

Course Name: Theory of Fire Propagation (Fire Dynamics)

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Week – 12

Lecture – 03

Module 9 – Fire safety aspects

Fire detectors:

Fire can be detected by sensing the presence of smoke, heat, flames and product gases.

Heat detectors – These are often used in smaller compartments where fire can grow at a faster rate. The response time for heat detectors is comparatively higher. Heat detectors work on various mechanisms. Primarily, a part of it or a working substance present in the heat detector responds to the incident heat flux. In a bimetallic-type heat detector, two metals having quite different coefficients of thermal expansion are used. The relatively larger expansion undergone by one of the metals causes a deflection in the mechanism. A heat detector with a fusible element uses an eutectic alloy that melts rapidly when heated to a given temperature.

Smoke detectors – In ionization smoke detectors, a special radioactive material is used to ionize the air flowing through the detector. Ionization is affected by the presence of smoke. When pure air is ionized, a certain quantity of current flows through the detector. This amount decreases when smoke enters the detector. When a certain concentration of smoke enters the ionization detector, the detector triggers an alarm. In a photoelectric smoke detector,

a light source and receiver are used. The light source is directed towards the receiver. In pure air medium, a certain intensity of light is received. When smoke is present in the line of sight, the intensity of light received by the receiver reduces. This is called the light obscuration principle. When the receiver receives light below a certain intensity, the alarm is triggered.

In another type of photoelectric smoke detector, the light source and receiver are not kept aligned as in the light obscuration principle. Light enters the receiver when smoke particles scatter it. When the receiver receives a certain amount of light, the alarm is triggered. Photoelectric detectors are more suitable for grey smoke, and ionization detectors are more suitable for dark smoke. In places with high humidity, photoelectric detectors are suitable.

Other special types of smoke detectors are projected beam detectors (work on the light obscuration principle) and cloud chamber detectors. The location, capacity, and installation of these detectors are carefully done as per standards.

Flame detectors – These detectors detect the ultraviolet (UV) and/or infrared (IR) emissions from fire. These have fast response and are usually used in industries and fuel handling facilities where the fire hazard is high. Both UV and IR detectors should be positioned so as to view the flame. Therefore, these are kept focussed towards the hazardous areas. IR detectors should not be allowed to see sunlight.

Gas detectors – These detectors detect carbon monoxide (CO) and carbon dioxide (CO₂). CO detectors are commonly used in residential apartments nowadays. Apart from these, a pressure detector that detects excess pressure is also used.