Procedure For The Dye Penetrant Testing Of Welds To BS EN ISO 3452-1

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1. Scope

This procedure describes the method of dye penetrant inspection of welded joints in 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 covers steel, stainless steel, aluminium and all other non-porous materials suitable for welding.

This specification is only applicable to solvent removable colour contrast dye penetrant used in conjunction with the non-aqueous wet developer method.

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

2. Applicable documents

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

BS EN ISO 3452-1:2021 Non-destructive testing. Penetrant testing. General principles

BS EN ISO 3452-2:2021 Non-destructive testing. Penetrant testing. Testing of penetrant materials

BS EN ISO 3452-3:2013 Non-destructive testing. Penetrant testing. Reference test blocks

BS EN ISO 12706:2009 Non-destructive testing. Penetrant testing. Vocabulary

BS EN ISO 3059:2012 Non-destructive testing. Penetrant testing and magnetic particle testing. Viewing conditions.

BS EN ISO 5817:2023 Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections

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 dye penetrant 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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Because of the flammability of most liquid penetrant materials the use of an open flame for heating components prior to liquid penetrant examination is prohibited.

Any equipment that requires the use of mains electricity shall have successfully passed a PAT test within the last 12 months and be in good working condition.

Highly volatile solvents are to be used with caution. Their vapours are relatively toxic and the liquids are primary skin irritants. Extreme care is to be exercised in handling volatile solvents as many of them are highly flammable liquids. The appropriate safety precautions are to be carried out at all times.

4. Personnel qualification

Operators trained and qualified in dye penetrant inspection to PCN (BS EN ISO 9712) Level 2 (including welds category) will be employed to carry out penetrant inspection in accordance with this procedure.

All personnel shall meet the eyesight requirements of BS EN ISO 9712 section 7.4 and shall be certified annually to ensure this.

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

5. Description of method

Liquid penetrant inspection is a method of non-destructive testing which provides for the detection of flaws which are open to the surface in non-porous metals. Typical flaws which are detectable are cracks, laminations, lack of fusion, porosity etc.

A liquid penetrant is applied to the surface to be examined and allowed to enter flaws, excess penetrant is removed using a suitable solvent, then the part is dried and a developer applied. The developer, when dry, will indicate escaping penetrant trapped in discontinuities so that defects may be more readily located.

Precautions:- Liquid penetrant inspection should be carried out in a well ventilated area. The materials used are inflammable and must be kept away from naked flames.

6. Testing materials

The following testing penetrant materials will be used.

Penetrant – Visible (red) solvent removable penetrant
Developer – Non-aqueous wet Developer
Remover – Solvent based cleaner

Penetrant system designation: IICe in accordance with BS EN ISO 3452-1 (Type II colour contrast penetrant, Method C solvent removal, Form e solvent-based non-aqueous

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developer). The sensitivity level of the product family shall be as stated by the manufacturer in accordance with BS EN ISO 3452-2.

All penetrant material used must conform to the requirements of BS EN ISO 3452-1 and BS EN ISO 3452-2.

Testing will only be carried out using one manufacturer's products (penetrant family) and non-compatible products shall not be mixed.

The penetrant materials used shall have been analysed for sulphur and halogen content and meet the general requirements of BS EN ISO 3452.

Penetrant consumables past their expiry (use by/best before) date **shall not be used.**

Certificates of conformity for consumables shall be kept on file and made available upon request.

All materials used as part of the liquid penetrant process are to be non-corrosive towards and compatible with the material to be examined. The chemical or physical properties of some non-metallic materials may be adversely affected by liquid penetrant process materials. Compatibility is to be established prior to use. In situations where deterioration of adjacent surfaces may occur, the surfaces are to be masked to ensure that the penetrant process materials are confined to the surface under examination.

Other equipment:

Lint free wipes.
Portable supplementary lighting, e.g. torch or LED/Halogen floodlight.
Lightmeter - Externally calibrated within the last 12 months (BS EN ISO 3059, section 8)
Timing device - Internally calibrated within the last 12 months.
Thermometer - Internally calibrated within the last 12 months
Surface roughness comparator gauges.

7. Method of application

7.1 Surface preparation

Welds to be inspected shall be specified on the works instruction or other document.

All welds shall be inspected after final heat treatment/stress relieving unless otherwise specified.

The areas 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.

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