MANNESMANN REXROTH

Variable Vane Pump
Type V4 / Series 2X, 3X and 4X
with controls

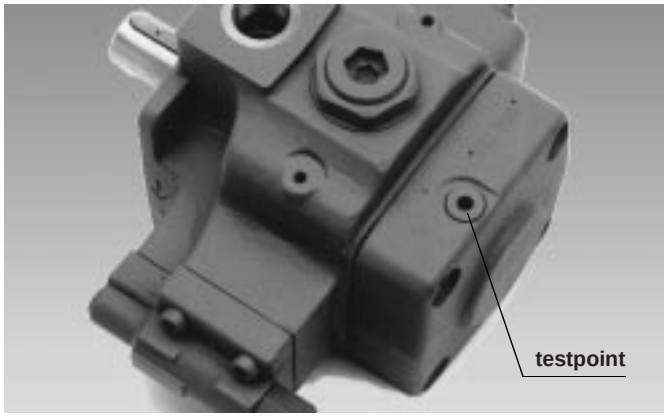
RE 10 460/08.90

Sizes 20 to 125	up to 160 bar	from 20 to125 cm³	Replaces RE 10 459

- variable displacement
- low noise level
- good bearing life by virtue of hydrodynamically lubricated plain bearings
- bronze-coated start and control plates giving good frictional characteristics
- single control device for all sizes (C, D W and E)
- optional control of pressure and flow
- low hysteresis
- very short control times
- high reliability by virtue of automatic bleeding
- test point
- can also be supplied as combination pump

K4752-7
Type V4/20

F90003
Type V4 with lock



F90005
Type V4/Testpoint

K4751-7
Type V4 + V4-Combination

Table of Contents

Functional description, Section, Symbols

Hydraulic pumps type V4 are variable displacement vane pumps.

Construction

They basically consist of the housing (1), the rotor (2), vanes (3), stator ring (4) , pressure regulator (5), setting screw (6), automatic bleed valve (7) and cover (17).

The circular stator ring is held between the small positioning piston (10) and the large positioning piston (11). The third contact point for the ring is the height adjustment screw (13).

The rotor (2) rotates inside the stator ring (4). The vanes within the rotor (3) are pressed against the stator ring (4) by centrifugal force.

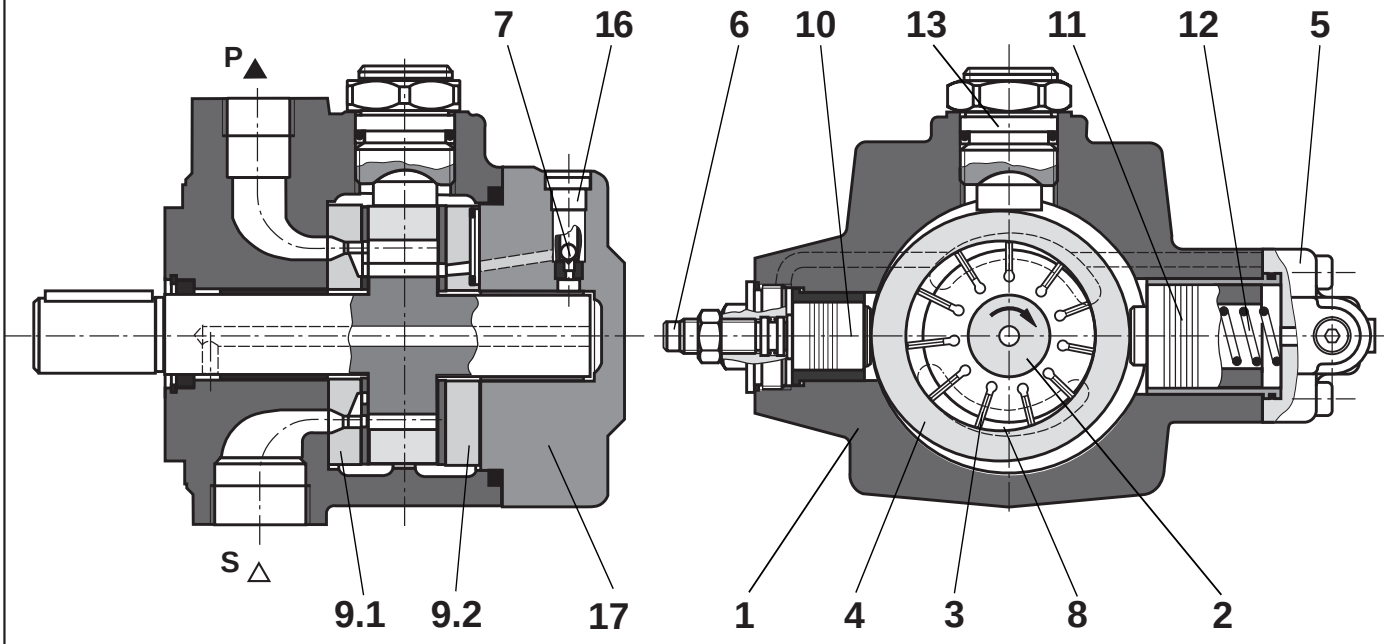
Pressure control

System pressure is fed continuously to the back of the small positioning piston (10) via an internal a channel.

As pressure builds up in the system, oil flows via the drilling in the pressure control spool (14) into the chamber behind piston (11). Pressure behind the large piston (11) then holds the stator ring (4) in the offset position.

At all pressures below the stall pressure set on the pressure controller (5). Control spool (14) is is held down by the spring (15). This causes system pressure to pass to the rear of the large positioning piston (11) holding the the stator ring (4) in the pumping position.

Removal of the plug (16) allows the automatic bleed valve point to be used as a test point.



Suction and pumping process

Chambers (8) required for transportation of the fluid are formed by the vanes (3), the rotor (2), the stator ring (4), the control plate (9.1) and the cover plate (9.2).

To ensure the operation of the pump on start-up the stator ring (4) is held in the eccentric position (maximum displacement position) by spring (12) behind the large positioning piston (11).

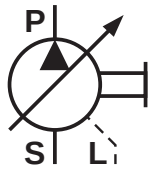
As the rotor rotates, chambers (8) increase in size due to the rotation of the rotor (2) and at the same time fill with fluid via the suction channel (S).

When maximum chamber volume is reached chambers (8) are disconnected from the suction port. As the rotor (2) continues to rotate they are connected to the pressure port, become smaller and pump oil into the system via the pressure channel (P).

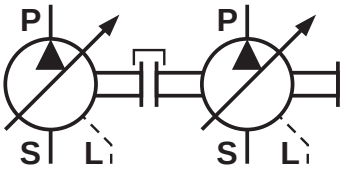
Principal Parts

1	Housing
2	Rotor
3	Vane
4	Stator ring
5	Pressure controller
10	Small positioning piston
11	Large positioning piston
13	Height adjustment screw
17	Cover

Symbols



Single pump



Pump combination

Control

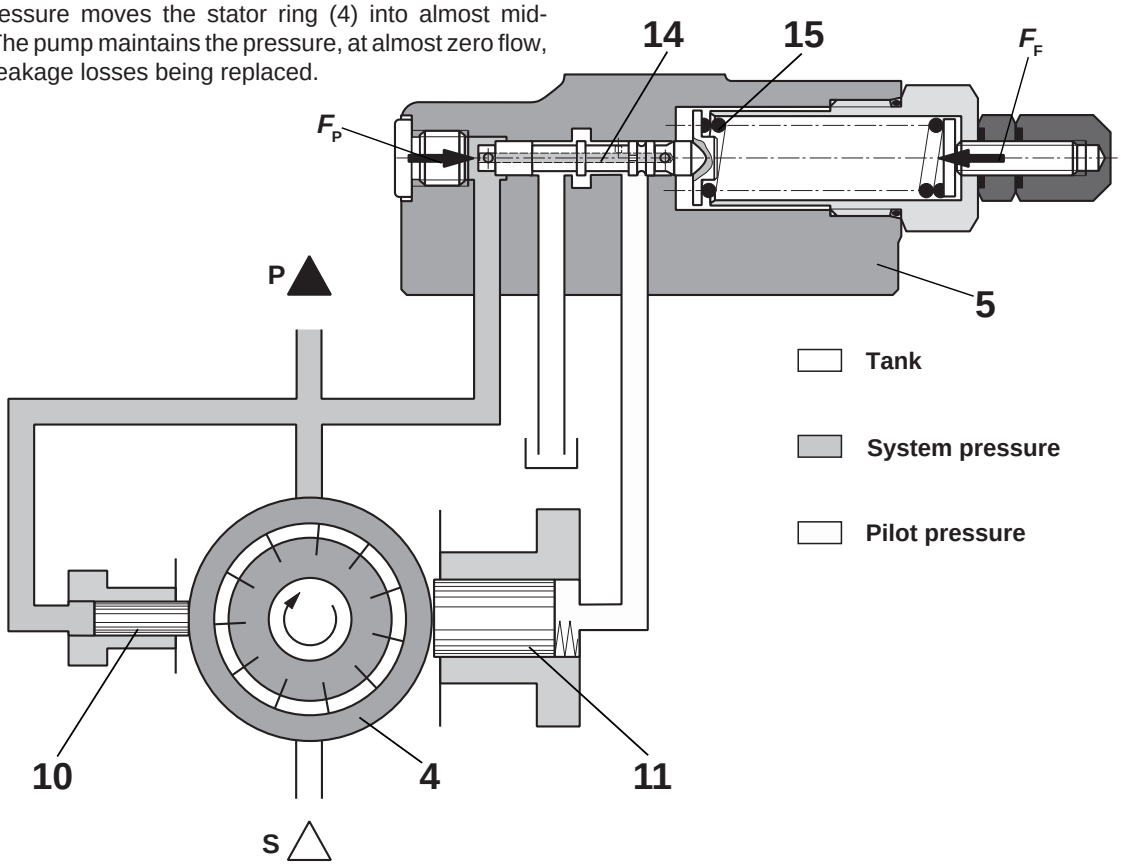
Control (decreasing flow)

If force F_P arising from the product of P(pressure) x A(area) exceeds counter force F_F of the spring, control piston (14) will be moved against the spring (15). In this way the area behind the large positioning piston (11) is connected to tank and is therefore at zero pressure.

The small positioning piston (10) which is constantly under system pressure moves the stator ring (4) into almost mid-position. The pump maintains the pressure, at almost zero flow, with only leakage losses being replaced.

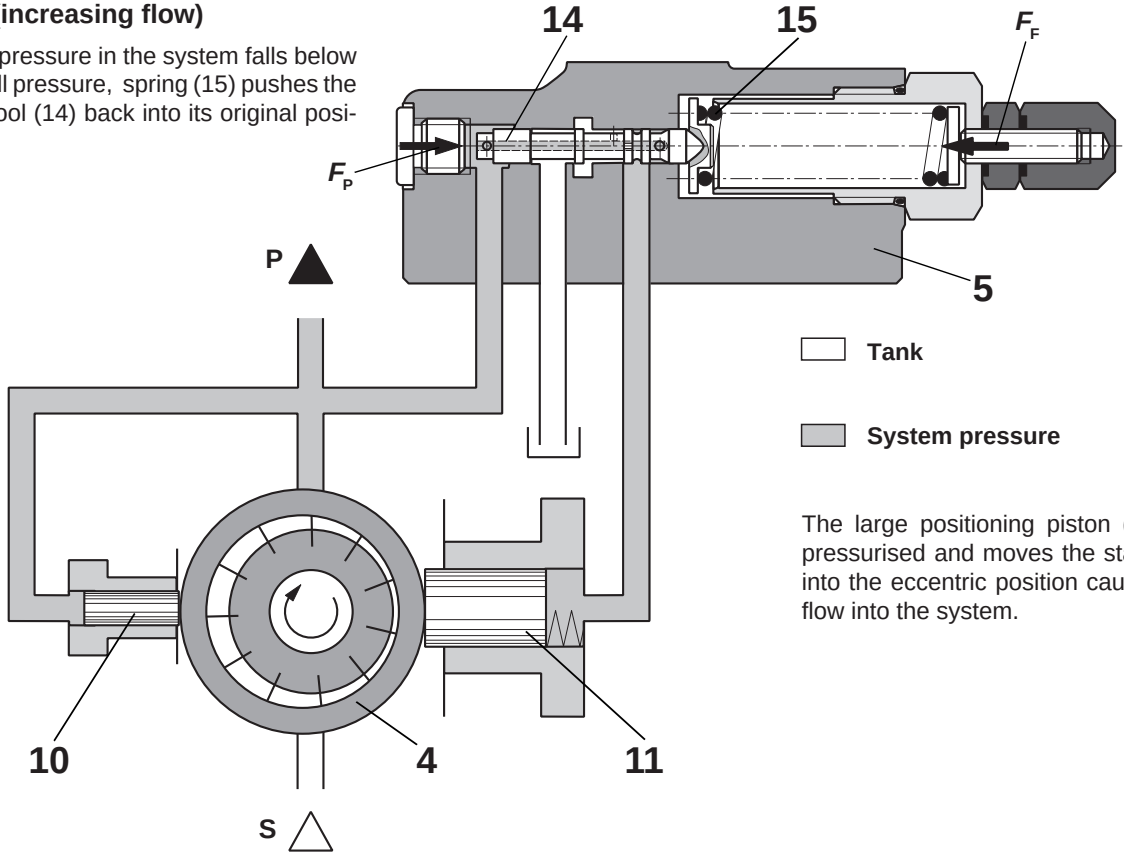
This reaction means that power losses and heating of the fluid are kept at a low level.

As adjustment of the stator ring (4) takes place hydraulically the flow/pressure curve is vertical and moves parallel to the axes of the performance curve as higher pressures are set.



Control (increasing flow)

When the pressure in the system falls below the set stall pressure, spring (15) pushes the control spool (14) back into its original position.



The large positioning piston (11) is now pressurised and moves the stator ring (4) into the eccentric position causing fluid to flow into the system.

Ordering Code, Preferred Types

1 PV 2 V4	–	/	R					–	16		1	*

Series
Series 20 to 29 **= 2X**
Size 20 and Size 50 [1])
(20 to 29, externally interchangeable)
Series 30 to 39 **= 3X**
Size 32 and Size 80 [1])
(30 to 39, externally interchangeable)
Series 40 to 49 **= 4X**
Size 125
(40 to 49, externally interchangeable)

Size / Displacement

	V_{eff}	
Size 20	20,7 cm³	**= 20**
Size 32	34,5 cm³	**= 32**
Size 50	55,2 cm³	**= 50**
Size 80	82,8 cm³	**= 80**
Size 125	127,6 cm³	**= 125**

Direction of rotation
Clockwise **= R**
(viewed on shaft end)

Shaft end
Single pump
Metric, parallel with key **= A**
Combination pumps
Front pump **= E**
Middle pump **= F**
Rear pump **= G**

Connections
Standard model
Size 20, 32, 50: suction and pressure ports: BSP thread **= 01**
Size 80: suction port: SAE flange **= 37**
pressure port: BSP thread;
Size 125: suction and pressure ports: SAE flanges **= 07**
Model with mounting for servo orifice on pressure port
Size 20, 32, 50: suction port: BSP thread **= 27**
Size 80: suction port: SAE flange **= 38**
Size 125: suction port: SAE flange **= 07**

Displacement control
N = without setting screw for displacement control
A = with setting screw for displacement control

Stall pressure range
16 = up to 160 bar
optimum range
40 to 160 bar
Other stall pressure settings
Details in clear text

Control settings
1 = setting screw
3 = [3; 4]) lockable rotary hand knob with scale
5 = [3]) setting screw and K-plate for start at lowest stall pressure (refer page 16)
7 = [3; 4]) lockable rotary handknob with scale and K-plate for start at lowest stall pressure

[2]) **Controls**
C = Pressure control with mechanical pressure setting
D = Pressure control with remote hydraulic pressure setting
W = Pressure control with electrical 2 stage pressure setting
E = Pressure control with electrical remote pressure setting

Seals
M = NBR-seals, suitable for use with mineral oils (HLP) to DIN 51 524 part 2
V = Viton-seals, suitable for use with phosphate-ester (HFD-R)
Please note the data on fluids published in our data sheet RE 07 075

1 = automatic bleed valve

*** =** further details in clear text

[1]) Size 50 from Series 22; Size 80 from Series 32

[2]) for other controllers see page 14

[3]) only available with controls C,D,W or E

[4]) Key (ident. number 008158) included in supply

Sample order

1. Standard pump
1PV2V4-3X/32RA01MC1-16A1
(Flow Q_{max} bei 1450 min^{-1}/10 bar
46,4 L/min; p_{NH} = 160 bar)

1. Pump with settings specified by customers
1PV2V4-3X/80RA37MD1-16A1
Details in clear text:
Q_{max} = 60 L/min p_{NH} = 100 bar
Pump set at required flow and stall pressure values.
Optimum operating noise level set for required stall pressure.

Preferred types = available ex stock

Type	Ordering code
1PV2V4-2X/ 20RA01MC1-16A1	584 653
1PV2V4-3X/ 32RA01MC1-16A1	584 655
1PV2V4-2X/ 50RA01MC1-16A1	585 159
1PV2V4-3X/ 80RA37MC1-16A1	585 039
1PV2V4-4X/125RA07MC1-16A1	584 657

Technical Data (For operation outside these parameters, please consult us!)

General

Construction			Variable vane pump				
Type			V4				
Mounting			Flange mounting				
Connections			Threaded or flanged, dependent on size of unit				
Installation position			Optional, preferrably horizontal (see page 8)				
Shaft loading			Radial and axial forces **cannot** be accepted				
Direction of rotation			Clockwise (viewed on shaft end)				
Speed range	n_{min} bis n_{max}	min^{-1}	900 to 1800				
Size			20	32	50	80	125
Drive power (n = 1450 min^{-1})	P_{eff}	kW	8,5	14,5	23	32	53
Torque	T_{max}	Nm	228	294	510	510	1330
Weight (with pressure control C1)	m	kg	23,5	31	42,8	56	98

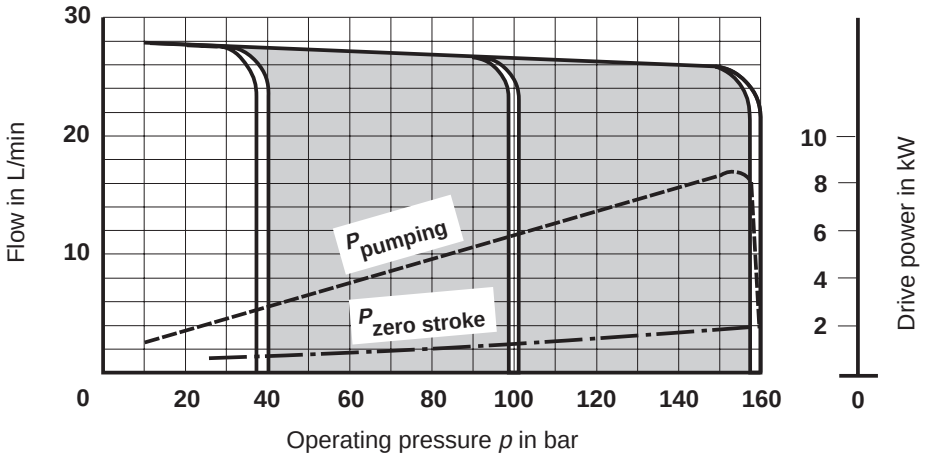
Hydraulic

Size			20	32	50	80	125
Displacement	V_{eff}	cm^3	20,7	34,5	55,2	82,8	127,6
Max. flow (at n = 1450 min^{-1}; p = 10 bar)	Q	L/min	29	46,4	72,5	116	181
Nominal pressure	p_N	bar	160				
Operating pressure (absolute)							
Inlet	p	bar	0,8 to 2,5				
Outlet	p	bar	up to 160				
optimum adjustable stall pressure range	p_{NH}	bar	40 to 160 [1])				
Leakage outlet, max	p	bar	2				
Fluid			HLP-mineral oils to DIN 51 524 part 2 or HM and HV to ISO 6074; phosphate-ester (HFD-R) **Please observe the specifications in our data sheet RE 07 075!**				
Fluid temperature range		°C	–10 to +70 (note permissible viscosity range)				
Viskosity range	ν	mm^2/s	16 to 160 at operating temperature and stall pressure < 63 bar 25 to 160 at operating temperature and stall pressure > 63 bar max. 800 when starting under flow conditions max. 200 when starting at zero flow (stalled)				
Fluid cleanliness			Max. permissible degree of contamination of fluid to NAS 1638 Class 9. We therefore recommend a filter of a minimum retention rate of $\beta_{20} \geq 75$. In order to achieve a longer service life, we recommend fluid cleanliness to NAS 1638 Class 8. For this, we recommend a filter with a minimum retention rate of $\beta_{10} \geq 100$.				

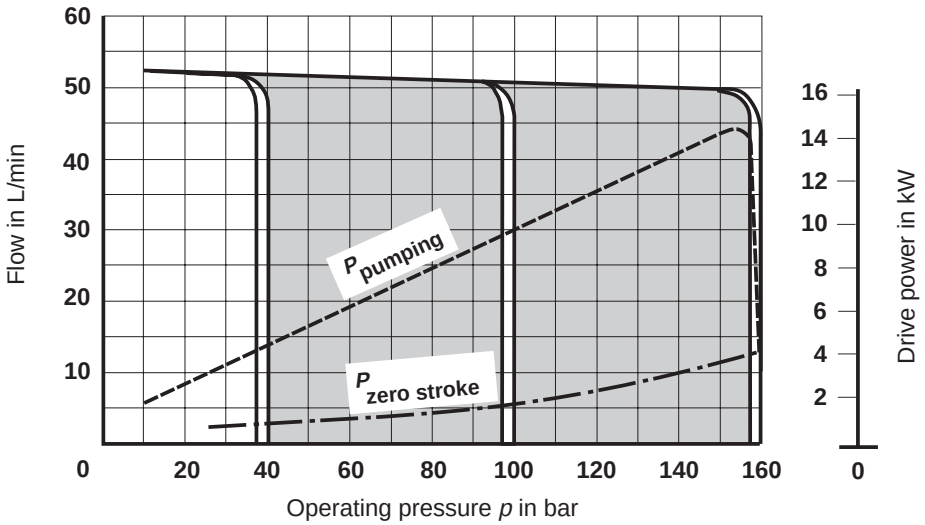
[1]) for stall pressure < 40 bar rquired, please consult us

Operating curves (mean values) measured at n = 1450 min^{-1}, v = 41 mm^2/s and t = 50°C

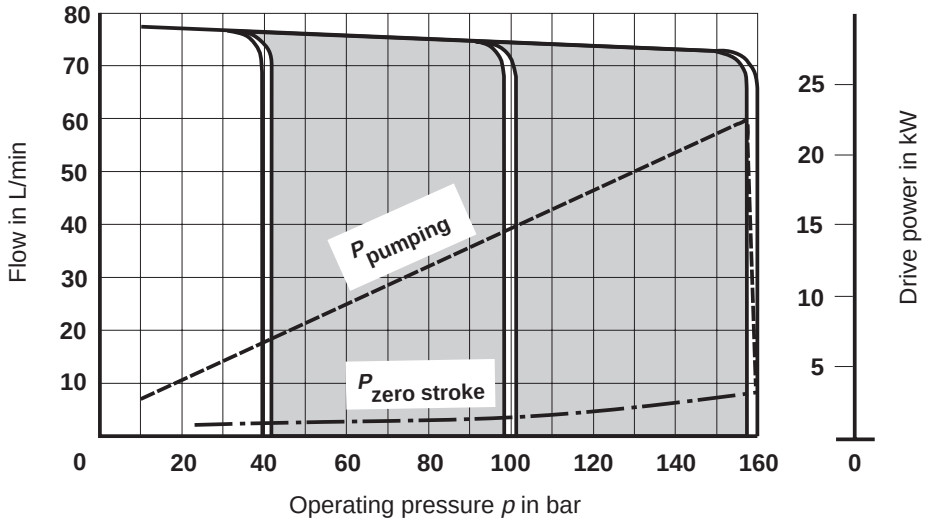
Size 20



Size 32

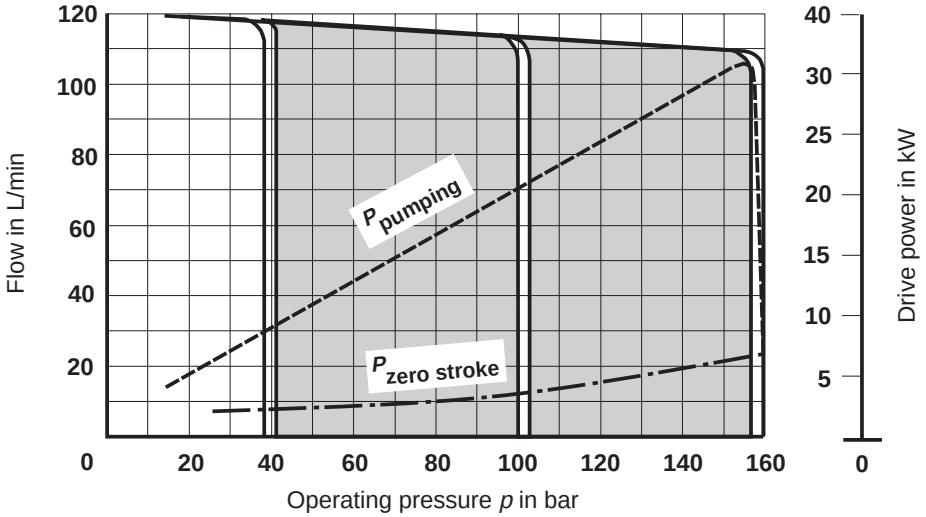


Size 50

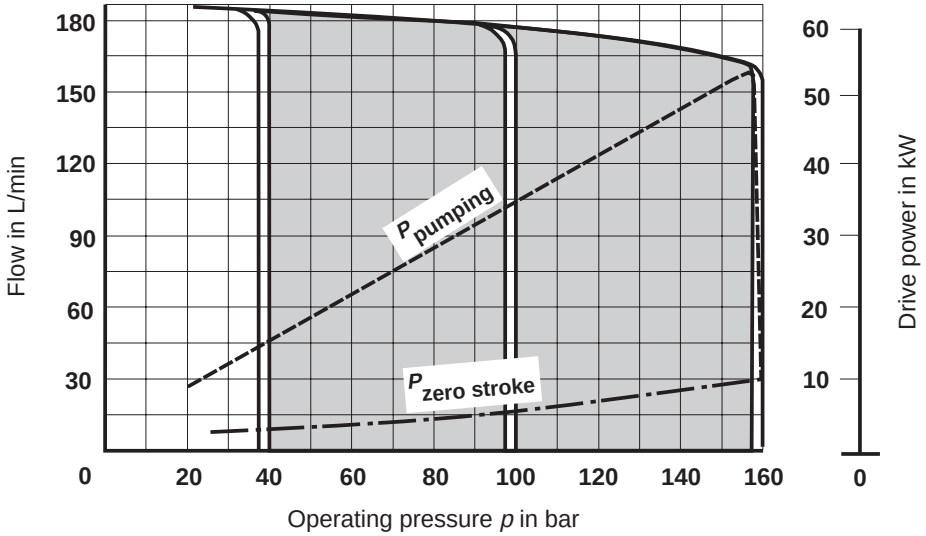


Operating curves (mean values) measured at n = 1450 min^{-1}, v = 41 mm^2/s and t = 50°C

Size 80

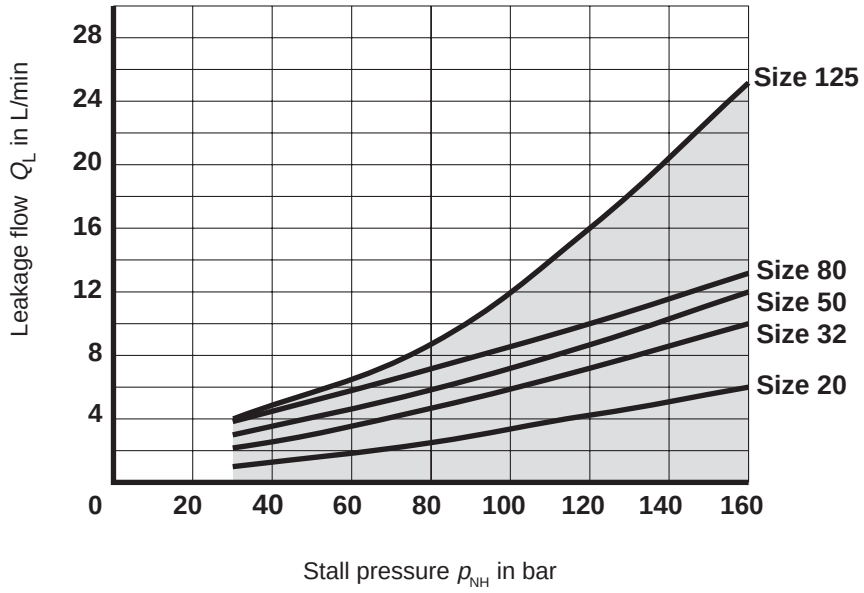


Size 125



Operating curves (mean values) measured at n = 1450 min^{-1}, v = 41 mm^2/s and t = 50°C

Case drain flow Q_L at zero stroke

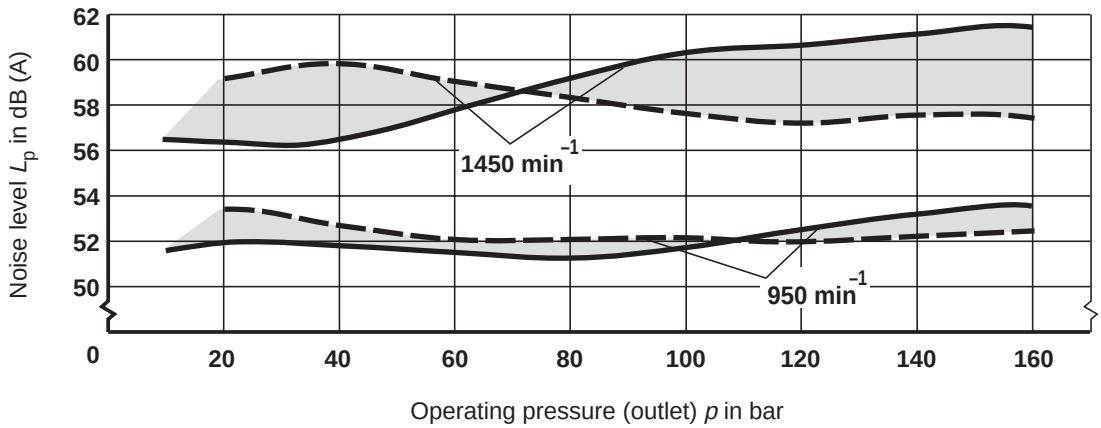


Noise level (mean values) measured at n = 1450 min^{-1}/ 950 min^{-1}, v = 41 mm^2/s und t = 50°C

Noise level measured in an anechoic chamber to DIN 45 635 sheet 1 in dB(A). Distance of microphone to pump = 1 m.
Please note when selecting stall pressure: The setting is made so that the best sound level is achieved at the highest stall pressure required!

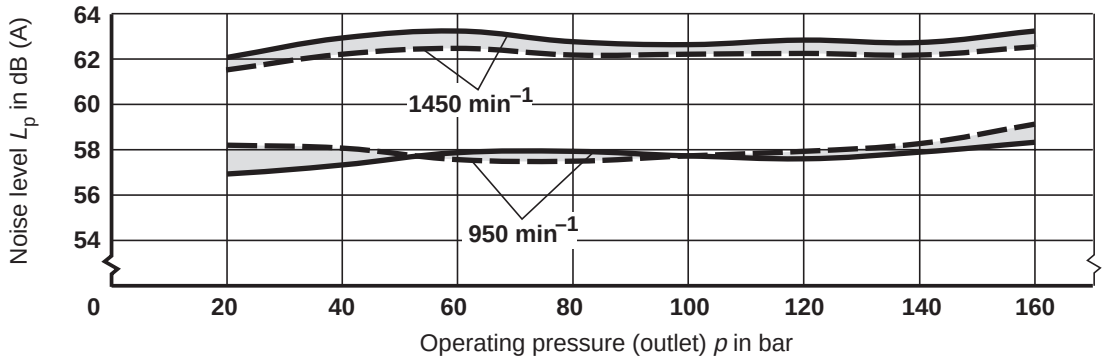
——— Noise level when pumping
– – – Noise level when stalled (set at 160 bar)

Size 20

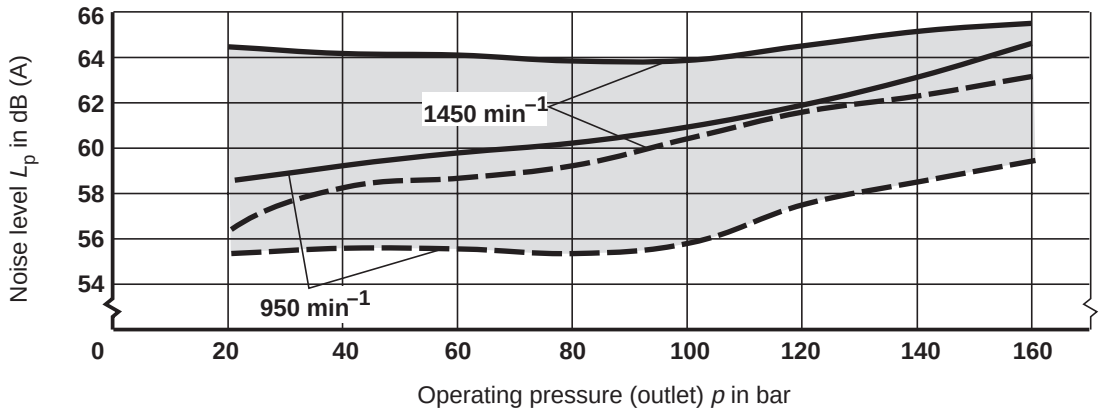


Noise level (mean values) measured at n = 1450 min^{-1}/ 950 min^{-1}, ν = 41 mm^2/s und t = 50°C

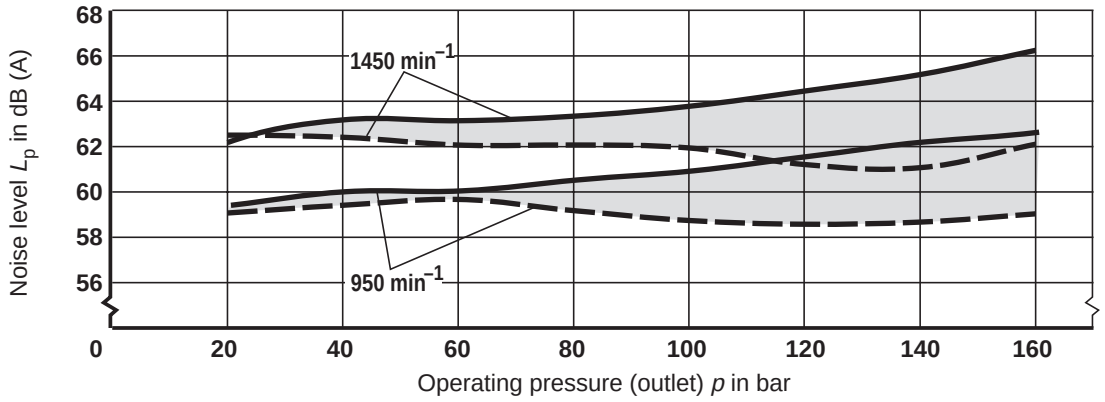
Size 32



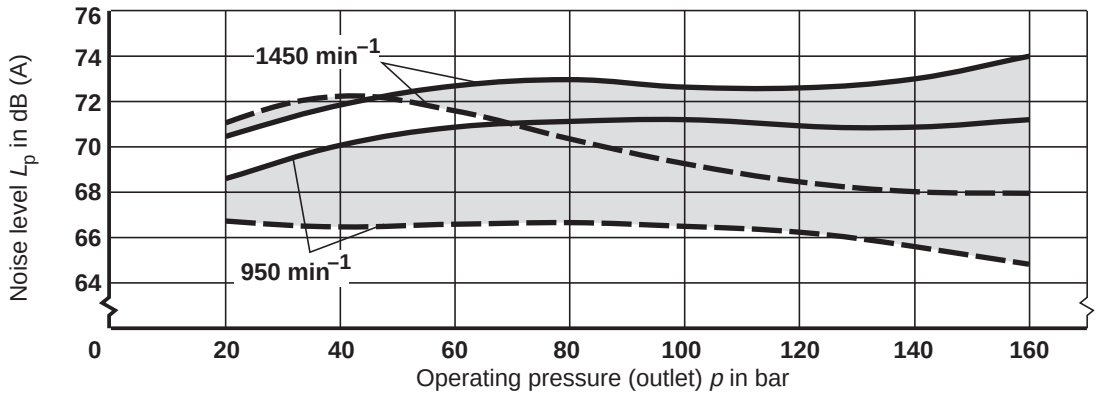
SIze 50



Size 80

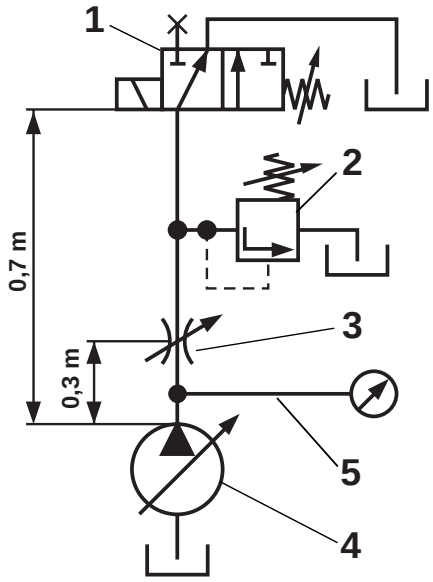


Size 125



Dynamic charcteristics

Test set up



1 Directional valve (duration of operating time 30 ms)

2 Pressure relief valve for limiting pressure peaks
max. permissible pressure:
Size 20 and 32 240 bar
Size 50, 80 and 125 220 bar

3 Throttle for setting pressure when pumping

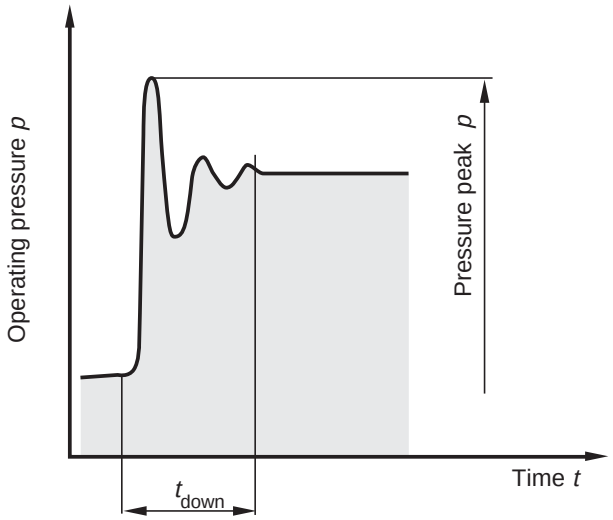
4 Hydraulic pump

5 Pressure measurement point

Dynamic characteristics

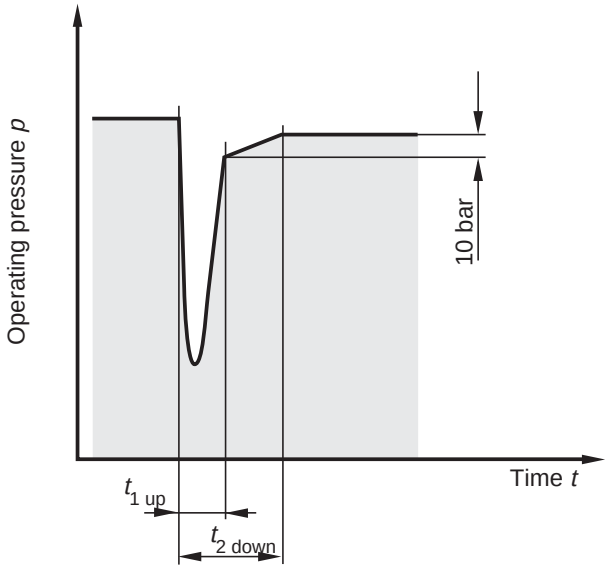
Control towards zero displacement
(C-control)

$Q_{pumping} \rightarrow Q_{zero\ stroke}$



Control towards maximum displacement
(C-control)

$Q_{zero\ stroke} \rightarrow Q_{pumping}$



Control towards zero stroke in ms (average values)

$Q_{pumping} \rightarrow Q_{zero\ stroke}$		at operating pressure	
		20 → 160 bar	**20 → 60 bar**
Time in ms		t_{down}	t_{down}
Size	20	110	120
	32	110	120
	50	110	120
	80	200	200
	125	200	220

Control towards maximum stroke in ms (average values)

$Q_{zero\ stroke} \rightarrow Q_{pumping}$		at operating pressure			
		160 → 150 bar		**60 → 50 bar**	
Time in ms		t_{1up}	$t_{2\ up}$	t_{1up}	$t_{2\ up}$
Size	20	70	100	60	100
	32	70	100	60	100
	50	70	170	70	170
	80	70	170	70	180
	125	70	170	80	210

Installation notes

Installation position

- horizontal preferred

Drive

- no rigid coupling permitted between motor and pump!
- pump and motor shaft ends must be aligned correctly!
- no axial or radial loads are permitted on the pump shaft!

Oil Tank

- The usable volume of the tank must meet requirements.

  CAUTION! The permitted fluid temperature may not be exceeded!

  → Fit cooler if required

Pipes and connections

- cut off at 45 degrees
- for min. clearances see "Suggested piping layout" below

  → Dirt deposits are not sucked up or disturbed.

  → Under no circumstances may the leakage and return flow be sucked up immediately.

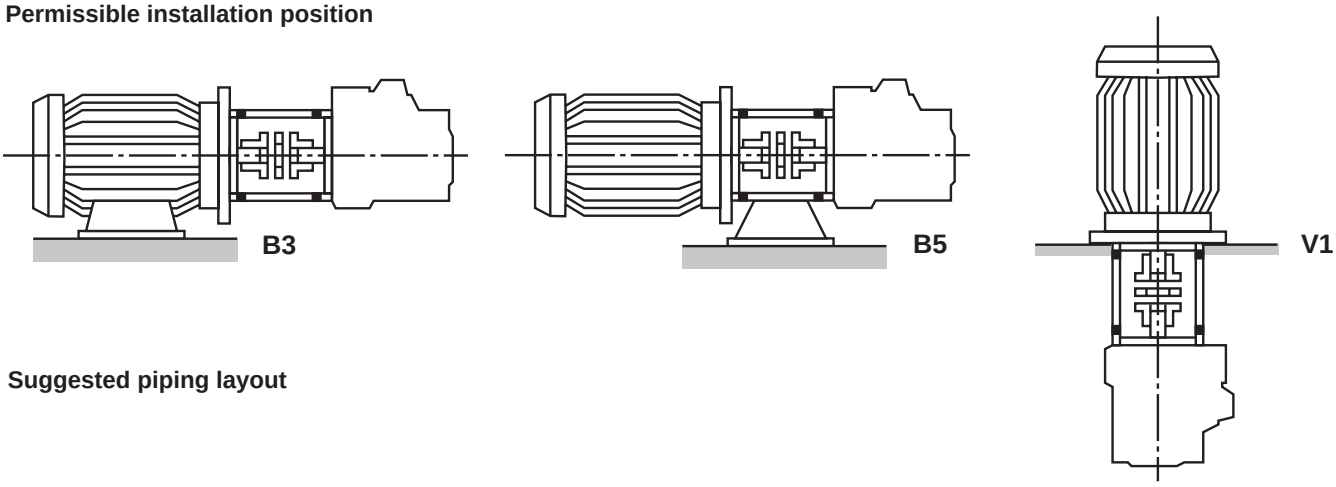
  → Foaming is avoided

  → Fluid temperature is kept low

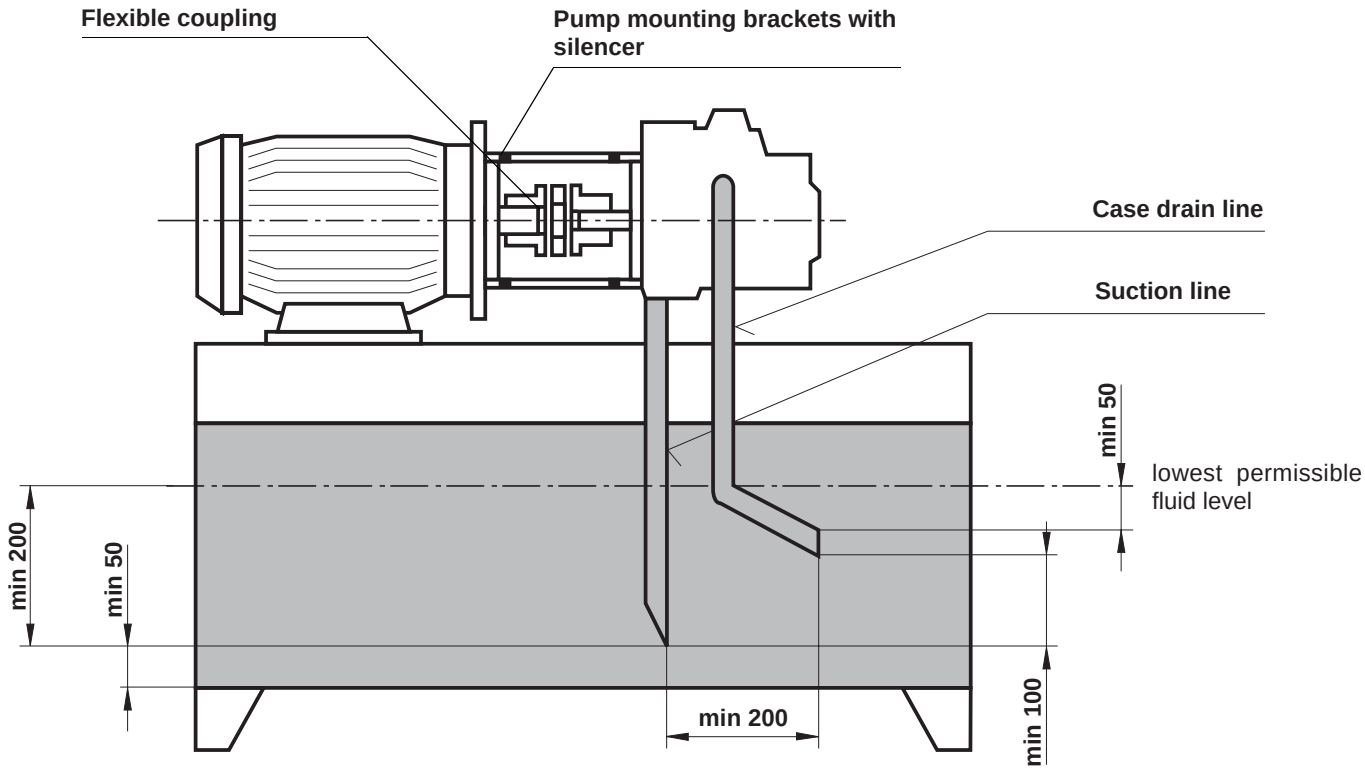
Pump mounting brackets

- See RE 32 110

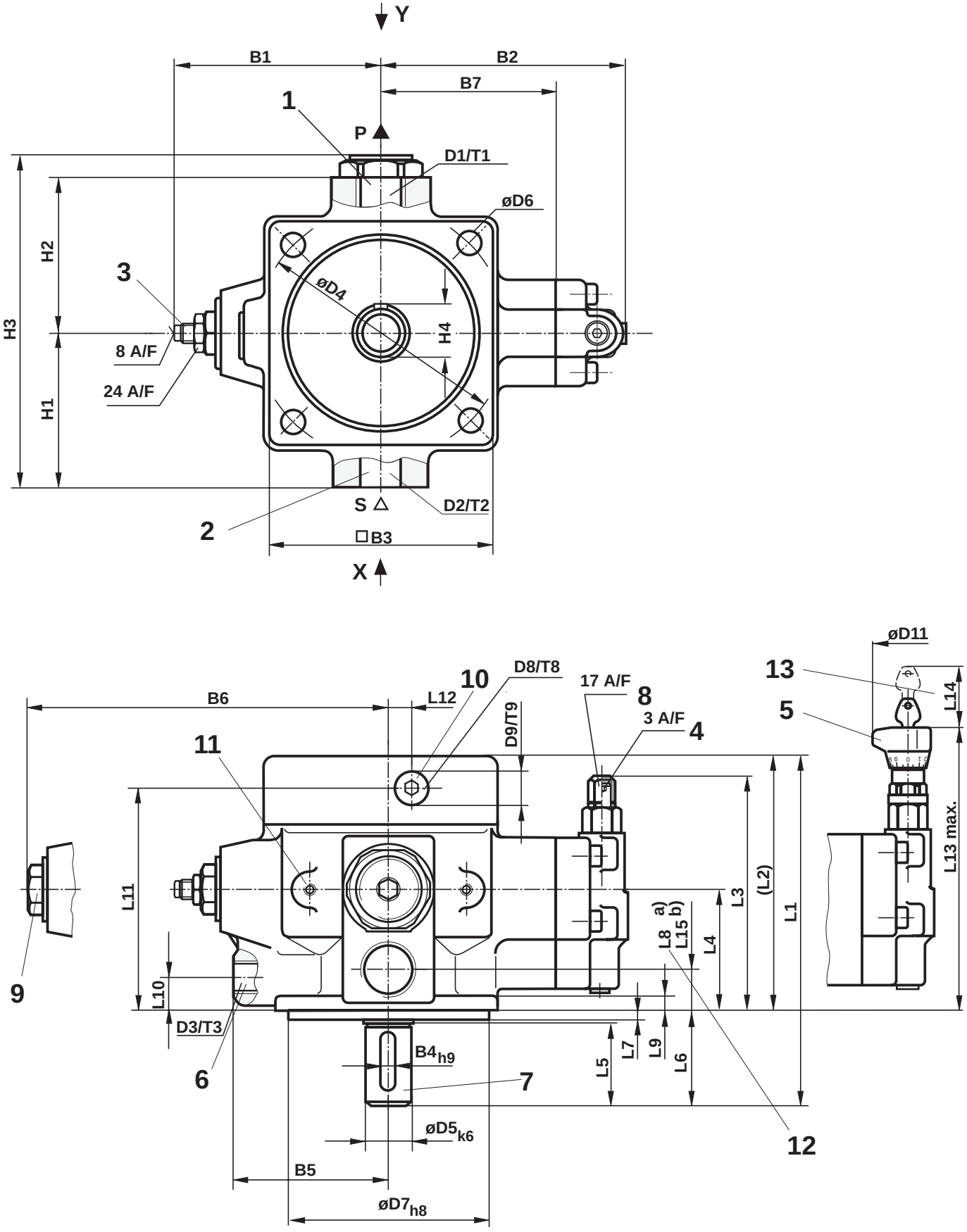
Permissible installation position



Suggested piping layout



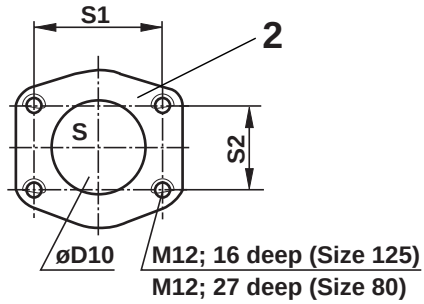
Unit Dimensions *): Pump - all sizes (dimensions in mm)



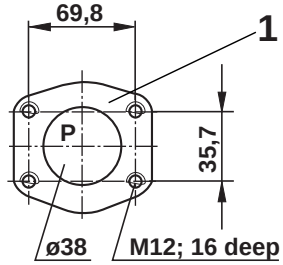
*) shown pump: 1 PV 2 V4-3X/80 RA 37 ... C $\frac{1}{3}$–16 $\frac{A}{N}$1

Unit dimensions: Pump - all sizes (dimensions in mm)

View X
Only size 80, 125



View Y
Only size 125



1 Pressure port

2 Suction port

3 Maximum displacement setting via adjustment screw
Type code ..**A**..
Clockwise rotation:
reduces replacement
Anti-clockwise rotation:
increases displacement

4 Stall pressure setting via adjustment screw mit internal hexagon 3 A/F
Ordering code see controller
Clockwise rotation:
increases set pressure
Anti-clockwise rotation:
reduces set pressure

5 Stall pressure setting via lockable adjustment device
Ordering code see controller
(key: ordering no. 008158)

6 Drain port

7 Drive shaft
(clockwise rotation)

8 Cap nut

9 **without** setting screw for adjusting displacement

10 Gauge port (remove plug)

11 Thread for transport lugs
Size 50: M8; 13 deep
Size 80: M8; 13 deep
Size 125: M10; 18 deep

12 **a)** Pressure line
b) Suction line
(180° opposite)

13 Space required for removal of key

For mounting brackets see RE 32 110

Note:
Unit dimensions for version 1 PV 2 V4–.X/..RA..MC $\frac{1}{3}$–16 $\frac{N}{A}$1

BSP threads to ISO 228/1

Size	B1	B2	□B3	$B4_{h9}$	B5	B6	B7	D1	T1	D2	T2	D3	T3	øD4±0,2	$øD5_{k6}$
V4-2X/**20**	150	151	120	8	100	129	99	1/2" BSP	14	1" BSP	18	3/8" BSP	12	125	28
V4-3X/**32**	157	162	152	10	83	136	110	3/4" BSP	16	1 1/4" BSP	20	3/8" BSP	12	160	32
V4-2X/**50**	163	176	150	10	100	142	124	1" BSP	18	1 1/2" BSP	22	1/2" BSP	14	160	38
V4-3X/**80**	176	182	200	10	108	155	130	1 1/4" BSP	20	2" SAE	–	3/4" BSP	16	200	38
V4-4X/**125**	214	265	224	14	156	193	165	1 1/2" SAE	–	2 1/2" SAE	–	1" BSP	18	250	50

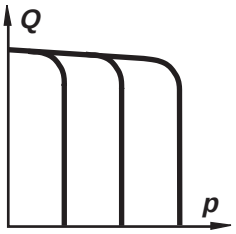
Size	øD6	$øD7_{h8}$	D8	T8	D9	T9	D10	D11	H1	H2	H3	H4	L1	L2	L3
V4-2X/**20**	12	100	1/4" BSP	12	20	2,5	–	60	79	99	184	31	215	163	167,5
V4-3X/**32**	14	125	3/8" BSP	12	23	12,5	–	60	93	108	206	35	237	168,5	171,5
V4-2X/**50**	14	125	3/8" BSP	12	23	4	–	60	92	115	220	41	283	215	193,5
V4-3X/**80**	18	160	3/8" BSP	12	23	8	48	60	109	123	243	41	288	220	199,5
V4-4X/**125**	22	200	3/8" BSP	12	23	7	63	60	118	130	291	53,5	375	282,5	221,5

Size	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	S1	S2
V4-2X/**20**	82	42	52	9	28	11	17	139	16	217	45	28	–	–
V4-3X/**32**	86	58	68,5	10	32	12	21	150	15	220	45	32	–	–
V4-2X/**50**	108	58	68	9	36,5	12,5	23	188	18	243	45	36,5	–	–
V4-3X/**80**	114	57,8	68	9	42,5	16	32	203	18	249	45	52	77,8	42,9
V4-4X/**125**	144	82	92,5	9	57	25	39	239	30	271	45	57	88,9	50,8

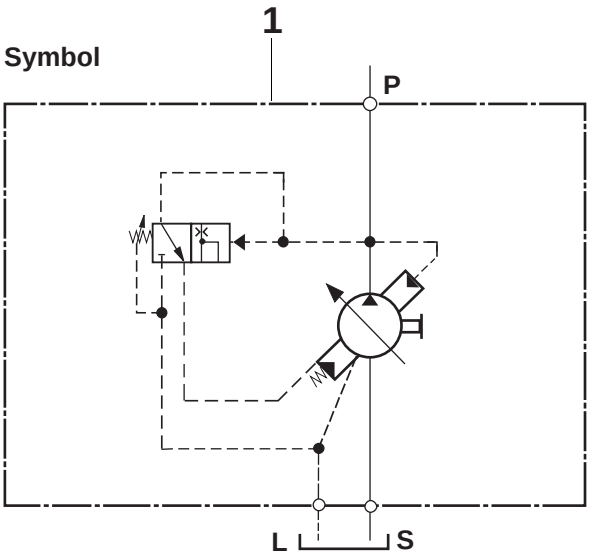
Control programme

C-control

Pressure controller
with manual pressure adjustment
Order code.... **C1** ..
(lockable version
Order code .... **C3** ..)



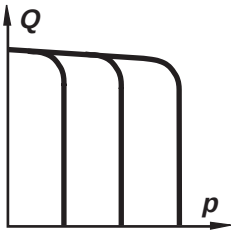
Symbol



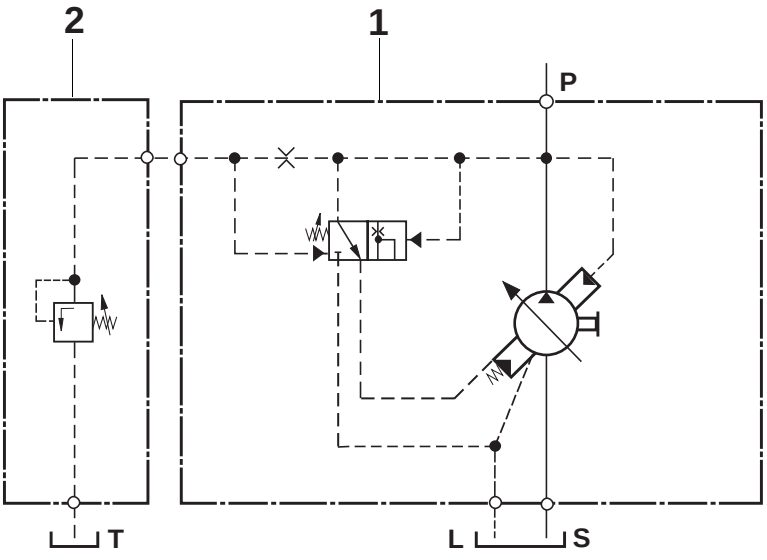
Sample order:
1 Pump: 1 PV2V4–3X/80 RA 37 M**C1**–16A1
or 1 PV2V4–2X/50 RA 01 M**C1**–16A1

D-control

Pressure controller
with hydraulic remote
control adjustment
Order code.... **D1** ..
(lockable version
Order code .... **D3** ..)



Symbol

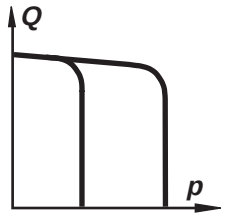


Typical order:
1 Pump: 1 PV2 V4–3X/80 RA 37 M**D1**–16 A1
2 Optional pressure relief valve;
pressure relief valve must be ordered separately.
The remote control line between the controller and the pressure relief valve (2) should be no longer than 2 metres.

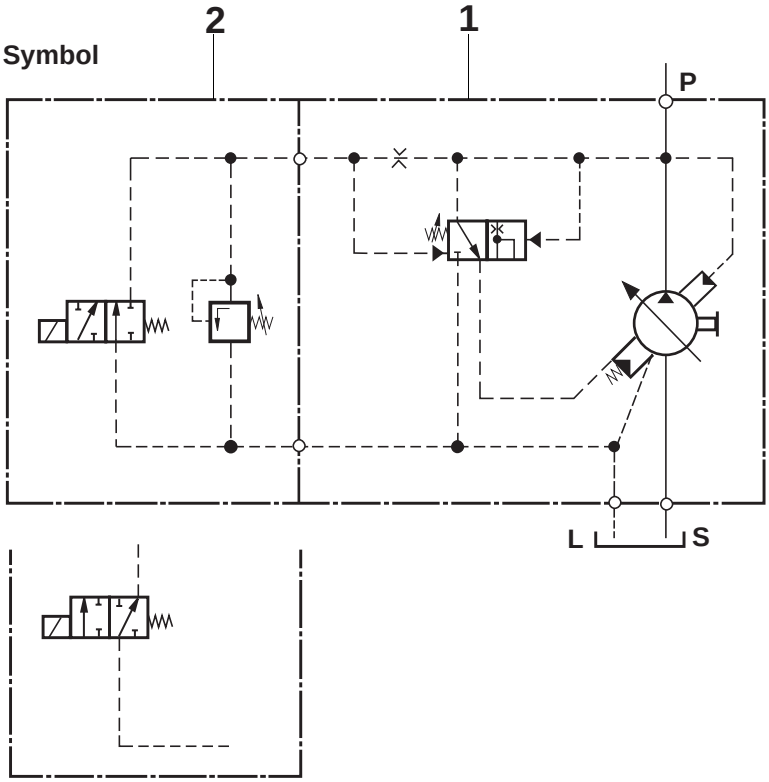
Controller

W-control

Pressure controller
with electrical 2-stage
pressure adjustment
Order code.... **W1** ..
(lockable version
Order code.... **W3** ..)



Symbol



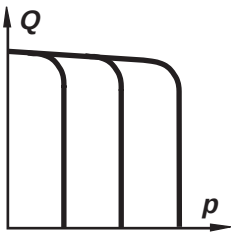
Sample order
1 Pump 1 PV2V4–3X/80 RA 37 M**W1**–16 A1
2 Pressure relief valve fitted to item 1

DBWT $\begin{matrix}A\\B\end{matrix}$ $\begin{matrix}1\\2\text{–}3X/315\ (G24\ NZ4)\ SO\ 206\\3\end{matrix}$

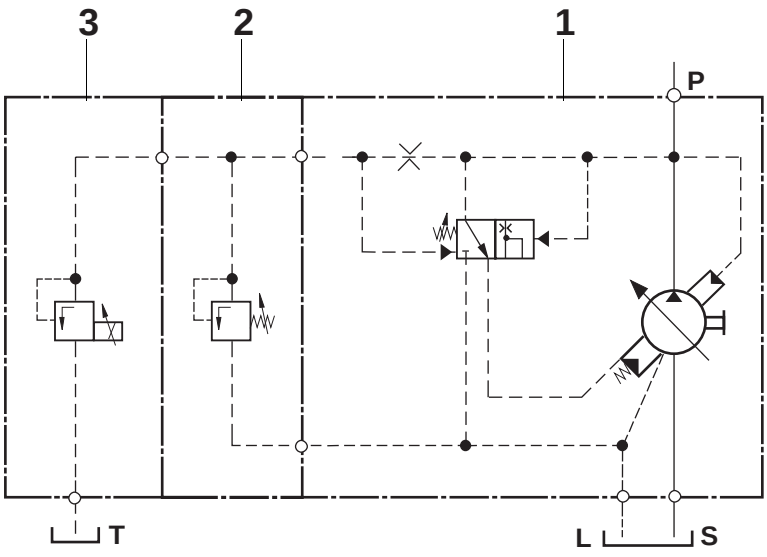
The pressure relief valve DBWT **must** be ordered separately. The unit is supplied completely assembled and tested as a unit.

E-Control

Pressure control
with electrical remote
pressure setting
ordering code.... **E1** ..
(lockable version
ordering code .... **E3** ..)



Symbol



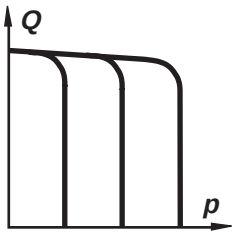
Sample order:
1 Pump: 1 PV2 V4–3X/80 RA 37 ME1–16 A1
2 Pressure relief valve fitted to item 1
DBWT.2–3X/315 SO 206
3 Pressure relief valve fitted to item 2
RS 415–1X/200/1,0/1,0/Y

RS-valve and DBWT **must** be ordered separately. The unit is supplied completely assembled and tested as a unit.
Fluid flowing from valve (3) must be piped separately to tank.

Control programme

K-plate

Sandwich plate
with unloading valve for
starting up at minimum stall pressure
min. stall pressure 25 bar
Order code ... **5** ... [1])
(lockable version
Order code ... **7** ...) [1])
Unit dimensions on request



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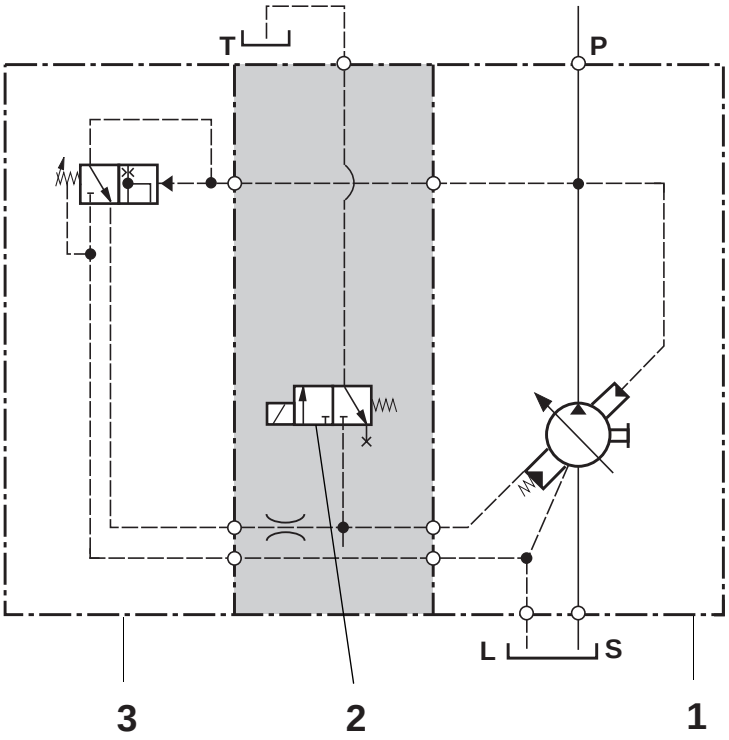


Sample order:

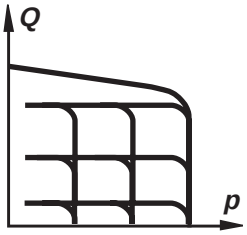
1 Pump 1 PV2 V4–3X/80 RA 37 MC5–16 A1
2 3/2-way directional cartridge valves to RD 23 140; e.g.: Type 3 WE 4 C1XK/AG26Z4
3/2-way directional cartridge valves bust be ordered separately
The unit is supplied completely assembled and tested as a unit.
3 Optional C-, D-, E- or W-control

[1]) only available with C-, D-, E- or W-control

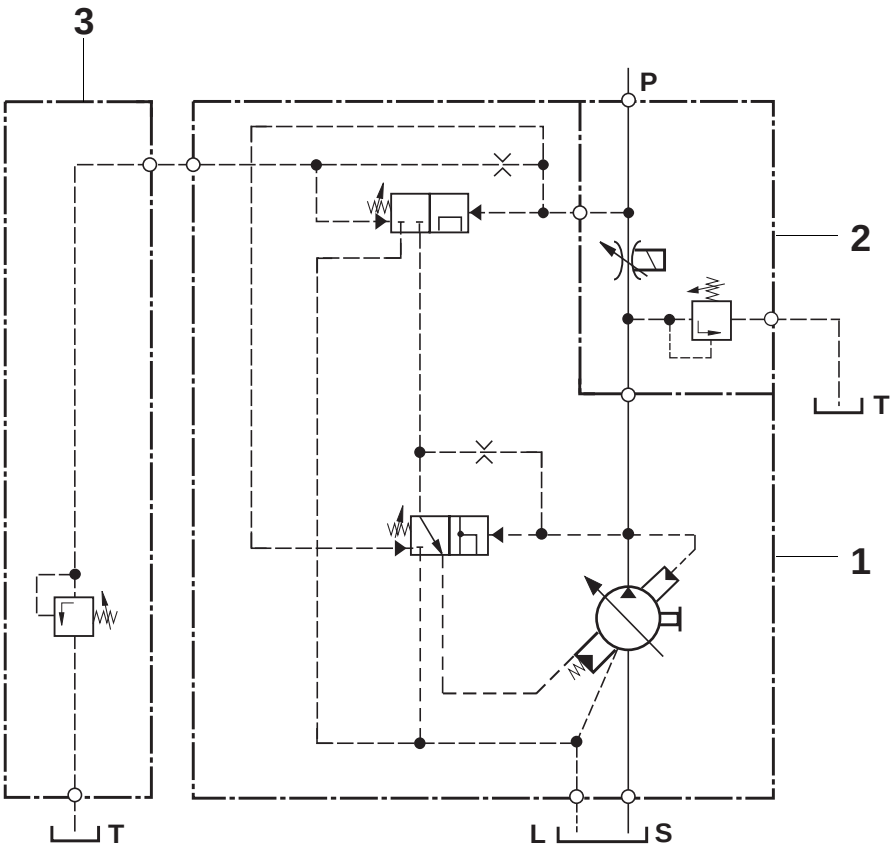
Control programme

U-Control

Flow and pressure control
with electrical control of flow
and hydraulic remote pressure
setting
Order code .... **U1** ..
(lockable version
not available)



Symbol



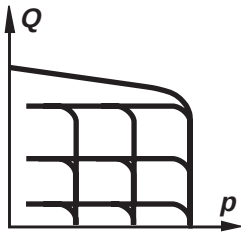
Sample order:
1 Pump 1 PV2V4–3X/80 RA 38 M**U1**–16 A1
2 Servo orifice size 25, order no. 300 745 fitted on item 1
3 Selected pressure relief valve

The servo orifice must be ordered separately.
The unit is supplied completely assembled and tested as a unit.
The pressure relief valve must be ordered separately, but will **not** be fitted and tested together with the unit.
The control line between the control and the pressure relief valve (3) must be piped on site. The T-port of the relief valve (integral with the servo orifice) must be connected to tank.

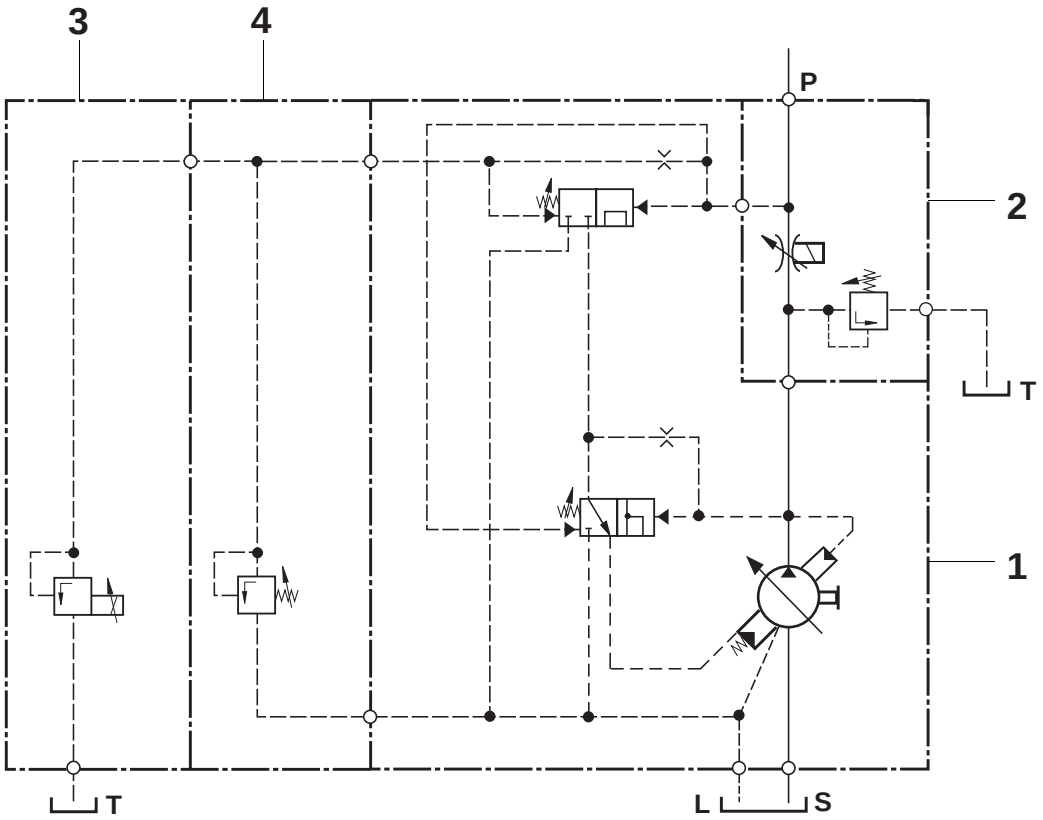
Control programme

F-Control

Flow and pressure control
with electrical remote of flow and pressure
Order code .... **F1** ..
(lockable version **not** available)



Symbol



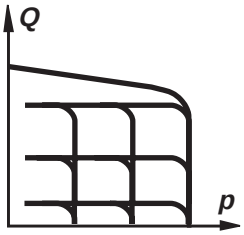
Sample order:
1 Pump 1 PV2V4–3X/80 RA 38 M**F1**–16 A1
2 Servo orifice size 25, order no. 300 745 fitted on item 1
3 Pressure relief valve fitted on item 4; RS 415-1X/200/1,0/1,0/Y
4 Pressure relief valve fitted on item 1; DBWT. 2-3X/315 SO 206

Servo orifice and pressure relief valves RS und DBWT **must** be ordered separately.
The unit is supplied completely assembled and tested as a unit.
The T-connections of items 2 and 3 are to be piped to tank.

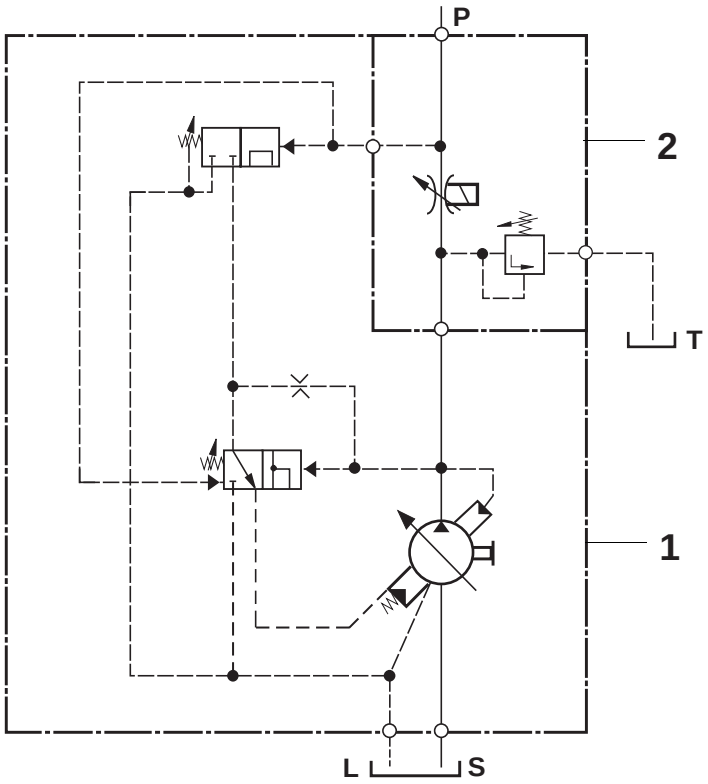
Control programme

V-Control

Flow and pressure control
with electrical setting of flow
and mechanical setting of
pressure
Order code .... **V1** ..
(lockable version
not available)



Symbol



Sample order:
1 Pump: 1 PV2V4–3X/80 RA 38 M**V1**–16 A1
2 Servo orifice size 25, order no. 300 745 fitted on item 1

The servo orifice must be ordered separately.
The unit is supplied completely assembled and tested as a unit.
The T-connection of pressure relief valve (integral with the servo orifice) (2) must be piped separately.

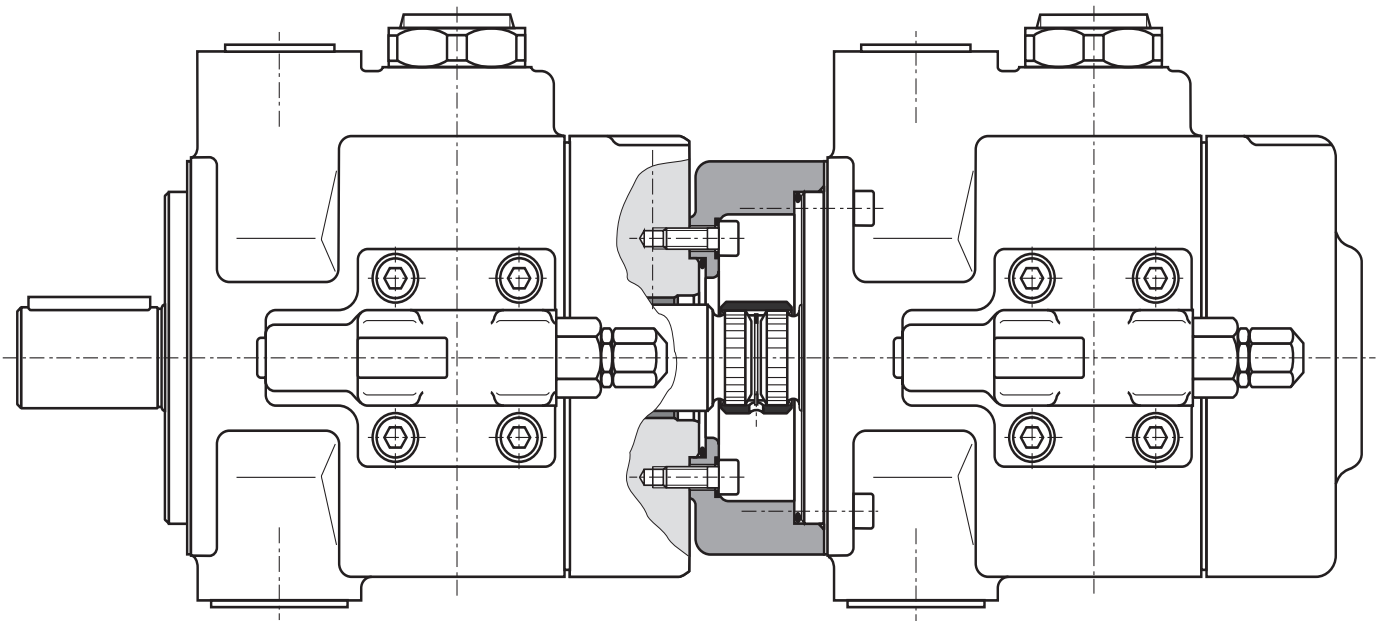
Combination pumps

Combination pumps V4 + V4

Any V4 regardless of size can also be supplied as a double or triple pump. The splined pump shafts are connected by means of a muff coupling (lubricated by internal leakage oil).

Important notes:

- The same general size codes apply as for the single pumps (see pages 5 to 10)
- The individual pumps are separated from each other on the suction side by means of a shaft seal.
  (The pumps may suck from separate tanks).
- Where several V4 pumps are combined the torques may attain unacceptable high levels. The sum of the torques may **not** exceed the permitted values (see page 5).
- The pumps are supplied assembled as one unit.
- Dimensions on request.



1 PV2 V4–.X/..R**E** ....16..1 + 1 PV2 V4–.X/..R**G**....16..1

Note: for triple combination, order code for middle pump 1PV2V4-.X/..R**F**...16..1

Pump combination V4 + other series

V4 + V3 (variable vane pump / with spring compensator – up to 47 cm^3 / up to 100 bar)
V4 + G2 (external gear pump – up to 22 cm^3 / up to 250 bar)
V4 + R4 (radial piston pump – up to 20 cm^3 / up to 700 bar)
Further information on request.

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