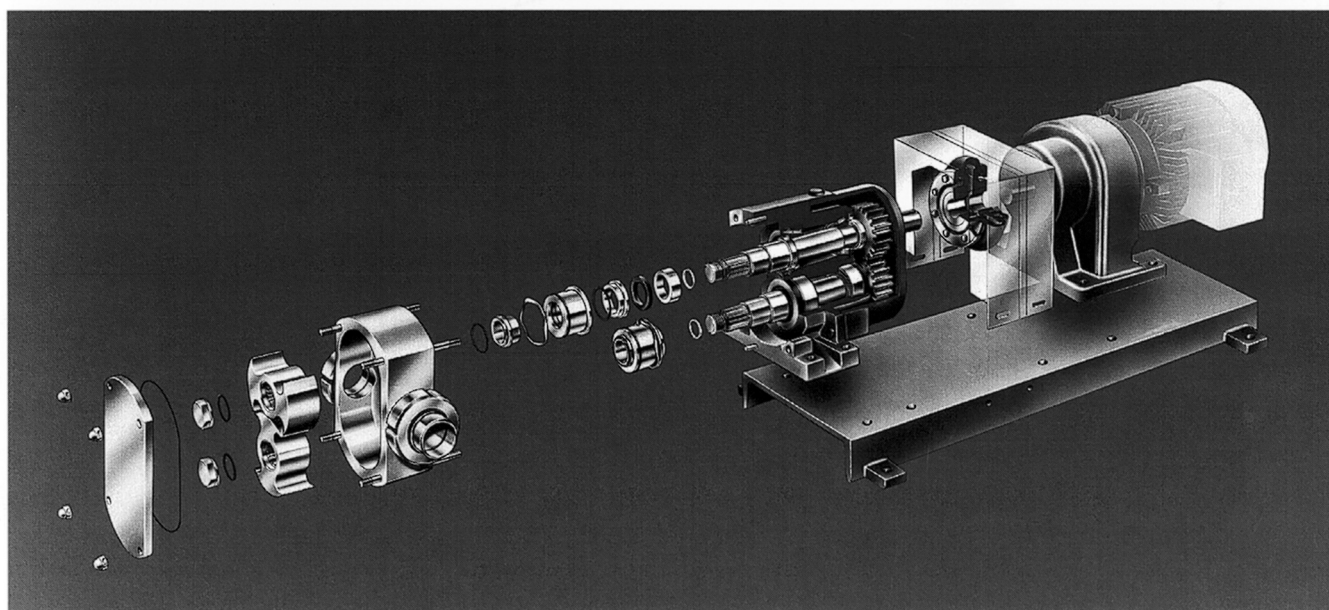
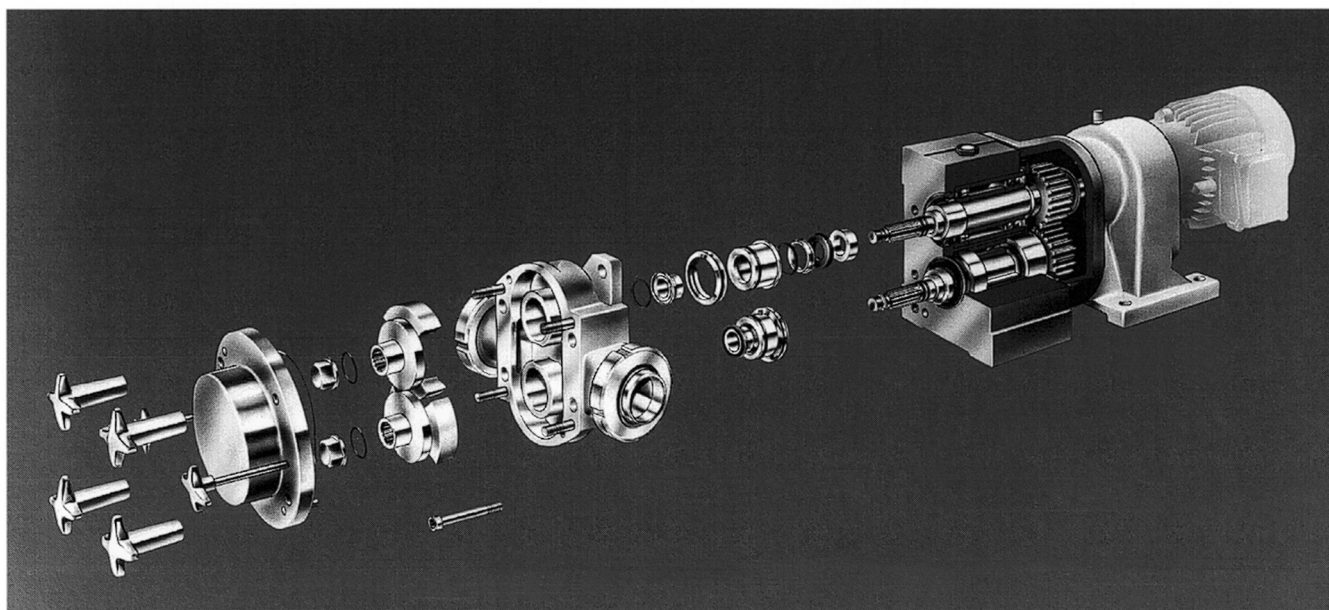


ROTARY CIRCUMFERENTIAL PISTON PUMPS FK SERIES

ROTARY LOBE PUMPS FL SERIES



Pump type:

Pump no. :

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1. General

These Operating Instructions apply for all the pump models in the FK and FL series.

Before installing or operating the pump, the Instructions must be read through and the safety instructions carefully followed.

1.1 Application

This will vary with the particular model ordered, but could include:



Dairy products

Cream, yoghurt, quark, blanc-mange, butter, milk, skimmed milk and dairy concentrates, desserts, whey, cheeses spreads.



Food

Animal and vegetable oils and fats, sauces, soups, egg products, ready meals, salads, cake mix, jams, tomato ketchup, baby food, honey, apple puree.



Brewery, alcohol-free and alcoholic drinks



Egg nogg, sparkling wine, yeast, fruit concentrates, syrup, malt extract.



Pharmaceutical/cosmetic preparations

Ointments, lotions, plant extracts, foam bath, shampoo, cosmetic creams, toothpaste.



Biotechnology

Cell suspensions, nutrient solutions, enzymes.



Sugar/confectionery

Liquid sugar, molasses, starch solution, chocolate, boiled sweet mixture, toffee, liquorice, praline filling, fondant.



Chemical

Photographic emulsions, adhesives, synthetic resin solutions, gelatine, plastics dispersions.



Meat and fish industry

Blood, aspic, sausage filling, caviar, meat and fish salads

and can also be applied in the following production processes:

filling and emptying
dosing
increasing pressure
evaporating
thickening
emulsifying
degassing
extracting
fermenting
filtering
homogenising
crystallising
separating
transferring
drying.

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.:

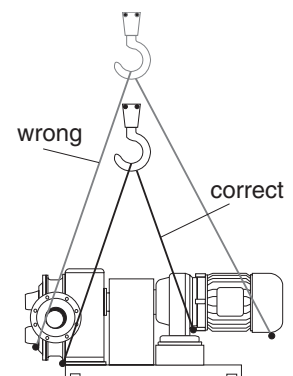
- by securing to the pallet with transport straps
- by screwing to the transport pallet.

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.:

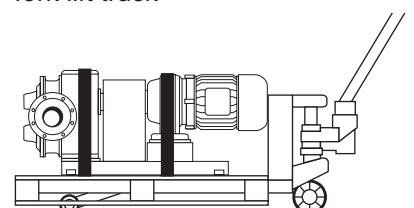
a) with a crane



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. The pumps and their accessories

4.1 Introduction

FRISTAM rotary circumferential piston pumps type FK are self-priming positive displacement pumps with single or twin-blade rotors.

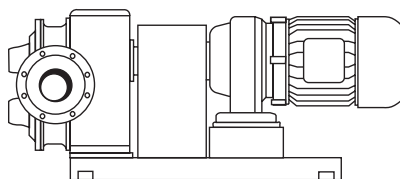
FRISTAM rotary lobe pumps type FL are positive displacement pumps with twin-blade impellers.

The reliability of FRISTAM pumps is achieved by the use of solid, cast or forged stainless steel components. The standard versions of both pump types are driven either by a fixed speed geared motor or by a V-belt variable speed electric drive. Where required, other drive systems can be supplied; see order documentation.

Depending upon the application, either single or double shaft seals are employed.

Where required, shrouds and heating jackets can be supplied.

4.2 Designs



4.2.1 Versions of the rotary circumferential piston pump FK

Description	F K F	F K S	F N N	F K S
Horizontal ports	X		X	
Vertical ports		X		X
Monobloc construction	X	X		
Separate construction with coupling and baseplate			X	X

Tab.1 for pump sizes
25, 25/30, 40, 40/45.

Description	F K N	F K S
Horizontal ports	X	
Vertical ports		X
Separate construction with coupling and baseplate	X	X

Tab.2 for pump sizes
48, 50 und 50/75

In addition, the following special versions can be supplied, identified by the letters:

...H - high pressure version
(cover liner)

Example: FKFH

...V - double-shaft seal

Example: FKNSV

...Ü - pressure relief valve in cover

Example: FKNÜ

A special version can be supplied with a heating jacket fitted to the housing and/or cover. The letter "H" or "h" after the pump size indicates:

- Housing with heating jacket "H"
(e.g. FKF 25 H)

- Cover with heating jacket "h"
(e.g. FKF 25/30 h)

- Housing and cover with heating jacket "Hh"
(e.g. FKF 40/45 Hh)

CAUTION

For pressures in excess of 5 bar,

FRISTAM rotary circumferential piston pumps must have been fitted with cover liners, model reference e.g. "FKFH", or they must be fitted subsequently.

Pump type	Recommended max. pressure for high pressure model [bar]
FKFH / FKFNH 25	15
FKFHV / FKFNHV 25	12
FKFH / FKFNH 25/30	12
FKFHV / FKFNHV 25/30	12
FKFH / FKFNH 40	18
FKFHV / FKFNHV 40	12
FKFH / FKFNH 40/45	12
FKFHV / FKFNHV 40/45	12
FKNH / FKFNH 48	20
FKNH 50	12
FKNHV 50	10
FKNH / FKFNH 50/75	10

Tab. 3 recommended, maximum pressure

CAUTION

For higher pressures it is essential that the manufacturer be contacted.

A distinction is made between normal and high temperature rotors, see Table 4.

Maximum application temperatures

Rotor type	Temperature [°C]
Standard	95
High temperature	150

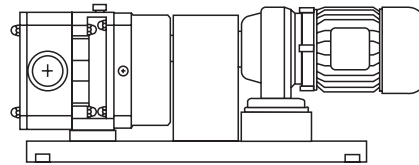
Tab. 4 Maximum temperature of the pumped medium

CAUTION

Exceeding the maximum permissible temperature of the pumped medium

incurs the risk of the pump being damaged.

4.2.2 Versions of the rotary lobe pump



Description	F L	F L S
Horizontal ports	X	
Vertical ports		X
Separat construction with coupling and baseplate	X	X

Tab.5 For pump sizes 55, 75, 100 and 130

In addition, the following special versions can be supplied, identified by the letters:

-V - Double-shaft seal
Example: FLSV
-U - Flow control valve in the cover
Example: FLU

Rotary lobe pumps FL are supplied with either short or long rotors. The letters "S" or "L" after the pump size indicate the rotor length:

- short rotor model, e.g. FL 55 S
- long rotor model, e.g. FL 75 L

A special version can be supplied with a heating jacket fitted to the housing and/or cover. The letter "H" or "h" after the pump size indicates:

- Housing with heating jacket "H" (e.g. FL 55 S H)
- Cover with heating jacket "h" (e.g. FL 50 L h)
- Housing and cover with heating jacket (e.g. FL 75 L Hh)

Pump type FL	Max. pressure [bar]
55 S	9
55 L	6
75 S	12
75 L	8
100 S	12
100 L	8
130 S	12
130 L	8

Tab. 6 Max. pressures

A distinction is made between normal and high temperature rotors, see Table 7.

Maximum application temperatures

Rotor type	Temperature [°C]
Standard	90
High temperature	160

Tab. 7 Max. temperature of the pumped medium

CAUTION

Exceeding the maximum permissible temperature of the pumped medium incurs the risk of the pump being damaged.

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.

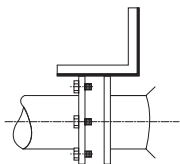
CAUTION

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.

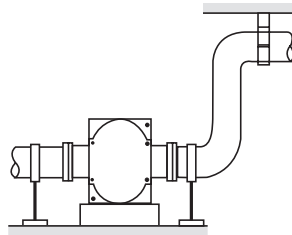
Distortion of the pump can be avoided by:

- 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.

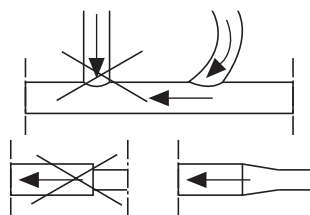
- Connect up according to the circuit diagram in the terminal box.
- Protect the terminal box and cable bushing against moisture.

5.4 Piping

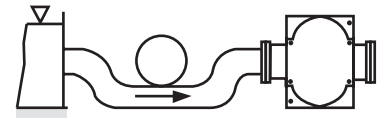
5.4.1 General

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

- Avoid abrupt pipe transition pieces.



- Avoid deposits



5.4.2 Suction pipe

- Keep as short as possible.
- If a shutoff valve is required, it must be installed as near to the pump as possible.

CAUTION

Do not regulate the pump with the shutoff valve.

5.4.3 Supply pipe

- Dimension sufficiently so that the $NPSH_{System} > NPSH_{Pump}$.
- Keep pipe resistance low. Avoid installing valves, elbows, transition pieces etc.

5.4.4 Liquid level

Before operating the pump it should be filled.

5.4.5 Delivery pipe

- Install a shutoff valve in the delivery pipe.

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 the pump
- Always start up the pump with the valve closed.

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.

6.2 Special directions

6.2.1 Double shaft seal

- Make sure the flushing pressure is correct (see Tab. 9).
- 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 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.).

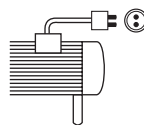
8. Maintenance

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 Double shaft seal

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

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

Tab. 9 Flushing pressure

See order-related documentation for special versions.

8.3 Lubricant tables

8.3.1 Lubricating FKF with grease

Up to pump size 40/45, the synchronous gear can be lubricated with either grease or oil.

The amount of lubricant will depend upon the positioning of the pump (vertical or horizontal model).

Pump size	Lubricant	Frequency	Quantity
25 and 25/30	Aral Aralub	every 4.000 hours	abt. 600 g
40 and 40/45	GFP 000	or 2.000 hours ¹	abt. 1250 g

Tab. 10 Horizontal port configuration

Pump size	Lubricant	Frequency	Quantity
25 and 25/30	Aral Aralub	every 4.000 hours	abt. 1000 g
40 and 40/45	GFP 000	or 2.000 hours ¹	abt. 2200 g

Tab. 11 Vertical port configuration

8.3.2 Lubricating FKF and FKN with oil

From pump size FK 48 upwards, the synchronous gear is only supplied with oil lubrication.

Pump size	Lubricant	Frequency	Quantity
25 and 25/30	Aral Vitam	every 4.000 hours or 2.000hours ¹	abt. 1.0 l
40 and 40/45	DE 46		abt. 2.5 l
48			abt. 4.5 l
50 and 50/75			abt. 5.5 l

Tab. 12 Horizontal port arrangement

Pump size	Lubricant	Frequency	Quantity
25 and 25/30	Aral Vitam	every 4.000 hours or 2.000 hours ¹	abt. 0.7 l
40 and 40/45	DE 46		abt. 1.8 l
48			abt. 4.0 l
50 and 50/75			abt. 4.0 l

Tab. 13 Vertical port arrangement

8.3.3 Lubricating FL with oil and grease

On the rotary lobe pumps type FL the rotary bearings are lubricated with grease and the gears of the synchronous gear with oil.

Pump size	Lubricant	Frequency	Quantity
55	Shell	every 4000 hours or 2000 hours ¹	abt. 60 g
75	Darina		abt. 120 g
100	grease 2		abt. 360 g
130			abt. 500 g

Tab. 14 Rotary bearing lubrication for FL synchronous gears.

Pump size	Lubricant	Frequency	Quantity
55	Aral	every 4000 hours or 2000 hours ¹	abt. 0.2 l
75	Vitam		abt. 0.4 l
100	DE 46		abt. 1.0 l
130			abt. 2.0 l

Tab. 15 Gear lubrication for FL synchronous gears.

¹ Short intervals under severe operating conditions e.g. high humidity levels, aggressive environment, extreme temperature fluctuations.

Other lubricant brands of the same grade and viscosity can be used.

Lubricant

Pump type	ARAL	BP	DEA/ Texaco	ELF	ESSO	Mobil	Shell
FL	Aralub HTR 2	Energrease HTG	Paragon EP 2	GRX 500	HT Grease 275	Mobiltemp SHC 100	Darina Grease 2
	Vitam DE 46	Energol HLP-D	Actis HLPD 46	Elfolna HLPD	HLPD-Oel 46	HLPD 46	Hydrol DO 46
FK	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 Dismantling the pump head

The description applies to all FK and FL models:

1. Undo the cover screws and remove the cover.
2. Undo the rotor nuts and remove the rotor.
3. Undo the screws securing the pump housing and carefully draw it off the synchronous gear.
4. Remove the shaft seals, see order documentation.
5. On twin-shaft seals, both bearing covers for the sealing water connection must be dismantled.

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.

When replacing the shaft seal or dismantling the pump head, the rotor clearance does not need to be checked.

This applies both for the rotary circumferential piston pump and for the rotary lobe pump. It is recommended that the rotor clearance be checked when new rotors are fitted.

The rotor clearance must be checked, however, once the synchronous gear has been dismantled.

CAUTION

The correct setting of the impeller clearance is important if the pump is to function properly. Incorrect assembly impairs the pump's delivery and can lead to it being damaged.

8.5.1.1 Bolt tightening torque

FKF and FKN Pump size	Torque with nylock ring
25 and 25/30	40 Nm
40 and 40/45	80 Nm
48	300 Nm
50 and 50/75	150 Nm

Tab. 16 Torque for tightening the impeller nuts on rotary circumferential piston pumps

FL Pump size	Torque with nylock ring
55	40 Nm
75	80 Nm
100	200 Nm
130	225 Nm

Tab. 17 Torque for tightening the impeller nuts on rotary lobe pumps

	M 8	M10	M 12	M 16
Nm	25	49	85	210

Tab. 18 Class 8.8 steel screws

	M 8	M10	M 12	M 16
Nm	17,5	35	60	144

Tab. 19 Stainless-steel screws A2-70 and A4-70

8.5.1.2 Assembly without checking impeller clearances

1. Fit the seals to the shaft sealing housing and fit it to the pump housing from the rear- see order documentation.
2. **Only** for eccentric shaft seals: The eccentric stationary ring is turned up to the stop to lock it in the shaft seal housing.
3. When fitting the shaft seal components, reference should be made to the order documentation.

CAUTION

Fixed bushings must not be interchanged as this would alter the rotor clearance set in the factory.

For this reason, the fixed bushings on FK pumps are marked with
- A for the drive shaft
- G for the synchronous shaft.

On FL pumps the impellers, fixed bushings and pump shafts are punch marked. Only those parts bearing the same number of punch marks must be put together.

4. Screw the pump housing to the synchronous gear. The pump housing must lie flat on the gearbox to exclude the risk of distortion.
5. Push the front sleeve of the shaft seal on to the drive or synchronous shaft.
6. Push both rotors on to the shafts. Slit open new nylock rings and insert them into the shaft groove beyond the end of the thread.
7. Tighten the rotor nuts with the torque specified in Tables 16 (FK) and 17 (FL).
8. Screw the cover in place.

8.5.2 Assembly including checking rotor clearances

8.5.2.1 Preparation before measuring the clearance

Before measurement of the clearance can be started,

- the pump head must be removed,
- the synchronous gear must be drained of oil or grease,
- and the three radial stop ring seals must be removed from the synchronous gear.

1. Replace the pump housing without the shaft housing and stationary ring. Care must be taken to ensure that pump housing lies flat on the gearbox to prevent the risk of distortion.

2. Push all the rotating parts of the shaft seal (see order documentation) on to the shafts. Please note that both fixed bushings are precision ground and marked.

CAUTION

Fixed bushings must not be interchanged as this would alter the rotor clearance set in the factory.

For this reason, the fixed bushings on FK pumps are marked with

- A for the drive shaft
- G for the synchronous shaft.

On FL pumps the rotors, fixed bushings and pump shafts are punch marked. Only those parts bearing the same number of punch marks must be put together.

3. Fully tighten the securing screws of the pump housing, see Table 19.

4. Fit both impellers and tighten the retaining nuts without the nylock ring. The specified torque for the rotor nuts is given in Table 20 for the FK and Table 21.

FKF and FKN pump sizes	Torque without nylock ring
25 and 25/30	21 Nm
40 and 40/45	50 Nm
48, 50 and 50/75	140 Nm

Tab. 20 Torque for tightening rotor nuts on rotary circumferential piston pumps

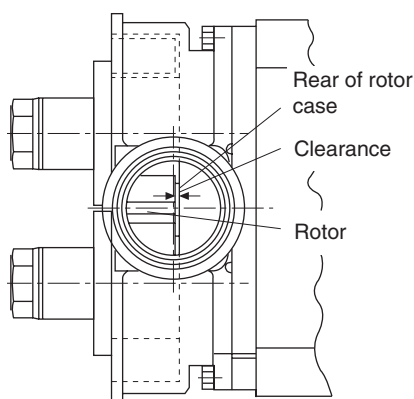
FL pump sizes	Torque without nylock ring
55	21 Nm
75	50 Nm
100	140 Nm
130	140 Nm

Tab. 21 Torque for tightening rotor nuts on rotary lobe pumps

5. Measuring the axial rotor clearance through the suction or delivery ports.

CAUTION

The gaps given in Tables 22 and 23 apply only when fitting new rotors. Because of material loss resulting from friction wear, used rotor have a larger clearance gap. After fitting the rotor, check that it runs freely.



Pump size	Clearance standard rotor/ rotor case [mm]	Clearance temperature rotor/ rotor case [mm]
25 and 25/30	0.03	0.13
40 and 40/45	0.05	0.15
48	0.18	0.28
50 and 50/75	0.15	0.25

Tab. 22 Axial clearance on FKF and FKN pumps

CAUTION

The clearance for high-temperature rotors is greater than for standard rotors. Setting too small a clearance can lead to damage when the pump is operated.

Pump size	Clearance standard rotor/ rotor case [mm]	Clearance temperature rotor/ rotor case [mm]
55 S/L	0.12 - 0.15	0.17 - 0.20
58 S/L	0.10 - 0.13	0.15 - 0.18
75 S/L	0.14 - 0.17	0.19 - 0.22
100 S/L	0.19 - 0.23	0.27 - 0.31
130 S	0.19 - 0.23	0.27 - 0.31
130 L	0.21 - 0.25	0.29 - 0.33

Tab. 23 Axial clearance on FL rotary lobe pumps

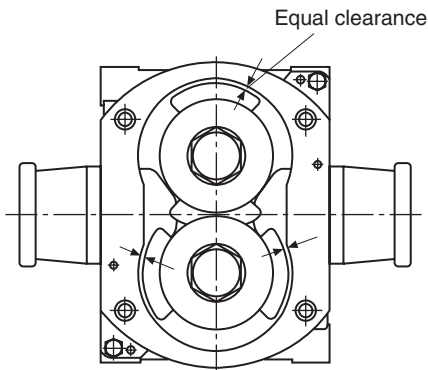
6. If the measured clearance is too large, the fixed bushing must be replaced or ground down.

7. If the measured clearance is too small, it can be enlarged using linings. In order to determine the number of shims, proceed as follows:

- remove rotor
- depending upon the clearance discrepancy, provisionally insert linings in front of the shaft seal
- next refit the impeller and measure the clearance again
- repeat this process until the required clearance is reached.

Having checked the axial clearance, the radial impeller clearance must be checked.

8. Measure the radial gap between housing and rotor with feeler gauges. The clearance must be equal all round.

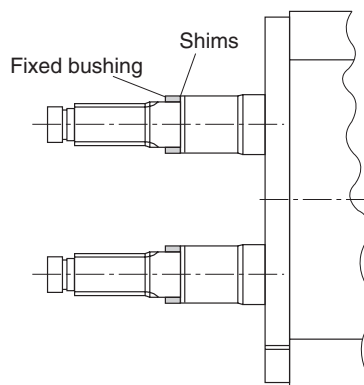


9. If the radial clearance is too small, the pump housing must be realigned and pinned.
10. The pinning must permit dismantling at any time i.e.:
 - firm location in the pump housing of the tapered pins (FK) and cylindrical pins (FL)
 - loose location, with no play of the tapered pins (FK) and cylindrical pins (FL) in the synchronous gear
11. Screw the pump cover in place.
12. Turn the drive shaft and check the free running of the rotors. If the rotors cannot easily be turned by hand, the clearances must be reset.

CAUTION On models with cover liners, the free running of the rotors must be checked. If the rotors do not turn easily, the pump cover must be realigned and re-pinned.

8.5.2.2 Re-assembly after setting clearance

1. Dismantle rotors, pump head and shaft seal.
2. Fit the seals into the shaft seal housing and insert it into the pump housing from the rear - see order documentation.
3. On eccentric shaft seals **only**: the stationary eccentric ring is locked into the shaft seal housing by being turned up to the stop.
4. Where required, shims must be inserted between the shaft shoulder and fixed bushings. The number of shims required is determined by the clearance discrepancy measured.



5. Fit rotating shaft seal components, see order documentation.

CAUTION Fixed bushings must not be interchanged as this would alter the rotor clearance set in the factory.

For this reason, the fixed bushings on FK pumps are marked with
 - A for the drive shaft
 - G for the synchronous shaft.

On FL pumps the rotors, fixed bushings and pump shafts are punch marked. Only those parts bearing the same number of punch marks must be put together.

6. Screw the pump housing to the synchronous gear. The pump housing must lie flat on the gear box in order to avoid distortion.

7. Push the front sleeve of the shaft seal on to the drive and synchronous shafts.
8. Push both rotors on to the shafts. Slit open new nylock rings and insert them into the shaft groove beyond the end of the thread.
9. Tighten the impeller nuts with the torque settings given in Tables 16 (FK) and 17 (FL).
10. Screw the cover back in place.
11. Fill the synchronous gear with lubricant and check the lubricant level.

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
No delivery	<ul style="list-style-type: none"> a. Pump is blocked, foreign body in the pump b. Air trapped in suction or delivery ports c. Pump drawing in air, suction line leakage d. Product viscosity too high, pump not drawing e. Coupling failure due to overloading f. V-belt on variable speed gear slipping due to overloading 	<ul style="list-style-type: none"> Remove cover and impellers and clean inside of pump Check seals on the ports and replace if necessary Remove leakage Contact FRISTAM Applications Department Contact FRISTAM Applications Department Contact FRISTAM Applications Department
Delivery too low	<ul style="list-style-type: none"> a. Suction line leakage, pump drawing air b. Motor speed too low (incorrect voltage) c. Resistance too high, safety valve switched, where fitted d. V-belt on variable speed gear slipping excessively due to overloading e. Material viscosity too high, suction power of the pump insufficient f. Rotors are worn 	<ul style="list-style-type: none"> Remove leakage Check mains voltage against machine label Check safety valves Contact FRISTAM Applications Department Contact FRISTAM Applications Department Replace rotors
Too noisy	<ul style="list-style-type: none"> a. Pump speed too high, pump hammering b. Pump speed too high, cavitation c. Mechanical wear in bearings and gears through overloading d. Mechanical wear in bearings and gears through lack of lubrication e. Mechanical wear in the pump 	<ul style="list-style-type: none"> Reduce pump speed Contact FRISTAM Applications Department Contact FRISTAM Applications Department Top up lubricant Pump parts incorrectly assembled
Pump leaks	<ul style="list-style-type: none"> a. Screws on cover or pumpconnections loose b. Shaft seal worn c. Shaft seal worn prematurely by running dry d. Shaft seal contact not chemical resistant e. Elastomer material of sealing rings not chemical resistant 	<ul style="list-style-type: none"> Tighten screws with specified torque Replace shaft seal Replace shaft seal Contact FRISTAM Applications Department Contact FRISTAM Applications Department

If a fault cannot be traced and rectified with the aid of the Table, our Fristam Applications Department is available at all times. When contacting the Department, the following information will be required:

1. Operating conditions
2. An exact description of the fault
3. Pump model and serial number
4. If possible, a sketch of the pump installation



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