

ebm-papst Muldingen GmbH & Co. KG

Bachmühle 2
74673 Muldingen
Germany
Phone +49 7938 81-0
Fax +49 7938 81-110
info1@de.ebmpapst.com
www.ebmpapst.com

Limited partnership • Headquarters Muldingen
Stuttgart District Court • HRA 590344
General partner Elektrobau Muldingen GmbH • Headquarters Muldingen
Stuttgart District Court • HRB 590142

Contents

1. Use	1
2. Safety regulations and instructions	1
2.1. Hazard levels for warnings	1
2.2. Personnel qualifications	1
2.3. Basic safety rules	1
2.4. Transportation and handling	2
3. Installation and connection	2
3.1. Installation space	2
3.2. Installation position and attachment of RadiPac fans with support bracket	2
3.3. Installation position and attachment of RadiPac fans with cube design	3
4. Vibration-absorbing elements	4
4.1. Basic principles	4
4.2. Selection of vibration-absorbing elements	4
4.2.1. Minimum speed	4
4.2.2. Consequences of selecting unsuitable vibration-absorbing elements	4
4.3. Special features of parallel operation in FanGrid	5
4.4. Recommendations for electrical hookup of a FanGrid	5
5. Commissioning	6
5.1. In situ vibration measurement	6
5.1.1. Vibration measurement on RadiPac with cube design	6
5.1.2. Vibration measurement for RadiPac with support bracket	6
5.2. Action to be taken in the event of excessive vibrational loading	6

1. USE

This guide is intended solely to provide assistance with the installation of centrifugal fans from the ebm-papst RadiPac product range in ventilation systems or AHUs.

It is not to be used instead of the fan operating instructions.

2. SAFETY REGULATIONS AND INSTRUCTIONS

Read this installation guide carefully before starting work. Observe the following warnings to prevent malfunctions or danger to persons. This installation guide may be duplicated and distributed to inform about potential dangers and their prevention.

Also observe the safety information in the fan operating instructions. Make sure the fan operating instructions are always to hand at the installation location.

2.1. Hazard levels for warnings

The following hazard levels are used in this installation guide to indicate potentially hazardous situations and important safety regulations:

**DANGER**

Indicates an imminently hazardous situation which will result in serious injury or even death if the specified actions are not taken. Compliance with the instructions is imperative.

**WARNING**

Indicates a potentially hazardous situation which will result in serious injury or even death if the specified actions are not taken. Exercise extreme caution while working.

**CAUTION**

Indicates a potentially hazardous situation which will result in slight or minor injury or damage to property if the specified actions are not taken.

NOTE

A potentially harmful situation can occur and, if not avoided, will lead to property damage.

2.2. Personnel qualifications

The device is only to be transported, unpacked, installed, operated, maintained and otherwise used by suitably qualified, trained and authorized technical staff.

Only authorized specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

2.3. Basic safety rules

The safety hazards associated with the device must be assessed again following installation in the end product.

The device is not to be modified or converted and no attachments are to be fitted without the approval of ebm-papst.



2.4. Transportation and handling

- Take care not to damage the impeller during transportation and installation. The impeller is not to be subjected to load.
- Set down the fan on a suitable surface to prevent any damage.
- Do not subject the impeller to any impact, as this could cause bearing damage or damage arising from imbalance, for example.
- Use appropriate hoisting equipment to prevent damage to the impeller or support structure.
- Pay attention to the information on the device and in the fan operating instructions.

3. INSTALLATION AND CONNECTION

3.1. Installation space

Installation losses may occur if a centrifugal fan is fitted in a confined space. The loss in fan output to be expected can be estimated from the curve shown (Fig. 1).

For boxes with a square cross-section, the hydraulic diameter is to be calculated from the width and height and the value then divided by the impeller diameter.

The correction factor for the air flow can then be read off the graph on the basis of this value.

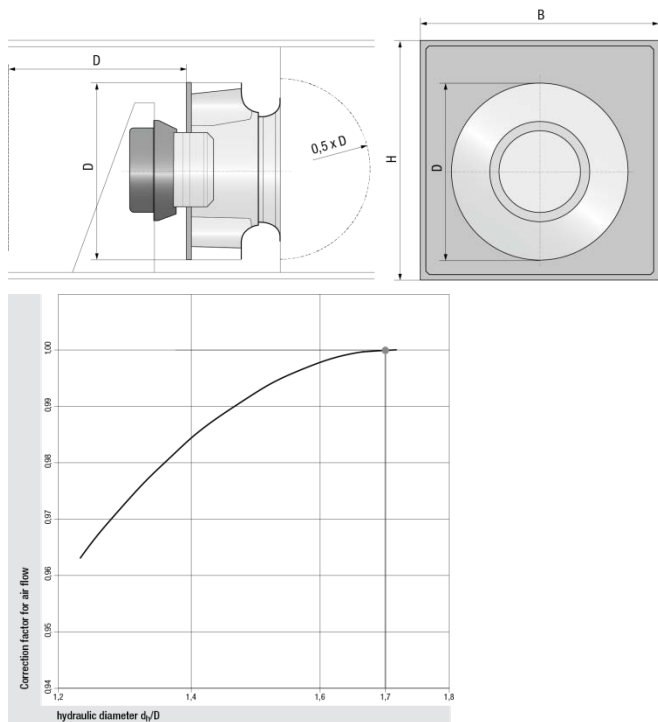


Fig. 1: Determination of output loss in confined installation space for RadiPac fans

d_h	Hydraulic diameter: $d_h = 2 \times B \times H / (B + H)$
B	Width of the installation space
H	Height of the installation space
D	Outer diameter of the fan

In the case of obstructions on the inflow side, noise emissions caused thereby can be reduced by fitting a FlowGrid air inlet grill from ebm-papst.



Fig. 2: FlowGrid for centrifugal fans

3.2. Installation position and attachment of RadiPac fans with support bracket

RadiPac devices with support bracket can be installed with the shaft horizontal or with the shaft vertical and the rotor at the bottom.

- Vertical shaft with rotor at the top on request only.
- In the case of installation with the shaft horizontal, the weld between the support struts and motor support plate must always be perpendicular
- Cable glands must always face downward to prevent the ingress of moisture.

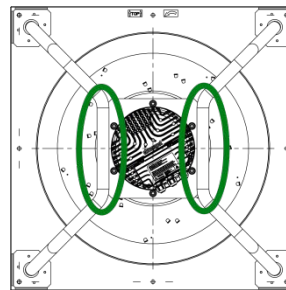


Fig. 3: Perpendicular weld with wall installation

- Pay attention to the information on the fan and in the fan operating instructions.
- A RadiPac with support bracket is designed for installation on the device wall.
- No provision is made for isolation of the fan with vibration-absorbing elements.

Attachment of fan to pressure wall

- Installation of the fan produces a new oscillatory arrangement.
- This arrangement must not exhibit any impermissibly severe vibration in the speed control range.
- See Section 4 for limit values.
- The transmission of vibration from external parts of the installation to the fan must also be avoided.
- The mechanical design of the pressure wall or air duct must ensure that no resonance occurs in the intended speed control range.

To prevent leakage, it is advisable to seal off the fan from the air duct or pressure wall.

Sealing with edge protection profile

For a RadiPac with support bracket, sealing can take the form of edge protection with sealing lips. The edge protection profile is fitted to the edge of the support plate.

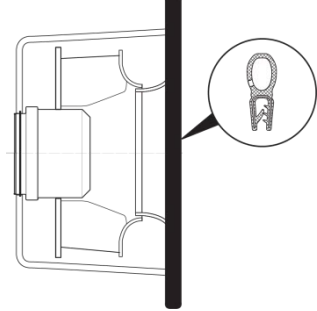


Fig. 4: Side view of a RadiPac with support bracket and edge protection profile on the intake side.

Sealing with elastic sealing material

Sealing can be achieved by attaching a suitable sealing material to the front of the fan.

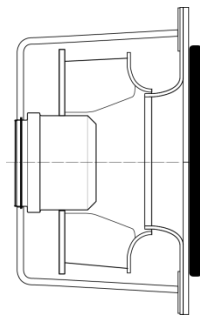


Fig. 5: RadiPac View of the intake side with foam sealant

3.3. Installation position and attachment of RadiPac fans with cube design

RadiPac centrifugal fans with cube design are intended solely for installation on the bottom of the device. They can be installed with either the shaft horizontal or the shaft vertical and with the rotor at the bottom. Vertical shaft with rotor at the top is only available on request.

There are two mounting options for installation with the shaft horizontal:

- Fixed floor mounting with flexible intake-side connection
- Floor mounting with vibration-absorbing elements and flexible intake-side connection

The cube design is not suitable for mounting on a wall. The cable glands on the control electronics must face downward.

Attachment of fan to pressure wall

- Check the stability of the device structure.
- Installation of the fan produces a new oscillatory arrangement.
- This arrangement must not exhibit any impermissibly severe vibration in the speed control range.
- See Section 4 for limit values.
- This also applies to the transmission of vibration from external parts of the installation to the fan.

To prevent leakage, it is advisable to seal off the fan from the pressure wall.

Sealing with elastic connecting elements

Bellow expansion sleeves can be used for the RadiPac with cube design.

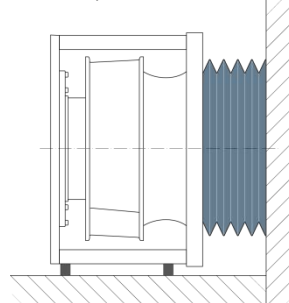


Fig. 6: Side view of a RadiPac with cube design and bellow expansion sleeve on the intake side

Sealing with sealing material

Sealing can be achieved by attaching a suitable sealing material to the front of the fan.

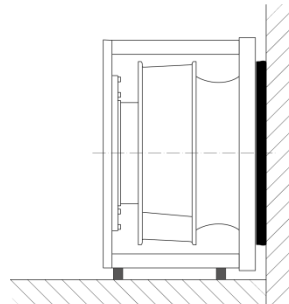


Fig. 7: RadiPac View of the intake side with sealing material

4. VIBRATION-ABSORBING ELEMENTS

4.1. Basic principles

Fans with vibration-absorbing elements pass through three ranges of relevance to vibration during start-up:

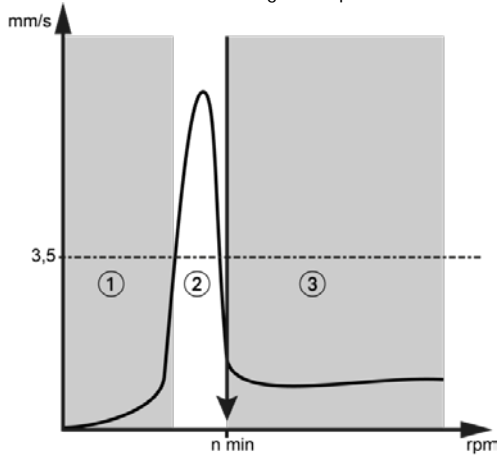


Fig. 8: Example of a vibration curve over the speed range of a fan with vibration-absorbing elements

① Range below resonant frequency:

In this range the vibration severity is below the permissible limit value of 3.5 mm/s.

Operation of the fan is possible in this range, but the vibration-absorbing elements have no effect for physical reasons.

② Range close to the resonant frequency:

In this speed range, the vibration velocity is sometimes well above the permissible limit value.

There is no immediate damage to the device, but lengthy operation in this range will shorten the overall service life.

High noise levels occur.

This speed range should be passed through as quickly as possible! Sustained operation in this range must always be avoided!

③ Range above resonant frequency:

The speed range in which the vibration level is well below the limit value starts sufficiently far from the resonance peak.

In this range, above the minimum speed (n_{min}), the vibration-absorbing elements are able to isolate the fan from the vibrations of the installation or the building.

4.2. Selection of vibration-absorbing elements

When installing ventilation systems on or in buildings, it is often the case that no consideration is given to the fact that the vibrations of the building, of the actual ventilation system and of the fan influence one another.

Fans with a cube design can be mounted on vibration-absorbing elements (rubber buffers or springs).

The purpose of the vibration-absorbing elements is to isolate the device or the building from the vibrations caused by the fans.

The RadiPac catalog contains the vibration-absorbing elements available as accessories from ebm-papst.

The corresponding minimum speeds can also be found in the catalog. It should however be remembered that the use of vibration-absorbing elements creates a new, additional spring-mass system that may behave differently than that of the individual fan.

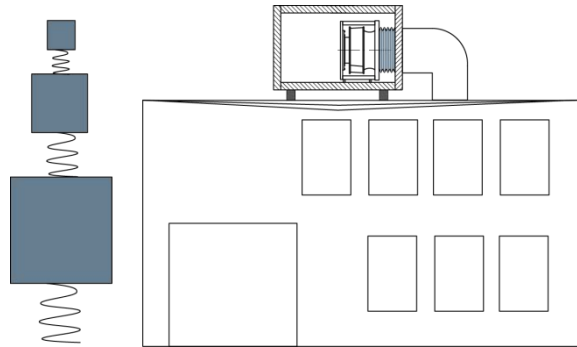


Fig. 9: Oscillatory configuration: Fan, ventilation unit, building

Therefore, the selection of the appropriate rocker elements may be possible only after an in situ vibration measurement in the installed state (see Section 5.1).

The following generally applies:

- It is essential to know the fan operating speed in the application when selecting vibration-absorbing elements for fans.
- Vibration measurement is to be performed on commissioning (see Section 5).
- The vibrations must be measured under all the relevant operating conditions (e.g. different speeds, fluctuating back pressure).
- For all fans, the vibration velocity must be below the limit value of 3.5 mm/s over the planned operating speed ranges.
- It must be ensured that vibration of the installation as a whole does not have any negative effects on use of the RadiPac fan.
- It is not permissible for multiple fans to be placed on the same set of vibration-absorbing elements.

4.2.1. Minimum speed

The minimum speed given in the catalog always relates to a single fan with vibration-absorbing elements without any allowance for external influences, e.g. from the device in which the fan is to be installed.

The installation of a fan with vibration-absorbing elements in a device creates a new oscillatory system with its own vibration characteristics. This may produce a shift in the resonant frequency range and hence in the minimum speed. This is generally difficult to predict.

Following installation of the fan in the application, it is therefore always essential to perform vibration measurement.

4.2.2. Consequences of selecting unsuitable vibration-absorbing elements

Incorrectly dimensioned vibration-absorbing elements do not adequately prevent the transmission of structure-borne noise. This may cause the entire ventilation system to resonate, thus resulting in a high noise level and damage to the fan.

The fan could be destroyed by unforeseeable resonant frequencies, caused by the installation as a whole or by other fans.

4.3. Special features of parallel operation in FanGrid

RadiPac with cube design

High air performance levels can be attained by connecting multiple fans in parallel. It is however essential to leave a sufficient amount of space between the fans on installation. For parallel operation, several fans are arranged side by side and one above the other in a compound (FanGrid). In such cases each individual fan must be installed separately. The entire mechanical structure must be adequately dimensioned for this. If the use of vibration-absorbing elements is envisaged, each fan must be individually isolated.

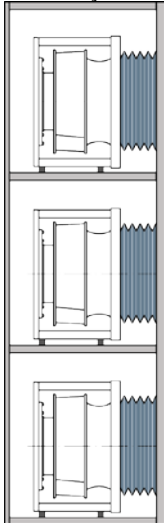


Fig. 10: Example of FanGrid installation with RadiPac with cube design

RadiPac with support bracket

A RadiPac with support bracket is fastened directly to the pressure wall. In this case, the connection to the pressure wall and the pressure wall itself must be stable enough to absorb the vibrations of the individual fans and of the installation as a whole.

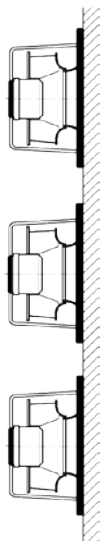


Fig. 11: Example of FanGrid installation with RadiPac with support bracket.

4.4. Recommendations for electrical hookup of a FanGrid



DANGER

The RadiPac fans are to be provided with individual line protection. Heed the operating instructions of the corresponding fan with regard to selection of the line protection fuses.

The simplest form of wiring for RadiPac fans is to have a separate power supply connection for each RadiPac fan and to connect all 0-10 V inputs in parallel.

- Note the following for 0-10 V wiring: Wire all 0-10 V inputs in parallel (e.g. with a patch panel).
- Individual actuation of the RadiPac fans is possible with the ebm-papst EC Controller (item no.: CCC000-AD06-02). The EC Controller permits individual regulation and separate monitoring of each individual fan (refer also to the operating instructions of the EC Controller).
- Note the following for BUS wiring: RS485 (RSA, RSB, GND) serial wiring with termination in accordance with the specifications of MODBUS.org (MODBUS over serial line spec).

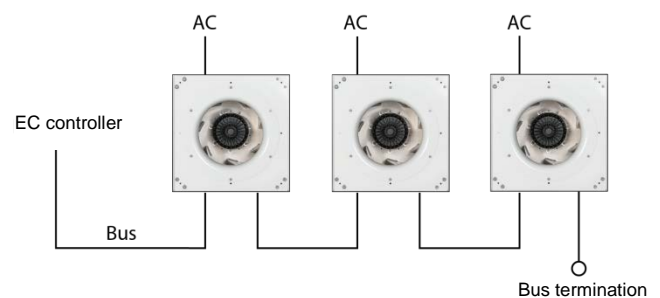


Fig. 12: Example of wiring with EC Controller

5. COMMISSIONING

5.1. In situ vibration measurement

The resonance characteristics of the fans must be checked in operation and in interaction with their environment and modified if necessary. The vibration level has to be determined and regions above the limit value avoided (see Section 4.2). The points of resonance also have to be identified and it must be ensured that these are not constantly attained in normal operation.

Regular observation of these points of resonance is necessary, at the very least at the intervals demanded in the operating instructions.

The vibration level of the fan is to be measured using a suitable vibration sensor.

The vibration characteristics must be determined at least in the axial direction and transversely thereto.

Measurement of the vibration in all three axes is recommended and should be performed over the entire speed range in order to obtain a complete picture of the vibrations occurring in the application.

- Repetition of measurements: Every 6 months.
- Increase the speed gradually, by 5% for example, and note down the readings in a table.

Speed in %	Speed in rpm	Vibration velocity in axis direction in mm/s (rms value)	Vibration velocity perpendicular to axis direction in mm/s (rms value)
10%			
15%			
...			
...			
100%			

Proposal for measurement protocol

- The balancing grade of ebm-papst RadiPac fans is G6.3 and is thus in dependence to ISO 14694 Industrial fans — Specifications for balance quality and vibration levels – application category BV-3.
- For flexibly mounted fans, ebm-papst recommends vibration velocities of less than 3.5 mm/s (rms) in accordance with the BV-3 grades.
- For rigidly mounted fans, ebm-papst recommends vibration velocities of less than 2.8 mm/s (rms) in accordance with the BV-3 grades.

5.1.1. Vibration measurement on RadiPac with cube design

An appropriate method is measurement at the motor fastening diameter on the motor support plate in the direction of the motor axis of rotation and perpendicular to this.

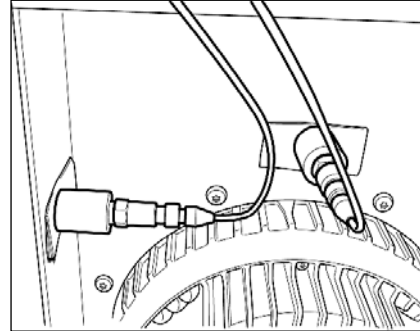


Fig. 13: Vibration measurement on RadiPac with cube design. The arrangement of the sensors depends on the device concerned and the installation situation.

5.1.2. Vibration measurement for RadiPac with support bracket

In the case of a support bracket, the sensors can be attached in axial direction as for the cube design. Measurements can be taken perpendicular to the motor axis by fitting a cube-shaped iron block with a magnet on the motor support plate. The magnetic vibration sensor is then attached to this iron block.

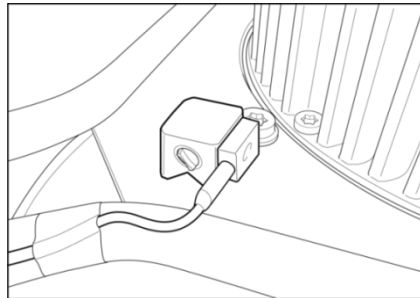


Fig. 14: Magnet as measuring aid

A more convenient method is to use a vibration sensor that takes measurements in all three directions from one measuring point (triaxial sensor)

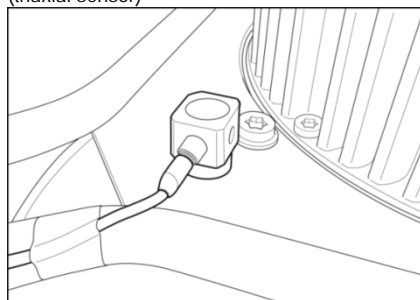


Fig. 15: Triaxial sensor

5.2. Action to be taken in the event of excessive vibrational loading

- More precise selection of vibration-absorbing elements
- Avoid dropping below minimum speed
- Pass through point of resonance quickly on start-up
- Always avoid resonant operation.
- Modify the design of the device/installation, e.g. using reinforcement braces.
- Ask the experts at ebm-papst.