NutriJet

Product description

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NutriJet

Contents

About this product description

This product description relates to the NutriJet, a compact and affordable fertiliser dosing unit. The principle, structure and operation of the dosing unit are discussed here. Use this product description to select the configuration of the fertiliser dosing unit. This product description also deals with the preconditions for installation and use of the NutriJet

Availability

This document is available in the following formats:
- as a paper document;
- as a PDF document on Dealernet AGRO of Priva: www.priva.nl.

Documentation

The following documentation on the NutriJet is available:

- product description *NutriJet*
- price list *NutriJet Connext, Intégro & Maximizer*
- manual *Operating NutriJet*
- manual *Installing and operating NutriJet*

The Priva process computers which can be used to control the NutriJet Substation have their own manuals. Furthermore, there are separate manuals for various system components, such as sensors.

Explanation of symbols in this document

Safety warning: danger of physical injury or damage to the product, the installation or the environment.

Caution

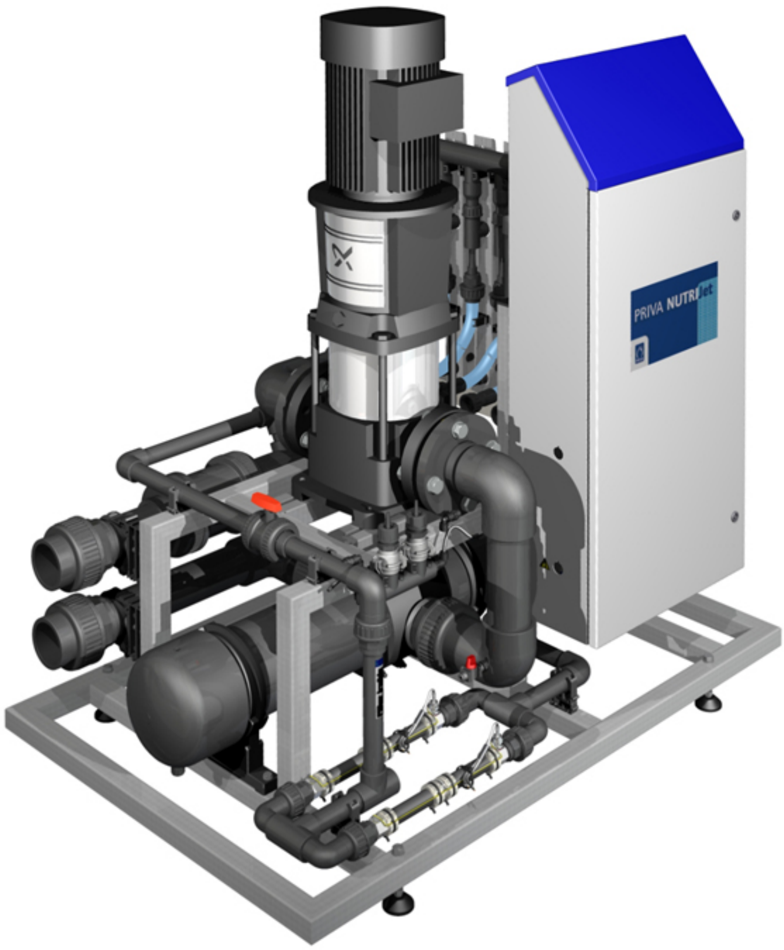
Information

Tip

Introduction

Accurate dosing

The NutriJet is a fertiliser dosing unit for the horticulture industry which produces an optimum mixture of supply water with fertilisers dissolved in water. The NutriJet has been developed in accordance with modern industrial design methods. The result is a revolutionary and attractive dosing system at an reasonable price. The NutriJet allows growers anywhere in the world to use an EC and pH controlled fertiliser dosing system.



NutriJet with system pump and supply pump

Multifunctional

The NutriJet fulfils various functions:

- NutriJet Inline: dosing and mixing fertilisers with supply water to form homogeneous irrigation water and pumping this irrigation water to the crop;
  NutriJet Bypass: dosing and mixing of fertilisers with water from the main line and returning this water to the main line, where further mixing takes place to form homogeneous irrigation water;
- correcting the pH value of the irrigation water.

For each irrigation system

The NutriJet can work with irrigation systems for both covered crop and outdoor crop. It can be connected to the following irrigation systems:

- overhead irrigation systems;
- dripper systems;
- ebb and flow systems (only with Priva Connext or Intégro process computer).

Another use for the NutriJet is filling tanks or silos with day stocks. From these silos the irrigation water can be distributed to the crop departments using separate pumps and irrigation valves.

For greater operational safety, the production of the irrigation water can be spread across two or more fertiliser dosing units. In this way, in the event of failure in one of the units, the crop can still be supplied with the minimum amount of irrigation water and crop damage is limited.

Optimum mix

The NutriJet can dose a maximum of 5 (NutriJet 300) or 10 (NutriJet 600) solutions (fertiliser, acid or lye) at one time. The dosage channels of the NutriJet have been constructed such that the required quantities can be dosed with a high degree of accuracy and uniformity. The result is stable, homogeneous irrigation water with the desired mixing ratio of fertilisers. This water is pumped by the system pump to the crop through one or more irrigation lines and irrigation valves (NutriJet Inline) or is injected into the main line (NutriJet Bypass).

The NutriJet can be used for two fertiliser mixing principles:

- The A+B principle where equal quantities of solutions A and B are dosed. This principle is generally used for full soil and substrate cultivation and for potted plants.
- The ABC principle where various fertilisers (for instance nitrogen, phosphates and potassium) are dosed with adjustable ratios. This principle is often used at an international level for potted plants.

With both principles, a nominal dilution of 1:100 (fertiliser:water) in the fertiliser stock tanks is assumed.

The NutriJet is fitted with double EC and pH sensors to measure the conductivity (and therefore the fertiliser concentration) and the acidity of the irrigation water and to adjust it to the desired EC and pH value. This ensures optimal growing conditions for the plants.

Environmentally-friendly

To avoid any waste of valuable water and the dissolved fertilisers that it contains, the NutriJet (only with Connext or Intégro process computer) can, if required, mix drain water with clean supply water via an EC pre-control valve. This makes an average saving of 30-40% on water and fertilisers possible. At the same time, it avoids unnecessary pollution of the environment.

The EC pre-control valve, the associated additional components and the installation work must be added by the dealer or contractor. Refer to System overview (page 9).

Pumps for every situation

Every NutriJet fertiliser dosing unit is equipped with a system pump. The unit is available with a range of different pumps, depending on the capacity, water pressure, mains voltage and mains frequency. System pumps are available for a mains frequency of 50 and 60 Hz with different 3-phase mains voltages with or without neutral. System pumps of 4 kW and higher are fitted with a softstarter.

See also Pump characteristics NutriJet Inline (page 29) and the price list.

Computer-operated

The control software operates and verifies the fertiliser dosing process. The software allows a range of fertiliser recipes to be input, with the EC and pH value adjustable according to your requirements.

The NutriJet is delivered as a substation. This means that the unit is remotely controlled using a Priva process computer (Connext, Intégro or Maximizer). Furthermore, the process computer controls other parts of the system, such as climate control (heating and ventilation), the energy centre and CO_2 dosing.

Capacity

Pump capacity

Operating pressure

Usually, the nominal operating pressure of the system pump is 2.5 to 4.0 bar. This pressure is necessary, amongst others, to drive the venturi's in the dosing channels.

The maximum permissible pressure is 7.0 bar. In the event that a pump is installed with too high a capacity and pressure, there is a risk of leaks and damage to the fertiliser dosing unit. In addition, the electrical power consumption will be unnecessarily high.

Maximum dosing capacity

The maximum dosing capacity of the dosing channels is 300 l/h or 600 l/u per channel (depending on the type of dosing chanel) at a minimum drive water pressure of 2.0 bar on the venturi (NutriJet Inline) or a minimum pressure difference of 2,0 bar over the venturi (NutriJet Bypass). The dosing capacity is almost independent of the drive water pressure or pressure difference over the venturi as long as the drive water pressure of the pressure difference is 2.0 bar at minimum. A typical dose is 1 l fertiliser solution per 100 l of irrigation water. There are also other types of dosing channels, having other maximum dosing capacities (refer to Technical specifications - dosing channels (page 25)).

To obtain a higher dosing capacity for a particular fertiliser solution, it is, of coarse, possible to apply multiple dosing channels for this fertiliser solution. To connect multiple dosing valves to an output of the I/O board, solid state relays must be added.

Accuracy of the dosing channel at a low dose

If the dosing with a dosing channel is less than 10 % of the maximum dosing capacity, the dosing accuracy will decrease. This is caused by the fact that the viscosity and specific mass of the fertiliser solutions, line resistance and fluid level in the fertiliser tanks plays a role at such low flow rates. In such cases, the following solutions can be applied:

- Dilute the fertiliser solution, for example so that it the dosing ratio will be 2 l of fertiliser solution to 100 l of irrigation water (2:100 instead of the usual 1:100).
- Let the engineer adjust the restriction screw of the dosing valve so as to reduce the maximum capacity (a dosing channel doses accurately between 10 and 100 % of the maximum flow rate. By decreasing the maximum flow rate, the minimum flow rate is decreased as well).

If, during design of the installation, it is already clear that low flow rates will (also) be applied, it is better to install low volume dosing channels for this. Consult Priva on this.

Pump capacity and volume of drive water

The following applies to a NutriJet Inline:

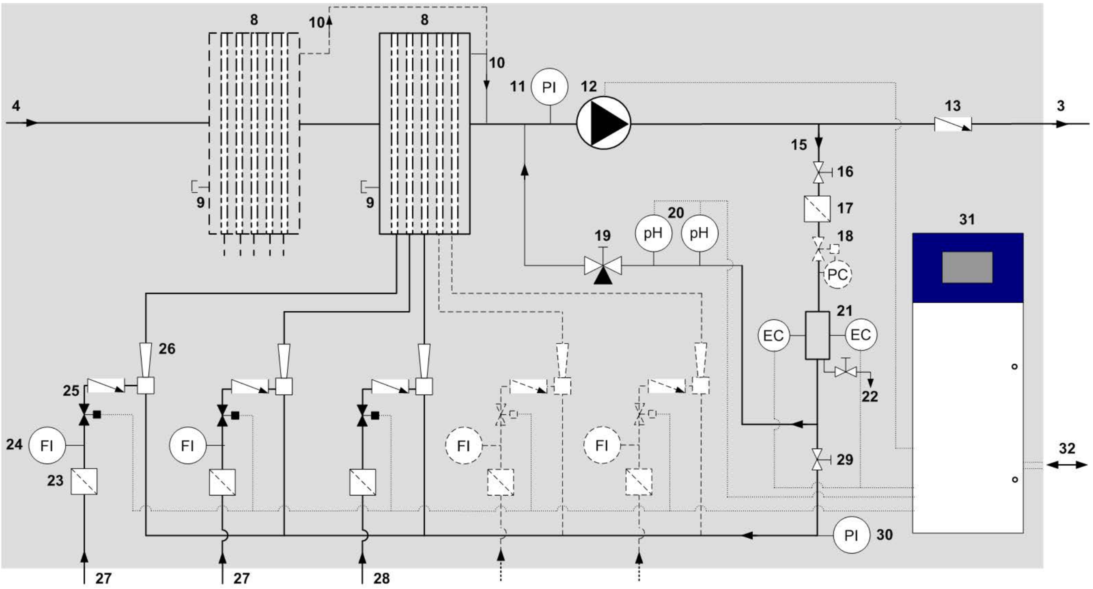
- A part of the capacity of the system pump is used to deliver drive water to the venturi's of the dosing channels. Therefore the net capacity of the unit is less than the gross capacity of the system pump, depending on the number of venturi's.
- The drive water flow rate also depends on the system pump pressure. At a higher pressure, the flow rate is higher. A typical drive water flow rate is 560 l/h (for a 300 l/h dosing channel with a Ø 2.7 mm nozzle) or 1250 l/u (for a 600 l/u dosing channel with a Ø 4.0 mm nozzle) per venturi at a system pump pressure of 3.0 bar. Besides, other types of dosing channels using other drive water flow rates are possible (see price list).
- In the net capacity curves (see Pump characteristics (page 28)), the capacity of the unit (= net pump flow rate) is shown versus the pump pressure, taking into account the drive water consumption of a typical number of venturi's with nozzles of Ø 2,7 mm or Ø 4,0 mm.

In case of a NutriJet Bypass, the system pump delivers its total flow to the main line, so that a net and gross pump flow rate are not distinguished. The irrigation capacity is not primarily determined by the system pump, in this case.

Furthermore refer to Technical specifications - general (page 16) and Technical specifications - dosing channels (page 25).

System overview

Scope of delivery



Graphic of the NutriJet Inline

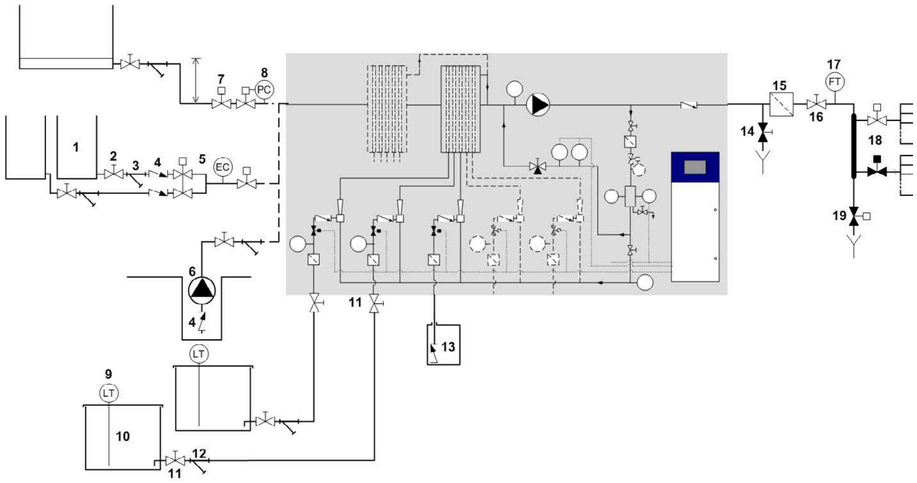
(The scope of delivery consists of the components within the grey section. The components shown with a dashed line are optional. The figure, including the numbers outside the grey section, is explained further in the chapter Operating principle (page 12).
The NutriJet Bypass has (almost) the same components, but a different course of the water. See also NutriJet Bypass (page 14)).

A NutriJet fertiliser dosing unit consists of the following components:

No.[1)]	Component
-	pressure reducing valve (1 or optionally 2, only NutriJet Bypass, see number 7 in the Graphic of the NutriJet Bypass fertiliser dosing unit in the section Operating principle (page 12))
8 and 9	mixing chamber with drain point (1 or optionally 2)
11 and 30	manometers
12	system pump
13	non-return valve
16 and 29	manually operated valves
17	dirt filter
18	pressure reducing valve (optional)
19 and 22	drain points
20	2 pH sensor holders with pressure-resistant pH sensors
21	2 EC sensors
23, 24, 25 and 26	a maximum of 5 or 10 dosing channels (for 1 or 2 mixing chambers respectively), each with a venturi (26), dosage valve (25) with non-return valve, dirt filter (23) and rotameter (24, optional) (there are also 'double dosing channels': these have 1 venturi, but occupy the space of 2 dosing channels)
31	control panel (without process computer)

[1)]Only the numbers that relate to the scope of delivery

Required components outside the scope of delivery



Graphic of the environment of the NutriJet Inline

(The components for a bypass configuration are similar. In that case, the components for the water supply and water distribution are not connected to the unit, but to the main line. The main line has its own pump and non-return valve).

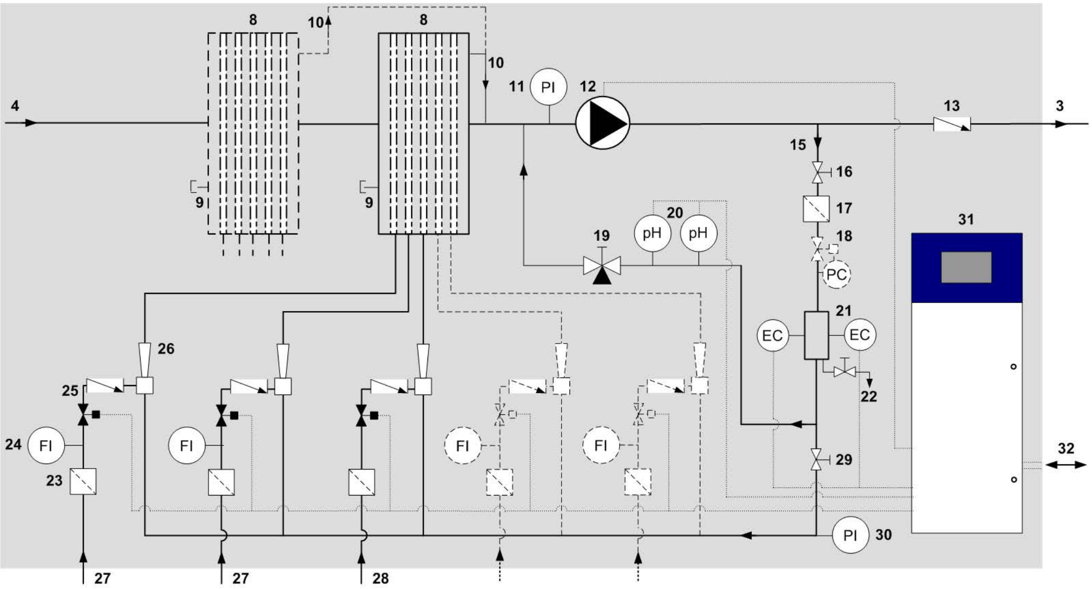
In addition to the NutriJet, other components are required in order to implement an irrigation system. Which components these are depends on the configuration of the irrigation system. Typical components include the following:

No.	Component	Explanation
Water supply		
-	pre-treatment of supply water	If the supply water contains more than 0.5 mmol/l bicarbonate, it must be pre-treated with acid (see Supply water quality (page 42)).
1 and 2	silos or tanks with manually operated valve	There can be multiple tanks or silos (1) with supply water, for instance a tank for drain water and a tank for fresh water. For maintenance or in the event of problems, make sure that the water supply can be shut off with a manually operated valve (2).
3	dirt filters or filters	Prevent blockages by installing a dirt filter or filter in the supply water line(s).
4	non-return valves in the supply water lines	If water is used from more than one tank or silo, water must be prevented from flowing from one tank to another by means of non-return valves.
5	EC pre-control or flow ratio control	On account of the high EC value of drain water, this water can only be reused as irrigation water by mixing it with fresh water (low EC value). The NutriJet (only with Connext or Intégro process computer) may control an EC pre-control valve for this purpose, based on an EC measurement of the mixed water. This EC pre-control ensures that the supply water has a constant EC value. In a similar manner, a flow ratio control may also be implemented with which water from different tanks is mixed in a specific ratio.
6, 7 and 8	supply pump and supply valve	The capacity of the supply water must be at least equal to and preferably slightly greater than the net capacity of the system pump. The pressure must be 2.5 - 7 bar. If the supply water does not intrinsically already have sufficient static pressure, a supply pump (6) is required. If the supply water intrinsically already has sufficient pressure, an electric supply valve (7) is required. The supply pump or supply valve may be controlled from the NutriJet. If the pressure is too high, a pressure reducing valve (8) must be installed in addition to the supply valve.
Supply of fertilisers and acid or lye		
9, 10 and 13	stock tanks for fertilisers (10) and acid or lye (13)	In the case of the A+B mixing principle, a NutriJet (only with Connext or Intégro process computer) can control the dosings in such a way that the level in the fertiliser tanks falls equally ('balance level control'). For this purpose, the fertiliser tanks must be fitted with level sensors (9). See also Fertiliser supply (page 47)

No.	Component	Explanation
11	manually operated valves	For maintenance or in the event of problems, make sure that the supply of fertilisers and acid or lye can be shut off with a manually operated valve, in any case on the side of the stock tank, but preferably also on the side of the NutriJet.
12	dirt filters or filters	Although the 300 or 600 l/hr dosing channels of the NutriJet are already equipped with a dirt filter, (finer-mesh) filters must also be installed, preferably both on the side of the stock tank and on the side of the dosing channel. Preferably install extra valves to enable flushing of the filter.
Distribution of irrigation water		
-	light measurement and external start contact	The preparation of irrigation water and its distribution to the crop can be started and stopped based on various criteria. One of the possibilities is to influence the start time according to the intensity of the sunlight. A light sensor can be connected for this purpose. The NutriJet can also be (manually) started via an external start contact.
14 and 16	valves to enable draining	It is advisable to fit valves with which, during the adjustment of the NutriJet or in the event of problems, the irrigation water can be drained to the sewer or to a discharge tank, instead of to the crop.
15	filter	Install a sand filter or screen filter to prevent blockages in the distribution network. See also Filters (page 45).
17	flow sensor	The quantity of irrigation water to the crop is controlled and monitored with a paddle wheel flow sensor ('litre counter'). For each valve section, a certain quantity can be measured out and the dosing control can anticipate changes in the flow, so that the desired quality of irrigation water is quickly available. A flow sensor is necessary for the operation of both the NutriJet Inline and the NutriJet Bypass.
18	irrigation valves	The irrigation valves (electric diaphragm valves) can be controlled from the hardware of the NutriJet. Ensure that the flow in the various valve sections is as equal as possible and is in line with the capacity of the system pump.
19	rinse valve	The NutriJet (only with Connext or Intégro process computer) can control an electric rinse valve at the end of the main irrigation line to flush the line in the event of a recipe change.

Operating principle

NutriJet Inline



NutriJetInline fertiliser dosing unit diagram

(The components within the grey area are standard supplied components. Optional components are drawn with a dashed line.)

Mixing chamber

The system pump (12) pumps the water from the supply line (4) through the mixing chamber(s) (8), through a non-return valve (13) to the crop (3). A part of the water flows to the branch (15) with the dosing channels.

To degas the mixing chamber, a degas line (10) has been made in the mixing chamber. Through the drain point (9) the mixing chamber can be emptied. A visual check of the suction pressure can be done by means of the manometer (12) after the mixing chamber.

The inline dirt filter (17) in the branch (15) prevents the venturi nozzles of the dosing channels from being blocked. The optional pressure reducing valve (18) on the branch controls the pressure of the water to the dosing channels. A visual check of the drive water pressure before the venturi's can be done by means of the manometer (30) on the branch.

The water in the branch (drive water) flows through the venturi's of the dosing channels (26). The nozzles in the venturi's create a vacuum which sucks in fertilisers (27) and acid or lye (28). Dosing valves (25) with built-in non-return valves have been installed just before the venturi's in the fertiliser lines, acid lines or lye lines. The control software controls the dosing valves pulsating on the basis of a recipe and EC and pH measurements. The open and closed time of the dosing valves determine the flow rate of fertiliser, acid or lye that on average is being dosed.

A mixing chamber has 5 connections for dosing channels. Therefore, with a second mixing chamber 10 connections are possible at maximum. Utilization of all connections is not compulsory. Afterwards not utilized connections still can be equipped with a dosing channel.

Dosing channels

The fertiliser line of a dosing channel contains a filter (23) for filtering the fertiliser solution. A rotameter (24) can be present with which the fertiliser suction can be monitored and dosing valves can be adjusted. The adjustment of dosing valves is especially important for fertiliser solutions and not so much for acid or lye solutions. As a consequence of this and other factors a dosing channel for acid and lye usually does not contain a rotameter.

A dosing channel for acid or lye may be identical to a dosing channel for fertilisers. However, when using concentrated acid or lye the flow rate of acid or lye is (much) smaller than the flow rate of fertilisers. Therefore a 38 % acid dosing channel can be selected when using acid or lye. In this dosing channel another type of dosing valve and other materials are used.

For fertilisers or other chemical substances that need a small flow rate (less than 8 l/h) low volume dosing channels can be used. The operating principle of these dosing channels and other dosing channels are the same, except they use another type of dosing valve with a specific dosing restriction, they lack a filter and they are constructed from other materials.

If selection between two fertiliser tanks per dosing channel must be possible, double dosing channels can be used. This type consist of two dosing channels (also occupying two dosing channel positions), side by side with one joint venturi. The fertiliser tank is selected by activating either the dosing valve on the left or the dosing valve on the right. By means of an adjustment of the drive circuit of the dosing valves it is also possible to use both dosing valves at the same time to achieve a higher capacity (however less than double capacity). The advantage of a double dosing channel compared to two single dosing channels is that only one venturi is needed as a result of which the initial costs are less. In addition, less drive water is flowing. A lesser amount of drive water can sometimes mean that the use a pump less powerful and thus cheaper (with respect to initial costs and energy costs) is possible.

EC and pH sensors

The electrical conductivity (measure of fertiliser concentration) of the irrigation water is measured by means of EC sensors (21) on the branch. The pH sensors (20) measure the pH value of the irrigation water. The pH-sensors are in a sensor holder that is connected to the branch with a thin line to prevent the pump pressure from interfering.

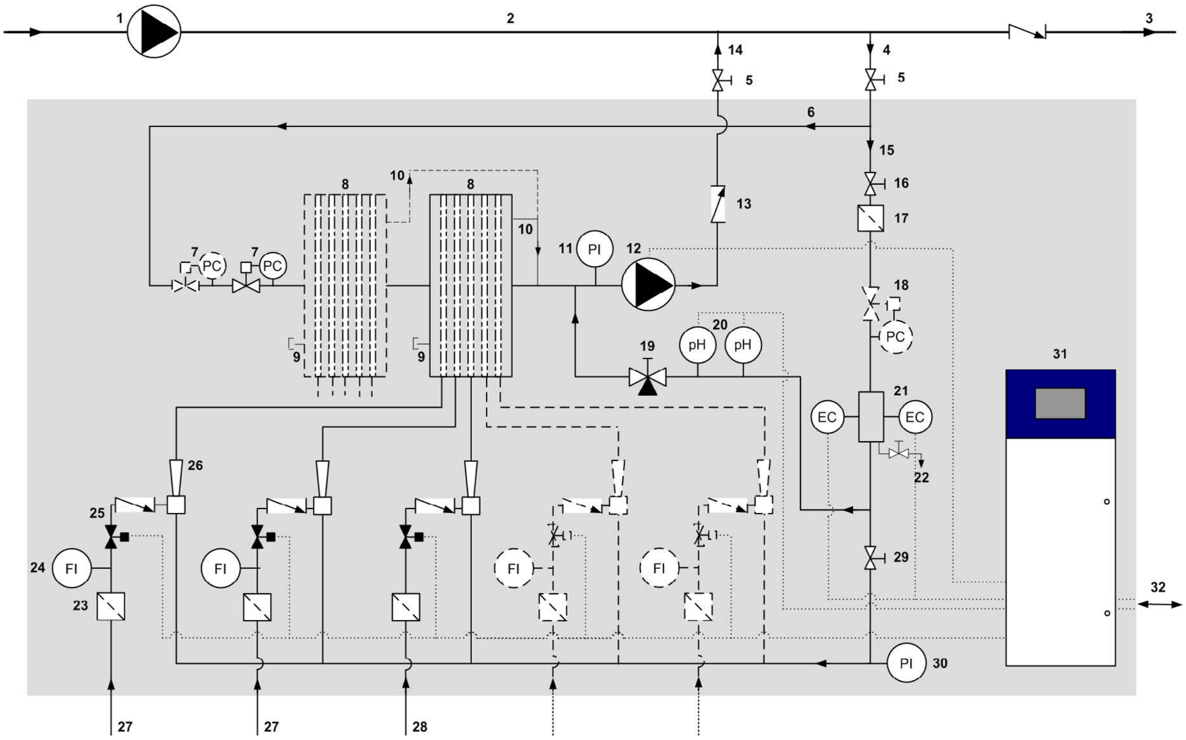
Using 2 EC sensors and 2 pH sensors, the control software can compare the measurements of the 2 sensors. If the measurements differ too much, the control software will indicate that one of the sensors does not work (properly) and will stop the unit to prevent crop damage. While awaiting maintenance or sensor replacement carry on working with the other sensor is temporarily possible. In that case, the user himself must keep an eye on the proper functioning of the remaining sensor (otherwise crop damage may still occur!)

To be able to safely disassemble the sensors, during maintenance for example, the line between the hand-valves (16 and 29) can be isolated using these hand-valves. In addition, the line can be depressurized using the drain valves (19 and 22) near the pH and EC sensors. These drain valves can also be used to empty the line, if the unit is taken out of operation for some time in the event of frost for example.

Cabinet

The unit does not have a built-in process computer, but is a substation of the process computer that has been set up elsewhere. The process computer communicates with the electrical components in the cabinet (31) through the (Connext or Intégro) network or by means of direct I/O connections (Maximizer). Depending on the unit model, various other connections (32) can be present in the cabinet, for instance connections for mains voltage, irrigation valves, a flush valve and sensors.

NutriJet Bypass



NutriJetBypass fertiliser dosing unit diagram

(The components within the grey area are standard supplied components. Optional components are drawn with a dashed line.)

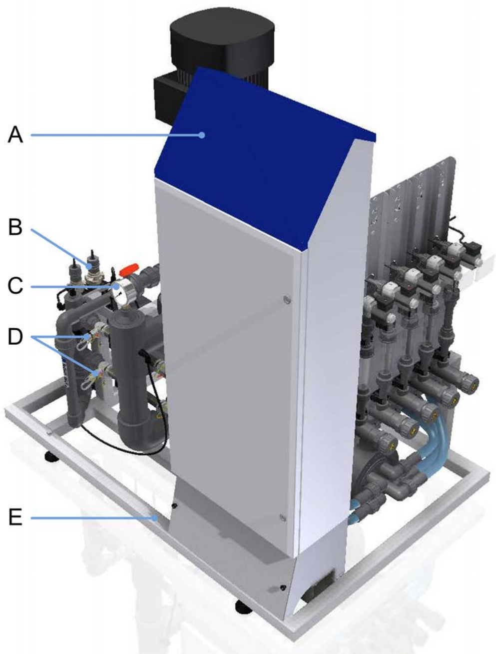
An external pump (1) pumps the water through the main line (2) to the crop (3). The system pump (12) pumps water from the main line through the supply line (4), the bypass line (6), the mixing chamber(s) (8), a non-return valve (13) and the outlet line (14) back to the main line (1). A part of the water flows to the branch (15) with the dosing channels.

Two pressure reducing valves (7) in the bypass line control the suction pressure of the (first) mixing chamber. The pressure reducing valve (18, optional) on the branch (15) controls the pressure of the water to the dosing channels. These pressure reducing valves are necessary to ensure the required minimum pressure difference over the venturi's.

To be able to stop the water supply and distribution in an emergency or during maintenance, both the supply line (4) and the outlet line (14) must be equipped with a manually operated valve (5).

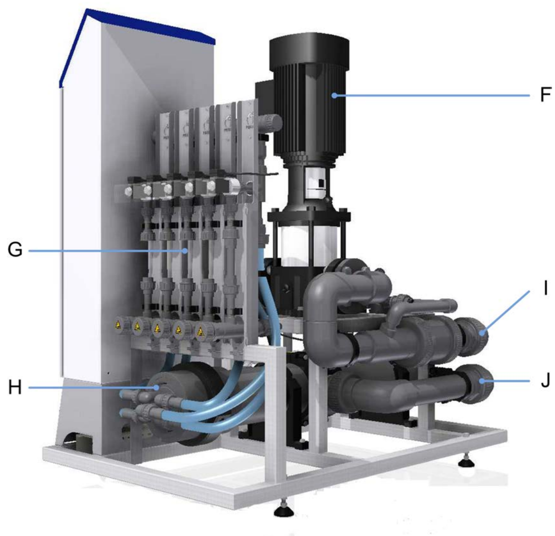
The operation of other components of the NutriJet Bypass and those of the NutriJet Inline are the same.

Construction



Front of (NutriJet 300)

A. cabinet
B. pH sensors
C. manometer
D. EC sensors
E. frame with adjustable posts



Rear of (NutriJet 300)

F. system pump
G. dosing channels
H. mixing chamber
I. connection for distribution line (line to crop)
J. connection for supply line

Technical specifications - general

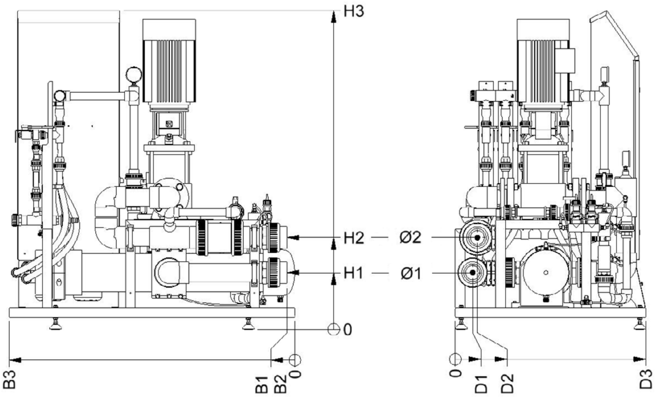
	NutriJet 300	NutriJet 600
Article number	depending on the model, see price list (for dealers)	
Operating principle	closed mixing chamber	closed mixing chamber(s)
Fertiliser mixing principle	A + B principle (equal quantities of fertilisers) ABC-principle (adjustable ratio of fertiliser quantities)	
Basic configurations	NutriJet Inline: all water in the supply line flows through the unit	
	NutriJet Bypass: a part of the water in the main line is directed through the unit and then fed back to main line by injection. The unit delivers a concentrated fertiliser solution that mixes with the other water in the main line.	
Irrigation capacity	NutriJet Inline: 5 .. 30 m^3/h net (depending on the system pump that has been selected)	NutriJet Inline: 30 .. 80 m^3/h net (depending on the system pump that has been selected)
	NutriJet Bypass: see price list (for dealers)	NutriJet Bypass: see price list (for dealers)
Possible types of dosing channels	• 300 l/h dosing channel (without rotameter: > 10% acid dosing channel) • 600 l/h dosing channel • double dosing channel (occupies 2 adjacent positions for dosing channels) • 38% acid dosing channel (50 l/h) • low volume dosing channel (1, 2, 4 or 8 l/h)	• 600 l/h dosing channel • double dosing channel (occupies 2 adjacent positions for dosing channels) • 38% acid dosing channel (50 l/h) • low volume dosing channel (1, 2, 4 or 8 l/h)
Maximum number of dosing channels	5	2 x 5
Diameter of mixing chamber	160 mm	200 mm
Permissible supply water pressure	2.5 .. 7 bar	
System pump	In the calculation of the installation, the system pump is selected on the basis of various criteria. System pumps are available with various capacities and for various mains voltages and mains frequencies.[1)]	
System pump protection	• overload protection based on motor protection • softstarter on pump > 4 kW	
Manometer for visual pressure check	3 manometers for checking of: • drive water pressure on venturi's (pressure side of system pump) • suction pressure (suction side of system pump) Depending on the configuration, more manometers are possible.	
Regulations and standards	see the EC Declaration of Conformity	

[1)]To make a choice, dealers can consult the specifications in the price list. The configuration that is finally delivered and the related most relevant specifications are summarized in the test report ("Product Delivery" form) that are delivered with the unit. The manuals of the selected components are delivered with the unit as well.

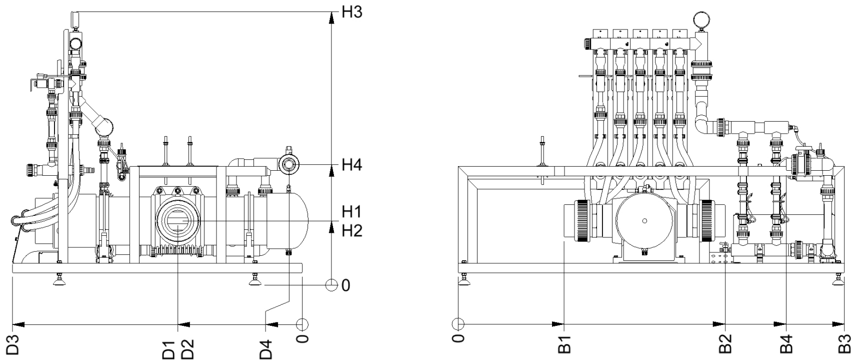
Technical specifications - mechanical

	NutriJet 300	NutriJet 600
Dimensions	see the figures NutriJet 300 (page 17) and NutriJet 600 (page 17)	
Dimensions in packaging (L x W x H)	135 x 95 x 145 .. 170 cm	183 .. 227 x 137 .. 142 x 155 .. 165 cm
Mass (lowest mass with lightest system pump, highest mass with heaviest system pump)	275 .. 355 kg	380 .. 450 kg
Materials which (may) come into contact with chemical substances	• PVC: lines and screw couplings • PP: filters of dosing channels • PA-12: tube of rotameter[1)] • fluor polymers: PVDF, PTFE and FPM for 38% acid dosing channel[1)] and PTFE for float body of rotameter[1)] • NBR: O-rings of rotameters[1)] and filters of dosing channels • EPDM: membranes and seals of dosing valves • SST: mixing chamber, frame, system pump and fixing equipment, AISI316 for housings of dosing valves and AISI329 for float body of rotameter[1)] • powder coated steel: system pump and cabinet	

[1)]If installed.



NutriJet 300



NutriJet 600

Sys. pump[1)]	Type[2)]	Ø1 (mm)[3)]	Ø2 (mm)[3)]	B1 (mm)	B2 (mm)	B3 (mm)	D1 (mm)	D2 (mm)	D3 (mm)	H1 (mm)	H2 (mm)	H3 (mm)[4)]
NutriJet 300												
CRI5	BP/1	50	50	65	65	1200	130	130	800	153	386	1340
CRI10	BP/1	50	50	65	65	1200	130	130	800	153	386	1340
CRI15	BP/1	75	75	34	34	1200	130	92.5	800	153	386	1340
CR20	BP/1	75	75	34	34	1200	130	92.5	800	153	386	1340
CR32	BP/1	75	75	34	34	1200	130	92.5	800	153	386	1340
CR5	IL/1	50	50	65	65	1200	90	130	800	238	386	1340
CR10	IL/1	50	50	65	65	1200	90	130	800	238	386	1340
CR15	IL/1	75	75	34	34	1200	72.5	92.5	800	238	386	1340
CR20	IL/1	75	75	34	34	1200	72.5	92.5	800	238	386	1340
CR32	IL/1	75	75	34	34	1200	72.5	92.5	800	238	386	1340
NutriJet 600												
CRN32	BP/1	50	75	315	284	1600	265	233	1200	411	548	1340
CRN32	BP/2	50	75	-183	284	1600	265	233	1200	411	548	1340
CR32	IL/1	75	75	480	284	1600	515	233	1200	266	548	1340
CR32	IL/2	75	75	-19	284	1600	515	233	1200	266	548	1340
CR45	IL/1	110	110	440	242	1600	515	233	1200	266	566	1340
CR45	IL/2	110	110	-59	242	1600	515	233	1200	266	566	1340
CR64	IL/1	110	110	440	242	1600	515	233	1200	266	566	1340
CR64	IL/2	110	110	-59	242	1600	515	233	1200	266	566	1340

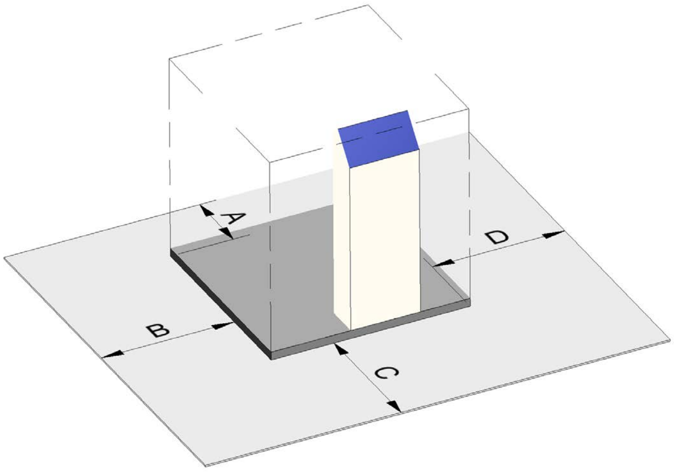
[1)]Not all the pumps in this table are included in the price list. They are, however, available on request.
[2)]BP = NutriJet Bypass, IL = NutriJet Inline. The figure after "/" indicates the number of mixing chambers.
[3)]Various adaptation rings are available for the screw coupling to connect to pipes of various diameters and pipes with screw thread.

[4] H3 is the highest point. This may also be the top of the pump or the cabinet.

Technical specifications - electrical

	NutriJet 300 and 600
Required mains voltage and mains frequency	The mains voltage and mains frequency must be specified on ordering. The following is standard: • 380 .. 415 Vac (3 phases, neutral and earth) • 50 Hz or 60 Hz Other options are available on request (dealers can consult the price list for this). The power supply of the unit that is finally delivered is indicated on the type plate on the unit.
Maximum power consumption	300 VA excluding system pump. The electrical power consumed by the system pump is, however, much greater (see specifications of system pump).
External fuse requirement	dependent on mains voltage and mains frequency in the country and the locally applicable regulations
Insulation class	I (basic insulation with earth wire)
Installation category (over voltage category)	II
Protection rate	IP34
Power supply connector type	screw terminals
Core diameter of power supply and earthing	dependent on the locally applicable regulations and the current consumption: • < 25 A: maximum 2.5 mm^2 (13 AWG) solid core • 25 .. 32 A: maximum 6 mm^2 (9 AWG) solid core or 4 mm^2 (11 AWG) flexible wire with crimp-on connector

Location and environmental conditions



Minimum free space around unit

A = minimum 50 cm
B, C, D = minimum 110 cm

Environmental requirements	
General	Position the unit in an indoor, well-ventilated room, free from drips and splashes, with a stable temperature (no rapid temperature changes). The unit must not be in direct sunlight. The temperature of the parts receiving bright sunlight may become too high, causing the plastic parts to deform and causing malfunctions in the electrical components. Select a location where the unit cannot easily be damaged (by mobile equipment for example). The surface on which the unit will stand should be hard, flat and level.
Temperature when out of operation	0 .. 35 °C As long as the unit contains water (remnants) and the pH sensors are still fitted, the unit must be kept frost-free.
Temperature during operation	5 .. 30 °C
Temperature supply water	5 .. 30 °C (the unit can withstand 30 °C as a maximum temperature. However, from the point of view of the water quality, such a high water temperature is usually unacceptable.)
Relative air humidity	< 85 % (This is lower than the maximum relative air humidity during transport because of the presence of chemical substances.) Condensation will form on the pipe-work, particularly when relatively cold supply water is used. This is very corrosive when combined with the vapours from the chemical substances. Hose clamps and other metal parts must, therefore, be of corrosion-resistant types of metals or must be well coated (and remain so). The cabinet contains sensitive electronic circuits and must definitely remain condensation-free.
Maximum installation height	1000 m above sea level (Cavitation may occur in the system pump when the ambient pressure is too low.)
Pollution degree	maximum 2

Capabilities

Applications

The most common application of the NutriJet is for directly dosing fertilisers: 'direct distribution'. In this respect, the NutriJet transports the irrigation water which contains dissolved fertilisers via the irrigation lines and irrigation valves directly to the various crop areas. The NutriJet may be used for overhead irrigation systems, drippers and ebb and flood systems on containers and tables (only with a Priva Connext or Intégro process computer). Depending on the crop, one NutriJet Inline can supply irrigation water to areas of approximately 0.5 .. 8 ha. In this application the NutriJet is only active during irrigation. In a bypass configuration, higher capacities are possible (see the price list).

For larger areas a NutriJet can be used to fill one or more day storage tanks: 'indirect distribution'. The irrigation water from the day storage tanks is transported to the crop areas by separate pumps and valves. A NutriJet can make the nutrient solution(s) which are then stored in tanks as a buffer stock for a period of 24-hours. In this case, a NutriJet with a pump of lower capacity, which is typically active at night, will suffice.

For even larger areas or under critical cultivation conditions, it is recommended that the irrigation water is prepared using 2 or more NutriJet fertiliser dosing systems. In the event of a breakdown, the user can switch over to the other NutriJet and thereby provide the plants with a minimum volume of irrigation water to prevent damage to the crop.

Basic functions

The construction of the NutriJet is suitable for a various functions when creating irrigation water:

- dosing and mixing fertilisers and supply water into homogenous irrigation water;
- correcting the pH and EC of the irrigation water;
- pumping the irrigation water to the crop.

Models

There are two models of the NutriJet: NutriJet 300 with 300 l/u dosing channels and NutriJet 600 with 600 l/u dosing channels.

Both models consist of two versions:

- NutriJet Inline: the unit is placed between the water supply line and the distribution line. All the water flows through the unit;
- NutriJet Bypass: the unit is placed next to the distribution line. A part of the water is directed from the distribution line, through the unit, back into the distribution line. The unit provides a dose such high, that the right dose results from mixing in the distribution line.

The NutriJet is supplied as substation. This means the unit does not have a built-in process computer and as a result must be remotely controlled by a Priva process computer (Connext, Intégro of Maximizer). Usually this computer also has other tasks, such as climate control, energy management and CO_2 dosage. As a default the Substation does not have a display and keyboard. However, optionally a monochrome display and film keyboard can be installed to be able to perform certain operating functions also locally (only Intégro).

The following can be chosen: the type of system pump, the system pump control (by means of motor relay or softstarter), the number of mixing chambers, the number of dosing channels and the types of dosing channels. For more details about the possibilities, refer to the technical specifications and the price list (for dealers).

Technical specifications - process computer

The process computer is described in detail in the hardware and software manuals of the process computer of concern. The table below only provides a summary of the aspects that are important for the fertiliser dosing unit.

	NutriJet with Connext or Intégro	NutriJet with Maximizer
Process computer	external: Connext or Intégro fertiliser dosing unit is a substation in the network of the process computer	external: Maximizer fertiliser dosing unit is connected to the I/Os of the process computer
Operation	remotely via external process computer (locally as an option, Intégro only)	remotely via external process computer
Program cycle	day or week (other options depending on configuration, see software manual)	week with number of starts per day (see software manual for other options)
Number of valve groups or valves to be started independently of each other[1)]	equal to the number of set start programs	equal to the number of set start programs
Number of periods per 24-hour period in which a start for a valve group or valve[1)] can be defined	6	4
Start based on[2)]	among other things time, temperature, radiation level, radiation sum, external control and manually (see software manual for all options)	among other things time, radiation level, radiation sum, external control and manually (see software manual for all options)
Stop based on[2)]	duration, quantity of irrigation water, external control, manually and malfunction or alarm	duration, quantity of irrigation water, external control, manually and malfunction or alarm
Number of recipes (a recipe includes, among other things, the settings for the desired EC and pH values)	depending on the selected configuration (see software manual)	8
Selection of fertiliser tank (tanks A1, B1, C1 etc. or tanks A2, B2, C2 etc.) [2)]	yes	no (if the option for selecting a supply water source is not applied, that option can be used with a small adjustment of the internal wiring for the selection of fertiliser tanks)
Balance level control (with A+B principle)[2)]	yes	no
Selection of supply water silos or day storage silos[2)]	yes	yes, maximum of 8 tanks
Irrigation water flow rate or volume measurement[2)]	yes	yes
Dosage can anticipate a change in irrigation water flow ('feed forward' control)	yes	no (there is a reaction to the change via 'feedback' control, but it is slower than via 'feed forward' control)
Control may take account of the number of irrigation valves that may be open at the same time	yes	no
Drain measurement[2)]	yes, both volume and EC (and pH) of several drain measurements The actual moment of starting (after the start program has been launched) can be influenced based on the drain quantity.	no
Supply water from different sources can be mixed on the basis of EC or flow ratio[2)]	yes	no
EC correction based on light intensity[2)] (lower EC value if there is a lot of sun and a large amount of evaporation)	yes	no
Controlling flush valve from unit during recipe change	yes	no
Backwashing program for sand filter[2)]	yes, up to 8 filters switched in parallel	yes, 1 filter
Registration of the measured values and settings	yes, with extensive reporting capabilities via Priva Office Direct (depending on selected configuration, see software manual)	yes, but without extensive reporting capabilities
Alarm functions and warning signal	various options (see software manual)	various options (see software manual)
Available languages for software operation	see price list	see price list

[1)]In the Connext and Intégro software, valve groups are linked to start programs, in the Maximizer software valves are linked to start programs.

[2)]To make use of these options, sensors and other components (such as I/O expansions) that are not supplied as standard may be required.

Dosing channels

The NutriJet has 5 or 10 dosing channel positions (depending on whether there are 1 or 2 mixing chambers). If single dosing channels have been installed on all these positions, a maximum of 5 or 10 fertiliser solutions or 4 or 9 fertiliser solutions and 1 acid or lye solution can be dosed at one time. The dosing channels have been designed in such a way that they can dose the required flow, virtually irrespective of the drive water pressure on the venturi. The flow is controlled by the pulsed opening of the dosage valve on the dosing channel. Dosing channels are available in a range of versions:

- 300 l/hr and 600 l/hr dosing channels;

  To prevent a negative impact on the service life of the components used, the concentration of the (nitric) acid in dosing channels with a rotameter must not exceed 3% (weight percent).

- 300 l/hr and 600 l/hr double dosing channels;

  Double dosing channels consist of 2 connected dosing channels with 1 common venturi. As a result of this, 2 fertiliser tanks can be connected. The process computer opens only one dosage valve at a time. In this way the choice between fertiliser supply A1+B1 or fertiliser supply A2+B2 is possible. A double dosing channel occupies 2 adjacent positions on the frame.
  As a custom solution, triple dosing channels are also possible, with 3 connected dosing channels on 1 venturi.

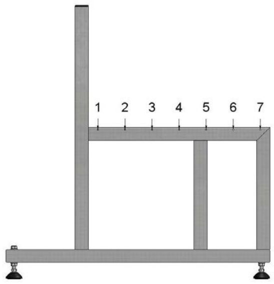
- 10% acid dosing channel and 38% acid dosing channel;
- low-volume dosing channels (custom solution).

See also Technical specifications - dosing channels (page 25).

Each dosing channel is generally connected to its own stock tank (fertiliser tank or acid or lye tank). However, central stock tanks can also be used to supply several fertiliser dosing units. In that case, each dosing channel must have its own line to the tank (i.e. it is not possible to have several dosing channels on a single line: the pulsating behaviour of the dosage valves would lead to mutual interference).

The fertiliser tanks contain fertilisers dissolved in water, in such a dilution that they do not contain any sediment or fixed particles. When determining the irrigation capacity, the user must take account of the fact that the dosing flow of each dosing channel can be set between 10% and 100% of its maximum capacity.

Layout of dosing channel positions on the frame

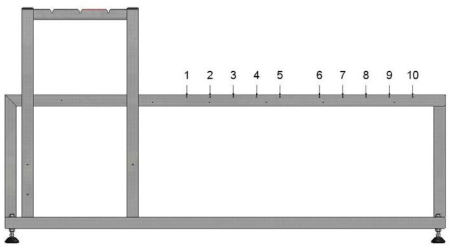


Dosing channel positions on the frame of a NutriJet 300

Possible layouts of the dosing channel positions on the frame of a NutriJet 300

Position	1	2	3	4	5	6	7
A, B, acid*		A	B	-	-	acid*	-
A, B, C, acid*		A	B	C	-	acid*	-
A, B, C, D, acid*		A	B	C	D	acid*	-
double A, double B, acid*	A1	A2	B1	B2	-	acid*	-
double A, double B, double C, acid*	A1	A2	B1	B2	acid*	C1	C2
double A, double B, C, acid*	A1	A2	B1	B2	C	acid*	-
double A, double B, C, D, acid*	A1	A2	C	acid*	D	B1	B2
double A, B, C, D, acid*	A1	A2	B	C	D	acid*	-

*) acid is optional



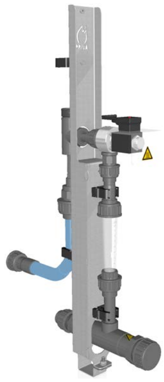
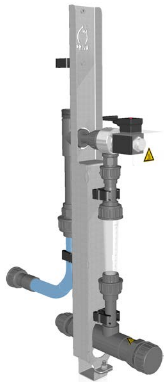
Dosing channel positions on the frame of a NutriJet 600

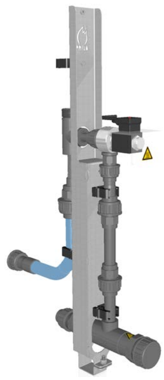
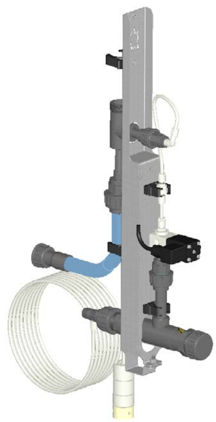
Possible layouts of the dosing channel positions on the frame of a NutriJet 600

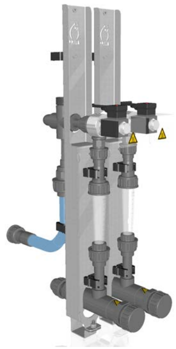
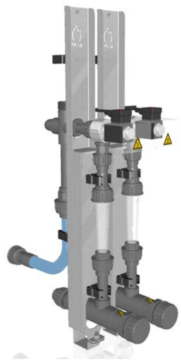
Position	1	2	3	4	5	6	7	8	9	10	2^e mixing chamber
A, B, acid*	A	B	-	-	acid*		-			acid*	
A, B, C, acid*	A	B	C	-	acid*		-			acid*	
A, B, C, D, acid*	A	B	C	D	acid*		-			acid*	
A, B, C, D, E, acid*	A	B	C	D	acid*	E				acid*	X
A, B, C, D, E, F, acid*	A	B	C	D	acid*	E	F			acid*	X
A, B, C, D, E, F, G, acid*	A	B	C	D	acid*	E	F	G		acid*	X
A, B, C, D, E, F, G, H, acid*	A	B	C	D	acid*	E	F	G	H	acid*	X
double A, double B, acid*	A1	A2	B1	B2	acid*					acid*	
double A, double B, double C, acid*	A1	A2	B1	B2	acid*	C1	C2			acid*	
double A, double B, double C, double D, acid*	A1	A2	B1	B2	acid*	C1	C2	D1	D2	acid*	
double A, double B, C, acid*	A1	A2	B1	B2	acid*	C				acid*	
double A, double B, C, D, acid*	A1	A2	B1	B2	acid*	C	D			acid*	

*) acid is optional

Technical specifications - dosing channels

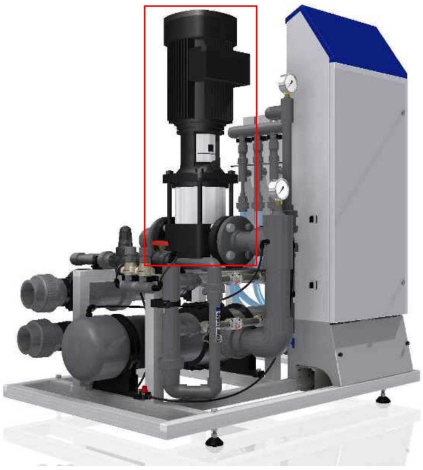
	300 l/h dosing channel	600 l/h dosing channel
Article		
Article number	8470 (50 Hz) 8471 (60 Hz)	8476 (50 Hz) 8477 (60 Hz)
Liquids to be used	fertilisers, lye and acid solutions with 3 % (weight percent) nitric acid at maximum	
Passage size of filter	< 2 mm	
Reading range of rotameter	0 .. 300 l/h	0 .. 1000 l/h
Dosing capacity	30 .. 300 l/h	60 .. 600 l/h
Drive water flow rate	Inline: approx. 560 l/h at 3 bar (Ø 2.7 mm nozzle) Bypass: see price list	Inline: approx. 1250 l/h at 3 bar (Ø 4.0 mm nozzle) Bypass: see price list
Dosing valve	Geva, 24 Vac, 0.60 A, 50 or 60 Hz, 8 W, EPDM membrane and restricting screw	
Dosing valve signalling	LED (red)	
Connection of fertiliser supply	hose connector Ø 20 mm	

	10% acid dosing channel	38% acid dosing channel
Article		
Article number	8486 (50 Hz) 8487 (60 Hz)	8485 (50 and 60 Hz)
Liquids to be used	lye and acid solutions with 10 % (weight percent) nitric acid at maximum	concentrated nitric acid up to 38 % (weight percent)
Passage size of filter	< 2 mm	
Reading range of rotameter	not present	
Dosing capacity	30 .. 300 l/h	5 .. 50 l/h
Drive water flow rate	approx. 560 l/h at 3 bar (Ø 2.7 mm nozzle)	
Dosing valve	Geva, 24 Vac, 0.60 A, 50 or 60 Hz, 8 W, EPDM membrane and restricting screw	Buschjost, 24 Vac, 0.5 A, 50 – 60 Hz, 13 VA, PTFE membrane, PVDF housing
Dosing valve signalling	LED (red)	LED (yellow)
Connection of fertiliser supply	hose connector Ø 20 mm	fixed PTFE hose (5 m long, internal Ø 4 mm, with foot valve and low level switch)

	300 l/h double dosing channel	600 l/h double dosing channel
Article		
Article number	8472 (50 Hz) 8473 (60 Hz)	8478 (50 Hz) 8479 (60 Hz)
Liquids to be used	with rotameter: fertilisers, lye and acid solutions with 3% (weight percent) nitric acid at maximum	
	without rotameter: fertilisers, lye and acid solutions with 10 % (weight percent) nitric acid at maximum	
Passage size of filter	< 2 mm	
Reading range of rotameter	if installed: 0 .. 300 l/h	if installed: 0 .. 1000 l/h
Dosing capacity	30 .. 300 l/h	60 .. 600 l/h
Drive water flow rate	approx. 560 l/h at 3 bar (Ø 2.7 mm nozzle)	approx. 1250 l/h at 3 bar (Ø 4.0 mm nozzle)
Dosing valve	Geva, 24 Vac, 0.60 A, 50 or 60 Hz, 8 W, EPDM membrane and restricting screw	
Dosing valve signalling	LED (red)	
Connection of fertiliser supply	hose connector Ø 20 mm	

Other types of dosing channels, such as low-volume dosing channels and trio dosing channels, are available as custom solutions. For more information, contact Priva.

System pumps



The system pump

A range of system pumps are available. The choice of system pump depends on:

- the desired flow;
  With the NutriJet Inline, this is the desired flow in the irrigation line plus the flow that is required to drive the dosing channels. The latter depends on the number (and type) of venturis installed (single dosing channels have 1 venturi. With double dosing channels, 2 dosing channels share 1 venturi).
  With the NutriJet Bypass, it is a question of the desired flow that should be injected into the main line;
- the required pressure;
  With the NutriJet Inline, this depends on the pressure that is required for the proper functioning of the drippers or sprinklers and the pressure losses across the distribution system (lines, valves, filter). A minimum pressure of 2.0 bar is, in any case, required for driving the venturis;
  With the NutriJet Bypass, it is a question of the pressure difference across the pump that is necessary to be able to inject the desired flow into the main line and to create a minimum pressure difference of 2.0 bar across the venturis (to drive the venturis).
- the mains voltage and mains frequency.

Calculating the irrigation capacity

The required pump capacity is largely determined by the required irrigation capacity. On its turn, this is determined by the amount of water that has to be delivered to the crop, the time in which this should take place and the number of valve section that should be irrigated at the same time. For the calculation of the irrigation capacity, one should take the situation in which the water demand is highest.

Calculation example

Total cultivation surface area	6000 m^2
Desired maximum water dose	10 litres (0.01 m^3) per m^2 per day
Total water dose	6000 x 0.01 = 60 m^3 per day
.	
Number of irrigation valves	3
Valve section area	6000 / 3 = 2000 m^2 (equal sized valve sections)
Water dose per valve section	2000 x 0.01 = 20 m^3 per day
.	
Number of drippers per m^2	6 per m^2
Number of drippers per valve section	6 x 2000 = 12000
Capacity of a single dripper	1,5 litres (0.0015 m^3) per hour
Capacity of all drippers in the valve section	12000 x 0,0015 = 18 m^3 per hour
Number of valve sections that has to be irrigated simultaneously	1
Required net capacity of the system pump	1 x 18 = 18 m^3 per hour
.	
Dosing time per valve section	20 / 18 = 1.11 hour per day
Total dosing time	1.11 x 3 / 1 = 3.33 hour per day
.	
Volume per cycle per dripper	100 ml (0.0001 m^3)
Volume per cycle per valve section	12000 x 0.0001 = 1.2 m^3
Total volume per cycle	3 x 1.2 = 3.6 m^3
System pump operating time per cycle	3.6 / 18 = 0.2 hour (12 minutes)
Number of cycles per day	60 / 3.6 = 16.667 Round this to 17 cycles of 12 x 16.667 / 17 = 11.76 minutes (11 minutes and 46 seconds)

Pump characteristics

When the desired (net) pump flow and the required pump pressure are known, the system pump may be selected based on the pump characteristics.

The pump characteristics shown here for the NutriJet Inline take account of the fact that part of the pump capacity is used to drive the venturis of the dosing channels (and for the flow-through of the pH sensor holders). The pump characteristics show the relationship between the flow to the irrigation line and the system pump pressure, assuming 3 or 5 venturis (1 mixing chamber) or 6 or 10 venturis (2 mixing chambers). With the CR15, CR20 and CR32 pumps the venturis have a nozzle diameter of 2.7 mm (as found for example on single 300 l/hr dosing channels), and with the CR45 and CR64 pumps the venturis have a nozzle diameter of 4.0 mm (as found for example on single 600 l/hr dosing channels). For a different number of venturis, the drive water flow that is associated with these additional/fewer venturis must be deducted from/added to the net pump flow. The drive water flow depends on the type of nozzle (diameter 2.7 mm or 4.0 mm) and the pump pressure and can be found in the price list.

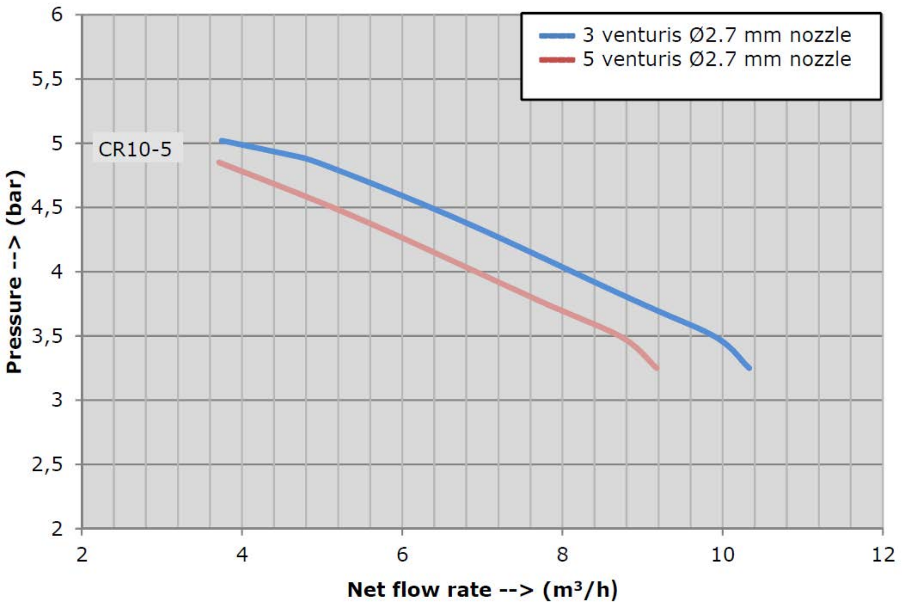
In the pump characteristics for the NutriJet Bypass, it is a question of the flow and the pressure of the flow that is injected into the main line. This is not the flow to the crop! In addition, this flow is separate from the flow that is required to drive the venturis.

For each main type of pump, the pump characteristics of the various subtypes have been combined in the same figure. Separate figures have been created for pumps for a mains frequency of 50 Hz and for pumps for a mains frequency of 60 Hz.

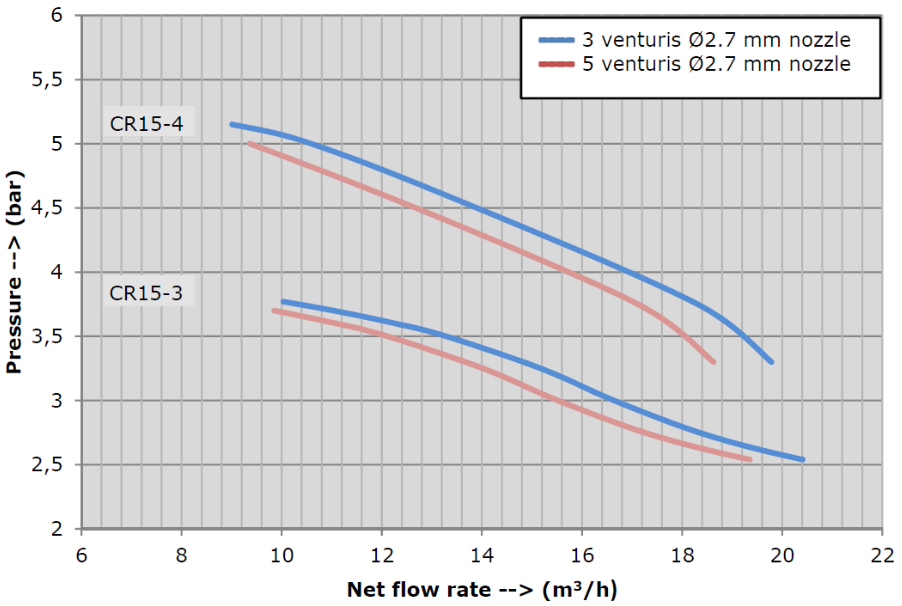
See the price list for the other technical specifications, such as article number, mains voltage, motor power and thermal overload protection.

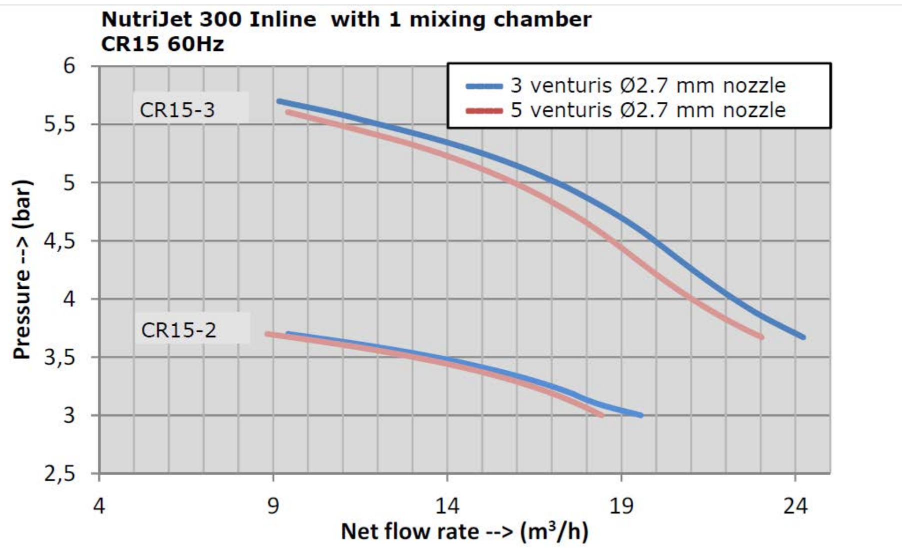
Pump characteristics NutriJet Inline

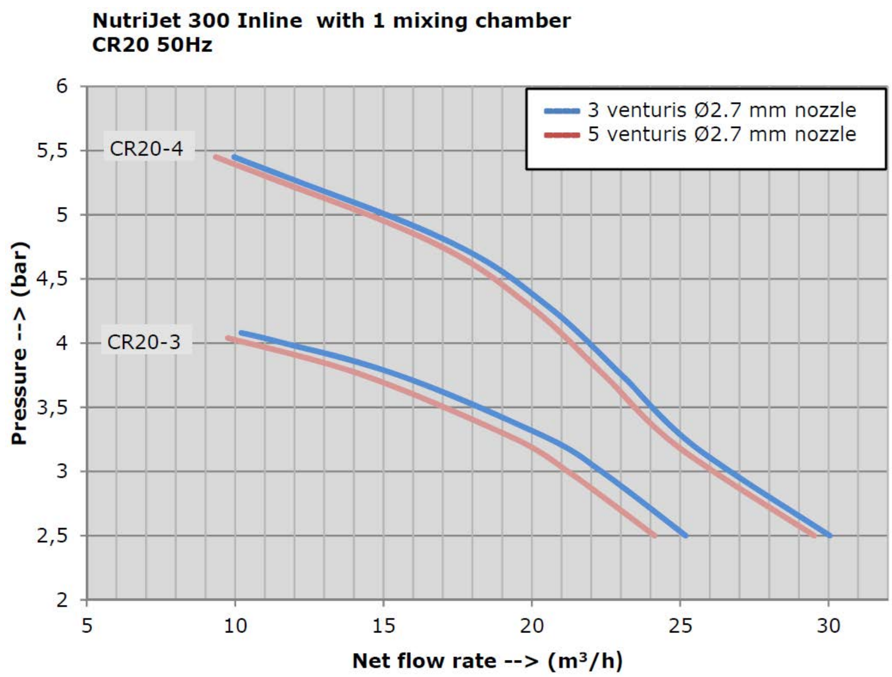
NutriJet 300 Inline with 1 mixing chamber
CR10 50Hz

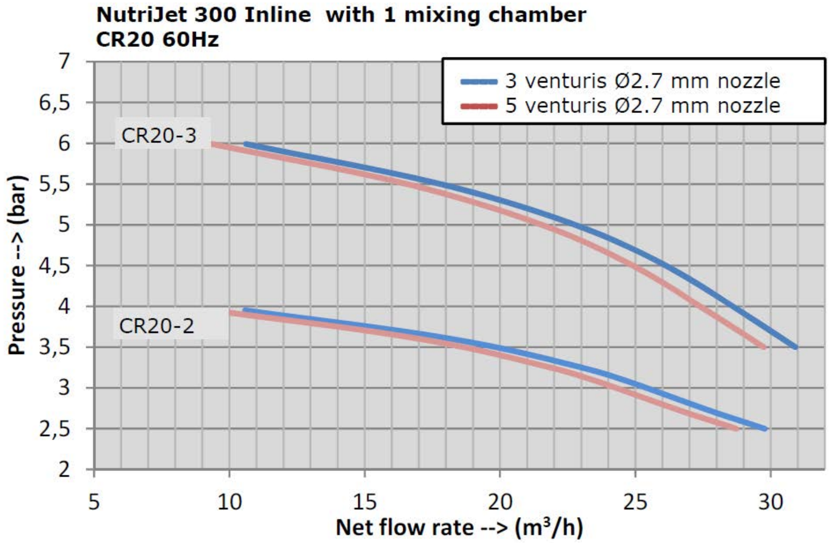


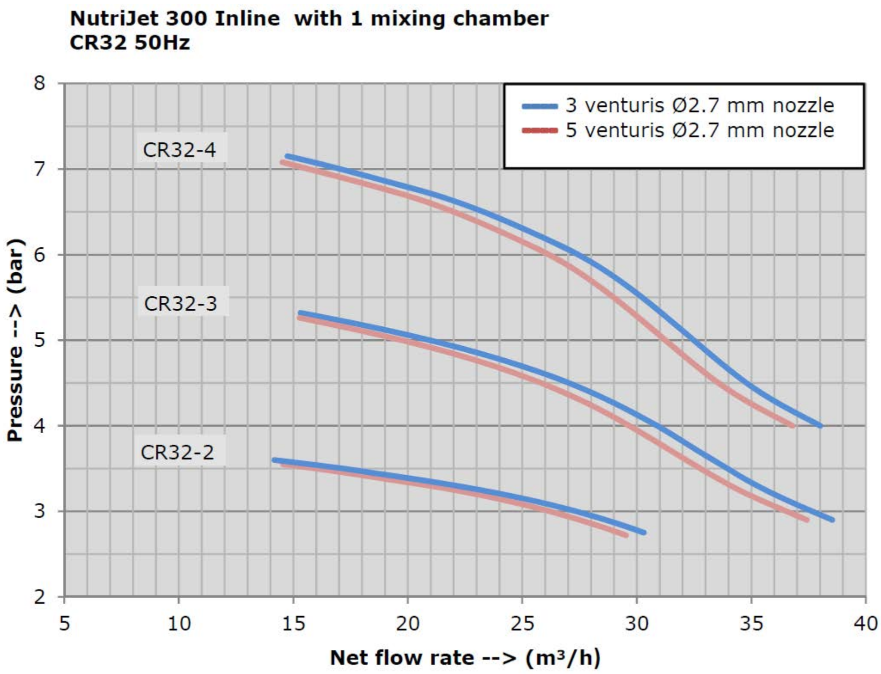
NutriJet 300 Inline with 1 mixing chamber
CR15 50Hz

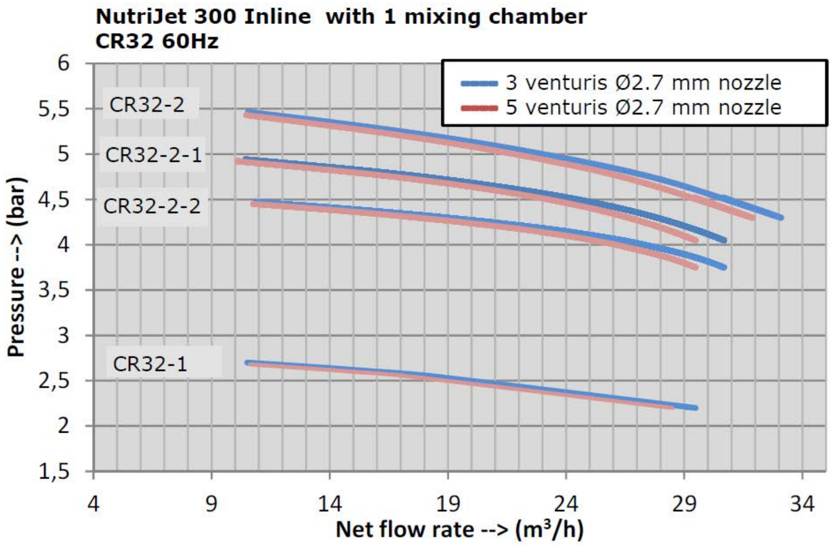


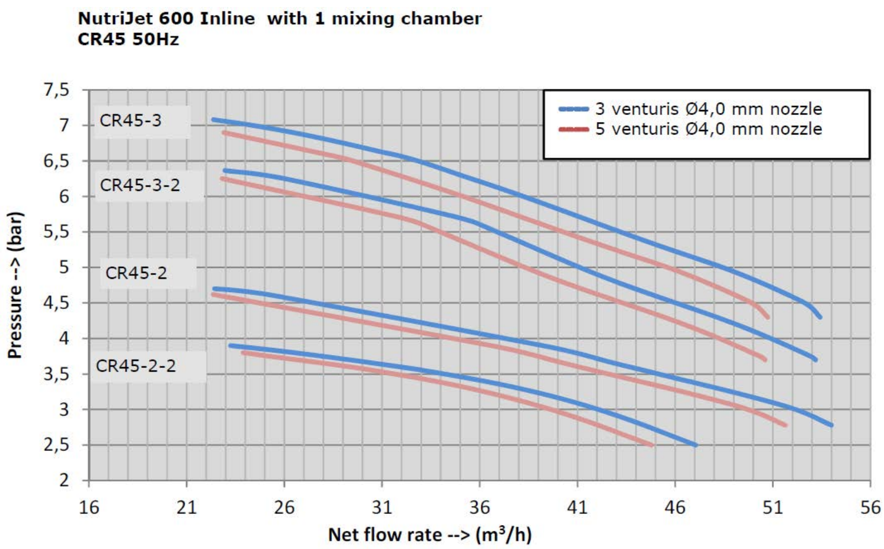

NutriJet 300 Inline with 1 mixing chamber
CR15 60Hz
3 venturis Ø2.7 mm nozzle
5 venturis Ø2.7 mm nozzle
CR15-3
CR15-2
Pressure --> (bar)
6
5,5
5
4,5
4
3,5
3
2,5
4
9
14
19
24
Net flow rate --> (m³/h)

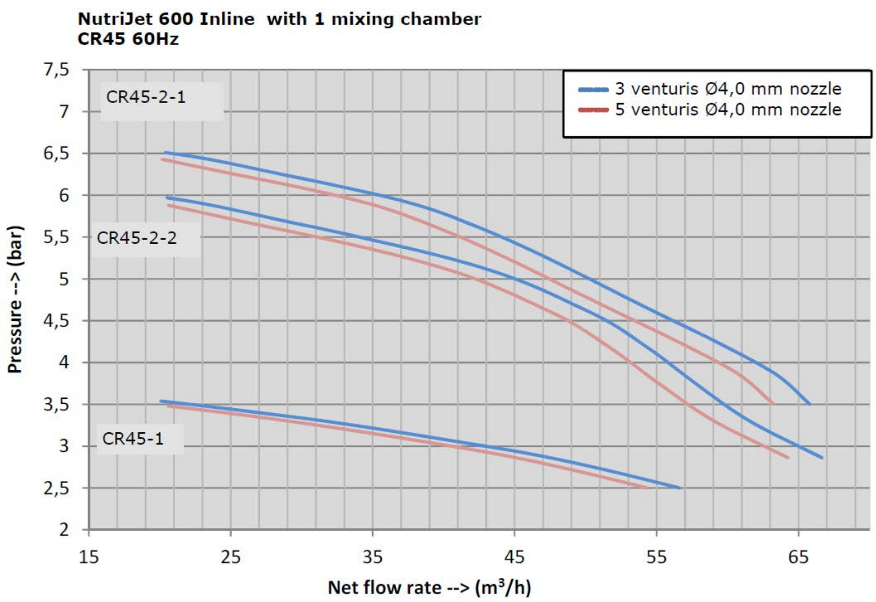

NutriJet 300 Inline with 1 mixing chamber
CR20 50Hz
3 venturis Ø2.7 mm nozzle
5 venturis Ø2.7 mm nozzle
CR20-4
CR20-3
Pressure --> (bar)
6
5,5
5
4,5
4
3,5
3
2,5
2
5
10
15
20
25
30
Net flow rate --> (m³/h)


NutriJet 300 Inline with 1 mixing chamber
CR20 60Hz
3 venturis Ø2.7 mm nozzle
5 venturis Ø2.7 mm nozzle
CR20-3
CR20-2
Pressure --> (bar)
Net flow rate --> (m³/h)

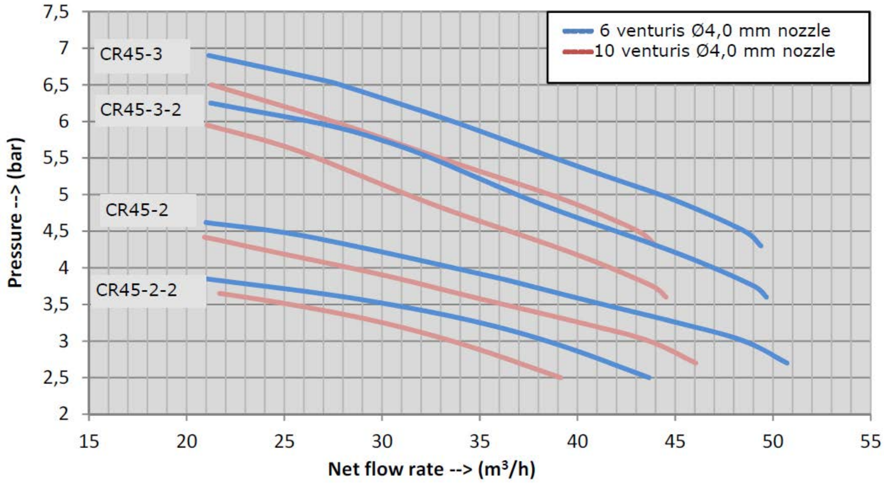

NutriJet 300 Inline with 1 mixing chamber
CR32 50Hz
3 venturis Ø2.7 mm nozzle
5 venturis Ø2.7 mm nozzle
CR32-4
CR32-3
CR32-2
Pressure --> (bar)
Net flow rate --> (m³/h)


NutriJet 300 Inline with 1 mixing chamber
CR32 60Hz
3 venturis Ø2.7 mm nozzle
5 venturis Ø2.7 mm nozzle
CR32-2
CR32-2-1
CR32-2-2
CR32-1
Pressure --> (bar)
6
5,5
5
4,5
4
3,5
3
2,5
2
1,5
4
9
14
19
24
29
34
Net flow rate --> (m³/h)

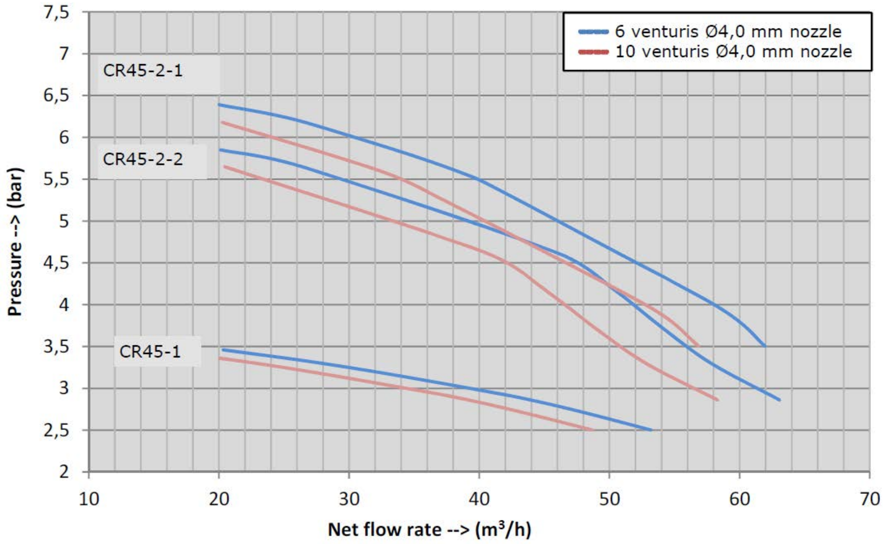

NutriJet 600 Inline with 1 mixing chamber
CR45 50Hz
3 venturis Ø4,0 mm nozzle
5 venturis Ø4,0 mm nozzle
CR45-3
CR45-3-2
CR45-2
CR45-2-2
Pressure --> (bar)
7,5
7
6,5
6
5,5
5
4,5
4
3,5
3
2,5
2
16
21
26
31
36
41
46
51
56
Net flow rate --> (m³/h)


NutriJet 600 Inline with 1 mixing chamber
CR45 60Hz
3 venturis Ø4,0 mm nozzle
5 venturis Ø4,0 mm nozzle
CR45-2-1
CR45-2-2
CR45-1
Pressure --> (bar)
7,5
7
6,5
6
5,5
5
4,5
4
3,5
3
2,5
2
15
25
35
45
55
65
Net flow rate --> (m³/h)

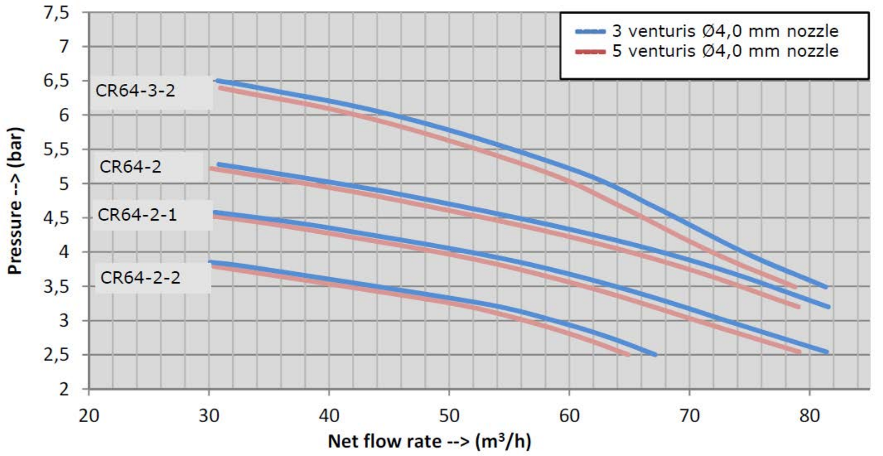
NutriJet 600 Inline with 2 mixing chambers
CR45 50Hz

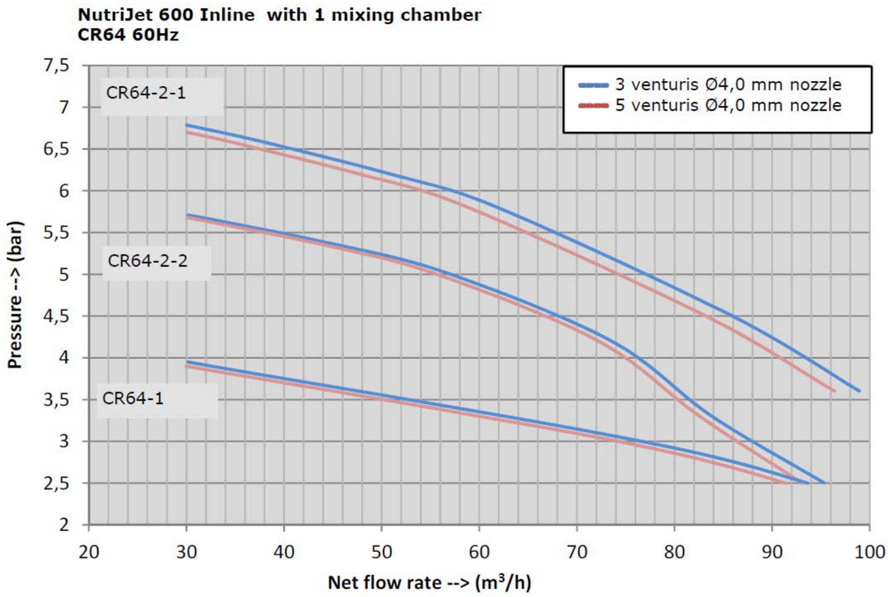


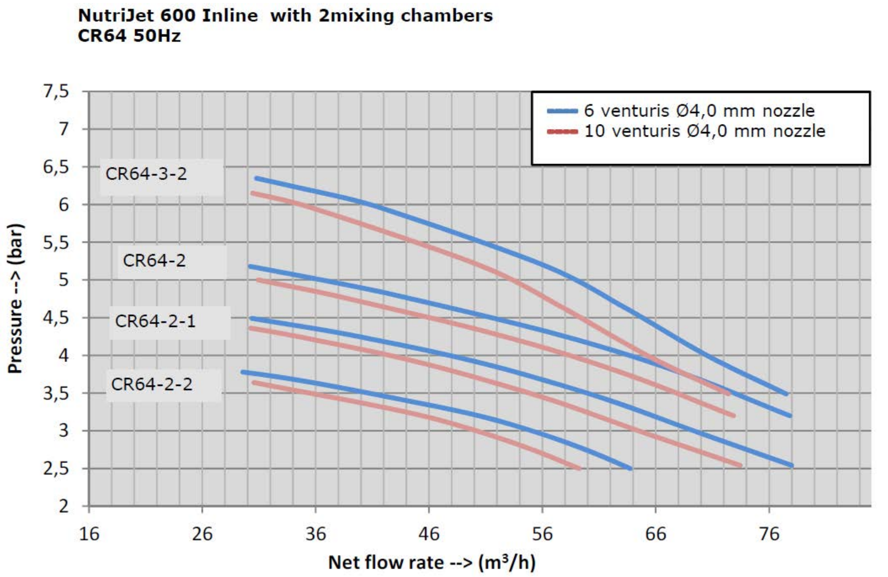
NutriJet 600 Inline with 2 mixing chambers
CR45 60Hz

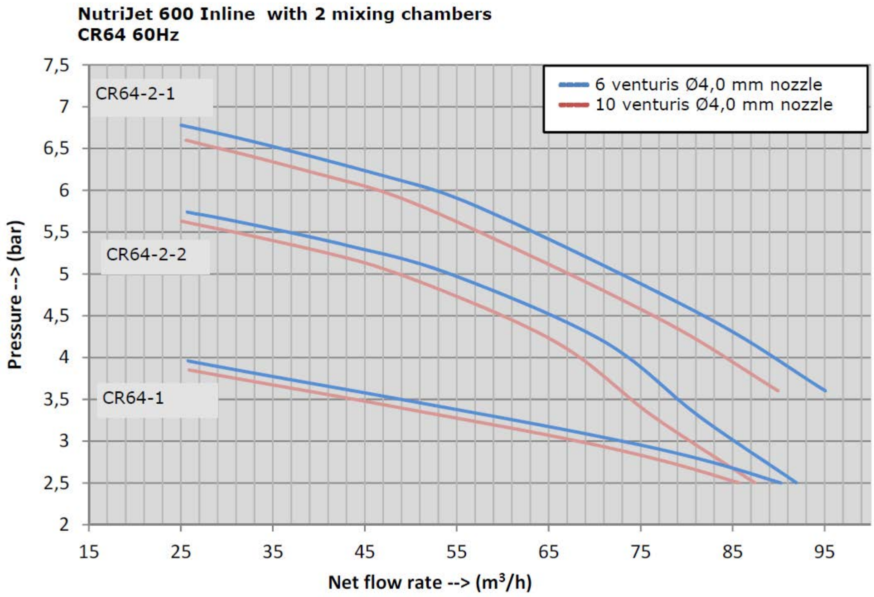


NutriJet 600 Inline with 1 mixing chamber
CR64 50Hz

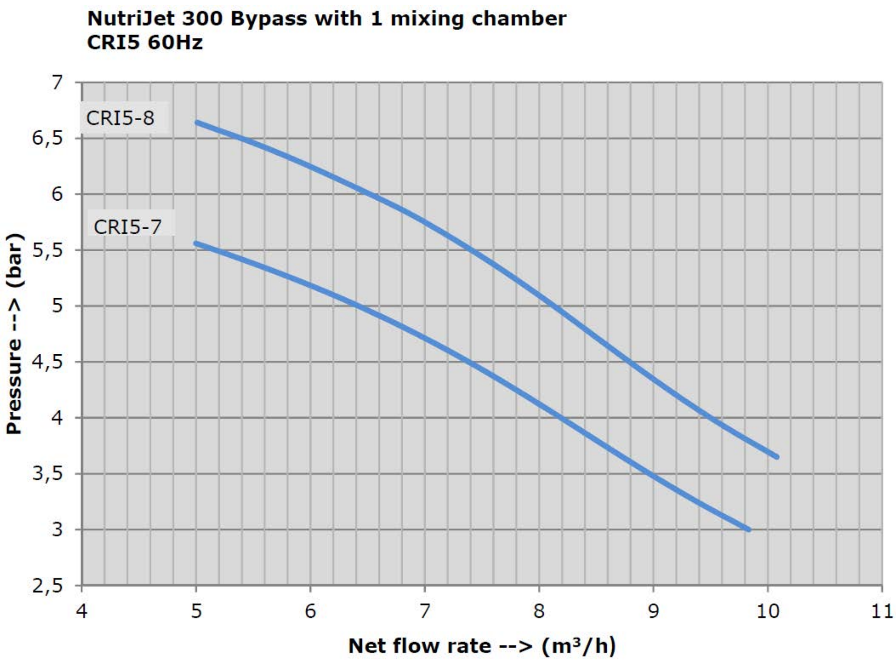



NutriJet 600 Inline with 1 mixing chamber
CR64 60Hz
3 venturis Ø4,0 mm nozzle
5 venturis Ø4,0 mm nozzle
CR64-2-1
CR64-2-2
CR64-1
Pressure --> (bar)
Net flow rate --> (m³/h)
7,5
7
6,5
6
5,5
5
4,5
4
3,5
3
2,5
2
20
30
40
50
60
70
80
90
100

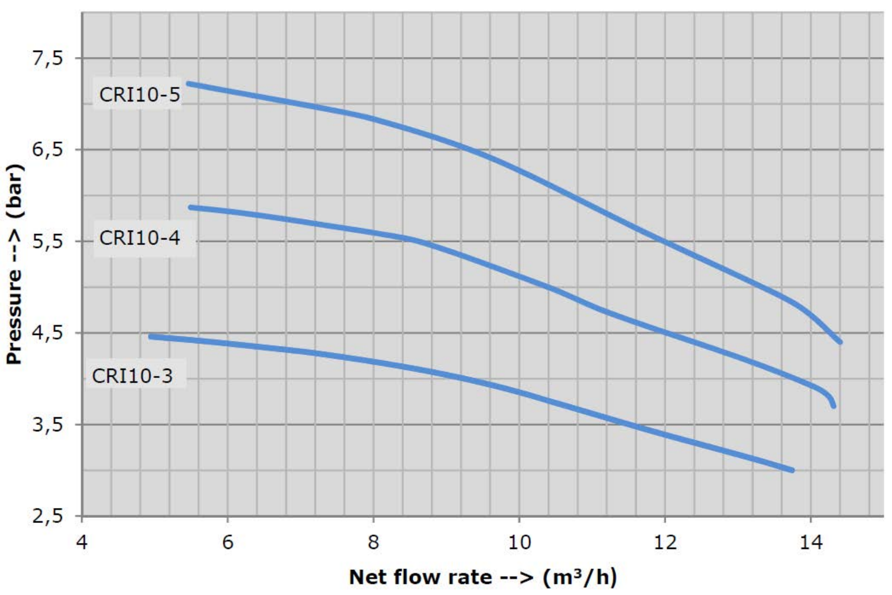

NutriJet 600 Inline with 2mixing chambers
CR64 50Hz
6 venturis Ø4,0 mm nozzle
10 venturis Ø4,0 mm nozzle
CR64-3-2
CR64-2
CR64-2-1
CR64-2-2
Pressure --> (bar)
Net flow rate --> (m³/h)
7,5
7
6,5
6
5,5
5
4,5
4
3,5
3
2,5
2
16
26
36
46
56
66
76



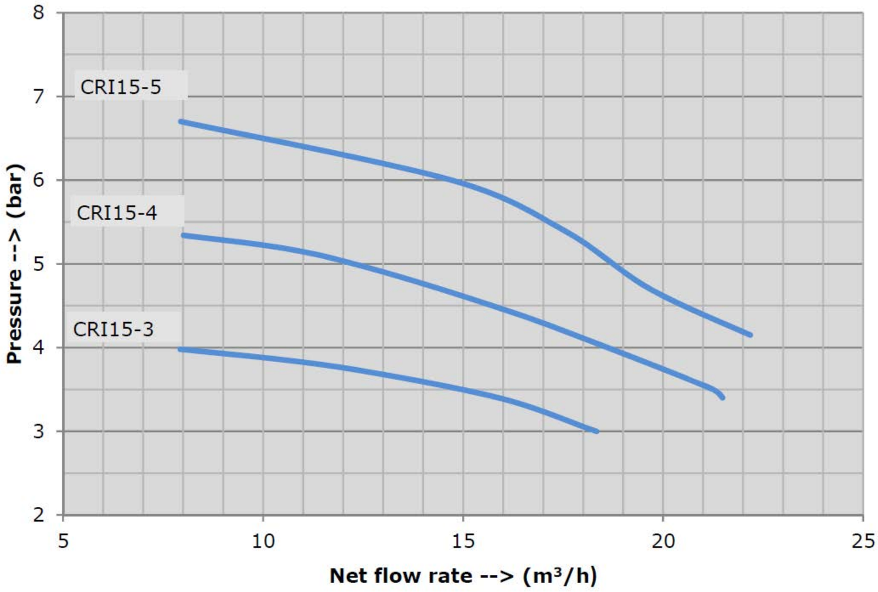
Pump characteristics NutriJet Bypass



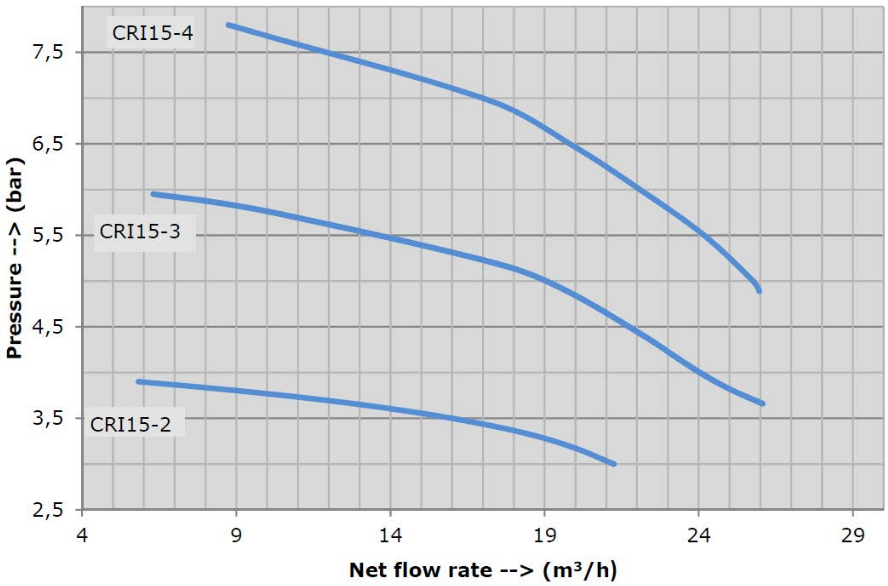
NutriJet 300 Bypass with 1 mixing chamber
CRI10 60Hz



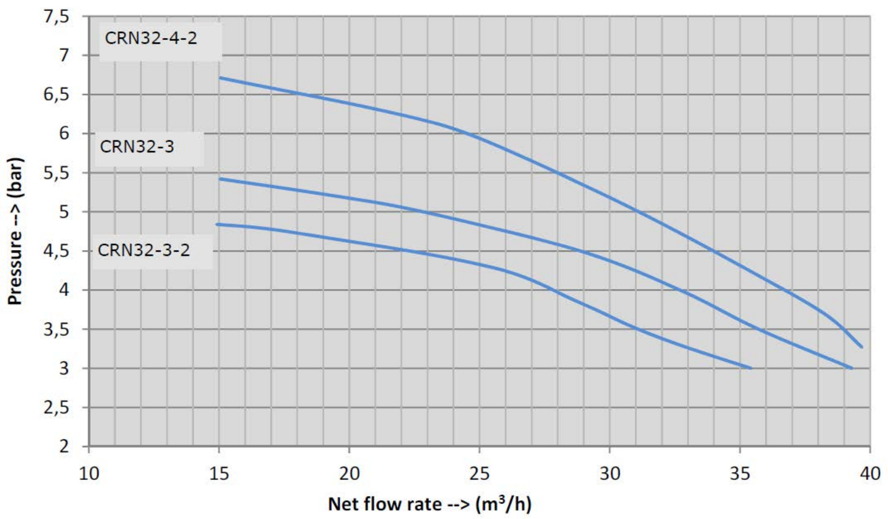
NutriJet 300 Bypass with 1 mixing chamber
CRI15 50Hz

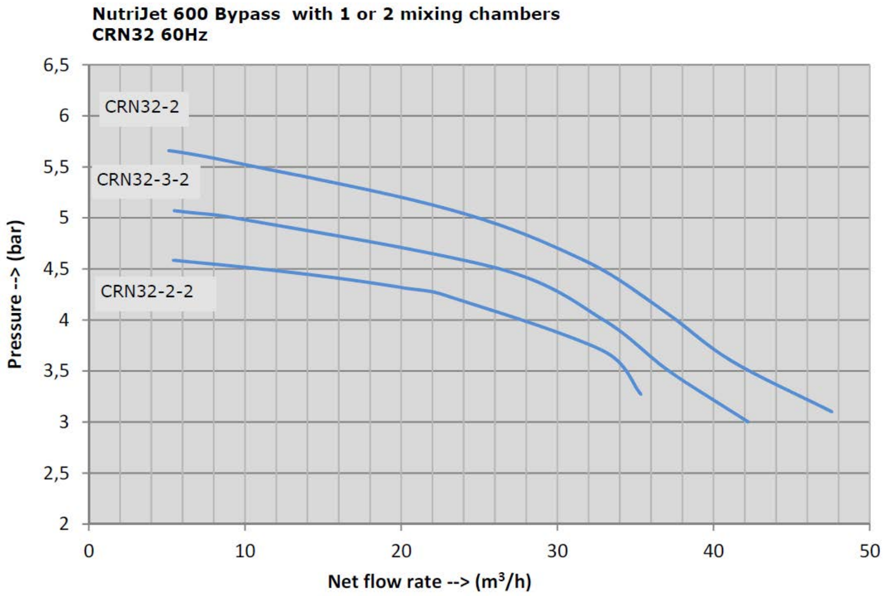


NutriJet 300 Bypass with 1 mixing chamber
CRI15 60Hz

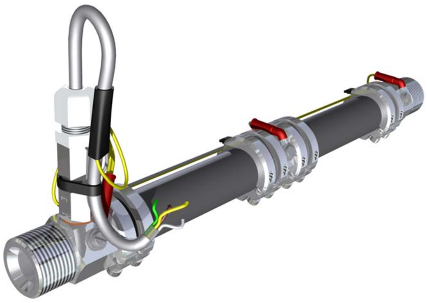


NutriJet 600 Bypass with 1 or 2 mixing chambers
CRN32 50Hz




NutriJet 600 Bypass with 1 or 2 mixing chambers
CRN32 60Hz
CRN32-2
CRN32-3-2
CRN32-2-2
Pressure --> (bar)
Net flow rate --> (m³/h)
6,5
6
5,5
5
4,5
4
3,5
3
2,5
2
0
10
20
30
40
50

EC sensors



Measuring tube with EC sensor

In order to control and to monitor the electrical conductivity (EC) and so the concentration of fertilisers in the irrigation water, the fertiliser dosing unit is equipped with 2 EC temperature-compensated sensors. There is an important advantage of using 2 sensors: the process computer is able to monitor the correct functioning of the sensors by comparing both measurements. If everything is all right, both measurements provide the same value at all times. Contamination or other influences may cause the values to deviate from one another. Then, it is no longer clear which value is right. This may cause an incorrect quantity of fertilisers being dosed, possibly causing crop damage. In case of a mutual deviation of the EC measurements, the process computer will stop the make-up of irrigation water and alert the user by an alarm signal. By this, crop damage is prevented.

Technical specifications for the EC sensor can be found in the manual of this sensor.

pH sensors

pH sensor holders with pH sensors

In order to adjust and monitor the pH value of the irrigation water, the fertiliser dosing unit is equipped with 2 pH sensors. There is an important advantage of using 2 sensors: the process computer is able to monitor the correct functioning of the sensors by comparing both measurements. If everything is all right, both measurements provide the same value at all times. Contamination or other influences may cause the values to deviate from one another. Then, it is no longer clear which value is right. This may cause an incorrect quantity of acid or lye being dosed, possibly causing crop damage. In case of a mutual deviation of the pH measurements, the process computer will stop the make-up of irrigation water and alert the user by an alarm signal. By this, crop damage is prevented.

Technical specifications for the pH sensor can be found in the manual of this sensor.

Flow sensor (litre counter)

Flow sensor ('paddle wheel type)

(Left: flow sensor with T-piece. Right: flowsensor on saddle fitting)

A flow sensor for determining the flow rate within the irrigation line is necessary for the functioning of the NutriJet. This sensor is a 'paddle wheel' type and is also referred to as a 'litre counter'. With this flow sensor the amount of irrigation water distributed to the crop is controlled and monitored. A certain amount can be measured per valve section and the dosing control can anticipate a change of flow rate, so that the desired quality of irrigation water gets available sooner.

The flow sensor is based on a Hall-sensor and must be installed on a T-piece or a saddle fitting. T-pieces and saddle fittings are available in a range of sizes for a range of diameters of the irrigation line. The calibration factor of the flow rate measurement depends on the internal dimensions of the T-piece/saddle fitting and the insertion depth of the flow sensor.

Technical specifications for the flow sensor can be found in the manual of this sensor.

Supply water quality

Composition and pH value

The dosing unit adds acid or lye to the supply water to:

- regulate the pH value of the irrigation water;
- chemically mix (homogenise) the irrigation water in a optimum manner;
- allow a chemical reaction to take place (convert bicarbonate into carbon dioxide).

The pH value of the irrigation water must be between 5.2 and 6.2, depending on the crop and growing medium.

Supply water consists of (a combination of) rain water, drinking water, bore hole water, downstream mill water, river water or reverse osmosis water, typically mixed with (disinfected) drain water. The variety of chemical elements in the supply water determine not only the composition and the pH value of the supply water but also whether or not the supply water can be used as irrigation water once fertiliser and acid or lye have been added using the dosing unit.

Influence of bicarbonate

It is important that the quantity of HCO_3^- (bicarbonate) in the supply water is established by means of water analysis. Bicarbonate has a buffering effect on the pH value and affects the operation of the acid dosing control in the dosing unit:

- An optimum quantity of HCO_3^- in the supply water helps to ensure that plants receive irrigation water with a reliable and accurate pH value via the dosing unit. The correct pH value of the irrigation water is necessary for the good take up of fertilisers by the plant.
- An excessively low quantity of HCO_3^- causes the pH control to become unstable.
- An excessively high quantity of HCO_3^- leads to the following problem: dosing acid neutralises HCO_3^-, with a quantity of CO_2 (carbon dioxide) being generated. Because the system is closed, this CO_2 cannot escape from the irrigation water and therefore reaches the plants. There it will be released into the ambient air, causing the pH to rise. In this case, the pH at the plants will not therefore be the same as the pH that was set on the unit.

The table below shows the limit values for the quantity of HCO_3^- and the qualification of the supply water in mmol/l or mg/l. In some cases, the quantity of HCO_3^- in the water is also displayed as calcium carbonate ($CaCO_3$), in which case it is usually quoted in mg/l. The corresponding values are included in the table.

Bicarbonate limit values and supply water quality

Supply water qualification	Quantity of bicarbonate		Quantity of bicarbonate expressed as calcium carbonate	
	HCO_3^- in mmol/l	**HCO_3^- in mg/l**	**$CaCO_3$ in mmol/l**	**$CaCO_3$ in mg/l**
Too low	< 0.10	< 6.1	< 0.050	< 5.0
Optimum	0.10 .. 0.50	6.1 .. 30.5	0.050 .. 0.250	5.0 .. 25.0
Too high	> 0.50	> 30.5	> 0.250	> 25.0

Pre-treat supply water

On the basis of the concentration of HCO_3^-, it must be determined which measures or combinations of measures should be taken to pre-treat the supply water.

Supply water with too low a concentration of bicarbonate

When using reverse osmosis water, but in some cases rain water also, too low a quantity of HCO_3^- (< 0.10 mmol/l) may be deemed to exist in the supply water. Dosing acid may give rise to an unstable chemical reaction in the irrigation water.

This unstable reaction can be stabilised by taking one of the following measures, or a combination thereof:

- Add disinfected drain water, which typically contains bicarbonate, to the supply water (via an EC pre-control).
- Add a small quantity of drinking water or bore hole water (1 .. 2 %) to the supply water via an electric valve with small diameter.
- Add a small quantity of bicarbonate to one of the fertiliser solutions. This can be done, for example, by replacing 1 % of caustic potash with an equal quantity of potassium carbonate ($KHCO_3$) or calcium carbonate (K_2CO_3).

Supply water with too high a concentration of bicarbonate

In many cases, too high a concentration of HCO_3^- (> 0.5 mmol/l) may be deemed to exist in the supply water when using bore hole water, river water and drinking water. Dosing acid may then result in there being insufficient time to neutralise the bicarbonate.

Stabilisation is possible by pre-treating the supply water using a Priva Neutralizer with an acid injection and aeration system. The treated supply water is then stored in a stock tank.

Supply water pressure and capacity

General: the pressure at the supply side of the unit shall be as constant as possible. The capacity of the supply water shall be at least equal to the net capacity of the system pump (preferably somewhat more). The pressure in the NutriJet shall not exceed 7 bar.

NutriJet Inline: the pressure at the supply side of the unit shall be 0.1 .. 0.4 bar (above atmospheric pressure). With this, the system pump shall deliver a pressure of 2.5 bar at miniumum.

NutriJet Bypass:

- The pressure in the main line shall be at least 0.5 bar lower than the pressure delivered by the system pump, and shall be 2,7 bar at minimum.
- When large differences in water off-take by the irrigation valves occur or when high EC values (higher than approximately 3.5 mS/cm) in the main line are desired, the system pump capacity (flow rate and pressure in bar) must be at least 15 % and not more than 65 % of the capacity of the pump in the main line.

  Choose the system pump capacity of the NutriJet Bypass so that precipitation of fertilisers in venturis and mixing chamber is avoided. The precipitation of fertilisers depends on the amounts of calcium and phosphate in the irrigation water among other things. An EC value until a maximum of 2.0 mS/cm in the irrigation water can be realized when the pump capacity is 15 %. At a capacity of 25 % this is a maximum of 3.0 mS/cm. It is possible to determine the pump capacity exactly if the chemical composition (of the recipe) with the desired EC and pH values of the irrigation water, and the amount of fertilisers and acid and/or lye to be added to the supply water is known.

- The distance between the connections of the inlet line and the outlet line on the main line must be approximately 1.5 m. In this part of the main line the flow must be turbulent to achieve well mixing of the water with the water that is injected by the unit. If the turbulence is insufficient, then install injection pipes in the inlet and outlet connections. These injection pipes induce turbulence.

Filters

Use filters to filter organic dirt and solid particles out of the water. The choice of a sand filter and/or screen filter will depend on the quality of the supply water.

Sand filter

Use a sand filter if the supply water contains large amounts of organic dirt such as algae or plant remnants.

In general, the following operational conditions apply to a sand filter:

- The flow rate of the water through the sand filter is approx. 40 .. 50 m/h.
- The rinse water speed must be approx. 40 .. 50 m/h to achieve an expansion of around 15 % in the bed of sand via an additional backwashing pump.
- The size of sand grains is approx. 1 .. 2 mm.
- The thickness of the bed of sand is approx. 40 cm.

Other points to consider:

- On account of the hydraulic resistance, always position a sand filter at the discharge side of pump.
- In the event of a pressure difference of approx. 0.5 bar over the bed of sand, the sand filter must be rinsed. To do this, you require an additional backwashing pump.
- A multi-layer or multimedia filter can be used for large quantities of suspended particles, such as a filter with layers of anthracite, sand and gravel. For more information, please consult the sand filter supplier's manual.
- If a standstill of the unit during the backwashing of the filter is a problem, consider multiple filters connected in parallel. In this way there is always enough filter capacity if one of the filters is being backwashed.

Screen filter

Use a screen filter ('sieve filter') when the supply water contains a large number of hard and coarse particles.

In general, the following operational conditions apply to a screen filter:

- The flow rate through the filter must be adjusted to the type of filter.
- It must be possible to clean the filter automatically or manually during use.
- The filter must be made from SST or a synthetic material with a passage size < 75 .. 500 µm, depending on the type of supply water and type of irrigation system (dripper or sprinkler).

- Clean filters on a regular basis. The frequency depends on the degree of contamination of the supply water. Consult the user instructions or contact the supplier of the filter concerned.
- If the filter is installed on the distribution side of the unit, a dirt filter with a maximum passage size of 2 mm must be installed on the supply side.

Because a screen filter usually has a relatively coarse mesh size (especially if it is a dirt filter), the hydraulic resistance is low and the filter can also be positioned on the suction side of the pump. On account of the hydraulic resistance, a fine-meshed screen filter must be positioned on the discharge side of the pump.

Position of the filter relative to the unit

There are many factors that determine whether a filter should be positioned on the supply side, on the distribution side or possibly on both sides of the unit. Some considerations:

- The smaller the openings on the sprinklers or drippers of the irrigation system, the easer it is for them to become clogged and the more important it is to ensure good filtration.
- Although it may seem logical to fine filter the supply water (thus protecting both the unit and the distribution system against particles), it is often better to position a relatively coarse filter (screen filter) on the supply side of the unit and a fine filter on the distribution side. This is because particles can also be produced in the unit, for instance as a result of algae growth or sediment or the depositing of fertilisers (especially when the unit is at a standstill). In addition, a fine filter may cause problems with the pump on the unit on account of the high hydraulic resistance.
- If recipes are changed frequently, a sand filter on the distribution side will be a disadvantage. This is because the sand filter will have to be frequently rinsed, resulting in a repeated loss of irrigation water.

Fertiliser supply

The dimensions of all components that are installed for fertiliser storage and the entire line path between the fertiliser stock tank and the dosing channel must be completely identical for all tanks to support a balanced level of fertiliser suction. Place the tanks, lines and the fertiliser dosing unit within a containment provision to receive the chemical substances in the event of a leakage. The following further aspects should be taken into account when installing fertiliser, acid and/or lye tanks for the fertiliser dosing unit:

Fertiliser and acid or lye tanks

Ensure that he bottom of the fertiliser and acid or lye tanks is not beneath the level of the connections of the dosing channels.

If balance level control is desired (and possible), then provide the fertiliser tanks with level sensors.

Fertiliser and acid or lye lines

Ensure that that the supply lines between the fertiliser tank and the fertiliser dosing unit are as short as possible for a maximum dosing capacity. Ensure in all cases that the pipes are shorter than 8 m.

Ensure that eventual air bubbles in the lines can escape via the dosing channels, and do not get trapped at a highest point in the line.

The hose connection for the fertiliser supply is fitted with a ribbed hose coupling having an external diameter of Ø 20 mm. For the fertiliser supply to 300 l/h and 600 l/h dosing channels, use reinforced PVC water hose of Ø 19 x Ø 27 mm. Use stainless steel hose clamps (SS 316; steel number: 1.4401) .

Use EPDM sealing material to be resistant to weak acid and alkaline solutions.

The 300 l/h and 600 l/h dosing channels with a rotameter are suitable up to 3 % (weight percent) nitric acid. The 300 l/h and 600 l/h dosing channels without rotameter are suitable up to 10 % (weight percent) nitric acid. For nitric acid up to 38 % (weight percent), a 38 % acid dosing channel is available with a PTFE hose of 5 m, an inner diameter of Ø 4 mm and at the end a foot valve that has to be hanged into the acid or fertiliser tank.

Install valves in the fertiliser and acid or lye supply lines in order to be able to safely carry out maintenance (such as cleaning filters and venturi's).

Fertiliser filters

Filtering the fertiliser solutions is crucial in preventing blockages and damage in the dosing channels. Incompletely dissolved fertilisers, sand grains or crystals that have formed in the supply pipes can damage the dosage valve seating and the dosing valve membrane. These defects must be prevented by careful filtering and are not covered by the warranty. The dirt filter on the dosing channel is meant as a last barrier against coarse dirt particles, not against fine particles. Therefore install a filter in the fertiliser supply line at the side of the stock tank, having a passage size < 500 µm. And install a second filter directly before the connection of the dosing channel, having a passage size < 130 µm. Select filters that can be easily cleaned, and having enough surface so that they do not need to be cleaned too often.

Do not use a filter on lines containing nitric acid at a concentration > 10 % (weight percent). The filters are not resistant to this. Ensure that no dirt gets into the nitric acid tank and that filtered nitric acid is supplied.

Maintenance

Plan periodic maintenance at a handsome moment, for example when the crop is being changed or before or after the winter period.

Maintenance to be carried out by the user

Action	Minimum frequency
Checking the water dosing to the plants by collecting the water from a random selection of drippers.	weekly
Keeping the dosing unit and the immediate surroundings tidy and clean (free of dust, water and chemical substances).	weekly
Checking the fertiliser and acid or lye lines for leaks and air bubbles.	weekly or monthly
Cleaning the dirt filter in the branch for drive water.	monthly
Cleaning the fertiliser filters.	monthly
Checking the entire installation for leaks.	monthly
Checking the pump pressure.	monthly
Calibrating the pH measurement.	monthly
Emptying the pump(s) and the lines before the winter period (if frost may happen)	annually
Cleaning the lens of the light sensor (if applicable).	annually

Maintenance to be carried out by the engineer/service engineer

Action	Minimum frequency
Checking the fertiliser and acid or lye lines for leaks.	annually
Cleaning the rotameters on the dosing channels (if applicable).	annually
Cleaning the sprinkler pipes in mixing chamber	annually
Calibrating the EC measurement.	annually
Checking the operation of the dosing channels.	annually

Use a Priva EC/pH Measuring Case (article number 3779190) to calibrate the EC and pH sensors.

Warranty and safety

Warranty

Priva fertiliser dosing units are delivered with the components as described in this product description. However, Priva maintains the right to make necessary alterations to the design.

Any warranty claim will be invalid if the unit has not been installed and used according to the guidelines given in this product description and in the manual for installation and operation. For the other conditions, refer to the general delivery conditions of Priva (these will be sent to you on request).

Safety

Mainly because of the combination of chemical substances, water, and electricity, it is important that the fertiliser dosing units are installed and operated in accordance with the safety instructions of Priva and the locally applicable regulations. The manuals on installation and operation pay much attention to the subject of safety.

EC Declaration of Conformity

The manufacturer:

Name of manufacturer	Priva B.V.
Manufacturer's address	Zijlweg 3 2678 LC De Lier P.O. Box 18 2678 ZG De Lier The Netherlands

declares the product:

Product name	NutriJet
Model/type	300/600 Substation
Function	Fertiliser dosing unit for the horticulture industry

is in conformity with the following European Directives:

- Machinery Directive 2006/42/EC
- Electromagnetic Compatibility Directive 2004/108/EC

and conforms to the following harmonized European Standards:

NEN-EN-ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
NEN-EN-IEC 61010-1:2010	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
NEN-EN-IEC 61326-1:2006	Electrical equipment for measurement, control and laboratory use - EMC-requirements - Part 1: General requirements
NEN-EN 55011:2009 - Class B + A1:2010	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
NEN-EN 61000-3-2:2006 + A1:2009, A2:2009	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
NEN-EN-IEC EN 61000-3-3:2008	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤16 A per phase and not subject to conditional connection

The technical file was compiled by the R&D department of Priva B.V.

The Netherlands, De Lier, February 2012

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