



Operating Manual



Ferrotest GWH 15 (400 V)
06215-116954



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This operation manual must be kept at the place of work and be accessible to operators and maintenance personnel at all times.

Unit no. 15

Order no. 215-

1. IMPORTANT SAFETY INFORMATION

1.1 INSTRUCTIONS FOR SAFE USE

The Ferrotest GWH 15 is manufactured to the highest technical standards. However, injury and damage can be caused by incorrect installation/assembly, inappropriate use and unauthorised removal of covers or safety devices.

You can ensure safe handling and trouble-free operation of your unit by observing general safety and accident prevention regulations, including the advice outlined below.

- Familiarise yourself with the unit's construction and method of operation. If necessary, contact the manufacturer - Magnaflux GmbH - for instruction/training.
- Follow the operating instructions carefully.
- DO NOT allow untrained personnel to operate the unit.
- Only allow authorised personnel who are aware of the potential dangers of electromagnetic exposure into the areas where the unit is being used.
- Power cables can pose a trip hazard - take care when installing and using the equipment.
- Like all portable testing units, the Ferrotest GWH 15 poses a crushing hazard to feet. Wear safety shoes at all times while moving or operating the unit.
- DO NOT attempt to modify or customise the unit. If you attempt any unauthorised modifications, Magnaflux GmbH - the manufacturer - is released from any and all responsibility and liability.

IN AN EMERGENCY:

Immediately disconnect the high-current generator from the power supply.

The mains switch serves as a mains isolation.

- OFF position is marked '0'.
- ON position is marked '1'.

With the switch in the OFF.position, the machine is isolated from the power supply and the switch can be secured with a padlock.

Faulty or disassembled safety devices can also be dangerous. If in doubt:

1. Switch off the device immediately
2. Secure it against being switched on again.
3. If necessary, isolate it from the power supply

Obligations of the operator

You, as the operator, are obligated to:

- comply with the requirements of the industrial safety regulations.
- ensure that the device is operated only by persons who:
 - are familiar with the basic regulations concerning industrial safety and prevention of accidents;
 - have been trained in the operation of the device;
 - have read and understood this manual.

Obligations of other personnel

All persons who are entrusted with work on this device, are obligated to:

- observe the basic regulations regarding industrial safety and prevention of accidents;
- read and strictly follow this operation manual before starting work.

The following must be carried out by trained and authorised personnel only:

- assembly and commissioning
- connecting the device to supply lines
- operating the device
- maintenance and repairs*
- transportation of the device

Anyone being trained on the use of this device must be supervised at all times.

* Do NOT make any additions or modifications to the device without the prior written consent of the manufacturer, Magnaflux GmbH.

Replacement parts and consumables

Use only original parts or parts approved by Magnaflux GmbH. The use of replacement parts and consumables from third party manufacturers may damage the device and make it hazardous to use. Magnaflux GmbH accepts no liability for damage resulting from the use of unapproved parts.



DANGER OF ELECTROCUTION

Make sure the power cable is undamaged before using this equipment. Inspect the cable regularly.

Never use water to clean this equipment. Do not use a high-pressure cleaner.

Repair work on the unit's electrical system should be only carried out by qualified personnel. Unplug the cable before opening the unit.



CRUSHING HAZARD

The Ferrotec GWH 15 unit is not equipped with brakes. Do not use on unlevelled ground. Even when parking on a flat surface, secure the unit in all driving direction using chocks or wedges.

Wear safety shoes at all times while moving or operating the unit.



RISK OF BURNS WHEN USING UV LAMPS

Always follow the relevant operating instructions when using UV lamps.

FIRE HAZARD WHEN USING OIL-BASED TESTING AGENTS

Oil-based testing agents are highly flammable. Only use non-volatile test oils with a minimum flash point of 100°C. Follow the supplier's instructions for use. When using test oils, ensure that appropriate fire extinguishers are available within the test area.

To avoid sparking, the magnetic contacts must always be clean bare metal.

The Ferrotec GWH 15 unit features the following safety and information signs:

Sign	Location
Pictogram: 'Prohibited for Pacemaker Wearers'	Front panel or operating panel.
Text: "Operate in a dry environment"	Front panel or operating panel.
Text: "Unplug power cable before opening machine"	Back panel

1.2 EXPOSURE TO MAGNETIC FIELDS



WARNING: Strong magnetic fields can have serious health effects.

- Do not attempt to repair or rebuild the unit.
- Observe the minimum safety distances specified by BGV B11 Accident prevention regulation - Electromagnetic fields.
- Do not carry magnetic and electronic data carriers with you.



DANGER TO LIFE FOR PERSONS WITH CARDIAC PACEMAKERS

Magnetic fields can interfere with cardiac pacemakers, insulin pumps and other implanted devices. If you wear a pacemaker, you must get a clearance certificate from your doctor before using this yoke.

DO NOT USE THIS EQUIPMENT IF YOU:

- have a pacemaker, insulin pump or other implanted device.
- have any metallic implants.
- are pregnant.
- are under 16 years of age.

The grey shaded zone in this diagram (right) shows the area of increased exposure to magnetic fields during operation of the Ferrotest GWH 15. The operator must measure and mark out this area in their own workplace and spend the shortest time possible within this zone.

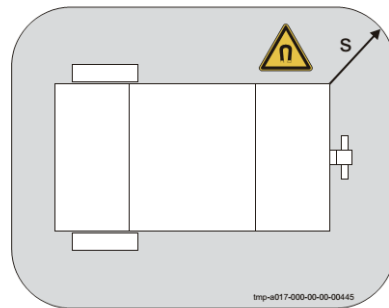
All other personnel should, wherever possible, stay outside this zone and maintain the following minimum safety distances from the high-current generator, the connected high-current cables and the magnetising device:

- people without body-implanted devices: 0.5 m / 1' 8"
- people with body-implanted devices (e.g. pacemakers): 3 m / 9' 10"

Important: magnetic fields can penetrate through walls!

Applicable regulations:

- BGV B11 Accident prevention regulation - Electromagnetic fields (June 2001)
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) (1998).



S = area of increased exposure

2. TECHNICAL INFORMATION

2.1 MAGNETIC PARTICLE INSPECTION

The Ferrotest mobile crack detection systems is designed specifically for non-destructive testing (NDT) of magnetic materials, known as magnetic particle inspection (MPI). The five key requirements for effective MPI magnetic particle inspection are:

- A qualified and competent tester
- Choosing the right testing method
- Using optimal testing equipment and test agent
- Using the proper lighting
- Carrying out the test correctly

2.2 FEATURES

The Ferrotest family of machines are designed as mobile inspection systems and can be either carried or transported as required, depending on the model. Standard models are:

- Ferrotest: Alternating Current (AC)
- Ferrotest GWH: Alternating Current (AC) and Half-Wave Direct Current (DC).

Depending upon the machine model, you can switch between AC and DC operation by plugging the high-current cable in the designated socket or using the selector switch. Both types of current are supplied from a high-current transformer; the DC is supplied to a rectifier, which is connected downstream from the high-current transformer.

2.3 ADDITIONAL EQUIPMENT

The standard additional equipment outlined below is built into the Ferrotest machines to cover a broad range of inspection problems.

Constant Current Control

The test current that needs to be applied at a current flux in order to achieve an appropriate magnetic field strength is influenced by an external circuit resistance. To compensate for any increased resistance, the test current must also be increased. The constant current control automatically compensates current levels, eliminating the need for manual adjustments caused from changing electrode distances or various work piece lengths.

Pulsed Magnetisation

The combination of continuous high current levels with increasingly longer magnetisation periods often leads to a considerable amount of heat buildup in the work piece, which can result in the destruction of the material structure.

Ferrotest machines are equipped with pulse magnetisation, offering a reliable solution to this testing problem. The test current is repeatedly and regularly interrupted, preventing heat buildup when using high current levels. The pulse duration and the pause times are defined via the control board.

If you are using pulsed magnetisation, any test material without residual magnetism will need to be sprayed with test agent and subjected to two additional magnetising pulses before being inspected.

Demagnetisation

Depending upon the material being tested, varying amounts of residual magnetism can remain after magnetisation, which may need to be removed by demagnetisation.

Ferrotest machines are capable of automatic demagnetisation. Set the demagnetising field strength equal to the initial magnetising field strength and the machine will electronically reduce the current value to approximately zero.

For demagnetisation following DC magnetisation, Ferrotest units can be fitted with an optional polarity switch.

Ferrotest GWH types:

- GWH 15, 30 and 40: Additional DC output socket.
- GWH 60, 80 and 100: Electronic change-over switch for AC and DC use.
Electronic polarity switch for DC demagnetisation.

2.4 ACCESSORIES

Special Electrodes to test sensitive or irregularly shaped work pieces:

- Prods for mounting on handles and for connection to high-current cables.
- Magnetic electrodes for connection to high-current cables.

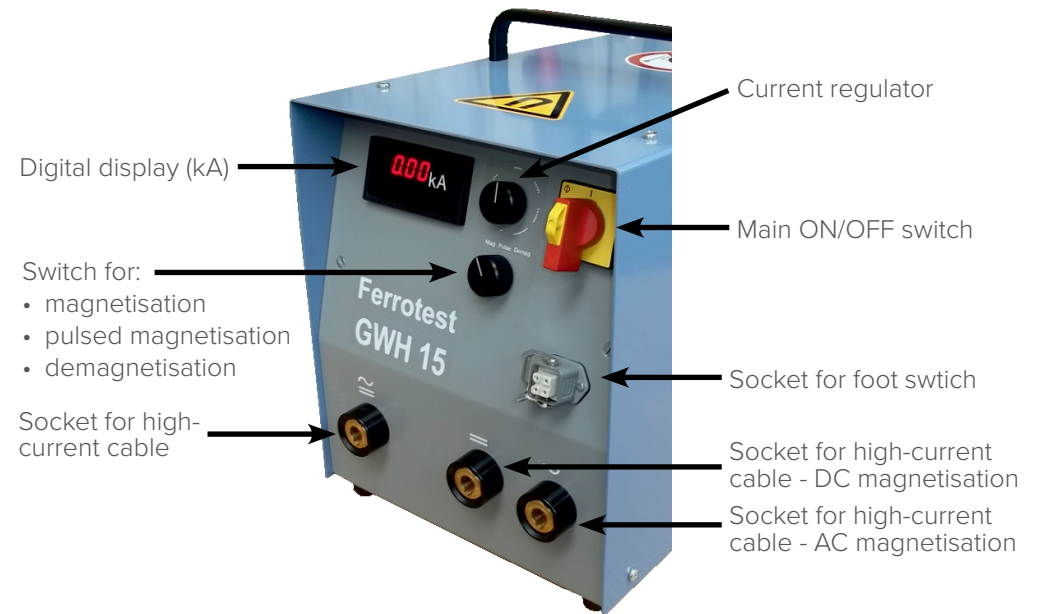
Coils: we offer a variety closed or hinged coils for coil magnetisation.

Handcart for Portable Machines

Our light-duty, two-wheeled handcart is designed for easy transportation of your Ferrotest unit. The cart has a fixture to wind up and store the high-current cable, and a storage box for testing agents, test objects, etc.

3. OPERATION

3.1 OPERATING ELEMENTS



3.2 INSTALLATION

- Plug the high-current cables into the sockets on the front of the machine.
- Connect the machine to mains supply.
- Plug the foot switch control cable to the socket on the front of the machine.
- Set main switch to ON position.

IMPORTANT: permitted voltage fluctuation for the safe operation of this device is $\pm 10\%$.

See the detailed safety instructions in section 1.1, as incorrect use of this device can be hazardous.

3.3 TEST PROCEDURE

- Attach electrodes or high-current cables to the object being tested, or to the test bench
- Select the current type (AC or DC)
- Insert the high-current cable into the corresponding socket.
- Switch the machine on.
- Select the magnetisation method (continuous or pulsed) using the selector switch.
- Set the magnetisation strength using the potentiometer.
- Start magnetisation using the foot switch (magnetisation continues as long as the foot switch is depressed).
- Spray the test piece with a liquid test agent and ensure it remains coated for the duration of the magnetisation process.
- Visually inspect the test piece.

NOTE: Also see section 3.5: Important Information about the test procedure.

3.4 DEMAGNETISATION

Depending upon the material being tested, varying amounts of residual magnetism can remain after magnetisation, which may need to be removed by demagnetisation.

For demagnetisation to occur, the alternating field amplitude has to steadily decrease towards zero. The demagnetising field strength must be equal to the initial magnetising field strength. The field strength of the test piece can be decreased electrically by reducing the magnetic field, or mechanically by slowly removing the work piece from a field-filled space (e.g. a demagnetisation coil).

Automatic Demagnetisation

The Ferrotec machines are capable of automatic demagnetisation. Set the magnetising current equal to the initial magnetising current and the machine will electronically reduce this maximum current value to approximately zero.

Procedure:

- Attach electrodes to test object.
- Select current type AC.
- Set selector switch to position 3: Demagnetisation.
- Start demagnetisation by pressing the foot switch.

After DC Demagnetisation

DC magnetisation forms a static magnetic field whose polarity cannot be changed. This means that, following DC magnetisation, many polarity-changing steps must be performed in order to achieve demagnetisation.

Procedure:

- Change polarity by plugging the high-current cable into another socket on the machine.
- Using the potentiometer, reduce the current strength to the same level as the initial magnetisation current strength.
- Press the foot switch.
- Repeat the steps above until the residual magnetisation is as small as possible.
- Reduce the remaining residual magnetism using AC.

3.5 IMPORTANT INFORMATION ABOUT THE TEST PROCEDURE

Current flux inspection often requires the conduction of high-current levels through electrodes. When using this inspection method, make sure that the electrode contacts are securely attached to the test areas of the work piece before switching on the testing current.

Important:

Turn off the testing current before placing an electrode on the test piece. Placing (or removing) an electrode carrying high-current onto the test piece can cause sparking, resulting in the pitting and hardening of the contact surface. Contact surfaces must be smooth, polished bare metal.

When operating with high-current, the use of unsuitable electrodes or contact surfaces that are too small can cause burning. If necessary, carry out a test before starting the inspection procedure to prevent damage to the test object.

Electrodes carrying high-current use a great deal of power, which places extreme requirements on both the machine and the mains supply. This high power consumption can damage the control electronics of the device.

The magnetisation must continue approximately 2 seconds longer than the test agent spraying time. This extra time insures that the defect indications are not be erased and is especially important when testing soft magnetic materials or using AC magnetisation (also see section 3.6: Residual Magnetism).

The optimal field strength is an important aspect of MPI testing. Current levels must be individually adjusted for each test object using the potentiometer.

Optimal field strength can also be determined by using one of our test objects or measuring equipment; see our website for the complete range.

If the machine is equipped with a mechanical high-current selection switch, make sure that the star grip is securely tightened after switching on the power!

3.6 RESIDUAL MAGNETISM

Testing for residual magnetism requires hard magnetic materials and the use of direct current (DC). Ferrotest GWH and Ferrotest GWV machines are equipped with a DC power source, making them ideal for this method of testing.

Hard magnetic materials (as opposed to soft magnetic materials) retain a high magnetic induction, which makes it possible to detect indications of cracks/flaws for a considerable time after the magnetisation process.

As a rule, this testing method can be applied to steel containing more than approx. 0.2% carbon. This lower limit varies according to the non-magnetic alloy content of the steel.

It is not possible to reliably test for magnetic induction using AC. The continuous polarity reversal at 50 Hz AC creates periodic phases that demagnetise the test object. Switching off the magnetisation during one of these phases will eliminate any residual magnetic induction, resulting in the loss of stray fields necessary for indicating flaws.

4. MAINTENANCE

The Ferrotest GWH 15 is constructed from maintenance-free components. However, we recommend you check and clean the unit after approximately 40 working hours.

- Check the power cable. Never operate the machine with a damaged cable.
- The contact surfaces of the high-current connectors, cables and conducting elements in the switch (if installed) should be occasionally cleaned with abrasive paper. This removes corrosion and reduces electrical resistance to a minimum.



DANGER OF ELECTROCUTION

The unit has no splashproof protection; do NOT clean with water.

Repairs to the electrical system of the appliance should only be carried out by qualified personnel.

Unplug the power cable before opening the machine.

Malfunction Information

The transformer and rectifier are protected by a thermal automatic circuit-breaker, which resets itself automatically after an interruption.

Transport and storage

During transport and storage, take care that the machine is not dropped and is protected from strong vibrations, either of which can damage the unit's electronics.

TECHNICAL DATA

Machine type	Ferrotest GWH 15 (400 V)
Part number	06215-116954
Max. test current measured via high-current cable, external circuit, 5 m:	
Effective AC / DC	1050 A / 950 A
Peak AC/ DC	1500 A / 1900 A
Short circuit current I_k approx.	7800 A
Test current adjustment	infinitely variable
Operating data	
Mains connection	400 V *
Frequency	50 Hz *
Power input	ca. 8.8 kVA **
Open circuit voltage	4.5 V
Control voltage	12 V
Duty cycle (intermittent) operating time (relative) (relative to 10 secs and 50% of effective output)	30 %
Duty cycle (intermittent) operating time (absolute) (relative to 10 secs and 50% of effective output)	3 secs ON and 7 secs OFF
High-current cable length	2 x 2.5 m
Cross section	95 mm ²
Dimensions/Weight	
Width	290 mm
Height (with handle)	395 mm
Depth	455 mm
Weight (without high-current cables) approx.	33 kg

* Standard version

** See information plate on the machine

EC/EU DECLARATION OF CONFORMITY FOR TIEDE STANDARD SMALL DEVICES



We hereby declare that this equipment complies with the following EU Directives. The device has been tested and approved. Any modification made to the device without our written consent will invalidate this declaration.

Applicable EC/EU Directives:

Low Voltage Directive (LVD) 2014/35/EU

Electromagnetic Compatibility (EMC) Directive 2014/30/EU

Equipment model: High current generator

Equipment type: Ferrotest GWH 15

Serial number:

Applied harmonised standards:

EN 60204-1:2014, DIN EN ISO 9934-3:2015

Other applicable standards and specifications:

DIN VDE 0100-410:2007, DIN VDE 0100-540:2012

Authorised person for documentation:

Mr. Georg Koch, Quality Management Officer

Address:

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Person responsible:
Sales/Design Manager
Mr. Silvio Georgi

Signature:

Date: 12.07.2016



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