Damp proofing

Objectives : At the end of this lesson you shall be able to,
- **define damp proofing**
- **state the causes and effects of dampness**
- **describe the requirements of ideal damp proofing material**
- **state the materials used for damp proofing**
- **explain the methods of damp proofing**
- **explain the water proofing treatments for roofs.**

Introduction

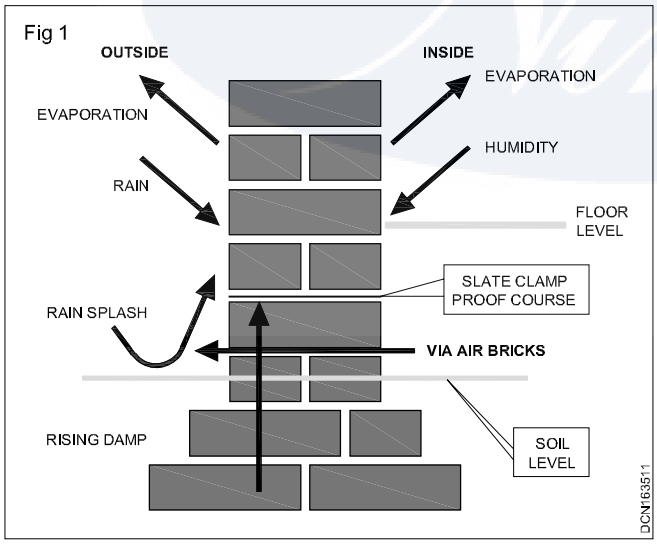
Dampness, is the unwanted and unauthorized accumulation of water in the building components. Continued presence of dampness in the building, deteriorates building components, spoils, the interior decoration and external appearance and affects the health and comfort of the occupants. Hence, in order to prevent the entry of damp into a building, the application of courses known as damp proofing courses, which are provided at various levels, at entry of damp into a building.

Definition

Treatments given to various places of building structure to keep walls, floors and basement dry, is called damp proofing.

Causes of dampness (Fig 1)

Fig 1



1 Rising moisture from ground
2 Condensation
3 Defective junctions between roof slab and parapet wall.
4 Defective roof covering of pitched roof
5 Faulty eaves and valley gutter.
6 Improper rain water pipe connections
7 Inadequate roof slope
8 Splashing of rain water
9 Unprotected tops of wall, parapet walls etc.

Effects of dampness

1 Metals used in the building corroded.
2 Unsighty patches formed
3 Decay of timber
4 Electrical deteriorated leakage of electricity and short circuiting.
5 Floor covering materials get damaged
6 Promotes the growth of termites.
7 Softening and crumbling of plaster
8 Gives rise to breading of mosquitoes, germs of dangerous diseases etc.
9 Wall decoration materials are damaged
10 Floorings get loosened
11 Cause efflorescence.

Requirements of an ideal damp proofing material

1 Durable
2 Remains steady and do not allow any movement it self.
3 Perfectly impervious
4 Capable of resisting the loads coming over it safely.
5 Flexible
6 Dimensionally stable
7 Reasonably cheap
8 Possible to carryout leak proof jointing work
9 Free from deliquescent salts like sulphates, chlorides and nitrates.

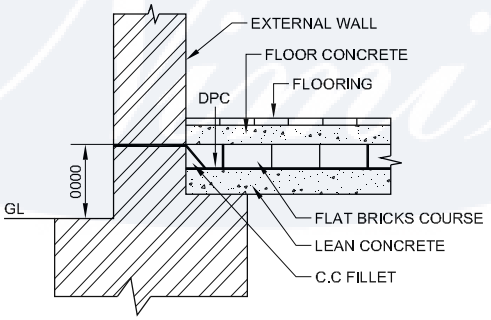
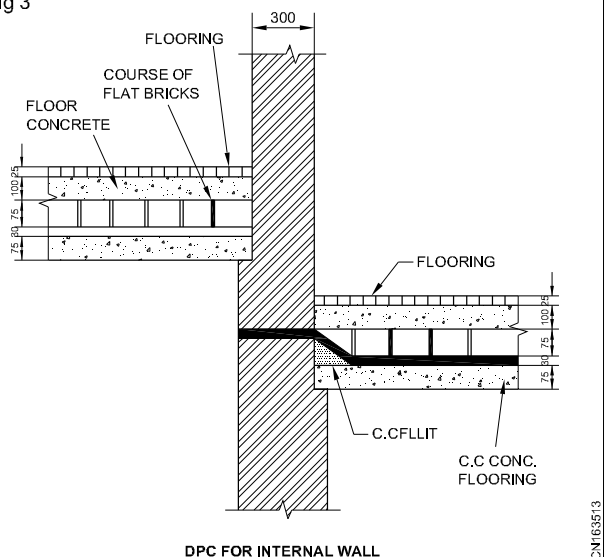
Materials for damp proofing

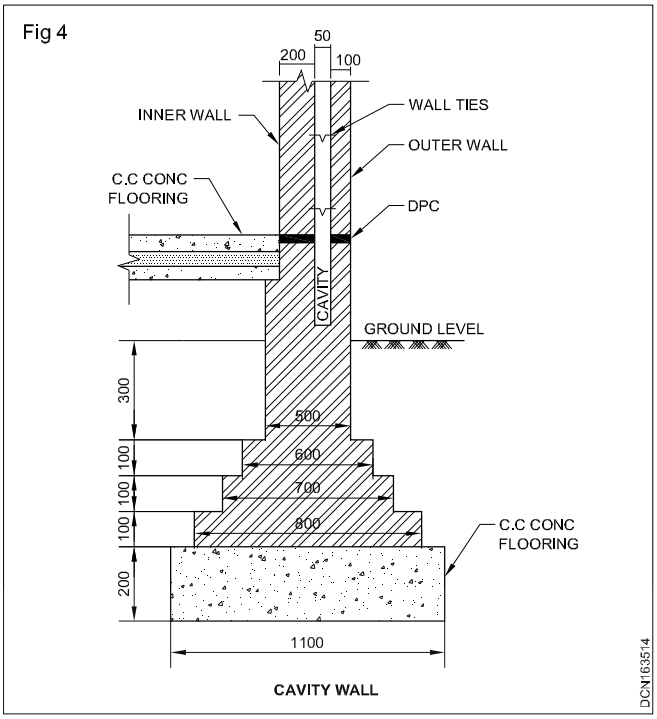
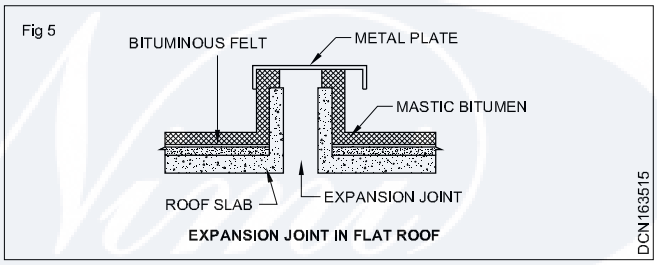
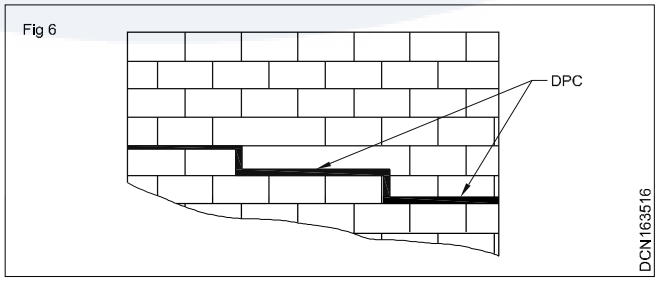
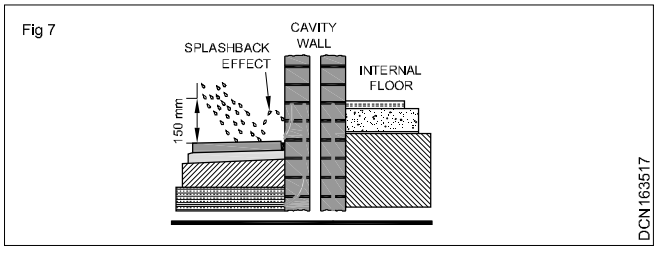
1 Bitumen
2 Mastic asphalt
3 Bituminous felt
4 Metal sheets (Lead, Copper, Aluminium)
5 Combination of sheets and felts
6 Stones
7 Bricks

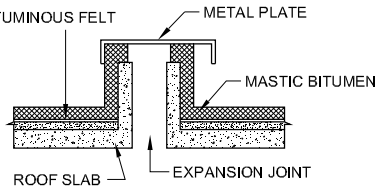
8 Mortar

9 Cement concrete

10 Plastic sheet.

Methods of damp proofing		
S.No	**Method**	**Description / Figure**
1	Integral treatment	Water proofing compounds or materials are added during the process of mixing the materials. Chalk, tale or filler's earth is used to fill the pores in concrete or mortar. Water proofing compounds such as Pudlo, Impermo etc. are used after diluting with water. Concrete is made water repellent by the use of soap solution, calcium and petroleum oil etc.
2	Surface treatment	Joints in brickwork or stone work are pointed or the surface is plastered. Paints, oils, waxes and soap solution are used for surface treatment. The cement paints act as vertical DPC.
3	Membrane damp proofing	This is done by providing a layer of water repellent materials between the source of dampness and part of the structure adjacent to it.
a (i)	Treatment to external walls	Fig 2  DAMP PROOFING OF AN EXTERNAL WALL
(ii)	Treatment to internal walls	Fig 3  DPC FOR INTERNAL WALL

S.No	Method	Description	Figure
b	Treatment to foundations against gravitational water		Fig 4  CAVITY WALL
c	Treatment to basements		Fig 5  EXPANSION JOINT IN FLAT ROOF
d	Treatment to sloping ground		Fig 6 
e	Treatment In pitched	1 In pitched roofs , the rain water gutters may be constructed in cement concrete and standard rain water fittings may be used. 2 The gutters lined with bituminous materials.	
4	Cavitywall construction	Cavity in between two walls prevents the moisture from reaching the inner wall Cavity wall prevent the entry of dampness	Fig 7 

S.No	Method	Description	Figure
5	Treatment to expansion and construction joints	The expansion joints and construction joints should be properly sealed by water proofing materials to obstruct the leakage of water.	Fig 8  EXPANSION JOINT IN FLAT ROOF
6	Guniting	Cement mortar consists of 1:3 is shot on the cleaned surface with the help of a cement gun, under a pressure of 2 to 3 kg/m2. Can be used over pipes, cisterns etc. for resisting water pressure	
7	Pressure grouting	Forcing cement grout, under pressure into cracks,voids,fissures etc. present in the structural components of the building or in the ground	

Water proofing treatment to flat roof

Flat roof must have to be provided with proper water proofing courses. Leakage of water through roof occur mainly due to stagnation of water at low area. To avoid this roof must have proper slope towards the outlets.

Following are the commonly adopted methods of water proofing treatments.

A Cement mortar plastering

1 The entire area of roof is cleaned with wire brush and all dirt is removed.

2 A neat cement wash is given to the surface and

3 20mm thick layer of cement mortar mixed with standard water proofing compound is laid and finished smooth.

B Tar felting

Hot bitumen is applied over the roof surface and tar felt is laid over it.

C Lime concrete terracing

1 It is most common in southern region of India.

2 They offer good resistance to solar radiation.

3 Lime concrete is made by mixing over burnt brick aggregate of size 25mm with lime mortar of 1:2mix.

4 First 10 cm thick lime concrete is laid, spread and rammed with wooden rammers.

5 Slope if required should be given in this layer.

6 Then entire surface is consolidated by beating.

D Lime concrete terracing with tiles

1 As explained above, proportion, method of laying, consolidation etc. is same.

2 At first a hot bitumen wash is given to the entire roof surface.

3 Then a layer of fine sand is spread immediately, when the bitumen is still hot.

4 Over this 10 cm thick lime concrete is spread and rammed with light rollers to get even thickness or the required slope.

5 Ramming is continued till 10 cm laid thickness will come down to 8 cm.

6 When lime concrete layer is still green, two courses of flat brick tiles are laid in cement mortar 1:3.

E Mud pushka terracing with tile paving

1 At first a layer of hot bitumen is spread over the entire roof surface.

2 The prepared mud pakka earth is spread to a thickness of 10 cm. and compacted to till the thickness reaches to 8cm.

3 Over this 25mm thick layer of mud mortar is laid and allowed to dry.

4 After drying up, a coat of gobi leaping is given.

5 Over this a layer of flat brick tiles is laid in mud mortar, and allowed to dry.

6 Joints are pointed with cement mortar 1:3.

7 Entire roof surface is covered with wet gunny bags.

8 After 12 hours brick terracing is cured by sprinkling of water.

Water proofing treatment for pitched roof

Usually the pitched roof has self draining property. The over laps should be as specified and size of gutters should be designed taking into consideration the average rainfall. The common methods adopted for water proofing are:

a Covering the entire roof surface with tar felt

b Covering the entire roof surface by lime mortar of proportion 1:1:2 (lime putty: surkhi: coarse sand)

Plastering

Objectives : At the end of this lesson you shall be able to,
- **to improve the appearace of the structure**
- **to give smooth surface**
- **to protect from atmosphere**
- **to cpm ceal the inferior materials and defective workmanship**
- **to protect from termites.**

Plastering

The method of applying mortar on the surface of masonry to protect the surface from atmospheric and to increase the beauty of the structure.

Requirements of good plaster

- it should adhere to the back ground
- it should hard and durable
- it should possess good workability
- it should be cheap and economical
- it should be possible to apply in all weather conditions

Types of mortar for plaster

- lime mortar
- cement mortar
- lime cement mortar
- water proof mortar

Method of plastering

- The mortar joints are raked to 20mm cleaned and well watered.
- A preliminary coat is applied to fill up the hollows
- Dots of 9mm to 10 mm thick are formed to make screeds at 2mm interval
- The first coat of plaster is applied, 9mm to 10mm thick
- The second coat of plaster is applied after about 6 hours with 2mm to 3mm thick
- If it is required a third coat also can be applied
- The completed work is allowed to rest for 24 hours and well watered for at least one week.

External finishes

Various types of external finished are given to the plastered surface to improve the appearance of the surface are

- Sand faced finish
- Pebble dash finish
- Rough cast finish
- Depeter finish
- Scrapped finish
- Textured finish

Fibrous plaster boards

It is combination of plaster canvas and lath united into structural mass in the form of pre-cast slabs or moulding. The fibrous plaster boards are available in different trade names in the market. These boards are used as final finishes to the surfaces.

Painting, Varnishing and Distempering

According to the nature of the surface and finishing required the surface are coated with paint, varnish, distemper or colour wash, etc. Painting is applied over surface of timber, metal or plasters, varnishing is applied over wooden surfaces and painted surfaces. Distempers are applied over plastered surfaces and white wash applied over distempered surfaces.

Special material for plastered surface

Material	Uses
Acoustic plaster	To make the room sound proof
Asbestos cement plaster	Beautiful marble like finish
Barium plaster	Used in X-ray rooms to protect the persons working
Granite silicon plaster	Quick setting highly elastic and used for superior work
Gypsum plaster	Fire resisting light in weight, not affected by bacteria, used for ornamental plaster, can be applied with ease and less wastage
Keene's cement	Used for skirting work, angles which gives glass like polish
Martin's cement	Internal finishing work

Painting

Objectives : At the end of this lesson you shall be able to,
- **protect surface from weathering effects**
- **prevent decay of timber and corrosion in metal**
- **gives good appearance to the surface**
- **provides smooth surface for easy cleaning.**

Methods of painting

- By brushes
- By spraying pistol
- By powder coating

Method of painting on different surfaces

Wood surfaces (new and repainting)

New woodwork

- Preparation of surfaces
- Knotting- Covering or killing of all knots in wood surfaces by red lead with glue or shellac with spirit or lime.
- Application of priming coat.
- Stopping - rubbing down of priming coat by pumice stone or glass paper or both
- Under coating second coat and successive coats are applied
- Finishing

Reprinting on old wood work

- Removal of old paint
  - With caustic soda
  - Mixture of soap, potash and quick lime
  - Washing soda and quick lime
- Cleaning of surfaces
- Under coating
- Finishing coat

Metal surfaces

New iron and steel surfaces

- Cleaning of surfaces removal rust, oil greease etc
- Treatment with phosphoric acid protects rusting
- Priming coat
- Under coating
- Finishing coating

Repainting old iron/steel

- Cleaning with soap water
- Removal of old paint by flaming cleaning
- Cleaning with caustic soda/slaked lime
- Priming coat
- Under coating
- Finishing coat

Galvanized iron

- To adhere paint, treatment with copper acetate or with another solution
- After 12 hours of this primer coat is applied
- Under coating
- Finsihing coat

Plastered Surfaces

Noted points are

Paint recommened for plastered surfces are cement paint, emulsion paint oil paint silicate paint etc

Surface is allowed to dry for 3 to 6 month to receive paint

Alkali resistant primer should be applied

Defects in plaster efflorescence should be removed

If necessary an antiseptic wash should be applied

Under coat and finishing coats are applied

Defects in Painting

Defects	Explanation
Blistering	Formation of bubbles on painted surfaces due to water vapour
Bloom	Formation of dull patches- due to bad ventilation
Fading	Gradual of colour - effect of sunlight
Flaking	Loose small portion - due to poor adhesion
Flashing	Glossy patches seen - bad workmanship, cheap paint
Grinning	Back ground is clearly seen - due to insufficient opacity
Running	Paint run back leave small area - due to too smooth
Sagging	When vertical and inclined surfaces are too thickly painted sagging occurs
Saponification	Formation of soap patches

Varnishing

Objectives : At the end of this lesson you shall be able to,
- **to brighten the appearance of natural grains in wood**
- **to render brilliancy to the painted surface**
- **to protect surface from atmospheric action.**

Application of varnish on wooden or painted surface is varnishing.

Process of Varnishing

Preparation of surface

The surface is smoothened by throughly rubbing it by sand paper or pumice stone.

Knotting

The process of covering or killing all knots in the wood work.

Stopping

Stopping is done by means of hot weak glue size so that the pores on the surfaces are filled up with boiled linseed oil.

Coats of varnishing

On the cleaned surface, two or more coats of varnish are applied .

Distempering

Objective : At the end of this lesson you shall be able to,
- **to create a smooth surface**

Application of distemper on plastered surface is known as distempering.

Process

Preparation on surface **:** Surface is thoroughly rubbed and cleaned.

Priming coat **:** It is applied and allowed to dry.

Coats of distemper **:** First coat is applied with a light tint and second coat is applied after heardening the first coat

White washing

Preparation of surface : The surface to be treated is well cleaned. The old loose white wash is removed and repairing plaster is carried out.

Application

The white wash is applied with jute brush. Three coats generally applied. Interior wall surface and ceilings are white washed.

Colouring washing

Colour wash is applied in the same fashion as white wash. This is prepared by adding the coloring pigment to the screened white wash. Exterior walls and interior walls are colour washed.

Termite proofing

Objectives: At the end of this lesson you shall be able to
- **define the term termite proofing**
- **state the types of termites**
- **explain the methods of anti termite treatment.**

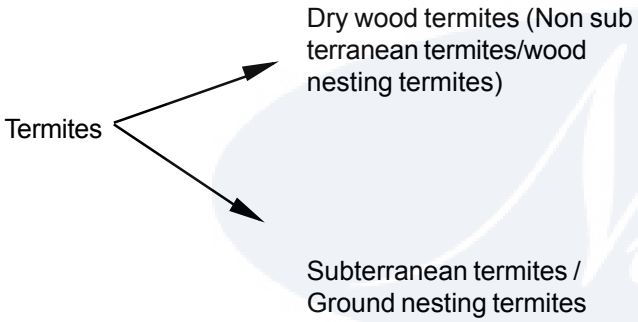
Introduction

The removal of termites from a building is not an easy task. The termites live in a colony and they are very fast in eating wood and other cellulosic materials as food. They damage materials of organic origin with cellulosic base, damage house hold articles like furniture, furnishings, clothing and stationary. Therefore it is necessary to adopt anti termite treatment in building.

Definition

The treatment which is given to a building to prevent or control the growth of termites is called termite proofing.

Types of termites



Methods of Anti-termite treatment

1 Preconstruction treatment

Here three operations involved.

a) Site preparation :- Remove stumps, roots, logs, waste wood etc. Detect termite mounds and destruct these by using insecticide solution. Chemicals for preparing solution are DDT, BHC, Aldrin, Heptachlor, Chlordane.

Chemical	Concentration by weight
DDT	5%
BHC	0.5%
Aldrin	0.25%
Heptachlor	0.25%
Chlordane	0.5%

Four litres of the above emulsion in water is required per cubic metre of volume of mound.

b) Soil treatment

The best method to protect the building to protect against termites is to apply a chemical treatment to the soil at the time of construction of the building. A complete chemical barrier is created.An insecticide solution consist of any one of the following chemicals in water solution.

Chemical	Concentration by weight
Aldrin	0.5%
Heptachlor	0.5%
Chlordane	1%

The emulsion should be applied evenly at the following stages.

Stage1-In foundation pits, to treat the bottom and sides upto a height of 30 cm.

Stage 2-Refill earth on both sides of the wall, for a width of 30cm and depth of 45cm approximately.

Stage 3-Before laying the floor ,entire levelled surface is to be treated at the rate of 5 litres of emulsion per square metre.

c) Structural Barriers:- These are concrete layer of 5cm-7.5cm thick or Metal sheets (Copper or G.I Sheets 0.8mm thick)

Post construction treatment

It is a maintenance treatment. Open earth around building and treat it with chemicals. In wood work or masonry work, bore holes and inject chemicals.

Fire protection

Objectives : At the end of this lesson you shall be able to,
- **define the term fire protection**
- **state the important considerations in fire protection**
- **explain the fire resistant construction.**

Introduction

Every building contains some materials which can either easily catch fire or which are impossible to fire..However, the architects and engineers should plan, design and construct the building in such a way that safety of the occupants may be ensured to the maximum possible extent.

Definition

It is defined as the protection of the occupants of the building, contents and structure of the building and adjacent buildings from the risks of fire and spread of fire.

Important considerations in fire protection:

1 It should be the objective of every engineer and arch tect while planning and designing the building that the structure offer sufficient resistance against fire so as to afford protection to the occupants, use of fire-resisting materials and construction techniques and providing quick and safe means of escape in the building.

2 All the structural elements such as floors, walls, columns, beams etc should be made of fire resisting materials

3 The construction of structural elements such as walls, floors, columns, lintels, arches etc

should be made in such a way that they should continue to function atleast for the time, which may be sufficient for occupants to escape safely in times of fire.

4 The building should be so planned or oriented that the elements of construction or building components can with stand fire for a given time depending upon the size and use of building, to isolate various compartments so as to minimize the spread of fire suitable separation is necessary to prevent fire, gases, and smoke from spreading rapidly through corridors, staircases ,shafts etc.

5 Adequate means of escape are provided for occupants to leave the building quickly and safely in terms of out break of fire.

6 In multi-storeyed office buildings suitable equipment for detecting, extinguishing and warning of fire should be installed in the niches.

Fire-resistant construction

National building code classifies the construction into four classes, namely type 1, type 2, type 3 and type 4 on the basis of fire-resistance offered by building components for 4-hours, 3- hours, 2-hours and 1-hour respectively. To achieve the objective of fire-resistance, due considerations should be made in design and construction of the structural members and use of combustible material should be avoided as far as possible in the construction

a) Walls and columns

b) Floor and roofs

c) Wall openings

d) Building fire escape elements (i.e.,) stair, staircase, corridors, entrances etc.

A Walls and columns:

1 The load-bearing non-load bearing walls should be plastered with fire resistive mortar.

2 Normally 20cm thick common wall is sufficient from fire resistance point of view.

3 Bricks should be preferred to stones if the construction is solid bearing wall.

4 For framed structures R.C.C. frames are preferred to those of steel frame.

5 Partition walls, should also be fire resistant materials.

6 Wooden partitions should be covered with metal lath and plaster.

7 Sufficient cover to R.C.C. members like beams or columns should be provided.

8 It has been recommended that a cover of atleast 5cm inside the main reinforcement of structural members, like columns, girders, trusses etc, 38mm for ordinary beam, long span slabs, arches etc, 25mm for partition walls, short spans should be provided.

9 Fire proofing treatments, which can possibly to concrete and steel column construction.

B) Floors and roofs

1 The floors and roofs should be made of fire-resisting material as they act as horizontal barriers to spread of heat and fire in vertical direction.

2 The floor such as concrete jack arch floor with steel joists embedded in concrete or hollow tiled ribbed floor, R.C.C. floor etc should be used as shown in figure.

C) Wall openings

1 The openings in the walls should be restricted to a minimum and they should be protected by suitable arrangements in case of fire.

2 Wireglass panels are preferred for windows.

3 Steel rolling shutters are becoming popular for door ways and window openings in garages, godowns, shops etc due to their ability in preventing the spread of fire

D) Building fire escape element

1 Staircases, corridors, Lobbies, entrances etc are the fire escape elements should be constructed out of fire-resistant materials and be well separated from the rest of the building.

2 Doors to the staircase, corridors and lifts should be made of fireproofing materials.

3 Staircase should be created next to the outerwalls and should be accessible from any floor in the direction of flow towards the exits from the building.

General measures of fire safety in building

In important buildings, in addition to the fire-resisting materials and adopting fire resistant construction, the following general measures of fire-safety have been recommended

i) Alarm system

ii) Fire extinguishing arrangements

iii) Escape routes for public buildings

Thermal insulation

Objectives : At the end of this lesson you shall be able to,

- **define thermal insulation**
- **state the advantages of thermal insulation**
- **state the thermal insulating materials**
- **explain the general methods of thermal insulation**
- **explain thermal insulation of roofs**
- **explain thermal insulation of exposed walls**
- **explain thermal insulation of exposed doors and windows.**

Introduction

When there is difference in temperature of inside of a building and outside atmosphere heat transfer takes place from areas of higher temperature to those of lower temperature. The aim of thermal insulation is to minimize the transfer of heat between outside and inside of the building.

Definition

The term thermal insulation is used to indicate the construction or provision by way of which transmission of heat from or in the room is retarded.

Advantages

1 Comfort-Thermal insulation keeps the room cool in summer and hot in winter.

2 Fuel saving-Since heat transfer is minimized due to thermal insulation,less fuel is required to maintain the desired temperature in the room.

3 Prevention of condensation-Use of thermal insulating materials inside a room results in prevention of condensation(moisture deposition) on interior walls and ceiling.

Thermal insulating materials

1 slab or block insulation.

2 blanket insulation.

3 loose fill insulation.

4 bat insulating materials.

5 Insulating boards.

General methods of thermal insulation

1 Heat insulation by orientation

- Orient the building with respect to the sun.
- During the day in summer minimum transfer of heat is desired.
- During winter maximum heating of rooms by solar heat is required.

2 Heat insulation by shading

- Shading of roof brings down the surface temperature.
- When the altitude angle of the sun is quite high ,during the period of peak heat gain this method is not effective.
- Raising the parapet walls can help only when the altitude angle of the sun is low.

3 Heat insulation by proper height of ceiling

- Provide a height of ceiling about 1 to 1.3 m above the occupants.

Thermal insulation of roofs

Heat gain through roofs may be reduced by adopting the following methods.

1 Heat insulating materials may be applied externally or internally to the roofs.

2 For flat roofs,external insulation may also be done by arranging asbestos cement sheets or corrugated galvenised iron sheets on bricks.

3 Shining and reflecting materials may be fixed on the top of the roof.

4 Roofs may be flooded with water in the form of sprays or otherwise.

5 Roofs may be white washed before on set of each summer

Thermal insulation of exposed walls

Heat insulation of the exposed walls may be achieved by the following ways

1 The thickness of the wall may be increased.

2 Cavity wall construction may be adopted, for external walls.

3 The wall may be constructed out of suitable heat insulating material.

4 Heat insulating material may be fixed on the inside or outside of the exposed wall.

5 Light coloured white wash or distember may be applied on the exposed side of the wall.

Thermal insulation of exposed doors and windows

Suitable methods should be adopted to reduce incidence of solar heat and heat transmission.

a) Reduction of incidence of solar heat:-This may be achieved by

1 External shading such as louvered shutters, sun breakers, etc.

2 Internal shading such as curtains and venetian blinds.

b) **Reduction of heat transmission**-This can be achieved by providing insulating glass or double glass with air space.