

Procedure For The Magnetic Particle Testing Of Steel Forgings In Accordance with BS EN 10228-1

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1. Scope

This procedure describes the method of magnetic particle inspection of steel forged and wrought products and must be adhered to as applicable to ensure customer requirements are met and that compliance with orders received is achieved. A steel forging is considered to be ferromagnetic if the magnetic flux density is greater than 1 T for a tangential magnetic field strength of 2.4 kA/m (BS EN 10228-1, clause 1).

This specification is only applicable to the testing of forged or wrought products using portable AC yoke MPI equipment or fixed bench equipment with black and fluorescent inks and employing the continuous wet method of inspection.

This procedure covers the testing of newly manufactured products, the testing of in-service items and the testing of any repair work undertaken by grinding, welding or similar.

2. References

This procedure makes reference to the following documents:-

BS EN 10228-1:2016	Non-destructive testing of steel forgings Part 1: Magnetic particle inspection
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 and fixed bench equipment produce magnetic fields which are 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 in the magnetic particle testing of forgings and wrought products, e.g. PCN Level 2.

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 applicable to non-ferromagnetic materials such as austenitic stainless steels.

The magnetic particle inspection test described in this procedure consists of either magnetising the whole part or 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.

Fluorescent method

Hydrocarbon based fluorescent magnetic ink.
The ink shall have a solid content within the manufacturer's specification for the product, as stated on the product data sheet.

Black and white method

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.

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 forged, proof machined or finished machined stage depending on customer requirements.

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

The surface subject to be inspected, 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 may be removed using a wire brush.

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 forged condition it is difficult to carry out a comprehensive test on a forged 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. For general applications, quality classes 1 and 2 shall be applicable.

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