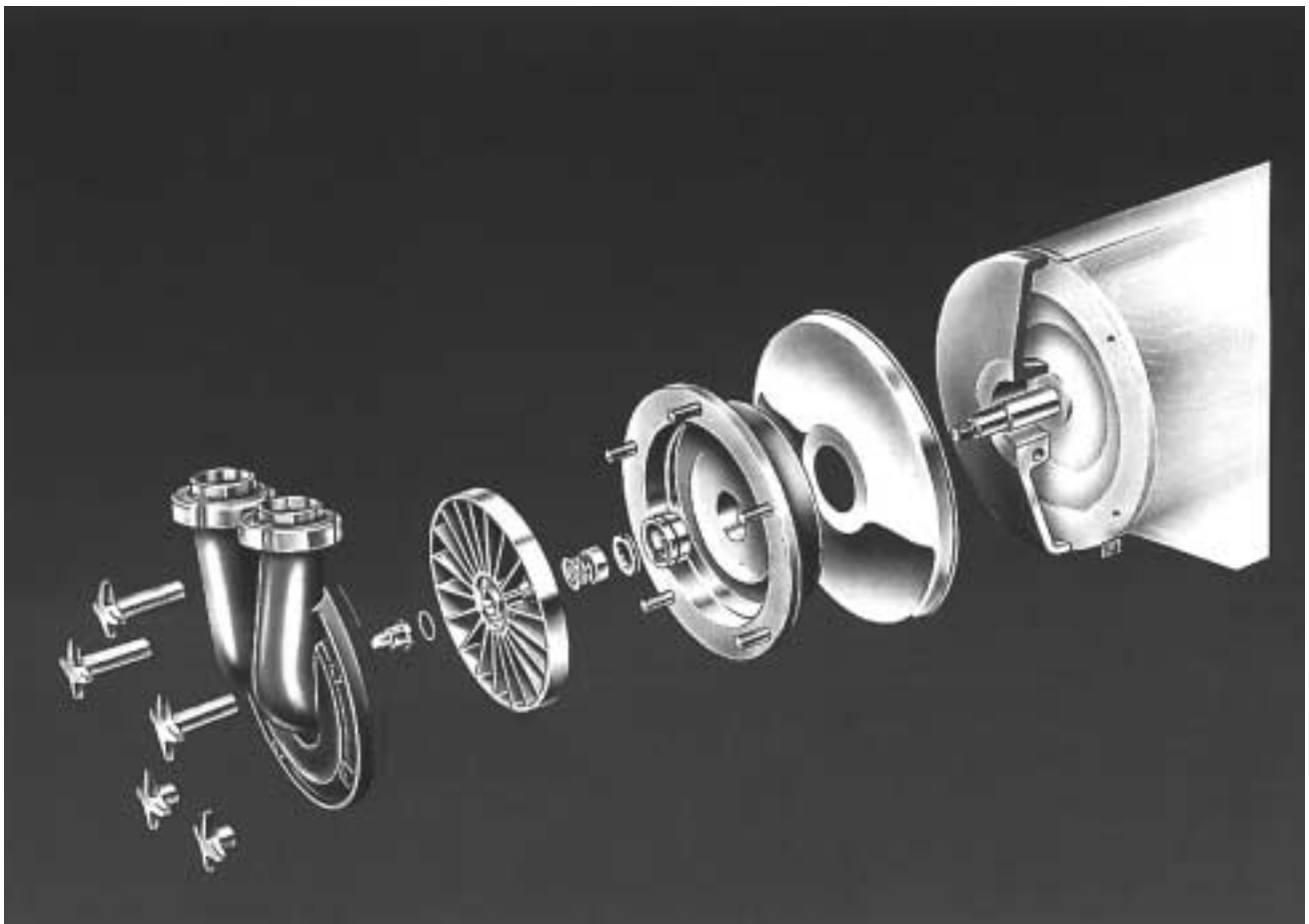


SELFPRIMING CENTRIFUGAL PUMPS FZ SERIES



Pump typ:

Pump no.:

Contents

		page			page
1.	General	1	6.	Putting into operation	4
1.1	Application	1	6.1	General	4
2.	Safety	1	6.2	Special directions	5
2.1	Identification of directions in the Operating Manuel	1	6.2.1	Double shaft seal	5
2.2	Staff qualification and training	1	6.2.2	Bearing pedestal version	5
2.3	Dangers connected with failure to observe the safety directions	1	6.2.3	Controlling and monitoring devices	5
2.4	Safety-conscious work	2	7.	Taking out of operating	5
2.5	Safety directions for the user/operator	2	8.	Maintenance	5
2.6	Safety directions for maintenance, inspection and installation work	2	8.1	General	5
2.7	Unauthorised modification and manufacture of spare parts	2	8.2	Maintenance directions	5
2.8	Unpermissible operating methods	2	8.2.1	Special motor	5
3.	Transport and storage	2	8.2.2	Motor for bearing pedestal	5
3.1	Safety measures	2	8.2.3	K and KF bearing bracket	5
3.2	Transportation	2	8.2.4	Bearing pedestal 1	5
3.3	Storing the pump	3	8.2.5	Bearing pedestal 2, 3, 3V and 4	5
3.4	Protection against ambient influences	3	8.2.6	Double shaft seal	5
4.	Description of the pump and its accessories	3	8.3	Lubrication table	6
4.1	General	3	8.4	Disassembly	6
4.2	Types	3	8.4.1	Impeller and shaft seal	6
5.	Installation and mounting	4	8.4.2	More extensive disassembly	7
5.1	Information on the place of installation	4	8.4.2.1	Versions A, B, C and D (special motor)	7
5.2	Inspection before installation	4	8.4.2.2	Versions K and KF	7
5.3	Electrical installation	4	8.4.2.3	Bearing pedestal version	7
5.4	Piping	4	8.5	Assembly	7
5.4.1	General	4	8.5.1	General	7
5.4.2	Liquid level	4	8.5.1.1.	Axial clearance	7
5.4.3	Sealing liquid pipe	4	8.5.1.2	Screw tightening torque	7
			8.5.2	FZ assembly	7
			8.5.2.1	Versions A, B, C and D (special motor)	8
			8.5.2.2	Versions K and KF	8
			8.5.2.3	Bearing pedestal version	8
			9.	Spare parts	8
			10.	Faults, Causes, Remedy	9

1. General

This Operating Manual applies to all FZ series pumps.

The Operating Manual must be read before installing or operating the pump. Please observe all safety directions.

1.1 Application

Depending on the order-related version, suitable for the following applications among others:



Dairy products

Raw milk, cream, whey



Foods

Animal and vegetable oils and fats, mayonnaise, essence, whole egg



Brewing

Yeast, beer, CIP solutions



Nonalcoholic beverages

Syrup, must, pulp concentrates



Alcohol industry

Wine, liqueurs, , distillates



Pharmaceutics/ Cosmetics/Biotechnology

Plant extracts, perfumes, lotions, toxic solutions, alcoholic solutions, nutrient solutions



Chemicals

Photoemulsions, cleaners, acids and alkaline solutions

and, for example, in the industrial processes below:

Cleaning return in CIP systems
 Sampling in breweries (FZP)
 Emulsification and homogenisation
 Draining product line residues
 Filling and discharging tankers
 Water treatment
 Emptying barrels, containers, pits and sumps
 Supplying filtration and filling machines
 Extraction
 Emptying bottles
 Fermentation

2. Safety

This Operating Manual contains directions of fundamental importance which must be observed during installation, operation and maintenance.

For this reason, it is imperative that the Operating Manual be read by the fitter as well as the responsible qualified staff/user before both installation and putting into operation and be kept constantly at hand at the place of use of the machine/system.

Apart from the general safety directions contained under the heading Safety, the special safety directions, e.g. for private use, included under the other headings must also be observed.

2.1 Identification of directions in the Operating Manual

The safety directions contained in this Operating Manual, which, if not observed, may endanger persons, are specially identified by the general danger symbol



safety symbol in compliance with
DIN 4844 - W 9

or by the following to warn of electrical voltage



safety symbol in compliance with
DIN 4844 - W 8

In the case of safety directions, whose nonobservance may endanger the machine and its functioning, the word

CAUTION

is inserted.

It is vital that directions located directly on the machine such as

- rotation arrow
- fluid connection identifier

be observed and kept in a fully readable state.

2.2 Staff qualification and training

The staff entrusted with operation, maintenance, inspection and installation must be suitably qualified for these tasks.

The area of responsibility, accountability and supervision of staff must be precisely laid down by the user. Should staff not possess the knowledge required, they must receive training and instruction. If necessary, this can be carried out on behalf of the user of the machine by the manufacturer/supplier.

Furthermore, the user must ensure that the contents of this Operating Manual are fully understood by its staff.

2.3 Dangers connected with failure to observe the safety directions

Failure to observe the safety directions may endanger persons as well as the environment and machine. Failure to observe the safety directions can result in the loss of all claims for compensation.

The following are examples of individual dangers which may result from failure to observe the safety directions:

- Failure of important machine/system functions
- Failure of prescribed methods of maintenance and servicing
- Endangerment of persons by electrical, mechanical and chemical effects
- Endangerment of the environment due to the leakage of dangerous substances

2.4 Safety-conscious work

The safety directions contained in this Operating Manual, the current national accident prevention regulations as well as any internal working, operating and safety rules issued by the user must be observed.

2.5 Safety directions for the user/operator

- Should hot or cold machine parts pose dangers, the customer must ensure that they cannot be touched.
- The touch guards fitted to moving parts (e.g. coupling) must not be removed when the machine is in operation.
- Leakages (e.g. of the shaft seal) of dangerous pumped fluids (e.g. explosive, toxic, hot) must be dealt with in such a way that no danger is posed to persons or to the environment. Any statutory provisions must be observed.
- Dangers resulting from electrical power must be prevented (see, for example, the directions issued by the Association of German Electrical Engineers (VDE) and the local power supply companies for details).

2.6 Safety directions for maintenance, inspection and installation work

The user must ensure that all maintenance, inspection and installation work is carried out by authorised and qualified staff with adequate knowledge of the machine gained by an in-depth study of the Operating Manual.

Work on the machine must always be carried out only when it is at standstill. It is imperative that the procedure described in the Operating Manual for shutting down the machine be observed.

Pumps or pumping sets conveying media of risk to health must be decontaminated.

All safety and protective devices must be refitted or returned to operation immediately after completing the work.

Before putting into or returning to operation, the points specified in the section entitled Putting into operation must be observed.

2.7 Unauthorised modification and manufacture of spare parts

Modifications or alterations to the machine are permissible only after consultation with the manufacturer. Original spare parts and accessories authorised by the manufacturer promote safety. The use of other parts may void liability for the consequences.

2.8 Unpermissible operating methods

The safety of operation of the machine supplied is ensured only when used properly. The limit values stated in the order-related documentation must never be exceeded.

3. Transport and storage

3.1 Safety measures



Before transportation the pump must be protected against falling over, e.g.:

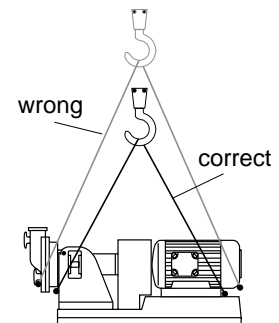
- by securing to the pallet with transport straps
- by screwing to the transport pallet.

3.2 Transportation

The choice of transport mode depends on the size and weight of the pump.

Pumps can be easily transported with a crane, low lift platform truck or fork lift truck, e.g.:

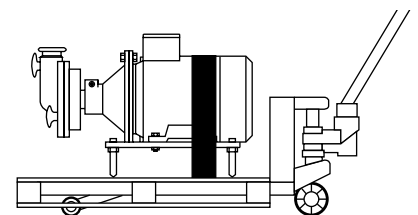
a) with a crane



CAUTION

The crane and strap must be of adequate capacity and strength. The lugs on the motor are not suitable for lifting or transporting the pump.

b) with a low lift platform truck or fork lift truck



3.3 Storing the pump

The place where the pump is stored should fulfil the following conditions:

it should be

- dry
- dust-free
- heated (approx. 20° - 25° C)
- ventilated.

CAUTION The pump must be cleaned before storing as there is otherwise a risk that pumping medium residue will harden, damaging the pump.

CAUTION The interior of the pump must be dry after cleaning and before sealing the suction and delivery connections.

3.4 Protection against ambient influences

With high air humidity (> 50%) it is recommended that the pump be packed with silica gel.

When covering the pump with a tarpaulin, take care to avoid the condensation of water.

When stored for extended periods (over 6 months), the seals, bearings and lubrication should be checked before putting into operation. In addition, moving parts should be rotated every 3 months.

4. Description of the pump and its accessories

4.1 General

All of the FRISTAM FZ centrifugal pumps except for the FZP 10 are self-priming.

The FZ pumps can vent the suction lines themselves and deliver liquids with high levels of entrained gas.

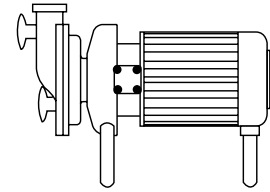
The FRISTAM FZP 10 centrifugal pump is a non-self-priming sampling pump. The FZ and FZP 10 achieve high delivery heads and steep Q-H characteristics. The power requirements drop with increasing capacity.

FRISTAM centrifugal pumps achieve their reliability through the use of solid cast or forged stainless-steel components.

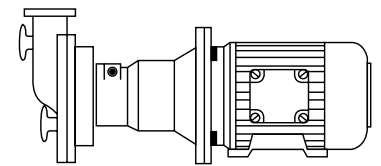
Open impellers are used. The FZ centrifugal pumps are fitted with single or double mechanical shaft seals depending on the conditions of use.

The pump housing and cover of all models are also available with a heating jacket.

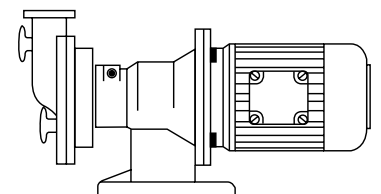
4.2 Types



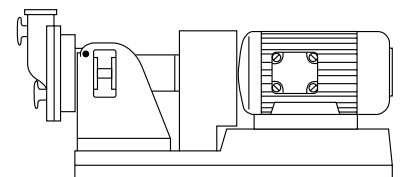
A,B,C,D: Special motor



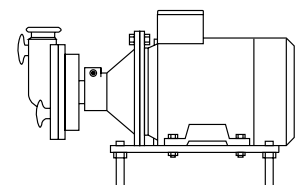
K: Compact bearing bracket with IEC standard motor type B3/B5



KF: Compact bearing bracket with base and IEC standard motor type B5



L: Bearing pedestal with coupling, coupling protector, IEC standard motor type B3, on joint base frame



FZP 10: IEC standard motor B3/B5 with clamping disc

Versions as standard or available with shroud and adjustable legs.

5. Installation and mounting

5.1 Information on the place of installation

Before installing the pump, it must be ensured

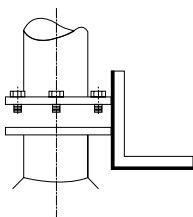
1. that the base is sufficiently dimensioned for the weight of the pump
2. that the installation surface is level
3. that there is sufficient space for maintenance work
4. that there is an adequate supply of air since the motor will not otherwise be sufficiently cooled
5. that the room characteristics conform with the legal provisions with regard to the max. permissible sound pressure
6. that the pump is suitable for the place of installation, e.g. operation of pumps in potentially explosive surroundings.

CAUTION If a pump is not equipped with an explosion-protected motor, it must not be operated in an explosive atmosphere.

During installation, care must be taken to ensure that the pump is not distorted by external forces.

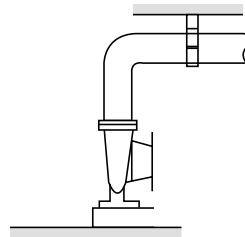
Distortion of the pump can be avoided by:

- alignment of the pump connections



Alignment with a try square

- supporting the piping in front of and behind the pump



Relieving the piping

5.2 Inspection before installation

The pump must be cleaned before operation. In addition, it must be ensured that no impurities are able to enter the pump through the system.

5.3 Electrical installation



Observe the electrical regulations. Heed the load ratings on the rating plate and do not exceed the performance data. The pump must be connected up to the power supply only by qualified staff.

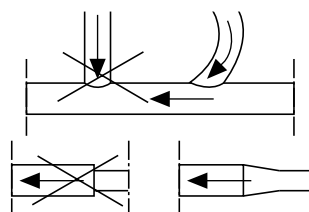
- Connect up according to the circuit diagram in the terminal box.
- Protect the terminal box and cable bushing against moisture.

5.4 Piping

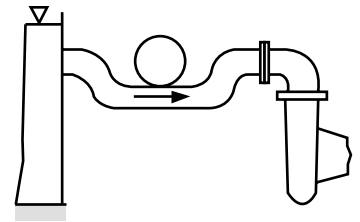
5.4.1 General

To ensure trouble-free operation, the following installation directions must be observed:

- Avoid abrupt pipe transition pieces.



- Avoid deposits



- Keep pipe resistance low. Avoid installing valves, elbows, transition pieces etc.

5.4.2 Liquid level

Before operating, fill the pump with the pumping medium at least up to the delivery connection.

CAUTION The pump must not be isolated completely during operation. It may only be restricted to the minimum delivery shown on the performance curve.

5.4.3 Sealing liquid pipe

- Install a throttle valve in the supply pipe.
- Fit the outlet pipe with a flow meter.

6. Putting into operation

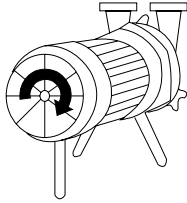
6.1 General

- Clean pump
- Clean pipework
- Prime and vent pump

CAUTION Ensure that discharge line is never shut off to the extent that the flow rate of the liquid falls below the minimum delivery shown on the performance curve. This would lead to the pump unit being damaged and the quality of the liquid impaired.

1. Fill the pump with pumped fluid and start the sealing liquid system, if fitted, at the specified pressure (Tab. 1).

2. Allow the pump to run for 1 second max.
3. If the fan rotates clockwise, the motor is connected correctly.



Checking the direction of rotation

CAUTION Running the pump dry may damage the shaft seal. With a **double shaft seal** the flow of sealing liquid to the shaft seal must be ensured **before putting into operation**. An incorrect direction of rotation may damage unidirectional shaft seals.

CAUTION Shutting off the delivery pipe for extended periods will damage the pumped fluid and possibly the pumping set.

CAUTION The max. speed may not exceed 1800 rpm.

6.2 Special directions

6.2.1 Double shaft seal

- Make sure the flushing pressure is correct (see Tab. 1).
- The sealing medium must be clean and have no abrasive constituents.
- The temperature of the sealing medium must not exceed 70°C.

6.2.2 Bearing pedestal version

- Check the oil level, except bearing pedestal 1.
- Fit the coupling protector.

6.2.3 Controlling and monitoring devices

(If fitted.) See order-related documentation for a detailed description.

7. Taking out of operation

- If fitted, close the shutoff valves in the suction and delivery pipes.
- Empty the pump.
- Clean the pump.
- Dry the pump.
- Protect the pump against ambient influences (dust, moisture, heat etc.).

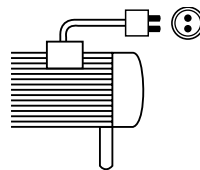
8. Maintenance

8.1 General

It is imperative that the maintenance directions be followed since the efficiency and service life of the pump may otherwise be impaired.



The pump must be disconnected from the power supply before all maintenance work.



Disconnecting the power supply

8.2 Maintenance directions

8.2.1 Special motor

The motors have a fixed bearing at the drive end. The motor bearings are a permanently lubricated type that cannot be greased. The motor shaft end play must not be less than the minimum value specified for the axial clearance in Table 3.

8.2.2 Motor for bearing pedestal

The motor bearings cannot be re-greased. If worn, the bearings must be replaced.

8.2.3 K and KF bearing brackets

The cylindrical roller bearing is to be greased every 3,000 operating hours (see 8.3 Lubrication chart). The ball bearing cannot be greased. The temperature of new bearings may be higher during the running-in period, only to reduce subsequently. The motor shaft end play must not be less than the minimum value specified in Table 3 for axial clearance.

8.2.4 Bearing pedestal 1

The bearings must be cleaned and greased every 3,000 operation hours (see 8.3 Lubrication table).

8.2.5 Bearing pedestals 2, 3, 3V and 4

- Check the oil level regularly.
- See 8.3 Lubrication table for changing the oil.
- Drain off the oil at operating temperature.
- Clean the drain plug and seal before resealing.

The motor shaft end play must not be less than the value specified for axial clearance in Table 3.

8.2.6 Double shaft seal

Check the sealing liquid pressure in accordance with the information in

Type of mech. shaft seal	max. flushing pressure P (bar)
Face to Face	P=0.2 bar
Back to Back	P=P _{System} +0.5 bar

Tab. 1 Flushing Pressure

See order-related documentation for special versions.

8.3 Lubrication table

	Lubricant	Change-interval	Quantity of Lubricant
Versions ABCD of FZ	Deep-groove ball bearing with lifetime lubrication. If necessary, replacement of entire bearing.		
Compact bearing bracket	Bearing with lifetime lubrication. If necessary, replacement of the entire bearing.		
Deep groove ball bearing			
Cylindrical-roller bearing	Darina Grease 2 (Deutsche Shell AG)	3,000 hours	Size 1: approx. 20 g Size 2: approx. 40 g Size 3: approx. 60 g
Shaft end IEC standard motor	COPASLIP (Slip-Ölprodukte GmbH Dudenhofen)	Apply before each assembly	approx. 5 g
Bearing pedestal 1	Darina Grease 2 (Deutsche Shell AG)	3,000 hours	approx. 20 g per bearing
Bearing pedestal 2	Aral Vitam DE 46 (Aral AG)	3,000 hours	approx. 1 litre
IEC standard motor	See motor manufacturer's lubrication instructions		

Tab. 2 Lubrication table

Another brand lubricant of equal quality and viscosity may also be used.

Lubricant

Type	ARAL	BP	DEA/Texaco	ELF	ESSO	Mobil	Shell
Compact bearing bracket Cylindrical-roller bearing	Aralub HTR 2	Energrease HTG	Paragon EP 2	GRX 500	HT Grease 275	Mobiltemp SHC 100	Darina Grease 2
Bearing pedestal 1	Aralub HTR 2	Energrease HTG	Paragon EP 2	GRX 500	HT Grease 275	Mobiltemp SHC 100	Darina Grease 2
Bearing pedestal 2	Vitam DE 46	Energol HLP-D	Actis HLPD 46	Elfolna HLPD	HLPD-Oel 46	HLPD 46	Hydrol DO 46

8.4 Disassembly



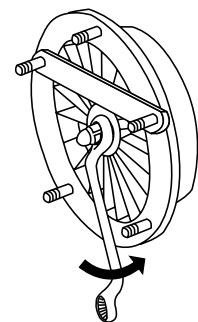
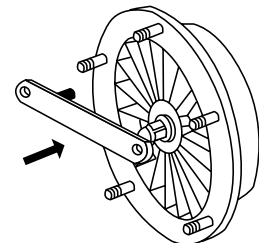
- Disconnect the pump from the power supply so that it is de-energised (see 8.1).
- If fitted, close the shutoff valve in the suction pipe and delivery pipe.
- Undo the suction/delivery connections and remove the pump from the system.



In the case of dangerous pumping media, legal and works safety directions must be observed.

8.4.1 Impeller and shaft seal

- Unscrew the cover and empty the pump, cleaning it if necessary.



- Undo the impeller nut.
- Pull off the impeller from the shaft and remove the feather key.
- Carefully dismantle the shaft seal parts in accordance with the order-related documentation.

8.4.2 More extensive disassembly

8.4.2.1 Versions A, B, C and D (special motor)

A distinction is made between:

- Pump with clamped joint
 - Undo the clamping screw.
 - Pull off the casing.
- Pump with flanged joint
 - Undo the screwed joint between the motor flange and pump skirt.
 - Pull off the pump bell housing with casing.
 - Undo the screwed joint between the pump housing and pump casing.
 - Pull off the casing.
 - Remove the shims.

8.4.2.2 Versions K and KF

A distinction is made between:

- Pump with clamped joint
 - Undo the clamping screw.
 - Pull off the casing.
 - Undo the screwed joint between the motor and bearing bracket.
 - Pull off the motor.
- Pump with flanged joint:
 - Undo the screwed joint between the bearing bracket and pump casing.
 - Pull off the casing.
 - Remove the shims.
 - Undo the screwed joint between the motor flange and bearing bracket.
 - Pull off the motor.

8.4.2.3 Bearing pedestal version

- Pump with clamped joint:
 - Undo the clamping screw.
 - Pull off the casing.
 - Remove the coupling protector.
 - Dismount the coupling in accordance with the order-related documentation.
 - Undo the base fastening screws on the motor and bearing pedestal.
- Pump with flanged joint:
 - Undo the screwed joint between the bearing pedestal and pump casing.
 - Pull off the casing.

- Remove the shims.
- Remove the coupling protector.
- Dismount the coupling in accordance with the order-related documentation.
- Undo the base fastening screws on the motor and bearing pedestal.

8.5 Assembly

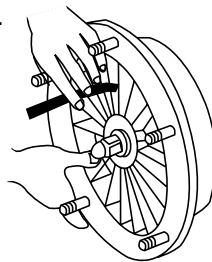
8.5.1 General

Before assembling the pump, the following must be carried out:

- the parts cleaned
- the sealing areas cleaned
- all parts checked for precision of fit and, if necessary, reworked, with the exception of the sliding surfaces of the shaft seal
- worn parts replaced
- seals generally replaced before assembly.

8.5.1.1 Axial clearance

The axial clearance of the pump is to be readjusted as shown in Table 3.



CAUTION The axial clearance of the pump must not be less than the minimum value specified in Table 3.

Pump type	Axial gap between housing/ impeller	tightening torque for impeller nuts
FZP 10	0.3 mm	42 Nm
FZ 15	0.15 - 0,2 mm	60 Nm
FZ 17	0.15 - 0.2 mm	100 Nm
FZ 20	0.25 - 0.3 mm	100 Nm
FZ 22	0.35 - 0.4 mm	70 Nm
FZ 25	0.45 - 0.5 mm	120 Nm

Tab. 3 Gap sizes

8.5.1.2 Screw tightening torque

The tightening torque in the tables below must be complied with.

	M 6	M 8	M 10	M 12	M 16
Nm	10	25	49	85	210

Tab. 4 Class 8.8 steel screws

	M 6	M 8	M 10	M 12	M 16
Nm	7,3	17,5	35	60	144

Tab. 5 Stainless-steel screws A2-70 and A4-70

8.5.2 FZ assembly

A distinction is made between pumps with

- **clamped joint**
- **flanged joint.**

Both versions can be equipped with a single or double shaft seal.

Assembly of the shaft seal:

- with a single shaft seal carry out steps II. and III.
- with a double shaft seal carry out steps I. to III.
See order-related documentation.

Pump with clamped joint:

1. Shaft seal step I.:
Push the rear seal set (drive side) onto the pump shaft.
2. Shaft seal step II.:
Fit the entire shaft seal housing with seals in the pump casing and protect against shifting.
3. Push the pump casing into the clamping element and fasten the clamping screw so as to be fingertight.
4. Shaft seal step III.:
Push the front seal set (product side) onto the pump shaft.
5. Insert the feather key, slotted retaining ring and impeller.
6. Insert the seal ring into the impeller nut. Secure the impeller against twisting and tighten the impeller nut with 100 Nm.

7. Adjust clearance between cover and impeller, and between impeller and housing, by moving the pump housing within the mounting clamp (see Table 3 for value).
8. Tighten the clamping screw with the following tightening torque:
 - special motor M 10 with 36 Nm
 - all others M 10 with 45 Nm
 - M 12 with 75 Nm.
9. Place the cover with seal onto the casing and screw down.

CAUTION Each time the impeller is assembled a check must be made to ensure that it does not touch at any point.

Pump with flanged joint

1. Shaft seal step I.:
Push the rear seal set (drive side) onto the pump shaft.
2. Shaft seal step II.:
Fit the entire shaft seal housing with seals in the pump casing and protect against shifting.
3. Screw the pump casing and shims to the carrier element (e.g. bearing pedestal).
4. Shaft seal step III.:
Push the front seal set (product side) onto the pump shaft.
5. Insert key and impeller and tighten impeller bolt.
6. Check clearance between cover and impeller, and between impeller and housing, against Table 3 and correct with shims between housing and assembly flange if necessary.
7. Locate impeller and tighten its bolt to torque specified in Table 3.
9. Put cover with gasket on the housing and bolt together.

CAUTION Each time the impeller is assembled a check must be made to ensure that it does not touch at any point.

8.5.2.1 Versions A, B, C and D (special motor)

Special features:

- **Pump with clamped joint:**
Clamped joint is permanently attached to the special motor.
- **Pump with flanged joint:**
Pump casing and motor are joined to a pump bell housing. Before installing the motor, this bell housing must be screwed to the pump casing.

8.5.2.2 Versions K and KF

Motor installation

1. Insert the plastic feather key supplied into the motor shaft extension.
2. Coat the motor shaft extension and feather key with a lubricating paste containing copper.
3. Screw together the motor and compact bearing bracket.

CAUTION Only insert the plastic feather key supplied.

8.5.2.3 Bearing pedestal version

Installation of the bearing pedestal, coupling and motor

1. Screw tight the bearing pedestal to the base frame.
2. Insert the coupling between the bearing pedestal and motor and align (in accordance with the order-related documentation).
3. Screw tight the motor to the base frame.
4. Mount the coupling protector.
5. Check the oil level and top up if necessary (not applicable with bearing pedestal 1).

9. Spare parts

Only use original Fristam spare parts. The use of other manufacturers parts renders the warranty void.

In order to ensure the prompt supply of spare parts, we require the following information:

1. Pump type and pump no.
2. Components list no.
3. Part no. of the spare part concerned
4. Material required
5. Number of the respective spare part

10. Faults	Causes	Remedy
Delivery head too small	a. Motor rotating in wrong direction	Motor connected to the terminals incorrectly. Compare connection with the circuit diagram and correct
	b. Motor speed too low (incorrect voltage)	Compare voltage applied with the rating plate
	c. Impeller not set correctly	Check the impeller gap and reset
	d. Pumped fluid too viscous	Call Fristam Application Advice Service
Flow rate too low	a. Motor rotating in wrong direction	Motor connected to the terminals incorrectly. Compare connection with the circuit diagram and correct.
	b. Resistance too great in suction pipe and/or delivery pipe	Increase pipe diameter and/or reduce number of pipe bends and valves
	c. Pumped fluid too viscous	Call Fristam Application Advice Service
	d. Impeller not set correctly	Check the impeller gap and reset
Power consumption of the drive motor is too high	a. Pumped fluid too viscous	Call Fristam Application Advice Service
	b. Impeller not set correctly	Check the impeller gap and reset
	c. Resistance in the delivery pipe too low (flow rate too high)	Regulate speed, e.g. with a frequency converter, or install a control valve in the delivery pipe
Excessive noise	a. Resistance in the suction pipe is too high	Increase the diameter of the suction pipe and/or reduce the length of the suction pipe
	b. Impeller hits against casing	Check the impeller gap and reset
	c. Bearing damage	Replace bearing

If you are not able to pinpoint and eliminate a fault by referring to the table above, the Fristam Application Advice Service is available to help you at any time. We require the following information:

1. Operating conditions
2. Precise description of the fault
3. Pump type and serial number
4. If possible, drawing of pump installation