5. Prevention of chemical and physical hazards

Good hygienic design does not only imply that products are not recontaminated with micro-organisms but also other hazards should be avoided to end up in the product.

5.1. Chemical hazards

5.1.1. Toxic compounds

Surface coatings in contact with the product should not release toxic compounds to the product.

Stainless steel materials such as AISI 304, 316 or 316L are fully acceptable for most applications. Elastomers and polymer materials may contain leachable toxic compounds (Lelieveld, 2000).

For application of these kind of materials one should refer to local legislation (Baughan and Montfort, 2000).

Figure 5.1 Production of chocolate eggs in copper vessel.

5.1.2. Lubricants

Lubricants and greases used for elastomers or other purposes should be food grade and comply with FDA regulations (178.3570 USA Food Drug Cosmetic Law Reports).

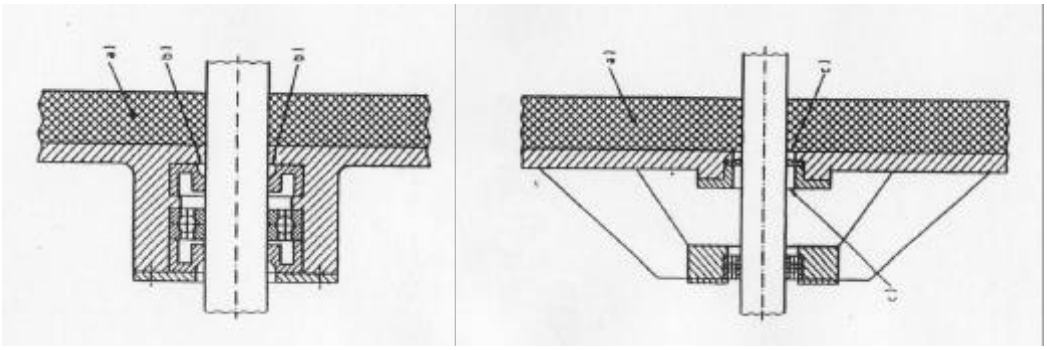

Figure 5.2 Non-hygienic (left) and hygienic (right) design of bearing for a rotating part.

When equipment is badly designed (left) lubricants from the ball bearing housing may leak to the product (a). In the hygienic design lubricant from the ball bearing housing will not be pressed through the seal (right).

Other liquids that may come into contact with the product, like signal transfer liquids should also be food grade. For this purpose, food grade qualities of silicone oil or glycerine may be used (doc 8, EHEDG).

5.1.3. Cleaning agents

Cleaning agents and disinfectants should not come into contact with the product. Therefore, storage of cleaning agents and products should be separate.

Figure 5.3 Incorrect storing: dangerous chemicals next to open bags of ingredients.

Furthermore, when one process lines needs to be cleaned when connected to another process line, no cleaning liquid should leak to the product side.

Therefore, special double-seat valves were developed (Figure 5.4). They can be operated in several ways:

A: product flow in top line, bottom line empty. B: product flows in both process lines (valve is open). C: product flows in both process lines, valve is open, valve internals flushed with anti-microbial fluid. D: product flows in both process lines, valve is closed, valve internals flushed with anti-microbial fluid.

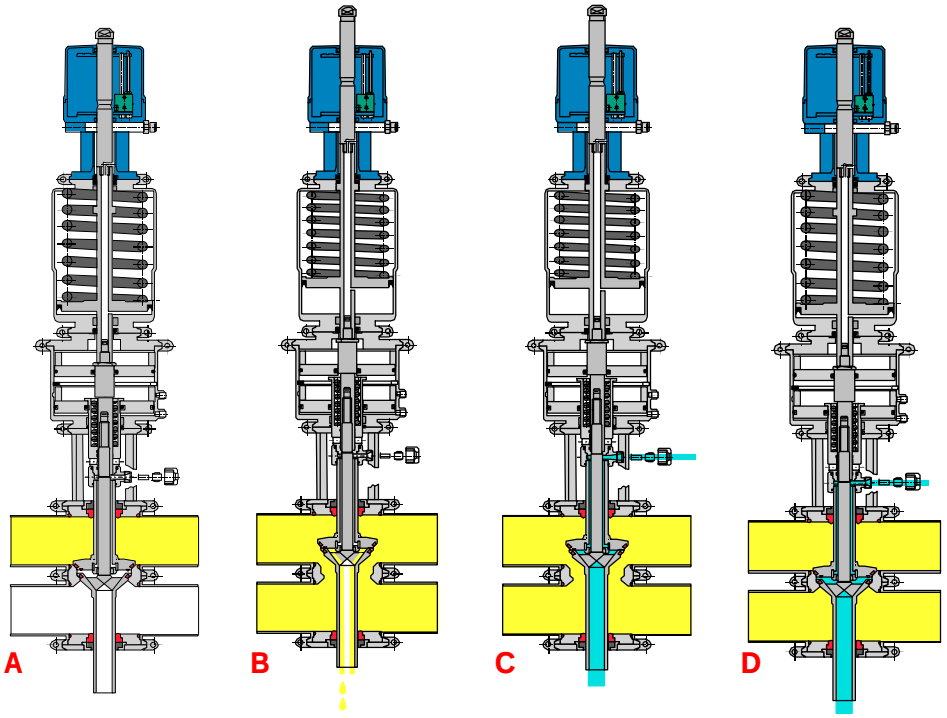

Figure 5.4 Double-seat valve separating two process lines. Colours: yellow: product; white: empty; blue: cleaning agent. .

These double seated valves also allow cleaning in place (CIP) of one process line while the other line is in operation (Figure 5.5).

The options indicated in Figure 5.5 are the following: A: top line is being cleaned, product flow continues in bottom line (valve is closed). B: same situation as in 'A'. Any cleaning agent that is leaking past the first seal is pumped back to the tank. The use of two seals prevents leakage of cleaning agents to the product line. C: after cleaning the

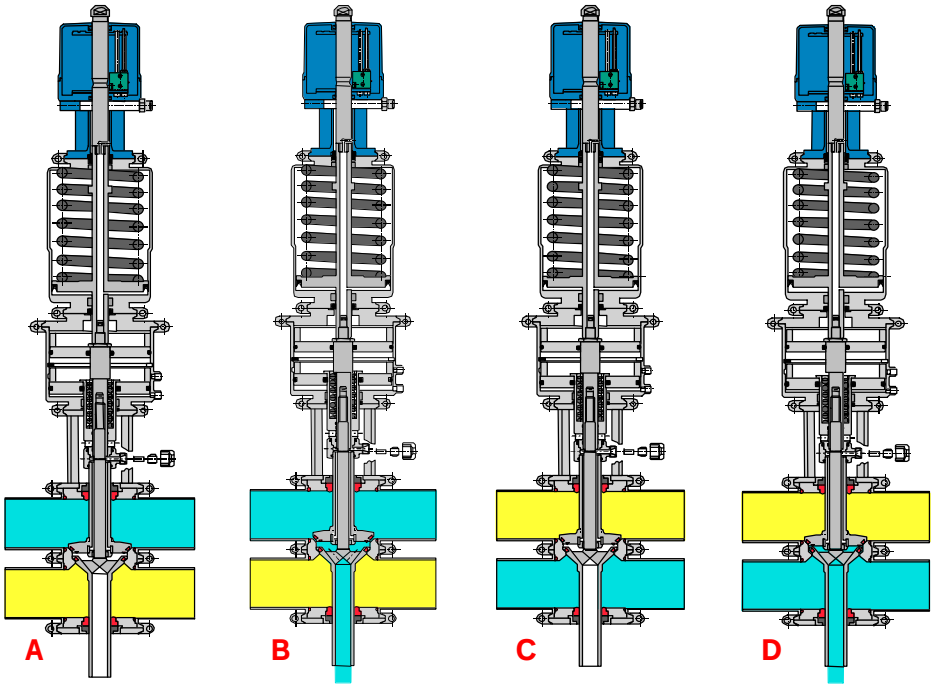

Figure 5.5 Double-seat valve separating two process lines. Colours: yellow: product; white: empty; blue: cleaning agent. .

top line, product is produced again and the bottom line can be cleaned. D: when cleaning agents are leaking past the first seal, they are pumped back to the tank.

Figure 5.6 Glass to stainless steel fusion .

5.2. Foreign bodies

5.2.1. Choice of materials

Materials used for food production should not release particles to the product. The use of glass, for example, should be avoided to prevent entrance of glass particles in the product. If glass is used, splintering should be prevented.

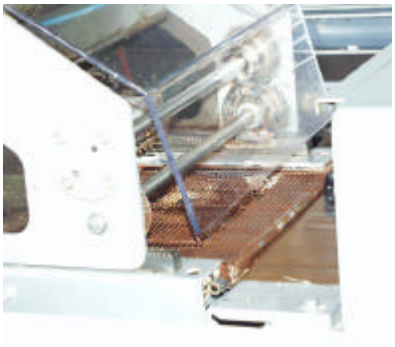

Figure 5.7 Chocolate machine (detail).

Equipment must not release foreign bodies to the product. When using sieves for instance they should be checked regularly for loose ends that may end up in the product. A chocolate machine may contain a conveyor like the one shown in Figure 5.7 that should be checked regularly for loose ends.

Repairing equipment should also be done hygienically and safely. 'Temporary' fixes like the one shown in Figure 5.8 are no part of Good Manufacturing Practices! Often the temporary fix will over time turn out to be less temporary

Figure 5.8 No good practice: 'temporary' fix with tape. Who knows where the pieces of the degrading material may end up.

then initially intended.

5.2.2. Paint

Material in contact with the product should not be painted. Chips of paint may be released, the material underneath may start corroding (together the main reason to preferably use materials like stainless steel and plastic), resulting in contamination of the product.

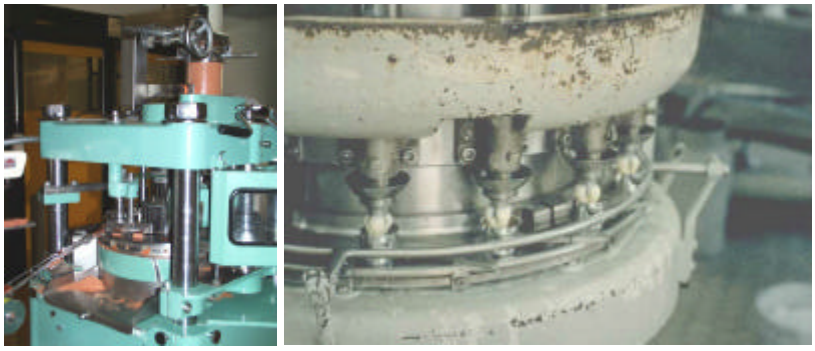

Figure 5.9 Painted equipment. No apparent problem when still in good order (left) , but after a while chipping and corrosion will be visible (right).

5.3. Further reading

1. H.L.M. Lelieveld (2000). Hygienic design of factories and equipment. In: Lund, B.M., Baird-Parker, T.C. and Gould, G.W. Microbiological safety and quality of food 2. Aspen Publishers Inc. Gaithersburg, 1656-1690

2. Baughan, J.S. and Montfort, J.P. (2001). Food contact materials. IN: Goodbrun, K. (eds). EU Food Law . Woodhead Publishing Ltd, Cambridge, 98-116

3. EN 1672 (1997). Food processing machinery-Basic concepts-Part 2: Hygiene requirements

4. Food Drug Cosmetic Law Reports, section 178.3570, latest update. Food and drug administration, Washington DC, USA

EHEDG guidelines:

5. Document 8: Curiel, G.J., Hauser, G., Peschel.P et al. (1993). Hygiene equipment design criteria. Trends in Food Science & Technology 4(7), 225-229

6. Document 20: Baumbach, F., Cocker, R., Curiel, G.J. et al. (2001). Hygienic design and safe use of double-seat mixproof valves. Trends in Science & Technology 12(5-6), 203-206