The most advanced customized solutions for clean room technology – designed and produced from a single supplier.
GebhardtVentilatoren has defined their core competences:

- Aerodynamics
- Acoustics
- Electrical motors
- Control systems

Investment in laboratories and test facilities enable GebhardtVentilatoren to deal with the most sophisticated tasks in every area of the above mentioned fields.

Filter Fan Units made by GebhardtVentilatoren are available

- as standard or customised versions
- for standard and customised ceiling grids
- for different filter and grid sizes
- as top load or bottom load versions
- for liquid or gasket seal systems
- for various air flows and pressure drops
- with minimal vibration and audible noise emissions
- with an external rotor motor system
- speed variation via BUS or supply voltage
- for various control systems

**EC-version**

- Internet/Intranet access for controlling, monitoring and visualising
- easy to install and set up with automatically addressed motor electronics
- built-in power factor controller (PFC) for reactive current compensation
- integrated self diagnosis and status messages
- high operational reliability as the impeller runs on latest command after power drop or loss

**Why should FFU’s be used in cleanrooms?**

**Benefits which count …**

... **Redundancy**
With hundreds, or thousands of individual FFU’s in a facility, the loss of one or more units does not jeopardise the integrity of the room.

... **Flexibility**
As the needs or uses change in a facility, the units can be exchanged with lay-in lights or blank panels. For facilities with lower classification, upgrades can be obtained by simply adding additional FFU’s. When a computer controlled management system is installed, units or clusters of units can be remote controlled to operational needs.

... **Cost effective**
Use motors with the lowest power consumption available. With complete controllability of each and every FFU (via control and monitoring software) use just as much of power as necessary for your process.

... **Negative plenum**
The negative plenum design draws recirculation air from the plenum itself. If there are any leaks, they migrate to the negative plenum and NOT the cleanroom.

... **Salvageability**
FFU’s are fully salvageable as stand alone units.
GebhardtVentilatoren’s aerodynamics research laboratories have brought forth over 40 years of experience in leading-edge fan design and highly efficient technology.

Since the very beginning of the GebhardtVentilatoren company the external rotor motor has been an essential element for driving fans. GebhardtVentilatoren has a manufacturing facility for production of external rotor motors – the conventional asynchronous version and the electronically controlled brushless DC design. An expert team with special laboratories and test rigs is pushing this development to new frontiers.

Filter Fan Units are key elements in clean room ventilation systems. GebhardtVentilatoren supplies the elements for Filter Fan Units (FFU) as well as the units themselves. Starting from standard FFU design, our team of experts implements the specification for your special project.

To guarantee a Running System join the power of your Convergence Company.
What are the exact dimensions required for your ideal FFU design?

Filter Fan Units (FFU) made by GebhardtVentilatoren with their perfectly matched components are designed for various kinds of industrial areas requiring clean room technology.

1. Dimensions of ceiling grid: (length, width, height in mm)

   - ceiling grid: \( l: \) \( w: \)
   - clearance between ceiling grid: \( l_1: \) \( w_1: \)
   - mounting clearance: \( l_2: \) \( w_2: \)
   - T-bar \( l_3: \) \( w_3: \)
   - \( h: \)

2. Filter adaptions:

   - sealing method: dry fluid

3. Casing:

   - material:
     - galvanised sheet metal (GI 90)
     - stainless steel (SUS 430)
     - aluminium zinc coated (AZ 150-300G)
     - aluminium (Al Mg3 W19)
   - fittings:
     - protection grid
     - pre-filter connector
   - structured to support body weight

4. Requirements for installation/maintenance:

   - FFU installation:
     - clean room side
     - plenum side
   - filter replacement:
     - clean room side
     - plenum side

Fans, motors and control units may be of Gebhardt standard design or they may be specially adapted to the actual requirements of a project.
A system of standard sizes makes it possible – by combining them in different ways – to fill in every special shape of a building and, in this way, to create a filter fan ceiling, actively covered by the most effective filter fan units.

### Main dimensions of the standard sizes

<table>
<thead>
<tr>
<th>nominal grid sizes</th>
<th>example $W_c$ [mm]</th>
<th>example $L_c$ [mm]</th>
<th>minimum $H_c$ [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFU 1200 x 1200</td>
<td>1172</td>
<td>1172</td>
<td>400</td>
</tr>
<tr>
<td>FFU 900 x 1200</td>
<td>872</td>
<td>1172</td>
<td>400</td>
</tr>
<tr>
<td>FFU 600 x 1200</td>
<td>572</td>
<td>1172</td>
<td>400</td>
</tr>
<tr>
<td>FFU 750 x 1500</td>
<td>720</td>
<td>1470</td>
<td>400</td>
</tr>
<tr>
<td>FFU 600 x 600</td>
<td>534</td>
<td>534</td>
<td>350</td>
</tr>
</tbody>
</table>

**Using standard sizes to adapt for special building requirements**
Gebhardt Ventilatoren offers software and hardware especially developed to match the high demands for a perfect clean room system.

What flowrate/air velocity do you need?

What are your noise criteria?

Any required flow of air can be achieved by adjusting the fan size or its rotating speed. Uneven air flow distribution can be caused by a poorly designed ventilation system or by the uneven flow of air through the filter.

### 5. Aerodynamics

<table>
<thead>
<tr>
<th>duty point</th>
<th>air flowrate: (m³/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>nominal</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>external static pressure: (Pa)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>filter losses: (Pa)</th>
</tr>
</thead>
</table>

### 6. Audible noise (single unit)

<table>
<thead>
<tr>
<th>sound pressure level (measured at 1.5 m below filter)</th>
<th>NC criteria:</th>
</tr>
</thead>
<tbody>
<tr>
<td>dB (A)</td>
<td>NC value</td>
</tr>
</tbody>
</table>

Sound pressure level at octave frequencies at 1.5 m distance (below filter)
The demands of air flow uniformity are magnified with the increased requirements of higher room cleanliness classifications and more end users are specifying reduced variation of velocity profiles.

**Low noise**

High efficiency includes low noise levels. Special sound measuring facilities make it possible to detect every peak in frequency bands and to improve a spectrum by designing new noise patterns.

**Noise measurement chamber class 2 DIN 45635**

Fan testing in accordance with ISO 5801 chamber to measure volumetric air flow, pressure difference and power consumption.

**FFU long-term study**

**Air distribution measurement**

Air velocity with the filter in 36 square sections of same size below the filter. No measurement point exceeded 30%. More than 80% have been less than +/- 20% deviation. Standards (VDI2083)
What about the power supply?

Asynchronous motor

This type of motor is available as an AC motor, wound in such a way that speed control by simple voltage variation is possible. The motor is a standard and has been on the market for about 50 years.

7. Electrical requirements / power supply

7.1 Asynchronous

<table>
<thead>
<tr>
<th>voltage:</th>
<th>VAC 1-phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VAC 3-phases</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>frequency:</th>
<th>Hz</th>
</tr>
</thead>
</table>

| motor protection: | PTC / Therm. Contact |

External rotor motors integrate exceptionally well into a centrifugal fan impeller. They don’t take up extra space because they are entirely built in the impeller without creating major disturbances to the air stream through the impeller.

This design feature places the motor directly in the air stream and the cooling for the motor cannot be better.

Comparison of efficiency
AC-EC-unit with a power rating \( P_n = 200 \) W

Asynchronous motor

- Established and proven technology
- Not affected by external radio interference
- Individual speed easily and directly adjustable with voltage control unit
- Various possibilities (options) for control:
  - Voltage control unit
  - Frequency converter (BUS compatible)
  - Single phase AC converter
  - Single phase or 3-phases power supply
Gebhardt motors comply with EN 50178, EN 60335-1 and EN 60950. Our motors fulfill insulation class “B”, higher protection class is possible.

The test procedure according to the Standards UL 507 / CAN CSA C22.2 No. 113-M 1984, UL 2111 and UL 1917 / CAN CSA C22.2 No. 156-M 1987 are executed.

Asynchronous motors

This allows the motor to operate more efficiently and therefore the motor size can be slightly smaller than that of a standard IEC motor.
What about the electronics?

EC motor
(Brushless DC motor)

The most advanced development is the EC motor which exploits the basic external rotor principle of a brushless DC motor.

EC motor
- High efficiency over wide range of speed
- BUS compatible
- Independent of mains frequency
- Integrated speed control
- Flexible in case of change in installation situation

A drive unit consisting of an electronically commutated motor differs from the former DC motors as there are no collector or carbon brushes.

These wearing components have been replaced in an electronic commutated motor with maintenance-free electronics (control unit).

7.2 EC

voltage: VAC 1-phase

frequency: Hz

motor protection:
  electronically monitored
**This is how it works:**

The EC motor has three winding circuits, which are controlled by the electronic commutation unit with a changing current impulse.

The electric current results in a magnetic field which interacts with the field of the permanent magnets of the rotor. This generates a torque for the motor.

To create a continuous rotating movement of the rotor, the electric current must now be switched relative to the position of the rotating permanent magnet rotor field.

The position of the permanent magnet is detected by hall effect sensors and as a result of this signal the control electronics carry out the commutation.

**Total harmonic distortion (according to EN 61800-1:1998, EN 61800-3:1996)**

Without Power-Factor-Controller (PFC) vs Gebhardt electronic with PFC
The FANCommander 200 is a stand-alone monitoring and control unit for up to 200 fans. Fans can be controlled and monitored individually or by groups.

The device offers easy commissioning and operating assisted by a clear menu structure and the single control element. Additional features like an automatic day/night shift (controlled by external input or by included clock), 3-level operator rights and non-volatile error storage downloadable to a PC make the FANCommander 200 a smart monitoring and control solution for small fan systems.

Properties

- Fan control and parametrization: Single, groups, line, total of up to 200 fans
- Addressing: Fan address 0...99 at 2 lines → 200 Fans
- Display: lighted LCD: 4 lines, 20 characters
- Control elements: One element (turn and push button)
- Operation and navigation: Menu controlled
- Fan parameter control: Day speed, Night speed, ON/OFF, Maximum speed, Restart delay, Wink function, Reset errors, non-volatile error storage, download error storage to PC (serial interface), separate error indication of: present errors, new (unconfirmed) errors, error indication by: Display, LED, dry contact output
- Automatic day/night shift: external control (24V DC input), internal control (clock controlled)
- Additional features: Internal clock, automatic fan registration (scan function)
- Supply voltage: 115/230V AC
### Compare one system to the other

<table>
<thead>
<tr>
<th>System Features</th>
<th>LONWORKS®</th>
<th>® BUS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardware</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FFU Server PC</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>User client local or remote via Ethernet</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Multiple clients</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Network topology</td>
<td>Free Topology</td>
<td>Line Topology</td>
</tr>
<tr>
<td>Backbone</td>
<td>FTT-10A</td>
<td>Ethernet</td>
</tr>
<tr>
<td>Field Bus</td>
<td>FTT-10A</td>
<td>RS485</td>
</tr>
<tr>
<td>Physical Repeater/Ethernet Gateway</td>
<td>2 or 3 way(^1)</td>
<td>5 lines(^2)</td>
</tr>
<tr>
<td>Nodes per Segment</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>Maximum number of FFUs at the network</td>
<td>32,000</td>
<td>127,000</td>
</tr>
<tr>
<td>Network Terminator</td>
<td>+ not needed</td>
<td>+ not needed</td>
</tr>
<tr>
<td>8 Digital Input Module</td>
<td>+ -</td>
<td>+</td>
</tr>
<tr>
<td>Digital I/O Station</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Temperature Sensor Module</td>
<td>+ -</td>
<td>+</td>
</tr>
<tr>
<td>Handheld Service Tool</td>
<td>+</td>
<td>not needed</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication Principle</td>
<td>Multi-Master</td>
<td>Master-Slave</td>
</tr>
<tr>
<td>Heartbeat (Send-On-Change)</td>
<td>+(^3)</td>
<td>-</td>
</tr>
<tr>
<td>Polling</td>
<td>+(^4)</td>
<td>+(^5)</td>
</tr>
<tr>
<td>Addressing</td>
<td>Neuron-ID(^6)</td>
<td>Hardware(^7)</td>
</tr>
<tr>
<td><strong>Server Software</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import FFUs(^8)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>FFUs organized in building structures</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Free definable FFU groups</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2 control modes (% of Maxspeed, Air Speed)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Integrated scheduler(^9)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3 different FFU error priorities</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>FFU runtime counter</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Digital input event handler</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Handling of temperature sensors</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Global emergency input(^10)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Printing of error messages</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>E-mailing, Paging, SMS(^11)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Log files (Error, Change, Speed Logs)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>OPC Server(^12)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>User Interface (Client)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User management with graduated authorisation(^13)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Optimized for MICROSOFT\® Internet Explorer\®</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Colours and operator rights customizable</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Background drawing for each structure element</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Project navigation tree</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Alarm sound customizable</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Help function</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

\(^1\) can drive 1 or 2 segments with 60 nodes each  
\(^2\) can drive 5 lines with 100 nodes each  
\(^3\) in case of error, speed change and time-out  
\(^4\) only if no heartbeat could be received by the server  
\(^5\) parallel polling of max. 500 FFUs by each gateway  
\(^6\) subnet/node addressing after FFU installation  
\(^7\) node address set by hardware switch  
\(^8\) from MICROSOFT\® EXCEL\® *.csv format  
\(^9\) weekly programmable (start, stop, set speed)  
\(^10\) one dry contact, configurable functions: “Shutdown All FFUs” or “Display Only”  
\(^11\) external service provider required  
\(^12\) optional  
\(^13\) “Viewer”, “Operator” and “Administrator”
How would you like to control your FFUs?

The keypoint of the clean room is the FFU, which can be selected in different performance/efficiency/configuration and used in different places in the process or ventilating system.

8. Control system

adjustable unit
adjustable group

9. Controls

(analogue) voltage converter
(digital) computer controlled network

Several clients, running under a conventional Internet browser like Microsoft™ Internet Explorer™ serve as visualisation and operating console (user interface).

An optional implementation and setup tool is available as well as an OPC access. These figures give an overview of the Gebhardt FFU Monitoring and Control System.
Topology Overview

This Figure shows the complete FFU GBUS control network topology as recommended by Gebhardt Ventilatoren. The field bus section uses GBUS technology in ring topology for the Ethernet part and line topology for the RS485 part.

The GBUS is structured with gateways with a redundant Ethernet backbone and several FFU lines. Additional I/O modules for connection to the server are also available. The FFU Server can be provided with a redundancy server in hot-standby configuration.
Benefits of BUS-Systems

Advantages of LONWORKS® based system
- Fast single command response
- Fast single error response
- FFU calibration from cleanroom
- Handheld service tool
- Free network topology
- Digital input modules available
- Temperature sensors available
- Extensible system
- Using of 3rd party components (compatible with Gebhardt specification)

Advantages of ® BUS based system
- Low system cost
- Easy and fast commissioning at jobsite
- Fast multiple command response
- Fast multiple error response
- Complete project engineering and programming at design phase
- Low effort for components change

General Advantages
- Analog interface available for using without network system (0-5V, 0-10V, n_min, n_max, error contact)
- Modular structure of controller allows easy change of interface type

Software & controlling
- Ethernet, IP network, HTTP protocol, HTML/XML, Internet Browsers (Microsoft™ Internet Explorer™)
- Registration of each FFU run time for preventive filter maintenance
- Remote maintenance and configuration via Internet connection
- Freely programmable time scheduler for automated FFU control (speed-up or speed-down of single FFUs or groups)
- Event logging (status- and change logfile)
This makes the FFU system (EC motors) offered by Gebhardt Ventilatoren so attractive:

- Only 1 person for implementing or maintenance needed
- Client and server run at one PC or at two separated PCs connected via Ethernet link
- Any desired number of FFUs can be handled

- Graduated authorisation levels ("view only", "operate" or "administration")
- Freely definable FFU groups (structural and logical groups)
- OPC option for master station access (Wonderware™, Intellution™ or other OPC capable clients)

Summary of the fan curves

<table>
<thead>
<tr>
<th>Type Name</th>
<th>Motor Type</th>
<th>Voltage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHA 1212-240-6D01-A</td>
<td>AC, 3ph, 50 Hz</td>
<td>Page 18</td>
<td></td>
</tr>
<tr>
<td>RHP 1212-240-EC00-A</td>
<td>EC, 1ph, 50/60 Hz</td>
<td>Page 19</td>
<td></td>
</tr>
<tr>
<td>RHA 0912-335-4D00-A</td>
<td>AC, 3ph, 50 Hz</td>
<td>Page 20</td>
<td></td>
</tr>
<tr>
<td>RHP 0912-231-EC00-A</td>
<td>EC, 1ph, 50/60 Hz</td>
<td>Page 21</td>
<td></td>
</tr>
<tr>
<td>RHA 0612-331-4D00-A</td>
<td>AC, 3ph, 50 Hz</td>
<td>Page 22</td>
<td></td>
</tr>
<tr>
<td>RHP 0612-331-EC03-A</td>
<td>EC, 1ph, 50/60 Hz</td>
<td>Page 23</td>
<td></td>
</tr>
<tr>
<td>RHA 1212-240-6E12-BAS</td>
<td>AC, 1ph, 50 Hz</td>
<td>Page 24</td>
<td></td>
</tr>
<tr>
<td>RHA 1212-240-6E42-BAS</td>
<td>AC, 1ph, 60 Hz</td>
<td>Page 25</td>
<td></td>
</tr>
<tr>
<td>RHA 0912-231-4E11-BAS</td>
<td>AC, 1ph, 50 Hz</td>
<td>Page 26</td>
<td></td>
</tr>
<tr>
<td>RHA 0912-231-6E41-BAS</td>
<td>AC, 1ph, 60 Hz</td>
<td>Page 27</td>
<td></td>
</tr>
<tr>
<td>RHA 0612-331-4E11-BAS</td>
<td>AC, 1ph, 50 Hz</td>
<td>Page 28</td>
<td></td>
</tr>
<tr>
<td>RHA 0612-331-6E41-BAS</td>
<td>AC, 1ph, 60 Hz</td>
<td>Page 29</td>
<td></td>
</tr>
<tr>
<td>RHA 1212-240-6DB4-A</td>
<td>AC, 3ph, 60 Hz</td>
<td>Page 30</td>
<td></td>
</tr>
<tr>
<td>RHA 1212-240-6E45-BAS</td>
<td>AC, 1ph, 60 Hz</td>
<td>Page 31</td>
<td></td>
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<tr>
<td>RHA 0912-231-6DB3-A</td>
<td>AC, 3ph, 60 Hz</td>
<td>Page 32</td>
<td></td>
</tr>
<tr>
<td>RHA 0912-231-6E43-BAS</td>
<td>AC, 1ph, 60 Hz</td>
<td>Page 33</td>
<td></td>
</tr>
<tr>
<td>RHA 0612-331-4DB4-A</td>
<td>AC, 3ph, 60 Hz</td>
<td>Page 34</td>
<td></td>
</tr>
<tr>
<td>RHA 0612-231-6E43-BAS</td>
<td>AC, 1ph, 60 Hz</td>
<td>Page 35</td>
<td></td>
</tr>
</tbody>
</table>
Data for duty point:

- Air velocity $v = 0.35 \text{ m/s}$ ($q_v = 1815 \text{ m}^3/\text{h}$)
- Fan static pressure $p_{st} = 170 \text{ Pa}$ (unit without filter, with inlet guard)
- Voltage $U = 245 \text{ V}$
- Speed $N = 850 \text{ 1/min}$ (on request)
- Input Power $P_e = 218 \text{ W}$ (on request)
- Current $I = 0.66 \text{ A}$ (on request)
- Sound pressure level $L_{pA1.5} = 48 \text{ dB}$ (with filter, A-weighted)
- Sound pressure levels at octave frequencies (on request)
- Octave frequency $63, 125, 250, 500, 1000, 2000, 4000, 8000 \text{ Hz}$
- Sound pressure level $63 = 54, 125 = 48, 250 = 45, 500 = 43, 1000 = 43, 2000 = 43, 4000 = 43, 8000 = 43 \text{ dB}$
- Unweighted

Fan Data

<table>
<thead>
<tr>
<th>Fan type</th>
<th>RLA 21-0400-6D-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor type</td>
<td>MFA F0-1112-6D-K1-00</td>
</tr>
<tr>
<td>Voltage $U$</td>
<td>$400 \text{ V (Y), 3~}$</td>
</tr>
<tr>
<td>Input power $P_e$</td>
<td>$0.29 \text{ kW}$</td>
</tr>
<tr>
<td>A-weighted sound pressure level at 1.5m distance (mid filter) $L_{pA1.5}$</td>
<td>$43 \text{ dB}$</td>
</tr>
<tr>
<td>A-weighted sound power level $L_{pA1.5} + 10 \text{ dB}$</td>
<td>$53 \text{ dB}$</td>
</tr>
<tr>
<td>Fan weight (steel) $m$</td>
<td>$55 \text{ kg (without filter)}$</td>
</tr>
<tr>
<td>Fan weight (aluminium) $m$</td>
<td>$38 \text{ kg (without filter)}$</td>
</tr>
<tr>
<td>Voltage $U$</td>
<td>$400 \text{ V (Y), 3~}$</td>
</tr>
<tr>
<td>Frequency $f$</td>
<td>$50 \text{ Hz}$</td>
</tr>
<tr>
<td>Max. input power $P_{e, \text{ max}}$</td>
<td>$0.29 \text{ kW}$</td>
</tr>
<tr>
<td>Max. current $I_{\text{ max}}$</td>
<td>$0.85 \text{ A}$</td>
</tr>
<tr>
<td>Speed $N$</td>
<td>$940 \text{ 1/min}$</td>
</tr>
</tbody>
</table>
Data for duty point:

- Air velocity $v$: 0.35 m/s ($q_v = 1815$ m$^3$/h)
- Fan static pressure $p_{sf}$: 170 Pa (unit without filter, with inlet guard)
- Speed $N$: 845 1/min (on request)
- Input Power $P_e$: 172 W
- Current $I$: 0.77 A (on request)
- Sound pressure level $L_{pA,1.5}$: 50 dB (with filter, A-weighted)
- Sound pressure levels at octave frequencies (on request)
- Octave frequency: 63, 125, 250, 500, 1000, 2000, 4000, 8000 Hz
- Sound pressure level unweighted

- Fan type: RLP 21-0400-EC
- Motor type: MFA FP-0817-EC-K0-02

- Fan weight (steel): 55 kg (without filter)
- Fan weight (aluminium): 38 kg (without filter)
- Voltage $U$: 230 V, 1~
- Frequency $f$: 50 Hz
- Max. input power $P_{e, max}$: 0.37 kW
- Max. current $I_{max}$: 1.62 A
- Max. speed $N_{max}$: 1070 1/min
Filter Fan Units

RHA 0912-335-4D00-A

Data for duty point:

- Air velocity \( v \) 0.35 m/s  \( (q_v = 1360 \text{ m}^3/\text{h}) \)
- Fan static pressure \( p_{sF} \) 170 Pa  \( \text{(unit without filter, with inlet guard)} \)
- Voltage \( U \) 220 V
- Speed \( N \) 1120 1/min  \( \text{(on request)} \)
- Input Power \( P_e \) 218 W  \( \text{(on request)} \)
- Current \( I \) 0.71 A  \( \text{(on request)} \)
- Sound pressure level \( L_{PA, 1.5} \) 52 dB  \( \text{(with filter, A-weighted)} \)
- Sound pressure levels at octave frequencies  \( \text{(on request)} \)
- Octave frequency 63 125 250 500 1000 2000 4000 8000 Hz
- Sound pressure level unweighted
- Fan weight (steel) \( m \) 49 kg  \( \text{(without filter)} \)
- Fan weight (aluminium) \( m \) 35 kg  \( \text{(without filter)} \)
- Voltage \( U \) 400 V  \( \text{(Y), 3~} \)
- Frequency \( f \) 50 Hz
- Max. inputpower \( P_{e, \text{max}} \) 0.33 kW
- Max. current \( I_{\text{max}} \) 0.76 A
- Speed \( N \) 1390 1/min

![Diagram of fan performance](image.png)

**Fan Data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit(s)</th>
<th>Value(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan type</td>
<td></td>
<td>RLA 31-3135-4D</td>
</tr>
<tr>
<td>Motor type</td>
<td></td>
<td>MFA F0-0911-4D-K1-00</td>
</tr>
<tr>
<td>Voltage ( U )</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Input power ( P_e )</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>A-weighted sound pressure level at 1.5m distance (mid filter) ( L_{PA, 1.5} )</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>A-weighted sound power level ( L_{PA, 1.5} + 10 \text{ dB} )</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Fan weight (steel) ( m )</td>
<td></td>
<td>49 kg  ( \text{(without filter)} )</td>
</tr>
<tr>
<td>Fan weight (aluminium) ( m )</td>
<td></td>
<td>35 kg  ( \text{(without filter)} )</td>
</tr>
<tr>
<td>Voltage ( U )</td>
<td></td>
<td>400 V  ( \text{(Y), 3~} )</td>
</tr>
</tbody>
</table>
### Fan Data

<table>
<thead>
<tr>
<th>Fan type</th>
<th>RLP 31-315-EC</th>
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<td>Motor type</td>
<td>MFA FP-0817-EC-K0-02</td>
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</table>

<table>
<thead>
<tr>
<th>N</th>
<th>Speed 1/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_e$</td>
<td>Input power W</td>
</tr>
<tr>
<td>$L_{P1/5}$</td>
<td>A-weighted sound pressure level at 1.5m distance (mid filter) dB</td>
</tr>
<tr>
<td>$L_{A1/5}$</td>
<td>A-weighted sound power level = $L_{P1/5} + 10$ dB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fan weight (steel)</th>
<th>m 49 kg (without filter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan weight (aluminium)</td>
<td>m 35 kg (without filter)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Voltage U</th>
<th>230 V, 1~</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency f</td>
<td>50 Hz</td>
</tr>
</tbody>
</table>

| Max. input power $P_{e, max}$ | 0.33 kW                |
| Max. current $I_{max}$        | 1.50 A                 |
| Max. Speed $N_{max}$          | 1300 1/min             |

### Data for duty point:

- Air velocity $v = 0.35$ m/s ($qv = 1360$ m³/h)
- Fan static pressure $p_{sf} = 170$ Pa (unit without filter, with inlet guard)
- Speed $N = 960$ 1/min (on request)
- Input Power $P_e = 132$ W
- Current $I = 0.59$ A (on request)
- Sound pressure level $L_{P1/5} = 50$ dB (with filter, A-weighted)
- Sound pressure levels at octave frequencies:
  - Octave frequency: $63, 125, 250, 500, 1000, 2000, 4000, 8000$ Hz
  - Sound pressure level unweighted: $59, 56, 51, 47, 44, 40, 31, 23$ dB
- Filter Fan Units:
  - RHP 0912-335-EC00-A
  - RHP 0912-231-EC00-A

### Filter Fan Units

- Air density $= 1.15$ kg/m³

### Graph:

- Data for duty point:
  - Air velocity $v = 0.35$ m/s ($qv = 1360$ m³/h)
  - Fan static pressure $p_{sf} = 170$ Pa (unit without filter, with inlet guard)
  - Speed $N = 960$ 1/min (on request)
  - Input Power $P_e = 132$ W
  - Current $I = 0.59$ A (on request)
  - Sound pressure level $L_{P1/5} = 50$ dB (with filter, A-weighted)
  - Sound pressure levels at octave frequencies:
    - Octave frequency: $63, 125, 250, 500, 1000, 2000, 4000, 8000$ Hz
    - Sound pressure level unweighted: $59, 56, 51, 47, 44, 40, 31, 23$ dB
  - Filter Fan Units:
    - RHP 0912-335-EC00-A
    - RHP 0912-231-EC00-A

### Additional:

- Fan weight (steel) $m 49$ kg (without filter)
- Fan weight (aluminium) $m 35$ kg (without filter)
- Voltage $U 230$ V, 1~
- Frequency $f 50$ Hz
- Max. input power $P_{e, max} 0.33$ kW
- Max. current $I_{max} 1.50$ A
- Max. Speed $N_{max} 1300$ 1/min
Filter Fan Units

RHA 0612-331-4D00-A

Data for duty point:

- Air velocity $v = 0.35 \text{ m/s}$ ($q_v = 910 \text{ m}^3/\text{h}$)
- Fan static pressure $p_{F} = 170 \text{ Pa}$ (unit without filter, with inlet guard)
- Voltage $U = 295 \text{ V}$
- Speed $N = 1230 \text{ 1/min (on request)}$
- Input Power $P_e = 143 \text{ W}$
- Current $I = 0.36 \text{ A}$ (on request)
- Sound pressure level $L_{pA1.5} = 51 \text{ dB}$ (unit without filter, with inlet guard)
- Sound pressure levels at octave frequencies (on request)
- Octave frequency: 63, 125, 250, 500, 1000, 2000, 4000, 8000 Hz
- Sound pressure level: 60, 63, 49, 46, 43, 41, 31, 25 dB

- Voltage $U = 400 \text{ V (Y), 3~}$
- Frequency $f = 50 \text{ Hz}$
- Max. input power $P_{e,\text{max}} = 0.19 \text{ kW}$
- Max. current $I_{\text{max}} = 0.44 \text{ A}$
- Speed $N = 1340 \text{ 1/min}$

Fan Data

<table>
<thead>
<tr>
<th>Fan type</th>
<th>RLA 31-2831-4D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor type</td>
<td>MFA F0-0810-4D-K1-01</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Voltage $U$</th>
<th>$V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input power $P_e$</td>
<td>$W$</td>
</tr>
<tr>
<td>$L_{pA1.5}$</td>
<td>A-weighted sound pressure level at 1.5m distance (mid filter) dB</td>
</tr>
<tr>
<td>$L_{pA}$</td>
<td>A-weighted sound power level $= L_{pA1.5} + 10 \text{ dB}$</td>
</tr>
<tr>
<td>Fan weight (steel)</td>
<td>$m$</td>
</tr>
<tr>
<td>Fan weight (aluminium)</td>
<td>$m$</td>
</tr>
<tr>
<td>Voltage $U$</td>
<td>$V$</td>
</tr>
<tr>
<td>Frequency $f$</td>
<td>$f$</td>
</tr>
<tr>
<td>Max. input power $P_{e,\text{max}}$</td>
<td>$P$</td>
</tr>
<tr>
<td>Max. current $I_{\text{max}}$</td>
<td>$I$</td>
</tr>
<tr>
<td>Speed $N$</td>
<td>$N$</td>
</tr>
</tbody>
</table>
**EC motor**

1ph, 50/60 Hz

600x1200 (2'x4')

**Fan type**

RLP 31-2831-EC-S

**Motor type**

MFA FP-0817-EC-K0-04

**N Speed 1/min**

1230.1/min (on request)

**Input Power** $P_e$

113 W

**Current** $I$

0.52 A (on request)

**Sound pressure level** $L_{P_{A1.5}}$

50 dB (with filter, A-weighted)

**Sound pressure levels at octave frequencies**

(on request)

**Octave frequency**

63 125 250 500 1000 2000 4000 8000 Hz

**Sound pressure level unweighted**

58 63 50 46 41 39 34 23 dB

**Voltage** $U$

230 V, 1~

**Frequency** $f$

50 Hz

**Max. input power** $P_{e, \text{max}}$

0.30 kW

**Max. current** $I_{\text{max}}$

1.35 A

**Max. Speed** $N_{\text{max}}$

1700 1/min

**Air density** $1.15 \text{ kg/m}^3$

**Data for duty point:**

- Air velocity $v$
  
  0.35 m/s ($q_v = 910 \text{ m}^3/\text{h}$)

- Fan static pressure $p_F$
  
  170 Pa
  (unit without filter, with inlet guard)

- Speed $N$
  
  1230.1/min (on request)

- Input Power $P_e$
  
  113 W

- Current $I$
  
  0.52 A (on request)

- Sound pressure level $L_{P_{A1.5}}$
  
  50 dB (with filter, A-weighted)

- Sound pressure levels at octave frequencies
  
  (on request)

- Octave frequency
  
  63 125 250 500 1000 2000 4000 8000 Hz

- Sound pressure level unweighted
  
  58 63 50 46 41 39 34 23 dB

**Filter Fan Units**

RHP 0612-331-EC03-A

**Fan Data**

- **Fan weight (steel)** $m$
  
  43 kg (without filter)

- **Fan weight (aluminium)** $m$
  
  32 kg (without filter)

- **Voltage** $U$
  
  230 V, 1~

- **Frequency** $f$
  
  50 Hz

- **Max. input power** $P_{e, \text{max}}$
  
  0.30 kW

- **Max. current** $I_{\text{max}}$
  
  1.35 A

- **Max. Speed** $N_{\text{max}}$
  
  1700 1/min
Filter Fan Units

**RHA 1212-240-6E12-BAS**

**Asynchronous motor**
1ph, 50 Hz

**Filter Fan Units**

**Fan Data**

<table>
<thead>
<tr>
<th>Fan type</th>
<th>RLA 21-0400-6E-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor type</td>
<td>MFA F0-1112-6E-K1-CD-S</td>
</tr>
<tr>
<td>Operating capacitor</td>
<td>8 µF</td>
</tr>
<tr>
<td>Voltage U</td>
<td>V</td>
</tr>
<tr>
<td>Input power P_input</td>
<td>W</td>
</tr>
<tr>
<td>L_pA1.5</td>
<td>A-weighted sound pressure level at 1.5m distance (mid filter) dB</td>
</tr>
<tr>
<td>L_pA6</td>
<td>A-weighted sound power level = $L_{pA1.5} + 10$ dB</td>
</tr>
</tbody>
</table>

**Power Data**

| Voltage U                   | 155 V |
| Input Power P_input         | 235 W |
| Current I                   | 1.56 A |
| Sound pressure level L_pA1.5 | 53 dB |
| Sound pressure level at octave frequencies | (on request) |
| Octave frequency            | Hz |
| Sound pressure level        | Hz |
| L_pA1.5                    | 55 dB |
| L_pA6                      | 55 dB |
| L_pA1.5, unweighted        | dB |

**Other specifications**

- Air density = 1.15 kg/m³
- Filter Fan Units
- Fan weight (steel) m = 55 kg (without filter)
- Fan weight (aluminium) m = 38 kg (without filter)
- Voltage U = 220 V, 1~
- Frequency f = 50 Hz
- Max. inputpower $P_{e,\text{max}}$ = 0.32 kW
- Max. current $I_{\text{max}}$ = 1.53 A
- Speed N = 940 1/min

**Data for duty point:**

- Air velocity $v = 0.35$ m/s ($q_v = 1815$ m³/h)
- Fan static pressure $p_{\text{SF}} = 170$ Pa (unit without filter, with inlet guard)
- Voltage U = 155 V
- Speed N = 850 1/min (on request)
- Input Power $P_{e} = 235$ W
- Current I = 1.56 A (on request)
- Sound pressure level $L_{pA1.5}$ = 53 dB (with filter, A-weighted)
- Sound pressure levels at octave frequencies (on request)
- Octave frequency 63 125 250 500 1000 2000 4000 8000 Hz
- Sound pressure level 61 55 50 51 48 45 38 26 dB unweighted

**Other specifications:**

- Fan weight (steel) m = 55 kg (without filter)
- Fan weight (aluminium) m = 38 kg (without filter)
- Voltage U = 220 V, 1~
- Frequency f = 50 Hz
- Max. inputpower $P_{e,\text{max}}$ = 0.32 kW
- Max. current $I_{\text{max}}$ = 1.53 A
- Speed N = 940 1/min

**Other specifications:**

- Fan type: RLA 21-0400-6E-S
- Motor type: MFA F0-1112-6E-K1-CD-S
- Operating capacitor: 8 µF
- Voltage U: 220 V, 1~
- Frequency f: 50 Hz
- Max. inputpower $P_{e,\text{max}}$: 0.32 kW
- Max. current $I_{\text{max}}$: 1.53 A
- Speed N: 940 1/min

**Diagram:**

- Air density = 1.15 kg/m³
- Filter Fan Units
- Fan static pressure $p_{\text{SF}}$ (Unit without filter)
- Volume flowrate $q_v$ m³/h
- Volume flowrate $q_v$ ft³/min
- Data for duty point:
  - Air velocity $v = 0.35$ m/s ($q_v = 1815$ m³/h)
  - Fan static pressure $p_{\text{SF}} = 170$ Pa (unit without filter, with inlet guard)
  - Voltage U = 155 V
  - Speed N = 850 1/min (on request)
  - Input Power $P_{e} = 235$ W
  - Current I = 1.56 A (on request)
  - Sound pressure level $L_{pA1.5}$ = 53 dB (with filter, A-weighted)
  - Sound pressure levels at octave frequencies (on request)
  - Octave frequency 63 125 250 500 1000 2000 4000 8000 Hz
  - Sound pressure level 61 55 50 51 48 45 38 26 dB unweighted
### Data for duty point:

- **Air velocity** $v$: 0.35 m/s ($q_v = 1815$ m$^3$/h)
- **Fan static pressure** $p_{sF}$: 170 Pa (unit without filter, with inlet guard)
- **Voltage** $U$: 108 V
- **Speed** $N$: 850 1/min (on request)
- **Input Power** $P_e$: 330 W
- **Current** $I$: 3.3 A (on request)
- **Sound pressure level** $L_{pA1.5}$: 53 dB (with filter, A-weighted)
- **Sound pressure levels at octave frequencies**
  - Octave frequency
  - Sound pressure level unweighted
  - Sound pressure level
  - Frequency
  - Level

### Key Specifications:

- **Fan weight (steel)**: 55 kg (without filter)
- **Fan weight (aluminium)**: 38 kg (without filter)
- **Voltage** $U$: 120 V, 1~
- **Frequency** $f$: 60 Hz
- **Max. inputpower** $P_{e,max}$: 0.40 kW
- **Max. current** $I_{max}$: 3.4 A
- **Speed** $N$: 950 1/min

### Additional Details:
- **Asynchronous motor, 1ph, 60 Hz**
- **Filter Fan Units**
- **Fan Data**
RHA 0912-231-4E11-BAS

Data for duty point:

- Air velocity $v$: $0.35 \text{ m/s}$ ($q_v = 1360 \text{ m}^3/\text{h}$)
- Fan static pressure $p_{sf}$: $170 \text{ Pa}$ (unit without filter, with inlet guard)
- Voltage $U$: $195 \text{ V}$
- Speed $N$: $970 \text{ 1/min}$ (on request)
- Input Power $P_e$: $238 \text{ W}$
- Current $I$: $1.26 \text{ A}$ (on request)
- Sound pressure level $L_{pA1.5}$: $51 \text{ dB}$ (with filter, A-weighted)
- Sound pressure levels at octave frequencies (on request)

Air density $= 1.15 \text{ kg/m}^3$

Fan Data

- Fan type: RLA 21-0315-4E-S
- Motor type: MFA F1-0911-4E-K1-C0-S
- Operating capacitor: $6 \mu\text{F}$
- Voltage $U$: $220 \text{ V, 1~}$
- Input power $P_e$: $260 \text{ W}$
- A-weighted sound pressure level at 1.5m distance (mid filter) $L_{pA1.5}$ dB
- A-weighted sound power level $L_{pWA6}$ dB
- Fan weight (steel) $m$: $49 \text{ kg (without filter)}$
- Fan weight (aluminium) $m$: $35 \text{ kg (without filter)}$
- Voltage $U$: $220 \text{ V, 1~}$
- Frequency $f$: $50 \text{ Hz}$
- Max. inputpower $P_{e,max}$: $0.30 \text{ kW}$
- Max. current $I_{max}$: $1.37 \text{ A}$
- Speed $N$: $1060 \text{ 1/min}$
Air density = 1.15 kg/m³

Data for duty point:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air velocity v</td>
<td>0.35 m/s</td>
</tr>
<tr>
<td>Fan static pressure P_{sf}</td>
<td>170 Pa</td>
</tr>
<tr>
<td>Voltage U</td>
<td>100 V</td>
</tr>
<tr>
<td>Speed N</td>
<td>980 1/min</td>
</tr>
<tr>
<td>Input Power P_e</td>
<td>195 W</td>
</tr>
<tr>
<td>Current I</td>
<td>2.1 A</td>
</tr>
<tr>
<td>Sound pressure level P_{a,F}</td>
<td>51 dB</td>
</tr>
<tr>
<td>Volume flowrate q_{v}</td>
<td>1360 m³/h</td>
</tr>
<tr>
<td>Sound pressure levels at octave frequencies</td>
<td>dB</td>
</tr>
</tbody>
</table>

Fan Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan weight m</td>
<td>49 kg</td>
</tr>
<tr>
<td>Fan weight (aluminium) m</td>
<td>35 kg</td>
</tr>
<tr>
<td>Voltage U</td>
<td>120 V</td>
</tr>
<tr>
<td>Frequency f</td>
<td>60 Hz</td>
</tr>
<tr>
<td>Max. inputpower P_{e,max}</td>
<td>0.24 kW</td>
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<tr>
<td>Max. current I_{max}</td>
<td>2.1 A</td>
</tr>
<tr>
<td>Speed N</td>
<td>1070 1/min</td>
</tr>
</tbody>
</table>

Asynchronous motor

1ph, 60 Hz

Filter Fan Units

RHA 0912-231-6E41-BAS

900x1200 (3'x4')
Filter Fan Unit

**RHA 0612-331-4E11-BAS**

Asynchronous motor
1ph, 50 Hz

**Data for duty point:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air velocity  ( v )</td>
<td>0.35 m/s (( q_v = 910 ) m³/h)</td>
</tr>
<tr>
<td>Fan static pressure  ( \rho_{SF} )</td>
<td>170 Pa (unit without filter, with inlet guard)</td>
</tr>
<tr>
<td>Voltage  ( U )</td>
<td>175 V</td>
</tr>
<tr>
<td>Speed  ( N )</td>
<td>1240 1/min (on request)</td>
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<tr>
<td>Input Power  ( P_e )</td>
<td>155 W</td>
</tr>
<tr>
<td>Current  ( I )</td>
<td>0.92 A (on request)</td>
</tr>
<tr>
<td>Sound pressure level  ( L_{PA1.5} )</td>
<td>54 dB (with filter, A-weighted)</td>
</tr>
<tr>
<td>Sound pressure levels at octave frequencies</td>
<td>(on request)</td>
</tr>
<tr>
<td>Octave frequency</td>
<td>63 125 250 500 1000 2000 4000 8000 Hz</td>
</tr>
<tr>
<td>Sound pressure level unweighted</td>
<td>61 62 53 50 49 46 38 29 dB</td>
</tr>
<tr>
<td><strong>Fan Data</strong></td>
<td></td>
</tr>
<tr>
<td>Fan type</td>
<td>RLA 31-2831-4E-S</td>
</tr>
<tr>
<td>Motor type</td>
<td>MFA F0-0908-4E-K1-CD-S</td>
</tr>
<tr>
<td>Operating capacitor</td>
<td>4 µF</td>
</tr>
<tr>
<td>U Voltage</td>
<td>V</td>
</tr>
<tr>
<td>( P_e ) Input power</td>
<td>W</td>
</tr>
<tr>
<td>( L_{PA1.5} ) A-weighted sound pressure level at 1.5m distance (mid filter) dB</td>
<td>61</td>
</tr>
<tr>
<td>( L_{WA6} ) A-weighted sound power level = ( L_{PA1.5} + 10 ) dB</td>
<td>51</td>
</tr>
<tr>
<td>Fan weight (steel)</td>
<td>m</td>
</tr>
<tr>
<td>Fan weight (aluminium)</td>
<td>m</td>
</tr>
<tr>
<td>Voltage</td>
<td>U</td>
</tr>
<tr>
<td>Frequency</td>
<td>f</td>
</tr>
<tr>
<td>Max. input power</td>
<td>( P_{e,\text{max}} )</td>
</tr>
<tr>
<td>Max. current</td>
<td>( I_{\text{max}} )</td>
</tr>
<tr>
<td>Speed</td>
<td>N</td>
</tr>
</tbody>
</table>

Air density  \( = 1.15 \) kg/m³
Filter Fan Units

**RHA 0612-231-6E41-BAS**

**Asynchronous motor**
1ph, 60 Hz

**600x1200 (2’x4’)**

---

### Data for duty point:

- **Air velocity** $v$: 0.35 m/s ($q_v = 910 \text{ m}^3/\text{h}$)
- **Fan static pressure** $p_{sf}$: 170 Pa (unit without filter, with inlet guard)
- **Voltage** $U$: 108 V
- **Speed** $N$: 920 1/min (on request)
- **Input Power** $P_e$: 162 W (on request)
- **Current** $I$: 1.57 A
- **Sound pressure level** $L_{pA1.5}$: 50 dB (with filter; A-weighted)
- **Sound pressure levels at octave frequencies** (on request)
  - **Octave frequency**: 63, 125, 250, 500, 1000, 2000, 4000, 8000 Hz
  - **Sound pressure level** unweighted: 61, 55, 47, 45, 46, 41, 33, 25 dB

---

### Fan Data

<table>
<thead>
<tr>
<th>Fan type</th>
<th>RLA 21-0315-6E-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor type</td>
<td>MFA F0-0908-6E-K1-A0-S</td>
</tr>
<tr>
<td>Operating capacitor</td>
<td>12 µF</td>
</tr>
<tr>
<td>U</td>
<td>Voltage</td>
</tr>
<tr>
<td>$P_i$</td>
<td>Input power</td>
</tr>
<tr>
<td>$L_{pA1.5}$</td>
<td>$A$-weighted sound pressure level at 1.5m distance (mid filter) dB</td>
</tr>
<tr>
<td>$L_{pA1.5}$</td>
<td>$A$-weighted sound power level $= L_{pA1.5} + 10 \text{ dB}$</td>
</tr>
<tr>
<td>$P_e$</td>
<td>140 W</td>
</tr>
<tr>
<td>$L_{pA1.5}$</td>
<td>51 dB</td>
</tr>
<tr>
<td>$U$</td>
<td>120 V, 1~</td>
</tr>
<tr>
<td>Frequency</td>
<td>f</td>
</tr>
<tr>
<td>$P_{e,\text{max}}$</td>
<td>0.20 kW</td>
</tr>
<tr>
<td>Max. current</td>
<td>$I_{\text{max}}$</td>
</tr>
<tr>
<td>Speed</td>
<td>N 940 1/min</td>
</tr>
</tbody>
</table>

### Fan weight

- **Steel**: 43 kg (without filter)
- **Aluminium**: 32 kg (without filter)

---

### Air density

$\text{Air density } = 1.15 \text{ kg/m}^3$
### Filter Fan Unit

#### RHA 1212-240-6DB4-A

**Asynchronous motor**
3ph, 60 Hz

**1200x1200 (4'x4')**

**Air density** = 1.15 kg/m³

---

#### Data for Duty Point:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air velocity v (m/s)</td>
<td>0.35</td>
</tr>
<tr>
<td>Fan static pressure pₓ F (Pa) (unit without filter, with inlet guard)</td>
<td>170 Pa</td>
</tr>
<tr>
<td>Voltage U</td>
<td>290 V</td>
</tr>
<tr>
<td>Speed N</td>
<td>850 1/min (on request)</td>
</tr>
<tr>
<td>Input Power Pₑ</td>
<td>290 W</td>
</tr>
<tr>
<td>Current I</td>
<td>0.73 A (on request)</td>
</tr>
<tr>
<td>Sound pressure level LₚA₁.₅ (with filter, A-weighted)</td>
<td>48 dB</td>
</tr>
<tr>
<td>Sound pressure levels at octave frequencies (on request)</td>
<td></td>
</tr>
<tr>
<td>Octave frequency</td>
<td>63 Hz</td>
</tr>
<tr>
<td>Sound pressure level</td>
<td>63 Hz</td>
</tr>
<tr>
<td>Unweighted</td>
<td></td>
</tr>
</tbody>
</table>

#### Fan Data

- **Fan type**: RLA 21-0400-6D-S
- **Motor type**: MFA F0-1112-6D-K7-91-S

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>U Voltage V</td>
<td></td>
</tr>
<tr>
<td>Pₑ Input power W</td>
<td></td>
</tr>
<tr>
<td>LₚA₁.₅ A-weighted sound pressure level at 1.5m distance (mid filter) dB</td>
<td></td>
</tr>
<tr>
<td>LₚA₁.₅ A-weighted sound power level = LₚA₁.₅ + 10 dB</td>
<td></td>
</tr>
</tbody>
</table>

#### Fan Weight

<table>
<thead>
<tr>
<th>Material</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>55</td>
</tr>
<tr>
<td>Aluminium</td>
<td>38</td>
</tr>
</tbody>
</table>

#### UL Certification

- **480V - valid for UL version**

---

**Filter Fan Units**

---
Filter Fan Units

RHA 1212-240-6E45-BAS

Asynchronous motor
1ph, 60 Hz

1200x1200
(4’x4’)

Air density = 1.15 kg/m³

Data for duty point:
- Air velocity \( v = 0.35 \text{ m/s} \) (\( q_v = 1815 \text{ m}^3/\text{h} \))
- Fan static pressure \( p_{sf} = 170 \text{ Pa} \) (unit without filter, with inlet guard)
- Voltage \( U = 99 \text{ V} \)
- Speed \( N = 850 \text{ 1/min} \) (on request)
- Input Power \( P_e = 325 \text{ W} \)
- Current \( I = 3.6 \text{ A} \) (on request)
- Sound pressure level \( L_{PA1.5} = 53 \text{ dB} \) (with filter, A-weighted)
- Sound pressure levels at octave frequencies
- Octave frequency
- Sound pressure level unweighted

Fan type: RLA 21-0400-6E-S
Motor type: MFA F0-1117-6E-K7-A1-S
Operating capacitor: 25 µF
Voltage: U
Input power: \( P_e = 360 \text{ W} \)

Fan Data

<table>
<thead>
<tr>
<th>Fan Data</th>
<th>115V - valid for UL-version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan type</td>
<td>RLA 21-0400-6E-S</td>
</tr>
<tr>
<td>Motor type</td>
<td>MFA F0-1117-6E-K7-A1-S</td>
</tr>
<tr>
<td>Operating capacitor</td>
<td>25 µF</td>
</tr>
<tr>
<td>U Voltage</td>
<td>V</td>
</tr>
<tr>
<td>( P_e ) Input power</td>
<td>W</td>
</tr>
<tr>
<td>( L_{PA1.5} ) A-weighted sound pressure level at 1.5m distance (mid filter) dB</td>
<td></td>
</tr>
<tr>
<td>( L_{AWE} ) A-weighted sound power level = ( L_{PA1.5} + 10 \text{ dB} )</td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>U</td>
</tr>
<tr>
<td>Input power</td>
<td>( P_e ) max</td>
</tr>
<tr>
<td>Max. input power</td>
<td>0.42 kW</td>
</tr>
<tr>
<td>Max. current</td>
<td>3.6 A</td>
</tr>
<tr>
<td>Speed</td>
<td>N</td>
</tr>
<tr>
<td>1030 1/min</td>
<td></td>
</tr>
</tbody>
</table>
Filter Fan Unit
RHA 0912-231-6DB3-A

Air density = 1.15 kg/m³

Data for duty point:
- Air velocity \( v \) 0.35 m/s \((q_v = 1360 \text{ m}^3/\text{h})\)
- Fan static pressure \( p_{f1} \) 170 Pa \( (\text{unit without filter, with inlet guard})\)
- Voltage \( U \) 260 V
- Speed \( N \) 980 1/min \( (\text{on request})\)
- Input Power \( P_e \) 175 W
- Current \( I \) 0.49 A \( (\text{on request})\)
- Sound pressure level \( L_{pA1.5} \) 51 dB \( (\text{unit without filter, A-weighted})\)
- Sound pressure levels at octave frequencies
  - Octave frequency Hz
  - Sound pressure level dB

Values:
- \( L_{pA1.5} = 51 \text{ dB} \)
- \( L_{pA1.5} = 55 \text{ dB} \)
- \( L_{pA6} = 59 \text{ dB} \)
- \( L_{pA10} = 47 \text{ dB} \)
- \( L_{pA20} = 39 \text{ dB} \)
- \( L_{pA40} = 30 \text{ dB} \)
- \( L_{pA60} = 23 \text{ dB} \)
- \( L_{pA100} = 19 \text{ dB} \)
- \( L_{pA200} = 16 \text{ dB} \)
- \( L_{pA400} = 12 \text{ dB} \)
- \( L_{pA800} = 9 \text{ dB} \)
- \( L_{pA1600} = 7 \text{ dB} \)
- \( L_{pA3200} = 5 \text{ dB} \)

Fan Data
- Fan type RLA 21-0315-6D-S
- Motor type MFA F0-1112-6D-K7-91-S
- Voltage \( U \) 480 V \( (\text{Y}), 3~\)
- Frequency \( f \) 60 Hz
- Input power \( P_\text{in} \) W
- Maximum input power \( P_{\text{in,max}} \) 0.25 kW
- Maximum current \( I_{\text{max}} \) 0.55 A
- Speed \( N \) 1140 1/min

480V - valid for UL-version

49 kg (without filter)
35 kg (without filter)

Fan weight (steel) m
Fan weight (aluminium) m
Voltage U
Max. inputpower \( P_{\text{in,max}} \)
Max. current \( I_{\text{max}} \)
Speed \( N \)
Filter Fan Units

RHA 0912-231-6E43-BAS

Asynchronous motor 1ph, 60 Hz

Air density = 1.15 kg/m³

Data for duty point:
- Air velocity \( v \): 0.35 m/s
- Fan static pressure \( p_{sf} \): 170 Pa (unit without filter, with inlet guard)
- Voltage \( U \): 100 V
- Speed \( N \): 980 1/min (on request)
- Input Power \( P_e \): 195 W (on request)
- Current \( I \): 2.1 A
- Sound pressure level \( L_{pA1.5} \): 51 dB (with filter: A-weighted)
- Sound pressure levels at octave frequencies:
  - Octave frequency: 63, 125, 250, 500, 1000, 2000, 4000, 8000 Hz
  - Sound pressure level: 59, 55, 50, 49, 46, 43, 33, 24 dB (unweighted)

Voltage \( U \): 120 V, 1~
Frequency \( f \): 60 Hz
Max. input power \( P_{e, max} \): 0.24 kW
Max. current \( I_{max} \): 2.1 A
Speed \( N \): 1070 1/min

Fan Data

<table>
<thead>
<tr>
<th>Fan type</th>
<th>RLA 21-0315-6E-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor type</td>
<td>MFA F0-0911-6E-K7-A0-S</td>
</tr>
<tr>
<td>Operating capacitor</td>
<td>16 µF</td>
</tr>
<tr>
<td>Voltage ( U )</td>
<td>V</td>
</tr>
<tr>
<td>Input power ( P_i )</td>
<td>W</td>
</tr>
<tr>
<td>( L_{pA1.5} )</td>
<td>A-weighted sound pressure level at 1.5m distance (mid filter) dB</td>
</tr>
<tr>
<td>( L_{pA1.5, B} )</td>
<td>A-weighted sound power level = ( L_{pA1.5} + 10 ) dB</td>
</tr>
</tbody>
</table>

Fan weight (steel): 49 kg
Fan weight (aluminum): 35 kg

Fan Data

<table>
<thead>
<tr>
<th>115V - valid for UL-version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan weight (steel): 49 kg (without filter)</td>
</tr>
<tr>
<td>Fan weight (aluminum): 35 kg (without filter)</td>
</tr>
<tr>
<td>Voltage ( U ): 120 V, 1~</td>
</tr>
<tr>
<td>Frequency ( f ): 60 Hz</td>
</tr>
<tr>
<td>Max. input power ( P_{e, max} ): 0.24 kW</td>
</tr>
<tr>
<td>Max. current ( I_{max} ): 2.1 A</td>
</tr>
<tr>
<td>Speed ( N ): 1070 1/min</td>
</tr>
</tbody>
</table>

33
Filter Fan Unit

RHA 0612-331-4DB4-A

**Data for duty point:**
- Air velocity $v$ = 0.35 m/s ($q_v = 910 \text{ m}^3/\text{h}$)
- Fan static pressure $p_{sf}$ = 170 Pa (unit without filter, with inlet guard)
- Voltage $U$ = 240 V
- Speed $N$ = 1240 1/min (on request)
- Input Power $P_e$ = 189 W
- Current $I$ = 0.56 A (on request)
- Sound pressure level $L_{PA1.5}$ = 50 dB (with filter, A-weighted)
- Sound pressure levels at octave frequencies (on request)
- Octave frequency 63 125 250 500 1000 2000 4000 8000 Hz
- Sound pressure level unweighted 60 63 51 44 41 38 32 25 dB

Air density = 1.15 kg/m³
Filter Fan Units

RHA 0612-231-6E43-BAS

Air density = 1.15 kg/m³

Fan static pressure $p_{f}$, 170 Pa (unit without filter, with inlet guard)
Speed $N$, 920 1/min (on request)
Input Power $P_{e}$, 172 W (on request)
Current $I$, 2.0 A (on request)
Sound pressure level $L_{pA,1.5}$, 50 dB (with filter, A-weighted)
Sound pressure levels at octave frequencies (on request)

Data for duty point:
- Air velocity $v$, 0.35 m/s ($q_v = 910$ m³/h)
- Fan static pressure $p_{f}$, 170 Pa
- Voltage $U$, 92 V
- Speed $N$, 920 1/min (on request)
- Input Power $P_{e}$, 172 W (on request)
- Current $I$, 2.0 A (on request)
- Sound pressure level $L_{pA,1.5}$, 50 dB (with filter, A-weighted)
- Sound pressure levels at octave frequencies (on request)
- Octave frequency 63, 125, 250, 500, 1000, 2000, 4000, 8000 Hz
- Sound pressure level unweighted

Fan type: RLA 21-0315-6E-S
Motor type: MFA F0-0911-6E-K7-A0-S
Operating capacitor 16 μF
Voltage $U$, 120 V, 1~
Frequency $f$, 60 Hz
Max. current $I_{max}$, 2.1 A

115 V - valid for UL-version
- Max. input power $P_{e, max}$, 0.24 kW
- Speed $N$, 1070 1/min

Fan Data

<table>
<thead>
<tr>
<th>Fan type</th>
<th>RLA 21-0315-6E-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor type</td>
<td>MFA F0-0911-6E-K7-A0-S</td>
</tr>
<tr>
<td>Operating capacitor</td>
<td>16 μF</td>
</tr>
<tr>
<td>Voltage</td>
<td>V</td>
</tr>
<tr>
<td>$P_{e}$, Input power</td>
<td>W</td>
</tr>
<tr>
<td>$L_{pA,1.5}$, A-weighted sound pressure level at 1.5m distance (mid filter) dB</td>
<td></td>
</tr>
<tr>
<td>$L_{pA}$, A-weighted sound power level</td>
<td></td>
</tr>
</tbody>
</table>

35
The results are brilliant technical solutions, patents on new findings and a steadily growing reference list …