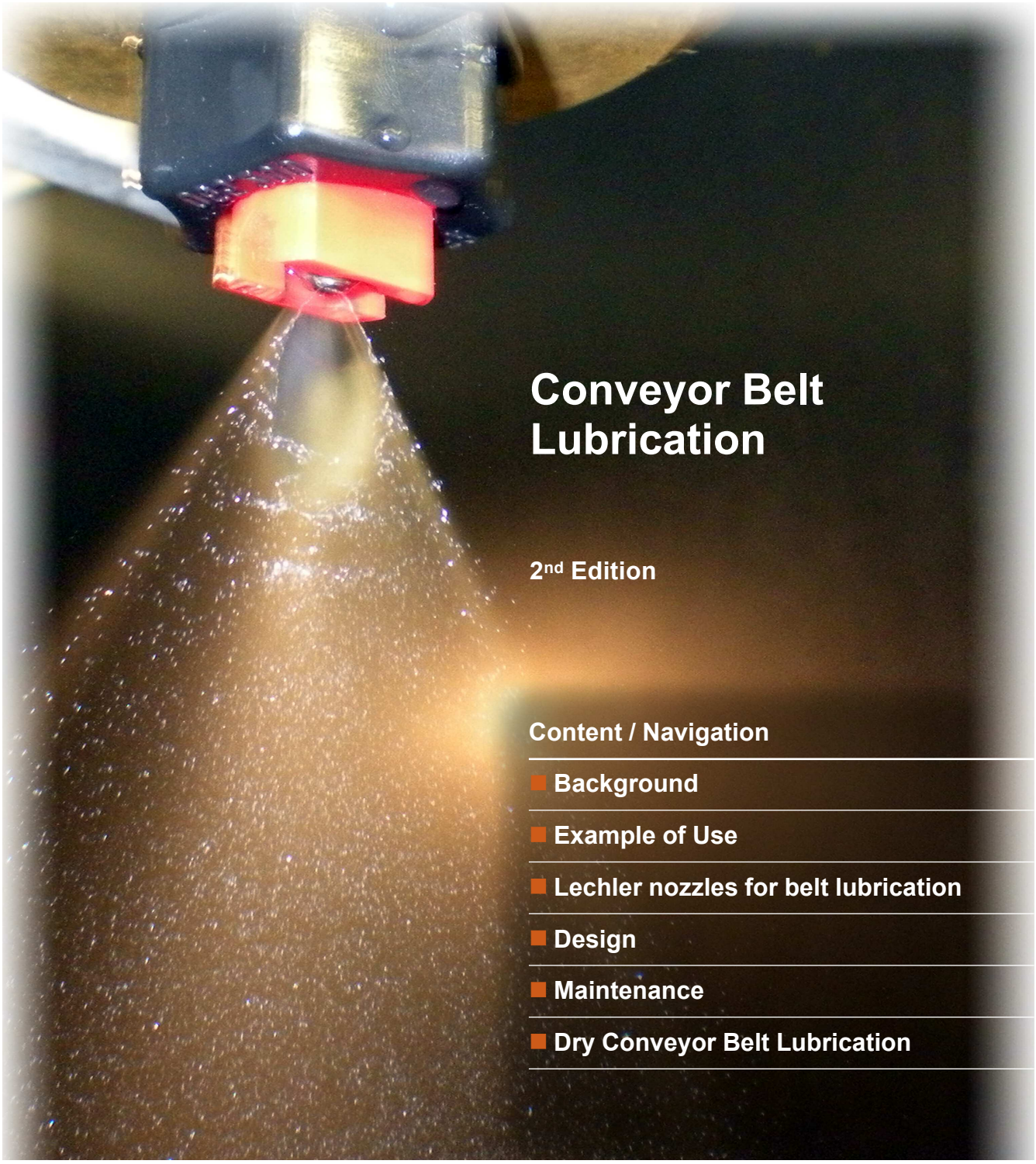
Knowledge Center

Lechler GmbH
Precision Nozzles · Nozzle Systems
P.O. Box 12 23
72544 Metzingen / Germany
Phone: +49 (0 ) 71 23 962-0
E-Mail: info@lechler.de

## Process Technology



# Conveyor Belt Lubrication

2nd Edition

Content / Navigation

**Important notice**



**Completion, addition and translation**

Please visit our website at http://shop.lechler.de for the most recent version of this document.
Persons experienced in this application who would like to add information, please contact us by e-mail at lkc@lechler.de. In addition, translations into other languages are welcome.

**Acknowledgements**

We would like to thank everyone who contributed his or her knowledge and information used in this document, as well as those persons involved in the editing and translation process.

**Publisher**

Lechler GmbH
Precision Nozzles · Nozzle Systems
P.O. Box 12 23
72544 Metzingen / Germany
Phone: (07123) 962-0
Fax: (07123) 962-444

E-mail: lkc@lechler.de
Internet: https://shop.lechler.de - http://www.lechler.de

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## Background

It is hard to imagine the food and beverage industry without the open transport of products on conveyor belts as portrayed in Figure 1. Most of the time, stainless steel or synthetic conveyor belts are used, which transport the product from one processing station to the next.

*Fig. 1: Open product transport on conveyor belts*

### Roles of Conveyor Belt Lubrication

The application conveyor belt lubrication relates to the spraying of a soapy solution, called the conveyor belt lubricant, onto the conveyor belt. There are numerous advantages to applying conveyor belt lubricants due to the reduction of these factors:

1) Abrasive wear of all components such as chains / matting chains, slide rails, curves, and wheels
2) Higher conveying speed
3) Current draw at the drive motors
4) Dynamic pressure on the belt, lowering the risk of damage to product and to bridge sheet metal and machine parts
5) Friction coefficient, which lowers the risk of products falling over
6) Lower noise level due to less friction
7) Transport of germs hampered

For this purpose, Lechler offers special nozzles (Figure 2). The volumetric flows are very small; the smallest nozzle delivers 0.05 l/min at 2 bar. In addition, there are numerous other nozzles with larger volumetric flows which can be used.

*Fig. 2: Flat fan spray nozzles with a very small volumetric flow and a parabolic liquid distribution are used for conveyor belt lubrication [Ecolab]*

For this purpose Lechler offers special nozzles (figure 2). The flow rates are very small. The smallest nozzle supplies 0.06 l/min at 3 bar. Of course higher flow rates are available as well.

## Example of Use

### Filling of bottles

Modern automatic high performance filling lines pose high demands for a smooth delivery and removal of the containers to be filled. The application of diluted lubricants to the conveyor belt in an exact, tailored concentration reduces the friction resistance between the moving parts, reduces their wear, and therefore avoids unnecessary production downtimes.

The preparation of the conveyor belt lubricant happens in a central dosing system. The solution is then pumped to the nozzles via pipe systems and is sprayed on evenly with low pressure (approx. 1 to 2 bar). The pressure can not be too high; otherwise unwanted spray mist is generated.

The nozzle assemblies are often switched on and off using time-controlled magnetic valves. This timing device saves water and chemicals.

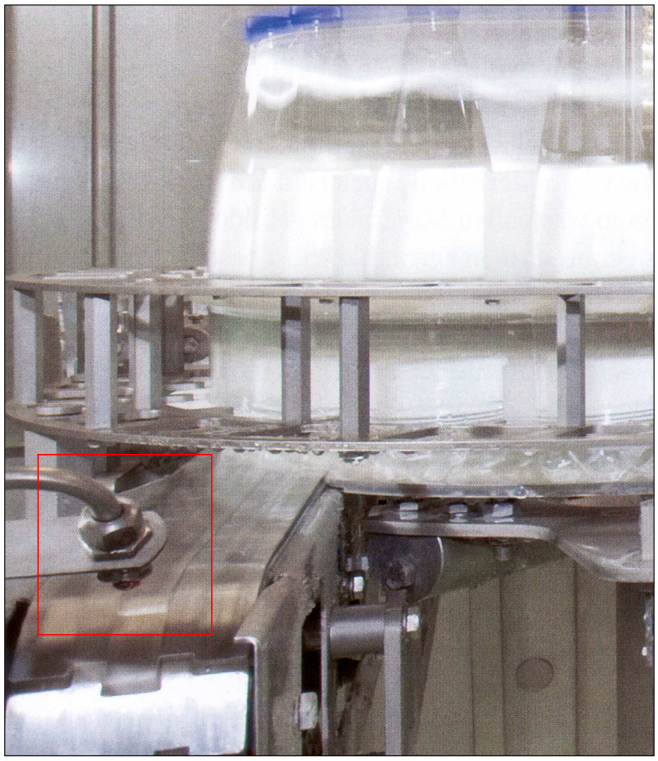


*Fig. 3: Single nozzle used for the lubrication of a stainless steel belt in a beverage bottling plant [KRONES]*

### Higher conveying speed possible with nozzles

The optimal conveying speed is important for a high effectiveness of the plant. However the chain speed cannot be increased arbitrarily. The criteria for the speed and the width of a belt are dependent on the quantity of product, which can be transported, for each time unit. Manufacturers of conveyors indicate recommended speeds for the different belt typs. This data indicates clearly that a higher conveying speed can be achieved by belt lubrication.

### Influencing factors of spray nozzles

The use of high-quality nozzles plays a major role for belt lubrication. Optimal sliding properties are reached only by even liquid distribution.

Buying the cheapest nozzles on the market might not satisfy the quality demands. Features of such nozzles include a spray jet leafing the nozzles inclined instead of straight, flow rates that are different to the values provided in the catalogue and others.The consequences are not trivial however. A too high flow rate can lead to an increased consumption of valuable belt lubricant hence equalizing the costs saved on the nozzle side very fast. In the worst case a bad spray can lead to critical lubricant shortage of certain belt segments, which can lead to downtimes of the entire plant. Thus, savings should not be made at the wrong end.

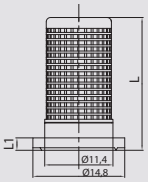
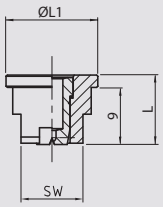
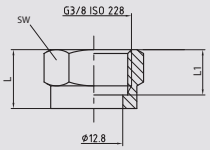
Lechler offers high-quality belt lubrication nozzles and e.g. co-operates in this area with manufacturers for belt lubrication system solutions like Ecolab GmbH, Jürgen Löhrke GmbH and others.

# Lechler nozzles for belt lubrication

## Product Features

Lechler nozzles for belt lubrication are flat fan spray nozzles with an especially low volumetric flow and a parabolic distribution of liquids. A complete belt lubrication nozzle consists of the nozzle itself, a strainer with a check valve, a flat gasket, and a cap nut.

## Parts Overview

| Component | Image | Drawing | Order-number | Material | Dimensions [mm] L | L1 | SW | * [mm] |
|---|---|---|---|---|---|---|---|---|
| Strainer with check valve |  |  | 065.260.16.02 | 1.4305 | 21,0 | 1,4 | – | 0,1 |
| | | | 065.260.30.02 | Brass | 21,0 | 1,4 | – | 0,1 |
| | | | 065.265.56.00 | POM | 21,5 | 2,0 | – | 0,25 |
| Flat gasket |  | | 065.240.55. | PTFE | – | – | – | – |
| | | | 065.240.72. | EWP-210 | – | – | – | – |
| | | | 065.240.73. | Rubber | – | – | – | – |
| Nozzle |  |  | 652.xxx.16.00 | 1.4305 | 11 | 15 | 10 | – |
| | | | 652.xxx.30.00 | Brass | 11 | 15 | 10 | – |
| | | | 652.xxx.8H.03. | 1.4305/POM | 12 | 14,8 | 8 | – |
| Cap Nut |  |  | 065.200.16 | 1.4305 | 13 | 10 | 22 | – |
| | | | 065.200.56 | POM | 14,5 | 11,5 | 22 | – |
| | | | 065.200.5E | PVDF | 14,5 | 11,5 | 22 | – |

*Mesh size

## Overview of Nozzles

| Order-number | Flow rate [l/min] at 3 bar | Spray angle | Color | Narrowest cross section **E** [mm] |
|---|---|---|---|---|
| **652.145.ww** | 0,06 | 75° | Black | 0,3 |
| **652.165.ww** | 0,077 | 75° | Black | 0,34 |
| **652.185.ww** | 0,1 | 75° | Red | 0,2 |
| **652.187.ww** | 0,1 | 120° | Grey | 0,3 |
| **652.215.ww** | 0,137 | 75° | Blue | 0,2 |
| **652.245.ww** | 0,2 | 75° | Orange | 0,3 |
| **652.247.ww** | 0,2 | 120° | Black | 0,3 |
| **652.275.ww** | 0,27 | 75° | Brown | 0,3 |
| **652.277.ww** | 0,27 | 120° | Black | 0,3 |
| **652.482.ww** | 2,53 | 30° | Black | 1,1 |
| **652.484.ww** | 2,53 | 60° | Black | 1,0 |

## Materials (ww)

ww=8H — Stainless steel nozzle insert 1.4305. Body made from POM can be delivered in miscellaneous colors

ww=16 / 30 — Can be delivered complete in stainless steel 1,4305 or brass (not color-coded)

*All values of the table a valid for water. Belt lubricants on oil basis and synthetic solutions can lead to deviating values.*

## Pressure Range

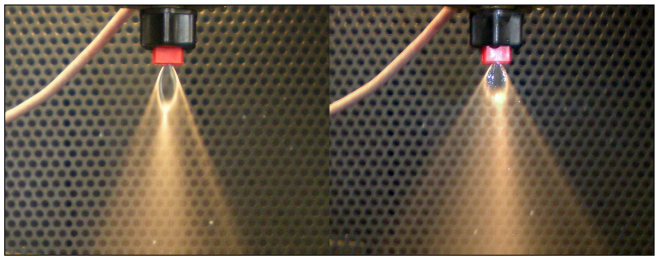


*Fig. 4: The spray angle of nozzles depends on the water pressure. With the shown lubrication nozzle the spray angle is 60° at 2 bar. At a pressure of 1 bar the spray angle decreases to 45°. This behavior is not a malfunctioning but physically given by the pressure. Click on the figure above to watch a video of the nozzles where the pressure is decreased from 2 bar to 1 bar.*

Nozzles can be operated at very pressures (~1 bar). The spray angle will be narrower at pressures below 2 bar. **A minimum pressure of 0,8 bar should not be fallen below**, since otherwise the spray angle opens only insufficiently. Below 0,5 bar the spray angle decreases even down to a solid jet.

The values for the spray angle of the nozzle overview (page 7) refers to a pressure of 3 bar.

## Conveyor belt lubricant and nozzle

Conveyor lubrication nozzles can spray all usual belt lubricants. The following lubricant types are common:

1. Lubricant on oil basis
2. Synthetic lubricants
3. Water-soluble lubricants and soaps
4. Water

It can not be ruled out that certain lubricant types can affect the performance data of the nozzles such as spray angle and flow rate. With lubricants on oil basis and with synthetic lubricants the viscosity should be taken into account. **Viscosities up to 50 mPas are suitable for lubrication nozzles**. It must be pointed out that physically the following changes of spray can be observed:

Spray angle: Narrows in general. Compared with water the spray angle opens at a higher pressure

Volumentric flow:

As consequence of higher viscosity the pressure loss of the nozzle increases. The nozzle of the series 652.185.16 has a pressure loss of 0,9 bar at a viscosity of 100 mPas and a flow rate of 0,1 l/min. At 50 mPas the pressure loss of the same nozzle is only half as large (0.47 bar). The filter was not considered thereby!

This effect should be considered with the choice of the belt lubricant, because otherwise the pump can not produce enough pressure to provide a good liquid distribution. A minimum pressure of 0,8 bar is needed to have good spray properties. Pressure losses of pipes, valves and the nozzle itself have to be considered. Figure 5 shows how nozzles should not spray actually.

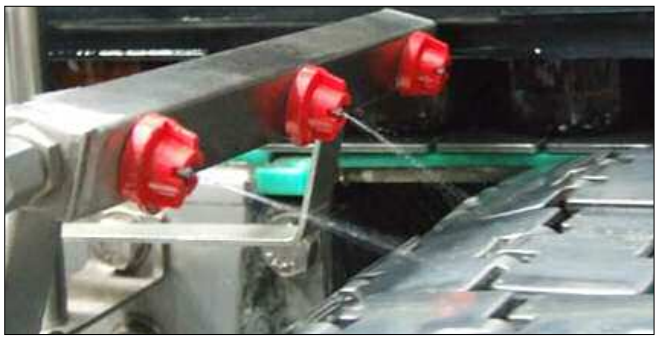


*Fig. 5: Flat jet nozzles spraying at a pressure which is too low. Thus an optimal liquid distribution cannot be achieved! [---]*

### Order related marking of the nozzles

Optional the nozzles can be marked individually in case higher order quanities are requested.

### Check valve with strainer

- Avoids dripping afterwards and saves liquid medium
- Opening pressure: 0.5 bar
- Closing pressure: 0.4 bar
- Width of mesh: 0.1 / 0.25 mm

### Customized Solutions

For large purchase quantities, Lechler also offers customized nozzle designs. These nozzles are sold only to the respective OEM.

*Fig. 6: Lubrication nozzle 652.185.16 at a spray pressure of 2 bar*

## Design

The spacing of the nozzles has to be designed according to their spray width. In this example, a spacing of 85 mm was chosen. The spray width depends on the nozzle, the pressure, and the spray height.

Normally the nozzles are attached with a setting angle of approx. 65° compared to the belt. In the majority of cases, the spray height is 50 to 200 mm (Fig. 8). The nozzles should be arranged in a way which prevents an overspray during use. Overspray means that the nozzle on the rim positions spray over the edges of the belt. Usually overspray is necessary in order to achieve an even distribution of liquids. However for this application it is not very important since the liquid usually distributes well on top of the belt. In addition, a lesser amount of conveyor belt lubricants is used and puddles below the spray nozzles are avoided.

Figures 7 and 8 show a design with nozzles of type series 652.185.

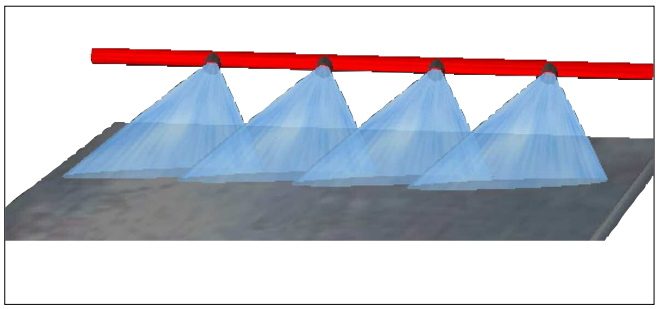


*Fig. 7: 3D view of a nozzle holder design with 4 belt lubricating nozzles of type series 652.185.*

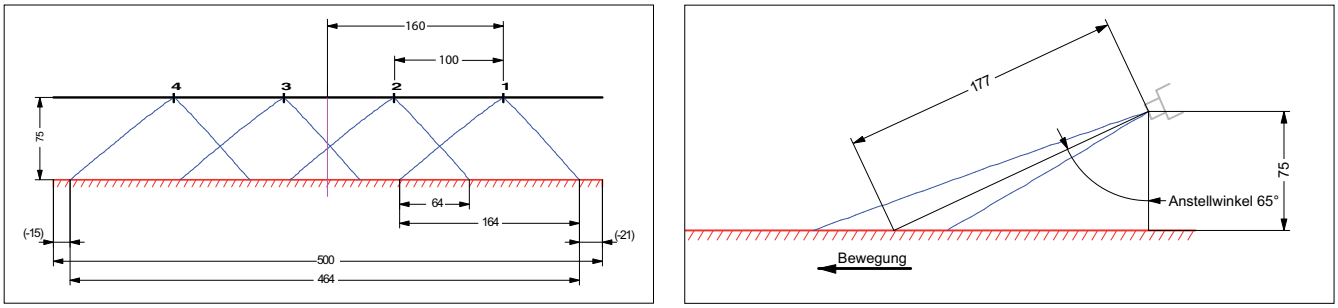



*Fig. 8: Nozzle holder with 4 nozzles of type series 652.185. Pressure 1 bar, spray angle 75°, setting angle 65°, spray distance 177 mm, nozzle spacing 100 mm, torsion angle 10°.*

## Maintenance

Depending on the belt lubricant the filters of the nozzles must be cleaned regularly, because the strainers sometimes get obstructed by slime due to a strong foam formation. The foam mainly accumulates on the filter fabric during downtime and cloggs it over time (Figure 9). A filter clogged by slime lets little liquid pass.

Also when using water as lubricants this step is important, if no central filter is present in the pipework.

Unfortunately the clogging of the nozzle can never be ruled out. However, there are several practical approaches which lead to a smooth operation:

*Fig. 9: Some synthetic belt lubricants have a high tendency for foam formation. This foam can accumulate on the strainer filter inserts of the nozzle and over time, lead to a blockage caused by slime [BRAUINDUSTRIE 2/2007]*

1. Air-cleaning of nozzle and filter with com pressed air
2. Use of a different conveyor belt lubricant with a low tendency for foam formation
3. Use of the nozzle without a filter (only applicable if the medium does not contain any particles which can clog the mouth piece of the nozzle. The max particle size has to be smaller then the values indicated at the nozzles overview on page7)

## Dry Conveyor Belt Lubrication

### Wet Belt Lubrication

To date, the wet conveyor belt lubrication is traditionally used in many cases. Strongly–diluted watery solutions, mostly amino acetate–based, are sprayed almost continuously onto the conveyor belts.

### New Method – Dry Belt Lubrication

Dry belt lubrication only rarely works completely dry but rather with low amounts of a specific substance. **So far this method only works for plastic conveyor belts which are directed on plastic traks.** The possible transported products are limited to PET-bottles, cans and Tetra packs.

### Disadvantages of dry belt compared to wet belt lubrication:

- After downtimes of the conveyor belt, it takes longer until all areas are optimally lubricated, since fewer lubricating stations are available. This can possibly lead to greater wear.
- Dry belt lubrication is so far only suitable for a limited range of conveyor belt systems.
- Contrary to the wet belt lubrication, no continuous rinsing of the filled product occurs during the dry belt lubrication; therefore it is crucial that the dry belt lubrication performance is not negatively affected by product remains on the belts.

### Advantages of dry belt compared to wet belt lubrication:

- High reduction of costs for fresh water and sewage
- Better lubrication characteristics of the new dry lubricant
- The floor does not get as wet
- Lower amount of aerosol is created due to a smaller total volumetric flow
- No foam formation; therefore no nozzles or strainers are clogged by slime
- No damage of packaging due to moisture

## Contact

In case you need further assistance when selecting nozzles for your application, contact us directly.

You can reach us by phone or via eMail.

Lechler GmbH
Ulmer Str. 128
72555 Metzingen, Germany

Phone: +49-7123-962-0
Fax: +49-7123-962-444

eMail: info@lechler.de

Lechler Inc.
445 Kautz Rd.,
St. Charles, IL 60174 USA

Phone: +1-(800)-777-2926
Fax: +1-(800)-444-7069

eMail: GeneralMgr@LechlerUSA.com

Lechler India Pvt. Ltd.
Plot No B 2, Main Road, Wagle Industrial Area,
THANE 400 604, India

Phone: +91-22-2582-1196
Fax: +91-22-2582-1262

Lechler Ltd.
1 Fell Street
Newhall, Sheffield, S9 2TP, UK

Phone: +44-114-249-2020
Fax: +44-114-249-3600
Email: info@lechler.com