

Insulation, Non condensable gas

Materials that retard or prohibit the flow of sound or heat or Electricity are called insulators or insulating materials. The heat and electricity are the main sources of power in large number of important operations, so a safe handling of these sources may be impracticable without the use of insulators.

Insulation is the name given to any material that helps the transfer of heat by any one or combination of three different modes of heat transfer. If an ideal insulation existed, it would be comparatively easy to refrigerate a space and keep it refrigerated. However there is no perfect insulation material. Insulation is not a positive barrier to heat flow but serves to retard the flow of heat. In all refrigeration systems, the surrounding are at the high temperature and the heat intends to travel from the surroundings to the refrigerated space which is kept at low temperature.

The important functions of the insulating materials are as follows,

- It reduces the heat transfer
- It prevents water vapour condensation on cold surfaces.
- It adds strength to the walls and ceiling.
- It gives smooth and better surface finish.
- It can absorb vibration and sound.

The important characteristics of good thermal insulation,

- It should not be affected by moisture.
- It should be strong to prevent the heat.
- It should have low factor of heat transmissions.
- It should be used easily.

4.3.1.Properties of insulating materials

Thermal properties

Thermal conductivity is the ability of material which retards the flow of heat. It is a property of a homogeneous material which changes with the variation of density. The compressible material such as glass wool is better insulation if loosely packed. Furnace insulations must have low thermal capacity for quick response to temperature changes required. The other thermal properties are specific heat capacity, thermal diffusivity and coefficient of thermal expansion. Heat capacity is known as the product of specific heat and density. Thermal diffusivity is the ratio of thermal conductivity and heat capacity. It is a measure of the rate of progression of temperature rise in an insulating material when certain heat energy is available at one of its surface.

Mechanical properties

The mechanical properties of the insulating material depend upon the type and use of insulating material. These mechanical properties are strength of compression, tension shear and impact. Important mechanical properties required generally are high abrasion resistance and hardness, good compressive strength.

Physical properties

The physical properties of insulating material include conventional properties like density, porosity, coefficient of thermal expansion, surface tension, hygroscopicity and compactness.

It should resist the moisture and should not absorb the moisture and should not absorb the moisture from the humid space. Insulating material should odor less and should not pickup odor of other article placed in the refrigerated space. Its density should be low to reduce its weight. It should be safe to health and its vapor and loose particles should not be dangerous to the health of the people. It should be fire proof.

4.3.2.Natural insulating materials

Hair fest

The hair of the animals be cleaned, washed and then it should be compressed and mat is made. When it is used in a refrigeration system it is a very good insulator.

Cork board

Cork is the name given to light bark of an oak tree. The bark is cleaned, ground, sized and baked into moulds. During baking its natural resin comes out and acts a binding material. Then it is converted into thin sheets or slice by pressing. It possesses very useful properties such as lightness, porosity, compressibility, resistance to water, insulation against heat and electricity. It is used as a lining material for cold storage refrigerators, bottle stoppers, packing gaskets etc.,

Kopak

These are the silken fibers in the root of corba tee. The slab made by these fibers is used to insulate the domestic refrigerators. It is light in weight.

Celotex

It is made by sugar cane. When the juice is extracted out from the sugar cane then its remaining material is made to dissolve in some chemicals. Then it is used as a insulating material. It is light in weight, water proof and has no smell.

Thermocol

It is also called styropore fomable polystyrene. It consists of a small cells. There are 3 to 6 lakhs cells in a kg. They are cling with one another. It is a good insulator to prevent moisture and is light in weight.

4.4.Defrosting

Evaporators for cold storage and for low temperature applications will necessarily have to be at a temperature lower than 0°C (the freezing percentage of water) and therefore the moisture from the air will not only condense but also freezes (or frost as it is called) on the evaporator surface. Therefore for such an applications frost formation on the evaporator coil is invetible. Also it is obvious that lower the evaporator temperature greater will be the frost formation.

Effects of frost formation on Refrigeration System,

- This reduces the evaporator temperature.
- The frost on the evaporator coil acts as an insulation and retards the heat transfer.
- With decreased heat transfer, the evaporator temperature will go down, causing thicker frost and decreases in evaporator capacity.
- If the frost is allowed to accumulate more, even liquid flood back to the compressor can occur due to the substantial reduction of the evaporator capacity.

For the reasons stated above, the frost formation on evaporator coil of low temperature installation should be melted out periodically. This process of removing the frost by melting is called defrosting.

Defrosting can be accomplished by any one of the following methods,

- Spraying warm water over the frost.

- Using electrical heater embedded in the evaporator (electrical defrosting)
- Circulating hot discharge gas from the compressor (hot gas defrosting)
- Time switches are used (timer) for accomplishing automatic defrosting.

4.5. Non condensable gas

Non condensable gases like air, chlorine, oil and water vapors and combinations of oxygen, hydrogen and nitrogen, collect within the refrigerating system. Since these gases do not condense with the refrigerant instead they usually collect in the condenser or receiver. Non condensable gases vary the condensing pressure above that required for the condensing temperature. This is so because it has been preserved scientifically that if several gases exist in the same closed container; the total pressure is the sum of the individual pressure that each gas would exist if it were alone in the container. The higher pressure (due to non condensable gases) increases the work of the compressor reduces the refrigerating effect and raises the power consumption. The sources of non condensable gases from outside the systems are Improper evacuation of a new system before charging, drawing air into the crankcase of the compressor during servicing, air may enter through the shaft seal when the system is being operated under a vacuum, some air may come from outside when the compressor is stopped for repairs, air may come from inside when the refrigerant or/and oils is decomposed under the heat of compression, air may also come from inside when refrigerant used is not 100% pure, but contains some foreign matter and through leaks in the systems when operating under vacuum. Such a presence of non-condensable gas or air in the system results in - undue increase in the condensing pressure, unnecessary increase in the work done by the compressor which means that a greater horse power is required and thereby the power consumption is increased and thereby the power consumption is increased without any benefit, a promotion in the oxidation of the oil, acting as a resistance to heat transfer, which makes a decrease in refrigeration capacity and gas also acts as an insulation. Therefore, to remove the noncondensable gas or air) gas purgers are used.