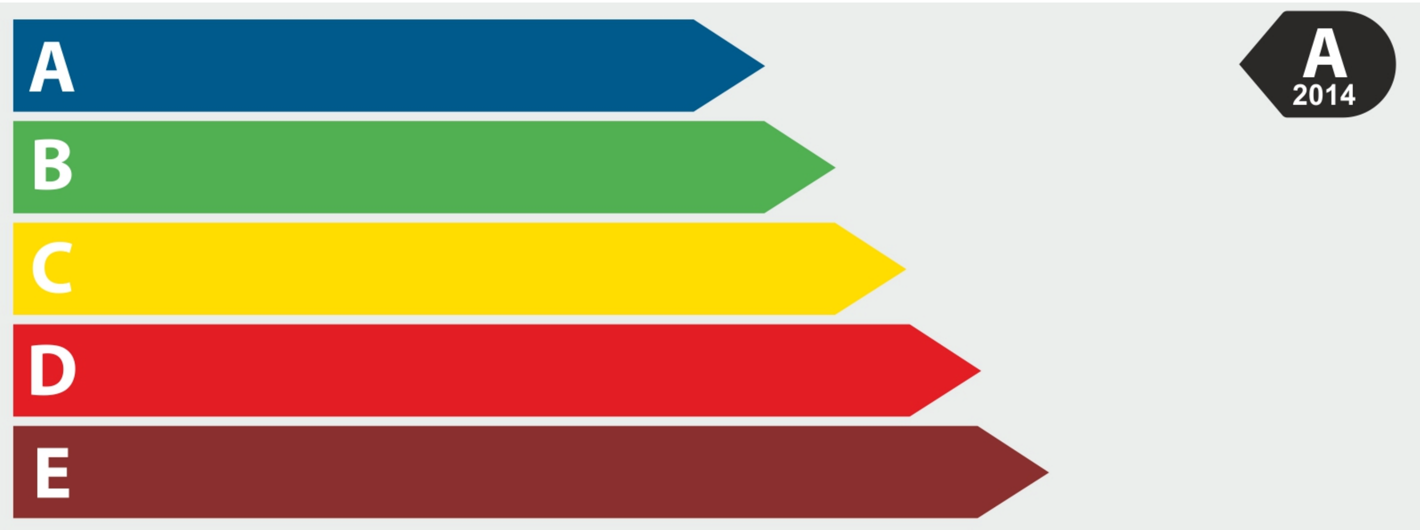

Certified Energy Efficiency.

Air handling units always boast up-to-date energy efficiency labels:
In accordance with the AHU-Guideline 01 of the German AHU-Manufacturers' Association or according to the EUROVENT-Guideline.

robatherm
the air handling company

Energy Efficiency: Up-to-Date with robatherm

Upon request, robatherm offers both energy efficiency classifications in accordance with the AHU-Guideline 01 of the German Association of AHU-Manufacturers as well as commendations with the Energy Efficiency Label from EUROVENT.

The energy efficiency classifications of air handling units (AHU) provide reliable guidance. As in the case of electrically operated household appliances and devices (refrigerators, washing machines, etc.), which for many years have undergone evaluations of their energy efficiency standards and have been subsequently awarded comprehensible labels.

Specific Fan Power Value Unsuitable for the Evaluation of AHU-Devices

The Specific Fan Power (SFP) value according to DIN EN 13779 only permits a rudimentary evaluation of a system's overall ventilation and air condition, as the AHU-system's efficiency is only taken into indirect consideration. This is due to the fact that the SFP-value is significantly influenced by the external pressure loss, which is neither influenceable by the equipment manufacturer nor dependent upon the quality of the device.

Specific Fan Power SFP_E[1, 2] according to DIN EN 13779

Class [-]	$P_{SFP} = P_M / q_v = \Delta p_{stat} / \eta_{stat}$ [Ws/m³]
SFP 1	< 500
SFP 2	500 to 750
SFP 3	750 to 1,250
SFP 4[3]	1,250 to 2,000
SFP 5	2,000 to 3,000
SFP 6	3,000 to 4,500
SFP 7	> 4,500

[1] to be determined with clean filters and dry mounting parts.
[2] Plus additional values for components according to DIN EN 13779
[3] Minimum requirement according to the German EnEV 2014 (Energy Savings Regulation)

Additional values for Components according to DIN EN 13779

Component [-]	Addition [Ws/m³]
Each additional filter stage above 1st filter stage	+ 300
Absolute filter stage (HEPA E10 to H13)	+ 1000
Active charcoal filter (gas filter)	+ 300
Heat recovery of Class H1 or H2 (according to DIN EN 13053)	+ 300
Cooler with dry air side pressure loss Δp > 200 Pa	+ 300

Recommended SFP-Classes for AHU-Systems according to DIN EN 13779

AHU [-]	SFP-Class [-]
ETA-system simple (without heat recovery)	SFP 2
ETA-system complex (with heat recovery)	SFP 3
SUP-system simple (without heat recovery)	SFP 3
SUP-system complex (with heat recovery)	SFP 4

Energy Efficiency Classes according to the AHU-Guideline 01

The energy efficiency classes in accordance with the AHU-Manufacturers' Association allow simple, traceable and verifiable evaluation of the factors that significantly influence energy efficiency. Energy efficiency labels render quick and reliable information to designers, plant engineers and operators as to whether an AHU-device is energetically optimized or not.

All required performance categories of an efficiency class must be fulfilled for awarding the efficiency label of the AHU Manufacturers' Association.
The AHU guideline classifies performance categories according to the European standard DIN EN 13053. These criteria are mandatory. The procedure is monitored by the German technical inspection agency "TÜV-Süd". Only certified member companies may award the AHU Manufacturers' Association label.

Criteria [-]	A+ [-]	A [-]	B [-]
Air velocity class			
- without thermodynamic air handling	V5	V6	V7
- with air heating	V4	V5	V6
- with further functions (incl. HRS)	V2	V3	V5
Heat recovery class	H1	H2	H3
Electrical motor capacity	P2	P3	P4

Important for the assignment of efficiency classes

Heat Transfer Rate
The calculation now takes place with balanced mass flow rate and standardized temperatures according to EN 308 (ODA: +5° C, 0 % r.F.; ETA: +25° C, 0% r.F.).

Auxiliary Energy of the HRS
The electrical power for operating the HRS is taken into consideration to overcome the pressure loss including eventually required operating energies, such as, the rotor-drive mechanism.

Coefficient of Performance of the HRS
The thermal use of the HRS is evaluated in comparison to the electrical input required for operation.

Energy Efficiency of the HRS
A value comprised of the heat transfer rate and coefficient of performance serves the cross-system evaluation of the HRS' energy efficiency.

Partial Load Factors of Electric Motors
Component tolerances and the engine operating point are taken into consideration, whereby the fan motor's absorbed electrical power is better displayed.

Supply air units
Supply air units without HRS may not be labeled.

Fans
Fan manufacturers who do not have a TÜV-certification neither of the test stand nor the software may not be used. Fan manufacturers with a certified test stand, but without software certification must be provided with a markup of 13 % on the electric motor power.

Air Velocity Classes[4] according to DIN EN 13053

Class [-]	Velocity in clear housing class section [m/s]
V 1	$v \leq 1.6$
V 2	$1.6 < v \leq 1.8$
V 3	$1.8 < v \leq 2.0$
V 4	$2.0 < v \leq 2.2$
V 5	$2.2 < v \leq 2.5$
V 6	$2.5 < v \leq 2.8$
V 7	$2.8 < v \leq 3.2$
V 8	$3.2 < v \leq 3.6$
V 9	$v > 3.6$

|4 The velocities are related to the filter cross-section of the AHU-device.

Heat Recovery Classes[5] according to DIN EN 13053

Class [-]	Energy efficiency[6] [%]
H1	$\eta_e \geq 71$
H2	$71 > \eta_e \geq 64$
H3	$64 > \eta_e \geq 55$
H4	$55 > \eta_e \geq 45$
H5	$45 > \eta_e \geq 36$
H6	$\eta_e < 36$

Reference values

η_t [-]	Δp_{HRS} [Pa]	ε [-]	η_e [-]
0,75	2x 280	19,5	0,71
0,67	2x 230	21,2	0,64
0,57	2x 170	24,2	0,55
0,47	2x 125	27,3	0,45
0,37	2x 100	26,9	0,36

Calculation of the HRS energy efficiency (η_e) with:

Temperature transfer rate HRS[7]	$\eta_t = (t_{SUP} - t_{ODA}) / (t_{ETA} - t_{ODA})$	[%]
Pressure loss:	$\Delta p_{HRS} = \Delta p_{HRS\_SUP} + \Delta p_{HRS\_ETA}$	[Pa]
Electrical auxiliary energy HRS[8]:	$P_{el\_HRS} = q_v \times \Delta p_{HRS} \times 1/0,6 + P_{el\_Aux}$	[W]
Coefficient of performance HRS:	$\varepsilon = Q_{HRS} / P_{el\_HRS}$	[-]
Energy efficiency HRS:	$\eta_e = \eta_t \times (1 - 1 / \varepsilon)$	[%]

|5 Classes define the quality of the HR, independent of the HR-System by balanced mass flow rates (1:1). The sole application of the heat recovery coefficient is no longer permitted.
|6 Values are based the calculation according to DIN EN 13053 as shown on the right side of the chart above.
|7 With heat transfer rate (dry) η_t [%] according to EN 308 (for mass flow 1:1)
|8 With air flow rate: q_v [m³/s]; operating power HRS: P_{el_Aux} [W]

Electrical Power Input Classes according to DIN EN 13053

Maximal permitted power input P_{m_ref}[9] [kW]
$P_{m\_ref} = (\Delta p_{stat}/450)^{0,925} \times [q_V + 0,08]^{0,95}$

Class [-]	Absorbed electrical power [kW]
P 1	$\leq 0.85 \times P_{m\_ref}$
P 2	$\leq 0.90 \times P_{m\_ref}$
P 3	$\leq 0.95 \times P_{m\_ref}$
P 4	$\leq 1.00 \times P_{m\_ref}$
P 5	$\leq 1.06 \times P_{m\_ref}$
P 6	$\leq 1.12 \times P_{m\_ref}$
P 7	$> 1.12 \times P_{m\_ref}$

|9 with static pressure loss Δp_{stat} [Pa] and air flow rate q_v [m³/s]

Energy Efficiency Classes according to EUROVENT

According to the EUROVENT-Procedure, five energy efficiency classes (from A to E) are available. This detailed differentiation allows the rating differences to be easily recognized.

As opposed to the AHU-Manufacturers' Association's process, EUROVENT applies the "compensation procedure". In this case, not all individual reference values of the desired energy efficiency class must be complied with. For example, a HRS' lower heat recovery coefficient can be compensated by a better (lower) power input of the fan motor.

The compensation of the influential variables, air-velocity and pressure loss of the HRS as well as the heat recovery coefficient of the HRS is based on the conversion into standard pressure loss allowances. The weighting of these allowances takes place based on the primary energy requirement. In this case, the primary energy factor of the electrical energy is calculated by a factor of 2 greater than the primary energy factor of thermal energy.

The air velocity in clear cross-section, the dry heat recovery coefficient and the pressure loss of heat recovery as well as the power input of the fans further remain the decisive variables for energy efficiency. However, due to the calculation's complexity, it is neither comprehensible nor self-explanatory for interested customers.

EUROVENT-Reference Values[10] according to EUROVENT 6/12

Energy Efficiency Class	Velocity in section[11]	Heat recovery factors[12]		Proof of coefficient of performance[13]
[-]	v_{class} [m/s]	η_{class} [%]	Δp_{class} [Pa]	$f_{class\text{-}Pref}$ [-]
A / A⤵ / A↑	1.8	75	280	0.90
B / B⤵ / B↑	2.0	67	230	0.95
C / C⤵ / C↑	2.2	57	170	1.00
D / D⤵ / D↑	2.5	47	125	1.06
E / E⤵ / E↑	No requirements			
A à E:	Units with outdoor air connection and planning temperature $t_{Winter} \leq 9°C$			
A⤵ à E⤵:	Units with recirculation air (100 %) or with permanent planning temperature > 9°C			
A↑ à E↑:	Extract air unit			

[10] The reference values present the basis for calculation of the compensation factors.
Due to the possible compensation, the unit-specific values could exceed/fall below the reference values.
[11] Valid for all unit-groups
[12] Valid for units with outdoor air connections and design temperature $t_{Winter} \leq 9°C$
[13] Valid for all unit-groups (evaluation of the electrical power input for the calculated reference power

To be permitted to implement this procedure, the members are subject to a strict certification process. This also includes, besides the annual inspections of the design software, measurements on real units, whereas the real unit must fulfill the performance data that has been denoted. This inspection may only be carried out by accredited inspection institutions (e.g. TÜV).

A direct comparison between energy efficiency classes, according to EUROVENT and according to the AHU-Manufacturers' Association, is not possible.

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