UA 0436

Turbulence Screen

FEATURES:

- Frequency range from 20 Hz to 5 kHz, —0, +5 dB
- Omnidirectional within ±4 dB from 20 Hz to 1 kHz
- High degree of turbulence-noise suppression
- Low weight
- Robust construction

USES:

- Measurement of airborne noise in air ducts

Measurement of airborne noise in ducts can be very difficult or even impossible, because of the presence of flow noise caused by turbulent pressure fluctuations which are produced within the duct and convected past the measuring microphone at the velocity of the airstream.

To reduce this measuring problem Brüel & Kjær has developed the Turbulence Screen UA 0436, in cooperation with Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt E. V., Institut für Turbulenzforschung and Herrick Laboratories, Purdue University.

The UA 0436 consists essentially of a tube with an axial slit covered with several layers of specially selected damping material, to accurately control the flow resistance of the slit. A streamlined nose cone is inserted into the front end of the tube, while the rear end is terminated by a clamping arrangement for a 1/2" Condenser Microphone and its Preamplifier. See Fig.1.

The Turbulence Screen is able to distinguish between turbulent pressure fluctuations, which have a low propagation velocity, and the sound pressure fluctuations which have a much higher propagation velocity. Pressure fluctuations at a point of the tube cause pressure waves to propagate inside the tube, the propagation velocity being nearly equal to the speed of sound. When used inside a duct, pressure fluctuations will exist at all points along the slit and the pressure at the microphone diaphragm will be a superposition of the pressure waves from all points. If the pressure fluctuations are sound waves, the pressure waves from all points will add constructively and create a high sound pressure at the diaphragm, because the propagation velocity of the sound inside and outside the tube are nearly the same.

However, if the pressure fluctuations are caused by turbulence around the tube, the pressure waves inside the tube will add de-

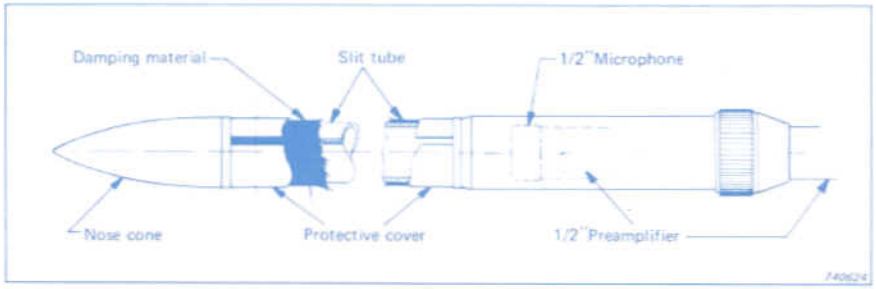

Fig.1. Schematic drawing of the UA 0436

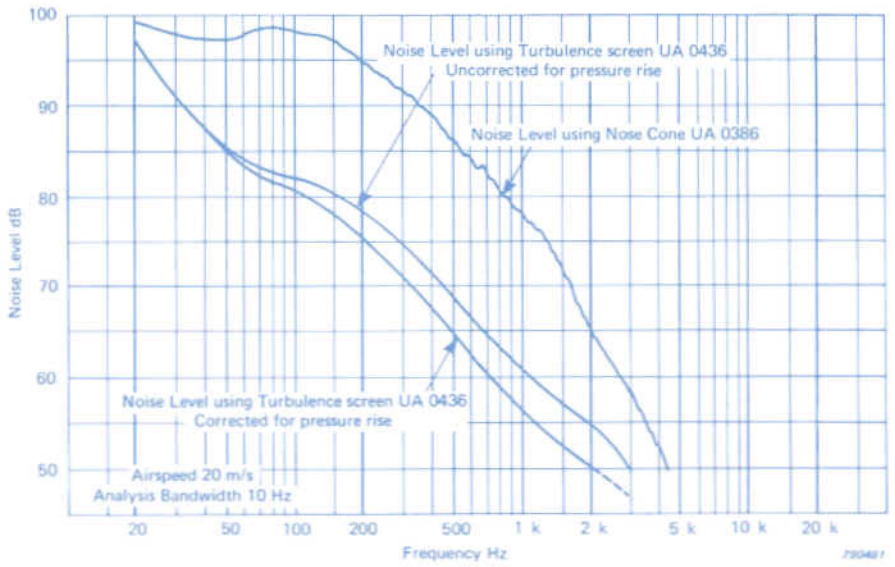

Fig.2. Turbulence noise suppression of the UA 0436 compared to that of a 1/2" Nose Cone UA 0486 as measured by Dr. Neise of Institut für Turbulenzforschung, Berlin

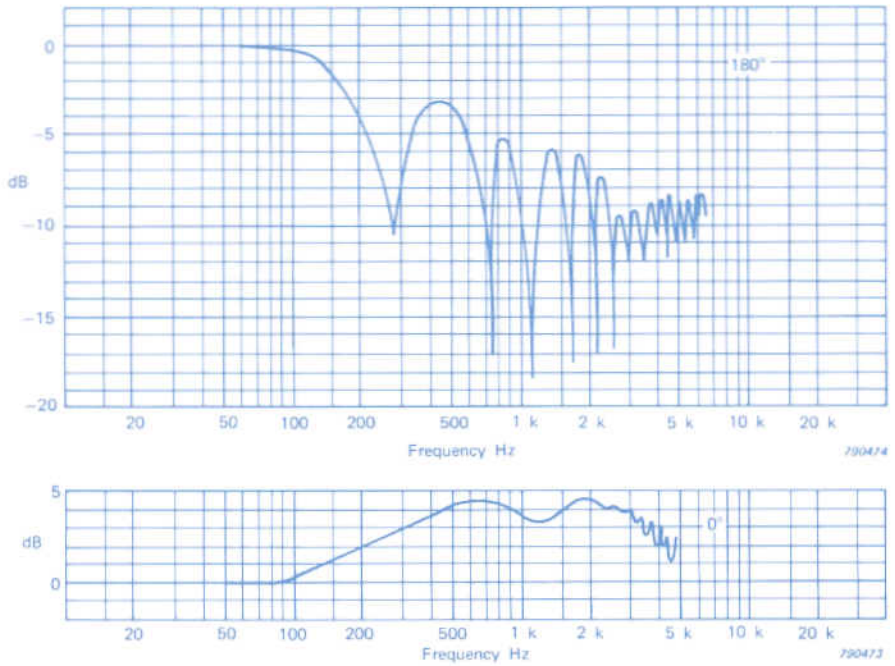

Fig.3. Frequency response of a 1/2" B & K free-field condenser microphone cartridge Type 4133 when fitted to a UA 0436

structively, because the propagation velocity inside the tube is much higher than the propagation velocity of the turbulence outside the tube, and only a very small pressure will therefore be created at the microphone diaphragm.

The width of the slit together with the damping material controls the flow resistance of the slit and thereby the noise suppression of the Screen.

The turbulence noise suppression obtained by use of the UA 0436 is approximately 16 dB better than that obtained with the Nose Cone UA 0386 measured in the frequency range 70 Hz to 1,5 kHz at an air velocity of 20 m/s. See the curves of Fig.2, which were measured in a duct with particularly high levels of turbulence.

The UA 0436 changes the frequency response of the microphone to axialy incidence sound waves as shown in Fig.3. The curves are the 0° and 180° frequency characteristics, i.e. the response to sound originating directly in front of or behind the screen and propagating along its axis. Both characteristics were measured in an anechoic room.

The Turbulence Screen can be used with a 1/2" B & K free-field Condenser Microphone Cartridge Type 4133, 4149 or 4165 mounted on a 1/2" Microphone Preamplifier Type 2619. The Preamplifier connects directly to B & K's extensive range of Measuring Amplifiers, Frequency Analyzers and Spectrometers.

Specifications UA 0436

Frequency Range:
(Measured in an anechoic room in a plane sound field propagating in the direction of the axis of the UA 0436)
Typically 20 Hz to 5 kHz with a change in microphone frequency response of less than + 5 dB

Omnidirectivity:
(Measured in an anechoic room)
Typical within ± 4 dB from 20 Hz to 1 kHz

Turbulence Noise Suppression:
(70 Hz to 1,5 kHz, measured in an air duct with an air velocity of 20 m/s) See Fig.2
Typically 16 dB better than that obtained by using Nose Cone UA 0386

Dimensions:
Length: 540 mm (21,2 in)
Diameter: 21 mm (0,8 in)

Weight:
0,2 kg (0,45 lb)

Accessories Available:
1/2" Condenser Microphone Cartridges Types 4133, 4149 and 4165
Microphone Preamplifier Type 2619