# Spray Nozzles and Accessories for Crop Protection

## Product Catalogue 109E


agrotop
Spray Technology

# Products for modern agriculture

The objective for every **agrotop** product is to make spray application more precise, efficient, simple and economical. We produce a variety of spray patterns to guarantee on-target application:

- Flat fan nozzles
- Double flat fan nozzles
- Hollow cone nozzles
- Off-centre nozzles
- Deflector nozzles

Our modular TurboDrop® technology makes it possible to offer these nozzles in each pressure and droplet range, for best results in both traditional and drift-reduction applications. Progressive agriculture demands it, **agrotop** delivers.

In addition to the extensive range of spray nozzles, **agrotop** supplies the leading manufacturers of sprayers with important components:

- Pumps and control valves
- Nozzle holders and filters
- Flow meters and dosage devices
- Calibrated measuring jugs for checking application rates

Our professional staff is committed to maintaining our extensive range of specialised products and available to attend to your order to your complete satisfaction.
No matter where you are in the world, **agrotop** is there for you.

# Quality. Designed, manufactured, guaranteed

Our superior technology is driven by the commitment of highly specialised technicians. Continuous supervision and documentation of ongoing production ensures the highest quality products, surpassing the specific requirements of national and international authorities.

Modern measurement technology enables our employees to control the critical factors for first-class spray nozzles:

- Accurate dimensions
- Flow accuracy
- Patternation

Behind all of our technological merit stand the spirit and inventions of the company's owner Steffen Graef and the high motivation of his team. They are specialists and far-seeing professionals who are trained to innovate and improve up to the latest technologies.

The result of their work can be seen in the vast number of national and international patents and awards for **agrotop** spray nozzle technology, products and accessories.

Customers in over 40 countries worldwide are loyal to our high-quality products. They know our nozzles help them to achieve excellent application over thousands of hectares, combining efficient crop protection with the highest environmental protection standards ... drop by drop.

# Content

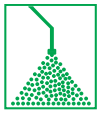


# Glossary and annotations

## The icons, used in this catalogue, stand for the following applications:

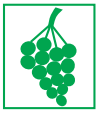
**Broadcast/Boom spraying**

**Band spraying**



**Knapsack sprayers**

**Orchards**



**Vineyard**

**Hops**

**Horticulture**

**Special applications**

## The symbols, used in this catalogue, stand for the following technical data:

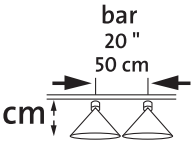
**Spray angle**


**Flow rate according to the ISO standard**

**Flow rate according to special standards**

**Spanner width required of bayonet cap hole to fit the nozzle**


**Recommended pressure range**




**Recommended boom height for 50 cm nozzle spacing**

**Application width**

**Approximate application width of single nozzle using the recommended boom height**

**JKI = Julius Kühn-Institut (former BBA)**

## Annotations

**agrotop** spray nozzles are developed and manufactured using sophisticated technology to guarantee the highest quality of our products. However, spray nozzles should be treated with care to ensure a perfect spray over many hours.

All spray nozzles are sensitive to mechanical damages. They must be cleaned only with adequate tools. Nozzle protection on the booms can help to prevent damage.

During use spray nozzles are exposed to wear and should be changed, at least, when the flow rate exceeds 10 % of the values given in the application charts. The wear rate of a nozzle can vary greatly, depending on pressure, chemical and material of the nozzle.

Ceramic nozzles have the highest wear resistance, but ceramic orifices or inlay tips can crack if directly hit. Plastic nozzles made from POM have a relatively good wear resistance considering the lower price, they are an excellent option.

To avoid excessive wear we recommend using our nozzles according to the technical notes given for each nozzle type in this catalogue.

All our spray nozzles are manufactured and tested to conform to the ISO 5682–1 and 5682–2 standards. The flow rate of most of our nozzle refers to the ISO colour code (ISO 10625). The technical data are given for each nozzle in this catalogue.

More information regarding application charts can be found beginning on page 42. For information on venturi nozzles, AirMix® and TurboDrop® see page 6–9 and page 20/21.

A growing number of countries have additional requirements for accreditation of spray nozzles, e.g. the German JKI (Julius Kühn-Institut). Most of **agrotop** nozzles conform to these higher requirements. Some of our venturi nozzles are officially approved for 50 %, 75 % or 90 % drift reduction. Because these requirements change frequently, please contact us to obtain current data.

**Contact us for any further information regarding our products.**

# Nozzles

## Venturi nozzles

AirMix® · Albuz® · TurboDrop®

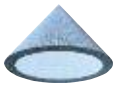
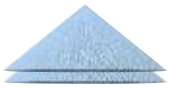
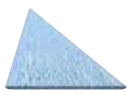
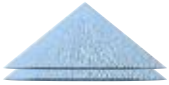
## Standard nozzles

## Liquid fertilizer application

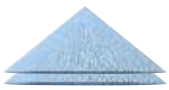
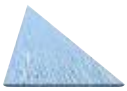
## Filters and valves

## Nozzle caps and nozzle holders

# agrotop nozzles – overview

| Nozzle type | | Spray pattern | bar | | Size | Use | Venturi | Page |
|---|---|---|---|---|---|---|---|---|
| AirMix® |  |  | 1–6 | 110° | ISO 01–06 | | ✓ | 13 |
| AirMix® HC |  |  | 1–6 | 80° | ISO 025 | | ✓ | 14 |
| AirMix® OC |  |  | 1–6 | 80° | ISO 02–05 | | ✓ | 15 |
| Albuz® AVI 110° |  |  | 3–8 | 110° | ISO 01–10 | | ✓ | 16 |
| Albuz® CVI 110° |  |  | 1.5–8 | 110° | ISO 015–05 | | ✓ | 16 |
| Albuz® AVI-TWIN |  |  | 2–8 | 2 x 110° | ISO 01–06 | S | ✓ | 17 |
| Albuz® CVI-TWIN |  |  | 1.5–8 | 2 x 110° | ISO 015–05 | S | ✓ | 17 |
| Albuz® AVI 80° |  |  | 2–20 | 80° | ISO 01–04 | S | ✓ | 18 |
| Albuz® CVI 80° |  |  | 2–20 | 80° | ISO 01–025 | S | ✓ | 18 |
| Albuz® AVI-OC |  |  | 3–7 | 80° | ISO 015–04 | S | ✓ | 19 |
| TurboDrop® TD |  |  | 2–10 | 80°/110° | ISO 01–10 | | ✓ | 22 |
| TurboDrop® HiSpeed |  |  | 2–10 | 2 x 110° | ISO 01–08 | S | ✓ | 24 |

# agrotop nozzles – overview

| Nozzle type | | Spray pattern | bar | | Size | Use | Venturi | Page |
|---|---|---|---|---|---|---|---|---|
| TurboDrop® TD-ADF |  |  | 1.5–8 | 2 x 110° | ISO 02–10 | S | ✓ | 26 |
| TurboDrop® TD-DF |  |  | 3–10 | 2x 80°/110° | ISO 01–10 | S | ✓ | 28 |
| TurboDrop® TD-XL |  |  | 1–8 | 110° | ISO 01–10 | | ✓ | 29 |
| TurboDrop® TD-OC |  |  | 2–10 | 80° | ISO 01–08 | S | ✓ | 30 |
| TurboDrop® TD-HC |  |  | 2–10 | 80° | ISO 01–04 | | ✓ | 30 |
| TurboDrop® TD-AN |  |  | 1–10 | 80°–145° | ISO 01–06 | | ✓ | 31 |
| TurboDrop® TD 80/60/40/20 |  |  | 5–35 | 20°/40° 60°/80° | ISO 01–08 | S | ✓ | 31 |
| Spray Max® |  |  | 1–4 | 80°/110° | ISO 01–10 | | — | 38 |
| TipCap TCP |  |  | 1–4 | 110° | ISO 02–20 | | — | 38 |
| TipCap TCC |  |  | 2–4 | 110° | ISO 015–08 | | — | 39 |
| TipCap TCHC |  |  | 0.5–3 | 90° | not ISO stand-ardised | | — | 39 |
| Albuz® ATR |  |  | 3–25 | 80° | not ISO stand-ardised | S | — | 40 |

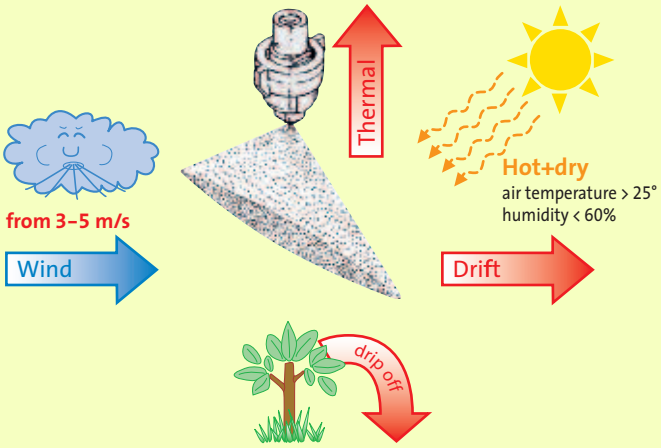
# Introduction to agrotop venturi nozzles

## agrotop venturi nozzles

Since their introduction by **agrotop** for agricultural sprayers in 1993, venturi nozzles have become successful in all types of chemical application, making them indispensable in modern agriculture, for effective and economic spraying as well as compliance with environmental standards.

Drift is one of the main problems in spray technology responsible for over 1/3 of all off target applications. This means that in more than 30 % of the applications farmers are wasting money.
Some basic principles can help in understanding the most important factors contributing to higher drift and the relevance of this to chemical applications.

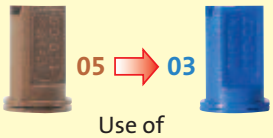
### Weather conditions increasing drift risk




### Application factors increasing drift risk

Increased spraying pressures

Higher application speeds




Use of smaller nozzle sizes

Boom heights above 50 cm for AirMix/AVI® Standard nozzles or over 70 cm for TurboDrop®

One of the main advantages of **agrotop** venturi nozzle technology is the combination of significant drift reduction with no impairment to spray performance.
The following will explain how venturi nozzles reduce drift.

## Drift

The drift potential is strongly related to the droplet size of the spray. Bigger droplets can reduce the drift drastically in the same application conditions.

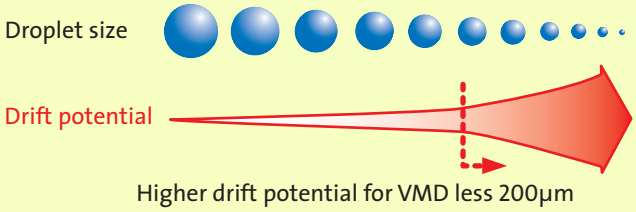
### Negative effects of drift

| | |
|---|---|
| • Loss of chemical | ⇨ Higher costs |
| • Part of the spray does not reach the target | ⇨ Inefficient application |
| • Spraying impossible in bad weather conditions | ⇨ Reduced "application window" |
| • Damage of neighbouring crops or environment | ⇨ Risk of claims for damages<br>Pollution<br>Legal restraints |
| • Contamination of farm workers | ⇨ Intoxication<br>Legal restraints |

### Drift potential

• 1/3 of bad applications are related to drift

• Drift potential is higher for smaller droplets (low VMD)




Higher drift potential for VMD less 200µm

# Venturi nozzles

## Droplet size

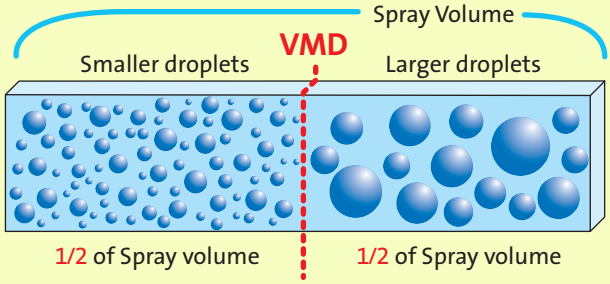
The droplet size of a spray is generally expressed as the VMD (Volume Median Diameter).

The VMD is mainly influenced by pressure and nozzle size. When the pressure rises, VMD is reduced. The VMD rises when using larger nozzle sizes.

Droplet size recommendations vary due to different modes of action of chemicals. There is also a difference between venturi and standard nozzles. Contact chemicals generally require smaller droplets of lower VMD for good efficacy.

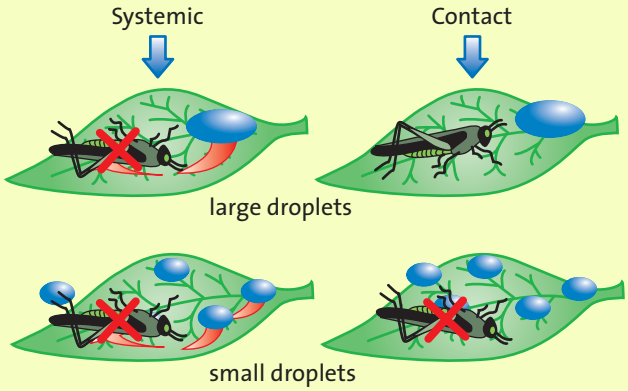
### Droplet size

The droplet size is generally given as **VMD**
= **V**olume **M**edian **D**iameter




VMD = Droplet size in µm when the accumulative volume of the smaller droplets reaches 50 % of the spray volume

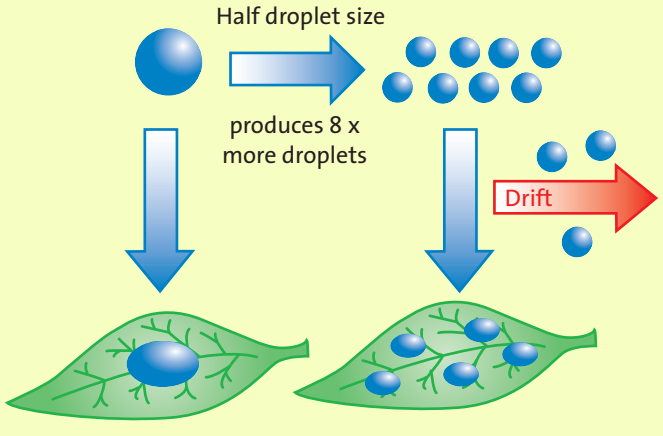
### Different modes of action of systemic and contact pesticides




## Coverage

- Good coverage is essential for the efficacy of the spray
- Contact chemicals require better coverage than systemic
- However, good coverage doesn't mean that spray chemical should be applied until dripping of the leaves.

### Effect of droplet size on coverage




The following droplet size classification gives an overview using contact or systemic chemicals. The droplet sizes conform to the ASAE/BCPC droplet size classes.

### Droplet size classification (ASAE/BCPC)

| Droplet size | | Venturi nozzle | Standard nozzle |
|---|---|---|---|
| extremely coarse | | Systemic using higher application rates | reduced coverage |
| very coarse | | Systemic | reduced coverage |
| coarse | | Systemic all; Contact using higher application rates | Systemic using higher application rates |
| medium | | Systemic; Contact | Systemic |
| fine | | Drift risk! | Systemic; Contact Drift risk! |
| very fine | | not recommended | not recommended |

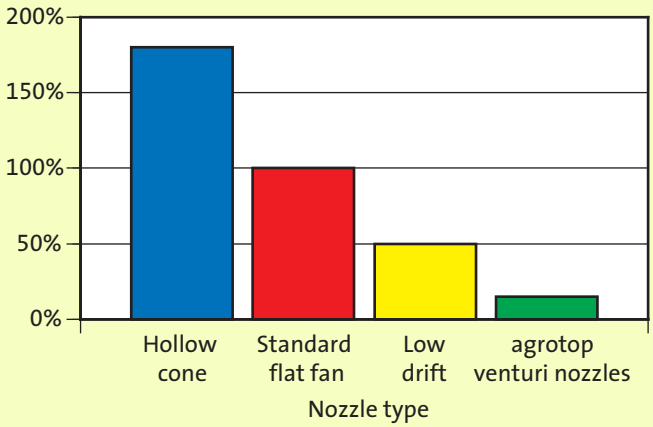
These recommendations are based upon extensive general experience under temperate climatic conditions. They do not substitute the individual application recommendations for the chemicals, especially under different climatic conditions.

# Venturi nozzles

## Efficient drift reduction

Normally, spraying should only be done when the risk of drift is low. However, often the farmer has to apply a chemical treatment when the drift risk is high, e.g. short "application window", which means the need to apply to large areas in a short time.

### Drift potential of different nozzle types




There are different advances in spray technology to reduce the drift potential. The easiest and most efficient is still to increase droplet size. However, simply using larger droplets can mean a significant drop in efficacy for many pesticides. **agrotop** venturi nozzles are the perfect solution to overcome this problem .

### Effective drift reduction

- Most of the factors for drift are difficult to control
- Spraying with larger droplets can strongly reduce the drift potential, **however larger droplets reduce coverage which can affect the spray efficacy**
- **Applications with lower volumes require smaller nozzle size which generally produces smaller droplets and more drift**
- **Solution:** applying larger air filled droplets that guarantee good coverage, even at lower volume

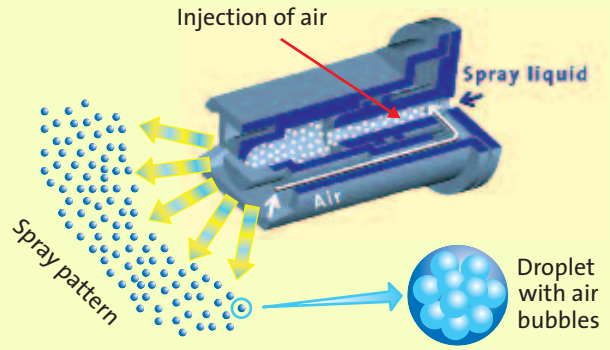
**agrotop venturi nozzles**

## How the agrotop venturi nozzle works

**agrotop** venturi nozzles, e.g. AirMix®, have two main parts, the injector and the distribution tip. The orifice of the injector determines the flow rate, therefore the size of the injector determines the size of a venturi nozzle.
The injector is also the part where the air is injected into the liquid flow, using the "Venturi principle". Air and liquid are mixed, forming larger droplets with air bubbles inside.

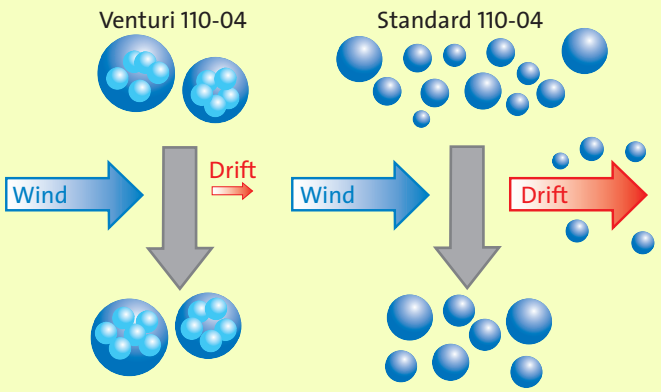
### Venturi nozzle

Injection and mixture of air and liquid – Mode of operation




The second component of a venturi nozzle is the distribution tip, responsible for the spray pattern.
The air-filled bubbles produced by the venturi nozzles are much larger than the "normal" droplets of a standard nozzle, for the same pressure and size.

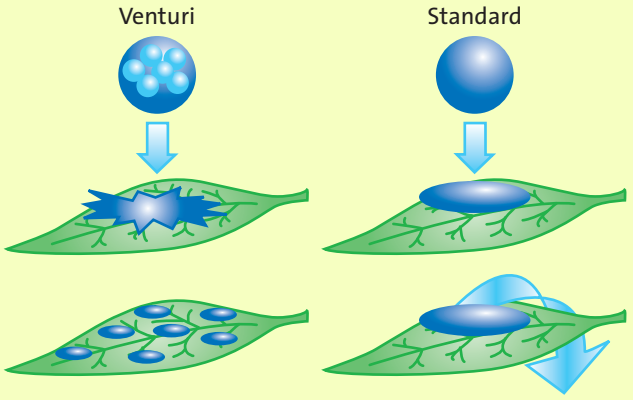
### Effect of venturi nozzles on drift



# Venturi nozzles

When the air-filled droplets of a venturi nozzle hit a surface, e.g. a leaf, the bubbles burst, distributing finer droplets all over the surface, improving the coverage (see pictures on page 20).
Larger droplets provide better penetration, even in dense canopies. The bursting droplets guarantee an excellent coverage, sometimes even on the underside of the leaves.

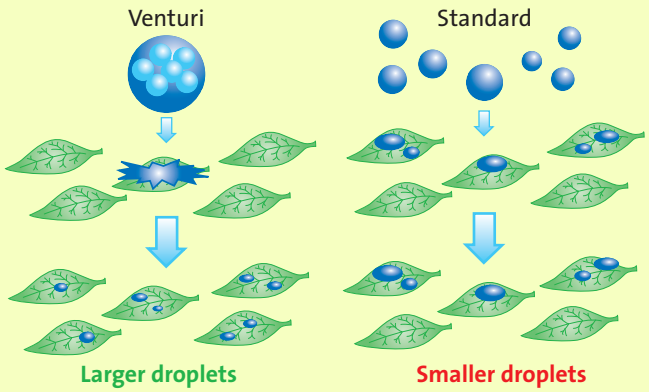
### Effect of venturi nozzles on coverage




## Advantages of agrotop venturi nozzles

In any situation where drift is a problem, the use of a venturi nozzle is highly recommended.
agrotop venturi nozzles enable farmers to apply pesticide within an optimum time frame, even when weather conditions are less favourable and large areas have to be treated.

### Penetration in the crop




### Advantages of venturi nozzles

- Drift reduction up to 90 %
  Depending on size and pressure
  **+ saves money**
  **+ protects environment**
- Same efficacy/coverage as standard nozzles
  Venturi nozzles might be operated at a different pressure
- Excellent penetration
- Spray applications are more independent from weather conditions
- Reduces contamination of environment, neighbouring crops or persons with chemical spray

## The agrotop range of venturi nozzles

agrotop has the widest range of venturi nozzles for all types of agricultural spraying. The compact AirMix® series is the culmination of 15 years' experience in venturi spray technology, offering all the advantages of venturi nozzles at a very economical price.

The TurboDrop® and TurboDrop XL® series are still the benchmark for venturi nozzles. The wide pressure range and relatively constant droplet size guarantee the best performance.

The modular system of the TurboDrop® nozzles allows us to offer unique solutions for all kinds of agricultural applications.

All of our venturi nozzles can be operated at low pressure for liquid fertilizer application. The extremely large droplets reduce the risk of phytotoxic damage.

To see the individual characteristics and advantages of all the agrotop venturi nozzles, please refer to the individual product pages in this catalogue. Special information about the TurboDrop® nozzle can be found on page 20/21.

Contact us for any additional information on our venturi nozzles.

# Double flat fan venturi nozzles

## Many farmers around the world use double flat fan venturi nozzles to optimise their application technology.

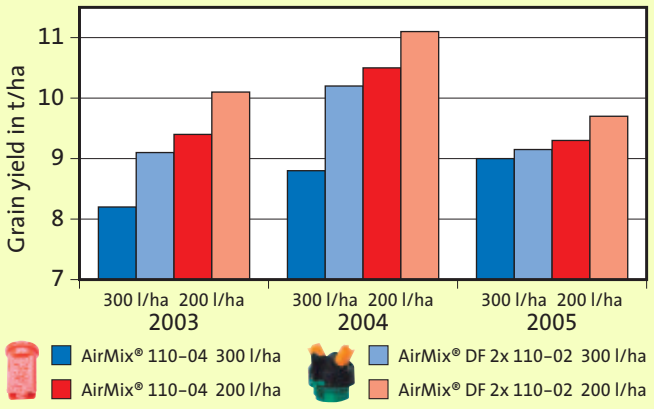
agrotop has more than 20 years of experience in developing our venturi nozzles to fit best to the local farmer conditions in every part of the world, pushing new trends in application technology.
During this period the agrotop double flat fan venturi nozzles have shown remarkable improvements:

- Better efficacy and higher yields
- Uniform coverage of all parts of the plant, including difficult to hit areas like small or inclined leaves.
- Improved all around coverage and deposition on vertical targets like grain ears
- Reaches also the "shadow areas" not covered by single flat fan nozzles
- Coarse to medium droplet size, perfect for fungicide or insecticide treatments, but with less extemely fine droplets. Therefore excellent drift control, making the HiSpeed nozzles a perfect fit also for herbicide application, especially for weeds with small leaves.
- HiSpeed nozzles are approved for drift reduction up to 90 % by authorities in several European countries.

**Comparative studies of different application technologies**

A long term study carried out by the state authorities of Bavaria "Bayerische Landesanstalt für Landwirtschaft" comparing single flat fan AirMix® venturi nozzles against 2 x AirMix® in a double cap (DF) with 30° forward/ backward spray angle at two different application rates, showed a clear advantage of the DF nozzles, increasing yield by 0.4 t/ha/year (average). Considering this, the benefit of an area of 15 ha would pay back the higher cost when assembling a standard boom with Double Flat Fan nozzles instead of single ones.

**Yield of AirMix® compared to AirMix® DF**




Source: Bayerische Landesanstalt für Landwirtschaft

## agrotop double flat fan nozzles: Successful in application technology

### TurboDrop® TD-DF

**1995**

**The professional nozzle**

Large range of different nozzle types using different spray angles and distribution tips with constant droplet size over a large pressure range. Easy disassembly for cleaning. Metering orifice and distribution nozzle made of ceramic, coated in POM, for maximum wear resistance. The choice for special applications.

### TurboDrop® HiSpeed

**2007**

**The innovative nozzle**

Improving coverage on vertical and angular target areas – at any application speed. Compact designed ceramic nozzle.
Proven TurboDrop® modular system for easy cleaning, reducing risk of blockage.
The choice for contractors and all application specialists.

### AirMix® DF/ADF

**2000**

**2012**

**The economical nozzle**

Perfect for applications at lower pressures down to 20 psi (1.5 bar). Wide application range and variable droplet size according to pressure used. Best value for money, easy cleaning, pays back investment also if used only on smaller properties.

### TurboDrop® ADF

**2012**

**The versatile nozzle**

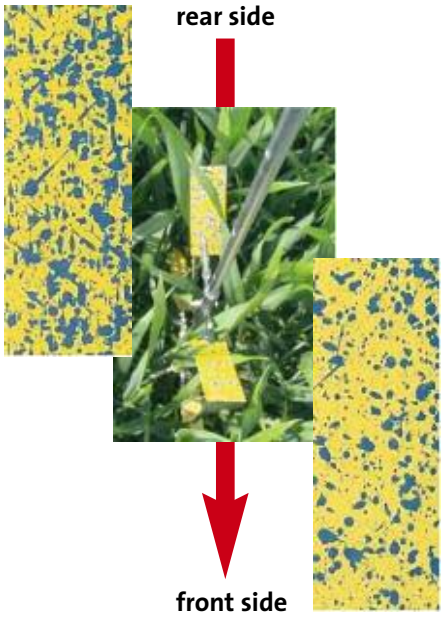
ADF cap with SprayMax tips mounted on a TurboDrop® injektor. The solution for extended droplet spectra and optimised spray angles.
The choice for a wide range of applications and crops, looking for anexcellent coverage and penetration at a competitive price.

# Field tests showing the efficacy of the TurboDrop® HiSpeed nozzles

Over the last few years dozens of field trials have been performed by **agrotop** in cooperation with different partners from sprayer manufacturers, chemical industries, official and private consultancy groups, local dealers or farmer groups to show the benefit of using TurboDrop® HiSpeed nozzles by **agrotop.** Some reports of the outstanding results of these trials can be found on the German version of our homepage **www.agrotop.com/berichte** or contact us directly for more details.

### TurboDrop® HiSpeed nozzles in practice

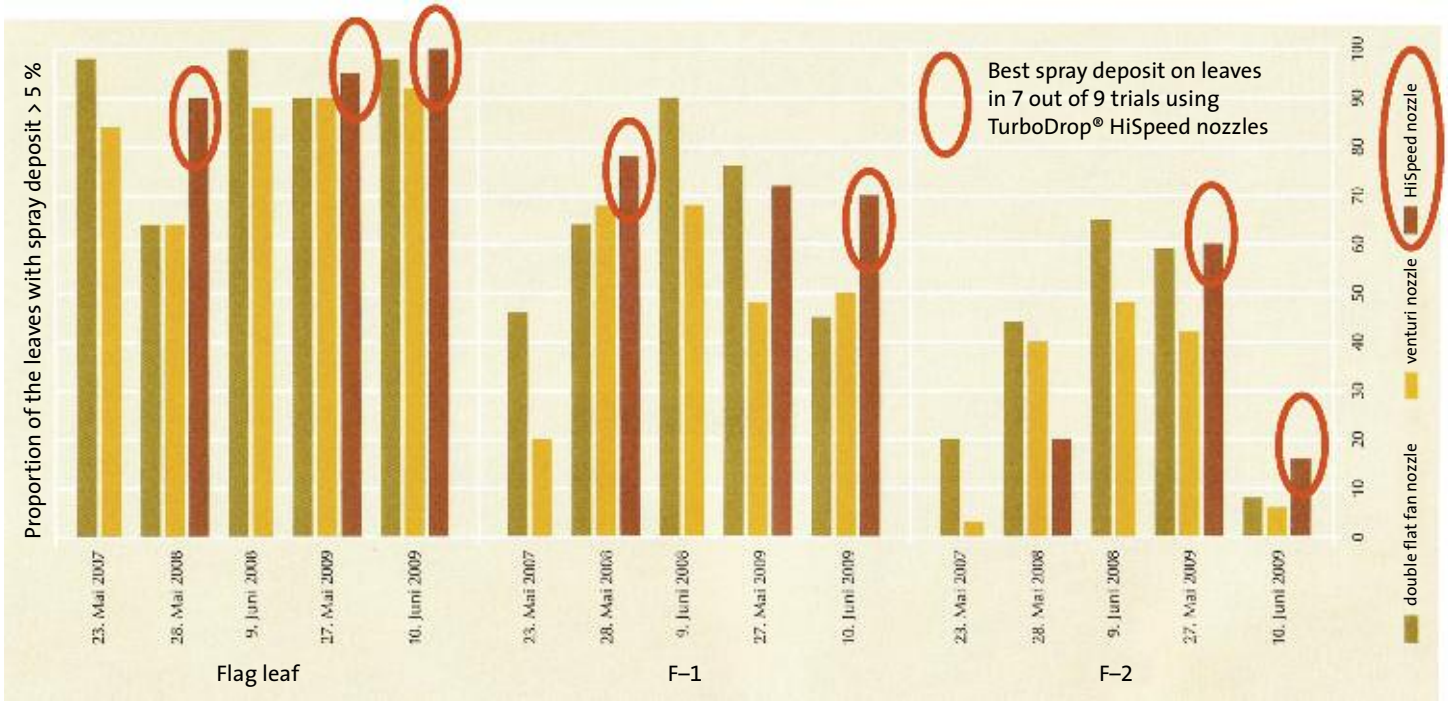
Application tests using water sensitive paper show the benefit of getting a uniform coverage on all plant parts, especially at the rear and front side of vertical targets. These results remain even when the application rate is reduced gradually and/or the application speed increases.




A typical spray deposit from a TurboDrop® HiSpeed nozzle, uniform distribution on the plants.

Tests in a study by DLR Bad Kreuznach, evaluating the covering of spray chemical on the leaves, showed a clear improvement of spray deposit on different parts of the plant using double flat fan nozzles compared to standard flat fan nozzles (published in DLG-Mitteilungen, German farmers association, see chart below). In addition the already good results from "regular" standard double flat fan nozzles are outperformed by TurboDrop® HiSpeed nozzles (with the asymmetric spray angles) in 7 from 9 trials.

**Spray deposit on wheat leaves (in %)**




Source: DLG-Mitteilungen (3/2010)

# Drift reduction – agrotop venturi nozzles


Application of herbicide with standard nozzle


Pictures: Tom Wolf, Agriculture and Agri-Food Canada, Saskatoon Research Centre, 1999.

Application of herbicide with venturi nozzle, e. g. AirMix® by agrotop

## QuickFit instant assembly

### Nozzle tips preassembled on standard bayonet caps for instant assembly and use on boom sprayers

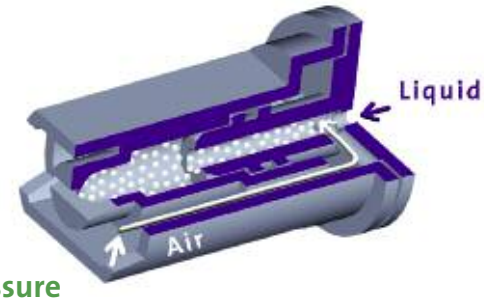
For most of our standard or venturi nozzles, we offer a pre-assembly on standard bayonet caps, inclusive washer. The nozzle will be packed in boxes of 25 units, just take them out of the box and assemble onto the nozzle holders of your sprayer boom.

**Available for:**

- All AirMix® nozzles, AVI, CVI and AVI-TWIN venturi nozzles
- Standard Flat Fan SprayMax or AXI nozzles
- EXA or ESI liquid fertilizer nozzles

**Advantages:**

- Easy assembly, no extra time for fumbling of nozzles into the caps
- Practical and safe storage in compact boxes
- Clear identification of nozzle size and type on the box
- No extra costs compared to price of individual parts


# AirMix® Flat Fan

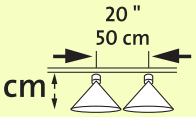
**Low pressure flat fan venturi nozzle made from hard-wearing plastic POM**

JKI G 1637 · JKI G 1631 · JKI G 1638

| 110-01 | 110-015 | 110-02 | 110-025 | 110-03 | 110-04 | 110-05 | 110-06 |
|---|---|---|---|---|---|---|---|

 Filter 50 M blue

 Filter 24 M white

| Spray angle | Size | Pressure range | Boom height |
|---|---|---|---|
|  |  |  |  |
| 110° | 01 – 06 | 1 – 6<br>15 – 90 psi | 40 – 90 cm<br>15 – 45" |

**Application:** 

**Characteristics:**

- Two-piece design, no tools required for opening, no seals
- Air cleaning system, no blocking of air entrance
- Droplet size adjustable from coarse to fine through pressure
- Up to 90 % drift reduction
- Wide application range from 40–1000 l/ha
- Fits in double flat fan cap, see page 62

 **Fits in caps with spanner width of 8 mm, commonly used on most sprayers**

*Application charts, see page 44/48*

Compact design, only 22 mm, slightly more than a standard tip

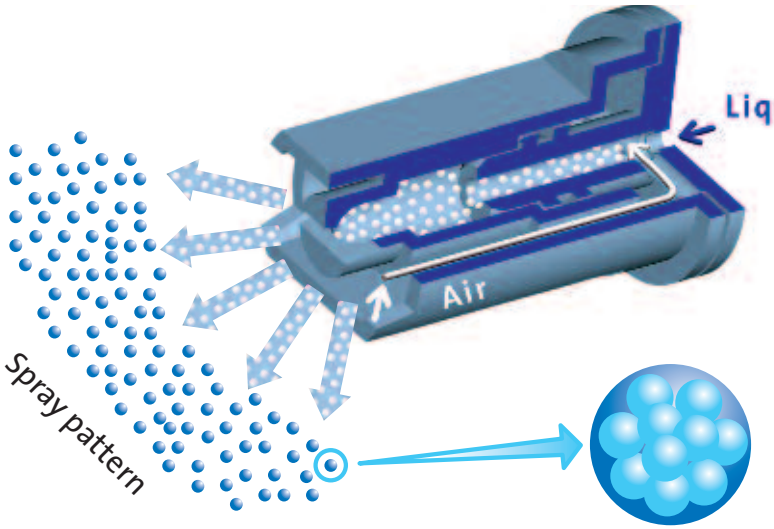
Easy disassembly for cleaning

Metering orifice easy accessible, blockage can be wiped off

Air suction from below through the spray fan

## The AirMix® nozzle – How does it work?

The metering orifice at the bottom of the injector controls the flow and injects a jet into it. This jet passes a second orifice where it takes in the air.
The air stream is cleaned by passing through the spray pattern, preventing the orifice from clogging.

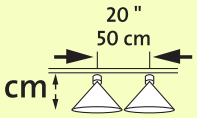


# AirMix® HC

**Low pressure hollow cone venturi nozzle made from hard-wearing plastic POM**

**80–025**

Filter 50 M blue

| Spray angle | Size | Pressure range | Boom height |
|---|---|---|---|
|  |  |  |  |
| **80°** | **025** | **1 – 6**<br>**15 – 90 psi** | **50 – 90 cm**<br>**20 – 45"** |







**Characteristics:**

- Two-piece design, no tools required for opening
- Air cleaning system, no blockage of air entrance
- High drift reduction
- Wide application range
- Uniform droplet spectra
- On a broadcast boom, horizontal distribution of pattern is less uniform compared to flat fan
- Particularly suitable for knapsack as nozzles can be operated at low pressure

**Fits in caps with spanner width of 8 mm, commonly used on most sprayers**

**Application:** 

*Application charts and flow chart, see page 43–48*


# AirMix® OC

**Low pressure off-centre venturi nozzle made from hard-wearing plastic POM**

| G 1887 / G 1891 | G 1888 / G 1892 | G 1889 / G 1893 | G 1890 |
|---|---|---|---|
| OC 02 | OC 025 | OC 03 | OC 04 | OC 05 |

Filter 50 M blue

Filter 24 M white

| Spray angle | Size | Pressure range | Application width |
|---|---|---|---|
| 80° (15° + 65°) | ISO 02 – 05 | bar 1 – 6 / 15 – 90 psi | = approx. 2.3 x application height |

**Application:**

**Characteristics:**

- Two-piece design, no tools required for opening, no seals
- Air cleaning system, no plugging of air entrance
- High drift reduction
- Wide application range
- Same flow rate as corresponding flat fan nozzle
- Suitable as end nozzle on booms in combination with AirMix® flat fan nozzles

**Fits in caps with spanner width of 8 mm, commonly used on most sprayers**

*Application charts and flow chart, see page 43–48*

## Recommendations for using AirMix® OC as boom end nozzles

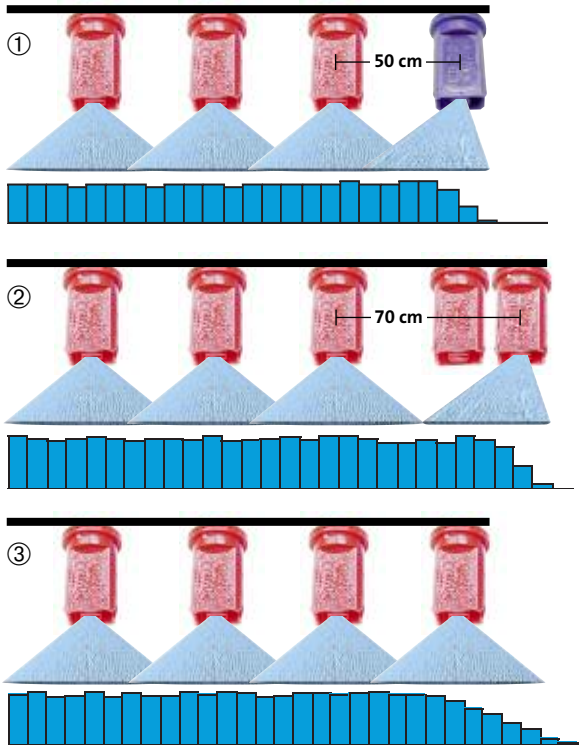
In combination with regular AirMix® 110° FF the AirMix® OC nozzles can be used to sharp cut the spray pattern at the boom ends, mandatory in some countries for applications at field edges. For this, the last AirMix® FF at the boom ends will be replaced by an AirMix® OC nozzle.

For best spray distribution (cv) we recommend the two options:

① Replacing the boom end nozzles at 50 cm spacing. Here the AirMix® OC nozzle should be selected one size smaller compared to AirMix® FF due to the smaller spray pattern of the AirMix® OC. E.g., if using AirMix® FF 04 on the boom use a AirMix® OC 03 as end nozzle when spraying at the edge of the field.

② Use an extra nozzle holder for boundary applications at 20 cm distance from last nozzle. When spraying at the field edges this extra nozzle must be switched on whereas the last regular nozzle must be shut off. In this case select same size for AirMix® FF and OC nozzles. For both options, when spaying inside the field, keep the AirMix® OC shut off.

③ For comparison, spray distribution at field edges using only AirMix® FF nozzles on the boom.



# Albuz® AVI 110°

# Albuz® CVI 110°

**Compact flat fan venturi nozzle made from ceramic (coated with POM)**

IKI G 1620 IKI G 1606 IKI G 1605

| AVI 110-01 | AVI 110-015 | AVI 110-02 | AVI 110-025 | AVI 110-03 | AVI 110-04 | AVI 110-05 | AVI 110-06 | AVI 110-08 | AVI 110-10 |
|---|---|---|---|---|---|---|---|---|---|

Filter 50 M blue — Filter 24 M white

| CVI 110-015 | CVI 110-02 | CVI 110-025 | CVI 110-03 | CVI 110-04 | CVI 110-05 |
|---|---|---|---|---|---|

Filter 50 M blue — Filter 24 M white

| Spray angle | Size | Pressure range | Boom height |
|---|---|---|---|
| AVI 110° | 01 – 10 | 3 – 8 bar<br>40 – 120 psi | 40 – 90 cm<br>15 – 35" |
| CVI 110° | 015 – 05 | 1.5 – 8 bar<br>20 – 120 psi | 40 – 90 cm<br>15 – 35" |

**Characteristics:**

- High drift reduction
- High accuracy and wear resistance
- Compact and rugged plastic body made from POM

**AVI: Fits in caps with spanner width of 11 mm**
- Best performing pressure range AVI: 4–7 bar

**CVI: Fits in caps with spanner width of 8 mm**
- Best performing pressure range CVI: 2–4 bar
- compact plastic body, only 22 mm

**Application:**

*Application charts and flow chart, see page 43–48*

Ceramic parts protected through compact, robust plastic body

Compact design, less risk of damage

Proven two-piece design, for easy cleaning

Metering orifice easy accessible, blockage can be wiped off

# Albuz® AVI-TWIN

# Albuz® CVI-TWIN


**Double flat fan venturi nozzle made from ceramic (coated with POM)**

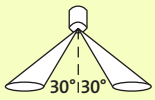
JKI G 1750

| AVI-TWIN 110-01 | AVI-TWIN 110-015 | AVI-TWIN 110-02 | AVI-TWIN 110-025 | AVI-TWIN 110-03 | AVI-TWIN 110-04 | AVI-TWIN 110-05 | AVI-TWIN 110-06 |
|---|---|---|---|---|---|---|---|
| Filter 50 M blue | | | | | | | |

| | | JKI G 1904 | JKI G 1903 | JKI G 1905 | JKI G 1928 |
|---|---|---|---|---|---|
| CVI-TWIN 110-015 | CVI-TWIN 110-02 | CVI-TWIN 110-025 | CVI-TWIN 110-03 | CVI-TWIN 110-04 | CVI-TWIN 110-05 |
| Filter 50 M blue | | | | | |

| Spray angle | Size | Pressure range | Boom height |
|---|---|---|---|
| | ISO | bar | 50 cm, cm |
| AVI 2 x 110° | 01 – 06 | 2 – 8<br>25 – 120 psi | 40 – 60 cm<br>15 – 25" |
| CVI 2 x 110° | 015 – 05 | 1,5 – 8<br>20 – 120 psi | 40 – 60 cm<br>15 – 25" |

**Orientation of spray patterns**




**Characteristics:**

- High drift reduction officially approved by many state authorities in Europe
- High accuracy and wear resistance through all ceramic parts made from extra strong pink ceramic
- Short compact design
- Recommended for:
  - **late fungicide applications in cereals (ear treatments)**
  - **post emergency applications in sugar beets**
  - **all applications requiring improoved coverage**
- Better coverage of vertical targets
- Official field trials prove better efficacy of double flat fan nozzles in fungicide applications
- Flow rate according to ISO-color code

**AVI-TWIN:**
**Fits in caps with spanner width of 11 mm**
- Best performing pressure range AVI: 4–7 bar
- Compact design, only 28 mm

**CVI-TWIN:**
**Fits in caps with spanner width of 8 mm**
- Best performing pressure range CVI: 2–4 bar
- Compact design, only 22 mm

**Application:**

*Application charts and flow chart, see page 43–48*

# Albuz® AVI 80°

# Albuz® CVI 80°

**Flat fan venturi nozzle made from ceramic (coated with POM)**

| G 1721 | G 1634 | G 1635 | | G 1636 | |
|---|---|---|---|---|---|
| AVI 80-01 | AVI 80-015 | AVI 80-02 | AVI 80-025 | AVI 80-03 | AVI 80-04 |
| Filter 100 M red | | Filter 50 M blue | | | |

| G 1900 | G 1901 | G 1902 | |
|---|---|---|---|
| CVI 80-01 | CVI 80-015 | CVI 80-02 | CVI 80-025 |
| Filter 100 M red | Filter 50 M blue | | |

**Spray angle**

AVI 80°

CVI 80°

**Size**

ISO

01 – 04

01 – 025

**Pressure range**

bar

2 – 20
30 – 300 psi
2 – 20
30 – 300 psi

**Characteristics:**

- High drift reducing potential
- High accuracy and wear resistance
- Spray angle of 80° to be used also on atomizers
- Lange Schlüsselfläche für sichere Einstellung
- Flow rate according to ISO-color code

**AVI: Fits in caps with spanner width of 11 mm**

**CVI: Fits in caps with spanner width of 8 mm**

- CVI nozzle with compact design, only 22 mm

**Application:**

*Flow chart, see page 43*
*Calculation of application rate, see formulas on page 49*

Metering disk and distribution tip made from extremely hard, high quality, pink ceramic

Less risk of breaking, only slightly longer than Albuz® ATR

No tools required for opening and cleaning

Metering disk easy accessible, blockage can easily be just wipped off

**Accessories:**

| | |
|---|---|
| Part no. 15619 | Special key for AVI and CVI made from stainless steel for adjusting nozzle position on atomizers |
| Part no. 13455 | Protection cap for AVI to avoid the accumulation of debris on the nozzles when turned off on the atomizer |
| Part no. 14456 | Adaptor seal to compensate difference of nozzle base when changing from ATR to AVI/CVI nozzles |

# Albuz® AVI-OC

**Off-centre venturi nozzles made from ceramic (coated with POM)**

| AVI-OC 80–015 | AVI-OC 80–02 | AVI-OC 80–025 | AVI-OC 80–03 | AVI-OC 80–04 |
|---|---|---|---|---|

Filter 50 M blue

| Spray angle | Size | Pressure range | Application width |
|---|---|---|---|
| 80° (15° + 65°) | ISO 015 – 04 | bar 3 – 7 40 – 100 psi | = approx. 2,3 x application height |

**Characteristics:**

- High drift reduction and wear resistance
- Compact design and easy to clean like all other AVI nozzles
- Coated in a rugged plastic body made from POM
- Corresponding nozzle to AVI 110° Flat Fan when used as boom end nozzle
- Recommended for herbicide band spraying in orchards and vineyards

**Fits in caps with spanner width of 11 mm**

**Application:** S

*Flow chart, see page 43*
*Calculation of application rate, see formulas on page 49*

# TurboDrop®

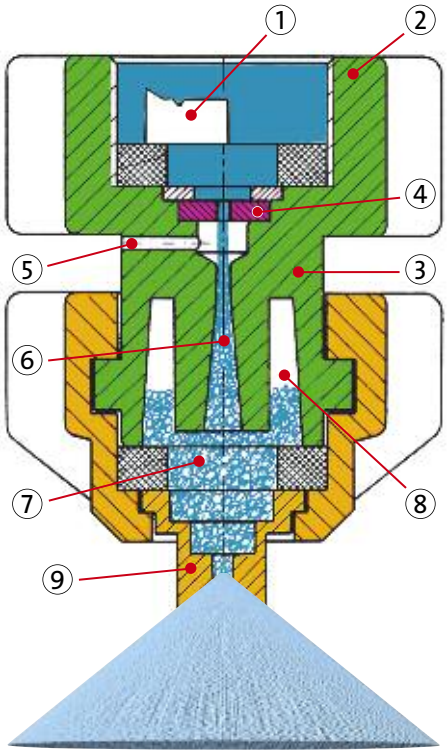
## Most advanced nozzle technology in plant protection
## The world's largest injector nozzle range for farmers and contract sprayers

International patents and awards – approved by thousands of farmers all over the world.

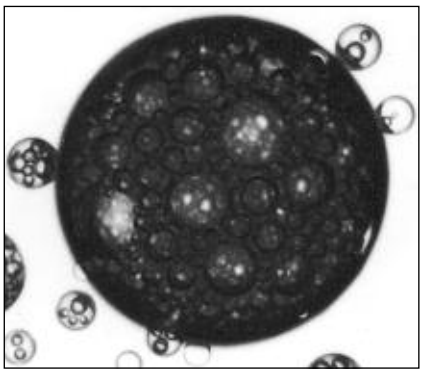
The modular TurboDrop® system can be adapted to any demand with regard to spray angle, pattern, droplet size and flow rate, optimising chemical application in all crops under any climate conditions.

Hundreds of independent test trials all over the world have proved the efficacy and the high drift reduction of the TurboDrop® nozzle.

## The TurboDrop® nozzle, how does it work?

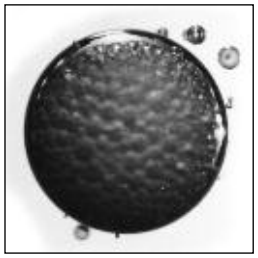



The TurboDrop® standard injector is made up in one piece. This includes a venturi injector (3) build on a standard bayonet cap (2). This cap fits on all nozzle holders using a standard bayonet (1) system, like TeeJet, ARAG, etc. Most sprayers today use this standard system. For all other bayonet systems or screwed caps, including brass nozzle holders used on orchard sprayers, TurboDrop® universal injectors are available (see page 23/36). The metering orifice (4) of the injector, that could be made from plastic or POM, depending on the version, controls the liquid flow. It sprays a stream into the injector entraining the air through the intake opening (5). In the mixing chamber (6) the air and liquid are finely mixed. The turbulences occurring in this process are reduced in the settling zone (7). The pulsations of the injector are damped in the ring-shaped air chamber (8). The largely homogeneous liquid-air mixture is distributed through the outlet or distribution nozzle (9), which can be a flat fan, hollow cone, deflector, off-centre nozzle or a TipCap. The flow is ultimately determined by the operating pressure at the metering orifice (4) in the injector. The outlet nozzle (9) has no influence on the flow rate, although there is a certain relationship between nozzle and orifice where the TurboDrop® nozzles have their best performance. The relationship between orifice and nozzle also influences the droplet size (VMD). The advantages of the air-filled drops (bubbles) produced by the TurboDrop® nozzle in terms of drift reduction, better penetration and coverage are explained on page 6–9 of this catalogue.



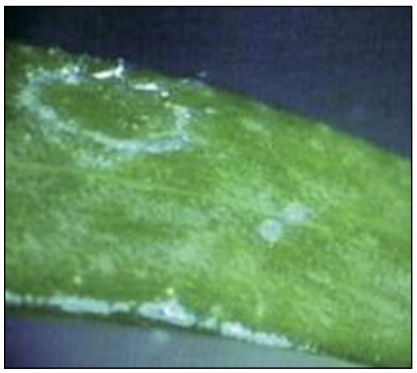
TurboDrop® nozzles produce air-filled droplets with any kind of spray liquid, even water, capturing high amounts of air inside.

**Chemical A**



**Chemical B**

Lifetime and the quantity of air captured inside the bubble may change depending on the foaming tendency of the spray chemicals or wetting agents.



Air bubbles cause the drops to explode upon hitting the target.

# The advantages of the TurboDrop® system

**TurboDrop® nozzles have many additional benefits**

## Modular design

The modular system allows nearly any combination of injector and distribution nozzle. Any type of spray pattern and droplet size can thus be created.
The metering orifice in the injector and the appropriate distribution nozzle ensure the perfect performance of the TurboDrop® nozzle. The distribution nozzle size has to be at least twice size of the injector.
The metering orifice in the injector always determines the flow rate and therefore the size of the TurboDrop® nozzle.
Several TurboDrop® product lines have been designed to cover the main areas of agricultural spraying. All the basic models shown on the following pages are available from stock.

## Pressure range

TurboDrop® nozzles and injectors are available from 1–35 bar pressure. This explains the tremendous possibilities regarding different flow rates. The patented air chamber and diffusor reduce the influence of pressure on droplet size, compared to other venturi or standard nozzles. Therefore the flow rate or pressure can be changed, with less influence on droplet size.

## Variability

It is possible to use different distribution nozzles with one injector to optimise the pattern or droplet size. E.g., for fungicide applications it is possible to change the flat fan outlet nozzle for a hollow cone outlet nozzle. This will not affect the flow rate or application rate, as the injector remains the same, and the pressure can be maintained at the same level.

## Injector types

The **Standard** version has a bayonet nut, adapted to the standardised bayonet nozzle holders common on most boom sprayers.

Standard injectors are available with a metering orifice either in polyacetal or ceramic, both standardised to the ISO colour coded flow rates.

The **Universal** version is adapted to all other bayonet systems or screwed caps. It is only available with a ceramic orifice, but in two different colour codes. One follows the ISO colour code and can be identified by the white shim holding the metering orifice. The other has a green shim and follows the Albuz® standard for ATR nozzles as regards colour and flow rate.

## Two in one

The TurboDrop® injector and outlet nozzle are connected via a standardised bayonet system, used by many manufacturers on their sprayers. Thus the outlet nozzle can be used together with the injector as a TurboDrop® nozzle or separately, as a normal standard nozzle
(In this case the flow rate is determined by the distribution nozzle!).

## Handling and cleaning

TurboDrop® nozzles are bigger and more rugged than other venturi nozzles. Thus, even in use under severe conditions, the nozzles can be disassembled for cleaning without tools, using gloves.

## Materials

TurboDrop® nozzles are made from either hard-wearing polyacetal, with high wear and shock resistance, and/or extremely hard aluminium oxide ceramics (pink colour).
Three different material options are available:
**POM** – metering orifice and outlet nozzle in hard-wearing polyacetal
**Semi Ceramic** – metering orifice in ceramic and outlet nozzle in hard-wearing plastic
**Ceramic** – metering orifice and outlet nozzle in ceramic
TurboDrop® ceramic nozzles have been used on boom sprayers applying more than 50.000 ha without significant wear.

Universal TurboDrop® nozzles and injectors are also available assembled with caps for different bayonet systems or on screwed caps (see page 36/62).

Threaded adapters (screws) for the universal TurboDrop® are available on request.

Different threaded adapters are available to fit the Universal Turbo-Drop® injectors on any nozzle holder system with bayonet or threaded caps. A lock washer is used to fix the universal injector on to the cap.

# TurboDrop® TD Standard

**Flat fan venturi nozzle made from Ceramic (coated with POM) for standard bayonet nozzle holders**

G 1610

| TD 110-01 | TD 110-015 | TD 110-02 | TD 110-025 | TD 110-03 | TD 110-04 | TD 110-05 | TD 110-06 | TD 110-08 | TD 110-10 |
|---|---|---|---|---|---|---|---|---|---|

Filter 50 M blue | Filter 24 M white

G 1624 | G 1703

| TD 80-01 | TD 80-015 | TD 80-02 | TD 80-025 | TD 80-03 | TD 80-04 | TD 80-05 | TD 80-06 | TD 80-08 | TD 80-10 |
|---|---|---|---|---|---|---|---|---|---|

Filter 50 M blue | Filter 24 M white

| Spray angle | Size | Pressure range | Boom height |
|---|---|---|---|
| 110°/80° | 01 – 10 | 2 – 10<br>30 – 150 psi | 50 – 90 cm<br>20 – 45" |

ISO | bar | 20 " 50 cm | cm

**Application:**

**Characteristics:**

- Small droplet size variation over pressure range
- Excellent drift reduction, even at higher pressure

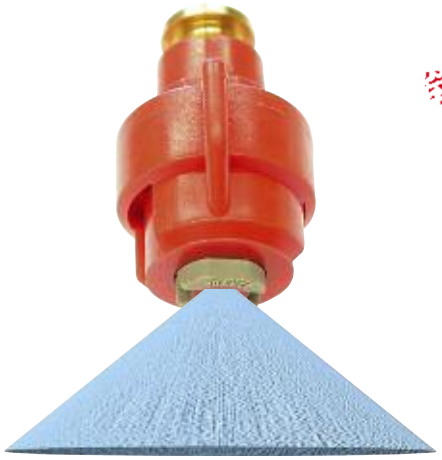
- All ceramic parts are made from extra strong, high quality pink ceramic
- This guarantees maximum wear resistance and accuracy
- Excellent penetration using higher pressure
- Wide range of pressure and application ranges
- Best performance using pressure:
  Pesticides 4–10 bar (50–150 psi)
  Liquid fertilizer 2–3 bar (30–45 psi)
- Easy assembly and disassembly, even with gloves, no tools required
- The perfect solution for large farms and contractors

*Application charts, see page 44/48*
*More information about the advantages of venturi nozzles, see page 6–9*

Colour injector = Colour nozzle cap

Distribution nozzle Albuz® APE

Diffuser for optimal patternation



**All TurboDrop® standard nozzles on the following pages are available in the universal version**

# TurboDrop® TD Universal

**High pressure flat fan venturi nozzle in ceramic (coated with POM) with threaded adapter screw available for all nozzle holder systems**

**Characteristics: Same performance as the TurboDrop® TD Standard and additionally**

- Pressure range: 3–20 bar (45–290 psi)
- Best performance using pressure:
  Pesticides 5–15 bar (70–220 psi)
  Liquid fertilizer 3 bar (45 psi)
- Perfect for orchards or vegetable growing and special applications, also for band spraying
- Different adapter screws fit any nozzle cap system
- For the main bayonet systems ready assembled versions, including bayonet cap, are available and also for screwed caps (see page 36)

*Application charts, see page 44/48*
*More information about the advantages of venturi nozzles, see page 6–9*

# Venturi nozzles – TurboDrop®


## TurboDrop® HiSpeed Standard

**Asymmetric double flat fan venturi nozzle made from ceramic (coated with POM) for standard bayonet nozzle holders**

| G 1819 | G 1896 | G 1820 | G 1821 | G 1822 |
|---|---|---|---|---|
| TD HiSpeed 110-01 | TD HiSpeed 110-015 | TD HiSpeed 110-02 | TD HiSpeed 110-025 | TD HiSpeed 110-03 | TD HiSpeed 110-04 | TD HiSpeed 110-05 | TD HiSpeed 110-06 | TD HiSpeed 110-08 |

Filter 50 M blue

Filter 24 M white

**Spray angle**

**2 x 110°**

**Size**

ISO

**01 – 08**

**Pressure range**

bar

**2 – 10**
**30 – 150 psi**

**Boom height**

50 cm

cm

**40 – 60 cm**
**15 – 25"**

**Orientation of spray patterns**

50° 10°

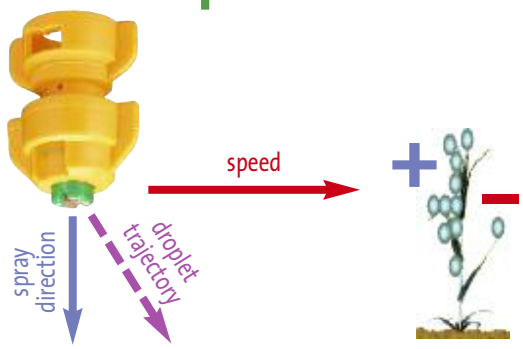
**Application:**

**Characteristics:**

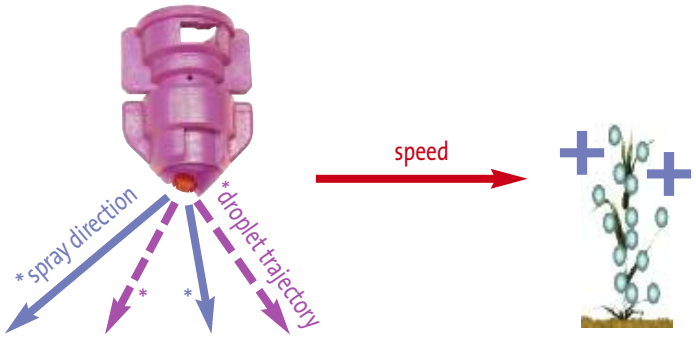
- Asymmetric orientation of the two spray patterns, especially designed for higher application speeds
- Compact design
- High drift reduction maintaining excellent coverage
- Perfect for fungicide, insecticide and post-emergence treatments
- Best performance working pressure: 4–8 bar (60–120 psi)
- Ceramic parts made from strong, high quality pink ceramic
- Easy assembly and disassembly, even with gloves, no tools required
- Improved coverage of vertical and angular targets

*Application charts, see page 44/48*

## TurboDrop® TD




## TurboDrop® HiSpeed



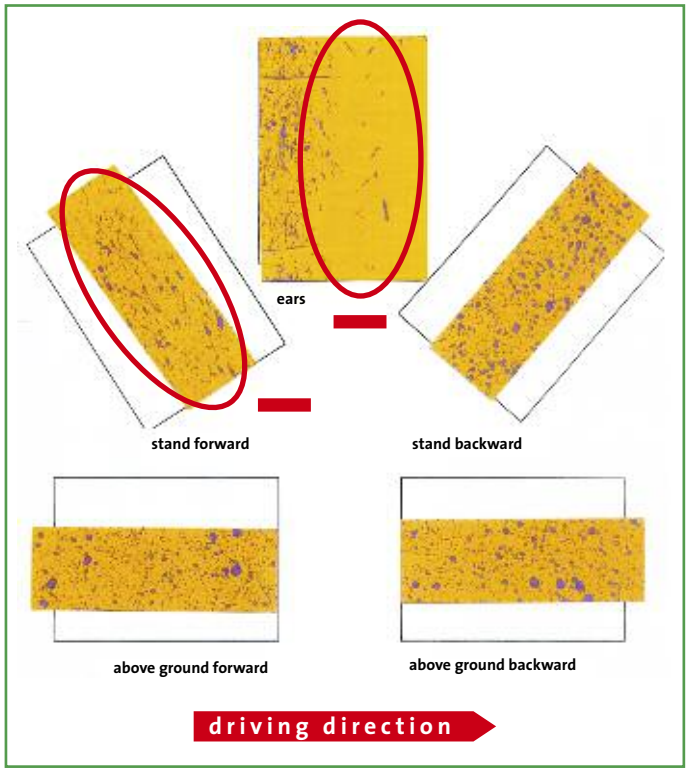

**TurboDrop® HiSpeed – the innovative nozzle technology**

Using normal standard flat fan nozzles, the force from the driving speed deflects the downward oriented droplets forward in the driving direction of the sprayer. Therefore the droplet trajectory is forward angled and not straight downward. The coverage on the back side of the plant is always poor under these conditions. Higher sprayer speeds will step up this effect. Traditional double flat fan nozzles with the same forward and backward orientation of the spray pattern may be able to balance this for application speeds up to 7–8 km/h. The TurboDrop® HiSpeed with a high orientation of the backward pattern and a downward orientation of the forward pattern is especially designed for speeds higher than 8 km/h. Influenced by the driving speed, the trajectory of the droplets will be deflected in the way that the backward angle will decrease and the forward will increase. Perfect for a similar forward and backward angle to optimise the coverage of the plants.

# Spray coverage of different flat fan nozzles

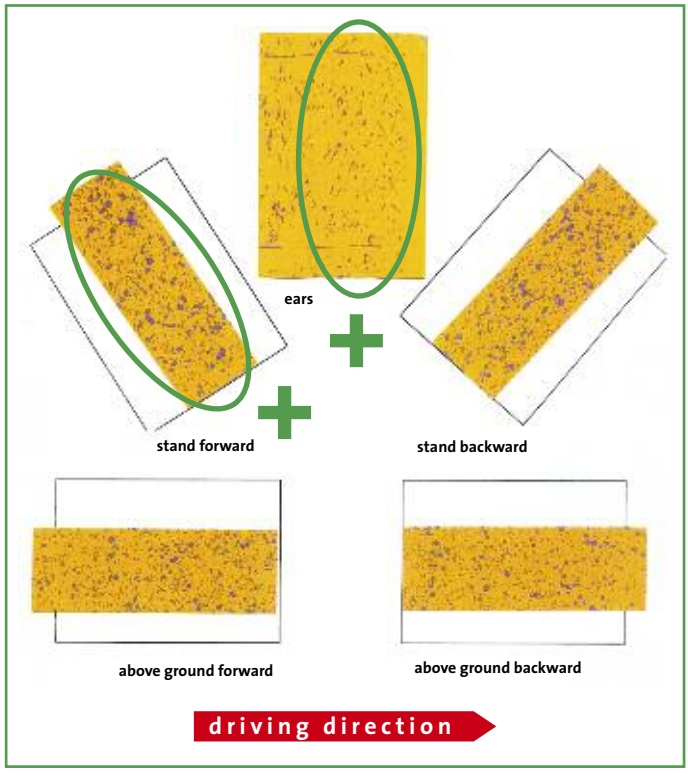
## AirMix® 110–04

**Application rate:** 150 l/ha
**Pressure:** 4.7 bar **at 16.0 km/h**




## TurboDrop® HiSpeed 110–03

**Application rate:** 150 l/ha
**Pressure:** 8.0 bar **at 16.0 km/h**




NEW

# TurboDrop® TD-ADF Standard

**Asymmetric double flat fan venturi nozzle made from POM for standard bayonet nozzle holders**

| TD-ADF 110-02 | TD-ADF 110-025 | TD-ADF 110-03 | TD-ADF 110-04 | TD-ADF 110-05 | TD-ADF 110-06 | TD-ADF 110-08 | TD-ADF 110-10 |
|---|---|---|---|---|---|---|---|

 Filter 50 M blue

 Filter 24 M white

**Spray angle**

**2 x 110°**

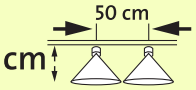
**Size**


**02 – 10**

**Pressure range**

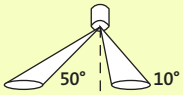

**1.5 – 8**
**20 – 120 psi**

**Boom height**




**40 – 60 cm**
**15 – 25"**

**Orientation of spray patterns**




**Application:**

**Characteristics:**

- Asymmetric orientation of spray pattern to improve application quality at any speed
- Compact design, easy disassembling of individual spray tips
- Good drift control an excellent coverage of vertical and angular targets
- 10° forward angle avoids that forward pattern will spray on boom parts or wheels
- Best performance: 2–4 bar
- Application speeds from 6–15 km/h or more
- Suitable for “all-around” nozzle

*Application charts, see page 43–48*

# Individual spray solutions using ADF twin caps

## ADF-cap

### Asymmetric Double Cap made from POM in a slim and robust design

NEW

The newly developed asymmetric ADF-double flat fan cap allows assembling two individual nozzles at different angles in only one cap. This offers the possibility of combining different nozzle types, sizes or spray patterns for one application. Additionally the asymmetric orientation of the two tips allows individual adjustments or alternating positioning of the nozzle tips, offering a wide range of solutions for difficult spray tasks. The new ADF-caps provide versatile application options at a competitive price, independent from the quantity of nozzles needed. The pre-assembled TurboDrop® ADF nozzles are a good, approved and ready to use solution for most applications. For individual spray solutions the ADF-caps, TurboDrop® injectors and spray tips can be acquired separately. Through an innovative slide system the nozzles can be individually exchanged without the need of disassembling the complete cap.

**Characteristics:**

- Short, compact design made from hard wearing plastic POM
- Slimmer than other comparable double flat fan nozzles
- Separate slides for each nozzle allows individual exchange of each nozzle tip, easy to clean
- Nozzles are placed in a 10°/50° orientation, this combination of spray patterns has been successfully proven by the TurboDrop® HiSpeed nozzles
- Two cap version are available for use with AirMix® or SprayMax nozzles
- ADF-caps fit on all TurboDrop® injectors made from POM or Ceramic
- Fits on all nozzle holders with standard bayonet system
- Adaptors for Hardi or Jacto are available (see page 36)
- Ready assembled TurboDrop®-ADF nozzles are available

**ADF slide system**

**SprayMax ADF**

**AirMix® ADF**

**TurboDrop® ADF**

# TurboDrop® TD-DF Standard

**Double flat fan venturi nozzle made from POM, semi ceramic or ceramic for standard bayonet nozzle holders**

| TD-DF 110–01 | TD-DF 110–015 | TD-DF 110–02 | TD-DF 110–025 | TD-DF 110–03 | TD-DF 110–04 | TD-DF 110–05 | TD-DF 110–06 | TD-DF 110–08 | TD-DF 110–10 |
|---|---|---|---|---|---|---|---|---|---|

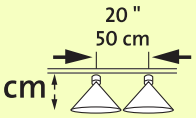
 Filter 50 M blue

 Filter 24 M white

| TD-DF 80–01 | TD-DF 80–015 | TD-DF 80–02 | TD-DF 80–025 | TD-DF 80–03 | TD-DF 80–04 | TD-DF 80–05 | TD-DF 80–06 | TD-DF 80–08 | TD-DF 80–10 |
|---|---|---|---|---|---|---|---|---|---|

 Filter 50 M blue

 Filter 24 M white

| Spray angle | Size | Pressure range | Boom height |
|---|---|---|---|
|  |  |  |  |
| 2 x 110°/80° | 01 – 10 | 3 – 10 bar 45 – 145 psi | 50 – 90 cm 20 – 45" |

**Characteristics:**

- Small droplet size variation over pressure range
- Excellent drift reduction but droplets are significantly smaller compared to single flat fan
- Equal patternation same as single flat fan
- Easy cleaning, disassembly and assembly thanks to bayonet system
- Perfect for ear treatments, post-emergence treatments in sugar beet and for pesticide applications in horticulture
- Better coverage of vertical parts of the plants compared to standard flat fan
- Best performance using pressure: 5–8 bar (70–120 psi)

**Application:** 

*Application charts, see page 44/48. More information about the advantages of venturi nozzles, see page 6–9*

# TurboDrop® TD-XL Standard

**Variable flat fan venturi nozzle made from hard-wearing plastic POM or semi ceramic for standard bayonet nozzle holders**

| TD-XL 110–01 | TD-XL 110–015 | TD-XL 110–02 | TD-XL 110–025 | TD-XL 110–03 | TD-XL 110–04 | TD-XL 110–05 | TD-XL 110–06 | TD-XL 110–08 | TD-XL 110–10 |
|---|---|---|---|---|---|---|---|---|---|

Filter 50 M blue

Filter 24 M white

| Spray angle | Size | Pressure range | Boom height |
|---|---|---|---|
| 110° | 01 – 10 | 1 – 8<br>15 – 90 psi | 60 – 90 cm<br>20 – 45" |

**Application:**

**Characteristics:**

- Variable droplet spectra from coarse to fine as pressure increases
- Excellent drift reduction, especially at lower pressure

- Offers a wide range in terms of pressure and droplet size
- Best performance using pressure:
  Pesticide 2–6 bar (30–90 psi)
  Liquid fertilizer 1–2 bar (15–30 psi)
- Easy cleaning, only two parts, no small parts, no fumbling
- Distributing nozzle/cap is a TipCap nozzle
- Distributing nozzle is exactly twice the size of the injector
- ISO colour-coded, but injector and distributing nozzles (TipCap) are different colours (size), see colour bar above
- Perfect if application conditions and application rates change frequently
- Maximum wear resistance in the semi ceramic version (injector with ceramic orifice coated in POM)
- Best price for excellent quality

*Application charts, see page 44/48*
*More information about the advantages of venturi nozzles, see page 6–9*

The TurboDrop® TD-XL nozzles use as a distribution nozzle a TipCap which is exactly twice the size of the TurboDrop® injector. For example, a TD-XL 110–04 nozzle comprises a red injector (ISO code for size 04) and a white TipCap (ISO code for size 110–08), but flow rate is determined by the red injector.

The second line of the colour code bar above shows the colour of each TipCap to match the corresponding TD-XL nozzle.

# TurboDrop® TD-OC Standard

**Off centre venturi nozzle for drift reduced band spraying and as end nozzle for standard bayonet nozzle holders**

| TD-OC 01 | TD-OC 015 | TD-OC 02 | TD-OC 025 | TD-OC 03 | TD-OC 04 | TD-OC 05 | TD-OC 06 | TD-OC 08 |
|---|---|---|---|---|---|---|---|---|

Filter 50 M blue

Filter 24 M white

| Spray angle | Size | Pressure range | Application width |
|---|---|---|---|
| 80° (15° + 65°) | 01 – 08 (ISO) | 2 – 10 bar / 30 – 145 psi | = approx. 2.3 x application height |

**Application:** S

**Characteristics:**

- Best performance using pressure: 3–4 bar (45–60 psi)
- Excellent for band spraying in orchards, vineyards and horticulture without drift risk
- End nozzle in combination with TurboDrop® TD Standard 110° for exact application at the boom ends

*Application charts and flow chart, see page 43–48*
*Calculation of application rate, see formulas on page 49*

| Spray angle | Size | Pressure | Boom height | Application |
|---|---|---|---|---|
| 80° | 01 – 04 (ISO) | 2 – 10 bar / 30 – 145 psi | 50 – 90 cm / 20 – 45" (20 " 50 cm, cm) | |

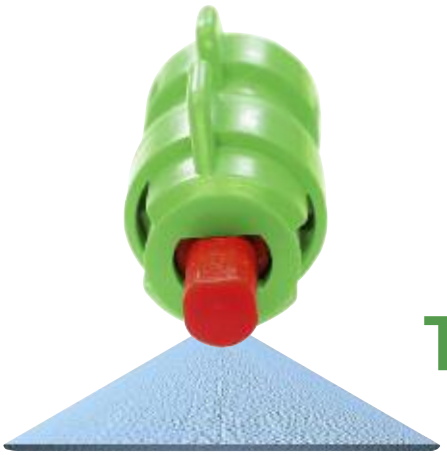
# TurboDrop® TD-HC Standard

**Hollow cone venturi nozzle made from POM or semi ceramic (Injector with ceramic orifice) for standard bayonet nozzle holders**

| TD-HC 80-01 | TD-HC 80-015 | TD-HC 80-02 | TD-HC 80-025 | TD-HC 80-03 | TD-HC 80-04 |
|---|---|---|---|---|---|

Filter 50 M blue

Filter 24 M white



| Spray angle | Size | Pressure | Application |
|---|---|---|---|
| 80° – 145° | 01 – 06 | 1 – 10<br>15 – 145 psi | only TDAN Universal |

# TurboDrop® TD-AN Standard

**Anvil venturi nozzle made from semi ceramic or ceramic for standard bayonet nozzle holders**

| TD-AN 01 | TD-AN 015 | TD-AN 02 | TD-AN 025 | TD-AN 03 | TD-AN 04 | TD-AN 05 | TD-AN 06 |
|---|---|---|---|---|---|---|---|

Filter 50 M blue

Filter 24 M white

# TurboDrop® TD 80/60/40/20 High Pressure

**Low angle high pressure flat fan venturi nozzle made from ceramic with threaded adapter screw**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TD 80–01 | TD 80–015 | TD 80–02 | TD 80–025 | TD 80–03 | TD 80–04 | TD 80–05 | TD 80–06 | TD 80–08 |
| TD 60–01 | TD 60–015 | TD 60–02 | TD 60–025 | TD 60–03 | TD 60–04 | TD 60–05 | TD 60–06 | TD 60–08 |
| TD 40–01 | TD 40–015 | TD 40–02 | TD 40–025 | TD 40–03 | TD 40–04 | TD 40–05 | TD 40–06 | TD 40–08 |
| TD 20–01 | TD 20–015 | TD 20–02 | TD 20–025 | TD 20–03 | TD 20–04 | TD 20–05 | TD 20–06 | TD 20–08 |

Filter 50 M blue

Filter 24 M white

| Spray angle | Size | Pressure range |
|---|---|---|
| 80°/60°/<br>40°/20° | 01 – 08 | 5 – 35<br>70 – 510 psi |

**Application:**

**Characteristics:**

- Coarse to extra coarse droplet size for effective drift reduction even at high pressure
- High droplet speed, therefore:
- Big application range (m) and excellent penetration
- Wide pressure range
- Maximum durability using extremely hard pink ceramic

*Application charts and flow chart, see page 43–48*
*More information about the advantages of venturi nozzles, see page 6–9*

# TurboDrop® venturi nozzle set “Hallertau” and “Tettnang” for atomizers used in hops

## JKI approved for up to 90 % drift reduction

Two pre selected nozzle sets of TurboDrop® venturi nozzles are available to guarantee a drift reduced efficient application and a good efficacy. Following the official recommendation for the sprayer set up – in combination with our nozzle sets – will allow the growers to reduce the buffer zones for this crop effectively.

Two different sets are available, covering main hop growing regimes. The nozzle sets have been tested for best combination of spray angle and nozzle sizes using TurboDrop® TD 80/60/40/20 nozzles (see page 33):

“Tettnang” working width 10.5 m / 34 feet (6 rows)
“Hallertau” working width 6.4 m / 21 feet (2 rows)

The TurboDrop® narrow angle nozzle sets are also perfect for drift reduced applications in other tall growing cultivars.
**Ask our application specialist for individual recommendations or other nozzle combinations of TurboDrop® nozzles.**

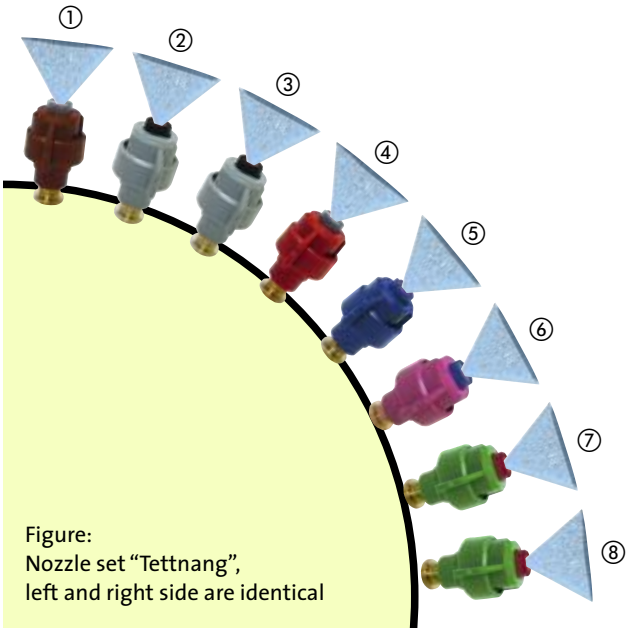



Figure:
Nozzle set “Tettnang”,
left and right side are identical

| | Nozzle set “Tettnang” | | | Nozzle set “Hallertau” | | |
|---|---|---|---|---|---|---|
| | Nozzle = Injektor | Tip | Flow rate (100 %) | Nozzle = Injektor | Tip | Flow rate (100 %) |
| ① | TD 60-05 | grey | 17 % | TD 40-04 | grey | 14 % |
| ② | TD 60-06 | black | 20 % | TD 40-05 | grey | 18 % |
| ③ | TD 60-06 | black | 20 % | TD 40-05 | grey | 18 % |
| ④ | TD 60-04 | grey | 14 % | TD 40-04 | grey | 14 % |
| ⑤ | TD 60-03 | blue | 10 % | TD 40-03 | blue | 11 % |
| ⑥ | TD 60-025 | blue | 9 % | TD 40-03 | blue | 11 % |
| ⑦ | TD 60-015 | red | 5 % | TD 60-025 | blue | 9 % |
| ⑧ | TD 60-015 | red | 5 % | TD 60-015 | red | 5 % |

Nozzle size = Injector = Flow rate!

| km/h | Application rate in l/ha | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1800 | 2000 | 2200 | 2400 | 2600 | 2800 | 3000 | 3200 | 3400 | 3600 | 3800 | 4000 |
| **Tettnang; pressure in bar** (Total flow rate of all nozzles l/min) | | | | | | | | | | | | |
| **1.0** | | | | | | | **15** (53) | **17** (56) | **20** (50) | **21** (63) | **24** (67) | **26** (70) |
| **1.2** | | | | | **16** (55) | **19** (59) | **21** (63) | **24** (67) | **27** (71) | **31** (78) | **34** (80) | |
| **1.4** | | | **16** (55) | **19** (59) | **22** (64) | **26** (69) | **30** (74) | **33** (78) | | | | |
| **2.0** | **21** (63) | **27** (70) | **32** (77) | | | | | | | | | |
| **Hallertau; pressure in bar** (Total flow rate of all nozzles l/min) | | | | | | | | | | | | |
| **1.6** | | | | | | | **16** (51) | **18** (55) | **20** (58) | **22** (61) | **25** (65) | **28** (68) |
| **1.8** | | | | | | **17** (54) | **20** (58) | **22** (61) | **25** (65) | **28** (68) | **32** (73) | |
| **2.0** | | | | **16** (51) | **18** (55) | **21** (60) | **24** (64) | **28** (68) | **32** (73) | **35** (77) | | |
| **2.2** | | | **16** (51) | **19** (55) | **22** (61) | **26** (68) | **29** (70) | **34** (75) | | | | |

Pressure measured at nozzle. There might be a significant pressure drop between gauge and nozzle depending on the design of the sprayer. Please check flow rate at nozzle when calibrating the sprayer. Optimum pressure 20 bar or more.

# TurboDrop® venturi nozzles set “Hochstamm” for atomizers

## JKI approved for up to 90 % drift reduction

Nozzle sets “Hochstamm” are available in two versions to cover a wide range of application rates. The nozzles and the spray angles are designed to reach higher treetops and to guarantee a good penetration while reducing the drift risk. Both sets are JKI approved for up to 90 % drift reduction.

It is recommended to switch off the side of the sprayer that is oriented to the outside while spraying the margin of an orchard.

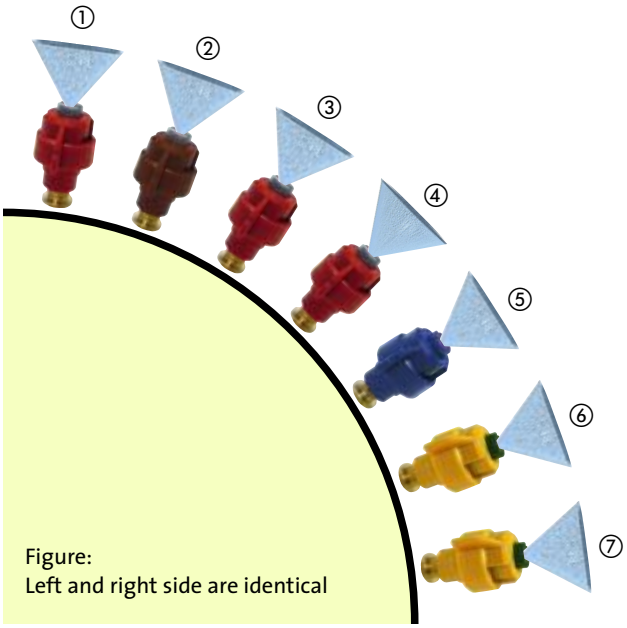



Figure:
Left and right side are identical

| | Nozzle set “Hochstamm” 500–800 l/ha 50–80 gallons/acre | | | Nozzle set “Hochstamm” 900–1000 l/ha 90–100 gallons/acre | | |
|---|---|---|---|---|---|---|
| | Nozzle = Injector | Tip | Flow rate (100 %) | Nozzle = Injector | Tip | Flow rate (100 %) |
| ① | TD 60-04 | grey | 17 % | TD 60-06 | black | 14 % |
| ② | TD 60-05 | grey | 21 % | TD 60-08 | ivory | 19 % |
| ③ | TD 60-04 | grey | 17 % | TD 60-08 | ivory | 19 % |
| ④ | TD 60-04 | grey | 17 % | TD 60-06 | black | 14 % |
| ⑤ | TD 60-03 | blue | 12 % | TD 60-06 | black | 14 % |
| ⑥ | TD 60-02 | green | 8 % | TD 60-05 | grey | 12 % |
| ⑦ | TD 60-02 | green | 8 % | TD 60-03 | blue | 8 % |

Nozzle size = Injector = Flow rate!

**Spray angle**

60°/40°/20°

**Size**


02 – 08

**Pressure range**


5 – 35
70 – 510 psi

**Characteristics:**

- Coarse to extra coarse droplet size for effective drift reduction
- High droplet speed
- Big application range (m) and excellent penetration
- Wide pressure range
- Maximum durability using extremely hard pink ceramic
- Best performing: 25–30 bar (350–450 psi)

| pressure bar | Flow rate in l/min each nozzle (pressure measured at nozzle) | | | | | | pressure psi |
|---|---|---|---|---|---|---|---|
| | 02 | 03 | 04 | 05 | 06 | 08 | |
| 16 | 1.85 | 2.77 | 3.70 | 4.62 | 5.54 | 7.39 | 230 |
| 18 | 1.96 | 2.94 | 3.92 | 4.90 | 5.88 | 7.84 | 260 |
| 20 | 2.07 | 3.10 | 4.13 | 5.17 | 6.20 | 8.26 | 290 |
| 22 | 2.17 | 3.25 | 4.33 | 5.42 | 6.50 | 8.67 | 320 |
| 24 | 2.26 | 3.39 | 4.53 | 5.66 | 6.79 | 9.05 | 350 |
| 26 | 2.36 | 3.53 | 4.71 | 5.89 | 7.07 | 9.42 | 380 |
| 28 | 2.44 | 3.67 | 4.89 | 6.11 | 7.33 | 9.78 | 410 |
| 30 | 2.53 | 3.80 | 5.06 | 6.33 | 7.59 | 10.12 | 440 |

Pressure measured at nozzle. There might be a significant pressure drop between gauge and nozzle depending on the design of the sprayer. Please check flow rate at nozzle when calibrating the sprayer.

## Formula

$$\text{Total flow rate l/min} = \frac{\text{Application rate l/ha} \times \text{Speed km/h} \times \text{Working width m}}{600}$$

# TurboDrop® VR

## The nozzle for highest flexibility in application rates

Spray nozzles can vary the flow rate only in a relatively small range. Pressure must be quadrupled to double the flow. Extended variations of speed or application rate cannot be done without changing the nozzles.

The new **TurboDrop® VR** (**V**ariable **R**ate) has a much larger flow range than other spray nozzles. It varies the orifice continuously and by that it covers the flow range of approximately four conventional nozzles.

**Main advantages:**

- Widely extended range of application rate, e. g. TurboDrop® VR 2: 100 – 420 l/ha at 8 km/h and 2 – 8 bar, compared to 100 – 200 l/ha for an ISO size –02 nozzle
- Widely extended speed range, e. g. TurboDrop® VR 3: 6 – 23 km/h at 200 l/ha and 2 – 8 bar, compared to 6 – 12 km/h for an ISO –03
- No need of expensive remote nozzle changers, multiple nozzle holders or various nozzle sets (cost reduction)
- Considerable time saving due to omission of nozzle changing
- More simple and smaller than multiple nozzle holders
- Continuously variable flow rate, no misapplication by nozzle changes
- Low cost retrofitting on all sprayers
- TurboDrop® modular system allows combination with TipCap, HiSpeed, TD-ADF or liquid fertilizer nozzles

# TurboDrop® VR variations

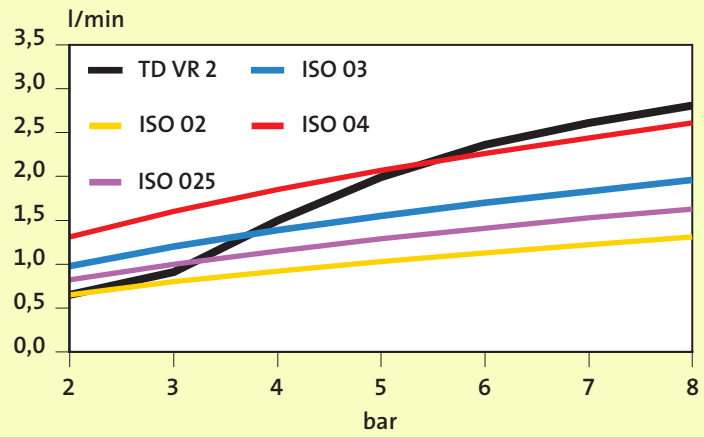
TurboDrop® VR 1.5
HiSpeed

TurboDrop® VR 2
HiSpeed

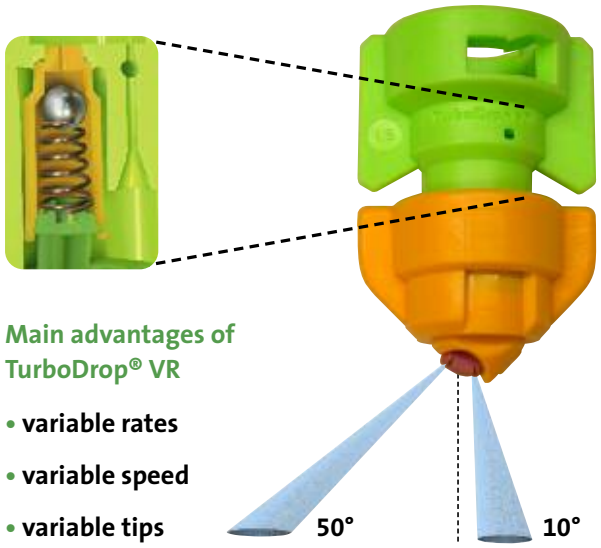
TurboDrop® VR 3
HiSpeed

TurboDrop® VR 2
fertilizer

## Characteristic curve TurboDrop® VR in comparison to ISO




An ISO nozzle size –02 will vary the flow rate from 0,65 l/min to 1,46 l/min at pressures between 2 and 10 bar. The TurboDrop® VR 2 can do it from 0,65 l/min to 3,14 l/min at same pressure range and will therefore replace the ISO sizes –02, –025, –03 and –04.




**Main advantages of TurboDrop® VR**

- **variable rates**
- **variable speed**
- **variable tips**

## TurboDrop® VR application chart at 50 cm nozzle spacing

| | Type | Pressure bar | l/min | Application rate l/ha at km/h 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | TurboDrop® VR 1.5 | 2 | 0,49 | 98 | 84 | 74 | 65 | 59 | 53 | 49 | 45 | 42 | 39 | 37 | 35 | 33 | 31 | 29 |
| | | 3 | 0,70 | 140 | 120 | 105 | 93 | 84 | 76 | 70 | 65 | 60 | 56 | 53 | 49 | 47 | 44 | 42 |
| | | 4 | 0,98 | 196 | 168 | 147 | 131 | 118 | 107 | 98 | 90 | 84 | 78 | 74 | 69 | 65 | 62 | 59 |
| | | 5 | 1,30 | 259 | 222 | 194 | 173 | 156 | 141 | 130 | 120 | 111 | 104 | 97 | 91 | 86 | 82 | 78 |
| | | 6 | 1,52 | 305 | 261 | 229 | 203 | 183 | 166 | 152 | 141 | 131 | 122 | 114 | 108 | 102 | 96 | 91 |
| | | 7 | 1,71 | 341 | 293 | 256 | 228 | 205 | 186 | 171 | 158 | 146 | 137 | 128 | 120 | 114 | 108 | 102 |
| | | 8 | 1,85 | 370 | 317 | 278 | 247 | 222 | 202 | 185 | 171 | 159 | 148 | 139 | 131 | 123 | 117 | 111 |
|  | TurboDrop® VR 2 | 2 | 0,65 | 131 | 112 | 98 | 87 | 78 | 71 | 65 | 60 | 56 | 52 | 49 | 46 | 44 | 41 | 39 |
| | | 3 | 0,91 | 182 | 156 | 137 | 121 | 109 | 99 | 91 | 84 | 78 | 73 | 68 | 64 | 61 | 57 | 55 |
| | | 4 | 1,50 | 300 | 257 | 225 | 200 | 180 | 164 | 150 | 138 | 129 | 120 | 113 | 106 | 100 | 95 | 90 |
| | | 5 | 1,99 | 398 | 341 | 299 | 265 | 239 | 217 | 199 | 184 | 171 | 159 | 149 | 141 | 133 | 126 | 119 |
| | | 6 | 2,36 | 472 | 405 | 354 | 315 | 283 | 257 | 236 | 218 | 202 | 189 | 177 | 167 | 157 | 149 | 142 |
| | | 7 | 2,61 | 522 | 447 | 391 | 348 | 313 | 285 | 261 | 241 | 224 | 209 | 196 | 184 | 174 | 165 | 156 |
| | | 8 | 2,81 | 561 | 481 | 421 | 374 | 337 | 306 | 281 | 259 | 241 | 225 | 211 | 198 | 187 | 177 | 168 |
|  | TurboDrop® VR 3 | 2 | 0,98 | 196 | 168 | 147 | 131 | 118 | 107 | 98 | 90 | 84 | 78 | 74 | 69 | 65 | 62 | 59 |
| | | 3 | 1,38 | 276 | 237 | 207 | 184 | 166 | 151 | 138 | 127 | 118 | 110 | 104 | 97 | 92 | 87 | 83 |
| | | 4 | 1,86 | 372 | 319 | 279 | 248 | 223 | 203 | 186 | 172 | 159 | 149 | 140 | 131 | 124 | 117 | 112 |
| | | 5 | 2,62 | 524 | 449 | 393 | 349 | 314 | 286 | 262 | 242 | 225 | 210 | 197 | 185 | 175 | 165 | 157 |
| | | 6 | 3,21 | 642 | 550 | 482 | 428 | 385 | 350 | 321 | 296 | 275 | 257 | 241 | 227 | 214 | 203 | 193 |
| | | 7 | 3,56 | 712 | 610 | 534 | 475 | 427 | 388 | 356 | 329 | 305 | 285 | 267 | 251 | 237 | 225 | 214 |
| | | 8 | 3,78 | 756 | 648 | 567 | 504 | 454 | 412 | 378 | 349 | 324 | 302 | 284 | 267 | 252 | 239 | 227 |

For flow controlled sprayers only.

**Application examples:** Variable speeds at constant rate Variable rates at constant speed

## Special bayonet caps

**ready assembled with TD Universal injector, no risk of skewing the right nozzle position on the boom**

Rau

Holder / Amazone / Lechler / Schmotzer

Hardi

BBG / Cebeco

**Special caps for other bayonets available on request.**

## Sealing washers for TurboDrop® Standard nozzles and caps

Part no. 14457 Washer 3.0 mm fits most standardised bayonet caps
Part no. 14461 Washer 2.8 mm for new caps, easy turning
Part no. 14969 Washer 3.4 mm for used caps, hard turning
Part no. 14460 Washer 1.0 mm for Evrard

Part no. 15111 Extension adapter for standardised bayonet cap
Using the adapter, standard nozzles for bayonet systems can be placed at the same height as TurboDrop® standard nozzles.

Part no. 15110 Bayonet adapter
Converts all screwed caps or caps with special bayonet systems into standardised bayonet systems. Assembly same as for TurboDrop® Universal. Ready assembled versions available.

Special adaptor to fit TurboDrop® standard nozzles on Hardi or Jacto bayonet systems. Compact, short design, just click on all TurboDrop® standard nozzles, also HiSpeed, and the nozzles will fit on any Hardi or Jacto sprayer with special bayonet cap systems. Suitable for any conversion of standard bayonet systems to Hardi or Jacto special bayonet systems.

Part. no. 15106 Adaptor for Hardi bayonet system
Part. no. 15107 Adaptor for Jacto bayonet system

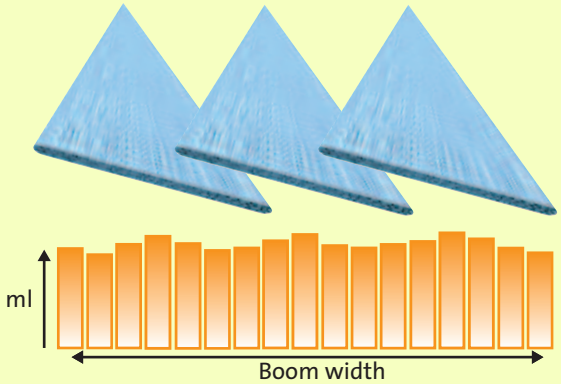
# Standard nozzles

Unlike the injector nozzles, where the expansion of the injected air helps to form the droplets leaving the distribution nozzle, standard nozzle tips have to break the liquid sheet into droplets strictly through pressure (hydraulic atomizing). Low pressure produces large droplets, whereas higher pressure makes the droplets finer.
Standard nozzles produce finer, driftable droplets compared to venturi nozzles.

## Basically there are two nozzle types for chemical applications in crops

**Flat fan nozzles** (V-slot orifice)
Common spray angles are 110° or 80° (SprayMax, TipCap). In general, 110° nozzles produce finer droplets than 80° nozzles.
Double flat fan nozzles with a forward and backward directed fan are available for special applications.

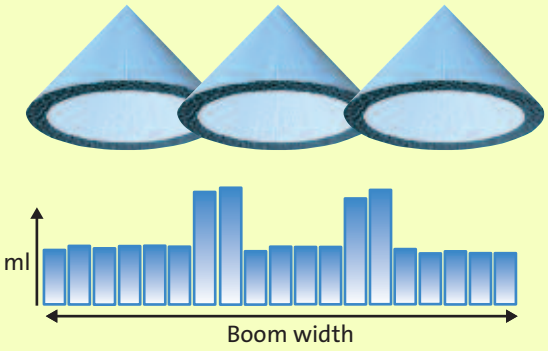
### Distribution of spray pattern of a boom with flat fan nozzles




**Hollow cone nozzles** with an orifice and a swirl (TipCap TCHC).
These produce slightly finer droplets compared to flat fan nozzles of the same size, and the droplet spray spectrum is narrower.

The common spray angle is 80° but unlike flat fan nozzles, droplets get finer at smaller spray angles.
Flat fan nozzles are designed to give equal distribution when overlapping. Hollow cones, on the other hand, give higher application volumes in the overlap area, resulting in a less uniform distribution on a boom.
Therefore hollow cone nozzles are not recommended for herbicide applications.

### Distribution of spray pattern of a boom with hollow cone nozzles




## Blocking risk

Plugging potential varies with size and the type of nozzle. Smaller sizes have a higher risk of plugging, and the risk increases from hollow cone to anvil to flat fan nozzles.

## ISO colour code

This describes the size of the nozzles as defined by flow rate at 3 bar pressure. Each size is assigned to a given colour, e.g. yellow for size 02.
The ISO values are determined using water at 20 °C.
For more information on ISO flow rates see page 43 in this catalogue.

## Density (specific weight)

The density of the spray liquid influences the application rate. At constant pressure, flow rate is reduced when the density of the liquid is higher. The values given in the application chart are normally based on the density of water. In general, the ratio of chemicals to carrier (water) is too low to alter the density of the spray significantly (water = 1.0 kg/l at 20 °C).
However, for liquid fertilizer applications it can be necessary to adjust the flow rate or application rate because of the higher density. See adaptations of application charts to liquid fertilizer on page 54/55.

## High durability plastics and Aluminium-Oxide ceramic

have replaced brass or stainless steel in agrochemical applications. Better compatibility with chemicals, better wear resistance and more accuracy of the pattern, are the advantages of spray nozzles made from these modern materials.

# SprayMax

**Universal flat fan nozzles made from hard-wearing plastic POM**

| 110-01 | 110-015 | 110-02 | 110-025 | 110-03 | 110-04 | 110-05 | 110-06 | 110-08 | 110-10 |
|---|---|---|---|---|---|---|---|---|---|
| Filter 50 M blue | | | | | | | Filter 24 M white | | |

| 80-01 | 80-015 | 80-02 | 80-025 | 80-03 | 80-04 | 80-05 | 80-06 | 80-08 | 80-10 |
|---|---|---|---|---|---|---|---|---|---|
| Filter 50 M blue | | | | | | Filter 24 M white | | | |

| Spray angle | Size | Pressure range | Boom height |
|---|---|---|---|
| 110°/80° | 01 – 10 | 1 – 4<br>15 – 60 psi | 40 – 60 cm<br>15 – 25" |

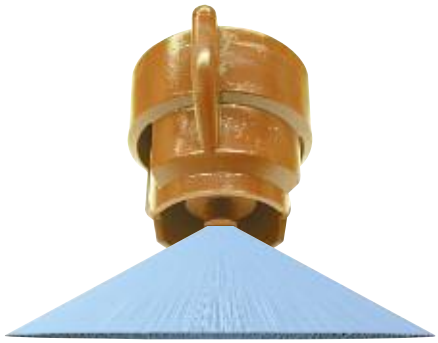
**Characteristics:**

- Flow rates in accordance with ISO standards
- High accuracy due to minimising variability in production
- Wide pressure range and application rate
- High durability

**Fits in caps with spanner width of 8 mm, commonly used on most sprayers**

**Application:**

*Application charts and flow chart, see page 43–48*



# TipCap TCP

**Universal flat fan nozzle and standard bayonet cap made from hard-wearing plastic POM**

| 110-02 | 110-03 | 110-04 | 110-05 | 110-06 | 110-08 | 110-10 | 110-12 | 110-16 | 110-20 |
|---|---|---|---|---|---|---|---|---|---|
| Filter 50 M blue | | | | Filter 24 M white | | no filter required | | | |

| Spray angle | Size | Pressure range | Boom height |
|---|---|---|---|
| 110° | 02 – 20 | 1 – 4<br>15 – 60 psi | 40 – 60 cm<br>15 – 25" |

**Characteristics:**

- Nozzle tip and cap one piece
- No small parts, quick and easy changing
- See-at-a-glance colour code, cap and nozzle in same ISO colour
- High durability
- Range from size 02 up to 20, application rates with largest volumes

**Application:**

*Application charts, see page 44/48*

| Spray angle | Size | Pressure | Boom height | Application |
|---|---|---|---|---|
| 110° | 015 – 08 | 2 – 4<br>30 – 60 psi | 40 – 60 cm<br>15 – 25" | |

# TipCap TCC

**Universal flat fan nozzle made from ceramic incorporated in standard bayonet cap**

| 110-015 | 110-02 | 110-03 | 110-04 | 110-05 | 110-06 | 110-08 |
|---|---|---|---|---|---|---|

Filter 50 M blue

Filter 24 M white

**Characteristics: Same performance as the TipCapTCP, but**

- Pressure range: 2 – 4 bar (30 – 60 psi)
- Available from size 015 – 08
- Long life and maximum accuracy using very hard pink ceramic

# TipCap TCHC

**Hollow cone nozzle made from hard-wearing plastic POM incorporated into standard bayonet cap**

| Type | D 7 C 13 black/red | D 7 C 23 black/blue | D 7 C 25 black/yellow | D 7 C 45 black/green |
|---|---|---|---|---|
| l/min at | | | | |
| 1.0 bar (15 psi) | 0.51 | 0.66 | 1.14 | 1.76 |
| 2.0 bar (30 psi) | 0.64 | 0.84 | 1.49 | 2.30 |
| 3.0 bar (45 psi) | 0.76 | 0.99 | 1.76 | 2.70 |

Filter 50 M blue

Filter 24 M white

| Spray angle | Size | Pressure range | Boom height |
|---|---|---|---|
| approx. 90° | no standardised size | 0.5 – 3<br>8 – 45 psi | 60 – 90 cm<br>25 – 45" |

**Characteristics:**

- Nozzle tip and cap one piece, no fumbling when changing nozzles, quick changing
- Starts working at very low pressure
- Constant, relatively medium-coarse droplet size
- Equal pattern distribution may not meet the demands when tested in a patternator
- Recommended use: fungicide or insecticide applications

**Application:**

*Calculation of application rate, see formulas on page 49*

# Albuz® ATR

Hollow cone nozzle made from ceramic

| | G 1348 | G 1349 | G 1350 | G 1351 | G 1352 | G 1353 | G 1354 |
|---|---|---|---|---|---|---|---|
| Type | ATR white | ATR lila | ATR brown | ATR yellow | ATR orange | ATR red | ATR grey | ATR green | ATR black | ATR blue |
| l/min at 10.0 bar | 0.38 | 0.50 | 0.67 | 1.03 | 1.39 | 1.92 | 2.08 | 2.47 | 2.78 | 3.40 |

 Filter 50 M blue

 Filter 24 M white

**Spray angle**

80°

**Size**

no standardised sizes

**Pressure range**

bar

3 – 25
45 – 360 psi

**Characteristics:**

- The standard nozzle for applications in orchards or vineyards
- Highest accuracy and wear resistance
- Two-piece design, easy disassembly for cleaning
- Constant fine droplet size (not recommended for drift reduced spraying)
- Wide pressure range

*Flow rate is not corresponding to ISO chart, see ATR flow rates at chart below*

*Calculation of flow rate see page 49 or agrotop's nozzle calculator for orchards on www.agrotop.com*

**Application:**

## Flow rate Albuz® ATR

| Pressure bar | white | lila | brown | yellow | orange | red | grey | green | black | blue |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0.21 | 0.28 | 0.38 | 0.57 | 0.77 | 1.08 | 1.18 | 1.40 | 1.57 | 1.92 |
| 4 | 0.24 | 0.32 | 0.43 | 0.65 | 0.89 | 1.24 | 1.35 | 1.60 | 1.80 | 2.20 |
| 5 | 0.27 | 0.36 | 0.48 | 0.73 | 0.99 | 1.38 | 1.50 | 1.78 | 2.00 | 2.45 |
| 6 | 0.29 | 0.39 | 0.52 | 0.80 | 1.08 | 1.51 | 1.63 | 1.94 | 2.18 | 2.67 |
| 7 | 0.32 | 0.42 | 0.56 | 0.86 | 1.17 | 1.62 | 1.76 | 2.09 | 2.35 | 2.87 |
| 8 | 0.34 | 0.45 | 0.60 | 0.92 | 1.24 | 1.73 | 1.87 | 2.22 | 2.50 | 3.06 |
| 9 | 0.36 | 0.48 | 0.64 | 0.97 | 1.32 | 1.83 | 1.98 | 2.35 | 2.64 | 3.24 |
| 10 | 0.38 | 0.50 | 0.67 | 1.03 | 1.39 | 1.92 | 2.08 | 2.47 | 2.78 | 3.40 |
| 11 | 0.39 | 0.52 | 0.70 | 1.07 | 1.45 | 2.01 | 2.17 | 2.58 | 2.90 | 3.56 |
| 12 | 0.41 | 0.55 | 0.73 | 1.12 | 1.51 | 2.09 | 2.26 | 2.69 | 3.03 | 3.71 |
| 13 | 0.43 | 0.57 | 0.76 | 1.17 | 1.57 | 2.17 | 2.35 | 2.79 | 3.14 | 3.85 |
| 14 | 0.44 | 0.59 | 0.79 | 1.21 | 1.63 | 2.25 | 2.43 | 2.89 | 3.26 | 3.99 |
| 15 | 0.46 | 0.61 | 0.81 | 1.25 | 1.69 | 2.33 | 2.51 | 2.99 | 3.36 | 4.12 |
| 16 | 0.47 | 0.63 | 0.84 | 1.29 | 1.74 | 2.40 | 2.59 | 3.08 | 3.47 | 4.25 |
| 17 | 0.48 | 0.64 | 0.86 | 1.33 | 1.79 | 2.47 | 2.67 | 3.17 | 3.57 | 4.37 |
| 18 | 0.50 | 0.66 | 0.89 | 1.37 | 1.84 | 2.54 | 2.74 | 3.25 | 3.67 | 4.49 |
| 19 | 0.51 | 0.68 | 0.91 | 1.40 | 1.89 | 2.60 | 2.81 | 3.34 | 3.76 | 4.61 |
| 20 | 0.52 | 0.70 | 0.93 | 1.44 | 1.94 | 2.67 | 2.88 | 3.42 | 3.85 | 4.72 |
| 21 | 0.54 | 0.71 | 0.95 | 1.48 | 1.99 | 2.73 | 2.95 | 3.50 | 3.94 | 4.84 |
| 22 | 0.55 | 0.73 | 0.98 | 1.51 | 2.03 | 2.79 | 3.01 | 3.57 | 4.03 | 4.94 |
| 23 | 0.56 | 0.74 | 1.00 | 1.54 | 2.07 | 2.85 | 3.07 | 3.65 | 4.12 | 5.05 |
| 24 | 0.57 | 0.76 | 1.02 | 1.58 | 2.12 | 2.91 | 3.14 | 3.72 | 4.20 | 5.15 |
| 25 | 0.58 | 0.77 | 1.04 | 1.61 | 2.16 | 2.97 | 3.20 | 3.80 | 4.28 | 5.25 |

# Demo stand for demonstration of individual and comparative nozzle performance


Many nozzle and sprayer specialists already use the **agrotop** demo stand to show and explain the performance of latest developments in crop protection technology to their customers. The demo stand helps to explain and demonstrate in an easy and understandable way the main features of different nozzle and sprayer technologies. The nozzles could be shown as mounted on a spray boom, helping your clients to make the right choice.
The demo unit can be easily installed on your show booth, used at training sessions or in your spray shop.


**Characteristics:**

- Demo box with water reservoir and background illumination
- Base with aluminium frame for demo box, can be disassembled if needed
- Two five-way nozzle holders, mounted side by side for easy nozzle comparison
- Support frame/nozzle holders for a wide selection of different nozzles
- Pressure regulator with pressure gauge
- Diaphragm pump 0–12 bar at max. 13 l/min, 230 V or 110 V optional

**Contact us for more details or individual design of demo stand.**

# Application charts and formulas

## Standard colour code ISO 10625

This determines the size of a nozzle according to its flow rate at 3 bar pressure. Each nozzle size is in a defined colour, indicating the size of the nozzle, see flow chart on page 43.
If the flow rate of a nozzle exceeds a 10 % tolerance from the value given in the chart, it is recommended to replace the nozzle. To check use QuickCheck Calibration jug (see page 80).

## Other colour codes

Most of our nozzles conform to the ISO colour code.
The TurboDrop® TDF and TD-ATR for orchard spraying follow the Albuz® ATR flow rates given on page 40. Note the indication on the respective page for each nozzle.

## Application rate

Based on the flow rate of the nozzle, the application rate can be calculated using the formulas on page 49.
For boom sprayers application charts are available giving the application rate in regard to pressure and speed, for a 50 cm (20") nozzle spacing.

## ISO application chart

The ISO application charts indicate the flow rate (l/min) that a nozzle delivers at a given pressure (bar). Considering this flow rate, the application rate (l/ha) is given for different application speeds (km/h).
See ISO application chart on page 48.

| Nozzle size ISO | Pressure bar | Flow rate l/min | Application rate l/ha at km/h 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|
| –02 yellow | 2.0 | 0.65 | 196 | 131 | 98 | 78 | 65 | 56 | 49 | 44 |
| | 3.0 | 0.80 | 240 | 160 | 120 | 96 | 80 | 69 | 60 | 53 |
| | 4.0 | 0.92 | 277 | 185 | 139 | 111 | 92 | 79 | 69 | 62 |
| –03 blue | 1.0 | 0.69 | 208 | 139 | 104 | 83 | 69 | 59 | 52 | 46 |
| | 2.0 | 0.98 | 294 | 196 | 147 | 118 | 98 | 84 | 74 | 65 |
| | 2.5 | 1.10 | 329 | 219 | 164 | 131 | 110 | 94 | 82 | 73 |
| | 3.0 | 1.20 | 360 | 240 | 180 | 144 | 120 | 103 | 90 | 80 |
| | 4.0 | 1.39 | 416 | 277 | 208 | 166 | 139 | 119 | 104 | 92 |
| | 5.0 | 1.55 | 465 | 310 | 232 | 186 | 155 | 133 | 116 | 103 |
| | 6.0 | 1.70 | 509 | 339 | 255 | 204 | 170 | 145 | 127 | 113 |

- Select nozzle size, e.g. **–03** ISO colour code **blue**
- Size –03 has a flow rate of **1.2 l/min** at **3.0 bar** pressure
- At an application speed of **10 km/h,** the application rate is **144 l/ha**

Following this chart, it is easy to find the application rate if the nozzle size, pressure and application speed are known, but many times a farmer is looking for the correct nozzle size to apply e.g. 150 l/ha. The value 144 l/ha as shown above may be a good approximation; however, searching up and down the chart, many options can be found.

## Universal application chart

The Universal application chart has been created to help farmers select a nozzle for a given application rate.

Here the first option is the desired application rate (l/ha,) then the application speed (km/h). Both determine the flow rate (l/min). For each flow rate the required pressure for the different nozzle sizes is shown, considering a range from 1 to 10 bar. See Universal application chart on page 44.

| Application rate l/ha 100 | 150 | 200 | 250 | Flow rate l/min | Nozzle size ISO –01 | –02 | –03 | –04 | –05 |
|---|---|---|---|---|---|---|---|---|---|
| 4.2 | | | | 0.35 | 2.3 | | | | |
| 4.8 | | | | 0.40 | 3.0 | | | | |
| 6.0 | 4.0 | | | 0.50 | 4.7 | 1.2 | | | |
| 7.2 | 4.8 | | | 0.60 | 6.7 | 1.7 | | | |
| 8.4 | 5.6 | 4.2 | | 0.70 | 9.2 | 2.3 | 1.0 | | |
| 9.6 | 6.4 | 4.8 | | 0.80 | | 3.0 | 1.3 | | |
| 10.8 | 7.2 | 5.4 | 4.3 | 0.90 | | 3.8 | 1.7 | | |
| 12.0 | 8.0 | 6.0 | 4.8 | 1.00 | | 4.7 | 2.1 | 1.2 | |
| 13.2 | 8.8 | 6.6 | 5.3 | 1.10 | | 5.7 | 2.5 | 1.4 | |
| 13.8 | 9.2 | 6.9 | 5.5 | 1.15 | | 6.2 | 2.8 | 1.5 | 1.0 |
| 14.4 | 9.6 | 7.2 | 5.8 | 1.20 | | 6.7 | 3.0 | 1.7 | 1.1 |
| 15.0 | 10.0 | 7.5 | 6.0 | 1.25 | | 7.3 | 3.3 | 1.8 | 1.2 |
| 15.6 | 10.4 | 7.8 | 6.2 | 1.30 | | 7.9 | 3.5 | 2.0 | 1.3 |
| 16.2 | 10.8 | 8.1 | 6.5 | 1.35 | | 8.5 | 3.8 | 2.1 | 1.4 |
| 16.8 | 11.2 | 8.4 | 6.7 | 1.40 | | 9.2 | 4.1 | 2.3 | 1.5 |
| 17.4 | 11.6 | 8.7 | 7.0 | 1.45 | | | 4.4 | 2.5 | 1.6 |

Speed km/h

Pressure bar

- Selected application rate is e.g. **150 l/ha** and the speed is **10.0 km/h**
- Going right in the same row the indicated flow rate is **1.25 l/min** per nozzle
- More right, the corresponding values show the pressure in bar for each nozzle size to get a flow rate of 1.25 l/min. For the **–03** nozzle the pressure should be **3.3 bar**

In the example we apply 150 l/ha at 10 km/h using a nozzle size –03 at 3.3 bar pressure.

## Droplet size chart

Droplet size is an important issue when selecting the right nozzle for an application. The significance of droplet size for spraying is explained on page 6 onwards (chapter on drift).
The droplet size classification in this catalogue follows the ASAE/BCPC classification scheme. Measurements were made by a Malvern Particle Sizer.
On page 45 the droplet size is shown with regard to the Universal application chart.
On page 46 droplet size is indicated regarding pressure.

## Different nozzle spacing on boom

Application charts are usually based on 50 cm (20") nozzle spacing. To adapt data to other distances use:

**ISO application chart**
Select the flow rate as shown in the ISO application chart and multiply the given application rate l/ha by:

x 2.0 for 25 cm spacing
x 1.43 for 35 cm spacing
x 0.66 for 75 cm spacing

For other distances, see formulas on page 50.

For instance, using a blue nozzle (size –03) at 3.3 bar and 10 km/h on a boom with 35 cm nozzle spacing, the application rate will be 215 l/ha (1.43 x 150 l/ha), instead of 150 l/ha shown in the chart.

**Universal application chart**
Select flow rate and speed as desired but multiply the given flow rate by:

x 0.5 for 25 cm spacing
x 0.7 for 35 cm spacing
x 1.5 for 75 cm spacing

For other distances, see formulas on page 50.

Then look in the flow rate column for the nearest value. Go right from this flow rate to find the corresponding pressure at the different nozzle sizes.
For instance, to apply 200 l/ha at 7.5 km/h using a 35 cm nozzle spacing the flow rate of single nozzle must be 0.88 l/min (1.25 l/min x 0.7). Next value in column is 0.90 l/min. The pressure and nozzles indicated on the right will give 200 l/ha at 7.5 km/h at 35 cm nozzle spacing.

## Flow rate and pressure

For flat fan nozzles:

| | |
|---|---|
| four times pressure | = two times flow rate |
| nine times pressure | = three times flow rate |
| one quarter of pressure | = half of flow rate |

## Liquid fertilizers

Liquids behave as follows: if the density of a liquid increases, the flow rate decreases in the same proportion. Therefore, to get the same flow rate, it is necessary to change the pressure the same way as the density of the liquid differs from that of water.

The special flow charts for liquid fertilizer application in this catalogue (see page 54/55) are already adjusted to the density of UAN (Urea-Ammonium-Nitrate) solutions.

When using an application chart based on water, the given pressure must be multiplied by 1.3 for UAN (1.3 kg/l).
E. g., to apply 200 l/ha at 7.5 km/h with a nozzle size –05 the Universal chart indicates 1.2 bar pressure. Applying UAN under same conditions the pressure must be increased to 1.56 bar (1.2 bar x 1.3).
Using the Universal chart, the pressure indicated for each nozzle must be changed in the same way.

See formula on page 50 for further liquid densities.

## Sprayer calibration

The pressures indicated in the Universal and ISO application charts are all measured directly at the nozzle, using water at 20°C.
Practical conditions may vary, therefore it is recommended to check the application rate with suitable calibration equipment, e.g. the QuickCheck Calibration jug (see page 80), before spraying.

## Flow chart and nozzle colour code according to ISO 10625 or equivalent

| Pressure bar | Flow rate l/min at nozzle size ISO | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -01 | -015 | -02 | -025 | -03 | -04 | -05 | -06 | -08 | -10 | -12 | -16 | -20 |
| 1.0 | 0.23 | 0.35 | 0.46 | 0.58 | 0.69 | 0.92 | 1.15 | 1.39 | 1.85 | 2.31 | 2.77 | 3.70 | 4.62 |
| 1.5 | 0.28 | 0.42 | 0.57 | 0.71 | 0.85 | 1.13 | 1.41 | 1.70 | 2.26 | 2.83 | 3.39 | 4.53 | 5.66 |
| 2.0 | 0.33 | 0.49 | 0.65 | 0.82 | 0.98 | 1.31 | 1.63 | 1.96 | 2.61 | 3.27 | 3.92 | 5.23 | 6.53 |
| 2.5 | 0.37 | 0.55 | 0.73 | 0.91 | 1.10 | 1.46 | 1.83 | 2.19 | 2.92 | 3.65 | 4.38 | 5.84 | 7.30 |
| 3.0 | 0.40 | 0.60 | 0.80 | 1.00 | 1.20 | 1.60 | 2.00 | 2.40 | 3.20 | 4.00 | 4.80 | 6.40 | 8.00 |
| 4.0 | 0.46 | 0.69 | 0.92 | 1.15 | 1.39 | 1.85 | 2.31 | 2.77 | 3.70 | 4.62 | 5.54 | 7.39 | 9.24 |
| 5.0 | 0.52 | 0.77 | 1.03 | 1.29 | 1.55 | 2.07 | 2.58 | 3.10 | 4.13 | 5.16 | 6.20 | 8.26 | 10.33 |
| 6.0 | 0.57 | 0.85 | 1.13 | 1.41 | 1.70 | 2.26 | 2.83 | 3.39 | 4.53 | 5.66 | 6.79 | 9.05 | 11.31 |
| 7.0 | 0.61 | 0.92 | 1.22 | 1.53 | 1.83 | 2.44 | 3.06 | 3.67 | 4.89 | 6.11 | 7.33 | 9.78 | 12.22 |
| 8.0 | 0.65 | 0.98 | 1.31 | 1.63 | 1.96 | 2.61 | 3.27 | 3.92 | 5.23 | 6.53 | 7.84 | 10.45 | 13.06 |
| 9.0 | 0.69 | 1.04 | 1.39 | 1.73 | 2.08 | 2.77 | 3.47 | 4.16 | 5.54 | 6.93 | 8.31 | 11.09 | 13.86 |
| 10.0 | 0.73 | 1.10 | 1.46 | 1.83 | 2.19 | 2.92 | 3.65 | 4.38 | 5.84 | 7.30 | 8.76 | 11.68 | 14.61 |
| 12.0 | 0.80 | 1.20 | 1.60 | 2.00 | 2.40 | 3.20 | 4.00 | 4.80 | 6.40 | 8.00 | 9.60 | 12.80 | 16.00 |
| 14.0 | 0.86 | 1.29 | 1.73 | 2.16 | 2.59 | 3.46 | 4.32 | 5.19 | 6.91 | 8.64 | 10.37 | 13.83 | 17.28 |
| 16.0 | 0.92 | 1.39 | 1.85 | 2.31 | 2.77 | 3.70 | 4.62 | 5.54 | 7.39 | 9.24 | 11.09 | 14.78 | 18.48 |
| 18.0 | 0.98 | 1.47 | 1.96 | 2.45 | 2.94 | 3.92 | 4.90 | 5.88 | 7.84 | 9.80 | 11.76 | 15.68 | 19.60 |
| 20.0 | 1.03 | 1.55 | 2.07 | 2.58 | 3.10 | 4.13 | 5.16 | 6.20 | 8.26 | 10.33 | 12.39 | 16.52 | 20.66 |
| 25.0 | 1.15 | 1.73 | 2.31 | 2.89 | 3.47 | 4.62 | 5.77 | 6.93 | 9.24 | 11.55 | 13.86 | 18.48 | 23.09 |

Data measured with water at 20 °C, pressure measured directly at the nozzle.
Check application rate before spraying.

## Universal application chart for boom sprayers at 50 cm nozzle spacing
## Nozzle size and colour according to ISO 10625 or equivalent

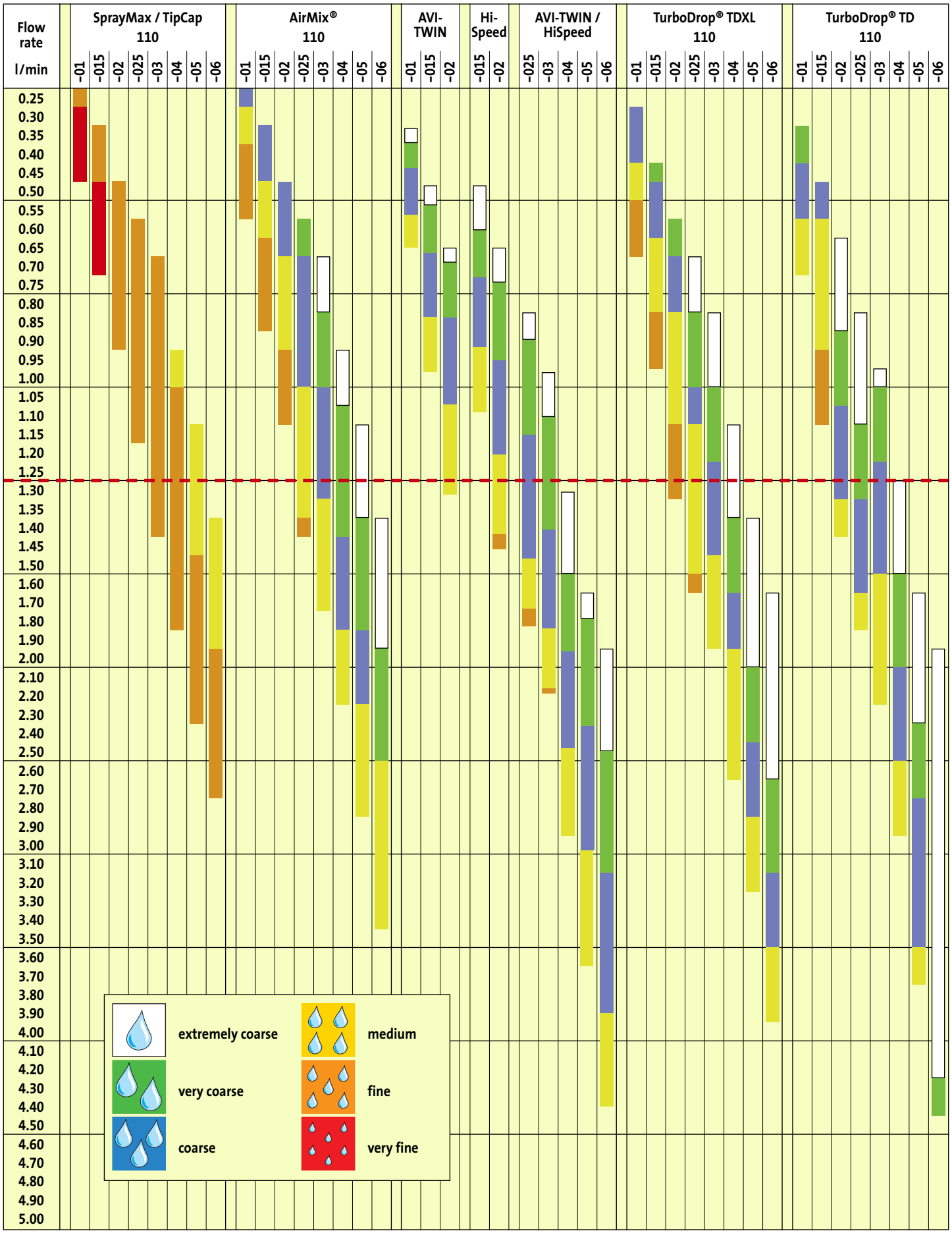
See our agrotop nozzle calculator in the internet www.agrotop.com

| Application rate l/ha | | | | | | | | | Flow rate l/min | Nozzle size ISO | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 100 | 150 | 200 | 250 | 300 | 400 | 500 | 600 | | -01 | -015 | -02 | -025 | -03 | -04 | -05 | -06 | -08 | -10 |
| 6.0 | | | | | | | | | 0.25 | 1.2 | | | | | | | | | |
| 7.2 | | | | | | | | | 0.30 | 1.7 | | | | | | | | | |
| 8.4 | 4.2 | | | | | | | | 0.35 | 2.3 | 1.0 | | | | | | | | |
| 9.6 | 4.8 | | | | | | | | 0.40 | 3.0 | 1.3 | | | | | | | | |
| 10.8 | 5.4 | | | | | | | | 0.45 | 3.8 | 1.7 | | | | | | | | |
| 12.0 | 6.0 | 4.0 | | | | | | | 0.50 | 4.7 | 2.1 | 1.2 | | | | | | | |
| 13.2 | 6.6 | 4.4 | | | | | | | 0.55 | 5.7 | 2.5 | 1.4 | | | | | | | |
| 14.4 | 7.2 | 4.8 | | | Speed km/h | | | | 0.60 | 6.7 | 3.0 | 1.7 | 1.1 | | | Pressure bar | | | |
| 15.6 | 7.8 | 5.2 | | | | | | | 0.65 | 7.9 | 3.5 | 2.0 | 1.3 | | | | | | |
| 16.8 | 8.4 | 5.6 | 4.2 | | | | | | 0.70 | 9.2 | 4.1 | 2.3 | 1.5 | 1.0 | | | | | |
| 18.0 | 9.0 | 6.0 | 4.5 | | | | | | 0.75 | | 4.7 | 2.6 | 1.7 | 1.2 | | | | | |
| 19.2 | 9.6 | 6.4 | 4.8 | | | | | | 0.80 | | 5.3 | 3.0 | 1.9 | 1.3 | | | | | |
| 20.4 | 10.2 | 6.8 | 5.1 | 4.1 | | | | | 0.85 | | 6.0 | 3.4 | 2.2 | 1.5 | | | | | |
| 21.6 | 10.8 | 7.2 | 5.4 | 4.3 | | | | | 0.90 | | 6.8 | 3.8 | 2.4 | 1.7 | | | | | |
| 22.8 | 11.4 | 7.6 | 5.7 | 4.6 | | | | | 0.95 | | 7.5 | 4.2 | 2.7 | 1.9 | 1.1 | | | | |
| 24.0 | 12.0 | 8.0 | 6.0 | 4.8 | 4.0 | | | | 1.00 | | 8.4 | 4.7 | 3.0 | 2.1 | 1.2 | | | | |
| 25.2 | 12.6 | 8.4 | 6.3 | 5.0 | 4.2 | | | | 1.05 | | 9.2 | 5.2 | 3.3 | 2.3 | 1.3 | | | | |
| | 13.2 | 8.8 | 6.6 | 5.3 | 4.4 | | | | 1.10 | | 10.1 | 5.7 | 3.6 | 2.5 | 1.4 | | | | |
| | 13.8 | 9.2 | 6.9 | 5.5 | 4.6 | | | | 1.15 | | | 6.2 | 4.0 | 2.8 | 1.5 | 1.0 | | | |
| | 14.4 | 9.6 | 7.2 | 5.8 | 4.8 | | | | 1.20 | | | 6.7 | 4.3 | 3.0 | 1.7 | 1.1 | | | |
| | 15.0 | 10.0 | 7.5 | 6.0 | 5.0 | 3.8 | | | 1.25 | | | 7.3 | 4.7 | 3.3 | 1.8 | 1.2 | | | |
| | 15.6 | 10.4 | 7.8 | 6.2 | 5.2 | 3.9 | | | 1.30 | | | 7.9 | 5.1 | 3.5 | 2.0 | 1.3 | | | |
| | 16.2 | 10.8 | 8.1 | 6.5 | 5.4 | 4.1 | | | 1.35 | | | 8.5 | 5.5 | 3.8 | 2.1 | 1.4 | | | |
| | 16.8 | 11.2 | 8.4 | 6.7 | 5.6 | 4.2 | | | 1.40 | | | 9.2 | 5.9 | 4.1 | 2.3 | 1.5 | 1.0 | | |
| | 17.4 | 11.6 | 8.7 | 7.0 | 5.8 | 4.4 | | | 1.45 | | | | 6.3 | 4.4 | 2.5 | 1.6 | 1.1 | | |
| | 18.0 | 12.0 | 9.0 | 7.2 | 6.0 | 4.5 | | | 1.50 | | | | 6.8 | 4.7 | 2.6 | 1.7 | 1.2 | | |
| | 19.2 | 12.8 | 9.6 | 7.7 | 6.4 | 4.8 | | | 1.60 | | | | 7.7 | 5.3 | 3.0 | 1.9 | 1.3 | | |
| | 20.4 | 13.6 | 10.2 | 8.2 | 6.8 | 5.1 | 4.1 | | 1.70 | | | | 8.7 | 6.0 | 3.4 | 2.2 | 1.5 | | |
| | 21.6 | 14.4 | 10.8 | 8.6 | 7.2 | 5.4 | 4.3 | | 1.80 | | | | 9.7 | 6.7 | 3.8 | 2.4 | 1.7 | 1.0 | |
| | 22.8 | 15.2 | 11.4 | 9.1 | 7.6 | 5.7 | 4.6 | | 1.90 | | | | | 7.5 | 4.2 | 2.7 | 1.9 | 1.1 | |
| | 24.0 | 16.0 | 12.0 | 9.6 | 8.0 | 6.0 | 4.8 | 4.0 | 2.00 | | | | | 8.3 | 4.7 | 3.0 | 2.1 | 1.2 | |
| | 25.2 | 16.8 | 12.6 | 10.1 | 8.4 | 6.3 | 5.0 | 4.2 | 2.10 | | | | | 9.2 | 5.2 | 3.3 | 2.3 | 1.3 | |
| | | 17.6 | 13.2 | 10.6 | 8.8 | 6.6 | 5.3 | 4.4 | 2.20 | | | | | 10.1 | 5.7 | 3.6 | 2.5 | 1.4 | |
| | | 18.4 | 13.8 | 11.0 | 9.2 | 6.9 | 5.5 | 4.6 | 2.30 | | | | | | 6.2 | 4.0 | 2.8 | 1.6 | 1.0 |
| | | 19.2 | 14.4 | 11.5 | 9.6 | 7.2 | 5.8 | 4.8 | 2.40 | | | | | | 6.7 | 4.3 | 3.0 | 1.7 | 1.1 |
| | | 20.0 | 15.0 | 12.0 | 10.0 | 7.5 | 6.0 | 5.0 | 2.50 | | | | | | 7.3 | 4.7 | 3.3 | 1.8 | 1.2 |
| | | 20.8 | 15.6 | 12.5 | 10.4 | 7.8 | 6.2 | 5.2 | 2.60 | | | | | | 7.9 | 5.1 | 3.5 | 2.0 | 1.3 |
| | | 21.6 | 16.2 | 13.0 | 10.8 | 8.1 | 6.5 | 5.4 | 2.70 | | | | | | 8.5 | 5.5 | 3.8 | 2.1 | 1.4 |
| | | 22.4 | 16.8 | 13.4 | 11.2 | 8.4 | 6.7 | 5.6 | 2.80 | | | | | | 9.2 | 5.9 | 4.1 | 2.3 | 1.5 |
| | | 23.2 | 17.4 | 13.9 | 11.6 | 8.7 | 7.0 | 5.8 | 2.90 | | | | | | 9.9 | 6.3 | 4.4 | 2.5 | 1.6 |
| | | 24.0 | 18.0 | 14.4 | 12.0 | 9.0 | 7.2 | 6.0 | 3.00 | | | | | | | 6.7 | 4.7 | 2.6 | 1.7 |
| | | 24.8 | 18.6 | 14.9 | 12.4 | 9.3 | 7.4 | 6.2 | 3.10 | | | | | | | 7.2 | 5.0 | 2.8 | 1.8 |
| | | 25.6 | 19.2 | 15.4 | 12.8 | 9.6 | 7.7 | 6.4 | 3.20 | | | | | | | 7.7 | 5.3 | 3.0 | 1.9 |
| | | | 19.8 | 15.8 | 13.2 | 9.9 | 7.9 | 6.6 | 3.30 | | | | | | | 8.2 | 5.7 | 3.2 | 2.0 |
| | | | 20.4 | 16.3 | 13.6 | 10.2 | 8.2 | 6.8 | 3.40 | | | | | | | 8.7 | 6.0 | 3.4 | 2.2 |
| | | | 21.0 | 16.8 | 14.0 | 10.5 | 8.4 | 7.0 | 3.50 | | | | | | | 9.2 | 6.4 | 3.6 | 2.3 |
| | | | 21.6 | 17.3 | 14.4 | 10.8 | 8.6 | 7.2 | 3.60 | | | | | | | 9.7 | 6.7 | 3.8 | 2.4 |
| | | | 22.2 | 17.8 | 14.8 | 11.1 | 8.9 | 7.4 | 3.70 | | | | | | | 10.3 | 7.1 | 4.0 | 2.6 |
| | | | 22.8 | 18.2 | 15.2 | 11.4 | 9.1 | 7.6 | 3.80 | | | | | | | | 7.5 | 4.2 | 2.7 |
| | | | 23.4 | 18.7 | 15.6 | 11.7 | 9.4 | 7.8 | 3.90 | | | | | | | | 7.9 | 4.5 | 2.9 |
| | | | 24.0 | 19.2 | 16.0 | 12.0 | 9.6 | 8.0 | 4.00 | | | | | | | | 8.3 | 4.7 | 3.0 |
| | | | 24.6 | 19.7 | 16.4 | 12.3 | 9.8 | 8.2 | 4.10 | | | | | | | | 8.8 | 4.9 | 3.2 |
| | | | 25.2 | 20.2 | 16.8 | 12.6 | 10.1 | 8.4 | 4.20 | | | | | | | | 9.2 | 5.2 | 3.3 |
| | | | | 20.6 | 17.2 | 12.9 | 10.3 | 8.6 | 4.30 | | | | | | | | 9.6 | 5.4 | 3.5 |
| | | Speed km/h | | 21.1 | 17.6 | 13.2 | 10.6 | 8.8 | 4.40 | | | Pressure bar | | | | | 10.1 | 5.7 | 3.6 |
| | | | | 21.6 | 18.0 | 13.5 | 10.8 | 9.0 | 4.50 | | | | | | | | | 5.9 | 3.8 |
| | | | | 22.1 | 18.4 | 13.8 | 11.0 | 9.2 | 4.60 | | | | | | | | | 6.2 | 4.0 |
| | | | | 22.6 | 18.8 | 14.1 | 11.3 | 9.4 | 4.70 | | | | | | | | | 6.5 | 4.1 |
| | | | | 23.0 | 19.2 | 14.4 | 11.5 | 9.6 | 4.80 | | | | | | | | | 6.8 | 4.3 |
| | | | | 23.5 | 19.6 | 14.7 | 11.8 | 9.8 | 4.90 | | | | | | | | | 7.0 | 4.5 |
| | | | | 24.0 | 20.0 | 15.0 | 12.0 | 10.0 | 5.00 | | | | | | | | | 7.3 | 4.7 |

Data measured with water at 20 °C, pressure measured directly at the nozzle. Check application rate before spraying.

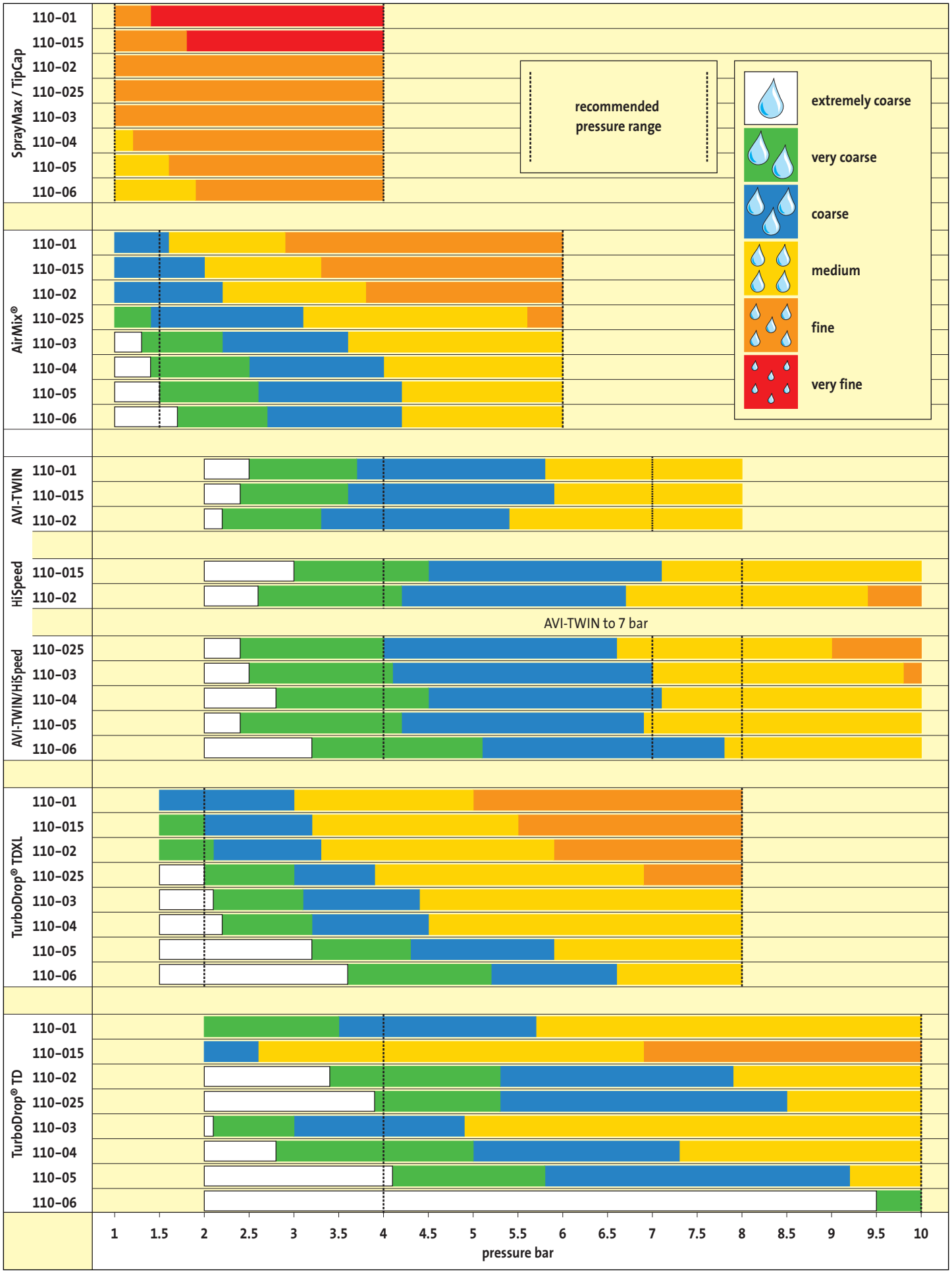
**E.g.: 150 l/ha at 10 km/ha requires a flow rate of 1.25 l/min at each nozzle, which can be obtained by setting pressure at 7.3 bar for nozzle size –02; 4.7 bar for size –025, 3.3 bar for size –03, 1.8 bar for size –04 or 1.2 bar for size –05.**

## Droplet size with respect to flow rate

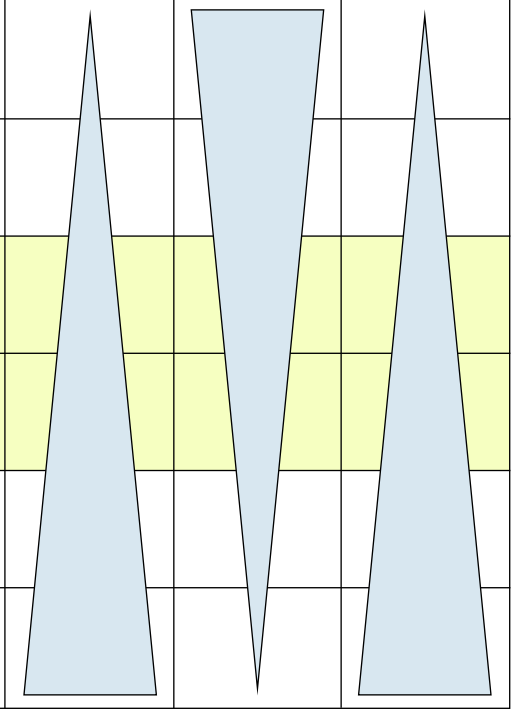
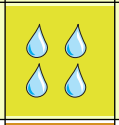



E.g.: AirMix® size –02 is at 7.3 bar outside of recommended pressure measured range, AirMix® –025 has at 4.7 bar medium droplets, AirMix® –03 at 3.3 bar coarse droplets, AirMix® –04 at 1.8 bar very coarse droplets and AirMix® –05 at 1.2 bar extremely coarse droplets.

## Droplet size with respect to pressure



## Optimum droplet size with respect to chemical and nozzle type in broadacre agriculture

| Droplet size | | Venturi nozzle | Standard nozzle | Coverage | Penetration | Drift risk |
|---|---|---|---|---|---|---|
| extremely coarse |  | Systemic using higher application rates | reduced coverage |  | | |
| very coarse |  | Systemic | reduced coverage | | | |
| coarse |  | Systemic all; Contact using higher application rates | Systemic using higher application rates | | | |
| medium |  | Systemic; Contact | Systemic | | | |
| fine |  | Drift risk! | Systemic; Contact Drift risk! | | | |
| very fine |  | not recommended | not recommended | | | |

These recommendations are based upon extensive general experience under temperate climatic conditions. They do not substitute the individual application recommendations for chemicals, specially under different climatic conditions.

## Application chart for boom sprayers at 50 cm nozzle spacing

| Application rate l/ha | Flow rate l/min at km/h | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | 10.0 | 12.0 |
| 50 | 0.17 | 0.19 | 0.21 | 0.23 | 0.25 | 0.27 | 0.29 | 0.31 | 0.33 | 0.35 | 0.38 | 0.42 | 0.50 |
| 80 | 0.27 | 0.30 | 0.33 | 0.37 | 0.40 | 0.43 | 0.47 | 0.50 | 0.53 | 0.57 | 0.60 | 0.67 | 0.80 |
| 100 | 0.33 | 0.38 | 0.42 | 0.46 | 0.50 | 0.54 | 0.58 | 0.63 | 0.67 | 0.71 | 0.75 | 0.83 | 1.00 |
| 120 | 0.40 | 0.45 | 0.50 | 0.55 | 0.60 | 0.65 | 0.70 | 0.75 | 0.80 | 0.85 | 0.90 | 1.00 | 1.20 |
| 150 | 0.50 | 0.56 | 0.63 | 0.69 | 0.75 | 0.81 | 0.88 | 0.94 | 1.00 | 1.06 | 1.13 | 1.25 | 1.50 |
| 200 | 0.67 | 0.75 | 0.83 | 0.92 | 1.00 | 1.08 | 1.17 | 1.25 | 1.33 | 1.42 | 1.50 | 1.67 | 2.00 |
| 250 | 0.83 | 0.94 | 1.04 | 1.15 | 1.25 | 1.35 | 1.46 | 1.56 | 1.67 | 1.77 | 1.88 | 2.08 | 2.50 |
| 300 | 1.00 | 1.13 | 1.25 | 1.38 | 1.50 | 1.63 | 1.75 | 1.88 | 2.00 | 2.13 | 2.25 | 2.50 | 3.00 |
| 350 | 1.17 | 1.31 | 1.46 | 1.60 | 1.75 | 1.90 | 2.04 | 2.19 | 2.33 | 2.48 | 2.63 | 2.92 | 3.50 |
| 400 | 1.33 | 1.50 | 1.67 | 1.83 | 2.00 | 2.17 | 2.33 | 2.50 | 2.67 | 2.83 | 3.00 | 3.33 | 4.00 |
| 450 | 1.50 | 1.69 | 1.88 | 2.06 | 2.25 | 2.44 | 2.63 | 2.81 | 3.00 | 3.19 | 3.38 | 3.75 | 4.50 |
| 500 | 1.67 | 1.88 | 2.08 | 2.29 | 2.50 | 2.71 | 2.92 | 3.13 | 3.33 | 3.54 | 3.75 | 4.17 | 5.00 |
| 600 | 2.00 | 2.25 | 2.50 | 2.75 | 3.00 | 3.25 | 3.50 | 3.75 | 4.00 | 4.25 | 4.50 | 5.00 | 6.00 |
| 700 | 2.33 | 2.63 | 2.92 | 3.21 | 3.50 | 3.79 | 4.08 | 4.38 | 4.67 | 4.96 | 5.25 | 5.83 | 7.00 |
| 800 | 2.67 | 3.00 | 3.33 | 3.67 | 4.00 | 4.33 | 4.67 | 5.00 | 5.33 | 5.67 | 6.00 | 6.67 | 8.00 |
| 900 | 3.00 | 3.38 | 3.75 | 4.13 | 4.50 | 4.88 | 5.25 | 5.63 | 6.00 | 6.38 | 6.75 | 7.50 | 9.00 |
| 1000 | 3.33 | 3.75 | 4.17 | 4.58 | 5.00 | 5.42 | 5.83 | 6.25 | 6.67 | 7.08 | 7.50 | 8.33 | 10.00 |

Data measured with water at 20 °C, pressure measured directly at the nozzle. Check application rate before spraying.

**Example of use:**
**Select designated application rate, e.g. 250 l/ha**
**Determine application speed, e.g. 7.0 km/h**
**Read required flow rate at each nozzle at 50 cm nozzle spacing for the selected specifications, e.g. 1.46 l/min**
**Select on page 43 the nozzles and pressure combinations that will deliver this flow rate, e.g. AirMix® ISO size –04 at 2.5 bar or TurboDrop® ISO size -025 at 6.0 bar. Please consider also the recommended pressure range of the nozzles, found on the individual nozzle pages earlier in this catalogue and droplet size info of the corresponding nozzles on page 46.**

## ISO application chart for boom sprayers at 50 cm nozzle spacing
## Nozzle size and colour following ISO 10625 or equivalent

| Nozzle size ISO | Pressure bar | Flow rate l/min | Application rate l/ha at km/h 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|
| -01 orange | 1.0 | 0.23 | 69 | 46 | 35 | 28 | 23 | 20 | 17 | 15 |
| | 1.5 | 0.28 | 85 | 57 | 42 | 34 | 28 | 24 | 21 | 19 |
| | 2.0 | 0.33 | 98 | 65 | 49 | 39 | 33 | 28 | 25 | 22 |
| | 2.5 | 0.37 | 110 | 73 | 55 | 44 | 37 | 31 | 27 | 24 |
| | 3.0 | 0.40 | 120 | 80 | 60 | 48 | 40 | 34 | 30 | 27 |
| | 4.0 | 0.46 | 139 | 92 | 69 | 55 | 46 | 40 | 35 | 31 |
| | 5.0 | 0.52 | 155 | 103 | 78 | 62 | 52 | 44 | 39 | 34 |
| | 6.0 | 0.57 | 170 | 113 | 85 | 68 | 57 | 49 | 42 | 38 |
| | 7.0 | 0.61 | 183 | 122 | 92 | 73 | 61 | 52 | 46 | 41 |
| | 8.0 | 0.65 | 196 | 131 | 98 | 78 | 65 | 56 | 49 | 44 |
| | 9.0 | 0.69 | 208 | 139 | 104 | 83 | 69 | 59 | 52 | 46 |
| | 10.0 | 0.73 | 219 | 146 | 110 | 88 | 73 | 63 | 55 | 49 |
| -015 green | 1.0 | 0.35 | 104 | 69 | 52 | 42 | 35 | 30 | 26 | 23 |
| | 1.5 | 0.42 | 127 | 85 | 64 | 51 | 42 | 36 | 32 | 28 |
| | 2.0 | 0.49 | 147 | 98 | 74 | 59 | 49 | 42 | 37 | 33 |
| | 2.5 | 0.55 | 164 | 110 | 82 | 66 | 55 | 47 | 41 | 37 |
| | 3.0 | 0.60 | 180 | 120 | 90 | 72 | 60 | 51 | 45 | 40 |
| | 4.0 | 0.69 | 208 | 139 | 104 | 83 | 69 | 59 | 52 | 46 |
| | 5.0 | 0.78 | 233 | 155 | 116 | 93 | 78 | 66 | 58 | 52 |
| | 6.0 | 0.85 | 255 | 170 | 127 | 102 | 85 | 73 | 64 | 57 |
| | 7.0 | 0.92 | 275 | 183 | 138 | 110 | 92 | 79 | 69 | 61 |
| | 8.0 | 0.98 | 294 | 196 | 147 | 118 | 98 | 84 | 74 | 65 |
| | 9.0 | 1.04 | 312 | 208 | 156 | 125 | 104 | 89 | 78 | 69 |
| | 10.0 | 1.10 | 329 | 219 | 164 | 131 | 110 | 94 | 82 | 73 |
| -02 yellow | 1.0 | 0.46 | 139 | 92 | 69 | 55 | 46 | 40 | 35 | 31 |
| | 1.5 | 0.57 | 170 | 113 | 85 | 68 | 57 | 49 | 42 | 38 |
| | 2.0 | 0.65 | 196 | 131 | 98 | 78 | 65 | 56 | 49 | 44 |
| | 2.5 | 0.73 | 219 | 146 | 110 | 88 | 73 | 63 | 55 | 49 |
| | 3.0 | 0.80 | 240 | 160 | 120 | 96 | 80 | 69 | 60 | 53 |
| | 4.0 | 0.92 | 277 | 185 | 139 | 111 | 92 | 79 | 69 | 62 |
| | 5.0 | 1.03 | 310 | 207 | 155 | 124 | 103 | 89 | 77 | 69 |
| | 6.0 | 1.13 | 339 | 226 | 170 | 136 | 113 | 97 | 85 | 75 |
| | 7.0 | 1.22 | 367 | 244 | 183 | 147 | 122 | 105 | 92 | 81 |
| | 8.0 | 1.31 | 392 | 261 | 196 | 157 | 131 | 112 | 98 | 87 |
| | 9.0 | 1.39 | 416 | 277 | 208 | 166 | 139 | 119 | 104 | 92 |
| | 10.0 | 1.46 | 438 | 292 | 219 | 175 | 146 | 125 | 110 | 97 |
| -025 lilac | 1.0 | 0.58 | 173 | 115 | 87 | 69 | 58 | 49 | 43 | 38 |
| | 1.5 | 0.71 | 212 | 141 | 106 | 85 | 71 | 61 | 53 | 47 |
| | 2.0 | 0.82 | 245 | 163 | 122 | 98 | 82 | 70 | 61 | 54 |
| | 2.5 | 0.91 | 274 | 183 | 137 | 110 | 91 | 78 | 68 | 61 |
| | 3.0 | 1.00 | 300 | 200 | 150 | 120 | 100 | 86 | 75 | 67 |
| | 4.0 | 1.15 | 346 | 231 | 173 | 138 | 115 | 99 | 87 | 77 |
| | 5.0 | 1.29 | 387 | 258 | 194 | 155 | 129 | 111 | 97 | 86 |
| | 6.0 | 1.41 | 424 | 283 | 212 | 170 | 141 | 121 | 106 | 94 |
| | 7.0 | 1.53 | 458 | 306 | 229 | 183 | 153 | 131 | 115 | 102 |
| | 8.0 | 1.63 | 490 | 326 | 245 | 196 | 163 | 140 | 122 | 109 |
| | 9.0 | 1.73 | 520 | 346 | 260 | 208 | 173 | 148 | 130 | 115 |
| | 10.0 | 1.83 | 548 | 365 | 274 | 219 | 183 | 157 | 137 | 122 |
| -03 blue | 1.0 | 0.69 | 208 | 139 | 104 | 83 | 69 | 59 | 52 | 46 |
| | 1.5 | 0.85 | 255 | 170 | 127 | 102 | 85 | 73 | 64 | 57 |
| | 2.0 | 0.98 | 294 | 196 | 147 | 118 | 98 | 84 | 74 | 65 |
| | 2.5 | 1.10 | 329 | 219 | 164 | 131 | 110 | 94 | 82 | 73 |
| | 3.0 | 1.20 | 360 | 240 | 180 | 144 | 120 | 103 | 90 | 80 |
| | 4.0 | 1.39 | 416 | 277 | 208 | 166 | 139 | 119 | 104 | 92 |
| | 5.0 | 1.55 | 465 | 310 | 232 | 186 | 155 | 133 | 116 | 103 |
| | 6.0 | 1.70 | 509 | 339 | 255 | 204 | 170 | 145 | 127 | 113 |
| | 7.0 | 1.83 | 550 | 367 | 275 | 220 | 183 | 157 | 137 | 122 |
| | 8.0 | 1.96 | 588 | 392 | 294 | 235 | 196 | 168 | 147 | 131 |
| | 9.0 | 2.08 | 623 | 416 | 312 | 249 | 208 | 178 | 156 | 139 |
| | 10.0 | 2.19 | 657 | 438 | 329 | 263 | 219 | 188 | 164 | 146 |
| -04 red | 1.0 | 0.92 | 277 | 185 | 139 | 111 | 92 | 79 | 69 | 62 |
| | 1.5 | 1.13 | 339 | 226 | 170 | 136 | 113 | 97 | 85 | 75 |
| | 2.0 | 1.31 | 392 | 261 | 196 | 157 | 131 | 112 | 98 | 87 |
| | 2.5 | 1.46 | 438 | 292 | 219 | 175 | 146 | 125 | 110 | 97 |
| | 3.0 | 1.60 | 480 | 320 | 240 | 192 | 160 | 137 | 120 | 107 |
| | 4.0 | 1.85 | 554 | 370 | 277 | 222 | 185 | 158 | 139 | 123 |
| | 5.0 | 2.07 | 620 | 413 | 310 | 248 | 207 | 177 | 155 | 138 |
| | 6.0 | 2.26 | 679 | 453 | 339 | 272 | 226 | 194 | 170 | 151 |
| | 7.0 | 2.44 | 733 | 489 | 367 | 293 | 244 | 209 | 183 | 163 |
| | 8.0 | 2.61 | 784 | 522 | 392 | 313 | 261 | 224 | 196 | 174 |
| | 9.0 | 2.77 | 831 | 554 | 416 | 333 | 277 | 238 | 208 | 185 |
| | 10.0 | 2.92 | 876 | 584 | 438 | 351 | 292 | 250 | 219 | 195 |

| Nozzle size ISO | Pressure bar | Flow rate l/min | Application rate l/ha at km/h 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|
| -05 brown | 1.0 | 1.16 | 347 | 231 | 173 | 139 | 116 | 99 | 87 | 77 |
| | 1.5 | 1.41 | 424 | 283 | 212 | 170 | 141 | 121 | 106 | 94 |
| | 2.0 | 1.63 | 490 | 327 | 245 | 196 | 163 | 140 | 122 | 109 |
| | 2.5 | 1.83 | 548 | 365 | 274 | 219 | 183 | 157 | 137 | 122 |
| | 3.0 | 2.00 | 600 | 400 | 300 | 240 | 200 | 171 | 150 | 133 |
| | 4.0 | 2.31 | 693 | 462 | 346 | 277 | 231 | 198 | 173 | 154 |
| | 5.0 | 2.58 | 775 | 516 | 387 | 310 | 258 | 221 | 194 | 172 |
| | 6.0 | 2.83 | 848 | 566 | 424 | 339 | 283 | 242 | 212 | 189 |
| | 7.0 | 3.06 | 917 | 611 | 458 | 367 | 306 | 262 | 229 | 204 |
| | 8.0 | 3.26 | 979 | 653 | 490 | 392 | 326 | 280 | 245 | 218 |
| | 9.0 | 3.46 | 1039 | 693 | 520 | 416 | 346 | 297 | 260 | 231 |
| | 10.0 | 3.65 | 1095 | 730 | 548 | 438 | 365 | 313 | 274 | 243 |
| -06 grey | 1.0 | 1.39 | 416 | 277 | 208 | 166 | 139 | 119 | 104 | 92 |
| | 1.5 | 1.70 | 509 | 339 | 255 | 204 | 170 | 145 | 127 | 113 |
| | 2.0 | 1.96 | 588 | 392 | 294 | 235 | 196 | 168 | 147 | 131 |
| | 2.5 | 2.19 | 657 | 438 | 329 | 263 | 219 | 188 | 164 | 146 |
| | 3.0 | 2.40 | 720 | 480 | 360 | 288 | 240 | 206 | 180 | 160 |
| | 4.0 | 2.77 | 831 | 554 | 416 | 333 | 277 | 238 | 208 | 185 |
| | 5.0 | 3.10 | 929 | 620 | 465 | 372 | 310 | 266 | 232 | 207 |
| | 6.0 | 3.39 | 1018 | 679 | 509 | 407 | 339 | 291 | 255 | 226 |
| | 7.0 | 3.67 | 1100 | 733 | 550 | 440 | 367 | 314 | 275 | 244 |
| | 8.0 | 3.92 | 1176 | 784 | 588 | 470 | 392 | 336 | 294 | 261 |
| | 9.0 | 4.16 | 1247 | 831 | 624 | 499 | 416 | 356 | 312 | 277 |
| | 10.0 | 4.38 | 1315 | 876 | 657 | 526 | 438 | 376 | 329 | 292 |
| -08 white | 1.0 | 1.85 | 554 | 370 | 277 | 222 | 185 | 158 | 139 | 123 |
| | 1.5 | 2.26 | 679 | 453 | 339 | 272 | 226 | 194 | 170 | 151 |
| | 2.0 | 2.61 | 784 | 523 | 392 | 314 | 261 | 224 | 196 | 174 |
| | 2.5 | 2.92 | 876 | 584 | 438 | 351 | 292 | 250 | 219 | 195 |
| | 3.0 | 3.20 | 960 | 640 | 480 | 384 | 320 | 274 | 240 | 213 |
| | 4.0 | 3.70 | 1109 | 739 | 554 | 443 | 370 | 317 | 277 | 246 |
| | 5.0 | 4.13 | 1240 | 826 | 620 | 496 | 413 | 354 | 310 | 275 |
| | 6.0 | 4.53 | 1358 | 905 | 679 | 543 | 453 | 388 | 339 | 302 |
| | 7.0 | 4.89 | 1466 | 978 | 733 | 587 | 489 | 419 | 367 | 326 |
| | 8.0 | 5.22 | 1567 | 1045 | 784 | 627 | 522 | 448 | 392 | 348 |
| | 9.0 | 5.54 | 1663 | 1108 | 831 | 665 | 554 | 475 | 416 | 369 |
| | 10.0 | 5.84 | 1753 | 1168 | 876 | 701 | 584 | 501 | 438 | 389 |
| -10 black | 1.0 | 2.31 | 693 | 462 | 346 | 277 | 231 | 198 | 173 | 154 |
| | 1.5 | 2.83 | 848 | 566 | 424 | 339 | 283 | 242 | 212 | 189 |
| | 2.0 | 3.27 | 980 | 653 | 490 | 392 | 327 | 280 | 245 | 218 |
| | 2.5 | 3.65 | 1095 | 730 | 548 | 438 | 365 | 313 | 274 | 243 |
| | 3.0 | 4.00 | 1200 | 800 | 600 | 480 | 400 | 343 | 300 | 267 |
| | 4.0 | 4.62 | 1385 | 924 | 693 | 554 | 462 | 396 | 346 | 308 |
| | 5.0 | 5.16 | 1549 | 1033 | 775 | 620 | 516 | 443 | 387 | 344 |
| | 6.0 | 5.66 | 1697 | 1131 | 848 | 679 | 566 | 485 | 424 | 377 |
| | 7.0 | 6.11 | 1833 | 1222 | 917 | 733 | 611 | 524 | 458 | 407 |
| | 8.0 | 6.53 | 1958 | 1306 | 979 | 783 | 653 | 560 | 490 | 435 |
| | 9.0 | 6.93 | 2078 | 1386 | 1039 | 831 | 693 | 594 | 520 | 462 |
| | 10.0 | 7.30 | 2191 | 1460 | 1095 | 876 | 730 | 626 | 548 | 487 |
| -12 turquoise | 1.0 | 2.77 | 832 | 554 | 416 | 333 | 277 | 238 | 208 | 185 |
| | 1.5 | 3.39 | 1018 | 679 | 509 | 407 | 339 | 291 | 255 | 226 |
| | 2.0 | 3.92 | 1176 | 784 | 588 | 470 | 392 | 336 | 294 | 261 |
| | 2.5 | 4.38 | 1314 | 876 | 657 | 526 | 438 | 376 | 329 | 292 |
| | 3.0 | 4.80 | 1440 | 960 | 720 | 576 | 480 | 411 | 360 | 320 |
| | 4.0 | 5.54 | 1663 | 1109 | 831 | 665 | 554 | 475 | 416 | 370 |
| | 5.0 | 6.20 | 1859 | 1240 | 930 | 744 | 620 | 531 | 465 | 413 |
| | 6.0 | 6.79 | 2037 | 1358 | 1019 | 815 | 679 | 582 | 509 | 453 |
| -16 violet | 1.0 | 3.70 | 1109 | 739 | 554 | 444 | 370 | 317 | 277 | 246 |
| | 1.5 | 4.53 | 1358 | 905 | 679 | 543 | 453 | 388 | 339 | 302 |
| | 2.0 | 5.23 | 1568 | 1045 | 784 | 627 | 523 | 448 | 392 | 348 |
| | 2.5 | 5.84 | 1752 | 1168 | 876 | 701 | 584 | 501 | 438 | 389 |
| | 3.0 | 6.40 | 1920 | 1280 | 960 | 768 | 640 | 549 | 480 | 427 |
| | 4.0 | 7.39 | 2217 | 1478 | 1109 | 887 | 739 | 633 | 554 | 493 |
| | 5.0 | 8.27 | 2480 | 1653 | 1240 | 992 | 827 | 708 | 620 | 551 |
| | 6.0 | 9.05 | 2716 | 1811 | 1358 | 1086 | 905 | 776 | 679 | 604 |
| -20 light blue | 1.0 | 4.62 | 1385 | 924 | 693 | 554 | 462 | 396 | 346 | 308 |
| | 1.5 | 5.66 | 1697 | 1131 | 849 | 679 | 566 | 485 | 424 | 377 |
| | 2.0 | 6.53 | 1960 | 1306 | 980 | 784 | 653 | 560 | 490 | 435 |
| | 2.5 | 7.30 | 2191 | 1461 | 1095 | 876 | 730 | 626 | 548 | 487 |
| | 3.0 | 8.00 | 2400 | 1600 | 1200 | 960 | 800 | 686 | 600 | 533 |
| | 4.0 | 9.24 | 2771 | 1848 | 1386 | 1109 | 924 | 792 | 693 | 616 |
| | 5.0 | 10.33 | 3098 | 2065 | 1549 | 1239 | 1033 | 885 | 774 | 688 |
| | 6.0 | 11.31 | 3394 | 2262 | 1697 | 1357 | 1131 | 970 | 848 | 754 |

Data measured with water at 20 °C, pressure measured directly at the nozzle. Check application rate before spraying.

## Helpful formulas

### For boom sprayers

$$\text{Application rate (l/ha)} = \frac{\text{Flow rate single nozzle (l/min)} \times 600}{\text{Application speed (km/h)} \times \text{Working width (m)}}$$

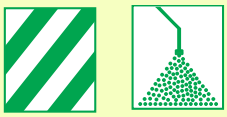
$$\text{Flow rate of one nozzle (l/min)} = \frac{\text{l/ha} \times \text{km/h} \times \text{Working width}}{600}$$

### For spraying in orchards, horticulture, grapes and hops

$$\text{Application rate (l/ha)} = \frac{\text{Flow rate of all nozzles (l/min)} \times 600}{\text{Application speed (km/h)} \times \text{Working width (m)}}$$

$$\text{Total flow rate (all nozzles) (l/min)} = \frac{\text{l/ha} \times \text{km/h} \times \text{Working width}}{600}$$

$$\text{Single nozzle flow rate (l/min)} = \frac{\text{Total flow rate (l/min)}}{\text{Number of nozzles}}$$



### For band and knapsack spraying

$$\text{Application rate (l/ha)} = \frac{\text{Single nozzle flow rate (l/min)} \times 60\,000}{\text{Application speed (km/h)} \times \text{Application/band width (m)}}$$

In this case the application rate takes into consideration only the **applied area** (application width).

$$\text{Saving on spray liquid (\%)} = 100 - \frac{\text{Application width (cm)} \times 100}{\text{Total width (cm)}}$$

### Speed

$$\text{Speed (km/h)} = 3{,}6 \times \frac{\text{Distance (m)}}{\text{Time (s)}}$$

Speed and time needed to travel a distance

| Distance | Speed km/h | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| m | 4 | 5 | 6 | 7 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| 50 | 45 s | 36 s | 30 s | 26 s | 23 s | 18 s | 15 s | 13 s | 11 s | 10 s | 9 s |
| 100 | 90 s | 72 s | 60 s | 51 s | 45 s | 36 s | 30 s | 26 s | 23 s | 20 s | 18 s |

# Application charts and formulas

## Nozzle spacing

**To convert application rate from ISO chart** (0.5 m spacing)

$$ISO_{new} = ISO_{0.5}\ (l/ha) \times \frac{0.5\ (m)}{nozzle\ (m)}$$

$ISO_{new}$ = Application rate for new nozzle spacing
$ISO_{0.5}$ = Application rate for 0.5 m spacing, given in the ISO application chart
nozzle (m) = New nozzle spacing

**To convert flow rate from Universal chart** (0.5 m spacing)

$$flow_{new} = flow_{0.5}\ (l/min) \times \frac{0.5\ (m)}{nozzle\ (m)}$$

$flow_{new}$ = Flow rate (l/min) for new nozzle spacing
$flow_{0.5}$ = Flow rate (l/min) for 0.5 m spacing, given in the Universal application chart
nozzle (m) = New nozzle spacing

## Liquid fertilizer – density

Most application charts are based on water with a density of 1 kg/l. Liquid fertilizers have a significant different density and the pressure given in these charts based on water should be adapted. The following formula can be used to adapt pressure either in the ISO or in the Universal chart:

$$P_{LFA}\ (bar) = D_{LF}\ (kg/l) \times P_{Chart}\ (bar)$$

$P_{LFA}$ = new pressure for liquid fertilizer application $P_{Chart}$ = Pressure selected from the application chart
$D_{LF}$ = Density of liquid fertilizer
$D_{LF}$ is: 1.3 for most UAN solutions 1.1 for most Urea solutions 1.4 for most Ammonium phosphate solutions

## Conversion factors

**Pressure** 1 bar = 14.5 psi 1 psi = 0.069 bar

| bar | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 14 | 16 | 18 | 20 | 25 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| psi | 14.5 | 29 | 43.5 | 58 | 72.5 | 87 | 102 | 116 | 131 | 145 | 174 | 203 | 232 | 261 | 290 | 363 | 435 |

| psi | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 120 | 140 | 160 | 180 | 200 | 250 | 300 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| bar | 0.7 | 1.4 | 2.1 | 2.8 | 3.4 | 4.1 | 4.8 | 5.5 | 6.2 | 6.9 | 8.3 | 9.7 | 11.0 | 12.4 | 13.8 | 17.2 | 20.7 |

**Application rate**
1 l/ha = 0.107 gal/ac (US) = 0.089 Imp gal/ac (UK) 1 gal/ac (US) = 9.348 l/ha 1 Imp gal/ac (UK) = 11.233 l/ha

| l/ha | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| gal/ac (US) | 5 | 11 | 16 | 21 | 27 | 32 | 37 | 43 | 48 | 53 | 59 | 64 | 70 |
| Imp gal/ac (UK) | 4 | 9 | 13 | 18 | 22 | 27 | 31 | 36 | 40 | 45 | 49 | 53 | 58 |

| gal/ac (US) | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| l/ha | 47 | 93 | 140 | 187 | 234 | 280 | 327 | 374 | 421 | 467 | 514 | 561 | 608 |

| Imp gal/ac (UK) | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| l/ha | 56 | 112 | 169 | 225 | 281 | 337 | 393 | 449 | 506 | 562 | 618 | 674 | 730 |

**Flow rate**
1 l/min = 0.264 gal/min (US) = 0.220 Imp gal/min (UK) 1 gal/min (US) = 3.785 l/min 1 Imp gal/min (UK) = 4.546 l/min

**Speed** 1 km/h = 0.621 mph 1 mph = 1.609 km/h

| km/h | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 22 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mph | 3.1 | 3.7 | 4.3 | 5.0 | 5.6 | 6.2 | 6.8 | 7.5 | 8.1 | 8.7 | 9.3 | 9.9 | 10.6 | 11.2 | 11.8 | 12.4 | 13.7 | 14.9 |

| mph | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 | 6.5 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| km/h | 4.8 | 5.6 | 6.4 | 7.2 | 8.0 | 8.9 | 9.7 | 10.5 | 11.3 | 12.9 | 14.5 | 16.1 | 17.7 | 19.3 | 20.9 | 22.5 | 24.1 | 25.7 |

# Nozzles for liquid fertilizer application

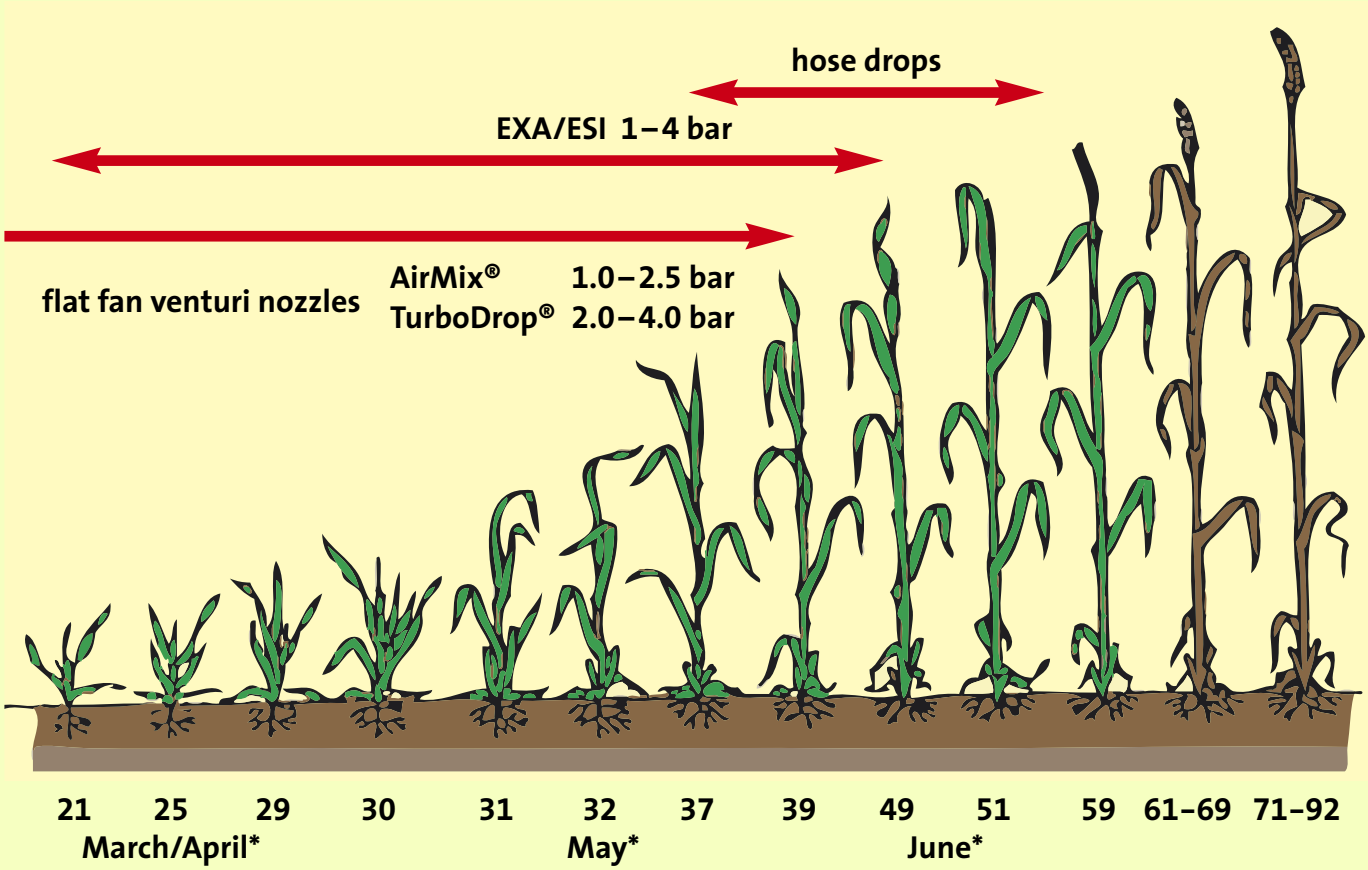
Considering the development stage of the crops and favourable weather conditions, liquid fertilizer can be applied using AirMix® und TurboDrop® flat fan venturi nozzles at low pressure with extremely or very coarse droplets. Using flat fan nozzles has the advantage of best distribution of fertilizer and the possibility of a combination with a pesticide application.

Under less favourable application conditions the use of special 3-or 6-stream fertilizer nozzles can reduce the risk of leaf burning. 6-stream fertilizer nozzles show a better distribution compared to the 3-stream version.
In later crop development stages the use of hose drops is recommended to avoid burning of leaves and grain ears. Hose drops with 5 distribution holes allow relatively high speed and good distribution.

## 10 tips to avoid crop damage by liquid fertilizer application

- Always apply in dry stands with a well established waxy layer
- Never apply after heavy rainfalls, give the leaves a few days to recover their waxy layer
- Never apply during or right before frost periods with temperatures clearly below 0 °C (32 °F)
- Do not apply in hot temperatures or strait sunlight at midday
- Apply on the seed bed only within three days of tillage
- Late applications only when using hose drops
- In corn never apply on leaves or green parts
- If diluted in water use max. 20–25 % liquid fertilizer in the solution
- Only apply with special multi stream fertilizer nozzles or flat fan venturi nozzles with extremely coarse droplets
- Check for compatibility and possible crop damages if mixed with pesticides and other chemical products

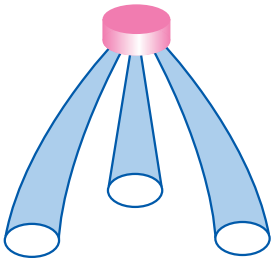
## Recommended application window for different liquid fertilizer nozzles in cereals




* Western Europe

Code for crop developing stage following BBCH

# Albuz® EXA 3-stream fertilizer nozzle



**Characteristics:**

- Very low leaf burning risk due to extremely coarse, soft droplets
- Highest wear resistance and accuracy with metering orifice made from high quality pink ceramic
- Spanner width 11 mm
- Pressure range 1–3.5 bar (15–50 psi)
- Best boom height 1.1–1.4 m (40–55")
- Color code following Albuz EXA flow chart does not conform to ISO

## Application chart for Albuz® EXA liquid fertilizer nozzles at 50 cm nozzle spacing on the boom

| Type | Pressure | | Application rate l/ha at km/h | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Colour | bar | l/min | 4 | 5 | 6 | 7 | 8 | 10 | 12 |
| EXA yellow | 1.0 | 0.31 | 92 | 74 | 62 | 53 | 46 | 37 | 31 |
| | 1.5 | 0.38 | 114 | 91 | 76 | 65 | 57 | 45 | 38 |
| | 2.0 | 0.44 | 132 | 106 | 88 | 75 | 66 | 53 | 44 |
| | 2.5 | 0.49 | 148 | 118 | 99 | 84 | 74 | 70 | 49 |
| | 3.0 | 0.54 | 161 | 129 | 107 | 92 | 81 | 64 | 54 |
| | 3.5 | 0.58 | 174 | 139 | 116 | 100 | 87 | 70 | 61 |
| EXA red | 1.0 | 0.49 | 148 | 118 | 99 | 84 | 74 | 59 | 49 |
| | 1.5 | 0.61 | 182 | 146 | 121 | 104 | 91 | 73 | 61 |
| | 2.0 | 0.70 | 209 | 167 | 139 | 119 | 104 | 83 | 70 |
| | 2.5 | 0.78 | 235 | 188 | 157 | 134 | 117 | 94 | 78 |
| | 3.0 | 0.85 | 256 | 205 | 171 | 146 | 128 | 102 | 85 |
| | 3.5 | 0.92 | 277 | 222 | 185 | 158 | 139 | 111 | 92 |
| EXA green | 1.0 | 0.56 | 169 | 135 | 113 | 97 | 84 | 68 | 56 |
| | 1.5 | 0.69 | 206 | 165 | 137 | 118 | 103 | 82 | 69 |
| | 2.0 | 0.79 | 238 | 190 | 158 | 136 | 119 | 95 | 79 |
| | 2.5 | 0.88 | 264 | 211 | 176 | 151 | 132 | 106 | 88 |
| | 3.0 | 0.97 | 290 | 232 | 194 | 166 | 145 | 116 | 97 |
| | 3.5 | 1.05 | 314 | 251 | 209 | 180 | 157 | 126 | 105 |
| EXA blue | 1.0 | 0.71 | 214 | 171 | 143 | 122 | 107 | 86 | 71 |
| | 1.5 | 0.87 | 261 | 209 | 174 | 149 | 131 | 105 | 87 |
| | 2.0 | 1.00 | 301 | 241 | 201 | 172 | 150 | 120 | 100 |
| | 2.5 | 1.13 | 338 | 270 | 225 | 193 | 169 | 135 | 113 |
| | 3.0 | 1.23 | 370 | 296 | 246 | 211 | 185 | 148 | 123 |
| | 3.5 | 1.33 | 399 | 319 | 266 | 228 | 199 | 159 | 133 |

| Type | Pressure | | Application rate l/ha at km/h | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Colour | bar | l/min | 4 | 5 | 6 | 7 | 8 | 10 | 12 |
| EXA white | 1.0 | 1.09 | 327 | 262 | 218 | 187 | 164 | 131 | 109 |
| | 1.5 | 1.34 | 401 | 321 | 268 | 229 | 201 | 161 | 134 |
| | 2.0 | 1.55 | 465 | 372 | 310 | 266 | 232 | 186 | 155 |
| | 2.5 | 1.72 | 517 | 414 | 345 | 296 | 259 | 207 | 172 |
| | 3.0 | 1.89 | 568 | 454 | 378 | 324 | 284 | 227 | 189 |
| | 3.5 | 2.04 | 612 | 490 | 408 | 350 | 306 | 245 | 204 |
| EXA brown | 1.0 | 1.50 | 449 | 359 | 299 | 256 | 224 | 180 | 150 |
| | 1.5 | 1.84 | 552 | 441 | 368 | 315 | 276 | 221 | 184 |
| | 2.0 | 2.12 | 636 | 509 | 424 | 364 | 318 | 254 | 212 |
| | 2.5 | 2.37 | 710 | 568 | 473 | 406 | 355 | 284 | 237 |
| | 3.0 | 2.60 | 779 | 623 | 519 | 445 | 389 | 312 | 260 |
| | 3.5 | 2.81 | 842 | 674 | 561 | 481 | 421 | 337 | 281 |
| EXA grey | 1.0 | 1.75 | 525 | 420 | 350 | 300 | 263 | 210 | 175 |
| | 1.5 | 2.15 | 644 | 515 | 429 | 368 | 322 | 258 | 215 |
| | 2.0 | 2.48 | 744 | 596 | 496 | 425 | 372 | 298 | 248 |
| | 2.5 | 2.77 | 832 | 665 | 554 | 475 | 416 | 333 | 277 |
| | 3.0 | 3.04 | 911 | 729 | 607 | 520 | 455 | 364 | 304 |
| | 3.5 | 3.28 | 985 | 788 | 656 | 563 | 492 | 394 | 328 |
| EXA black | 1.0 | 2.34 | 702 | 562 | 468 | 401 | 351 | 281 | 234 |
| | 1.5 | 2.86 | 858 | 686 | 572 | 490 | 429 | 343 | 286 |
| | 2.0 | 3.31 | 993 | 794 | 662 | 567 | 496 | 397 | 331 |
| | 2.5 | 3.70 | 1109 | 887 | 739 | 634 | 554 | 444 | 370 |
| | 3.0 | 4.05 | 1214 | 972 | 810 | 694 | 607 | 486 | 405 |
| | 3.5 | 4.37 | 1312 | 1050 | 875 | 750 | 656 | 525 | 437 |

Data measured at 50 cm nozzle spacing for liquid fertilizer with a density of 1.3 kg/l at 10 °C, pressure measured directly at the nozzle.
Check application rate before spraying.

**Nozzle filter recommendations for EXA:** yellow – green: 50 M

blue – black: 24 M

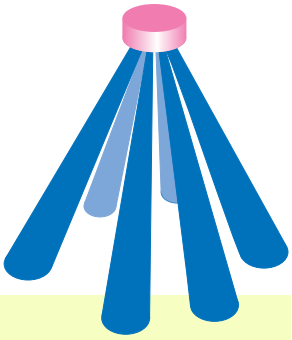
**Nozzle filter recommendations for ESI:** green – blue: 50 M

red – grey: 24 M

Filter 24 M

Filter 50 M


# Albuz® ESI 6-stream fertilizer nozzle



**Characteristics:**

- Low leaf burning risk due to very coarse, soft droplets
- Good distribution due to six individual jets
- Highest wear resistance and accuracy with metering orifice made from high quality pink ceramic
- Spanner width 11 mm
- Pressure range 1–4 bar (15–60 psi)
- Best boom height 0.6 m (24")
- Color code conform to ISO flow chart
- Application charts based on water must be converted if used for UAL (see chart below)

## Application chart for Albuz® ESI liquid fertilizer nozzles at 50 cm nozzle spacing on the boom

| Type ISO | Pressure bar | l/min | Application rate l/ha at km/h 4 | 5 | 6 | 7 | 8 | 10 | 12 |
|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.30 | 91 | 73 | 61 | 52 | 46 | 37 | 30 |
| | 1.5 | 0.37 | 112 | 90 | 75 | 64 | 56 | 45 | 37 |
| ESI | 2.0 | 0.43 | 129 | 103 | 86 | 74 | 65 | 52 | 43 |
| -015 | 2.5 | 0.48 | 143 | 114 | 95 | 81 | 71 | 57 | 48 |
| green | 3.0 | 0.53 | 158 | 127 | 106 | 91 | 79 | 63 | 53 |
| | 3.5 | 0.56 | 169 | 135 | 113 | 97 | 84 | 68 | 56 |
| | 4.0 | 0.61 | 182 | 146 | 121 | 104 | 91 | 73 | 61 |
| | 1.0 | 0.41 | 122 | 98 | 81 | 70 | 61 | 49 | 41 |
| | 1.5 | 0.50 | 149 | 120 | 100 | 85 | 75 | 60 | 50 |
| ESI | 2.0 | 0.57 | 172 | 138 | 115 | 99 | 86 | 69 | 57 |
| -02 | 2.5 | 0.64 | 193 | 154 | 128 | 110 | 96 | 77 | 64 |
| yellow | 3.0 | 0.70 | 211 | 169 | 141 | 121 | 106 | 84 | 70 |
| | 3.5 | 0.76 | 227 | 182 | 151 | 130 | 114 | 91 | 76 |
| | 4.0 | 0.80 | 240 | 192 | 160 | 137 | 120 | 96 | 80 |
| | 1.0 | 0.61 | 183 | 146 | 122 | 105 | 91 | 73 | 61 |
| | 1.5 | 0.75 | 224 | 179 | 149 | 128 | 112 | 90 | 75 |
| ESI | 2.0 | 0.86 | 259 | 207 | 172 | 148 | 129 | 103 | 86 |
| -03 | 2.5 | 0.96 | 289 | 231 | 193 | 165 | 145 | 116 | 96 |
| blue | 3.0 | 1.06 | 317 | 253 | 211 | 181 | 158 | 127 | 106 |
| | 3.5 | 1.14 | 343 | 275 | 229 | 196 | 172 | 137 | 114 |
| | 4.0 | 1.22 | 367 | 294 | 245 | 210 | 183 | 147 | 122 |

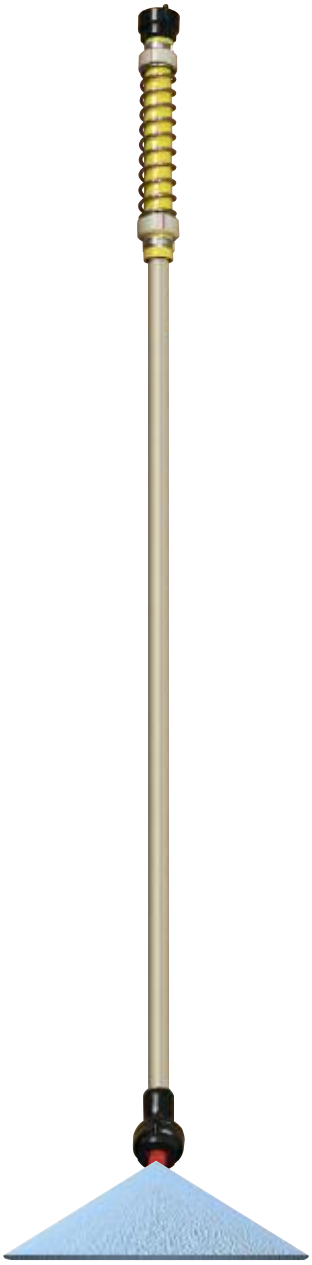
| Type ISO | Pressure bar | l/min | Application rate l/ha at km/h 4 | 5 | 6 | 7 | 8 | 10 | 12 |
|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.81 | 244 | 195 | 163 | 139 | 122 | 98 | 81 |
| | 1.5 | 1.00 | 299 | 239 | 199 | 171 | 149 | 119 | 100 |
| ESI | 2.0 | 1.15 | 345 | 276 | 230 | 197 | 172 | 138 | 115 |
| -04 | 2.5 | 1.29 | 386 | 309 | 257 | 220 | 193 | 154 | 129 |
| red | 3.0 | 1.41 | 422 | 338 | 282 | 241 | 211 | 169 | 141 |
| | 3.5 | 1.52 | 457 | 365 | 304 | 261 | 228 | 183 | 152 |
| | 4.0 | 1.63 | 488 | 391 | 326 | 279 | 244 | 195 | 163 |
| | 1.0 | 1.01 | 304 | 243 | 202 | 173 | 152 | 121 | 101 |
| | 1.5 | 1.24 | 373 | 299 | 249 | 213 | 187 | 149 | 124 |
| ESI | 2.0 | 1.44 | 431 | 345 | 287 | 246 | 216 | 172 | 144 |
| -05 | 2.5 | 1.60 | 480 | 384 | 320 | 275 | 240 | 192 | 160 |
| brown | 3.0 | 1.76 | 528 | 422 | 352 | 302 | 264 | 211 | 176 |
| | 3.5 | 1.90 | 570 | 456 | 380 | 326 | 285 | 228 | 190 |
| | 4.0 | 2.02 | 607 | 486 | 405 | 347 | 304 | 243 | 202 |
| | 1.0 | 1.22 | 365 | 292 | 244 | 209 | 183 | 146 | 122 |
| | 1.5 | 1.49 | 447 | 358 | 298 | 256 | 224 | 179 | 149 |
| ESI | 2.0 | 1.72 | 517 | 413 | 344 | 295 | 258 | 207 | 172 |
| -06 | 2.5 | 1.92 | 577 | 462 | 385 | 330 | 289 | 231 | 192 |
| grey | 3.0 | 2.11 | 633 | 506 | 422 | 361 | 316 | 253 | 211 |
| | 3.5 | 2.28 | 683 | 547 | 456 | 391 | 342 | 273 | 228 |
| | 4.0 | 2.43 | 730 | 584 | 487 | 417 | 365 | 292 | 243 |

Data measured at 50 cm nozzle spacing for liquid fertilizer with a density of 1.3 kg/l at 10 °C, pressure measured directly at the nozzle.
Check application rate before spraying.

# Hose drops with distribution nozzle

**Characteristics:**

- Easy to connect, using standard bayonet nozzle holders and 50 cm nozzle spacing on the boom
- Slim, streamlined design for low driving resistance in the stand
- Using an anvil wide angle nozzle on the end of the hose guarantees even distribution
- Shatter-proof connection using a spring-supported joint and hoses made of extremely flexible plastic
- Ball check valve avoids dripping after shut off
- Total length of 90 cm (37") allows use on large booms
- Hose drops must penetrate the stand by at least 30 cm (12")
- Leaf burning only at highest application speeds, when nozzles come out of the top of the stand



## Application chart for hose drops with distribution nozzle

| Type | | Pressure | | Application rate l/ha at km/h | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Colour | | bar | l/min | 5 | 6 | 7 | 8 | 9 | 10 |
| DT 1.0 yellow | 50 M blue | 1.0 | 0.34 | 82 | 68 | 58 | 51 | 45 | 41 |
| | | 1.5 | 0.44 | 106 | 88 | 75 | 66 | 59 | 53 |
| | | 2.0 | 0.53 | 127 | 106 | 91 | 80 | 71 | 64 |
| | | 2.5 | 0.60 | 144 | 120 | 103 | 90 | 80 | 72 |
| DT 1.5 blue | 50 M blue | 1.0 | 0.51 | 122 | 102 | 87 | 77 | 68 | 61 |
| | | 1.5 | 0.66 | 158 | 132 | 113 | 99 | 88 | 79 |
| | | 2.0 | 0.80 | 192 | 160 | 137 | 120 | 107 | 96 |
| | | 2.5 | 0.90 | 216 | 180 | 154 | 135 | 120 | 108 |
| DT 2.0 red | 50 M blue | 1.0 | 0.68 | 163 | 136 | 117 | 102 | 91 | 82 |
| | | 1.5 | 0.88 | 211 | 176 | 151 | 132 | 117 | 106 |
| | | 2.0 | 1.06 | 254 | 212 | 182 | 159 | 141 | 127 |
| | | 2.5 | 1.20 | 288 | 240 | 206 | 180 | 160 | 144 |
| DT 2.5 brown | 24 M white | 1.0 | 0.85 | 204 | 170 | 146 | 128 | 113 | 102 |
| | | 1.5 | 1.10 | 264 | 220 | 189 | 165 | 147 | 132 |
| | | 2.0 | 1.33 | 319 | 266 | 228 | 200 | 177 | 160 |
| | | 2.5 | 1.50 | 360 | 300 | 257 | 225 | 200 | 180 |
| DT 3.0 grey | 24 M white | 1.0 | 1.02 | 245 | 204 | 175 | 153 | 136 | 122 |
| | | 1.5 | 1.32 | 317 | 264 | 226 | 198 | 176 | 158 |
| | | 2.0 | 1.60 | 384 | 320 | 274 | 240 | 213 | 192 |
| | | 2.5 | 1.80 | 432 | 360 | 309 | 270 | 240 | 216 |
| DT 4.0 white | 24 M white | 1.0 | 1.36 | 326 | 272 | 233 | 204 | 181 | 163 |
| | | 1.5 | 1.76 | 422 | 352 | 302 | 264 | 235 | 211 |
| | | 2.0 | 2.12 | 509 | 424 | 363 | 318 | 283 | 254 |
| | | 2.5 | 2.40 | 576 | 480 | 411 | 360 | 320 | 288 |
| DT 5.0 light blue | no | 1.0 | 1.70 | 408 | 340 | 291 | 255 | 227 | 204 |
| | | 1.5 | 2.20 | 528 | 440 | 377 | 330 | 293 | 264 |
| | | 2.0 | 2.66 | 638 | 532 | 456 | 399 | 355 | 319 |
| | | 2.5 | 3.00 | 720 | 600 | 514 | 450 | 400 | 360 |

Values given in this table are valid for the application of liquid fertilizer UAN (Urea-Ammonium-Nitrate solution) with a density of 1.3 kg/l at 10 °C using a ball check valve, pressure measured at nozzle holder. Check values with calibration device for fine tuning.

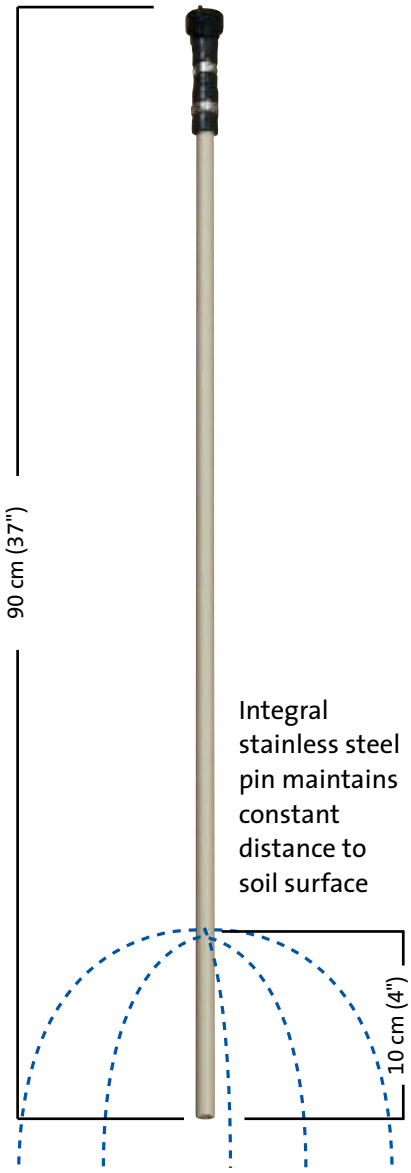
Part no. 13053 for standardised bayonet system
Part no. 13057 for Amazone
Part no. 13061 for Hardi
Part no. 13056 for Rau

**Other systems available on request.**
Don't forget to add the required nozzle size, e.g. 13053, DT 2.0

# Hose drops with 5 distribution holes

**Characteristics:**

- Extremely slim hose with no nozzle for lowest driving resistance
- The five jets, orientated in a 180° angle from both sides to the front, give a good distribution of the liquid fertilizer
- Low risk of leaf burning due to extremely coarse droplets and correct orientation of the jets
- Shatter-proof connection using a strengthened hose joint and very flexible hoses
- Easy to connect, using standard bayonet nozzle holders and 50 cm nozzle spacing on the boom
- Integral stainless steel pin maintains constant distance to soil surface, even when boom oscillates
- Total length of 90 cm (37") allows use on large booms
- Hose drops must penetrate the stand by at least 30 cm (12")




## Application chart for hose drops with 5 distribution holes

| Metering Disc | Pressure bar | l/min | Application rate l/ha at km/h 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|
| D 2 brown (057D2) | 1.0 | 0.57 | 136 | 113 | 97 | 85 | 75 | 68 |
| | 1.5 | 0.64 | 155 | 129 | 110 | 97 | 86 | 77 |
| | 2.0 | 0.71 | 171 | 143 | 122 | 107 | 95 | 86 |
| | 2.5 | 0.76 | 182 | 151 | 130 | 114 | 101 | 91 |
| | 3.0 | 0.80 | 192 | 160 | 137 | 120 | 107 | 96 |
| D 3 orange (057D3) | 1.0 | 0.68 | 163 | 136 | 116 | 102 | 90 | 81 |
| | 1.5 | 0.78 | 188 | 157 | 134 | 117 | 104 | 94 |
| | 2.0 | 0.84 | 203 | 169 | 145 | 127 | 113 | 101 |
| | 2.5 | 0.91 | 219 | 183 | 157 | 137 | 122 | 110 |
| | 3.0 | 0.98 | 236 | 197 | 169 | 147 | 131 | 118 |
| D 4 red (057D4) | 1.0 | 1.13 | 271 | 226 | 194 | 170 | 151 | 136 |
| | 1.5 | 1.31 | 313 | 261 | 224 | 196 | 174 | 157 |
| | 2.0 | 1.56 | 374 | 311 | 267 | 234 | 208 | 187 |
| | 2.5 | 1.65 | 397 | 331 | 283 | 248 | 220 | 198 |
| | 3.0 | 1.81 | 434 | 362 | 310 | 271 | 241 | 217 |
| D 5 blue (057D5) | 1.0 | 1.83 | 438 | 365 | 313 | 274 | 244 | 219 |
| | 1.5 | 2.18 | 524 | 437 | 374 | 328 | 291 | 262 |
| | 2.0 | 2.48 | 595 | 496 | 425 | 372 | 331 | 298 |
| | 2.5 | 2.68 | 643 | 536 | 459 | 402 | 357 | 322 |
| | 3.0 | 2.87 | 689 | 574 | 492 | 431 | 383 | 345 |
| D 6 yellow (057D6) | 1.0 | 2.29 | 549 | 458 | 392 | 343 | 305 | 275 |
| | 1.5 | 2.76 | 662 | 552 | 473 | 414 | 368 | 331 |
| | 2.0 | 3.18 | 762 | 635 | 544 | 476 | 423 | 381 |
| | 2.5 | 3.46 | 831 | 693 | 594 | 519 | 462 | 416 |
| | 3.0 | 3.78 | 906 | 755 | 647 | 566 | 503 | 453 |

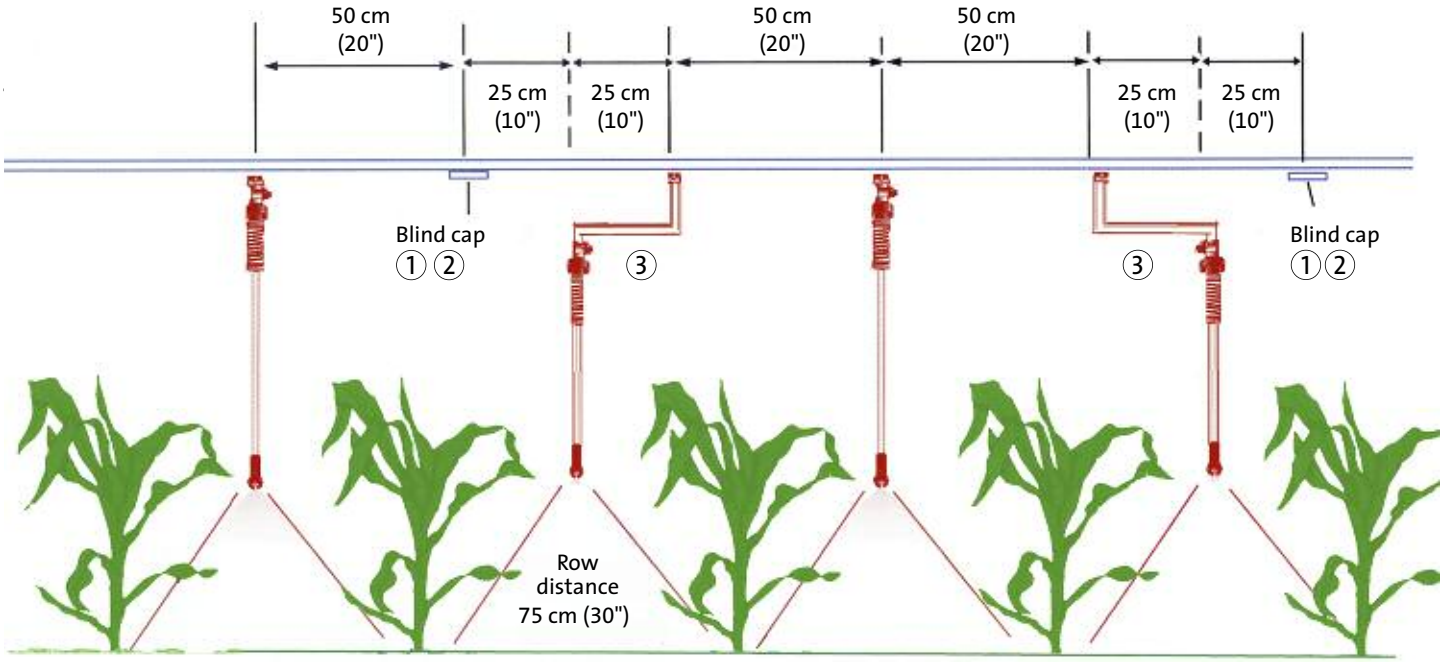
Values given in this table are valid for the application of liquid fertilizer UAN (Urea-Ammonium-Nitrate solution) with a density of 1.3 kg/l at 10 °C using a ball check valve, pressure measured at nozzle holder. Check values with calibration device for fine tuning

Part no. 13043 for standardised bayonet system
Part no. 13045 for Amazone
Part no. 13046 for Hardi
Part no. 13044 for Rau

**Adaptations to other systems available on request.**

# Liquid fertilizer application

Hose drops can be adapted to 75 cm row spacing. To convert a boom with 50 cm spacing it is necessary to shut off some of the nozzle holders. Others need a special adapter hose to relocate the hose drop sideways on the boom as shown in the figure.




**This adaptation requires the following parts:**

| | | |
|---|---|---|
| ① | Part no. 12904 | Blind cap (standard bayonet) |
| ② | Part no. 14457 | Washer for blind cap |
| ③ | Part no. 15174 | Extension hose with bayonet adapter 25–50 cm Standard |
| | Part no. 15175 | Extension hose with bayonet adapter 25–50 cm Rau |
| | Part no. 15177 | Extension hose with bayonet adapter 25–50 cm Hardi |

**Other systems available on request.**

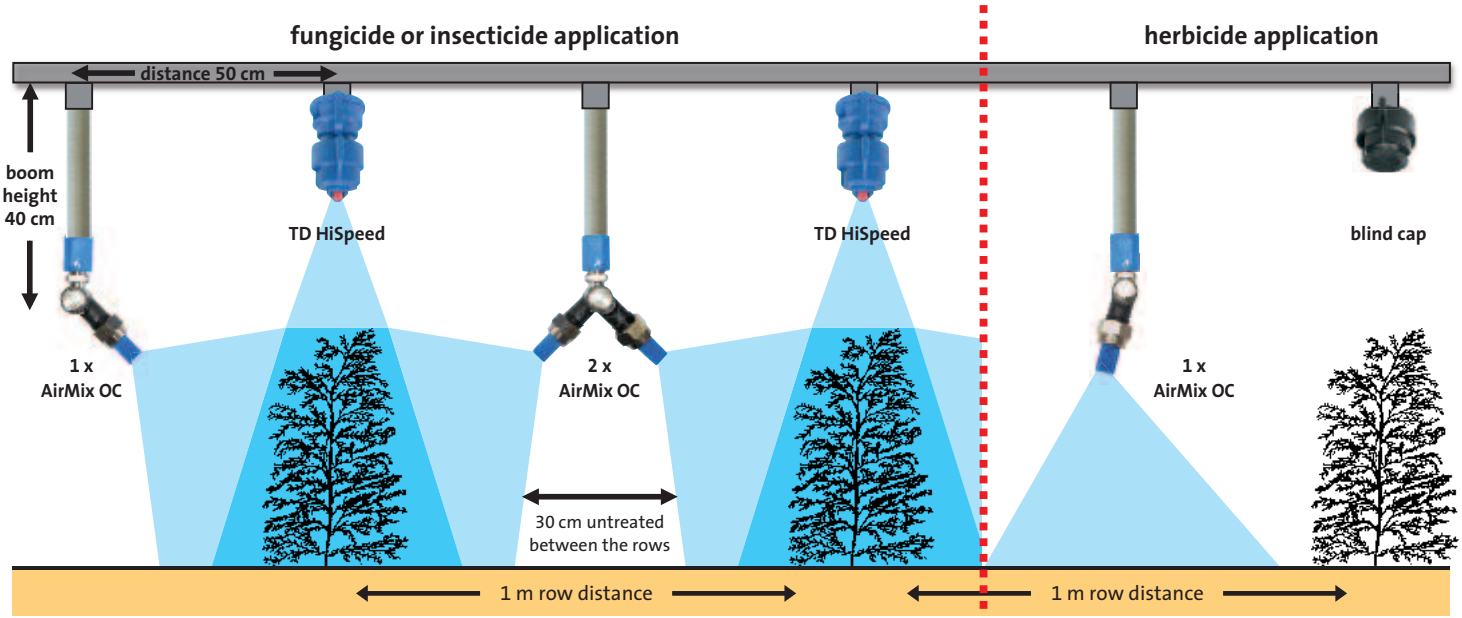
# Nozzle combination for row spraying with boom sprayers

**For fungicide or insecticide application:**
- Adjust swivel nozzle holders for best coverage from the sides

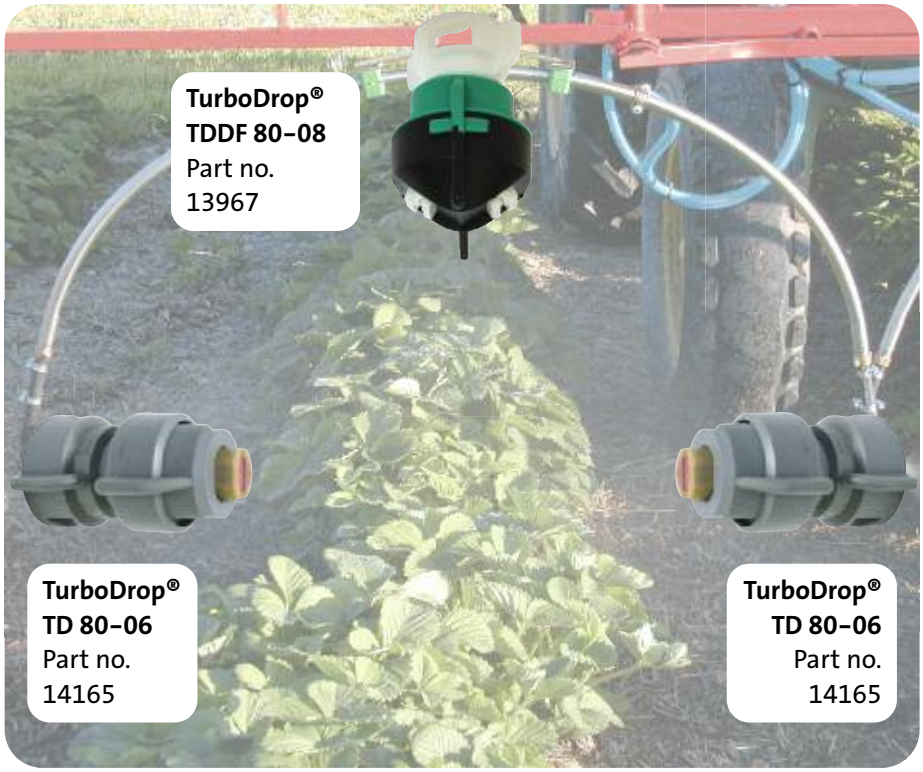
**For herbicide application**
- Use long hose drops only, blank off HiSpeed nozzles
- Lower pressure and adjust OC nozzles to avoid any contact with crop leaves
- Keep end of hose drops at least 15–20 cm above the ground


AirMix OC

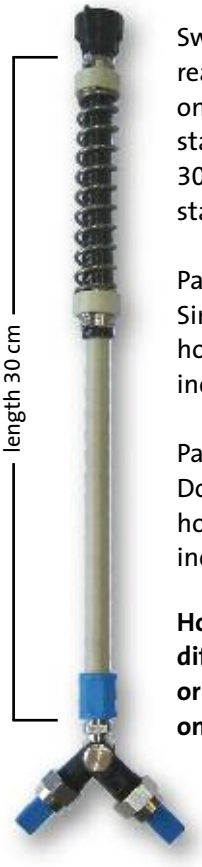

TD HiSpeed




## Triangle frame for strawberries using narrow angle TurboDrop® nozzles at higher pressure for best coverage and penetration, alternatively hose drops with swivel nozzles holders may be used




## Hose drop with swivel nozzle holder




Swivel nozzle holders ready assembled on hose drops with standard length 30 cm, mounted on standard bayonet cap

Part no. 13051
Single swivel nozzles holder (nozzle not included)

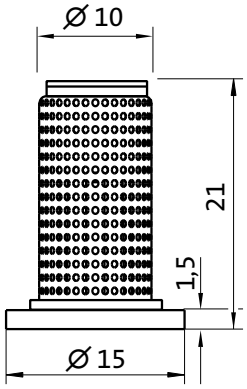
Part no. 13052
Double swivel nozzles holder (nozzle not included)

**Hose drops for different cap systems or length available on request.**

# Filters and ball check valves

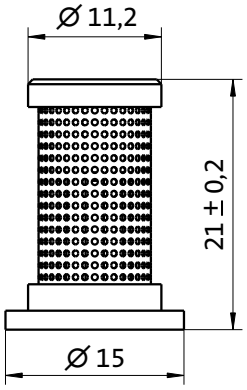
## Current version

### Current version




Fits on most older nozzle holders not conform to ISO 8169

### New design




**New!** Fits on all nozzle holders conform to ISO 8169

### Strainer F

| Part no. | Mesh | Colour |
|---|---|---|
| 12984 | 24 M | white |
| 12985 | 50 M | blue |
| 12982 | 100 M | red |

### Ball valves NKV

| Part no. | Opening pressure | Colour bottom/top |
|---|---|---|
| 12908 | 0.3 bar | blue/white |
| 12909 | 0.7 bar | blue/red |
| 12910 | 2.8 bar | blue/green |

### Ball check strainers KVF

| Part no. | Opening pressure | Mesh | Colour |
|---|---|---|---|
| 12973 | 0.3 bar | 24 M | white/white |
| 12974 | 0.7 bar | 24 M | white/red |
| 12975 | 2.8 bar | 24 M | white/green |

| Part no. | Opening pressure | Mesh | Colour |
|---|---|---|---|
| 12976 | 0.3 bar | 50 M | blue/white |
| 12977 | 0.7 bar | 50 M | blue/red |
| 12978 | 2.8 bar | 50 M | blue/green |

| Part no. | Opening pressure | Mesh | Colour |
|---|---|---|---|
| 12967 | 0.3 bar | 100 M | red/white |
| 12968 | 0.7 bar | 100 M | red/red |
| 12969 | 2.8 bar | 100 M | red/green |

| Colour-coated bottom indicates opening pressure | | |
|---|---|---|
| white = 0.3 bar (4 psi) | red = 0.7 bar (10 psi) | green = 2.8 bar (40 psi) |

## New design

### Cup filter

| Part no. | Type | Colour |
|---|---|---|
| 12935 | stainless steel 32 mesh | red |
| 12936 | stainless steel 50 mesh | blue |
| 12937 | stainless steel 80 mesh | yellow |
| 12938 | stainless steel 100 mesh | green |

### Slotted filter, plastic

| Part no. | Mesh | Colour |
|---|---|---|
| 12943 | ca. 24 M | black |
| 12949 | ca. 50 M | blue |

### Strainer F

| Part no. | Mesh | Colour bottom/top |
|---|---|---|
| 12965 | 24 M | white/black |
| 12966 | 50 M | blue/black |
| 12963 | 100 M | red/black |
| 12964 | 200 M | green/black |

### Ball check strainers KVF

| Part no. | Opening pressure | Mesh | Colour bottom/top |
|---|---|---|---|
| 12957 | 0.3 bar | 24 M | white/white |
| 12958 | 0.7 bar | 24 M | white/red |
| 12959 | 2.8 bar | 24 M | white/green |

| Part no. | Opening pressure | Mesh | Colour bottom/top |
|---|---|---|---|
| 12960 | 0.3 bar | 50 M | blue/white |
| 12961 | 0.7 bar | 50 M | blue/red |
| 12962 | 2.8 bar | 50 M | blue/green |

| Part no. | Opening pressure | Mesh | Colour bottom/top |
|---|---|---|---|
| 12950 | 0.3 bar | 100 M | red/white |
| 12951 | 0.7 bar | 100 M | red/red |
| 12952 | 2.8 bar | 100 M | red/green |

| Part no. | Opening pressure | Mesh | Colour bottom/top |
|---|---|---|---|
| 12953 | 0.3 bar | 200 M | green/white |
| 12955 | 0.7 bar | 200 M | green/red |
| 12956 | 2.8 bar | 200 M | green/green |

**Current colour codes not ISO standardised. New ISO colour codes will be introduced following production plan.**

| Colour-coated top indicates opening pressure | | |
|---|---|---|
| white = 0.3 bar (4 psi) | red = 0.7 bar (10 psi) | green = 2.8 bar (40 psi) |

# Constant flow valves CF

## Constant pressure/flow relief valves for use with single nozzles or in pressure pipes with flows up to 2 l/min

CF-valves have a pre-determined pressure at the outlet side of the valve independent from the pressure at the inlet side. The pressure is only determined by the size of the CF-valve. Valves are available in 1.0/1.5/2.0 or 3.0 bar versions. In combination with a specific nozzle size a constant flow rate is guaranteed independent from pressure variations of the pump, e.g. at knapsack sprayers or piston pumps.

The CF-valve will only open when the determined pressure is reached and will not allow any further pressure increase. No further diaphragm or ball check valves are needed.

In combination with ISO- colour coded nozzles and different CF-valves the following constant flow rates can be reached:

| Valve / pressure size in bar (psi) | Flow rate in l/min of different ISO nozzle types (gal/min) | | | | | | |
|---|---|---|---|---|---|---|---|
| | -01 orange | -015 green | -02 yellow | -03 blue | -04 red | -05 brown | -06 grey |
| yellow 1.0 (15) | 0.230 (0.06) | 0.345 (0.09) | 0.460 (0.12) | 0.690 (0.18) | 0.920 (0.24) | 1.150 (0.30) | 1.380 (0.36) |
| red 1.5 (21) | 0.280 (0.07) | 0.420 (0.11) | 0.560 (0.15) | 0.835 (0.22) | 1.110 (0.29) | 1.390 (0.37) | 1.670 (0.44) |
| blue 2.0 (29) | 0.325 (0.09) | 0.490 (0.13) | 0.650 (0.17) | 0.980 (0.26) | 1.305 (0.34) | 1.630 (0.43) | — — |
| green 3.0 (44) | 0.400 (0.11) | 0.600 (0.16) | 0.800 (0.21) | 1.200 (0.32) | 1.600 (0.42) | — — | — — |

Easy assembling between sprayer lance and nozzle

50 mesh filter before CF-valve is recommended

**Application examples:**

Knapsack sprayers usually show a high pressure variation during application. Generally pressure is pumped up manually to 3–6 bar before starting spraying. During the application pressure decreases constantly till reservoir is empty. It is nearly impossible to calculate even an approximate application rate due to the high variability in pressure and flow rate.

Knapsack sprayers with diaphragm or piston pumps show high oscillation in spray pressure due to pump pulsations.

Using CF-valves will eliminate any pressure changes allowing operation of the knapsack sprayer at a unique pressure rate independent from pump type or operator fatigue. In combination with a nozzle the CF-valve controls the flow rate, droplet size and spray pattern to guarantee maximum accuracy of chemical application.

Assembling the CF-valve onto the sprayer lance is easy. Just screw off the nozzle, put the valve in between and fix the nozzle again on the outlet (male threat) of the valve. The CF-valve is available for different sprayer/screw threats, like G 3/8" (Solo) and M 18 x 1.5 (Hardi, Berthoud). Adaptor for G 3/8" to fit on M 11 x 1 (Maesto, Gloria) is available.

CF-valve with hose barbs

**Characteristics:**

- Opening pressure = working pressure, fixed
- Tolerance: approx. +/– 1.5 %
- Max. inlet pressure: 7 bar
- Thread: female thread at inlet, male thread at outlet, available in G 3/8" or M 18 x 1.5 respectively
- Recommended filter: 50 M or smaller
- Material: case in POM, internal parts POM/stainless steal, diaphragm in Viton® (EPDM on request)
- Length: 5 cm
- Diameter: 3.3 cm
- Weight: 19 g

**Application examples:**

Diaphragm or piston pumps generally have some pump pulsations, particularly small 12 V pumps. Assembling a CF-valve into the pressure pipe after the pump is an easy and economical way to eliminate this pulsation, especially for small scale sprayers.

Small spray booms often show a strong pressure drop between the nozzles, especially when fed by a hose with small diameter. Placing a CF-valve before each nozzle will eliminate this problem, dispensing the use of a pressure gauge (check for bypass to spray container).

CF-valves can be used also as an inline pressure relief valve. Ask us for the required fittings. Maximum flow should not exceed 2 l/min to guarantee best performance of the valve. For higher flows several valves may be installed parallel.

If one CF-valve supplies several nozzles, these nozzles can be switched on and off individually without pressure changes, not exceeding the flow limit of 2 l/min.

Using different CF-valves enables to operate individual nozzles at different pressures on the same system.

Using a CF-valve before the nozzle will allow running the pumping cycle at a higher pressure if required, e.g. for agitation or injection, without changing application rate of the nozzles.

## CF Ventil

| Part no. | Pressure | | Thread |
|---|---|---|---|
| 15119 | 1.0 bar yellow | (15 psi) | G 3/8" |
| 15118 | 1.0 bar yellow | (15 psi) | M 18 x 1.5 |
| 15124 | 1.5 bar red | (20 psi) | G 3/8" |
| 15123 | 1.5 bar red | (20 psi) | M 18 x 1.5 |
| 15126 | 2.0 bar blue | (30 psi) | G 3/8" |
| 15125 | 2.0 bar blue | (30 psi) | M 18 x 1.5 |
| 15128 | 3.0 bar green | (44 psi) | G 3/8" |
| 15127 | 3.0 bar green | (44 psi) | M 18 x 1.5 |

Ready assembled valve to fit onto M 11 x 1

## Adaptor parts for thread M 11 x 1

| | |
|---|---|
| Part no. 15104 | brass adaptor (fits for filters F 50 M) with female thread |
| Part no. 10735 | nut G 3/8" |
| Part no. 13525 | adaptor screw with M 11 x 1 male thread |

# Nozzle caps

## Bayonet caps for bayonet systems

| Part no. | size | cap / slot | fits nozzle type | | | |
|---|---|---|---|---|---|---|
| 12856<br>12858<br>12860<br>12863<br>12865<br>12868<br>12870<br>12872<br>12874<br>12876 | 01<br>015<br>02<br>025<br>03<br>04<br>05<br>06<br>08<br>91 | 8 mm  |  SprayMax |  Albuz® AXI |  AirMix® |  Albuz® CVI |
| 12879<br>12881<br>12883<br>12885<br>12887<br>12889<br>12891<br>12893<br>12895<br>12897 | 01<br>015<br>02<br>025<br>03<br>04<br>05<br>06<br>08<br>91 | 11 mm  |  Albuz® APE<br>Albuz® APG |  Albuz® AVI |  Albuz® EXA/ESI | |
| 12900 | | round hole, black |  DT |  DC | | |
| 12903 | | ATR, black |  Albuz® ATR |  Albuz® TVI | | |
| 12904 | | bayonet cap, blind, black | closure of nozzle holders | | | |
| 12816 | | 1/4", black | female thread 1/4" NPT | | | |
| 12817 | | 1/8", black | female thread 1/8" NPT | | | |
| 12822 | | double flat fan cap | SprayMax | Albuz® AXI | AirMix® | Albuz® CVI |
| 12823 | | double flat fan cap RAU bayonet system | SprayMax | Albuz® AXI | AirMix® | Albuz® CVI |
| 12824 | | asymmetric double flat fan cap | SprayMax | | | |
| 12825 | | asymmetric double flat fan cap | | | AirMix® | |

Part no. 15111 Extension adaptor for standardised bayonet cap
Using the adapter could avoid that shorter standard nozzles spray at spray boom

Part no. 15110 Bayonet adaptor
Converts all screwed caps or caps using not standardised systems into standard bayonet systems. Assembles as TurboDrop® universal. Ready assembled adaptors are available for different cap systems

## Washer

| Part no. | |
|---|---|
| 14457 | Standard washer 3 mm |
| 14461 | Washer 2.8 mm for easy fitting |
| 14969 | Washer 3.4 mm for tight fitting<br>and for caps 00540291001 and 00540291201 |
| 14460 | Washer 1 mm |
| 15129 | O-ring for ATR/TVI nozzles |
| 14456 | Special washer when changing from ATR to AVI nozzles |
| 14465 | Special washer for threaded nozzle holders/caps |

# Nozzle holders

**A** = outlet thread or SB = standard bayonet

**Bar** = max. pressure (bar)

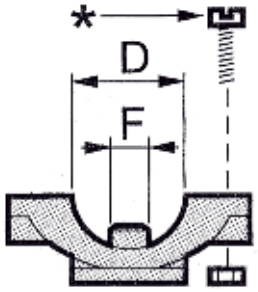
**D** = pipe outside diameter

**E** = inlet thread, i = female, a = male

**F** = diameter

**M** = material, KS = plastic, MS = brass

**S** = screw type
2 = two slotted screws M6 incl. nuts




Part no. 14353 zinced
Part no. 15587 stainless steel

### Nozzle holders for different threads

| Part no. | E | A | Bar | M |
|---|---|---|---|---|
| 15104 | M11x1 i | G 3/8" a | 50 | MS |
| 15102 | G 1/4" a | G 3/8" a | 50 | MS |
| 15103 | G 1/4" i | 11/16" a | 50 | MS |
| 12812 | G 1/4" a | 11/16" a | 50 | MS |
| 15105 | G 1/4" i | G 3/8" a | 50 | MS |
| 12663 | G 1/8" a | G 3/8" a | 50 | MS |
| 12815 | ∅ 6 mm | G 3/8" a | 10 | KS |

### Single swivel nozzle holders

| Part no. | E | A | Bar | M |
|---|---|---|---|---|
| 12732 | G 1/4" i | SB | 10 | KS |
| 12735 | G 3/8" i | SB | 10 | KS |
| 12731 | G 1/4" i | G 3/8" a | 10 | KS |
| 12734 | G 3/8" i | G 3/8" a | 10 | KS |
| 12665 | G 1/4" a | G 3/8" a | 15 | MS/KS |

### Double swivel nozzle holders

| Part no. | E | A | Bar | M |
|---|---|---|---|---|
| 12737 | G 1/4" i | SB | 10 | KS |
| 12740 | G 3/8" i | SB | 10 | KS |
| 12736 | G 1/4" i | G 3/8" a | 10 | KS |
| 12739 | G 3/8" i | G 3/8" a | 10 | KS |
| 12666 | G 1/4" a | G 3/8" a | 15 | MS/KS |

## Bayonet nozzle holders for different thread types

| Part no. | E | A | Bar | M |
|---|---|---|---|---|
| 12680 | G 1/4" a | SB | 20 | KS |
| 12681 | G 1/4" i | SB | 20 | KS |
| 12682 | G 3/8" i | SB | 20 | KS |
| 12685 | G 1/2" i | SB | 20 | KS |
| 12686 | G 3/4" i | SB | 20 | KS |
| 15110 | M11x1 i | SB | 20 | KS |
| 12683 | M18x1,5 i | SB | 20 | KS |
| 12684 | M20x1,5 i | SB | 20 | KS |

## Single nozzle holders with diaphragm flow stop

| Part no. | D | F | A | Bar | M | S |
|---|---|---|---|---|---|---|
| 12713 | 20 mm | 7 | SB | 20 | KS | 2 |
| 12714 | 1/2" | 7 | SB | 20 | KS | 2 |
| 12715 | 1/2" | 10 | SB | 20 | KS | 2 |
| 12716 | 3/4" | 10 | SB | 20 | KS | 2 |
| 12717 | 1" | 10 | SB | 20 | KS | 2 |
| 12708 | 20 mm | 7 | G 3/8" a | 20 | KS | 2 |
| 12709 | 1/2" | 10 | G 3/8" a | 20 | KS | 2 |

## Single nozzle holders with diaphragm flow stop (hinged clamp)

| Part no. | D | F | A | Bar | M | S |
|---|---|---|---|---|---|---|
| 12723 | 20 mm | 10 | SB | 20 | KS | 1 |
| 12725 | 1/2" | 7 | SB | 20 | KS | 1 |
| 12726 | 1/2" | 10 | SB | 20 | KS | 1 |
| 12728 | 25 mm | 10 | SB | 20 | KS | 1 |
| 12727 | 3/4" | 10 | SB | 20 | KS | 1 |
| 12730 | 1" | 10 | SB | 20 | KS | 1 |

## Tripple nozzle holders with diaphragm flow stop

| Part no. | D | F | A | Bar | M | S |
|---|---|---|---|---|---|---|
| 12703 | 20 mm | 10 | SB | 12 | KS | 2 |
| 12700 | 1/2" | 10 | SB | 12 | KS | 2 |
| 12706 | 25 mm | 10 | SB | 12 | KS | 2 |
| 12701 | 3/4" | 10 | SB | 12 | KS | 2 |
| 12702 | 1" | 10 | SB | 12 | KS | 2 |

## Tripple nozzle holders with diaphragm flow stop

| Part no. | D | F | A | Bar | M | S |
|---|---|---|---|---|---|---|
| 12755 | 1/2" | 10 | SB | 20 | KS | incl. |
| 12756 | 3/4" | 10 | SB | 20 | KS | incl. |
| 12757 | 1" | 10 | SB | 20 | KS | incl. |

# Cleaning equipment

## Sprayer washdown kits
## Tank rinsing nozzles
## Container/can rinsing

NEW

## Continuous sprayer cleaning systems

# Sprayer washdown kits

High pressure washdown kits for sprayers, including high pressure piston pump flanged to hydraulic motor, pressure control valve, high pressure hose and lance

Washdown kit HYD-XM 15.15, 15 l/min, 150 bar, required oil flow 29 l/min
Part no. 11618 20 m hose
Part no. 11619 25 m hose

Washdown kit HYD-RK 15.20, 15 l/min, 200 bar, required oil flow 29 l/min
Part no. 11621 15 m hose
Part no. 15532 20 m hose

Washdown kit HYD-XW 30.10, 30 l/min, 100 bar, required oil flow 32 l/min
Part no. 11622 16 m hose

## Hose reels with automatic spring retraction

| | |
|---|---|
| Part no. 11231 | Hose reel, 250 bar, G 1/2", max. 16 m hose 1/2" steel, painted |
| Part no. 11223 | Hose reel, 300 bar, G 3/8", max. 20 m hose 3/8" steel, painted |

| | |
|---|---|
| Part no. 11229 | Hose reel, 20 bar, G 1/4", max. 15 m hose Ø 12 mm external, plastic |
| Part no. 11234 | Hose reel, 20 bar, G 1", max. 20 m hose 1" steel, painted |

| | |
|---|---|
| Part no. 11476 | High pressure hose 16 m |
| Part no. 11477 | High pressure hose 20 m |
| Part no. 15037 | High pressure hose 25 m |

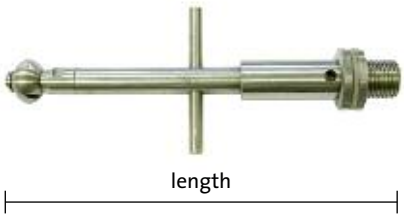
**Frames for wall mount on request.**

## Accessories

Rotopower – straight jet rotating nozzle for maximum cleaning power

| | |
|---|---|
| Part no. 11249 | fitting with washdown kit no. 15.20 |
| Part no. 11250 | fitting with washdown kit no. 15.15 |
| Part no. 11251 | Pipe cleaning nozzle, 1 forward cleaning jet and 3 driving jets, fits on the above listed washdown kits |

# Container/can rinsing




Container rinsing valve for installation in induction hoppers or similar, rotating cleaning nozzle in stainless steel, valve opens progressivly when chemical containers are attached and pressed down, intensive jet power towards container bottom, consumption approx. 17 l/min at 3 bar, male thread G 1/2"

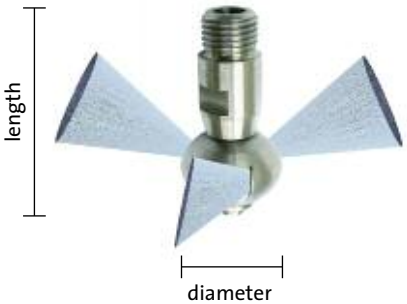
| | |
|---|---|
| Part no. 11246 | Container rinsing valve and nozzle, stainless steel |
| Part no. 11247 | Container rinsing valve and nozzle, stainless steel, short version, for smaller induction bowls |

**JKI-tested rinsing unit, exceeding requirements by EN 12761 (compulsory for new field sprayers in Germany)**

# Tank rinsing nozzles


**Spherical rotating nozzles**
Rotating tank rinsing nozzle, made from stainless steel. Nozzle head with 5 powerful jets giving an operating range of 360° for complete internal cleaning of boom or orchard sprayer tanks.
See chart below for flow rates and connection options.

**New flow rates and operating ranges**



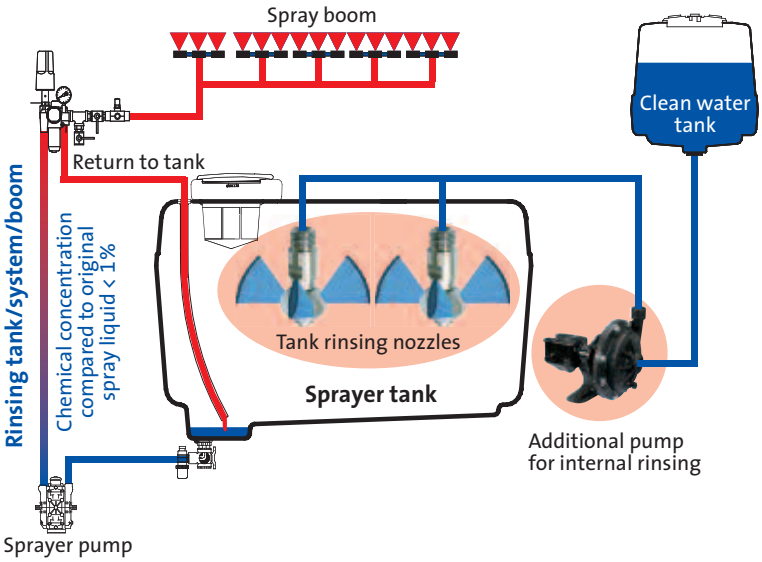

**Hemispherical rotating nozzles**
Rotating tank rinsing nozzle, made from stainless steel. Nozzle head with 2 or 3 powerful jets giving an operating range of 180° for extra cleaning power on upside and lateral internal tank walls, especially made for sprayers with continuous sprayer rinsing systems.
See chart below for flow rates and connection options.

## Rotating tank rinsing nozzles made from stainless steel

| Part no. | 11240 | 11239 | 11243 | 11242 | 11241 |
|---|---|---|---|---|---|
| Connection threads | G 1/4" | G 1/2" | G 1/4" | G 1/4" | G 1/2" |
| Spray pattern | Spherical coverage | Spherical coverage | Hemispherical coverage | Hemispherical coverage | Hemispherical coverage |
| Approx. flow rate at 3 bar | 22.0 | 35.0 | 10.0 | 22.0 | 28.0 |
| Dimensions length / diameter in mm | 50 / 25 | 65 / 38 | 50 / 25 | 50 / 25 | 65 / 38 |

# Continuous internal sprayer rinsing

The new especially developed procedure for continuous internal rinsing of sprayers benefits from a reduction of time and clean water consumption. The residual spray solution is applied effectively on the field while rinsing or cleaning without spilling at the farm yard.



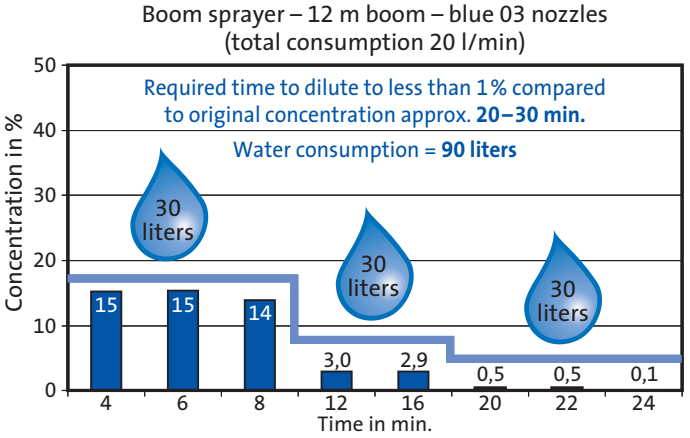

## Technical requirements

**Rinsing procedure:**

- Empty the sprayer tank **on the field** (regular application)
- Liquid pressure drops, nozzles start to spit
- Switch on the rinsing pump, continue regular application on untreated area or at reduced rate on treated area
- After 1/3 of the clean water is used up, open and close boom sections, agitation and circulation shortly a few times while still spraying to flush all contaminated pipes
- Internal cleaning is finished when clean water tank is empty

# Comparison of different sprayer rinsing procedures

## Standard procedure – triple rinsing



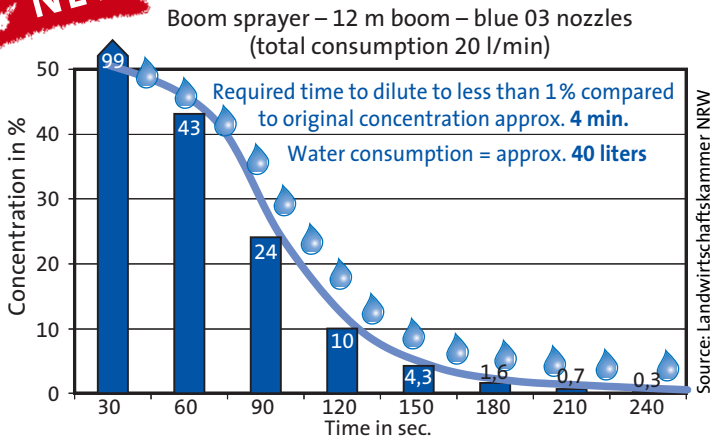

Water consumption triple rinsing 3 x 30 l

**Rinsing procedure:**

- Spray till tank is empty
- Stop and step down from truck/tractor to put sprayer in rinsing mode
- Return to tractor to add 30 l of clean water
- Rinsing of the sprayer tank – step down again
- Set sprayer in application mode, return to tractor and apply diluted solution on the field till tank is empty again
- Repeat same procedure two more times to rinse sprayer completely

**Time required 20–25 min. + 90 l clean water (incl. time to step down and up from the tractor plus time required to spray the rinsing water on the field)**

## NEW Continuous internal rinsing




Continuous rinsing has a water consumption of 10 l/min

**Rinsing procedure:**

- Spray till tank is empty
- Spray pressure drops, nozzles start spitting
- Activate additional rinsing pump, start to rinse internal walls of sprayer tank, continue spraying
- Concentrated spray solution is pushed out of the system by clean water. After approx. one minute the concentration of spray liquid starts to dilute quickly
- After approx. 1/3 of the clean water is used open and rinse agitation pipes, etc. to guarantee a complete cleaning of the sprayer plumbing system

**Required time approx. 5 min. + 40 liter clean water (the complete procedure could be operated from the tractor with no need in stopping and stepping down)**

# Abstract continuous sprayer rinsing

Using the triple rinsing method, the first application of the rinsing solution will already be at a reduced chemical rate. This will affect the efficacy of the chemical when rinsing solution is applied on an untreated area. Using the continuous rinsing method, the rinsing water will first push the rest of the undiluted spray solution out of the pipes, delivering the original concentration. For large sprayers the additional area that could be sprayed with regular spray solution is up to 1/4 ha. Additionally, time saving and reduced clean water consumption make the continuous cleaning procedure a much more economical method. Frequent internal cleaning of the sprayer reduces the risk of crop damage or environmental contamination.

The continuous procedure cleans the sprayer faster than the traditional way of double or triple rinsing, as only clean water is used for the rinsing procedure.

It is important that the flow rate of rinsing water does not exceed the total output of the nozzles on the boom. Otherwise diluted spray solution would build up in the sump or tank, contaminating the clean rinsing water.

To match to the different flow rates we offer a large range of different tank rinsing nozzles and pumps for hydraulic or electric power supplies. For smaller sprayers we recommend the use of electric pumps, larger sprayers may require the use of hydraulic driven centrifugal pumps like the FMC-75-HYD. Diaphragm pumps can be also used for external sprayer cleaning.

The flow rates of the pumps can be adjusted via oil flow with hydraulic driven pumps, via pressure control/manifold or by intermittent use of the pump.

The continuous sprayer cleaning system can be easily fitted on almost any sprayer type, new or used. Place a 3-way valve at the outlet of the clean water tank to switch between the regular rinsing systems and the newly installed continuous sprayer cleaning system. Already existing tank rinsing nozzles should not be used, as their flow rate is generally too high for this application.

**agrotop** offers complete tank-rinsing-kits for different tank/sprayer volumes that can be found on next page.

### Family Helminger, horticultural farmers from Goldach/Germany

“On our property we crop over 20 different vegetables, each requiring special chemicals plus liquid or foliar fertilizers. Most vegetables are very sensitive to residues remaining in the tank from earlier applications of other crops. Therefore, a completely clean sprayer tank (and plumbing) is a must for us before we prepare a new spray for a different crop.
In spring 2010 we equiped our field sprayer with a tank rinsing system from **agrotop**. The assembly kit was easy to install, even on our used sprayer, and we used it a hundred times since then. It is an efficient, easy to use and time saving tool giving us a perfect clean tank. We would never like to be without it again.”

## Mounting arrangements for continuous internal rinsing systems (left: diaphragm pump, right: centrifugal pump)

## Tank-rinsing-kit for boom sprayers using tank volumes of more than 800 l, using a centrifugal pump with hydraulic motor


**including:**

- ACE-Centrifugal pump FMC-75HYD-204 with hydraulic-motor, plus all fittings for the required hose connections to the fresh water tank, centrifugal pump and tank rinsing nozzles (hoses not included)
- two rotating tank rinsing nozzles made from stainless steel, AG1/2", Flow rate 28 l/min at 3 bar, including back pressure valve 3/4" IG, preventing chemical contamination of fresh water tank
- All fittings, hose barbs, washers and clamps, required for installation
- Plain instruction manual

Part no. 11215

Additional tank rinsing nozzle for large tank sizes 4000 l plus: **Add-on kit,** Part no. 15610

**General note for all tank-rinsing-kits:**
Pressure and suction hoses, as hydraulic pipes are not included and must be purchased extra according to the individual set up of the sprayer.

## Tank-rinsing-kit for orchard sprayers or other sprayers with external cleaning option, using a diaphragm pump with hydraulic motor


**including:**

- Diaphragm pump AR 252 driven by hydraulic motor OMP 50, incl. manifold, plus all fittings for the required hose connections to the fresh water tank, diaphragm pump and tank rinsing nozzles (hoses not included)
- 3 rotating tank rinsing nozzles made from stainless steel, AG 1/4", including back pressure valve 1/2" IG
- All fittings, hose barbs, washers and clamps, required for installation
- Plain instruction manual

Part no. 11217

**optional:**
Kit for external sprayer cleaning, connects to manifold
Part no. 15033

## Tank-rinsing-kit for small sprayers with max. tank capacity of 800 l, using a 12 V electrical pump

**including:**

- 12 V electrical pump, max. flow rate l/min, inc.l remote on/off switch with 5 m wire (weather proof IP 65), plus all fittings for the required hose connections to the fresh water tank, diaphragm pump and tank rinsing nozzles (hoses not included)
- two rotating tank rinsing nozzles made from stainless steel, AG 1/4", flow rate 15 l/min at 3 bar, including back pressure valve 1/2" IG
- All fittings, hose barbs, washers and clamps, required for installation
- Plain instruction manual

Part no. 11216

# Chemical handling

QuantoFill M NEW

QuantoFill

AgriFill®

VacuFill®

Flow meter

Quick-Connect coupling

ChemKart®

ChemTipper®

# Automatic proportioner for liquid chemicals in agriculture





## QuantoFill M

QuantoFill M is a dosing and transfer unit for safe, accurate and contamination-free preparation of the spray liquid when filling the tank on a sprayer or nurse truck.

The QuantoFill M automates the procedure of measuring and pouring the liquid spray chemicals into the sprayer tank, saving time and avoiding dosage errors. Up to five different chemicals can be connected to the QuantoFill M.

The unit automatically calculates the correct volume of each chemical to be transferred based on the application rate of each product, the water rate and the treatment area or tank volume. The products will be dosed in the correct sequence, and the system is flushed in between chemical doses.

Using quick coupling fittings the QuantoFill M can be connected spill-free to larger chemical containers.
Small containers can be transferred via a stainless steel chem-hopper.

Users say: "Proportioning three different chemicals (ca. 90 l) into a 4000 l tank takes about 5 minutes using the QuantoFill M. I'm already in spraying the field while my neighbour is still counting and pouring the measuring jugs into his sprayer tank."

Part no. 10139 QuantoFill M max. 3 chemicals 230 V
Part no. 10140 QuantoFill M max. 5 chemicals 230 V

Part no. 10141 QuantoFill M max. 3 chemicals 12 V
Part no. 10142 QuantoFill M max. 5 chemicals 12 V

### Application range QuantoFill M

| | |
|---|---|
| Product characteristics: | Only suitable for licensed crop protection products or respective stock solutions |
| Viscosity: | 1.0 to 3000 CPS |
| Sprayer tank volumes: | 50–49.999 liter |
| Water application rates: | 50–4999 l/ha |
| Chemical proportion range: | 1.00–999.99 liter |
| Chemical application range: | 0.10–99.99 l/ha |
| Number of chemicals: | 2–5 |
| Data storage: | max. 25 different chemicals or rates |

### Main advantages of the new QuantoFill M

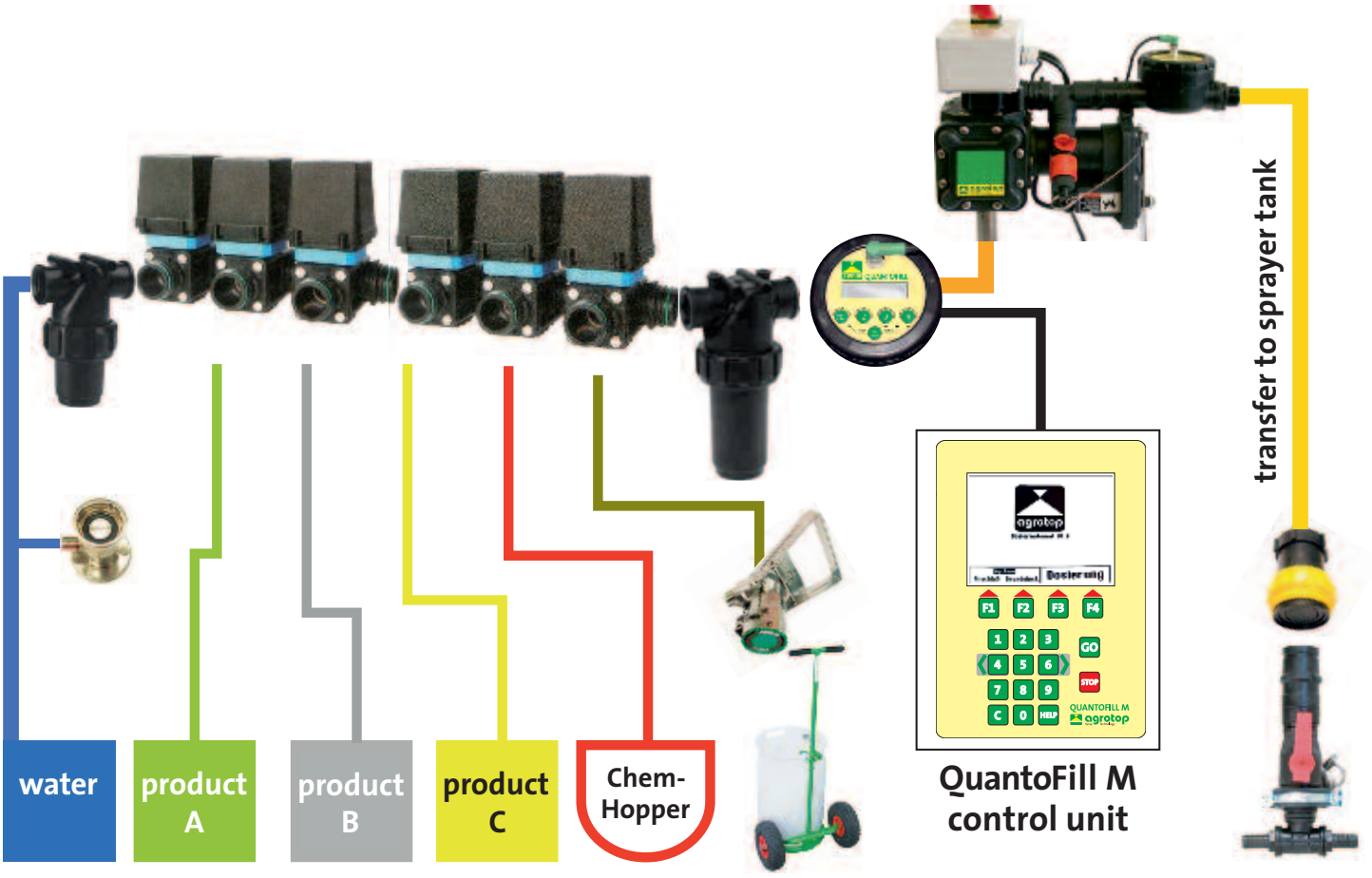
- Reduced calculation and measuring errors when preparing the spray liquid
- Reduced filling time = increasing efficiency
- Easy handling of up to 25 different chemicals through data input before spray season
- Environmentally and operator friendly by avoiding direct contact with the product and spilling (using MicroMatic valves)
- Avoiding residual amount of spray liquid by automatically calculating the correct volume for each product spraying subareas or partial tank filling at end of treatment

### Technical data transfer unit QuantoFill M

| | |
|---|---|
| Min. transfer volume: | 3.00 liters, optional 1.00 liter |
| Measuring error: | < 2,5 % |
| Supply voltage: | 12 V DC, optional 230 V/50 Hz AC |
| Power consumption: | 25 A DC, or 1.5 A AC |
| Pump performance: | max. 40 l/min |
| Pumping head: | max. 8 m |
| Temperature: | –5°C – 45°C |
| Max. hose length: | 3 m on suction, 8 m on pressure side |
| Permitted running time for each proportion cycle: | 30 min |

# QuantoFill M – automatic proportioner

## Dosage device – installation diagram




The **QuantoFill M** is mounted on a support frame for secure and safe handling and operation, the main components of the proportioner are:

1. **Main control unit**, including the main board, calculating, controlling and supervising the complete transfer and dosage process of all connected components like pumps, sensors, meters and max. 6 electronic valves. The external parts are connected through weather proven plugs (IP 65) and the complete unit is protected by a robust aluminum case (IP 65). The included cable loom allows placing the control unit up to 5 m apart from the transfer module mounted on a support frame. A main on/off switch is placed on the control unit.

2. **Valve manifold**, mounted on the support frame with up to 6 electric valves (12 V DC). One is permanently connected to a fresh water source, the others are available for connecting to the chemical containers.

3. **Volumetric flow meter**, including an air detector for precise measurement of liquid flow preventing measuring errors due to occasionally entrapped air (e.g. when container is empty).

4. **Diaphragm pump**, appropriate for transfer of the vast majority of registered agricultural chemicals. The pump is available in a 12 V or 230 V version, the max. flow rate is 40 l/min and has a pressure control switch.

5. **Two strainers,** one for the fresh water connection and another to protect the flow meter are installed.

6. **All fittings, hoses** and **couplings** needed to connect the **QuantoFill M** to the sprayer tank and to the chemical containers (please contact us for details) are included.

**Complementary high volume transfer pumps or tank filling pumps see page 89.**

# Electronic dosage device for liquid chemicals in agriculture


## QuantoFill

### The best way to dose and transfer agricultural chemicals, easy, secure and eco friendly

Till today it is common to pour the chemicals in a measuring jug and empty it into the chem-hopper or directly into the sprayer tank. Overfilling the jug usually results in overdosing because it is difficult to return excess chemical back to the chemical container.
Dosage out from large containers, using a chemical transfer system with a flow meter, may be easier, but the exact timing to close the valve, stopping the flow, is tricky, requiring a lot of practice.

Now you can put an end to these problems.

### Easy Handling

The QuantoFill makes the metering and the injection of your chemicals easy, secure and eco friendly.

The QuantoFill proportioner can be connected directly to the suction side of the sprayer or using a dry break coupler (avoids spilling) to any other spray equipment, e.g. stationary pumps.

A MicroMatic clutch or a standpipe connects the chemical container to the QuantoFill system.

The user selects the product name of the chemical used from a pre-selected list or enters the calibration factor (viscosity) of the chemical.

Use the PRESET button to adjust the required volume.

Press START (ON) and the QuantoFill will transfer exactly the calculated quantity of chemical into your sprayer tank, switching-off automatically when the required volume is reached.

No spilling, no over dosage, no contaminated measuring jugs.

Leave the QuantoFill proportioner connected to the chemical container until work is done or container is empty.

For cleaning connect the suction side to clean water and press RINSING for auto-rinsing of the device. The fluid will be injected into the sprayer tank for safe, eco-friendly use of the rinsing water.

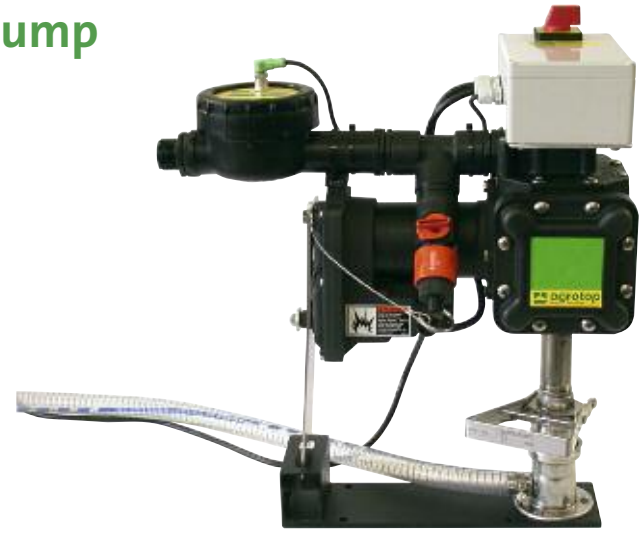
### Principal benefits using the QuantoFill

- Exact and controlled dosage of chemicals avoiding errors
- Highest accuracy using air detector, volumetric measuring system considering the switch on/off delay
- Easy to operate by a secure and clear five key handling with functions: preselection of volume; start of liquid transfer (ON/OFF); flushing; selection of chemical or calibration factor (viscosity of liquid); reset or total volume
- Measuring and transfer in one step, saves time
- No contamination of measuring jugs, no direct contact with chemicals, eco-friendly
- Auto cleaning, no extra effort required

### Technical Data

- Capacity: 10 to 70 l/min
- Pressure: –0.9 to 4 bar
- Supply voltage: 12 V DC (using converter input 230 V)
- Scale: 0.5 to 999.9 l
- Measuring error: < 2 %
- Measuring units: liter, gallon, ounce

# QuantoFill dosage device including pump



## QuantoFill 400 with high performance diaphragm pump and MicroMatic coupler for large containers

- 3 meter pressure hose and tap gun
- Dry break coupler to connect system to sprayer tank available on request
- Maximal flow approx. 45 l/min (depending on viscosity of chemical)

| | | |
|---|---|---|
| Part no. 10134 | QuantoFill 415 | 12 V DC (consumption ca. 20 A) |
| Part no. 10135 | QuantoFill 475 | 230 V AC (consumption ca. 250 W) |

## QuantoFill 100 with small diaphragm pump

- Installed in a shock- and corrosion-resistant box with hinged lid
- For installation on the sprayer or in the shop
- 3 meter hose on suction side
- 7 meter pressure hose with fittings for fixed installation
- Tap gun or dry break coupler available on request
- Maximal flow ca. 2 l/min (depending on viscosity of chemical)

| | | |
|---|---|---|
| Part no. 10131 | QuantoFill 115 | 12 V DC (consumption ca. 7 A) |
| Part no. 10132 | QuantoFill 130 | 230 V AC (consumption ca. 120 W) |

**Fittings and standpipes for all containers on request.**

# QuantoFill dosage device for assembly on sprayers (suction side)

- Including electric valve (12 DC) for instant shut-off
- Installed in a shock- and corrosion-resistant box with hinged lid
- Recommended for 1" hoses
- Adaptors for differing systems on request
- Maximal flow rate ca. 70 l/min (depending on viscosity of chemical and sprayer type)

| | |
|---|---|
| Part no. 14765 | QuantoFill dosage device 12 V DC (consumption maximal ca. 3 A) |

**For devices with 12 V supply, remote control available on request.**

## Chemtraveller®

### Portable chemical pump for transfer and mixing of liquid spray chemicals

Part no. 14743 Chemtraveller 12 V direct current (DC)
Part no. 14744 Chemtraveller 230 V alternating current (AC)

**Characteristics:**

- Self-priming, double diaphragm pump with automatic protection against overpressurization
- 3 years warranty on the diaphragm
- Maximum flow rate of 49 l/min (varies with the density and viscosity of the liquid)
- Available in 12 V direct current (DC) or 230 V alternating current (AC)
- Mounted on a support frame, including suction and pressure hose, tap valve, cable and switch
- QuantoFill or flow meter not included (available on request)


## Flow meter Sotera 850

Part no. 15636 Flow meter Sotera 850

**Characteristics:**

- Volumetric flow meter for liquid spray chemicals
- Flow rate: 8–60 l/min, pressure from 0 to max. 5 bar (90 psi)
- Display range from 0–9999 l
- Four-digit display for current flow, total flow and calibration values for different densities
- Measurement is interrupted when rinsing, air detector stops counter automatically if air is introduced
- Hard-wearing, robust construction in polypropylene reinforced with fibreglass
- Easy adaptation to different densities of spray chemicals using preset values (max. 19 different values)

## Quick Connect coupling anti-spill

### for liquid spray chemicals

**Characteristics:**

- Couplings seal automatically when disconnected, to avoid any spilling
- Robust design in polypropylene reinforced with fibreglass and stainless steel
- We recommend mounting the male coupling on the sprayer

Part no. 15637 Quick Connect male coupling, with 1" female thread
Part no. 15638 Quick Connect female coupling, with 1" female thread

MicroMatic male valve
with female thread G 1"
Part no. 14739

Rinsing pedestal for MicroMatic system with 3/4" connection for fresh water hose, can be used as bracket for MicroMatic male valve
Part no. 14736

# Quick coupling

made of polypropylene with stainless steel cam lock

## Male quick coupling with female thread connection (IG)

| Part no. | Diameter quick coupling IG/AG | thread |
|---|---|---|
| 10386 | 3/4" | G 1/2 |
| 10385 | 3/4" | G 3/4 |
| 10400 | 1" | G 1 |
| 10410 | 1 1/4" | G 1 1/4 |
| 10215 | 1 1/2" | G 1 1/4 |
| 10420 | 1 1/2" | G 1 1/2 |
| 10435 | 2" | G 2 |
| 10446 | 3" | G 2 1/2 |
| 10445 | 3" | G 3 |
| 10465 | 4" | G 4 |

## Female quick coupling with male thread connection (AG)

| Part no. | Diameter quick coupling IG/AG | thread |
|---|---|---|
| 10388 | 3/4" | G 1/2 |
| 10387 | 3/4" | G 3/4 |
| 10401 | 1" | G 1 |
| 10411 | 1 1/4" | G 1 1/4 |
| 10422 | 1 1/2" | G 1 1/4 |
| 10421 | 1 1/2" | G 1 1/2 |
| 10436 | 2" | G 2 |
| 10448 | 3" | G 2 1/2 |
| 10447 | 3" | G 3 |
| 10466 | 4" | G 4 |

## Female quick coupling with hose barb

| Part no. | Diameter quick coupling IG/AG | barb for hose diameter |
|---|---|---|
| 10390 | 3/4" | 13 mm |
| 10389 | 3/4" | 19 mm |
| 10402 | 1" | 25 mm |
| 10403 | 1" | 32 mm |
| 10413 | 1 1/4" | 30 mm |
| 10412 | 1 1/4" | 32 mm |
| 10425 | 1 1/2" | 32 mm |
| 10423 | 1 1/2" | 38 mm |
| 10424 | 1 1/2" | 40 mm |
| 10437 | 2" | 50 mm |
| 10438 | 2" | 53 mm |
| 10450 | 3" | 60 mm |
| 10452 | 3" | 63 mm |
| 10449 | 3" | 75 mm |
| 10451 | 3" | 78 mm |
| 10453 | 3" | 87 mm |
| 10467 | 4" | 105 mm |

## Female quick coupling with female thread connection (IG)

| Part no. | Diameter quick coupling IG/AG | thread |
|---|---|---|
| 10392 | 3/4" | G 1/2 |
| 10391 | 3/4" | G 3/4 |
| 10404 | 1" | G 1 |
| 10414 | 1 1/4" | G 1 1/4 |
| 10427 | 1 1/2" | G 1 1/4 |
| 10426 | 1 1/2" | G 1 1/2 |
| 10439 | 2" | G 2 |
| 10455 | 3" | G 2 1/2 |
| 10454 | 3" | G 3 |
| 10468 | 4" | G 4 |

**Max. operation pressure:**
For couplings from 3/4" to 2": 9 bar (130 psi)
For couplings from 2 1/2" to 4": 5 bar (70 psi)

O-rings made from EPDM (Viton® and NBR on request).

## Male quick coupling with hose barb

| Part no. | Diameter quick coupling IG/AG | barb for hose diameter |
|---|---|---|
| 10394 | 3/4" | 13 mm |
| 10393 | 3/4" | 19 mm |
| 10405 | 1" | 25 mm |
| 10406 | 1" | 32 mm |
| 10416 | 1 1/4" | 30 mm |
| 10415 | 1 1/4" | 32 mm |
| 10430 | 1 1/2" | 32 mm |
| 10428 | 1 1/2" | 38 mm |
| 10429 | 1 1/2" | 40 mm |
| 10440 | 2" | 50 mm |
| 10441 | 2" | 53 mm |
| 10457 | 3" | 60 mm |
| 10459 | 3" | 63 mm |
| 10456 | 3" | 75 mm |
| 10458 | 3" | 78 mm |
| 10460 | 3" | 87 mm |
| 10469 | 4" | 105 mm |

## Male quick coupling with male thread connection (AG)

| Part no. | Diameter quick coupling IG/AG | thread |
|---|---|---|
| 10396 | 3/4" | G 1/2 |
| 10395 | 3/4" | G 3/4 |
| 10407 | 1" | G 1 |
| 10417 | 1 1/4" | G 1 1/4 |
| 10432 | 1 1/2" | G 1 1/4 |
| 10431 | 1 1/2" | G 1 1/2 |
| 10442 | 2" | G 2 |
| 10462 | 3" | G 2 1/2 |
| 10461 | 3" | G 3 |
| 10470 | 4" | G 4 |

**Max. operation pressure:**
For couplings from 3/4" to 2": 9 bar (130 psi)
For couplings from 2 1/2" to 4": 5 bar (70 psi)

O-rings made from EPDM (Viton® and NBR on request).

## Blind cap for female quick coupling

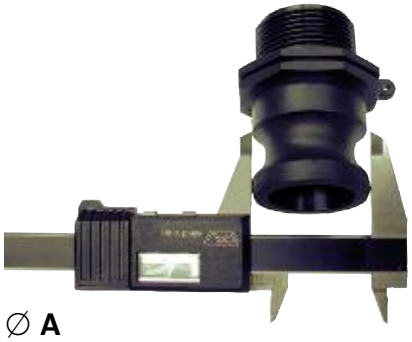
| Part no. | Diameter quick coupling IG/AG |
|---|---|
| 10397 | 3/4" |
| 10408 | 1" |
| 10418 | 1 1/4" |
| 10433 | 1 1/2" |
| 10443 | 2" |
| 10463 | 3" |
| 10471 | 4" |

## Blind cap for male quick coupling

| Part no. | Diameter quick coupling IG/AG |
|---|---|
| 10398 | 3/4" |
| 10409 | 1" |
| 10419 | 1 1/4" |
| 10434 | 1 1/2" |
| 10444 | 2" |
| 10464 | 3" |
| 10472 | 4" |

## Coupling diameter

∅ I



∅ A

| Coupling diameter | 3/4" | 1" | 1 1/4" | 1 1/2" | 2" | 3" | 4" |
|---|---|---|---|---|---|---|---|
| ∅ I (mm) | 32,5 | 37 | 46 | 54 | 63,5 | 92 | 120.5 |
| ∅ A (mm) | 32 | 36.5 | 45.5 | 53.5 | 63 | 91.5 | 120 |

# Measuring and testing

NEW

**Pressure gauge**
**QuickCheck Calibration jug**
**DigE-Check sprayer calibrator**
**agrotop Calibration cylinder**
**Measuring jugs**
**Measuring cylinder**
**Hand-held anemometer**
**Water-sensitive paper**


## Pressure gauge

**Characteristics:**

- High precision quality
- Ø 63 mm
- Threaded adaptor fitting G 1/4"
- Case in stainless steel, gauge-glass filled with glycerine to reduce vibrations
- Divided scale for exact reading, even at low pressure
- Do not use standard design with liquid fertilizers

| Part no. | Scale (bar) | Adaptor fitting | Design |
|---|---|---|---|
| 10205 | 0 – 5 / 25 | bottom | tolerates liquid fertilizers |
| 10210 | 0 – 5 / 25 | rear | standard |
| 10209 | 0 – 5 / 25 | rear | tolerates liquid fertilizers |
| 10207 | 0 – 8 / 25 | bottom | tolerates liquid fertilizers |
| 10211 | 0 – 8 / 25 | rear | tolerates liquid fertilizers |
| 10199 | 0 – 20 / 60 | rear | standard |
| 10200 | 0 – 20 / 60 | bottom | standard |

Personalised layouts are available on request

## QuickCheck Calibration jug

### Handy calibration jug including many additional features for adjusting boom or row sprayers

1. Adjusting application rate: hold QuickCheck jug below the nozzle for 30 sec. Effective application rate can be easily read off the jug for desired application speeds. If necessary adjust the sprayer and test again.
2. Testing application speed: timescale for test distance on the jug.
3. Testing nozzles for wear: hold QuickCheck jug below the nozzle for 30 sec. and compare volume captured with ISO nozzle scale on the jug for different pressures.
4. Choosing nozzle: all the main specifications such as pressure, application speed, flow rate and application rate can be read off the jug for different nozzle sizes.

**Characteristics:**

- Measuring jug in transparent polypropylene
- Extremely durable printing
- Volume 2 l
- Scales for application ranges from 50–800 l/ha at 5–10 km/h
- Measuring accuracy +/– 20 ml

Part no. 10190 QuickCheck Calibration jug

G 1915

NEW

# DigE-Check sprayer calibrator

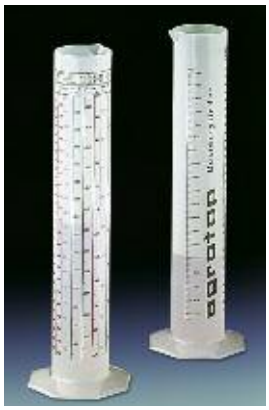
## Electronic flow rate measurement in seconds, quick and easy determination of flow rate and worn spray nozzles

Simply press the start button then hold meter under a sprayer nozzle at a constant angle. Allow the meter to fill until display shows the flow rate. Display holds the reading for 90 seconds. Pour the water out of the meter and press start for next measurement.

**Characteristics:**

- Simple, waterproof design, no moving parts, break resistant plastic
- Reading of single tip takes approx. 10 sec. or less
- Readings in l/min, oz./min or GPM, accuracy +/– 3 % or last digit on display
- Measurement range: 0–3.5 l/min
- Easy one handed operation, easy cleaning
- Small size stores in cap tool box etc. (23.5 x 5.7 cm), weight 236 g
- Power source: 2 x LR1 alkaline batteries

Part no. 15605 DigE-Check sprayer calibrator



## agrotop Calibration cylinder

### Maximum accuracy for exact sprayer calibration for boom and row sprayers or banding

Measuring similar to agrotop QuickCheck calibration jug, but the larger scales, with the cylindrical shape, make reading easier and more accurate, measuring times for different nozzle spacing or band width can be read directly from the cylinder

**Characteristics:**

- Measuring jug in transparent polypropylene
- Extremely durable printing
- Volume 2 l
- Height 50 cm
- Scales for application ranges from 100 – 1600 l/ha at 3 – 12 km/h
- Measuring accuracy +/– 1 % from the scale

Part no. 10186 agrotop Calibration cylinder

## Measuring jugs

### in polypropylene with embossed blue scale

| Part no. | Volume | Scale | Height | ∅ |
|---|---|---|---|---|
| 10181 | 1000 ml | 10 ml | 170 mm | 115 mm |
| 10182 | 3000 ml | 50 ml | 240 mm | 170 mm |
| 10183 | 5000 ml | 100 ml | 270 mm | 205 mm |

## Measuring cylinder

### in polypropylene with embossed scale

| Part no. | Volume | Scale | Height | ∅ |
|---|---|---|---|---|
| 10177 | 500 ml | 10 ml | 220 mm | 70 mm |
| 10178 | 1000 ml | 20 ml | 285 mm | 78 mm |
| 10180 | 2000 ml | 20 ml | 482 mm | 97 mm |

**for official sprayer testing, scientific studies and similar duties:**
**Part no. 10179 Measuring cylinder, transparent, 2000 ml, DIN 12681, conforms to class A category, including testing certificate**


## Hand-held anemometer

**Characteristics:**

- Wind speed measured in mph, km/h, m/s or knots
- LCD back-light
- Auto power OFF
- Water resistant
- Lithium battery and neck band included
- Wind speed measuring range: 0.2–30 m/s
- Wind speed accuracy: ± 5 % or ± least significant digit
- Power source: 1 x 3 V lithium cell (CR2032)
- Dimensions (L x W x H): 39 x 17 x 98 mm

Part no. 10159 Hand-held anemometer
Part no. 10162 Protective bag for hand-held anemometer

## Water-sensitive paper

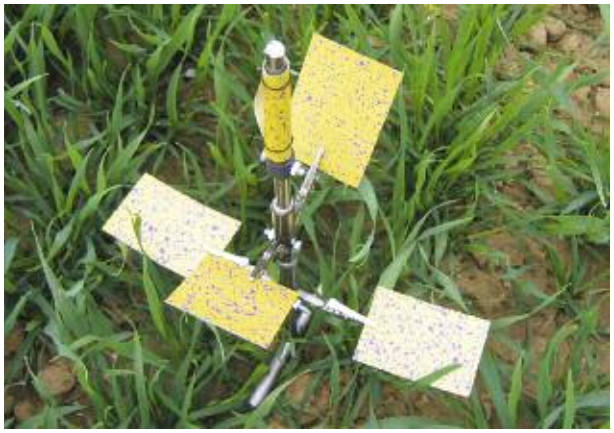
Strips of water-sensitive paper with special coating which turns blue upon contact with water. Perfect for checking penetration, coverage and distribution.

Part no. 10156 Packing unit of 25 strips 500 x 26 mm
Part no. 10157 Packing unit of 50 strips 52 x 76 mm
Part no. 10158 Packing unit of 50 strips 76 x 26 mm

## Support stand for water sensitive paper

Secure and standardised fixation of water sensitive paper at different angles in the crop canopy for correct comparison of different spray applications.
Stand in stainless steel with support base and ground spike, adjustable clamps to fix the paper strips.

Part no. 10154 Support stand for water sensitive paper



# Centrifugal pumps

## Centrifugal pumps
## for sprayer and transfer

# Centrifugal pumps

**for use on municipal watering or irrigation trucks, high volume transfer systems or on agricultural sprayers**

Rugged, standard or self priming centrifugal pumps, case in cast iron or stainless steel, stainless steel power shaft, VALOX® impeller and Viton® seal.

FMC-150-HYD-206 cut

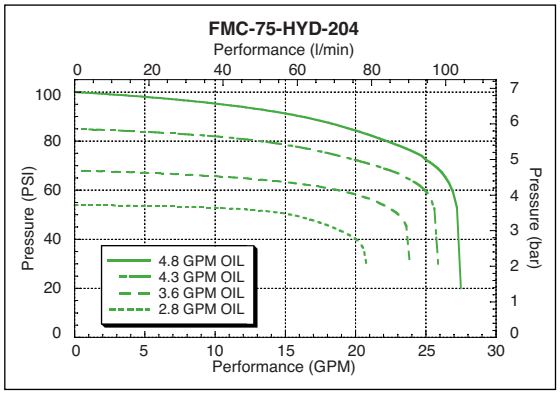
## Pumps driven by hydraulic motor

**Characteristics:**

- Pump shaft seperated from motor for easy disassembly and maintenance
- Pump shaft with double ball bearings for smooth running
- Rugged gear motor with adjustable bypass and check valve avoiding damage by reverse connecting
- FMC-75 case and impeller made from noncorrosive polypropylene, resistant to liquid fertilizer

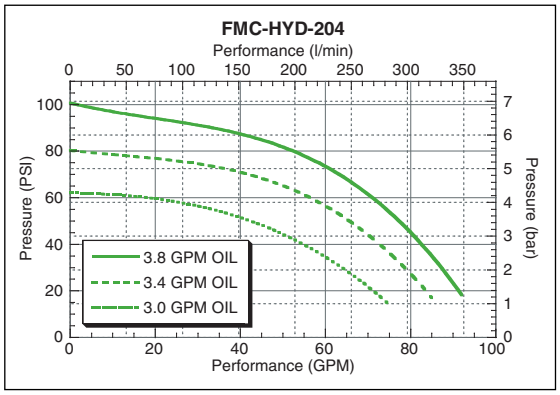
### Standard centrifugal pumps

FMC-75-HYD-204
Part no. 11390



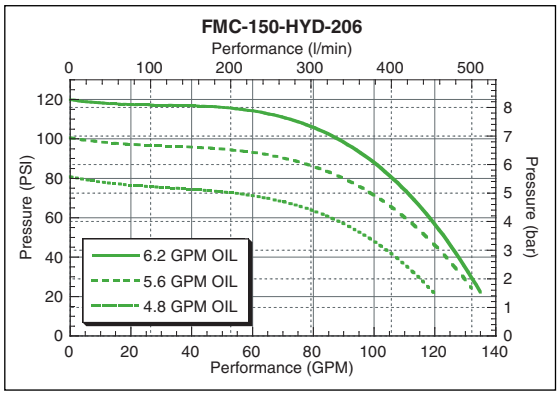

| Flow rate hydraulic oil GPM | l/min |
|---|---|
| 4.8 | 18.0 |
| 4.3 | 16.0 |
| 3.6 | 11.0 |
| 2.8 | 8.0 |

FMC-HYD-204
Part no. 11392



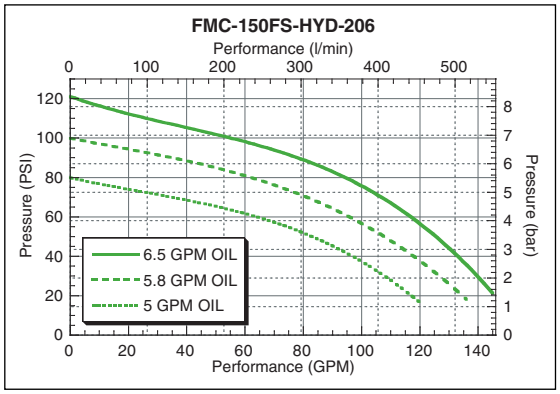

| Flow rate hydraulic oil GPM | l/min |
|---|---|
| 3.8 | 14.4 |
| 3.4 | 12.9 |
| 3.0 | 11.4 |

FMC-150-HYD-206
Part no. 11403



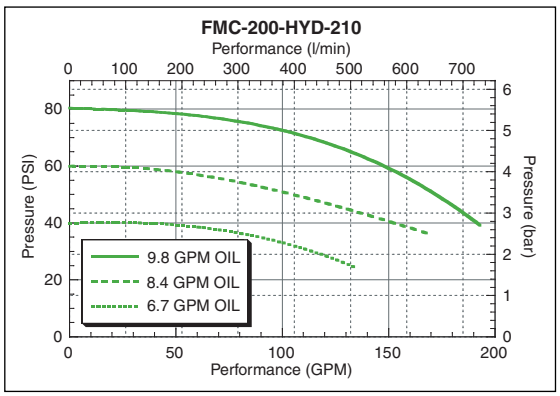

| Flow rate hydraulic oil | |
|---|---|
| GPM | l/min |
| 6.2 | 23.5 |
| 5.6 | 21.2 |
| 4.8 | 18.2 |

FMC-150FS-HYD-206
Stainless steel case,
resistant to liquid fertilizer
Part no. 11412




| Flow rate hydraulic oil | |
|---|---|
| GPM | l/min |
| 6.5 | 24.6 |
| 5.8 | 21.9 |
| 5.0 | 18.9 |

FMC-200-HYD-210
Part no. 11398




| Flow rate hydraulic oil | |
|---|---|
| GPM | l/min |
| 9.8 | 37.1 |
| 8.4 | 31.8 |
| 6.7 | 25.4 |

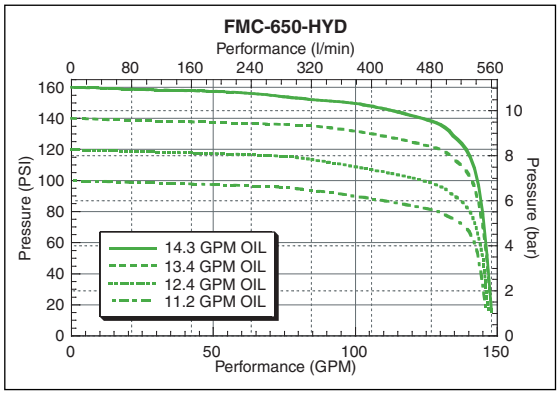
## Flow limiter

For hydraulic motors, fits onto the inlet thread of the motor (limits max. rotation of motor)

Part no. 11387 Flow limiter for hydraulic motor -204
Part no. 11388 Flow limiter for hydraulic motor -206
Part no. 11389 Flow limiter for hydraulic motor -210

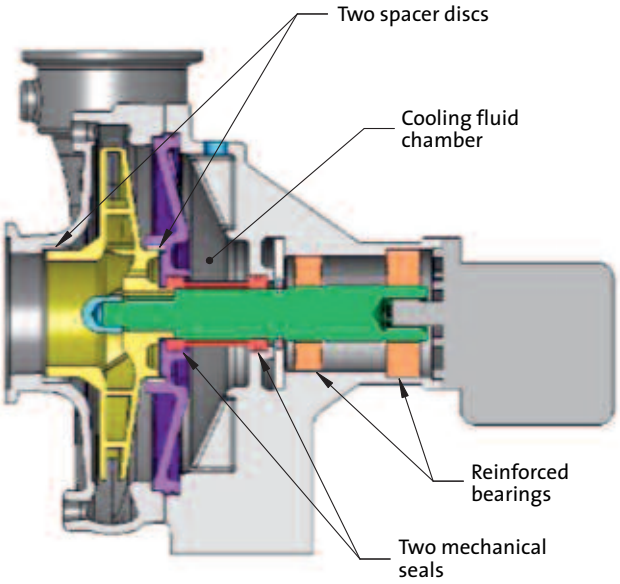
**For tractors/trucks using high volume hydraulic systems an adjustable two-way control valve is available on request.**

FMC-650-HYD
Part no. 11411




| Flow rate hydraulic oil | |
|---|---|
| GPM | l/min |
| 14.3 | 54.2 |
| 13.4 | 50.8 |
| 12.4 | 47.0 |
| 11.2 | 42.4 |

## Centrifugal pumps with wet sealing



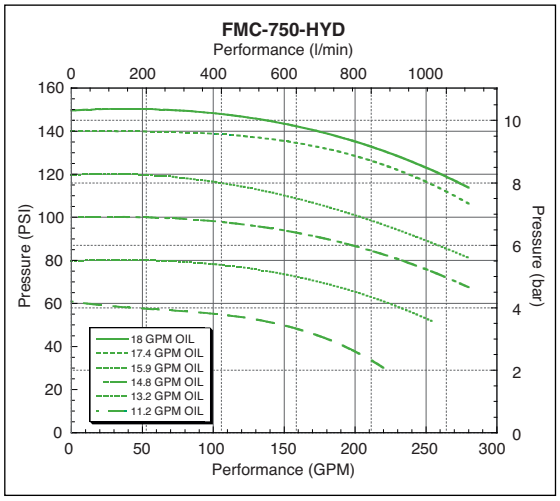

NEW

Instead of a regular pump shaft seal this pump type features a pressurized chamber filled with a cooling fluid and two opposing mechanical seals. In case of running the pump dry, the cooling fluid will lubricate and cool the pump shaft seals.

**Characteristics:**

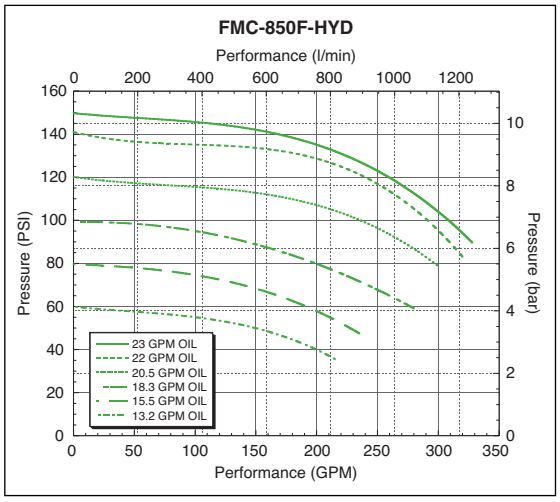
- Special wet sealing prevents pump damage when running dry
- Sealing chamber filled with cooling fluid
- Double spacer disc for best pump performance
- Suction/discharge side with flange type quick connection

FMC-750-HYD
Part no. 11414




| Flow rate hydraulic oil | |
|---|---|
| GPM | l/min |
| 18.0 | 68.0 |
| 17.4 | 66.0 |
| 15.9 | 60.0 |
| 14.8 | 56.0 |
| 13.2 | 50.0 |
| 11.2 | 42.0 |

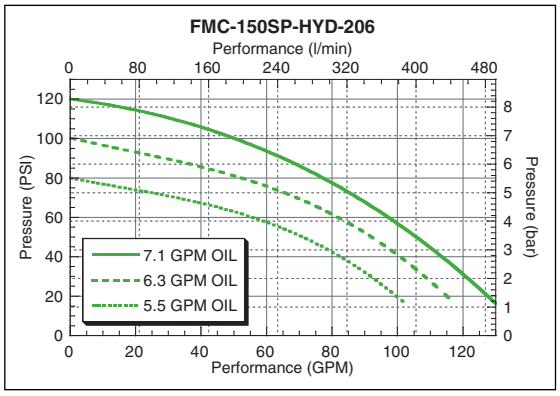
FMC-850F-HYD
Part no. 11413




| Flow rate hydraulic oil | |
|---|---|
| GPM | l/min |
| 23.0 | 87.2 |
| 22.0 | 83.4 |
| 20.5 | 77.7 |
| 18.3 | 69.4 |
| 15.5 | 58.7 |
| 13.2 | 50.0 |

## Self priming centrifugal pumps

FMC-150SP-HYD-206
Part no. 11409




| Flow rate hydraulic oil | |
|---|---|
| GPM | l/min |
| 7.1 | 26.9 |
| 6.3 | 23.8 |
| 5.5 | 20.8 |

# High flow centrifugal pumps 300 PHY and 300 PIHY

## Rugged, self priming centrifugal pumps with hydraulic motor for filling or transfer of large tank volumes

For installation on stationary or mobile transfer units, optional pre-mounted on rugged plastic base plate

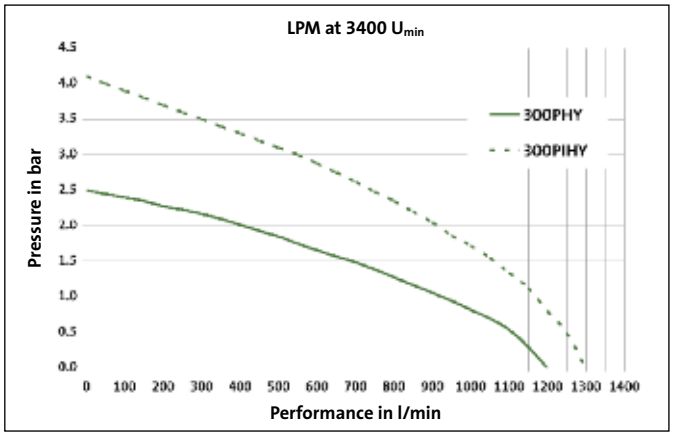
### Technical data pump:

- 3" inlet/outlet threads
- self priming
- 300 PHY: max. flow rate 1200 l/min (flow not restricted)
- 300 PIHY: max. flow rate 1300 l/min (flow not restricted)

### Technical data hydraulic motor:

- max. 49 l/min oil flow
- max. 3400 rpm
- max. 210 bar pressure (13 bar return)

Transfer pump 300 PHY
Polypropylene case
Part no. 11272




Transfer pump 300 PIHY
Cast iron case
Part no. 11273

Operation and regulation valve
Part no. 14450

Rugged strainer for tank filling from open water sources
Part no. 14365

**Contact us for fittings or adaptors to your sprayer.**

# Overview centrifugal pumps

| Part no. | pumpe typ | inlet ∅ NPT** | outlet ∅ NPT** | Hydraulic oil flow l/min | weight kg | tolerates liquid fertilizer | self priming | max. pressure dead end bar at 0 l/min | max. low rate l/min at 0 bar |
|---|---|---|---|---|---|---|---|---|---|
| 11390 | FMC-75-HYD-204 | 1" | 3/4" | 18 | 9.3 | yes | no | 7 | 100 |
| 11391 | FMC-75-HYD-206 | 1" | 3/4" | 20 | 9.3 | yes | no | 7 | 100 |
| 11392 | FMC-HYD-204 | 1 1/4" | 1" | 15 | 12 | no | no | 7 | 350 |
| 11403 | FMC-150-HYD-206 | 1 1/2" | 1 1/4" | 24 | 14 | no | no | 8 | 500 |
| 11412 | FMC-150FS-HYD-206* | 1 1/2" | 1 1/4" | 25 | 14 | yes | no | 8 | 550 |
| 11398 | FMC-200-HYD-210 | 2" | 1 1/2" | 38 | 15 | no | no | 8 | 800 |
| 11411 | FMC-650-HYD | 1 1/2" | 1 1/4" | 53 | 18 | no | no | 11 | 550 |
| 11414 | FMC-750-HYD | F3" | F2" | 68 | 30.4 | no | no | 10 | 1100 |
| 11413 | FMC-850F-HYD | F3" | F2" | 87 | 31 | no | no | 10 | 1250 |
| 11409 | FMC-150SP-HYD-206 | 1 1/2" | 1 1/4" | 27 | 20 | no | yes | 8 | 500 |
| 11272 | 300PHY | 3" | 3" | 49 | 11 | yes | yes | 2.5 | 1200 |
| 11273 | 300PIHY | 3" | 3" | 49 | 54 | no | yes | 4 | 1300 |

*stainless steel ** fittings for flange or NPT ports on request

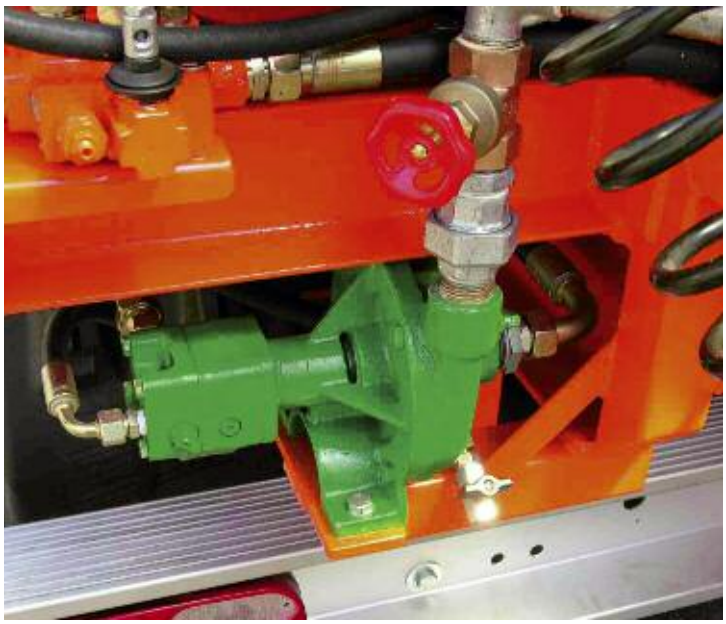
**Notes:**

**Standard centrifugal pumps** are not able to pump air. To prime the pump, the suction side of the pump must be completely filled with liquid. Therefore the pump should be installed at the same level or below the bottom of the sprayer tank. If placed above water level, the suction line must be completely filled with liquid before running the pump. A foot valve at the suction line prevents a reflux after pumping (valves available on request).

**Self priming centrifugal pumps** must be filled with liquid before operation and any time after emptied. When the case is completely filled, this type of pump is able to operate above the liquid surface. Even though a foot valve at the end of the suction line is recommended preventing a reflux of the liquid after operation.

**To prevent high volume centrifugal pumps from damage by water hammer special pressure spike valves are available on request.**

## Mounting arrangements for centrifugal pumps



# Pneumatic control units

NEW

## SeleJet
## Pneumatic on/off and control valves

# SeleJet

NEW

## Quick fit nozzle holders for individual nozzle shut-off with flow-stop

Four-way or two-way nozzle holders with individual pneumatic nozzle shut-off. Diaphragm valve closes by spring load, pneumatic pressure opens the valve (min. 4 bar). Max. pneumatic working pressure 8 bar, pneumatic connection G 1/8" female. **Connection fittings on request.**

### SeleJet 4 Four-way pneumatic nozzle holders

| Part no. | D | F | A | Bar | M | S |
|---|---|---|---|---|---|---|
| 12749 | 20 mm | 10 | SB | 8 | KS | incl. |
| 12750 | 1/2" | 10 | SB | 8 | KS | incl. |
| 12751 | 22 mm | 10 | SB | 8 | KS | incl. |
| 12752 | 3/4" | 10 | SB | 8 | KS | incl. |
| 12753 | 25 mm | 10 | SB | 8 | KS | incl. |
| 12754 | 1" | 10 | SB | 8 | KS | incl. |

### SeleJet 2 Two-way pneumatic nozzle holders

| Part no. | D | F | A | Bar | M | S |
|---|---|---|---|---|---|---|
| 12741 | 20 mm | 10 | SB | 8 | KS | incl. |
| 12742 | 1/2" | 10 | SB | 8 | KS | incl. |
| 12743 | 22 mm | 10 | SB | 8 | KS | incl. |
| 12744 | 3/4" | 10 | SB | 8 | KS | incl. |
| 12745 | 25 mm | 10 | SB | 8 | KS | incl. |
| 12746 | 1" | 10 | SB | 8 | KS | incl. |

**D** = pipe outside diameter

**F** = diameter

**A** = outlet thread
SB = standard bayonet

**Bar** = max. pressure (bar)

**M** = material
KS = plastic

**S** = screw

### Pneumatic valves for nozzle holders

Allows individual control of each nozzle. Boom sections can be divided independently from liquid supply or end nozzles can be operated individually.

Pneumatic shut off valve in plastic, for nozzle holder with diaphragm check valve, mounted in place of the diaphragm check valve.
Connection to air supply (max. 8 bar) by female thread G 1/8",
valve opens with pressure and closes automatically by spring load.

Part no. 14687 Pneumatic valve for nozzle holders, opens with air pressure, Viton® diaphragm

Part no. 14688 Pneumatic valve for nozzle holders, opens with air pressure, EPDM diaphragm

# Pneumatic on/off and control valves

**Advantages of pneumatic valves:**
- Easy installation – simple and secure operation
- Short response time
- Rugged design
- Light weight
- Interface to computerized spray control systems available

## Section valves

Pneumatic section valves to switch off individual boom sections. Due to the light weight and the small dimensions of the valves, they can be installed not only at the sprayer central control unit, but also directly on the boom sections, reducing the length of the hoses.

**Characteristics:**
Max. flow rate 40 l/min at 20 bar pressure
Liquid inlet: male thread G 3/4"; Liquid outlet: female thread G 1/2"
Compressed air: female thread G 1/8"

Part no. 14668 Pneumatic section valve

**Functional description:**
A spring in the cylinder holds the valve open. By air pressure on the piston the valve plate is pushed against the inlet valve seat and the valve shuts off immediately. If the pressure is switched off, the spring pushes back the piston and the valve plate, opening the valve instantly.

## Main valves

Pneumatic control valves for large liquid volumes and for central control of liquid flow, e.g. main boom valve and other high flow applications such as injector pumping, tank mixing and liquid transfer.

**Characteristics:**
see table below

### Main valves

| Part no. | connections * G " | liquid working pressure (bar) | pneumatic working pressure (bar) | max. flow l/min | type ** | mode *** |
|---|---|---|---|---|---|---|
| 14676 | 1 1/4 a x 1 i | 0 – 12 | 3 – 8 | 180 | E | open |
| 14685 | 1 1/4 a x 1 1/4 i | 0 – 12 | 3 – 8 | 250 | E | open |
| 14665 | 1 a x 1 a | 0 – 10 | 5.5 – 7 | 130 | D | closed |
| 14666 | 1 1/2 a x 1 1/2 a | 0 – 10 | 5.5 – 7 | 300 | D | closed |
| 14667 | 2 a x 2 a | 0 – 10 | 5.5 – 7 | 550 | D | closed |

* i = female thread a = male thread
** E = angled valve, inlet front, outlet sideways D = gate valve, inlet and outlet alternating
*** open = valve open without pressure, closed by pneumatic pressure
closed = valve closed by spring load, pneumatic pressure opens valve

## Pressure control valve

The pneumatic pressure control valve allows pressure changes in very short time. This is important in combination with automatic control units for flow rate/ pressure adaptation to variations in application speed.
A delay in the response time of the pressure control valve may lead to incorrect application of the chemical. The pneumatic pressure control valves allow infinite adjustment of the valve response time.
Unlike spring loaded pressure control valves, the air pressure buffers pressure changes due to cut-off or switch-on of boom sections, maintaining the desired pressure.

**Characteristics:**
Max. flow rate 250 l/min at 12 bar pressure
Inlet: male thread G 1 1/4"; Outlet: male thread G 1 1/2"
Compressed air: female thread G 1/8"

Part no. 14660 Pneumatic pressure control valve

**Functional description:**
The adjusted air pressure pushes the piston, on the air side, against the control cone, on the liquid side. The liquid and air pressures are balanced. Increasing the air pressure compels the liquid pressure to rise, the control cone is pushed downwards, reducing the cross section.
However, when only the flow rate of the spray liquid is changed, e.g., when cutting off a boom section, the control cone is pushed upwards, increasing the cross section, but the liquid pressure does not change if the air pressure stays the same.
As the diameter of the piston is larger than that of the valve plate, less air pressure is required to hold against the liquid pressure.
The response time of the valve can be infinitely adjusted using an air flow regulator.

## Mounting arrangement

Pneumatic section valve installed for flushing filter

Pneumatic section valve on a spray boom

## Accessories

12 V air compressor unit with 10 l air storage tank, primed, pressure switch, thermal protection, pressure gauge, on/off switch in rugged body, power cable, ready to use mounted on a frame with carrying handle, max. working pressure 8 bar.

Part no. 14656

Air compressor 12 V, max. 30 l/min aspiration power, 8 bar max. output pressure, oil and maintenance free use, rugged design, consumption max. 18 A, thermal protection switch, short connection cable, without power and safety switches.

Part no. 14657

Compressed air storage tank 10 l, max. 10 bar, steel, primed

Part no. 15721

Kit with mounting brackets and threads for fixing air storage tank

Part no. 15722

Pressure switch for air compressor, on at 5,6 bar, off at 8 bar, connecting thread G 1/4", switch capacity max. 2 A at 12 V

Part no. 14649

**Important note:** to operate the air compressor an additional relay tolerating min. 18 A power input is required.

Part no. 14650 Protection cap for pressure switch

Plug-in fittings for pneumatic hoses 6 mm external, noncorrosive, made from polyacetal and stainless steel

Part no. 14473 angular plug
Part no. 14472 T-plug
Part no. 14638 straight plug with thread G 1/8" on one side

**Other pneumatic fittings and pneumatic hoses on request.**

# General Terms of Business

**§ 1 General Terms – Area of Applicability**

(1) The following terms shall apply to all our consultations, offers, sales, deliveries and services as well as to all present and future legal relationships between our customer and ourselves. Any purchasing terms of our customer that conflict with our terms or the statutory terms either in part or in their entirety are hereby expressly contradicted. Such conflicting terms shall not become part of the contract even if we perform delivery or work without reservations whilst being knowledgeable of conflicting terms.

(2) All agreements concluded between the customer and ourselves for the purpose of performing this contract have been recorded in writing in this contract. No additional verbal agreements exist. Any agreements deviating from these terms in individual cases, especially with our commissioned agents, shall only be valid provided that they are confirmed by us in writing.

**§ 2 Offer/Prohibition of Assignment**

(1) Our offers shall always be without engagement. Contracts, also those entered into at trade fairs and by our commissioned agents, shall not come into force until our written order acknowledgement has been received by our customer. Should the order qualify as an offer in keeping with § 145 of the Civil Code (BGB), we may accept it within two weeks. The nature of the object of the contract shall be described exclusively in our offers, order acknowledgements and pertinent documents. This shall not constitute a guarantee in the sense of § 443 of the Civil Code (BGB) however.

(2) Our customer shall not be entitled to assign or transfer to third parties any rights or obligations ensuing from these business relations without previously obtaining our written consent. This shall also apply to claims that he is entitled to enforce on us on the grounds of a statutory regulation.

**§ 3 Prices – Terms of Payment**

(1) Provided that nothing to the contrary is stated on the order acknowledgement, our prices shall be valid "ex works" and excluding packaging. This shall be invoiced separately.

(2) Our prices do not include statutory value added tax; it shall be stated on the invoice separately in the amount legally applicably on the day the invoice is issued.

(3) The deduction of cash discount shall be subject to a special written agreement.

(4) Provided that nothing to the contrary is stated on the order acknowledgement, the purchasing price shall be due for payment net (without discount) within 30 days of the date of the invoice. The statutory regulations shall apply with regard to the consequences of default in payment.

(5) Payments by bill of exchange or cheque shall only be accepted on account of performance and subject to special agreement. In any event, discounting and bill charges shall be borne by our customer.

(6) Should there be any changes in calculation criteria subsequent to the conclusion of the contract as a result of higher wages and material costs, an increase in turnover tax or other circumstances, particularly technically justified calculation amendments, we shall be entitled to increase the contractually agreed price at a reasonable proportion to the change in calculation criteria that has arisen. This shall also apply to call-up orders.

(7) Our customer shall only be entitled to set-off rights provided that his counterclaims have become res judicata, are undisputed or have been recognised by us.

**§ 4 Delivery Period**

(1) The commencement of the delivery period stipulated by us shall be subject to the clarification of all technical questions.

(2) Compliance with our delivery obligations shall be subject to the punctual and correct fulfilment of obligations on the part of our customer. We hereby reserve the right to a defence of non-performance of the contract.

(3) Should the customer be in default of acceptance or should he culpably violate any other cooperation obligations, we shall be entitled to demand reimbursement for damages thus incurred to us including any extra expenses. We hereby reserve the right to any further claims.

(4) Should the prerequisites as stipulated in Paragraph (3) exist, the risk of accidental loss or accidental deterioration of the purchased item shall be assumed by the customer from the point in time at which the customer defaults in acceptance or is in debtor's default.

(5) We shall be liable in keeping with the statutory regulations provided that the underlying purchase agreement is a transaction for delivery by a fixed date in the sense of § 286 Paragraph 2 No. 4 of the Civil Code (BGB) or of § 376 of the Commercial Code (HGB). We shall also be liable in keeping with the statutory regulations should, as a result of default in delivery for reasons for which we are responsible, the customer be entitled to claim a loss in interest concerning the continued fulfilment of the contract.

(6) We shall also be liable in keeping with the statutory regulations should default in delivery ensue from an intentional or grossly negligent violation of the contract for which we are responsible. Should the delivery contract not ensue from an intentional violation of the contract for which we are responsible, our liability for damages shall be limited to the foreseeable damages that typically occur.

(7) We shall also be liable in keeping with the statutory rights should the default in delivery for which we are responsible ensue from the culpable violation of a major contractual obligation. In this case, however, our liability for damages shall be limited to the foreseeable damages that typically occur.

(8) Furthermore, in the event of default in delivery, we shall be liable by way of a lumpsum default compensation amounting to 3% of the delivery value for each complete week of default up to a maximum of 15% of the delivery value however.

(9) The customer hereby reserves the right to any further statutory claims and rights.

**§ 5 Transfer of Risk – Packaging Costs**

(1) Unless anything to the contrary is stated in the order acknowledgement, delivery is agreed "ex works".

(2) With the exception of pallets, transport packaging and any other packaging subject to the Packaging Ordinance shall not be taken back. Our customer shall be obliged to dispose of the packaging at his own expense.

(3) If requested by the customer, we shall take out transport insurance cover for delivery. Costs thus incurred shall be assumed by the customer.

**§ 6 Liability for Defects**

(1) The agreed nature of the object of the contract to be provided by us is based exclusively on the contractual agreements with our customer and not on any publicity statements, brochures, consultations or information of a similar nature. The assumption of a guarantee, e.g. in the sense of § 443 of the Civil Code (BGB) is not associated with this.

(2) We provide consultation to the best of our knowledge and on the basis of our experience to the exclusion of any form of liability however. Any details and information on suitability and use or application of the object of the contract shall be without engagement unless such information expressly constitutes an agreed characteristic in the sense of Paragraph (1). Such information shall not release the customer from his obligation to perform his own checks.

(3) With regard to purchases, we shall be liable for defects as follows to the exclusion of further claims:

(a) Our customer shall be obliged to check the object of the contract conscientiously and without delay upon receipt and to perform spot checks if necessary. Claims in respect of any obvious defects must be stated in writing and specified immediately after receipt and prior to use of the object of the contract, within 8 days of receipt at the latest however. In the event of a complaint, the customer shall still be obliged to accept the object of the contract and store it duly. It may only be returned at our express request.

(b) Claims in respect of any defects that cannot be established at first despite thorough checks must be made on us in the same way immediately upon their discovery. Should complaints not be made in due form or within the specified time, the object of the contract shall be regarded as having been approved.

(c) Our customer must provide our commissioned agents with the opportunity to view and inspect the object of the contract about which a complaint has been made. All guarantee claims shall otherwise be forfeited.

(d) As of despatch, we provide a 1-year guarantee for perfect material and due manufacturing unless a longer guarantee period is stipulated by imperative legal provisions.
(e) We shall not provide a guarantee in the event of improper use or handling of the object of the contract. Guarantee claims shall also be forfeited in the event of damage to or destruction of the object of the contract as a result of improper handling or storage subsequent to the transfer of risk. Notwithstanding the information and guidelines we have included in the contract, guarantee claims of any nature on us shall be forfeited.
(f) Deviations in dimensions and material usual in commercial practice and/or resulting from manufacturing shall not constitute entitlement to complain about the object of the contract. If available, DIN norms and our works norms shall apply with respect to allowable variations.
(g) We shall eliminate defects by carrying out improvements or providing a replacement delivery at our discretion. Our customer must grant us a reasonable period of time and opportunity to eliminate defects. Should we be denied this, guarantee claims of any nature on us shall be forfeited. Should several attempts to perform fulfilment retroactively prove unsuccessful, our customer may rescind the contract or demand a price reduction. Any further claims on us or our commissioned agents are hereby excluded regardless of their legal basis unless we act at least gross negligently or unless personal injury is caused.
(h) No guarantee shall apply for items made to specification in keeping with our customer's information, calculations or construction documents should complaints ensue from them.
(i) The orderer's claims ensuing from any defects shall be subject to his having duly fulfilled his inspection and complaint obligations as stipulated in § 377 of the Commercial Code (HGB).

**§ 7 Total Liability**

(1) Any liability to provide compensation in excess of that provided for in § 6 is hereby excluded regardless of the legal nature of the claim enforced. This shall particularly apply to compensation claims ensuing from negligence upon the conclusion of the contract or in respect of other obligation violations or claims in tort to the reparation of material damage in keeping with § 823 of the Civil Code (BGB).
(2) Should our liability to provide compensation be excluded or limited, the same shall apply with respect to the personal liability to provide compensation of our salaried employees, employees, assistants, representatives and of persons employed in the performance of obligations.

**§ 8 Assurance of the Reservation of Title**

(1) We hereby reserve our title to the purchased item until all payments ensuing from the delivery contract have been received. In the event of conduct in breach of the contract on the part of our customer, particularly in the event of default in payment, we shall be entitled to regain possession of the purchased item. Our regaining possession of the purchased item shall not constitute rescission of the contract unless we issue an express written declaration to this effect. The attachment of the purchased item by us shall always constitute rescission of the contract. Upon taking back the purchased item, we shall be entitled to utilize it. The proceeds of such utilization shall be set off against the customer's obligations subsequent to the deduction of reasonable utilization costs.
(2) The customer hereby undertakes to handle the purchased item with care and, in particular, he hereby undertakes to take out at his own expense adequate insurance cover for the purchased item at replacement value against damage caused by fire, water and theft. Should maintenance and inspection work be necessary, the customer must perform such work in good time and at his own expense.
(3) In the event of the attachment of property or other forms of intervention by third parties, the customer must notify us accordingly in writing and without delay in order to enable us to institute legal proceedings in keeping with § 771 of the Code of Civil Procedure (ZPO). Should the third party not be in a position to reimburse us for judicial and extra-judicial costs in accordance with § 771 of the Code of Civil Procedure (ZPO), the customer shall be liable for such costs incurred to us.
(4) The customer shall be entitled to sell the purchased item in the due course of business. However, he hereby assigns to us all claims amounting to the final invoice amount (including VAT) of our claim that he gains on his customer or third party due to resale irrespective of whether the purchased item is resold without or subsequent to processing. The orderer shall still be entitled to collect this claim subsequent to assignment. Our entitlement to collect the claim ourselves shall remain unaffected by this. However, we hereby undertake to refrain from collecting the claim as long as the customer meets his payment obligations from the collected proceeds, does not default in payment and, in particular, does not petition the institution of bankruptcy, composition or insolvency proceedings and provided there is no suspension of payments. Should this be the case, however, we shall be permitted to demand that the customer provides us with information on the assigned claims and their debtors and with all the details required for collection and that he issues to us the pertinent documents and informs the debtors (third parties) of the assignment.
(5) The customer shall always process or transform the purchased item for us. Should the purchased item be processed with other objects not belonging to us, we shall acquire co-ownership of the new item at a ratio of the value of the purchased item (final invoice amount including VAT) to the other processed objects at the time of processing. Furthermore, the same terms that apply to the purchased item delivered under reservation shall apply to the item created by processing.
(6) Should the purchased item be mixed inseparably with other objects not belonging to us, we shall acquire co-ownership of the new item at a ratio of the value of the purchased item (final invoice amount including VAT) to the other mixed objects at the time of mixing. Should mixing entail the customer's item being regarded as the main item, it is hereby agreed that the customer shall assign co-ownership to us on a prorata basis. The customer shall safekeep the sole ownership or co-ownership thus ensuing for us.
(7) The customer shall also assign to us the claims that secure our claims on him and that can be enforced on a third party due to the combination of the purchased item with a plot of land.
(8) At the customer's request, we hereby undertake to release securities to which we are entitled provided that the realizable value of our securities exceeds the claims to be secured by more than 10 %. We shall select the securities to be released at our discretion.

**§ 9 Protected Privileges and Tools**

(1) We hereby reserve our title and copyrights on illustrations, drawings, calculations and other documents. This shall also apply to any written documents described as "confidential". Prior to forwarding such documents to third parties, the customer shall require our express written consent.
(2) Should we make deliveries in keeping with details, drawings, models and samples from our customer or using parts supplied by our customer, he shall be liable for the violation of any protected privileges of third parties. Our customer shall release us from all claims made by third parties and provide compensation for any damages incurred. Should a third party prohibit us from manufacturing or delivering making reference to a protected privilege owned by him, we shall be entitled to cease work without checking the legal situation. Our customer shall assume the costs of any legal proceedings.
(3) Tools required to manufacture the delivered object and made by us shall remain our property even if our customer is charged pro rata costs for such tools.

**§ 10 Place of Jurisdiction – Place of Fulfilment**

(1) Should the customer be a merchant, the place of jurisdiction shall be at the location of our registered offices. However, we shall also be entitled to bring an action against the customer at the court located at his place of residence.
(2) The law of the Federal Republic of Germany shall apply. The validity of the UN-Convention on Contracts for the International Sale of Goods is hereby excluded.
(3) Unless anything to the contrary is stated on our order acknowledgement, the location of our registered offices shall be the place of fulfilment.



**Bank account:** **Sort code: 75070013** **IBAN no.: DE53750700130395590300**
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agrotop GmbH · Köferinger Straße 5 · 93083 Obertraubling (Germany)
Telefon +49 (0) 94 53 / 99 38-0 · Telefax +49 (0) 94 53 / 99 38 45
E-Mail info@agrotop.com · Internet www.agrotop.com