

NDT Method Summary

Penetrant Testing	Magnetic Particle Testing	Ultrasonic Testing	Eddy Current Testing	Radiographic Testing
Scientific Principles				
<p>Penetrant solution is applied to the surface of a component.</p> <p>The liquid is pulled into surface-breaking defects by capillary action. Excess penetrant material is carefully cleaned from the surface.</p> <p>A developer is applied to pull the trapped penetrant back to the surface. Where it is spread out and forms an indication.</p>	<p>A magnetic field is established in a component made from ferromagnetic material.</p> <p>Defects such as crack or voids cannot support as much flux, and force some of the flux outside of the part.</p> <p>Magnetic particles distributed over the component will be attracted to areas of flux leakage and produce a visible indication.</p>	<p>High frequency sound waves are sent into a material by use of a transducer.</p> <p>The amount of energy transmitted or received and the time the energy is received are analyzed to determine the presence of flaws.</p> <p>Changes in material thickness, and changes in material properties can also be measured.</p>	<p>Alternating electrical current is passed through a coil producing a magnetic field. When the coil is placed near a conductive material, the changing magnetic field induces current flow in the material.</p> <p>Eddy currents produce their own magnetic field that can be measured and used to find flaws and characterize conductivity, permeability, and dimensional features.</p>	<p>X-rays are used to produce images of objects using film.</p> <p>The test object is placed between the radiation source and detector. The thickness and the density of the material that X-rays must penetrate affects the amount of radiation reaching the detector.</p> <p>This variation in radiation produces an image on the detector that often shows internal features of the test object.</p>
Main Uses				
<p>Used to locate cracks, porosity, and other defects that break the surface of a material and have enough volume to trap and hold the penetrant material.</p> <p>Liquid penetrant testing is used to inspect large areas very efficiently and will work on most nonporous materials.</p>	<p>Used to inspect ferromagnetic materials (those that can be magnetized) for defects that result in a transition in the magnetic permeability of a material.</p> <p>Magnetic particle inspection can detect surface and near surface defects.</p>	<p>Used to locate surface and subsurface defects in many materials including metals, plastics, and wood.</p> <p>Ultrasonic inspection is also used to measure the thickness of materials and otherwise characterize properties of material based on sound velocity and attenuation measurements.</p>	<p>Used to detect surface and near-surface flaws in conductive materials.</p> <p>It is also used to sort materials, based on electrical conductivity and magnetic permeability, and also measure the thickness of thin sheets of metal and nonconductive coatings such as paint.</p>	<p>Used to inspect almost any material for surface and subsurface defects.</p> <p>X-rays can also be used to locate and measure internal features, confirm the location of hidden parts in an assembly, and to measure thickness of materials.</p>
Main Advantages				
<p>Large surface areas or large volumes of parts/materials can be inspected rapidly and at low cost.</p> <p>Parts with complex geometry.</p> <p>Indications are produced directly on the surface of the part providing a visual image of the discontinuity.</p> <p>Equipment investment is minimal.</p>	<p>Large surface areas of complex parts can be inspected rapidly.</p> <p>Can detect surface and subsurface flaws.</p> <p>Magnetic particle indications are produced directly on the surface of the part and form an image of the discontinuity.</p> <p>Equipment costs are relatively low.</p>	<p>Depth of penetration for flaw detection or measurement is superior to other methods.</p> <p>Only single sided access is required.</p> <p>Provides distance information.</p> <p>Minimum part preparation is required.</p>	<p>Detects surface and near surface defects.</p> <p>Test probe does not need to contact the part.</p> <p>Method can be used for more than flaw detection.</p> <p>Minimum part preparation is required.</p>	<p>Can be used to inspect virtually all materials.</p> <p>Detects surface and subsurface defects.</p> <p>Ability to inspect complex shapes and multi-layered structures without disassembly.</p> <p>Minimum part preparation is required.</p>
Disadvantages				
<p>Detects only surface breaking defects.</p> <p>Surface preparation is critical as contaminants can mask defects.</p> <p>Requires a relatively smooth and nonporous surface.</p> <p>Post cleaning is necessary to remove chemicals.</p> <p>Chemical handling precautions are necessary (toxicity, fire, waste).</p>	<p>Only ferromagnetic materials can be inspected.</p> <p>Proper alignment of magnetic field and defect is critical.</p> <p>Requires relatively smooth surface.</p> <p>Paint or other nonmagnetic coverings adversely affect sensitivity.</p> <p>Demagnetization and post cleaning is usually necessary.</p>	<p>Surface must be accessible to probe and couplant.</p> <p>Surface finish and roughness can interfere with inspection.</p> <p>Thin parts may be difficult to inspect.</p> <p>Linear defects oriented parallel to the sound beam can go undetected.</p> <p>Reference standards are often needed.</p>	<p>Only conductive materials can be inspected.</p> <p>Ferromagnetic materials require special treatment to address magnetic permeability.</p> <p>Depth of penetration is limited.</p> <p>Flaws that lie parallel to the inspection probe coil winding direction can go undetected.</p> <p>Skill and training required is more extensive than other techniques.</p>	<p>Access to both sides of the structure is usually required.</p> <p>Orientation of the radiation beam to non-volumetric defects is critical.</p> <p>Field inspection of thick section can be time consuming.</p> <p>Relatively expensive equipment investment is required.</p> <p>Possible radiation hazard for personnel.</p>