

## Air Handling Units RM-/RL-Line



## AHU Casing Characteristics, Design Details For Outdoor Installation And Increased Hygiene Requirements

## Characteristics of the robatherm casing construction

robatherm's AHUs provide a product quality by far outperforming the minimum quality requirements in all versions. Both type series RM and RL are available in special design versions for outdoor installation and for increased hygiene requirements.

### Thermal transmittance

Thermal transmittance is a measure for an AHU's heat loss per square meter and kelvin. Thermal transmittance coefficients are determined for the overall casing construction.

Minimum requirements for the thermal insulation of AHU casings include:<sup>11</sup>

Class T5 according to DIN EN 1886 for AHUs without thermodynamic air conditioning,

Class T4 with up to 1.99 W/(m<sup>2</sup>K) for AHUs with air heating or further functions, and

Class T3 for weatherproof AHUs with air heating or further functions.

Using noncombustible mineral wool and market standard insulation thicknesses, Class T2 is the best thermal transmittance class achievable.

robatherm line	Thermal transmittance class	Thermal transmittance coefficient [W/(m <sup>2</sup> K)]	Value added compared to T4
RM	T2 <sup>12</sup>	1,0	+ 50 %
RL	T2 <sup>12</sup>	1,0	+ 50 %

### Hygiene

Units with increased hygiene requirements demand for at least T3.<sup>11</sup>

### Thermal bridging

One of the crucial criteria for assessing casing quality is the thermal bridging factor  $k_b$ . It allows to provide statements on the risk of condensation forming on the AHU.

At least Class TB3 (i.e. thermal bridging coefficient >0,45) is required for indoor units where the internal temperature in outdoor air intake chambers and downstream components is below -7 °C, or TB4 between -7 °C and +5°C.

Class TB3 is the minimum for cooling sections and downstream casing components at an internal air temperature below 7°C. Between 7°C and 13°C, Class TB4 is required.

Weatherproof units with air heating and further functions need to be TB3 as well.<sup>11</sup>

The theoretical maximum value is  $k_b=1.0$ . The thermal bridging class TB1, where  $k_b \geq 0.75$ , offers highest possible protection from condensation on the AHU's casing.

robatherm line	Thermal bridging class	Thermal bridging coefficient $k_b$ [-]	Value added compared to TB3
RM	TB1 <sup>12</sup>	0,77	+ 71 %
RL	TB1 <sup>12</sup>	0,76	+ 69 %

## Soundproofing

Sound emissions from AHUs to the outside must be limited. Permissible limits for outdoor units depend on the building area and its environment. Reflections from surrounding objects may cause violations of accepted limits. In such cases, excellent sound insulation is particularly important. The casing itself already provides a high sound dampening effect.

Particularly in the relevant low frequency range, the measure of sound reduction in casings of the RM and RL lines is up to 36 % above market average.<sup>13</sup>

Line Frequency [Hz]	Insertion loss ( $D_p$ ) in the respective octave band [dB]						
	125	250	500	1,000	2,000	4,000	8,000
RM	14,7	20,9	29,5	34,4	37,4	42,5	42,5
RL	11,9	19,0	28,6	32,7	33,3	39,9	44,1

## Airtightness

Loosing conditioned air through casing or duct leaks is energy lost.

Therefore, AHUs are required to meet at least casing leakage class L3(R) with a maximum 1.90 l/(sm<sup>2</sup>) at 700 Pa test pressure and 1.32 l/(sm<sup>2</sup>) at 400 Pa negative pressure.<sup>11</sup>

At present, Class L1(M) is the best achievable airtightness class.<sup>12</sup>

robatherm line	Class	Test pressure [Pa]	Air leakage [l/(sm <sup>2</sup> )]	Value added compared to L3
RM	L1(M) <sup>12</sup>	-400 / +700	0,04 / 0,05	+ 98 % / + 97 %
RL	L1(M) <sup>12</sup>	-400 / +700	0,07 / 0,11	+ 96 % / + 94 %

**Hygiene** Class L2(R) is stipulated for units subject to increased hygiene requirements.<sup>11</sup>

## Filter bypass leakage

The higher the filter class in use the more serious are any leaks at the filter mounting frame, as leaking unfiltered air will mix with filtered air.

DIN EN 1886 allows maximum leakages of 6 % of the nominal volume flow with G1 filters, and up to 0.5 % with F9 filters. F9 is the highest tightness class with the lowest filter bypass leakage.

robatherm line	Class	Test pressure [Pa]	Leakage rate [%]	Added value compared to 0,5%
RM	F9	-400 / +400	< 0,1 / < 0,1	+ 80 %
RL	F9	-400 / +400	< 0,1 / < 0,1	+ 80 %

**Hygiene** Filter bypass leakage class F9 ( $\leq 0.5$  % of nominal volume flow) is stipulated for units subject to increased hygiene requirements.<sup>11</sup>

## Casing strength

Pressure variations as e.g. in the case of closing fire dampers involve the risk of permanent deformations on the AHU. The deflection per meter of the casing's cover plates is the criterion for its strength. The minimum requirement is a mechanical stability of Class D2(M), with a maximum deflection of 10 mm/m.<sup>11</sup>

The measurement procedure to DIN EN 1886 yields the measured value, confirming that even a test pressure of  $\pm 2,500$  Pa does not entail any permanent deformation on the model box.

robatherm line	Class	Test pressure [Pa]	max. deflection [mm/m]	Added value compared to 10 mm/m
RM	D2(M) <sup>12</sup>	-1.000 / +1.000	0,1 / 6,6	+ 99 % / + 34 %
RL	D2(M) <sup>12</sup>	-1.000 / +1.000	0,3 / 8,2	+ 97 % / + 18 %

<sup>11</sup> The AHU Guideline 01 "General Requirements for Air Handling Units" of the German AHU Manufacturers' Association summarizes the state of the art, addressing the relevant standards and guidelines.

<sup>12</sup> The certified test body uses a standardized model casing – the "model box" – for each line for determining the casing characteristics according to DIN EN 1886.  
(M) stands for "model box".  
(R) stands for "real unit". Specification/measurement is based on in-house investigations using real AHUs.

<sup>13</sup> Averaged values of commercially available AHUs whose manufacturers are members of the German AHU Manufacturers' Association.

# Design of the robatherm AHU casing

Dismountable construction with thermal break between outer- and inner shell, two-shell panels insulated with mineral wool of reaction to fire class A1 (noncombustible).

Disinfectant-resistant materials and certified material resistance to disinfection using hydrogen peroxide vapor. Seals do not absorb moisture and are not metabolizable by microorganisms.

**Hygiene** These disinfectant-resistant materials and closed-cell seals are stipulated, among other things, where increased hygiene requirements are to be met. Further requirements see “Design details AHU casings subject to increased hygiene requirements”

## Outer shell

Made of hot dip galvanized sheet steel, standard version with additional powder coating ( $\geq 60 \mu\text{m}$ ). Color similar to RAL 7035 ("light gray")

Options      Outer/inner shells, casing bottom, and condensate trays

- with powder coating of outer shell in custom colors on request
- with powder coating inside in same color as outer shell
- with antimicrobial powder coating similar to RAL 9010 ("pure white")
- with double coating (AHUs for swimming pools) similar to RAL 5005 ("Signal blue")
- made of stainless steel 1.4301 or stainless steel 1.4571

## Inner shell

Made of hot dip galvanized sheet steel.

Options      - Coatings or stainless steel versions see outer shell

- RL Line: third shell with additional 30mm insulation

## Modular design

Bolted connections allow disassembly of the casing, easing site-installation. Lifting eyes provided on casing top.

## Inspection doors

Inspection doors come with thermal bridging class TB1. Circumferential hollow profile gasket seals are multi hollow profile type. The gasket seals are fixed to the door in a form locking manner and completely removable. The seal's corners are miter milled and properly welded in order to avoid any pads and to achieve constant contact pressure and the best possible air-tightness.

Options are windows made from Acryl or isolation glass in TB1 quality – see “technical data”

Options      - Acrylic sight glass (as per DIN EN 13053)

- Isolating sight glass, thermal bridging class TB1 (as per VDI 3803-1)

## Casing bottom

No inaccessible corners or recesses, very easy to be cleaned and maintained. Casing bottom galvanized.

Options      - Additional coatings or stainless steel versions see Outer shell

- RL Line: grating flush with frame construction
- RL Line: third shell, in line with frame for increased hygiene requirements
- RL Line: third shell with additional 30mm insulation

### **Bottom trays**

It is possible to provide unit floor with integrated drain pans. In the standard version, the drain pans are laser welded and made from stainless steel 1.4301. The pans are sloped to all sides with a draining connection at its lowest point. The height is 80 mm (units type RL) and 120 mm (units type RM). For place of assembly and details to the type of stainless steel see “technical data”

The gas- and liquid tight pans are laser welded in an inert gas atmosphere. They come with a perfectly slender weld seam, its surface is both appealing and hygienically even and plain. As opposed to a conventionally welded drain pans, laser welded pans are distortion free due to extremely low thermal load and a fractional heat effected zone.

Options           - Execution made from stainless steel 1.4571 including drainage nipple

### **Base frame**

Base frame made of allround U-profiles under all sections of the casing modules, standard height 100 mm. Therefore, no more than two longitudinal girders must be provided by customer up to AHU depths of 2.5 m (or 3 girders up to 5 m).

Options           - U-profile base frame 200, 306 or 406 mm in height  
                      - RL-Line with thermal break frame – thermal bridging class TB1

### **Sectional dampers**

Sectional dampers can be fitted inside or to the AHU. The standard version is from galvanized sheet steel, having profiled blades and gearwheel drive. Installation location and design see Technical Data.

Options           - Sectional damper made of aluminum, coated aluminum, or stainless steel 1.4301  
                      - Tightness class to DIN EN 1751: Class 2, 3 or 4  
                      - Drive with external levers

## Design details

### AHU casings for outdoor installation

Packaged rooftop units are included in VOB Part C / DIN 18379 and shall be considered as part of the building services installation. They are manufactured following the rules of mechanical engineering and thus not to be seen as a part of the building. As stipulated in DIN EN 13053 and VDI 3803, the casing bottom must not replace the building's roof! robatherm AHU casings designed for outdoor installation have the following additional features:

#### **Weatherproofing**

With UV-resistant roofing foil, roof overhang, and weather groove, in light gray color.

Eaves flashing at base frame, made of hot dip galvanized sheet steel with additional powder coating in same color as outer shell.

#### **Outdoor air intake + exhaust air blow out**

- Options
- Protection hood or weather louver made of hot dip galvanized sheet steel with additional powder coating in same color as outer shell (as specified in DIN EN 13053)
  - Outdoor air intake chamber with bottom tray (design see Bottom trays) and inspection doors (as specified in DIN EN 13053)

#### **Inspection doors**

- Options
- All inspection doors from 459 mm width upwards come with a fixing device to prevent unintentional closing (as specified in VDI 3803-1)

#### **Sectional dampers**

- Options
- All sectional dampers installed inside (as specified in VDI 3803-1)
  - Outdoor air sectional dampers made of aluminum, tightness class 2 (as specified in AHU Guideline 01)
  - Sectional dampers made of aluminum, coated aluminum, or stainless steel 1.4301
  - Tightness class to DIN EN 1751: Class 3 or 4
  - Drive with external levers

## Design details

### AHU casings subject to increased hygiene requirements

A number of additional details must be taken into account since AHUs are subject to increased hygiene requirements. Most of these are covered by the standard version of robatherm AHUs – see above. Examples of design details for increased hygiene requirements, going beyond the robatherm standard, include:

#### Sectional dampers

- Options
- Sectional dampers on all air inlet and outlet openings (as specified in DIN 1946-4)
  - Driven with connecting levers i.e. gearwheels outside air stream (as specified in DIN 1946-4)
  - Tightness class to DIN EN 1751: Class 2, 3 or 4 (as specified in DIN EN 13053)
  - Room-side sectional dampers tightness class 4 (as specified in DIN EN 13053)
  - Sectional damper of aluminum, coated aluminum or stainless steel 1.4301 (as specified in DIN 1946-4)

#### Outer/inner shell

- Options
- Side walls and all components facing the air stream made of hot dip galvanized sheet steel with additional powder coating in same color as outer shell (as specified in DIN 1946-4)
  - With antimicrobial powder coating similar to RAL 9010 ("pure white")
  - Made of stainless steel 1.4301 or stainless steel 1.4571

#### Inspection doors

- Options
- All functional components accessible via inspection doors (as specified in DIN EN 13053)
  - Inspection doors for filters and fans with sight glass and illuminated chamber (as specified in DIN 1946-4)

#### Casing bottom

- Options
- Near-floor-level surfaces are made of stainless steel 1.4301 (as specified in DIN 1946-4)
  - Stainless steel 1.4571
  - RL Line: third shell, in line with frame

#### AHU connection

- Options
- Smooth, sound-insulated AHU connection of hot dip galvanized sheet steel with additional, allround powder coating in same color as the unit's outer shell. Designed as U-profile frame with intermediate insulation profile (closed cell), including equipotential bonding (as specified in DIN 1946-4)
  - Sound-insulated AHU connection of stainless steel 1.4301

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