NDT/NDE Technologies

Many people are already familiar with some of the technologies that are used in NDT and NDE from their uses in the medical industry.

Most people have also had an X-ray taken or have experienced “key-hole” surgery. Similarly during recuperation ultrasonics have used to enhance healing. X-rays and ultrasound are only a few of the technologies used in the field of NDT/NDE. The number of inspection methods seems to grow daily, but a quick summary of the most commonly used methods is provided below.

Visual and Optical Testing (VT)

The most basic NDT method is visual examination. Visual examiners follow procedures that range from simply looking at a part to see if surface imperfections are visible, to using computer controlled camera systems to drive around plants and buried assets to determine their internal condition. Since void spaces vary, there is huge variety of visual inspection equipment – binoculars, borescopes, cameras, magnifying glass.

Radiography (RT)

RT involves the use of penetrating gamma- or X-radiation to examine material's and product's defects and internal features. An X-ray machine or radioactive isotope is used as a source of radiation. Radiation is directed through a part and onto film or other media. The resulting shadowgraph shows the internal features and soundness of the part. Material thickness and density changes are indicated as lighter or darker areas on the film. The darker areas in the radiograph below represent internal voids in the component.

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Magnetic Particle Testing (MT)

This NDT method is accomplished by inducing a magnetic field in a ferromagnetic material and then dusting the surface with iron particles (either dry or suspended in liquid). Surface and near-surface flaws produce magnetic poles or distort the magnetic field in such a way that the iron particles are attracted and concentrated. This produces a visible indication of defect on the surface of the material. The images demonstrate a component before and after inspection using dry magnetic particles.

Ultrasonic Testing (UT)

In ultrasonic testing, high-frequency sound waves are transmitted into a material to detect imperfections or to locate changes in material properties. The most commonly used ultrasonic testing technique is pulse echo, whereby sound is introduced into a test object and reflections (echoes) from internal imperfections or the part's geometrical surfaces are returned to a receiver. This is an example of shear wave weld inspection. Notice the indication extending to the upper limits of the screen. This indication is produced by sound reflected from a defect within the weld. Generally good clean surfaces free from corrosion etc are required to perform this type of inspection along with the some means of a couplant existing between the sensor and the subject.

Penetrant Testing (PT)

The test object is coated with a solution that contains a visible or fluorescent dye. Excess solution is then removed from the surface of the object but leaving it in surface breaking defects. A developer is then applied to draw the penetrant out of the defects. With fluorescent dyes, ultraviolet light is used to make the bleedout fluoresce brightly, thus allowing imperfections to be readily seen. With visible dyes, vivid color contrasts between the penetrant and developer make "bleedout" easy to.

Electromagnetic Testing (ET)

Electrical currents (eddy currents) are generated in a conductive material by a changing magnetic field. The strength of these eddy currents can be measured. Material defects cause interruptions in the flow of the eddy currents which alert the inspector to the presence of a defect. Eddy currents are also affected by the electrical conductivity and magnetic permeability of a material, which makes it possible to sort some materials based on these properties.

Leak Testing (LT)

Several techniques are used to detect and locate leaks in pressure containment parts, pressure vessels, and structures. Leaks can be detected by using electronic listening devices, pressure gauge measurements, liquid and gas penetrant techniques, and/or a simple soapbubble test.