Ammeraal Beltech

Food Safety Guidelines
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Content

1. Introduction

The focus of the Ammeraal Beltech Food Safety Guidelines is on the impact that our belting products and components have on food safety throughout the Food Industry.

These guidelines are applicable to the entire industry and to every industry segment from Bakery to Beverage. At every level, including manufacturing, processing, packaging and storage, the Food Industry is sensitive to issues of food safety. The goal of all major food companies is to eliminate any claims regarding foreign bodies and contaminations in their products. This is an area where there should never be a question of "compromise in quality", as the EHEDG put it in their World Congress 2018 statement. In fact, food safety belting solutions are an area where price setting isn't, or shouldn't be, a major factor in decision-making, since any failure to maintain proper food safety could ultimately be a great deal more expensive: such a failure carries the cost of the risk of contaminated food, damage to human health, higher production waste, product recall and serious damage to brand image.

These guidelines are for internal use **only**. They were created for the benefit of the Ammeraal Beltech (AB) Conveyor Belt division of Ammega, AB salesman and AB central and local management; they weren't written for distributors, re-sellers, OEMs or Food Industry end users, who can instead rely on advice and assistance from the AB team. What's more, this document is "live", and we will be looking to add new instructions and to update it continuously so as to include any additional new products.
In addition, it should be noted that these guidelines are focused on Ammeraal Beltech solutions regarding food safety and do not cover details of competitor's food safety products or solutions. At the same time, because our own extensive knowledge in the field of hygiene and food safety as related to the Belting industry is a clear business advantage, and because this knowledge was used to create these guidelines, any quality issues, sales arguments or product or fabrication choices that are **not** aligned to these guidelines could damage AB business and the company's reputation. A company culture of concern for food safety and Hygiene is essential to achieve belting business success in the Food Industry.

N.B. The EHEDG Guideline Documents. No. 43 "Hygienic Design of belt conveyors for the Food Industry" is a useful additional resource for the readers of these guidelines, even though it is quite generic and does not specifically deal with Ammeraal Beltech wide range of product solutions.

Giuseppe Allais
Global Food Manager

2. Restrictions on copying and distribution

The ***Food Safety Guidelines*** are the property of Ammeraal Beltech, part of the Ammega Group. Copying and distributing full texts or extracts of these guidelines without the written approval of the author is not permitted.

3. Scope of the guidelines

The scope of these guidelines is to:

- Teach – via the support of the AB sales force – the Food Industry and the AB distributors active within this industry how to choose belting solutions and components in light of food safety, cleaning issues, and the risks of contamination
- Provide as many food safety benefits as possible to Food Industry end users and OEMs
- Establish the main food safety sales arguments regarding belting solutions that the AB sales network (including distributors) can use with end users and OEMs
- Consolidate knowledge regarding hygiene and safety demands in the Food Industry
- Improve Ammeraal Beltech food safety product quality
- Align all Ammeraal Beltech food safety sales arguments

In every food manufacturing facility, no matter which segment (i.e., processing, packaging, or storage), there is always a risk of contamination.

From our perspective, by offering our experience regarding belting and food safety, we are helping to protect companies against the risk of contamination or pollution from:

- fragments of belts and/or accessories
- foreign bodies (excluding fragments of belts and/or accessories)
- improper equipment or conveyor frame and/or component design
- inadequate or incorrect sanitising, cleaning and/or disinfecting
- chemical migration contamination from the belt

In the end, our goal is to reduce the risk to the Food Industry from:

- consumer deaths, injuries, or sickness
- product recall
- product withdrawal from the market
- product substitution
- claims for damages or other lawsuits, including class-action lawsuits
- damage to brand image
- lost production time
- legislation involving economic penalties for food producers

4. Hygiene and food safety definitions

The concept of **hygiene** is a particularly broad one, and there are several definitions of "hygiene" as related to cleanliness, health, and medicine. From our standpoint, the most useful definition is:
A set of practices performed for the preservation of health among food consumers and for the prevention of the spread of diseases.

On the other hand, the definition of **food safety** is simpler and more specific:
food safety is a discipline involving food handling, food processing, and food storage to prevent food contamination or poisoning.

As we have already noted, no compromises should ever be permitted regarding food safety. Regarding this, it's important to note that risks of contamination are directly related to the quantity of liquid contained in the foodstuff, as dry food processing is less susceptible to such incidents. In fact, the segments most prone to such risks are the beverage and dairy industries, whereas the bakery industry has a much lower level of risk, thanks to the heat component from the oven, which reduces viral and bacterial numbers.

The table below shows the level of risk in every main Food Industry segment

Food Industry Segments	Belting Hygiene risk levels
Fish, Meat & Poultry	Very high
Fruit and Vegetable processing	High
Dairy	Very high
Cereals, Milling and Grains	Low
Confectionery and Sugar	High
Baking	Low
Snack Food	Low
Beverage	Very high

This matrix is even a support to discern high to low belting hygienic risk assessment.
As from the EHEDG doc. 43 guideline in lower risk applications possible deviation from hygienic design standard

5. Basic hygiene facts

Hygienic food processing environments are fundamental to every Food Industry. It's important to deal with both what we can see with the human eye (such as mildew or foreign bodies in the foodstuff) and what we cannot detect visually (such as biofilm), because visible and invisible contamination are equally dangerous. It is for this reason that we carry out both cleaning and sanitising.

Biofilm comprises any group of microorganisms (MO) in which cells stick to each other on a surface. There are five stages in the development of biofilm: (1) Initial attachment, (2)

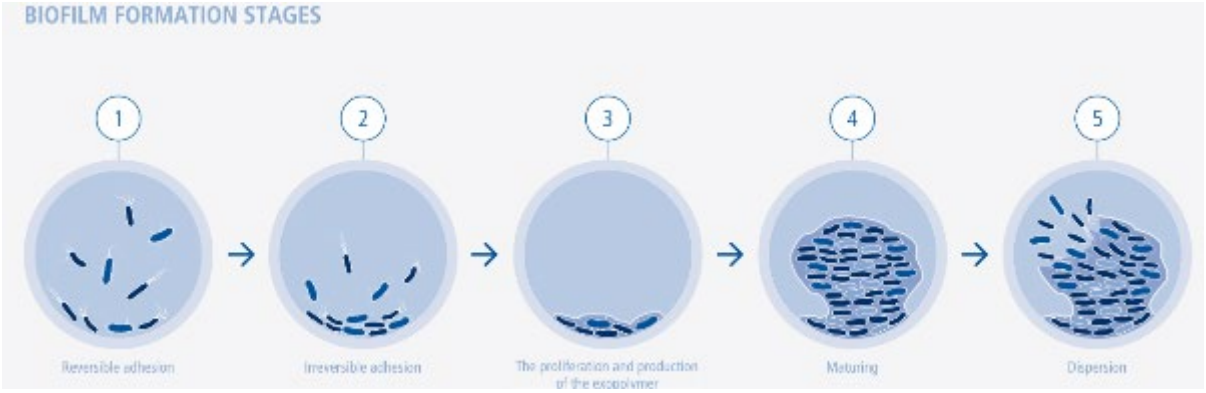


FIGURE 1: BIOFILM STAGES

Irreversible adhesion, (3) Proliferation (4) Maturation and (5) Dispersion.
Biofilm is difficult to eliminate, as it is highly resistant to conventional cleaning, disinfection and sanitation processes. It can be found in all those environments in which bacteria naturally exist, in natural, clinical or food production environments, given that it only requires conditions of moisture and a minimal presence of nutrients in order to develop.

The most common system for identifying the presence of biofilm is with an ATP test: this is a quick process measuring actively growing microorganisms through the detection of adenosine triphosphate (ATP). ATP testing tools are inexpensive and available all over the globe.

FIGURE 2: ATP TEST TOOL

The most common dangerous microorganisms are:

- Listeria monocytogenes
- Campylobacter
- Salmonella
- Clostridium botulinum
- Escherichia coli
- Vibrio cholera

To make belts and parts of the conveyor frame easier to clean thoroughly, smooth surfaces are superior to rough surfaces. A glossy belt, for instance, is easier to clean than a belt with a matt or a profiled belt surface. Rough belt surfaces or materials prone to air bubbles are a serious issue for hygiene as they will end up collecting parts of the product, which will become almost impossible to remove. Similar hygiene problems occur with belt components or accessories that have cavities. Every belt with a complex design or with rough surfaces represents a

hygiene risk, as does every additional millimeter of surface area. To improve cleaning efficiency, the surface area (in mm2) of belts and accessories should be reduced as much as possible.

All components or accessories from thermoplastic parts welded directly on the belts, as well as belt and conveyor components such as sprockets, scrapers, pulleys, land other mechanical parts, are subject to the same principles described above: less surface area means easier, faster and more efficient cleaning.

Another rule of hygiene involves the importance of **round design.** Sharp corners are difficult to clean, no matter what system or tool you use. A square corner, even one with an open angle, will always be much more difficult to clean than a round corner. To help in cleaning, a minimum corner radius of approximately 5 mm is recommended for either dry or wet applications. In any case, the belt and components on the conveyor system need to comply with FG standards and the end user's HAACP program.

FIGURE 3: ROUND VS. SHARP CORNERS

Mold is a fungus that grows in the form of multicellular filaments. In contrast, fungi that can adopt a single-celled growth habit are called yeasts.
Mold are fungi that stick on wet surfaces, including belts.
Every belt even with AM cannot slow down all thousands of molds, this is a dream of many customers looking to don't clean the belt while it's always necessary.
Anyhow if your end user is working with a felt or cotton belt, in the time will jump to a polyester base belt the mold certainly will be reduced.

6. Contamination

Contamination is defined as: *the introduction of any biological or chemical agent foreign matter or substance not intentionally added to a food product which may compromise product safety or suitability.*

Types of contamination include:

- Chemical
- Biological
- Foreign bodies
- Allergenic

Incidents involving chemical (approx. 40%), biological (approx. 30%) and allergenic (approx. 10%) contamination form approximately 80% of all contamination incidents, while foreign bodies represent only about 6%.

Cross-contamination is the transfer of harmful bacteria to **food** from other foods, cutting boards, utensils, etc., if they are not handled properly.

EHEDG Guideline No. 8 describe Food contact surfaces as follow.
Surfaces which are exposed intentionally or unintentionally to the product and surfaces from which splashed product, condensate, liquids or materials may drain, drop, diffuse or be drawn into the product or onto product contact surfaces or surfaces that come into contact with product contact surfaces of packaging materials.
From mentioned principles Food Safety need to be applied not only to the belt surface but to the entire conveyor components as for examples, pulleys, sprocket, retainers, guides etc.

7. Cleaning, sanitation and disinfection

The term "cleaning" is frequently abused, as are the terms "disinfection" and "sanitation". We should be careful to use them correctly, as the meaning behind each of them is quite different:

- **Cleaning** is the process of removing unwanted substances, such as soil, dirt, infectious agents or other impurities from an object or an environment.
- **Disinfection** it's the second step after cleaning to obtain the microbe-free level.
- **Sanitation** it's cleaning and disinfection together with the meaning of both steps.

Broadly speaking, cleaning is achieved through mechanical action and/or solvent action; many methods rely on both processes. Below is a list of cleaning methods:

- *Washing*, usually done with water and often some kind of soap or detergent
- *Pressure washing*, using a high-pressure stream of water
- *Abrasive blasting*, typically used to remove bulk material from a surface, may be used to remove contaminants as well
- *Acoustic cleaning*, the use of sound waves to shake particulates loose from surfaces
- *Ultrasonic cleaning*, using ultrasound, usually at frequencies from 20–400 kHz

- *Carbon dioxide cleaning*, a group of methods for cleaning and sterilizing that uses carbon dioxide in its various phases
- *Dry cleaning* of clothing and textiles, using a chemical solvent rather than water
- *Flame cleaning* of structural steel with an oxyacetylene flame
- *Green cleaning*, using environmentally friendly methods and products
- *Plasma cleaning*, using energetic plasma or dielectric barrier discharge plasma created from various gases
- *Sputter cleaning*, performed in a vacuum by bombarding the surface with ions
- *Steam cleaning,* in both domestic and industrial contexts
- *Thermal cleaning,* in industrial settings, involving pyrolysis and oxidation
- *Wet cleaning,* methods of professional laundering that avoid the use of chemical solvents

Disinfecting vs. sanitising

To "disinfect" is not the same as "sanitise."

When you disinfect, you use a chemical that can completely destroy all microbes.

The chemical is called a disinfectant. Depending on what kind of microbe a particular disinfectant can kill, the treated surface remains microbe-free. Most disinfectants can kill bacteria and pathogens that can cause several diseases. However, when you disinfect, the viruses and fungi present on the surface might not be eliminated. According to the EPA's guidelines, a disinfectant should reduce the level of pathogenic bacteria by 99.999 percent during a time frame of greater than 5 minutes but less than 10 minutes. Disinfecting involves not only the use of disinfectants such as bleach products but can also involve the use of heat to destroy pathogenic bacteria on surfaces.

On the other hand, when you sanitise, you use a chemical sanitiser. With a sanitiser, you are only reducing the number of microbes to a safe level. Like disinfectants, sanitisers can't kill viruses or fungi. According to the EPA's guidelines, a sanitiser should kill 99.999 percent of the infectious organisms present within 30 seconds.

The disinfecting and sanitising processes can both reduce microbial presence by 99.99 percent. However, disinfecting is regarded as the superior cleaning process, since it can also kill the spores of the microbes. Sanitisers can kill microbes on contact but cannot kill their spores, and if these spores remain viable, the microbes can start multiplying again.

The choice between disinfectants and sanitisers depends on the application setting. Disinfectants are greatly favoured for medical environments. Since medical settings always need to be free from pathogenic microbes, the use of disinfectants is strongly advised. In a Food Industry environment, sanitizing is sufficient. However, both disinfectants and sanitizers can harm the environment, so if there is no compelling need to use them, an all-purpose cleaner or even just soap and water are fine.

Before you disinfect or sanitise any surface, you should first clean the surfaces. Disinfectants and sanitisers should form the final process in dealing with unclean surfaces.

In summary, we can say:

There is an important difference between cleaning and sanitation; they are, in general, two separate processes with two different definitions. "Clean" means that food particles and other visible substances have been removed from surfaces. When items are "sanitized" or "disinfected", it means that those surfaces have undergone a reduction in pathogens.

Cleaning is a process to remove parts of sticky products as food product, dirt, dust and clutter on surfaces. Sanitation is a process to make something sanitary (almost free of MO - microorganisms) by sterilizing.
(Some cleaning agents can kill bacteria and clean at the same time; they can, that is, both clean and sanitize.)

I. When you disinfect, you use a chemical that can completely destroy all microbes. The chemical is called a disinfectant.
II. On the other hand, when you sanitise, you use a chemical sanitiser. With a sanitiser, you can only reduce the number of microbes to a safe level.
III. Both the disinfecting and sanitising processes reduce microbial presence by 99.99 percent. However, disinfecting is regarded as the superior cleaning process, since it can also kill the spores of the microbes.

It is a basic rule that every belt, even a brand new belt, needs final cleaning and sanitation.

There are no "ready-to-buy" belts with sufficient inherent hygienic or aseptic properties available on the market from any belting supplier (such belts would be useless in any case – please see the section on Belt installation and Packaging to further understand why). Even belts packed in vacuum-sealed bags are not sufficiently clean or safe to be installed on a Food Industry processing conveyor "as is". Every belt and every component needs cleaning and sanitation before it is used in food processing, and this should preferably take place in situ on the conveyor, to avoid the risk of contamination or pollution when moving it from where it's been cleaned to its final working position.

Belting systems operate in either dry or wet environments; cleaning can take place either off-line (i.e., by disassembling the belt from the conveyor frame) or on-line (i.e., in place on the conveyor).

Wet cleaning by water-jet or via spray bar installed on Cleaning stations should not exceed 20 bar pressure for an effecting soil removal without risks of belt damaging.

On-line cleaning can take place while the belt is running via Cleaning-In-Place (C.I.P.) stations; this is described as C.I.M., or Cleaning In Motion.
Systems are available for dry or wet cleaning.

In the industry, we find far fewer C.I.P. dry stations and many more C.I.P. wet stations.
Dry cleaning stations utilize rotating motorized brushes and/or belt scrapers.
The cleaning efficiency of brushes is always limited as dirt and other residue are not completely removed but instead remain circulating inside the brush. In addition, all brushes are intrinsically at risk of introducing their own foreign bodies (e.g., bristles or bristle fragments) as well.

FIGURE 4: DRY CIP STATION

Wet C.I.P. stations use liquid jet sprays or steam from nozzles. Spraying nozzles are fixed or mobile; frequently, mobile nozzles move in a circular pattern so as to spray liquids over the entire surface of the belts, bottom as well as conveying. The C.I.P. stations with fixed nozzles might damage belt surfaces as they concentrate the stress factor from their jets on one particular area or line.
The liquid used is water together with a chemical detergent at a certain density or percentage of volume.

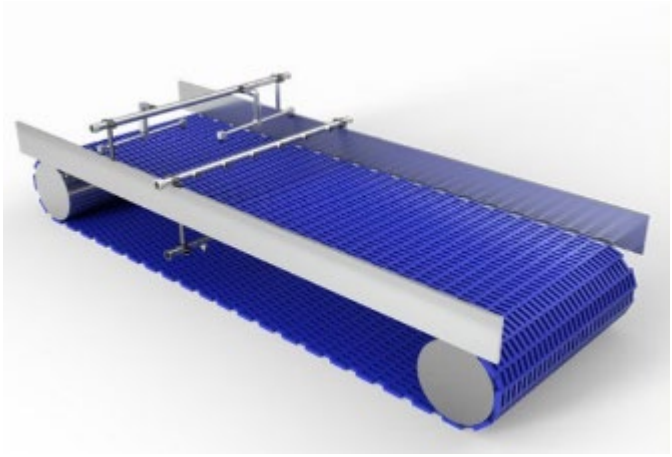


FIGURE 5: WET CIP STATION

Often, the operations that clean, sanitize and disinfect working areas, equipment and belts must take place frequently, in order to maintain proper food safety. Automated water/detergent mixing systems can reduce cleaning time and improve cleaning efficiency.
Such automatic cleaning systems, with valve control units for mixing water, chemical and disinfectant solutions are currently available on the market.
As it is usual in the Food Industry to clean the equipment at a pre-scheduled time every shift, the use of cleaning control units that mix the detergent and water and apply it automatically is a practical, timesaving and labor-saving solution.

FIGURE 6: AUTOMATIC CLEANING SYSTEM WITH DETERGENT & WATER MIXING UNIT

On the other hand, cleaning by steam, either manually or via C.I.P. stations is not a solution that can be applied to our products as this process is damaging to the belts due to too high temperatures and humidity.

Steam sanitation its' normally made at +120/+130°C.

OEM must comply the EC legislation 2006/42 Directive asking to input instructions on cleaning and disinfection.

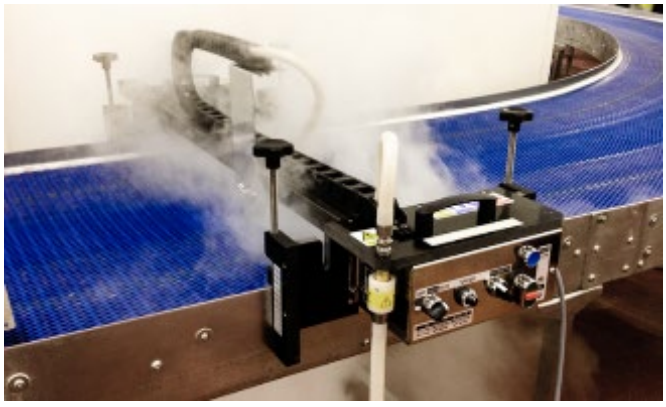


FIGURE 7: SANITATION BY STEAM CIP STATION

8. Food grade (FG) standards

FG requirements must be considered from the beginning of your business relationship (and certainly before you deliver a quotation) with your end user or OEM because it's almost impossible to make the changes necessary to meet the criteria for FG certification in a timely fashion afterwards if, for instance, the end user fails a food safety audit.
The belt itself is not the focus of these standards; belt materials are. It is also important how a belt is handled as part of a production process. There are no prescribed industry-wide standard belt requirements and, in general, there are no time limitations to the validity of approvals for materials or application standards. Once these standards have been met, they will normally remain valid for as long as there is no change to material or construction. Material standards are the most commonly encountered standards, application standards are less common. The data sheet for each belt type lists which standards that particular belt meets.

Types of standards
Material standards (1), Application standards (2) and Industry standards (3)

Material standards involve the raw materials that are allowed to come into contact with both unpacked and packed food. In most cases, approval for material standards is obtained by the raw material suppliers.

An example of this would be: EU 10/2011

Application standards pertain to the overall construction of a belt for a particular application. Usually, the belt cover must meet a material standard first. In this case, approval is always subject to a test by an official institute.
An example of this would be: 3A

Industry standards relate to the use of the belt in an industry or a group of industries.
An example of this would be: ISO 22.000.
If a customer is exporting equipment, it's important to determine which standards are applicable, the standards of the export/import country

For the Food Industry, we adhere to the following standards:

- EC 1935/2004 and EU 10/2011
- FDA

It should be noted that we are also working towards the Chinese GB 4806.1-2016 Food Grade certificate, also simply known as" Guobiao".

EC Directives (Fork and Glass logo)

Within the framework provided by Regulation EC 1935/2004 regarding permissible food contact materials, Regulation EU 10/2011 applies to plastics that are intended to come into contact with foodstuffs. Products that comply with EC 1935/2004 (including, of course, those that comply with Regulation EU 10/2011), can bear the Fork and Glass logo. The principle behind these regulations is that food contact materials should be safe and should not capable of transferring component substances (i.e., migration) into the foodstuff in unacceptable quantities. The EU legislation for food contact materials is based on lists of permitted

substances and maximum limits of migration into food. Only permitted substances may be used in the manufacture of food contact plastics. The framework regulation EC 1935/2004 replaces the former framework, Directives 89/109/EEC and 80/590/EEC. The Regulation EU 10/2011 replaces Directive 2002/72/EC (with amendments 2004/1/EC, 2004/19/EC and 2007/19/EC). This Directive had previously replaced a former directive, Directive 90/128/EEC (with amendments 92/39/EEC, 93/9/EEC, 95/3/EC, 96/11/EC, 99/91/EC, 2001/62/EC, and 2002/17/EC).

Ammeraal Beltech product datasheets indicate which, if any, FG standards the products meet. A typical AB datasheet might include text such as:
Characteristics:
Food grade (FG) Yes, compliant with EC 1935/2004 (and amendments); food contact surface compliant with FDA

FIGURE 8: TYPICAL AMMERAAL BELTECH DATASHEET WITH FOOD GRADE STATEMENTS

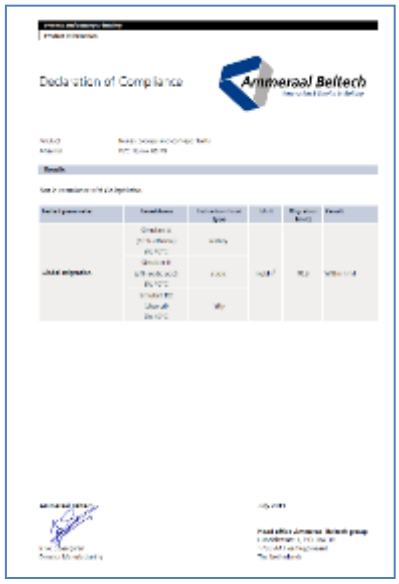
In addition, there are AB declarations that cover the EC and EU together on one page, and the FDA on a separate page.

FIGURE 9: FOOD GRADE DECLARATION EC 1935

FIGURE 10: FOOD GRADE DECLARATION FDA

These declarations, made in accords with the rights we have within the European community, are documents that show the market that we are meeting FG standards.

We have the right to show the Fork and Glass logo from the EC on the FG declaration, but we cannot reproduce the FDA logo.
At times, these self-declarations are wrongly judged as insufficient proof that we are meeting FG standards, and therefore we can also offer an additional declaration showing that we are within the migration limits.



Please note that we always refuse to share migration test laboratory results in any form to avoid unhelpful discussions on migration levels from our products vs. those of the competition.

FIGURE 11: FOOD GRADE DECLARATION ON MIGRATION LEVEL

FDA

The American Food and Drug Administration (FDA) of the Public Health Service of the U.S. Department of Health, Education and Welfare is the world's best-known authority involved in consumer protection against potential detrimental influences from the inclusion of any substances or ingredients of an unacceptable nature in foodstuffs. Many countries, including Australia and nations in South America and Asia follow FDA food grade standards.

The FDA has prepared a review "Title 21: Code of Federal Regulations" regarding their approval of raw materials in a processed or finished state and specified the conditions under which that approval is valid.

Different paragraphs of the document refer to different substances. Below is a short list of some of the pertinent paragraphs:
175.300 – for resinous and polymeric coatings
178.2010 – for antioxidants and/or stabilizers for polymers
178.3740 – plasticizers in polymeric substances

Ammeraal Beltech belts that meet FDA standards for wrapped and unwrapped food and for dry and wet foodstuff have a top cover made of approved materials.

For EC, EU and FDA food grade standards, no distinction is made between the belt and the component accessories; even though the accessories may, in fact, never come in direct contact with stuff, they still need to comply with the applicable standards, as they have the potential to pollute the food.

Additional FG standards
There are additional, sometimes mandatory, FG standards that apply to Food Industry segments and therefore to the AB belting business.

USDA (Meat & poultry)

Approval from the United States Department of Agriculture – Meat & Poultry Inspection (USDA), means that a belt can be used in the meat and poultry industry in the USA. An approval will be granted if:
- the coating meets the FDA regulations, and
- the USDA has subsequently inspected and approved the construction of the belt.

If these criteria are met, the belt will be listed in the Meat & Poultry Equipment Program's Accepted Equipment List. Any previously issued statement becomes invalid and can no longer be used as an authorization.

3-A

Approval from the American 3-A Sanitary Standards Committee means that a belt can be used in the US Dairy Industry. The standards apply to belt covers are described as follow:
Serial #18-00 for multiple-use rubber and rubber-like material (PUR, Silicone): approved covers include Ropanyl 93 white and Silam R55
Serial #20-15 for multiple-use plastic materials (PVC): there are no approved covers yet

NSF (National Sanitary Foundation)

Approval from the American National Sanitary Foundation (NSF) means a belt is suitable for specific segments in the Food Industry in the USA (meat and grocery chains). NSF takes into consideration both materials and belt construction.

HACCP /ISO 22.000 - Hazard Analysis and Critical Control Points (No official logo available)
The HACCP it's not valid anymore but still a very famous Food Industry Standard.
HACCP certificates issued after 1 January 2018 will expire from 1st of January 2021.
Starting on 1st January 2020, no new certificates will be issued.
Any certificates issued based on the HACCP certification programme, and which have not expired, been terminated, suspended or withdrawn by 1 January 2021, will no longer be considered valid from that date. To protect consumers with an useful level of Food Safety the reference standard will be the ISO 22.000.
As a belt supplier, AB doesn't need to meet HAACP or ISO 22.000 standards as they aren't applicable to the Belting Industry. Instead, these standards are pertinent to the Food Industry and not to individual industrial components such as conveyor belts within that industry.
HACCP was a management system in which food safety is addressed through the analysis and control of biological, chemical and physical hazards (that may cause a food product to be unsafe for human consumption) from the stage of raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product.

For successful implementation of an HACCP plan, management must be strongly committed to the HACCP concept.

HACCP was based around seven established principles:
1. Hazard analysis, which is the determination of food safety hazards and the identification of preventive measures to control these hazards
2. The identification of critical control points, or CCPs, which are points, steps or procedures within a food processing or manufacturing system at which control can be applied and, as a result, a food safety hazard can be prevented, eliminated, or reduced to an acceptable level
3. The establishment of critical limits, which is to say is the maximum/minimum value to which a hazard must be controlled at a CCP to prevent, eliminate, or reduce the hazard to an acceptable level.
4. Monitoring critical levels, which is necessary to ensure that the process is under control at each CCP.
5. The establishment of corrective actions, measures to be taken in case of a deviation from an established critical limit, such measures being intended to ensure that no deviating product enters commerce
6. The creation of procedures for verifying that the HACCP system is working as intended and that that the plans accomplish their goal, the production of a safe product. (Plants have to validate their own HACCP plans to verify that the HACCP plan is adequate and working as intended)
7. The establishment of proper record-keeping procedures to ensure that certain documents, including a hazard analysis overview and a written HACCP plan, are preserved, and that records documenting the monitoring of CCP's, critical limits, verification activities, and the handling of processing deviations are kept

Belts that are being sold on the market under descriptions that include the term "HACCP" do not, in fact, meet any set of mandatory standards. A document to support our true position regarding HACCP programs is available on Infonet under the title "HAACP Programs and Belting Products".

The Food Industry has to apply HAACP standards, but these specifications are decided individually, at company level. Criteria for belts and belt components could, of course, form part of those standards; for example, companies might decide that blue belts or antimicrobial belts were necessary on food processing lines.

FIGURE 12: AMMERAAL BELTECH STATEMENT ON HACCP

BRC British Retail Consortium

British Retail Consortium Global Standards do not set legislative criteria to which belting companies need to comply. However, BRC Global Standards is a market-leading global brand that helps build confidence in the supply chain; their criteria for food safety, packaging and packaging materials, storage and distribution, as well as agent and broker behavior, all set the benchmark for good manufacturing practice and help provide assurance to customers that their products are safe, legal and of high quality. BRC is one of the food safety standards recognized by the Global Food Safety Initiative (GFSI), an international initiative whose main purpose is to strengthen and promote food security along the whole supply chain.

Recently, the GFSI succeeded in getting some international retailers (including Carrefour, Tesco, Metro and Migros) to accept the concept of equal validity and interchangeability between the standards recognized by the GFSI itself, thus reducing the duplication of claims compliance with similar or identical standards.

Approval by the BRC is, therefore, a very useful prerequisite for exporting food products, and is a recognized guarantee tool for company reliability.

EHEDG European Hygienic Engineering Design Group

The EHEDG was founded in 1989 as a non-profit consortium of equipment manufacturers, food producers, suppliers to the Food Industry, research institutes and universities, public health authorities and governmental organizations. Ammeraal Beltech has been a member since 2011, contributing actively to the EHEDG Guidelines' focus on food safety. In particular, we developed Guideline Document No. 43: Hygienic design of belt conveyors for the Food Industry. Certification from the EHEDG falls into the “nice-to-have” category; while such certification is not mandatory in belting, it is recognized as a powerful statement.

BfR The Federal Institute for Risk Assessment (BfR) recommendation for "Plastics in the foodstuff chain".

The Federal Institute for Risk Assessment - previously the Federal Institute for Consumer Health Protection and Veterinary Medicine (BgVV) - was created to increase health protection for consumers; it issues scientific recommendations and creates and distributes educational material regarding possible health risks from materials that come into contact with foodstuff. These recommendations are listed in the "Recommendations within the framework of the German Food and Feed Code (LFGB)".

9. Ammeraal Beltech food safety belting solutions

The following chapters are dedicated to your next food safety belting consultancy.
The chapter topics include food safety instructions and the sales arguments that can be made to promote AB product solutions within the Food industry.
From a hygiene and food safety point of view, if you look at those product families that are focused on the Food Industry, you can identify the following categories:

1. Soliflex friction drive
2. Rapplon elastic homogeneous belt
3. Solicord
4. Soliflex PRO & Mini, CB and FB positive drive
5. Synthetic
6. Lightweight rubber
7. Permaline
8. ZipLink®
9. Peak
10. Ultrascreen
11. AmDough
12. Timing Belts
13. Ultrasync
14. Plastic Modular
15. Steel chains

You should keep this entire list in mind - no matter which specific market segment you're working with - as you consider different solutions for the Food Industry.

As Ammeraal Beltech, we have a long history in the Food Industry, and over the years, we have come up with many food safety solutions. There are food safety solutions for nearly every product family that we've listed here, and there are explanations, too, for why to choose a particular belt for each application.

To choose the correct food safety belt solution, it’s always necessary to evaluate:

- hygiene requirements
- maintenance requirements
- cleaning and sanitation frequency and methods

This evaluation is independent of and in addition to the PPLESC method of determining the proper product choice.

There are food safety belt features common to all product families and there are solution features that only apply to one product family.

Examples of AB food safety solutions include the following:

- ✓ Blue belts
- ✓ KleenEdge non-fray Synthetic belts
- ✓ Pinless easy-to-clean Modular belts
- ✓ Single-link Modular belts
- ✓ Antimicrobial synthetic belts
- ✓ Ultrascraper metal detectable scraper
- ✓ Pop-up flight hygienic product support
- ✓ AmSeal sealed edges

- ✓ Soliflex homogeneous hygienic design belts
- ✓ TPN Footless carriers
- ✓ Ultraclean non-stick compound belts
- ✓ Matt M1 non-stick belt finish

Within these guidelines, we are focussing on the consequences on a food safety level of our belt solution selection.

10. Belt colour

One of the most effective basic supports for food safety is the colour of belts and their components, and it's an important area in which we can leverage the benefits that we can offer, perhaps in part because of the number of mistakes that are routinely made regarding this aspect of conveying.
Choosing a belt color that exhibits the highest contrast to the color of the final food product to be processed or conveyed will drastically reduce the risk that fragments from the belting product could contaminate food.

As a belting company, we should be focused on this topic to protect our market position. That's why, for instance, transparent belts and components cannot be supplied to the food industry at all! Transparent belt material makes it very difficult to spot any contamination from belt fragments to the foodstuff and represents an unacceptable risk to food safety for end consumers. Transparent tracking ropes and guides should not be considered even if they are certified for different food grades. Transparent belts, including belting products made with transparent layers, are simply not welcome in the food industry. In fact, even a belt with different surfaces in different colors represents a risk to food safety.

When choosing a belt color (either white or blue), that choice should apply to all the belt product surfaces. All the belts and components in one processing line and dedicated to one food recipe need to be color-aligned, i.e., either all white or all blue. No matter which belt product family it is (round belt, timing belt, endless woven, or homogeneous) all the belts and components need to match with the one color that has been selected.

From a food safety point of view, every belt, belt component, and accessory in a system should:

- be one color, and they should all be the same color
- not be transparent or have transparent layers
- be one uniform color on every surface, and that color should exactly match the color of the conveying side of the belt

In the picture on the right, the clear difference in contrast between the dough being processed and the white belt on the one hand and, blue belt on the other is obvious. On the white belt, it's hard to even spot the sticky product on the surface, while on the blue we can perceive the position and even the quantity of the dough in the blink of an eye.

In food processing, it's all about either blue or white. Green and black belts and components are usually non-food grade and should therefore be out of the running for any recommended solutions, even those for logistics or packaging applications where there is no direct contact with foodstuff. You should instead only recommend either white or blue belts; at present, these colors are dominant in the Food Industry for reasons of optical hygiene detection.
Whether the market (or the customer) wants white or blue belts is immaterial; the main factor in making a color choice is the color of the product being processed. With that information, you can make an informed choice and give the customer an appropriate explanation that is related to food safety risks.

FIGURE 13: WHITE & BLUE BELT COLOUR DIFFERENCES

If your end user happens to be processing foodstuff of varying colors, you should choose the belt and component color with the best average contrast across those colors. In theory, every foodstuff needs its own high-contrast color, but in practice, the Food Industry uses mainly white or blue belting solutions. There is no preference (except for that regarding the product/ belt contrast) between white and blue belts in food processing. For instance, as you can see in the pictures below, white belts can be used with dark brown chocolates and blue belts can be used with white dough.

FIGURE 14: HIGH FOOD SAFETY EFFICIENCY ON BROWN CHOCOLATE WITH WHITE BELT

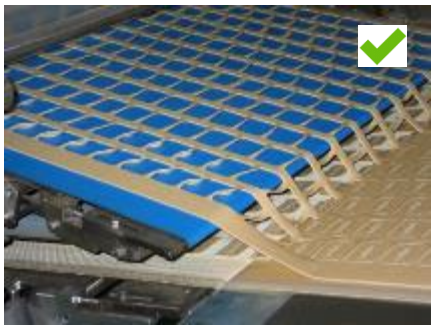


FIGURE 15: HIGH FOOD SAFETY EFFICIENCY ON BROWN DOUGH WITH LIGHT BLUE BELT

Poultry products are usually in between white and red meat on the color spectrum so you could choose either blue or white. At Ammeraal Beltech, we recommend **BLUE** color RAL 5015 (light blue) as, on average, it's the color that offers the most efficient contrast with the greatest number of foodstuffs.

Main benefits of white and blue belts:

- ✓ Greater accuracy in spotting contamination coming from belts into food products
- ✓ Easier recognition of belt sanitation level
- ✓ Easier overall quality control of food products

FIGURE 16: WHITE & BLUE BELT ON POULTRY PROCESSING

In summary, the rules about colour for belting products for the food industry are:

- No transparent belts or components at all
- Belt colour consistency: a belting product should be one colour on every layer
- The choice of belt colour depends on which colour affords the best contrast to the product being processed
- Green and black belts should not be included in your recommended solutions for the Food Industry, even in logistics and packaging
- Belt color should remain consistent at every step of the processing line

Product/belt reference matrix:

Product		White Belt	Blue Belt
Brown chocolate		Yes	No
Bakery dough		No	Yes
Red meat		Yes	No
Poultry		Yes	Yes
Green vegetables		Yes	Yes
Potatoes		No	Yes
White rice		No	Yes
Fish		No	Yes
Breads		No	Yes

Products like green vegetables, leafy greens/herbs, and fish need blue belts and components because some parts of them either are or might be white. In general, wherever it's necessary to switch from white to blue belts, you can expect the following benefits:

- Improved hygiene
- Less cross-contamination
- Less risk of product liability issues
- Higher visual aspects
- Modern design with a technical colour
- Improved belt image
- Cleaner belts and conveyors
- Extra antimicrobial treatment on synthetic belts
- Greater support for HAACP programme aims
- A reduction in eye fatigue

11. Cleaning agents

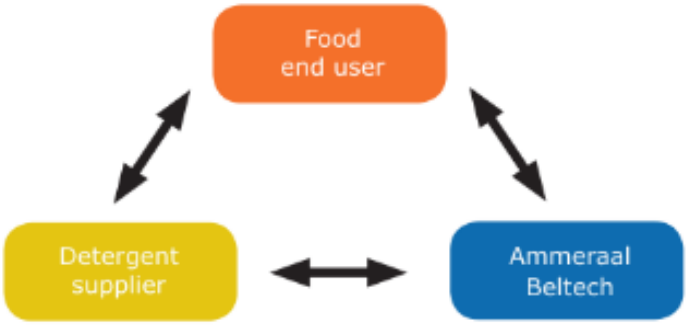
We often get questions about cleaning instructions from Food Industry end users of our belting solutions, and while these questions are always welcome, customer queries are often better addressed to their chemical detergent supplier.

As a belting company, we need to be very clear when giving information to our customers – we have to distinguish between our "Cleaning references" regarding the compatibility of the cleaning agent with the belting material and the detergent supplier's "Cleaning instructions" regarding how their product should be used.

We all know that there's a big difference between food products that are processed in dry or wet conditions (e.g. stickiness levels in confectionery compared to those in dairy). To cover all food-related applications, we have many different belts, and companies supplying detergents need a wide variety of products to clean them, and to clean them in light of the various processing factors (including fats and dry vs. wet).

The Food Industry end user should always:

1. In consultation with the detergent supplier, choose the appropriate cleaning agent, always considering food product quality.
2. Check with Ammeraal Beltech to find out about the resistance of the belt material to the particular cleaning agent.
3. Follow all the cleaning procedure instructions, including the detergent volume density percentage, from the supplier of the detergent



Incorrect cleaning methods and/or incompatibility between belt and chemical detergents can result in problems such as:

- Cracks on surfaces
- Discolourations or change of belt colour surfaces

Cleaning in dirty environments or improper environments, including in the open air, is a mistake that will negatively impact the cleaning process and lead to less than optimal results.

C.O.P. Cleaning Out of Place in a controlled specific environment it's a valid system removing the belt

FIGURE 17: CLEANING ON DIRTY ENVIRONMENT

Cleaning validation is the methodology used to assure that a particular cleaning process is effective in removing any residue of the active pharmaceutical ingredients of the cleaning product or any related microbial attributes from a piece of equipment or the cleaning aids utilized in the cleaning process.

The most common cleaning problems are caused by the wrong cleaning chemical agent volume density/volume percentage. Belts have been wrongly cleaned or sanitized with 100% chemical detergent, i.e., without any dilution at all. Even just one instance of cleaning with the wrong density could destroy the belt surface and/or modify the colour.

The compatibility of Ammeraal Beltech products with different cleaning agents is based largely on product families. There are certain products that require dry cleaning systems only, while other products can be cleaned in wet systems or even in both.

For Synthetic, Ultrasync and homogeneous Soliflex belts, cleaning instructions and restrictions are largely similar. Modular belts, on the other hand, have their own separate cleaning guidelines.

FIGURE 18: SANITATION STEP BY DETERGENT FOAM

Endless woven AmDough

Rotary moulder belts contain natural yarns and are therefore sensitive to humidity.

In our "Conditioning Instructions", we point out that neither steam nor water should be used at all, as otherwise the belt will quickly shrink and its yarns will be damaged. In other words, wet cleaning is inappropriate for AmDough. In fact, the lifetime for Amdough belts is pretty short because of the limited cleaning possibilities available. We could recommend just dry cleaning, but in fact we **do not have** any official cleaning instructions for AmDough belts.

12. Foreign bodies

Major Food Industry manufacturers have ranked the source of product contamination from foreign bodies; numbers 3, 4 and even 7 could come from parts of belts and/or components.

1	Insect	33%
2	Human hairs	24%
3	**Rigid plastic**	**10%**
4	**Flexible materials: film, bags**	**7%**
5	Wood	6%
6	Stone, rock	4%
7	**Metal***	**4%**
8	Leaves, skin, husks, stems	3%
9	String	3%
10	Nutshell, fruit stone, seed	2%
11	Bones	2%
12	Glue	1%

** #7 Metal could be caused by steel chains or by timing belts with steel cords*

That metal contamination stands at 4% shows us that even metal detectors and X-Ray machines are not infallible.

The greatest quantity of foreign bodies from belts come from yarns present in Synthetic belts; from lightweight and Heavy-duty rubber belts; and from cotton, wool and felt belts. Modular, homogeneous and even extruded belts contribute to a much smaller percentage of food contamination, as any parts that might break away from them are usually much bigger and consequently easier to detect and remove.

Figure 19: Broken belt side

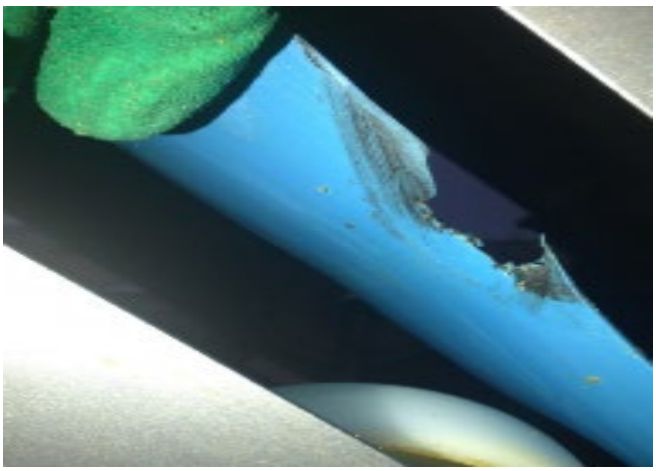


Figure 20: Broken bel side

Steel and slat chain belts rarely pollute food or beverage as they're made from strong materials that are difficult to break and easy to spot; their rather large fragments can be easily located by metal detectors and X-Ray machines.

The order of risk levels for foreign body contamination from AB belt types are as follows:

1. Cotton, felt and wool belts
2. Synthetic belts
3. Heavy-duty rubber belts
4. Plastic Modular belts
5. Homogeneous extruded belts
6. Steel chains

Cotton, felt and wool belts are made from short fibers that can lose multifilament yarns very easily from weft, warp and spun ends, even when twisted in woven fabric edges. Synthetic belts (based on woven polyester fabrics) are made from multi-filament yarns, spun yarns and monofilament yarns.

Monofilaments are useful for the weft and represent a lower risk of becoming foreign bodies as they exist in "one piece" and are pretty difficult to break.

The main risks come from the warp ends which could escape from the fabric at the belt sides during mistracking or due to friction from guiding blocks.

FIGURE 21: BELT YARN MOULDED INTO BISCUITS

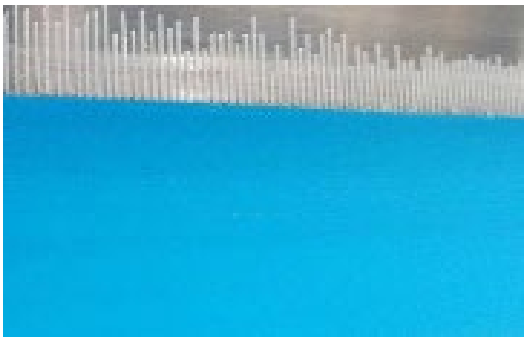


FIGURE 22: WEFT ENDS OUT OF BELT EDGE

FIGURE 23: BELT WARP YARNS

FIGURE 24: TRACKING BLOCK WEARING BELT EDGE

You should also consider that bad belt finishing as regards slitting could cause fraying, even on a homogeneous belt without fabric yarns – as shown in the following pictures.

Today, there are metal and other X-ray additives available for thermoplastic materials, making it possible to use metal detectors and X-ray machines to filter out foreign bodies coming from plastic belts. For further information, please see Chapter 32, *"Metal and X-Ray belting solutions".*

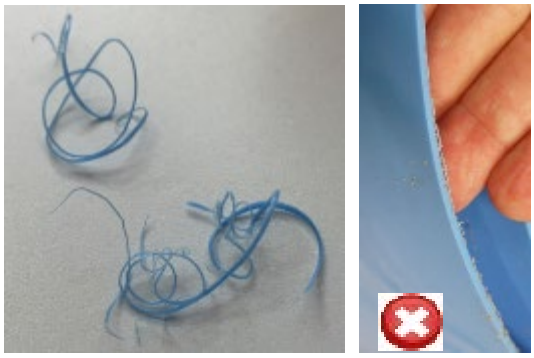


FIGURE 25: HOMOGENOUS BELT HAIRS

Components/accessories are much more susceptible to contributing foreign bodies than the belt body itself. Tracking ropes, flights, sealed edges, sidewalls, side tape curtains and other items can fragment or even detach from the belt body and pollute the food product.

Apart from the fraying from Synthetic belts, the most common source for foreign bodies coming from belting solutions are belt components and accessories.

There are a number of reasons that belt accessories/components present this risk:

- Low adhesion to the belt body
- Heavy loads
- Misstracking
- Heavy impact
- Fatigue from flexing
- Mistakes in fabrication
- High/low working temperatures
- Mechanical accidents

And many other factors that can lead to fragmentation.

FIGURE 26: BROKEN ACCESSORIES

13. Non-stick properties

Non-stick belt solutions contribute to food safety.
Non-stick belts come with many benefits and should be always preferred in food processing. A 100% non-stick solution is, unfortunately, not achievable, but all reduction in sticking helps. A belt with sticky food products adhering to its surfaces will mix fresh food ingredients with older foodstuff (potentially even expired foodstuff) and with dirt/dust and other contaminants from the environment, compromising both the flavour and the quality of the finished food product. The main element that distinguishes a non-stick belt surface is its reduced contact surface. For this reason, a matt belt finish should always be described as a profiled surface, highlighting its reduced contact surface.

Profiled belt surfaces are, in combination with the belt material, useful in ensuring non-stick performance. A matt finish, for instance, could be compared to sand paper, which is available in different degrees of roughness, achieved by surface density. Nevertheless, evaluating non-stick properties based on the quantity of air between the belt and the product does not produce a reliable value.

In the end, there is no definitive standard measurement of non-stick properties. The level of impact on non-stick characteristics from (1) material or (2) rough matt profiled surface is not possible to quantify theoretically. What's more, the possible combinations of materials, hardnesses and profiles, together with different food types and different physical states, are just too numerous. In order to evaluate whether the required non-stick level has been reached, a practical test, either in field or in the laboratory, is always required.
Matt finishes at Ammeraal Beltech are described with the terms M1 and M2, where "M" mean matt and 1 and 2 signify the level of rough.

You should consider that there is no relationship between the grip and release characteristics you feel with your hand and the release from the belt of the food product. This is often something that is not clear to Food Industry end users. Grip, release and non-stick performance for different products are often used interchangeably in belting discussions, particularly when someone is referring to his personal experience with “similar” products.

We strongly recommend that you test every release performance with the belt in order to avoid unfounded performance claims. The idea of grouping together similar foodstuffs and projecting the same non-stick belt properties often doesn't work. We could perhaps provide a generic guideline instead, with an understanding that it should always be followed with field testing. After all, one of the reasons why we have many different belts and finishes in our product range is because of the variations in grip and release properties.

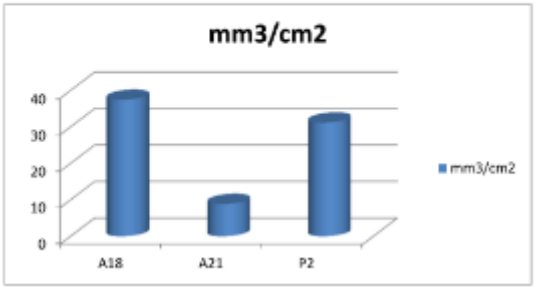
To start with, you should consider the different belt materials and their properties. Below is a list ranking non-stick Synthetic materials with EC 1935/2004, EU 10/2011, and FDA approval based on their performance properties (regardless of the specific food product in contact with the belt surface).
1. Silam (top performance)
2. Duraclean
3. Poliflex
4. Ropanyl
5. Ropanol
6. Nonex

Teflon belts from Chemprene are not listed for the restrictions of the min. diameters that frequently cannot match the needs of the small transfer point necessary in Food. Anyhow the Duraclean TPU+Teflon works out top release performance as particularly made for energy bars.

For Modular belts, the ranking is:
1. PVDF - Polyvinylidene fluoride
2. PE – Polyethylene
3. PP –Polypropylene
(Similar release properties were achieved with PEMI and PPMI, materials that are detectable by metal detectors and X-ray machines)

Negative pyramid profile volume

Profile	mm3/cm2
A18	37,45
A21	8,875
P2	31,2



For the non-stick performance of belt profiles, we cannot provide a clear view of the level of non-stick properties even though we can calculate the volume of air that exists between the product and the belt surface.

14. AmSeal and KleenSeal sealed edges

The Ammeraal Beltech sealed-edge solution described as "AmSeal" is, in general, applied to Synthetic belts and Ultrasync belts. In the Food Industry, such sealed edges can boost hygiene, as the plastic rope on the belt edges collect less product residue in comparison to slit edges with exposed fabric yarns. However, sealed edges, even wear-resistant sealed edges, cannot fully support food safety because there is no guarantee that the plastic parts of an AmSeal edge won't break, polluting the foodstuff. In addition, rough belt surfaces collect more liquid than smooth surfaces: a synthetic belt with impregnated fabric and an exposed rough surface is already a food safety risk. Belting solutions such as homogeneous belts, which do not require sealed edges, should be always preferred in food applications.

Wet food will easily stick to the belt edges of a slit Synthetic belt, particularly if fraying is present. Every fabric suffers from warp-end fraying; even EF, or polyester-flexible material, suffers from multifilament fraying from the weft. With AmSeal, we can protect fabrics from fraying, reducing the build-up of sticky product on the belt edges and making cleaning with water-jets easier so as to boost sanitation levels. Cleaning AmSeal-sealed belt edges is in fact much easier to do than cleaning slit edges with rough fabric where food particles can accumulate. On the other hand, benefits from AmSeal are limited regarding dry food processing, where Ammeraal Beltech prefers to work with non-fray Synthetic belts, largely because of the absence of the liquid factor. In bakery applications, the presence of liquids is limited and thus the proportional risk of products sticking to the edges is low.

Under the right conditions, however, AmSeal should be recognized as one of AB's top food safety solutions due to the lower level of particle adhesion and the longer lifetime of rope adhesion to the belt body, thanks to the wide welding design of the rope on the edges.

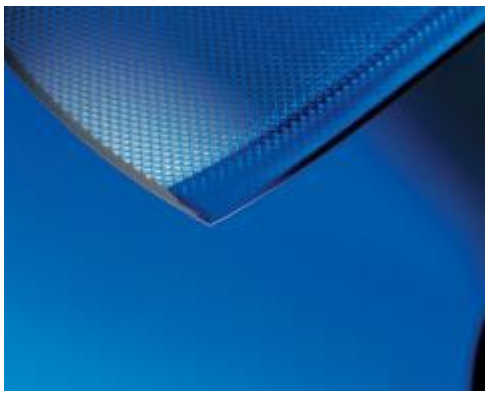
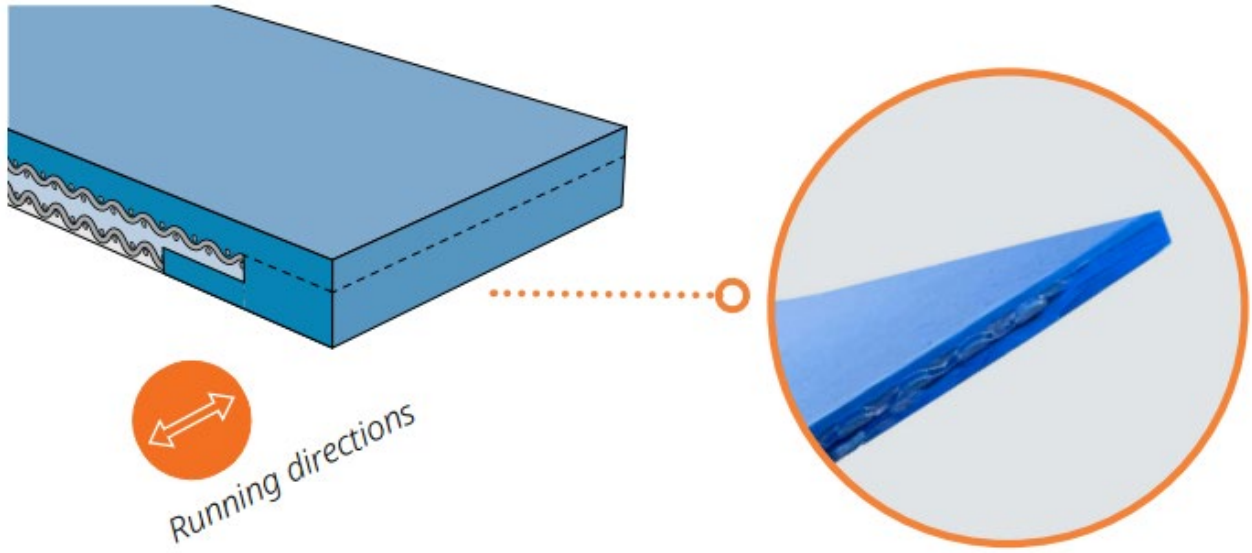


FIGURE 27: SEALED BELT EDGES AMSEAL

For Meat, Poultry and Fish, Dairy and Beverage, all segments with greater liquid presence in processing, AmSeal is highly recommended and as there are greater possibilities here that sticky wet particles might adhere to the belt edges. Water and other liquid on the belt surfaces acts like glue, encapsulating and trapping food and dirt particles. On food grade Ultrasync belts, AmSeal is always recommended, whether for wet or dry food processing, because the Ultrasync fabric, with its long ends, is prone to fraying.

Product family	Wet cleaning	Dry cleaning
Synthetic belts	AmSeal	Non-Fray
Ultrasync belts	AmSeal	AmSeal

For the Food Industry we have developped the Hygienic Amseal with the benefit of calibrated thickness and smooth finish that can be applied on all Ammeraal Beltech synthetic belts (mono-, two- or three-ply belts) and with many profiles.



All in all we have available 2 Amseal types:
the classic with the bottom side embossed with negative pyramide profile A18 and the hygienic version, dedicated to the Food Industry.

It's important to note that the AmSeal in Nonex and Ropanyl materials, does not offer protection to the fabric against the wear and tear that comes from misstracking. Wherever there's wear like that, there's always the risk of contamination, so the belts need to be aligned for proper tracking.

The main factors to be considered when choosing whether to use an AmSealed belt:

- Misstracking on sealed Synthetic belts creates a very high risk of food contamination (please consider switching to non-fray Synthetic belts).
- AmSealed belts should be supplied for wet food processing in particular.
- Sealed belts with round edges from our competition are much easier to clean, but the adhesion of the rope to the belt body is limited (unlike AmSeal, with its extended adhesion).
- If your end user doesn't carry out sufficient regular maintenance on the belts and there's frequent misstracking, the preferable food safety solution is a non-fray option, not the AmSeal.

FIGURE 28: BROKEN BELT EDGE

On the left, a picture of an AmSealed Synthetic belt after misstracking, with evidence of breakage and belt fragment loss

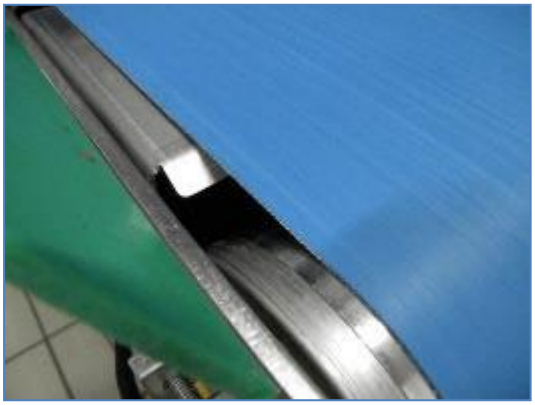


FIGURE 29:
NON-FRAY BELT EDGE AFTER MISS-TRACKING

On the left, a picture of a non-fray Synthetic belt after misstracking, with almost fully intact belt edge integrity

15. uni Modular belts

Modular Belt design:
According to the principles of food safety design, modular 'top hygienic performance' belts should be made with designs like:

- Smooth, glossy surfaces
- Round corners
- Minimum surface area
- Wide inches
- Single links across the width of the belt
- Pin-Less systems
- Flush and clean around pins
- Closed and round hinges on conveying surfaces, around sprockets
- Ultra-Open (cleanable) hinges on the bottom
- No middle bar on the bottom belt link side

These optimal criteria are already well-known within the Food Industry.
The brick lays (gaps in between links and assembling pattern) present one of the main hygiene issues. The more gaps and links we have in a belt, the greater additional food safety risks we face. Single links are always a welcome benefit to food safety.

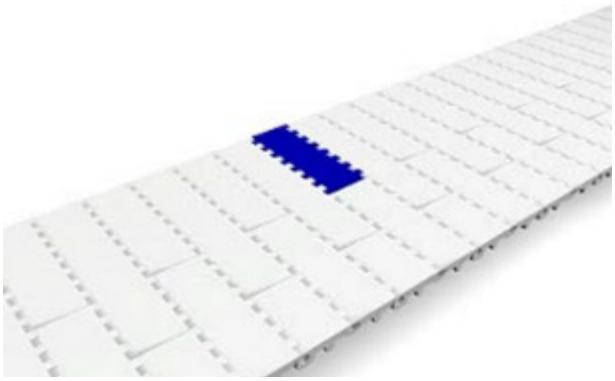


FIGURE 30: BRICK-LAY ON MODULAR BELT

The issue of brick lay should be evaluated in light of the additional risks of cleaning difficulties that might come from the poor finish to cavities that could leave marks and rough surfaces on milled, sawn, or machined links.

All in all, brick lay should be avoided wherever possible, and single links should be used whenever they are capable of delivering the final belt width requirements.

Wide inches and regular could be identified with the picture in between the Intralox 800 (regular inches) and wide inches on Intralox 850.

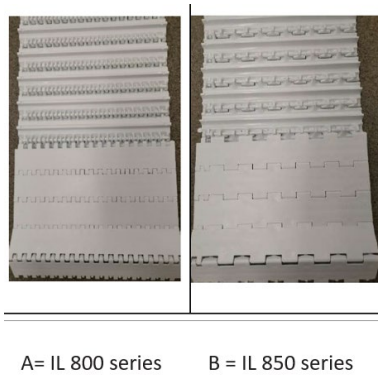


FIGURE 31: SINGLE LINKS OF MODULAR BELT

Middle bar on the bottom side of the modular belt work out sanitation and drainage problems.
From left to right:
Modular belt section with middle bar; middle bar highlighted; belt without middle bar.

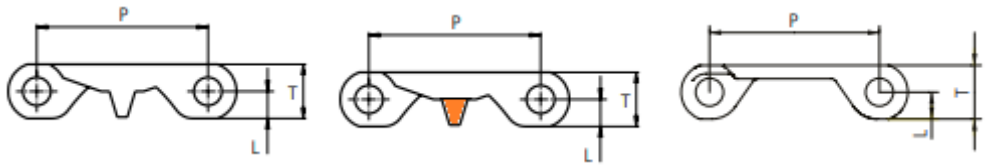


FIGURE 32: MODULAR BELT SECTIONS WITH & WITHOUT BAR

Cutting modular belts (particularly belts without single links) could easily compromise food safety by leaving a bad edge finish as pictured below.

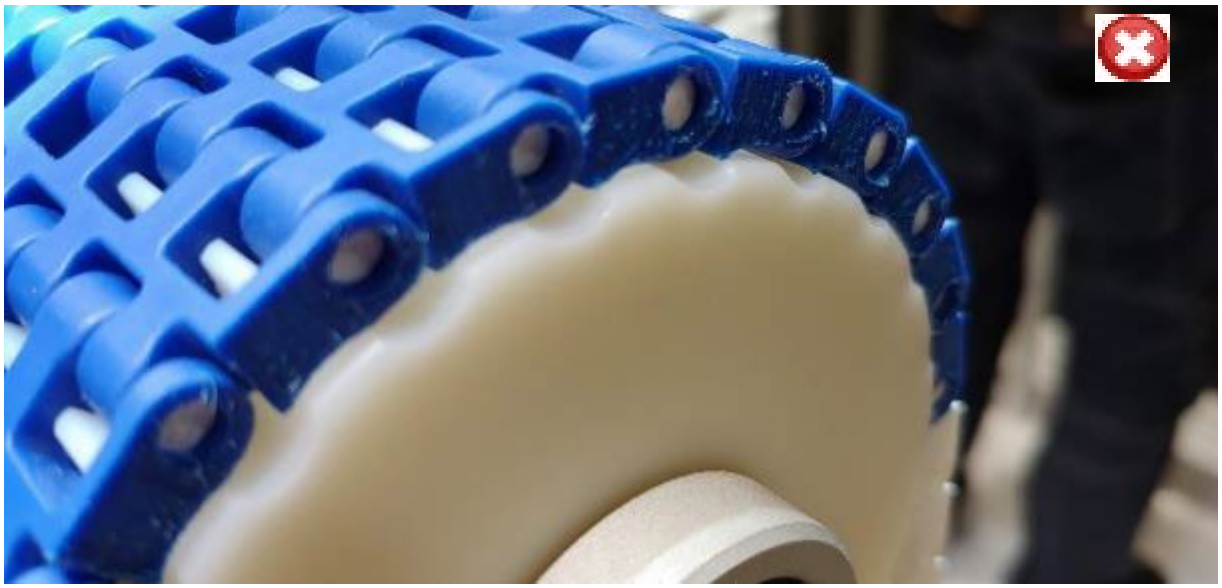


FIGURE 33: BAD FINISH OF CUT LINKS ON MODULAR BELT

Some explanation might be needed regarding the connection between links, gaps and brick lays, drainage and pin-less designs and the benefits to hygiene.

Looking at the belt in light of HAACP principles, we can identify the following hygiene hazards:

- Large gaps in between links can trap large amounts of product particles. That's why modular belts designed with smaller gaps in between links for straight conveyors are preferable to those belts designed for curves, which need a wider gap for bending/side-flexing.
- Large perimeter gaps in the width cause additional food safety risks

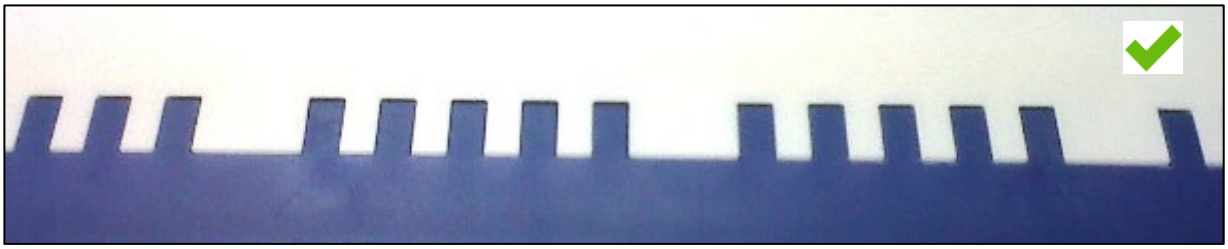


FIGURE 34: NARROW GAPS IN BETWEEN LINKS WHITE & BLUE FROM A MODULAR BELT

- Flush grid belts are belts with extra openings, increasing the risks to food safety
- Links with cavities on the bottom side can also trap particles
- Brick lays always increase food safety risks

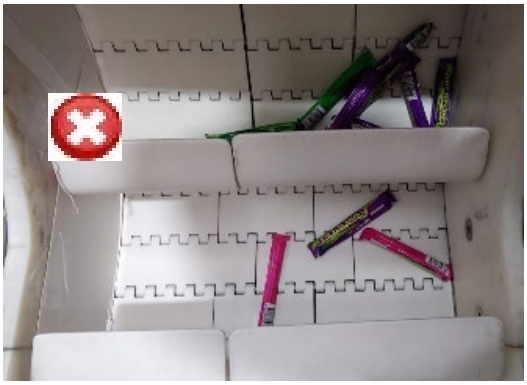


FIGURE 35: BRICK LAY ON PRODUCT SUPPORT & LINKS

Pin vs. Pin-less

Pin-less modular belt designs are always preferable, due to better cleanability; there are different pin-less locking designs available as well.

Steel and stainless steel material should be not recommended for food processing applications.

Large pin diameters (over 8 mm) or small diameters (less than 3 mm) and the related holes within the links are one of the greatest hazards to hygiene. The cavities through which the pins pass should always be reduced to the minimum length possible. Every lock-pin system is potentially a trap for sticky product residue.
(Pin colour should be aligned to the belt colour, as described in Chapter 10 of this document.)

Sprockets and retainers

Like gears, sprockets can collect food product particles and dirt, thanks to the tight spaces between the teeth, and are, therefore, always a risk to food safety.
Single and split-open sprocket design lend themselves to manual water spray cleaning, but still represent a serious food safety risk, as unwanted residue could easily collect inside the openings and on the inner side of the sprocket.

Figure 36: Sprocket out of Hygienic design

Sprockets should be positioned on the shaft so as to sit as far as possible from difficult-to-clean positions on the conveyor frame positions and where foodstuff cannot fall. The number of sprockets should be kept at a minimum as every extra sprocket represents an additional item that must be cleaned. Retainer rings should be reduced to a minimum size as well, and the same principle applies to rollers and idler rollers. Retainers in a ring are much difficult to sanitize offering many and large gaps to hook Food product.
Small retainer to fix sprocket in one spot left & right are Food Safety efficient.
Bi-directional wider sprockets with extra teeth should be used only if necessary.
Round bore sprockets are preferred to square bore sprockets as this design offers fewer gaps and greater cleanability.

Figure 37: UltraClean Retainer

Single sprockets should be always preferred to split sprockets as they, too, reduce the number of gaps. (The colour of the sprockets should always be aligned to the belt colour, as described in Chapter 10 of this document.)
Although the latest development on split sprocket with hygienic design features have their benefits as rounded teeth and open bore and split line design.

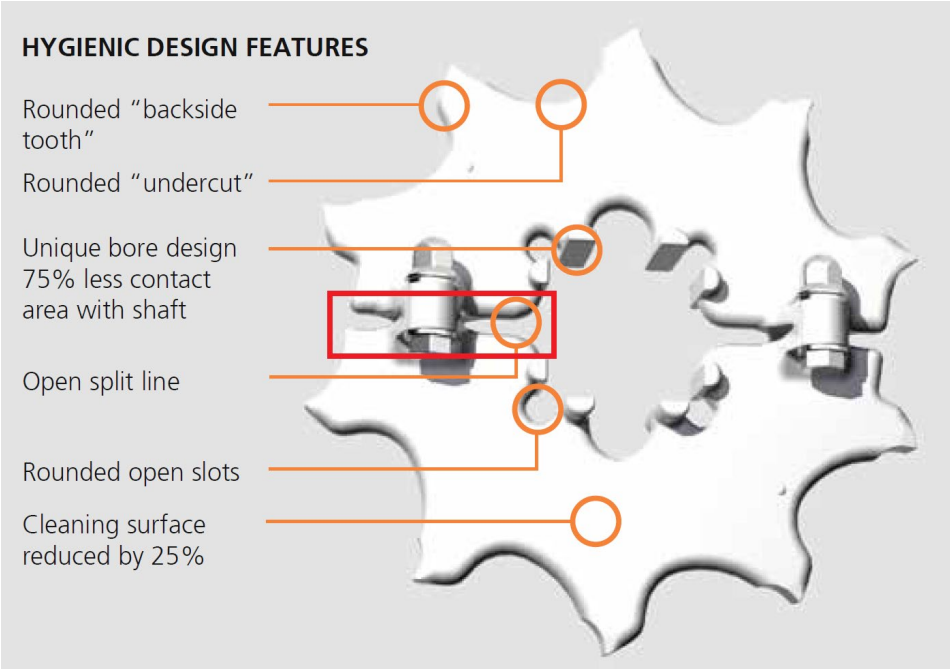


Figure 38: Hygienic 2 part sprocket UltraClean

Guide strips and wear strips

Guide strips support the belts from the bottom, so they are already in a partially hidden, difficult-to-reach and difficult-to-clean location.

Such strips should preferably be made from food grade UHMWPE material, in the same colour as the belt, and should be easy to remove from the conveyor frame. Hygiene design rules and principles for guide strips are similar to those for the sprockets. During the engineering of the conveyor frame or when the need arises for retrofits, you should bear in mind that every extra wear strip represents an additional cleaning requirement and that they also reduce cleaning efficiency by reducing the water jet range and by complicating sanitising procedures.

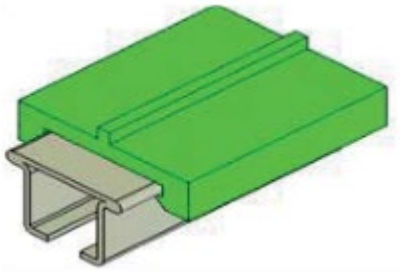


FIGURE 39: SNAP ON GUIDE

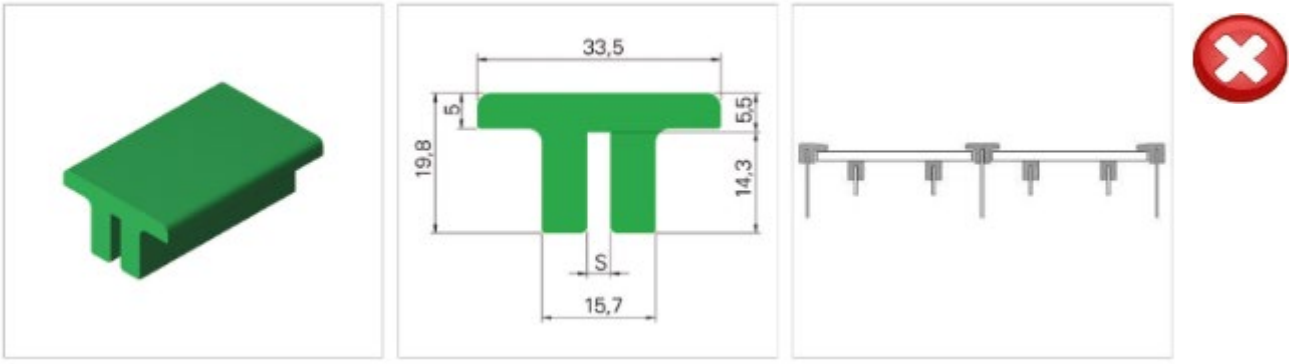


FIGURE 40: SNAP-ON UHMWPE GUIDE DETAILS

Snap-on guide strips of every design increase the risk of unwanted residue build-up between the frame and the guide; what's more, they are not easy to clean as they first need to be extracted – sometimes a difficult job – and then affixed again.
We recommend using easy-to-remove-and-reinstall self-supporting guides (as in the picture 39 below) with limited contact with the steel frame.

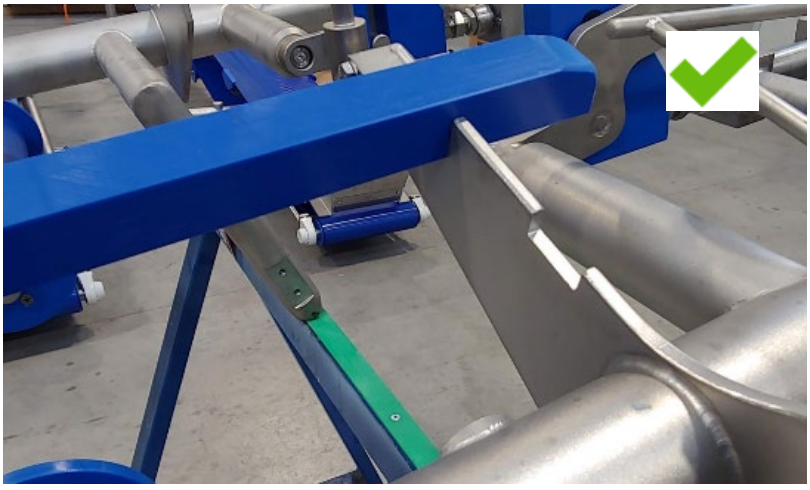


FIGURE 41: SELF-SUPPORT HYGIENIC UHMWPE GUIDE

Self-supporting food grade UHMWPE guide strips should always be preferred, as extra frame contact means an extra gap and greater cleaning difficult. Modular belt guide strips with pins or guide strips made of steel are not recommended.

Accessories / Components

All extra components create additional problems for food safety and should be reduced to a minimum.
Components that need to be clipped onto the belt should be avoided.
Every component, including side guards and rubber tops, needs to be the same colour as the belts.

FIGURE 42: SLIDING BELT SUPPORT

FIGURE 43: SNAP-ON RUBBER TOP LINK SUPPORT

16. Homogeneous Soliflex Belts

Homogenous belts have both friction and positive drive systems.
This extruded belts should always on top of the list of belts to choose as they offer the highest level of Food Safety due to the monolithic body.
Different performances as regards food safety are evaluated for positive drive belt types only, because flat homogeneous friction drive belts don't have the complexities of materials or teeth that would cause such differences. With friction drive homogenous belt, different Food Safety performance could come from matt to profiled surfaces. In any case, if you're looking to achieve the maximum in terms of hygiene & food safety, homogeneous friction drive belts are always the state of the art for hygienic belt solutions.
Homogenous belt materials available are TPU and TPU.
The most hygienic material it's TPE; it has excellent resistance to the chemical detergents used for cleaning, sanitising and disinfecting.
Belt designs based on rounded teeth or lugs, in addition to self-tracking offer even benefit on hygiene.

Let's take a look on the different design of homogenous belt available on the market for a Food Safety evaluation.

Round teeth lugs: Soliflex PRO & mini PRO

Both belt designs are based on a couple of rounded teeth with a gap in between.
The smallest mini PRO it's short but wide while the PRO it's longer than wide.
Gap in between it's useful for sanitation and to lock by side the sprocket and align it.

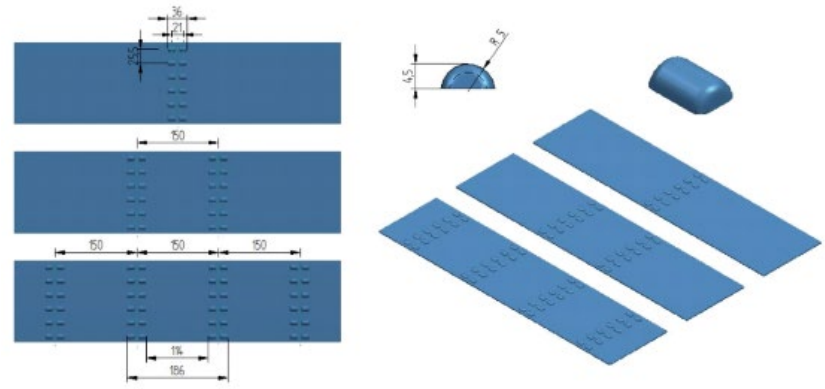


FIGURE 44: SOLIFLEX MINI PRO BELT SETUP MONO, DUPLEX AND QUATRO

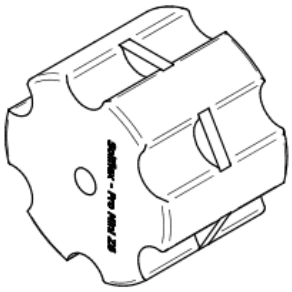


FIGURE 45: SOLIFLEX MINI PRO SPROCKET Z6

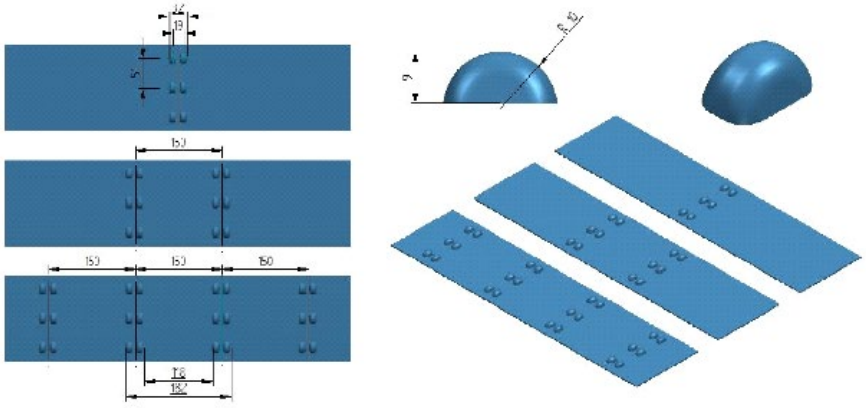


FIGURE 46: SOLIFLEX PRO BELT SETUP MONO, DUPLEX AND QUATRO

FIGURE 47: SOLIFLEX MINI PRO SPROCKET Z6

From a design point of view, the Soliflex PRO offers greater food safety benefits than the Soliflex PRO Mini; the Mini's smaller lugs and sprocket cavities makes it harder to clean, regardless of whether it's Half Mono, Duplex or Quatro. Nonetheless, due to the smart hygienic design of the Soliflex PRO and PRO Mini, we have the definitive hygienic belt on the market

Homogenous belt Center bar design

Center bar belt design are available on the market with one or 2 engagement lines, usually about 3 inches (76 mm wide). They offer tracking and positive drive but anyhow due to straight teeth sanitation process cannot be accurate, efficient and quick as rounded lugs.
Like Full bar need sanitation on teeth left & right sides.
Cavities necessary on sprockets or motordrum for Central bar are a significant issue in Food Safety.
Due to belt design moulding center bar and full bar could present air extraction spots or step lines as Figures below. Spots are more critical than step line because are creating a cavity with clear difficulties in sanitation. Deep of the moulding spot are even with bad finish and not in a regular deep level. Step moulding line its regular and out of cavity, so should be preferred looking for hygiene.

FIGURE 48: CENTER BAR BELT DESIGN 1 LINE

FIGURE 49: CENTER BAR WITH MOULDING SPOTS

FIGURE 50: CENTER BAR WITH MOULDING STEP LINE

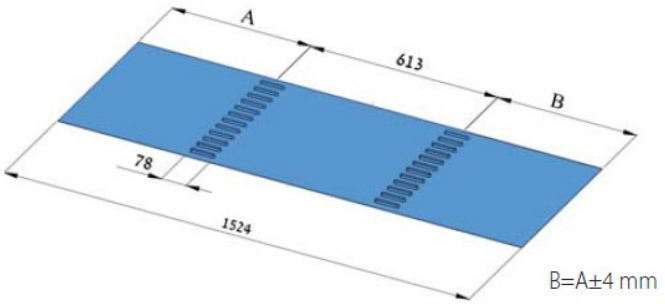
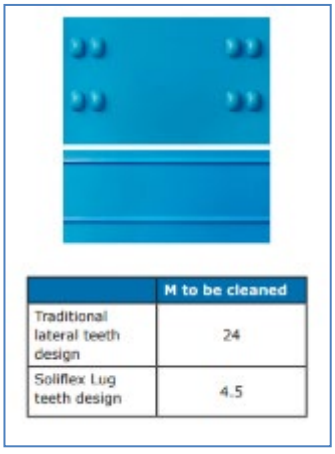


FIGURE 51: CENTER BAR 2 LINES

Homogenous belt Full bar design

The Soliflex's round lugs PRO & mini are easy to clean while centre bar and full bar (with teeth on the belt widths) need extensive cleaning. In point of fact, most homogeneous belts have a lateral tooth design profile with a great number of right-angled ridges.
A typical lateral positive drive belt with a width of 600 mm will have over 24 meters of raised 90° edges per meter of belt, creating more than 24 meters where dirt and other residue can accumulate.
The lugs on our Soliflex Pro belt have no right-angled disruptions at all, and have a total edge-length of just over 4.5 m on a 600 mm belt (see table below), roughly one-sixth of that present on a common lateral positive-drive belt.

Both testing and real-time application use have demonstrated the belt's hygienic effectiveness, creating an unique selling point for the market.



	M to be cleaned
Traditional lateral teeth design	24
Soliflex Lug teeth design	4.5

FIGURE 52: FULL BAR VS. PRO ROUND LUGS DESIGN

From a practical point of view, you should consider that to clean teeth instead of lugs you need to spend much more time, energy, detergent, and water, because you need to direct the water jet both left and right of every single tooth, while to clean lugs you can spray from the top.

Cleaning lugs from the top with the water jet pipe remaining in one fixed position permits a more thorough and safer cleaning and sanitizing process than moving the water jet pipe all over in an attempt to clean each tooth.

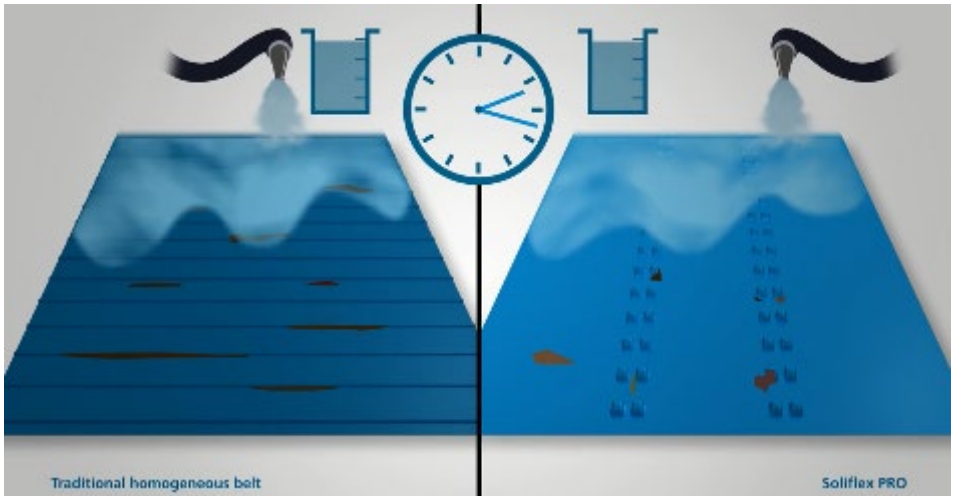


FIGURE 53: FULL BAR SANITATION VS. PRO

All positive drive Soliflex PRO and PRO Mini belt types (including Half Mono, Duplex and Quatro) can be cleaned by fixed overhead water jets.

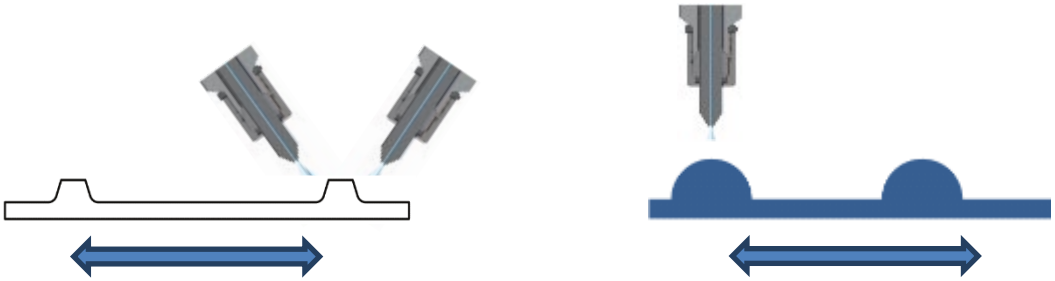


FIGURE 54: CENTER & FULL BAR SANITATION 2 SIDES VS. PRO ONLY FROM TOP

For reasons that have already been mentioned and for better belt tracking, V and square ropes as guides are not recommended on Soliflex positive drive PRO and PRO Mini belts or on Soliflex friction drive belts.
Mechanical fasteners in plastic material or metallic are a non-sense joint solution for homogenous hygienic belts as are totally against every safety in Food.

Reinforced belts with steel or Aramide cords, with polyester fabrics cannot be identified as homogeneous or monolithic anymore due to the presence of extra layers, material inside with risks of contamination.
Extruded belts with aramide Kevlar cords cannot match the level of full homogenous belt.
Fabrics or cords could surgir from the edge of the belt, on the surfaces or on the splice area.

To provide you a view on the Value of Food Safety we could obtain from homogenous belts in different designs even looking on the level of synthetic and modular belts, please look on the following graph that it's considering:

- Hygienic belt design
- Sanitation efficiency
- Scraper-ability
- Risks of foreign bodies
- Sanitation time

FIGURE 55: FOOD SAFETY SCORE LEVELS BY BELT

Soliflex Components

Sprockets and pulleys for Soliflex come in blue (like the belts) and are machined from food grade UHMWPE. As with the modular belts, the quantity of sprockets for Soliflex belts should be reduced to the minimum number that is necessary for efficient tracking.

Soliflex sprockets in split executions and self-cleaning sprockets should be used only when absolutely necessary as they present additional risks for food safety in the form of extra surface to clean and a greater complexity of design.

Using Modular tools to weld the cleats without end-stops results in too much free flow of material and leads to unhygienic results, as shown in the picture to the right.

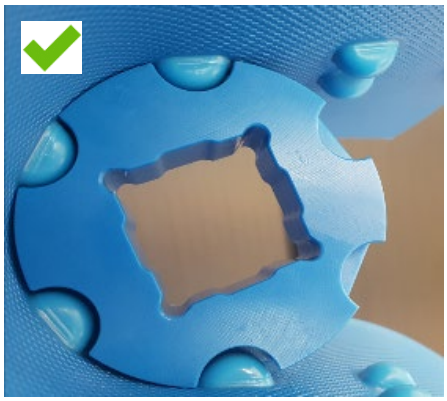


FIGURE 56: BLUE UHMWPE SPROCKET ON BLUE BELT SOLIFLEX

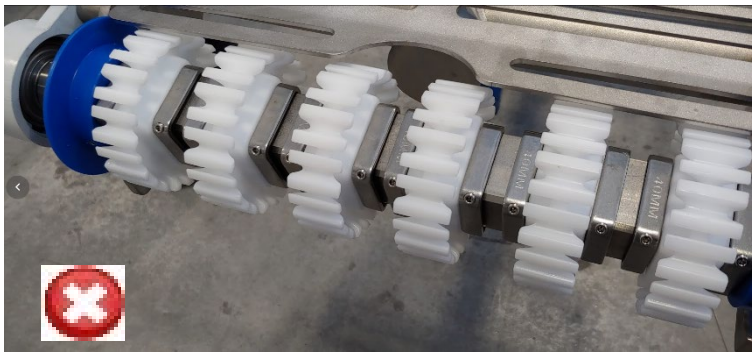


FIGURE 57: LARGE QUANTITY OF UN-NECESSARY SPROCKETS WORK OUT EXTRA PROBLEM IN SANITATION

FIGURE 58: BAD FINISH BELT ACCESSORIES BY WELDING

Drum motors

Soliflex positive drive drum motors are frequently used in food processing equipment, particularly in industry segments such as Fruit & Vegetable, Dairy, Meat, Poultry, and Fish. Motor-drums are a good alternative to sprockets for modular and homogenous positive drive belts from hygienic point of view and not only.
Looking for Food Safety the motor-drums should be always preferred vs. sprockets.
Benefits are about the compact design that could permit a compact conveyor design frame up to the missing gear-motor that lead to leak risks and extra needs of cleaning.

The recommended design for a drum motor to be adapted to a Solfielx PRO or Mini PRO are:

- Without cavities and with transversal grooves for the entire width
- With cavities rounded at the edges

Polyurethane food grade coating material is available.

Fixing extra rings on a drum motor body frame isn't recommended; it increases both the complexity of design and the number of gaps.

FIGURE 59: SPROCKET WHEELS ON MOTORDRUM

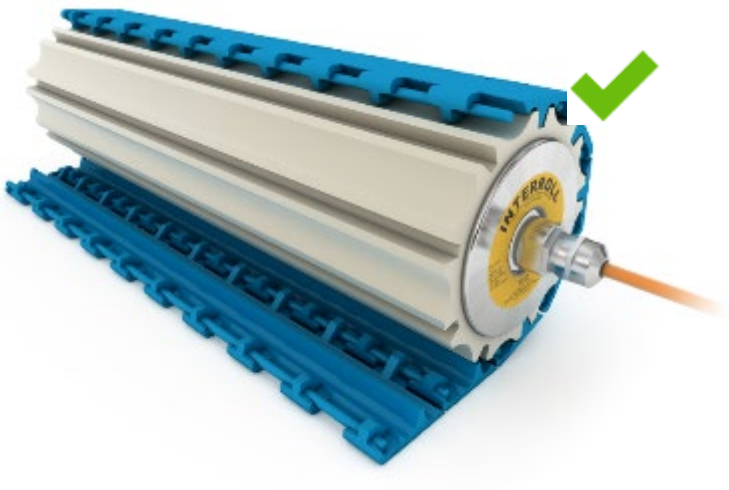


FIGURE 60: MOTORDRUM WITH CAST SLEEVE

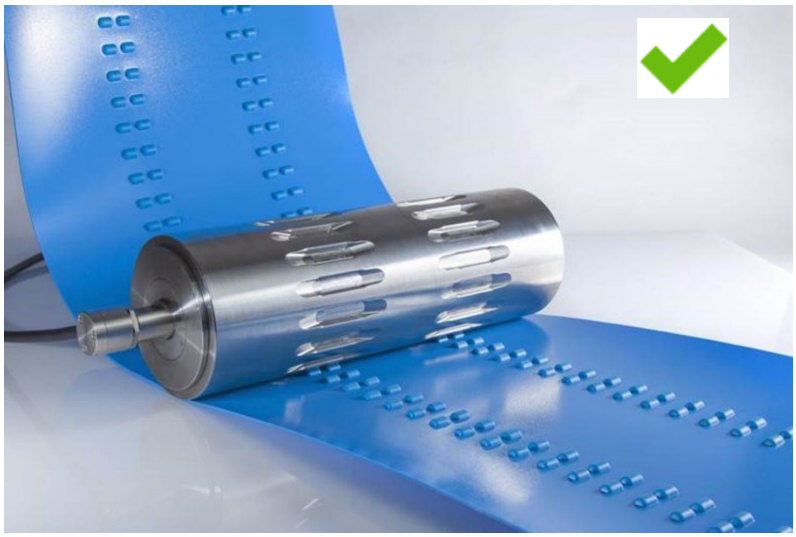


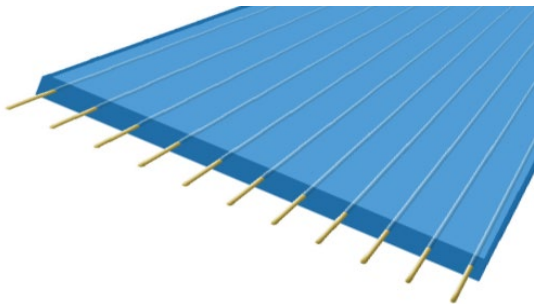
FIGURE 61: STEEL MOTORDRUM

Splicing a belt is the preferred endlessing method for Soliflex. In some cases, our customers choose a belt with a fastener instead, but we should always try to discourage this choice. Mechanical fasteners can be used on belts with scrapers, but again, this cannot be recommended. Plastic or steel fasteners can be a convenient solution for spare belts or for when belts need to be taken off the conveyor for cleaning. The standard TPU lace is welded to the belt and closed with a nylon pin.

Due to the small size of the pin (to go with the thickness of the belt) it's almost impossible to clean. The lace is suitable for 2 mm and 3 mm Soliflex TPU belts and comes flush with the top of the belt, but is slightly thicker.

16. AMMdrive and Soliflex RS reinforced homogeneous belts

Soliflex RS is food grade friction drive belt extruded as homogeneous with aramid cords. While AMMdrive are positive drive belts with reinforced fabric(s) all over the width with sealed edges.



AMMdrive are belts with 1, 2 or 3 plies of fabric with PRO or PRO mini lugs with covers on both sides. As a standard, AMMdrive belt is supplied with Amseal edges with the exception of thin belts with one fabric core.

Focus benefits of both belt types are with low elongation, in addition to the self-tracking and hygienic design of the Soliflex positive drive belt series, while for the RS for the friction drive belts.
From an hygienic point of view they could be on top of the performance in sanitation, but due to extra layers they have the risk of exposing cords or fabric that could generate foreign bodies and could even stick the food processed staff.

17. Rapplon elastic homogeneous food grade belt

Friction-drive elastic food grade belts are similar to homogeneous Soliflex belts.
The main difference lies in material elasticity and related additional tensioning.
The main food safety benefit from elastic homogeneous belts is the possibility of achieving the right results with pre-tensioning so that there's no need for tension devices, making it simpler to keep the conveyor frame clean.

18. Solicord

Homogeneous Solicord Round and V-belts with solid thermoplastic bodies are welcome in the Food Industry, both for their food safety features and for their product performance. Narrow pulley grooves, while not ideal for reasons that have already been mentioned, are preferable to guides that introduce their own cleaning problems.

Smooth round belts are preferable to rough matt, thanks to their superior cleanability.
The elastic Rapplon homogeneous belt also offers the benefits that come with pre-tensioning so that the belt can be installed without any tensioning devices that interfere with conveyor cleanability.

19. Components and accessories for Synthetic belts

Cleats, tracking ropes and sidewalls, like all other belt components and accessories, can pose food safety problems. Every additional component on the belt needs cleaning, and they should all be evaluated from a food safety risk point of view.

Today, there are many solutions for cleats on the market. The most common cleat design includes a groove or cavity on the bottom or foot side of the extruded material that, theoretically, should disappear in the welding process. In practice, however, when the cleat is welded on the top cover this cavity frequently becomes a divot at the bottom of the cleat that is almost impossible to clean.

As was previously mentioned, the conventional cleats for Synthetic belts, which are at times also welded onto other belts, such as homogeneous or timing belts, should not be recommended for Food Industry applications. Fabric-reinforced cleats are even worse as, in addition to the unhygienic gap on the bottom of each cleat, they offer additional food safety risks due to possible fraying.

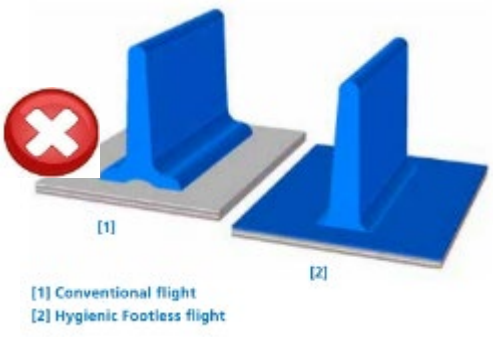


FIGURE 62: CLEATS WITH CAVITY ON FOOT AND FOOTLESS CLEATS

FIGURE 63: REINFORCED CLEATS BY FABRICS

Likewise, profiled cleats should not be recommended, due to the possibility they present for collecting dirt and foodstuff.

FIGURE 64: CLEATS, PRODUCT SUPPORT WITH HOLES, CAVITIES AND PROFILES

Belt components and accessories represent an important food safety problem.
This is because they are subject to a number of different risks, the most important of which is perhaps breakage leading to contamination, followed by partial or complete detachment from the belt.

There are additional risks related to gluing. Glue contains solvents that pose a severe risk to human health. All components (including cleats, sidewalls and tracking ropes) need to be welded using methodologies that run from hot air to high frequency so as to avoid using gluing materials, because gluing materials do not meet any food grade standard.
Components such as:

- sidewalls with "weaves" and/or "spondaflat" are **not** recommended due to difficulties in cleaning
- cleats with design geometry that could retain part of the conveyed product are **not** recommended
- Tracking ropes located close to the belt edges on the bottom or conveying side are **not** recommended because of the dirt that could easily collect in the channel between edge and rope
- Notched tracking ropes are not recommended because the grooves present difficulties in cleaning and potential for fragmenting.

If the flexibility of the rope does not match the diameter of the drum, a smaller size should be chosen.

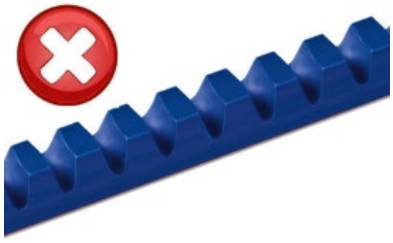


FIGURE 65: NOTCHED ROPE

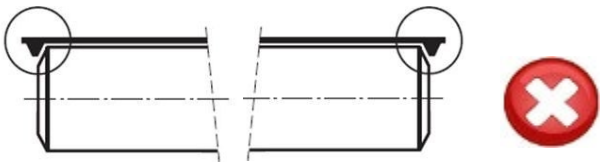


FIGURE 66: TRACKING ROPES ON THE BELT EDGES

Cups for bucket elevators where every additional cleat is fixed with screws and bolts perforating the belts cannot be recommended from a food safety point of view. The preferable solution is welded cleats and a cup design without the need for metallic parts or belt perforations.

FIGURE 67: ELEVATOR BELT WITH BUCKETS

Support rollers in U or V shapes are usually used with long heavy-duty conveyors. In the Food Industry, they are most often found in applications involving raw material conveyors and elevator belts. The large number of components, together with gaps in between rollers, undermine food safety; a smooth shaped slide bed without gaps helps reduce hygiene issues.

Side tape, also called side skirting and useful in sealing belt edges, is common in the Food Industry.
The positioning of products in bulk form cannot always be controlled properly, and so a sidewall is needed. Rather than welding the sidewall to the frame or otherwise installing it on the belt, it's possible to affix the sidewall to the edge of the conveyor frame.

FIGURE 68: THROUGH CONVEYOR FRAME

Often, Synthetic belt material containing fabrics are used for this; however, a homogeneous product like Soliflex is much better from a food safety viewpoint as it has as no fabric that might fray.

FIGURE 69: BLUE HOMOGENOUS SIDE TAPE ON BLUE BELT

20. Tracking systems for Synthetic and lightweight rubber belts

Hygiene could be put at risk by using an incorrect belt tracking system.
Grooves in slide beds and drums are an obvious food safety problem, but frequently OEMs solve tracking issues without considering the impact a solution might have on hygiene.

Ideally, tracking should be achieved by drum crowning alone, without the need for extra accessories or complex systems that might increase the risk of contamination. Whenever other systems, in addition to drum crowning, become necessary, the preferred one should be flat snub rollers positioned on the bottom side of the conveyor. Unfortunately, snub-rollers are not frequently used; instead, fixed guiding blocks are favored. Fixed blocks laid out in a "L" shape pattern on the belt are still the most common solution for the tracking of long processing belts in the Food Industry. However, there are many problems related to the use of fixed blocks.

The following are just a few issues that fixed blocks present:

- Greater belt abrasion, with increased risks of contamination from fraying
- Sticky food product build-up in the block gap
- Cleanability almost impossible
- Bolts and screws trapping dirt and other residue

Driving and tracking systems for curved or round conveyors are based on components that link the external edge of the belt to steel chains via springs, laces and round belts.

Every solution represents a clear food safety problem. Even those systems based on used ropes that are either welded or stitched onto the external belt edge are not particularly hygienic, but they are the systems with the lowest food safety risk.

FIGURE 70: BEARINGS ON ROUND CONVEYOR SYNTHETIC BELT

21. Mechanical fasteners

Every mechanical fastener on every belt in every material and design presents a food safety problem. Ammeraal Beltech is against the use of every kind of mechanical fastener for food applications.

Extra material on the belt, particularly items with pin and complex designs, creates nothing but difficulties regarding cleaning and sanitising. Mechanical fasteners made from plastic materials can be declared food grade-appropriate according to the general standards of the FDA, the EC and the EU, but there are no approved steel fasteners from any supplier.

Spiral lace is usually woven onto a base fabric, frequently resulting in long frays. Food product traces or residue can easily find its way into the section of the mechanical joint; once there, it becomes very difficult to extract and the area proves hard to sanitise as well.

22. UltraScraper

Scrapers are now widely used to help clean belt surfaces.
However, in the field we have observed frequent improper use of scrapers due to:

- Bad positioning
- Improper material selection
- Poor design
- Use of too much pressure

Scrapers are, in fact, one of the main sources of food safety issues.

Frequently encountered problems include:

- Reduced hygiene
- Increased miss-tracking
- Short belt lifetime
- Belt drive issues
- Cross-contamination between foodstuffs
- Short scraper lifetime
- Poor cleaning performance
- High cost of maintenance
- Non-food grade quality scrapers
- Belt surface wear and tear caused by scraper
- Compromised food quality from scraper material contamination

FIGURE 71: RIGID SCRAPER WITH GAPS VS. BELT

The entire Food Industry is using scrapers throughout its processing lines, and the majority of these are rigid scrapers made of UHMWPE, Teflon or other rigid plastics or even sometimes steel materials. Rigid scrapers clean in limited narrow lines by pressing on the part of the surface of the belt where there's a drum underneath.

The AB UltraScraper is a solid blade belt cleaner made from abrasive-resistant polyurethane that ensures durability. The scraper's unique co-extruded soft-lip design made from an exclusive blend of FDA-approved metal-detectable thermoplastic material permits the belt and splice to pass under the scraper easily without incurring damage.

FIGURE 72: SCRAPER COEXTRUDED WITH SOFT LIP

The main cleaning benefit of the soft lip is that, unlike rigid-material scrapers, it can follow the true contours of the belt surface; because rigid scrapers cannot do this, sticky product build-up occurs on the bottom side of the belt, causing the belt surface to bend as it crosses the drum.

Ultrascraper hardness is at a similar level to that of a Ropanyl belt so as to extend the lifetime of both the belt and the scraper; not hard enough, and it wouldn't clean, but too hard and it would damage the belt surface

The magnetic signature of this product allows them (or their fragments) to be seen by most metal detectors and X-ray devices used on packaging and production lines. UltraScrapers are suitable for primary cleaning in between drums or at the head/tail pulley.

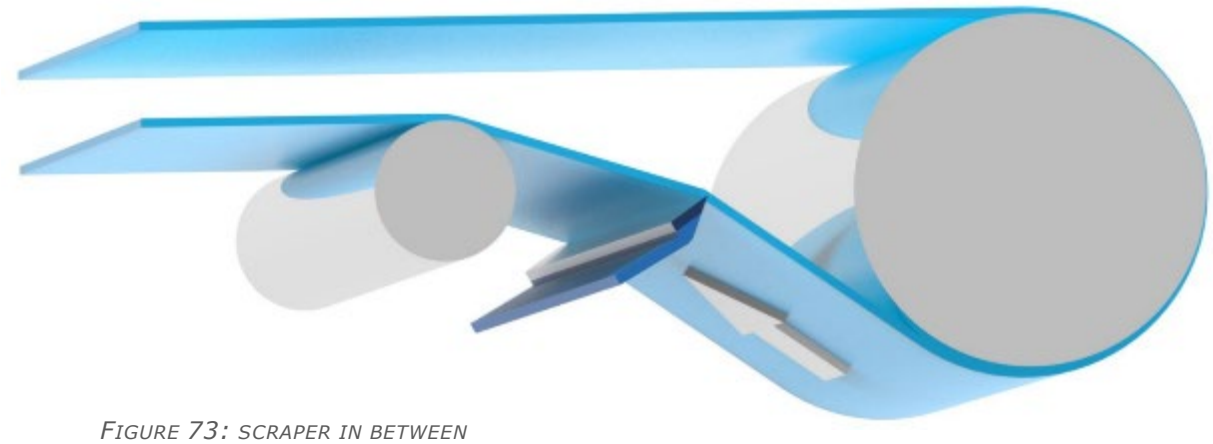


FIGURE 73: SCRAPER IN BETWEEN DRUMS WITH BENEFIT ON SPRING EFFECT

Ultrascrapers meet the relevant FDA requirements for use in the food-processing industry.
They are resistant to oil and petrol and have good low-temperature flexibility.
Temperature range: -30°C to +80°C (+100°C short term).
Hardness of the soft lip: 76 ShA

23. Permaline

While laser marking can be used in the manufacturing of positioning belts destined for applications in industries such as Logistics (sorting and automation), Airport and Sport and Leisure, it is not recommended for use in the Food Industry.

With laser-marking technology, indelible marks such as lettering or images can be printed on thermoplastic covered belts using a heated laser process. However, since heating can damage or modify the chemical properties of what originally was a food grade belt, laser marking can compromise food safety and thus laser-marked belts cannot be certified under any food grade regulations. What's more, laser marking has only a limited range of grey-black colours.

Laser engraving reduces the belt-cleaning efficiency of scrapers, meaning that, because laser marked belts require greater scraper pressure to be effective, belt life time will be shortened as well.

Ammeraal Beltech Permaline U2 belts meet the following food grade standards:
- EC 1935/2004
- EU 10/2011
- EC 2023/2006
- FDA standards for direct food contact according to 175.300 (resinous and polymeric coatings) and 177.2600 (rubber articles intended for repeated use) for conveying all wrapped and unwrapped foodstuffs
- Permaline U2 can assist in implementing and maintaining in-house ISO 22.000 programs.

24. ZipLink® + ZipLock belts

Spiral lace and Zip belts are based on a join-by-pin weft concept. Although both belt types can be certified at every food grade level, they present serious food safety issues.
The problem with these belts is similar to that facing modular belts; the pin construction requires the existence of holes, and these cavities are a nightmare for food safety. What's more, the Zip spiral fabric itself, with its exposed surfaces and its open-looped ends, cannot be considered a hygienic belting solution.

25. Timing belts and Ultrasync

Ultrasync and timing belts with lateral teeth present cleaning difficulties, even at food grade execution, due to the positive drive design. All AB Ultrasync products that are being used in food processing where there's direct contact with foodstuff should always have sealed edges as the fabric frays easily.
The tooth pattern running across the belt, even when in a wide pitch, cannot be considered hygienic, even when it is colour-matched to either the white or blue food grade materials.
The use of steel or aramide cords to enhance body strength are additional potential issues.
Double-sided timing belts present double the food safety risks.

26. Other belt types

Poly-V and Multi-belts are basically for power transmission, but they are sometimes used in food processing as well. These products carry intrinsic design-based food safety risks and should not be recommended, even if food grade declarations are available.

27. Anti-fray solutions

Food safety risks from fraying edges of Synthetic belts is most probably one of the most common and most critical belting food safety issues. Using the classic weaving system, warp and weft are bound together. When the fabric becomes damaged on one edge, the weft cannot keep the warp securely inside the fabric. Fraying comes mainly from the warp ends; the weft could potentially contaminate the foodstuff as well, but when this does happen, it's usually in less quantity than what the warp ends give off.
Over time, as misstracking takes place, the belt edge slides on the fixed frame, loosening parts of the warp from one or more ends, even when the product is a truly endless woven belt with woven edges.

There are several solutions on the market with varying success rates in reducing fraying. Apart from homogeneous belts without any cords or fabric, there are other approaches to reducing fraying in synthetic belts:

A. Knitted fabric
B. Fabric body in width sections
C. Dip-coated woven fabric

At Ammeraal Beltech, we are active in the market with solutions A and C.
Sealed belts cannot be recognized as an adequate edge-protecting or anti-fraying solution for the Food industry. Explanations for why the sealed systems aren't sufficiently foolproof for food grade applications can be found in Chapter 14 of this document but, in brief, while a number of systems are useful in reducing fraying, none can guarantee that no fraying will take place. (Non-fray belt properties are denoted by the Synthetic belt nomenclature NF and are achieved by knitting and dip-coating.)

The knitting system is one of the most common methods of reducing fraying and is based on binding the yarns using knitting rather than weaving techniques.
On the left weaved fabric on the right: knitted.

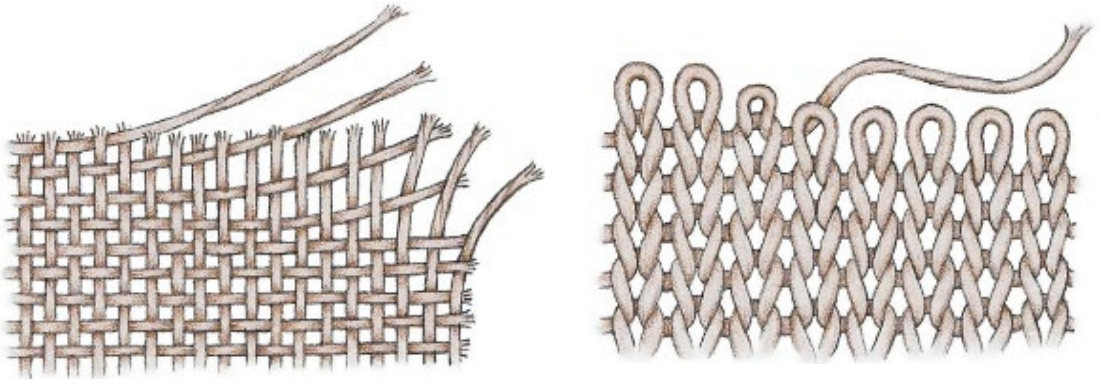


FIGURE 74: WEAVED (LEFT) AND KNITTED (LEFT) FABRICS

28. Antimicrobial belts

There are two different types of Antimicrobial (AM) systems we should consider: ***Bacteriostatic and Bactericide***.

A bacteriostatic agent or bacteriostat, abbreviated *Bstatic*, is a biological or chemical agent that stops bacteria from reproducing, while not necessarily killing them.
A bactericide or bacteriocide, abbreviated *Bcidal*, is a substance which kills bacteria.

Only a limited number of companies have installed belts with Antimicrobial properties and they've only done it for a limited number of products. The purpose of the AM belts from Ammeraal Beltech is to reduce bacterial growth through bactericide system. It's interesting to note that companies manufacturing gluten-free products (including cookies and snacks) frequently request belts with AM properties even though this isn't a particularly important benefit for this market segment.

The AM Bcidal properties are based on the use of silver ions, inorganic materials highly toxic to microorganisms. The ion is a charged particle, created when an atom loses or gains one or more electrons.

Silver ions slow down bacteria, breaking down their cell walls attacking respiration and replication functions of the microorganism. Their presence is able to inhibit the existence and consequent proliferation of pathogens. Chemically, silver acts as a catalyst in demolishing 16 of the vital enzymes that bacteria produce.

FIGURE 75: ANTI-BACTERIA SILVER IONES SYSTEM

The belt cover consists of two separate layers: first a special "antimicrobial" finish is applied on the fabric; this is in addition to the finish normally required by the FDA. Damage to the belt cover, for instance by cutting or cracking, creates a spot which is difficult to clean. However, because of the special AM finish, bacteria and fungus will not be able to grow in that damaged area. Either a similar AM cover or AM impregnation protects the bottom side of the belts.

However, you should be aware that the same strict cleaning regimen, encompassing all equipment, all surfaces and even personal hygiene, that is required when using conventional food grade belts remains essential with AM belts as well.

28. Splice of synthetic belts and AMMdrive without foils

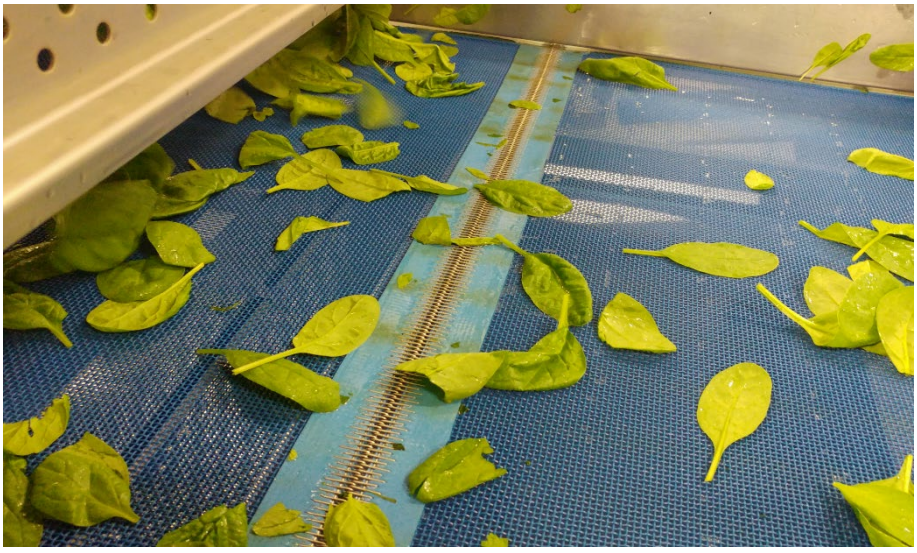
Splice of thermoplastic belts from Synthetics to AMMdrive should not receive foil on top or bottom. Foil could become easily foreign bodies out of additional issues on flexibility, finish etcetera.

29. Lightweight rubber belts

Lightweight rubber belts made from thermoset materials require glues with solvents for the splice which poses a significant food safety risk.

30. Mesh belt UltraScreen (PRO)

Mesh belts are sealed on edges and splice at ends by extra homogenous tape.
Accessories are available as tracking ropes and flights while frequently are equipped with mechanical steel fasteners that we should try to avoid.
Mainly used in the fruit & vegetable industry for washing are always a risk in Food Safety, while they provide the top drainage.



The positive drive version Ultrascreen PRO with lugs as Soliflex PRO guarantees

- No slippage
- Self-Tracking
- Easy installation with low tension

29. Cotton, wool and felt belts

All fabric belts with short fibers represent a serious food safety risk. Even when coated, they always have the potential to lose fibers.

Problems arising from woolen, felt and cotton-based fabric belts include:

- Moisture absorption
- Splices by stitching or by gluing
- Fraying at edges
- Yarns losing fibres
- Pilling
- Scrapers spread contaminants into fabric fibres
- Short life time
- Food grade declaration not available
- No lateral stability, leading to mistracking
- Shrinkage

There are applications such as dough moulding and handling where there's no easy substitution for cotton. However, from time to time, solutions come along, including belts such as Poliflex, Ropanol, and Ropanyl, sometimes even profiled. The long open-air bridge cooling belt in cotton for biscuits can and should be replaced with Ropanyl belts without any loss of efficiency.

30. Ultraviolet germicidal irradiation

Ultraviolet germicidal irradiation (UVGI) is a disinfection method that uses short-wavelength ultraviolet (UV-C) light to kill or render inactivate microorganisms by destroying nucleic acids and disrupting their DNA, leaving them unable to perform vital cellular functions. The disinfection effect is achieved by means of UVC radiation and not by the use of filters or chemicals.

UVGI devices can produce strong enough UV-C light in circulating air or water systems to make them inhospitable environments for microorganisms such as bacteria, viruses, moulds and other pathogens. UVGI can be coupled with a filtration system to sanitise air and water.

UVC radiation of 254 nm has an intense germicidal effect.

The use of chemical disinfectants in some food processing areas is prohibited. These areas, however, often feature the hot and humid ambient conditions that make them good breeding grounds for harmful bacteria, molds and yeasts.

UVC radiation is a safe and reliable disinfection method. The effectiveness of germicidal UV depends on a number of factors: the length of time a microorganism is exposed to UV; the intensity and wavelength of the UV radiation; the presence of particles that can protect the microorganisms from UV; and a microorganism's own ability to withstand UV.

UV water treatment devices can be used for both well water and surface water disinfection. UV treatment compares favourably with other water disinfection systems in terms of cost, labour, and the need for technically trained personnel for operation. Water chlorination treats larger organisms and offers residual disinfection, but these systems are expensive because they need special operator training and a steady supply of a potentially hazardous material. Finally, boiling water is the single most reliable treatment method, but it demands labour and is costly. UV treatment is rapid and, in terms of primary energy use, approximately 20,000 times more efficient than heating the water to boiling point.

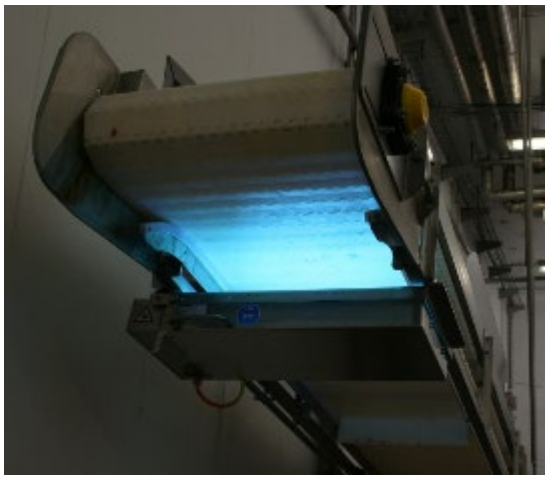


FIGURE 76: UV-C RAYS ON MODULAR BELT

Generic belt materials suffer when exposed to this level of UV rays; they become brittle and break on the surfaces that have been exposed to the radiation.
There are uni-chains plastic materials for modular belts that, with stabilizer additives, are able to resist to UV rays in outdoor applications, and there is a specially developed stabilizer that protects against UV-C rays; both of these innovations have food grade approval at FDA level. The uni-chains UV stabilizer is used as additives for POM, PP and PE, while their UVC standard stabilizers are used in POM materials only.

31. Rules for visits to food production/packaging areas

Don’t ask permission to visit a food production facility if you aren't in good health!
In any case, you won't be permitted to enter facility areas if you are displaying symptoms of any infectious disease.

When visiting Food Industry clients, be prepared to visit production sites. Metal-detectable pens and similar tools can help food safety, but you should limit other objects such as tablets, computers or notebooks, to what is necessary.

Wear whatever your client supplies, as this clothing will comply with his rules for cleanliness. Regarding your own clothes, dress in preferably white or light blue clothing with snap fasteners, not buttons, and be ready to remove rings, bracelets, watches and ties, as you will be visiting a
food production environment and these items are normally prohibited.

- All persons entering the production areas must adhere to company policies concerning protective clothing and footwear.
- Wear a hat/hairnet that completely covers your hair. Do not comb your hair in a processing room or storeroom. Keep beards and moustaches neat and trimmed. Beard restraints are required in any food production area.
- Do not handle any food if you have sores, boils, septic spots, a bad cold, chest infection, sore throat or an upset stomach. Report any of these to the manager and do alternative work.
- Cover all cuts, burns, sores and abrasions with a clean, waterproof dressing. Inform floor manager of any wounds.
- Nail varnish/enamel is not permitted. Gloves can be provided if necessary.
- Excessive perfume or aftershave should not be worn, as it can taint products.
- Person entering production areas must not wear jewellery other than a plain wedding ring, and that only when permitted. No piercings that can be removed are permitted.
- Persons entering the production areas must ensure that they have washed their hands thoroughly with appropriate soap and sanitiser. Hands must also be washed thoroughly after using toilet facilities, eating, smoking, coughing, blowing your nose and combing your hair, as well as after handling waste food, rubbish or cleaning chemicals. Dry them on a clean towel before handling food again.
- Do not cough or sneeze over the food. Do not spit while in a processing room or storeroom.
- Visitors must adhere to the company’s No Smoking policy, i.e., no smoking (or chewing tobacco) except in the smoking booth or area provided, and visitors must also refrain from eating in any room where uncovered food is present, as bacteria could be transferred from their mouth to that food.
- Keep fingernails cut short.
- Do not put yourself at risk; follow the safety advice and wear protective clothing as directed.
- In the event of an evacuation, visitors must make their way to the fire evacuation point as specified by Main Reception.
- No food or drink is to be taken into the production areas unless otherwise specified by the company.
- No chewing gum is permitted on site.

32. Metal and X-Ray belting solutions

Given that antistatic belts (AS) should be always preferred in food processing because of the risk of belts collecting dust when running in dry conditions, it's common to equip lines with metal detectors, particularly in the Food Industry, to meet the needs of the company's ISO 22.000 Program. There are usually at least three metal detectors in position: at the raw materials stage, during food processing and in packaging.

The most commonly used metal detector has three coils and is called a "balanced coil" detector. It is capable of detecting any conductive material that is able to disturb the magnetic field. That includes both ferrous and non-ferrous materials and even stainless steel or stone.

The balanced coil system works on the principle of three coils exactly parallel to each other. The centre one sends out the signal, acting as the transmitter. The two outer ones act as receivers, and are placed exactly at the same distance from the transmitter. By sending out a signal, a voltage is induced in the receiving coils. These are normally connected in a way that the voltages will cancel each other out.

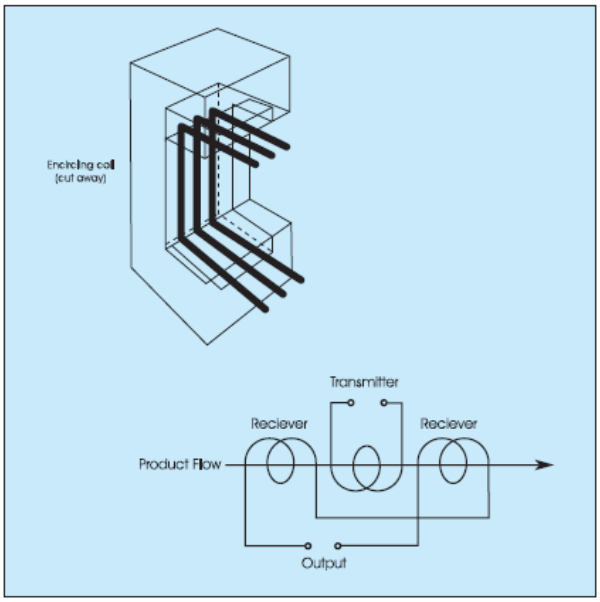


FIGURE 77: COILS SETUP INTO METAL DETECTOR

When the belt conveys products through the coil arrangement, the product disturbs the high frequency field twice, first near the first receiver and then near the second receiver when it leaves the detector. This disturbance generates a signal that can be identified. The software of the detector can modify the amplitude of the signal and use it to detect unwanted conductive materials. Depending on the type of material that needs to be detected, the frequency of the transmitter can be tuned to higher or lower frequencies.

The problem with belts running through metal detectors is usually the splice area. Problems occur when antistatic fibres in the belt are intermitted in the splice area or the splice is polluted by metal parts (from the punching blades) released during the punching fabrication. One solution would be to use a belt without antistatic yarns. However, sometimes in wet environments or with low sensitivity metal detectors and with a conveyor equipped with slider bed that is properly earthed, it's possible to use a belt with antistatic yarns. Of course, the downside of such an environment is that it is also more difficult to detect any unwanted materials, as liquid is conductive as well. Therefore, the best way to apply a metal detector is in dry circumstances. The principles of utilising non-AS belts remains valid for every product, from modular to homogeneous.

Metal detectors don't have a sensitivity standard, as detection depends a number of different factors, including product types being analysed, belt speed, product position and the immediate environment. Therefore, gauge tools (or test samples) are used to adjust the detectors so that they can achieve the necessary sensitivity.

Gauge tools come from metal detector suppliers, and different suppliers have different materials and sizes available, but the most common MD test samples are spherical in shape and made of ferrous material. The highest sensitivity level required can typically detect objects of 1.0 mm in diameter, while an average sensitivity level is able to detect an object with a diameter of 1.5 mm.

FIGURE 78: TESTING TOOLS FOR METAL & X-RAY DETECTORS

X-rays are a form of invisible electromagnetic energy with short wavelengths and high energies. The use of X-ray technology is most familiar to people through its use in medical imaging. However, X-rays can also penetrate food products and allow the imaging of the internal features of the food so as to detect physical defects or contaminants without damaging the food product.

As X-rays enter the food, they lose some of its electromagnetic energy. If the X-ray encounters a dense area in the food, such as a metal contaminant, this will reduce the X-ray energy further. As the X-rays leave the food, a sensor in the inspection equipment converts the X-rays into a greyscale image of the food's interior. The denser a contaminant, the darker it will appear in the image, which can helps in its identification.

X-rays could be equipped with mono or multi beams in different direction to look inside the product

Single beam and multi beams could help to identify foreign bodies and look on food product in different levels, positions.

As concerns belts and in light of the fact that X-rays would need to penetrate all the layers of the belt before establishing an exit image, the carbon conductive antistatic yarns of Synthetic belts present a problem.

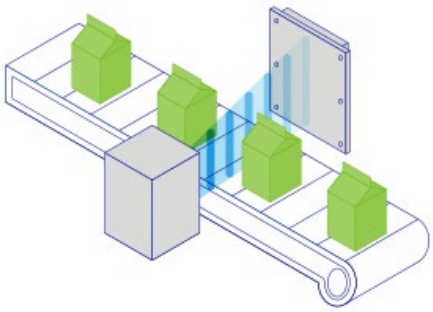


FIGURE 79: INGLE BEAM ON X-RAY DETECTOR

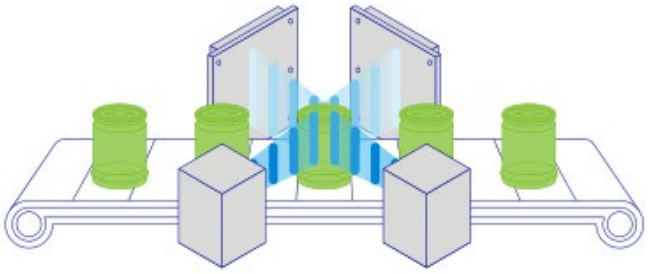


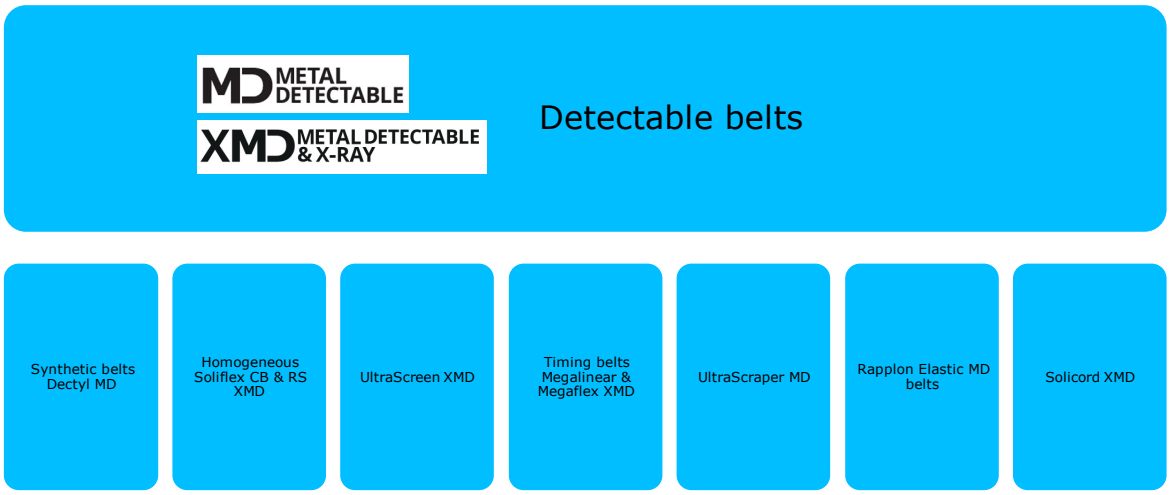
FIGURE 80: MULTI-BEAM ON X-RAY DETECTOR

Material densities are playing the most important data on x-ray detection.
Products processed in X-ray with similar density to the contaminant are challenging.

Material	Density [kg/m³]	Detection
Gold	19.30	Easy detection
Lead	11.30	Easy detection
Copper	8.92	Easy detection
Stainless steel	7.93	Easy detection
Steel	7.86	Easy detection
Iron	7.15	Easy detection
Aluminum	2.71	Detection
Glass	2.40 – 2.80	Detection
Stones	2.30 – 3.00	Detection
Bones	2.20	Detection
PTFE	2.19	Almost detectable
PVC	1.5	Almost detectable
Acetal	1.31	Almost detectable
Polycarbonate	1.20	Almost detectable
Nylon	1.15	Almost detectable
water	1.00	Reference
Polypropylene	0.90	Not detectable
Wood	0.65	Not detectable
Insects	0.59	Not detectable
Cherry stone	0.56	Not detectable
Hair	0.32	Not detectable

Ammeraal Beltech detectable belts are available at Metal or X-Ray & Metal detectable levels.
As nomenclatures are recognizable as MD or XMD if dual detectable.
As explained the X-Ray detection it's possible from the gap in between the density of the Food product and the density of the foreign bodies, in this case about the belt body or the belt accessories. Consequently, not all the belts could be XMD.
Here the list of detectable belts with brands.

Detectable belts overview



Detectable belts are a very powerful sales argument with a clear benefit in food safety but anyhow Detectable belts are generating foreign bodies as any other belt. For this reason belts that offer performance as Non Frays that are reducing the risk are an efficient support in food safety. All AB detectable belts are available with Test-Cards in coins (flat) or spheres in different diameters that could proof detection and could show the minimum detection size.

Value propositions of detectable belts are:

- Input of automated quality control out of human weak visual random control
- Supporting the prevention of expensive product recalls
- Input a NEW efficient tool in food safety
- Reduce foreign bodies from belting product
- Protecting Brand reputations
- Cost saving
- Detect maintenance issues on conveyor frame from broken belt & accessories parts

This is in addition to the fact that anyhow there is always a benefit against foreign bodies from belt out of any size.

All AB detectable belts and accessories are matching the main Food Grade standards as well lifetime and sanitation level of any similar standard belts.
Mix of detectable belts body and accessories with standard materials non detectable it's out of the logic of food safety and cannot be applied.

33. Belt labelling

For proper belt identification, belts are printed and labelled. Printed logos, achieved either with inks and/or lasering at manufacturing level or at AB workshop level, can represent a food safety risk; with lasering, the belt surface suffers damage from the high temperature generated by the laser ray and no longer meets the main food grade criteria, particularly those standards concerning migration levels.

Printing using food grade ink is fine at either manufacturing or workshop level, but the best and safest solution is a self-adhesive belt identification label that can then be stuck out of harm's way on the conveyor frame, eliminating any need for putting ink on the belt.

34. Belt installation and packaging

Belts need to be sanitised every time they are installed on a conveyor frame. This applies to every belt type and even to brand new belts straight out of the original box from the belting supplier. The possibility of supplying sufficiently aseptic belts does not exist, as contamination during the installation of the belts into the conveyor frame will always be an insuperable food safety risk.

For badly soiled or very dirty belts with an excess of sticky food residue, it's a good idea to take the belt off the frame, clean it thoroughly and then, once it's back on the frame, to sanitise and disinfect it. Of course, the fact that all belts have to be sanitised before installation doesn't mean that new belts being supplied should be dirty or contaminated. When welcoming new belts, the Food Industry is happiest to find their products in sealed black foil that protects against foreign bodies and UV rays alike.

35. On-site installation

Fitters working at Food Industry sites need to be familiar with the basic rules of food safety.

- Every tool need to be packaged properly with a view to reducing contamination.
- No material (such as wood or cardboard) that might easily transfer contaminants into food factories should ever be used in that environment.
- Chemical detergents need labels that are easily and immediately recognizable.
- Every belt that fitters handle, whether it's for just a simple tracking adjustment or for a splice, will require final cleaning, sanitizing and disinfecting by the end user.

36. Acronym glossary

AB: Ammeraal Beltech
EC: European Community
FDA: Food & Drugs Administration
EHEDG: European Hygienic Engineering Design Group
EU: European Union
OEM: Original Equipment Manufacturer
ABH: Ammeraal Beltech Holding
CIP: Cleaning in Place
SIP: Sanitising-in place
CIM: Cleaning in Motion
MO: microorganisms
ATP: adenosine triphosphate
Non-AS: non anti-static
MD: Metal detector
AM: Antimicrobial
FG: Food grade
PPLESC: Product, Process, Lay-out of the conveyor, Environment, Standards and Commercial factors
EPA: United States Environmental Protection Agency
GFSI: Global Food Safety Initiative
UHMWPE: Ultra-high-molecular-weight polyethylene
UVGI: Ultraviolet germicidal irradiation
C.O.P.: Cleaning Out of Place

Not correct 

Correct