PRINCIPLES OF MAGNETIC PARTICLE TESTING
OPTIMISED SOLUTIONS WITH PFINDER

Physical basics
• When magnetizing a ferromagnetic material, the magnetic lines follow the best conducting medium as they search for the lowest resistance.
• If the magnetic field lines make contact with an area which is a poor magnetic conductor such as a surface crack or defect, the result is a flux change due to the high level of magnetic resistance.
• This provokes a disturbance of the flux on the surface, which in turn accumulates ferromagnetic particles, making surface defects visible.

Which materials can be tested?
• All ferromagnetic materials with a permeability of $\mu > 100$.
• Ferromagnetic materials are all kind of steel and their alloys as well as cast iron
• Exception: Austenitic materials.

Which defects can be detected?
• Crack like defects at the surface or close to surface with corresponding position, size and orientation to magnetic field.
• Defects under surface will be shown weaken with increasing depth.
• Optimal detection will be if orientation of the defect is at a $90^\circ \pm 45^\circ$ angle to magnetic field lines.

Magnetisation methods
Yoke magnetisation
• Available as hand yokes or test benches with AC and DC
• Detection of transverse defects.

Advantage of DC magnetisation:
• Longest possible clamping lengths at test benches and rugged construction.

Disadvantage of DC magnetisation:
• Field reduction at gradual change in section.
• Demagnetisation is necessary.
• Huge weight of hand yokes.

Advantage of AC magnetisation:
• Constant and even near surface field at complicated shaped parts with gradual change in section.
• Easy and quick demagnetisation if required

Disadvantage of AC magnetisation:
• Delimited possible clamping lengths and extensive construction at test benches.

Coil and cable magnetisation
• Magnetisation possible with cable or with fixed or moving coil possible.
• Detection of transverse defects (in accordance with the direction of the coil windings).
• Tube testing with AC only magnetisation of outside surface is possible.

Conductor magnetisation
• Detection of longitudinal defects (inside and outside surface / end plane star-shaped from inside to outside).
• Pipes will be magnetised inside by AC.
• No danger of arc burns.

Direct contact part magnetisation
• Detection of longitudinal defects (circular magnetic field surrounds current path).
• High amperage requirements and possibility of arc burns and heating up of parts.
• No detection of defects close to contact areas possible.

Induced magnetisation
• Detection of circumferential defects (inside, outside and end plane).
• Only closed parts testable.
• Induced magnetisation only with alternative current possible (dynamic field necessary).
• No danger of arc burns.
• Good possibilities of combining with indirect magnetisation, for contactless detection of defects of all directions.

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