PMG Engineering Private Limited
The End-to-End Engineering Company in Food Industry
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Floor Construction for Food Manufacturing Industries

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AGENDA

1	Introduction
2	Food Safety Issues
3	Purpose
4	Features
5	Floor Composition

1. Introduction

- Food safety is vital for consumer confidence and the hygienic design of flooring system for food processing facilities is central to the production of safe food and beverage products.There are a number of factors that must be consider while selecting a new floor finish inside food manufacturing facilities because they face many challenges with respect to their needs. For example:

1. **Wineries** need a floor that will not be subjected to constant abrasion from acids
2. **Meat Processing Facilities** requires to deal with the heavy chemical abrasion that occurs from blood and meat residues.
3. **Oil Production** companies need to deal with slippery surfaces that occur from oils falling on the floor.
4. **Dairy Product Plants** requires a floor resistant to abrasion from lactic acids.

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2. Food Safety Issues

- Unhygienic designed /installed flooring can arise many problems which can disturb the food safety of the facility.
- Major food safety issues associated with unhygienic designed floorings are:

1. Pest Infestation
2. Increased chances of cross contamination
3. It can become site of growth for the various pathogenic microorganisms.
4. Increases the risk of accidents due to slipping of workers.
5. Spoils the aesthetic view of the environment.

3. Purpose

- Hygienic floor design is a very important component for a productive and safe manufacturing operation as it:
    1. It maintains hygienic and aesthetic environment.
    2. It helps in reducing frequency of cleaning time.
    3. It prevent the risk of accidents due to slippery floor.
    4. It prevents the chances of microbial cross contamination.
    5. It reduce cost and labor associated activities.
    6. It helps in achieving legal compliance against benchmark food safety standards.

4. Features

4.1 Seamless Floor

- Floor surfaces should be even and free from cracks.
- Open joints must be absent as they can become bacterial niches, and which are difficult to clean.

4.2 Non-Absorbing Surface

- Should be pore less.
- Must be waterproof and suitable for daily washing.
- Must be repellent to oils, acids, fats and other food related residues.
- Resistant to cleaning agents

4. Features

4.3 Easy-To-Clean

- Junctues between floors and walls need to be rounded for preventing the dirt accumulation resulting in efficient cleaning.
- Floors must be easy to clean.
- Floors must be provided with adequate drainage in areas subjected to flooding type cleaning or where normal operation releases/discharges water, condensate or liquid ingredients.
- Floors of high moisture processing areas should have a minimum slope or gradient of 2.0% .

4.4 Slip Resistance

- Floors with anti slip properties are required for preventing slipping accidents in food facilities.

4. Features

4.5 Operability

- Floors should also withstand the installation of heavy machinery (e.g. horizontal mixers, tunnel ovens, spiral coolers, packaging lines).

- Floors should also withstand the installation of heavy machinery (e.g. horizontal mixers, tunnel ovens, spiral coolers, packaging lines).

- Equipment should not be located directly over drainage channels as this may restrict access for cleaning and inspection.

5. Floor Composition

- Floor consists of 3 parts:

5.1 Substrate

- It is the material that supports flooring and has a great impact on the quality of the flooring material.
- It is also known as “Floor Base”.
- It can be of two types:
  1. **Existing** : It has to be properly prepared.
  2. **New** : It has to be properly constructed and prepared before applying the flooring in order to allow a good adherence.

- It must be dry i.e. a concrete slab must be let to dry for a minimum of 28 days)
- able to prevent humidity reaching the impervious flooring.
- It must be capable of withstanding all structural, thermal and mechanical stresses and loads that will occur during service.
- it must be sloped sufficiently in order for liquids to flow to the drains.

5. Floor Composition

5.2 Flooring

- Generally, two families of flooring materials are recommended for food processing areas.

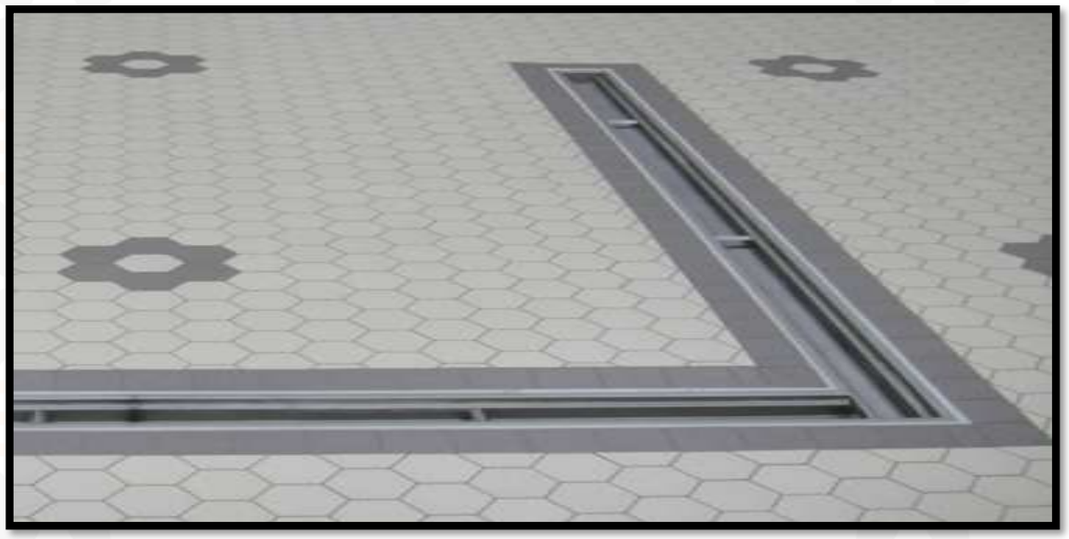
5.2.1 Ceramic Tiles

- They are made of clay that after shaping is subjected to high temperature.
- Vitrified unglazed ceramic tiles are recommended for food processing areas.
- They are highly resistant to the main constraints i.e. heat shocks
- The vitrified tiles are of two types based on shape:
  1. **Pressed:** they are usually square or hexagonal
  2. **Extruded:** They are always rectangular
- Dimension tolerances of the pressed tiles are better than those of extruded ones, allowing thinner joints.

5.2.1 Ceramic Tiles

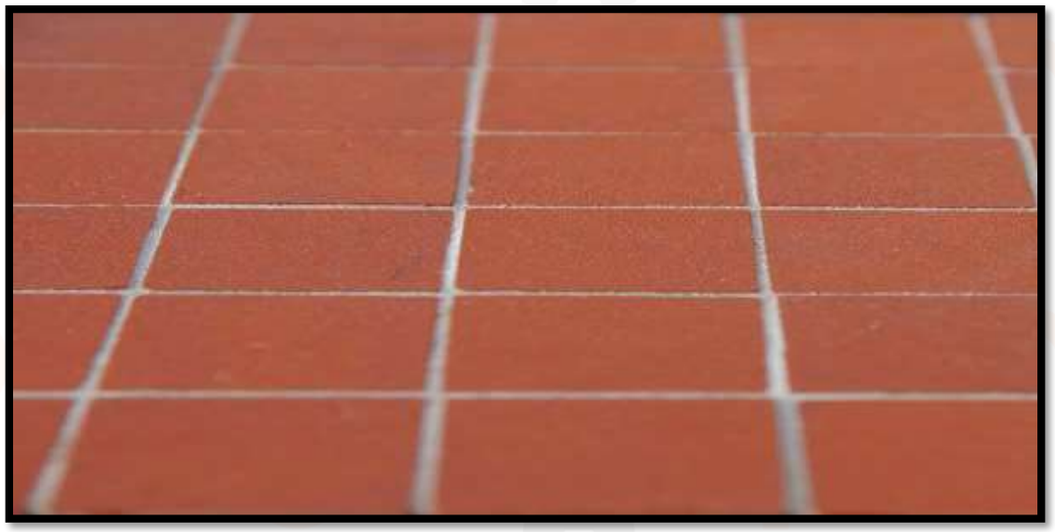
Advantages

- Extremely high melting point.
- Corrosion resistance.
- Extreme hardness.
- Inexpensive.
- Easily available.



Disadvantages

- Dimensional tolerances difficult to control during processing.
- Weak in tension.
- Poor shock resistance.
- Labor Intensive Installation.



5.2.2 Resin-based floors

- Resin-based floors are obtained by application of a mortar made of a mix of one or more organic or inorganic binders, aggregates, fillers and additives, and/or admixture.
- These floorings are considered more hygienic as they are seamless.

5.2.2.1 Binders

- Resin Based Floors can be classified into two groups based on nature of the binder(s)

1. Hydraulic binder

- It is the cement or lime that requires water to harden.
- Major drawback associated with this type is that they have high porosity due to water evaporation.
- To combat this drawback, few amount of synthetic polymer(5% resin) is added which reduces porosity and cracking risk and increases mechanical resistance.
- Examples: acrylic-modified cementitious systems used in the meat industry.
- Advantage: can be applied on Damp substrate.

2. Synthetic resins

- These are organic polymers that react with a hardener at ambient temperature.
- Epoxy resins are the more frequently used type of resin followed by polyurethane and methacrylate resins.
- Characteristics of the different resins change according to the formulation used.
- Epoxy flooring installation generally requires 1±3 days at 15±20 C before trafficking.

5.2.2.2 Aggregates

- These are granular materials that do not contribute to the hardening reaction of the mortar. Roles of aggregate depend on their size and abrasion resistance.
- Small aggregates (fillers) reduces shrinkage and increasing the mechanical resistance. Such aggregates are often made of sand with high silica content (SiO2 orquartz, 7 on the Mohs scale).
- Hard aggregates are used to increase resistance to abrasion. Example: aluminium oxide, silicon carbide

5.2.2.3 Primer

- A primer (one or two coats) is most generally used to aid the adhesion of the final flooring and to seal and consolidate the surface of a porous substrate.
- It consists of a liquid product, which is often a solvent-based epoxy, applied to a substrate.

5.2.2.4 Coats

- One-coat or multicoat systems are used for obtaining anti-slip resin-based floorings.
- Multicoat systems that are the more frequently proposed are thin flooring (2±5 mm) made of a self-levelling mortar on which large aggregates are sprinkled. This type of coat has poor durability(1-2 years)
- One-coat systems, also called monolithic systems, are made of mortar in which all the aggregates are mixed prior to application. The maximum diameter of the aggregates must be smaller than the third of the flooring thickness.

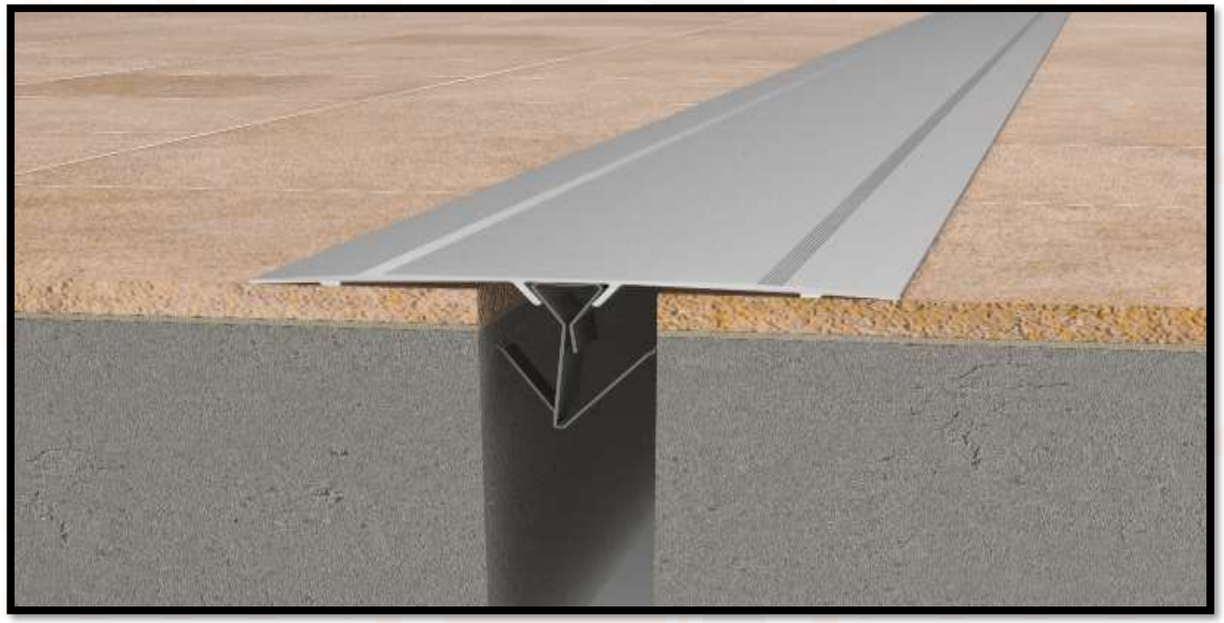
5.2.2.5 Gas Removal

- Gas bubble holes are highly undesirable for hygienic considerations.
- Surface-active agents can be added to avoid or decrease their formation during polymerization of resin-based floors.
- In few cases, prickle roller is used when the mortar is in the fresh state to release entrapped gas bubbles.

S.No	Ceramic Based Tile	Resin Based Flooring
1	Grout Lines are present.	Grout Lines are absent
2	Requires more installation time.	Requires less installation time.
3	Damage tile can be replaced.	If there occurs any cracks, then new layer of this flooring needs to installed
4	Installation is cost effective.	Installation is not cost effective.

5.3 Jointing

- A jointing material is used for completely filling the gap between to ceramic tiles right up to the top edge of the tile.
- Various types of joints used for construction of floors are as follows: day joints, expansion joints, movement joints, and isolation joints.



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