



ZER-O-MAT

Helling Magnetic Particle Test Facility

The ideal solution for detection of surface defects with arbitrary orientation of pipes and other round materials, rectangular or irregularly shaped cross sections

General description

For testing of discontinuities at the surface of round materials, Helling has developed the magnetising technique ZER-O-MAT. With this compact equipment defects with various orientation directions can be detected within short time.

A transportation roller table, either delivered or provided by the customer serves for screw-like forward motion in the magnetising coil. Thus, magnetic particle testing can be performed on the entire outer surface if required. Items with diameters of 20 to 700 mm can be tested. ZER-O-MAT magnetising coils dimensioned accordingly provide optimal testing conditions.

Specific advantages of ZER-O-MAT magnetising technique are:

- Contactless magnetisation (viz. no contact spots or screenburn)
- Simultaneous testing of all defect directions
- Low expenditure of time (short clock cycles)
- Demagnetisation is not required

The general design of a ZER-O-MAT facility is represented schematically in Fig. 1, left. Fig. 1, right, shows the equipment as delivered.

The processed work piece is conveyed to the ZER-O-MAT device by a roller table. After magnetisation and sprinkling during rotation of the test specimen the inspection is carried out by the test personnel.

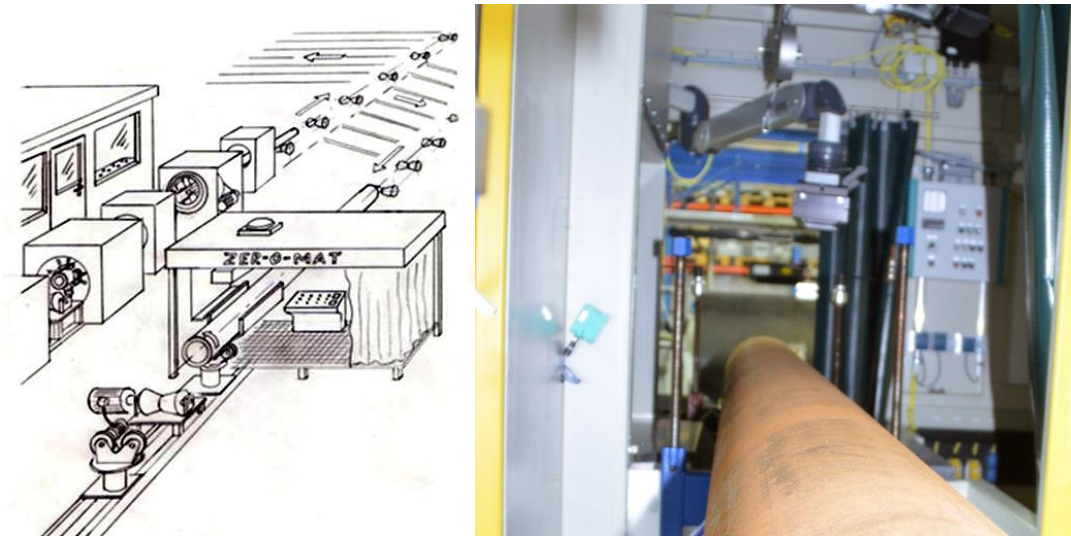


Figure 1: ZER-O-MAT Equipment

Function principle

Main item of the ZER-O-MAT equipment are the ZER-O-MAT coils which are developed and patented by Helling. They consist of copper windings twisted spirally in one layer. Afterwards they are deformed into U-shape (Fig. 2).

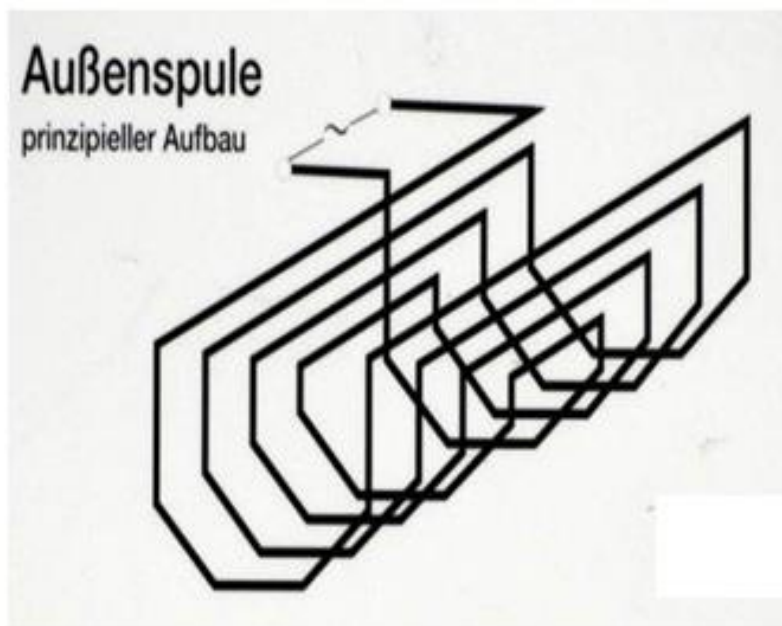


Figure 2: Current flow chart

For magnetisation and testing of e.g. a pipe section it is placed into the U-shaped coil and put into rotation (Fig. 3, red arrow).

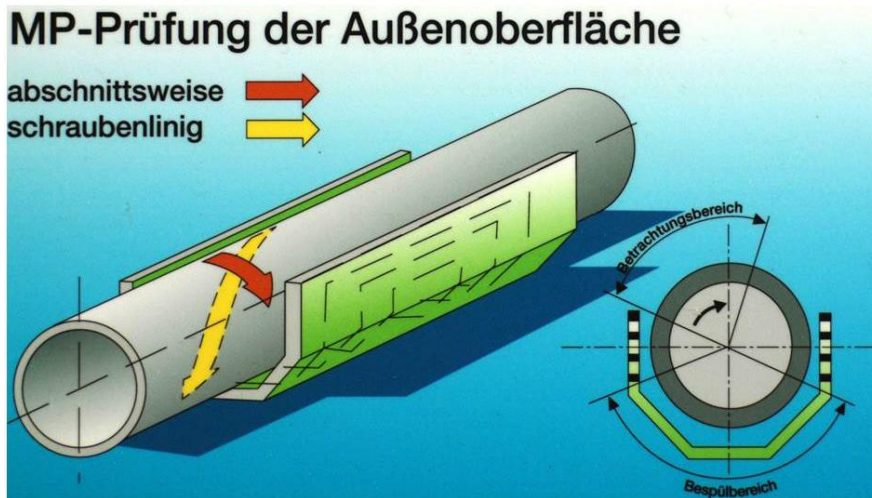


Figure 3: Section-wise and helical magnetic particle testing

If not only a section but the entire surface of a work piece has to be tested the test specimen can be moved screw-like through the magnetic field (yellow arrow).

ZER-O-MAT coils are supplied with alternating current produced by high current transformers. Thus, due to the skin effect, only a surface layer of about 1.5 mm is magnetised effectively. Demagnetisation after testing is not necessary. The field line distribution of a current-carrying ZER-O-MAT coil is shown in Fig. 4.

Note that the field lines in the centre of the coil are oriented vertically and horizontally towards the ends. By appropriate determination of the coil length, the number and positioning of the windings the relation of the horizontal and vertical course of the coil field can be adapted optimally to the work piece.

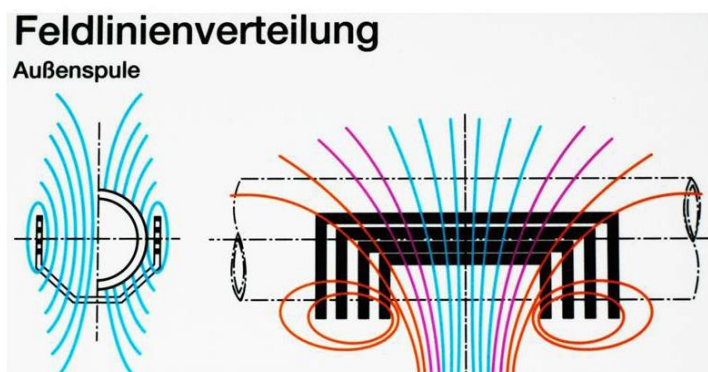


Figure 4: Field line distribution

The evidence of magnetisation and defect directions can be provided, among others, with Castrol test pieces (Fig. 5).

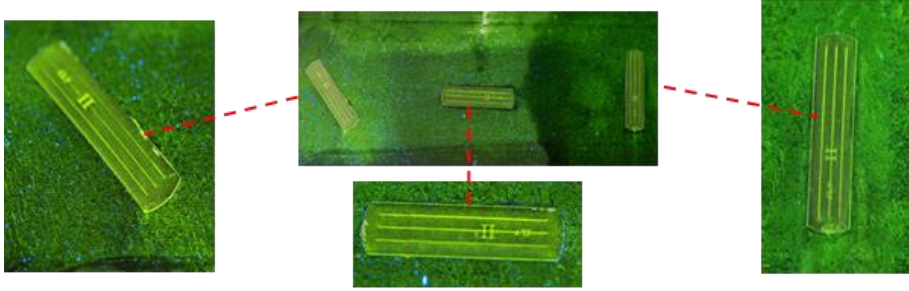


Figure 5: Detection of magnetic field and defect orientation

Electric features and control

The electric control of ZER-O-MAT equipment comprises all functions and power units which are required for the operation of the test station:

- Control voltage
- Magnetisation current
- Test fluid cycle
- Vertical positioning of ZER-O-Mat coil
- Power supply for UV and white light
- Emergency shut-down

The electrical supply data are:

- Connection voltage 400 V / 50 Hz
- Control voltage 230 V / 50 Hz
- Power input max. 90 kVA
- Current supply min. 250 A
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Illumination

UV-LED Flat Panel Type ZERO-500/5; IP 65

White light 4 x 50 W lighting gear

Mounting adjustment of height or with Rittal rotary arm

Data subject to technical changes

Helling – Quality and Innovation with Tradition

