Testing of Welding

To obtain extensive assurance of high quality of the actual welded job it becomes necessary to subject all of its welded joints to testing (NDT). There are various commonly used NOT methods which are in use as explained below. The proper understanding will also help a person to use full potential of the techniques so that they are properly understood to obtain correct interpretation of test results.

1. Visual Inspection
   a. Before Welding
   b. After Welding
   c. During Welding
2. Magnetic Particle Inspection
3. Liquid Dye Penetration Test (DP Test)
4. Ultrasonic Inspection
5. Radiographic Inspection
6. Eddy Current Testing
7. Proof Testing
8. Leak Testing

1. Visual Inspection

This is the first step of inspection and should be used for all,types of joints weather critical or non critical. Tools required for carrying out this test are magnifying glass, scales, bore scope etc. This involves 3 stages of inspection.

Before welding Before the welding starts , checked for oil ,grease lust, scale. or any other foreign matter before assembly and welding. The angle of the prove, alignment cleanliness, root gap should be pecked thoroughly.

During welding It should be ensured that all the details given below should be checked thoroughly. Welding electrodes preheat, and interpass temperature, type of weld beads stringer, weaved, chipping of slag, welding sequence, welding procedure, jigs and fixtures if required, etc.

After welding Atter the job has been welded check for dimensional accuracy.

2. Magnetic Particle Inspection

This inspection method is applicable to only magnetic materials. This method is based on a principle that when a magnetic field is set up in a piece of ferromagnetic material having defects in the path of the magnetic flux, minute magnetic poles are created at these detects. These poles have the property of attracting magnetic particles more strongly than surrounding surface of the job.

Thus if a job is to be inspected is magnetized by passing sufficiently high current thru it & the areas to be inspected are covered by finely divided magnetic powder (particles). These particles form a pattern or indication on the surface and magnetization takes through shape of the effect which becomes clearly visible when the surplus magnetic powder is removed. This occurs only when the defect is perpendicular to the flux path. If the defect lies parallel to the flux path ,no such pattern will app-ear & the defect will lie undetected.

3. Dye Penetrate Test

The surface to be inspected must be cleaned completely from slag, oil, grease, scale etc., and must be dry. The kit consists of cleaner, dye penetrate and developer, all three will be available separately in aerosol cans As a last step cleaner is applied (sprayed) on to the surface where defect is to pre detected. Apply the dye penetrate and wait for 10 minutes during which the dye penetrates in to the crack. Now with a rag wipe off the surface to

remove the excess dye on the area. Finally apply the white developer on the area. The dye emerges out wherever crack *I* defect is noticed which can be marked for rectification. Thus DP test can detect only the surface cracks, defects, on any surface.

4. Ultrasonic Test

In this method of testing, ultra high frequency sound waves are projected in the form of a beam into the materials being tested. The sound beam emanating from the transducer travels through the homogenous medium in a straight line until it meets an acoustic boundary. At the boundary some of the sound is reflected in the same way as light reflects from a smooth surface. The reflected sound is formed an echo. The time and amplitude of the echo is received and analyzed to provide RADIO GRAPHIC INSPECTION.

In this method of testing x-ray or gamma ray radiation of sufficient penetrating' capability is passed through the full thickness of the material being tested. Part of the radiation is absorbed and balance penetrates the material. The amountabsorbed and the amount transmitted are Determined by the thickness of the material. Wherever defect exists in the material there is less material to absorb the radiation. This creates a differential in absorption which is registered on a photographic film as a shadow picture called Radiograph.

5. Eddy Current Inspection

In this method of eddy current inspection, eddy Currents are induced in a part by subjecting it to the influence of an alternating electromagnetic field. frequency choose to excite the field ranges between 500 to 20000 Hz. The field is usually provided by an inductor placed closed to the part . The inductor can be of any shape and size depending on the geometry of the part and on the types of defects to be detected. When discontinuities are present in the part, they alter the magnitude and direction of eddy currents. The alteration is detected by a detector coil and the discontinuity is registered. Changes in the eddy current are interpreted by various electrical variables such as voltage, current, impedance phase or their combinations. These variables are electronically analyzed and desired information in useful form.

6. Proof Testing

Impartment welded structures are proof tested by subjecting them to stresses above those they are expected to carry in service, but below the elastic limit of the material and making sure they will not get permanently deformed in any part. Closed containers such as pressure vessels and boiler shells are. proof tested by applying internal pressure with compressed air or water pressure. The pneumatic test using compressed air is used only for pressure testing because of the inherent danger of explosion if the job fails suddenly. The hydraulic test using water under pressure is a high pressure test. In this case the pressure used is the design working pressure plus a certain % in excess. The container under pressure which may also be subjected to a hammer test is visually examined for leaks.

7. Leak Test

Welded jobs such as vessels, containers etc., are leak tested to determine if any discontinuities through thickness exists in the welded joints which will result in a loss of liquid or gas in service. A simple leak test consists of internally pressure rising the container with water or light oil and examining the welds externally for evidence of leakage. By adding a small percentage of tracer gas to air or carrier gas, introducing the mixture in to the vessel and increasing the pressure to a pre determined level. A serving probe is then passed over the outside of the vessel and any leak present is detected by the presence of tracer gas.