TRIBOLOGY

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Tribology is the science of the mechanisms of **friction, lubrication, and the wear of parts that interact with each other.** It has many applications in the automobile industry.

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- Safety
- Environment
- Life on board
- Mobility
- **Competitiveness**

BASIC FACTS

How to reduce friction inside an engine, to limit the wear of a gearbox, to stop brakes from screeching, a sun roof from creaking, or electric connectors from working loose are all questions to which tribology can provide answers. It is a science whose aim is to study in detail the behaviour of surfaces that come into contact with each other. Tribology also considers which materials can be combined to limit friction most effectively. Take camshaft tappets or crankshaft bearings, for example. The kind of alloy chosen for the composition of each part determines wear. Through tribology it is possible to determine which combinations of materials are most reliable and best suited to preventing a loss of engine performance and controlling CO_2 emissions. Tribology is also applied to fine-tuning the minute parts in electric connectors. Vibration causes micro-friction between internal parts that rub against each other, impairing their surfaces, and loosening connections. Drawing on tribology, it is possible to optimize surface coatings and the shape of each contact so that connectors resist vibration more effectively and enjoy longer life spans. Some tribological studies focus on comfort. There are, for example, plastic parts that tend to squeak or grate when they interact. Although this may not in itself be serious, it is unpleasant and reflects badly on the quality of the part – a sunroof that creaks makes a bad impression. Tribologists conduct studies into the composition of the interacting plastic parts and add materials – e.g. teflon – in order to modify their mechanical characteristics and eliminate irritating noise. Tribology can intervene at very upstream stages of the engineering process, like the design of tool for manufacturing vehicles. A case in point: sheet metal stamping dies. Stamping involves short-lived but extremely intense friction. Stamping quality is strongly determined by the friction between the sheet metal and the die when it is hit by the press.

IN SHORT

TRIBOLOGY IS THE STUDY OF FRICTION CAUSED BY INTERACTION BETWEEN TWO PARTS. IT PLAYS A PART IN REDUCING FRICTION INSIDE ENGINES AS WELL AS ELIMINATING IRRITATING NOISE TO OPTIMIZE USER WELL-BEING.

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HOW DOES IT WORK?

It is difficult to place sensors on or take measurements directly from a working engine or gearbox. Each part is therefore tested on a test bench that scrupulously reproduces working conditions. Stress and force, kinematic parameters, temperature, and the lubrication to which a part is submitted are identical to those it will experience in real life. To test crankshaft bearings, for example, a metering machine can reproduce the operating conditions of any engine up to rev speeds of 6,000 rpm. As for electric connectors they are tested on electro-dynamic exciters – vibrating test benches where vibration amplitude and frequency are adjustable. For a gearbox the measuring bench generates levels of mechanical stress identical to those that it would have to withstand when climbing a steep gradient at an engine speed at 3,000 rpm. Each part has its own dedicated metering tool.
For windscreen wipers to operate with optimum efficiency, they must leave a thin layer of water on the windscreen to prevent their motor from overloading. Hydraulic jacks measure the ideal pressure that the wipers must exert on the windscreen and accordingly adjust the optimum power setting of the motor that drives them.

Tribology has always helped to expose many received ideas. Among the most strategic parts of an engine, for example, are the points of contact between the piston rings and the crankcase bore. One would have thought they should be as smooth as possible. Tribology has demonstrated the opposite is true. When surfaces are too smooth they prevent the formation of stable, homogeneous oil films.
To be effective, the oil must “stick” to cylinder walls. Accordingly Renault has developed surface treatment specific to cylinder bores. Their surfaces are covered by meshes of tiny helic striations, similar to the barrel of a gun. Similarly, the shape of the piston rings has been designed to encourage the formation of oil films between the piston rings and the crankcase bore. Innovative processes like plasma spraying, even more efficient than the striation system, are under development.

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