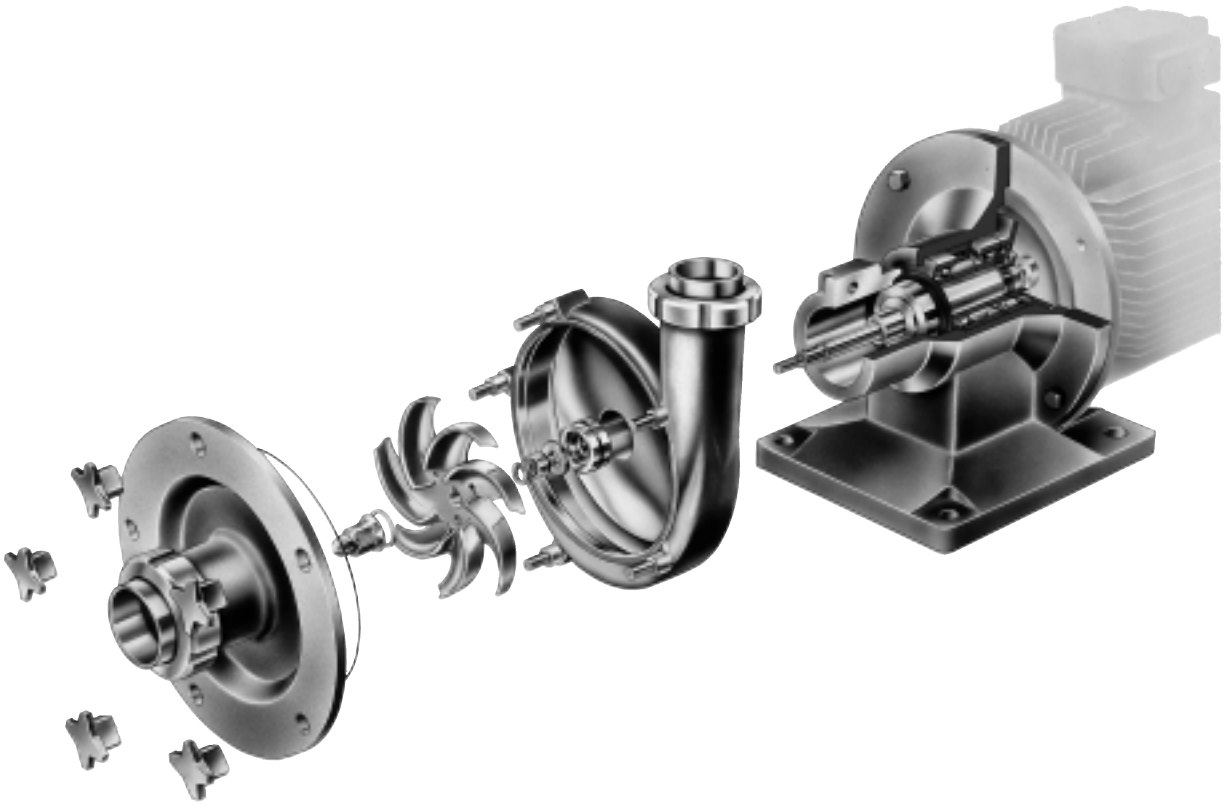
Fristam

P U M P E N

# CENTRIFUGAL PUMPS FP SERIES



**Pump type:**

**Pump no. :**

# Contents

# 1. General

This Operating Manual applies to all FP 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, whey, cream, skimmed milk, milk concentrate, whey concentrate

**Foods**
Animal and vegetable oils nad fats, vinegar, sauces, flavourings

**Nonalcoholic beverages**
Syrup, concentrates, must

**Alcoholic beverages**
Liqueur, wine, sparkling wine, pot ale

**Pharmaceuticals/ Cosmetics**
Superpure water, infusion solutions, lotions, plant extracts, perfumes

**Paper/pulp**
Glues, starch solutions, resin solutions, kaolin solutions

**Biotechnology**
Cellular suspensions, nutrient solutions, enzymes

**Sugar/confectionery**
Liquid sugar, treacle, starch solution

**Meat utilisation**
Brine, meat broth, blood

**Brewing**
Mash, wort, yeast, beer

**Chemicals**
Photographic emulsions, acids, lyes, waste water containing crystals, detergents

and, for example, in the industrial processes below:

Water conditioning
Evaporating
Distillation
Dealcoholisation
Reverse osmosis
Filtration
Extraction
Carbonising
Heating/pressure increase
Fermentation
Emulsifying
Homogenising
Mechanical separation
Dialysis
Bottling
Dosing
Degassing
Transfer
Cleaning applications/CIP
In-line mixing

# 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.:

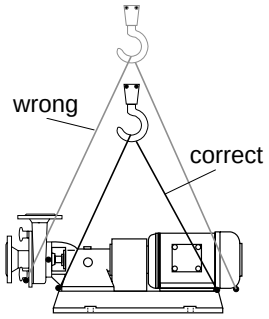
- by securing to the pallet with transport straps
- by screwing to the transport pallet.

### 3.2 Transportation

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

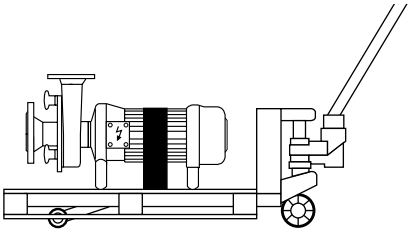
Pumps can be easily transported with a crane, low lift platform truck or fork lift truck, e.g.:

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. An exception is the FP 1250 which is fitted with lugs on the motor, bearing pedestal 4 and pump casing for transportation.

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 six months), the O-rings and, if necessary, the 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

FRISTAM type FP centrifugal pumps are non-self-priming pumps for fed media.

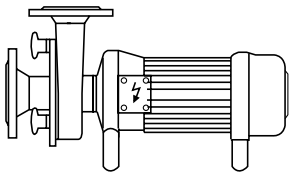
FRISTAM centrifugal pumps owe their reliability to the use of components made of solid, cast or forged stainless-steel material.

Open impellers are predominantly used.

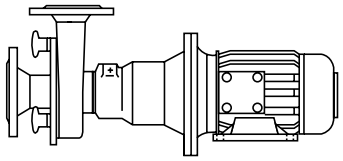
Depending on the operating conditions, Fristam type FP centri-fugal pumps are equipped with single or double shaft seals.

The pump casing and cover are available with a heating jacket for all types except FPE.

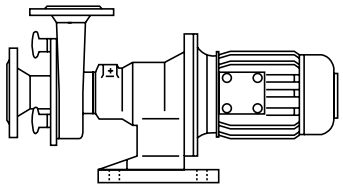
### 4.2 Types



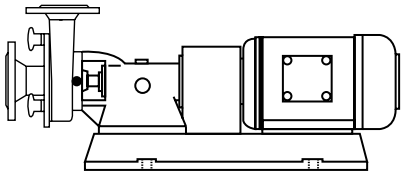
**A,B,C,D:** Special motor



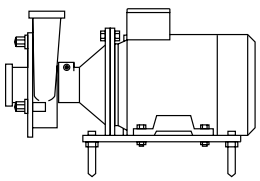
**K:** Compact bearing bracket with IEC standard motor type B3/B5



**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



**FPE:** 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

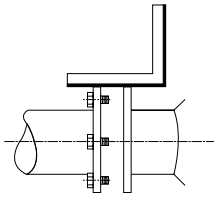
1. that the base is sufficiently dimensioned for the weight of the pump
2. that the installation surface is level
3. that there is sufficient space for maintenance work
4. that there is an adequate supply of air since the motor will not otherwise be sufficiently cooled
5. that the room characteristics 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.

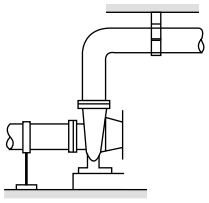
Distortion of the pump can be avoided by:

• 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. The pump must be connected to the power supply by qualified staff only .

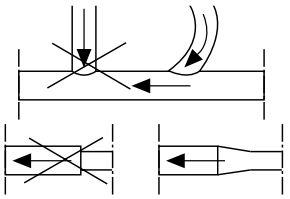
- Adjust the overloads according to the motor name plate
- Do not overload the unit.
- Connect according to the circuit diagram in the terminal box.
- Protect the cable glands against moisture.
- Check the direction of rotation using a rotating field measurement.

### 5.4 Piping

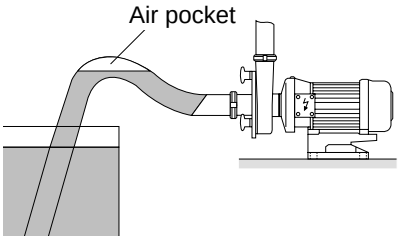
#### 5.4.1 General

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

• Avoid abrupt pipe transition pieces.

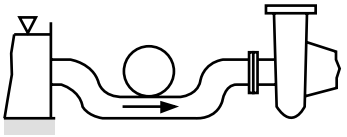


• Avoid the formation of air pockets in the piping




Danger due to air pockets

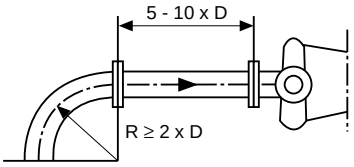
• Avoid deposits



#### 5.4.2 Suction pipe

• Keep as short as possible.

• Do not locate any pipe bends directly in front of the suction connection.



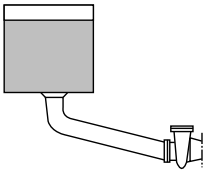

Suction-side pipe bend

- Never allow the pump to become drained when at standstill, e.g. by installing a foot valve.
- If a shutoff valve is required, it must be installed as near to the pump as possible.

**CAUTION** Do not regulate the pump with valves on the suction side.

#### 5.4.3 Supply pipe

- Dimension sufficiently so that the $NPSH_{System} > NPSH_{Pump}$.
- Install with constant downward slope without reverse gradients.



Optimum supply

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

#### 5.4.4 Liquid level

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

#### 5.4.5 Delivery pipe

• Install a shutoff valve in the delivery pipe.

**CAUTION** Abruptly shutting off the delivery pipe during operation of the pump may cause hammering:

• Risk of damaging the fluid pumped and the pump itself.

#### 5.4.6 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 the pump.

• Clean the pipe system.

• Fill and vent the pump and suction pipe.

• Always start up the pump with the valve closed.

**CAUTION** Check the direction of rotation: (see identifying marking on the pump).

An incorrect direction of rotation may damage unidirectional shaft seals.

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

**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**.

**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 3,600 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.

• Water used as sealing medium, must not exceed an over all hardness of 10° dH at a temperature of 60° C.

#### 6.2.2 Bearing pedestal version

• Check the oil level and top up, if necessary.

**CAUTION** The coupling guard must be fitted before putting into operation.

#### 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.

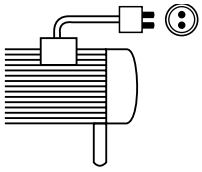
• Protect the pump against ambient influences (dust, moisture, heat etc.).

## 8. Maintenance

#### 8.1 General

It is imperative that the ma intenance 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 Versions A, B, C, D

The motors have a locating bearing at the A-end (drive) and a floating bearing at the B-end. The motor bearings cannot be regreased.

Under normal conditions, it is recommanded to replace the motor bearings after approx. 15,000 to 20,000 operating hours.

### 8.2.2 K- and KF-bearing bracket version

| Type | Bearing | Lubricant | Quantity of Lubricant | Change-interval |
|---|---|---|---|---|
| **K- / KF 1** | Deep groove ball bearing<br>Cylindrical-roller bearing | Lifetime lubrication. If necessary, replacement of the entire bearing<br>Darina Grease II (Deutsche Shell AG) | approx. 20 g | 6,000 hours |
| **K- / KF 2** | Deep groove ball bearing<br>Cylindrical-roller bearing | Lifetime lubrication. If necessary, replacement of the entire bearing<br>Darina Grease II (Deutsche Shell AG) | approx. 40 g | 5,000 hours |
| **K- / KF 3** | Deep groove ball bearing<br>Cylindrical-roller bearing | Lifetime lubrication. If necessary, replacement of the entire bearing<br>Darina Grease II (Deutsche Shell AG) | approx. 60 g | 5,000 hours |

During the run-in phase, increased temperatures may occur with new bearings, which then drop back to normal.

The motor bearings cannot be regreased. Under normal conditions, it is recommanded to replace the motor bearings after approx. 15,000 to 20,000 operating hours.

### 8.2.3 Bearing pedestal version

| | Lubricant | Quantity of Lubricant | Change-interval |
|---|---|---|---|
| **Type** | Darina Grease II (Deutsche Shell AG) | approx. 10 g | 19,000 hours |
| **1**<br>**2** | SAE 15 - W 40<br>Lubricant<br>(Essolube HDX Plus 30) | approx. 1 litre | 8,000 hours |
| **3 and 3V** | SAE 15 - W 40<br>Lubricant<br>(Essolube HDX Plus 30) | approx. 3 litre | 8,000 hours |
| **4** | SAE 15 - W 40<br>Lubricant<br>(Essolube HDX Plus 30) | approx. 5 litre | 8,000 hours |

- Check the oil level regularly.
- Oil change once a year
  - Drain off the oil at operating temperature.
  - Clean the drain plug and seal before resealing.
- The motor bearings cannot be regreased. If worn, the bearings must be replaced. Under normal conditions, it is recommanded to replace the motor bearings after approx. 15,000 to 20,000 operating hours.

### 8.2.4 FPE

The motors have a locating bearing at the A-end (drive end) and a floating bearing at the B-end. The motor bearings cannot be regreased. The motor bearings cannot be regreased. If worn, the bearings must be replaced. Under normal conditions, it is recommanded to replace the motor bearings after approx. 15,000 to 20,000 operating hours.

### 8.2.5 Double shaft seal

Check the sealing liquid pressure in accordance with the information in Tab. 1.

| 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 fot special versions.

### 8.3 Lubrication table

## 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 |
| **Bearing pedestal 3, 3V, 4** | Turboral 30 W | Energol HD-S 30 | Cronos Super SAE 30 | ELF Perfor-mance XR 30 | Essolube HDX plus 30 | Delvac 1300 | Rotella MX |

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

### 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 Disassembly of the shaft seal

- Unscrew the cover and empty the pump clean if necessary.
- Block the impeller, e. g. with round aluminium or plastic object in the delivery connection.
- Undo the impeller nut.
- Pull off the impeller from the shaft and remove the drive key.
- Carefully dismantle all accessible parts of the shaft seal in accordance with the order-related documentation.
- **Tip regarding double shaft seal:**

  Generally, the flush liquid pipes on the pump may stay in place for the ABCD, L or K/KF versions. Only for the FPE and older L and K/KF versions, the sealing liquid pipes need to be removed before disassembly of the pump casing.
- Disassemble the pump casing. A distinction is made between:
  - **Pumps with clamped joints**
    - Undo the clamping screw
    - Spread the clamp open slightly with a wedge
    - Pull the casing out of the clamp
  - **Pumps with a flanged joint**
    - Undo the fastening screws on the flange.
    - Pull off the casing.
- Remove the remaining parts of the shaft seal.

### 8.5 Assembly

### 8.5.1 General

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

- the parts cleaned
- the sealing faces are cleaned, or reworked if necessary (lapping, etc.)
- all parts are to be checked for precision fit and, if necessary,

reworked.

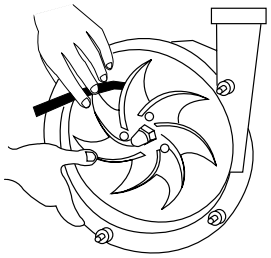
- replace worn parts.
- O-rings (elastomers) are generally replaced before assembly.

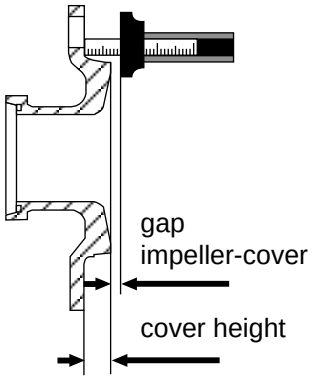
**CAUTION** Application of grease when mounting the pump cover and the shaft seal:

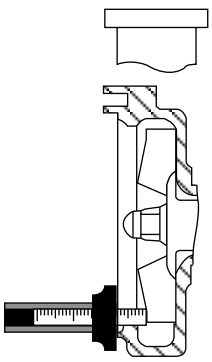
1. The grease used must be compatible with the product, e. g. food-safe quality.
2. Use no grease or oil with O-rings made of EPDM material.
3. Do not apply grease or oil to the seal faces.

### 8.5.1.1 Setting the gap

The gap size of the pump must be reset in accordance with Tab. 3.





| Type of pump | Axial gap between Impeller/ cover | Impeller/ casing |
|---|---|---|
| 711 / 712 | 0.5 mm | |
| 721 / 722 | | |
| 741 / 742 | | |
| 3401 / 3402 | | |
| 3421 / 3422 | 0.5 mm | |
| 3521 / 3522 | | |
| 3431 / 3432 | 0.5 mm | 1.0 mm |
| 3531 / 3532 | | |
| 3441 / 3442 | 1.0 mm | |
| 3541 / 3542 | | |
| 3451 / 3552 | | |
| 3551 / 3552 | | |
| 751 / 752 | | |
| 1051 / 1052 | 0.7 mm | 0.6 mm |
| 1151 / 1152 | 2.0 mm | |
| 1231 / 1232 | 1.0 mm | 1.5 mm |
| 1251 / 1252 | | |
| 101 / 102 – 200 | 0.5 mm | 1.2 mm |
| 101 / 102 – 250 | | |

Tab. 3 Gap sizes

### 8.5.1.2 Screw tightening torque

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

Material: steel
Class of strength: 8.8

| | M6 | M8 | M10 | M12 | M16 | M20 |
|---|---|---|---|---|---|---|
| Nm | 10 | 25 | 49 | 85 | 210 | 420 |

Material: stainless steel
Class of strength: A2-70 and A4-70

| | M6 | M8 | M10 | M12 | M16 | M20 |
|---|---|---|---|---|---|---|
| Nm | 7,3 | 17,5 | 35 | 69 | 144 | 281 |

Tab. 4 Screw tightening torque

### 8.5.2 Assembling the pump head

#### 8.5.2.1 FP pump with clamp and flanged joint

**Version:**

**A, B, C, D, K / KF, Bearing pedestal**

**Size:**

**7.. / 10.. / 11.. / 123. / 34.. / 35..**

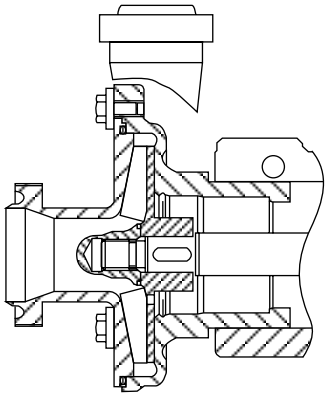
**A distinction is made between pumps with**
- **clamped joint**
- **flanged joint.**

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.

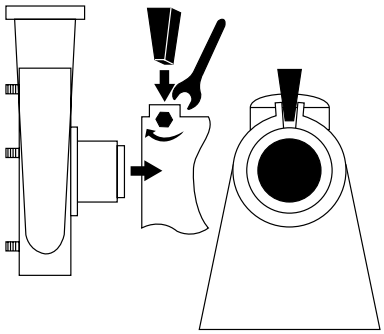
See order-related documentation.

**Pump with clamped joint:**

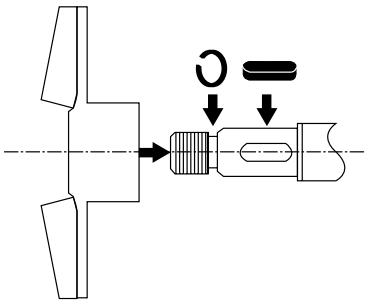


1. Shaft seal step I.
   (only for double shaft seal):
   Push the rear seal set (drive side) onto the pump shaft.
2. Shaft seal step II.
   (applies to single and double shaft seal):
   Fit the entire shaft seal housing with seals in the pump casing and protect against shifting.
3. Carefully slightly open the clamped joint. Push the pump housing over the pump shaft and

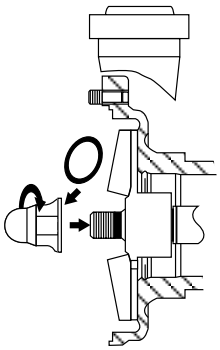
into the clamping element and tighten the clamping screw by hand.



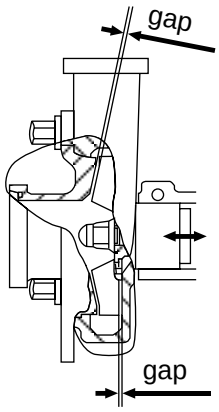
4. Shaft seal step III.:
   Push the front seal set (product side) onto the pump shaft.
5. Insert the feather key, slotted retaining ring and impeller.



6. Insert the seal ring into the impeller nut. Secure the impeller against twisting and tighten the impeller nut with 100 Nm.



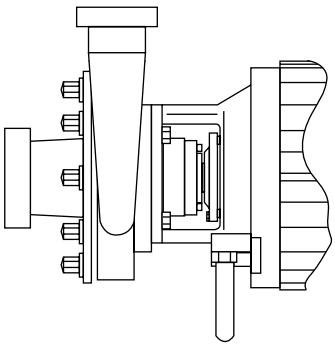
7. Set the gap size of the cover/ impeller and impeller/casing by shifting the pump casing within the clamped joint (see Tab. 3 for gap size).



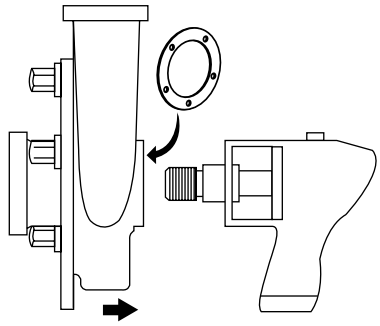

8. Tighten the clamping screw with the following tightening torque:
   - special motor M 10 with 36 Nm
   - all others M 10 with 45 Nm
     M 12 with 75 Nm.
9. Place the cover with seal onto the casing and tighten the cover nuts.

**CAUTION** Check each time the impeller is assembled, that it does not touch the casing at any point.

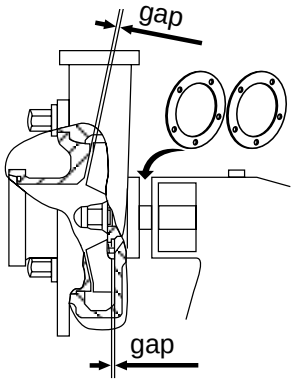
**Pump with flange joint**



1. Shaft seal step I.
   (only for double shaft seal):
   Push the rear seal set (drive side) onto the pump shaft.
2. Shaft seal step II.
   (applies to single and double shaft seal):
   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 the feather key and impeller and screw tight the impeller nut.
6. Check the gap size of the cover/ impeller and impeller/casing in accordance with Tab. 3 and correct, if necessary, with shims between the casing and pump skirt.




7. Remove the impeller nut and push the slotted retaining ring onto the pump shaft.
8. Fit the seal ring to the impeller nut and mount on the pump shaft. Block the impeller and tighten the impeller nut with 100 Nm.
9. Place the cover with seal onto the casing and tighten the cover nuts.

**CAUTION** Check each time the impeller is assembled, that it does not touch the casing at any point.

### 8.5.2.2 FP 1251 / 1252

**Version:**

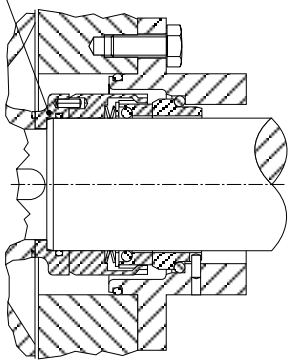
**A, B, C, D, Bearing pedestal**

**Size:**

**1251 / 1252**

1. Fit the stationary seal with an O-ring.
2. Insert the stationary seal into the shaft seal housing and secure against twisting. This is done by pushing the stationary seal groove to meet the cylindrical pin.

Gapping bush



3. Screw the shaft seal housing with the greased O-ring onto the pump casing.
4. Screw the pump casing to bearing pedestal or special motor.
5. Push the front rotary seal (product-side) onto the pump shaft.
6. Insert the gapping bush with the driver. If this is a new bush, it must first be fitted with a cylindrical pin.
7. Fit the seal to the impeller.
8. Insert the drive key and impeller and tighten the impeller nut.
9. Check the gap between the cover/impeller and impeller/ casing in accordance with Tab. 3 and, if necessary, correct by reducing the gapping bush. The casing/impeller gap is given by the distance between the gapping bush and the casing base.
10. Remove the impeller nut and fit the slotted locking ring onto the pump shaft.
11. Fit the seal to the impeller nut and screw onto the pump shaft. Hold the impeller in position and torque up the impeller nut with 200 Nm.
12. Place the cover with greased seal onto the casing and tighten the cover nuts.

**CAUTION** Check each time the impeller is assembled, that it does not touch the casing at any point.

### 8.5.2.3 FPE 1251 / 1252

**Version:**

**FPE with single mechanical shaft seal**

**Size:**

**1251 / 1252**

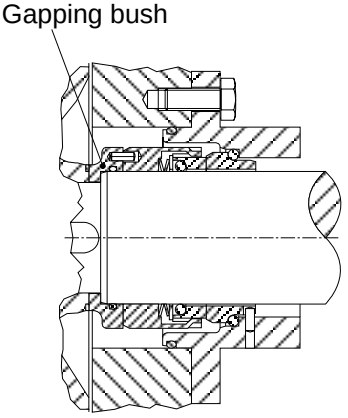
1. Remove the drive key from the motor shaft.
2. Clean the grease from the motor shaft and the bore of the stub shaft.
3. Seal the motor shaft in the area of the shaft shoulder with a sea ling gel (e.g. Stucarit sealing gel 309).
4. Push the stub shaft with shrink-fit ring onto the motor shaft up to the shaft shoulder.
5. Tighten the hex socket screws on the shrink-fit ring in diagonally opposite sequence (see Tab. 5).

| Hex socket screw | Tightening torque |
|---|---|
| M 6 | 12 Nm |
| M 8 | 30 Nm |

Tab. 5 Tightening torque for screws on the shrink-fit ring.

6. Check and align the true running of the stub shaft. **Concentricity tolerance max. 0.06 mm for motors ≤ 30 kW 0.08 mm for motors > 30 kW**
7. Fit the bellhousing to the motor flange.
8. Fit the mating ring with an O-ring.

Gapping bush



9. Insert the mating ring into the shaft seal housing and secure against twisting. This is done by pushing the mating ring groove over the cylindrical pin.
10. Screw the shaft seal housing with the greased O-ring onto the pump casing.
11. Screw the pump casing to bea- ring pedestal or special motor.
12. Push the front seal set (pro- duct-side) onto the pump shaft.
13. Insert the fixed bushing with the driver. If this is a new bushing, it must first be given a cylindrical pin.
14. Fit the impeller with a seal ring.
15. Insert the feather key and impeller and screw the impeller nut tight.
16. Check the gap size of the cover/impeller and impeller/ casing in accordance with Tab. 3 and, if necessary, correct by reducing the fixed bushing. The casing/impeller gap size consists of the spacing between the fixed bushing and the casing base.
17. Remover the impeller nut and

push the slotted retaining ring onto the pump shaft.

18. Fit the seal to the impeller nut and screw onto the pump shaft. Hold the impeller in position and torque up the impeller nut with 200 Nm.
19. Place the cover with greased seal onto the casing and screw down.

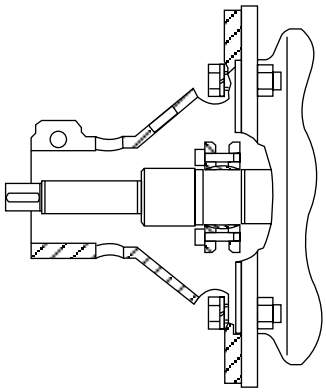
**CAUTION** Check each time the impeller is assembled, that it does not touch the casing at any point.

#### 8.5.2.4 FPE with single mechanical shaft seal

**Size:**

**7.. / 10.. / 11.. / 123. / 34.. / 35..**

1. Remove the feather key from the motor shaft extension.
2. Degrease the motor shaft extension and bore of the hollow shaft.
3. Seal the motor shaft extension around the shaft shoulder with a sealing gel (e.g. Stucarit sealing gel 309).
4. Push the hollow shaft with shrink-fit ring onto the motor shaft extension **up to the shaft shoulder.**

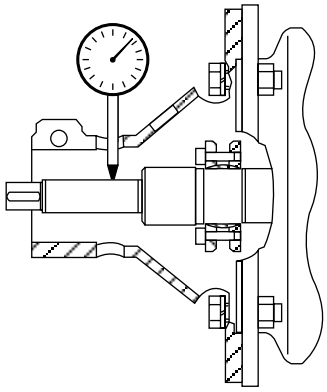


5. Tighten the hexagon socket screws of the shrink-fit ring in diagonally opposite sequence (see Tab. 6).

| Hex socket screw | Tightening torque |
|---|---|
| M 5 | 6 Nm |
| M 6 | 12 Nm |

Tab. 6 Tightening torque for the fastening screws of the shrink-fit ring

6. Check the hollow shaft for concentricity and align.
   **Concentricity tolerance max.**
   **0.06 mm for motors ≤ 30 kW**
   **0.08 mm for motors > 30 kW**



7. Screw the clamping disc to the motor flange.
8. Insert the shaft seal housing or mating ring with seal in to the pump casing and secure (in accordance with the order-related documentation).
9. Screw together the pump casing and clamping disc so as to be fingertight.
10. Fit the front seal set of the shaft seal.
11. Insert the seal ring into the impeller nut. Secure the impeller against twisting and tighten the impeller nut with 100 Nm.
12. Set the gap size of the cover, impeller and casing by shifting the pump casing within the clamped joint (see Tab. 3 Gap sizes).
13. Tighten the clamping screw with the following tightening torque:
    - M 10 with 45 Nm
    - M 12 with 75 Nm.
14. Place the cover with seal onto the casing and screw down.

**CAUTION** Check each time the impeller is assembled, that it does not touch the casing at any point.

#### 8.5.2.5 FPE with double mechanical shaft seal

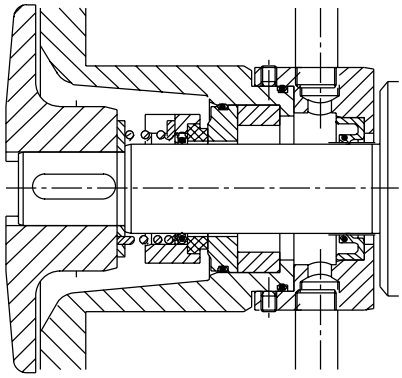
**Size:**

**7.. / 10.. / 11.. / 123. / 34.. / 35..**

1. Remove the feather key from the motor shaft extension.
2. Degrease the motor shaft extension and bore of the hollow shaft.
3. **CAUTION** The radial lip seal must run on a shaft protecting sleeve. For the position of the shaft protecting sleeve, see the mechanical shaft seal drawing (order-related documentation). Push the protecting sleeve onto the shaft using a tube (asembly aid).

| Motor-Power | Tube length | Inner diameter |
|---|---|---|
| < 7.5 kW | 120 mm | 23 mm |
| > 7.5 kW | 150 mm | 36 mm |

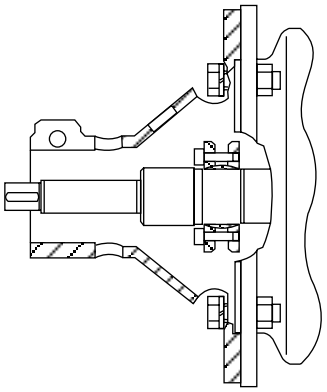
Tab. 7 Assembly tool



4. **Only for shafts with a 22 mm diameter (drive up to 7.5 kW):**

   Insert greased O-ring into the groove on the pump casing. Place seal cover with radial lip seal onto the pump casing. Align seal cover on pump casing. The pipe bores for the sealing liquid must be vertical. Tighten the three grub screws in the seal cover.

   Seal the motor shaft extension around the shaft shoulder with a sealing gel (e.g. Stucarit sealing gel 309).

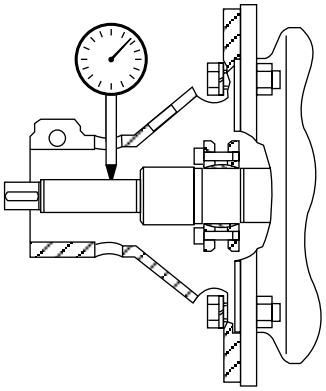


5. Push the hollow shaft with shrink-fit ring onto the motor shaft extension **up to the shaft shoulder.**
6. Tighten the hexagon socket screws of the shrink-fit ring in diagonally opposite sequence (see Tab. 8).

| Hex socket screw | Tightening torque |
|---|---|
| M 5 | 6 Nm |
| M 6 | 12 Nm |

Tab. 8 Tightening torque for the fastening screws of the shrink-fit ring

7. Check the hollow shaft for concentricity and align.
   **Concentricity tolerance max.**
   **0.06 mm for motors ≤ 30 kW**
   **0.08 mm for motors > 30 kW**



8. Screw the clamping disc to the motor flange.
9. Fit the stationary parts of the mechanical seal into the pump casing (in accordance with the order-related document).
10. Carefully wedge open the clamping ring slightly.
11. Push the pump casing into the clamping ring and tighten the screw by hand.
12. Screw the sealing liquid pipe into the seal cover, seal with sealant.
13. Mount the rotary parts of the shaft seal. Insert the drive key, slotted locking ring and impeller.
14. Insert the seal ring into the impeller nut. Secure the impeller against twisting and tighten the impeller nut with 100 Nm.
15. Set the gap size of the cover, impeller and casing by shifting the pump casing within the clamped joint (see Tab. 3 Gap sizes).
16. Tighten the clamping screw with the following tightening torque:
    - M 10 with 45 Nm
    - M 12 with 75 Nm.
17. Place the cover with seal onto the casing and screw down.

**CAUTION** Check each time the impeller is assembled, that it does not touch the casing at any point.

### 8.5.3 Assembly Motor

The motor is fitted together with the pump head:

| | | |
|---|---|---|
| **A, B, C, D** | **version** | **yes** |
| **K / KF** | **version** | **no** |
| **Bearing pedestal** | **version** | **no** |
| **FPE** | **version** | **yes** |

#### 8.5.3.1 Versions K and KF

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.

#### 8.5.3.2 Bearing pedestal version

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 applicab le 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 diameter too small | Replace impeller after consulting the Fristam Application Advice Service |
| | d. Impeller not set correctly | Check the impeller gap and reset |
| | e. 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 frequencyconverter, or install a control valve in the delivery pipe |
| | d. Impeller diameter too large | Reduce the Impeller after consulting Fristam Application Advice Service |
| **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. Liquid level in the suction pipe is too low | Increase $NPSH_{level}$ |
| | c. Impeller hits against casing | Check the impeller gap and reset |
| | d. 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

Fristam PUMPEN

BA/FP/GB/0204