

NONDESTRUCTIVE TESTING

The American Society of Mechanical Engineers, founded in 1880, developed a Boiler Code during the years 1911-1914. That code recommended certain rules governing the inspection of boilers during construction. Visual Testing was the first method employed in non-destructive testing.

This was in a period which saw a number of major boiler explosions, often with disastrous results. In the wake of the most horrific incidents there would follow demands for more efficient testing methods.

The ASME recommendations did not ensure that inspections would be carried out in uniformity or by competent inspectors. The various states and provinces had their own procedures in place and partisan politics was often a factor. In Canada, the first Boiler Inspection Acts came into effect in 1894 with Quebec and Manitoba leading the parade. Other jurisdictions would not be far behind.

The formation of the National Board of Boiler and Pressure Vessel Inspectors in 1919 was another important step. It was to become the body that would enforce the ASME minimum requirements for design, fabrication, installation and inspection of boilers, pressure vessels and related components. Every provincial and/or state³ Boiler Inspection Department would eventually become a member and supporter of the "National Board" headquartered in Columbus, Ohio.

It was during the 1920's that the steel fabrication industry introduced welding as an eventual replacement for riveting. Large processing vessels were in demand by processing industries; boilermakers began looking to fusion welding of boiler drums and vessels.

By 1930, the United States Navy adopted arc-welded construction for joints of twenty-four boiler drums installed in new heavy cruisers (Naval work is not covered by the ASME code).

Some method other than Visual Testing (VT) had to be employed in the nondestructive testing of the welded joints. Radiographic Testing (RT) was approved by the ASME Code of welded pressure vessels for the highest pressures possible.

The first Radiographic Testing was set up in a boiler shop in 1930. It was positioned on rollers making it possible to record successive exposures along welded seams on a cylindrical shell.

Improvements in RT equipment followed over the 1930 – 1940's making it possible to move it out onto construction projects. Portable RT equipment was utilized on X-raying, large pressure vessels, storage tanks and pipelines. On hydro electric installations RT was used to X-ray the penstock and scroll casings.

Another significant method of non-destructive testing appeared on the scene around 1950, Electromagnetic Testing (ET), it involved more than ten different methods, Eddy Current became the most widely used and best known.

Next came Ultrasonic Testing (UT), it was slow in becoming accepted. It was well into the 1950's before firms in this field were firmly established. It proved to be a valuable tool in evaluating welds, plate and the forging of pressure vessels.

The American Society of Nondestructive Testing (ASNT) was formed in 1941 and it too became headquartered in Columbus. This is a national technical society whose sole purpose is the advancement of scientific, engineering and technical knowledge in the field of non-destructive testing through education, research, and the compilation and dissemination of information. The ASNT is credited with being responsible for many advances made through the years in the field of examination and testing.

Modern day inspection under the ASME Boiler and Pressure Vessel Code is carried out using one or more of the following techniques:

Radiographic Inspection (X-Ray)

used for the examination of the internal soundness of welds, castings, forgings and plate material.

Radiography Inspection (gamma ray)

used for the same purposes as X-rays, but more suitable for heavy thicknesses or where portability is an advantage.

Magnetic Particle Inspection

locates surface and subsurface defects that are not too deep but may be overlooked by radiographic testing. It is especially useful for the inspection of nozzle and manhole welds, weld repairs and the detection of laminations at plate edges.

Penetrant (dye) Inspection

mostly used for surface defects, nonmagnetic materials and the inspection of nozzles and manhole welds when radiography is difficult.

Penetrant (fluorescent) Inspection

used for locating defects that run through to the surface; especially applicable for nonmagnetic materials, rough surfaces and the detection of porosity that would otherwise be difficult to locate.

Ultrasonic Inspection

used mainly for the detection of defects in welds and plate material and determining the thickness of plate; advantages are that it can access from one side of a part being tested and that it reveals small root cracks and defects not picked up by a radiographic film, especially in thick-walled vessels.