General description

DanX air-conditioning and ventilation systems are a range of units design to perform a number of different air treatment tasks, from simple industrial requirements to more comfort-oriented applications.

The DanX range comprises of six different sizes to handle air volumes ranging from 2000 to 32 000 m3/h, with functions including the following:

- Comfort conditioning with heat recovery, heat pump and cooling
- Swimming pool hall ventilation with dehumidification
- Industrial ventilation with or without heat recovery

The DanX range is modular, making it possible to create a customised solution for a specific application. A wide range of ventilation components are available, including heating and cooling coils, dampers, filters, a variety of control options etc.

Design

The cabinet is designed as a load-bearing frame construction with insulated cover panels. The strong closed section framework is fixed with cast alloy corners and is internally insulated.

Doors and cover panels are insulated with 50 mm mineral wool and internal partitions with 30 mm mineral fibre, thus avoiding un-intentional heat transmission between airstreams and condensation on cold spots.

The framework sections and the cover panels are designed to achieve good airtightness and a smooth surface, thus minimising pressure losses in the unit and facilitating cleaning. Inspection covers are in the form of doors with strong hinges and handles. All seals are silicone-free. Inspection windows and internal lighting can also be ordered.

The various integral components, e.g. the heat exchanger and fan, are mounted on special assembly rails which slide in from the outside over the curved edges of the pillar sections.

Surface treatment

The standard unit is hot-dip galvanised and thus complies with Class I of EN 1886.

In more aggressive environments such as swimming pool halls or the outdoors, the units can be given a 60 µm powder coated paint finish both internally and externally, thus fulfilling the Class II requirements of EN 1886.

Thermal insulation

Thermal insulation is an expression of heat losses through the cabinet and is described as U = W/m²K. EN 1886 specifies the following classes:

T1	=	$0 < U < 0,5$
T2	=	$0,5 < U < 1,0$
T3	=	$1,0 < U < 1,4$
T4	=	$1,4 < U < 2,0$
T5	=	no requirements

The figure measured for DanX is U = 1.2, thus fulfilling the requirements for Class T3.

Cold bridging factor

The cold bridging factor kB is defined as follows

$$k_B = (t_o - t_i) / (t_a - t_i)$$

to	=	the minimum surface temperature of the cabinet
ti	=	the average temperature of the unit
ta	=	the average temperature of the ambient air

The cold bridging factor may be between 0 and 1, where 1 signifies no risk of cold bridging.

Again, EN 1886 specifies various classes:
kB
TB1 = 0.75 ‹ kB ‹ 1
TB2 = 0.60 ‹ kB ‹ 0.75
TB3 = 0.45 ‹ kB ‹ 0.60
TB4 = 0.30 ‹ kB ‹ 0.45
TB5 = no requirements

For units with fresh-air intake and an external temperature below -7 C, the requirements for class TB3 need to be met. The DanX cabinet satisfies this requirement.

Airtightness of cabinet

EN 1886 specifies the following values for the airtightness of the cabinet:

Cabinet application	Class	Max. air leakage
		$dm^2 \times s^{-1} \times m^{-2}$
Negative pressure only	A	1,32
(at a negative test pressure of 400 Pa)	B	0,44
Positive pressure only	A	1,90
(at a positive test pressure of 700 Pa)	B	0,63

DanX units fulfil the requirements of airtightness Class A, but Class B requirements can be met if ordered specially.

Cabinet stability

EN 1886 stipulates the following requirements under normal operating conditions:

Class 1: 10 mm/m deflection
Class 2: 4 mm/m deflection

In Classes 1A and 2A the test pressure is set at the maximum fan pressure for a nominal r.p.m. Under these conditions no deformation or damage in the unit may occur.

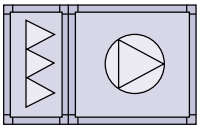
DanX units fulfil the requirements for Class 2A.

Examples of configurations

There are many different ways of configuring a ventilation plant. The examples below show the most common combinations of DanX ventilation modules.

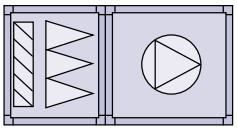
A. Fresh air/exhaust without heat recovery

1. Ventilation with basic filter



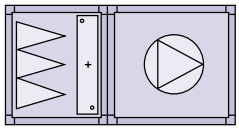
DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	1460	1675	1765	2025	1875	1975
Height mm	915	915	995	1210	1275	1400
Depth mm	880	1400	1900	1800	2200	2200

2. Ventilation with bag filter and multi-leaf damper



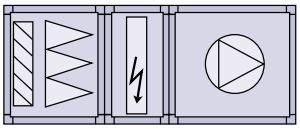
DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	1865	2080	2170	2430	2280	2380
Height mm	915	915	995	1210	1275	1400
Depth mm	880	1400	1900	1800	2200	2200

3. Ventilation with bag filter and heating coil



DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	1865	2080	2170	2430	2280	2380
Height mm	915	915	995	1210	1275	1400
Depth mm	880	1400	1900	1800	2200	2200

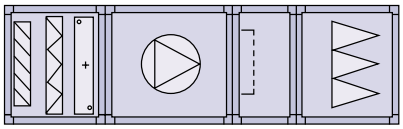
4. Ventilation with bag filter, multi-leaf damper and electric heating coil



F E V

DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	2340	2555	2645	2905	2755	2855
Height mm	915	915	995	1210	1275	1400
Depth mm	880	1400	1900	1800	2200	2200

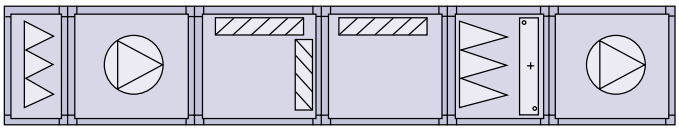
5. Ventilation with pre-filter and bag filter, heating coil and multi-leaf damper. This example is used with an EU 8/9 filter which must always be located after a belt driven fan.



F V E F

DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	3220	3435	3525	3785	3635	3735
Height mm	915	915	995	1210	1275	1400
Depth mm	880	1400	1900	1800	2200	2200

6. Combined fresh air/exhaust unit with mixing section.



E V B B F V

DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	5085	5515	5695	6215	5915	6915
Height mm	915	915	995	1210	1275	1400
Depth mm	880	1400	1900	1800	2200	2200

B. Fresh air/exhaust with heat recovery

The first question to be answered is: what kind of heat recovering to choose? Each of the different types has its advantages.

Cross-flow heat exchanger

In a cross-flow heat exchanger the fresh and exhaust air are not in direct contact, and this type of exchanger can therefore be used for air-conditioning, industrial use and swimming pool hall ventilation.

There are no mechanical parts to maintain in the cross-flow heat exchanger.

Heat pump and cross-flow heat exchanger

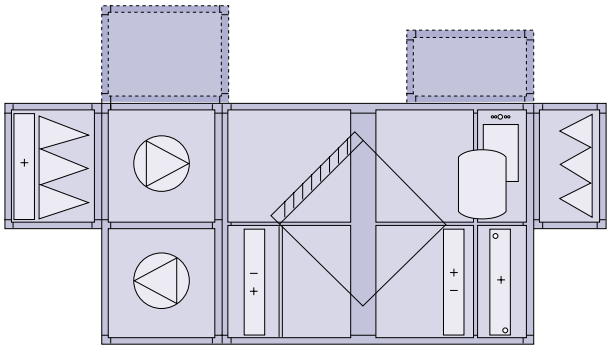
This combination is used for air-conditioning and swimming pool hall ventilation. The additional heat pump provides far greater efficiency and thus far higher dehumidification capacity for swimming pool hall operation.

In the case of air conditioning extra cooling can be achieved by switching the heat pump cycle to cooling mode.

1. This configuration with the fans placed above one another is primarily selected when it is necessary to prevent any exhaust air contaminating the fresh air. A cross-flow heat-exchanger always has a certain amount of leakage, the positive pressure on the fresh air side ensures that only fresh air can escape to the exhaust air, and not vice versa.

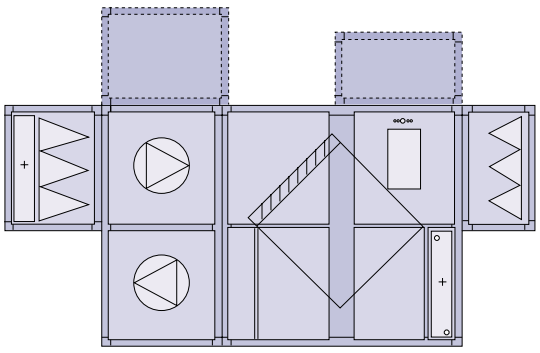
Alternatively it is possible to mount the filter modules above the unit.

The disadvantage with this design (1) is the relatively large pressure differential across the cross-flow heat exchanger, which entails overcoming a relatively large pressure loss on the extract side. An electric reheating coil cannot be mounted in the XWP/XK model. This requires a separate EE module with a length of 475 mm.



F W XWP E

DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	4610	4825	4915	5405	5355	6385
Height mm	1760	1760	1920	2350	2550	2800
Depth mm	880	1400	1900	1800	2200	2200



F W XK E

DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	4047	4262	4352	4825	4675	5505
Height mm	1760	1760	1920	2350	2550	2800
Depth mm	880	1400	1900	1800	2200	2200

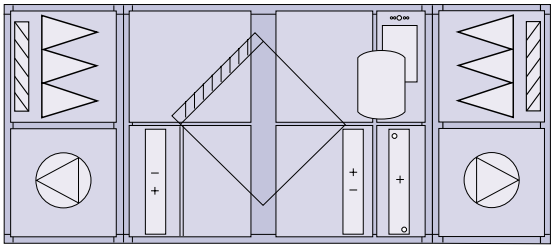
2. This is the best solution for a DanX ventilation plant. In this system the pressure differential across the heat exchanger is approximately zero, resulting in low heat exchanger pressure losses.

In addition, both fans are located so as to discharge directly into the ducts, lowering dynamic pressure loss in the fans.

With this configuration, separate filter modules are unnecessary, as filter, multi-leaf damper or pre-heating coil can be mounted directly above the fans in the VF section.

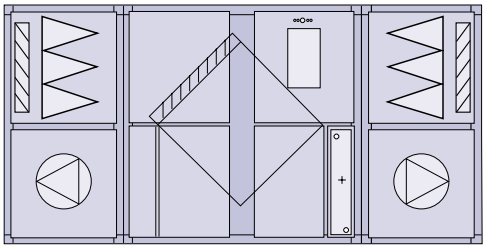
The negative pressure on both sides also provides the best possible airtightness in the cross-flow exchanger.

An electric reheating coil cannot be mounted in the XWP/XK model. This requires a separate EE module with a length of 475 mm.



VF XWP VF

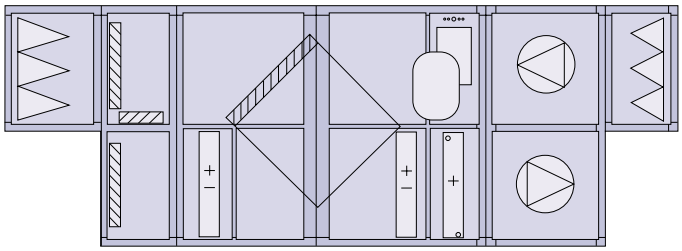
DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	4240	4670	4850	5600	5400	6530
Height mm	1760	1760	1920	2350	2550	2800
Depth mm	880	1400	1900	1800	2200	2200



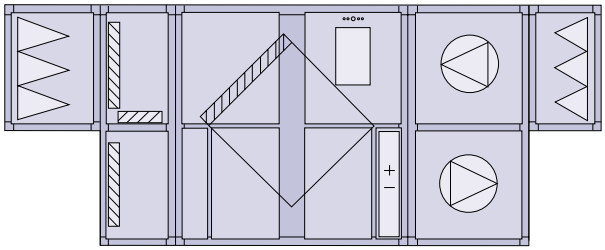
VF XK VF

DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	3677	4107	4287	5020	4720	5650
Height mm	1760	1760	1920	2350	2550	2800
Depth mm	880	1400	1900	1800	2200	2200

3. This solution is preferred where regulation of fresh air volume is required. Otherwise the design is as for plant B1.
An electric reheater coil cannot be mounted in the XWP/XK model. This requires a separate EE module with a length of 475 mm.

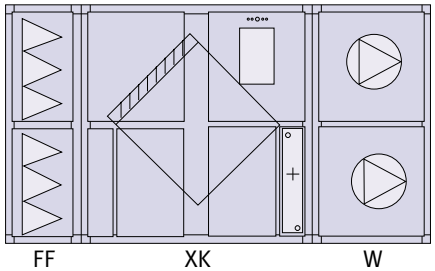


DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	5085	5300	5390	6005	5955	7085
Height mm	1760	1760	1920	2350	2550	2800
Depth mm	880	1400	1900	1800	2200	2200



DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	4522	4737	4827	5425	5275	6205
Height mm	1760	1760	1920	2350	2550	2800
Depth mm	880	1400	1900	1800	2200	2200

4. This solution can only be used in plants without heat pump. The plant has the same advantages as in example 2, combined with the short length of the unit, as mentioned in example B1.
An electric reheater coil cannot be mounted in the XK model. This requires a separate EE module with a length of 475 mm.

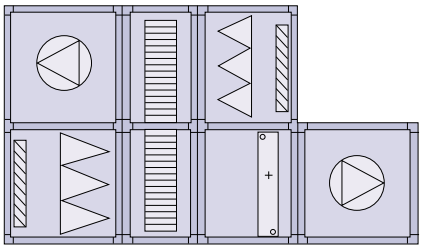


DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	3572	3787	3877	4350	4200	5030
Heigth mm	1760	1760	1920	2350	2550	2800
Depth mm	880	1400	1900	1800	2200	2200

Rotary heat exchangers

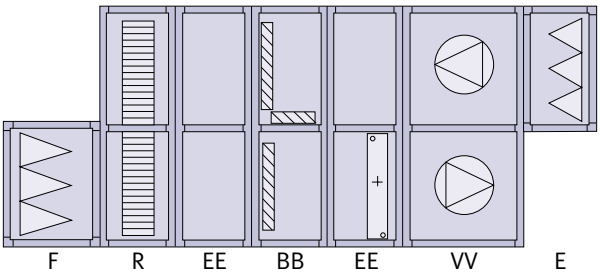
The rotary heat exchanger is suitable for air-conditioning and in certain cases for industrial ventilation. The great advantage of this heat exchanger is its particularly high efficiency and very compact design. A hygroscopic wheel transfers moisture from the exhaust air into the fresh air, which may be advantageous in winter for comfort ventilation.

1. This is the typical configuration for a unit incorporating a rotary heat exchanger. If possible, the fans should be arranged to draw air through the heat exchanger to reduce the pressure difference between the fresh air and the exhaust air and thus minimise air leakage in the rotary heat exchanger. It should also be noted that the pressure on the fresh air side is higher than on the exhaust side with a rotary heat exchanger and therefore no exhaust air can penetrate to the fresh air side through leakage in the exchanger.
   The modules should also be arranged to give easy access to the rotary exchanger for cleaning/servicing.



DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	3325	3755	3935	4455	4155	4355
Height mm mm	1760	1760	1920	2350	2550	2800
Depth mm	1400	1700	1900	2200	2450	2650

2. This solution is preferred where regulation of fresh air volume is required. Otherwise the design is as for plant B5. Here it is not necessary to have positive pressure on the fresh air side as the mixing of fresh and exhaust air is acceptable.



DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	4240	4455	4545	4930	4780	4980
Height mm	1760	1760	1920	2350	2550	2800
Depth mm	1400	1700	1900	2200	2450	2650

C. Fresh air/exhaust with heat recovery for swimming pool halls

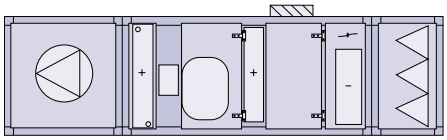
Here the choice is between cross-flow heat exchangers with or without heat pump or with a simple AF-type heat pump dehumidifier.

The solution with the cross-flow heat exchanger and heat pump dehumidifies the air in swimming pool hall by using fresh dry air, whereas type AF uses a heat pump to achieve this.

The AF-type heat pump has the advantage of requiring little space and it is thus suitable as a replacement for old plant and for smaller hotel swimming pool halls.

Nowaday, the cross-flow heat exchangers/heat pump combination is preferred for large public swimming pool hall applications as it is possible to operate with 100% fresh air. This gives a particularly good dehumidification capacity in the critical winter period and the possibility of free cooling in the summer.

1. 1. This AF solution is designed for pure recirculation/dehumidification. However, a multi-leaf damper on the unit makes it possible to supply the hall with up to 30% fresh air. An electric reheating coil cannot be mounted in the AF model. This requires a separate EE module with a length of 475 mm.

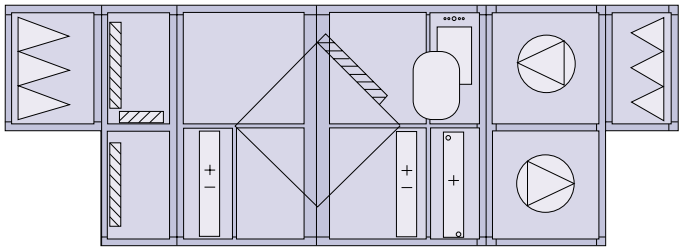


V AF E

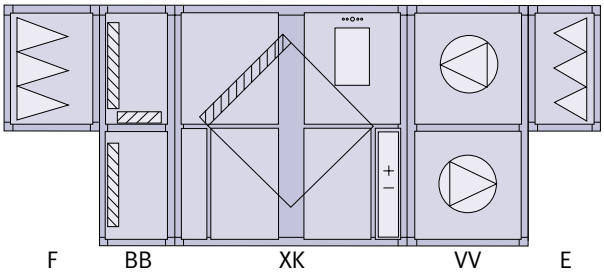
DAN X	3/6	5/10	7/14	12/24
Length mm	3380	3595	4015	4125
Height mm	915	915	995	1275
Depth mm	880	1400	1900	2200

2. This solution is preferred in swimming pool halls where regulation of fresh air volumes is required. Otherwise the design is as for plant B1. In the heat pump version it is also possible to mount a recirculation damper in the heat exchanger section, allowing the unit to run without fresh air at night with the heat pump acting as a dehumidifier. The recirculation damper can be used to reduce the airflow over the evaporator in order to achieve an optimum surface temperature for dehumidification.

An electric reheating coil cannot be mounted in the XWP/XK model. This requires a separate EE module with a length of 475 mm, or alternatively the coil can be positioned in the supply air duct.



DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	5085	5300	5390	6005	5955	7085
Height mm	1760	1760	1920	2350	2550	2800
Depth mm	880	1400	1900	1800	2200	2200



DAN X	3/6	5/10	7/14	9/18	12/24	16/32
Length mm	4522	4737	4827	5425	5275	6205
Height mm	1760	1760	1920	2350	2550	2800
Depth mm	880	1400	1900	1800	2200	2200