

Introduction to Nondestructive Testing

Introduction to Nondestructive Testing (NDT)

NDT is the process of inspecting, testing, or evaluating materials, components or assemblies for defects **without destroying it.**

In other words, “Inspect, test or evaluate without doing harm.”

Introduction to Nondestructive Testing

- NDT plays a vital role in assuring the safe operation of equipment and systems
- NDT is commonly used in Industries like:
 - Airline and Aerospace
 - Automotive and Railroad
 - Construction
 - Hydroelectric, Fossil, and Nuclear Power
 - Manufacturing
 - Logistics and Supply
 - Medical.... and many more

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Uses of NDT

- Flaw Detection and Evaluation - the size, shape, or orientation of a flaw (such as a crack or porosity)
- Leak Detection
- Location Determination
- Dimensional Measurements
- Estimation of Mechanical and Physical Properties
- Measuring thickness of a material or coating
- Measuring hardness of a material

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Commonly used NDT methods are:

- *Acoustic Emission Testing (AE)*
- *Liquid Penetrant Testing (PT)*
- *Electromagnetic Testing (ET)*
- *Magnetic Particle Testing (MT)*
- *Radiographic Testing (RT)*
- *Ultrasonic Testing (UT)*
- *Visual Testing (VT)*

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Visual Testing (VT)

VT is the visual observation of the surface to evaluate the presence of surface discontinuities. Corrosion, misalignment of parts, physical damage and cracks are some of the discontinuities that may be detected by VT.

VT is the most commonly used test method in industry as most test methods require that the operator look at the surface of the part being inspected. VT inspections may be by direct looking, or may be by use of optical instruments such as magnifying glasses, mirrors, borescopes, and remote Viewing.

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Liquid Penetrant Testing (PT)

PT uses a liquid with high surface wetting characteristics is applied to the surface and allowed to seep into defects and then excess liquid is removed.

A developer is applied the trapped penetrant is pulled out of the defect where it can be seen.

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Magnetic Flux Leakage (MFL)

MFL detects anomalies in normal flux patterns created by discontinuities in ferrous material saturated by a magnetic field. This technique can be used for piping and tubing inspection, tank floor inspection and other applications. This technique can be done without removing the insulation, resulting in a fast, economic way to inspect long runs of pipe or tubing.

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Ultrasonic Testing (UT)

UT uses the same principle as is used in naval SONAR and fish finders. Ultra-high frequency sound is introduced into the part being inspected and if the sound hits a material with a different acoustic impedance (density and acoustic velocity), some of the sound will reflect back to the sending unit and can be presented on a visual display.

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Electromagnetic Testing (ET)

Electromagnetic testing is a general test category that includes Eddy Current testing (ECT), Alternating Current Field Measurement (ACFM) and Remote Field testing. While magnetic particle testing is also an electromagnetic test, due to its widespread use it is considered a stand-alone test method rather than an electromagnetic testing technique. All of these techniques use the induction of an electric current or magnetic field into a conductive part, then the resulting effects are recorded and evaluated.

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Radiographic Testing (RT)

RT involves exposing a test object to radiation so that the radiation passing through the object is recorded on a medium placed against the opposite side. The recording media can be industrial x-ray film or one of several types of digital radiation detectors. If there is a void or defect in the part, more radiation passes through, causing a darker image on the film or detector.

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Acoustic Emission Testing (AE)

AE is performed by applying a localized external force such as an abrupt mechanical load or rapid temperature or pressure change to the part being tested. The resulting stress waves in turn generate short-lived, high frequency elastic waves in the form of small material displacements, or plastic deformation, on the part surface that are detected by sensors that have been attached to the part surface. When multiple sensors are used, the resulting data can be evaluated to locate discontinuities in the part.

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Magnetic Particle Testing (MT)

In MT the part is magnetized. Finely milled iron particles coated with a dye pigment are then applied to the specimen. These particles are attracted to magnetic flux leakage fields and will cluster to form an indication directly over the discontinuity. This indication can be visually detected under proper lighting conditions.

Common Applications of NDT

- Inspection of forgings, castings and extrusions etc.
- Inspection of welded joints
- Pipeline Inspection.
- Aircraft Inspection
- Jet Engines Inspection
- Pressure Vessels Inspection
- Bridges and concrete structures etc.