

MODULAR AIR-HANDLING UNITS KU Series



ME20

 **proKLIMA**

Owing to an extraordinarily flexible range of products the KU series is undoubtedly able to offer solutions which will best meet your specific requirements for air handling and ventilation of:



◀ industrial plants, workshops, warehouses



◀ shopping malls, supermarkets ...



▲ shops, points of sale



▼ restaurants, cafés, bars



▲ offices, business premises



or residential buildings. ▶



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Air-handling units are designed to maintain purity, temperature and humidity of air by means of air filtration, heating, cooling and humidification or dehumidification. In most cases the air treatment process in air-handling units is completely automatic.

The air-handling units of the KU series, size 1 - 3, are air treatment units that provide a comfort environment of air-conditioned rooms. By combining diverse functional units it is possible to provide equipment with options ranging from common ventilation including filtration to a complete air conditioning, including the exhaust heat recovery.

The units are designed in conformity with the EN 1886.

The units are dimensioned on the basis of the module dimension of 305 mm, which means that inner dimensions are multiples of 305 and the units are consequently adapted to the basic filter insert framework being 610 x 610 mm.

Air-handling units designed in 18 different sizes cover the air flow volumes ranging from 800 - 80,000 m³/h. The combination of sizes and designs provides a maximum adaptability to the space available. The devices are manufactured as single units or blocks comprising several individual elements depending on the air handling unit size and conditions of transporting and bringing the device into a building. The commonly used blocks are offered as standard configurations whose elements are assembled into wholes in dependence of their size and thus reduce the costs of transport, handling and installation.

The air-handling units of the sizes KU 1 - KU 11 are manufactured with two insulation thickness values ($d = 25$ mm, $d = 50$ mm), and those of the sizes KU 12 - KU 17 with a 50 mm thick insulation, which enables installation in an in-door and open space as well as in areas with varying climatic conditions. The lining meets the basic thermal and sound insulation requirements and falls within A1 category of non-combustible materials according to DIN 4102. The heat transfer coefficient of the devices with a 25 mm thick insulation is $k=0.92$ W/m²K and with a 50 mm thick insulation it is $k=0.65$ W/m²K. The air-handling unit lining is made of galvanized steel sheet, which, including the aluminium profile framework, can have a powder coating of a RAL colour according to the customer's request. The air-handling unit internal surfaces are absolutely smooth, making the air flow resistance negligible and the unit cleaning and maintenance much easier.

The casing structure consists of profiles and angle elements made of die cast aluminium alloy. Locks, small handles and metal fittings can be easily operated and all connections are sealed with a special waterproof and airtight rubber band.

Owing to their design and quality, the units and built-in materials allow a carefree and quiet operation that meets the noise level requirements prescribed.

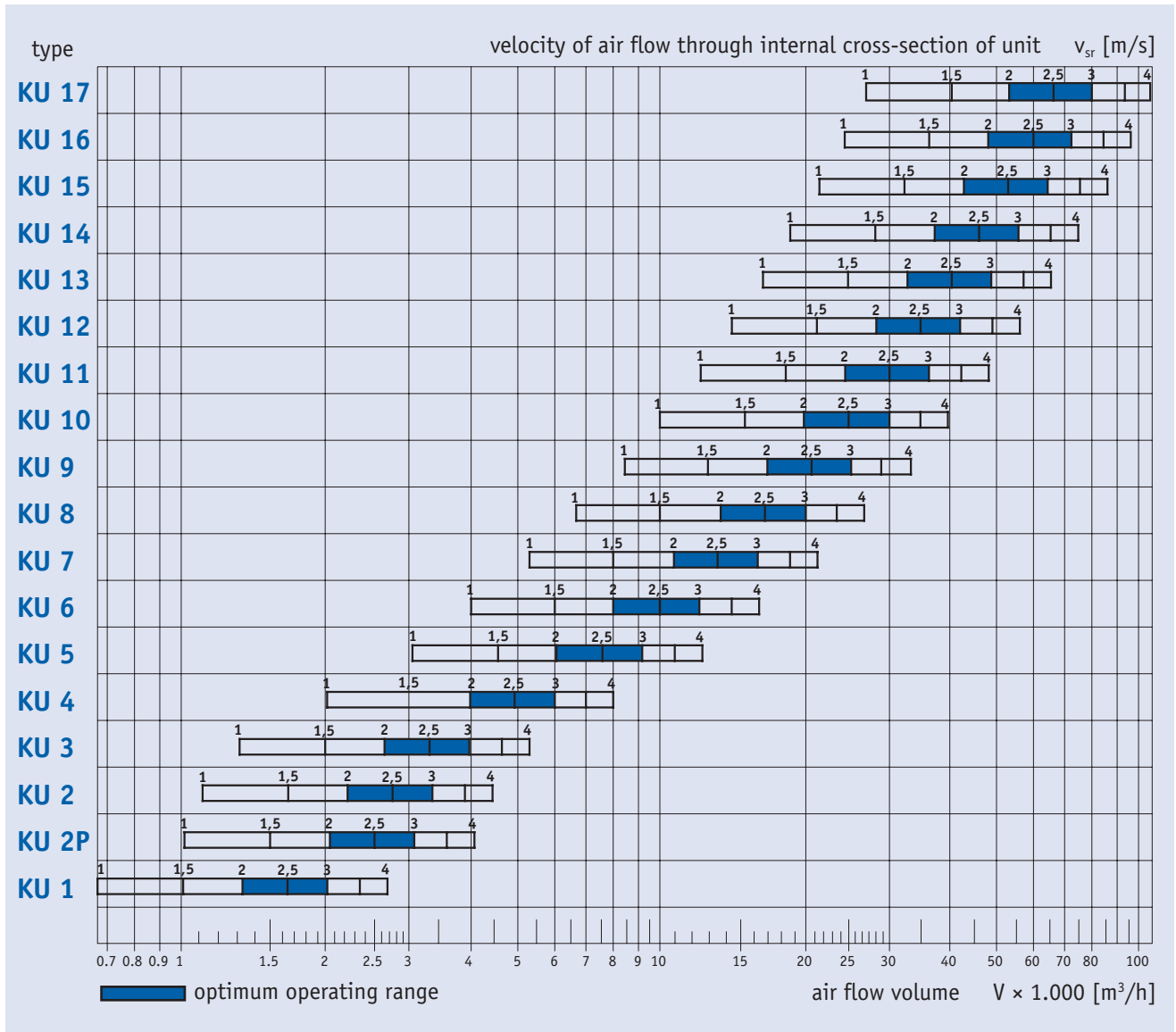
Due to particular conditions and impacts of atmospheric agents, out-door air-handling units are produced with an additional hood, an elevated base and water-protection louvres and with a powder coating applied to the external panel surface.

For discharge of air with a high content of greasy vapour and unpleasant smells (kitchens) and also for discharge of explosive gases, the air-handling units have a necessary level of protection and a special design.

For the purpose of air-conditioning of special-purpose buildings, such as hospitals, laboratories and similar, we also manufacture air-handling units of the so-called hygienic design in conformity with the DIN 1946. The lining of air-handling units of a hygienic design is made of powder-coated steel sheet, which makes it resistant to disinfectants. On the customer's request the lining may also be made of stainless steel plates.

2 DETERMINATION OF DIMENSIONS

This diagram is used for a quick determination of the corresponding air-handling unit size, depending on the air flow volume and recommended velocity of air flow through the internal cross-section of the unit.



3

The recommended velocities of air flow through the internal cross-section of the unit are:

- panel filter and short bag filter, class G3 and G4 - up to 3.5 m/s
- bag filter, class F5 - F9 - up to 3.2 m/s
- electric heater - up to 4 m/s
- heater - up to 3.5 m/s
- cooler - up to 3 m/s
- plate recuperator - up to 3 m/s
- rotating recuperator - up to 3 m/s
- steam humidifier - up to 3/5 m/s
- honeycomb humidifier - up to 2.8 m/s
- spray humidifier - up to 3.2 m/s

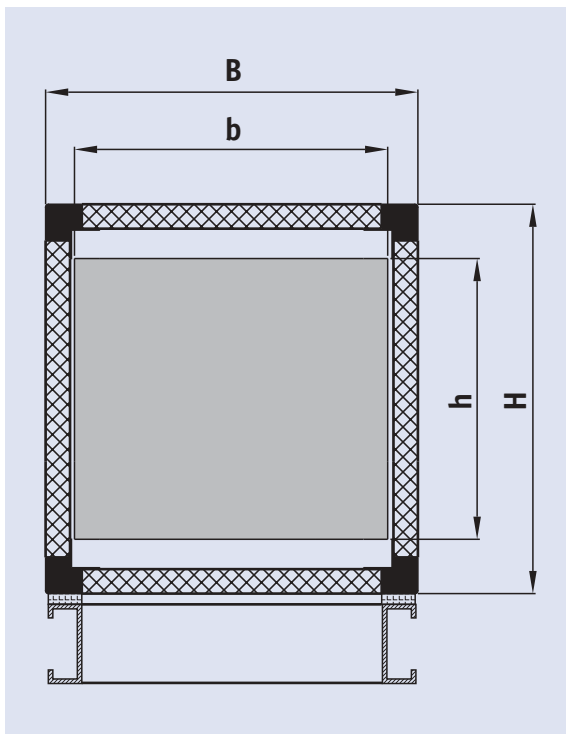
UNIT POSITIONING 4

A proper position of the air-handling unit enables a simple maintenance and replacement of individual built-in components.

It is recommended to leave a free space, $B + 250$ mm wide, on the operator's side of the unit. Pipe connections between heat exchangers and other components including fittings and thermal insulation must allow for a smooth maintenance of all air-handling unit components.

The base on which the air-handling unit will be placed must be absolutely level. We recommend to use an elevated concrete base.

BASIC DIMENSIONS 5



Insulation thickness: 25 mm

Unit size	B	H	b	h
KU 1	665	410	610	305
KU 2P	970	410	915	305
KU 2	665	610	610	508
KU 3	665	715	610	610
KU 4	970	715	915	610
KU 5	970	1040	915	915
KU 6	1275	1040	1220	915
KU 7	1275	1365	1220	1220
KU 8	1580	1365	1525	1220
KU 9	1580	1675	1525	1525
KU 10	1885	1675	1830	1525
KU 11	1885	1980	1830	1830

Insulation thickness: 50 mm

Unit size	B	H	b	h
KU 1	705	450	610	305
KU 2P	1010	450	915	305
KU 2	705	650	610	508
KU 3	705	755	610	610
KU 4	1010	755	915	610
KU 5	1010	1060	915	915
KU 6	1315	1060	1220	915
KU 7	1315	1365	1220	1220
KU 8	1620	1365	1525	1220
KU 9	1630	1715	1525	1525
KU 10	1935	1715	1830	1525
KU 11	1935	2020	1830	1830
KU 12	2240	2020	2135	1830
KU 13	2240	2325	2135	2135
KU 14	2545	2325	2440	2135
KU 15	2545	2630	2440	2440
KU 16	2850	2630	2745	2440
KU 17	3155	2630	3050	2440

Notes:

- Dimensions of air-handling units with built in absolute HEPA filters of the class EU 10 - EU 14 are available on request.

Subject to technical alterations without previous notification.

Air-handling unit lengths (L) with insulation thickness d = 50 mm

		F1	F2	F3	GE		GV	HV	HI	V _A	V _B	PR	P	OP	OS	OV		
		Filter unit			Electric heater		Heater	Cooler		Fan unit		Air distr.	Empty unit	Steam humidifier	Honeycomb humidifier	Spray humidifier		
Air-handling unit size	B	H	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
KU 1	665	410	390	600	870	480	720	350	700	700	870	×	300	300	1200	×	×	×
KU2P	970	410	390	600	870	480	670	350	700	700	870	×	300	300	1200	×	×	×
KU 2	665	610	390	600	870	480	800	350	700	700	970	970	300	300	1200	×	×	×
KU 3	665	715	390	600	870	480	720	350	700	700	1170	1170	300	300	1200	1000	1200	1800
KU 4	970	715	390	600	870	480	670	350	700	700	1170	1170	600	300	1200	1000	1200	1800
KU 5	970	1040	410	620	890	480	600	350	720	720	1380	1380	600	300	1200	1050	1200	1800
KU 6	1275	1040	410	620	890	400	500	350	720	720	1560	1560	600	300	1200	1050	1200	1800
KU 7	1275	1365	430	640	910	n.u.	n.u.	400	790	790	1770	1770	600	300	1200	1050	1200	1800
KU 8	1580	1365	430	640	910	n.u.	n.u.	400	790	790		2060	600	300	1200	1050	1200	1800
KU 9	1580	1675	430	640	910	×	×	400	790	790	2060	2190	600	300	1200	1050	1200	1800
KU10	1885	1675	430	640	910	×	×	400	790	790		2370	900	300	1200	1050	1200	1800
KU11	1885	1980	430	640	910	×	×	400	790	790	2190	2370	900	300	1200	1050	1200	1800

		PZ1	PZ2	PZ3	PZ4	PZ5	RP	RR	RLG		RLH	M _V	MM _V	M _U	MM _U	
		Sound attenuator					Plate recuperator	Rotating regenerator	Multi-plate recuperator			Mixing unit				
Air-handling unit size	B	H	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
KU 1	665	410	600	900	1200	1500	1800	960	×	400	450	700	270	660	330	710
KU2P	970	410	600	900	1200	1500	1800	960	×	400	450	700	270	660	330	710
KU 2	665	610	600	900	1200	1500	1800	1290	×	400	450	700	370	860	430	910
KU 3	665	715	600	900	1200	1500	1800	1530	420	400	450	700	470	1060	530	1110
KU 4	970	715	600	900	1200	1500	1800	1530	420	400	450	700	470	1060	530	1110
KU 5	970	1040	600	900	1200	1500	1800	1830	420	400	450	700	590	1280	630	1320
KU 6	1275	1040	600	900	1200	1500	1800	1830	420	400	450	700	690	1480	730	1520
KU 7	1275	1365	600	900	1200	1500	1800	2220	420	440	580	790	810	1700	850	1740
KU 8	1580	1365	600	900	1200	1500	1800	2220	420	440	580	790	810	1700	850	1740
KU 9	1580	1675	600	900	1200	1500	1800	2560	450	440	580	790	910	1900	950	1940
KU10	1885	1675	600	900	1200	1500	1800	2560	450	440	580	790	1010	2100	1050	2140
KU11	1885	1980	600	900	1200	1500	1800	n.u.	n.u.	440	580	790	1110	2300	1150	2340















Notes:

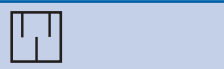








The lengths indicated are maximum values. The actual length may lie below these values depending on the dimensions of built-in components (fan, electric motor, heat exchangers, etc.).

The length of a water heater unit (GV) operating at 50/45°C is to be taken as the length of a multi-plate recuperator (RLG) of a heater with the equivalent number of rows.

The electric heater (GV) lengths depend on the electric heater power installed.

Air-handling unit lengths (L) with insulation thickness d = 50 mm

			F1	F2	F3	GE		GV	HV	HI	V _A	V _B	PR	P	OP	OS	OV	
			Filter unit			Electric heater		Heater	Cooler		Fan unit		Air distrib.	Empty unit	Steam humidifier	Honeycomb humidifier	Spray humidifier	
																		
Air-handling unit size	B	H	(28)	(29)	(30)	(31)		(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	
	mm	mm	mm	mm	mm	mm		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
KU 1	705	450	430	640	910	520	760	400	740	740	910	×	300	300	1200	×	×	×
KU2P	1010	450	430	640	910	520	710	400	740	740	910	×	300	300	1200	×	×	×
KU 2	705	650	430	640	910	520	840	400	740	740	1020	1020	300	300	1200	×	×	×
KU 3	705	755	430	640	910	520	760	400	740	740	1210	1210	300	300	1200	1050	1200	1800
KU 4	1010	755	430	640	910	520	710	400	740	740	1210	1210	600	300	1200	1050	1200	1800
KU 5	1010	1060	430	640	910	520	620	400	740	740	1400	1400	600	300	1200	1050	1200	1800
KU 6	1315	1060	430	640	910	420	520	400	740	740	1560	1560	600	300	1200	1050	1200	1800
KU 7	1315	1365	430	640	910	n.u.	n.u.	400	790	790	1810	1810	600	300	1200	1050	1200	1800
KU 8	1620	1365	430	640	910	n.u.	n.u.	400	790	790	1810	2090	600	300	1200	1050	1200	1800
KU 9	1630	1715	470	680	950	×	×	450	830	830	2230	2230	600	300	1200	1100	1200	1800
KU10	1935	1715	470	680	950	×	×	450	830	830	2230	2410	900	300	1200	1100	1200	1800
KU11	1935	2020	470	680	950	×	×	450	830	830	2410	2410	900	300	1200	1100	1200	1800
KU12	2240	2020	470	680	950	×	×	450	830	830	2590	2760	900	300	1200	1100	1200	1800
KU13	2240	2325	470	680	950	×	×	450	830	830	2760	2890	900	300	1200	1100	1200	1800
KU14	2545	2325	470	680	950	×	×	450	830	830	2760	2890	900	300	1200	1100	1200	1800
KU15	2545	2630	470	680	950	×	×	450	830	830	3180	3650	1200	300	1200	1100	1200	1800
KU16	2850	2630	470	680	950	×	×	450	830	830	3180	3650	1200	300	1200	1100	1200	1800
KU17	3155	2630	470	680	950	×	×	450	830	830	3180	3650	1200	300	1200	1100	1200	1800

			PZ1	PZ2	PZ3	PZ4	PZ5	RP	RR	RLG		RLH	M _V	MM _V	M _U	MM _U	
			Sound attenuator					Plate recuperator	Rotating regenerator	Multi-plate recuperator			Mixing unit				
																	
Air-handling unit size	B	H	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)	(51)	(52)	(53)	(54)		
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		
KU 1	705	450	600	900	1200	1500	1800	1000	×	440	580	740	310	700	370	750	
KU2P	1010	450	600	900	1200	1500	1800	1000	×	440	580	740	310	700	370	750	
KU 2	705	650	600	900	1200	1500	1800	1330	×	440	580	740	410	900	470	950	
KU 3	705	755	600	900	1200	1500	1800	1570	460	440	580	740	510	1100	570	1150	
KU 4	1010	755	600	900	1200	1500	1800	1570	460	440	580	740	510	1100	570	1150	
KU 5	1010	1060	600	900	1200	1500	1800	1850	460	440	580	740	610	1300	670	1350	
KU 6	1315	1060	600	900	1200	1500	1800	1850	460	440	580	740	710	1500	770	1550	
KU 7	1315	1365	600	900	1200	1500	1800	2220	460	440	580	790	810	1700	870	1750	
KU 8	1620	1365	600	900	1200	1500	1800	2220	460	440	580	790	810	1700	870	1750	
KU 9	1630	1715	600	900	1200	1500	1800	2600	500	480	620	830	950	1940	990	1980	
KU10	1935	1715	600	900	1200	1500	1800	2600	500	480	620	830	1050	2140	1090	2180	
KU11	1935	2020	600	900	1200	1500	1800	n.u.	n.u.	480	620	830	1150	2340	1190	2380	
KU12	2240	2020	600	900	1200	1500	1800	n.u.	n.u.	480	620	830	1150	2340	1190	2380	
KU13	2240	2325	600	900	1200	1500	1800	n.u.	n.u.	480	620	830	1250	2540	1290	2580	
KU14	2545	2325	600	900	1200	1500	1800	n.u.	n.u.	480	620	830	1250	2540	1290	2580	
KU15	2545	2630	600	900	1200	1500	1800	n.u.	n.u.	480	620	830	1350	2740	1390	2780	
KU16	2850	2630	600	900	1200	1500	1800	n.u.	n.u.	480	620	830	1350	2740	1390	2780	
KU17	3155	2630	600	900	1200	1500	1800	n.u.	n.u.	480	620	830	1350	2740	1390	2780	

× - not supplied

n.u. - on request

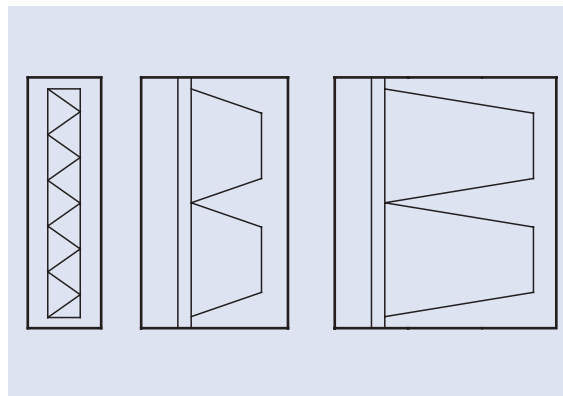
Subject to alterations of dimensions and technical features.

6 DESCRIPTION OF UNITS

FILTER UNIT (F1, F2, F3) is a segment of an air-handling unit that separates impurities from the air. We normally manufacture three types: a panel filter (F1), a short bag filter (F2) and a long bag filter (F3).

In accordance with EN 779 and the EUROVENT 4/5 classification dimensions and types are adjusted to the air-handling unit size and to the level of separation or rather efficiency from class G1 to F9. The filter is made of glass fibre, synthetic fibre, fabric, etc. with a labyrinth structure.

Special filters such as activated charcoal filters, degreasing filters, compact filters, absolute filters (class EU 10 - EU 14), etc. can be supplied on request.

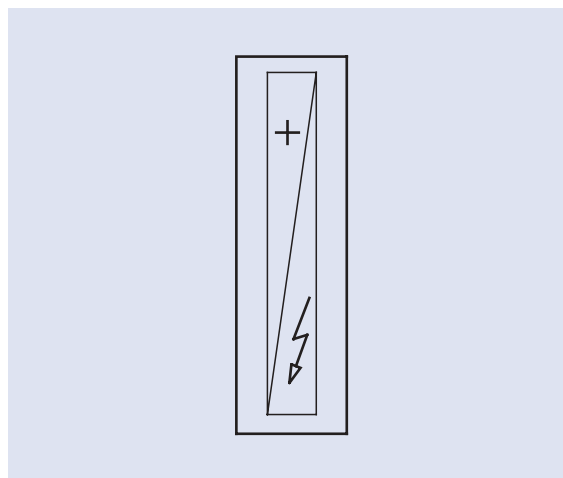


ELECTRIC HEATER (GE) is a heat exchanger in which electrical energy is transformed into thermal. It is used mostly in cases when no other thermal energy source is available (warm water or vapour) or as an alternative heater.

It is normally manufactured for air-handling units series KU 1 to KU 6 and also for larger units on request.

Electric heater protection elements are a safety thermostat and an air flow sensor.

It is recommended to mount the electric heater on the discharge side of the fan. A flow distribution unit is to be installed between the fan and the electric heater to enable the distribution of air current over the entire electric heater cross-section.

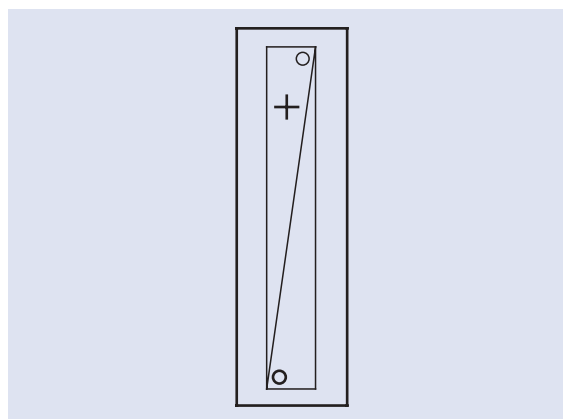


HEATER (H) is a heat exchanger between warm or hot water and air (GV) or vapour and air. It is made of aluminium fins and mechanically expanded copper tubes which allows for a high heat transfer coefficient.

Manifold connections may be threaded or flanged (on request) and are to be attached in the counterflow.

It is used as an exchange unit of the multi-plate recuperator.

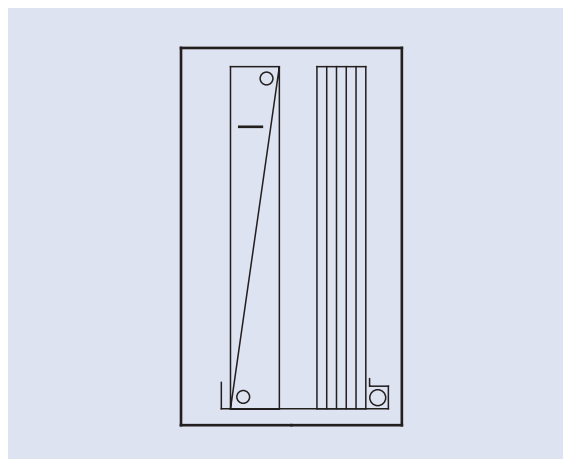
On request an antifreeze thermostat may be installed after the heater.

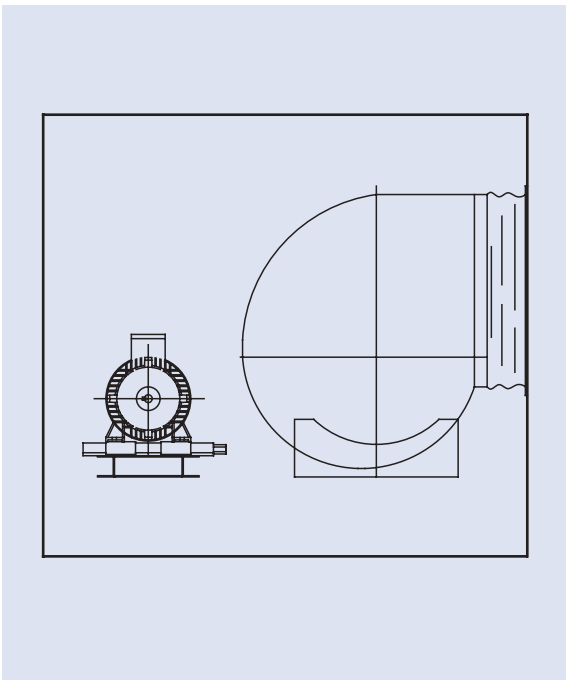


COOLER (H) is a heat exchanger between cold water and air (HV) or rather freon and air (HI). It is made of aluminium fins and mechanically expanded copper tubes, which allows for a high heat transfer coefficient. A cooler of a standard design includes also a droplet eliminator (EK), but on request or if possible (for lower air velocity) it can also be supplied without a droplet eliminator which will reduce the unit. The unit is equipped with a stainless steel condensate header with a connection for condensate drain and an adequate siphon.

Manifold connections may be threaded or flanged (on request) and are to be attached in the counterflow.

It is also used as an exchange unit of a multi-plate recuperator.





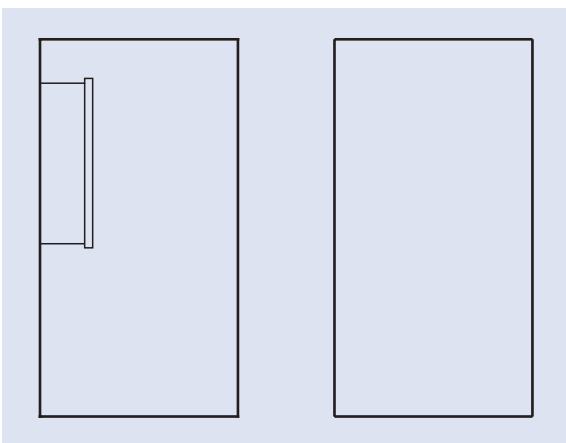
FAN UNIT (V) is an air-handling device driving unit in which the air is given energy necessary to overcome resistance to the flow through the device (internal pressure drop) and through air circuit elements (external pressure drop).

The fan and the electric motor are mounted on a joint platform and are connected to the fan unit casing by means of shock absorbers and a flexible connection for vibration damping purposes. The position and arrangement of the devices built in is adjusted to the discharge connection or rather to the operator's side.

Standard casings contain various types of radial two-sided suction fans with blades bent forward or backward and fans without a spiral casing. A great number of types and sizes make it possible to select the most suitable fan for all specific requirements.

Centrifugal fans with blades bent backward and a powder-coated wheel are used for discharge of air with a high content of fatty vapours (kitchen). The electric motor is cooled by clean external air.

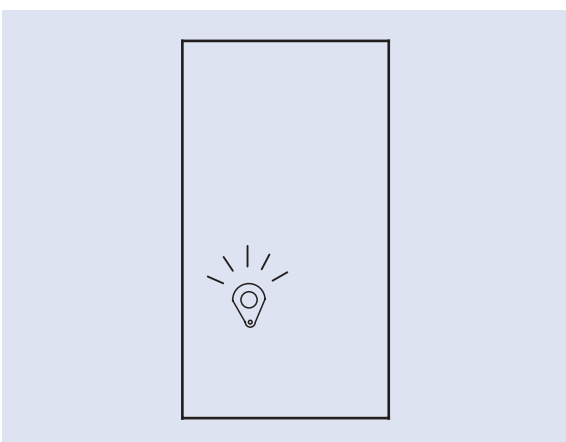
Fans and electric motors installed for explosive gas discharge must have an adequate protection ("S" design).



AIR FLOW DISTRIBUTION UNIT (PR) is used for distribution of air flow over the entire inner cross-section of the air-handling unit. It is mainly installed between the fan unit and the sound attenuator, filter, heat exchanger, etc.

EMPTY UNIT (P) is used:

- for air flow tranquillization,
- for installation of an antifreeze thermostat or other check and/or control elements,
- as a service unit of other air-handling unit components (filters, humidifiers, etc.).



STEAM HUMIDIFIER (OP) is an air-handling unit component in which the air is humidified by direct mixing of the air stream and water vapour. Humidification is an almost isothermal process. The vapour source may be:

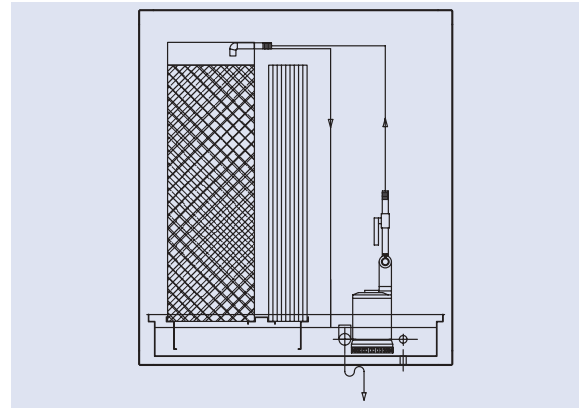
- central vapour processing, in which the vapour is supplied to the device by means of a distributing unit of an adequate size equipped with a valve and an electric-motor drive;
- electrical steam humidifier with the pertaining distributing units, vapour supply lines and a condensate drain.

The unit must be connected to the treated water and electricity supply lines.

The supply of vapour into the stream of air may be controlled by means of ON/OFF or continuously (0-10 V).

HONEYCOMB HUMIDIFIER (OS) is a unit designed for humidification of air by establishing a contact between air and a large wet surface (honeycomb) which results in evaporation of water. The honeycomb is made of specially formed PVC fins covered by a layer of viscous fibres enabling the flow of air. Water pours from the vessel on top of the honeycomb down the walls to the receiver from which it is pumped back into the vessel on top of the honeycomb.

The unit must be connected to treated (preferably softened) water and electricity supply. In order to prevent the growth of algae and microorganisms in water receptacles the unit must be regularly maintained and cleaned.

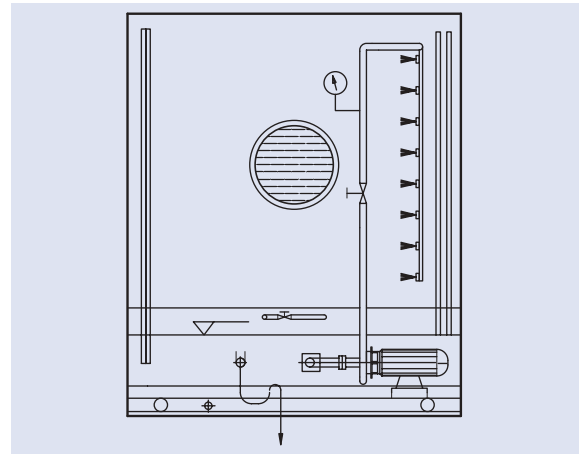


SPRAY HUMIDIFIER (OV) is a unit in which water is dispersed into small drops by means of nozzles. The process of adiabatic cooling results in evaporation of water or rather humidification of air.

The condition of air upon completion of the process depends on the initial condition of air, the velocity of air flow through the unit and the unit length.

The unit is equipped with a coil with nozzles, a pump, necessary fittings, a droplet eliminator and an air-distributing unit if required.

The unit must be connected to treated (preferably softened) water and electricity supply. In order to prevent the growth of algae and microorganisms in water receptacles the unit must be regularly maintained and cleaned.

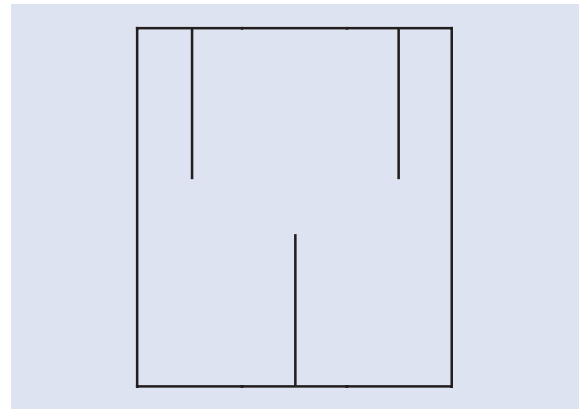


SOUND ATTENUATOR (PZ) is a unit designed to reduce the fan-generated noise level. It consists of barriers made of a special paper lined mineral wool stuffed into galvanized steel frames.

The material used for barriers is highly absorbing, does not absorb moisture and is non-combustible according to DIN 4102 class A1.

The barriers are wear resistant. Air deflectors built in on the front side provide favourable airflow conditions.

The unit is available in five different lengths, depending on the air-handling unit size.



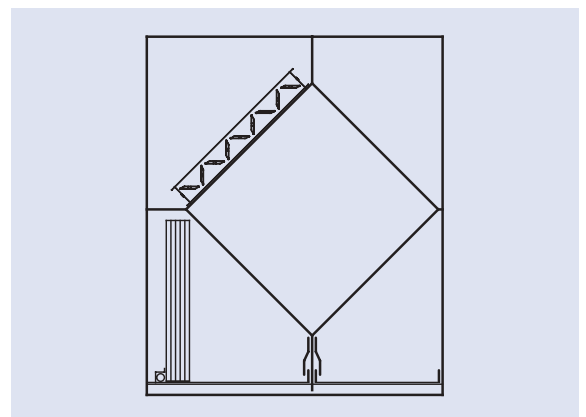
RECUPERATORS

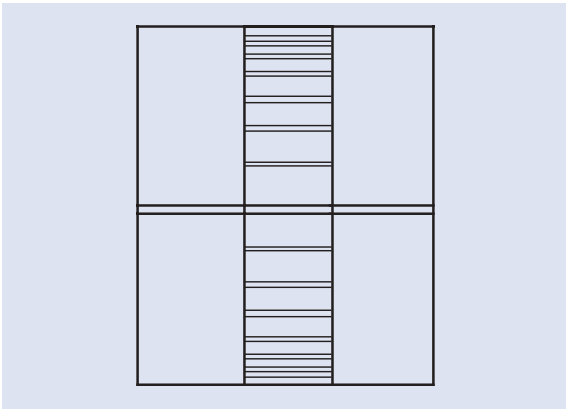
Through the return air heat recovery considerable energy savings may be achieved. The recuperators most often used are of the plate, rotating and multi-plate type.

PLATE RECUPERATOR (RP)

They are made of specially formed interconnected aluminium fins that facilitate cross-exchange of heat between the return and fresh air flow. The plate exchanger design allows for an absolute separation of air flow, thus preventing the transfer of any impurity, smell, moisture, bacteria, etc. from the return to the fresh air.

In order to prevent any heat exchange in the transitional period and to protect the exchanger against freezing a by-pass can be mounted to allow the stream of air circumvent the heat exchanger partly or completely.



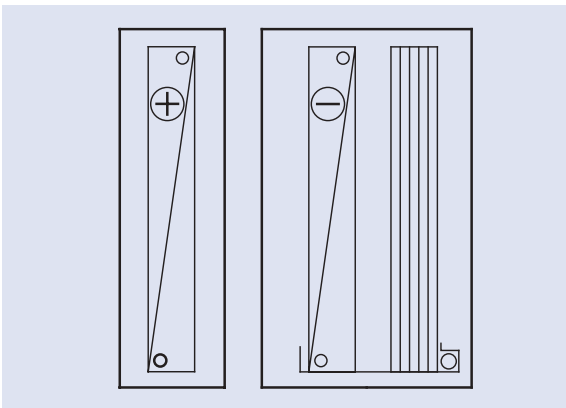


ROTATING REGENERATOR (RR)

The accumulation segment made of corrugated aluminium strips receives heat while rotating slowly in the return air stream and transmits the same to the fresh air stream.

The selection of a hygroscopic accumulation segment allows for the sensible and latent heat return and in this manner increases the total heat recovery level.

The regenerator is supplied with automatic controls for the speed control of the recuperator wheel.

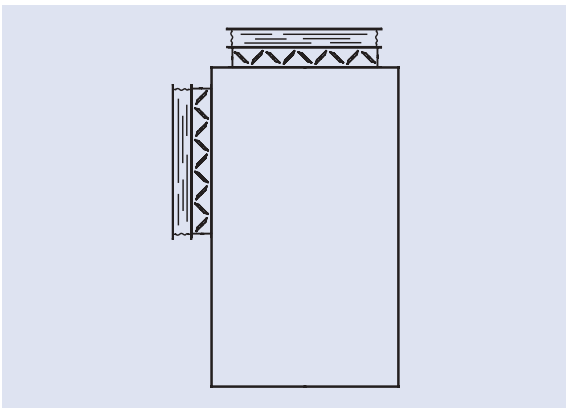


MULTI-PLATE RECUPERATOR (RL)

In a heat exchanger (RLH) a heating medium (water or non-freezing liquid) receives heat from the return air stream and superheats the fresh air stream in another one (RLG).

The heat medium circulates in a closed circuit by means of a pump, while a mixing valve with a by-pass enables the control in transitional periods.

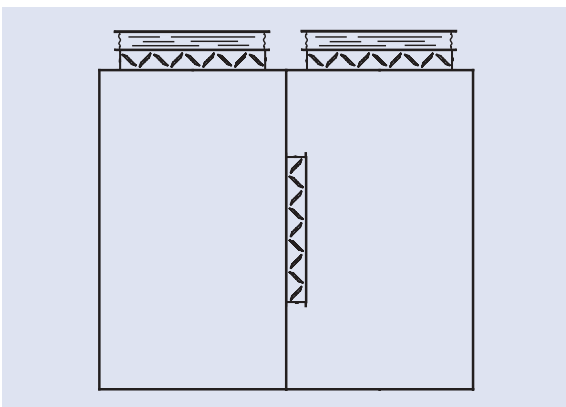
Owing to a complete separation of fresh and return air flows they are especially suitable for facilities in which the mixing of air flows is excluded (hygienic design - hospitals, etc.).



AIR MIXING UNIT (M) (with two ports) or rather a **SUCTION / DISCHARGE UNIT** (with one port) is a component of the air-handling unit which makes it possible to connect the same to the ventilation duct system, including a possibility of mixing fresh and return air flows.

The unit is equipped with one or two dampers (external and internal) and a flexible connection.

The dampers may be manually or electric motor operated.



DOUBLE AIR MIXING UNIT (MM) enables mixing of the fresh and return air in a desired proportion.

The unit is equipped with three dampers (external or internal) and flexible connections.

The dampers may be manually or electric motor operated.

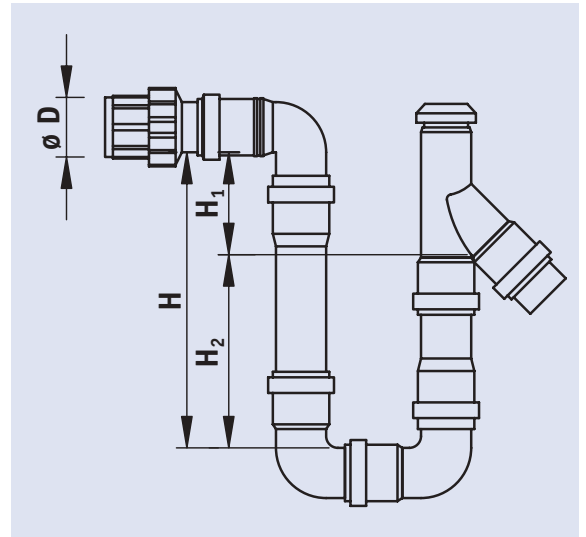
PLATFORM of the air-handling unit is C-shaped and made of galvanized steel plate of an adequate thickness. The platform height is determined according to the air-handling unit weight and the height of the siphon mounted. When in out-door design, the platform is to be higher.

RUBBER WASHERS serve to reduce the transmission of vibrations from the air-handling unit to the platform. They are fixed to the platform frame angles and the thickness is determined according to table 7.

Table 7:

Air-handling unit size	Thickness / mm
KU 1-KU 6	25
KU 7-KU 17	35

SIPHON is used to remove condensate generated during the cooling, humidification or recuperation process. It is made of PVC tubes and rubber or Teflon seals. In out-door design it is necessary to mount a heater to prevent freezing of water.



Siphon connection dimensions are shown in table 9.

The platform height is determined according to the siphon height required.

The siphon height is calculated by the below mentioned formulas:

- with overpressure at the point of installation:
 $H_1 = 30 \text{ mm}$,
 $H_2 = p + 30 \text{ mm}$
- with underpressure at the point of installation:
 $H_1 = p + 30 \text{ mm}$,
 $H_2 = p / 2 + 30 \text{ mm}$

Table 9:

Air-handling unit size	ø D
KU 1-KU 6	1 "
KU 7-KU 12	1 1/4 "
KU 13-KU 17	1 1/2 "

where

p = means pressure at the point of installation [mm VS] (1 mm VS = 10 Pa)

Out-door design

Due to specific conditions and atmospheric influences (moisture, dust, etc.) air-handling units for out-door installation are externally powder coated and protected by an additional roof, an elevated platform and water-protection louvres.

The roof is made of a double, powder-coated galvanized steel plate with cantilevers determined according to the unit size.

The platform is 200-300 mm high.

The water-protection louvres are mounted into special sheet metal attachments made of a powder-coated galvanized steel plate.

In order to prevent freezing of damper fins or rather of condensate in siphons, the fins and siphons are equipped with electric heaters containing corresponding controls.



Hygienic design

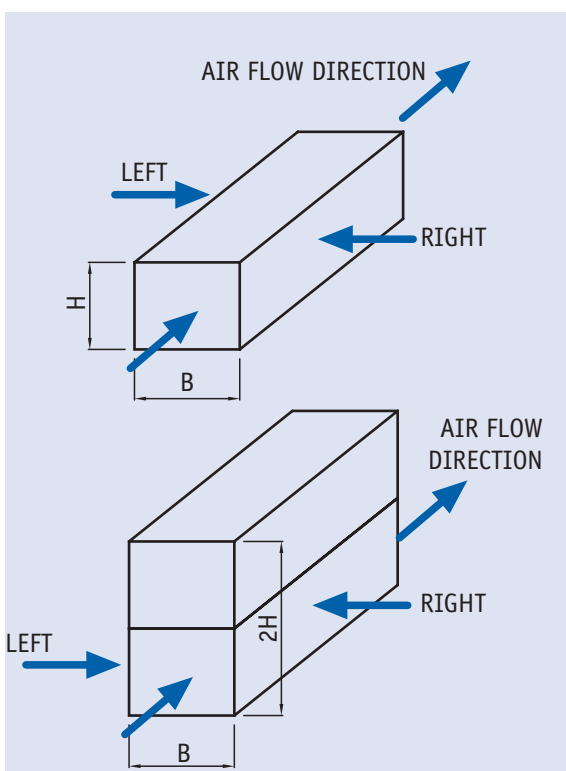
(in compliance with DIN 1946 guidelines, Part 4)



For the purpose of an easy and quick cleaning and disinfecting the "H" (hygienic) design of air-handling units differs from the standard design in the following:

- External and internal surfaces are made of galvanized steel plate and are additionally powder coated, which makes them resistant to cleaning and disinfecting agents;
- Floor surfaces of all units are made of stainless steel plates. On request all internal surfaces may be made of stainless steel plates;
- All internal sealing is carried out by a special sealing agent, which makes the air-handling unit airtight, waterproof and resistant to cleaning and disinfecting agents;
- All vats of cooler units (humidifiers, recuperators) are made of stainless steel plates;
- All built-in components of the air-handling unit are placed on stainless steel guides to make their pulling out, cleaning and disinfecting easier;
- Filter units have frameworks tightly mounted, which enables them to be fitted in an airtight manner and to meet the requirements under DIN 24185, Part 2. As a rule a filter class G4 is mounted on the suction side of the pressure-controlled air-handling unit and a filter class F7 as the last unit on the air supply side;
- Special seals enable the airtight design of dampers;
- Individual units of the air-handling device are interconnected by external connections only;
- Perforations and elements for connecting lines and cables correspond to impermeability class II according to DIN 24194, Part 2;
- All fans have a condensate drain connection built in.
- Larger fans have a cleaning hole built in.

DETERMINATION OF SERVICE SIDE 7



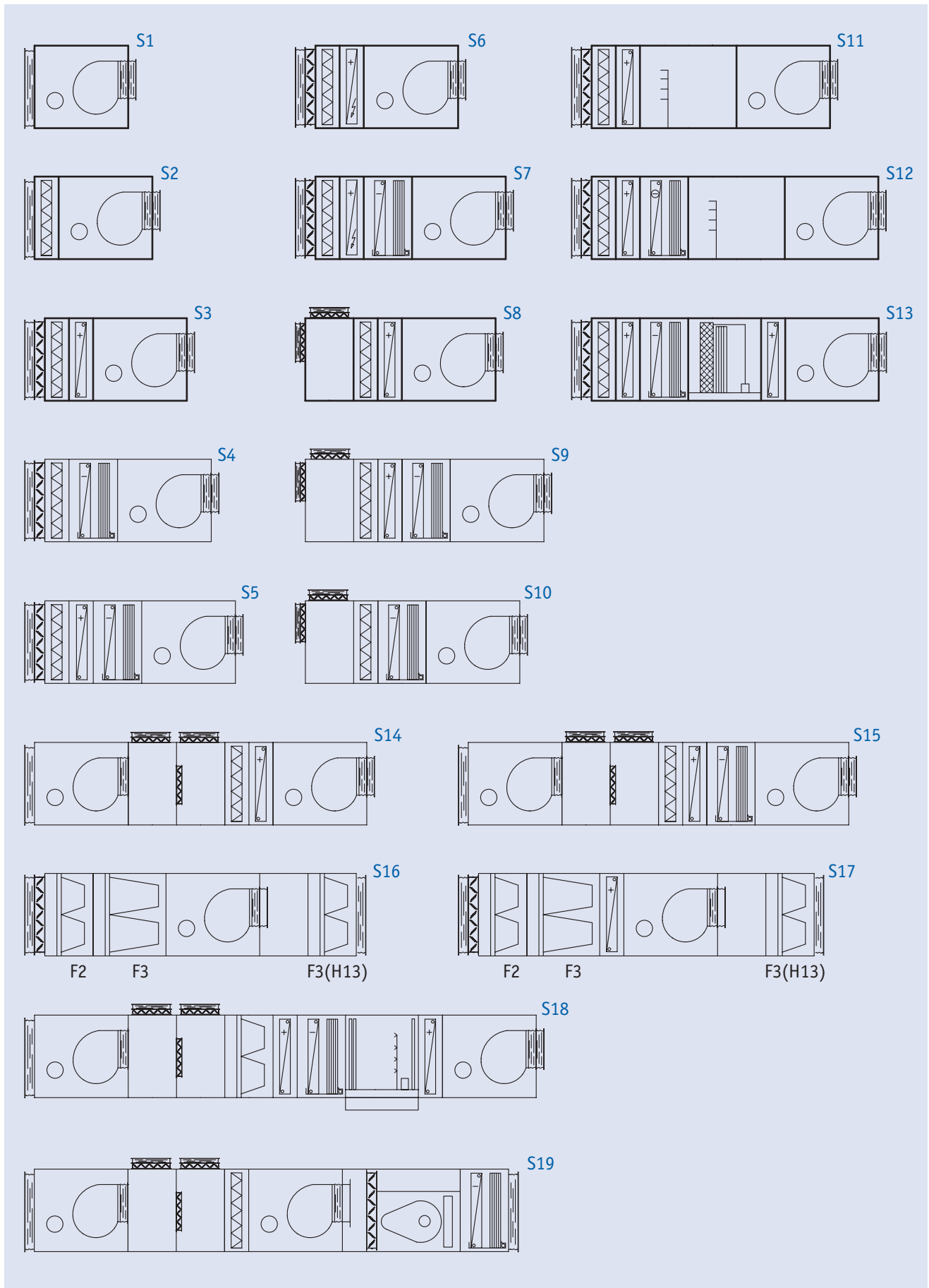
The service side is always determined looking in the air low direction towards the exhaust fan. In case of double air-handling units the basic service side is the one of the lower component.

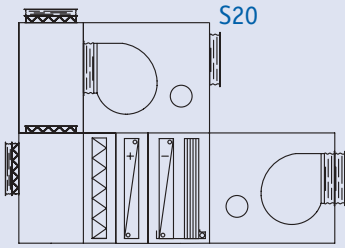
With upright designs the service side is to be agreed with the manufacturer by means of a special isometric sketch.

The principle of determining the service side is shown in the sketches.

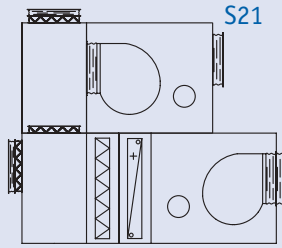
8 OVERVIEW OF STANDARD CONFIGURATIONS

Apart from configurations indicated it is also possible to have configurations containing the same unit with a different marking (e.g. the same standard configuration with a filter unit F1 as for a configuration with a filter unit F2 or F3). The same applies to configurations containing humidifiers, a plate recuperator and a rotating heat regenerator.

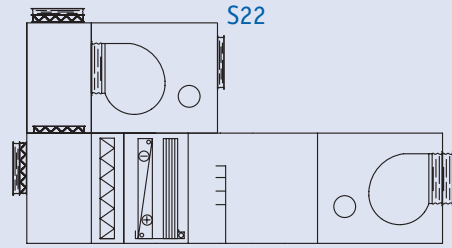




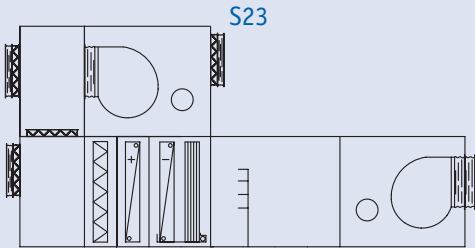
S20



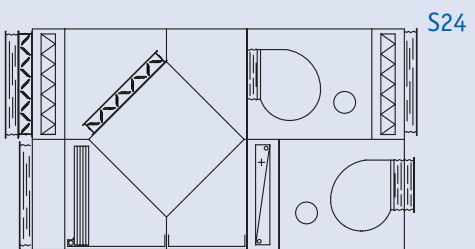
S21



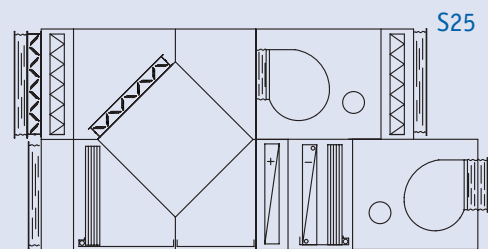
S22



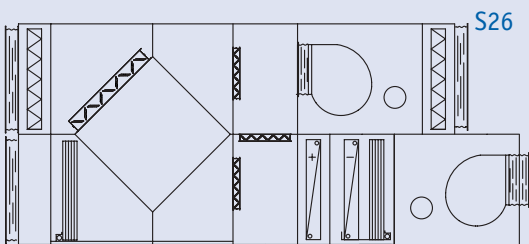
S23



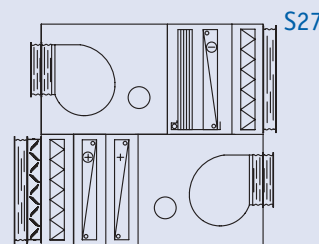
S24



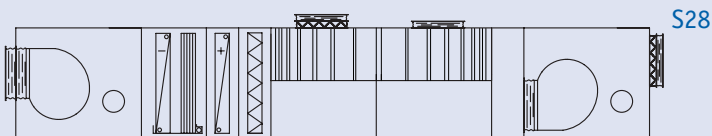
S25



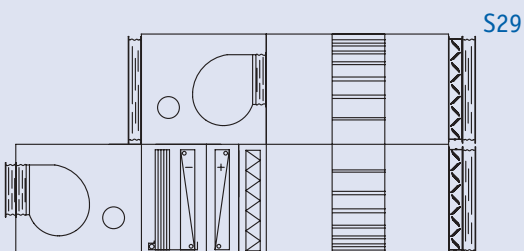
S26



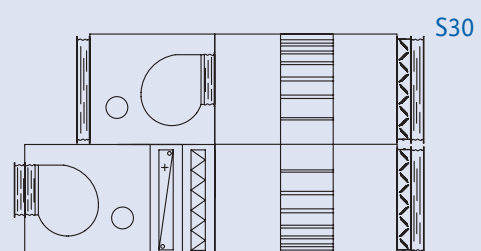
S27



S28



S29



S30

9 GUIDELINES FOR PRESSURE DROP CALCULATION AND SELECTION OF ELECTRIC MOTORS

Diagrams showing the pressure drop in each unit or a configuration may be found at the beginning of each chapter for a particular air-handling unit size.

- The value of pressure drop on a cooler, a multi-plate recuperator (cooler), a plate recuperator and a honeycomb humidifier does **NOT** include the pressure drop on a droplet eliminator (the value read from the droplet eliminator (EK) diagram is to be added).
- The pressure drop in a heater (GV) operating at 50/45°C is equal to the pressure drop on a cooler (HV) with a corresponding number of rows operating at 7/12°C.
- The pressure drop on a multi-plate recuperator (heater and cooler) is equal to the pressure drop on a 4R (four-row) heater (GV) operating at 90/70°C increased by 50%. The pressure drop calculated on a multi-plate recuperator relates to a 6R (six-row) heat exchanger. The calculation of the pressure drop on an 8R (eight-row) multi-plate recuperator is available on request.
- The fan unit pressure drop Δp_v (due to belt pulley resistance, belt transmission guard and distance between suction port and the unit panel) at air escape into the ventilation duct is determined by the formula:

$$\Delta p_v = 1,2 \times p_{din}$$

where

p_{din} - dynamic pressure (read from the fan diagram)

In case of a free air escape the fan unit pressure drop is to be additionally corrected according to the following formulas:

For **ADH** fans: $\Delta p_{vs} = K_d \times \Delta p_v$ $K_d = 2,2$ (size 160); $K_d = 1,66$ (size 180 - 1000)

For **RDH** fans: $\Delta p_{vs} = K_d \times \Delta p_v$ $K_d = 1,74$

After calculation of the pressure drop Δp_{int} over the unit, the total pressure drop Δp_{tot} is determined by the formula:

$$\Delta p_{tot} = \Delta p_{ext} + \Delta p_{int} + \Delta p_v (\Delta p_{vs})$$

where

Δp_{ext} - means the external pressure drop (in ducts, grids, anemostats, etc.)

Δp_{int} - means the sum of all pressures over the unit (read from pressure drop diagrams for individual units)

Δp_v - means the fan unit pressure drop (at air escape in the ventilation duct)

Δp_{vs} - means the fan unit pressure drop (at free air escape)

The total pressure drop Δp_{tot} is used to determine the fan size, the driving electric motor rating and other values.

ELECTRIC MOTOR SELECTION

The fan shaft horsepower P_v is calculated by the formula:

$$P_v = P_r + P_b$$

where

P_r - means the fan rotor horsepower (read from the fan diagram)

P_b - means the bearing power (read from the scale on the right of the fan diagram)

The electric motor power P_m required is calculated by the formula:

$$P_m \geq k_w \cdot P_v$$

where

k_w - means the safety coefficient (for compensation of power loss on the belt transmission, minor modifications in the operating point resulting from changed operating conditions, etc.). The safety coefficient k_w is determined according to the fan shaft power P_v by the following formulas:

$$\begin{array}{ll} k_w = 1,25 & \text{za } P_v < 0.75 \text{ kW} \\ k_w = 1,15 & \text{za } 0.75 \text{ kW} \leq P_v < 10 \text{ kW} \\ k_w = 1,12 & \text{za } P_v \geq 10 \text{ kW} \end{array}$$

It is recommended to use a star delta starter for all electric motors exceeding 7.5 kW.

Example: Air-handling unit size: KU 6

Air flow (supply): 10,050 m³/h

Air flow (exhaust): 10,050 m³/h

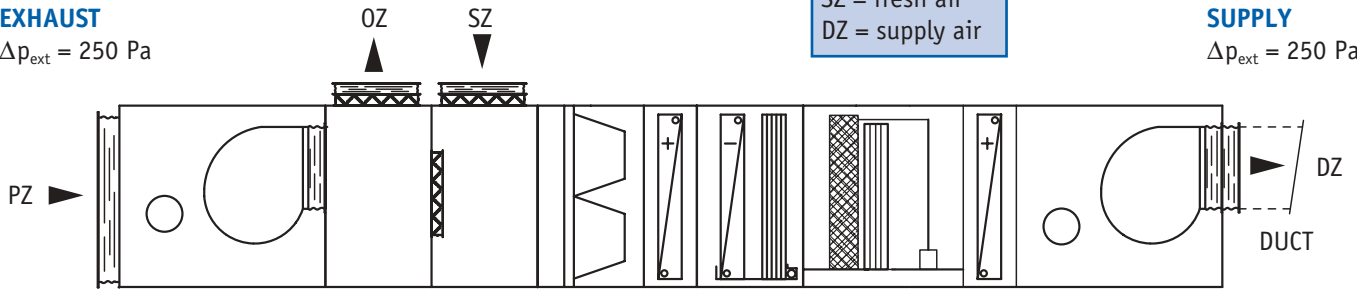
PZ = return air
 OZ = exhaust air
 SZ = fresh air
 DZ = supply air

EXHAUST

$\Delta p_{ext} = 250 \text{ Pa}$

SUPPLY

$\Delta p_{ext} = 250 \text{ Pa}$



Unit	V	MM		F2	GV	HV + EK	OS + EK	GV	V
Description	RDH 400	41	30	G4	2R	4R	TS-30	2R	RDH 400
Pressure drops	$\Delta p_{vs} = 80 \cdot 1,2 \cdot 1,74$			148	43	93 + 23	185 + 23	43	$\Delta p_v = 80 \cdot 1,2$

EXHAUST: $\Delta p_{tot} = \Delta p_{ext} + \Delta p_{int} + \Delta p_v = 250 \text{ Pa} + 41 \text{ Pa} + 167 \text{ Pa} = 458 \text{ Pa}$

SUPPLY: $\Delta p_{tot} = \Delta p_{ext} + \Delta p_{int} + \Delta p_v' = 250 \text{ Pa} + 588 \text{ Pa} + 96 \text{ Pa} = 934 \text{ Pa}$

Exhaust: $P_r = 2,1 \text{ kW}$ (read from the diagram)

$P_b = 43 \text{ W}$ (read from the scale - casing design L-R)

$n_v = 2800 \text{ min}^{-1}$ (read from the diagram)

$L_w(A) = 87 \text{ dB(A)}$

$P_v = P_r + P_b = 2,143 \text{ kW}$

$k_w = 1,15$

$P_m = k_w \cdot P_v = 2,46 \text{ kW}$

Electric motor selected: $P_m = 3 \text{ kW}$

Supply: $P_r = 3,7 \text{ kW}$ (read from the diagram)

$P_b = 60 \text{ W}$ (read from the scale - casing design L-R)

$n_v = 4000 \text{ min}^{-1}$ (read from the diagram)

$L_w(A) = 89 \text{ dB(A)}$

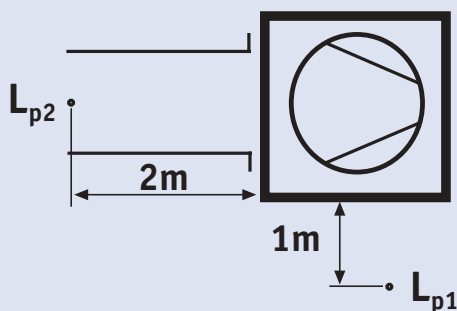
$P_v = P_r + P_b = 3,76 \text{ kW}$

$k_w = 1,15$

$P_m = k_w \cdot P_v = 4,32 \text{ kW}$

Electric motor selected: $P_m = 5,5 \text{ kW}$

GUIDELINES FOR FAN NOISE LEVEL CALCULATION 10



The noise level shown in diagrams for individual fans relates to the acoustic power level (A value) and inlet values measured according to the AMCA STANDARD 300 Fig. 2 - "A" configuration.

The fan noise levels are determined in the following manner:

The acoustic power level $L_w(A)$ (A value) is read from the fan diagram.

The sound pressure level is calculated as follows:

a) in the open air

$$L_p(A) = L_w(A) - (20 \log_{10} d) - 11$$

b) inside a building (room)

$$L_p(A) = L_w(A) - (20 \log_{10} d) - 8$$

where d means the distance from the fan [m].

The fan selection programmes VENTIL and AEOLUS enable an accurate calculation of the fan noise level values.

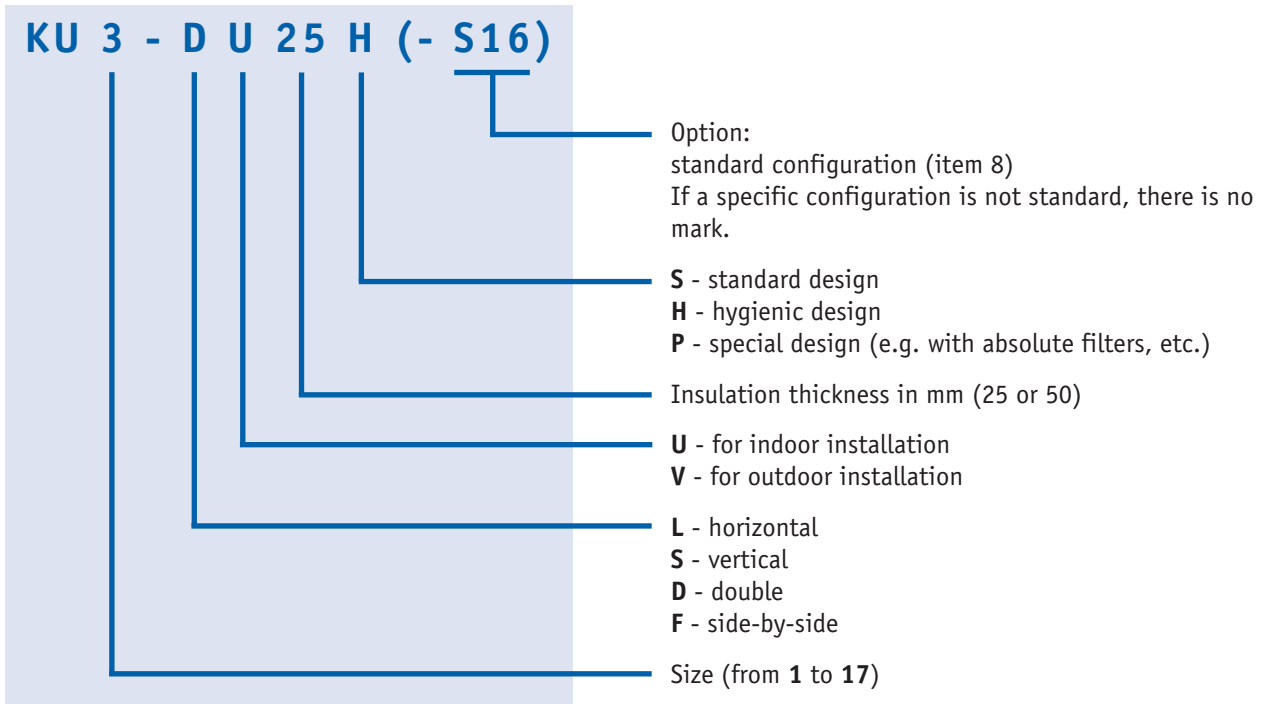
The sound pressure level at a distance of 1 m from the unit inside a room considering attenuation by the air-handling unit casing is calculated by the formula:

$$L_{p1}(A) = L_p(A) - R$$

Sound attenuation R[dB] by air-handling unit casing at a distance of d=1m (according to DIN 52210)

	Frequency range [Hz]							
	63	125	250	500	1000	2000	4000	8000
d=25mm	21	22	23	25	35	36	36	33
d=50mm	31	33	33	37	42	45	48	45

11 MARKING OF UNITS

**Example: KU 4-LV50H-S16**

Air-handling unit size 4. Design: horizontal. Installation: for outdoor installation. Insulation thickness: 50 mm. Hygienic design. Standard configuration S16.

12 TENDER TEXT

(example)

Air-handling unit, type KU 3, product of PROKLIMA.

Design: double. Position: for indoor (outdoor) installation. Lower component: supply (exhaust)

Insulation thickness: 25 cm. External powder coating in RAL 9010. (Hygienic design - internally powder coated and made of INOX).

Operated: left-hand. With the 80 mm high platform.

Dampers in airtight design (according to DIN 1946).

- Accessories: maintenance switch, inspection glasses, electric-motor driven louvres without (with) recoil spring, illumination.
- Outdoor design accessories: water protection louvres, suction duct, roof.

Remarks:

Approximate module length supplied: 2000 mm

Air-handling unit dimensions: BxHxL = 665 x 1440 x 3080 mm

Project designation: H1 System - CORRIDOR 1ST FLOOR

Technical features:

EXHAUST (DISCHARGE)

- flexible connection, front side
- damper external, front side

PANEL FILTER (F1) class G3

- length: 390 mm
- type: synthetic (, made of wire)
- with spare inserts
- filter dirt control: inclined pressure gauge 0-500 Pa

BAG FILTER SHORT (F2), class F9

- length: 600 mm
- type: bag filter short (compact ...)
(• with spare inserts)
- filter dirt control: excess pressure protector

BAG FILTER LONG (F3), class F9

- length: 870 mm
- type: bag filter long
(• with spare inserts)
- filter dirt control: excess pressure protector

ELECTRIC HEATER (GE)

- length: 480 mm
- electric heating capacity

Q,g	kW	42
t,z	°C	-20/18)

(• inlet/outlet air tem.)
- heater actuation: stepwise (,continuous)

HEATER (GV) - standard water heater

- length: 350 mm
- heating capacity

Q,g	kW	47,6
-----	----	------
- inlet/outlet air temperature

t,z	°C	-20/22
-----	----	--------
- pressure drop on the air side

dp,z	Pa	50
------	----	----
- medium: water
- inlet/outlet temperature of medium

t,w	°C	90/70
-----	----	-------
- pressure drop on the water side

dp,w	kPa	7,1
------	-----	-----
- design: standard (,epoxy layer)
- type of connection: threaded (,flanged)

HEATER (GP) - steam heater

- length: 350 mm
- heating capacity

Q,g	kW	47,6
-----	----	------
- inlet/outlet air temperature

t,z	°C	-20/22
-----	----	--------
- pressure drop on the air side

dp,z	Pa	40
------	----	----
- absolute steam pressure

p,d	bar	2
-----	-----	---
- steam temperature

t,d	°C	120
-----	----	-----
- design: standard (,epoxy layer)
- type of connection: threaded (,flanged)

COOLER (HV) - standard water cooler

- length: 700 mm
- cooling capacity

Q,h	kW	23,7
-----	----	------
- inlet air temperature/relative humidity

t,zu	°C DB/rel.v	32/40 %
------	-------------	---------
- outlet air temperature/relative humidity

t,zi	°C DB/rel.v	16,8/81 %
------	-------------	-----------
- pressure drop on the air side

dp,z	Pa	184
------	----	-----
- medium: water
- inlet/outlet temperature of medium

t,w	°C	6/12
-----	----	------
- pressure drop on the water side

dp,w	kPa	4,7
------	-----	-----
- design: standard (,epoxy layer)
- with droplet eliminator (• no droplet eliminator)
- type of connection: threaded (,flanged)

FREON COOLER (HI)

- length: 700 mm
- cooling capacity

Q,h	kW	29,5
-----	----	------
- inlet air temperature/relative humidity

t,zu	°C DB/rel.v	32/40 %
------	-------------	---------
- outlet air temperature/relative humidity

t,zi	°C DB/rel.v	14,6/82 %
------	-------------	-----------
- pressure drop on the air side

dp,z	Pa	193
------	----	-----
- refrigerant: R22 (R407C,...)
- evaporation temperature

t,i	°C	+5
-----	----	----
- design: standard (,epoxy layer)
- with droplet eliminator (• no droplet eliminator)
- type of connection: threaded (,flanged)

FAN UNIT (V)

- length: 1170 mm

FAN

air flow	V,z	m ³ /h	3350
external pressure drop	dp,ext	Pa	120
total pressure drop	dp,tot	Pa	750
fan type: AND 255l (,RDN 255 l, ...)			
pressure port orientation: left top (, right top)			
design: standard (,explosion-proof, ...)			
accessories: condensate outlet, cleaning port, suction protection, ...			

ELECTRIC MOTOR

electric motor power	P,m	kW	1,2
protection class: IP54 (,IP55)			
number of speeds: 1 (2, 3)			
supply voltage	V/f/Hz		400/3/50
design: standard (explosion-proof, tropic, marine)			
(• thermal protection (,temperature sensor)			
(• with frequency converter)			
(• with spare motor)			
(• with belt transmission guard)			

AIR FLOW DISTRIBUTOR (PR)

- length: 300 mm

EMPTY UNIT (P)

- length: 300 mm
- (• with antifreeze thermostat built in)

STEAM HUMIDIFIER (OP)

length: 1200 mm			
inlet air temperature/relative humidity	t,zu	°C DB/rel.v	30 / 25 %
outlet air temperature/relative humidity	t,zi	°C DB/rel.v	32 / 75 %
(• steam volume)	G,p	kg/h	25,4)
steam generation: electric steam humidifier (central generation of steam)			

HONEYCOMB HUMIDIFIER (OS)

length: 1000 mm			
inlet air temperature/relative humidity	t,zu	°C DB/rel.v	30 / 25 %
outlet air temperature/relative humidity	t,zi	°C DB/rel.v	32 / 75 %
(• degree of humidification)	eta	%	88)

SPRAY HUMIDIFIER (OV)

length: 1200 mm			
inlet air temperature/relative humidity	t,zu	°C DB/rel.v	30 / 25 %
outlet air temperature/relative humidity	t,zi	°C DB/rel.v	32 / 75 %
degree of humidification	eta	%	89

SOUND ATTENUATOR (PZ)

- length: 1500 mm
 - sound attenuation at 250 Hz
- | | | | |
|--|--|-------|----|
| | | dB(A) | 21 |
|--|--|-------|----|

PLATE RECUPERATOR

length: 1530 mm			
fresh/return air flow	V,z	m ³ /h	3350/3350
fresh air temperature/relative humidity	t,zu	°C DB/rel.v	-18 / 90 %
pressure drop on the air side	dp,z	Pa	149
return air temperature/relative humidity	t,zi	°C DB/rel.v	20 / 50 %
pressure drop on the air side	dp,z	Pa	156
heat recovery coefficient	eta	%	65)
with by-pass installed			

ROTATING RECUPERATOR (RR)

- length: 420 mm
- wheel type: ET12
- design: L or V

fresh/return air flow	V,z	m ³ /h	3350/3350
fresh air temperature/relative humidity	t,zu	°C DB/rel.v	-18 / 90 %
pressure drop on the air side	dp,z	Pa	88
return air temperature/relative humidity	t,zi	°C DB/rel.v	20 / 50 %
pressure drop on the air side	dp,z	Pa	101
heat recovery coefficient	eta	%	74

HEATER (RLG) a component of multi-plate recuperator

- length: 400 mm

inlet/outlet air temperature	t,z	°C	-18/6,4
pressure drop on the air side	dp,z	Pa	149

medium: glycol 40% (water)

inlet/outlet medium temperature	t,w	°C	3,2/-1,9
pressure drop on the water side	dp,w	kPa	45
heat recovery coefficient	eta	%	30

- design: standard (,epoxy layer)
- type of connection: threaded (, flanged)

COOLER (RLH) a component of multi-plate recuperator

- length: 700 mm

inlet air temperature/relative humidity	t,zu	°C DB/rel.v	20 / 50 %
outlet air temperature/relative humidity	t,zi	°C DB/rel.v	8,8 / 85 %
pressure drop on the air side	dp,z	Pa	274

medium: glycol 40% (water)

inlet/outlet medium temperature	t,w	°C	-1,9/3,2
pressure drop on the water side	dp,w	kPa	55
heat recovery coefficient	eta	%	30

- design: standard (,epoxy layer)
- with droplet eliminator (• no droplet eliminator)
- type of connection: threaded (, flanged)

MIXING UNIT

- length: 470 mm
- flexible connection, front side
- damper external, front side

DOUBLE MIXING UNIT

- length: 1060 mm
- flexible connection, front side
- damper external, front side
- damper drive: electric motor 0-10 V (,on/off)

NOTES

A large grid of graph paper for taking notes. The grid consists of 20 columns and 30 rows of small squares. The lines are light blue and form a consistent pattern across the page.



Quality first of all

Owing to the outstanding product workmanship and quality of installation PROKLIMA was awarded the **GOST** certificate this year. Such a total quality approach will continue through active participation in European and world certification programmes.



Our partners and representatives:



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