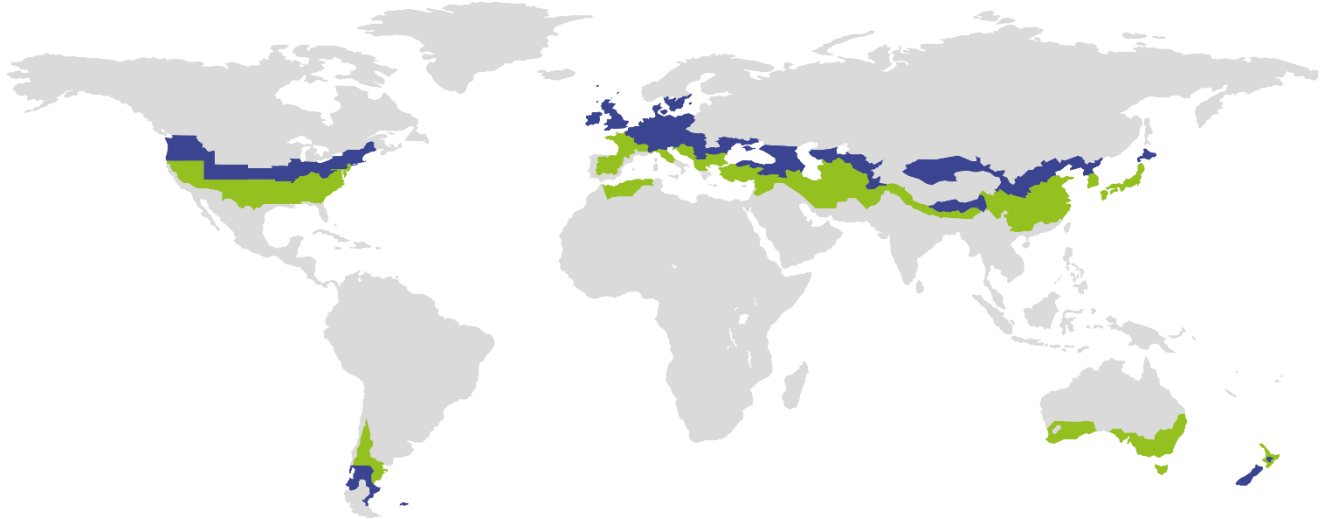


CERTIFICATE

Certified Passive House Component

Valid until 31st December 2020

Passive House Institute
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Category: **Air handling unit with heat recovery**
Manufacturer: **Menerga GmbH**
Germany
Product name: **Ventilation unit series**
Adconair 76 03 01 – 76 37 01
Specification: Airflow rate > 600 m³/h
Heat exchanger: Recuperative

This certificate was awarded based on the product meeting the following main criteria

Heat recovery rate	η_{HR}	\geq	75 %
Specific electric power	$P_{el,spec}$	\leq	0.45 Wh/m ³
Leakage		$<$	3 %
Performance number		\geq	10
Comfort			Supply air temperature \geq 16.5 °C at outdoor air temperature of -10 °C

Airflow range
1000-15000 m ³ /h at an external pressure of 265-390 Pa ¹⁾ Requirements non-residential buildings (Therefore also applic- able for residential buildings)
Heat recovery rate
$\eta_{HR} \geq 88 \%$
Specific electric power
$P_{el,spec} \leq 0.45 \text{ Wh/m}^3$
Performance number
> 10

¹⁾ The pressure drop of filters is covered in the listed external pressure. Additional components (e.g. heating coil) decrease the available external pressure accordingly.



Component ID	Unit model	Testing requirements	Airflow range		External pressure Pa	Actual available external pressure ¹⁾ Pa	Specific electric power Wh/m ³	Heat recovery rate %	Performance number -
			Min m ³ /h	Max m ³ /h					
0845vl03	760301	Non-residential	1000	2000	265	228	0.45	88	10
0846vl03	760501	Non-residential	1200	2800	286	250	0.44	89	10
0847vl03	760601	Non-residential	1000	3000	290	255	0.45	91	10
0502vl03	761001	Non-residential	1500	4500	316	281	0.42	93	11
0848vl03	761301	Non-residential	2000	6000	333	299	0.43	91	11
0849vl03	761601	Non-residential	3000	7000	343	312	0.43	91	11
0850vl03	761901	Non-residential	3200	8800	359	326	0.43	94	11
0851vl03	762501	Non-residential	6000	10000	365	337	0.44	94	11
0852vl03	762901	Non-residential	8500	11500	376	349	0.45	94	11
0853vl03	763701	Non-residential	8000	15000	390	363	0.45	94	11

Table 1: Certified values for each unit model. ¹⁾ Pressure drop of filters were taken into account.

Passive House comfort criterion

A supply air temperature of 16.5 °C is maintained at an outdoor air temperature of about -10.0 °C can only be maintained if an adequate frost protection system with pre or post heating coils is installed. The controller comes with corresponding algorithms.

Efficiency criterion (heat recovery rate)

The effective heat recovery rate is measured at a test facility using balanced mass flows of the outdoor and exhaust air. The boundary conditions for the measurement are documented in the testing procedure.

$$\eta_{HR} = \frac{(\theta_{ETA} - \theta_{EHA}) + \frac{P_{el}}{\dot{m} \cdot c_p}}{(\theta_{ETA} - \theta_{ODA})}$$

With

η_{HR}	Heat recovery rate in %
θ_{ETA}	Extract air temperature in °C
θ_{EHA}	Exhaust air temperature in °C
θ_{ODA}	Outdoor air temperature in °C
P_{el}	Electric power in W
\dot{m}	Mass flow in kg/h
c_p	Specific heat capacity in Wh/(kg.K)

- The heat recovery rates for each model of the unit are listed in Table 1.

Airflow range and external pressure difference

The operational range of the device results from the efficiency criterion (see below). As per the certification criteria for ventilation units > 600 m³/h the applicable pressure differences vary with the nominal range of operation (as declared by the producer) and the application (residential or non-residential building).

The external pressure difference includes all pressure losses of the ventilation system caused by components apart from the tested unit (consisting of casing, heat exchanger and fans). If filters are installed inside of the unit, their pressure losses are to be reduced accordingly. The average filter pressure drop of an operational filter is assumed to be 30% higher than that of the clean filter.

- The airflow ranges and available external pressures for each model of the unit are listed in Table 1.

Efficiency criterion (electric power)

The overall electrical power consumption of the device including controllers was measured at the test facility as per the requirements for non-residential buildings at an external pressure difference of 265-390 Pa.

- The specific electric powers for each model of the unit are listed in Table 1.

Performance number

Based on the measured values for the calculation of heat recovery efficiency and power consumption and on the climatic data of central Europe (Gt: 84 kWh, heating time: 5400 h/a), an average performance number at the airflow range was determined.

- The performance numbers for each model of the unit are listed in Table 1.

Leakage

The airtightness of the unit is tested for under pressure and over pressure before the thermodynamic test is conducted. As per the certification criteria the leakage airflows must not exceed 3 % of the average airflow of the device's operating range.

Internal leakage	External leakage
2.30 %	< 1 %

- These appliances meet the airtightness requirements.

Settings and airflow balance

It must be possible to adjust the balance of airflows at the unit itself (either between the exhaust and the outdoor airflows or between the supply and the extract airflows, if the unit is respectively placed inside or outside of the insulated thermal envelope of the building). Available operation modes are explained in detail in the operation manual.

- Balancing of the airflow rates of the unit is possible.
 - ✓ The airflow volumes can be held steady automatically (by measurement of pressure differences at the fan inlet nozzle).
- The standby power consumption of these devices makes 45 W. The target value of 1 W was exceeded. The device should be equipped with an additional external switch so that it can be disconnected from the mains, if required.
- After a power failure, the device will automatically resume operation.

Acoustical testing

A ventilation unit > 600 m³/h is assumed to be operated in an installation room, for which sound limits are defined in the applicable regulations. The total acoustic power levels were determined by producer for each model of the units at an upper limit of the airflow range.

Unit model	Testing requirements	Airflow range		Total acoustic power level				
		Min m ³ /h	Max m ³ /h	Casing dB(A)	Duct			
					ODA dB(A)	SUP dB(A)	ETA dB(A)	EHA dB(A)
760301	Non-residential	1000	2000	57	64	78	72	69
760501	Non-residential	1200	2800	55	62	78	72	66
760601	Non-residential	1000	3000	56	62	78	72	67
761001	Non-residential	1500	4500	61	69	82	77	72
761301	Non-residential	2000	6000	61	68	81	76	73
761601	Non-residential	3000	7000	57	70	85	80	73
761901	Non-residential	3200	8800	62	70	81	76	74
762501	Non-residential	6000	10000	63	70	84	79	75
762901	Non-residential	8500	11500	65	70	87	82	77
763701	Non-residential	8000	15000	65	71	86	81	78

Tabele 2: Acoustic power levels at an upper limit of the airflow range.

- For complying with the required sound level in the supply air and extract air rooms, dimensioning of a suitable silencer is required for the specific project on the basis of the measured sound level.

Indoor air quality

Instructions for changing of the air filters are documented in the operation manual. This device is equipped with following filter qualities:

Outdoor air filter	Extract air filter
F7	M5

If the device is not operated during summer, the filter should be replaced before the next operation. The producer of the device has to ensure that based on the latest findings, room air hygiene can be maintained by means of integrated or obligatory components.

For the operation of ventilation systems a strategy for avoiding permanent moisture penetration of the outdoor air filter needs to be considered. The strategies are mentioned in the full report and can be implemented through installation of either an additional component of the ventilation device or on the ventilation site system.

Frost protection

Appropriate measures should be taken to prevent the heat exchanger and optional downstream hydraulic heater coil from getting damaged by frost during extreme winter temperatures (-15 °C). It must be ensured that the unit's ventilation performance is not affected during frost protection cycles.

- Frost protection of the heat exchanger:
 - ✓ The device series Adconair 76 comes standard with an appropriate defrost function for the heat exchanger. If a temperature of $< 0\text{ °C}$ is measured in the exhaust air area of the heat exchanger and if the extract air temperature drops below the dew point, a periodic defrost interval is driven by partially opening the HR bypass damper. Higher heating requirements of the heater must possibly be considered when designing the heating supply in order to meet the comfort criterion.

Bypass of the heat recovery

The heat recovery system is equipped as standard with HR bypass dampers in both air streams. If both HR bypass dampers are fully open, no heat recovery takes place. Hence the device series is suitable for concepts with free cooling and free night cooling. The effectiveness of free cooling was not analysed within the scope of the tests.