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Operating, usage and maintenance instructions

Designation: _____

Serial number: _____

Place of installation: _____

_____

_____

1. Table of contents

Field of use and application range

The centrifugal fan is a mechanical device for moving air or other gases specified in chapter 3.

Explanation of symbols and notes

Symbol ‘Safety’

In the operating instructions, this symbol is used for instructions related to workplace safety, life- and health-threat. We ask you to pay attention to these instructions and to read them with increased attention. Transfer this attention to other users as well. General safety regulations and accident prevention regulations have to be observed.

Symbol ‘Warning’

WARNING!

This symbol indicates points when the user has to observe all guidelines, regulations and correct operation. Damage to the mechanical device or other parts of the system is thus avoided.

Notes for safety at work

Particular attention has to be paid to the following safety notes:

The centrifugal fan is designed and manufactured according to the present state of the art and the operational safety. Nevertheless, the incorrect use of the centrifugal fan by unskilled person can be dangerous.

The entire operator’s staff, who have to work with the centrifugal fan during its installation, removal, commissioning, operation and maintenance (e.g. check, service, repair), have to read these instructions completely and understand them. We recommend to have this information always confirmed in writing.

The centrifugal fan can only be used for the purpose specified in chapter 3. Damage due to improper use is excluded from the warranty.

The specified application also includes compliance with prescribed conditions for installation, removal and repeated installation, commissioning, operation, maintenance and repairs.

Maintenance and repairs can only be carried out by authorized, skilled persons. These persons have to be specially trained if danger can arise during the operation of the centrifugal fan.

For all installation / removal procedures, commissioning, replacement procedures, alignment and repair, observe the shutdown procedures specified in the operating instructions.

All activities that could affect the safety of the operation of centrifugal fans should be avoided.

The user is obliged to make any changes to the centrifugal fan that affect safety.

The user can only use the centrifugal fans which are in perfect technical condition and in accordance with the safety regulations.

The user has to ensure the cleanliness and order of the workplace where the centrifugal fan is installed by means of appropriate instructions and controls.

If the surface temperature of the centrifugal fan is above 50 °C, the user is obliged to affix a warning sign on or nearby the centrifugal fan to warn of the possibility of burns or to prevent contact with the hot surface (insulation, fencing, etc.).

When operating the centrifugal fan, do not stand within the reach of the centrifugal effects of the impeller!

Unauthorized renovations or modifications of the centrifugal fan that affect safety are forbidden.

When installing the centrifugal fan without ductwork connected to the suction or pressure side, the relevant side has to be protected by a protective grille according to the valid regulations.

All operations on the centrifugal fan have to only be carried out during standstill.

Before starting any work on the centrifugal fan, its drive has to be secured against unintentional start-up and marked with a warning sign.

The inspection door can only be opened when the impeller is in absolute standstill and the centrifugal fan is secured against being switched back on.

Protective devices can only be removed when the impeller is in a standstill and the centrifugal fan is secured against being switched on again.

Before the commissioning and after repairs, the installation of all protective devices has to be checked.

After installing or repairing the electrical equipment, check the direction of the rotation of the impeller and check the condition of the wiring (e.g. the earth resistance).

The centrifugal fan can only be used in the working conditions for which it is intended.

The wiring has to be carried out expertly in accordance with valid regulations for the given environment.

The direction of rotation of the impeller is marked with the directional label.

During the operation, the coupling, the cooling disk, the fan belt and the shaft has to be secured with protective covers and must not be manipulated. This also applies to the inspection doors.

If the centrifugal fan is sucked from the free space, the inlet of the fan has to be provided with a protective grille. The protective grille has not to be handled during the operation.

If the centrifugal fan is delivered with an open impeller, it has to be equipped with a protective cover in accordance with relevant standards to avoid contact with the impeller. The design of the placement of the centrifugal fan has to be made so that the fan meets all safety and performance parameters.

This has to be ensured by the buyer-operator.

Current regulations of the electric motor manufacturer apply to the operation and maintenance of the electric motor.

The presence of persons in front of the air inlet (suction side) and behind the air outlet (pressure side) of the centrifugal fan is forbidden (in case of non-connected ductwork).

3. General information

Everyone who handles the fan must follow and understand this information.

Operating instructions help to prevent a breakdown of the centrifugal fan and to guarantee trouble-free operation. It is important that the responsible persons are familiar with the operating instructions.

Read operating instructions thoroughly as we assume no responsibility for any damages and difficulties caused by not following these instructions.

Field of use

3.1. Centrifugal fans

The centrifugal fan is intended for use in a non-explosive area (unless ATEX is required).

WARNING!

The directly driven centrifugal fan (B1) with foot-mounted electric motor is suitable for the movement of air without admixtures of impurities up to a temperature of up to 80 °C.

The directly driven centrifugal fan (B1) with the flange-mounted electric motor is suitable for the movement of air without admixtures of impurities up to a temperature of 60 °C.

The centrifugal fan driven through the coupling (B3) or the fan belt (B2) is suitable for movement air without the admixtures of impurities higher than temperature of 60 °C.

The use of centrifugal fan for higher temperatures has to be consulted with the manufacturer for the sake of design of the centrifugal fan.

The centrifugal fans are not gas-tight.

Abrasion resistant steel can be used when moving air material with abrasive mixtures. The use of this steel has to be consulted with the manufacturer.

The type of drive and the size of the motor is chosen according to the agreement with the manufacturer.

The centrifugal fan can only be operated according to the parameters stated on the manufacturer's label or according to the information agreed with manufacturer.

3.2. Centrifugal fans for movement of adhesive and abrasive admixtures

It is necessary to carry out regular checks and cleaning of the impeller and the fan casing. (chapter 9)

The checks can be carried out by inspection or cleaning door.

In special cases, the centrifugal fan is designed with the tilting impeller.

The control and cleaning periods have to be determined after the test run. Observe the centrifugal fan during test run to avoid damage. Vibration and wear values for safe operation are described in chapter 7, 9.

The type of drive and the size of the motor is chosen according to the agreement with the manufacturer.

The centrifugal fan can only be operated according to the parameters stated on the manufacturer's label or according to the information agreed with manufacturer.

3.3. Transport centrifugal fans

These fans are used for the transport of industrial non-sticky and non-abrasive admixtures in the wood industry (e.g. sawdust, wood shavings etc.), paper mills and similar plants.

The installation of a protective grille on the air inlet of the centrifugal fan (the suction side) is necessary if damage of the impeller could be caused by the penetration of a bigger part of the transported material.

These centrifugal fans are designed for non-explosive environments at temperatures ranging from -20 °C up to 85 °C.

These centrifugal fans are not gas-tight.

These centrifugal fans are basically designed on the drive through the fan belt. The directly driven or through coupling driven centrifugal fan has to be consulted with the manufacturer.

4. Transport, storage, downtime

The centrifugal fans have to be stored in a dry environment about 50 mm above the ground. During storage, a free space of at least 0,5 m from the centrifugal fan has to be provided for inspection.

Turn the impeller manually every 2 weeks during the storage, assembly or downtime (to prevent the deformation of bearings).

The manufacturer reserves the right to inspect the centrifugal fan during the warranty period.

Packing

The centrifugal fans are delivered without packing.

The centrifugal fans are normally delivered as assembled and prepared for installation.

Ordered accessories is enclosed or packaged separately.

Fragility

After delivery, check for any damage during transport. During the subsequent handling, the centrifugal fan has to be handled with care to avoid damage caused by careless handling.

The centrifugal fan can only be suspended by hoisting ropes at places designed for this purpose! Never use the motor or the inlet for hanging!

Storage

The centrifugal fans have to be stored in a closed space and in a dry environment.

Turn the impeller manually every 2 weeks during the storage (to prevent the deformation of bearings).

Scope of delivery

The scope of delivery is listed on the delivery note. According to the delivery note it is necessary to check the completeness of the delivery upon receipt of the goods.

Any damage to the goods or missing parts have to be reported immediately in writing.

5. Construction and operating form

General description

The centrifugal fan consists of the baseframe, the fan casing, the impeller and the electric motor. Individual parts are welded. The impeller is mounted on the shaft of the / fan / electric motor by means of an impeller hub and secured by a cover disc (washer) against spontaneous loosening.

The centrifugal fans are not gas-tight (there is a clearance between impeller hub and fan casing).

A shaft seal can be mounted around the shaft on the fan casing.

The flange electric motor is mounted on the fan casing.

Produced versions of centrifugal fans (drive, type of electric motor, fan mounting)

1. Direct drive - designation B1 (or without designation)

2. Belt drive - designation B2

3. Coupling drive - designation B3

The choice of the type of drive with regard to the temperature and the size of the electric motor used determines the manufacturer.

The electric motor can be used in the standard design for temperatures from -20 °C up to + 40 °C. The operating speed range for frequency converter operation is 50 – 100 %.

The casing position of the centrifugal fan is in the accordance with the standard.

WARNING!

For safety reasons, never operate an unregulated centrifugal fan. The regulated centrifugal fan operates with the electric motor without overload.

6. Assembly

General notes

The centrifugal fan is available as a ready-to-install and easy-to-install set. All ordered equipment is included. It is necessary to observe the notes in these operation instructions as we are not responsible for any damages caused by incorrect installation.

The centrifugal fan can only be suspended by hoisting ropes at places designed for this purpose! Never use the motor or the suction part for hanging!

Installation

During the centrifugal fan installation, it is necessary to consider a free space around the centrifugal fan to be able to assemble or disassemble individual parts of the fan safely. This applies in particular to the space in front of the fan inlet and to the surroundings of the electric motor.

The centrifugal fan has to be installed on a concrete floor or on a sufficiently dimensioned steel construction.

If the centrifugal fan is placed on a steel construction, we recommend to use vibration dampers. In this case, the ductwork has to be flexibly connected.

If the centrifugal fan doesn’t have vibration dampers, it has to be freely stored during the installation. Before fixing the set to the base/floor it has to be horizontal leveled.

The ductwork, especially on the suction side (if used) has to be thoroughly cleaned before connecting to the centrifugal fan. Objects, such as welding slag, can damage the centrifugal fan and cause imbalance of the impeller.

The installation of the centrifugal fan has to be carried out by the skilled person or under his supervision. The centrifugal fans have to be mounted on a sufficiently rigid and firm base to avoid increased vibration.

The permissible centrifugal fan inclination in the x-y axis is 1 mm per 1000 mm. In case of centrifugal fan thermal insulation, the lubrication points, the inspection doors, the directional and centrifugal fan label and the cooling disc have not to be covered.

Checks and tests carried out during the assembly process and before commissioning

- Before starting the installation, check whether the centrifugal fan has been stored according to chapter 4. and if it's not damaged. In case of failure to comply with the prescribed method of storage or damage to the fan, it is necessary to inform the manufacturer and determine the type of repair.
- If the centrifugal fan has been stored for more than 6 months from the date of delivery, the control of the coating is required.
- The permissible centrifugal fan inclination in the x-y axis is 1 mm per 1000 mm.
- Vibration dampers (flexible mounting) are mounted in the holes in the base frame - layout according to the drawing.
- The centrifugal fan operation test - there has to be a clearance between the impeller hub and the fan casing.
- Check tightening of bolts, especially mounting of the fan, the electric motor, the bearings, the impeller and other connections.
- Check that no objects are left in the ductwork, in the area in front of the centrifugal fan and in the centrifugal fan itself, which could affect the proper operation of the fan or could cause a breakdown.
- Check the electric motor according to valid regulations and the operating instructions of the electric motor manufacturer.
- Check the wiring (see chapter 2). If vibration dampers are used, the electrical wiring and grounding have not to prevent free vibration of the centrifugal fan.
- Check and align the shaft coupling (if necessary). There is the workflow in the annex (for coupling drive B3).
- Check the tension of the fan V-belt.
- Check the tension of the fan flat-belt.
- Check if all dangerous places (rotating parts, inspection doors, fan inlet, etc.) are provided with protective covers.
- Check bearings condition, grease level in fan bearings (see annex).
- If vibration dampers are used, we recommend flexible connectors (compensators) to be used on the suction (inlet) and pressure (outlet) side of the centrifugal fan. Flexible connectors have not to prevent the centrifugal fan from free vibrating.
- No ductwork should be hung or placed on the centrifugal fan. The connected ductwork has to be supported separately.
- The centrifugal fan moving air above 40 °C has to be provided with flexible connectors (compensators) on the suction and pressure side to prevent thermal deformation due to thermal expansion of the ductwork.

Keeping records of checks and tests

The assembler is obliged to create a report about the above-mentioned checks and tests and to hand it over to the user. The user is obliged to submit this report to the manufacturer in case of breakdown.

This report should contain at least this following information:

a) Type of centrifugal fan, the serial number
b) Type of electric motor, the serial number
c) Type of checking operation
d) Measured values
e) Control result
f) Information about who performed the check (company, name, date and signature)

Commissioning preparation

The wiring (provided by customer).

Check the correct electrical connection in accordance with customer regulations and local regulations.

Check the wiring in the terminal box of the electric motor (there is a wiring diagram in the terminal box cover).

Check and set the protective devices (overload relay, earthing resistance, etc.).

Mechanical part

Open the inspection door of the centrifugal fan and manually turn the impeller in the fan casing. Make sure it turns easily. The generated sounds may indicate that the impeller has not been released. Remove this fault before testing commissioning. Close the inspection door!

Check the direction of rotation of the impeller in accordance with the direction of the fan outlet and directional label.

If the direction of rotation of the impeller is incorrect, the flow direction won’t change, but the power will be greatly reduced and the electric motor could be overloaded.

To check the direction of rotation of the impeller, start briefly the electric motor. If the direction of rotation is incorrect at high speed, the electric motor could be overloaded.

7. Commissioning

Commissioning preparations have to be carried out according to chapter 6.

Commissioning is carried out by skilled person familiar with these instructions. During commissioning for the first time, the electric motor power input has to be monitored.

If the centrifugal fan is equipped with a throttle or other throttling device, it is advisable to close it. After starting the electric motor to the nominal speed, the throttling device is opened gradually and the electric motor power input is monitored. The rated motor power input has not to be exceeded.

If the centrifugal fan is equipped with a frequency converter or a soft-start device, it can be started without throttling device.

After starting the centrifugal fan, its performance parameters are checked.

Checks and tests during operation

a) check the direction of rotation of the impeller according to the direction of the fan outlet and directional label (on the fan casing)
b) check the load and temperature of the electric motor
c) after 50 operating hours, check the coupling alignment (for coupling drive B3) and tighten the bolt connections (in case of increased vibration the centrifugal fan is stopped and the coupling is aligned)
d) the centrifugal fan operation is checked according to chapter 9

Keeping records of checks and tests

The assembler is obliged to create the report (mentioned under the point 4.1) and to hand it over to the user. The user is obliged to submit this report to the manufacturer in case of a fault.

This report should contain at least the following information:

a) Type of centrifugal fan, the serial number
b) Type of electric motor, the serial number
c) Type of checking operation
d) Measured values
e) Control result
f) Information about who performed the check (name, date, company and signature)

Electricity consumption of electric motor

The electric current is measured on the switchboard by means of an ammeter or by clamp ammeter on the cable (with star-delta wiring it is measured in front of the switchboard!).

Help with commissioning problems

Faults	Possible causes of faults	Remedial measures
The centrifugal fan does not start	The electric motor runs on two phases	Check the electric motor and the wiring
Electric motor does not rotate at full speed	Existing circuit breakers are inappropriate or incorrectly set	Change the reaction time of the circuit breaker or start with high load
The motor current consumption is too high	The direction of rotation of the electric motor is incorrect	Change the direction of rotation by exchanging two phases
	Too little throttling in the ductwork	Lock the installed throttles until the desired volume flow is achieved
The desired volume flow is not achieved	The direction of rotation of the electric motor is incorrect	Change the direction of rotation by exchanging two phases
	Installed throttle is (partly) closed	Open the throttle
	The resistance in the electrical circuit is too high	Compare the operating conditions with design values and adjust them to design data
Excessive centrifugal fan vibration	The centrifugal fan is not well leveled	Check the connection of the ductwork and the baseframe of the centrifugal fan according to the instructions
	The impeller or another rotating part is not well balanced	Check eventually rebalance rotating parts → possible damage during transport?

8. Operation

Behaviour in case of breakdown

The installation of the centrifugal fan and its operation has to comply with the relevant national regulations of the operator's country. The operator is responsible for their observance.

Disconnection for safety reasons

We recommend to use the lockable disconnector, which prevents the unintentional switching on of the centrifugal fan during repairs or breakdown.

Help with operating problems

Faults	Possible causes of faults	Remedial measures
Volume flow is too low	The resistance has increased Rotating speed of centrifugal fan is too low	Check that the ductwork is not clogged Check the fan belt transmission / drive
Unbalance	Fouled impeller Damaged bearings	Thoroughly clean the impeller Replace the bearings
Centrifugal fan doesn't reach the required power	Wrong direction of impeller rotation	Change the direction of rotation by exchanging two phases
	Incorrectly set throttling or regulating device in ductwork	Open / adjust the regulating device
	Fouled impeller	Thoroughly clean the impeller
	Damaged / fouled ductwork	Replace / clean the ductwork
Excessive centrifugal fan vibration	Unbalanced impeller	Remove impurities from the impeller, balance the impeller
	Damaged bearing or shaft of the electric motor	Replace the damaged part
	Incorrectly aligned / damaged coupling	Align or replace the coupling
	Loose fan belt	Restore the fan belt tension
Overheating of the electric motor	Higher power input of the centrifugal fan, parameters don't comply with the required ones	Contact the electric motor manufacturer
	Lower temperature or density of moving air	Contact the electric motor manufacturer
	Defect of the electric motor or its connection	Repair by the specialist
Excessively overheated/noisy bearing	Non-lubricated bearing	Lubricate if the bearing is not damaged
	Unsuitable lubricant	Lubricant replacement
	Defective bearing	Bearing replacement
	Higher temperature around the bearing	Lower the temperature

9. Maintenance

General notes

During maintenance and inspections all directions in chapter 2 "Safety" have to be observed.

Operating problems due to insufficient or incorrect maintenance can lead to high repair costs and long downtime. Regular maintenance is therefore necessary. Among other influences, the operational reliability and durability of the centrifugal fan depend on proper maintenance.

The following table is a guideline for the intervals, inspections and maintenance for standard centrifugal fan use.

Schedule of maintenance and inspections

For reliable and safe operation, the centrifugal fan has to be stopped and checked at periodic intervals. The centrifugal fan can also be checked during unplanned downtime or standstill.

If the centrifugal fan is not running, the temperature in the fan casing has not to be higher than +80 °C (for centrifugal fan version up to 200 °C and 400 °C). In case of higher temperature would result in excessive heating of the bearings.

Records of the results and date of the inspection have to be kept.

<table>
<tr><th>Controlled part</th><th colspan="2">The kind of check</th><th>Interval</th></tr>
<tr><td rowspan="6">Impeller</td><td colspan="2">Tighten of bolt connections</td><td>6 months</td></tr>
<tr><td colspan="2">The integrity of the welds</td><td>See impeller wear</td></tr>
<tr><td colspan="2">Air purity</td><td>6 months</td></tr>
<tr><td>Impeller deposits</td><td>The air with sticky admixtures can cause increased vibration. Vibration values have to be monitored. When the maximum permissible values are reached, the impeller has to be mechanically cleaned.</td><td>Determination of cleaning intervals and centrifugal fan checks based on test operation</td></tr>
<tr><td rowspan="2">Wear out of the impeller</td><td>With abrasive impurities - if the impeller material is reduced by 0.5 mm, replace the impeller</td><td>Every 24 hours or in determined cleaning intervals and fan checks according to test operation</td></tr>
<tr><td>With chemical impurities - if the impeller material is reduced by 0.5 mm, replace the impeller</td><td>Every 24 hours</td></tr>
</table>

Controlled part	The kind of check	Interval
Centrifugal fan	Tighten of bolt connections	6 months
	Vibration check - centrifugal fan design (3.1)	1 month
	Vibration check - centrifugal fan design (3.2 and 3.3)	Determination of cleaning intervals and centrifugal fan checks based on test operation
Bearings	Amount of lubricant	See annex
	Lubricant condition	6 months
	Bearing temperature (see annex “lubrication”)	After lubrication and then once a week
	Replacement of bearings (in case of special operating conditions and increased vibration, the period is shortened as needed)	36 months
Fan casing	Centrifugal fan design (3.1)	6 months
	Centrifugal fan design (3.2 and 3.3)	Determination of cleaning intervals and centrifugal fan checks based on test operation
Electric motor	Inspection	according to valid regulations and manufacturer's instructions
Wiring	Inspection	according to valid regulations
Coupling	Coupling alignment according to annex, replacement of rubber parts	3 months
Fan belt	V-belt – damage, tension	14 days
	flat belt – damage, tension	1 month
- Acoustic and visual check of the centrifugal fan - Inspection of protective devices - Inspection of flexible duct connections		Every 500 operating hours or once a month

Vibration values for vibration check:

Operating status: vibration values of centrifugal fan with flexible connectors:

Electric motor input up to 15 kW 7.1 $mm \cdot s^{-1}$

Electric motor input 15 kW – 75 kW 9.0 $mm \cdot s^{-1}$

Electric motor input 75 kW – 300 kW 11.2 $mm \cdot s^{-1}$

Temporary admissible status: vibration values of centrifugal fan with flexible connectors:

Electric motor input up to 15 kW 11.0 $mm \cdot s^{-1}$

Electric motor input 15 kW – 75 kW 14.0 $mm \cdot s^{-1}$

Electric motor input 75 kW – 300 kW 18.0 $mm \cdot s^{-1}$

The causes of increased centrifugal fan vibration have to be quickly remedied.

WARNING!

Also observe the special instructions for maintenance and inspection of accessories and other parts of the delivery.

Maintenance notes

General notes

It is necessary to check visually and acoustically the operation of the centrifugal fan regularly. If deviation from normal operation is detected, the cause has to be found and the problem solved.

The condition of the protective and safety devices has to be regularly checked. If necessary, these devices have to be repaired out of operation of the centrifugal fan.

The accessible bolt connections have to be checked regularly and tightened if necessary.

Impeller

Depending on the abrasion rate of the moved medium, it is necessary to regularly check the impeller for deformation, wear, cracks and other damage.

With abrasive impurities - if the impeller material is reduced by 0.5 mm, replace the impeller, otherwise operational reliability can't be guaranteed!

Never use the damaged impeller. It has to be inspected or repaired by the manufacturer.

10. Repairs

General notes

Below you will find a description of the repair of any defects you may encounter during maintenance or that require replacement of wear or spare parts.

If you are replacing parts yourself, observe the following notes and steps.

We recommend to have spare parts that cannot be delivered in a short delivery time in the stock.

Before starting any repairs, the centrifugal fan has to be shut down and protected against unintentional start-up! Also wait until all rotating parts have come to a complete standstill!

Impeller replacement

If the centrifugal fan is connected to the suction side with ductwork (without flexible connectors), loosen the bolt connection with the suction flange and remove the duct part with a length at least of two cross sections of the inlet part.

If the centrifugal fan is connected to the suction side with ductwork (with flexible connectors), loosen the bolt connection and remove the flexible connectors.

Loosen the bolts of the cover plate of the fan casing (on the suction side) and remove it.

Remove the cover disc (washer) as axial protection of the impeller, which is now accessible.

Remove the impeller using the two threaded holes in the impeller hub and the impeller puller removal tool from the shaft. Support the impeller in the fan casing.

Before refitting the impeller, carefully clean the shaft and the shaft key. Apply the Molykote paste to the contact surface. Clean the contact surface of the impeller hub as well.

To refit the impeller on the shaft easily, heat the impeller hub sufficiently (e.g., with a gas burner).

Use the threaded hole in the shaft and the winding tool to fully tighten the impeller to the shaft. Then secure the impeller with the cover disc (washer).

WARNING!

When installing the impeller, never use blows that can cause impeller imbalance and bearing damage!

Reassemble the cover plate of the fan casing (on the suction side). Make sure that the impeller inlet cone and the cover plate are concentrically positioned and that the operating clearance is kept.

Refit the ductwork on the suction side.

Coupling replacement

Dismount the electric motor.

Remove the coupling from the fan shaft and electric motor shaft using the puller removal tool (also pay attention to the locking screws of the coupling). Before reassembling the coupling, carefully clean the shaft and the shaft key. Apply the Molykote paste to the contact surface.

Clean the contact surface of the coupling as well.

Use the threaded hole in the shaft and the winding tool to fully tighten the coupling to the shaft.

Align the coupling.

WARNING!

Coupling alignment according to instructions in annex.

Pulley replacement

Remove the pulley cover.

Loosen the electric motor bolts and remove the fan belts.

Pull the fan belts in the direction of the shaft axis.

Loosen the screws of the clamping device and remove the pulley cover.

Do not open inner part of pulley (conical hub), there is a possibility of cracking.

Before refitting the pulley, carefully clean the shaft and the shaft key. Apply the Molykote paste to the contact surface.

Fit the pulley with the hub on the shaft, align the pulleys, tighten the pulleys, align the electric motor - use a ruler to check pulley alignment.

Tighten the fan belts, tighten the screws of the electric motor.

11. Lubrication

a) Lubrication of fan bearings - see annex
   (In case of fan belt B2 / coupling drive B3)
b) Lubrication of electric motor bearings
   (Lubrication according to the instructions of the electric motor manufacturer)

12. Other

Tightening torques of bolt connections

thread		M6	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27
outer hexagon		10	14	17	19	22	24	27	30	32	36	41
inner hexagon		5	6	8	10	12	14	14	17	17	19	-
strength class ISO (DIN)	yield pt. ($N \cdot mm^{-2}$)	tightening torques in (N·m)										
5.6	300	-	11	22	37	60	80	120	160	200	280	370
5.8	400	-	16	32	54	80	115	175	230	290	400	(540)
8.8	640	10	23	45	76	120	168	250	320	400	(580)	(780)
10.9	900	14	33	63	107	168	230	350	450	(580)	(820)	-
12.9	1080	17	39	75	128	200	280	420	(560)	(700)	(980)	-

Guarantee and spare parts

The device warranty is valid according to the Commercial Code. Unless otherwise stated in the purchase contract.

We recommend storing the most important wear and spare parts at the fan's operation place.

When ordering spare parts, the following information have to be provided:

- Serial number of the supplied centrifugal fan
- Spare part designation
- The part number in the spare parts list
- Quantity

We only guarantee spare centrifugal fan parts supplied by us.

We refuse to accept any liability for damage caused by parts not supplied by us.

13. Noise emission

Noise emission are in accordance with regulation EN ISO 3744.

The sound pressure / power level is specified in the technical data of the centrifugal fan.

14. Disposal of the fan after end-of-life

The device has to be disposed of according to current regulations.

With regard to the presence of oils and lubricants, it is essential that the device is disposed of by a qualified person for end of life.

15. Annexes - regulations

These documents are sent separately:

- Technical data
- Ecodesign
- Certificate of product quality and completeness
- Dynamic balancing protocol
- Declaration of Conformity
- Operating instructions of the motor

16.A Annex - Lubrication of fan bearings (B2, B3)

Fans are equipped with roller bearings, which are filled with lubricant (grease). The standard type of lubricant is Mogul LV 2-3, which is suitable for a bearing housing temperature of max. 100 ° C. For higher temperatures, the lubricant in the bearings must be replaced with lubricant that meets required temperatures (see list below the table). The bearing manufacturer allows the permitted heating of double-row roller bearings to a temperature of up to 180 °C.

When changing the type of lubricant, the bearing unit must be degreased, cleaned and dried.

It is important to constantly check the bearing temperature.

The relubrication intervals and the amount of lubricant are given in the following table.

Bearing size	Lubricant type	Interval RPM n = 3000 min^{-1}	Interval RPM n = 1500 min^{-1}	Amount of lubricant
22208K	Mogul LV 2-3 (or similar)	1 000 hr	1 500 hr	20 g
22209K		1 000 hr	1 500 hr	25 g
22210K		1 000 hr	1 500 hr	30 g
22211K		1 000 hr	1 500 hr	30 g
22213K		1 000 hr	1 500 hr	30 g
22215K		1 000 hr	1 500 hr	35 g
22217K		-	1 500 hr	40 g
22220K		-	1 500 hr	50 g

Lubrication of bearings for body temperatures up to 100 °C: Mogul LV 2-3 eventual: LGWA2)

Lubrication of bearings for body temperatures up to 140 °C: LGHP2

Lubrication of bearings for body temperatures up to 160 °C: ESSO UNIREX N3

Lubrication of bearings for body temperatures up to 180 °C: XINTEX Super Impact

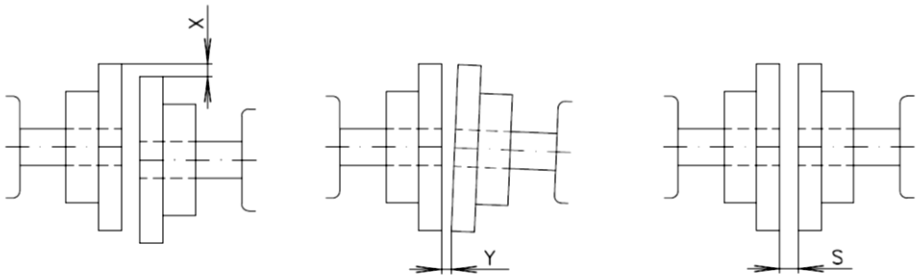
When lubricating, care must be taken not to over-lubricate – this may cause the temperature to rise above the permitted limit and subsequently degrade the grease. Degraded grease can damage the bearing.

16.B Annex – Coupling alignment (B3)

Digital devices are used to align the shaft coupling, which evaluate the radial / axial / angular coaxiality or older dial indicators and measuring instruments.

The coupling may only be aligned by a qualified person.

The following table shows the maximum coaxiality values:



RPM n = 3000 min^{-1}	
horizontal / vertical position	MAX. permissible coaxiality value
X	0,03 mm
Y	0,03 mm
S	according to the size of the coupling

RPM n = 1500 min^{-1}	
horizontal / vertical position	MAX. permissible coaxiality value
X	0,06 mm
Y	0,06 mm
S	according to the size of the coupling

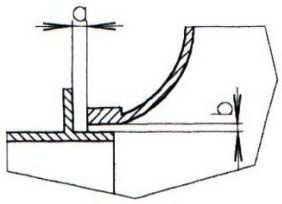
After each alignment of the coupling, it is necessary to draw up a measurement report with the measured values of coaxiality.

16.C Annex – Clearance between impeller inlet cone and nozzle

After replacing the impeller or removing the cover plate, it is necessary to check the prescribed clearance along the entire circumference of the impeller inlet cone (eg with a wire with a diameter of 2 mm) to prevent the impeller from being rubbed by the inlet nozzle. Turn the impeller by hand when checking.

If there is no specified clearance around the entire circumference of the inlet nozzle, loosen the cover plate screws and try to center it again.

If the rubbing still occurs after repeated centering, please contact the fan manufacturer.



Distance	Impeller diameter	Clearance
a	<900 mm	8–12 mm
a	>900 mm	10–15 mm
b	<900 mm	3–5 mm
b	>900 mm	4–6 mm