

Ferrite Meter MF300Fe+

Measure Ferrite Content of Austenitic & Duplex Steel

DIVERSE

www.diverse-technologies.net



Overview

Industrial processing and chemical plants work at high temperatures and pressures, often with aggressive media and stainless steel is often the material of choice for these applications. If the ferrite content of the steel is too low, then welding of stainless material may crack at elevated temperature or with high stress or vibration. Alternatively, if the ferrite content is too high, the weld may be weaker and corrode.

To address the need to measure the amount of ferrite in a sample the Welding Research Council introduced the Ferrite Number (FN) as a standardised value which related to the ferrite content of an equivalently magnetic weld metal.

The volume percentage of ferrite can be estimated as about 70% of the FN but the relationship depends upon the type and origin of the stainless steel used and the measurement technique.

The Diverse Ferrite meter MF300Fe+ measures the Ferrite number (FN) of austenitic and duplex stainless steel weld material. It has a probe that is sensitive to ferrite content in a 10 mm area to a depth of approximately 1 mm. The instrument is calibrated using the secondary weld standards validated by National Institute of Standards and Technology (NIST) in the USA. All 16 standards are used in the calibration giving an instrument with a measurement range from 0 to 115 FN. Transfer standards are supplied with the instrument allowing performance to be verified at any time.

A variety of measurement modes are supported to ensure that good repeatable measurements can be made.



MF300Fe+ measuring the transfer standards

Features

- **Non-destructive test of the ferrite content in a range of 0.1 to 115 FN equivalent to 0.1 to 80.5% Fe in austenitic and duplex steel.**
- **Robust and portable**
- **Standard or peak measurement of Ferrite Number**
- **Estimate of ferrite percentage (70% of FN)**
- **Automatic zero on demand**
- **Supplied with 5 transfer standards allowing veracity of instrument to be checked**
- **Storage of 1000 measurements including 4 character record ID, downloaded to PC with RS232/USB (option)**
- **Use with high temperature samples (air-cooled probe option)**
- **Simple measurement with small sample area.**
- **Units selectable between WRC-FN and %Fe.**
- **Calibration to weld standards validated by NIST**
- **Supplied in carry case**



MF300Fe+: Performance Specification

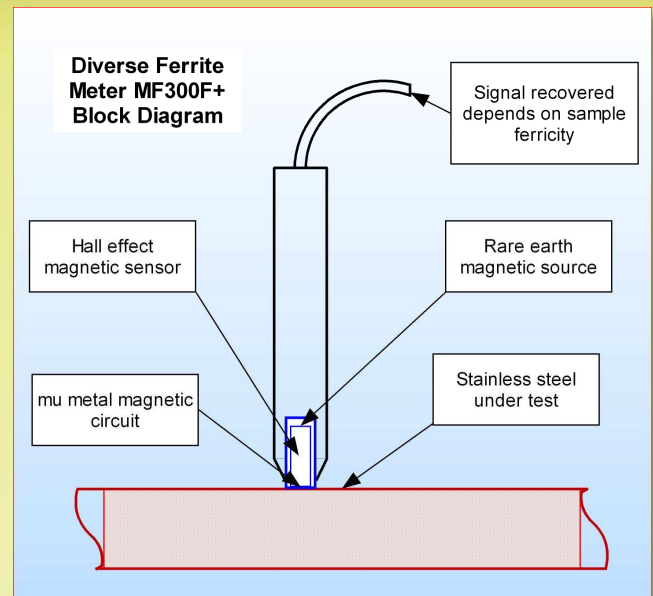
Units	Ferrite Number FN Ferrite percentage F%
Range	0 - 115 FN 0 - 80.5% (percent ferrite)
Resolution	0.1 FN 0.1 F%
Standard: Accuracy (10°C - 30°C) FN 0 - 10 FN 10 - 30 FN 30 - 100	± 0.5 FN ± 5% of the reading ± 10% of the reading
Air cooled: Accuracy (30°C - 300°C) FN 0 - 10 FN 10 - 30 FN 30 - 100	± 1 FN ± 10% of the reading ± 20% of the reading
Calibration	Factory calibration to NIST standards User calibration to supplied transfer standards
Transfer standards	Five transfer standards Range typically 3 FN to 115 FN
Zero	Automatic on demand
Mode	Average or peak
Storage	1000 records with 4 character record ID (Characters available 0-9, A-Z and space)
PC Download and Upload	Optional RS232 and USB Functions include download of record or part or entire database and upload of record IDs
Probe	Pencil style, 15mm diameter length 120mm Sensing area 10mm diameter
Operating temperature	Standard 0°C - 40°C Air cooled 0°C - 300°C
Air cooled operation	Air line supply regulated to 1 bar maximum Oil filtered supply desirable Air temperature: ambient (10°C - 30°C)
Humidity	Non-condensing
Weight in case	1.25 kg
Case dimensions	210 x 100 x 45 mm
Support	Call/email Diverse for support for use of the instrument or assistance with unusual application.

Operation

The MF300Fe+ uses a static magnetic field technique to determine the degree of ferricity. A rare earth magnet is introduced into a complex mu metal magnetic circuit such that the introduction of ferritic material at the tip of the probe modifies the field distribution in the probe.

The change in the magnetic field is detected using a state of the art Hall effect magnetic sensor. The signal from this sensor is processed by the instrument to produce a reading. The calibration of the different readings is matched to the known ferrite numbers of weld standards validated by NIST.

A key advantage of the technique over other ac excitation methods is that there is no error due to ac skin effect or extraneous ac induction.

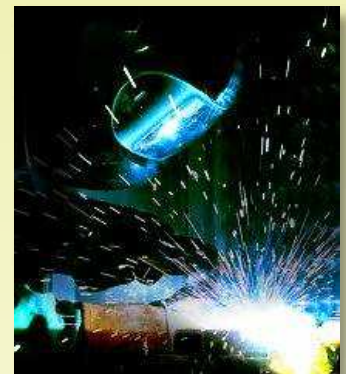


Ferrite Number

Ferrite number is a measure of Chromium and Nickel equivalent in an Austenitic stainless steel material and is a measure for denoting the ferrite content in stainless steel. It should be between 3-7% maximum because very low ferrite can lead to cracks. Ferrite Number has been adopted as a relative measure for quantifying ferritic content using magnetic techniques. The Ferrite Number approach was developed in order to reduce the large variation in ferrite levels determined on a given specimen when measured using different techniques in different laboratories.



The ferrite level is important to assure minimum exposure to solidification cracking when depositing austenitic stainless steel weld metal. A lower ferrite number is better for corrosion resistance, while balancing higher ferrite content to avoid solidification cracking in the weld deposit. Low ferrite numbers are less important for applications such as cladding where no cracking is observed. Testing for ferrite number can be achieved using the MF300Fe+ and crack testing can be done using liquid penetration verification.



About the MF300Fe+

MF300Fe+ is the latest instrument in the popular range of magnetic meters from Diverse and includes extended record storage. The robust slimline probe benefits from a novel magnetic design with excellent coupling to the measurement sample. This results in sensitivity to a small well defined volume and excellent response over the full range of ferrite samples.

An air-cooled version of the probe (this must be specified at time of order) allows Ferrite measurement of hot samples.

The latest software supports calibration over the whole range of secondary ferrite samples prepared by NIST. Transfer samples are supplied with a range of FN allowing user verification of the calibration.

Storage of up to 1000 measurements is included. Communication with a PC, via RS232 or USB, is provided as an option, including downloading of records or all or part of the database and upload of record IDs. Record structure now includes record number (0-999), measured ferrite number, record ID (4 characters, valid characters 0-9, A-Z and space).

The instrument supports user calibration to the transfer standards supplied.

Calibration Standards

The Diverse MF300Fe+ is calibrated using standards that are traceable to internationally accepted secondary standards. The International Institute of Welding in the UK (IIW) developed secondary standards that have been tested by NIST and The Welding Institute,(TWI) according to methods described in DIN EN ISO 8249 and ANSI/AWS A4.2.

The master calibration of the instrument is made against these standards. The transfer calibration standards supplied with the MF300Fe+ are simulations of the magnetic effect of ferrite number and are each calibrated for this effect against the IIW standards.

Probes

The Diverse MF300Fe+ is supplied with a pencil-like probe made of aluminium with an internal precision magnetic circuit and sensor.



The probe is constructed with a 10mm diameter ring that is set proud at the tip. For measurement, this ring is brought into contact with a reasonably flat portion of the object under test and a reading can be taken.



With an air flow adaptor and other internal and calibration changes, the air cooled probe version allows for measuring of hot samples. Air flow is directed in the standard hose connector, over the sensor and magnetic components and is routed out of vent holes in the probe barrel.



Items supplied

Diverse MF300Fe+ Ferrite Meter and probe
5 x Transfer standards
Carry case

Options

Air cooled probe
Serial/USB cable and software