

# **PART 1**

# **NONDESTRUCTIVE TESTING AND NONDESTRUCTIVE EVALUATION**

# ***NONDESTRUCTIVE TESTING AND NONDESTRUCTIVE EVALUATION***

**Nondestructive testing (NDT) is the process of inspecting, testing, or evaluating materials, components or assemblies for discontinuities, or differences in characteristics without destroying the serviceability of the part or system. In other words, when the inspection or test is completed the part can still be used.**

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**In contrast to NDT, other tests are destructive in nature and are therefore done on a limited number of samples ("lot sampling"), rather than on the materials, components or assemblies actually being put into service.**

**These destructive tests are often used to determine the physical properties of materials such as impact resistance, ductility, yield and ultimate tensile strength, fracture toughness and fatigue strength, but discontinuities and differences in material characteristics are more effectively found by NDT.**

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**Today modern nondestructive tests are used in manufacturing, fabrication and in-service inspections to ensure product integrity and reliability, to control manufacturing processes, lower production costs and to maintain a uniform quality level. During construction, NDT is used to ensure the quality of materials and joining processes during the fabrication and erection phases, and in-service NDT inspections are used to ensure that the products in use continue to have the integrity necessary to ensure their usefulness and the safety of the public.**

## **NDT methods :**

- a) Magnetic Particle Testing (MPI)**
- b) Acoustic Emission Testing (AE)**
- c) Radiography (RT)**
- d) Visual and Optical Testing (VT)**
- e) Leak Testing (LT)**
- f) Penetrant Testing (PT)**
- g) Ultrasonic Testing (UT)**
- h) Electromagnetic Testing (ET)**

## **Levels of certification**

**Most NDT personnel certification schemes listed above specify three "levels" of qualification and/or certification, usually designated as Level 1, Level 2 and Level 3 (although some codes specify Roman numerals, like Level II). The roles and responsibilities of personnel in each level are generally as follows (there are slight differences or variations between different codes and standards).**

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**Level 1** are technicians qualified to perform only specific calibrations and tests under close supervision and direction by higher level personnel. They can only report test results. Normally they work following specific work instructions for testing procedures and rejection criteria.

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**Level 2 are engineers or experienced technicians who are able to set up and calibrate testing equipment, conduct the inspection according to codes and standards (instead of following work instructions) and compile work instructions for Level 1 technicians. They are also authorized to report, interpret, evaluate and document testing results. They can also supervise and train Level 1 technicians. In addition to testing methods, they must be familiar with applicable codes and standards and have some knowledge of the manufacture and service of tested products.**



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**Level 3** are usually specialized engineers or very experienced technicians. They can establish NDT techniques and procedures and interpret codes and standards. They also direct NDT laboratories and have central role in personnel certification. They are expected to have wider knowledge covering materials, fabrication and product technology.

## **Terminology**

### **Indication**

**The response or evidence from an examination, such as a blip on the screen of an instrument. Indications are classified as true or false. False indications are those caused by factors not related to the principles of the testing method or by improper implementation of the method, like film damage in radiography, electrical interference in ultrasonic testing etc.**

## **Flaw**

**A type of discontinuity that must be investigated to see if it is rejectable. For example, porosity in a weld or metal loss.**

## **Evaluation**

**Determining if a flaw is rejectable. For example, is porosity in a weld larger than acceptable by code?**

## **Defect**

**A flaw that is rejectable — i.e. does not meet acceptance criteria. Defects are generally removed or repaired.**