to the applicable specifications of IEC 61672 part 1 for a limit set of KEY tests and for the environmental conditions under which these tests were performed.**

MICROPHONES

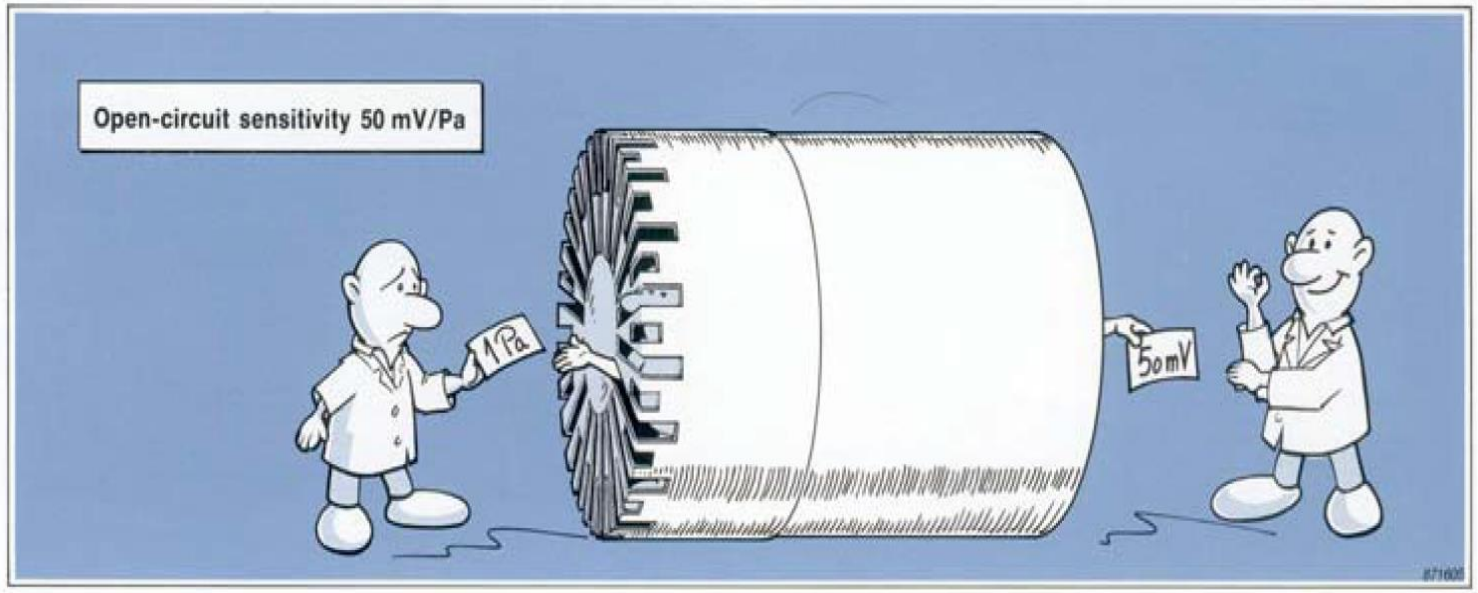


- **Interface between the Acoustic Field and the measurement system.**
- **The Diaphragm of the Microphone responds to changes in the air pressure caused by sound waves.**
- **Sound Pressure Level Meter (SPL).**
- **The movement of the diaphragm converts sound pressure (Pa) into an electrical signal (mV).**
- **A logarithmic conversion is usually applied, and the sound pressure level is stated instead in decibels.**

OPEN CIRCUIT SENTIVITY

- **An important characteristic which features prominently in the specifications for all measuring microphones is Open-circuit sensitivity.**

- **The open-circuit sensitivity tells of the output voltage to be expected at the microphone's output terminal for every unit of sound pressure acting on the diaphragm (when the microphone is not attached to a pre-amplifier). The units are mV/Pascal.**



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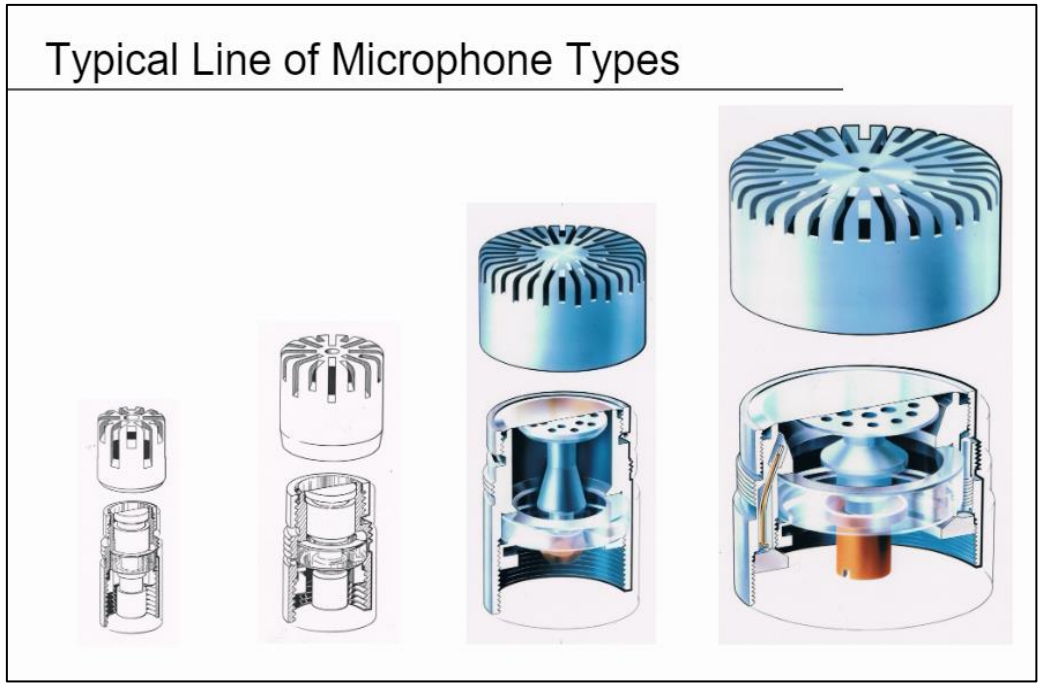
OPEN CIRCUIT SENTIVITY

- **The Sound Level Meters manual will indicate the precise nominal sensitivity the microphone shall have for that specific Sound Level Meter.**

- **With each purchase of “New” Microphone or Sound Level Meter Kit, the Manufacturer shall supply the unique manufacturer calibration certificate for the microphone.**



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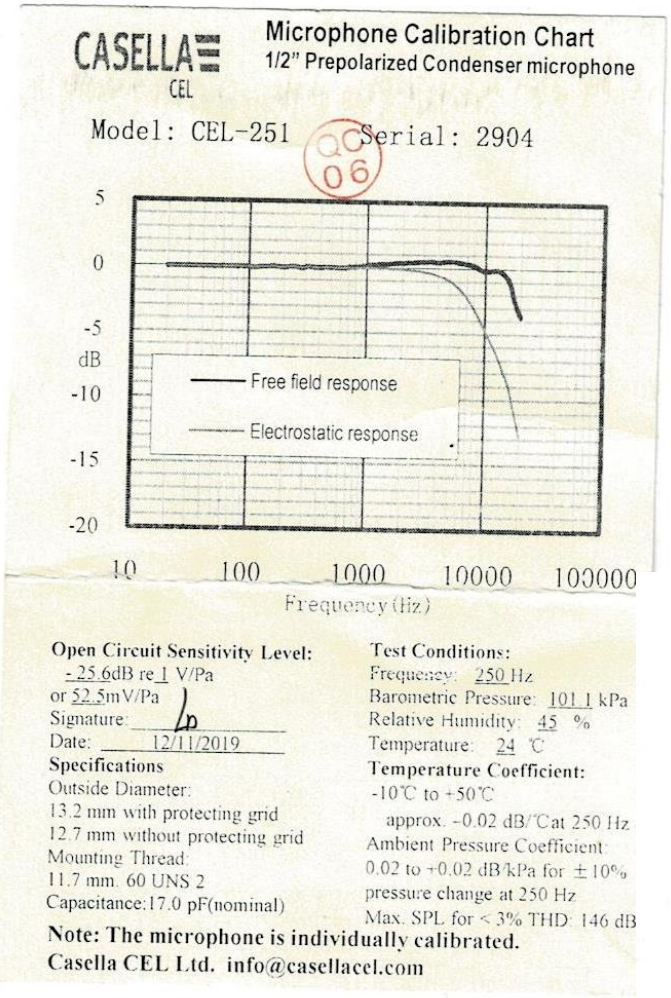
Each Microphone's manufacturer's calibration certificate shall be filed, not just for comparison evaluation for the calibration laboratory testing the open-circuit sensitivity of the microphone but also for the purpose of history and drift of the microphone.


CASELLA CEL

Microphone Calibration Chart
1/2" Prepolarized Condenser microphone

Model: CEL-251 Serial: 2904

QC 06

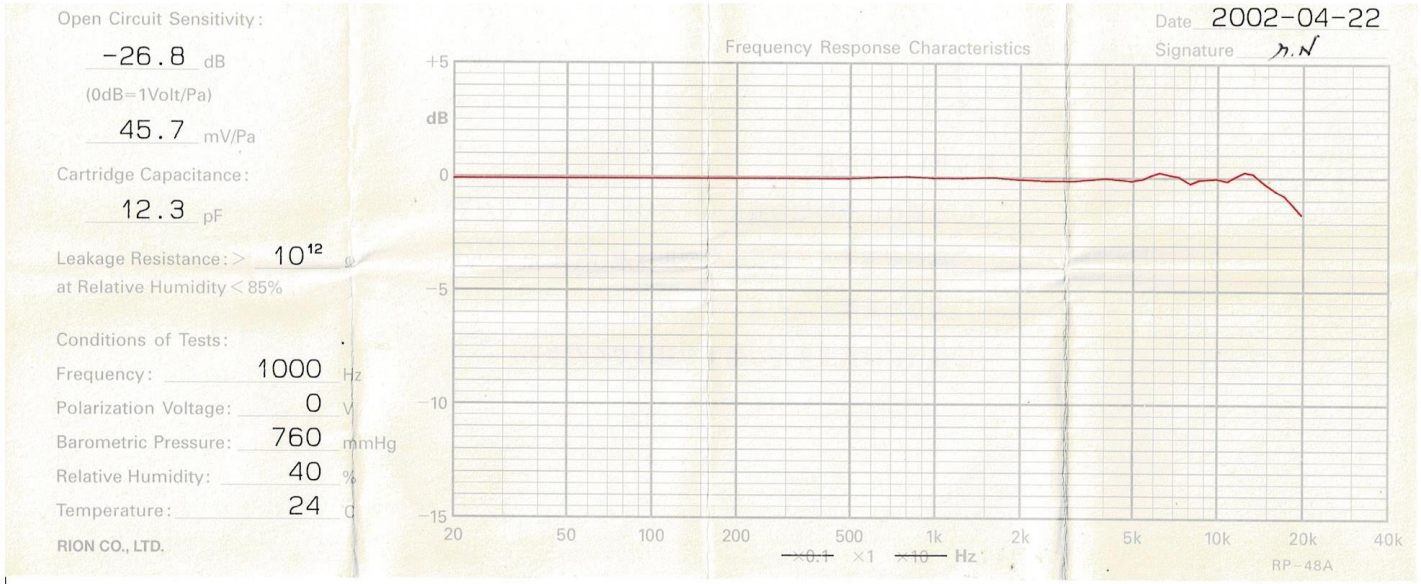
Open Circuit Sensitivity Level:
-25.6dB re 1 V/Pa
or 52.5mV/Pa
Signature:
Date: 12/11/2019

Specifications
Outside Diameter:
13.2 mm with protecting grid
12.7 mm without protecting grid
Mounting Thread:
11.7 mm. 60 UNS 2
Capacitance:17.0 pF(nominal)

Test Conditions:
Frequency: 250 Hz
Barometric Pressure: 101.1 kPa
Relative Humidity: 45 %
Temperature: 24 ℃

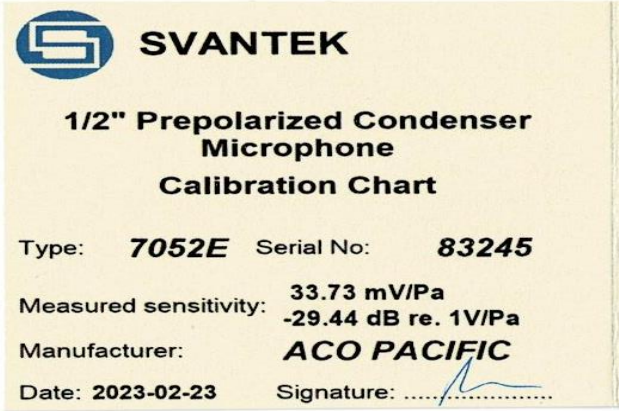
Temperature Coefficient:
-10℃ to +50℃
approx. -0.02 dB/℃at 250 Hz
Ambient Pressure Coefficient:
0.02 to +0.02 dB/kPa for ±10% pressure change at 250 Hz
Max. SPL for < 3% THD: 146 dB

Note: The microphone is individually calibrated.
Casella CEL Ltd. info@casellacel.com


Open Circuit Sensitivity:
-26.8 dB
(0dB=1Volt/Pa)
45.7 mV/Pa
Cartridge Capacitance:
12.3 pF
Leakage Resistance: > 10^{12} Ω
at Relative Humidity < 85%

Conditions of Tests:
Frequency: 1000 Hz
Polarization Voltage: 0 V
Barometric Pressure: 760 mmHg
Relative Humidity: 40 %
Temperature: 24 ℃
RION CO., LTD.

Frequency Response Characteristics
Date 2002-04-22
Signature


SVANTEK

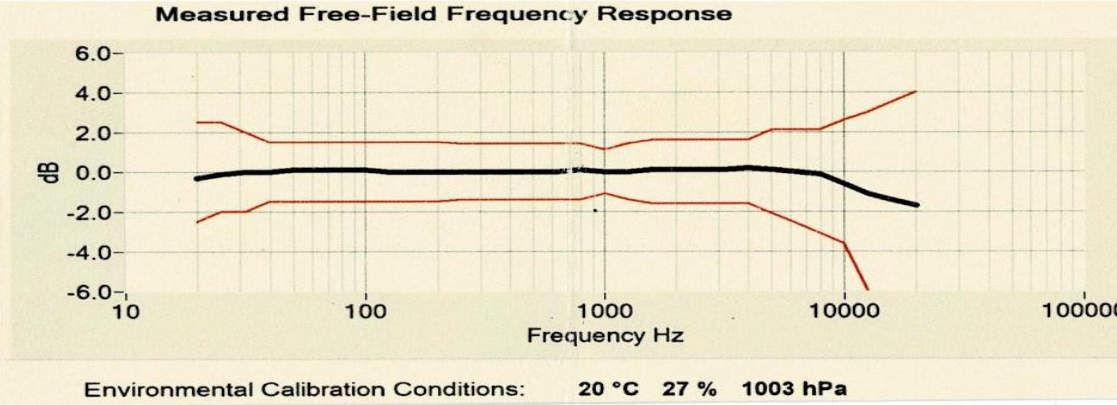
1/2" Prepolarized Condenser Microphone
Calibration Chart

Type: *7052E* Serial No: *83245*

Measured sensitivity: 33.73 mV/Pa
-29.44 dB re. 1V/Pa

Manufacturer: *ACO PACIFIC*

Date: 2023-02-23 Signature: .....



Environmental Calibration Conditions: 20 °C 27 % 1003 hPa

- **When a sound level meter is calibrated by a calibration laboratory the microphone and the sound level meter are calibrated as a unit and should therefore only be used in that manner.**

- **The microphone's frequency range determines the useful frequency range of the sound level meter and vice versa.**

- **Example: If a microphone was calibrated electro-acoustically with a sound level meter (and complies/conforms) and the microphone's frequency range (only conformed to the relevant IEC clause form) 500 Hz to 4 kHz.** ***This in effect, limits the use of the sound level meter to within that frequency range. Measurements that are made outside the 500 Hz to 4 kHz frequency range will be null and void.***

PERSONAL SOUND EXPOSURE METER

- **Personal Sound Exposure Meters are also known as Noise Dosimeters and Dose Badges.**
- **The need to ascertain the noise exposure of workers during their normal working day, has led to the development of the Noise Dosimeter or Personal Sound Exposure Meter.**
- **Personal sound exposure meters conform to the IEC 61252 standard and is categorized as a Class 2 instrument.**
- **Where a PSEM has been specified by the manufacturer to IEC 60651, IEC 60804 and IEC 61252 the instrument may be calibrated accordingly.**
- **Important Settings to remember on the Personal sound exposure meters is the Exchange Rate to be set to 3dB and the criterion level set to 85 dB.**
- **For compliance to IEC 61252, tests shall be performed for Sound Pressure Level (dB) as well as sound exposure (Pa2S).**

INTERNAL BATTERY OF PERSONAL NOISE EXPOSURE METERS

- **Preserve the life of the internal battery, recommend that the dosimeter is turned off when stored.**
- **Do not store your dosimeter in low battery state condition**
- **Room Temperature, charged to about 40% to 60% capacity.**

- **Charge the dosimeter prior to storage for prolonged period longer than 3 months.**
- **Re-Charge every 2 or 3 months**
- **Charge the dosimeter before attempting to switch the unit on if the dosimeter has not been used for a prolonged period.**

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INTERNAL BATTERY RUN-TEST

- **Recommend Frequent Internal Battery Ch**
- **Indicate when your internal battery needs**
- **Run a fully charged Dosimeter in a contro for a minimum of 18 Hours, also check if t indicate any diagnostics concerns for exa Temp too High, Battery Failed.**

ACOUSTIC CALIBRATOR

- **Provides a reference sound source, used to calibrate and check the performance/verification of the SLM, ISLM and Personal Dosimeter.**
- **Comply to the requirements of IEC 60942 and calibrated annually.**
- **Most calibrators generate a level of 94dB re:20uPa, which may have to be corrected according to microphone type.**
- **Typically, the calibrator is fitted over the meter's microphone and the reading is either checked manually by the user or automatically by the meter.**

ACOUSTIC CALIBRATOR

A field Acoustic Calibrator cannot check:

- **Whether your noise instruments work at a wide range of frequencies.**
- **Acoustic Parameters such as exposure, LA_{eq} and LCpeak**
- **That Octave Band Filter are working correctly.**
- **Whether your microphone is working at a range of frequencies**
- **The Open Circuit Sensitivity of the Microphone.**

A change in atmospheric pressure can alter the calibration levels slightly.
The manufacturer's manual will indicate if any corrections must be applied.

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STORAGE, HANDLING AND TRANSPORTATION OF EQUIPMENT

- It is obvious that great care must be taken of the instruments.
- They should not be exposed to extremes of temperature or to direct sunshine. The limits that the instruments can stand are usually defined by the manufacturer. The operating range of temperature should also be specified: it is usually narrower.

- Instruments should also not be exposed to extremes of humidity, and any condensation should be carefully avoided. This means in particular that the instrument should not be taken from a cold environment (a cold car in wintertime for instance) directly to a hot and humid place.
- If the temperature of the instrument is lower than the dew point of this environment, condensation might occur, provoking short-circuits or general malfunctioning that might be unnoticed.

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STORAGE, HANDLING AND TRANSPORTATION OF EQUIPMENT

- **The problem is of a greater importance for microphones. Condensation on the membrane might in the short term induce erroneous measurement; in the long term however, oxidation of the membrane develops, and small holes might appear in this case, the microphone must be replaced.**
- **Before going from a cold to a hot environment, the instrument, in its tight box, should be progressively brought to a temperature near that of the new environment and certainly well above its dew point.**
- **This means also that the equipment should not be left in the cold overnight or transported in the trunk of a car. The equipment should also be stored in a normal temperature (10 to 25°C) and dry (30 to 70% relative humidity) environment.**

STORAGE, HANDLING AND TRANSPORTATION OF EQUIPMENT

Microphones should be taken care of by surrounding them with desiccating capsules.

Measuring instruments should not be exposed to vibration for obvious reasons. This implies that they should always be stored, handled and transported in their original box with damping materials such as plastic foam around them.

This is also a further reason for not transporting them in the trunk of a car.

Batteries should be removed from the instrument when it is not used for a prolonged period. Non rechargeable batteries should be checked regularly and replaced as soon as they are flat, otherwise they might leak which might corrode and completely wreck the instrument. Rechargeable batteries must be kept fully charged as far as possible.

STORAGE, HANDLING AND TRANSPORTATION OF EQUIPMENT

- **Care must also be taken with microphone threads while screwing to sound level meters.**

- **Finally, the manual of each instrument might give special instructions concerning its handling, the storage and the maintenance.**
  This must not be overlooked but must be practised during the entire life of the instrument.

PRE- AND POST CALIBRATION

- **By means of a sound calibrator, the acoustic sensitivity of the meter immediately before and after each series of sound level measurements should be checked and the results of the sound measurements should be discarded if the two checks do not coincide to within 1,0 dB**

- **If measurements are conducted over extended time periods for each series, acoustic sensitivity checks should be conducted at regular intervals, i.e., at least once or twice a day.**

- **The level on which the sound level meter/dosimeter has been calibrated will usually be 94,0 dB/114 dB, however, the level will be indicated on the Acoustic Calibrator.**

PRE- AND POST CALIBRATION

NOTE: A record-keeping system should be incorporated, and Calibration Certificates, as well as pre- and post-calibration results should be recorded and should be kept and be readily available.

Please Note:

The calibrator is a battery-operated sound source and only provides a reference frequency and a reference level to enable the operator to reference his noise-measuring instrument for a reference point in the acoustics field.

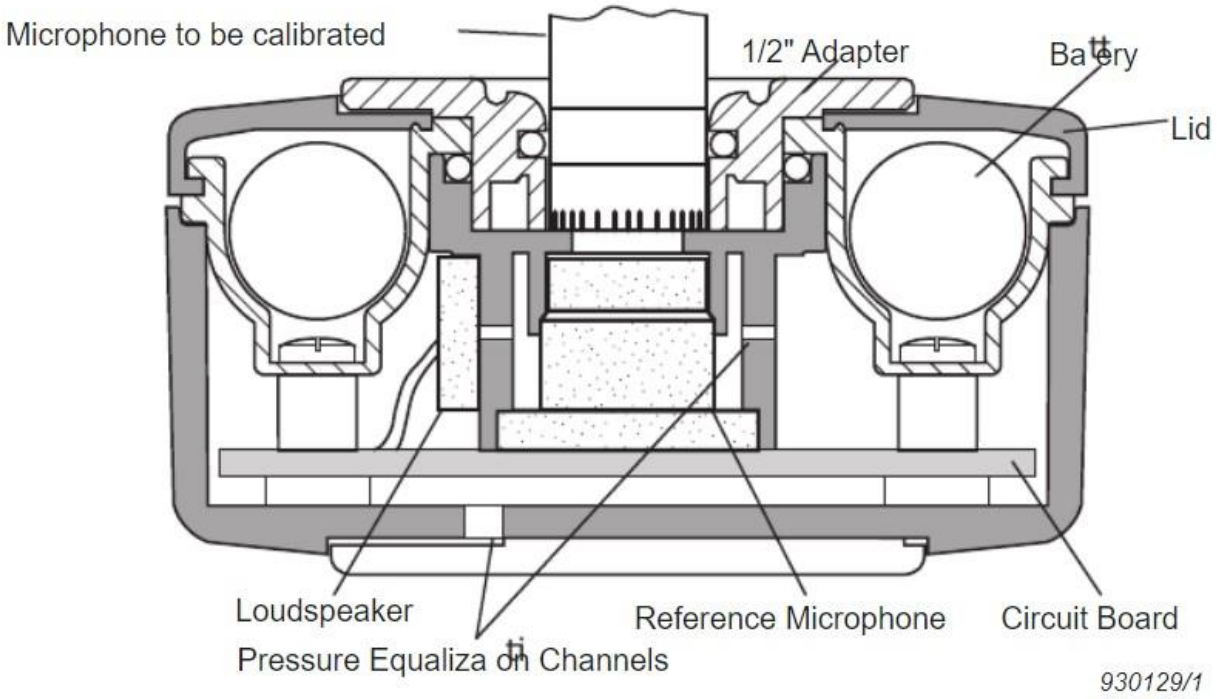
It DOES NOT calibrate your sound level meter/noise dosimeter according to the prescribed calibration IEC standards designed for each instrument.

PRE- AND POST CALIBRATION

- **Always calibrate the instrument without the windscreen or windsock.**
- **Use a windscreen of a type specified by the manufacturer as being suitable for the microphone and which does not detectably influence the accuracy of the meter under the ambient conditions of the test.**

PRE- AND POST CALIBRATION

Cross-section of the calibrator



Be sure to use only the ½” Microphone adaptor and ¼” microphone adaptor designed specifically for the specific calibrator.

Using another adapter may cause incorrect calibration.

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PRE- AND POST CALIBRATION

The manufacturer will specify in which circumstances the Sound Level Meter can be used to measure noise within the Manufacturer's specifications, for example:

Warm-up time: **< 5 seconds for 0,5 dB**

< 10 seconds for 0,1 dB

Effect of Humidity: **0,5 dB for humidity higher than 30% and smaller than 90%**

Effect of Temperature: **0,5 dB for temperature bigger than -10°C to 50°C**

PRE- AND POST CALIBRATION

- **A change in atmospheric pressure can alter the calibration levels slightly. The manufacturer's manual will indicate if any corrections must be applied.**
- **The calibration (reference point) must be checked at the end of the session. If the sound level meter is not calibrated anymore, the data might have to be discarded and the reasons for this calibration change should be investigated as this might indicate an important malfunctioning of the sound level meter.**

UNCERTAINTY OF MEASUREMENT – NOISE SURVEY

- **The following Environmental Conditions can affect the accuracy of noise data:**
  - ❖ **TEMPERATURE**
  - ❖ **HUMIDITY**
  - ❖ **ATMOSPHERIC PRESSURE**
  - ❖ **WIND AND DUST**
  - ❖ **REFLECTING SURFACES**
  - ❖ **ELECTROMAGNETIC FIELD**
  - ❖ **VIBRATION**
  - ❖ **BACKGROUND NOISE**

UNCERTAINTY OF MEASUREMENT – NOISE SURVEY

- **Around the world use the GUM method to estimate measurement uncertainty. You can download it here: https://www.bipm.org/en/publications/guides/**

- **ISO 9612 Acoustics – Determination of occupational noise exposure – Methodology is also a standard which addresses uncertainty of measurement complete with different examples.**

PART 3: CALIBRATION OF NOISE MEASURING EQUIPMENT

PART 3
CALIBRATION REQUIREMENTS

- Calibration of equipment
- Calibration Laboratory
- Manufacturer Certificate/Factory Calibration Data Sheet -ISO 9001 Certificate
- Verification Certificate
- SANAS Calibration Certificate of Compliance
- Issue and Reporting of Results on a Calibration Certificate
- Statement of Uncertainty of Measurement
- Example of a Certificate

CALIBRATION OF EQUIPMENT

When calibrating your sound level meter or Noise dosimeter using an Acoustic Calibrator, only one level and one frequency are checked, whereas when you are undertaking a real noise measurement, your instrument will be recording a wide range of frequencies, functions and levels which are combined to provide the noise parameters that you need.

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CALIBRATION OF EQUIPMENT

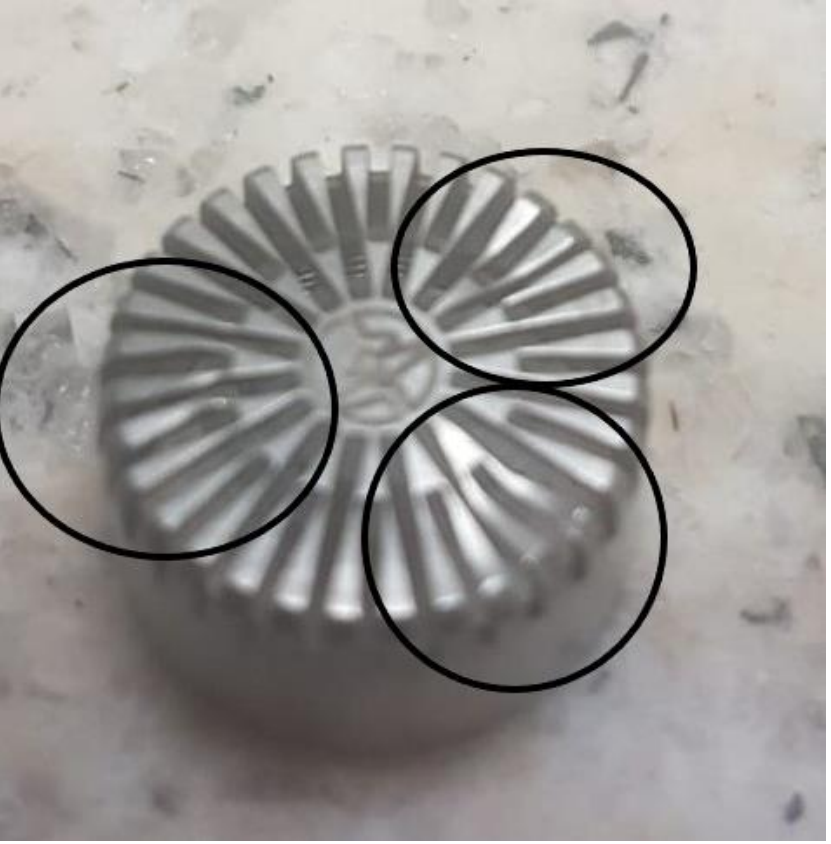
Therefore, regular recalibration also known as Periodic Verification is essential to ensure that all the features and functions of your noise equipment are working as intended by the manufacturer.

Calibration (or recalibration) carried by a calibration laboratory "periodically" is to check if the instruments is performing as expected and complying to the re

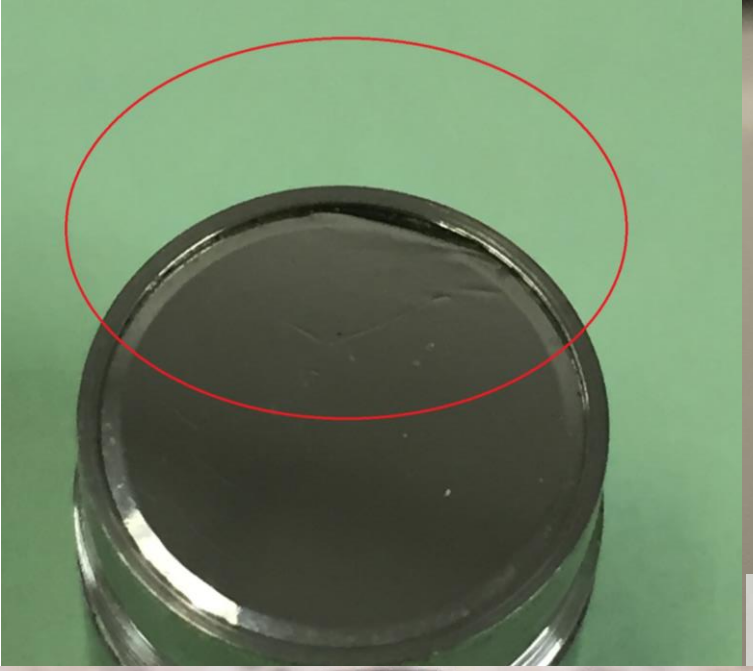
CALIBRATION OF EQUIPMENT

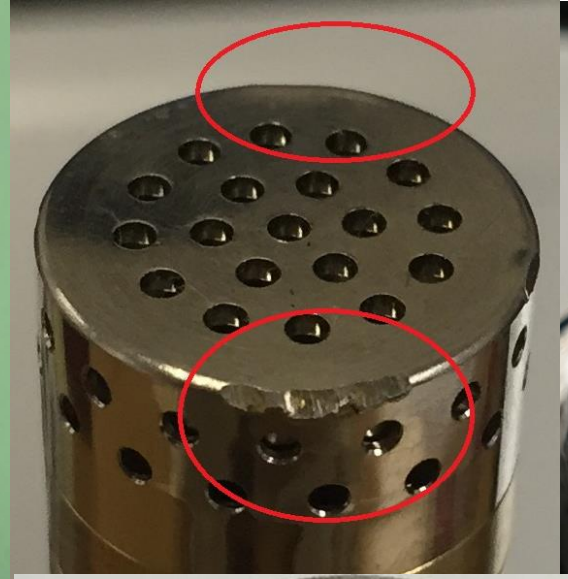
- **Ensure that all items of sound measuring equipment used are calibrated against the requirements of IEC 60942, IEC 61672, IEC 61252 (by an accredited facility as prescribed standards as indicated on the back of the instrument), at intervals not exceeding one year for the sound calibrator, and two years for the rest of the equipment.**

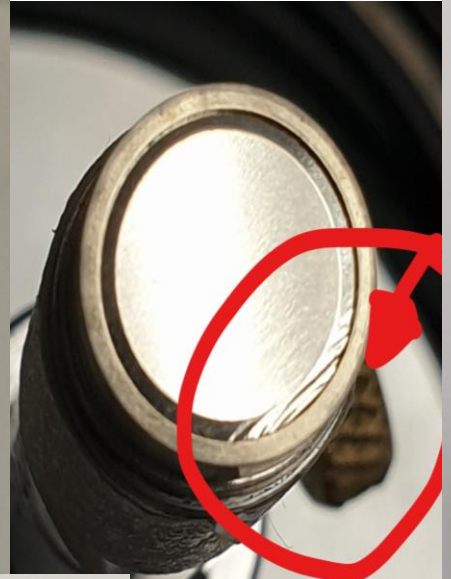
- **When the instruments are received for calibration at the calibration laboratory, an initial visual inspection of the instruments should be performed to ascertain if the instruments have been damaged. During this inspection, the protection grid and diaphragm of the microphone should also be inspected for any dents, deformities, tears etc.**

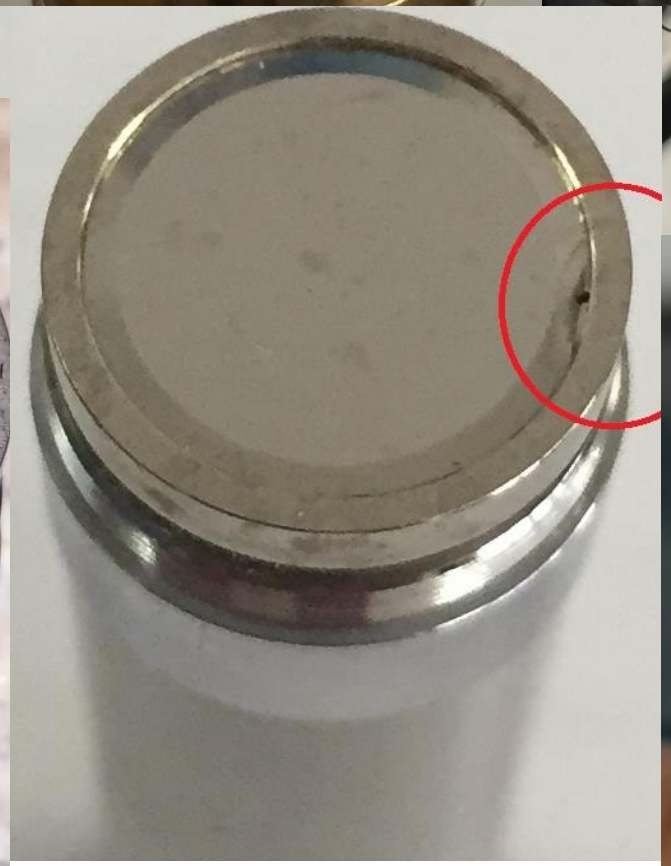


Should any defects be present, it is recommended to replace the microphone with another suitable (equivalent) microphone, as the microphone is precision engineered to have a certain calculated effect on the sound field to which it is subjected.









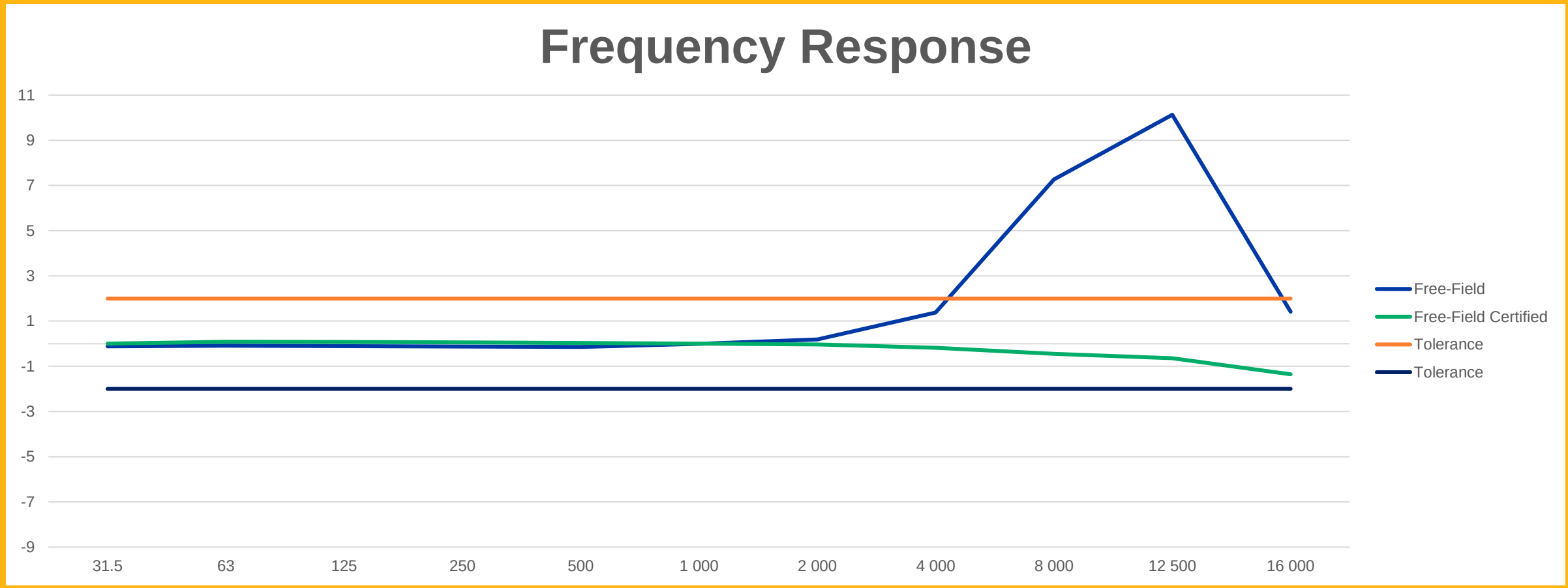
CALIBRATION OF EQUIPMENT

Any deviation in the deviation of the microphone's physical dimensions may result in undesirable effects caused within the sound field it is subjected to and ergo unreliable measurements.

- ***NOTE:*** *The microphone's diaphragm may not appear as being damaged, but it can still be less sensitive due to shocks incurred or of being subjected to extreme environmental conditions or abuse, causing the diaphragm to stretch.*

NOTE: *If equipment were repaired, it should not be taken out into service before a comprehensive calibration had been undertaken in accordance with the set standards, and a calibration certificate should be produced.*

CALIBRATION OF EQUIPMENT



CALIBRATION LABORATORY

- **Accreditation provides assurance that a third party independently verified the laboratories processes.**
- **The scope of accreditation for the calibration Laboratory should:**
  - **Provide traceability in accordance with the relevant national legislation.**
  - **Implement and maintain a quality management system in accordance with SANS 17025.**
  - **Be accredited by a recognized accreditor.**
- **The calibration laboratory must be compliant with regards to having implemented a Quality Management system according to IEC 17025, this however does not indicate the laboratory compliant to calibrate acoustical instruments.**

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CALIBRATION LABORATORY

- https://www.sanas.co.za/Certificate%20Published/1600-11-2022.pdf
- https://www.sanas.co.za/Certificate%20Published/1302-08-2022.pdf

- **An accredited calibration is a calibration that is within an ISO/IEC 17025 accredited laboratory approved scope of accreditation which demonstrates the lab's technical competence to perform those measurements.**
- **A laboratory must have the specific measurement standard on their Scope of Accreditation to be able to state accredited compliance.**

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ORIGINAL EQUIPMENT MANUFACTURER CERTIFICATE / FACTORY CALIBRATION DATA SHEET "ISO 9001 CERTIFIED"

- **ISO 9001 is defined as the internationally recognized standard for Quality Management Systems (QMS).**
- **It is the most widely used QMS standard in the world. ISO 9001 provides a framework and set of principles that ensure a common-sense approach to the management of your organization to consistently satisfy customers and other stakeholders. In simple terms, ISO 9001 certification provides the basics for effective processes and effective people to deliver an effective product or service time after time.**

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ORIGINAL EQUIPMENT MANUFACTURER CERTIFICATE / FACTORY CALIBRATION DATA SHEET "ISO 9001 CERTIFIED"

A non-accredited calibration (*obtained from the manufacturer),* also referred to as a "commercial calibration", has the following attributes:

- **A certificate of calibration will be issued. The certificate may however not have an accreditation logo or a statement of traceability.**
- **Basic information that identifies the instrument, calibration/due dates, a statement of conformance either being in or out of tolerance, laboratory and technician performing the calibration.**
- **Laboratory assets used and the environmental conditions.**

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ORIGINAL EQUIPMENT MANUFACTURER CERTIFICATE / FACTORY CALIBRATION DATA SHEET "ISO 9001 CERTIFIED"

- **May or may not contain the actual data report depending on, if this was specified at the time of service.**
- **May not contain the recommended tests according to the IEC Standards or ARP 0109 to state compliance to a specific standard.**
- **May not contain the specific uncertainty of Measurements of tests conducted.**
- **ISO 9001 is not an accredited standard for Noise instruments, but a Quality Management system.**

WHAT IS THE DIFFERENCE BETWEEN ISO 17025 ACCREDITATION AND ISO 9001?

- **The emphasis if ISO 9001, is to establish compliance to a quality management systems requirements.**
- **ISO 17025 includes additional technical requirements for laboratory personnel and operations.**
- **Being certified to ISO 9001 should not be interpreted to imply compliance to ISO 17025.**
- **A laboratory's fulfilment of the requirements of ISO 17025 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid tests results and calibrations.**
- **The management system requirements in ISO 17025 are written in language relevant to laboratory operations and meet the principles of ISO 9001 QMS – requirements, and are aligned with its pertinent requirements.**

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VERIFICATION CERTIFICATE

- **Verification is an activity that is technology specific and usually involves examination, inspection, testing and reviewing a product to establish that it meets the fit for the purpose for which it was designed.**

- **Tests are normally conducted with a Standard Acoustic Calibrator at the reference sound pressure level of 94,0 dB/114,0 dB at 1 000 Hz.**

- **No compliance to an IEC standard will be reported and the uncertainty of measurement will not be within the uncertainty of measurement tolerances indicated in the IEC standards.**

- **Compliance to the standard will be on the onus of the client.**

SANAS CALIBRATION CERTIFICATE OF COMPLIANCE

The main differences for an accredited calibration are:

- The parameter is on the laboratories Scope of Accreditation and can be accessed.
- An accreditation logo will be present on the calibration documents.
- The calibration will be traceable to SI units through NIST or other National Metrology Institutes (NMI).
- Most importantly, the data report includes the measurement data and measurement uncertainties.

The Guideline for the compilation of a mandatory Code of Practice for an Occupational Health Programme for Noise state that an accredited laboratory must be used, and it require an accredited calibration.

ISSUED/REPORTING OF RESULTS ON CALIBRATION CERTIFICATE

Calibration Certificate shall be issued according to R-79 “REQUIREMENTS FOR THE ISSUE OF SANAS CALIBRATION CERTIFICATES.”

Where limitations are applicable it should be clearly stated and reported on the certificate.

The wording of certificates should be clear and unambiguous, regarding the statement of conformance or non-conformance.

ISSUED/REPORTING OF RESULTS ON CALIBRATION CERTIFICATE

Conformance to a performance specification is demonstrated when the following criteria are both satisfied:

1. A measured deviation from a design goal does not exceed the applicable acceptance limit and

2. The corresponding uncertainty of measurement does not exceed the corresponding maximum-permitted uncertainty of measurement given in the IEC standard for the same coverage probability of 95%

STATEMENT OF UNCERTAINTY OF MEASUREMENT

- A laboratory may at its own discretion state an uncertainty for each measurement or state a global uncertainty for a group of measurement(s) or parameter(s).
- The measurand plus the uncertainty of measurement shall be within the stated tolerances given in SANS 60942, SANS 61672-1, and SANS 61672-3; SANS 61252 as applicable.
- For laboratories performing periodic tests, the uncertainties associated with all measurements shall be determined in accordance with the procedures of ISO/IEC Guide 98-3.
- Actual measurement uncertainties shall be calculated for a coverage factor of 95%.

STATEMENT OF UNCERTAINTY OF MEASUREMENT

- Laboratories performing pattern evaluation tests or periodic tests shall demonstrate that the uncertainties of measurements do not exceed the corresponding maximum-permitted uncertainties given in the appropriate international standards.
- Conformance to a performance specification is demonstrated when a measured deviation from a design goal equals or does not exceed the corresponding acceptance limits and the laboratory demonstrated that the associated uncertainty of measurements equals or does not exceed the maximum permitted uncertainty.

STATEMENT OF UNCERTAINTY OF MEASUREMENT

- Where no uncertainty tolerances are indicated by the IEC standards, the calibration laboratory shall ensure that its uncertainties will not result in a statement where no conformance or non-conformance cannot be stated because of the calibration laboratory's expanded uncertainty being too large.