

Facade Fan Coil Unit Type A/C System FVM For Facade Installation



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The Program for Room Air Technology

Components

Air diffusers for walls, floors and ceilings · LTG System clean[®] · linear diffusers Coandatrol[®] · ceiling air diffusers Coadavent[®] · displacement diffusers · LTG chilling fans cool wave[®] · induction units Klimavent[®] · fan coil units Raumluft · ceiling fan coil units Ventotel[®] · facade fan coil units · airflow control units · labair[®] system

Engineering services

Technical services for investors, architects, engineers and plant builders during design, construction and operation of buildings. Reliable and precise data relating to the ventilation of air conditioning system are given already before realization of the project, determined by measurements, calculations, building simulations and experiments.

Components for Process Air Technology

Japan

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The Program for Process Air Technology

Components

Axial-flow, centrifugal and tangential fans · Collector system for: coarse and fine particle filtration, separating and compacting, compressing and humidifying.

Engineering services

Technical services for construction engineers and plant designers during development and operation of assembly groups, machines and plants.

Facade Fan Coil Unit Type A/C System FVM for Decentralized Ventilation with Outside Air via the Facade and for Heating and Cooling

Application

Decentralized modular A/C system, flush mounted in a single-shell facade, for decentralized ventilation of occupied rooms via the facade using outside air, as well as for heating and cooling. All functions integrated in one ready-to-install unit.

Functions

- Ventilation (air diffusion + return)
- Outside air filtering F7
- Heating and cooling in the outside air and recirculating air mode
- Heat and humidity recovery

Functional Principle

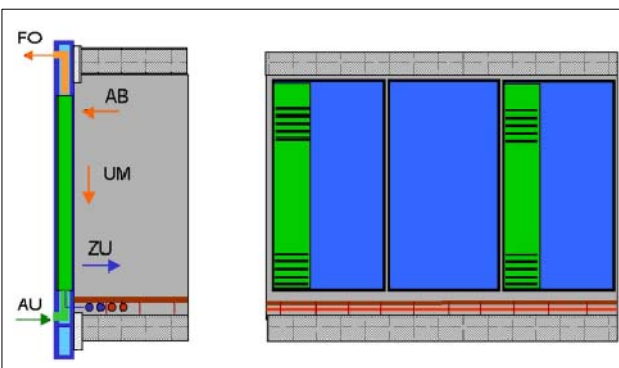
The A/C system type FVM serves for a decentralized ventilation of occupied rooms via the facade using outside air as well as for heating and cooling.

The **supply air fan** draws in outside air via a slot or opening in the facade element through the open **outside air damper** and the **outside air filter** (filter class F7).

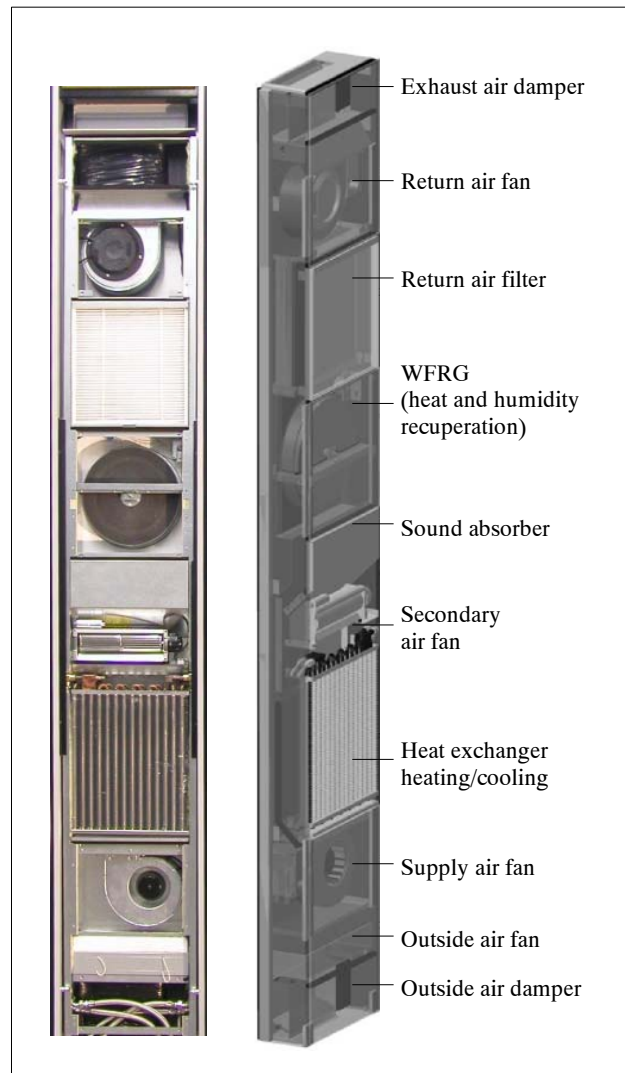
Then the air passes through a **heat and humidity recuperation unit** (where the air is preheated or chilled) and through a **sound absorber** to finally exit via an induction slot. Behind the induction slot, the **secondary air fan** adds room air and the air mixture then passes through the 4-pipe **heat exchanger** with separate water circuits. The heated or chilled air enters the room through the facade covering.

The **return air fan** draws in room air via the **return air filter** (F5). The air is conveyed via the **heat and humidity recuperation unit (WFRG)** to the fan. Behind the fan the heated/chilled air exits to the outside via the open **exhaust air damper** through the facade opening.

If the fan is off or in the case of a power failure the shut-off dampers are securely closed by a spring return actuator. The FVM then serves as a facade convective e.g. by night for static heating of the room.



Integration in the facade



A/C System Type FVM

Tolerances

- For the data given in this brochure General Tolerances according to DIN 2768-vL apply. For the outlet grille the special tolerances given in the drawing apply.
- Straightness and twist tolerances according to DIN EN 12020-2.

Surface Finish

- The surface finish was designed to meet requirements for the use in buildings - room air climate according to DIN 1946 Part 2. Other requirements on request.

You will find the actual **tender documentations** at the end of this document.

They are available in word format at your local dealership or at www.LTG-AG.de.

Facade Fan Coil Unit Type A/C System FVM

Advantages

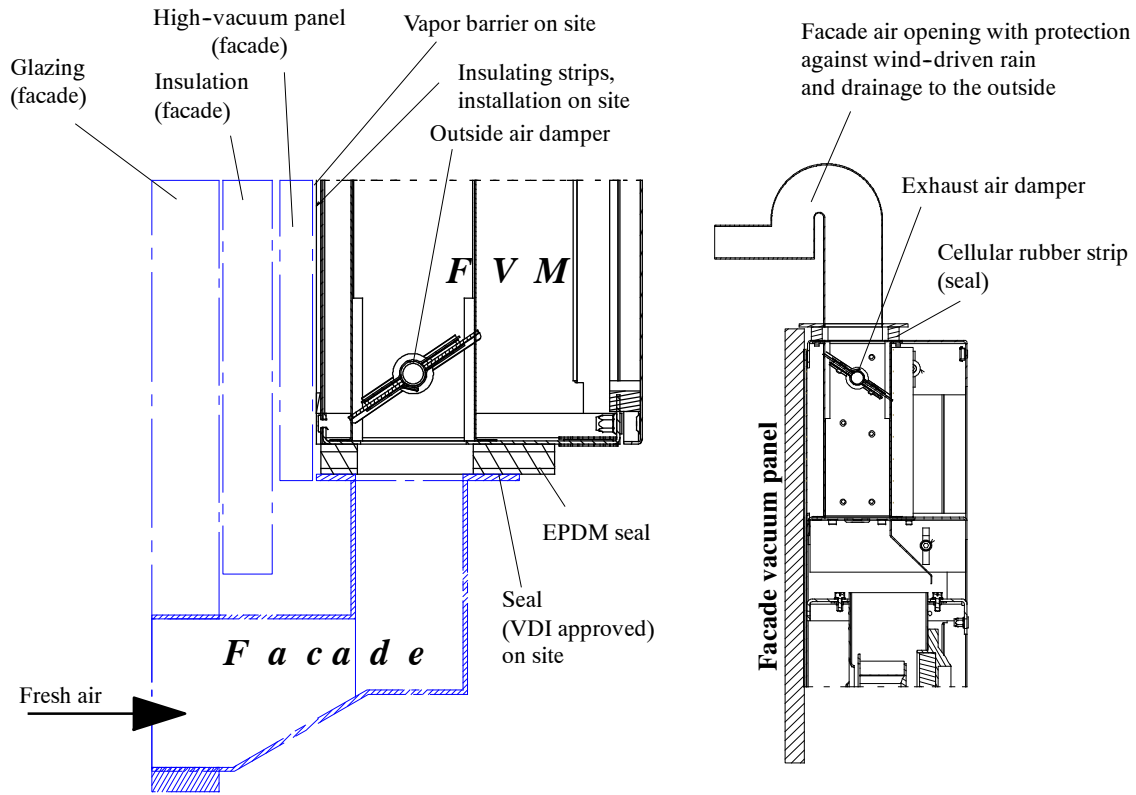
- Minimum space requirement even when installed in single-shell facades:
width: 450 mm, depth: 160 mm, height: 2680 mm.
- Maximum space efficiency due to savings in floor height, shaft surfaces, and technician rooms.
- Modular construction, extendable in steps from static heating to air conditioning, therefore
 - no unnecessary preparation costs
 - easy retrofitting
 - unlimited tenant/user flexibility
- High user acceptance due to individual operability.
- Complete, discrete integration in the facade
 - due to low unit depth and with
 - due to flush facade installation.
- Free design of the A/C unit's room side
- Complete freedom of interior room design since walls, floors, and ceiling remain free of A/C components
- Clearly defined interfaces.
- Sound and heat insulation properties of the facade remain unaffected.
- Mature MCR (Measuring-Control-Regulation) solution, from stand alone to LON compatible.
- Installation space required on site remains the same, no matter which extension stage
- Good indoor air quality and high thermal comfort due to mixed displacement air flow.
- Low energy consumption thanks to highly efficient actuators.
- Clearly simplified installation resulting in considerable time savings due to
 - exact fitting of the unit in the facade
 - complete preassembly and final testing at the manufacturer's
 - ready-to-plug-in connections for water, power and MCR.



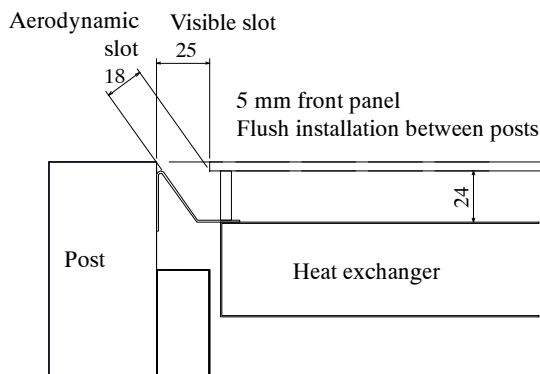
A/C system type FVM

Facade Fan Coil Unit Type A/C System FVM

Connection to the facade (example)



Internal face covering / appearance (examples)

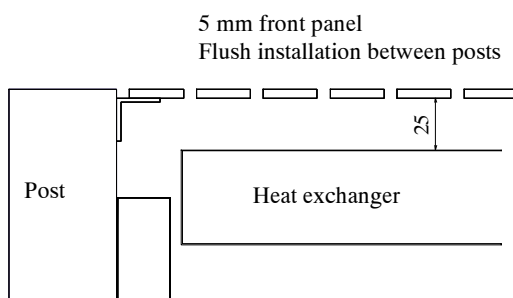


Picture 1

Closed covering with surrounding air gap

Dimensioning example:

Outside air flow rate	120 m ³ /h
Recirculating air flow rate	100 m ³ /h



Picture 2

Perforated covering without surrounding air gap

Dimensioning example:

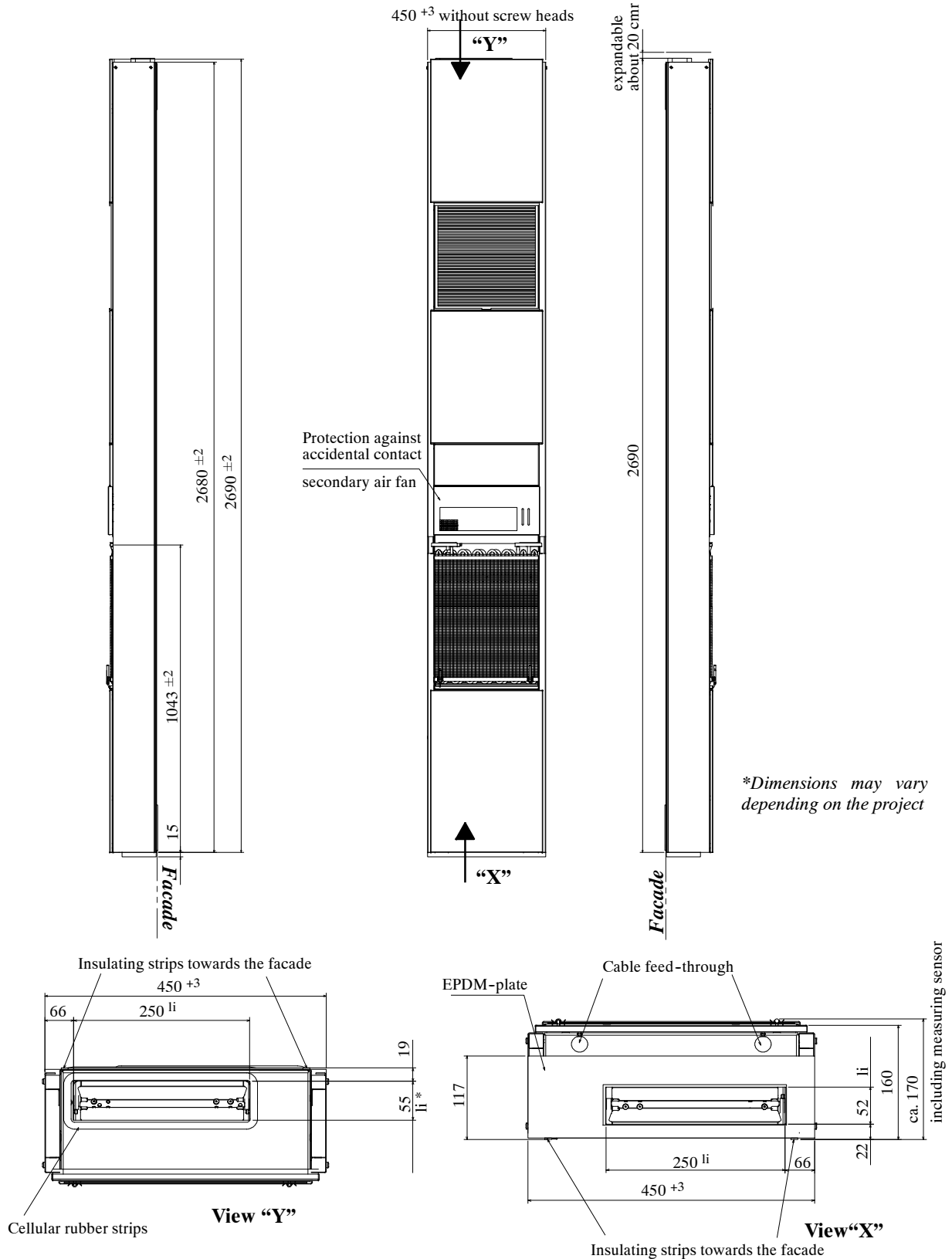
Outside air flow rate	120 m ³ /h
Recirculating air flow rate	100 m ³ /h

Required free opening surface A_F
in the covering at least 0.35 m²

- 50% in the lower unit area as the diffusion section
- 50% in the upper unit area as the suction section

Facade Fan Coil Unit Type A/C System FVM

Dimensions



Facade Fan Coil Unit Type A/C System FVM

Technical Specifications

Functions:

Outside air/return air mode, Recirculating air mode, Cooling and Heating, Heat and Humidity Recovery (WFRG)

Recirculating air only

n_A^1 [-]	n_s^2 [-]	V_A^3 [m ³ /h]	V_U^4 [m ³ /h]	L_{A18} [dB(A)]	L_{wA} [dB(A)]	$Q_{k \text{ Unit}}^5$ [W]	$Q_{k \text{ Room}}^5$ [W]	$Q_{h \text{ Unit}}^6$ [W]	$Q_{h \text{ Room}}^6$ [W]	WRG-coeff [-]	P_{el} [W]
O	I	-	75	26	32	200	200	850	850	-	14
O	II	-	100	30	36	250	250	1100	1100	-	17

Outside air only

n_A^1 [-]	n_s^2 [-]	V_A^3 [m ³ /h]	V_U^4 [m ³ /h]	L_{A18} [dB(A)]	L_{wA} [dB(A)]	$Q_{k \text{ Unit}}^5$ [W]	$Q_{k \text{ Room}}^5$ [W/K]	$Q_{h \text{ Unit}}^6$ [W]	$Q_{h \text{ Room}}^6$ [W]	WRG-coeff [-]	P_{el} [W]
I	O	60	20	31	37	235	180	1355	1010	0.62	14
II	O	90	25	32	38	290	205	1670	1160	0.58	18
III	O	120	30	35	41	375	280	1940	1245	0.54	27

Outside air and recirculating air

n_A^1 [-]	n_s^2 [-]	V_A^3 [m ³ /h]	V_U^4 [m ³ /h]	L_{A18} [dB(A)]	L_{wA} [dB(A)]	$Q_{k \text{ Unit}}^5$ [W]	$Q_{k \text{ Room}}^5$ [W]	$Q_{h \text{ Unit}}^6$ [W]	$Q_{h \text{ Room}}^6$ [W]	WRG-coeff [-]	P_{el} [W]
I	I	60	80	32	38	330	275	1690	1345	0.62	23
I	II	60	100	34	40	350	295	1840	1500	0.62	23
II	I	90	90	33	39	370	290	1930	1415	0.58	27
II	II	90	105	35	41	400	320	2040	1530	0.58	28
III	I	120	110	35	41	430	335	2145	1450	0.54	37
III	II	120	130	37	43	465	370	2220	1525	0.54	37

$w_{ok}/\Delta p_w$ [kg/h]/[kPa] = 120/10

$w_{oh}/\Delta p_w$ [kg/h]/[kPa] = 100/3

Supply voltage 230 V AC

Power consumption ca. 100 VA

Weight abt. 75 kg

Depending on the type of unit casing the performance loss may be e.g. 10%

¹ Fresh air

² Secondary air

³ Outside air flow rate

⁴ Secondary air flow rate by induction + secondary air flow rate from recirculating air fan (- 10%)

⁵ Water supply temperature: 17 °C, intake air temperature: 32 °C, non-condensing operation, room air temperature: 26 °C; 27 °C return air temperature

⁶ Water supply temperature: 75 °C, intake air temperature: -12 °C, room air temperature: 22 °C (intake air temperature may differ from average room temperature)

Note: The A/C unit's caloric performance data have been determined with the following marginal conditions. The overall cooling/heating capacity can be calculated from the water-side temperature difference when entering the unit. If these performance data are corrected by the outside air heating/cooling data to room temperature, this will result in the room cooling capacity. Heat conducting effects inside the unit have been considered. Heat losses through the on-site facade insulation on the unit's backside may be neglected. Heat capacity losses into facade posts may be in favor of the room if thermal insulation is good.

n_A - fresh air fan speed
 n_s - recirculating air fan speed
 V_A, V_S - flow rate ($\pm 10\%$)
 L_{A18} - sound pressure level with 18 m² Sabine room absorption
 L_{wA} - sound power level (± 3 dB) (without covering and air diffusers)
 $Q_{k \text{ Unit}}$ - cooling capacity unit
 $Q_{h \text{ Unit}}$ - heating capacity unit

w_{ok} - standard water flow rate at cooling capacity*
 w_{oh} - standard water flow rate at heating capacity*
 Δp_w - water-side pressure loss
 $Q_{k \text{ Room}}$ - cooling capacity room
 $Q_{h \text{ Room}}$ - heating capacity room
 P_{el} - electric power consumption ($\pm 20\%$)

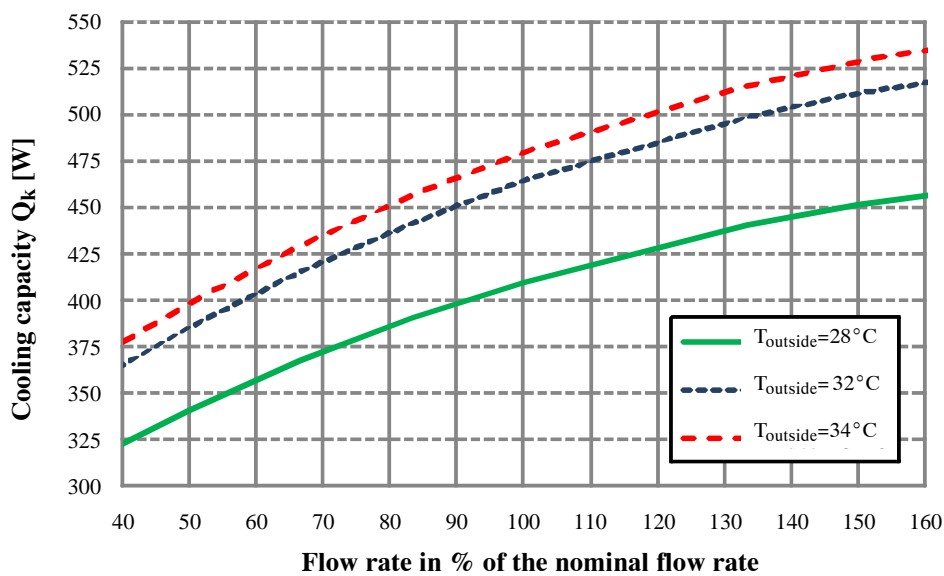
* correction for other flow rates
see page 8

Facade Fan Coil Unit Type A/C System FVM

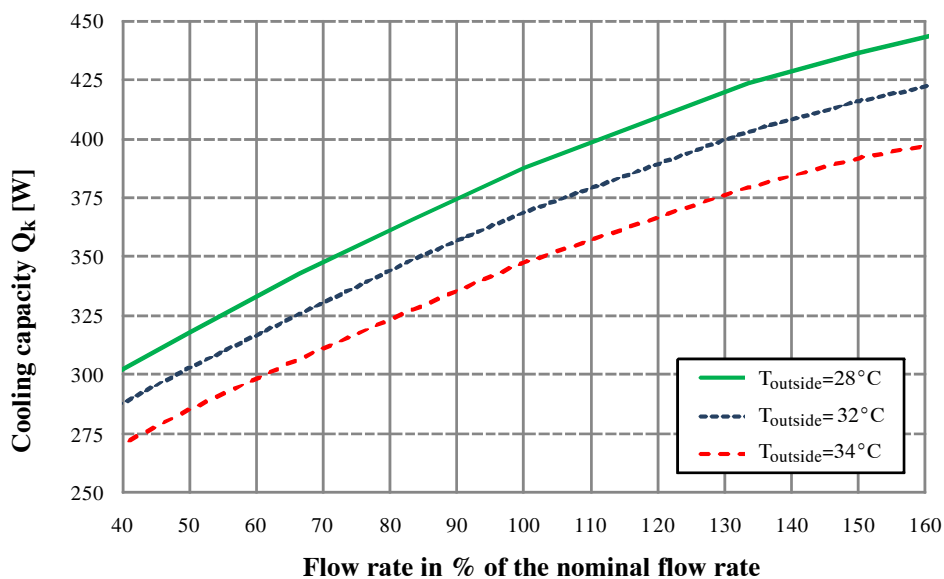
Due to the many parameters decisive for a decentralized unit's output we will state one example only. Further dimensioning on request using a specific program.

Example for:	
Type	FVM Z2/W1/A3
Outside air flow rate	120 m ³ /h
Room temperature	26 °C
Water intake temperature	17 °C
Nominal water volume	120 kg/h
Speed outside air and exhaust air fan	III (116 m ³ /h)
Speed secondary air fan	II
Heat and humidity recovery	on

Overall cooling capacity with different water flow rates



Room-effective cooling capacity with different water flow rates



Facade Fan Coil Unit Type A/C System FVM

Control

When integrating the A/C system type FVM into a closed-loop control circuit the following particularities will have to be considered:

In the decentralized A/C system type FVM, both outside air and room air are routed through the heat exchanger. As outside air temperature variations can be significantly higher than intake temperatures in standard recirculating air units, standard fan coil unit control strategies cannot be used without making certain modifications.

Room temperature control

Room temperature control must be cascade controlled in a way to ensure that the required room temperature in the occupied zone is achieved.

In any case, this will require the use of continuous control valve actuators.

To ensure that dampers, the unit, and the MCR are continuously controlled, i.e. provide a constant supply air temperature, the hot water supply temperature must be controlled based on the outside air temperature.

Emergency closing function

In case of an emergency such as fire or "gas alarm" it is desirable to keep outside air from entering and to seal the facade.

Therefore, the facade fan coil unit's outside and exhaust air damper is provided with a spring return motor. In case of a power failure or when switched off (contrary to the switched fan level "0") the outside and exhaust air damper will be closing automatically within a few seconds. Closing by spring, however, produces a little bit more noise which is why for the standard closing procedure switching to level "0" is to be preferred (unit is supplied with 230 V AC, however with no connection of the control line to any of the three fan speed lines).

Wind Pressure Control / Supply Air Flow Rate

Maintaining the required outside air flow rate as a function of applied wind pressures at the suction inlet will be ensured by a controller integrated in the fan coil unit's power electronics. No external access to this controller is provided.

Three connectable flow rates represent the customer specified set flow rates (e.g. 50 m³/h - 85 m³/h - 120 m³/h). If no flow rate is chosen, the unit will shut the outside and exhaust air damper and stop the fan. The required outside air flow rate may be selected/switched by an external controller choosing among three different set flow rates.

With no voltage supplied, the outside air damper will be shut in the spring return mode.

Frost Protection

Since the heat exchanger in decentralized A/C units can handle outside air there is risk that the heat exchanger might freeze in the case of LPHW/LTHW failure or fan motor failure.

Such failure may be detected before causing any damage to the heat exchanger by monitoring the diffused air temperature.

A digital anti-freeze sensor monitoring the diffused air temperature will shut off the fan if the temperature drops below the limit of 10 °C and close the outside and exhaust air damper (5 minutes). This function is not invoked, in both heating & cooling mode, if the unit is working correctly.

The digital anti-freeze sensor will not protect from simultaneous controller failure. Therefore, maximum security is achieved if an additional automatic frost protection controller with capillary tube sensor is used in terms of a redundant system.

After 5 minutes the unit will be put back into operation.

An external controller may have additional access via an optional additional diffused air temperature sensor, so that further error messages may be displayed and the outside air dampers be closed (fan - set flow rate 0).

Diffused Air Temperature Limiting

In order to optimize comfort in the occupied zone the diffused air temperature will have to be monitored and its lower limit be restricted through suitable valve settings.

This limit should not be more than 8 K below room temperature.

However, this will also limit the available cooling capacity.

Facade Fan Coil Unit Type A/C System FVM

Comfort Control Type DKR 5000

Comfort controller in connecting box for installation in window sills or false floors as stand-alone system or integrated in a bus system (LON/KNX)

Type DKR 5000 in a protection class IP 45 casing to be connected to the FVM unit's cable harness, voltage supply (24 V), grounding, connection to the operating unit, connection to LON bus or to the neighboring unit in the same room. Digital controller with the following functions:

- PI room temperature controller for heating/cooling with separate setting of P and I shares to activate heating and cooling valves, continuous action type
- Local switching of the outside air fan in 2 or 3 speeds (outside air flow rates) depending on the operating unit
- Room temperature control offering integration of another fan coil unit
- Automatic/manual switching on/off of the secondary air fan
- Start-up switching (winter)
- Supply air temperature sensor with supply air temperature limitation, free setting of limits
- Additional temperature sensor for antifreeze monitoring of the heat exchanger (unit protection)
- Collective fault indicator in case of outside air and exhaust air fan failure
- Inputs for presence switch for operating set points "pre-comfort" and "comfort"
- Input for window contact to close the dampers and cut off the fans if the window is open, antifreeze remains unaffected
- Monitoring of the room with view to upper and lower temperature limits (room protection) through central transmission of set points (LON bus)
- LON interface to transmit data such as operating mode, presence (network variable), window contact, collective fault indication, load status (for central optimization control) and to override the operating mode, (building protection, nocturnal cooling, economy, pre-comfort, and comfort)
- Maximum of two FVM units and one recirculating air fan coil unit connected to one controller

The controller uses 5 operating modes.

Controller operating modes:

The controller knows five operating modes of the units, two of which (pre-comfort and comfort) may be called at the standard operating unit. Via bus system (LON/KNX) all modes may be activated:

- **Building protection:** A minimum building temperature is maintained. The building is actually not being used.
- **Nocturnal cooling:** The room is ventilated with outside air (without cooling) until it reaches the heating limit. The diffusion air temperature limit is off.
- **Economy:** This room is not being used for a longer period of time.
- **Pre-comfort:** The room is not used for several more hours. Set points may slide within a predefined range. Ventilation is off.
- **Comfort:** The room is being used. Set points are to be kept according to preset values. Ventilation on, if required.

Technical Data:

Power supply

Operating voltage	AC 24 V ± %
Frequency	50 Hz
Power input	10 VA max. (including connected units, <u>without</u> fan)

Operating environment

Temperature	-25 ... 65°C
Humidity	< 85 % rH

Dimensions/weight of junction box

Width x height x depth	350 x 290 x 120
Weight	approx. 2 kg

Facade Fan Coil Unit Type A/C System FVM

Comfort Control Type DKR 5000

Operating Unit

The operating unit QAA 88.3 with LCD display is connected to the individual room controller via PPS2 interface. It offers the following functions:

- Digital operating unit with temperature sensor, operating keys and display, connected to the controller via PPS2 bus (no LON/KNX)
- \pm 3K room temperature set point adjuster
- Presence key to switch from pre-comfort to comfort set point

Alternatively, any LON-compatible operating unit may be used. Functions and key assignments through binding on site.

Technical data operating unit:

Power supply	
Operating voltage (SELV)	DC 12 V, from controller
Controller interface	
Interface type	PPS 2
Cable type	0,8 mm ² or 1.0 mm ²
max. admissible cable length of copper cable \geq 0.8 mm ²	100 m
Temperature sensor	
Sensing element	NTC element
Operating range	0 ... 40°C
Time constant	10 min
Measuring accuracy	1 K
Degree of protection	
Casing	IP 30 acc. to EN 60 529
Weight	ca. 0,1 kg
Colour	RAL 9003

Dimensions: 96 mm x 119 mm x 25 mm

Four defined control programs for the “comfort” operating mode:

1. AUTO No ventilation required

Function: Room temperature is to be maintained based on set points, however without outside air
 Application: Empty conference room
 Components: Ventilation off / recirculating air fan switches speeds in cascade

2. Low-noise operation

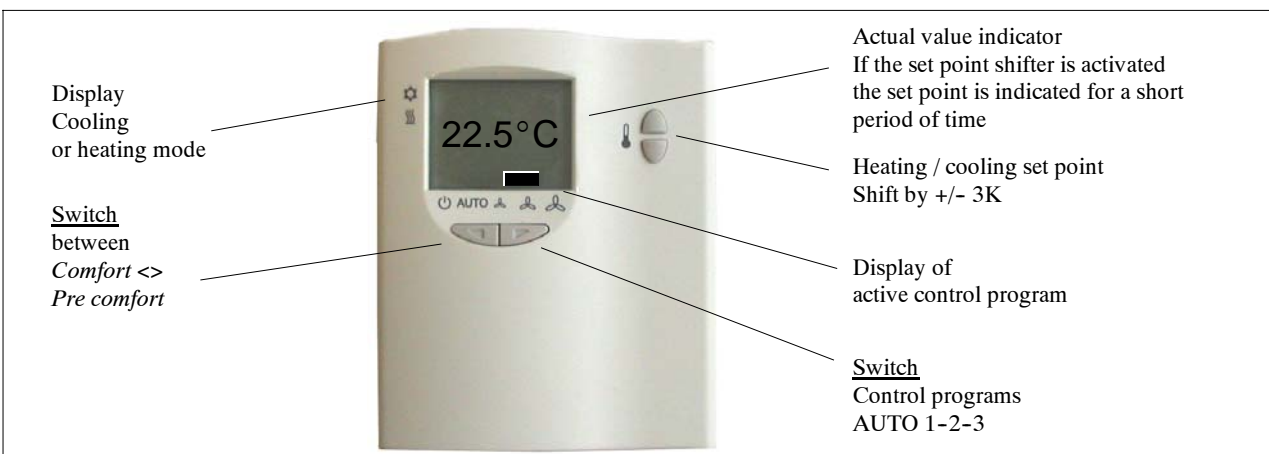
Function: Ventilation with recirculating air fan off, heat recuperation off**
 Application: User requires low-noise operation, room temperature may slide off
 Components: Ventilation set point 1 / recirculating air off

3. Normal use

Function: Ventilation required and room temperature shall be maintained
 Application: Normal use
 Components: Ventilation set point 2 / recirculating air fan switches speeds in cascade

4. Maximum ventilation:

Function: Maximum outside air volume, maximum cooling
 Application: Quick ventilation / large number of persons present
 Components: Ventilation set point 3 / recirculating air fan switches speeds in cascade



Specification and Schedule of Prices

Facade Fan Coil Unit Type A/C System FVM

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Qty	Description	Unit price €	Total €																																																																																													
	<p>General Description Facade fan coil unit for installation in element facades with airtight connection to the outside air and exit air openings. For decentralized ventilation of occupied rooms directly via the facade as well as outside air heating and cooling, heat recovery and secondary air mode. Secondary air mode with integrated fan for:</p> <ul style="list-style-type: none"> - increased caloric heating and cooling output, even with the outside air off - high thermal comfort due to increased temperature of the diffused air (control) - lower freezing and condensation risk. <p>Data and Classification according to VDMA Standard Sheet 24390 Technical data apply to free suction and free diffusion.</p> <p>Nominal heating capacity of the unit Performance data with secondary air fan at speed II</p> <table border="0"> <tr> <td>Maximum flow rate</td> <td>[m³/h]</td> <td>140</td> </tr> <tr> <td>Nominal outside air flow rate (+/-10 % of V_{max})</td> <td>[m³/h]</td> <td>120</td> </tr> <tr> <td>Outside air temperature (temperature of the outside air sucked in by the unit)</td> <td>[°C]</td> <td>-12</td> </tr> <tr> <td>Indoor air temperature</td> <td>[°C]</td> <td>22</td> </tr> <tr> <td>Hot water supply temperature</td> <td>[°C]</td> <td>60</td> </tr> <tr> <td>Hot water return temperature</td> <td>[°C]</td> <td>50</td> </tr> <tr> <td>Nominal heating capacity of the unit (-5 %)</td> <td>[W]</td> <td>1860</td> </tr> <tr> <td>Nominal room heating capacity (-5 %)</td> <td>[W]</td> <td>1120</td> </tr> <tr> <td>Nominal water mass flow rate</td> <td>[kg/h]</td> <td>160</td> </tr> <tr> <td>Nominal pressure loss</td> <td>[kPa]</td> <td>9</td> </tr> </table> <p>Recommended use</p> <table border="0"> <tr> <td>Hot water supply temperature</td> <td>[°C]</td> <td>50</td> </tr> <tr> <td>Hot water return temperature</td> <td>[°C]</td> <td>40</td> </tr> <tr> <td>Nominal heating capacity of the unit (-5 %)</td> <td>[W]</td> <td>1405</td> </tr> <tr> <td>Nominal room heating capacity (-5 %)</td> <td>[W]</td> <td>615</td> </tr> <tr> <td>Water mass flow rate</td> <td>[kg/h]</td> <td>120</td> </tr> <tr> <td>Pressure loss</td> <td>[kPa]</td> <td>5</td> </tr> </table> <p>Nominal cooling capacity of the unit Performance data with secondary air fan at speed II</p> <table border="0"> <tr> <td>Nominal outside air flow rate (+/-10 % of V_{max})</td> <td>[m³/h]</td> <td>120</td> </tr> <tr> <td>Outside air temperature (temperature of the outside air sucked in by the unit)</td> <td>[°C]</td> <td>32</td> </tr> <tr> <td>Indoor air temperature</td> <td>[°C]</td> <td>26</td> </tr> <tr> <td>Cold water supply temperature</td> <td>[°C]</td> <td>16</td> </tr> <tr> <td>Cold water return temperature</td> <td>[°C]</td> <td>18</td> </tr> <tr> <td>Nominal cooling capacity of the unit (-5 %)</td> <td>[W]</td> <td>580</td> </tr> <tr> <td>Nominal room cooling capacity (-5 %)</td> <td>[W]</td> <td>490</td> </tr> <tr> <td>Nominal water mass flow rate</td> <td>[kg/h]</td> <td>250</td> </tr> <tr> <td>Nominal pressure loss</td> <td>[kPa]</td> <td>34</td> </tr> </table> <p>Recommended use</p> <table border="0"> <tr> <td>Cold water supply temperature</td> <td>[°C]</td> <td>17</td> </tr> <tr> <td>Cold water return temperature</td> <td>[°C]</td> <td>20</td> </tr> <tr> <td>Nominal cooling capacity of the unit (-5 %)</td> <td>[W]</td> <td>480</td> </tr> <tr> <td>Nominal room cooling capacity (-5 %)</td> <td>[W]</td> <td>380</td> </tr> <tr> <td>Water mass flow rate</td> <td>[kg/h]</td> <td>140</td> </tr> <tr> <td>Pressure loss</td> <td>[kPa]</td> <td>12</td> </tr> </table>	Maximum flow rate	[m ³ /h]	140	Nominal outside air flow rate (+/-10 % of V _{max})	[m ³ /h]	120	Outside air temperature (temperature of the outside air sucked in by the unit)	[°C]	-12	Indoor air temperature	[°C]	22	Hot water supply temperature	[°C]	60	Hot water return temperature	[°C]	50	Nominal heating capacity of the unit (-5 %)	[W]	1860	Nominal room heating capacity (-5 %)	[W]	1120	Nominal water mass flow rate	[kg/h]	160	Nominal pressure loss	[kPa]	9	Hot water supply temperature	[°C]	50	Hot water return temperature	[°C]	40	Nominal heating capacity of the unit (-5 %)	[W]	1405	Nominal room heating capacity (-5 %)	[W]	615	Water mass flow rate	[kg/h]	120	Pressure loss	[kPa]	5	Nominal outside air flow rate (+/-10 % of V _{max})	[m ³ /h]	120	Outside air temperature (temperature of the outside air sucked in by the unit)	[°C]	32	Indoor air temperature	[°C]	26	Cold water supply temperature	[°C]	16	Cold water return temperature	[°C]	18	Nominal cooling capacity of the unit (-5 %)	[W]	580	Nominal room cooling capacity (-5 %)	[W]	490	Nominal water mass flow rate	[kg/h]	250	Nominal pressure loss	[kPa]	34	Cold water supply temperature	[°C]	17	Cold water return temperature	[°C]	20	Nominal cooling capacity of the unit (-5 %)	[W]	480	Nominal room cooling capacity (-5 %)	[W]	380	Water mass flow rate	[kg/h]	140	Pressure loss	[kPa]	12		
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Specification and Schedule of Prices

Facade Fan Coil Unit Type A/C System FVM

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Qty	Description	Unit price €	Total €																																													
	<p>Sound power level in the outside air mode with heat and humidity recovery (WFRG), secondary air fan, speed II Sound power level (+3 dB) measurement with F7filter free suction, free diffusion</p> <table> <tr> <td>120 m³/h (nominal outside air flow rate)</td> <td>[dB(A)]</td> <td>43</td> </tr> <tr> <td>90 m³/h</td> <td>[dB(A)]</td> <td>41</td> </tr> <tr> <td>60 m³/h</td> <td>[dB(A)]</td> <td>40</td> </tr> </table> <p>Sound power level in the secondary air only mode Speed 1 [dB(A)] 30 Speed 2 [dB(A)] 38</p> <p>Sound power level in the outside air only mode with WFRG off Sound power level (+3 dB) measurement with F7filter free suction, free diffusion</p> <table> <tr> <td>120 m³/h (nominal outside air flow rate)</td> <td>[dB(A)]</td> <td>39</td> </tr> <tr> <td>90 m³/h</td> <td>[dB(A)]</td> <td>35</td> </tr> <tr> <td>60 m³/h</td> <td>[dB(A)]</td> <td>28</td> </tr> </table> <p>Weighted sound reduction index (example) Weighted sound reduction index referring to an installation recess in the facade with</p> <table> <tr> <td>A (reference surface)</td> <td>[m²]</td> <td>1,5</td> </tr> <tr> <td>Rw of the closed facade, without unit</td> <td>[dB]</td> <td>34</td> </tr> <tr> <td>Rw with unit and open dampers</td> <td>[dB]</td> <td>31</td> </tr> <tr> <td>Rw with unit, open dampers, with door</td> <td>[dB]</td> <td>32</td> </tr> </table> <p>Wind impact Meets the highest requirements of Device Category III for external static pressure differences of +/-200 Pa. Compensation of the filter pressure loss through integrated flow rate control.</p> <p>Fans Low-noise centrifugal fan with highly efficient, energy-saving infinitely variable EC motor for outside air flow rates of 60 – 140 m³/h (V_{max}). Power consumption data:</p> <table> <tr> <td>120 m³/h (outside air + exit air + WFRG)</td> <td>[W]</td> <td>27</td> </tr> <tr> <td>Secondary air fan only - Speed II</td> <td>[W]</td> <td>18</td> </tr> <tr> <td>Power consumption max.</td> <td>[W]</td> <td>70</td> </tr> <tr> <td>Required back-up fuse</td> <td>[A]</td> <td>10</td> </tr> <tr> <td>Fan connection</td> <td>[V]</td> <td>230</td> </tr> </table> <p>Outside air and exhaust air filters Outside air filter for fine dusts, filter class F7, exhaust air filter class F5, marked with direction of air and filter type, field for filter replacement date. Filter is made completely of synthetic composite.</p>	120 m ³ /h (nominal outside air flow rate)	[dB(A)]	43	90 m ³ /h	[dB(A)]	41	60 m ³ /h	[dB(A)]	40	120 m ³ /h (nominal outside air flow rate)	[dB(A)]	39	90 m ³ /h	[dB(A)]	35	60 m ³ /h	[dB(A)]	28	A (reference surface)	[m ²]	1,5	Rw of the closed facade, without unit	[dB]	34	Rw with unit and open dampers	[dB]	31	Rw with unit, open dampers, with door	[dB]	32	120 m ³ /h (outside air + exit air + WFRG)	[W]	27	Secondary air fan only - Speed II	[W]	18	Power consumption max.	[W]	70	Required back-up fuse	[A]	10	Fan connection	[V]	230		
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Specification and Schedule of Prices

Facade Fan Coil Unit Type A/C System FVM

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Qty	Description	Unit price €	Total €
	<p>Diffusers On-site front door with lateral ventilation slots to shield the facade through mixed displacement air flow. Front door optional perforated in the heat exchanger area to produce a low-impulse displacement air flow, optional with diffused air temperature limitation. Thermal comfort according to DIN EN ISO 7730 for classes A and B.</p> <p>Outside air dampers / Exit air dampers The outside air and exit air dampers are automatically closed in case of a power failure via spring return actuator. Leakage air flow via closed damper meets DIN EN 1751 tightness requirements for class 3 (< 8 l/(sm²) at a differential pressure of 100 Pa and for a damper surface of 0.017m²)</p> <p>Control Also available with additional temperature sensor to limit the diffused air temperature, e.g. PT 100 with 1 m cable and plug (e.g. white) for connection to the control unit.</p> <p>Antifreeze Optionally, the unit may be provided with an internal antifreeze circuit and a digital diffused air temperature sensor cutting the device off if the diffused air temperature reaches 10 °C and turning it on again above 15 °C. Alternatively, an automatic independent antifreeze controller may be integrated. Output for error messages if antifreeze is triggered, in case of fan failure or if the unit is cut off because of excessive wind pressure.</p> <p>Sanitation The unit has not been designed for condensate formation. Low condensate volumes are collected in a condensate tray and may be discharged via a condensate drainage system. The inside of the unit is lined with mineral wool and abrasion resistant glass silk to muffle sound. Cutting edges are protected against fibre exposure. All air carrying parts are partly removable for easy cleaning. Filter, actuator, outside air damper, heat exchanger, and condensate tray are easily accessible for maintenance and repair from the room via their front cover.</p> <p>Materials, Finishes The housing is made of galvanized sheet steel, including a 4-litre heat exchanger with copper tubing and aluminum fins for heating and cooling. All visible surfaces are powder coated in black.</p> <p>Connection of media Heat exchanger connections with DN = 12 mm smooth copper tubing to take flexible hoses via quick coupling, flexible water connections are included detached in the delivery. Electrical connections via cable harness.</p> <p style="text-align: center;">-4-</p>		

Specification and Schedule of Prices

Facade Fan Coil Unit Type A/C System FVM

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Qty	Description	Unit price €	Total €																		
	<p>Dimensions, Limits, and Installation Suitable for ready-to-plug-in installation in element facades and outer walls meeting legal heat insulation requirements even without installation of the ventilation unit. Modular construction, i.e. also available as a secondary air unit or supply air unit only. On site a removable front panel or front door must be provided. Slots and perforations for technical functions must be harmonized with LTG Aktiengesellschaft. The unit is wired and tested ex factory. It is delivered with cable harness for on-site wiring to external MSR.</p> <table data-bbox="252 772 1069 985"> <tr> <td>Unit height</td> <td>[mm]</td> <td>2600</td> </tr> <tr> <td>Unit depth</td> <td>[mm]</td> <td>160</td> </tr> <tr> <td>Unit width</td> <td>[mm]</td> <td>450</td> </tr> <tr> <td colspan="3">Operating pressure</td> </tr> <tr> <td>Admissible water-side operating pressure</td> <td>[bar]</td> <td>12</td> </tr> <tr> <td>Test pressure</td> <td>[bar]</td> <td>15</td> </tr> </table> <p><u>Corrosion protection</u> The unit housing is made of galvanized steel with powder coating in visible areas.</p> <p>Manufacturer: LTG Aktiengesellschaft Series: Facade Fan Coil Units Type: FVM</p>	Unit height	[mm]	2600	Unit depth	[mm]	160	Unit width	[mm]	450	Operating pressure			Admissible water-side operating pressure	[bar]	12	Test pressure	[bar]	15		
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Specification and Schedule of Prices

Facade Fan Coil Unit Type A/C System FVM

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Qty	Description	Unit price €	Total €
	<p style="text-align: center;">Control</p> <p>Digital single-room controller Type DKR 5000 in a housing, class of protection IP 45, for connection to the FVM's cable harness, 24 V power supply, grounding, connection for the operating panel, LON bus connection or connection to the neighbour unit in the same room; digital controller offering the following functions:</p> <ul style="list-style-type: none"> - PI room temperature controller for heating / cooling with separate setting of the P and I shares to trigger heating and cooling valves in a continuous manner (0-10V) - Local switching of outside air fans at 2 or 3 speeds (outside air flow rates) depending on the operating unit - Room temperature controller for connection of one more fan coil unit - Automatic manual on/off switching of secondary air fan - Starting switching**Anfahrerschaltung (winter) - Supply air temperature sensor with temperature limitation, free setting of limit values - Additional temperature sensor for heat exchanger antifreeze surveillance (device protection) - Centralized fault alarm in case of failure of the outside and exit air fans - Switching inputs for presence switch for operating setpoints „precomfort“ and „comfort“ - Switching input for window contact to close the dampers and cut off the fans if the window is open, antifreeze remains unaffected - Room monitoring for upper and lower temperature limits (room protection) through central transmission of setpoints (LON bus) - LON interface to pass on information such as operating mode, presence (network variable), window contact, centralized fault alarms, load conditions (for center control for optimization) and to override the operating mode, (building protection, nocturnal cooling, economy, precomfort and comfort) <p>Operating unit</p> <ul style="list-style-type: none"> - Digital operating unit with temperature sensor, operating keys and display, connected to the controller via PPS2 bus (no LON/KNX) - Setpoint adjustment of room temperature $\pm 3K$ - Presence key to switch from precomfort to comfort setpoints - Auto: heating and cooling mode without outside and exit air, speed of secondary air fans is cascade switched - Speed 1: with outside and exit air, e.g. 60m³/h, without secondary air mode - Speed 2: with outside and exit air, e.g. 90m³/h and secondary air fan (speed in cascade) - Stufe 3: mit Außen- u. Fortluftstrom, z. B. 120m³/h und Sekundärluftventilator (Drehzahl in Kaskade) <p>Accessories / Extras (optional, at extra charge):</p> <ul style="list-style-type: none"> - Full-way valve VVP 45. with actuator SSB 0 – 10 V continuous 		