TECHNICAL INFORMATION
DanX XD & DanX HP
SWIMMING POOL AIR MANAGEMENT

Dantherm®
CONTROL YOUR CLIMATE

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DanX XD and HP

Compact units for swimming pool air management

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1.0 GENERAL DESCRIPTION

A controlled and comfortable indoor climate is an important factor, particularly in swimming pool halls where high relative humidity and condensation can reduce the well-being of the occupants and cause damage to the building. With Dantherm's corrosion-proof DanX XD and DanX HP (DanX 1, 2 and 3) units you are guaranteed a superior solution, offering not only significant heat recovery but also the possibility of high-quality demand air management. Dantherm's DanX XD and HP solutions are ideal for private or hotel swimming pools and wellness areas.

Concept

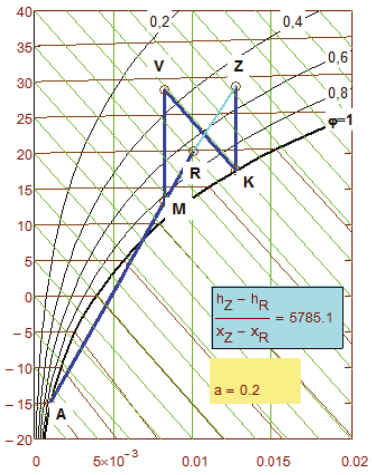
It is impossible to avoid water evaporation in swimming pool halls, however using a carefully designed ventilation / dehumidification solution, the relative humidity can be controlled to a comfortable level. On the basis of pool size, water temperature, air temperature, humidity and swimming activity, the DanX XD and HP units can be designed to accommodate any requirement. Available with a one or two stage heat recovery system and a bespoke controls package, it is the ideal device for providing energy efficient, cost-effective control of swimming pool hall environments – anywhere in the world.

Energy efficient

Maintaining a comfortable indoor environment is a priority in any swimming pool project, but what is equally important to consider is the total life cycle cost of the chosen solution. The DanX caters for life cycle costs in the broadest sense. Highly efficient heat recovery and low specific fan power, combined with an optimized control strategy, contribute to cost-efficient operation and ultimately significant energy savings, while durable components ensure reliable operation and long life. Ultimately, all of this results in economic gains in the long run and contributes to a low cost of ownership.

Service and support

Across the world, we have a broad net of authorized partners with a professional trained staff of technicians who are available to solve any problems with our units. By sharing our know-how and experience, we make sure that you have access to the unique Dantherm Air Handling service and support.



2.0 PROJECT PLANNING AND UNIT SELECTION

2.1 The humidity problem

In a swimming pool hall large quantities of water evaporate into the air of the hall. If the humidity is not kept artificially low, the relative humidity will rise to an unacceptable level, both for the construction of the building and for the comfort of the user. The building will gradually be destroyed as water vapour condenses onto cold surfaces, causing corrosion and mould attack. Poorly insulated windows will steam up when the internal air cools to a temperature below dew point. The maximum acceptable humidity will depend on the degree of insulation and the minimum outside temperature.

For example at 30°C/54% RH, the internal air has a dew point of 20°C, and if the outside temperature is -10°C the building structure must have a U-value of at least 1 W/m2K.

Air movements and especially the distribution of supply air in the swimming pool hall are of major significance, as warm dry supply air does not condense as easily as stationary air, which has had time to cool down. The supply air should therefore be blown along walls and windows at high velocity while the humid air is extracted at the opposite end of the hall. Directly over the pool surface, the air should preferably be more or less stationary, as too much air movement will affect evaporation.

In addition, the pressure in the hall should be kept slightly lower than outside to avoid water vapour being forced into the building structure. For comfort reasons, the relative humidity in the swimming pool hall should be kept under 65% RH, depending on the temperature, but equivalent to an absolute water content of 14.3 g/kg, (according to VDI 2089). Only in summertime when the absolute humidity of the outside air is going above 9 g/kg a higher absolute water content of 14.3 g/kg inside the swimming pool hall is acceptable.

The choice of operating conditions is very important in order to avoid humidity and minimise running costs. The higher the internal air temperature in comparison with the water temperature, the lower the evaporation. However, in practice it is not possible to maintain a difference of more than 2-3°C. Nor should the relative humidity be lower than necessary, as this will cause evaporation to increase.

In private or hotel swimming pool halls, the internal air is normally maintained at 28°C/60% - 30°C/54% RH, and the water temperature at 26-28°C.

2.2 Selecting the right type of unit

Dantherm's DanX 1, 2 and 3 range offers two different types of units which both are well-suited for the task.

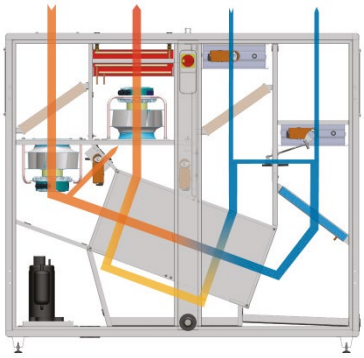
DanX - HP
DanX - XD

The principle of the DanX – HP or XD system differs mainly to that of a traditional swimming pool dehumidifier in the way how the return air from the swimming pool hall is dehumidified and the possibility of supplying up to 100% outside air for an increased comfort level.

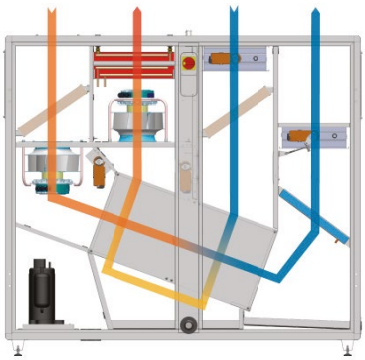
Traditional units are dehumidifying the return air mechanically by the means of a refrigeration system, whereas the DanX HP or XD dehumidifies through exchanging the wet return air with dry outside air. To avoid ventilation losses the DanX systems are equipped with a heat pump and double cross flow heat exchanger (HP) or only a double cross flow heat exchanger (XD).

One of the main benefits of the DanX is that its dehumidification capacity in the critical winter period is far higher than the capacity required because of the very dry outside air. This means that the relative humidity can be lowered under the calculated value if this should be necessary at very low outside temperatures.

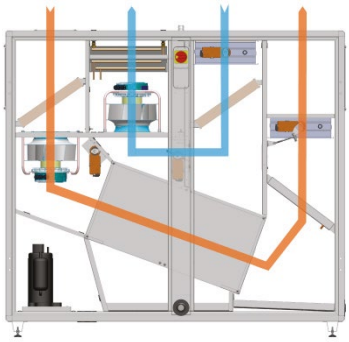
Another important advantage is the possibility of using free cooling, something which is often necessary because of the large glazed areas of modern private and hotel pools.



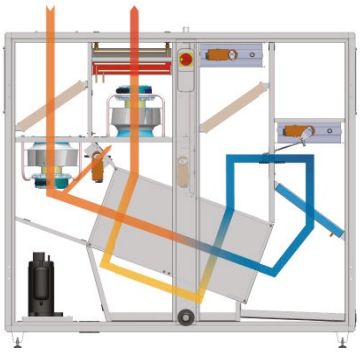
Daytime winter



Daytime summer



Daytime summer free cooling



Night time dehumidification

2.2.1 DanX HP with 2 stage heat recovery

The DanX HP combines the best advantages of a heat pump and outside air dehumidification system. The combination of heat pump and highly efficient double cross flow heat exchanger is designed to perfectly control the humidity and indoor temperature. Significant running cost reductions due to energy savings of up to 100% make this system the obvious choice in climates with low outside winter temperatures. The integrated mixing box ensures that only the exact quantity of outside air required to sustain comfortable conditions is supplied.

For further energy optimization, a water-cooled condenser can be integrated into the heat pump. This allows the excess heat, to be transferred to the pool or the hot water supply, where the energy is efficiently re-used.

Daytime operation winter

The DanX HP is running with the minimum outside air which is required for hygienic reasons for the pool hall. To keep pressure drops low and get a good dehumidification capacity in the heat pump, only a part of the wet swimming pool air is been running through the double heat exchanger and evaporator. Then a part of the exhaust air is leaving the unit with the other part joining the outside air. These two airstreams are then preheated first in the double cross flow heat exchanger and afterwards in the heat pumps condenser. If the supply air temperature still is not high enough a reheater will be activated. In this operation mode the dehumidification is done with the dry outside air and heat pump. If the dehumidification capacity is not sufficient the amount of dry outside air will automatically be increased.

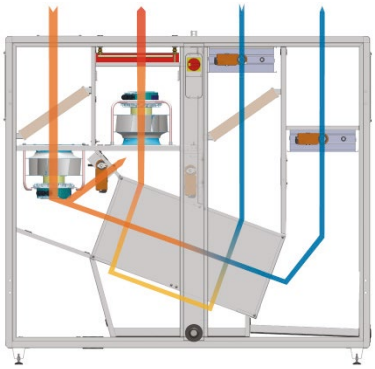
Daytime operation summer

The DanX HP is running with 100% outside air. The reheater and heat pump will normally be stopped as the temperature is high enough, after been pre heated in the double cross flow heat exchanger. If the outside temperature raises more, a by-pass will open to run the unit in free cooling mode. In this operation mode the dehumidification is done just with the dry outside air.

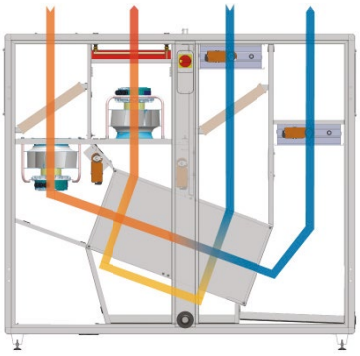
Night time operation

The DanX HP is running in recirculation mode. If no dehumidification is needed the pool air is directly recirculated and heated up by the reheater.

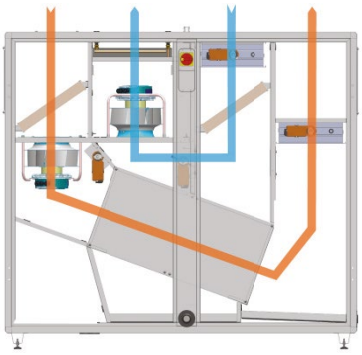
If dehumidification is needed a part of the swimming pool air is pre cooled in the double cross flow heat exchanger before being dehumidified in the evaporator. In this operation mode the dehumidification is done just with the heat pump. Normally the fans will run on low speed in night time, or are stopped if a pool cover is used.



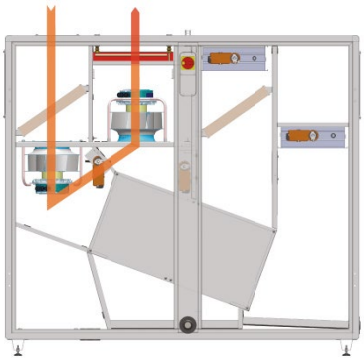
Day/night time winter



Daytime summer



Daytime summer, free cooling



Night time recirculation

2.2.2 DanX XD with 1 stage heat recovery

The DanX XD is an air dehumidification system with a high efficient double cross flow heat exchanger. This system perfectly controls the humidity and indoor temperature while offering significant running cost reductions due to energy saving of up to 90%. The integrated mixing section ensures that only the exact quantity of outside air needed is supplied – which keeps running costs at a minimum.

Daytime operation winter

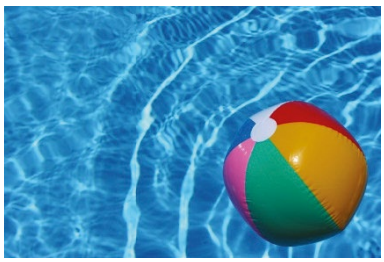
The DanX XD is running with the minimum outside air which is required for hygienic reasons for the pool hall. To keep pressure drops low, only the amount of air which should be changed with the outside air is been running through the double heat exchanger. The rest is directly recirculated and heated up by the reheater. If the dehumidification capacity is not sufficient the amount of dry outside air will automatically be increased.

Daytime operation summer

The DanX XD is running with 100% outside air. The reheater will normally be stopped as the temperature is high enough, after been pre heated in the double cross flow heat exchanger. If the outside temperature goes further up, a by-pass will open to run the unit in free cooling mode.

Night time operation

The DanX XD is running in recirculation mode. If no dehumidification is needed the return air is directly recirculated and heated up by the reheater. If dehumidification is needed a small part of the return air is changed with outside air like in daytime operation winter. When the humidity level in the swimming pool hall again reaches the set point, the unit is running again in recirculation mode. Normally the fans will run on low speed in night time, or maybe even stopped if a pool cover is used.



2.3 Calculation of evaporation

The need for dehumidification arise when evaporation occur from the pool surface, the wet areas and from the bathers themselves. Physical dimensions, temperatures, humidity and air currents are the main factors that influence the evaporation rates.

There are many different formulas for calculating the dehumidification requirement. Common to most of them is that they generate high values in relation to what is actually necessary. This is due to the fact that there is always unintentional ventilation through doors, windows and cracks or maybe that pool usage is lower than anticipated. If there is good air distribution in the hall and the water surface is somewhat lower than the surrounding tiled areas, this also reduces the need for dehumidification.

As the formula applied have a rather high safety margin, it is advisable not to make any extra allowances in the calculations to account for worst-case scenarios. This will merely result in unnecessarily high operation and investment costs. If a drastic rise in relative humidity occurs at peak periods, this will generally be short-lived until levels stabilise again at their normal level.

The German VDI 2089 and Biasin & Krumme are two standards which are most commonly used for calculating dehumidification requirements. The choice which one should be used, very often depends on national preferences. After calculation of the amount of water evaporating from the pool surface the necessary DanX unit can be selected.

2.4 Selecting the unit

The volume of outside air required to deal with the evaporation rate can be calculated as follows:

$$V = W (X_i - X_u) \times 1.175$$

W = Water evaporation from pool (g/h)

X_u = absolute moisture content, outside air (g/kg)

X_i = absolute moisture content, return air (g/kg)

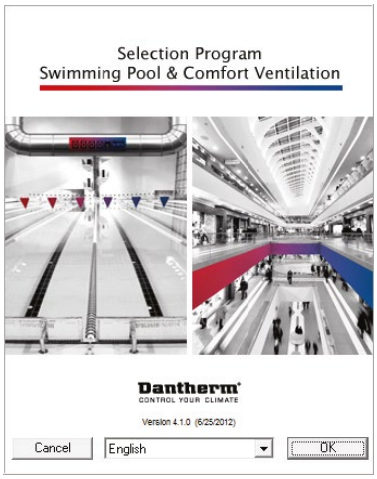
1.175 = air density (kg/m3)

The absolute moisture content of the outside air (X_u) varies with the season from a maximum of 11-12 g/kg in the summer to 2-3 g/kg in the winter. In practice X_u can be set at 9,0 g/kg in Europe, a figure which will only be exceeded for approx. 20% of the year in summertime. There are in any case no condensation problems in summer and the water content of the return air X_i can if necessary be permitted to go a little higher.

The air volume for the DanX 1, 2 and 3 is between 500 and 3500 m^3/h. If a higher air volume has been calculated to dehumidify the pool hall a larger DanX has to be chosen. For this see our technical documentation for DanX 2/4 – 16/32 swimming pool units.

Beside the calculation of the air volume needed for dehumidification it is also important to check that the air change inside the swimming pool hall is sufficient. As a rule of thumbs an air flow of 3-5 times the volume of the swimming pool hall will be sufficient.

2.5 Selection program



For a quick selection you can always use the general technical data from chapter 3 of this catalogue. Here at Dantherm we always use our selection program. Here we can perform an accurate selection of a unit and obtain exact technical data and drawings of the unit.

3.0 GENERAL TECHNICAL DATA

3.1 DanX 1 XD technical data and capacities

Air volume range high speed	m^3/h	500 – 1300

Air volume nominal	m^3/h	1000
Ext. duct pressure [1]	Pa	200
Fresh air volume	%	0–100

Supply air filter		F7
Exhaust air filter		M5

Occupied, according VDI 2089 [2]	kg/h	7
Occupied, partly outside air [3]	kg/h	3.5

Heat output heat exchanger [3]	kW	2.4

Supply air fan [4]	KW	0.3
Exhaust air fan [4]	KW	0.3
Total power consumption [3]	KW	0.6
SFP [3]	kJ/m^3	1.4
Max full load current	A	4.4
Max. power consumption	kW	1.0
Electrical connection	V	1 x 230 + N

Heating coil [5]	RR	2
Heat output max	kW	2.7
Coil off temperature max	°C	38.0
Water flow	m^3/h	0.11
Pressure loss waterside	kPa	7.4
Coil connection	“	3/8

Heating coil [5]	RR	3
Heat output max	kW	3.9
Coil off temperature max	°C	41.5
Water flow	m^3/h	0.14
Pressure loss waterside	kPa	22
Coil connection	“	3/8

[1] Higher external pressures possible
[2] Pool hall condition at 30°C/54%r.h
[3] Pool hall condition at 30°C/54%r.h. with 30% outside air @ 5°C/85%r.h.
[4] 100% air exchange
[5] Air inlet temperature 30°C, water temperature 60°/40°C

3.2 DanX 1 HP technical data and capacities

Air volume range high speed	m^3/h	500 – 1300

Air volume nominal	m^3/h	1000
Ext. duct pressure [1]	Pa	200
Fresh air volume	%	0–100

Supply air filter		F7
Exhaust air filter		M5

Unoccupied, according VDI 2089 [2]	kg/h	1.7
Occupied, according VDI 2089 [2]	kg/h	7
Occupied, partly outside air [3]	kg/h	5

Heat output heat pump / exchanger [3]	kW	5.4
Heating capacity [4]	kW	2.4
Compressor COP [3]		3.9

Supply air fan [5]	KW	0.3
Exhaust air fan [5]	KW	0.3
Compressor power consumption [3]	KW	0.6
Total power consumption [3]	KW	1.2
SFP [3]	kJ/m^3	1.76
Max full load current	A	7.4
Max power consumption	kW	1.7
Electrical connection	V	1 x 230 + N

Heating coil [7]	RR	2
Heat output max	kW	2.7
Coil off temperature max	°C	38.0
Water flow	m^3/h	0.11
Pressure loose waterside	kPa	7.4
Coil connection	“	3/8

Heating coil [7]	RR	3
Heat output max	kW	3.9
Coil off temperature max	°C	41.5
Water flow	m^3/h	0.14
Pressure loss waterside	kPa	22
Coil connection	“	3/8

[1] Higher external pressures possible
[2] Pool hall condition at 30°C/54%r.h.
[3] Pool hall condition at 30°C/54%r.h. with 30% outside air @ 5°C/85%r.h.
[4] Difference between return / supply air
[5] 100% air exchange
[7] Air inlet temperature 30°C, water temperature 60°/40°C
[8] Water temperature 30°C / HP: 40°C

3.3 DanX 2 XD technical data and capacities

Air volume range high speed	m^3/h	1000 – 2100

Air volume nominal	m^3/h	1750
Ext. duct pressure [1]	Pa	200
Fresh air volume	%	0–100

Supply air filter		F7
Exhaust air filter		M5

Occupied, according VDI 2089 [2]	kg/h	11
Occupied, partly outside air [3]	kg/h	6

Heat output heat exchanger [3]	kW	3.7

Supply air fan [4]	KW	0.5
Exhaust air fan [4]	KW	0.5
Total power consumption [3]	KW	0.8
SFP [3]	kJ/m^3	1.2
Max full load current	A	7.0
Max. power consumption	kW	1.6
Electrical connection	V	1 x 230 + N

Heating coil [5]	RR	2
Heat output max	kW	4.9
Coil off temperature max	°C	38.2
Water flow	m^3/h	0.22
Pressure loss waterside	kPa	4.7
Coil connection	“	3/8

Heating coil [5]	RR	3
Heat output max	kW	6.9
Coil off temperature max	°C	41.8
Water flow	m^3/h	0.29
Pressure loss waterside	kPa	12.5
Coil connection	“	3/8

[1] Higher external pressures possible
[2] Pool hall condition at 30°C/54%r.h
[3] Pool hall condition at 30°C/54%r.h. with 30% outside air @ 5°C/85%r.h.
[4] 100% air exchange
[5] Air inlet temperature 30°C, water temperature 60°/40°C

3.4 DanX 2 HP technical data and capacities

Air volume range high speed	m^3/h	1000 – 2100

Air volume nominal	m^3/h	1750
Ext. duct pressure [1]	Pa	200
Fresh air volume	%	0–100

Supply air filter		F7
Exhaust air filter		M5

Unoccupied, according VDI 2089 [2]	kg/h	5
Occupied, according VDI 2089 [2]	kg/h	11
Occupied, partly outside air [3]	kg/h	9

Heat output heat pump / exchanger [3]	kW	11.3
Heating capacity [4]	kW	2.8
Compressor COP [3]		4.4

Supply air fan [5]	KW	0.5
Exhaust air fan [5]	KW	0.5
Compressor power consumption [3]	KW	1.2
Total power consumption [3]	KW	2.1
SFP [3]	kJ/m^3	1.5
Max full load current	A	7.0
Max power consumption	kW	2.9
Electrical connection	V	2 x 400 + N

Heating coil [7]	RR	2
Heat output max	kW	4.9
Coil off temperature max	°C	38.2
Water flow	m^3/h	0.22
Pressure loose waterside	kPa	4.7
Coil connection	“	3/8

Heating coil [7]	RR	3
Heat output max	kW	6.9
Coil off temperature max	°C	41.8
Water flow	m^3/h	0.29
Pressure loss waterside	kPa	12.5
Coil connection	“	3/8

Heat output water cooled condenser [8]	kW	3.2
Water flow max	l/h	600
Pressure loss waterside	kPa	10
Temperature raise (max flow)	K	12
Coil connections	“	3/4

[1] Higher external pressures possible
[2] Pool hall condition at 30°C/54%r.h.
[3] Pool hall condition at 30°C/54%r.h. with 30% outside air @ 5°C/85%r.h.
[4] Difference between return / supply air
[5] 100% air exchange
[7] Air inlet temperature 30°C, water temperature 60°/40°C
[8] Water temperature 30°C / HP: 40°C

3.5 DanX 3 XD technical data and capacities

Air volume range high speed	m^3/h	1500 – 3500

Air volume nominal	m^3/h	2750
Ext. duct pressure [1]	Pa	200
Fresh air volume	%	0–100

Supply air filter		F7
Exhaust air filter		M5

Occupied, according VDI 2089 [2]	kg/h	18
Occupied, partly outside air [3]	kg/h	10

Heat output heat exchanger [3]	kW	5.8

Supply air fan [4]	KW	0.8
Exhaust air fan [4]	KW	0.8
Total power consumption [3]	KW	1.3
SFP [3]	kJ/m^3	1.3
Max full load current	A	12.6
Max. power consumption	kW	2.9
Electrical connection	V	1 x 230 + N

Heating coil [5]	RR	2
Heat output max	kW	7.7
Coil off temperature max	°C	38.3
Water flow	m^3/h	0.32
Pressure loss waterside	kPa	5.1
Coil connection	“	3/8

Heating coil [5]	RR	3
Heat output max	kW	10.7
Coil off temperature max	°C	41.4
Water flow	m^3/h	0.43
Pressure loss waterside	kPa	6.0
Coil connection	“	3/8

[1] Higher external pressures possible
[2] Pool hall condition at 30°C/54%r.h
[3] Pool hall condition at 30°C/54%r.h. with 30% outside air @ 5°C/85%r.h.
[4] 100% air exchange
[5] Air inlet temperature 30°C, water temperature 60°/40°C

3.6 DanX 3 HP technical data and capacities

Air volume range high speed	m^3/h	1500 – 3500

Air volume nominal	m^3/h	2750
Ext. duct pressure [1]	Pa	200
Fresh air volume	%	0–100

Supply air filter		F7
Exhaust air filter		M5

Unoccupied, according VDI 2089 [2]	kg/h	7
Occupied, according VDI 2089 [2]	kg/h	18
Occupied, partly outside air [3]	kg/h	15

Heat output heat pump / exchanger [3]	kW	17.9
Heating capacity [4]	kW	4.4
Compressor COP [3]		4.4

Supply air fan [5]	KW	0.8
Exhaust air fan [5]	KW	0.8
Compressor power consumption [3]	KW	1.9
Total power consumption [3]	KW	3.4
SFP [3]	kJ/m^3	1.5
Max full load current	A	12.6
Max power consumption	kW	4.6
Electrical connection	V	2 x 400 + N

Heating coil [7]	RR	2
Heat output max	kW	7.7
Coil off temperature max	°C	38.3
Water flow	m^3/h	0.32
Pressure loose waterside	kPa	5.1
Coil connection	“	3/8

Heating coil [7]	RR	3
Heat output max	kW	10.7
Coil off temperature max	°C	41.4
Water flow	m^3/h	0.43
Pressure loss waterside	kPa	6.0
Coil connection	“	3/8

Heat output water cooled condenser [8]	kW	3.2
Water flow max	l/h	600
Pressure loss waterside	kPa	10
Temperature raise (max flow)	K	12
Coil connections	“	3/4

[1] Higher external pressures possible
[2] Pool hall condition at 30°C/54%r.h.
[3] Pool hall condition at 30°C/54%r.h. with 30% outside air @ 5°C/85%r.h.
[4] Difference between return / supply air
[5] 100% air exchange
[7] Air inlet temperature 30°C, water temperature 60°/40°C
[8] Water temperature 30°C / HP: 40°C

4.0 COMPONENTS

4.1 Cabinet

The cabinet is primarily designed for swimming pool environment and consists of a self-bearing sandwich panel construction, with bottom rails and adjustable feet.

The outer sandwich panel's und doors are 50 mm double skinned and built from hot dip galvanized sheet material and insulated with mineral wool. Inspection covers are in form of doors with strong hinges and tongue locks with handles. Internal partition panels are 30 mm thick and built from hot dip galvanised sheet material insulated with mineral wool.

For special protection against chlorine air and to fulfil corrosion class C4 according to EN/ISO 12944-2 all panels and metal parts of the unit are powder coated, with every part painted separately before assembly. The powder coat finish has a thickness of 70 µm.

The cover panels are designed to achieve good air tightness and a smooth surface, thus to make cleaning easy together with a low heat and sound transmission, and avoiding cold spots which is essential for swimming pool units. The doors can be opened 180°, which ensures easy access for inspection and service.

The casing is designed in accordance with EN 1886 and fulfils the following classes:

Test criteria	Class
Mechanical strength	D2
Air leakage	L3
Filter bypass leakage	F7
Thermal transmittance	T3
Thermal bridging	TB3

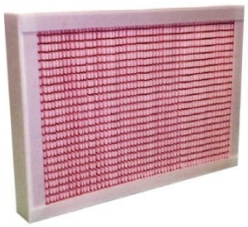
4.2 Double cross flow heat exchanger

An essential part of the DanX 1, 2 and 3 is the double heat exchanger from which significant energy savings are obtained since the energy in the extract air is used to preheat the fresh air before entering the room. The double cross flow heat exchanger is fabricated with epoxy pre painted aluminium plates, suitable for the aggressive swimming pool environment. The dry temperature efficiency of the heat exchanger above 70%, but will be higher in practice in a swimming pool because water vapour condenses on the exhaust side. Therefore the normal efficiency of the heat exchanger in swimming pools is up to 90%.

The exhaust and return air side of the cross flow heat exchanger is equipped with a drip tray where condensate from the heat exchanger and mixing box is drained out of the unit.

4.3 Fans

The DanX 1, 2 and 3 units are equipped with two direct driven fans with high efficient EC motors, which together with the other components in the unit give a very low SFP value and a low noise level. The printed circuit board of the EC motor is specially coated to protect them against chlorine air, as are the fan wheels on the DanX 2. The fan wheels on the DanX 1 and 3 are produced from composite material. For exact technical data, please use our selection program.



4.4 Filters

The DanX 1, 2 and 3 units are equipped with M5 (return) and F7 (outdoor) compact filters. Each filter is hold by two U rails for easy service and good tidiness. For more exact technical data of the filters, especially the pressure loss, please use our selection program.

4.5 Damper and actuators

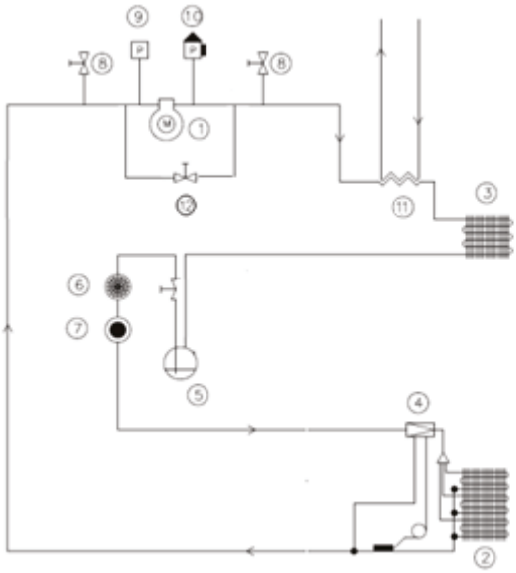
There are three damper arrangements built in into the DanX 1, 2 and 3 units. The first are the three mixing box dampers, the second the recirculation damper and the third the bypass damper over the double heat exchanger. As standard all dampers are equipped with modulation damper motors, but as an option the outdoor and exhaust air damper can be ordered with a modulation spring return damper actuator, so in the case of a power cut the dampers will close automatically.

4.6 Heat pump

In the DanX HP units the heat pump will be used both for heat recovery and air dehumidification. In night time, when no outside air is needed in the pool hall the cooling circuit works fully as a dehumidifier, whereas in day time when running with outside air, the cooling circuit is used as a heat pump to recover as much energy from the return air as possible.

The heat pump consists of a cooling circuit with one compressor. The condenser and evaporator coil manufactured from copper tubing with pre painted aluminium fins housed within an aluminium frame and epoxy painted after assembly and therefore especially suitable for the aggressive swimming pool environment. Furthermore the cooling circuit is equipped with all necessary components like high/low pressure stats, dry filter and so on. The compressor is an energy efficient rotary compressor filled with R407c.

1. Compressor
2. Evaporator
3. Condenser
4. Expansion valve
5. Receiver
6. Dry filter
7. Sight glass
8. Schrader valve
9. LP stat
10. HP stat
11. Water cooled Condenser
12. Solenoid valve



4.6.1 Water cooled condenser

As an option the heat pump can be fitted with a water-cooled condenser, so that any surplus heat, which cannot be used for heating up the return/supply air, can be transferred to the pool or sanitary water. This option is not available for the DanX 1.

	DanX 2 and 3 HP
Heat output [1] [kw]	3.2
Water flow max [m3/h]	0.6
Pressure loss [kPa]	10
Temperature out (max flow) [°C]	42
Coil connections ["]	¾

1) Water temperature 30°C / HP 40°C

4.7 LPHW heating coil

LPHW heating coils with two different sizes can be supplied mounted into the DanX units. The coils are manufactured from copper tubing with aluminium fins housed within an aluminium frame and epoxy painted after assembly. The maximum working pressure is 16 bar at a maximum water temperature of 120°C. For exact technical data, please use our selection program.

4.7.1 Valve and actuator

This two way valve is designed to combine automatic balancing and full modulating control regardless of the present flow. This means that neither further regulating valves are required. At the same time only one valve type is needed for different flows and water temperatures and a calculation of the Kvs value is no longer needed. The actuator for the valve will be directly connected to the 0-10V temperature control signal.

4.7.2 Electrical Heating Coils

The electrical heating coil is designed to be built externally into the duct system. They have an alu-zinc coated metal frame and designed for a minimum air speed of 1.5 m/s and a maximum outlet temperature of 40°C. All coils are equipped with Limit and OT safety thermostats and have protection class IP 43.

The heating coil is equipped with a built in capacity control for a 0-10V control signal for connection to the DanX unit. The capacity of the coil is then regulated steeples by the internal controller. Please note that the main power supply for the heating coil has to be connected separately and will not come from the DanX unit.

	DanX 1	DanX 2	DanX 3	DanX 3
Air volume [m3/h]	1000	1750	2750	3500
Capacity [kw]	4.5	7.5	12	17
Temperature in/out [°C]	25.0 / 38.2	25.0 / 37.9	25.0 / 38.1	25.0 / 39.0
Max. current 3 x 400V [A]	6.5	10.9	17.3	24.5
Max. current 3 x 230V [A]	11.3	18.9	30.1	42.7
Duct connection Ø [mm]	250	315	400	500

5.0 CONTROL SYSTEM

A complete DanX 1, 2 and 3 ventilation system for swimming pools includes a control system that corresponds to the actual unit configuration in the most energy efficient way as possible. The unit is supplied ready wired and with all necessary sensors, damper motors and safety devices installed.

The control system is based on a Honeywell MVC controller, programmed by Dantherm to perform control strategies and functions in the most energy efficient way. The MVC controller is mounted in the front door of the unit. It has a clear LCD display with messages all important service conditions, such as temperatures, multi-leaf damper settings, operating problems etc. Function keys allow easy and logic pre-programming of all operating situations.

5.1 Fan control

The EC fan motors can be set to three different air volumes in the timer program of the MVC controller, high air volume, low air volume and stop. The air volume set point will then be automatically kept through a modulating control. Instead of the time program, an external signal like a movement sensor or pool cover contact can be used to set the air volume.

Depending on the situation, the humidity and temperature control can overrule the air volume set point and force the fans to start up from stop, or change from low air volume to high air volume.

In unoccupied mode it is possible to stop ventilation and only start up if the humidity or temperature requires that.

5.2 Humidity control

With the DanX HP units the humidity in the swimming pool is controlled by the heat pump together with the mixing box. The wanted humidity is set in the MVC controller, together with the minimum wanted percentage of outside air entering the pool hall through the mixing box in day time. The heat pump normally has the first priority, which means it will start first if there is a demand to dehumidify. Only if the temperature in the pool hall is too high the heat pump is not started to avoid overheating. If more dehumidification is needed the mixing box outdoor air set point will be overruled and slowly more dry outdoor air will enter the swimming pool hall. When the set humidity is maintained, the mixing box will slowly go back into the minimum position and

the heat pump will stop. In case of that the mixing box opens 100% the heat pump will stop, as none of the dehumidified air will return to the pool hall.
With the DanX XD system the humidity in the swimming pool is controlled with the mixing box. The wanted humidity is set in the MVC controller, together with the minimum wanted percentage of outside air entering the pool hall through the mixing box in day time. If there is a demand to dehumidify the minimum mixing box outside air set point will be overruled and slowly more dry outside air will enter the swimming pool hall. When the set humidity is maintained, the mixing box will slowly go back into the start position.

At high outside temperatures (>23°C) an outdoor temperature compensation of the humidity set point will start. The set point will automatically be raised by 1% r.h. for each °C higher outside temperature until 28°C. After that temperature the humidity set point will not be changed any more. This means the maximum humidity set point compensation will be +5% r.h.

5.3.1 Temperature control (heating)

The temperature in the swimming pool hall is controlled by the heat pump (HP) together with the heating coil. The wanted room temperature and the minimum / maximum supply air temperature are set in the MVC controller.

The heat pump has the first priority, which means it will start first if there is a demand to heat up. If this is not enough the after heating coil will start up. The heating coil is controlled by a 0-10V signal for the valve actuator and a volt free signal for the hot water pump. When the set room temperature is maintained, the heating coil will slowly stop heating and the heat pump will stop. In case of that the mixing box is closed (normally night time), the heat pump will not start, as no energy can be recovered from the exhaust air and the heating is only done by the heating coil.

With the DanX 1/2/3 XD the temperature in the swimming pool is controlled only by the heating coil.

For the control of the temperature we are recommending always a duct sensor. Only if the unit is stopped in night time a wall mounted temperature sensor is needed so it is possible to start up the unit when the temperature level is too low.

5.3.2 Temperature control (free cooling)

If the temperature in the swimming pool hall is above the set point and the outside air below the actual room temperature, the mixing box setting will be overruled and up to 100% of outdoor air will enter the swimming pool. If this is not enough the by-pass over the cross flow heat exchanger will open, to bring outdoor air directly into the swimming pool hall (free cooling).

5.3.3 Temperature control (active cooling)

If free cooling is not enough there is the possibility to get a volt free signal from the controller to start a DX cooling coil or air conditioner.

5.3.4 Water cooled condenser (DanX 2/3 HP)

If there is no demand for heating or dehumidification of the pool hall air, the heat pump will normally be stopped. If a water cooled condenser is built in into the heat pump circuit energy can still be transferred to the pool or sanitary water. The MVC controller needs an external signal (digital) from the water supply if heating is needed. If this is the case the MVC controller will start up the heat pump and give a volt free start signal for a pump to start circulating water through the water cooled condenser.

5.3.5 Evaporator de icing

To avoid icing on the evaporator (DanX HP) at cold outside temperatures a passive (compressor stop) de-icing function is built in to the control system.

5.4 External signal

If you do not want to control the DanX over the time program, you have the possibility to connect a PIR sensor or a pool cover switch to the MVC controller. If there is movement in the pool hall, or the pool cover opens, the unit will automatically go over into “Open mode”. When everybody has left the pool hall, or the pool cover is closed, the unit automatically switches over to “Closed mode” again.

5.5 Alarms

The following alarms can be seen on the MVC controller display:

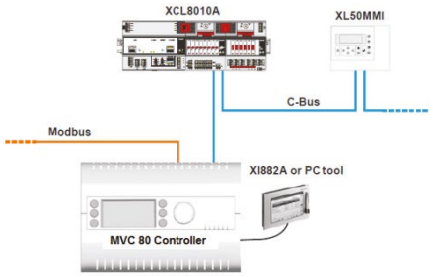
- Filter alarm
- Fan motor alarm, which will stop the ventilation plant totally.
- HP/LP pressure alarm from the heat pump (DanX HP), which will stop the heat pump, but not the fans.
- Frost alarm* LPHW heating coil, which will stop the ventilation plant totally and open the valve actuator fully.
- OT alarm from the overheating sensor of the electric heating coil, which will stop the ventilation plant totally.
- Fire alarm*, which will stop the ventilation plant completely.

* Only if mounted

If one of these alarms appears a common fault signal will automatically be sent to a volt free contact where a building alarm can be connected.

5.6 Communication

There are different possibilities for communication between the DanX 1, 2 or 3 and a BMS system, depending on if a MVC 80 or MCV Web has been chosen as a controller for the unit.



5.6.1 Communication with MVC 80

The MVC 80 controller is normally operated via the standard function keys and the LCD display. Beside that the following possibilities are available to operate the controller remotely or through a BMS system.

5.6.1.1 PC tool XL Online (MVC 80)

XL Online is a PC tool to service the MVC 80 controller. With this tool it is possible to upload new programs, edit time programs and set points, viewing data points, make tend logging and viewing alarms. The PC tool is available for free from our FTP server. A special USB/RS232 cable to connect the MVC 80 to a laptop can be purchased from Dantherm.

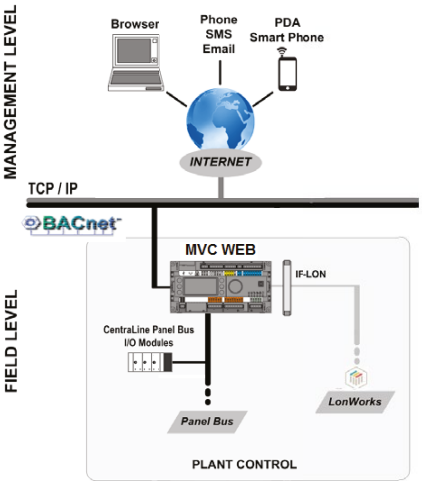
5.6.1.2 Honeywell C-Bus (MVC 80)

The Honeywell C-Bus allows integrating the MVC 80 controller directly into a Honeywell Excel 5000 system. In C-Bus all data points of the controller are readable and all set points readable and writable.

5.6.1.3 Modbus RTU (MVC 80)

The MVC 80 can work as a Modbus RTU slave and it is possible to read or read / write the following data points. When Modbus RTU is ordered a complete list of addresses and integration instructions will follow with each unit.

Data point	Data type	Message type
Temperature open mode	uint 16	Read/write
Temperature closed mode	uint 16	Read/write
Humidity open mode	uint 16	Read/write
Humidity closed mode	uint 16	Read/write
Min outdoor air	uint 16	Read/write
Min supply temperature	uint 16	Read/write
Max supply temperature	uint 16	Read/write
Return air volume low	uint 16	Read/write
Return air volume high	uint 16	Read/write
Supply air volume low	uint 16	Read/write
Supply air volume high	uint 16	Read/write
Room temperature	uint 16	Read
Supply temperature	uint 16	Read
Outdoor temperature	uint 16	Read
Evaporator temperature	uint 16	Read
Room humidity	uint 16	Read
Return air volume	uint 16	Read
Supply air volume	uint 16	Read
Mix damper	uint 16	Read
Heating signal	uint 16	Read
Unit status	uint 16	Read
Program status	uint 16	Read
Common Fault	bool	Read
Fan alarm	bool	Read
Filter alarm	bool	Read
Fire alarm	bool	Read
Heating coil alarm	bool	Read
HP/LP alarm	bool	Read
Pump heating coil	bool	Read
Pump WCC	bool	Read
DX cooling	bool	Read
Compressor	bool	Read
External Stop	bool	Read



5.6.2 Communication with MVC WEB

The MVC Web controller is normally operated via a standard internet browser like Internet Explorer, Mozilla Firefox or Goggle Chrome. By default, an integrated web-server provides all operation pages for a full browser-based operation. Through the consequent use of software standards, any PC platform can be used as an operator interface (client), including laptops, desktops PCs, or touch screen PCs for direct flush mounting into electrical panel doors. At the same time simple mail transfer protocol (SMTP) is used for e-mail alarming via network and internet DSL connections.

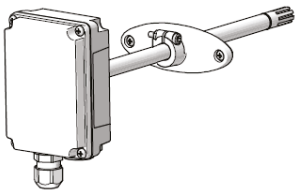
Alternatively it is also possible to operate the controller via the standard function keys and the LCD display, or the following communication protocols.

5.6.1 Bacnet MSTP or IP (MVC WEB)

All time programs, data points and set points of the program can communicate directly with other Bacnet controllers which are based on the international Bacnet protocol.

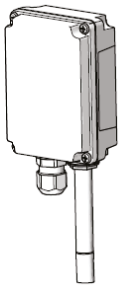
5.6.2 LON Talk (MVC WEB)

If you wish to communicate via LON, please contact Dantherm as at the moment there is no standard solution for this Bus system.



5.7 Optional sensors

As standard all DanX XD/HP units are delivered with a duct humidity/temperature sensor to measure the pool halls humidity and temperature in the return air duct. This sensor is connected from the factory with a 10m cable to the unit's electrical panel. The temperature sensor for the outdoor temperature measurement is built as standard into the unit before the outdoor duct damper. As an option these two sensors can be replaced by an alternative option.



5.7.1 Pool hall humidity/temperature sensor

If you want to use the Wake up function for temperature and humidity we recommend that you order instead of the standard duct mounted sensor a pool hall sensor, as there will be no air flow through the ducts in night time with the Wake up function activated. The pool hall sensor comes with a short cable connected to the unit's electrical panel. This cable has to be replaced with the right length on site.

5.7.2 Separate outdoor temperature sensor

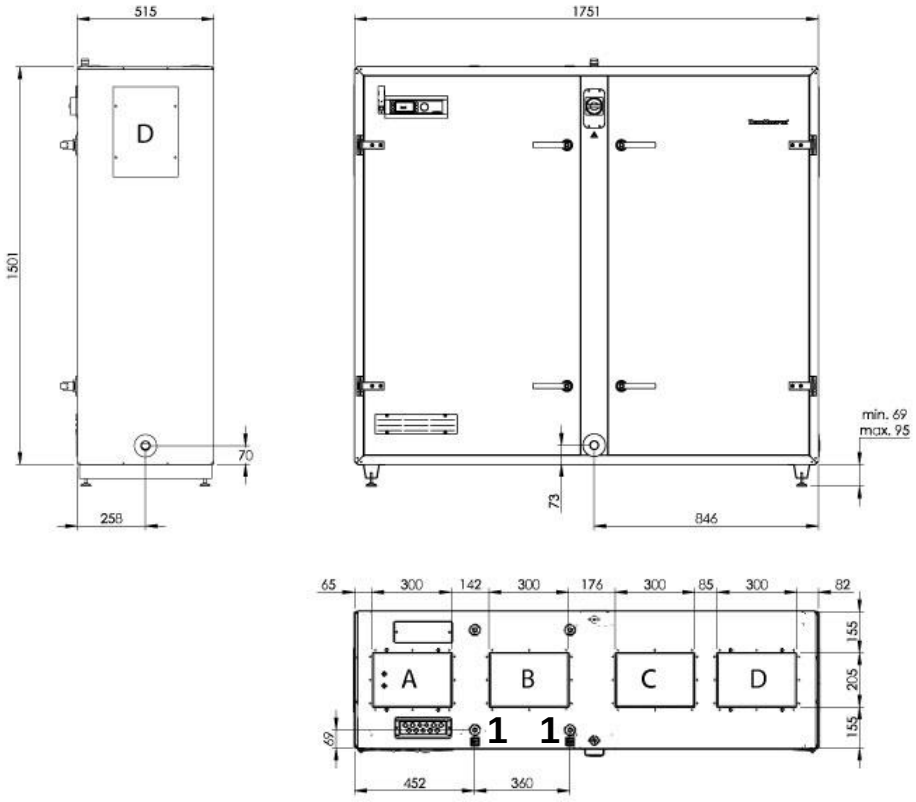
If the outdoor duct is quite long, or is heated up by the surrounding air in the building, there can be a problem with measuring the right outdoor temperature before the outdoor duct damper of the unit. In this case we recommend an outdoor temperature sensor to replace the built in sensor. The outdoor sensor will be delivered separately with the unit and has to be connected to the electrical panel instead of the standard sensor.

5.7.3 P.I.R. sensor

If you do not want to run the DanX XD/HP over the timer program in the controller, it is possible to connect a PIR sensor, which will start the unit in "Open mode" if there is movement in the pool hall.

6.0 DIMENSIONS AND WEIGHT

DanX 1 XD/HP



A. Return air duct
B. Supply air duct
C. Outdoor duct
D. Exhaust air duct

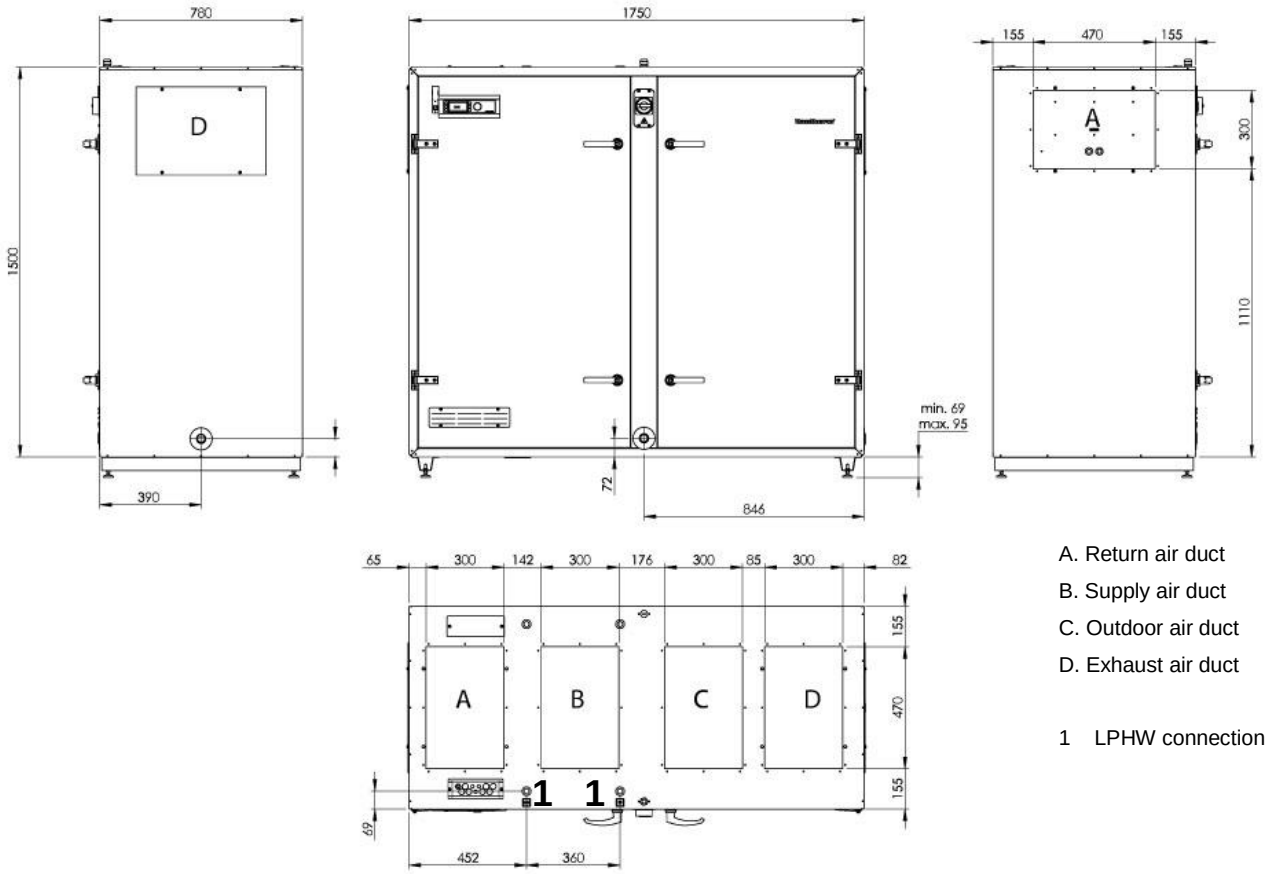
1 LPHW connection

The unit shown in the picture is left hand position.

DanX 1 HP	Weight [kg]
Unit	279
2 RR LPHW heating coil	1
3 RR LPHW heating coil	2
External electrical heating coil	13

DanX 1 XD	Weight [kg]
Unit	254
2 RR LPHW heating coil	1
3 RR LPHW heating coil	2
External electrical heating coil	13

DanX 2 XD/HP



A. Return air duct
B. Supply air duct
C. Outdoor air duct
D. Exhaust air duct

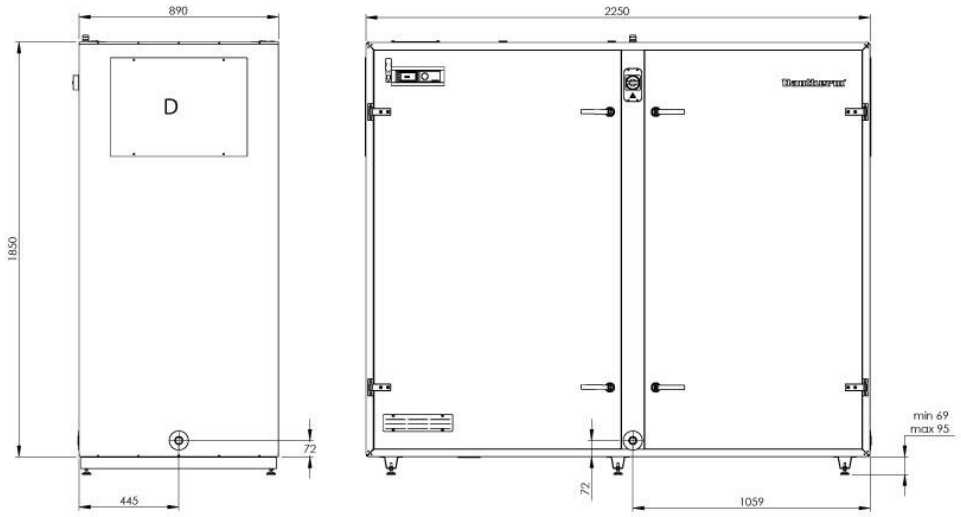
1 LPHW connection

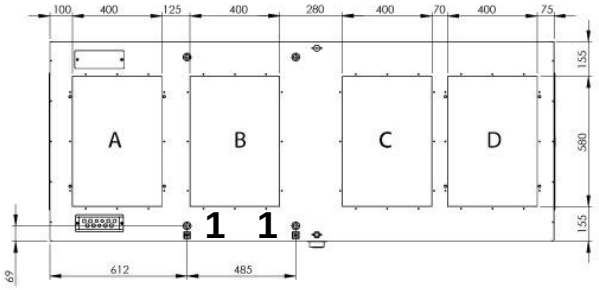
The unit shown in the picture is left hand position.

DanX 2 HP	Weight [kg]
Unit	379
2 RR LPHW heating coil	8
3 RR LPHW heating coil	10
External electrical heating coil	19
Water cooled condenser	10

DanX 2 XD	Weight [kg]
Unit	344
2 RR LPHW heating coil	8
3 RR LPHW heating coil	10
External electrical heating coil	19

DanX 3 XD/HP





A. Return air duct
B. Supply air duct
C. Outdoor air duct
D. Exhaust air duct

1 LPHW connection

The unit shown in the picture is left hand position.

DanX 3 HP	Weight [kg]
Unit	500
2 RR LPHW heating coil	11
3 RR LPHW heating coil	14
External electrical heating coil	19
Water cooled condenser	10

DanX 3 XD	Weight [kg]
Unit	465
2 RR LPHW heating coil	11
3 RR LPHW heating coil	14
External electrical heating coil	19

ABOUT THE DANTHERM GROUP

Control your climate

The Dantherm Group is a leading provider of climate control products and solutions. The group companies have more than 60 years of experience in designing and manufacturing high quality and energy efficient equipment for heating, cooling, drying and ventilation for a wide range of mobile and fixed applications.

Every year Dantherm Group uses significant resources on product development to stay in the forefront and are constantly adapting the products to changing market demands and legislation.

The Dantherm Group has a number of strong brands with well established market positions in the mobile, pool, commercial/industrial and residential markets.

Dantherm Group customers benefit from our comprehensive knowledge base and the experience and expertise that we have gained from more than three million climate control products and solutions sold worldwide.

Global reach

The Dantherm Group is headquartered in Skive, Denmark and has an own market presence in Norway, Sweden, United Kingdom, Germany, Switzerland, Italy, Spain, Poland, Russia, China and United Arab Emirates.

In 2016 the Dantherm Group was acquired by the Swedish equity fund Procuritas Capital Investors V LP – a strong owner with the ambition to continue the development and growth of the company.

Dantherm A/S
Marienlystvej 65 | DK-7800 Skive
Tel. +45 96 14 37 00 | Fax +45 96 14 38 20
info@dantherm.com | www.dantherm.com