SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution)
Coimbatore – 641035.

UNIT- 4

CONSTRUCTION OF COLD STORAGE, INSULATING MATERIALS AND VAPOUR BARRIERS

32.1 Introduction

Cold storage is a basic requirement for the storage of perishable dairy and food products. For example milk is stored at around 4 °C in cold storage while ice cream is stored at -30 ºC. The design of cold storage requires information on the following aspects.

(i) Size of the cold storage

(ii) Products to be stored

(iii) Incoming temperature of the product

(iv) Storage temperature

(v) Ambient temperature

(vi) Air change load

(vii) Numbers of persons working in the cold storage.

32.2 Location of Cold Storage

The location of cold storage is important in terms of ease of product movement as well as operating and construction cost of the cold storage. The cold storage room preferably is located on the cold side of the plant. In case of more cold storages, all the cold storages should be located side by side to reduce the cost of insulation in common wall of adjacent cold stores. It should be located in such a way that finished product can be transferred to the cold stores easily and finished products can be dispatched conveniently. In cash of milk cold storage, conveyers are used to transfer the milk crates directly from packaging machine.

32.3 Size of the Cold Store

The size of the cold storage is estimated based on the capacity requirement for the storage of product. The method of storage, working space, air circulations etc. are considered to decide the dimensions of the cold storage. Considering number of milk pouch crates which can be stacked, working space etc; the capacity of storage per m^2 area of the cold room is worked out. Similarly for potato, apples, butter etc., the dimensions of the cold storage can be calculated e.g. 600 kg butter/m^2 area, 500 lit ice-cream/m^2 etc. Storage period is one of the basic requirements to decide the size of cold storage to store the product. The capacity and number of of cold storages required for storage of cheddar cheese will be more as the cheese is stored in the cold storage for 4-5 months for ripening. This may not be the requirement for milk cold storage as it is dispatched twice a day. In addition to exact space required for storage of product, 30 to40 % space is kept for moment.

32.4 Construction of Cold Storages

The basic construction of cold storage is just similar to other rooms except the requirement of insulation for the cold storages. The room is constructed by using masonry work and it is plastered with at least 25 mm thick plaster material (mortar). After curing of the plaster insulation of wall, ceilings & floor is carried out to make it cold storage. Thermocol or expanded polystyrene, cork etc. were widely used for insulation. Presently PUF panels are available to insulate the cold storage. The material of application of insulation varies depending on the type of insulating material and the thickness of insulation required. It is recommended to use PUF panels having stainless steel as the panel material to get long life of the insulation. Holes prepared in PUF panels for inserting support for evaporator, cables, pipes etc. should be sealed perfectly to prevent water vapour inside the insulation.

32.4.1 Insulating materials

The materials having extremely low thermal conductivities are called insulating materials. It is necessary to insulate the cold storages to prevent the entry of heat through the walls, ceilings and floor of the cold storage when ambient air temperature is higher than the cold storage temperature. Insulation of cold storages is important to reduce the operating cost of the refrigeration plant by reducing heat gain through structure of the cold storage. Insulation is also necessary on suction pipe line of the refrigeration plant in order to reduce the super-heating of suction gas. Chilled water pipelines are also insulated to prevent surface condensation on the pipeline.

32.4.1.1 Describe properties of insulating materials

The desirable properties of insulating materials are listed below.

(i) Low thermal conductivity

(ii) Higher structural strength

(iii) Light in weight

(iv) High water repellent property

(v) Odorless

(vi) Non-inflammable

(vii) Low cost

32.4.2 Vapour barriers

The vapour barriers are the materials which are placed on the hot side of the cold storage to prevent moisture migration and to protect the insulation from moisture condensation. Various types of vapour barriers such as structural sheet of Aluminum and S.S., thin aluminum foils, plastic film hot melt type bitumen, special type of paints etc. are used to prevent moisture transfer through the insulating material. Bitumen and aluminum foil are widely used in insulation as permeance is very low. Vapour penetration into the insulation will occur as vapour pressures are lower at lower temperature and warm air will condense which in term will form ice which may damage the panels. Panel and electrical services are carefully designed to ensure long term vapour sealing. Penetrations are required for evaporator supports, electrical wiring and refrigeration pipes. In such cases, make a hole in the panel and use PVC sleeve for the required penetration and sealing materials such as silicon may be used to make it air tight.