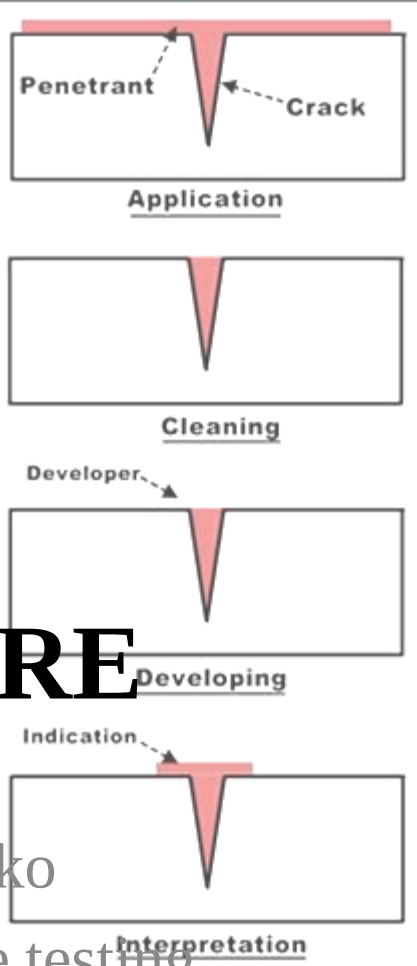

PART 5
PENETRANT PROCEDURE

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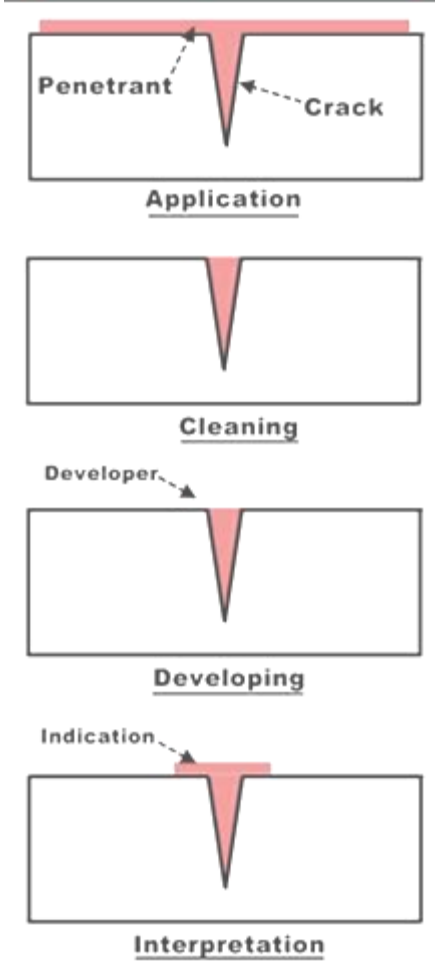
Content:

1.Abstract

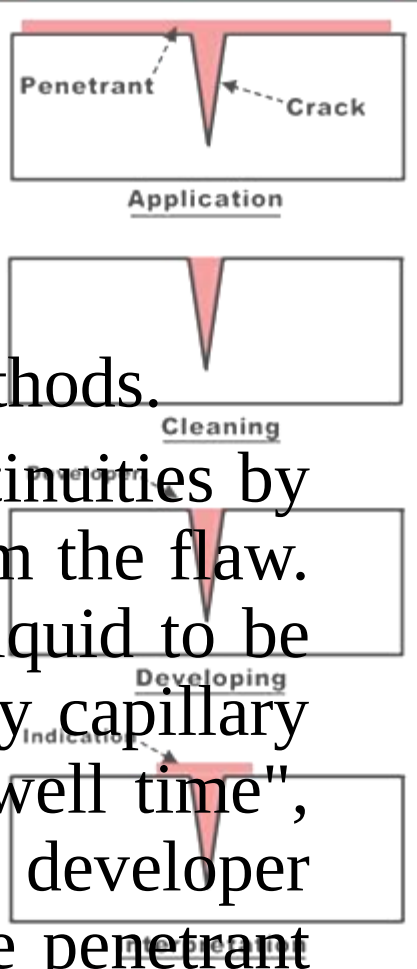
2. Steps of PT

3. Health and Safety

4. Advantages and Limitation

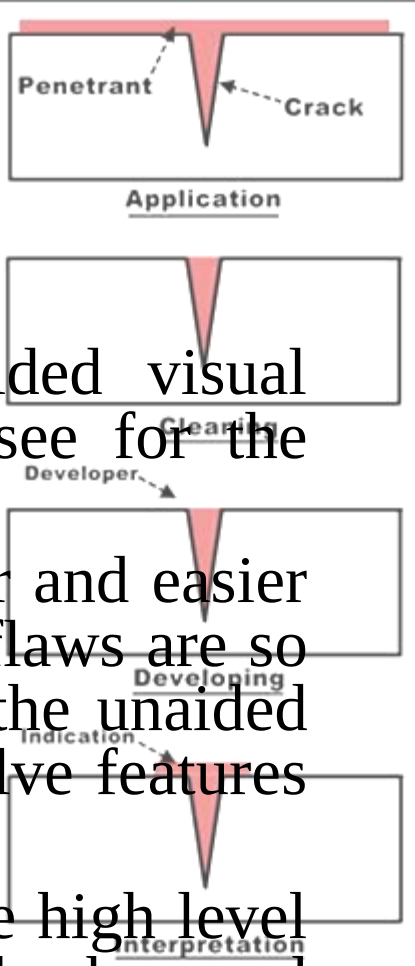


Abstract:



- PT is one of the oldest and simplest NDT methods.
- This method is used to reveal surface discontinuities by bleedout of a colored or fluorescent dye from the flaw. The technique is based on the ability of a liquid to be drawn into a "clean" surface discontinuity by capillary action. After a period of time called the "dwell time", excess surface penetrant is removed and a developer applied. This acts as a blotter that draws the penetrant from the discontinuity to reveal its presence.

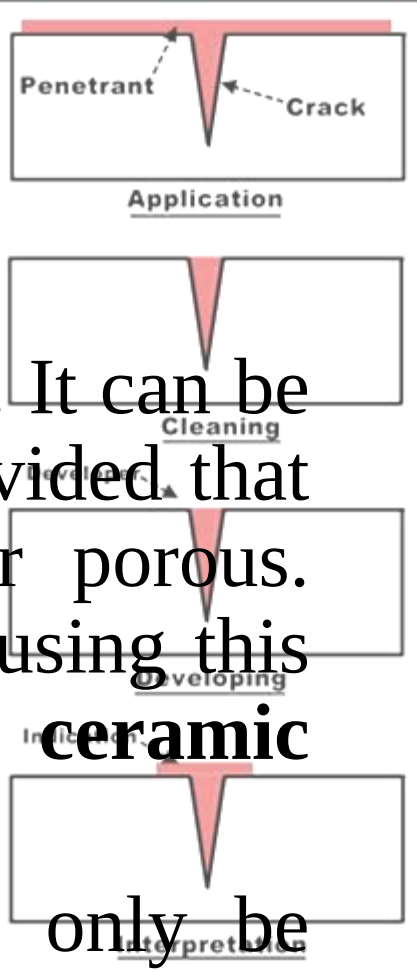
Abstract:



The advantage that a PT offers over an unaided visual inspection is that it makes defects easier to see for the inspector where that is done in two ways:

- It produces a flaw indication that is much larger and easier for the eye to detect than the flaw itself. Many flaws are so small or narrow that they are undetectable by the unaided eye (a person with a perfect vision can not resolve features smaller than 0.08 mm).
- It improves the detectability of a flaw due to the high level of contrast between the indication and the background which helps to make the indication more easily seen (such as a red indication on a white background for visible penetrant or a penetrant that glows under ultraviolet light for fluorescent penetrant).

Abstract:

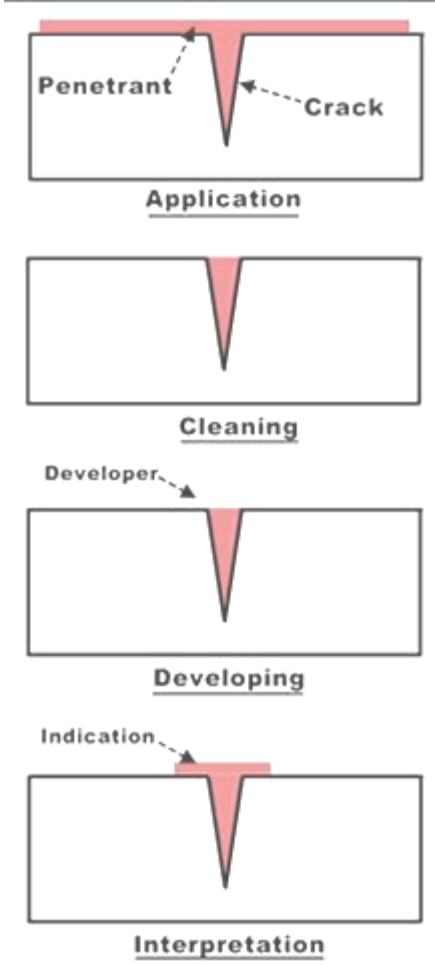


Its relative ease of use and its flexibility. It can be used to inspect almost any material provided that its surface is not extremely rough or porous. Materials that are commonly inspected using this method include; **metals, glass, many ceramic materials, rubber and plastics.**

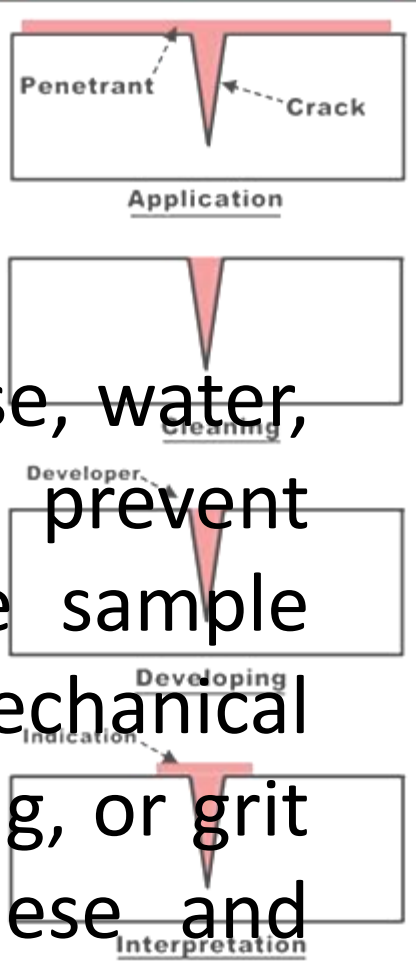
However, liquid penetrant testing can only be used to inspect for flaws that break the surface of the sample (such as surface cracks, porosity, laps, seams, lack of fusion, etc.).

Steps of PT:

1. Surface preparation
2. Penetrant application
3. Penetrant dwell time
4. Excess penetrant removal
5. Developer application
6. Indication development
7. Inspection
8. Clean surface



Surface preparation:



The surface must be free of oil, grease, water, or other contaminants that may prevent penetrant from entering flaws. The sample may also require etching if mechanical operations such as machining, sanding, or grit blasting have been performed. These and other mechanical operations can smear metal over the flaw opening and prevent the penetrant from entering.

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

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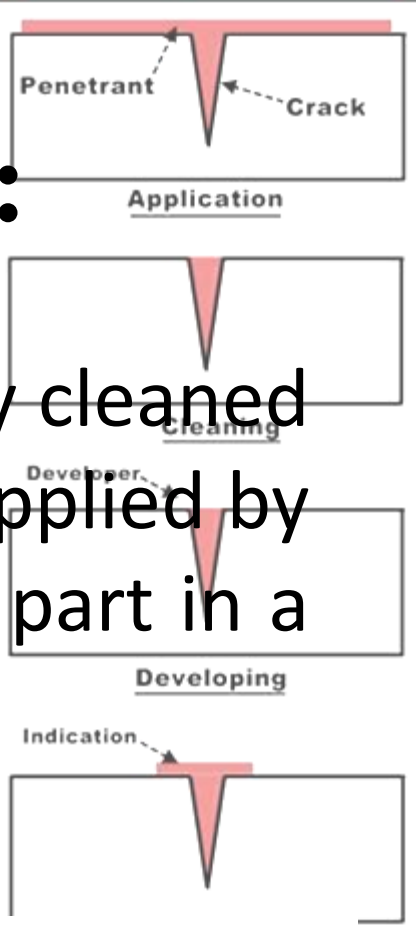
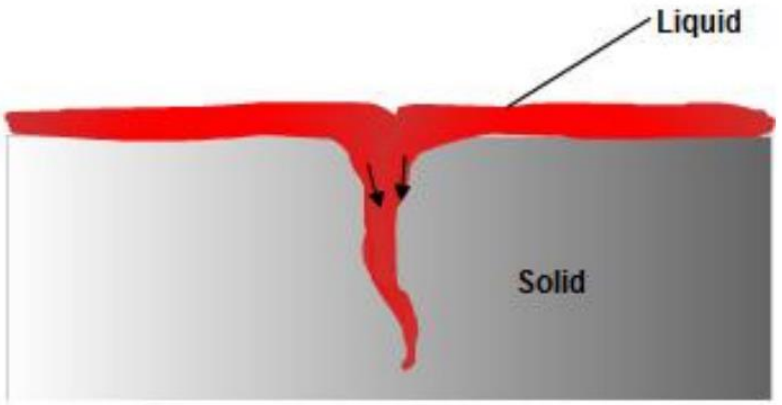
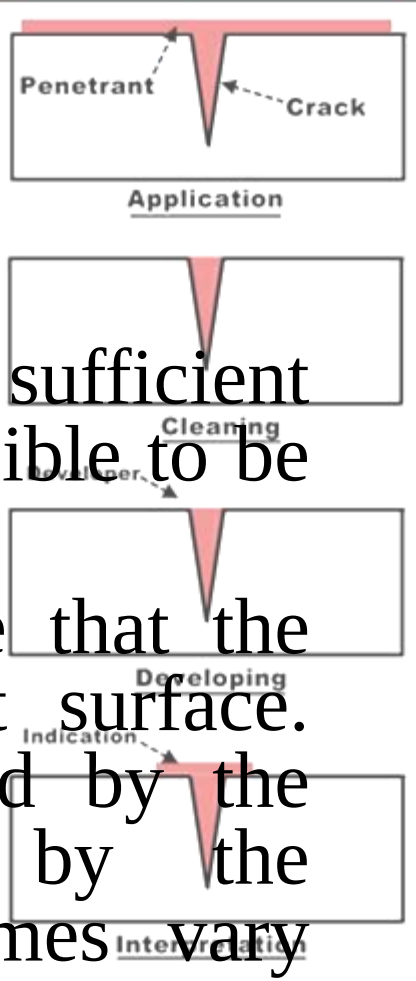




Penetrant dwell time:

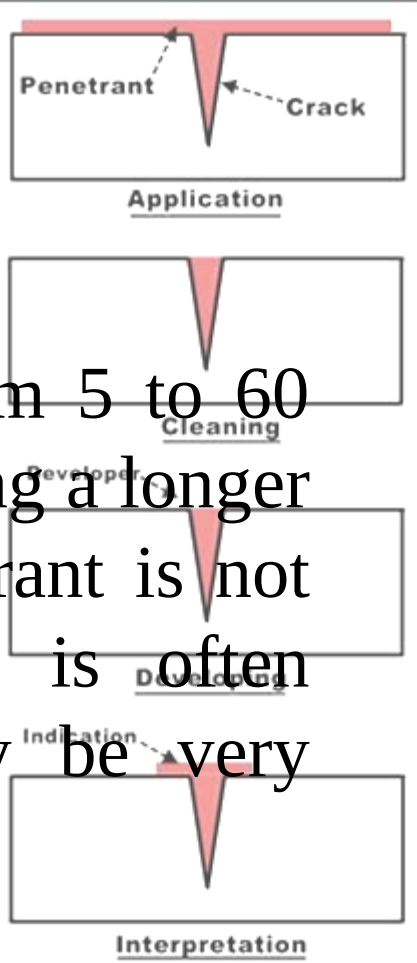


The penetrant is left on the surface for a sufficient time to allow as much penetrant as possible to be drawn or to seep into a defect.

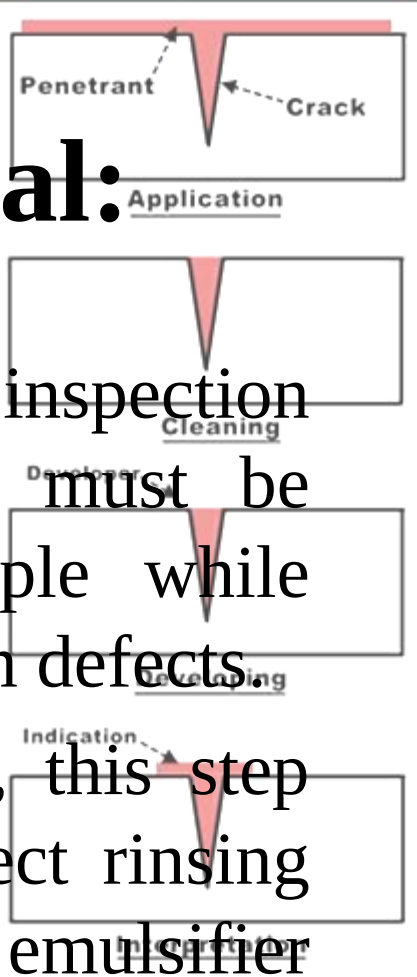
Penetrant dwell time is the total time that the penetrant is in contact with the part surface. Dwell times are usually recommended by the penetrant producers or required by the specification being followed. The times vary depending on the application, penetrant materials used, the material, the form of the material being inspected, and the type of discontinuity being inspected for.

Penetrant dwell time:

Minimum dwell times typically range from 5 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.

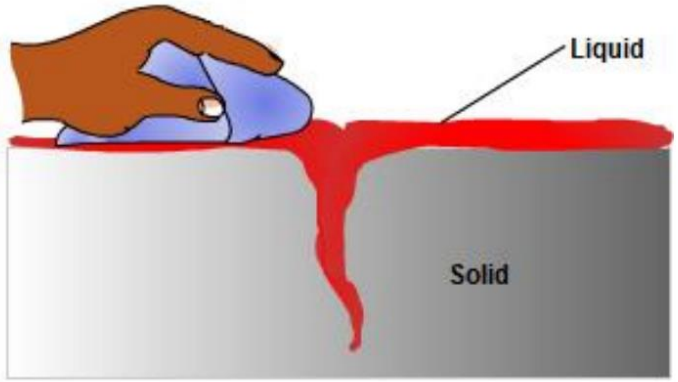


Excess penetrant removal:



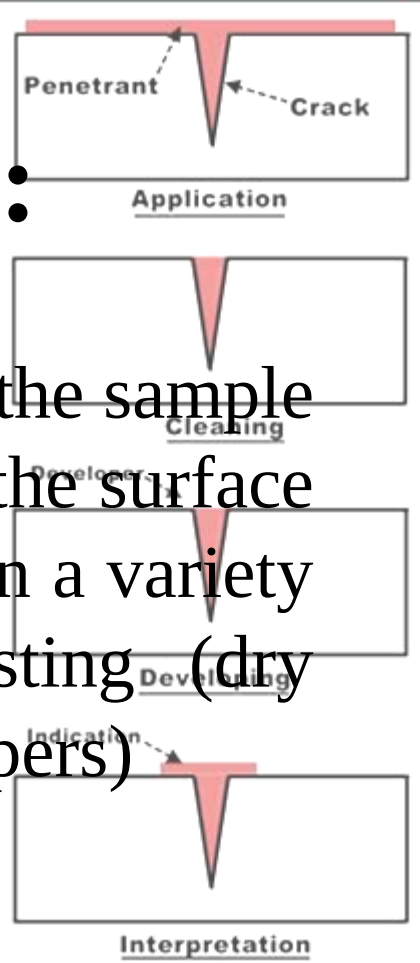
This is the most delicate step of the inspection procedure because the excess penetrant must be removed from the surface of the sample while removing as little penetrant as possible from defects.

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.



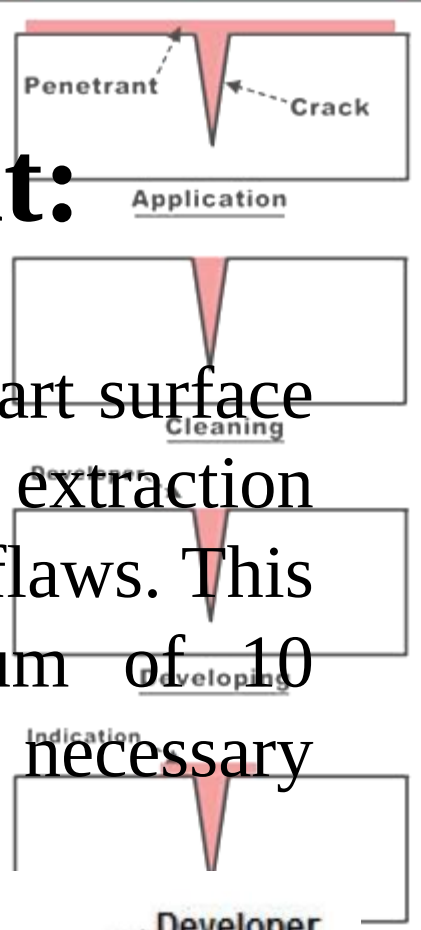
Developer application:

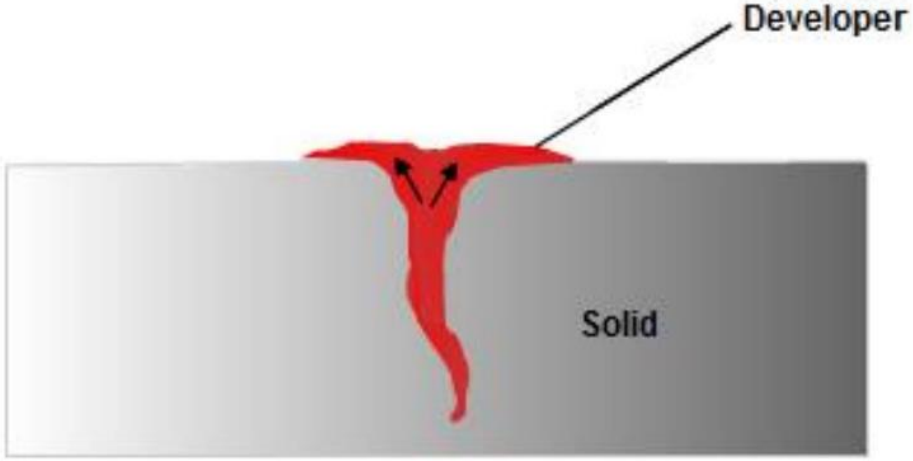
A thin layer of developer is then applied to the sample to draw penetrant trapped in flaws back to the surface where it will be visible. Developers come in a variety of forms that may be applied by dusting (dry powders), dipping, or spraying (wet developers)



Indication development:

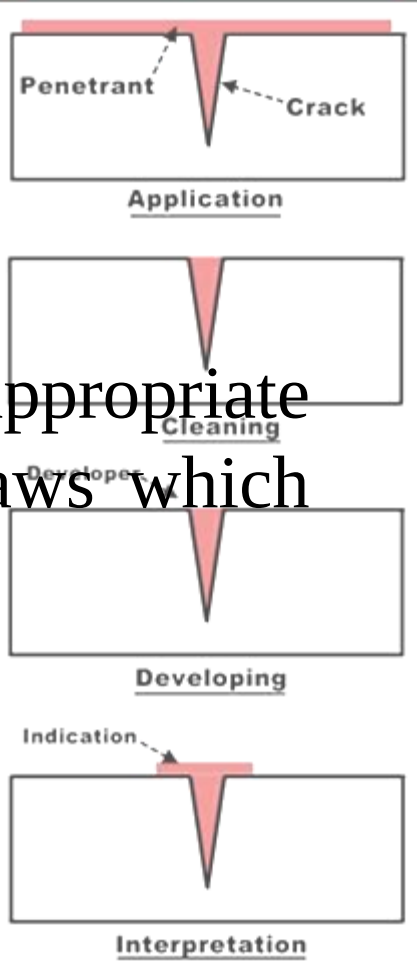
The developer is allowed to stand on the part surface for a period of time sufficient to permit the extraction of the trapped penetrant out of any surface flaws. This development time is usually a minimum of 10 minutes. Significantly longer times may be necessary for tight cracks.





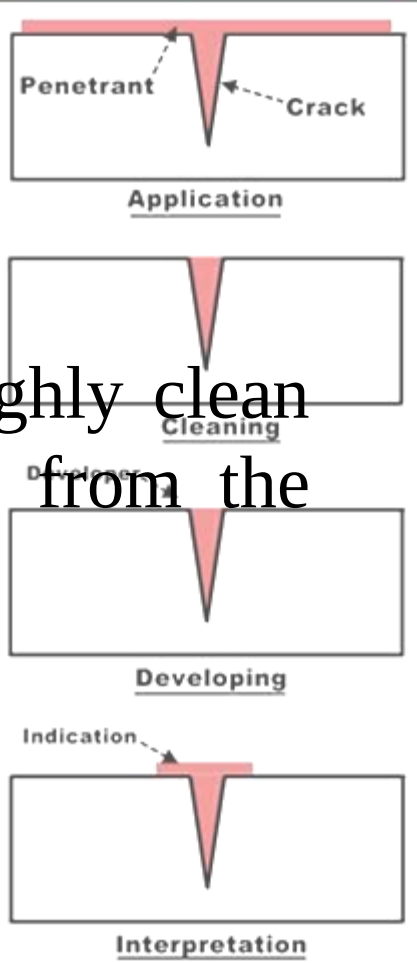
Inspection:

Inspection is then performed under appropriate lighting to detect indications from any flaws which may be present.



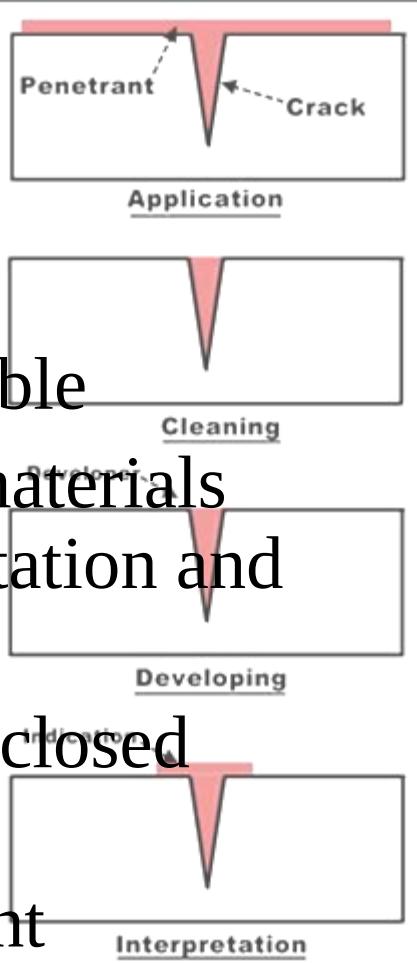
Clean surface:

The final step in the process is to thoroughly clean the part surface to remove the developer from the parts that were found to be acceptable.



Health and safety:

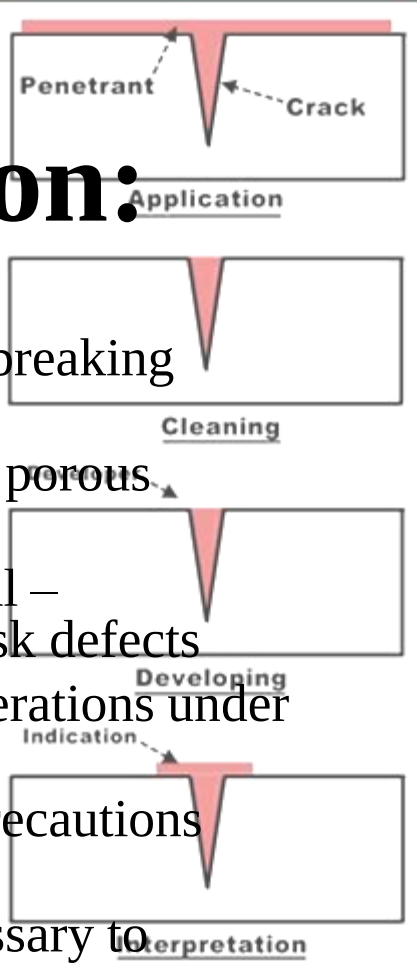
- Fire – many penetrant materials are flammable
- Skin and eye protection – many penetrant materials contain chemicals which can cause skin irritation and dermatitis
- Solvent vapour inhalation – be careful in enclosed areas
- Blacklight safety – protect eyes from uv light

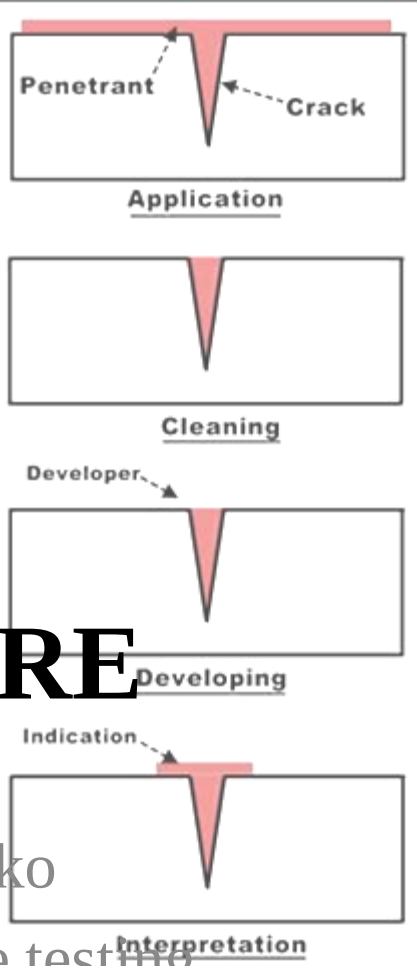


Advantages and limitation:

- Relative ease of use
- Can be used on a wide range of materials
- Works on parts with complex shapes
- Indications produced directly on the surface giving a visual image of the defect
- Aerosol can systems are cheap and portable
- Works on non magnetic materials

- Only detects surface breaking defects
- Requires smooth non porous surface
- Pre-cleaning is critical – contaminants can mask defects
- Requires multiple operations under controlled conditions
- Chemical handling precautions necessary
- Post cleaning is necessary to remove chemicals
- Much slower than MPI





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