Application Note

FESTO

Use of cylinders under Water

Selection and conditions for the use of cylinders under water

Piston Rod-cylinders

100287

Title ..... Use of cylinders under water
Version 1.10
Document number 100287
Original ..... en
Author ..... Festo

Last date saved 08.06.2022

Copyright notice

Legal information

Table of contents

1 Used components

Type/Name
Standard cylinders with piston rod extension
High corrosion protection (R3)
Wiper variant unlubricated operation (A3)
Stainless steel cylinder (CR)

Table 1.1: Used piston rod cylinders

2 Required information

Resistance
Are there any additives in the water, such as chlorine, salt, detergents or other chemicals?
What is the concentration of the additive?
What is the water and ambient temperature?

Application
Is the cylinder permanently under water or only temporarily?
How long is the cylinder under water?
How deep is the cylinder immersed in the water?
Is the cylinder extended or retracted under water?

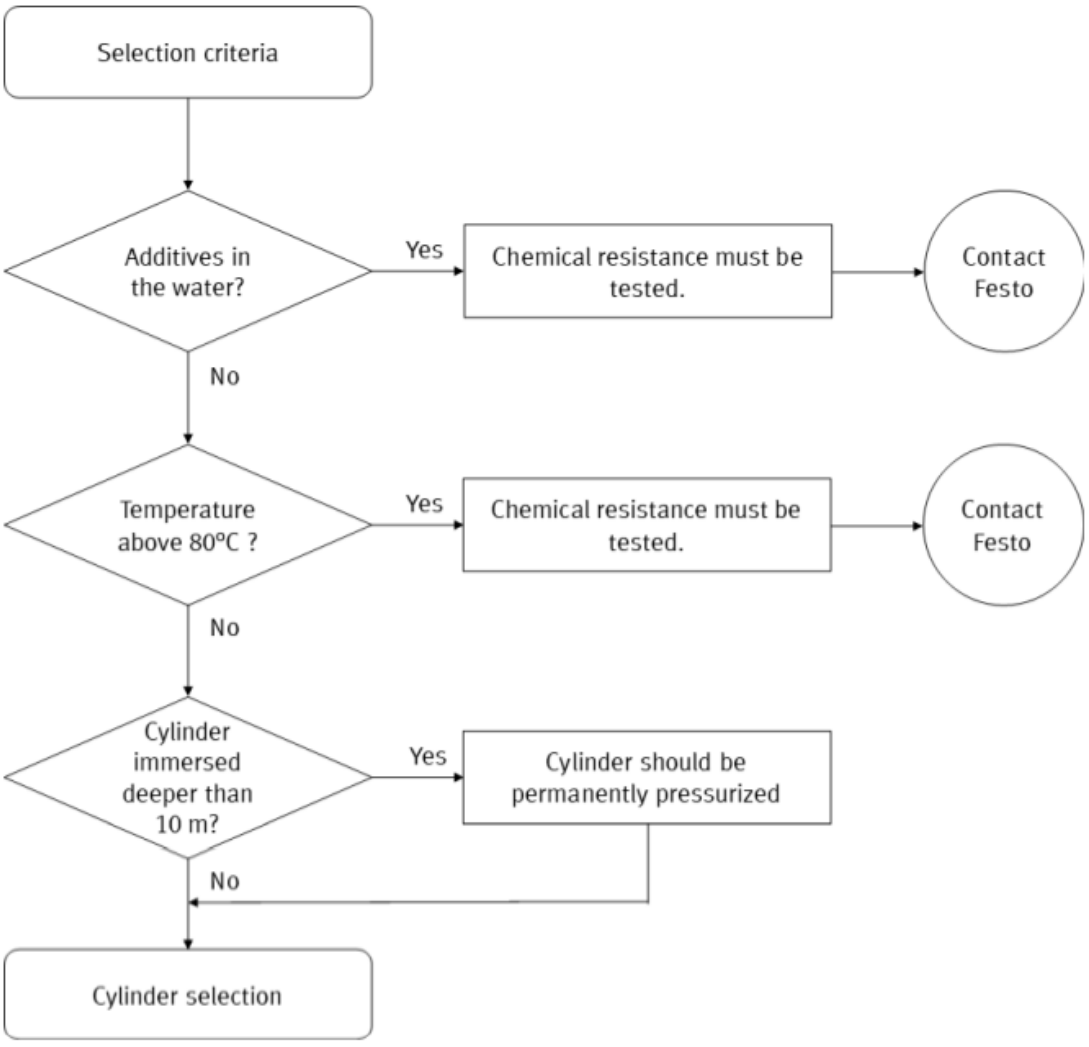

Figure 2.1: Selection Criteria

Figure 2.1: Selection Criteria

3 Application

3.1 Only the piston rod dips into the water

If only the immersion of the piston rod in the water is necessary, a piston rod extension in the length of the stroke could be used.
The advantage is that neither bearings nor seals come into contact with water. The part of the piston rod that enters the cylinder remains dry and the grease is not dissolved by the water.
When designing the cylinder, the piston rod extension must be taken into account according to the following tables.

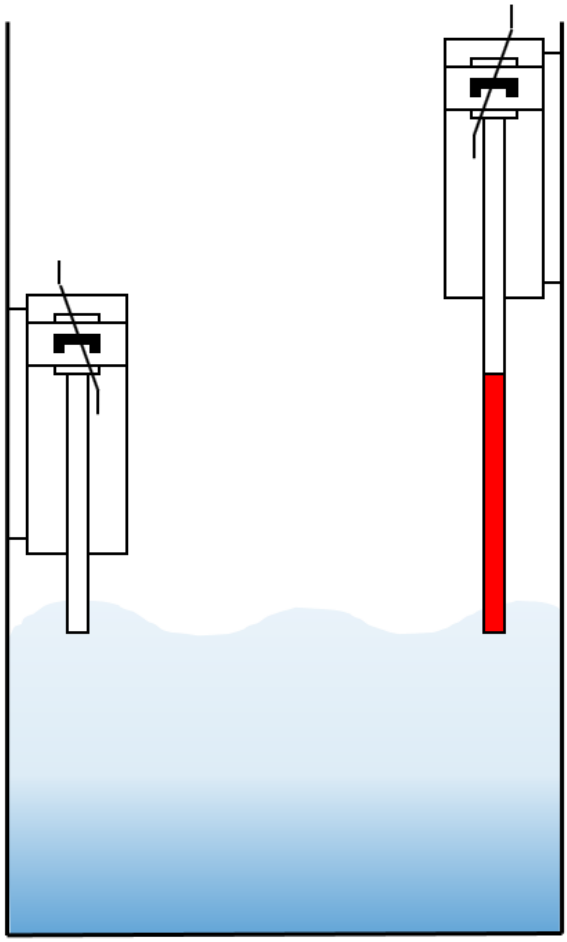

Figure 3.1: Application example with piston rod extension

3.1.1 Rod cylinder with piston rod extension

Type	Piston Ø [mm]	Stroke [mm]	Extension[1] [mm]
Double acting cylinders			
ADN	12 - 25	1 - 300	1 - 300
ADN	32 - 63	1 - 400	1 - 400
ADN	80 - 125	1 - 500	1 - 500
ADN-EL	20 - 25	10 - 300	1 - 300
ADN-EL	32 - 63	10 - 400	1 - 400
ADN-EL	80 - 100	10 - 500	1 - 500
CDC	20 – 25	1 – 300	1 – 300
CDC	32 – 63	1 – 400	1 – 400
CDC	80	1 - 500	1 - 500
DSBC	32 – 125	1 – 2800	1 - 500
DSBG	32 - 320	1 - 2000	1 - 500
DSBF	32 - 125	1 - 2000	1 - 500
DSNU	8 - 10	1 - 100	1 - 50
DSNU	12 - 16	1 - 200	1 - 100
DSNU	20	1 - 320	1 - 110
DSNU	25 - 63	1 - 500	1 - 150

Table 3.1 Double acting rod cylinders with piston rod extension

Type	Piston Ø [mm]	Stroke [mm]	Extension[1] [mm]
Double acting stainless steel cylinders			
CRDSNU	12 - 16	1 - 200	1 - 100
CRDSNU	20	1 - 320	1 - 100
CRDSNU	25	1 - 500	1 - 100

Table 3.2 Double acting stainless steel rod cylinders with piston rod extension

Type	Piston Ø [mm]	Stroke [mm]	Extension[1] [mm]
Single acting cylinders			
AEN	12	1 - 10	1 - 10
AEN	16 - 100	1 - 25	1 - 25
ESNU	8 - 63	1 - 50	1 - 50

Table 3.3 Single acting rod cylinders with piston rod extension

[1] Observe the maximum total stroke length when selecting the piston rod extension in the corresponding documentation.

3.2 Entire cylinder immerses in the water

If it is necessary to immerse the entire cylinder in the water or to operate it under water, it is necessary to select a suitable cylinder considering the operating conditions.
When using cylinders under water, the ingress of water into the cylinder should be avoided. Depending on the application, this can be done by controlling the cylinder, or just by selecting special wipers.

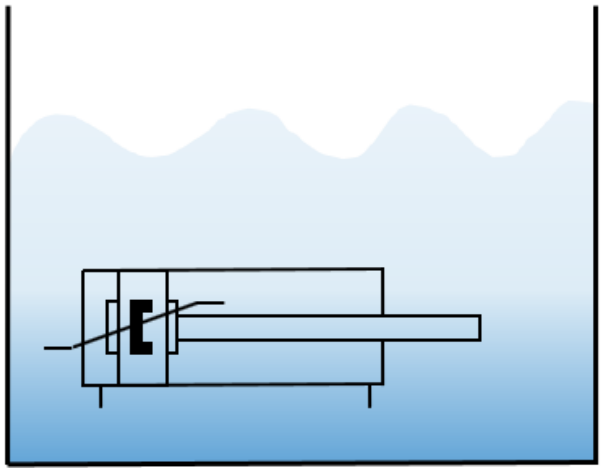

Figure 3.2: Application example cylinder under water

3.2.1 Without movement under water

If the cylinder is only immersed in the water, but not extended or retracted under water, it is sufficient to use a dry-running wiper to prevent the water from penetrating.
The standard wiper is not resistant to hydrolysis, i.e. it dissolves in water, so e.g. a dry-running wiper is recommended.
In addition, a water-resistant grease should be used, e.g. Klüberplex BE 31-222 or Hevolit PE 280-1 FG, as small quantities of water could penetrate via the piston rod.

3.2.2 With movement under water

If the cylinder is moved under water, both special wipers and a suitable control system should be selected to prevent water ingress. In this case it is recommended to operate the cylinder chamber at the bearing cap permanently with low pressure. Example circuits are listed in the chapter “Circuit configuration”.
Here too, a water-resistant grease should be used in addition, e.g. Klüberplex BE 31-222 or Hevolit PE 280-1 FG, as small quantities of water could penetrate via the piston rod.

4 Cylinder selection

Depending on the application and water quality or water additives, the following cylinder variants can be used:
- Standard cylinder with A3 dry-running wiper
- R3-cylinder (high corrosion protection) with Viton (fluorinated rubber) seal
- CR-cylinder (stainless steel) with A3 dry run wiper

Each cylinder variant should be used with water-resistant grease Z-B. Klüberplex BE 31-222 or Hevolit PE 280-1 FG.

4.1 Notes on materials

Scraper:
- The standard wipers, mostly made of NBR or TPE-U(PU) are not resistant to hydrolysis, i.e. they dissolve in water.
- PUR media wiper (P5600) are possible
- FKM (A1; S6/T1/T4 high temperature) are possible
- Dry run (A3) are possible
- NBR hydrolysis resistant (only as CS) are possible

Aluminium:
- The aluminum components become discoloured by deposits. The appearance becomes unsightly, but this has no influence on the function.

Stainless steel:
- Unsuitable for salt water

Grease:
- The standard grease is not water-resistant, therefore use e.g. Klüberplex BE 31-222 or Hevolit PE 280-1 FG.

Additives in water:
- If additives are used, the chemical resistance of our components / materials must be tested.

5 Circuit configuration

The circuits are exemplarily with a DSBG cylinder and VUVS valves.

5.1 Control without overpressure

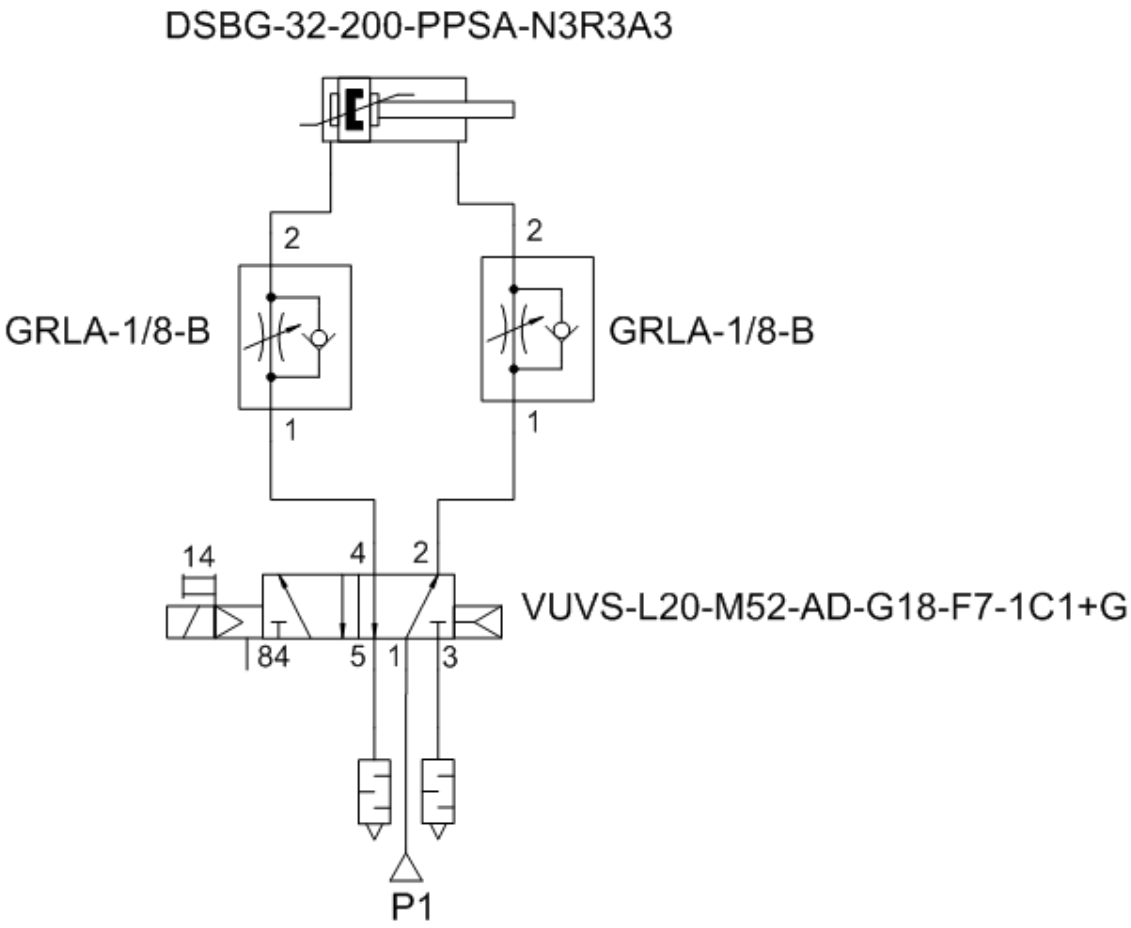

Figure 5.1: Control without overpressure

The cylinder control can be used for applications where the cylinder is and remains under water. When retracted, the cylinder chamber at the bearing cover is already pressurized with air, so no water can penetrate.

5.2 Control with switchable overpressure

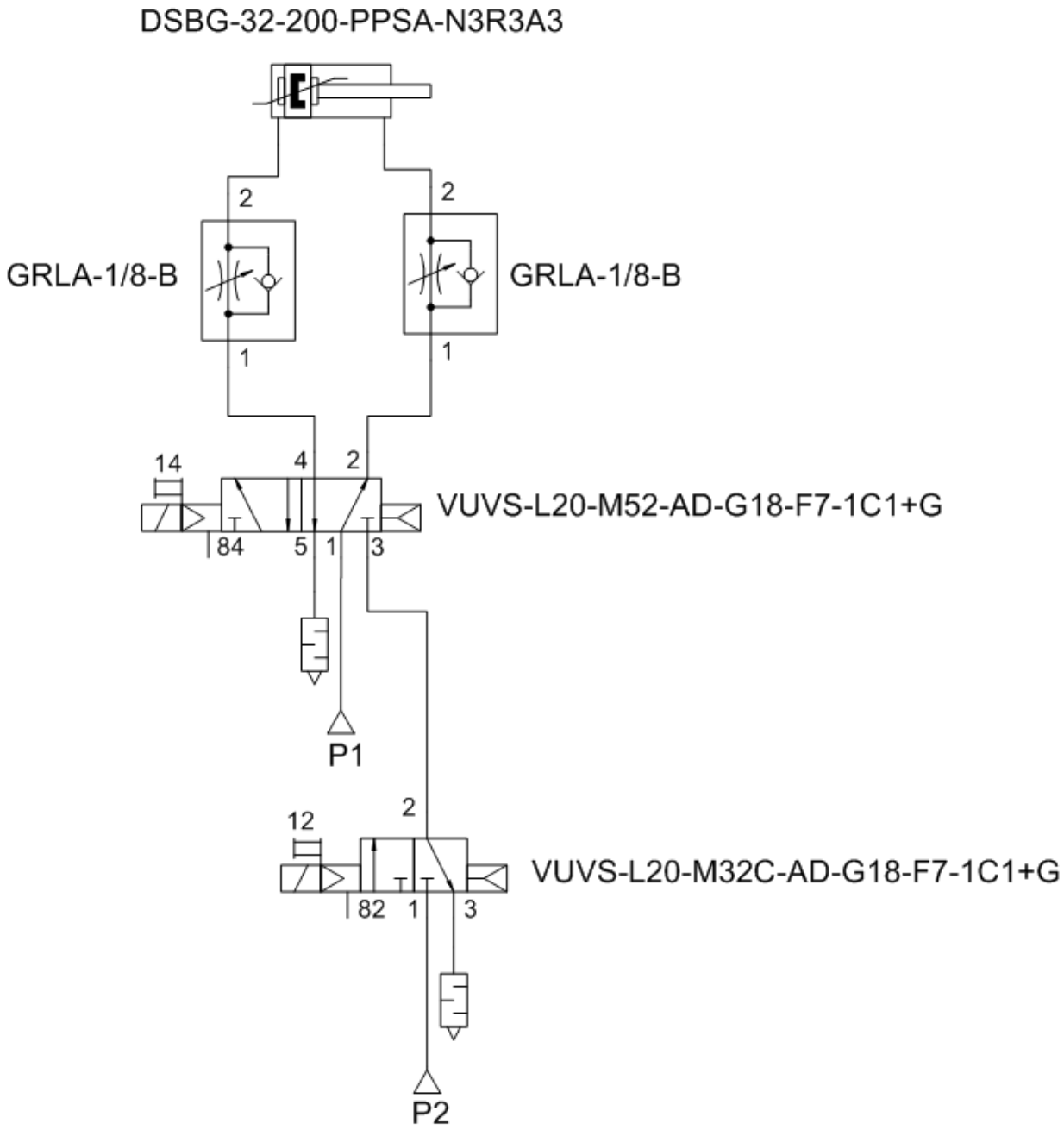

Figure 5.2: Control with switchable overpressure

The cylinder control can be used for applications where the cylinder is and remains extended under water.
The cylinder is extended to the front end position before immersion. When the front end position is reached, the cylinder chamber at the bearing cover is pressurized with a low pressure via the 3/2-way valve, thus preventing water from entering.
On the one hand, the minimum operating pressure of the valve must be observed; lower operating pressures are possible for valves with external pilot air. On the other hand, a counterforce is created by the pressure P2, which must be taken into account when designing the cylinder.

5.3 Control with permanent overpressure

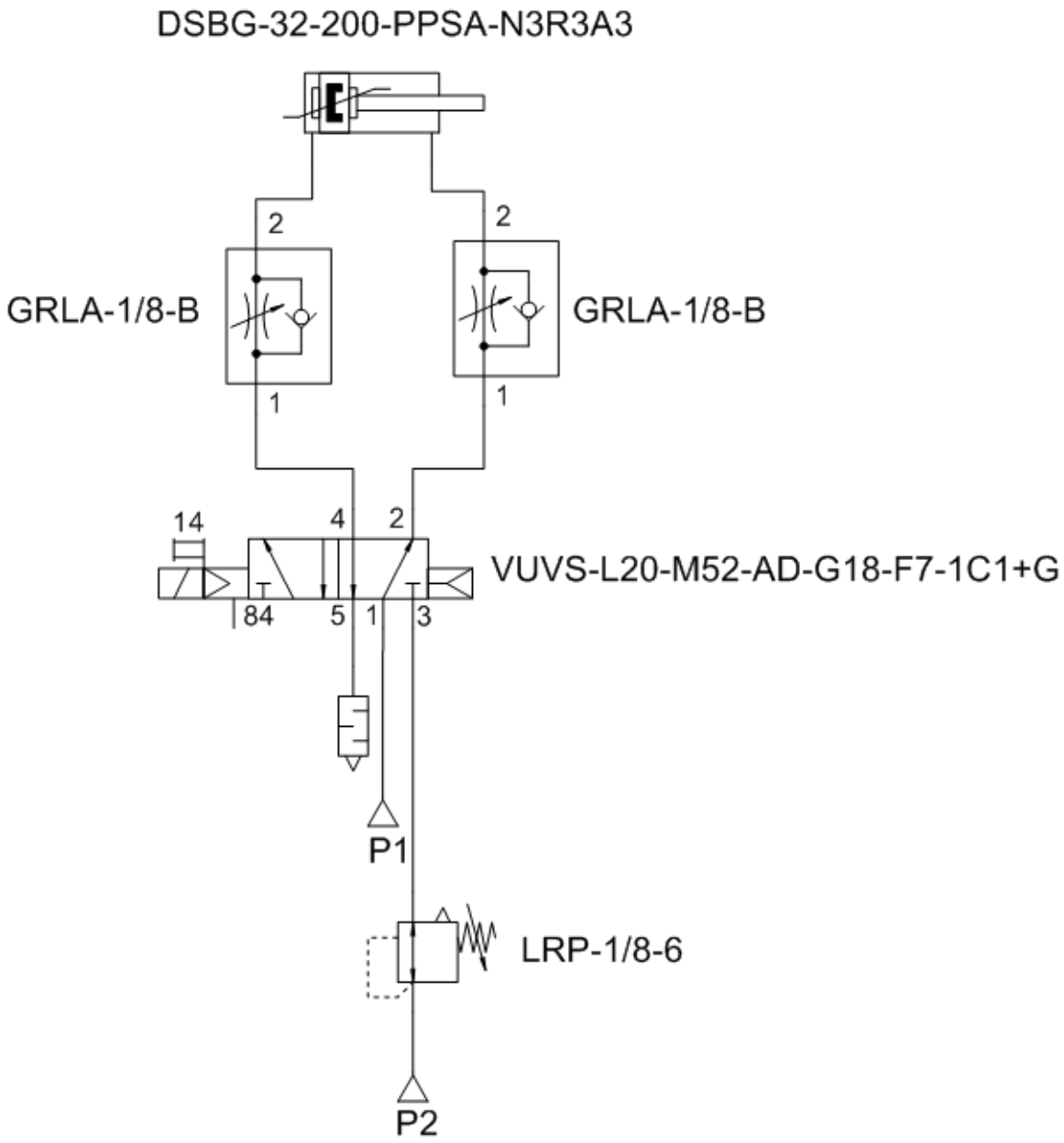

Figure 5.3: Control with permanent overpressure

The cylinder control can be used for applications where the cylinder is extended or retracted under water. Due to the precision pressure control valve, the cylinder chamber at the bearing cap is permanently pressurized and is only vented up to the preset pressure.
The pressure P2 creates a counterforce which must be taken into account when designing the cylinder.