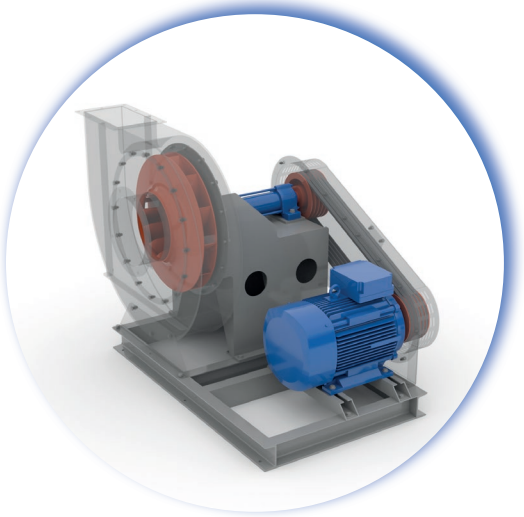

Operating and maintenance instructions for Zenner radial fans **Original**

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1 GENERAL INFORMATION

Please read through these operating instructions carefully. If you have any questions, please contact Zenner Ventilatoren Werke GmbH directly.

This technical documentation is a guide for proper operation and maintenance by competent personnel. It applies in conjunction with the technical knowledge and experience in the operation of turbomachinery and requires familiarisation with the generally applicable and local accident prevention regulations and with this documentation. Damage resulting from the non-observance of these operating instructions or improper handling is not covered by the warranty obligation of Zenner Ventilatoren Werke GmbH. The documentation should be made available to all persons responsible for the fan. Faults on the fan can only be avoided and trouble-free operation can only be guaranteed if the personnel are familiar with the operating instructions.

2 AREAS OF APPLICATION AND LIMITS OF USE

Zenner radial fans are built according to the state of the art and are safe to operate. They are subjected to quality control at the factory and leave the factory in perfect condition.

Zenner radial fans are used in equipment, machines and devices of numerous sectors for conveying air and air-gas mixtures. They are suitable for all processes requiring the conveyance of heat, moisture as well as solid components such as dust, grains, flakes, chips, scrap, fibres, grit, small threads, etc. The solid components can be made of various materials, such as
wood, wool, glass, plastic, sand, flour, ash, coal, metal, ceramics, paper, cardboard, straw, hay, salt, cement and other materials. They are used in equipment, devices and machines for: ventilation, air conditioning, extraction, dust removal, heating, cooling, drying, fresh air supply, flue gas removal, for conveying solids, for creating air curtains, air jets and air cushions, such as in the following equipment, industries and processes: workshops, factory workshops, storage rooms, paint shops and spray booths, laboratories, offices, dining and assembly rooms, cinemas, restaurants, club rooms, halls, telecom systems, combustion plants, textile machines, paper machines, drying systems, plant nurseries, air curtain systems, stables, garages, boiler houses, hospitals, shops, department stores, joiner‘s workshops,

foundries, wood processing, plastics processing, metal industry, textile industry, ceramics industry, wood drying, shipbuilding, air conditioners, cement industry, chip extraction systems, chemical processes and many more.

Limits of use:

The fans can be designed for the following areas of application:

•	Volume flow VRZ and VUZ:	from	0.02	to	30 m³/s
•	Volume flow VTZ:	from	0.02	to	25 m³/s
•	Total pressure increase:	from	50	to	15000 Pa
•	Temperature of the conveyed medium:	from	- 20	to	+ 800 °C
•	Type of conveyed medium:	all gases and gaseous mixtures with the exception of some toxic, chemically aggressive and explosive gases that belong to extreme explosion groups and temperature classes			
•	Ambient temperature:	from	- 20	to	+ 40 °C
•	Vibration stress:	for the contractually agreed areas of application, e.g. shipbuilding, railways, earthquake safety, etc.			
•	Solid additives:	generally up to 20 g dust per m³ air, for chip conveyance up to a concentration of 200 g/m³			
•	Operating mode:	Continuous operation unless otherwise agreed upon			

However, not every fan can be used for every application, because a special structural design may be required due to the wide range of external conditions.

Despite the high level of safety in the structural design, it must be pointed out that a fan may only be used for the contractually agreed application. In particular, it must be ensured that no higher loads act on the fan from the outside, e.g.:

- static or dynamic forces (vibrations; if elastic transition pieces to the air ducts, also referred to as expansion joints, and vibration isolators are provided between the valve door frame and the base, they must not be omitted or non-functional)
- higher ambient temperatures (bearing lubricants)
- higher temperatures of the conveyed medium
- unauthorised changes in speed leading to resonance vibrations of individual components, higher stress on material strength or excessive drive power
- higher solids content in the conveyed medium, which can lead to excessive wear or increased dust deposits and to unauthorised imbalances
- excessively deviating system resistance, which primarily affects the performance data, power consumption, sound power level and behaviour with respect to dust
- disturbances in the inflow area in front of the fan
- switching off and on too frequently

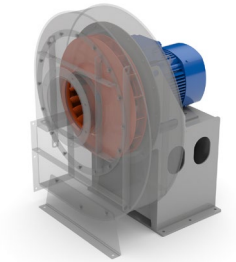
3 FAN DESIGN

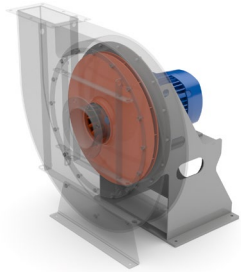
The radial fans can be designed with 3 different drive types:

- Design W: Direct drive, impeller on the shaft end of the electric motor
- Design Z: Drive via coupling and intermediate shaft
- Design F: Drive via V-belts and intermediate shaft

3.1 Desing W

In design W, power is transferred from the electric motor directly to the impeller by attaching the impeller to the shaft end of the motor.





The fan is made up of the following assemblies:

Impeller
Welded sheet steel construction, dynamically balanced to quality class 6.3 according to VDI 2060, strength dimensioned only for the contractually agreed speed, consisting of rotor blades, a base plate and a cover plate, fixed to the shaft by a hub.

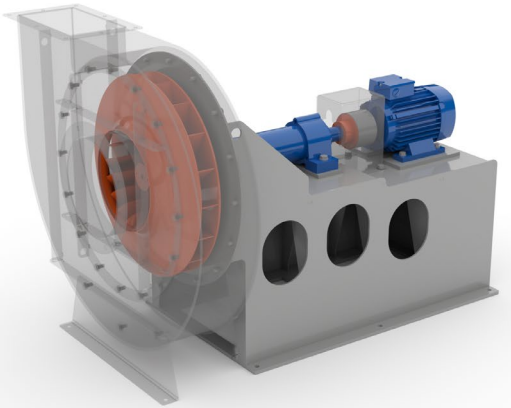
Spiral housing
Welded sheet steel construction, screwed to the motor base, casing position rotatable, if required: with labyrinth seal at the shaft end, if required: horizontally or otherwise divided, if required: with inspection opening, connection flanges for pipeline as per dimension sheet in accordance with DIN 24154,
the casing must not be subject to static loads due to connecting ducts, elastic transition pieces should be connected as a rule
(available as accessories).

Motor base
Welded sheet steel construction, to accommodate the electric motor and the volute casing, connection to the foundation can be either direct: Motor base foundation or indirectly: Motor base frame foundation or motor base anti-torsion / vibration isolator foundation (frame and vibration isolators available as accessories).

Electric motor
As a rule, an asynchronous short-circuit rotor is used. The impeller is attached to the shaft end. The normal scope of delivery ends with the terminal box.

3.2 Desing Z

In design Z, power is transmitted from the motor to the impeller via a coupling and an intermediate shaft, which is mounted separately.
In terms of vibration and strength, the construction is only dimensioned for the contractually agreed speed range. The intermediate bearing is necessary if the temperature of the conveyed medium is greater than 80°C or if the impeller mass is too much for the motor shaft end.



The fan is made up of the following assemblies:

Impeller
as above

Spiral housing
as above

Bearing pedestal
Is made of a welded sheet steel construction and serves to accommodate the bearings for the intermediate shaft, on which the impeller and one coupling half sit, as well as the electric motor with the other coupling half and the spiral housing. It is fixed to the foundation in the same way as for design W (base frame or anti-torsion frame and vibration isolators are available as accessories).

Intermediate bearing
Consisting of a loose and a fixed bearing (on the coupling side), designed as either 2 bearing housings or as a double bearing, generally roller bearings with grease quantity control.

Intermediate shaft
Steel shaft, supported in intermediate bearings, for holding the impeller and one coupling half, designed such that the operating speed is at least 20% below the critical speed of the rotor.

Coupling
Elastic pin or claw coupling

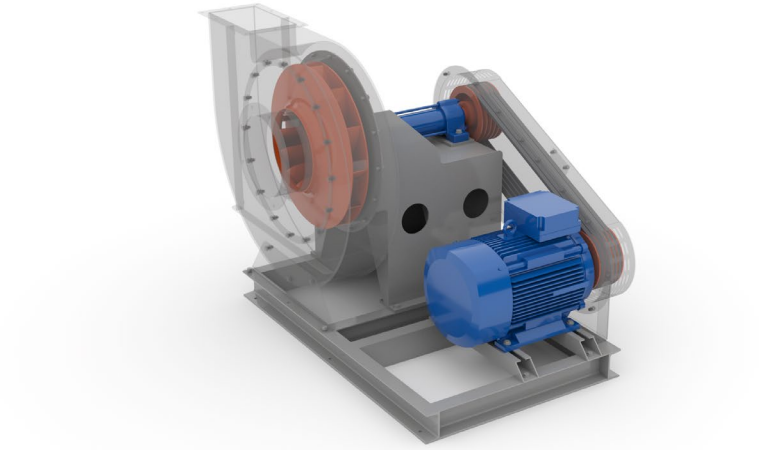
Coupling protection
Designed as contact protection

Electric motor
as above

Electrode radiator
If the temperature of the conveyed medium is greater than 80°C, in order to avoid heat transfer to the bearings, the material is generally aluminium.

3.3 Design F

In design F, power is transmitted from the motor to the impeller via a V-belt and an intermediate shaft, which is mounted separately.
In terms of vibration and strength, the construction is only dimensioned for the contractually agreed speed range. The intermediate bearing is necessary if the temperature of the conveyed medium is greater than 80°C or if the impeller mass is too much for the motor shaft end. Moreover, the operating point in the design phase can be precisely adjusted by means of an appropriate belt transmission.



The fan is made up of the following assemblies:

Impeller
as above

Spiral housing
as above

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Bearing pedestal
Welded sheet steel construction used to hold the bearings with the intermediate shaft on which the impeller and a V-belt pulley are attached as well as the spiral housing.

Intermediate bearing
Consisting of a loose and a fixed bearing (on the side of the V-belt pulley), designed as either 2 bearing housings or as a double bearing, generally roller bearings with grease quantity control.

Intermediate shaft
Steel shaft, supported in intermediate bearings, for holding the impeller and one V-belt pulley, designed such that the operating speed is at least 20% below the critical speed of the rotor.

V-belt pulleys
On the intermediate shaft and the motor shaft stub respectively.

V-belts
For power transmission from the motor to the intermediate shaft, with the number and dimensions depending on the power and the speed.

V-belt protection
Designed as contact protection.

Electric motor
Bolted to the base frame or anti-torsion frame, can be moved to tensioning the V-belts by loosening the screws.

Base or anti-torsion frame with vibration isolators
For holding the electric motor, the bearing pedestal and the spiral housing.

4 TRANSPORT INSTRUCTIONS

Fans are shipped in complete condition either unpacked on skids or in boxes. The vehicles, lifting gear and aids provided for transport must be adapted to the size and mass of the fan.

The fan may only be suspended from the fittings provided for this purpose. It is not permitted to suspend the fan from the motor lugs.

The fan may only be transported in its installation position. The relevant instructions on the packaging must be observed.

The fans must be secured on the means of transport against slipping, tilting and rubbing against each other and against other objects and side walls. With each transport and storage, care must be taken to ensure that no water enters the motor, the bearings or other sensitive components.

Any transport damage must be identified and repaired before assembly.

5 STORAGE OF FANS AND SPARE PARTS

Fans must be stored in such a way that their functioning cannot be impaired by the effects of moisture and dust. Strongly fluctuating temperatures must be avoided. Failure to observe this adequately may result in damage to electric motors, cable boxes, bearings, paint coatings and seals. It should be noted that not all paints are weatherproof, e.g. rust may easily form under the paint if only a primer coat is applied.

For longer periods of storage, the impeller should be rotated once a month. A marking on the shaft or on the impeller must be applied to ensure that the bearing is given a new, offset resting position after being rotated.

In case of very long storage periods (> 1 year), it is necessary to remove the old grease, wash out the bearings and add new grease before commissioning.

Spare parts should be stored in a temperature-controlled room at 15°C to 25°C.

- Rolling bearings
  The maximum storage period for rolling bearings in their original packaging is 2 years. Once this period elapses, the parts must be replaced
- Rubber-like materials
  Parts made of rubber-like materials, such as shaft seals, O-rings, flexible connectors, vibration dampers and V-belts, must be stored away from light.
  The parts should be checked annually for elasticity and brittleness. The maximum storage period is 5 years unless otherwise specified by the manufacturer
- Metal parts
  Metal parts, such as impellers, shafts, shaft sleeves, belt pulleys and bearing housings should be inspected annually. The preservation of machined surfaces must be repaired if necessary. Bare metal parts must be greased.

6 ASSEMBLY / INSTALLATION OF RADIAL FANS

6.1 Fan set-up

When setting up fans, the instructions according to DIN 4024 (Machine foundations; flexible structures that support machines with rotating elements) must be taken into account.

The fans may only be assembled in the mounting position for which they were ordered and equipped (horizontal / vertical).

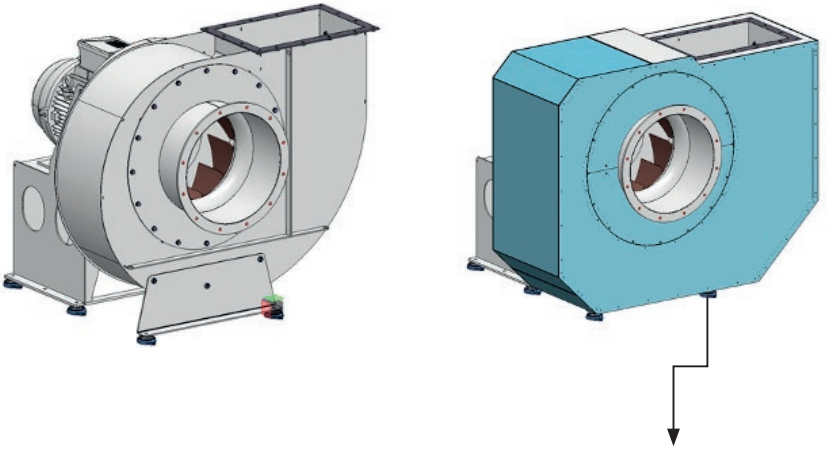
The fan must be mounted firmly and vibration-free on a level substructure. Care must be taken that the fan is not mechanically deformed or subject to unwanted forces in order to prevent the jamming or grinding of the impeller.

Pipe connections or other components must not exert any static or dynamic load on the fan. With the exception of the fan manufacturer's accessories, these must be supported upstream or downstream of the fan.

6.2 Vibration dampers

For vibration isolation of Zenner fans from foundations or supporting structures, vibration dampers are attached to the base as well as to the supporting foot. The size, number and hardness of the dampers are determined by the fan manufacturer in accordance with the requirements (weight, natural frequency, design). Zenner Ventilatoren Werke GmbH will not accept any warranty claims in the event of the unauthorised modification of the vibration dampers.

Arrangement and fastening of the vibration dampers



Support foot with internal thread
for vibration damper with stud

The vibration dampers must be screwed to the holes provided in the fan in an arrangement depending on the number of dampers specified.

If only 4 vibration dampers are sufficient, 2 must be attached to the end of the base and 2 to the support foot (vibration dampers are always mounted at these two positions!). For fans with housing insulation, the vibration dampers intended for the support base are fitted with a stud and can be screwed to the support base from below by means of the attached internal thread.
The dampers for the base, however, remain identical.

6.3 Expansion joints

The installation of elastic spacers (expansion joints) prevents the transmission of vibrations and noise that may emanate from the fan to the system.
The elastic connections must be installed in such a way that the fan has sufficient freedom of movement, especially when starting up. On the other hand, they must not be pressed together or displaced to such an extent that folds form, thereby obstructing the air flow.

Expansion joints are used to vibrationally isolate the fan from the ventilation system. They are not spacers!

The expansion joints are supplied as fabric or elastomer expansion joints depending on the intended use and may only be operated with the fan for which they are supplied. Furthermore, it must be ensured that the expansion joint is firmly connected to the fan and the system.

Each expansion joint supplied is adapted to the geometric dimensions, the conveyed medium and the customer-specific installation site of the respective fan system. For this reason, only the appropriate expansion joint should be used.

The following is a brief list of intended uses and improper uses:

Intended use:

- The expansion joint is firmly attached to the Zenner fan and the system.
- The expansion joint may only be operated in conjunction with the matching Zenner fan.
- The expansion joint is not subjected to tension or pressure.
- The mounting ducts between which the expansion joint is installed have no angular offset and are precisely aligned with each other.
- The temperature of the medium to be conveyed corresponds to the permissible temperatures of the respective expansion joint.
- The conveyed medium corresponds to the conveyed medium agreed with Zenner Ventilatoren Werke GmbH.

Improper use:

- Ambient conditions that were not agreed upon, e.g. excessive ambient temperature at the place of installation/use.
- The expansion joint must compensate for a length or angular offset between the mounting ducts.
- The expansion joint is subjected to tension or compression.
- The fan is operated with a conveyed medium that was not agreed upon.
- The conveyed medium deviates from the permissible temperatures.
- The expansion joint is operated in the system with transport lock (threaded spindle).

You can find further information on the handling of Zenner expansion joints in our **„Operating instructions for expansion joints“.**

6.4 Electrical connection

The motor should only be connected to the mains once the fan has been installed. The electrical connection of the fan motor must be established according to the circuit diagram in the terminal box or the manufacturer's instructions. It must be ensured that there is an unobstructed supply of cooling air to the motor. For this purpose, the specifications of the motor manufacturer must be observed.

The work may only be carried out by authorised specialists in compliance with the protection and safety regulations.

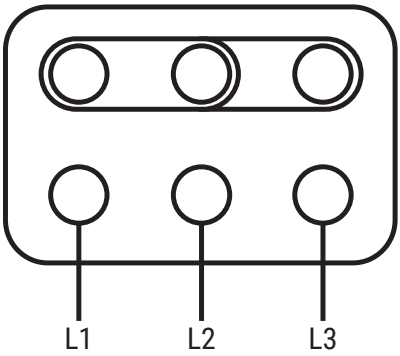
Terminal connections

When connecting three-phase motors with one speed, a distinction is made between 2 connection types. It is also important which mains/voltage is provided at the place of use.

If the motor is supplied with too low an input voltage, the current consumption increases and the winding can burn out when starting or during operation of the fan.

Star connection — motor voltage 230/400 V

This suggested circuit is only applicable with a 400 V mains. With a 230 V mains, the delta connection described below must be applied.

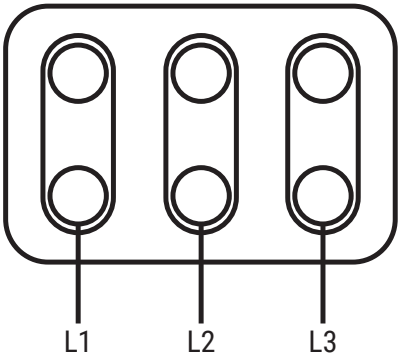


If the motor has 6 types from the winding, a star bridge (W2-U2-V2) is mounted on the terminal board.

For motors with 3 windings, the star point is already connected in the motor winding. In this case, the star bridge can be omitted.

Delta connection — motor voltage 400/690 V

This suggested circuit is only applicable with a 400 V mains. For a 690 V mains, the previously described star connection must be used.



Motors for delta connection generally have 6 winding types.

For direct starting, 3 delta bridges (U1-W2, V1-U2, W1-V2) are mounted on the terminal board to connect the ends of the strands.

With star-delta starting, the bridges are omitted. Switching is done manually by star-delta switches or automatically by contactor circuits.

Operation with frequency converter

For fan operation with a frequency converter, the output voltage of the converter is decisive for the bridges in the motor (star or delta connection).
Please refer to the enclosed data sheet for the maximum speed of the fan and the maximum output frequency of the frequency converter. In addition, the start-up time must be adapted to the relevant fan or fan application in consideration of the current consumption.
In order to avoid potential damage to the bearing, it must be ensured that the fan is earthed by means of an earthing strap. This is used to discharge voltage peaks that may be caused by a frequency converter.

When the fan is put into commission, the direction of rotation of the motor or impeller must be checked. The direction of rotation must correspond to the directional arrow on the fan. If this is not the case, connection lines L1 and L2 must be swapped.

7 COMMISSIONING

Before commissioning the fan, the interior of the fan and the upstream and downstream machines, ducts and pipelines must be cleared of foreign bodies. There is danger due to a suction effect.

All protective devices provided (protective grating, belt guard, coupling guard, etc.) must be checked for proper attachment. There is a danger to life due to rotating parts in case of improper handling.

Hearing protection must be worn due to increased noise generation when starting the fan!

Hot gas fans, throttled fan operation and bearings may have hot surfaces. Caution: Risk of burns!

The safety regulations for electrical devices and systems as well as those of electricity companies must be observed.

Additional important information

All control elements installed upstream and downstream of the fan, such as louvre closures, sliders and vane controllers, must be checked for adjustability. Before commissioning, these control elements must be closed to ensure the fastest possible start-up.

The direction of rotation of the drive motor must be checked (switch the motor on and off briefly). This must match the directional arrow on the fan housing. After switching on the motor and reaching the nominal speed, the control elements can be opened slowly, during which the current consumption of the motor must be checked constantly. Pay attention to the bearing and winding temperature of the motor.

If no higher switching frequency has been contractually agreed, operating mode S1 (continuous operation) applies. According to DIN VDE 0530, Part 12, Sections 6 and 7 (starting performance), a maximum of 2 starts in succession are permissible.

After reaching the nominal speed and opening the upstream or downstream control elements, the running smoothness must be checked. It must not exceed the value veff = 2.8 mm/s at the bearings.

In the case of fans with V-belt drive, ensure that the belt runs smoothly.
After 5 hours of continuous operation at the latest, the belt tension must be checked and corrected if necessary.

The bearing temperature must be monitored. The normal temperature range is approx. 50°C to 70°C. If the temperature rises to higher values, the start-up must be repeated after a cool-down phase and then troubleshooting must be carried out to find and eliminate a potential fault.

The fan must not be operated at a higher speed than specified in the data sheet. The speed may only be reduced after consultation with Zenner. A check must be carried out to ensure that the fan is not operated at a speed at which a resonance frequency is excited to a harmful degree. When regulating the speed, it must be taken into account that the natural frequencies of various fan components are reached at various points in the range from the lowest to the highest speed. Continuous operation must not take place at these points. When the system is started up, the speed controller must be adjusted to ensure that this rotational frequency is passed through quickly.

Dampers that can completely block the air flow must be switched in such a way that the fan is switched off immediately after closing. Otherwise, unacceptable heating of the fan and unacceptable vibrations due to flow separation may occur.

If fans are connected in parallel, it must be ensured prior to switch-on that fans that are not switched on do not rotate in the opposite direction. Otherwise, switching on may result in mains overload, motor overload and blade damage due to the reversal of the rotation direction.

8 SERVICING AND MAINTENANCE

8.1 General information

The safety instructions in the Commissioning section also apply to recommissioning after carrying out maintenance work.

The maintenance frequency depends essentially on the mode of operation, the ambient conditions and the required availability. It must be determined by the system operator in consideration of the system concept and the specifications provided by Zenner Ventilatoren Werke GmbH.

Spare and wear parts that are not available at short notice should be kept in stock.

All screw connections must be checked regularly for tightness and, if necessary, retightened according to the following table.

Screw strength class 8.8	Tightening torque [Nm]
M4	3
M5	6
M6	10
M8	25
M10	49
M12	85
M16	210
M20	425
M24	730

8.2 Impellers

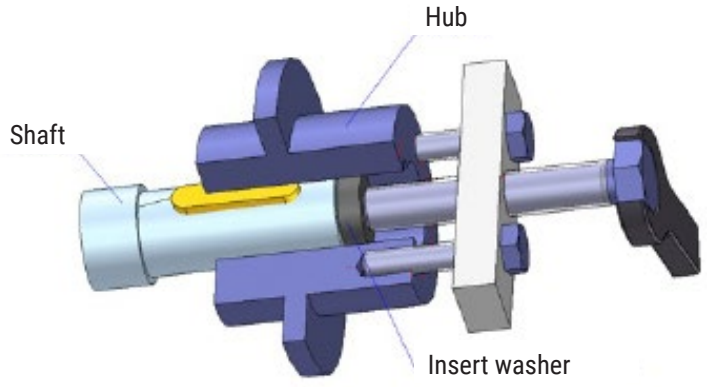
All impellers are statically and dynamically balanced at the factory according to the balance quality specified in the fan data sheet.
In the case of fans used to convey contaminated gases, the impellers are subject to wear or there may be a build-up of material on the blades. The unsteady running of the fan is often a clear sign of this. In order to ensure the operational safety of the fan unit, the regular inspection, cleaning and rebalancing of the impellers is required under such operating conditions. The times must be specified by the operator.

8.2.1 Assembly instructions for impeller with extraction device

The assembled impeller is clamped against the shaft shoulder with a screw and an end plate. It is secured against becoming loose by a locking plate and 2 fixing screws.

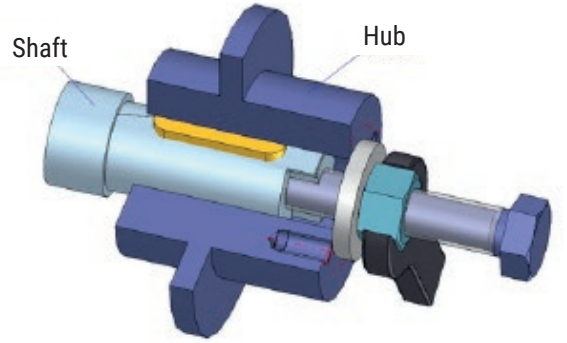
Disassembly (removal)
(Do not use hammers, crowbars or impact wrenches!)

- Remove the clamping disc.
- Cover the hole in the shaft with an insert washer.
- Position the extraction device as shown in the figure and screw in the screw until the impeller comes loose.
- Lift out the impeller, lay it down gently and do not roll it (otherwise there is a risk of imbalance).



Reassembly (mounting)
(Do not use hammers, crowbars or impact wrenches!)

- Clean and grease the shaft and the impeller holes.
- Lift the impeller onto the shaft and press lightly.
- Screw the screw with a washer into the shaft.
- Refit the locking elements.



8.2.2 Assembly instructions for impeller with taper bushings

The hub has a conical internal hole. A tapered bushing that is cylindrical on the inside is inserted into this. When the retaining screws are tightened, the bushing is clamped between the shaft and the hub.

Assembly holes Disassembly holes

Disassembly
(Do not use hammers, crowbars or impact wrenches!)

- Loosen all retaining screws. Depending on the size of the bushing, unscrew one or two screws completely, oil them and screw them into the forcing holes.
- Tighten the screw or screws in the forcing hole evenly until the bushing is released from the hub and the hub can be moved on the shaft.
- Remove the impeller with the bushing from the shaft.
- Lift out the impeller, lay it down gently and do not roll it (otherwise there is a risk of imbalance).

Reassembly
(Do not use hammers, crowbars or impact wrenches!)

- Clean and degrease all bare surfaces and the tapered hole of the hub. Insert the taper bushing into the hub and align all connecting holes (half threaded holes must be opposite half smooth holes).
- Lightly oil the set screws (size 1008-3030) or hexagon socket head cap screws (size 3525-5050) and screw them in. Do not tighten the screws.
- Clean and degrease the shaft. Slide the disc with taper bushing onto the shaft until it is in the desired position.
- If a feather key is used, it must first be inserted into the shaft groove. There must be a clearance between the key and the hole groove.
- Tighten the set screws or hexagon socket head cap screws evenly with the tightening torques specified in the table.
- After a short period of operation (approx. 1 hour), check the tightening torque of the screws and correct if necessary.

Taper lock bushing	1008	1108	1210	1610	1615	2012	2517	3020	3030
Screw tightening torque [Nm]	4,8	4,8	17	17	17	26	41	77	77
Number of retaining screws	2	2	2	2	2	2	2	2	2
Size	1/4“	1/4“	3/8“	3/8“	3/8“	7/16“	1/2“	5/8“	5/8“
Taper lock bushing	3525	3535	4030	4040	4535	4545	5040	5050	
Screw tightening torque [Nm]	95	95	145	145	145	163	230	230	
Number of retaining screws	3	3	3	3	3	3	3	3	
Size	1/2“	1/2“	5/8“	5/8“	3/4“	3/4“	7/8“	7/8“	

Table: Tightening torques for taper bushings

8.3 Vibration monitoring

Increased vibrations are always a danger sign. Changes in the running smoothness are determined by measuring the mechanical vibrations at the bearings and drive motors. Comparing the measured values over an extended period of time allows a reliable determination of changes. If the values change significantly, the causes must be investigated (e.g. contamination of the impeller). In addition, cleaning or rebalancing may be necessary.

8.4 Bearings / grease quality / lubrication intervals

The bearings must be inspected on a regular basis. In order to avoid premature bearing failures, no foreign bodies, dirt or moisture may enter the bearings. When relubricating, changing lubricants and replacing bearings, good cleanliness must be ensured.

Please refer to the lubrication instructions for the relubrication intervals and quantities and refilling. The grease to be used is also specified there (lubricant types from other manufacturers with the same chemical and physical properties (miscibility) can be used). When relubricating, it must be ensured that the grease has sufficient space to expand or else it may leak from the housing space. During relubrication, the temperature rises due to accumulated grease. Once the excess grease has been displaced, the temperature drops back to its steady-state value.

Lubricants must be stored in clean, closed containers in order to prevent the ingress of dust and moisture and to minimise the oxidising effect of the air. The storage location should be dry and cool.

For storing the motor, please refer to the lubrication instructions in the motor manufacturer‘s documentation.

8.5 V-belt drive

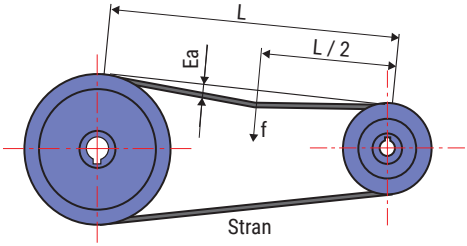
The correct belt pretension is of enormous importance for proper power transmission and for achieving the usual belt service life. Too little or too much pretension often leads to premature belt failure. Excessive pretension also often results in bearing defects on the drive or working unit. It is therefore advisable to calculate the required static belt tension individually for each drive.

Profile	Diameter of small pulley [mm]	Static belt tension – pretension [N]	
		Initial assembly	Operation after running-in
SPZ	≤ 71	200	150
	> 71 ≤ 90	250	200
	> 90 ≤ 125	350	250
SPA	≤ 100	350	250
	> 100 ≤ 140	400	300
	> 140 ≤ 200	500	400
SPB	≤ 160	650	500
	> 160 ≤ 224	700	550
	> 224 ≤ 355	900	700
SPC	≤ 250	1000	800
	> 250 ≤ 355	1400	1100
	> 355 ≤ 560	1800	1400
XPZ	≤ 71	250	200
	> 71 ≤ 90	300	250
	> 90 ≤ 125	400	300
XPA	≤ 100	400	300
	> 100 ≤ 140	500	400
	> 140 ≤ 200	600	450
XPB	≤ 160	700	550
	> 160 ≤ 224	850	650
	> 224 ≤ 355	1000	800
XPC	≤ 250	1400	1100
	> 250 ≤ 355	1600	1200
	> 355 ≤ 560	1900	1500

The values listed in the table apply to the use of an Optibelt tension gauge.

When using another measuring device, you must work with the indentation depth of the strand. Please refer to the V-belt calculation enclosed in the documentation for the values required for this (indentation depth of the strand [Ea] and test force [f]).

The value of the indentation depth of the belt must be multiplied by 0.75 for the initial assembly only.



Ea — indentation depth per belt [mm]
f — test force per belt [N]
L — centre distance [mm]

The following retightening intervals apply:

- Inspection: 0.5 hours after commissioning
- Inspection: 10 hours after commissioning
- Inspection: 1 week after commissioning

The V-belts are retightened by moving the motor in parallel on the tensioning rails. It must be ensured that the V-belt pulleys are exactly aligned.

If belts need to be replaced, they must be replaced in sets. It is not permissible to replace individual belts.

The assembly and reassembly of the V-belt pulleys with taper bushing is carried out as described in the „Assembly instructions for impeller with taper bushings“.

8.6 Shaft seals

There are a variety of different sealing methods.

The standard design is an orifice plate. The sealing effect is based on an annular gap between fan housing and hub or shaft of approx. 1 mm - 2 mm. No special requirements are necessary with regard to tightness. In addition to the orifice plate, the back blading of the impeller is also possible, with the negative pressure created by this reducing the discharge of the medium.

For fans with higher leak-tightness requirements, shaft seals with sealing rings are available. There are different designs in terms of the sealing rings and the material of the sealing rings. In addition, there are designs with a grease chamber and relubrication device with grease overflow channel as well as connections for sealing gas.

The selection of shaft seals with sealing rings depends on the respective requirements with regard to the leak-tightness of the fan.

8.7 Electric motors

For electric motors, the manufacturer‘s regulations and safety instructions must be observed. All work on the electrical connection may only be carried out by qualified personnel.

If motors are operated above the permissible ambient temperature range, the permissible motor power is reduced compared to the rated power.
The same applies to installation above 1000 m above mean sea level.
The fan manufacturer must be consulted in this case. When using pole-changing motors, it must be ensured that the switch from high to low speed is smooth. Delayed switching must be shock-free. If the system has been at a standstill for an extended period of time, the insulation resistance must be checked before commencing the start-up procedure.
Damp windings must be dried with hot air.

Unless otherwise agreed in the supply contract, the regulations for switching conditions issued by the motor manufacturer must be observed.
Attachments or conversions may not hinder the cooling of the motors.

9 SPECIAL INSTRUCTIONS

9.1 Gas tightness

In the case of fans that are designed to be gas-tight, the tightness must be monitored by means of regular measurements.

If there is a risk to human health due to exceeding the permissible limit values, the fan must be put out of operation. General room ventilation should always be provided so that no toxic or explosive gas concentrations occur in the event of unnoticed leaks.

The shaft seals in the shaft feedthrough must not be damaged during installation and maintenance work. It must be ensured that damage to the shaft surface (scratches, rust, etc.) at the running surfaces of the sealing rings is avoided, as such damage will result in leakage.

After reassembly, new sealing material must be used and a new leak test must be carried out. Additional measures due to local or legal regulations, standards or guidelines must be observed. A check must be carried out in case of imbalance and abnormal vibrations as well as after the disassembly and reassembly of the impeller.

In the case of shaft seals intended for sealing gas, it must be ensured that the sealing gas pressure is always higher than the pressure of the medium. Equal or lower sealing gas pressure would allow solids to enter the seal, resulting in increased wear and even seal failure. Pressure monitoring and control is strictly necessary. In the standard case, our performance limit lies at the sealing gas nipple on the seal. Pressure monitoring and control must therefore be provided by the customer.

9.2 Elevated temperatures

In the case of fans intended for operation with hot media (temperatures > 80°C), contact with hot surfaces must be prevented by means of insulation, grating or warning signs.

If the fan is started in a cold state, the power requirement may exceed the design specification and the current consumption may reach impermissibly high values. For this reason, a damper on the pressure side must be closed when starting up the fan from a cold state.

Before the fan is switched off, it should be operated for some time at a lower temperature (<100°C) until the impeller, shaft and housing have cooled down. The purpose of this is to prevent heat from affecting the bearings or bearing grease during standstill.

The cooling discs used at elevated temperatures only provide adequate cooling at a sufficient speed. At low speed (e.g. frequency converter) or standstill (e.g. power failure), the operator must cool the cooling disc externally (e.g. by using an external fan with secured power supply to blow on the cooling disc).

9.3 Frequency converter

he use of a frequency converter must always be agreed with the fan manufacturer. The unauthorised alteration of the contractually agreed speed, e.g. for the purpose of power adjustment or regulation, entails risks and is not permitted.

When operating with a frequency converter or speed control, the following must be observed: The frequency converter should be set in such a way that high loads for the impeller and the motor due to rapid acceleration or deceleration are avoided. The run-up time should be matched to final speed, motor power and mass moment of inertia of the impeller. This is generally the case if the run-up time for impellers with a diameter of up to 1000 mm is at least 30 seconds and between 1000 and 2000 mm at least 60 seconds.

Resonance frequencies, which can also occur in the interaction between fan and system, must be determined on site. Resonance frequencies must be locked in the frequency converter. The frequency at which such frequencies are passed through must be reduced to a minimum.
The motor parameters to be set at the frequency converter can be found on the motor nameplate/data sheet and the fan data sheet. In the event of deviations, the parameters on the fan data sheet are valid. The maximum speed specified by the fan manufacturer must not be exceeded.

A motor current limit is recommended to prevent excess load on the motor in the event of unintended fan operation.

Shielded cables must be used for the electrical connections between frequency converter and motor. The potential equalisation of fan and motor must be ensured by a suitable earthing strap.

If the fan is operated by a frequency converter in a potentially explosive atmosphere, the additional instructions in section 10.3 of this instruction manual must be observed.

The manufacturer's safety instructions for frequency converters must be noted prior to assembly and commissioning.

10 EXPLOSION PROTECTION

10.1 General information

Explosion-proof fans are manufactured in accordance with the design specifications of DIN EN 14986:2017 and obtain their conformity in accordance with Directive 2014/34/EC (ATEX for manufacturers). For operators of potentially explosive systems, Directive 1999/92/EC (ATEX for operators) and DIN EN 1127-1:2019 must be applied.

All the necessary information regarding explosion protection was collected by the operator and provided to the fan manufacturer by means of an ATEX questionnaire. The ATEX classification applicable to the fan can be found on the nameplate, the Declaration of Conformity, the fan data sheet or the ignition hazard analysis.

10.2 Notes on maintenance and servicing

It must be pointed out that any modification will affect the operating permit and warranty.

Permissible maintenance and servicing work
The following maintenance work is to be carried out without coordination with the fan manufacturer:

- In all applications where it is expected that dust layers may form on the surface of the fan and its components, regular cleaning must be carried out at suitable intervals.

- Dust caking may cause gaps between rotating and stationary parts to diminish in such a way that frictional heat generates temperatures above the permissible surface temperature. This may cause the fan to become a source of ignition. Dust caking can also occur on protective grating or similar equipment and change the pressure losses in the system in such a way that the fan operates in an unstable characteristic curve range. Regular cleaning of the complete fan is this absolutely necessary and must be carried out at least twice a year, or at shorter intervals in the case of heavy contamination.

- Impermissibly high relubrication quantities and insufficient relubrication cause the bearing temperature to rise. If the permissible surface temperature is exceeded, the fan may become an ignition source. The lubrication instructions enclosed with the documentation (relubrication intervals and grease replacement) must be observed. The requirements of the manufacturer's documentation for the bearings of the drive motors must be observed.

- Bearing temperatures > 120°C damage the rolling bearing considerably. These bearings must be replaced. Otherwise the fan may become a source of ignition due to bearing failure.

- The ingress of foreign bodies during operation or when the fan is at a standstill may result in the generation of ignitable sparks. This renders the fan a source of ignition.

- The fan must have a protection rating of at least IP20. If the fan is operated without a duct connection on the suction or pressure side, a protective air inlet and/or outlet grille must be provided.

Maintenance and servicing work requiring coordination
The following maintenance work is to be carried out following coordination with the fan manufacturer:

- The radial and axial impeller gap must be adjusted and documented according to the information on the fan drawing.

The motor base screws must be tightened and locked with the suitable torque specified in the motor documentation. If not properly assembled, the fan will become a source of ignition!

- Slipping belts may generate hot surfaces above the maximum permissible surface temperature. Therefore, great importance must be attached to the alignment of the belt pulleys to each other and to the correct belt tension. The values set must be documented. V-belts for fans in explosion-proof design are electrostatically conductive and meet the requirements of DIN EN ISO 80079-37:2016. Operation is only permitted with these certified V-belts. Otherwise the fan may become a source of ignition due to electrostatic charges. The use of belt wax or similar aids to change the air flow is not permitted!

10.3 Notes on electrical installation

If electrical installation work is performed on fans, the following instructions must be observed:

- The entire fan unit must be earthed locally by the operator. For this purpose, there is an earthing connection on the motor base or on the base frame.

- Generally speaking, fans in potentially explosive atmospheres must not be operated with a frequency converter. If a special explosion-proof motor is installed, it must be certified for speed-controlled applications. The operating limits of the motor can be found in the documentation from the motor manufacturer. The general instructions in section 9.3 of this instruction manual for fan operation with a frequency converter must be observed regardless of the motor.

10.4 Nameplates / marking

The suitability of the fan for operation in potentially explosive atmospheres is confirmed on the EC certificate of conformity. The nameplate indicates the machine group and category together with the temperature class separately according to fan interior and fan exterior. The information on the nameplate is important for the intended use. All nameplates must remain legible at all times. Illegible or lost nameplates as well as warning signs must be replaced immediately.

11 BASIC SAFETY INSTRUCTIONS

The following general occupational safety instructions must be observed in particular:

- The fan has been built according to the state of the art and the recognised safety regulations and is safe to operate if the maintenance and operating instructions are observed. Improper use or use not in accordance with the intended purpose will result in the system becoming inoperable and in dangers to people and property.

- This technical documentation is binding for everyone involved in assembly, disassembly and reassembly, commissioning, operation, inspection, maintenance and repair in the company of the user. These employees must have read the operating instructions in full.

- The delivered product must strictly be used for the contractually agreed purpose. Any use deviating from this is considered improper use. The manufacturer is not liable for any damage resulting from this. The risk for this is borne by the operator alone. The product may not be passed on to third parties if this could result in additional risks. Refrain from any mode of operation that impairs the safety of the fan and the associated system parts.

- Fans and associated system parts may only be operated, serviced and repaired by authorised, trained and instructed personnel. These personnel must have received appropriate instruction on the hazards that may occur based on these operating instructions. The responsibilities for assembly, disassembly and reassembly, commissioning, operation and maintenance must be clearly defined and adhered to so that there are no unclear responsibilities in terms of safety. During the warranty period, maintenance and repair work is the responsibility of the manufacturer‘s service personnel. Work on the electrical equipment of the machine/system may only be carried out by a skilled electrician or by instructed persons under the supervision and guidance of a skilled electrician in accordance with electrical engineering regulations.

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For all work involving assembly, disassembly and reassembly, commissioning and maintenance, the switch-off procedures specified in the operating instructions for the complete system must be observed.

- The operator/user is obligated to operate the delivered product only if in good condition. Unauthorised modifications and attachments that impair the function and/or safety of the fan and/or associated system parts are not permitted.

- The removal of information, instruction and prohibition signs from the fan is prohibited.

- All work on the fan must only be carried out when the machine is at a standstill. This applies in particular to the removal of protective devices. Before starting any necessary work on the fan, the drive must be secured against being switched on unintentionally.

- Before recommissioning after maintenance work has been carried out, it is essential to check that all protective devices are properly fitted.

- Cleaning and inspection openings may only be opened when the fan is at a standstill.

- In the event of malfunctions, the machine/system must be shut down immediately. The fault must be rectified immediately.

- In addition, the special local safety and accident prevention regulations always apply for the operation of the fan.

12 MALFUNCTIONS

If a malfunction occurs during the operation of the fan, the cause can be determined using the following table. Measures that can be taken to remedy the problem are also listed.

Fault / malfunction	**Possible cause**	**Remedial measures**
Excessive vibrations	Caking on the impeller	Clean impeller and measure vibrations; rebalance if necessary
	Impeller damaged	Replace impeller
	V-belt pulleys not aligned	Align the V-belt pulleys
	Bearing wear	Replace bearing
	Drive motor not running smoothly	Measure vibrations during operation; if values are too high, uncouple and measure separately; after consultation with manufacturer, change motor or motor bearing
Bearing temperature >80°C	Vibrations	Measure vibrations; rebalance if necessary
	Bearing wear	Replace bearing
	Too much / too little grease in the bearing; grease used up	Check grease quantity and reduce or re-grease accordingly
	Faulty temperature monitoring	Check temperature sensor and evaluation device and replace defective device
Flow rate and total pressure too low	System resistances are much higher than predicted	Check whether all dampers are fully open
	System parts (filter, dampers, etc.) are not functional	Carry out a functional test of the system parts

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Fault / malfunction	Possible cause	Remedial measures
Noises	Impeller rubbing	Check installation position; check screw connections and tighten if necessary
	Motor imbalanced	Measure vibrations; consult manufacturer
	Electrical faults on the motor	Consult manufacturer
	V-belts squeaking or slipping	Retighten V-belts or replace the complete set
	Bearing damage	Replace bearing
Motor overload; motor protection has switched off	Impeller rubbing	Check installation position; check screw connections and tighten if necessary
	Excessive speed	Correct speed limit to design specification
	Incorrect direction of rotation	Change direction of rotation
	Fuse defective	Check fuse and motor protection
Fan does not start	Power supply failed	Restore power supply
	Motor defective	Consult manufacturer, replace motor if necessary
	Impeller jammed due to soiling	Clean fan and realign
	V-belt loose or torn	Retighten V-belts or replace the complete set

YOUR NOTES

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WE OFFER SERVICE AND OPTIMAL SOLUTIONS:

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- Balancing of fan impellers
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