

GRAS 45CA

Headphone/Hearing-protector Test
Fixture



ISO: 4869-3
IEC: 60318-1 and 60318-4
depending on configuration

The GRAS 45CA Hearing-protector Test Fixture is a versatile test fixture for measuring sound isolation of hearing-protectors according to ISO 4869-3 and ear- and headphones according to IEC60318-1 or 60318-4. For testing hearing-protectors according to ANSI/ASA S12.42, choose GRAS 45CB.

Introduction

GRAS 45CA provides the basis for reliable and exact measurements and is designed with

- A test fixture mounted on a resilient base that reduces the noise floor to a minimum in a typical test situation. Foam plugs and grease are supplied to avoid sound leakage along the cable
- A test fixture head, made for optimizing the acoustic isolation
- An acoustic cup and plug for testing the acoustic isolation
- A range of moulded-rubber KEMAR pinnae, e.g. for testing ear plugs, can be fitted

The 45CA's robust design is ideally suited for binaural testing of active and passive earplugs, as well as circumaural hearing protectors.

It is primarily intended for testing the performance of hearing-protection devices such as ear plugs and ear muffs (supra-aural and circum-aural) but can also be used for testing sound sources such as earphones and headphones. It is fitted with either microphones or ear simulators, depending on the device to test and the standard to comply with.

Compliance with ISO 4869-3, IEC 60318-1 and IEC 60318-4 assures technicians, decision makers, and authorities of repeatability and transparent data when developing and verifying hearing protectors.

The pinnae for the 45CA are basically the same as the standardized KEMAR pinnae, but rounded to fit the large 45CA base plate. This large base plate reduces or eliminates the risk of leakage.

The 45CA includes two plugs for measuring the acoustic isolation in a closed ear.

We recommend calibration prior to each use to ensure the accuracy of your measurements. The GRAS 42AP Intelligent Pistonphone or the GRAS 42AA Pistonphone are ideally suited for this task.

Typical applications and use

45CA Headphone/Hearing-protector Test Fixture, Non-configured is a versatile test platform that you can

configure to suit specific needs. The most common configurations can be ordered fully assembled, calibrated and tested from GRAS These are:

45CA-1 Headphone/Hearing-protector Test Fixture, ISO 4869-3 1" Mic. LEMO

The 45CA-1 is a configuration for testing of outside-the-ear devices, i.e. for measuring the insertion loss of ear muffs and the sound quality of headphones. In this configuration, 45CA is configured with two GRAS 40EN 1" pressure microphones. The configuration conforms with ISO 4869-3.

45CA-2 Headphone/Hearing-protector Test Fixture, ISO 4869-3 1/2" Mic. CCP

The 45CA-2 is a configuration for testing of outside-the-ear devices, i.e. for measuring the insertion loss of ear muffs and the sound quality of headphones. In this configuration, 45CA is configured with two GRAS 40AD 1/2" pressure microphones. This configuration conforms with ISO 4869-3

45CA-3 Headphone/Hearing-protector Test Fixture, IEC 60318-1 LEMO

45CA-3 is configured for measurement of insertion loss of circum-aural hearing protectors and the sound quality of headphones, with two RA0039 Ear Simulators with 40AG 1/2" externally polarized microphones. The configuration conforms with IEC 60318-1. The RA0039 cannot be used with a pinna simulator, and therefore cannot be used for measuring in-ear earphones.

45CA-4 Headphone/Hearing-protector Test Fixture, IEC 60318-1 CCP

The 45CA-4 is configured with two RA0039 Ear Simulators with 40AO 1/2" prepolarized microphones. The configuration complies with IEC 60318-1 and is used for measurements of insertion loss of circum-aural hearing protectors and sound quality of headphones. The RA0039 cannot be used with a pinna simulator, and therefore cannot be used for measuring in-ear earphones.

45CA-5 Headphone/Hearing-protector Test Fixture, IEC 60318-4 LEMO

The 45CA-5 is configured with RA0045 externally polarized ear simulators for use with pinna simulators. It can be used for measurements of the insertion loss of ear muffs and ear plugs, and the sound quality of earphones and headphones. The configuration complies with IEC 60318-4.

45CA-6 Headphone/Hearing-protector Test Fixture, IEC 60318-4 CCP

The 45CA-6 is configured with RA0045-S1 prepolarized ear simulators for use with pinna simulators. This configuration can be used for measurements of the insertion loss of ear muffs, sound quality of earphones and hearing aids. The configuration complies with IEC 60318-4.

45CA-7 Headphone/Hearing-protector Test Fixture, IEC 60318-4 LEMO, with Anthropometric Pinnae

The 45CA-7 is configured with RA0045 externally polarized ear simulators and anthropometric pinnae. It can be used for measurements of the insertion loss of ear muffs and ear plugs, and the sound quality of earphones and headphones. The configuration complies with IEC 60318-4.

45CA-8 Headphone/Hearing-protector Test Fixture, IEC 60318-4 CCP, with Anthropometric Pinnae

The 45CA-8 is configured with RA0045-S1 prepolarized ear simulators and anthropometric pinnae. This configuration can be used for measurements of the insertion loss of ear muffs, sound quality of earphones and hearing aids. The configuration complies with IEC 60318-4.

The application specific items for each of these configurations are listed under the tab Ordering Information.

System verification

For daily verification and check of your measurement setup, we recommend using a calibrator like GRAS 42AG Multifunction Sound Calibrator.

For proper sensitivity calibration, we recommend using a pistonphone like GRAS 42AP Intelligent Pistonphone.

Service

If you accidentally damage the diaphragm on a GRAS microphone, we can—in most cases—replace it at a very reasonable cost and with a short turn-around time. This not only protects your investment, but also pleases your quality assurance department because you don't have to worry about new serial numbers, etc.

Calibration

Before leaving the factory, all GRAS microphones are calibrated in a controlled laboratory environment using traceable calibration equipment.

Depending on the use, measurement environment, and internal quality control programs, we recommend recalibrating the microphone at least once a year.

Performance and warranty

The GRAS 45CA is made of components from our standard portfolio and are all manufactured of high-quality material and branded parts that were chosen and processed to ensure life-long stability and robustness. This enables us to offer 2 years warranty against defective materials and workmanship.

Exceptions: Microphones included in 45CA as for these our normal 5 year warranty apply. The warranty period for cables is 6 months.

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IEC standard		Dep. on conf.
ITU-T recommendations		P.380
CE/RoHS compliant/WEEE registered		Yes/Yes/Yes
Weight	g / oz	11.6 k / 409.18

45CA-1 and 45CA-2

Self Insertion Loss, Measured with closed ear simulators: 80 – 250 Hz > 50 dB

Self Insertion Loss, Measured with closed ear simulators: 350 – 4000 hz > 65 dB

Self Insertion Loss, Measured with closed ear simulators: 5000 – 20000 Hz > 55 dB

Specs for the GRAS 40EN 1" Externally Polarized Pressure Microphone can be found [here](#).

Specs for the GRAS 40AD 1/2" Prepolarized Pressure Microphone can be found [here](#).

45CA-3 and 45CA-4

Specs for the GRAS RA0039 Ear Simulator can be found [here](#).

Specs for the GRAS 40AG 1/2" Externally Polarized Pressure Microphone can be found [here](#).

Specs for the GRAS 40AO 1/2" Prepolarized Pressure Microphone can be found [here](#).

45CA-5 to 45CA-8

Specs for the GRAS RA0045 Ear Simulator can be found [here](#).

Specs for the GRAS RA0045-S1 Ear Simulator can be found [here](#).

GRAS Sound & Vibration reserves the right to change specifications without notice.



Included items with GRAS 45CA

Common to all configurations - and delivered when ordered non-configured

GRAS GR1085	Cover Plate, 2 pcs
GRAS GR0970	Insert
GRAS GR0974	Acoustic Cup (for acoustic isolation testing)
GRAS RA0178	1" Acoustic Plug
GRAS GR1281	Foam plug for leakage sealing (2 pcs)
GRAS MI0016	7 ml Silicon grease for leakage sealing
GRAS YY0019	Allen Key, 6 mm
GRAS YY0016	Allen Key, 2.5 mm
GRAS YY0018	Allen Key, 2 mm
GRAS YY0022	Allen Key, 1.5

Configurations

8 different pre-configurations of 45CA are available. Each of these are sold fully assembled and tested, ready for use.

45CA-1 1" Headphone/Hearing-Protector Test Fixture, ISO 4869-3 1" Mic. LEMO **For test of ear muffs**

GRAS 40EN	1" Ext. Polarized Pressure Microphone (2 pcs)
GRAS RA0017	Adapter for 1" microphone and 1/2" preamplifier (2 pcs)
GRAS RA0003	Adapter for 1/2" microphone and 1/4" preamplifier (2 pcs)
GRAS 26AS	1/4" Standard Preamplifier with 3 m integrated cable, very short (2 pcs)

45CA-2 1/2" Headphone/Hearing-Protector Test Fixture, ISO 4869-3 1/2" Mic. CCP **For test of ear muffs**

GRAS 40AD	1/2" Prepolarized Pressure Microphone, High Sensitivity (2 pcs)
GRAS RA0177	1" Microphone protection grid (2 pcs)

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GRAS RA0058	1/2" to 1" Microphone Adapter (2 pcs)
GRASGR0010	1/2" to 1/4" Adapter (2 pcs)
GRAS 26CS	1/4" CCP Preamplifier with Microdot connector, very short (2 pcs)
GRAS AA0070	3 m Microdot - BNC Cable (2 pcs)

45CA-3 Headphone/Hearing-Protector Test Fixture, IEC 60318-1 LEMO
For test of ear muffs and headphones

GRAS RA0039	Ear Simulator according to IEC 60318-1 (2 pcs)
GRAS 40AG	1/2" Ext. Polarized Pressure Microphone (2 pcs)
GRAS RA0176	1/2" to 1" Adapter for RA0039 (2 pcs)
GRAS GR0010	1/2" to 1/4" Adapter (2 pcs)
GRAS 26AS	1/4" Standard Preamplifier with 3 m integrated cable, very short (2 pcs)

45CA-4 Headphone/Hearing-Protector Test Fixture, IEC 60318-1 CCP
For test of ear muffs and headphones

GRAS RA0039	Ear Simulator according to IEC 60318-1 (2 pcs)
GRAS 40AO	1/2" Prepolarized Pressure Microphone (2 pcs)
GRAS RA0176	1/2"-1" Adapter for RA0039 (2 pcs)
GRAS GR0010	1/2" to 1/4" Adapter (2 pcs)
GRAS 26CS	1/4" CCP Preamplifier with Microdot connector, very short (2 pcs)
GRAS AA0070	3 m Microdot - BNC Cable (2 pcs)

45CA-5 Headphone/Hearing-Protector Test Fixture, IEC 60318-4 LEMO
For test of ear muffs, ear plugs, headphones and ear phones

GRAS KB0070	Large Right KEMAR Pinna, 55 Shore 00
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GRAS KB0071	Large Left KEMAR Pinna, 55 Shore 00
GRAS GR1075	Pinna Holder Plate
GRAS GR1069	Ear Canal Extension
GRAS RA0045	Externally Polarized Ear Simulator according to IEC 60318-4 (60711) (2 pcs)
GRAS GR0010	1/2" to 1/4" Adapter
GRAS 26AS	1/4" Standard Preamplifier with 3 m integrated cable, very short (2 pcs)

45CA-6 Headphone/Hearing-Protector Test Fixture, IEC 60318-4 CCP
For test of ear muffs, ear plugs, headphones and ear phones

GRAS KB0070	Large Right KEMAR Pinna, 55 Shore 00
GRAS KB0071	Large Left KEMAR Pinna, 55 Shore 00
GRAS GR1075	Pinna Holder Plate (2 pcs)
GRAS GR1069	Ear Canal Extension (2 pcs)
GRAS RA0045-S1	Prepolarized Ear Simulator according to IEC 60318-4 (60711) (2 pcs)
GRAS GR0010	1/2" to 1/4" Adapter (2 pcs)
GRAS 26CS	1/4" CCP Preamplifier with Microdot connector, very short (2 pcs)
GRAS AA0018	3 m Microdot - BNC Cable, High Temp (2 pcs)

45CA-7 Headphone/Hearing-Protector Test Fixture, IEC 60318-4 LEMO, with Anthropometric Pinnae
For test of ear muffs, ear plugs, headphones and ear phones

GRAS KB5010	Large Right Anthropometric KEMAR Pinna 35 Shore 00
GRAS KB5011	Large Left Anthropometric KEMAR Pinna 35 Shore 00
GRAS GR1075	Pinna Holder Plate
GRAS RA0045	Externally Polarized Ear Simulator according to IEC 60318-4 (60711) (2 pcs)
GRAS GR0010	1/2" to 1/4" Adapter
GRAS 26AS	1/4" Standard Preamplifier with 3 m integrated cable, very short (2 pcs)

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GRAS GR0408	Exterior Ear Canal (for calibration)
GRAS GR0409	Union Nut (for calibration)

45CA-8 Headphone/Hearing-Protector Test Fixture, IEC 60318-4 CCP, with Anthropometric Pinnae
For test of ear muffs, ear plugs, headphones and ear phones

GRAS KB5010	Large Right Anthropometric KEMAR Pinna 35 Shore 00
GRAS KB5011	Large Left Anthropometric KEMAR Pinna 35 Shore 00
GRAS GR1075	Pinna Holder Plate (2 pcs)
GRAS RA0045-S1	Prepolarized Ear Simulator according to IEC 60318-4 (60711) (2 pcs)
GRAS GR0010	1/2" to 1/4" Adapter (2 pcs)
GRAS 26CS	1/4" CCP Preamplifier with Microdot connector, very short (2 pcs)
GRAS AA0018	3 m Microdot - BNC Cable, High Temp (2 pcs)
GRAS GR0408	Exterior Ear Canal (for calibration)
GRAS GR0409	Union Nut (for calibration)

Optional accessories

KEMAR Pinnae for configurations with using IEC 60318-4 Ear Simulator

GRAS RA0172	Pinna & Ear Simulator Mounting Kit (required to hold a pinna) Included with 45CA-5 and -6.
	Note: Contains a cover plate, ear canal extension, screws and Allen key
GRAS KB0070	KEMAR Large Right Pinna Shore 55 Hearing Protector. Included with 45CA-5 and 6.
GRAS KB0071	KEMAR Large Left Pinna Shore 55 Hearing Protector. Included with 45CA-5 and 6.
GRAS KB1070	KEMAR Large Right Pinna Shore 35 Hearing Protector
GRAS KB1071	KEMAR Large Left Pinna Shore 35 Hearing Protector
GRAS KB0072	KEMAR Small Right Pinna Shore 55 Hearing Protector
GRAS KB0073	KEMAR Small Left Pinna Shore 55 Hearing Protector

GRAS KB5010	KEMAR Large Right Anthropometric Pinna for 45CA, Shore 35. Included with 45CA-7 and 8
GRAS KB5011	KEMAR Large Left Anthropometric Pinna for 45CA, Shore 35. Included with 45CA-7 and 8

Cables for LEMO configurations

GRAS AA0008	3 m LEMO 7-pin - LEMO 7-pin Cable
GRAS AA0009	10 m LEMO 7-pin - LEMO 7-pin Cable
GRAS AA0020-CL	Customized length LEMO 7-pin - LEMO 7-pin Cable (specify length in cm, e.g. -CL0500 for a 5 m cable)

Cables for CCP configurations

GRAS AA0035	3 m BNC - BNC Cable
GRAS AA0037	10 m BNC - BNC Cable
GRAS AA0039-CL	Customized length BNC - BNC Cable (specify length in cm, e.g. -CL0500 for a 5 m cable)
GRAS AE0074	BNC - BNC adapter

Power modules

GRAS 12AQ	For all configurations (dual channel LEMO/CCP)
GRAS 12AA	For externally polarized configurations only (dual channel)
GRAS 12AU	1-Channel Universal Power Module with signal conditioning and power amplifier

Power Supply +15 VDC (provides +15 VDC power to the Power Module)

GRAS AB0002	Mains/line power supply, 230 VAC (EU mains connector)
GRAS AB0006	Mains/line power supply, 230 VAC (UK mains connector)

GRAS AB0003	Mains/line power supply, 120 VAC (US mains connector)
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Calibration Equipment

GRAS 42AP	Intelligent Pistonphone, Class 0
GRAS 42AA	Pistonphone, Class 1
GRAS RA0023	Coupler for 1" microphones (Note: RA0023 is included with 42AP but optional for 42AA)
GRAS RA0287	Calibration Adapter (for in-situ verification of RA0039)
GRAS RA0157	1/2" Calibration Adapter for KEMAR Pinna (For the IEC60318-4 configuration only)

GRAS Sound & Vibration reserves the right to change accessories without notice.

We Make Microphones

Tradition

Since the establishment in 1994, GRAS has been 100% dedicated to developing and manufacturing high-quality measurement microphones and related acoustic equipment.

Innovation

We work with everybody with an interest in sound or noise within the fields of aerospace, automotive, audiology, consumer electronics, noise monitoring, building acoustics and telecommunications.

Quality

At GRAS we know that in order for you to trust your measurement results; signal quality, stability and robustness are essentials. We design and build them to perform under real life conditions – and beyond.

