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Flooring Considerations for the Dairy Industry



Every year dairy farms in the USA produce around 23 billion gallons of milk in a giant industry worth approximately USD 140 billion. Yet less than one percent of foodborne illness outbreaks in the US involve dairy products. This is despite the vast amount of produce consumed, its inherent vulnerability to spoilage and the fact that dairy is one of the nation's main dietary sources, especially amongst children and older citizens who are especially at risk from harmful pathogens.

This impressive statistic is thanks to the impeccable hygiene standards of domestic dairy farmers, who have to comply with rigorous operating benchmarks set by regulatory authorities. The innovation and efficiency of America's dairy farms means that, as a result of these high standards, they are the world's most prolific milk producers, accounting for just under than 15% of total global production.

To be both hygienic and productive means carefully considering each element of a farm's design prior to operation, and the choice of flooring installed throughout the dairy complex is a crucial aspect to meeting both of these key criteria.

Challenges Facing Dairy Floors

Milking facilities have to be efficient, reliable and hygienic environments that can cope with the challenges of an arduous workload and an inadequate floor can create a multitude of problems.

Every day the dairy environment will be subject to traffic from rubber boots, cattle and forklift trucks as well as having to manage heavy machinery, lactic acid spillages and intense cleaning routines. While all this is occurring, the level of cleanliness, animal welfare and employee safety have to be simultaneously accounted for in the ongoing operations.

All of these routine factors can potentially cause irreparable damage to the floor and a failing floor will not only affect the movement of people, vehicles and animals across the facility but also cause a dangerous hygiene risk. Contaminants can easily accumulate within hard to clean cracks or gaps and this drastically increases the possibility of spoiled products, sick cattle, damaged reputations and a failure to meet the expectations of regulatory bodies.

Regulations that dairies have to comply with include the Pasteurized Milk Ordinance's (PMO) criteria for Grade A dairy status. This is one of the primary accreditations across the US that assures

authorities and end users of the quality of the product and credentials of the manufacturer.

Making sure the floor is up to the task it faces is a key part of achieving this status. The PMO specifically states that all rooms involved with the processing, packaging or storage of milk products should be created from an “impervious and easily cleanable material” that is also “smooth, properly sloped, provided with trapped drains and kept in good repair”. These rules mean that the choice of floor plays an important role in a dairy’s ability to satisfy regulatory demands.

The Properties of Resin Floors

There are many types of hard flooring systems available to the dairy industry to help maximize the potential of their buildings.

The advice from the PMO is that the floors are “constructed of concrete or other similarly

impervious material” as this is easier to keep clean than “wood or other pervious or easily disintegrating material” because they won’t “absorb organic matter” that will corrode and contaminate the floor.

The seamless finish of a resin floor creates a shield against the damaging corrosives that would compromise other substances, and is even more robust and durable than the recommended concrete. A resin floor will provide a smooth, easy to clean surface that will work effectively with the onsite cleaning regime to remove germs from the area.

The robustness of a resin floor also means that dairy farmers can subject it to heavy trauma from cattle, staff, machinery and vehicles without concern for its integrity. The sturdy and level surface is also ideal for coping with the internal transport from forklift trucks that will be frequently braking and turning on the floor. Should even further resilience be required, aggregates such as quartz sand, aluminum oxide and bauxite can be added to the resin layer to improve its strength and anti slip properties.

Resin floors have varying chemical and bacterial resistance profiles, depending on the specific make up of the system. This affects the floor’s ability to protect from corrosive chemicals that would otherwise lead to the floor failing from erosion, softening, embrittlement, blistering or delamination.

Of the different types of resin flooring systems, one of the most popular hard wearing solutions able to provide the necessary benefits is cementitious urethane. This material combines cement and water-based technologies to produce a mortar that is trowel applied on site to create a very strong and seamless finish. Cementitious urethane has a high cross-linked density, which makes it a good choice for areas that undergo abusive chemical attack.



TIP:

Durable cementitious urethane systems can withstand heavy duty machinery.

The impervious nature of cementitious urethane helps to avoid bacterial contamination as pathogens cannot seep into the floor and are much easier to remove during cleaning. This solution is better than epoxy alternatives at resisting bacterial excretion on the floor, which is especially beneficial in areas of the dairy which are prone to contact with excessive amounts of dung.

Importantly, cementitious urethane is much better at resisting thermal shock than other types of resin flooring, as it has a thermal coefficient of expansion similar to concrete. This means that when it is applied over concrete it is able to expand, contract and move with the substrate when the floor is subjected to large temperature changes, like hot water cleaning techniques. Floor coatings that do not react in line with the substrate are much more likely to crack along the surface.

Cementitious urethane have good resistance to corrosives such as organic acids, which is highly beneficial in a dairy where lactic acid is present in large quantities and where it will often spill onto the floor.

In the milking areas, an epoxy floor would not be as effective as cementitious urethane as the high level of organic chemical attacks and thermal shock that cementitious urethane is able to withstand would make an epoxy floor crack or de-bond.

Importance of Hygiene

In the United States, a government estimate of seven foodborne pathogens reported a cost of between USD 5.6 billion to USD 9.4 billion in lost work and medical expenses.

This highlights the importance of maintaining a high standard of hygiene within food production areas, and an effective cleaning routine is vital to ensuring this. If not acted upon contaminant build up could not only lead to corrosion of the floor but also affect the health of the animals, contaminate the milk and ruin the dairy's reputation.

To maintain a hygienic milking area, many dairies undergo cleaning sessions of between 30 to 60 minutes after the milking. If there are two or three milking sessions per day then just cleaning the dairy can take up a significant amount of time and energy.

**TIP:**

Floors laid to falls will allow for integrated drainage.

TIP:

Integrated, seamless coving provides a hygienic joint between floors and walls.



The PMO's guidance to attaining Grade A dairy status states that the floors and walls must be "impervious and washable" but if it's not strong enough, then the frequent washes will erode the surface layer and make a previously impervious floor porous and ineffective. This means that the floor needs to not only be smooth and level to allow for effective cleaning but also highly durable to withstand the intensive maintenance.

Unprotected concrete floors are especially at risk of deteriorating when faced with hot water cleaning that could potentially eat into the surface layer. The harsh cleaning chemicals required to eliminate dangerous and resilient microorganisms will also damage concrete over time, making it porous and harder to clean.

If a floor coating is not able to cope with the strains of the environment it will start to crack. Substances can penetrate cracks in a floor, which could result in microbial growth and the spread of bacteria from pathogens that are able to thrive in broken flooring. This means that the facility could face an increased contamination risk that the cleaning regime will find difficult to cope with and which could adversely affect the sanitation of the dairy, with the possibility of contaminants entering into the extraction and storage processes.

Joins Between the Floor and Wall

A key area of the floor to consider when designing or renovating a dairy is the joint between the floor and the wall, as this creates a difficult to clean gap where bacteria can accumulate.

The PMO recognizes this problem and advises that in all the rooms involved with the production, handling, processing, packaging or storage of milk "the joints between the floor and the walls be tight, impervious" and with "coved or sealed joints". Coving creates a seamless transition between the floor and wall surfaces, covering up the gap with an easy to clean layer. The coving system installed must be able to withstand the same abuses as the floor, as it will encounter the same corrosives, heat and use.

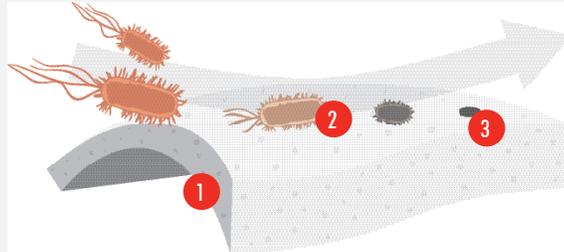
If grouting is chosen to seal the joints the "Handbook of Hygiene Control in the Food Industry" recommends using anti-acid grouting, as simple epoxy grouting will not be able to resist the acidic conditions found in a dairy.

Draining In A Dairy

Liquid from dung, cleaning fluids, lactic acid spillages and many other sources can create substantial excess water in a milking facility. Water ponding can be a serious hygiene concern as it is a prime site for bacterial growth. A non-porous, well drained floor

How the Polygiene® Antimicrobial Additive Works

- 1 The silver ions are homogenously distributed throughout the floor.
- 2 The silver ions migrate to the surface of the floor.
- 3 The silver ions kill the surface bacteria by penetrating the cell.



is important to making sure that water does not stagnate and lead to unhygienic conditions.

A resin floor is impervious to water and facilitates good draining, allowing for more effective removal of any unwanted matter or liquid. This is especially important when coping with the large amounts of fecal matter that build up during milking, as blocked dung channels or long standing effluence pose exceptionally dangerous hazards.

The potential danger from unmoved animal waste is evident in the fact that disease causing pathogens such as Salmonella, E. coli and fecal coliform can be 10 to 100 times more concentrated than in human waste. It was manure from dairy cows that was thought to have contributed to the disastrous Cryptosporidium contamination of Milwaukee's drinking water in 1993, which killed more than 100 people, made 400,000 sick and resulted in USD 37 million in lost wages and productivity.

Effective drainage is vital to making sure that the unwanted effluence quickly flows away. Properly sloped floors will facilitate this process and help to avoid undesirable, unhygienic, unsafe conditions.

Drainage is another area where the smoothness of a resin floor is beneficial, as it will aid the flushing

of water and help to ensure that there are no pools of standing water. Installing a floor that effectively drains is another way to ensuring the dairy meets the PMO's regulations, which insists on a "smooth and sloped" floor surface that leads to a covered floor drain. The PMO also advises having drain traps to prevent sewer gas from entering the facility.

Antimicrobial Floor Solutions

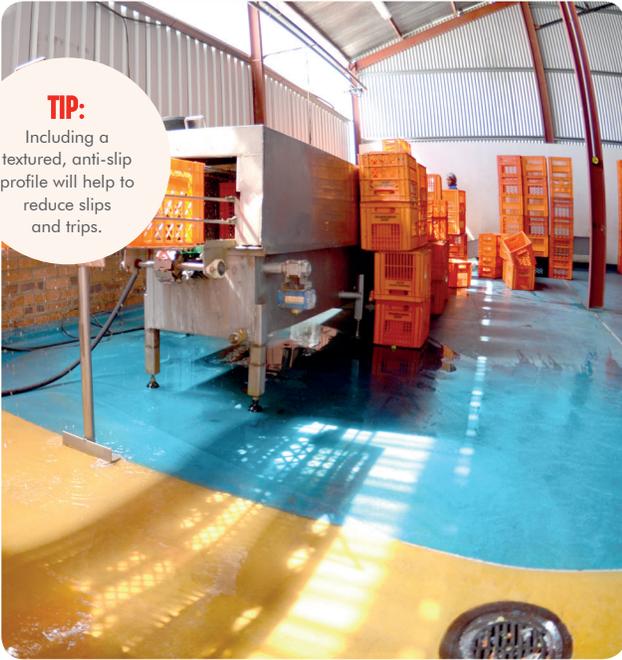
Resin flooring systems are highly adaptable and additives can be included to cater for specific challenges. Anti-microbial agents can be included into the finish to give an enhanced hygiene performance that actively works to inhibit the growth of bacteria.

By combining these additives into the resin matrix of a cementitious urethane system, harmful microorganisms are destroyed as soon as they encounter the floor's surface. And because it is resin based, the floor retains the hard-wearing properties required in a dairy.

When looking into the best anti-microbial floor solution it is important to keep in mind that some will have the additive spread throughout the resin while others will only have it on the surface. The practical difference is that as the surface becomes worn, then the additive is still available to deal with the pathogens.

TIP:

Including a textured, anti-slip profile will help to reduce slips and trips.



Workers' Health And Safety

Contamination isn't the only danger that can stem from excessive water, as slippery conditions are a danger to the health and safety of any workers or visitors in the area.

In any facility with areas prone to wet conditions the site's management needs to minimize the risk of slippery surfaces, especially in a workplace as potential dangerous as a dairy, which the Journal of Agromedicine identified as "among the most hazardous occupations".

When assessing the onsite conditions it is not just the main milking zone that needs to be considered, but also the storage rooms, staff areas, corridors and walkways.

Effective draining is important in tackling slip hazards, but to further decrease the chance of falling, special aggregates can be added into the mixture of a resin floor to create an anti-slip surface which actively enhances grip underfoot.

Again hygiene requirements need to be brought into the decision-making process, as the ease of cleaning needs to be judged against the level of grip required because coarsely textured surfaces are harder to clean than smooth surfaces.

Flooring Away From The Milking Area

While the main focus of attention will be on the milking area, a dairy operator shouldn't overlook all the other buildings that make up the facility - as the condition of these areas can have a significant impact on a dairy's productive capacity. A recent study by the University of Guelph highlighted this fact as it showed that the frequent cleaning of the barn alley floors has a significant correlation to the cow's health.

The PMO has specific guidelines for different areas of a dairy. Many of the regulations follow the same advice as for the main milking area (e.g. impervious, washable floors sloped to a drain). However these rules are not always the same, for example it states that "coolers do not need drains" however the floor must still be "sloped to doorways so that they can be cleaned and dried".

Epoxy resin surfaces are ideal for non-processing zones such as offices, entrances, staff rooms, corridors, warehousing and most areas exposed to less rigorous service conditions. Like the other systems, they can have anti-slip resistance profiles, limiting the risk of falls across the dairy complex.

A resin floor is useful in storage rooms in particular, as they especially need to be kept clean at all times. Ideally placed away from all the obvious sources of contamination, this room's design should mimic the main milking area with impervious floors that are free draining to a suitable trapped drain and walls that are smooth and easy to clean.

Considerations Prior To Installation

Before you decide to have a resin floor installed, it is important to weigh up a dairy's specific requirements. Contacting the local dairy inspector and inviting him or her to take a look at your facility, construction and equipment is a great way to understand what changes need to be carried out to reach Grade A dairy status.

By talking to a resin flooring specialist about the individual demands of a facility you will get a good understanding of what solutions will work best for you. For example do you need a very high-level of anti-slip flooring? Will the floor be exposed to thermal shock? Where is hygiene the biggest priority? What type of chemicals will the floor be exposed to?

Once you have come to an informed conclusion, make sure the specialist resin floor is installed by a qualified applicator to ensure that the coating adheres properly to the substrate with a seamless finish able to provide a strong and impervious surface.

After installation, the finish needs to be properly cleaned and maintained. If you are introducing a new cleaning product, conduct a small spot test on an inconspicuous area as a precaution. Most special purpose cleaning materials won't damage a resin floor but to get the most out of a new surface and to maintain any properties that may have been added, treat the floor in accordance with the manufacturer's instructions.

This guide has been produced to give an overview of the choices available and factors to consider when specifying a resin flooring system within a dairy processing environment.

Detailed recommendations and advice are available from our network of regional technical and sales representatives.

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