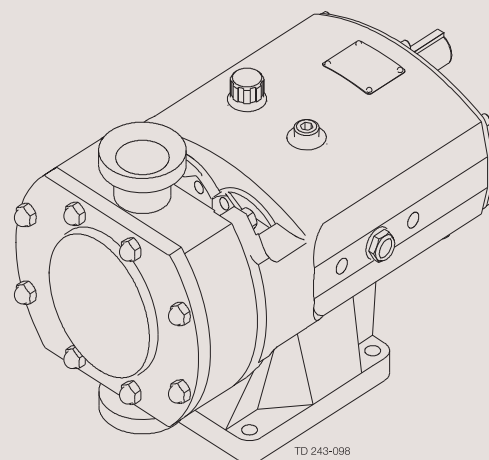
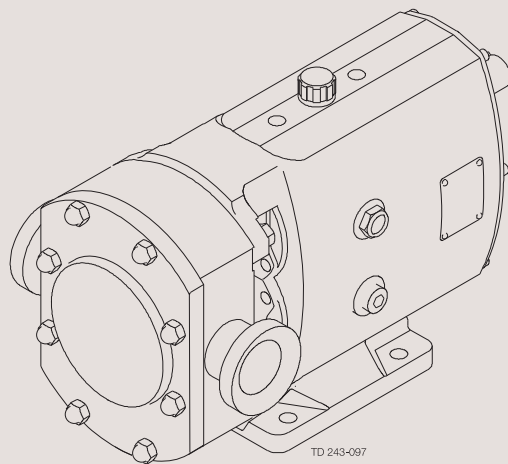




Instruction Manual

ATEX Addendum to SRU Instruction Manual - Rotary Lobe Pump - SRU Range



IMPORTANT!

When ordering spare parts please quote Pump Serial No.

Read all of this pump manual and any instructions supplied for ancillary equipment before the unit is installed, operated or maintained.

ESE02195-EN9

2020-02

Original manual



www.sksonline.com

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

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1 EC Declaration of Conformity

This declaration of conformity is issued under sole responsibility of the manufacturer:

Alfa Laval Eastbourne Ltd

Company Name

Brich Road, Eastbourne, East Sussex, BN23 6PQ United Kingdom

Address

+44 (0) 1323 412555

Phone No.

Equipment covered by this declaration of conformity:

Pump

Designation

SRU1, SRU2, SRU3, SRU4, SRU5, SRU6

Type


From serial number E222350 to E500.000


Is in conformity with the requirements of the following directives:


2006/42/EC Machinery Directive


2014/34/EU Equipment Explosive Atmospheres (ATEX)

This declaration of conformity covers pumps with the following ATEX markings:

 II 2G Ex h IIB T4 .. T2 Gb

 II 3G Ex h IIB T4 .. T2 Gc

 II 2G Ex h IIC T4 .. T2 Gb

 II 3G Ex h IIC T4 .. T2 Gc

For ATEX directive 2014/34/EU the following harmonized standards EN 80079-36:2016 and EN 80079-37:2016 for non-electrical equipment have been applied.

ATEX directive 2014/34/EU conformity for the motor and coupling is covered by the relevant EU Type examination certificates and declarations supplied by the manufacturers.

The Pump Technical file is stored with: Teknologisk Institut, Kongsvang Alle 29, 8000 Aarhus C, Denmark

Notified Body no.: 0396

Archive no.: 2019-1-0330A

The person authorized to compile the technical file is the signer of this document

Global Product Quality Manager

Pumps, Valves, Fittings and Tank Equipment

Title

Alfa Laval Kolding, Albuen 31, DK 6000 Kolding

Place

Lars Kruse Andersen

Name

2020-02-11

Date



Signature

(This Declaration of Conformity replaces Declaration of Conformity dated 2018-06-01)



1.1 ATEX Directive 2014/34/EU

ATEX Directive 2014/34/EU

The ATEX Directive 2014/34/EU covers equipment and protective systems that will be used in areas endangered by potentially explosive atmospheres created by the presence of flammable gases, vapors and dusts.

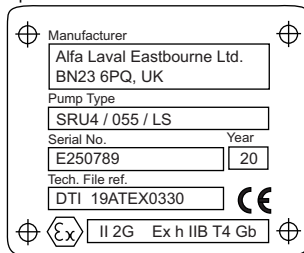
Rotary Lobe Pumps supplied with an ATEX symbol are classified for use in potentially explosive gas and vapour atmospheres under ATEX Directive 2014/34/EU Group II, Categories 2 and/or 3.

Technical File Ref:	2019-1-0330A
Equipment Group and Category:	Group II Category 2G Zone 1 Group II Category 3G Zone 2
Standards Used:	EN 80079-36:2016, EN 80079-37:2016

1.2 ATEX marking

In addition to the standard pump nameplate, ATEX Certified units have an additional ATEX name plate affixed to the pump gearbox housing stating the unit ATEX certification standard.

Name plate example:



3204-0006

2 Safety

Unsafe practices and other important information are emphasized in this manual. Warnings are emphasized by means of special signs, see description in Standard Instruction Manual section 2.1 Special Conditions for Safe Use and 2.2 General Information. Always read the manual before using the pump!

2.1 Special conditions for safe use



- **Ensure** checks and running conditions for the pump unit during operation to be according to section 4 Operation
- **Never** operate pump outside max duty conditions specified in section 6.3 Seal Operation Data. If the duty conditions change please refer to pump manufacturer.

2.2 General information



- **Always** make sure that the Serial Number Stamped on the pump nameplate matches the number shown on the Declaration and in section 6.3 Seal Operation Data
- **Always** check that the components and equipment supplied is suitable for the area intended and corresponds with the order acknowledgement.
- **Always** read this ATEX addendum thoroughly before using the pump and read the safety instructions in the Standard Instruction Manual prior to handling, installing, operating or maintaining the pump.
- **Always** order genuine spare parts using the serial number of the pump, stated on the pump nameplate, for identification purposes.
- **Always** ensure that intentionally or potentially mixing of fluids do not create hazardous reactions/situations (eg. process media and flush media)

Education:

Operators must have necessary knowledge about the pump supplied including the mechanical seals before doing any installation or maintenance work relating to the pump unit. Necessary knowledge includes the understanding of the:

- function of the pump unit including the mechanical seal
- maintenance/service procedures of the pump unit including the mechanical seals.
- safety instructions.
- operational limits for the pump unit including the mechanical seals

Installation

- Always read section 3 Installation

Operation

- Always read section 4 Operation

Maintenance

- Always read section 5 Maintenance
-

3.1 Installation



Pumps and motorized pump units

- **Always** follow the Installation instructions in the Standard Instruction Manual in conjunction with this addendum
- **Always** ensure that instructions for all ATEX compliant equipment and components are followed (motors, couplings, reduction gears etc.)
- **Always** make sure that pump gearbox, base plate and motor are electrically earthed
- **Always** read section 4 Operation before pump start up
- **Ensure** correct alignment of pump and drive unit
- **Ensure** that all control and monitoring equipment complies with the requirements in appropriate ATEX standards e.g. EN 13463-6
- **Never** install the pump or pump unit at an angle of more than 5° from the horizontal plane
- **Never** cover up pump gearbox, motor or reduction gearbox in any way that will reduce the cooling effects intended

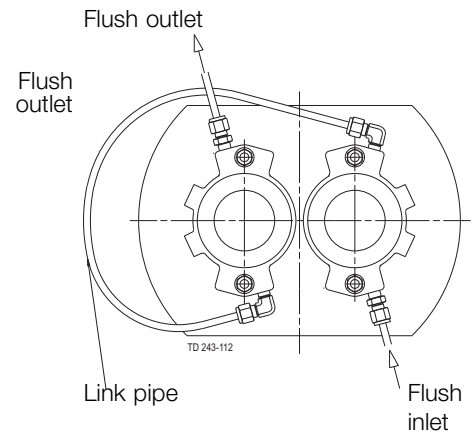
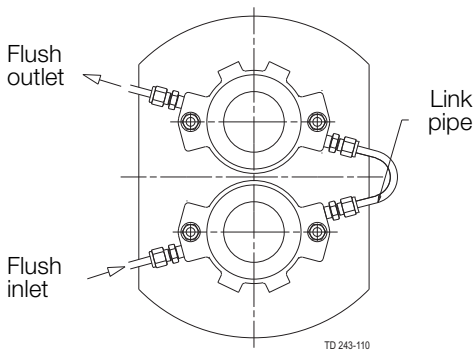
Thermocouple installation See section 5.3.2 and 5.3.5 5 Maintenance

For pumps fitted with the ATEX Pressure Relief Valve please see section 5.6 ATEX Pressure Relief Valve



Flush system

- **Always** connect the two flush housings in series, see examples in the sketch below.
- **Always** measure flush media parameters at flush housing outlet eg. temperature, flow and/or pressure (see section 6.1 6 Technical data, for more information)
- **Ensure** inlet connection to be lower than outlet connection on the individual housing
- **Ensure** the distance between the flush housing outlet and the flush media temperature sensor (if optional thermocouple is fitted) does not exceed 200mm. For information on required flows, pressures etc. (see section 6.1 6 Technical data).



4 Operation

4.1 Operation



Pump units

- **Always** read the operations instructions in the Standard Instruction Manual
- **Always** read "Technical information" for shaft seals in section 6.1 6 Technical data
- **Always** vent and purge the seal cavities and flush housing (if applied) of air/gas prior to start-up to avoid any dry-running.
- **Always** make a visual inspection of the pump unit at startup to ensure there are no malfunctions e.g. leaks, abnormal noises, vibration or heat. If found the equipment must be stopped immediately and the cause rectified.
- **Always** remove the rotorcase cover to drain the pump head
- **Ensure** that the temperature of the heating jacket/saddle, if fitted, does not exceed those shown in section 5.4 Heating/Cooling devices
- **Never** run pump with suction side and/or pressure side blocked
- **Never** operate other equipment/components in pump unit outside limits specified in manufacturers instructions manuals eg. motor, reduction gear, coupling etc.
- **Never** expose thermocouple lead (if fitted) to any force higher than 5N (eg. high pressure cleaning etc.)
- **Never** use a heating/cooling media in saddles/jackets, that can cause a hazardous situation in case of leakage
- **Never** run the pump dry unless a flushed mechanical seal is fitted and operated correctly.

4.2 Seal operation safety checks

Pumps fitted with Double Flushed Mechanical Seals

The end user is required to ensure that:

- Flush media is present.
- Flush media is at a pressure of 1.0 bar min. above the pump discharge pressure.
- Seal faces are receiving the required volume of flush media, so as to cool them and dissipate any heat build up.

In practice this means the end user **should** monitor:

- Flush media pressure.
- Flush media flow rate.

and **must** monitor:

- Temperature - either of flush media or change of temperature at outboard seal face.

Pumps fitted with Single Flushed Mechanical Seals

The end user is required to ensure that:

- Flush media is present.
- Seal faces are receiving the required volume of flush media, so as to cool them and dissipate any heat build up.

In practice this means the end user should monitor:

- Flush media pressure or flow rate.

and **must** monitor:

- Temperature of flush media.

Pumps fitted with Single Mechanical Seals

The end user is required to ensure that:

- Seal face temperature does not exceed the temperature class limit.

In practice this means the end user **must** monitor either:

- Presence of pumped media either by flow rate or pressure indicator.
- Pumped media temperature.

or alternatively:

- Seal face temperature change.

4.3 Daily Checks

Shaft seals, all types:

- Ensure there is no unacceptable leakage.

Shaft seals fitted with optional thermocouple:

- Ensure proper function of signals, alarms and associated Ignition Prevention Systems related to the thermocouple.
- Ensure for single seal, that the thermocouple reading is similar to the process media temperature (no more than 20°C above). If this is not the case, the equipment must be stopped immediately, checked and the cause rectified. Check for abnormal running conditions.
- Ensure, for double flushed mechanical seals, that the thermocouple reading is similar to the flush media temperature (no more than 20°C above). If this is not the case, the equipment must be stopped, checked and the cause rectified. Check for abnormal running conditions.

Pump unit:

- Ensure the oil levels to be correct with no signs of oil contamination.
- Ensure there are no signs of overheating.
- Ensure there are no abnormal running conditions such as loose components, abnormal noise, vibration, heat or oil leakage. If found the equipment must be stopped immediately and the cause rectified.
- Ensure the pump duty conditions and running speed never exceed the limits specified in section 6.3 Seal Operation Data
- Ensure all sealing elements are effective to prevent ingress of solid foreign objects and liquids.
- Ensure exterior surfaces are clean and free from any dust deposits.

Control / Monitoring equipment:

- Ensure, at least daily, correct function of control and monitoring equipment so as to ensure surface temperatures stay within the specified temperature class (eg. process media temperature/pressure sensors).
- Ensure, at least daily, correct function of signals, alarms and associated Ignition Prevention Systems so as to ensure surface temperatures stay within the specified temperature class.

NOTE:

Any maintenance work must be carried out when an explosive atmosphere is not present. Additionally, prior to any maintenance work the equipment must be electrically and mechanically isolated.

5 Maintenance

5.1 General Maintenance Guidelines

- **Always** follow the Maintenance instructions in the Standard Instruction Manual
- **Always** read "Technical information" section 6.1 Shaft Seals and section 6.3 Seal Operation Data
- **Always** ensure that instructions of all ATEX compliant equipment and components are followed (motors, couplings, reduction gears etc.)
- **Always** read section 4 Operation before starting up the pump unit after maintenance

Pump Gearbox

It is essential to ensure the oil level to be correct as specified in the standard instruction manual. Recommended oil as follows:

(-20 to +130°C)

Castrol Alphasyn PG150
Mobil Glygoyle 22
Shell Omala S4 WE 150
Chevron Meropa Synlube WS 150

(+130 to +200°C)

Castrol Alphasyn PG 220
Mobil Glygoyle 30
Shell Omala S4 WE 220
Chevron Meropa Synlube WS 220

Food Grade (-20 to +130°C)

Mobil Glygoyle 150
Total Nevastane XSH 150
Fusch Cassida Fluid GL 150

Pump Gearbox bearings changing intervals

If the bearings are worn excessively it can cause increased friction and thus increased surface temperature on the gearbox. Gearbox bearings should be renewed before the running hours stated in the table below have been exceeded. Alternatively it should be ensured by other means that the bearings are working satisfactorily eg. bearing frequency analysis. The bearings should be checked/monitored continuously or at least every 1000 running hours when the running hours in the table below are exceeded.

Pump model	Bearing changing intervals (pump running hours x1000)		
	Process media differential pressure		
	0 to 8 bar	8 to 10 bar	10 to 15 bar
SRU1/005	30	Non-applicable	Non-applicable
SRU1/008	30*	Non-applicable	Non-applicable
SRU2/013	30	30	9
SRU2/018	20	10	Non-applicable
SRU3/027	30	30	30
SRU3/038	30	30	Non-applicable
SRU4/055	30	30	13
SRU4/079	30	18	5.5
SRU5/116	30	30	20
SRU5/168	30	25	8
SRU6/260	20	12	3.8
SRU6/353	12	6	2

* Or maximum rated pump differential pressure, whichever is lower.

5.2 Ordering Spare Parts

When ordering spare parts please quote Pump Serial No.

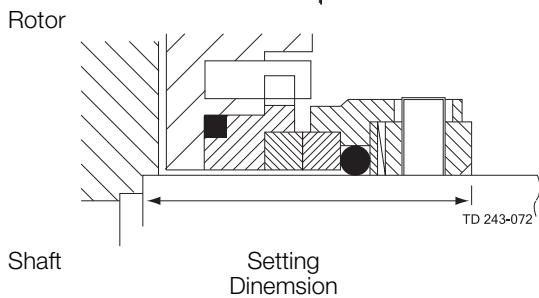
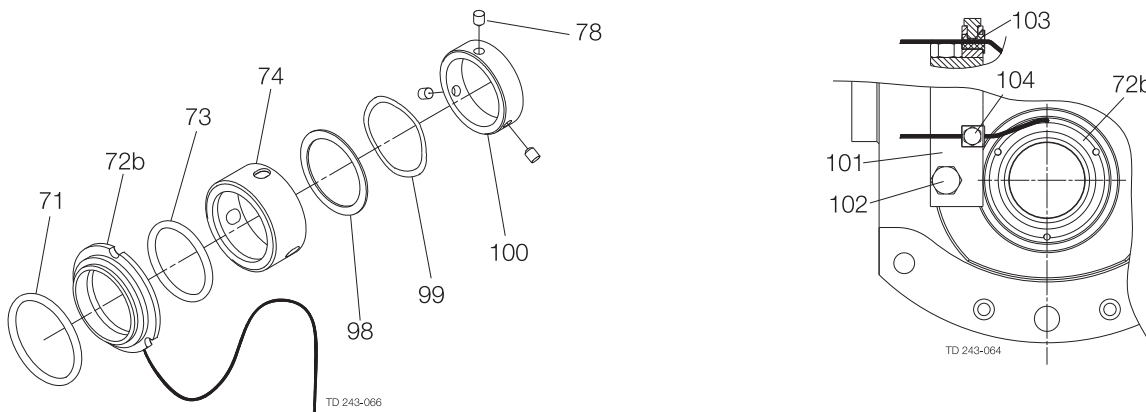
5.3 Mechanical seals

Mechanical seals should not be removed unless they are to be replaced.

5.3.1 R90 Single mechanical seal

Refer to section 4.5.1 in Standard Instruction Manual

5.3.2 R90 Single mechanical seal with optional thermocouple



Pump	Setting mm	Dimension in	Grub Screw (78) Torque (Nm)
SRU1	33.6	1.32	4.5
SRU2	35.6	1.40	4.5
SRU3	38.1	1.50	4.5
SRU4	39.6	1.56	4.5
SRU5	47.6	1.87	8
SRU6	50.7	2.00	15

Item	Description
71	Stationary seal ring O-ring
72b	Stationary seal ring with thermocouple
73	Rotary seal ring O-ring
74	Rotary seal assembly comprising of rotary seal ring, Washer (98), wave spring (99), drive ring (100) and grub screw (78)
101	Thermocouple clamp plate
102	Clamp plate screw
103	Plastic bush
104	Bush locking screw

Seal removal

1. Unplug or disconnect the thermocouple lead connection – keep lead clamped to rotorcase until rotorcase removed
2. Remove the rotorcase, cover, rotors and rotorcase
3. Loosen bush locking screw (104)
4. Extract the stationary seal ring (72b) ensuring not to damage thermocouple wire, and remove o-ring (71)
5. Loosen the grub screws (78)
6. Remove the rotary seal assembly (74) from the shaft.
7. Remove abutment spacer if fitted.
8. Extract the rotary seal O-ring (73) from the rotary seal assembly

5 Maintenance

Seal fitting

1. Mark the shaft to indicate the seal setting length.
2. Lightly lubricate O-rings (71 and 73) with appropriate grease and fit to rotary and stationary seals (74 and 72).
3. If fitted replace abutment spacers.
4. Slide rotary seal assembly on to the shafts until aligned with the setting dimension mark.
5. Tighten the grub screws (78) to the recommended torque figure as shown above.
6. Press stationary seals into rotorcase bores ensuring the thermocouple wire is oriented towards the center of the rotorcase.
7. Fit lead through thermocouple fixture and position plastic bush (103) in the fixture.
8. Tighten the bush locking screw (104), torque 4Nm, holding the static seal face in place. Do not apply more than 5N force to lead.
9. Wipe clean the sealing faces with solvent.
10. Refit the rotorcase, rotors and front cover.
11. Make sure the lead from the thermocouple is mounted properly and kept away from any moving parts and sharp edges.
12. Connect the flying leads of the thermocouple to data system, type K connection
13. Verify the function and reading of the thermocouple. If there is no signal, the thermocouple has been damaged or incorrectly connected.
14. Verify proper function of seal and temperature reading at startup, see section 6.3 Seal Operation Data

For horizontally ported pumps, the thermocouple is fitted on the upper shaft and for vertically ported pumps the thermocouple can be fitted on either shaft.

The components and equipment used for the monitoring system must comply with the requirements of appropriate ATEX standard e.g. EN13463-6.

For further information on the installation and operation of the Thermocouple please see section 5.5 Thermocouple

Mechanical seals should not be removed unless they are to be replaced.

5.3.3 R90 Single flushed mechanical seal

Refer to section 4.5.2 in Standard Instruction Manual

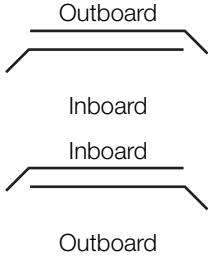
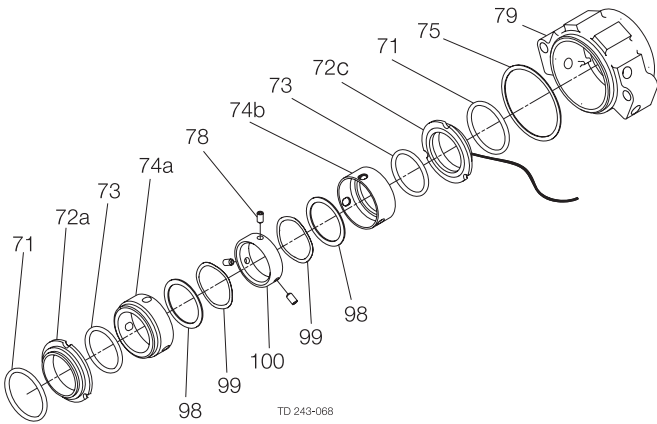
5.3.4 R90 Double flushed mechanical seal

Refer to section 4.5.3 in Standard Instruction Manual

5.3.5 R90 Double flushed mechanical seal with optional thermocouple

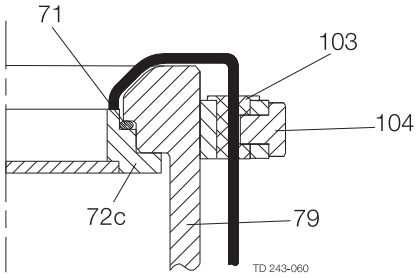
Item	Description
71	Stationary seal ring O-ring
72	Stationary seal ring
72c	Stationary seal ring with thermocouple
73	Rotary seal ring O-ring
74a	Rotary seal ring assembly - inboard Comprising of rotary seal ring, washer (98), wave spring (99) and drive ring (100)
74b	Rotary seal ring assembly - outboard Comprising of rotary seal ring, grub screw (78), washer (98) and wave spring (99)
75	Seal housing gasket
79	Seal housing
103	Plastic bush
104	Bush locking screw

Type	Torque Nm
SRU1	4.5
SRU2	4.5
SRU3	4.5
SRU4	4.5
SRU5	15.0
SRU6	15.0
SRU4	4.5
SRU5	15.0
SRU6	15.0



Series 1, the outboard seal fits over the inboard seal.

Series 2-6, the inboard seal fits over the outboard seal.



5 Maintenance

Seal removal

1. Ensure the flush media is turned off and disconnect the flushing pipework.
2. Remove the rotorcase cover and rotors.
3. Turn the drive shaft until the drive ring grub screws (78) are visible through the flushing connections.
4. Loosen the grub screws.
5. Remove the rotorcase.
6. Remove seal housings (79) complete with rotary seal assemblies (74a and 74b) and outboard stationary seals.
7. Loosen bush locking screw (104) on thermocouple fixture and extract carefully without damaging the thermocouple wire.
8. Extract the seal housing gasket (75), stationary seal ring (72) and O-ring (71) from the rotorcase.

Seal fitting:

Ensure seal orientation is correct.

1. Lightly lubricate O-rings (71 and 73) with appropriate grease and fit to rotary seal assemblies and stationary seal rings (74A, 74B and 72).
2. Fit stationary seals into the rotorcase bores and seal housings (79) making sure the thermocouple lead is positioned at the thermocouple fixture.
3. Fit lead carefully through thermocouple fixture and position plastic bush (103) in the fixture. Do not apply more than 5N to the lead.
4. Tighten the bush locking screw (104), torque 4Nm, holding the static seal face in place. Do not apply more than 5N force to lead.
5. Fit gaskets (75) into the rotorcase bores.
6. Wipe clean the sealing faces with solvent.
7. Locate rotary seal assemblies and fit the seal housings to the rotorcase ensuring that the grub screws (78) are accessible so they can be tightened.
8. Refit the rotorcase.
9. Turn the drive shaft until the grub screws are visible through the flushing connections.
10. Tighten the grub screws to the recommended torque figure as shown on page 13.
11. Refit the rotors and rotorcase cover.
12. Make sure the lead from the thermocouple is mounted properly and kept away from any moving parts and sharp edges.
13. Connect the flying leads of the thermocouple to data system, type K connection
14. Verify the function and reading of the thermocouple. If there is no signal, the thermocouple has been damaged or incorrectly connected.
15. Verify proper function of seal and temperature reading at startup, see section 6.3 Seal Operation Data
16. Verify proper function of overall pump unit at startup

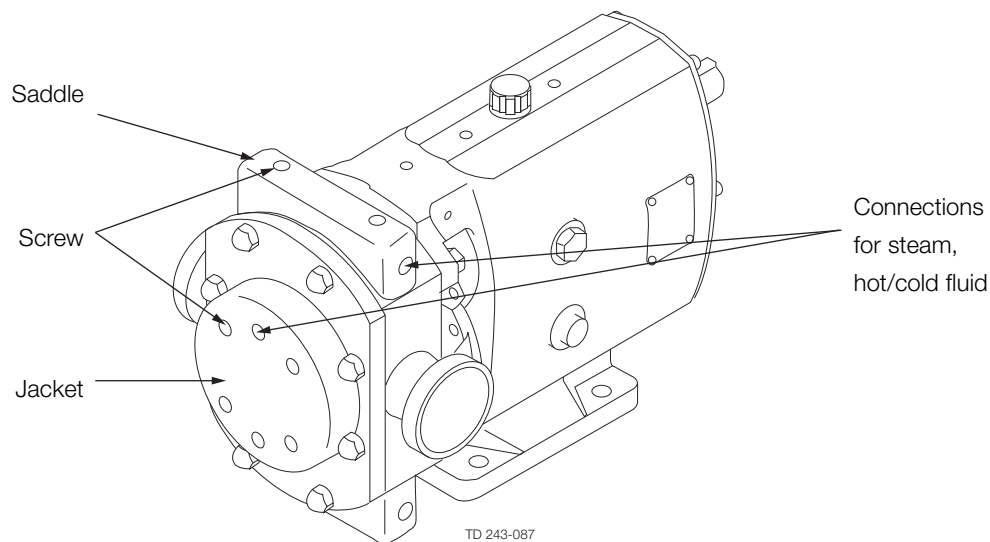
For horizontally ported pumps, the thermocouple is fitted on the upper shaft and for vertically ported pumps the thermocouple can be fitted on either shaft.

The components and equipment used for the monitoring system must comply with the requirements of appropriate ATEX standard e.g. EN13463-6.

For further information on the installation and operation of the Thermocouple please see section 5.5 Thermocouple.

5.4 Heating/Cooling devices

SRU pumps have the option of being fitted with jackets to the rotorcase cover and/or saddles to the rotorcase. These are primarily used for heating the pumphead so as to maintain the pumped media temperature. They may also be used for cooling purposes.



The maximum allowable pressure and temperature of heating/cooling fluid is 3.5 bar and 150°C respectively, except in T4 applications in which the maximum allowable temperature is 115°C.

5 Maintenance

5.5 Thermocouple

Thermocouple Installation and Operation

Thermocouples are fitted to the Pressure Relief Valve option and are offered as an option to monitor the mechanical seal temperature.

The thermocouples supplied are Type-K.

The thermocouple/s needs to be connected to a suitable Ignition Prevention System (IPS) conforming to Ignition Protection Level 1 (IPL1) as per the appropriate requirements of EN ISO80079-37:2016, Clause 7. It is the user's responsibility to assess and ensure that the selected Ignition Prevention System is suitable for the intended application.

Prior to connecting the thermocouple sensor to a suitable Ignition Protection System, the user shall observe all ATEX requirements of the selected Ignition Protection System and ensure the assembly (i.e. the thermocouple sensor and any other part/device that forms the Ignition Protection System) shall not itself be an ignition source. The thermocouple sensor shall be fitted to the selected Ignition Prevention System by means of a suitably certified IS barrier and by competent personnel.

Pressure Relief Valve (if fitted)

The Ignition Prevention System shall be set up appropriately so as to shut the equipment down in the event of the the front cover surface temperature exceeding the below values when measured on the thermocouple sensor fitted to the front cover relief valve assembly:

T4 (135°C) = 115°C or maximum rated pump temperature (whichever is lower)

T3 (200°C) = 150°C or maximum rated pump temperature (whichever is lower)

T2 (300°C) = 150°C or maximum rated pump temperature (whichever is lower)

The Ignition Protection System shall cause the equipment to shut down within the maximum permitted rundown time of 30 seconds in the event of the above temperatures being met.

Mechanical Seal Thermocouple (if fitted)

The Ignition Prevention System shall be set up appropriately so as to shut the equipment down in the event of the seal face temperature exceeding that stated in the 'Seal Operating Data - Section 6.3'. The limits shown below are maximum limits which are not to be exceeded:

T4 (135°C) = 115°C or maximum rated pump temperature (whichever is lower)

T3 (200°C) = 150°C or maximum rated pump temperature (whichever is lower)

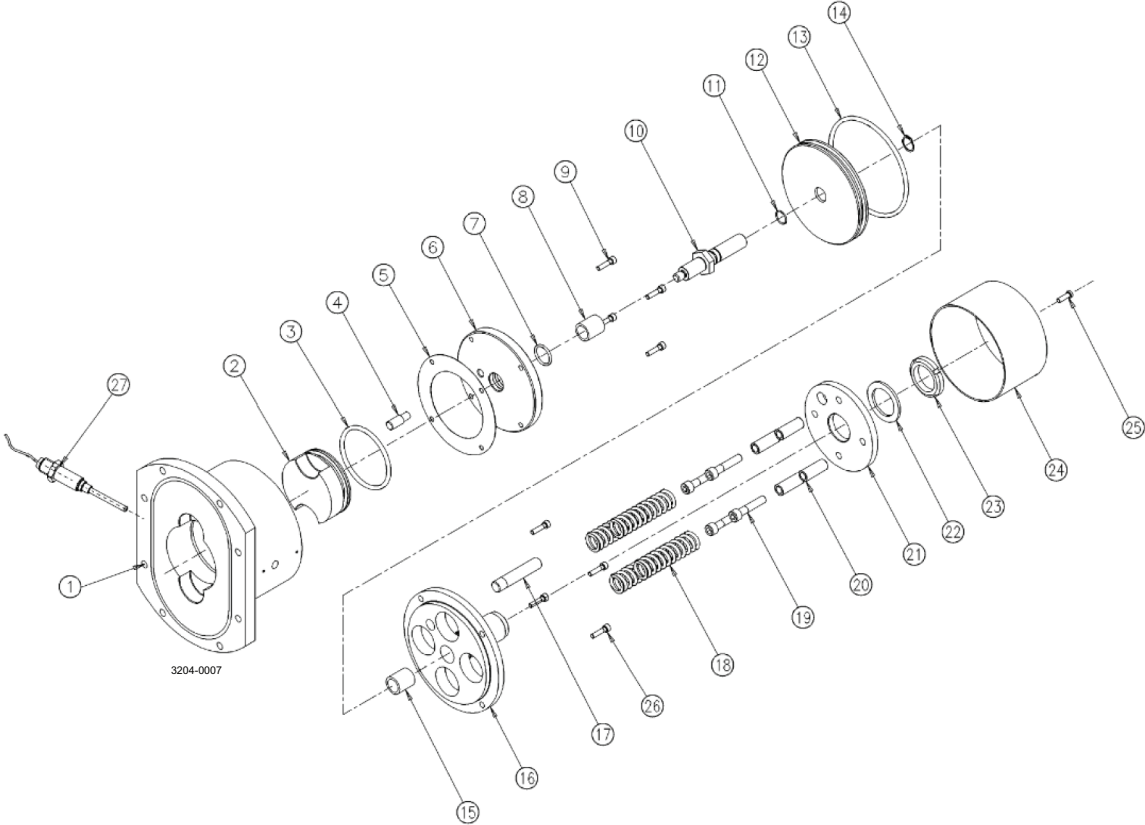
T2 (300°C) = 150°C or maximum rated pump temperature (whichever is lower)

The Ignition Protection System shall cause the equipment to shut down within the maximum permitted rundown time of 5 seconds in the event of the above temperatures being met.

For more details on monitoring seal face temperature see section 6.2 Monitoring Seal Face Temperature

5.6 ATEX Pressure Relief Valve

The below instructions replace those shown in the Installation Manual, pages 35 & 36.



Item	Description
1	Rotorcase cover
2	Hydraulic piston
3	O-ring, hydraulic piston
4	Valve pin
5	Shim
6	Backstop disc
7	O-ring, backstop disc
8	Bush
9	Screw, backstop disc
10	Valve shaft
11	O-ring, pneumatic piston
12	Pneumatic piston
13	O-ring, pneumatic piston

Item	Description
14	Circlip
15	Bush
16	Valve guide
17	Valve pin
18	Spring
19	Screw
20	Valve spring guide
21	Spring adjuster
22	Washer
23	Notched nut
24	Valve housing
25	Screw
26	Screw, spring adjuster
27	Thermocouple

5 Maintenance

5.6.1 Relief Valve Disassembly

1. Unplug or disconnect the thermocouple lead connection (27).
2. Remove manual override lever if fitted.
3. Remove screws (25) and valve housing (24).
4. Remove notched nut(s) (23) and spring adjuster (21), If springs are still compressed when the notched nut reaches end of thread, release the spring adjuster screws (26).
5. Remove springs (18) (series 1-5), spring stacks (series 6), screws and valve guide (16).
6. Remove circlip (14) and pneumatic piston (12).
7. Remove screws, backstop disc (6) and hydraulic piston (2).
8. Unscrew hydraulic piston (2) from valve shaft (10) and remove O-rings (3, 7, 11 and 13).

5.6.2 Relief Valve Assembly

New O-rings should be fitted during assembly.

Clean components before fitting; check there is no damage to faces.

1. Lubricate all o-rings.
2. Fit O-ring (7) to backstop disc (6) and fit backstop disc to valve shaft (10).
3. Fit O-ring (3) to hydraulic piston (2) and screw onto valve shaft.
4. Locate assembly into rotorcase cover, replace backstop disc screws (9).
5. Fit pneumatic piston o-rings (11 and 13) and locate assembly on valve shaft. Replace circlip (14) and springs (18). (Series 6 pumps only - each spring stack should contain an equal amount of springs, noting correct orientation). Place valve guide (16) over springs and replace screws (25).
6. Fit spring adjuster (21) and notched nut (23), valve housing (24) and screw (25).
7. Replace manual override lever if applicable.
8. Connect the thermocouple (27) to the data system.
9. Verify the function and reading of the thermocouple. If there is no signal, the thermocouple has been damaged or incorrectly connected.

5.6.3 Valve Adjustment

The relief valve will require setting to suit duty requirements.

Note: A gauge is required to measure discharge pressure during adjustment.

1. Stop the pump.
2. Remove valve housing (24).
3. Release notched nut(s) (23) to end of thread.
4. Insert a thin rod into valve guide (16) and mark to indicate closed position.
5. Start pump and increase pressure noting pressure gauge reading when the rod starts to move. This indicates the valve is beginning to open.
6. Tighten the notched nut gradually until desired system pressure is achieved (Series 6 pump only - evenly tighten the spring stack nuts after adjusting the notched nut).
7. Apply thread locking adhesive to the notched nut after relief valve is set.
8. If pneumatic override is required connect air supply and adjust pressure until valve opens. Check piston reseats when air supply is disconnected.

Pressure Relief Valve Operation

The relief valve fitted to pumps certified for use in ATEX areas are fitted with a thermocouple used to measure the surface temperature of the front cover.

During pump running, if the relief valve operates, the increased product slip (internal product recirculation) within the pump head can cause an increase in pumped product temperature and thereby allowing an uncontrolled increase in the pump head surface temperature beyond that allowed under the ATEX T-rating certified.

The thermocouple allows monitoring of the front cover surface temperature during use and is to be used to ensure that in the event of an abnormal temperature increase being detected, the pump equipment is shut down to stop any further temperature rise.

In addition to the thermocouple it is recommended that, to ensure safe operation of both the pump and other piping system/components, that the line pressure is monitored as close to the pump discharge port as possible to ensure equipment shut down if an over pressure event occurs and the cause investigated and rectified before restarting.

6 Technical data

6.1 Shaft Seals

The correct function of a mechanical seal is largely dependent upon its lubrication and cooling of the sealing surfaces. It is therefore extremely important to avoid any dry-running of the seal faces since this can cause excessive generation of heat and thus the possibility of exceeding the specified temperature class. During normal operation a mechanical seal will generate a very small but controlled leakage which will increase upon failure. If dry-running of the process media cannot be avoided or if any leakage of the process media can cause a hazardous situation (i.e. flammable media), a flush system must be fitted.

The standard ATEX compliant mechanical seal options are described below:

A. Double Flushed Mechanical Seal

This seal arrangement provides the user with the highest level of protection against the seal faces running hot. On this seal arrangement the flush is used as a 'Barrier' fluid. The pressure of the barrier fluid should be 1.0 bar min. above the pump discharge pressure. The inboard seal interface film will therefore be flush media. The barrier fluid will act as a coolant and lubricant for both inboard and outboard seals. Leakage of pumped media into the barrier fluid will not occur. Flush housings should be connected in series (not parallel) as shown in section 3.1 Installation. Proper function of the flush system is essential - if the flush flow is interrupted or stopped the outboard seal will run dry and the seal face temperature increased to become a potential explosion risk, see section 6.2 Monitoring Seal Face Temperature

A double mechanical seal fitted with a thermocouple allows the user to provide alarms based on the temperature at the seal face, see section 6.2 Monitoring Seal Face Temperature

Thermosiphon flush systems are not recommended.

B. Single Flushed Mechanical Seal

This seal arrangement provides the user with a high level of protection against the seal faces running hot. On this seal arrangement the flush is used as a 'Buffer' fluid. The pressure of the buffer fluid should be 0.5 bar max. The seal interface film will therefore be pumped media. The buffer fluid will act as a coolant for the seal and prevent the pumped media from coagulating, solidifying or crystallising on the seal faces. Any leakage of pumped media is carried away to ensure good seal function. Flush housings should be connected in series (not parallel) as shown in section 3.1 Installation. Proper function of the flush system is essential - if the flush flow is interrupted or stopped the seal will run dry and the seal face temperature increased to become a potential explosion risk, see section 6.2 Monitoring Seal Face Temperature

Note: A double flushed mechanical seal can also be operated in a low pressure flush mode as above.

C. Single Mechanical Seal

On this seal arrangement the seal interface film is the pumped media. The pumped media acts as a coolant and lubricant for the seal faces. For single mechanical seals without a thermocouple fitted there is no monitoring device or protection and relies on the process media to cool and lubricate the seal faces to stay within the stated temperature class. The process must be controlled / monitored to ensure the seal faces do not exceed the temperature limit. This can be achieved by ensuring there is a reasonable flow of the process media and the process temperature does not exceed the values listed in the 'Seal Operation Data', section 6.3 Seal Operation Data

A single mechanical seal fitted with a thermocouple allows the user to provide alarms based on the temperature at the seal face, see section 6.2 Monitoring Seal Face Temperature

6.2 Monitoring Seal Face Temperature

It must be ensured that the temperature of the seal face does not exceed the temperature class limit. This can be achieved by:

- A. Ensuring that the temperature measured locally at the seal face does not exceed the temperature listed in section 6.3 Seal Operation Data, e.g. with a thermocouple fitted to the stationary seal ring.
- B. For double and single flushed mechanical seals only, ensuring the barrier / buffer fluid temperature does not exceed the value listed in section 6.3 Seal Operation Data, and the total flow is a minimum of 30 l/hr. The temperature and flow must be measured after the flush housing outlet. If a recommended flow higher than 30 l/hr is stated on the 'Seal Operation Data', this should be adhered to.
- C. For double and single flushed mechanical seals only, ensuring the barrier / buffer fluid temperature does not exceed the value listed in section 6.3 Seal Operation Data, and the total flow is sufficient to reach the temperature sensor within 10 seconds after leaving the flush housing outlet. The distance between the flush housing outlet and the temperature sensor should not exceed 200mm. This applies when the barrier / buffer flow is lower than 30 l/hr.

Thermocouple

The thermocouple will allow temperature measurement when connected to appropriate instrumentation (see section 5.5 Thermocouple). The temperature reading of the thermocouple must not exceed the maximum temperature stated in section 6.3 Seal Operation Data'.

When the use of thermocouples for monitoring is selected, then depending upon the nature of the application one or alternatively two thermocouples per pump may be used (one per seal). The thermocouple is only available on SRU pumps fitted with R90 type mechanical seals. The only seal face/seat option being silicon carbide versus silicon carbide. For horizontally ported pumps, the thermocouple is fitted on the upper shaft (seal most likely to run dry), regardless of whether pump has single or double mechanical seals. For vertically ported pumps, the thermocouple is fitted on the shaft (seal) being flushed last when pump has double mechanical seals and on either shaft when pump has single mechanical seals.

False temperature readings

False temperature readings can result from:

1. The thermocouple lead being cut, thereby the signal is subsequently lost.
2. If a short circuit occurs on the thermocouple lead the temperature measuring point will move from the seal face to the new point in contact and thus give a false reading. Therefore it is important to ensure that the temperature is being read at the seal face.

Correct function of the thermocouple

Correct function of the thermocouple must be ensured to avoid false temperature readings. Prior to start-up the thermocouple must be calibrated as closely as possible to the temperature of the pumped media i.e. $\pm 5^{\circ}\text{C}$. This must be undertaken during commissioning:

Example 1 (one thermocouple per pump)

Checking by manual inspection with the pump stationary.

1. Inspect visually that the thermocouple lead is fixed properly and there are no signs of wear or damage to the lead due to vibration, moving parts etc.
2. Produce a local temperature change around the stationary seal fitted with the thermocouple, making sure that the temperature reading reflects the change in temperature. This can be done by spraying cold spray on the back of the seal.

Example 2 (two thermocouples per pump)

Checking electronic monitoring of the thermocouple function. Compare the readings from both thermocouples. These should be similar during normal operation. If the reading differential between the two thermocouples increases this can be due to:

- A. One of the thermocouples being broken and therefore must be replaced.
- B. Abnormal operating conditions i.e. dry running. If the temperature reading on both thermocouples exceeds the maximum temperature stated in section 6.3 Seal Operation Data', this indicates abnormal operating conditions and the pump must be stopped.

6.3 Seal Operation Data

How to contact Alfa Laval

Contact details for all countries are continually updated on our website.

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