BRÜEL & KJÆR® Vibration transducers

Artificial Mastoid Type 4930

Artificial Mastoid Type 4930 has been designed for the calibration of bone conduction hearing aids and bone vibrators used in audiometry.

It consists of a mechanical simulation of the human head, incorporating a built-in force transducer to monitor the output of the device to be calibrated.

All the components of the artificial mastoid have been selected to ensure both excellent long-term stability and accurate correspondence with the mechanical characteristics of the human mastoid.

It is designed in accordance with the International Electrotechnical Commission publication IEC 60318–6 from 2007 (formerly IEC R 373 and IEC 60373) and meets the requirements of the British Standard BS EN 60318–6 (2008).

Uses and features

Uses

- Objective measurement of hearing aid and audiometer bone vibrator parameters
- Frequency response and output determination of bone vibrators
- Design and production testing and calibration of vibration motors
- Measurement of bone conduction threshold values

Features

- Stable, reproducible simulation of the mechanical characteristics of the human head
- Built-in force transducer with high-stability characteristic
- Simulation of mechanical impedance of human mastoids
- Adjustable static force from 2 N to 8 N from 50 Hz to 10 kHz
- Compliant with IEC 60318–6 standard

Description

The artificial mastoid consists of an inertial mass, simulating the human head, mounted on a baseplate by resilient plastic spacers which surround the securing-bolts. The baseplate isolates the whole apparatus from external disturbances, such as someone bumping the table during use.

The baseplate is carried on a suspension composed of three conical springs filled with foam rubber to provide damping. The natural frequencies of this suspension, are all below 5 Hz, which is one-tenth of the low-frequency limit of the working range.

The baseplate also carries a loading-arm and its associated supports. The function of the loading-arm is to maintain the device to be calibrated reliably in position, pressing against the calibration surface of the artificial mastoid with a static force which can be adjusted between 2 and 8 N. A spring balance and level indicator are included to facilitate this adjustment. Rubber retaining bands ensure virtually massless rear support for the device under calibration.

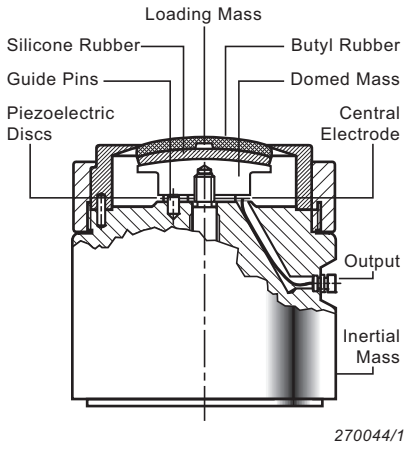


Fig. 1
Cross-sectional drawing showing the key features of the artificial mastoid

The inertial mass is shown in cross-section in Fig. 1. It weighs 3.5 kg, is machined from ECO BRASS® and is nickel-plated.

Above the inertial mass is a smaller, domed mass made of stainless steel. The two are connected by a high-strength steel bolt, which pre-loads the piezoelectric discs forming the force transducer. These discs are made of a special rubber compound.

A teflon guide pin passes through the center of each disc and is anchored in the inertial mass.

An electrode connected to the discs carries the signal to the output socket, which is a standard miniature coaxial socket with a 10-32 UNF external thread, suitable for mating with connecting cable AO-0038-D-012.

The domed mass is covered by a neoprene-rubber pad and a butyl-rubber pad*, the latter incorporating a loading-mass. This method of construction consistently produces artificial mastoids that reliably simulate the complex impedance of human skin within the specified frequency range as closely as possible.

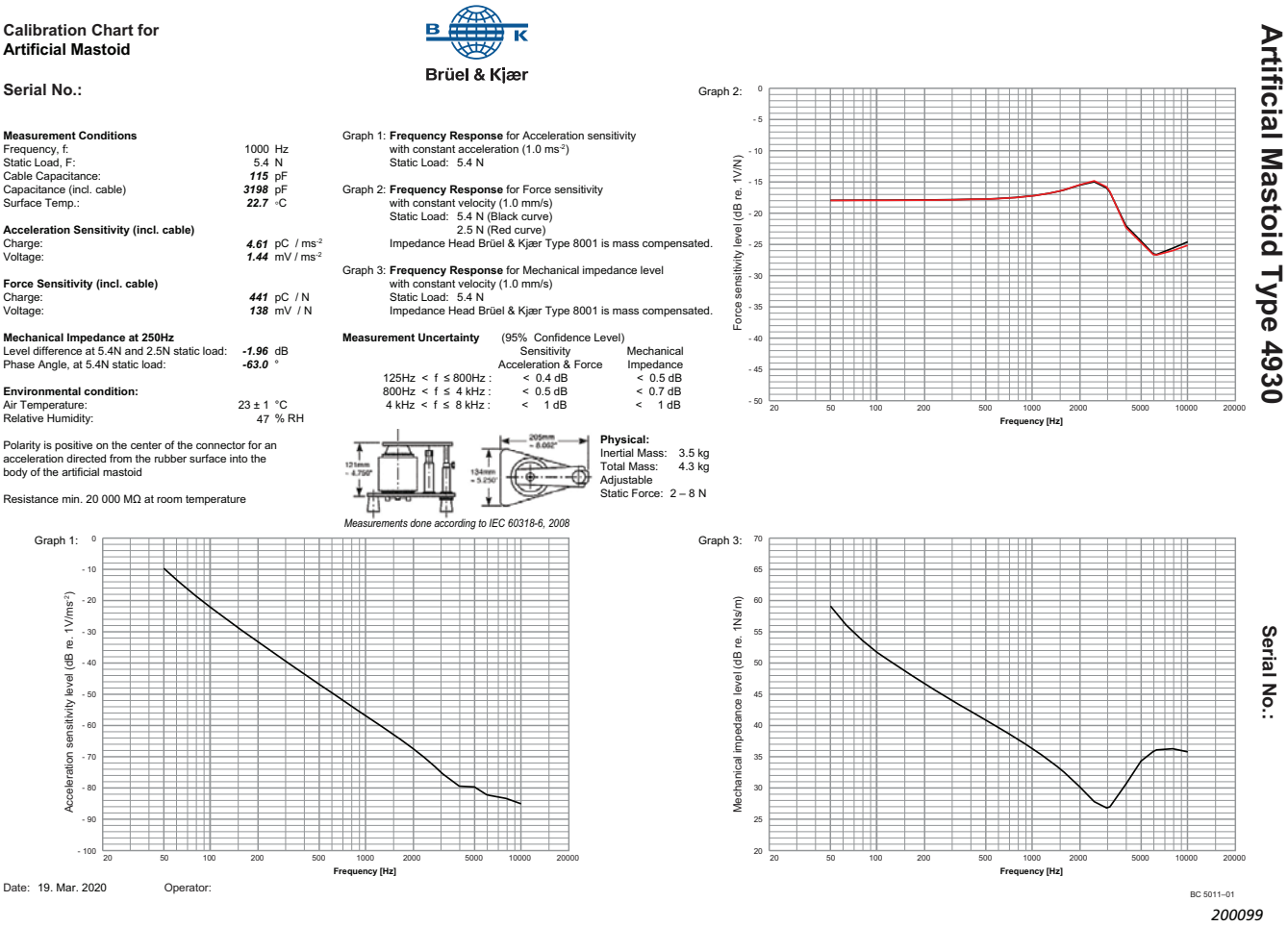
When the electrical output of the artificial mastoid is connected to suitable measurement system, the complete characteristics of bone vibration may be determined in a reproducible manner. The instrumentation output w,ill be proportional to the force variable, but if it is required to determine the acceleration characteristic of the bone vibrator, this may be readily calculated by using the calibration chart.

Each artificial mastoid is calibrated by Hottinger Brüel & Kjær and supplied with a calibration chart including three plots showing mechanical impedance, output for constant force, and output for constant acceleration, all a function of frequency (Fig. 2).

To ensure traceability to international and national calibration bodies as well as compliance with relevant standards, it is highly recommended that the Type 4930 is calibrated every year.

* The performance specifications of the rubber dome can be guaranteed for 1 year.

Fig. 2 *Individual calibration chart as delivered with the artificial mastoid showing the force sensitivity, the accelerations sensitivity and the mechanical impedance as a function of frequency*



Calibration

A turnkey system capable of performing the calibration of the artificial mastoid and associated instrumentation is useful where it is convenient or required to calibrate a complete system, instead of calibrating the instrumentation separately and then making allowances for the characteristics of the artificial mastoid.

It is also an advantage for you to be able to check that the artificial mastoid has not become damaged in use.

The key elements in such a turnkey system for calibration of the artificial mastoid could consist of the following items:

- Artificial Mastoid Type 4930
- Impedance Head Type 8001
- Mini-shaker Type 4810
- Shaker arm UA-0274
- Spring arrangement UA-0263

Mini-shaker Type 4810 is used to excite the artificial mastoid, via the Impedance Head Type 8001, which provides electrical outputs of both force and acceleration. These items are secured in position against the calibration surface of the artificial mastoid by the shaker arm, and the static force is adjusted to any value between 2 and 8 N by means of the spring arrangement.

With appropriate instrumentation, this apparatus enables measurements of force, acceleration, velocity and displacement. Keeping any one of these quantities' constant, the mechanical impedance can be determined over the frequency range specified.

The mini-Shaker, impedance head and similar associated instrumentation may also be used to take the same measurements on human mastoids and foreheads, and to determine bone conduction threshold values.

Electrical connections to both the mini-shaker and the impedance head are made by means of the same kind of miniature 10-32 UNF screw-locking coaxial connector as used on the artificial mastoid.

Transporting the Artificial Mastoid

The artificial mastoid needs to be disassembled for transport, see Fig. 3:

Fig. 3
The artificial mastoid shown disassembled in the transport case

Compliance with standards

	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China WEEE mark indicates compliance with the EU WEEE Directive
Safety	EN/IEC 61010 – 1: Safety requirements for electrical equipment for measurement, control and laboratory use ANSI/UL 61010 – 1: Safety requirements for electrical equipment for measurement, control and laboratory use
EMC Emission	EN/IEC 61000 – 6 – 3: Generic emission standard for residential, commercial and light industrial environments EN/IEC 61000 – 6 – 4: Generic emission standard for industrial environments CISPR 32: Radio disturbance characteristics of information technology equipment. Class B Limits FCC Rules, Part 15: Complies with the limits for a Class B digital device This ISM device complies with Canadian ICES – 001 (standard for interference-causing equipment)
EMC Immunity	EN/IEC 61000 – 6 – 1: Generic standards – Immunity for residential, commercial and light industrial environments EN/IEC 61000 – 6 – 2: Generic standards – Immunity for industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements **Note:** The above is only guaranteed using accessories listed in this product data
Temperature	IEC 60318 – 6: Electroacoustics – Simulators of human head and ear – Part 6: Mechanical coupler for the measurement on bone vibrators Operating Temperature: +18 to 28 °C (+64 to 82 °F) **Note:** In general, the values for the temperature dependence cannot be used directly to correct data measured at other temperatures to the reference temperature of 23 °C, as the effect of the change in mechanical impedance level on the alternating force output of the bone vibrator under test will not be known Storage Temperature: +18 to 28 °C (+64 to 82 °F)

Specifications – Artificial Mastoid Type 4930

FREQUENCY RANGE
50 Hz to 10 kHz

CHARGE SENSITIVITY TO ACCELERATION*
2 pC per ms^{-2} at 1.0 kHz

VOLTAGE SENSITIVITY TO ACCELERATION*
– 63 dB ref. 1 Volt per ms^{-2} (0.7 mV per ms^{-2}) at 1.0 kHz

CHARGE SENSITIVITY TO FORCE
300 pC/N

VOLTAGE SENSITIVITY TO FORCE*
100 mV

* Individually calibrated

CAPACITANCE
3 nF

ADJUSTABLE STATIC FORCE
2 to 8 N

CALIBRATION SURFACE AREA
1260 mm^2

INERTIAL MASS
3.5 kg (7.7 lbs)

DIMENSIONS
Height: Maximum: 165 mm (6.5 in)
Width: 205 mm (8.1 in)
Depth: 134 mm (5.3 in)

WEIGHT
3.4 kg (9.5 lbs)

Specifications - Impedance Head Type 8001 and Mini-shaker Type 4810

For full specifications of Impedance Head Type 8001, and Mini-shaker Type 4810, see product data sheets BP 0244 and BP 0232 respectively

Ordering information

Type 4930 Artificial Mastoid
Includes the following accessories:
- AO-0038-D-012: Cable, super low-noise, 10-32 UNF (M) to 10-32 UNF (M), 1.2 m (4.0 ft)
- JP-0028: Adapter, banana (M) to 10-32 UNF (F)
- 4 × YJ-0497: O-ring, ∅26.70 mm × ∅1.78 mm (inner diameter), FPM 75, according to ISO 3601
- UA-0247: Spring Balance, 1 kg
- UA-0262: Level Indicator
- KE-0067: Equipment Carrying Case

OPTIONAL ACCESSORIES

Type 8001	Impedance Head
Type 4810	Mini-shaker
UA-0274	Shaker Arm
UA-0247	Spring Balance, 1 kg, for Type 4930

Service Products

4930-CAI	Initial Accredited Calibration of Artificial Mastoid
4930-CAF	Accredited Calibration of Artificial Mastoid
4930-EW1	Extended Warranty for Artificial Mastoid for 1 year

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