



## Non-destructive – Testing of **COLD ROLLING MILL ROLLS**

Once a roll is completed, whatever defect is inside the roll cannot be seen with naked eyes. From outside, roll appears to be normal.

There is every possibility that there are minute surface and sub-surface defects, may be due to Raw Material or Heat Treatment. These defects are to be determined by Nondestructive Testing. Four methods are prevalent :

1. **Ultrasonic Test**
2. **Acid Etching Test**
3. **Magnetic Particle Test**
4. **Die Penetrant Test**

**ULTRASONIC TEST - IS MOST RELIABLE AFTER EDDY CURRENT TEST**

Ultrasonic test is used to detect internal cracks by pulse echo contact method/ back reflection technique. Piezo Electric waves are generated by a probe. While contacting object by probe, these waves propagate in the object and get reflected if any phase change takes place. If there is no phase change, then waves get reflected from other end of object which return from full depth of material. In case of discontinuity waves are reflected from crack.

Representation on screen will tell whether there is flaw or discontinuity in the item.

Test is conducted as per ASTM A388/ A388M.

Rejection criteria is -

- a) Loss in back wall echo exceeding 20% of initial echo.
- b) Travelling discontinuity more than 5% of initial echo.
- c) Any discontinuity flaw equal to or greater than 10% of the B.W.E.

With the use of suitable probe internal defects can be detected. Sometimes there is a signal indicating a flaw at surface, but it is not visible with naked eyes. In such cases acid etching is done to ascertain surface defect.



### **ACID ETCHING TEST -**

Surface to be examined is cleaned by alcohol. Then it is etched with 1:3 or 1:4 solution of Nitric Acid in Methanol. Overheated areas, grinding cracks, bruise marks and surface cracks become visible after acid etching. The process of etching indicates clearly the defective regions.

Ultrasonic test in conjunction with acid etching is very reliable.

Ultrasonic test can throw light on following defects :

1. **Internal cracks/ flaws** - These generally occur where there is drastic change in cross section and crack propagates along the axial or longitudinal direction.
2. **Piping defects** - These are forging defects and can be along with the axis in the core zone.
3. **Slag inclusion** - These occur during casting the ingots for forging.
4. **Shrinkages** - These are generally due to less material while casting the ingots.
5. **Internal forging laps/ folds** - These are forging defects and are caused due to overlapping of ingots.
6. **Porosity** - These are due to trapped gases/ fumes during casting the ingots.

**Dee Tee Industries Limited, Unit-II (R.M.R. Division)**

28/33, Pologround Industrial Estate, Indore-452 015 (INDIA) Ph. : (0091-731) 4296777 Fax : (0091-731) 2422108, 4296766  
e-mail: deetee@deeteegroup.com web site : www.deeteegroup.com

Dee Tee stands for total quality movement

## MAGNETIC PARTICLE TEST -

This test is conducted to detect cracks on surface and sub-surface layer in ferrous material only.

Normally, Iron particles are suspended in spirit/ petrol and the solution is spread over the surface of rolls after magnetising the surface. Accumulation of Iron particles over surface of rolls indicates cracks. Magnetic particle test is conducted as per ASTM SA 275 & SE 709.

Any magnetic particle build up having width more than 1.0 mm and ratio of length to width more than three times will mean defect/ crack.

Following defects can be traced by Magnetic Particle Test :

### 1. Forging bursts -

These defects are due to temperature of the metal, lesser than required.

### 2. Flakes

These cracks may occur at the surface or sub-layer of the material and are due to rapid cooling of the rolls during heat treatment.

### 3. Grinding cracks -

These surface cracks are developed due to improper grinding.

### 4. Local heating cracks -

These cracks are developed when the rolls are in service where high pressing forces are in application resulting high work hardening.

### 5. Stress cracks -

These are developed while material is in use or in service where material is subjected to heavy alternating or fluctuating stresses.



## DIE PENETRAINT TEST (I.S. 12889:1989)

This test is conducted for detecting surface cracks in ferrous and non-ferrous material by application of developer and penetrant. Any dark hair line will be treated as defect. This test is performed after grinding.

Following fine surface defects can be traced by Die Penetrant Test :

### 1. Surface hardening cracks -

This type of crack generally occurs when the hardness of the surface layer is more than the sub-layer hardness.

### 2. Pitting -

These are pin/ pinch type marks and occur at the surface.

### 3. Grinding cracks -

These are due to grinding heat and are called heat checks.

### 4. Local heating cracks -

These cracks are developed at the surface when the rolls are in service where high pressing forces are in application resulting in high work hardening.

**Tools WHICH LAST LONGER - Slitting Line Tooling, Tube/Section Mill Rolls, Tube Cut Off Knives, Cold Rolling Mill Rolls, Leveller Rolls, Fins, Steel Centers, Chipper Knives, Friction Saws, Shear Blades, H.S.S. Saws & C.T. Saw Bodies.**

