

# NON-DESTRUCTIVE TESTING

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Non-destructive testing (NDT) **seeks to root out the slightest imperfection in a mechanical part.** It uses ultrasound, eddy currents, and X-rays to look into solid car parts without having to cut into, and therefore destroy, them.



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## BASIC FACTS

**Small defects like internal cavities and microscopic cracks in a metal part** can have dire consequences for the reliability of the part, the engine, or even the whole car. Unlike surface defects that can be spotted through simple observation, these structural defects are invisible to the naked eye for they are embedded in the piece. Yet once they are submitted to the stresses and vibration inherent to the automobile, these structural defects can cause a component to rupture or break down.

It is therefore essential to be able to detect any flaws. Non-destructive testing (NDT) is generally carried out in two ways. In the first place great use is made of it in prototyping, when the whole production process of a part is studied. Smelting, metal injection, die-casting, and welding are among the processes that have to be checked to ensure they are reliable and do not lead to any internal structural defects. NDT is very efficient and much easier to carry out than cutting

into the part under examination. NDT also intervenes in the production process, helping to validate the reliability of production technology by regularly collecting samples for analysis. It offers one major advantage. Because the physical integrity of a component is not damaged, its future usefulness is not impaired. If NDT shows it is flawless, it can return to the production line. As a result, non-destructive testing can be used widely without excessively increasing manufacturing costs.

## IN SHORT

**NDT IS A TECHNIQUE FOR DETECTING EFFICIENTLY AND RAPIDLY ANY DEFECT THAT MAY BE EMBEDDED IN A MECHANICAL COMPONENT WITHOUT IMPAIRING ITS PHYSICAL INTEGRITY. IF NDT SHOWS IT IS FLAWLESS, IT CAN BE USED AGAIN BECAUSE TESTING HAS NOT DAMAGED IT.**

# HOW DOES IT WORK?

**Although** there are many techniques of NDT, four are widely used. They are: dye-penetrant inspection, ultrasonic inspection, eddy current testing, and X-ray tomography. The different methods complement each other, while each possesses specific features that suit it to a certain kind of piece or powertrain component.

## **Dye-penetrant inspection**

highlights minute surface defects like microscopic cracks or hollows. The part is cleaned then smeared with a coloured dye. Excess dye is wiped off, and a sort of blotting paper, called "the revealer" is pressed against the part's surface. It absorbs the dye trapped in the surface defects, which rises to the surface so revealing any defects.

**Ultrasonic** inspection uses a technique similar to that used in antenatal ultrasound scans (or echographies). A probe that doubles as tiny loud-speaker and microphone is brought into contact with the part to inspect. The probe

emits a brief salvo of ultrasounds, which propagate through the metal piece. Any break in the structure of the metal part causes the ultrasonic waves to be partially reflected, resulting in an "echo". This echo betrays the presence of a flaw. Furthermore, because the speed of propagation of the ultrasound through the metal is a known quantity, the probe can determine how deep the flaw lies by measuring the length of time between the emission of the ultrasound waves and reception of the echo. Ultrasound inspection is also a very effective way of testing the quality of the welding on bodywork parts, for example.

**Eddy current inspection** uses induction to detect flaws in metal, and therefore conductive, parts. An electromagnet powered by high-frequency voltage induces an electric current in the part being tested. If there are no defects, the current flows freely through the metal piece. Any microscopic fissure, however, breaks the flow

of the electric circuit, acting like a local insulator. The loss of current modifies the power being consumed by the electromagnetic and the measurement device registers the drop in electricity consumption. Fluctuating electricity consumption reflects the metal part's internal structure. Analysis of the fluctuations reveals any flaw in the geometry or structure of the metal part. Brake disks and engine components can be tested using the eddy current inspection technique, but it can also be used to precision- measure the thickness of a layer of plaster or paint.

**X-ray tomography** is directly derived from medical imagery technology. The testing devices are very similar to medical scanners. The chief advantage of the technique is that it yields 3D images of defects. They come as digital image files, which makes them simpler to read and use on a computer. In addition, a new device called a micro-tomograph provides tenth-micron resolution images.