NON-DESTRUCTIVE TESTS

Non-destructive testing is used as part of a manufacturing or installation inspection to check if quality demands are being met. As an example, welded steel joints are x-rayed to check the quality of the welding. The radiographic test reveals if the joint is fully welded or contains unacceptable faults.

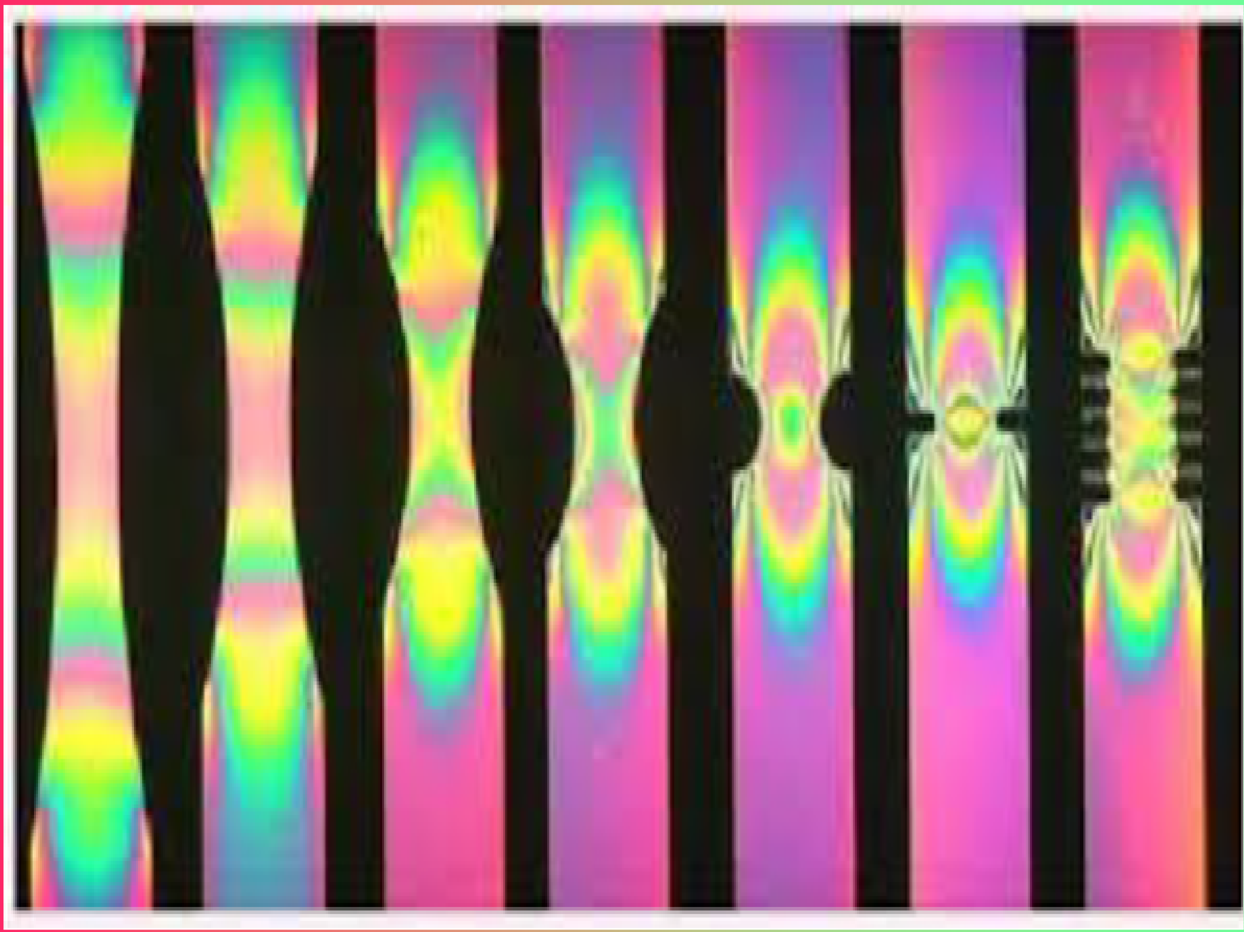
Benefits of using NDT

- High quality
- Verifies requirements
- Prevents failure or break down of critical equipment

POLARISCOPE TEST

It is a nondestructive test used to determine stress concentration in transparent materials by studying fringe pattern.

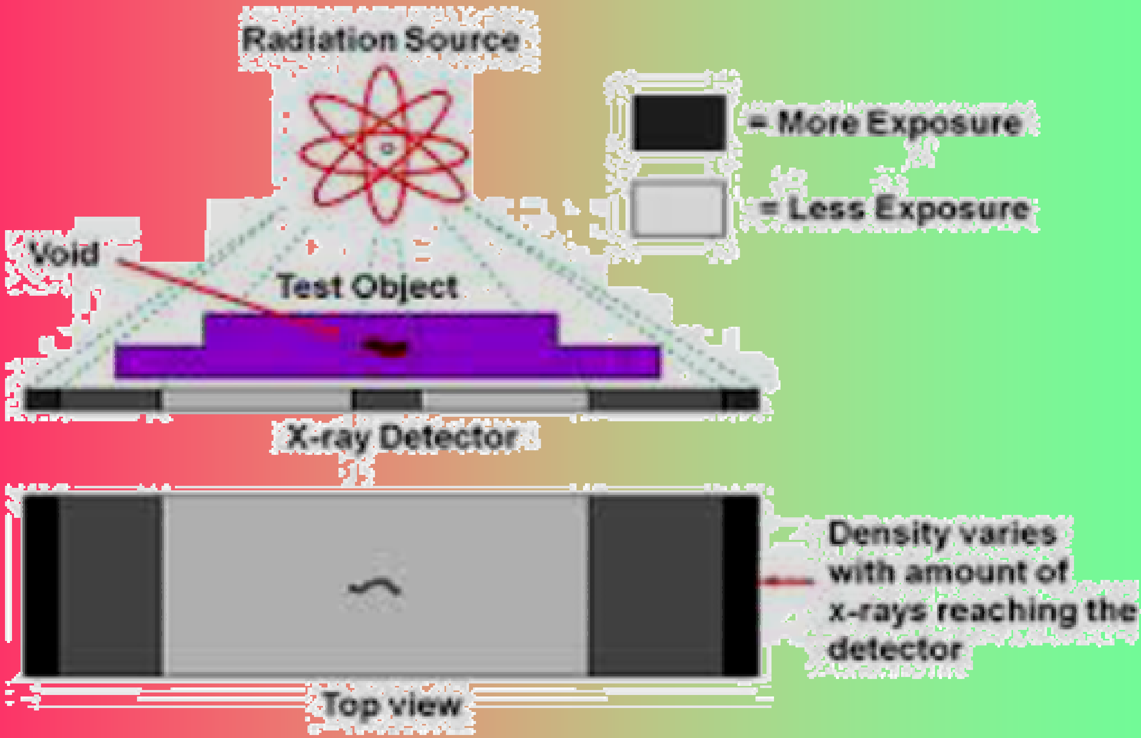
The method is based on the property of birefringence exhibited by certain transparent materials. Birefringence is a property where a ray of light passing through a birefringent material experiences two refractive indices. The property of birefringence (or double refraction) is observed in many optical crystals. Upon the application of stresses, photo elastic materials exhibit the property of birefringence, and the magnitude of the refractive indices at each point in the material is directly related to the state of stresses at that point. Information such as maximum shear stress and its orientation are available by analyzing the birefringence with an instrument called polariscope. When a ray of light passes through a photo elastic material, its electromagnetic wave components gets resolved along the two principal stress directions and each of these components experiences different refractive indices due to the birefringence. The difference in the refractive indices leads to a relative phase retardation between the two components



RADIOGRAPHY (X-RAY TEST)

X Rays can be used for detection of internal flaws and faults in most engineering materials. X ray testing is expensive due to the costly equipment, film and processing required. There is also the need for the implementation of specialized safety equipment and procedures. X ray or Gamma radiation is passed through the test specimen and then recorded upon a photo-sensitive film. The flaws or defects are indicated as dark areas on the film because faults absorb less radiation than the material itself. Complex shapes require examination from two different angles.

- Due to its expense X ray detection is generally used during product development, or in laboratory testing.
- Gamma radiation is suited to field or on site applications as less complex equipment is used.



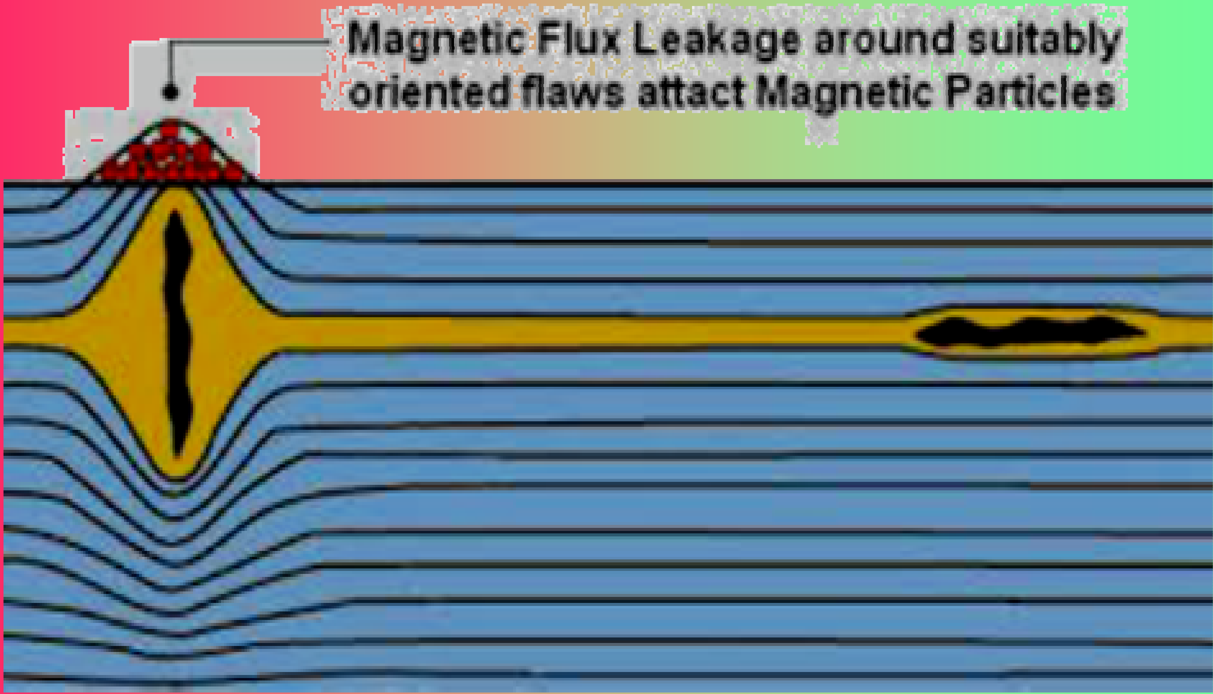
Radiation Source
= More Exposure
= Less Exposure
Void
Test Object
X-ray Detector
Density varies with amount of x-rays reaching the detector
Top view

MAGNETIC PARTICLE INSPECTION TEST

Magnetic particle tests are suitable only for ferrous metals capable of being magnetized. Almost any size or shaped component can be tested. The test specimen is first thoroughly cleaned and dried before the test. When magnetized ferromagnetic specimens have a distorted magnetic field in the region of the fault or defect. This distortion can be seen with the application of magnetic particles as a powder or suspended in a liquid. These particles are often coated in a fluorescent material enabling inspection under ultraviolet light. The flaw can be seen as a disturbance in the flow lines.

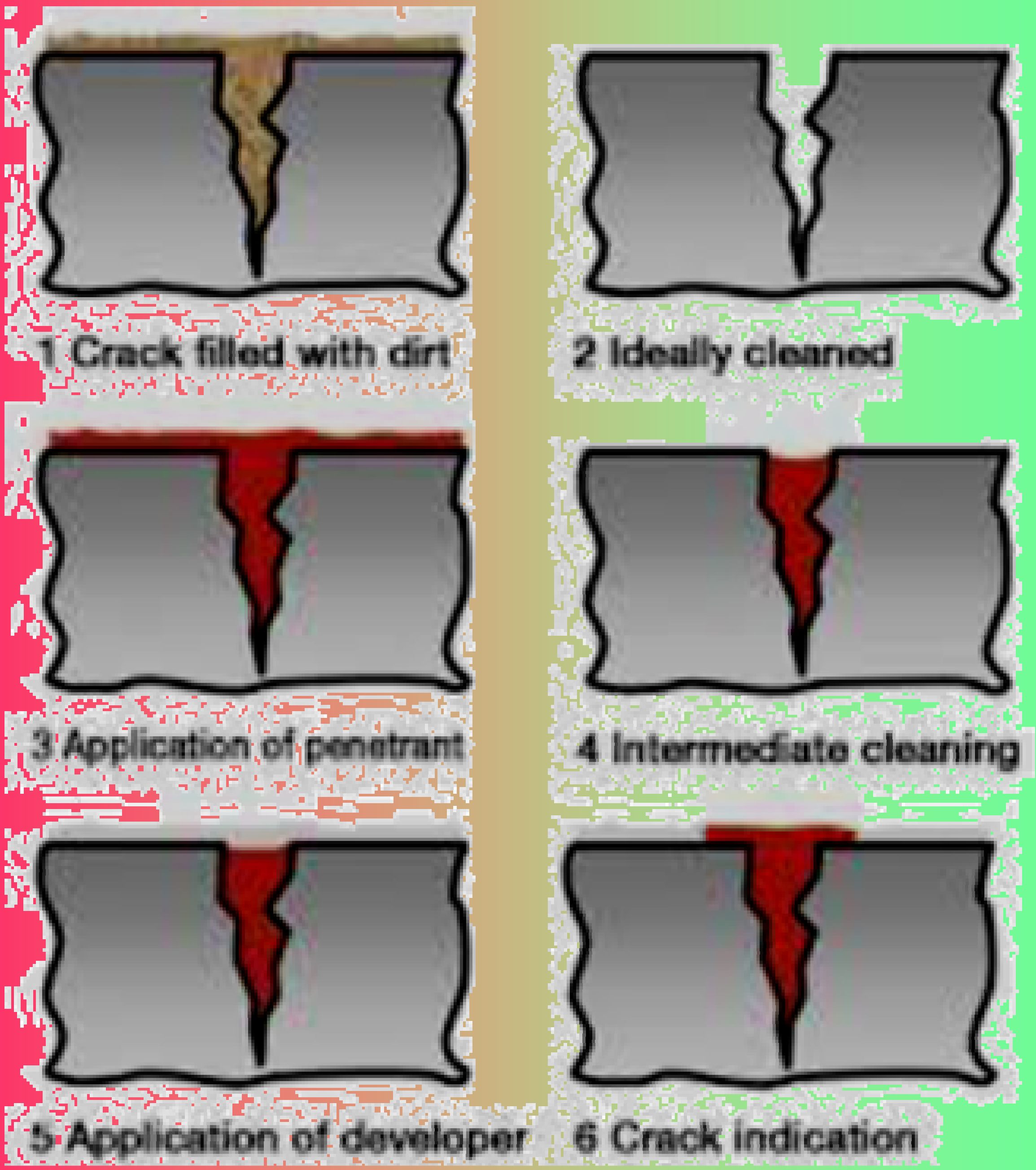
Faults perpendicular to induced field are easily detected, whereas faults parallel to the induced field may be misinterpreted. To avoid this, inspections and magnetization, should be carried out from different orientations. If a permanent record is required a photograph, videotape or inspectors report may be kept.

Specialized techniques of recording the defect patterns are also available.


Magnetic Flux Leakage around suitably
oriented flaws attact Magnetic Particles

DYE PENETRANT TEST

The test specimen is first thoroughly cleaned and dried before the test. A liquid penetrant is applied to the surface; spraying, dipping or brushing may do this. Over a period of time the liquid penetrant is drawn into any surface faults by capillary action, any excess liquid is removed. Depending on the process being used, the surface is coated with whiting or a developer. Faults open to the surface will appear as a discoloured line in the whiting. Fluorescent or coloured dyes drawn into the faults are readily seen under ultraviolet light or as a line in the developer. Liquid penetrant tests are simple, versatile, portable and inexpensive. The results are easy to interpret but only surface faults can be detected. If a permanent record is required a photograph or videotape or inspectors report may be kept. The use of laser scanners and digital control allows this process to be used as a mass production technique.

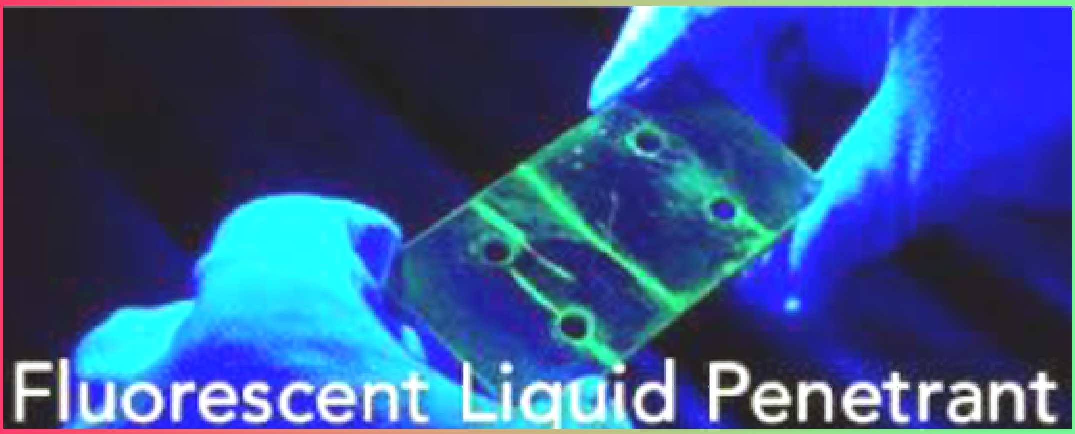

1 Crack filled with dirt
2 Ideally cleaned
3 Application of penetrant
4 Intermediate cleaning
5 Application of developer
6 Crack indication

FLUORESCENT TEST

FLUORESCENT PENETRANT INSPECTION (**FPI**) is a nondestructive testing method for detecting discontinuities (cracks, seams, laps, cold shuts, laminations, and porosity) that are open to the surface. It is a type of dye penetrant inspection in which a fluorescent dye is applied to the surface of a non-porous material in order to detect defects that may compromise the integrity or quality of the part in question. Noted for its low cost and simple process, FPI is used widely in a variety of industries.

Inspection Steps: The following are the main steps in a Fluorescent Penetrant Inspection Process:

1. Initial Cleaning:
2. Penetrant Application:
3. Excess Penetrant Removal:
4. Developer Application:
5. Inspection:
6. Final Cleaning



Advantages:

- Highly sensitive fluorescent penetrant is ideal for even the smallest imperfections
- Low cost and potentially high volume
- Suitable for inspection of non-magnetic materials and electrical insulators.

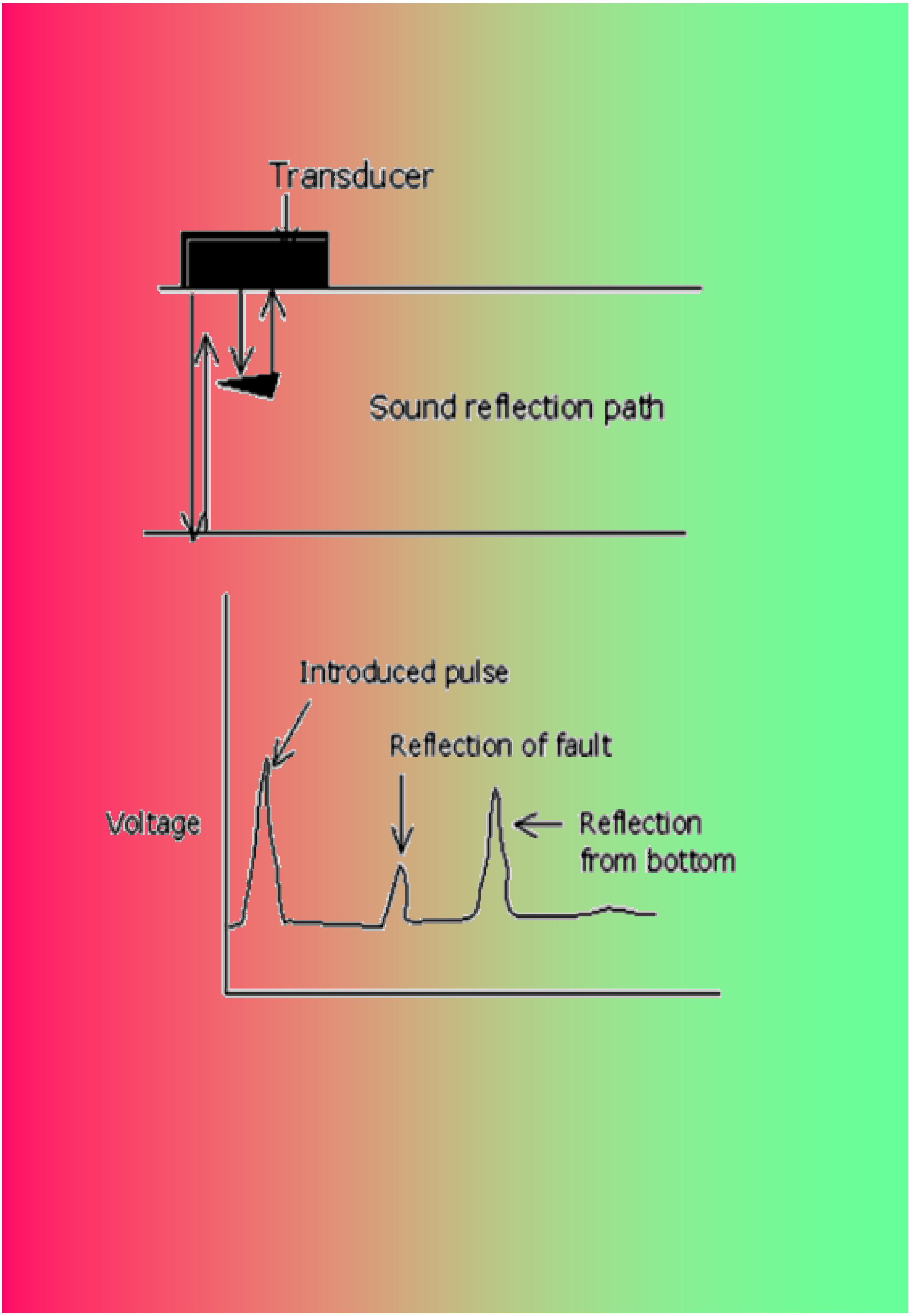
Potential Disadvantages:

- The method requires thorough cleaning of the inspected items. Inadequate cleaning may prevent detection of discontinuities.
- Test materials can be damaged if compatibility is not ensured. The operator or his/her supervisor should verify compatibility on the tested material, especially when considering the testing of plastic components and ceramics. The method is unsuitable for testing porous ceramics.
- Penetrant stains clothes and skin and must be treated with care
- The method is limited to surface defects.
- Training is required for the inspector.

ULTRASONIC TEST

Ultrasonic testing offers immediate results and a high degree of accuracy for cracks and internal faults such as gas porosity. The test is suitable for metals, plastics, glass, concrete and ceramics. Components that are thin, small, have complex shapes or have rough surfaces are difficult to test. Ultrasonic testing involves sending high frequency vibrations (100 kHz to 200 kHz) through a material and sensing their reflections. The high frequency vibrations are produced by a transducer, which uses a piezoelectric crystal to convert electrical oscillations into mechanical vibrations. The transducer is placed on the surface of the material to be tested. Vibrations penetrate the material and are refracted and reflected at discontinuities within the material. Another transducer picks up the reflected signal which is displayed on an oscilloscope. The resulting reflection indicates the internal integrity of the test specimen. Flaws are shown as a peak, the size of the peak indicates the size of the fault.

Ultrasonic signals can be recorded if a permanent record is needed. Ultrasonic testing is also used in high-speed automated productions e.g., railway tracks.


Transducer
Sound reflection path
Introduced pulse
Reflection of fault
Voltage
Reflection
from bottom