

Procedure For The Magnetic Particle Testing Of Iron And Steel Castings In Accordance With BS EN 1369

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1. Scope

This procedure describes the method of magnetic particle inspection of ferromagnetic iron and steel castings and must be adhered to as applicable to ensure customer requirements are met and that compliance with orders received is achieved. An iron or steel casting is considered to be ferromagnetic if the magnetic induction is greater than 1 T for a magnetic field strength of 2.4 kA/m (BS EN 1369, clause 1).

This specification is only applicable to the testing of castings using portable AC yoke MPI equipment using the colour contrast (black ink) continuous wet method of inspection.

This procedure covers both the testing of newly manufactured products, in-service items and repairs to cast items.

2. References

This procedure makes reference to the following documents:-

BS EN 1369:2012	Founding - Magnetic particle testing
BS EN ISO 9712:2022	Non-destructive Testing. Qualification and certification of NDT personnel.
BS EN ISO 9934-1:2016	Non-destructive testing. Magnetic particle testing. Part 1: General principles
BS EN ISO 9934-2:2015	Non-destructive testing. Magnetic particle testing. Part 2: Detection media
BS EN ISO 9934-3:2015	Non-destructive testing. Magnetic particle testing. Part 3: Equipment
BS EN ISO 3059:2012	Non-destructive testing. Penetrant testing and magnetic particle testing. Viewing conditions.
BS EN 1330-1:2014	Non-destructive testing. Terminology. List of general terms

Controlling document highlighted in **bold**.

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3. Safety

Personnel working to this procedure shall work in such a manner as to comply with the Health and Safety at Work act (1974)

All consumables used shall have accompanying COSHH data sheets and shall be disposed of in a way that is non-injurious to site personnel or to the environment.

Personnel working to this procedure shall at all times wear mandatory PPE; overalls, safety boots, hard hat, high visibility clothing, etc.

Mains powered equipment i.e. 110V yokes shall be in good working order and have been PAT tested within the last 12 months.

Caution: AC yokes produce magnetic fields which may be capable of disrupting and or stopping the normal operation of watches, credit cards, pacemakers and other items sensitive to strong magnetic fields.

4. Personnel qualification

All personnel operating to this procedure shall hold a minimum of Level 2 certification in accordance with BS EN ISO 9712, covering the MPI testing of castings. e.g. MPI PCN Level 2 castings or Pre & In-service (Multi).

All personnel shall also hold a valid eyesight certificate (meeting the requirements of BS EN ISO 9712 section 7.4) obtained within the last 12 months.

Documentation relating to operators certification shall be kept on file at the administration offices for review purposes

5. Description of method

Magnetic particle inspection is a method used to detect cracks, cold laps, inclusions and other discontinuities on or close to the surface of ferromagnetic materials. Magnetic particle examination is not suitable for testing non-ferromagnetic materials such as austenitic stainless steels.

The magnetic particle inspection test described in this procedure consists of locally magnetising an area to be examined, then by applying suitably prepared magnetic particles and subsequently interpreting and evaluating any resulting particle accumulations. Maximum detectability occurs when the discontinuity is positioned on the surface and perpendicular to the magnetic flux.

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6. Testing materials

The following magnetic particle inspection materials shall be used.

Hydrocarbon based black magnetic ink.
The ink shall have a solid content within the manufacturer's specification for the product, as stated on the product data sheet.
White contrast aid paint.
Solvent cleaner.

All consumables shall comply with the requirements of BS EN ISO 9934-2. It is highly recommended that all MPI consumables used are from the same product family to ensure compatibility.

7. Method of testing

7.1 Surface preparation

All accessible surfaces of each finished part shall be inspected after final heat treatment and either in the as cast, proof machined or finished machined stage depending on customer requirements.

Where practicable, final acceptance testing shall be performed on the casting in its delivery condition.

Where parts are to be tested which have been in-service the surface shall be free from any coatings which may affect the sensitivity of the test. Well adhered/bonded coatings up to a thickness of 50 µm may be allowed but it should be demonstrated that the coating will not adversely affect the sensitivity of the test.

The surface subject to inspection, will be free from scale, grease, oil, dirt or any other substance which may interfere with the effectiveness of the testing materials. Loose scale and other contaminants shall be removed before testing.

Acetone, cleaning solvent or a water based degreasing wash will be used as the cleaning and degreasing agents if necessary. The part shall be thoroughly dried before being subject to MPI testing.

The temperature of the part under test shall be between 5°C and 50°C

In the as-cast condition it is not possible to carry out a satisfactory test on an unprepared as-cast surface. The surface to be tested shall be prepared by shot-blasting, sand-blasting or surface grinding so that defects can be clearly distinguished from indications resulting from surface irregularities.

If sand blasting or shot blasting is required it shall be as light as possible, heavy and prolonged blasting may affect the sensitivity of the test.

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