WHITEPAPER

CLEANING CONVEYOR BELTS IN THE FOOD INDUSTRY

Siegling – total belting solutions

Forbo
MOVEMENT SYSTEMS

Foreword

Conveyor belts are used in many food production processes. To ensure superior hygiene standards and good quality food, they need cleaning frequently.

This whitepaper presents standard conveyor belt cleaning methods. An overview of how detergents work provides important basic information.

The type and thoroughness of the cleaning methods depends on lots of factors. Which is why they differ depending on the food and production conditions. Therefore, only basic outlines are given of the methods used and serve merely as examples. To achieve optimum cleaning results, a customized approach is required in each case.

All cleaning processes must comply with the relevant statutory requirements and safety regulations.

Whitepaper
Cleaning conveyor belts in the food industry - 10/24

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1 Belt cleaning methods

Cleaning belts manually takes a lot of time and manpower. It's also costly and often energy intensive. Which is why there are many ways of facilitating this step. Users can choose from fully to semi-automatic stationary end-to-end systems all the way to mobile cleaning equipment.
Cleaning processes are usually based on three standard methods, which can be combined with one another if required:

– Wiping/scraping
– Brushing (with water and detergents if necessary)
– Spraying/rinsing (with detergents if necessary)

Depending on the level of automation and the cleaning result required, these can be used both continuously and intermittently and are often integral to cleaning processes (see section 3).

Apart from the methods mentioned, others are used in special cases, such as rubbing the belt with scouring powder or wiping it down with alcohol.
Steam cleaning is increasingly an option when the products conveyed on the belt mean that water can't be used.

1.1 Wiping/scraping (manual/automatic)

Manual method:	With hand-held scrapers. Commonly used on smooth top faces with dirt that's hard to budge and/or flights that prohibit the use of automatic scrapers
Automatic method:	With fixed scrapers. Normally used on smooth top faces without profiles and side walls (see fig. 1)

Scrapers are very good at removing paste-like products (e.g. dough). They are also ideal for very adhesive, highly viscous soiling from oil and sugar and just leave very thin residual layers. To minimize product loss, scraped-off product can be fed back into the production cycle.

To automate processes and save money, lots of industries fit scrapers to the belts' return sides. These can be stationary or spring-loaded and come in different designs and materials. The product that requires scraping off governs which one is used.

Scrapers made of polyamide, polyester or polyurethane are commonly used. Some of these are also available as co-extruded profiles with a particularly flexible scraper lip (see fig. 1). Flexible scrapers compensate for any irregularities in the belt and therefore improve the cleaning process. Heated metal scrapers, which are used to remove chocolate residues, for example, are special cases.

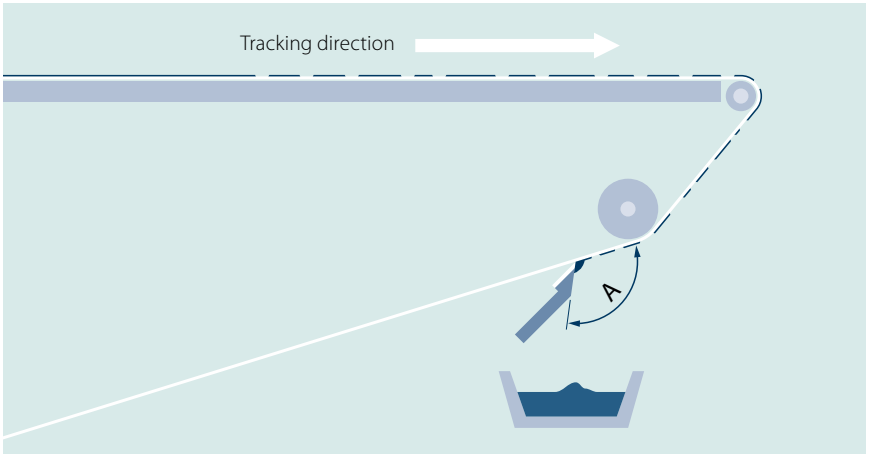

Fig. 1:
Belt scraper on the return side with a scraping angle (A) of approx. 110 – 120° (coextruded belt scraper with flexible scraper lip).

1.2 Brushing (manual/automatic)

Manual method:	With hand-held brushes. Often applied on top faces with flights where automatic rotary brushes are not an option. Can be used with water and/or detergents.
Automatic method:	Using fixed rotary brushes. Popular on top faces (also slightly patterned ones) without profiles and side walls (see fig. 2). Can be used with water and/or detergents.

In many cases, brushes can remove product residue efficiently.
They consist of a core (made of wood, metal, or plastic) that accommodates and stabilizes the brush (made of natural or synthetic fiber). Their shape and level of robustness can be adapted to the cleaning process concerned.

To automate processes and save money, lots of industries fit rotary brushes to the belts' return sides. To achieve good results, they rotate counter to the belt's direction of travel.

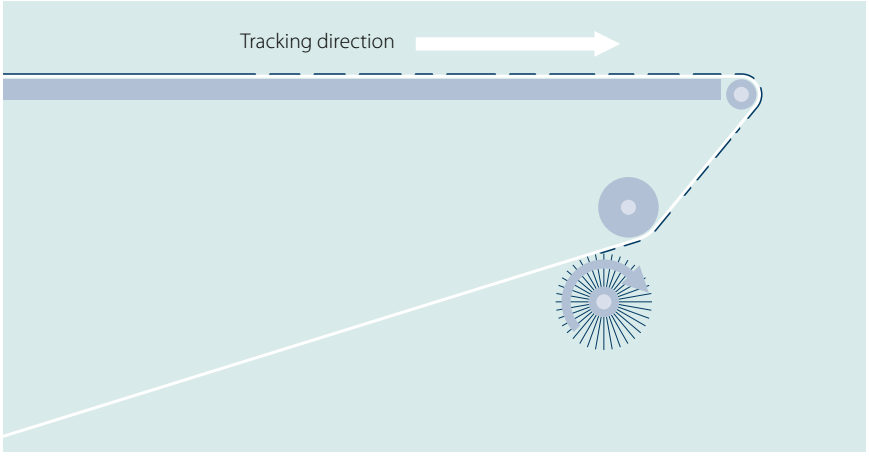

Fig. 2:
Rotary brushes used on the return side.

1.3 Spraying/rinsing manual/automatic)

Water, detergent mixtures, and/or foam are sprayed onto the belt in jets through nozzles. Pressure and temperatures are often increased to improve results. Water that is lukewarm at the most and very low water pressure are applied to rinse off and leave production residue, soiling and/or detergent/other residues to soak. Spraying equipment can also be used for rinsing.

Manual method:	With hand-held pressure washer lances, spray nozzles etc. Customary on all belt surfaces; also ideal for belts with profiles and side walls, as well as plastic modular belts.
Automatic method:	With fixed spray booms. Customary for all belt surfaces, also ideal for plastic modular belts. Limited suitability for belts with profiles and side walls.

By spraying and rinsing, users can also clean patterned belt surfaces and shapes that aren't flat.
The end result depends on multiple factors, for instance:
– How well scrapers and/or brushes have precleaned the belt
– The type, consistency, and level of dirt/soiling
– The spraying/rinsing medium's pressure, temperature, composition, and contact time
– The spraying angle and nozzle opening angle

Fixed spray booms and/or single nozzles are used for automatic mode. These are adapted to the shape of the belt and can clean whole belt carcasses if required.

Forbo Movement Systems recommends using flat-jet/fan nozzles to remove heavy soiling on belt surfaces. The correct nozzle opening angle depends on the belt width and level of soiling. Nozzles with a small horizontal opening angle (e.g. < 90°) can remove solid particles from the belt more easily at the same flow rate than those with a large opening angle. More nozzles are required for the same belt width. We recommend opening angles of between 90° and 120° (see fig. 3).

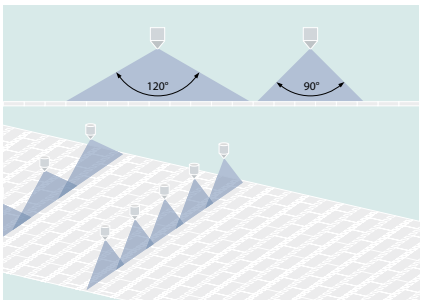

Fig. 3:
Example of nozzle layouts wit a horizontal opening angle of 90° and 120°.

Fig. 4:
Homogenous conveyor belt with quick tensioning device and lifting device.

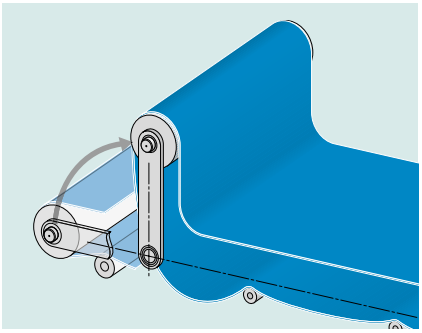

Fig. 5:
Homogenous conveyor belt with quick-release mechanism.

For plastic modular belts and elastic belt types, a system design with a quick tensioning device and, if necessary, a lifting device makes sense (see figs. 4 and 5). Thanks to these types of designs, the belt can be easily lifted and also cleaned from the underside.

To clean the eyelets/hinges on plastic modular belts, the nozzles should be positioned at the return drums. Depending on the sprocket size and modular belt type, the nozzles must have a different vertical opening angle to ensure the hinges are cleaned properly. Therefore, the nozzles must be adjustable and match the required opening angle (see figures 6 and 7).

Ideally, the underside of the modules is cleaned by positioning the spray jet at right angles to the belt's tracking direction. As a result, the spray is directed along the modules' ribbing, which helps to rinse out any dirt.

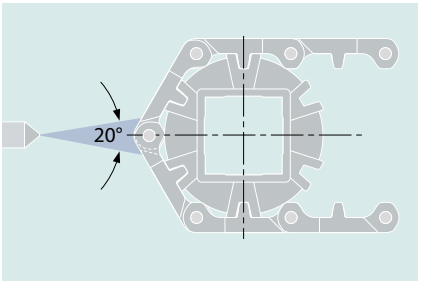

Fig. 6:
Sprocket from the Prolink 6.1 series with 6 teeth, flat jet nozzle with a 20° vertical opening angle.

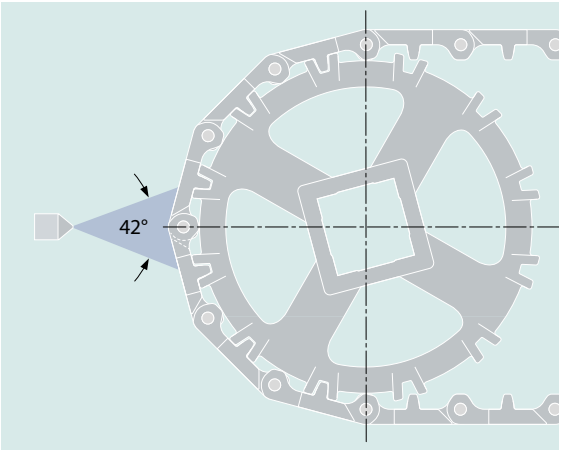

Fig. 7:
Sprocket from the Prolink 6.1 series with 12 teeth, flat jet nozzle with a 42° vertical opening angle.

2 Detergents and disinfectants/ sterilization processes

When using cleaning agents and disinfectants, you must comply with the concentrations and contact time specified by the manufacturer and information on the resistance of conveyor belt coatings (see the Forbo's chemical resistance list). Failure to comply will mean that the conveyor belts won't last as long. They can become porous and rupture.
Detergents and disinfectants must not be combined with each other.

Click

To refer to the Forbo list on
the chemical resistance of various Siegling Transilon coatings (ref. no. 309)
use the QR code above or go to www.forbo.com/movement > Downloads > Product Brochures > conveyor and processing belts

2.1 Detergents

The end result depends on the concentration of the detergent, the temperature and contact time. Detergents vary considerably in terms of their impact. To achieve a good result, choosing the right detergent is crucial and depends on the following factors:

- Type of soiling (grease, protein – raw or cooked – etc.)
- Belt surface (resistance of the coating material, see Forbo list on chemical resistance)
- Water quality (water hardness)
- Cleaning methods available/possible (spraying, lathering, brushing, etc.)
- The cleaning costs incurred

The type of soiling, i.e. the solvent required to remove the residue, determines which detergent is suitable (see table 1). Alkaline detergents can remove organic residue such as grease, sugar, protein and starch. Acidic detergents can remove inorganic residues such as salts, hard water buildup, rust, limescale, and tartaric acid.

Detergent mixtures are often used. Dosing devices can adjust the concentrations of each element.

Type of soiling	Solubility	Ease of removal	Change when heat is added
Sugar	soluble in water	easy	caramelization, hard to clean
Grease and oil	not soluble in water, alkali-soluble	difficult	polymerization, hard to clean
Proteins	not soluble in water, alkali-soluble, easily soluble in acid	very difficult	denaturation, very difficult to clean
Simple salts	soluble in water, acid soluble	easy	none
Complex salts (e.g. $CaPO_4$)	soluble in water, acid soluble	difficult	salts interact with each other, harder to clean

Table 1:
Solubility of diverse residues.

	Poly-urethane	PVC	Polyolefin (PE, PP)	Silicon	Polyamide	POM
Water	++	+++	+++	+++	+++	+++
Concen. acids	–	++	++	+	–	–
Diluted acids	++	+++	+++	++	+	+
Concen. lyes	–	++	+++	+	+	++
Diluted lyes	++	+++	+++	+++	++	+++
Oxidizing agents	+	+	+	+	+	+
Solvents	Because of the huge number of solvents, it's impossible to make any general recommendation. Refer to your list on **the chemical resistance of Siegling Transilon coatings** (ref. no. 309) or details about resistance in the **Prolink Engineering Manual** (ref. no. 888, section 2.1).					

Table 2:
A comparison of chemical resistance of diverse plastics at room temperature.

+++ Exceptional resistance
++ Average resistance
+ Low resistance
– No resistance

The table is just a rough guide because resistance doesn't just depend on the temperature, but also the contact time and concentration.

Click

To refer to the Forbo list on
the chemical resistance of various Siegling Transilon coatings (ref. no. 309)
use the QR code above or go to
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To refer to the **Prolink Engineering Manual (ref. no. 888,** section 2.1)
use the QR code above or go to
www.forbo.com/movement > Downloads >
Product Brochures > plastic modular belts

2.2 Disinfectants

Disinfecting means using chemical or physical methods to deliberately kill harmful organisms encountered on an object or a surface. The following methods are possible:

- A physical method using heat (steam, hot water, hot air)
- A chemical method with disinfectants (halogens, phenols, quaternary ammonium compounds). Before starting the machinery for the next batch, remove all the chemical disinfectants.

2.3 Sterilization processes

UV-C based sterilization processes deactivate harmful organisms. As a result, these are no longer infectious and unable to multiply.
Most current UV-C sterilization devices operate with wavelengths of around 254 nm.
Forbo produces all PVC and PU coatings for fabric-based conveyor and processing belts as well as fully homogenous belts with UV-stabilized recipes. This reliably prevents premature ageing under the impact of UV-C radiation (cracking and tendency to break). The belt surface stays closed and is still easy to clean. Forbo plastic modular belts are also UV-C resistant.

Click

Download the Forbo brochure on
UV-C-resistant Conveyor Belts (ref. no. 261)
via the QR code above or go to www.forbo.com/movement > Downloads > Product Brochures > conveyor and processing belts

3 Cleaning methods

What are the key workflows involved in common cleaning methods?
The following aspects and others need to be taken into account in each case:

- The type and degree of soiling/contamination
- Belt type/roughness and pattern on the belt surface
- Material resistance and design of the production machinery
- The time available between two production batches
- Quality assurance methods (HACCP, IFS 8, BRC, …)
- Commercial considerations

The OEM's recommendations and specifications should also be prioritized, as there may be limitations regarding the pH value and temperature depending on the material.

Conveyors in hygienic designs decrease the cleaning time and water consumption drastically. Consequently, companies also benefit from lower costs (due to clean-in-place systems).

Forbo recommends the following cleaning procedure:

3.1 Removing food residue

Good precleaning decreases the time spent cleaning overall. Use a scraper, brush etc. to get rid of any easy-to-remove food residues before they dry and stick to the belt.

3.2 Rinsing

The first rinse is preparation for the main cleaning process. Only preclean the surface with cold or hot water (40 °C max.) and at low water pressure (10 – 20 bar). Because high temperatures and steam cause protein to coagulate and stick to the machinery. Otherwise, the final result will be much poorer.

3.3 Main cleaning process

There are lots of ways of carrying out main cleaning processes. Several steps are usually involved and these need to suit the relevant requirements.
The main cleaning process is normally carried out at low pressure to prevent water from splashing or aerosols from occurring. Consequently, any cleaned surfaces can't come into contact with contaminated particles. The machinery is lathered, cleaned manually with brushes after a short contact time if necessary, and then rinsed with water. Alkaline residues are then neutralized with acidic agents.

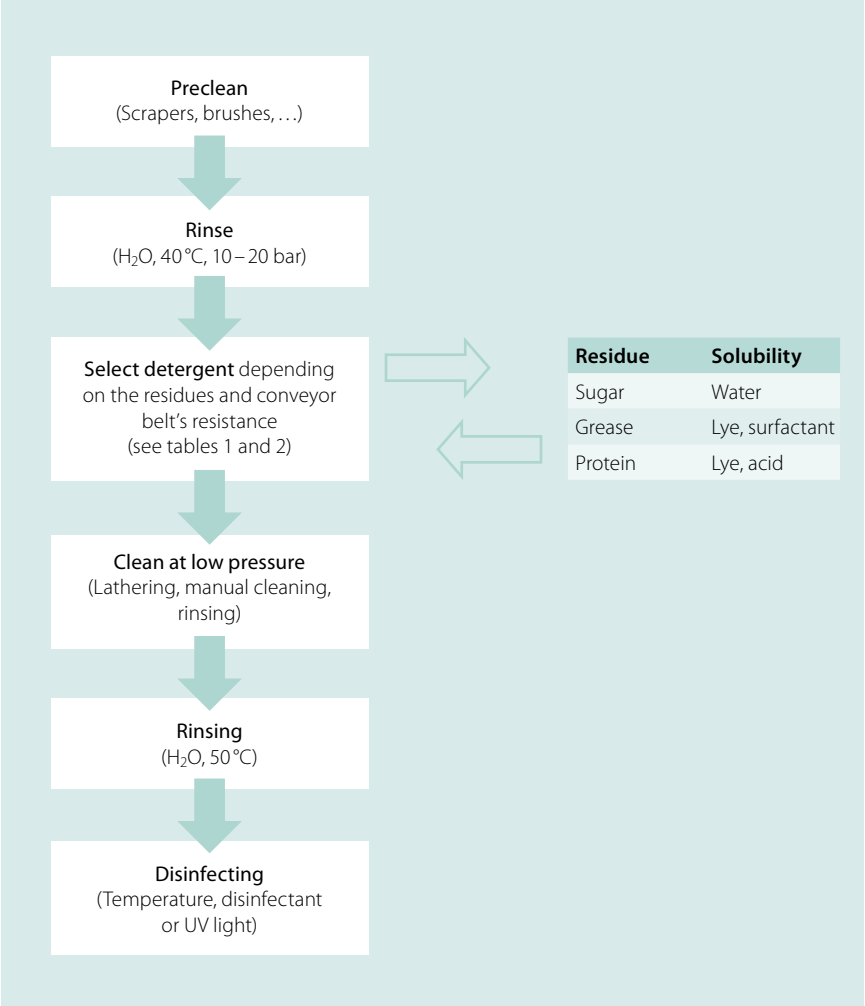
3.4 Rinsing

A further rinsing cycle must follow the main cleaning cycle and addition of alkaline and/or acidic detergents. This cycle uses drinking water at a temperature of approx. 50 °C. The rinsing process is repeated until all residues from the cleaning cycle are removed.
After the rinsing process, activate the belt to get rid of any remaining water before it's used on the production line.

3.5 Disinfecting

We recommend disinfecting all hygiene-critical areas in the food production and packaging process.

Furthermore, Forbo recommends you check the impact of the cleaning process frequently.



Residue	Solubility
Sugar	Water
Grease	Lye, surfactant
Protein	Lye, acid

Fig. 8:
Cleaning process of a conveyor belt in the food industry (an example).

4 Cleanliness during fitting and repair

4.1 Careful preparation before fitting

All components such as return and drive drums, idler rollers and slider beds must be cleaned before each belt fitting. The conveyor belt's packaging may only be removed on site. Once you've unwrapped the belt, do not roll or drag it over a rough or dirty floor. Keep covers to protect prepared splices on until the new conveyor belt is fitted to the conveyor.

4.2 Cleaning during fitting

Very strong bonded or melt splices are achieved, if the contact between the surface and adhesive is as close as possible during splicing.
Which is why the areas that need to be stuck together must be clean and free of dust, grease and silicon.
Therefore, cleaning the ends of the belt before splicing is vital. All splicing accessories (splice films) and devices (e.g. punch presses) must also be cleaned with a cloth and alcohol (methylated spirits).

5 Conclusion

Cleaning processes for conveyor belts are generally based on three different techniques, which can also be combined if required:

– Scrapers
– Brushes (if necessary with water and detergents)
– Spraying/rinsing (with detergent if necessary)

In some cases, scrubbing with scouring powder, wiping with alcohol and steam-cleaning methods are also used.

Fully or semi-automatic systems and mobile cleaning systems can minimize time-consuming manual work. Appropriate production-line equipment (e.g. with clean-in-place systems = a cleaning solution circulated in the production machinery) also cuts the time taken, water consumption and therefore costs.

The above-mentioned methods are part of an overarching concept and carried out in a specified sequence, as described in the examples above. The method must be geared to the application concerned and based on numerous criteria. This is the only way of achieving good cleaning results that fulfil the quality assurance requirements (HACCP, IFS 8, BRC, …).

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