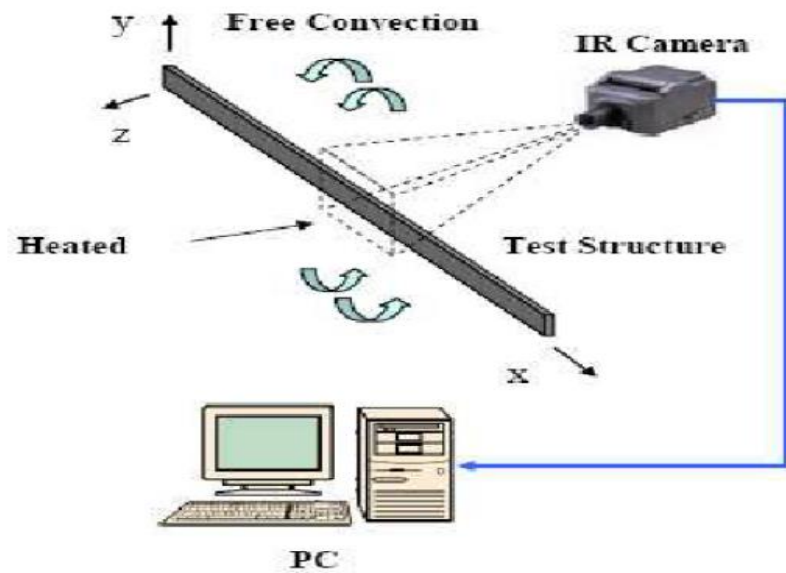


3.5 THERMOGRAPHY TEST



- ❖ Infrared testing or thermography uses sensors to determine the wavelength of infrared light emitted from the surface of an object, which can be used to assess its condition.
- ❖ A thermographer views an object with a thermal imager to measure the infrared emitted from the surface. However, to confuse matters, the sources behind the imager can reflect from the surface making the objects appear hotter than they really are. Even the heat from the body of the thermographer can cause this effect on objects at ambient temperature.

1. PRINCIPLE

- ❖ The usual method is to use a specially television camera with an infrared sensitive detector and a lens which transmits infrared radiation. Such cameras can operate at normal video rates.

2. TYPES OF THERMOGRAPHY

- ❖ **Passive thermography** uses sensors to measure the wavelength of the emitted radiation and if the emissivity is known or can be estimated, the temperature can be calculated and displayed as a digital reading or as a false Colour image.

- ❖ **Active thermography** induces a temperature gradient through a structure. Features within it that affect the heat flow result in surface temperature variations that can be analyzed to determine the condition of a component. Often used to detect near surface delamination or bonding defects in composites.
- ❖ **The external excitations/optical excitations** or may be the external energy says so generally this energy is delivered to the surface and then propagated through the material until it encounters flaw example photographic classes for heat pulsed simulations, halogen lamps for periodic heating.
- ❖ **Internal excitations/mechanical excitations** so generally the energy is injected into the specimen in order to stimulate exclusively the defects.

1. BASIC AIDS OR COMPONENTS IN THERMOGRAPHY

- ❖ **Thermographic camera** so it is also known as infrared camera or may the thermal imaging camera. It is a device that forms a heat zone using infrared radiation it operates in wavelengths as long as 14 nanometer.
- ❖ There are two basic types of thermographic camera. One is called cooled infrared detectors another one is called the uncooled infrared detectors.
- ❖ **Control unit** is which sets the level of adjustment for halogen lamp heater.
- ❖ **Pe/image processing unit** which displays the defect unit after deep process of unit.

2. WORKING OF VARIOUS THERMOGRAPHY TESTING METHODS

(a) Lock in vibrothermography method

- ❖ A very short pulse- usually in the units of milliseconds - is used to excite the object.

- ❖ A ultrasonic transducer is typically used as an excitation source.
- ❖ The advantage of this method is the speed of the analysis and a possibility to estimate the defects depth.
- ❖ The disadvantage is a limited to of detection capabilities based on geometrical orientation of defects.

(b) Lock In Thermography Method

- ❖ Lock-In thermography is a periodic excitation method). When the input energy (Halogen lamps) wave penetrates the object's surface, it absorbed.
- ❖ The reflected portion of the wave causing an interference pattern in the local surface temperature.

(c) Pulsed thermography method

- ❖ Pulsed thermography is classical optical excitation thermography technique. In pulsed thermography, high-energy lamps are often used to produce a uniform heating source on the specimen surface.
- ❖ The heat transmits through the inspected specimen to the subsurface defects or damages, and then returns to the specimen surface.
- ❖ A uniform temperature rise will be recorded if there are no defects in the specimen. If there are defects such as voids or delamination, a localized high temperature zone will be observed above the defect due to the insulation effect.

3. ADVANTAGES

- ❖ Data collection system can record temperature changes with time
- ❖ High-speed, portable, and non-contact
- ❖ Ability to inspect large areas
- ❖ Effective prevention of test scrap
- ❖ Contactless testing with low thermal stress
- ❖ Simple analysis of large, uneven surfaces
- ❖ Categorization of different types of defects

4. DISADVANTAGES

- ❖ Risk of damage the sample(e.g., overheating)
- ❖ Limitations of inspected thickness
- ❖ Variable emissivity of materials
- ❖ Dependence from thermal contrast
- ❖ Expensive instrumentation require qualified personnel accuracy

7. APPLICATIONS

- ❖ Used largely in Aerospace industry Automotive industry and Power industry.
- ❖ Quality assurance for bonded, welded, soldered and other joints by means of cavity detections (e.g. on vehicle interior parts).
- ❖ Localization of defects in joints such as cavities, defective welding seams/points.
- ❖ Testing of metallic and non-metallic materials/material compounds.
- ❖ Tests of internal structures, such as fractures or impacts in honeycomb lightweight constructions.