

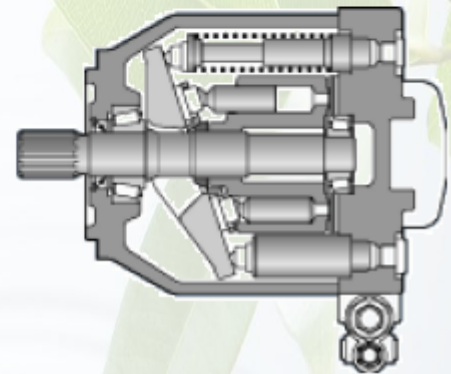
# A10VSO Piston Pumps



- Sizes 18 to 140
- Series 31, 52 & 53
- Nominal pressure 280 Bar
- Maximum pressure 350 Bar
- Open circuit

## FEATURES

- Variable pump in axial piston swashplate design for hydrostatic drives in an open circuit.
- The flow is proportional to the drive speed and the displacement.
- The flow can be steplessly varied by adjustment of the swashplate angle.
- 2 case drain ports
- Excellent suction characteristics
- Low noise level
- Long service life
- Axial and radial load capacity of drive shaft
- Favorable power/weight ratio
- Versatile controller range
- Short control time
- The through drive is suitable for adding gear pumps and axial piston pumps up to the same size, i.e., 100% through drive.



Number	Serie	Displacement	Pressure: Cont./Peak
A10VSO18	31	18 cc/rev.	280 Bar/350 Bar
A10VSO28	31	28 cc/rev.	280 Bar/350 Bar
A10VSO45	31	45 cc/rev.	280 Bar/350 Bar
A10SVO45	52	45 cc/rev.	250 Bar/315 Bar
A10VSO60	53	60 cc/rev.	250 Bar/315 Bar
A10VSO71	31	71 cc/rev.	280 Bar/350 Bar
A10VSO100	31	100 cc/rev.	280 Bar/350 Bar
A10VSO140	31	140 cc/rev.	280 Bar/350 Bar

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# A10VSO Piston Pumps

Control device—flow control	Model
X-T open	DFR
X-T closed	DFR1

## Technical data

### Operating pressure range

#### Pressure at service line port B

Nominal pressure  $p_{nom}$  \_\_\_\_\_ 280 bar absolute

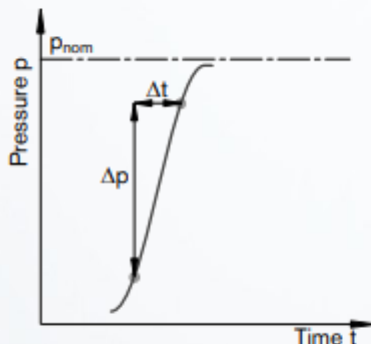
Maximum pressure  $p_{max}$  \_\_\_\_\_ 350 bar absolute

Single operating period \_\_\_\_\_ 2.5 ms

Total operating period \_\_\_\_\_ 300 h

Minimum pressure (high-pressure side) \_\_\_\_\_ 10 bar absolute<sup>1)</sup>

Rate of pressure change  $R_{A\ max}$  \_\_\_\_\_ 16000 bar/s



#### Pressure at suction port S (inlet)

Minimum pressure  $p_{S\ min}$  \_\_\_\_\_ 0.8 bar absolute

Maximum pressure  $p_{S\ max}$  \_\_\_\_\_ 10 bar<sup>1)</sup> absolute

#### Note

Please contact us for values for other hydraulic fluids.

#### Case drain pressure

Maximum permissible case drain pressure (at port L, L<sub>1</sub>):  
Maximum 0.5 bar higher than the inlet pressure at port S,  
however not higher than 2 bar absolute.

$p_{L\ max\ abs}$  \_\_\_\_\_ 2 bar absolute<sup>1)</sup>

<sup>1)</sup> Other values on request

### Definition

#### Nominal pressure $p_{nom}$

The nominal pressure corresponds to the maximum design pressure.

#### Maximum pressure $p_{max}$

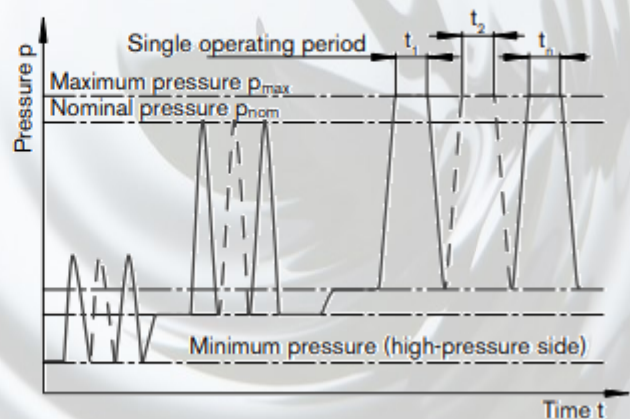
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The total of the single operating periods must not exceed the total operating period.

#### Minimum pressure (high-pressure side)

Minimum pressure in the high-pressure side (port B) that is required in order to prevent damage to the axial piston unit. The minimum pressure depends on the speed and displacement of the axial piston unit.

#### Rate of pressure change $R_A$

Maximum permissible pressure build-up and pressure reduction speed with a pressure change over the entire pressure range.



Total operating period =  $t_1 + t_2 + \dots + t_n$

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# A10VSO Piston Pumps

## Technical data, standard unit

**Table of values** (theoretical values, without efficiencies and tolerances: values rounded)

Size	NG		18	28	45	71	100	140		
Geometrical displacement per revolution										
	$V_g$ max	cm <sup>3</sup>	18	28	45	71	100	140		
Speed <sup>1)</sup>										
	maximum at $V_g$ max	$n_{nom}$	rpm	3300	3000	2600	2200	2000	1800	
	maximum at $V_g < V_g$ max	$n_{max perm}$	rpm	3900	3600	3100	2600	2400	2100	
Flow										
	at $n_{nom}$ and $V_g$ max	$q_v$ max	l/min	59	84	117	156	200	252	
	at $n_E = 1500$ rpm and $V_g$ max	$q_{vE}$ max	l/min	27	42	68	107	150	210	
Power at $\Delta p = 280$ bar										
	at $n_{nom}$ , $V_g$ max	$P_{max}$	kW	30	39	55	73	93	118	
	at $n_E = 1500$ rpm and $V_g$ max	$P_{E max}$	kW	12.6	20	32	50	70	98	
Torque										
	at $V_g$ max and	$\Delta p = 280$ bar	$T_{max}$	Nm	80	125	200	316	445	623
		$\Delta p = 100$ bar	T	Nm	30	45	72	113	159	223
Rotary stiffness, drive shaft										
	S	c	Nm/rad	11087	22317	37500	71884	121142	169537	
	R	c	Nm/rad	14850	26360	41025	76545	-	-	
	P	c	Nm/rad	13158	25656	41232	80627	132335	188406	
Moment of inertial rotary group										
	$J_{TW}$	kgm <sup>2</sup>	0.00093	0.0017	0.0033	0.0083	0.0167	0.0242		
Angular acceleration, maximum <sup>2)</sup>										
	$\alpha$	rad/s <sup>2</sup>	6800	5500	4000	3300	2700	2700		
Filling capacity										
	V	L	0.4	0.7	1.0	1.6	2.2	3.0		
Weight (without through drive) approx. m										
	kg		12	15	21	33	45	60		

1) The values are applicable:

- for an absolute pressure  $p_{abs} = 1$  bar at suction port S
- within the optimum viscosity range from  $\nu_{opt} = 16$  to  $36$  mm<sup>2</sup>/s
- for mineral-oil based hydraulic fluid.

2) The scope of application lies between the minimum necessary and the maximum permissible drive speeds.

- Valid for external excitation (e.g. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2-fold rotary frequency).  
The limiting value is only valid for a single pump.  
The loading capacity of the connecting parts must be taken into account.

### Note

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend to check the loading through tests or calculation / simulation and comparison with the permissible values.

### Determination of size

Flow	$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$	[l/min]	$V_g$ = Displacement per revolution in cm <sup>3</sup>
			$\Delta p$ = Differential pressure in bar
Torque	$T = \frac{V_g \cdot \Delta p}{20 \cdot p \cdot \eta_{mh}}$	[Nm]	n = Speed in rpm
			$\eta_v$ = Volumetric efficiency
Power	$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t}$	[kW]	$\eta_{mh}$ = Mechanical-hydraulic efficiency
			$\eta_t$ = Total efficiency ( $\eta_t = \eta_v \cdot \eta_{mh}$ )

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# A10VSO Piston Pumps

## Technical data, high-speed version

**Table of values** (theoretical values, without efficiencies and tolerances: values rounded)

Size	NG		45	71	100	140		
Geometrical displacement per revolution								
	$V_{g \max}$	cm <sup>3</sup>	45	71	100	140		
Speed <sup>1)</sup>								
	maximum at $V_{g \max}$	$n_{\text{nom}}$	rpm	3000	2550	2300	2050	
	maximum at $V_g < V_{g \max}$	$n_{\text{max perm}}$	rpm	3300	2800	2500	2200	
Flow								
	at $n_{\text{nom}}$ and $V_{g \max}$	$q_{v \max}$	l/min	135	178	230	287	
Power at $\Delta p = 280$ bar								
	at $n_{\text{nom}}$ , $V_{g \max}$	$P_{\max}$	kW	63	83	107	134	
Torque								
	at $V_{g \max}$ and	$\Delta p = 280$ bar	$T_{\max}$	Nm	200	316	445	623
		$\Delta p = 100$ bar	T	Nm	72	113	159	223
Rotary stiffness, drive shaft								
	S	c	Nm/rad	37500	71884	121142	169537	
	R	c	Nm/rad	41025	76545	–	–	
	P	c	Nm/rad	41232	80627	132335	188406	
Moment of inertial rotary group								
		$J_{TW}$	kgm <sup>2</sup>	0.0033	0.0083	0.0167	0.0242	
Angular acceleration, maximum <sup>2)</sup>								
		$\alpha$	rad/s <sup>2</sup>	4000	3300	2700	2700	
Filling capacity								
	V	L		1.0	1.6	2.2	3.0	
Weight (without through drive) approx.								
	m	kg		21	33	45	60	

1) The values are applicable:

- for an absolute pressure  $p_{\text{abs}} = 1$  bar at suction port S
- within the optimum viscosity range from  $v_{\text{opt}} = 16$  to  $36$  mm<sup>2</sup>/s
- for mineral-oil based hydraulic fluid.

2) The scope of application lies between the minimum necessary and the maximum permissible drive speeds.

Valid for external excitation (e.g. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2-fold rotary frequency).

The limiting value is only valid for a single pump.

The loading capacity of the connecting parts must be taken into account.

### Note

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend to check the loading through tests or calculation / simulation and comparison with the permissible values.

Sizes 45, 71, 100 and 140 are optionally available in high-speed version.

External dimensions are not affected by this option.

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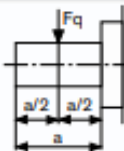
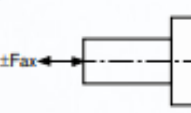
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# A10VSO Piston Pumps

## Technical data

### Permissible radial and axial loading on the drive shaft

Size	NG	18	28	45	71	100	140
Radial force maximum at $a/2$	 $F_{q \max}$ N	350	1200	1500	1900	2300	2800
Axial force maximum	 $\pm F_{ax \max}$ N	700	1000	1500	2400	4000	4800

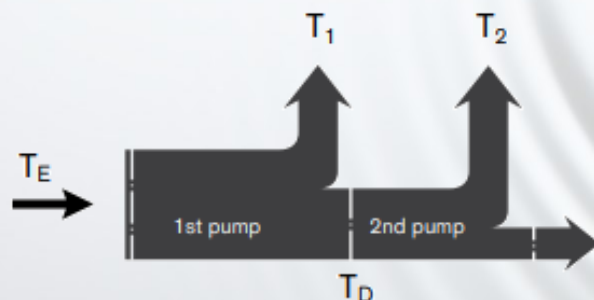
### Permissible input and through-drive torques

Size	NG	18	28	45	71	100	140
Torque at $V_{g \max}$ and $\Delta p = 280 \text{ bar}^1$	$T_{\max}$ Nm	80	125	200	316	445	623
Input torque for drive shaft, maximum <sup>2)</sup>							
S	$T_{E \max}$ Nm	124	198	319	626	1104	1620
	$\emptyset$ in	3/4	7/8	1	1 1/4	1 1/2	1 3/4
R	$T_{E \max}$ Nm	160	250	400	644	–	–
	$\emptyset$ in	3/4	7/8	1	1 1/4	–	–
P	$T_{E \max}$ Nm	88	137	200	439	857	1206
	$\emptyset$ mm	18	22	25	32	40	45
Maximum through-drive torque for drive shaft							
S	$T_{D \max}$ Nm	108	160	319	492	778	1266
R	$T_{D \max}$ Nm	120	176	365	548	–	–
P	$T_{D \max}$ Nm	88	137	200	439	778	1206

1) Without considering efficiency

2) For drive shafts free of radial load

### Distribution of torques



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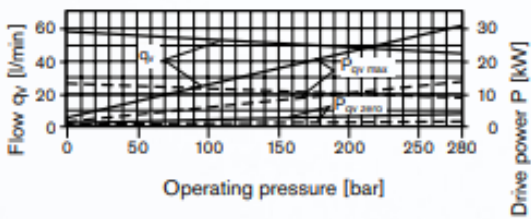
# A10VSO Piston Pumps

## Drive power and flow

Operating material:  
Hydraulic fluid ISO VG 46 DIN 51519,  $t = 50\text{ }^{\circ}\text{C}$

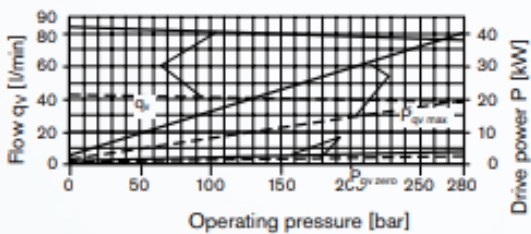
### Size 18

-----  $n = 1500\text{ rpm}$   
\_\_\_\_\_  $n = 3300\text{ rpm}$



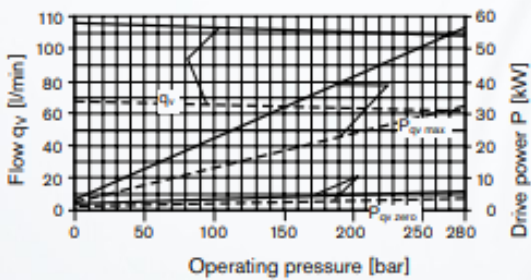
### Size 28

-----  $n = 1500\text{ rpm}$   
\_\_\_\_\_  $n = 3000\text{ rpm}$



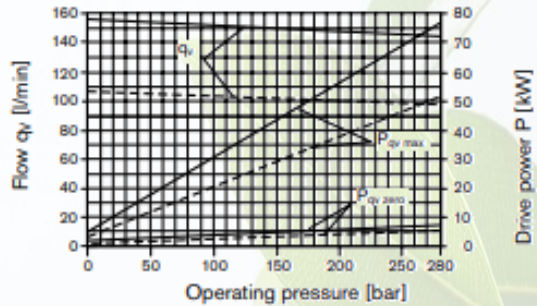
### Size 45

-----  $n = 1500\text{ rpm}$   
\_\_\_\_\_  $n = 2600\text{ rpm}$



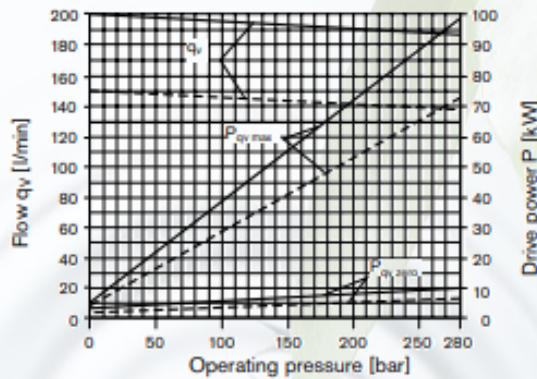
### Size 71

-----  $n = 1500\text{ rpm}$   
\_\_\_\_\_  $n = 2200\text{ rpm}$



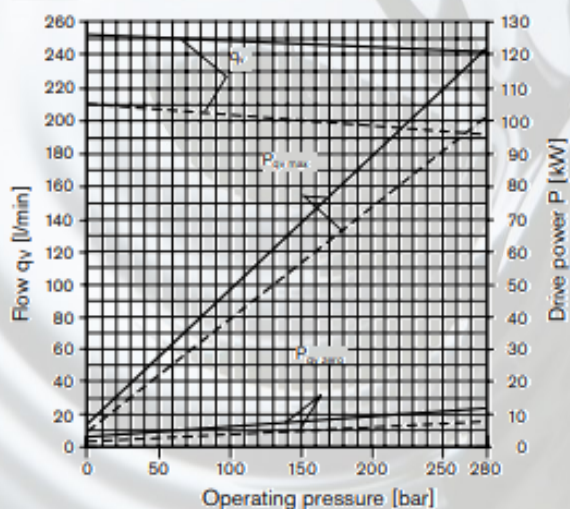
### Size 100

-----  $n = 1500\text{ rpm}$   
\_\_\_\_\_  $n = 2000\text{ rpm}$



### Size 140

-----  $n = 1500\text{ rpm}$   
\_\_\_\_\_  $n = 1800\text{ rpm}$



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# A10VSO Piston Pumps

## DG – Two-point control, directly operated

The variable pump can be set to a minimum swivel angle by connecting an external control pressure to port X.

This will supply control fluid directly to the stroke piston; a minimum control pressure of  $p_{st} \geq 50$  bar is required.

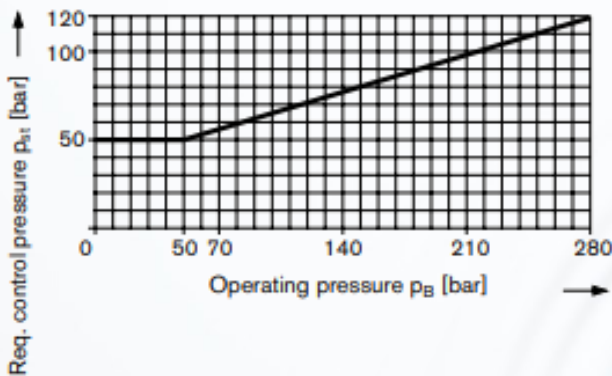
The variable pump can only be switched between  $V_{G \max}$  or  $V_{G \min}$ .

Please note, that the required control pressure at port X is directly dependent on the actual operating pressure  $p_B$  in port B. (See control pressure characteristic).

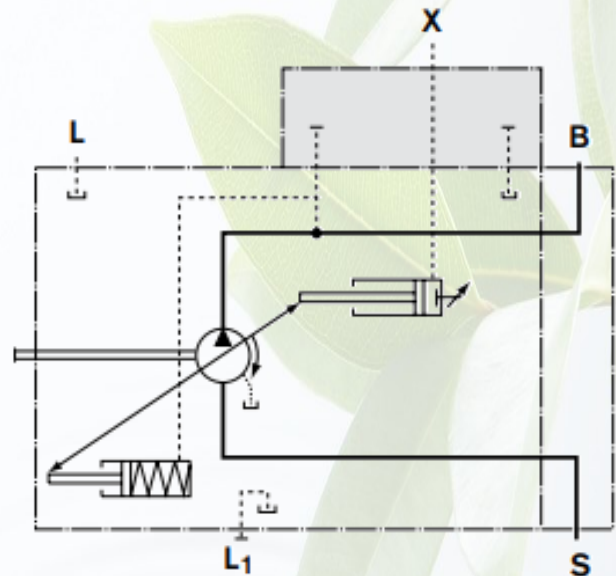
Control pressure  $p_{st}$  in  $X = 0$  bar  $\hat{=}$   $V_{G \max}$

Control pressure  $p_{st}$  in  $X \geq 50$  bar  $\hat{=}$   $V_{G \min}$

### Control pressure characteristic



### Circuit diagram



	Port for
<b>B</b>	Service line
<b>S</b>	Suction line
<b>L, L<sub>1</sub></b>	Case drain (L <sub>1</sub> plugged)
<b>X</b>	Pilot pressure

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# A10VSO Piston Pumps

## DFR/DFR1 – Pressure and flow control

In addition to the pressure control function (see page 11), the pump flow may be varied by means of a differential pressure over an adjustable orifice (e.g. directional valve) installed in the service line to the actuator. The pump flow is equal to the actual required flow by the actuator, regardless of changing pressure levels.

The pressure control overrides the flow control function.

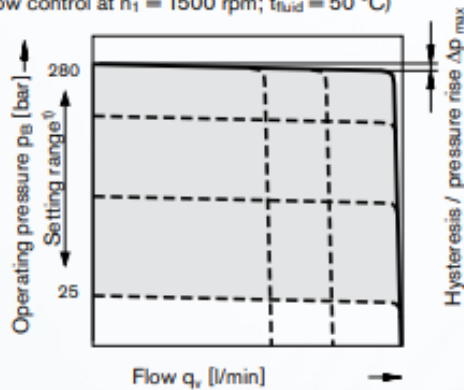
### Note

The DFR1 version has no connection between X and the reservoir. Unloading the LS-pilot line must be possible in the valve system.

Because of the flushing function sufficient unloading of the X-line must also be provided.

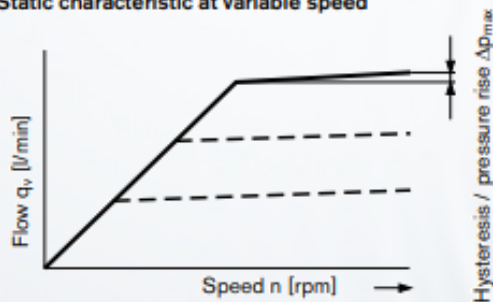
### Static characteristic

Flow control at  $n_1 = 1500 \text{ rpm}$ ;  $t_{\text{fluid}} = 50 \text{ }^\circ\text{C}$



- In order to prevent damage to the pump and the system, this setting range is the permissible setting range and must not be exceeded. The range of possible settings at the valve are greater.

### Static characteristic at variable speed



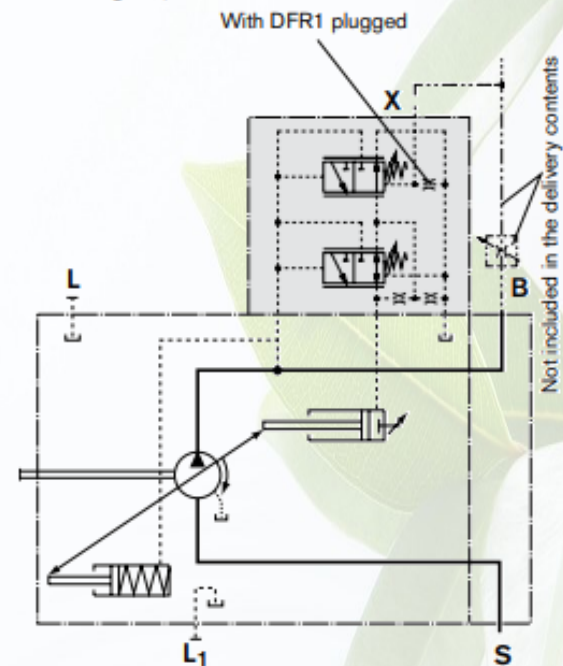
### Differential pressure $\Delta p$

Standard setting: 14 to 22 bar.

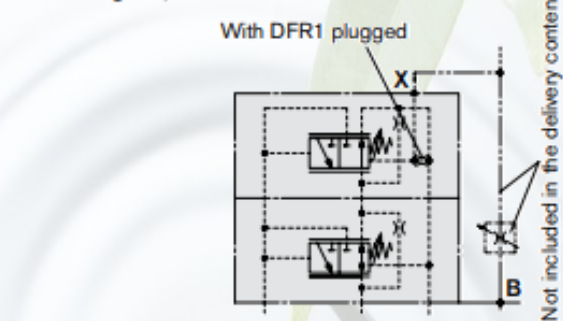
If another setting is required, please state in clear text.

Relieving the load on port X to the reservoir results in a zero stroke ("standby") pressure which lies about 1 to 2 bar higher than the differential pressure  $\Delta p$ . System influences are not taken into account.

### Circuit diagram, sizes 18 to 100



### Circuit diagram, size 140



	Port for
B	Service line
S	Suction line
L, L <sub>1</sub>	Case drain (L <sub>1</sub> plugged)
X	Pilot pressure

### Control data

Data for pressure control DR, see page 11.

Maximum flow deviation measured at drive speed  $n = 1500 \text{ rpm}$ .

NG	18	28	45	71	100	140
$\Delta q_{v, \text{max}}$ l/min	0.9	1.0	1.8	2.8	4.0	6.0

Control fluid consumption DFR maximum approx. 3 to 4.5 l/min

Control fluid consumption DFR1 \_\_\_\_ maximum approx. 3 l/min

Volume flow loss at  $q_{v, \text{max}}$ , see page 9.

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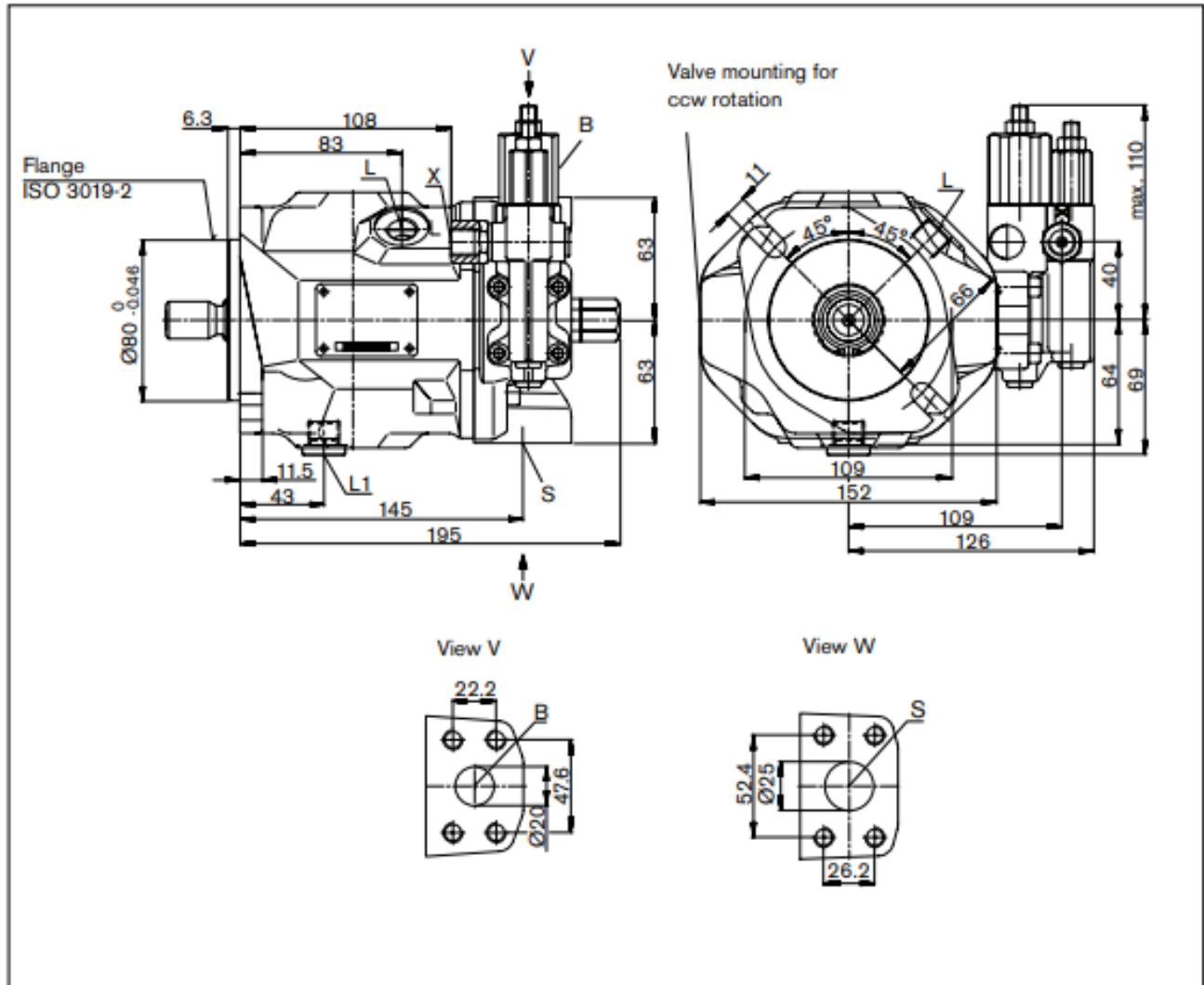
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# A10VSO Piston Pumps

## Size 18

DFR, DFR1 – Pressure and flow control, hydraulic  
Clockwise rotation



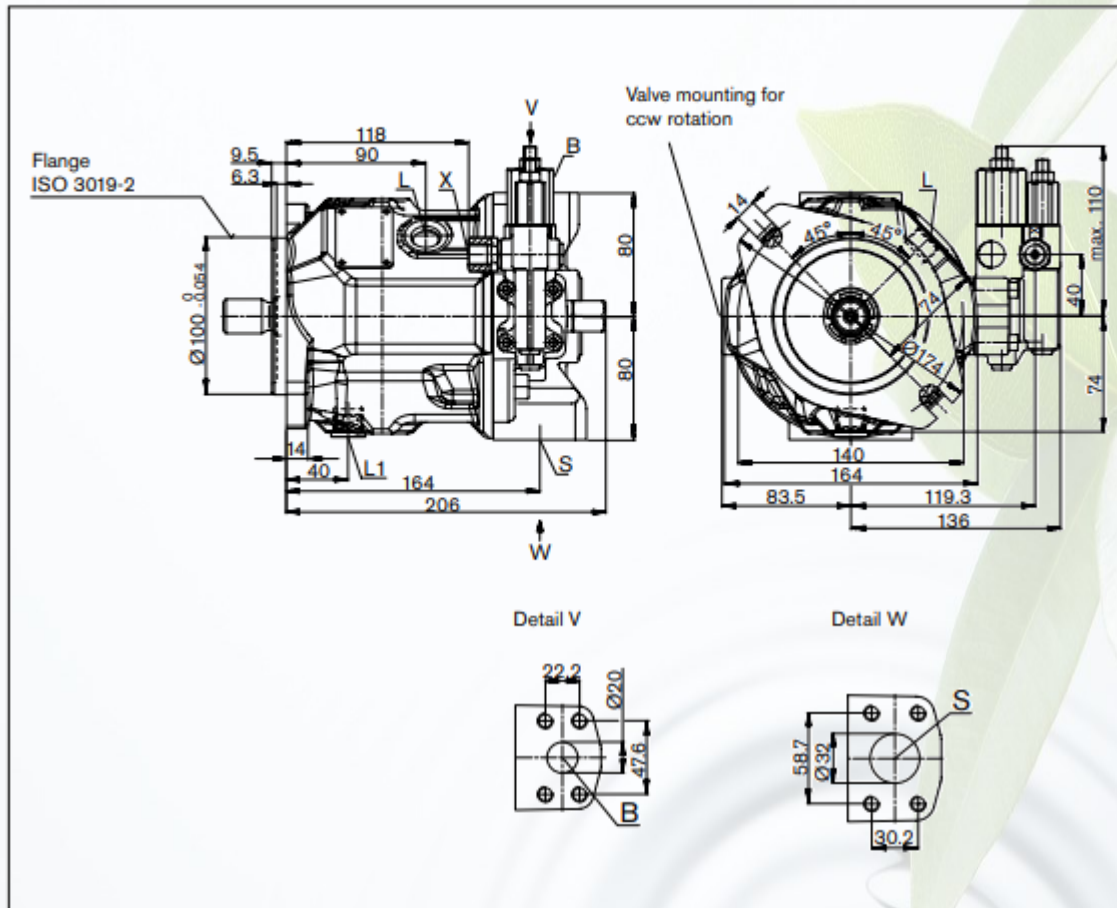
### Ports

Designation	Port for	Standard	Size <sup>1)</sup>	Maximum pressure [bar] <sup>2)</sup>	State
B	Service line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	3/4 in M10 x 1.5; 17 deep	350	O
S	Suction line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	1 in M10 x 1.5; 17 deep	10	O
L	Case drain fluid	DIN 3852 <sup>4)</sup>	M16 x 1.5; 12 deep	2	O <sup>5)</sup>
L <sub>1</sub>	Case drain fluid	DIN 3852 <sup>4)</sup>	M16 x 1.5; 12 deep	2	X <sup>5)</sup>
X	Pilot pressure	DIN 3852 <sup>4)</sup>	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228 <sup>4)</sup>	G 1/4 in	350	O

# A10VSO Piston Pumps

## Size 28

DFR/DFR1 – Pressure and flow control, hydraulic  
Clockwise rotation



### Ports

Designation	Port for	Standard	Size <sup>1)</sup>	Maximum pressure [bar] <sup>2)</sup>	State
B	Service line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	3/4 in M10 x 1.5; 17 deep	350	O
S	Suction line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	1 1/4 in M10 x 1.5; 17 deep	10	O
L	Case drain fluid	DIN 3852 <sup>4)</sup>	M18 x 1.5; 12 deep	2	O <sup>5)</sup>
L <sub>1</sub>	Case drain fluid	DIN 3852 <sup>4)</sup>	M18 x 1.5; 12 deep	2	X <sup>5)</sup>
X	Pilot pressure	DIN 3852 <sup>4)</sup>	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228 <sup>4)</sup>	G 1/4in; 12 deep	350	O

- 1) For the maximum tightening torques the general instructions on page 48 must be observed.
  - 2) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
  - 3) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
  - 4) The spot face can be deeper than as specified in the standard.
  - 5) Depending on the installation position, L or L<sub>1</sub> must be connected (see also installation instructions on pages 44, 45)
- O = Must be connected (plugged on delivery)  
X = Plugged (in normal operation)



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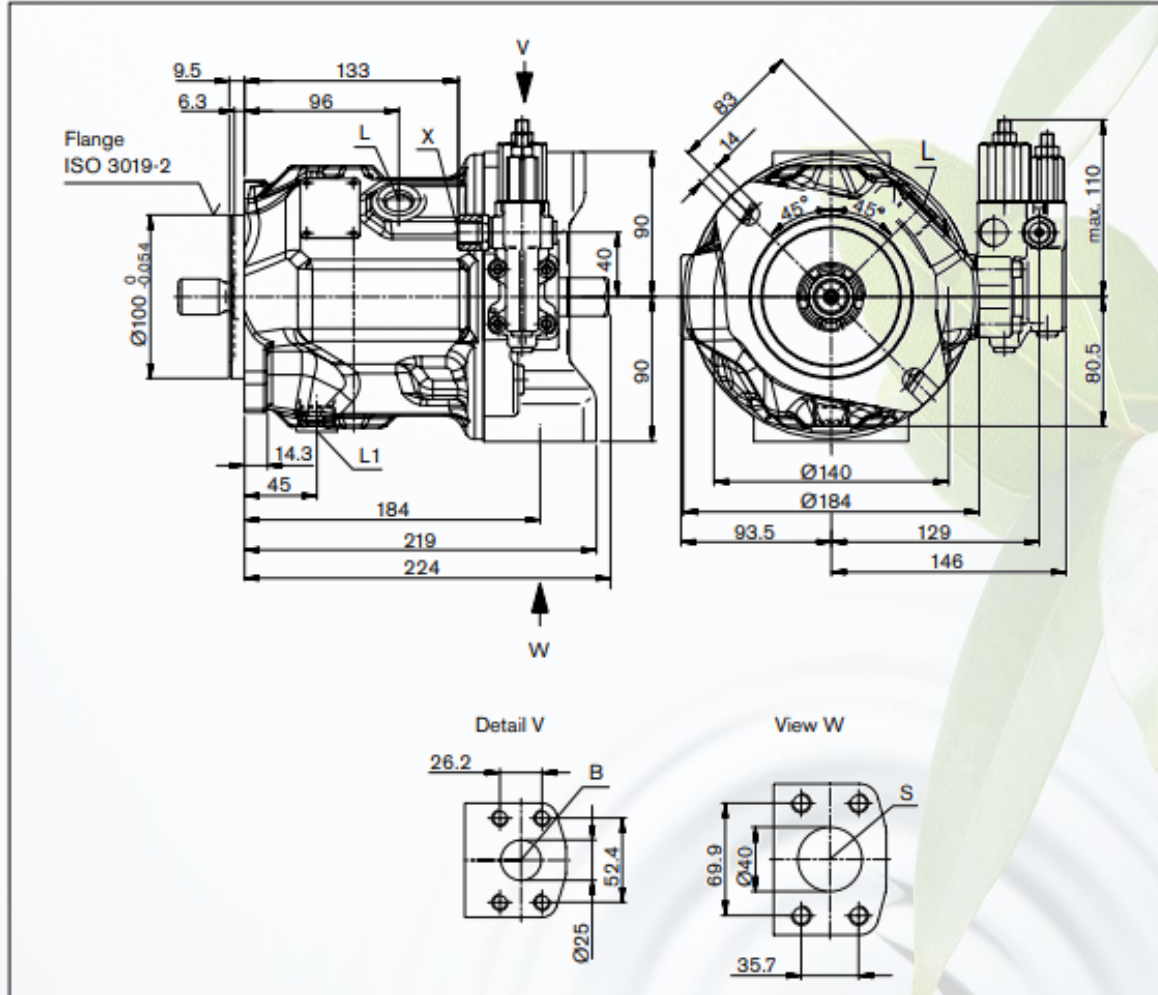


# A10VSO Piston Pumps

## Size 45

### DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



### Ports

Designation	Port for	Standard	Size <sup>1)</sup>	Maximum pressure [bar] <sup>2)</sup>	State
B	Service line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	1 in M10 x 1.5; 17 deep	350	O
S	Suction line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	1 1/2 in M12 x 1.75; 20 deep	10	O
L	Case drain fluid	DIN 3852 <sup>4)</sup>	M22 x 1.5; 14 deep	2	O <sup>5)</sup>
L <sub>1</sub>	Case drain fluid	DIN 3852 <sup>4)</sup>	M22 x 1.5; 14 deep	2	X <sup>5)</sup>
X	Pilot pressure	DIN 3852 <sup>4)</sup>	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228 <sup>4)</sup>	G 1/4 in	350	O

- 1) For the maximum tightening torques the general instructions on page 48 must be observed.
  - 2) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
  - 3) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
  - 4) The spot face can be deeper than as specified in the standard.
  - 5) Depending on the installation position, L or L<sub>1</sub> must be connected (see also installation instructions on pages 44, 46)
- O = Must be connected (plugged on delivery)  
X = Plugged (in normal operation)



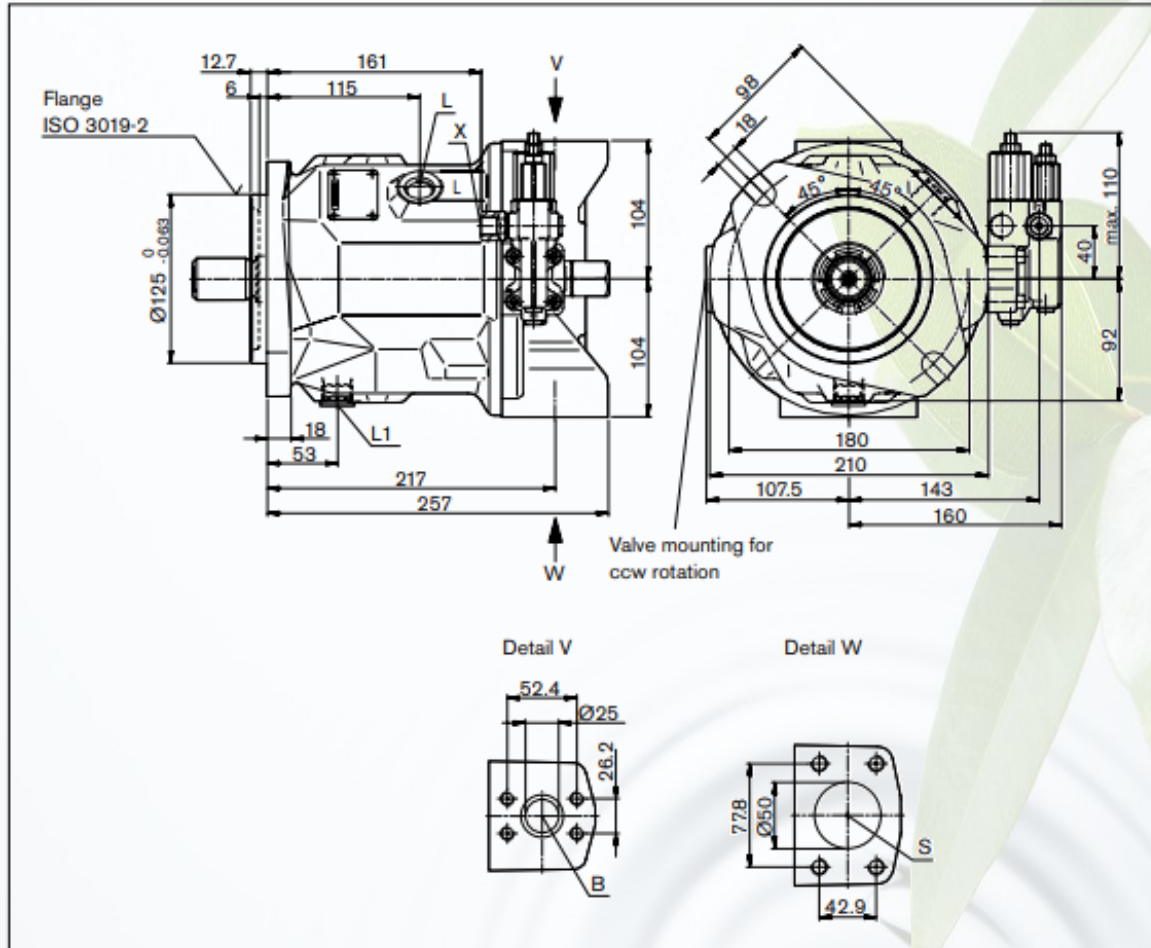
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# A10VSO Piston Pumps

## Size 71

DFR/DFR1 – Pressure and flow control, hydraulic  
Clockwise rotation



### Ports

Designation	Port for	Standard	Size <sup>1)</sup>	Maximum pressure [bar] <sup>2)</sup>	State
B	Service line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	1 in M10 x 1.5; 17 deep	350	O
S	Suction line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	2 in M12 x 1.75; 20 deep	10	O
L	Case drain fluid	DIN 3852 <sup>4)</sup>	M22 x 1.5; 14 deep	2	O <sup>5)</sup>
L <sub>1</sub>	Case drain fluid	DIN 3852 <sup>4)</sup>	M22 x 1.5; 14 deep	2	X <sup>5)</sup>
X	Pilot pressure	DIN 3852 <sup>4)</sup>	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228 <sup>4)</sup>	G 1/4 in	350	O

- 1) For the maximum tightening torques the general instructions on page 48 must be observed.
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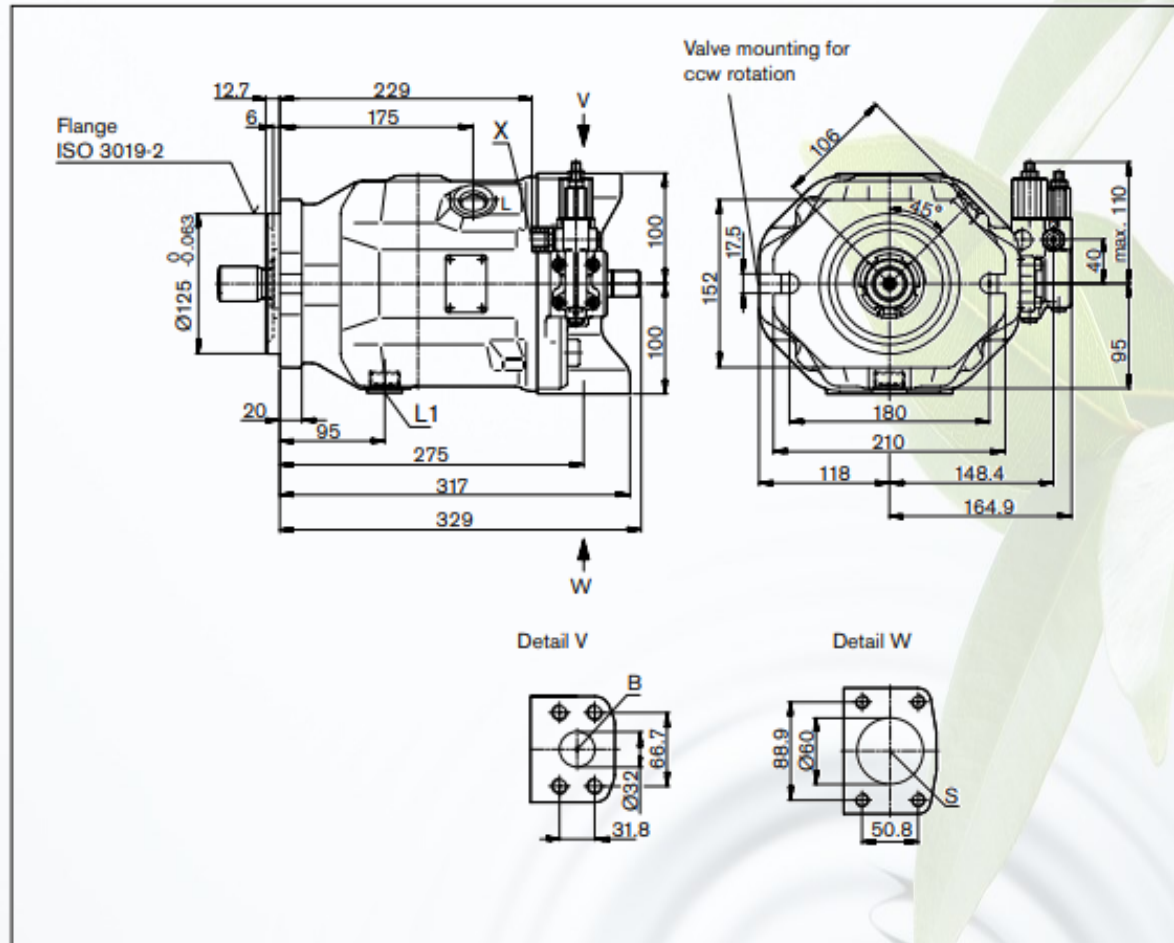
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# A10VSO Piston Pumps

## Size 100

DFR/DFR1 – Pressure and flow control, hydraulic  
Clockwise rotation



### Ports

Designation	Port for	Standard	Size <sup>1)</sup>	Maximum pressure [bar] <sup>2)</sup>	State
B	Service line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Case drain fluid	DIN 3852 <sup>4)</sup>	M27 x 2; 16 deep	2	O <sup>5)</sup>
L <sub>1</sub>	Case drain fluid	DIN 3852 <sup>4)</sup>	M27 x 2; 16 deep	2	X <sup>5)</sup>
X	Pilot pressure	DIN 3852 <sup>4)</sup>	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228 <sup>4)</sup>	G 1/4 in	350	O

- 1) For the maximum tightening torques the general instructions on page 48 must be observed.
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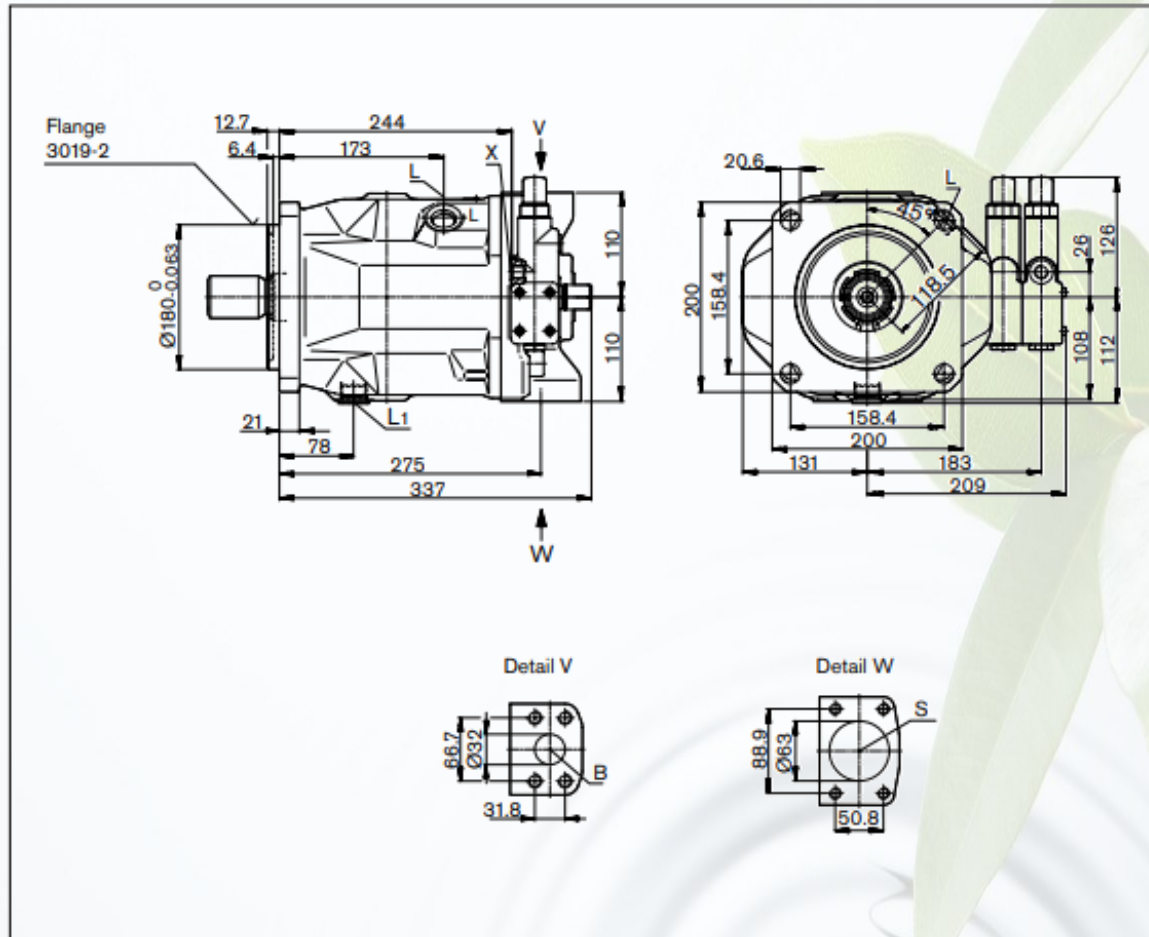
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# A10VSO Piston Pumps

## Size 140

DFR/DFR1 – Pressure and flow control, hydraulic  
Clockwise rotation



### Ports

Designation	Port for	Standard	Size <sup>1)</sup>	Maximum pressure [bar] <sup>2)</sup>	State
B	Service line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction line, fastening thread	SAE J518 <sup>3)</sup> DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Case drain fluid	DIN 3852 <sup>4)</sup>	M27 x 2; 16 deep	2	O <sup>5)</sup>
L <sub>1</sub>	Case drain fluid	DIN 3852 <sup>4)</sup>	M27 x 2; 16 deep	2	X <sup>5)</sup>
X	Pilot pressure	DIN 3852 <sup>4)</sup>	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN 3852 <sup>4)</sup>	M14 x 1.5; 12 deep	350	O
M <sub>H</sub>	Gauge port, high pressure	DIN 3852	M14 x 1.5; 12 deep	350	X

1) For the maximum tightening torques the general instructions on page 48 must be observed.

2) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.

3) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.

4) The spot face can be deeper than as specified in the standard.

5) Depending on the installation position, L or L<sub>1</sub> must be connected (see also installation instructions on pages 44, 46)

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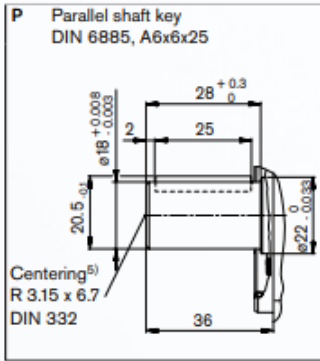
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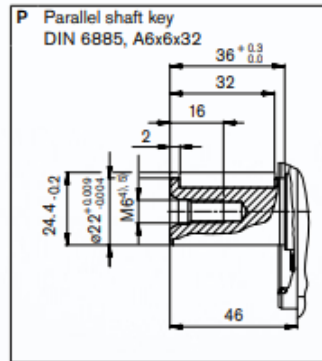
# A10VSO Piston Pumps

## Shaft dimensions

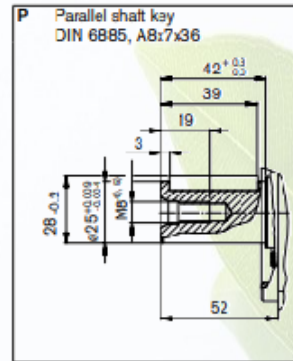
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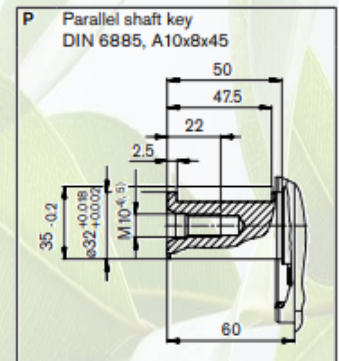
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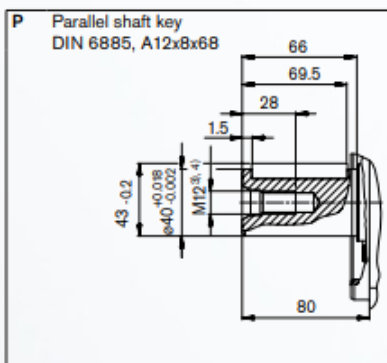
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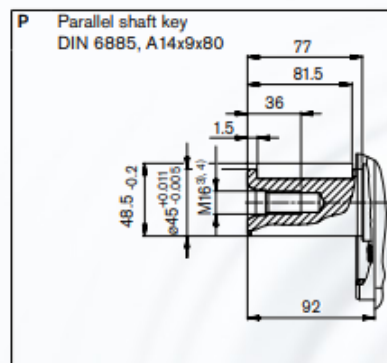
Size 71



Size 100



Size 140



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# A10VSO Piston Pumps

## Installation instructions

### General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit empty via the hydraulic lines.

Especially with the installation position "drive shaft upwards" or "drive shaft downward", attention must be paid to a complete filling and air bleeding since there is a risk, for example, of dry running.

The case drain fluid in the motor housing must be directed to the reservoir via the highest case drain port ( $L_1$ ,  $L_2$ ,  $L_3$ ).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the case drain ports of the units, the shared case drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate case drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the suction line and case drain line must flow into the reservoir below the minimum fluid level. The permissible suction height  $h_s$  is a result of the overall pressure loss, but may not be greater than  $h_{s\ max} = 800\ mm$ . The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation.

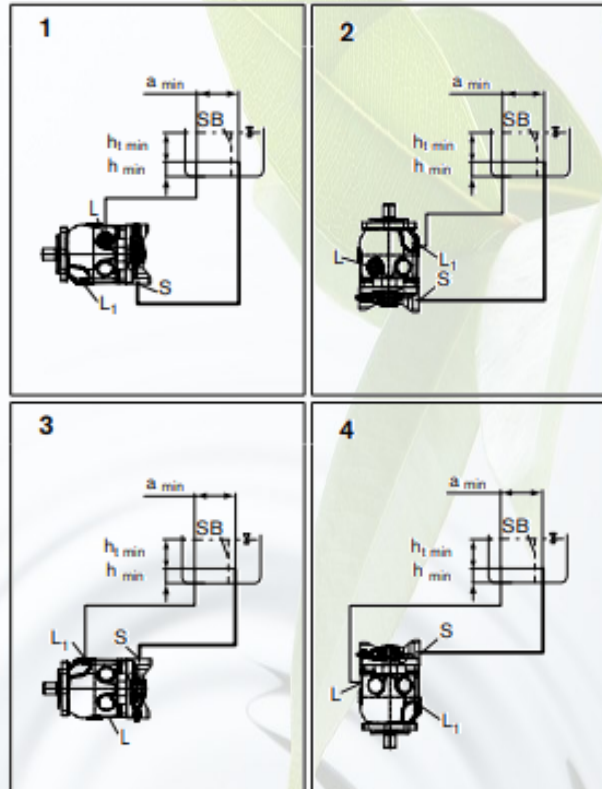
### Installation position

See the following examples 1 to 12. Additional installation positions are available upon request.

Recommended installation positions: 1 and 3.

### Below-reservoir installation (standard)

Below-reservoir installation means the axial piston unit is installed outside the reservoir below the minimum fluid level.



Installation position	Air bleed	Filling
1	L	S + $L_1$
2	$L_1$	S + L
3	$L_1$	S + L
4	L	S + $L_1$

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# A10VSO Piston Pumps

## Installation instructions

### Above-reservoir installation

Above-reservoir installation means the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining, a height difference  $h_{ES \min}$  of at least 25 mm at port  $L_1$  is required in installation position 6.

Observe the maximum permissible suction height  $h_{S \max} = 800$  mm.

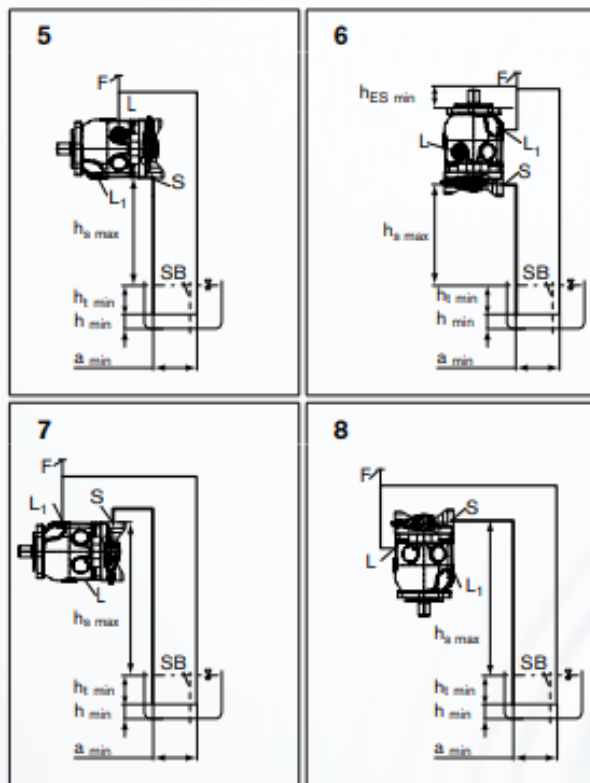
A check valve in the case drain line is only permissible in individual cases. Consult us for approval.

### Inside-reservoir installation

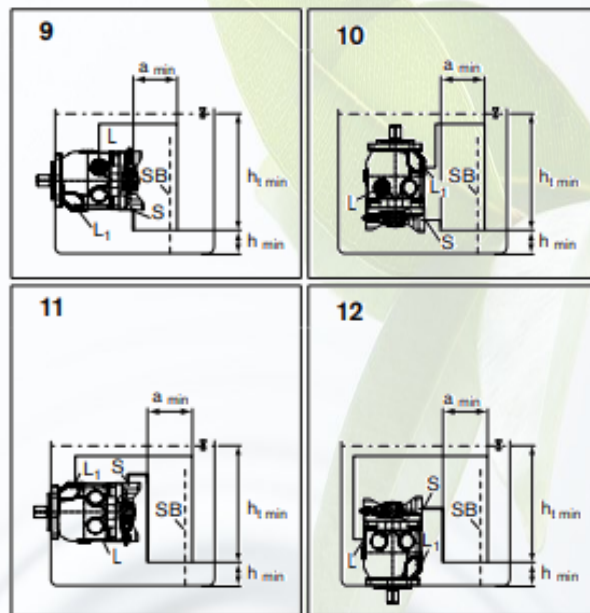
Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid.

If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "Above-reservoir installation".

Axial piston units with electrical components (e.g. electric control, sensors) may not be installed in a reservoir below the fluid level.



Installation position	Air bleed	Filling
5	F	L (F)
6	F	$L_1$ (F)
7	F	S + $L_1$ (F)
8	F	S + L (F)



Installation position	Air bleed	Filling
9	L	L, $L_1$
10	$L_1$	L, $L_1$
11	$L_1$	S + L, $L_1$
12	L	S + L, $L_1$

- S** Suction port
- F** Filling / air bleeding
- L,  $L_1$**  Case drain port
- SB** Baffle (baffle plate)
- $h_{L \min}$**  Minimum necessary immersion depth (200 mm)
- $h_{\min}$**  Minimum necessary spacing to reservoir bottom (100 mm)
- $h_{ES \min}$**  Minimum necessary height needed to protect the axial piston unit from draining (25 mm).
- $h_{S \max}$**  Maximum permissible suction height (800 mm)
- $a_{\min}$**  When designing the reservoir, ensure adequate distance between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.