

# TOUGHER THAN THE REST

## **The rugged automotive microphone from GRAS**

Provides accurate data under even the most challenging test conditions.

Resists shock, vibration, drop, water, dust and extreme temperatures.



**GRAS** Sound  
& vibration





## HIGH QUALITY DATA - EVEN WHEN MEASURING UNDER THE MOST EXTREME CONDITIONS

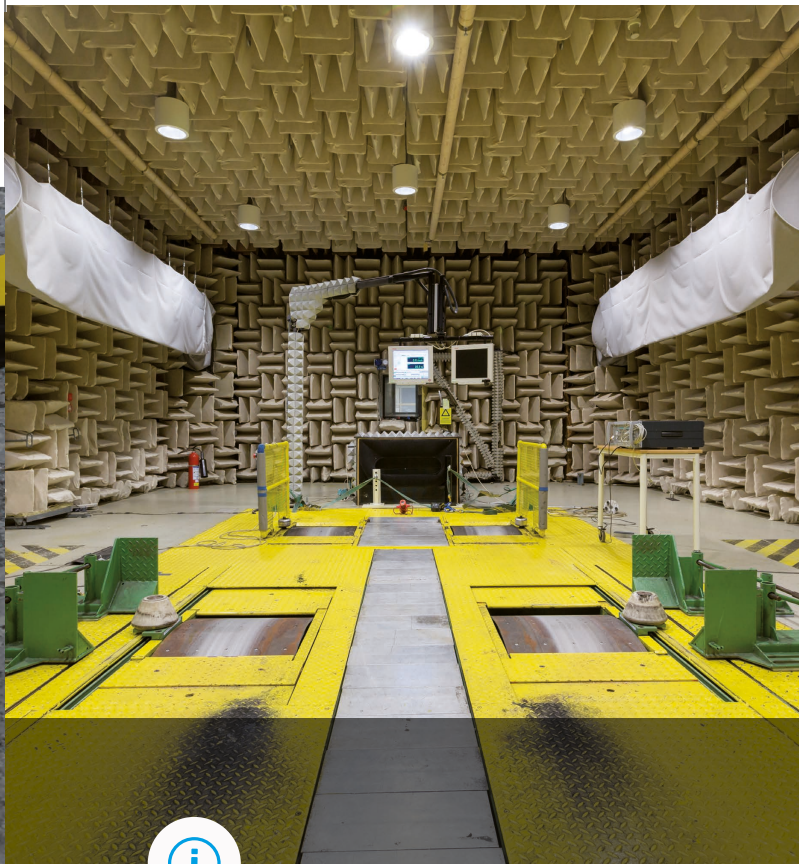
Automotive noise testing can be extremely demanding so you need a tough product to meet your expectations. That's why GRAS has developed the 146AE - a measurement microphone especially designed to perform under extreme test conditions.

Setting up multichannel measurement systems multiple times a day exposes your equipment to additional shocks and drops. It's important that your test systems are protected against vibrations, extreme temperatures, high humidity, dust and even oil mist.

To maintain efficient testing you also have to trust that your microphones are ready and working when you roll a vehicle into the test chamber - and confident that your data is accurate when you roll it out again. Re-testing or rescheduling is a costly option.

**Our answer is the 146AE** - the world's only measurement microphone set that is shock resistant, waterproof, dust and oil mist resistant and able to withstand high temperatures - all without compromising measurement quality.





### Built for extreme conditions

- ✓ Shock and drop resistant – limited downtime and higher efficiency
- ✓ Water, oil and dust-proof (IP67 Rated) – withstands rain, high humidity and oil mist
- ✓ Dust, water and high-speed particle protected with a replaceable grid – change the filter not the microphone
- ✓ Can be used at high temperatures (125°C) – ideal for engine compartment measurements, transmissions, exhaust and brake noise tests
- ✓ PowerOn Indicator – efficient control of your measurement set-up
- ✓ Online data – ensure valid data with access to electronic calibration data for your system software
- ✓ Repairable diaphragm – low cost on repairs

### Precise data every time

- ✓ Frequency range and dynamic range as you know it from IEC compatible ½" measurement microphones:  
3.15Hz – 20kHz, 18dB(A) – 138dB, 50mV/Pa
- ✓ 5 year warranty



## DESIGNED TO BE USED IN REAL LIFE CONDITIONS

The 146AE is the world's first rugged CCP microphone set specifically designed to operate reliably in the harsh environments and conditions that you encounter in real life – such as strong vibrations, shock, drop, extreme temperatures and wet or dusty conditions.

The rugged design of the 146AE makes it possible to perform many different types of measurement in the same automotive test set up using only a single type of microphone.

Not only does this improve your NVH test performance and data quality in rugged conditions, it also extends the lifetime of your measurement set-up.

There is no need to repeat costly and time-consuming testing, providing you with efficient, valid data and high performance all at the same time.

All this makes the 146AE the most cost-efficient measurement microphone in your workshop.



# THE STRONGEST LINK IN YOUR MEASUREMENT CHAIN

Every detail of the **146AE microphone** set has been developed to handle even the most challenging test conditions, with materials and mechanical design carefully selected for optimal performance.



# EXPLORE THE BENEFITS

IP  
67



## Shock absorbing design

Carefully selected materials and a new innovative mechanical design of the microphone capsule and

pre-amplifier adds a level of robustness never before seen in a measurement microphone.

## Water, oil and dust resistant & replaceable grid

The grid has a built-in filter, protecting the diaphragm from water, oil, dust and high-velocity particles.

This filter is made from an acoustically transparent fabric that is water and oil

repellant and sits securely so that you can measure in high humidity and dusty environments.

If the filter becomes clogged by dust or particles over time, the grid can easily be exchanged on the fly – reducing downtime and costs.



## Shock absorbing grid

The grid of the 146AE has a built-in shock absorber

which prevents shock or drop damage to the microphone.



## Waterproof construction

A water and oil repellant protective coating protects all exposed parts, while the BNC connector is waterproof.

## PowerOn Indicator

There is a visual indicator showing that the microphone is correctly connected before you start the test which can even be seen from a distance. This allows a PowerOn sequence to be activated channel-by-channel by a simple TEDS reading – a fast way of checking the setup and a helpful indication that you are ready to run the test.



## Sealed dual venting

A unique waterproof sealing protects the venting, and dual venting holes limit the risk of water or oil drops blocking these venting holes.

All this makes the microphone set the world's only fully waterproof measurement microphone – IP67.

IP67: Totally protected against dust and protected against the effect of water up to 1 m of submersion.

## Enhanced grip

Easier no-slip handling on-site for the test engineer.

## Extreme temperature performance

The mechanical and electronic design is optimized for performance at both very high and very low temperatures giving this rugged microphone set an incredible operating range from  $-40$  to  $+125^{\circ}\text{C}$  without changing the sensitivity. This makes the 146AE by far the most temperature stable CCP measurement microphone currently available on the market.

## Vibration

The unique design of the microphone capsule makes the 146AE far less sensitive to vibrations. Tailor-made to measure under vibrating test conditions, the microphone will work accurately day in and day out.

# IEC 61094 COMPLIANT MEASUREMENT MICROPHONE

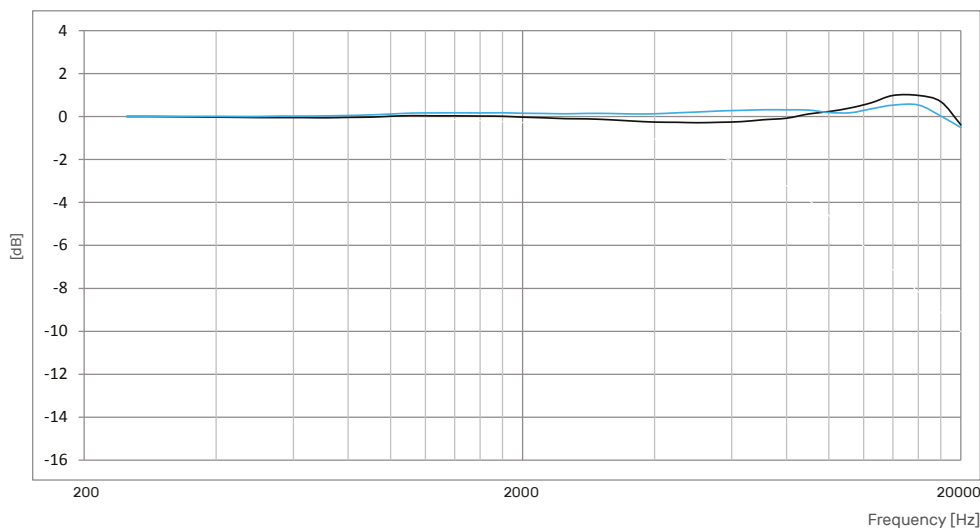
No need to compromise on the quality of your data in order to measure in warm, humid, oily & dusty environments.

## MODEL SPECIFICATIONS

### 146AE ½" CCP Free-field Rugged Microphone Set

IEC 61094 Compliance  
Freq range: 3.15 Hz to 20 kHz  
Dyn range: 18db(A) to 138 dB  
Sensitivity: 50 mV/Pa  
Temperature: -40 to +125°C  
Humidity: 0 – 95% (IP67)  
PowerOn Indicator (TEDS controlled)

### Typical Free Field Response



Frequency range and dynamic range as you know it from IEC compatible ½" measurement microphones

46AE

146AE

## ACCESSORIES

### > Replaceable shock absorption grid

Protecting the diaphragm from water, oil, dust and high-velocity particles. The grid has a built-in shock absorber, protecting the microphone from shock or drop. This grid is for measurement according to IEC61094-4 or IEC 61672 Class 1

### > Waterproof cable

IP67 rated cable, 3 meters

### > GoPro adapter

The special designed adaptor ensures compatibility with GoPro mounting accessories

### > Calibration adaptor for protection grid

For daily verification with sound calibrator and sensitivity calibration with Pistonphone. (Recommended 42AG Sound Calibrator and 42AP Intelligent Pistonphone)

### > ½" standard grid

For sensitivity calibration/verification with a Sound Level Calibrator of a Pistonphone using a standard ½" coupler adaptor (correction data is available online) and for measurement fulfilling IEC61094-4 or IEC61672 Class 1

### > Online calibration data

Continuous access to online calibration data for calibration sheet or electronic file for your system software.  
[gras.dk/e-data](https://gras.dk/e-data)

# THE BEST RESULTS EVERY TIME



At GRAS we have earned the trust of our customers. They know that we design and test measurement microphones for everyday life, where drop, shock, vibration, humidity and heat are inevitable factors.

We call these tests **GRAS HALT** "Highly Accelerated Life Tests" and they involve four types of stress tests:

- ✓ Temperature; both constant and cyclic
- ✓ Humidity at high temperature
- ✓ Vibrations; both horizontally and vertically
- ✓ Mechanical impulse involving shock and drop

It is all about securing long-term stability and robustness of measurement microphones.

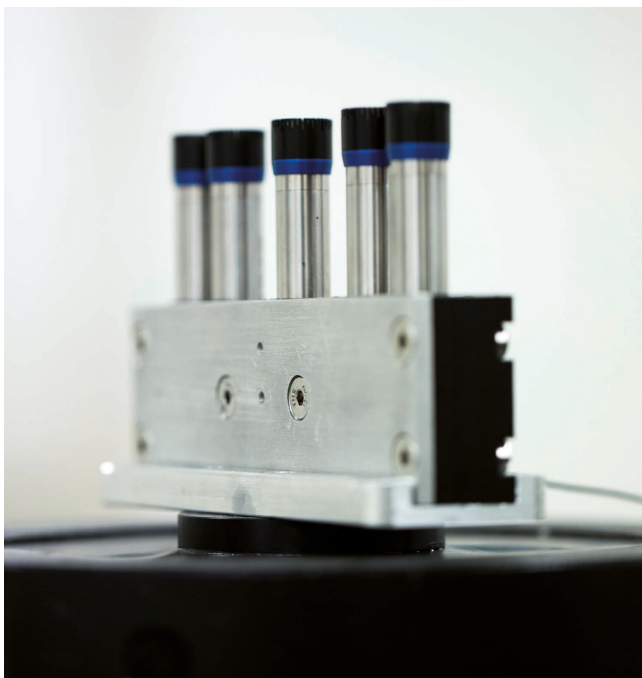
With the new rugged automotive microphone, we have elaborated our HALT test to reflect the harsh environments and conditions in NVH measurements.

#### **NVH measurement conditions**

Strong vibrations, shock, drop, extreme temperatures and wet or dusty conditions are all par for the course for a automotive microphone. And at the end of the day you need to be confident that you have valid data, reliable repeatability and minimal downtime or re-tests.

#### **The 146AE**

Is vibrated for 60 hours, kept in temperatures varying from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , dropped horizontally from 150cm onto a hard surface and finally put through a tumbling test randomly falling 100cm on a floor more than 500 times.



# THE MOST COST-EFFICIENT MEASUREMENT MICROPHONE IN YOUR WORKSHOP

It takes a flexible, high precision and rugged measurement microphone to meet all your expectations. The 146AE is the answer – setting a new standard for automotive measurement microphones where no compromise is necessary.

## **It's flexible to meet your many measurement needs:**

Using different microphones for various measurement points can result in inconsistent data and a more complex test setup. Extreme test conditions can also ruin your equipment. With the 146AE you can use the same microphone to measure in high temperatures, in high humidity or under dusty conditions. This optimizes efficiency and saves you time setting up, conducting and evaluating your entire test setup.

## **It's high precision lets you obtain valid data in challenging measurement positions:**

The consequences of inaccurate or incorrect data can be disastrous, especially if identified late in your test sequence. The unmatched stability of the 146AE and the unique PowerOn feature and on-line

calibration data means you can trust the accuracy of data from all your measurement positions.

## **It's rugged design allows it to survive NVH test conditions:**

You need to be confident that high temperatures, water or dust will not damage your equipment. You want to use your microphone on the test track or park a vehicle outside without rain or condensation damaging your equipment. And you need a microphone robust enough to be handled or even dropped avoiding rescheduling or redoing a test.

The extended lifetime due to the rugged design and the unique GRAS service where we can repair the diaphragm, will reduce your cost of ownership and improve your overall performance. We are, of course, offering our normal 5 year warranty.

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