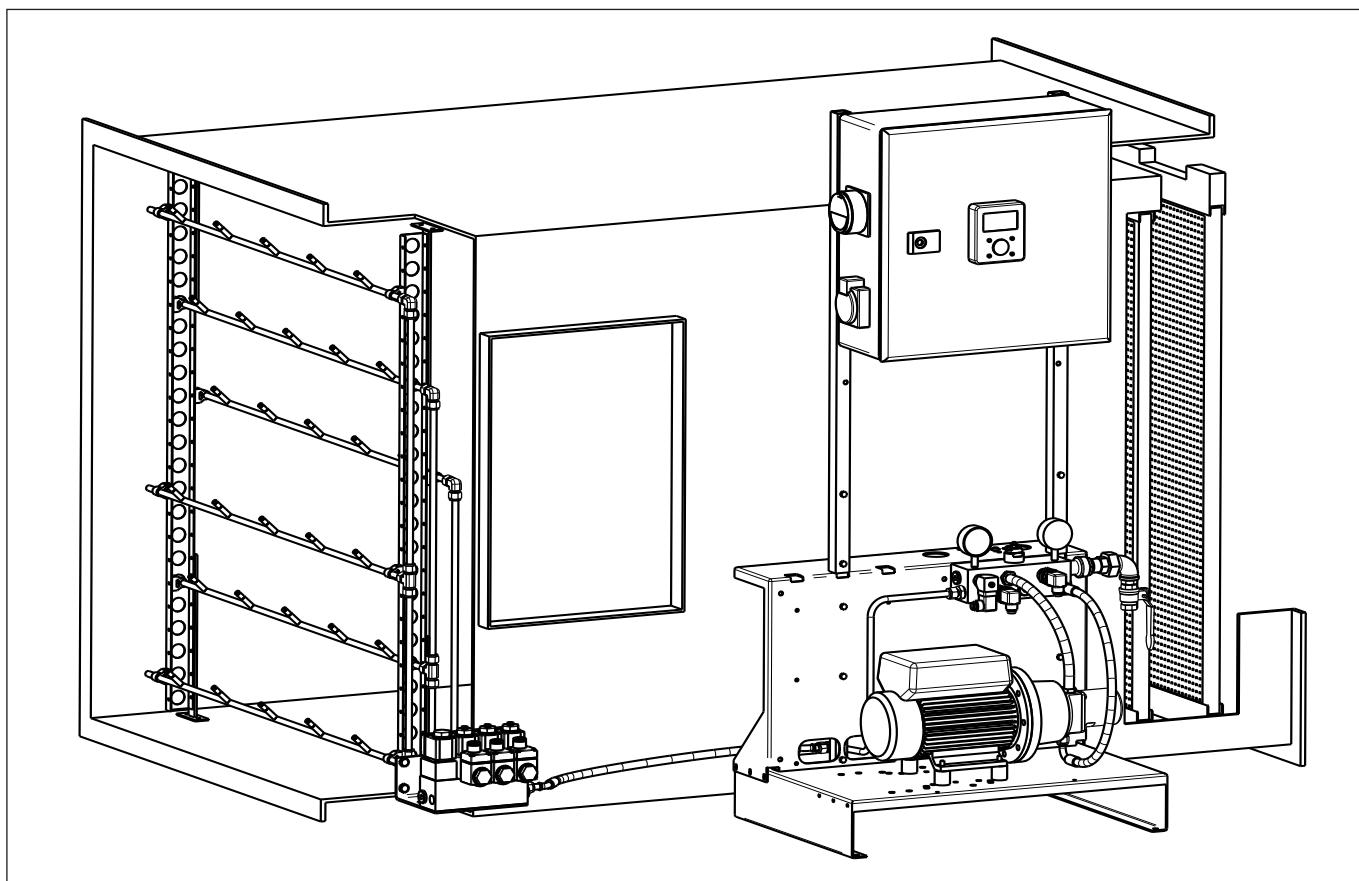


Nessie® Nozzle racks for high-pressure supply-air humidification and exhaust-air adiabatic cooling in HVAC systems



Introduction

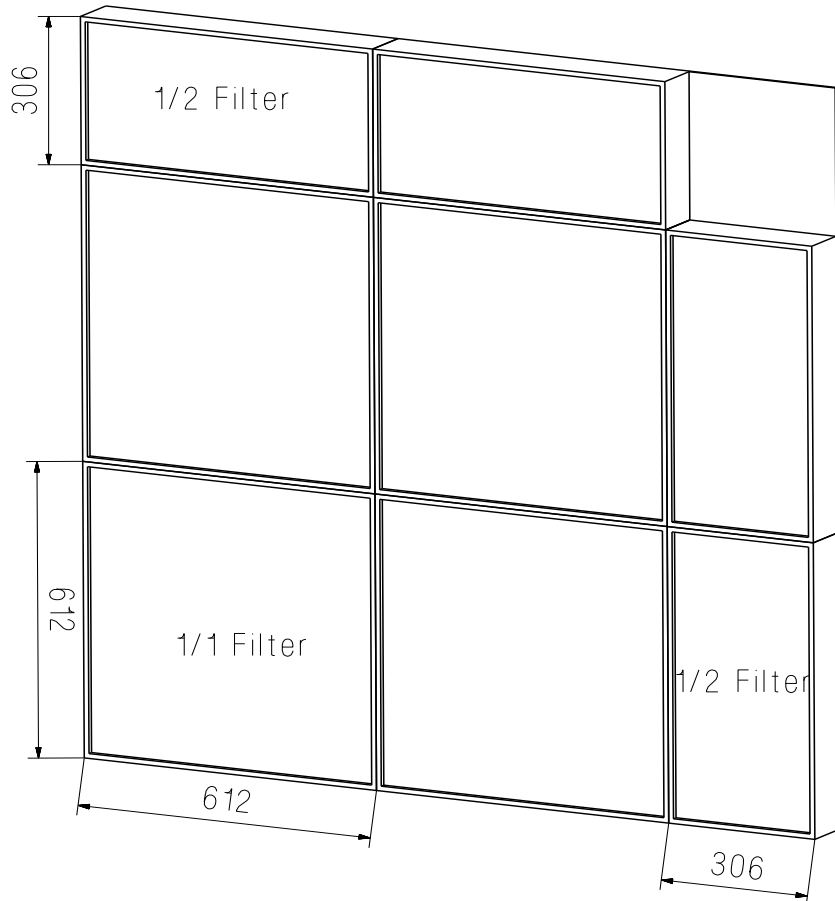
With 31 variants for supply-air humidification as well as exhaust-air adiabatic cooling, Danfoss offers an extensive and thoroughly customized delivery programme of high-pressure nozzle racks for installation in standard air-handling units as well as custom-made industrial high-pressure humidifiers and / or retrofit of existing systems. While developing the system, special

attention was directed to ensuring a simple and speedy installation. Combined with high-pressure pump units and valves – also offered by Danfoss – for the control of humidifier or adiabatic cooling, Danfoss has created a total solution setting new standards in respect of economy, reliability as well as quality and hygiene requirements in the air-handling business.

Dimensioning

Nowadays, duct dimensions for air-handling-units follow in substance the dimensions of the widely used filter cassettes that come in two standard sizes: whole cassettes of 612 mm x 612 mm and half cassettes of 306 mm x 612 mm. These are built into the air duct both vertically and across (depth). Subsequently, the clear internal dimension of the air duct is thus a multiplication of the installed filter cassettes. This fact Danfoss has utilized and made their range

of product match the number of whole and half filter cassettes, respectively. With the 31 variants, Danfoss thus covers air ducts from 612 mm x 612 mm to 2400 mm high and 3600 mm wide ducts (see technical data). Dimensioning of the humidifier capacity or capacity of the adiabatic cooling was based on the defined air flow rate per half or whole filter cassette – being a result of the air velocities of 2.5 m/s generally used in the HVAC business.

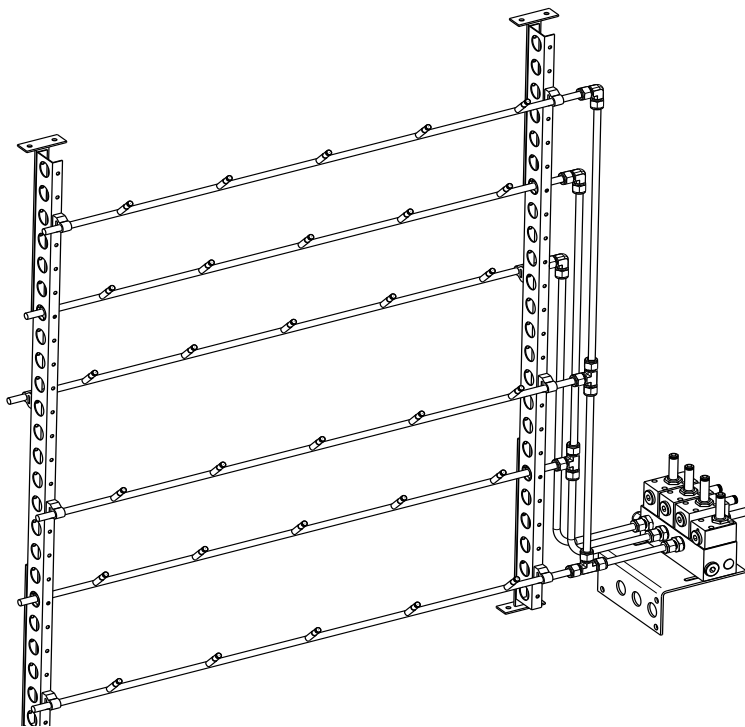


Schematic view of cassette dimensions (here a 2,5 x 2,5 system)

Product information

All 31 variants of the nozzle racks for supply air humidification are dimensioned according to the constant pressure control principle and the 6-stage control system controlled by means of high-pressure valves. With the matching arrangement and combination of 6 to 9 nozzle branches in the air duct it is possible to obtain a sufficient graduation of the humidifier capacity in order to achieve the required relative humidity after the humidifier.

Besides the nozzle racks, the scope of supply of the system includes all fixing devices, connection fittings, wall supports for building in the high-pressure pipes in the duct as well as the valve block described below.



System for supply-air humidification

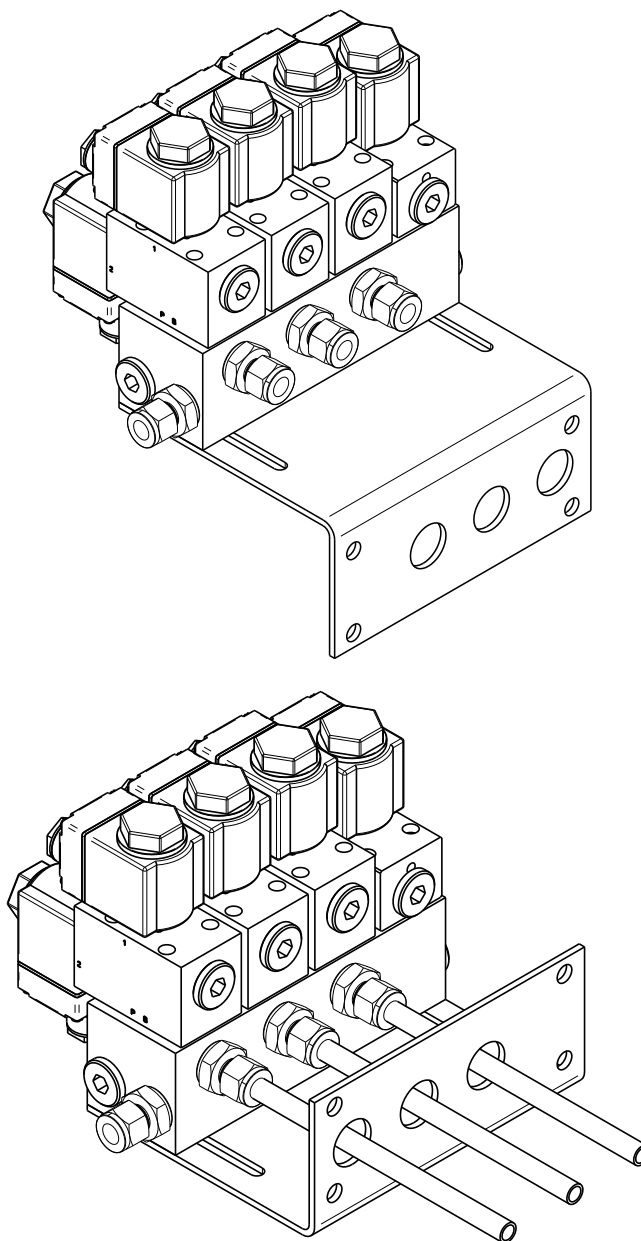
Valve block

The valve block for the 6-stage control of the humidifier capacity is preassembled from factory with all connection fittings. The block is equipped with 3 valves in the 3/2-way design with which the 6-stage control is implemented. Furthermore, the block is equipped with a 2/2-way flush valve for flushing the system right to the valve block at regular intervals at system standstill in order to observe the hygiene requirements. When switching off one valve, the corresponding nozzle branch will open to the atmosphere by means of the 3/2-way technology. This will cause an immediate pressure relief preventing the nozzles from dripping and ensuring emptying of the nozzle branch. Thus no water will stay in the nozzle branch for longer periods, and the risk of negative hygiene impact is minimized. Water used for flushing the valve block and water drained off the nozzle branches is led to drain through a pipe connection.

The valve block is placed directly outside the air duct at the plating by means of a manifold included in the supply. The wall bushings – also supplied - (standard cable gland sets) are used for both sealing and for vibration and noise decoupling.

Please note that the solenoid coils for activating the valves (7) are not included in the scope of delivery of the nozzle system. They are part of the pump unit! Included in the pump delivery is a 3 m long high-pressure hose.

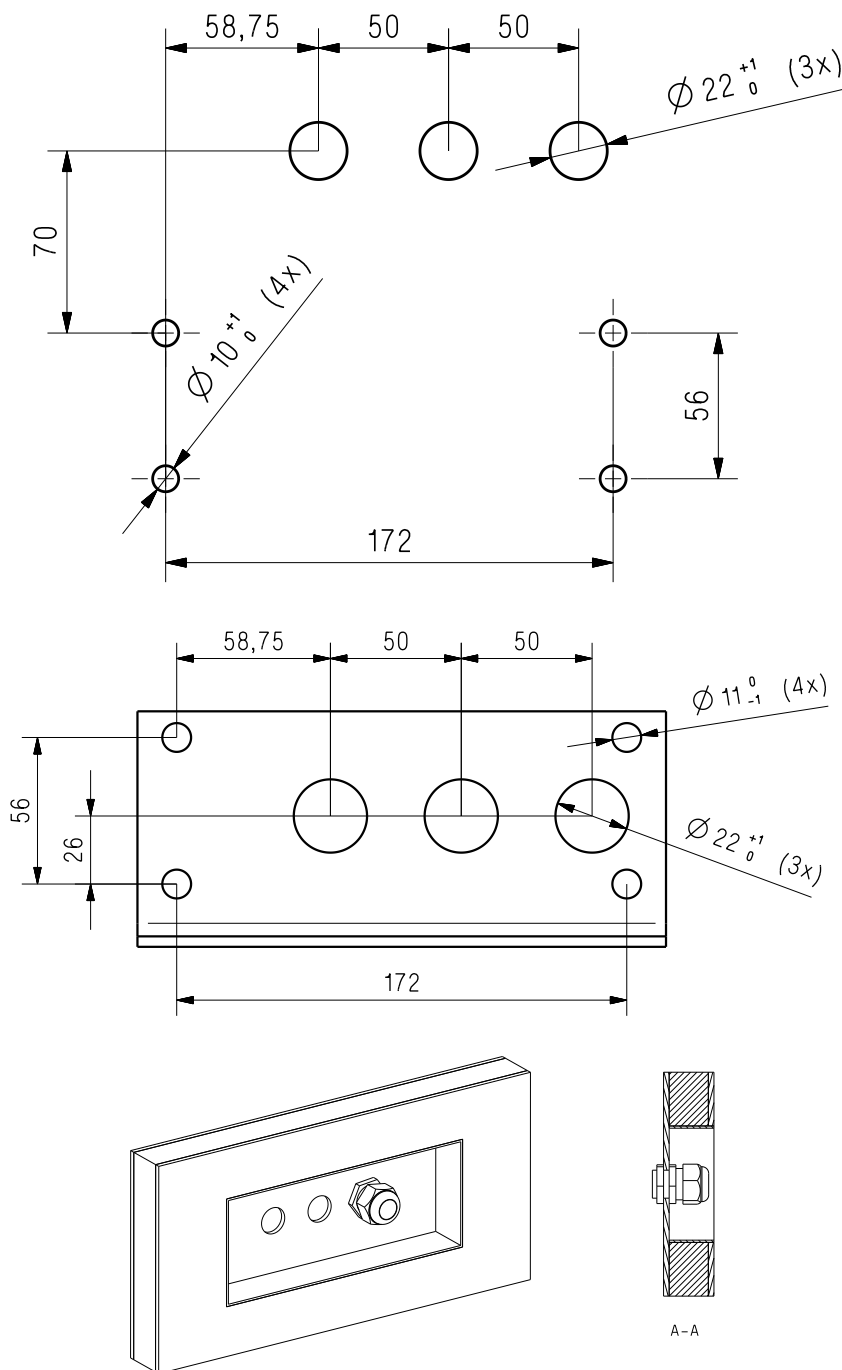
Depending on the space available, the mounting manifold is mountable in angled positions upwards or downwards. The valve block may be relocated up to 80 mm into the duct depending on the air handling unit wall thickness and alignment of the nozzle rack in the duct.



Drilling diagram for mounting manifold

Drilling diagram for mounting manifold seen from the outside, with manifold angled upwards or downwards.

For fixing insulated air handling units it will be necessary to make a groove in the insulation material where the unit is to be fixed, or have the air handling unit manufacturer include an appropriate bushing for the connection pipe.



Nozzles mounted on nozzle racks for supply-air humidification:

Nozzle racks for supply-air humidification are equipped with nozzles with capacities of 2.5 l/h or 3.3 l/h at 70 bar working pressure depending on the duct cross section. A min. humidification output of $\Delta x = 5$ g/kg is thus obtainable at 2.5 m/s air velocity. For higher level of humidification or substantially increased air

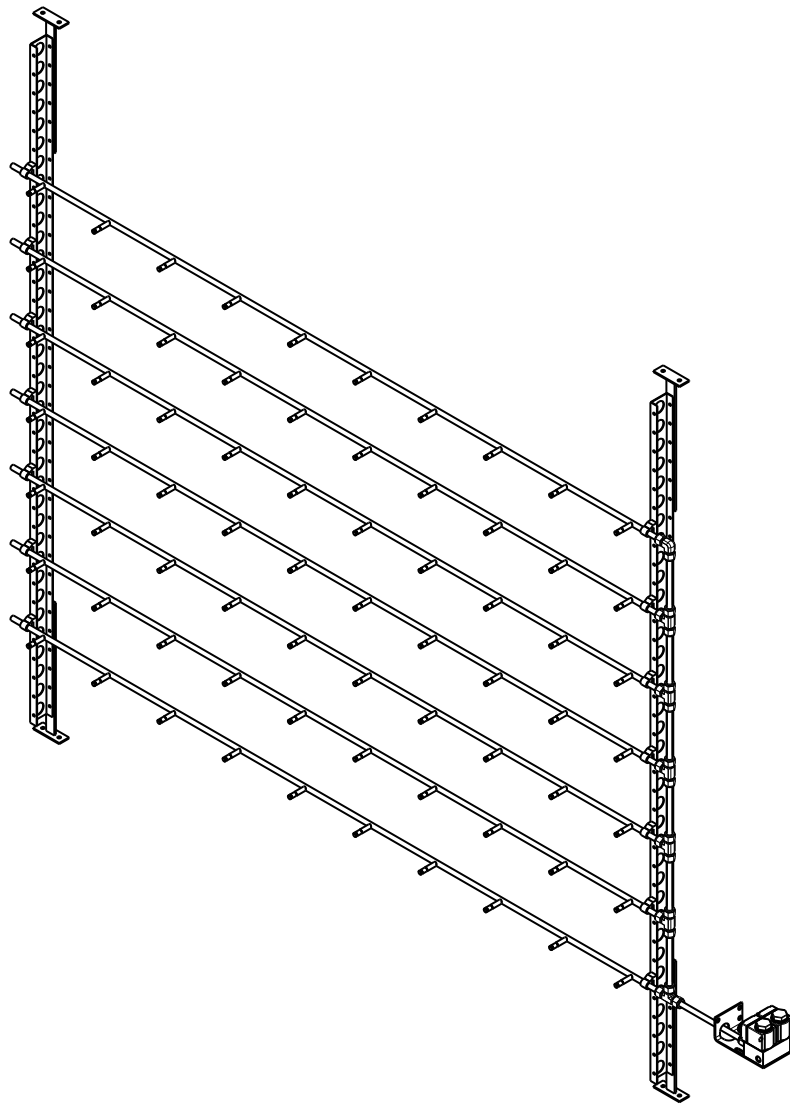
velocity in the air duct, 3.3 l/h or 4.9 l/h nozzles may be installed. Danfoss will readily assist in dimensioning the required nozzle capacity correctly. A further increase of the total system output may be obtained by eg increasing the working pressure to 80 bar.

Product information

Design of nozzle racks for exhaust-air cooling is analogous to the racks for supply-air humidification. Also for this function, Danfoss can provide 31 nozzle rack variants.

All nozzle branches are connected to each other by vertical connection pipes. Depending on the height of the air duct, 3 to 9 nozzle branches are installed in order to obtain the required cooling capacity.

Besides the nozzle racks, here too the scope of supply comprises all fixing devices, connection fittings, wall ducts for building in the high-pressure pipes in the duct wall as well as a 3/2-way valve described further below.



System for exhaust-air cooling

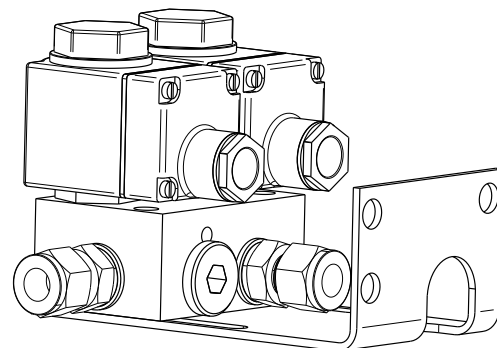
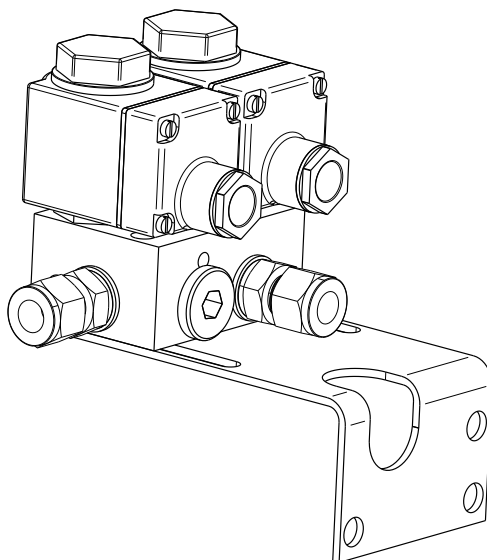
Valve

The valve for controlling the exhaust-air cooling is preassembled from factory with all connection fittings. The valve is designed according to the 3/2-way principle as well. When switching off the valve, the nozzle system will open to the atmosphere by means of the 3/2-way technology. This will cause an immediate pressure relief preventing the nozzles from dripping and ensuring emptying of the nozzle system. Thus no water will stay in the nozzle branch for longer periods, and the risk of negative hygiene impact is minimized. The water drained off the nozzle branches is led to drain through a pipe connection.

The valve is placed directly outside the air duct at the plating by means of a manifold included in the supply. The wall bushings – also supplied - (standard cable gland sets) are used for both sealing and for vibration and noise decoupling.

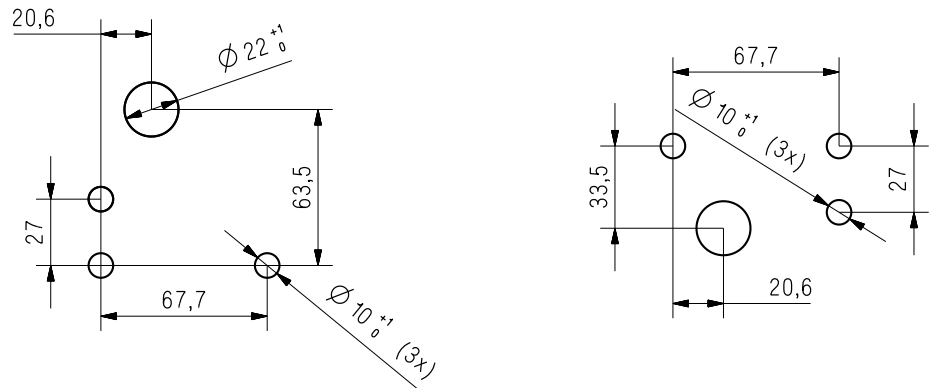
Please note that the solenoid coils for activating the valve (2) are not included in the scope of delivery of the nozzle system. They are part of the pump unit!

Depending on the space available, the mounting manifold is mountable in angled positions upwards or downwards. The valve block may be relocated up to 80 mm into the duct depending on the air handling unit wall thickness and alignment of the nozzle rack in the duct.



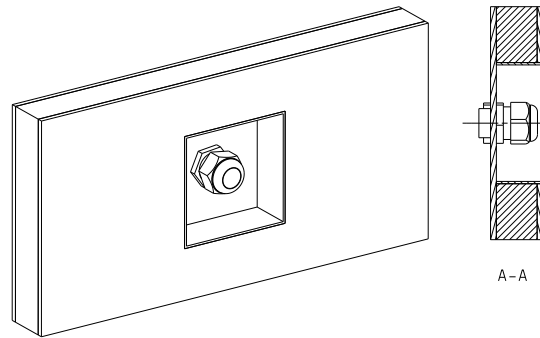
Drilling diagram for mounting manifold

Drilling diagram for mounting manifold seen from the outside, with manifold angled upwards or downwards.

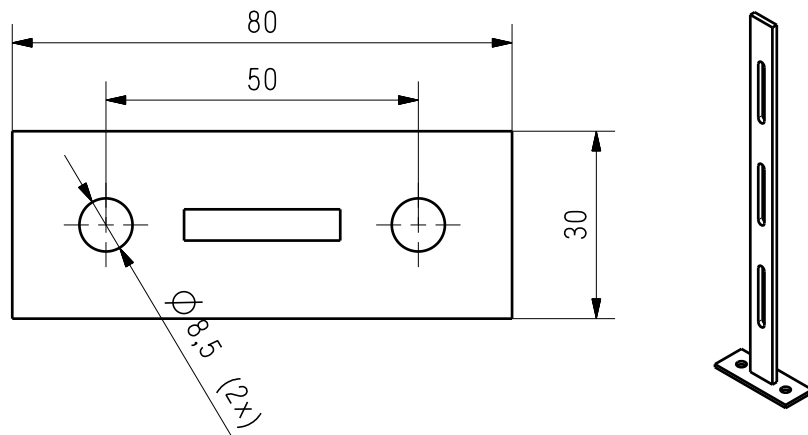


For fixing insulated air handling units it will be necessary to make a groove in the insulation material where the unit is to be fixed, or have

the air handling unit manufacturer include an appropriate bushing for the connection pipe.



Mounting of support in the air handling unit



Detailed drawing of the mounting base

The supporting structure for the nozzle branches is attached to the duct ceiling and duct floor by means of the mounting base. If no suitable position points are available at the duct floor, a transverse bracing should be supplied by the manufacturer of the air handling unit. If so, please consider the required clear duct height.

The mounting bases are infinitely variable to 230 mm at both ends. The minimum and maximum clear duct height can be read off the table below.

Range of nozzle systems

By means of the table below, the nozzle system suiting the relevant air duct is easily found.

Furthermore, total capacity of the nozzle system – normally stated in liter/h - can be taken from the number of nozzles and the individual nozzle capacity.

Cassettes/ Nozzle rack		Type	Free cross section				No. of nozzles		Nozzle branches			Supports		Weight *
Height	Width		Height		Width		Hum.	Cool.	No. x Length		Distance	No.	Height	Hum./ Cool.
			min	max	min	max			Hum.	Cool.				
1	1	1x1	610	909	600	899	18	6	6x500	2x500	100	2	550	20 / 8
1	1.5	1x1.5	610	909	900	1199	24	8	6x800	2x800	100	2	550	21 / 8
1	2	1x2	610	909	1200	1499	30	10	6x1000	2x1000	100	2	550	22 / 9
1.5	1	1.5x1	910	1309	600	899	18	12	6x500	4x500	150	2	900	21 / 9
1.5	1.5	1.5x1.5	910	1309	900	1199	24	12	6x800	3x800	150	2	900	21 / 9
1.5	2	1.5x2	910	1309	1200	1499	30	15	6x1000	3x1000	200	2	900	22 / 10
1.5	2.5	1.5x2.5	910	1309	1500	1799	42	21	6x1400	3x1400	200	2	1500	24 / 11
2	1	2x1	1210	1509	600	899	18	12	6x500	4x500	100	2	550	21 / 9
2	1.5	2x1.5	1210	1509	900	1199	24	16	6x800	4x800	200	2	1200	22 / 10
2	2	2x2	1210	1509	1200	1499	30	20	6x1000	4x1000	200	2	1200	22 / 10
2	2.5	2x2.5	1210	1509	1500	1799	42	28	6x1400	4x1400	200	2	1200	24 / 11
2	3	2x3	1210	1509	1800	2399	48	40	6x1600	5x1600	200	2	1200	24 / 12
2	4	2x4	1210	1509	2400	2999	60	50	6x2000	5x2000	200	2	1200	25 / 13
2	5	2x5	1210	1509	3000	3599	84	70	12x1400	10x1400	200	3	1200	30 / 18
2	6	2x6	1210	1509	3600	4200	96	80	12x1600	10x1600	200	3	1200	32 / 19
2.5	2.5	2.5x2.5	1510	1809	1500	1799	42	42	6x1400	6x1400	200	2	1500	23 / 12
3	2	3x2	1810	2399	1200	1499	35	35	6x1000	6x1000	200	2	1800	24 / 13
3	2.5	3x2.5	1810	2399	1500	1799	42	49	6x1400	6x1400	200	2	1500	24 / 14
3	3	3x3	1810	2399	1800	2099	56	56	6x1600	6x1600	200	2	1800	26 / 15
3	3.5	3x3.5	1810	2399	2100	2399	70	70	7x2000	7x2000	200	2	1800	28 / 17
3	4	3x4	1810	2399	2400	2999	70	70	7x2000	7x2000	200	2	1800	28 / 17
3	5	3x5	1810	2399	3000	3599	98	98	14x1400	14x1400	200	3	1800	33 / 22
3	6	3x6	1810	2399	3600	4200	112	112	14x1600	14x1600	200	3	1800	34 / 23
3.5	3.5	3.5x3.5	2110	2399	2100	2399	90	90	9x2000	9x2000	200	2	2100	31 / 20
3.5	4	3.5x4	2110	2399	2400	2999	90	90	9x2000	9x2000	200	2	2100	31 / 20
3.5	5	3.5x5	2110	2399	3000	3599	126	126	18x1400	18x1400	200	3	2100	38 / 27
4	2	4x2	2410	2999	1200	1799	45	45	9x1000	9x1000	200	2	2400	28 / 17
4	3	4x3	2410	2999	1800	2399	72	72	9x1600	9x1600	200	2	2400	30 / 19
4	4	4x4	2410	2999	2400	2999	90	90	9x2000	9x2000	200	2	2400	31 / 20
4	5	4x5	2410	2999	3000	3599	126	126	18x1400	18x1400	200	3	2400	38 / 27
4	6	4x6	2410	3000	3600	4200	144	144	18x1600	18x1600	200	3	2400	40 / 29

* The weight stated covers the whole scope of delivery including valve(s), base and nozzle system, however exclusive of magnetic coils and exclusive of packing (total installation weight).

Further dataMaterial:

All components for the nozzle systems are made of stainless steel, W1.4301 (AISI 304), W1.4511 (AISI 316) or plastic. All materials have been certified according to the demands of VDI 6022

as to their biological and chemical properties in respect of inactivity and harmlessness by the *Institut für Lufthygiene* (Institute for air hygiene) in Berlin.

Fittings:

Danfoss only uses double compression ring high-pressure fittings of stainless steel.

Please be sure not to use so-called cutting ring fittings (also called Ermeto fittings) as these are not sufficiently corrosion-resistant.

Water quality:

Basically, Danfoss recommends operation on demineralized water for both supply-air humidification and exhaust-air cooling.

All materials for the Danfoss systems are suitable for operation with demineralized water with conductivity as low as 1 $\mu\text{S}/\text{cm}$.

Code numbers

Type	Humidification			Adiabatic cooling		
	Nozzle 2.5 l/h	Nozzle 3.3 l/h	Nozzle 4.9 l/h	Nozzle 2.5 l/h	Nozzle 3.3 l/h	Nozzle 4.9 l/h
1x1	180U4510/2	180U4510/3	180U4510/4	180U4550/2	180U4550/3	180U4550/4
1x1.5	180U4511/2	180U4511/3	180U4511/4	180U4551/2	180U4551/3	180U4551/4
1x2	180U4512/2	180U4512/3	180U4512/4	180U4552/2	180U4552/3	180U4552/4
1.5x1	180U4513/2	180U4513/3	180U4513/4	180U4553/2	180U4553/3	180U4553/4
1.5x1.5	180U4514/2	180U4514/3	180U4514/4	180U4554/2	180U4554/3	180U4554/4
1.5x2	180U4515/2	180U4515/3	180U4515/4	180U4555/2	180U4555/3	180U4555/4
1.5x2.5	180U4516/2	180U4516/3	180U4516/4	180U4556/2	180U4556/3	180U4556/4
2x1	180U4517/2	180U4517/3	180U4517/4	180U4557/2	180U4557/3	180U4557/4
2x1.5	180U4518/2	180U4518/3	180U4518/4	180U4558/2	180U4558/3	180U4558/4
2x2	180U4519/2	180U4519/3	180U4519/4	180U4559/2	180U4559/3	180U4559/4
2x2.5	180U4520/2	180U4520/3	180U4520/4	180U4560/2	180U4560/3	180U4560/4
2x3	180U4521/2	180U4521/3	180U4521/4	180U4561/2	180U4561/3	180U4561/4
2x4	180U4522/2	180U4522/3	180U4522/4	180U4562/2	180U4562/3	180U4562/4
2x5	180U4523/2	180U4523/3	180U4523/4	180U4563/2	180U4563/3	180U4563/4
2x6	180U4524/2	180U4524/3	180U4524/4	180U4564/2	180U4564/3	180U4564/4
2.5x2.5	180U4525/2	180U4525/3	180U4525/4	180U4565/2	180U4565/3	180U4565/4
3x2	180U4526/2	180U4526/3	180U4526/4	180U4566/2	180U4566/3	180U4566/4
3x2.5	180U4527/2	180U4527/3	180U4527/4	180U4567/2	180U4567/3	180U4567/4
3x3	180U4528/2	180U4528/3	180U4528/4	180U4568/2	180U4568/3	180U4568/4
3x3.5	180U4529/2	180U4529/3	180U4529/4	180U4569/2	180U4569/3	180U4569/4
3x4	180U4530/2	180U4530/3	180U4530/4	180U4570/2	180U4570/3	180U4570/4
3x5	180U4531/2	180U4531/3	180U4531/4	180U4571/2	180U4571/3	180U4571/4
3x6	180U4532/2	180U4532/3	180U4532/4	180U4572/2	180U4572/3	180U4572/4
3.5x3.5	180U4533/2	180U4533/3	180U4533/4	180U4573/2	180U4573/3	180U4573/4
3.5x4	180U4534/2	180U4534/3	180U4534/4	180U4574/2	180U4574/3	180U4574/4
3.5x5	180U4535/2	180U4535/3	180U4535/4	180U4575/2	180U4575/3	180U4575/4
4x2	180U4536/2	180U4536/3	180U4536/4	180U4576/2	180U4576/3	180U4576/4
4x3	180U4537/2	180U4537/3	180U4537/4	180U4577/2	180U4577/3	180U4577/4
4x4	180U4538/2	180U4538/3	180U4538/4	180U4578/2	180U4578/3	180U4578/4
4x5	180U4539/2	180U4539/3	180U4539/4	180U4579/2	180U4579/3	180U4579/4
4x6	180U4540/2	180U4540/3	180U4540/4	180U4580/2	180U4580/3	180U4580/4

Spare parts

High-pressure nozzle with anti-drip valve	2.5 l/h	180Z1939
	3.3 l/h	180Z1940
	4.9 l/h	180Z1941
Blind plug (to close individual nozzle positions)		180Z1938
Nozzles and plugs come in packages of 10 Nos.! Please order multiples of 10.		
Supports	550mm	180N1221
	900 mm	180N1222
	1200 mm	180N1223
	1500 mm	180N1224
	1800 mm	180N1225
	2100 mm	180N1226
	2400 mm	180N1227
Mounting support		180N1199
Nozzle pipes with adapters	500 mm (3 nozzles)	180N1213
	800 mm (4 nozzles)	180N1214
	1000 mm (5 nozzles)	180N1215
	1400 mm (7 nozzles)	180N1216
	1600 mm (8 nozzles)	180N1217
	2000 mm (10 nozzles)	180N1218
High-pressure pipe Ø12 mm	1000 mm	180N0538
Pipe clamp		180N1230
Duct wall bushing (M20 cable gland)		614X6151
High-pressure fittings		
Straight connector (Union)		180N0461
Angle fitting		180N0457
T-connector		180N0465
Adapter of 1/2" BSP on 12 mm pipe		180N0423
Adapter of 3/8" BSP on 12 mm pipe		180N0422
Valve manifold for 3+1 valve block (humidification)		
Valve manifold for a 3/2-way valve (cooling)		180N1228
Valve block HVAC 3+1 (without fittings)		180L0183
3/2-way valve VDHT 15EC for 3+1 block		180L0240
3/2-way valve VDHT 15E for adiabatic cooling		180L0173
2/2-way flush valve VDHT 30EC for 3+1 block		180L0096

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