G.R.A.S.
SOUND & VIBRATION

Instruction Manual

43AF 1” 6cc Coupler Kit according to IEC 60318-3

Revision History

Revision	Date	Description
1	30 May 2017	Extracted from Earbook as separate document

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Trademarks

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Introduction

The 43AF 1" 6cc Coupler Kit is a complete test jig for acoustically testing telephone handsets and earphones and complies with the following international requirements:

- ANSI S 3.7 – 1995 – American National Standard for Testing Earphones.

Components

The 43AF comprises the following main components:

- RA0075 NBS 9A Coupler, see Appendix page 11 for more detail
- RA0076 Thread Adapter
- 40EN 40EN 1" Microphone in Type L [1] (W.E. 640-AA) configuration
- 26AC ¼" Preamplifier (used with Adapter RA0001 instead of GR0010)
- RA0052 Test Jig

When assembled as shown in Fig. 1, it is ready for testing earphones and headphones (see example in Fig. 2). An exploded view of its user-serviceable components is shown in Fig. 5.

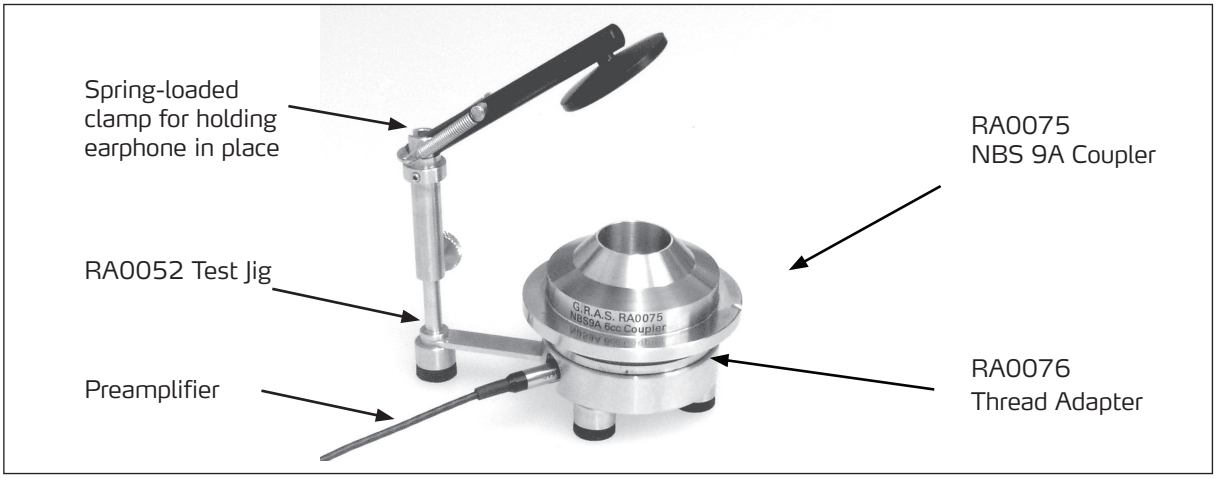

Fig. 1. *Assembled 43AF*

Additional Equipment

The following additional equipment is required for making the necessary measurements:

1) Power supply for the 26AC ¼" Preamplifier Type, e.g. the G.R.A.S. 12AK Power Module
2) Calibration source for the microphone, e.g. the G.R.A.S. 42AA Pistonphone which produces 114 dB re. 20 µPa (10 Pa) at 250 Hz. **Note.** The pistonphone must be fitted with an RA0023 coupler for calibrating 1" microphones.
3) Audio signal generator capable of generating one or more of the following within the audio frequency range [2]:

- logarithmically swept tones
- pink noise

This audio signal is fed (directly or indirectly) to the earphone.

[1] ASA Z 24.8-1949
[2] For example from 50 Hz to 10 kHz

Fig. 2. *Example of a supra-aural earphone mounted on the test jig*

4) Audio frequency analyser capable of one or both of the following:
   - wide band measurement
   - ⅓ octave-band measurement

The audio analyser receives, via the 12AK Power Module, the signal picked up by the Artificial Ear, and, depending on whether this is a swept tone or pink noise, will:

a) measure the response of the earphone to the swept tone

Or

b) measure the response of the earphone to the pink noise in terms of ⅓ octave bands

Items 3 and 4 could be combined in the same unit, e.g. a computer fitted with suitable hardware and software for A/D and D/A conversions in order to simulate both a signal generator and an analyser. Fig. 3 shows a block diagram of a possible set-up for making tests.

Test Procedure

The 4 stages of the Test Procedure

The basic stages in the test procedure are:

1) Setting up the test jig, e.g. as shown in Fig. 3
2) Calibration using the G.R.A.S. 42AA Pistonphone
3) Mounting the earphone on the test jig (see example shown in Fig. 2)
4) Applying a signal to the earphone and analysing the output from the 43AF.
   Depending on requirements, the signal applied to the earphone could be:
   - a swept tone, e.g. under laboratory conditions
   - pink noise, e.g. during mass production of mobile telephones

   Pink noise testing is usually quicker, and more economical, than using swept tones.

The following sections deal in more detail with each stage of the test procedure.

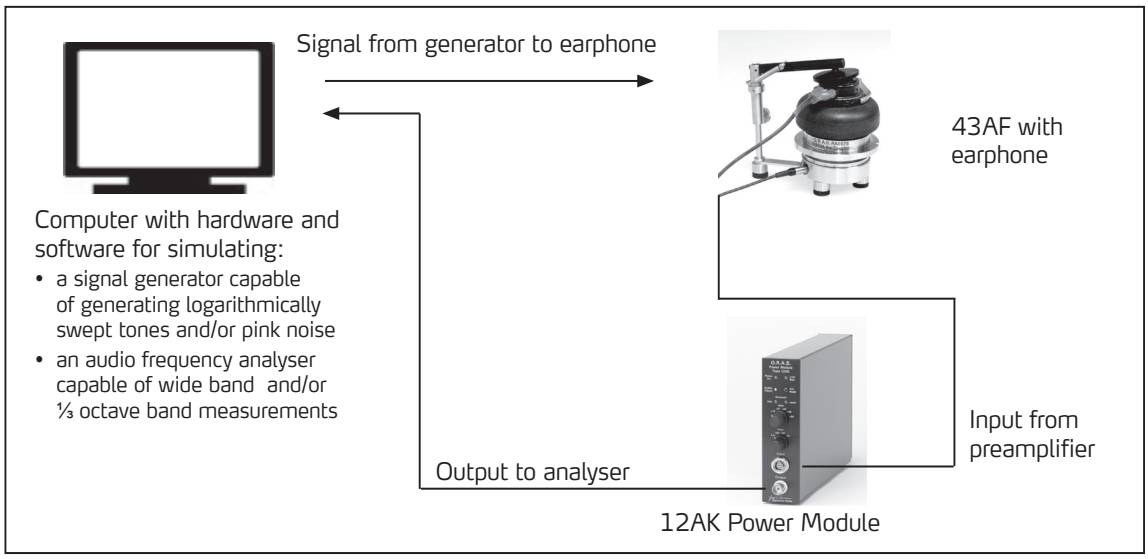

Fig. 3. *Block diagram of a complete set-up for making tests*

1: Setting up the Test Jig

Note: the terms generator and analyser refer to a set up which simultaneously sends the test signal to the earphone and analyses the signal picked up by the 43AF.

With the Artificial Ear assembled as shown in Fig. 1 and everything switched on, proceed as follows:

1) 12AK Power Module
- Connect the free end of the preamplifier cable to the Lemo **Input** socket.
- Connect, via a suitable cable, the BNC **Output** to the input of the analyser.
- Select **Lin**.
- Select a **Gain** that is within the input range of the analyser.

2) Earphone
- Connect the earphone to the signal output of the generator.

3) Adjust the signal output level from the generator to lie within the normal working range of the earphone.

2: Calibration

For this, access to the microphone is necessary. This means partially dismantling the test jig.

1) Snap the spring-loaded clamp (see Fig. 1) to its upright position, or remove it.
2) Unscrew the RA0075 NBS 9A Coupler (but not the RA0076 Thread Adapter) and carefully remove it from the test jig. The microphone is now accessible.
3) Place the coupler of the Pistonphone over the microphone, push it gently down to the microphone stop and switch on (see Fig. 4).
4) Set the analyser to either wide band or to the ⅓ octave band whose centre frequency is 250 Hz.

Fig. 4. *Calibration using the Pistonphone*
a) Place coupler over microphone, push gently down to microphone stop
b) Switch on

5) When conditions are stable, adjust the analyser so that it correctly gauges the Pistonphone signal (nominally 114 dB re. 20 µPa). See Pistonphone manual for making barometric corrections.
6) Switch the Pistonphone off and remove it from the microphone.
7) Screw the RA0075 NBS 9A Coupler carefully back in place; do not use excessive force.

3: Mounting the Earphone on the Test Jig

You may have to detach the earphone from its yoke before proceeding.

1) Place the earphone centrally on the Artificial Ear so that it transmits directly into the NBS 9A Coupler.
2) If necessary, use the spring-loaded clamp to hold the earphone in place, see Fig. 1.

4: Applying the Test Signal and Analysing the Output from the Microphone

The following describes typical procedures for applying:

a) a swept signal
b) pink noise
and shows some typical results.

In both cases, it is assumed that the generator and analyser work to produce constant-confidence results (i.e. maintaining a constant β T product) in real time throughout the frequency range of interest and make the measurement data available graphically and numerically.

Swept Signal

With everything set up as described above, proceed as follows:

a) set the generator to oscillator mode
b) set the analyser to flat response
c) initiate a constant-level logarithmic sweep [3] on the generator.
The analyser will follow the response of the Artificial Ear to the earphone throughout the sweep and record and display the results accordingly (see example in Fig. 5).

[3] For example from 50 Hz to 10 kHz

Pink noise

With everything set up as described above, proceed as follows:

a) set the generator to pink noise mode and start generating.

b) set the analyser to ⅓ octave-band mode [4] and wait until conditions are stable.

c) start the analyser.

The analyser will record the response of the Artificial Ear to the earphone for each ⅓ octave band and record and display the results accordingly (see example in Fig. 6).

In both cases, curves showing the upper and lower tolerance levels for the frequency range of interest could be superimposed on the graphical displays.

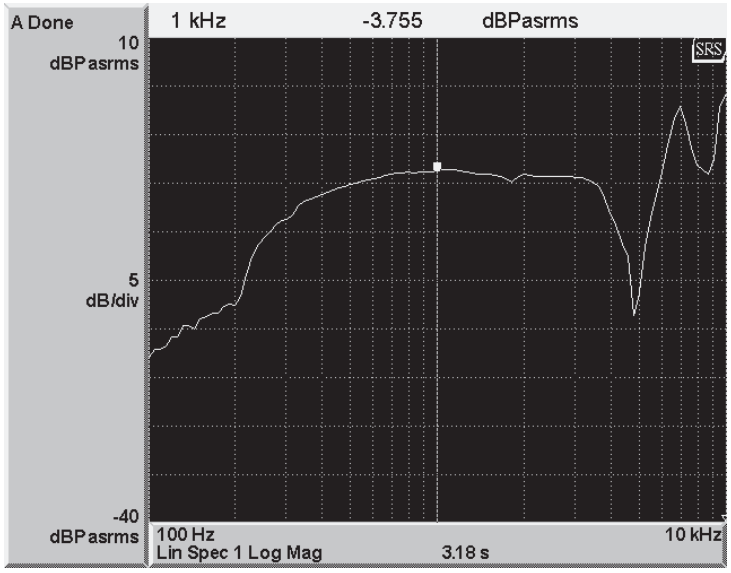

Fig. 5. *Example of test results using a swept tone*

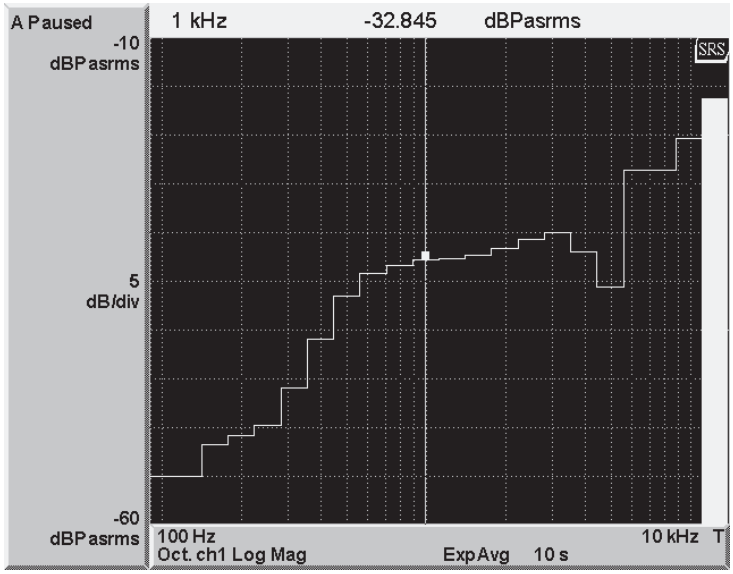

Fig. 6. *Example of test results using ⅓ octave-band analyses*

[4] For example from 50 Hz to 10 kHz

User Serviceable Components

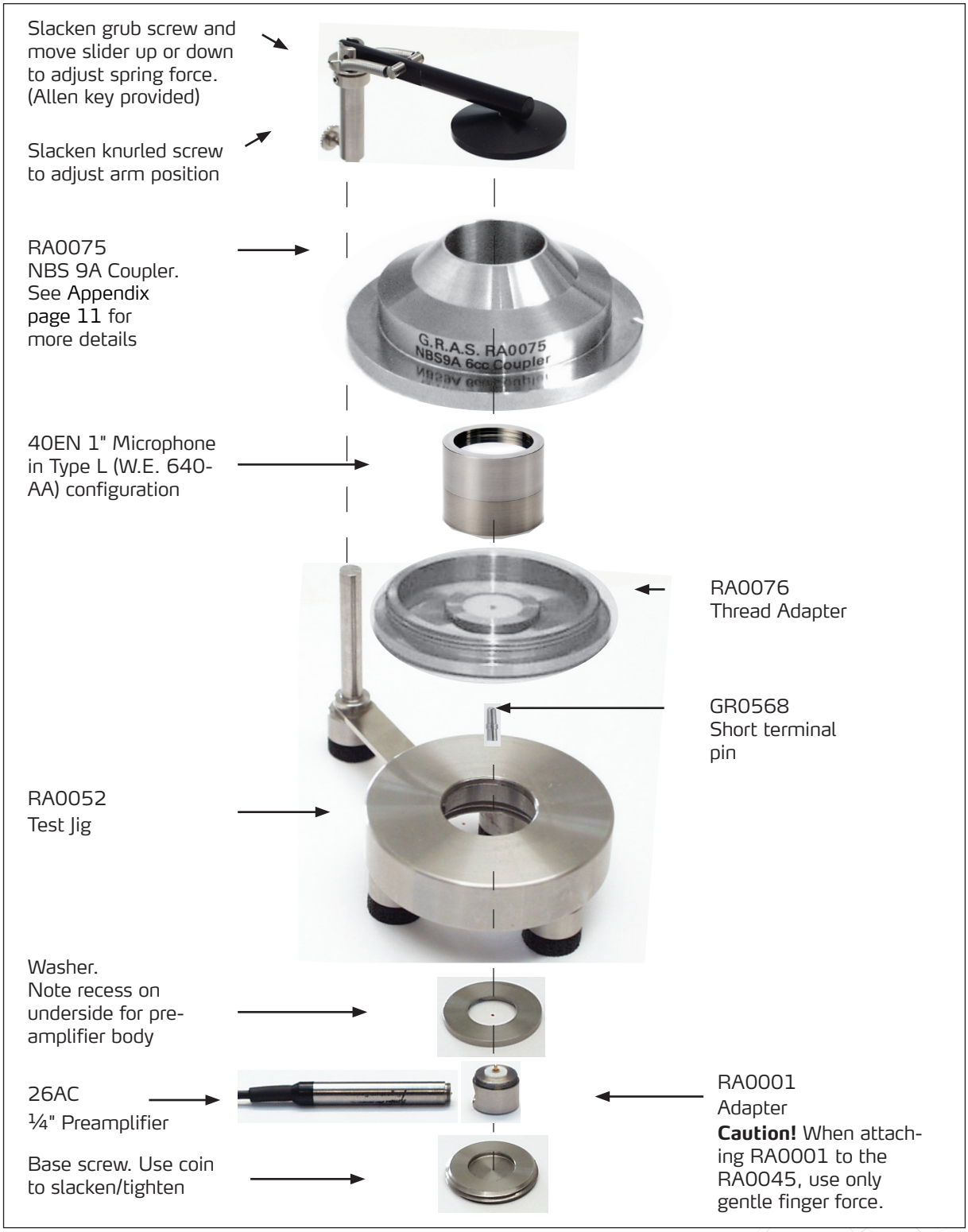

Fig. 7. *Exploded view of all the user-serviceable components of the 43AF*

Warranty, Service and Repair

Calibration

Before leaving the factory, all G.R.A.S. products are calibrated in a controlled laboratory environment using traceable calibration equipment.

We recommend a yearly recalibration at minimum, depending on the use, measurement environment, and internal quality control programs.

We recommend calibration prior to each use to ensure the accuracy of your measurements.

Warranty

Damaged diaphragms in microphones can be replaced. The microphone diaphragm, body, and improved protection grid are made of high-grade stainless steel, which makes the microphone resistant to physical damage, as well as corrosion caused by aggressive air or gasses. This, combined with the reinforced gold-plated microphone terminal which guarantees a highly reliable connection,enables G.R.A.S. to offer 5 years warranty against defective materials and workmanship.

The warranty does not cover products that are damaged due to negligent use, an incorrect power supply, or an incorrect connection to the equipment.

Service and Repairs

All repairs are made at G.R.A.S. International Support Center located in Denmark. Our Support Center is equipped with the newest test equipment and staffed with dedicated and highly skilled engineers. Upon request, we make cost estimates based on fixed repair categories. If a product covered by warranty is sent for service, it is repaired free of charge, unless the damage is the result of negligent use or other violations of the warranty. All repairs are delivered with a service report, as well as an updated calibration chart.

Manufactured to conform with:

CE marking directive:
93/68/EEC

WEEE directive:
2002/96/EC

RoHS directive:
2002/95/EC

G.R.A.S. Sound & Vibration continually strives to improve the quality of our products for our customers; therefore, the specifications and accessories are subject to change.

Appendix

The RA0075 NBS 9A Coupler

Introduction

The G.R.A.S. RA0075 is a coupler for testing earphones. It uses a 1″ condenser microphone with preamplifier.

The RA0075 complies with the requirements of:

- ANSI S 3.7 – 1995 – American National Standard for Testing Earphones.

It is also part of the 43AF 1″ 6cc Coupler Kit.

Components

The RA0075 comprises the following components:

- RA0075 NBS 9-A Coupler
- GR0572 Stop Collar (to maintain consistent coupler-volume)

The RA0075 is delivered as shown in Fig. 8. It uses a 1″ pressure condenser microphone with preamplifier. An exploded view of its user-serviceable components together with a suitable pre-amplifier and adapter, and microphone is shown in Fig. 9.

Preamplifiers

It can use either a 1″ preamplifier or ½″ preamplifier with an adapter. The example in Fig. 9 shows:

- 26AK ½″ Preamplifier
- RA0073 ½″ - to 1″ Adapter

Microphones

It uses primarily a 1″ pressure condenser microphone (of the type WS1P) with the normal protection grid replaced by a special coupler-adapter ring. The example in Fig. 9 shows the RA0075 configured with:

- 40EN 1″ Pressure Condenser Microphone fitted with
- RA0074 Coupler-adapter ring

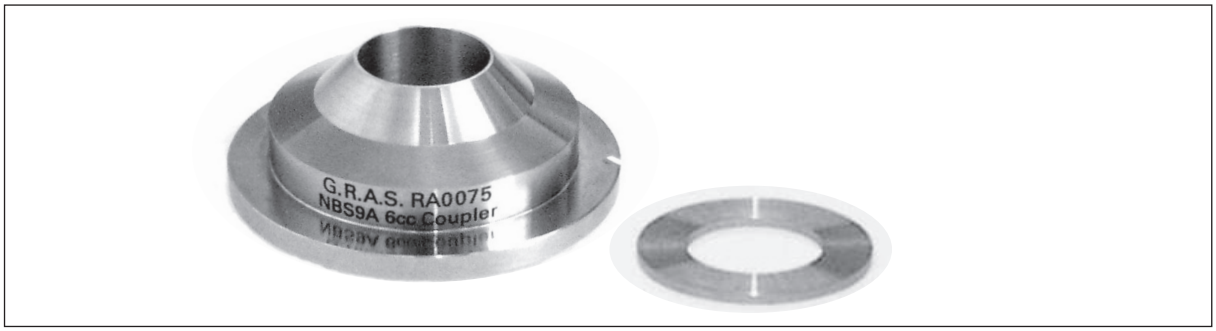

Fig. 8. *RA0075 NBS 9A Coupler as delivered*

Use with ½" Microphone

The RA0075 can also be used with the G.R.A.S. 40AG ½" Microphone. In this case, the optional Adapter RA0077 should replace the protection grid of the 40AG. This combination will allow measurements to frequencies higher than those with a 1" microphone.

Characteristics

Main Purpose

ANSI specifies the NBS 9A Coupler for calibrating the earphones of audiometers. It has been chosen because of it's simple construction and because the threshold transfer data[1] of so many different earphones have already been determined.

Volume

It has a volume of about 5.6 cm^3 which approximates the volume enclosed by a supra-aural earphone on a human ear.

Frequency

The output level of an earphone on a real ear measured below 500 Hz is lower because of leakage and flesh compliance. From 500 Hz to 1500 Hz, it is about the same for both ear and coupler.

Between 1500 Hz and 8000 Hz, the response of the coupler is a fair indication of the earphone's performance. However this cannot necessarily be used as a precise indication of the relationship between coupler and ear because of complex interactions between the earphone and its acoustic load.

[1] Earphone coupler sound pressure level produced when earphone is excited by a voltage corresponding to hearing threshold. See also ANSI S3.6-1989 and ISO R 389-1985, Standard Reference Zero for the Calibration of Pure Tone Air Conduction Audiometers, and Addendum 1-1983 to ISO R389-1975.

User Serviceable Components

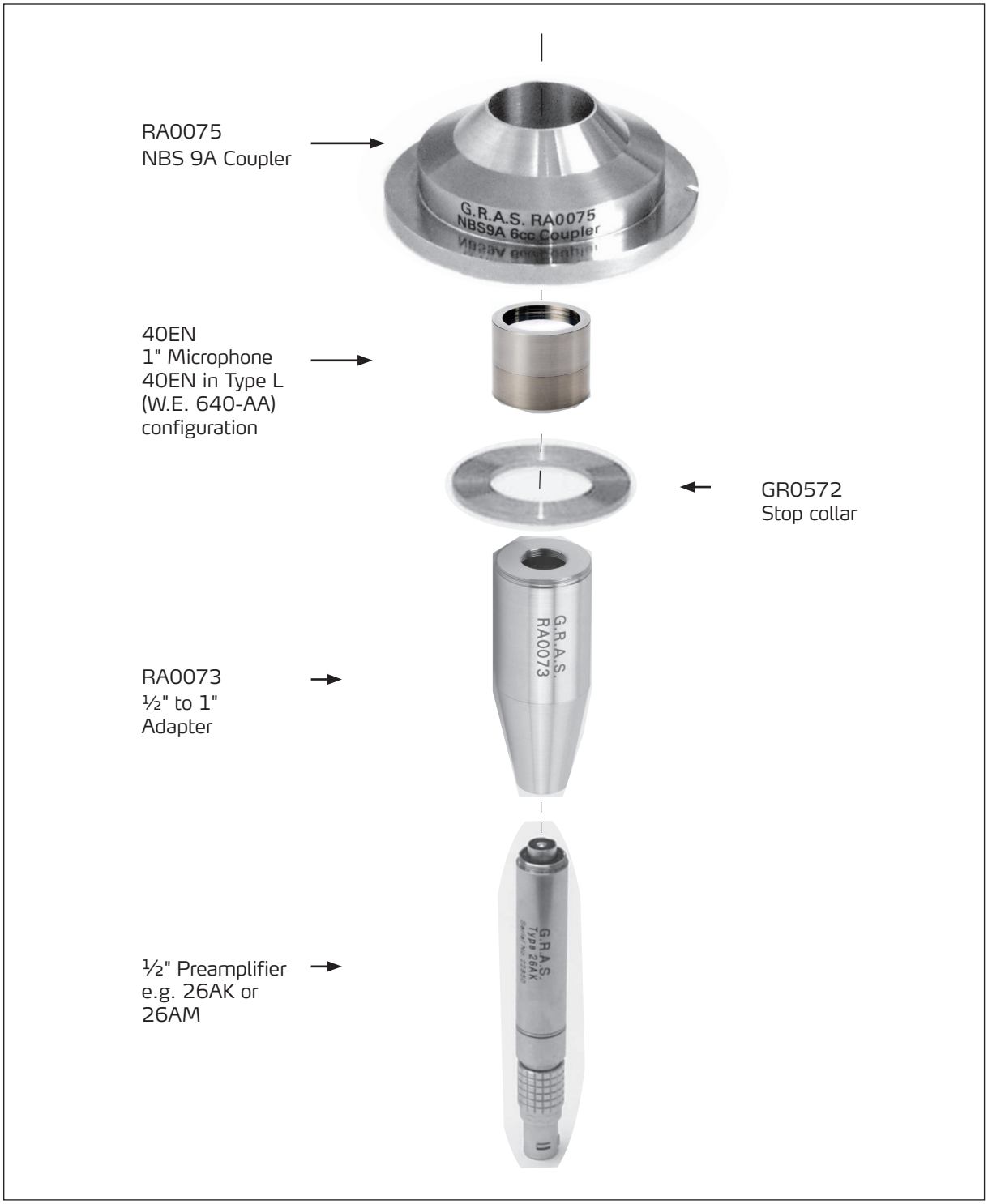

Fig. 9. *Exploded view of user-servicable parts with a 1" microphone and a ½" preamplifier*