

ALARMS AND DETECTORS:

Alarms and detectors are fitted in accommodation and machinery space to give early warning. This is one method of structural fire protection in ships.

VARIOUS TYPES OF DETECTORS:

1. **Heat detectors** which operate at a pre determined temperature.
2. Heat detectors which operate on the rate of rise of emperature.
3. **Smoke detectors** of light obscure type.
4. Smoke detectors of light scatter type.
5. **Combustion products detector**
6. **Flame detectors.**
7. Water sprinkler system.
8. Smoke sampling system.
9. Fire patrol.

FIRE ALARM PANEL:

This consists of an alarm panel, situated outside the machinery space which indicates the zone of fire. The alarm panel is shown in the fig.

When the contacts in a detector head close (open under normal conditions) they short the circuit and cause the operation of the audible alarm. The lines in the circuits are continuously monitored through 1 to 2 and 3 to 4 and hence any fault such as damaged insulation, break in cable etc which develops causes the system failure alarm to sound.

In the event of main power failure automatic auxiliary power is supplied from the fully charged standby batteries for up to 6hrs.

Most systems operate on 24V d c and for those operating at 220 V a c, an inverter is to be installed for converting the 24 V d c in to 220 V a c.

The fire alarm is usually an intermittent audible signal where as fault and manual test are normally a continuous audible signal.

FIRE DETECTOR HEADS.

Various types of fire detector heads are available for fitting the detectors on board. However standard bases are fitted to economise and to make it simple.

HEAT DETECTOR:

Fixed temperature type-BS3116:1970 part-I of Automatic fire alarm system in buildings.

-it is either a bimetallic strip or a soldered joint.

A bimetallic type detector is shown in the fig.

In this type of detectors the strip is used to make or break contact at a predetermined temperature. Two bimetallic coils attached to a vertical support

bracket are encased in a protective metal cap. When the temperature increases, A, will move to close the gap C at a faster rate than B being better insulated from heat than A. When the preset temperature is reached, gap C will close causing the alarm.

This type of detectors are used in **boiler rooms** due to rapid variation in temperature that may occur.

Quartzoid bulbs fitted in water sprinkler system are of fixed temperature type detectors. They are used for spaces other than engine and boiler room.

Soldered Joint type:

In this type two electric contacts are joined together through a light spring by low melting point solder,

When the solder melts at a predetermined temperature, the alarm is activated.

This type of detectors are not generally used on the ship due to practical difficulties of routing and testing and rusting of solder.

HEAT DETECTOR--RATE OF RISE OF TEMPERATURE TYPE:

BS 3116:part-I -1970.

They work on the rate of rise of temperature of the surrounding. The detector will operate between given time limits, the latter depending on the rate of increase of temperature.

RASPNSE TIME-

The detector should have response time to act. It depends on the height at which they are fitted. As the height is more the response time should be shorter especially in unattended machinery spaces.

The detector should also act at a particular temperature even if the rate of rise is small.

A graph showing response time Vs rate of rise of temperature is shown .

The detector must operate between curve 4 & 1 or curve 2 & 3. The curves to the right of 1, 2 or 3 is not sensitive and not acceptable. Response time to the left of the curve 4 is also not acceptable as it is very sensitive.

These don't operate when the rate of rise of temperature is less as in moving into tropical regions or switching on a heater. Heat detectors are certified to operate before 78 deg C and not before 54 deg C, when the temperature is raised to those limits at less than 1 deg C per minute.

At higher rate of rise of temperature the detector shall operate within limits.

Permissible limits of heat detectors may be increased to 30 deg C above maximum detector head temperature in drying rooms or similar spaces.

PNEUMATIC TYPE:

A pneumatic type heat detector is shown in the fig.

In this a sealed chamber is fitted with a bleed off orifice. Under normal circumstances the bleed off hole will be able to exhaust and inhale air such that the alarm condition is never reached.

When rapid input of heat as under fire results, the air expands faster than it can exhaust through its bleed off orifice and the resulting expansion causes the contacts close and the alarm sounds.

In any case a fixed temperature screw is fitted and by adjusting it, the temperature at which the detector should work can be fixed and the detector made to operate at that temperature.

SMOKE DETECTORS:

LIGHT SCATTER TYPE:

When a beam of light traverses a transparent medium as in air, its intensity is reduced by absorption and partly by scattering.

The latter arises due to heterogeneity of the medium, due to suspended particles such as smoke, dust or liquid particles.

The light scattering property is called Tyndall effect.

A smoke detector of light scatter type is shown in the fig.

The light is prevented from illuminating the photo electric cell by a light barrier. The surrounding atmosphere circulates through the detector head by virtue of normal air current and providing no dust or smoke particles present in it.

Thus the electrical balance of the circuit remains undisturbed.

On smoke entering the detector, however the light rays reflected or scattered around the light barrier and reach the photoelectric cell. The change in the current due to increase in the quantity of light falling on the photo electric cell thus altering the balance of the electric circuit and the unbalance is used to raise the alarm.

Smoke may be present without much heat or flame. Hence this type of detectors could give early warning of fire.

TESTING—is done with smoke from a cigarette or smoking cotton.

These detectors are used in the detecting cabinet of CO₂ flooding system of cargo holds.

LIGHT OBSCURING TYPE:

This type of detector is shown in the fig.

In this type a parallel beam of light is caused to pass through an inwardly facing photoelectric cell .

The inside of the chamber is made black and the cells are to receive only a small amount of stray light.

The light also falls on an end cell obliquely fitted and so angled that the balance of the circuit is obtained.

On smoke entering the chamber, the intensity of light falling on the end cell decreases and the intensity of light falling on the inwardly facing cell increased due to deflections of the light beam by smoke particles.

The imbalance in the circuit is arranged to cause an alarm sound.

DISADVANTAGES OF SMOKE DETECTORS:

- 1.Failure of lamp filament.
- 2.Gradual fall in the performance of Photo electric cell.
- 3.Susceptibility to vibration.

FLAME DETECTORS:

These are infrared or ultra -violet type. In ships it is mostly the former type used.

A typical flame detector is shown in the fig.

These respond to radial heat and light. In order to avoid false alarm by natural or artificial light, they are designed to operate to a particular spectrum of light which is characteristic to flame. Flame has a characteristic frequency of about 25hz and use is made of this fact to trigger an alarm. Flickering radiation from the flames reaches the detector lens/filter unit, which only allows infrared rays to pass and be focussed on the cell. The signal goes from the cell to a sensitive amplifier which is tuned to 25hz then into a time delay unit to trigger an alarm circuit.

Heat that emanates from hot machineries will not affect the detectors. They are designed to operate not immediately sensing the fire but only if the radiation persists for a pre-determined time.

Very early warning is possible and suitable for high fire risk areas such as machinery space. Not recommended for boiler room where naked flame torches are to be used for igniting oil. Reflected radiation from these can be a problem .

These are always used in addition to other detectors.

The detector for machinery space will should ideally consist of, Smoke or ionised type of detectors and backed by infrared type detectors and thermal detectors of rate of rise of temperature type.

Servicing is done at regular intervals due to intricate electronic devices.
TESTING-is done by a naked flame .

COMBUSTION PRODUCTS TYPE DETECTOR:

A typical detector is shown in the fig.

These types have two ionised chambers in series. One is open to the atmosphere and the other is enclosed. The atmosphere in both the chambers is ionised by a radio active source such as americium or radium. The ionisation in both the chambers emits a continuous supply of ionising particles in normal course permits a minute current to flow caused by positive and negative ions created by the radiation in opposite directions.

The supply voltage across the two chambers is therefore divided and a common connection being taken from the central point to a cold cathode tube.

When the products of combustion entering the outer chamber, the tendency for them is to collect ions by collision and as the aerosols are much larger than the ions, the latter are virtually stopped by the collision.

A reduction in ions flow results in reduction in voltage across the chamber and hence a change in the voltage at the common terminal. The change in voltage is connected to trigger the electrode of a cold cathode tube which on reaching a predetermined voltage, the tube fires and permits passage of a small current sufficient to activate an alarm relay.

The alarm will continue to sound till such time the electric power is removed . This permits the tube to return to its initial state.

The sensitivity of the detector is varied by altering the level of radiation in the chamber or by altering the voltage necessary to fire the tube.

This type of detectors depend more on the number of particles rather than the combustion products as in the case of steam present in atmosphere which may cause a false alarm.

TYPES OF DETECTORS, APPLICATION ON BOARD SHIP AND TESTING OF DETECTORS:

1. Heat detectors ---Boiler room.
(Bi metal type)

2. Quartzoid bulbs ---Accommodation.(other than machinery and boiler room)
(Sprinkler system)--- Testing is done by a sigarett lighter and increasing the temperature of the bulb.

3. Smoke detectors --- machinery space, accomodation spaces.

--Tested by sigarette smoke or by burning waste

cotton.

4.ionised type detectors –machinery space.
 --Testing is done by smoke from a smoking cotton.

5.Thermal type ---- machinery space,Boiler room
 (Rate of rise of temperature Type)

6..Flame detectors ----machinery space.
 (Infrared type detectors)
 (not suitable for boiler room as naked flame may be used.)
 -- Used as a backup detector in addition to smoke
 and other detectors in machinery space.
 ---Testing is done by naked flame.

SELETION OF DETECTORS:

Selection of detectors depend on the following factors:

- 1.Fire risk potential.
- 2.Position of the detector.
- 3.Area to be covered by the detector.
- 4.Volume and height of compartment.
- 5.Atmosphere in the compartment,like dust etc..
- 6.Type of equipment fitted in the space
- 7.Ventilation inside the space.
- 8.Temperature variation inside the compartment.

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