

Procedure For The Magnetic Particle Testing Of Welds To ASME BPVC Section V

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1. Scope

This procedure describes the method of magnetic particle inspection of welded joints in steel plate and pipe sections and must be adhered to as applicable to ensure customer requirements are met and that compliance with orders received is achieved.

This procedure is only applicable to the testing of weldments using portable AC electromagnetic yokes (ASME BPVC V T-755) and the continuous wet method (T-773), using either fluorescent magnetic ink in darkened conditions or black magnetic ink on a white contrast background. Non-magnetic coatings shall be removed from the area to be examined; examination through coatings (Article 7, Mandatory Appendix I) is outside the scope of this procedure.

This procedure covers the testing of, 1) newly fabricated products, 2) any required repairs to newly fabricated products, 3) in-service products, 4) repair work to in-service products.

When required by the referencing Code Section, the capability of this procedure to detect relevant discontinuities shall be demonstrated to the satisfaction of the Inspector by its application on a sample containing at least one known discontinuity (ASME BPVC V Article 1, T-150(a)). Where ASME BPVC VIII-1 applies, this procedure shall be certified by the Manufacturer as meeting the requirements of T-150 (VIII-1 Mandatory Appendix 6, 6-1(c)).

2. References

This procedure makes reference to the following documents:-

ASME BPVC V:2025 Nondestructive Examination. Article 1: General Requirements; Article 7: Magnetic Particle Examination; Article 25, SE-709 (ASTM E709-21): Standard Guide for Magnetic Particle Testing

ASME BPVC VIII-1:2025 Rules for Construction of Pressure Vessels, Division 1. Mandatory Appendix 6: Methods for Magnetic Particle Examination (MT)

BS EN ISO 9712:2022 Non-destructive Testing. Qualification and certification of NDT personnel.

3. Safety

Personnel working to this procedure shall work in such a manner as to comply with the Health and Safety at Work etc. 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.

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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 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 be qualified and certified to a minimum of Level 2 in magnetic particle testing in accordance with their employer's written practice, as required by ASME BPVC V Article 1, T-120(e). As permitted by T-120(f), certification under a BS EN ISO 9712-based central certification scheme (e.g. PCN Level 2 magnetic particle testing of welds or general) may be used to fulfil the written practice requirements for training, experience and the general, basic and method examinations.

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. Where ASME BPVC VIII-1 applies, each examiner shall be able to read a Jaeger Type No. 2 Standard Chart at a distance of not less than 12 in. (300 mm), with correction if necessary, and shall be capable of distinguishing and differentiating contrast between the colours used; these requirements shall be checked annually (VIII-1 Mandatory Appendix 6, 6-2). A current BS EN ISO 9712 eyesight certificate meets these requirements.

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 method described in this procedure consists of locally magnetising the area to be examined, applying suitably prepared magnetic particles while the area is magnetised 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.

Colour Contrast Method

Hydrocarbon based black (visible) magnetic ink, wet method.
The ink concentration shall give a settling volume of 1.2 mL to 2.4 mL per 100 mL of suspension, unless otherwise specified by the particle manufacturer (ASME BPVC V T-765.2).
White contrast aid paint (non-magnetic surface contrast enhancement, T-741.2).

Fluorescent Method

Hydrocarbon based fluorescent magnetic ink, wet method.
The ink concentration shall give a settling volume of 0.1 mL to 0.4 mL per 100 mL of suspension, unless otherwise specified by the particle manufacturer (T-765.2).

All magnetic particles and suspension vehicles shall be in accordance with the applicable specifications listed in Article 25, SE-709, para. 2.2 (T-731(b)). Other consumables may be used provided they meet the same requirements.

7. Method of testing

7.1 Surface preparation

Prior to examination, the surface to be examined and all adjacent areas within at least 25 mm shall be dry and free of all dirt, grease, lint, scale, welding flux and spatter, oil, or other extraneous matter that could interfere with the examination (ASME BPVC V T-741.1). Loose scale and other contaminants may be removed using a wire brush. Satisfactory results are usually obtained with surfaces in the as-welded condition; however, grinding may be necessary where surface irregularities could mask indications due to discontinuities.

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.

Non-magnetic coatings (e.g. paint) shall be removed from the area to be examined. White contrast paint shall be applied only in amounts sufficient to enhance particle contrast, and it shall be demonstrated that indications can be detected through it (T-741.2), using a sample containing at least one known discontinuity. The demonstration shall be recorded.

The temperature of the part under test shall be between 5 °C and 50 °C, and within the temperature range recommended by the particle manufacturer (T-731(c)).

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