

# A10VSO Series Variable Displacement Pump

**Hydraulus**

## Product show and brief introduction

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### Open Circuit

Size 28...140  
Series 31  
Nominal Pressure 28 MPa  
Peak pressure 35 MPa



### Features

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- Variable displacement axial piston pump of swashplate design for hydraulic open circuit systems
- Flow is proportional to drive speed and displacement. It can be infinitely varied by adjustment of the swashplate
- ISO mounting flange
- Flange connections to SAE metric
- 2 case drain ports
- Good suction characteristics
- Permissible continuous pressure 28 MPa
- Low noise level
- Long service life
- Axial and radial loading of drive shaft possible
- High power-weight ratio
- Wide range of controls
- Short response times
- Through drive option for multi-circuit system

## Model Code

A10VS	O	71	DR	/31	R	-P	P	A	12	N00
Axial piston unit	Type of operation	Size (mL/r)	Control device	Series	Direction of rotation	Seals	Shaft end	Mounting flange	Service line connections	Through drives
HA10VS: Variable swash-plate design, for industrial applications Nominal pressure 28MPa, peak pressure 35MPa	O: Pump in open circuits	28	DR: Pressure control	31	(Viewed on shaft end)  R: Clockwise  L: Anti clockwise	P: NBR nitril-caoutchouc to DIN ISO 1629 (shaft seal in FKM)  V: FKM fluor-caoutchouc to DIN ISO 1629	See below	A: ISO 2-hole	12: Pressure port B, Suction port S (SAE ports at opposite sides Metric fixing thread)	See below
		45	DRG: Pressure control, remotely controlled							
		71	DFR: Pressure /flow control							
		100	DFR1: Pressure /flow control, without orifice in X-line							
		140						B: ISO 4-hole		

## Shaft end

Size		28	45	71	100	140
Parallel with key DIN6885	P	✓	✓	✓	✓	✓
Splined shaft SAE	S	7/8 "	1 "	1 1/4 "	1 1/2 "	1 3/4 "
Splined shaft SAE (higher through drive torque)	R	7/8 "	1 "	1 1/4 "	/	/

## Through drives

Size		28	45	71	100	140
Without through drive	N00	✓	✓	✓	✓	✓
ISO 100,2-hole splined shaft 7/8 " 22-4 (SAE B) HA10VSO28(shaft S or R)	KB3	✓	/	✓	✓	✓
ISO 100,2-hole splined shaft 1 " 25-4 (SAE B-B) HA10VSO45(shaft S or R)	KB4	/	✓	✓	✓	✓
ISO 125,2-hole splined shaft 1 1/4 " 32-4 (SAE C) HA10VSO71(shaft S or R)	KB5	/	/	✓	✓	✓
ISO 125,2-hole splined shaft 1 1/2 " 38-4 (SAE C-C) HA10VSO100(shaft S)	KB6	/	/	/	✓	✓

✓ = available    / = not available

## Technical Data

### ● Operating pressure range-inlet

Absolute pressure at port S

$P_{abs\ min}$  \_\_\_\_\_ 0.08 MPa  
 $P_{abs\ max}$  \_\_\_\_\_ 3 MPa

### ● Operating pressure range-outlet

Pressure at port B

Nominal pressure  $P_N$  \_\_\_\_\_ 28 MPa  
 Peak pressure  $P_{max}$  \_\_\_\_\_ 35 MPa

(Pressure data to DIN 24312)

Applications with intermittent operating pressures up to 31.5 MPa at 10% duty are permissible.

Limitation of pump output pressure spikes is possible with relief valve blocks mounted directly on flange connection.

### ● Case drain pressure

Maximum permissible pressure of leakage fluid (at port L, L<sub>1</sub>);  
 Maximum 0.05 MPa higher than the inlet pressure at port S,  
 but no higher than 0.2 MPa absolute.

### ● Direction of through flow

S to B

### ● Table of values (theoretical values, without taking into account $\eta_{mh}$ and $\eta_v$ ; values rounded off)

Size			28	45	71	100	140	
Displacement	$V_{g\ max}$	mL/r	28	45	71	100	140	
Max. speed <sup>1)</sup>	at $V_{g\ max}$	$n_{o\ max}$	rpm	3000	2600	2200	2000	1800
Max. permitted speed (limit speed) with increased input pressure $P_{abs}$ bzw. $V_g < V_{g\ max}$		$n_{o\ max}$	rpm	3600	3100	2600	2400	2100
Max. flow	at $n_{o\ max}$	$q_{v\ max}$	L/min	84	117	156	200	252
	at $n_g = 1500\ min^{-1}$		L/min	42	68	107	150	210
Max. power ( $\Delta P = 28\ MPa$ )	at $n_{o\ max}$	$P_{o\ max}$	kW	39	55	73	93	118
	at $n_g = 1500\ min^{-1}$		kW	20	32	50	70	98
Max. torque ( $\Delta P = 28\ MPa$ )	at $V_{g\ max}$	$T_{max}$	Nm	125	200	316	445	623
Torque ( $\Delta P = 10\ MPa$ )	at $V_{g\ max}$	$T$	Nm	45	72	113	159	223
Moment of inertia about drive axis		$J$	kgm <sup>2</sup>	0.0017	0.0033	0.0083	0.0167	0.0242
Case volume		$L$		0.7	1.0	1.6	2.2	3.0
Weight (without fluid)	$m$	kg		15	12	33	45	60
Permissible loading of drive shaft: max. axial force	$F_{ax\ max}$	N		1000	1500	2400	4000	4800
Max. permissible radial force <sup>2)</sup>	$F_{q\ max}$	N		1200	1500	1900	2300	2800

1) These values are valid for an absolute pressure of 0.1 MPa at the suction port S. By reducing the displacement or increasing the input pressure the speed can be increased as shown in the diagram.

2) Please consult us for higher radial forces.

### ● Determination of displacement

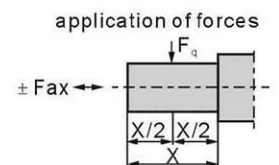
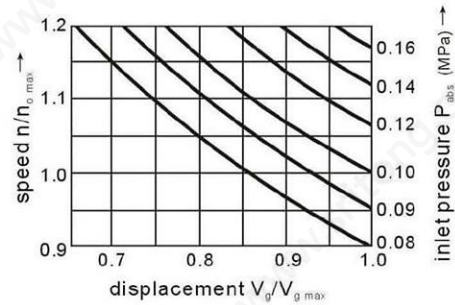
$$\text{Flow } q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad [\text{L/min}]$$

$$\text{Torque } T = \frac{1.59 \cdot V_g \cdot \Delta P}{1000 \cdot \eta_{mh}} = \frac{V_g \cdot \Delta P}{20 \cdot \pi \cdot \eta_{mh}} \quad [\text{Nm}]$$

$$\text{Power } P = \frac{T \cdot n}{9549} = \frac{2 \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta P}{600 \cdot \eta_t} \quad [\text{kW}]$$

$V_g$  = displacement (mL/r) per revolution  
 $\Delta P$  = pressure differential (MPa)  
 $n$  = speed (rpm)  
 $\eta_v$  = volumetric efficiency  
 $\eta_{mh}$  = mechanical-hydraulic efficiency  
 $\eta_t$  = overall efficiency ( $\eta_t = \eta_v \cdot \eta_{mh}$ )

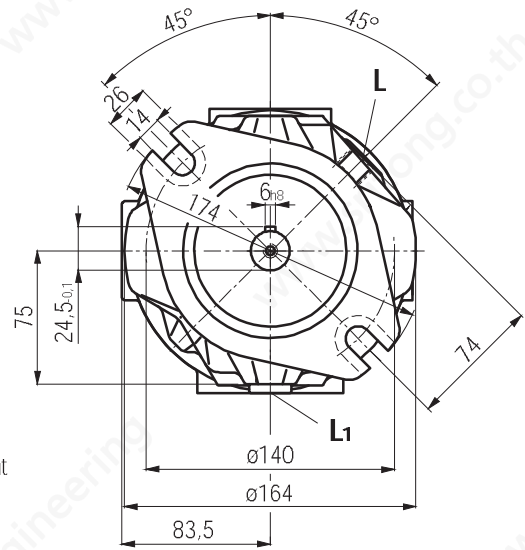
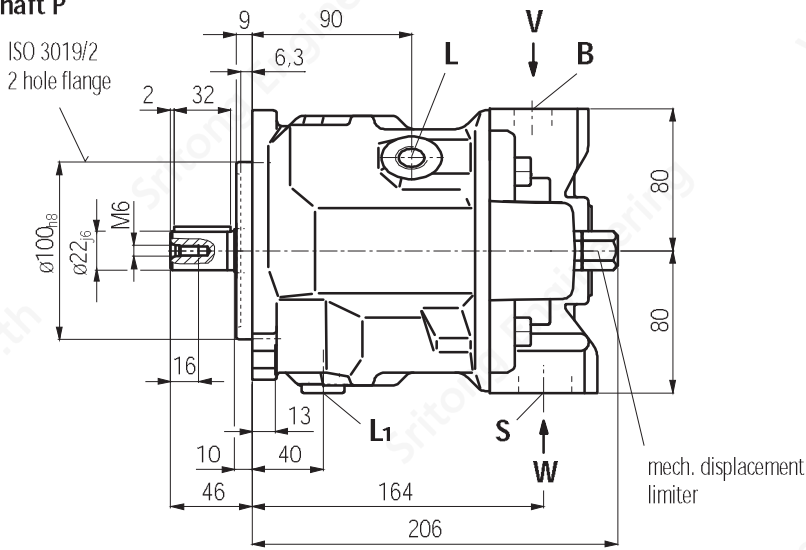
Determination of inlet pressure  $P_{abs}$  at suction port S or reduction of displacement for increasing speed.



## Unit Dimensions Size 28

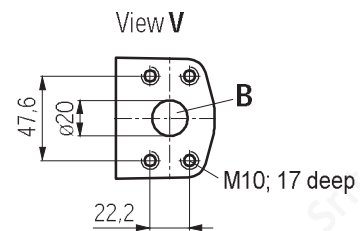
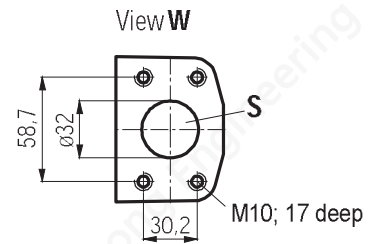
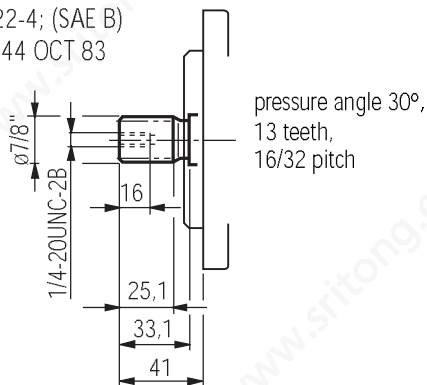
N00 model (without through drive)  
without control valves

### Shaft P



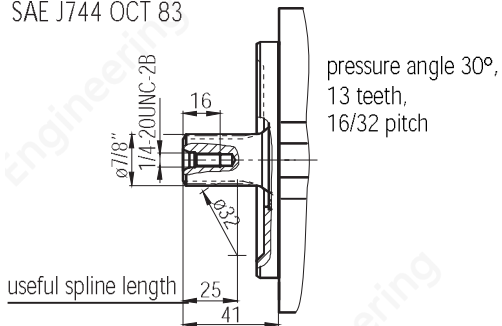
### Shaft S

Shaft 22-4; (SAE B)  
SAE J744 OCT 83



### Shaft R

Shaft 22-4; (SAE B)  
SAE J744 OCT 83



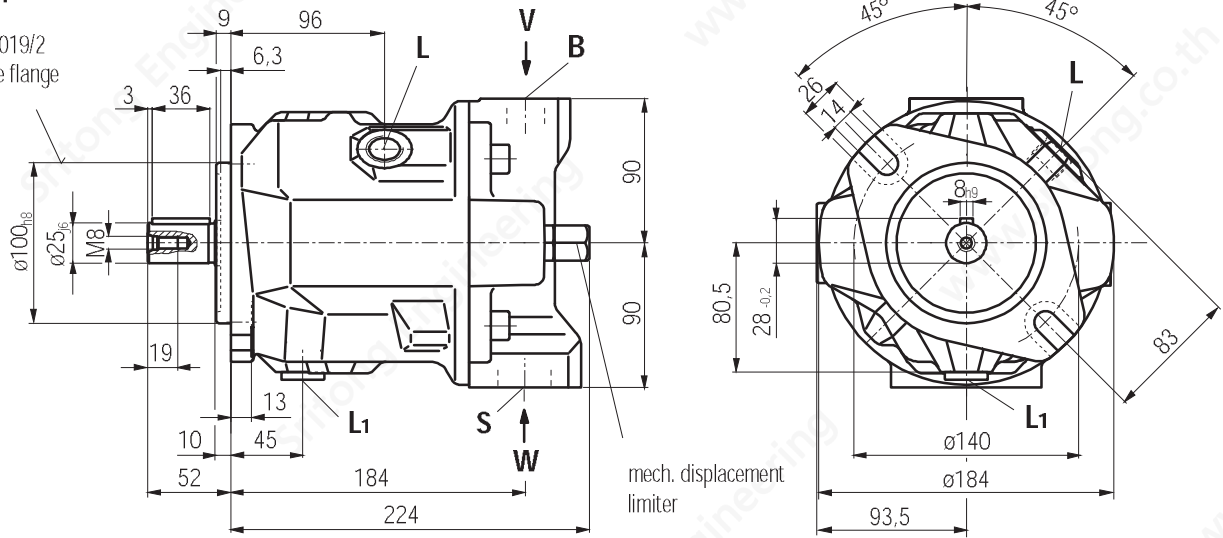
B	Pressure port	SAE 3/4"	(Standard pressure range)
S	Suction port	SAE 1 1/4"	(Standard pressure range)
L/L <sub>1</sub>	Case drain ports	M18x1,5	(L <sub>1</sub> plugged at factory)

## Unit Dimensions Size 45

N00 model (without through drive)  
without control valves

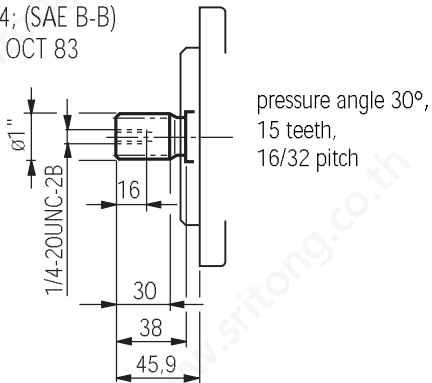
### Shaft P

ISO 3019/2  
2 hole flange

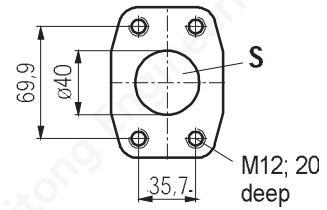


### Shaft S

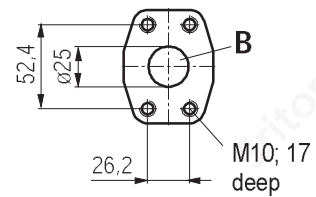
Shaft 25-4; (SAE B-B)  
SAE J744 OCT 83



View W

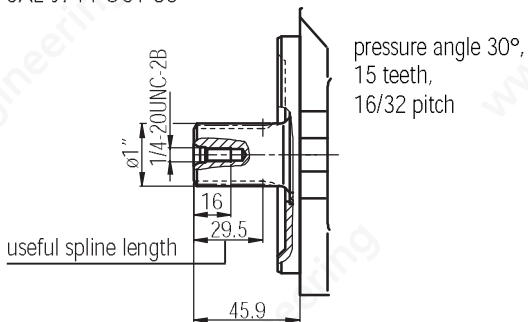


View V



### Shaft R

Shaft 25-4; (SAE B-B)  
SAE J744 OCT 83



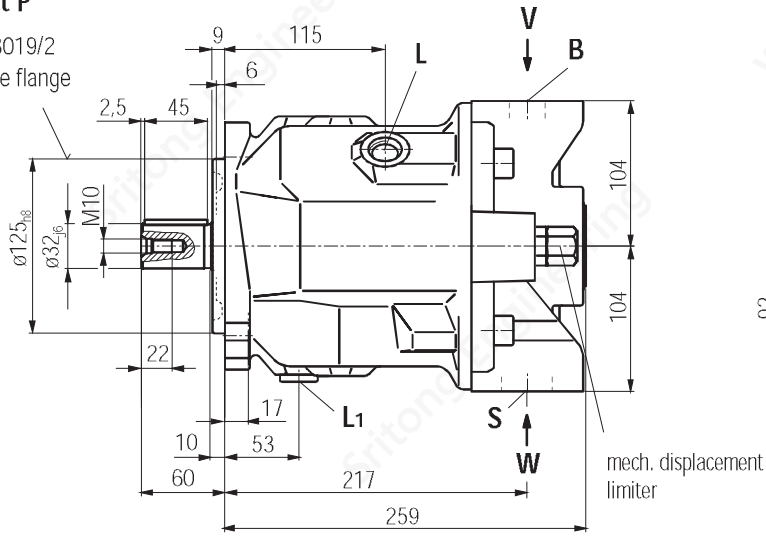
B	Pressure port	SAE 1"	(Standard pressure range)
S	Suction port	SAE 1 1/2"	(Standard pressure range)
L/L <sub>1</sub>	Case drain ports	M22x1,5	(L <sub>1</sub> plugged at factory)

## Unit Dimensions Size 71

N00 model (without through drive)  
without control valves

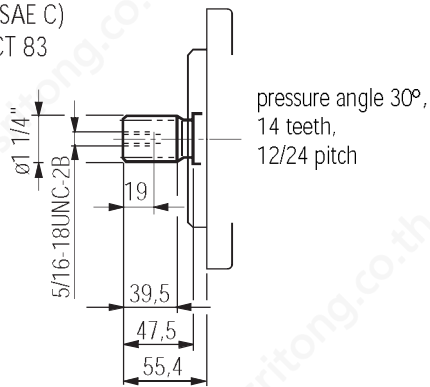
### Shaft P

ISO 3019/2  
2 hole flange

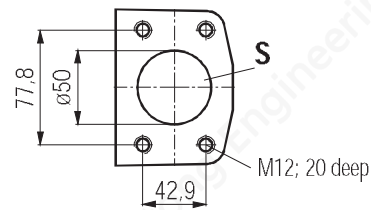


### Shaft S

Shaft 32-4; (SAE C)  
SAE J744 OCT 83

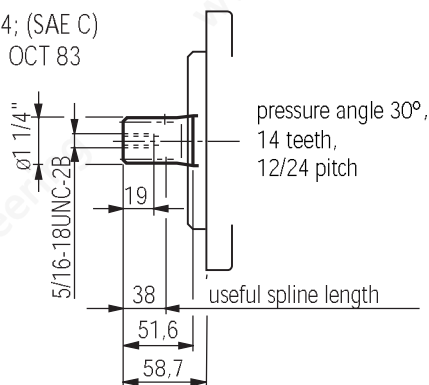


View W

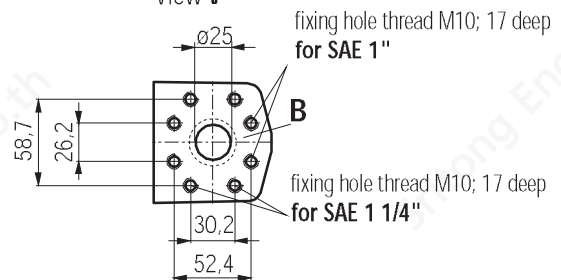


### Shaft R

Shaft 32-4; (SAE C)  
SAE J744 OCT 83



View V

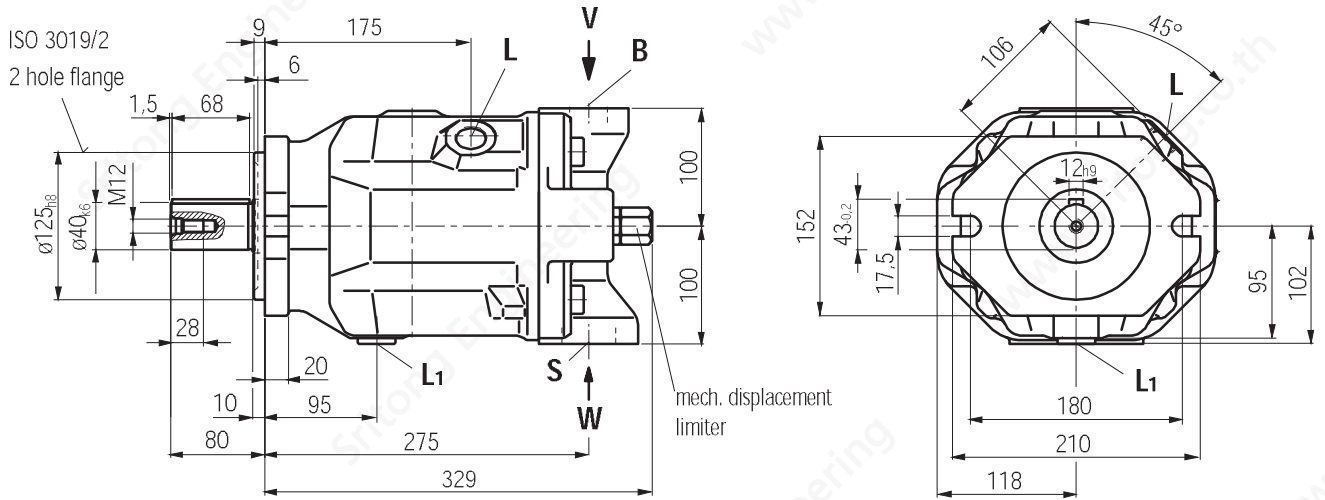


B	Pressure port	<b>SAE 1"</b>	(Standard pressure range) bolt hole threads to either SAE 1" or SAE 1 1/4" (optional)
S	Suction port	<b>SAE 2"</b>	(Standard pressure range)
L/L <sub>1</sub>	Case drain ports	<b>M22x1,5</b>	(L <sub>1</sub> plugged at factory)

## Unit Dimensions Size 100

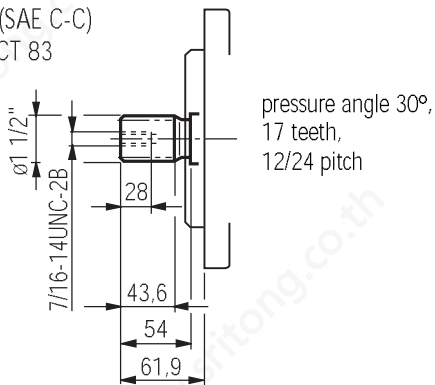
N00 model (without through drive)  
without control valves

### Shaft P

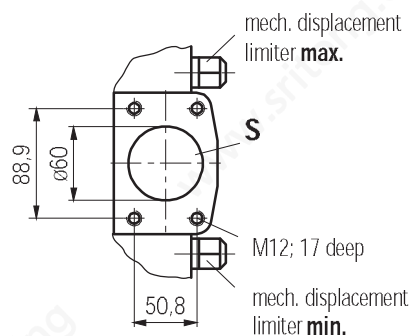


### Shaft S

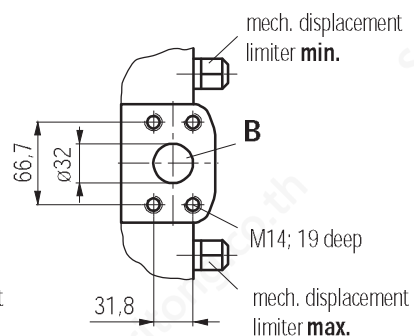
Shaft 38-4; (SAE C-C)  
SAE J744 OCT 83



View W



View V



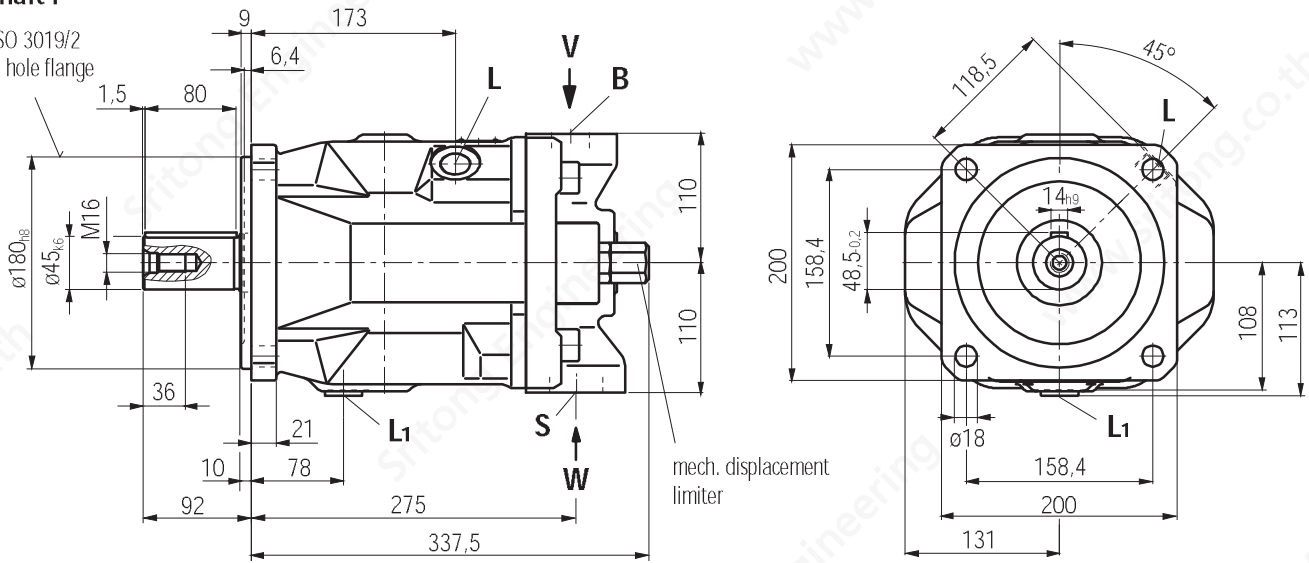
B	Pressure port	SAE 1 1/4"	(High pressure range)
S	Suction port	SAE 2 1/2"	(Standard pressure range)
L/L <sub>1</sub>	Case drain ports	M27x2	(L <sub>1</sub> plugged at factory)

# Unit Dimensions Size 140

N00 model (without through drive)  
without control valves

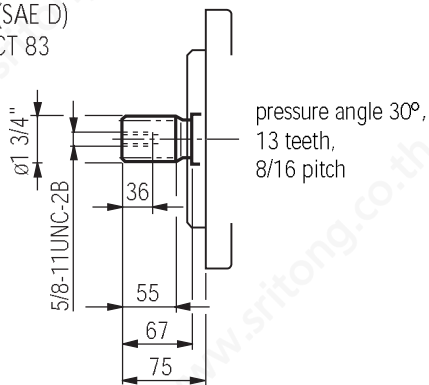
## Shaft P

ISO 3019/2  
4 hole flange

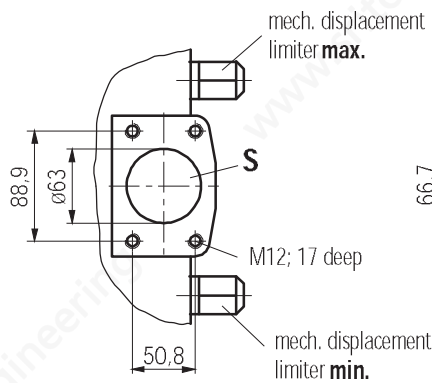


## Shaft S

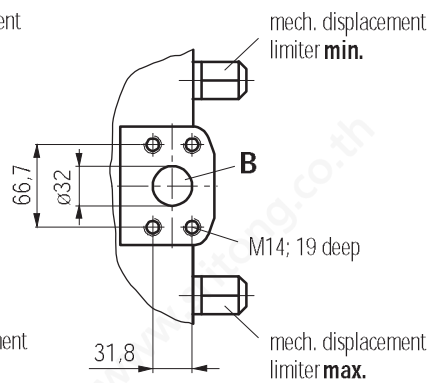
Shaft 44-4; (SAE D)  
SAE J744 OCT 83



View W



View V



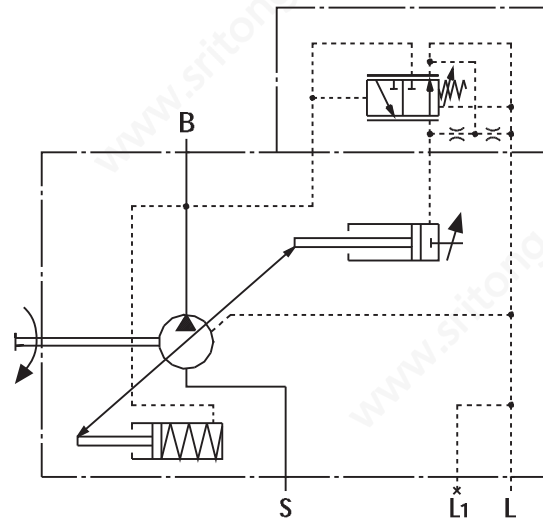
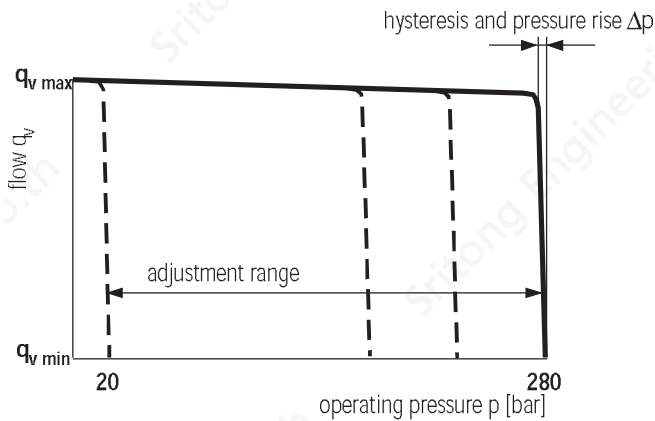
B	Pressure port	SAE 1 1/4"	(High pressure range)
S	Suction port	SAE 2 1/2"	(Standard pressure range)
L/L <sub>1</sub>	Case drain ports	M27x2	(L <sub>1</sub> plugged at factory)

## DR Pressure Control

The pressure controller serves to maintain a constant pressure in a hydraulic system within the control range of the pump. The pump therefore supplies only the amount of hydraulic fluid required by the system. Pressure may be steplessly set at the control valve.

### Static operating curve

(at  $n_1 = 1500$  rpm;  $t_{oil} = 50^\circ$  C)



### Ports

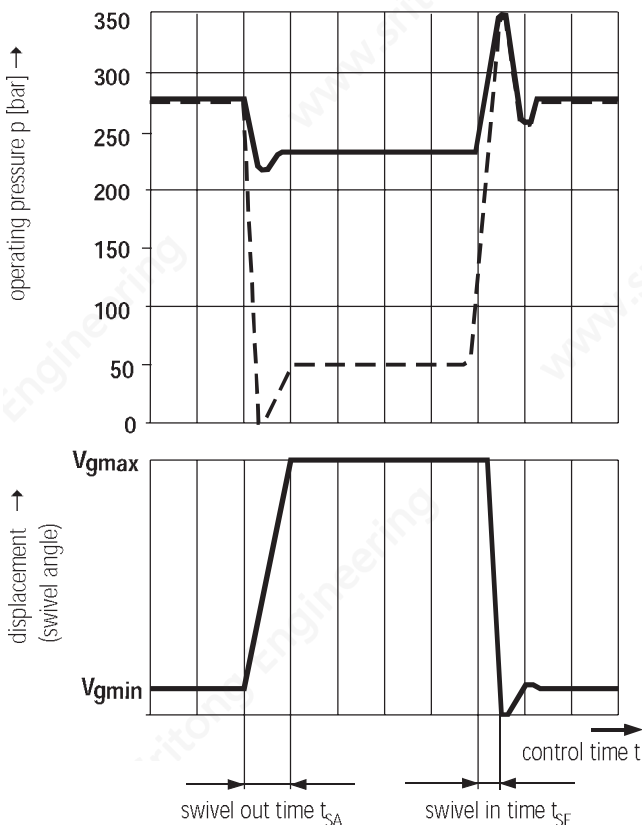
- B** Pressure port
- S** Suction port
- L, L1** Case drain ports ( L1 plugged)

### Dynamic operating curves

The operating curves are mean values measured under test conditions with the unit mounted inside the tank.

Conditions:  $n = 1500$  rpm  
 $t_{oil} = 50^\circ$  C  
 Main relief set at 350 bar

Load steps were obtained by suddenly opening and closing the pressure line with a pressure relief valve as load valve 1 m from the output flange of the pump.



### Controller data

Hysteresis and repetitive accuracy  $\Delta p$  \_\_\_\_\_ max. 3 bar

Max. Pressure rise

Size	28	45	71	100	140
$\Delta p$ bar	4	6	8	10	12

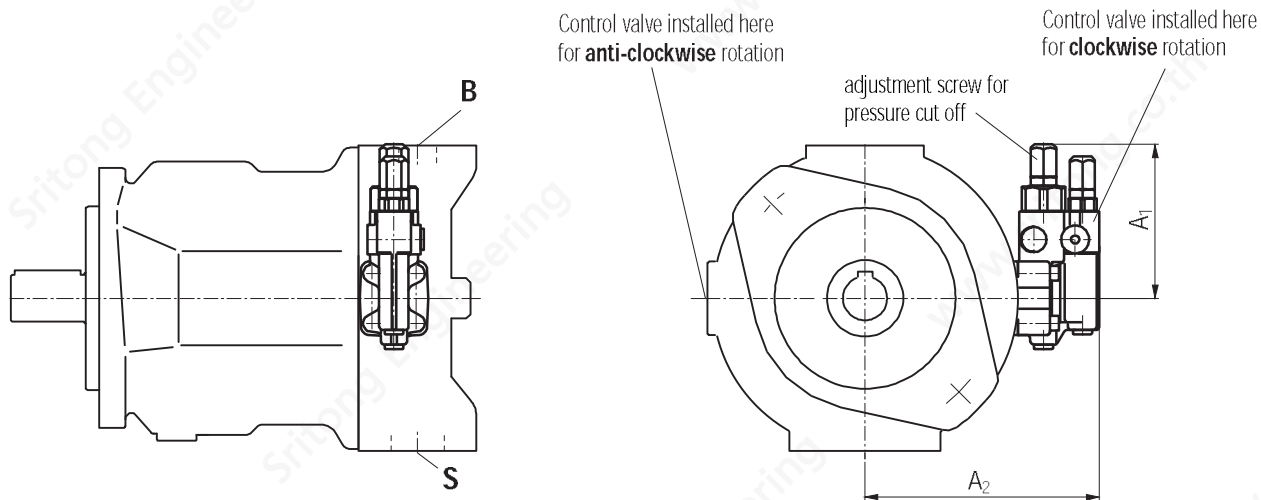
Pilot oil requirement \_\_\_\_\_ max. approx 3 L/min

### Control times

Size	$t_{SA}$ (ms) against 50 bar	$t_{SA}$ (ms) against 220 bar	$t_{SE}$ (ms) stalled at 280 bar
28	60	30	20
45	80	40	20
71	100	50	25
100	125	90	30
140	130	110	30

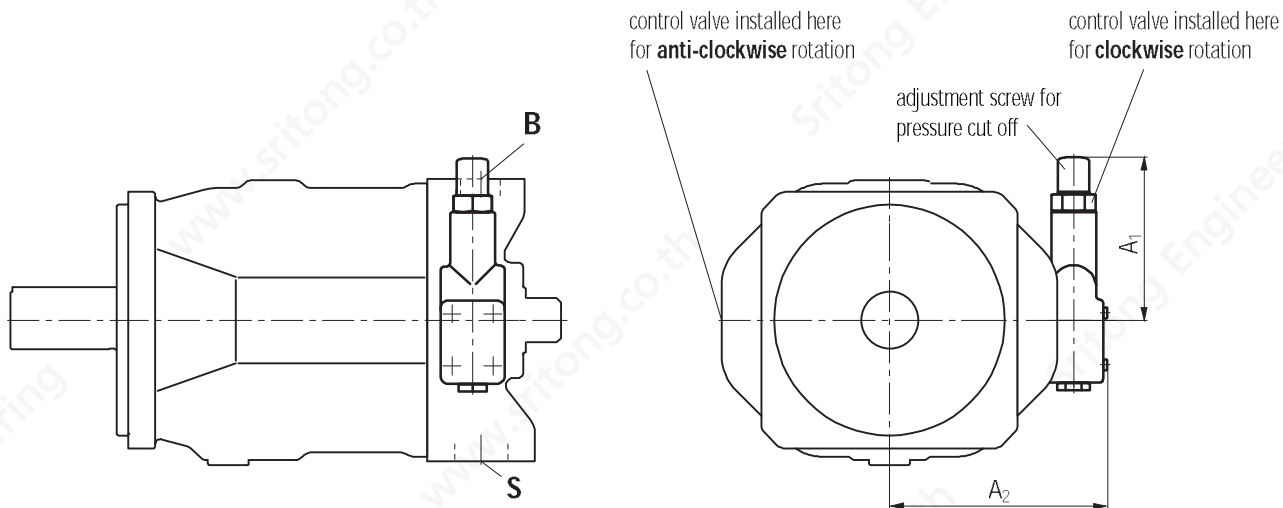
# Unit Dimensions Pressure Control DR

Sizes 28...100



On sizes 28 to 100 the DFR valve used has the flow control spool blocked in the factory and is not tested.

Size 140



Size	A <sub>1</sub>	A <sub>2</sub>
28	109	136
45	106	146
71	106	160
100	106	165
140	127	169

# DRG Pressure Controller, Remote Control

Function and equipment as for DR.

A pressure relief valve can be connected to port X for remote control applications; this is not included in the items supplied with the DRG control.

The standard pressure differential setting at the control valve is 20 bar. A pilot oil flow of approx. 1,5 L/min is then used. If an other setting (range 10-22 bar) is required please indicate in clear text.

We recommend the following as separate pressure relief valves:

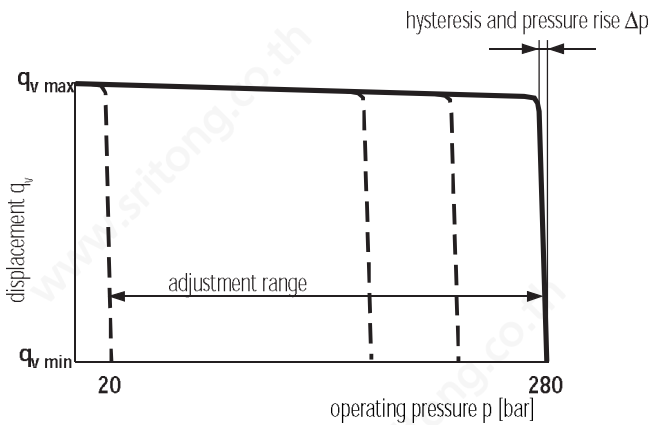
DBDH 6 (hydraulic) to RE 25402 or

DBETR -SO 381 with orifice  $\varnothing 0,8$  in P (electric) to RE 29166.

The max. pipe length should not exceed 2m.

## Static Operating Curve

(at  $n_1 = 1500$  rpm;  $t_{oil} = 50^\circ C$ )



## Controller data

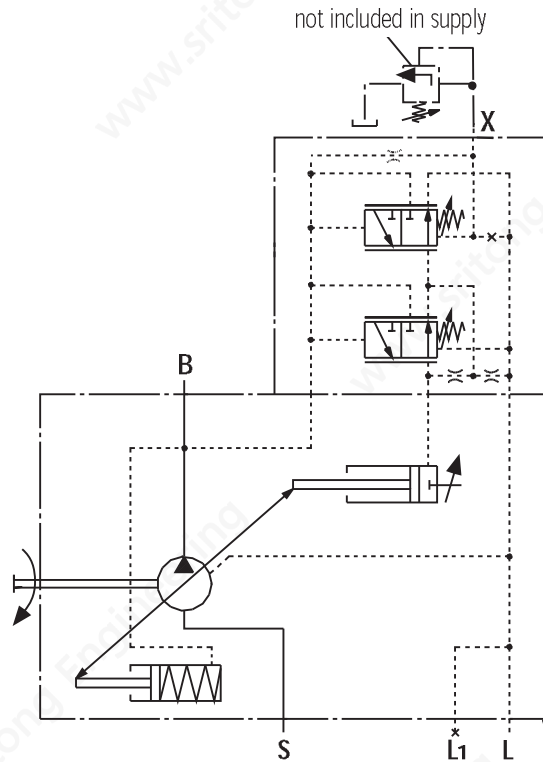
Hysteresis  $\Delta p$  \_\_\_\_\_ max. 3 bar

Max. pressure rise \_\_\_\_\_

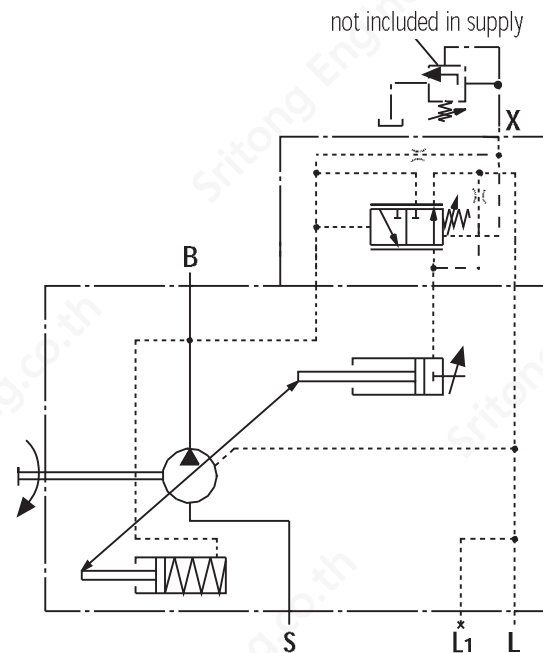
Size	28	45	71	100	140
$\Delta p$ bar	4	6	8	10	12

Pilot oil requirement \_\_\_\_\_ approx. 4,5 L/min

## Sizes 28...100



## Size 140



## Ports

B

Pressure port

S

Suction port

L, L1

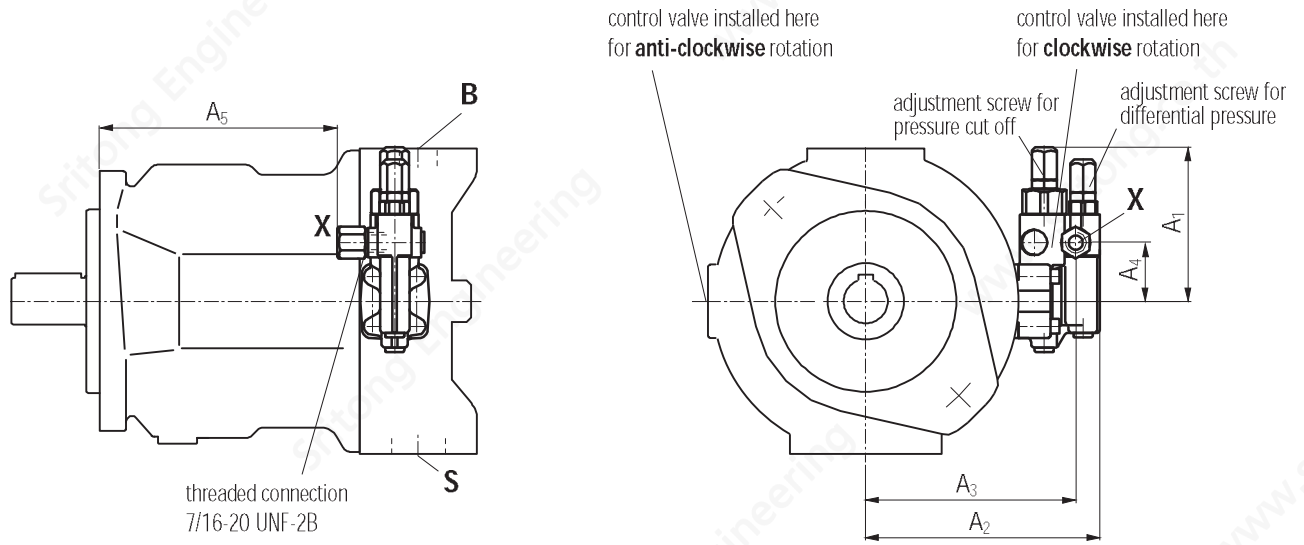
Case drain ports ( L1 plugged)

X

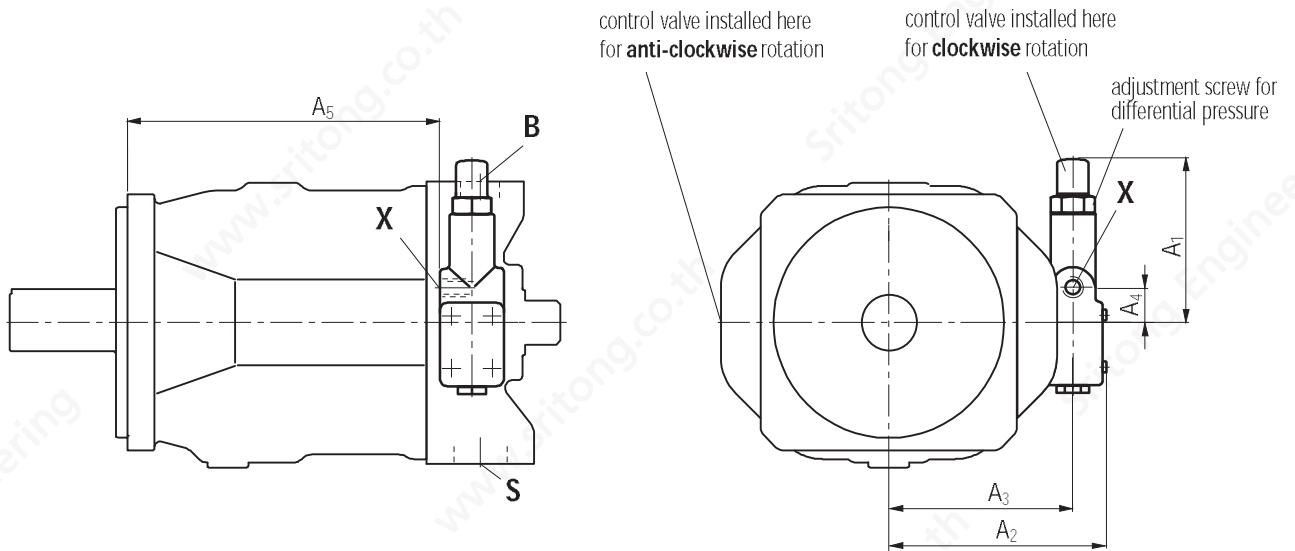
Pilot pressure port

# Unit Dimensions Pressure Controller with Remote Control DRG

## Size 28...100



## Size 140



Size	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	Port X
28	109	136	119	40	119	M14x1,5; 12 deep
45	106	146	129	40	134	M14x1,5; 12 deep
71	106	160	143	40	162	M14x1,5; 12 deep
100	106	165	148	40	229	M14x1,5; 12 deep
140	127	169	143	27	244	M14x1,5; 12 deep without adaptor

} with adaptor

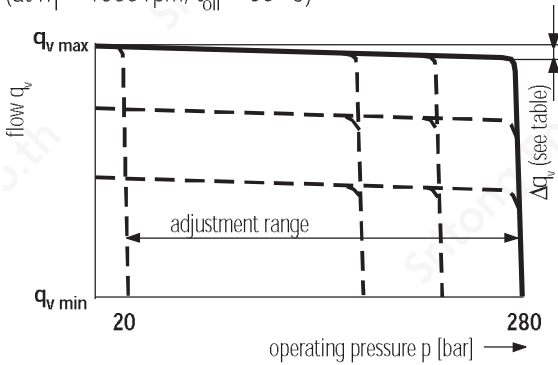
# DFR/DFR1 Pressure / Flow Control

In addition to the pressure control function, the pump flow may be varied by means of a differential pressure over an orifice or valve spool, installed in the service line. The pump flow is equal to the actual required flow by the actuator.

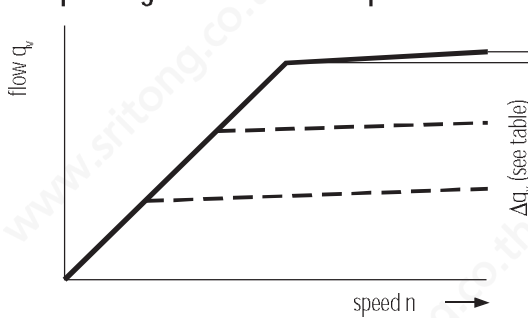
The DFR1-valve has no connection between X and the tank.

## Static operating curve

(at  $n_1 = 1500 \text{ rpm}$ ;  $t_{oil} = 50^\circ \text{ C}$ )

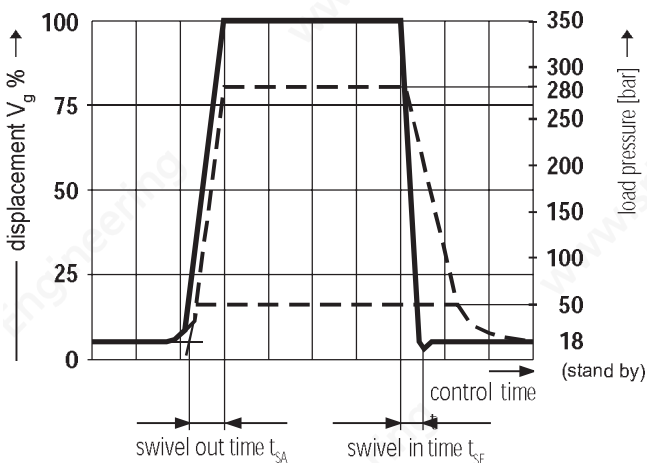


## Static operating curve at variable speed

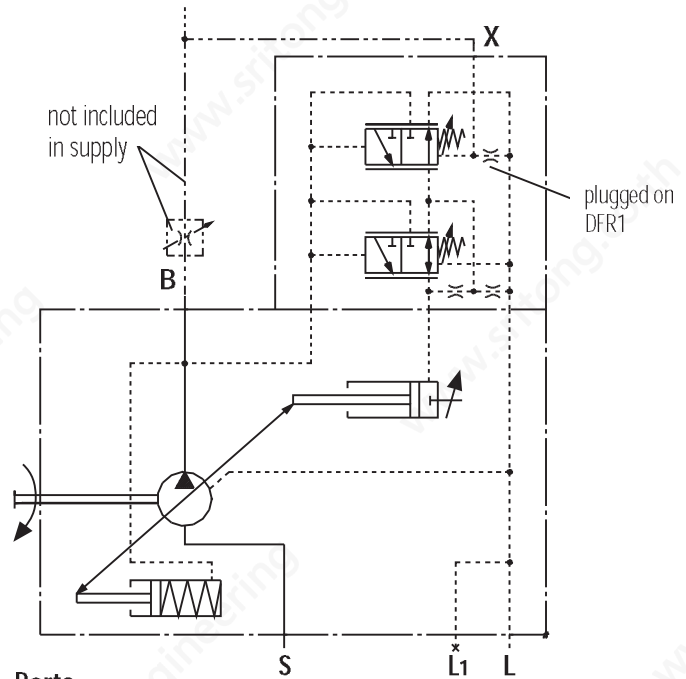


## Dynamic flow control operating curve

The operating curves are average values measured under test conditions with the unit mounted inside the tank.



NG	$t_{SA}$ [ms] stand by-280 bar	$t_{SE}$ [ms] 280 bar-stand by	$t_{SE}$ 50 bar-stand by
28	40	20	40
45	50	25	50
71	60	30	60
100	120	60	120
140	130	60	130



### Ports

- B** Pressure port
- S** Suction port
- L, L1** Case drain ports (L1 plugged)
- X** Pilot pressure port

### Differential pressure $\Delta p$ :

Adjustable between 10 and 22 bar (higher values on request).

Standard setting: 14 bar. If a different setting is required please indicate in clear text.

When port X is unloaded to tank a "zerostroke pressure" of  $p = 18 \pm 2 \text{ bar}$  ("stand by") results (dependent on  $\Delta p$ ).

### Controller data

Max. flow variation (hysteresis and increase) measured at drive speed  $n = 1500 \text{ rpm}$

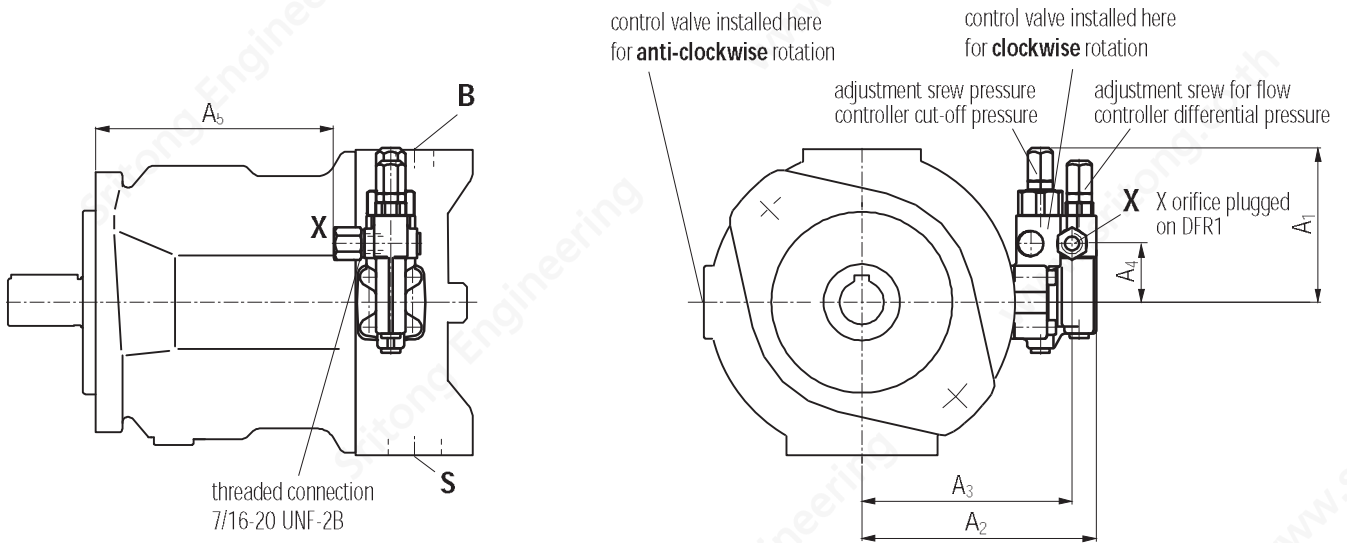
Size	28	45	71	100	140	
$\Delta q_{v \max}$	L/min	1,0	1,8	2,8	4,0	6,0

DFR pilot oil consumption \_\_\_\_\_ max. approx. 3 ... 4,5 L/min

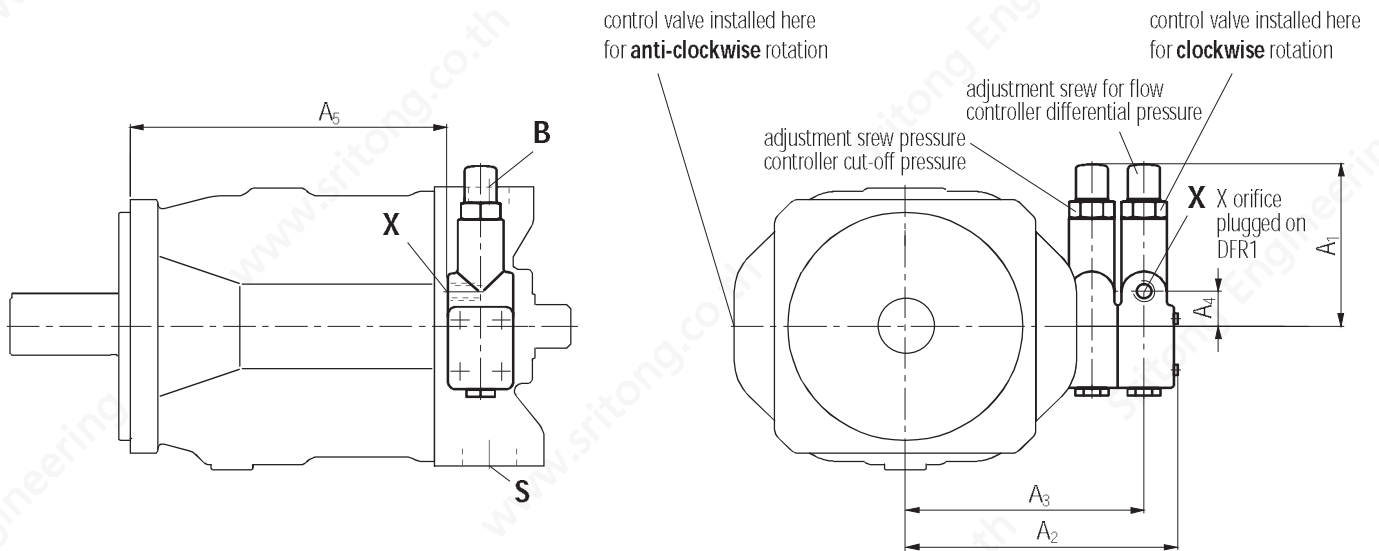
DFR1 pilot oil consumption \_\_\_\_\_ max. approx. 3 L/min

# Unit Dimensions DFR; DFR1 Pressure and Flow Control

Sizes 28...100



Size 140



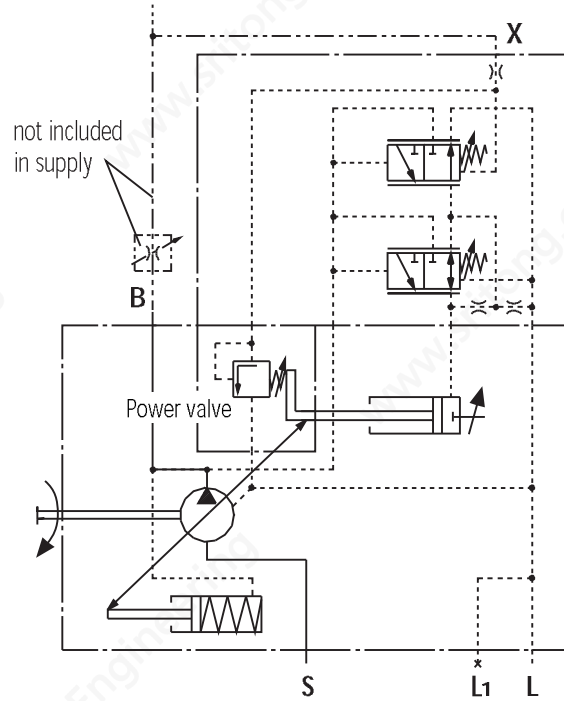
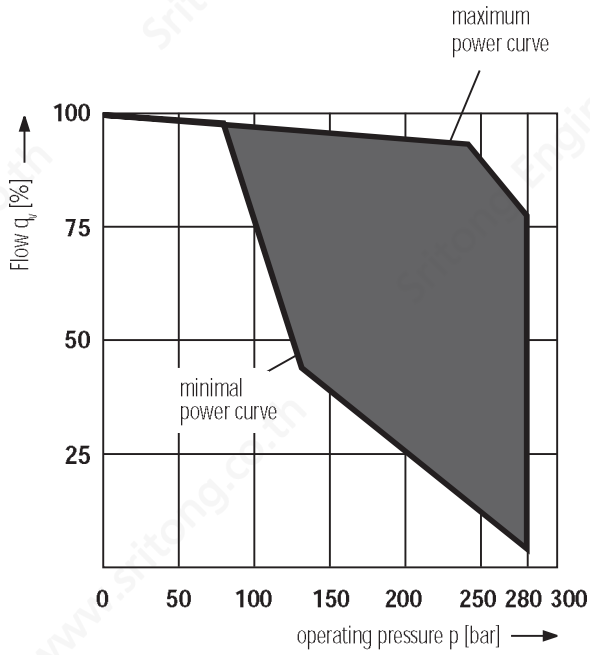
NG	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	port X	
28	109	136	119	40	119	M14x1,5; 12 deep	} with adaptor
45	106	146	129	40	134	M14x1,5; 12 deep	
71	106	160	143	40	162	M14x1,5; 12 deep	
100	106	165	148	40	229	M14x1,5; 12 deep	
140	127	209	183	27	244	M14x1,5; 12 deep	without adaptor

# DFLR Pressure / Flow / Power Control

In order to achieve a constant drive torque with a varying operating pressure, the swivel angle and with it the output flow of the axial piston pump is varied so that the product of flow and pressure remains constant.

Constant flow control is possible below the power curve.

## Static operating curve



### Ports

- B** Pressure port
- S** Suction port
- L, L1** Case drain ports ( L1 plugged)
- X** Pilot pressure port

The power curve is set at the factory, please state your requirements in clear text e.g. 20 kW at 1500 rpm.

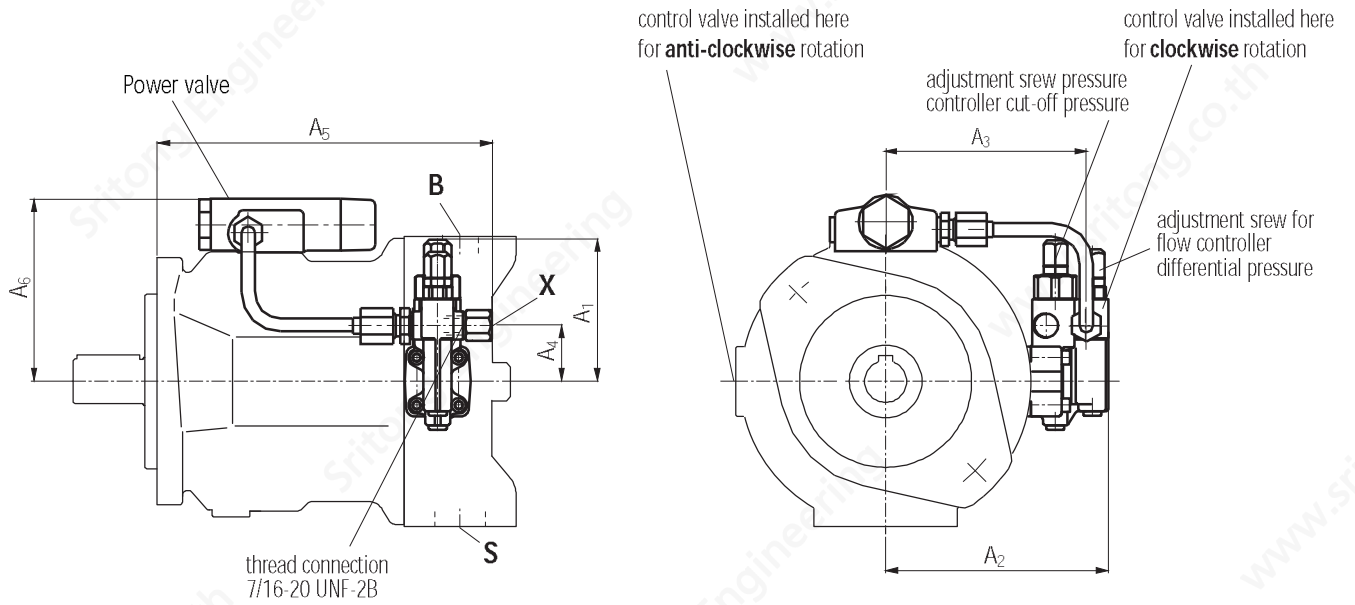
## Controller data

Start of control \_\_\_\_\_ ab 80 bar

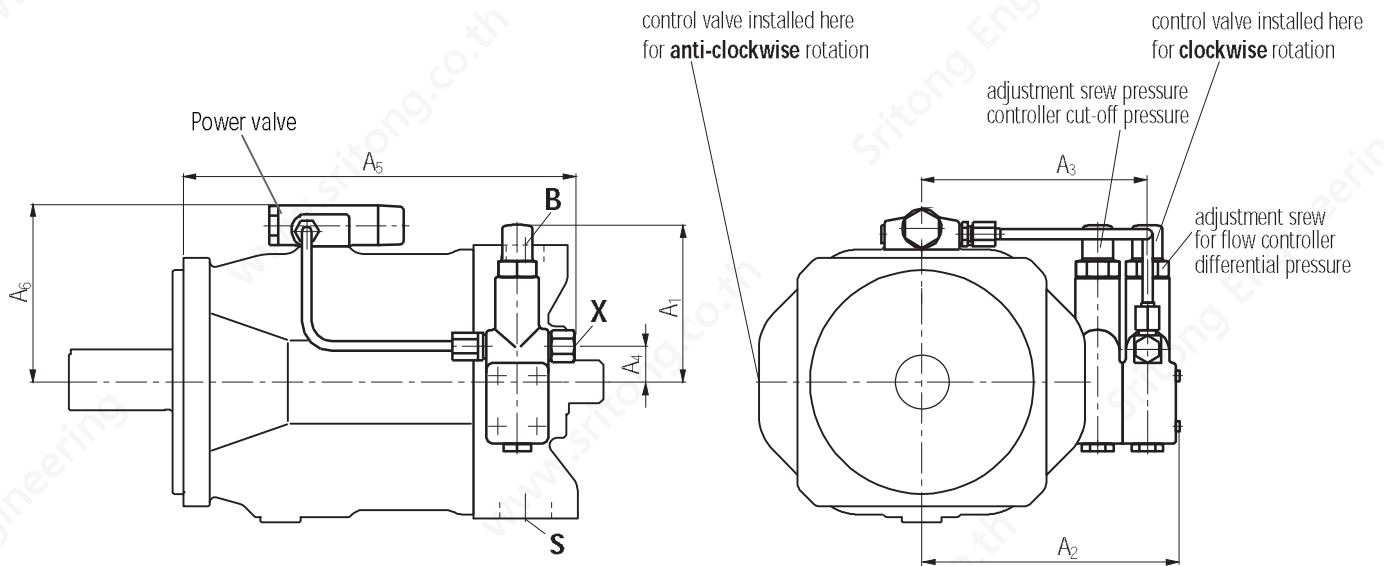
Pilot oil requirement \_\_\_\_\_ max. approx. 5,5 L/min

# Unit Dimensions Pressure / Flow / Power Control DFLR

Sizes 28...100



Size 140



NG	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	Port X
28	109	136	119	40	197	107	M14x1,5; 12 deep
45	106	146	129	40	212	112	M14x1,5; 12 deep
71	106	160	143	40	240	124	M14x1,5; 12 deep
100	106	165	148	40	307	129	M14x1,5; 12 deep
140	127	209	183	27	314	140	M14x1,5; 12 deep