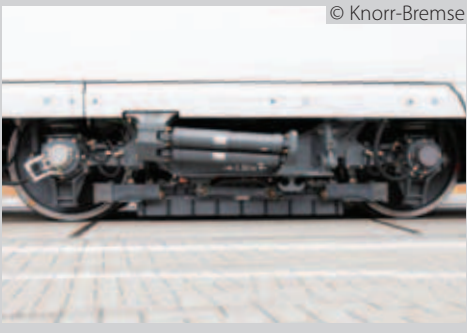
HOW DOES THAT WORK?

EDDY-CURRENT BRAKING

At speeds above 350km/h conventional train brakes, which rely on friction, cannot stop a train within an acceptably short distance. With increasingly longer, heavier and faster trains being introduced, braking has become a major technical problem requiring a novel solution.

The breakthrough: In recent years French, German and Japanese rail engineers have developed eddy-current braking, a wear-free system that bypasses the practical problems of wheel-to-rail adhesion, such as skidding.

Eddy-currents are a characteristic of Lenz's law published in 1834. Russian physicist Heinrich Lenz determined that an induced current always has a direction where its magnetic field opposes the magnetic field causing the current flow. Eddy-currents develop secondary flux that cancels part of the external flux. These currents are capable of creating heat-producing resistance as the eddy-currents circulate in the rail directly below the coils. This produces a brake force opposing the direction of movement, powerful enough to slow a high-speed train.



Today, train operators are using Lenz's law to great effect. In Germany's latest ICE3 trains, bogies carry two 1540mm-long magnets with eight coils. In braking, the magnets are lowered to just 7mm above the rail-head. The energised coils induce an opposite magnetic force which acts against the motion of the train, giving a powerful and almost constant deceleration down to 50km/h when conventional brakes take over.