



**PENETRANT TESTING
EN4179 LEVEL 2 SYLLABUS**

DOCUMENT APPROVAL

Function	Name	Signature	Date
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General Theory

Instruction shall be given in the principles, limitations and theoretical aspects of the following:

- Introduction – Brief history of the development of penetrant testing, philosophy of NDT and penetrant testing capabilities in relation to other methods. Basic aerospace product technology.
- Principles of penetrant testing – Surface tension, viscosity, volatility, capillary action and their relevance to penetrating fluids.
- Properties and requirements of emulsifiers, spirit remover and of a developer, plus terminology associated with penetrant testing.
- Equipment and materials – Fixed installations, portable inspection kits and auxiliary equipment; Penetrants: Colour contrast, fluorescent, combined colour contrast and fluorescent; Penetrant removers: Solvents in liquid form, water only, water soluble and oil soluble emulsifiers; Developers: Dry powders, powders in aqueous liquid carriers, developers in solution and powder in non-aqueous liquid carrier.
- Methods of assessing sensitivity and control testing – Chromium plated aluminium test blocks, TAM panels and defective components; Colour: Fluorescent intensity and comparator checks of penetrants; Efficiency of penetrant removers; Fluorescence: Coverage and concentration checks on developers.

Specific Theory

Instruction shall be given in the following:

- Preparation for penetrant testing – Surface preparation, cleaning methods, effects of surface finish and contaminants. Also compatibility of materials.
- Safety precautions – Fire hazards, electrical safety, ventilation, toxic materials and safe use of UV(A) radiation.

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- Test procedures – Selection of penetrant and developer process for optimum sensitivity with due regard to inspection criteria, surface condition and ambient light levels; Method of application of penetrant, significance of temperature, drainage and self-drying, removal of excess penetrant and contact time; Penetrant removal: Liquid solvents, aqueous washes, post emulsifiers and contact times; Drying of components; Application of developers: Dry powders and liquid developers (aqueous and non-aqueous); Viewing conditions: Under white light and UV(A) radiation including their assessment; Types of discontinuity, identification, false indications and their causes.
- Detectability of defects – Advantages and limitations of the test method with regard to defect detection; Characteristics of indications; Factors affecting indications: Surface preparation, detecting medium and application.
- Interpretation and reporting – Types of discontinuity and their identification; Relevant, non-relevant and false indications and their causes; Preservation of indications: Transparent tape transfer and other coating transfers, photographic (fluorescent and non-fluorescent), lacquer developers.
- Post test procedures – Post test cleaning and the need for restoration of preserving coatings.
- Standards and specifications.

Reference material

- ASNT – Study guide
- Metals Handbook Volume 17 Non-destructive evaluation of quality control
- Supplement to SNT-TC-1A as appropriate
- Non-destructive testing handbook - R McMaster
- Inspection of metals: Visual Examination. - R Anderson
- Basic Metallurgy for NDT - JL Taylor
- Principles of penetrants - C Betz
- Penetrant Inspection - D Lovejoy