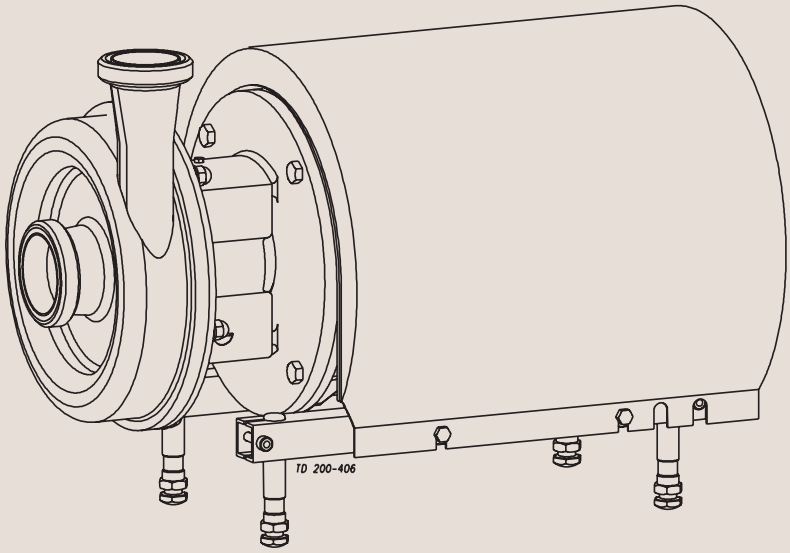
Instruction Manual

LKHex Centrifugal Pump



IM70969-GB1 2003-08

Declaration of Conformity

The designating company

Alfa Laval

Company Name

Albuen 31, DK-6000 Kolding, Denmark

Address

+45 79 32 22 00

Phone No.

hereby declare that

Centrifugal Pump	**LKHex**	
Denomination	Type	Year

is in conformity with the following directives with amendments:

- **Low Voltage Directive 73/23/EEC**
- **EMC Directive 89/336/EEC**
- **Machinery Directive 89/392/EEC**
- **ATEX Directive 94/9/EC**

Vice President, R & D	Bjarne Søndergaard
Title	Name
Alfa Laval	
Company	Signature

Designation

CE

The information contained herein is correct at the time of issue but may be subject to change without prior notice.

Unsafe practices and other important information are emphasized in this manual.
Warnings are emphasized by means of special signs.

Always read the manual before using the pump!

WARNING!
Indicates that special procedures must be followed to avoid severe personal injury.

CAUTION!
Indicates that special procedures must be followed to avoid damage to the pump.

NOTE!
Indicates important information to simplify or clarify.

General warning.

Dangerous electrical voltage.

Caustic agents.

ATEX Directive 94/9/EC

The ATEX Directive 94/9/EC covers equipment and protective systems that will be used in areas endangered by potentially explosive atmospheres created by the presence of flammable gases, vapours and dusts. Centrifugal pumps supplied with an ATEX symbol are classified for use in potentially explosive atmospheres under ATEX Directive 94/9/EC Group II, Categories 2 and 3.

Technical File Ref:	LKHex - Document reference no 9612-9600-01
Type of Equipment:	LKHex Centrifugal Pump
Equipment Group and Category:	Group II category 2 G (zone 1) and D (zone 21) Group II category 3 G (zone 2) and D (zone 22)
Ignition Protection used:	EN13463-1: 2001

All warnings in the manual are summarized on this page.
Pay special attention to the instructions below so that severe personal injury and/or damage to the pump are avoided.

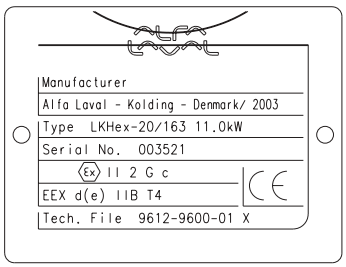
Installation:

Always read the technical data thoroughly. (See chapter 5).
Always use a lifting crane when handling the pump.
Pump without impeller screw:
- Always remove the impeller before checking the direction of rotation.
- Never start the pump if the impeller is fitted and the pump casing is removed.

Pump with impeller screw:
- Never start in the wrong direction of rotation with liquid in the pump.

Check the nameplate and make sure that the pump is labelled according to the particular application where it is going to be used.
Always use the ATEX-approved installation material.
In order to prevent the pump unit from operating under abnormal conditions an ATEX-aproved protection device has to be installed.
The pump unit must be connected to earth before operation.

Example of nameplate:



Always have the pump electrically connected by authorized personnel. (See the motor instructions).

Operation:

Always read the technical data thoroughly. (See chapter 5).
Never touch the pump or the pipelines when pumping hot liquids or when sterilizing.
Never run the pump with both the suction side and the pressure side blocked.
All pump head and seal cavities must be vented to purge air from the system prior to start-up.
If the pump unit operates in dust filled atmospheres regular inspections must ensure that the pump unit can operate freely and the necessary cooling conditions are present

Always handle lye and acid with great care.

Maintenance:

Always read the technical data thoroughly. (See chapter 5).
- Never service the pump when it is hot.
- Never service the pump with pump and pipelines under pressure.

Motors with grease nipples:
Remember lubrication according to information stated in this manual.

Always disconnect the power supply when servicing the pump.

The instruction manual is part of the delivery. Study the instructions carefully.
The standard delivery does not include the test certificate. This can be supplied on request.
The large pump sizes are very heavy.
Alfa Laval therefore recommends the use of a lifting crane when handling the pump.

Step 1
Always use a lifting crane when handling the pump (see technical data).

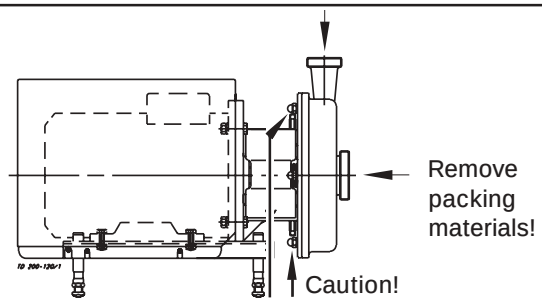
CAUTION!
Alfa Laval cannot be held responsible for incorrect unpacking.

Check the delivery for:
1. Complete pump.
2. Delivery note.
3. Motor instructions.
4. Test certificate, IF ORDERED!I

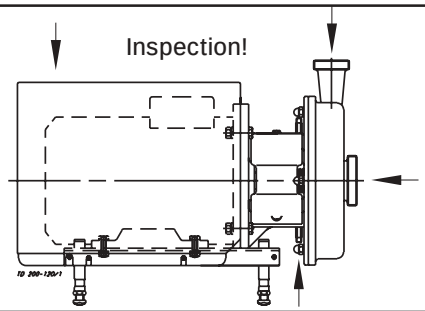
Step 2
Remove possible packing materials from the inlet and the outlet.

Avoid damaging the inlet and the outlet.

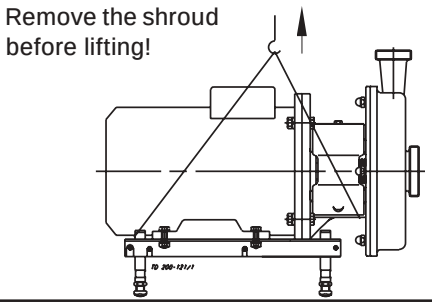
Avoid damaging the connections for flushing liquid, if supplied.



Step 3
Inspect the pump for visible transport damages.



Step 4
Always remove the shroud, if fitted, before lifting the pump.



Study the instructions carefully and pay special attention to the warnings! Always check the pump before operation.
- See pre-use check in section 2.3.
The large pump sizes are very heavy.
Alfa Laval therefore recommends the use of a lifting crane when handling the pump.

Step 1

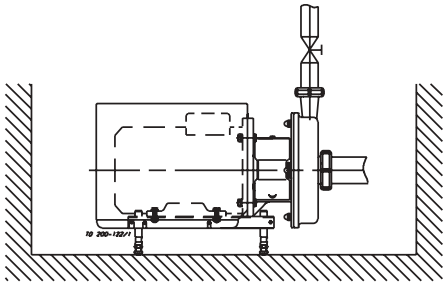
Always read the technical data thoroughly (see chapter 5).

Always use a lifting crane when handling the pump (see technical data).

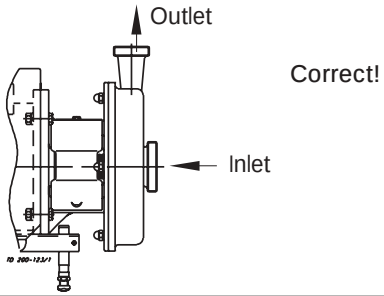
Always have the pump electrically connected by authorized personnel (see the motor instructions).

CAUTION!
Alfa Laval cannot be held responsible for incorrect installation.

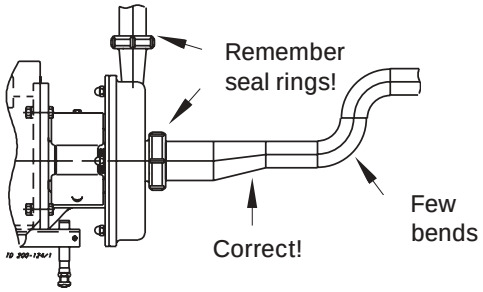
Step 2
Ensure that there is sufficient clearance around the pump (min. 0.5 m) *(1.6 ft)*.



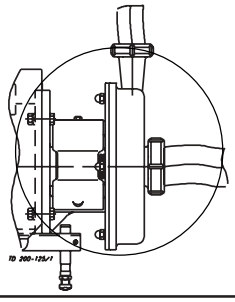
Step 3
Check that the flow direction is correct.



Step 4
1. Ensure that the pipelines are routed correctly.
2. Ensure that the connections are tight.



Step 5
Avoid stressing the pump.
Pay special attention to:
- Vibrations.
- Thermal expansion of the tubes.
- Excessive welding.
- Overloading of the pipelines.



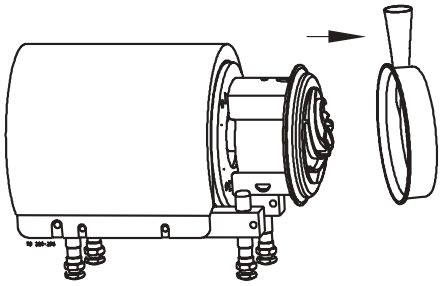
Study the instructions carefully and pay special attention to the warnings!
LKH-10 to -60 is without impeller screw as standard but can be supplied with one.
Check the direction of rotation of the impeller before operation.
- See the indication label on the pump.

Step 1

⚠

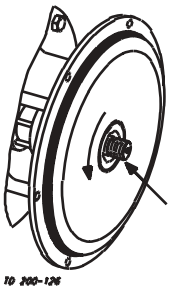
- Always remove the impeller before checking the direction of rotation.
- Never start the pump if the impeller is fitted and the pump casing is removed.

1. LKH-10 to -60: Remove cap nuts (24), washers (24a) and pump casing (29).
2. Remove impeller (27) (see also instruction 4 on page 16).



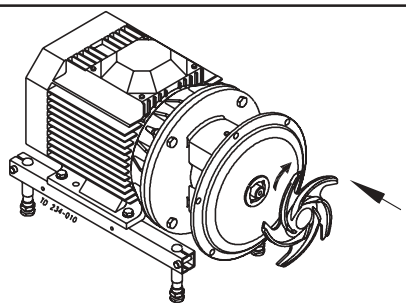
Step 2

1. Start and stop the motor momentarily.
2. Ensure that the direction of rotation of the stub shaft (7) is anticlockwise as viewed from the inlet side.



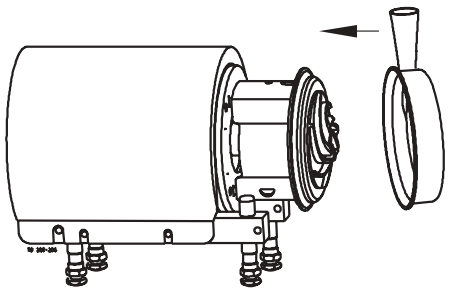
Step 3

Fit and tighten impeller (27).



Step 4

1. Fit pump casing (29).
2. LKH-10 to -60: Fit washers (24a) and tighten cap nuts (24).



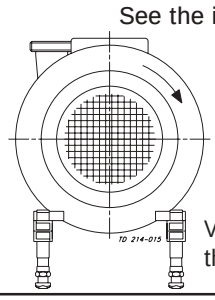
Pump with impeller screw

Step 1

⚠

Never start in the wrong direction of rotation with liquid in the pump.

1. Start and stop the motor momentarily.
2. Ensure that the direction of rotation of the motor fan is clockwise as viewed from the rear end of the motor.



Study the instructions carefully and pay special attention to the warnings!
The pump is fitted with a warning label indicating correct throttling.

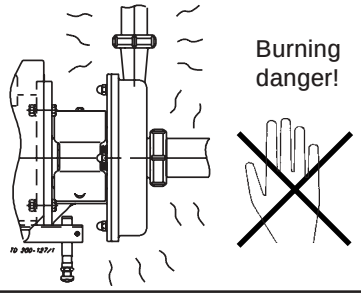
Step 1

Always read the technical data thoroughly (see chapter 5).

CAUTION!
Alfa Laval cannot be held responsible for incorrect operation/control.

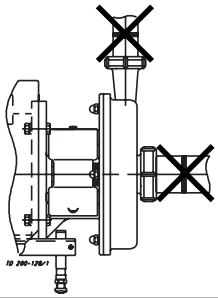
Step 2

Never touch the pump or the pipelines when pumping hot liquids or when sterilizing.

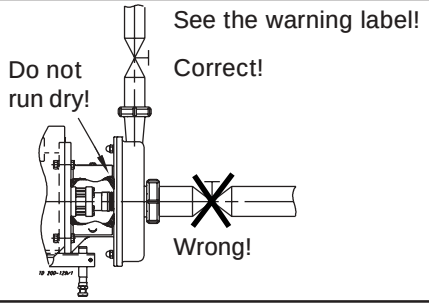


Step 3

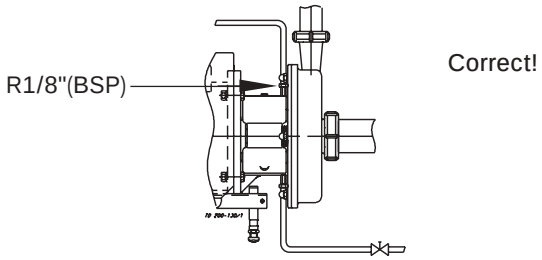
Never run the pump with both the suction side and the pressure side blocked.



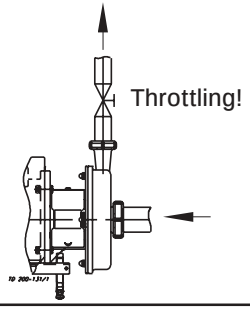
Step 4
CAUTION!
- The shaft seal must not run dry.
- Never throttle the inlet side.
- Pump casing must be completely filled before operation.



Step 5
Double mechanical shaft seal:
1. Connect the inlet of the flushing liquid correctly.
2. Read instructions in manual “Incorporation/operation manual for the LKH Series mechanical seals (ATEX supplement).
3. Regulate the water and steam supply correctly.



Step 6
Control:
Reduce the capacity and the power consumption by means of:
- Throttling the pressure side of the pump.
- Reducing the impeller diameter.
- Reducing the speed of the motor.



Pay attention to possible faults.
Study the instructions carefully.

NOTE!
Study the maintenance instructions carefully before replacing worn parts. - See section 4.1

Problem	Cause/result	Remedy
Overloaded motor	- Pumping of viscous liquids	- Larger motor or smaller impeller
	- Pumping of liquids with high density	
	- Low outlet pressure (counter pressure)	- Higher counter pressure (throttling)
	- Lamination of precipitates from the liquid	- Frequent cleaning
Cavitation:	- Low inlet pressure	- Increase the inlet pressure
- Damage	- High liquid temperature	- Reduce the liquid temperature
- Pressure reduction (sometimes to zero)		- Reduce the pressure drop before the pump
- Increasing of the noise level		- Reduce speed
Leaking shaft seal	- Dry run (See section 3.1)	Replace: All wearing parts (See section 4.1)
	- Incorrect rubber grade	If necessary: - Select a different rubber grade
	- Abrasive particles in the liquid	- Select stationary and rotating seal ring in Silicon Carbide/Silicon Carbide
Leaking seals	Incorrect rubber grade	Replace with seals of a different rubber grade

The pump is designed for cleaning in place (CIP). CIP = Cleaning In Place.
Study the instructions carefully and pay special attention to the warnings!
NaOH = Caustic Soda.
HNO_3 = Nitric acid.

Step 1

Always handle lye and acid with great care.

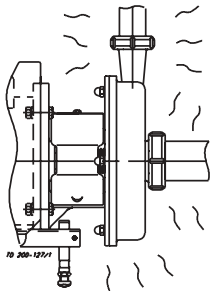
Caustic danger!

Always use rubber gloves!

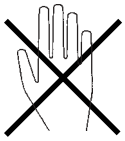
Always use protective goggles!

Step 2

Never touch the pump or the pipelines when sterilizing.



Burning danger!



Step 3

Examples of cleaning agents:

Use clean water, free from chlorides.

1. 1% by weight NaOH at 70° C *(158° F)*.

1 kg *(2.2 lbs)* NaOH	+	100 l *(26.4 gal)* water	=	Cleaning agent.
2.2 l *(0.6 gal)* 33%NaOH	+	100 l *(26.4 gal)* water	=	Cleaning agent.

2. 0.5% by weight HNO_3 at 70° C *(158° F)*.

0.7 l *(0.2 gal)* 53% HNO_3	+	100 l *(26.4 gal)* water	=	Cleaning agent.

Step 4

1. Avoid excessive concentration of the cleaning agent
   ⇒ Dose gradually!

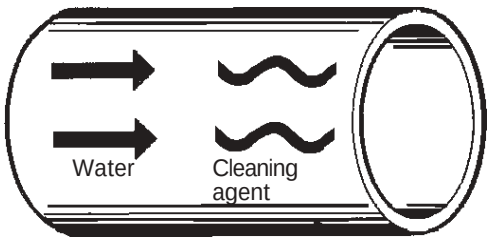
2. Adjust the cleaning flow to the process
   Sterilization of milk/viscous liquids
   ⇒ Increase the cleaning flow!

Step 5

Always rinse well with clean water after the cleaning.

NOTE!
The cleaning agents must be stored/disposed of in accordance with current rules/directives.

Always rinse!



Maintain the pump carefully. Study the instructions carefully and pay special attention to the warnings!
Always keep spare shaft seals and rubber seals in stock.
See separate motor instructions.

Step 1

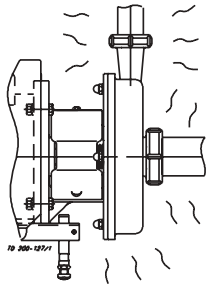
Always read the technical data thoroughly (see chapter5).

Always disconnect the power supply when servicing the pump.

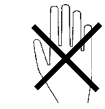
NOTE!
All scrap must be stored/disposed of in accordance with current rules/directives.

Step 2

Never service the pump when it is hot.



Burning danger!

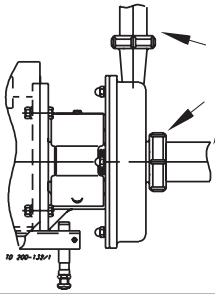


Step 3

Never service the pump with pump and pipelines under pressure.

CAUTION!
Fit the electrical connections correctly if they have been removed from the motor during service (see pre-use check in section 2.3).

Pay special attention to the warnings!



Atmospheric pressure required!

Step 4
Recommended spare parts:
Service kits (see chapter 6).
Order service kits from the service kits list (see chapter 6).
Ordering spare parts:
- Contact the Sales Department.

Maintain the pump carefully. Study the instructions carefully.
Always keep spare shaft seals and rubber seals in stock.
See separate motor instructions.
Check the pump for smooth operation after service.

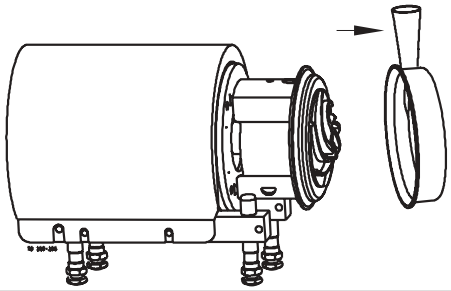
	Shaft seal	Rubber seals	Motor bearings
Preventive maintenance	Replace after 12 months: (one-shift) Complete shaft seal	Replace when replacing the shaft seal	
Maintenance after leakage (leakage normally starts slowly)	Replace at the end of the day: Complete shaft seal	Replace when replacing the shaft seal	
Planned maintenance	- Regular inspection for leakage and smooth operation - Keep a record of the pump - Use the statistics for planning of inspections Replace after leakage: Complete shaft seal	Replace when replacing the shaft seal	Yearly inspection is recommended - Replace complete bearing if worn - Ensure that the bearing is axially locked (See motor instructions)
Lubrication	Before fitting Lubricate the O-rings with silicone greaseor silicone oil	Before fitting Silicone grease or silicone oil	See section 5.2

Pre-use check

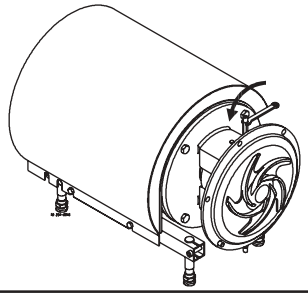
CAUTION!
Fit the electrical connections correctly if they have been removed from the motor during service.
(See pre-use check in section 2.3).
Pay special attention to the warnings!
1. Start and stop the motor momentarily.
2. Ensure that the pump operates smoothly.

Study the instructions carefully. The items refer to the parts list and service kits section.
Handle scrap correctly.
✸ *: Relates to the shaft seal.*

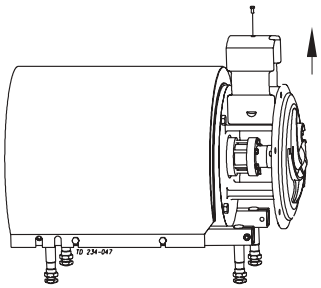
Step 1
1. LKH-10 to -60: Unscrew cap nuts (24) and remove washers (24a) and pump casing (29).



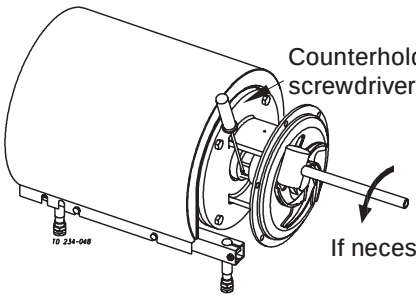
Step 2 ✸
Double mechanical shaft seal:
Unscrew tubes (42) using a spanner.



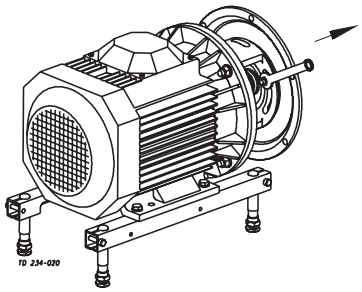
Step 3
Remove screw (23) and safety guard (22).



Step 4
1. Remove impeller screw (36), if fitted.
2. Remove impeller (27). If necessary, loosen the impeller by knocking gently on the impeller vanes.
3. Remove the O-ring (38) from the impeller, if fitted.

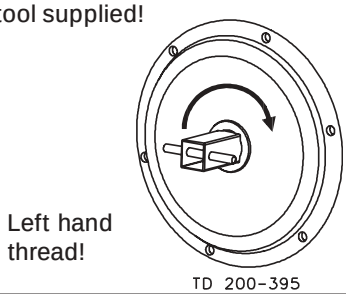


Step 5
1. Pull off the O-ring (26) from back plate (25).
2. Unscrew nuts (20) and remove washers (21) and the back plate.



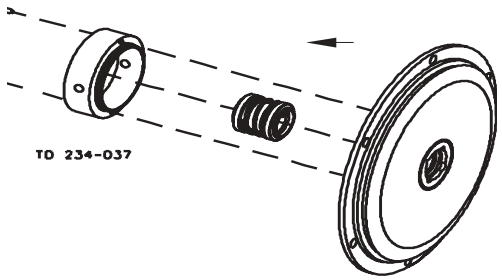
Step 6 ✸
1. Remove the stationary seal ring (11).
2. Remove the O-ring (12) from back plate (25).

Use the tool supplied!

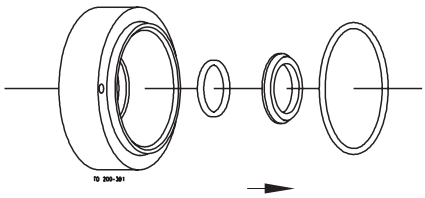


Study the instructions carefully. The items refer to the parts list and service kits section.
Handle scrap correctly.
✸ *: Relates to the shaft seal.*

Step 7 ✸
Double mechanical shaft seal:
1. Remove screws (41) and seal housing (40a).
2. Remove rotating seal rings (14) and drive ring (52) from spring (13).
3. Remove O-rings (15) from rotating seal rings (14).

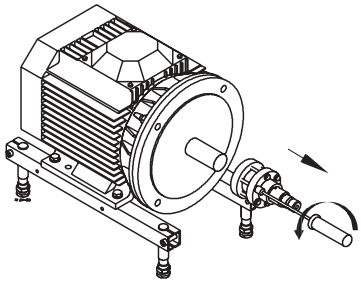


Step 8 ✸
Double mechanical shaft seal:
1. Remove stationary seal ring (51) from seal housing (40a).
2. Remove O-ring (50) from stationary seal ring (51).
3. Remove O-ring (44) from seal housing (40a).

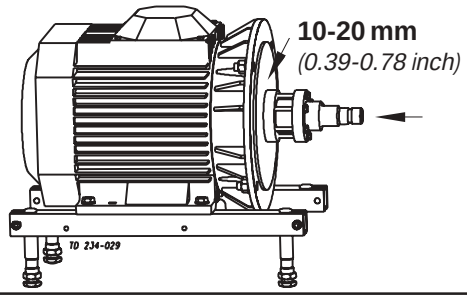


Study the instructions carefully.
The items refer to the parts list and service kits section .
Lubricate the rubber seals before fitting them.
✸ *: Relates to the shaft seal.*

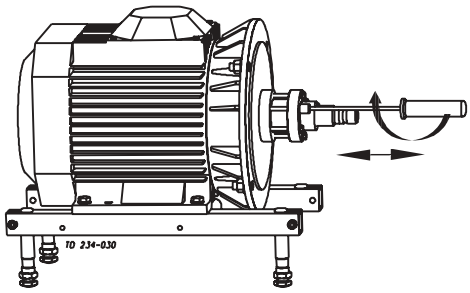
Step 1
1. Loosen screws (6).
2. Pull off stub shaft (7) together with compression rings (5a, 5b).



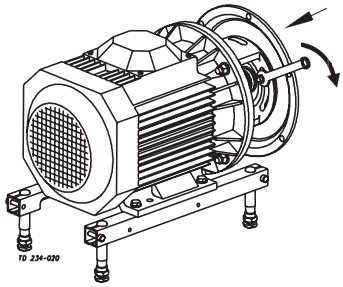
Step 2
1. Push stub shaft (7) together with compression rings (5a, 5b) onto the motor shaft.
2. Check that the clearance between the end of the stub shaft and the motor flange is 10-20mm *(0.39-0.78 inch)*.



Step 3
1. Tighten screws (6) lightly and evenly.
2. Ensure that stub shaft (7) can be moved on the motor shaft.

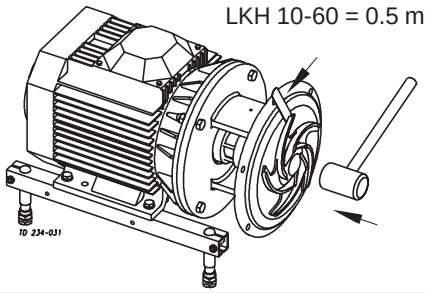


Step 4 ✸
1. For double mechanical shaft seal:
   Fit drive ring (52) on stub shaft (7).
2. Fit back plate (25), washers (21) and nuts (20) and tighten.

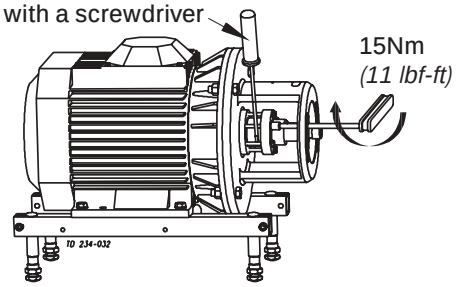


Step 5
1. Fit impeller (27) on stub shaft (7).
2. Ensure that the clearance between the impeller and back plate (25) is correct: 0.5mm *(0.02 inch)* for LKH-10-60.

NOTE!
If pump has been ordered with increased clearence between impeller and backplate this additional clearence must be taken into account when adjusting the shaft.



Step 6
1. Remove impeller (27), back plate (25) and drive ring (52).
2. Tighten screws (6) evenly to 15 Nm *(11 lbf-ft)*.



Study the instructions carefully.
The items refer to the parts list and service kits section .
Lubricate the rubber seals before fitting them.
✸ *: Relates to the shaft seal.*

Step 1 ✸

1. Fit O-rings (15) in rotating seal rings (14).
2. Fit spring (13) on one of the rotating seal rings (14) and place the drive ring (52) in between.

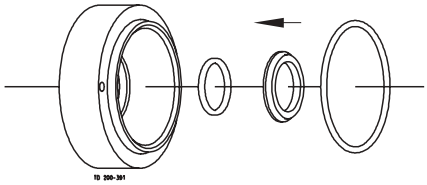
Step 2 ✸

1. Fit the second rotating ring (14) on the other end of the spring.
2. Place the parts on the stationary seal ring fitted in back plate (25).

NOTE:
Ensure that both drive pins on the drive ring enters the notches in rotating seal rings.

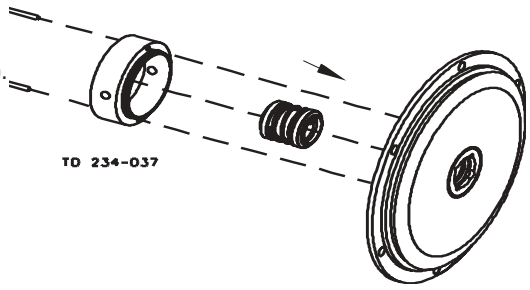
Step 3 ✸

1. Lubricate O-ring (44) and slide onto seal housing (40a).
2. Lubricate O-ring (50) and fit on stationary seal ring (51) and fit this in the seal housing.



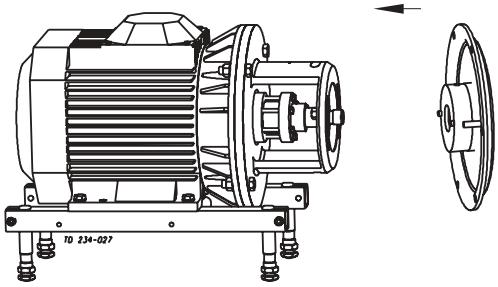
Step 4 ✸

1. Clean the sealing surfaces with contact cleaner.
2. Fit seal housing (40a) on the back plate (25) and tighten screws (41).

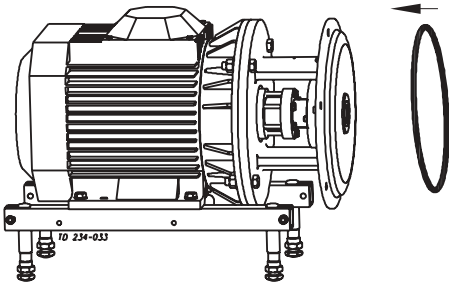


Step 5

1. To enable fitting back plate (25) with the shaft seal remove connex pin (8) from stub shaft (7) (if fitted).
2. Carefully guide the back plate onto adaptor (16).
3. Fit washers (21) and nuts (20).

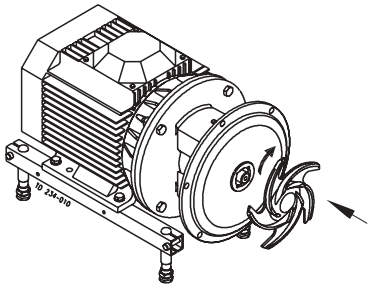


Step 6
Lubricate O-ring (26) and slide it onto back plate (25).

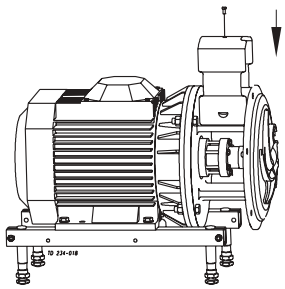


Study the instructions carefully.
The items refer to the parts list and service kits section .
Lubricate the rubber seals before fitting them.
✸ *: Relates to the shaft seal.*

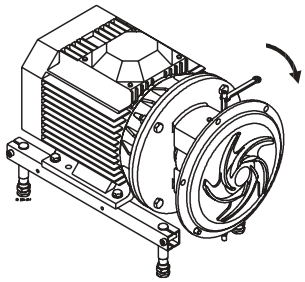
Step 7
1. Lubricate O-ring (38) and fit it in impeller (37), if impeller screw is used.
2. Lubricate the impeller hub with silicone grease or oil.
3. Screw impeller (27) onto stub shaft (7).
4. Fit impeller screw (36) and tighten, if used.



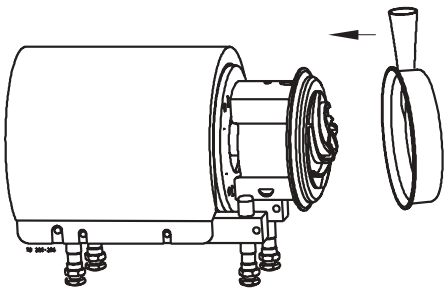
Step 9
Fit safety guard (22) and screw (23) and tighten. ✸



Step 8
1. Screw tubes (42) into seal housing (40a).
2. Tighten with a spanner.



Step 10
1. Fit pump casing (29).
2. Tighten nuts (20) for back plate (25).
3. Fit washers (24a) and cap nuts (24) and tighten.



It is important to observe the technical data during installation, operation and maintenance.
Inform the personnel about the technical data.

Data	
Max. inlet pressure	LKH-10 to -60 (50 Hz): 1000 kPa (10 bar) *(145 psi)* LKH-10 to -60 (60 Hz): 1000 kPa (10 bar) *(145 psi)*
Fluid temperature range	-10° C to +80° C (EPDM) *(14 to 176°F)*
Max. ambient temperature	-10°C to +30°C *(14 to 86°F)*
Materials	
Product wetted steel parts	AISI 316L
Other steel parts	AISI 304
Finish	Semi-bright
Product wetted seals	EPDM (standard)
Other O-rings	EPDM (standard)
Alternative seals	Nitrile (NBR), Fluorinated rubber (FPM) and FEP
Shaft seal	
Seal types	Double mechanical seal
Max. water pressure LKH-10 to -60 (DMS)	Normally atmospheric (max. 5 bar) *(max. 72.5 psi)*
Water consumption (double mechanical seal)	Min. 0.5 l/min. *(0.13 gl)*
Material, stationary seal ring	Acid resistent steel with sealing surface of Silicon Carbide
Material, rotating seal ring	Carbon (standard) or Silicon Carbide
Material, O-rings	EPDM (standard)
Alternative material, O-rings	Nitrile (NBR), Fluorinated rubber (FPM) and FEP
Motor	
Foot-flanged motor acc. to IEC metric standard 2 poles = 3000/3600 rpm. at 50/60 Hz	
Voltage and frequency (standard)	3~, 50 Hz, 220-240VΔ/380-420VY ≤ 4 kW 3~, 60 Hz, 250-280VΔ/440-480VY ≤ 4.6 kW 3~, 50 Hz, 380-420VΔ/660-690VY ≥ 5.5 kW 3~, 60 Hz, 440-480VΔ ≥ 6.3 kW
Motor sizes (kW), 50 Hz	1.5, 2.2, 3.0, 4.0, 5.5, 7.5, 11.0, 15.0, 18.5, 22.0
Motor sizes (kW), 60 Hz	1.75, 2.5, 3.5, 4.6, 6.3, 8.6, 12.5, 17.0, 21.0, 25.0
Motor sizes (Hp), 60 Hz	*1.5, 2.0, 3.0, 5.0, 7.5, 10.0, 15.0, 20.0, 25.0, 30.0*
Weight	
Max. weight for LKH-pumps, see PD sheet	

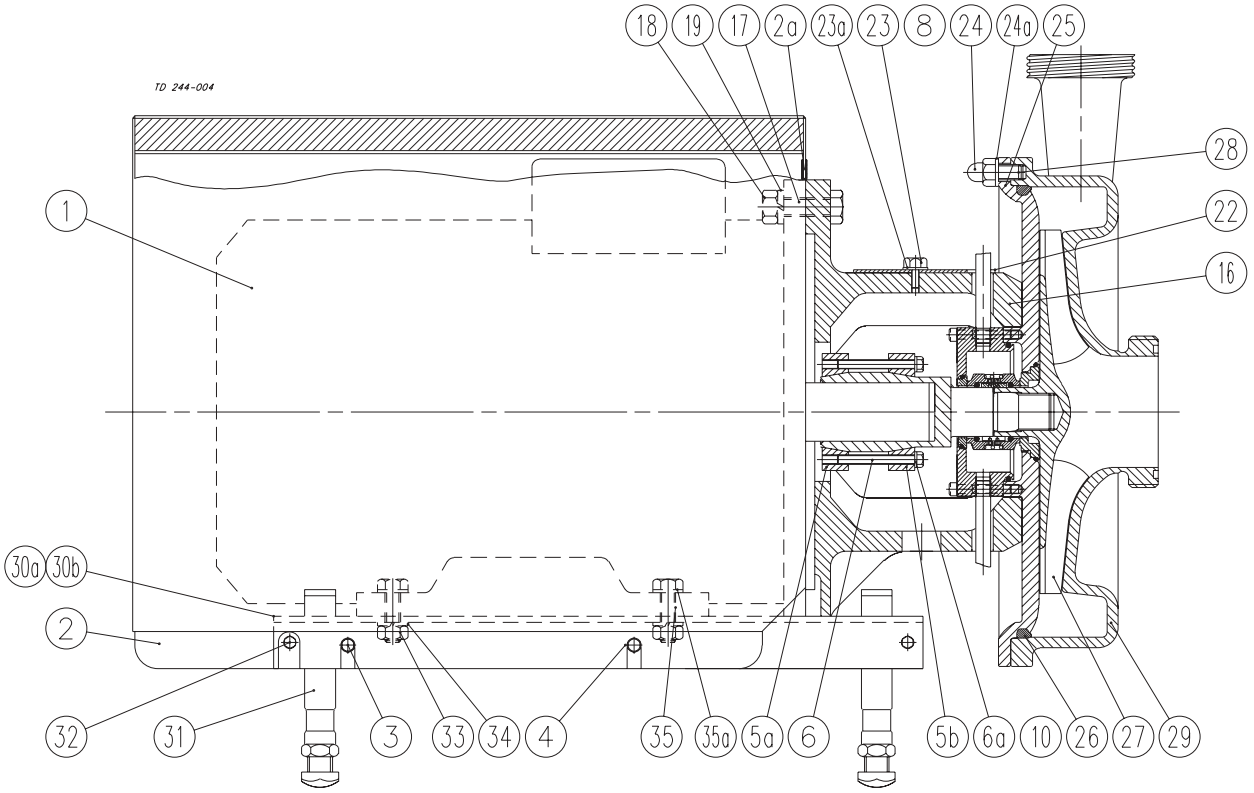
All motor bearings in range of 1.5 kW to 22 kW are permanently lubricated.

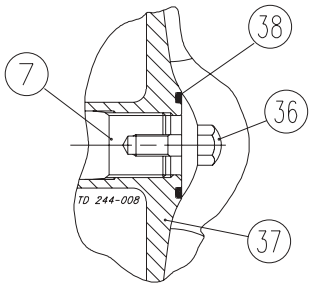
The motor bearing lifetime is heavily dependent on the operation conditions i.e. motor load, ambient temperature, temperature of fluid, pump speed, pressure and pressure variations.

The motor bearing lifetime can therefore not be determined with a reasonable accuracy as it can vary several thousand hours.

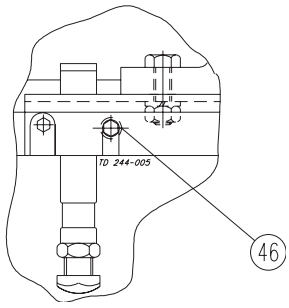
It is therefore recommended that the actual bearing lifetime is determined by means of a vibration analysis (shock pulse measurement).

The drawing shows LKHEX, sanitary version.
The items refer to the parts list in sections 6.2 to 6.7.

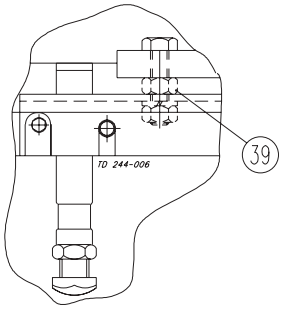




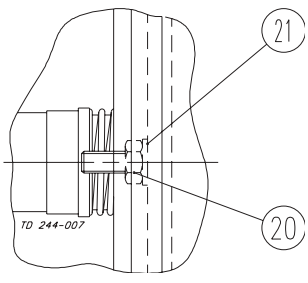
Impeller screw



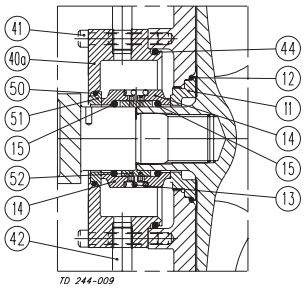
Fitting of legs



Only used for 0.75 and 1.1 kW
Fitting of legs



Fitting of back plate



Double mechanical shaft seal

The drawing and the parts list include all items.

Parts List

Pos.	Qty.	Denomination
1	1	Motor
2	1	Shroud
2a	1	Edge list
3	4	Screw
5a	1	Compression ring with thread
5b	1	Compression ring without thread
6	6	Screw
6a	6	Washer
7	1	Shaft
8	1	Connex pin
10	1	Drive ring
11 ●	1	Stationary seal ring
12 ●	1	O-ring
13 ●	1	Spring
14 ●	2	Rotating seal ring
15 ●	2	O-ring
16	1	Adaptor
17	4	Screw for adaptor
18	4	Nut for adaptor
19	4	Washer for adaptor
20	2	Nut
21	2	Washer
22	1	Safety guard
23	1	Screw for safety guard
24	6	Cap nut
24a	6	Washer
25	1	Back plate
26 ●	1	O-ring
27	1	Impeller
28	6	Stud bolt
29	1	Pump casing
30a	1	Support bar, right
30b	1	Support bar, left
31	4	Leg
32	4	Screw
33	4	Nut
34	4	Spring washer
35	4	Screw
35a	4	Washer
36	1	Impeller screw
37	1	Impeller for impeller screw
38 ●	1	O-ring ⊗
39	4	Nut
40a	1	Seal housing
41	2	Screw for seal housing
42	2	Tube
44 ●	1	O-ring for seal housing
50 ●	1	O-ring
51 ●	1	Sec. stationary seal ring
52 ●	1	Drive ring

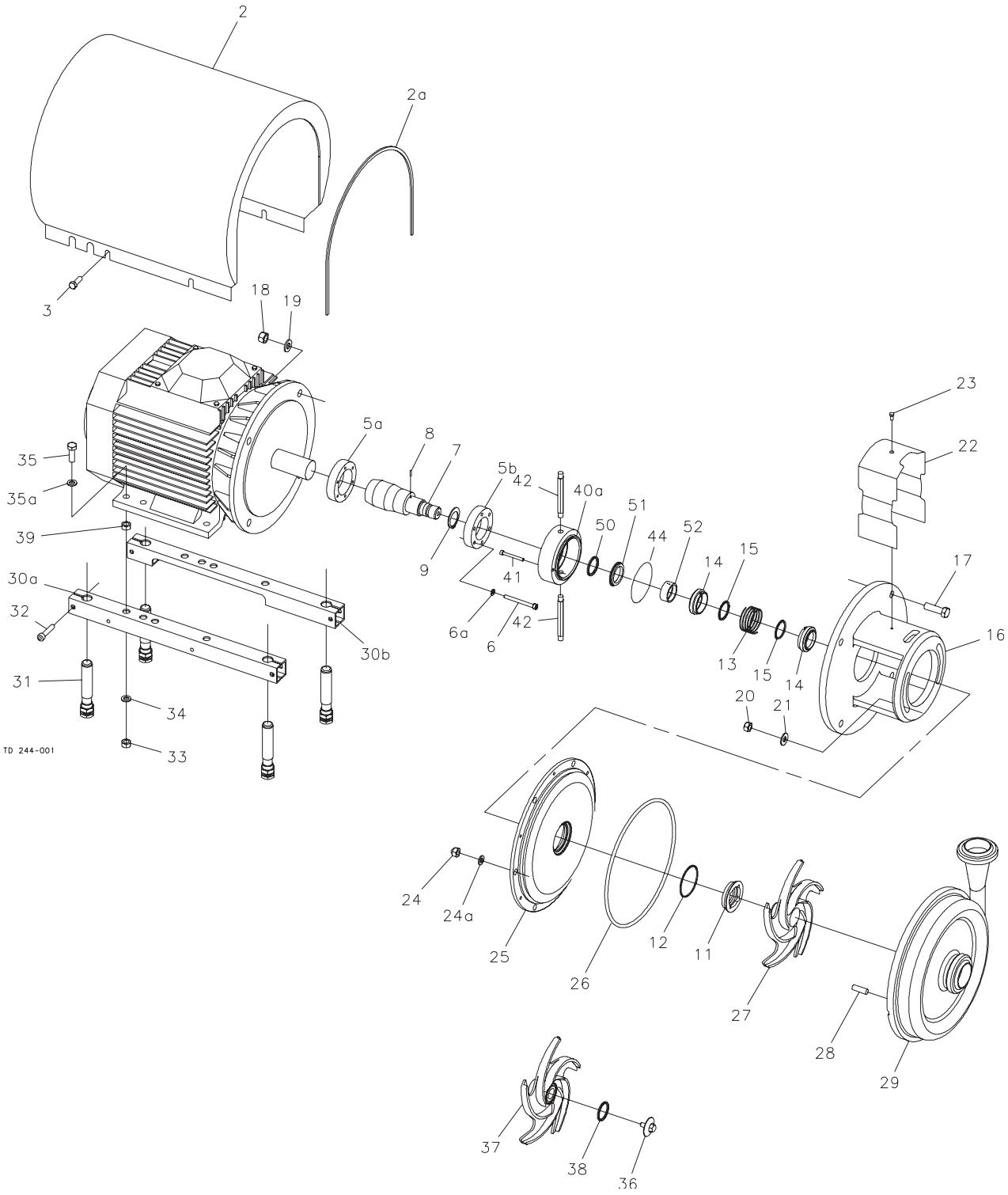
⊗ Only for Servicekit with impeller screw.

Service Kits

Denomination	Item number
Double mechanical shaft seal	
Service kit, EPDM (Standard)	9611-92-2206
Service kit, NBR	9611-92-2207
Service kit, FPM	9611-92-2208
Service kit, FEP	9611-92-2209
Double mechanical shaft seal and impeller screw	
Service kit, EPDM (Standard)	9611-92-2210
Service kit, NBR	9611-92-2211
Service kit, FPM	9611-92-2212
Service kit, FEP	9611-92-2213

●: Double mechanical shaft seal

The drawing shows LKHex, sanitary version.
The drawing includes all items of the pump.



The drawing and the parts list include all items.

Parts List

Pos.	Qty.	Denomination
1	1	Motor
2	1	Shroud
2a	1	Edge list
3	4	Screw
5a	1	Compression ring with thread
5b	1	Compression ring without thread
6	6	Screw
6a	6	Washer
7	1	Shaft
8	1	Connex pin
9	1	Retaining ring
10	1	Drive ring
11 ●	1	Stationary seal ring
12 ●	1	O-ring
13 ●	1	Spring
14 ●	2	Rotating seal ring
15 ●	2	O-ring
16	1	Adaptor
17	4	Screw for adaptor
18	4	Nut for adaptor
19	4	Washer for adaptor
20	2	Nut
21	2	Washer
22	1	Safety guard
23	1	Screw for safety guard
24	6	Cap nut
24a	6	Washer
25	1	Back plate
26 ●	1	O-ring
27	1	Impeller
28	6	Stud bolt
29	1	Pump casing
30a	1	Support bar, right
30b	1	Support bar, left
31	4	Leg
32	4	Screw
33	4	Nut
34	4	Spring washer
35	4	Screw
35a	4	Washer
36	1	Impeller screw
37	1	Impeller for impeller screw
38 ●	1	O-ring ⊗
39	4	Nut
40a	1	Seal housing
41	2	Screw for seal housing
42	2	Tube
44 ●	1	O-ring for seal housing
46	4	Distance sleeve
50 ●	1	O-ring
51 ●	1	Sec. stationary seal ring
52 ●	1	Drive ring

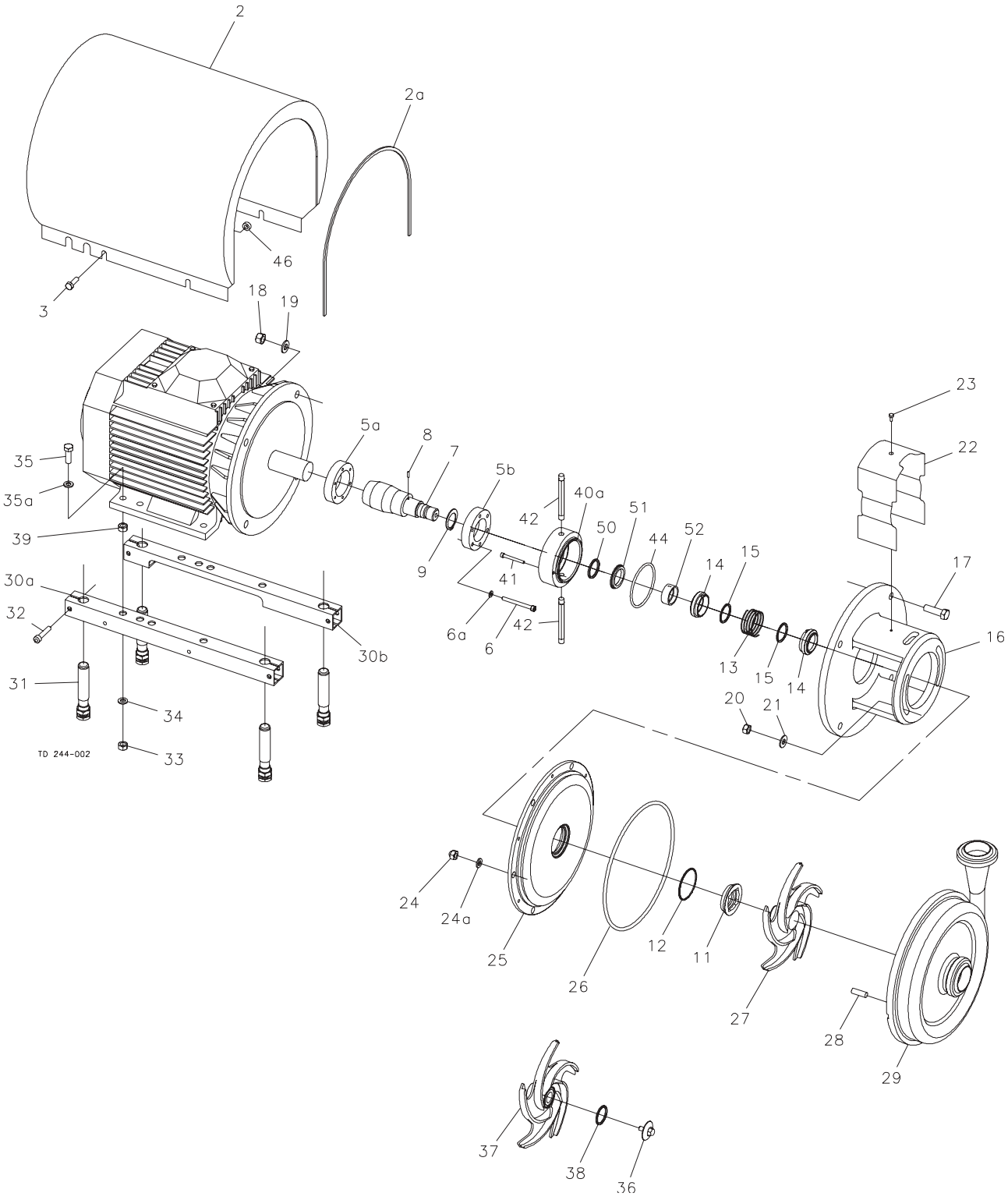
⊗ Only for Servicekit with impeller screw.

Service Kits

Denomination	Item number
Double mechanical shaft seal	
Service kit, EPDM (Standard)	9611-92-2214
Service kit, NBR	9611-92-2215
Service kit, FPM	9611-92-2216
Service kit, FEP	9611-92-2217
Double mechanical shaft seal and impeller screw	
Service kit, EPDM (Standard)	9611-92-2218
Service kit, NBR	9611-92-2219
Service kit, FPM	9611-92-2220
Service kit, FEP	9611-92-2221

●: Double mechanical shaft seal

The drawing shows LKHex, sanitary version.



The drawing and the parts list include all items.

Parts List

Pos.	Qty.	Denomination
1	1	Motor
2	1	Shroud
2a	1	Edge list
3	4	Screw
5a	1	Compression ring with thread
5b	1	Compression ring without thread
6	6	Screw
6a	6	Washer
7	1	Shaft
8	1	Connex pin
10	1	Drive ring
11 ●	1	Stationary seal ring
12 ●	1	O-ring
13 ●	1	Spring
14 ●	2	Rotating seal ring
15 ●	2	O-ring
16	1	Adaptor
17	4	Screw for adaptor
18	4	Nut for adaptor
19	4	Washer for adaptor
20	2	Nut
21	2	Washer
22	1	Safety guard
23	1	Screw for safety guard
24	6	Cap nut
24a	6	Washer
25	1	Back plate
26 ●	1	O-ring
27	1	Impeller
28	6	Stud bolt
29	1	Pump casing
30a	1	Support bar, right
30b	1	Support bar, left
31	4	Leg
32	4	Screw
33	4	Nut
34	4	Spring washer
35	4	Screw
35a	4	Washer
36	1	Impeller screw
37	1	Impeller for impeller screw
38 ●	1	O-ring ⊗
40a	1	Seal housing
41	2	Screw for seal housing
42	2	Tube
44 ●	1	O-ring for seal housing
46	4	Distance sleeve
50 ●	1	O-ring
51 ●	1	Sec. stationary seal ring
52 ●	1	Drive ring

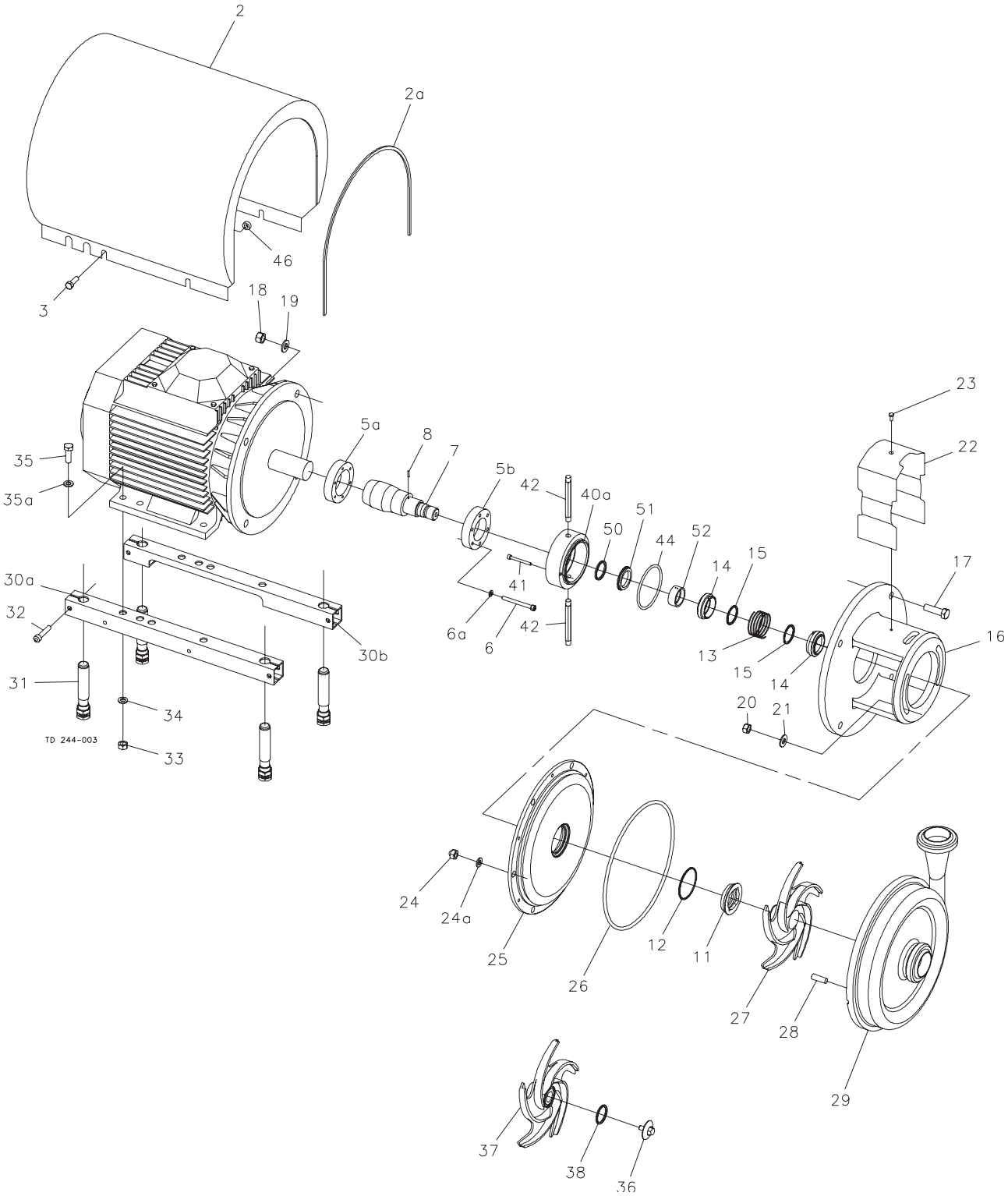
⊗ Only for Servicekit with impeller screw.

Service Kits

Denomination	Item number
Double mechanical shaft seal	
Service kit, EPDM (Standard)	9611-92-2222
Service kit, NBR	9611-92-2223
Service kit, FPM	9611-92-2224
Service kit, FEP	9611-92-2225
Double mechanical shaft seal and impeller screw	
Service kit, EPDM (Standard)	9611-92-2226
Service kit, NBR	9611-92-2227
Service kit, FPM	9611-92-2228
Service kit, FEP	9611-92-2229

●: Double mechanical shaft seal

The drawing shows LKHex, sanitary version.



The drawing and the parts list include all items.

Parts List

Pos.	Qty.	Denomination
1	1	Motor
2	1	Shroud
2a	1	Edge list
3	4	Screw
5a	1	Compression ring with thread
5b	1	Compression ring without thread
6	6	Screw
6a	6	Washer
7	1	Shaft
8	1	Connex pin
10	1	Drive ring
11 ●	1	Stationary seal ring
12 ●	1	O-ring
13 ●	1	Spring
14 ●	2	Rotating seal ring
15 ●	2	O-ring
16	1	Adaptor
17	4	Screw for adaptor
18	4	Nut for adaptor
19	4	Washer for adaptor
20	2	Nut
21	2	Washer
22	1	Safety guard
23	1	Screw for safety guard
24	6	Cap nut
24a	6	Washer
25	1	Back plate
26 ●	1	O-ring
27	1	Impeller
28	6	Stud bolt
29	1	Pump casing
30a	1	Support bar, right
30b	1	Support bar, left
31	4	Leg
32	4	Screw
33	4	Nut
34	4	Spring washer
35	4	Screw
35a	4	Washer
36	1	Impeller screw
37	1	Impeller for impeller screw
38 ●	1	O-ring ⊗
40a	1	Seal housing
41	2	Screw for seal housing
42	2	Tube
44 ●	1	O-ring for seal housing
46	4	Distance sleeve
50 ●	1	O-ring
51 ●	1	Sec. stationary seal ring
52 ●	1	Drive ring

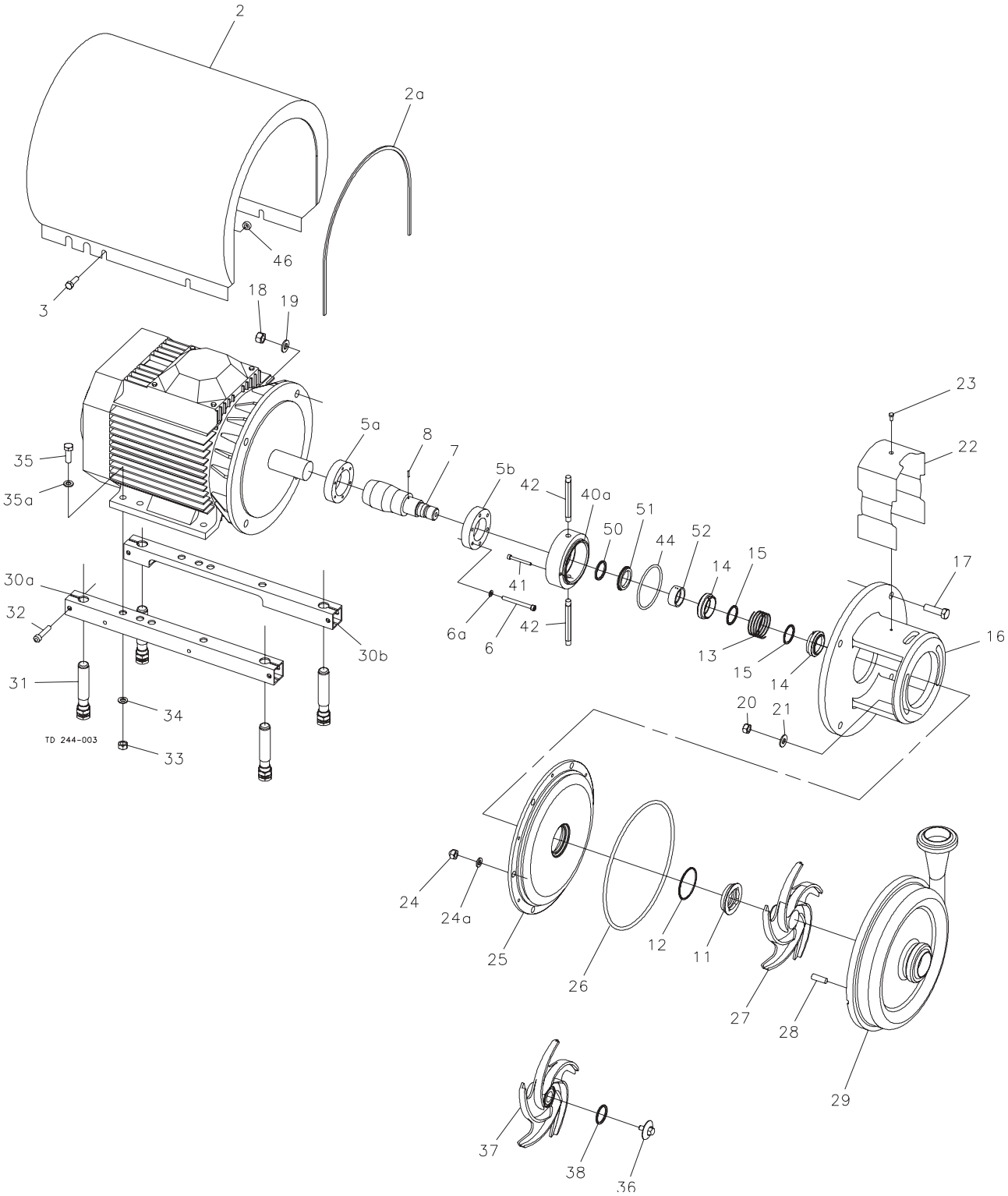
⊗ Only for Servicekit with impeller screw.

Service Kits

Denomination	Item number
Double mechanical shaft seal	
Service kit, EPDM (Standard)	9611-92-2230
Service kit, NBR	9611-92-2231
Service kit, FPM	9611-92-2232
Service kit, FEP	9611-92-2233
Double mechanical shaft seal and impeller screw	
Service kit, EPDM (Standard)	9611-92-2234
Service kit, NBR	9611-92-2235
Service kit, FPM	9611-92-2236
Service kit, FEP	9611-92-2237

●: Double mechanical shaft seal

The drawing shows LKHex, sanitary version.



The drawing and the parts list include all items.

Parts List

Pos.	Qty.	Denomination
1	1	Motor
2	1	Shroud
2a	1	Edge list
3	4	Screw
5a	1	Compression ring with thread
5b	1	Compression ring without thread
6	6	Screw
6a	6	Washer
7	1	Shaft
8	1	Connex pin
10	1	Drive ring
11●	1	Stationary seal ring
12●	1	O-ring
13●	1	Spring
14●	2	Rotating seal ring
15●	2	O-ring
16	1	Adaptor
17	4	Screw for adaptor
18	4	Nut for adaptor
19	4	Washer for adaptor
20	2	Nut
21	2	Washer
22	1	Safety guard
23	1	Screw for safety guard
24	6	Cap nut
24a	6	Washer
25	1	Back plate
26●	1	O-ring
27	1	Impeller
28	6	Stud bolt
29	1	Pump casing
30a	1	Support bar, right
30b	1	Support bar, left
31	4	Leg
32	4	Screw
33	4	Nut
34	4	Spring washer
35	4	Screw
35a	4	Washer
36	1	Impeller screw
37	1	Impeller for impeller screw
38●	1	O-ring ⊗
40a	1	Seal housing
41	2	Screw for seal housing
42	2	Tube
44●	1	O-ring for seal housing
46	4	Distance sleeve
50●	1	O-ring
51●	1	Sec. stationary seal ring
52●	1	Drive ring

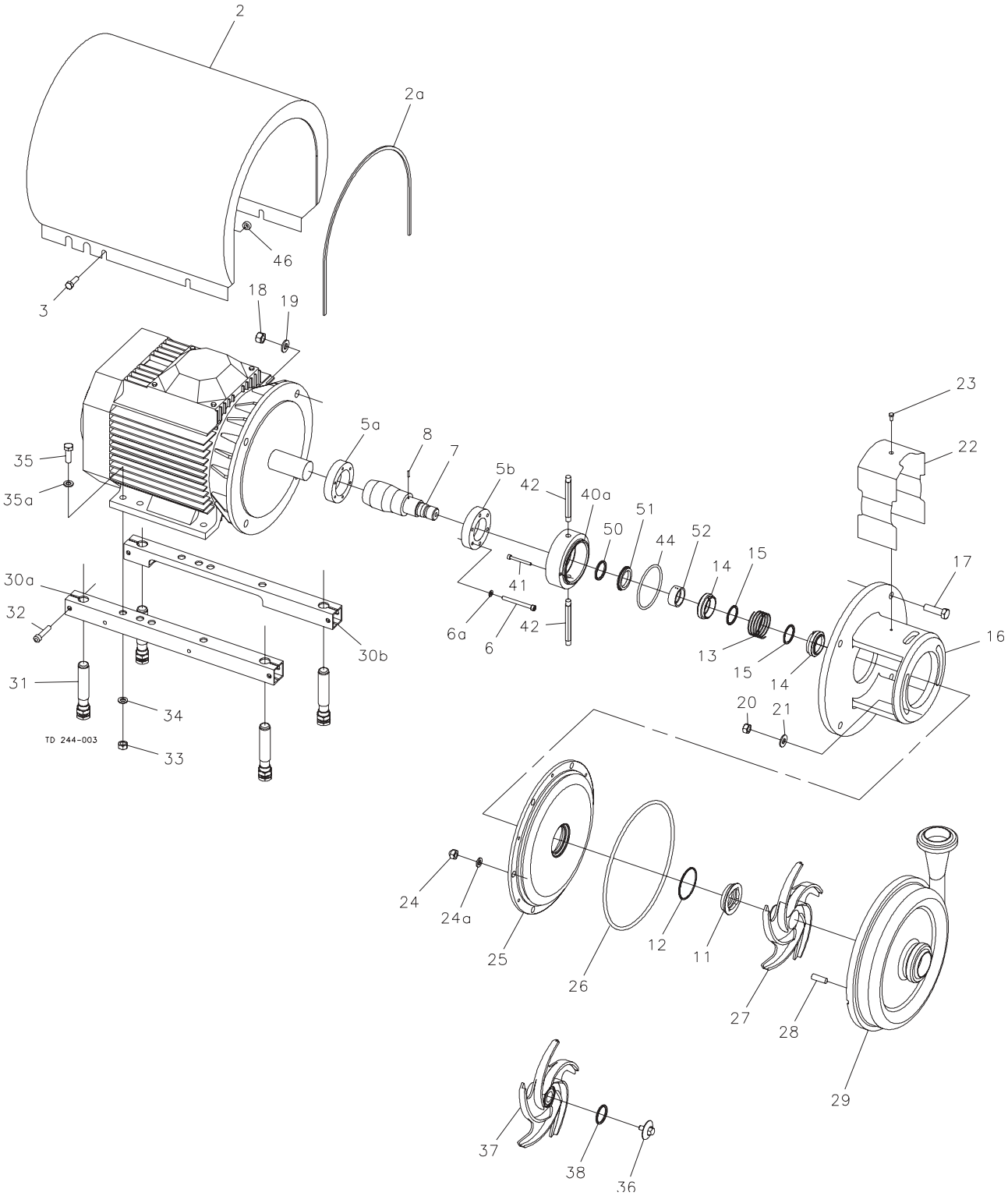
⊗ Only for Servicekit with impeller screw.

Service Kits

Denomination	Item number
Double mechanical shaft seal	
Service kit, EPDM (Standard)	9611-92-2222
Service kit, NBR	9611-92-2223
Service kit, FPM	9611-92-2224
Service kit, FEP	9611-92-2225
Double mechanical shaft seal and impeller screw	
Service kit, EPDM (Standard)	9611-92-2226
Service kit, NBR	9611-92-2227
Service kit, FPM	9611-92-2228
Service kit, FEP	9611-92-2229

●: Double mechanical shaft seal

The drawing shows LKHex, sanitary version.



The drawing and the parts list include all items.

Parts List

Pos.	Qty.	Denomination
1	1	Motor
2	1	Shroud
2a	1	Edge list
3	4	Screw
5a	1	Compression ring with thread
5b	1	Compression ring without thread
6	6	Screw
6a	6	Washer
7	1	Shaft
8	1	Connex pin
10	1	Drive ring
11 ●	1	Stationary seal ring
12 ●	1	O-ring
13 ●	1	Spring
14 ●	2	Rotating seal ring
15 ●	2	O-ring
16	1	Adaptor
17	4	Screw for adaptor
18	4	Nut for adaptor
19	4	Washer for adaptor
20	2	Nut
21	2	Washer
22	1	Safety guard
23	1	Screw for safety guard
24	6	Cap nut
24a	6	Washer
25	1	Back plate
26 ●	1	O-ring
27	1	Impeller
28	6	Stud bolt
29	1	Pump casing
30a	1	Support bar, right
30b	1	Support bar, left
31	4	Leg
32	4	Screw
33	4	Nut
34	4	Spring washer
35	4	Screw
35a	4	Washer
36	1	Impeller screw
37	1	Impeller for impeller screw
38 ●	1	O-ring ⊗
40a	1	Seal housing
41	2	Screw for seal housing
42	2	Tube
44 ●	1	O-ring for seal housing
46	4	Distance sleeve
50 ●	1	O-ring
51 ●	1	Sec. stationary seal ring
52 ●	1	Drive ring
53	4	Pivot screw (30 kW only)

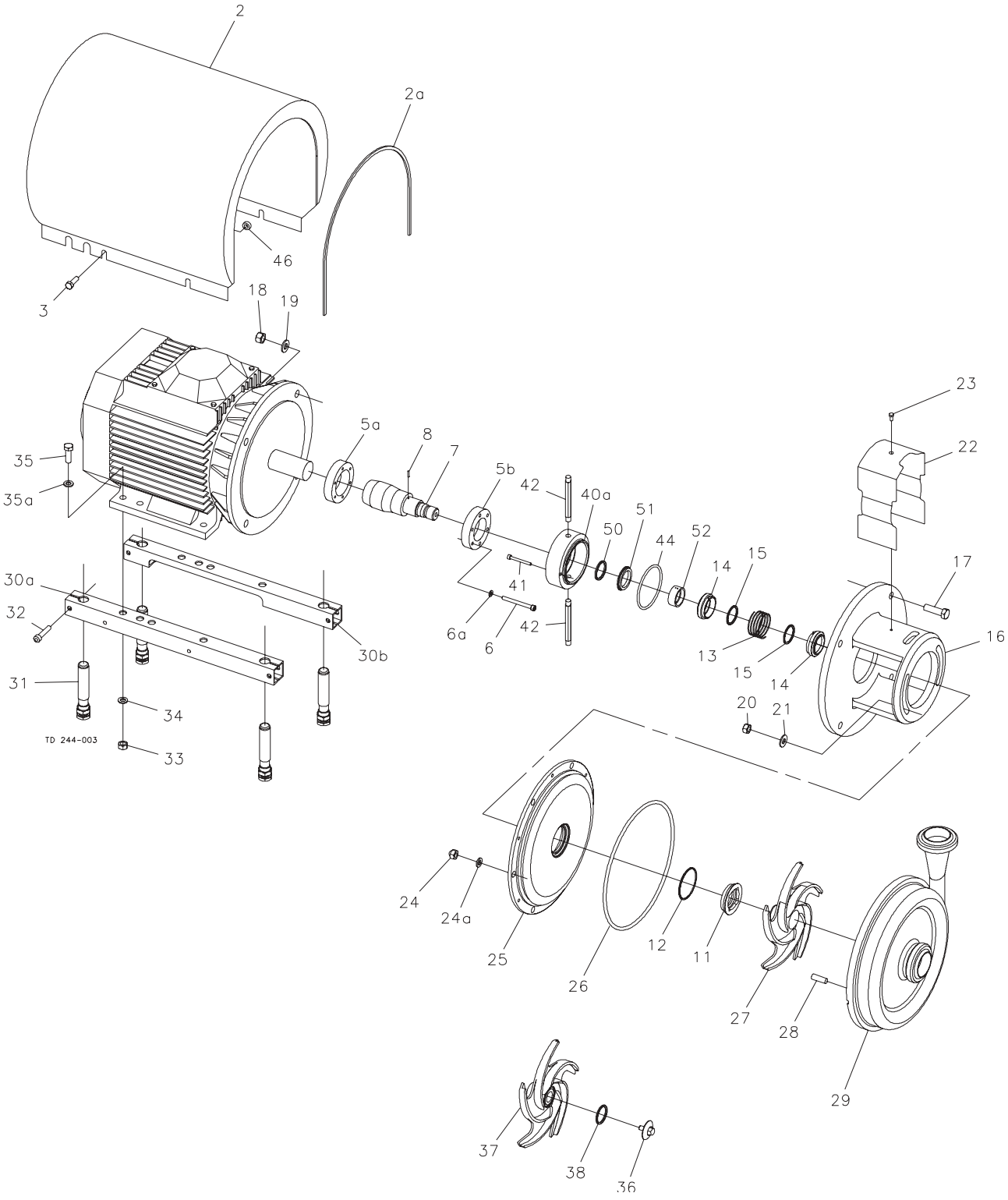
⊗ Only for Servicekit with impeller screw.

Service Kits

Denomination	Item number
Double mechanical shaft seal	
Service kit, EPDM (Standard)	9611-92-2230
Service kit, NBR	9611-92-2231
Service kit, FPM	9611-92-2232
Service kit, FEP	9611-92-2233
Double mechanical shaft seal and impeller screw	
Service kit, EPDM (Standard)	9611-92-2234
Service kit, NBR	9611-92-2235
Service kit, FPM	9611-92-2236
Service kit, FEP	9611-92-2237

●: Double mechanical shaft seal

The drawing shows LKHex, sanitary version.



APPENDIX

INCORPORATION MANUAL FOR THE LKHex SERIES SEAL (ATEX) REV. 0 OF JUNE 2003.

INCORPORATION/OPERATION MANUAL FOR THE LKH SERIES MECHANICAL SEALS (ATEX SUPPLEMENT)

To be used for LKH series of mechanical seals to comply with the raised attestation of conformity for components as per 94/9/EC article 8 (3).

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mail: info@roplan.com

Type denomination: LKH series mechanical seals.

General: This incorporation manual applies to the LKH series mechanical seals fitted into applications covered by the ATEX directive 94/9/EC.

Protection class:  II 2 GD c Tx[1]

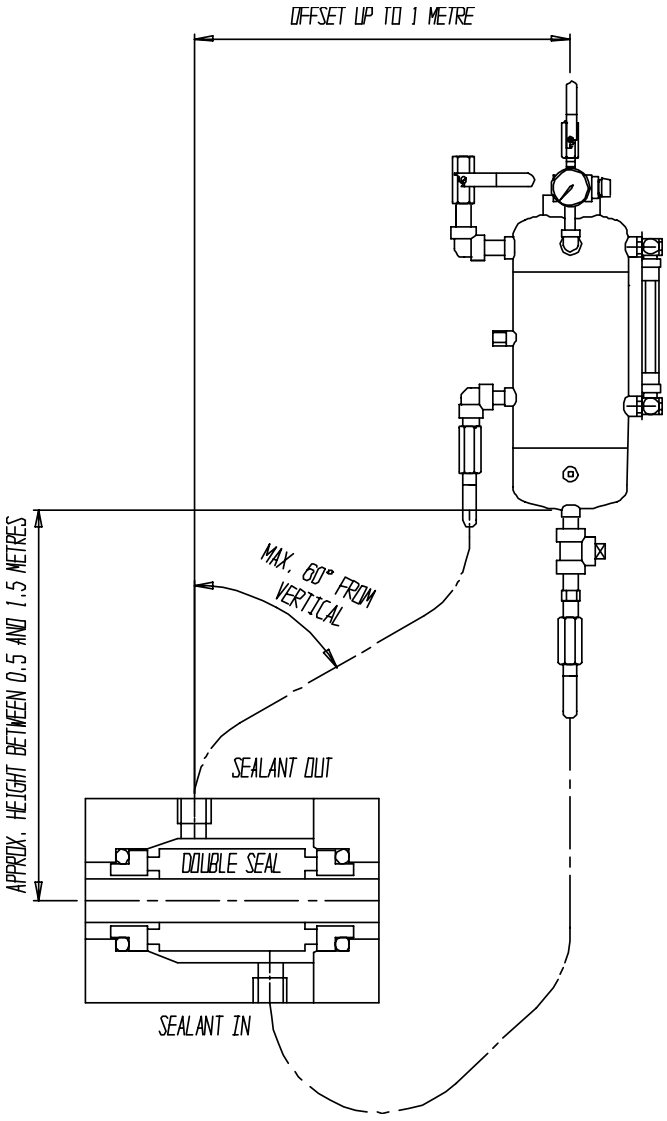
Type of protection: EN 13463-1:2001 'c'

Safety Zones applicable: Zone 1 & 21
Zone 2 & 22

Maximum surface temperature: The maximum surface temperature of the LKH mechanical seals are very much dependant upon the temperature of the media processed by the pump. In the table below the maximum temperature of the processed fluid within the pump is specified to ensure that the maximum surface temperature of the mechanical seal components does not exceed the corresponding temperature class.

Temperature Class	Maximum surface temperature	Maximum temperature of processed fluid[2]
T1	450°C	N/A
T2	300°C	150°C
T3	200°C	140°C
T4	135°C	88°C
T5	100°C	60°C
T6	85°C	48°C

Safety instructions: To prevent the potential risk of hot surfaces on the mechanical seal it is essential to apply additional cooling and lubrication of the seal faces through the use of an additional auxiliary support system together with a double mechanical seal assembly. There are two basic types of system to apply, either a low-pressure quench fluid (sometimes referred to low-pressure flush) or a high-pressure barrier fluid (sometimes referred to as a high pressure flush) system. In addition to this, only high-pressure barrier fluid should be used when either of the following two conditions apply;
1. Viscosity of the process fluid is less than 1 cP at process temperature when using Carbon v. Silicon Carbide.
2. Viscosity of the process fluid is less than 10 cP at process temperature when using Silicon Carbide v. Silicon Carbide.



Installation of the auxiliary system and monitoring components should be performed as per the supplier's instructions. For the mechanical seal arrangement it is very important to provide full venting to purge air/gas and correct position of the system thus the presented installation scheme applies.

It is essential to ensure that all the air/gas is purged from the seal housings so that the mechanical seals are fully immersed in the quench/barrier fluid.

Pressure and flow rate of the low-pressure quench fluid and high-pressure barrier fluid shall conform to the following conditions;

- Low pressure quench:

  Maximum pressure is 0,5 bar (7 psi).
  Flow rate required is minimum 30 l/hr (8 USG/hr).

- High pressure barrier fluid:

  The barrier fluid should have 1 bar higher pressure referred to the pressure within the seal cavity. For safety, the discharge

pressure of the pump can be used as a reference.

Barrier flow rate is calculated with the following formula:

$$Q = \frac{(0{,}6 \times p + 0{,}25) \times n \times d^3 \times T}{c_p \times \rho \times 2{,}5 \times 10^9}$$

where:

Q = Flow rate	[l/hr]
p = Applied barrier pressure	[bar]
n = Shaft speed	[rpm]
d = Shaft diameter	[mm]
T = Temperature of processed media	[°C]
r = Specific gravity of barrier fluid	[kg/dm³]
c_p = Specific heat capacity for barrier fluid	[kJ/(kg×K)]

Minimum flow rate required is 30 l/hr (8 USG/hr).

Temperature of the low-pressure quench and high-pressure barrier fluid shall never be allowed to exceed the maximum temperature of processed fluid for the specified temperature class (refer to table above).

For the high-pressure barrier fluid system it is essential to have a controlled pressure of the barrier fluid of 1 bar above discharge pressure of the pump during all operating conditions.

To ensure temperature, flow rate and pressure of the low-pressure quench or high-pressure barrier fluid is within specification these shall be monitored:

- Temperature of the low-pressure quench or high-pressure barrier fluid. This shall be done on the outlet from the seal housing ensuring temperature of the low-pressure quench or high-pressure barrier fluid does not exceed maximum temperature (refer to text above). The temperature can be measured with a temperature probe. The temperature shall be monitored continuously and connected to an alarm providing the operator with instant information on eventual incorrect operation of the system.
- Flow rate of the low-pressure quench or high-pressure barrier fluid. This should be done on the inlet to the seal housing ensuring correct flow rate is applied to the seal arrangement. The flow rate can be measured with a flow meter. The flow rate shall be controlled weekly.
- Pressure of the low-pressure quench or high-pressure barrier fluid. This shall be done on the inlet to the seal housing ensuring pressure of the low-pressure quench or high-pressure barrier fluid does not exceed specification for the mechanical seal. The pressure can be measured with a pressure transmitter or pressure gauge. The pressure shall be controlled weekly.
- Presence of the low-pressure quench or high-pressure barrier fluid. This shall be done on the inlet to the seal housing ensuring the sealing arrangement has proper lubrication and cooling. The presence of the low-pressure quench or high-pressure barrier fluid can be verified with a level indicator or a sight glass or the use of a flow meter. The presence of the low-pressure quench or high-pressure barrier fluid shall be monitored continuously and connected to an alarm providing the operator with instant information on eventual incorrect operation of the system.

The operator shall, from respective supplier(s), require a written attestation of conformity as per 94/9/EC article 8 (3) for, or an affixed CE-marking as per 94/9/EC applied to, the auxiliary system and monitoring components used.

To prevent hazardous reaction between;

- processed fluid and materials of construction the materials of construction shall be ensured to be suitable for the application.
- the low-pressure quench or high-pressure barrier fluid and materials of construction the materials of construction shall be ensured to be suitable for the application.
- processed fluid and the low-pressure quench or high-pressure barrier fluid the low-pressure quench or high-pressure barrier fluid shall be ensured to be suitable for the application.

Start-up:

Before start-up of LKH series mechanical seals the following shall be controlled and verified:

- Shaft seal arrangement being correctly fitted as per fitting instruction.
- Materials of construction chosen are suitable for the application.
- The application is within operating parameters originally specified.
- The auxiliary system chosen for the application is suitable.
- Pressure, flow rate and temperature of the auxiliary system are within specification.

- Auxiliary system monitoring devices are as per supplier(s) specification and suitable for the application.
- Check cooling water flow rate, temperature and pressure and adjust if required.
- When the low-pressure quench or high-pressure barrier fluid is applied check for eventual leakage.

Operation:

The LKH series mechanical seals shall not operate beyond the following operating limits;

Pressure/speed limits

Single seal:	Max pressure (at speed)	Max speed (at pressure)
C/SiC[3]	10 bar (3600 rpm)	3600 rpm (10 bar)
SiC/SiC[4]	10 bar (3600 rpm)	3600 rpm (10 bar)

Double

Outboard seal:	Max pressure (at speed)	Max speed (at pressure)
C/SiC	10 bar (3600 rpm)	3600 rpm (10 bar)
SiC/SiC	5 bar (3600 rpm)	3600 rpm (5 bar)

Temperature limits

Seal face	max operating temperature[5]
Solid Resin-impregnated Carbon	200°C
Inserted Silicon Carbide	150°C

Elastomer	operating temperature[6]
NBR	-30 – 100°C
EPDM	-40 – 150°C
FPM (Fluoroelastomer)	-20 – 200°C
FEP Encapsulated	-200 – 200°C

Viscosity limits

Seal face	Viscosity [cP]
Solid Carbon	Up to 5000
Silicon Carbide	Up to 150000

Assembly:

The LKH series mechanical seals shall be fitted as per the fitting instructions specified within the LKHex centrifugal pump technical manual (IM 70969).

Disassembly:

The LKH series mechanical seals shall be disassembled as per the disassembly instructions specified within the LKHex centrifugal pump technical manual (IM 70969).

Maintenance:

Daily:
Check for eventual leakage from the mechanical seal. If leakage is considered to be severe replacement of the mechanical seal shall be considered.
Verify the low-pressure quench or high-pressure barrier fluid temperature, flow rate, pressure and presence and adjust if required.
Verify the function of the alarms applied.

Every two years or 8000 hrs of operation:
Replace the mechanical seal with a new or a professionally refurbished LKH series mechanical seal. Do note that the used mechanical seal usually can be refurbished thus it is essential to handle with care to prevent unnecessary damages.

Installation:

The mechanical seals shall be fitted as per the fitting instructions specified within the LKHex centrifugal pump technical manual (IM 70969).

Set-up:

There are no requirements for “set-up” of the LKH series mechanical seals.

Education:

Operator must have necessary knowledge about the LKH mechanical seals before handling the mechanical seals. Necessary knowledge includes the understanding of the;
- function of a mechanical seal.
- fitment of the LKH series mechanical seals to the pump.
- safety instructions within this incorporation manual.
- operational limits for the LKH series mechanical seals.

Operational limits:

The LKH series mechanical seals shall not operate beyond the limits specified within the operation section of this incorporation manual.

Special conditions which by experience proved likely to happen:

- If the pump is to be used within another application than originally intended there will be a risk of chemical incompatibility in between the processed fluid and the materials of construction as well as the quench/barrier fluid used creating a possible hazard. Each and every application shall be handled individually to ensure the safety conditions are maintained.
- If the mechanical seal is subjected to poor lubrication this will create excessive wear and heat and subsequently premature failure. It is therefore essential that the applied auxiliary system is properly installed, monitored and maintained.
- If the mechanical seal is exposed to rough handling permanent damages can occur. It is therefore essential that personnel involved receive the specified education above.
- If the mechanical seal is incorrectly fitted conditions could very likely be similar to poor lubrication creating excessive wear and heat and subsequently premature failure. It is therefore important that the operator has received the specified education above.
- If the pump is operated beyond it's operating limits severe vibrations might apply to the sealing arrangement and subsequently create excessive wear of involved components creating a failure. It is essential that the operator has received the specified education above together with the full understanding of the pump and the education related thereto.
- If the mechanical seal is disassembled it should not be fitted again unless inspected and approved by Roplan personnel.

Important accessories: There are no additional important accessories required for the use of LKH series mechanical seals.

Drawings and diagrams: No special drawings or diagrams are required for the safe operation of the LKH series mechanical seals.

(Footnotes)

[1] Temperature class depending upon processed media temperature, refer to section "Maximum surface temperature".
[2] LKH series of mechanical seals are limited to a processed fluid temperature of maximum 150°C.
[3] C/SiC = Carbon v. Silicon Carbide
[4] SiC/SiC = Silicon Carbide v. Silicon Carbide
[5] Temperature limit is dependant on liquid being processed.
[6] Temperature limit is dependant on liquid being processed.

How to contact Alfa Laval
Contact details for all countries are continually updated on our website. Please visit www.alfalaval.com to access the information direct.