

FOOD PROCESSING EQUIPMENT DESIGN

The correct design of equipment and facilities is an important aid to thorough cleaning as it prevents soils and associated micro-organisms from building up and contaminating foods. In this technical brief some simple principles are described which can be used to check the design of locally made or imported equipment and the facilities for creating adequate hygienic standards. Correctly designed, easily cleaned equipment and facilities also promotes better hygienic standards by operators - people will clean a piece of equipment regularly and properly if it is not difficult whereas a time-consuming and laborious cleaning procedure is more likely to be ignored or only partly done.

Location

A food processing unit should not be located near swamps, ditches, refuse dumps or other places where insects and rodents are likely to be found in large numbers.

The site should allow wastewater to drain away freely and have suitable facilities for removing or disposing of waste food, peelings etc outside of the site. A supply of clean water is usually essential.

The site itself should be cleared of undergrowth and kept clean of debris and waste food which would attract rodents. Trees provide useful shade, but also attract birds which are a potential source of contamination of foods.

Interior

A clean uncluttered room gives a good impression to visitors and inspectors and also encourages good hygiene practices by the workers. Walls and floors should be smooth for easy cleaning and free of cracks in which liquids and bits of food can collect. The room should ideally have a ceiling, which prevents dust falling from rafters into the food and helps keep birds and insects out.

Where possible pipes and cables should be laid together and covered for easy cleaning. High level pipes are more difficult to clean and collect dust which can fall into the food or equipment. Window ledges should be sloped for the same reason, and also to prevent people leaving cloths, bottles etc lying around.

Equipment

The type of material used in the construction of equipment is an important factor for ease of cleaning. Wood is used for barrels, vats, bins and sometimes for machine supports when metal is too expensive. It is also widely used for chopping/cutting boards. However, wood is difficult to clean properly, particularly when used as chopping boards, as soils collect in cracks and fissures. If possible, metals and plastic should be used in place of wood, although this will increase the cost of the equipment. If wood is used, particular attention should be paid to thorough scrubbing with detergents and sterilants.

Cast iron has similar problems to wood and the above comments apply. Iron rusts easily and not only becomes difficult to clean, but also risks contamination of food with pieces of rust. It should be painted if it is used in a processing room but it should never be used in contact with wet foods and especially not with acidic foods such as fruit products, yoghurt etc. Stainless steel is the preferred material for these foods but it is expensive and often unobtainable, plastic

is a suitable alternative if these foods are not heated but there is no alternative to stainless steel for heating acidic foods. Low acid or dry foods do not have the same problem and aluminium, galvanised iron, enamelled iron and even brass or copper vessels can be used. However, the last two should never be used in contact with oils or fats and aluminium should not be used with meat. In each case the metal surface should be polished smooth for easy cleaning.

Metal joints should ideally be welded with a continuous weld which is ground to a smooth finish with a grinding tool. Crevices, cracks, weld debris and burrs should be removed by grinding and inside corners of equipment should have a radius greater than 1/4 inch. These precautions prevent the accumulation of food and allow easy cleaning. If welding is not possible, metal joints can be pop-riveted and sealed with a strong adhesive such as 'Araldite'. Solder can also be used, subject to the above precautions and provided that the solder contains at least 50% tin and is free of poisonous metals such as cadmium and antimony.

All bearings leak oil or grease to some extent and they should therefore be positioned outside of the equipment so that they cannot come into contact with the food.

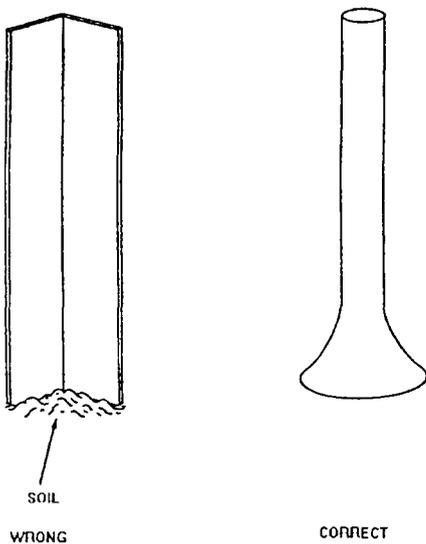


Figure 1: Support leg design to prevent soils accumulating

Electrical wires should be grouped together where possible and placed inside a smooth conduit for easy cleaning and protection from water splashes. Electric motors should be enclosed for similar reasons. Pipes for steam and hot water should be insulated for safety and the insulation should be covered with a smooth material for easy cleaning. All pipes should be at least 6" from a floor or wall to allow cleaning behind them.

Machines should be supported off the floor for proper cleaning underneath. The place where the support legs meet the floor should be carefully designed to prevent soils accumulating see Figure 1. A minimum number of supports should be used.

The insides of pipes and equipment should be easily accessible for cleaning with brushes. Dead-ends to pipes should be avoided and all bends should be smooth and never right-angled. A useful rule is that the radius of the bend should not be less than the outside diameter of the pipe. Pipe joints are needed to gain access for cleaning and these are a particular source of contamination. Ideally, a sanitary metal pipe fitting, which has no internal thread, should be

used.

However, these may be unavailable and particular care is therefore needed to dismantle and thoroughly clean pipework and valves at regular intervals. Food grade plastic pipes are suitable, provided that the diameter is large enough to allow cleaning with a bottle brush. Pipework and other equipment can be 'cleaned in place' by passing detergent and sterilant through them. However, technical advice should be sought if this is planned to ensure that the cleaning is effective.

Hand tools such as knives, peelers etc should be checked to make sure wooden handles are not cracked or split. They should be scrubbed, dipped in a dilute chlorine solution and hung up to dry. Cloths, towels etc should also be regularly washed and hung up to dry. Wet cloths should never be left inside equipment.

Work Surfaces

Ideally, these should have a metal or melamine surface that is smooth and free of cracks for easy cleaning. However, wood is cheaper and is widely used. If possible, tables should be covered with a layer of plastic to prevent liquids and pieces of food collecting between the planks of the table surface.

Reference and Further Reading

Food Processing Building Design Technical Brief, ITDG

Food Poisoning & Its Prevention Technical Brief, ITDG

Quality Assurance for Small-scale Rural Food Industries FAO Agricultural Service Bulletin 117, Food and Agriculture Organization of the United Nations 1995

Starting a Small Food Processing Enterprise by Peter Fellows, Ernesto Franco & Walter Rioas ITDG Publishing/CTA 1996

technical brief