Warner Electric

Boston Gear

TB Wood's

Formsprag Clutch

Wichita Clutch

Marland Clutch

Industrial Clutch

Bauer Gear Motor

Nuttall Gear

Warner Linear

Delroyd Worm Gear

Stieber Clutch

Ameridrives Couplings

Inertia Dynamics

Matrix International

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Bibby Turboflex

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Kilian Manufacturing

Lamiflex Couplings

Ameridrives Power Transmission

Hygienic Surface Design of Aseptic Drives

For Sensitive Production Areas

Bauer® Gear Motor

An Altra Industrial Motion Company

Hygienic Surface Design of Aseptic Drives

For Sensitive Production Areas

Producers, consumers and last but not least the EHEDG all want preventive measures against the contamination of foodstuffs. The EHEDG has established directives specifying the requirements which must be met. And it is the task of creative developers to work out how this can be achieved.

The European Hygienic Engineering & Design Group, in short EHEDG, terms constructions which satisfy these requirements "Hygienic Design". The primary objective of this "Hygiene supervisory board" is to ensure that food products are protected against contamination with micro-organisms. The resulting designs are solutions which are not only suitable for applications in the food and beverages industry, but also in the pharmaceutical and cosmetics sector.

In the USA, the FDA (Food and Drug Administration) has a similar function to that of the EHDEG. Its directives are also aimed at protecting public health. Above and beyond this, the FDA also monitors the composition and production of medicines and foodstuffs. The directives it issues are binding for manufacturers of such products in the USA and for companies intending to export such products to the USA.

Smooth surfaces

To help prevent contamination with bacteria, fungi and micro-organisms, the first task facing mechanical and plant engineers supplying these industries is an apparently simple one: their products must have smooth surfaces which offer no possibility for soiling and which allow easy drainage of cleaning agents.

The first step geared motor manufacturer Bauer Gear Motor took in order to meet these requirements was to remove the cooling ribs and terminal boxes from its motors in Hygienic Design and to round the edges of the housing.

In addition, the motors were designed without the usual fan for cooling. This ensures that suspended germs and dirt particles cannot be sucked up and then blown out into the surrounding air. This also significantly reduces the danger of aerosol formation and thus of reinfection of products or components within the plant. This means the customer gets not only a geared motor, but a completely closed system, for which brake and gearing attachments in fully enclosed design are available if required.

Requirements with regard to materials

However, this "mechanical smoothing" alone is not sufficient. There are stringent legal requirements, and these start with the selection of materials. The crucial questions which need to be answered are: does the food come into contact with the material surface, what type of surface structure is required, is the process in question open or closed, what are the cleaning procedures used and how can it be ensured that the surface is sufficiently resistant to the cleaning agents and disinfectants used? Plus, there are additional regulations governing labelling and traceability.

Common materials used are:

Stainless steel – Used with most food products

Mild steel – Used with dry products and dry cleaning procedures or for special products such as chocolate

Plastics (polymers and elastomers) – For specific applications and products such as cable insulation, slide bars and guide rails

Paints and coatings – Mainly used for protective coatings

Selection of materials

Food-safe

EU Directive 1935/2004 of 27 October 2004 (replacing Directives 80/590/EEC and 89/109/EEC) specifies the materials which may be allowed to come into contact with foodstuffs. Here, the rules of "Good Manufacturing Practice" (GMP) apply, which naturally means that materials used must not pose a threat to the health of human beings in any way (materials must be non-toxic and physiologically safe). The Directive also stipulates that the materials used must not trigger inacceptable changes in the composition of the foodstuffs or changes in their organoleptic (affecting the sensory organs) properties, which means that they must neither absorb nor release substances.

Traceability

All materials used in hygiene-sensitive areas must be traceable, which covers:

- inspections
- recall of faulty products
- information for the consumer
- proof of responsibility for the product

Requirements

Every design engineer selects materials with a specific food production process in mind. This means that the criteria are strength and resistance to corrosion, wear and temperature.

In addition, neither the microstructure nor macrostructure of the surface must be subject to any alteration as a result of corrosion, abrasion or flaking, even as a result of ageing.

And smooth is not always smooth either. A surface which comes into contact with food must be easy to clean (Fig.1).

If the surface is rougher, proof must be provided that it is easy to clean.

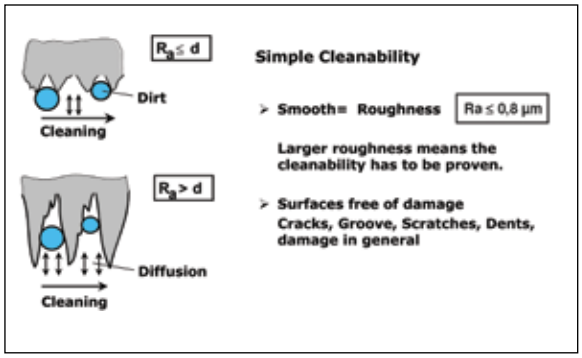

Figure 1: Defining smooth vs. rough surfaces.

Wettability

How easy-clean a surface is depends on its wettability. There are three possible states:

Complete Wettability, hydrophilic properties such as those of stainless steel. Liquids spread evenly over the surface of the object. The surfaces must be tilted strongly to allow liquid to drain. Even then, traces of the liquid remain (Fig. 2.1).

Figure 2.1: Complete wettability.

Partial Wettability. The liquid hardly spreads and forms semispherical droplets on the surface of the object. It will drain if the surface is tilted somewhat and leaves little residue. This can be seen, for example, with some paints (Fig. 2.2).

Figure 2.2: Partial wettability.

No Wettability, hydrophobic properties - the ideal conditions found, for example with paints and plastics. The liquid does not spread over the surface of the object but forms beads. It drains off completely as soon as the surface is tilted slightly and leaves no residue (Fig. 2.3).

Figure 2.3: No wettability.

Special paint system

The fact that stainless steel is completely wettable was one of the reasons why the developers of Bauer geared motors decided not to use it for their housings. Instead, the cast housings are coated with a multi-layer paint system with hydrophobic properties and in accordance with FDA requirements. The inclusion of the material used for the cover coat in the FDA “White List“ confirms this.

Surface

Despite careful selection, a cast housing will naturally exhibit a rough and uneven surface profile. A primer coat fills and levels out the surface and provides an elastic base for subsequent layers of paint. A base coat then further evens out any rough areas. The final top coat further seals the surface and creates an extremely smooth, unstructured surface with macroscopic unevenness.

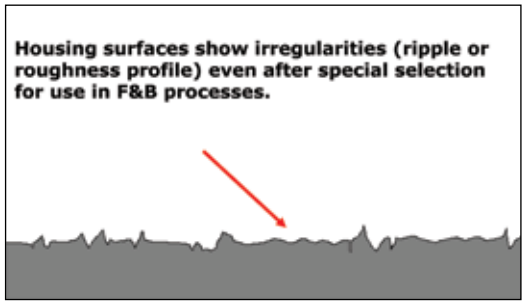

Figure 3: Cast housing, no coatings.

Chemical resistance

In addition, the Bauer Aseptic paint system is also resistant to product-specific substances such as butter or lactic acid and to ammonia and soap solutions. This paint remains unaffected by process-specific cleaning agents commonly used in the branch, lyes and acids and disinfectants increasingly used today, for example peroxyacetic acid and chlorine dioxide. This is due to its high resistance in the range of pH 2 to pH 12.

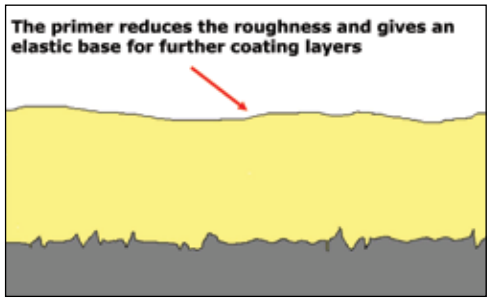

Figure 4: Primer coat.

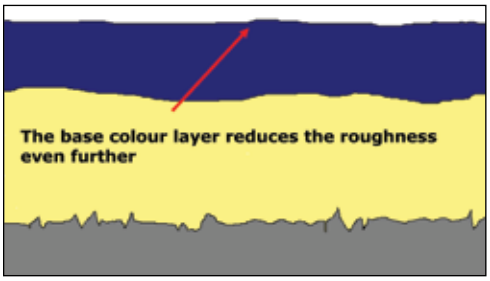

Figure 5: Base paint coat over primer coat.

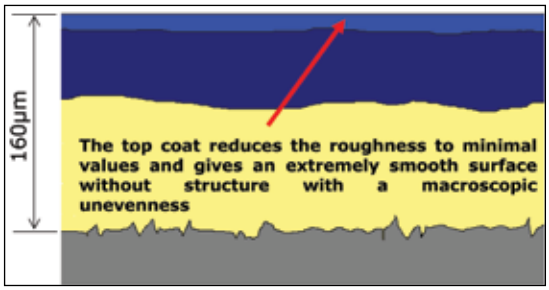

Figure 6: Final paint top coat over base paint and primer coats.

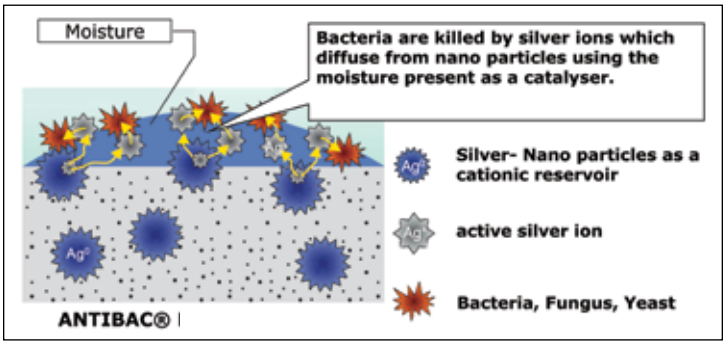

Figure 7: Antibac® paint biochemical process.

Antiseptic

And Bauer offers even more. The Esslingen-based company introduced a patented special paint for its geared motors, under the trade name Antibac®. It has antibacterial and antimicrobial properties. This protective coating is designed to release positively charged silver ions through structural modification of biomolecules, for example proteins or deoxyribonucleic acid (DNA). This hinders or stops the growth of bacteria, fungi and yeasts.

This biochemical process has no effect on humans, animals or plants. The waste water from cleaning presents no risk for aerobic or anaerobic sewage treatment plants, as the silver ion content measurable in one litre is lower than that in a comparable quantity of normal mineral water (Fig. 7).

Advantages of appropriate surface design

The advantages of hygienic material and surface characteristics are plain. They increase product and production safety and boost overall quality. Longer cleaning intervals mean higher productivity and lower running costs. And these advantages of the drive will at least in part have benefits for the overall plant.

Bauer® Gear Motor

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