RLT-Guideline 01

General requirements for Air Handling Units

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For the latest version, please refer to the internet.

Adaption to new
DIN EN 13053
DIN 1946 Part 4
VDI 3803 Part 1

Herstellerverband Raumlufttechnische Geräte e. V.
AHU Manufacturers Association

Preface

With the present **RLT-Guideline 01** 'General requirements for Air Handling Units' the Herstellerverband Raumlufttechnische Geräte e. V. (AHU Manufdacturers Association) provides the basis for a high quality standard.

This guideline contains all relevant standards and, in the case of incongruent statements and gaps in the provisions, defines the acknowledged rules of technology.

The **RLT-Guideline 01** is a logical development that has evolved from the 'Güte- und Prüfbestimmungen' for 'RAL-Geräte' (Quality and Testing Guidelines for RAL-approved units) published by us for the first time in 1995. It provides uniform, comparable criteria and thereby is a reliable guide for selecting standard-compliant and energy-efficient air handling equipment that meets hygiene requirements. The introduction of energy classes A+, A and B takes into account recent legislation that requires clear and comprehensible statements to be made regarding energy efficiency. All requirements for the use of energy efficiency labels on AHUs of the Association of AHU Manufacturers are cited in the **RLT-Guideline Certification** with detailed explanations.

The guideline will be supplemented and brought up to date to reflect advances in technology.

Other guidelines of the Herstellerverband Raumlufttechnische Geräte e. V. have been published to date on the following topics relating to central air handling units:
RLT-Guideline 02: Explosion protection requirements for air handling units
RLT-Guideline 03: EC conformity assessment of air handling units
RLT-Guideline 04: Ventilation systems with smoke extraction function
RLT-Guideline 05: Building information modelling for Air Handling Units
RLT-Guideline Certification: Audition guideline and certification program for the evaluation of the energy efficiency of air handling units

Bietigheim-Bissingen, June 2021

Herstellerverband Raumlufttechnische Geräte e. V.

This RLT-Guideline can be downloaded free of charge from the homepage of the Herstellerverband Raumlufttechnische Geräte e. V. (www.rlt-geraete.de).

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1. Purpose and scope

This guideline applies to all Air Handling Unit (AHU) and requirements for its construction. An AHU is any part of a ventilation / air conditioning system in accordance with **EN 13053**. This guideline comments on the energy, hygiene and mechanical properties of AHU's.

In this guideline, the Herstellerverband Raumlufttechnische Geräte e. V. provides an overview of the acknowledged rules of technology for AHU units. Where standards and guidelines do not make clear statements on certain points, but only put forward recommendations or give classifications, this guideline provides concrete specifications.

RLT-Guideline 01 is intended as a guide for investors, users, architects, planners, installers, servicers, maintenance companies and manufacturers in order to ensure that AHU's equipment reflects state-of-the-art in air technology.

This RLT-Guideline 01 does not contain any information on special explosion protection requirements or maintaining functionality of AHU's when used for smoke extraction. These topics are dealt with in **RLT-Guideline 02 and 04**.

2. Legislation, regulations, standards, guidelines and data sheets

The following standards and guidelines were taken into consideration for the purpose of compiling this guideline.

- VDI 3803 sheet 1 (05/2020)
  Air-conditioning systems - Structural and technical principles
- VDI 3803 sheet 5 (04/2013)
  Heat recovery systems in AHU-plants
- VDI 6022 sheet 1 (01/2018)
  Hygienic requirements for ventilating and air-conditioning systems and air-handling units
- EN 1822-1 (10/2019)
  High efficiency air filters (EPA, HEPA and ULPA)
- EN 1886 (07/2009)
  Mechanical properties and measuring methods
- EN 13053 (05/2020)
  Ventilation for buildings - Air handling units - Rating and performance for units, components and sections
- EN 16798-3 (11/2017)
  Performance requirements for ventilation and room-conditioning systems
- DIN 1946-4 (09/2018)
  Ventilation and air conditioning systems in hospitals
- EN 1751 (06/2014)
  Aerodynamic testing of dampers and valves
- EN 13501-1 (05/2019)
  Fire classification of construction products and building elements
- EN ISO 16890-1 (08/2017)
  Air filters for general ventilation
- RLT-Guideline Certification (11/2017)

General requirements	Mechanical Performance	Performance data	Hygiene requirements
EN 13053 EN 16798-3 VDI 3803-1 **RLT 01**	EN 1886 DIN 1751 EN 13501-1 **RLT 01**	EN 13053 EN 16798-3 VDI 3803-5 **RLT 01**	EN 13053 VDI 6022 DIN 1946-4 **RLT 01**

3. Terms and definitions

Access doors:
Doors have hinges and a maximum of 3 locks.
Access panels:
Inspection door are metal cover sheets fixed with metric internal or external hexagon screws or Torx screws or toggle closure. Screws with slot or crosshead operation or tapping screws are not permissible for inspection covers.
Accessible (walk-in) units:
Units from a clear internal height from 1.6 m.
Coating:
Hot-dip galvanized steel sheet with powder coating or 2-coat wet painted with primer and top coat (minimum 60 µm) or with continuous coating (minimum 25 µm) or materials with corrosion protection class III in accordance with **DIN 55928-8**.
Drainage properties of condensate tray:
Condensate tray must have a slope to all sides and have a drain. Draining is considered sufficient where any water remaining due to surface tension can be dried off completely by running the system dry. This requirement is deemed to have been met when, after adding 5 l of water for each 1 m^2 of tray base area, at least 95% of the water will drain away within 10 minutes.
Grooves and indents:
Construction-related indentations should be avoided or filled. An exception is indentations owing to radii of rolled steel sections, as sealing can only be applied outside the radii. Where the base has no grooves (e. g. owing to sealing rubber) it is not necessary to do any filling.
High-performance cooler:
Cooling coil with a dry pressure loss of more than 200 Pa.
Internal air temperature:
In order to determine the internal air temperature where the external air is sucked in via a mixing chamber, the entry temperature of the pre-heater is used.
Minimal requirements for materials:
If the usage of stainless steal is required in this guideline, the minimal quality of 1.4301 must be used. If the usage of aluminium is required in this guideline, the minimal quality of AlMg must be used.
Tubular rivets:
Tubular rivets are rivets with a mandrel that is completely removed after setting the rivet, leaving a hole through the rivet. Only those rivets are permissible on which the mandrel is mechanically locked after setting, which means that it cannot fall out. Rivets have to be splash-proof. The mandrel of the rivet must not protrude from the rivet head after setting (but it may break at a lower point).
Units with extended hygiene requirements:
Unit for which the general requirements in the standards with respect to hygiene of AHU equipment are not sufficient. This may be AHU equipment for areas such as hospitals, clinics, doctors' surgeries with operating room, outpatient operating centres, facilities for the preparation of medical products, production of medicines in chemists and in the pharmaceutical industry.
Units with other functions:
Units with other thermodynamic functions, other than air heating, such as air humidification, air dehumidification, air cooling etc.
Weatherproof units:
Units for stationing in the open without additional housings or shelter from buildings.

4. Energy efficiency classes

4.1 Specific Fan Power (SFP)

The **EN 16798-3** 'Energy performance of buildings – Ventilation for buildings – Part 3: For non-residential buildings – Performance requirements for ventilation and room-conditioning systems' describes Specific Fan Power (SFP) in the context of energy consumption. It describes eight SPF classes (section 6).

$$P_{SFP} = \frac{P_m}{q_V}$$

With

P_{SFP}	[W/(m³/s)]	Specific Fan Power
P_m	[W]	Electric power input; including correction factors (see RLT-Guideline Certification)
q_V	[m³/s]	Nominal air volume flow

When assuming a system efficiency rating of 0.60 it is possible to calculate the approximate overall pressure increase of the fan.

$$\Delta p_{fan} = P_{SFP} \cdot \eta_{total}$$

With

Δp_{fan}	[Pa]	Overall fan pressure increase
P_{SFP}	[W/(m³/s)]	Specific Fan Power
η_{total}	[-]	System efficiency rating fan/motor/drive

The pressure increase available has to overcome both the pressure drop of the components in the unit (internal) as well as that of the duct system (external). Since no quantified data have been given for the pressure drop of the duct system and this is not within the unit manufacturer's 'sphere of responsibility', the SFP values are not suitable for evaluating the energy efficiency of an air handling unit.

4.2 Energy efficiency classes A+, A and B

If a manufacturer fulfils the criteria from the **RLT-Guideline Certification**, he can mark his unit, as well as all regarding technical documentation, with the energy efficiency class calculated by the RLT design software.

The labels used therefore are shown below.

4.3 Regulation conformity for RLT-Guideline 01

Under the following conditions, the manufacturer is entitled to point out the conformity the guideline RLT 01:

- The AHU-unit fulfils all relevant criteria of this guideline
- At least one energy efficiency class A+, A or B regarding the **RLT-Guideline Certification** is achieved

In this case, the AHU-unit, as well as all regarding technical documentation, can be marked with the R-label. The label used therefore is shown below.

With the marking of the AHU with the regulation conformity label shown below the member commit that all criteria are complied with and that this is ensured by a self-verification.

5. AHU requirements

5.1 Casing

Table 1: General requirements

No.	Requirements	Standard	Supp. standard
Surfaces and materials			
01	Double-skinned panels with sandwiched insulation (including where frame insulated).	EN 13053 (6.2)	VDI 3803-1 (6.1)
02	Thermal insulation fitted without cavities.	RLT 01	
03	The use of single-skin plastic panels for components in contact with the air, e. g. in heat exchangers, is not permitted owing to fire risk and hygiene considerations.	RLT 01	
04	Insulation material building material class A1 or A2-s1 d0. Exception: Combustible materials building material class A2, B, C-s3 d2 are admissible if unit is separated to room by fire and smoke protection damper. For coatings thickness ≤ 0,5 mm materials E-d2 admissible.	EN 1886 (10) EN 13501-1	VDI 3803-1 (6.1)
05	Minimising combustible materials.[1)]	EN 1886 (10)	VDI 3803-1 (5.4.1)
06	Abrasion resistant, emissions free, odourless material non-metabolsable by micro-organisms. Do not use seals that absorb moisture or provide a nutrient substrate for micro-organisms.	EN 13053 (6.2)	VDI 3803-1 (6.1) VDI 6022 (6.1.1) DIN 1946-4 (6.1.2)
07	Interior wall surfaces smooth and without any open adsorptive areas. Porous materials in the air flow (except sound absorbers) are not permitted.	VDI 6022 (6.1.1)	EN 13053 (6.2) VDI 3803-1 (6.1) DIN 1946-4 (6.1.2)
08	Surface characteristics internal and external (incl. base frame) at least hot-dip galvanized steel sheeting. Inner skin of components immediately downstream of the humidifier to be hot-dip galvanized and coated (section 3).	EN 13053 (6.2)	VDI 3803-1 (6.1) VDI 3803-1 (5.4.1)
Casing indicator values			
09	Casing indicator values have to be identified with the extension (R) for real units and (M) for model box.	EN 1886 (4)	
10	Mechanical strength class D2 (R).	VDI 3803-1 (6.1)	EN 1886 (5.1) DIN 1946-4 (6.5.3)
11	Casing air leakage class L3 (R). Permitted overall leakage max. 2 % of the nominal volume flow.	VDI 3803-1 (6.1)	EN 1886 (6.1.1)
12	The leakages in the HRS and the housing must be taken into account in the design. Specification of the external pressures separated according to negative pressure and positive pressure side.	VDI 3803-1 (6.2.12)	
13	Filter bypass leakage (400 Pa): – Filter class ISO ePM1 ≥ 80 % max. 0,5 % – Filter class ISO ePM1 ≥ 70 % max. 1,0 % – Filter class ISO ePM1 ≥ 50 % max. 2,0 % – Filter class ISO ePM2,5 ≥ 50 % max. 4,0 % – Coarser filter max. 6,0 %	EN 1886 (7.1.2)	EN ISO 16890
14	Thermal transmittance. – T5 (M): units without thermodynamic air treatment – T4 (M): units with air heating and other functions	VDI 3803-1 (6.1)	EN 1886 (8.2.1)
15	Thermal bridging factor for suction intake chamber and downstream parts of casing. – TB2 (M) recommended if there is an increased risk of condensation – TB3 (M) when internal air temperature < -7 °C – TB4 (M) when internal air temperature -7 °C to + 5 °C	VDI 3803-1 (6.1)	EN 1886 (8.2.2) DIN 1946-4 (6.5.3)
16	Thermal bridging factor for cooling components and downstream parts of casing. – TB2 (M) recommended if there is an increased risk of condensation – TB3 (M) when internal air temperature < 7 °C – TB4 (M) when internal air temperature 7 °C to + 13 °C	VDI 3803-1 (6.1)	EN 1886 (8.2.2) DIN 1946-4 (6.5.3)
17	Sound insertion loss De (M) has to be stated for 125 Hz to 8,000 Hz.	VDI 3803-1 (6.1)	EN 1886 (9.5)

[1)] Combustible materials are inadmissible for units with air temperatures of 85 °C or if combustible materials can settle.
Low quantities (sealing, handle, store, measuring device, thermal decouplings, covers) of combustible materials are admissible.

Continuation of table 1: General requirements

No.	Requirements	Standard	Supp. standard
Access doors and access panels			
18	For casing parts with a mandatory thermal bridging factor TB3 (M) or better, the sight glass has to be double-glazed; also, the respective framing must not form an additional thermal bridge.	VDI 3803-1 (6.1)	
19	Up to a clear internal unit height of less than 1.6m, removable access panels are permitted; for taller units doors have to be provided.	VDI 6022 (6.3.5)	
20	Doors to components causing a danger, must be openable only with a tool and must bear a warning sign showing the danger (for example on fans). If this is not possible, the fan has to be equipped with suction, blow-out and belt protection.	EN 1886 (11)	VDI 3803-1 (5.1)
21	Sealing gaskets / paint coating must no get damaged by the door closers over a longer period.	RLT 01	
22	Access doors of accessible (walk-in) units must be openable from the inside.	VDI 3803-1 (6.1)	
23	Protection against injury when opening doors on the positive pressure side. No devices must be used that can be deactivated (e. g. a chain that can be disconnected).	EN 1886 (11)	VDI 3803-1 (5.1)
Further requirements			
24	Protection against injury from sharp edges or pointed objects.	EN 13053 (6.2)	EN 1886 (11) VDI 3803-1 (5.1)
25	All components have to be designed in such a way that they are accessible for maintenance and cleaning through doors or access panels from the air inlet side and the outlet side. Alternatively, up to a clear unit height of 1.6 m, components can be designed for pulling out.	EN 13053 (6.2)	VDI 3803-1 (5.1) DIN 1946-4 (6.1.1) VDI 6022 (6.1.1)
26	Maintenance platforms for units more than 3 m in height.	VDI 3803-1 (6.2)	
27	When installing the units on site, no additional insulation and cover measures are permitted for the joints of the casings (an exception is the floor area for units with extended hygiene requirements).	RLT 01	
28	In accessible (walk-in) units, openings in the floor and openings in maintenance areas require gratings.	VDI 3803-1 (6.1)	
29	Floors to be without grooves or indentations so that they can be wipe-cleaned without leaving any residue.	EN 13053 (7.3)	DIN 1946-4 (6.5.1) VDI 6022 (6.3.5)
30	All components must be protected by filters. Apparatus filter preheating before the first filter stage is therefore not permitted.	VDI 3803-1 (6.2.2)	

Table 2: Additional requirements for weatherproof units

No.	Requirements	Standard	Supp. standard
01	Thermal transmittance: – T5 (M): units without thermodynamic air treatment – T3 (M): units with air heating and other functions	VDI 3803-1 (6.1)	EN 1886 (8.2.1)
02	Thermal bridging factor: – TB5 (M): units without thermodynamic air treatment – TB3 (M): units with air heating and other functions	VDI 3803-1 (6.1)	EN 1886 (8.2.2)
03	Outer skin hot-dip galvanized and coated.	VDI 3803-1 (6.1)	
04	Weatherproof roof with overhang and drip edge.	VDI 3803-1 (6.1)	
05	Doors with stay mechanism.	VDI 3803-1 (6.1)	
06	Weatherproof units must not be used for structural functions or as part of the roof for the building.	EN 13053 (6.2)	VDI 3803-1 (5.1)
07	Outdoor air intake chamber with condensate tray in stainless steel or aluminium; drainage in accordance with section 3.	VDI 3803-1 (6.1)	EN 13053 (6.2)

Table 3: Additional requirements for units with extended hygiene requirements

No.	Requirements	Standard	Supp. standard
01	Casing air leakage: – ClassL2 (R) Casing air leakage for clean rooms : – Class L1 (R)	VDI 3803-1 (6.1)	DIN 1946-4 (6.5.3) EN 1886 (6.1.1) EN 13053 (7.6)
02	Thermal insulation (section 6): – T2 (M): for all units.	DIN 1946-4 (6.5.3)	
03	Thermal bridge factor for the suction chamber and the following housing parts: – TB3 (M) when the inside air temperature in the outside air chamber ≥ -7 ° C – TB2 (M) if the inside air temperature in the outside air chamber is < -7 ° C or with weatherproof design. – Recommended if there is an increased risk of condensation.	DIN 1946-4 (6.5.3)	DIN EN 1886 (8.2)
04	Side panels and all components whose surfaces are lying in the air flow, hot-dip galvanized and coated. Floor incl. drawer rails as well as all surfaces in the floor range touching condensate made of stainless steel or aluminium.	DIN 1946-4 (6.5.1)	VDI 3803-1 (6.1)
05	Materials with resistance to disinfectants, sealing gasket with closed cell structure.	DIN 1946-4 (6.5.1)	
06	All parts of the unit must be accessible for cleaning on the suction and pressure sides; access via doors or, for units with a clear internal height < 1.6 m possible via access panels. Alternatively it is possible to design components for pulling out (attention to pipe connections).	EN 13053 (7.2)	DIN 1946-4 (6.5.1)
07	Doorlocks have to be suitable for cleaning, resistant to disinfectants and abrasion-proof (e. g. die cast aluminium) if on the inside.	RLT 01	
08	Hollow rivets are not permitted on the inside of casing.	RLT 01	
09	– Cables to be installed outside the unit if possible – Inside units, cables should not be installed in ductwork – Where cables are installed inside the unit, distances should be kept as short as possible	RLT 01	
10	The surfaces should not encourage the deposit of dirt particles.	DIN 1946-4 (6.1.2)	
11	It is preferable that components are installed within the unit.	DIN 1946-4 (6.3)	
12	The sealing devices for doors may be inserted by push-fit, clamping or foaming (sealings glued in are not permitted).	DIN 1946-4 (6.5.1)	
13	Filter bypass leakage: – All filter classes max. 0.5 % of the nominal volume flow.	DIN 1946-4 (6.5.3)	DIN EN 1886 (7.1.2)
14	– Outside air suction range with floor as tub – Connecting pipe made of stainless steel or aluminium – tub: length min. 0.5 m; discharge behaviour acc. to Chapter 3 – condensate tubs at least for following components: Outside air suction chamber, cooler, humidifier, heat recovery (air inlet and outlet side)	DIN 1946-4 (6.5.2)	
15	Outdoor air intake chamber with access panel or door.	DIN 1946-4 (6.5.5)	
16	All components have to be protected from dirt and damage during construction time.	DIN 1946-4 (6.1.3)	

5.2 Air connections / air openings

Table 4: General requirements

No.	Requirements	Standard	Supp. standard
01	Air velocity max. 5 m/s (except fan outlet).	EN 13053 (6.6.1)	VDI 3803-1 (6.2.9)
02	– Recommended inflow angle to opening min. α = 25° – Recommended outflow angle from opening min. β = 35°[1)]	EN 13053 (6.6.1)	VDI 3803-1 (6.2.9)
03	Impact sound insulation (no contact with metal).	VDI 3803-1 (6.2)	
04	Equipotential bonding.	VDI 3803-1 (6.2)	
05	Surfaces outside and inside in hot-dip galvanized steel sheeting.	RLT 01	
06	Outdoor air intake opening: – Air ductwork to the AHU as short as possible – Draining and cleaning facility for water that may have entered – Drainage not to be connected directly to the wastewater drainage system – Inspection opening at the chamber or overwork Exhaust air discharge opening: – Draining for water that may have entered	VDI 6022 (6.3.1) VDI 6022 (6.3.4)	

Table 5: Additional requirements for weatherproof units

No.	Requirements	Standard	Supp. standard
01	Weather-proofing device on suction and pressure side with wire mesh (max. 20 × 20 mm) accessible on one side for cleaning. Weather-proofing device also effective when system not in operation. Lower angle of rain hood min. 45°.	EN 13053 (6.2)	VDI 3803-1 (6.1) DIN 1946-4 (6.2)
02	Max. air velocities in weather-protection device Outdoor air: – 2.5 m/s with louvres – 3.5 m/s with droplet eliminator – 4.5 m/s with rain hood Exhaust air: – 4.0 m/s with louvres – 5.0 m/s with droplet eliminator – 6.0 m/s with rain hood	EN 13053 (6.2)	VDI 6022 (6.3.4)
03	Exhaust air opening discharge: preferably above roof and higher than the outdoor air intake opening.	RLT 01	VDI 6022 (6.3.4) DIN 1946-4 (6.2)
04	Outdoor air intake opening (pointers for system design): – Should be positioned to ensure that negative effects from local sources of emissions are kept small – Not in the proximity and the main wind direction of wet cooling towers – Where air intake is above the roof keep max. possible distance to the roof surface min. 1.5 times the expected snow cover (≥ 0.3 m) – Distance to exhaust air discharge opening min. 2 m – Distance to adjacent buildings min. 8 m	VDI 6022 (6.3.1)	DIN 1946-4 (6.2)
05	Surfaces outside and inside min. hot-dip galvanized steel sheeting and Coated.	RLT 01	

Table 6: Additional requirements for units with extended hygiene requirements

No.	Requirements	Standard	Supp. standard
01	Elastic connection of unit with material with closed cell structure without grooves and indentations (no flexible connector with folds).	DIN 1946-4 (6.5.1)	
02	Outdoor intake opening min. 3 m above ground level.	DIN 1946-4 (6.2)	
03	Surface quality: – outside min. hot-dip galvanized steel sheeting – inside min. hot-dip galvanized steel sheeting and coated.	RLT 01	

[1)] The text and diagram regarding the angles are contradictory in EN 13053. VDI 3803/1 has adopted the version of the diagram from EN 13053. RLT-01 relates to the text of EN 13053 which in our opinion is correct.

5.3 Dampers and mixing sections

Table 7: General requirements

No.	Requirements	Standard	Supp. standard
01	Air leakage class 2 for dampers that are closed while the system is in operation, e. g. mixing dampers or bypass dampers.	EN 13053 (6.6.2)	EN 1751 (C.2) VDI 3803-1 (6.2.9)
02	Dampers must be provided to prevent air flowing through the unit when it is not in operation or being serviced.	VDI 6022 (6.2.2)	DIN 1946-4 (6.4.1)
03	Outdoor air damper to be fitted on the inside or in double-skin construction with insulation in the gap.	VDI 3803-1 (6.2.9)	DIN 1946-4 (6.5.6)
04	Air velocity for dampers max. 5 m/s (except recirculation air and bypass dampers).	EN 13053 (6.6.1)	VDI 3803-1 (6.2.9)
05	– Recommended inflow angle to damper min. α = 25° – Recommended outflow angle from damper min. β = 35° [1)]	EN 13053 (6.6.1)	VDI 3803-1 (6.2.9)
06	Possibility for the installation of a damper actuator (providing space or locating axis further out).	VDI 3803-1 (6.2.9)	
07	Surface finish hot-dip galvanized steel sheeting.	RLT 01	
08	Units with a mixing chamber where temperature layering can be expected are recommended to have the heating element downstream from the fan.	VDI 3803-1 (6.2.4)	
09	The position of the damper must be visible from the outside of the damper.	VDI 3803-1 (6.2.9)	DIN 1946-4 (6.4.1)

Table 8: Additional requirements for weatherproof units

No.	Requirements	Standard	Supp. standard
01	All dampers to be installed on the inside.	VDI 3803-1 (6.2.9)	DIN 1946-4 (6.5.6)
02	Surface finish outdoor air damper hot-dip galvanized and coated (section 3).	RLT 01	

Table 9: Additional requirements for units with extended hygiene requirements

No.	Requirements	Standard	Supp. standard
01	Air leakage class to the room: class 4 (’airtight’ damper) all other dampers at least leakage class 2 Exception for special requirements – all class 4.	EN 13053 (6.6.2)	EN 1751 (C.2) DIN 1946-4 (6.5.6)
02	Surface finish hot-dip galvanized and coated.	RLT 01	
03	No gearwheels are permitted in the air flow.	DIN 1946-4 (6.4.1)	
04	Dampers on all air intake and outlet openings; Outdoor air dampers to be arranged at the unit inlet.	DIN 1946-4 (6.5.6)	
05	Surface finish of outdoor air dampers in stainless steel or aluminium.	DIN 1946-4 (6.4.2)	
06	In the event of a power cut, the outdoor air dampers have to close automatically.	DIN 1946-4 (6.4.2)	

[1)] The text and diagram regarding the angles are contradictory in EN 13053. VDI 3803/1 has adopted the version of the diagram from EN 13053. RLT 01 relates to the text of EN 13053 which in our opinion is correct.

5.4 Filter section

Table 10: General requirements

No.	Requirements	Standard	Supp. standard
Indicator values			
01	Only air filters tested in accordance with EN ISO 16890 or EN 1822 are permitted. These have to be marked individually and visibly.	VDI 6022 (6.3.9)	DIN 1946-4 (6.5.7) EN 13053 (6.9)
02	The following filter classes must be used at a minimum: – at the supply air inlet and extract air intake min. ISO $ePM_{10} \geq 50$ %, but better ISO $ePM_1 \geq 50$ % (additional coarse filters are permitted) – recommended is class ISO $ePM_{2,5} \geq 50\%$ in the extract air before the heat recovery unit – Second filter stage ISO $ePM_1 \geq 50$ %, but better ISO ePM1 ≥ 80 % – In case of single-stage supply air filtering min. ISO ePM1 ≥ 50 % Moreover, minimum filter classes depend on outdoor air quality (ODA) and the requirements for room air (IDA). The choice of air quality class should be specified to the equipment manufacturer.	EN 13053 (6.9.2)	VDI 6022 (6.3.9) VDI 3803-1 (6.2.2) DIN 1946-4 (6.5.7) EN ISO 16890
03	After active carbon filter, a filter stage min. ISO $ePM_1 \geq 70$ % has to be arranged. For outside air category ODA 3, active carbon filters shall be used.	RLT 01	VDI 3803-1 (6.2.2) EN ISO 16890
04	Filter area for bag-type filters: – min. 10 m^2 per 1 m^2 filter intake area (based on 610 × 610 mm).	EN 13053 (6.9.2)	VDI 3803-1 (6.2.2) DIN 1946-4 (6.5.7)
05	The design pressure loss is given by: $\frac{\Delta p_{Start} + \Delta p_{End}}{2}$ In the absence of any other stipulations a volume flow change of ± 10 % due to filter soiling is acceptable.	EN 13053 (6.9.2)	VDI 3803-1 (6.2.2)
06	Max. permitted maximum final pressure loss: ISO ePM1, ISO ePM2.5, ISO ePM10: The lesser value, either from adding 100 Pa to the pressure difference with an unpolluted filter or three times the pressure difference with unpolluted filters. ISO coarse dust: The lesser value, either from adding 50 Pa to the pressure difference with an unpolluted filter or three times the pressure difference with unpolluted filters	EN 13053 (6.9.2)	VDI 3803-1 (6.2.2) EN ISO 16890
07	Filters should maintain the filter class throughout their service life.	VDI 6022 (6.3.9)	DIN 1946-4 (6.5.7)
Arrangement in the air handling unit			
08	Filter changes should be from dusty air side or by pulling the filter out.	VDI 6022 (6.3.9)	
09	The first filter stage should be arranged at the intake side. The second supply air filter stage should be placed at the output side. A filter stage should also be placed downstream of a belt drive (except flat belts without lateral restraint). The air extraction of kitchens should have a grease filter as the first filter stage.	EN 13053 (6.9.2)	DIN 1946-4 (6.5.7) VDI 3803-1 (6.2.2) VDI 6022 (6.3.9)
10	The following filter steps must be used at a minimum: – behind the recirculation air damper if present — ISO $ePM_{10} \geq 50$ % – for mixed air operation — ISO $ePM_1 \geq 50$ % – for extract air with particle loading (ETA 3) — ISO $ePM_{10} \geq 50$ % – with evaporation cooling — ISO $ePM_1 \geq 50$ % – with danger of nutrient input — ISO $ePM_1 \geq 50$ %	RLT 01	VDI 6022 (6.3.9) VDI 3803-1 (6.2.2) DIN 1946-4 (6.5.7) EN ISO 16890
11	Access via a door that is larger than the outside dimensions of the filter element to be changed. For changeable filters there should be enough space in front of the filter to perform the change. Filters should be visible and accessible for inspection at any time.	EN 13053 (6.9.1)	VDI 6022 (6.3.9) DIN 1946-4 (6.5.7) VDI 3803-1 (6.2.2)
12	In case the following air conditions prevail for a long time, the filters should be protected (e. g. pre-heating by 3 K): – relative humidity > 80 % at air temperature > 0 °C – relative humidity > 90 %	VDI 6022 (6.1.1)	EN 13053 (6.9) VDI 3803-1 (6.2.2) DIN 1946-4 (6.5.7)
13	Additional air disinfection components have to be placed on the positive pressure side downstream of the last filter stage (min. ISO ePM1 ≥ 50 %).	VDI 3803-1 (6.2.2)	EN ISO 16890

Continuation of table 10: General requirements

No.	Requirements	Standard	Supp. standard
Further requirements			
14	Sealing rubbers must be of a closed-cell structure (incl. proof). Filter materials must not be a nutrient for micro-organisms.	EN 13053 (6.9.2)	VDI 3803-1 (6.2.2) VDI 6022 (6.3.9)
15	Surface finish of filter support frame: hot-dip galvanized steel sheeting.	RLT 01	
16	In the floor area, only filter units with standing pockets are permitted.	VDI 6022 (6.3.9)	
17	A permanent tight fit must be guaranteed for the seal. If springs and clamps act opposite the direction of the air flow, an additional device is required for maintaining the system leak proof on a permanent basis.	EN 13053 (6.9.2)	VDI 3803-1 (6.2.2) VDI 6022 (6.3.9) DIN 1946-4 (6.5.7)
18	Independently of filter resistance, the following max. service periods are recommended: – First filter stage: 1 year – Additional filter stage resp. exhaust air filter: 2 years	VDI 6022 (7.6.8)	DIN 1946-4 (6.5.7)
19	Inspection window (diameter min. 150 mm) incl. illumination from a clear internal unit height of 1.6 m.	VDI 3803-1 (6.2.2)	EN 13053 (6.9) VDI 6022 (6.3.9) DIN 1946-4 (6.5.13)
20	Filter pressure drop monitored and displayed on site with pressure tapping point.	EN 13053 (6.9.2)	VDI 3803-1 (6.2.2) VDI 6022 (6.3.9)
21	For germ killing by UV-rays, values of 7 to 70 Ws/m² are required. Pay attention to an even arrangement of the UV-beamers in the chamber.	VDI 3803-1 (6.2.2)	
22	For filters made of combustible materials, downstream grid (mesh size max. 20 × 20 mm in system) or behind a suitable component preventing combustible particles from being entrained into the air inlet duct.	EN 1886 (10.6)	

Table 11: Additional requirements for weatherproof units

No.	Requirements	Standard	Supp. standard
01	Surface finish outdoor air filter frame hot-dip galvanized steel sheeting with coating.	VDI 3803-1 (6.2.2)	

Table 12: Additional requirements for units with extended hygiene requirements

No.	Requirements	Standard	Supp. standard
01	Surface finish of filter frame hot-dip galvanized steel sheeting with coating (section 3).	RLT 01	
02	Inspection window (diameter min. 150 mm) incl. illumination with smooth surface from a clear device height of 1.6 m.	RLT 01	EN 13053 (7.4)
03	Only reversible sealing devices (fitted by push-fit, clamping) or foaming are permitted on filter frames. Glued sealing gaskets are only permitted on the filter.	DIN 1946-4 (6.5.1)	
04	Filter exchange only admissible on dust-air side [not extensible for room class Ia and Ib]. The respective space requirement (min. 1 filter pocket length) has to be provided in front of the filter unit.	DIN 1946-4 (6.5.7.1)	
05	If filters have an anti-bacterial coating, proof of effectiveness and toxic safety is required.	DIN 1946-4 (6.5.7.3)	
06	Arrangement of the third, normally final filter stage in the unit is only possible with expert report. Material of suspended particle filter hydrophobic.	DIN 1946-4 (6.5.7.4)	
07	The following filter classes must be used at a minimum: – For room class Ia and Ib 3-stage filtration min. ISO $ePM_1 \geq 50\%$ / $ePM_1 \geq 80\%$ / H13 – For room class II 2-stage filtration: min. ISO $ePM_1 \geq 50\%$ / $ePM_1 \geq 80\%$ – In exhaust air systems with particle contamination: At least ISO $ePM_1 \geq 50\%$ in the exhaust air area	DIN 1946-4 (5.7.4)	EN 1822-1 EN ISO 16890
08	The following filter classes must be used at a minimum: – Infection room: H13 in outlet air – Isolation room: final min. $ePM_1 \geq 80\%$ if necessary H13 in inlet air	DIN 1946-4 (Tab. 1)	EN ISO 16890
09	In recirculation units the first filter stage can be omitted when there is no humidification at the cooling unit.	DIN 1946-4 (Tab. 1)	
10	Filter pressure drop meter without barrier fluid.	DIN 1946-4 (Tab. 1)	

5.5 Heat recovery section

Table 13: General requirements

No.	Requirements	Standard	Supp. standard
01	Combined units with supply air and extract air must be fitted with heat recovery. Exceptions: very high exhaust air, inefficiency and lack of space, unless no heat recovery falls under the scope of EU Guideline 1253/2014.	EN 13053 (6.5.1)	VDI 3803-1 (5.3.1)
02	A system selection acc. to following exhaust air qualities is recommended. The choice of ETA class should be specified to the equipment manufacturer: – ETA 1: Leakages to be calculated into nominal volume flow – ETA 2: on air inlet side of heat recovery, overpressure is required – ETA 3: complete air inlet side with overpressure to exhaust air for humidity transfer max. 5 % leakage – ETA 4: dirt transfer is completely avoided. Systems with an intermediate medium shall be used Heat recovery systems in which it is not possible to prevent the mixing of extract air with outdoor air should only be used where recirculation air would be permissible.	RLT 01	VDI 3803-1 (6.2.6) VDI 6022 (6.3.15)
03	Condensate tray in stainless steel or aluminium; drainage in accordance with section 3. In rotary heat exchangers the trays are only mandatory where condensate occurs.	EN 13053 (6.5.2)	VDI 3803-1 (6.2.6)
04	Surface finish of rotary and plate heat exchangers: – Frame in hot-dip galvanized steel sheeting – Lamella/plates: coated or aluminium or made of plastic non-metabolsable by micro-organisms	RLT 01	
05	Non-return valve and self-filling if with siphon.	RLT 01	
06	The requirements for heat pipe and heat transfer system are similar to those for heat exchangers.	RLT 01	
07	It is recommended to equip heat recovery systems additionally with an extract air humidification system, in order to reduce the need for mechanical cooling.	EN 13053 (6.5.1)	VDI 3803-1 (6.2.6)
08	Pressure tapping points on all 4 air flows.	EN 13053 (6.5.2)	
09	The heat exchanger should be sealed to the housing with gaskets.	EN 13053 (6.5.2)	
10	Where no air circulation is provided, the rotors should be equipped with a purge sector.	EN 13053 (6.5.2)	
11	Heat recovery systems with transfer of pollutants and/or odours from the extract air to the outdoor air are only permitted where air recirculation is permitted.	VDI 6022 (6.3.14)	VDI 3803-1 (6.2.6)
12	When rating preheater capacity, anti-icing protection and start-up operation have to be taken into account. After heater has to be rated without condensation.	VDI 3803-1 (6.2.6)	
13	For plate heat exchangers from a construction depth of 1.200 mm (based on 3 mm lamella spacing), special measures are required (for example divided). For larger lamellae-distances, the admissible construction depth can be chosen proportionally and linearly larger. The minimum lamella spacing for plate heat exchangers must be 2 mm.	VDI 3803-1 (6.2.6)	
14	To ensure the performance, the leakage (see Chapter 6) of the heat recovery unit must be taken into account during the preparation of the planning documents: – with a heat recovery unit the characteristics must be adjusted, e. g. the details of the degree of temperature variation must be based on the standard volume flows changed by the leakage figure – with fans the actual volume flows must be used to design the pressure loss and power requirements If data is not available, with rotational heat transmission and switch over reservoirs a leakage of 10 % needs to be assumed on each air side. This means that with a design of heat recovery unit and fans an increase with outside air and outlet air of 10% each must be considered. If the leakage of the heat recovery was not considered by the equipment manufacturer it must be mentioned. In this case it is assumed that the leakage was already considered in the planning.	VDI 3803-5 (5.4) RLT 01	

Continuation of table 13: General requirements

No.	Requirements	Standard	Supp. standard
15	The following values of heat recovery systems must be indicated: – Temperature transfer degree η_t in dry conditions – Pressure loss of heat recovery system including demister, damper, filter, etc. (sum of outside air and outlet air), caused by Heat Recovery – Electric power input P_{el} caused by pressure losses, including auxiliary powers for heat recovery system – Energy efficiency η_e (= efficiency of heat recovery system η_{WRG})	EN 13053 (6.5.2) VDI 3803-5	
16	Transfer of fire between exhaust air and inlet air must be excluded (e. g. fire-protection dampers, separated heat exchangers).	EN 1886 (10.7)	
17	Necessary intake and exhaust flow chambers shall be considered with minimum inflow angle from previous component to heat recovery system α = 35°and minimum outflow angle from heat recovery system to following component β = 25°.[1)]	RLT 01	
18	The rotary heat transmitter must be operated in counter flow. In systems with outside air usage only, it is recommended to arrange the fans to minimise the transmission of the inlet air and minimise leakage.	RLT 01	
19	In heat recovery systems in order to simplify power measurements on site or in the laboratory deviating from EN 308 the following conditions are possible: – Temperature difference AU-entry to FO-entry 20 K (AU not necessary +5 °C) – Conditions without condensation – With KVS systems the power measurement shall be done with the actual glycol percentage in water (0 % is also possible). If there are differences to the design concentration the power figures for the prevalent percentage of glycol shall be declared by the manufacturer	RLT 01	

Table 14: Additional requirements for units with extended hygiene requirements

No.	Requirements	Standard	Supp. standard
01	Surface finish of rotary and plate heat exchangers: frame made of hot-dip galvanized steel sheeting and coated (section 3) Lamella/plates coated or made of aluminium or made of microbial materials not replaceable with plastic.	RLT 01	
02	Installation rails in stainless steel or aluminium.	RLT 01	
03	Condensate tray on supply air and extract air side in stainless steel or aluminium, drainage outlet DN 40, drainage behaviour in accordance with section 3.	DIN 1946-4 (6.5.5)	
04	In rooms where no cross-room air recirculation is permitted only such systems are permitted that will not allow the transfer of particles from the extract air to the supply air.	DIN 1946-4 (6.5.9)	
05	Heat recovery systems should be placed on the outdoor air side downstream of the first filter stage. Extract air filter min. $ePM_{10} \geq 50$ %. When indirect evaporation cooling is used, filter class $ePM_1 \geq 50$ % is recommended.	RLT 01	EN ISO 16890

[1)] Position of the angle in accordance with the text relating to the dampers in EN 13053. The size of the angle differs in relation to the dampers as the inflow is decisive for the function in the case of the heat recovery system while the function of the subsequent components is decisive in the case of the dampers.

5.6 Air heating and cooling section

Table 15: General requirements

No.	Requirements	Standard	Supp. standard
Materials and surfaces			
01	Materials should be corrosion resistant, fins should be technically smooth (without punchings, burr-free and without inner splices in direction of air flow). The usage of corrugated lamellae is permitted.	EN 13053 (6.4.1)	VDI 3803-1 (6.2.3) DIN 1946-4 (6.5.8) VDI 6022 (6.3.15)
02	Installation rails for cooling coils in stainless steel or aluminium.	DIN 1946-4 (6.5.1)	
03	Heater surface for Cu/Al or Cu/Cu: – Fins: aluminium or copper – Frame: hot-dip galvanized – Pipework: copper – Collector: coated black steel or galvanised steel or copper	RLT 01	DIN 1946-4 (6.5.8)
04	Cooler with St/Zn hot-dip galvanized.	VDI 3803-1 (6.2.5)	
05	Cooling coils surface with Cu/Al or Cu/Cu: – Fins: aluminium or copper – Frame: stainless steel or corrosion-resistant aluminium (min. AlMg): with Cu/Al hot-dip galvanized and coated (section 3) is also possible if it does not have to be pulled out for cleaning – Pipework: copper – Collector: copper	EN 13053 (6.4.4) RLT 01	VDI 3803-1 (6.2.5) DIN 1946-4 (6.5.8)
06	Condensate tray in stainless steel or aluminium; drainage in accordance with section 3.	EN 13053 (6.4.4)	DIN 1946-4 (6.5.5) VDI 3803-1 (6.2.5) VDI 6022 (6.3.15)
07	Minimum fin spacing: – min. 2.0 mm for cooling coil without dehumidification – min. 2.5 mm for cooling coil with dehumidification – min. 4.0 mm for outdoor air heaters – min. 2.0 mm for other heat exchangers	EN 13053 (6.4.3)	VDI 3803-1 (6.2.3) VDI 6022 (4.3.15) DIN 1946-4 (6.5.8)
08	waterside pressure drop design conditions (not heat recovery): – Heating coil: max. 20 kPa – Cooling coil: max. 50 kPa	RLT 01	
09	Maximum ribbed construction depth for cleaning into the core: (referred to 2 mm lamellae distance. In case of larger lamellae distances, the admissible construction depth can be chosen proportionally and linearly larger): – 300 mm with offset pipes – 450 mm with pipes in line For requirements higher than these, the heat exchanger should be split.	EN 13053 (6.4.3)	VDI 3803-1 (6.2.3) DIN 1946-4 (6.5.8) VDI 6022 (6.3.15)
Further requirements			
10	Recommendation for cooling coil position: – Cooling coil with dehumidification on suction side (reheating effect of fan) – Cooling coil without dehumidification on discharge side (higher temperature difference)	VDI 3803-1 (6.2.5)	
11	Heat exchanger capable of being entered from both sides or up to a clear internal unit height of 1.6 m for pulling out, without having to remove other attachment parts.	EN 13053 (6.4.4)	VDI 3803-1 (6.2.5) VDI 6022 (6.3.15) DIN 1946-4 (6.5.8)
12	No water drops to carry over into downstream sections.	EN 13053 (6.4.4) DIN 1946-4 (6.5.8.3)	VDI 6022 (6.3.15)
13	Droplet eliminators should only be used where necessary. Cooling coils without droplet eliminators are to be preferred.	EN 13053 (6.4.4)	VDI 6022 (6.3.15) DIN 1946-4 (6.5.8) VDI 3803-1 (6.2.5)
14	Corrosion-proof droplet eliminators with pull-out function for cleaning, with access via door or access panel. Fins demountable for cleaning.	EN 13053 (6.4.4)	VDI 6022 (6.3.15) DIN 1946-4 (6.5.8) VDI 3803-1 (6.2.5)
15	Penetration of cooler connection pipe through wall to be insulated. The connection pipes of heat recovery heaters also have to be insulated.	EN 13053 (6.4.4)	VDI 3803-1 (6.2.5)
16	Non-return value and self-filling if with siphon. A direct connection to the wastewater network is not permitted.	VDI 6022 (6.3.15)	
17	Heat exchangers have to be sealed with gaskets to the unit casing in order to prevent bypass leakage.	EN 13053 (6.4.3)	

Continuation of table 15: General requirements (Further requirements)

No.	Requirements	Standard	Supp. standard
18	Cooling coils with dehumidification must not be located immediately upstream of filters or silencers. Heaters or fans have to be installed in between.	EN 13053 (6.4.4)	VDI 3803-1 (6.2.5) DIN 1946-4 (6.5.7)
19	For drop separators made of combustible materials, downstream grid (mesh size max. 20 × 20 mm in the system) or suitable connected component preventing combustible particles from being entrained into the air inlet duct.	EN 1886 (10.6)	
20	For heat exchanger inflow below, return flow above for better ventilation (exception: steam).	VDI 3803-1 (6.2.3)	
21	It must be easy to retrofit a droplet eliminator for dehumidification coolers. The space required for subsequent installation must be provided.	VDI 3803-1 (6.2.5)	
Electric air heaters			
22	Safety devices for electric heaters: – Safety temperature limiter with manual reset with type approval certificate switch off temperature 110 °C – Note on the unit pointing out that flow control is necessary – Note on the unit pointing out that fan overrun is necessary	VDI 3803-1 (5.4.5)	EN 1886
23	Distance to the next building component min. 300 mm for electric heater surface temperatures > 100°C.	RLT 01	
24	Air heater with surface temperature > 160 °C: – In air flow downstream temperature monitor – (automatic switch off > 110 °C) – Flow monitor (automatic switch-off in case of missing air flow)	EN 1886 (10.5)	

Table 16: Additional requirements for units with extended hygiene requirements

No.	Requirements	Standard	Supp. standard
01	Heater: Collector made of steel galvanized and coated or copper.	RLT 01	
02	Cooling coil surface with Cu/Al or Cu/Cu: – Frame: in stainless steel or corrosion-resistant aluminium or equivalent – Fins: coated or in corrosion-resistant aluminium or Cu – or: heat exchanger completely coated with epoxy resin provided it does not have to be pulled out for cleaning	RLT 01	DIN 1946-4 (6.5.8)
03	Drop eliminator frame in corrosion-resistant materials, e. g. stainless steel or aluminium.	RLT 01	
04	All condensate connections to be located on the same side.	DIN 1946-4 (6.5.8.1)	
05	Cleaning must be possible for all parts in the wet area.	DIN 1946-4 (6.5.8.2)	
06	Cooler and drop eliminator to be located upstream of the second filter stage.	DIN 1946-4 (6.5.8.2)	
07	Lamellae distance cooler min. 2.5 mm.	DIN 1946-4 (6.5.8.2)	
08	Cooler must be visible from both sides.	DIN 1946-4 (6.5.8.2)	

5.7 Sound attenuator section

Table 17: General requirements

No.	Requirements	Standard	Supp. standard
01	Minimum distance to components : – upstream: 1.0 × max. width of splitter (except filter) – downstream: 1.5 × max. width of splitter	EN 13053 (6.10)	VDI 3803-1 (6.2.8)
02	An increased pressure loss must be avoided. Pressure loss max. 50 Pa recommended.	VDI 3803-1 (6.2.8) RLT 01	
03	Surface quality material to be permanently abrasion-resistant and made of material that is durable when exposed to cleaning processes (e. g. glass fibre).	VDI 6022 (6.3.12)	DIN 1946-4 (6.5.12) EN 13053 (6.10) VDI 3803-1 (6.2.8)
04	Splitters to be demountable for cleaning without having to remove other parts.	EN 13053 (6.10)	VDI 3803-1 (6.2.8) VDI 6022 (6.3.12)
05	Attenuator should be located in the air handling unit, directly near the fan, and between the first and second filter stage. They must not be placed directly downstream from the dehumidification cooler or humidifier.	EN 13053 (6.10)	VDI 3803-1 (6.2.8) VDI 6022 (6.3.12) DIN 1946-4 (6.5.12)
06	It is recommended to use flow profiles (e. g. also rounded splitters).	EN 13053 (6.10)	VDI 3803-1 (6.5.2.8)
07	With an silencer in the system, measures must be taken (e. g. pre-heating by 3 K), if the following air conditions are maintained for a long time: – relative humidity > 80 % at air temperature > 0 °C – relative humidity > 90 %	VDI 6022 (6.1.1)	
08	Surface finish of splitter silencer baffles: frame, chamber sheets and flow profiles hot-dip galvanized.	RLT 01	
09	Insertion loss silencer at 63 Hz to 8 kHz to be determined.	VDI 3803-1 (5.7.2)	

Table 18: Additional requirements for units with extended hygiene requirements

No.	Requirements	Standard	Supp. standard
01	Installation rails in stainless steel or aluminium.	RLT 01	
02	Surface quality of silencer baffles: frames, chamber sheets and inflow profiles hot-dip galvanized and coated.	DIN 1946-4 (6.5.1)	

5.8 Humidifier section

Table 19: General requirements

No.	Requirements	Standard	Supp. standard
01	Humidifiers must not be placed directly upstream of filters or attenuator (exception: steam humidifiers).	EN 13053 (6.8.1)	VDI 3803-1 (6.2.2) VDI 6022 (6.3.7) DIN 1946-4 (6.5.7)
02	All components must be demountable. All parts in contact with water to be accessible for inspection and cleaning and consisting of corrosion-resistant and disinfectant-resistant material.	EN 13053 (6.8.3)	DIN 1946-4 (6.5.11) VDI 3803-1 (6.2.10) VDI 6022 (6.3.7)
03	Supply air units to have at least two filter stages (first stage min. $ePM_1 \geq 50$ %). (Exception: with steam humidifiers only one filter stage). The humidifier to be placed between the filter stages.	EN 13053 (6.8.1)	VDI 3803-1 (6.2.10) EN ISO 16890
04	Sealing compounds must not be of material that can be metabolised (incl. test certificate). Plastics are no breeding ground to micro-organisms.	VDI 3803-1 (6.2.10)	
05	Seal must not absorb moisture or provide a nutrient substrate for micro-organisms.	VDI 3803-1 (6.2.10)	
06	Finish of inner surfaces of components downstream of the humidifier to be hot-dip galvanized and coated.	VDI 3803-1 (6.2.10)	
07	Max. number of germs of the circulation water: – relating to the total colony number 1,000 cfu/ml. – relating to Legionella spp. 100 cfu/100 ml.	VDI 6022 (6.3.7)	EN 13053 (6.8)
08	Humidifier fitted with condensate tray with drain and siphon (with non-return valve).	VDI 6022 (6.3.7)	
09	The relative humidity downstream from the humidification section must not exceed 90 %. It must be ensured that drops of water could not reach the following components.	VDI 6022 (6.3.7)	DIN 1946-4 (6.5.11)
Nozzles / evaporation humidifiers			
10	The humidifier needs to be emptied and dried completely when the system is not in use (e. g. by overrunning the fan). When the unit is switched off, the humidifier must switch off automatically. All components in contact with water to have sufficient slope. It is recommended to use UV degermination.	EN 13053 (6.8.1)	VDI 3803-1 (6.2.10) VDI 6022 (6.3.7)
11	Sloped condensate tray; drainage in accordance with section 3.	EN 13053 (6.8.3)	VDI 3803-1 (6.2.10) VDI 6022 (6.3.7)
12	Droplet eliminator and flow straightener should be demountable for cleaning.	VDI 6022 (6.3.7) EN 1886 (10.6)	EN 13053 (6.8) DIN 1946-4 (6.5.8)
13	Inspection opening	EN 13053 (6.8.3)	
14	Inspection window (clear width min. 150 mm) with means of darkening including illumination. There must be no light coming in through the housing of the illumination. It must be possible to detect the operating status of the illumination from the outside.	EN 13053 (6.8.3)	VDI 3803-1 (6.2.10) VDI 6022 (6.3.5) VDI 6022 (6.3.7)
15	Pump to be protected against running dry.	EN 13053 (6.8.3)	
16	Deconcentration device.	EN 13053 (6.8.3)	VDI 3803-1 (6.2.10) VDI 6022 (6.3.7)
17	Inside surface quality: – Washer and high-pressure evaporator: stainless steel or aluminium or GRP – Contact humidifier: hot-dip galvanized steel sheeting with coating (section 3)	EN 13053 (6.8.3)	VDI 3803-1 (6.2.10) VDI 6022 (6.3.7)
18	For contact humidifier and drop separator made of combustible materials, downstream grid (mesh size max. 20 × 20 mm in system) or suitable component installed downstream preventing burning particles from being entrained into the air inlet duct.	EN 1886 (16.6)	
Steam and ultrasonic humidifiers			
19	The length of the humidification section has to comply with manufacturer's instructions and/or droplet separators have to be installed. Homogenous distribution over the unit cross-section must be assured.	EN 13053 (6.8.3)	VDI 6022 (6.3.7)DIN 1946-4 (6.5.11)
20	Inspection window (clear width min. 150 mm) incl. illumination.	EN 13053 (6.8.3)	VDI 3803-1 (6.2.10) VDI 6022 (6.3.5) VDI 6022 (6.3.7)DIN 1946-4 (6.5.13)
21	Condensate tray in stainless steel or aluminium with slope; drainage in accordance with section 3.	EN 13053 (6.8.3)	VDI 3803-1 (6.2.10) VDI 6022 (6.3.7)
22	Inner surface quality hot-dip galvanized steel sheeting with coating.	EN 13053 (6.8.3)	VDI 3803-1 (6.2.10)

Table 20: Additional requirements for units with extended hygiene requirements

No.	Requirements	Standard	Supp. standard
01	Surface quality stainless steel.	DIN 1946-4 (6.5.11)	
02	In OR-section only steam humidifiers are permitted. To be placed before the second filter stage (class $ePM_1 \geq 80\ \%$).	DIN 1946-4 (6.5.11)	EN ISO 16890
03	Equipment with tray on air inlet and outlet side in stainless steel or aluminium, connecting pipe min. 40 mm with siphon. Drains with different pressure level with single siphon, drainage behaviour acc. to Chapter 3.	DIN 1946-4 (6.5.5)	
04	In case of breakdowns in the system, the formation of condensate in the supply system must be prevented.	DIN 1946-4 (6.5.11)	

5.9 Fan section

Table 21: General requirements

No.	Requirements	Standard	Supp. standard
Arrangement in the air handling unit			
01	Supply air fans should be so arranged that the suction side leakage is minimised.	EN 13053 (6.3.1)	VDI 3803-1 (6.2.1)
02	Where there are two stages of filtering, the supply air fan should be placed between the first and second filter stage.	EN 13053 (6.9.2)	VDI 3803-1 (6.2.2) DIN 1946-4 (6.5.10)
03	A filter stage should also be placed downstream of fans with belt drive (except flat belts without lateral restraint).	VDI 6022 (6.3.13)	
04	The fan should be so arranged inside the unit, that an even inflow and outflow is achieved.	EN 13053 (6.3.1)	VDI 3803-1 (6.2.1)
05	Distance on the negative pressure side: – from components or walls in axial direction min. 0.5 × impeller diameter – in radial flow configurations min. 1.5 × impeller diameter or flow intake device	RLT 01	
06	Distance on the positive pressure side: – from components: open impellers min. 1 × impeller diameter – from components: other fans outflow angle min. $\alpha = 45°$ – from walls: for open impeller the manufacturer's instructions should be complied with regarding distance on the positive pressure side	RLT 01	
Fan features and accessories			
07	In the case of belt drive, fan and motor incl. motor clamping device mounted on horizontal base frame.	RLT 01	
08	Where motor driven by belt, up to motor size 200, motor should be movable parallel to the axis (motor-pivot not permitted).	RLT 01	
09	Where operated by belt, clamping bushing system should be used.	RLT 01	
10	Inspection window (diameter min. 150 mm) incl. illumination from a clear internal unit height of 1.6 m.	VDI 3803-1 (6.2.1)	EN 13053 (6.3) EN 1886 (11) VDI 6022 (6.3.5)
11	Motor protection from 0.25 kW.	RLT 01	
12	Lockable maintenance switch near the fan.	EN 13053 (6.3.1)	EN 1886 (11) VDI 3803-1 (6.2)
13	Equipotential bonding.	RLT 01	
14	Equipment with air flow meter.	RLT 01	
15	Fans with housings to have condensate drainage and from size 400 additionally inspection opening.	VDI 6022 (6.3.13)	DIN 1946-4 (6.5.10)
16	Electric power consumption classes P1-P7 are to be determined with the correction factors described in the RLT-Guideline Certification.	RLT 01	RLT-Guideline Certification (7.3)
17	Fans with backward curved blades are preferred. Energy saving motors are recommended. It is recommended that free running impellers are used for total pressures < 1,500 Pa.	EN 13053 (6.3.1) VDI 3803-1 (6.2.1)	VDI 6022 (6.3.13)
18	It is recommended to use fans without belt drive (especially open impeller).	VDI 6022 (6.3.13)	DIN 1946-4 (6.5.10)

Continuation Table 21: General requirements

No.	Requirements	Standard	Supp. standard
19	For selecting the fan the dry cooler pressure drop is to be used unless there are other instructions.	EN 13053 (6.3.1) VDI 3803-1 (6.2.11)	
20	Fan heat (1 to 2 K) has to be taken into account for rating.	VDI 3803-1 (6.2.1)	
21	Surface quality: – Fan impeller generally protected against corrosion – Fan housing in hot-dip galvanized steel sheeting – Base frame of fan and motor in hot-dip galvanized steel sheeting – Installation rails in hot-dip galvanized steel sheeting	RLT 01	
22	Doors to components which present a risk must only be openable with tools. In addition, the door must have a warning sign on it which refers to the danger (e. g. fan).	EN 1886 (11)	
23	For the details of the operating values of fans it is recommended to follow the accuracy class 1 as per DIN 24166.	RLT 01	

Table 22: Additional requirements for units with extended hygiene requirements

No.	Requirements	Standard	Supp. standard
01	Surface quality: – Fan impeller generally protected against corrosion – Fan housing in hot-dip galvanized steel sheeting with coating – Base frame of fan and motor in hot-dip galvanized steel sheeting with coating – Installation rails in hot-dip galvanized steel sheeting with coating	DIN 1946-4 (6.5.10)	
02	Up to a casing height of 1.0 m and with spiral housing fans it should be possible to pull out the fan/motor unit. Gliding surfaces of the pull-out rails to be corrosion-resistant and abrasion-resistant, e. g. stainless steel.	RLT 01	
03	Inspection window (clear diameter min. 150 mm) incl. illumination with smooth surface from a clear internal unit height of 1.6 m.	RLT 01	EN 13053 (7.4)
04	There must be good access for service and maintenance.	DIN 1946-4 (6.5.10)	
05	Provision of air flow meter devices with display.	DIN 1946-4 (6.5.13)	

5.10 Additional equipment and documentation

Table 23: General requirements

No.	Requirements	Standard	Supp. standard
01	Sensitive components to be fitted with transport guards (e. g. fans on spring insulators) – appropriate notice to be attached to unit. Very sensitive parts of the unit, at the joints, to be protected against damage.	EN 13053 (8.1)	VDI 3803-1 (6.4)
02	Eybolts, timbers / pallets for forklift trucks or crane transport.	EN 13053 (8.1)	VDI 3803-1 (6.3)
03	Durable name plate with durable inscription and fixing, stating the following as a minimum: for filters: – Nominal air flow, number of filters, filter type, dimensions, filter class, medium type, initial pressure loss, final pressure drop for fans: – Type and year of manufacture – Nominal air flow – Total pressure increase – Nominal and maximum speed – Nominal motor power – Turning direction arrow on the housing – Durable inscription of components stating function	EN 13053 (6.9.2) EN 13053 (8.3)	VDI 3803-1 (6.4) VDI 6022 (6.3.9) DIN 1946-4 (6.5.10) DIN 1946-4 (6.1.4)
04	Units to be identified with energy efficiency class labels A+, A or B.	RLT 01	
05	Scale drawing of unit with all main dimensions and dimensions for duct connections.	EN 13053 (8.3)	VDI 3803-1 (6.4)
06	Spare parts list.	EN 13053 (8.3)	VDI 3803-1 (6.4)
07	Instructions for installation, commissioning and maintenance.	EN 13053 (8.3)	VDI 3803-1 (6.4)
08	Doors to components which present a risk must only be openable with tools. In addition, the door must have a warning sign on it which refers to the danger (e. g. fan).	EN 1886 (11)	VDI 3803-1 (6.4)
09	The unit and its components should be cleaned after manufacture. Transport of units in dry and clean conditions, protected from the weather. Units to be protected against dust and dampness when stored on building sites.	VDI 6022 (6.1.2) VDI 6022 (6.4)	DIN 1946-4 (6.1.3)
10	The values listed for the criteria in the RLT-Guideline Certification shall be given in the technical datasheet).	RLT 01	RLT-Richtlinie Zertifizierung (6)

Table 24: Instructions for installation, commissioning and maintenance

No.	Sections and requirements to be covered in the instructions.	Standard	Supp. standard
01	Table of contents.	VDI 3803-1 (6.4)	
02	Use in accordance with design purpose: Contents should also be described graphically, to ensure that the AHU and its components are used in accordance with their design purpose.	EN 13053 (5.4) VDI 3803-1 (6.4)	
03	Safety: – Risk potential presented by air handling unit (type, severity, source, consequences) – Warnings (use signal words and symbols) – Protective measures taken and their benefit	VDI 3803-1 (6.4)	
04	General information: – Area of application – Accessories – Taking unit out of service during maintenance/servicing	VDI 3803-1 (6.4)	
05	Storage, transport and installation: – Storing units and components – Building site transport of units and components – Fixing points for lifting devices (illustrated by drawing) – Transport guarding devices – Installation of units indoors and outdoors – Foundations – Impact sound isolation – Potential equalisation – Air connections – Water connections – Wastewater connections (condensate-, drain-, overflow pipes, siphon) – Media connections (hot water, cold water, refrigerant, steam) – Fuel connections (oil, gas) – Filters – Frost protection – Space requirement for operation and maintenance	VDI 3803-1 (6.4)	
06	Commissioning and maintenance/servicing – Maintenance (type and frequency) for each component in the form of a table – Inspections (type and frequency) for each component in the form of a table – Repair operations – Cleansing agents, disinfectants	VDI 3803-1 (6.4) EN 13053 (8.1)	VDI 6022 (6.5)
07	Decommissioning, dismantling, disposal.	VDI 3803-1 (6.4)	
08	Emergency: – Fighting fire – Emission of noxious substances in case of fire	VDI 3803-1 (6.4)	
09	Address of manufacturer.	VDI 3803-1 (6.4)	

6. Appendix

Table A1: Mechanical stability (EN 1886)

Casing class	max. relative deflection [mm/m]
D1	4
D2	10
D3	> 10

Table A2: Casing leakage under negative pressure (EN 1886)

Leakage class	Max. leakage rate at -400 Pa test pressure [l/(sm²)]	Filter class as per EN ISO 16890
L1	0,15	ISO ePM_1 > 80 %
L2	0,44	ISO ePM_1 ≥ 70 %
L3	1,32	Coarser filter

Table A3: Casing leakage under positive pressure (EN 1886)

Leakage class	Max. air leakage rate at + 700 Pa test pressure [l/(sm²)]
L1	0.22
L2	0.63
L3	1.90

Table A4: Thermal transmittance (EN 1886)

Casing class	Thermal transmittance [W/(m²K)]
T1	U ≤ 0,5
T2	0.5 < U ≤ 1.0
T3	1.0 < U ≤ 1.4
T4	1.4 < U ≤ 2.0
T5	no requirements

Table A5: Thermal bridging factor (EN 1886)

Casing class	Thermal bridging factor k_b [-]
TB 1	0.75 ≤ k_b < 1.00
TB 2	0.60 ≤ k_b < 0.75
TB 3	0.45 ≤ k_b < 0.60
TB 4	0.30 ≤ k_b < 0.45
TB 5	no requirements

Table A6: Dampers (EN 1751)

Leakage class	Max. leakage rate at test pressure 500 Pa [dm³/(sm²)]
4	4
3	20
2	100
1	500

Table A7: Classes of insulation material (EN 13501)

Class	Description
A1 A2-s1 d0	not combustible
A2 B C-s1 d0...C-s3 d2	no significant contribution to fire growth
D-s1 d0...D-s3 d2 E...E-d2	contribution to flashover
F	not class A1 to E (easy combustible)

s = smoke development (s1 to s3)
d = dripping behaviour (d0 bis d2)

Table A8: Classes of average air velocity levels inside the casing (EN 13053)

Class	air velocity in the unit, regard to the filter unit or ventilation unit, if no filter is present [m/s]
V1	≤ 1.6
V2	> 1.6 to 1.8
V3	> 1.8 to 2.0
V4	> 2.0 to 2.2
V5	> 2.2 to 2.5
V6	> 2.5 to 2.8
V7	> 2.8

Table A9: Classes of power consumption of drives (fans) (EN 13053)

Class	$P_{m\ max.}$ [kW]
P1	≤ $P_{m\ ref}$ × 0.85
P2	≤ $P_{m\ ref}$ × 0.90
P3	≤ $P_{m\ ref}$ × 0.95
P4	≤ $P_{m\ ref}$ × 1.00
P5	≤ $P_{m\ ref}$ × 1.06
P6	≤ $P_{m\ ref}$ × 1.12
P7	> $P_{m\ ref}$ × 1.12

The electrical power consumption depends on the respective air flow and the static pressure increase of the fan.
Pressure losses for fan guard and -baffle plates are not contained in the static pressure increase, but shall be considered as fan losses.

$$P_{m\,ref} = \left(\frac{\Delta p_{stat}}{450}\right)^{0,925} \times \left(q_v + 0{,}08\right)^{0,95}$$

$P_{m\,ref}$	[kW]	electrical power consumption
Δp_{stat}	[Pa]	static pressure increase of the fan
q_v	[m³/s]	air flow

Table A10: Classes of heat recovery (EN 13053)

Class	Energy efficiency $\eta_{e\ 1:1}$
H1	≥ 74
H2	≥ 70
H3	≥ 65
H4	≥ 60
H5	< 60

$$\eta_e = \eta_t \times \left(1 - \frac{1}{\varepsilon}\right)$$

η_e	[%]	Energy efficiency (= η_{WRG} efficiency of heat recovery system)
η_t	[%]	Temperature efficiency under dry condition
ε	[-]	Coefficient of performance

If the airflows are not balanced and no specific HRS values are available, the values may be calculated by the empiric formula:

$$\eta_{t1:1} = \eta_t \cdot \frac{\left(1 + \frac{m_2}{m_1}\right)}{2}$$

Table A11: Specific fan power per fan (EN 16798-3)

Class	specific fan power per fan [W/(m³/s)] (for any additional values see tab. A12)
SFP 0	< 300
SFP 1	≤ 500
SFP 2	≤ 750
SFP 3	≤ 1.250
SFP 4	≤ 2.000
SFP 5	≤ 3.000
SFP 6	≤ 4.500
SFP 7	> 4.500

Table A12: Additions on specific fan power (EN 16798-3)

Component	Added SFP-class [W/(m³/s)]
additional mechanical filter stage	+ 300
HEPA filter	+ 1.000
gas filter	+ 300
heat recovery class H2-H1	+ 300
very high-performance cooler	+ 300
Additions shall be considered if the component is fitted in the AHU (possibly also outside the AHU). No additions for sections kept empty.	

Table A13: Guiding values of electric power input classes (VDI 3803-1)

Air flow [m³/h]	AHU without thermod. air heating	AHU with air heating	AHU with other functions
2.000 to 4.000	SFP 5	SFP 5	SFP 5
to 25.000	SFP 4	SFP 4	SFP 4
to 50.000	SFP 3	SFP 4	SFP 4
above 50.000	SFP 3	SFP 3	SFP 3

Table A14: Examples for pressure drops for specific components in air handling systems

Component	Pressure losses [Pa]		
	low	normal	high
Ductwork supply	200	300	600
Ductwork extract	100	200	300
Heating coil	40	80	100
Cooling coil	100	140	200
Heat recovery unit H3	100	150	250
Heat recovery unit H2-H1	200	300	400
Humidifier	50	100	150
Air washer	100	200	300
Air filter (final pressure):			
ISO ePM10 ≥ 50 %	100	150	250
ISO ePM2,5 ≥ 50 %	100	150	250
ISO ePM1 ≥ 50 %	100	150	250
ISO ePM1 ≥ 70 %	150	250	400
HEPA filter	400	500	700
gas filter	100	150	250
Silencer	30	50	80
Terminal device	30	50	100
Air inlet and outlet	20	50	70

Table A15: Extract air classification (EN 16798-3)

Category	Description
ETA 1	Extract air with low pollution level
ETA 2	Extract air with moderate pollution level
ETA 3	Extract air with high pollution level
ETA 4	Extract air with very high pollution level

Table A16: Exhaust air classification (EN 16798-3)

Category	Description
EHA 1	Exhaust air with low pollution level
EHA 2	Exhaust air with moderate pollution level
EHA 3	Exhaust air with high pollution level
EHA 4	Exhaust air with very high pollution level

Table A17: Classification of outdoor air (EN 16798-3)

Outdoor air class	Description
ODA 1	Pure air which may be only temporarily dusty (e. g. pollen)
ODA 2	Outdoor air with high concentrations of particulate matter and/or gaseous pollutants
ODA 3	Outdoor air with very high concentrations of particulate matter and/or gaseous pollutants

Table A18: Classification of inlet air (EN 16798-3)

SUP 1	Supply air with very low concentration of dust or fine dust and/or gaseous impurities
SUP 2	Supply air with low concentration of dust or fine dust and/or gaseous impurities
SUP 3	Supply air with moderate concentration of dust or fine dust and/or gaseous impurities
SUP 4	Supply air with high concentration of dust or fine dust and/or gaseous impurities
SUP 5	Supply air with very high concentration of dust or fine dust and/or gaseous impurities

Table A19: Basic classification of indoor air quality

Indoor air class	Description	CO_2-concentration over ODA [ppm]
IDA 1	high indoor air quality	≤ 400
IDA 2	medium indoor air quality	400 to 600
IDA 3	moderate indoor air quality	600 to 1.000
IDA 4	low indoor air quality	> 1,000

Table A20: Definition of air types (EN 16798-3)

Abbr.	Description
ODA	Outdoor air
SUP	Supply air
IDA	Indoor air
TRA	Transferred air
ETA	Extract air
RCA	Recirculation air
EHA	Exhaust air
SEC	Secondary air
LEA	Leakage
INF	Infiltration
EXF	Exfiltration
MIA	Mixed air
SRO	Single room outdoor air
SRS	Single room supply air
SET	Single room extract air
SEH	Single room exhaust air

Table A21: Room classes in buildings and rooms of health care (DIN 1946-4)

Room class	Description
Ia	Operating rooms: protection area with low turbulence replacement flow (TAV)
Ib	Operating rooms: system with mixed or replacement flow
II	Other rooms: used for medical purposes

Table A22: Characteristic numbers of heat recovery systems (VDI 3803-5)

Performance characteristic numbers for the comparison of heat recovery systems with defined operating conditions.	
$\eta_t = \Phi_t$	Degree of temperature change (previously heat recovery efficiency)
Ψ	Degree of humidity change (previously moisture recovery figure)
ε	Performance number
η_e	Energy efficiency (=η_{WRG} efficiency of heat recovery system)
–	Degree of heat availability (unsuitable for AHU units)
–	Reference operating condition
Energy characteristic numbers balanced over a year, to express the efficiency and use of the heat recovery system.	
ε_a	Annual work number
N_a	Annual degree of cover
Φ_a	Annual degree of temperature variation
η_a	Annual degree of efficiency
The leakage numbers describe the increase of flow in comparison with the leak free system. The recirculation number describes the recirculation percentage in the outdoor air.	
L_1	Leakage number exhaust air flow
L_2	Leakage number outdoor air flow
U	Recirculation air number

Table A23: Translation table of filter classes between EN 779 and EN ISO 16890 (FGK StatusReport 44 und EVIA FAQ)

Bezeichnung DIN EN 779	Mindestqualität gemäß DIN EN ISO 16890
G1	ISO coarse < 30 %
G2	ISO coarse ≥ 30 %
G3	ISO coarse ≥ 45 %
G4	ISO coarse ≥ 60 %
M5	ISO ePM10 ≥ 50 %
M6	ISO ePM2,5 ≥ 50 %
F7	ISO ePM1 ≥ 50 %
F8	ISO ePM1 ≥ 70 %
F9	ISO ePM1 ≥ 80 %

Table A 24: Classification of the Outdoor air correction factor (EN 16798-3)

	OACF	
Class	ODA to EHA	ETA to SUP
1	1,03	0,97
2	1,05	0,95
3	1,07	0,93
4	1,10	0,90
5	Not classified	

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