

# Magnetite Meter MF500M



MF500M WITH PROBE

- **Measures Magnetite levels**
- **Digital Display**
- **Selectable occlusion display**
- **Output Data to Computer**

## Background

Stainless steel superheater and reheater tubes, operating with high temperature steam for extended periods, develop a two-part oxide layer on the inner bore of the tubes. The magnetite oxide is characterised by two distinct phases which have different coefficients of expansion. The layer closest to the tube centre which is iron rich, and an inner layer which is chrome rich. At metal temperatures of 90C to 150C, the outer layer of magnetite oxide tends to delaminate from the tightly adhering inner layer and parent metal.

Delamination of this outer layer and a small amount of inner layer causes magnetite to fall under gravity and block the bottom of vertical or pendant superheaters. If total blockage occurs in a tube, the steam flow paths being established in a boiler as it builds steam pressure bypass this blocked tube. Without the cooling steam, this causes overheating of the blocked tube leg which results in failure of the tube.

Failure of a single tube results in that tube moving violently amongst neighbouring tubes which causes other tubes to become damaged and potentially rupture. Steam escaping onto nearby tube walls becomes another mechanism of failure. Eventually, so much steam will be lost that a gas side pressure excursion will remove the boiler from service, or the boiler feed pumps will not maintain the feed. Repair of the damage may take several weeks.

## An Overview

The Diverse hand held, battery operated Magnetite Meter using a novel magnetic force probe. The instrument may be used to determine the amount of magnetite in cooling pipes.

The magnetic detector is housed in a separate hand held case with a stainless steel cap for maximum protection. The processor based meter uses a user friendly menu driven interface to allow simple operation.

The instrument can be used to display raw data from the sensor, as well as estimates of the amount of magnetite in a given (non-magnetic) pipe. Auto zero can be requested at any time by the press of a single key.

Measurements of magnetite levels are displayed on the unit and can be stored in its internal memory for later recall. Options will be available to download this data into a PC, enabling data to be saved and entered in spreadsheets.

## MF500M Features

- *Measures magnetite effect*
- *Ideal for use with cooling pipes*
- *Rugged probe for extra protection.*
- *Auto Zero facility.*
- *Smart instrument able to estimate degree of occlusion*
- *Supplied with a protective carrying case and full user instructions.*

## Optional Features

- *Serial output for computer connection*
- *Multi-point analysis*
- *Rechargeable cells*

## Applications

- *Magnetite detection in pipes*
- *Pipe occlusion estimation*



MF500M PROBE

### About the MF500M

The Software embedded in the MF500M provides acquisition of the magnetic force extended by the magnetic effect of the magnetite. The force is a measure of the amount of magnetite and its range. This information is used together with the geometry of the pipe (assumed linear with defined diameter and wall thickness) to gauge the amount of occlusion. The force effect is dependent on how the magnetite appears in the pipe. It may be deposited in a similar way to calcite, or appear as broken magnetite. The density reduction of broken magnetite is built into the instrument, so that the degree of occlusion can be inferred for each scenario.

Serial download software is built into the instrument, and there is an option for data collection on the PC. The software will run on Windows XP or 98 and the data can be further processed using standard spreadsheets.

The serial software allows Magnetite measurements to be recorded together with the time and date. Readings can be requested by pressing a key on the meter or directly from the computer keyboard. Alternatively, readings can be taken automatically at regular time intervals.

#### **DIVERSE**

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### Specification

**Reading range:** 0 - 500 force units.

**Occlusion:** 0 to 100%

**Zero:** Can be zeroed at any time

**Probe Orientation:** Independent - zero as required

**Gravity:** Zero removes gravity offset

**Functions:** Raw force, occlusion for solid and broken magnetite

**Accuracy:** 1% Full Scale at 20C

**Repeatability:** 1 +/- 5% assuming sample is degaussed

**Probe Size:** 40 x 60 x 120 mm H,W,L

**Storage:** 40 records

**Power supply:** 4 standard AA cells

**Monitor Size:** 165 x 100 x 50mm

**Weight in Case:** 1.1kg

**Warranty:** 12 months

### DIVERSE Technologies

The MF500M is part of a range of magnetic field measuring equipment. Others include:

- MF300H Magnetic field measurement with a robust stainless steel probe.
- MF300B measures magnetic flux inside steel components.
- MF300F measures the ferrite content of stainless steels.

DIVERSE specialises in the supply of magnetic instruments used particularly in welding and metallurgy. Other DIVERSE welding and NDT products include: Zeromag, a portable Weld Demagnetiser, and the Squeeze Analyser for resistance welding.