

Procedure For The Dye Penetrant Testing

Of Steel Forgings To BS EN 10228-2

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1. Scope

This procedure describes the method of dye penetrant inspection of steel forgings and must be adhered to as applicable to ensure customer requirements are met and that compliance with orders received is achieved. The method is used for the detection of discontinuities open to the surface (BS EN 10228-2, clause 1).

This procedure covers the liquid penetrant testing of open die and closed die steel forgings, rolled rings, forged bars, billets and sections, and of products machined from forged or wrought material, e.g. shafts, fasteners, gears and spindles, in the as-forged, rough machined and finish machined conditions.

This procedure covers newly manufactured products but may also be used for in-service inspection and repair work provided the requirements stipulated in this procedure can be met.

This procedure is applicable to solvent removable and water washable colour contrast penetrants and water washable fluorescent penetrants, used in conjunction with the non-aqueous wet developer method.

The following shall be agreed between the purchaser and the supplier at the time of enquiry and order (BS EN 10228-2, clause 4) and stated on the purchase order, a supplementary technique sheet and/or the drawing which covers the part under test: the manufacturing stage(s) at which testing is performed; the areas to be examined; whether colour contrast or fluorescent penetrant is to be used; the quality class(es) required and the surface areas to which they apply; any recording levels and acceptance criteria different from Table 2; whether the test is to be witnessed by the purchaser or their representative; and whether this procedure is to be submitted to the purchaser for approval.

2. Applicable documents

BS EN 10228-2:2016	Non-destructive testing of steel forgings. Penetrant testing
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 3452-4:1999	Non-destructive testing. Penetrant testing. Equipment

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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.

Controlling document highlighted in bold.

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.

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

All personnel operating to this procedure shall hold a minimum of Level 2 certification in accordance with BS EN ISO 9712 in the penetrant testing of forgings and wrought products, e.g. PCN Level 2.

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.

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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 materials. Typical flaws which are detectable are cracks, seams, laps, cold shuts, 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 or water, 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
Or
Penetrant – Visible (red) water washable penetrant
Or
Penetrant – Fluorescent water washable penetrant

Developer – Non-aqueous wet developer

Remover – Solvent based cleaner (solvent removable)
Or
Remover – Water (water washable)

Penetrant system designation in accordance with BS EN ISO 3452-1: IICe (Type II colour contrast penetrant, Method C solvent removal, Form e solvent-based non-aqueous developer) for solvent removable penetrant; IIAe (Method A water removal) for water washable penetrant; or IIEe (Method E water and solvent removal) where water removal is followed by a solvent wipe; IAe (Type I fluorescent penetrant, Method A water removal) for fluorescent water washable penetrant. The sensitivity level of the product family shall be as stated by the manufacturer in accordance with BS EN ISO 3452-2. The combination of penetrant testing products shall enable the recording level of the specified quality class (Table 2) to be achieved (BS EN 10228-2, 7.1).

Generally solvent removable penetrants shall be used for machined surfaces where removal by solvent is possible and water washable penetrants shall be used on rough, as-forged, descaled or shot-blasted surfaces where removal by solvent would be difficult or problematic.

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

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