

Instruction Manual

43AG/43AG-S1 Ear and Cheek Simulator



Revision History

Any feedback or questions about this document are welcome at gras@gras.dk.

Revision	Date	Description
1	17 March 2008	First Publication
2	10 September 2012	Minor corrections to specifications
3	13 May 2014	Minor corrections to parts list and specs
4	26 February 2015	Cautionary note about mounting of Cheek Plate added to page 7

This manual applies to:

Ear and Cheek Simulator Type 43AG

(with IEC 60318-4 Ear Simulator RA0045 and 1/4" Preamplifier Type 26AC)

Ear and Cheek Simulator Type 43AG-S1

(prepolarised version fitted with Ear Simulator RA0045-S1 and 1/4" Preamplifier Type 26CB)

In this manual, text and illustrations are displayed for Type 43AG.

If you have purchased Type 43AG-S1:

- substitute Type 26AC for Type 26CB
- substitute RA0045 for RA0045-S1.

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1 Introduction

Type 43AG represents the section of a head that is important for realistically reproducing the acoustic properties of the ear of an average human head.

1.1 Typical Applications

- Earphone testing, both concha and insert types
- Headphone and headset testing, both circum-aural and supra-aural types
- Hearing-aid testing, all common types
- Telephone handset testing

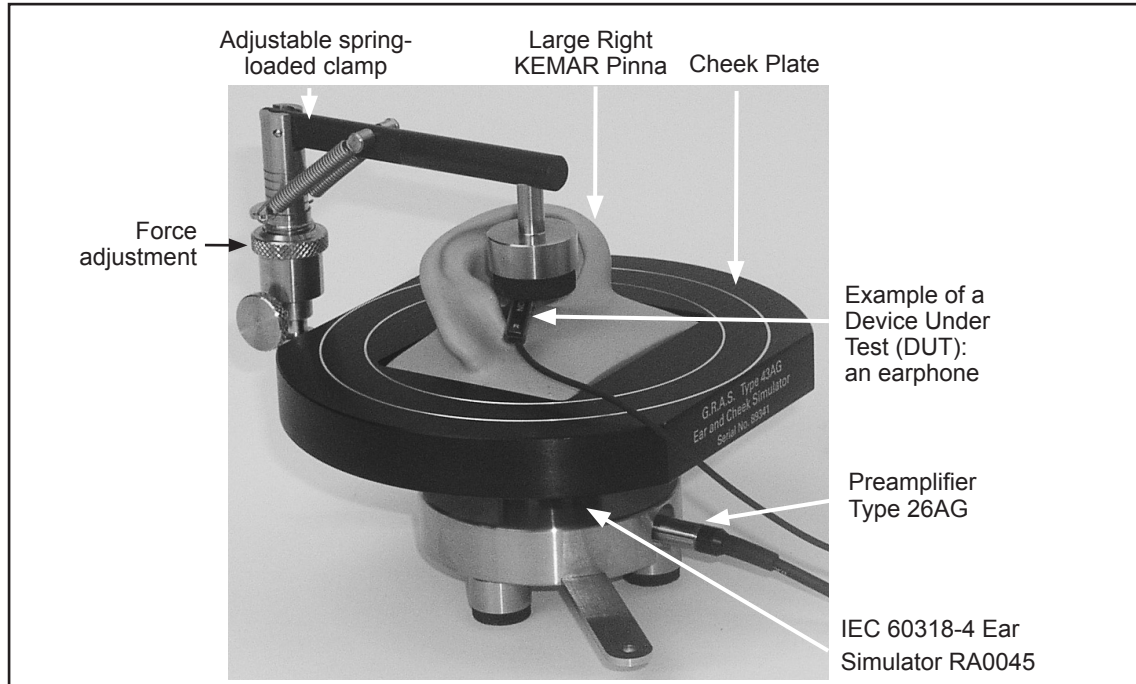


Fig. 1.1 Typical application of the Ear and Cheek Simulator Type 43AG: testing earphones.
All displayed components, except DUT, are supplied.

1.2 Special Features

- Applicable for both right and left KEMAR pinnae
- Spring-loaded clamp applying adjustable force to the device under test - for clearly defined test conditions
- Two devices supplied for securely holding test objects in their prescribed positions:
 - Standardized disc for large objects such as headphones
 - Index finger simulator for in-the-ear devices such as earphones

1.3 Standards

- IEC 60959
- IEC 60318-4 (former IEC 60711)
- ITU-T Rec. P.57 Type 2 Artificial Ear
- ITU-T Rec. P.57 Type 3.3 Pinna Simulator

2 Delivered components

Check that all components in the carrying case are present.

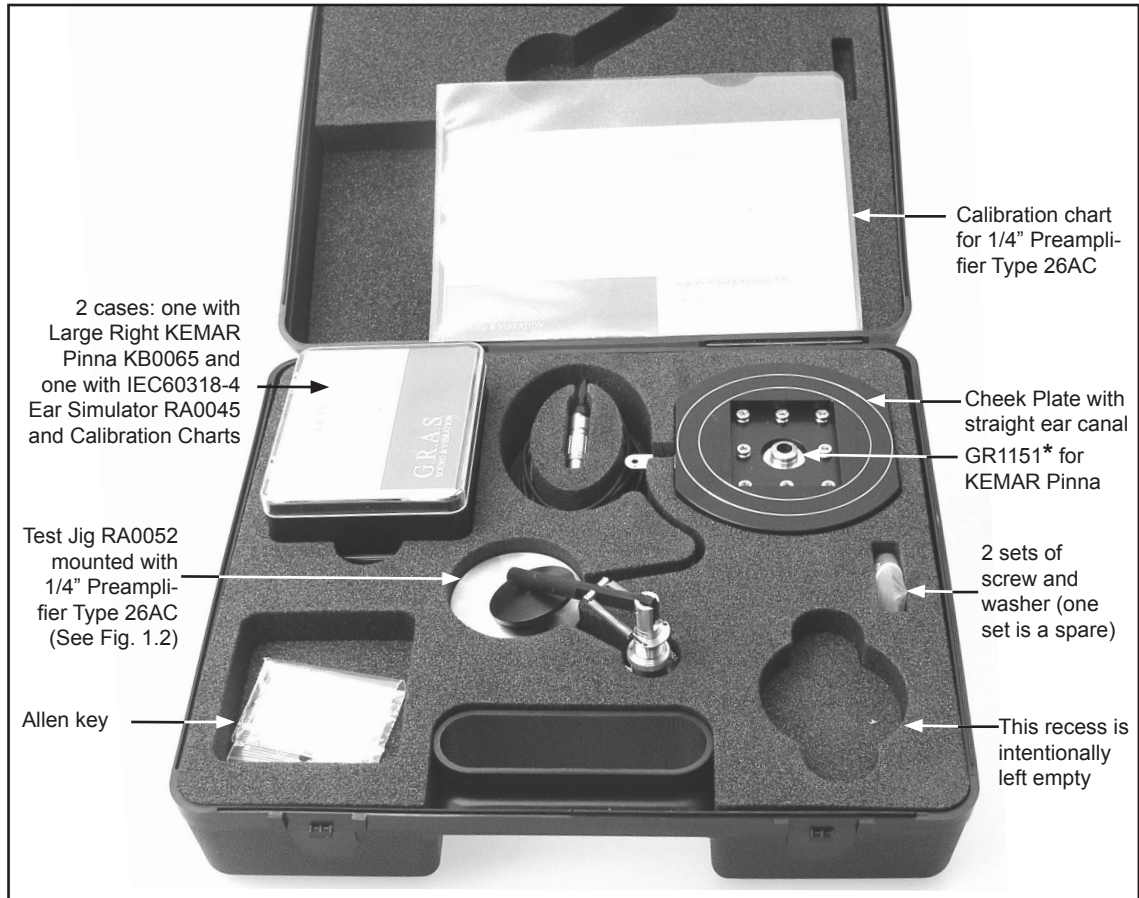


Fig. 2.1 Carrying case with all delivered components

*) The straight ear canal shown above is made of steel.

As of serial no. 81280, these ear canals are being made of black plastic.

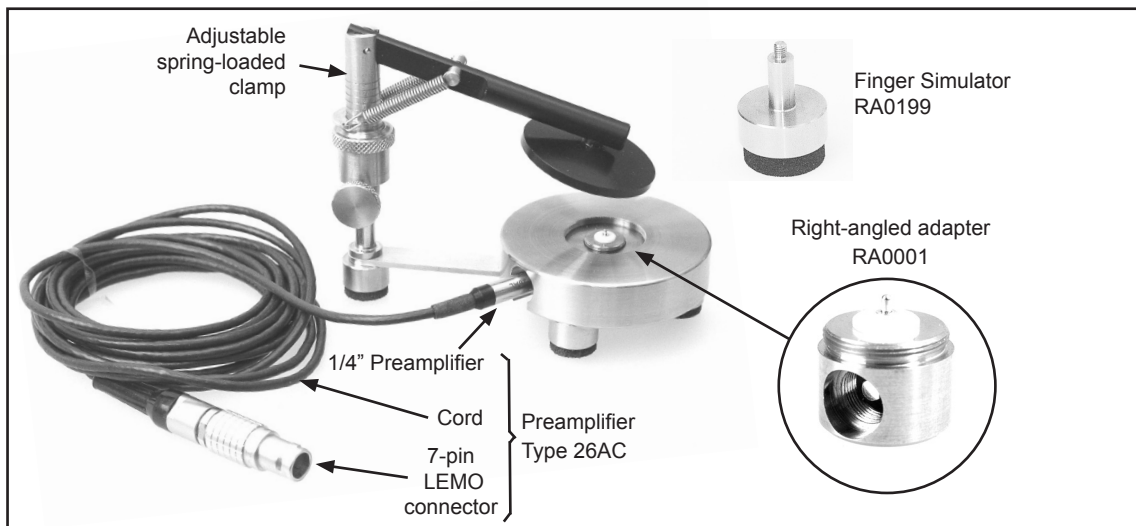


Fig. 2.2 Test Jig RA0052 fitted with Preamplifier Type 26AC (1/4" Preamplifier 26AC incl. cord and 7-pin LEMO connector), RA0001 (Right-angled Adapter), spring-loaded clamp, and Finger Simulator RA0199

3 Assembly: Mounting the Cheek Plate onto the Test Jig

1. Fig. 3.1: On the Test Jig, A: Slacken the knurled screw, B.
2. Remove the spring-loaded clamp, C .

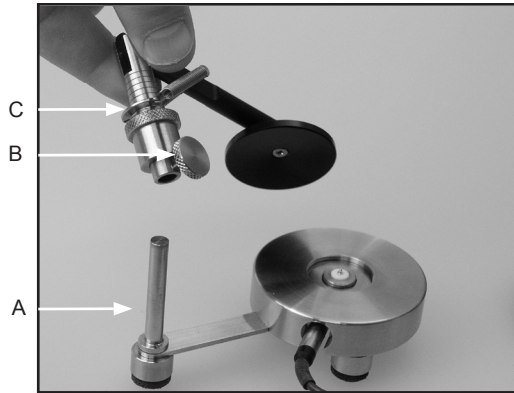


Fig. 3.1

3. Fig. 3.2: Unscrew the foot, D.
4. Remove the pin, E.

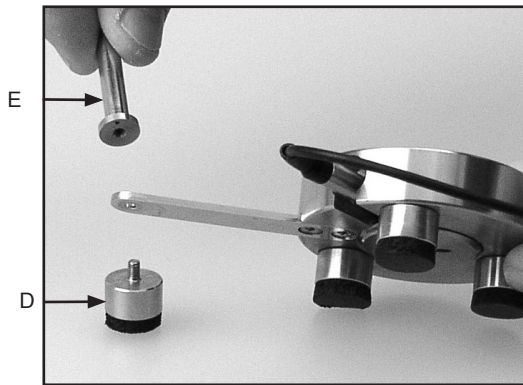


Fig. 3.2

5. Fig. 3.3: On the Cheek Plate, F: Mount the pin, E, onto the flat-arm, G, using one of the supplied sets of screw and washer, H, and the allen key, I:

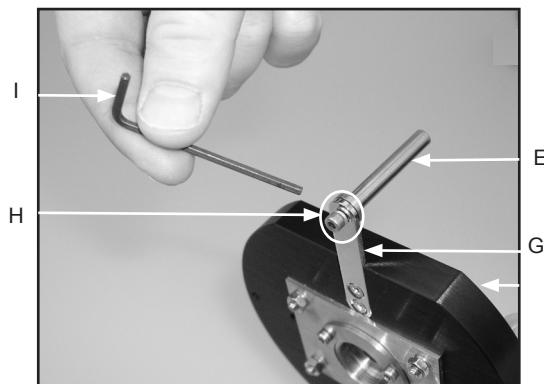


Fig. 3.3

6. Mount the spring-loaded clamp onto the pin:

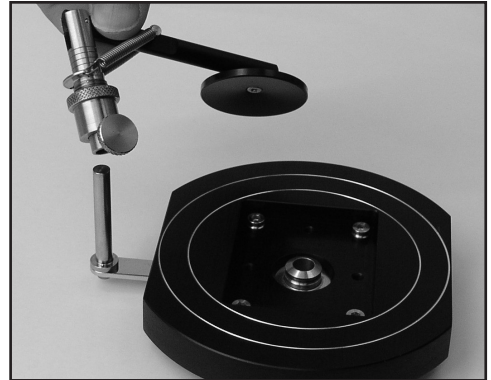


Fig. 3.4

7. Remove the Union Nut and External-ear Simulator from the Ear Simulator RA0045:

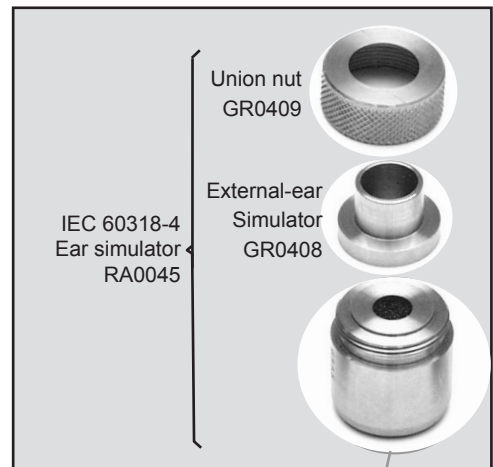


Fig. 3.5

8. GENTLY screw the ear simulator onto the Test Jig. **NB!** Do not screw too tightly; i.e., use your fingers only, no tools:

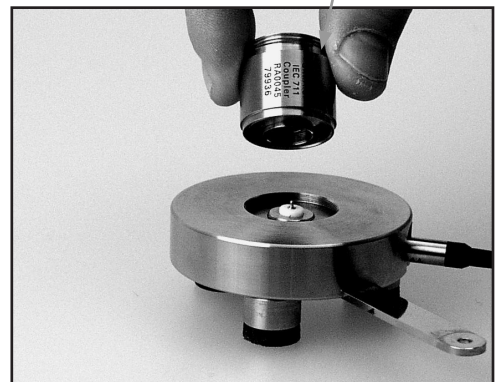
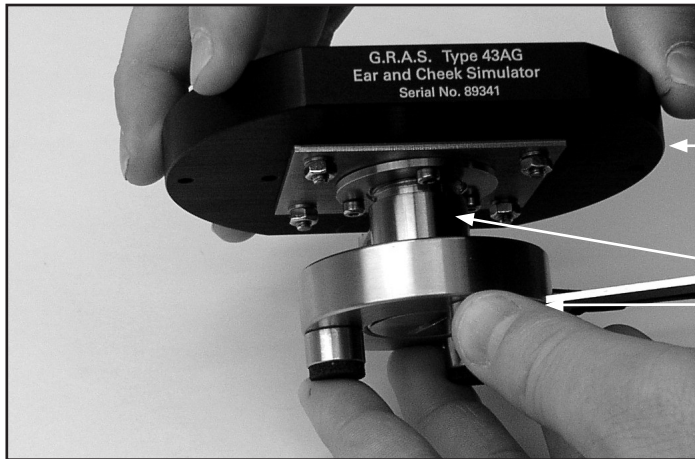


Fig. 3.6

9. GENTLY screw the Test Jig / Ear Simulator assembly onto the Cheek Plate:



GENTLY turn the Cheek Plate clockwise.

CAUTION!

Stop turning IMMEDIATELY when the resistance to turning starts to increase.

The large mass and diameter of the cheek plate relative to the ear simulator makes it easy to apply too much force. Doing this will jeopardize the calibration.

Ear Simulator

Hold Test Jig in place

Fig. 3.7

10. Place the KEMAR Pinna into the recess of the Cheek Plate.

For right pinnae, correct orientation is as shown:



Fig. 3.8 Note orientation of right pinna

11. For left pinnae, correct orientation is as shown:



Fig. 3.9 Note orientation of left pinna

- 12 The Ø 39-mm dish factory-mounted on the spring loaded clamp will hold large test objects such as headphones in place:



Fig. 3.10 Correct configuration for headphones

13. If testing earphones and other small in-the-ear devices, remove the Ø 39-mm dish, and mount Index Finger Simulator RA0199 (supplied):

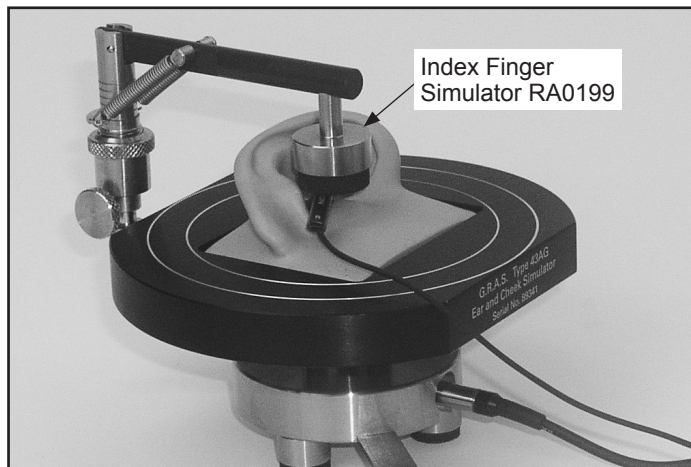


Fig. 3.11 Correct configuration for earphones

4 Calibration: Using Pistonphone Type 42AP (or Type 42AA)

NB! For information about operating the pistonphones, refer to the manual “Pistonphones Types 42AA / 42AP”.

There are two options for calibrating the Ear and Cheek Simulator Type 43AG:

4.1 Calibration Option 1: Pistonphone and Calibration Adapter RA0157

Using this calibration method, there is no need to disassemble the IEC 60318-4 Ear Simulator from the Cheek Plate:

1. Remove the pinna simulator from the Cheek Plate:

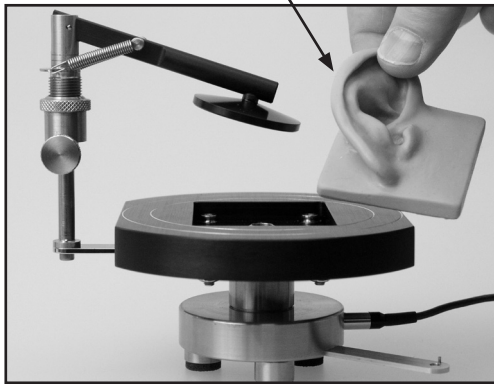


Fig. 4.1

3. Mount the Calibration Adapter RA0157 into the pistonphone:

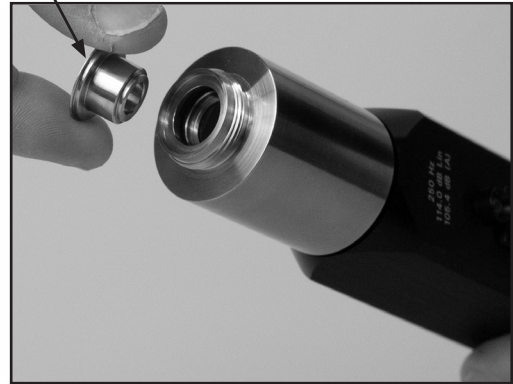


Fig. 4.3

2. Remove the pistonphone's retention collar:

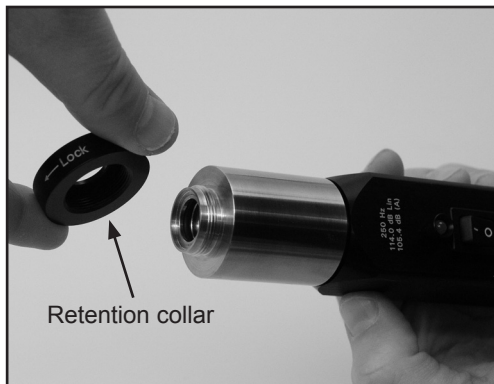


Fig. 4.2

4. a. Switch on the pistonphone via the I/O button.
b. Check that the LED is showing green.
c. Place the pistonphone (Type 42AP shown) carefully onto the ear canal.

NB! Hold the pistonphone strictly vertically.

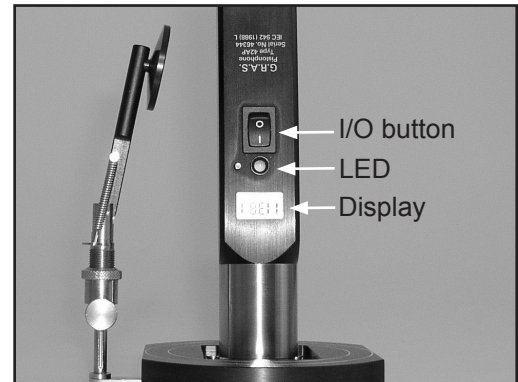


Fig. 4.4

5. When using Pistonphone Type 42AP AA), the correction factor for this setup is -0,62 dB. Hence, your analyzer should ideally read:
 $114.00 \text{ dB} - 0.62 \text{ dB} = 113.38 \text{ dB}$.

4.2 Calibration Option 2: Pistonphone and External-Ear Simulator GR0408

1. To gain access to the IEC Ear Simulator RA0045, unscrew the cheek plate from the Ear Simulator / Test Jig assembly:

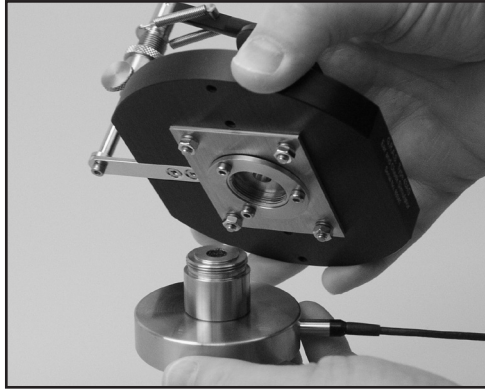


Fig. 4.5

- 2.. Mount the External-Ear Simulator GR0408 using Union Nut GR0409 (parts of IEC 60318-4 Ear Simulator RA0045):

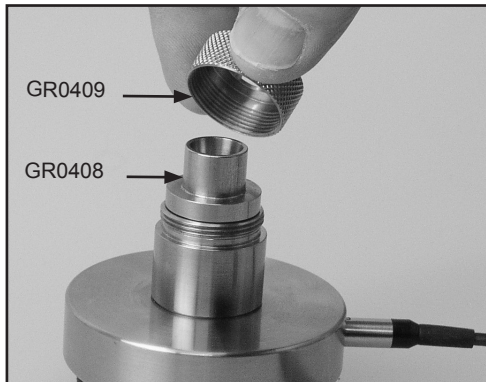


Fig. 4.6

3.
 - a. Switch on the Pistonphone via the I/O button.
 - b. Verify the LED is showing green.
 - c. Mount the pistonphone (Type 42AP shown) onto the External-Ear Simulator.

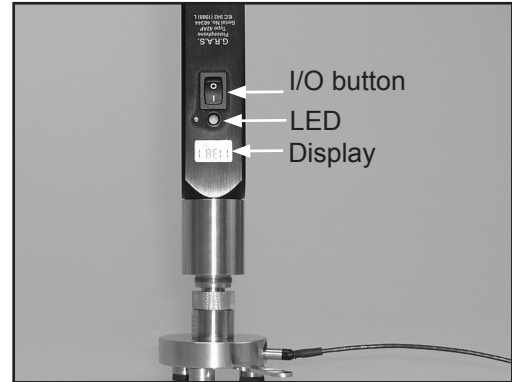


Fig. 4.7

4. When using Pistonphone Type 42AP (42AA), the correction factor for this setup is -1.03 dB.

Hence, the analyzer should ideally read:

$$114.00 \text{ dB} - 1.03 \text{ dB} = 112.97 \text{ dB}.$$

5 Test Setup

5.1 Adjusting the Force applied to the Device under Test

Referring to Fig. 5.1 below: The position of the spring-connected plate (A) determines the force the spring-loaded arm applies to the device under test:

1. Adjust the screw (B) for the plate (A) to step between the grooves 1-7.
2. Use a force gauge (Fig. 5.3) to determine the force applied for each groove.

A force gauge is available from G.R.A.S. - see section 8.

Note: If a maximum force of 8 N (Fig. 5.1) is insufficient, high-tension can be supplied - see section 8 *What to Order*.

Warning! When mounting and dismounting springs, always use a plier to prevent injuries to your hands.

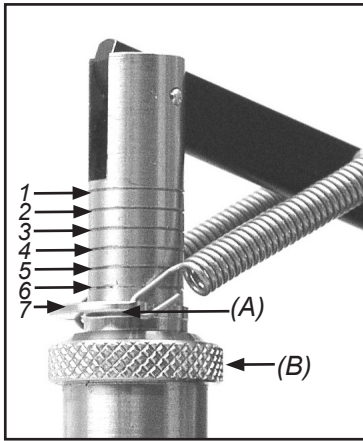


Fig. 5.1 The plate (A) adjusted to groove 7 leads to maximum force (approx. 8 N)

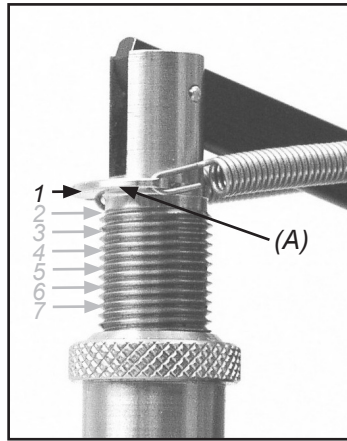


Fig. 5.2 The plate (A) adjusted to groove 1 leads to minimum force (approx. 1 N)



Fig. 5.3 Force measured for an angle of 90°

5.2 Adjusting the spring-loaded clamp's height above the Cheek Plate

Fig. 5.4: Slacken the knurled screw, A, to adjust the height of the spring-loaded clamp:

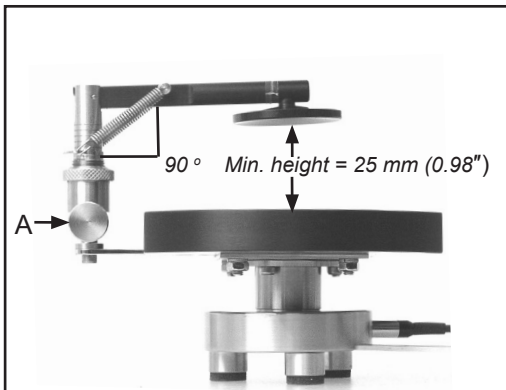


Fig. 5.4

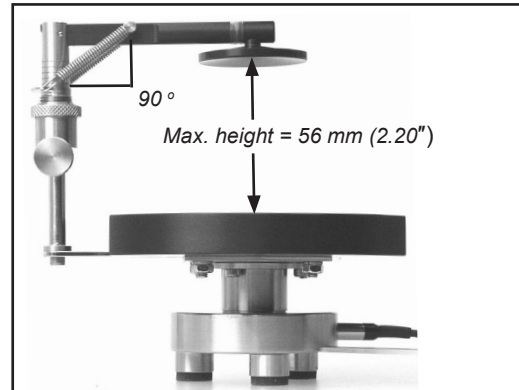


Fig. 5.5

5.3 Typical Test Setup

Fig. 5.6 shows at test setup: An electroacoustic analyzer both applies the input signal to the device under test and analyses the output.

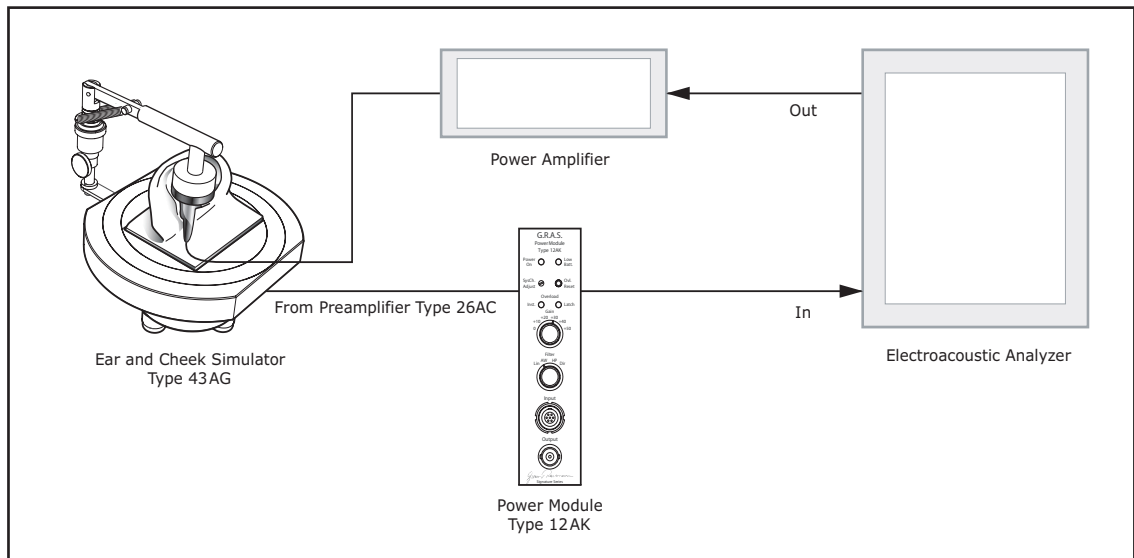


Fig. 5.6 Typical test setup for Type 43AG

The Power Module Type 12AK and the Power Amplifier displayed in Fig. 5.6 above can be replaced by a single unit, the G.R.A.S. Power Module Type 12AP (combined microphone conditioning and DUT (device under test) power amplifier).

6 Cleaning

To clean the Pinna: remove it from the cheek plate, and clean it using a soft brush, a drop of washing-up liquid, and luke-warm water.

7 Technical specifications

7.1 Ear and Cheek Simulator Type 43AG

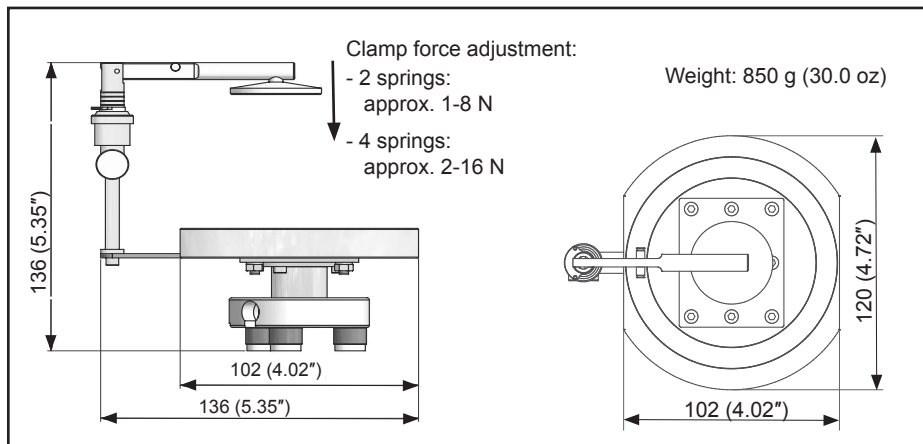


Fig. 7.1 Dimensions in millimeters (and inches) and weight in gram (and ounces) of Type 43AG

Clamp Force Adjustment

As of July 2014, 43AG is delivered with a clamp that can hold 4 springs. For previous versions of 43AG, designed for two springs only, the High-tension Kit RA0196 is available. This kit, including four springs, is offered for replacement of the top of 43AG (RA0052).

Number of springs	Force range
1	1-8 N
2	2-16 N

7.2 Specifications KEMAR Pinna KB0065 and Ear Canal GR1151

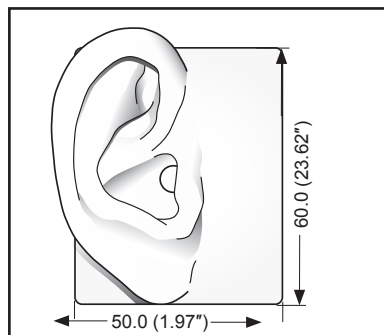


Fig. 7.2 Dimensions in millimeters (and inches) of KEMAR Pinna base

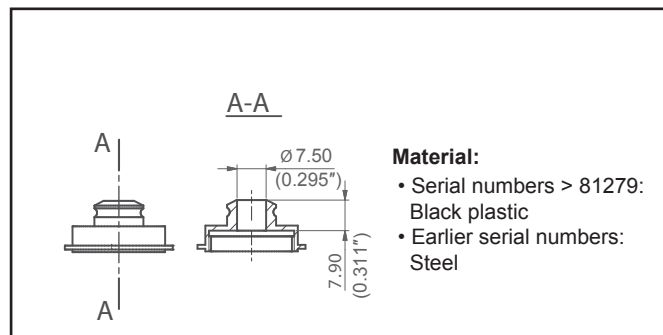


Fig. 7.3 Dimensions in millimeters (and inches) and material spec. of Ear Canal GR1151

7.3 IEC60318-4 Ear Simulator RA0045 and RA0045-S1

- RA0045 part of 43AG
- RA0045-S1 part of 43AG-S1

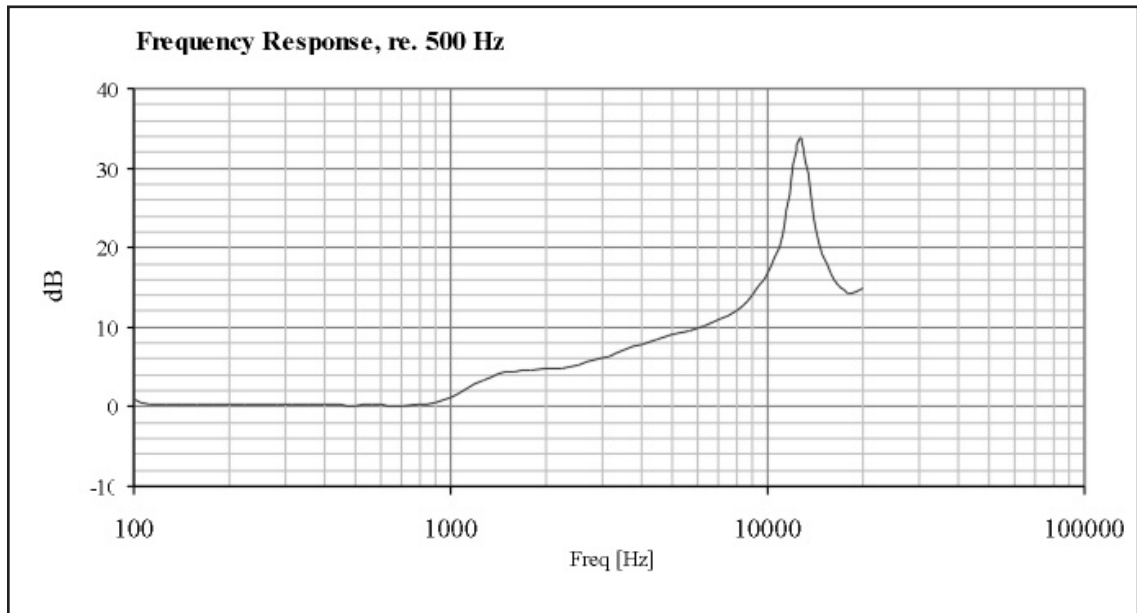


Fig. 7.4 Typical Ear Simulator frequency response re. 500 Hz, of RA0045 and RA0045-S1

Standards *:

- IEC 60959 Ear Simulator § 3.3 and § 3.4
- IEC 60318-4 (former IEC 60711)
- ITU-T Rec. P.57 Type 2 Artificial Ear
- ITU-T Rec. P.57 Type 3.3 Pinna Simulator

Resonant frequency: 13.5 kHz \pm 1 kHz

Effective volume @ 500 Hz: 1260 mm³

Weight: 52 g

Environmental calibration conditions:

Temperature: 23 °C \pm 3 °C

Relative humidity: 60 % \pm 20 %

Barometric pressure: 101.3 kPa \pm 3 kPa

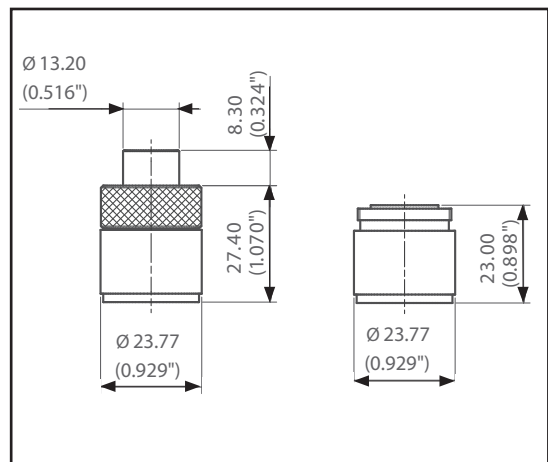


Fig. 7.5 Dimensions in millimeters (and inches) of RA0045 and RA0045-S1

* See also section 7.6 Former and Present Names of Relevant IEC Standards

		43AG	43AG-S1
Theoretical dynamic range lower limit with G.R.A.S. preamplifier	dB(A)	25	25
Theoretical dynamic range upper limit with G.R.A.S. preamplifier @ +28 V / ± 14 V power supply	dB	154	150
Theoretical dynamic range upper limit with G.R.A.S. preamplifier @ +120 V / ± 60 V power supply	dB	166	
Set sensitivity @ 250 Hz (± 3 dB)	mV/Pa	12.5	12
Set sensitivity @ 250 Hz (± 3 dB)	re 1V/Pa	-38.1 dB	-38.5 dB
Coupler volume		Complex	Complex
Resonance frequency	kHz	13.5 (ear sim)	13.5 (ear sim)
Temperature range, operation	$^{\circ}\text{C}$ / $^{\circ}\text{F}$	-30 to 60 / -22 to 140	-30 to 60 / -22 to 140
Temperature coefficient @250 Hz	dB/ $^{\circ}\text{C}$ / dB/ $^{\circ}\text{F}$	- 0.01/ -0.006	- 0.01/ -0.006
Humidity range non condensing	% RH	0 to 80	0 to 80
ANSI standard		S3.7	S3.7
IEC standard		60318-4 (former 60711)	60318-4 (former 60711)
ITU-T recommendations		P.380	P.380
CE/RoHS compliant/WEEE registered		Yes/Yes/Yes	Yes/Yes/Yes
Connector type		3 m 7-pin LEMO	Microdot
Weight	g / oz	1.95 / 68.784	

7.4 Former and Present Names of Relevant IEC Standards

Present name	Former name
IEC 60318-4	IEC 60711
IEC 60318-1 and -2	IEC 60318
IEC 60318-5	IEC 60126
IEC 60318-3	IEC 60303

8 What to Order

Alternative Ear Simulators

The modular design of G.R.A.S.'s Artificial Ear System allows you to use the Ear and Cheek Simulator Type 43AG / 43AG-S1 for measurements based on several other standardized G.R.A.S. ear simulators:

1. IEC 60318-5 2cc Coupler with ½" microphone

IEC 60318-5 2cc Coupler RA0038

½" Pressure-field Microphone Type 40AG (for Type 43AG)

½" Prepol. Pressure-field Microphone Type 40AO (for Type 43AG-S1).

2. IEC 60318-5 2cc Coupler with 1" microphone

(Configuration only available for Type 43AG)

IEC 60318-5 2cc Coupler RA0113

1" Pressure-field Microphone Type 40EN

Adapter Plate RA0076.

3. IEC 60318-3 6cc Coupler / NBS-9A Coupler with 1" microphone

(Configuration only available for Type 43AG)

IEC 60318-3 6cc Coupler / NBS-9A Coupler RA0075

1" Pressure-field Microphone Type 40EN

Adapter Plate RA0076.

4. IEC 60318-1 Ear Simulator with ½" microphone

IEC 60318-1 Ear Simulator RA0039

½" Pressure-field Microphone Type 40AG (for Type 43AG)

½" Prepol. Pressure-field Microphone Type 40AO (for Type 43AG-S1).

5. IEC 60318-4 Ear Simulator

No additional parts required.

Optional KEMAR Pinnae

Hardness 55 Shore OO (hard)

Small Right Pinna: KB0060

Small Left Pinna: KB0061

Large Right Pinna (included): KB0065

Large Left Pinna: KB0066

Large Right Pinna (VA-style): KB0090

Large Left Pinna (VA-style): KB0091

Hardness 35 Shore OO (soft)

Small Right Pinna: KB1060

Small Left Pinna: KB1061

Large Right Pinna: KB1065

Large Left Pinna: KB1066

Large Right Pinna (VA-style): KB1090

Large Left Pinna (VA-style): KB1091

Calibration Equipment

Pistonphone, built-in precision barometer (250 Hz or 251.2 Hz, 114 dB \pm 0.05 dB): (recommended) or	Type 42AP
Pistonphone (250 Hz, 114 dB \pm 0.08 dB):	Type 42AA
Required for the IEC 60318-4 Configuration: ½" Calibration Adapter for KEMAR pinnae:	RA0157
Force Gauge (0 - 25 N):	RA0184

Power Supply & Signal Conditioning

For both Type 43AG and 43AG-S1:

Power Module, programmable, dual-channel:	Type 12AQ
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For Type 43AG:

Power Module, single-channel:	Type 12AK
Power Module, dual-channel:	Type 12AA
Built-in power amplifier, built-in power amplifier:	Type 12AP

For Type 43AG-S1:

Power Module, CCP, single-channel	Type 12AL
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Cables

3-m Microphone Extension cable, 7-pin LEMO to 7-pin LEMO (for Power Modules Types 12AQ, 12AK, 12AA, and 12AP)	AA0008
2-m Extension Cable BNC to BNC, 50 Ω (for Power Modules Type 12AL)	AA0034

Additional Accessories

Retrofit High-tension Spring Kit:	RA0196
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Manufactured to conform with:

CE marking directive:
93/68/EEC



WEEE directive:
2002/96/EC



RoHS directive:
2002/95/EC

