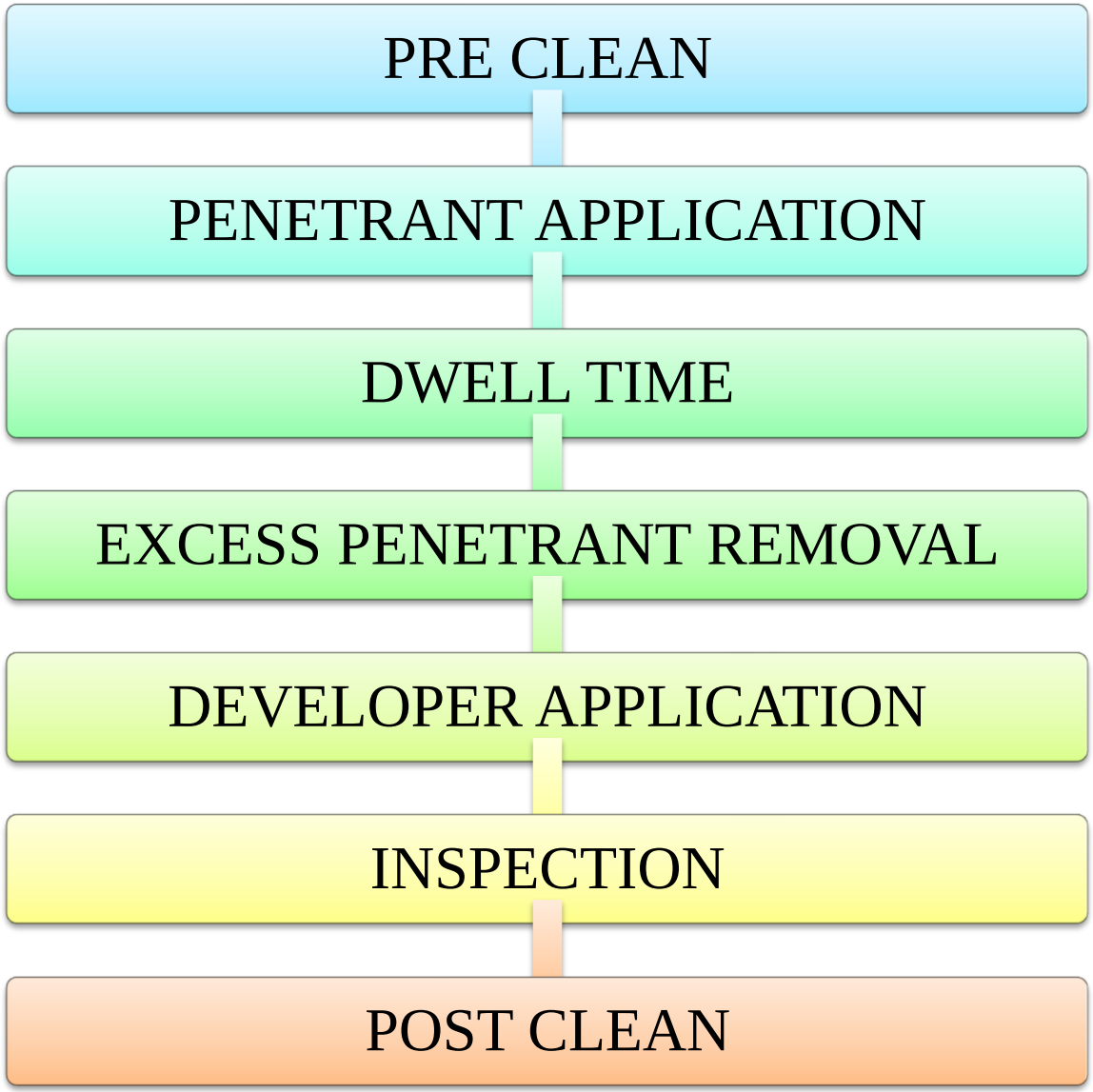
Procedure or steps in LPI

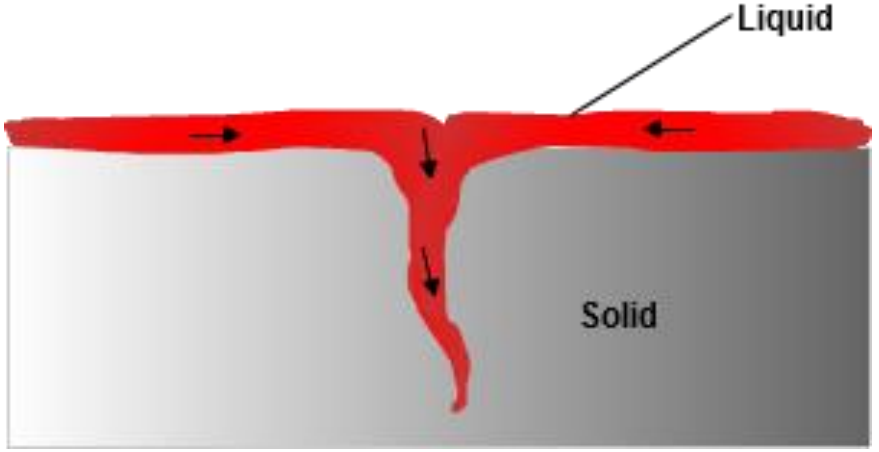


1. Pre-clean part.

This can range from grinding and wire brushing to merely wiping the part with a rag moistened with the cleaner/ remover. The surface needs to be free of dirt, rust, scale, paint, oil, and grease, and be smooth enough to wipe off the penetrant without leaving residue

2. Penetrant Application:

Once the surface has been thoroughly cleaned and dried, the penetrant material is applied by spraying, brushing, or immersing the part in a penetrant bath



3. Penetrant Dwell:

•The penetrant is left on the surface for a sufficient time to allow as much penetrant as possible to be drawn from or to seep into a defect.

•Penetrant dwell time is the total time that the penetrant is in contact with the part surface.

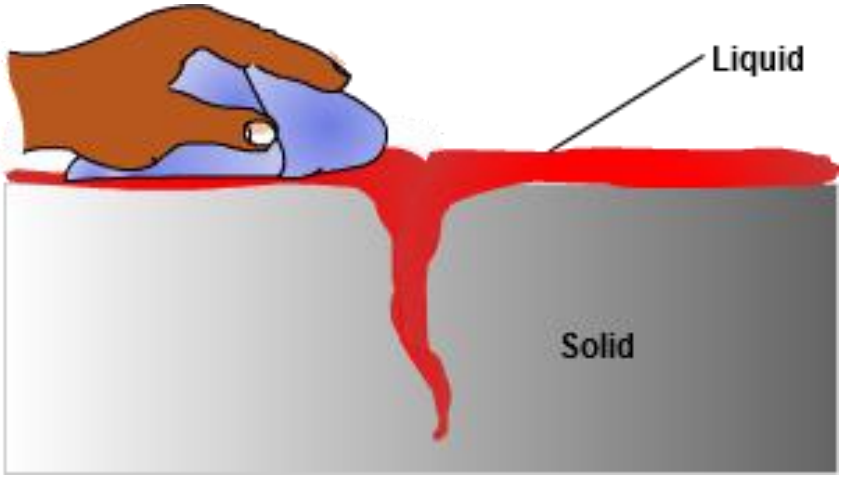
•Dwell times are usually recommended by the penetrant producers or required by the specification being followed. The times vary depending on the application, penetrant materials used, the material, the form of the material being inspected, and the type of defect being inspected for. Minimum dwell times typically range from five to 60 minutes.

•Generally, there is no harm in using a longer penetrant dwell time as long as the penetrant is not allowed to dry.

• The ideal dwell time is often determined by experimentation and may be very specific to a particular application.

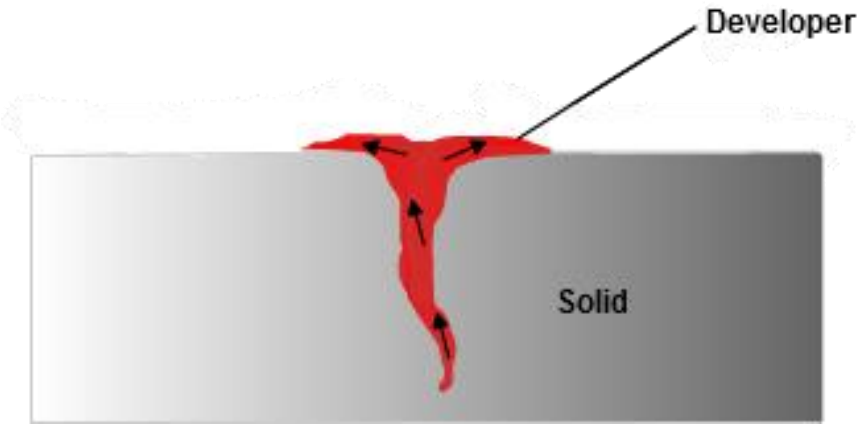
4. Excess Penetrant Removal:

This is the most delicate part of the inspection procedure because the excess penetrant must be removed from the surface of the sample while removing as little penetrant as possible from defects. Depending on the penetrant system used, this step may involve cleaning with a solvent, direct rinsing with water, or first treating the part with an emulsifier and then rinsing with water



5.Developer Application:

A thin layer of developer is then applied to the sample to draw penetrant trapped in flaws back to the surface where it will be visible. Developers come in a variety of forms that may be applied by dusting (dry powdered), dipping, or spraying (wet developers).

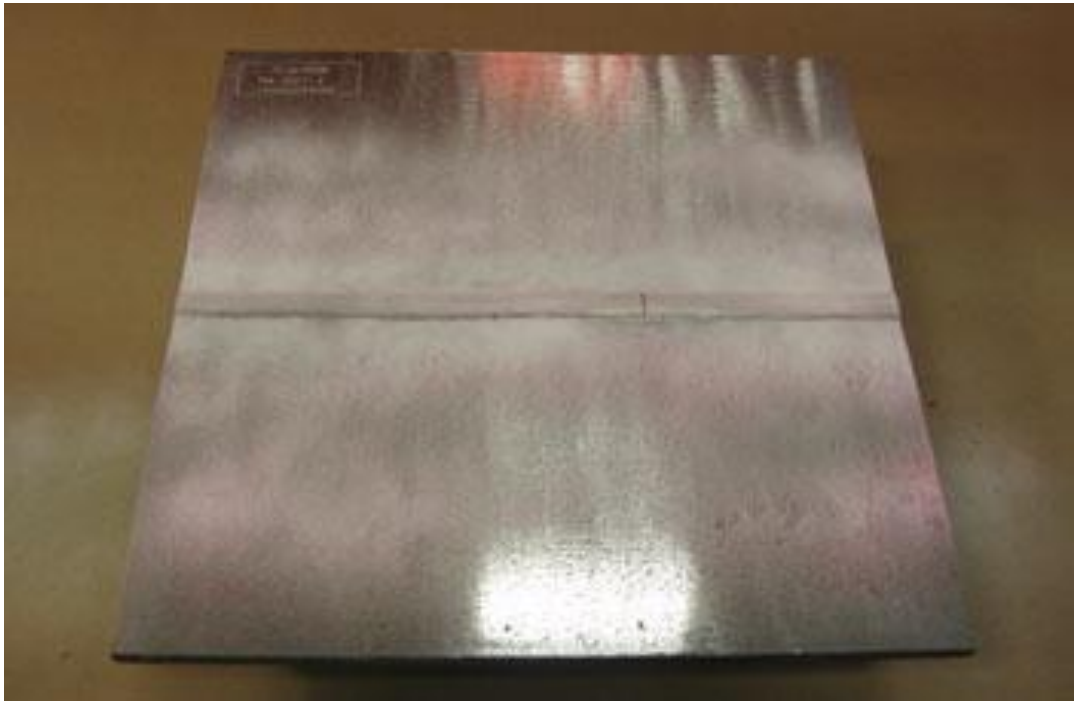


6.Evaluate indications.

It is critical to examine the part within the time frame designated in the written procedure. Length of an indication can grow over time as penetrant bleeds out, causing an acceptable indication to be a rejectable defect. Length of indication is measured for evaluation, not length of the flaw. Here, the two linear indications are rejectable defects. The round indication is non relevant.

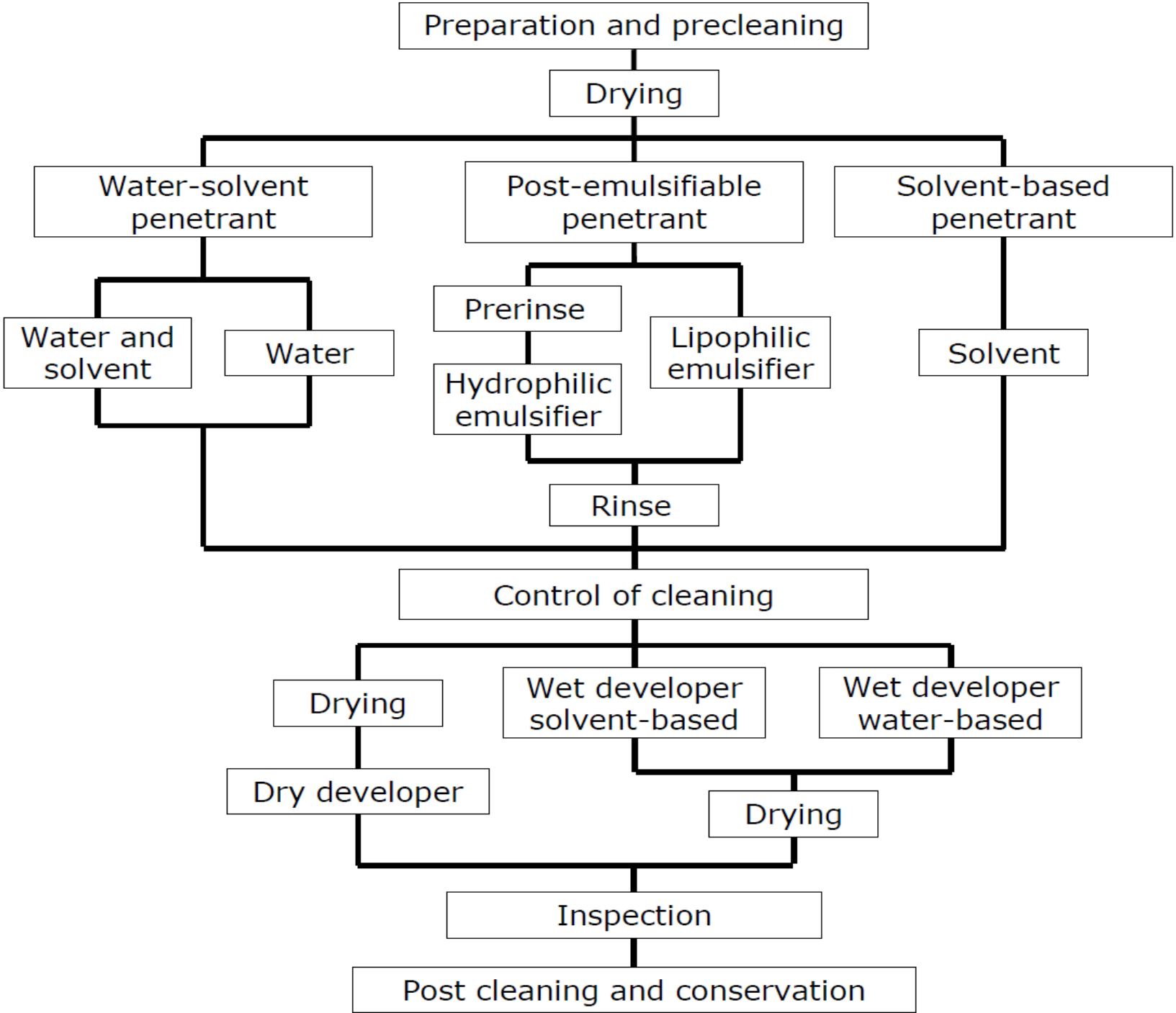
7. Post-clean part.

The part needs to be cleaned to remove all developer after it has been evaluated.



PENETRANT TESTING METHODS

i. Water washable
ii. Post emulsifiable
iii. Solvent removable


Preparation and precleaning
Drying
Water-solvent penetrant
Post-emulsifiable penetrant
Solvent-based penetrant
Water and solvent
Water
Prerinse
Hydrophilic emulsifier
Lipophilic emulsifier
Solvent
Rinse
Control of cleaning
Drying
Wet developer solvent-based
Wet developer water-based
Dry developer
Drying
Inspection
Post cleaning and conservation

Interpretation of Results

SL NO	Defect	Descripton
1	Casting Porosity	Spherical surface Indications
2	Casting Cold Shut	Dotted lines
3	Cracks	Staight continuous surface lines
4	Hot tears	Ragged line of variable width
5	Heat treat Cracks	Multiple irregular lines
6	Thermal cracks	interconnecting lines
7	Lack of fusion	Broken line of varying width
8	Fatigue cracks	continues line in parts

False Indications

- A false indication is an accumulation of penetrant caused by a drop of penetrant left on the workpiece.
- However, there are two conditions which may create accumulations of penetrant that are sometimes confused with the true crack and discontinuities
- The first includes indications caused by poor washing and the other one may created where parts press fit to each other.
- If a wheel press fit onto a shaft, penetrant will show an indication at the fit line
- But these types of indications are easy to identify since they are regular in form and shape

Safety precautions in LPI

Safety Precautions

- Flammability
  - Use exhaust fans to disperse vapors
  - Ignition sources must be avoided
- Skin Irritation
  - Wear gloves to protect hands
  - Wear safety glasses to protect eyes from splashing
- UV Light
  - Lamps get hot – be cautious!
  - Report missing or cracked filter on lamps
    - UV rays can cause sunburn and eye damage if filters not used or not functional

Advantages & Limitations of Liquid Penetrant Method

ADVANTAGES

- Simple & inexpensive
- Versatile & portable
- Applicable to ferrous, non-ferrous, non-magnetic & complex shaped materials which are non-porous & of any dimension
- Detects cracks, seams, lack of bonding, etc.

LIMITATIONS

- Detect surface flaws
- Non-porous surface for material
- Surface cleaning before & after inspection
- Deformed surfaces & surface coatings prevent detection

Typical applications of Liquid penetrant Inspection

1. ***Aerospace*** :Typical Components that are checked by this method include Turbine, rotor disc, blades, aircraft wheels, Casting, forged parts and welded assemblies

2. ***Automobiles:*** Many automotive parts particularly aluminium castings and forging including pistons and cylinder heads are subjected to this form of quality checks before assembly

3. ***Railways***: LPI to detect fatigue cracking is also used for the regular in service examination of the bogie frames of railway locomotive and the rolling stock

4. ***Tool and die***s***:*** field drilling rays, drill pipes, castings and drilling equipment's inspected by this methods

5.***Inspection on reactors and tank***: Tanks, vessels, reactors, piping, dyers in the chemical, petro-chemical industries.