

# Electric Guitar Pickups

The word *pickup* refers to a device that “picks up” the sound of an instrument and turns the sound into an electrical signal. The most common type of electric guitar pickup uses electromagnetic induction to convert string vibrations into electrical energy.

In their most basic form, magnetic pickups consist simply of a permanent magnet and a coil of copper wire. A pole piece under each guitar string concentrates and shapes the magnetic field. Because guitar strings are made from magnetic materials (steel and/or nickel), a vibrating guitar string causes a change in the magnetic field above the pickup. This changing magnetic field induces a current in the pickup coil.

Many turns of very fine gauge wire—finer than the hair on your head—are wound around each pole piece. The number of turns determines the current that the pickup produces, with more windings resulting in a larger current.

Electric guitar pickups come in many different styles, and a single electric guitar can have two or three different types of pickups in it. One such style, the hum-bucking pickup, is designed to reduce the noise, or hum, that single-coil pickups generate from ac electricity. The windings, magnets, and location of the pickup all affect the sound that the guitar and pickup produce.



## SECTION REVIEW

1. A circular current loop made of flexible wire is located in a magnetic field. Describe three ways an emf can be induced in the loop.
2. A bar magnet is positioned near a coil of wire, as shown to the right. What is the direction of the current in the resistor when the magnet is moved to the left, as in (a)? to the right, as in (b)?
3. A 256-turn coil with a cross-sectional area of  $0.0025 \text{ m}^2$  is placed in a uniform external magnetic field of strength  $0.25 \text{ T}$  so that the plane of the coil is perpendicular to the field. The coil is pulled steadily out of the field in  $0.75 \text{ s}$ . Find the average induced emf during this interval.
4. **Critical Thinking** Electric guitar strings are made of ferromagnetic materials that can be magnetized. The strings lie closely over and perpendicular to a coil of wire. Inside the coil are permanent magnets that magnetize the segments of the strings overhead. Using this arrangement, explain how the vibrations of a plucked string produce an electrical signal at the same frequency as the vibration of the string.

