

Procedure For The Dye Penetrant Testing Of Castings To BS EN 1371-1

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1. Scope

This procedure describes the method of dye penetrant inspection of cast items made from various metals and their alloys and must be adhered to as applicable to ensure customer requirements are met and that compliance with orders received is achieved.

This procedure applies to castings produced in conventional sand moulds and by gravity and low-pressure die casting, in most cast metals. It does not apply to investment castings, high-pressure die castings, or copper-tin and/or copper-tin-lead alloy castings where copper is the major constituent (BS EN 1371-1, clause 1).

This procedure covers the liquid penetrant testing of castings in both the finished machined, proof machined and as cast stages i.e. dressed, ground, etc.

This procedure may also be used to examine any repairs made to the casting by welding, dressing or otherwise as part of the initial manufacturing process.

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

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

This procedure does not cover the extent to which dye penetrant testing is required nor the stage at which the dye penetrant exam shall take place. This should be stated in a supplementary technique sheet and/or drawing which covers the part under test.

2. Applicable documents

BS EN 1371-1:2011	Founding. Liquid penetrant testing - Sand, gravity die and low pressure die castings
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

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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

Operators trained and qualified in dye penetrant inspection (covering castings) to PCN (BS EN ISO 9712) Level 2 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 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

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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

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

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 cast, dressed 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.

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) date **shall not be used.**

Certificates of conformity for consumables shall be 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

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