

## Sound Measurements

- Sound waves are, in fact, pressure waves or fluctuations of the pressure of air around the normal pressure of 1 atm.
- Capacitive microphone is used to reproduce the pressure fluctuations faithfully.
- Capacitive microphone is designed to have flat frequency response from 10 Hz to 20 kHz, and the designs are immune from effects of any variations in the atmospheric pressure.
- The human ear is more sensitive to frequencies around 1 kHz and it can detect pressure fluctuations at this frequency, having an rms value of 0.002  $\mu$ bar. This value of pressure is accepted as standard of reference for measurement of sound levels.
- The sound pressure level is defined in dB and is given by 
$$\text{Sound pressure level} = 20 \log \left( \frac{P}{0.002} \right) \text{ dB}$$

where  $P$  = rms sound pressure in  $\mu$ bar.

Hence, the average threshold of hearing for human beings is reckoned as 0 dB.

Applications:-

- Capacitive microphones are used in sound level meters.
- They are also used to measure the noise level of machinery and for analysis and diagnosis of vibration problems of machinery.

## Capacitive Microphone

- Here, vibratory displacements of membrane due to pressure variations results in variation of capacitance.

- The capacitive microphone membrane should be sensitive pressure fluctuations component only and provision must be made to equalize the pressure on either side of membrane so as to prevent it from bursting due to atmospheric pressure variations.

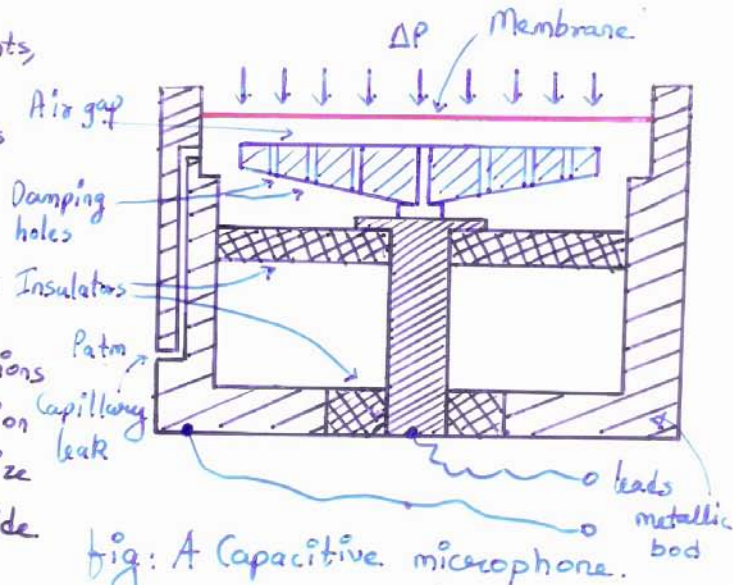


fig: A Capacitive microphone.

- Capacitive microphone consists of a very thin metallic membrane kept under radial tension.
- The capillary tube or hole connecting the chamber behind the membrane to atmosphere is intended to equalize the pressure on either side of the diaphragm.
- The capillary path and volume of microphone chamber allow slow variations of Patm but preventing the pressure fluctuations of sound waves from appearance on backside of the membrane.
- Thus, at any instant, the membrane is subjected to pressure fluctuations on the front side only.
- The fixed plate of capacitor is held rigidly inside the chamber and is provided with 'damping holes' to allow the air to pass freely from space between the electrodes to other side of chamber.
- The capacitance variations develop o/p voltage across the high resistance R. A high impedance amplifier amplifies the voltage.