

The complete guide to all plans for supplying mechanical seals

**EagleBurgmann®**

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# API 682 4th edition piping plans



**API 682 4th edition**

## Introduction

A sealing system, consisting of a mechanical seal and an associated supply system that is balanced by individual applications, is the utmost guarantee for a reliable sealing point and uninterrupted pump service. The performance of the seal is greatly influenced by the environment around the seal faces, making the provision of suitable, clean fluids as well as a moderate temperature an essential topic.

This guiding booklet provides a condensed overview of all piping plans established by the API 682 4th edition guidelines. Each illustrated piping plan is briefly described, and a recommendation that considers the media characteristics in terms of the relevant application and corresponding configurations is given to help you reliably select your sealing system.

Furthermore, we have enriched this booklet's content by providing clues – so-called ‘remarks and checkpoints’ – where we share the experiences we have gained from multiple equipped plants.

## Remark

The configurations listed for each individual piping plan are to be understood as recommendations including possible utilizations which may also be applied.

## Overview on API piping plans - location and characteristics

Process side		Between seals	Atmospheric side
<b>Plan 01</b>	Internal circulation in pump	<b>Plan 52</b>	Buffer liquid reservoir
<b>Plan 02</b>	Dead ended, clean medium	<b>Plan 53A</b>	Barrier liquid, reservoir
<b>Plan 03</b>	Tapered seal chamber bore	<b>Plan 53B</b>	Barrier liquid, bladder accumulator
<b>Plan 11</b>	Circulation, pressure increase	<b>Plan 53C</b>	Barrier liquid, piston accumulator
<b>Plan 12</b>	Circulation, pressure increase + strainer	<b>Plan 54</b>	External barrier liquid system
<b>Plan 13</b>	Circulation, venting	<b>Plan 55</b>	External buffer liquid system
<b>Plan 14</b>	Circulation, venting, Plan 11 + 13, vertical pumps	<b>Plan 71</b>	Tapped connections for purchaser's use
<b>Plan 21</b>	Circulation via cooler	<b>Plan 72</b>	Buffer gas system
<b>Plan 22</b>	Circulation via cooler, strainer	<b>Plan 74</b>	Barrier gas system
<b>Plan 23</b>	Forced loop via cooler	<b>Plan 75</b>	Leakage collection and alarm, reservoir
<b>Plan 31</b>	Circulation, cyclone separator	<b>Plan 76</b>	Vapor leakage to flare
<b>Plan 41</b>	Circulation, cyclone separator + cooler		
<b>Plan 32</b>	External flush		
			<b>Engineered</b>
			<b>Plan 99</b>
			Engineered to customer's specifications

## Color key

Plan location:

- Process side plans
- Between seals plans
- Atmospheric side plans














Seals:

- Stationary seal parts
- Mating ring (stationary)
- Rotary seal parts
- Seal ring (rotating)

- Pump medium

## Symbols library

Instrument symbols	
(FO)	Flow orifice
(LI)	Level indicator
(LIT)	Level transmitter with local indicator
(PDI)	Differential pressure transmitter with local indicator
(PI)	Pressure indicator
(PIT)	Pressure transmitter with local indicator
(TI)	Temperature indicator
(TIT)	Temperature transmitter with local indicator
HLA	High level alarm set point
LLA	Low level alarm set point
NLL	Normal liquid level

Equipment symbols	
	Bladder accumulator
	Piston accumulator
	Cyclone separator
	Filter, coalescing
	Flow orifice
	Seal cooler
	Strainer, Y
	Valve, normally open
	Valve, normally closed
	Valve, needle
	Valve, check
	Valve, pressure control
	Valve, pressure relief

## EagleBurgmann in profile

EagleBurgmann is one of the internationally leading companies for industrial sealing technology. Our products are used wherever safety and reliability are important: in the oil and gas industry, refining technology, the petrochemical, chemical and pharmaceutical industries, food processing, power, water, mining, pulp & paper and many others. More than 6,000 employees contribute their ideas, solutions and commitment towards ensuring that customers all over the world can rely on our seals and services.

## EagleBurgmann and API 682

We offer our customers the widest product portfolio of seals and seal supply systems according to API 682 4th edition.

### A sealing provider you can count on

More than 21,000 EagleBurgmann API-seals and systems are installed world-wide.



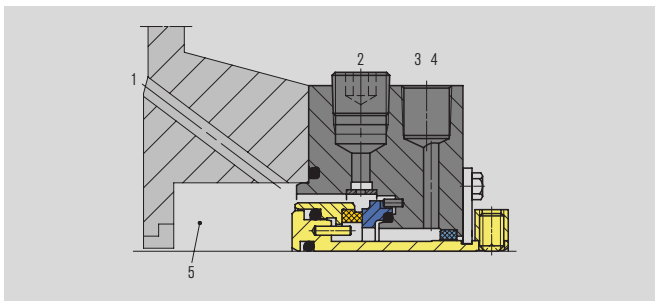
EagleBurgmann SPB6 seal supply system Plan 53B



EagleBurgmann range of balanced pusher and metal bellows mechanical seals acc. to API 682 4th ed.

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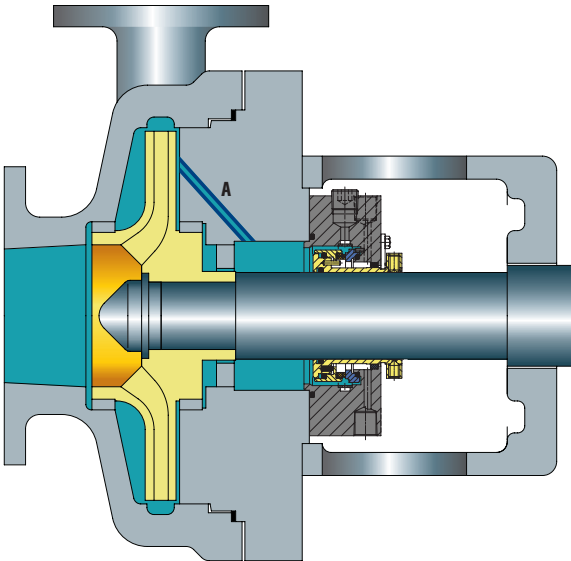




### Seal chamber details

- 1 Inlet
- 2 Flush (F), plugged (for possible future circulating fluid or for venting on vertical pumps)
- 3 Quench (Q)
- 4 Drain (D)
- 5 Seal chamber

Example seal: EagleBurgmann **APitex-S**  
single pusher mechanical seal.



A Internal recirculation

**Process side**

**Plan 01**

**Plan 01**

### Applicable EagleBurgmann seals

#### Category 1

#### Configuration 1CW-FX:

APitex-S

#### Configuration 2CW-CW:

APitex-T

#### Configuration 3CW-FB:

APitex-T

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## Features

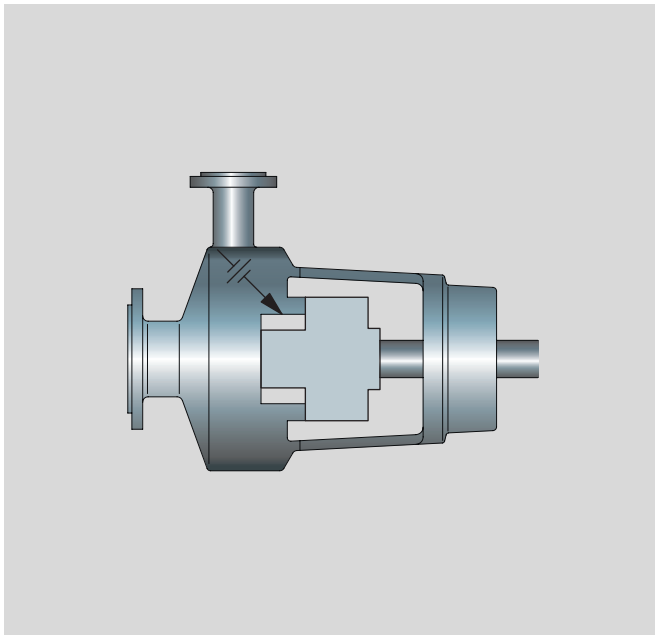
- Plan 01 does not need any external piping.
- Acts as an internal flushing line for the mechanical seal.
- Prevents highly viscous fluids from freezing/polymerizing at lower temperatures because the flushing line is not exposed to the atmosphere like in Plan 11.

## Application

- Generally used for horizontal pumps.
- Highly viscous fluids which tend to thicken, solidify or polymerize.
- More applicable to ANSI pumps.

## Remarks, checkpoints

- The flow of the flush fluid must be sufficient to remove the heat from the mechanical seal chamber.
- Unlike in Plan 11, the flush is seldom directed over the seal faces.
- Not recommended for dirty products as they will tend to clog the flushing line.
- Not applicable for vertical pumps.



## Plan 01

Integral (internal) recirculation from the pump discharge to the seal chamber.

### Pump media characteristics

- Highly viscous media with a tendency to congeal or polymerize when cooled.

### Configurations

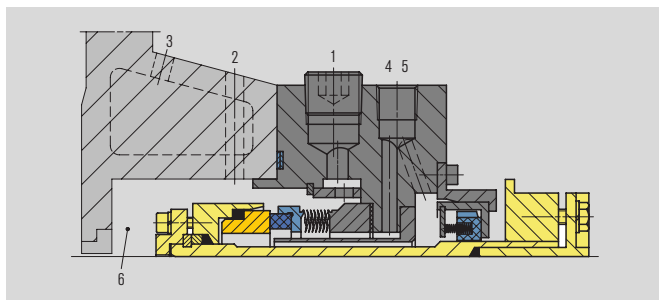
1CW-FX,  
2CW-CW,  
3CW-FB

1CW-FL\*, 2CW-CS\*, 3CW-BB\*, 3CW-FF\*,  
3NC-FB\*, 3NC-BB\*, 3NC-FF\*

### Location, function

- Process side
- Flushing and cooling

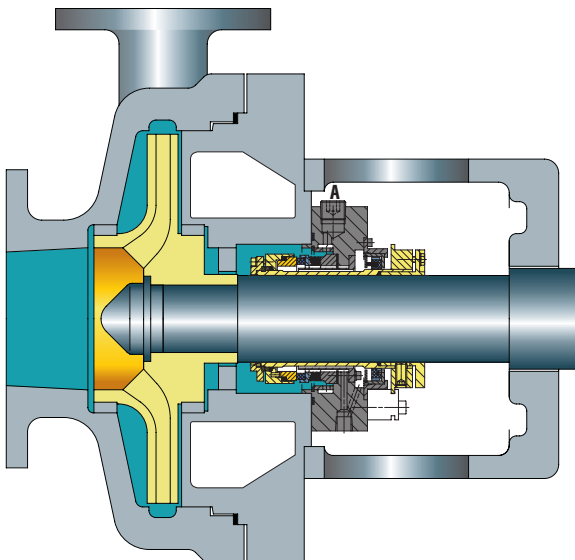
\* Possible, see remark on page 2.



### Seal chamber details

- 1 Flush (F), plugged (for possible future circulating fluid or for venting on vertical pumps)
- 2 Vent (V), if required
- 3 Heating/cooling inlet (HI or CI), heating/cooling outlet (HO or CO), if required
- 4 Quench (Q)
- 5 Drain (D)
- 6 Seal chamber

Example seal: EagleBurgmann **LY9TC**  
single stationary metal bellows mechanical seal.



A Flush connection plugged

## Process side

### Plan 02

## Plan 02

### Applicable EagleBurgmann seals

#### Category 1

**Configuration 1CW-FX:**

APItex-S

**Configuration 2CW-CW:**

APItex-T

**Configuration 2NC-CS:**

H75LG4-C

**Configuration 3CW-FB:**

APItex-T

**Configuration 3NC-BB:**

CGSH-KD

#### Category 2/3

**Configuration 1CW-FL:**

H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

**Configuration 2CW-CW:**

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

**Configuration 2CW-CS:**

H75A4-C, LL9DTUE, LL9DJUE

**Configuration 2NC-CS:**

H75LG4-C

**Configuration 3CW-FB:**

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

**Configuration 3CW-BB:**

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

**Configuration 3CW-FF:**

LL9DSUU, SH-D, LY9DSTT

**Configuration 3NC-FB:**

HRGS-DD, LNF992

**Configuration 3NC-BB:**

CGSH-KD

**Configuration 3NC-FF:**

RGS-D

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## Features

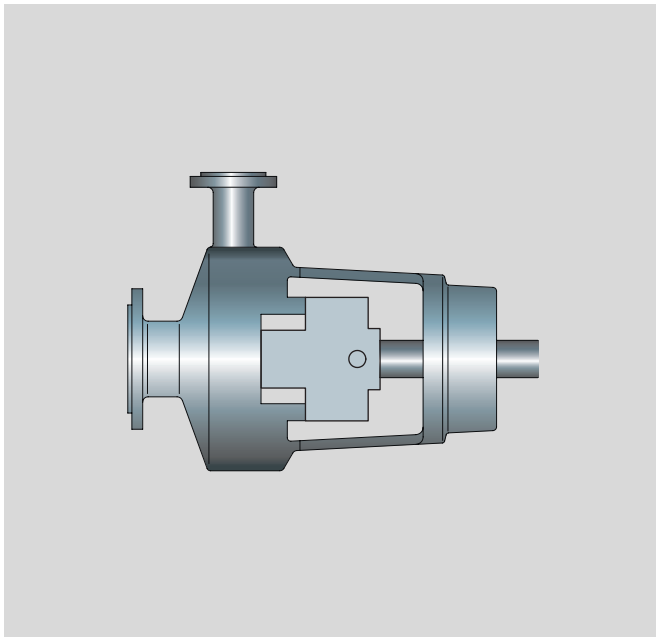
- Does not need any external piping.
- Cooling water or low temperature steam can be used in the seal chamber cooling jacket to decrease seal chamber temperature.
- Used in combination with Plan 62 steam quench for hot process media.

## Application

- Large bore seal chambers, preferably with a cooling jacket.
- Low speed pumps.
- Generally popular in chemical industry.

## Remarks, checkpoints

- The vapor pressure margin in the seal chamber must be considered carefully in order to avoid flashing.
- Provide a 12 o'clock vent when used with horizontal pumps with cylindrical seal chambers.
- Always use a cooling/heating jacket for cylindrical seal chambers.
- Regular maintenance and cleaning of the cooling jacket is recommended as they are prone to fouling in high temperature applications and also tend to become ineffective over a period of time due to poor cooling water quality.



## Plan 02

**Dead-ended seal chamber with no recirculation of flushed fluid. Flush connections plugged.**

### Pump media characteristics

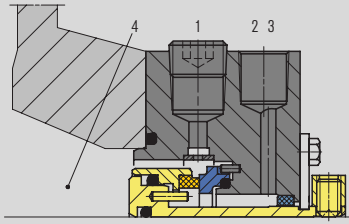
- Clean fluids with low temperatures and higher specific heat.
- Fluids which have adequate PTM (product temperature margin).

### Configurations

1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS, 2NC-CS,  
3CW-FB, 3CW-BB, 3CW-FF, 3NC-FB,  
3NC-BB, 3NC-FF

### Location, function

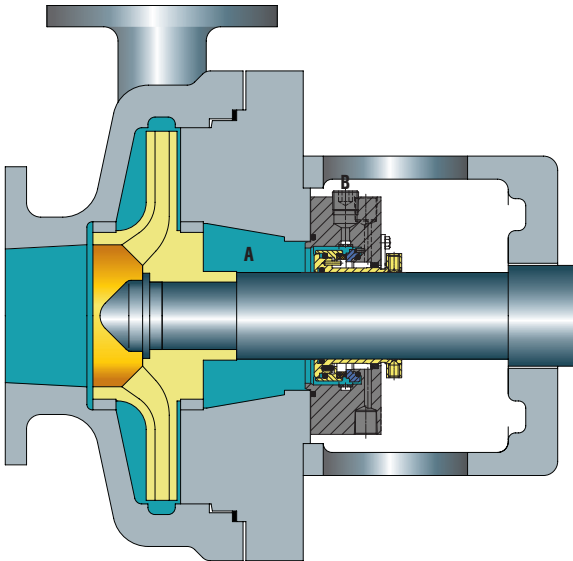
- Process side
- Lubrication



### Seal chamber details

- 1 Flush (F), plugged (for possible future circulating fluid or for venting on vertical pumps)
- 2 Quench (Q)
- 3 Drain (D)
- 4 Seal chamber

Example seal: EagleBurgmann **APitex-S** single pusher mechanical seal.



- A Taper bore design of seal chamber
- B Flush connection plugged

**Process side**

**Plan 03**

**Plan 03**

### Applicable EagleBurgmann seals

#### Category 1

**Configuration 1CW-FX:**

APitex-S

**Configuration 2CW-CW:**

APitex-T

**Configuration 2NC-CS:**

H75LG4-C

**Configuration 3CW-FB:**

APitex-T

**Configuration 3NC-BB:**

CGSH-KD

#### Category 2/3

**Configuration 1CW-FL:**

H75VA4-S, LL9UC, LEK777, SH, LY9SA, MBS682, LY9TC

**Configuration 2CW-CW:**

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS, MBS682-PTA, LY9DZTT

**Configuration 2CW-CS:**

H75A4-C, LL9DTUE, LL9DJUE

**Configuration 2NC-CS:**

H75LG4-C

**Configuration 3CW-FB:**

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS, MBS682-PTA, LY9DZTT

**Configuration 3CW-BB:**

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

**Configuration 3CW-FF:**

LL9DSUU, SH-D, LY9DSTT

**Configuration 3NC-FB:**

HRGS-DD, LNF992

**Configuration 3NC-BB:**

CGSH-KD

**Configuration 3NC-FF:**

RGS-D

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## Features

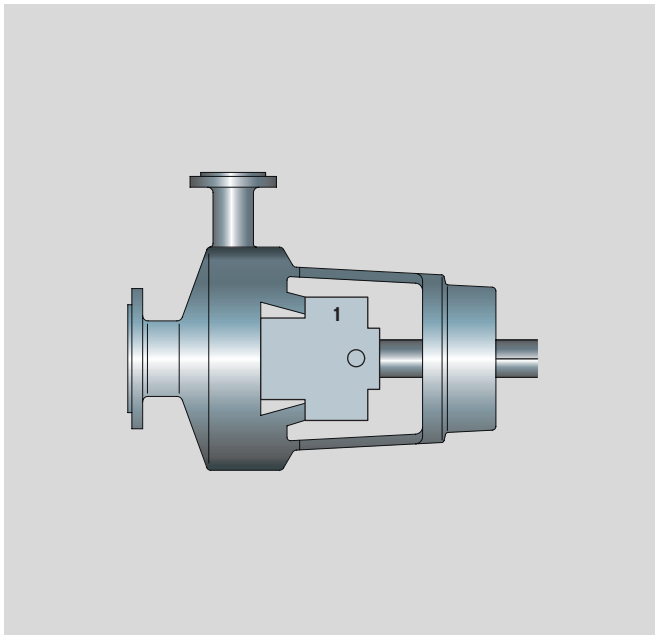
- Does not need any external piping.
- Cooling of the mechanical seal and venting of the seal chamber is a function of the geometry or flow enhancement features of the seal chamber.

## Application

- Pumps with taper bore seal chamber and without throat bushing.
- Applications where mechanical seal heat generation is not very significant.
- Applications where solids may tend to collect in a traditional cylindrical bore seal chamber.
- Generally used for ANSI pumps – with Category 1 seals.

## Remarks, checkpoints

- Not to be used with cylindrical bore seal chambers.
- Exercise caution for applications involving high seal chamber temperatures as well as pressures.



## Plan 03

**Circulation between the seal chamber and the pump created by the design of the seal chamber. Flush connections plugged.**

### Pump media characteristics

- Suspended solids
- Low temperature and pressure

## Key

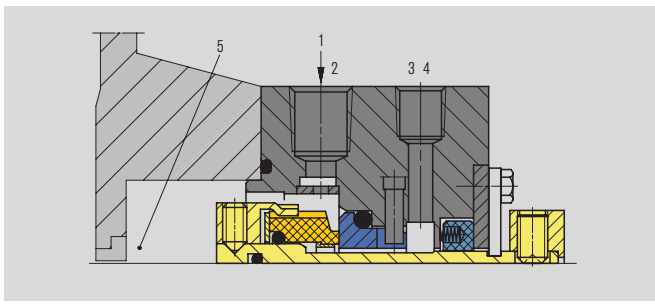
- 1 Flush (F), plugged (for possible future circulating fluid or for venting on vertical pumps).

## Configurations

1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS, 2NC-CS,  
3CW-FB, 3CW-BB, 3CW-FF,  
3NC-FB, 3NC-BB, 3NC-FF

## Location, function

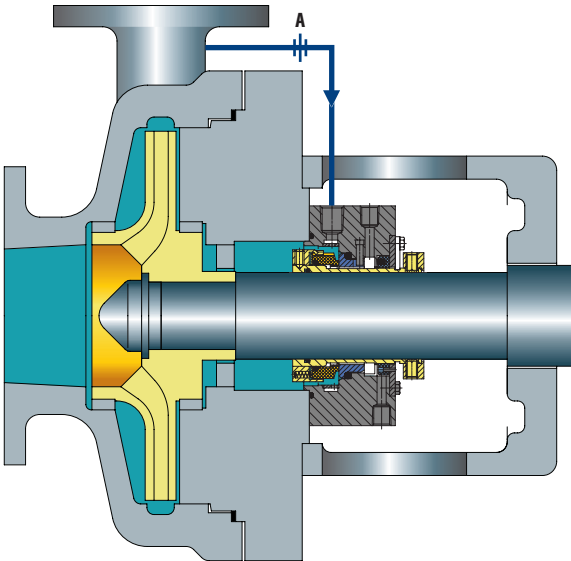
- Process side
- Lubrication



### Seal chamber details

- 1 From high pressure region of pump (pump discharge or pump discharge piping)
- 2 Flush (F)
- 3 Quench (Q)
- 4 Drain (D)
- 5 Seal chamber

Example seal: EagleBurgmann **H75VA4-S**  
single pusher mechanical seal.



A Flow control orifice

## Process side

### Plan 11

## Plan 11

### Applicable EagleBurgmann seals

#### Category 1

**Configuration 1CW-FX:**

APtTex-S

**Configuration 2CW-CW:**

APtTex-T

**Configuration 3CW-FB:**

APtTex-T

#### Category 2/3

**Configuration 1CW-FL:**

H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

**Configuration 2CW-CW:**

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

**Configuration 2CW-CS:**

H75A4-C, LL9DTUE, LL9DJUE

**Configuration 3CW-FB:**

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

**Configuration 3CW-BB:\***

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

**Configuration 3CW-FF:\***

LL9DSUU, SH-D, LY9DSTT

**Configuration 3NC-FB:\***

HRGS-DD, LNF992

**Configuration 3NC-BB:\***

CGSH-KD

**Configuration 3NC-FF:\***

RGS-D

\* Possible, see remark on page 2.

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## Features

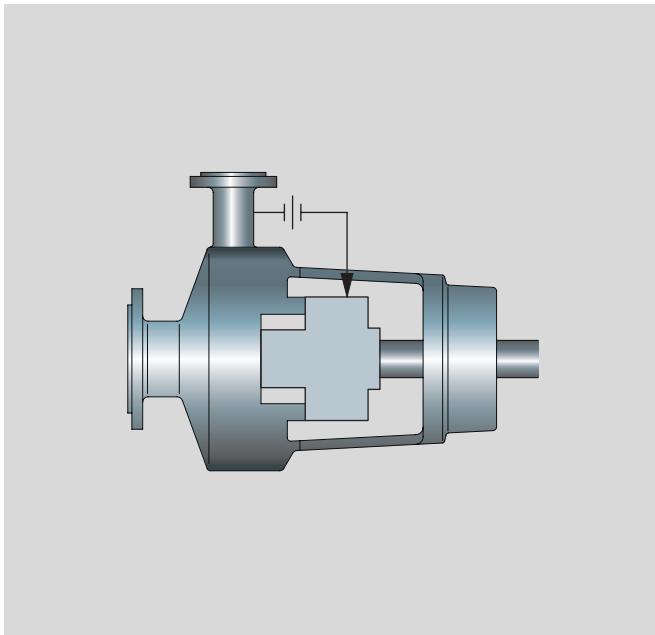
- Default flush plan for all single seals.
- Acts as a flushing as well as a self-venting plan for horizontal pumps.
- Helps in creating additional vapor pressure margin in the seal chamber.
- Uses a flow control orifice(s) to restrict the flow of flush fluid going to the mechanical seal.
- Use of a distributed flush makes the cooling and lubrication more effective.

## Application

- Normally applicable for all general duties except pumps with less differential between discharge and seal chamber pressures.

## Remarks, checkpoints

- The orifice size and/or the number of orifices for high head applications must be calculated very carefully. Minimum orifice size should be 3 mm (1/8").
- Throat bush clearance and orifice sizing together both ensure the proper flow of flush fluid to the seal.
- Always check the difference between the discharge and the seal chamber pressure. If the difference is too low, Plan 13 must be preferred.
- Use for media with solids or abrasives or polymerizing media to be avoided.
- Orifice clogging can be confirmed by checking pipe surface temperatures upstream and downstream of the orifice.



## Plan 11

**Recirculation from the pump discharge through a flow control orifice into the seal chamber.**

### Pump media characteristics

- Clean, non-polymerizing fluids with moderate temperatures.

### Configurations

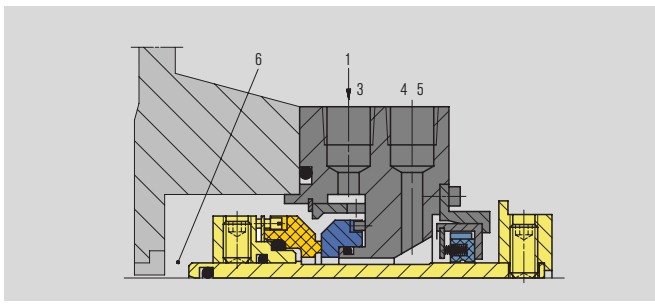
1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS,  
3CW-FB

*3CW-FF\*, 3CW-BB\*, 3NC-FB\*, 3NC-BB\*,  
3NC-FF\**

### Location, function

- Process side
- Flushing and cooling

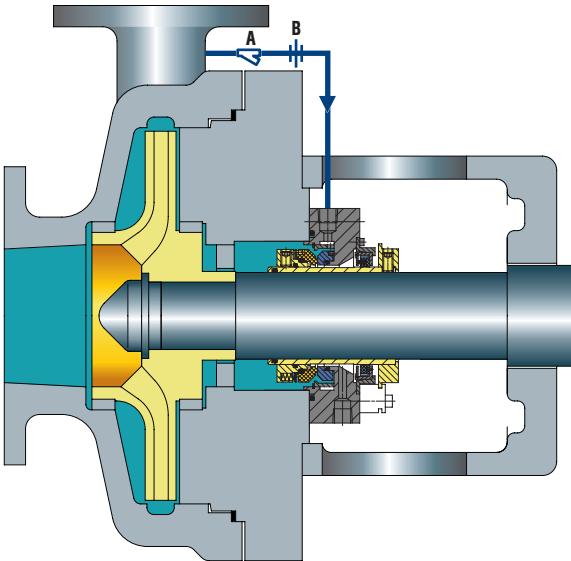
\* Possible, see remark on page 2.



### Seal chamber details

- 1 From high pressure region of pump (pump discharge or pump discharge piping)
- 3 Flush (F)
- 4 Quench (Q)
- 5 Drain (D)
- 6 Seal chamber

Example seal: EagleBurgmann **LL9UC**  
single pusher mechanical seal.



- A Strainer
- B Flow control orifice

## Process side

### Plan 12

## Plan 12

### Applicable EagleBurgmann seals

#### Category 1

**Configuration 1CW-FX:**

APtTex-S

**Configuration 2CW-CW:**

APtTex-T

**Configuration 3CW-FB:**

APtTex-T

#### Category 2/3

**Configuration 1CW-FL:**

H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

**Configuration 2CW-CW:**

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

**Configuration 2CW-CS:**

H75A4-C, LL9DTUE, LL9DJUE

**Configuration 3CW-FB:**

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

**Configuration 3CW-FF:\***

LL9DSUU, SH-D, LY9DSTT

**Configuration 3CW-BB:\***

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

**Configuration 3NC-FB:\***

HRGS-DD, LNF992

**Configuration 3NC-BB:\***

CGSH-KD

**Configuration 3NC-FF:\***

RGS-D

\* Possible, see remark on page 2.

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## Features

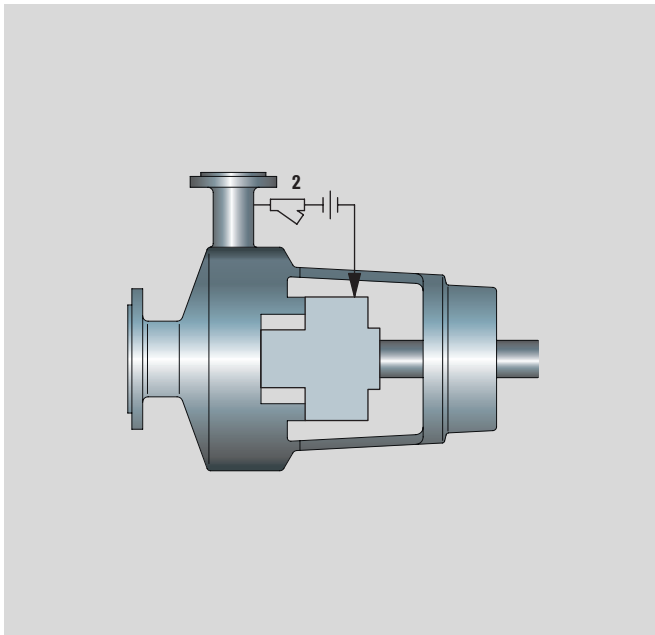
- Similar to Plan 11 but with the addition of a “Y” strainer to remove occasional solid particles.
- Acts as a flushing as well as a self-venting plan for horizontal pumps.
- Uses a flow control orifice to restrict the flow of flush fluid going to the mechanical seal.

## Application

- Slightly contaminated (fluids with suspended solids), non-polymerizing fluids with low temperatures.

## Remarks, checkpoints

- The strainer must always be installed before the orifice.
- Strainers often have a tendency to choke and thus lead to starvation and, eventually, failure of the mechanical seal. The strainer should be maintained and serviced at regular intervals.
- This plan does not function reliably enough to achieve a three-year operating life and is therefore generally discouraged.
- For the same reason Plan 22 (12 + cooler) is also discouraged.
- A Plan 32 or a dual pressurized seal is a recommended option for such applications.



## Plan 12

**Recirculation from the pump discharge through a strainer and a flow control orifice into the seal chamber.**

### Pump media characteristics

- Clean, non-polymerizing fluids with moderate temperatures.

### Key

2 Strainer

### Configurations

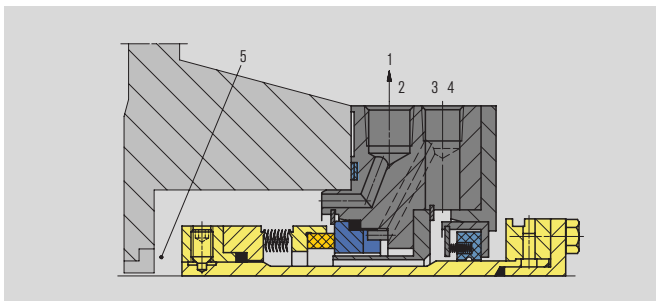
1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS,  
3CW-FB

*3CW-FF\*, 3CW-BB\*, 3NC-FB\*, 3NC-BB\*,  
3NC-FF\**

### Location, function

- Process side
- Flushing and cooling

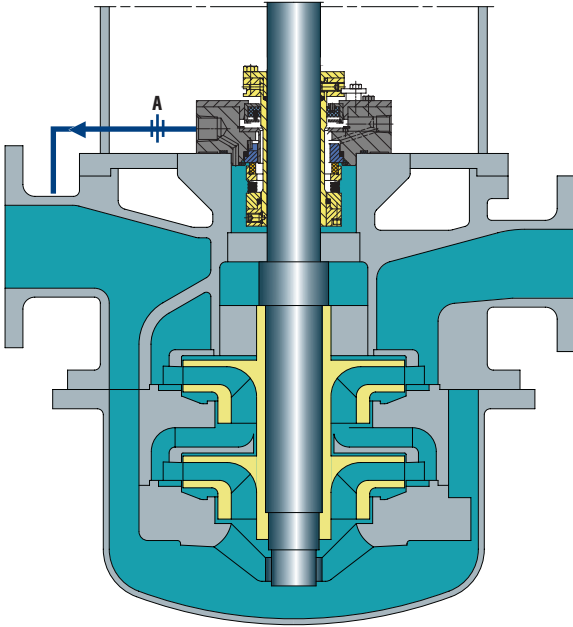
*\* Possible, see remark on page 2.*



### Seal chamber details

- 1 To pump suction
- 2 Flush (F)
- 3 Quench (Q)
- 4 Drain (D)
- 5 Seal chamber

Example seal: EagleBurgmann **MBS682**  
single metal bellows mechanical seal.



A Flow control orifice

## Process side

### Plan 13

## Plan 13

### Applicable EagleBurgmann seals

#### Category 1

**Configuration 1CW-FX:**

APItex-S

**Configuration 2CW-CW:**

APItex-T

**Configuration 3CW-FB:**

APItex-T

#### Category 2/3

**Configuration 1CW-FL:**

H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

**Configuration 2CW-CW:**

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

**Configuration 2CW-CS:**

H75A4-C, LL9DTUE, LL9DJUE

**Configuration 3CW-FB:**

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

**Configuration 3CW-BB:\***

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

**Configuration 3CW-FF:\***

LL9DSUU, SH-D, LY9DSTT

\* Possible, see remark on page 2.

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## Features

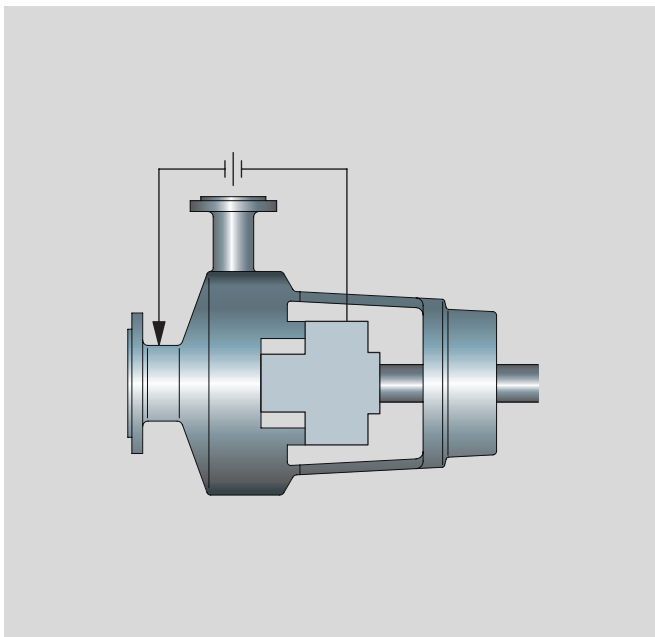
- Plan 13 is self-venting.
- Relieves pressure in the seal chamber.
- A distributed flush is not recommended for this plan.
- Plan 13 can be used in combination with Plan 11 (Plan 14).

## Application

- Standard flush plan for vertical pumps without a bleed bush below the seal chamber.
- Also used for high head horizontal pumps where Plan 11 cannot be used.

## Remarks, checkpoints

- Orifice size should be at least 3 mm (1/8").
- The flow of the flush fluid must be sufficient to remove the heat from the mechanical seal chamber. Calculate the orifice size and the throat bushing clearance carefully to ensure the desired flush flow-rate.
- Do not use in case the difference between seal chamber pressure and suction pressure is very low. Use Plan 11 instead.
- A high-point vent must be provided in the vertical pump seal chamber (or seal gland) to ensure that seal faces never see vapors.



## Plan 13

Recirculation from the seal chamber through a flow control orifice and back to the pump suction or pump suction piping.

### Pump media characteristics

- Clean, non-polymerizing fluids with moderate temperatures.
- Light hydrocarbons

### Configurations

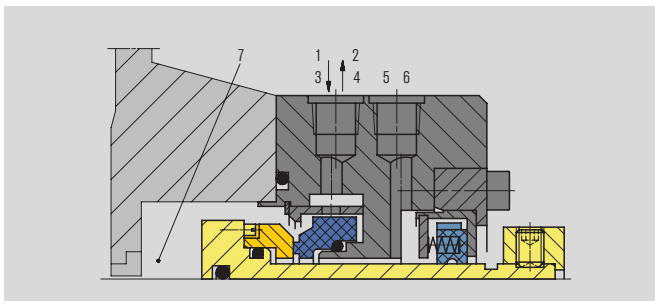
1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS,  
3CW-FB

3CW-BB\*, 3CW-FF\*

### Location, function

- Process side
- Lubrication, cooling

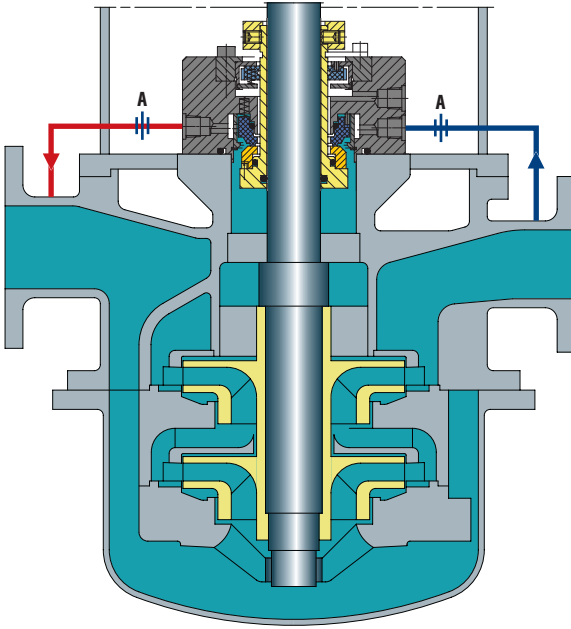
\* Possible, see remark on page 2.



### Seal chamber details

- 1 From pump discharge
- 2 To pump suction
- 3 Flush inlet (FI)
- 4 Flush outlet (FO)
- 5 Quench (Q)
- 6 Drain (D)
- 7 Seal chamber

Example seal: EagleBurgmann **LEK777**  
single pusher mechanical seal.



A Flow control orifice

## Process side

## Plan 14

### Plan 14

#### Applicable EagleBurgmann seals

##### Category 1

##### Configuration 1CW-FX:

APltex-S

##### Configuration 2CW-CW:

APltex-T

##### Configuration 3CW-FB:

APltex-T

##### Category 2/3

##### Configuration 1CW-FL:

H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

##### Configuration 2CW-CW:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

##### Configuration 2CW-CS:

H75A4-C, LL9DTUE, LL9DJUE

##### Configuration 3CW-FB:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

##### Configuration 3CW-BB:\*

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

##### Configuration 3CW-FF:\*

LL9DSUU, SH-D, LY9DSTT

\* Possible, see remark on page 2.

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## Features

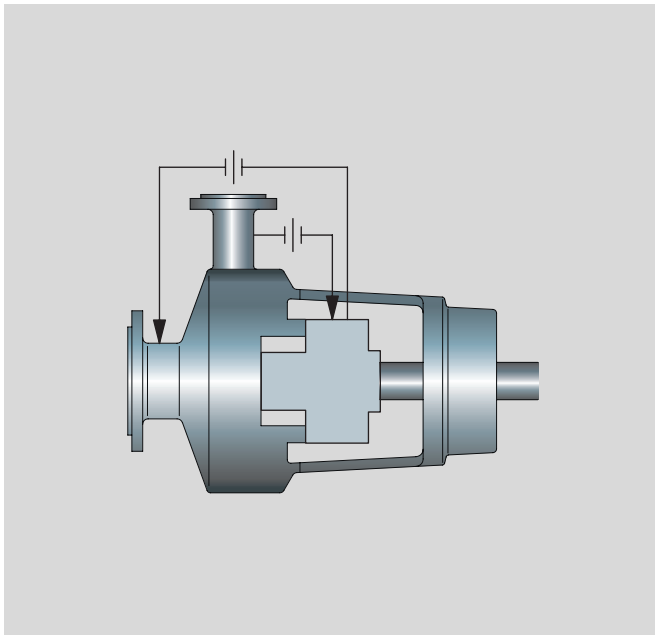
- Plan 14 is a combination of Plan 11 and Plan 13.
- Acts as a flushing as well as a self-venting plan.
- Cool fluid enters from Plan 11 piping, and hot fluid as well as seal chamber pressure is relieved through Plan 13 piping.
- The flush is directed onto the seal faces.
- Allows creation of sufficient vapor pressure margin independent of throat bushing design.

## Application

- Generally used on vertical pumps.

## Remarks, checkpoints

- Orifice size should be at least 3 mm (1/8").
- The flow of the flush fluid across the seal chamber must be sufficient to remove the heat and increase the pressure. Orifice size to be calculated carefully to ensure desired flush flow-rate.
- Not applicable if difference between seal chamber pressure and suction pressure is very low. In this case Plan 13 is recommended.
- A high-point vent must be provided in the vertical pump seal chamber (or seal gland) to ensure seal faces never see vapors.



## Plan 14

**Recirculation from pump discharge through a flow control orifice to the seal and simultaneously from the seal chamber through a flow control orifice to pump suction.**

### Pump media characteristics

- Clean, non-polymerizing fluids with moderate temperature.
- Light hydrocarbons

### Configurations

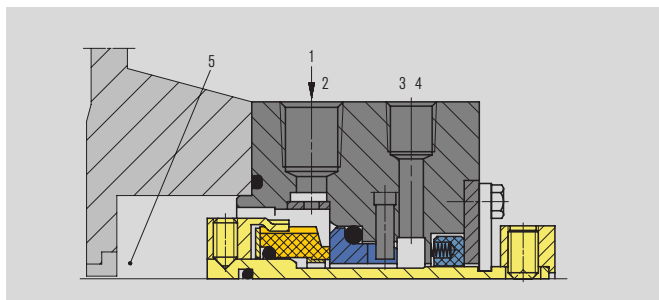
1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS,  
3CW-FB

3CW-BB\*, 3CW-FF\*

### Location, function

- Process side
- Flushing and cooling

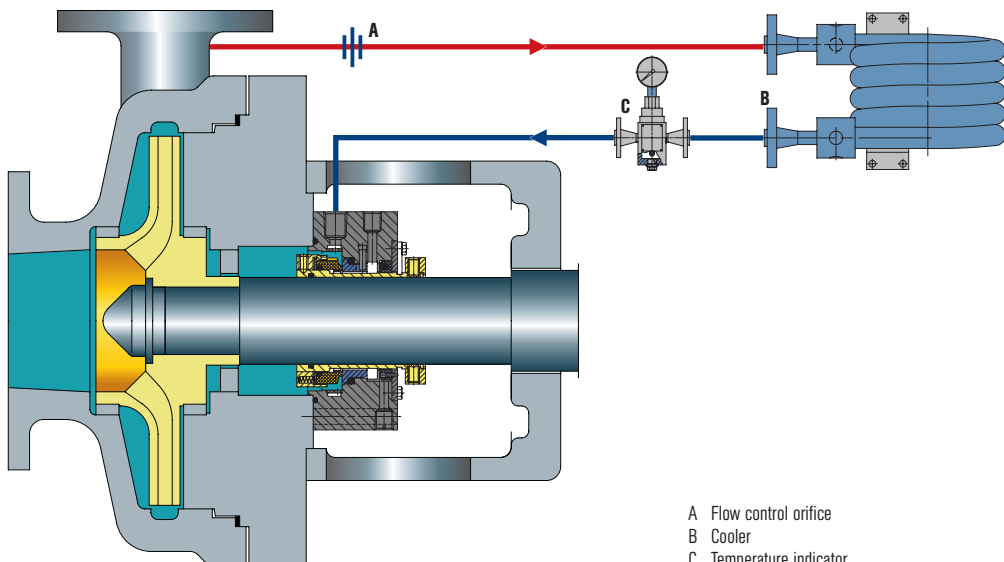
\* Possible, see remark on page 2.



## Seal chamber details

- 1 From high pressure region of pump (pump discharge or pump discharge piping)
- 2 Flush (F)
- 3 Quench (Q)
- 4 Drain (D)
- 5 Seal chamber

Example seal: EagleBurgmann **H75VA4-S** single pusher mechanical seal.



- A Flow control orifice
- B Cooler
- C Temperature indicator

## Process side

### Plan 21

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 1CW-FX:

APtEx-S

#### Configuration 2CW-CW:

APtEx-T

#### Configuration 3CW-FB:

APtEx-T

#### Configuration 3NC-BB:\*

CGSH-KD

##### Category 2/3

#### Configuration 1CW-FL:

H75VA4-S, LL9UC, LEK777, SH, LY9SA, MBS682, LY9TC

#### Configuration 2CW-CW:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS, MBS682-PTA, LY9DZTT

#### Configuration 2CW-CS:

H75A4-C, LL9DTUE, LL9DJUE

#### Configuration 3CW-FB:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS, MBS682-PTA, LY9DZTT

#### Configuration 3CW-BB:\*

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

#### Configuration 3CW-FF:\*

LL9DSUU, SH-D, LY9DSTT

#### Configuration 3NC-FB:\*

HRGS-DD, LNF992

#### Configuration 3NC-BB:\*

CGSH-KD

#### Configuration 3NC-FF:\*

RGS-D

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## Plan 21

#### EagleBurgmann coolers



EagleBurgmann WEF6 Water cooler



EagleBurgmann WEL6 Air cooler

\* Possible, see remark on page 2.

## Features

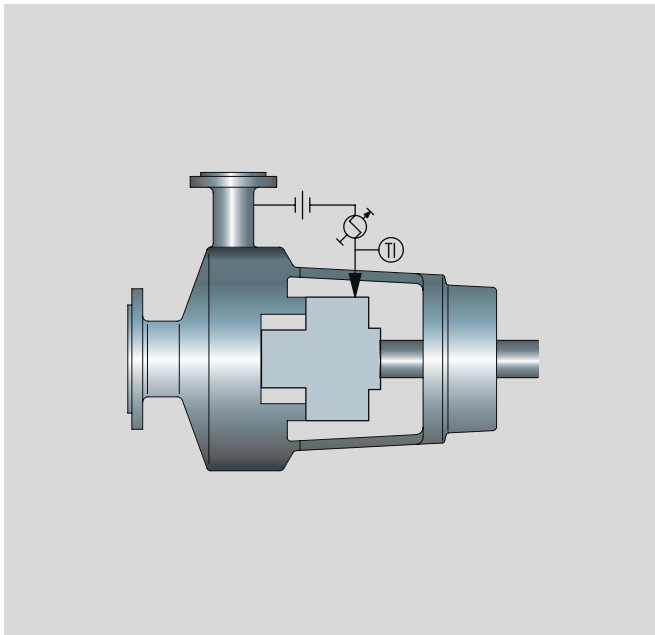
- Provides a cool flush to the seal.
- Plan 21 is self-venting.
- Improves the product temperature margin to avoid vapor formation.
- Helps reduce coking.
- Helps improve lubricity (e.g. hot water).
- Utilizes a close clearance throat bushing for better efficiency.

## Application

- Fluids with low vapor pressure margin in seal chamber.

## Remarks, checkpoints

- Minimum size of the orifice should be 3 mm (1/8").
- High cooler duty is leading to fouling and plugging on the water side.
- Plan 21 consumes more energy than Plan 23 because the fluid needs to be pumped back continuously.
- Potential plugging on the process side if the fluid viscosity gets high quickly.



## Plan 21

Recirculation from pump discharge through a flow control orifice and cooler into the seal chamber.

### Pump media characteristics

- Close to vaporization point.
- Hot, non-polymerizing clean fluids typically less than 176 °C (349 °F).
- Bad lubricity fluids (like hot water).

## Key

TI Temperature indicator

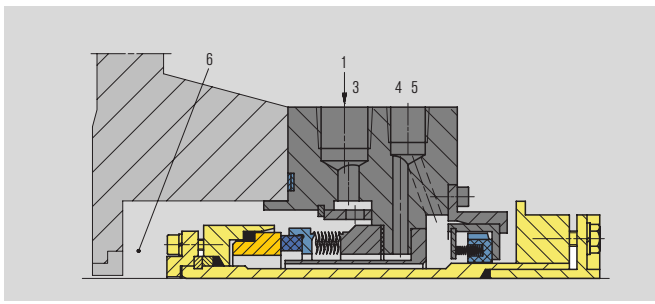
## Configurations

1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS,  
3CW-FB

3CW-BB\*, 3CW-FF\*, 3NC-FB\*, 3NC-BB\*,  
3NC-FF\*

## Location, function

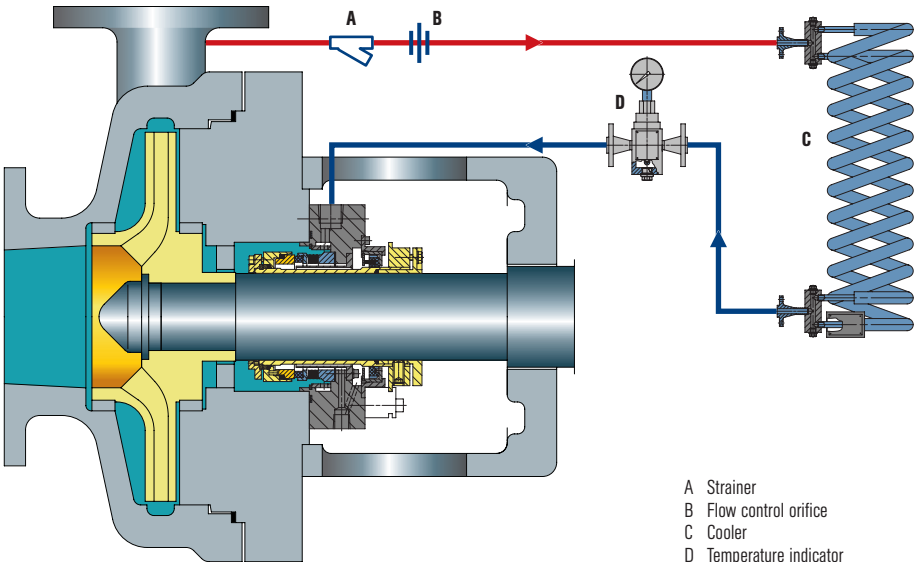
- Process side
- Flushing and cooling
- Increases vapor pressure margin



### Seal chamber details

- 1 From high pressure region of pump (pump discharge or pump discharge piping)
- 3 Flush (F)
- 4 Quench
- 5 Drain (D)
- 6 Seal chamber

Example seal: EagleBurgmann **LY9TC** single metal bellows mechanical seal.



- A Strainer
- B Flow control orifice
- C Cooler
- D Temperature indicator

## Process side

### Plan 22

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 1CW-FX:

APtEx-S

#### Configuration 2CW-CW:

APtEx-T

#### Configuration 3CW-FB:

APtEx-T

#### Configuration 3NC-BB:\*

CGSH-KD

##### Category 2/3

#### Configuration 1CW-FL:

H75VA4-S, LL9UC, LEK777, SH, LY9SA, MBS682, LY9TC

#### Configuration 2CW-CW:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS, MBS682-PTA, LY9DZTT

#### Configuration 2CW-CS:

H75A4-C, LL9DTUE, LL9DJUE

#### Configuration 3CW-FB:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS, MBS682-PTA, LY9DZTT

#### Configuration 3CW-BB:\*

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

#### Configuration 3CW-FF:\*

LL9DSUU, SH-D, LY9DSTT

#### Configuration 3NC-FB:\*

HRGS-DD, LNF992

#### Configuration 3NC-BB:\*

CGSH-KD

#### Configuration 3NC-FF:\*

RGS-D

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#### EagleBurgmann coolers



EagleBurgmann WEF6 Water cooler



EagleBurgmann WEL6 Air cooler

\* Possible, see remark on page 2.

## Features

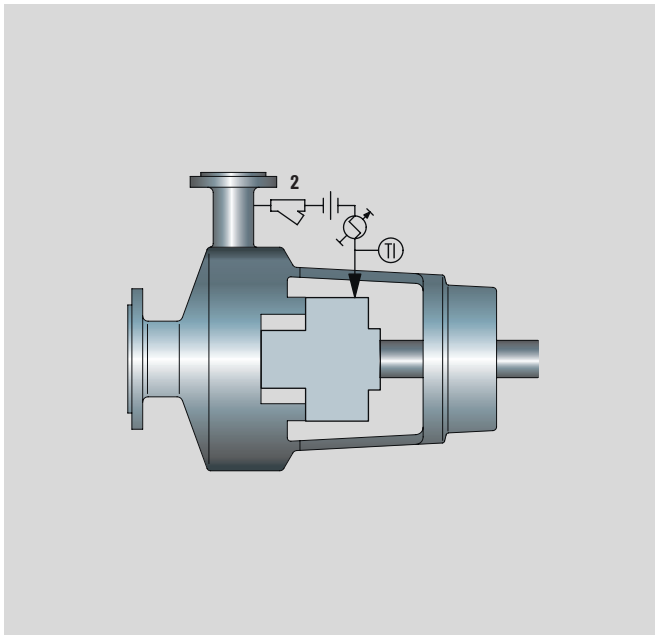
- Similar to Plan 21 but with the addition of a strainer to remove occasional solid particles.
- Acts as a flushing as well as a self-venting plan for horizontal pumps.
- Uses a flow control orifice to restrict the flow of flush fluid going to the mechanical seal.
- Improves the product temperature margin thus avoiding vapor formation.

## Application

- Slightly contaminated (fluids with suspended solids), non-polymerizing fluids with high temperatures.

## Remarks, checkpoints

- Strainer to be installed before the orifice
- Strainers often have a tendency to choke and thus lead to starvation and, eventually, failure of the mechanical seal.
- Minimum size of the orifice should be 3 mm (1/8").
- Cooler duty is high, leading to fouling and plugging on the water side.
- This plan does not function reliably enough to achieve a three-year operating life and is therefore not generally recommended. Plan 32 or a dual pressurized seal is a recommended option for such duties.



## Plan 22

**Recirculation from pump discharge through a strainer, a flow control orifice and a cooler into the seal chamber.**

### Pump media characteristics

- High temperature with some suspended solids.
- Close to vaporization point.

### Key

- 2 Strainer
- TI Temperature indicator

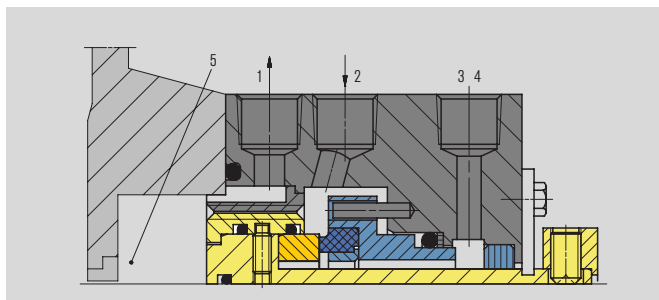
### Configurations

1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS,  
3CW-FB

*3CW-BB\*, 3CW-FF\*, 3NC-FB\*, 3NC-BB\*,  
3NC-FF\**

### Location, function

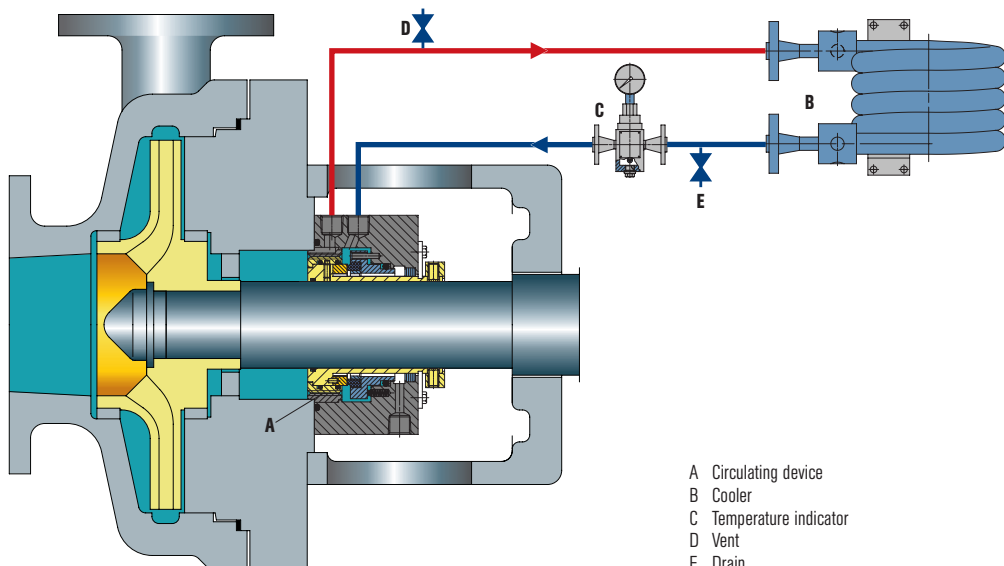
- Process side
- Flushing and cooling



### Seal chamber details

- 1 Flush outlet (FO)
- 2 Flush inlet (FI)
- 3 Quench (Q)
- 4 Drain (D)
- 5 Seal chamber

Example seal: EagleBurgmann **SHF** single pusher mechanical seal.



- A Circulating device
- B Cooler
- C Temperature indicator
- D Vent
- E Drain

## Process side

### Plan 23

#### Applicable EagleBurgmann seals

##### Category 1

##### Configuration 1CW-FX:

APItex-S

##### Configuration 2CW-CW:

APItex-T

##### Configuration 3CW-FB:

APItex-T

##### Category 2/3

##### Configuration 1CW-FL:

H75VA4-S, LL9UC, LEK777, SH, LY9SA, MBS682, LY9TC

##### Configuration 2CW-CW:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS, MBS682-PTA, LY9DZTT

##### Configuration 2CW-CS:

H75A4-C, LL9DTUE, LL9DJUE

##### Configuration 3CW-FB:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS, MBS682-PTA, LY9DZTT

## Plan 23

#### EagleBurgmann coolers



EagleBurgmann WEF6 Water cooler



EagleBurgmann WEL6 Air cooler

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## Features

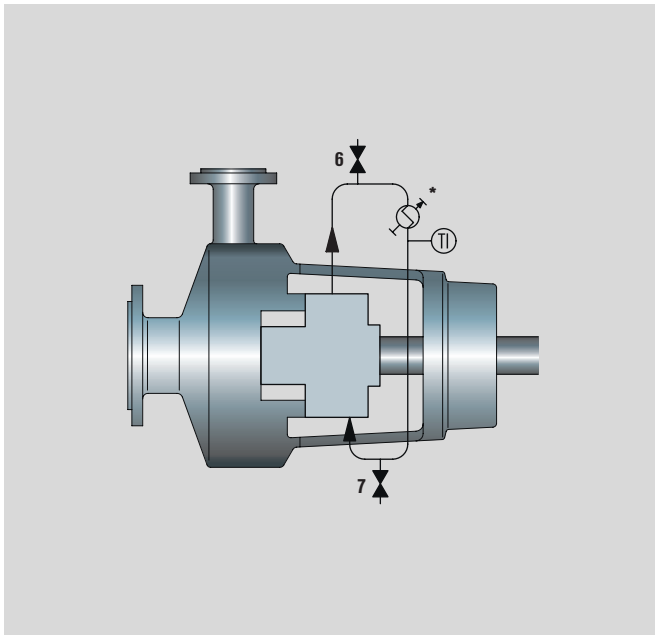
- Product in seal chamber is isolated from pumping area using a close clearance throat bushing.
- Increases product temperature margin in the seal chamber thus avoiding vaporization.
- Seal runs at a lower stabilized temperature of the media.
- Removes only the generated seal face heat and the heat soak from the pump area, thus the cooler is smaller and more effective as compared to an equivalent Plan 21.
- Uses a pumping ring for circulation in running condition.
- In idle condition, thermosiphon effect ensures circulation.
- A distributed flush is not recommended for this plan.

## Application

- Hot hydrocarbons.
- Hot water services above 80 °C (176 °F).
- Boiler feed water.
- Applications where increasing seal chamber pressure to improve vapor pressure margin is not possible.

## Remarks, checkpoints

- For media with high viscosities and higher freezing points, steam must be used in the cooling lines instead of water.
- A high-point vent valve to be provided to vent the system before start-up.
- A close clearance throat bushing must always be in place to reduce the heat soak from the pump.
- Avoid sharp bends and 90° elbows in piping. Piping should be smooth and continuously rising.
- Cooler to be installed approx. 500 mm (20") above pump centerline.
- Good quality cooling water is recommended to avoid deterioration of cooler efficiency.
- Flush outlet from seal chamber should be in the top half of the seal gland plate or the seal chamber.



## Plan 23

**Recirculation from a circulation device in the seal chamber through a cooler and back into the seal chamber.**

### Pump media characteristics

- High temperature, clean non-polymerizing fluids.
- Close to vaporization point.

### Key

- 6 Vent (normally closed)
- 7 Drain (normally closed)

TI Temperature indicator

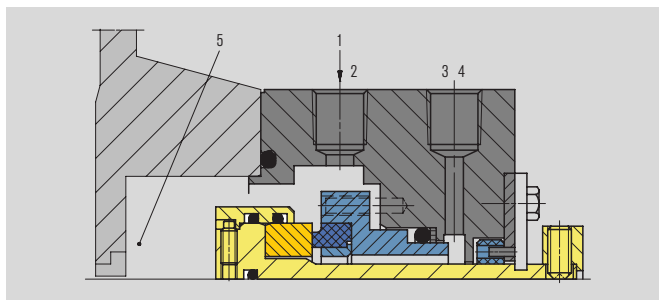
\* Vertically oriented finned air cooler shall be installed if specified.

### Configurations

1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS,  
3CW-FB

### Location, function

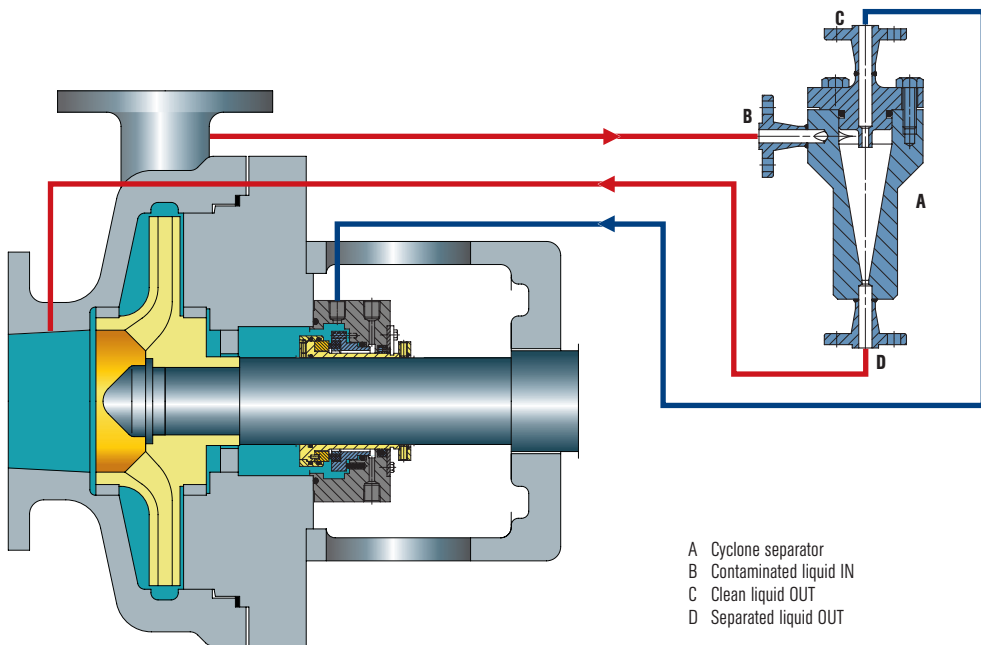
- Process side
- Flushing and cooling



## Seal chamber details

- 1 From clean discharge connection of cyclone separator
- 2 Flush (F)
- 3 Quench (Q)
- 4 Drain (D)
- 5 Seal chamber

Example seal: EagleBurgmann **SH** single pusher mechanical seal.



- A Cyclone separator
- B Contaminated liquid IN
- C Clean liquid OUT
- D Separated liquid OUT

## Process side

### Plan 31

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 1CW-FX:

APtEx-S

#### Configuration 2CW-CW:

APtEx-T

#### Configuration 3CW-FB:

APtEx-T

#### Configuration 3NC-BB:\*

CGSH-KD

##### Category 2/3

#### Configuration 1CW-FL:

H75VA4-S, LL9UC, LEK777, SH, LY9SA, MBS682, LY9TC

#### Configuration 2CW-CW:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS, MBS682-PTA, LY9DZTT

#### Configuration 2CW-CS:

H75A4-C, LL9DTUE, LL9DJUE

#### Configuration 3CW-FB:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS, MBS682-PTA, LY9DZTT

#### Configuration 3CW-BB:

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

#### Configuration 3CW-FF:

LL9DSUU, SH-D, LY9DSTT

#### Configuration 3NC-FB:\*

HRGS-DD, LNF992

#### Configuration 3NC-BB:\*

CGSH-KD

#### Configuration 3NC-FF:\*

RGS-D

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## Plan 31

#### EagleBurgmann cyclone separators



#### ZYA6000-A4

Cyclone separator for high flow rates and high pressures.

#### ZYB6000-A4

Cyclone separator for high flow rates and high pressures; 100 % X-ray capability.

#### ZYC6000-A4

Cast version, block-type design with integral flanges.

\* Possible, see remark on page 2.



## Features

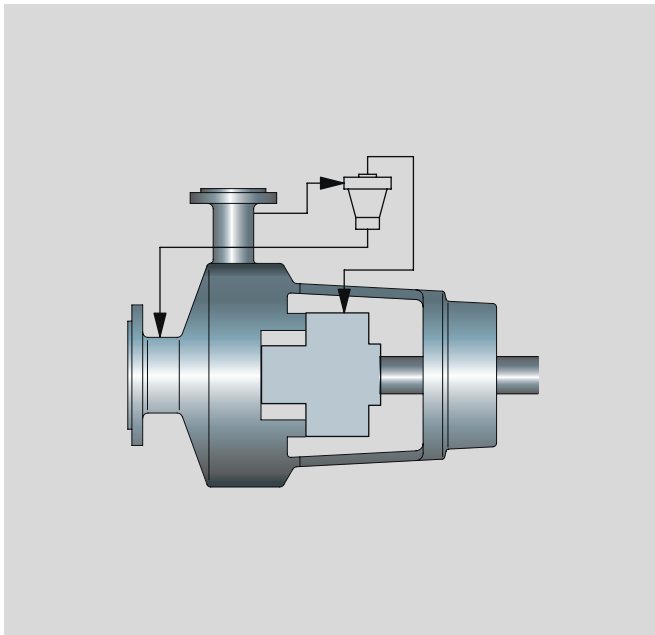
- Plan 31 is a variant of Plan 11 (Plan 11 + cyclone separator).
- The cyclone separator removes solids and prevents all but a few minor particles from reaching the seal chamber.
- The media properties retained as solids are routed back to pump suction.

## Application

- Horizontal pumps conveying media like water with sand particles.
- Horizontal pumps conveying media with heavy suspended solids.

## Remarks, checkpoints

- Specific gravity of the solids should be at least twice that of the pumped media. In other cases Plan 32 is recommended.
- The installation of the pump throat bushing must be ensured.
- Do not use for extremely contaminated media. Plan 32 is recommended in such cases.
- Can lead to reduced reliability due to abrasive wear inside the cyclone.
- Routine inspection of the cyclone for abrasive wear is recommended.



## Plan 31

Recirculation from the pump discharge through a cyclone separator delivering the clean fluid to the seal chamber. The solids are delivered to the pump suction line.

### Pump media characteristics

- Suspended solids

### Configurations

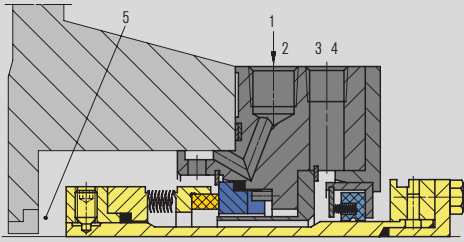
1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS,  
3CW-FB, 3CW-BB, 3CW-FF

3NC-FB\*, 3NC-BB\*, 3NC-FF\*

### Location, function

- Process side
- Flushing and cooling

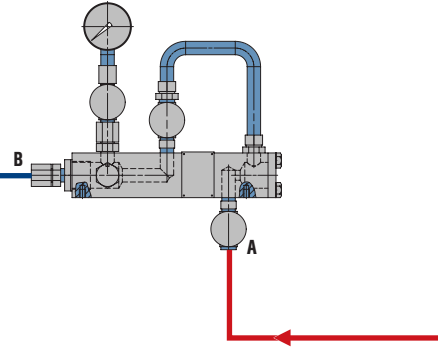
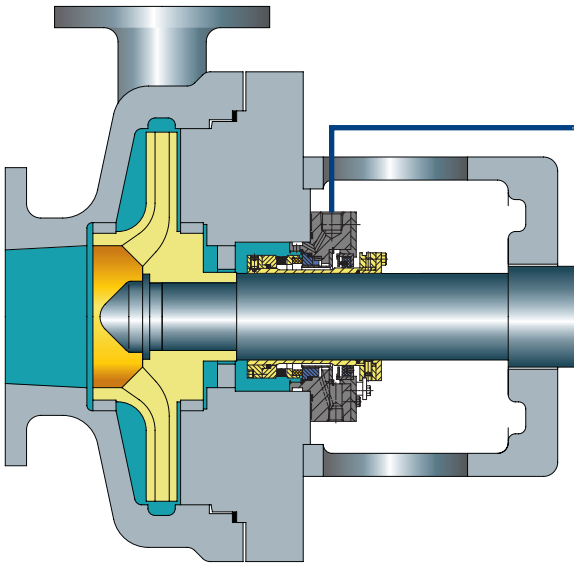
\* Possible, see remark on page 2.



### Seal chamber details

- 1 From external source
- 2 Flush (F)
- 3 Quench (Q)
- 4 Drain (D)
- 5 Seal chamber

Example seal: EagleBurgmann **MBS682**  
single metal bellows mechanical seal.



- A From external source  
B To seal

## Process side

### Plan 32

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 1CW-FX:

APtEx-S

#### Configuration 2CW-CW:

APtEx-T

#### Configuration 3CW-FB:

APtEx-T

#### Configuration 3NC-BB:\*

CGSH-KD

##### Category 2/3

#### Configuration 1CW-FL:

H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

#### Configuration 2CW-CW:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### Configuration 2CW-CS:

H75A4-C, LL9DTUE, LL9DJUE

#### Configuration 3CW-FB:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### Configuration 3CW-BB:

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

#### Configuration 3CW-FF:

LL9DSUU, SH-D, LY9DSTT

#### Configuration 3NC-FB:\*

HRGS-DD, LNF992

#### Configuration 3NC-BB:\*

CGSH-KD

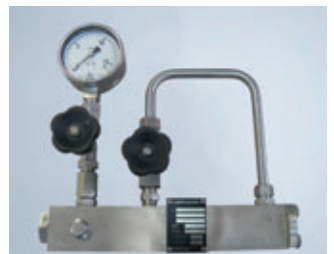
#### Configuration 3NC-FF:\*

RGS-D

## Plan 32

#### EagleBurgmann SPX6 Flush unit

The EagleBurgmann flush unit of the SPX6000-A4 range consist of a manifold with integrated inline filter supplied together with a needle valve and pressure gauge. Optional available with temperature gauge and/or flow indicator.



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\* Possible, see remark on page 2.

## Features

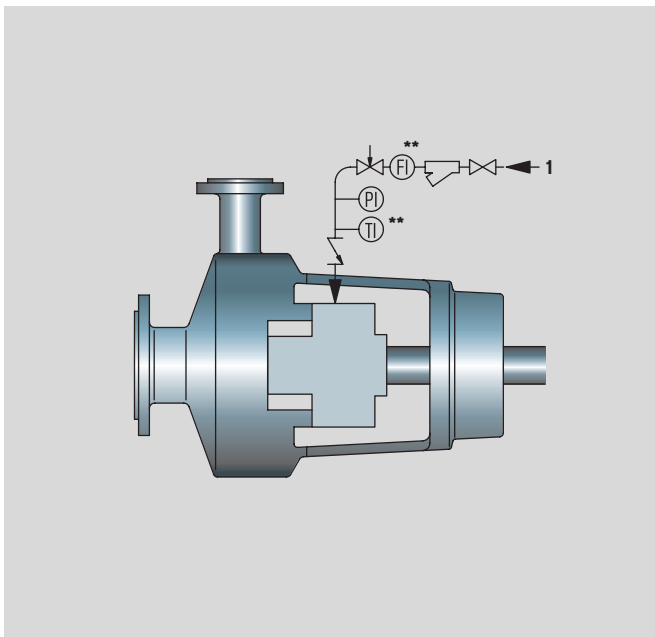
- If maintained properly, the best flush plan for single seals or inboard seals in dual seal arrangements (provided media dilution is acceptable).
- Used in conjunction with a close clearance throat bush to maintain an elevated pressure in the seal chamber and to isolate it from pumped media.

## Application

- Fluids with solids and contaminants where pumped fluid can accept an external flush.
- To reduce flashing or air intrusion (as in vacuum services).
- Can be used on horizontal as well as vertical pumps.

## Remarks, checkpoints

- The external flush media should be compatible with the pumped media.
- Flush media should not vaporize on entering the seal chamber and should be always on – even during start-up and shut-down.
- Pressure of the external flush should always be at least 2 bar (29 PSI) above seal chamber pressure.
- Consider economic impact of product dilution, if any.



## Plan 32

Injection of clean fluid into the seal chamber from an external source.

### Pump media characteristics

- Suspended solids
- Poor lubrication
- High temperature
- Hazardous / environmentally harmful (only in combination with additional API plan).

## Key

1 From external source

FI Flow indicator\*\*

PI Pressure indicator

TI Temperature indicator\*\*

\*\* Optional

## Configurations

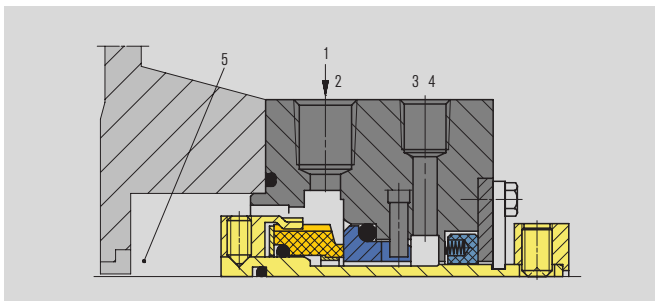
1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS,  
3CW-FB, 3CW-BB, 3CW-FF

3NC-FB\*, 3NC-BB\*, 3NC-FF\*

## Location, function

- Process side
- Flushing and cooling

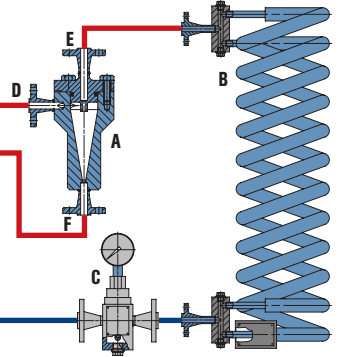
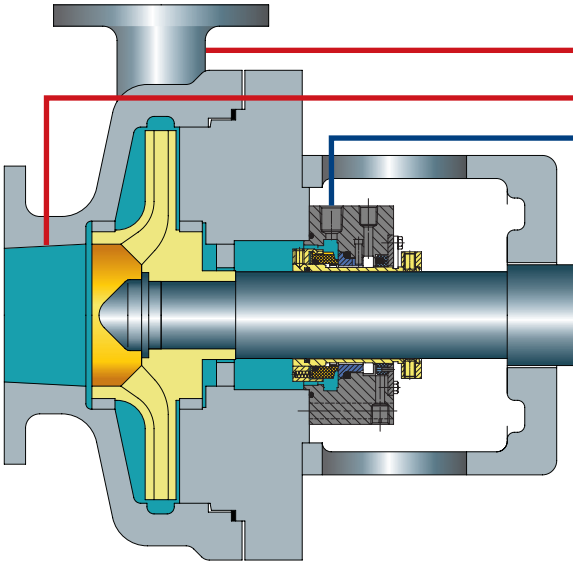
\* Possible, see remark on page 2.



### Seal chamber details

- 1 From cooler
- 2 Flush (F)
- 3 Quench (Q)
- 4 Drain (D)
- 5 Seal chamber

Example seal: EagleBurgmann **H75VA4-S**  
single pusher mechanical seal.



- A Cyclone separator
- B Cooler
- C Temperature indicator
- D Contaminated liquid IN
- E Clean liquid OUT
- F Separated liquid OUT

## Process side

### Plan 41

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 1CW-FX:

APtEx-S

#### Configuration 2CW-CW:

APtEx-T

#### Configuration 3CW-FB:

APtEx-T

#### Configuration 3NC-BB:\*

CGSH-KD

##### Category 2/3

#### Configuration 1CW-FL:

H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

#### Configuration 2CW-CW:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### Configuration 2CW-CS:

H75A4-C, LL9DTUE, LL9DJUE

#### Configuration 3CW-FB:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### Configuration 3CW-BB:

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

#### Configuration 3CW-FF:

LL9DSUU, SH-D, LY9DSTT

#### Configuration 3NC-FB:\*

HRGS-DD, LNF992

#### Configuration 3NC-BB:\*

CGSH-KD

#### Configuration 3NC-FF:\*

RGS-D

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## Plan 41

#### EagleBurgmann seal supply components



EagleBurgmann WEL6 Air cooler



EagleBurgmann SPT6 Temperature indicator

\* Possible, see remark on page 2.

## Features

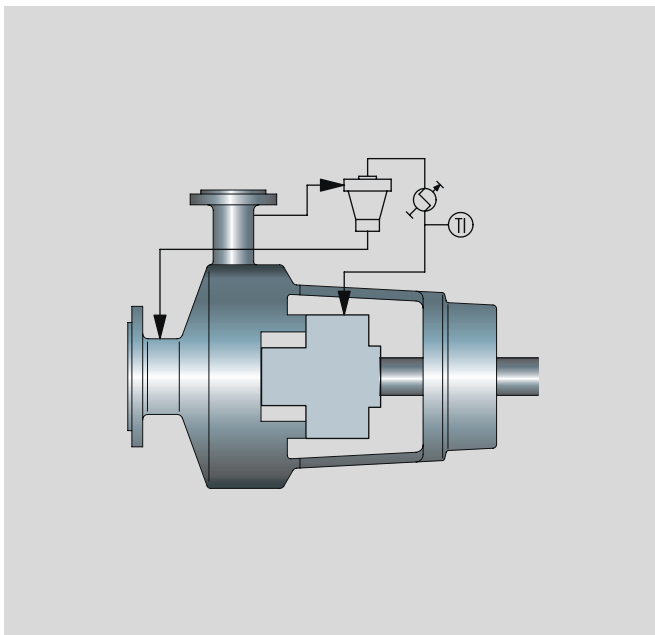
- Plan 41 is a variant of Plan 31 (Plan 31 + cooler).
- A cyclone separator removes solids and prevents all but a few minor particles from reaching the seal chamber.
- The media properties retained as solids are routed back to the pump suction.
- The cooler cools down the media and improves the pressure margin to the vapor pressure.

## Application

- Horizontal pumps conveying hot media with heavy solids.
- Horizontal pumps conveying hot water with sand or slag inclusions.

## Remarks, checkpoints

- Specific gravity of the solids should be at least twice that of the pumped media. In other cases Plan 32 is recommended.
- The installation of the pump throat bushing must be ensured.
- Not applicable for extremely contaminated media. Plan 32 is recommended in such cases.
- Cooler performance is high and may lead to water side fouling.
- Can lead to reduced reliability due to abrasive wear inside the cyclone.
- Routine inspection of the cyclone for abrasive wear is recommended.



## Plan 41

Recirculation from the pump discharge through a cyclone separator delivering the clean fluid to a cooler and then to the seal chamber. The solids are delivered to the pump suction line.

### Pump media characteristics

- Suspended solids
- Poor lubrication
- High temperature
- Close to vaporization point

### Key

TI Temperature indicator

### Configurations

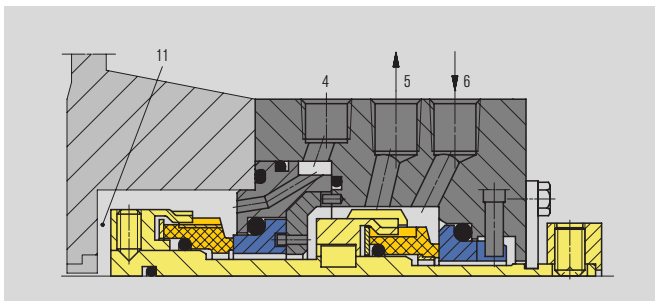
1CW-FL, 1CW-FX,  
2CW-CW, 2CW-CS,  
3CW-FB, 3CW-BB, 3CW-FF

3NC-FB\*, 3NC-BB\*, 3NC-FF\*

### Location, function

- Process side
- Flushing and cooling

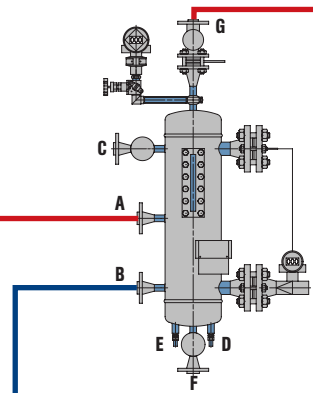
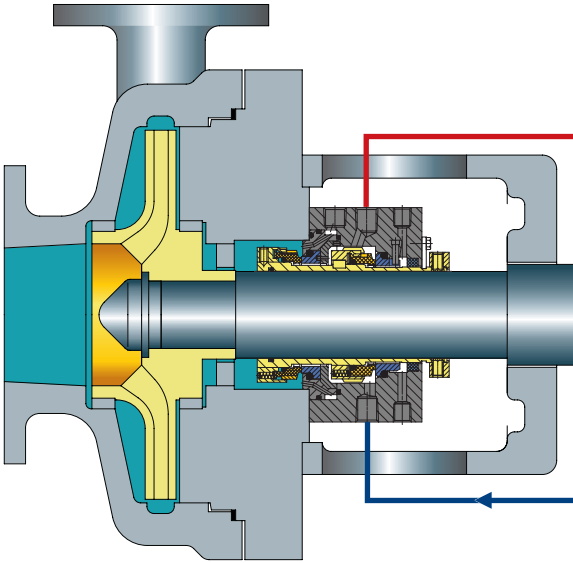
\* Possible, see remark on page 2.



### Seal chamber details

- 4 Flush (F)
- 5 Liquid buffer OUT (LBO)
- 6 Liquid buffer IN (LBI)
- 11 Seal chamber

Example seal: EagleBurgmann **H75A4-T**  
dual pusher mechanical seal.



- A From mechanical seal
- B To mechanical seal
- C Filling connection
- D Cooling water IN
- E Cooling water OUT
- F Drain
- G Connection to flare

## Between seals

### Plan 52

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 2CW-CW:

APT<sub>tex</sub>-T

##### Category 2/3

#### Configuration 2CW-CW:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### EagleBurgmann Barrier/buffer fluid systems

##### TSA6, TSB6

The EagleBurgmann barrier/buffer fluid systems of the TSA6000-A4 range meet all the requirements to supply mechanical seals in accordance with the API682 4th edition guidelines.

The vessels are equipped with all essential connections for fitting additional components.



TSA6 – Standard vessel with dished heads



TSB6 – Alternative vessel, bottom flanged

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## Features

- Provides lubrication and cooling to the contacting wet outboard safety backup seal.
- The pumped fluid will not become contaminated.
- The pumped media does not leak directly to atmosphere.
- No pressurization required for the reservoir as is case of a Plan 53A.
- Provision of cooling coil inside the reservoir or an external water or air cooler takes care of the heat removal.
- Uses an internal circulating device to ensure buffer liquid circulation.

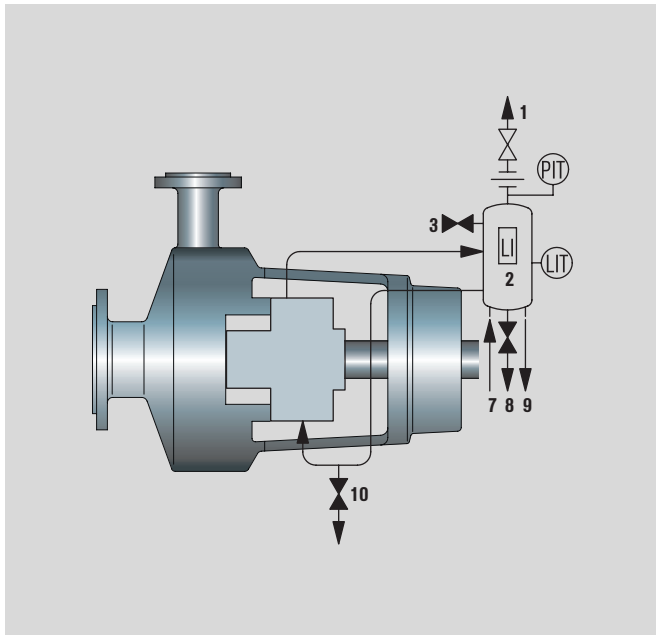
## Application

- For flashing services – for example light hydrocarbons, high vapor pressure fluids. Can also be used for non-flashing services.
- For services where product contamination by a barrier fluid is not acceptable.

## Remarks, checkpoints

- Do not use for contaminated and polymerizing media.
- Use a restriction orifice plate in the vent line to maintain a back pressure in the reservoir.
- Vent the system before start-up. Later ensure that the vent line always remains open and is connected to the flare.
- The piping from the seal to the reservoir should be self-venting.
- Sense the seal inlet and outlet line temperatures. Difference in the temperatures is an indication of proper flow.
- An increase in either the reservoir pressure or reservoir level is an indication of inboard seal leakage.
- A decrease in the reservoir level is an indication of outboard seal leakage.
- Ensure the compatibility of buffer liquid with the pump media.

- The buffer liquid shall be maintained at a pressure less than the seal chamber pressure and less than 2.8 bar (40 PSI).
- Check buffer liquid quality at regular intervals and replace if required.



## Key

- 1 To collection system
- 2 Reservoir
- 3 Make-up buffer liquid
- 7 Cooling water IN
- 8 Reservoir buffer fluid drain
- 9 Cooling water OUT
- 10 Buffer fluid drain

LI Level indicator  
LIT Level transmitter with local indicator

## Configurations

2CW-CW

## Plan 52

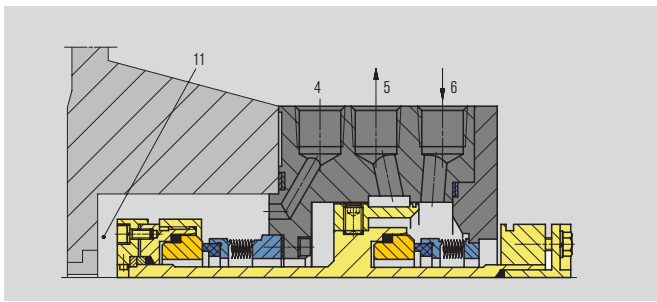
Reservoir providing buffer liquid for the outer seal of an arrangement 2 unpressurized dual seal. The buffer liquid shall be maintained at a pressure less than seal chamber pressure and less than 2.8 bar (40 PSI).

## Pump media characteristics

- High vapor pressure, flashing media
- Clean, non-polymerizing
- Hazardous / environmentally harmful if leaked directly to the atmosphere.

## Location, function

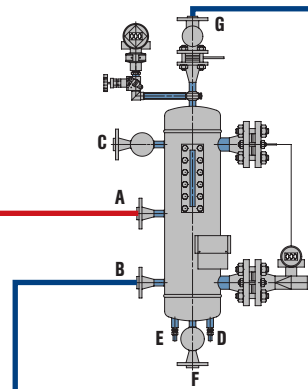
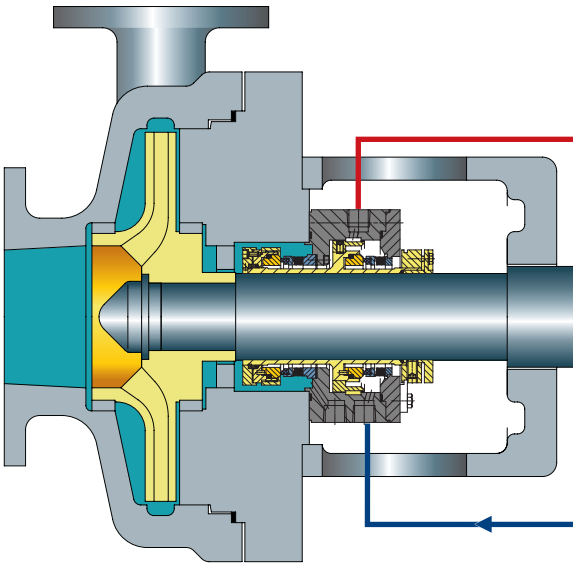
- Between seals
- Buffer system ( $p_{\text{sealchamber}} > p_{\text{betweenseals}}$ )
- Lubrication and flushing for the outboard seal and cooling for inboard as well as outboard seals.



### Seal chamber details

- 4 Flush (F)
- 5 Liquid barrier OUT (LBO)
- 6 Liquid barrier IN (LBI)
- 11 Seal chamber

Example seal: EagleBurgmann **LY9DZTT**  
dual pusher mechanical seal.



- A From mechanical seal
- B To mechanical seal
- C Filling connection
- D Cooling water IN
- E Cooling water OUT
- F Drain
- G From external pressure source

## Between seals

### Plan 53A

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 3CW-FB:

APTtex-T

##### Category 2/3

#### Configuration 3CW-FB:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### Configuration 3CW-BB:

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

#### Configuration 3CW-FF:

LL9DSUU, SH-D, LY9DSTT

#### EagleBurgmann Barrier/buffer fluid systems

##### TSA6, TSB6

The EagleBurgmann barrier/buffer fluid systems of the TSA6000-A4 range meet all the requirements to supply mechanical seals in accordance with the API682 4th edition guidelines.

The vessels are equipped with all essential connections for fitting additional components.



TSA6 – Standard vessel with dished heads



TSB6 – Alternative vessel, bottom flanged

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## Features

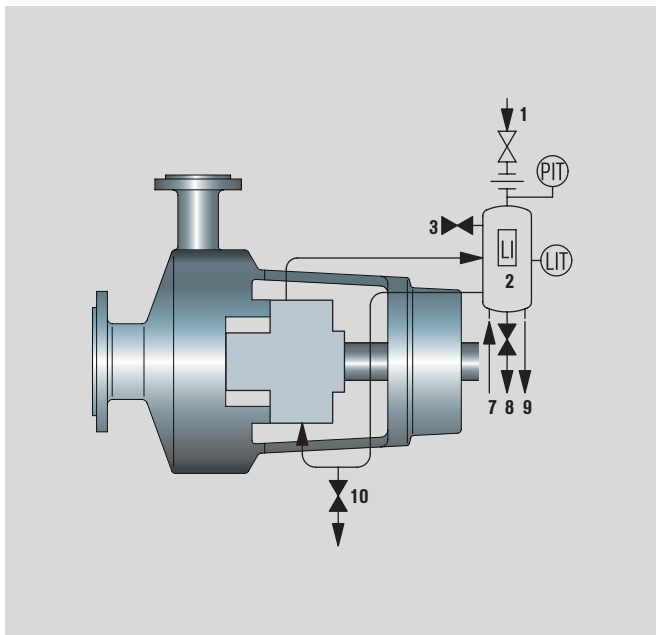
- The pumped media never leaks to the atmosphere unless the reservoir pressure is lost.
- A nitrogen source is required for pressurization.
- Provision of cooling coil inside the reservoir or an external water or air cooler takes care of the heat removal.
- Uses an internal circulating device to ensure barrier liquid circulation.
- Barrier liquid enters the process medium through the inner seal faces.

## Application

- For services where product dilution is acceptable.
- For services where media is unsuitable for lubricating the inner seal faces.
- For barrier pressures up to 16 bar (232 PSI).

## Remarks, checkpoints

- Always ensure that the source pressure is higher than the desired barrier pressure.
- Vent the system before start-up. Later ensure that the vent line always remains closed.
- Sense the seal inlet and outlet line temperatures. Difference in the temperatures is an indication of proper flow.
- Decrease in the reservoir level is an indication of inboard or/and outboard seal leakage.
- Ensure that the barrier pressure is always higher than the seal chamber pressure by at least 1.4 bar (20 PSI).
- For barrier pressures above 16 bar (232 PSI) use Plan 53B, 53C or 54.
- Check with the process engineer if product contamination is acceptable.
- Ensure the compatibility of barrier liquid with the pump media.



## Plan 53A

**Pressurized barrier fluid reservoir supplying clean fluid for an arrangement 3 pressurized dual seal.**

### Pump media characteristics

- Suspended solids
- Polymerizing and contaminated media
- Poor lubrication properties
- Hazardous / environmentally harmful
- Leakage may form solids
- Close to vaporization point
- Can tolerate dilution with barrier media

### Key

- 1 From external pressure source
- 2 Reservoir
- 3 Make-up barrier liquid
- 7 Cooling water IN
- 8 Reservoir barrier fluid drain
- 9 Cooling water OUT
- 10 Barrier fluid drain

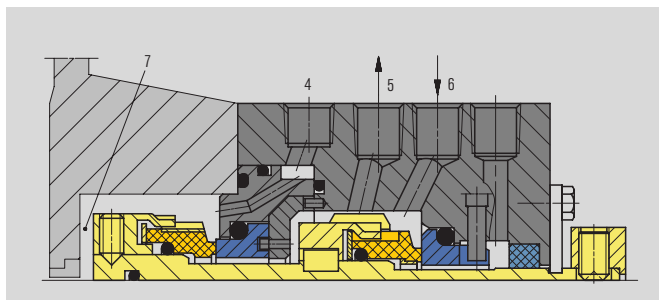
LI Level indicator  
LIT Level transmitter with local indicator  
PIT Pressure transmitter with local indicator

### Configurations

3CW-FB, 3CW-BB, 3CW-FF

### Location, function

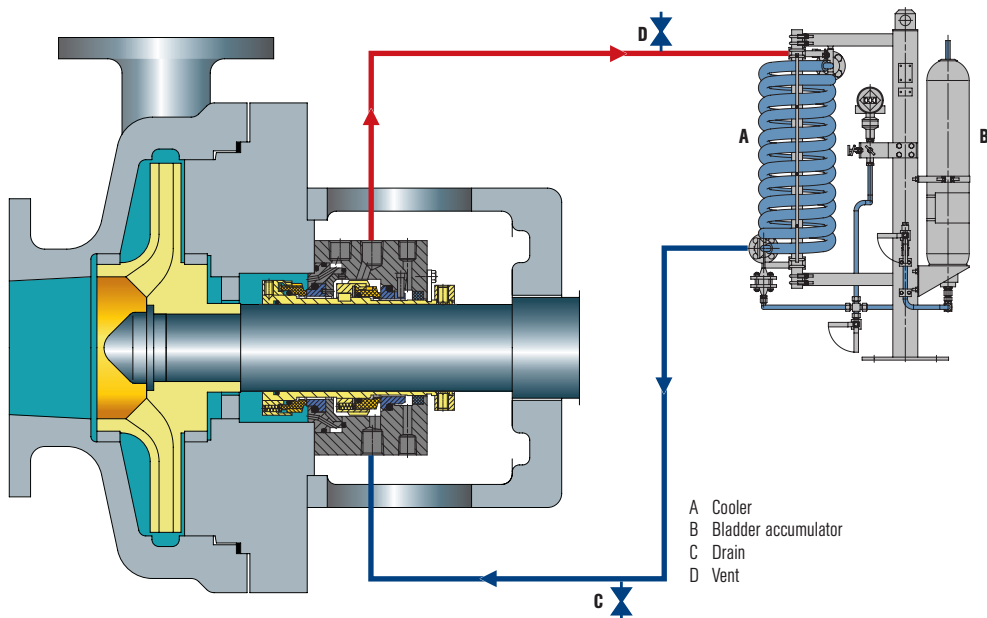
- Between seals
- Barrier system ( $p_{\text{sealchamber}} < p_{\text{betweenseals}}$ )
- Lubrication, flushing and cooling for both inboard as well as outboard seals.



### Seal chamber details

- 4 Flush (F)
- 5 Liquid barrier OUT (LBO)
- 6 Liquid barrier IN (LBI)
- 7 Seal chamber

Example seal: EagleBurgmann **H75A4-T**  
dual pusher mechanical seal.



- A Cooler
- B Bladder accumulator
- C Drain
- D Vent

## Between seals

### Plan 53B

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 3CW-FB:

APTex-T

##### Category 2/3

#### Configuration 3CW-FB:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### Configuration 3CW-BB:

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

#### Configuration 3CW-FF:

LL9DSUU, SH-D, LY9DSTT

#### EagleBurgmann seal supply system

##### SPB6

Pressurized barrier system (closed circuit) for use in seal systems with high pressures and/or for hazardous/environmentally harmful processes.

The SPB6000-A4 (Plan 53B) range is available with a pressure accumulator, cooler (finned tube, water or air cooler with fan) and a wide range of instruments.



SPB6 Barrier fluid system with bladder accumulator

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## Features

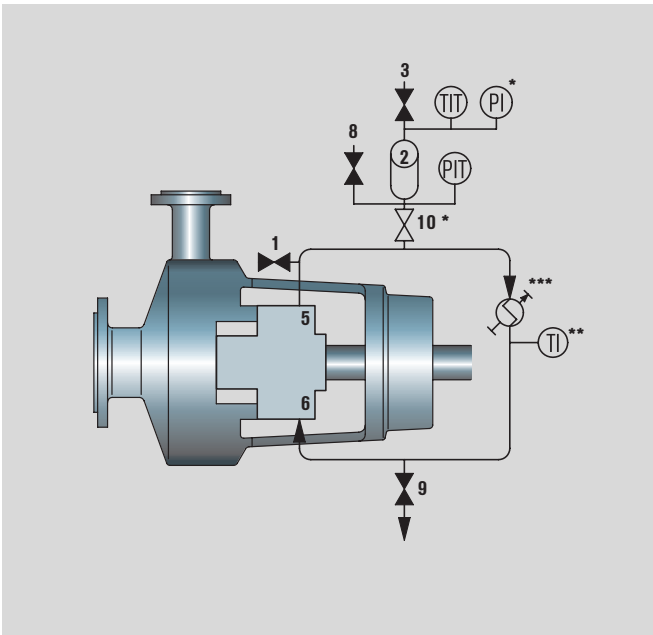
- The barrier fluid and nitrogen are separated by a bladder which effectively prevents the nitrogen from mixing with the barrier fluid as in the case of a Plan 53A.
- The pumped medium generally does not leak to the atmosphere unless the bladder pressure is lost.
- High reliability as a stand-alone system without need for a permanent nitrogen source and external pressure.
- Heat removal by water or air cooler.
- Uses an internal circulating device to ensure barrier liquid circulation.
- Barrier liquid enters the process medium through the inner seal faces.

## Application

- For services where product dilution is acceptable.
- For services where media is unsuitable for flushing the inner seal faces.
- For services where Plan 53A cannot be used due to non-availability of a permanent, reliable nitrogen supply at required pressure.
- For applications with barrier pressures above 16 bar (232 PSI) where Plan 53A cannot be used.

## Remarks, checkpoints

- Check with the process engineer if product contamination is acceptable.
- Check barrier fluid compatibility with the media.
- Always pre-charge the bladder at the correct pressure to ensure the required barrier pressure at the operating temperature. Refer to the nameplate affixed to the accumulator.
- Vent the system before start-up. Later ensure that the vent line always remains closed.
- Sense the seal inlet and outlet line temperatures. Difference in the temperatures is an indication of proper flow.
- Ensure that the barrier pressure is always higher than the seal chamber pressure by at least 1.4 bar (20 PSI).
- Since there is less barrier fluid volume in the accumulator, heat dissipation is a function of the cooler efficiency.



## Plan 53B

**Barrier fluid system pressurized by a bladder accumulator supplying clean liquid for an arrangement 3 pressurized dual seal.**

### Pump media characteristics

- Suspended solids
- Polymerizing and contaminated media
- Poor lubrication properties
- Hazardous / environmentally harmful
- Leakage may form solids
- Close to vaporization point
- Can tolerate dilution with barrier media

### Key

- 1 Make-up barrier liquid
- 2 Bladder accumulator
- 3 Bladder charge connection
- 8 Vent
- 9 Barrier fluid drain
- 10 Valve\*  
(for checking accumulator bladder integrity)

PI Pressure indicator\*

PIT Pressure transmitter with local indicator

TI Temperature indicator\*\*

TIT Temperature transmitter local indicator

\* If specified, both the PI and valve 10 shall be installed for checking bladder integrity.

\*\* If specified.

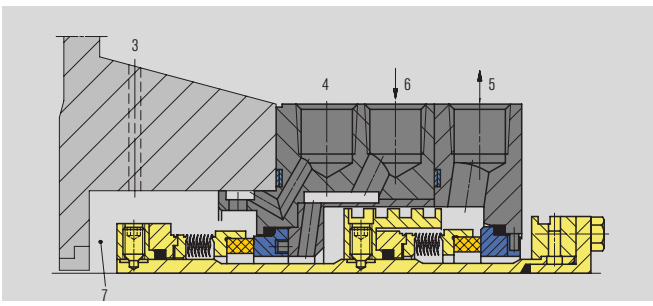
\*\*\* Vertically oriented, finned air cooler shall be installed if specified.

### Configurations

3CW-FB, 3CW-BB, 3CW-FF

### Location, function

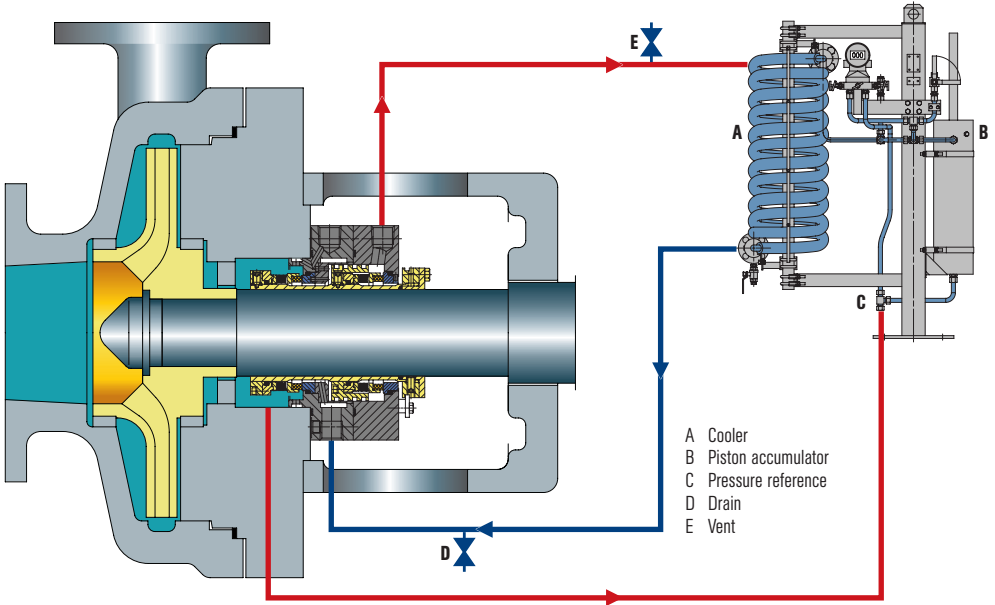
- Between seals
- Barrier system ( $p_{\text{sealchamber}} < p_{\text{betweenseals}}$ )
- Lubrication, flushing and cooling for both inboard as well as outboard seals.



### Seal chamber details

- 3 Pressure reference
- 4 Flush (F)
- 5 Liquid barrier OUT (LBO)
- 6 Liquid barrier IN (LBI)
- 7 Seal chamber

Example seal: EagleBurgmann **MBS682-PTA** dual metal bellows mechanical seal.



- A Cooler
- B Piston accumulator
- C Pressure reference
- D Drain
- E Vent

## Between seals

### Plan 53C

#### Applicable EagleBurgmann seals

##### Category 1

**Configuration 3CW-FB:**  
APTex-T

##### Category 2/3

**Configuration 3CW-FB:**  
H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

**Configuration 3CW-BB:**  
H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

**Configuration 3CW-FF:**  
LL9DSUU, SH-D, LY9DSTT

#### EagleBurgmann seal supply system

##### SPC6

Pressurized barrier system (closed circuit) for use in seal systems with high pressures and/or for hazardous/environmentally harmful processes.

The SPC6000-A4 (Plan 53C) range is available with a pressure booster, cooler (finned tube or water). Plan 53C can also be offered including air cooler with fan.



SPC6 Barrier fluid system with piston accumulator

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## Features

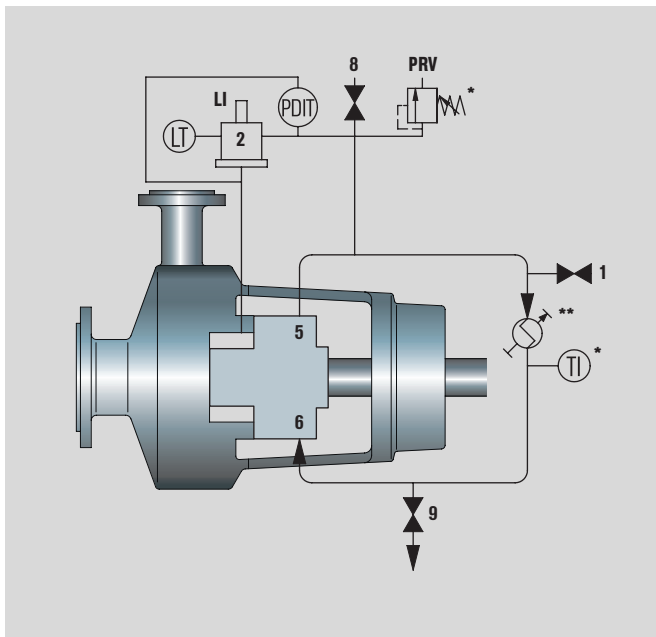
- A piston accumulator dynamically adjusts the barrier pressure which is based on the seal chamber pressure, thus maintaining a fixed, steady differential pressure across the inboard seal faces.
- Barrier liquid enters the process medium through the inner seal faces.
- Uses the seal chamber pressure as a reference pressure and accordingly magnifies the barrier pressure by a pre-defined ratio.
- Highly reliable since there is no need for an external pressure source.
- Heat is removed with the help of a water cooler or an air cooler.
- Uses an internal circulating device to ensure barrier liquid circulation.

## Application

- For services where product dilution is acceptable.
  - For services where media is unsuitable for flushing the inner seal faces.
  - For services where Plan 53A cannot be used due to non-availability of a permanent, reliable nitrogen supply.
  - Ideal plan for applications with varying seal chamber pressures. Pressure ratio depending on stuffing box pressure range:
    - 4 bar (58 PSI) ... <10 bar (145 PSI) = piston ratio 1:1.5
    - 10 bar (145 PSI) ... <22 bar (319 PSI) = piston ratio 1:1.2
    - 22 bar (319 PSI) ... 40 bar (580 PSI) = piston ratio 1:1.1
- For stuffing box pressures less than 4 bar (58 PSI) or above 40 bar (580 PSI) consult EagleBurgmann.

## Remarks, checkpoints

- Check with the process engineer if product contamination is acceptable.
- Check barrier fluid compatibility with the media.
- Vent the system before start-up. Later ensure that the vent line always remains closed.
- Sense the seal inlet and outlet line temperatures. Difference in the temperatures is an indication of proper flow.
- Ensure that the barrier pressure is always higher than the seal chamber pressure by at least 1.4 bar (20 PSI) (for piston ratio selection).
- Since there is less barrier fluid volume in the accumulator, heat dissipation is very much a function of the cooler efficiency.
- Ensure that the seal chamber reference line is not choked and that it is connected to the downstream of the accumulator.
- Ensure proper heating or cooling of the reference pressure line if necessary.
- Check the compatibility of the accumulator materials with the pump media.



## Plan 53C

Barrier fluid system pressurized by a piston accumulator supplying clean liquid for an arrangement 3 pressurized dual seal. The barrier pressure is generated from the seal chamber pressure. The system is self-energizing and reacts to fluctuations in the seal chamber pressure.

### Pump media characteristics

- Non-polymerizing and clean media
- Poor lubrication properties
- Hazardous / environmentally harmful
- Close to vaporization point
- Can tolerate dilution with barrier media

### Key

- 1 Make-up barrier liquid
- 2 Piston accumulator
- 5 Liquid barrier OUT (LBO)
- 6 Liquid barrier IN (LBI)
- 8 Vent
- 9 Barrier fluid drain

- LI Level indicator  
 LT Level transmitter  
 PRV Pressure relief valve\*  
 PDIT Differential pressure transmitter with local indicator  
 TI Temperature indicator\*

\* If specified

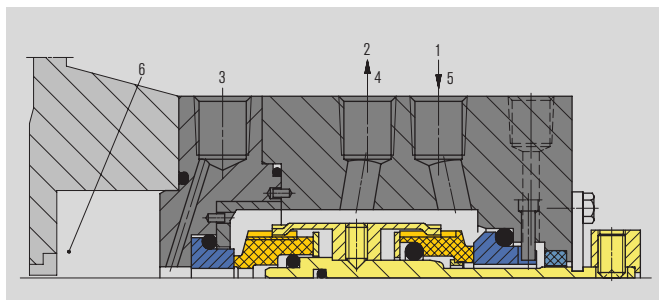
\*\* Vertically oriented, finned air cooler may be provided if specified

### Configurations

3CW-FB, 3CW-BB, 3CW-FF

### Location, function

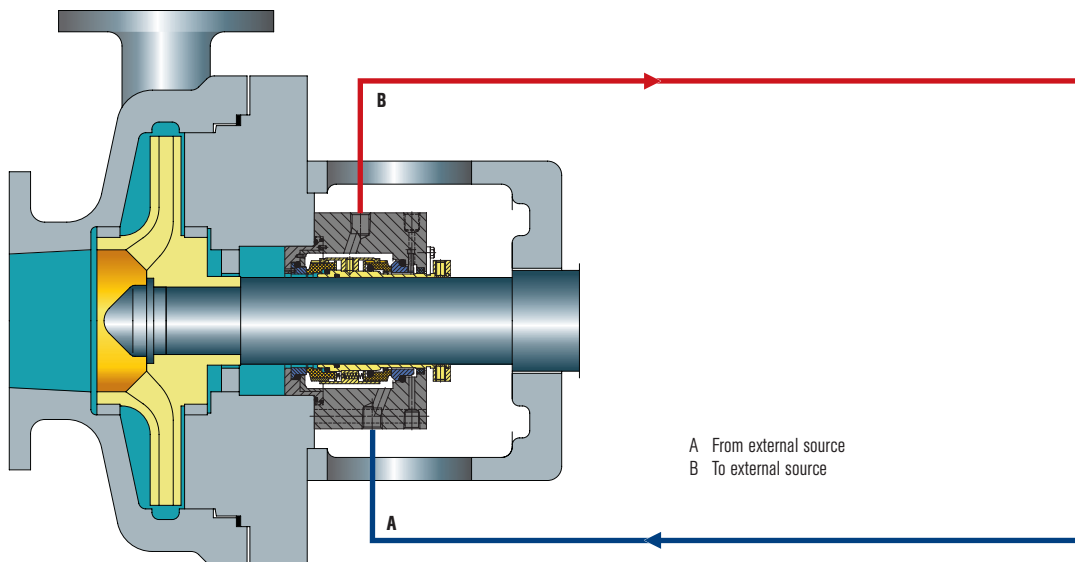
- Between seals
- Barrier system ( $p_{\text{sealchamber}} < p_{\text{betweenseals}}$ )
- Lubrication, flushing and cooling for both inboard as well as outboard seals.



### Seal chamber details

- 1 From external source
- 2 To external source
- 3 Flush (F)
- 4 Liquid barrier OUT (LBO)
- 5 Liquid barrier IN (LBI)
- 6 Seal chamber

Example seal: EagleBurgmann **H75A4-B**  
dual pusher mechanical seal.



- A From external source
- B To external source

## Between seals

### Plan 54

#### Applicable EagleBurgmann seals

##### Category 1

##### Configuration 3CW-FB:

APtTex-T

##### Category 2/3

##### Configuration 3CW-FB:

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

##### Configuration 3CW-BB:

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

##### Configuration 3CW-FF:

LL9DSUU, SH-D, LY9DSTT

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## Features

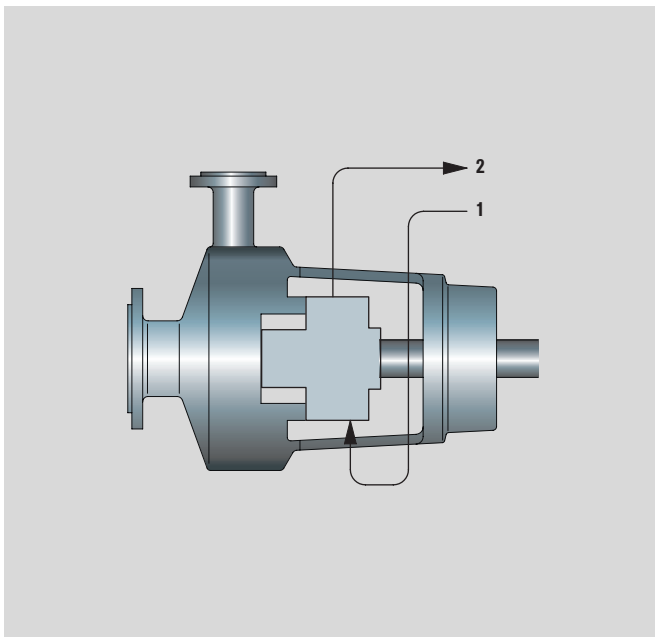
- Most reliable of all dual pressurized plans when properly engineered.
- Provides barrier liquid circulation and cooling even though the process pump is in stand-by mode.
- The pumped fluid becomes contaminated but never leaks to the atmosphere unless the system pressure is lost.
- Ensures positive barrier fluid circulation and better heat dissipation due to higher flow rates as compared to 53A, 53B or 53C. Heat is removed with the help of a water cooler or an air cooler.
- Uses a pump to ensure barrier liquid circulation and pressurization.
- May employ a nitrogen / inert gas blanket for barrier oil applications.

## Application

- Applications which require higher heat dissipation, which limits the use of Plans 53A, 53B, or 53C.
- For services where product dilution is acceptable.
- For services where media is unsuitable for flushing the inner seal faces.
- For services where Plan 53A cannot be used due to non-availability of central pressure source.
- For applications with high pressure and/ or high temperature or where an internal circulating device would not lead to effective circulation.
- Where a single system is utilized for multiple seals.

## Remarks, checkpoints

- Check with the process engineer if product contamination is acceptable.
- Check barrier fluid compatibility with the media.
- In case the system has a strainer or a filter, check for blockages.
- Note that the loss of pressure in the system may cause the pumped media to enter the entire Plan 54 system.
- Ensure that the barrier pressure is always higher than the seal chamber pressure by at least 1.4 bar (20 PSI).
- Plan 54 systems need careful engineering based on the application.



## Plan 54

Pressurized external barrier fluid system supplying clean liquid for an arrangement 3 pressurized dual seal. The barrier liquid is maintained at a pressure greater than seal chamber pressure and is circulated by an external pump or pressure system.

### Pump media characteristics

- Suspended solids
- Polymerizing and contaminated media
- Poor lubrication properties
- Hot services
- Hazardous / environmentally harmful
- Leakage may form solids
- Close to vaporization point
- Can tolerate dilution with barrier media

### Key

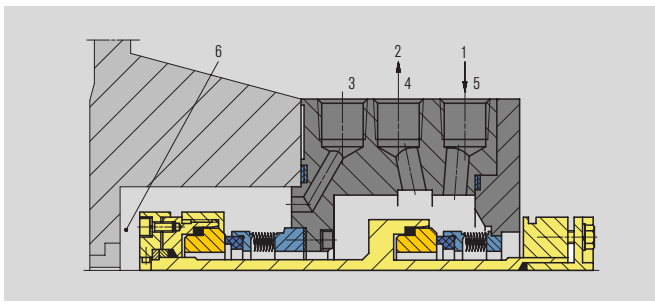
- 1 From external source
- 2 To external source

### Configurations

3CW-FB, 3CW-BB, 3CW-FF

### Location, function

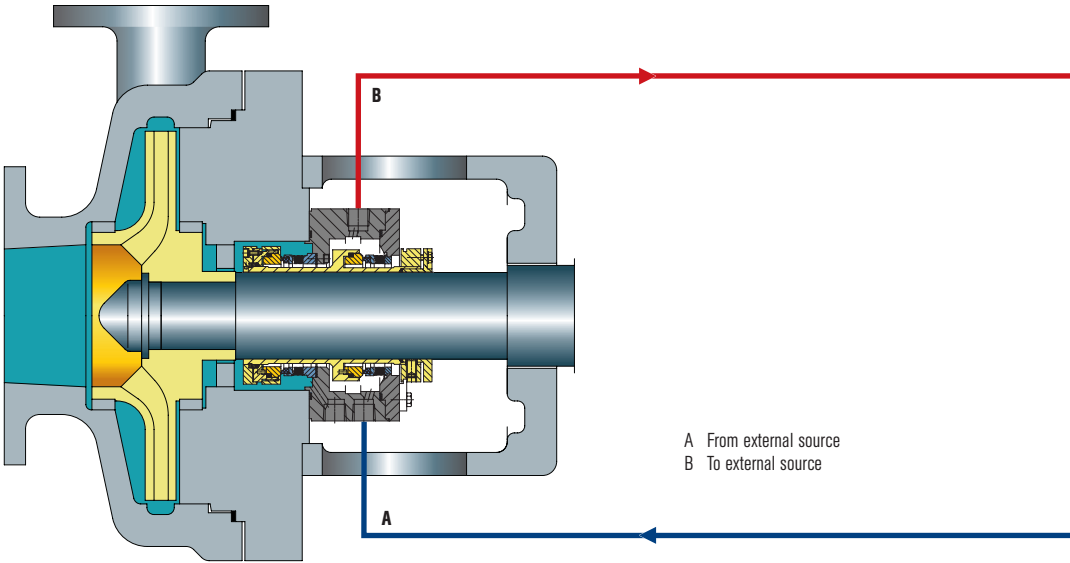
- Between seals
- Barrier system ( $p_{\text{sealchamber}} < p_{\text{betweenseals}}$ )
- Lubrication and flushing for the outboard seal and cooling for inboard as well as outboard seals.



### Seal chamber details

- 1 From external source
- 2 To external source
- 3 Flush (F)
- 4 Liquid buffer OUT (LBO)
- 5 Liquid buffer IN (LBI)
- 6 Seal chamber

Example seal: EagleBurgmann **LY9DZTT**  
dual pusher mechanical seal.



- A From external source
- B To external source

## Between seals

### Plan 55

#### Applicable EagleBurgmann seals

##### Category 1

**Configuration 2CW-CW:**  
APItex-T

##### Category 2/3

**Configuration 2CW-CW:**  
H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

## Plan 55

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## Features

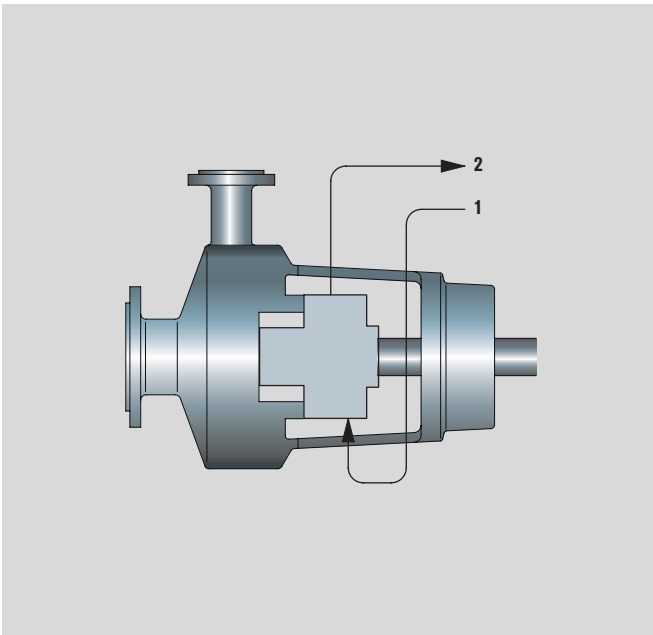
- Provides lubrication and cooling to the outboard safety backup seal.
- The pumped fluid does not become contaminated.
- The pumped media does not leak directly to the atmosphere.
- Uses an external pump or pressure system to ensure buffer liquid circulation.
- Provides buffer liquid circulation and cooling even though the process pump is in stand-by mode.

## Application

- For flashing services – for example light hydrocarbons, high vapor pressure fluids.
- Can also be used for non-flashing service.
- For services where product dilution is not acceptable.
- Where a single system is to be utilized for multiple seals.

## Remarks, checkpoints

- Not to be used for contaminated and polymerizing media.
- Sense the seal inlet and outlet line temperatures. Difference in the temperatures is an indication of proper flow.
- Provide proper instruments like a flowmeter which will indicate outboard seal leakage when the flow increases. Also provide suitable pressure reduction as well as non-return valves in the flushing pipeline.
- The buffer liquid shall be maintained at a pressure less than seal chamber pressure and less than 2.8 bar (40 PSI).
- Ensure the compatibility of buffer liquid with the pump media.
- These systems may need additional engineering depending on application.



## Key

- 1 From external source
- 2 To external source

## Configurations

2CW-CW

## Plan 55

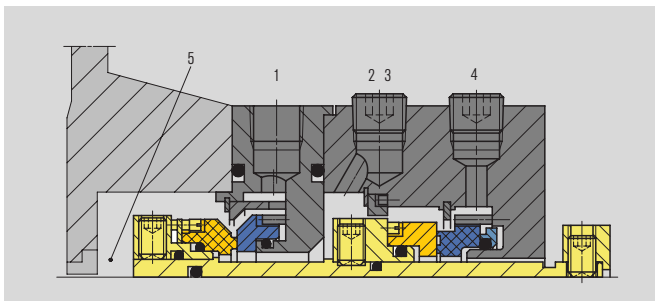
Unpressurized external buffer fluid system supplying clean buffer liquid for the outer seal of an arrangement 2 unpressurized dual seal. Buffer liquid is circulated by an external pump or pressure system.

## Pump media characteristics

- High temperature
- High vapor pressure, flashing media
- Clean, non-polymerizing
- Hazardous / environmentally harmful if leaked directly to the atmosphere.

## Location, function

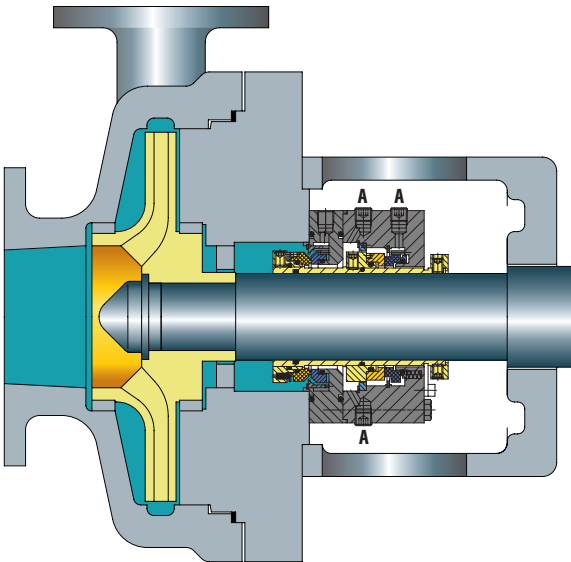
- Between seals
- Buffer system ( $p_{\text{sealchamber}} > p_{\text{betweenseals}}$ )
- Flushing and cooling



### Seal chamber details

- 1 Flush (F)
- 2 Containment seal vent (CSV), plugged
- 3 Containment seal drain (CSD), plugged
- 4 Gas buffer inlet (GBI), plugged
- 5 Seal chamber

Example seal: EagleBurgmann **LL9DTUE**  
dual pusher mechanical seal.



A Connection plugged

## Between seals

### Plan 71

#### Applicable EagleBurgmann seals

##### Category 1

**Configuration 2NC-CS:**  
H75LG4-C

##### Category 2/3

**Configuration 2CW-CS:**  
H75A4-C, LL9DTUE, LL9DJUE  
**Configuration 2NC-CS:**  
H75LG4-C

## Plan 71

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## Features

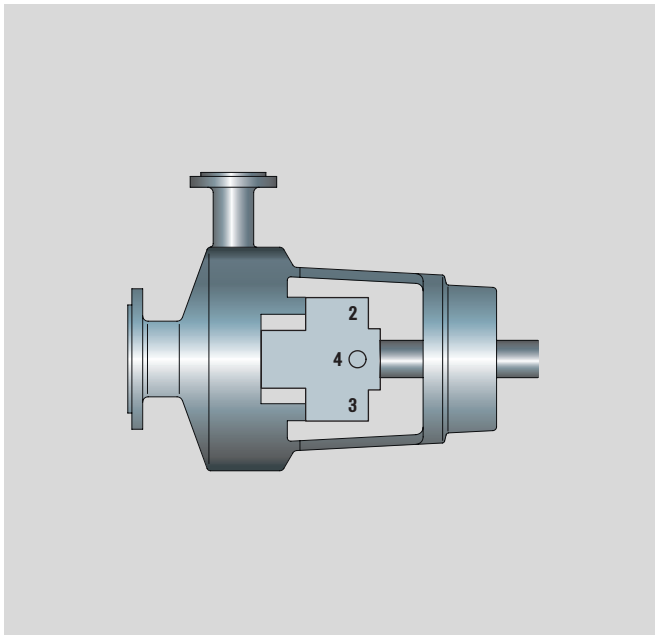
- When a gas buffer is to be provided, the GBI port can be converted to Plan 72.
- The CSV connection is piped to connect to vent when converted to Plan 76.
- The CSD connection is piped to collect condensate when converted to Plan 75.

## Application

- May be used for flashing as well as non-flashing services.
- For contacting or non-contacting containment seals where provision for future use of Plans 72, 75 or 76 is desired.

## Remarks, checkpoints

- Ensure that the ports are plugged with metallic plugs when a Plan 72, 75 or 76 is not connected.
- Ensure that the CSV port is oriented to the 12 o'clock position and CSD to the 6 o'clock position.



## Plan 71

Tapped connections for the purchaser's use e.g., for future use of buffer gas.

### Pump media characteristics

- Hazardous / environmentally harmful
- High vapor pressure fluids
- Clean non-polymerizing fluids
- Fluids condensing or vaporizing at ambient temperatures.

## Key

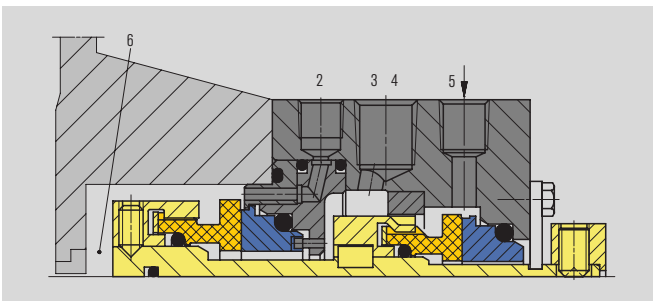
- 2 Containment seal vent (CSV), plugged
- 3 Containment seal drain (CSD), plugged
- 4 Gas buffer inlet (GBI), plugged

## Configurations

2CW-CS, 2NC-CS

## Location, function

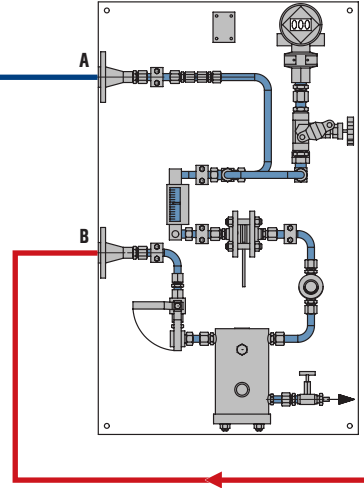
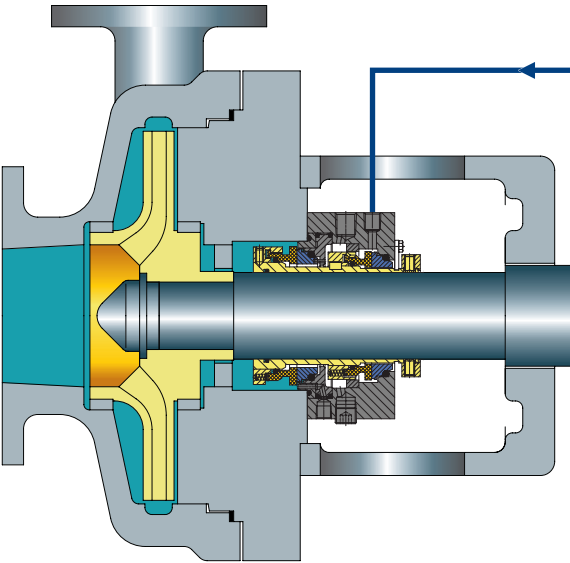
- Between seals



### Seal chamber details

- 2 Flush (F)
- 3 Containment seal vent (CSV)
- 4 Containment seal drain (CSD)
- 5 Gas buffer inlet (GBI)
- 6 Seal chamber

Example seal: EagleBurgmann **H75LG4-C**  
dual pusher mechanical seal.



- A Gas OUT
- B Gas IN

## Between seals

### Plan 72

#### Applicable EagleBurgmann seals

##### Category 1

**Configuration 2NC-CS:**  
H75LG4-C

##### Category 2/3

**Configuration 2CW-CS:**  
H75A4-C, LL9DTUE, LL9DJUE

**Configuration 2NC-CS:**  
H75LG4-C

#### EagleBurgmann gas supply system

##### GSS6000

- Safe operation due to incorporated pressure regulator with upstream filter.
- System mounted on a plate.
- Easy wall or rack mounting.
- Coalescing filter with integrated sight-glass for monitoring liquid level to ensure safe operation even in case of poor gas quality.
- Rigid base frame for easy rack mounting.
- Wide range of flow monitoring to ensure utmost reliability of mechanical seals.



GSS6000 Gas supply system

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## Features

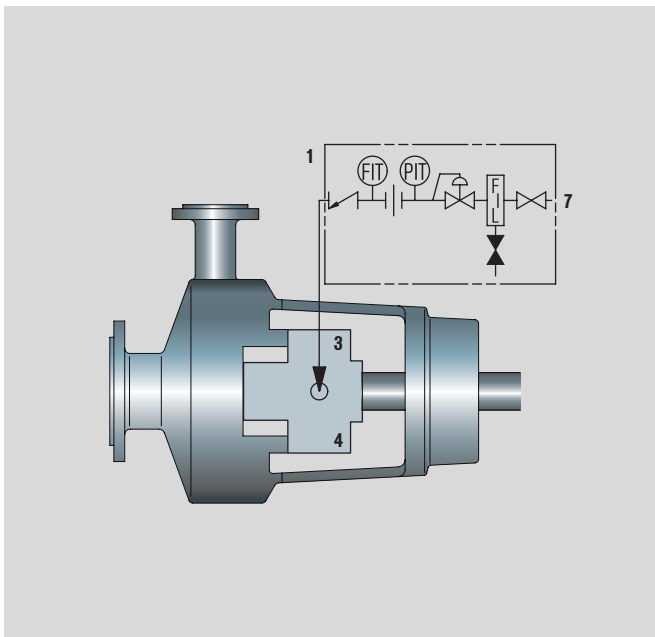
- Is used together with Plan 75 (for condensing leakage) or Plan 76 (for vaporizing leakage).
- The buffer gas is usually nitrogen and acts as a supply medium for the outboard seal and as a sweeping medium for leakages from the inboard seal.
- Nitrogen blanket reduces the explosion hazard arising out of leakages from the inboard seal as well as prevents icing in cryogenic applications.

## Application

- May be used for flashing as well as non-flashing services.

## Remarks, checkpoints

- Always ensure that the buffer gas pressure is less than the seal chamber pressure.
- Set the forward pressure regulator to min 0.4 bar (5 PSI) above the normal flare pressure.
- The buffer gas pressure should not exceed 0.7 bar (10 PSI).
- Ensure that the CSV port is oriented to the 12 o'clock position and CSD to the 6 o'clock position.



## Plan 72

Externally supplied buffer gas for arrangement 2 unpressurized seals with a dry running containment seal. Buffer gas is maintained at a pressure less than seal chamber pressure.

### Pump media characteristics

- Hazardous / environmentally harmful
- High vapor pressure fluids
- Clean non-polymerizing fluids
- Fluids condensing or vaporizing at ambient temperatures.

### Key

- 1 Buffer gas panel
- 3 Containment seal vent (CSV)
- 4 Containment seal drain (CSD)
- 7 From buffer gas supply

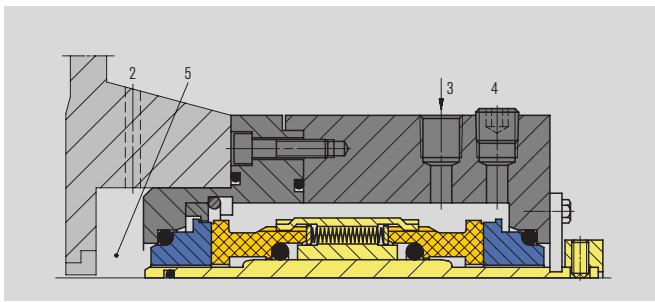
- FIL Coalescing filter
- FIT Flow transmitter with local indicator
- PCV Pressure control valve
- PIT Pressure transmitter with local indicator

### Configurations

2CW-CS, 2NC-CS

### Location, function

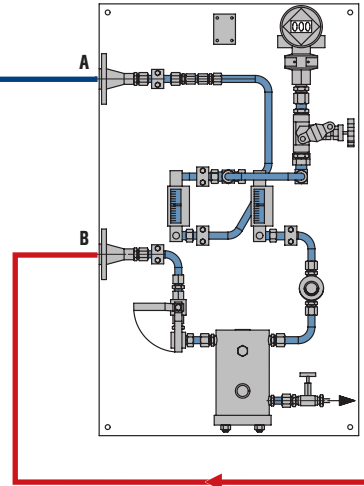
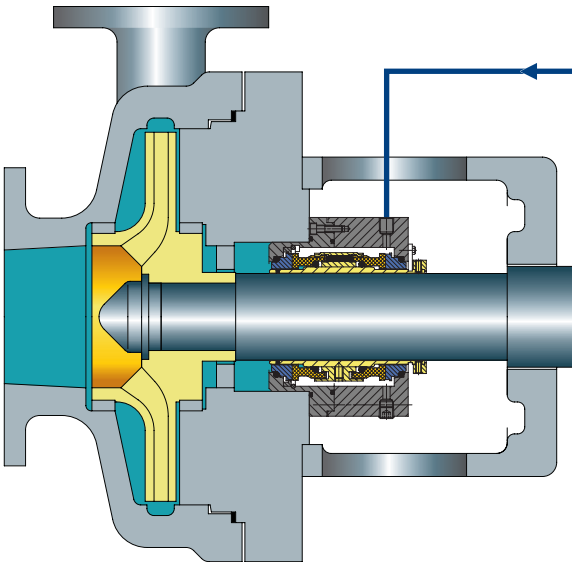
- Between seals
- Buffer system ( $p_{\text{sealchamber}} > p_{\text{betweenseals}}$ )



### Seal chamber details

- 2 Vent (if required)
- 3 Gas barrier inlet (GBI)
- 4 Gas barrier outlet (GBO) (normally closed), used only to depressurize barrier
- 5 Seal chamber

Example seal: EagleBurgmann **CGSH-KD** dual pusher mechanical seal.



- A Gas OUT  
B Gas IN

## Between seals

### Plan 74

#### Applicable EagleBurgmann seals

##### Category 1

**Configuration 3NC-BB:**  
CGSH-KD

##### Category 2/3

**Configuration 3NC-FB:**  
HRGS-DD, LNF992

**Configuration 3NC-BB:**  
CGSH-KD

**Configuration 3NC-FF:**  
RGS-D

#### EagleBurgmann gas supply system

##### GSS6001

- Safe operation due to incorporated pressure regulator with upstream filter.
- System mounted on a plate.
- Easy wall or rack mounting.
- Coalescing filter with integrated sight-glass for monitoring liquid level to ensure safe operation even in case of poor gas quality.
- Rigid base frame for easy rack mounting.
- Wide range of flow monitoring to ensure utmost reliability of mechanical seals.



GSS6001 Gas supply system

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## Features

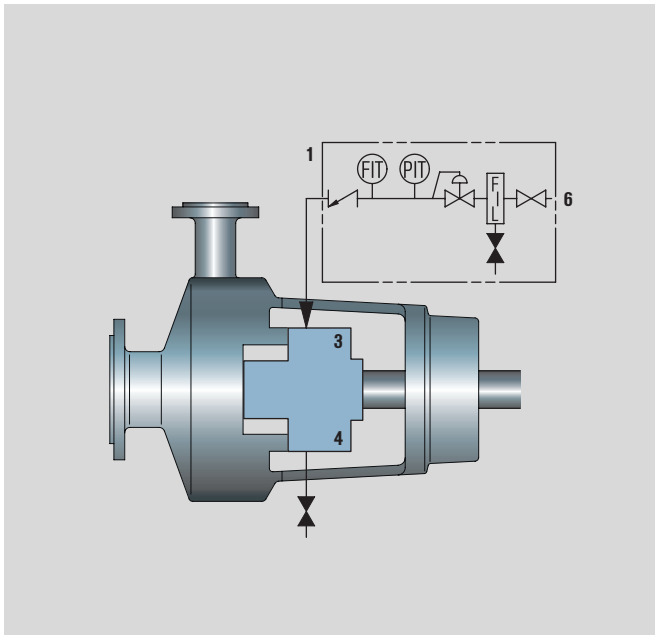
- Nitrogen is used as barrier gas.
- Pumped media never leaks to the atmosphere.
- High reliability due to the absence of foreign particles/solids in the barrier gas.

## Application

- For dual pressurized non-contacting seals.
- For media with moderate temperatures, with poor lubrication properties or with hazardous or toxic nature.
- For services where media contamination is acceptable but no media leakage to atmosphere is tolerated.
- Flashing light hydrocarbons.

## Remarks, checkpoints

- Check if nitrogen is compatible with the pumped media.
- Ensure that the barrier gas pressure is higher than the seal chamber pressure by at least 1.7 bar (25 PSI).
- Set the back pressure regulator at least 1.7 bar (25 PSI) above the seal chamber pressure.
- Check filter from time to time for any blockages.
- Do not use for polymerizing and sticky media as this creates problems with the inboard seal faces.
- Ensure a reliable nitrogen supply. Avoid usage of nitrogen gas bottles.
- Use individual gas panel per seal assembly in a between bearing pump.



## Key

- 1 Barrier gas panel
- 3 Gas barrier inlet (GBI)
- 4 Gas barrier outlet (GBO) (normally closed), used only to depressurize barrier
- 6 From barrier gas supply

- FIL Coalescing filter  
 FIT Flow transmitter with local indicator  
 PCV Pressure control valve  
 PIT Pressure transmitter with local indicator

## Configurations

3NC-FB, 3NC-BB, 3NC-FF

## Plan 74

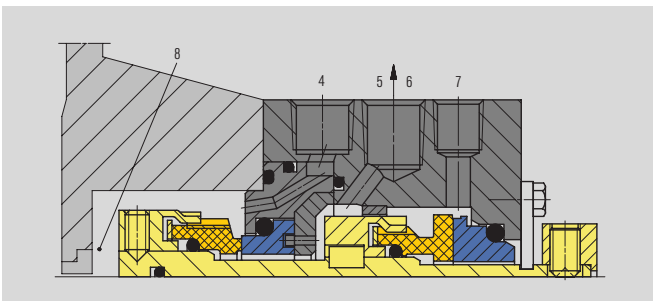
Externally supplied barrier gas for arrangement 3 dual pressurized non-contacting gas seals.

## Pump media characteristics

- Poor lubrication
- Clean, non-polymerizing moderate temperature fluids.
- Hazardous / environmentally harmful
- Close to vaporization point
- High vapor pressure media

## Location, function

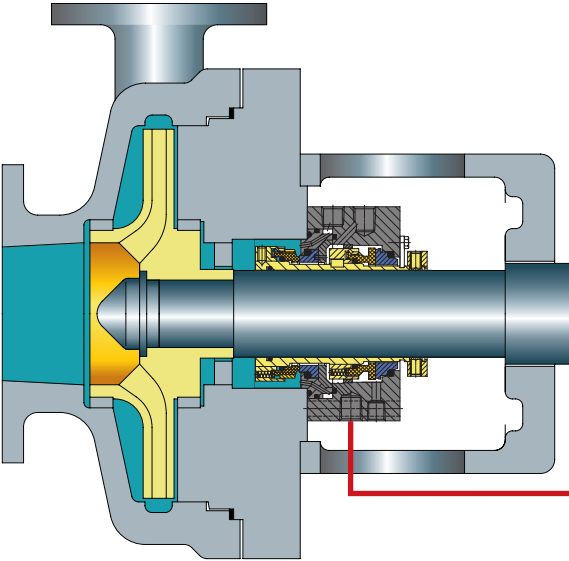
- Between seals
- Barrier system ( $p_{\text{sealchamber}} < p_{\text{betweenseals}}$ )



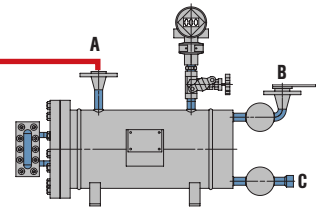
### Seal chamber details

- 4 Flush (F)
- 5 Containment seal vent (CSV), plugged
- 6 Containment seal drain (CSD)
- 7 Gas buffer inlet (GBI), plugged unless used with a Plan 72
- 8 Seal chamber

Example seal: EagleBurgmann **H75A4-C** dual pusher mechanical seal.



- A From mechanical seal
- B To vapor collection system
- C Drain



## Between seals

### Plan 75

Applicable EagleBurgmann seals

Category 2/3

Configuration 2CW-CS:

H75A4-C, LL9DTUE, LL9DJUE

### EagleBurgmann leakage collection reservoir

#### LSC6

The EagleBurgmann leakage control systems of the LSC6000-A4 range are utilized to collect condensing or mixed phase leakage - vapor passing through. A level indicator is installed to determine when the tank needs to be drained. A pressure gauge tracks and indicates seal leakage.



LSC6 Leakage collection reservoir

## Plan 75

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## Features

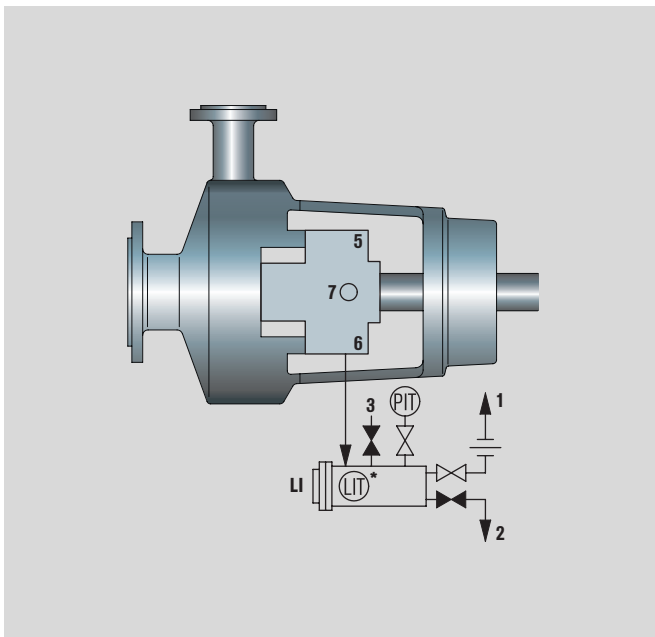
- This plan can be used with buffer gas (Plan 72) or without buffer gas (Plan 71).
- Avoids direct leakage of pumped media to the atmosphere.
- Liquid leakage is collected in the leakage collector and vapors pass to the collection system.
- Excessive leakage and the use of an orifice in the outlet line of the collector together leads to a pressure build-up in the collector and triggers a pressure alarm at 0.7 bar (10 PSI) with the help of a pressure transmitter.

## Application

- For condensing media.
- For configurations utilizing an outboard containment seal – contacting or non-contacting type.
- Generally used in combination with a Plan 72 nitrogen purge.

## Remarks, checkpoints

- Set the pressure transmitter alarm to a pressure of 0.7 bar (10 PSI) so as to trigger an alarm when the pressure in the leakage collector increases. This indicates inboard seal leakage.
- Ensure that the vent line is always open and an orifice is present to generate back pressure.
- Always mount the leakage collection system below the pump centerline.
- Use sloping lines from the CSD port to the leakage collector.
- Use the level gauge to ascertain if the leakage collector needs to be drained.



## Plan 75

A containment seal chamber leakage collection system for condensing or mixed phase leakage on arrangement 2 unpressurized seals with containment seals.

### Pump media characteristics

- Hazardous / environmentally harmful (generally in combination with additional API plan).
- Clean non-polymerizing fluids
- Fluids condensing at ambient temperatures.

## Key

- 1 To vapor collection system
- 2 To liquid collection system
- 3 Test connection (if specified)
- 5 Containment seal vent (CSV), plugged
- 6 Containment seal drain (CSD)
- 7 Gas buffer inlet (GBI), plugged unless used with a Plan 72

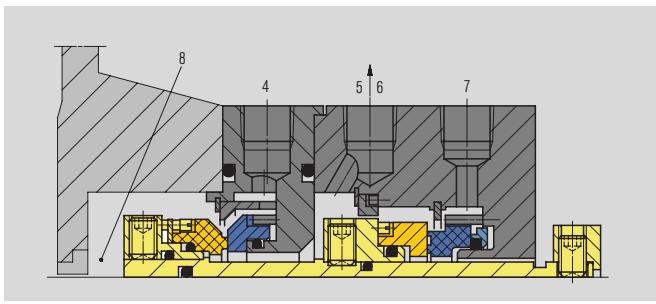
- |     |   |
|-----|---|
| LI  | Level indicator                           |
| LIT | Level transmitter with local indicator    |
| PIT | Pressure transmitter with local indicator |

### Location, function

- Between seals
- Leakage alarm and collection

### Configurations

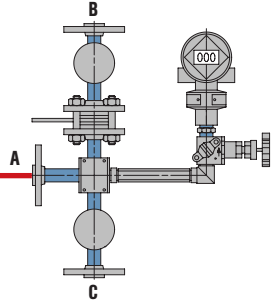
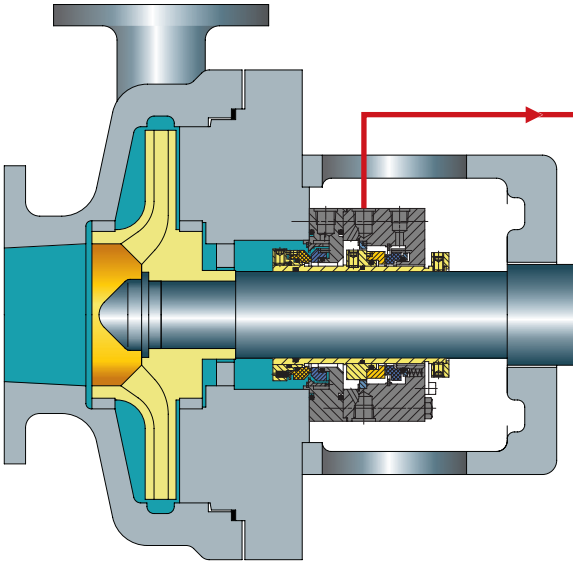
2CW-CS



### Seal chamber details

- 4 Flush (F)
- 5 Containment seal vent (CSV)
- 6 Containment seal drain (CSD), closed
- 7 Gas buffer inlet (GBI), plugged unless used with Plan 72
- 8 Seal chamber

Example seal: EagleBurgmann **LL9DTUE**  
dual pusher mechanical seal.



- A From mechanical seal
- B To vapor collection system
- C Drain

## Between seals

### Plan 76

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 2NC-CS:

H75LG4-C

##### Category 2/3

#### Configuration 2CW-CS:

H75A4-C, LL9DTUE, LL9DJUE

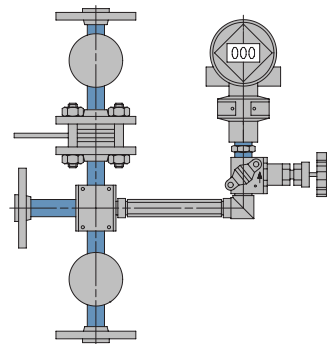
#### Configuration 2NC-CS:

H75LG4-C

#### EagleBurgmann leakage detection system

##### SPP6

The EagleBurgmann leakage control systems of the SPP6000-A4 range consist of a pressure transmitter which is supplied together with a block and bleed valve as well as an orifice and drain valve.



SPP6 Typical design

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## Features

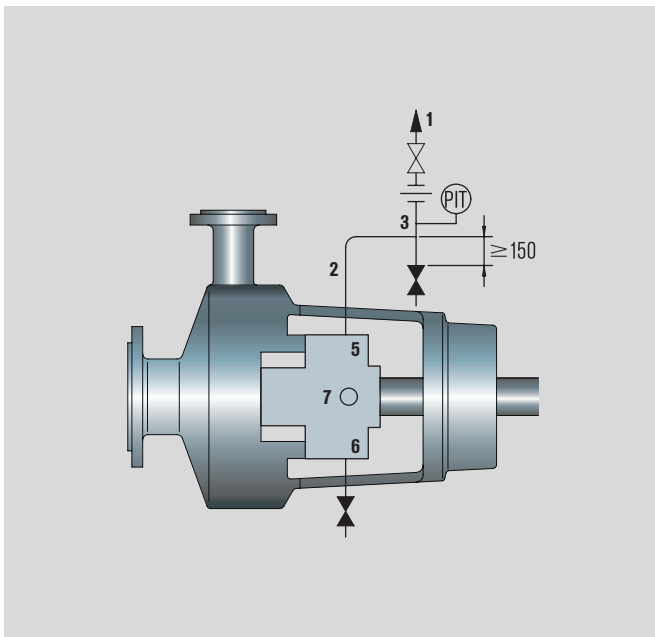
- Avoids direct leakage of pumped media to the atmosphere and ensures almost no leakage from the outboard seal.
- The vapors are directed to the vapor collection system.
- This plan can be used with buffer gas (Plan 72) or without buffer gas (Plan 71).

## Application

- For non-condensing media – typically high vapor pressure flashing light hydrocarbons.
- For configurations utilizing an outboard containment seal – contacting or non-contacting type.

## Remarks, checkpoints

- Set the pressure transmitter alarm to a pressure of 0.7 bar (10 PSI) so as to trigger an alarm when the pressure in the vapor collection system increases. This indicates inboard seal leakage.
- Ensure that the vent line is always open and an orifice is present to generate back pressure.
- Ensure a low point condensate drain.
- Check that the support to the harness piping is sufficient.
- Use a minimum 1/2" (13 mm) tubing for the CSV line and ensure that the pipeline rises continuously upwards.
- Do not use for condensing media.



## Plan 76

A containment seal chamber drain for non-condensing leakage on arrangement 2 unpressurized seals with containment seals. Used if the pumped fluid does not condense at ambient temperatures.

### Pump media characteristics

- Hazardous / environmentally harmful (generally in combination with additional API plan).
- Clean non-polymerizing fluids
- Fluids vaporizing at ambient temperatures.

## Key

- 1 To vapour collection system
- 2 Tube
- 3 Pipe
- 5 Containment seal vent (CSV)
- 6 Containment seal drain (CSD), closed
- 7 Gas buffer inlet (GBI), plugged unless used with Plan 72

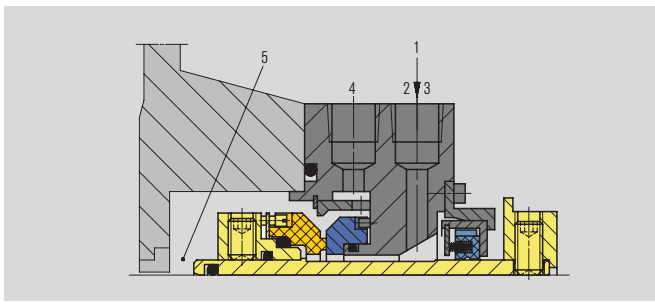
## Configurations

2CW-CS, 2NC-CS

## Location, function

- Between seals
- Leakage alarm and collection

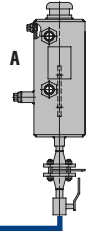
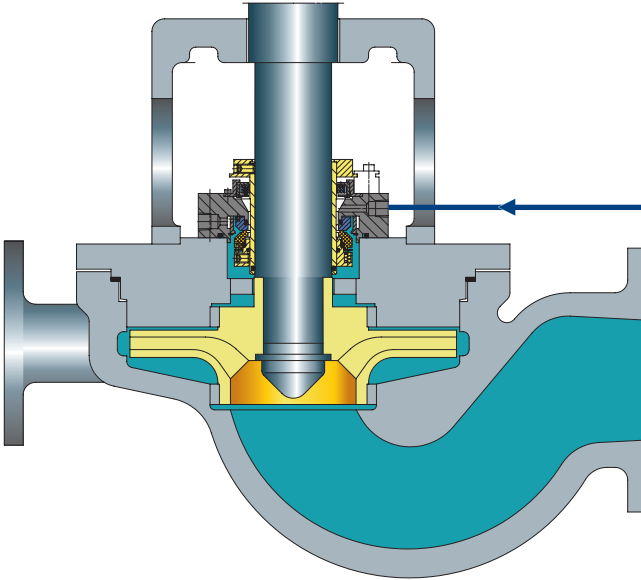
PIT Pressure transmitter with local indicator



### Seal chamber details

- 1 From reservoir
- 2 Quench (Q)
- 3 Drain (D), plugged
- 4 Flush (F)
- 5 Seal chamber

Example seal: EagleBurgmann **LL9UC**  
single pusher mechanical seal.



A Reservoir

## Atmospheric side

### Plan 51

#### Applicable EagleBurgmann seals

##### Category 1

**Configuration 1CW-FX:**  
APItex-S

##### Category 2/3

**Configuration 1CW-FL:**  
H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

#### EagleBurgmann Quench system

##### QFT6

Quench fluid supply systems are used with single mechanical seals. They act as a convenient fluid reservoir. The QFT6000-A4 stainless steel tank is equipped with a sight-glass for monitoring the MIN/MAX filling level and can be fastened with a lug fixture.

## Plan 51



QFT6 Quench system

\* Possible, see remark on page 2.

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## Features

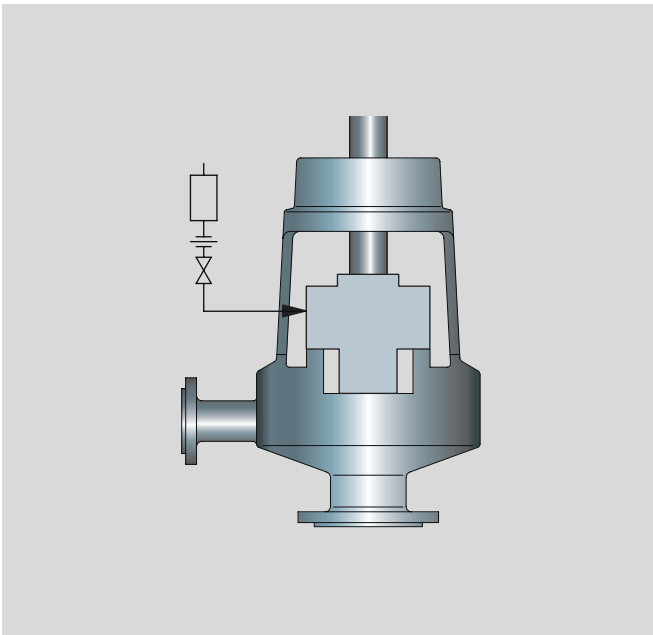
- Typically uses an auxiliary sealing device.
- Can help to prevent icing on the atmospheric side.

## Application

- Vertical pumps with dead-ended atmospheric quench.

## Remarks, checkpoints

- Routine inspection of the liquid level is recommended.



## Plan 51

Reservoir providing a dead-ended blanket for fluid to the quench connection of the gland plate. Only recommended for vertical pumps.

### Pump media characteristics

- Tendency to ice at ambient temperatures.

### Configurations

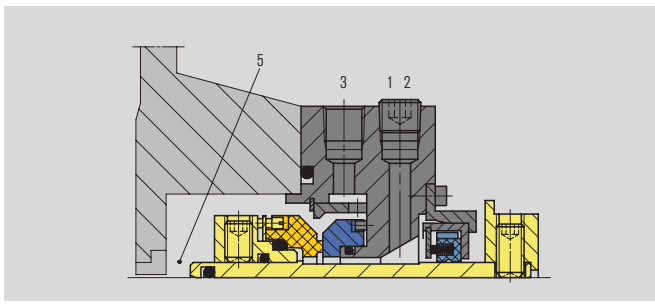
1CW-FL

1CW-FX\*

### Location, function

- Atmospheric side
- Quenching

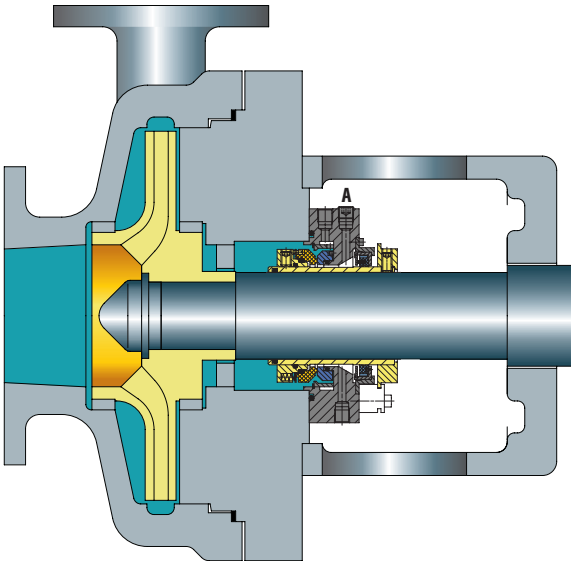
\* Possible, see remark on page 2.



### Seal chamber details

- 1 Quench (Q), plugged, metal
- 2 Drain (D), open connected to metal tubing
- 3 Flush (F)
- 5 Seal chamber

Example seal: EagleBurgmann **LL9UC**  
single pusher mechanical seal.



A Connection plugged

## Atmospheric side

### Plan 61

## Plan 61

#### Applicable EagleBurgmann seals

##### Category 1

##### **Configuration 1CW-FX:**

APItex-S

##### **Configuration 2CW-CW:\***

APItex-T

##### Category 2/3

##### **Configuration 1CW-FL:**

H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

##### **Configuration 2CW-CW:\***

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

##### **Configuration 3CW-FB:\***

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

##### **Configuration 3CW-BB:\***

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

##### **Configuration 3CW-FF:\***

LL9DSUU, SH-D, LY9DSTT

\* Possible, see remark on page 2.

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## Features

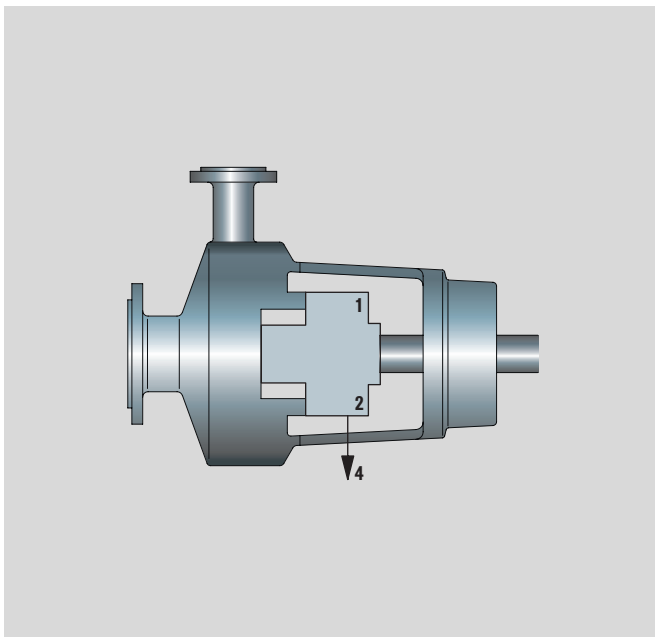
- Normally used for single seals but can be applied for dual seals as well.
- The 'Q' and 'D' connections when piped, this plan is converted to Plan 62.
- The 'D' connection can be piped to a drain collection system.

## Application

- On horizontal and vertical pumps as a future provision for Plan 62 or Plan 65.

## Remarks, checkpoints

- Ensure that atmospheric side ports are always plugged if not in use as foreign particle entry will cause seal failure.
- Use metallic plugs or connect the necessary piping by replacing the plastic plugs fitted on the mechanical seal gland plate.



## Plan 61

Tapped and plugged atmospheric-side connections for purchaser's use.

## Key

- 1 Quench (Q), plugged, metal
- 2 Drain (D), open connected to metal tubing
- 4 To collection point

## Configurations

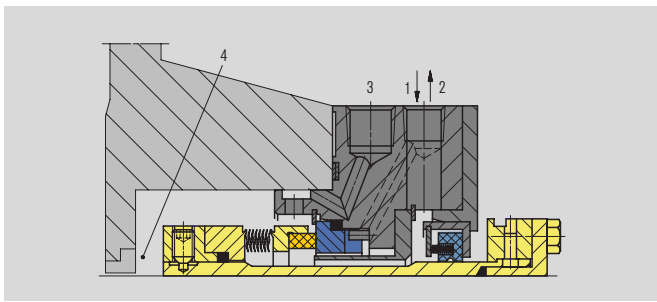
1CW-FL, 1CW-FX

2CW-CW\*, 3CW-FB\*, 3CW-BB\*,  
3CW-FF\*

## Location, function

- Atmospheric side
- Drain

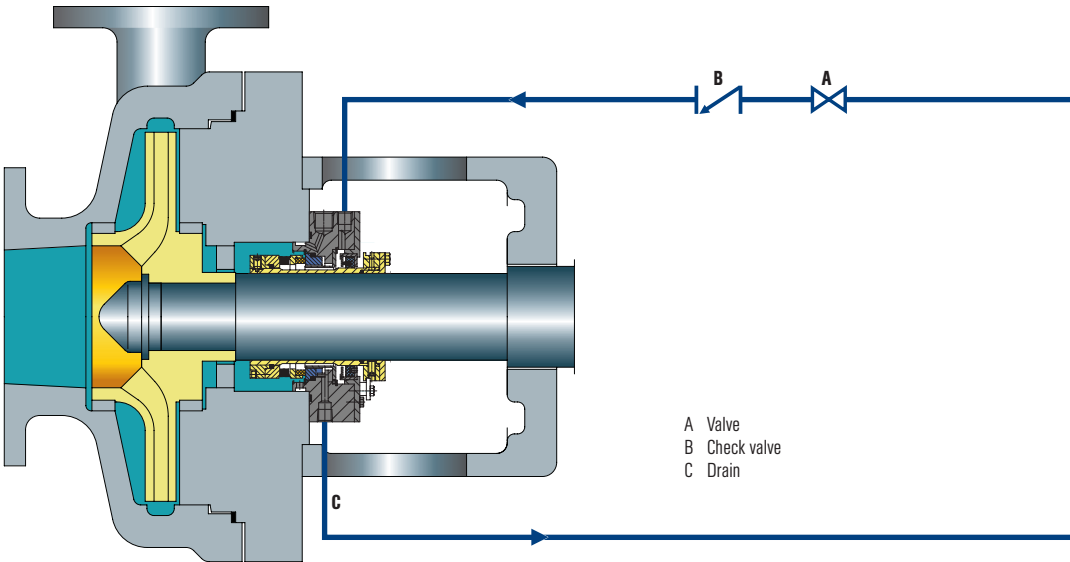
\* Possible, see remark on page 2.



### Seal chamber details

- 1 Quench (Q)
- 2 Drain (D)
- 3 Flush (F)
- 4 Seal chamber

Example seal: EagleBurgmann **MBS682**  
single metal bellows mechanical seal.



- A Valve
- B Check valve
- C Drain

## Atmospheric side

### Plan 62

## Plan 62

### Applicable EagleBurgmann seals

#### Category 1

##### Configuration 1CW-FX:

APItex-S

##### Configuration 2CW-CW:\*

APItex-T

#### Category 2/3

##### Configuration 1CW-FL:

H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

##### Configuration 2CW-CW:\*

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

##### Configuration 3CW-FB:\*

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

##### Configuration 3CW-BB:\*

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

##### Configuration 3CW-FF:\*

LL9DSUU, SH-D, LY9DSTT

\* Possible, see remark on page 2.

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## Features

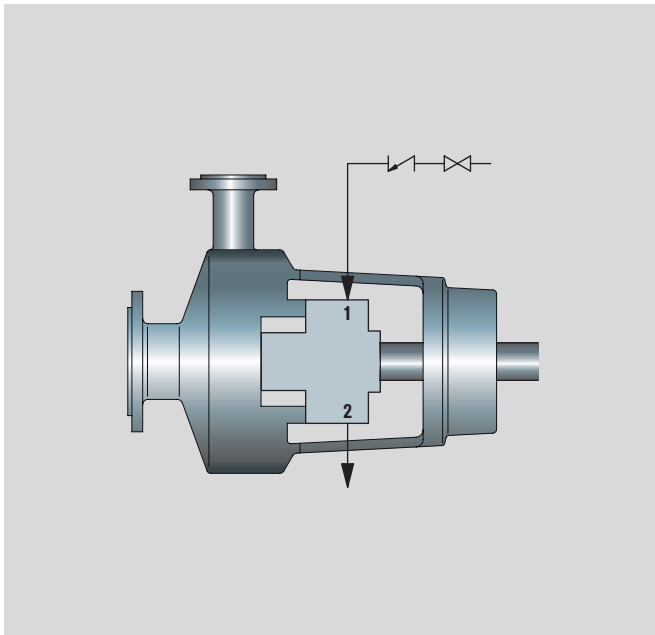
- The quench fluid cools the seal faces from underneath and also reduces coking and oxidation of the media by creating a barrier between the seal faces and the atmosphere.
- Flushes away built-up material or solids underneath the seal faces.
- Uses water, steam or nitrogen.
- Applied with or without quench baffle.

## Application

- Used with steam to avoid coking or crystallization in hot hydrocarbon services.
- Used with nitrogen to avoid icing in cryogenic services.
- Used for services that tend to salt out e.g. caustic and salt services.
- Applied at horizontal as well as vertical pumps.

## Remarks, checkpoints

- It has to be ensured that a close clearance throttle bush is fitted on the atmospheric side of the seal.
- Quench pressure to be maintained between 0.2 to 0.3 barg (2.9 to 4.3 PSIG).



## Key

- 1 Quench (Q)
- 2 Drain (D)

## Configurations

1CW-FL, 1CW-FX

2CW-CW\*, 3CW-FB\*, 3CW-BB\*,  
3CW-FF\*

## Plan 62

Quench stream from an external source to the atmospheric side of the seal faces. The quench stream can be low pressure steam, nitrogen or clean water.

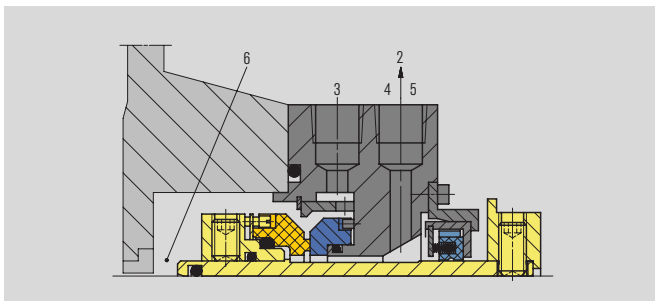
## Pump media characteristics

- High temperature
- Leakage may form solids
- Cryogenic

## Location, function

- Atmospheric side

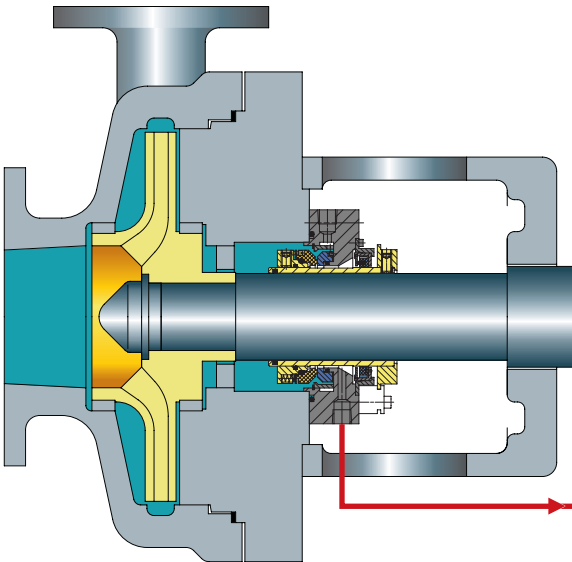
\* Possible, see remark on page 2.



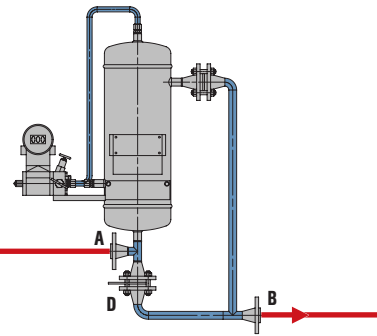
### Seal chamber details

- 2 To liquid collection system
- 3 Flush (F)
- 4 Quench (Q)
- 5 Drain (D)
- 6 Seal chamber

Example seal: EagleBurgmann **LL9UC**  
single pusher mechanical seal.



- A From mechanical seal.
- B To liquid collection system
- C Valve (locked open)
- D Flow control orifice



## Atmospheric side

### Plan 65A

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 1CW-FX:

APItex-S

#### Configuration 2CW-CW:\*

APItex-T

#### Configuration 3CW-FB:\*

APItex-T

##### Category 2/3

#### Configuration 1CW-FL:

H75A4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

#### Configuration 2CW-CW:\*

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### Configuration 3CW-FB:\*

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### Configuration 3CW-BB:\*

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

#### Configuration 3CW-FF:\*

LL9DSUU, SH-D, LY9DSTT

## Plan 65A

#### EagleBurgmann leakage collection reservoir

##### LSA6

In accordance with API Plan 65A, the EagleBurgmann leakage control systems of the LSA6000 range consist of a leakage collection tank with integrated orifice and overflow pipe. The level can be monitored with the differential pressure transmitter which is supplied together with a five-way manifold valve.

\* Possible, see remark on page 2.

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## Features

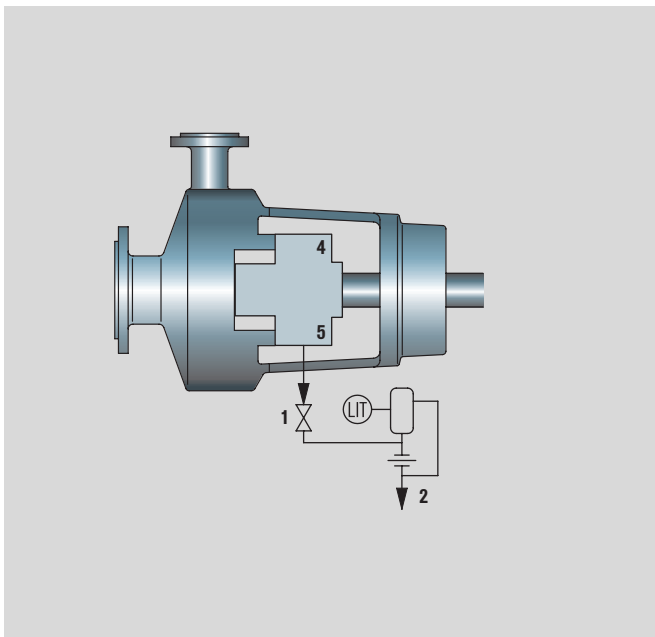
- Uses the Plan 61 drain connection.
- Collects the leakage from a single seal in a leakage collection reservoir.
- Is equipped with a level transmitter with a high level alarm.
- This plan is applied with a floating or segmented bushing or a similar containment device.

## Application

- For single seals with expected condensing leakage.
- Generally for horizontal pumps.

## Remarks, checkpoints

- A 5 mm (0.20") orifice in the vertical piping leg should be installed.
- It must be ensured that the drain connection on the gland is at the bottom-most position (6 o'clock).
- The valve below the gland (1) should always be kept open during pump operation.



## Plan 65A

Atmospheric leakage collection and alarm system for condensing leakage. Failure of the seal will be detected by an excessive flow rate into the leakage collection system.

### Pump media characteristics

- Condensing, medium temperature fluids.

## Key

- 1 Valve (locked open)
- 2 To liquid collection system
- 4 Quench (Q)
- 5 Drain (D)

LIT Level transmitter with local indicator

## Configurations

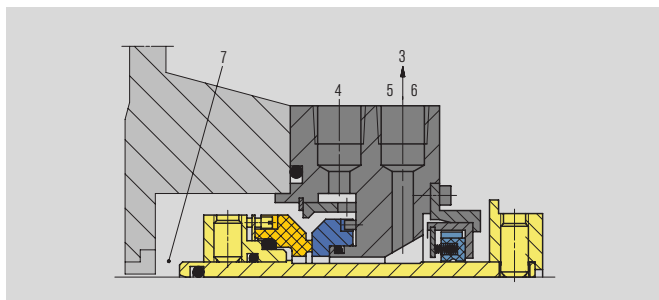
1CW-FL, 1CW-FX

2CW-CW\*, 3CW-FB\*, 3CW-BB\*,  
3CW-FF\*

## Location, function

- Atmospheric side
- Leakage collection, detection and alarm

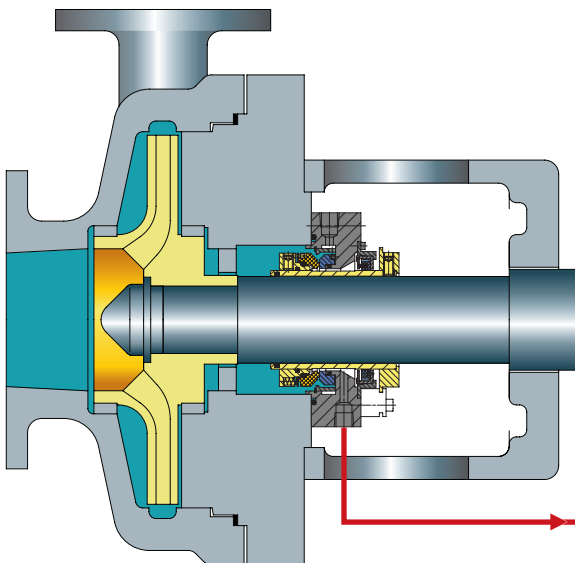
\* Possible, see remark on page 2.



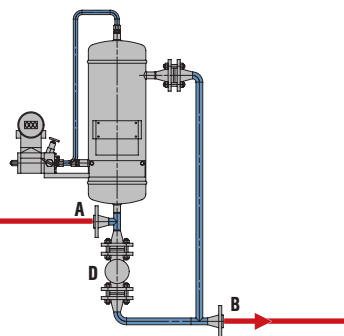
### Seal chamber details

- 3 To liquid collection system
- 4 Flush (F)
- 5 Quench (Q)
- 6 Drain (D)
- 7 Seal chamber

Example seal: EagleBurgmann **LL9UC**  
single pusher mechanical seal.



- A From mechanical seal.
- B To liquid collection system
- C Valve (locked open)
- D Valve (normally closed)



## Atmospheric side

### Plan 65B

#### Applicable EagleBurgmann seals

##### Category 1

#### Configuration 1CW-FX:

APItex-S

#### Configuration 2CW-CW:\*

APItex-T

#### Configuration 3CW-FB:\*

APItex-T

##### Category 2/3

#### Configuration 1CW-FL:

H75A4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

#### Configuration 2CW-CW:\*

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### Configuration 3CW-FB:\*

H75A4-T, LL9DTUU, LL9DJUU, LY9DTSS,  
MBS682-PTA, LY9DZTT

#### Configuration 3CW-BB:\*

H75A4-B, LL9DKUU, LY9DZSS, MBS682P-D

#### Configuration 3CW-FF:\*

LL9DSUU, SH-D, LY9DSTT

## Plan 65B

#### EagleBurgmann leakage collection reservoir

##### LSB6

In accordance with API Plan 65B, the EagleBurgmann leakage control systems of the LSB6000 range consist of a leakage collection tank with valve and overflow pipe. The level can be monitored with the differential pressure transmitter which is supplied together with a five-way manifold valve.

\* Possible, see remark on page 2.

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## Features

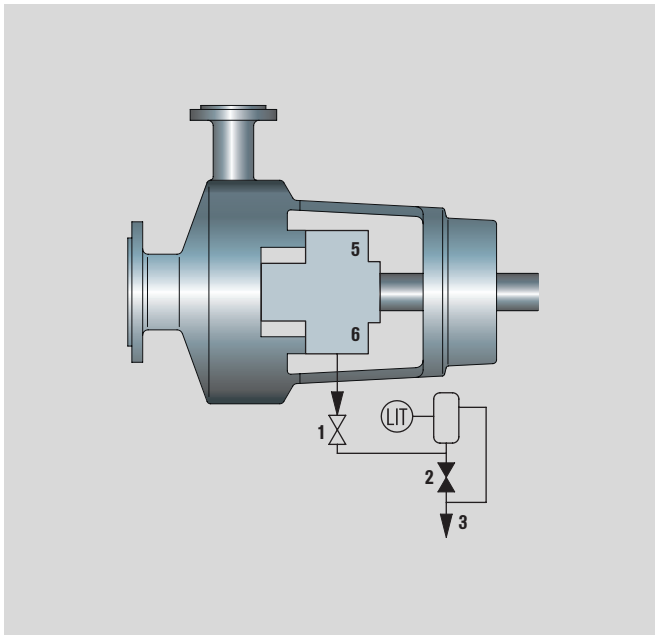
- Uses the Plan 61 drain connection.
- Collects the leakage from a single seal in a leakage collection reservoir.
- Is equipped with a level transmitter with a high level alarm.
- This plan is used with a floating or segmented bushing or a similar containment device.
- Identical to Plan 65A except that it uses a normally closed valve in place of the orifice of Plan 65A.

## Application

- For single seals with expected condensing leakage.
- Generally for horizontal pumps.

## Remarks, checkpoints

- It must be ensured that the valve downstream of the reservoir is always kept closed during operation of the pump.
- Drain connection on the gland must be at the bottom-most position (6 o'clock).
- The valve below the gland (1) should always be kept open during pump operation.



## Plan 65B

Atmospheric leakage collection and detection system for condensing leakage. Failure of the seal will be detected by a cumulative leakage into the system.

### Pump fluid characteristics

- Condensing, medium temperature fluids

## Key

- 1 Valve (locked open)
- 2 Drain valve
- 3 To liquid collection system
- 5 Quench (Q)
- 6 Drain (D)

LIT Level transmitter with local indicator

## Configurations

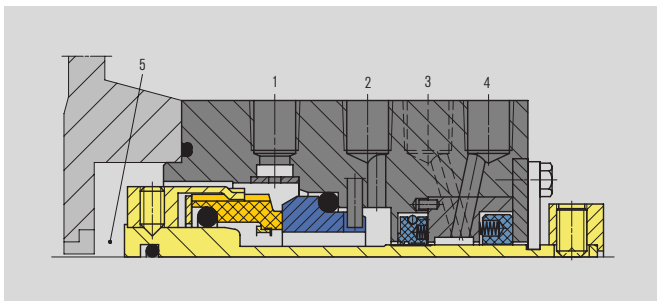
1CW-FL, 1CW-FX

2CW-CW\*, 3CW-FB\*, 3CW-BB\*,  
3CW-FF\*

## Location, function

- Atmospheric side
- Leakage collection, detection and alarm

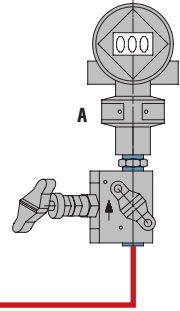
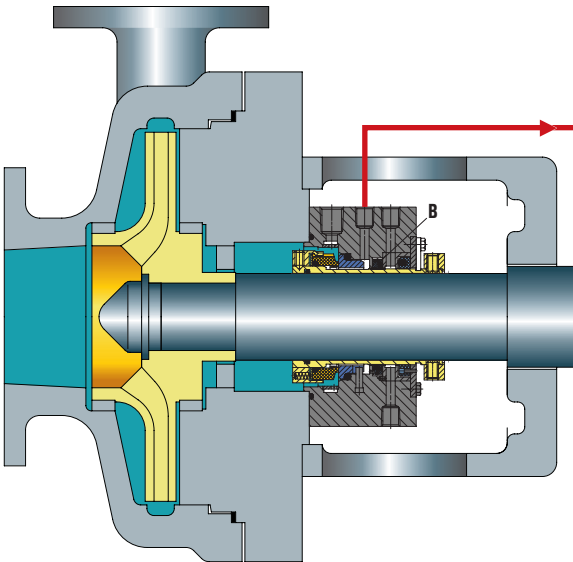
\* Possible, see remark on page 2.



### Seal chamber details

- 1 Flush (F)
- 2 Pressure transmitter sensing port (PT)
- 3 Quench (Q)
- 4 Drain (D)
- 5 Seal chamber

Example seal: EagleBurgmann **H75VA4-S**  
single pusher mechanical seal.



- A Pressure transmitter
- B Segmented bushing

## Atmospheric side

### Plan 66A

#### Applicable EagleBurgmann seals

##### Category 1

**Configuration 1CW-FX:**  
APltex-S

##### Category 2/3

**Configuration 1CW-FL:**  
H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

## Plan 66A



EagleBurgmann SPP pressure transmitter

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## Features

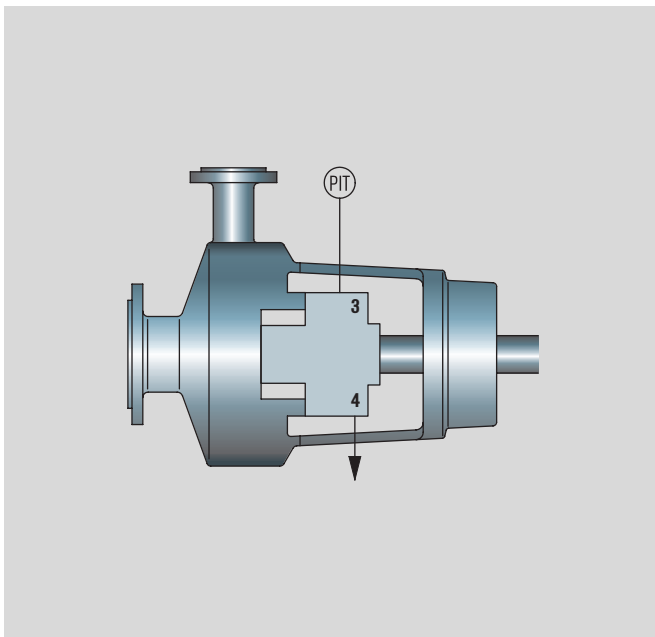
- Utilizes two bushings – the inner segmented floating bushing and the outer solid carbon floating bushing.
- Normal leakage continues to flow freely to the drain port.
- Excessive leakage is restricted by the inner bushing causing a pressure build-up which subsequently triggers a pressure alarm by the pressure transmitter.

## Application

- Commonly used on horizontal pipeline pumps.

## Remarks, checkpoints

- It must be ensured that the leakage from the drain port is collected and piped to a leakage recovery system.
- Drain connection on the gland must be at the bottom-most position (6 o'clock).



## Key

- 3 Quench (Q)
- 4 Drain (D)

PIT Pressure transmitter with local indicator

## Configurations

1CW-FL, 1CW-FX

## Plan 66A

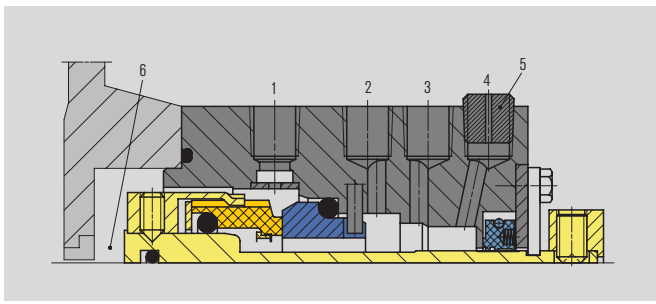
Throttle bushings in the seal gland minimize the seal leakage leaving the seal gland and allow for detection of a seal failure by an alarm of the monitoring pressure transmitter.

## Pump media characteristics

- Low to medium temperature liquids

## Location, function

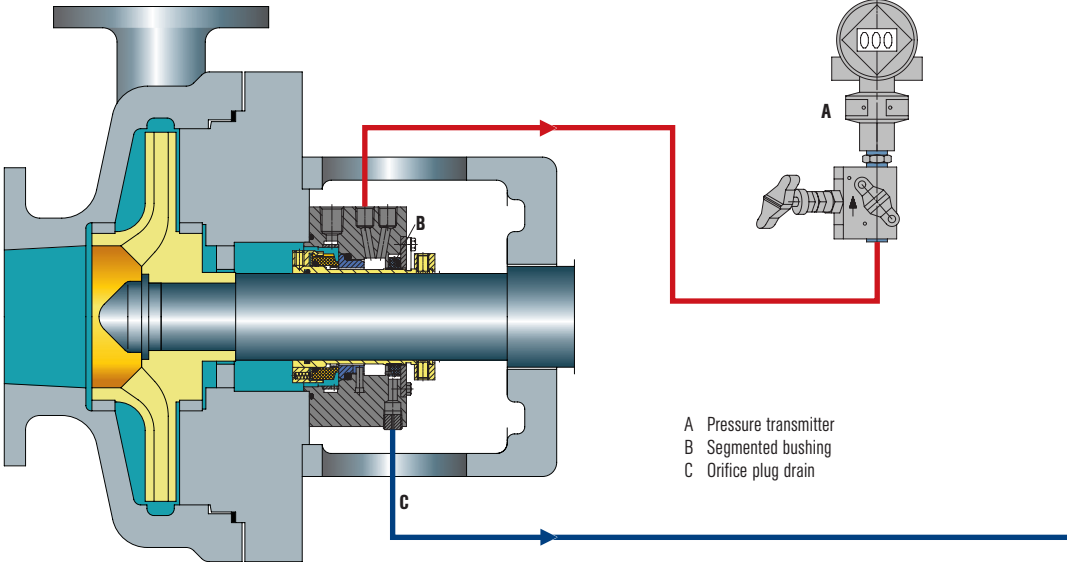
- Atmospheric side
- Leakage limiting detection and alarm



### Seal chamber details

- 1 Flush (F)
- 2 Pressure transmitter sensing port (PIT)
- 3 Quench (Q)
- 4 Drain (D), with orifice plug installed
- 5 Orifice plug
- 6 Seal chamber

Example seal: EagleBurgmann **H75VA4-S**  
single pusher mechanical seal.



- A Pressure transmitter
- B Segmented bushing
- C Orifice plug drain

## Atmospheric side

### Plan 66B

#### Applicable EagleBurgmann seals

##### Category 1

**Configuration 1CW-FX:**  
APltex-S

##### Category 2/3

**Configuration 1CW-FL:**  
H75VA4-S, LL9UC, LEK777, SH, LY9SA,  
MBS682, LY9TC

## Plan 66B



EagleBurgmann SPP pressure transmitter

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## Features

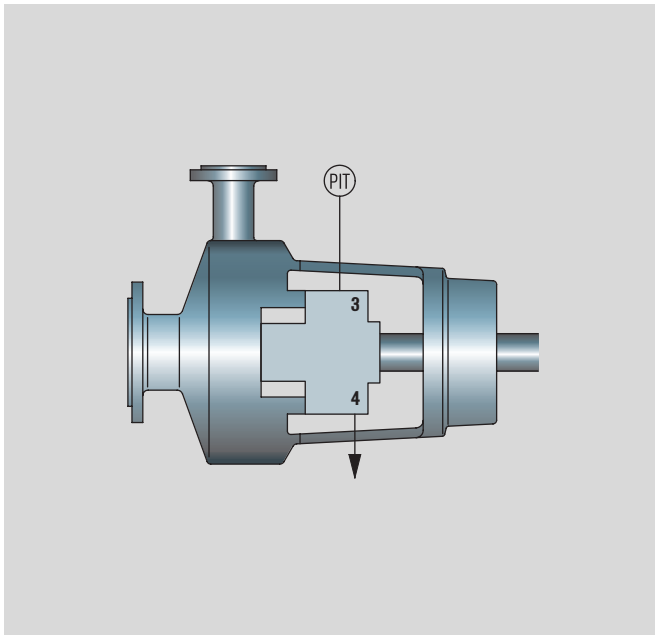
- Utilizes an orifice plug to limit the amount of leakage leaving the seal gland.
- Normal leakage continues to flow freely to the drain port.
- Excessive leakage causes a pressure build-up upstream of the orifice plug which subsequently triggers a pressure alarm by the pressure transmitter.

## Application

- Commonly used on horizontal pipeline pumps.

## Remarks, checkpoints

- It must be ensured that the leakage from the drain port is collected and piped to a leakage recovery system.
- Drain connection on the gland must be at the bottom-most position (6 o'clock).
- Media properties to be checked for possible blockage of the orifice plug due to congealing.



## Plan 66B

An orifice plug in the drain port minimizes the seal leakage leaving the seal gland and allows for detection of a seal failure by an alarm of the monitoring pressure transmitter.

### Pump media characteristics

- Low to medium temperature liquids

## Key

- 3 Quench (Q)
- 4 Drain (D)

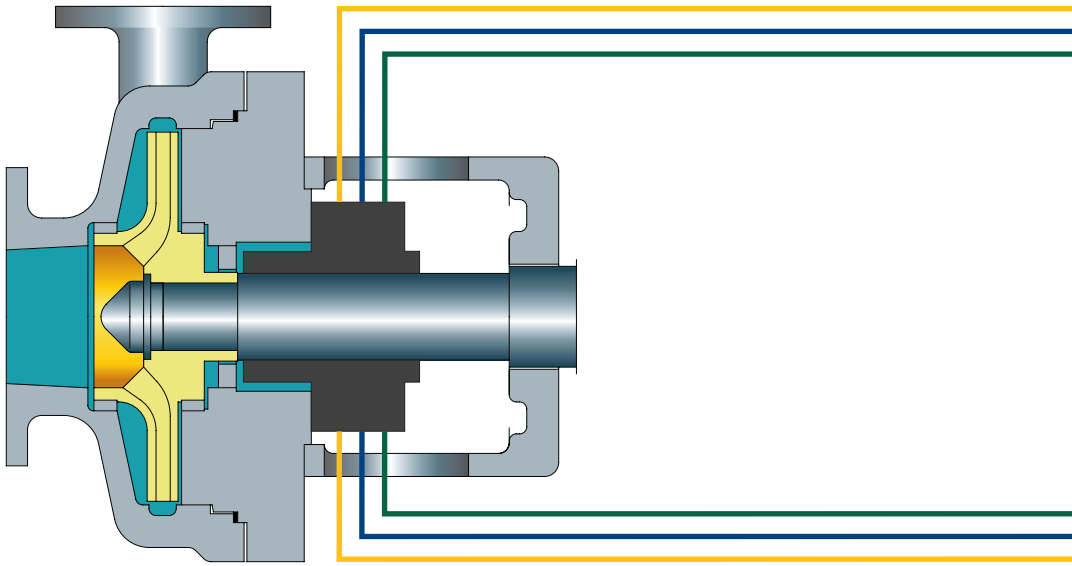
PIT Pressure transmitter with local indicator

## Configurations

1CW-FL, 1CW-FX

## Location, function

- Atmospheric side
- Leakage limiting detection and alarm



**Engineered  
Plan 99**

**Plan 99**

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## Features

- Typically an engineered system – as per API 682 guidelines or at times beyond the scope of the standard.

## Application

- May be applied to any duties – non-hydrocarbons, non-flashing or flashing hydrocarbons.
- May be applied to horizontal as well as vertical pumps.

## Remarks, checkpoints

- This plan always needs detailed engineering as well as detailed discussions between the seal manufacturer and client.

## Pump media characteristics

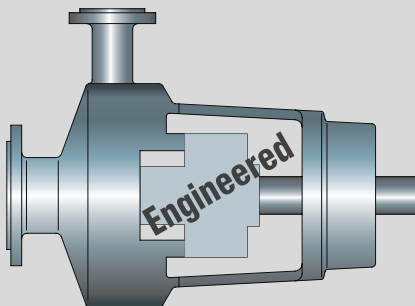
- Depends on the application.

## Configurations

- May be applied to any of the configurations defined in the API 682.

## Location, function

- Depending upon the application, may be applied on the process side or the atmospheric side.
- Depending upon the application the function may be flushing, cooling, lubrication or leakage detection or leakage collection or alarm.



## Plan 99

Engineered piping plan not defined by other existing plans.



API 682 4th edition piping plans

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API 682  
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