



Guidance on Auditing Liquid Penetrant Testing (LPT)

This document is a guidance for API Monogram/APIQR auditors conducting API audits. This document does not prescribe any requirements that must be complied with by Licensed and/or Registered organizations. Actual requirements are listed in API product specifications and quality management system standards. Specifically, auditors are expected to ensure that the facility is conforming to (1) applicable product specification requirements for this activity, and (2) quality management system requirements, such as conformance with the company's own procedures, regulatory requirements, or contract requirements.

Auditors should familiarize themselves with standards referenced in the applicable API product specification. In the case of Liquid Penetrant Testing, such referenced standards may include ASTM E165. Auditors may review the following areas of emphasis:

Auditors may review the Liquid Penetrant Testing procedure(s) to identify the type and method of LPT described by the procedure. For example:

1. Visible Penetrant Examination:
 - a. Water-washable
 - b. Solvent removable
2. Fluorescent Penetrant Examination:
 - a. Water-washable
 - b. Solvent removable
 - c. Post-emulsifiable, hydrophilic (water) or lipophilic (oil)

While each of the six methods will have specific requirements, some general processes can apply to several methods. For readability purposes, these processes are organized in this work instruction in the categories shown. More information on each of these areas is provided below. The auditor may consider whether these processes are addressed by the procedure (regardless of method):

1. Examination sequence
2. Preclean
3. Application of Penetrant
4. Removal of Penetrant
5. Application of Developer
6. Inspection
7. Post-Clean
8. Records

The auditor may review the organization's LPT procedure for the information specified below. If possible, auditors can observe facility personnel performing Liquid Penetrant Testing on a production part. In reviewing the procedure and observing the activity, the auditor may consider the following:

1. Examination Sequence
 - Requirements for examination sequence and whether they conform with the specification

- Requirements for the minimum and maximum time between steps
- 2. Preclean:
 - Acceptance criteria for cleaning and drying
 - Acceptance criteria for part roughness/surface irregularities and other surface treatment, as applicable
 - Requirements for part temperature/temperature limits
- 3. Application of Penetrant:
 - Requirements of penetrant material or if a specific brand/product is identified
 - Requirement of penetrant chemicals used are within the validity period and/or from same manufacturers
 - Method of application (e.g. brushing, spraying, dipping, etc.)
 - Required penetrant dwell time
 - Temperature of part and penetrant to align with properties
- 4. Removal of Penetrant
 - Water-washable:
 - Required water temperature
 - Spray angle or method of water application to ensure no over washing
 - Required (maximum) water pressure (if applicable)
 - Requirement for drying of the part (oven or ambient)
 - Solvent removable
 - Requirement for using lint-free wipe¹
 - Evaporation break/time
 - Post-emulsifiable
 - For Hydrophilic (water): Requirements for pre-rinsing (including water temperature, pressure, and time, as applicable); how to apply the emulsifier (including emulsifier concentration, temperature, pressure, and contact time, as applicable); and post-rinsing (including temperature, pressure, and time, as applicable)
 - For Lipophilic (oil): Requirements for how to apply the emulsifier; the dwell time for the emulsifier; and requirement for post-rinsing (including time, temperature, and pressure, as applicable)
- 5. Application of Developer
 - Type of developer required by procedure (dry powder, aqueous, liquid film, non-aqueous, etc.)
 - Requirements of developer material or if a specific brand/product is identified
 - Requirements for periodically verifying the condition of the dry developer
 - Required developing time, including minimum and maximum (if applicable)
 - Method of application
 - If aqueous developer is used, requirements for contamination and concentration checks
 - If aqueous developer is used, requirement for drying of the part (over or ambient) after application of developer
- 6. Inspection
 - Areas of the part to be examined (entire part or specific area)
 - Review process for interpretation and acceptance criteria for indications²
 - Fluorescent light examination:
 - Dark room/maximum visible light requirements

- Black light intensity
 - Visual light examination:
 - Requirement for minimum natural or artificial light
- 7. Post-Clean
 - Post-cleaning requirements
 - Are there requirements to dry the part to prevent rust?
- 8. Records
 - What records are maintained by the organization and required by the specifications?

Procedure qualification – Have the processes/methods defined in the procedure been validated to achieve the intended results? For example:

- Has the testing been validated using a testing block or panel with known defects?
- Has the validation shown capability to identify defects that are the same size or smaller than the acceptance criteria?
- Are records of the validation test available reflecting the LPT type (Visible or Fluorescent), method (Water-washable, Solvent removable, Post-emulsifiable) and details of penetrant application, drying, penetrant removal, and developer application (spraying, bath, etc.)
- What are the revalidation requirements of the procedure, for example, upon changes to essential variables.

Equipment calibration:

- Visible light meters
- UV light meters
- Pressure gauges
- Thermometers

Personnel competence:

- Competence requirements and records of personnel performing inspection³
 - This may include testing scores, practical hours of inspection, continuance log, when required.
- Are inspector's vision test records available?

Notes:

Notes provide additional guidance regarding some items identified above. Any findings raised during audits must reference specific requirements from normative documents and cannot be raised based on this document.

1. It is sometimes prohibited to flush the part surface directly with solvent.
2. Procedure may or may not contain the acceptance criteria. If not, how is the acceptance criteria documented and known by the NDE technician?

3. There are usually competence requirements associated with LPT. (e.g. Level III approves the procedure, Level II or higher interprets indications, Level I or higher performs the process). Review the specific requirements in the relevant Standards/Specifications.