Casting Inspection | Non Destructive Testing | Destructive Testing

Inspection of Castings:

A large number of methods have been developed to inspect castings for defects that may occur during their production. Such inspections may be in process inspections or finished product inspections.

In process inspections are carried out before a lot of castings have been completed to detect any flaws that may have occurred in the process so that corrective measures can be taken to remove the defect in the remaining units. Finished product inspections are carried out after the castings have all been completed to make sure that the product meets the requirements specified by the customer.

Defective castings may be salvaged or completely rejected to be re-melted for their material content depending upon the nature and extent of defect. The inspection methods may also be divided into destructive or non-destructive categories depending upon the magnitude of damage done to the casting during inspection. Destructive methods generally relate to sawing or breaking off of parts of the castings at places where voids or internal defects are suspected. Castings may also be damaged during strength tests.

Destructive tests suffer from the disadvantage that the saw cuts may miss the flaw or the sample may not represent the behavior of the entire lot. Because of these reasons non-destructive tests are generally more commonly relied upon than destructive tests.

Some of the prominent non destructive methods are described below:

Visual Inspection:

It consists of inspecting the surface of the casting with naked eye or sometimes with a magnifying glass or microscope. It can only indicate surface defects such as blow holes, fusion, swells, external cracks, and mismatch. Almost all castings are subjected to certain degree of visual inspection.

Dimensional Inspection:

Dimensional inspection is carried out to make sure that the castings produced have the required overall dimensions including allowances for machining. It may sometimes be necessary to break a part of the casting to take measurements of inside dimensions.

Sound Test:

This is a rough test to indicate a flaw or discontinuity in a casting. The casting is suspended from a suitable support free of all obstructions and tapped at various places on its surface with a small hammer. Any change in the tone produced indicates the existence of a flaw. The method cannot indicate the exact location and extent of the discontinuity.

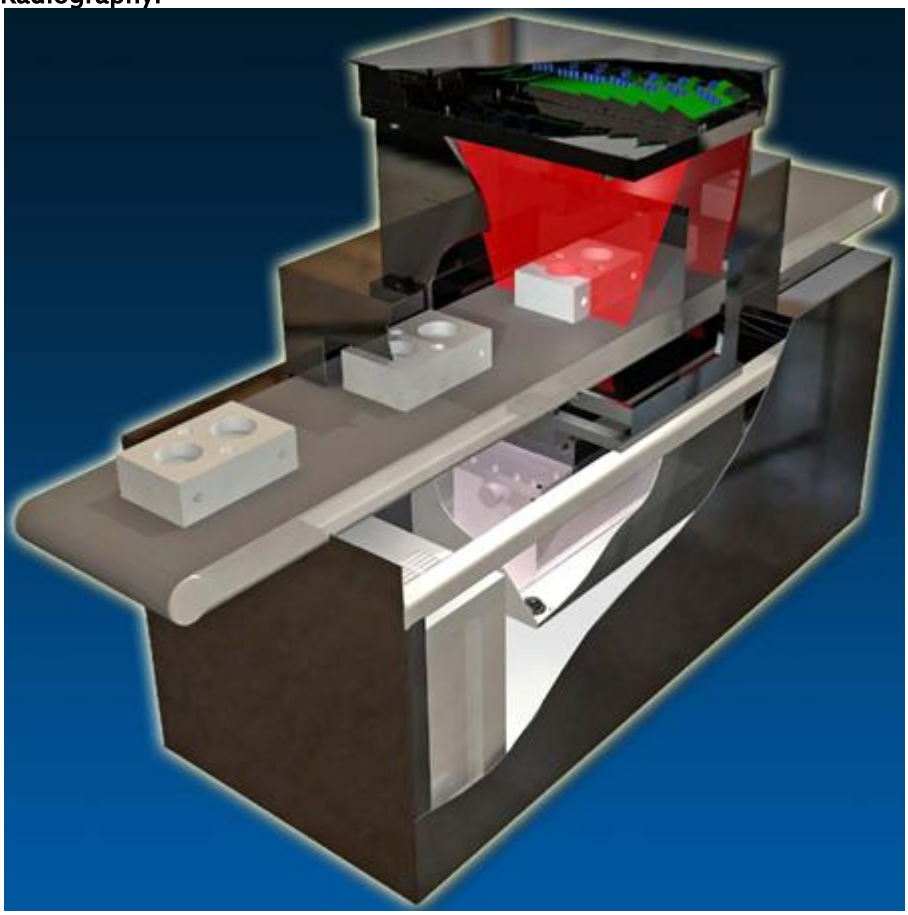
Impact Test:

In this test the casting is subjected to a blow from a hammer of known weight striking or falling on the casting. Defective castings fail under the impact of the blow but the method is very crude and unreliable.

Pressure Test:

This test is carried out on castings required to be leak proof. All openings of the castings are closed and a gas or fluid under pressure is introduced in it. Castings having porosity leak under this pressure. The leakage may be detected by submerging the casting in a water tank or using a soap film if the pressure is applied by compressed air. If a liquid is used for applying pressure the leakage can be found by visual inspection.

Radiography:



Radiography uses X-rays or gamma rays penetrating through the castings and giving a shadow picture on a photographic film placed behind the work piece. These rays have very short wave length of the order of 0.001 Angstrom (10^{-10}m) units to 40 Angstrom units for x-rays and 0.005 to about 3 Angstrom units for gamma rays compared to about 5500 Angstrom units for the centre of the visible spectrum.

The ability of these waves to penetrate through metal depends also on the density of the metal and as such they can penetrate more easily in places where there is less metal that those where more metal is present leading to a shadow picture formation on the film. Any defects in the casting can easily be identified from this picture. Because of their shorter wave length gamma rays have a better penetration through the metal and are more commonly used.

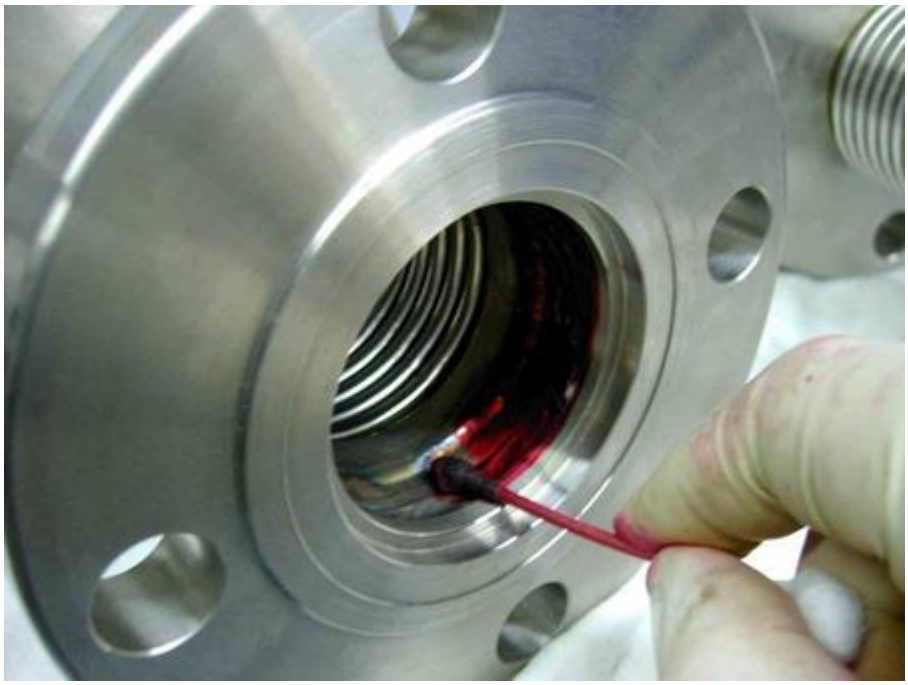
Magnetic Particle Testing:

This test is used for detecting cracks in metals like cast iron and steel which can be magnetized. For carrying out the test the casting is magnetized and then fine particles of iron or steel are spread on its surface. Presence of a crack or void in the casting results in interruption of the magnetic field and leakage of magnetic flux at the place of the crack.

The particles of iron or steel spread on the casting surface are held by this leaking flux giving a visual indication of the nature and extent of crack. Very small cracks or voids at or near the surface which may not even be detected by radiography are easily revealed by this method.

Penetrant Testing:

This method also is used for detecting very small surface cracks and has the advantage over the magnetic particle method that it can be used for any material. The parts to be tested are either dipped into or covered with a penetrant testing liquid which has very good wetting and penetrating ability. The liquid is drawn into the cracks or voids by capillary action.



After the penetrant has been applied to the surface to be tested extra penetrant is wiped off the surface is dried and a developer applied to it. This developer helps in drawing out the penetrant so that it becomes visible on the surface. The penetrant liquids often contain materials which fluoresce under ultraviolet light or a die to indicate their presence.

Ultrasonic Testing:

Ultrasonic testing is used to detect defects like cracks, voids or porosity within the interior of the casting. The method uses reflection and transmission of high frequency sound waves. Ultrasonic

sound waves much higher than the audible range are produced and made to pass through the casting.

The time interval between the transmitted ray and reflected ray is recorded by a cathode ray oscilloscope. Any crack or void in the casting results in reflection or some of the sound from the crack which appears as a pip between the two pips representing the thickness of the casting. The depth of the crack from the surface of the casting can be easily calculated from the distance between these pips.

Source:

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