

Types of Testing: there are two main types of tests:

1. Destructive testing
2. Nondestructive testing

Nondestructive Testing

In certain applications, the evaluation of engineering materials or structures without impairing their properties is very important, such as the quality control of the products, failure analysis or prevention of the engineered systems in service. This kind of evaluations can be carried out with non destructive test (NDT) methods. It is possible to inspect and/or measure the materials or structures without destroying their surface texture, product integrity and future usefulness. These methods can be performed on metals, plastics, ceramics, composites, cermet, and coatings in order to detect cracks, internal voids, surface cavities, incomplete defective welds and any type of flaw that could lead to premature failure.

A general definition of nondestructive testing (NDT) is an examination, test, or evaluation performed on any type of test object without changing or altering that object in any way, that can provide useful information regarding the condition of the object being examined, approved procedures are followed, and the examinations are conducted by qualified personnel in order to determine the absence or presence of conditions or discontinuities that may have an effect on the usefulness or serviceability of that object. Nondestructive tests may also be conducted to measure other test object characteristics, such as size; dimension; structure, including alloy content, hardness, grain size, etc. Nondestructive examination (NDE), nondestructive inspection (NDI), and nondestructive evaluation (NDE) are also expressions commonly used to describe this technology.

Although NDT cannot guarantee that failures will not occur, it plays a significant role in minimizing the possibilities of failure. Other variables, such as inadequate design and improper application of the object, may contribute to failure even when NDT is appropriately applied.

Nondestructive testing, in fact, is a process that is performed on a daily basis by the average individual, who is not aware that it is taking place.

The human body has been described as one of the most unique nondestructive testing instruments ever created. all the human senses, the sense of sight provides us with the most versatile and unique nondestructive testing approach. When one considers the wide application of the sense of sight and the ultimate information that can be determined by mere visual observation, it becomes quite apparent that visual testing (VT) is a very widely used form of nondestructive testing.

Nondestructive testing, in fact, can be considered as an extension of the human senses, often through the use of electronic instrumentation and

other unique equipment. It is possible to increase the sensitivity and application of the human senses when used in conjunction with these instruments and equipment. On the other hand, the misuse or improper application of a nondestructive test can cause catastrophic results. If the test is not properly conducted or if the interpretation of the results is incorrect, disastrous results can occur. It is essential that the proper nondestructive test method and technique be employed by qualified personnel, in order to minimize these problems. In industry, nondestructive testing can do so much more. It can effectively be used for the:

1. Examination of raw materials prior to processing
2. Evaluation of materials during processing as a means of process control
3. Examination of finished products
4. Evaluation of products and structures once they have been put into service

Some types of non-destructive methods

Visual inspection:

VI is particularly effective detecting macroscopic flaws, such as poor welds, VI is also suitable for detecting flaws in composite structures and piping of all types, poor fits, wrong dimensions, improper surface finish, delamination in coatings, large cracks, cavities

Radiography

Detecting cracks, however this method is less popular because of the hazards of handling radioactive materials.

Liquid (Dye) penetrant method

The technique is based on the ability of a liquid to be drawn into a "clean" surface breaking flaw by capillary action. Materials that are commonly inspected using LPI include the following; metals (aluminum, copper, steel, titanium, etc.), glass, many ceramic materials, rubber, plastics. Liquid penetrant inspection is used to inspect of flaws that break the surface of the sample. Some of these flaws are listed below; fatigue cracks, quench cracks grinding cracks, overload and impact fractures, porosity, laps seams, pin holes in welds, lack of fusion or braising along the edge of the bond line.

Magnetic particles:

The component being inspected must be made of a ferromagnetic material such iron, nickel, cobalt, or some of their alloys

Eddy current testing:

Eddy currents can be used for crack detection, material thickness measurements, coating thickness measurements, conductivity measurements for material identification, heat damage Detection applicability just on conductive materials

Ultrasonic Inspection:

Ultrasonic Testing (UT) uses a high frequency sound energy to conduct examinations and make measurements. Ultrasonic inspection can be used for flaw detection, evaluation, dimensional measurements, material characterization, and more. The ultrasonic inspection method has high penetrating power and sensitivity. It can be used from various directions to inspect flaws in large parts, such as rail road wheels pressure vessels and die blocks.

Benefits of nondestructive testing include:

- The part is not changed or altered and can be used after examination
- Every item or a large portion of the material can be examined with no adverse consequences
- Materials can be examined for conditions internal and at the surface
- Parts can be examined while in service
- Many NDT methods are portable and can be taken to the object to be examined
- Nondestructive testing is cost effective

Limitations of nondestructive testing include:

- It is usually quite operator dependent
- Some methods do not provide permanent records of the examination
- NDT methods do not generally provide quantitative data
- Orientation of discontinuities must be considered
- While most methods are cost effective, some, such as radiography, can be expensive
- Defined procedures that have been qualified are essential