Dynamometer Encyclopedia Article

Dynamometer

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Dynamometer

Deriving its name from the dyne, the fundamental metric unit of force, the dynamometer is an apparatus designed to measure the power, force, or energy of any machine that has a spinning shaft. Dynamometers are frequently used in determining the horsepower of internal combustion engines, and are often employed by the automobile industry in the testing and development of car engines.

Though there are many types of dynamometers, most fall into two general varieties: absorption and transmission. The earliest dynamometers were of the absorption variety, measuring the horsepower of a machine by finding out how much force had to be absorbed in order to impede the shaft's motion. In 1821 the French engineer Baron Gaspard de Prony (1755-1839) designed a rope-and-scale dynamometer called the Prony brake; when the rope was wrapped tightly around an engine's flywheel, the turning shaft would slow. At the same time, the weighted rope would be pulled slightly, and this increased tension could be measured upon the attached scale. This type of system is also called a rope brake.

The Prony brake was used extensively until the development of the water brake by William Froude, an English engineer. Froude had spent much of his career studying the ability of fluids to resist motion (such as water's resistance to the action of a boat moving through it). The water brake he designed consisted of a rotor encased within a water-filled compartment. The engine being tested would turn the rotor, and the horsepower could be found by measuring the amount of resistance exerted by the water.

A third type of brake dynamometer has since been invented that uses a large fan; using a principle similar to that of the water brake, the fan brake measures horsepower by measuring air resistance. There are also brakes that measure electrical resistance called electromagnetic brakes, but their efficiency is limited to relatively low horsepowers. Most automakers use brake dynamometers in their research, and the horsepower of their vehicles are usually expressed in brake horsepower (bhp).

The second, less commonly used type of dynamometer is the transmission variety. The transmission dynamometer allows researchers to measure an engine's power without slowing its motion. Because this is nearly impossible in any resistance-type device, transmission dynamometers are used principally in electric engines; here, the power is measured by calculating the current and voltage necessary to turn the shaft at a constant speed and is then translated into horsepower.