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HARTING in the food and beverage industry

Information about using connectors for food and beverage facilities

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Machines, facilities and their related components must all meet numerous requirements for usage in the food industry. The guidelines are intended to ensure that the processed food is optimally protected against contamination. Standards such as EN 1672-2 must also be taken into account whenever connectors are used. This whitepaper is intended to explain the basic principles for using connectors in food processing applications.

It contains the information required by users to assemble connectors and cables safely and in a standardised manner within facilities. It is always necessary to make an individual check of your installation situation. An individual check helps to avoid the use of unnecessary equipment and other errors. Basic information for connecting contacts can be found in the User's Guide Termination Technologies, or in various HARTING installation instructions (and also in the Han® F+B installation instruction).

Connectors from HARTING

Han® F+B connectors

Han-INOX® connectors

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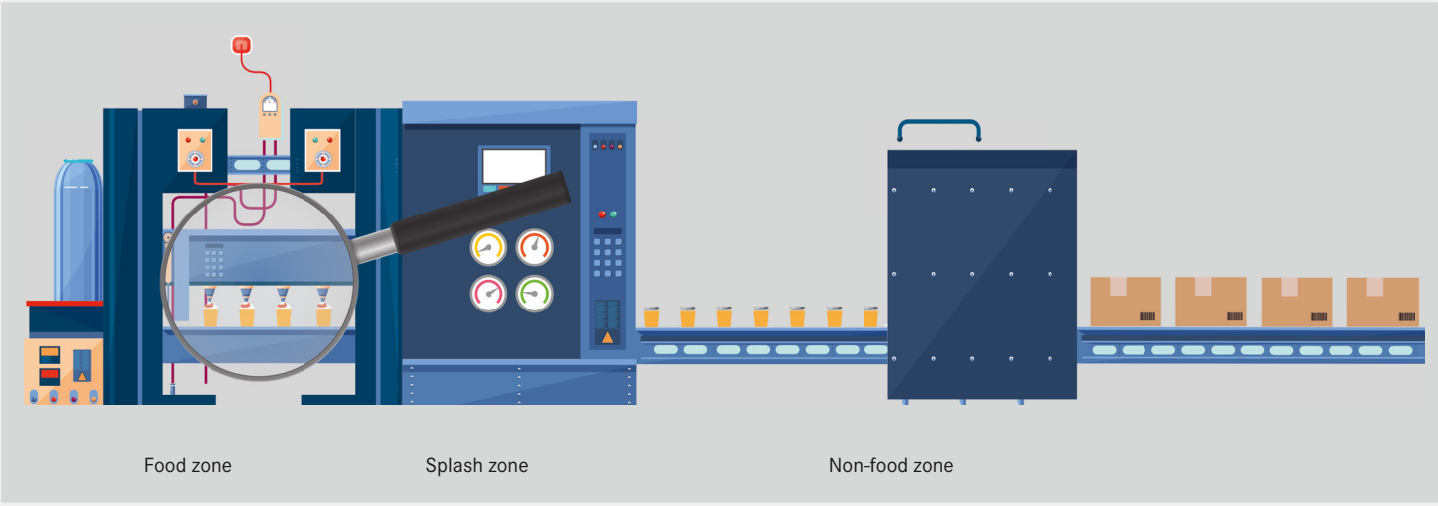

Figure 1: The classification of the different zones

Zone classification

The EN 1672-2 standard defines three zones for food production which meet different hygienic requirements. These requirements differ depending on where the connectors and cables are positioned. That is why you must already know which zone a connector will be used in before choosing the connection technique.

Food zone (1)

All facility parts and components that come into direct contact with foodstuffs are within the food zone.

The following requirements apply to these components:

They must be:

- Washable, capable of being disinfected, corrosion resistant, non-toxic, non-absorbent, smooth, continuous or sealed.
- Connectors are normally not supposed to come into direct contact with food and are, therefore, rarely positioned in this zone.

Splash zone (2)

The splash zone includes all facility parts and components that come into direct contact with food which does not return to the production process. Such parts should be designed and constructed according to similar criteria as used for zone 1. With the growing importance of hygienic design, HARTING has focussed on the requirements for this zone during the design and construction of the Han® F+B special connectors. In this way, HARTING is keeping abreast of the increasing importance of hygienic design.

Non-food zone (3)

Facility and machine components located within this zone do not come into direct contact with foodstuffs. Nevertheless, all facility components must be resistant to corrosion and capable of being washed and disinfected. Numerous components and connectors from the HARTING product portfolio may be used within the non-food zone. So users can benefit from all the advantages that the modularisation of machine and system components offers: conversions and replacements of system

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components for a malfunction are possible at any time and do not cause major interruptions in the production process. Connectors help to save time and reduce costs. It is important to conduct a careful assessment of the environmental influences before a connector component is designed into an F+B facility. For example, there is the question of whether the connector material can withstand the cleaning agents used in the processes.

Design information for machines and facility components in the food and beverage industry

In order to protect the foodstuffs, no substances may be emitted or absorbed by the processing machines or their components. Such substances could negatively affect the smell or taste of food, or even be harmful to health. Therefore, direct or indirect contact with foodstuffs must be avoided (refer also to migration behaviour). During cleaning, the machine's materials must not react to the detergent or other antimicrobial chemicals (disinfectants). Hence they must be corrosion resistant, mechanically stable and constructed so that the surface of the material cannot be damaged.

Materials normally used

The material most commonly used for machines and facilities in the food and beverage industry is high-alloy stainless steel (e.g. AISI 316L, DIN 1.4401). A material often used as a construction material is aluminium – but it normally has no contact with the cleaning agent or the food. Plastics and elastomers which could directly contact food must comply with the provisions of the regulation 1935/2004/EC, the Plastics Ordinance 10/2011 or the directives of the FDA 21. This is the case, for example, when using polypropylene (PP).[1]

HARTING products are not articles which are explicitly intended to come into contact with food. This means that you must check individually, in consultation with HARTING, whenever there will be permanent contact with foodstuffs. This significance of this topic for the Han® F+B connector has been reviewed and systematically analysed. A comprehensive overview of the materials used in the HARTING Han® F+B connectors, as well as their resistance to different substances, can be found here[2] (Link)

Important information about cleaning machinery and facilities:

Hygienic cleaning is absolutely necessary for the industrial production and packaging of foodstuffs. The top priority is preventing contamination and germs from getting into the food. The following factors are critical for optimal cleaning practices:

- (Exposure) time
- Temperature
- (Mechanical) force
- Concentration (of the cleaning agent/cleanser)

Migration = migration of low molecular weight substances (such as plasticizers) to the surface of plastics (e.g. foils) or to surrounding materials. This is a particularly relevant toxicological factor when working with food packaging, medicines and toys.

[1] The conformity of an individual plastic type must be confirmed even when the group of plastics (e.g. PA) conforms to the directives. A group of plastics is never fundamentally compliant.

[2] Remember that the specified substance resistance always refers to the basic material and never to the complete connector assembly. HARTING therefore recommends separate testing using your cleaning substances.

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Types of cleaning:

Dry cleaning	Dry ice cleaning	High-pressure cleaning	Low-pressure foaming process
Dry cleaning is used to remove loose, easily removable dirt.	Use 3mm dry ice pellets with compressed air greater than 150 m/s at approx. -80° C. The pellets penetrate into cracks and blast off dirt and contaminants.	Pre-clean with water under high pressure (approx. 90 bar) and foam with an acid or alkaline cleanser. Follow the proper exposure times. Rinse with high pressure.	Pre-cleaning and rinsing are carried out under a lower pressure than high-pressure cleaning.
Frequently: • Sweep • Wipe dry • Brush • Vacuum	For decontaminating surfaces, against bacteria such as salmonella, E. coli and listeria. No secondary wastes.	The disadvantage is that using high mechanical force can cause contamination to be rinsed out and deposited in corners. This can lead to contamination in the medium term.	The advantage here is contaminants are not transported as much into the nooks and corners.

HARTING's Han® F+B connectors are suitable for all types of cleaning, but must always undergo adequate specific testing for your application.

Cleaning processes

CIP: Cleaning **I**n **P**lace
The cleaning (in accordance with the manufacturer's instructions) takes place according to a defined sequence and regular schedule.

COP: Cleaning **O**ut of **P**lace
During this cleaning, the facility parts and components are removed. Cleaning is often carried out in automated tunnel washers (e.g. for the conveyor belts used for meats). Facility components which are electrically connected and must be removed for cleaning can be handled quickly and reliably when they have plug-in connections.

SIP: Sterilisation **I**n **P**lace
An automated process ensures that the specified facility parts are sterilised; these parts do not need to be removed. This process is used when cleaning the filling chambers for dairy products such as yoghurt.

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SOP: Sterilisation **O**ut of **P**lace
In this process, the facility parts must be removed before they can be sterilised. Both manual and automated sterilisation processes may be carried out. An example of this is surgical tools in hospitals.

Cleaning and disinfecting agents

The DIN 10516 standard is a guide for this subject. It aims to ensure that hygienic conditions are maintained and facilitated whenever food is handled. The food company itself is responsible for the cleaning and disinfecting. Concerning the subject of cleaning and disinfecting, the DIN 10516 standard should be seen as an instruction manual outlining the obligations for cleaning and disinfecting.

Cleaners should be selected according to the particular type of contamination, corrosion resistance and the cleaning or disinfecting process. A distinction is made between:

- Alkaline cleaner
- Acidic cleaner
- Disinfectant
- Neutral cleaner

In order to estimate the long-term behaviour and resistance of the materials used, the material are tested and approved (e.g. by Ecolab). An overview of the Eco-Lab tests for the Han® F+B can be found at (Link).

Requirements for hygienic design

Surfaces

The surfaces must have a high surface finish to prevent microbiological impurities. For the food sector, the roughness value should be ≤ 0.8 µm. HARTING's Han® F+B connectors are specially designed for the requirements of the spray zone.

Corners

Very small nooks and corners always present a hygienic risk because they reduce the flow rates of the cleaning and disinfecting agents. Consequently, the desired cleaning effect cannot be achieved. The prescribed minimum radius is 3 mm.

Connecting elements / screws

Connecting elements such as screws are problematic from a hygienic point of view. If they are technically unavoidable, then they must be designed so that they can be cleaned and disinfected (by using a cap nut, for example). For the Han® F+B connectors, slotted screws may be used according to DIN EN ISO 1207; slotted cylinder screws of product class A (DM head < 7.0 mm) may also be used.

No dead space

Machinery and facility parts must be designed so that there is no dead space. So product residues in these spaces are no longer accessible for cleaning. This would inevitably lead to contamination. Thus, critical parts of the facility must either be designed to be completely open or completely closed.[3] The use of conduits for bundling cables is often recommended for such cases. However, dead spaces can also occur in conduits (when they are damaged).

[3] Damages to seals due to mechanical stress, in particular, can lead to dead spaces on plug connectors. Therefore, regular inspections are recommended.

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Since connectors have indispensable connecting elements (because they combine two elements: the cable and the mounting side), they must always be checked and well cleaned regularly during normal operations.

Installation site

The user must ensure that outgoing cables from the plug-in connection are routed in conformity with the applicable national safety, health and hygiene regulations (e.g. routed in suitable trays). Therefore, the cables should be routed away from common traffic/transport paths to prevent risks of personnel tripping or damage to machinery, vehicles and tools. Sufficient strain relief can be achieved, for example, by routing in accordance with DIN VDE 0100-520: 2013-06 (Low-voltage electrical installations - Part 5-52: Selection and erection of electrical equipment, cable and wiring systems).
The following mounting/fastening distances, depending on the cable cross-section in use, are specified:

Outer diameter of the cables (mm)	Maximum distance between fastening (mm)	
	horizontal	vertical
D ≤ 9	250	400
D < D < 15	300	400
15 < D < 20	350	450
20 < D < 40	400	550

Table 1: Mounting/fastening distances depending on cable cross-section

Overview of the applicable standards:

Standard	Description	Facility manufacturer	Facility operator
EN 1672-2	General design guidelines - Part 2: Hygiene requirements	Must be considered by the facility engineer when designing the machines	
EC 1935/2004	Materials and objects which are intended to come into contact with foodstuffs	Must be followed when selecting food-contact materials	
Plastic regulation 10/2011	Individual measures for plastics (specialisation of the EC1935/2004)	Follow this when selecting food-contact material made of plastic	
FDA sub-section C: 21 CFR § 177	Regulations concerning food-contact materials from the US Food and Drug Administration	Follow when planning the food-contact material in facilities	
DIN 10516	Cleaning and disinfection	Should be planned by the manufacturer of the facility	Should be carried out by the operator at the scheduled interval
EHEDG: European Hygienic Engineering & Design Group	A community of experts from machine and component manufacturers, as well as experts from the food industry, research institutes and health agencies	Influences EN 1672-2	

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