siegling
belting

TecInfo

Cleaning conveyor belts

Cleaning is a general term for maintaining and regaining levels of cleanliness in industry, trade and households. In addition to maintenance and hygiene, the term also covers safety (tidiness) and aesthetic aspects.

The purpose of carrying out maintenance is to ensure that machinery remains in good working order, or is repaired should it break down.

Hygiene is defined as all steps taken to prevent infectious diseases, in particular cleaning, disinfecting and sterilising.

Safety refers to a condition free of any unreasonable risks, or can be considered free of risks.

Conveyor belts are used in many different industrial processes (e.g. tobacco manufacture, food production, chipboard and fibreboard production, printing industry) and have to be cleaned as well. The type and scope of conveyor belt cleaning in each industrial sector is very different and depends on the following factors:

- type and degree of soiling
- material resistance and production machinery design
- the interval between two production runs
- recommended quality-assurance measures (HACCP, IFS 5, BRC, …)
- financial aspects

A conveyor belt can be cleaned manually, but the process is usually quicker and better when tools, machines and cleaning agents are used.

1. Tools

Tools are defined as equipment required to make a mechanical impact on the conveyor belt.

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1.1 Belt scrapers

Belt scrapers are applied in many industrial processes, such as for example the food industry, tobacco manufacture or chipboard and fibreboard production. In addition to minimising product loss and fulfilling maintenance requirements, belt scrapers make a huge contribution to hygiene in food production.

A number of very different types of scrapers are available in various materials. Which one is the right choice depends on the property of the goods conveyed that need to be cleaned off.

As well as heated metallic scrapers, which are used to remove chocolate residues for example, polyamide, polyester or polyurethane scrapers are also on the market. Belt scrapers can be inserted so that they are fixed or spring-loaded.

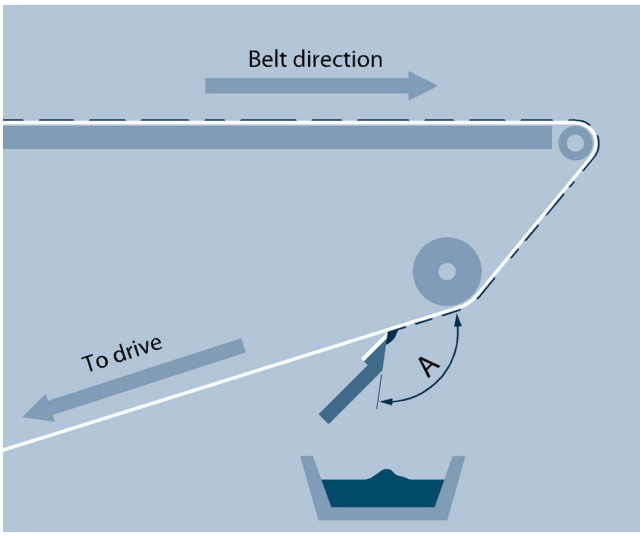

Fig. 1: Example of a belt scraper's position on the underside at an angle (A) of approx. 100°.

1.2 Brushes

A vast range of brushes are used in industry. They consist of a basic corpus (made of wood, metal or plastic) which affixes and stabilises the brush (made of natural or synthetic fibres). The shapes and levels of robustness can be altered to offer the right solution for any application. In tobacco manufacture, rotating brushes are used whose fibres are made of the leaves of an agave that only grows wild in the uplands of Mexico (Mexico fibre [Tampico]). Similarly to the Siegling Transilon TT range, the chemical composition of this natural fibre fulfils the stringent demands of the tobacco industry. The mechanical effect of these temperature-resistant, hard and aggressive fibres is ideal for cleaning belts. Fewer cleaning agents are required and the belt's surface is protected in the best possible way.

1.3 Belt washing/cleaning systems

Cleaning belts manually is a time-consuming process requiring a lot of manpower, involving often high energy consumption and therefore making it a costly process. There are many ways of optimising this step, starting with fully and semi-automatic, stationary complete systems, to mobile cleaning equipment.

Typical cleaning systems in food production or tobacco manufacture are rotating rollers installed on the return side of the machinery that are fitted with brushes or felt coatings. These operate in the opposite direction of belt travel and clean the top face of the belt. Depending on the process, these systems could be operated both continuously and intermittently with water and cleaning agents.

2. Cleaning agents and disinfectants

When using cleaning agents and disinfectants, always adhere to the manufacturer's stipulations on concentrations and reaction times, as well as information on the resistance of conveyor belt top layers (http://www.forbo-siegling.com/pages/brochures/technical/download/fms200708_cemical_resistance_properties_309_en.pdf). Improper use shortens the service life of the conveyor belts. They can become porous and rupture. Cleaning agents and disinfectants must not be mixed with one another.

2.1 Cleaning agents

The success of the cleaning process depends on the concentration of the cleaning agent, the temperature (generally 50 - 75°C) and the cleaning time (exposure time). Different cleaning agents vary significantly in the way they take effect. The right choice of cleaning agent is decisive in producing a good result and depends on the following factors:

- the type of soiling (grease, proteins [raw or cooked] etc.)
- belt surface (resistance of the coating material, see Forbo Siegling resistances list)
- water quality (water hardness)
- cleaning methods available and possible (spraying, foaming, brushing etc.)
- cleaning costs incurred

The type of soiling is also important, i.e. which solvent can be used to get rid of the residue (see table 1). Alkaline cleaning agents can be used to remove organic residues, e.g. fat, sugar, protein and starch. Acid cleaning agents can be used to remove inorganic residues like salts, water hardness, rust, calcium carbonate, tartar and scale.

Type of soling	Solubility	Removing soiling	Changes when heat is added
Sugar	water soluble	easy	caramelisation, very difficult to clean
Grease and oil	not water soluble, soluble in an alka-line, tenside/emul-gator soluble	difficult	polymerisatin difficult to clean
Proteins	water insoluble, alkaline soluble, soluble in acids	very difficult	denaturation, very difficult to clean
Simple salts	water soluble, acid soluble	easy	none
Complex salts ($CaPO_4$)	water soluble, acid soluble	difficult	interaction of the salts, more difficult to clean

Table 1: Solubility of various residues.

Mixtures of cleaning agents are often used. Metering equipment can help to adjust the concentrations of the individual components.

	Poly-ure-thane	PVC	Polyolefin (PE, PP)	Silicone	Poly-amide	POM
Water	++	+++	+++	+++	+++	+++
Concentrated acids	-	++	++	+	-	-
Diluted acids	++	+++	+++	++	+	+
Concentrated lyes	-	++	+++	+	+	++
Diluted lyes	++	+++	+++	+++	++	+++
Oxidants	+	+	+	+	+	+
Solvents (e.g. alcohol)	++	+	++	++	+++	++

Table 2: Comparison of chemical resistance of different plastics at room temperature.

+++ high resistance
++ average resistance
+ low resistance
- no resistance

2.2 Disinfectants

Disinfection is defined as specifically killing pathogens on an object or surface with the help of chemical or physical methods. The following processes are possible:

a) physical by heat (steam, hot water, hot air)
b) chemical by using disinfectants (halogens, phenols, quarternary ammonium compounds) before starting the machine, chemical disinfectants must be completely removed before the next production run
c) radiation (UV-C radiation; λ= 100 - 280 nm) to reduce germs

	Changes	**Resistance**
PVC (Food)	discolouring, ruptures on the top layer, changes in mechanical properties	+(+)
Polyurethane	yellowing, slight change in the mechanical properties	++
Polyolefin (PE, PP)	change in the mechanical properties	+
Polyester		+++
Silicone		+++
Polycarbonate		+++
Polyamide	change in the mechanical properties	+
POM	change in the mechanical properties, discolouring	+

Table 3: UV resistance of different coating materials.

+++ high resistance
++ average resistance
+ low resistance

3. Methods

3.1 Food industry

A hygienically designed conveyor reduces the time and water required for cleaning and therefore overheads (e.g. clean-in-place systems = circulation of a cleaning solution in the production machinery).

Forbo Siegling recommends the following steps are always followed:

3.1.1 Removing food residues
The cleaning cycle is shortened if a good pre-clean is carried out. Easy-to-remove food residues should be got rid of with scrapers, brushes etc. before they dry.

3.1.2 Rinsing
The purpose of the first rinsing cycle is to prepare for the main cleaning process. The surface may only be pre-cleaned with cold or hot water (40°C max) and at low water pressure (10 - 20 bar), because at high temperatures and in hot steam proteins coagulate and stick fast to the machinery. Therefore, the end result of the cleaning process would be a lot poorer. Ensure that the water used for rinsing never gets into the motor directly or is sprayed into electrical parts of the machinery.

3.1.3 Main cleaning cycle
The main cleaning cycle is then carried out. There are various cleaning methods which have to be adapted to suit the process. For example:

- high-pressure cleaning (applying cleaning agents and rinsing the machinery at high pressure). Pressure-reducing valves are often used to protect the surface of the conveyor belt. The valves ensure that a defined level of outlet pressure is not exceeded
- normal pressure cleaning (e.g. lathering the machinery, after a short contact period possibly manually cleaning with brushes, rinsing at normal pressure)

The main cleaning cycle should be carried out in several steps. First of all the cleaning agent is used, a rinse with water is carried out and then the alkaline residues are removed with acid (usually at 50 - 75°C).

3.1.4 Rinsing
After the main cleaning cycle, using alkaline and/or acid cleaning agents, a further rinsing cycle follows. Potable water and a temperature of approx. 50°C are required to do this. Rinsing is done until the cleaning residues are completely removed.

3.1.5 Disinfection

Subsequent disinfection is recommended for all hygiene-critical food areas in the manufacturing and packaging process.

Forbo Siegling also recommends regularly checking the machinery to monitor the end result.

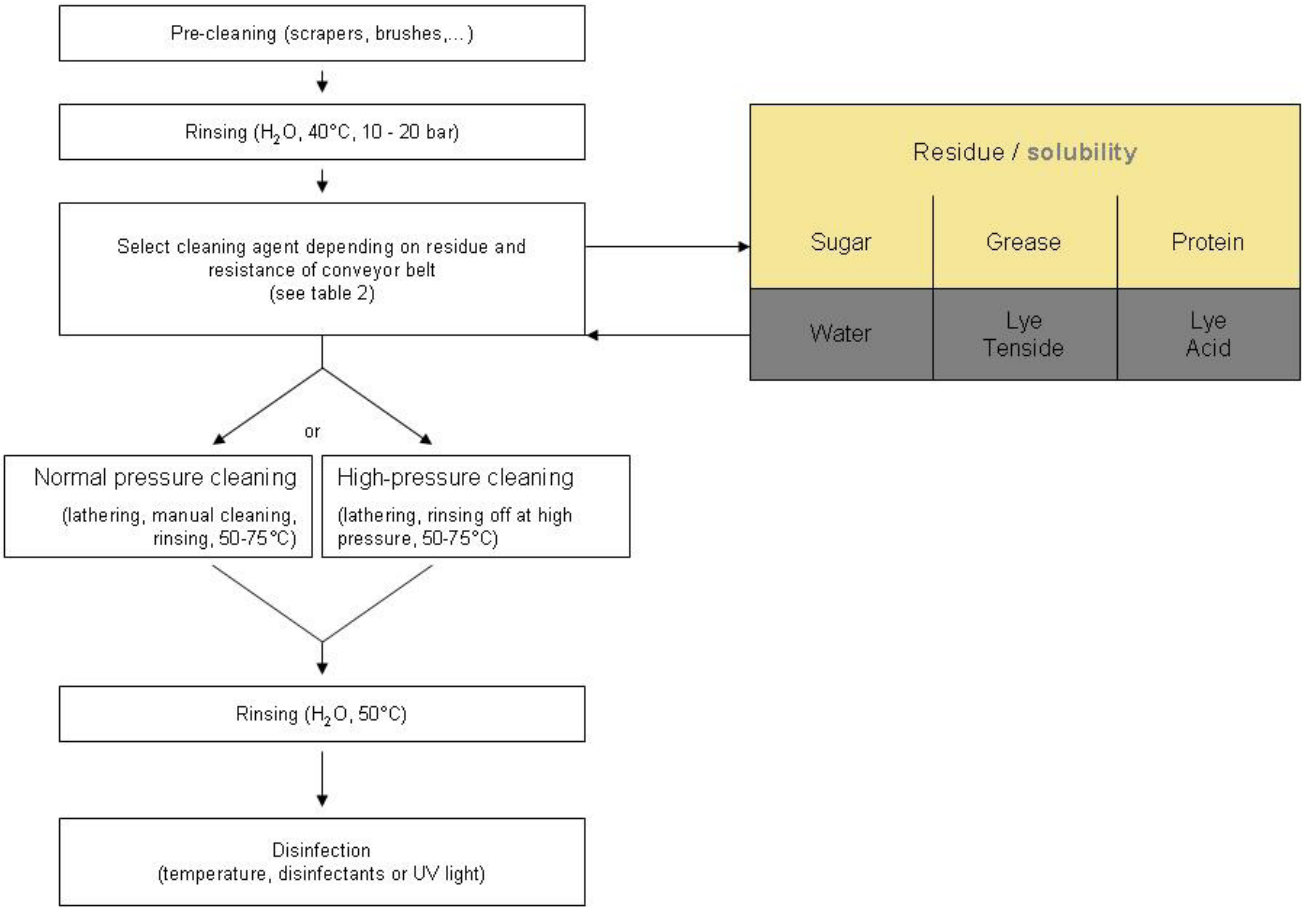

Fig. 2: Procedure for cleaning a conveyor belt in the food industry.

PLEASE NOTE:

Due to the range of machinery and applications, this is only to be considered a recommendation by Forbo Siegling. The recommendations and specifications of the machinery manufacturer must always take priority, as there may be restrictions regarding the pH level and the temperature, depending on the material. The cleaning process must be adapted accordingly.

3.2 Chipboard and particle board production

When producing chipboard and fibreboard, release agents (tenside mixtures) are used in concentrations of 2 to 4%. The release agents are sprayed at the beginning of the production line onto the conveyor belt (spreader belt) and serve the following purposes:

- reduction of the surface tension between the conveyor belt and mat (wood-adhesive mixture)
- formation of suspensions; release of small solids (chip/pulp fibre) from the top-face coating (to avoid caking)
- improvement of heat transmission into the chip/fibre mat in order to increase production speed

Should slight levels of caking occur, despite using separating agents, this is removed by a rotating brush.

4. Practical tips

4.1 Plastic modular belts

To remove coarse soiling on the surface of the modular belt, Forbo Siegling recommends using flat spray/fan nozzles. The nozzle's ideal opening angle depends on the width of the belt and degree of soiling. If nozzles with a small horizontal opening angle are used (e.g. < 90°) and where the flow rate is the same, solid particles can more easily be removed from the belt than when the opening angle is big (however where the belt width is the same a greater number of nozzles is necessary). Opening angles between 90° to 120° are recommended.

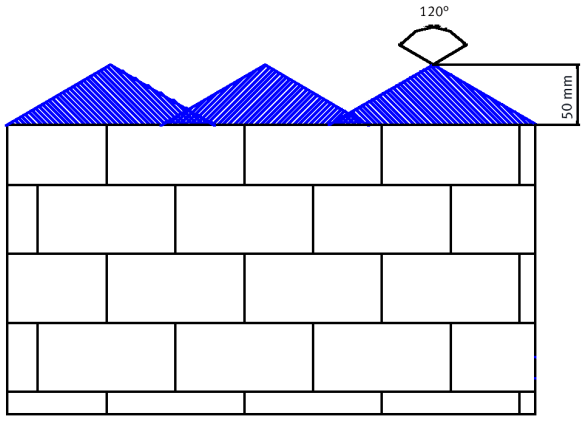

Fig. 3: Example of a nozzle layout with a horizontal opening angle of 120°.

We recommend a conveyor with quick release, where the belt is lifted up and can therefore also be cleaned from the underside.

To clean the modular belt efficiently around the eyelets/hinges, the cleaning nozzles should be positioned around the return drums. The nozzles must be adjustable, so that depending on the sprocket diameter and module size, optimum through-flow and therefore cleaning of the hinges is guaranteed. Depending on the size of the sprocket, another vertical angle of opening is recommended (see figure 4 and 5).

Ideally, the underside of the modules is cleaned by fitting the spray jet perpendicularly to the direction.

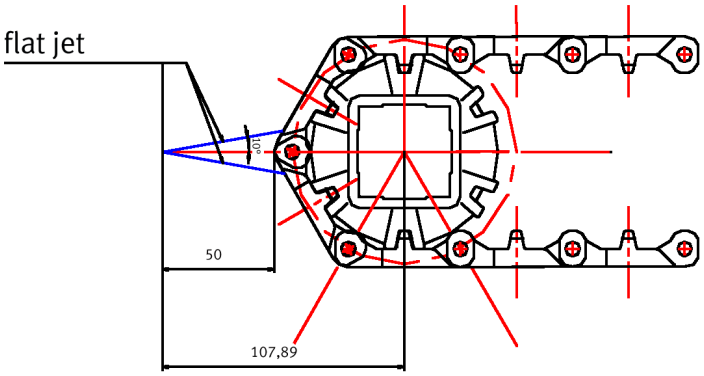

Fig. 4: Sprocket with 6 teeth, flat-jet nozzle with 20° vertical angle of opening.

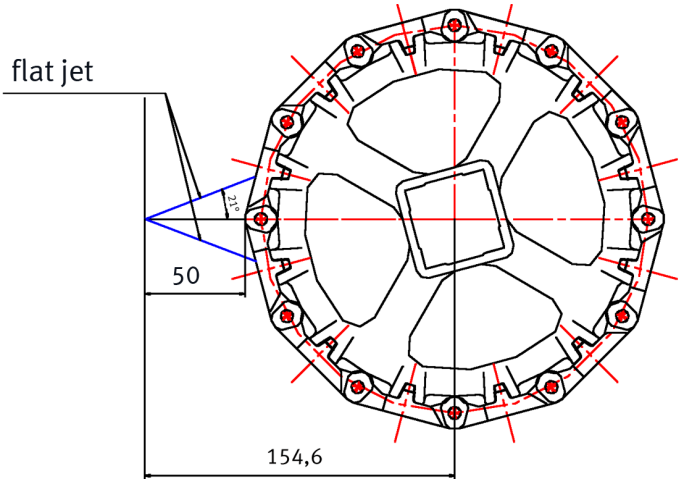

Fig. 5: Sprocket with 12 teeth, flat-jet nozzle with 42° vertical angle of opening.

MOVEMENT SYSTEMS

4.2 Fitting/repair

4.2.1 Care before fitting

Before fitting any belt, all parts of the machinery such as end and drive drums, support rollers and slider beds must be cleaned.

The packaging used during transport may only be removed at the place where the belt is fitted. The belt which is being unpacked must not be rolled or pulled over a rough or dirty floor. Splice protection sleeves must remain on the prepared splice until the new conveyor belt has been inserted.

4.2.2 Cleaning during fitting

A bonded or melted splice adheres well when as close a contact as possible is made between the surface and the adhesive. Therefore, the bonded areas must be clean, free of dust, grease and silicone.

As a result, before making any splice, the ends of the belt, all splicing accessories (films), as well as all tools (e.g. for punching) must be cleaned with a cloth and alcohol (methylated spirit) or benzene.

Special care required:
After fitting, printing blankets are cleaned all over. Scouring powder is used as a cleaning agent and applied to the belt with a sponge. Cleaning is done with belt washing machinery at 10 m/min for 30 minutes. Then the belt is rinsed for 15 minutes with fresh water (40 m/min) and wiped down with alcohol.