

Measuring Microphones, Studio Microphones, Hydrophones and Accessory Equipment

types 4133, 4134, 4135, 4136, 4138, 4144, 4145, 4147, 4148, 4149, 4160, 4165 and 4166

Condenser Microphone Cartridges



FEATURES:

- Frequency ranges from below 0,01 Hz to 140 kHz
- Dynamic ranges from -20 dB to 180 dB SPL
- Very wide temperature range
- High resistance to humidity
- Artificially aged for long term stability
- Flush mounted diaphragms
- Robust construction
- All operating characteristics well defined
- All important data individually calibrated and supplied
- Wide range of accessories

USES:

- Precision sound measurements
- Pressure variation measurements

The B & K measurement microphones are designed for accurate sound measuring purposes. They are precision engineered from materials selected to give long term stability. Their resistance to humidity is very high, the temperature range very wide and the temperature coefficients extremely small compared to other types of condenser microphones. A robust construction makes them easy to handle in the field. Each microphone is delivered in a protective mahogany box supplied with an individual calibration chart giving the frequency response and all data necessary for precision measurements (Fig. 1).



Fig. 1. 1" microphone cartridge in mahogany case with calibration chart

plied with an individual calibration chart giving the frequency response and all data necessary for precision measurements (Fig. 1).

General Description

Construction

The different cartridges have the same basic design (Figs. 2 and 3). The smaller diameters generally provide higher limits for the frequency and dynamic ranges, at the expense of a lower sensitivity.

Fig. 2 shows a sectional view of a condenser microphone cartridge. Depending on type, the insulator is made of either silicone-treated quartz, synthetic sapphire or a synthetic ruby to give dimensional stability. The diaphragm is made of pure nickel and backplate and housing are made of high nickel alloys. This minimizes variations of sensitivity with temperature.

During production the microphone cartridges are subjected to a high temperature (150°C), forced ageing process which ensures good long term stability.

Special care has been devoted to the equalization of the static air pressure between the inside and the outside of the cartridge to give a low and well defined lower limiting frequency.

The principles of the pressure equalization arrangements used in the cartridges are shown in Figs. 4 and 5. The Types 4147, 4148, 4149, 4160, 4165 and 4166 are back-vented for use with dehumidifiers, while all the other types are side-vented.

The cartridges are available with four different diameters:

1": 23,77 mm (Types 4144, 4145 and 4160)

1/2": 12,70 mm (Types 4133, 4134, 4147, 4148, 4149, 4165 and 4166)

1/4": 6,35 mm (Types 4135 and 4136)

1/8": 3,175 mm (Type 4138)

This wide range of condenser microphones is made available to cover an extensive field of applications. The microphones 4144, 4145, 4133, 4134, 4165, 4166, 4135, 4136 and

* Exactly 0,936 inch in accordance with the American Standard ANSI S1.12-1967.

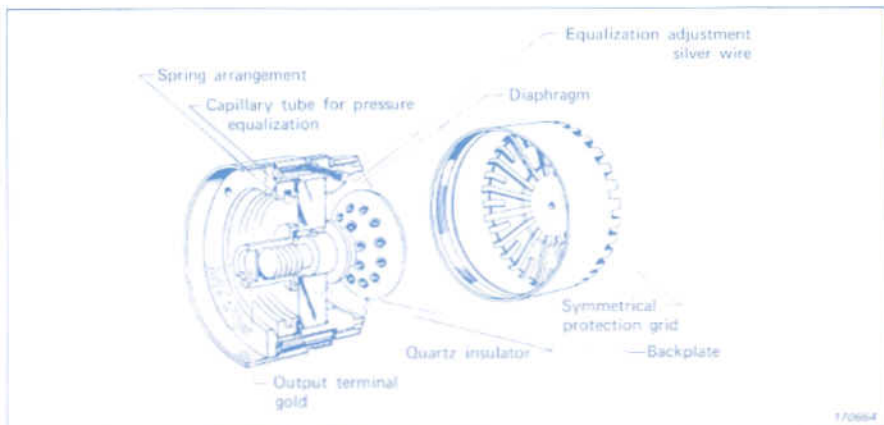


Fig. 2. Sectional view of a 1" condenser microphone cartridge

4138 together cover the requirements for environment, frequency and dynamic ranges for most sound measurements, while the special microphones 4147, 4148, 4149 and 4160 have been developed to suit particular applications.

Each size is available with either linear, 0° incidence, free-field frequency response or linear pressure response (the 1/8" Type 4138 pressure only). When using a free-field microphone it should be pointed towards the sound source, if the sound field is judged to come mainly from that direction. In some applications a pressure microphone may be used for free field measurements if arranged so that the diaphragm is parallel to the direction of sound. In coupler measurements a pressure microphone is used. In this case no specific orientation of the microphone in relation to the sound source is required. The smaller pressure microphones (1/2", 1/4" and 1/8" types) can be used for random incidence measurements at audio frequencies, as their frequency responses in this range are less dependent on angle of incidence. The 1" free-field microphone Type 4145 can also be used for random measurements in the audio range, when fitted with Random Incidence Corrector UA 0055.

A low cost microphone, Type 4130 is also available. The 4130 is a 1/2" condenser microphone cartridge for use with the self-contained microphone system consisting of the 1/2" Microphone Pre-amplifier Type 2642 and the battery operated Two-channel Microphone Power Supply Type



Fig. 3. 1" cartridge with protection grid removed. The diaphragm is flat and practically flush with the housing. This ensures a well defined acoustic impedance and excellent omnidirectivity

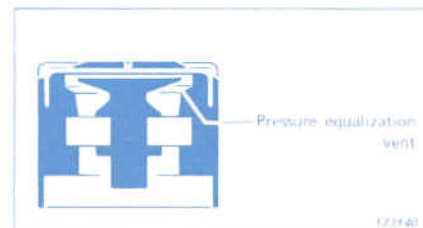


Fig. 4. Side-vented microphone cartridge

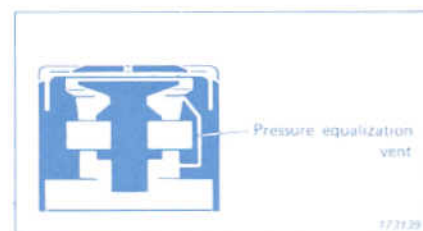


Fig. 5. Back-vented microphone cartridge

2810. The 2642 may also be used with other B & K 1/2" condenser microphones. For further information on Types 4130, 2642 and 2810, see separate Product Data sheet.

Three 1/2" Pre-polarized Condenser Microphones Types 4129, 4155 and 4176 are also available. Type 4129 is acoustically equivalent to externally

polarized Type 4130 and is used with Sound Level Meters Types 2225 and 2226. Type 4155 is acoustically equivalent to externally polarized Type 4165 and is used with Precision Integrating Sound Level Meters Types 2230 and 2233. Type 4176 is used with Precision Integrating Sound Level Meters Types 2221/22 and Precision Sound Level Meter Type 2232. For further details, see the Product Data sheet available for Types 4129, 4155 and 4176.

In the following section a short description of characteristics and application ranges of each microphone is given.

General Purpose Types

Free Field Response Types

4145. 1" diameter for general laboratory use and very low sound level measurements.

4133. 1/2" diameter for general electroacoustic purposes, loudspeaker and microphone measurements.

4165. 1/2" diameter for general and low level sound measurements, and for standardized noise measurements according to IEC and ISO standards. It has a sensitivity similar to that of a 1" cartridge and may therefore be used as a substitute for 1" cartridges in applications where these would introduce an intolerable disturbance in the sound field being measured. The 4165 has a quartz covered diaphragm and is backvented for use with the 1/2" Dehumidifier UA 0308 for measurements in humid environments.



Fig. 6. Types 4145, 4133, 4165 and 4135

4135. 1/4" diameter for general high level, high frequency measurements and model work.

Pressure Response Types

4144. 1" diameter used for coupler measurements, audiometer calibra-

tion, low frequency and low level measurements, and as a laboratory standard.

4134. 1/2" diameter for medium and high level measurements in the audio range and coupler measurements.

Especially suitable where good random incidence characteristics are demanded.

4166. 1/2" diameter for random incidence measurements. Same application range as the 4165. The 4166 has also a quartz covered diaphragm and is backvented for use together with the UA 0308.

Especially suitable for noise measurements according to ANSI standards.

4136. 1/4" diameter for random incidence, coupler, high level and high frequency measurements.

4138. 1/8" diameter used for high level and very high frequency measurements, or for pulse measurements.



Fig. 7. Types 4144, 4134, 4166, 4136 and 4138

Especially suitable for applications which require a high spatial resolution of the sound field or where space is limited, e.g. model testing.

Special Types

Very Low Frequency Types

4147. 1/2" diameter. Pressure type designed with special attention to the back-venting pressure equalization arrangement to bring the lower limiting frequency below 0,01 Hz. It is used for ultra-low frequency acoustic pulses, e.g. sonic boom measurements in conjunction with Adaptor UA 0271 and Microphone Carrier System 2631.

Low Polarization Voltage Type

4148. 1/2" diameter. Free-field type used with 28 V polarization voltage for general sound level measurements with battery operated assemblies such as Preamplifier Type 2619 in conjunction with Power Supply Type 2804.



Fig. 8. Types 4147 and 4148

Type 4149, Protected for Outdoor Use

4149. 1/2" diameter. Free-field type, similar to 4133 but with diaphragm and backplate covered with thin layers of quartz (Fig. 9), which increases the lifetime in humid or corrosive atmospheres. It is back-vented for use with Dehumidifier UA 0308, (see section "Accessories"). The 4149 is used in noise monitoring systems such as the Type 4921, for permanent outdoor installations.

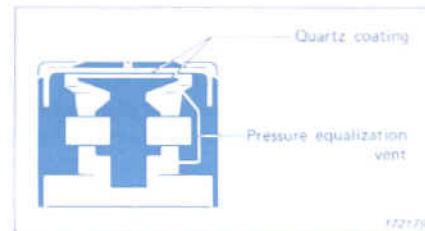


Fig. 9. Cross sectional view of the quartz-coated microphone Type 4149



Fig. 10. Type 4149

Western Electric WE 640 A Equivalent

4160. 1" diameter. Pressure type for coupler measurements and as



Fig. 11. Type 4160



Fig. 12. Mounting the different microphones on the microphone preamplifiers and the carrier system head. Adaptor DB 0375 is included with the 2619 S, whereas other adaptors should be ordered separately

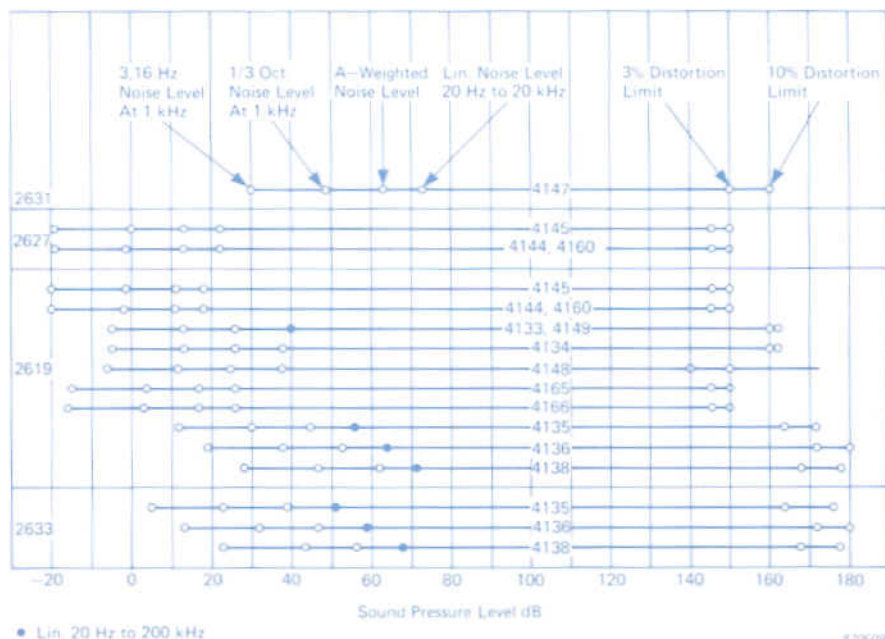


Fig. 13. Dynamic ranges of B & K Microphone Preamplifiers (except 2642) and the Carrier System 2631 with different microphones. The upper limit is indicated for two degrees of distortion while the lower limit is given for various bandwidths of the measuring equipment. The limits for 3,16 Hz and 1/3 octave bandwidth are valid at 1000 Hz only

laboratory standard. It has a linear pressure response and is equivalent to the Western Electric condenser microphone WE 640 A. The front cavity of the microphone is tested for hydrogen leakage. The 4160 is included with the Reciprocity Calibration Apparatus Type 4143.

Preamplifiers

The microphones are designed for use with a DC polarization voltage of 200 V (28 V for 4148) or with a 10 MHz carrier frequency. A microphone assembly will consist of a microphone cartridge and a preamplifier, when using the DC polarization voltage, and of the 10 MHz Carrier Frequency System Type 2631 and a cartridge when using the carrier frequency.

The cartridges screw directly onto the preamplifier housing or the 2631

head if both have the same diameter, or use is made of adaptors if the diameters differ (Fig. 12).

Three different preamplifiers are available. They all use a field effect transistor to achieve high input impedance and low inherent noise. Type 2619, 1/2" diameter is used directly with 1/2" microphone cartridges. To use 1", 1/4" and 1/8" cartridges with this preamplifier it must be fitted with the adaptors DB 0375, UA 0035 and UA 0036, respectively. The 2619 is available in two versions: 2619 S, with accessories and 2619 T without accessories. Type 2633, 1/4" diameter is used directly with 1/4" cartridges and with 1/8" cartridges via the adaptor UA 0160. Type 2627 is a 1" preamplifier with electrical insulation between the grounded housing of the preamplifier and the microphone cartridge. The 2627 is used primarily for calibration purposes.

Fig. 13 shows the dynamic ranges of the preamplifiers and the Carrier System Type 2631, when used with the different microphone cartridges.

For further details on the Preamplifiers see separate product data sheets (2619, 2627 and 2633; 4130, 2642 and 2810; and 2631).

Power Supply

The stabilized polarization voltage for the cartridges (200 volt) and the

power supply for the microphone preamplifier is available at the 7-pin preamplifier input socket of the B & K measuring amplifiers and frequency analyzers to which the microphone assemblies can be connected directly.

For operation with other equipment and for special applications the microphone assembly can be powered from the Power Supplies Types 2804 or 2807, the Eight Channel Multiplexer Type 2811 or use can be made of the Outdoor Microphone Unit Type 4921 or the Microphone Carrier System Type 2631. Further information can be found under "Accessories".

The condenser microphones described in this data sheet and pre-polarized Types 4129, 4155 and 4176 are also intended for use with the B & K Sound Level Meters, which supply the necessary polarization voltage (0V for Types 4129, 4155 and 4176) and preamplification. Furthermore the Sound Level Meters contain a measuring amplifier with indicating instrument, weighting filters and an output amplifier for driving recording instruments such as Tape Recorders Types 7005 and 7006 and Level Recorders Types 2306, 2307 and 2309.

The Precision Sound Level Meter Type 2215 accepts, with appropriate adaptors, the 1", 1/2" and 1/4" car-

tridges using 200 V DC polarization voltage. Type 4176 is intended for use with Precision Sound Level Meters Types 2221/22 and 2232. Type 4129 is used with Sound Level Meters 2225/26. Type 4155 is used with Precision Sound Level Meters Types 2230 and 2233. For further details, see Product Data sheets for Types 2215, 2221/22, 2225/26, 2232, 2230 and 2233.

Assembly Response

All data given in this leaflet are open circuit, which means that the cartridges have looked into an infinitely large impedance. In practice, however, the microphone cartridges are used together with a preamplifier which will influence the response of the total microphone assembly.

The size of the influence depends on the preamplifier input impedance, the capacitance of the microphone (and adaptor), the load by extension cables connected to the preamplifier and the attenuation of the preamplifier itself. The total response of the microphone assembly is found by adding the open circuit response to the response curves given in the data sheet for the preamplifiers.

For detailed information on the response of the microphone Type 4147 used with 10 MHz carrier frequency, see data sheet for Microphone Carrier System Type 2631.



Fig. 14. Sound Level Meters Types 2215, 2221/22, 2225/26, 2232, 2230 and 2233

Cartridge Response

The microphone cartridges have well defined operating characteristics. Their sensitivities are high in relation to their dimensions and as can be seen from Figs. 15 and 16 their frequency ranges are very wide.

The long term stability is extremely good. The stability is of the order of 1 dB in several hundred years (see

specifications) while the same change appears in a few hours at 150 °C for all 1" and 1/2" microphones.

Individual Calibration

The microphones fulfil the American standard ANSI S1.12-1967 "Specifications for Laboratory Standard Microphones" as indicated in Table 1.

| ANSI Type | B & K Type |
|-----------|--|
| XL | 4144, 45, 47, 48, 33, 34, 49, 60, 65, 66 |
| L | 4144, 45, 60 |
| M | 4133, 34, 35, 36, 47, 49 |
| H | 4135, 36, 38 |

Table 1.

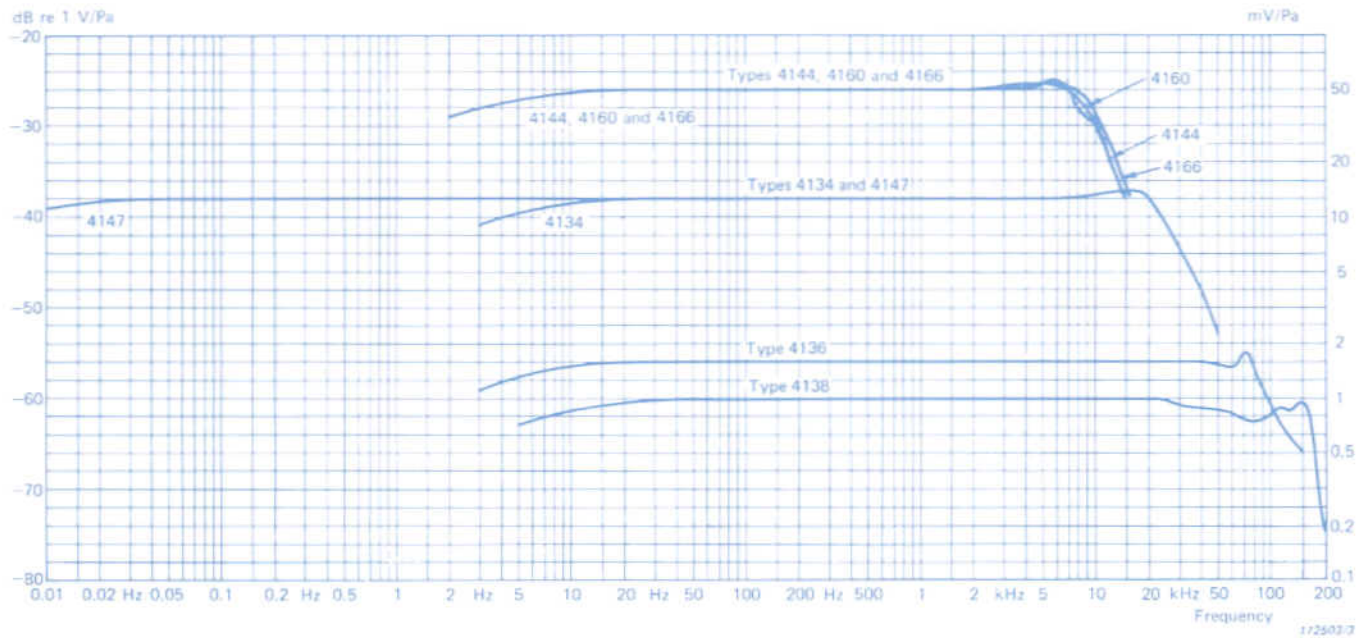


Fig. 15. Typical frequency responses of the different pressure microphones recorded by means of the electrostatic actuator method

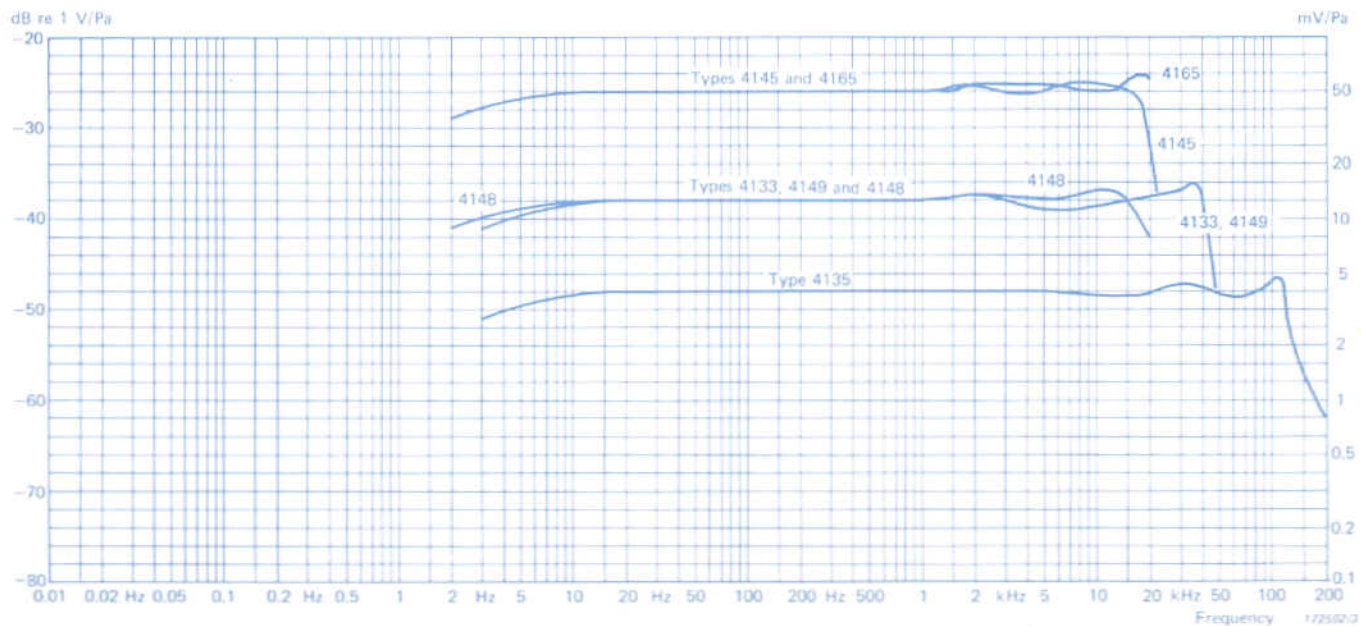


Fig. 16. Typical 0° incidence frequency response of the different free-field microphones recorded by means of the electrostatic actuator method and corrected according to the curves shown in Fig. 19

Each microphone cartridge is provided with an individual calibration chart including a complete frequency response curve recorded by the electrostatic actuator method. In the case of the free-field cartridges Types 4145, 4133, 4135, 4148, 4149, and 4165 the free-field response for 0° incidence is also given (see Fig. 18). This is derived by adding the free-field corrections to the recorded pressure response. Similarly, the diffuse-field response is individually determined for the cartridges 4134, 4135 and 4166.

The cartridge Type 4147 is additionally supplied with an individual calibration chart showing the time constant of the pressure equalization. From this chart the lower limiting frequency can easily be determined. See Fig. 17.

For the microphones, a comprehensive handbook is available describing, among other things, the design, the theory and the operation of each condenser microphone together with extensive documentation of its properties. Also described are the application of accessories and the influence of different environmental factors, such as temperature, atmospheric pressure, humidity etc. on the microphone.

Free-Field Corrections (to be added to the pressure response obtained from the calibration chart)

The free-field corrections which represent the increase of sound

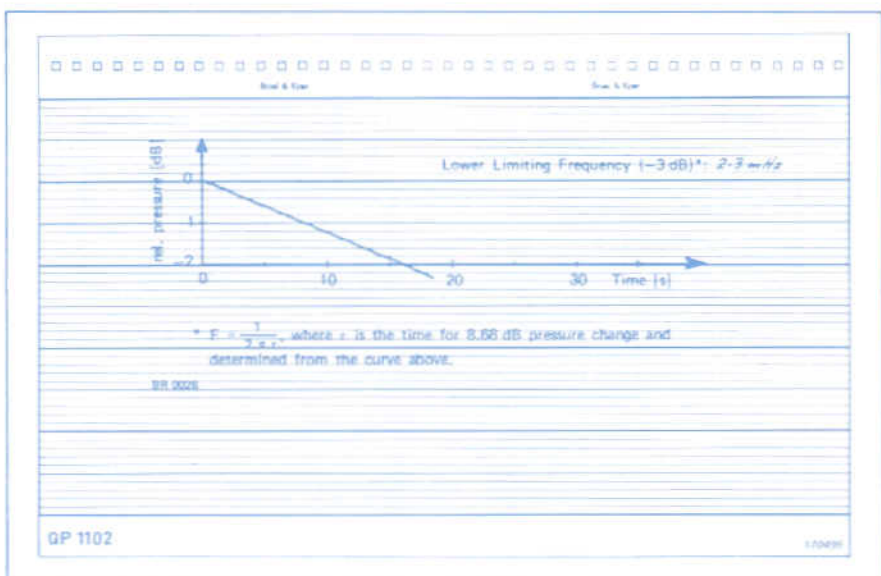


Fig. 17. Additional calibration chart delivered with the Condenser Microphone Cartridge Type 4147

pressure caused by diffraction of the sound waves around the microphone are only important at high frequencies where the wavelengths are comparable with the external dimensions of the microphone.

The free-field correction curves for diverse angles of incidence are given in Fig. 19. It can be seen that the random incidence (diffuse-field) corrections are very small at audio frequencies.

A microphone (1/2" to 1/8" diameter) with a flat pressure frequency char-

acteristic should consequently be preferred for measurements in diffuse-fields, for example for indoor measurements. However, by mounting specially designed correctors (Nose Cones) the response of the 1", 1/2" and 1/4" free-field microphones can be made practically independent of the angle of incidence over an extended frequency range.

A detailed description of the characteristics and specifications of the microphones will be found in the handbook available.

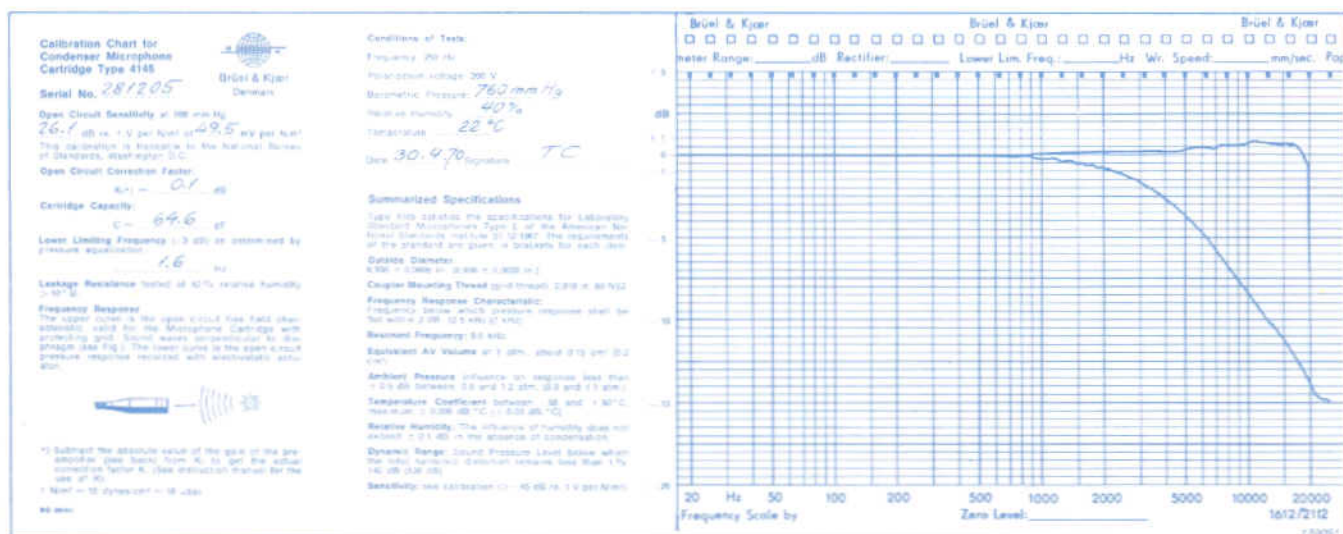


Fig. 18. Complete calibration chart delivered with the condenser microphone cartridges

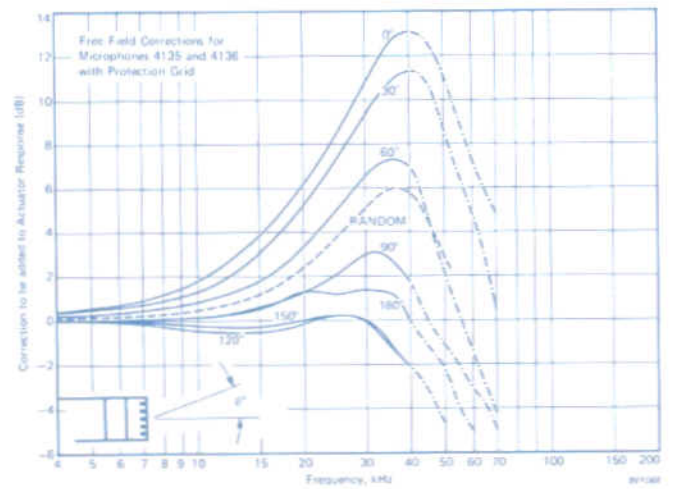
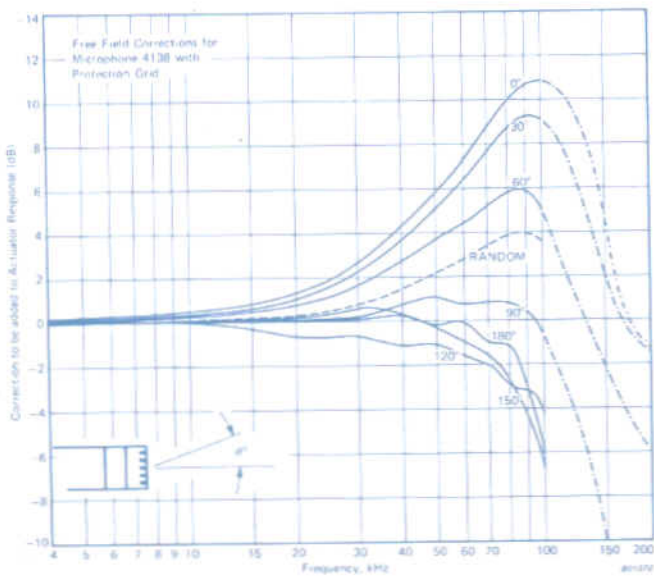
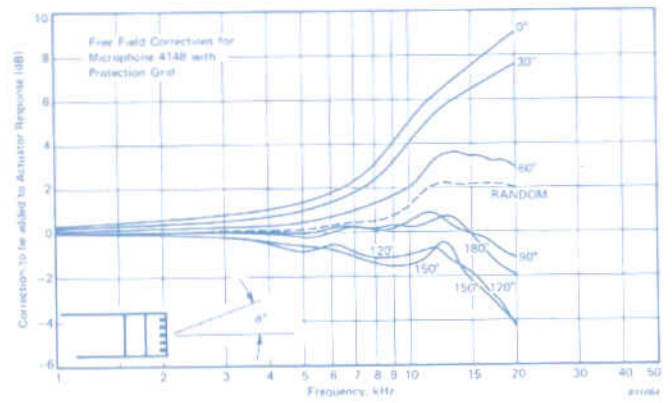
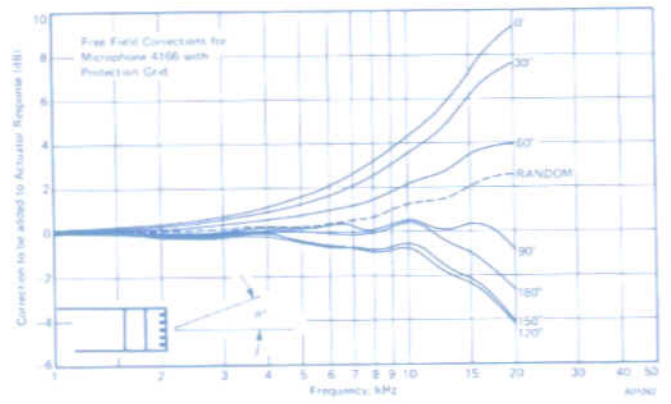
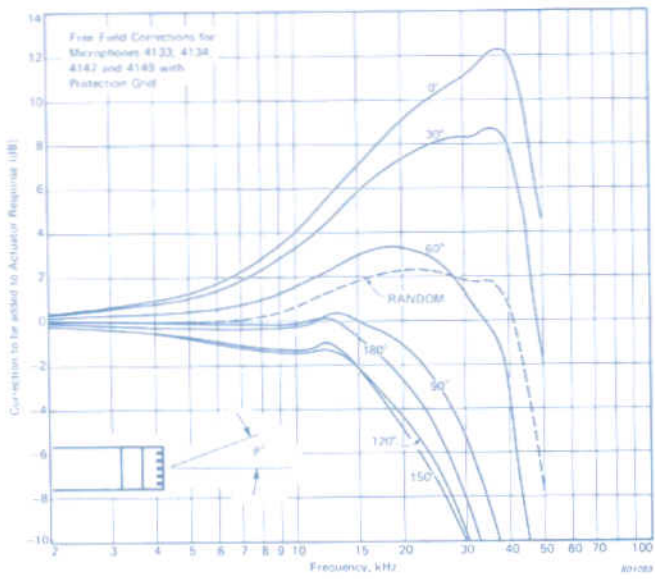
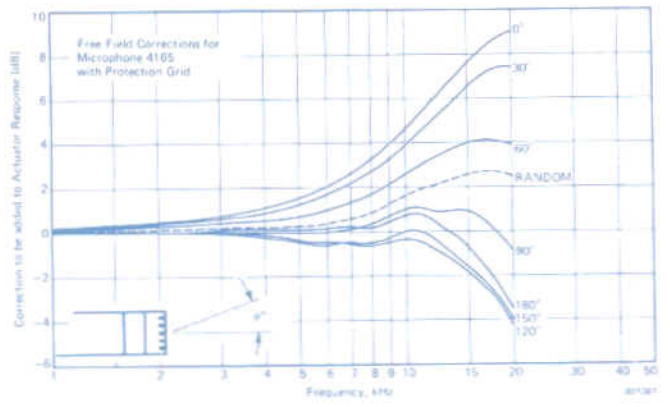
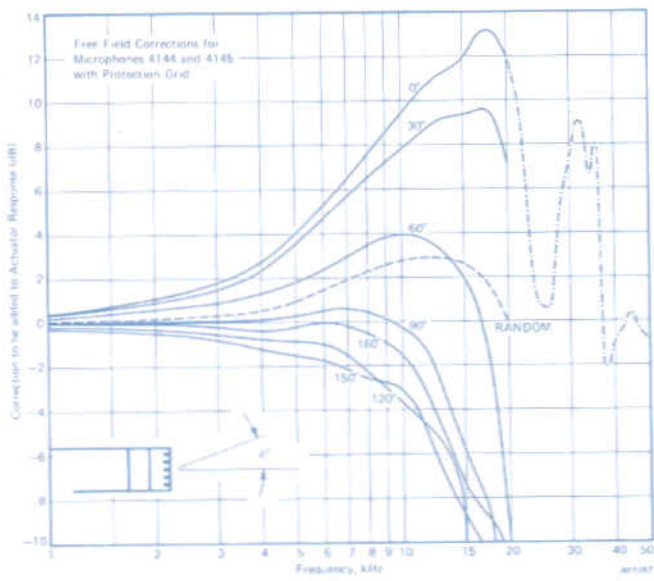


Fig. 19. Free-field correction curves for the various B & K condenser microphone cartridges

Accessories

To facilitate sound measurements under various conditions a variety of accessory equipment has been developed. A short description of these accessories is given in this section. For further information please see separate leaflets and the handbook available with the microphones.

Calibration Equipment 4220, 4230, 4143, 2627 and 4221

For accurate calibration of the microphones and complete sound measuring set-ups either in the laboratory or in the field, the Pistonphone Type 4220 or the Sound Level Calibrator Type 4230 can be used (Fig. 20). Both are battery operated and easy to handle. The 4220 gives a signal of 124 dB at 250 Hz and calibrates with an accuracy of $\pm 0,15$ dB. The Sound Level Calibrator Type 4230 gives a signal of 94 dB at 1000 Hz and calibrates with an accuracy of $\pm 0,3$ dB.

For laboratory calibration of standard microphones in accordance with IEC R 327 and IEC R 402 (reciprocity method) and for measurement of the frequency response of 1", 1/2", 1/4" and 1/8" condenser microphones by the electrostatic actuator method, the Reciprocity Calibration Apparatus Type 4143 is available (see Fig. 21). It is an advanced, fast and easily operated high precision laboratory instrument. The 4143 can also be used for comparison calibration of 1" and 1/2" microphones, mea-



Fig. 20. Pistonphone Type 4220 and Sound Level Calibrator Type 4230



Fig. 21. Reciprocity Calibration Apparatus Type 4143



Fig. 22. Accessories delivered with the 4143

surement of front and equivalent volume, reciprocity and comparison calibration of accelerometers, reference sound source, ratio voltmeter and zero indicator. The 4143 is delivered with an individual calibration chart and a comprehensive range of accessories. See Fig. 22.

For calibration of 1", 1/2", 1/4" and 1/8" condenser microphones at high sound levels the High Pressure Microphone Calibrator Type 4221 is an ideal tool (Fig. 23). Due to the low acoustic impedance of the 4221 the sound pressure produced in the cou-



Fig. 23. High Pressure Microphone Calibrator Type 4221

plers is practically independent of variation in coupler volume, atmospheric pressure and changes in the process from adiabatic to isothermal at low frequencies. Calibration can be performed in the frequency ranges 3 Hz to 1000 Hz and 10^{-2} Hz to 95 Hz at SPLs up to 164 dB. In connection with tonebursts, supplied from the Gating System Type 4440, calibration up to 170 dB SPL can be performed.

Electrostatic Actuators UA 0023 and UA 0033

The actuators are designed for measurement of the pressure frequency response of the condenser microphone cartridges. They are available in two sizes UA 0023 for 1" microphones and UA 0033 for 1/2" microphones. The UA 0033 can also be used with 1/4" and 1/8" cartridges by means of the adaptors DB 0264 (1/4" to 1/2") and DB 0900 (1/8" to 1/2").

Electrostatic actuators not only enable laboratory frequency response calibration of microphones to high levels of accuracy but also allow users without extensive lab-

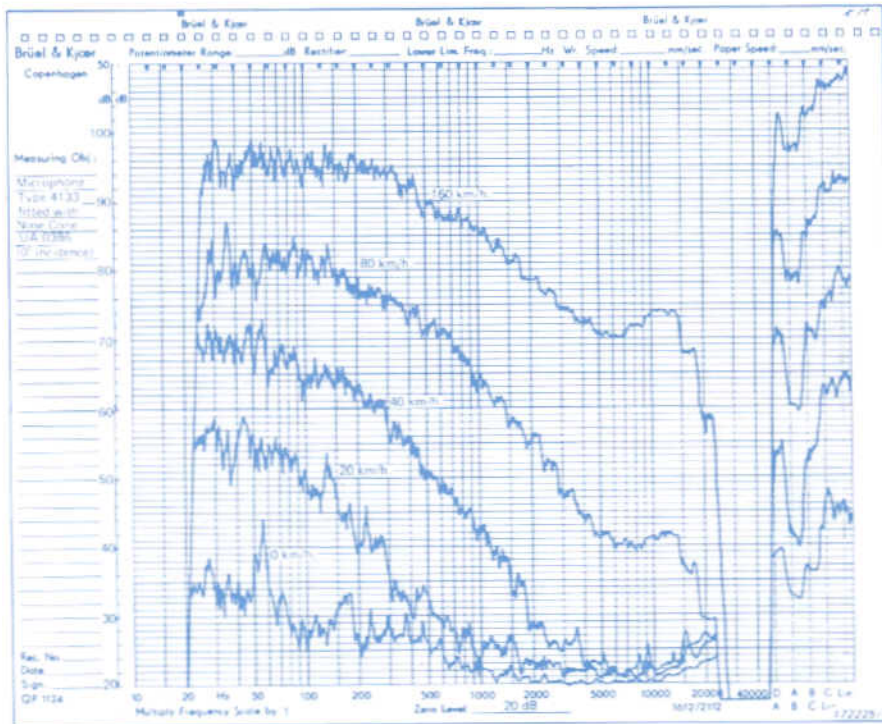


Fig. 24. Induced noise levels as a function of windspeed and frequency of the $\frac{1}{2}$ " free-field Condenser Microphone Cartridge Type 4133 fitted with Nose Cone UA 0386

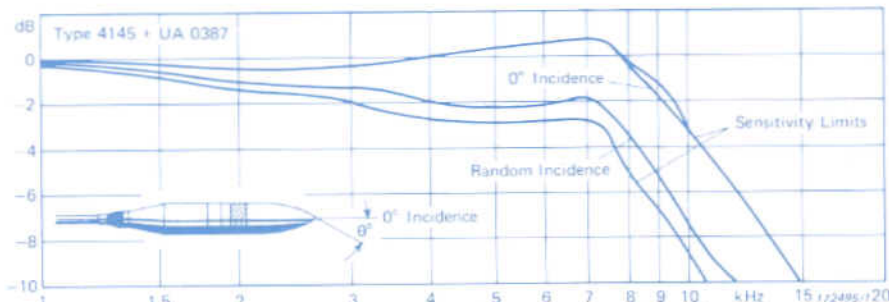


Fig. 25. Frequency response of the 1" free-field Condenser Microphone Cartridge Type 4145 fitted with Nose Cone UA 0387

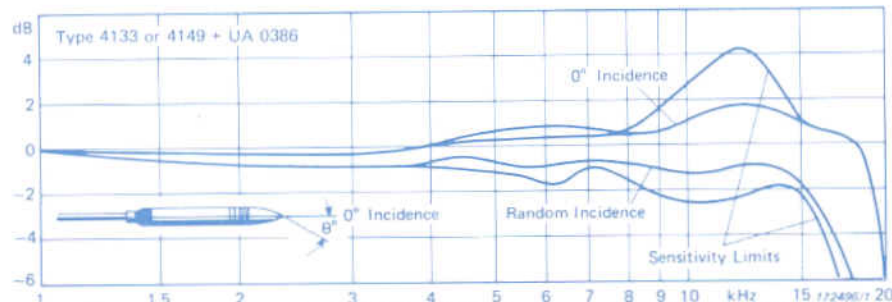


Fig. 26. Frequency response of the $\frac{1}{2}$ " free-field Condenser Microphone Cartridges Types 4133 and 4149 fitted with Nose Cone UA 0386

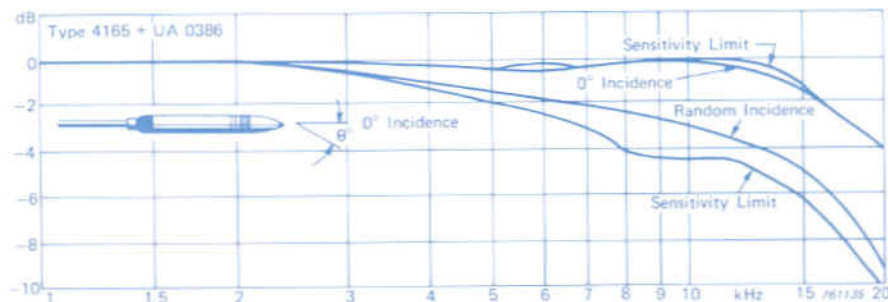


Fig. 27. Frequency response of the $\frac{1}{2}$ " free-field Condenser Microphone Cartridge Type 4165 fitted with Nose Cone UA 0386

oratory facilities to carry out periodic checks on the frequency response characteristics of their own microphones to ensure that they remain within acceptable limits.

Nose Cones UA 0387, UA 0386, UA 0385 and UA 0355

The Nose Cones (Fig. 28) are designed to reduce the aerodynamically induced noise present when the microphones are exposed to high wind speeds in a known direction, for example during sound measurements in wind tunnels, ducts, etc. They are designed to replace the normal protection grid of the microphones, and are of a streamlined shape with a highly polished surface in order to give the least possible air resistance. The fine wire mesh around the circumference allows sound waves to penetrate to the microphone diaphragm.

Fig. 24 shows the aerodynamically induced noise at various windspeeds in the microphone cartridge 4133 fitted with Nose Cone UA 0386. The diagram is valid for microphone 4149.

When the Nose Cones are used, the omnidirectional characteristics are improved (Figs. 25, 26, 27 and 30). Fig. 31 shows the omnidirectional characteristics of the $\frac{1}{8}$ " pressure cartridge fitted with Nose Cone UA 0355.

Random Incidence Corrector UA 0055

The UA 0055 (Fig. 29) screws directly onto the one inch microphone Type 4145 instead of the normal protection grid. It improves the microphone's omnidirectional characteristics so that IEC 651 Type 1 is fulfilled up to 10 kHz. See Fig. 32.

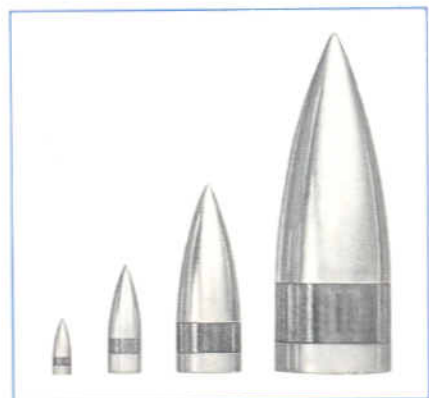


Fig. 28. Nose Cones UA 0355, UA 0385, UA 0386 and UA 0387

Rain Cover UA 0393

The Rain Cover (Fig. 29) is designed to be mounted on B & K 1/2" condenser microphones instead of the normal protection grid, and allows permanent outdoor installation even under adverse weather conditions. When fitted, the Rain Cover will improve the omnidirectional characteristics of the 1/2" free-field microphones (see Fig. 33). The combination of a 1/2" free-field cartridge, UA 0393 and Windscreen UA 0570 fulfils the requirements on directivity given in IEC 651 for Type 1 Sound Level Meters. To allow remote calibration and checking of remote microphone installations the UA 0393 has a built-in electrostatic actuator. The Rain Cover can be delivered calibrated at the factory together with a 1/2" microphone cartridge to give an equivalent SPL of 90 ± 1 dB by injection of an AC voltage of 215 V.

The B & K plugs JP 0012, which fit the actuator terminal are available in sets UA 0129, 20 plugs with mounting tool and UA 0130, 25 plugs only. The cable AC 0010 for plug JP 0012 is available in free length.

It is recommended that, whenever weather protection is important, the Permanent Outdoor Windscreen UA 0570 is always used in conjunction with the Rain Cover UA 0393, and that the Pre-amplifier heating element operates continuously.



Fig. 29. Random Incidence Corrector UA 0055 and Rain Cover UA 0393

Permanent Outdoor Windscreen UA 0570

The Windscreen UA 0570 (Fig. 34) for 1/2" microphones, reduces the aerodynamically induced noise during outdoor sound measurements. The Windscreen is designed for mounting on the microphone assembly and gives an effective reduction, of the order of 10 dB or higher, of wind induced noise at lower wind ve-

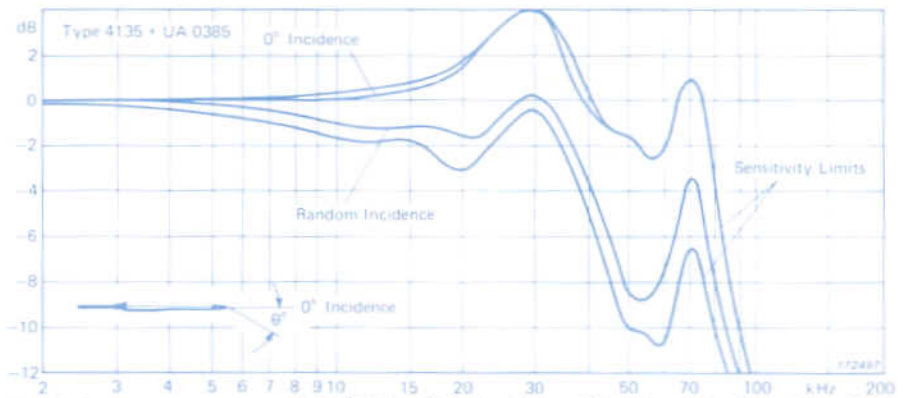


Fig. 30. Frequency response of the 1/4" free-field Condenser Microphone Cartridge Type 4135 fitted with Nose Cone UA 0385

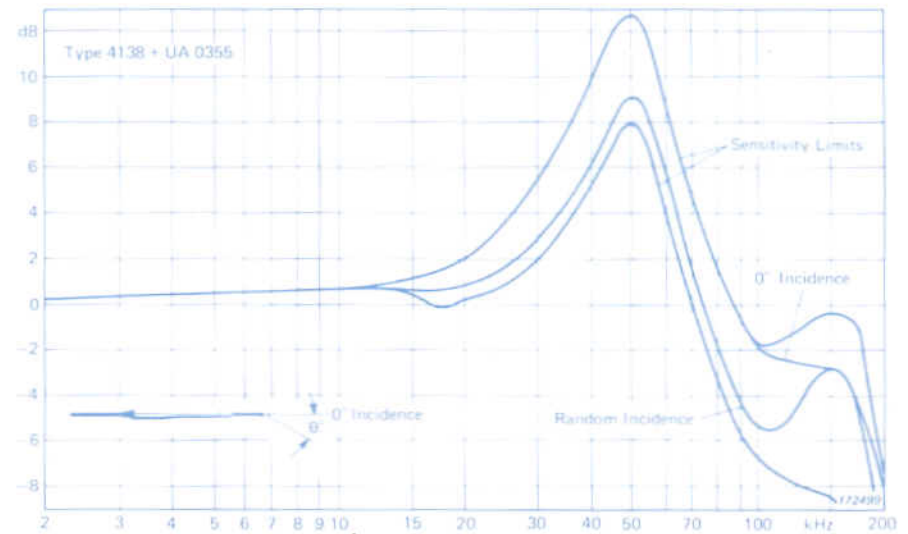


Fig. 31. Frequency response of the 1/8" pressure Condenser Microphone Cartridge Type 4138 fitted with Nose Cone UA 0355

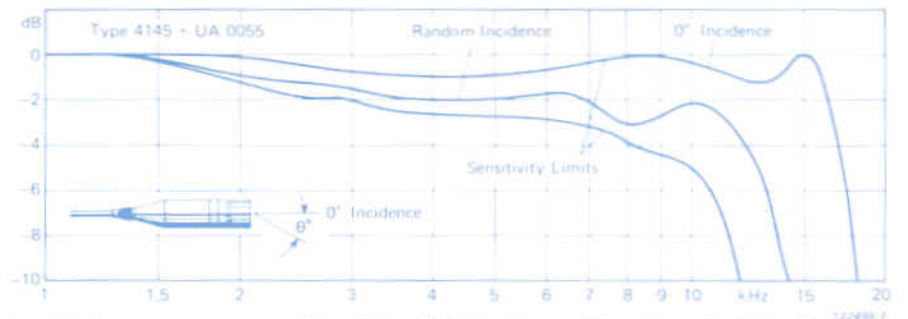


Fig. 32. Frequency response of the 1" free-field Condenser Microphone Cartridge Type 4145 fitted with Random Incidence Corrector UA 0055. The linearity is maintained practically up to 10 kHz, and the omnidirectivity is effective within ± 3 dB. (See also Fig. 19)

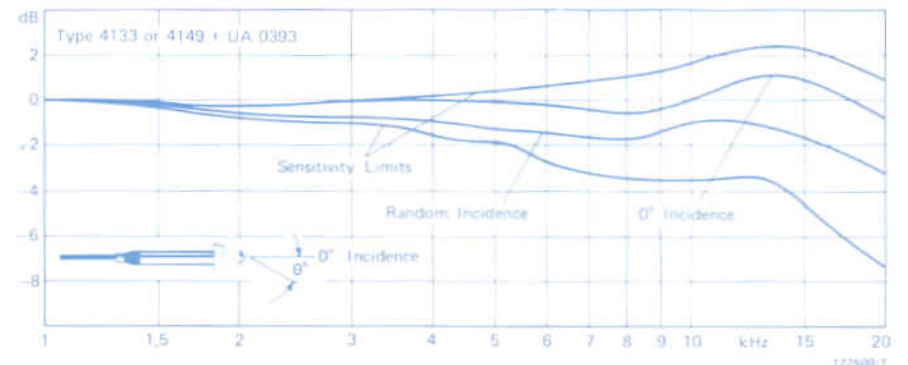


Fig. 33. Frequency response of the 1/2" free-field condenser Microphone Cartridges Types 4133 and 4149 fitted with Rain Cover UA 0393

locities. It is well suited to permanent outdoor installations in connection with Rain Cover UA 0393. Additionally, it is equipped with spikes to prevent birds from resting on top. The Windscreen is recommended for all unattended noise measurements.

Windscreens UA 0207, UA 0237 and UA 0459

The Windscreens UA 0207 and UA 0237 (Fig. 34) fit the 1" and 1/2" microphone assemblies respectively. They are made of specially prepared porous polyurethane sponge attenuating wind noise 10 to 12 dB, at lower wind velocities, and are well suited for hand-held outdoor sound measurements. These windscreens are only available as sets. Set UA 0253 contains six 1" windscreens UA 0207, and set UA 0254 contains six 1/2" windscreens UA 0237.

The Windscreen UA 0459, 65 mm diameter, is designed to fit the 1/2" Condenser Microphone Type 4130 but can also be used with the other 1/2" microphones if a small screen is required. The UA 0459 has approximately the same properties as the UA 0237. The windscreens are available in sets of six as UA 0469.

For complete curves showing the influence of any of the windscreens upon the free-field corrections see the handbook for the microphones.

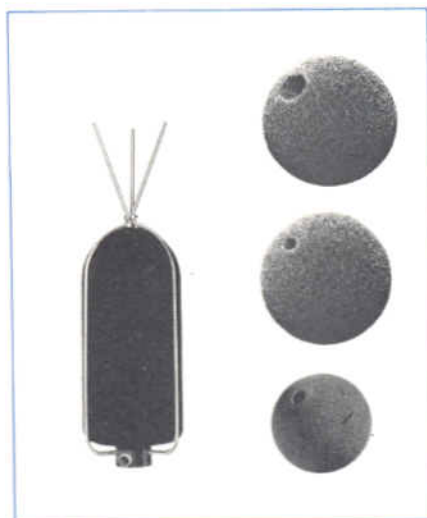


Fig. 34. Windscreens UA 0570, UA 0207, UA 0237 and UA 0459



Fig. 35. Turbulence Screen UA 0436

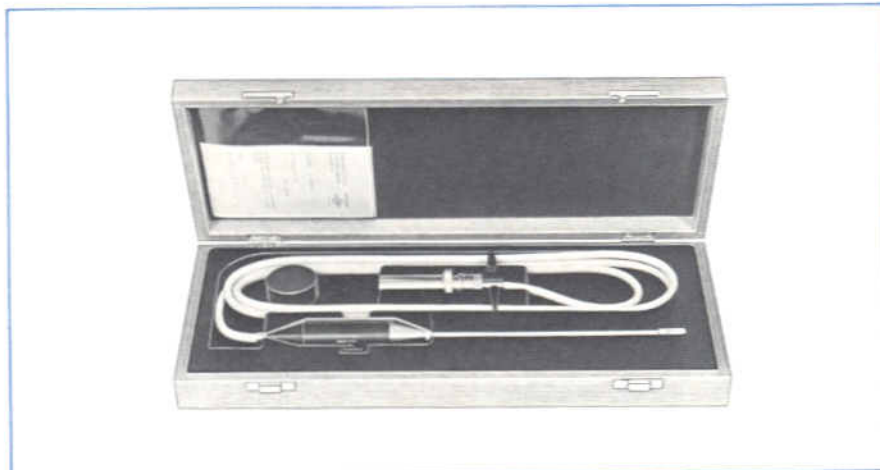


Fig. 36. Probe Microphone Type 4170

Turbulence Screen UA 0436

The Turbulence Screen UA 0436 (Fig. 35) is designed to attenuate turbulence noise, when measuring airborne noise in ducts, wind tunnels etc. The UA 0436 can be used together with any 1/2" free-field condenser microphone mounted on a 1/2" microphone preamplifier. The turbulence noise suppression obtained using the UA 0436 is approximately 16 dB better than that obtained with the Nose Cone UA 0386 in the frequency range 70 Hz to 1,5 kHz.

Probe Microphone Type 4170

Probe microphones can be used in a variety of applications, such as measurements inside the ear and inside ear protectors, measurements on sound insulating materials and inside intricate machinery, as well as in other confined spaces, e.g. small ducts, furnaces, oilburners etc.

Type 4170 (Fig. 36) is a pre-adjusted probe microphone with built-in preamplifier. It uses an acoustical exponential horn to couple a probe tube to a 1/2" condenser micro-

phone. An acoustic matching impedance at the microphone equalizes the frequency response of the assembly, thereby obtaining a frequency response from 30 Hz to 8 kHz within 3 dB. In order to obtain minimum disturbance in the sound field being measured the probe tube is very thin and has a high acoustic orifice impedance. The probe microphone is delivered with an individual calibration chart and an adaptor DP 0181 for fitting it to the Pistonphone Type 4220 or to the Calibrator Type 4230 for calibration.

Power Supplies 2804 and 2807

The Power Supply Type 2804 is battery driven and can be used with the Preamplifier Types 2619 and 2633. It supplies all necessary voltages for two microphone assemblies and can be adjusted to give 28 or 200 V polarization voltage. The Two Channel Power Supply Type 2807 can supply all voltages for two microphone assemblies using 200 V polarization voltage, and allows automatic switching between the measuring points, e.g. for sound insulation measurements.

**Eight Channel Multiplexer
Type 2811**

For multichannel measurements, the Eight Channel Multiplexer Type 2811 (Fig. 39) can supply all necessary voltages for up to eight microphone assemblies. The polarization voltage may be 0, 28 or 200 V and manual, automatic or external scanning may be selected. The 2811 has a built in IEC/IEEC interface.

Outdoor Microphone Unit 4921

The Outdoor Microphone Unit Type 4921 (Fig. 37) has been designed to allow permanent outdoor noise monitoring. It consists of the 1/2" quartz-coated microphone Type 4149 fitted with Windscreen UA 0570, Rain Cover UA 0393 and a preamplifier all mounted on a stainless steel tube. A weather-proof case, to which the steel tube is connected, contains power supply, amplifier, calibration generator and a dehumidification system. Several different output possibilities are available to suit any particular measuring requirement. Moreover facilities for remote control and external supply of power and calibration signal are included. For further information see system development sheet "Airport Noise Monitoring Systems".



Fig. 37. Outdoor Microphone Unit Type 4921



Fig. 38. Power Supplies Types 2804 and 2807

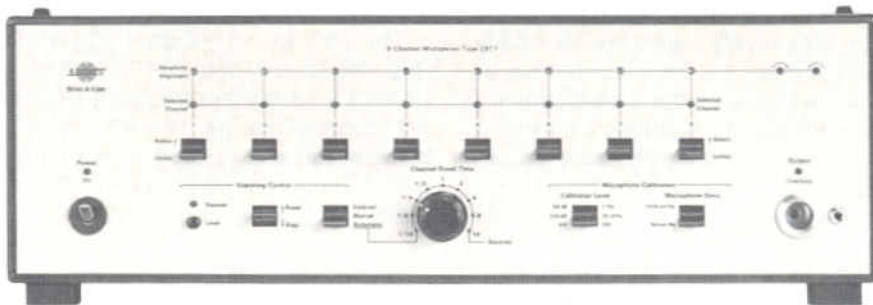


Fig. 39. Eight Channel Multiplexer Type 2811

Microphone Carrier System 2631

The Microphone Carrier System Type 2631 (Fig. 40) is made for measurement of low frequency pressure variations and shock waves and should be used with the microphone cartridge Type 4147. It supplies a carrier frequency of 10 MHz to the microphone cartridge instead of the normal 200 V polarization voltage.



Fig. 40. Microphone Carrier System Type 2631

Artificial Ears, Ear Simulator and Couplers

The Artificial Ears Type 4152 and 4153, Ear Simulator Type 4157 (Fig. 41) and the couplers DB 0138, DB 0909, and DB 0161 have been developed for measurements on head-

and earphones.



Fig. 41. Artificial Ears Types 4152 and 4153, and Ear Simulator Type 4157

Sealing Kit UA 0240

This kit (Fig. 42) is for sealing cartridge Types 4144 and 4145 so that measurements down to 0,1 Hz can be made.

Dehumidifier UA 0308

Use of dehumidifier is recommended in any situation where humidity may affect measurements.

The 1/2" diameter Dehumidifier UA 0308 (Fig. 43) is designed to be mounted between a microphone pre-amplifier or a sound level meter, and a backvented 1/2" condenser microphone cartridge. It contains silica gel and effectively removes humidity from the air in the microphone. A small window in the Dehumidifier's case allows the humidity content in the silica gel to be controlled, as the gel changes colour from blue in dry state to red when saturated. By heating for some hours at 100°C, or longer at lower temperatures, the gel is easily dried out again. When used in 100% RH the Dehumidifier requires drying-out approximately once a month.

Flexible Adaptors UA 0122 and UA 0123

The Flexible Adaptors (Fig. 44) allow the 1/2" and 1/4" microphones to be mounted on the 1/2" preamplifiers. The UA 0123 has a straight connector while the UA 0122 has a right angled connector. The flexibility of the adaptors makes the microphone assembly less sensitive to mechanical vibration and high temperatures



Fig. 44. Adaptors UA 0122, UA 0123, DB 0225, DB 0264 and DB 0900



Fig. 42. Sealing Kit UA 0240

(150°C). Both sets are delivered with adaptors for flush mounting of the microphone for measurement of turbulence and other pressure variations in the plane of a surface.

Adaptor DB 0225

The 1/2" to 1" Adaptor DB 0225 (Fig. 44) screws onto the 1/2" microphones to give them the same external dimensions as the 1" microphones. For use of 1/2" microphones with 1" standard couplers, or 1" actuator with 1/2" microphones.

Adaptor DB 0264

The 1/4" to 1/2" Adaptor DB 0264 (Fig. 44) screws onto the 1/4" microphones to give them the same external dimensions as the 1/2" microphones. For use of 1/2" accessories with 1/4" microphones, e.g. with 1/2" actuator.

Adaptor DB 0900

The 1/8" to 1/2" Adaptor DB 0900 (Fig. 44) screws onto the 1/8" microphone to give it the same external dimensions as the 1/2" microphones. For use of 1/2" accessories with the 1/8" microphone, e.g. 1/2" actuator.

Portable Floor Stand UA 0587

This portable tripod (Fig. 45) is of rugged construction. The microphone assembly is held in position



Fig. 45. Portable Floor Stand UA 0587 fitted with Adaptor UA 0588



Fig. 43. 1/2" Dehumidifier UA 0308

by means of the Tripod Adaptor UA 0588 which is included with the tripod. Height of the tripod is adjustable from 50 to 140 cm. The Adaptor UA 0588 may be ordered separately for use on any stand with 3/8" W thread. A 3/8" W to 1/4" W adaptor DB 1112 is supplied with the tripod, which is also suitable for mounting Sound Level Meters.

NB. The Adaptor UA 0588 does not accept the 1/4" Preamplifier Type 2633.

Rotating Microphone Boom Type 3923

The 3923 (Fig. 46) is designed for use in sound power measurements to ISO 3741 and in building acoustics. It is battery powered, from rechargeable NiCd-cells, but can also be operated from mains via the battery charger ZG 0113. It has rotation times of 16, 32 and 64 s and a built-in microswitch allows synchronization of external equipment. The length of the boom can be varied from 50 cm to 200 cm.



Fig. 46. Rotating Microphone Boom Type 3923 mounted on a tripod

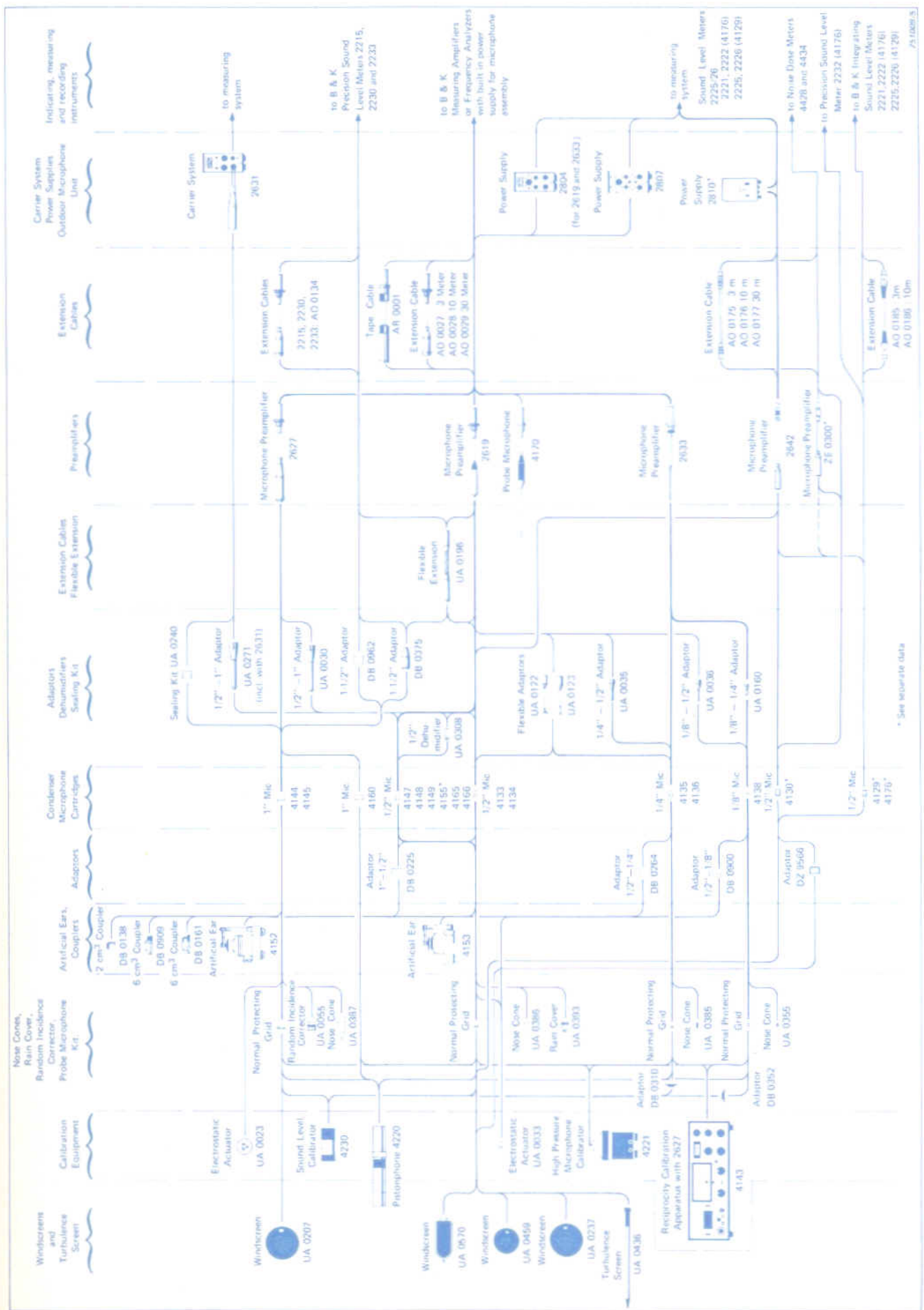


Fig. 47. Survey of adaptors and accessories for the condenser microphone cartridges

Specifications

| Type No. | 4144 | 4145 | 4160 | 4133, 4149 | 4134 | 4147 ^{a)} | 4148 | 4165 | 4166 | 4135 | 4136 | 4138 | |
|---|---|-------------------------|---------------------|--|-----------------------------|------------------------------|-------------------------|-------------------------|-----------------------------|--|-----------------------------|-----------------------------|------|
| Nominal Diameter | 1" | | | 1/2" | | | 1/4" | | | 1/8" | | | |
| Frequency Response Characteristic | Pressure | Free-Field 0° Incidence | Pressure | Free-Field 0° Incidence | Random Incidence & Pressure | Random Incidence & Pressure | Free-Field 0° Incidence | Free-Field 0° Incidence | Random Incidence & Pressure | Free-Field 0° Incidence | Random Incidence & Pressure | Random Incidence & Pressure | |
| Open Circuit Frequency Response* (±2 dB) | 2,6 Hz to 8 kHz | 2,6 Hz to 18 kHz | 4 Hz - 8 kHz ± 1 dB | 4 Hz to 40 kHz | 4 Hz to 20 kHz | 0,0065 Hz to 18 kHz | 4 Hz to 16 kHz | 2,6 Hz to 20 kHz | 2,6 Hz to 10 kHz | 4 Hz to 100 kHz | 4 Hz to 70 kHz | 6,5 Hz to 140 kHz | |
| Open Circuit Sensitivity* dB re: 1V/Pa | 50 | -26 | 48,5 | 12,5 | -38 | 1,1 x 10 ⁻³ pF/Pa | 12,5 | 50 | -26 | 4 | 1,6 | 1,0 | |
| Lower Limiting Frequency, -3 dB | 1 to 2 Hz | | | 1 to 3 Hz | | | 1 to 3 Hz | 1 to 2 Hz | | | 0,3 to 3 Hz | | |
| Cartridge Thermal Noise (dB(A)) | 9,5 | 10 | 9,5 | 20 | 18 | — | 12,5 | 14,5 | 15 | 29,5 | 30,5 | — | |
| Open Circuit Distortion Limit, 3% (dB re: 20 µPa) | >146 | | | >160 | | | >140 | >146 | | | >164 | >172 | >168 |
| Resonance Frequency | 8 kHz | 11 kHz | 8,5 kHz | 24 kHz | 23 kHz | — | 11 kHz | 14 kHz | 11 kHz | 100 kHz | 70 kHz | 160 kHz | |
| Polarization Voltage (V) | 200 | | | | | | | | | | | | |
| Polarized Cartridge Capacitance at 250 Hz* | 55 pF | 66 pF | 55 pF | 18 pF | 18,5 pF | 19,5 | 17 pF | 19 pF | 21 pF | 6,4 pF | | 3,5 pF | |
| Mean Temperature Coefficient -10°C to +50°C (dB/°C) | -0,003 | -0,002 | -0,003 | -0,002 | -0,002 | -0,015 | -0,015 | -0,007 | -0,007 | -0,01 | | 0,1 | |
| Equivalent Air Volume at 1 atm. (mm ³) | 148 | 130 | 148 | 10 | 10 | 80 | 40 | 40 | 0,6 | 0,25 | 0,1 | 0,1 | |
| Expected Long Term Stability at 150°C | >1000 years/dB (>200 years/dB ^{b)}) | | | | | | | | | | | | |
| Influence of Static Pressure at 250 Hz (dB/mbar) | -0,0016 | -0,0015 | -0,0016 | -0,0007 | -0,0007 | -0,00025 | -0,0016 | -0,001 | -0,001 | -0,0007 | -0,00025 | -0,001 | |
| Influence of 1 m/s ² Axial Vibration (dB re: 20 µPa) ^{c)} | 67 | | | | | | | | | | | | |
| Influence of 50 Hz, 80 A/m magnetic field (dB re: 20 µPa) ^{c)} | 18 | | | 20 | | | 28 | | | 30 | | | |
| Influence of Relative Humidity | 0,0025 dB/100% RH | | | <0,1 dB in the absence of condensation | | | 0,004 dB/%RH | | | <0,1 dB in the absence of condensation | | | |
| Height of Cartridge: Without Protection Grid With Protection Grid | 17 mm 19 mm | 19 mm 19,35 mm | 11,5 mm 12,6 mm | 15,2 mm 16,3 mm | — | | | 9,0 mm 10,5 mm | 6 mm 6,7 mm | — | | | |
| Diameter of Cartridge: Without Protection Grid With Protection Grid | 23,77 mm 23,77 mm | — | 12,7 mm 13,2 mm | 12,7 mm 13,2 mm | — | | | 6,35 mm 7 mm | 3,175 mm 3,5 mm | — | | | |
| Thread for Protection Grid or Coupler Mounting | 23,11 mm — 60 UNS | | | 12,7 mm — 60 UNS | | | 6,35 mm — 60 UNS | | | M3,175 x 0,2 | | | |
| Thread for Preamplifier Mounting | 23,11 mm — 60 UNS | | | 11,7 mm — 60 UNS | | | 5,7 mm — 60 UNS | | | M 3 x 0,2 | | | |

a) For specifications with 10 kHz carrier, see data sheet for Microphone Carrier System Type 2631
 b) Type 4149
 c) Typical value
 * Individually calibrated