

■ Product description：

□ **The HD-A10VSO , variable pump in axial piston swash plate design for hydrostatic drives in an open circuit, is designed for stationary applications.**

□ **The HD-A10VO, variable pump in axial piston swash plate design for hydrostatic drives in an open circuit，is designed for mobile applications.**

□ **The flow is proportional to the drive speed and the displacement. The flow can be steplessly varied by adjusting the swash-plate angle.**

■ Features：

■ Excellent suction characteristics

■ Permissible continuous operating pressure up to 28 MPa

■ Axial and radial load capacity of drive shaft

■ Short response time

■ The through drive is suitable for adding gear pumps and axial piston pumps up to the same size

■ Low noise and long service life

■ Favorable power-to-weight ratio

■ Versatile controller range

■ Applications：

■ The Steel Metallurgy and Forging Machine

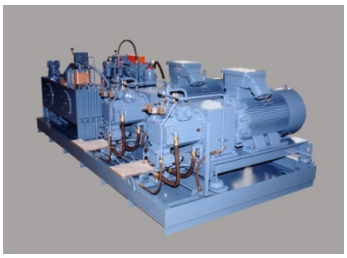
■ Engineering Machinery and facility processing

■ The Ships and Water Resources and Hydropower Hoist

■ The Oil and Petrochemical Machinery

■ Building and mobile machine









■ Type Code For Standard Program：

HD	-		A10VS	O	100	DR	/	31	R	-	P	P	A	12	N00
0		1	2	3	4	5		6	7		8	9	10	11	12

0. Manufacturer：

华德液压 HUADE HYDRAULIC

1. Hydraulic fluid version：

Hydraulic fluid/ Standard：	10	18	28	45	71	100	140	Code
Mineral oil……no code	■	■	■	■	■	■	■	-
Flame retardant hydraulic fluid （HF）….. See details in Hydraulic Selection	-	-	■	■	■	■	■	E
High-speed version	-	-	-	□	□	□	■	H

2. Axial piston unit：

Axial piston unit / Version：：	10	18	28	45	71	100	140	代码
Swash plate design, variable, up to industrial grade	■	■	■	■	■	■	■	A10VS
Size10：Nominal pressure 250 bar， Peak Pressure 315 bar。Size 18…140: Nominal pressure 280 bar，Peak Pressure 350 bar.								

3. Type of operation：

Type of operation / Version：	10	18	28	45	71	100	140	Coede
Pump, open circuit	■	■	■	■	■	■	■	O

4. Size：

Size / Version：	10	18	28	45	71*	100	140	Code
Size ≙ V_{gmax}（cm^3/r）	10	18	28	45	71	100	140	-

5. Control devices：

Control devices / Version：			10	18	28	45	71	100	140	Code
Two-point control, directly operated			-	■	■	■	■	■	■	DG
Pressure control			■	■	■	■	■	■	■	DR
pressure control…remotely operated			■	■	■	■	■	■	■	DRG
Flow control			■	■	■	■	■	■	■	DFR
Pressure and Flow control, X-T plugged			■	■	■	■	■	■	■	DFR1
Pressure, flow and power control			■	■	■	■	■	■	■	DFLR
Electro-flow control…with swash-plate position feedback			-	-	□	□	□	□	□	FE1
Flow/Pressure electronic control			-	□	□	□	□	□	□	DFE1
Electro -hydraulic pressure control	negative characteristic	12V	-	□	□	□	□	□	□	ED71
		24V	-	□	□	□	□	□	□	ED72
	positive characteristic	12V	-	□	□	□	□	□	□	ER71
		24V	-	□	□	□	□	□	□	ER72

■ Type Code For Standard Program：

6. Series：

Series / Version：	10	18	28	45	71	100	140	Code
Series 31	-	■	■	■	■	■	■	31
Series 52	■	-	-	-	-	-	-	52

7. Direction of rotation：

Direction of rotation：	Direction of rotation	Code
With view on drive shaft	Clockwise(forward dextral)	R
	Counter-clockwise (reverse left-handed)	L

8. Seals：

Seals / Version：	10	18	28	45	71	100	140	Code
NBR（Nitri-caoutchouc to DIN ISO 1629, with shaft seal FKM ）	■	■	■	■	■	■	■	P
FKM（fluor-caoutchouc to DIN ISO 1629）	■	■	■	■	■	■	■	V

9. Shaft end：

Shaft end / Version：		10	18	28	45	71	100	140	Code
Keyed parallel shaft to DIN 6885	not for through drive	■	■	■	■	■	■	■	P
Splined shaft SAE	standard shaft	■	■	■	■	■	■	■	S
ANSI B92.1a	similar to shaft S , however for higher input torque	-	■	■	■	■	-	-	R
	reduced diameter, not for through drive	■	-	-	-	-	-	-	U

10. Mounting flange：

Mounting flange / Version：：		10	18	28	45	71	100	140	Code
ISO 3019-2 DIN	2-hole	■	■	■	■	■	■	-	A
	4-hole	-	-	-	-	-	-	■	B
ISO 3019-1 SAE	2-hole	■	-	-	-	-	-	-	C

11. Service line port：

Service line port / Version：	10	18	28	45	71	100	140	Code
Port B and S at rear of opposite sides	-	■	■	■	-	■	■	12
SAE flange port , metric fixing thread								
Port B and S at rear of opposite sides	-	-	-	-	■	-	-	42
SAE flange port , metric fixing thread								
Port B and S at rear	■	-	-	-	-	-	-	14
Metric threaded ports, not for through drive								

■ Type Code For Standard Program：

12. Through drive：

Through drive / Version：		10	18	28	45	71	100	140	Code
Without through drive		■	■	■	■	■	■	■	N00
With through drive for mounting an axial piston unit, gear，or radial piston pump									
Flange	Coupling for splined shaft	10	18	28	45	71	100	140	Code
Flange ISO 3019-1	ANSI B92.1a								
82-2 （A）	5/8” 9T 16/32 DP	-	■	■	■	■	■	■	K01
	3/4” 11T 16/32 DP	-	■	■	■	■	■	■	K52
101-2（B）	7/8” 13T 16/32 DP	-	-	■	■	■	■	■	K68
	1” 15T 16/32 DP	-	-	-	■	■	■	■	K04
127-2（C）	1-1/4” 14T 12/24 DP	-	-	-	-	■	■	■	K07
	1-1/2” 17T 12/24 DP	-	-	-	-	-	■	■	K24
152-4（D）	1-3/4 13T 8/16 DP	-	-	-	-	-	-	■	K17
Φ63 metric 4-hole	shaft key Φ25	-	-	■	■	■	■	■	K57
Flange ISO 3019-1	ANSI B92.1a								
ISO 80 2-hole	3/4” 11T 16/32 DP	-	■	■	■	■	■	■	KB2
ISO 100 2-hole	7/8” 13T 16/32 DP	-	-	■	■	■	■	■	KB3
	1” 15T 16/32 DP	-	-	-	■	■	■	■	KB4
ISO 125 2-hole	1-1/4” 14T 12/24 DP	-	-	-	-	■	■	■	KB5
	1-1/2” 17T 12/24 DP	-	-	-	-	-	■	■	KB6
ISO 180 2-hole	1-3/4” 13T 8/16 DP	-	-	-	-	-	-	■	KB7

= Preferred scenario （ short available time）

■ = available

□ = on request

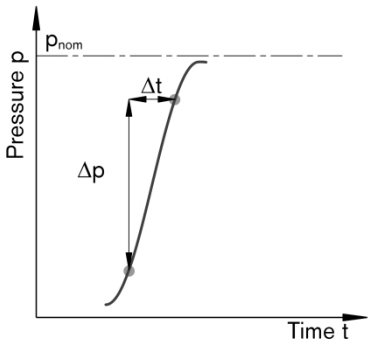
\- = not available

■ Technical data…Size10 Series 52：

- Applies to mineral oil medium run

■ Operating pressure range：

- Pressure at service line port (pressure port) B：
  Nominal pressure P_{nom} ---------- 250 bar
  Peak pressure P_{max} ---------- 315 bar
- Single operating period 2.5 ms，Total operating period 300 h
- Minimum pressure (high-pressure side)：10 bar absolute
- Rate of pressure change $R_{A\,max}$：16000 bar/s



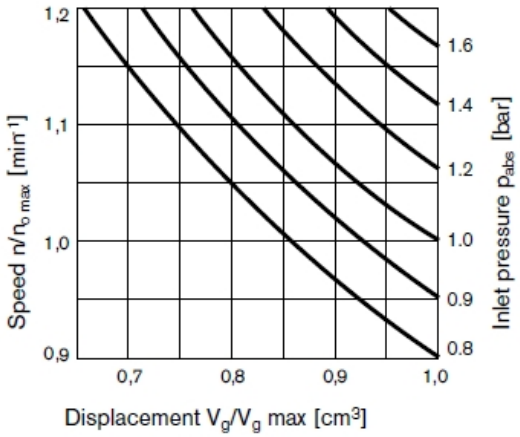
- Pressure at suction port S (inlet)：

  Minimum pressure $P_{S\,min}$ ---------- 0.8 bar…absolute
  Maximum pressure $P_{S\,max}$ ---------- 5 bar ...absolute

■ Case drain pressure：

- The lower the input speed and the case drain pressure, the longer the service life of the shaft end seal.
- Maximum permissible case drain pressure (at port L, L1)
  Maximum 0.5 bar higher than the inlet pressure at port S, however not higher than 2 bar absolute.
  $P_{L\,max}$ ---------- 2 bar…absolute

- Maximum permissible speed (limit speed)
- To determine the min.required inlet pressure Pabs at inlet port S or the reduction of displacement at higher input speeds, see the diagram below：

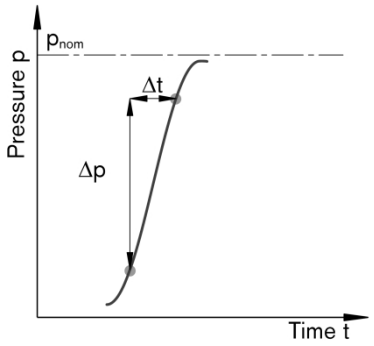


■ Technical data…Size18…140 Series 31

- Applies to mineral oil medium run

■ Operating pressure range：

- Pressure at service line port (pressure port) B：
  Nominal pressure P_{nom} ---------- 280 bar
  Peak pressure P_{max} ---------- 350 bar
- Single operating period 2.5 ms，Total operating period300 h
- Minimum pressure （high-pressure side)：10 bar absolute
- 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

■ Case drain pressure：

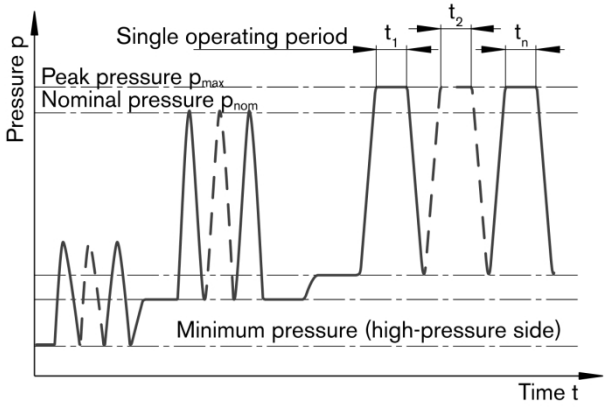
- The lower the input speed and the case drain pressure, the longer the service life of the shaft end seal.
- Maximum permissible case drain pressure (at port L, L1)
  Maximum 0.5 bar higher than the inlet pressure at port S, however not higher than 2 bar absolute.
  $P_{L\,max}$ ---------- 2 bar…absolute

■ Definition：

- Nominal pressure Pnom

The nominal pressure corresponds to the maximum design pressure.

- Peak pressure P_{max}
  The peak pressure corresponds the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.
- Minimum pressure (high-pressure side)：
  Minimum pressure on the high-pressure side (B) that is required in order to prevent damage to the axial piston unit.
- Rate of pressure change R_A
  Maximum permissible rate of pressure build-up and pressure reduction during a pressure change over the entire pressure range.



- Total operating period $=t_1 + t_2 + t_3 \ldots\ldots + t_n$

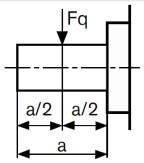
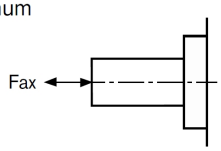
■ Technical data…Size10 Series 52：

□ Standard Program，applies to mineral oil medium run

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

Size		NG		10
Geometrical displacement per revolution		$V_{g\,max}$	cm^3	10.5
Speed[3]				
maximum at $V_{g\,max}$		n_{nom}	rpm	3600
maximum at $V_g < V_{g\,max}$		$n_{max\,perm}$	rpm	4320
Flow				
at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	l/min	37
at $n_E = 1500$ rpm and $V_{g\,max}$		$q_{vE\,max}$	l/min	15
Power at $\Delta p = 250$ bar				
at n_{nom}, $V_{g\,max}$		P_{max}	kW	16
at $n_E = 1500$ rpm and $V_{g\,max}$		$P_{E\,max}$	kW	7
Torque				
at $V_{g\,max}$ and	$\Delta p = 250$ bar	T_{max}	Nm	42
	$\Delta p = 100$ bar	T	Nm	17
Rotary stiffness, drive shaft	S	c	Nm/rad	9200
	R	c	Nm/rad	–
	U	c	Nm/rad	6800
	W	c	Nm/rad	–
	P	c	Nm/rad	10700
Moment of inertia rotary group		J_{TW}	kgm^2	0.0006
Angular acceleration, maximum[5]		α	rad/s^2	8000
Filling capacity		V	L	0.2
Weight (without through drive) approx.		m	kg	8

□ Permissible radial and axial forces on the drive shaft

Size	NG		10
Radial force maximum at a/2 	$F_{q\,max}$	N	250
Axial force maximum 	$+ F_{ax\,max}$	N	400

□ Permissible input and through drive torques

Size	NG		10
Torque at $V_{g\,max}$ and $\Delta p = 250$ bar[1]	T_{max}	Nm	42
Input torque for drive shaft, maximum[2]			
S	$T_{E\,max}$	Nm	126
	Ø	in	3/4
R	$T_{E\,max}$	Nm	–
	Ø	in	–
U	$T_{E\,max}$	Nm	60
	Ø	in	5/8
W	$T_{E\,max}$	Nm	–
	Ø	in	–
P	$T_{E\,max}$	Nm	90
	Ø	mm	18
Maximum through-drive torque for drive shaft			
S	$T_{D\,max}$	Nm	–
R	$T_{D\,max}$	Nm	–

■ Technical data…Size18…140 Series 31

□ Standard Program，applies to mineral oil medium run

□ 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^3	18	28	45	71	100	140
Speed[1]									
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^2	0.00093	0.0017	0.0033	0.0083	0.0167	0.0242
Angular acceleration, maximum[2]		α	rad/s^2	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 absolute pressure P_{abs} = 1 bar at the suction port S;
- for the optimum viscosity range of V_{opt} = 16 to 36 mm2/s
- for mineral-based operating materials

2) The scope of application lies between the minimum necessary and the maximum permissible drive speeds;
- Valid for external excitation;
- The limiting value is only valid for a single pump;
- The loading capacity of the connecting parts must be taken into account.
- If the drive speed continuous increasing and up to the limit speed, please conform to the curves shows.

□ Notes：

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 checking the loading with tests or calculations / simulations and comparison with the permissible values.

□ Determination of size：

Flow $q_V = \dfrac{V_g \cdot n \cdot \eta_V}{1000}$ [l/min]

Torque $T = \dfrac{V_g \cdot \Delta p}{20 \cdot p \cdot h_{mh}}$ [Nm]

Power $P = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{q_V \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = Displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency($\eta_t = \eta_V \cdot \eta_{mh}$)

■ Technical data…Size18…140 Series 31：

□ High- speed version，applies to mineral oil medium run

□ 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^3	45	71	100	140
Speed[1]							
maximum at $V_{g\,max}$		n_{nom}	rpm	3000	2550	2300	2050
maximum at $V_g < V_{g\,max}$		$n_{max\,perm}$	rpm	3300	2800	2500	2200
Flow							
at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	l/min	135	178	230	287
Power at $\Delta p = 280$ bar							
at n_{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^2	0.0033	0.0083	0.0167	0.0242
Angular acceleration, maximum[2]		α	rad/s^2	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

3) The values are applicable:

- for absolute pressure P_{abs} = 1 bar at the suction port S；
- for the optimum viscosity range of V_{opt} = 16 to 36 mm2/s
- for mineral-based operating materials

4) The scope of application lies between the minimum necessary and the maximum permissible drive speeds；

- Valid for external excitation；
- The limiting value is only valid for a single pump；
- The loading capacity of the connecting parts must be taken into account.
- If the drive speed continuous increasing and up to the limit speed, please conform to the curves shows.

□ Notes：

- 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 checking the loading with tests or calculations / simulations and comparison with the permissible values.

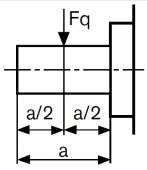
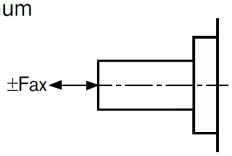
□ Recommendation：

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

External dimensions are not affected by this option.

■ Technical data:

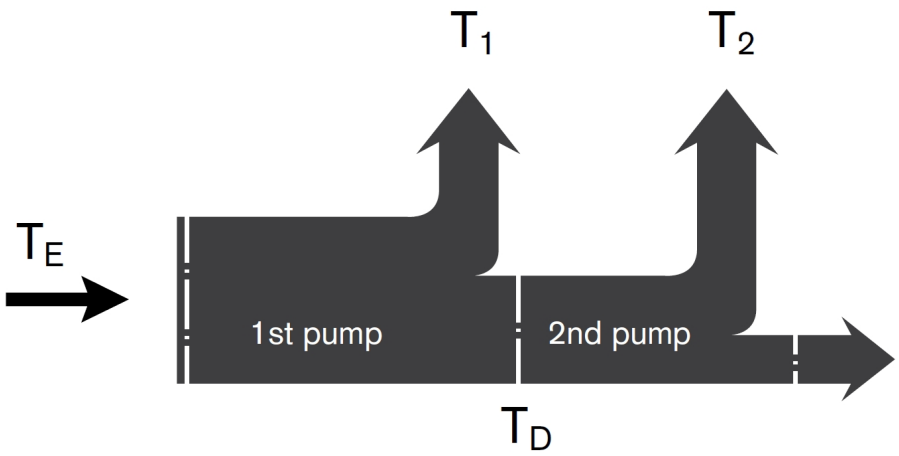
□ Permissible radial and axial loading on the drive shaft

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		$+ F_{ax\,max}$	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 $\Delta p = 280$ bar[1)]		T_{max}	Nm	80	125	200	316	445	623
Input torque for drive shaft, maximum[2)]									
	S	$T_{E\,max}$	Nm	124	198	319	626	1104	1620
		Ø	in	3/4	7/8	1	1 1/4	1 1/2	1 3/4
	R	$T_{E\,max}$	Nm	160	250	400	644	–	–
		Ø	in	3/4	7/8	1	1 1/4	–	–
	P	$T_{E\,max}$	Nm	88	137	200	439	857	1206
		Ø	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

□ Distribution of torques:



■ Drive power and flow：

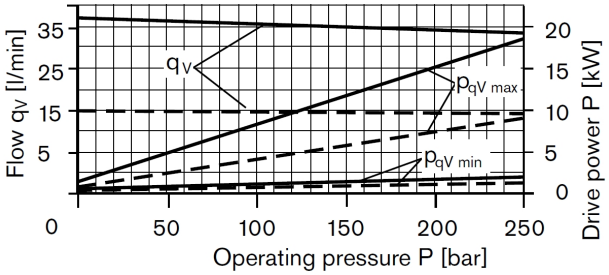
□ Operating material：

Hydraulic fluid ISO VG 46 DIN 51519, t = 50 ° C

□ Size10

_ _ _ _ n = 1500 rpm

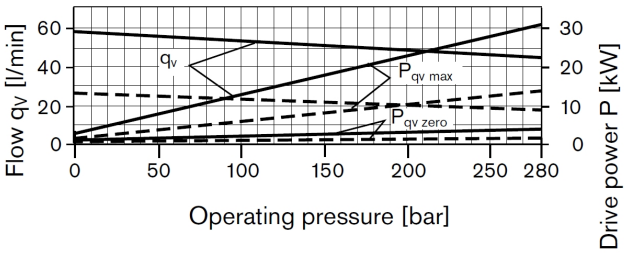
_____n = 3600 rpm



□ Size18

_ _ _ _ n = 1500 rpm

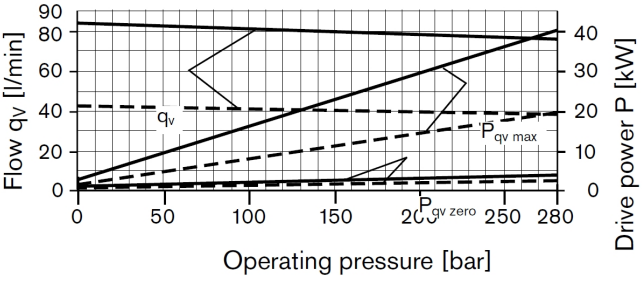
_____n = 3300 rpm



□ Size 28

_ _ _ _ n = 1500 rpm

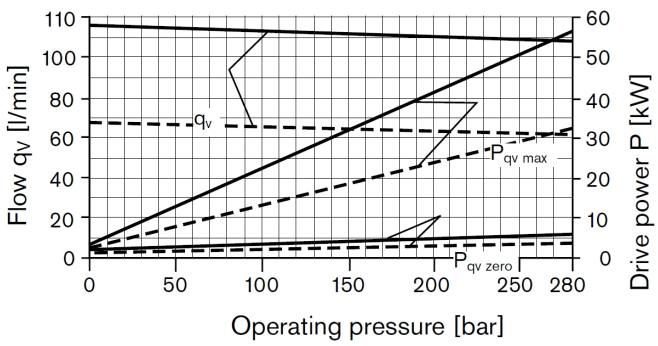
_____n = 3000 rpm



□ Size 45

_ _ _ _ n = 1500 rpm

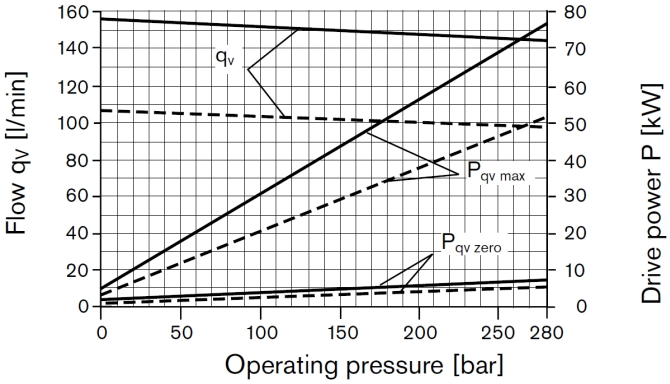
_____n = 2600 rpm



□ Size 71

_ _ _ _ n = 1500 rpm

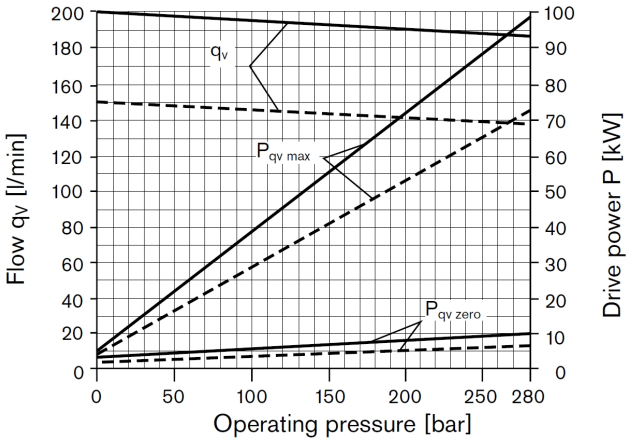
_____n = 2200 rpm



□ Size100

_ _ _ _ n = 1500 rpm

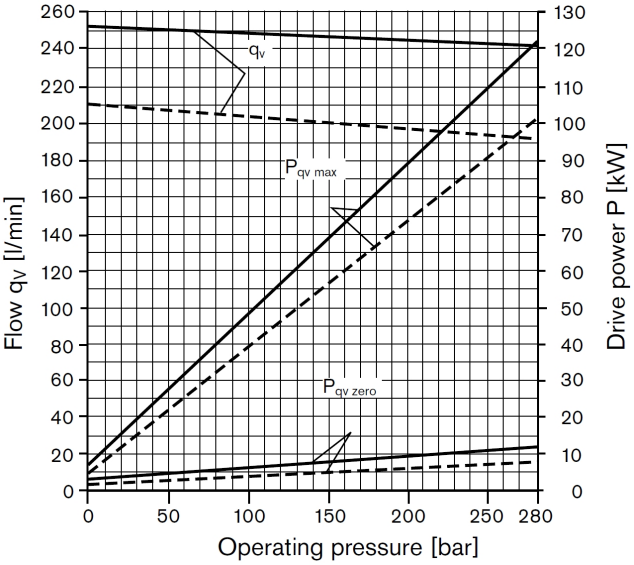
_____n = 2000 rpm



□ Size140

_ _ _ _ n = 1500 rpm

_____n = 1800 rpm



■ Characteristics curves……Pressure control DR：

■ Noise level

Characteristics for pump

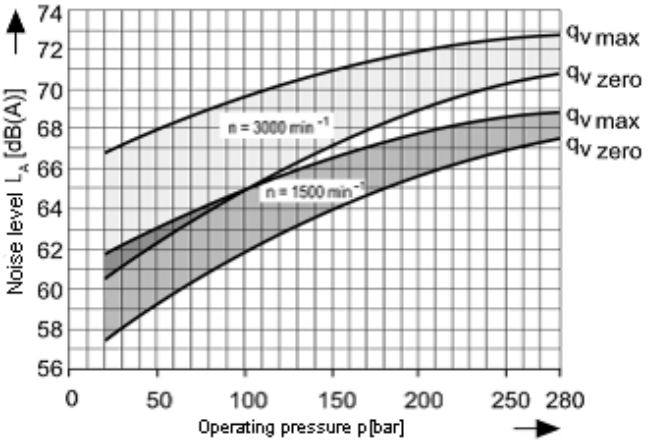
Measured in an anechoic chamber

Distance from microphone to pump = 3.3ft (1m)

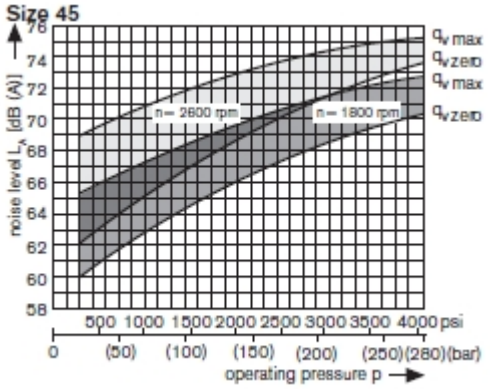
Measuring error: ± 2dB(A)

Fluid: Hydraulic oil to DIN45 635, t=122℉(50℃)

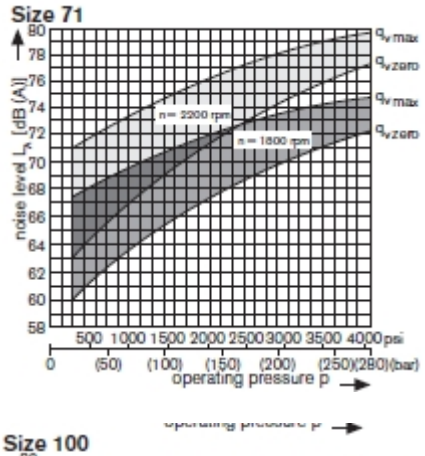
□ Size 28



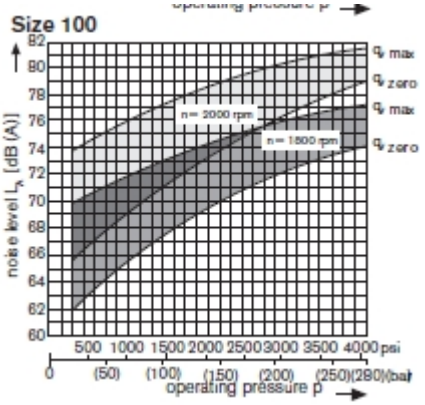
Size 45



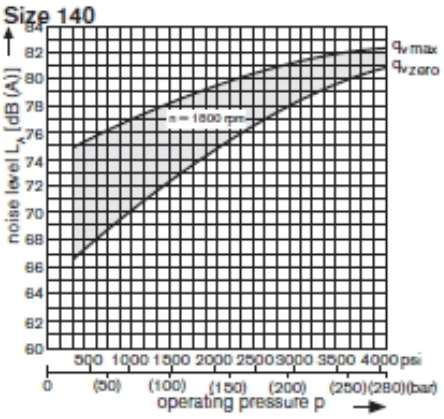
Size 71



Size 100



Size 140



■ DG - Two-point control, directly operated

- Characteristics：
- 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 pst ≥ 50 bar is required
- The variable pump can only be switched between Vgmax or Vgmin.

■ Controls

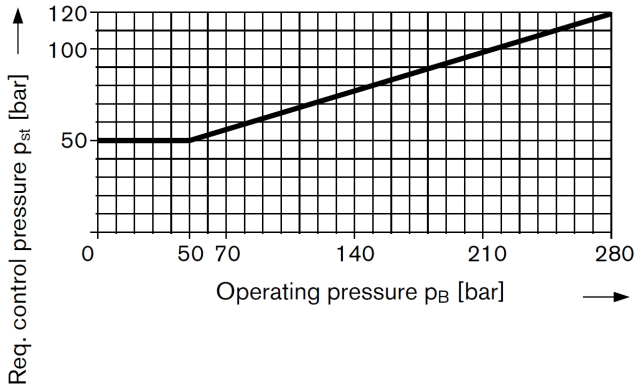
- The required control pressure at port X is directly dependent on the actual operating pressure PB in port B. (See control pressure characteristic).

Control pressure p_{st} in X = 0 bar ≙ $V_{g\,max}$

Control pressure p_{st} in X ≥ 50 bar ≙ $V_{g\,min}$

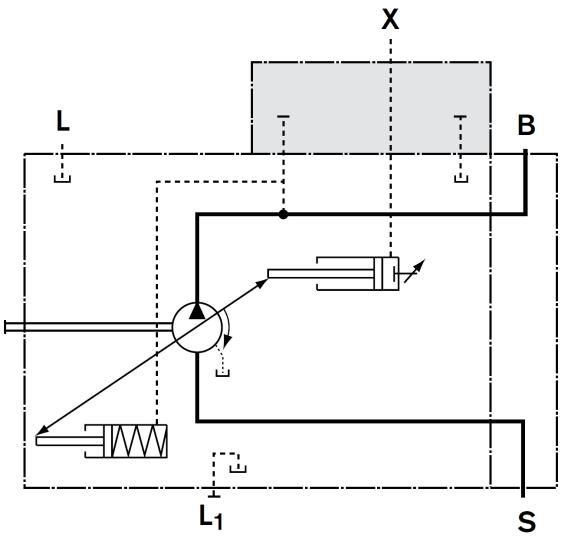
- Controller Data：
  - Min operating pressure — 50 bar
  - Max operating pressure — 120 bar

■ Control pressure characteristic：



■ Circuit diagram：

- Size18…140 Series 31：



- Service line port

	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
X	Pilot pressure

■ DR – Pressure control：

■ Characteristics：

The pressure control limits the maximum pressure at the pump output within the pump control range. The variable pump only supplies as much hydraulic fluid as is required by the consumers.

If the operating pressure exceeds the pressure setpoint set at the integrated pressure valve, the pump will adjust towards a smaller displacement and the control deviation will be reduced. The pressure can be set steplessly at the control valve.

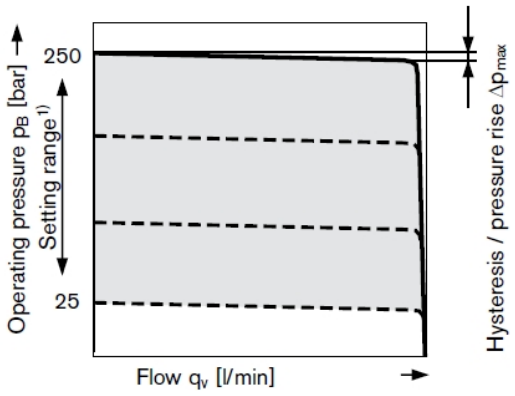
Pressure setting range：

Size10	Series 52	25...250 bar
Size18…100	Series 31	25...280 bar

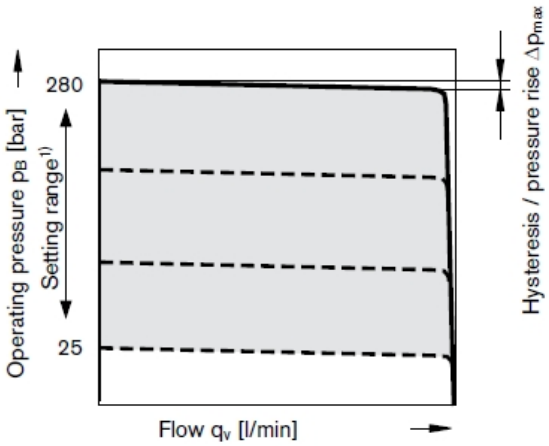
■ Static characteristic：

□ Working Conditions：n = 1500 rpm t_{oil} = 50℃

□ Size10 Series 52



□ Size18…100 Series 31



1) 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 is higher.

■ Controller Data：

□ Hysteresis and repeatability ⊿p.....maximum 3 bar

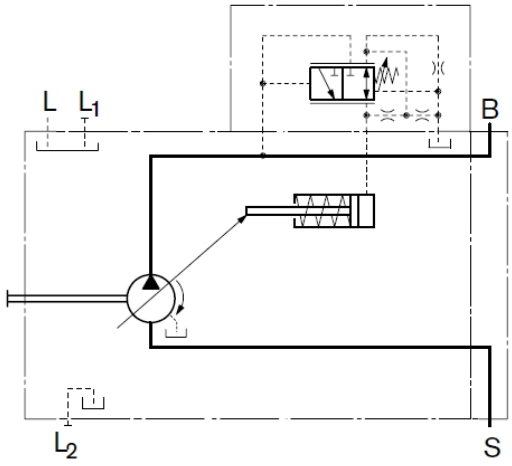
□ Pressure rise, maximum：

Size	10	18	28	45	71	100	140
⊿p bar	6	4	4	6	8	10	12

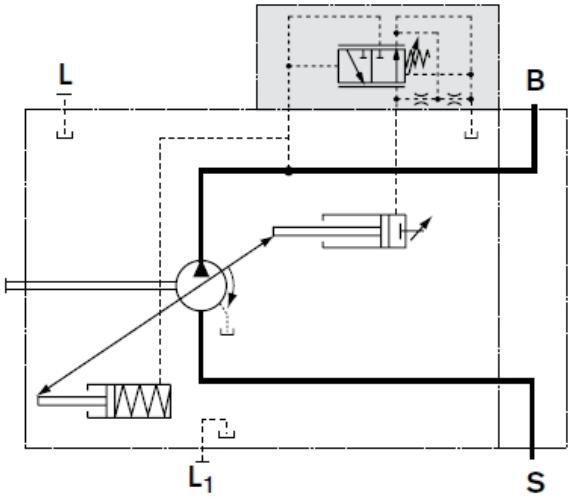
□ Control fluid consumption……maximum approx.3 L/min

■ Circuit diagram：

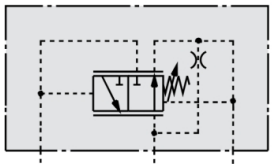
□ Size10 Series 52



□ Size18…100 Series31



□ Size 140 Series31



□ Service line port

	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)

■ DRG - Pressure control, remotely operated

■ Characteristics：

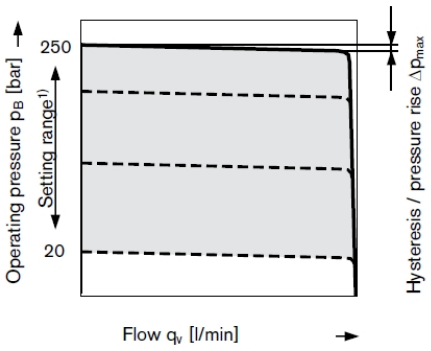
- The pressure control limits the maximum pressure at the pump output within the pump control range. The variable pump only supplies as much hydraulic fluid as is required by the consumers. The pressure can be set steplessly at the control valve.
- The DRG control valve overrides the function of the DR pressure controller
- A pressure relief valve can be externally piped to port X for remote setting of pressure below the setting of the DR control valve spool. This relief valve is not included in the delivery contents of the DRG control. As per consumers' requirements , the DRG controller can also be equipped with pressure regulating valve block or multiple pressure regulating valve block specially designed for HUADE hydraulic.
- The max. length of piping should not exceed 2 m.

■ Setting：

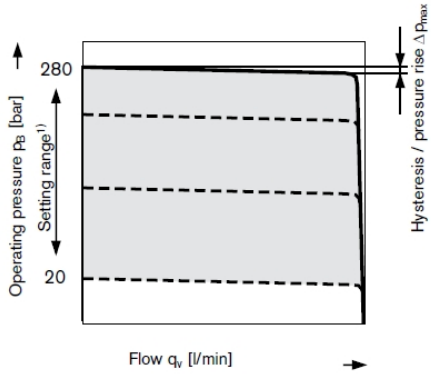
- The differential pressure at the DRG control valve is set as standard to 20 bar. This results in a pilot oil flow to the relief valve of approx. 1.5 l/min at port X. If another setting is required (range from 10-22 bar) please state in clear text.

■ Static characteristic：

- Working Conditions：n = 1500 rpm t_{oil} = 50℃
- Size10 Series 52



- Size18…140 Series 31



1) 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 is higher

■ Controller data：

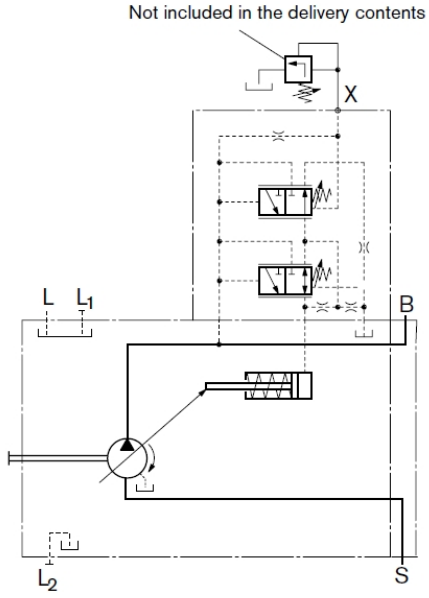
- Hysteresis and repeatability ⊿p.....maximum 3 bar
- Pressure rise, maximum：

Size	10	18	28	45	71	100	140
⊿p bar	6	4	4	6	8	10	12

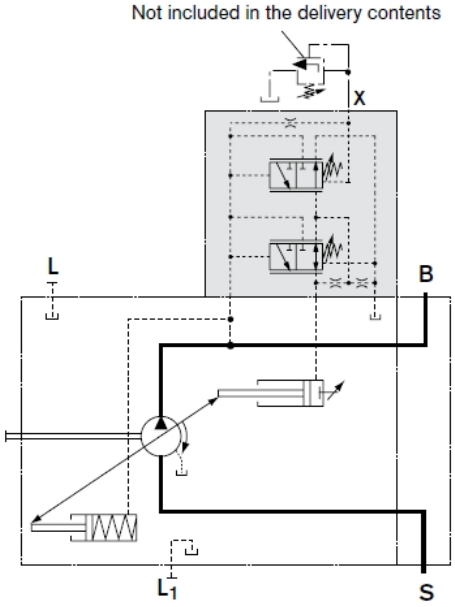
- Control fluid consumption.....maximum approx.4.5 L/min

■ Circuit diagram：

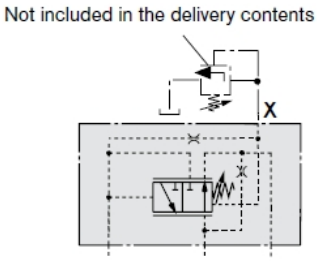
- Size10 Series 52



- Size18…100 Series31



- Size140



- Connection lines：

B	Service line
S	Suction line
L/L_1	Case drain (L1 plugged)
X	Pilot pressure Size10…100 with adapter
X	Pilot pressure Size140 without adapter

■ DFR/DFR1– Pressure and flow control

□ Constant flow control

■ Characteristics：

□ In addition to the pressure control function, the pump flow may be varied by means of a differential pressure over an adjustable orifice 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

■ Setting：

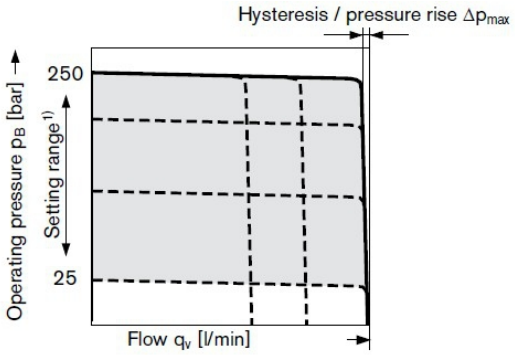
□ The DFR1 version has no connection between X and the reservoir. Unloading the LS-pilot line must be possible in the valve system.

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

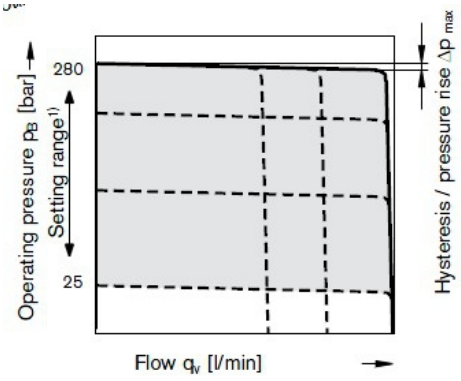
■ Static characteristic：

(n = 1500 rpm t_{oil} = 50℃)

□ Size10 Series 52



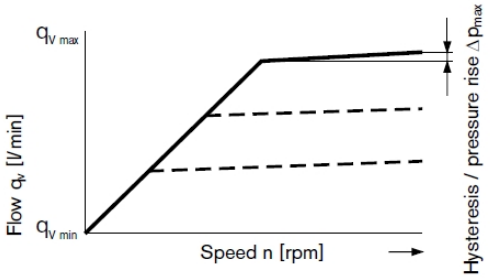
□ Size18…140 Series 31



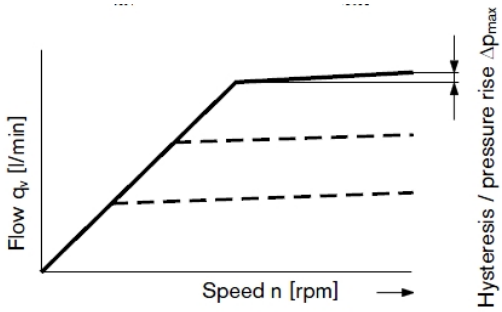
1) In order to prevent damage to the pump and the system, this setting range is the permissible setting range and must not be exceeded.

■ Static characteristic at variable speed：

□ Size10 Series 52



□ Size18…140 Series31



□ Differential pressure⊿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 pressureΔp. System influences are not taken into account.

■ Controller data ：

□ Hysteresis and repeatability ⊿p.....……maximum 3 bar

□ Pressure rise, maximum：

Size	10	18	28	45	71	100	140
⊿p bar	6	4	4	6	8	10	12

□ Control fluid consumption……maximum approx.4.5 L/min

■ Maximum flow deviation:

□ Measured at drive speed n = 1500 rpm

Size	10	18	28	45	71	100	140
⊿q_{max} l/min	0.5	1.0	1.0	1.8	2.8	4.0	6.0

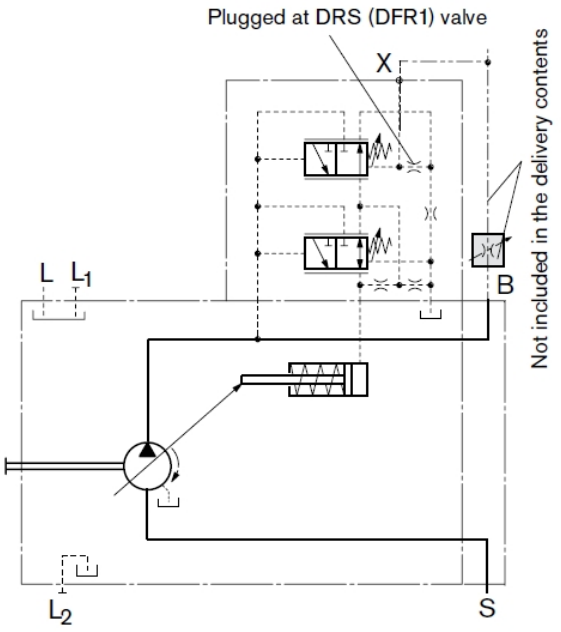
□ Control fluid consumption DFR_maximum approx. 3 to 4.5 l/min

□ Control fluid consumption DFR1_____ maximum approx. 3 l/min

■ DFR/DFR1– Pressure and flow control：

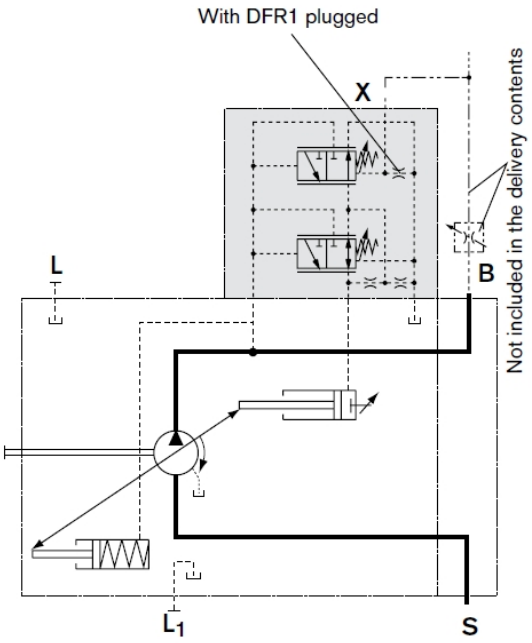
■ Circuit diagram：

□ Size 10 Series 52

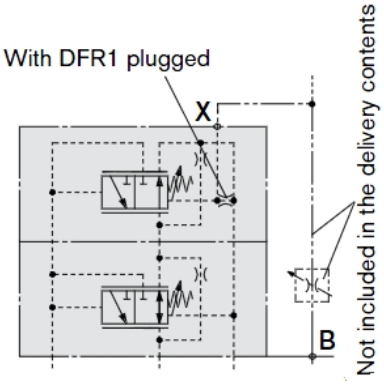


■ Circuit diagram：

□ Size18…100 Series 31



□ Size140 Series 31



□ Connection lines：

B	Service line
S	Suction line
L/L1	Case drain (L1 plugged)
X	Pilot pressure

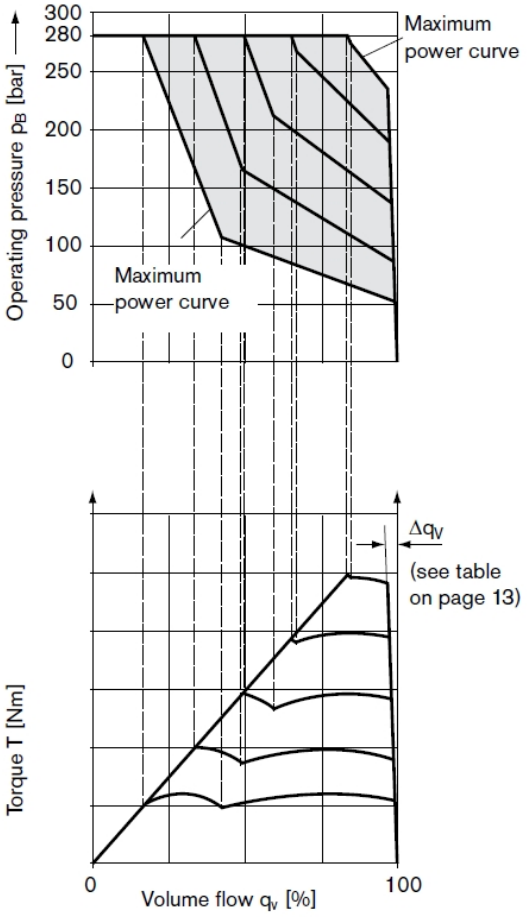
■ DFLR – Pressure, flow and power control：

- Constant power control

■ Characteristics：

- In order to achieve a constant drive torque with varying operating pressures, the swivel angle and with it the output flow from the axial piston pump is varied so that the product of flow and pressure remains constant.
- Flow control is possible below the power control curve.

■ Static curves and torque characteristic：



- The power characteristic is set in the factory; when ordering, please state in clear text, e.g. 20 kW at 1500 rpm.

■ Controller data：

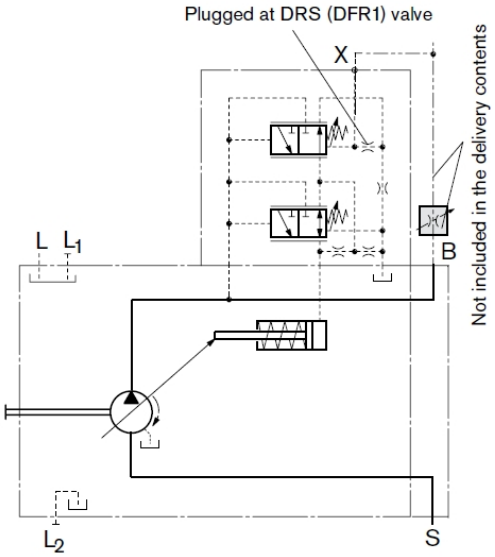
- Beginning of control.....……..…50 bar
- Control fluid consumption……..maximum approx. 5.5 L/min
- For pressure control DR data：See page 14.
- For flow control FR data：See page 16.

- Connection lines：

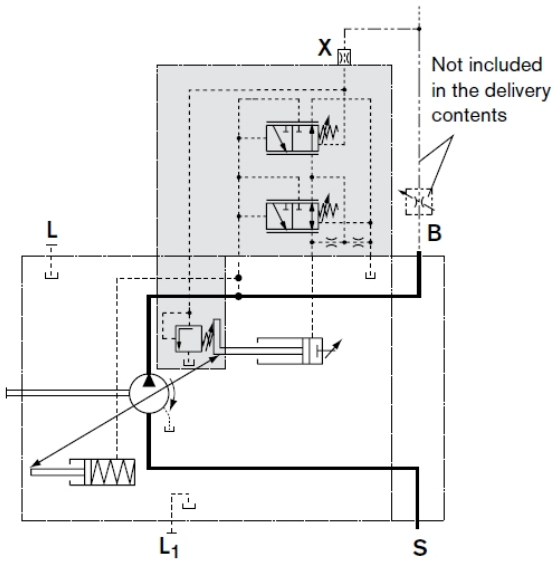
B	Service line
S	Suction line
L/L_1	Case drain (L_1 plugged)
X	Pilot pressure

■ Circuit diagram：

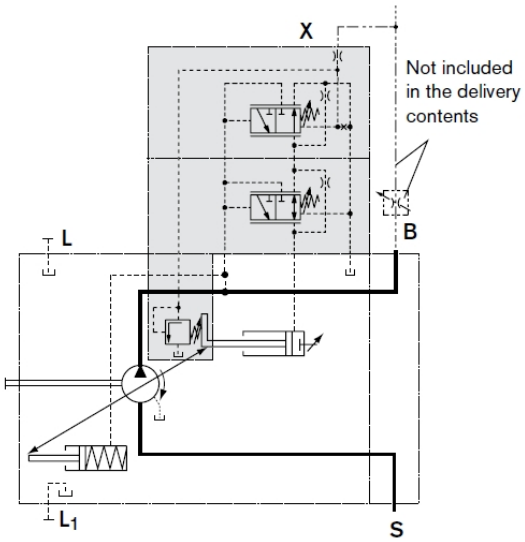
- Size10 Series 52



- Size18…100 Series31



- 规格 140 系列 31



■ ED – Electro-hydraulic pressure control：

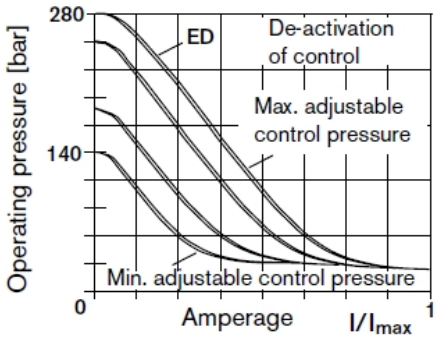
- Electro-hydraulic pressure control…negative characteristic

■ Characteristics：

- The ED valve is set to a certain pressure by a specified, variable solenoid current， If there is a change at the consumer (load pressure), the position of the control piston changes.
- This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.
- When the solenoid current signal drops towards a zero value, the maximum output pressure is limited to pmax by an adjustable hydraulic pressure cut-off.
- The response time characteristic of the ED-control was optimized for the use as a fan drive system. When ordering, state the type of application in clear text.

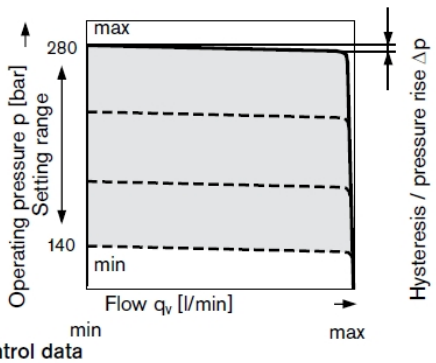
■ Static current-pressure characteristic ED：

- Measured at pump in zero stroke – negative characteristic
- Hysteresis of the static current-pressure characteristic < 3 bar



■ Static flow-pressure characteristic：

- At n = 1500 rpm t_{oil} = 50℃

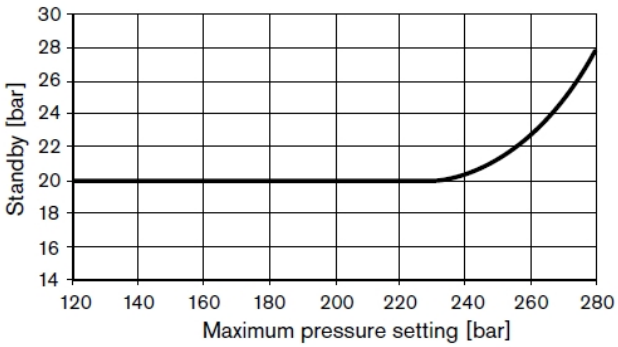


Control data

Stand-by standard setting 20 bar, other values on request.

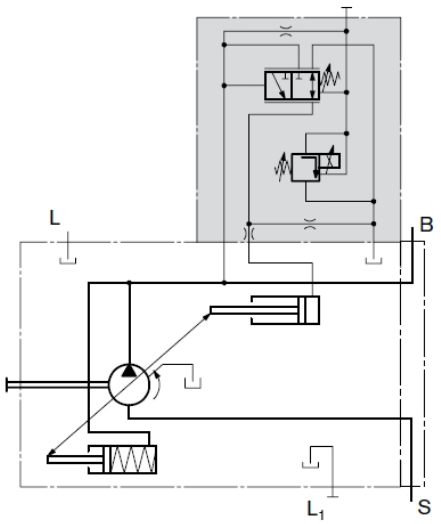
Hysteresis and pressure increase _____ Δp < 4 bar
Control fluid consumption_____ 3 to 4.5 l/min.

■ Influence of pressure setting on standby level：



■ Circuit diagram：

- Size18…100 Series 31



- Connection lines：

B	Service line
S	Suction line
L/L1	Case drain (L1 plugged)

■ Technical data：

- Operating temperature range at valve -20 ℃ to +115℃

Technical data, solenoid	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Control begin at $q_{v\,min}$	100 mA	50 mA
End of control at $q_{v\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %

For type of protection, see plug design on page 43
For details on the control electronics, see page 16

■ ER – Electro-hydraulic pressure control：

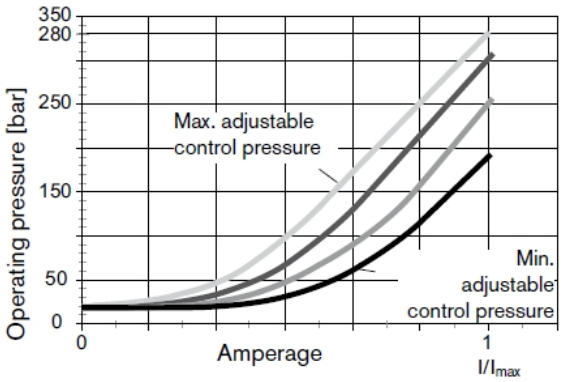
- Electro-hydraulic pressure control…positive characteristic

■ Characteristics：

- The ER valve is set to a specific pressure by a specified, variable solenoid current. If there is a change at the consumer (load pressure), the position of the control piston changes.
- This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level. The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.
- If the solenoid current drops to zero, the pressure is limited to p_{min} (stand-by).

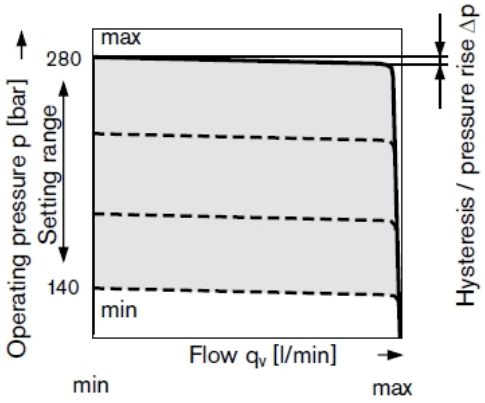
■ Static current-pressure characteristic ER：

- measured at pump in zero stroke – positive characteristic
- Hysteresis of the static current-pressure characteristic < 3 bar
- Influence of pressure setting on stand-by ±2 bar



■ Static flow-pressure characteristic：

- At n = 1500 rpm t_{oil} = 50℃

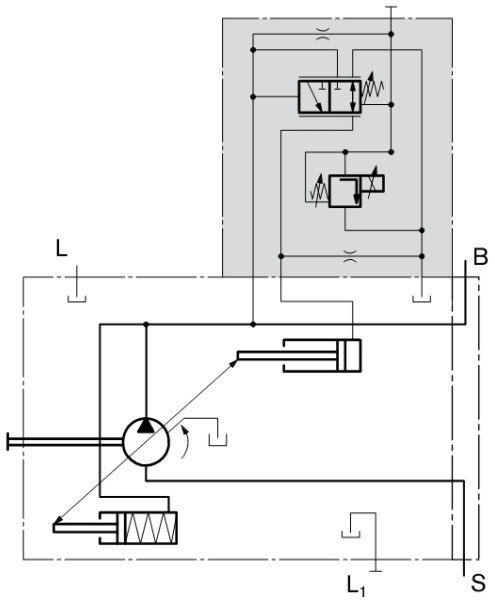


■ Control data：

- Standby standard setting 20 bar, other values on request.
- Hysteresis and pressure increase……..... ⊿p＜4 bar
- Control fluid consumption……..……3～4.5 L/min

■ Circuit diagram：

- Size18…100 Series 31



- Connection lines：

B	Service line
S	Suction line
L/L1	Case drain (L1 plugged)

■ Technical data：

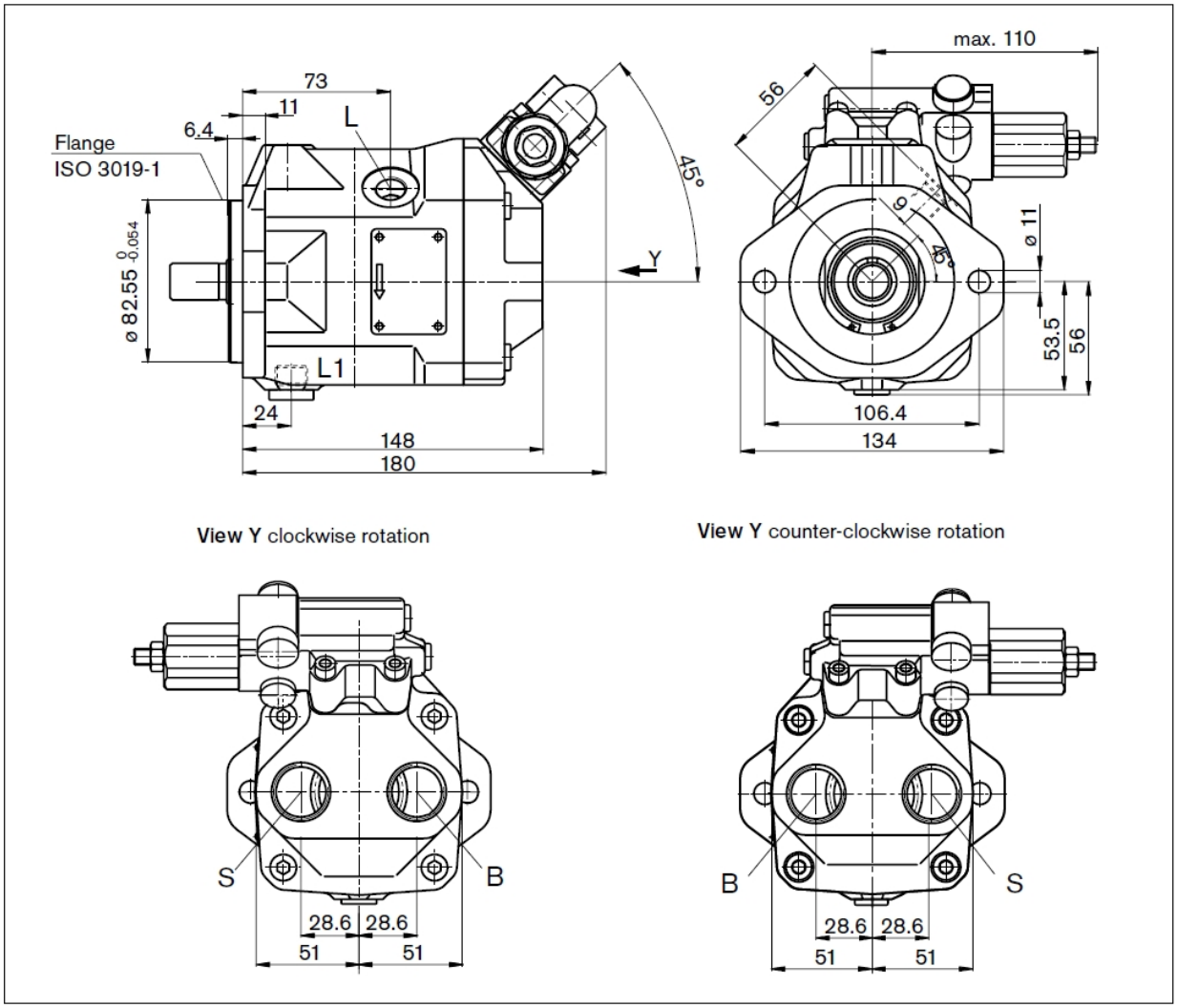
- operating temperature range at valve -20 ℃ to +115℃

Technical data, solenoid	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Control begin at $q_{v\ min}$	100 mA	50 mA
End of control at $q_{v\ max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %
For type of protection, see plug design on page 43		

■ Dimensions：Size10 Series 52

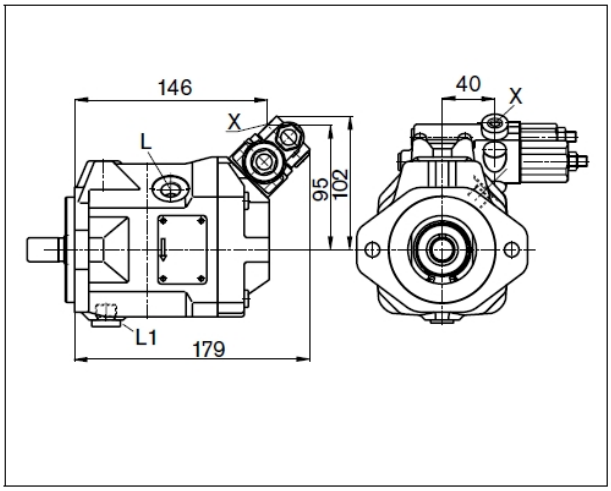
□ DR - Pressure control：

□ Centering flange SAE version



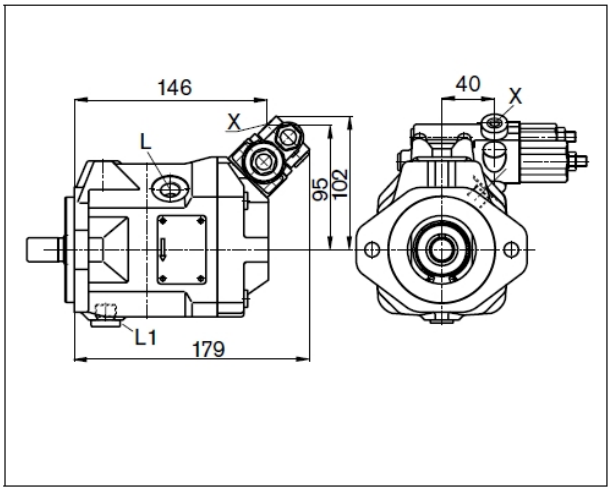
DRG

Pressure and flow control, remote controlled



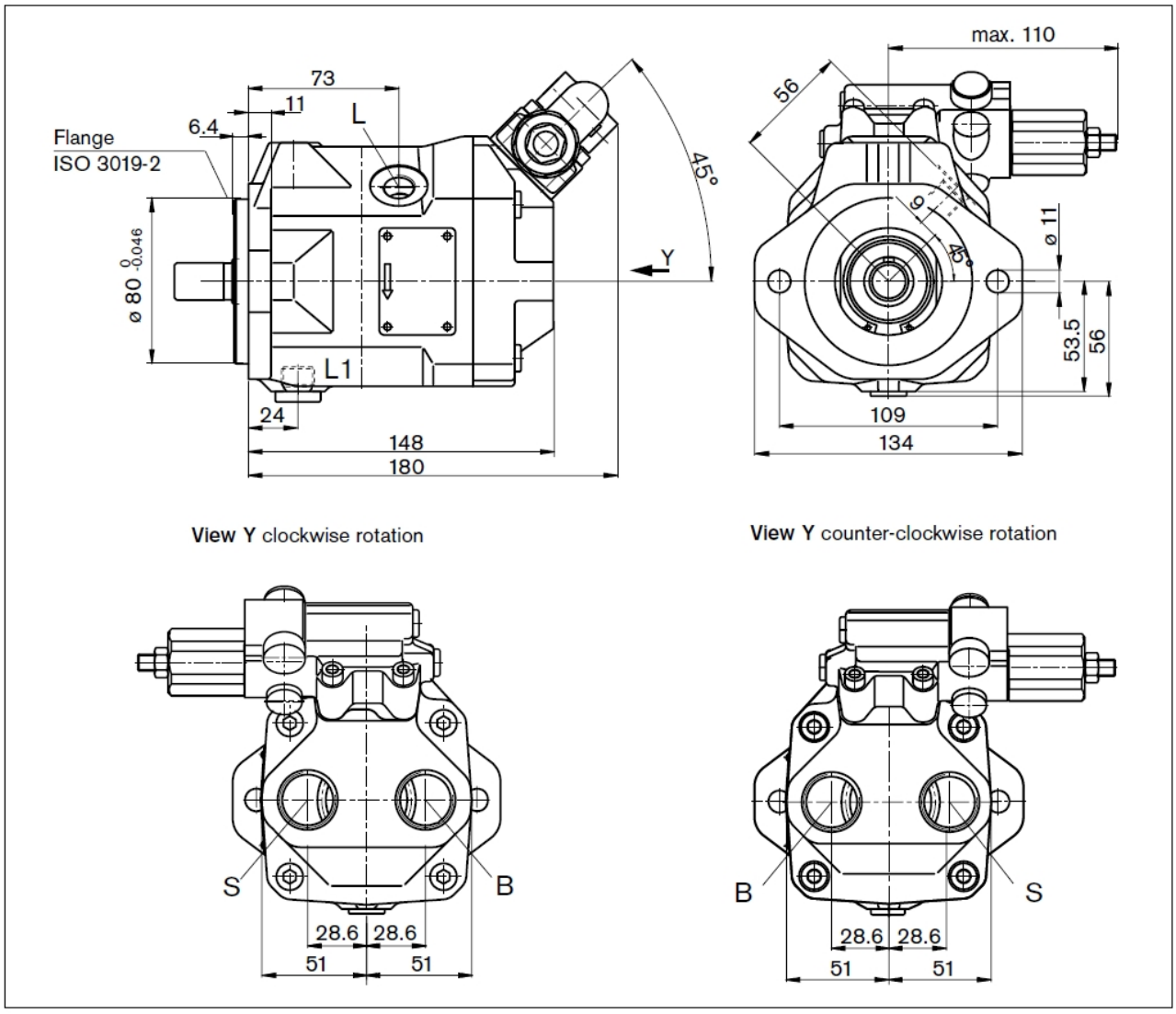
DFR / DFR1

Pressure and flow control

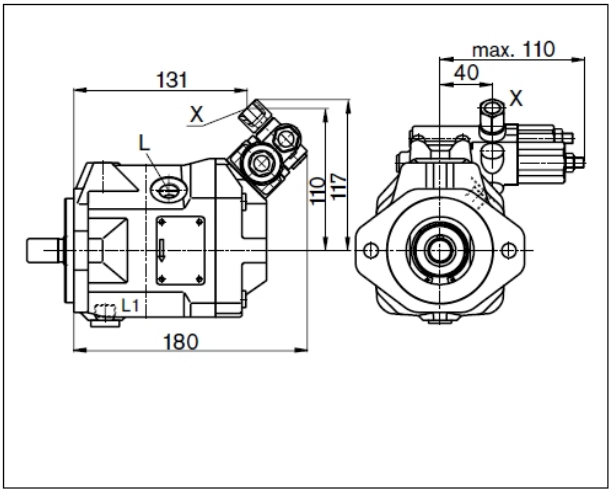


■ Dimensions ： Size10 Series 52

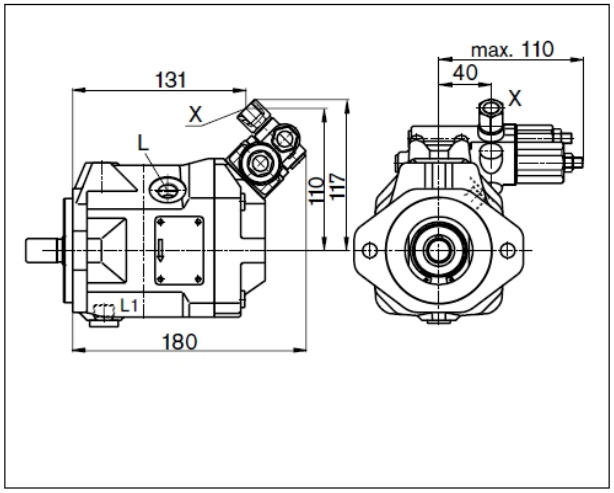
- ☐ DR - Pressure control：
- ☐ Center flange metric version



DRG
Pressure control, remotely operated

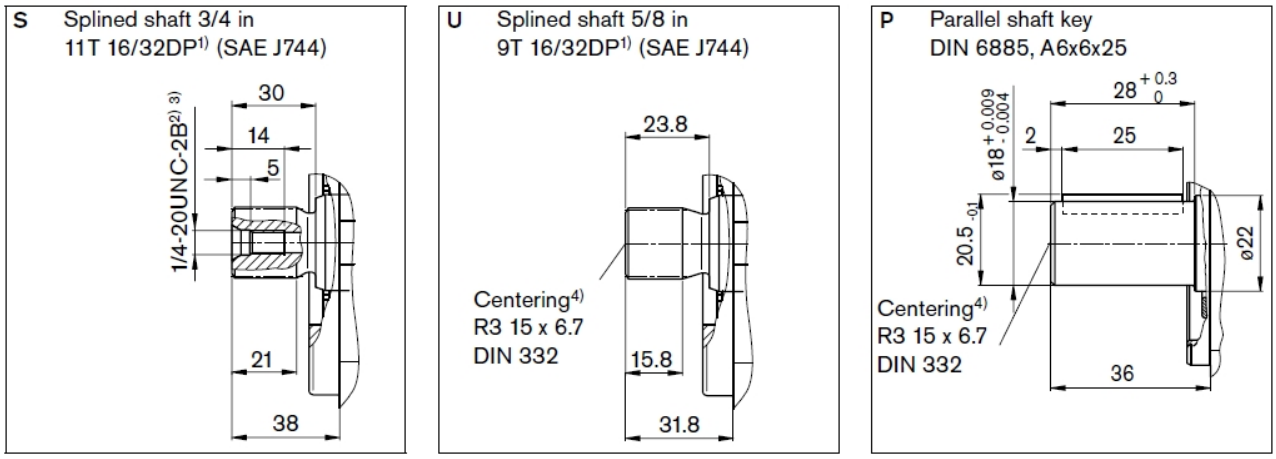


DFR / DFR1
Pressure and flow control



■ Dimensions：Size10 Series 52

□ Drive shaft：



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to ASME B1.1

3) For the maximum tightening torques the general instructions on page 9 must be observed.

4) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw

□ Ports：

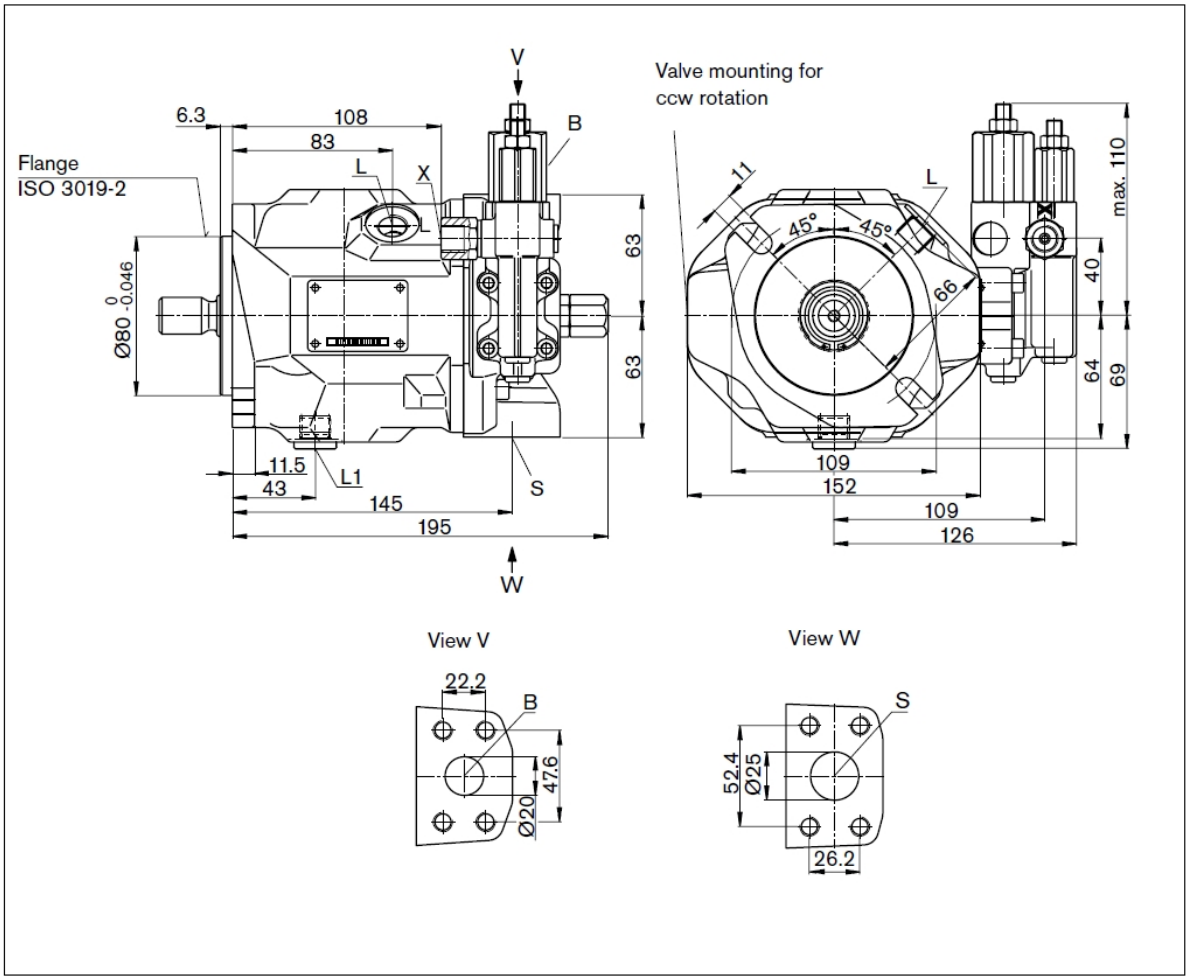
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line	DIN 3852	M27 X 2 16 deep	315	O
S	Suction line	DIN 3852	M27 X 2 16 deep	5	O
L…metric	Case drain fluid	DIN 3852	M16 X 1.5 12 deep	2	O
L_1…metric	Case drain fluid	DIN 3852	M16 X 1.5 12 deep	2	X
L…SAE	Case drain fluid	ISO 11926	9/16-18 UNF-2B 16 deep	2	O
L_1…SAE	Case drain fluid	ISO 11926	9/16-18 UNF-2B 16 deep	2	X
X…with adapter	Pilot pressure	DIN 3852	M14 X 1.5 11.5 deep	315	O
X…without adapter	Pilot pressure	ISO 11926	7/16-20 UNF-2B 11.5 deep	315	O

□ O = Must be connected (plugged on delivery)

□ X = Plugged (in normal operation)

■ Dimensions：Size 18

- ☐ DFR/DFR1 - Pressure and flow control, hydraulic：
- ☐ Clockwise rotation



☐ Ports：

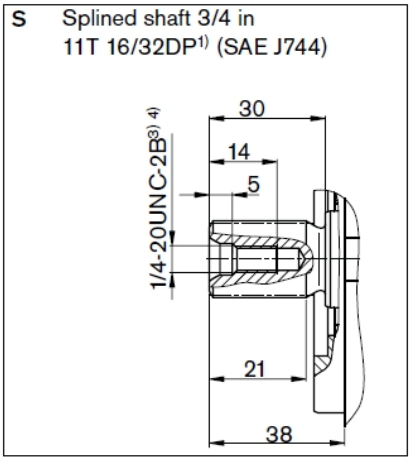
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	3/4” M10 X 1.5 17 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	1” M10 X 1.5 17 deep	10	O
L	Case drain fluid	DIN 3852	M16 X 1.5 12 deep	2	O
L_1	Case drain fluid	DIN 3852	M16 X 1.5 12 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	ISO 228	G 1/4” 12 deep	350	O

- ☐ O = Must be connected (plugged on delivery)
- ☐ X = Plugged (in normal operation)

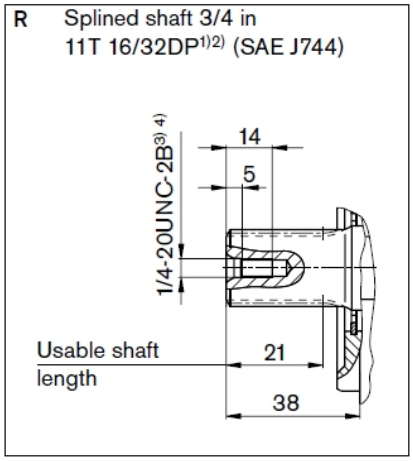
■ Dimensions：Size 18

□ Drive shaft：

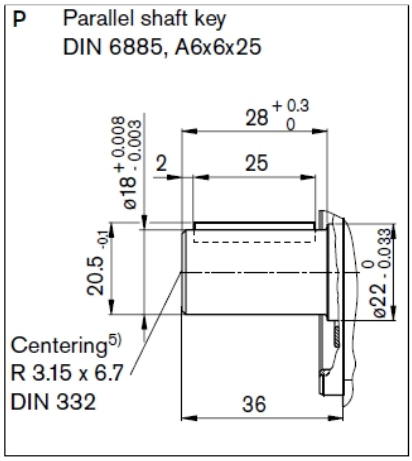
S Splined shaft 3/4 in
11T 16/32DP[1] (SAE J744)



R Splined shaft 3/4 in
11T 16/32DP[1][2] (SAE J744)



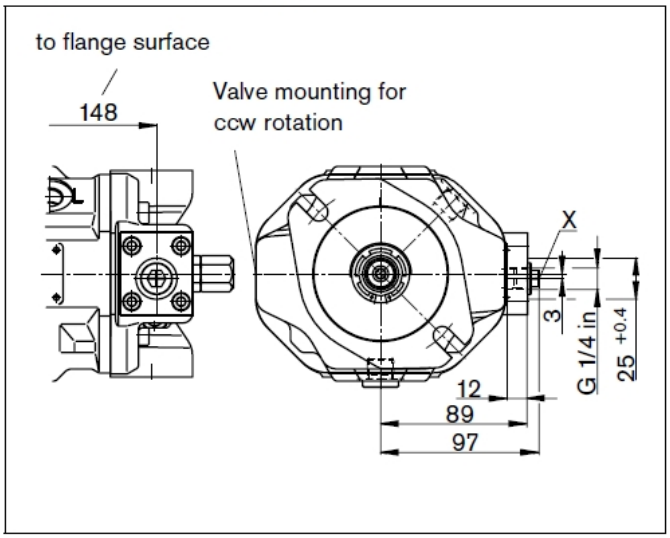
P Parallel shaft key
DIN 6885, A6x6x25



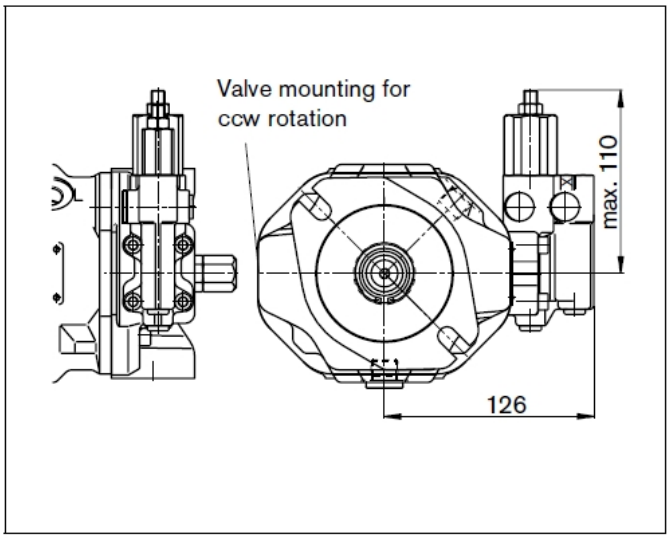
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 9 must be observed
5) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw

■ Dimensions：Size18

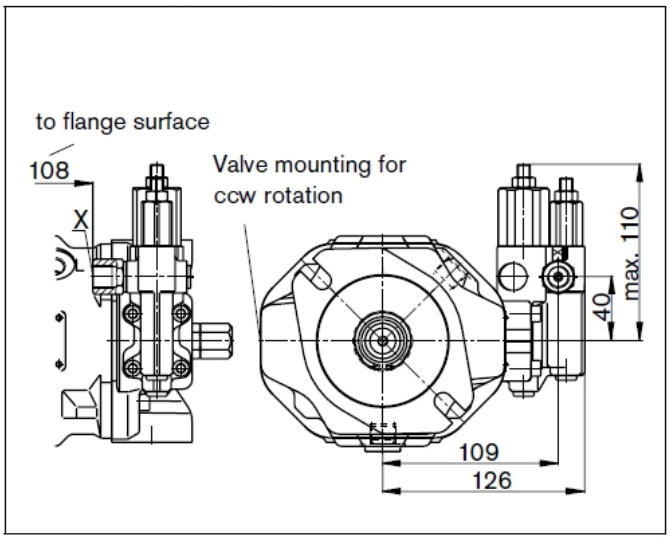
DG
Two-point control, directly operated



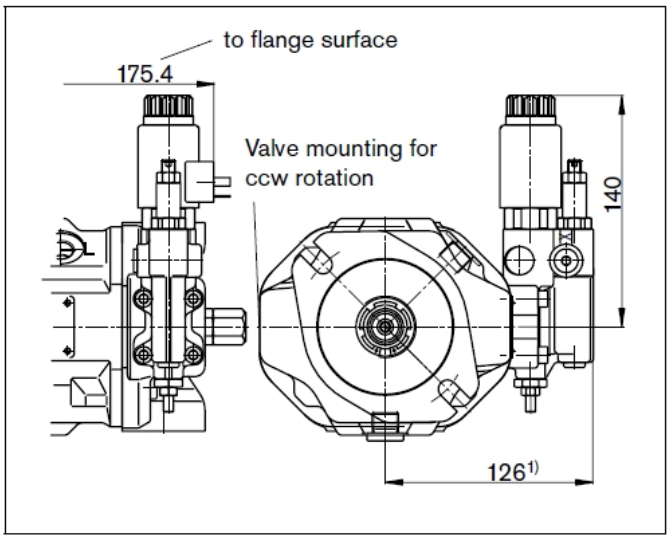
DR
Pressure control



DRG
Pressure control, remotely operated



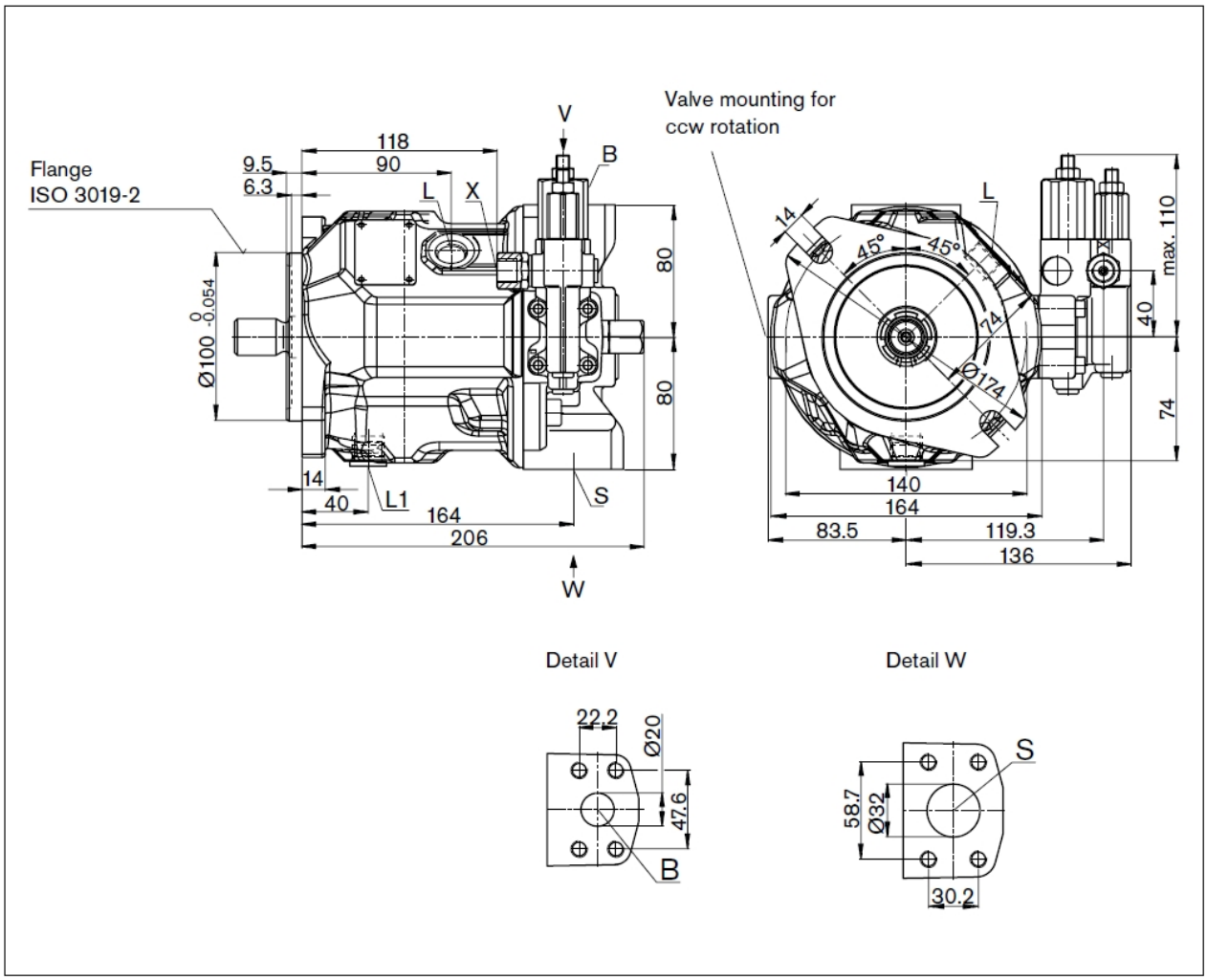
ED7., ER7.
Electro-hydraulic pressure control



1) ER7.: 161 mm if using a sandwich plate pressure reducing valve.

■ Dimensions：Size 28

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



- ☐ Ports：

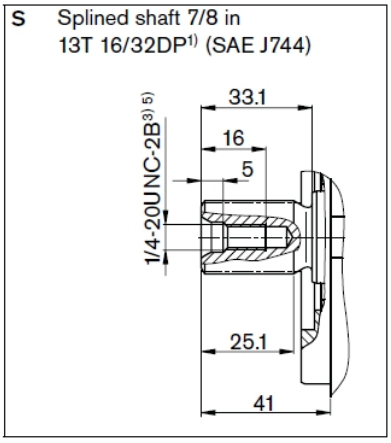
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	3/4” M10 X 1.5 17 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	1-1/4” M10 X 1.5 17 deep	10	O
L	Case drain fluid	DIN 3852	M18 X 1.5 12 deep	2	O
L_1	Case drain fluid	DIN 3852	M18 X 1.5 12 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	ISO 228	G 1/4” 12 deep	350	O

- ☐ O = Must be connected (plugged on delivery)
- ☐ X = Plugged (in normal operation)

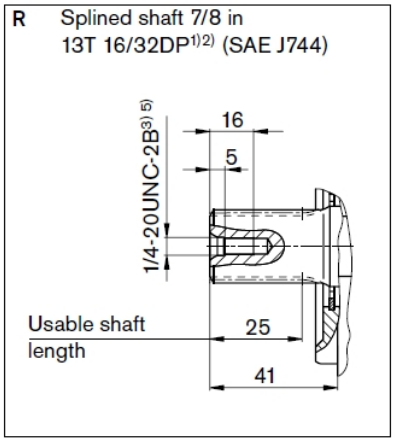
■ Dimensions：Size 28

□ Drive shaft：

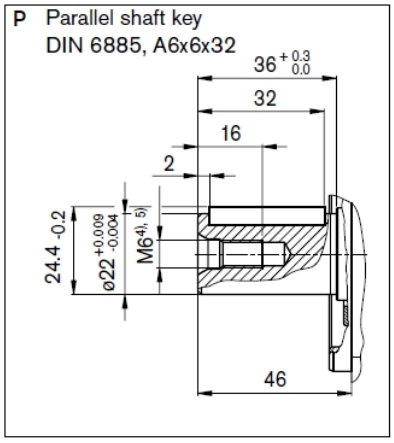
S Splined shaft 7/8 in
13T 16/32DP[1] (SAE J744)



R Splined shaft 7/8 in
13T 16/32DP[1)2)] (SAE J744)



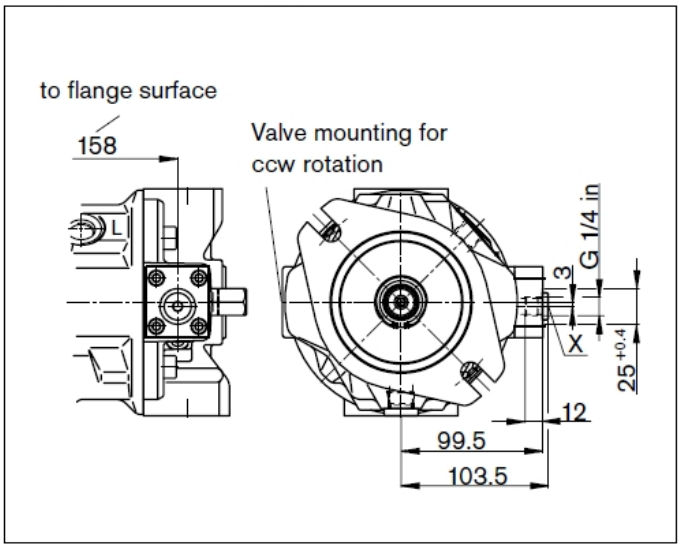
P Parallel shaft key
DIN 6885, A6x6x32



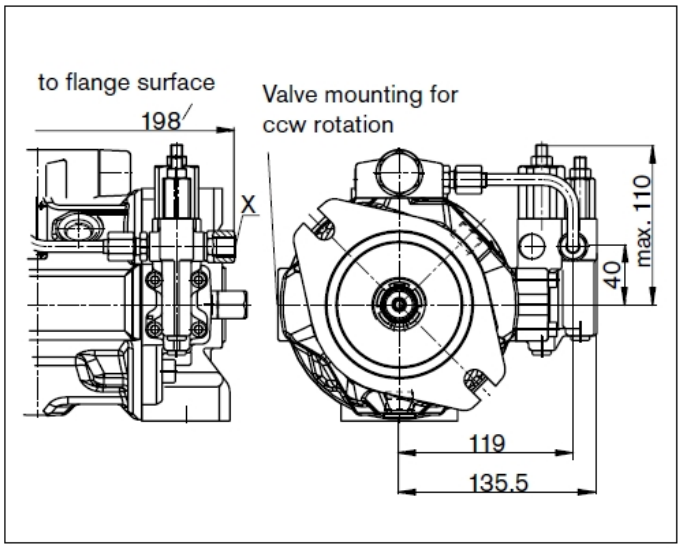
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) Thread according to DIN 13
5) For the maximum tightening torques the general instructions on page 9 must be observed.

■ Dimensions：Size 28

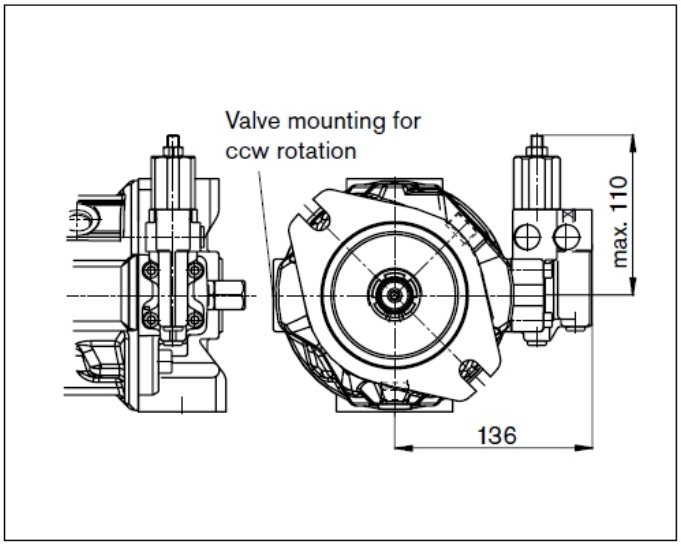
DG
Two-point control, directly operated



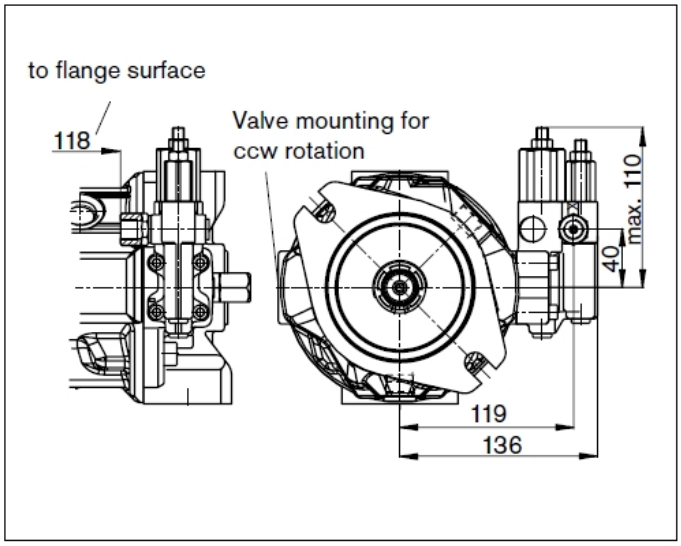
DFLR
Pressure, flow and power control



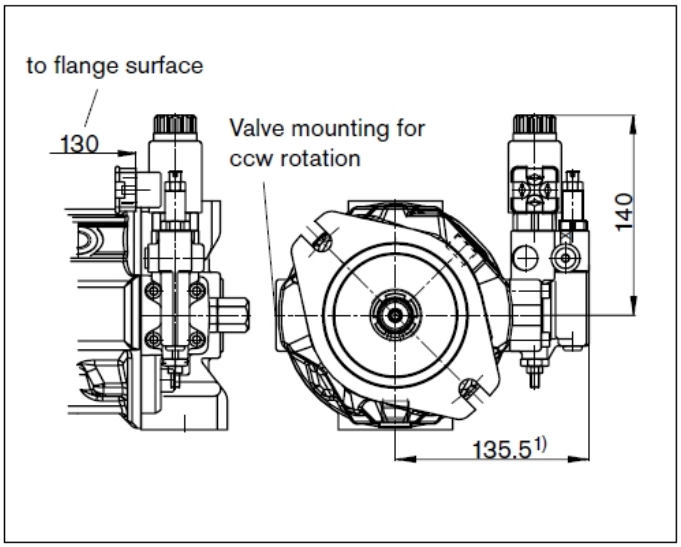
DR
Pressure control



DRG
Pressure control, remotely operated



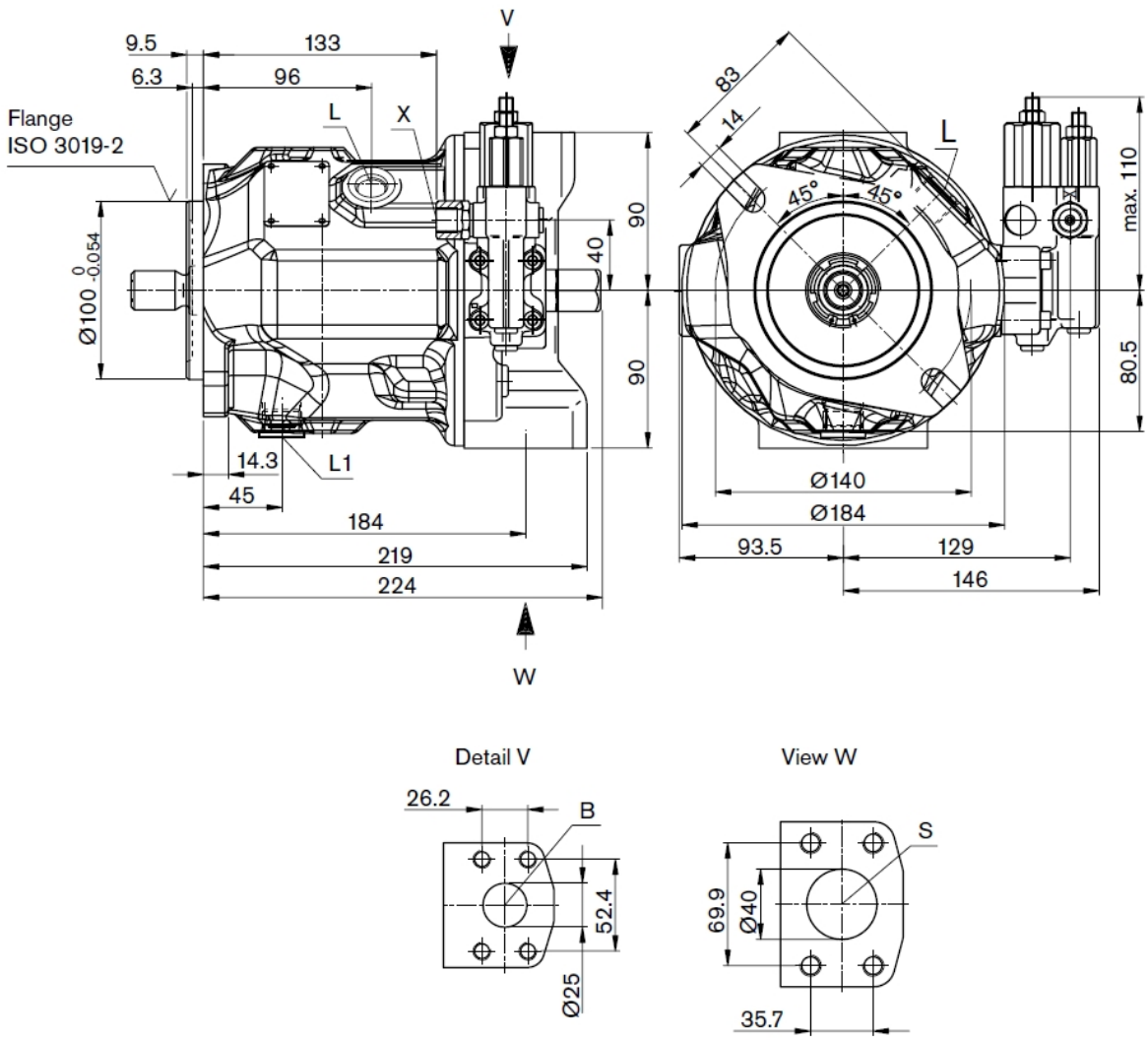
ED7. / ER7.
Electro-hydraulic pressure control



1) ER7.: 170.5 mm when using a sandwich plate pressure reducing valve.

■ Dimensions：Size 45

- ◘ Pressure and flow control, hydraulic：
- ◘ Clockwise rotation



- ◘ Ports：

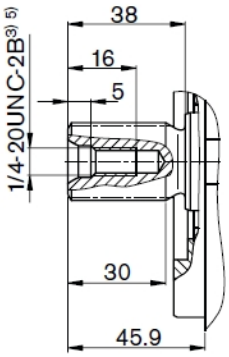
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	1” M10 X 1.5 17 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	1-1/2” M12 X 1.75 17 deep	10	O
L	Case drain fluid	DIN 3852	M22 X 1.5 12 deep	2	O
L_1	Case drain fluid	DIN 3852	M22 X 1.5 12 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	ISO 228	G 1/4” 12 deep	350	O

- ◘ O = Must be connected (plugged on delivery)
- ◘ X = Plugged (in normal operation)

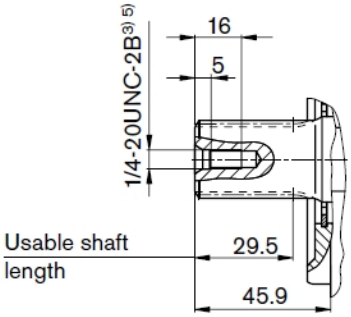
■ Dimensions：Size 45

□ Drive shaft：

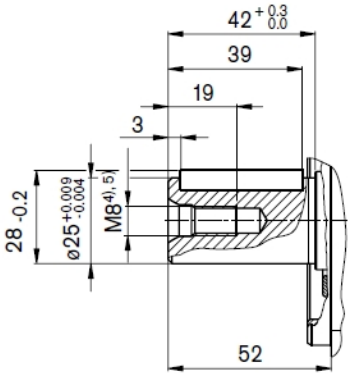
S Splined shaft 1 in
15T 16/32DP[1] (SAE J744)



R Splined shaft 1 in
15T 16/32DP[1)2)] (SAE J744)



P Parallel shaft key
DIN 6885, A8x7x36



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.

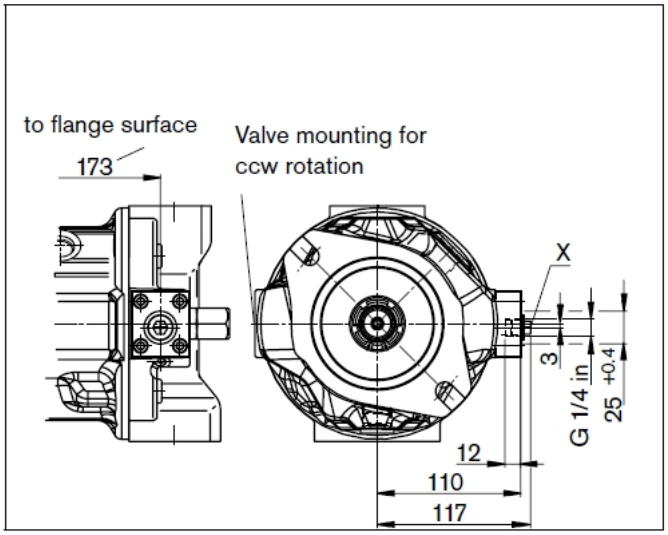
3) Thread according to ASME B1.1

4) Thread according to DIN 13

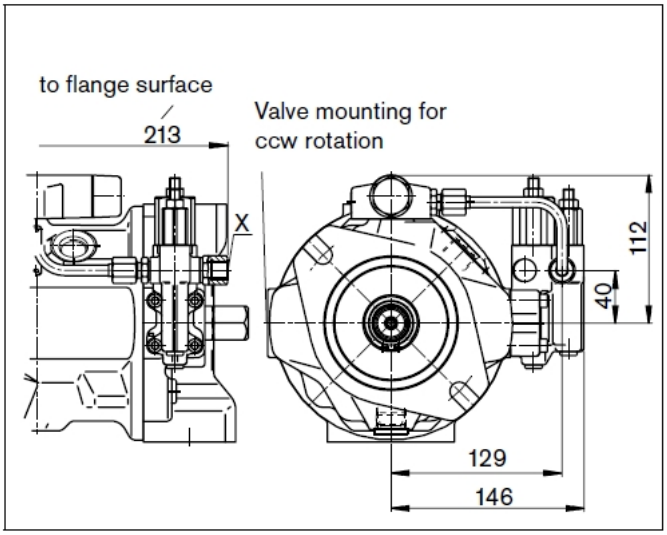
5) For the maximum tightening torques the general instructions on page 9 must be observed.

■ Dimensions：Size 45

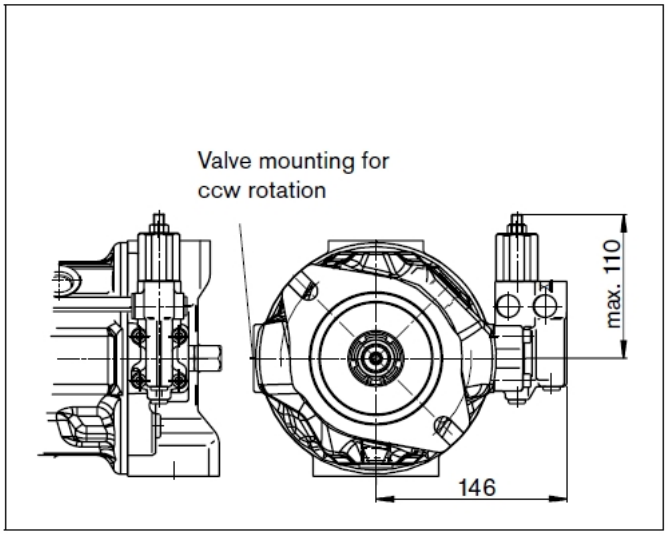
DG
Two-point control, directly operated



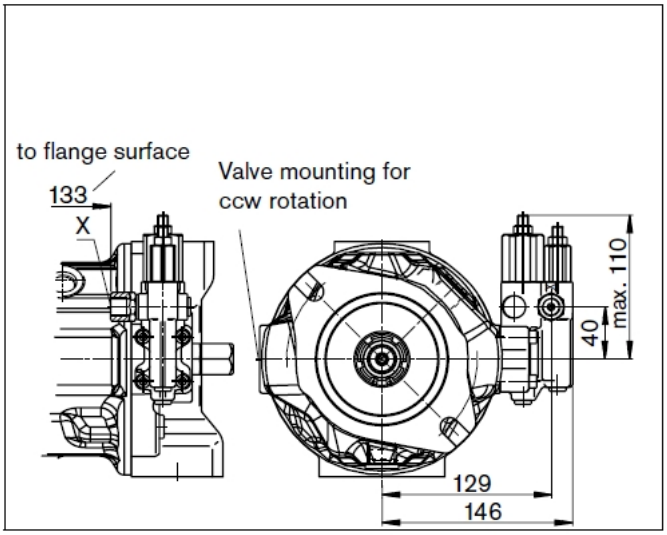
DFLR
Pressure, flow and power control



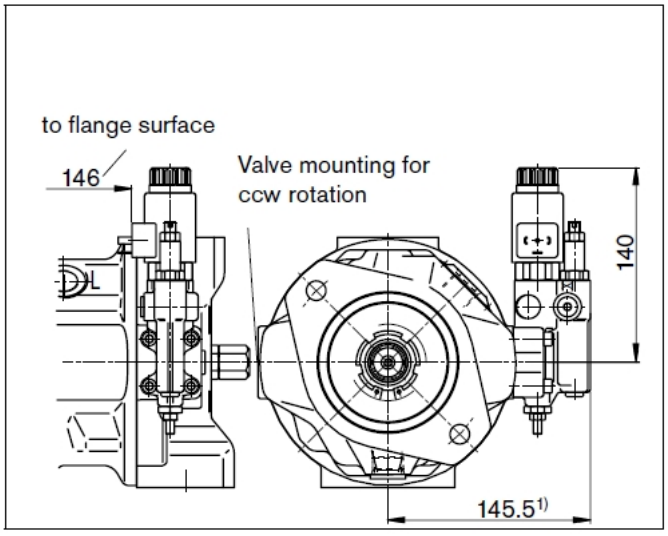
DR
Pressure control



DRG
Pressure control, remotely operated



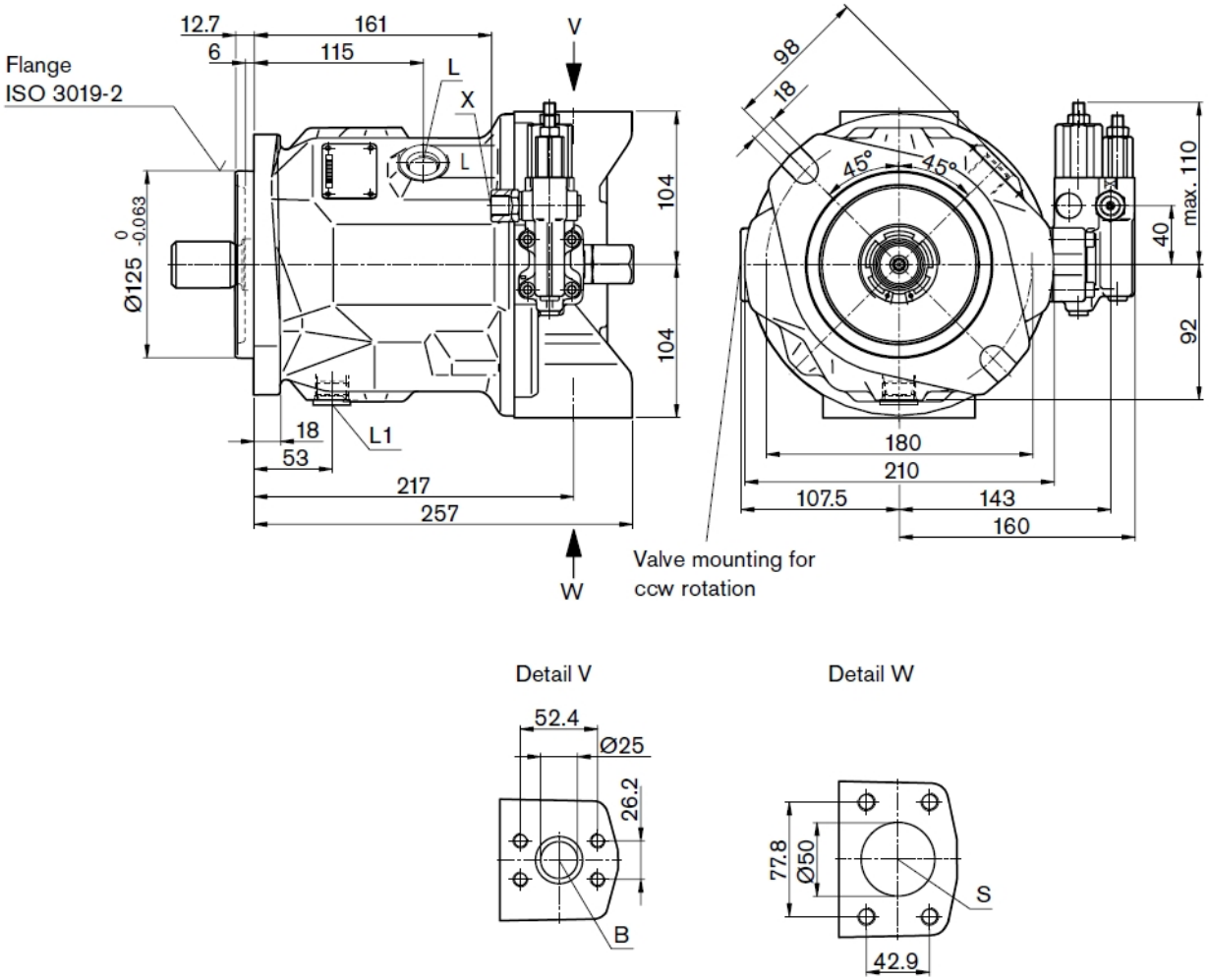
ED7. / ER7.
Electro-hydraulic pressure control



1) ER7.: 180.5 mm if using a sandwich plate pressure reducing valve.

■ Dimensions：Size 71

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



- ◘ 油口尺寸：

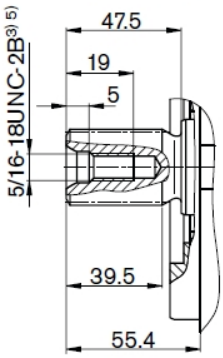
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	1” M10 X 1.5 17 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	2” M12 X 1.75 20 deep	10	O
L	Case drain fluid	DIN 3852	M22 X 1.5 14 deep	2	O
L_1	Case drain fluid	DIN 3852	M22 X 1.5 14 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	ISO 228	G 1/4” 12 deep	350	O

- ◘ O = Must be connected (plugged on delivery)
- ◘ X = Plugged (in normal operation)

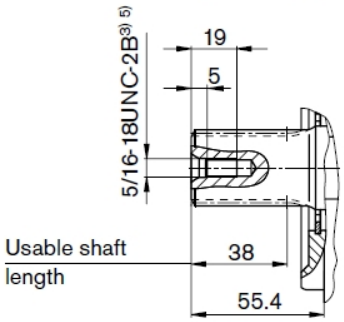
■ Dimensions：Size 71

□ Drive shaft：

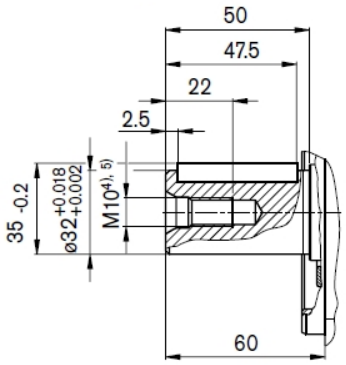
S Splined shaft 1 1/4 in
14T 12/24DP[1] (SAE J744)



R Splined shaft 1 1/4 in
14T 12/24DP[1)2)] (SAE J744)



P Parallel shaft key
DIN 6885, A10x8x45



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.

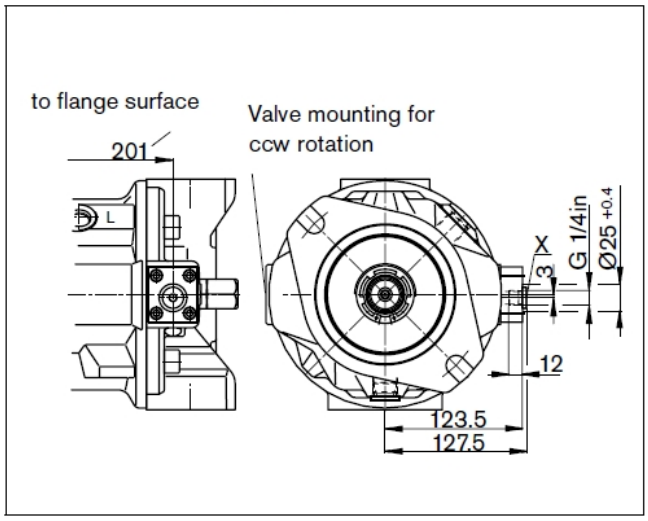
3) Thread according to ASME B1.1

4) Thread according to DIN 13

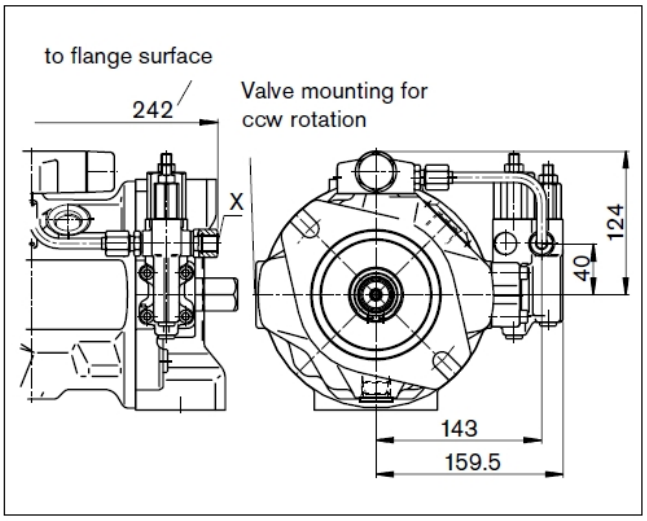
5) For the maximum tightening torques the general instructions on page 9 must be observed.

■ Dimensions：Size 71

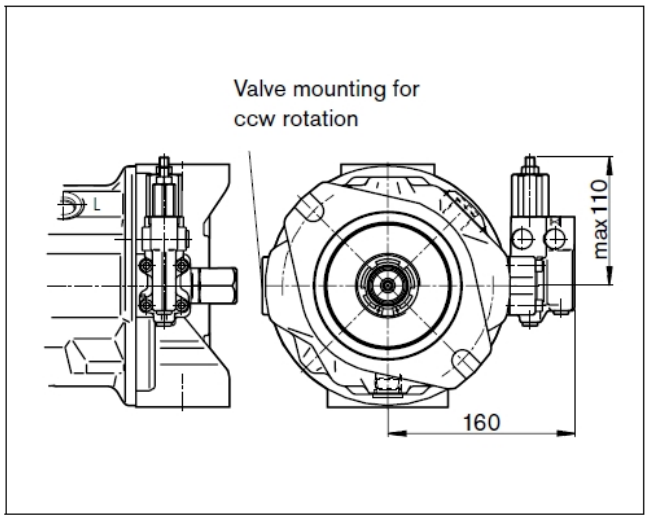
DG
Two-point control, directly operated



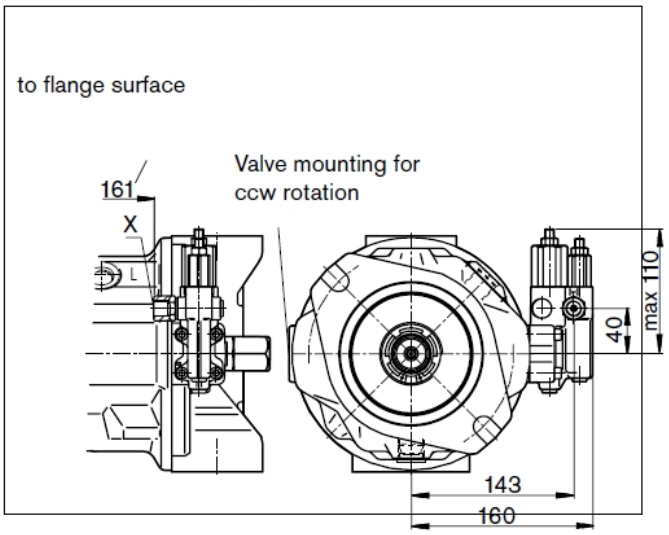
DFLR
Pressure, flow and power control



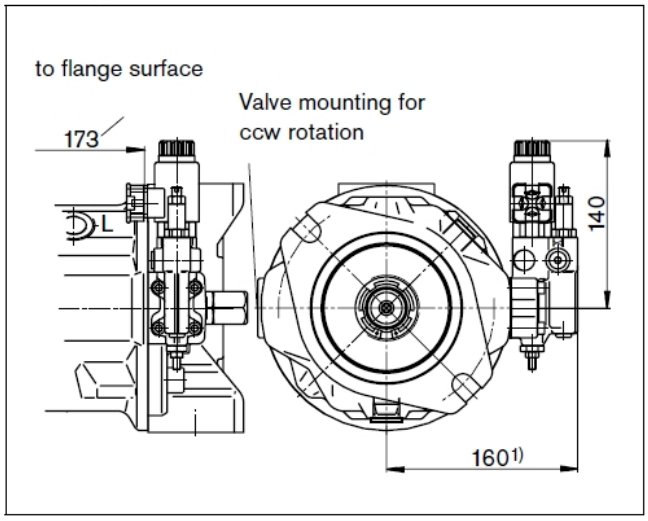
DR
Pressure control



DRG
Pressure control, remotely operated



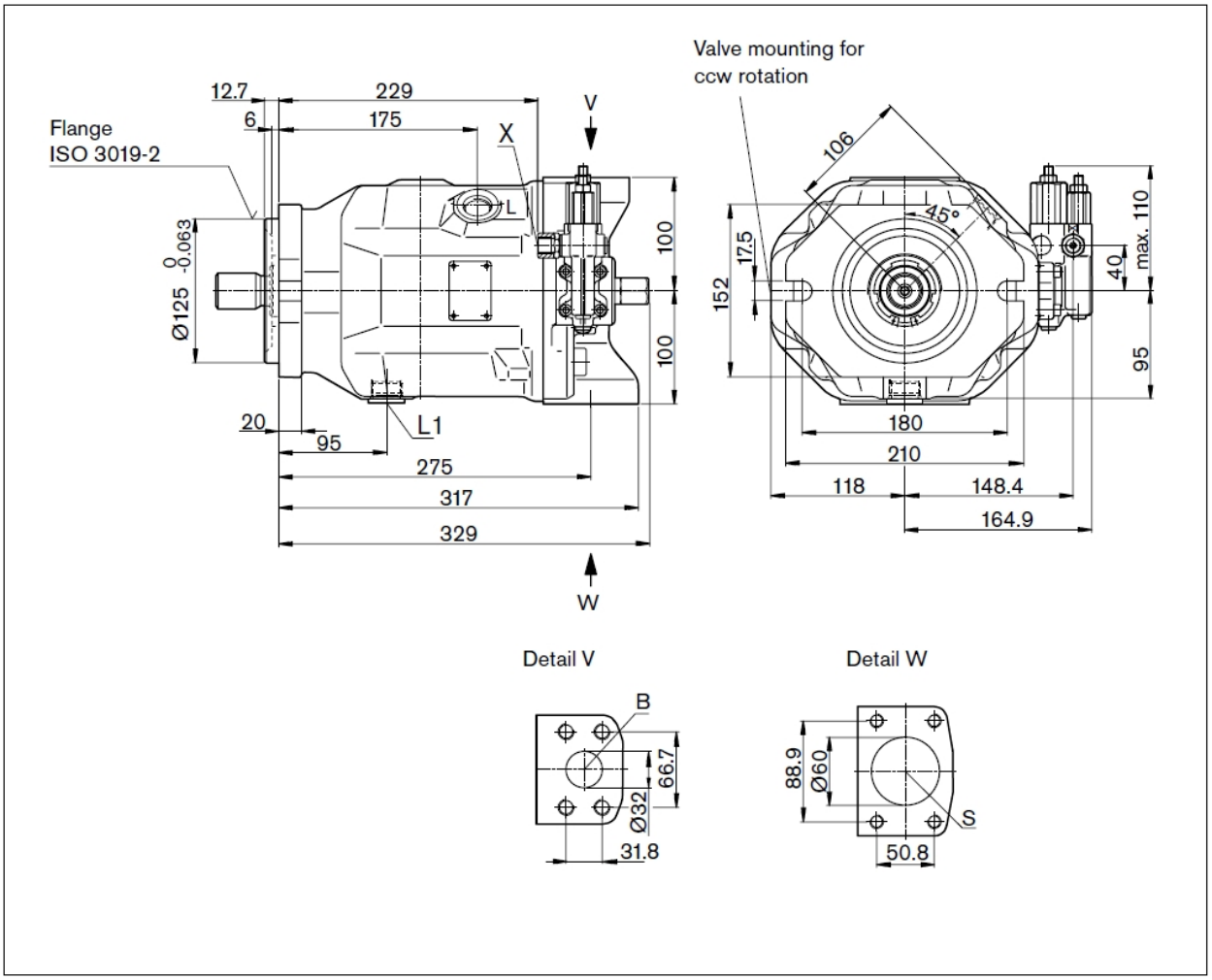
ED7. / ER7.
Electro-hydraulic pressure control



1) ER7.: 195 mm if using a sandwich plate pressure reducing valve.

■ Dimensions：Size 100

- ◘ DFR/DFR1- Pressure and flow control, hydraulic：
- ◘ Clockwise rotation



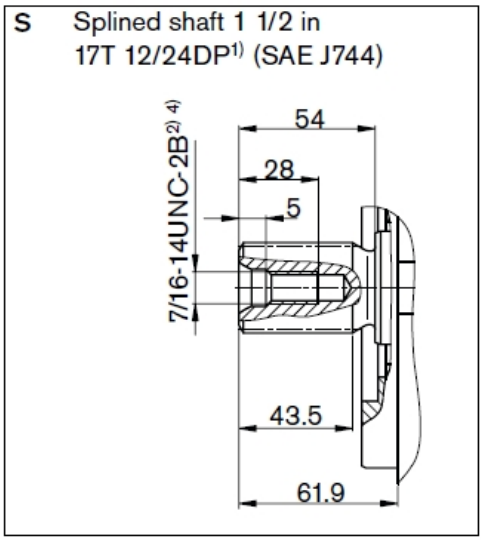
◘ 油口尺寸：

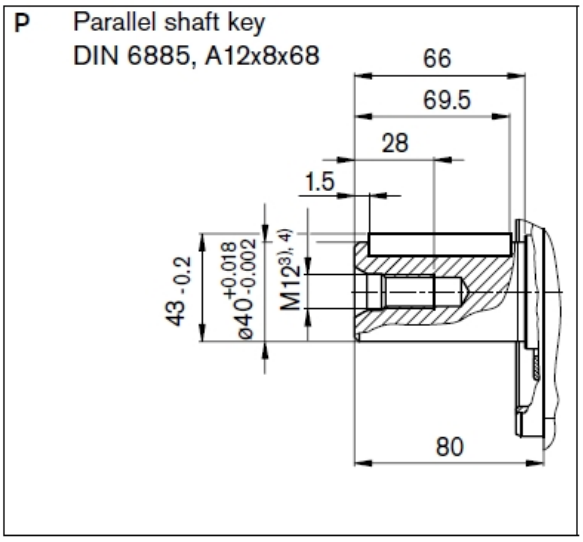
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	1-1/4” M14 X 2 19 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	2-1/2” M12 X 1.75 17 deep	10	O
L	Case drain fluid	DIN 3852	M27 X 2 16 deep	2	O
L_1	Case drain fluid	DIN 3852	M27 X 2 16 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	ISO 228	G 1/4” 12 deep	350	O

- ◘ O = Must be connected (plugged on delivery)
- ◘ X = Plugged (in normal operation)

■ Dimensions：Size 100

□ Drive shaft：





1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

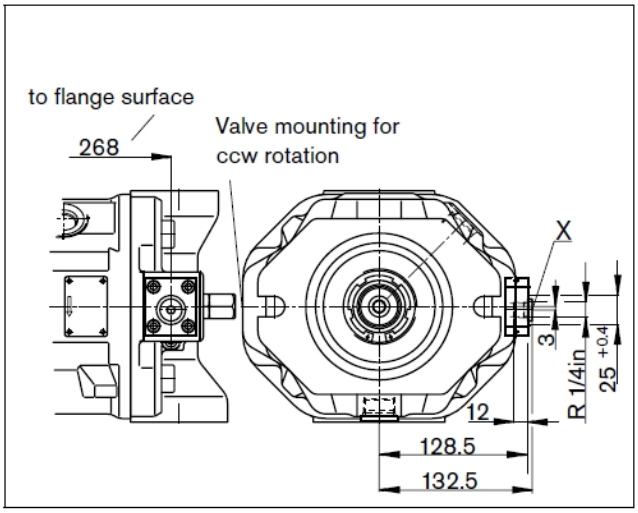
2) Thread according to ASME B1.1

3) Thread according to DIN 13

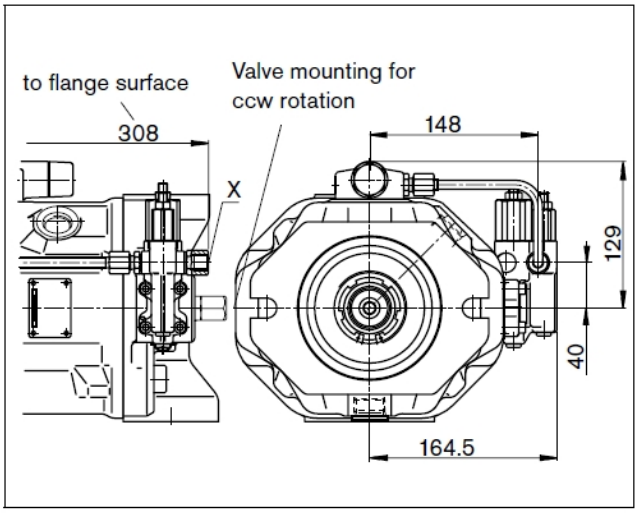
4) For the maximum tightening torques the general instructions on page 9 must be observed.

■ Dimensions：Size 100

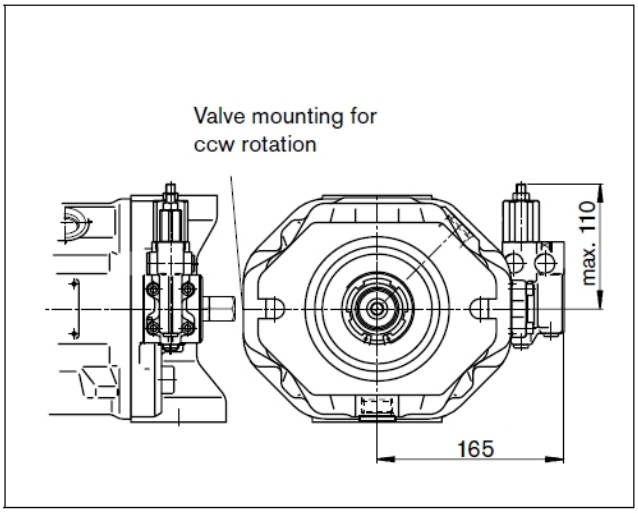
DG
Two-point control, directly operated



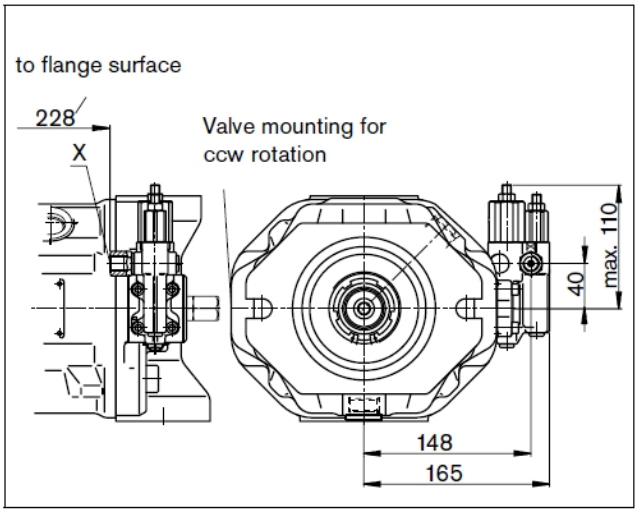
DFLR
Pressure, flow and power control



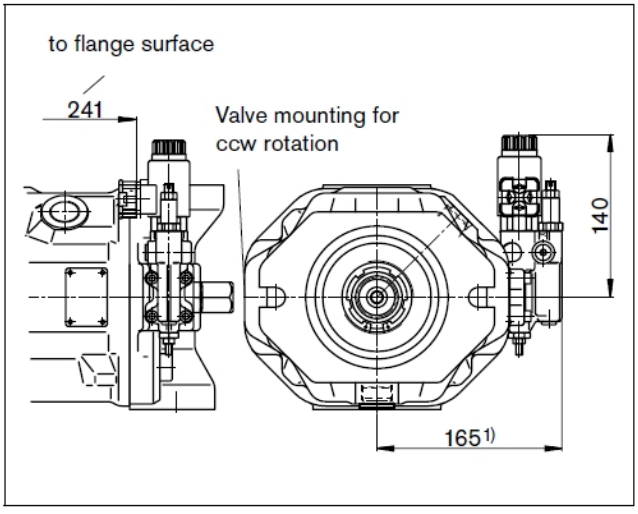
DR
Pressure control



DRG
Pressure control, remotely operated



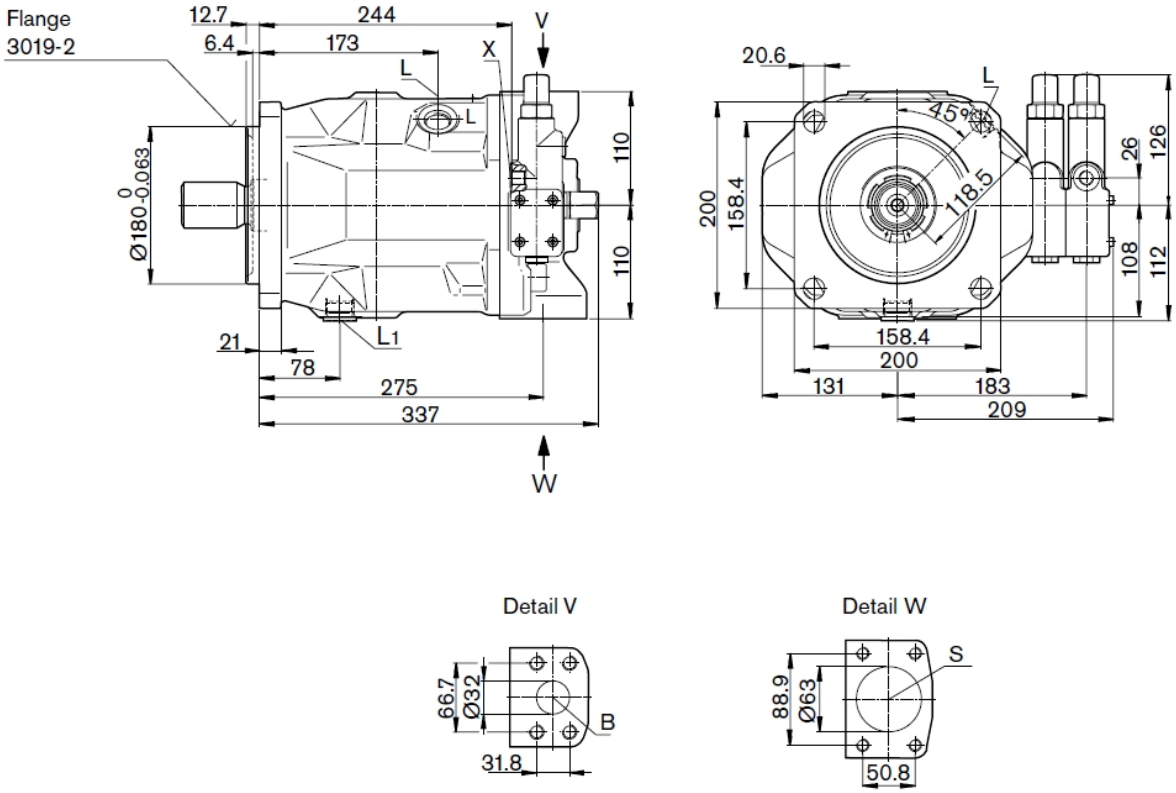
ED7. / ER7.
Electro-hydraulic pressure control



1) ER7.: 200 mm when using a sandwich plate pressure reducing valve.

■ Dimensions：Size 140

- ◘ DFR/DFR1- Pressure and flow control, hydraulic
- ◘ Clockwise rotation



◘ Ports：

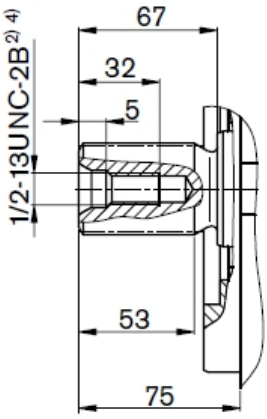
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	1-1/4” M14 X 2 19 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	2-1/2” M12 X 1.75 17 deep	10	O
L	Case drain fluid	DIN 3852	M27 X 2 16 deep	2	O
L_1	Case drain fluid	DIN 3852	M27 X 2 16 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	DIN 3852	M14 X 1.5 12 deep	350	O
M_H	Gauge port, high pressure	DIN 3852	M14 X 1.5 12 deep	350	X

- ◘ O = Must be connected (plugged on delivery)
- ◘ X = Plugged (in normal operation)

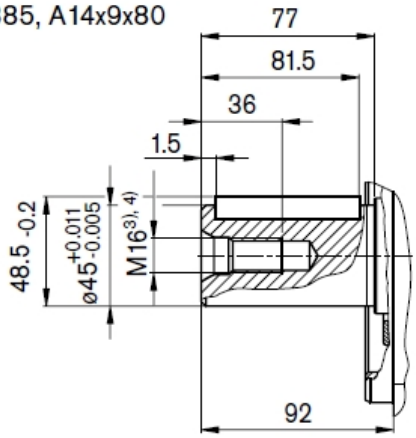
■ Dimensions：Size140

□ Drive shaft：

S Splined shaft 1 3/4 in
13T 8/16DP[1] (SAE J744)



P Parallel shaft key
DIN 6885, A14x9x80



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

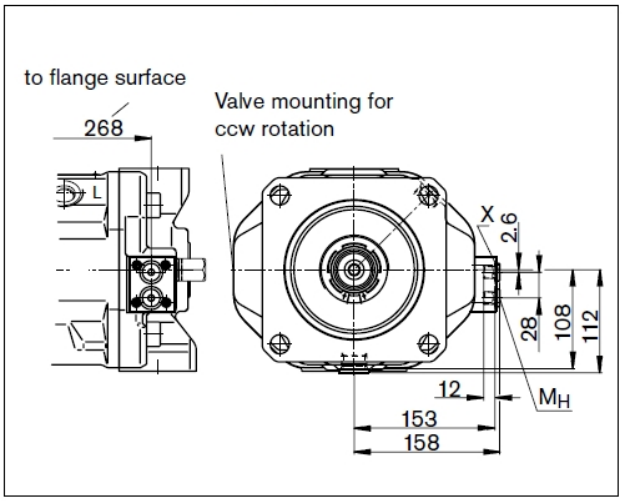
2) Thread according to ASME B1.1

3) Thread according to DIN 13

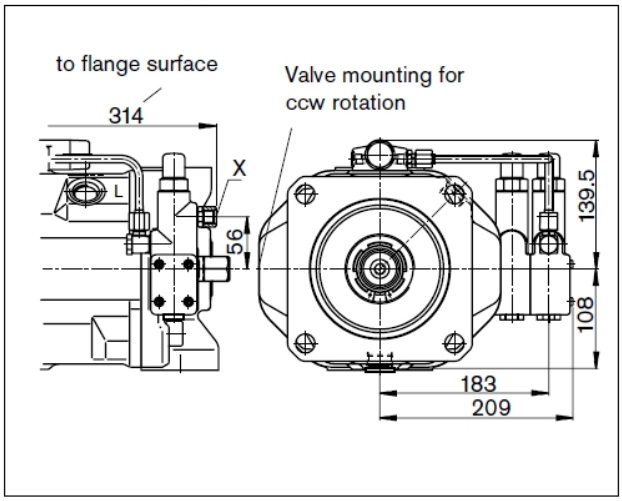
4) For the maximum tightening torques the general instructions on page 9 must be observed.

■ Dimensions：Size 140

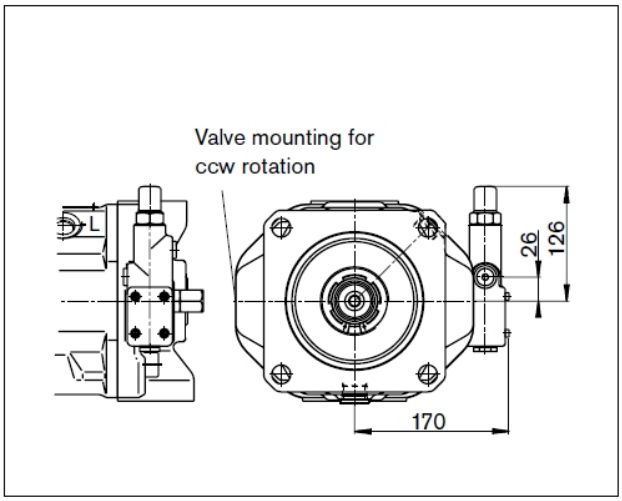
DG
Two-point control, directly operated



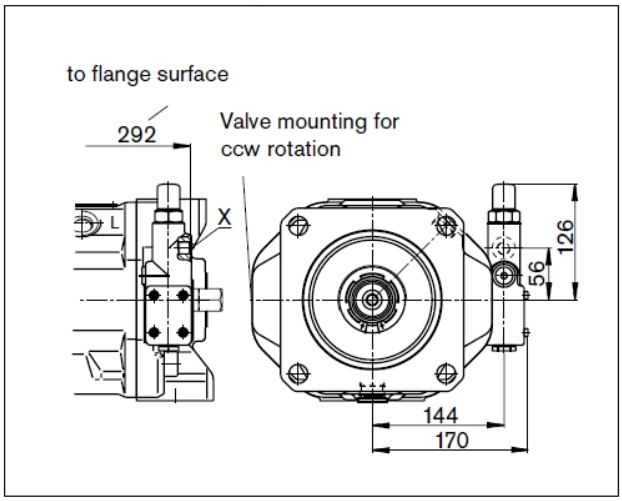
DFLR
Pressure, flow and power control



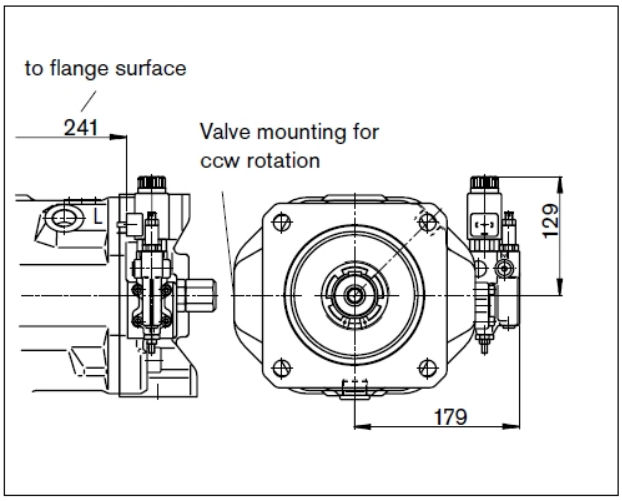
DR
Pressure control



DRG
Pressure control, remotely operated



ED7. / ER7.
Electro-hydraulic pressure control



1) ER7.: 214 mm when using a sandwich plate pressure reducing valve.

■ Type Code For Standard Program：

HD	-		A10V	O	100	DR	/	31	R	-	P	S	C	11	N00
0		1	2	3	4	5		6	7		8	9	10	11	12

0. Manufacturer：

华德液压 HUADE HYDRAULIC

1. Hydraulic fluid / Version：

Hydraulic fluid / Version：	18	28	45	71	100	140	Code
Mineral oil and HFD-fluids……no code	■	■	■	■	■	■	-
High-Speed-Version	-	-	□	□	□	■	H

2. Axial piston unit：

Axial piston unit / Version：	18	28	45	71	100	140	Code
Swash plate design, variable,up to industrial grade	■	-	-	-	-	-	A10VS
Nominal pressure 280 bar，Peak pressure350 bar	-	■	■	■	■	■	A10V

3. Type of operation：

Type of operation / Version：	18	28	45	71	100	140	Code
Pump, open circuit	■	■	■	■	■	■	O

4. Size：

Size / Version：	18	28	45	71*	100	140	Code
Size ≙ V_{gmax}（cm^3/r）	18	28	45	71	100	140	-

5. Control devices：

Control devices / Version：			18	28	45	71	100	140	Code
Two-point control, directly operated			■	■	■	■	■	■	DG
Pressure control			■	■	■	■	■	■	DR
Pressure control…remotely operated			■	■	■	■	■	■	DRG
Pressure-flow control			■	■	■	■	■	■	DFR
Pressure-flow control…X-T plugged			■	■	■	■	■	■	DFR1
Pressure/Flow/Power control			■	■	■	■	■	■	DFLR
Electro-proportional control with flow control			-	□	□	□	□	□	EF
Electro-hydraulic pressure control	negative characteristic	12V	□	□	□	□	□	□	ED71
		24V	□	□	□	□	□	□	ED72
	positive characteristic	12V	□	□	□	□	□	□	ER71
		24V	□	□	□	□	□	□	ER72

■ Type Code For Standard Program：

6. Series：

Series / Version：	18	28	45	71	100	140	Code
31 Series	■	■	■	■	■	■	31

7. Direction of rotation：

Direction of rotation：	旋转方向	Code
With view on shaft end	Clockwise(forward dextral)	R
	Counter-clockwise (reverse left-handed)	L

8. Seals：

Seals / Version	18	28	45	71	100	140	Code
NBR（Nitrile-rubber DIN ISO 1629), with shaft seal FKM	■	■	■	■	■	■	P
FKM (Fluoro-rubber DIN ISO 1629)	■	■	■	■	■	■	V

9. Shaft end：

Shaft end / Version：		18	28	45	71	100	140	Code
Splined shaft SAE ANSI B92.1a	standard shaft	■	■	■	■	■	■	S
	similar to shaft , S “ however for higher input torque	■	■	■	■	-	-	R
	reduced diameter, not for through drive	■	■	■	■	■	□	U
	similar to shaft "U", however for higher torque	-	■	■	■	■	□	W

10. Mounting flange：

Mounting flange / Version：		18	28	45	71	100	140	Code
ISO 3019-1 SAE	2-hole	■	■	■	■	■	■	C
	4-hole	-	-	-	-	□	■	D

11.Service line connections：

Service line connections / Version：	18	28	45	71	100	140	Code
Port B and S at rear	-	■	■	-	■	■	11
SAE flange port at rear, metric fixing thread (not for through drive)	-	-	-	■	-	-	41
Port B and S at rear, on opposite side	■	■	■	-	■	■	12
SAE flange port at rear, metric fixing thread (not for through drive)	-	-	-	■	-	-	42

■ Type Code For Standard Program：

12. Through drive：

Through drive / Version：		18	28	45	71	100	140	Code
without through drive		■	■	■	■	■	■	N00
with through drive for mounting an axial piston unit, gear or radial piston pump								
Flange	coupling for splined shaft	18	28	45	71	100	140	Code
Flange ISO 3019-1	Diameter ANSI B92.1a							
82-2 （A）	5/8” 9T 16/32 DP	■	■	■	■	■	■	K01
	3/4” 11T 16/32 DP	■	■	■	■	■	■	K52
101-2（B）	7/8” 13T 16/32 DP	-	■	■	■	■	■	K68
	1” 15T 16/32 DP	-	-	■	■	■	■	K04
127-2（C）	1-1/4” 14T 12/24 DP	-	-	-	■	■	■	K07
	1-1/2” 17T 12/24 DP	-	-	-	-	■	■	K24
152-4（D）	1-3/4 13T 8/16 DP	-	-	-	-	-	■	K17

= Preferred Program

■ = Available

□ = On request

- = Not Available

■ Technical Data：

- Applies to mineral oil medium run

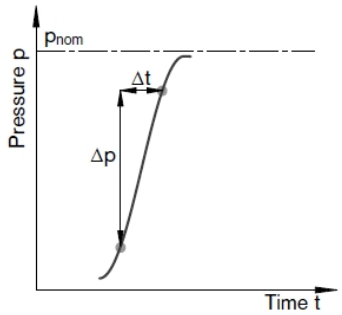
■ Operating pressure range：

- Pressure at service line port (pressure port) B：

  Nominal pressure P_{nom} ---------- 280 bar

  Peak pressure P_{max} ---------- 350 bar

- Single operating period 2.0 ms
- Total operating period 300 h
- Minimum pressure（high-pressure side）：10 bar absolute
- Rate of pressure change $R_{A\,max}$：16000 bar/s



- Pressure at suction port S (inlet)：

  Minimum pressure $P_{S\,min}$ ---------- 0.8 bar…绝对压力

  Maximum pressure $P_{S\,max}$ ---------- 10 bar

■ Case drain pressure：

- The lower the input speed and the case drain pressure, the longer the service life of the shaft end seal.
- Maximum permissible case drain pressure (at port L, L1)

Maximum 0.5 bar higher than the inlet pressure at port S, however not higher than 2 bar absolute.

$P_{L\,max}$ ---------- 2 bar…absolute

■ Definition：

■ Nominal pressure P_{nom}

The nominal pressure corresponds to the maximum design pressure.

- Peak pressure P_{max}

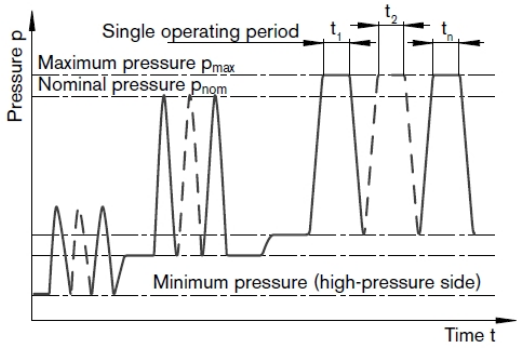
  The peak pressure corresponds the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

- Minimum pressure (high-pressure side)：

  Minimum pressure on the high-pressure side (B) that is required in order to prevent damage to the axial piston unit.

- Rate of pressure change R_A

  Maximum permissible rate of pressure build-up and pressure reduction during a pressure change over the entire pressure range.



Total operating period $=t_1 + t_2 + t_3 \ldots\ldots + t_n$

■ Technical data：

☐ Standard Program，applies to mineral oil medium run

☐ 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^3	18	28	45	71	100	140
Maximum speed [1]									
at $V_{g\,max}$		n_{nom}	rpm	3300	3000	2600	2200	2000	1800
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	–	–
	U	c	Nm/rad	8090	16695	30077	52779	91093	–
	W	c	Nm/rad	–	19898	34463	57460	101847	–
Moment of inertial rotary group		J_{TW}	kgm^2	0.00093	0.0017	0.0033	0.0083	0.0167	0.0242
Angular acceleration, maximum[2]		α	rad/s^2	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 absolute pressure P_{abs} = 1 bar at the suction port S;
- for the optimum viscosity range of v_{opt} = 16 to 36 mm2/s
- for mineral-based operating materials

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

- Valid for external excitation;
- The limiting value is only valid for a single pump;
- The loading capacity of the connecting parts must be taken into account.
- If the drive speed continuous increasing and up to the limit speed, please conform to the curves shows.

☐ Notes：

- 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 checking the loading with tests or calculations / simulations and comparison with the permissible values.

☐ Determination of size：

Flow $q_V = \dfrac{V_g \cdot n \cdot \eta_V}{1000}$ [l/min]

Torque $T = \dfrac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ [Nm]

Power $P = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{q_V \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = Displacement per revolution in cm^3
Δp = Pressure differential in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

■ Technical Data：

☐ High- speed version，applies to mineral oil medium run

☐ 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^3	45	71	100	140
Maximum speed [1]							
at $V_{g\,max}$		n_{nom}	rpm	3000	2550	2300	2050
at $V_g < V_{g\,max}$		$n_{max\,perm}$	rpm	3300	2800	2500	2200
Flow							
at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	l/min	135	178	230	287
Power at $\Delta p = 280$ bar							
at n_{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	–	–
	U	c	Nm/rad	30077	52779	91093	–
	W	c	Nm/rad	34463	57460	101847	–
Moment of inertial rotary group		J_{TW}	kgm^2	0.0033	0.0083	0.0167	0.0242
Angular acceleration, maximum [2]		α	rad/s^2	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 absolute pressure pabs = 1 bar at the suction port S；
- for the optimum viscosity range of v_{opt} = 16 to 36 mm2/s
- for mineral-based operating materials

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

- Valid for external excitation；
- The limiting value is only valid for a single pump；
- The loading capacity of the connecting parts must be taken into account.
- If the drive speed continuous increasing and up to the limit speed, please conform to the curves shows.

☐ Notes：

- 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 checking the loading with tests or calculations / simulations and comparison with the permissible values.

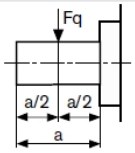
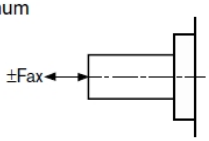
☐ Recommendation：

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

External dimensions are not affected by this option.

■ Technical Data：

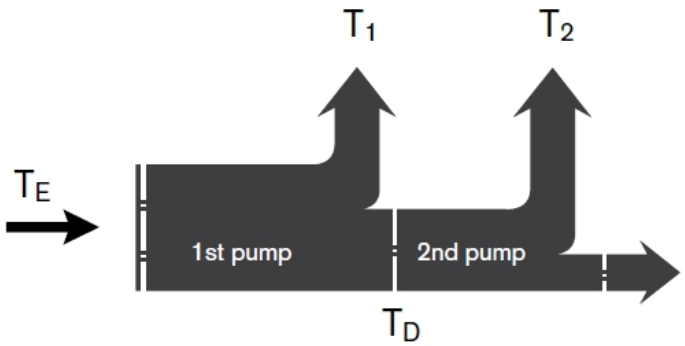
□ Permissible radial and axial loading on the drive shaft

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			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 $\Delta p = 280$ bar[1]		T_{max}	Nm	80	125	200	316	445	623
Input torque for drive shaft, maximum[2]									
	S	$T_{E\,max}$	Nm	124	198	319	626	1104	1620
		Ø	in	3/4	7/8	1	1 1/4	1 1/2	1 3/4
	R	$T_{E\,max}$	Nm	160	250	400	644	–	–
		Ø	in	3/4	7/8	1	1 1/4	–	–
	U	$T_{E\,max}$	Nm	59	105	188	300	595	–
		Ø	in	5/8	3/4	7/8	1	1 1/4	–
	W	$T_{E\,max}$	Nm	–	140	220	394	636	–
		Ø	in	–	3/4	7/8	1	1 1/4	–
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	–	–

□ Distribution of torques：



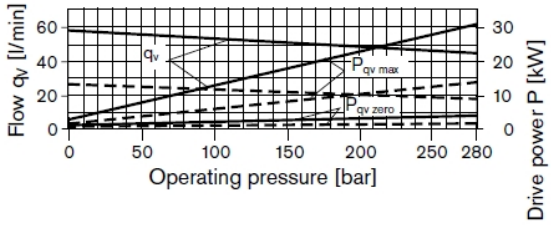
■ Drive power and flow：

□ Hydraulic fluid ISO VG 46 DIN 51519, t = 50 ℃

□ Size18

_ _ _ _ n = 1500 rpm

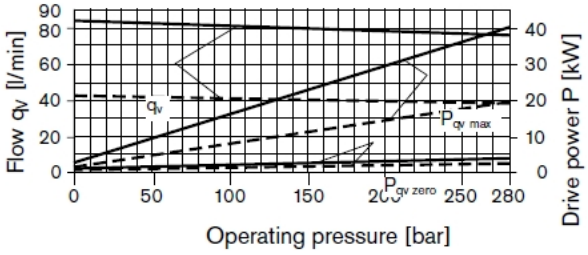
_____n = 3300 rpm



□ Size 28

_ _ _ _ n = 1500 rpm

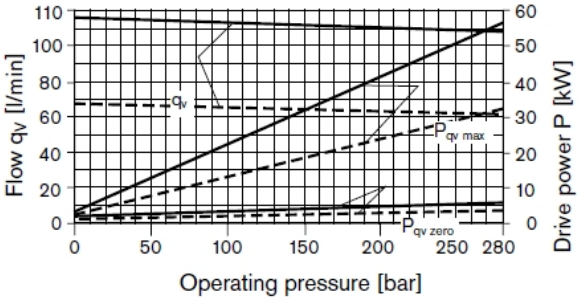
_____n = 3000 rpm



□ Size 45

_ _ _ _ n = 1500 rpm

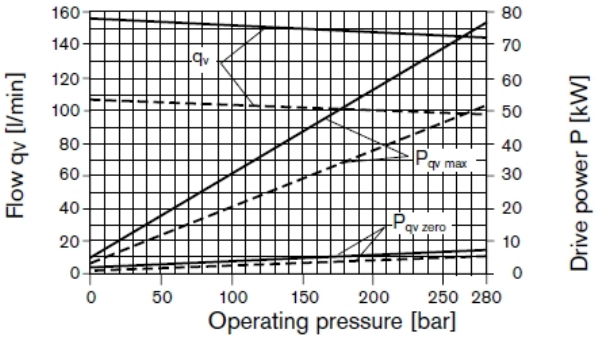
_____n = 2600 rpm



□ Size 71

_ _ _ _ n = 1500 rpm

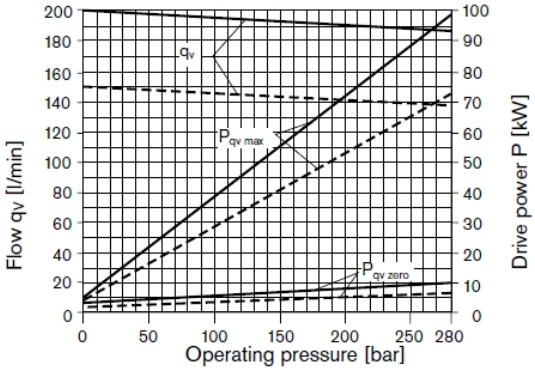
_____n = 2200 rpm



□ Size100

_ _ _ _ n = 1500 rpm

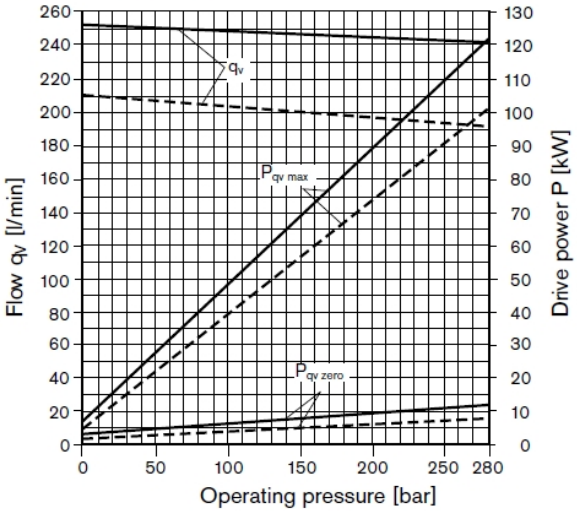
_____n = 2000 rpm



□ Size 140

_ _ _ _ n = 1500 rpm

_____n = 1800 rpm



■ DG - Two-point control, directly operated

- Two-point control, directly operated
- Refer to HD-A10VSO on page 12.

■ DR - Pressure control：

- Constant pressure control
- Refer to HD-A10VSO on page 13

■ DRG - Pressure control, remotely operated

- Pressure control, remotely operated
- Refer to HD-A10VSO on page 14

■ DFR/DFR1- Pressure and flow control：

- Constant flow control
- Refer to HD-A10VSO on page 15

■ DFLR - Pressure, flow and power control：

- Constant power control
- Refer to HD-A10VSO on page 16

■ ED - Electro-hydraulic pressure control

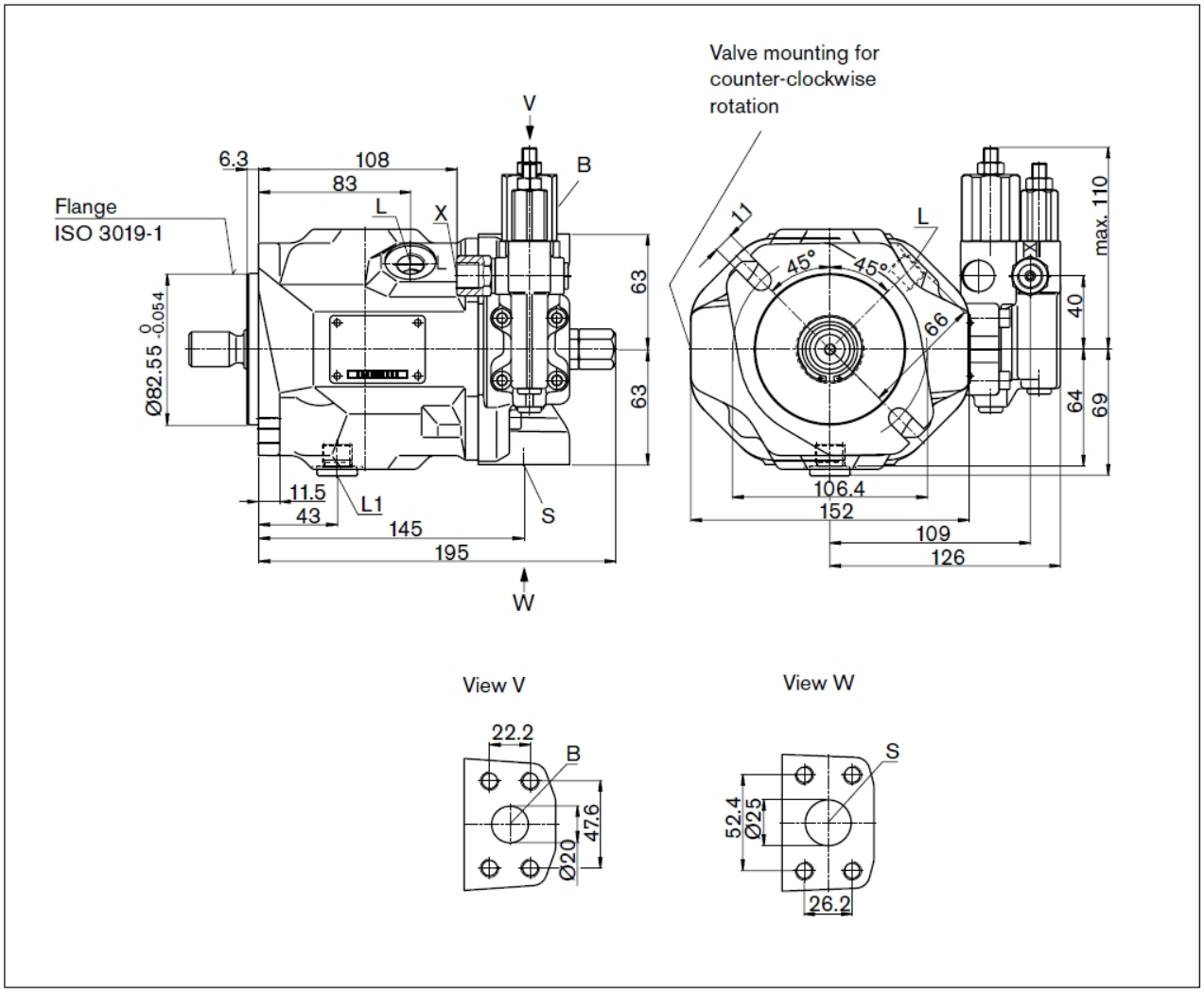
- Electro-hydraulic pressure control…negative characteristic
- Refer to HD-A10VSO on page 18

■ ER - Electro-hydraulic pressure control

- Electro-hydraulic pressure control …positive characteristic
- Refer to HD-A10VSO on page 19

■ Dimensions：Size 18

- ☐ DFR/DFR1 - Pressure and flow control, hydraulic：
- ☐ Clockwise rotation



- ☐ Ports：

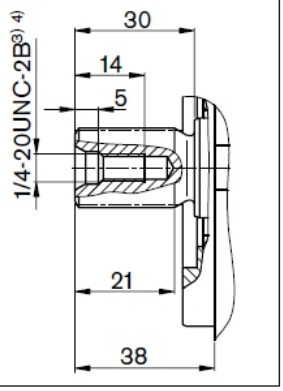
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	3/4” M10 X 1.5 17 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	1” M10 X 1.5 17 deep	10	O
L	Case drain fluid	DIN 3852	M16 X 1.5 12 deep	2	O
L_1	Case drain fluid	DIN 3852	M16 X 1.5 12 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	ISO 228	G 1/4” 12 deep	350	O

- ☐ O = Must be connected (plugged on delivery)
- ☐ X = Plugged (in normal operation)

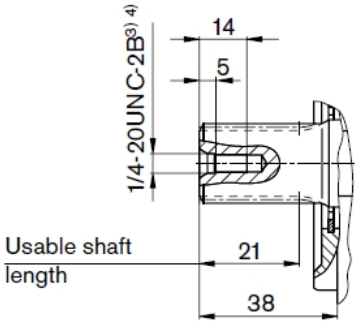
■ Dimensions：Size 18

□ Drive shaft：

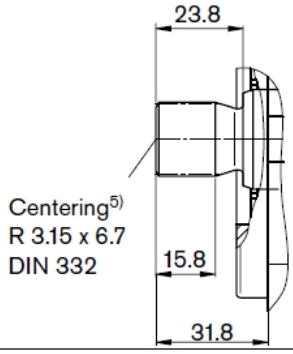
S Splined shaft 3/4 in
11T 16/32DP[1] (SAE J744)



R Splined shaft 3/4 in
11T 16/32DP[1][2] (SAE J744)



U Splined shaft 5/8 in
9T 16/32DP[1][2] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard

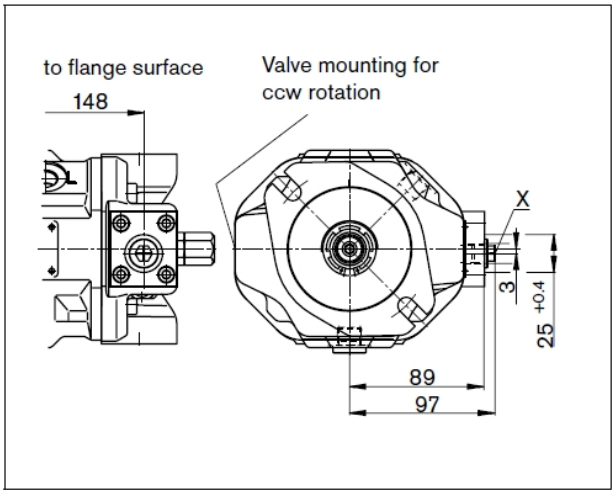
3) Thread according to ASME B1.1

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

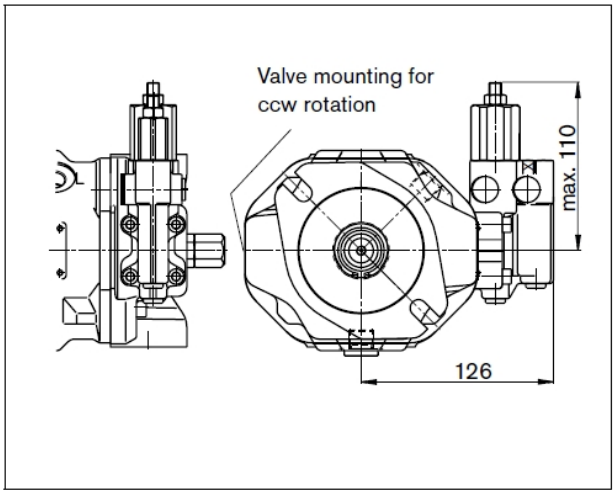
5) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw

■ Dimensions：Size 18

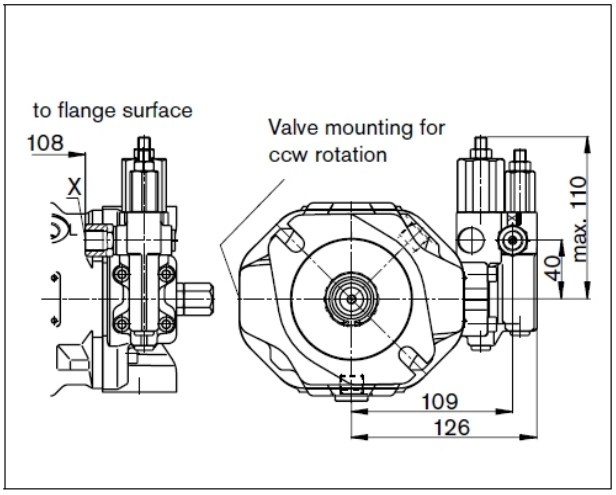
DG
Two-point control, directly operated



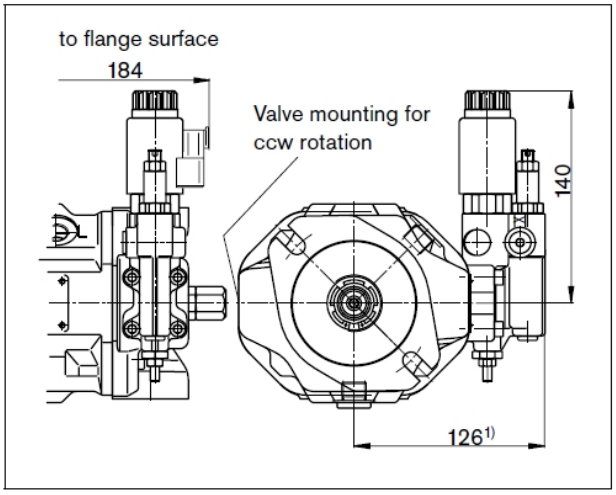
DR
Pressure control



DRG
Pressure control, remotely operated



ED7., ER7.
Electro-hydraulic pressure control

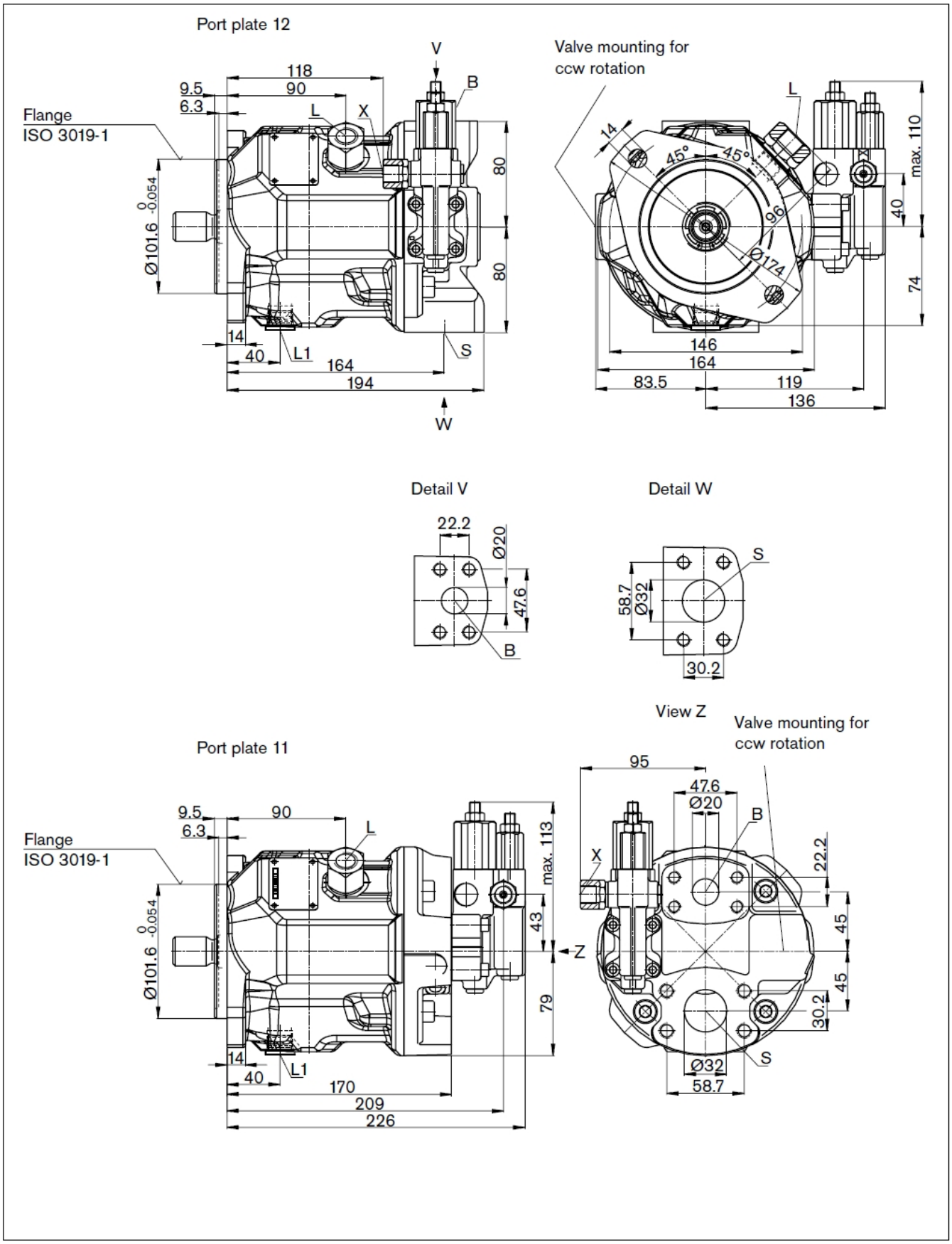


1) ER7.: 161 mm if using a sandwich plate pressure reducing valve.

■ Dimensions：Size 28

□ DFR/DFR1 - Pressure and flow control, hydraulic ：

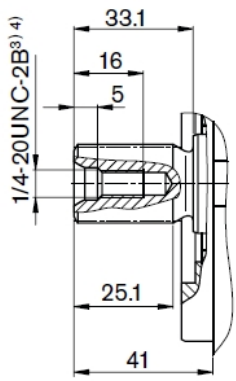
□ Clockwise rotation



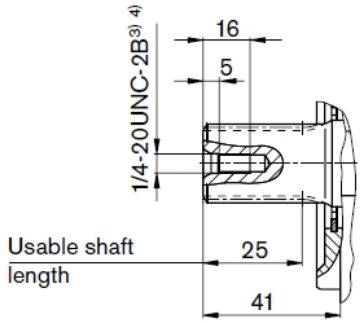
■ Dimensions：Size 28

□ Drive shaft：

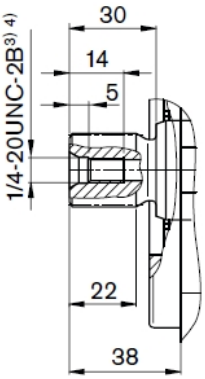
S Splined shaft 7/8 in
13T 16/32DP[1] (SAE J744)



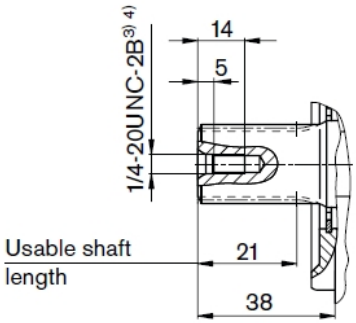
R Splined shaft 7/8 in
13T 16/32DP[1)2)] (SAE J744)



U Splined shaft 3/4 in
11T 16/32DP[1] (SAE J744)



W Splined shaft 3/4 in
11T 16/32DP[1)2)] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 47 must be observed.

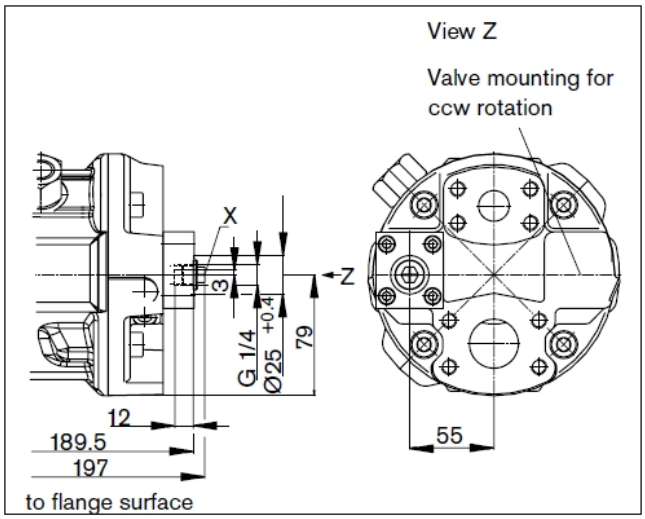
□ Ports：

Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	3/4” M10 X 1.5 17 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	1-1/4” M10 X 1.5 17 deep	10	O
L	Case drain fluid	DIN 3852	M18 X 1.5 12 deep	2	O
L_1	Case drain fluid	DIN 3852	M18 X 1.5 12 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	ISO 228	G 1/4” 12 deep	350	O

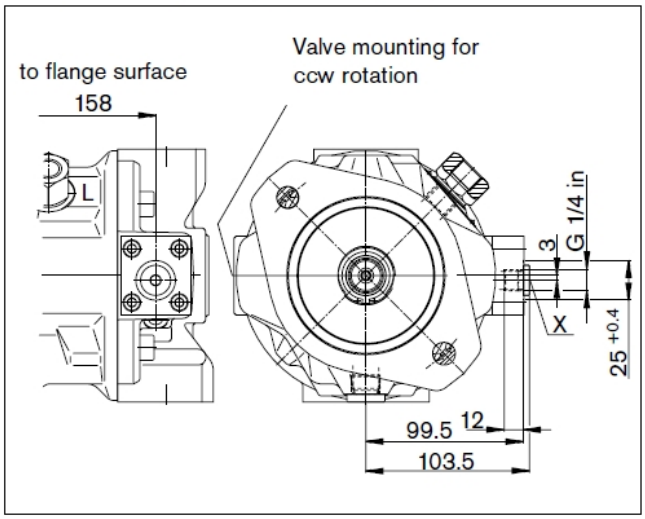
□ O = Must be connected (plugged on delivery)
□ X = Plugged (in normal operation)

■ Dimensions：Size 28

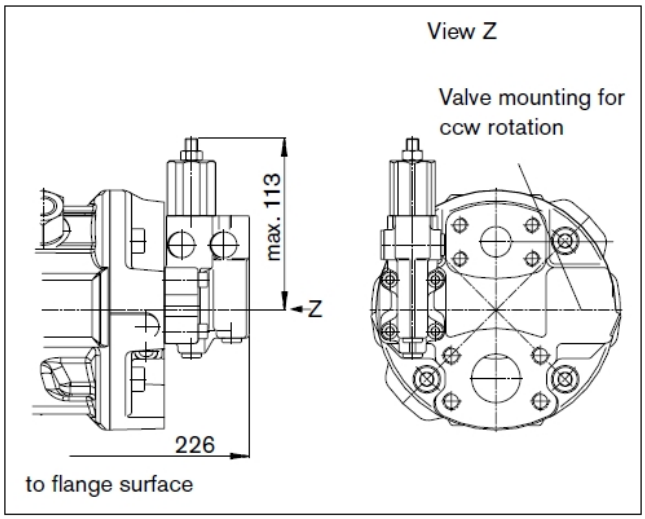
DG
Two-point control, directly operated, **port plate 11**



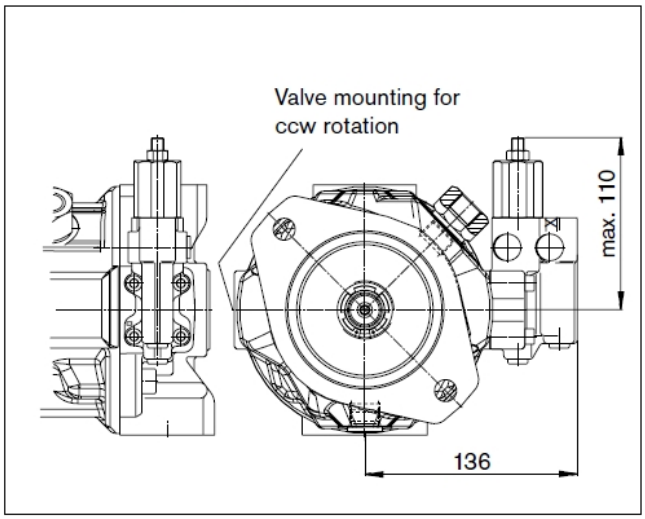
DG
Two-point control, directly operated, **port plate 12**



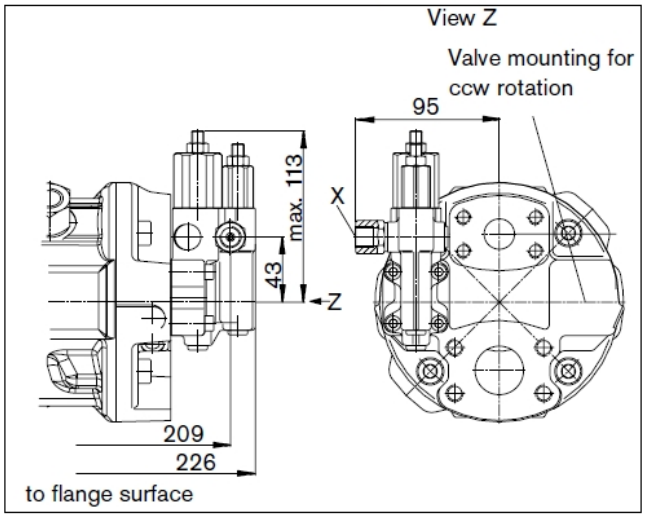
DR
Pressure control, **port plate 11**



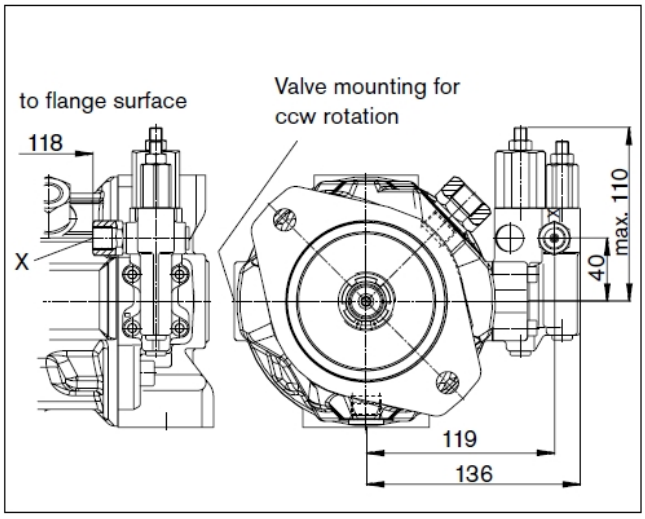
DR
Pressure control, **port plate 12**



DRG
Pressure control, remotely operated, **port plate 11**

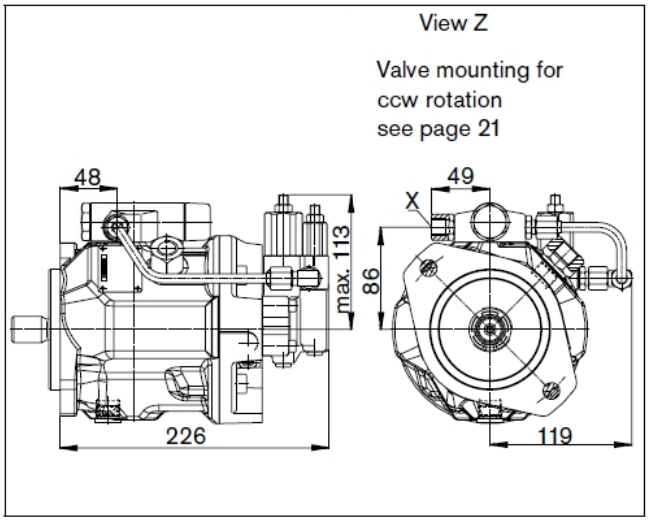


DRG
Pressure control, remotely operated, **port plate 12**

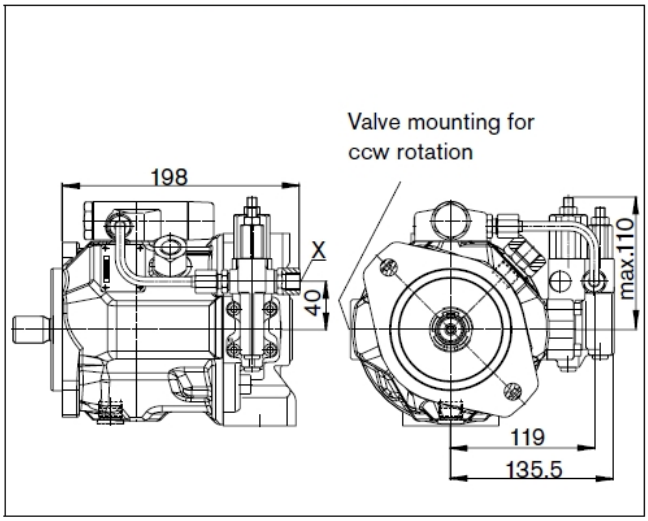


■ Dimensions：Size 28

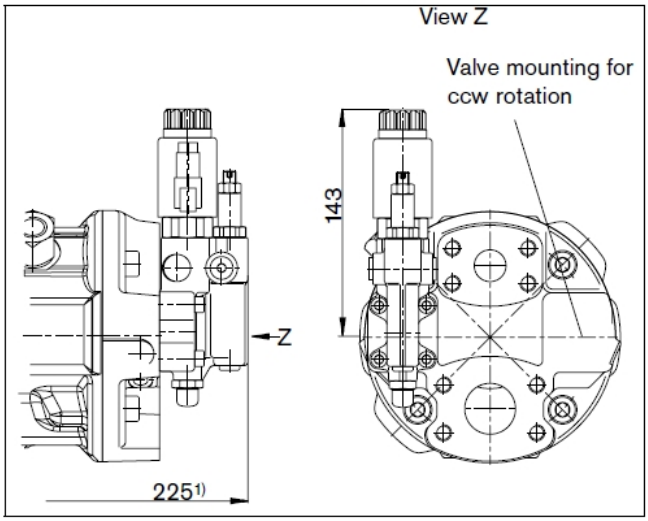
DFLR
Pressure, flow and power control, **port plate 11**



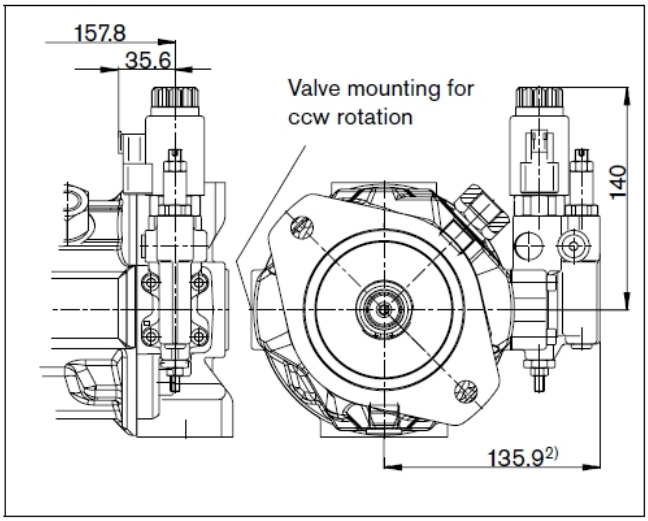
DFLR
Pressure, flow and power control, **port plate 12**



ED7. / ER7.
Electro-hydraulic pressure control, **port plate 11**



ED7. / ER7.
Electro-hydraulic pressure control, **port plate 12**

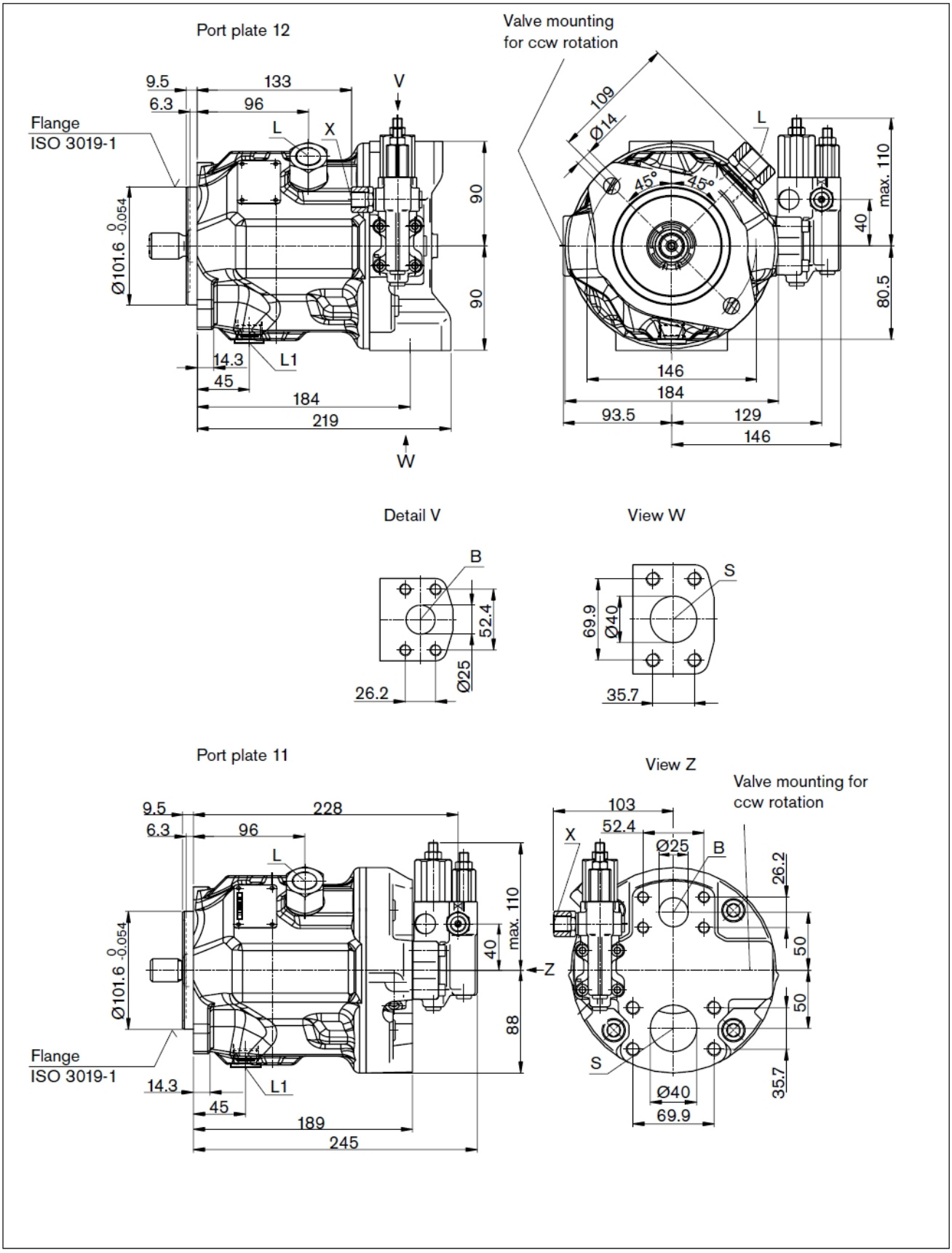


1) ER7.: 260 mm when using a sandwich plate pressure reducing valve.

2) ER7.: 170.9 mm when using a sandwich plate pressure reducing valve.

■ Dimensions：Size 45

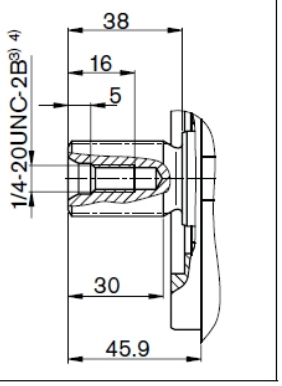
- ☐ DFR/DFR1 - Pressure and flow control, hydraulic：
- ☐ Clockwise rotation



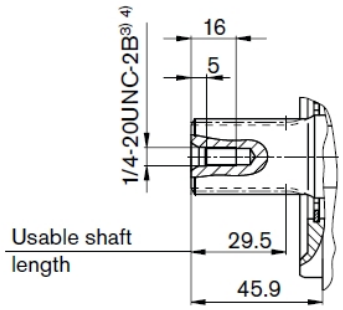
■ Dimensions：Size 45

□ Drive shaft：

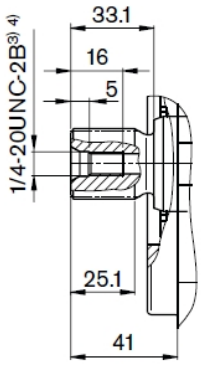
S Splined shaft 1 in
15T 16/32DP[1] (SAE J744)



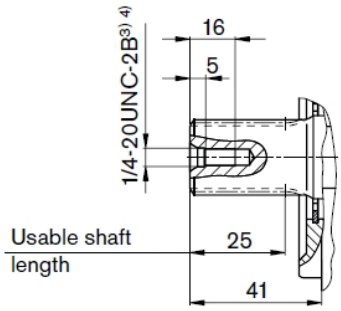
R Splined shaft 1 in
15T 16/32DP[1][2] (SAE J744)



U Splined shaft 7/8 in
13T 16/32DP[1] (SAE J744)



W Splined shaft 7/8 in
13T 16/32DP[1][2] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 52 must be observed.

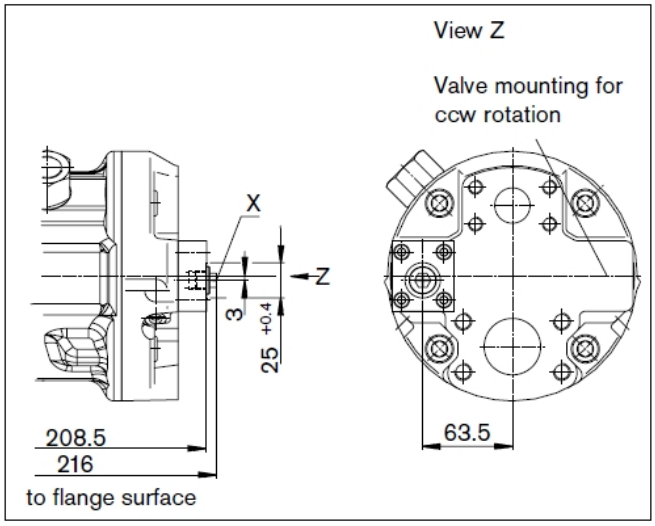
□ Ports：

Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	1” M10 X 1.5 17 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	1-1/2” M12 X 1.75 17 deep	10	O
L	Case drain fluid	DIN 3852	M22 X 1.5 12 deep	2	O
L_1	Case drain fluid	DIN 3852	M22 X 1.5 12 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	ISO 228	G 1/4” 12 deep	350	O

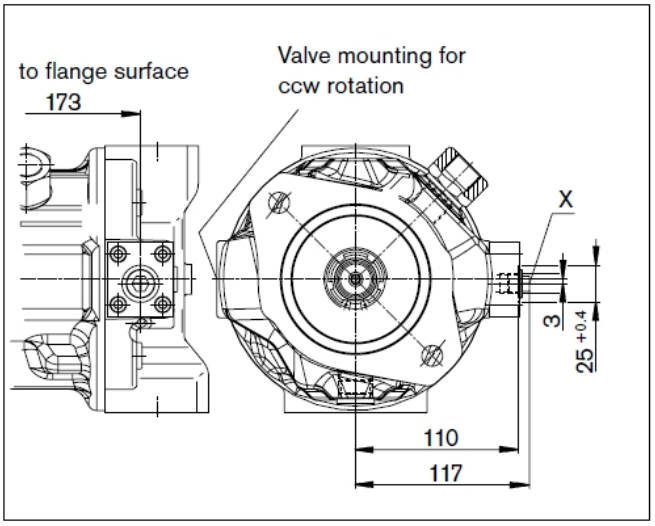
□ O = Must be connected (plugged on delivery)
□ X = Plugged (in normal operation)

■ Dimensions：Size 45

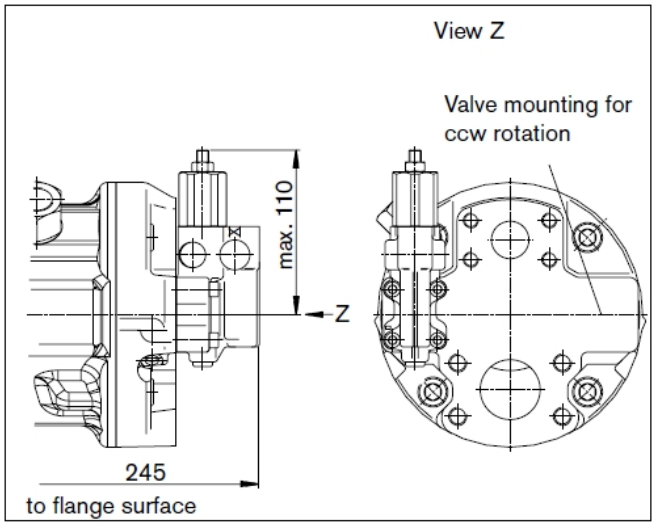
DG
Two-point control, directly operated, **port plate 11**



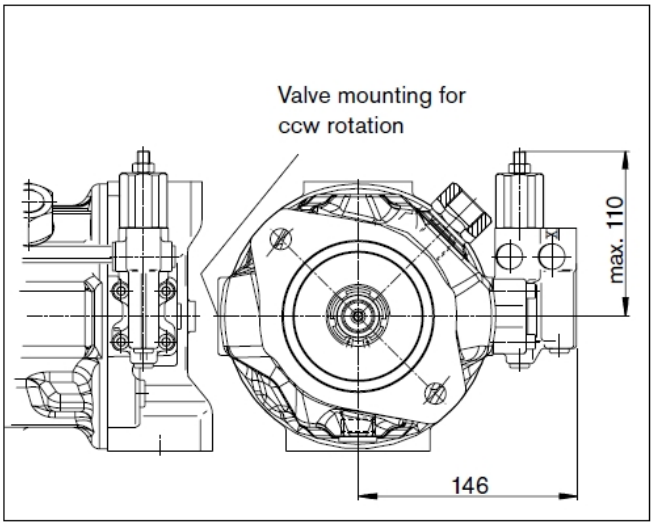
DG
Two-point control, directly operated, **port plate 12**



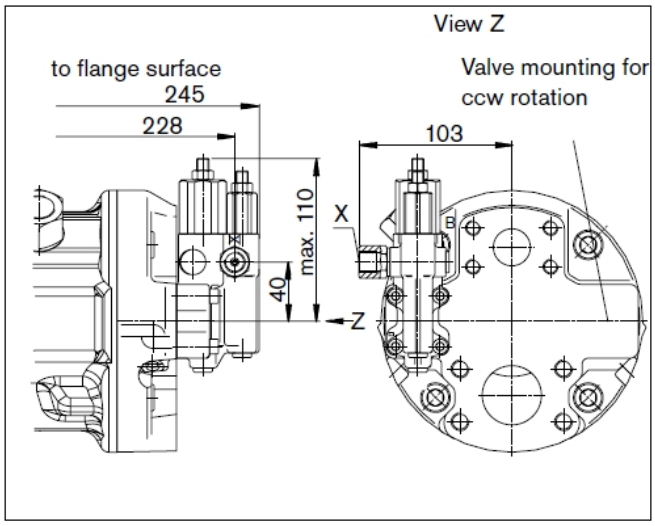
DR
Pressure control, **port plate 11**



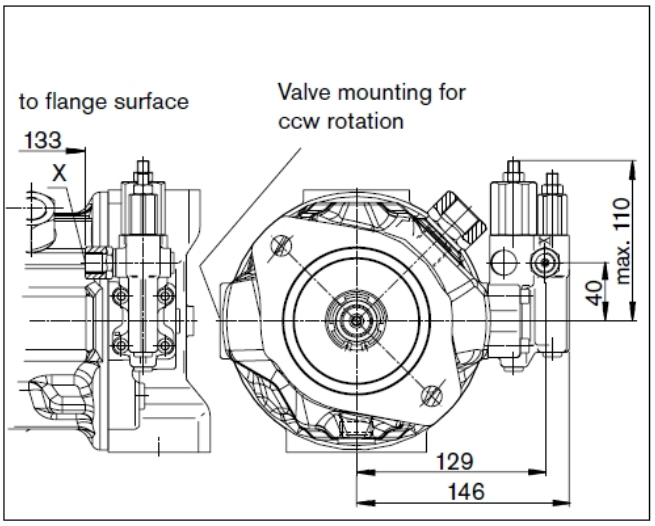
DR
Pressure control, **port plate 12**



DRG
Pressure control, remotely operated, **port plate 11**

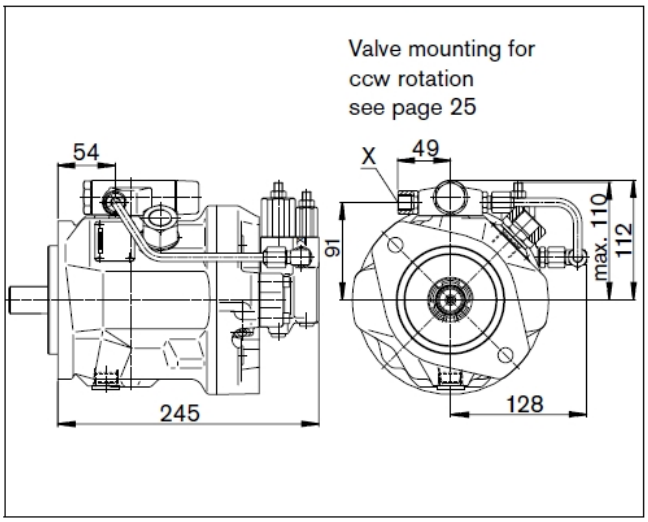


DRG
Pressure control, remotely operated, **port plate 12**

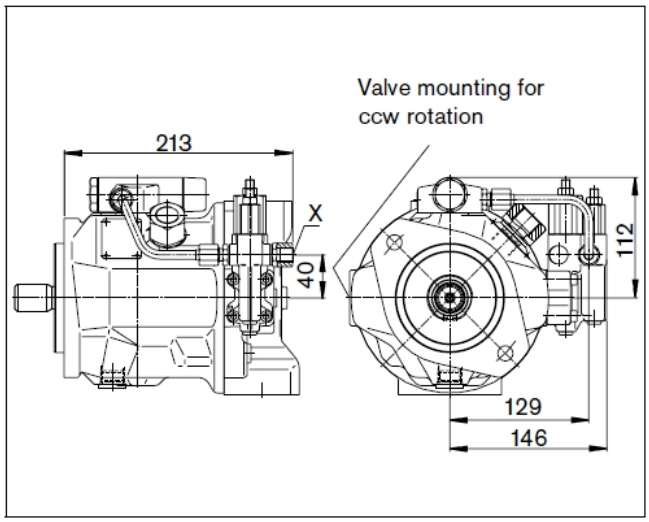


■ Dimensions：Size 45

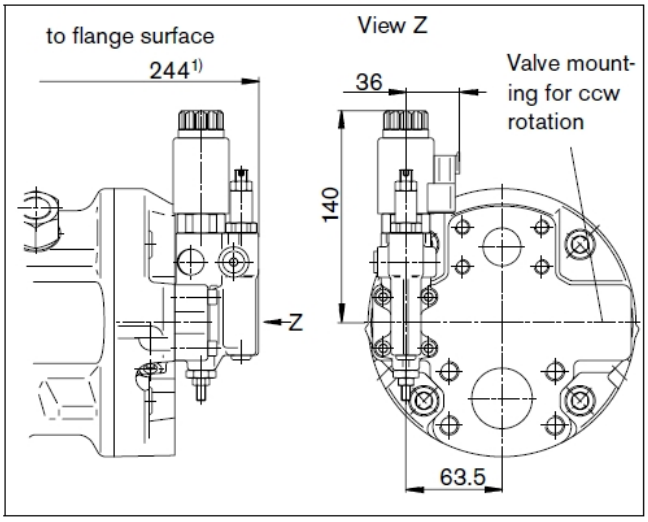
DFLR
Pressure, flow and power control, **port plate 11**



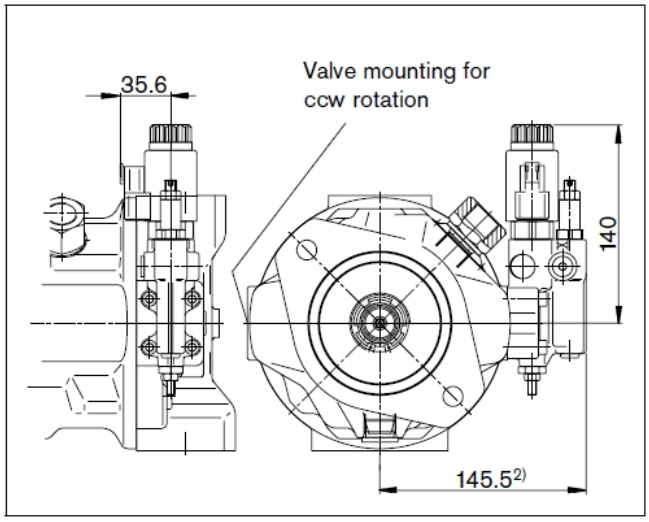
DFLR
Pressure, flow and power control, **port plate 12**



ED7. / ER7.
Electro-hydraulic pressure control, **port plate 11**



ED7. / ER7.
Electro-hydraulic pressure control, **port plate 12**

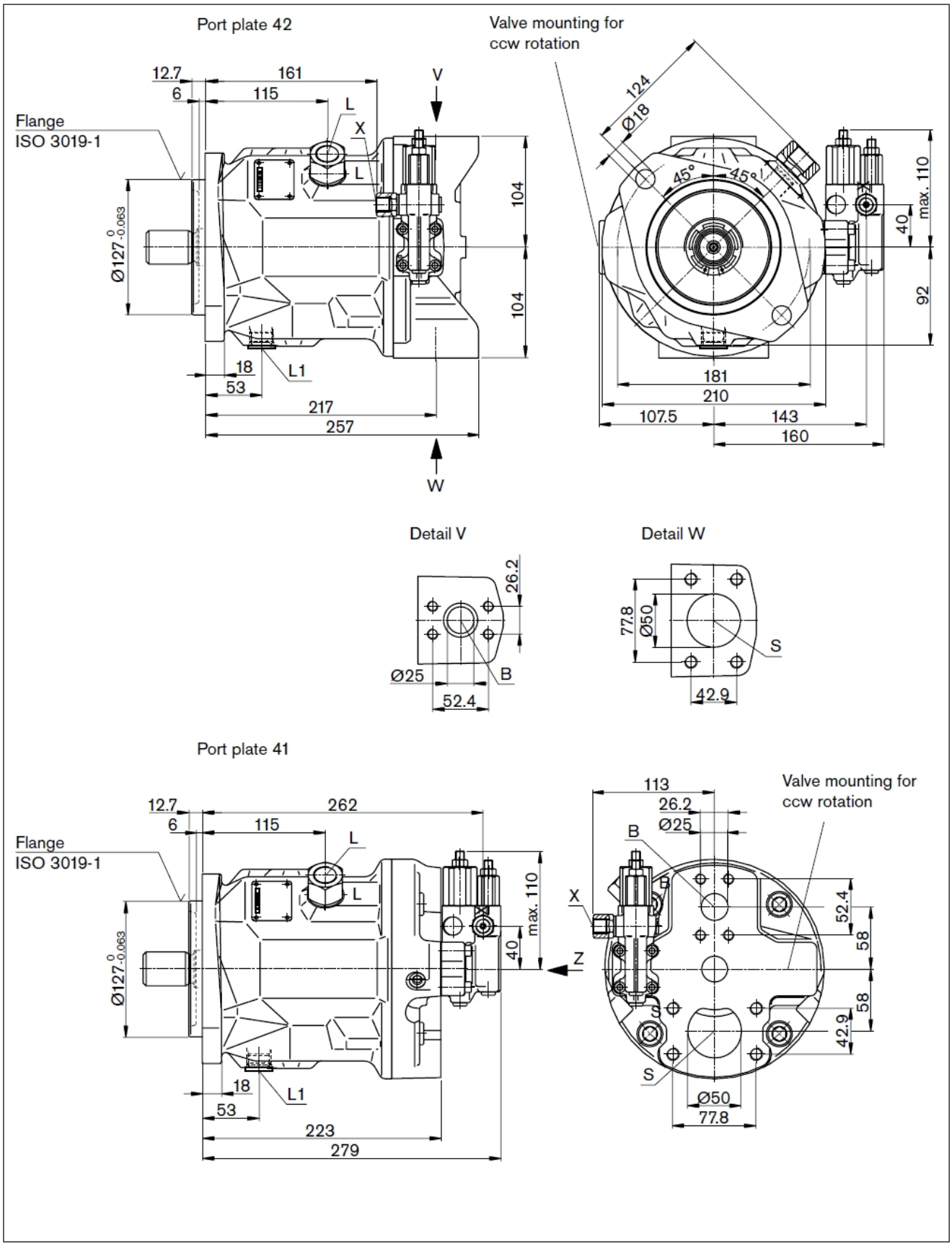


1) ER7.: 279 mm when using a sandwich plate pressure reducing valve

2) ER7.: 180.5 mm when using a sandwich plate pressure reducing valve.

■ Dimensions：Size71

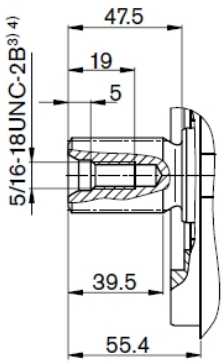
- ☐ DFR/DFR1– Pressure and flow control, hydraulic：
- ☐ Clockwise rotation



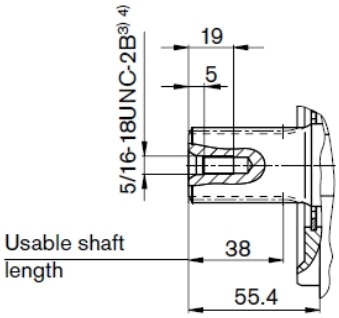
■ Dimensions：Size 71

□ Drive shaft：

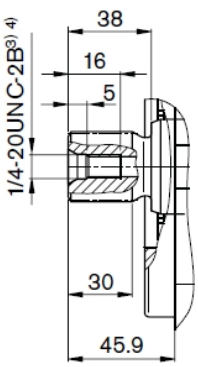
S Splined shaft 1 1/4 in
14T 12/24DP[1] (SAE J744)



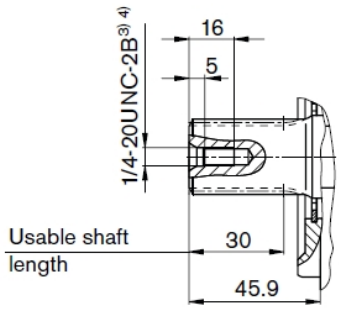
R Splined shaft 1 1/4 in
14T 12/24DP[1][2] (SAE J744)



U Splined shaft 1 in
15T 16/32DP[1] (SAE J744)



W Splined shaft 1 in
15T 16/32DP[1][2] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.

3) Thread according to ASME B1.1

4) For the maximum tightening torques the general instructions on page 52 must be observed

□ Ports：

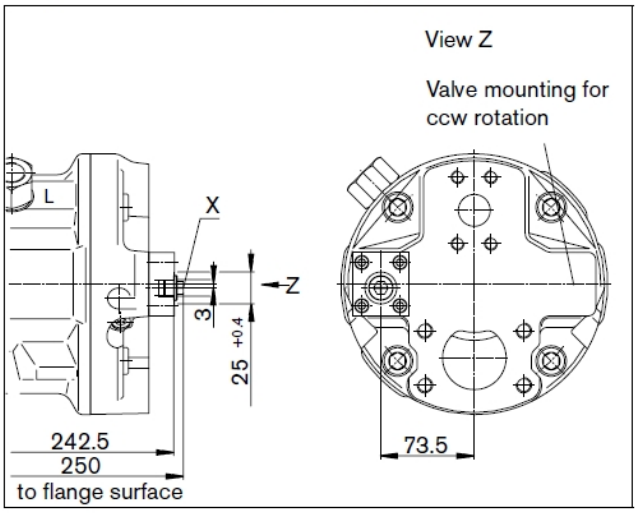
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	1” M10 X 1.5 17 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	2” M12 X 1.75 20 deep	10	O
L	Case drain fluid	DIN 3852	M22 X 1.5 14 deep	2	O
L_1	Case drain fluid	DIN 3852	M22 X 1.5 14 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	ISO 228	G 1/4” 12 deep	350	O

□ O = Must be connected (plugged on delivery)

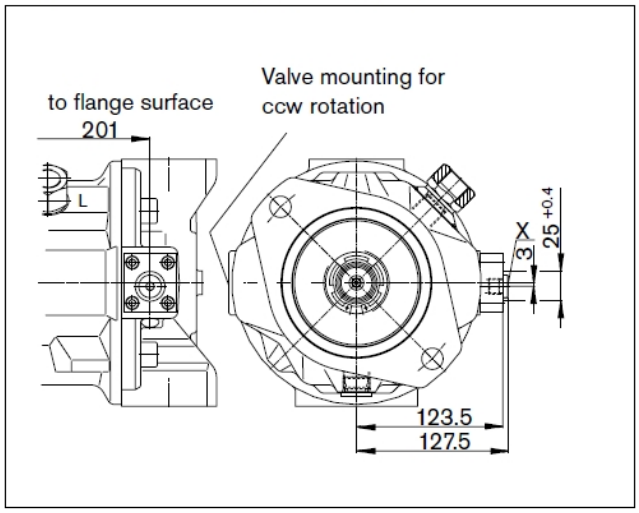
□ X = Plugged (in normal operation)

■ Dimensions：Size 71

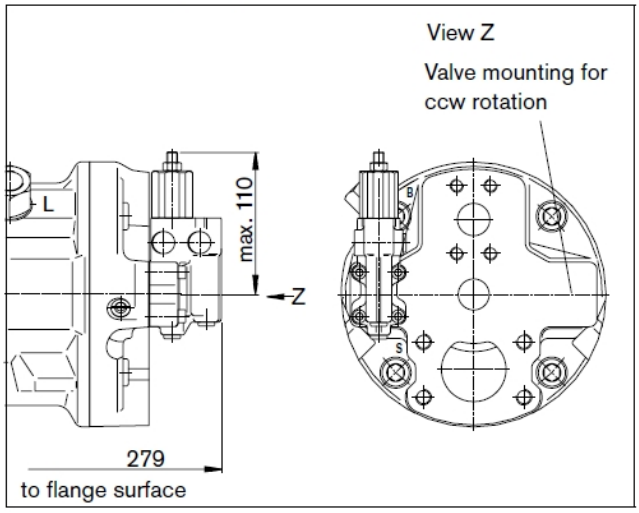
DG
Two-point control, directly operated, **port plate 41**



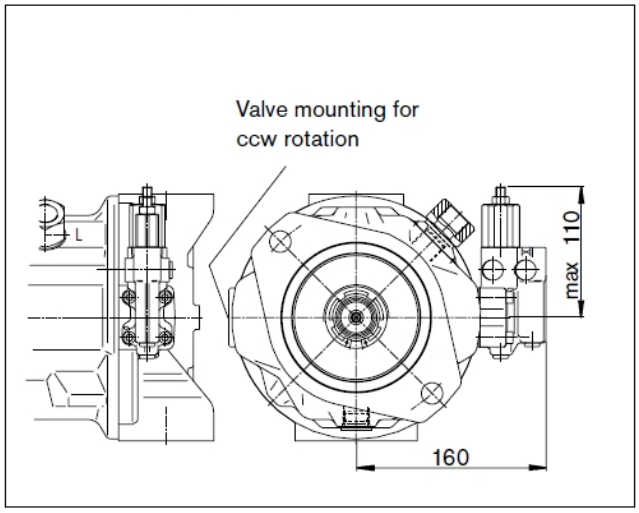
DG
Two-point control, directly operated, **port plate 42**



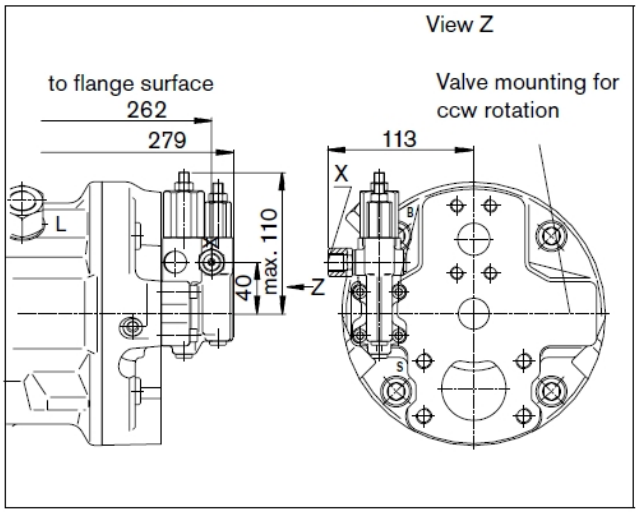
DR
Pressure control, **port plate 41**



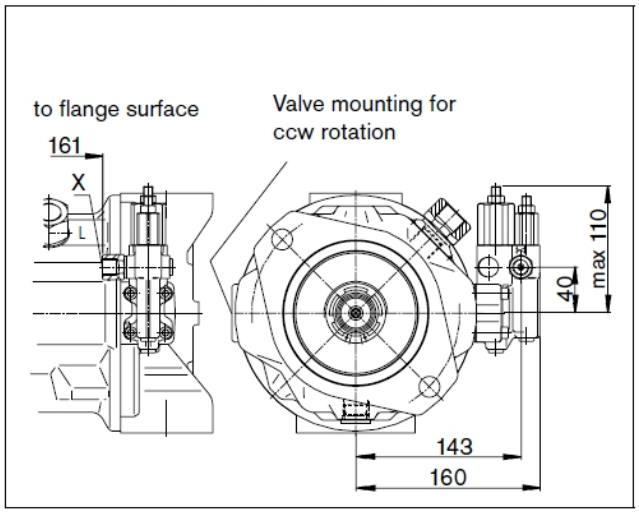
DR
Pressure control, **port plate 42**



DRG
Pressure control, remotely operated, **port plate 41**

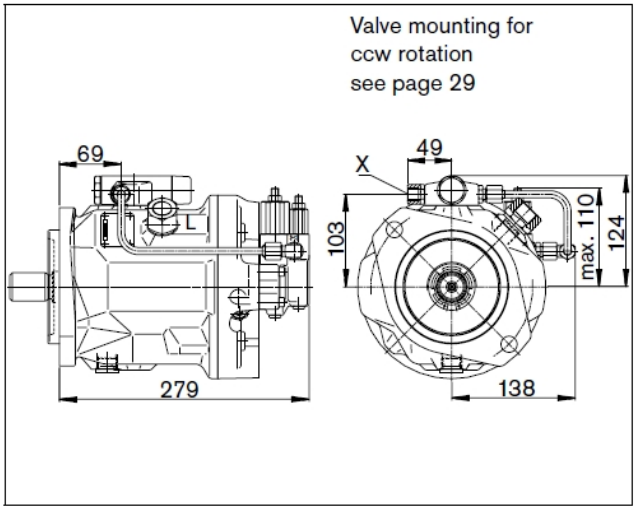


DRG
Pressure control, remotely operated, **port plate 42**

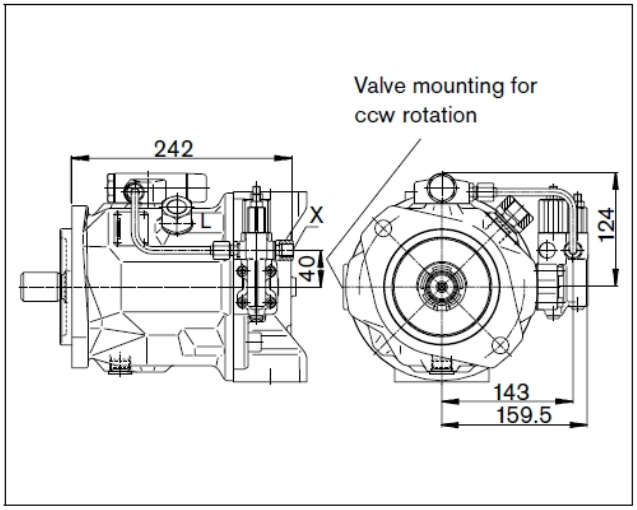


■ Dimensions：Size 71

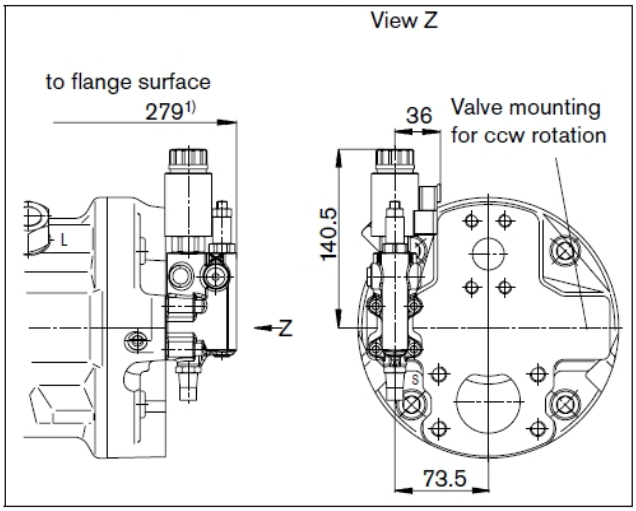
DFLR
Pressure, flow and power control, **port plate 41**



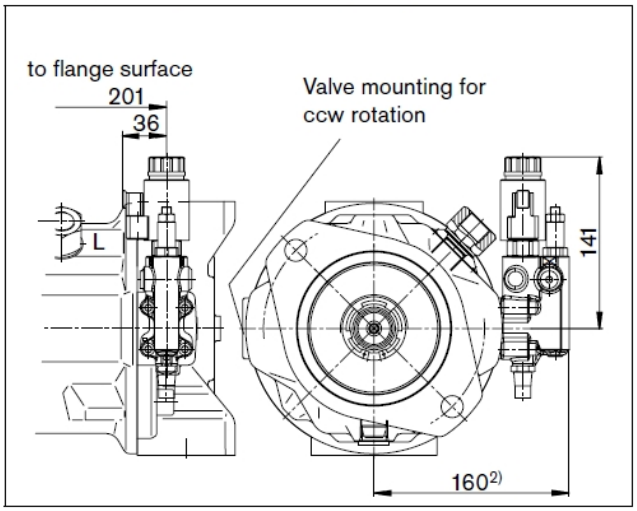
DFLR
Pressure, flow and power control, **port plate 42**



ED7. / ER7.
Electro-hydraulic pressure control, **port plate 41**



ED7. / ER7.
Electro-hydraulic pressure control, **port plate 42**

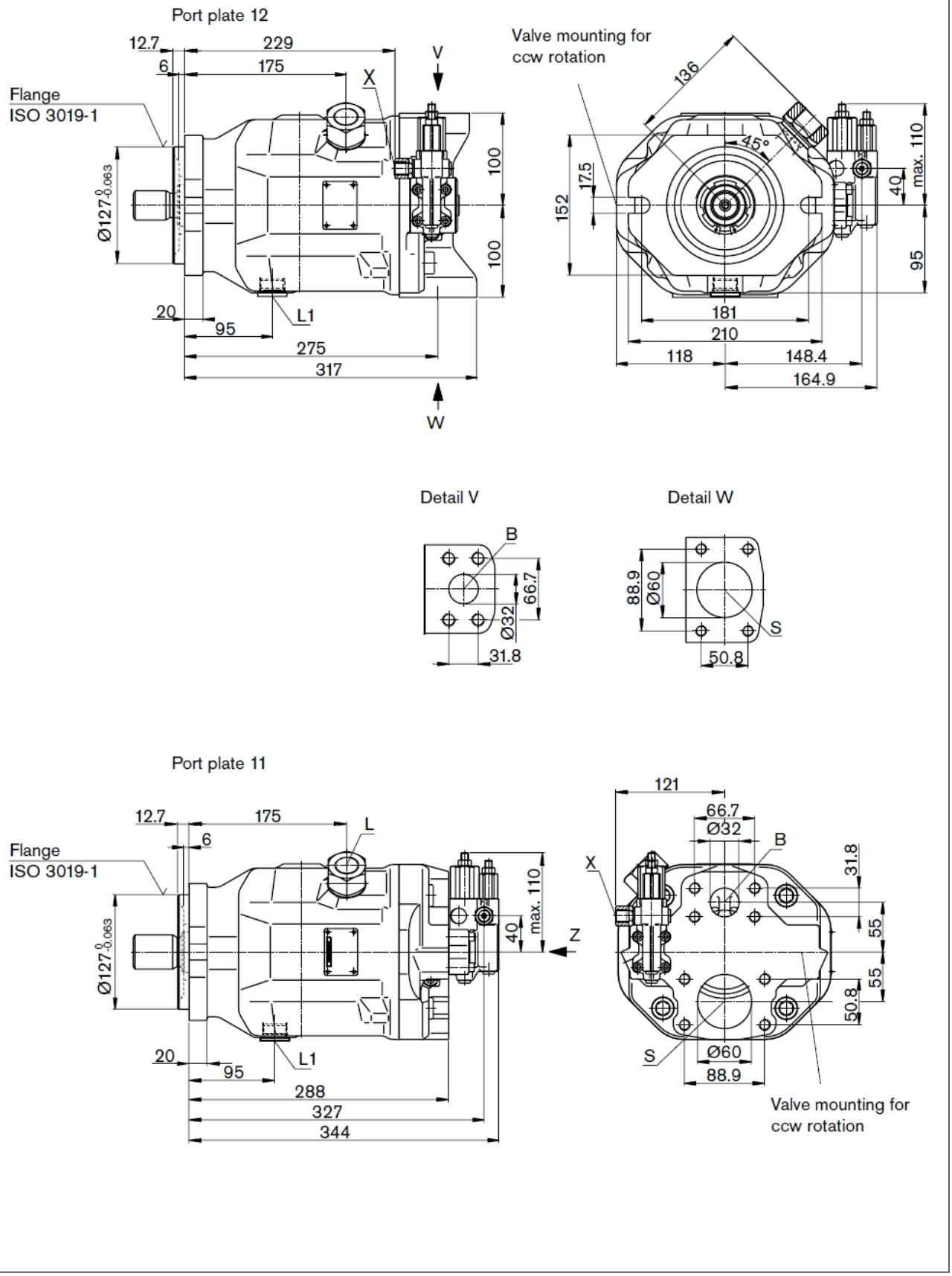


1) ER7.: 314 mm when using a sandwich plate pressure reducing valve.

2) ER7.: 195 mm when using a sandwich plate pressure reducing valve.

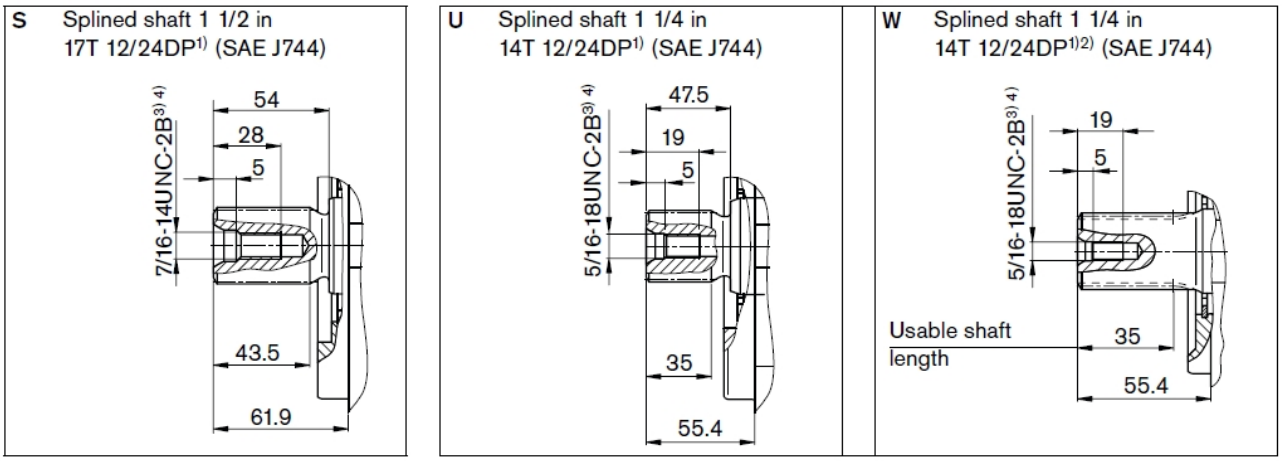
■ Dimensions：Size 100

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



■ Dimensions：Size 100

□ Drive shaft：



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.

3) Thread according to ASME B1.1

4) For the maximum tightening torques the general instructions on page 52 must be observed.

□ Ports：

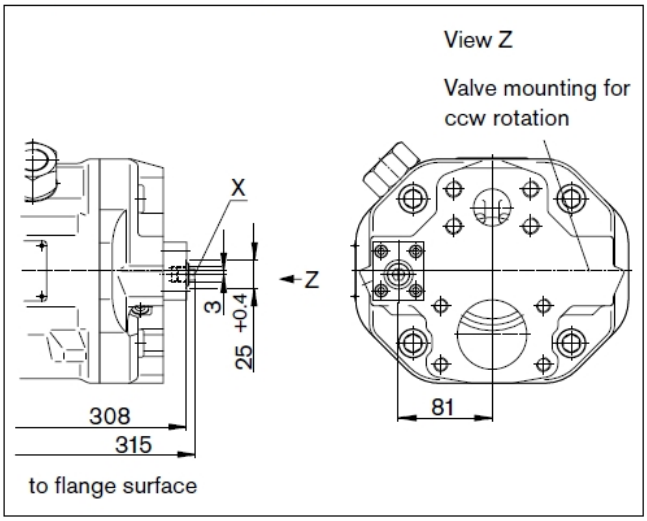
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	1-1/4” M14 X 2 19 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	2-1/2” M12 X 1.75 17 deep	10	O
L	Case drain fluid	DIN 3852	M27 X 2 16 deep	2	O
L_1	Case drain fluid	DIN 3852	M27 X 2 16 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	ISO 228	G 1/4” 12 deep	350	O

□ O = Must be connected (plugged on delivery)

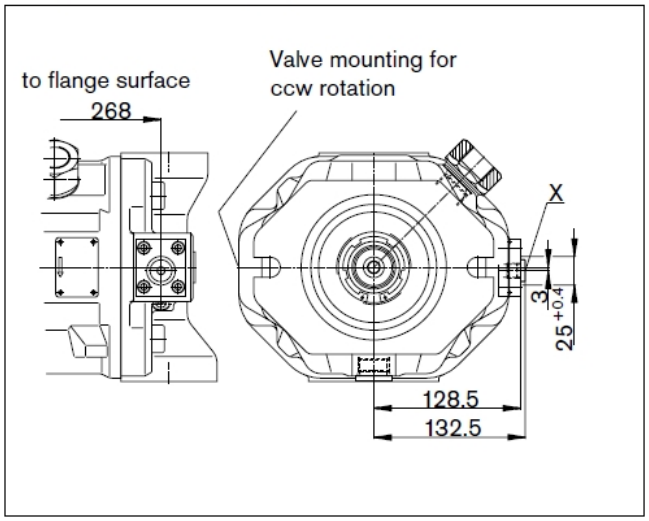
□ X = Plugged (in normal operation)

■ Dimensions：Size 100

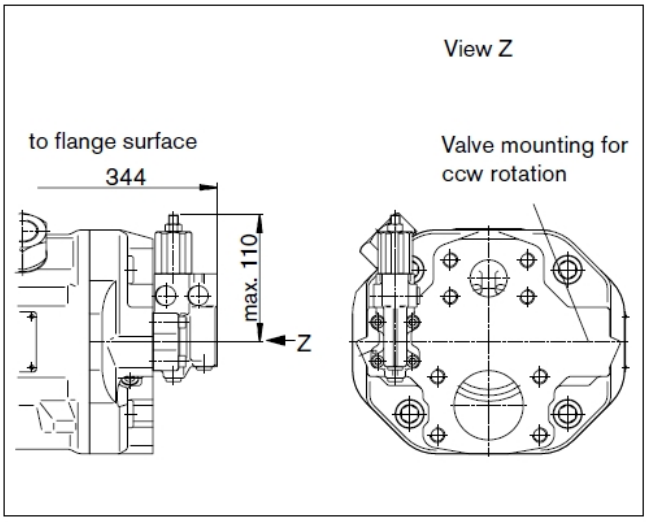
DG
Two-point control, directly operated, **port plate 11**



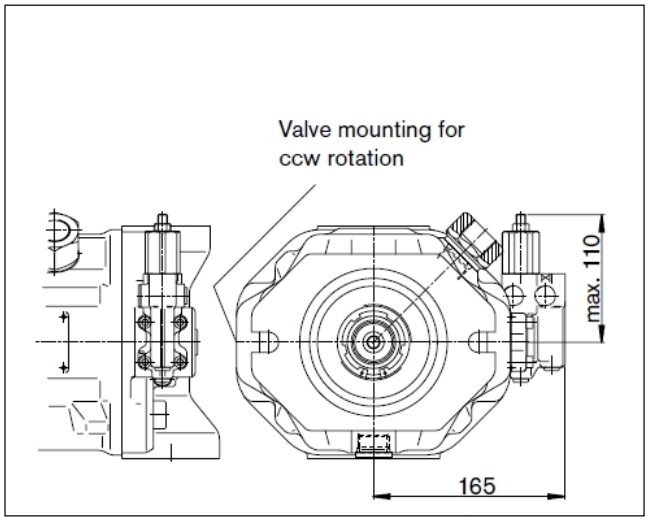
DG
Two-point control, directly operated, **port plate 12**



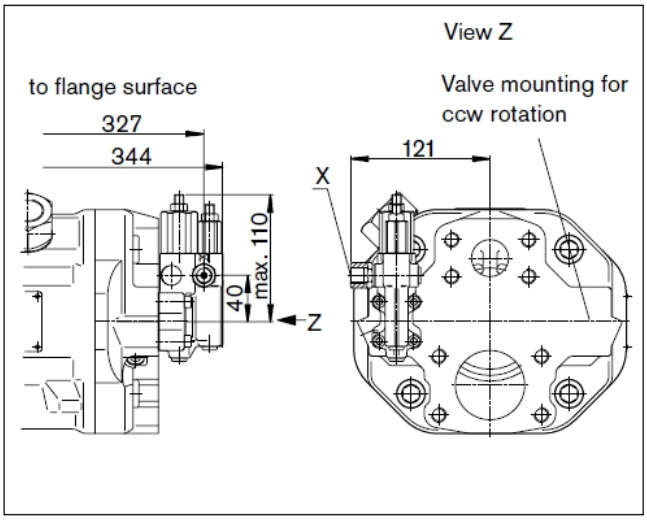
DR
Pressure control, **port plate 11**



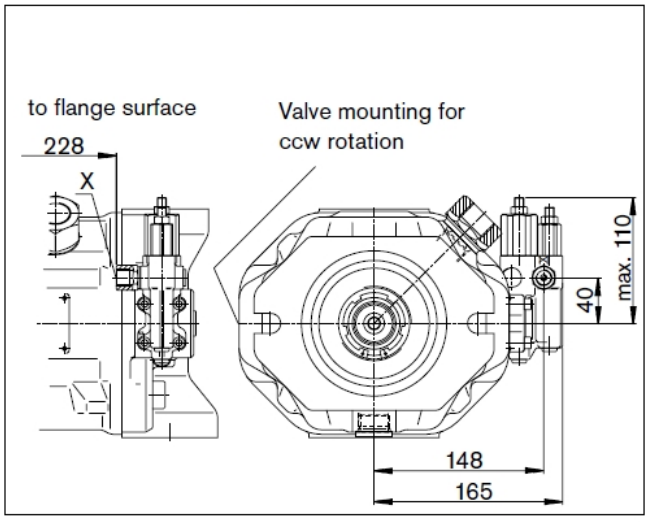
DR
Pressure control, **port plate 12**



DRG
Pressure control, remotely operated, **port plate 11**

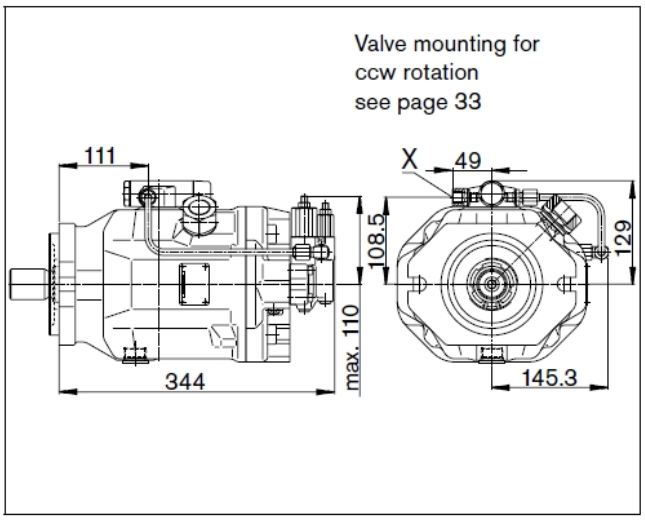


DRG
Pressure control, remotely operated, **port plate 12**

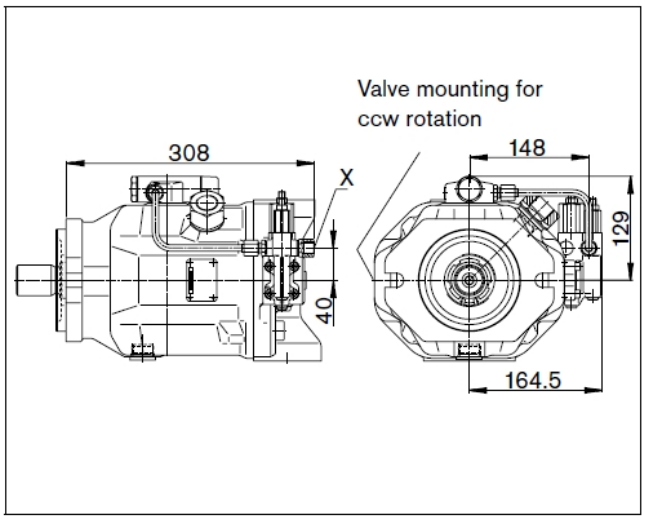


■ Dimensions：Size100

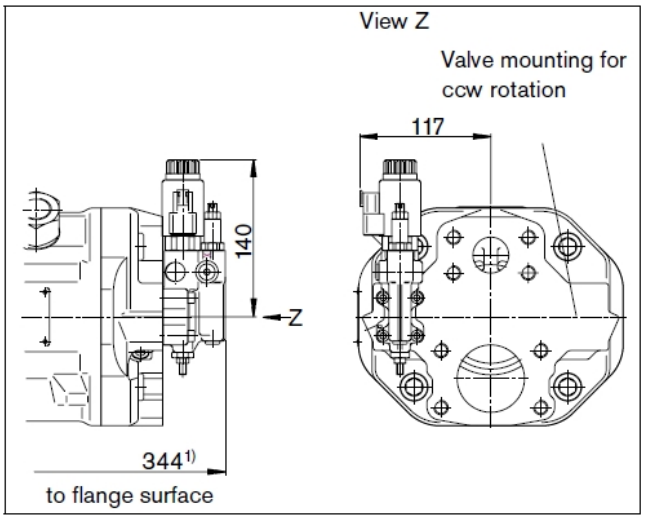
DFLR
Pressure, flow and power control, **port plate 11**



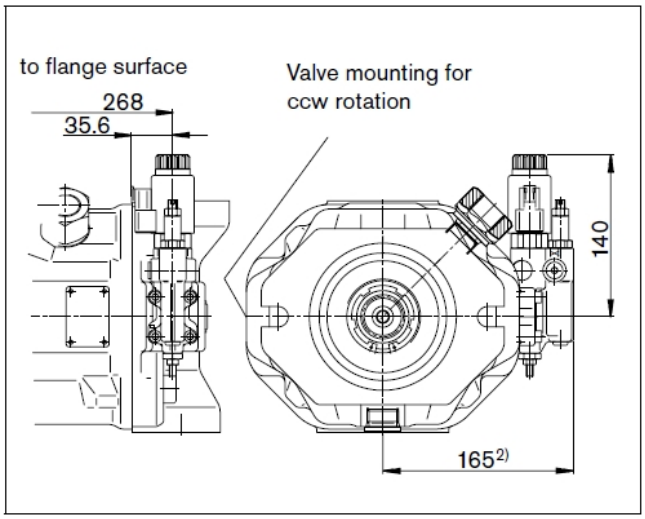
DFLR
Pressure, flow and power control, **port plate 12**



ED7./ER7.
Electro-hydraulic pressure control, **port plate 11**



ED7./ER7.
Electro-hydraulic pressure control, **port plate 12**



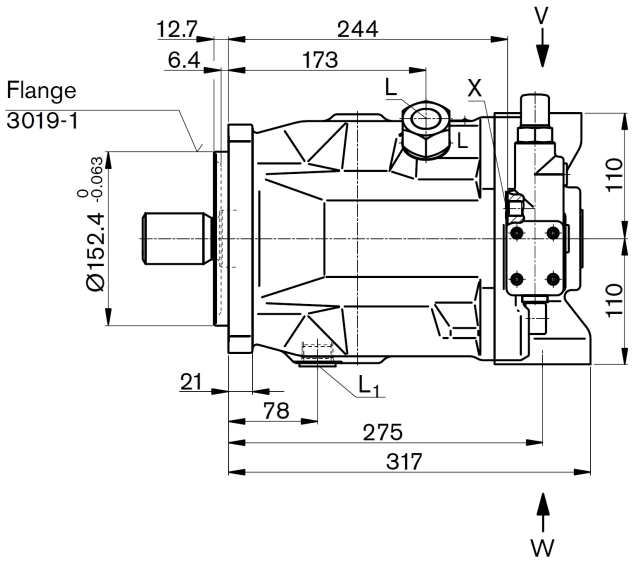
1) ER7.: 379 mm when using a sandwich plate pressure reducing valve.

2) ER7.: 200 mm when using a sandwich plate pressure reducing valve.

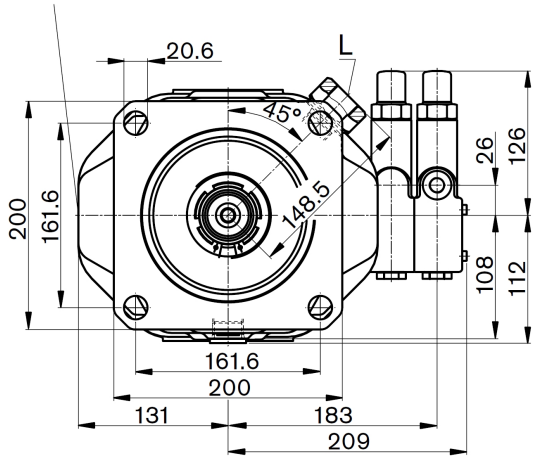
■ Dimensions：Size140

- ☐ DFR/DFR1– Pressure and flow control, hydraulic：
- ☐ Clockwise rotation，mounting flange D

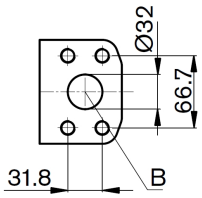
Port plate 12



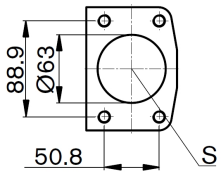
Valve mounting for
ccw rotation



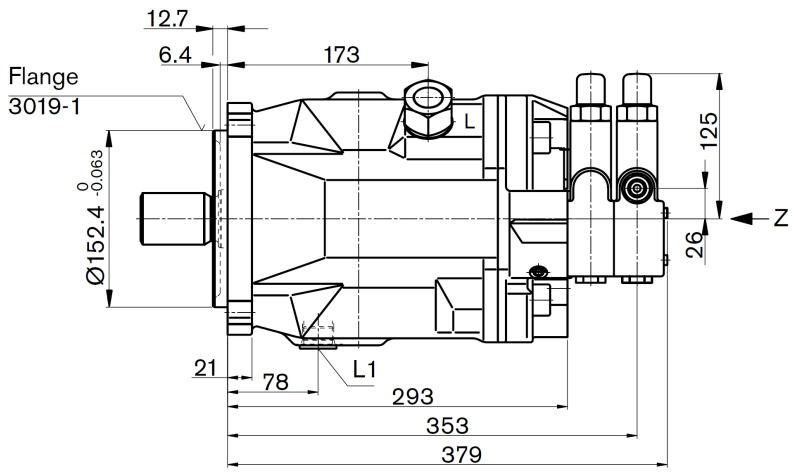
Detail V

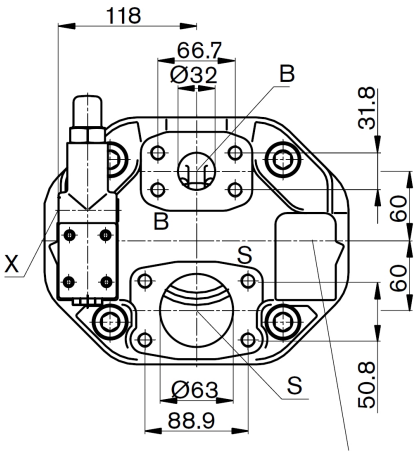


Detail W



Port plate 11



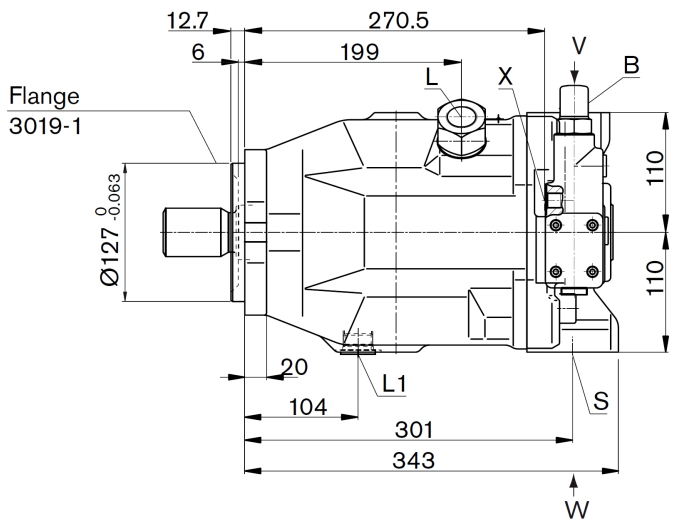


Valve mounting for
ccw rotation

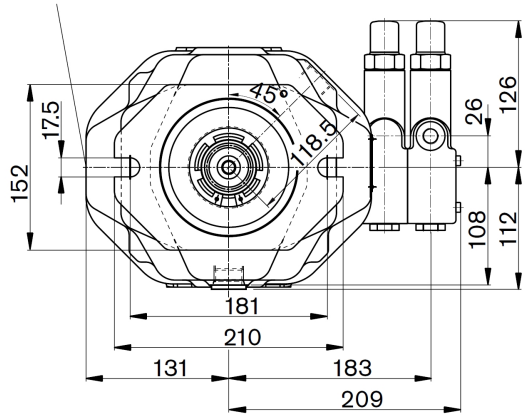
■ Dimensions：Size 140

- ☐ DFR/DFR1– Pressure and flow control, hydraulic：
- ☐ Clockwise rotation，mounting flange C

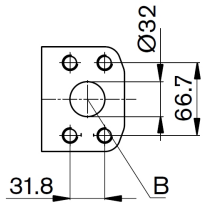
Port plate 12



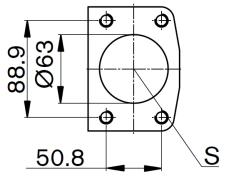
Valve mounting for
ccw rotation



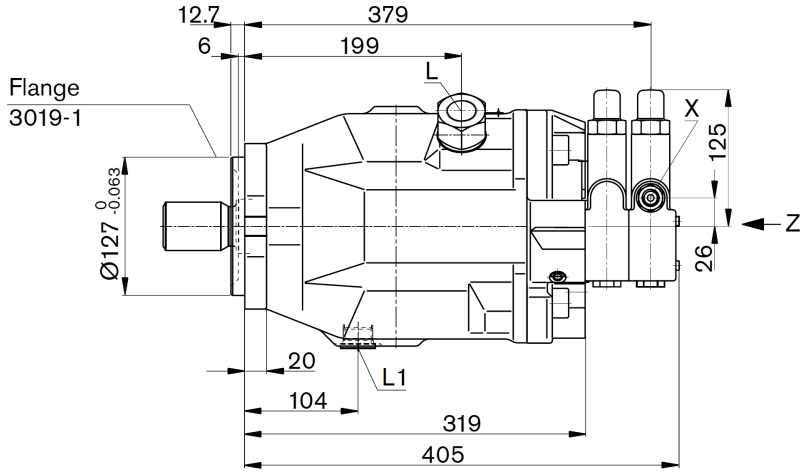
Detail V

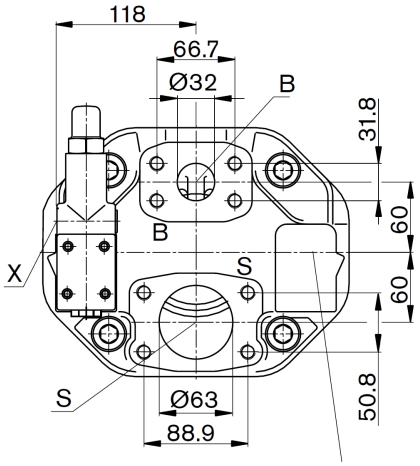


Detail W



Port plate 11



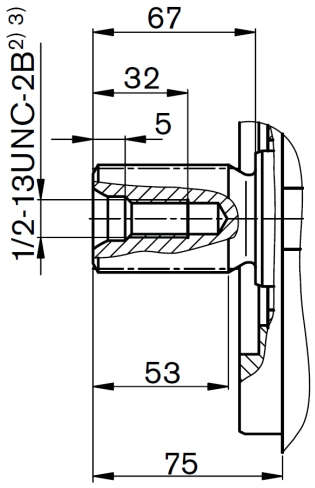


Valve mounting for
ccw rotation

■ Dimension: Size 140

□ Drive shaft：

S Splined shaft 1 3/4 in
13T 8/16DP[1)] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to ASME B1.1

3) For the maximum tightening torques the general instructions on page 52 must be observed.

□ Ports：

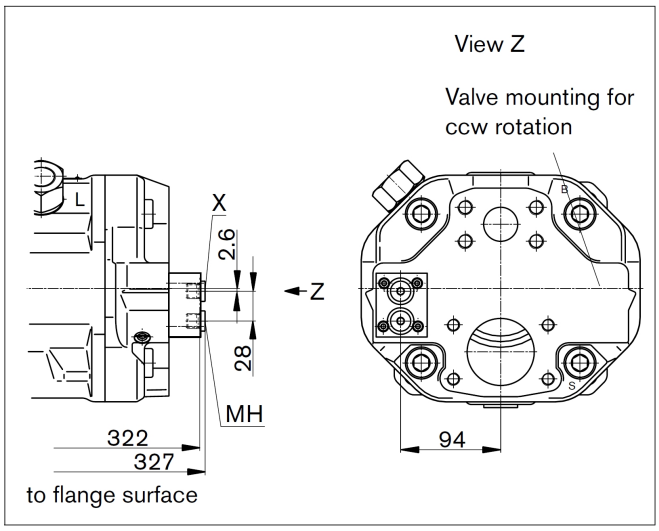
Designation	Port for	Standard	Size	Maximum pressure (bar)	State
B	Service line fastening thread	SAE J518 DIN 13	1-1/4” M14 X 2 19 deep	350	O
S	Suction line fastening thread	SAE J518 DIN 13	2-1/2” M12 X 1.75 17 deep	10	O
L	Case drain fluid	DIN 3852	M27 X 2 16 deep	2	O
L_1	Case drain fluid	DIN 3852	M27 X 2 16 deep	2	X
X	Pilot pressure	DIN 3852	M14 X 1.5 12 deep	350	O
X	Pilot pressure with DG-control	DIN 3852	M14 X 1.5 12 deep	350	O
M_H	Gauge port, high pressure	DIN 3852	M14 X 1.5 12 deep	350	X

□ O = Must be connected (plugged on delivery)

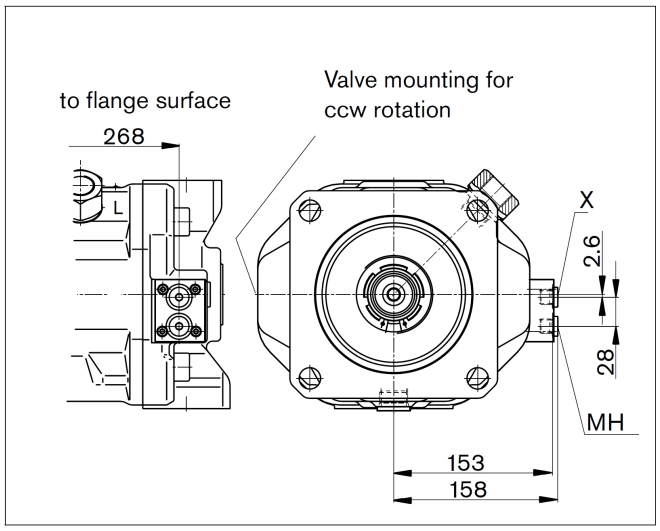
□ X = Plugged (in normal operation)

■ Dimensions：Size 140

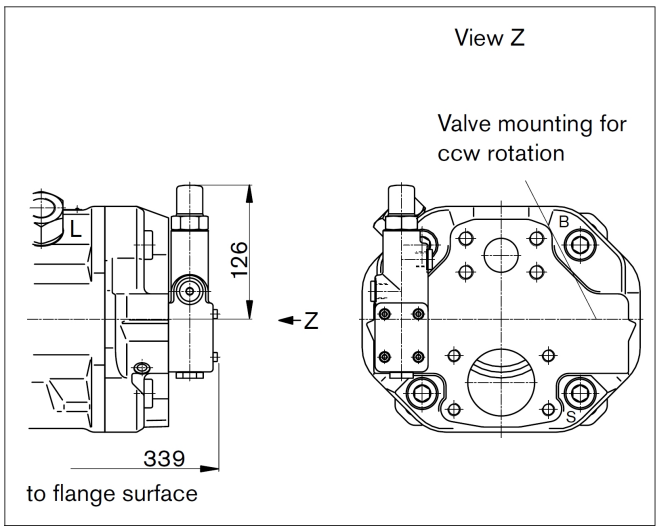
DG
Two-point control, directly operated, **port plate 11**



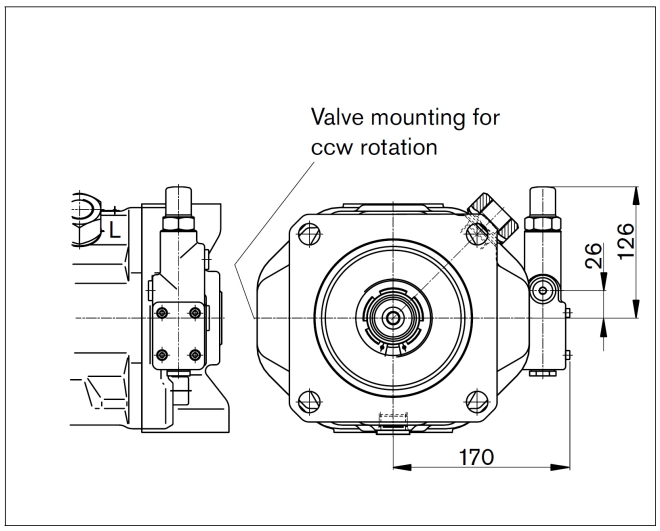
DG
Two-point control, directly operated, **port plate 12**



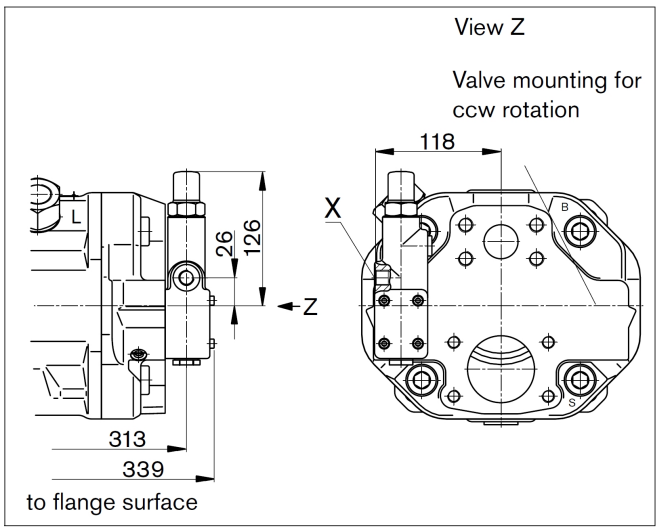
DR
Pressure control, **port plate 11**



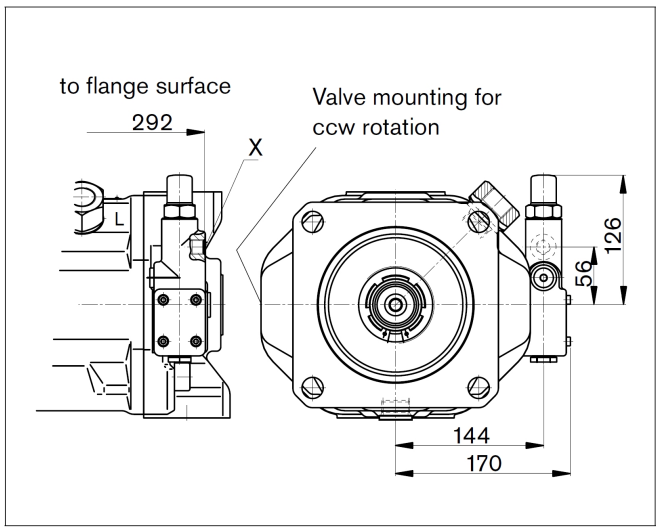
DR
Pressure control, **port plate 12**



DRG
Pressure control, remotely operated, **port plate 11**

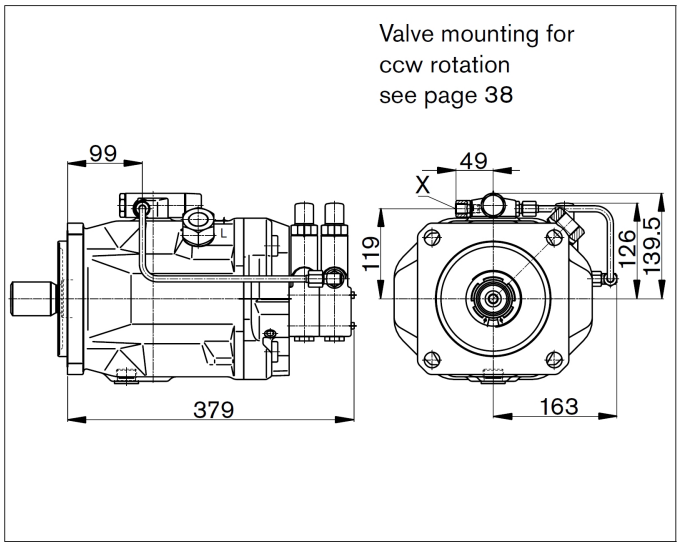


DRG
Pressure control, remotely operated, **port plate 12**

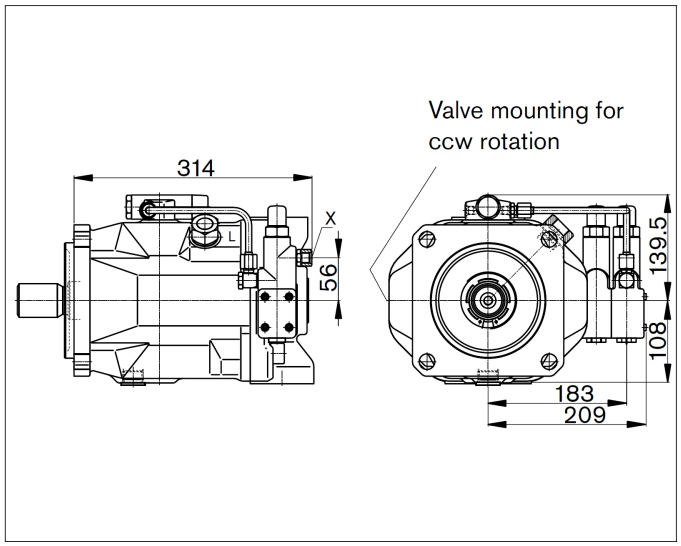


Dimensions：Size 140

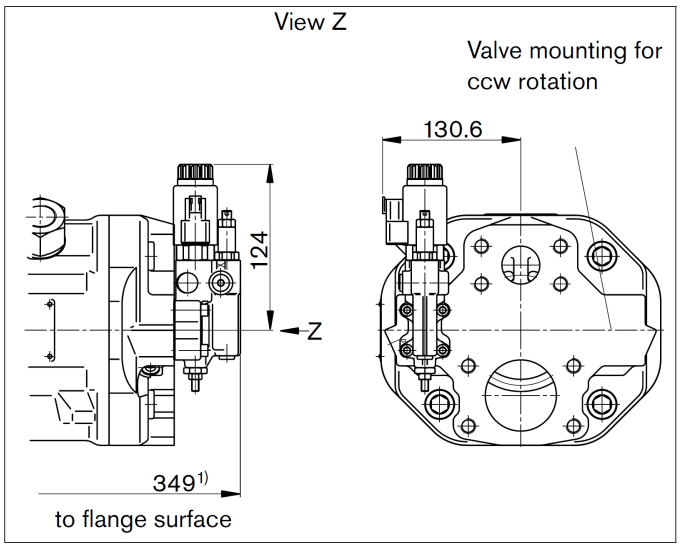
DFLR
Pressure, flow and power control, **port plate 11**



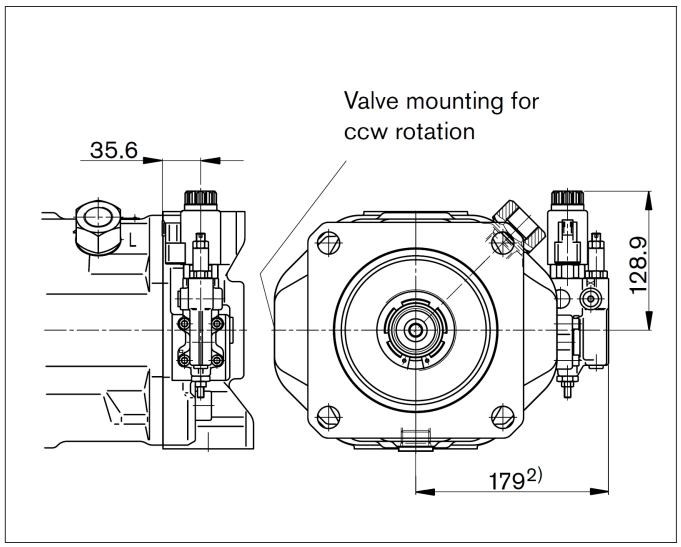
DFLR
Pressure, flow and power control, **port plate 12**



ED7. / ER7.
Electro-hydraulic pressure control, **port plate 11**



ED7. / ER7.
Electro-hydraulic pressure control, **port plate 12**

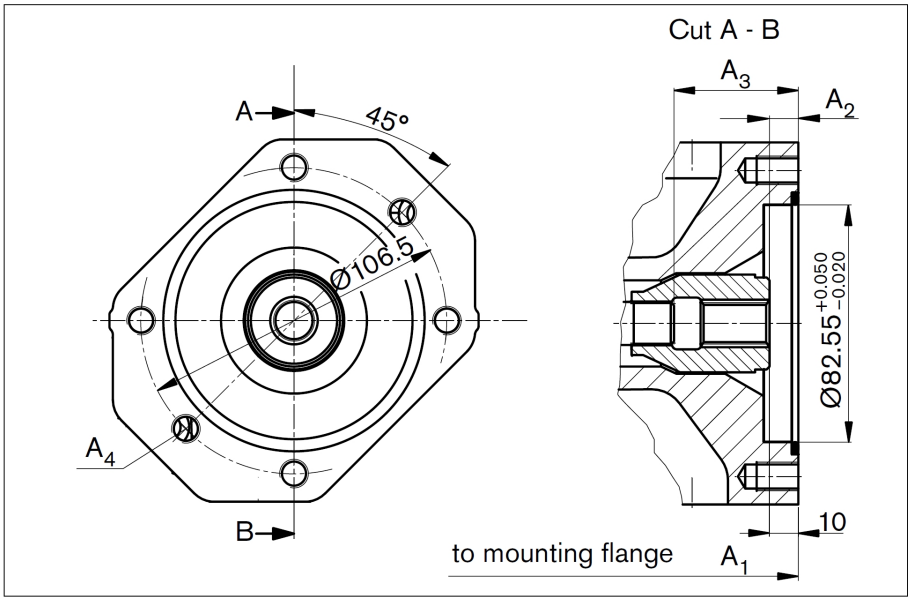


1) ER7.: 384 mm when using a sandwich plate pressure reducing valve.

2) ER7.: 214 mm when using a sandwich plate pressure reducing valve.

■ Dimensions…though drive K01：

- □ Flange ISO 3019-2 (SAE J744-82-2 A)
- □ Coupling for splined shaft according to ANSI B92.1a-1996 5/8” 9T 16/32 DP[1](SAE J744-16-4 A)



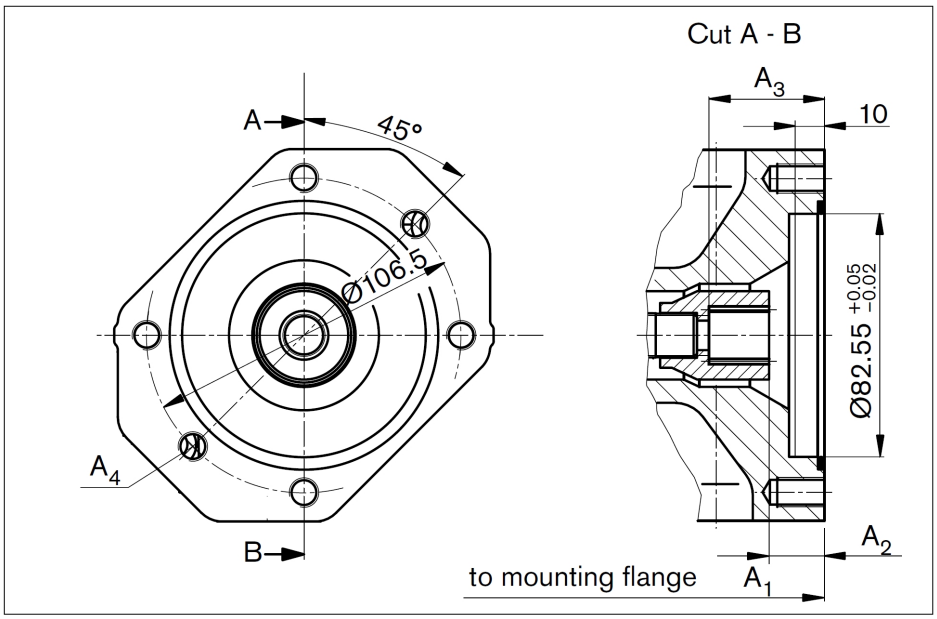
NG	A_1	A_2	A_3	A_4[2]
18	182	10	43.3	M10 x 1.5, 14.5 deep
28	204	10	33.7	M10 x 1.5, 16 deep
45	229	10.7	53.4	M10 x 1.5, 16 deep
71	267	11.8	61.3	M10 x 1.5, 20 deep
100	338	10.5	65	M10 x 1.5, 16 deep
140	350	10.8	77.3	M10 x 1.5, 16 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Dimensions…though drive K52：

- □ Flange ISO 3019-2 (SAE J744-82-2 A)
- □ Coupling for splined shaft according to ANSI B92.1a-1996 3/4” 11T 16/32 DP[1] (SAE J744-19-4 A-B)



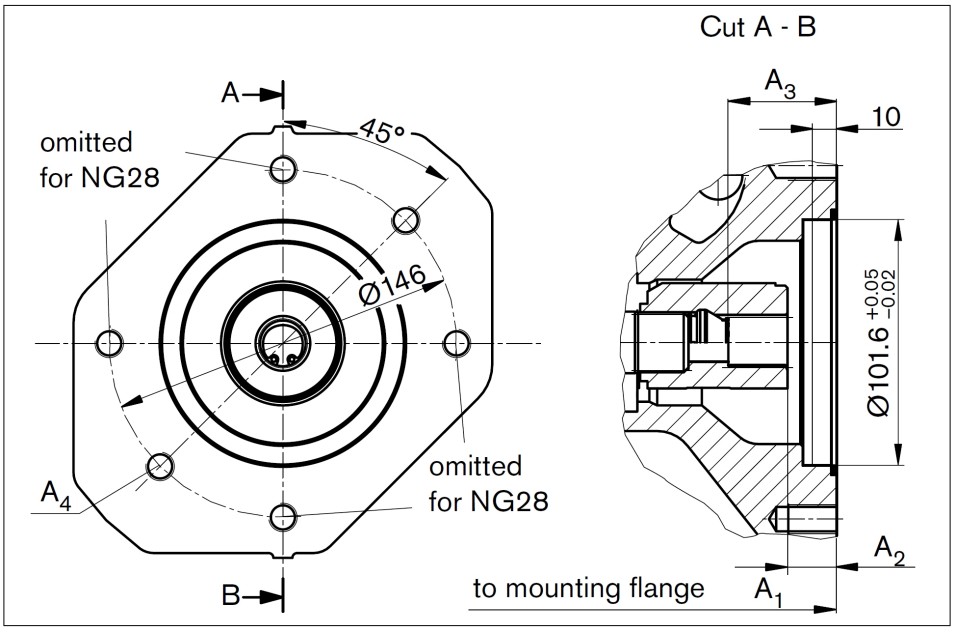
NG	A_1	A_2	A_3	A_4[2]
18	182	18.8	38.7	M10 x 1.5, 14.5 deep
28	204	18.8	38.7	M10 x 1.5, 16 deep
45	229	18.9	38.7	M10 x 1.5, 16 deep
71	267	21.3	41.4	M10 x 1.5, 20 deep
100	338	19	38.9	M10 x 1.5, 16 deep
140	350	18.9	38.6	M10 x 1.5, 16 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Dimensions…though drive K68：

- □ Flange ISO 3019-2 (SAE J744-101-2 B)
- □ Coupling for splined shaft according to ANSI B92.1a-1996 7/8” 13T 16/32 DP[1] (SAE J744-22-4 B)



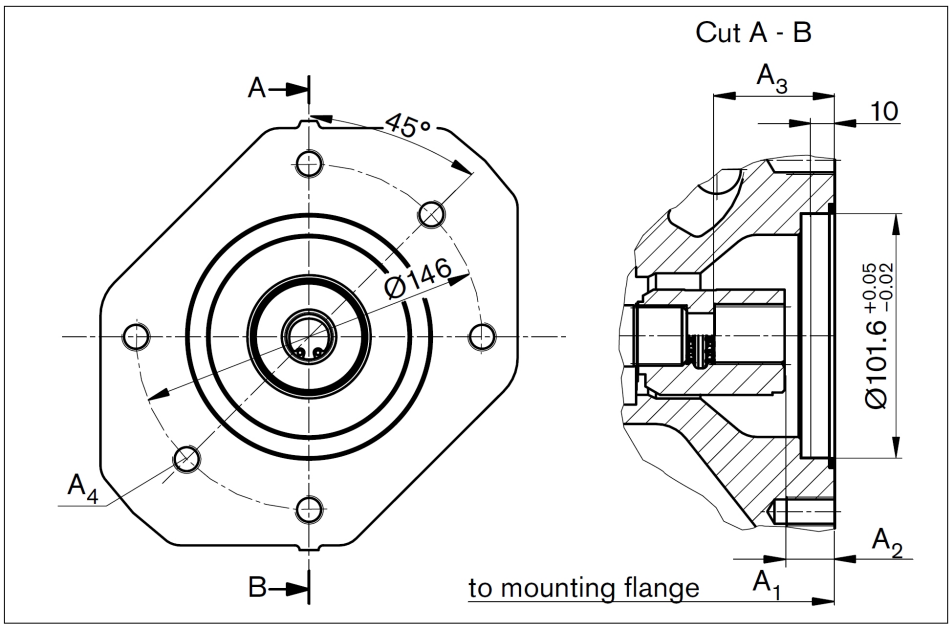
NG	A_1	A_2	A_3	A_4[2]
28	204	17.8	41.7	M12 x 1.75, continuous
45	229	17.9	41.7	M12 x 1.75, 18 deep
71	267	20.3	44.1	M12 x 1.75, 20 deep
100	338	18	41.9	M12 x 1.75, 20 deep
140	350	17.8	41.6	M12 x 1.75, 20 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Dimensions…though drive K04：

- □ Flange ISO 3019-2 (SAE J744-101-2 B)
- □ Coupling for splined shaft according to ANSI B92.1a-1996 1” 15T 16/32 DP[1] (SAE J744-25-4 B-B)



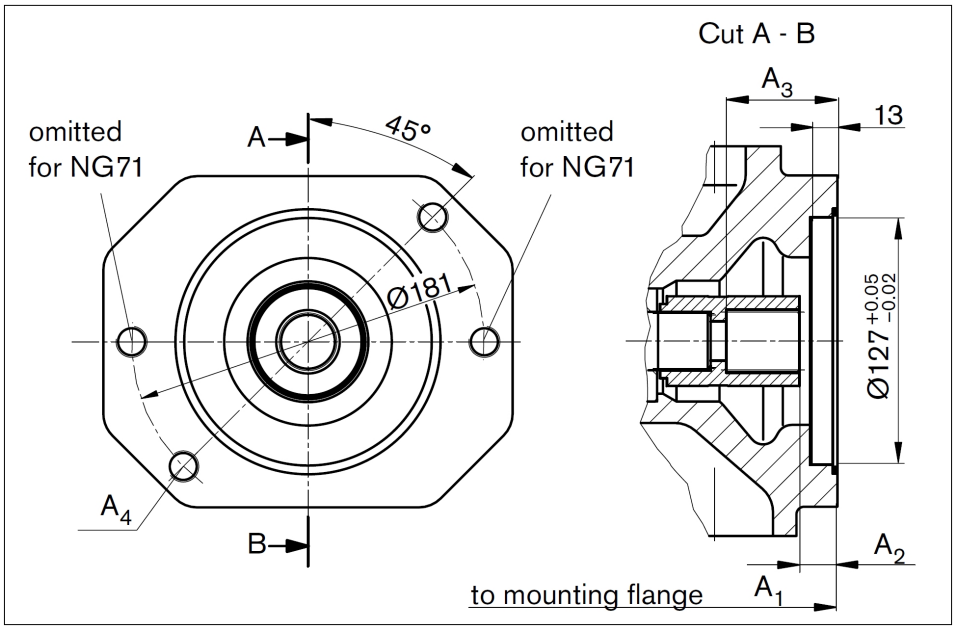
NG	A_1	A_2	A_3	A_4[2]
45	229	18.4	46.7	M12 x 1.75, 18 deep
71	267	20.8	49.1	M12 x 1.75, 20 deep
100	338	18.2	46.6	M12 x 1.75, 20 deep
140	350	18.3	45.9	M12 x 1.75, 20 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Dimensions…though drive K07：

- □ Flange ISO 3019-2 (SAE J744-127-2 C)
- □ Coupling for splined shaft according to ANSI B92.1a-1996 1-1/4” 14T 12/24 DP[1)] (SAE J744-32-4 C)



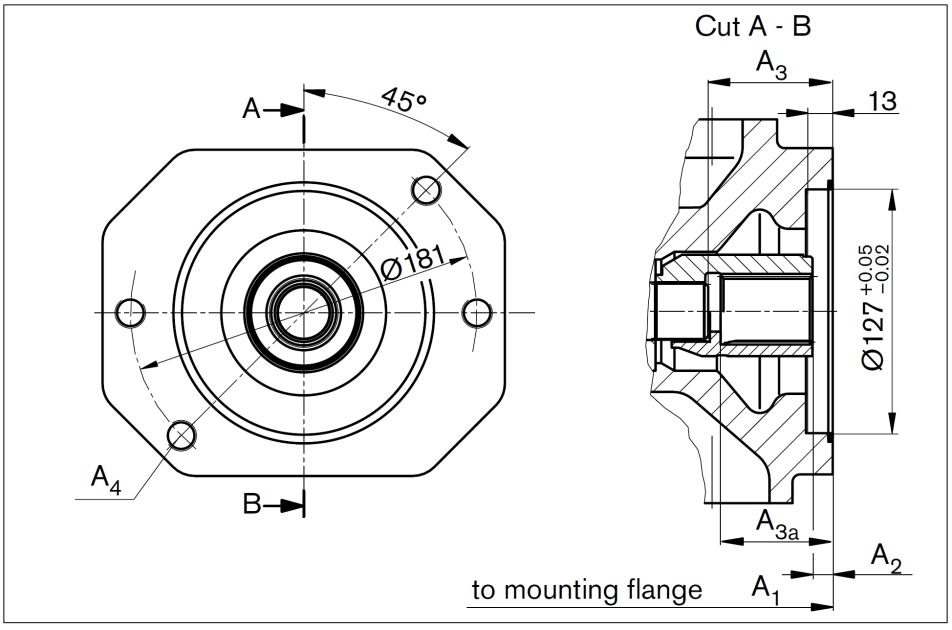
NG	A_1	A_2	A_3	A_4[2)]
71	267	21.8	58.6	M16 x 2, continuous
100	338	19.5	56.4	M16 x 2, continuous
140	350	19.3	56.1	M16 x 2, 24 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Dimensions…though drive K24：

- □ Flange ISO 3019-2 (SAE J744-127-2 C)
- □ Coupling for splined shaft according to ANSI B92.1a-1996 1-1/2” 17T 12/24 DP[1)] (SAE J744-38-4 C-C)



NG	A_1	A_2	A_3[3)]	A_{3a}[4)]	A_4[2)]
100	338	10.5	65	–	M16 x 2, continuous
140	350	10.8	75	–	M16 x 2, 24 deep
	350	10.3	–	69.1	M16 x 2, 24 deep

1) 30°pressure angle, flat root, side fit, tolerance class 5

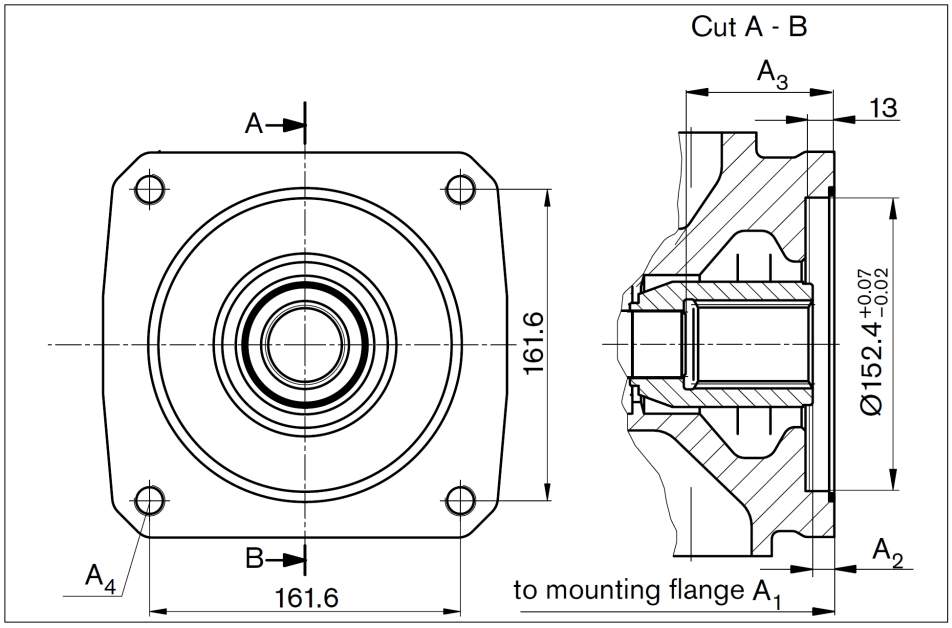
2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

3) Coupling without stop

4) Coupling with stop

■ Dimensions…though K17：

- □ Flange ISO 3019-2 (SAE J744-152-4 A)
- □ Coupling for splined shaft according to ANSI B92.1a-1996 1-3/4" 13T 8/16 DP[1)] (SAE J744-44-4 D)



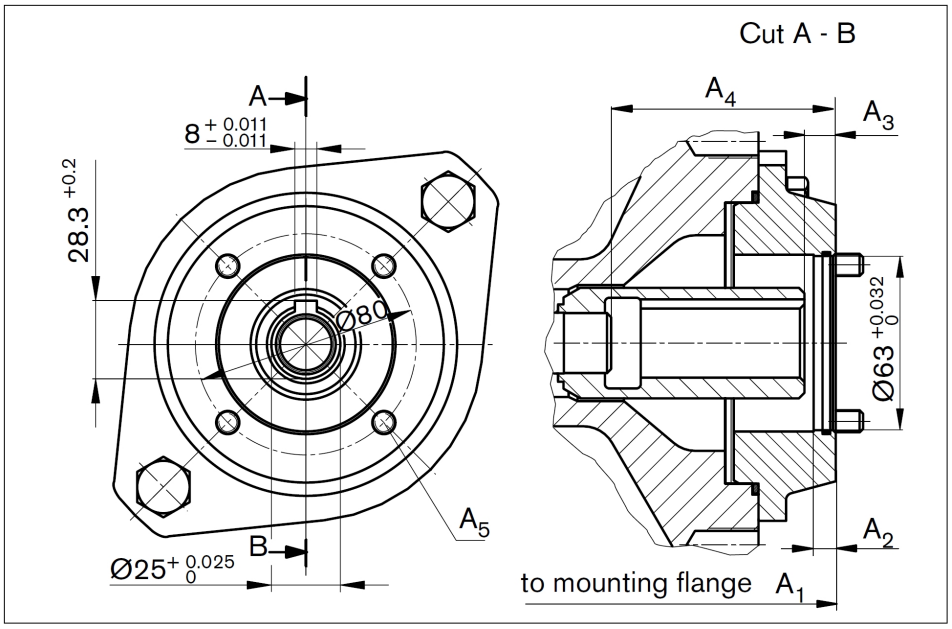
NG	A_1	A_2	A_3	A_4[2)]
140	350	11	77.3	M6 x 2, continuous

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Dimensions…though K57：

- □ Metric 4-hole flange for mounting an R4 radial piston pump
- □ Coupling for metric shaft key

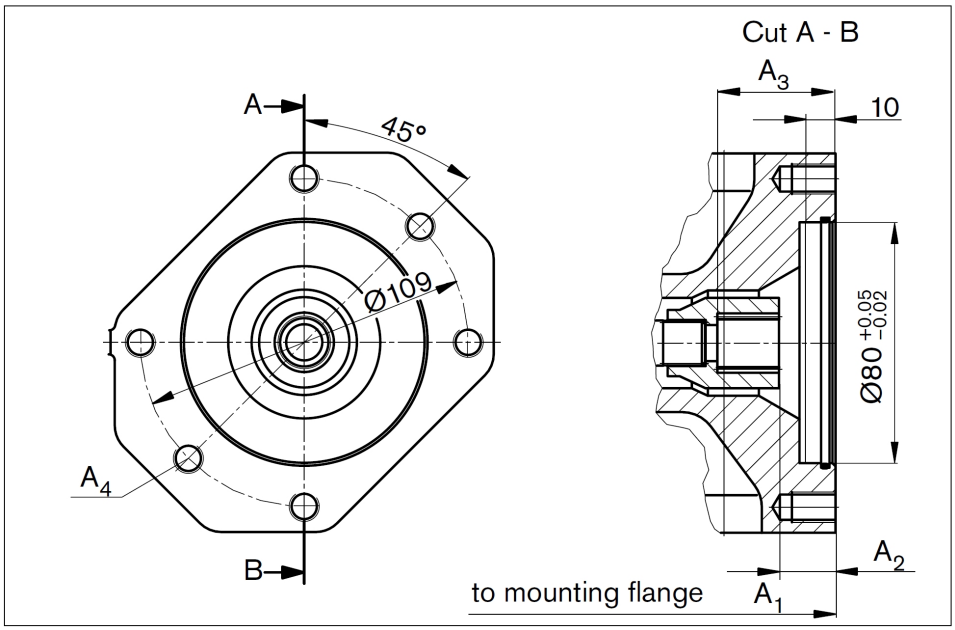


NG	A_1	A_2	A_3	A_4	A_5[3)]
28	232	8	10.6	58.4	M8
45	257	8	11	81	M8
71	283	8	12.5	77	M10
100	354	8	10.5	81	M10
140	366	8	11	93	M8

1) Screws for mounting the radial piston motor are included in the delivery contents.

■ Dimensions…though KB2：

- □ Flange ISO 3019-2 80A2SW
- □ Coupling for splined shaft according to B92.1a-1996 3/4”11T 16/32 DP[1] (SAE J744-19-4 A-B)



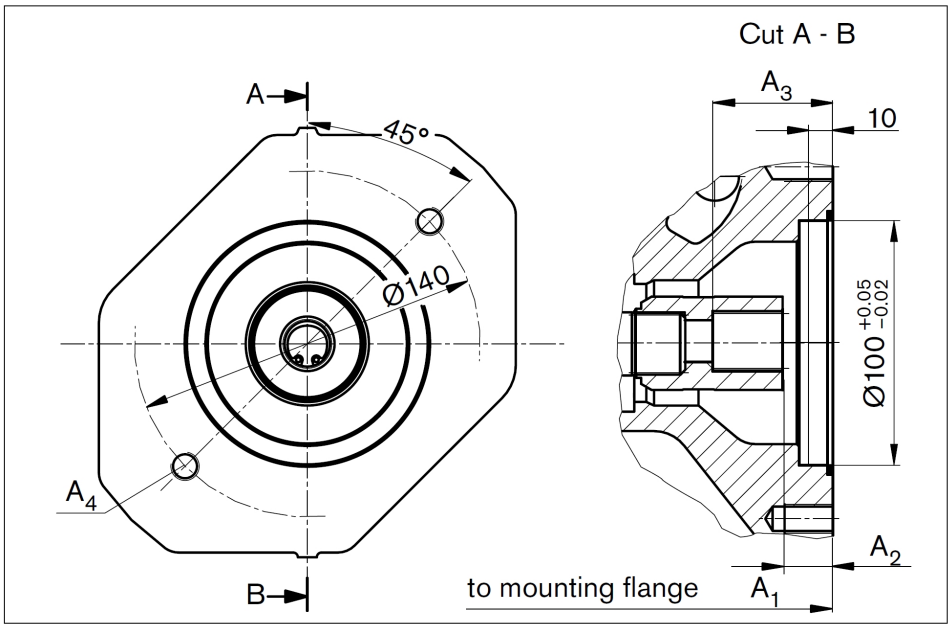
NG	A_1	A_2	A_3	A_4[2]
18	182	18.8	38.7	M10 x 1.5, 14.5 deep
28	204	18.8	38.7	M10 x 1.5, 16 deep
45	229	18.9	38.7	M10 x 1.5, 16 deep
71	267	21.3	41.4	M10 x 1.5, 20 deep
100	338	19	38.9	M10 x 1.5, 20 deep
140	350	18.9	38.6	M10 x 1.5, 20 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Dimensions…though KB3：

- □ Flange ISO 3019-2 100A2SW
- □ Coupling for splined shaft according to ANSI B92.1a-1996 7/8” 13T 16/32 DP[1] (SAE J744-22-4 B)



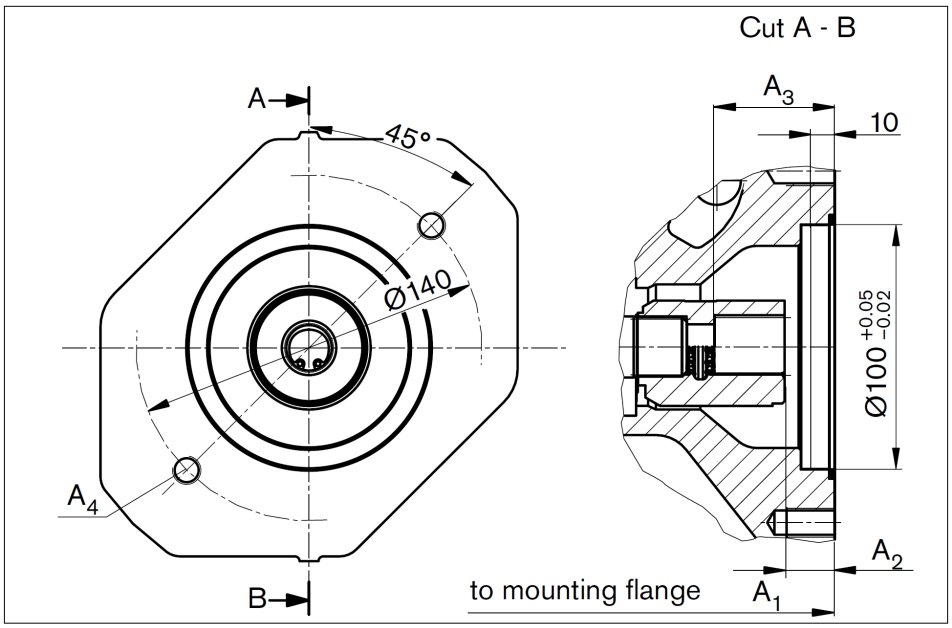
NG	A_1	A_2	A_3	A_4[2]
28	204	17.8	41.7	M12 x 1.5, continuous
45	229	17.9	41.7	M12 x 1.5, continuous
71	267	20.3	44.1	M12 x 1.5, 20 deep
100	338	18	41.9	M12 x 1.5, 20 deep
140	350	17.8	41.6	M12 x 1.5, 20 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Dimensions…though KB4：

- □ Flange ISO 3019-2 100A2SW
- □ Coupling for splined shaft according to ANSI B92.1a-1996 1” 15T 16/32 DP[1] (SAE J744-25-4 B-B)



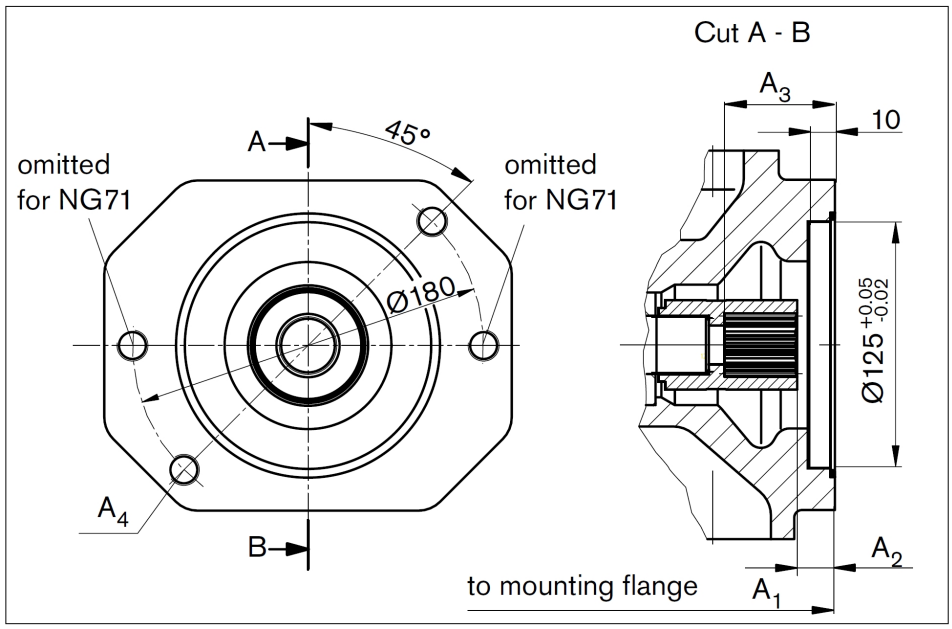
NG	A_1	A_2	A_3	A_4[2]
45	229	18.4	46.7	M12 x 1.75, continuous
71	267	20.8	49.1	M12 x 1.75, 20 deep
100	338	18.2	46.6	M12 x 1.75, 20 deep
140	350	18.3	45.9	M12 x 1.75, 20 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Dimensions…though KB5：

- □ Flange ISO 3019-2 125A2SW
- □ Coupling for splined shaft according to ANSI B92.1a-1996 1-1/4” 14T 12/24 DP[1] (SAE J744-32-4 C)



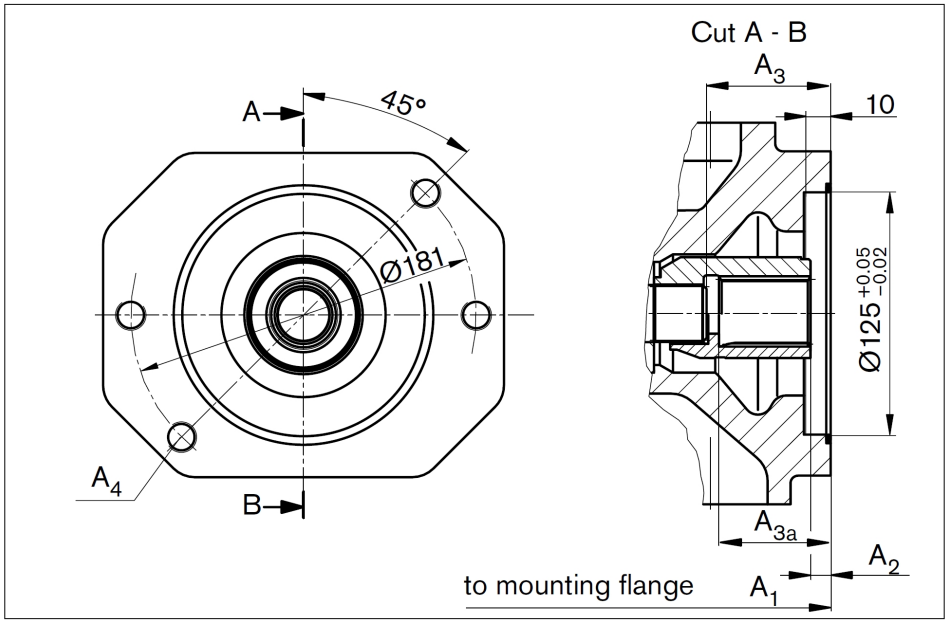
NG	A_1	A_2	A_3	A_4[2]
71	267	21.8	58.6	M16 x 2, continuous
100	338	19.5	56.4	M16 x 2, continuous
140	350	19.3	56.1	M16 x 2, 24 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Dimensions…though KB6：

- □ Flange ISO 3019-2 125A2SW
- □ Coupling for splined shaft according to ANSI B92.1a-1996 1-1/2” 17T 12/24 DP[1)]
  (SAE J744-38-4 C-C)



NG	A_1	A_2	A_3[3)]	A_{3a}[4)]	A_4[2)]
100	338	10.5	65	–	M16 x 2, continuous
140	350	10.8	75	–	M16 x 2, 24 deep
	350	10.3	–	69.1	M16 x 2, 24 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

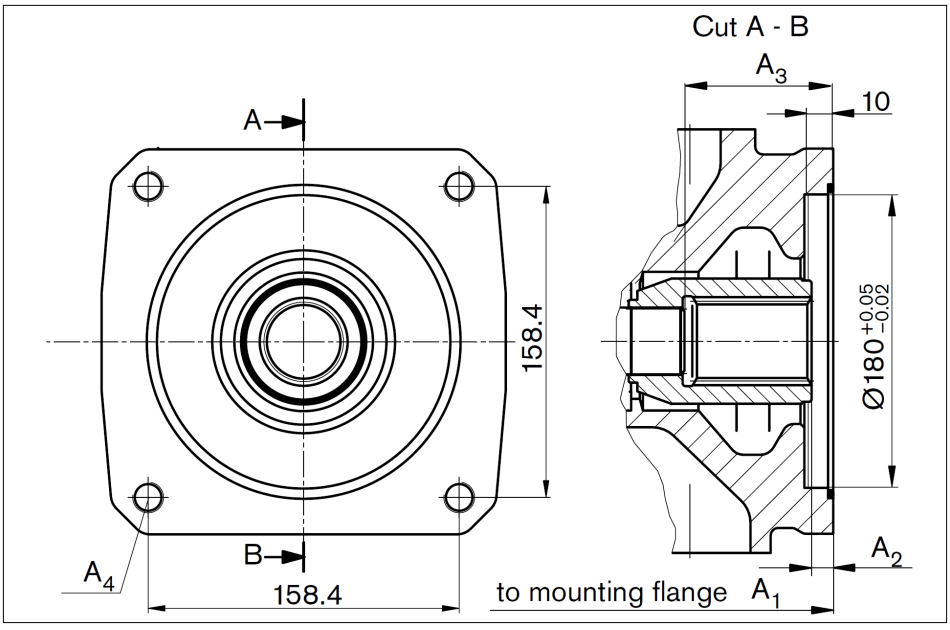
2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

3) Coupling without stop

4) Coupling with stop

■ Dimensions…though KB7：

- □ Flange ISO 3019-2 180B4HW
- □ Coupling for splined shaft according to ANSI B92.1a-1996 1-3/4” 13T 8/16 DP[1)]
  (SAE J744-44-4 D)



NG	A_1	A_2	A_3	A_4[2)]
140	350	11.3	77.3	M16 x 2, continuous

2) Thread according to DIN 13, observe the general instructions on page 47 for the maximum tightening torques.

■ Summary mounting options:

□ SAE – mounting flange

Through-drive[1]			Mounting option – 2nd pump			
Flange ISO 3019-1	Coupling for splined shaft	Short des.	A10VO/31 NG (shaft)	A10V(S)O/5x NG (shaft)	External gear pump design (NG)	Through drive available for NG
82-2 (A)	5/8 in	**K01**	18 (U)	10 (U)	F (5 to 22)	18 to 140
	3/4 in	**K52**	18 (S, R)	10 (S) 18 (U) 18 (S, R)	–	18 to 140
101-2 (B)	7/8 in	**K68**	28 (S, R) 45 (U, W)[1]	28 (S, R) 45 (U, W)[1]	N/G (26 to 49)	28 to 140
	1 in	**K04**	45 (S, R) –	45 (S, R) 60, 63 (U, W) [2]	–	45 to 140
127-2 (C)	1 1/4 in	**K07**	71 (S, R) 100 (U)[3]	85 (U, W)[3] 100 (U, W)	–	71 to 140
	1 1/2 in	**K24**	100 (S)	85 (S) 100 (S)	–	100 to 140
152-4 (4-hole D)	1 3/4 in	**K17**	140 (S)	–	–	140

1) Not for main pump NG28 with K68
2) Not for main pump NG45 with K04
3) Not for main pump NG71 with K07

□ ISO – mounting flange

Through-drive[1]			Mounting option – 2nd pump			
Flange ISO 3019-2	Coupling for splined shaft	Short des.	A10VO/31 NG (shaft)	A10V(S)O/5x NG (shaft)	Gear pump design (NG)	Through drive available for NG
80-2	3/4 in	**KB2**	18 (S, R)	10 (S)	–	18 to 140
100-2	7/8 in	**KB3**	28 (S, R)	–	–	28 to 140
	1 in	**KB4**	45 (S, R)	–	–	45 to 140
125-2	1 1/4 in	**KB5**	71 (S, R)	–	–	71 to 140
	1 1/2 in	**KB6**	100 (S)	–	–	100 to 140
180-4 (4-hole B)	1 3/4 in	**KB7**	140 (S)	–	–	140

□ Shaft key:

Through-drive[1]			Mounting option – 2nd pump			
Flange ISO 3019-2	Coupling for shaft key	Short des.	A10VO/31 NG (shaft)	A10V(S)O/5x NG (shaft)	Radial piston pump	Through drive available for NG
80-2	3/4 in	**K57**	–	–	R4	28 to 140

■ Though drives：

- ☐ The type of though drive is determined by code "K**".
- ☐ If no further pumps are to be factory-mounted, the simple type code is sufficient. Include in this case are: shaft coupler, fastening screw, seals, and if necessary an adapter flange.

■ Combination pumps：

- ☐ It is possible to have multiple, mutually independent circuits when using combination pumps.
- ☐ When ordering combination pumps the model codes for the first and the second pump must be joined by a "+".
- ☐ Order example:

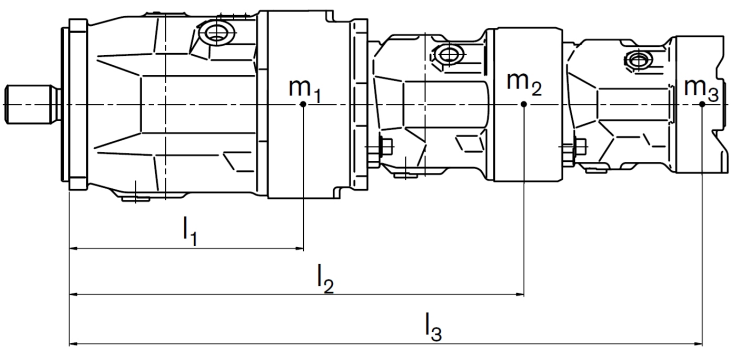
A10VSO100DR/31R-PPA12KB5 + A10VSO71DFR/31R-PSA12N00

- ☐ If there's a need for combination of gear pumps or piston pumps in factory, please contact us.

■ For combination pumps comprising more than two pumps, the mounting flange must be calculated for the permissible moment of inertia.

■ Permissible mass moment of inertia：

NG			18	28	45	71	100	140
Permissible mass moment of inertia								
static	T_m	Nm	500	880	1370	2160	3000	4500
dynamic at 10 *g* (98.1 m/s²)	T_m	Nm	50	88	137	216	300	450
Mass with through-drive plate	m	kg	14	19	25	39	54	68
Mass without through drive (e.g. 2nd pump)	m	kg	12	15	21	33	45	60
Distance center of gravity	l	mm	90	110	130	150	160	160



m_1, m_2, m_3 Mass of pumps [kg]

l_1, l_2, l_3 Distance center of gravity [mm]

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{102} \text{ [Nm]}$$

■ Selection of hydraulic fluid：

■ Classification of hydraulic oil：

□ Hydraulic oil suitable for axial pistion pump ：

□ Hydraulic fluids based on mineral

□ Environmentally acceptable hydraulic fluids：

- Synthetic hydraulic fluids based on esters, HEES.
- Synthetic hydraulic fluids based on Polyglycol, HEPG.
- Synthetic hydraulic fluids based on Vegetable, HETG

□ Fire-resistant, water-containing hydraulic fluids：

Code	Type of Fluid	Water content (wt%)
HFA	oil-in-water emulsion	95…98
HFB	water-in-oil emulsion	＞40
HFC	water-based solutions	35…55
HFD	water-free fluids	≤0.1

■ Selection of Fluids：

□ In order to ensure the high work efficiency , the selection of fluids should base on the working conditions , such as the viscosity and viscosity - temperature curve, the density, and pour point should also be considered.

□ All mineral oil based fluids are suitable to a greater or lesser degree for applications with axial piston units. Their basic classification of application results from what has already been said due to the water, viscosity and temperature relationships, with consideration of oxidization and corrosion protection, material compatibility, air and water separation characteristics.

□ Axial piston pump on operation with oil-in-water emulsion (HFA), water-in-oil emulsion (HFB), water-based solution (HFC) or environmentally acceptable hydraulic fluids, to consider the axial piston pump technology data restriction or reduced. HUADE hydraulic technology necessary contact consulting.

■ Operating viscosity range：

□ In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected in the range.

v_{opt} = opt. viscosity range 16...36 mm^2/s

referred to tank temperature (open circuit).

□ Limit of viscosity range：

V_{min} = 10 mm^2/s，for short periods (t < 3 min)

at max. permissible case drain temperature 90°C

V_{max} = 1000 mm^2/s, for short periods, on cold start（t_{min} = -25℃）

□ Temperature range：

t_{min} = -25℃

t_{max} = 90℃

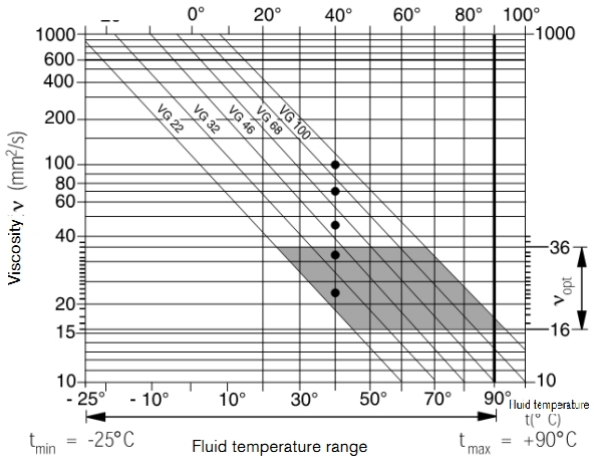
■ Mechanical displacement limiter：

□ Mechanical displacement limiter is standard on the non-through drive model N00, but not possible for the model with through drive.

$V_{g\,max}$： For size 18…140
Setting range from V_{gmax} to 50% $V_{g\,max}$ stepless

$V_{g\,min}$： For size 100…140
Setting range from $V_{g\,min}$ to 50% $V_{g\,min}$ stepless

■ Selection diagram：



□ Selection of hydraulic fluid：

- In order to select the correct hydraulic fluid, it is necessary to know the operating temperature in relation to the ambient temperature. In an open circuit this is the reservoir temperature.
- The fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (v_{opt}), see shaded section of the selection diagram. We recommend to select the higher viscosity grade in each case.
- Example: at an ambient temperature of X °C the operating temperature in the reservoir is 60 °C. In the optimum operating viscosity range (nopt; shaded area) this corresponds to viscosity grades VG 46 resp. VG 68; VG 68 should be selected.

□ Important：

- The case drain temperature is influenced by pressure and input speed and is always higher than the reservoir temperature. However, at no point in the component may the temperature exceed 90°C
- Please contact us if the above conditions cannot be met due to extreme operating parameters.

■ Filtration of the hydraulic fluid：

□ The finer the filtration the better the fluid cleanliness class and the longer the service life of the axial piston unit.

□ To ensure the functioning of the axial piston unit a minimum purity grade of：

- NAS 1638 9
- SAE 6
- ISO/DIS 4406 to 18/15

□ At very high temperatures of the hydraulic fluid (90 °C to max.115 °C) at least cleanless class:

- NAS 1638 8
- SAE 5
- ISO/DIS 4406 17/14

□ Please contact us if the above classes cannot be observed

■ General safety instructions

- The axial piston unit has been manufactured according to the generally accepted rules of current technology. There is, however, still a danger of personal injury or damage to equipment if the following general safety instructions and the warnings before the steps contained in these instructions are not complied with.
- Read this documentation completely and thoroughly before working with the axial piston unit.
- Keep these instructions in a location where they are accessible to all users at all times.
- Always include the required documentation when you pass the axial piston unit on to third parties.

■ Intended use：

- Axial piston units is exclusively intended for being integrated in a machine or system or for being assembled with other components to form a machine or system. The product may only be commissioned after it has been installed in the machine/system for which it is intended.
- The axial piston unit is only approved as a pump for hydrostatic drives in open circuit.。
- Observe the technical data, operating conditions and performance limits as specified in the data sheet and order confirmation.
- The axial piston unit is only intended for professional use and not for private use.
- Intended use includes having read and understood these instructions, especially chapter "General safety instructions".

■ Improper use：

- Any use other than that described as intended use shall be considered as improper and is therefore impermissible.
- HUADE Hydraulic shall accept no liability whatsoever for damage resulting from improper use. The user shall bear all risks arising from improper use.
- Similarly, the following foreseeable faulty usages are also considered to be improper:
- Using outside the operating parameters approved in the data sheet (unless customer-specific approval has been granted).
- Use for non-approved fluids, e.g. water or polyurethane components.
- Modification of factory settings by non-authorized persons.
- Use of add/on parts (e.g. mountable filter, control unit, valves) that are not specified HUADE components.
- Using the axial piston unit under water at a depth of more than 10 meters without necessary additional measures, e.g. pressure equalization.
- Using the axial piston unit when the exterior pressure is greater than the interior pressure (case pressure).
- Using the axial piston unit in explosive environments unless the component or machine/system has been certified as compliant with the ATEX directive 94/9/EC.
- Using the axial piston unit in an aggressive atmosphere.
- Using the axial piston unit in aircraft or space craft

■ Personnel qualifications：

- The activities described in this documentation require basic mechanical, electrical and hydraulic knowledge, as well as knowledge of the associated technical terms.
- For transporting and handling the product, additional knowledge is necessary with regard to working with a lifting device and the corresponding attachment equipment.
- Qualified personnel are those who can recognize possible hazards and institute the appropriate safety measures due to their professional training, knowledge, and experience, as well as their understanding of the relevant regulations pertaining to the work to be done. Qualified personnel must observe the rules relevant to the subject area and have the necessary hydraulic knowledge.

■ General safety instructions：

- Observe the applicable accident prevention and environmental protection regulations.
- Observe the safety regulations and provisions of the country in which the product is used/operated.
- Use HUADE products only when they are in good technical order and condition.
- Observe all notes on the product. Inspect the product for obvious defects.
- Do not modify or retrofit the axial piston unit.
- Conform to the technical data and ambient conditions specified in the product documentation.
- Persons who install, operate, remove or maintain HUADE products must not consume any alcohol, drugs or pharmaceuticals that may affect their ability to respond.
- Only use HUADE original accessories and spare parts to ensure there is no risk to persons from unsuitable spare parts.
- If unsuitable products are installed or used in applications that are of relevance to safety, unexpected operating conditions may occur in the application which could result in injury to persons or property damage. For this reason, only use the product in a safety-relevant application if this use is expressly specified and permitted in the product documentation, for example in ex-protection applications or in safety-related parts of a control system (functional safety).
- You may only commission the product if it has been determined that the end product (e.g. machinery or a system) into which the HUADE products are installed complies with the country-specific provisions, safety regulations and standards of the application.
- Pressure cut-off and pressure control do not provide security against pressure overload. A separate pressure relief valve is to be provided in the hydraulic system.

■ Product-specific safety instructions：

- Never apply to the product of any mechanical load. Never stand under or put you hands under suspended loads. Do not place or stack any object on the top the product.
- The noise emission of axial piston units depends on speed, operating pressure and installation conditions. The sound pressure level may rise above 70 dBA during normal application conditions.
- Always wear hearing protection when in the vicinity of the operating axial piston unit.
- Hot surfaces on the axial piston unit! There is a risk of burns when the operating solenoid valves upon pump became overheated.
- Allow the axial piston unit to cool down sufficiently before touching it.
- Wear heat-resistant protective clothing, e.g. gloves.

During transport：

- Make sure that the lifting device has adequate lifting capacity. The weight can be found in chapter "Transport and storage".

During assembly：

- Before assembling, make sure that all fluids have been completely removed from the axial piston unit to prevent mixing with the hydraulic fluid used in the system.
- Make sure the relevant system component is not under pressure or voltage before assembling the product or when connecting and disconnecting plugs. Protect the system against being switched on.
- Make sure that nobody will damage or trip over when laying of cables and pipeline.
- Before commissioning，make sure that all electrical and hydraulic ports are connected or plugged to prevent leakage, prevents liquid and dirt penetrate into the product.
- When assembling, provide for absolute cleanliness in order to prevent contaminants such as welding beads or metal cuttings from getting into the hydraulic lines and causing product wear or malfunctions.

During commissioning：

- Make sure that all electrical and hydraulic ports are connected or plugged. Only commission a completely installed product.

During cleaning：

- Check whether all seals and fittings on the connections are securely seated to ensure that no moisture can penetrate into the axial piston unit during cleaning.
- Use only water and, if necessary, a mild detergent to clean the axial piston unit. Never use solvents or aggressive detergents.
- Do not point the power washer at sensitive components, e.g. shaft seal, electrical connections and components.

Maintenance and repair

- Carry out the specified inspection and maintenance work at the intervals described in this manual(see chapter " Maintenance").
- Make sure that all the lines, connections or components are connected as long as the system is under pressure. Protect the system against being switched on.

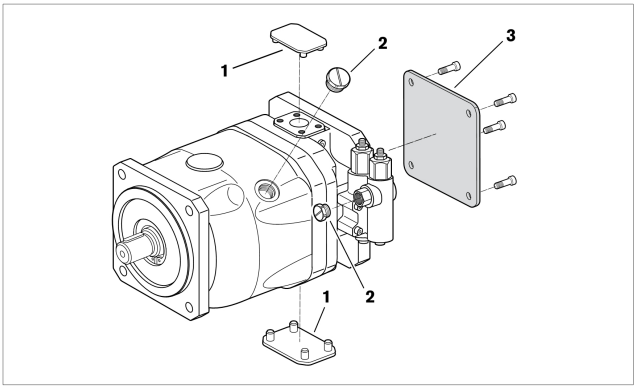
Disposal：

- Dispose of the axial piston unit and packaging material in accordance with the national regulations in your country.

Operator's obligations

- The operator of the axial piston unit from HUADE must provide personnel training on a regular basis regarding the following subjects:
- Observation and use of the operating instructions and the legal regulations Intended use and operation of the axial piston unit .
- Observation of the instructions from the factory security offices and of the work instructions from the operator.

Delivery contents：



- Included in the delivery contents are：
  - Axial piston unit as per order confirmation
- The following parts are also installed on delivery:
  - Protective covers made of plastic (1) (metal protective covers are used for painted axial piston units)
  - Protective plug/threaded plug (2)
  - On version with through drive, metallic protective cover and fixing screws (3) at the through drive

■ Performance description：

- The Axial piston variable pump generates, controls and regulates a hydraulic fluid flow. The A10VO is designed for mobile applications such as construction machinery. The A10VSO is designed for stationary applications such as tooling machines.
- Refer to data sheets and the order confirmation for the technical data, operating conditions and operating limits of the axial piston unit.

■ Product description：

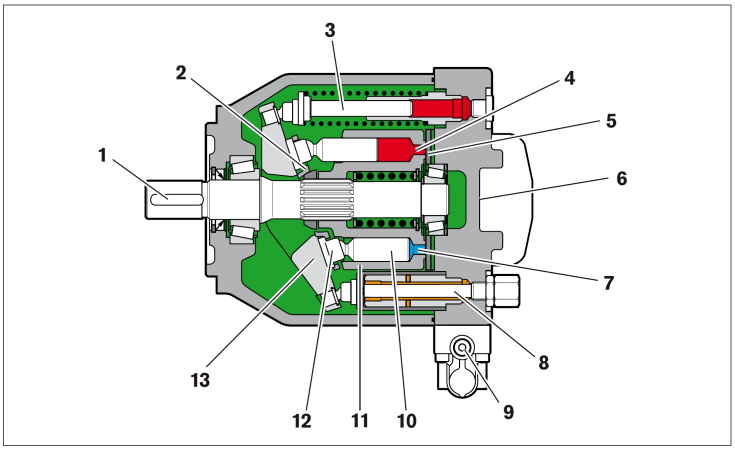
- The A10VO and A10VSO are variable pumps with axial piston rotary group in swashplate design for hydrostatic drive in an open circuit.
- Flow is proportional to drive speed and displacement. The flow can be steplessly changed by adjusting the swashplate.

■ Open circuit：

- In an open circuit, the hydraulic fluid flows from the reservoir to the hydraulic pump from where it is fed to the consumer, e.g. hydraulic motor. From the consumer, the hydraulic fluid flows directly back to the reservoir.

■ Assembly of the axial piston unit：

- Assembly of the HD-A10V(S)O：



1. Drive shaft
2. Retaining plate
3. Opposing piston
4. High-pressure side
5. Control plate
6. Port plate
7. Suction side
8. Stroke piston
9. Control valve
10. Piston
11. Cylinder
12. Slipper pad
13. Swashplate

- For axial piston units with swashplate design, the pistons (11) are arranged axially with respect to the drive shaft (1). They are guided in the rotating cylinder (10) and support themselves with the slipper pads (12) on the non-rotating swashplate (13). The drive shaft (1) and cylinder (10) are connected to one another by means of gearing.

■ Functional description：

■ Pump：

- Torque and rotational speed are applied to the drive shaft (1) by an engine. The drive shaft is connected by splines to the cylinder (11) to set this in motion. With every revolution, the pistons (10) in the cylinder bores execute one stroke whose magnitude depends on the setting of the swashplate (13). The pistons hold the slipper pads (12) onto the glide surface of the swashplate with the retaining plate (2) and guide them along. The swashplate setting during a rotation causes each piston to move over the bottom and top dead centers and back to its initial position. Here, hydraulic fluid is fed in and drained out through the two control slots in the control plate (5) according to the stroke displacement. On the suction side (7) hydraulic fluid flows into the piston chamber as the piston recedes. At the same time, on the high-pressure side (4) the hydraulic fluid is pushed out of the cylinder chamber into the hydraulic system by the pistons.

■ Control：

- The swivel angle of the swashplate (13) is steplessly variable. Controlling the swivel angle of the swashplate changes the piston stroke and therefore the displacement. The swivel angle is changed hydraulically by means of the stroke piston. The swashplate is mounted for easy motion in swivel bearings and it is kept in balance by the opposing piston (3). Increasing the swivel angle increases the displacement; reducing the angle results in a corresponding reduction in displacement.
- The swivel angle can never be swiveled completely to zero because a minimum amount of hydraulic fluid is necessary for
  - Cooling the pistons.
  - Supplying the control.
  - Compensating for case drain fluid and.
  - Lubricating all moving parts.

Transporting the axial piston unit：

- The transportation options below exist depending on the weight and duration of the transport
- Transporting by hand
- Transporting with lifting device (ring screw or lifting strap)
- Dimensions and weights：

Size		10	18	28	45	71	100	140
Weight	Kg	8	12	15	21	33	45	60
Width	mm	The dimensions vary with the unit type. The values applicable for your axial piston unit can be found in the installation drawing (request if necessary).						
Height	mm							
Depth	mm							

Transporting by hand：

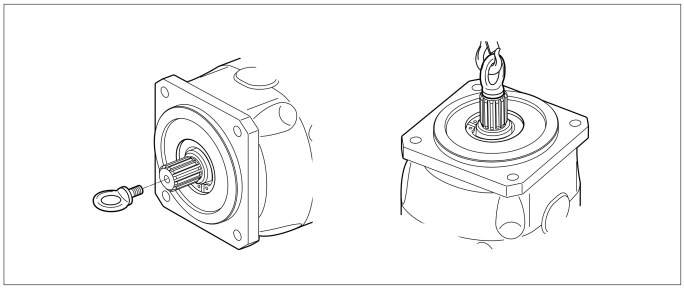
- Axial piston units with a weight of up to 15 kg can be transported manually for a short time if necessary.
- Caution! Danger from heavy loads!
- There is a danger of health damage when carrying axial piston units.
- Use suitable lifting, placement and relocation equipment.
- Use your personal protective equipment (e.g. safety glasses, safety gloves, suitable working clothes, safety shoes).
- Do not transport the axial piston unit at sensitive attachment parts (e.g. sensors or valves).
- Carefully place the axial piston unit on the seating to prevent it from being damaged.

Transporting with lifting device：

- For transporting, the axial piston unit can be connected to a lifting device via a ring screw or a lifting strap.

Transport with ring screw：

- The axial piston unit can be transported suspended from a ring screw screwed into the drive shaft as long as only outward (pulling) axial forces are applied.
- Screw a ring screw completely into the thread on the drive shaft. The thread sizes is stated in the installation drawing.
- Make sure that the ring screw can bear the total weight of the axial piston unit plus 20%.
- You can hoist the axial piston unit as shown in Figure below with the ring screw screwed into the drive shaft without any risk of damage.



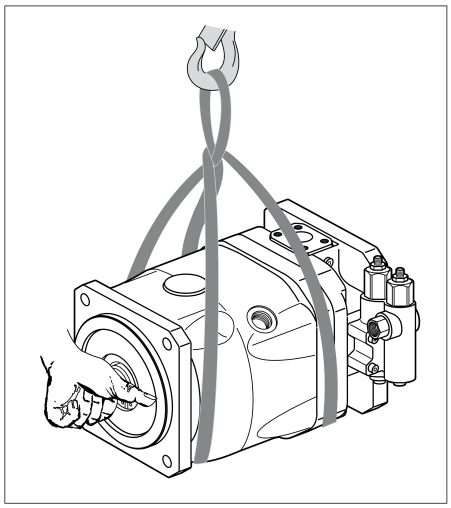
- Fixing the ring screw

WARNING ! Risk of injuries!

- Hitting or impulsive forces on the drive shaft can damage the axial piston unit.
- Do not hit the coupling or drive shaft of the axial piston unit.
- Do not set/place the axial piston unit on the drive shaft.
- See detailed information of the permissible axial and radial force in the data sheet.

Transport with lifting strap：

- Place the lifting strap around the axial piston unit in such a way that it passes over neither the attachment parts (e.g. valves) nor such that the axial piston unit is hung from attachment parts (see Figure below).



- Transport with lifting strap

WARNING! Danger from suspended loads!

- During transport with a lifting device, the axial piston unit can fall out of the lifting strap and cause injuries.
- Use the widest possible lifting strap.
- Make sure that the axial piston unit is securely fixated with the lifting strap.
- Only guide the axial piston unit by hand for fine positioning and to avoid oscillations.
- Never stand under or put you hands under suspended loads.

■ Storing the axial piston unit：

■ Requirements：

- The storage areas must be free from corrosive materials and gases.
- To prevent damage to the seals, ozone-forming equipment (e.g. mercury-vapor amps, high voltage equipment, electric motors, sources of electrical sparks or electrical discharges) must not be operated in storage areas.
- The storage areas must be dry.
- Ideal storage temperature: +5 ℃ ～ +20 ℃ 。 Minimum storage temperature：-50℃，Maximum storage temperature：+60℃。
- Avoid high light irradiation (e.g. bright windows or direct fluorescent lighting).。
- Do not stack axial piston units and store them shock-proof.
- Do not store the axial piston unit on sensitive attachment parts, e.g. Speed sensors.
- For other storage conditions, see table below.
- Check the axial piston unit monthly to ensure proper storage。

■ After delivery：

- The axial piston units are provided ex-works with corrosion protection packaging (corrosion protection film).
- The following table lists the maximum permissible storage times for an originally packed axial piston unit .
- Storage time with factory corrosion protection：

Storage conditions	Standard corrosion protection	Long-term corrosion protection
Closed, dry room, uniform temperature between +5℃ and +20℃. Undamaged and closed corrosion protection film.	Maximum 12 months	Maximum 24 months

- Procedure after expiry of the maximum storage time：

1. Check the entire axial piston unit for damage and corrosion prior to installation.

2. Check the axial piston unit for proper function and leaks during a test run.

3. If the storage time exceeds 24 months, the shaft seal ring must be replaced.

- In the event of questions regarding repair and spare parts, please contact HUADE service department for the axial piston unit,

■ After removal

- If a removed axial piston unit is to be stored, it must be conserved against corrosion for the duration of the storage.
- HUADE recommends the following procedure:

1. Clean the axial piston unit, see chapter " Cleaning and care" for further information.

2. Completely empty the axial piston unit.

3. For storage time up to 12 months: Moisten the inside of the axial piston unit with mineral oil and fill with approx. 100 ml mineral oil.

For storage time up to 24 months: Fill the axial piston unit with corrosion protection VCI 329 (20 ml). Fill via case drain port K_1 or K_2, see chapter "Assembling the axial piston unit".

4. Seal all ports airproof.

5. Moisten the unpainted surfaces of the axial piston unit with mineral oil.

6. Package the axial piston unit airproof together with desiccant in corrosion protection film.

7. Store the axial piston unit so that it is protected against jolts. See "Requirement" in this chapter for further conditions.

Assembly

- Prior to assembly, the following documents must be available:
- Installation drawing for the axial piston unit (available from huade)
- Hydraulic circuit diagram for the axial piston unit (in the installation drawing) .
- Hydraulic circuit diagram for the system (available from the system manufacturer).
- Order confirmation (contains the preset data of the axial piston unit)
- Data sheet for the axial piston unit (contains the technical data)

Unpacking

- The axial piston unit is delivered in a corrosion protection film made of polyethylene material.
- Remove the packaging from the axial piston unit.
- Check the axial piston unit for transport damage and completeness, see chapter "Delivery contents".
- Dispose of the packaging according to the national regulations of your country.

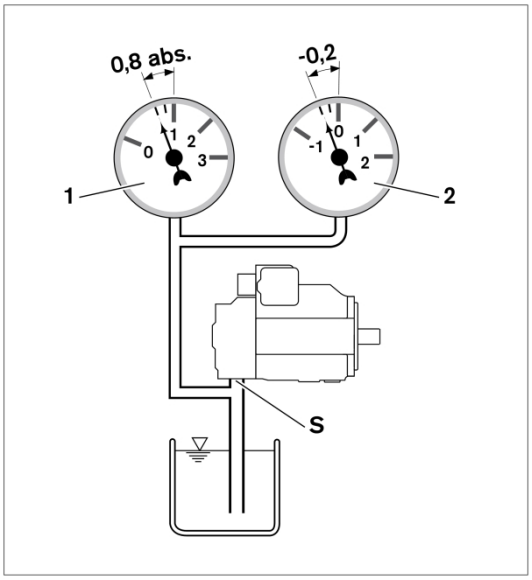
Caution! Danger from parts falling out!

- If the packaging is not opened correctly, parts may fall out and damage the parts or even cause injuries!
- Place the packaging on a flat and solid surface.
- Only open the packaging from the top.

Installation conditions：

- The installation location and position of the axial piston unit essentially determine the procedures during installation and commissioning (such as when filling and air bleeding the axial piston unit).
- Note that you can expect certain installation positions to affect the control device. Because of gravity, dead weight and case pressure, minor characteristic displacements and actuating time changes may occur.
- Adhere to all limits specified in the data sheet regarding temperature, viscosity, cleanliness of the hydraulic fluid.
- Fix the axial piston unit so that the expected forces and torques can be transferred without any danger. The machine/system manufacturer is responsible for dimensioning the fasteners.
- Observe the permissible radial forces on the drive shaft when transferring output drive with radial loading (belt drives). If necessary, the belt pulley must be separately mounted.
- Make sure that the axial piston unit is air bled and filled with hydraulic fluid during commissioning and operation. This is also to be observed following relatively long standstill periods as the axial piston unit may empty via the hydraulic lines.
- The case drain fluid in the case interior must be directed to the reservoir via the highest case drain port. Use the line size which is appropriate for the port.
- A check valve in the reservoir line is not permissible.
- To achieve favorable noise values, decouple all connecting lines from all vibration-capable components (e.g. reservoir) using elastic elements.
- Make sure that the suction, reservoir and return lines lead into the reservoir below the minimum fluid level in all operating conditions. This will prevent air from being drawn in and foam from being formed.

- Suction pressure：



1. Absolute pressure gauge
2. Standard pressure gauge

- Make sure that a minimum suction pressure of 0.8 bar absolute is present at port S during operation for all installation positions and installation locations of the axial piston pump; see Figure above. See data sheet for pressure values.
- The suction conditions improve with below- and inside-reservoir installation
- Make sure that the working environment at the installation site is fully free of dust and foreign substances. The axial piston unit must be installed in a clean condition. Dirt contamination in the hydraulic fluid can seriously impair the function and service life of the axial piston unit.
- Use lint-free cloths for cleaning.
- Use suitable mild detergents to remove lubricants and other difficult-to-remove contamination. Cleaning agents must not enter the hydraulic system.

■ Installation instructions：：

■ General Instructions：

- 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 illing 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 hs is a result of the overall pressure loss, but may not be greater than h_{smax} = 800mm. The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation.

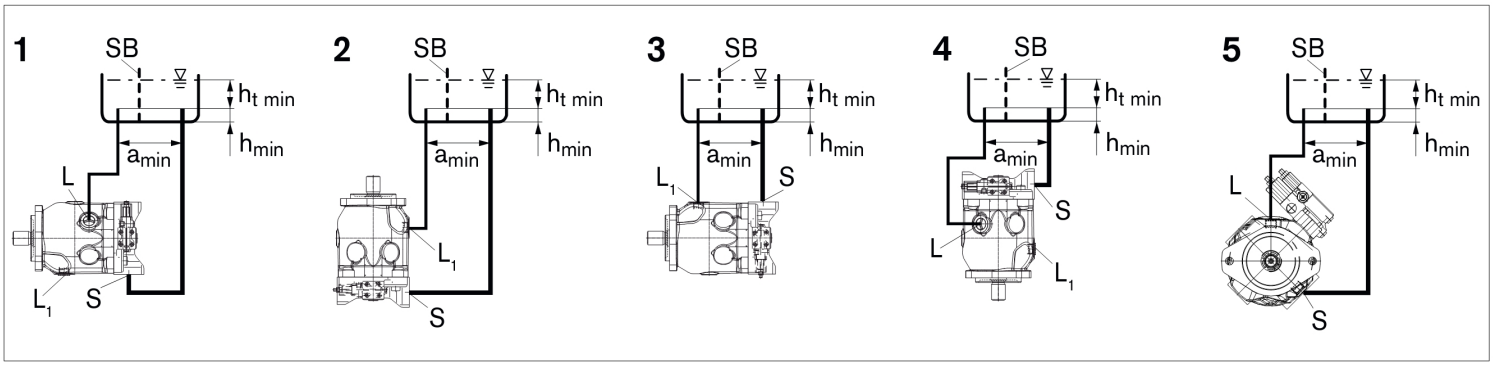
■ Installation position：

- See the following examples 1 to 15. Additional installation positions are available upon request.
- Recommended installation positions: 1 and 3.

■ Below-tank installation(standard)：

- Below-reservoir installation means the axial piston unit is installed outside of the reservoir below the minimum fluid level.
- In this case，Port L / L1 and S must be connected with pipelines，please refer to figures below.
- Recommended installation positions: 1 and 3.
- The axial piston unit must be filled with hydraulic fluid during the first operation.

- Below-reservoir installation A10VO/A10VSO with installation position 1–5



- Annotation：

L,L_1	Highest case drain port
S	Suction port
SB	Baffle (baffle plate)
$h_{t\,min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required spacing to reservoir bottom (100 mm)
a_{min}	When designing the reservoir, ensure adequate space between the suction line and the drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

- Below-reservoir installation：

Installation Position	Air bleed	Filling
1 (drive shaft, horizontal)	L	S+L
2 (drive shaft vertically upward)	L_1	S+ L_1
3 (drive shaft, horizontal)	L_1	S+ L_1
4 (drive shaft, vertically downward)	L	S+L
5 (drive shaft, horizontal)	L	S+L

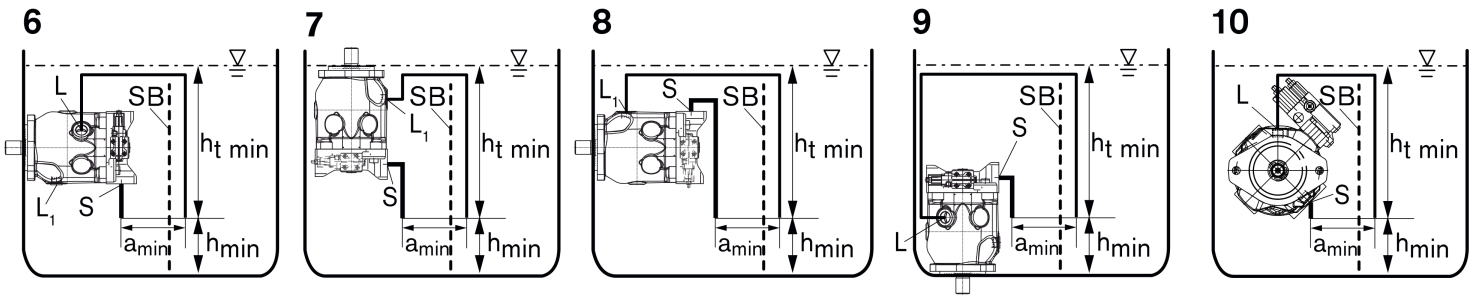
■ Inside-reservoir installation：

- Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level.
- If the minimum fluid level is equal to or below the upper edge of the pump, see "Above-reservoir installation".
- When the min. Fluid level is lower than the flange height of pump in the front, port L_1 and port S can be opened, while port L must be plugged, but we recommend to fit a suction pipe to the suction port S and and to fit a pipe to case drain port L_1.
- When the min. Fluid level is lower than the flange height of pump in the front, port L and port L1 must be connected by pipelines, The distance between two ports is longer than 200mm，please refer to Above-reservoir installation。

■ Risk of damage with inside-reservoir installation!

- To prevent damage to the axial piston unit, all plastic parts (e.g. protective plugs, covers) must be removed prior to installation in the reservoir.
- Remove all plastic parts before installing the axial piston unit in the reservoir. Make sure that no pieces of these parts remain in the reservoir.
- Axial piston units with electric components (e.g. electric controls, sensors) must not be installed in a reservoir below the fluid level.
- Before install pipelines, the axial piston pump must be filled with hydraulic oil and fuel tank filled with hydraulic oil too.

- Inside-reservoir installation A10VO/A10VSO with installation position 6–10



- Annotation：

L,L_1	Highest case drain port
S	Suction port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required spacing to reservoir bottom (100 mm)
a_{min}	When designing the reservoir, ensure adequate space between the suction line and the drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

- Inside-reservoir installation：

Installation Position	Air bleed	Filling
1 (drive shaft, horizontal)	L	L
2 (drive shaft vertically upward)	L_1	L_1+S
3 (drive shaft, horizontal)	L_1	L_1+S
4 (drive shaft, vertically downward)	L	L +S
5 (drive shaft, horizontal)	L	L

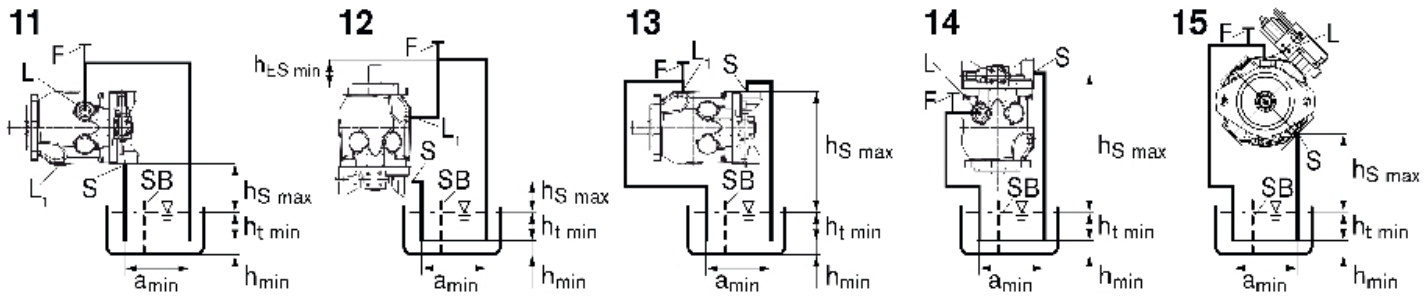
■ Above-reservoir installation：

- 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_{ESmin} of at least 25 mm at port L 1 is required in installation position 12.
- The permissible suction height h_s is derived from the total pressure loss. The maximum permissible suction height h_{smax} = 800 mm, The minimum required immersion depth ht min ⩾ 200mm
- In static or dynamic case, the minimum inlet pressure of the pump Pin min (suction pressure) must be not less than 0.8 bar absolute pressure
- The check valve in the case drain line is only allowed in individual cases, any information about certification, please consult us.
- To achieve the low noise operation, should avoid the pump above the oil tank.

■ Risk of damage with inside-reservoir installation!

- The air accumulating in the bearing area will damage the axial piston pump.
- For the "drive shaft up" installation position, filling and air bleeding must be carried out completely in the pump during commissioning and operating process.
- During commissioning and operating process, make sure the suction line is always filled with hydraulic fluid.

- Above-reservoir installation A10VO/A10VSO with installation position 11–15



- Annotation：

L,L_1	Highest case drain port
S	Suction port
SB	Baffle (baffle plate)
$h_{s\ max}$	Maximum permissible suction height
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required spacing to reservoir bottom (100 mm)
$h_{ES\ min}$	Minimum necessary height to provide protection against the axial piston unit running dry (25 mm)
a_{min}	When designing the reservoir, ensure adequate space between the suction line and the drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

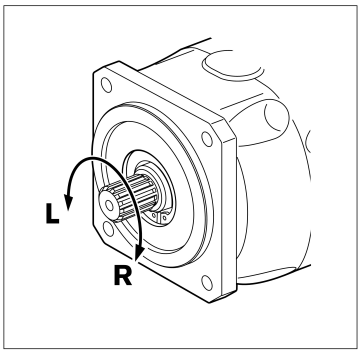
- Above-reservoir installation：

Installation Position	Air bleed	Filling
1 (drive shaft, horizontal)	F	L (F)
2 (drive shaft vertically upward)	F	L_1(F)
3 (drive shaft, horizontal)	F	L_1(F)
4 (drive shaft, vertically downward)	F	L (F)
5 (drive shaft, horizontal)	F	L (F)

■ Installing the axial piston unit：

■ Preparation：

1. Check the delivery contents for completeness and transport damages.
2. Compare the material number and designation (ordering code) with the details in the order confirmation.
3. Before installation, completely empty the axial piston unit to prevent mixing with the hydraulic fluid used in the machine/system.
4. Check the direction of rotation of the axial piston unit (on the name plate) and make sure that this corresponds to the direction of rotation of the engine.



- Direction of rotationL： L (Counter-clockwise) R (Clockwise)

■ Dimensions：

- The installation drawing contains the dimensions for all connections and ports on the axial piston unit. Also observe the manuals provided by the manufacturers of the other hydraulic components when selecting the required tools.

■ General instructions：

- During assembly (and disassembly) of the axial piston unit, observe the following general instructions and handling instructions:
- Note that you can expect certain installation positions to affect the control device. Because of gravity, dead weight and case pressure, minor characteristic displacements and actuating time changes may occur.
- After a short operating time, toothed belts lose a major portion of their pre-tension and thus cause speed variations and torsional vibrations. Torsional vibrations may cause leakages on the shaft seal or increased rotary angle accelerations of the rotary group of the axial piston unit. Particularly at risk are diesel drives with a small number of cylinders and low flywheel mass.
- V-belt drives without automatic clamper are also critical with regard to speed variations and torsional vibrations. These can also lead to leakages on the shaft seal ring. An automatic clamper can lessen the speed variations and vibrations and thus avoid consequential damage.
- On the input or output drive of an axial piston unit, a cardan shaft may cause vibrations and impermissible rotary angle accelerations. Depending on the frequency and temperature, they may result in leakage on the shaft seal and damage to the rotary group.

■ Note：

- Always use an automatic tensioning device when using toothed belts or V-belts to transfer the input or output drive.
- Fix the axial piston unit so that the expected forces and torques can be transferred without any danger.
- The permissible axial and radial loading of the drive shaft, the permissible torsional vibration, the optimum direction of load force, as well as the limit speeds can be found in the data sheet.
- Observe the permissible radial forces on the drive shaft when driving with radial loading (belt drives). If necessary, the belt pulley must be separately mounted.

■ Installation with coupling：

- The method for installing the axial piston unit with a coupling is described below:

1. The drive shaft of the axial piston unit is equipped with a threaded bore. Use this threaded bore to pull the coupling element onto the drive shaft. The size of the threaded bore can be seen in the installation drawing.
2. Remove dirt and contaminants from the installation location.
3. Clamp the coupling hub onto the drive shaft or ensure permanent lubrication of the drive shaft. This prevents the formation of frictional corrosion and the associated wear.
4. Transport the axial piston unit to the installation location. The axial piston unit may not be bolted down until the coupling has been correctly installed.
5. Install the coupling on the drive shaft of the machine/system in accordance with the specifications provided by the coupling manufacturer.
6. Fix the axial piston unit at the installation location.
7. Align the drive shaft of the axial piston unit and the drive shaft of the machine or system so that there is no angular deviation.。
8. Make sure that no impermissible axial and radial forces act on the drive shaft.
9. For bell housing installation, check the coupling axial play through the bell window according to the manufacturer's instructions.
10. Details on the required tools and tightening torques for the fixing screws are available from the machine/system manufacturer.
11. When using flexible couplings, check that the output drive is free of resonance after completing the installation.

■ Installation on a gearbox：

- The installation layout for the axial piston unit on a gearbox is described below.：
- After installing on a gearbox, the axial piston unit is covered and is difficult to access。
- Therefore, before installing, make sure that the centering spigot centers the axial piston unit (observe tolerances) and that no impermissible axial or radial forces act on the drive shaft of the axial piston unit (installation length).
- Protect the drive shaft against frictional corrosion by providing permanent lubrication.
- Fix the axial piston unit at the installation location.

■ Installation with cardan shaft

- To connect the axial piston unit to the engine via a cardan shaft:

1. Position the axial piston unit close to the specified installation location. It should allow enough space for the cardan shaft to fit through on both sides.
2. Position the cardan shaft on the output shaft of the engine.
3. Push the axial piston unit to the cardan shaft and join the cardan shaft to the drive shaft of the axial piston unit.
4. Bring the axial piston unit to the installation position and secure. Details on the required tools and breakaway torques for the fixing screws can be obtained from the system manufacturer if required.

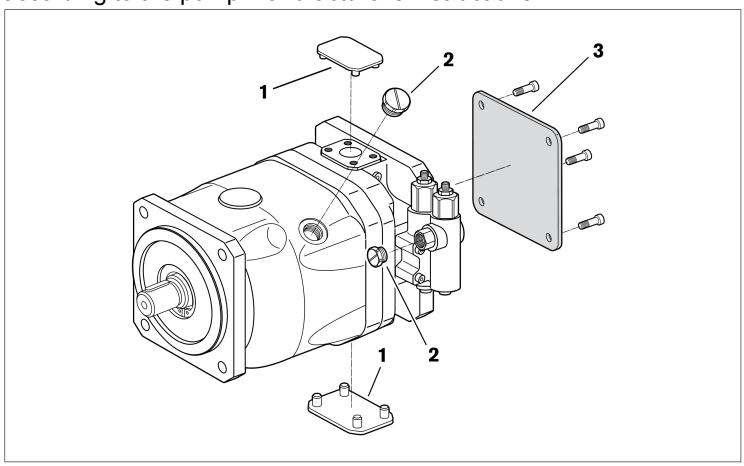
■ Completing installation：

1. Remove any mounted transport screws
2. Remove the transport protection

The axial piston unit is delivered with protective covers and protective plug . They are not pressure-resistant, therefore they have to be removed prior to connection.

3. Make certain that the sealing and functional surfaces are not damaged.

4. For versions with through drive, assemble the auxiliary pump according to the pump manufacturer's instructions.



- Removing transport protection:

1. Transport protection for shaft end
2. Protective covers
3. Plastic plugs / locking screws
4. Flange cover and fixing screws (optional for versions with through drive)

■ Hydraulically connecting the axial piston unit：

- The machine/system manufacturer is responsible for dimensioning the lines.
- The axial piston unit must be connected to the rest of the hydraulic system in accordance with the hydraulic circuit diagram of the machine/system manufacturer.
- The ports and fixing threads are designed for the maximum pressure specified in the data sheet. The machine/system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

■ Warning！Insufficient suction pressure!！

- Generally, a minimum permissible suction pressure at port S is specified for axial piston pumps in all installation positions. If the pressure at port S drops below the specified values, damage may occur which may lead to the axial piston pump being damaged beyond repair!
- Make sure that the necessary suction pressure is not undercut.

This is influenced by:

- the piping suction cross-section
- the pipe diameter, length of suction line
- the position of the reservoir
- the viscosity of the hydraulic fluid
- if fitted, a filter cartridge or check valve in the suction line

(regularly check the level of soiling of the filter cartridge)

■ Notes on routing the lines

- Observe the following notes when routing the suction, pressure and reservoir lines.：
- Lines and hoses must be installed without pre-charge pressure, so that no further mechanical forces are applied during operation that will reduce the service life of the axial piston unit and, if applicable, the entire machine/system.
- Use suitable seals as sealing material.
- Suction line (pipe or hose)：
- The suction line should be as short and straight as possible.
- Measure the line cross section of the suction line so that the pressure at the suction port does not drop below the minimum permissible pressure. Make sure that the maximum suction pressure is not exceeded (e.g. when prefilling).
- Make sure the connections and connecting elements are air-tight.
- Pressure line：
- For the pressure lines, use only pipes, hoses and connecting elements rated for the operating pressure range specified in data sheets.
- Drain line
- Always route the reservoir lines so that the case is constantly filled with hydraulic fluid and to ensure that no air gets through the shaft seal even during extended standstill periods.
- The case internal pressure must not exceed the limit values listed for the axial piston unit in the data sheet under any operating conditions.
- The reservoir line joint in the reservoir must always be below the minimum fluid level under all conditions.

■ Procedure

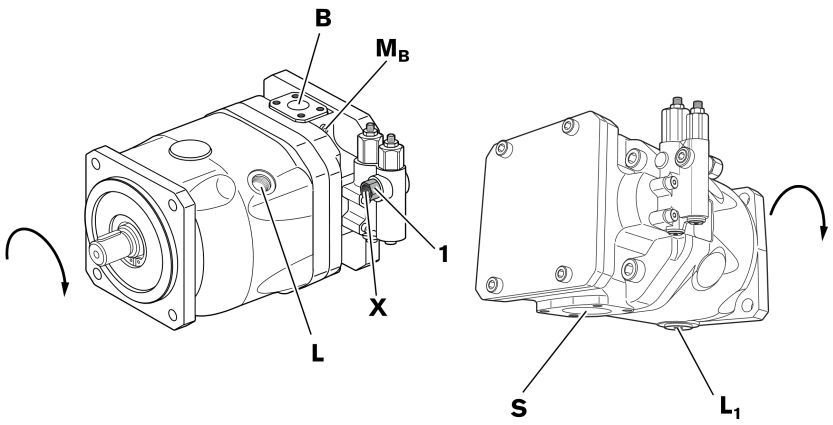
- To connect the axial piston unit to the hydraulic system:

1. Remove the locking screws at the ports at which the connections are to be made according to the hydraulic circuit diagram.
2. Use only clean hydraulic lines.
3. Connect the lines according to the hydraulic circuit diagram. Either pipes or hoses must be connected to all ports according to the installation drawing and machine or system circuit diagram or the ports plugged using suitable locking screws.
4. Make sure

- that the cap nuts are correctly tightened on the fittings and flanges (observe tightening torques!). Mark all checked fittings using e.g. a permanent marker
- that the pipes and hose lines and every combination of connecting piece, coupling or connecting point with hoses or pipes have been inspected by a technically qualified person for safe working condition.

■ Port overview：

□ Port overview HD-A10V(S)O ：



□ Ports A10VSO Series 31：

Designation	Port for	Standard	Maximum Pressure bar [1]	State
B	Service line（High-speed version） Fixing threads	SAE J518 [2] DIN 13	350	O
S	Suction line Fixing threads	SAE J518 [2] DIN 13	1	O
L	Reservoir line (case drain fluid)	DIN 3852 [3]	2	O [4]
L_1	Reservoir line (case drain fluid)	DIN 3852 [3]	2	X [4]
X	Pilot pressure…DRG,DRF,DRS,LA	DIN 3852 [3]	350	O
X	Pilot pressure…DG	DIN ISO 228 [3]	350	O
M_B	Gauge port	DIN 3852 [3]		X

□ Ports A10VO Series 52：

Designation	Port for	Standard	Maximum Pressure bar [1]	State
B	Service line（High-speed version） Fixing threads	SAE J518 [2] DIN 13	350	O
S	Suction line Fixing threads	SAE J518 [2] DIN 13	1	O
L	Reservoir line (case drain fluid)	DIN 3852 [3]	2	O [4]
L_1	Reservoir line (case drain fluid)	DIN 3852 [3]	2	X [4]
X	Pilot pressure…DRG,DRF,DRS,LA	DIN 3852 [3]	350	O
X	Pilot pressure…DG	DIN ISO 228 [3]	350	O

1) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings. Pressure data in bar absolute.

2) Metric fixing thread, deviating from standard.

3) The countersink may be deeper that specified in the standard.

4) Depending on the installation position, L or L1 must be connected.

O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

■ Tightening torques：

- Threaded hole of the axial piston unit:
  The maximum permissible tightening torques $M_{G\ max}$ are maximum values of the female threads and must not be exceeded. For values, see the following table.
- Fittings：
  Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
- Fixing screws:
  For fixing screws with metric ISO thread according to DIN 13 or with thread according to ASME B1.1, we recommend checking the tightening torque in individual cases as per VDI 2230.
- Threaded plugs：
  For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs MV apply. For values, see the following table.

■ Risk of mix-ups with threaded connections：

The axial piston units are used in application areas with metric as well as with Imperial systems of units.

- Both the system of units as well as the size of threaded hole and threaded plug (e.g. locking screw) must match.
- If a threaded plug which is of a different measurement system and size with respect to the female thread is pressurized, the threaded plug may loosen itself or even be ejected from the hole in a projectile-like manner. This can result in serious injury and damage to equipment. Hydraulic fluid can be discharged from this leakage point.
- Use the drawings (installation drawing/data sheet) to determine the required threaded plug for each fitting.
- Make sure that there are no mix-ups when installing fittings, fixing screws and threaded plugs.
- For all female threads, use a threaded plug from the same system of units and of the correct size.

■ Electrically connecting the axial piston unit：

- The machine/system manufacturer is responsible for the layout of the electric control.
- Electrically controlled axial piston units must be connected in accordance with the electrical circuit diagram for the machine/system.
- For axial piston units with electrical control and/or mounted sensors, please comply with the details given in data sheets , e.g.:
  - the permissible voltage range and the permissible current
  - the recommended electrical control units
- Exact details on the connector, type of protection and matching mating connector can also be found in data sheets . The mating connector is not included in the delivery contents.

1. Switch off power supply to the relevant system component.
2. Electrically connect the axial piston unit (12 or 24V). Before connection, check that the connector including all seals are intact.

■ NOTE：Short circuit in event of penetrating hydraulic fluid!

- Fluid can penetrate the product and cause a short circuit!
- Do not install axial piston units with electric components (e.g. electric controls, sensors) in a reservoir below the fluid level (inside-reservoir installation).

■ Tightening torques for the female threads and threaded plugs：

- Values for A10VSO：

Ports		Maximum permissible tightening torque for female threads $M_{G\ max}$	Required tightening torque for threaded plugs M_V	Size of hexagon socket of threaded plugs
Standard	Thread size			
DIN 3852	M14 x 1.5	80 Nm	35 Nm[1)]	6 mm
	M16 x 1.5	100 Nm	50 Nm[1)]	8 mm
	M18 x 1.5	140 Nm	60 Nm[1)]	8 mm
	M22 x 1.5	210 Nm	80 Nm[1)]	10 mm
	M27 x 2	330 Nm	135 Nm[1)]	12 mm
DIN ISO 228	G 1/4 in	70 Nm	–	–
ISO 11926	7/8-14 UNF-2B	240 Nm	110 Nm	3/8 in
	1 1/16-12 UNF-2B	360 Nm	170 Nm	9/16 in

1) The tightening torques of the threaded plugs M_V apply for screws in the "dry" state as received on delivery and in the "lightly oiled" state for installation

☐ Values for A10VO：

Ports Standard	Thread size	Maximum permissible tightening torque for female threads $M_{G\,max}$	Required tightening torque for threaded plugs M_V	Size of hexagon socket of threaded plugs
DIN 3852	M14 x 1.5	80 Nm	45 Nm	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M27 x 2	330 Nm	170 Nm	12 mm
ISO 11926	7/16-20UNF-2B	40 Nm	18 Nm	3/16 in
	9/16-18UNF-2B	80 Nm	35 Nm	1/4 in
	3/4-16UNF-2B	160 Nm	70 Nm	5/16 in
	7/8-14UNF-2B	240 Nm	110 Nm	3/8 in
	1 1/16-12UN-2B	360 Nm	170 Nm	9/16 in

■ First commissioning

■ Filling the axial piston unit

- You will require an approved hydraulic fluid:
- The machine or system manufacturer can provide you with precise details on the hydraulic fluid. Details on minimum requirements for mineral-oil based hydraulic fluids, environmentally acceptable hydraulic fluids or HF hydraulic fluids for the axial piston unit are available.
- To ensure the functional reliability of the axial piston unit, cleanliness level 20/18/15 according to at least ISO 4406 is necessary for the hydraulic fluid. For permissible temperatures, see the data sheet.

1. Place a drip tray under the axial piston unit to collect any hydraulic fluid that may escape.
2. Fill and air bleed the axial piston unit via the appropriate ports, see chapter "Installation position". The hydraulic lines of the system must also be filled.
3. When using a shut-off valve in the suction and/or reservoir line, make sure that the input of the axial piston unit can only be started when the shut-off valves are open.
4. Test the direction of rotation of the engine. To do this, rotate the engine briefly at the lowest rotational speed (inching). Make sure that direction of rotation of the axial piston unit matches the details on the name plate.
5. Operate the axial piston pump at a lower speed (starter speed for internal combustion engines or inching operation for electric motors) until the hydraulic system is completely filled and bled.To inspect, drain the hydraulic fluid at the case drain port and wait until it drains without bubbles.
6. Make sure that all ports are either connected to pipes or plugged according to the general circuit diagram.

■ Testing the hydraulic fluid supply：

1. The axial piston unit must always have a sufficient supply of hydraulic fluid.
2. For this reason, the supply of hydraulic fluid must be ensured at the start of the commissioning process.
3. When you test the hydraulic fluid supply, constantly monitor the noise development and check the hydraulic fluid level in the reservoir. If the axial piston unit becomes louder (cavitation) or the case drain fluid is discharged with bubbles, this is an indication that the axial piston unit is not being sufficiently supplied with hydraulic fluid.

- Notes on troubleshooting can be found in "Troubleshooting".
- To test the hydraulic fluid supply:

1. Allow the engine to run at the lowest speed. The axial piston unit must be operated without load. Pay attention to leakage and noise.

2. Check the axial piston unit's reservoir line during the test. The case drain fluid should not contain any bubbles.

3. Increase the load and check whether the operating pressure rises as expected.

4. Carry out a leak test to ensure that the hydraulic system is sealed and can withstand the maximum pressure.

5. Check the suction pressure at port S of the axial piston pump at nominal speed and maximum swivel angle. Refer to data sheet for the permissible value.

6. At maximum pressure, check the case drain pressure at port L or L_1. Refer to data sheet for the permissible value.

■ Performing functional test

- Once you have tested the hydraulic fluid supply, you must perform a functional test on the machine or system. The functional test should be performed according to the instructions of the machine or system manufacturer.
- The axial piston unit is checked for functional capability before delivery according to the technical data. During commissioning, it must be ensured that the axial piston unit was installed in accordance with the design of the machine or system.
- Use the swivel angle indicator to check whether the axial piston unit swivels in and out correctly during operation.
- If necessary, disconnect the gage and plug the ports with threaded plugs.

■ Performing flushing cycle

- In order to remove foreign bodies from the system, HUADE recommends a flushing cycle for the entire system.
- The axial piston unit must not be included in the flushing cycle.
- The flushing cycle must be performed with an additional flushing unit.
- Follow the instructions of the flushing unit's manufacturer for the exact procedure during the flushing cycle.

■ Recommissioning after standstill：

- Depending on the installation conditions and ambient conditions, changes may occur in the hydraulic system which make recommissioning necessary.
- the following criteria may make recommissioning necessary:
- Air and/or water in the hydraulic system
- Other contamination
- Before recommissioning, proceed as "First commissioning".

■ Running-in phase

- The increased friction at the start of the running-in phase results in increased heat development which decreases with increasing operating hours. The volumetric and mechanical-hydraulic efficiency increases as well through the conclusion of the running-in phase of approx. 10 operating hours.
- To ensure that contamination in the hydraulic system does not damage the axial piston unit, HUADE recommends the following procedure after the running-in phase:
- After the running-in phase, have a hydraulic fluid specimen analyzed for the required cleanliness level.
- Change the hydraulic fluid if the required cleanliness level is not reached. If a laboratory test is not carried out after the running-in phase, HUADE recommends the hydraulic fluid be changed.

■ Damage to equipment by insufficient viscosity!

- An increased hydraulic fluid temperature may reduce the viscosity values by too much and damage the product!
- Monitor the operating temperature during the running-in phase
- Reduce the loading (pressure, rpm) of the axial piston unit if impermissible operating temperatures and/or viscosities occur.

■ Operation：

- The product is a component which requires no settings or changes during operation. For this reason, this chapter of the manual does not contain any information on adjustment options. Only use the product within the performance range provided in the technical data.
- The machine or system manufacturer is responsible for the proper project planning of the hydraulic system and its control.

Cleaning and care

- For cleaning and care of the axial piston unit, observe the following:
  - Plug all openings with suitable protective caps/devices.
  - Check whether all seals and plugs of the plug connections are securely seated to ensure that no moisture can penetrate into the axial piston unit during cleaning.
  - Use only water and, if necessary, a mild detergent to clean the axial piston unit. Never use solvents or aggressive detergents.
  - Remove coarse external dirt and keep sensitive and important components, such as solenoids, valves, indicators and sensors, clean.

Inspection：

- In order to enable long and reliable operation of the axial piston unit, HUADE recommends testing the hydraulic system and axial piston unit on a regular basis, and documenting and archiving the following operating conditions:
- Inspection schedule：

Task to be carried out		Interval
Hydraulic system	Check level of hydraulic fluid in the reservoir.	Daily
	Check the operating temperature at a comparable load condition at the reservoir port and in the reservoir.	Weekly
	Conduct analysis of hydraulic fluid: viscosity, aging and dirt contamination.	Yearly or every 2000 operating hours (whichever occurs first)
Axial piston unit	Check axial piston unit for leakage. Early detection of hydraulic fluid loss can help to find errors on the machine/system and to rectify them. For this reason, HUADE recommends that the axial piston unit and system are always kept in a clean condition.	Daily
	Check axial piston unit for unusual noise development.	Daily
	Check fasteners for tight seating. All fasteners have to be checked when the hydraulic system is switched off, depressurized and cooled down.	Monthly

Maintenance

- The axial piston unit is low maintenance when used properly.
- The service life of the axial piston unit is heavily dependent on the quality of the hydraulic fluid. For this reason, we recommend changing the hydraulic fluid at least once per year or every 2000 operating hours (which ever occurs first) or having it analyzed by the hydraulic fluid manufacturer or a laboratory to determine its suitability for further use.
- The service life of the axial piston unit is limited by the service life of the bearings fitted. The service life can be requested on the basis of the load cycle from the responsible HUADE Service partner.
- Based on these details, a maintenance period is to be determined by the system manufacturer for the replacement of the bearings and included in the maintenance schedule of the hydraulic system.

Repair：

- HUADE offers a comprehensive range of services for the repair of HUADE axial piston units。
- Repairs on the axial piston unit may only be performed by service centers certified by HUADE, and use exclusively original spare parts from HUADE to repair the HUADE axial piston units.
- Tested and pre-assembled original HUADE assembly groups allow for successful repair requiring only little time.

Spare parts：

- The list of spare parts for axial piston units are order specific. When ordering spare parts, please quote the material and serial number of the axial piston unit as well as the material numbers of the spare parts.
- Please address all questions regarding spare parts to your responsible huade Service partner or the service department of the manufacture's plant for the axial piston unit.

Troubleshooting：

- The following table may assist you in troubleshooting. The table makes no claim for completeness.
- In practical use, problems which are not listed here may also occur.

How to proceed for troubleshooting：

- Always act systematically and purposefully, even under pressure of time. Random and imprudent removal and changing of settings could result in the inability to ascertain the original failure cause.
- First obtain a general overview of how your product works in conjunction with the entire system.
- Try to determine whether the product worked properly in conjunction with the entire system before the error occurred.
- Try to determine any changes of the entire system in which the product is integrated：
  - Were there any changes to the product's application conditions or operating range?？
  - Has maintenance work recently been carried out? Is there an inspection or maintenance log?
  - Were changes (e.g. conversions) or repairs made to the complete system (machine/system, electrics, control) or on the product? If yes, which?
  - Has the hydraulic fluid been changed?
  - Was the product or machine operated as intended?
  - How did the malfunction appear?
- Try to get a clear idea of the error cause. Directly ask the (machine) operator.
- Document the work carried out。
- If you cannot rectify the error, contact HUADE service department.

■ Axial piston unit malfunction table：

Fault	Possible cause	Remedy
Unusual noises	Drive speed too high.	Machine/system manufacturer.
	Wrong direction of rotation.	Ensure correct direction of rotation.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Improper fixing of the axial piston unit.	Check the fixing of the axial piston unit according to the specifications of the machine/ system manufacturer. Observe tightening torques.
	Improper fixing of the attachment parts, e.g. coupling and hydraulic lines.	Fix attachment parts according to the information provided by the coupling or fitting manufacturer.
	Pressure relief valves on axial piston unit	Air bleed axial piston unit Check viscosity of the hydraulic fluid Contact HUADE Service.
	Mechanical damage to the axial piston unit (e.g. bearing damage).	Exchange axial piston unit, contact HUADE Service.
No or insufficient flow	Faulty mechanical drive (e.g. defective coupling).	Machine or system manufacturer.
	Drive speed too low.	Machine or system manufacturer.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize nlet conditions, use suitable hydraulic fluid).
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Hydraulic fluid not in optimum viscosity range.	Use suitable hydraulic fluid (machine or system manufacturer).
	External control of the control device defective.	Check external control (machine or system manufacturer).
	Insufficient pilot pressure or control pressure..	Check pilot pressure, contact HUADE Service.
	Malfunction of the control device or controller of the axial piston unit.	Contact HUADE Service.
	Wear of axial piston unit.	Exchange axial piston unit, contact HUADE Service.
	Mechanical damage to the axial piston unit.	Exchange axial piston unit, contact HUADE Service.
No or insufficient pressure	Faulty mechanical drive (e.g. defective coupling).	Machine or system manufacturer.
	Drive power too low.	Machine or system manufacturer.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
		Remove contaminants from the suction line.
	Hydraulic fluid not in optimum viscosity range.	Use suitable hydraulic fluid (machine or system manufacturer).
	External control of the control device defective.	Check external control (machine or system manufacturer).
	Insufficient pilot pressure or control pressure.	Check pilot pressure, contact HUADE Service.
	Malfunction of the control device or controller of the axial piston unit.	Contact HUADE Service.
	Wear of axial piston unit.	Exchange axial piston unit, contact HUADE Service.
	Mechanical damage to the axial piston unit (e.g. bearing damage).	Exchange axial piston unit, contact HUADE Service.
	Output unit defective (e.g. hydraulic motor or cylinder).	Machine or system manufacturer.
Pressure/flow fluctuations	Axial piston unit not or insufficiently air bled.	Completely air bleed axial piston unit.
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too high, suction pressure too low, contaminants in the suction line.	Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid).
		Completely air bleed axial piston unit, fill suction line with hydraulic fluid.
		Remove contaminants from the suction line.
Excessive hydraulic fluid temperature and case temperature	Excessive inlet temperature at the axial piston unit.	Machine or system manufacturer: inspect system, e.g. malfunction of the cooler, insufficient hydraulic fluid in the tank.
	Malfunction of the pressure control valves (e.g. high-pressure relief valve, pressure cut-off, pressure control).	Contact HUADE Service.
	Wear of axial piston unit.	Exchange axial piston unit, contact HUADE Service.
Instability/vibrations	Target value not stable.	Machine/system manufacturer.
	Resonance in the reservoir line. Machine/system manufacturer.	Machine/system manufacturer.
	Malfunction of the control devices or the controller.	Contact HUADE Service.













华德液压

HD-A2F 6系列

斜轴式轴向柱塞定量泵马达

北京华德液压工业集团有限责任公司

BEIJING HUADE HYDRAULIC INDUSTRIAL GROUP CO.,LTD.

北京华德液压工业 集团有限责任公司	HD-A2F 系列斜轴式轴向柱塞定量泵马达 6 系列 轴向锥形柱塞设计	HDBT2012PA

HD-A2FO 定量泵 规格 5...500	6 系列结构 额定压力：40 MPa 峰值压力：45 MPa
	■ HD-A2FO 斜轴式轴向柱塞定量泵，适用于开式回路中的液压传动。 ■ 适用于行走机械或工业领域。 ■ 输出流量与驱动转速和排量成正比。 ■ 驱动轴承设计适合长时间工作，延长工作寿命。 ■ 多种规格广泛匹配任何驱动设备。 ■ 结构紧凑，优秀的功率/重量比、最佳容积效率。 ■ 带柱塞环的一体化轴向锥形柱塞设计。
HD-A2FM 定量马达 规格 5...500	6 系列结构 额定压力：40 MPa 峰值压力：45 MPa
	■ HD-A2FM 斜轴式轴向柱塞定量马达，适用于开式和闭式回路中的液压传动。 ■ 输出转速与输入流量成正比，而与排量成反比。 ■ 驱动扭矩随马达的高压侧和低压侧的压差加大而增大。 ■ 仔细选择所提供的排量，其规格可与实际应用情况匹配。 ■ 结构紧凑，优秀的功率/重量比、最佳容积效率。 ■ 带柱塞环的一体化轴向锥形柱塞设计。
HD-A2FE 定量马达规格 28...355	6 系列结构 额定压力：40 MPa 峰值压力：45 MPa
	■ HD-A2FE 斜轴式轴向柱塞定量马达，适用于开式和闭式回路中的液压传动。 ■ 为优先安装在减速机驱动而设计，如履带驱动减速机。 ■ 马达的安装法兰设计在马达壳体中间位置，允许马达和减速机安装在一起，使其结构相当紧凑。 ■ 安装方便，只需简单地插入机械式减速机上，无需注意安装公差。 ■ 带柱塞环的一体化轴向锥形柱塞设计。






■ 内容索引：

序号	内容	页码
A	HD-A2FO 斜轴式轴向柱塞定量泵，适用于开式回路中的液压传动。	
1	型号说明	3
2	技术数据	5
3	规格尺寸	12
4	安装指南	25
5	常规操作	27
B	HD-A2FM 斜轴式轴向柱塞定量马达，适用于开式和闭式回路中的液压传动。	
1	型号说明	28
2	技术数据	31
3	规格尺寸	38
4	附件阀组	58
5	安装指南	66
6	常规操作	69
C	HD-A2FE 斜轴式轴向柱塞定量马达，适用于开式和闭式回路中的液压传动。	
1	型号说明	69
2	技术数据	72
3	规格尺寸	79
4	附件阀组	83
5	安装指南	92
6	常规操作	93
D	HD-A2F 斜轴式轴向柱塞定量泵马达----维护维修	
1	故障处理	94

■ 型号说明：

HD	-		A2F		O	56	/	6	1	R	-	P	A	B	05
0		1	2	3	4	5		6	7	8		9	10	11	12

0. 制造商：

华德液压 HUADE HYDRAULIC

1. 液压油/类型：

液压油/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
矿物油和 HFD...无代码	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-
HFD 油液对规格 250～500 仅适用驱动轴承为“L”的结构形式																					
规格：5～200...无代码	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	-	-
规格：250～500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	■	■	E
HFB、HFC 油液对规格 250～500 仅适合驱动轴承为“L”的结构形式																					

2. 轴向柱塞元件：

元件形式/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
斜轴式结构	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	□	□	□	□	A2F
轴向柱塞定量泵马达																					

3. 驱动轴承：

轴承类别/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
标准轴承....无代码	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	-	-
长寿命轴承	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	■	■	L

4. 工作方式：

工作方式/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
泵 开式回路	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	O

5. 元件规格：

元件排量/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
排量≙ V_{gmax}（cm^3/r）	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	-

6. 结构系列：

结构系列/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
6 系列	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	6

7. 结构标号：

结构标号/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
规格 10～180	-	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	-	-	1
规格 200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	-	-	-	3
规格 5 和 250～500	■	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	■	■	0

■ 型号说明：

8. 旋转方向：

查看方向/旋转方向：	旋转方向	代码
从轴端看：	顺时针（正转右旋）	L
	逆时针（反转左旋）	R

9. 元件密封：

密封类型/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
NBR（丁腈橡胶）	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	-	P
NBR（丁腈橡胶）	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	-	N
轴端密封用氟橡胶																					
FKM（氟橡胶）	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	V

10. 元件出轴：

出轴类型/规格：		5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
花键轴	I 系列	-	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	-	A
DIN 5480	II 系列	-	■	■	-	■	■	-	■	■	-	■	-	■	-	■	-	-	■	■	■	Z
平键轴	I 系列	■	■	■	■	■	■	■	-	■	■	■	■	■	■	■	■	■	-	-	-	B
DIN 6885	II 系列	-	■	■	-	■	■	-	■	■	-	■	-	■	-	■	-	-	■	■	■	P
圆锥轴 DIN 6888		■	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C

11. 安装法兰：

法兰形式/规格：		5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
ISO 3019-2	4 孔	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	B
	8 孔	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	■	H

12. 进出油口 A(B)和 S 位置：

油口位置/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
A(B)：SAE 法兰在侧面	-	-	-	-	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	05
S：SAE 法兰在后面	公制固定螺纹																				
A(B)：螺纹在侧面	-	■	■	■	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	06
S：螺纹在后面	公制固定螺纹																				
A(B)：SAE 法兰在后面	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	■	11
S：SAE 法兰在后面	公制固定螺纹																				
A(B)：螺纹在侧面	■	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	07
S：螺纹在侧面	公制固定螺纹																				

■ = 优选方案（较短的交货时间）

■ = 可供货

□ = 准备中

- = 无供货

■ 技术数据：

■ 液压油分类：

□ 适合轴向柱塞泵马达的液压油可分为：

□ 矿物油基液压油

□ 环保型液压油：

- 酯基合成液压油液 HEES
- 乙二醇基合成液压油液 HEPG
- 植物油基液压油液 HETG

□ 阻燃液压油（HF 油液）

代号	油液类型	含水量（重量%）
HFA	包油乳化液	95…98
HFB	包水乳化液	＞40
HFC	基溶液	35…55
HFD	水油液	≤0.1

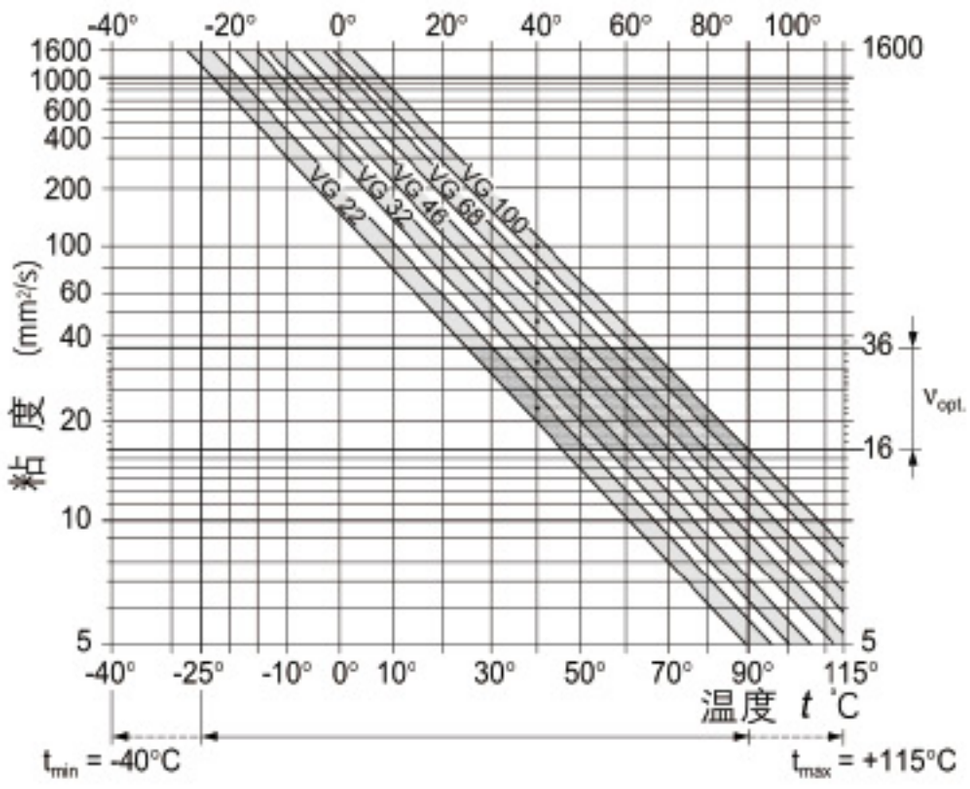
■ 液压油应用：

□ 为了保证无故障的高效工作，在设计选用期间应根据工况仔细选择液压系统的液压油。粘度和粘度/温度曲线相当重要，密度和倾点也必须考虑。

□ 所有矿物油基液压油均在某种程度上适合轴向柱塞泵，应用时基本划分取决于上述的水、粘度与温度关系，并考虑氧化和腐蚀保护、材料相容性、空气和水分离特性。

□ 轴向柱塞泵马达不适合使用水包油乳化液（HFA）；使用油包水乳化液（HFB）、水基溶液（HFC）、无水油液（HFD）或环保型液压油时，要考虑对轴向柱塞泵马达技术数据进行适当的限制或降低。必要时可与华德液压技术部门联系咨询。

■ 液压油温度和粘度：



油液温度范围

■ 液压油选择：

□ 为了正确选择液压油，必须知道与环境温度有关的工作温度：闭式回路中针对回路温度，开式回路中针对油箱温度。

□ 液压油选择：在工作温度范围内工作粘度处于最佳范围 V_{opt} 内，见选择图阴影部分。推荐在每种场合下选择较高粘度等级。

□ 示例：

在 X ˚C的环境温度下，回路中工作温度为 60˚C，闭式回路中针对回路温度，开式回路中针对油箱温度。在最佳工作温度范围（V_{opt} 阴影部分）内，对应粘度范围等级 VG 46 或 VG68，选择 VG68。

□ 注意状况：

- 泄漏油（壳体泄油）温度受压力和转速的影响，总是高于回路温度或油箱温度。但是回路中任何一点温度都不许超过 115˚C（规格 5…200）和 90˚C（规格 250…500）.
- 如果遇到极端工作参数或较高的环境温度不能满足上述条件，我们推荐壳体冲洗或采取冲洗阀。进一步请与华德液压技术部门联系。

■ 液压油过滤：

□ 液压油过滤的越干净，液压油达到的清洁度等级越高，轴向柱塞泵马达的寿命就越长。

□ 为了保证元件的正常工作，最低清洁度等级是：

- 按 NAS 1638　9 级
- 按 SAE　6 级
- 按 ISO/DIS 4406　18/15 级

□ 液压油处于高温时（90˚C至最高 115˚C）最低的清洁度等级是：

- 按 NAS 1638　8 级
- 按 SAE　5 级
- 按 ISO/DIS 4406　17/14 级

□ 如果不能达到上述清洁度等级，请与华德液压技术部门联系。

■ 技术数据：

■ 液压油粘度和温度极限范围：

内容	粘度 mm^2/s	温度	说明
运输和存储 的环境温度		T_{min} ⩾ -50°C T_{opt} = +5°C～+20°C 最佳	保存时间：标准为 12 个月 最长不超过 24 个月
冷启动时	V_{max} = 1600	T_{St} ⩾ -40°C	t ⩽ 3 min 没有负载（p ⩽ 50 bar） n ⩽ 1000 rpm 适合规格 5～200 n ⩽ 0.25 n_{nom} 适合规格 250～500
允许温差		⊿T ⩽ 25 K	在泵和液压油之间
热启动时	V＜1600～400	T = -40°C°C～-25°C	在 p ⩽ 0.7＊p_{nom} ，n ⩽ 0.5＊n_{nom} 和 t ⩽ 15 min
运转状态时 温差 最高温度		 ⊿T = 约 12 K 115°C 103°C	 在轴承部位液压油和泄油口 T 之间 在轴承部位 在泄油口 T 处测量
连续运转	V = 400～10 V_{opt} = 36～16 最佳	T = -25°C～+90°C	在泄油口 T 处测量 在可允许范围内没有限制
短时运转 [2)]	V_{min} ⩾ 7	T_{max} = +103°C	在泄油口 T 处测量，t ＜ 3 min，p ＜ 0.3＊p_{nom}
FKM 轴端密封 [1)]		T ⩽ +115°C	

1）在温度低于-25°C，要求采用 NBR（丁腈橡胶）轴密封（允许温度范围-40°C～+90°C）

2）规格 250～500，请向华德液压咨询。

■ 技术数据：

■ 轴端密封：

□ 允许的工作压力

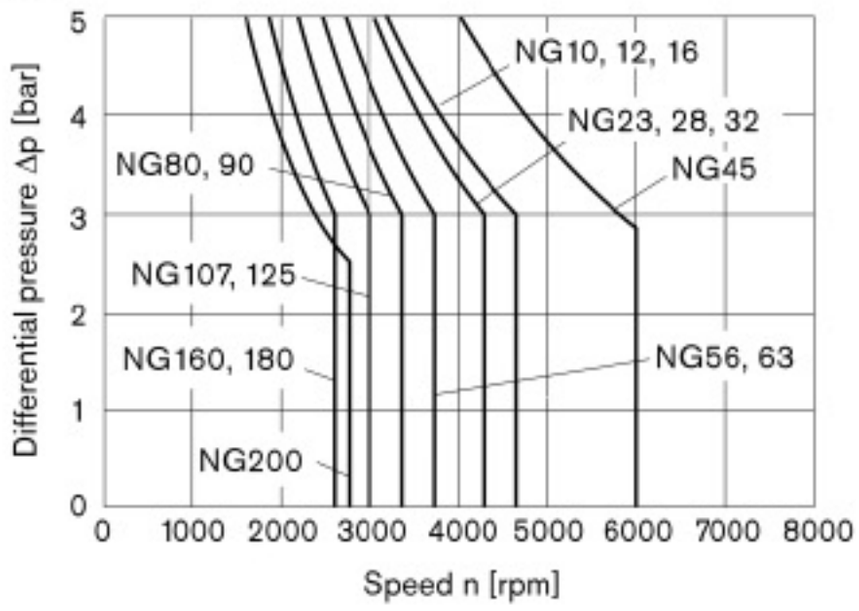
□ 轴端密封寿命取决于泵的转速和壳体压力（壳压）。在正常的环境温度下，壳体和外界压力之间的 2 bar 的压差是不允许超过的。更高的压差将影响泵的转速，见图示。

□ 短时壳体压力峰值（t<0.1 秒）允许达到 10 bar，但随着壳体压力峰值的频率增加，轴端密封的寿命将会缩短。

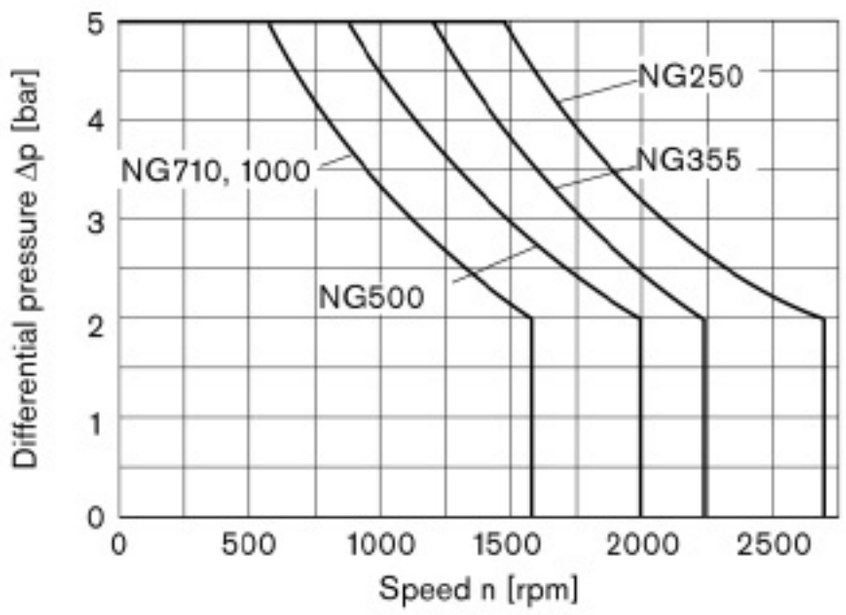
□ 使用丁腈橡胶（NBR）密封同使用氟橡胶（FKM）密封相比，允许壳体压力减少 33%，在某些工况下可能需要减小这些值

□ 壳体内的压力必须等于或高于轴密封上的外界压力。

□ 规格 10…200



□ 规格 250…500



□ 表中数值在外界压力 P_{abs} = 1 bar 时有效。

■ 温度范围：

□ 轴密封为 FKM （氟橡胶）温度范围从-25°C到+115°C，在-25°C以下请使用 NBR（丁腈橡胶）轴密封。

□ 轴密封为 NBR（丁腈橡胶）温度范围从-40°C到+90°C，规格 250…500 柱塞泵采用特殊结构轴封。

■ 流动方向：

□ 从驱动轴端看旋转方向

顺时针转动	逆时针转动
S 到 B	S 到 A

■ 长寿命轴承结构（L）：

□ 规格 250…500

□ 长寿命轴承结构用于延长工作寿命和允许使用阻燃液压油（HF 油液），长寿命轴承结构安装尺寸和标准结构完全相同，相互之间可以随时互换。

□ 推荐在油口 U 实现轴承冲洗。

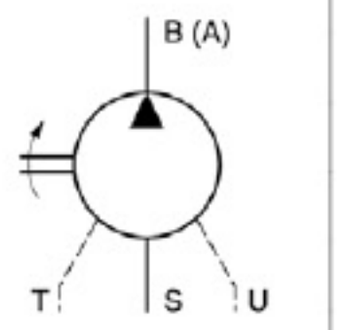
■ 轴承冲洗：

□ 规格 250…500 柱塞泵，可以通过油口 U 实现轴承和壳体冲洗。

□ 冲洗量（推荐）：

冲洗量/规格	250	355	500
$q_{v\,冲洗量}$（L/min）	10	16	16

■ 液压符号：

油口符号	油口名称	液压原理图
A 、B	工作油口	
S	吸油口	
T	泄漏油口	
U（规格 250…500）	轴承冲洗油口	

■ 安装方式：

□ 详见泵安装设计指南

■ 技术数据：

□ 适用于矿物油介质运行

■ 工作压力范围：

□ 工作油口（A 或 B 口）压力：

□ 规格 5

公称压力 P_{nom} ---------- 315 bar（绝对压力）

峰值压力 P_{max} ---------- 350 bar（绝对压力）

单次工作时间 10 s（秒），总工作时间 300 h（小时）

□ 规格 10～200

公称压力 P_{nom} ---------- 400 bar（绝对压力）

峰值压力 P_{max} ---------- 450 bar（绝对压力）

单次工作时间 10 s（秒），总工作时间 300 h（小时）

□ 规格 250～500

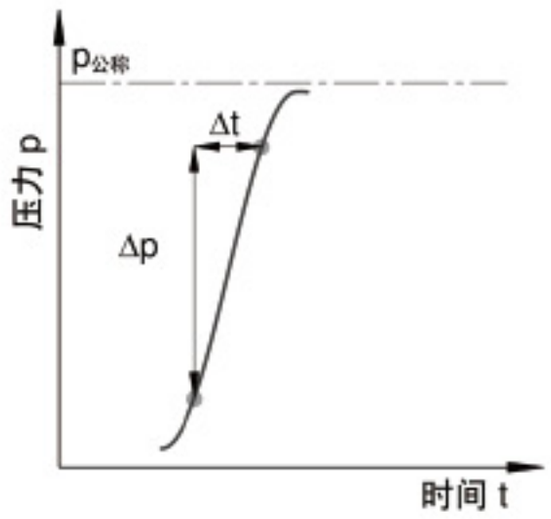
公称压力 P_{nom} ---------- 350 bar（绝对压力）

峰值压力 P_{max} ---------- 400 bar（绝对压力）

单次工作时间 10 s（秒），总工作时间 300 h（小时）

□ 最小压力（A 或 B 口高压侧）：25 bar（绝对压力）

□ 压力变化率 $R_{A\,max}$：16000 bar/s



□ 吸入油口（S 口）压力：

最小压力 $P_{S\,min}$ ---------- 0.8 bar（绝对压力）

峰值压力 $P_{S\,max}$ ---------- 30 bar（绝对压力）

■ 名词定义：

□ 公称压力 P_{nom}

公称压力与最大设计压力相对应

□ 峰值压力 P_{max}

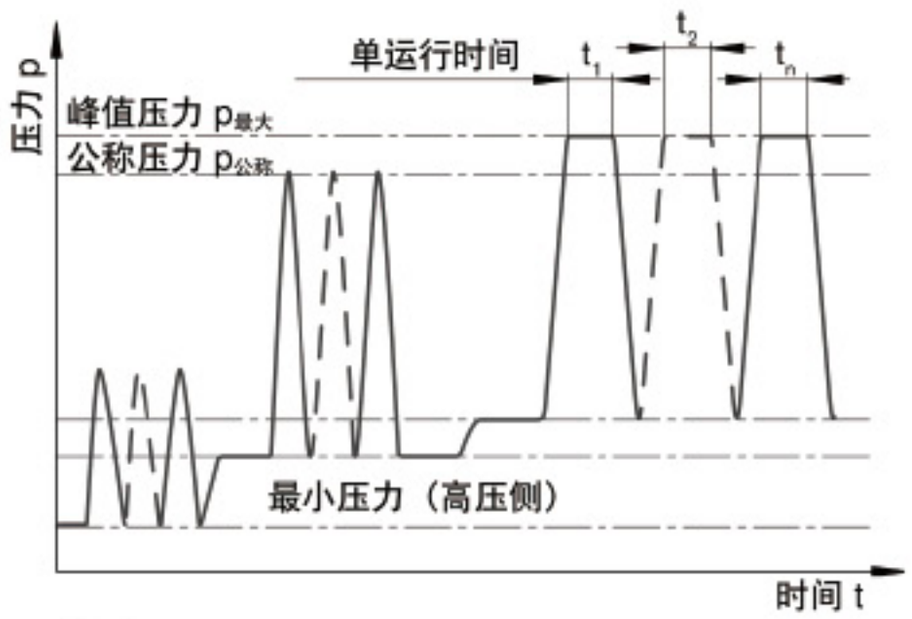
峰值压力与单次工作时间内的最大工作压力相对应。单次工作时间的总和不得超过总工作时间。

□ 最小压力（高压侧）：

防止损坏轴向柱塞泵所需的高压侧最小压力（油口 B）。

□ 压力变化率 R_A

整个压力范围内压力变化时最大允许增压和减压速度



□ 总工作时间=$t_1 + t_2 + t_3$ ……$+ t_n$

■ 技术数据：

□ 数值表：

理论数值，未考虑 η_{mh} 和 η_v 效率；四舍五入值

技术数据/规格	代号	单位	5	10	12	16	23	28	32	45	56	63	80
排量	V_g	cm^3	4.93	10.3	12	16	22.9	28.1	32	45.6	56.1	63	80.4
转速 1)	n_{nom}	rpm	5600	3150	3150	3150	2500	2500	2500	2240	2000	2000	1800
	n_{max} 2)	rpm	8000	6000	6000	6000	4750	4750	4750	4250	3750	3750	3350
流量 在 n_{nom} 时	q_v	L/min	27.6	32	38	50	57	70	80	102	112	126	145
功率 ⊿p=350 bar	P	KW	14.5 4)	19	22	29	33	41	47	60	65	74	84
⊿p=400 bar	P	KW	-	22	25	34	38	47	53	68	75	84	96
扭矩 3) ⊿p=350 bar	T	Nm	24.7 4)	57	67	89	128	157	178	254	313	351	448
在 V_g 和 ⊿p=400 bar	T	Nm	-	66	76	102	146	179	204	290	357	401	512
旋转刚度	c	kNm/rod	0.63	0.92	1.25	1.59	2.56	2.93	3.12	4.18	5.94	6.25	8.73
旋转总成转动惯量	J_{GR}	Kgm^2	0.00006	0.0004	0.0004	0.0004	0.0012	0.0012	0.0012	0.0024	0.0042	0.0042	0.0072
最大角速度 2)	α	rad/s^2	5000	5000	5000	5000	6500	6500	6500	14600	7500	7500	6000
加注容量	V	L	0.17	0.17	0.17	0.17	0.20	0.20	0.20	0.33	0.45	0.45	0.55
重量 近似值	m	Kg	2.5	6	6	6	9.5	9.5	9.5	13.5	18	18	23

技术数据/规格	代号	单位	90	107	125	160	180	200	250	355	500		
排量	V_g	cm^3	90	106.7	125	160.4	180	200	250	355	500		
转速 1)	n_{nom}	rpm	1800	1600	1600	1450	1450	1550	1500	1620	1200		
	n_{max} 2)	rpm	3350	3000	3000	2650	2650	2750	1800	1600	1500		
流量 在 n_{nom} 时	q_v	L/min	162	171	200	233	261	310	375	469	600		
功率 ⊿p=350 bar	P	KW	95	100	117	136	152	181	219	273	350		
⊿p=400 bar	P	KW	108	114	133	155	174	207	-	-	-		
扭矩 3) ⊿p=350 bar	T	Nm	501	594	696	893	1003	1114	1393	1978	2785		
在 V_g 和 ⊿p=400 bar	T	Nm	573	679	796	1021	1146	1273	-	-	-		
旋转刚度	c	kNm/rod	9.14	11.2	11.9	17.4	18.2	57.3	73.1	96.1	144		
旋转总成转动惯量	J_{GR}	Kgm^2	0.072	0.0116	0.0116	0.0220	0.0220	0.0353	0.061	0.102	0.178		
最大角加速度	α	rad/s^2	6000	4500	4500	3500	3500	11000	10000	8300	5500		
加注容量	V	L	0.55	0.8	0.8	1.1	1.1	2.7	2.5	3.5	4.2		
重量 近似值	m	Kg	23	32	32	45	45	66	73	110	155		

□ 说明：

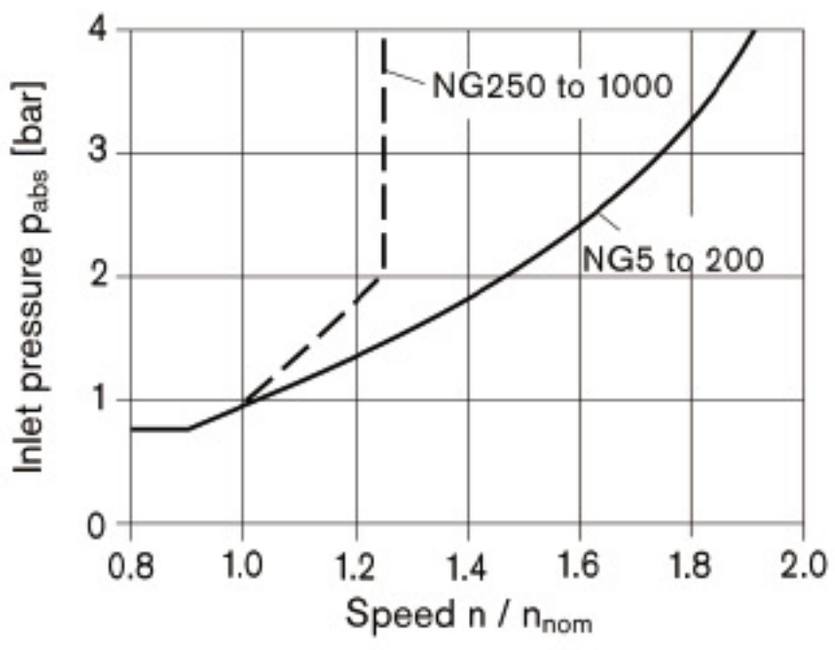
1) 数值适用于：
- 进油口 S 处的入口压力 P_{abs} 为 1 bar 时；
- 最佳工作粘度范围 V_{opt} = 16～36 mm^2/s
- 用于矿物油基液压油

2) 提高进口压力（S 油口）时，转速可增大到最高允许速度（速度极限）；见图示：

3) 扭矩不带径向力，带径向力见后面资料。

4) 扭矩在 ⊿p=315 bar

□ 在吸油口 S 的进油压力 P_{abs} 增加时，允许最大转速计算：



□ 注意事项：

- 超过最大允许值或低于最小允许值可能导致功能消失、使用寿命缩短或泵完全损坏。
- 其他允许的极限值，包括限制转速变化，减小角加速度的频率功能和允许启动的角加速度（低于最大角加速度），请在数据表中查找。

■ 技术数据：

■ 驱动轴参数：

□ 驱动轴允许有轴向和径向力负载

□ 表中数值为最大值，不能用于连续工作工况。

技术数据/规格	代号	单位	5	5[3]	10	10	12	12	16	23	23	28	28
驱动轴 [1]	Φ	mm	12	12	20	25	20	25	25	25	30	25	30
最大径向力	$F_{q\,max}$	KN	1.6	1.6	3.0	3.2	3.0	3.2	3.2	5.7	5.4	5.7	5.4
在距离 a 时	a	mm	12	12	16	16	16	16	16	16	16	16	16
从轴肩起													
允许扭矩	T_{max}	Nm	24.7	24.7	66	66	76	76	102	146	146	179	179
允许压力 ⊿p	Δp_{perm}	Bar	315	315	400	400	400	400	400	400	400	400	400
最大轴向力 [2]	$+F_{ax\,max}$	N	180	180	320	320	320	320	320	500	500	500	500
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0	0	0
每 bar 工作压力时允许的轴向力	$\pm F_{ax\,max/bar}$	N/bar	1.5	1.5	3.0	3.0	3.0	3.0	3.0	5.2	5.2	5.2	5.2

技术数据/规格	代号	单位	32	45	56	56[4]	56	63	80	80[4]	80	90	
驱动轴 [1]	Φ	mm	30	30	30	30	35	35	35	35	40	40	
最大径向力	$F_{q\,max}$	KN	5.4	7.6	9.5	7.8	9.1	9.1	11.6	11.1	11.4	11.4	
在距离 a 时	a	mm	16	18	18	18	18	18	20	20	20	20	
从轴肩起													
允许扭矩	T_{max}	Nm	204	290	357	294	357	401	512	488	512	573	
允许压力 ⊿p	Δp_{perm}	Bar	400	400	400	330	400	400	400	280	400	400	
最大轴向力 [2]	$+F_{ax\,max}$	N	500	630	800	800	800	800	1000	1000	1000	1000	
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0	0	
每 bar 工作压力时允许的轴向力	$\pm F_{ax\,max/bar}$	N/bar	5.2	7.0	8.7	8.7	8.7	8.7	10.6	10.6	10.6	10.6	

技术数据/规格	代号	单位	107	107	125	160	160	180	200	250	355	500	
驱动轴 [1]	Φ	mm	40	45	45	45	50	50	50	50	60	70	
最大径向力	$F_{q\,max}$	KN	13.6	14.1	14.1	18.1	18.3	18.3	20.3	1.2[6]	1.5[6]	1.9[6]	
在距离 a 时	a	mm	20	20	20	25	25	25	25	41	52.5	52.5	
从轴肩起													
允许扭矩	T_{max}	Nm	679	679	796	1021	1021	1146	1273	-[5]	-[5]	-[5]	
允许压力 ⊿p	Δp_{perm}	Bar	400	400	400	400	400	400	400	-[5]	-[5]	-[5]	
最大轴向力 [2]	$+F_{ax\ max}$	N	1250	1250	1250	1600	1600	1600	1600	2000	2500		
	$-F_{ax\ max}$	N	0	0	0	0	0	0	0	0	0	0	
每 bar 工作压力时允许的轴向力	$\pm F_{ax\,max/bar}$	N/bar	12.9	12.9	12.9	16.7	16.7	16.7	16.7	-[5]	-[5]	-[5]	

1) 在间歇工作时

2)在间歇或泵无压力工作时最大允许轴向力

3) 圆锥柱轴 DIN 6888，带螺纹轴头和半圆键

4) 适用花键轴

5) 待开发，请联系华德。

6) 在间歇或泵无压力工作时，若出现较高轴向力时，请联系华德。

□ 注意：

使用规格 28...200 时必须注意最大允许轴向力的作用方向

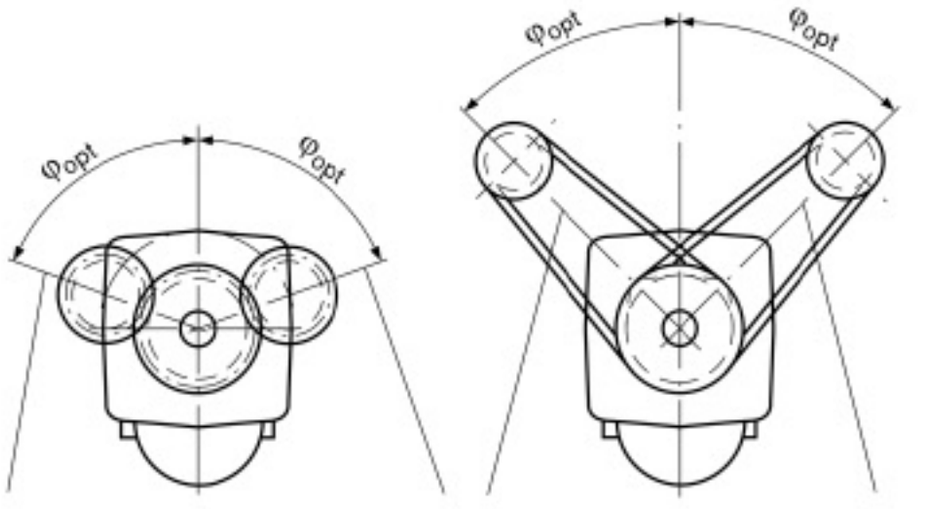
$+F_{ax\ max}$ = 增加轴承寿命

$-F_{ax\ max}$ = 降低轴承寿命（尽量避免）

■ 技术数据：

- □ F_q 最佳轴向作用力方向：
- □ 选择适合的 F_q 轴向作用力方向可减少内驱动力对轴承产生的负荷，从而延长轴承寿命。

	齿轮传动	V-皮带传动
规格	Ψ_{opt}	Ψ_{opt}
5～180	±70°	±45°
200～500	±45°	±70°



顺时针转动　　逆时针转动　　顺时针转动

油口 B 压力　　油口 A 压力　　油口 B 压力

■ 规格计算：

流量　$q_v = \dfrac{V_g \cdot n \cdot \eta_v}{1000}$　[l/min]

扭矩　$T = \dfrac{V_g \cdot \Delta p}{20 \cdot p \cdot h_{mh}}$　[Nm]

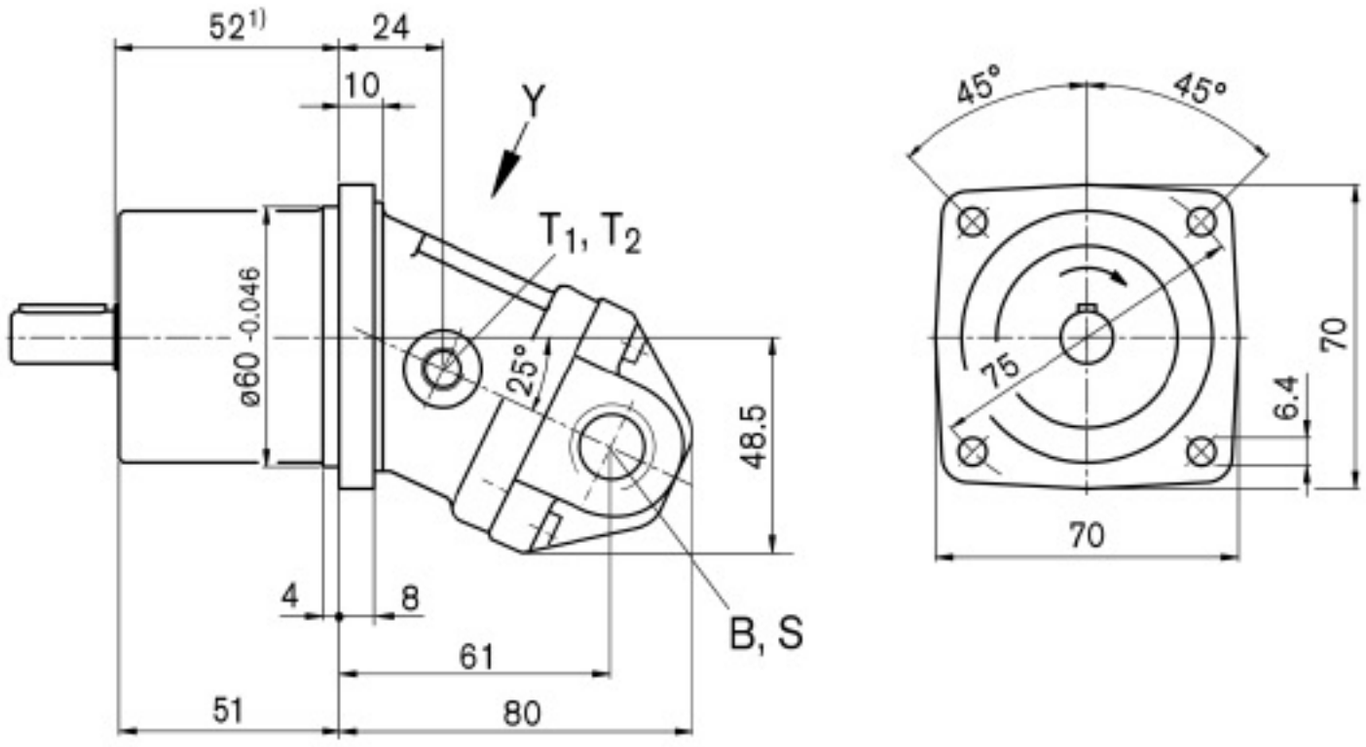
功率　$P = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{q_v \cdot \Delta p}{600 \cdot \eta_t}$　[kW]

V_g = 每转排量 (cm^3)
Δp = 压差 (bar)
n = 转速 (rpm)
η_v = 容积效率
η_{mh} = 机械 — 液压效率
η_t = 总效率 ($\eta_t = \eta_v \cdot \eta_{mh}$)

■ 元件尺寸（mm）：规格 5

□ 油口接板 7...螺纹油口 A/B 和 S 在侧面：

□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：

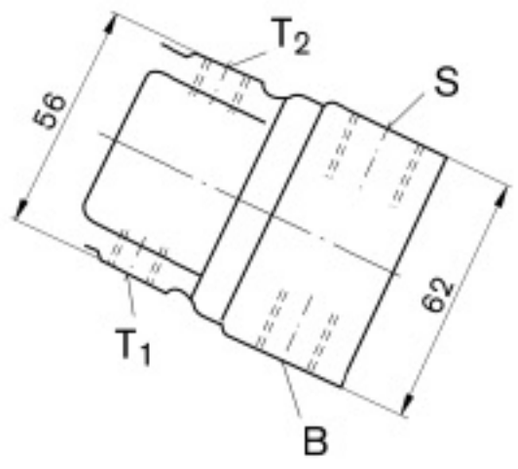


1） 到轴肩

□ 油口尺寸：

名称	油口用途	标准[6)]	规格[3)]	峰值压力 bar[5)]
B（A）	工作油口	DIN 3852	M18 X 1.5 深 12	350
S	吸油油口	DIN 3852	M22 X 1.5 深 14	30
T_1	泄油口	DIN 3852	M10 X 1 深 8	3
T_2	泄油口	DIN 3852	M10 X 1 深 8	3

Y 向：油口视图

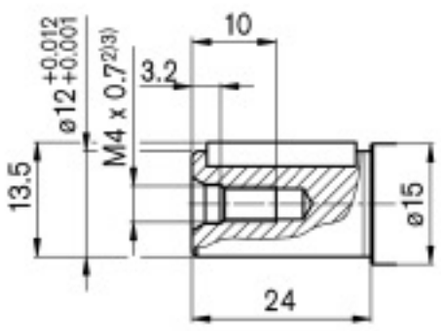


□ 轴端尺寸：

■ 规格 5

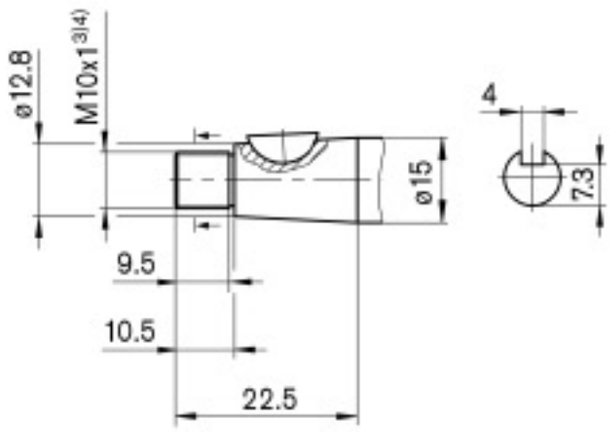
B 平键直轴 DIN 6885

A 4 X 4 X 20



C 圆锥柱轴 DIN 6888

带螺纹轴头和半圆键 3 X 5 锥度 1:10



2）中心孔符合 DIN 332（螺纹符合 DIN 13）

3）参见最大固定扭矩

4）螺纹依据 DIN 3852，最大固定扭矩：30 Nm

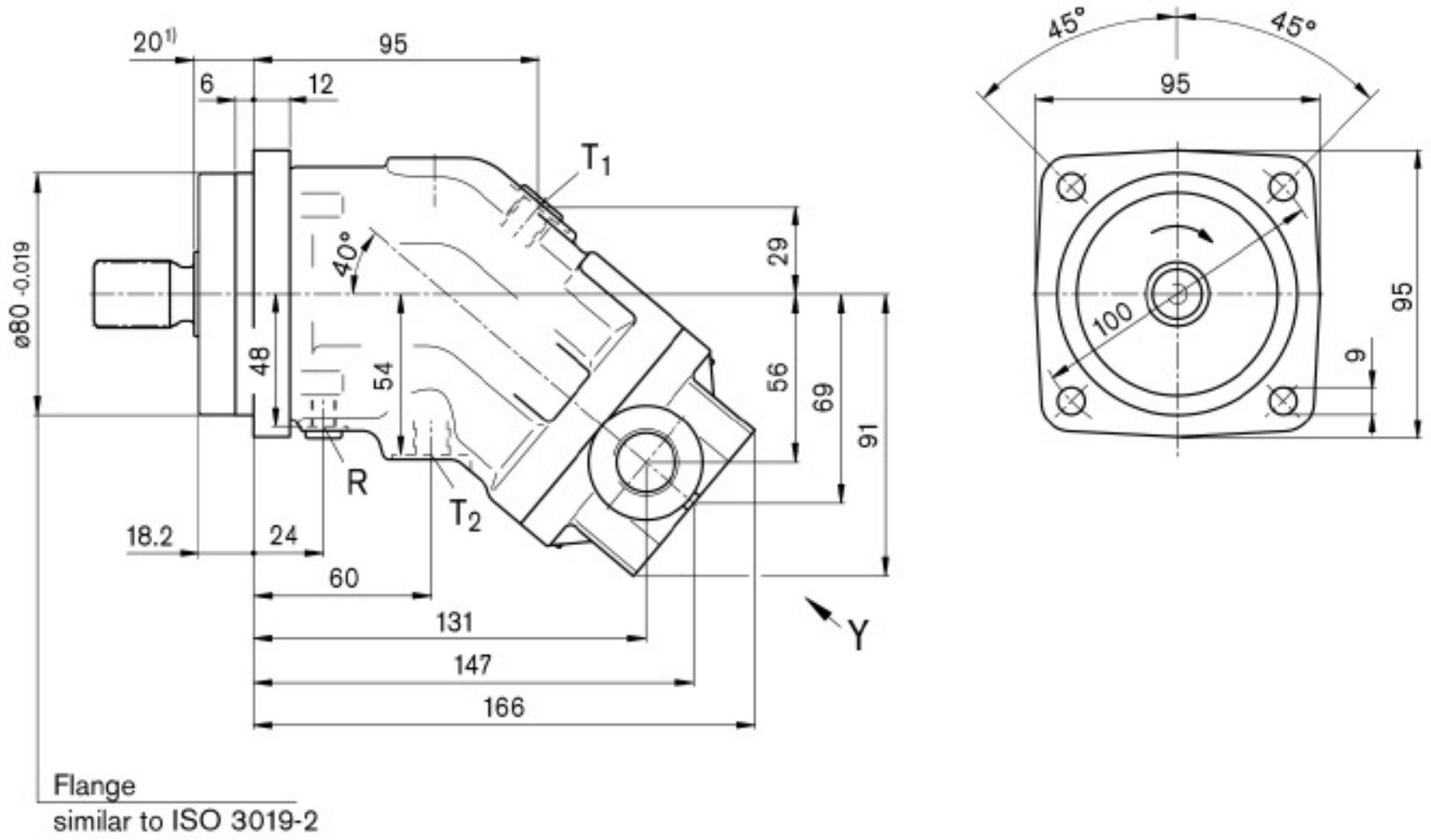
5）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

6）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 10、12、16

□ 油口接板 06…螺纹油口 A/B 在侧面和螺纹油口 S 在后部：

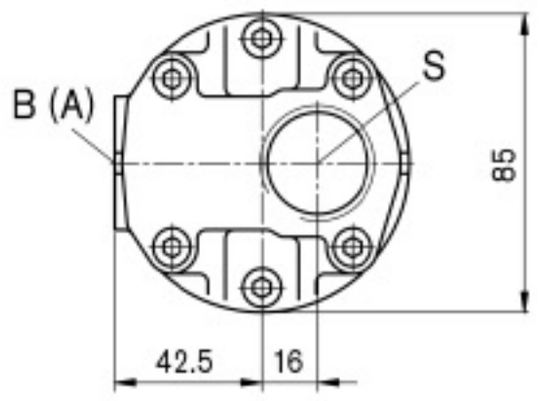
□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：



1）到轴肩

□ 油口尺寸：

名称	油口用途	标准 5)	规格 2)	峰值压力 bar3)	Y 向：油口视图
B（A）	工作油口	DIN 3852	M22 X 1.5 深 14	450	
S	吸油油口	DIN 3852	M33 X 2 深 18	30	
T_1	泄油口 4)	DIN 3852	M12 X 1.5 深 12 （封堵）	3	
T_2	泄油口 4)	DIN 3852	M12 X 1.5 深 12	3	
R	排气口	DIN 3852	M8 X 1 深 8 （封堵）	3	

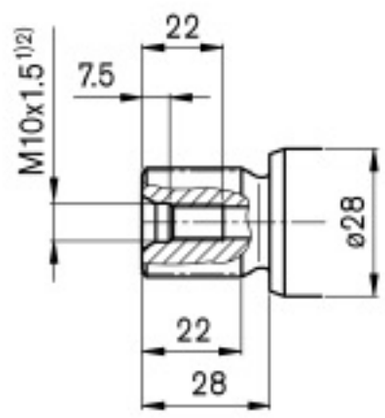


□ 轴端尺寸：

■ 规格 10、12、16

A 花键轴 DIN 5480

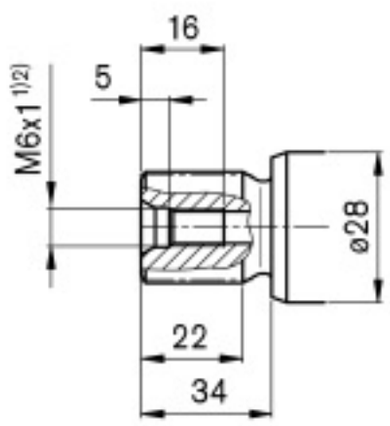
W 25 X 1.25 X 18 X 9g



■ 规格 10、12

Z 花键轴 DIN 5480

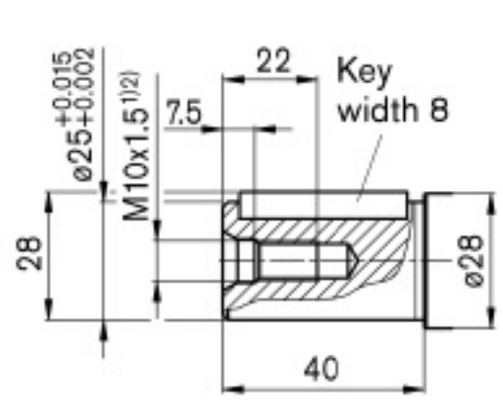
W 20 X 1.25 X 14 X 9g



■ 规格 10、12、16

B 平键直轴 DIN 6885

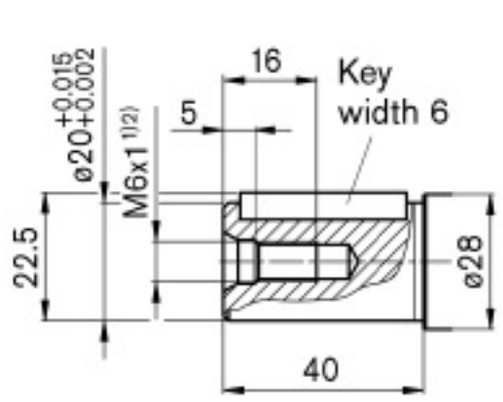
AS 8 X 7 X 32



■ 规格 10、12

P 平键直轴 DIN 6885

AS 6 X 6 X 32



1）中心孔符合 DIN 332（螺纹符合 DIN 13）

2）参见最大固定扭矩

3）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

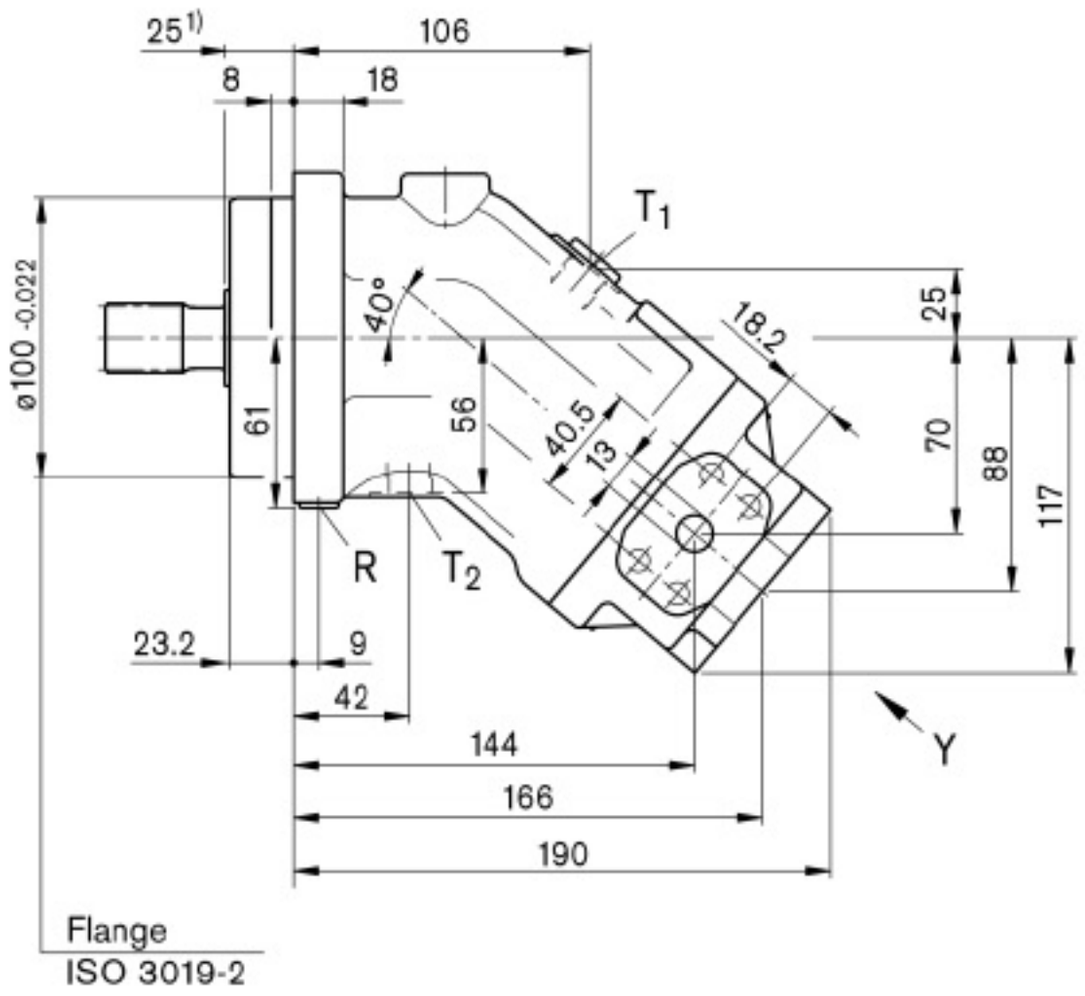
4）根据安装位置，T_1 或 T_2 必须连接管路。

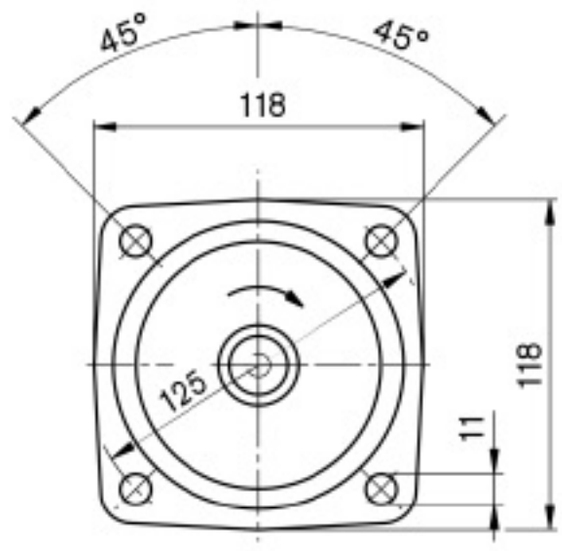
5）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 23、28、32

□ 油口接板 05…SAE 法兰油口 A/B 在侧面和 SAE 法兰油口 S 在后部：

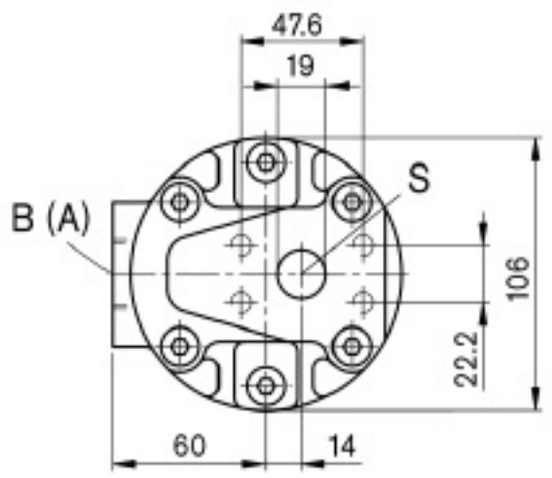
□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：





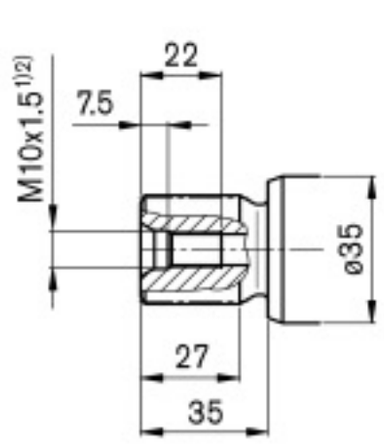
1）到轴肩

□ 油口尺寸：

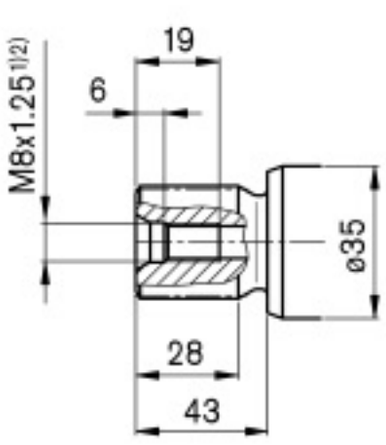
名称	油口用途	标准	规格 [2]	峰值压力 bar [3]	Y 向：油口视图
B（A）	工作油口 固定螺纹 B（A）	SAE J518 [5] DIN13	1/2" M8 X 1.25 深 15	450	
S	吸油油口 固定螺纹	SAE J518 [5] DIN13	3/4" M10 X 1.5 深 17	30	
T_1	泄油口 [4]	DIN 3852 [6]	M16 X 1.5 深 12 （封堵）	3	
T_2	泄油口 [4]	DIN 3852 [6]	M16 X 1.5 深 12	3	
R	排气口	DIN 3852 [6]	M10 X 1 深 12 （封堵）	3	

□ 轴端尺寸：

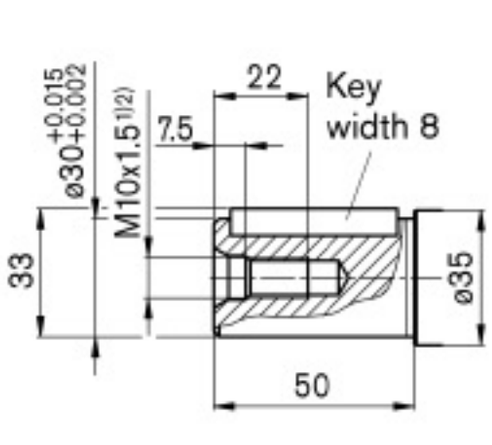
■ 规格 23、28、32
A 花键轴 DIN 5480
W 30 X 2 X14 X 9g



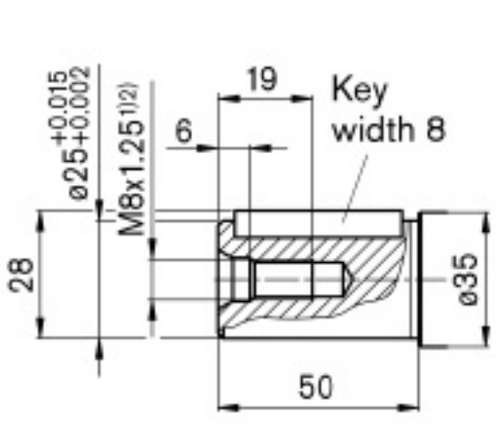
■ 规格 23、28
Z 花键轴 DIN 5480
W 21 X 1.25 X 18 X 9g



■ 规格 23、28、32
B 平键直轴 DIN 6885
AS 8 X 7 X 40



■ 规格 23、28
P 平键直轴 DIN 6885
AS 8 X 7 X 40



1）中心孔符合 DIN 332（螺纹符合 DIN 13）

2）参见最大固定扭矩

3）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

4）根据安装位置，T_1 或 T_2 必须连接管路。

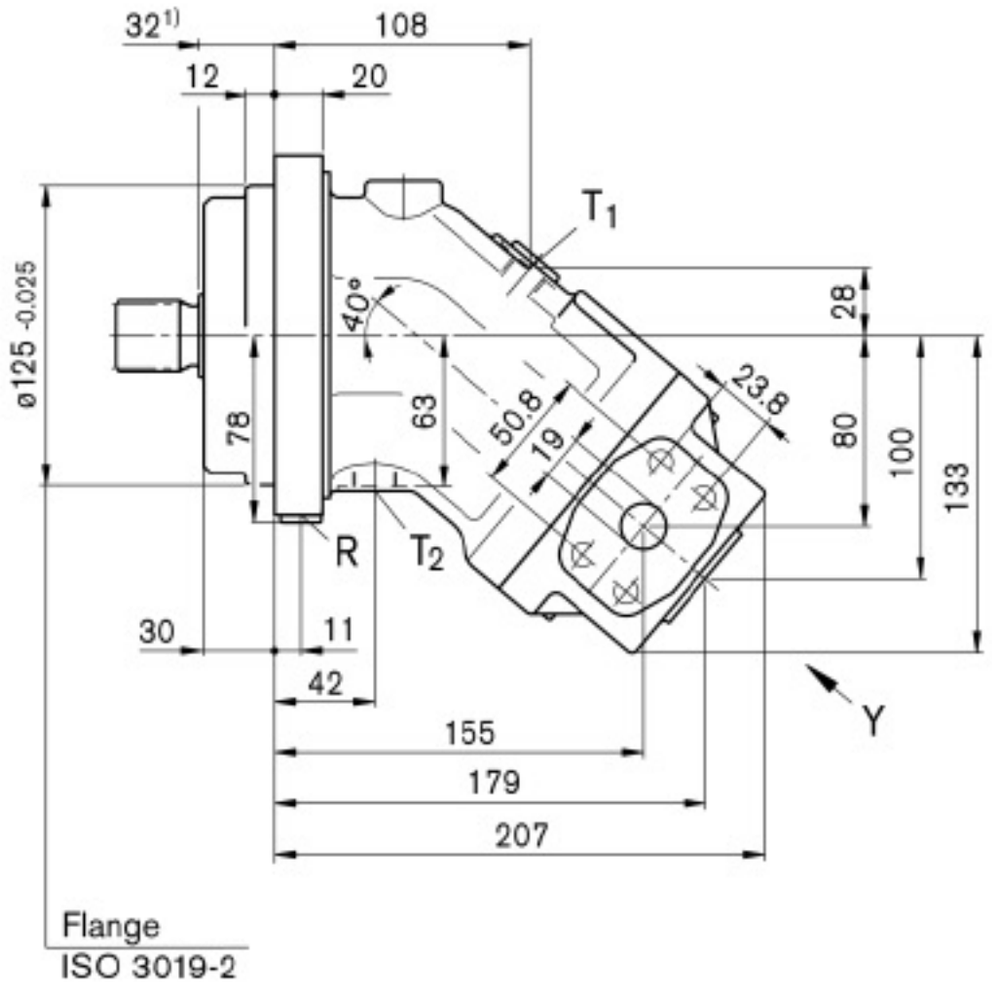
5）只有尺寸依据 SAE J518，公制紧固螺纹偏离标准。

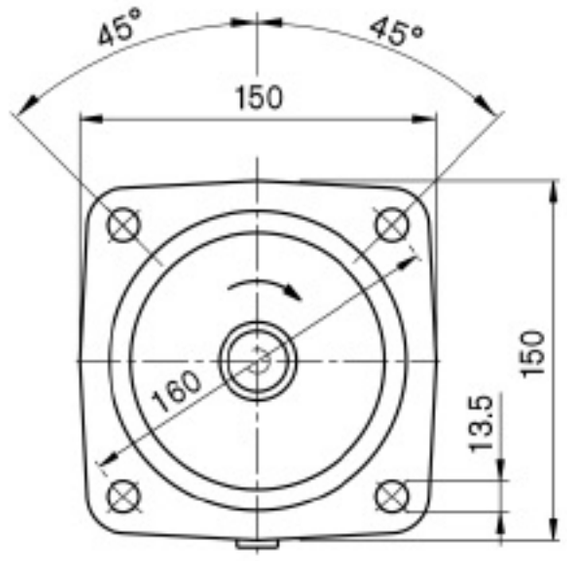
6）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 45

□ 油口接板 05…SAE 法兰油口 A/B 在侧面和 SAE 法兰油口 S 在后部：

□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：

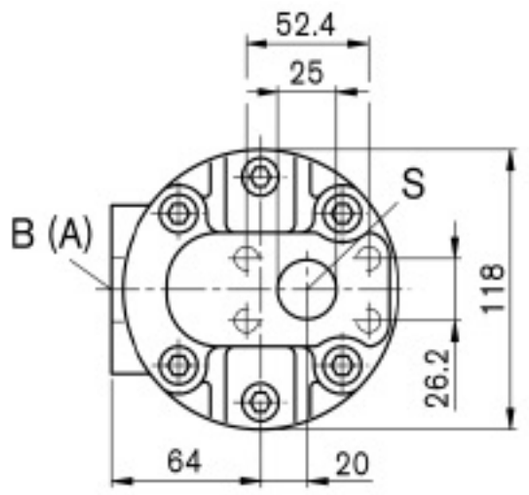




View Y

1）到轴肩

□ 油口尺寸：

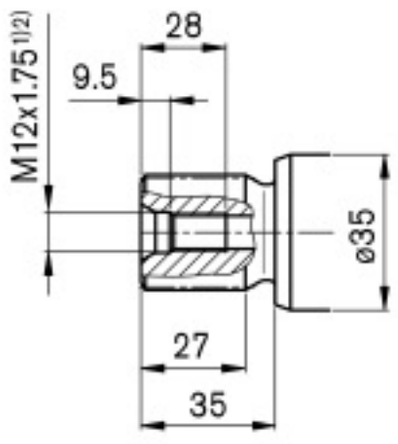
名称	油口用途	标准	规格 [2]	峰值压力 bar [3]	Y 向：油口视图
B（A）	工作油口 固定螺纹 B（A）	SAE J518 [5] DIN13	3/4" M10 X 1.5 深 17	450	
S	吸油油口 固定螺纹	SAE J518 [5] DIN13	1" M10 X 1.5 深 17	30	
T_1	泄油口 [4]	DIN 3852 [6]	M18 X 1.5 深 12 （封堵）	3	
T_2	泄油口 [4]	DIN 3852 [6]	M18 X 1.5 深 12	3	
R	排气口	DIN 3852 [6]	M12 X 1.5 深 12 （封堵）	3	

□ 轴端尺寸：

■ 规格 45

Z 花键轴 DIN 5480

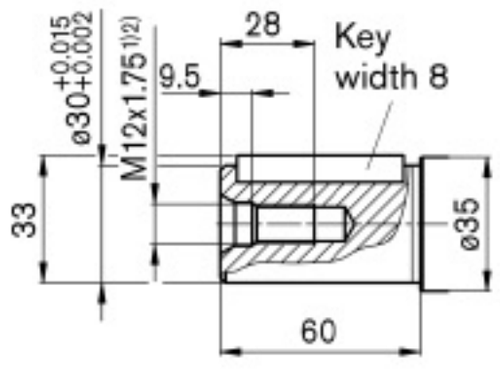
W 30 X 2 X 14 X 9g



■ 规格 45

P 平键直轴 DIN 6885

AS 8 X 7 X 50



1）中心孔符合 DIN 332（螺纹符合 DIN 13）

2）参见最大固定扭矩

3）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

4）根据安装位置，T_1 或 T_2 必须连接管路。

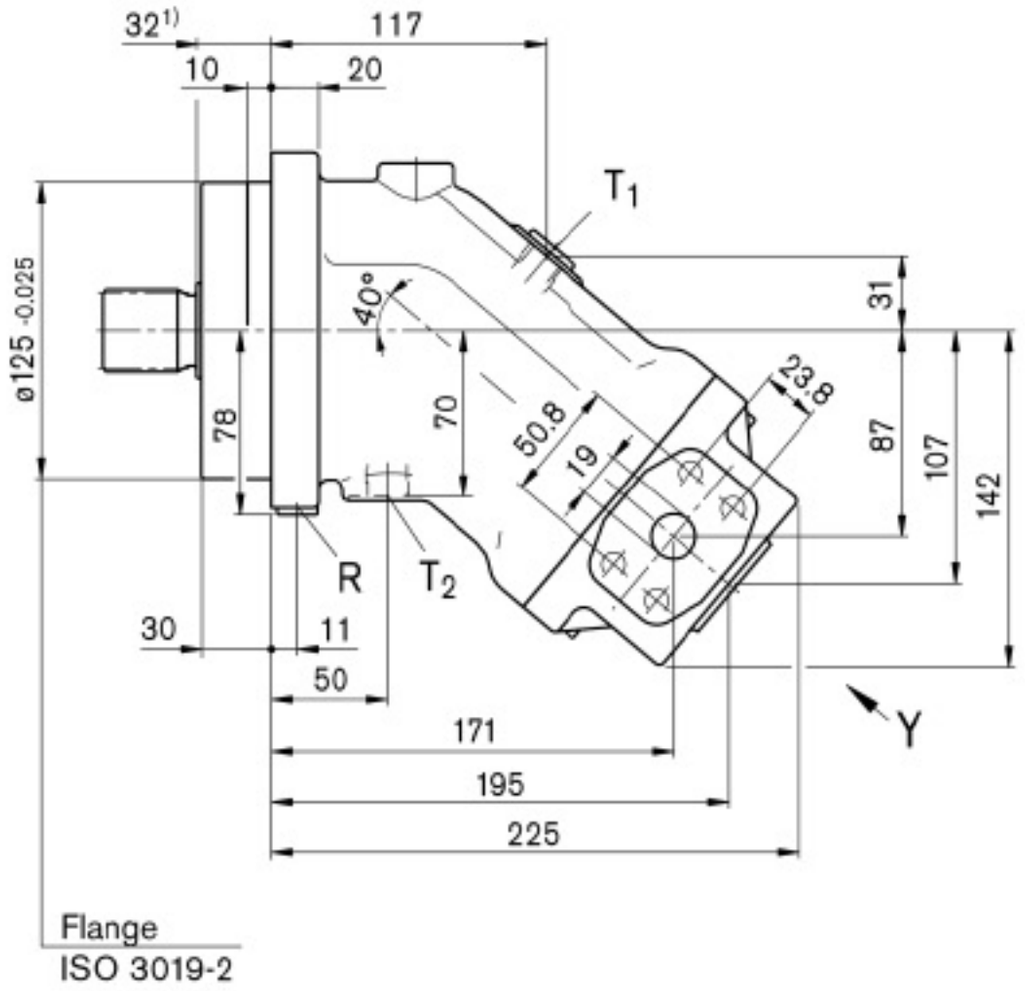
5）只有尺寸依据 SAE J518，公制紧固螺纹偏离标准。

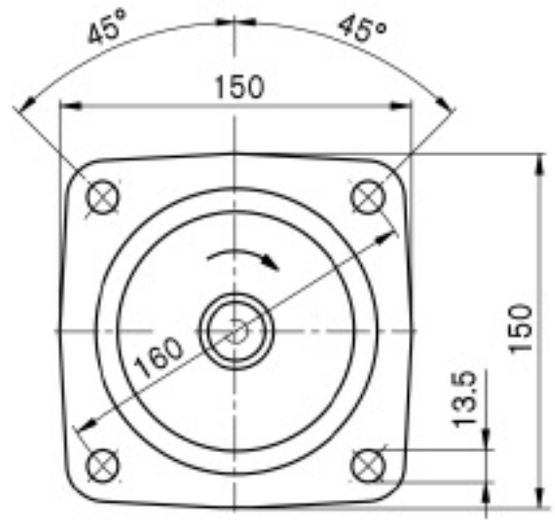
6）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 56、63

□ 油口接板 05…SAE 法兰油口 A/B 在侧面和 SAE 法兰油口 S 在后部：

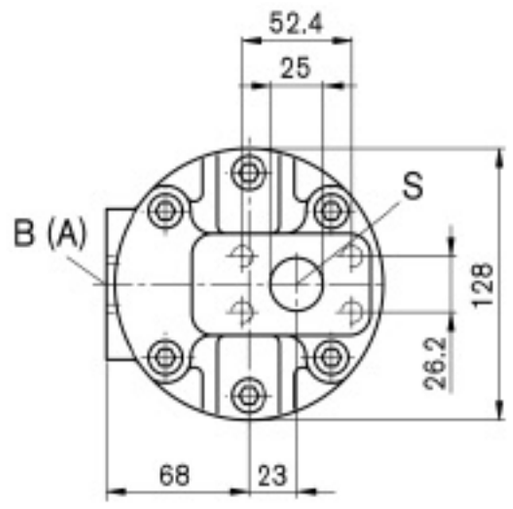
□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：





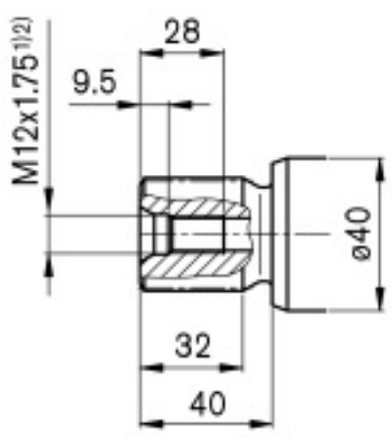
1）到轴肩

□ 油口尺寸：

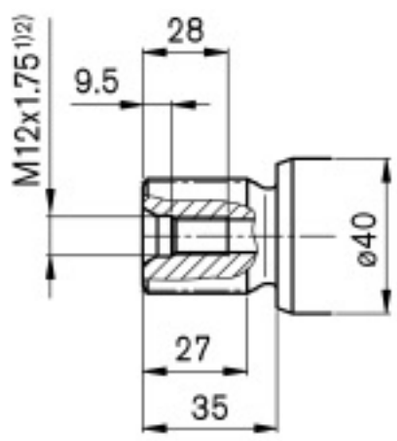
名称	油口用途	标准	规格 [2]	峰值压力 bar [3]	Y 向：油口视图
B（A）	工作油口 固定螺纹 B（A）	SAE J518 [5] DIN13	3/4" M10 X 1.5 深 17	450	
S	吸油油口 固定螺纹	SAE J518 [5] DIN13	1" M10 X 1.5 深 17	30	
T_1	泄油口 [4]	DIN 3852 [6]	M18 X 1.5 深 12 （封堵）	3	
T_2	泄油口 [4]	DIN 3852 [6]	M18 X 1.5 深 12	3	
R	排气口	DIN 3852 [6]	M12 X 1.5 深 12 （封堵）	3	

□ 轴端尺寸：

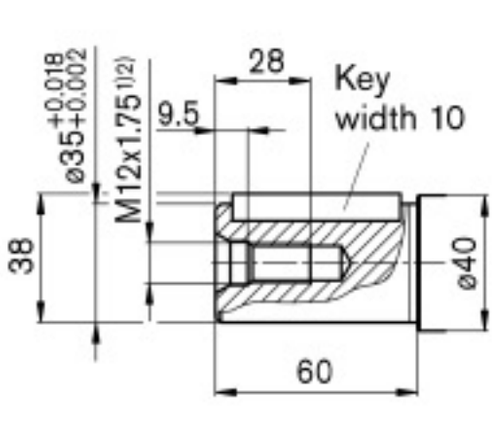
■ 规格 56、63
A 花键轴 DIN 5480
W 35X 2 X16 X 9g



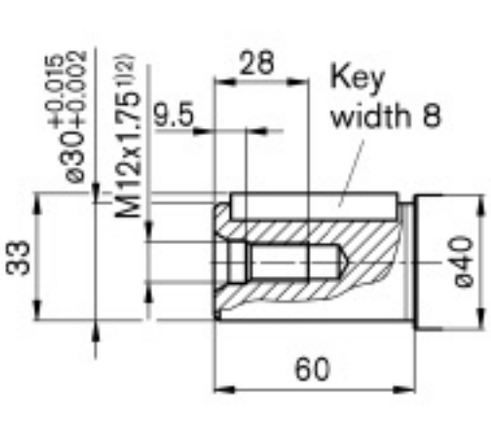
■ 规格 56
Z 花键轴 DIN 5480
W 30 X 2 X14 X 9g



■ 规格 56、63
B 平键直轴 DIN 6885
AS 10 X 8 X 50



■ 规格 56
P 平键直轴 DIN 6885
AS 8 X 7 X 50



1）中心孔符合 DIN 332（螺纹符合 DIN 13）

2）参见最大固定扭矩

3）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

4）根据安装位置，T_1 或 T_2 必须连接管路。

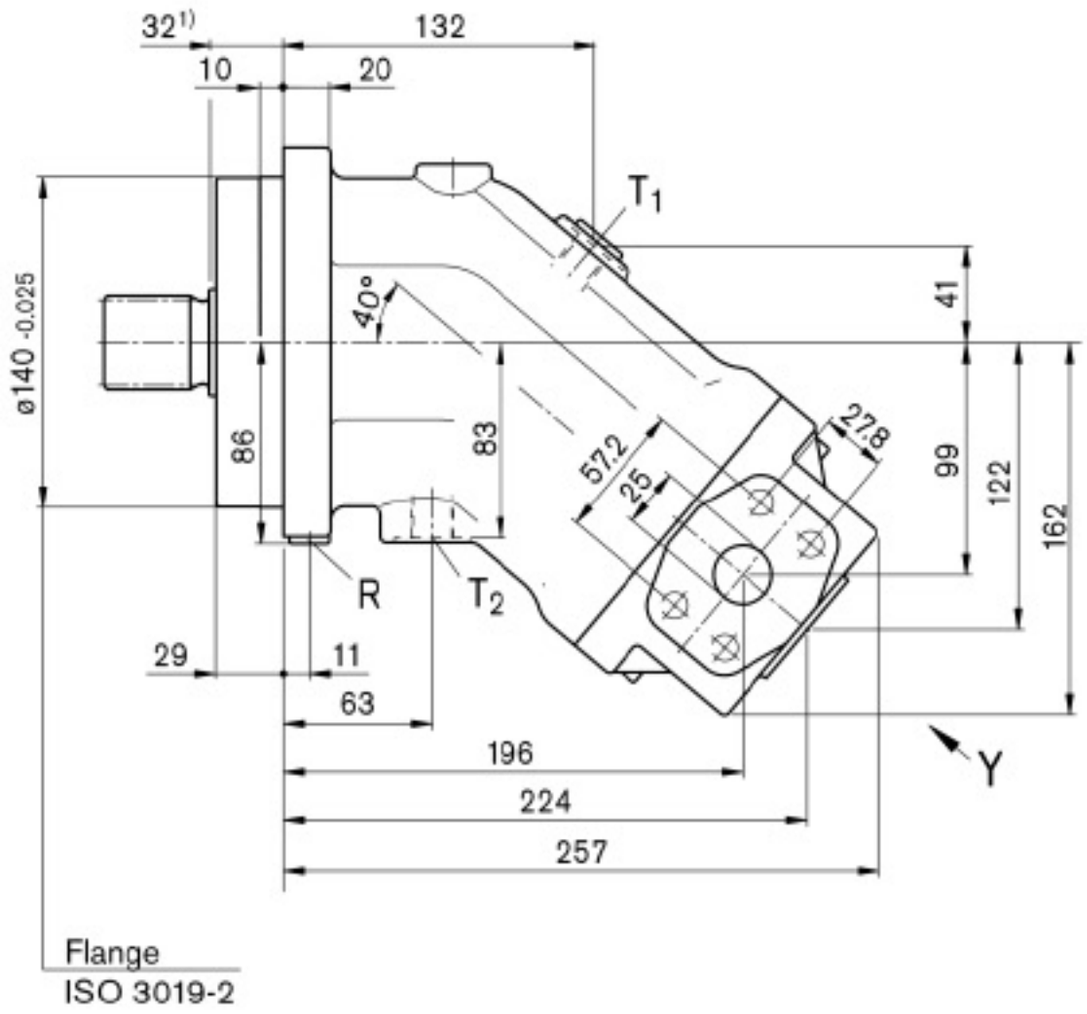
5）只有尺寸依据 SAE J518，公制紧固螺纹偏离标准。

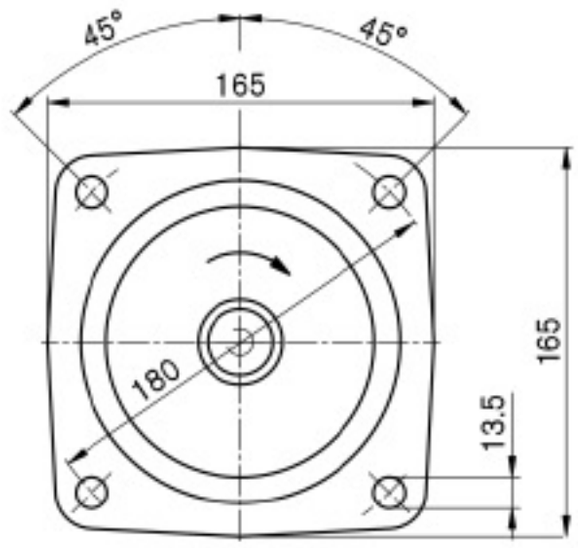
6）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 80、90

□ 油口接板 05…SAE 法兰油口 A/B 在侧面和 SAE 法兰油口 S 在后部：

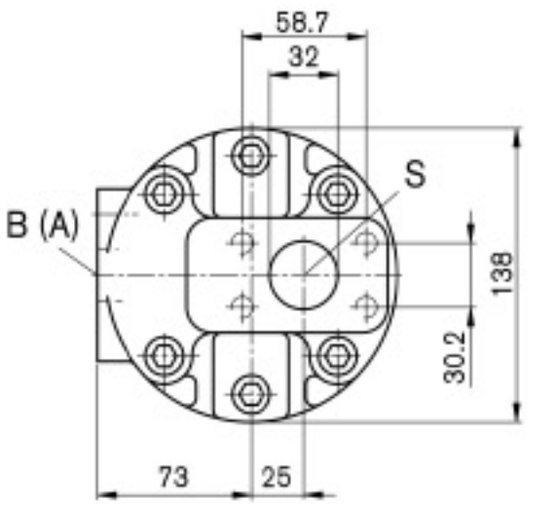
□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：





1）到轴肩

□ 油口尺寸：

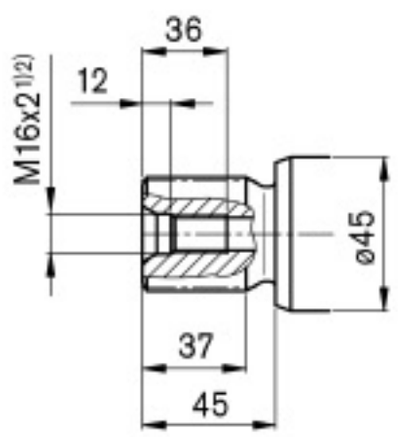
名称	油口用途	标准	规格 [2]	峰值压力 bar [3]	Y 向：油口视图
B（A）	工作油口 固定螺纹 B（A）	SAE J518 [5] DIN13	1” M12 X 1.5 深 17	450	
S	吸油油口 固定螺纹	SAE J518 [5] DIN13	1-1/4” M10 X 1.5 深 17	30	
T_1	泄油口 [4]	DIN 3852 [6]	M18 X 1.5 深 12 （封堵）	3	
T_2	泄油口 [4]	DIN 3852 [6]	M18 X 1.5 深 12	3	
R	排气口	DIN 3852 [6]	M12 X 1.5 深 12 （封堵）	3	

□ 轴端尺寸：

■ 规格 80、90

A 花键轴 DIN 5480

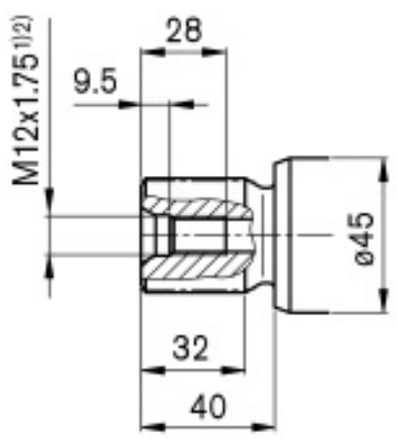
W 40 X 2 X18 X 9g



■ 规格 80

Z 花键轴 DIN 5480

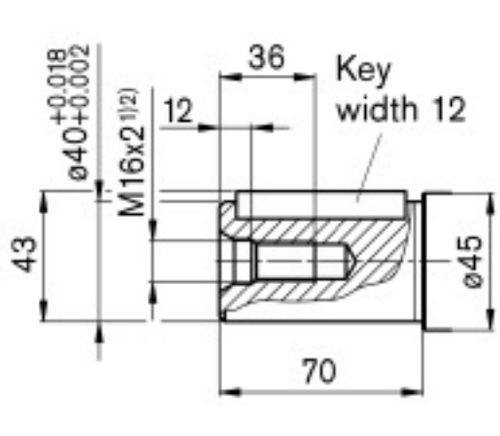
W 35 X 2 X16 X 9g



■ 规格 80、90

B 平键直轴 DIN 6885

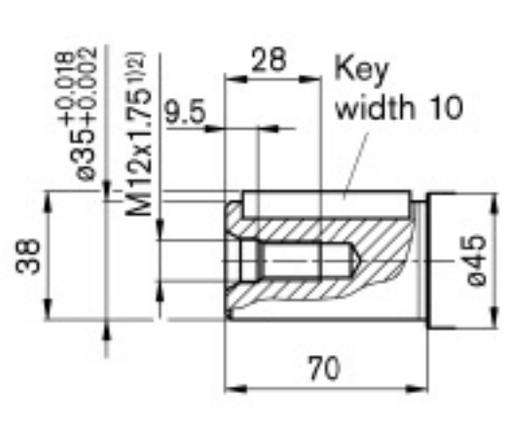
AS 12 X 8 X 56



■ 规格 80

P 平键直轴 DIN 6885

AS 10 X 8 X 56



1）中心孔符合 DIN 332（螺纹符合 DIN 13）

2）参见最大固定扭矩

3）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

4）根据安装位置，T_1 或 T_2 必须连接管路。

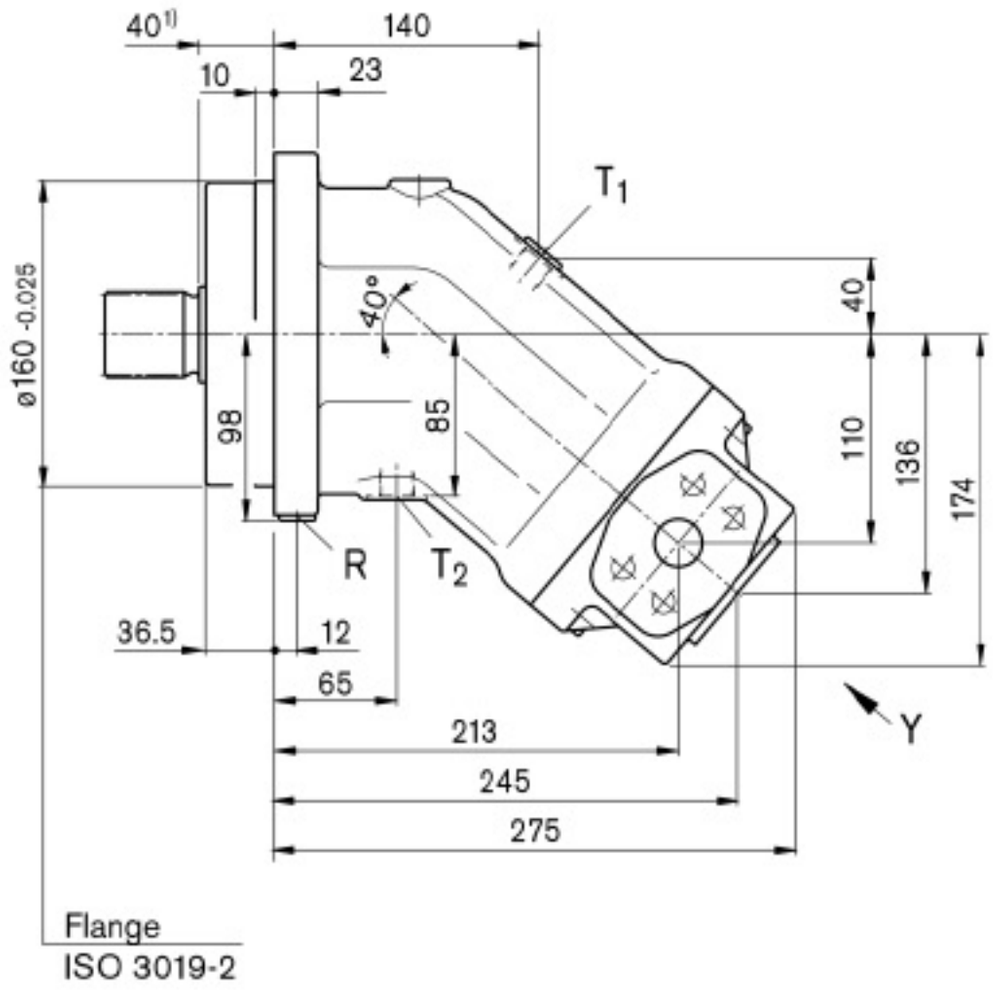
5）只有尺寸依据 SAE J518，公制紧固螺纹偏离标准。

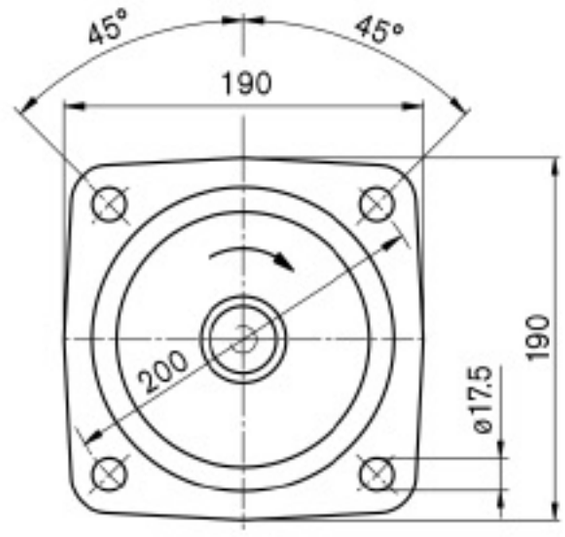
6）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 107、125

□ 油口接板 05…SAE 法兰油口 A/B 在侧面和 SAE 法兰油口 S 在后部：

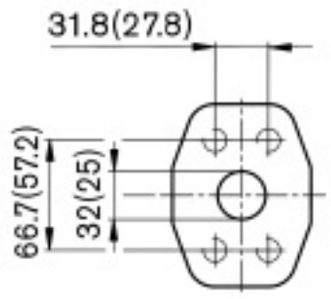
□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：

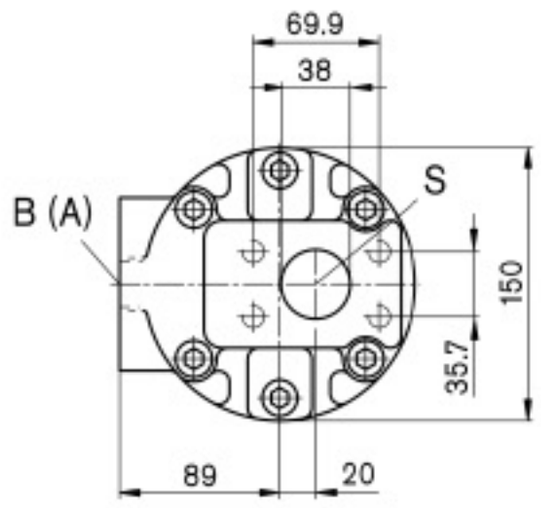




1）到轴肩

油口资料：A/B	Y 向：油口视图
括号内为规格 107 尺寸	





■ 元件尺寸（mm）：规格 107、125

□ 油口尺寸：

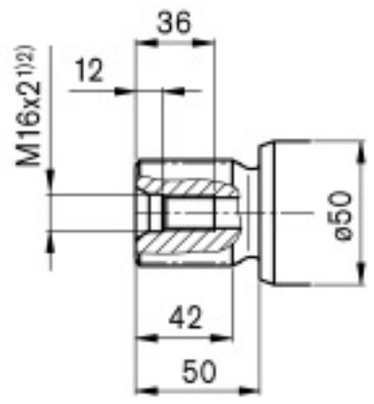
名称	油口用途	标准	规格 [2]	峰值压力 bar [3]
B（A）	工作油口	SAE J518 [5]	1"　规格 107 1-1/4"　规格 125	450
	固定螺纹 B（A）	DIN13	M12 X 1.75 深 17 规格 107 M14 X 2 深 19 规格 125	
S	吸油油口	SAE J518 [5]	1-1/2"	30
	固定螺纹	DIN13	M12 X 1.75 深 20	
T_1	泄油口 [4]	DIN 3852 [6]	M18 X 1.5 深 12 （封堵）	3
T_2	泄油口 [4]	DIN 3852 [6]	M18 X 1.5 深 12	3
R	排气口	DIN 3852 [6]	M14 X 1.5 深 12 （封堵）	3

□ 轴端尺寸：

■ 规格 107、125

A 花键轴 DIN 5480

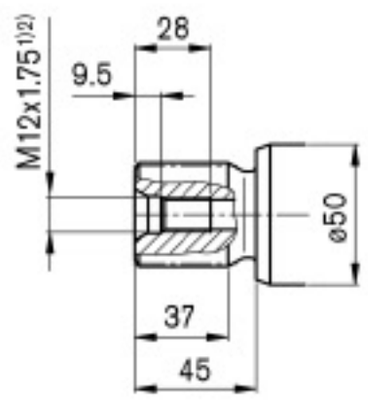
W 45 X 2 X 21 X 9g



■ 规格 107

Z 花键轴 DIN 5480

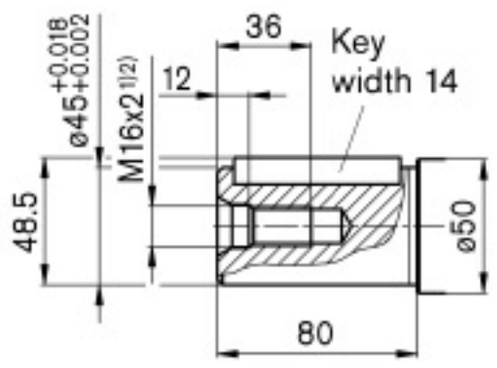
W 40 X 2 X18 X 9g



■ 规格 107、125

B 平键直轴 DIN 6885

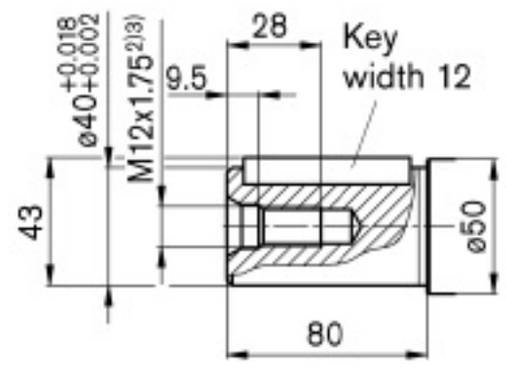
AS 14 X 9 X 63



■ 规格 107

P 平键直轴 DIN 6885

AS 12 X 8 X 63



1）中心孔符合 DIN 332（螺纹符合 DIN 13）

2）参见最大固定扭矩

3）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

4）根据安装位置，T_1 或 T_2 必须连接管路。

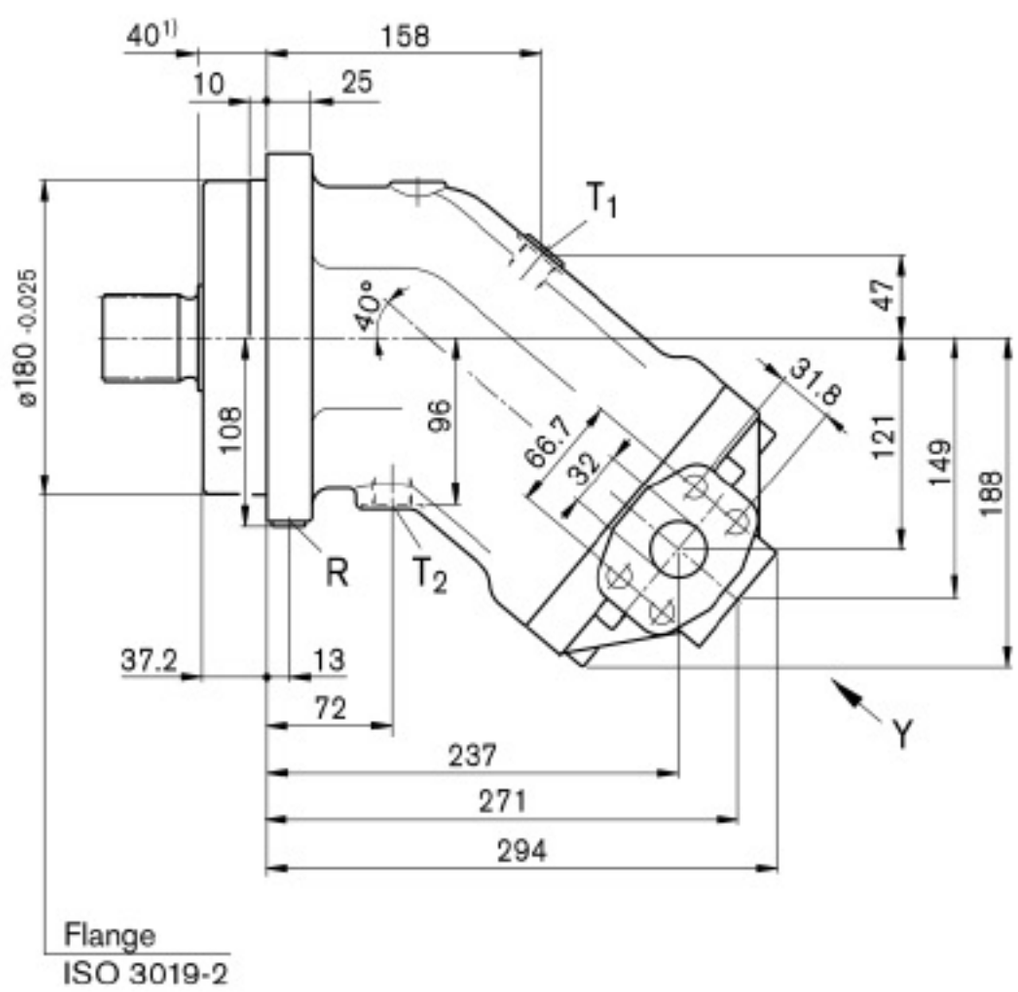
5）只有尺寸依据 SAE J518，公制紧固螺纹偏离标准。

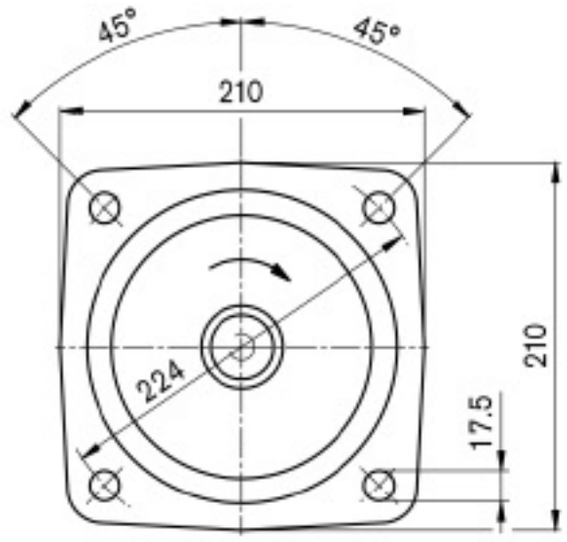
6）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 160、180

□ 油口接板 05…SAE 法兰油口 A/B 在侧面和 SAE 法兰油口 S 在后部：

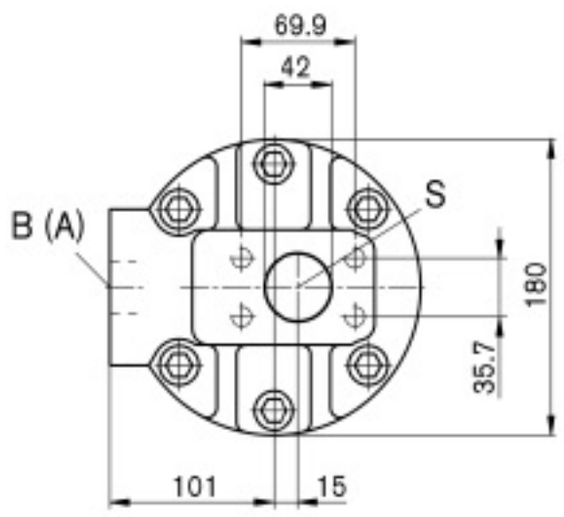
□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：



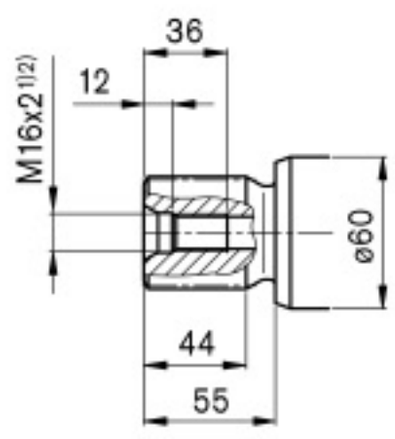
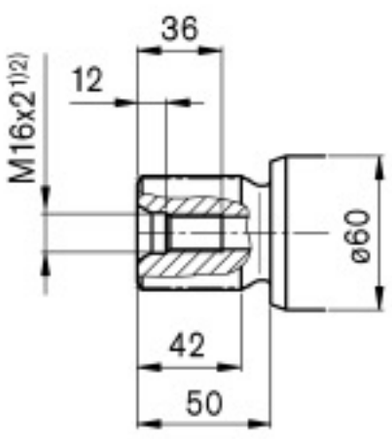
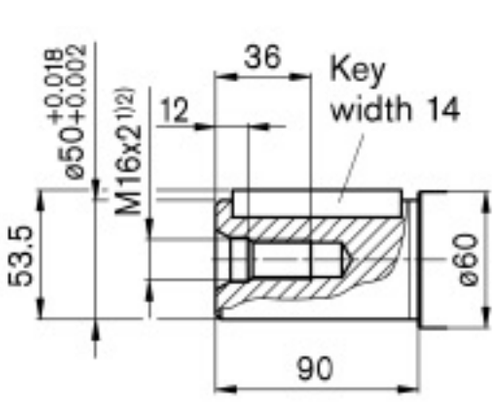
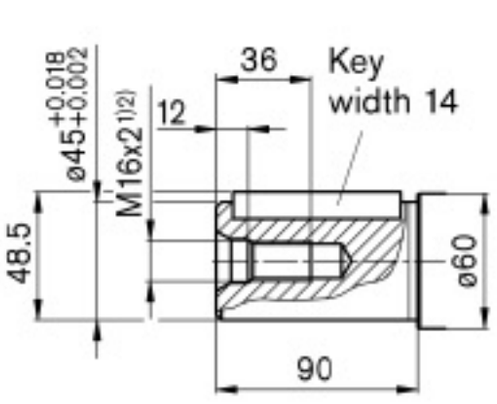


1）到轴肩

□ 油口尺寸：

名称	油口用途	标准	规格 [2]	峰值压力 bar [3]	Y 向：油口视图
B（A）	工作油口 固定螺纹 B（A）	SAE J518 [5] DIN13	1-1/4” M14 X 2 深 19	450	
S	吸油油口 固定螺纹	SAE J518 [5] DIN13	1-1/2” M12 X 1.75 深 20	30	
T_1	泄油口 [4]	DIN 3852 [6]	M22 X 1.5 深 14 （封堵）	3	
T_2	泄油口 [4]	DIN 3852 [6]	M22 X 1.5 深 14	3	
R	排气口	DIN 3852 [6]	M14 X 1.5 深 12 （封堵）	3	

□ 轴端尺寸：

■ 规格 160、180 A 花键轴 DIN 5480 W 50 X 2 X 24 X 9g	■ 规格 160 Z 花键轴 DIN 5480 W 45 X 2 X 21 X 9g	■ 规格 160、180 B 平键直轴 DIN 6885 AS 14 X 9 X 70	■ 规格 160 P 平键直轴 DIN 6885 AS 14 X 9 X 70
			

1）中心孔符合 DIN 332（螺纹符合 DIN 13）

2）参见最大固定扭矩

3）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

4）根据安装位置，T_1 或 T_2 必须连接管路。

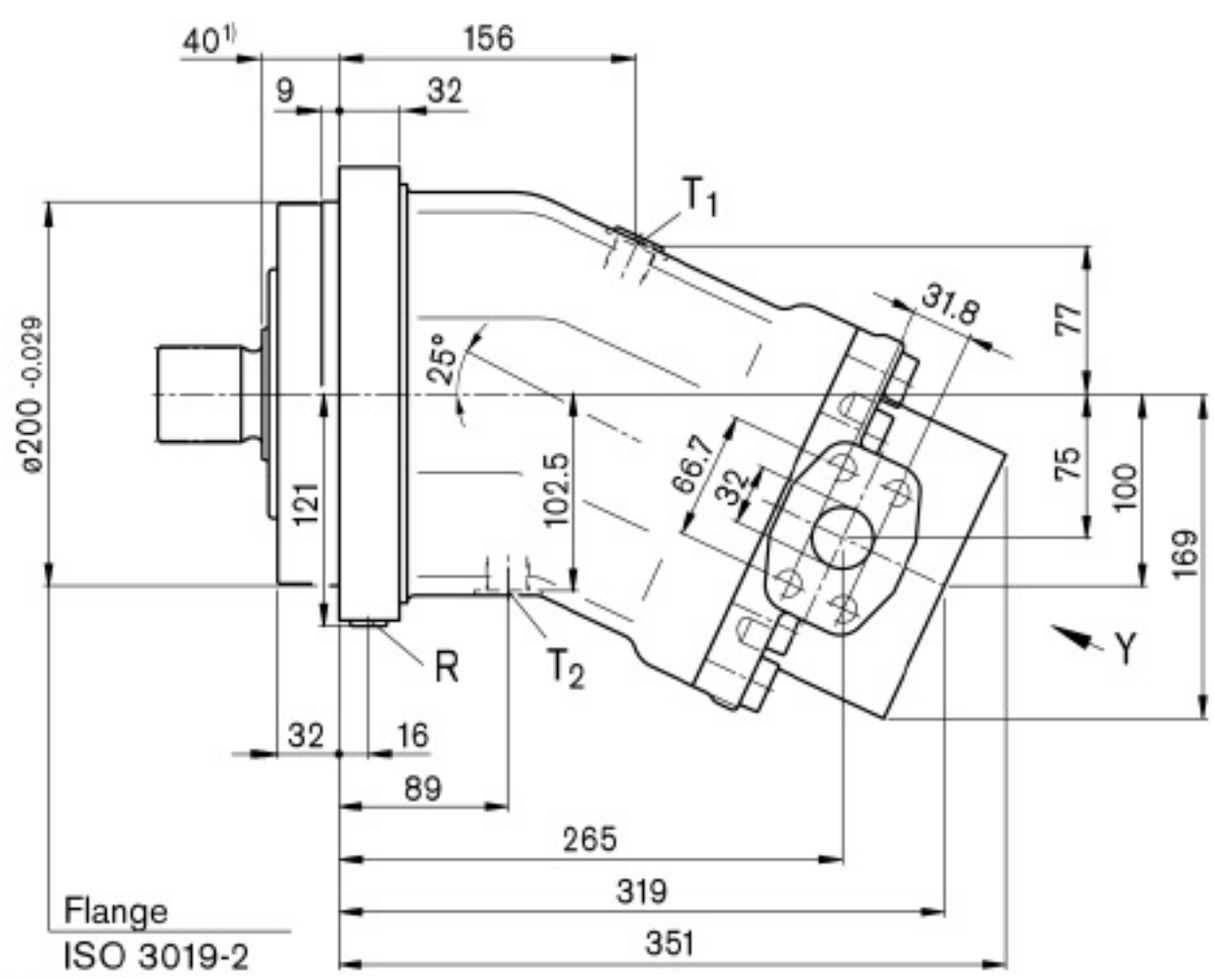
5）只有尺寸依据 SAE J518，公制紧固螺纹偏离标准。

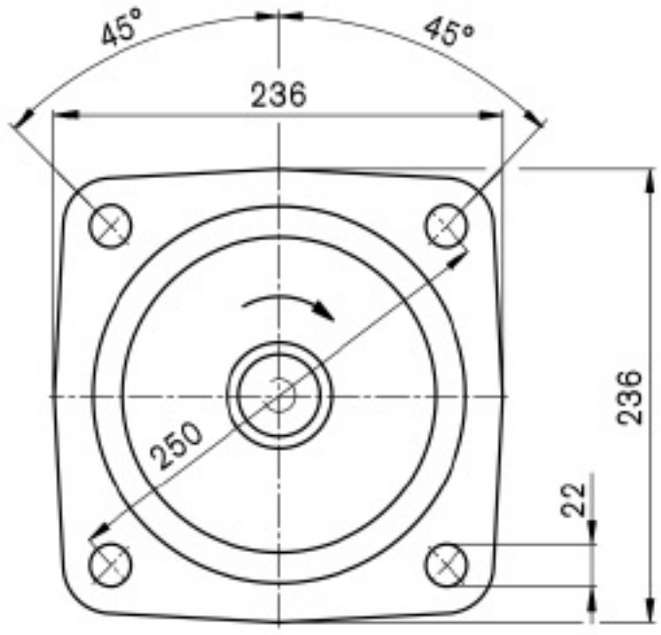
6）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 200

□ 油口接板 05…SAE 法兰油口 A/B 在侧面和 SAE 法兰油口 S 在后部：

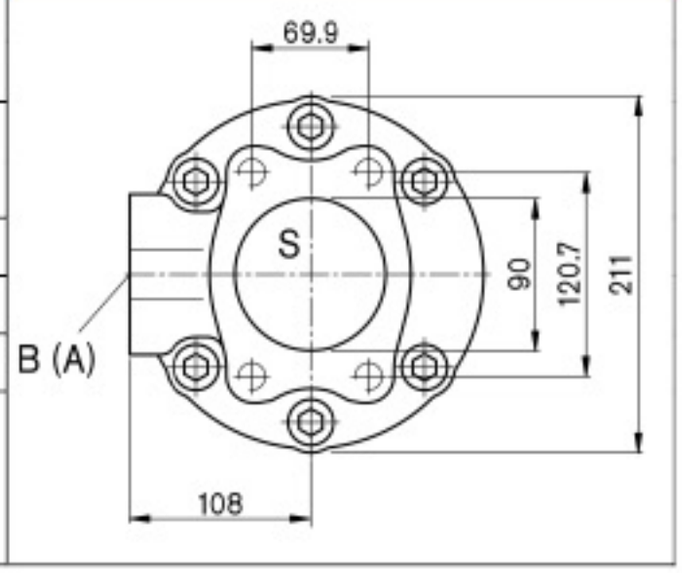
□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：





1）到轴肩

□ 油口尺寸：

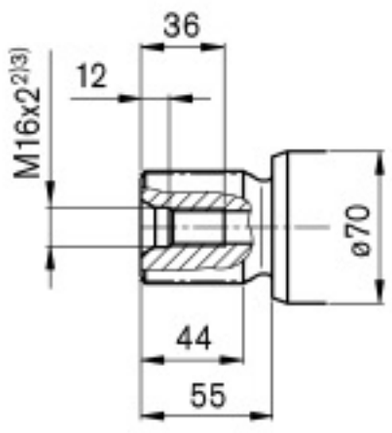
名称	油口用途	标准	规格 [3]	峰值压力 bar [4]	Y 向：油口视图
B（A）	工作油口 固定螺纹 B（A）	SAE J518 [6] DIN13	1-1/4" M14 X 2 深 19	450	
S	吸油油口 固定螺纹	SAE J518 [6] DIN13	3-1/2" M16 X 2 深 24	30	
T_1	泄油口 [5]	DIN 3852 [7]	M22 X 1.5 深 14 （封堵）	3	
T_2	泄油口 [5]	DIN 3852 [7]	M22 X 1.5 深 14	3	
R	排气口	DIN 3852 [7]	M14 X 1.5 深 12 （封堵）	3	

□ 轴端尺寸：

■ 规格 200

A 花键轴 DIN 5480

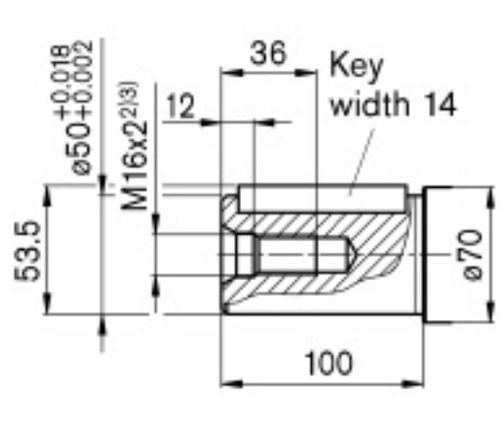
W 50 X 2 X 24 X 9g



■ 规格 200

B 平键直轴 DIN 6885

AS 14 X 9 X 80



2）中心孔符合 DIN 332（螺纹符合 DIN 13）

3）参见最大固定扭矩

4）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

5）根据安装位置，T_1 或 T_2 必须连接管路。

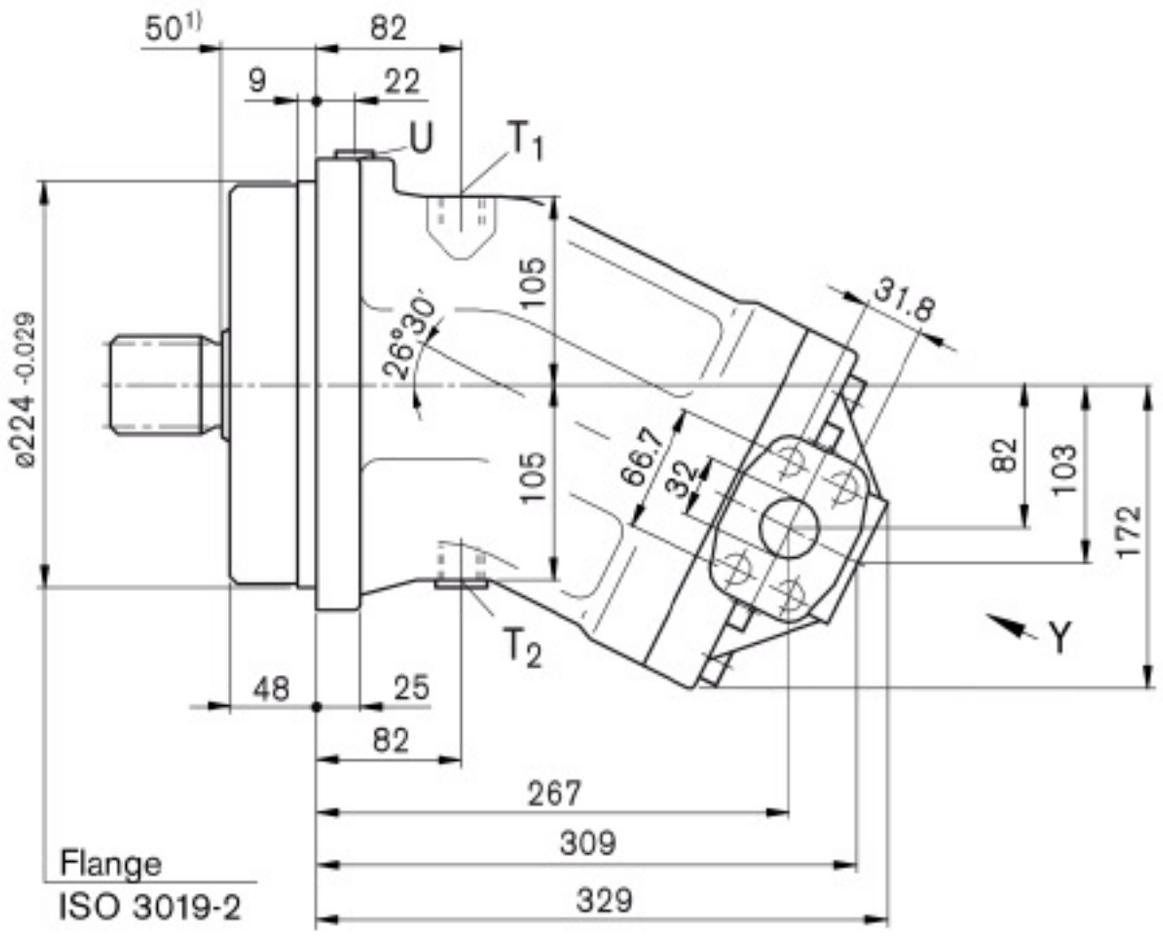
6）只有尺寸依据 SAE J518，公制紧固螺纹偏离标准。

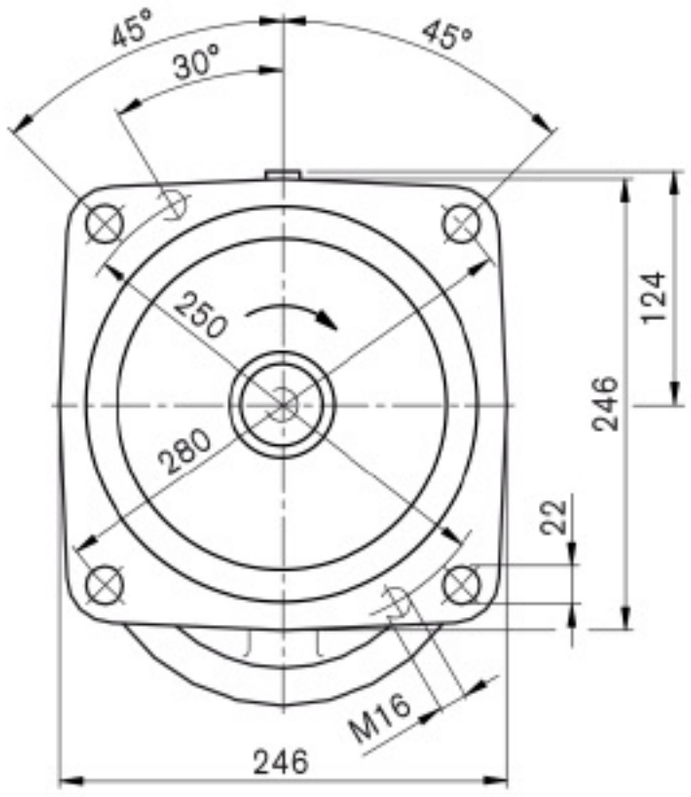
7）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 250

□ 油口接板 05…SAE 法兰油口 A/B 在侧面和 SAE 法兰油口 S 在后部：

□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：

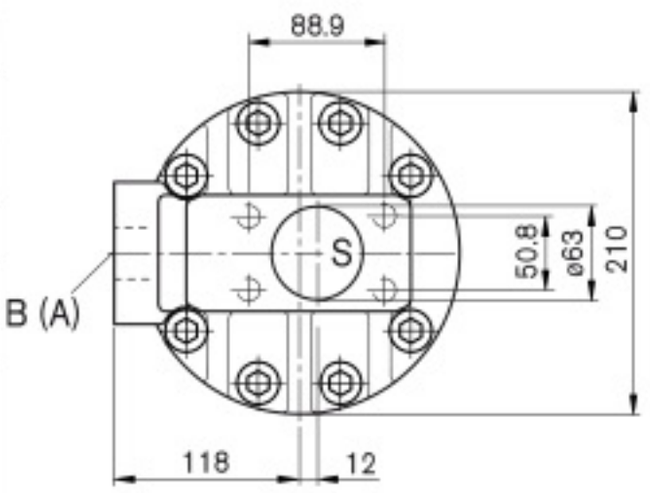




Detail Y

1）到轴肩

□ 油口尺寸：

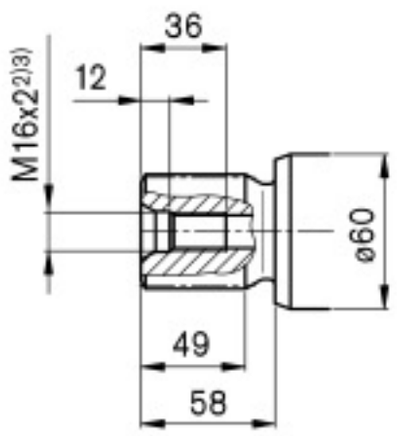
名称	油口用途	标准	规格 [3]	峰值压力 bar [4]	Y 向：油口视图
B（A）	工作油口 固定螺纹 B（A）	SAE J518 [6] DIN13	1-1/4" M14 X 2 深 19	400	
S	吸油油口 固定螺纹	SAE J518 [6] DIN13	2-1/2" M12 X 1.75 深 17	30	
T_1	泄油口 [5]	DIN 3852 [7]	M22 X 1.5 深 14	3	
T_2	泄油口 [5]	DIN 3852 [7]	M22 X 1.5 深 14 （封堵）	3	
U	排气口	DIN 3852 [7]	M14 X 1.5 深 12 （封堵）	3	

□ 轴端尺寸：

■ 规格 250

Z 花键轴 DIN 5480

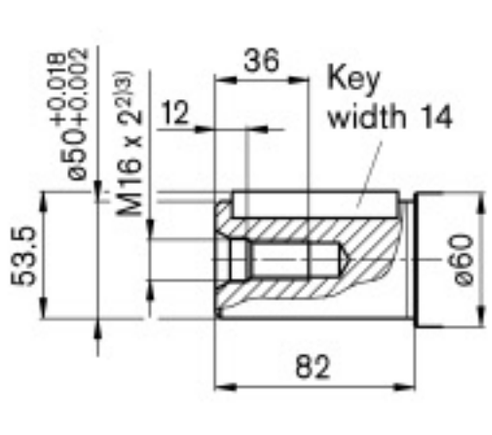
W 50 X 2 X 24 X 9g



■ 规格 250

P 平键直轴 DIN 6885

AS 14 X 9 X 80



2）中心孔符合 DIN 332（螺纹符合 DIN 13）

3）参见最大固定扭矩

4）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

5）根据安装位置，T_1 或 T_2 必须连接管路。

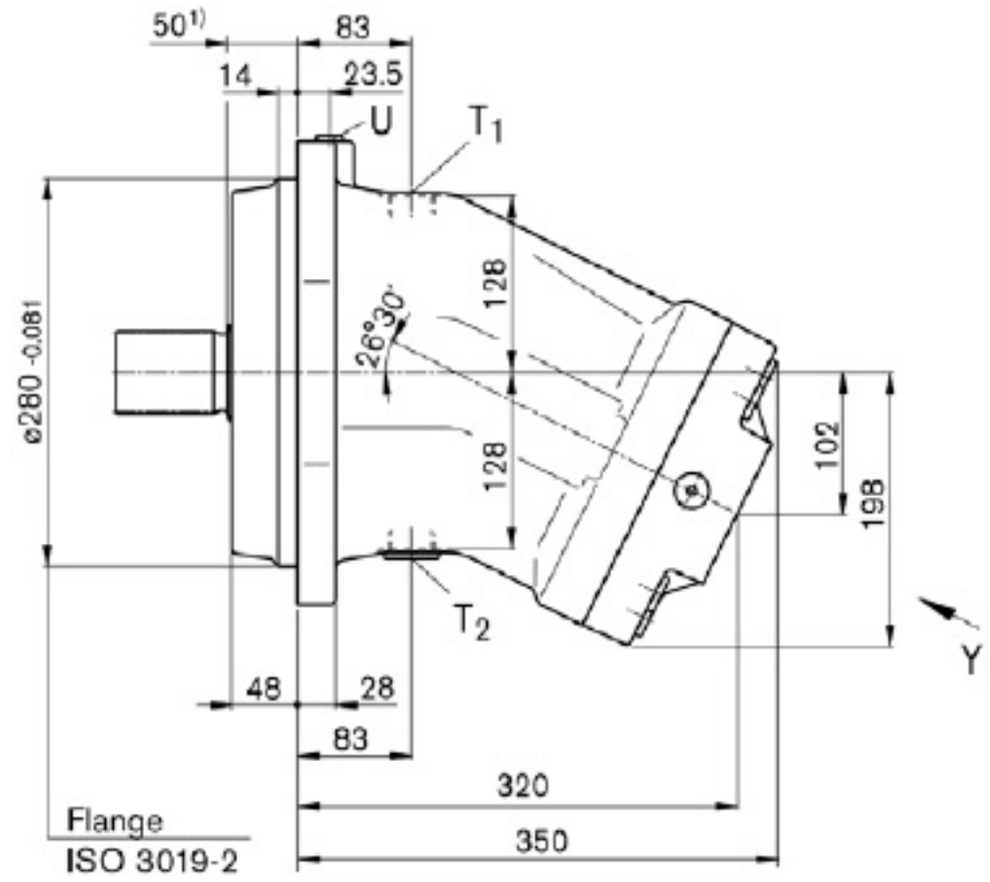
6）只有尺寸依据 SAE J518，公制紧固螺纹偏离标准。

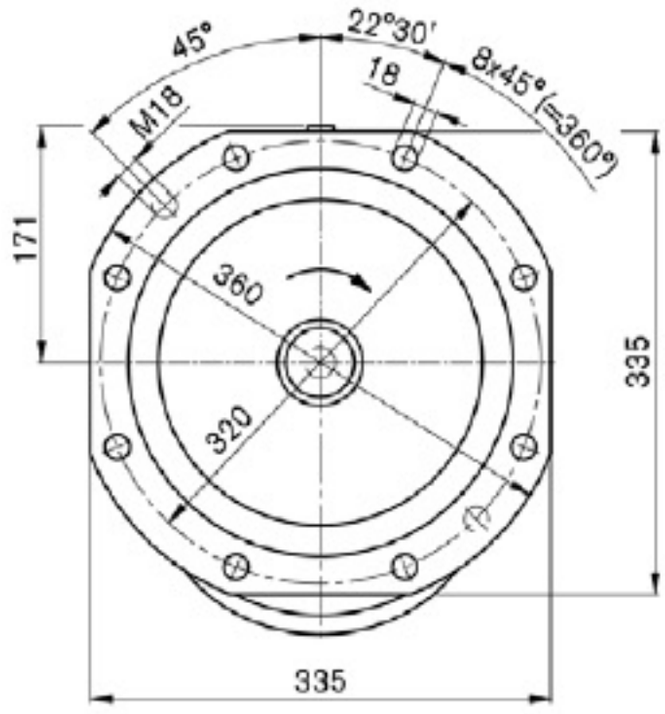
7）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 355

□ 油口接板 11…SAE 法兰油口 A/B 和 S 在后部：

□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：





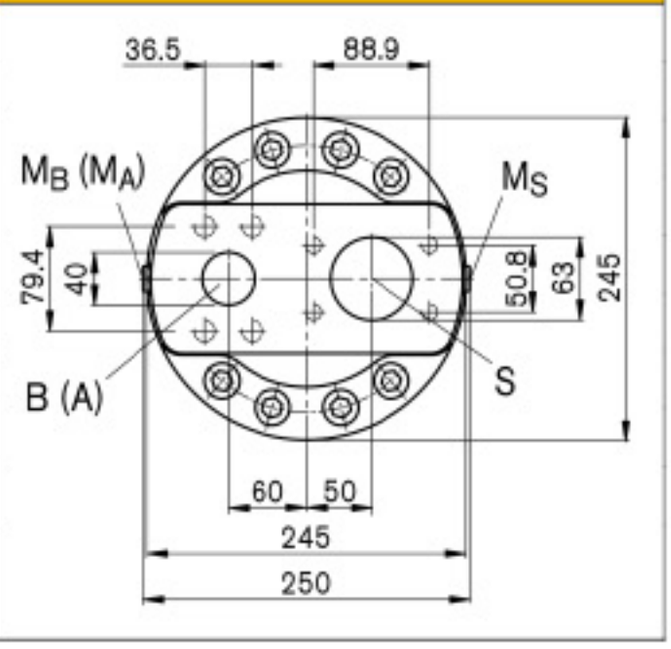
Detail Y

1）到轴肩

□ 油口尺寸：

名称	油口用途	标准	规格 [3]	峰值压力 bar [4]
B（A）	工作油口 固定螺纹 B（A）	SAE J518 [6] DIN13	1-1/2" M16 X 2 深 21	400
S	吸油油口 固定螺纹	SAE J518 [6] DIN13	2-1/2" M12 X 1.75 深 17	30
T_1	泄油口 [5]	DIN 3852 [7]	M33 X 2 深 18	3
T_2	泄油口 [5]	DIN 3852 [7]	M33 X 2 深 18（封堵）	3
U	排气口	DIN 3852 [7]	M14 X 1.5 深 12 （封堵）	3
M_A、M_B	出油口压力检测油口	DIN 3852 [7]	M14 X 1.5 深 12 （封堵）	400
M_S	吸油口压力检测油口	DIN 3852 [7]	M14 X 1.5 深 12 （封堵）	30

Y 向：油口视图

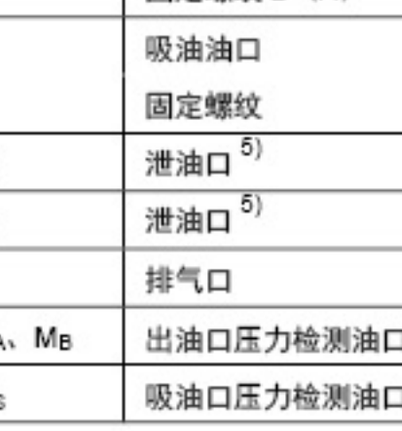


□ 轴端尺寸：

■ 规格 355

A 花键轴 DIN 5480

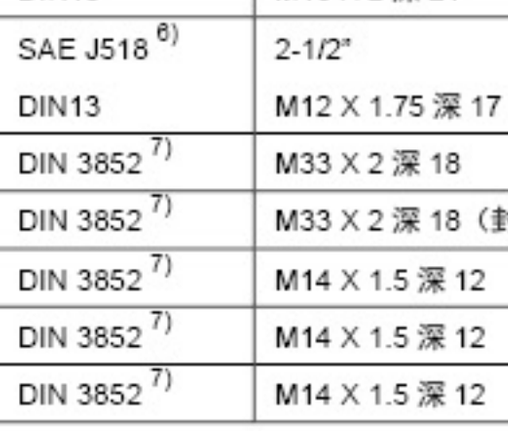
W 60 X 2 X 28 X 9g



■ 规格 355

B 平键直轴 DIN 6885

AS 18 X 11 X 100



2）中心孔符合 DIN 332（螺纹符合 DIN 13）

3）参见最大固定扭矩

4）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

5）根据安装位置，T_1 或 T_2 必须连接管路。

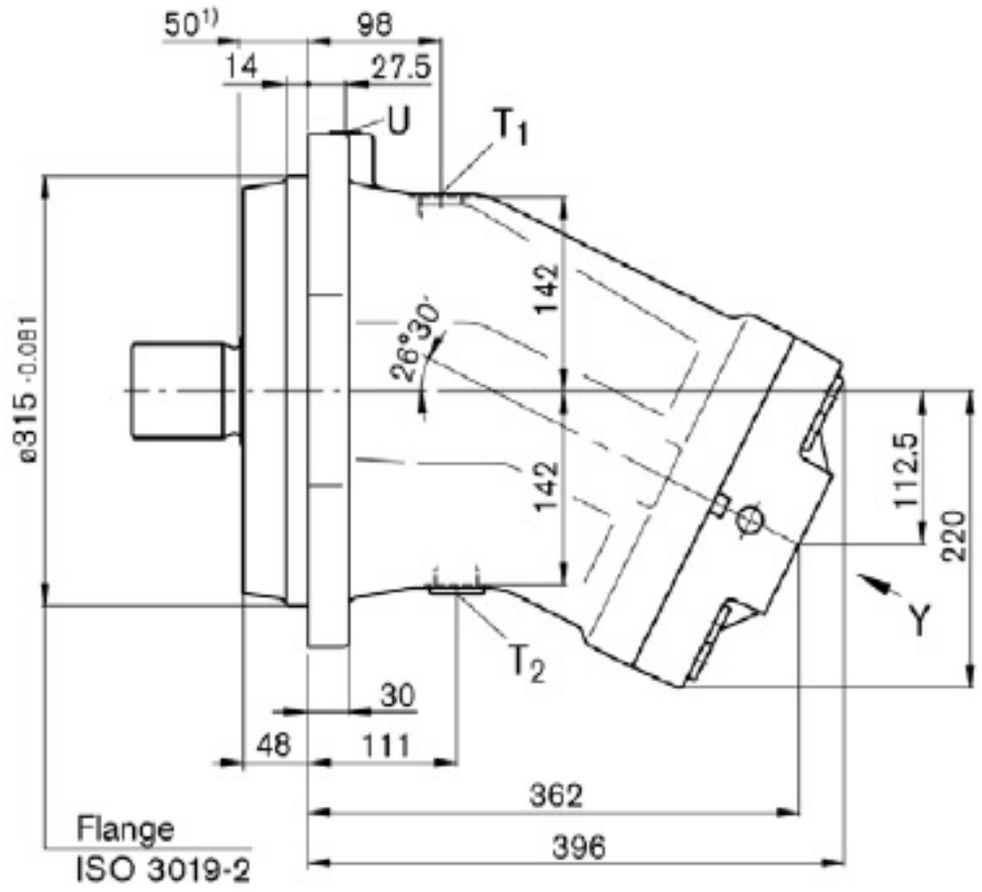
6）只有尺寸依据 SAE J518，公制紧固螺纹偏离标准。

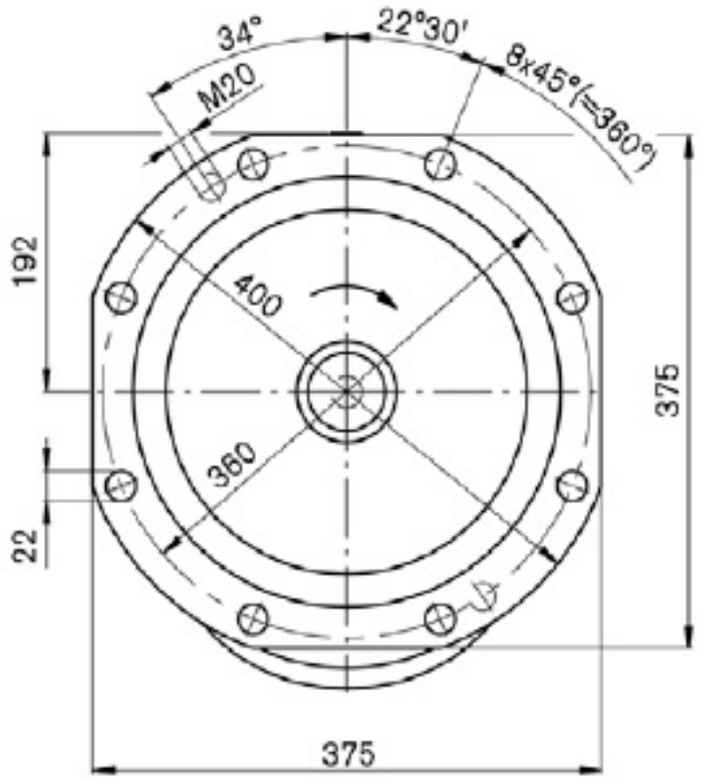
7）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 500

□ 油口接板 11...SAE 法兰油口 A/B 和 S 在后部：

□ 图示：顺时针转动（对逆时针转动，油口接板反转 180°）：

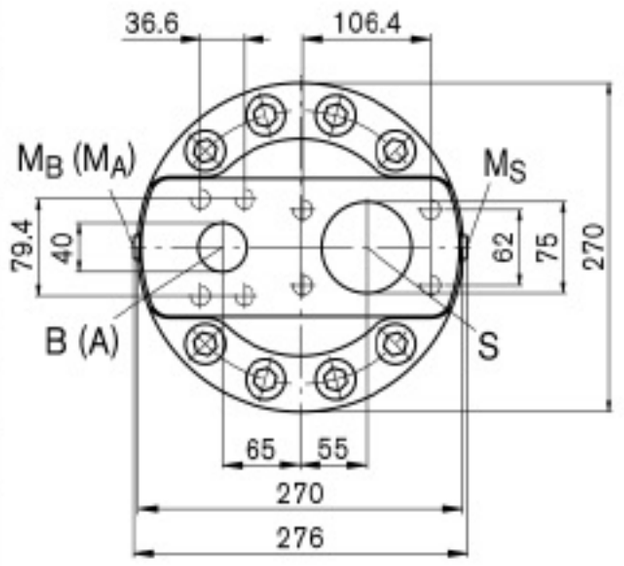




1）到轴肩

□ 油口尺寸：

名称	油口用途	标准	规格 [3]	峰值压力 bar [4]	Y 向：油口视图
B（A）	工作油口 固定螺纹 B（A）	SAE J518 [6] DIN13	1-1/2" M16 X 2 深 21	400	
S	吸油油口 固定螺纹	SAE J518 [6] DIN13	3" M16 X 2 深 24	30	
T_1	泄油口 [5]	DIN 3852 [7]	M33 X 2 深 18	3	
T_2	泄油口 [5]	DIN 3852 [7]	M33 X 2 深 18（封堵）	3	
U	排气口	DIN 3852 [7]	M18 X 1.5 深 12 （封堵）	3	
M_A、M_B	出油口压力检测油口	DIN 3852 [7]	M14 X 1.5 深 12 （封堵）	400	
M_S	吸油口压力检测油口	DIN 3852 [7]	M14 X 1.5 深 12 （封堵）	30	

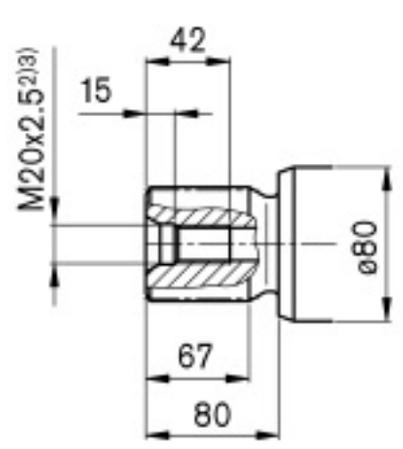


□ 轴端尺寸：

■ 规格 500

Z 花键轴 DIN 5480

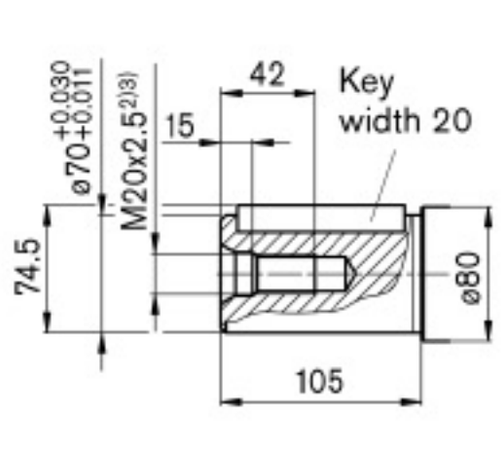
W 70 X 3 X 22 X 9g



■ 规格 500

P 平键直轴 DIN 6885

AS 20 X 12 X 100



2）中心孔符合 DIN 332（螺纹符合 DIN 13）

3）参见最大固定扭矩

4）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑。

5）根据安装位置，T_1 或 T_2 必须连接管路。

6）只有尺寸依据 SAE J518，公制紧固螺纹偏离标准。

7）孔口平面比指定应用标准要深。

■ 泵安装设计指南：

■ 概述说明：

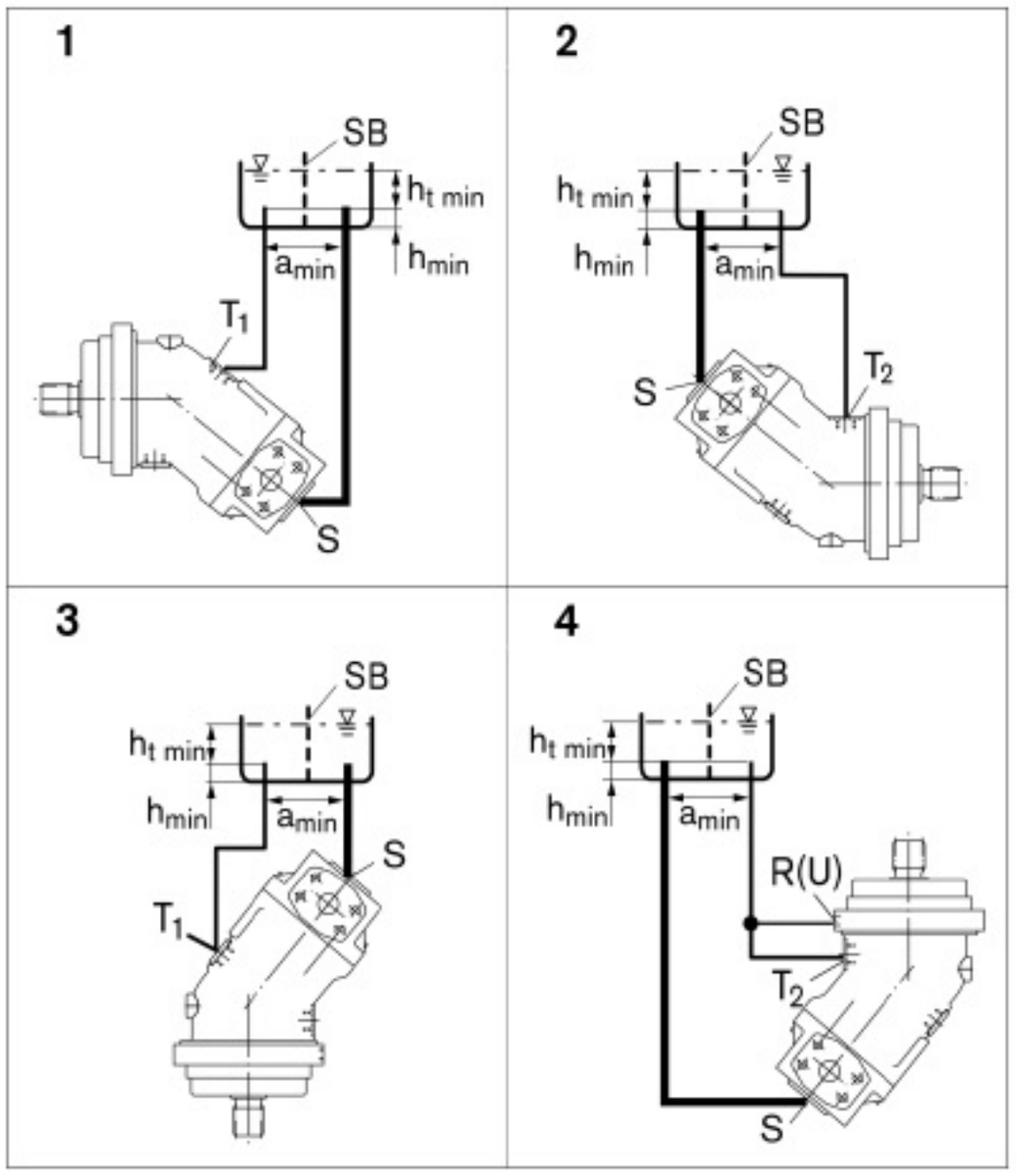
- 在泵初次起动及工作时，泵壳体内部必须充满液压油。起动必须在低速和无负载工况下进行，直至系统中空气全部排完。
- 泵长期停机后，泵壳体的液压油可能通过工作管道泄出。在重新起动时必须保证泵壳体内部充满液压油。
- 对于“传动轴朝上”或“传动轴朝下”的安装位置，必须注意完全地充满液压油和充分放气，否则会造成风险（空运转）。
- 泵壳体中的泄油必须通过壳体上位置最高的一个泄油口（T_1、T_2）排至油箱，管路上不准安装单向阀且管径不得缩小。
- 为了减少噪音，建议所有与油箱连接的管路采用柔性软管连接，隔离噪音；泵尽量避免放置在油箱之上。
- 在所有工况下，吸油管路和壳体泄油管路必须通入油箱中最低油位以下的位置。允许吸油高度 h_s 取决于总压力损失，但不会高于其最大值（$h_{s\,max}$=800 mm）。在运行期间，在吸油口 S 处的吸油压力不得低于 0.8 bar 绝对压力压力。

■ 安装位置：

- 参考实例 1...8 其他安装位置可应要求提供。
- 建议优先安装位置为 1 和 2

■ 在油箱下方安装：

- 泵在油箱外部下方安装，低于油箱最低油位。
- 如果在油箱下部，T / T_1、S 口必须用管路连接，请参考图示。
- 泵初次起动及工作时，通过泵壳体上位置最高的泄油口将泵内部充满液压油。如果泵的安装位置是“主轴朝上”，注油时要到通气口 R 或冲洗油口 U 溢出油液为止。
- 推荐：将吸油管道灌满液压油。
- 吸油管或泄油管在油箱中的淹没深度 $h_{t\,min}$≥200mm。



安装位置	空气排放	注油
1	-	T_1
2	-	T_2
3	-	T_1
4	R（U）	T_2

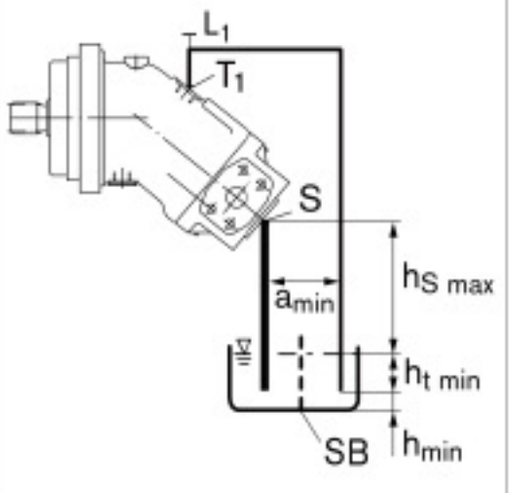
■ 安装在油箱液面之上：

- 泵安装在油箱中油液的最低液位之上
- 和低于油箱液面安装一样操作
- 如果泵长期停机，泵壳体的液压油可能通过工作管道泄出（通过轴密封处空气进入泵壳体），因此在重新起动时轴承润滑不充分。所以在重新起动时必须通过泵壳体上位置最高的一个泄漏口向泵壳体内部灌满液压油。（空气通过 R 或 U 口排除）
- 在安装位置 8 时注意，这种方式安装泵，即使泵壳体不泄漏也会造成轴承润滑不充分。为了防止泵壳体中液压油通过泄漏口漏出，在泄油管中设置一个单向阀（开启压力为 0.5 bar）。
- 允许吸油高程和总的压力损失有关，吸油高度 $h_{s\,max}$≤800mm；吸油管或泄漏油管在油箱中的最小淹没深度 $h_{t\,min}$≥200mm（相对与油箱的最低液面）。如图所示
- 在静态或动态情况下，泵的最低进口压力 $P_{in\,min}$（吸入压力），必须不低于 0.8 bar 绝对压力。
- 如果要求低噪音运行，则应避免将泵置于油箱之上。

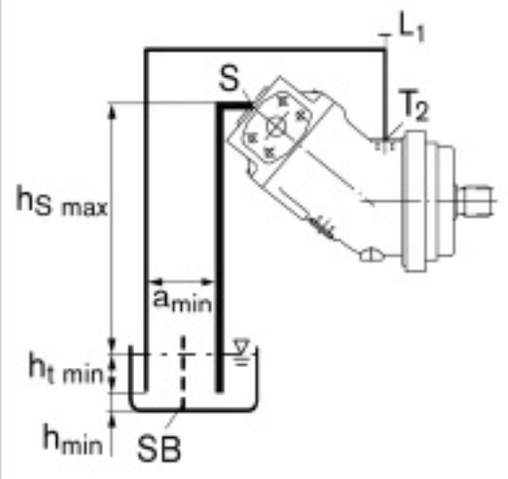
■ 名词解释：

S	吸油口
F	注油/排空
L、L_1	壳体泄油口
SB	隔板 (挡板)
$h_{t\,min}$	所需最低浸没深度 (200 mm)
h_{min}	至油箱底部的所需最短距离 (100 mm)
$h_{ES\,min}$	防止轴向柱塞单元排空所需的最小高度 (25 mm)。
$h_{S\,max}$	最大允许吸油高度 (800 mm)
a_{min}	在设计油箱时，确保吸油管路和壳体泄油管路之间有足够的距离。这可以防止加热的回油流量被直接吸回至吸油管路。

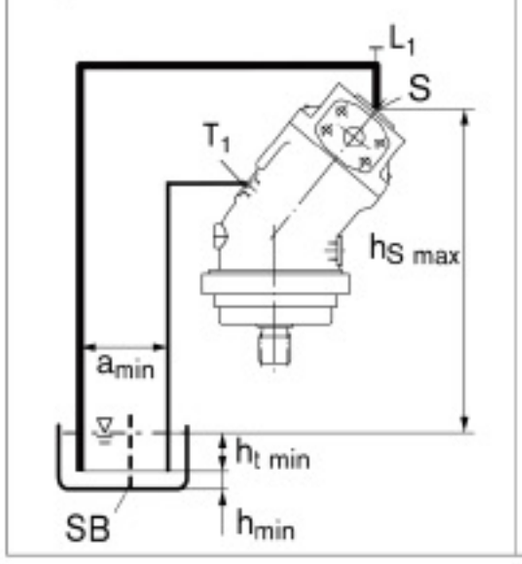
5



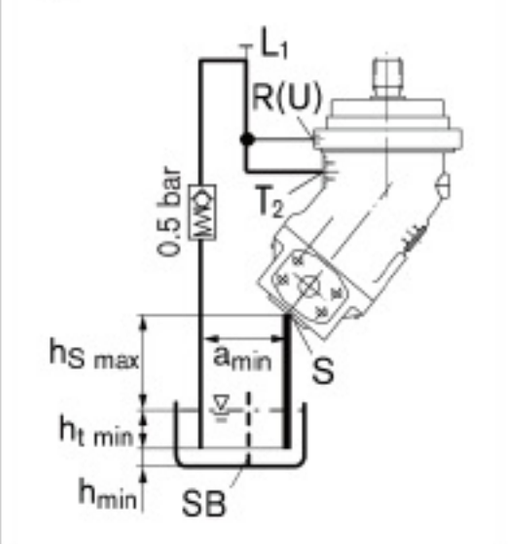
6



7



8



安装位置	空气排放	注油
5	L_1	T_1（L_1）
6	L_1	T_2（L_1）
7	L_1	T_1（L_1）
8	R（U）	T_2（L_1）

■ 常规操作指南：

- HD-A2FO 泵设计用于开式回路中。
- 轴向柱塞泵的项目规划、组装和调试必须由合格人员进行。
- 在使用轴向柱塞单元前，请完整阅读相应的说明手册。如有必要，可以咨询华德液压。
- 运行期间及运行后不久，轴向柱塞泵可能存在造成灼伤的风险。 应采取适当的安全措施（ 例如：穿着防护服)。
- 根据轴向柱塞泵的不同工作条件（ 工作压力、油液温度)，特性可能会改变。
- 工作管路油口：
  - 油口和固定螺纹设计用于最大规定压力。机器或系统制造商必须确保连接元件和管路的安全系数满足规定的工作条件（压力、流量、液压油、温度)。
  - 工作管路油口和功能油口仅设计用于液压管路。
- 必须遵循此处包含的数据和说明。
- 该产品未被认证为满足 DIN EN ISO 13849 的通用机器安全概念要求的部件。
- 在液压系统中安装溢流阀。
- 采用以下紧固扭矩：
- 接头：
  - 有关所使用接头的紧固扭矩，请参见制造商说明。
- 安装螺栓：
  - 对于符合 DIN 13 的 ISO 公制螺纹标准和符合 ASME B1.1 的螺纹标准的安装螺栓，我们建议根据 VDI 2230 单独检查紧固扭矩。
- 轴向柱塞泵的螺纹孔：
  - 最大允许紧固扭矩 $M_{G\,max}$ 对于螺纹孔是最大值，不得超过该值。有关数值请参见下表。
- 锁紧螺钉：
  - 对于与轴向柱塞单元一起提供的金属锁紧螺钉，需要施加紧固扭矩 M_V 有关数值请参见下表。

■ 油口螺纹规格和锁紧螺钉的紧固扭矩：

油口		内螺纹最大允许紧固扭矩	锁紧螺钉所需的紧固扭矩	锁紧螺钉内六角规格
螺纹规格	标准	M_{Gmax}	M_v [1)]	WAF
DIN 3852	M8 x 1	10 Nm	7 Nm	3 mm
	M10 x 1	30 Nm	15 Nm [2)]	5 mm
	M12 x 1.5	50 Nm	25 Nm [2)]	6 mm
	M14 x 1.5	80 Nm	35 Nm	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M33 x 2	540 Nm	225 Nm	17 mm
	M42 x 2	720 Nm	360 Nm	22 mm

1）螺纹的紧固扭矩是针对收货清空状态和轻压油状态安装。
2）在轻压油状态，对 M12×1.5 的 M_v 减少 17Nm

■ 型号说明：

HD	-		A2F		M	56	/	6	1	W	-	V	A	B	010		
0		1	2	3	4	5		6	7	8		9	10	11	12	13	14

0. 制造商：

华德液压 HUADE HYDRAULIC

1. 液压油/类型：

液压油/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
矿物油和 HFD...无代码	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-
HFD 油液对规格 250～500 仅适用驱动轴承为“L”的结构形式																					
规格：5～200...无代码	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	-	-
规格：250～500																					
HFB、HFC 油液对规格 250～500 仅适合驱动轴承为“L”的结构形式																		■	■	■	E

2. 轴向柱塞元件：

元件形式/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
斜轴式结构	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	□	□	□	□	A2F
轴向柱塞定量泵马达																					

3. 驱动轴承：

轴承类别/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
标准轴承....无代码	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-
长寿命轴承	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	■	■	L

4. 工作方式：

工作方式/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
定量马达	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	M

5. 元件规格：

元件排量/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
排量≌ V_{gmax}（cm^3/r）	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	-

6. 结构系列：

结构系列/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
6 系列	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	6

7. 结构标号：

结构标号/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
规格 10～180	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	-	-	1
规格 200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	-	-	-	3
规格 5 和 250～500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	■	■	0

■ 型号说明：

8. 旋转方向：

查看方向/旋转方向：	旋转方向	代码
从轴端看：	双向正反可逆	W

9. 元件密封：

密封类型/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
FKM（氟橡胶）	□	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	V

10. 元件出轴：

出轴类型/规格：		5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
花键轴	I 系列	-	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	-	A
DIN 5480	II 系列	-	■	■	-	■	■	-	■	■	-	■	-	■	-	■	-	-	■	■	■	Z
平键轴	I 系列	■	■	■	■	■	■	■	-	■	■	■	■	■	■	■	■	■	-	-	-	B
DIN 6885	II 系列	-	■	■	-	■	■	-	■	■	-	■	-	■	-	■	-	-	■	■	■	P
圆锥轴 DIN 6888		■	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C

11. 安装法兰：

法兰形式/规格：		5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
ISO 3019-2	4 孔	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-	-	B
	8 孔	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	■	■	H

■ = 优选方案（较短的交货时间）

■ = 可供货

□ = 准备中

- = 无供货

■ 型号说明：

12. 工作油口位置：

*螺纹油口为公制螺纹，法兰安装螺钉为公制螺纹。

油口位置/规格：			5	10-16	23	28-32	45	56-63	80-90	107-125	160-180	200-250	355-500	代码
油口 A 和 B	01	0	-	-	■	■	■	■	■	■	■	■	-	010
SAE 法兰、在后部		7	-	-	■	■	■	■	■	-	-	-	-	017
油口 A 和 B	02	0	-	-	■	■	■	■	■	■	■	-	-	020
SAE 法兰、侧面相对		7	-	-	-	-	■	■	■	■	■	-	-	027
		9												029
油口 A 和 B，螺纹接口、侧面相对	03	0	■	■	■	■	-	-	-	-	-	-	-	030
油口 A 和 B，螺纹接口、侧面后部	04	0	-	■	■	■	■	■	-	-	-	-	-	040
油口 A 和 B，SAE 法兰，同侧面	10	0	-	-	-	■	■	■	■	■	■	-	■	100
后盖带水平溢流阀 BVD	17	1	-	-	-	■	■	■	■	-	-	-	-	171
加装平衡阀		8												178
BVE	18	1	-	-	-	■	■	■	■	■	■	-	-	181
		8												188
后盖插装溢流阀	19	1	-	-	-	■	■	■	■	■	■	-	-	191
		2	-	-	-	■	■	■	■	■	■	-	-	192

配装阀说明：

0	不带阀
1	带插装式溢流阀（无液控先导控制）
2	带插装式溢流阀（带液控先导控制）
7	配装冲洗阀和补油压力阀
8	配装平衡阀 BVD/BVE
9	配装内置式冲洗和补油压力阀

13. 速度传感器：

法兰形式/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
不带传感器...无代码	-	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-
带传感器	-	-	-	-	■	■	■	■	■	■	■	■	■	■	■	■	-	■	■	■	D

14. 特殊结构：

法兰形式/规格：	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	代码
标准型....无代码	□	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	-
特殊结构	-	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	J

■ = 优选方案（较短的交货时间）

■ = 可供货

□ = 准备中

- = 无供货

■ 技术数据：

■ 液压油分类：

□ 适合轴向柱塞泵马达的液压油可分为：

□ 矿物油基液压油

□ 环保型液压油：

- 酯基合成液压油液 HEES
- 乙二醇基合成液压油液 HEPG
- 植物油基液压油液 HETG

□ 阻燃液压油（HF 油液）

代号	油液类型	含水量（重量%）
HFA	包油乳化液	95…98
HFB	包水乳化液	＞40
HFC	基溶液	35…55
HFD	水油液	≤0.1

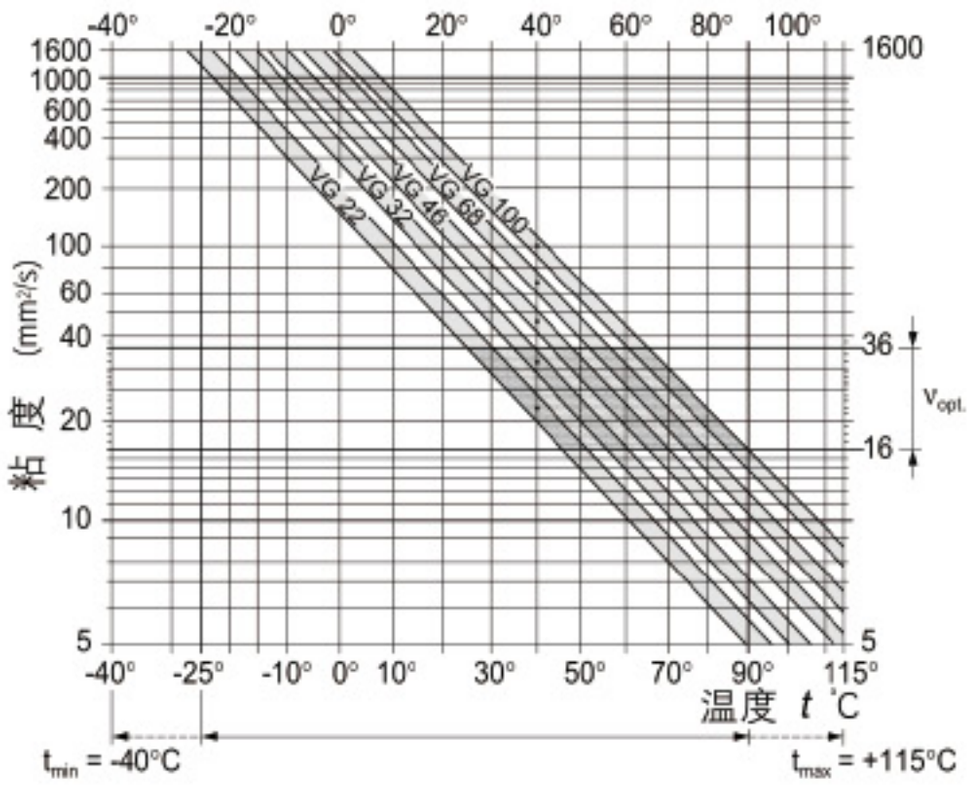
■ 适用液压油：

□ 为了保证无故障的高效工作，在设计选用期间应根据工况仔细选择液压系统的液压油。粘度和粘度/温度曲线相当重要，密度和倾点也必须考虑。

□ 所有矿物油基液压油均在某种程度上适合轴向柱塞马达，应用时基本划分取决于上述的水、粘度与温度关系，并考虑氧化和腐蚀保护、材料相容性、空气和水分离特性。

□ 轴向柱塞泵马达不适合使用水包油乳化液（HFA）；使用油包水乳化液（HFB）、水基溶液（HFC）、无水油液（HFD）或环保型液压油时，要考虑对轴向柱塞泵马达技术数据进行适当的限制或降低。必要时可与华德液压技术部门联系咨询。

■ 液压油选择图：



油液温度范围

■ 液压油选择：

□ 为了正确选择液压油，必须知道与环境温度有关的工作温度：闭式回路中针对回路温度，开式回路中针对油箱温度。

□ 液压油选择：在工作温度范围内工作粘度处于最佳范围 v_{opt} 内，见选择图阴影部分。推荐在每种场合下选择较高粘度等级。

□ 示例：

在 X ℃的环境温度下，回路中工作温度为 60℃，闭式回路中针对回路温度，开式回路中针对油箱温度。在最佳工作温度范围（v_{opt} 阴影部分）内，对应粘度范围等级 VG 46 或 VG68，选择 VG68。

□ 注意状况：

- 泄漏油（壳体泄油）温度受压力和转速的影响，总是高于回路温度或油箱温度。但是回路中任何一点温度都不许超过 115℃（规格 5…200）和 90℃（规格 250…500）.
- 如果遇到极端工作参数或较高的环境温度不能满足上述条件，我们推荐壳体冲洗或采取冲洗阀。进一步请与华德液压技术部门联系。

■ 液压油过滤：

□ 液压油过滤的越干净，液压油达到的清洁度等级越高，轴向柱塞泵马达的寿命就越长。

□ 为了保证元件的正常工作，最低清洁度等级是：

- 按 NAS 1638　9 级
- 按 SAE　6 级
- 按 ISO/DIS 4406　18/15 级

□ 液压油处于高温时（90℃至最高 115℃）最低的清洁度等级是：

- 按 NAS 1638　8 级
- 按 SAE　5 级
- 按 ISO/DIS 4406　17/14 级
- 如果不能达到上述清洁度等级，请与华德液压技术部门联系。

■ 技术数据：

■ 液压油粘度和温度：

内容	粘度 mm^2/s	温度	说明
运输和存储 的环境温度		T_{min} ≥ -50°C T_{opt} = +5°C～+20°C 最佳	保存时间：标准为 12 个月 最长不超过 24 个月
冷启动时	V_{max} = 1600	T_{St} ≥ -40°C	t ≤ 3 min 没有负载（p ≤ 50 bar） n ≤ 1000 rpm 适合规格 5～200 n ≤ 0.25 n_{nom} 适合规格 250～500
允许温差		⊿T ≤ 25 K	在泵和液压油之间
热启动时	V＜1600～400	T = -40°C°C～-25°C	在 p ≤ 0.7＊p_{nom} ，n ≤ 0.5＊n_{nom} 和 t ≤ 15 min
运转状态时 温度差 最高温度		 ⊿T = 约 12 K 115°C 103°C	 在轴承部位和泄油口 T 之间液压油温差 在轴承部位处测量 在泄油口 T 处测量
连续运转	V = 400～10 V_{opt} = 36～16 最佳	T = -25°C～+90°C	在泄油口 T 处测量 在可允许范围内没有限制
短时运转 [2)]	V_{min} ≥ 7	T_{max} = +103°C	在泄油口 T 处测量，t ＜ 3 min，p ＜ 0.3＊p_{nom}
FKM 轴端密封 [1)]		T ≤ +115°C	

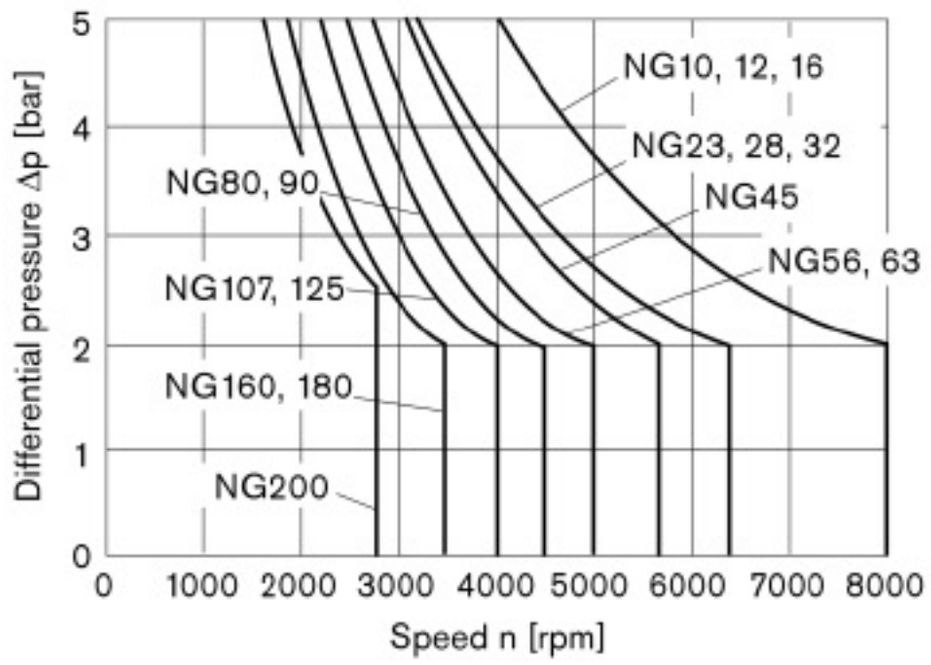
1）在温度低于-25°C，要求采用 NBR（丁腈橡胶）轴密封（允许温度范围-40°C～+90°C）

2）规格 250～500，请向华德液压技术部门咨询。

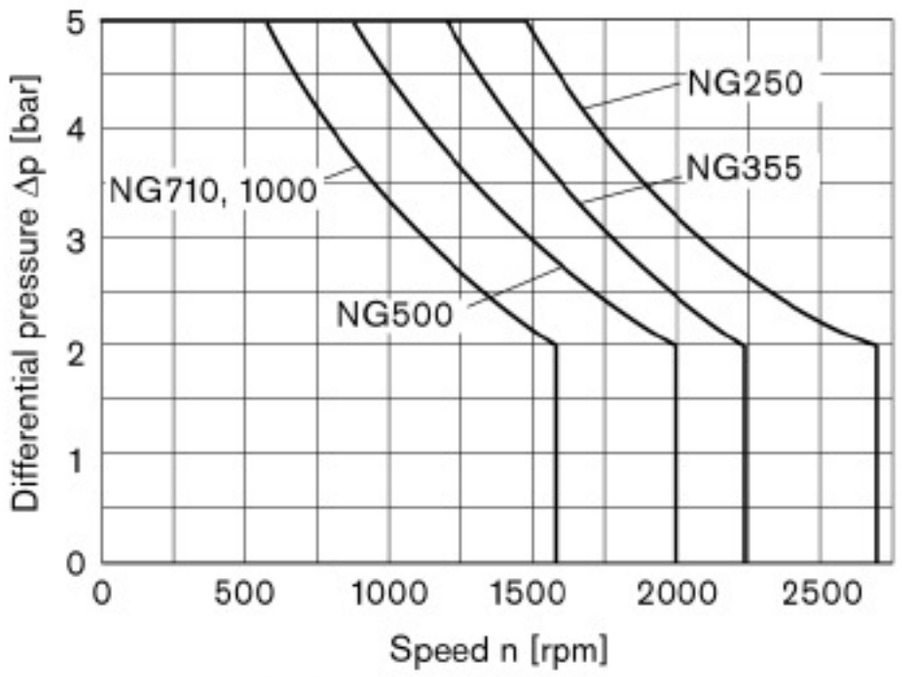
■ 技术数据：

■ 轴端密封

- □ 允许的工作压力
- □ 轴端密封寿命取决于泵的转速和壳体压力（壳压）。在正常的环境温度下，壳体和外界压力之间的 2 bar 的压差是不允许超过的。更高的压差将影响泵的转速，见图示。
- □ 短时壳体压力峰值（t<0.1 秒）允许达到 10 bar，但随着壳体压力峰值的频率增加，轴端密封的寿命将会缩短。
- □ 使用丁腈橡胶（NBR）密封同使用氟橡胶（FKM）密封相比，允许壳体压力减少 33%，在某些工况下可能需要减小这些值
- □ 壳体内的压力必须等于或高于轴密封上的外界压力。
- □ 规格 10...200



- □ 规格 250...500



- □ 表中数值在外界压力 P_{abs} = 1 bar 时有效。

■ 温度范围：

- □ 轴密封为 FKM （氟橡胶）温度范围从-25°C到+115°C，在-25°C以下请使用 NBR（丁腈橡胶）轴密封。
- □ 轴密封为 NBR（丁腈橡胶）温度范围从-40°C到+90°C，规格 250...500 柱塞泵采用特殊结构轴封。

■ 流动方向：

- □ 从驱动轴端看旋转方向

顺时针转动	逆时针转动
A 到 B	B 到 A

■ 转速范围：

- □ 最低转速 n_{min} 没有限制，如需平稳运行，最低转速 n_{min} 不能低于 50 rpm.；最高转速见参数表。

■ 长寿命轴承结构（L）

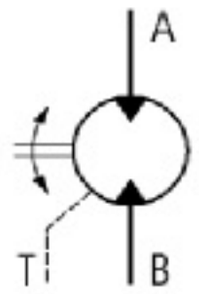
- □ 规格 250...500
- □ 长寿命轴承结构用于延长工作寿命和允许使用阻燃液压油（HF 油液），长寿命轴承结构安装尺寸和标准结构完全相同，相互之间可以随时互换。
- □ 推荐在油口 U 实现轴承冲洗。

■ 轴承冲洗：

- □ 规格 250...500 柱塞泵，可以通过油口 U 实现轴承和壳体冲洗。
- □ 冲洗量（推荐）：

冲洗量/规格	250	355	500
$q_{v\,冲洗量}$（L/min）	10	16	16

■ 液压符号：

油口符号	油口名称	液压原理图
A 、B	工作油口	
T	泄漏油口	

■ 安装方式：

- □ 详见泵安装设计指南

■ 技术数据：

□ 适用于矿物油介质运行

■ 工作压力范围：

□ 工作油口（A 或 B 口）压力：

□ 规格 5

公称压力 P_{nom} ---------- 315 bar（绝对压力）

峰值压力 P_{max} ---------- 350 bar（绝对压力）

单次工作时间 10 s（秒），总工作时间 300 h（小时）

压力总和（$P_A + P_B$）P_{SU} = 630 bar

□ 规格 10～200

公称压力 P_{nom} ---------- 400 bar（绝对压力）

峰值压力 P_{max} ---------- 450 bar（绝对压力）

单次工作时间 10 s（秒），总工作时间 300 h（小时）

压力总和（$P_A + P_B$）P_{SU} = 700 bar

□ 规格 250～500

公称压力 P_{nom} ---------- 350 bar（绝对压力）

峰值压力 P_{max} ---------- 400 bar（绝对压力）

单次工作时间 10 s（秒），总工作时间 300 h（小时）

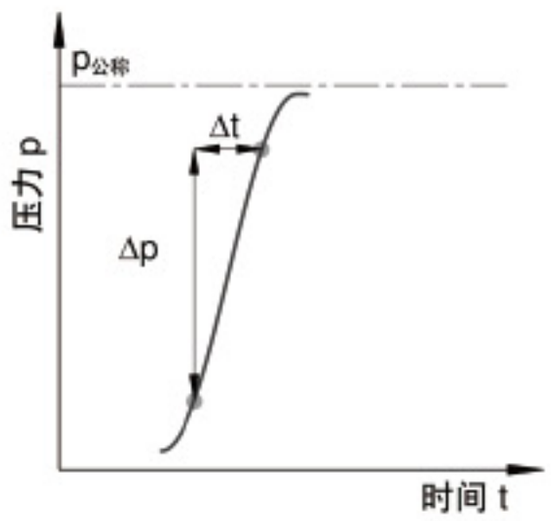
压力总和（$P_A + P_B$）P_{SU} = 700 bar

□ 最小压力（A 或 B 口高压侧）：25 bar（绝对压力）

□ 压力变化率 $R_{A\,max}$：

带内置溢流阀----------9000 bar/s

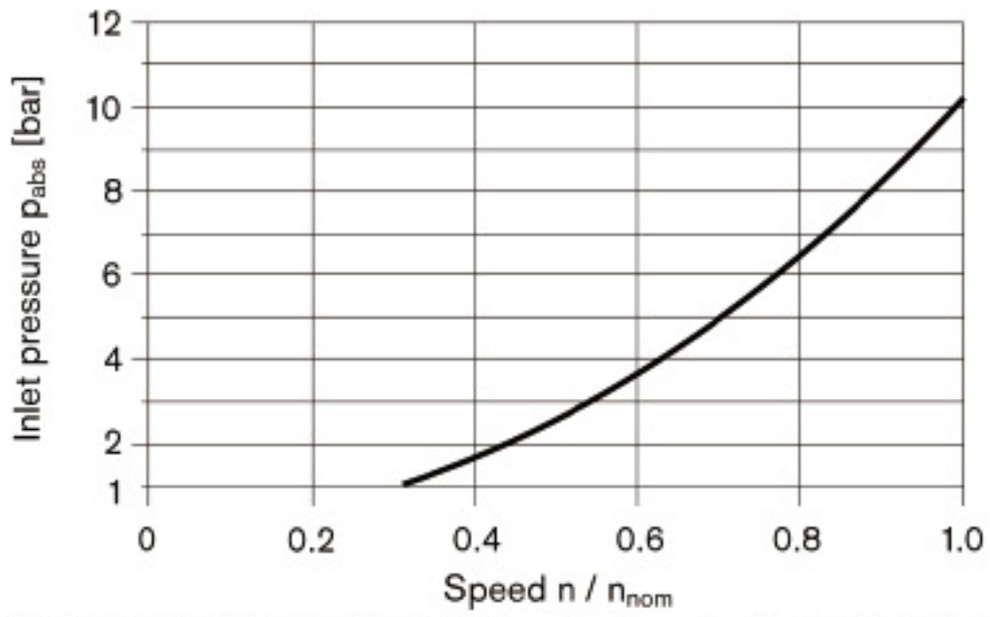
不带溢流阀----------16000 bar/s



□ 其他油液的参数，请向华德液压技术部门咨询。

■ 最小压力---泵模式（吸入油口）：

□ 为了预防损坏泵模式运行的马达(在不改变旋转方向而改变高压侧，相当于刹车)，在工作油口（吸入油口）必须保证为最小压力。最小压力取决于泵的转速。



□ 本图表只适合最佳粘度范围值的油液 V_{opt} = 36～16mm²/s，其他条件的油液请咨询华德液压技术部门。

■ 名词定义：

□ 公称压力 P_{nom}

公称压力与最大设计压力相对应

□ 峰值压力 P_{max}

峰值压力与单次工作时间内的最大工作压力相对应。单次工作时间的总和不得超过总工作时间。

□ 最小压力（高压侧）：

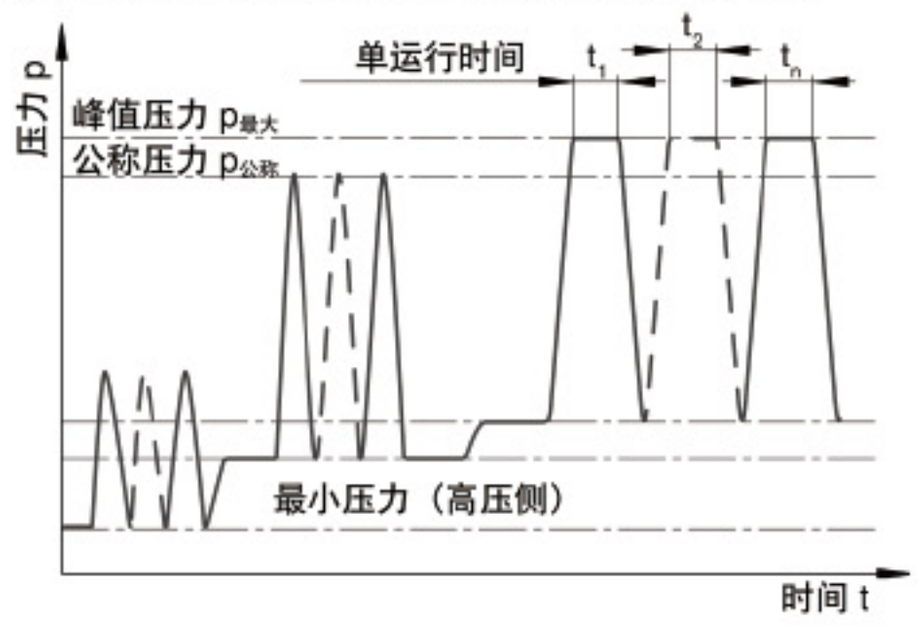
防止损坏轴向柱塞泵所需的高压侧最小压力（油口 A 或 B）。

□ 压力总和 P_{SU}

压力总和是所有工作油口压力之和（油口 A 和 B）

□ 压力变化率 R_A

整个压力范围内压力变化时最大允许增压和减压速度



□ 总工作时间=$t_1 + t_2 + t_3$ ……$+ t_n$

■ 技术数据：

□ 数值表：

理论数值，未考虑 η_{mh} 和 η_v 效率；四舍五入值

技术数据/规格		代号	单位	5	10	12	16	23	28	32	45	56	63	80
几何排量	每转的排量	V_g	cm^3	4.93	10.3	12	16	22.9	28.1	32	45.6	56.1	63	80.4
最大转速 1)	转速	n_{nom}	rpm	10000	8000	8000	8000	6300	6300	6300	5600	5000	5000	4500
		n_{max} 2)	rpm	11000	8800	8800	8800	6900	6900	6900	6200	5500	5500	5000
进口流量 3)	在 n_{nom} 和 V_g 时	q_v	L/min	49	82	96	128	144	177	202	255	281	315	362
扭矩 4)	⊿p=350 bar	T	Nm	24.7 5)	57	67	89	128	157	178	254	313	351	448
在 V_g 和	⊿p=400 bar	T	Nm	-	66	76	102	146	179	204	290	357	401	512
旋转刚度		c	kNm/rod	0.63	0.92	1.25	1.59	2.56	2.93	3.12	4.18	5.94	6.25	8.73
旋转总成转动惯量		J_{GR}	Kgm^2	0.00006	0.0004	0.0004	0.0004	0.0012	0.0012	0.0012	0.0024	0.0042	0.0042	0.0072
最大角速度		α	rad/s^2	5000	5000	5000	5000	6500	6500	6500	14600	7500	7500	6000
加注容量		V	L	0.17	0.17	0.17	0.17	0.20	0.20	0.20	0.33	0.45	0.45	0.55
重量	近似值	m	Kg	2.5	6	6	6	9.5	9.5	9.5	13.5	18	18	23

技术数据/规格		代号	单位	90	107	125	160	180	200	250	355	500		
几何排量	每转的排量	V_g	cm^3	90	106.7	125	160.4	180	200	250	355	500		
最大转速 1)	转速	n_{nom}	rpm	4500	4000	4000	3600	3600	2750	2700	2240	2000		
		n_{max} 2)	rpm	5000	4400	4400	4000	4000	3000	-	-	-		
进口流量 3)	在 n_{nom} 和 V_g 时	q_v	L/min	405	427	500	577	648	550	675	795	1000		
扭矩 4)	⊿p=350 bar	T	Nm	501	594	696	893	1003	1114	1393	1978	2785		
在 V_g 和	⊿p=400 bar	T	Nm	573	679	796	1021	1146	1273	-	-	-		
旋转刚度		c	kNm/rod	9.14	11.2	11.9	17.4	18.2	57.3	73.1	96.1	144		
旋转总成转动惯量		J_{GR}	Kgm^2	0.0072	0.0116	0.0116	0.0220	0.0220	0.0353	0.061	0.102	0.178		
最大角加速度		α	rad/s^2	6000	4500	4500	3500	3500	11000	10000	8300	5500		
加注容量		V	L	0.55	0.8	0.8	1.1	1.1	2.7	2.5	3.5	4.2		
重量	近似值	m	Kg	23	32	32	45	45	66	73	110	155		

□ 说明：

1) 数值适用于：
- 进油口 S 处的入口压力 P_{abs} 为 1 bar 时；
- 最佳工作粘度范围 V_{opt} = 16～36 mm^2/s
- 用于矿物油基液压油

2) 间歇状态的最高转速：在卸载过程和超载过程中的超转速，t＜5 秒和⊿p＜150 bar。
3) 用平衡阀限制进口流量，见后面资料。
4) 不带径向力扭矩，带径向力见后面资料。
5) 在⊿p=315 bar 时扭矩

□ 注意事项：

- 超过最大允许值或低于最小允许值可能导致功能消失、使用寿命缩短或泵完全损坏。
- 其他允许的极限值，包括限制转速变化，减小角加速度的频率功能和允许启动的角加速度（低于最大角加速度），请在数据表中查找。

■ 技术数据：

■ 驱动轴参数：

□ 驱动轴允许有轴向和径向力负载

□ 适用花键轴和平键轴

技术数据/规格	代号	单位	5	5[3]	10	10	12	12	16	23	23	28	28
驱动轴 [1]	Φ	mm	12	12	20	25	20	25	25	25	30	25	30
最大径向力	$F_{q\,max}$	KN	1.6	1.6	3.0	3.2	3.0	3.2	3.2	5.7	5.4	5.7	5.4
在距离 a 时	a	mm	12	12	16	16	16	16	16	16	16	16	16
从轴肩起													
允许扭矩	T_{max}	Nm	24.7	24.7	66	66	76	76	102	146	146	179	179
允许压力 ⊿p	Δp_{perm}	Bar	315	315	400	400	400	400	400	400	400	400	400
最大轴向力 [2]	$+F_{ax\,max}$	N	180	180	320	320	320	320	320	500	500	500	500
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0	0	0
每 bar 工作压力允许的轴向力	$\pm F_{ax\,max/bar}$	N/bar	1.5	1.5	3.0	3.0	3.0	3.0	3.0	5.2	5.2	5.2	5.2

技术数据/规格	代号	单位	32	45	56	56[4]	56	63	80	80[4]	80	90	
驱动轴 [1]	Φ	mm	30	30	30	30	35	35	35	35	40	40	
最大径向力	$F_{q\,max}$	KN	5.4	7.6	9.5	7.8	9.1	9.1	11.6	11.1	11.4	11.4	
在距离 a 时	a	mm	16	18	18	18	18	18	20	20	20	20	
从轴肩起													
允许扭矩	T_{max}	Nm	204	290	357	294	357	401	512	488	512	573	
允许压力 ⊿p	Δp_{perm}	Bar	400	400	400	330	400	400	400	280	400	400	
最大轴向力 [2]	$+F_{ax\,max}$	N	500	630	800	800	800	800	1000	1000	1000	1000	
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0	0	
每 bar 工作压力允许的轴向力	$\pm F_{ax\,max/bar}$	N/bar	5.2	7.0	8.7	8.7	8.7	8.7	10.6	10.6	10.6	10.6	

技术数据/规格	代号	单位	107	107	125	160	160	180	200	250	355	500	
驱动轴 [1]	Φ	mm	40	45	45	45	50	50	50	50	60	70	
最大径向力	$F_{q\,max}$	KN	13.6	14.1	14.1	18.1	18.3	18.3	20.3	1.2[6]	1.5[6]	1.9[6]	
在距离 a 时	a	mm	20	20	20	25	25	25	25	41	52.5	52.5	
从轴肩起													
允许扭矩	T_{max}	Nm	679	679	796	1021	1021	1146	1273	-[5]	-[5]	-[5]	
允许压力 ⊿p	Δp_{perm}	Bar	400	400	400	400	400	400	400	-[5]	-[5]	-[5]	
最大轴向力 [2]	$+F_{ax\ max}$	N	1250	1250	1250	1600	1600	1600	1600	2000	2500		
	$-F_{ax\ max}$	N	0	0	0	0	0	0	0	0	0	0	
每 bar 工作压力允许的轴向力	$\pm F_{ax\,max/bar}$	N/bar	12.9	12.9	12.9	16.7	16.7	16.7	16.7	-[5]	-[5]	-[5]	

1) 在间歇工作时

2) 间歇或泵无压力工作时最大允许轴向力

3) 圆锥柱轴 DIN 6888，带螺纹轴头和半圆键

4) 适用花键轴

5) 待开发，请联系华德。

6) 在间歇或泵无压力工作时，若出现较高轴向力时，请联系华德。

□ 注意：

注意允许轴向力的作用方向的影响：

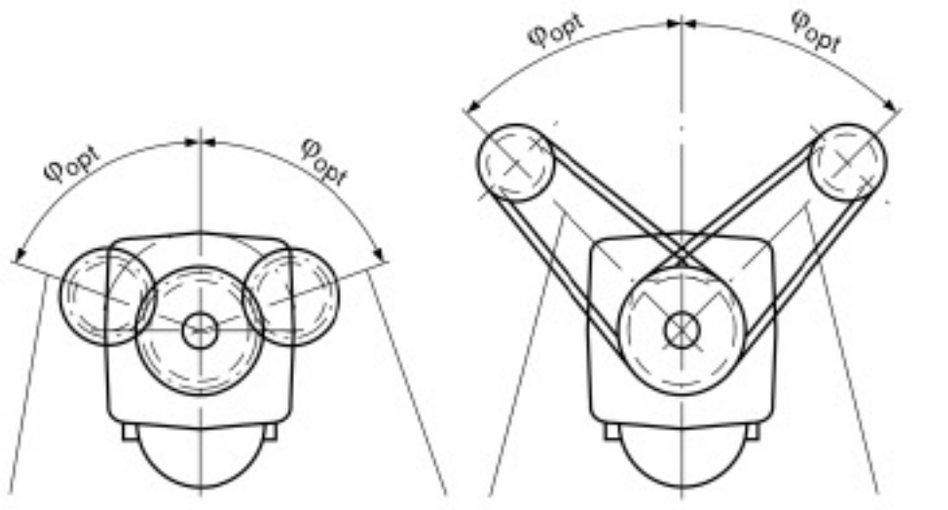
$+F_{ax\ max}$ = 增加轴承寿命

$-F_{ax\ max}$ = 降低轴承寿命（尽量避免）

■ 技术数据：

- □ Fq 最佳轴向作用力方向
- □ 选择适合的 F_q 轴向作用力方向可减少内驱动力对轴承产生的负荷，从而延长轴承寿命。

	齿轮传动	V-皮带传动
规格	Ψ_{opt}	Ψ_{opt}
5～180	±70°	±45°
200～500	±45°	±70°



顺时针转动　　逆时针转动　　顺时针转动

油口 B 压力　　油口 A 压力　　油口 B 压力

■ 规格计算：

排量　$q_V = \frac{V_g \cdot n}{1000 \cdot \eta_v}$　L/min

输出转速　$n = \frac{q_V \cdot 1000 \cdot \eta_v}{V_g}$　min^{-1}

输出扭矩　$T = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi}$

$= \frac{1{,}59 \cdot V_g \cdot \Delta p \cdot \eta_{mh}}{100}$　Nm

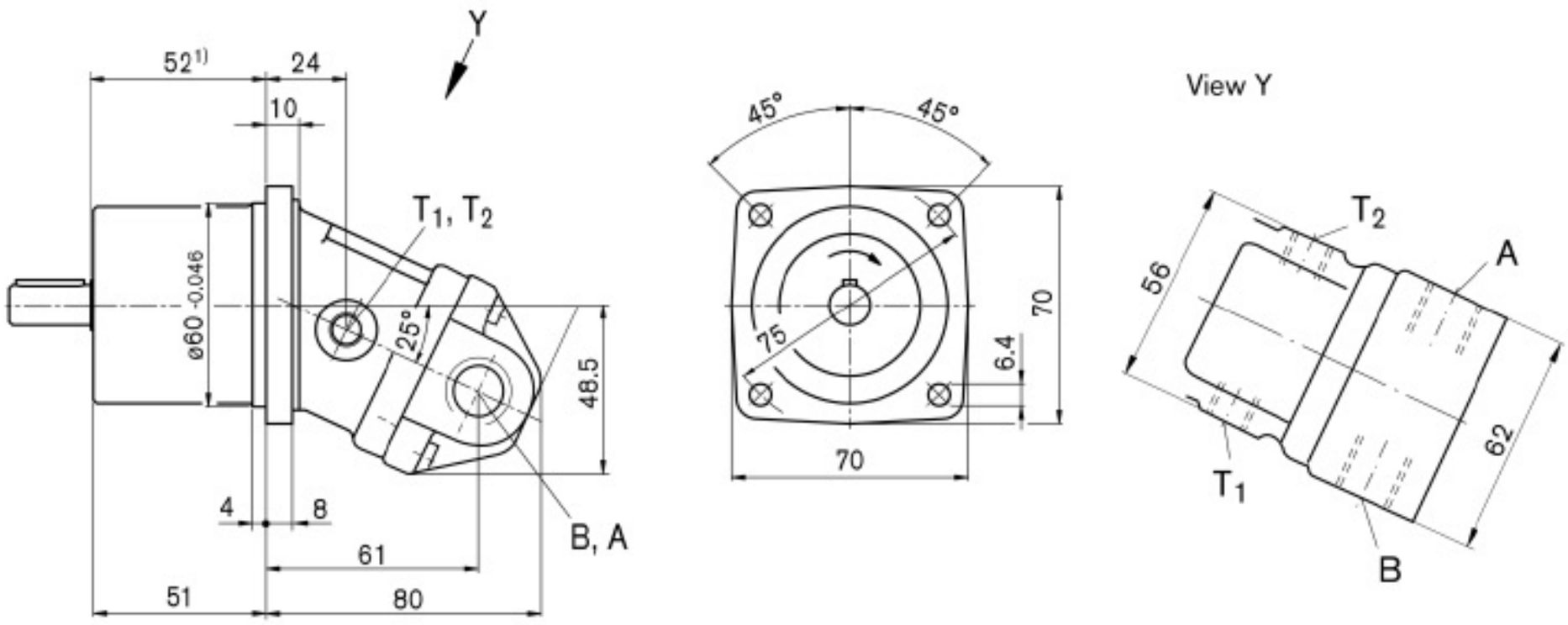
或 $T = T_K \cdot \Delta p \cdot \eta_{mh}$　Nm

输出功率　$P = \frac{2\pi \cdot T \cdot n}{60\,000} = \frac{T \cdot n}{9549}$

$= \frac{q_V \cdot \Delta p}{600} \cdot \eta_t$　kW

V_g = 每转体积排量
T = 扭矩
Δp = 压差
n = 转速
T_K = 扭矩常量
η_v = 容积效率
η_{mh} = 机械－液压效率
η_t = 总效率

■ 元件尺寸（mm）：规格 5



1）到轴肩

□ 油口尺寸：

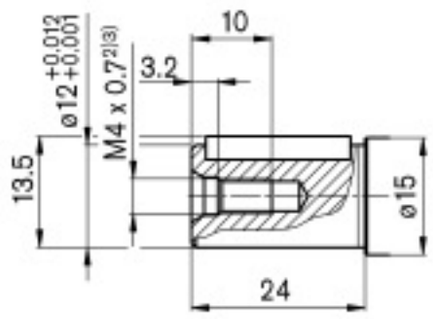
名称	油口用途	标准 [6]	规格 [3]	峰值压力 bar [4]
A、B	工作油口	DIN 3852	M18 X 1.5 深 12	350
T_1	泄油口 [4]	DIN 3852	M10 X 1 深 8	3
T_2	泄油口 [4]	DIN 3852	M10 X 1 深 8	3

□ 轴端尺寸：

■ 规格 5

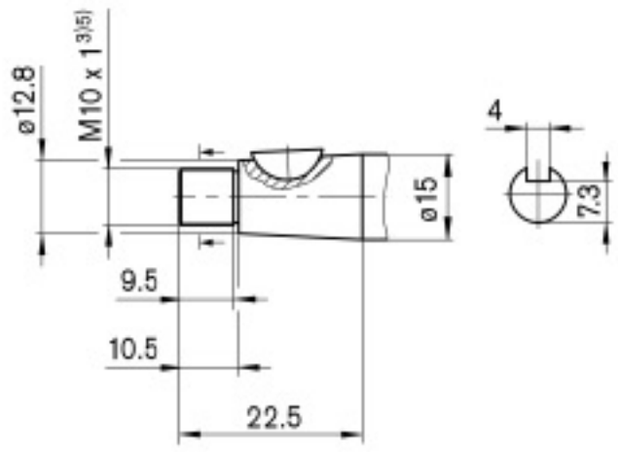
B 平键直轴 DIN 6885

A 4 X 4 X 20



C 圆锥柱轴 DIN 6888

带螺纹轴头和半圆键 3 X 5 锥度 1:10



2）中心孔符合 DIN 332（螺纹符合 DIN 13）

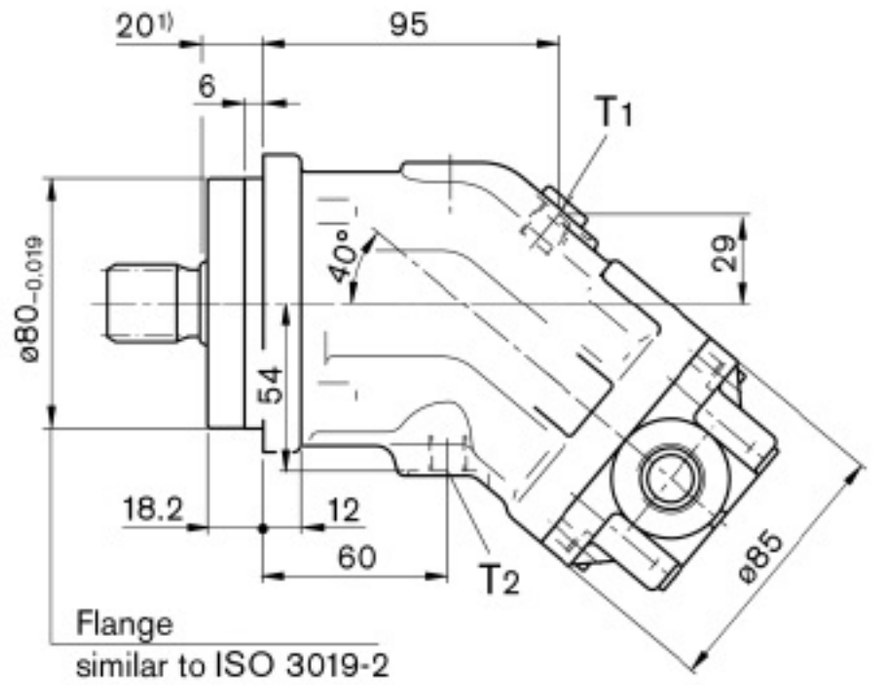
3）参见最大固定扭矩

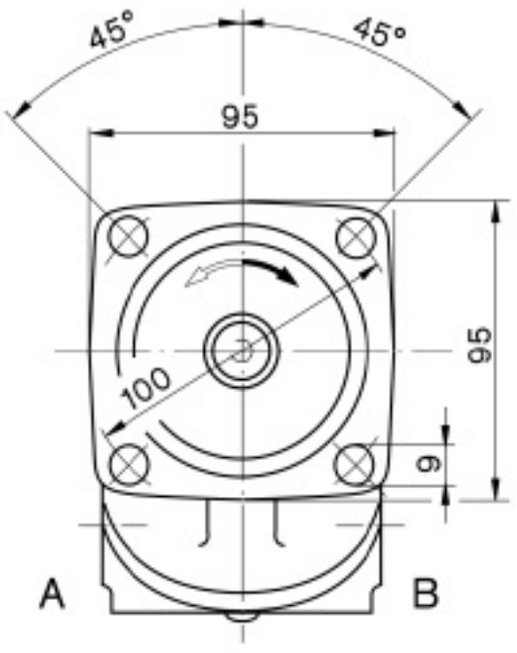
4）根据应用情况，可能会出现瞬时压力峰值，选择测量设备和接头时应考虑

5）螺纹依据 DIN 3852，最大固定扭矩：30 Nm。

6）孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 10、12、16



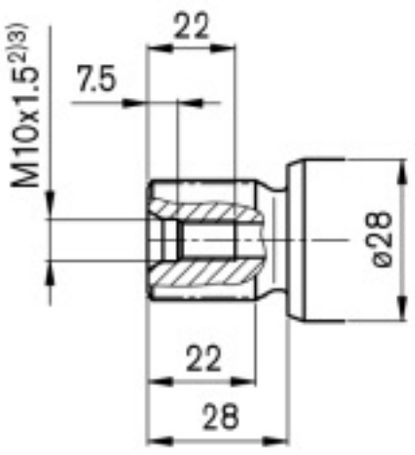


□ 轴端尺寸：

■ 规格 10、12、16

A 花键轴 DIN 5480

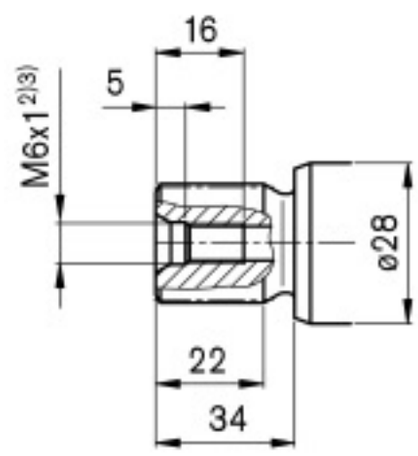
W 25 X 1.25 X 18 X 9g



■ 规格 10、12

Z 花键轴 DIN 5480

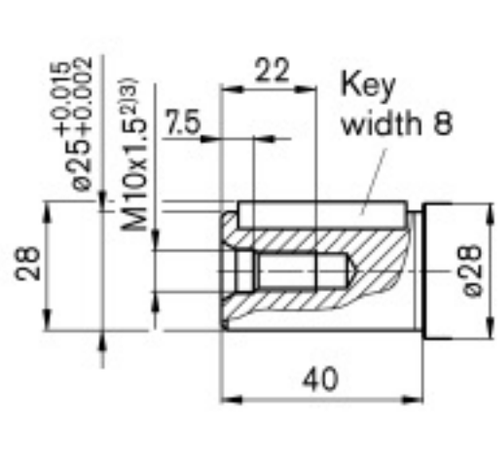
W 20 X 1.25 X 14 X 9g



■ 规格 10、12、16

B 平键直轴 DIN 6885

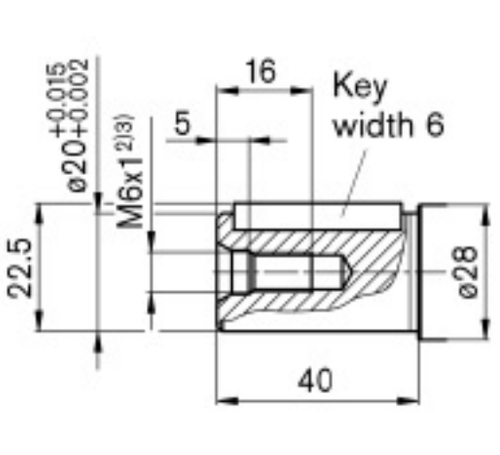
AS 8 X 7 X 32



■ 规格 10、12

P 平键直轴 DIN 6885

AS 6 X 6 X 32



□ 油口尺寸：

名称	油口用途	标准 [6]	规格 [3]	峰值压力 bar [4]
A、B	工作油口		详见油口接板	450
T_1	泄油口 [5]	DIN 3852	M12 X 1.5 深 8 （封闭）	3
T_2	泄油口 [5]	DIN 3852	M12 X 1.5 深 8	3

1) 到轴肩

2) 中心孔依照 DIN 332（螺纹依照 DIN 13）

3) 最大坚固扭矩参照通用标准

4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

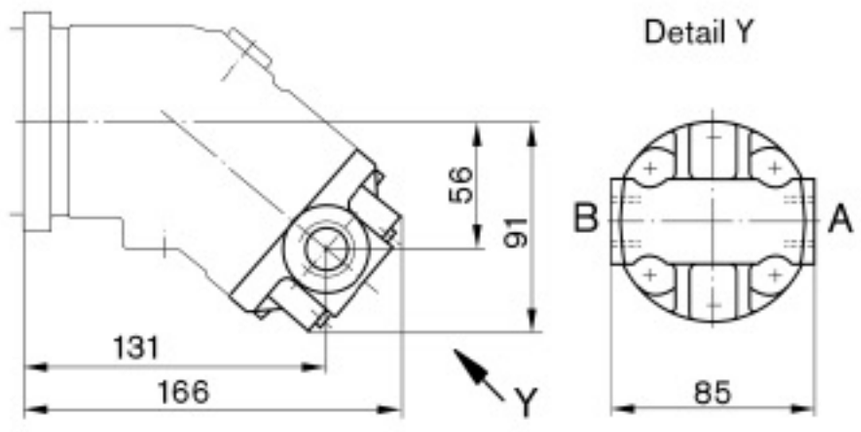
5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6) 孔口平面比指定应用标准要深。

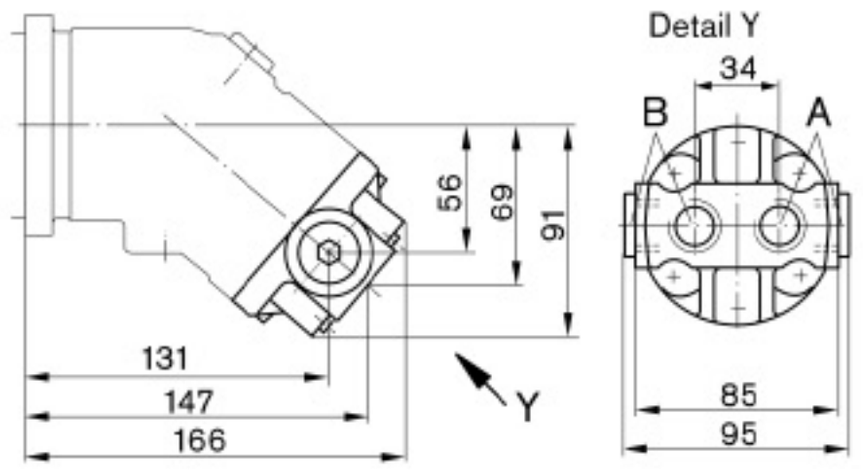
■ 元件尺寸（mm）：规格 10、12、16

□ 油口接板：

■ 油口代码 03：螺纹油口，在侧面，相对。



■ 油口代码 04：螺纹油口，在侧面和后面

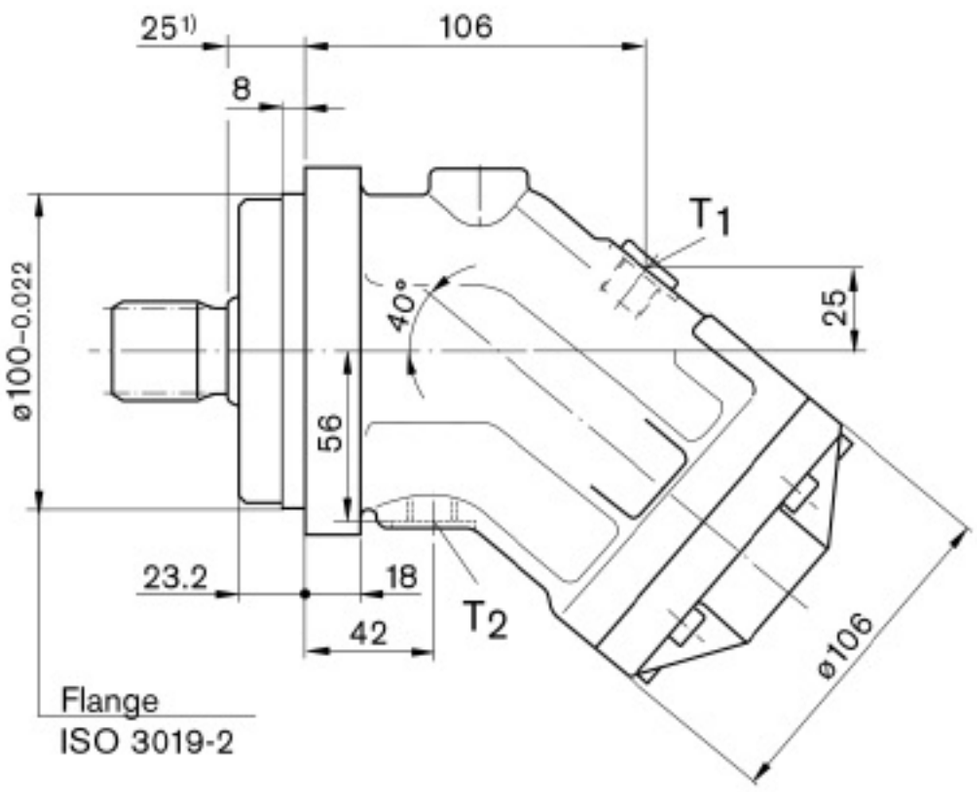


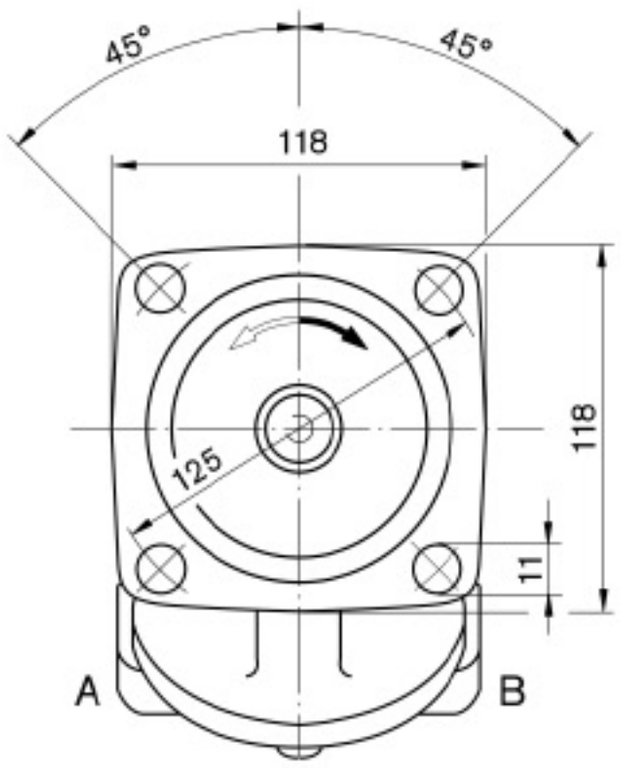
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]	名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口	DIN 3852	M22 X 1.5 深 14	450	A、B	工作油口	DIN 3852	M22 X 1.5 深 14	450

1）最大坚固扭矩参照通用标准

2）峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

■ 元件尺寸（mm）：规格 23、28、32



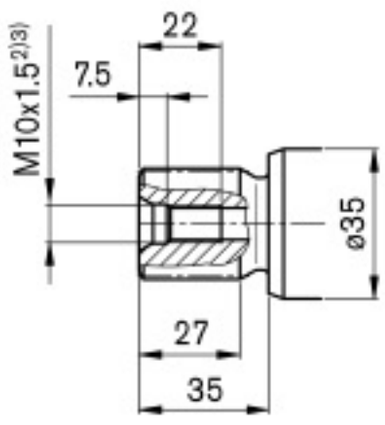


□ 轴端尺寸：

■ 规格 23、28、32

A 花键轴 DIN 5480

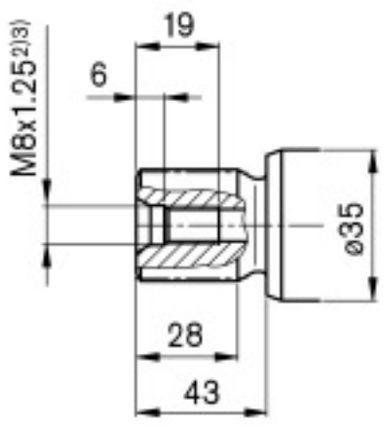
W 30 X 2 X 14 X 9g



■ 规格 23、28

Z 花键轴 DIN 5480

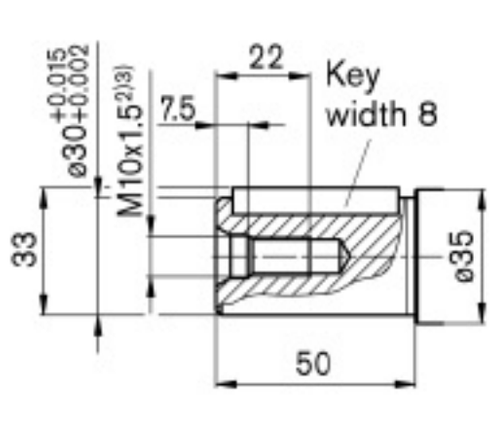
W 25X 1.25 X 18 X 9g



■ 规格 23、28、32

B 平键直轴 DIN 6885

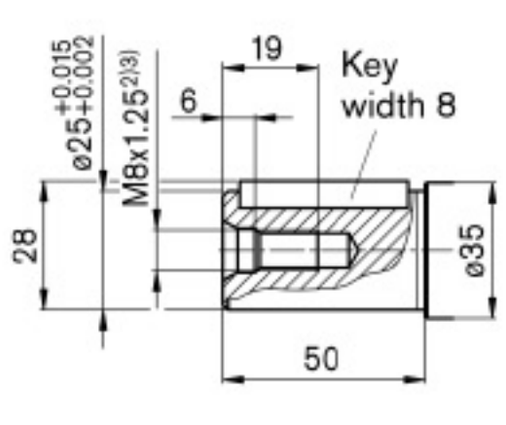
AS 8 X 7 X 40



■ 规格 23、28

P 平键直轴 DIN 6885

AS 8 X 7 X 40



□ 油口尺寸：

名称	油口用途	标准 [6]	规格 [3]	峰值压力 bar[4]
A、B	工作油口		详见油口接板	450
T_1	泄油口 [5]	DIN 3852	M16 X 1.5 深 12（封闭）	3
T_2	泄油口 [5]	DIN 3852	M16 X 1.5 深 12	3

1) 到轴肩

2) 中心孔依照 DIN 332（螺纹依照 DIN 13）

3) 最大坚固扭矩参照通用标准

4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

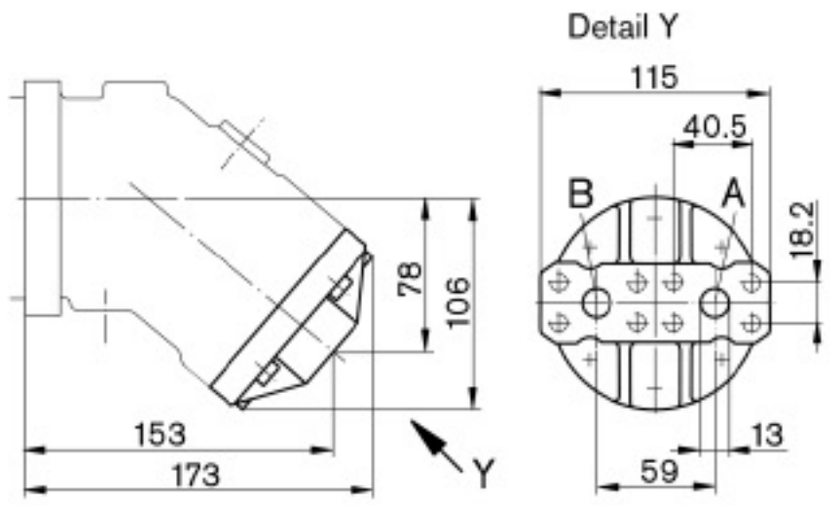
5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6) 孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 23、28、32

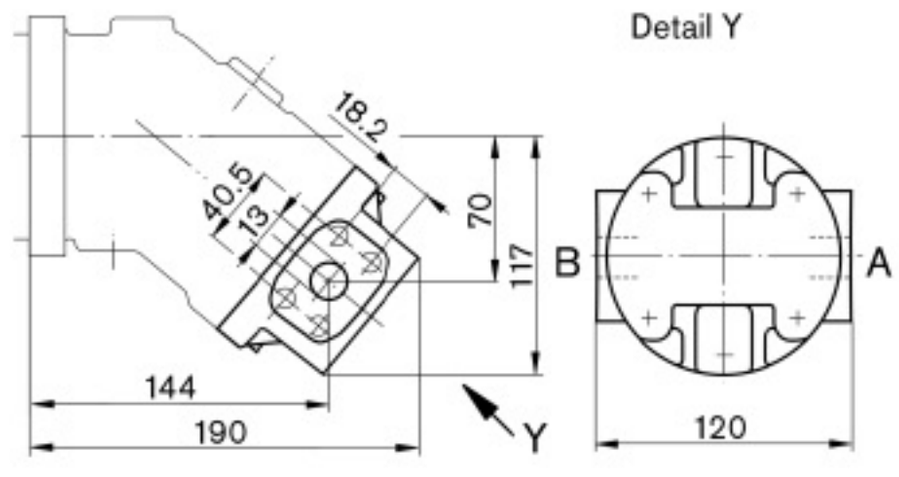
□ 油口接板：

■ 油口代码 01：SAE 法兰，在后部。



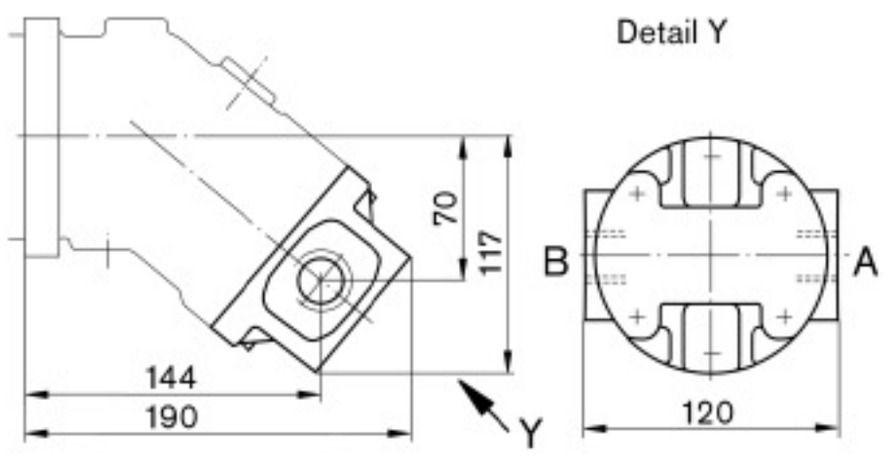
名称	油口用途	标准	规格 [1]	峰值压力 bar [2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1/2" M8 X 1.25 深 14	450

■ 油口代码 02：SAE 法兰，在侧面，相对。



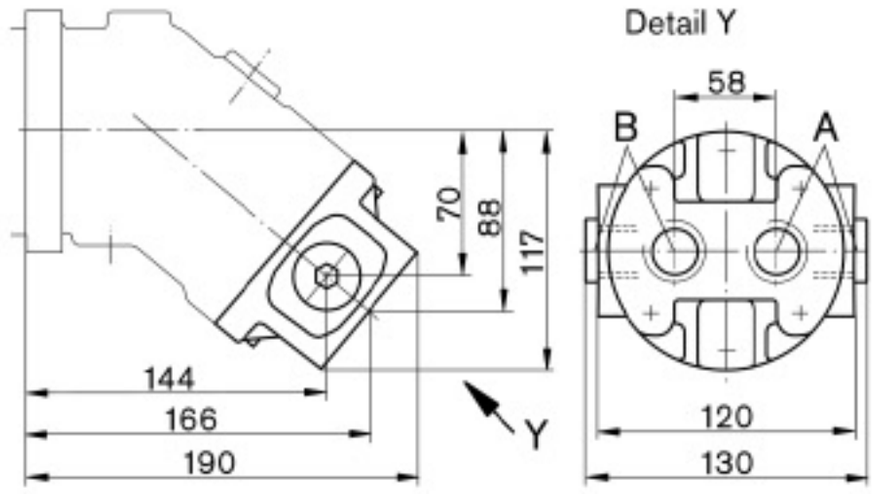
名称	油口用途	标准	规格 [1]	峰值压力 bar [2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1/2" M8 X 1.25 深 14	450

■ 油口代码 03：螺纹油口，在侧面，相对。



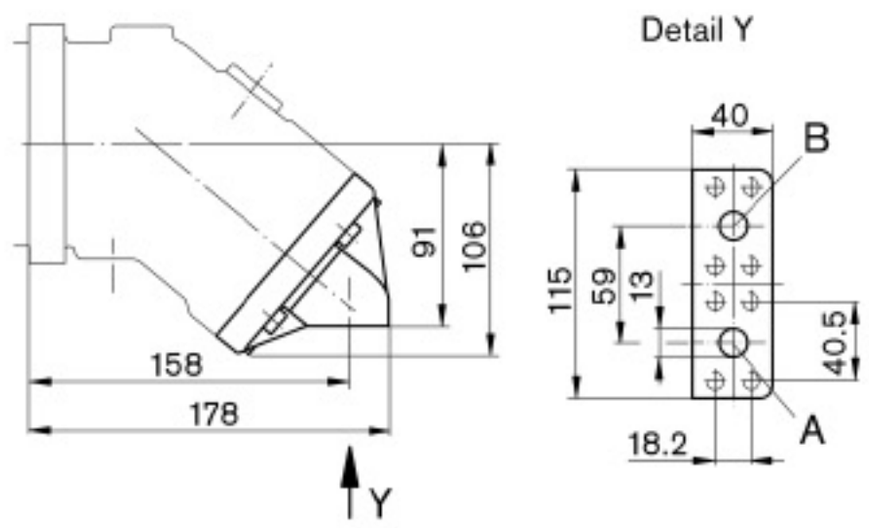
名称	油口用途	标准	规格 [1]	峰值压力 bar [2]
A、B	工作油口	DIN 3852	M27 X 2 深 16	450

■ 油口代码 04：螺纹油口，在侧面和后部



名称	油口用途	标准	规格 [1]	峰值压力 bar [2]
A、B	工作油口	DIN 3852	M27 X 2 深 16	450

■ 油口代码 10：SAE 法兰，在底部，同一侧 [3]。



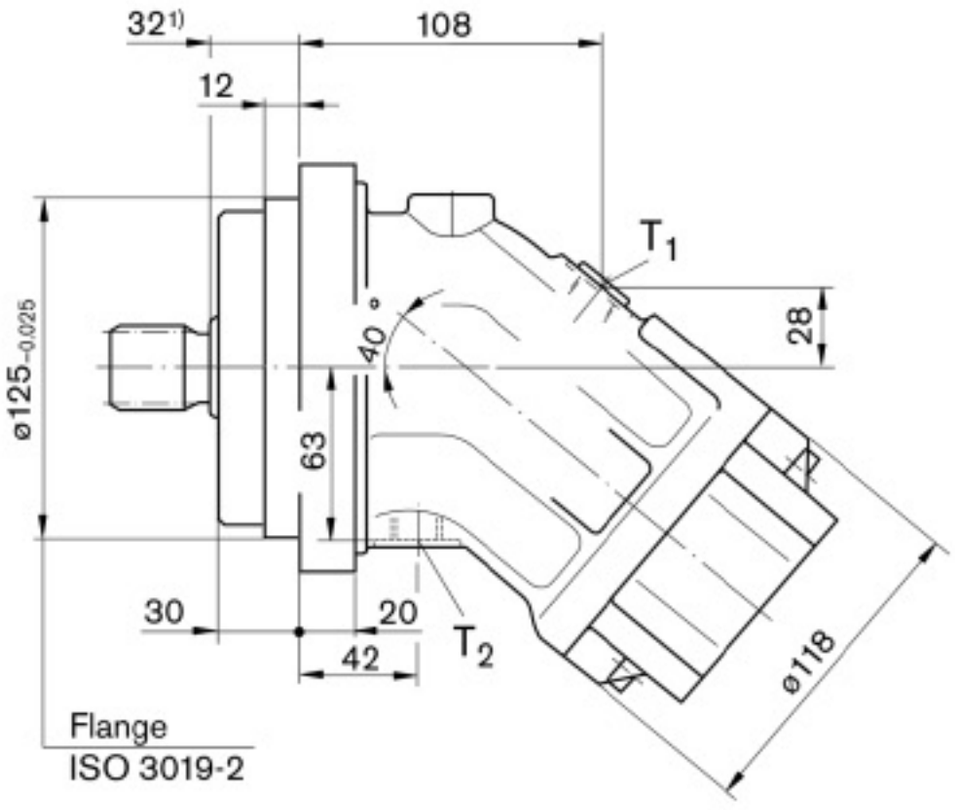
名称	油口用途	标准	规格 [1]	峰值压力 bar [2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1/2" M8 X 1.25 深 14	450

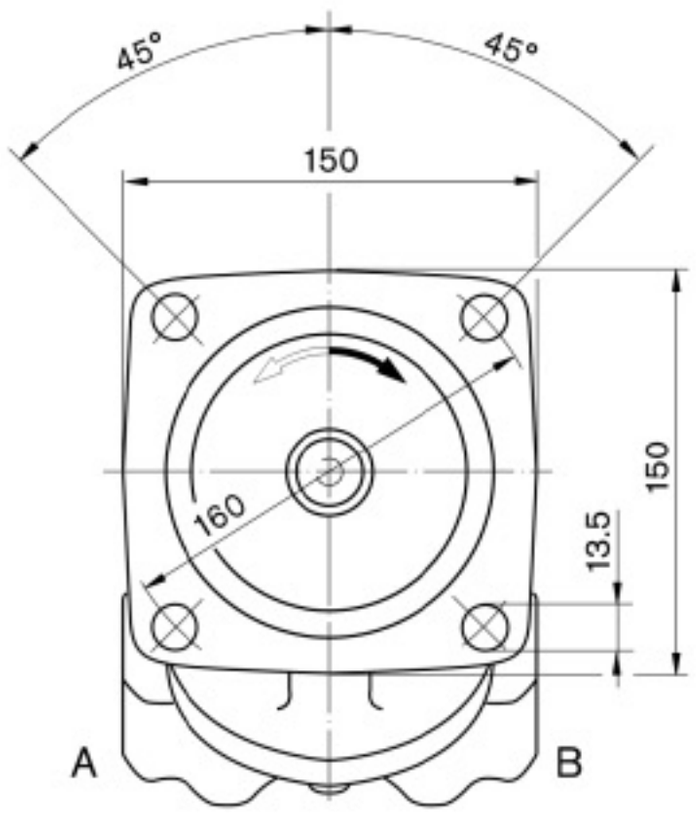
1) 最大坚固扭矩参照通用标准

2) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

3) 仅适合规格 28 和 32

■ 元件尺寸（mm）：规格 45



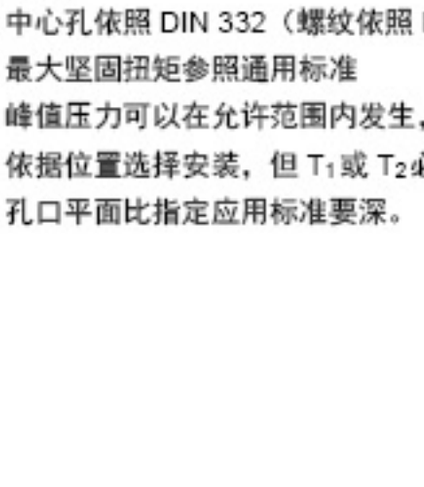


□ 轴端尺寸：

■ 规格 45

Z 花键轴 DIN 5480

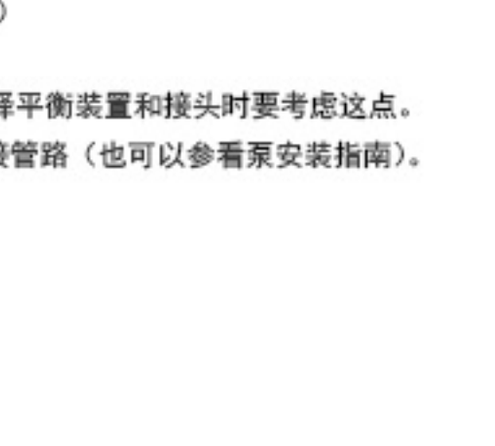
W 30 X 2 X14 X 9g



■ 规格 45

P 平键直轴 DIN 6885

AS 8 X 7 X 50



□ 油口尺寸：

名称	油口用途	标准 [6]	规格 [3]	峰值压力 bar [4]
A、B	工作油口		详见油口接板	450
T_1	泄油口 [5]	DIN 3852	M18 X 1.5 深 12（封闭）	3
T_2	泄油口 [5]	DIN 3852	M18 X 1.5 深 12	3

1) 到轴肩

2) 中心孔依照 DIN 332（螺纹依照 DIN 13）

3) 最大坚固扭矩参照通用标准

4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

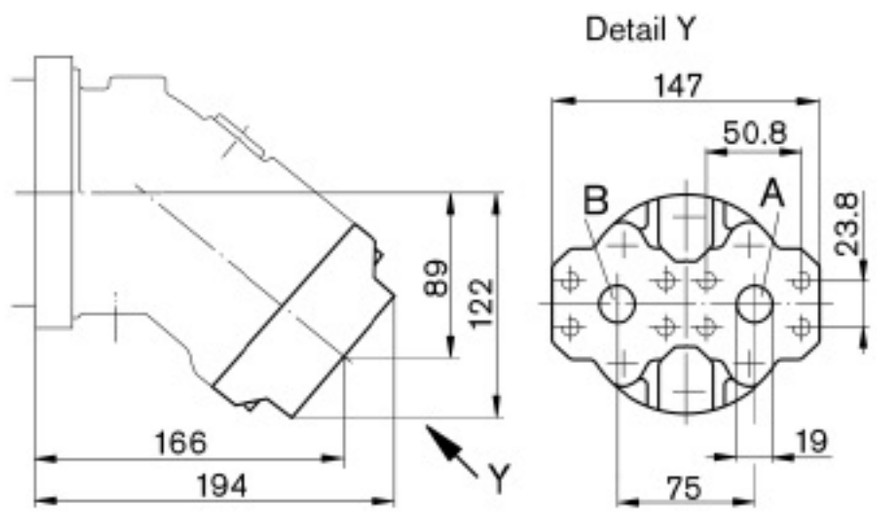
5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6) 孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 45

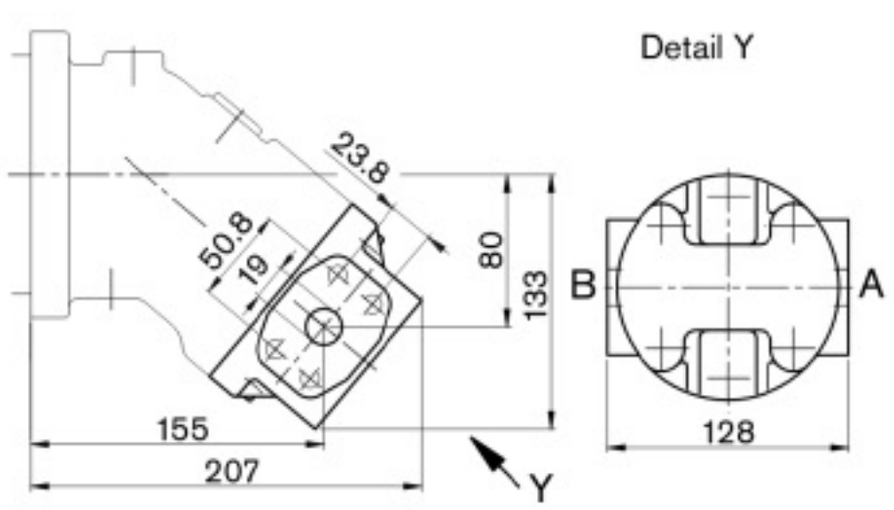
□ 油口接板：

■ 油口代码 01：SAE 法兰，在后部。



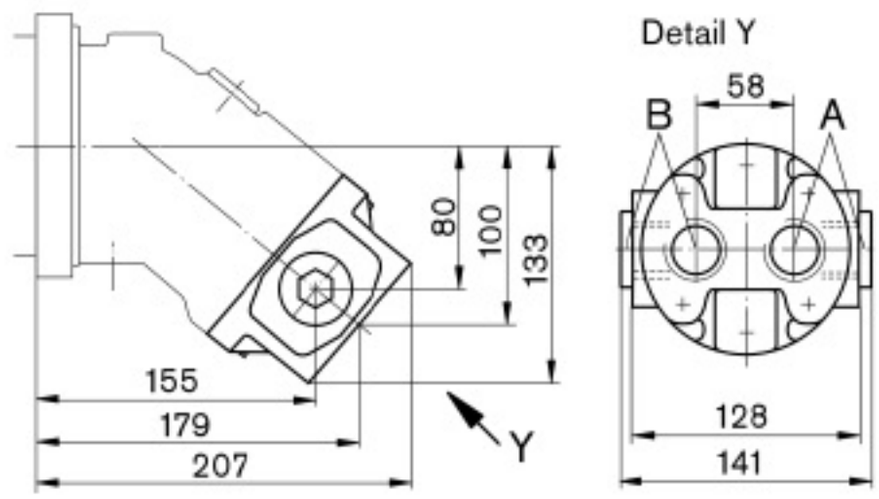
名称	油口用途	标准	规格 [1]	峰值压力 bar [2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	3/4" M10 X 1.5 深 17	450

■ 油口代码 02：SAE 法兰，在侧面，相对。



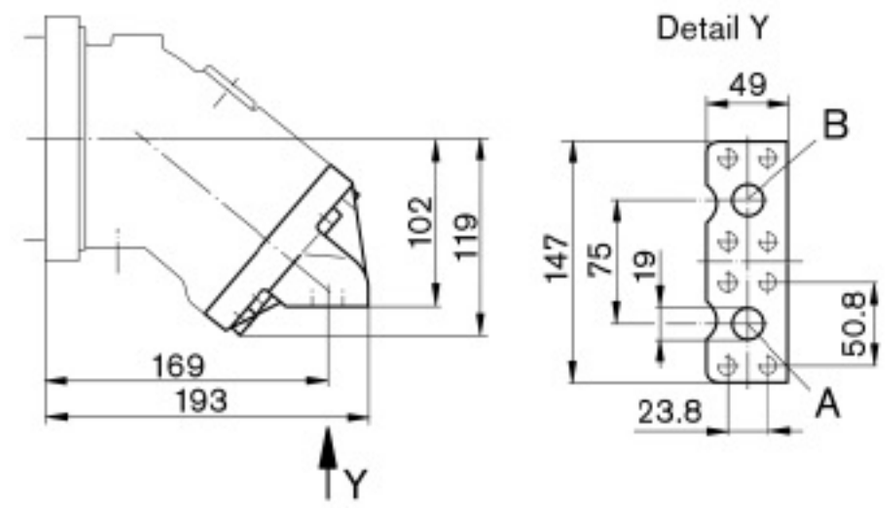
名称	油口用途	标准	规格 [1]	峰值压力 bar [2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	3/4" M10 X 1.5 深 17	450

■ 油口代码 04：螺纹油口，在侧面和后部



名称	油口用途	标准	规格 [1]	峰值压力 bar [2]
A、B	工作油口	DIN 3852	M33 X 2 深 18	450

■ 油口代码 10：SAE 法兰，在底部，同一侧。

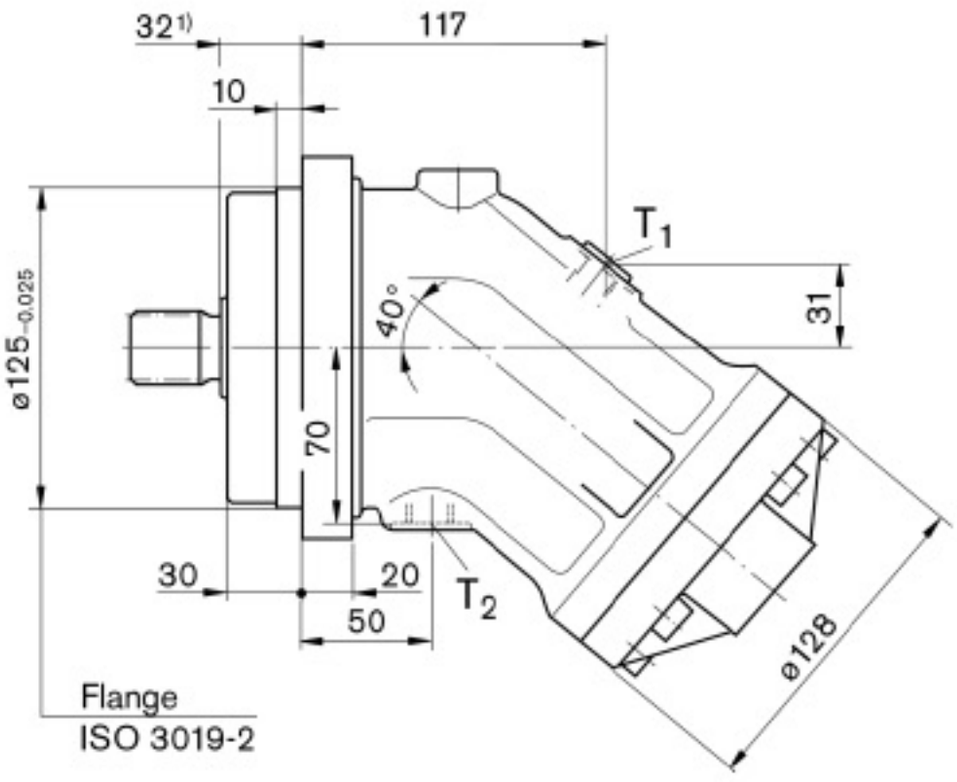


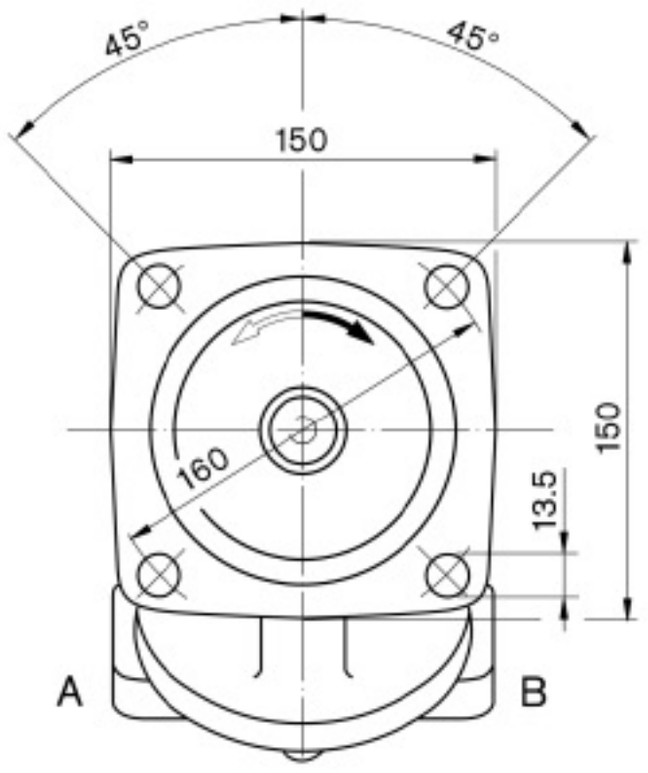
名称	油口用途	标准	规格 [1]	峰值压力 bar [2]
A、B	工作油口	DIN 3852	3/4"	450
			M10 X 1.5 深 17	

1）最大坚固扭矩参照通用标准

2）峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

■ 元件尺寸（mm）：规格 56、63



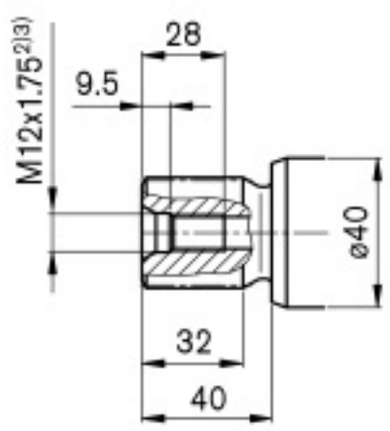


□ 轴端尺寸：

■ 规格 56、63

A 花键轴 DIN 5480

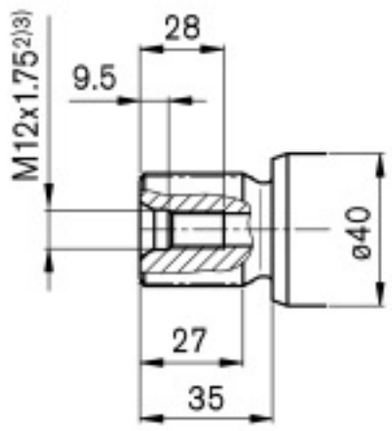
W 35X 2 X16 X 9g



■ 规格 56

Z 花键轴 DIN 5480

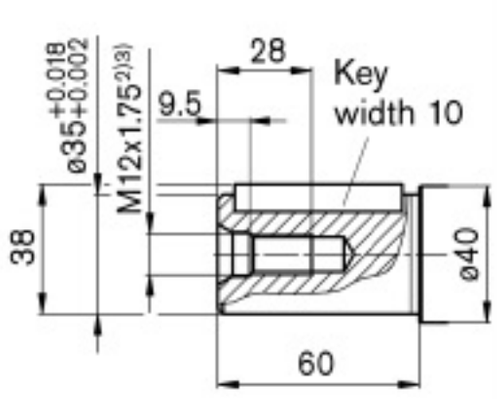
W 30 X 2 X14 X 9g



■ 规格 56、63

B 平键直轴 DIN 6885

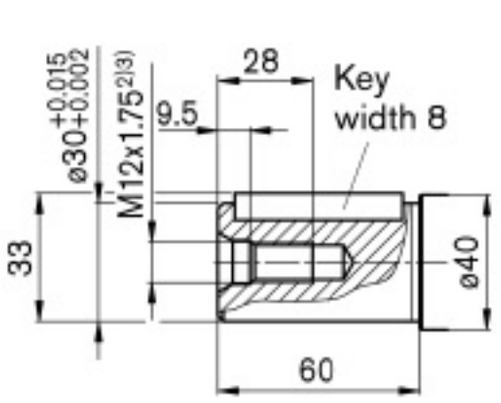
AS 10 X 8 X 50



■ 规格 56

P 平键直轴 DIN 6885

AS 8 X 7 X 50



□ 油口尺寸：

名称	油口用途	标准 6)	规格 3)	峰值压力 bar 4)
A、B	工作油口		详见油口接板	450
T_1	泄油口 5)	DIN 3852	M18 X 1.5 深 12（封闭）	3
T_2	泄油口 5)	DIN 3852	M18 X 1.5 深 12	3

1) 到轴肩

2) 中心孔依照 DIN 332（螺纹依照 DIN 13）

3) 最大坚固扭矩参照通用标准

4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

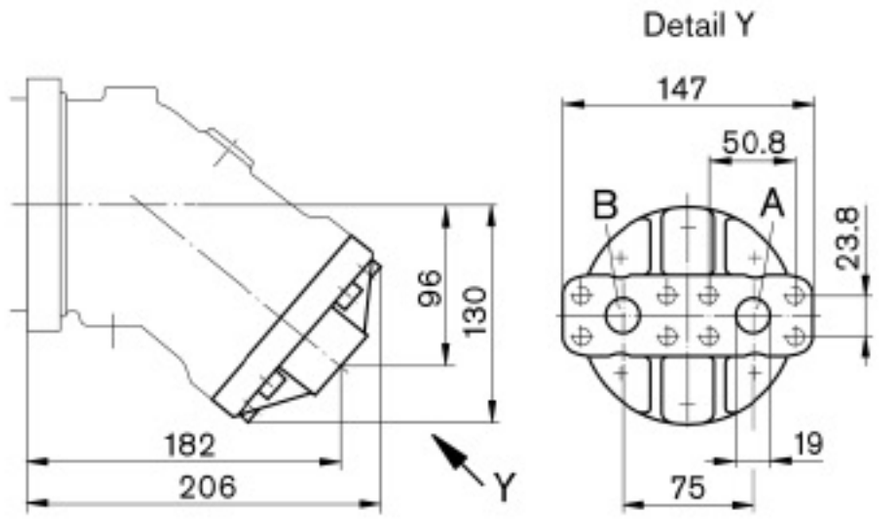
5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6) 孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 56、63

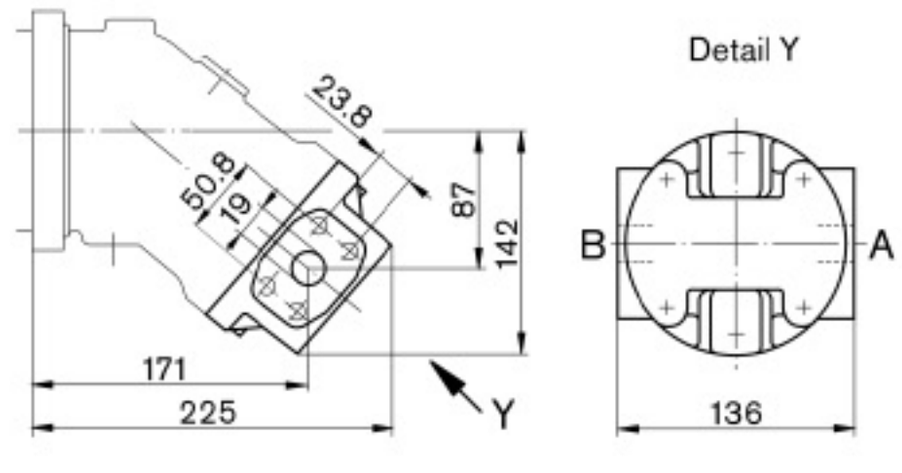
□ 油口接板：

■ 油口代码 01：SAE 法兰，在后部。



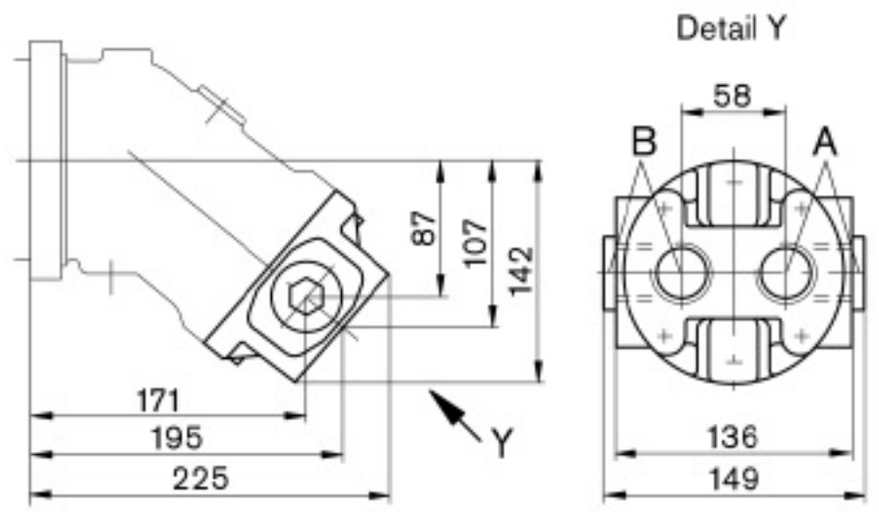
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	3/4" M10 X 1.5 深 17	450

■ 油口代码 02：SAE 法兰，在侧面，相对。



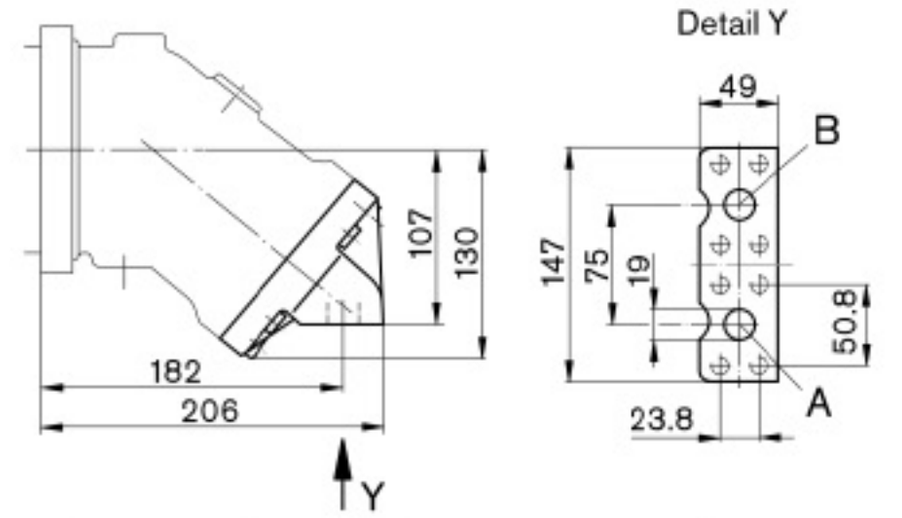
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	3/4" M10 X 1.5 深 17	450

■ 油口代码 04：螺纹油口，在侧面和后部



名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口	DIN 3852	M33 X 2 深 18	450

■ 油口代码 10：SAE 法兰，在底部，同一侧。

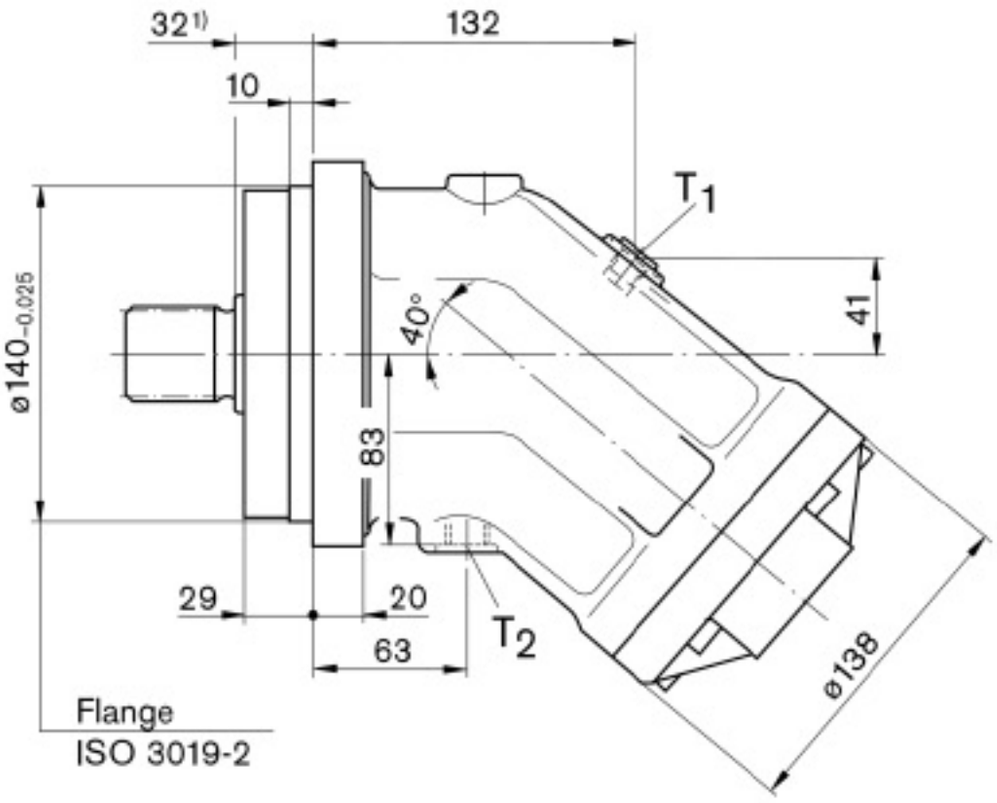


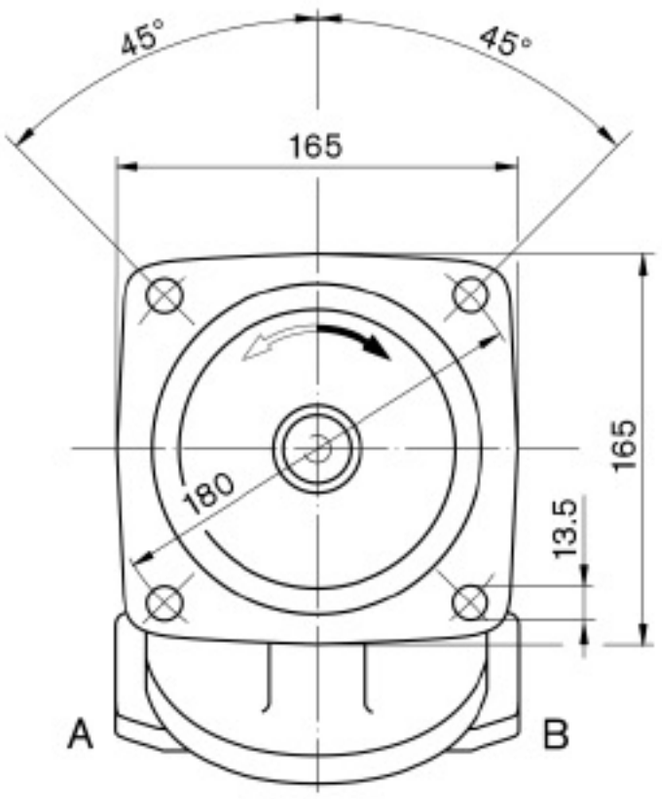
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口	DIN 3852	3/4"	450
			M10 X 1.5 深 17	

1）最大坚固扭矩参照通用标准

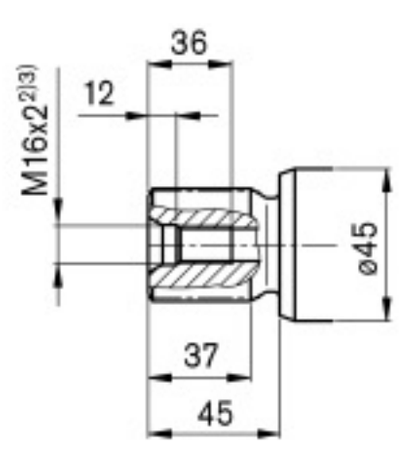
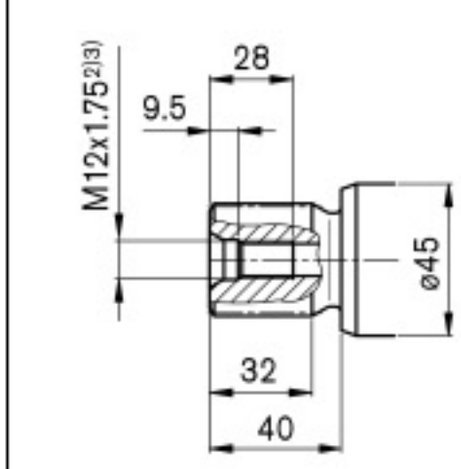
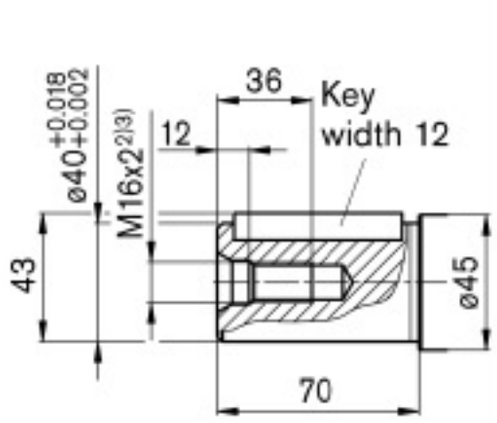
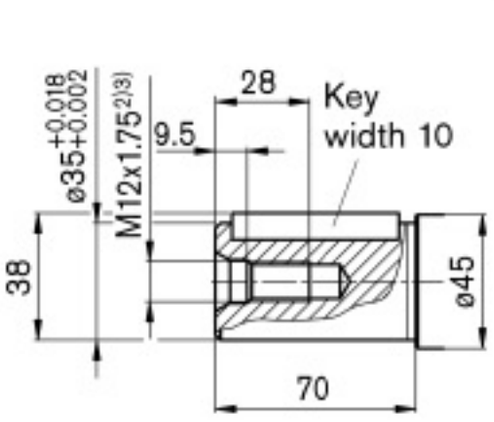
2）峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

■ 元件尺寸（mm）：规格 80、90





□ 轴端尺寸：

■ 规格 80、90 A 花键轴 DIN 5480 W 40 X 2 X18 X 9g	■ 规格 80 Z 花键轴 DIN 5480 W 35 X 2 X16 X 9g	■ 规格 80、90 B 平键直轴 DIN 6885 AS 12 X 8 X 56	■ 规格 80 P 平键直轴 DIN 6885 AS 10 X 8 X 56
			

□ 油口尺寸：

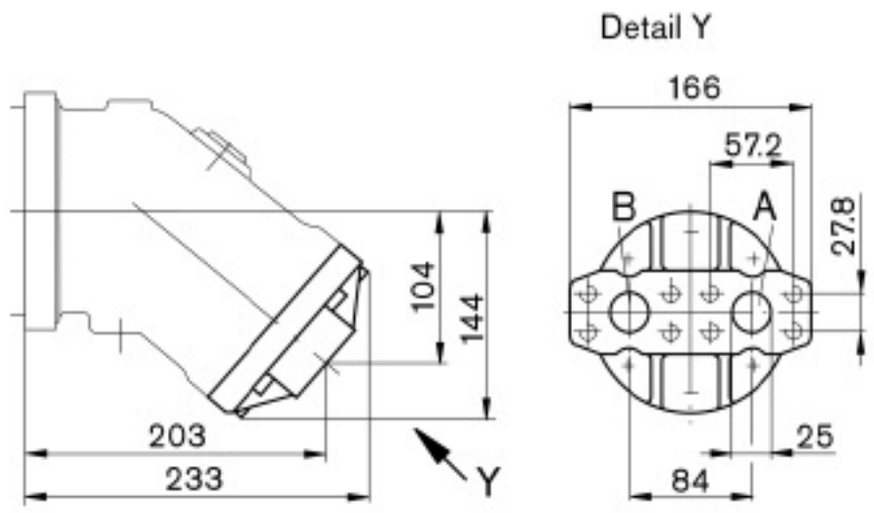
名称	油口用途	标准 6)	规格 3)	峰值压力 bar4)
A、B	工作油口		详见油口接板	450
T_1	泄油口 5)	DIN 3852	M18 X 1.5 深 12（封闭）	3
T_2	泄油口 5)	DIN 3852	M18 X 1.5 深 12	3

1) 到轴肩
2) 中心孔依照 DIN 332（螺纹依照 DIN 13）
3) 最大坚固扭矩参照通用标准
4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。
5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。
6) 孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 80、90

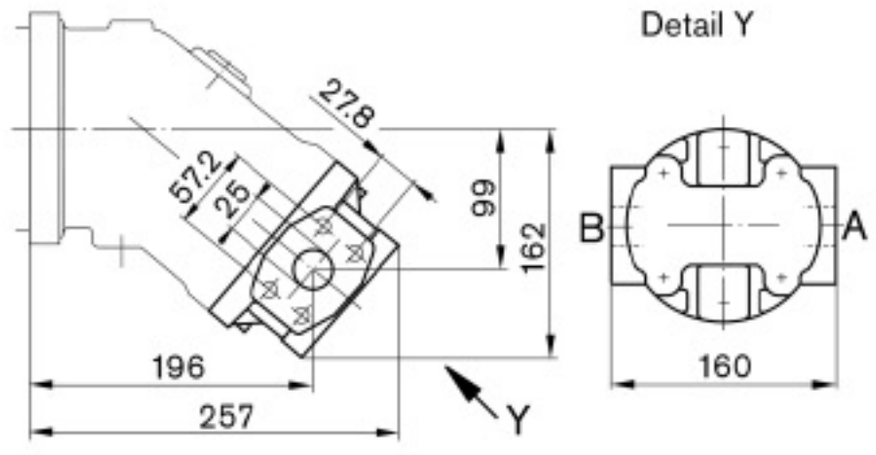
□ 油口接板：

■ 油口代码 01：SAE 法兰，在后部。



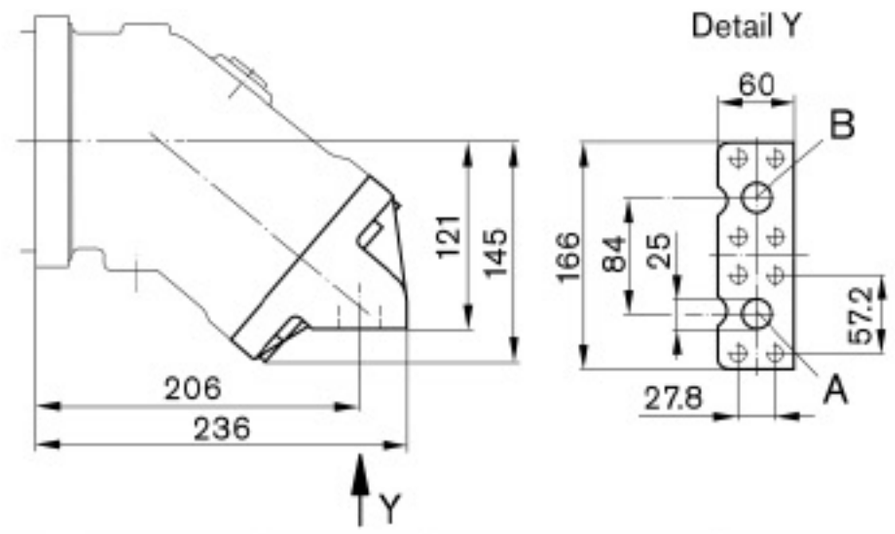
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1” M12 X 1.75 深 17	450

■ 油口代码 02：SAE 法兰，在侧面，相对。



名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1” M12 X 1.75 深 17	450

■ 油口代码 10：SAE 法兰，在底部，同一侧。

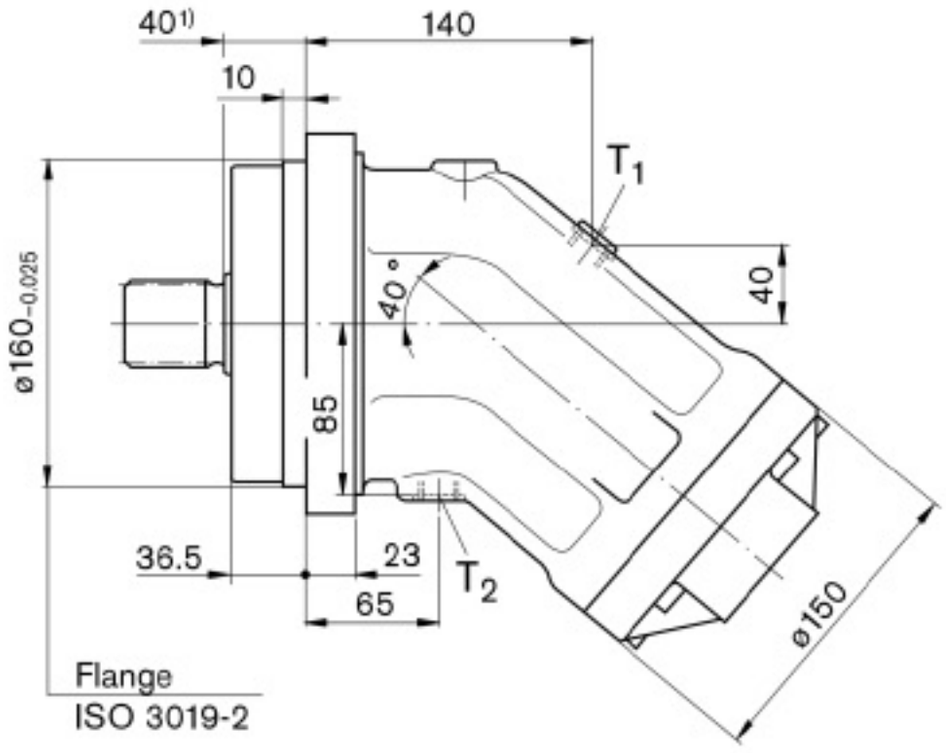


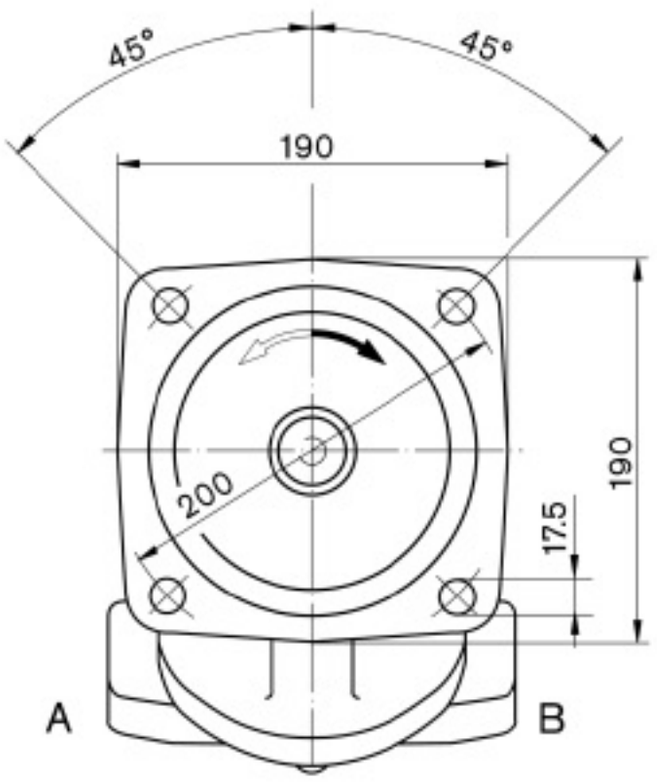
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	DIN 3852 DIN 13	1” M12 X 1.75 深 17	450

1) 最大坚固扭矩参照通用标准

2) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

■ 元件尺寸（mm）：规格 107、125



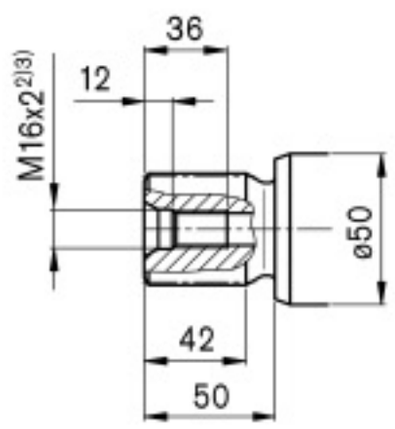


□ 轴端尺寸：

■ 规格 107、125

A 花键轴 DIN 5480

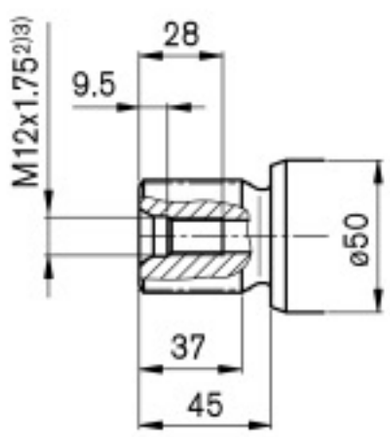
W 45 X 2 X 21 X 9g



■ 规格 107

Z 花键轴 DIN 5480

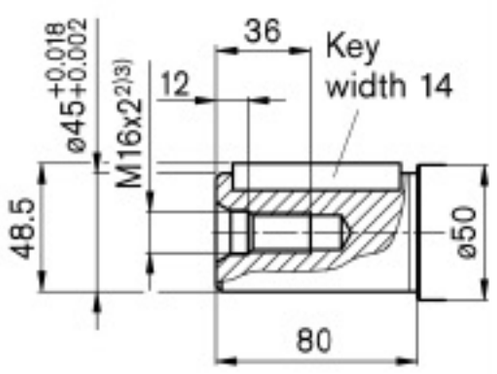
W 40 X 2 X18 X 9g



■ 规格 107、125

B 平键直轴 DIN 6885

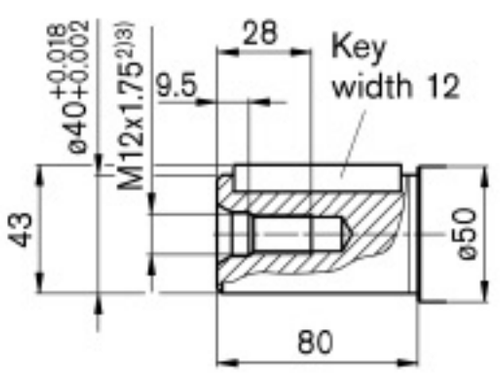
AS 14 X 9 X 63



■ 规格 107

P 平键直轴 DIN 6885

AS 12 X 8 X 63



□ 油口尺寸：

名称	油口用途	标准 6)	规格 3)	峰值压力 bar 4)
A、B	工作油口		详见油口接板	450
T_1	泄油口 5)	DIN 3852	M18 X 1.5 深 12（封闭）	3
T_2	泄油口 5)	DIN 3852	M18 X 1.5 深 12	3

1) 到轴肩

2) 中心孔依照 DIN 332（螺纹依照 DIN 13）

3) 最大坚固扭矩参照通用标准

4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

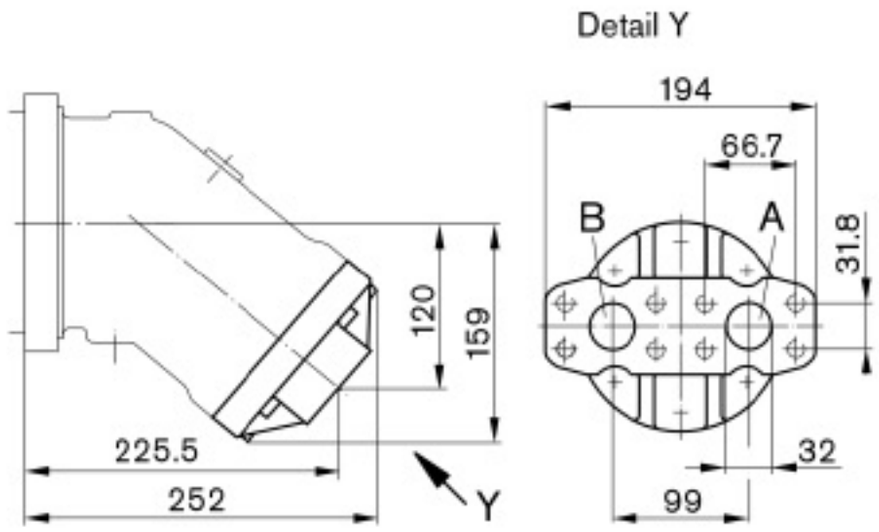
5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6) 孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 107、125

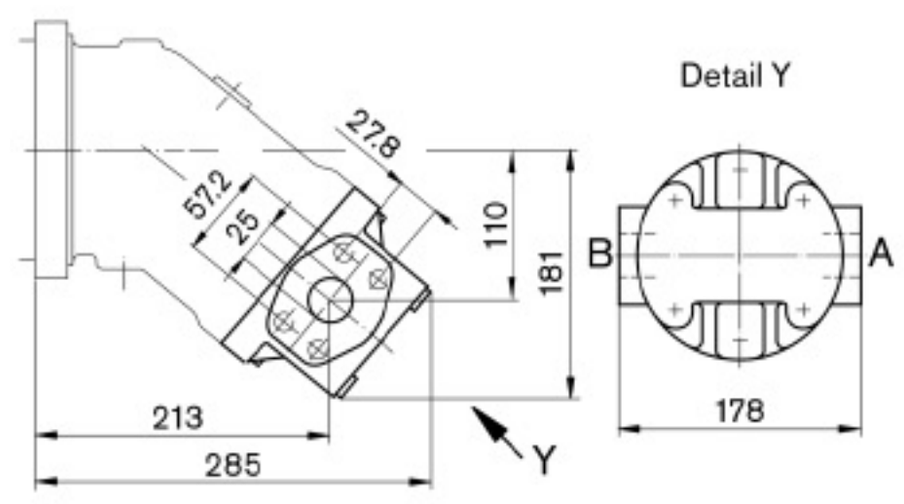
□ 油口接板：

■ 油口代码 01：SAE 法兰，在后部。



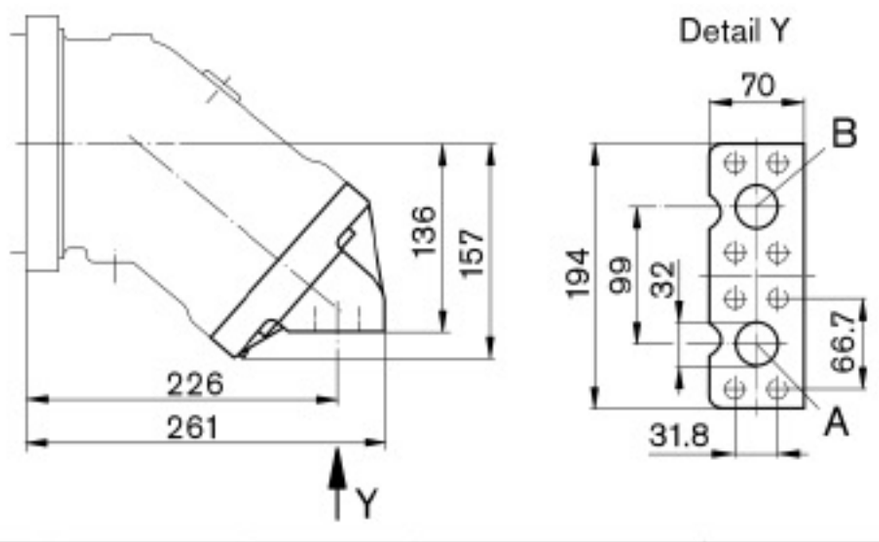
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1-1/4" M14 X 2 深 19	450

■ 油口代码 02：SAE 法兰，在侧面，相对（规格 107）。



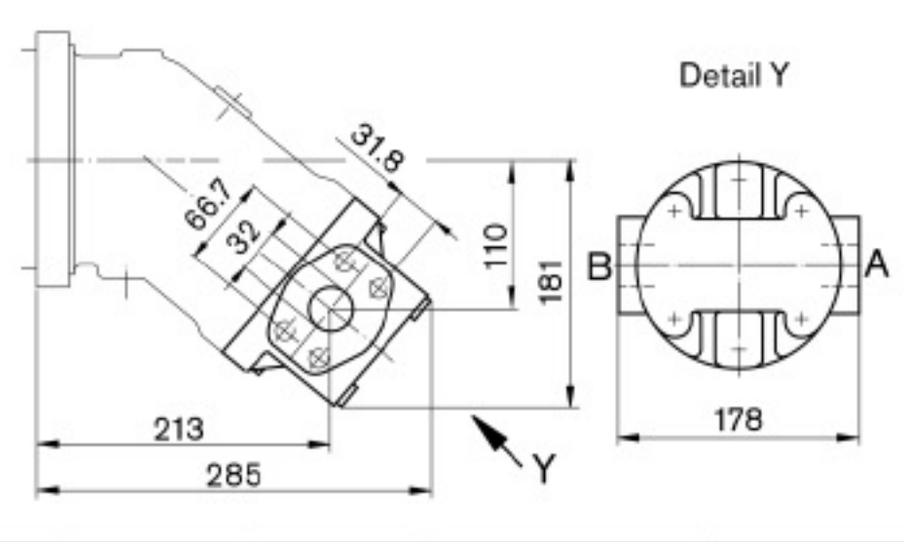
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1" M12 X 1.75 深 17	450

■ 油口代码 10：SAE 法兰，在底部，同一侧。



名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口	DIN 3852	1-1/4" M14 X 2 深 19	450

■ 油口代码 02：SAE 法兰，在侧面，相对（规格 125）。

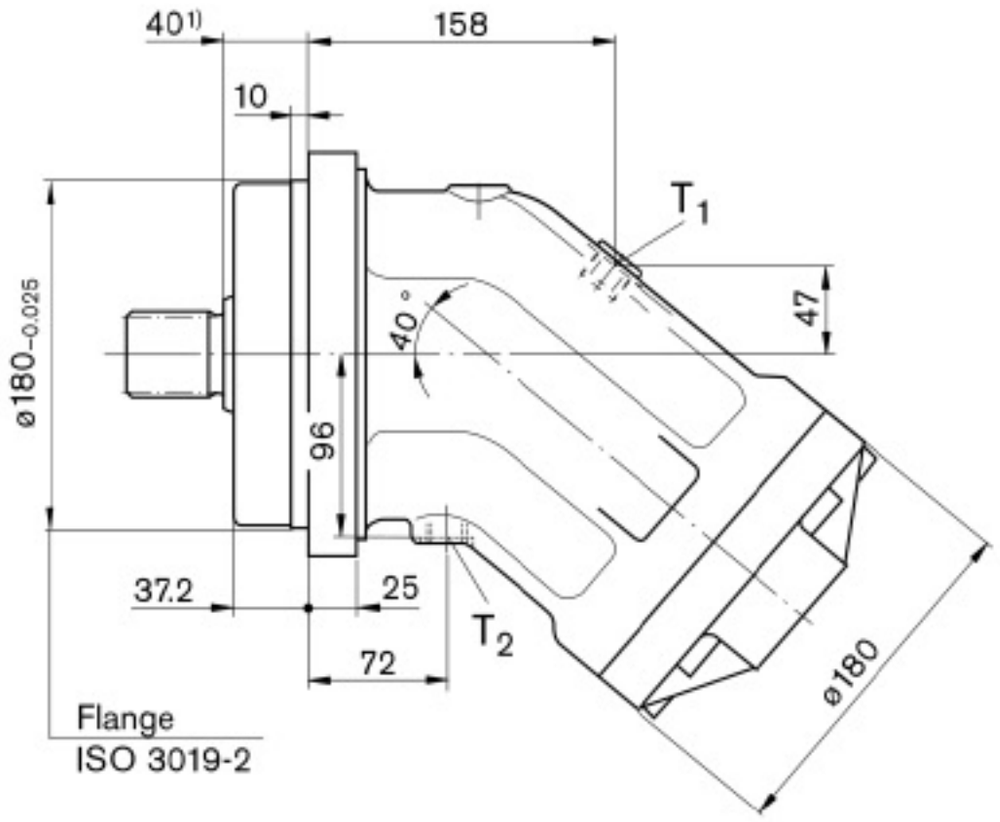


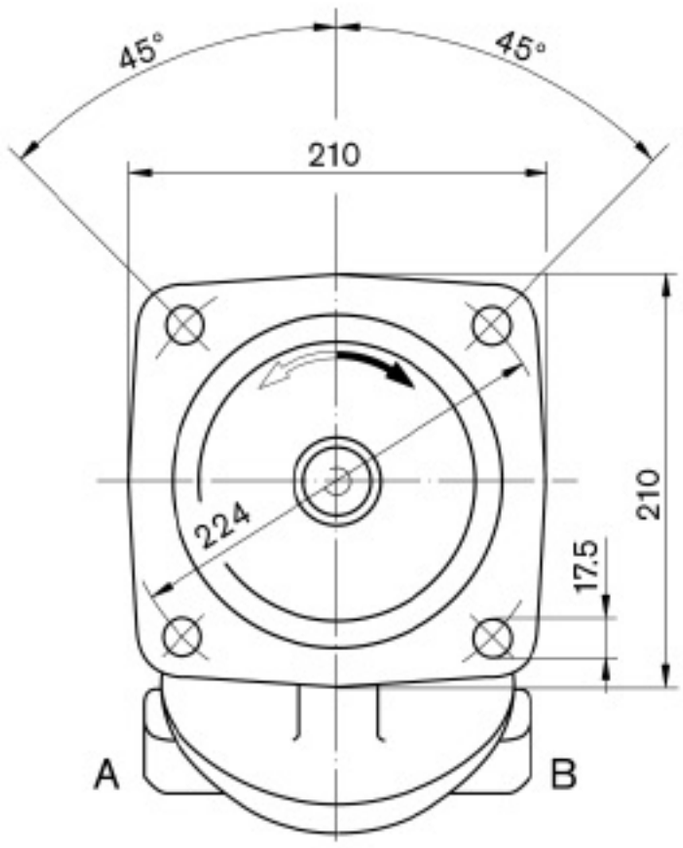
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1-1/4" M14 X 2 深 19	450

1）最大坚固扭矩参照通用标准

2）峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

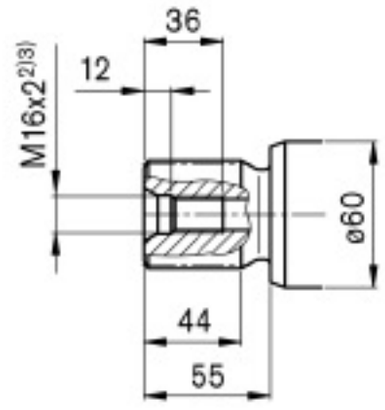
■ 元件尺寸（mm）：规格 160、180



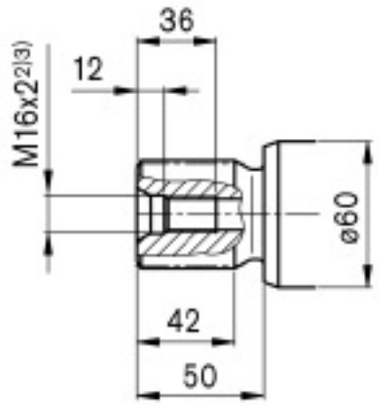


□ 轴端尺寸：

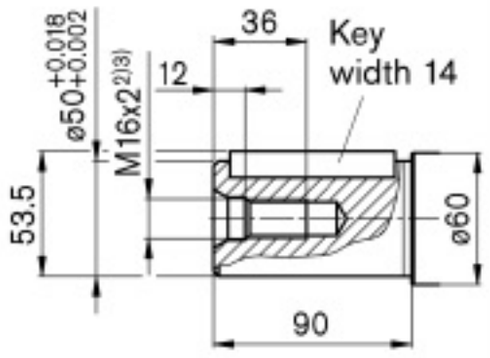
■ 规格 160、180
A 花键轴 DIN 5480
W 50 X 2 X 24 X 9g



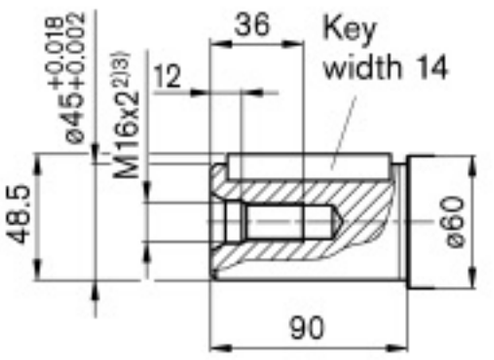
■ 规格 160
Z 花键轴 DIN 5480
W 45 X 2 X 21 X 9g



■ 规格 160、180
B 平键直轴 DIN 6885
AS 14 X 9 X 70



■ 规格 160
P 平键直轴 DIN 6885
AS 14 X 9 X 70



□ 油口尺寸：

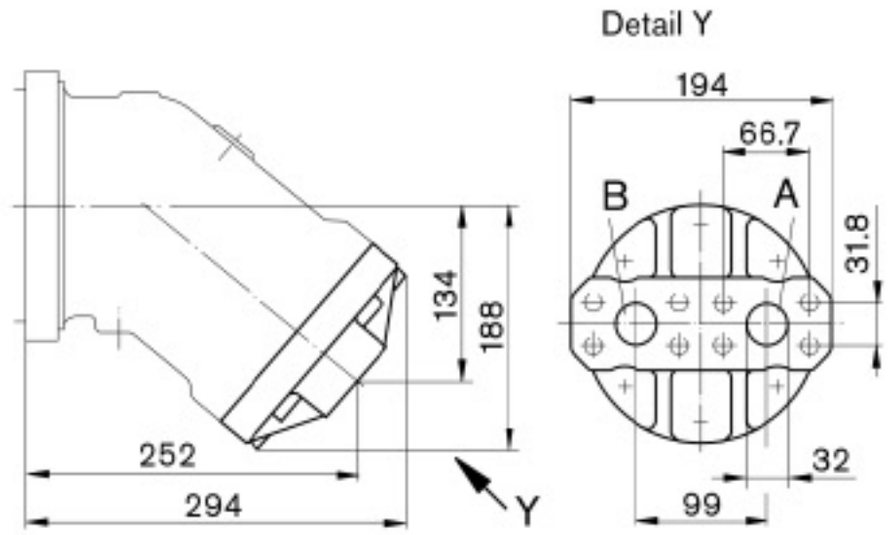
名称	油口用途	标准 6)	规格 3)	峰值压力 bar 4)
A、B	工作油口		详见油口接板	450
T_1	泄油口 5)	DIN 3852	M22 X 1.5 深 14（封闭）	3
T_2	泄油口 5)	DIN 3852	M22 X 1.5 深 14	3

1) 到轴肩
2) 中心孔依照 DIN 332（螺纹依照 DIN 13）
3) 最大坚固扭矩参照通用标准
4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。
5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。
6) 孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 160、180

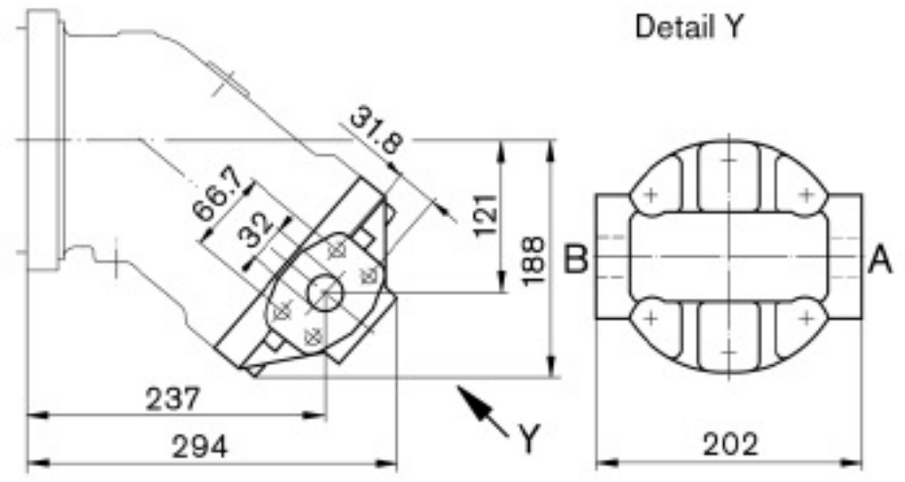
□ 油口接板：

■ 油口代码 01：SAE 法兰，在后部。



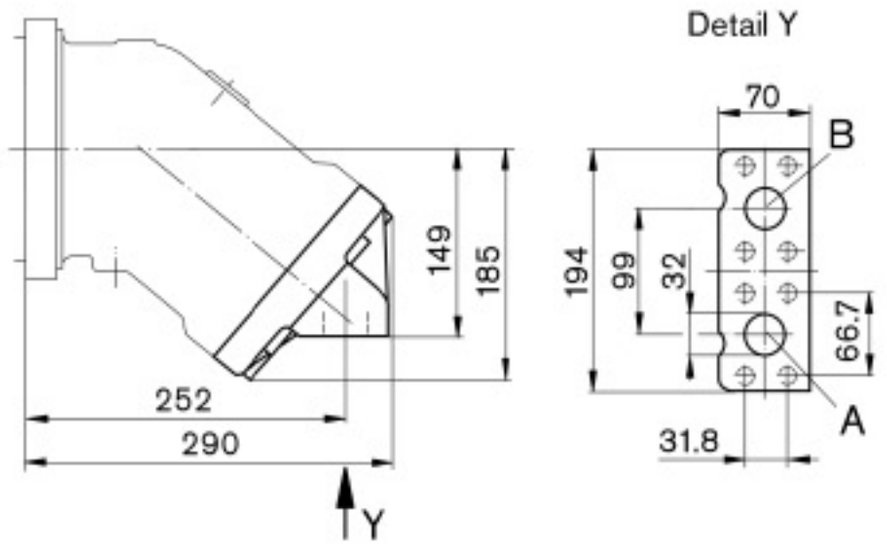
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1-1/4" M14 X 2 深 19	450

■ 油口代码 02：SAE 法兰，在侧面，相对。



名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1-1/4" M14 X 2 深 19	450

■ 油口代码 10：SAE 法兰，在底部，同一侧。

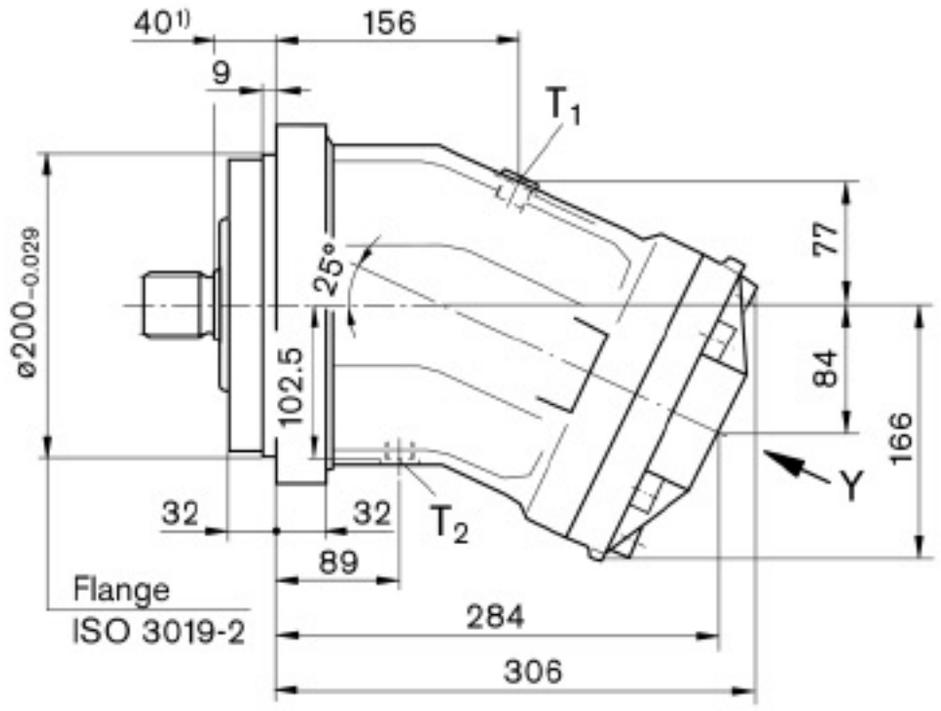


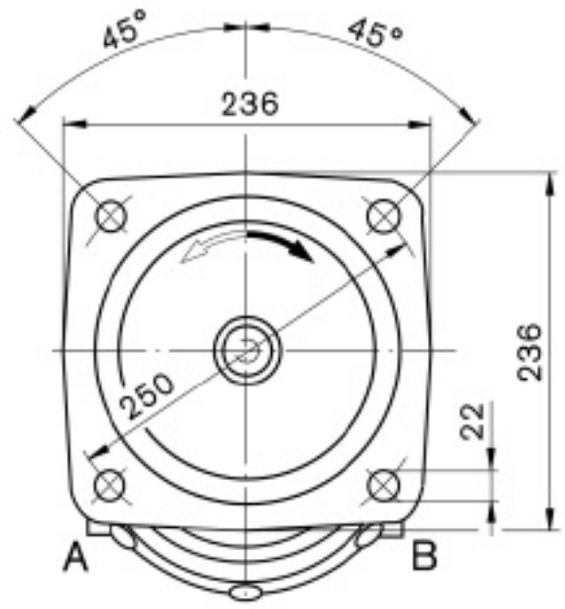
名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口	DIN 3852	1-1/4" M14 X 2 深 19	450

1) 最大坚固扭矩参照通用标准

2) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

■ 元件尺寸（mm）：规格 200





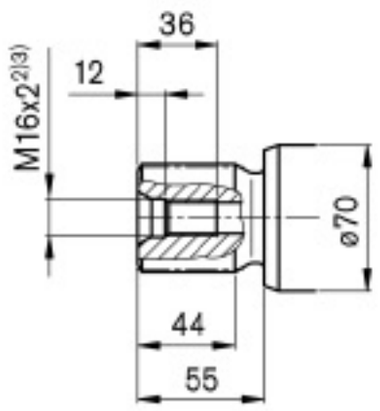
Detail Y

□ 轴端尺寸：

■ 规格 200

A 花键轴 DIN 5480

W 50 X 2 X 24 X 9g

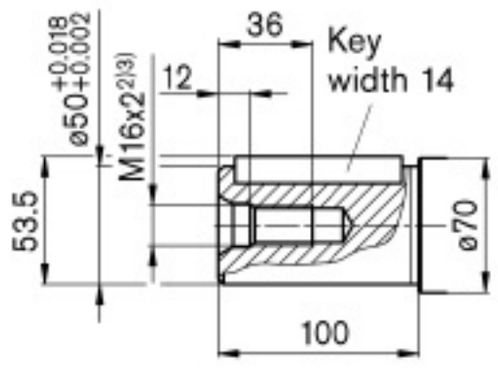


P_N = 400 bar

■ 规格 200

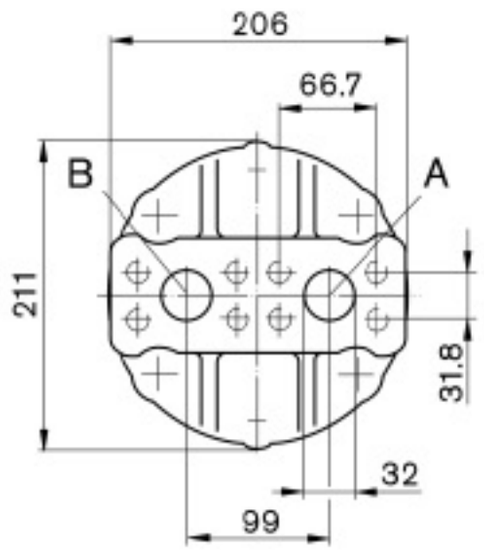
B 平键直轴 DIN 6885

AS 14 X 9 X 80



P_N = 350 bar

Y 向：油口视图



□ 油口尺寸：

名称	油口用途	标准 [6]	规格 [3]	峰值压力 bar[4]
A、B	工作油口	SAE J518	1-1/4"	450
	固定螺纹	DIN 13	M14 X 2 深 19	
T_1	泄油口 [5]	DIN 3852	M22 X 1.5 深 14（封闭）	3
T_2	泄油口 [5]	DIN 3852	M22 X 1.5 深 14	3

1) 到轴肩

2) 中心孔依照 DIN 332（螺纹依照 DIN 13）

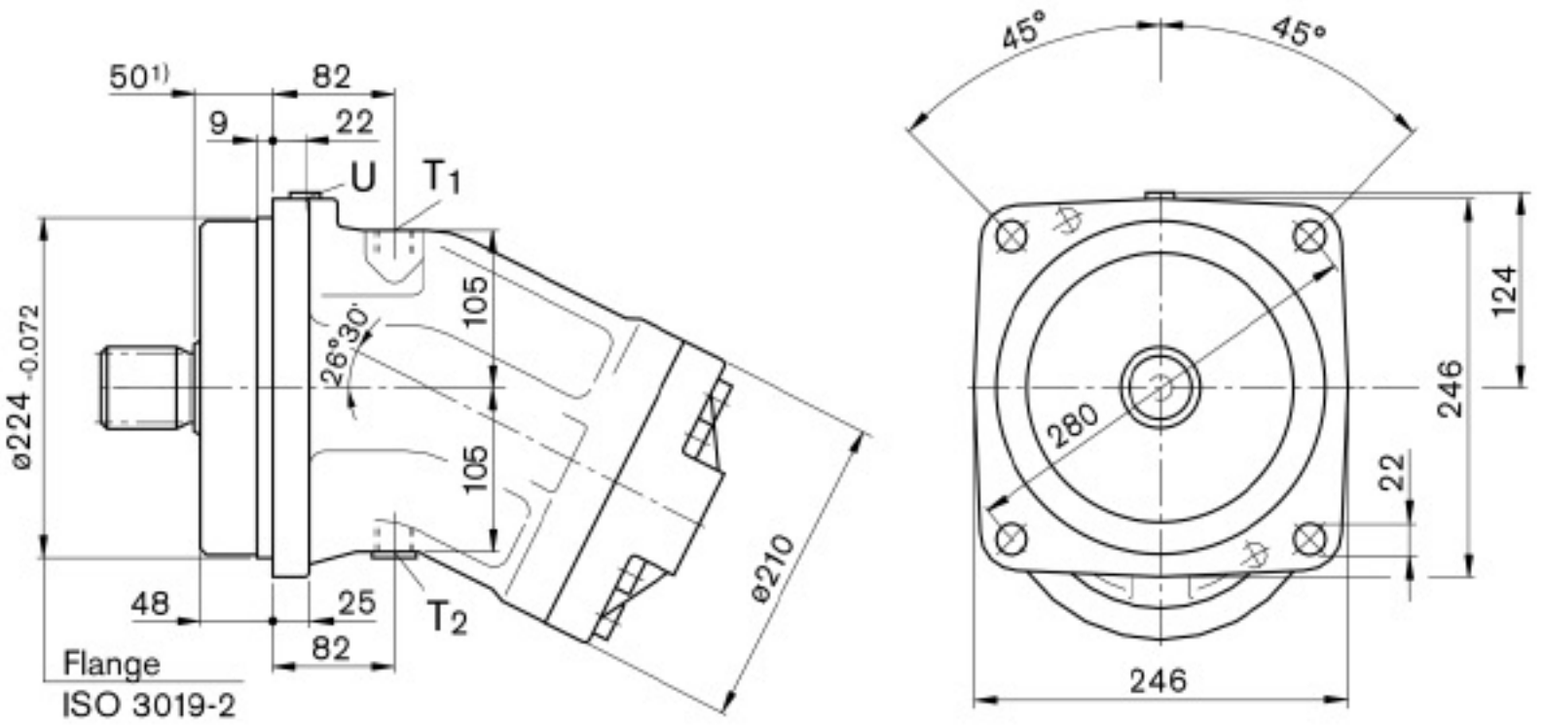
3) 最大坚固扭矩参照通用标准

4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6) 孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 250

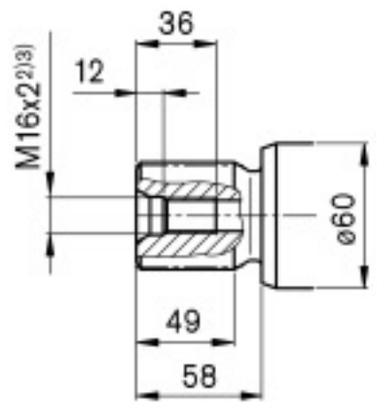


□ 轴端尺寸：

■ 规格 250

Z 花键轴 DIN 5480

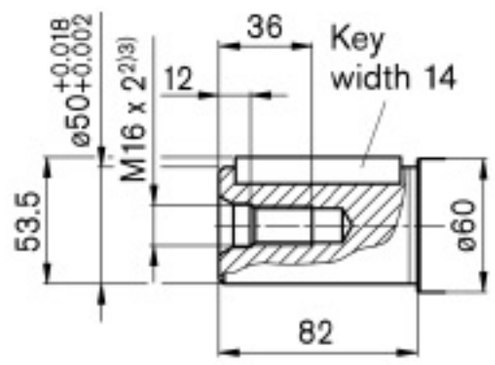
W 50 X 2 X 24 X 9g



■ 规格 250

P 平键直轴 DIN 6885

AS 14 X 9 X 80



□ 油口尺寸：

名称	油口用途	标准 6)	规格 3)	峰值压力 bar 4)
A、B	工作油口		详见油口接板	400
T_1	泄油口 5)	DIN 3852	M22 X 1.5 深 14	3
T_2	泄油口 5)	DIN 3852	M22 X 1.5 深 14 （封闭）	3
U	冲洗油口	DIN 3852	M14 X 1.5 深 12 （封闭）	3

1）到轴肩

2）中心孔依照 DIN 332（螺纹依照 DIN 13）

3）最大坚固扭矩参照通用标准

4）峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

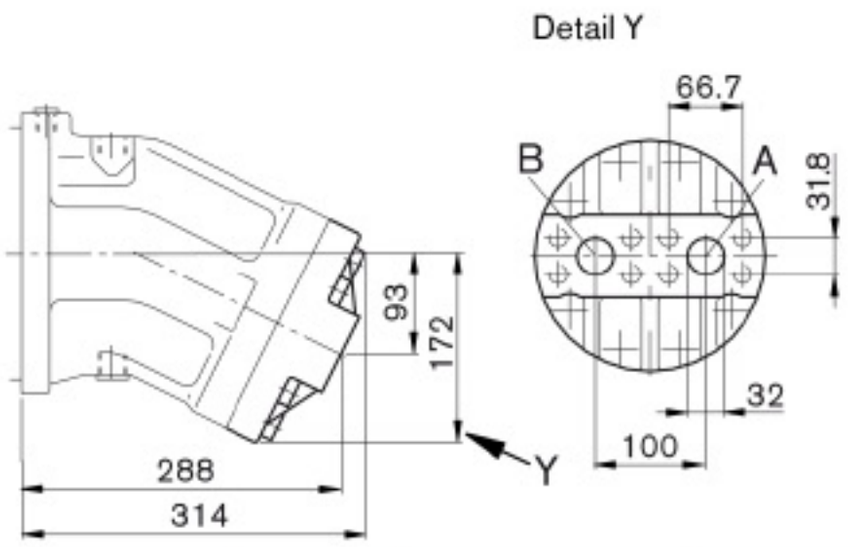
5）依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6）孔口平面比指定应用标准要深。

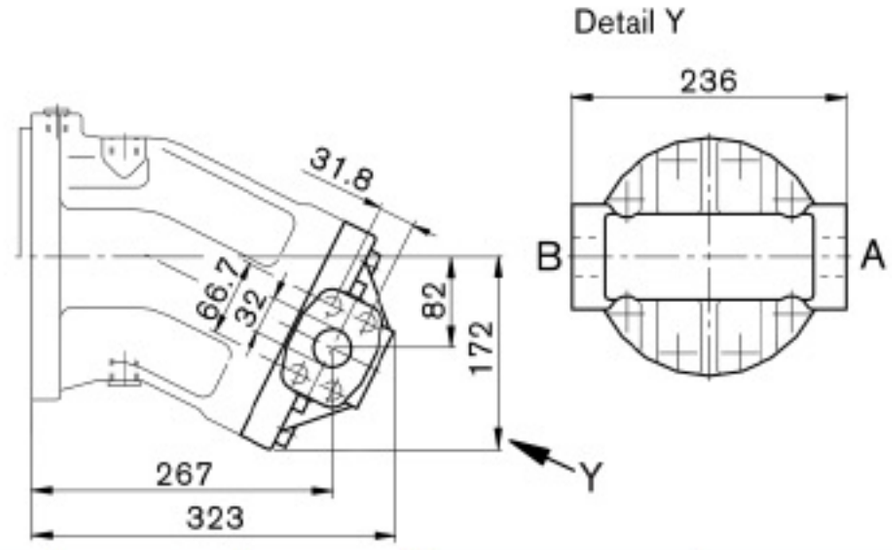
■ 元件尺寸（mm）：规格 250

□ 油口接板：

■ 油口代码 01：SAE 法兰，在后部。



■ 油口代码 02：SAE 法兰，在侧面，相对。

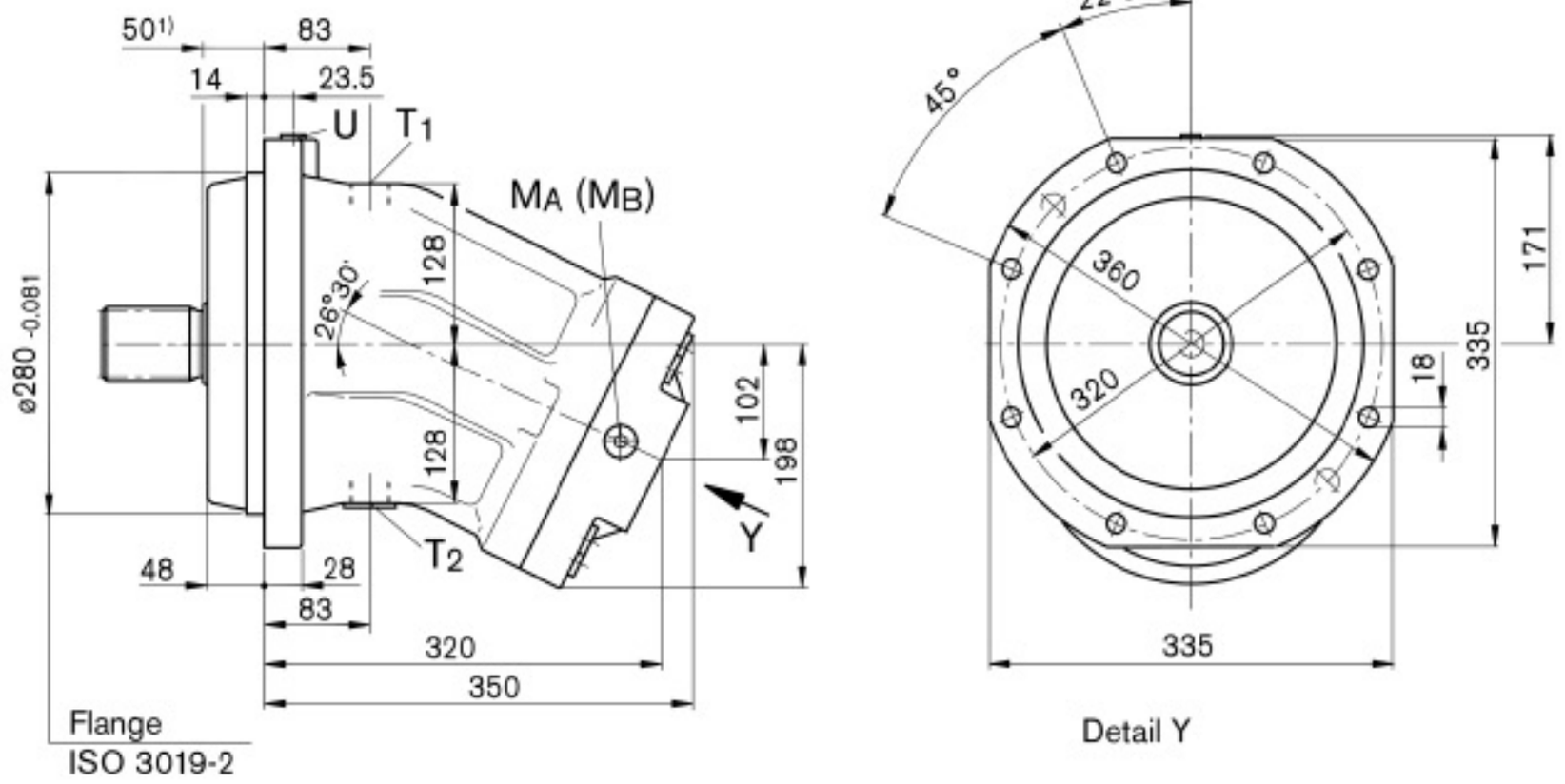


名称	油口用途	标准	规格 [1]	峰值压力 bar[2]	名称	油口用途	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1-1/4” M14 X 2 深 19	400	A、B	工作油口 固定螺纹	SAE J518 DIN 13	1-1/4” M14 X 2 深 19	400

1) 最大坚固扭矩参照通用标准

2) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

■ 元件尺寸（mm）：规格 355

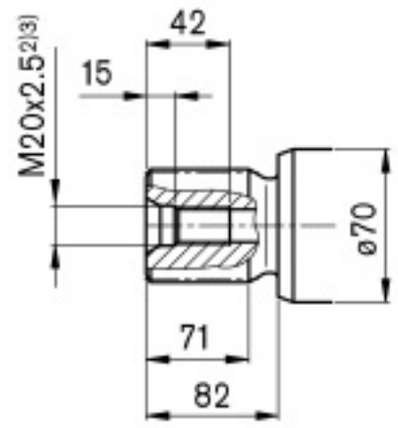


□ 轴端尺寸：

■ 规格 355

A 花键轴 DIN 5480

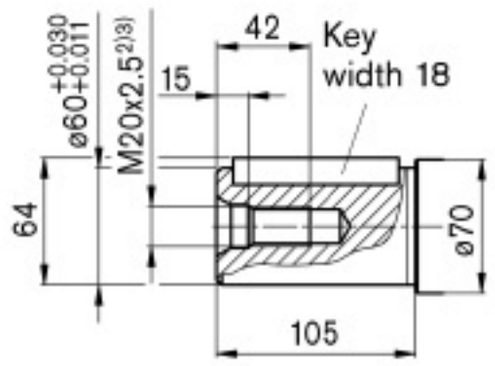
W 60 X 2 X 28 X 9g



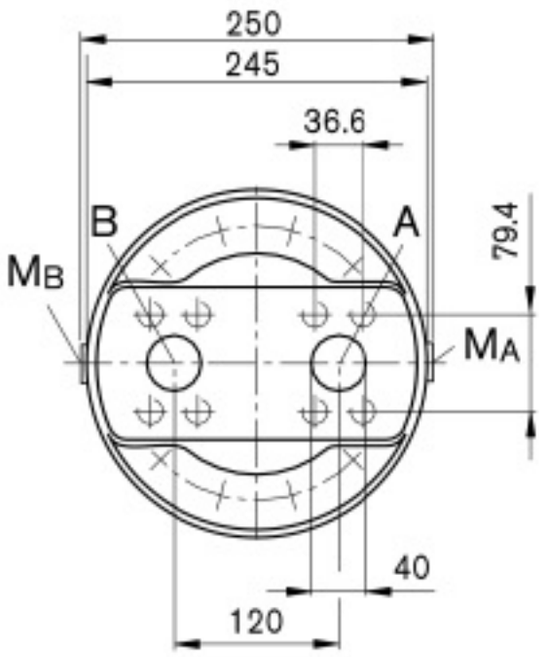
■ 规格 355

B 平键直轴 DIN 6885

AS 18 X 11 X 100



Y 向：油口视图



□ 油口尺寸：

名称	油口用途	标准 6)	规格 3)	峰值压力 bar 4)
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1-1/2" M16 X 2 深 21	400
T_1	泄油口 5)	DIN 3852	M33 X 2 深 14	3
T_2	泄油口 5)	DIN 3852	M33 X 2 深 14（封闭）	3
U	冲洗油口	DIN 3852	M14 X 1.5 深 12（封闭）	3
M_A 、M_B	工作压力检测口	DIN 3852	M14 X 1.5 深 12（封闭）	400

1) 到轴肩

2) 中心孔依照 DIN 332（螺纹依照 DIN 13）

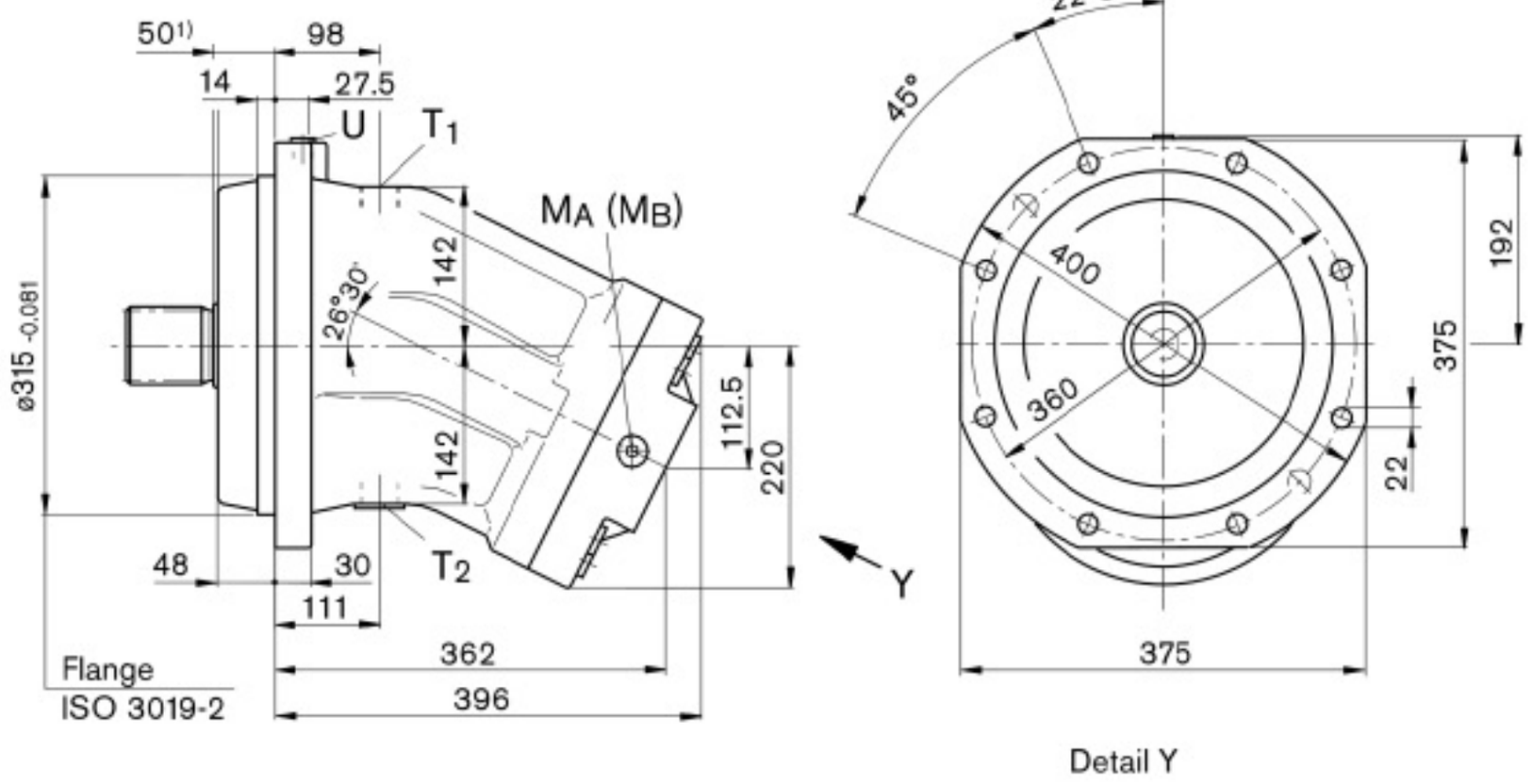
3) 最大坚固扭矩参照通用标准

4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6) 孔口平面比指定应用标准要深。

■ 元件尺寸（mm）：规格 500

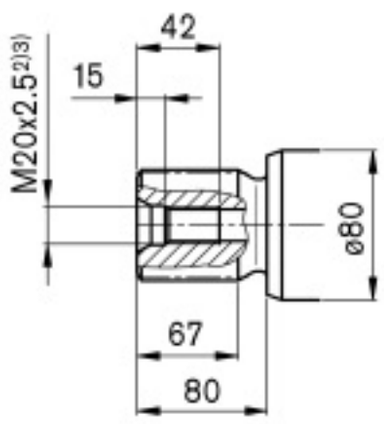


□ 轴端尺寸：

■ 规格 500

Z 花键轴 DIN 5480

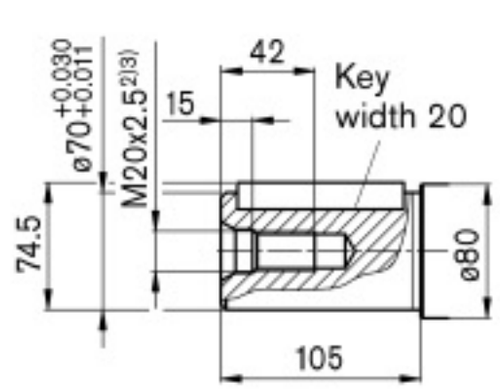
W 70 X 3 X 22 X 9g



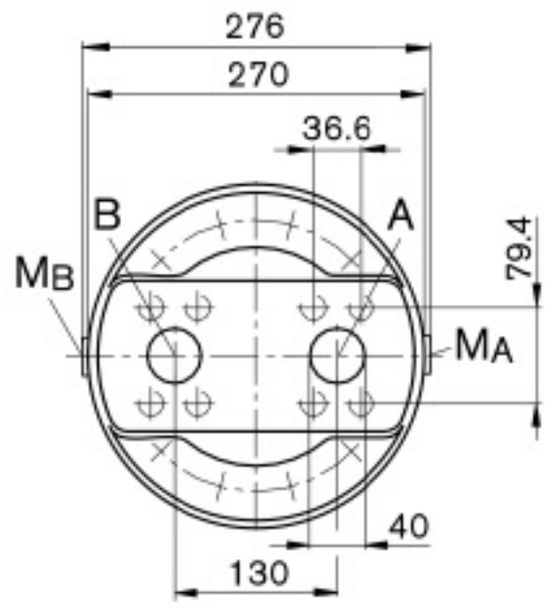
■ 规格 500

P 平键直轴 DIN 6885

AS 20 X 12 X 100



Y 向：油口视图



□ 油口尺寸：

名称	油口用途	标准 [6]	规格 [3]	峰值压力 bar [4]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1-1/2" M16 X 2 深 21	400
T_1	泄油口 [5]	DIN 3852	M33 X 2 深 18	3
T_2	泄油口 [5]	DIN 3852	M33 X 2 深 18（封闭）	3
U	冲洗油口	DIN 3852	M18 X 1.5 深 12（封闭）	3
M_A 、M_B	工作压力检测口	DIN 3852	M14 X 1.5 深 12（封闭）	400

1) 到轴肩

2) 中心孔依照 DIN 332（螺纹依照 DIN 13）

3) 最大坚固扭矩参照通用标准

4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6) 孔口平面比指定应用标准要深。

■ 冲洗和增压阀

■ 功能说明：

□ 冲洗和增压阀在液压回路中起到散热作用。

□ 在开式回路，只用来冲洗壳体。

□ 在闭式回路，在附件壳体冲洗时确保最小的增压水平。

□ 冲洗油从马达低压侧流入壳体，和壳体泄漏油一起流回油箱。如果是闭环回路，流出的流量必须由增压泵补充冷却油液。

□ 带油口接板 027，阀体直接安装在马达上（规格 45～180、250）；
带油口接板 017，阀体安装阀板上（规格 355 和 500）；

■ 参数设定：

□ 溢流阀的设定压力（注意：主回路溢流阀设定值）：
规格 45～500，压力设定值----------16 bar

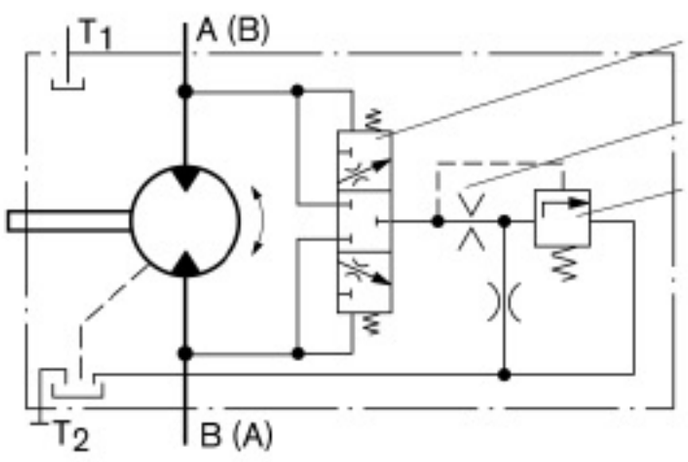
□ 冲洗阀的切换压力⊿p
规格 45～500，压力设定值----------8±1 bar

■ 冲洗流量 q_v：

□ 节流孔（节流阀带阀组）能够建立所需的冲洗流量。

□ 流量参数基础条件：
$\Delta P_{ND} = P_{ND} - P_G = 25$ bar
$V = 10\ mm^2/s$
P_{ND} ：低压； P_G：壳体压力

■ 工作原理图：



■ 标准冲洗流量：

□ 冲洗和增压阀，配装式（标号 7）

规格	冲洗流量 q_v L/min	节流孔 Φ mm
45	3.5	1.2
107、125	5	1.8
160、180	8	2.0
250	10	2.0
355、500	10	2.5

□ 说明：
对规格 45～180，节流孔可以提供冲洗流量范围 3.5～10 L/min，如果需要冲洗流量和标准冲洗流量不同，请在订货时注明。不带节流孔的冲洗流量是大约值。12～14 冲洗流量为在低压 ⊿p = 25 bar 时的标准冲洗流量。

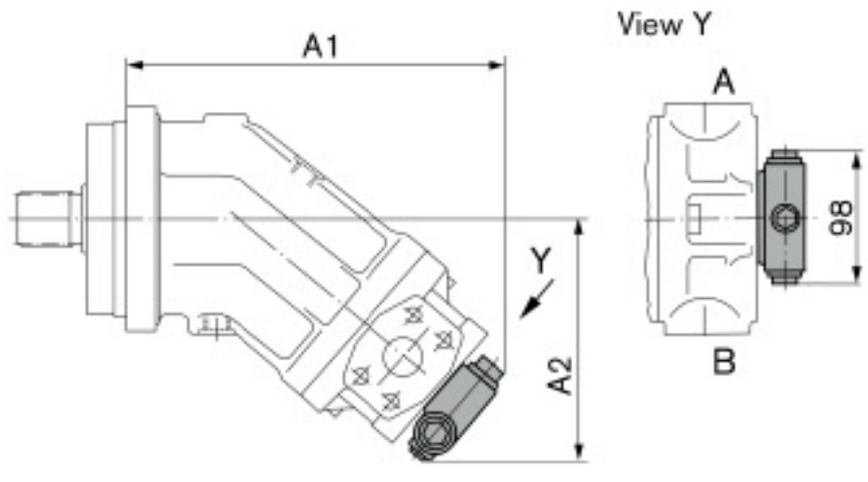
□ 冲洗和增压阀，整体式（标号 9）

规格	冲洗流量 q_v L/min	节流孔 Φ mm
56、63	6	1.5
80、90	7.3	1.8

■ 冲洗和增压阀

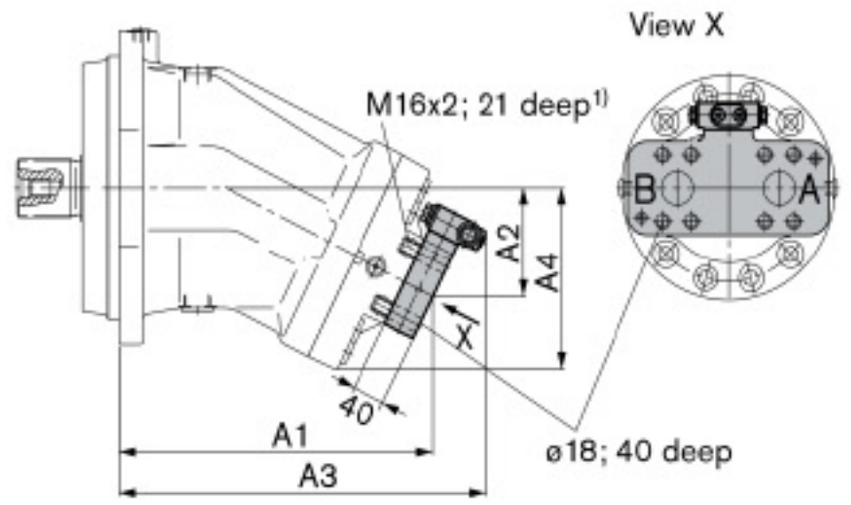
■ 外形尺寸（mm）：

■ 油口接板 027：SAE 法兰，在侧面。



规格	A1	A2		
45	223	151		
107、125	294	192		
160、180	315	201		
250	344	172		

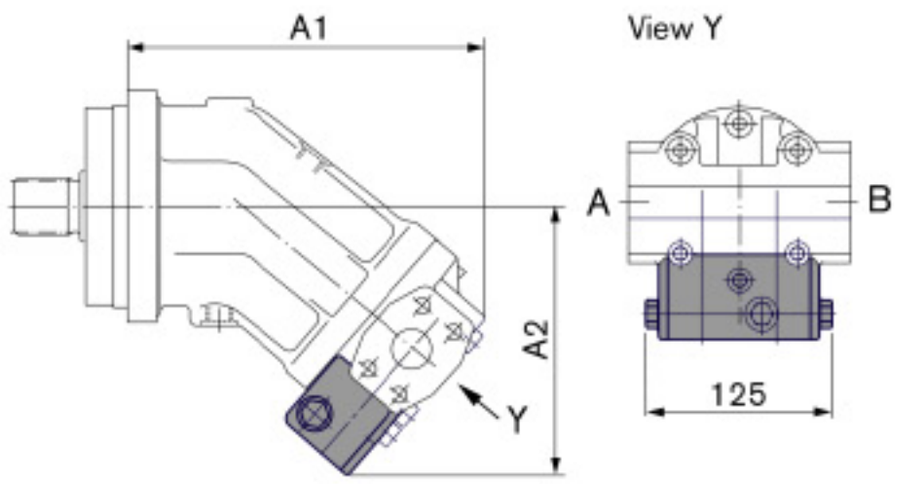
■ 油口接板 017：SAE 法兰，在后部。



规格	A1	A2	A3	A4
355	356	120	421	198
500	397	130	464	220

1) DIN13，最大坚固扭矩参照通用标准

■ 油口接板 029：SAE 法兰，在侧面。



规格	A1	A2		
56、63	225	176		
80、90	257	186.7		

■ 溢流阀：

■ 功能说明：

□ 溢流阀是用来保护马达免于过载。只要达到设定的开启溢流压力，高压侧的油液直接短路到低压侧。

□ 溢流阀仅适用于油口接板 181、191 或 192。

□ 开启压力设定范围：50～420 bar

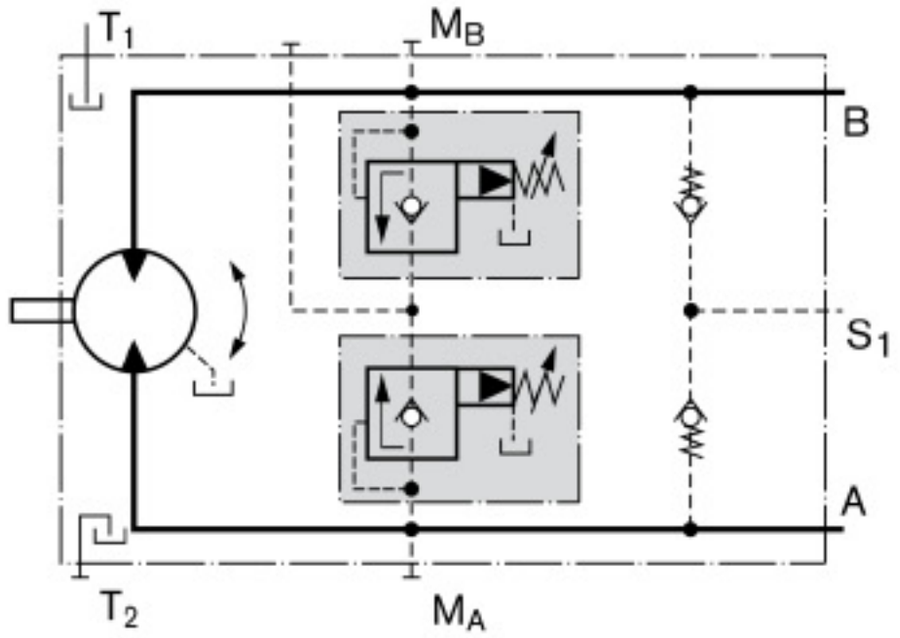
□ 在带“压力分段范围 192”结构中，压力设定可以通过在 P_{st} 口提供 25～30 bar 的外控先导压力来实现高压的设定。

■ 订货时要注明：

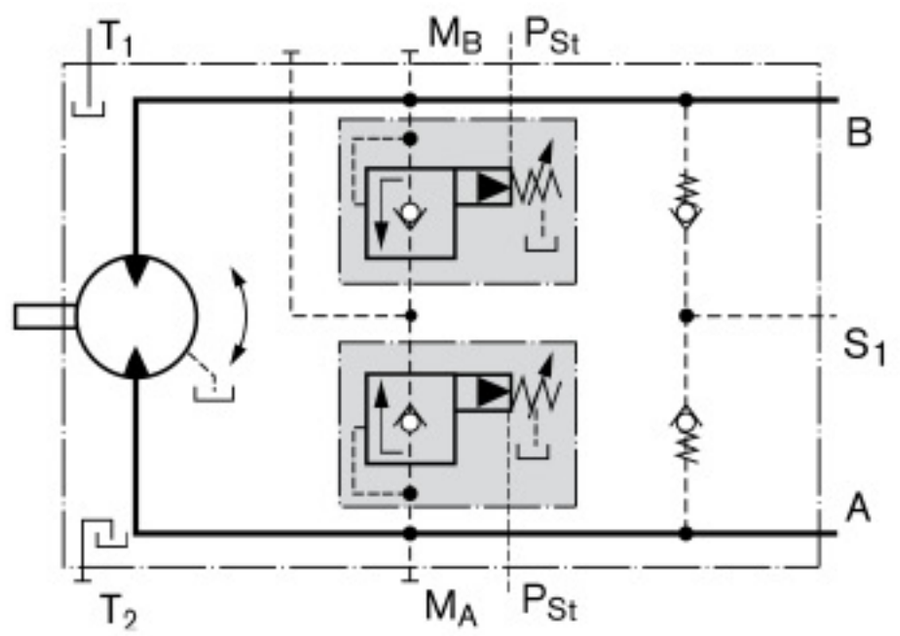
□ 溢流阀开启压力

□ 在 P_{st} 口的先导控制压力的开启压力（对 192 型结构）

□ 带内置溢流阀（带压力分段范围 191）原理图

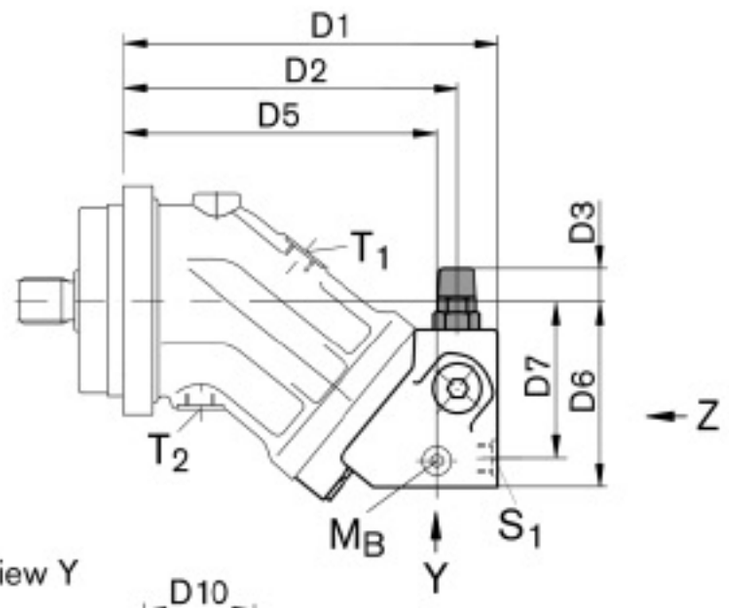


□ 带内置溢流阀（带压力分段范围 192）原理图

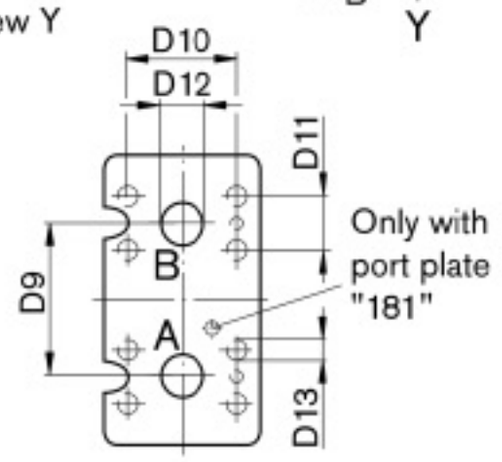


■ 溢流阀：

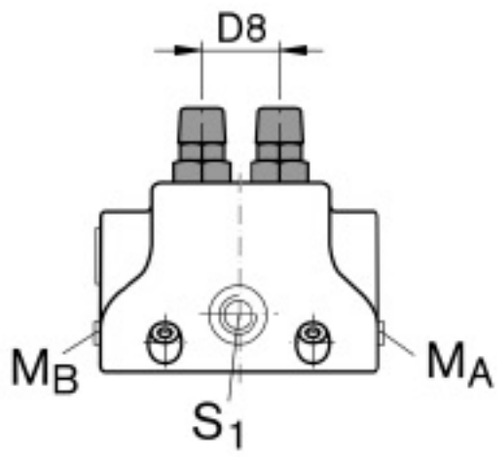
□ 外形尺寸（mm）：



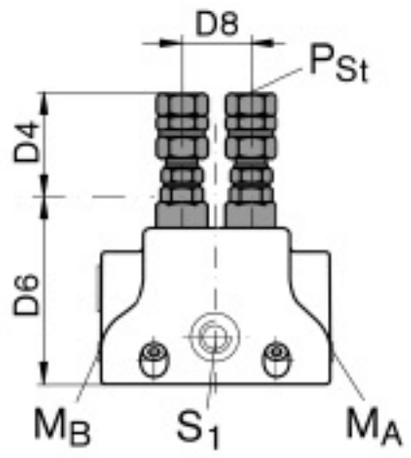
View Y



视图 Z：不带压力增加装置的模块 191 或 181



视图 Z：带压力增加装置的模块 192



Size		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13[2]
28, 32	MHDB.**16**	209	186	25	68	174	102	87	36	66	50.8	23.8	ø19	M10; 17 deep
45	MHDB.**16**	222	198	22	65	187	113	98	36	66	50.8	23.8	ø19	M10; 17 deep
56, 63	MHDB.**22**	250	222	19	61	208	124	105	42	75	50.8	23.8	ø19	M10; 13 deep
80, 90	MHDB.**22**	271	243	17.5	59	229	134	114	42	75	57.2	27.8	ø25	M12; 18 deep
107, 125	MHDB.**32**	298	266	10	52	250	149.5	130	53	84	66.7	31.8	ø32	M14; 19 deep
160, 180	MHDB.**32**	332	301	5	47	285	170	149	53	84	66.7	31.8	ø32	M14; 19 deep

Size	A, B	S_1[1]	M_A, M_B[1]	P_{St}[1]
28, 32	3/4 in	M22 x 1.5; 14 deep	M20 x 1.5; 14 deep	G 1/4
45	3/4 in	M22 x 1.5; 14 deep	M20 x 1.5; 14 deep	G 1/4
56, 63	3/4 in	M26 x 1.5; 16 deep	M26 x 1.5; 16 deep	G 1/4
80, 90	1 in	M26 x 1.5; 16 deep	M26 x 1.5; 16 deep	G 1/4
107, 125	1 1/4 in	M26 x 1.5; 16 deep	M26 x 1.5; 16 deep	G 1/4
160, 180	1 1/4 in	M26 x 1.5; 16 deep	M30 x 1.5; 16 deep	G 1/4

□ 油口尺寸：

名称	油口用途	标准	规格	峰值压力 bar[2]
A、B	工作油口	SAE J518	详见上部参数表	450
S_1	支持油口，适用 191/192	DIN 3852	详见上部参数表	5
M_A 、M_B	工作压力检测口（封闭）	DIN 3852	详见上部参数表	450
P_{St}	外控压力油口，适用 192	DIN 3852	详见上部参数表	30

1) 最大坚固扭矩参照通用标准

2) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

■ 制动平衡阀 BVD 和 BVE：

□ 带制动阀 BVD...W 和 BE

□ 适用选项：

- 起重机上绞车驱动
- 掘进机的履带启动

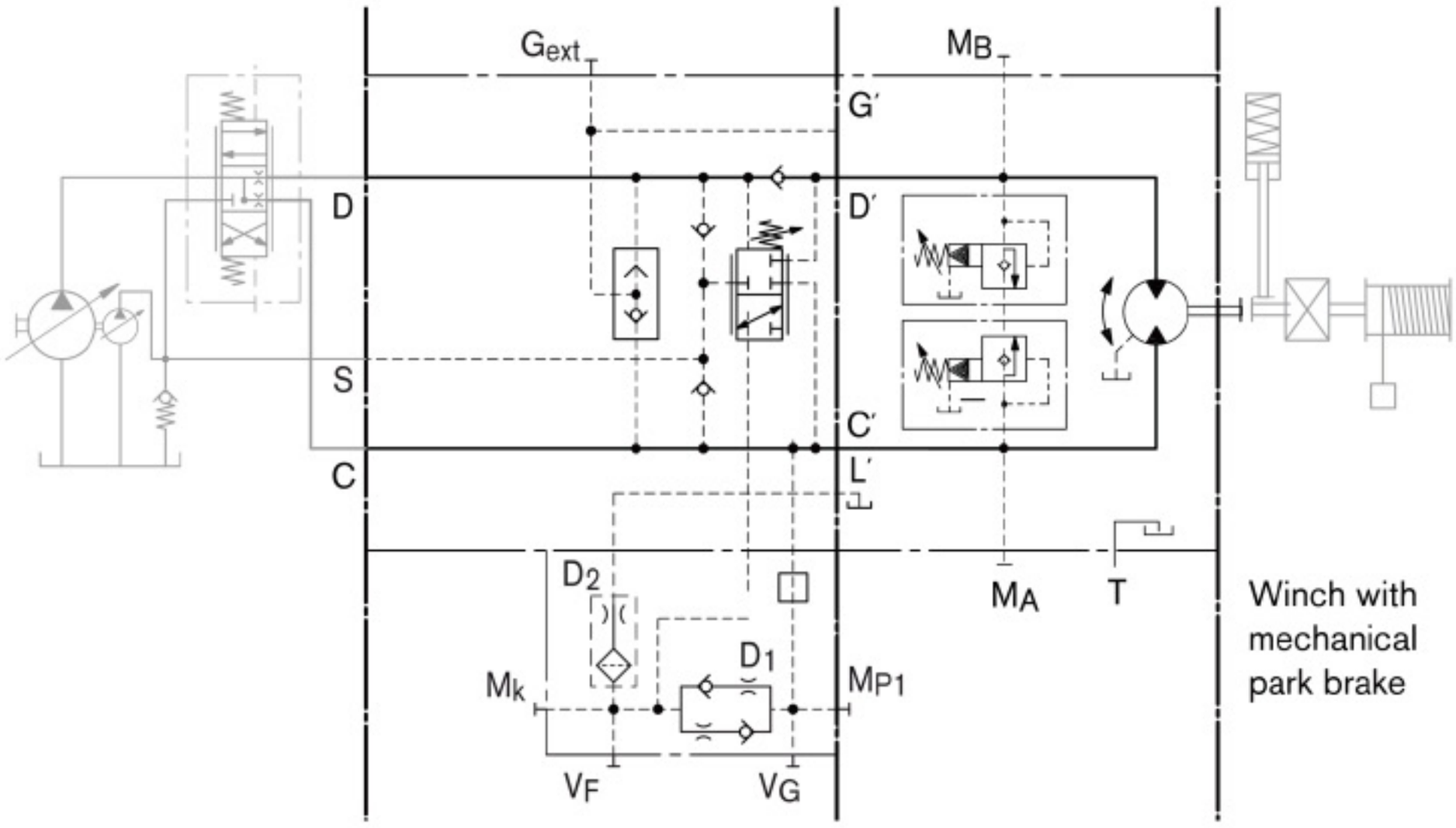
■ 功能说明：

□ 对开式回路运行的液压马达，外部驱动转速超过马达输入流量相应的转速时，液压马达会产生供油不足、吸空情况。制动阀可以避免超转速，避免供油不足、吸空。

■ 举例示意图...起重机上绞车驱动：

□ A2FM090/61W-VAB188 + BVE25W385/51ND-V100K00D4599T30S00-0

换向阀，泵	制动平衡阀	柱塞马达	卷扬机构
不包括连接回路	BVE	A2FM	HD-GFT-W



□ 制动平衡阀 DBV 和 BVD/BVE 允许输入流量或控制压力

马达	不带制动平衡阀时		带制动平衡阀 DBV 时限制值				带制动平衡阀 BVD/BVE 时限制值			
Motor			DBV				BVD/BVE			
NG	p_{nom}/p_{max} [bar]	$q_{V\ max}$ [L/min]	NG	p_{nom}/p_{max} [bar]	q_V [L/min]	Code	NG	p_{nom}/p_{max} [bar]	q_V [L/min]	Code
28	400/450	176	16	350/420	100	181 191, 192	20 (BVD)	350/420	100	188
32		201								
45		255								
56		280	22		240				220	
63		315								
80		360								
90		405								
107		427				171 191, 192				178
125		500								
107		427	32		400	181 191, 192	25 (BVD/BVE)		320	188
125		500								
160		577								
180		648								

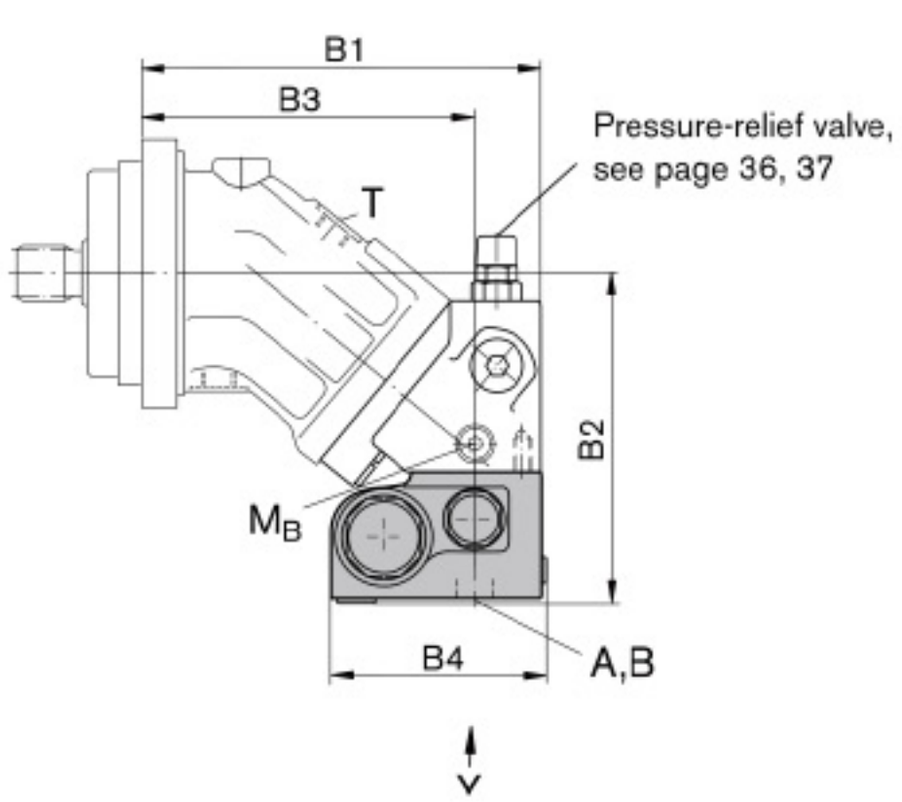
DBV----------溢流阀

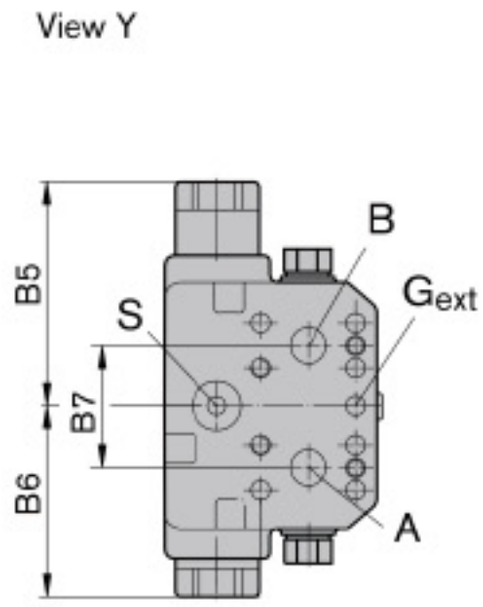
BVD----------制动平衡阀，双作用

BVE----------制动平衡阀，单作用

■ 制动平衡阀 BVD 和 BVE：

□ 外形尺寸（mm）：





马达	制动平衡阀	控制油口	尺寸数据							
规格	型号	尺寸	mm							
		A, B	B1	B2	B3	B4 (S)	B4 (L)	B5	B6	B7
28, 32	BVD20..16	3/4 in	209	175	174	142	147	139	98	66
45	BVD20..16	3/4 in	222	196	187	142	147	139	98	66
56, 63	BVD20..17	3/4 in	250	197	208	142	147	139	98	75
80, 90	BVD20..27	1 in	271	207	229	142	147	139	98	75
107, 125	BVD20..28	1 in	298	238	251	142	147	139	98	84
107, 125	BVD25..38	1 1/4 in	298	239	251	158	163	175	120.5	84
160, 180	BVD25..38	1 1/4 in	332	260	285	158	163	175	120.5	84
107, 125	BVE25..38	1 1/4 in	298	240	251	167	172	214	137	84
160, 180	BVE25..38	1 1/4 in	332	260	285	167	172	214	137	84
250	On request									

□ 油口尺寸：

名称	油口用途	类型	标准	规格 [1]	峰值压力 bar [2]
A、B	工作油口		SAE J518	详见上部参数表	420
S	横进油口	BVD20	DIN 3852	M22 X 1.5 深 14（封闭）	30
		BVD25、BVE25	DIN 3852	M27 X 2 深 16（封闭） [5]	30
Br	制动释放，降低高压	L	DIN 3852	M12 X 1.5 深 12.5	30
G_{ext}	制动释放，降低高压	S	DIN 3852	M12 X 1.5 深 12.5（封闭）	420
M_A 、M_B	工作压力检测口 A、B		ISO 6149	M12 X 1.5 深 12（封闭）	420

1) 最大坚固扭矩参照通用标准

2) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

■ 制动平衡阀 BVD 和 BVE：

■ 安装说明：

□ 装运时，制动阀由马达上有两个定位螺钉固定（运输保护作用）。在固定工作油管时不要卸下此螺钉。在制动阀和马达分开装运时，先将制动阀用定位螺钉固定在马达盖板上。然后，配上工作油管将制动阀固定在马达上。

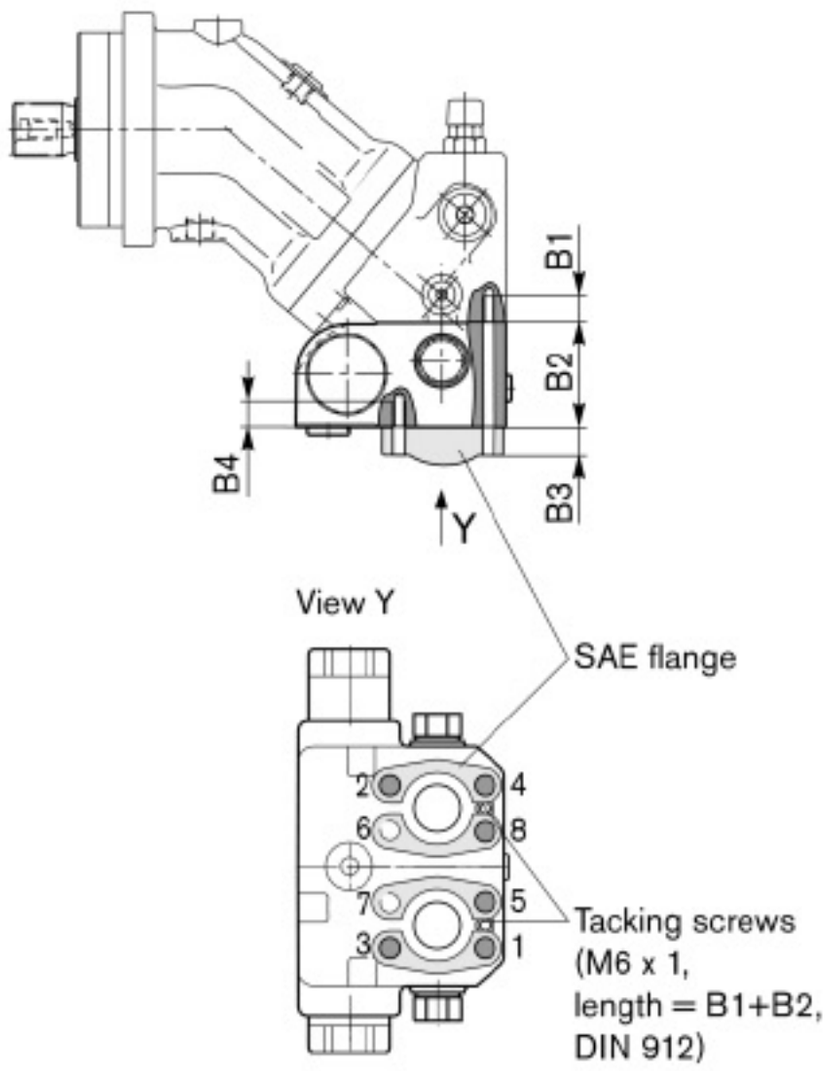
□ 6 个螺钉（1、2、3、4、5、8）-------旋入深度 B1+B2+B3

□ 1 个螺钉（6、7）----------旋入深度 B3+B4

□ 拧紧螺钉时分二步按 1～8 顺序安装。第一步，螺钉必须按一半坚固扭矩拧紧，第二步按最大坚固扭矩拧紧。

螺钉	强度级别	安装扭矩
M6 X 1 平头螺钉	10.9	15.5
M10	10.9	75
M12	10.9	130
M14	10.9	205

■ 外形尺寸：



■ 外形尺寸：

Size	28, 32, 45	56, 63	80, 90	107, 125, 160, 180	107, 125
Port plate	18				17
B1[1]	M10 x 1.5; 17 deep	M10 x 1.5; 17 deep	M12 x 1.75; 18 deep	M14 x 2; 19 deep	M12 x 1.75; 17 deep
B2	78[2]	68	68	85	68
B3	customer-specific				
B4	M10 x 1.5; 15 deep	M10 x 1.5; 15 deep	M12 x 1.75; 16 deep	M14 x 2; 19 deep	M12 x 1.75; 17 deep

1) 最低要求的螺纹深度 1 X 螺纹直径

2) 带连接板

■ 转速传感器：

■ 功能说明：

□ 机型 A2FM...U 和 A2FM...F 马达内有齿轮传动的转动组件，适合选配转速传感器。交货时，在预装速度传感器部位，油口是用高强度堵头封闭的。

□ 带 DSA 或 HDD 比例信号速度传感器的马达速度可以实现。

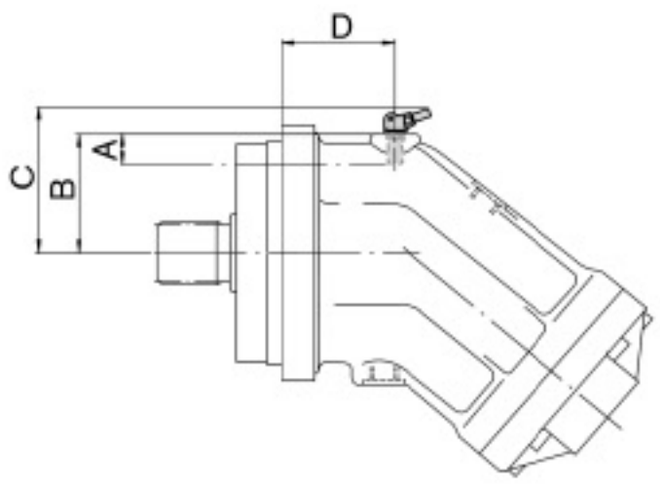
□ 传感器可以检测速度和旋转方向

□ 与转速成正比的电信号由花键连接的转动组件的转动产生，转速传感器检测、计算和远传。

■ 外形尺寸：

□ 机型 V

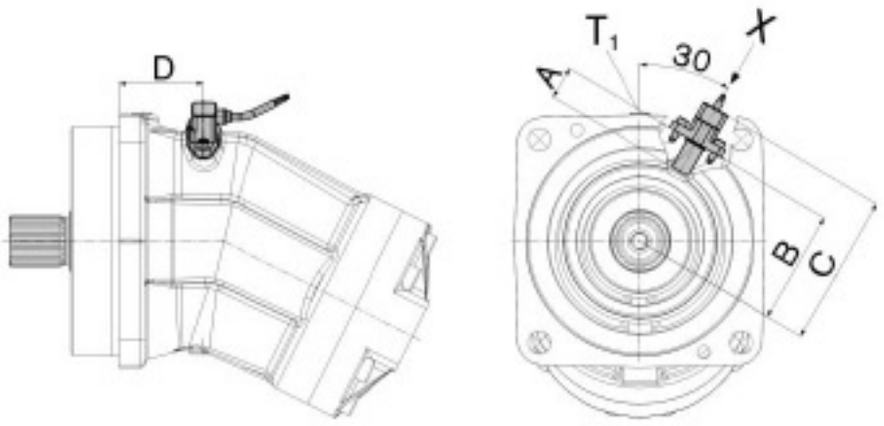
□ 规格 23～200 带 DSA 传感器



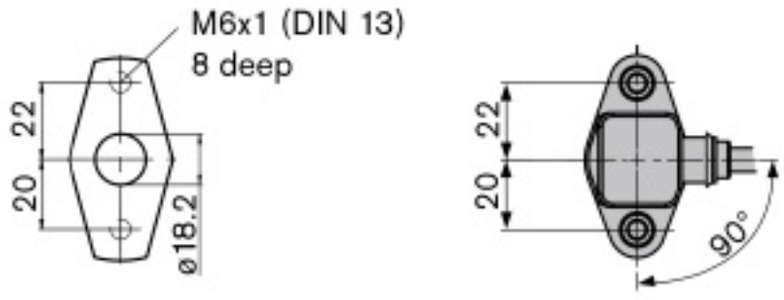
■ 外形尺寸：

□ 机型 H

□ 规格 250～500 带 HDD 传感器



□ 视图 X



■ 数据表：

Size			23, 28, 32	45	56, 63	80, 90	107, 125
Number of teeth			38	45	47	53	59
DSA	A	Insertion depth (tolerance ± 0.1)	18.4	18.4	18.4	18.4	18.4
	B	Contact surface	57.9	64.9	69.9	74.9	79.9
	C		74.5	81.5	86.5	91.5	96.5
	D		54.7	54.3	61.5	72.5	76.8

Size			160, 180	200	250	355	500
Number of teeth			67	80	78	90	99
HDD	A	Insertion depth (tolerance ± 0.1)	–	–	32	32	32
	B	Contact surface	–	–	110.5	122.5	132.5
	C		–	–	149	161	171
	D		–	–	82	93	113
DSA	A	Insertion depth (tolerance ± 0.1)	18.4	18.4	32	32	32
	B	Contact surface	87.4	100.9	–	–	–
	C		104	117.5	–	–	–
	D		86.8	97.5			

■ 安装及试运行指南：

■ 概述说明：

- 在马达初次起动及工作时，马达壳体内部必须充满液压油和空气排净。起动必须在低速和无负载工况下进行，直至系统中空气全部排完。
- 马达长期停机后，马达壳体的液压油可能通过工作管道泄出。在重新起动时，必须保证马达壳体内部充满液压油。
- 对于“传动轴朝上”或“传动轴朝下”的安装位置，必须注意完全地充满液压油和充分放气，否则会造成风险（空运转）。
- 马达壳体中的泄油必须通过壳体上位置最高的泄油口（T_1、T_2）排至油箱，管路上不准安装单向阀且管径不得缩小。
- 对于多个马达组合使用，要确认各自的壳体压力没有超限。在马达泄油口的压差值，集合的泄油管路必须改变以满足最小允许壳体压力在任何情况下都不能超出。如果达不到要求，就需要铺设单独的泄油管路。
- 为了减少噪音，建议所有与油箱连接的管路采用柔性软管连接，隔离噪音；泵尽量避免放置在油箱之上。

■ 安装位置：

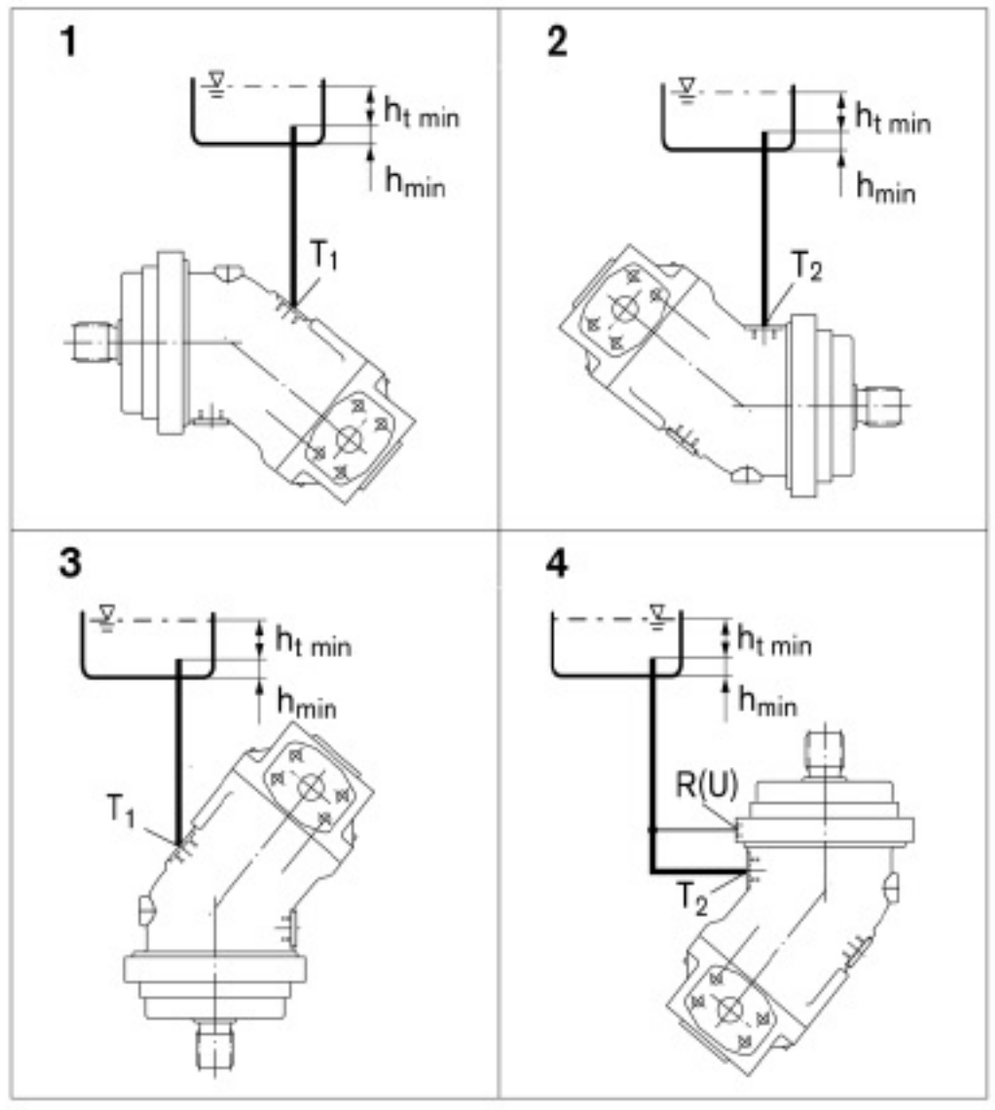
- 参考安装实例 1...8，其他安装位置可应要求提供。
- 建议优先安装位置为 1 和 2

■ 注意事项：

- 如果规格 10～200 马达的安装方式是“主轴朝上”，要保留通气口 R（在订货时注明...特殊类型）。规格 250～500 马达，在轴承附近部位的冲洗口 U 作为标准预留给空气排放。
- 在起动前马达壳体内部必须充满液压油（注油时要直至油从通气口 R 或冲洗口 U 溢出为止）。轴承处气泡会导致马达损坏。

■ 在油箱下方安装（标准）：

- 标准马达安装时进出油口应该低于油箱中油液的最低液位。
- 在马达起动前，通过马达壳体上位置最高的一个泄油口将液压油充满马达壳体。
- 低速运行马达（起始速度），直至马达壳体和整个回路全部充满液压油。
- 油箱中吸油管或排油管在油箱中的最小淹没深度：200mm（相对与油箱的最低液面）



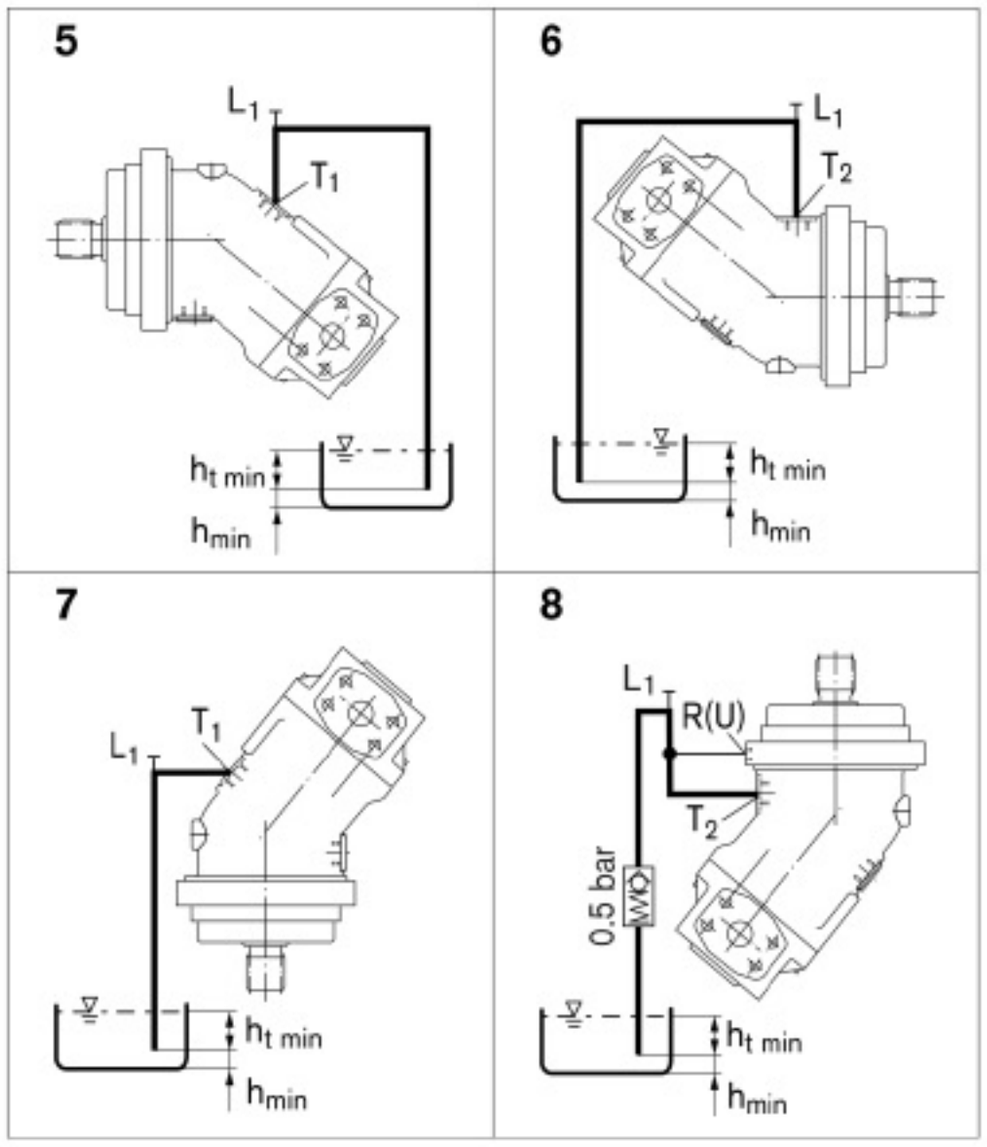
安装位置	空气排放	注油
1	-	T_1
2	-	T_2
3	-	T_1
4	R（U）	T_2

■ 在油箱上方安装：

- 马达安装在油箱中油液的最低液位之上
- 和低于油箱液面安装一样操作
- 如果马达长期停机，马达壳体的液压油可能通过工作管道泄出（通过轴密封处空气进入马达壳体）。因此在重新起动时，轴承将得不到充分润滑。在重新起动时必须通过马达壳体上位置最高的一个泄漏口向马达壳体内部灌满液压油，（空气通过 R 或 U 口排除）。
- 安装位置 8（主轴朝上）：这种方式安装马达，即使马达壳体不泄漏也会造成轴承润滑不充分。为了防止马达壳体中液压油通过泄漏口漏出，在泄油管中设置一个单向阀（开启压力为 0.5 bar）

■ 名词解释：

L_1	注油/排气口
R	空气排放口（特殊版本）
U	轴承冲洗口/空气排放口
T_1、T_2	泄油口
$h_{t\,min}$	所需最低浸没深度（200mm）
h_{min}	到油箱底部的所需最短距离（100mm）



安装位置	空气排放	注油
5	L_1	T_1（L_1）
6	L_1	T_2（L_1）
7	L_1	T_1（L_1）
8	R（U）	T_2（L_1）

■ 常规操作指南：

- HD-A2FM 泵设计用于开式和闭式回路中。
- 轴向柱塞泵的项目规划、组装和调试必须由合格人员进行。
- 在使用轴向柱塞单元前，请完整阅读相应的说明手册。如有必要，可以咨询华德液压。
- 运行期间及运行后不久，轴向柱塞泵可能存在造成灼伤的风险。 应采取适当的安全措施（ 例如：穿着防护服)。
- 根据轴向柱塞泵的不同工作条件（ 工作压力、油液温度)，特性可能会改变。
- 工作管路油口：
  - 油口和固定螺纹设计用于最大规定压力。机器或系统制造商必须确保连接元件和管路的安全系数满足规定的工作条件（压力、流量、液压油、温度)。
  - 工作管路油口和功能油口仅设计用于液压管路。
- 必须遵循此处包含的数据和说明。
- 该产品未被认证为满足 DIN EN ISO 13849 的通用机器安全概念要求的部件。
- 在液压系统中安装溢流阀。
- 采用以下紧固扭矩：
- 接头：
  - 有关所使用接头的紧固扭矩，请参见制造商说明。
- 安装螺栓：
  - 对于符合 DIN 13 的 ISO 公制螺纹标准和符合 ASME B1.1 的螺纹标准的安装螺栓，我们建议根据 VDI 2230 单独检查紧固扭矩。
- 轴向柱塞泵的螺纹孔：
  - 最大允许紧固扭矩 $M_{G\,max}$ 对于螺纹孔是最大值，不得超过该值。有关数值请参见下表。
- 锁紧螺钉：
  - 对于与轴向柱塞单元一起提供的金属锁紧螺钉，需要施加紧固扭矩 M_V 有关数值请参见下表。

■ 油口螺纹规格和锁紧螺钉的紧固扭矩：

油口		内螺纹最大允许紧固扭矩	锁紧螺钉所需的紧固扭矩	锁紧螺钉内六角规格
螺纹规格	标准	M_{Gmax}	M_v [1)]	WAF
DIN 3852[1)]	M10 x 1	30 Nm	15 Nm[2)]	5 mm
	M12 x 1.5	50 Nm	25 Nm[2)]	6 mm
	M14 x 1.5	80 Nm	35 Nm	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M20 x 1.5	170 Nm	80 Nm	10 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M26 x 1.5	230 Nm	120 Nm	12 mm
	M27 x 2	330 Nm	135 Nm	12 mm
	M30 x 2	420 Nm	215 Nm	17 mm
	M33 x 2	540 Nm	225 Nm	17 mm
	M42 x 2	720 Nm	360 Nm	22 mm
DIN ISO 228	G 1/4	40 Nm	–	–

1）螺纹的紧固扭矩是针对收货清空状态和轻压油状态安装。
2）在轻压油状态，对 M12×1.5 的 M_v 减少 17Nm

■ 型号说明：

HD	-		A2F		E	56	/	6	1	W	-	N	A	L	010		
0		1	2	3	4	5		6	7	8		9	10	11	12	13	14

0. 制造商：

华德液压 HUADE HYDRAULIC

1. 液压油/类型：

液压油/规格：	28	32	45	56	63	80	90	107	125	160	180	250	355	代码
矿物油和 HFD...无代码	■	■	■	■	■	■	■	■	■	■	■	■	■	-
HFD 油液仅适用规格 250～355 且驱动轴承为长寿命“L”的结构形式元件														
规格：28～180...无代码	■	■	■	■	■	■	■	■	■	■	■	-	-	-
规格：250～500	-	-	-	-	-	-	-	-	-	-	-	■	■	E
HFB、HFC 油液仅适用驱动轴承为长寿命“L”的结构形式元件														

2. 轴向柱塞元件：

元件形式/规格：	28	32	45	56	63	80	90	107	125	160	180	250	355	代码
斜轴式结构	■	■	■	■	■	■	■	■	■	■	■	□	□	A2F
轴向柱塞定量马达														

3. 驱动轴承：

轴承类别/规格：	28	32	45	56	63	80	90	107	125	160	180	250	355	代码
机械轴承....无代码	■	■	■	■	■	■	■	■	■	■	■	■	■	-
长寿命轴承	-	-	-	-	-	-	-	-	-	-	-	■	■	L

4. 安装方式：

安装方式/规格：	28	32	45	56	63	80	90	107	125	160	180	250	355	代码
插装马达 （内藏式）	■	■	■	■	■	■	■	■	■	■	■	■	■	E

5. 元件规格：

元件排量/规格：	28	32	45	56	63	80	90	107	125	160	180	250	355	代码
排量≌ V_{gmax}（cm^3/r）	28	32	45	56	63	80	90	107	125	160	180	250	355	-

6. 结构系列：

结构系列/规格：	28	32	45	56	63	80	90	107	125	160	180	250	355	代码
6 系列	■	■	■	■	■	■	■	■	■	■	■	■	■	6

7. 结构标号：

结构标号/规格：	28	32	45	56	63	80	90	107	125	160	180	250	355	代码
规格：28...180	■	■	■	■	■	■	■	■	■	■	■	-	-	1
规格：250...355	-	-	-	-	-	-	-	-	-	-	-	■	■	0

■ 型号说明：

8. 旋转方向：

查看方向/旋转方向：	旋转方向	代码
从轴端看：	正反可逆	W

9. 元件密封：

密封类型/规格：	28	32	45	56	63	80	90	107	125	160	180	250	355	代码
FKM（氟橡胶）	■	■	■	■	■	■	■	■	■	■	■	■	■	V

10. 马达出轴：

出轴类型/规格：		28	32	45	56	63	80	90	107	125	160	180	250	355	代码
花键轴	I 系列	■	■	-	■	■	■	■	■	■	■	■	-	-	A
DIN 5480	II 系列	■	-	■	■	-	■	-	■	-	■	-	■	■	Z

11. 安装法兰：

法兰形式/规格：		28	32	45	56	63	80	90	107	125	160	180	250	355	代码
特制法兰	2 孔	■	■	■	■	■	■	■	■	■	■	■	-	-	L
ISO 3019-2	4 孔	-	-	-	-	-	-	-	-	-	-	-	■	■	M

■ = 优选方案（较短的交货时间）

■ = 可供货

□ = 准备中

- = 无供货

■ 型号说明：

12. 工作油口位置：

油口位置/规格：			28	32	45	56	63	80	90	107	125	160	180	250	355	代码
油口 A 和 B	01	0	-	-	-	-	-	-	-	-	-	-	-	■	□	010
SAE 法兰，在后部。		7	-	-	-	-	-	-	-	-	-	-	-	-	□	017
油口 A 和 B	02	0	-	-	-	-	-	-	-	-	-	-	-	■	□	020
SAE 法兰，侧面相对。		7	-	-	■	-	-	-	-	■	■	■	■	■	-	027
		9	-	-	-	■	■	■	■	-	-	-	-	-	-	029
油口 A 和 B	10	0	■	■	■	■	■	■	■	■	■	■	■	-	■	100
SAE 法兰，为同侧面。		7	■	■	■	■	■	■	■	-	-	-	-	-	■	107
内置溢流阀油口接板	BVD	1	-	-	-	-	-	-	-	■	■	-	-	-	-	171
可用于安装平衡阀		8	-	-	-	-	-	-	-	■	■	-	-	-	-	178
	BVE	1	■	■	■	■	■	■	■	■	■	■	■	-	-	181
		8	-	-	-	-	-	-	-	■	■	■	■	-	-	188
内置溢流阀油口接板	19	1	■	■	■	■	■	■	■	■	■	■	■	-	-	191
		2	■	■	■	■	■	■	■	■	■	■	■	-	-	192

配装阀说明：

0	不带阀
1	带插装式溢流阀（不带液控先导控制）
2	带插装式溢流阀（带液控先导控制）
7	配装冲洗阀和补油压力阀
8	配装平衡阀 BVD/BVE
9	配装内置式冲洗和补油压力阀

13. 速度传感器：

法兰形式/规格：	28	32	45	56	63	80	90	107	125	160	180	250	355	代码
不带传感器…无代码	■	■	■	■	■	■	■	■	■	■	■	■	■	-
预留备装 HDD 传感器	-	-	-	■	■	■	■	■	■	■	■	■	-	F
配装 HDD 速度传感器	-	-	-	□	□	□	□	□	□	□	□	■	-	H
预留备装 DSA 传感器	□	□	□	□	□	□	□	□	□	□	□	□	-	U
配装 DSA 速度传感器	□	□	□	□	□	□	□	□	□	□	□	□	-	V

14. 特殊结构：

法兰形式/规格：	28	32	45	56	63	80	90	107	125	160	180	250	355	代码
标准型….无代码	■	■	■	■	■	■	■	■	■	■	■	■	■	-
特殊结构	■	■	■	■	■	■	■	■	■	■	■	■	■	J

= 优选方案（较短的交货时间）

■ = 可供货

□ = 准备中

\- = 无供货

■ 技术数据：

■ 液压油分类：

□ 适合轴向柱塞泵马达的液压油可分为：

□ 矿物油基液压油

□ 环保型液压油：

- 酯基合成液压油液 HEES
- 乙二醇基合成液压油液 HEPG
- 植物油基液压油液 HETG

□ 阻燃液压油（HF 油液）

代号	油液类型	含水量（重量%）
HFA	包油乳化液	95…98
HFB	包水乳化液	＞40
HFC	基溶液	35…55
HFD	水油液	≤0.1

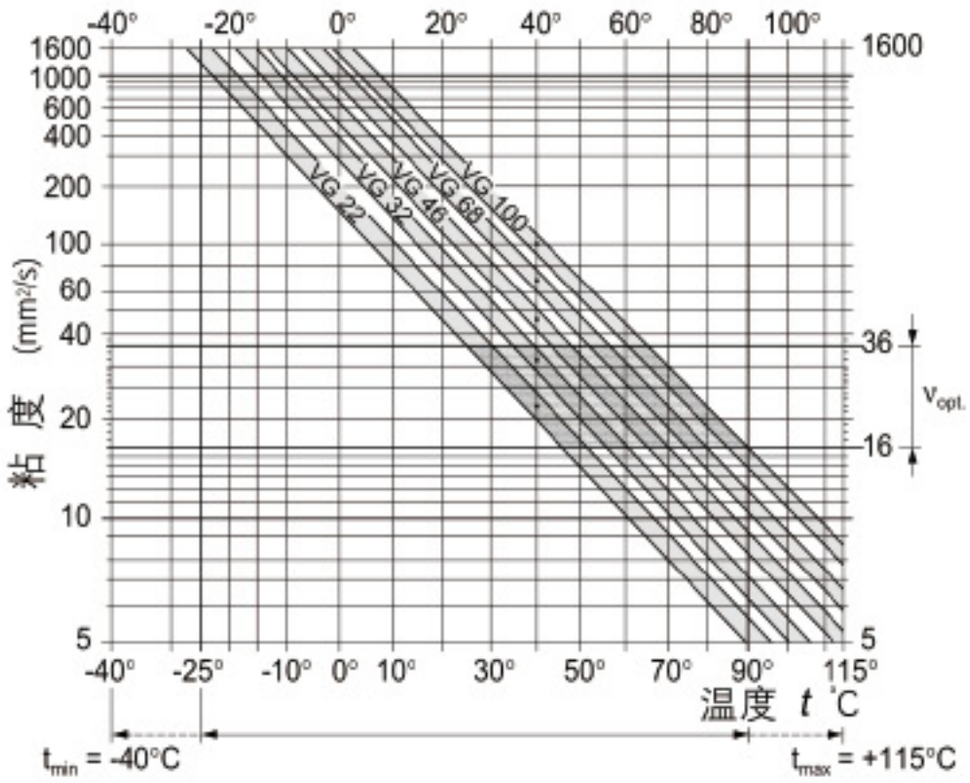
■ 适用液压油：

□ 为了保证无故障的高效工作，在设计选用期间应根据工况仔细选择液压系统的液压油。粘度和粘度/温度曲线相当重要，密度和倾点也必须考虑。

□ 所有矿物油基液压油均在某种程度上适合轴向柱塞马达，应用时基本划分取决于上述的水、粘度与温度关系，并考虑氧化和腐蚀保护、材料相容性、空气和水分离特性。

□ 轴向柱塞泵马达不适合使用水包油乳化液（HFA）；使用油包水乳化液（HFB）、水基溶液（HFC）、无水油液（HFD）或环保型液压油时，要考虑对轴向柱塞泵马达技术数据进行适当的限制或降低。必要时可与华德液压技术部门联系咨询。

■ 液压油选择图：



油液温度范围

■ 液压油选择：

□ 为了正确选择液压油，必须知道与环境温度有关的工作温度：闭式回路中针对回路温度，开式回路中针对油箱温度。

□ 液压油选择：在工作温度范围内工作粘度处于最佳范围 V_{opt} 内，见选择图阴影部分。推荐在每种场合下选择较高粘度等级。

□ 示例：

在 X ˚C的环境温度下，回路中工作温度为 60˚C，闭式回路中针对回路温度，开式回路中针对油箱温度。在最佳工作温度范围（V_{opt} 阴影部分）内，对应粘度范围等级 VG 46 或 VG68，选择 VG68。

□ 注意状况：

- 泄漏油（壳体泄油）温度受压力和转速的影响，总是高于回路温度或油箱温度。但是回路中任何一点温度都不许超过 115˚C。下面表中指定的温度差是在考虑到轴承中油的粘度时要确定。
- 如果遇到极端工作参数或较高的环境温度不能满足上述条件，我们推荐壳体冲洗或采取冲洗阀。进一步请与华德液压技术部门联系。

■ 液压油过滤：

□ 液压油过滤的越干净，液压油达到的清洁度等级越高，轴向柱塞泵马达的寿命就越长。

□ 为了保证元件的正常工作，最低清洁度等级是：

- 按 NAS 1638　9 级
- 按 SAE　6 级
- 按 ISO/DIS 4406　18/15 级

□ 液压油处于高温时（90˚C至最高 115˚C）最低的清洁度等级是：

- 按 NAS 1638　8 级
- 按 SAE　5 级
- 按 ISO/DIS 4406　17/14 级
- 如果不能达到上述清洁度等级，请与华德液压技术部门联系。

■ 技术数据：

■ 液压油粘度和温度：

内容	粘度 mm^2/s	温度	说明
运输和存储的环境温度		$T_{min} \geqslant -50^{\circ}C$ $T_{opt} = +5^{\circ}C \sim +20^{\circ}C$ 最佳	保存时间：标准为 12 个月 最长不超过 24 个月
冷启动时	$V_{max} = 1600$	$T_{St} \geqslant -40^{\circ}C$	t ≤ 3 min 没有负载（p ≤ 50 bar） n ≤ 1000 rpm 适合规格 5～200 n ≤ 0.25 n_{nom} 适合规格 250～500
允许温差		$\Delta T \leqslant 25$ K	在泵和液压油之间
热启动时	V＜1600～400	T = -40°C°C～-25°C	在 p ≤ 0.7＊p_{nom} ，n ≤ 0.5＊n_{nom} 和 t ≤ 15 min
运转状态时 温度差 最高温度		 $\Delta T =$ 约 12 K 115°C 103°C	 在轴承部位和泄油口 T 之间液压油温差 在轴承部位处测量 在泄油口 T 处测量
连续运转	V = 400～10 $V_{opt} = 36 \sim 16$ 最佳	T = -25°C～+90°C	在泄油口 T 处测量 在可允许范围内没有限制
短时运转 2)	$V_{min} \geqslant 7$	$T_{max} = +103^{\circ}C$	在泄油口 T 处测量，t ＜ 3 min，p ＜ 0.3＊p_{nom}
FKM 轴端密封 1)		T ≤ +115°C	

1）在温度低于-25°C，要求采用 NBR（丁腈橡胶）轴密封（允许温度范围-40°C～+90°C）

2）规格 250～500，请向华德液压技术部门咨询。

■ 技术数据：

■ 轴端密封

□ 允许的工作压力

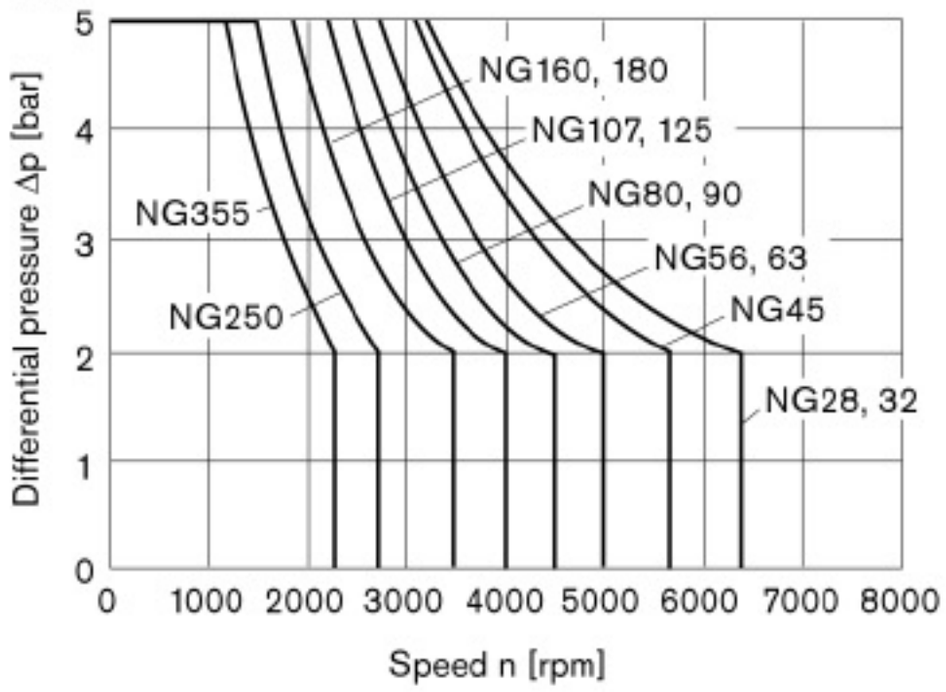
□ 轴端密封寿命取决于泵的转速和壳体压力（壳压）。在正常的环境温度下，壳体和外界压力之间的 2 bar 的压差是不允许超过的。更高的压差将影响泵的转速，见图示。

□ 短时壳体压力峰值（t<0.1 秒）允许达到 10 bar，但随着壳体压力峰值的频率增加，轴端密封的寿命将会缩短。

□ 使用丁腈橡胶（NBR）密封同使用氟橡胶（FKM）密封相比，允许壳体压力减少 33%，在某些工况下可能需要减小这些值

□ 壳体内的压力必须等于或高于轴密封上的外界压力。

□ 规格 28...355



□ 表中数值在外界压力 P_{abs} = 1 bar 时有效。

■ 温度范围：

□ 轴密封为 FKM （氟橡胶）温度范围从-25℃到+115℃。

□ 在-25℃以下请使用 NBR（丁腈橡胶）轴密封（温度范围从-40℃到+90℃）。订购轴密封为 NBR（丁腈橡胶），请在订货时注明。

■ 流动方向：

□ 从驱动轴端看旋转方向

顺时针转动	逆时针转动
A 到 B	B 到 A

■ 转速范围：

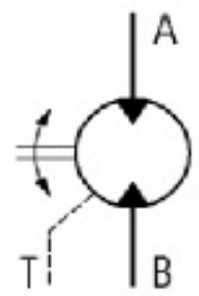
□ 最低转速 n_{min} 没有限制，如需平稳运行，最低转速 n_{min} 不能低于 50 rpm.；最高转速见参数表。

■ 长寿命轴承结构（L）

□ 规格 250...500

□ 长寿命轴承结构用于延长工作寿命和允许使用阻燃液压油（HF 油液），长寿命轴承结构安装尺寸和标准结构完全相同，相互之间可以随时互换。

■ 液压符号：

油口符号	油口名称	液压原理图
A 、B	工作油口	
T	泄漏油口	

■ 安装方式：

□ 详见泵安装设计指南

■ 技术数据：

- 适用于矿物油介质运行

■ 工作压力范围：

- 工作油口（A 或 B 口）压力：
- 规格 28～180

  公称压力 P_{nom} ---------- 400 bar（绝对压力）

  峰值压力 P_{max} ---------- 450 bar（绝对压力）

  单次工作时间 10 s（秒），总工作时间 300 h（小时）

  压力总和（$P_A + P_B$）P_{SU} = 700 bar

- 规格 250～355

  公称压力 P_{nom} ---------- 350 bar（绝对压力）

  峰值压力 P_{max} ---------- 400 bar（绝对压力）

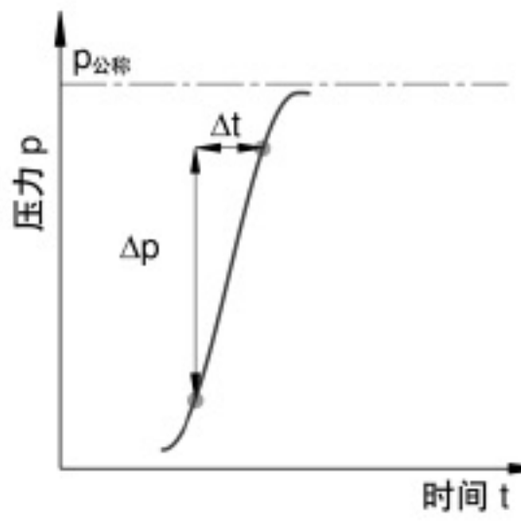
  单次工作时间 10 s（秒），总工作时间 300 h（小时）

  压力总和（$P_A + P_B$）P_{SU} = 700 bar

- 最小压力（A 或 B 口高压侧）：25 bar（绝对压力）
- 压力变化率 $R_{A\,max}$：

  带内置溢流阀----------9000 bar/s

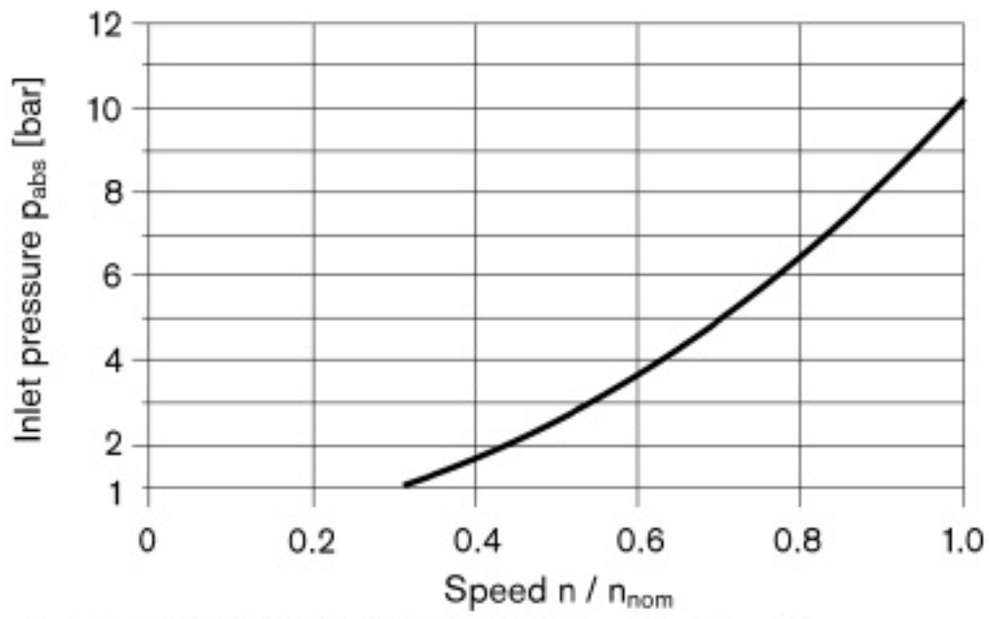
  不带溢流阀----------16000 bar/s



- 其他油液的参数，请向华德液压技术部门咨询。

■ 最小压力---泵模式（吸入油口）：

- 为了预防损坏泵模式运行的马达(在不改变旋转方向而改变高压侧，相当于刹车)，在工作油口（吸入油口）必须保证为最小压力。最小压力取决于泵的转速。



- 本图表只适合最佳粘度范围值的油液 V_{opt} = 36～16mm²/s，
- 其他条件的油液请咨询华德液压技术部门。

■ 名词定义：

- 公称压力 P_{nom}

  公称压力与最大设计压力相对应

- 峰值压力 P_{max}

  峰值压力与单次工作时间内的最大工作压力相对应。单次工作时间的总和不得超过总工作时间。

- 最小压力（高压侧）：

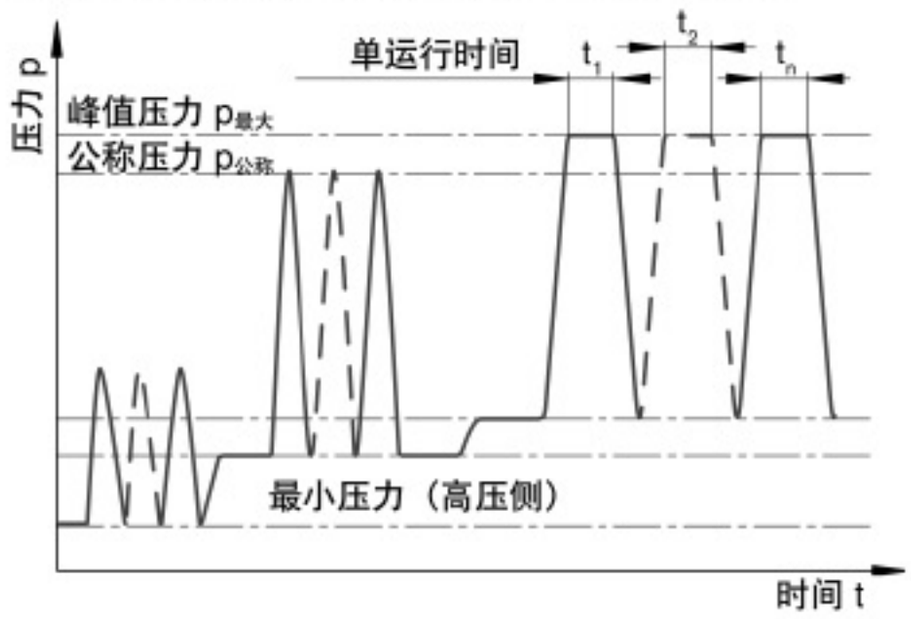
  防止损坏轴向柱塞泵所需的高压侧最小压力（油口 A 或 B）。

- 压力总和 P_{SU}

  压力总和是所有工作油口压力之和（油口 A 和 B）

- 压力变化率 R_A

  整个压力范围内压力变化时最大允许增压和减压速度



- 总工作时间=$t_1 + t_2 + t_3$ ……$+ t_n$

■ 技术数据：

□ 数值表：

理论数值，未考虑 η_{mh} 和 η_v 效率；四舍五入值

技术数据/规格		代号	单位	28	32	45	56	63	80	
几何排量	每转的排量	V_g	cm^3	28.1	32	45.6	56.1	63	80.4	
最大转速 1)	转速	n_{nom}	rpm	6300	6300	5600	5000	5000	4500	
		n_{max} 2)	rpm	6900	6900	6200	5500	5500	5000	
进口流量 3)	在 n_{nom} 和 V_g 时	q_v	L/min	177	202	255	281	315	362	
扭矩 4)	⊿p=350 bar	T	Nm	157	178	254	313	351	448	
在 V_g 和	⊿p=400 bar	T	Nm	179	204	290	357	401	512	
旋转刚度		c	kNm/rod	2.93	3.12	4.18	5.94	6.25	8.73	
旋转总成转动惯量		J_{GR}	Kgm^2	0.0012	0.0012	0.0024	0.0042	0.0042	0.0072	
最大角速度		α	rad/s^2	6500	6500	14600	7500	7500	6000	
加注容量		V	L	0.20	0.20	0.33	0.45	0.45	0.55	
重量	近似值	m	Kg	10.5	10.5	15	18	19	23	

技术数据/规格		代号	单位	90	107	125	160	180	250	355
几何排量	每转的排量	V_g	cm^3	90	106.7	125	160.4	180	250	355
最大转速 1)	转速	n_{nom}	rpm	4500	4000	4000	3600	3600	2700	2240
		n_{max} 2)	rpm	5000	4400	4400	4000	4000	-	-
进口流量 3)	在 n_{nom} 和 V_g 时	q_v	L/min	405	427	500	577	648	675	795
扭矩 4)	⊿p=350 bar	T	Nm	501	594	696	893	1003	1393	1978
在 V_g 和	⊿p=400 bar	T	Nm	573	679	796	1021	1146	-	-
旋转刚度		c	kNm/rod	9.14	11.2	11.9	17.4	18.2	73.1	96.1
旋转总成转动惯量		J_{GR}	Kgm^2	0.0072	0.0116	0.0116	0.0220	0.0220	0.061	0.102
最大角加速度		α	rad/s^2	6000	4500	4500	3500	3500	10000	8300
加注容量		V	L	0.55	0.8	0.8	1.1	1.1	2.5	3.5
重量	近似值	m	Kg	25	34	36	47	48	82	110

□ 说明：

1) 数值适用于：
最佳工作粘度范围 V_{opt} = 36～16 mm^2/s
用于矿物油基液压油
2) 间歇状态的最高转速：在卸载过程和超载过程中的超转速，t＜5 秒和⊿p＜150 bar。
3) 用平衡阀限制进口流量，见后面资料。
4) 不带径向力扭矩，带径向力见后面资料。

□ 注意事项：

- 超过最大允许值或低于最小允许值可能导致功能消失、使用寿命缩短或泵完全损坏。
- 其他允许的极限值，包括限制转速变化，减小角加速度的频率功能和允许启动的角加速度（低于最大角加速度），请在数据表中查找。

■ 技术数据：

■ 驱动轴参数：

□ 驱动轴允许有轴向和径向力负载

□ 适用花键轴和平键轴

技术数据/规格	代号	单位	28	28	32	45	56	56[4]	56
驱动轴	Φ	mm	25	30	30	30	30	30	35
最大径向力 [1]	$F_{q\,max}$	KN	5.7	5.4	5.4	7.6	9.5	7.8	9.1
在距离 a 时	a	mm	16	16	16	18	18	18	18
从轴肩起									
允许扭矩	T_{max}	Nm	179	179	204	290	357	294	357
允许压力 ⊿p	Δp_{perm}	Bar	400	400	400	400	400	330	400
最大轴向力 [2]	$+F_{ax\,max}$	N	500	500	500	630	800	800	800
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0
每 bar 工作压力允许的轴向力	$\pm F_{ax\,max/bar}$	N/bar	5.2	5.2	5.2	7.0	8.7	8.7	8.7

技术数据/规格	代号	单位	63	80	80[4]	80	90	107	107
驱动轴 [1]	Φ	mm	35	35	35	40	40	40	45
最大径向力	$F_{q\,max}$	KN	9.1	11.6	11.1	11.4	11.4	13.6	14.1
在距离 a 时	a	mm	18	20	20	20	20	20	20
从轴肩起									
允许扭矩	T_{max}	Nm	401	512	488	512	573	679	679
允许压力 ⊿p	Δp_{perm}	Bar	400	400	280	400	400	400	400
最大轴向力 [2]	$+F_{ax\,max}$	N	800	1000	1000	1000	1000	1250	1250
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0
每 bar 工作压力允许的轴向力	$\pm F_{ax\,max/bar}$	N/bar	8.7	10.6	10.6	10.6	10.6	12.9	12.9

技术数据/规格	代号	单位	125	160	160	180	250	355	
驱动轴 [1]	Φ	mm	45	45	50	50	50	60	
最大径向力	$F_{q\,max}$	KN	14.1	18.1	18.3	18.3	1.2[5]	1.5[5]	
在距离 a 时	a	mm	20	25	25	25	41	52.5	
从轴肩起									
允许扭矩	T_{max}	Nm	796	1021	1021	1146	-[3]	-[3]	
允许压力 ⊿p	Δp_{perm}	Bar	400	400	400	400	-[3]	-[3]	
最大轴向力 [2]	$+F_{ax\ max}$	N	1250	1600	1600	1600	2000	2500	
	$-F_{ax\ max}$	N	0	0	0	0	0	0	
每 bar 工作压力允许的轴向力	$\pm F_{ax\,max/bar}$	N/bar	12.9	16.7	16.7	16.7	-[3]	-[3]	

1) 在间歇工作时

2) 在泵停止或无压力工作状态时最大允许轴向力

3) 待开发，请联系华德。

4) 限制数据只适用花键轴

5) 在间歇或泵无压力工作时，若出现较高轴向力时，请联系华德。

□ 注意：

注意允许轴向力的作用方向的影响：

$+F_{ax\ max}$ = 增加轴承寿命

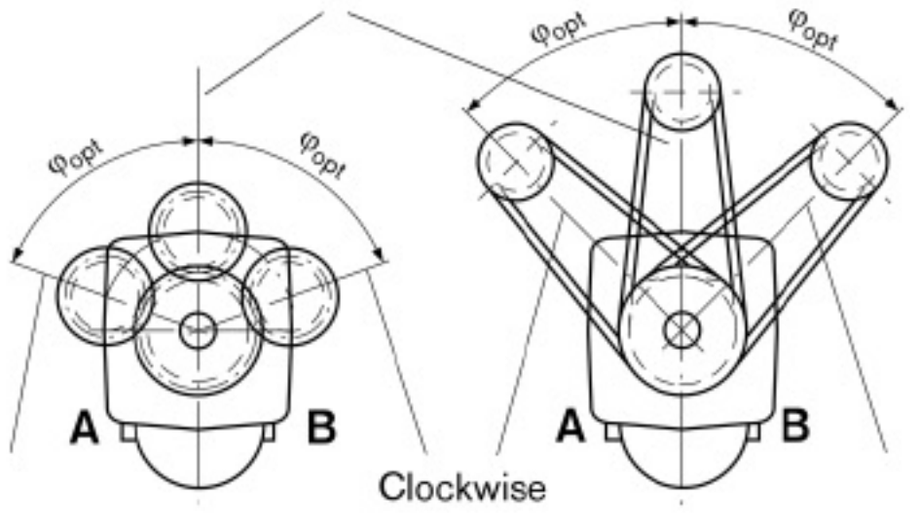
$-F_{ax\ max}$ = 降低轴承寿命（尽量避免）

■ 技术数据：

- □ Fq 最佳轴向作用力方向
- □ 选择适合的 F_q 轴向作用力方向，可减少内驱动力对轴承产生的负荷，从而延长轴承寿命。推荐配套齿轮位置是依据旋转方向。
- □ 示例如下：

	齿轮传动	V-皮带传动
规格	Ψ_{opt}	Ψ_{opt}
28～180	±70°	±45°
250 和 500	±45°	±70°

交替旋转方向



逆时针转动	顺时针转动	逆时针转动
油口 B 压力	油口 A 压力	油口 B 压力

■ 规格计算：

排量　$q_V = \frac{V_g \cdot n}{1000 \cdot \eta_v}$　L/min

输出转速　$n = \frac{q_V \cdot 1000 \cdot \eta_v}{V_g}$　min^{-1}

输出扭矩　$T = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi}$

$= \frac{1{,}59 \cdot V_g \cdot \Delta p \cdot \eta_{mh}}{100}$　Nm

或 $T = T_K \cdot \Delta p \cdot \eta_{mh}$　Nm

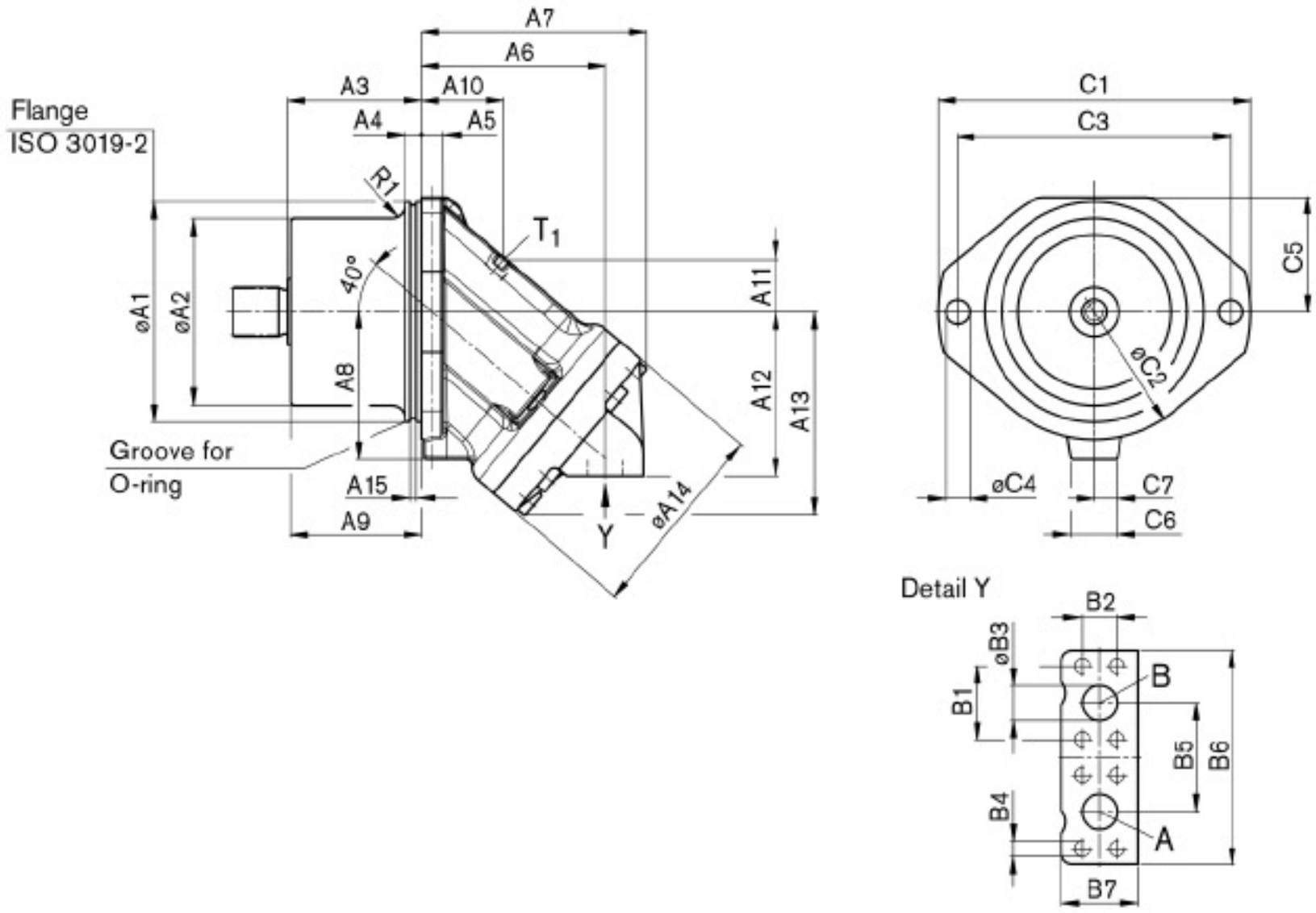
输出功率　$P = \frac{2\pi \cdot T \cdot n}{60\,000} = \frac{T \cdot n}{9549}$

$= \frac{q_V \cdot \Delta p}{600} \cdot \eta_t$　kW

V_g = 每转体积排量
T = 扭矩
Δp = 压差
n = 转速
T_K = 扭矩常量
η_v = 容积效率
η_{mh} = 机械－液压效率
η_t = 总效率

■ 元件尺寸（mm）：规格 28…180

□ 油口连接板 10



■ 外形和油口尺寸：

Size	øA1	øA2	A3[1]	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	øA14	A15
28, 32	$135_{-0.025}$	$94_{-0.5}$	88.8	15	16	94	114	95	87.1	45	27	91	106	106	5.2
45	$160_{-0.025}$	$117^{+1.5}_{-2}$	92.3	15	18	109	133	106	90	50	31.3	102	119	118	5.2
56, 63	$160_{-0.025}$	$121_{-0.5}$	92.3	15	18	122	146	109	90	59	34	107	130	128	5.2
80, 90	$190_{-0.029}$	$140.3_{-0.5}$	110	15	20	127	157	123	106	54	41	121	145	138	5.2
107, 125	$200_{-0.029}$	$152.3_{-0.5}$	122.8	15	20	143	178	135	119	58	41	136	157	150	5.2
160, 180	$200_{-0.029}$	$171.6_{-0.5}$	122.8	15	20	169	206	134	119.3	75	47	149	185	180	5.2

Size	B1	B2	øB3	B4, DIN 13[2]	B5	B6	B7	C1	øC2	C3	øC4	C5	C6	C7
28, 32	40.5	18.2	13	M8 x 1.25; 15 deep	59	115	40	188	154	160	14	71	42	13
45	50.8	23.8	19	M10 x 1.5; 17 deep	75	147	49	235	190	200	18	82	47.5	15
56, 63	50.8	23.8	19	M10 x 1.5; 17 deep	75	147	48	235	190	200	18	82	36	0
80, 90	57.2	27.8	25	M12 x 1.75; 17 deep	84	166	60	260	220	224	22	98	40	0
107, 125	66.7	31.8	32	M14 x 2; 19 deep	99	194	70	286	232	250	22	103	40	0
160, 180	66.7	31.8	32	M14 x 2; 19 deep	99	194	70	286	232	250	22	104	42	0

规格	R1	O 型圈[3]	工作油口 A,B SAE	泄油口 T_1 DIN 3852[2]
28, 32	10	126 x 4	1/2 in	M16 x 1.5; 12 deep
45	10	150 x 4	3/4 in	M18 x 1.5; 12 deep
56, 63	10	150 x 4	3/4 in	M18 x 1.5; 12 deep
80, 90	10	180 x 4	1 in	M18 x 1.5; 12 deep
107, 125	16	192 x 4	1 1/4 in	M18 x 1.5; 12 deep
160, 180	12	192 x 4	1 1/4 in	M22 x 1.5; 14 deep

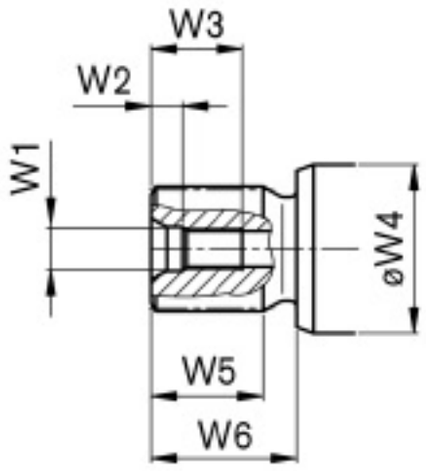
1) 到轴肩

2) 最大固定扭矩遵照通用标准

3) 不包括传动部分装置

■ 元件尺寸（mm）：规格 28...180

□ 轴端尺寸：

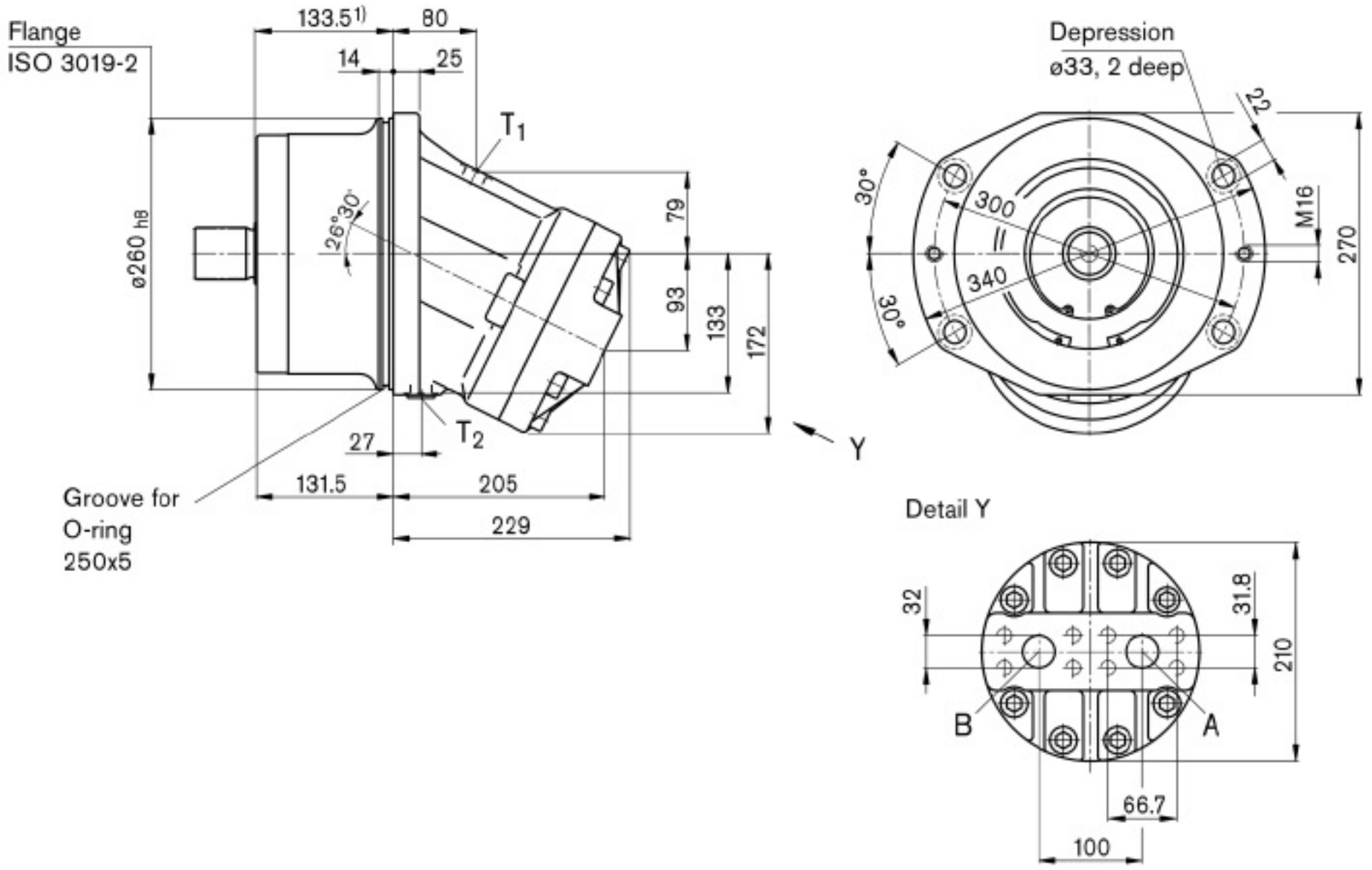


规格	花键轴 DIN 5480	尺寸 W1	尺寸 W2	尺寸 W3	尺寸 W4	尺寸 W5	尺寸 W6
28, 32	**A** W30 x 2 x 14 x 9g	M10 x 1.5	7.5	22	35	27	35
28	**Z** W25 x 1.25 x 18 x 9g	M8 x 1.25	6	19	35	28	43
45	**Z** W30 x 2 x 14 x 9g	M12 x 1.75	9.5	28	35	27	35
56, 63	**A** W35 x 2 x 16 x 9g	M12 x 1.75	9.5	28	40	32	40
56	**Z** W30 x 2 x 14 x 9g	M12 x 1.75	9.5	28	40	27	35
80, 90	**A** W40 x 2 x 18 x 9g	M16 x 2	12	36	45	37	45
80	**Z** W35 x 2 x 16 x 9g	M12 x 1.75	9.5	28	45	32	40
107, 125	**A** W45 x 2 x 21 x 9g	M16 x 2	12	36	50	42	50
107	**Z** W40 x 2 x 18 x 9g	M12 x 1.75	9.5	28	50	37	45
160, 180	**A** W50 x 2 x 24 x 9g	M16 x 2	12	36	60	44	55
160	**Z** W45 x 2 x 21 x 9g	M16 x 2	12	36	60	42	50

1) 中心孔依据 DIN 332（螺纹依据 DIN 12），最大固定扭矩遵照通用标准。

■ 元件尺寸（mm）：规格 250

□ 油口连接板 01

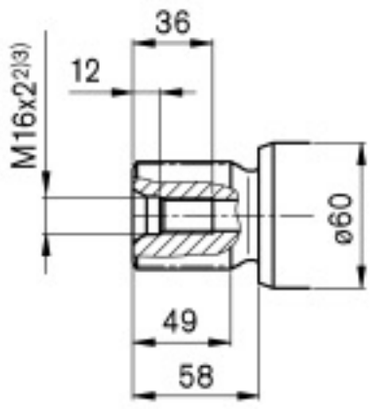


□ 轴端尺寸：

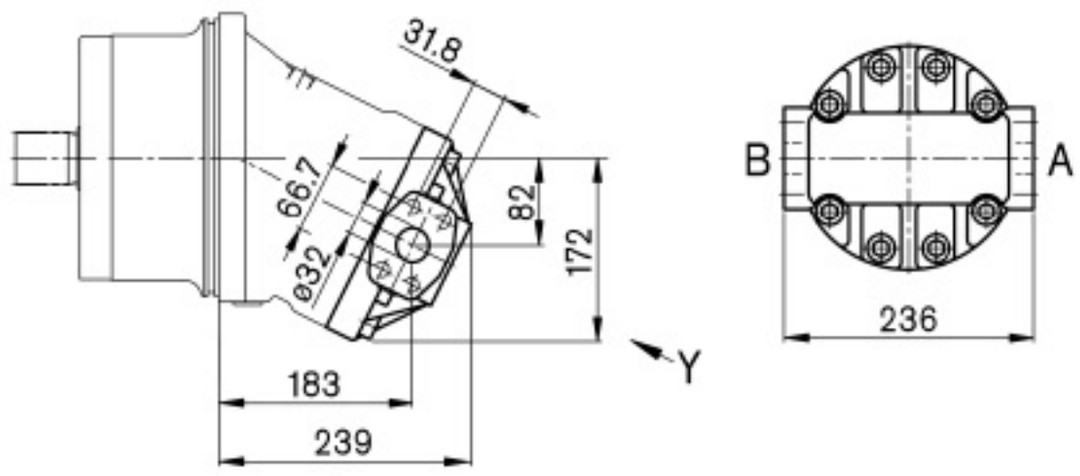
■ 规格 80

Z 花键轴 DIN 5480

W 50 X 2 X24 X 9g



■ 接口油板：　　SAE 法兰，在侧面。



□ 油口尺寸：

名称	油口用途	标准 6)	规格 3)	峰值压力 bar 4)
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1-1/4" M14 X 2 深 19	400
T_1	泄油口 5)	DIN 3852	M22 X 1.5 深 14	3
T_2	泄油口 5)	DIN 3852	M22 X 1.5 深 14（封闭）	3

1) 到轴肩

2) 中心孔依照 DIN 332（螺纹依照 DIN 13）

3) 最大坚固扭矩参照通用标准

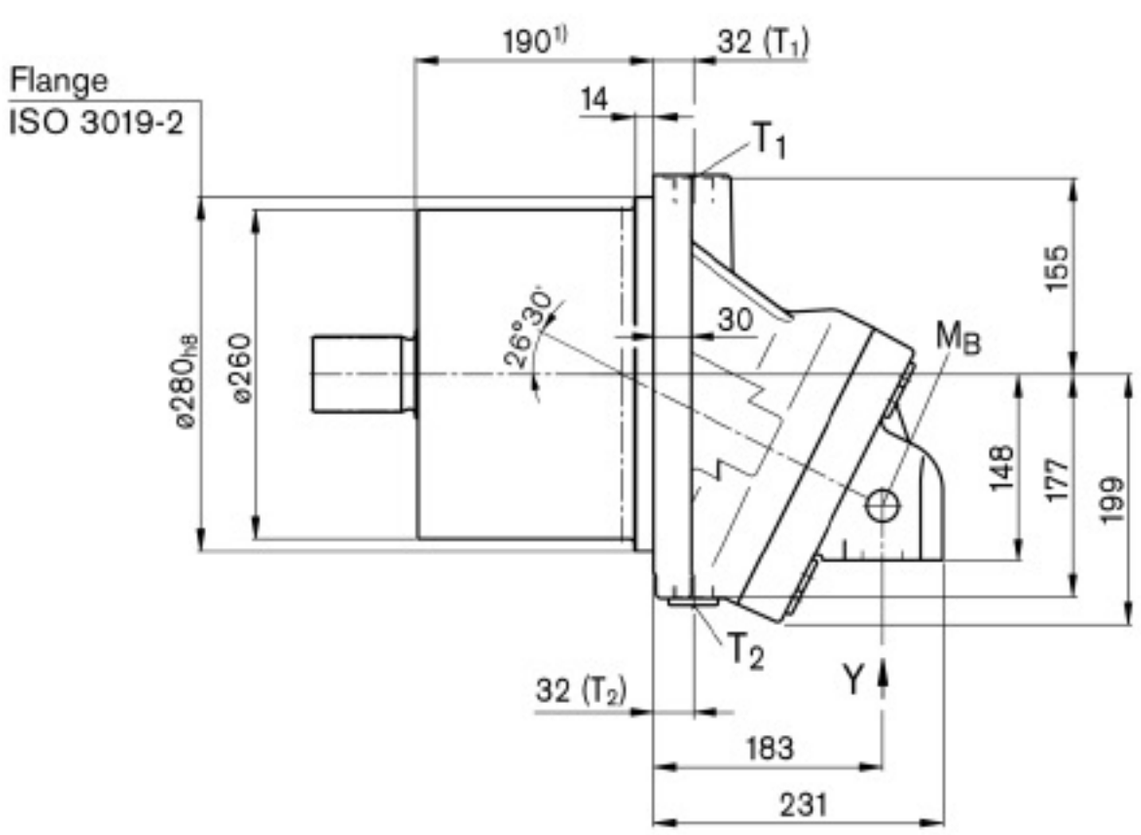
4) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

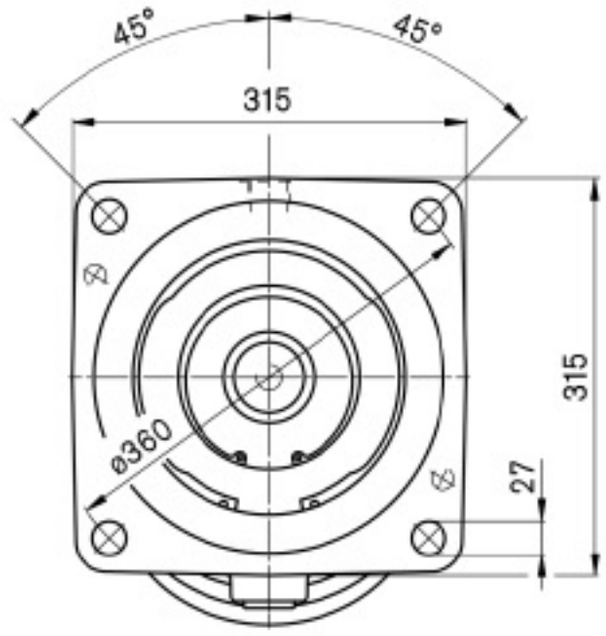
5) 依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6) 实际制造详见通用标准

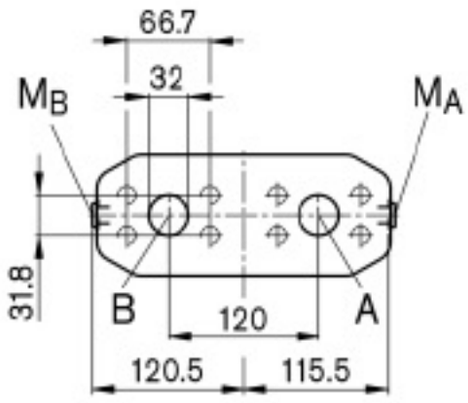
■ 元件尺寸（mm）：规格 355

□ 油口连接板 10





Detail Y

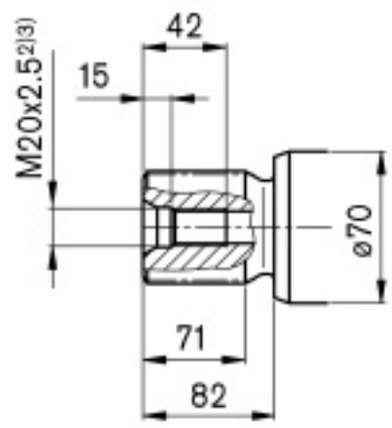


□ 轴端尺寸：

■ 规格 80

Z 花键轴 DIN 5480

W 60 X 2 X28 X 9g



□ 油口尺寸：

名称	油口用途	标准 [6]	规格 [3]	峰值压力 bar [4]
A、B	工作油口 固定螺纹	SAE J518 DIN 13	1-1/4” M14 X 2 深 22	400
T_1	泄油口 [5]	DIN 3852	M33 X 2 深 18	3
T_2	泄油口 [5]	DIN 3852	M33 X 2 深 18（封闭）	3

1）到轴肩

2）中心孔依照 DIN 332（螺纹依照 DIN 13）

3）最大坚固扭矩参照通用标准

4）峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

5）依据位置选择安装，但 T_1 或 T_2 必须连接管路（也可以参看泵安装指南）。

6）实际制造详见通用标准

■ 冲洗和增压阀

■ 功能说明：

- □ 冲洗和增压阀在液压回路中起到散热作用。
- □ 在开式回路，只用来冲洗壳体。
- □ 在闭式回路，在附加壳体冲洗时确保最小的增压水平。
- □ 冲洗油从马达低压侧流入壳体，和壳体泄漏油一起流回油箱。如果是闭环回路，流出的流量必须由增压泵补充冷却油液。
- □ 带油口接板 027，阀体直接安装在马达上（规格 45～180、250）；带油口接板 017，阀体安装阀板上（规格 355 和 500）；

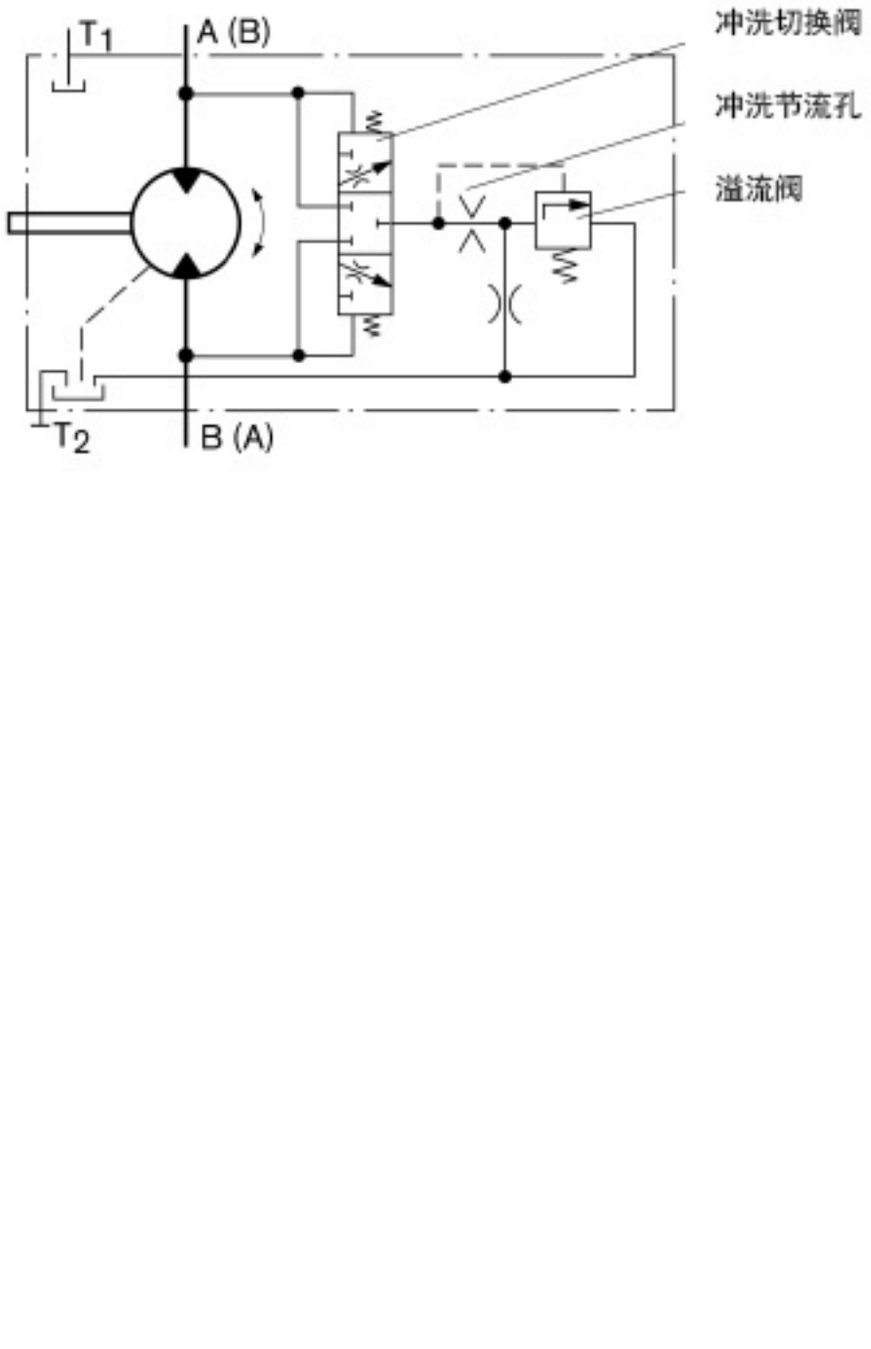
■ 参数设定：

- □ 溢流阀的设定压力（注意：主回路溢流阀设定值）：
  规格 45～500，压力设定值----------16 bar
- □ 冲洗阀的切换压力 Δp
  规格 45～500，压力设定值----------8±1 bar

■ 冲洗流量 q_v：

- □ 节流孔（节流阀带阀组）能够建立所需的冲洗流量。
- □ 流量参数基础条件：
  $\Delta P_{ND} = P_{ND} - P_G = 25$ bar
  $V = 10\ mm^2/s$
  P_{ND} ：低压； P_G：壳体压力

■ 工作原理图：



■ 标准冲洗流量：

□ 冲洗和增压阀，配装式（标号 7）

规格	冲洗流量 q_v L/min	节流孔 Φ mm
45	3.5	1.2
107、125	5	1.8
160、180	8	2.0
250	10	2.0
355、500	10	2.5

□ 说明：
对规格 45～180，节流孔可以提供冲洗流量范围 3.5～10 L/min，如果需要冲洗流量和标准冲洗流量不同，请在订货时注明。不带节流孔的冲洗流量是大约值。12～14 冲洗流量为在低压 Δp = 25 bar 时的标准冲洗流量。

□ 冲洗和增压阀，整体式（标号 9）

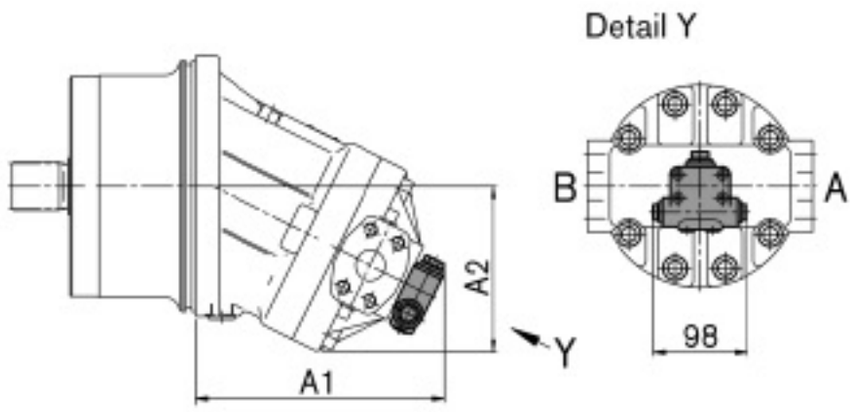
规格	冲洗流量 q_v L/min	节流孔 Φ mm
56、63	6	1.5
80、90	7.3	1.8

■ 冲洗和增压阀

■ 外形尺寸（mm）：

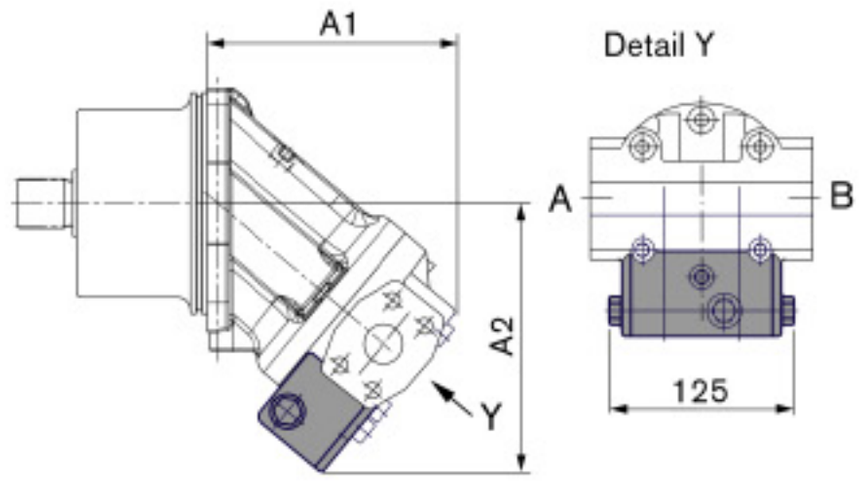
■ 规格：107～250

■ 油口接板 027：SAE 法兰，在侧面。



■ 规格：56～90

■ 油口接板 029：SAE 法兰，在侧面。

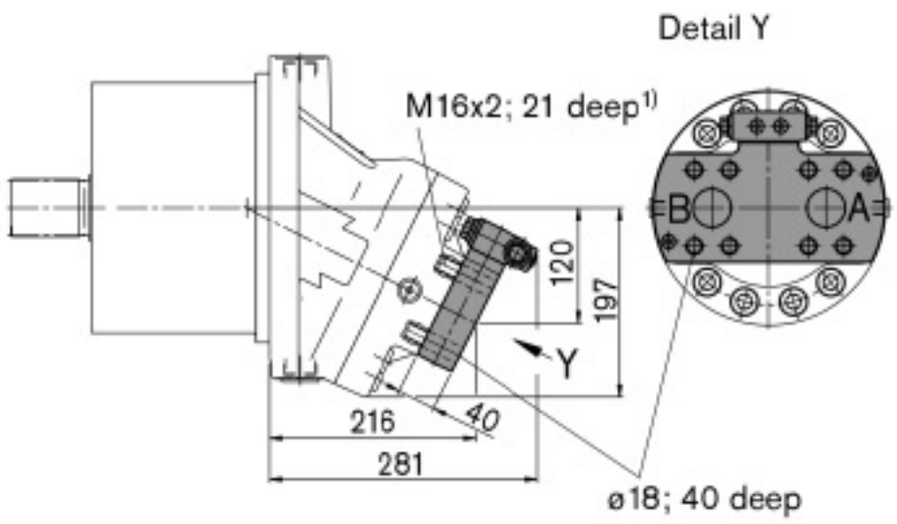


规格	A1	A2		
107、125	211	192		
160、180	232	201		
250	260.5	172		

规格	A1	A2		
56、63	165	176		
80、90	178	186.7		

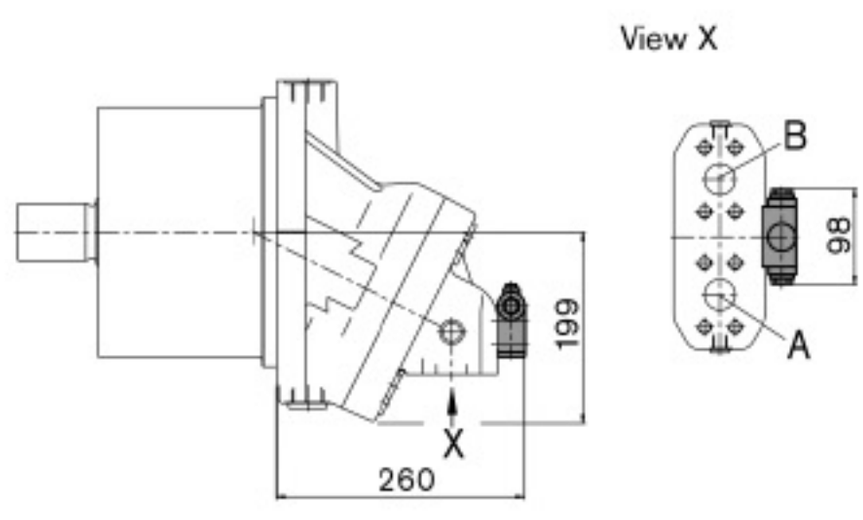
■ 规格：355

■ 油口接板 017：SAE 法兰，在后部。



■ 规格：355

■ 油口接板 017：SAE 法兰，在底部。



1）最大坚固扭矩参照通用标准

■ 溢流阀：

■ 功能说明：

□ 溢流阀是用来保护马达免于过载。只要达到设定的开启压力，高压侧的油液直接短路到低压侧。

□ 溢流阀仅适用于带油口接板 181、191 或 192 的装置。

□ 开启压力设定范围：50～420 bar

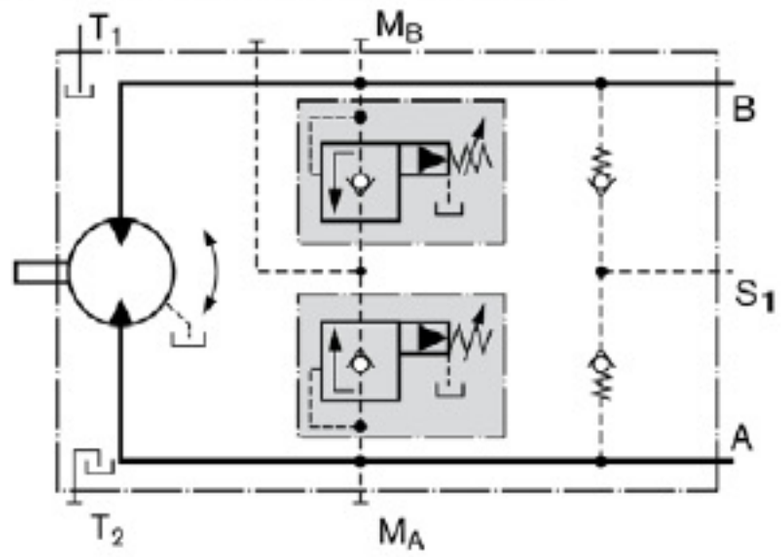
□ 结构带“压力放大装置 192”，可以通过在 P_{st} 油口提供 25～30 bar 的外控先导压力来实现更高压力设定值。

■ 订货时，请在订单注明：

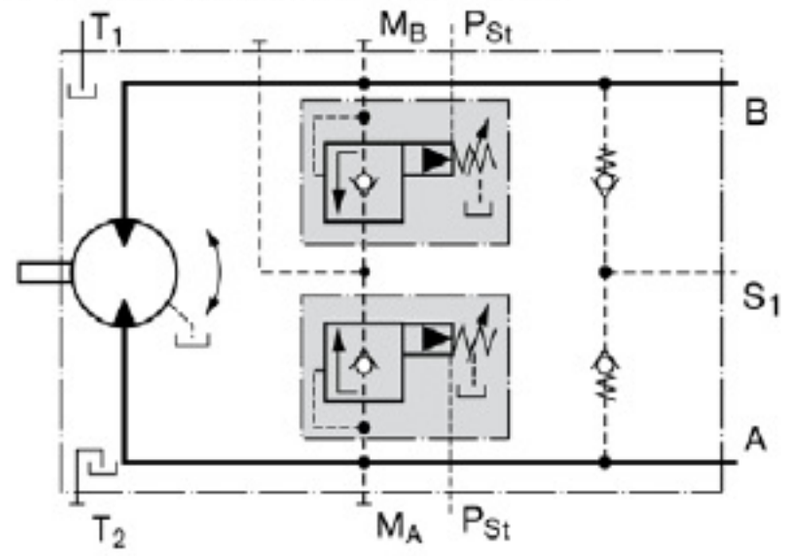
□ 溢流阀开启压力

□ 在先导控制压力 P_{st} 口的开启压力（只适用 192 结构）

□ 结构带压力放大装置 191 原理图

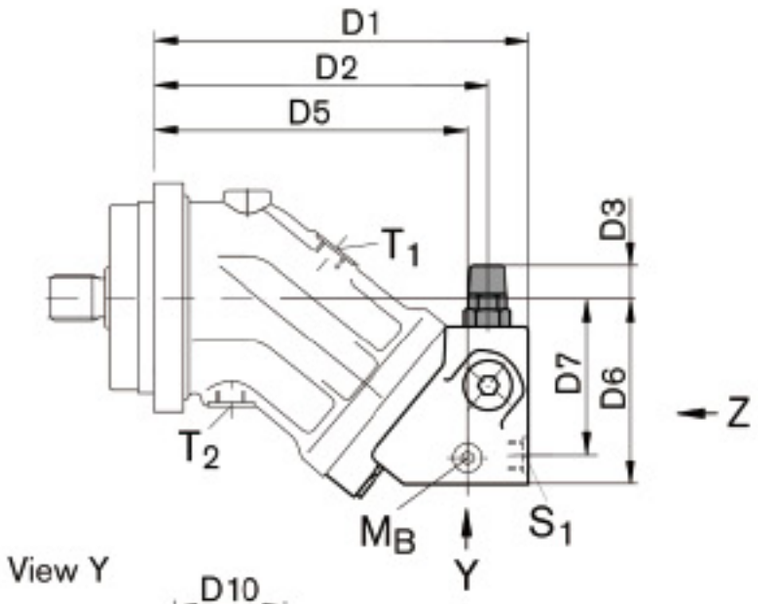


□ 结构带压力放大装置 192 原理图

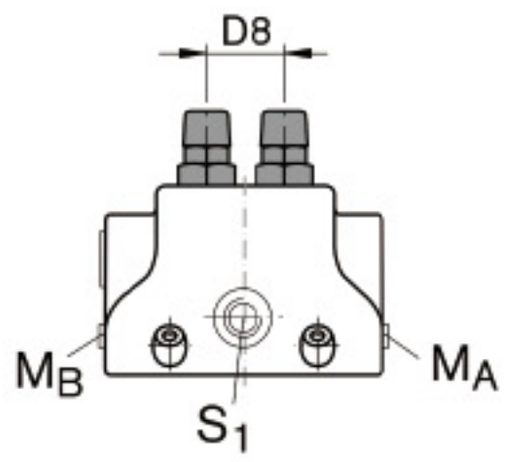


■ 溢流阀：

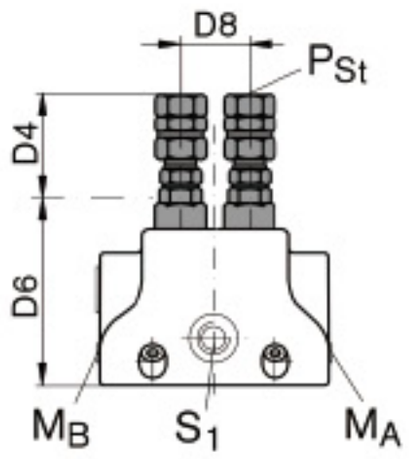
□ 外形尺寸（mm）：



视图 Z：结构不带压力放大装置 191 或 181



视图 Z：结构带压力放大装置 192



Size		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13[2]
28, 32	MHDB.**16**	209	186	25	68	174	102	87	36	66	50.8	23.8	ø19	M10; 17 deep
45	MHDB.**16**	222	198	22	65	187	113	98	36	66	50.8	23.8	ø19	M10; 17 deep
56, 63	MHDB.**22**	250	222	19	61	208	124	105	42	75	50.8	23.8	ø19	M10; 13 deep
80, 90	MHDB.**22**	271	243	17.5	59	229	134	114	42	75	57.2	27.8	ø25	M12; 18 deep
107, 125	MHDB.**32**	298	266	10	52	250	149.5	130	53	84	66.7	31.8	ø32	M14; 19 deep
160, 180	MHDB.**32**	332	301	5	47	285	170	149	53	84	66.7	31.8	ø32	M14; 19 deep

Size	A, B	S_1[1]	M_A, M_B[1]	P_{St}[1]
28, 32	3/4 in	M22 x 1.5; 14 deep	M20 x 1.5; 14 deep	G 1/4
45	3/4 in	M22 x 1.5; 14 deep	M20 x 1.5; 14 deep	G 1/4
56, 63	3/4 in	M26 x 1.5; 16 deep	M26 x 1.5; 16 deep	G 1/4
80, 90	1 in	M26 x 1.5; 16 deep	M26 x 1.5; 16 deep	G 1/4
107, 125	1 1/4 in	M26 x 1.5; 16 deep	M26 x 1.5; 16 deep	G 1/4
160, 180	1 1/4 in	M26 x 1.5; 16 deep	M30 x 1.5; 16 deep	G 1/4

□ 油口尺寸：

油口名称	油口用途	标准	规格	峰值压力 bar[2]
A、B	工作油口	SAE J518	详见上部参数表	450
S_1	支持油口，适用 191/192	DIN 3852	详见上部参数表	5
M_A 、M_B	工作压力检测口（封闭）	DIN 3852	详见上部参数表	450
P_{St}	外控压力油口，适用 192	ISO 228	详见上部参数表	30

1) 最大坚固扭矩参照通用标准

2) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

■ 制动平衡阀 BVD 和 BVE：

■ 功能说明：

□ 行走驱动或绞车带制动平衡阀的设计，可以在开式回路运行时，减少柱塞马达超速和吸空的危险。

□ 在制动、行驶下坡或负载降低时，外部驱动转速就会超过马达额定输入流量所对应转速，这时液压马达会产生供油不足、吸空情况。

□ 如果进口压力下降，制动平衡阀芯将节流回流来制动马达，直到进口压力恢复约 20 bar。

■ 使用配置：

□ BVD 适合规格 28～180，BVE 适合规格 107～180

□ 制动平衡阀必须单独订购，我们建议制动平衡阀和马达一起订购。
例如：A2FE90/61W-VAB188 + VD20F27S/41B-V03K16D0400S12

□ 制动平衡阀不能取代机械式制动和停车制动。

□ BVE 制动平衡阀和 BVD 制动平衡阀详细资料见后续说明。

□ 在设计制动释放阀时，我们必须知道机械停车制动情况：

- 操作开始时的压力
- 制动平衡阀芯最小行程（闭合制动）和最大行程（在 21 bar 时释放制动）之间的容积
- 热动设备要求的制动时间（在油粘度约 15mm^2/ s）

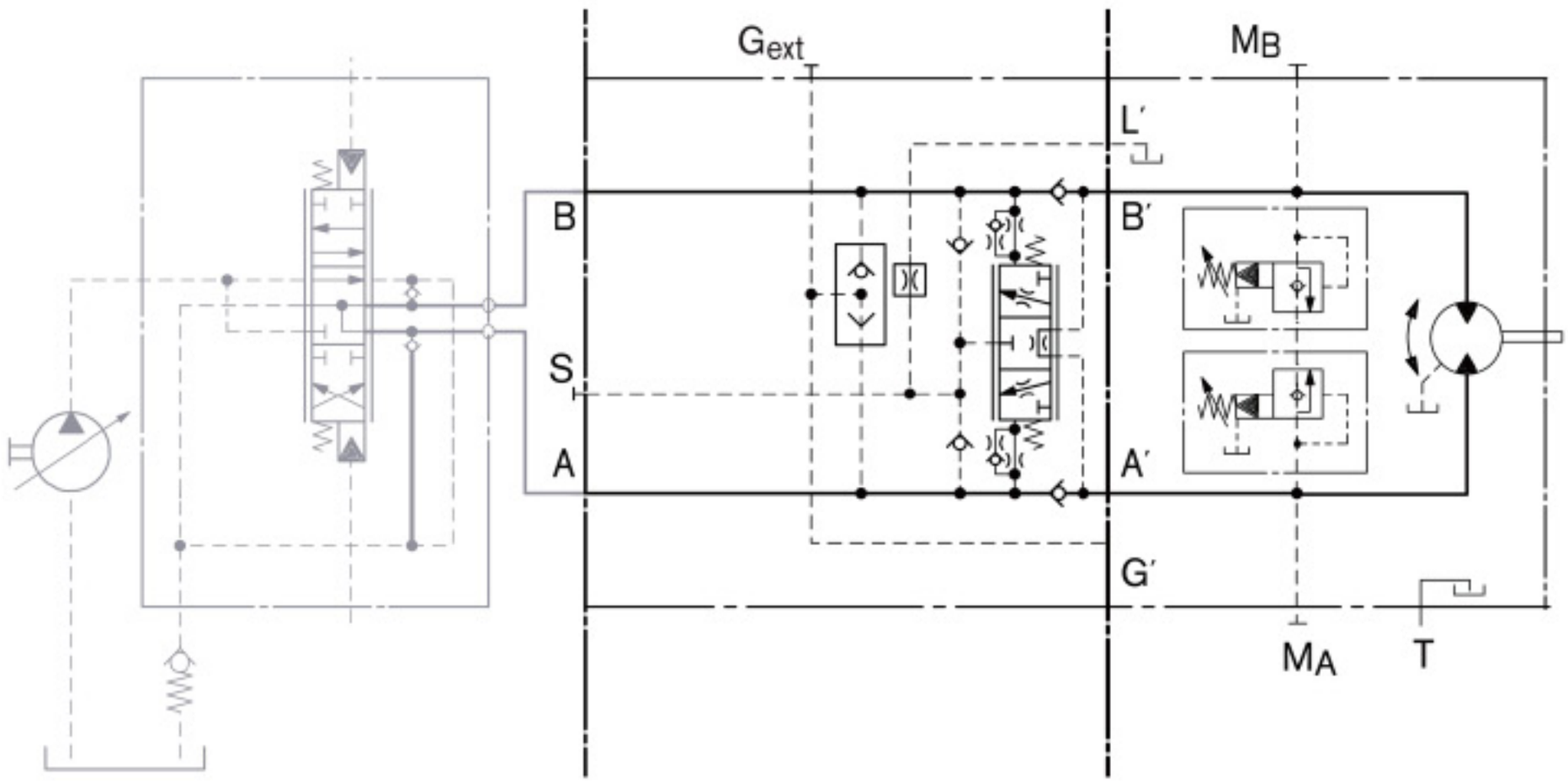
■ 制动平衡阀 BVD...F

□ 适用选项：轮式挖掘机的行走驱动

■ 举例示意图...轮式挖掘机的行走驱动：

□ A2FE090/61W-VAB188 + BVD20F27S/41B–V03K16D0400S12

换向阀，泵 不包括连接回路	制动平衡阀 BVD	柱塞马达 A2FE



■ 制动平衡阀 BVD 和 BVE：

□ 绞车用制动平衡阀 BVD...W 和 BVE

□ 适用状况：

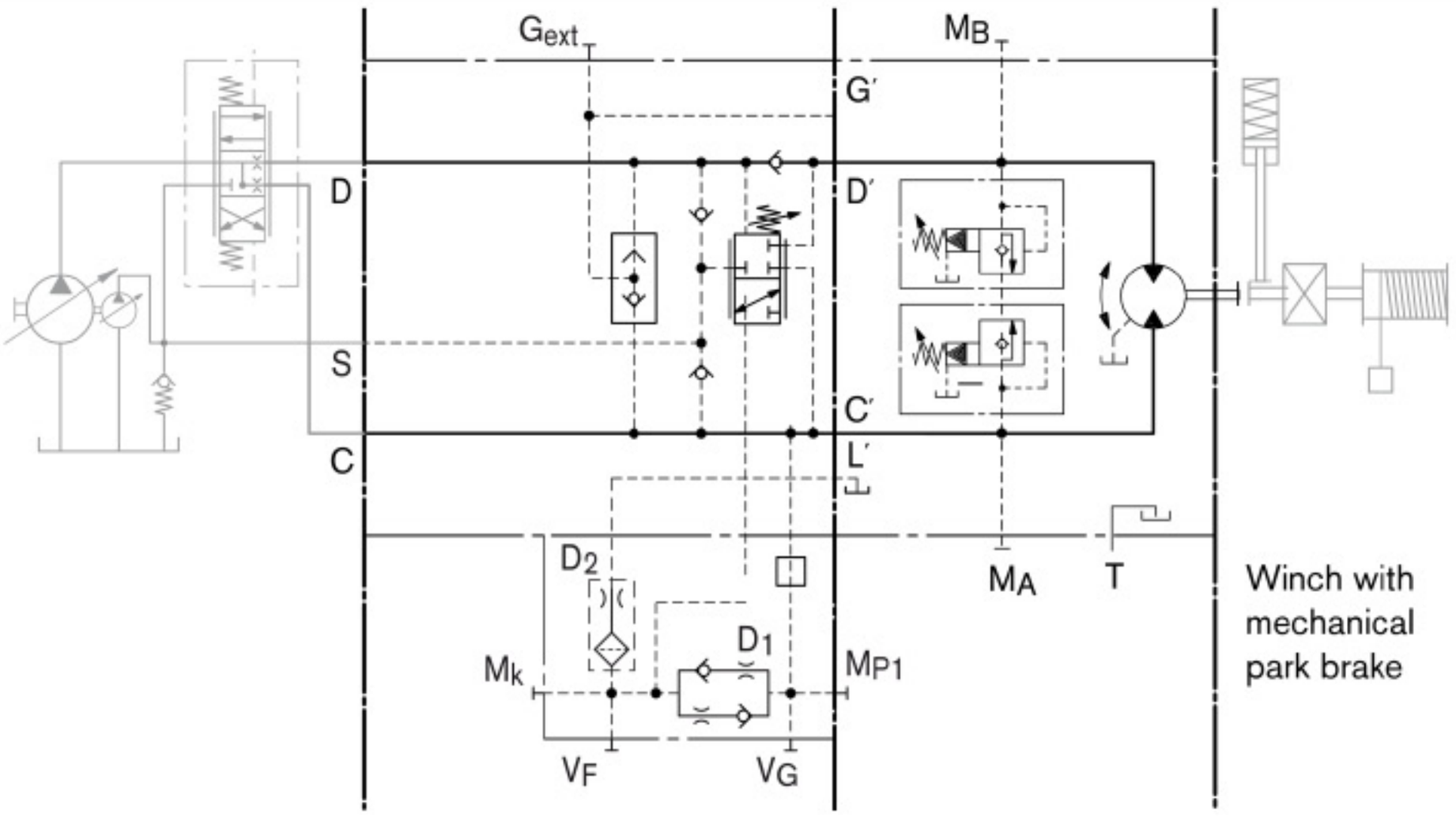
起重机上绞车驱动（BVD 和 BVE）

掘进机的行走驱动（BVD）

■ 举例示意图...起重机上绞车驱动：

□ A2FM090/61W-VAB188 + BVE25W385/51ND-V100K00D4599T30S00-0

换向阀，泵 不包括连接管路	制动平衡阀 BVE	柱塞马达 A2FE	卷扬机构 HD-GFT-W



□ 带制动平衡阀 DBV 和 BVD/BE 时，马达允许输入流量或操作压力：

马达	不带制动平衡阀时		带制动平衡阀 DBV 时限制值				带制动平衡阀 BVD/BVE 时限制值				代码
Motor NG	p_{nom}/p_{max} [bar]	$q_{V\ max}$ [L/min]	DBV NG	p_{nom}/p_{max} [bar]	q_V [L/min]	Code	BVD/BVE NG	p_{nom}/p_{max} [bar]	q_V [L/min]	Code	
28	400/450	176	16	350/420	100	181 191, 192	20 (BVD)	350/420	100	188	
32		201									
45		255									
56		280	22		240				220		
63		315									
80		360									
90		405									
107		427				171 191, 192				178	
125		500									
107		427	32		400	181 191, 192	25 (BVD/BVE)		320	188	
125		500									
160		577									
180		648									

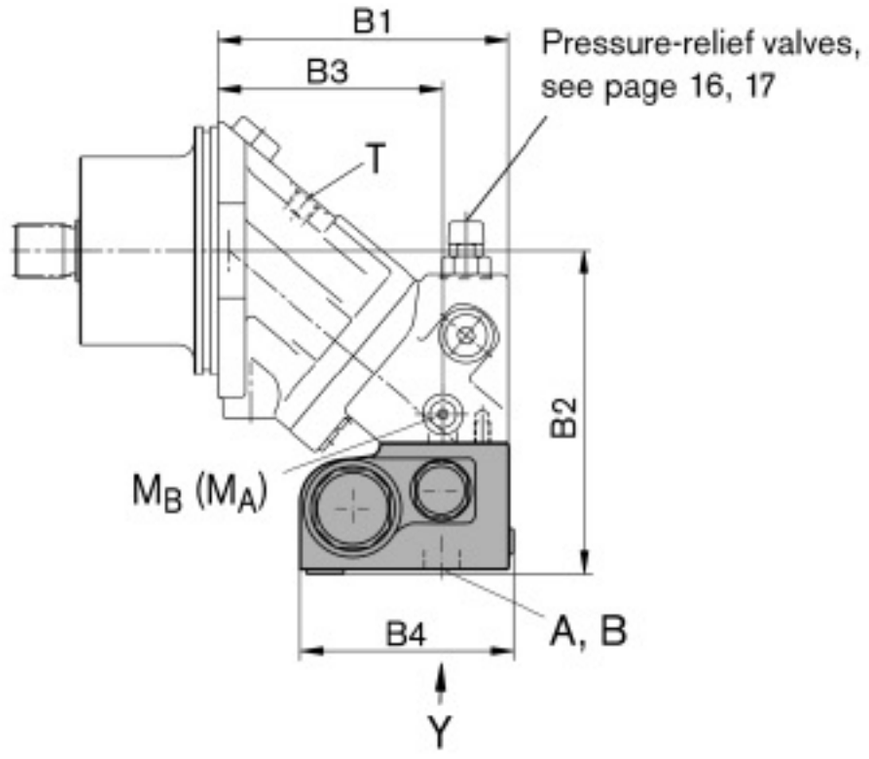
DBV----------溢流阀

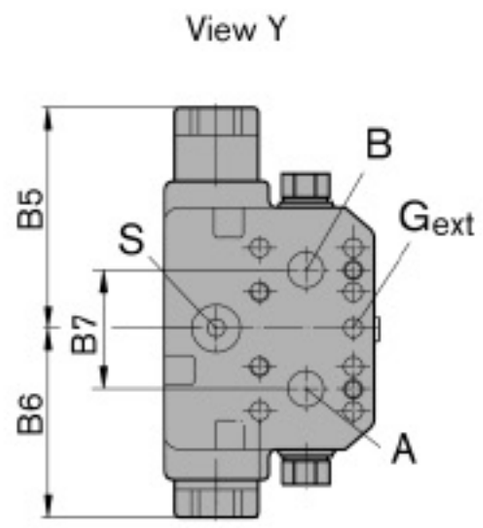
BVD----------制动平衡阀，双作用

BVE----------制动平衡阀，单作用

■ 制动平衡阀 BVD 和 BVE：

□ 外形尺寸（mm）：





马达	制动平衡阀									
规格	型号	控制油口	尺寸数据 mm							
		A, B	**B1**	**B2**	**B3**	**B4** (S)	**B4** (L)	**B5**	**B6**	**B7**
28, 32	BVD**20**..16	3/4 in	209	175	174	142	147	139	98	66
45	BVD**20**..16	3/4 in	222	196	187	142	147	139	98	66
56, 63	BVD**20**..17	3/4 in	250	197	208	142	147	139	98	75
80, 90	BVD**20**..27	1 in	271	207	229	142	147	139	98	75
107, 125	BVD**20**..28	1 in	298	238	251	142	147	139	98	84
107, 125	BVD**25**..38	$1^1/_4$ in	298	239	251	158	163	175	120.5	84
160, 180	BVD**25**..38	$1^1/_4$ in	332	260	285	158	163	175	120.5	84
107, 125	BVE**25**..38	$1^1/_4$ in	298	240	251	167	172	214	137	84
160, 180	BVE**25**..38	$1^1/_4$ in	332	260	285	167	172	214	137	84
250	On request									

□ 油口尺寸：

名称	油口用途	结构	标准	规格 [1]	峰值压力 bar[2]
A、B	工作油口		SAE J518	详见上部参数表	420
S	进油口	BVD20	DIN 3852	M22 X 1.5 深 14（封闭）	30
		BVD25、BVE25	DIN 3852	M27 X 2 深 16（封闭）	30
Br	制动释放，降低高压。	L	DIN 3852	M12 X 1.5 深 12.5	30
G_{ext}	制动释放，高压。	S	DIN 3852	M12 X 1.5 深 12.5（封闭）	420
M_A 、M_B	工作压力检测口 A、B		ISO 6149	M12 X 1.5 深 12（封闭）	420

1) 最大坚固扭矩参照通用标准

2) 峰值压力可以在允许范围内发生，在选择平衡装置和接头时要考虑这点。

■ 制动平衡阀 BVD 和 BVE：

■ 安装说明：

□ 装运时，制动阀由马达上有两个定位螺钉固定（运输保护作用）。在固定工作油管时不要卸下此螺钉。在制动阀和马达分开装运时，先将制动阀用定位螺钉固定在马达盖板上，再将 SAE 法兰用下列螺钉安装在马达上。

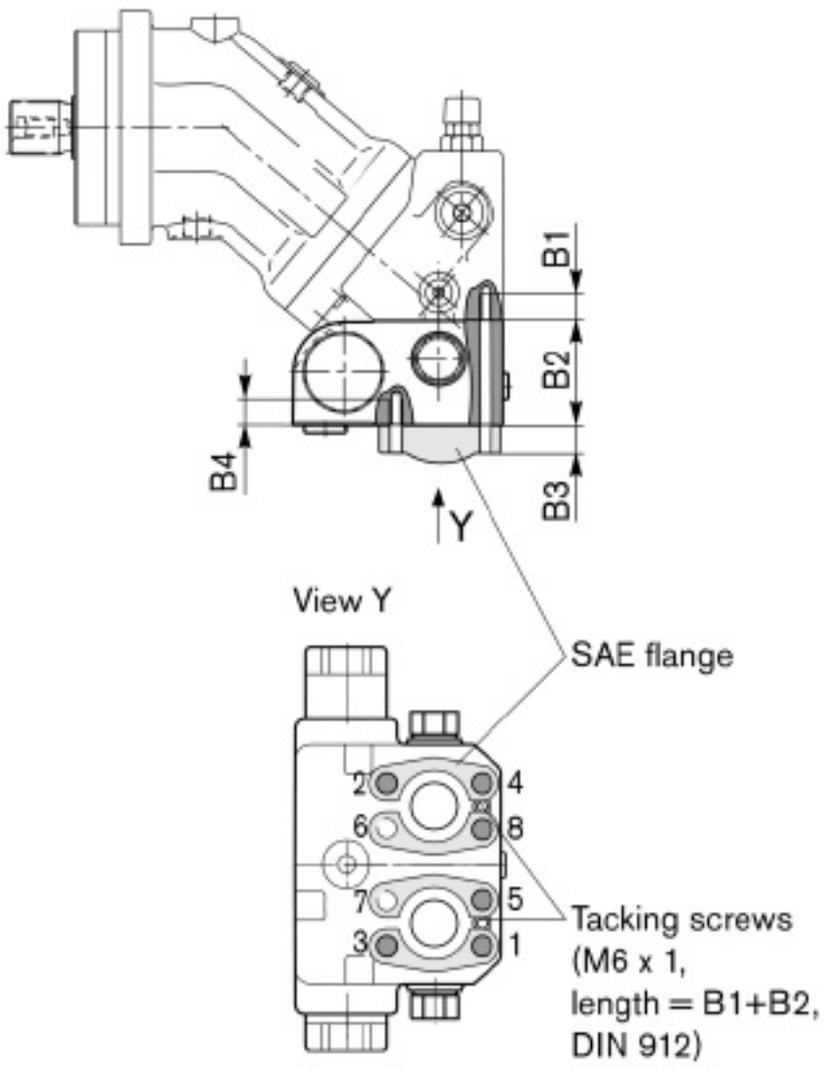
□ 6 个螺钉（1、2、3、4、5、8）-------旋入深度 B1+B2+B3

□ 2 个螺钉（6、7）----------旋入深度 B3+B4

□ 拧紧螺钉时分二步按 1～8 顺序安装。第一步，螺钉必须按一半紧固扭矩拧紧，第二步按最大坚固扭矩拧紧。

螺钉	强度级别	安装扭矩
M6 X 1 平头螺钉	10.9	15.5
M10	10.9	75
M12	10.9	130
M14	10.9	205

■ 外形尺寸：



■ 外形尺寸（mm）：

Size	28, 32, 45	56, 63	80, 90	107, 125, 160, 180	107, 125
Port plate	18				17
B1[1]	M10 x 1.5; 17 deep	M10 x 1.5; 17 deep	M12 x 1.75; 18 deep	M14 x 2; 19 deep	M12 x 1.75; 17 deep
B2	78[2]	68	68	85	68
B3	customer-specific				
B4	M10 x 1.5; 15 deep	M10 x 1.5; 15 deep	M12 x 1.75; 16 deep	M14 x 2; 19 deep	M12 x 1.75; 17 deep

1) 最低要求的螺纹深度 1 X 螺纹直径

2) 带连接板

■ 转速传感器：

■ 功能说明：

□ 结构 A2FM...U 和 A2FM...F（有备装速度传感器的接口，但不带传感器）马达内有齿轮传动的转动组件，适合选配转速传感器。

□ 交货时，在备装速度传感器接口处，油口是用高强度堵头封闭的。

□ 与转速成比例的电信号由花键连接的转动组件的转动产生，DSA 或 HDD 速度传感器可以对速度和旋转方向进行检测、转换和远传。

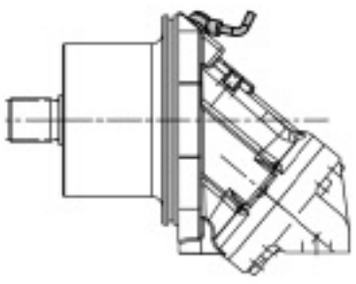
□ 有关传感器的订购代码、技术数据、连接尺寸和细节，再加上安全信息，可以查询相关数据表。

■ 外形尺寸：

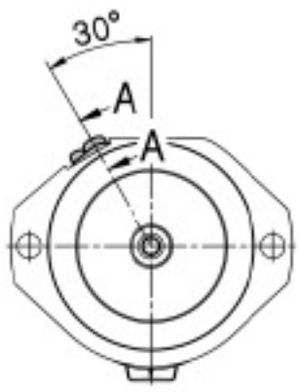
□ 结构 V

□ 规格 28～180 带 DSA 传感器

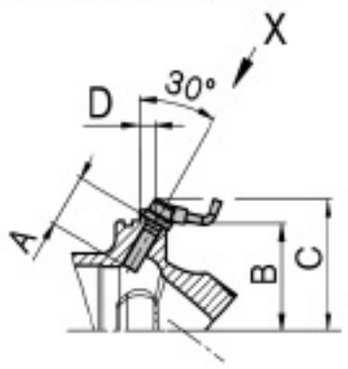
□ 规格 250 要求带 DSA 传感器



Detail



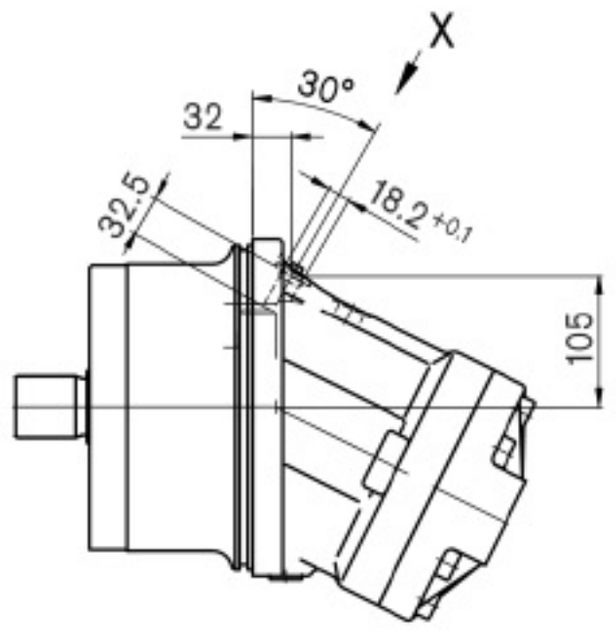
Section A-A rotated



■ 外形尺寸（mm）：

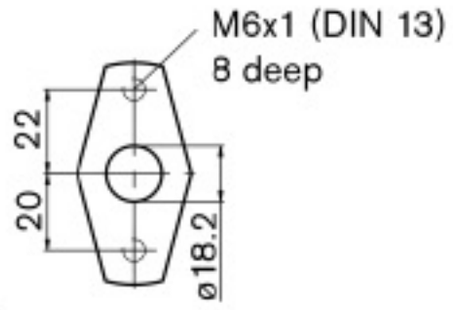
□ 结构 H

□ 规格 250 带 HDD 传感器

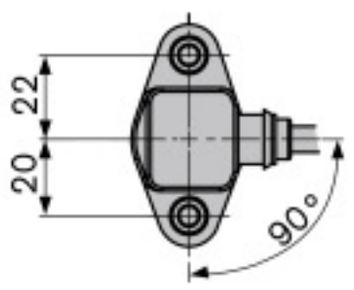


□ 视图 X

不带 HDD 传感器



带 HDD 传感器



■ 数据表：

规格		28、32	45	56、63	80、90	107、125	160、180	250
螺纹齿牙数量		38	45	47	53	59	67	78
DSA	A 插入深度（公差±0.1）	32	32	32	32	32	32	32
	B 接触面	66	按要求					
	C	按要求						
	D	12.3	按要求					

■ 安装及试运行指南：

■ 概述说明：

- □ 在马达初次起动及工作时，马达壳体内部必须充满液压油和空气排净。起动必须在低速和无负载工况下进行，直至系统中空气全部排完。
- □ 马达长期停机后，马达壳体的液压油可能通过工作管道泄出。在重新起动时，必须保证马达壳体内部充满液压油。
- □ 对于“传动轴朝上”或“传动轴朝下”的安装位置，必须注意完全地充满液压油和充分放气，否则会造成风险（空运转）。
- □ 马达壳体中的泄油必须通过壳体上位置最高的泄油口（T_1、T_2）排至油箱，管路上不准安装单向阀且管径不得缩小。
- □ 对于多个马达组合使用，要确认各自的壳体压力没有超限。在马达泄油口的压差值，集合的泄油管路必须改变以满足最小允许壳体压力在任何情况下都不能超出。如果达不到要求，就需要铺设单独的泄油管路。
- □ 为了减少噪音，建议所有与油箱连接的管路采用柔性软管连接，隔离噪音；泵尽量避免放置在油箱之上。
- □ 在所有操作条件下，泄漏管线必须接入油箱的最低液面以下的部位。

■ 安装位置：

- □ 参考安装实例 1...5，其他安装位置可应要求提供。
- □ 建议优先安装位置为 1 和 2

安装位置	空气排放	注油
1	-	T_1
2	-	T_1 规格 28～180 T_2 规格 250 和 355
3	-	T_1
4	L_1	T_1（L_1）
5	L_1	T_1（L_1）
6	L_1	T_2（L_1）

■ 名词解释：

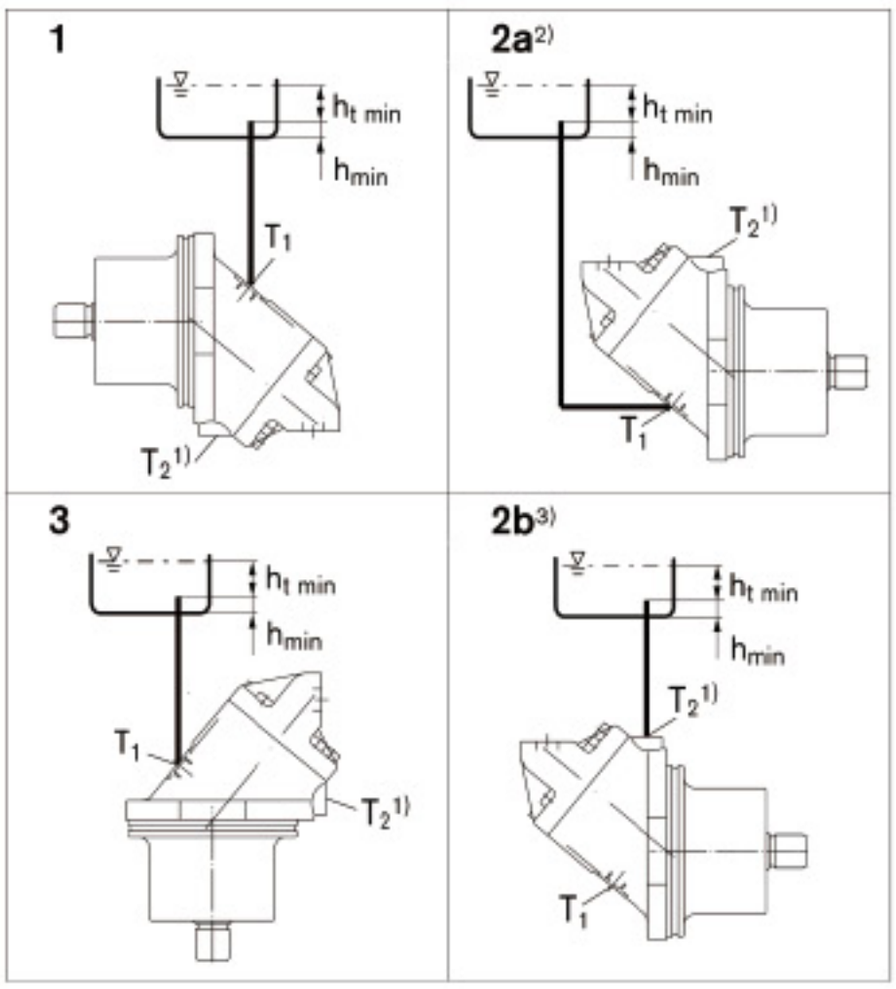
L_1	注油/排气口
T_1、T_2	泄油口
$h_{t\,min}$	所需最低浸没深度（200mm）
h_{min}	到油箱底部的所需最短距离（100mm）

■ 标注说明：

1) 规格 250 和 355 为标准结构，规格 28～180 为特殊结构。
2) 不用 T_2 油口连接管路（规格 28～180 为标准结构）
3) 用 T_2 油口连接管路（规格 250 和 355 为标准结构，规格 28～180 为特殊结构）
4) 如果在油口 T_2 安装，只允许安装位置（规格 250 和 355 为标准结构，规格 28～180 为特殊结构）。

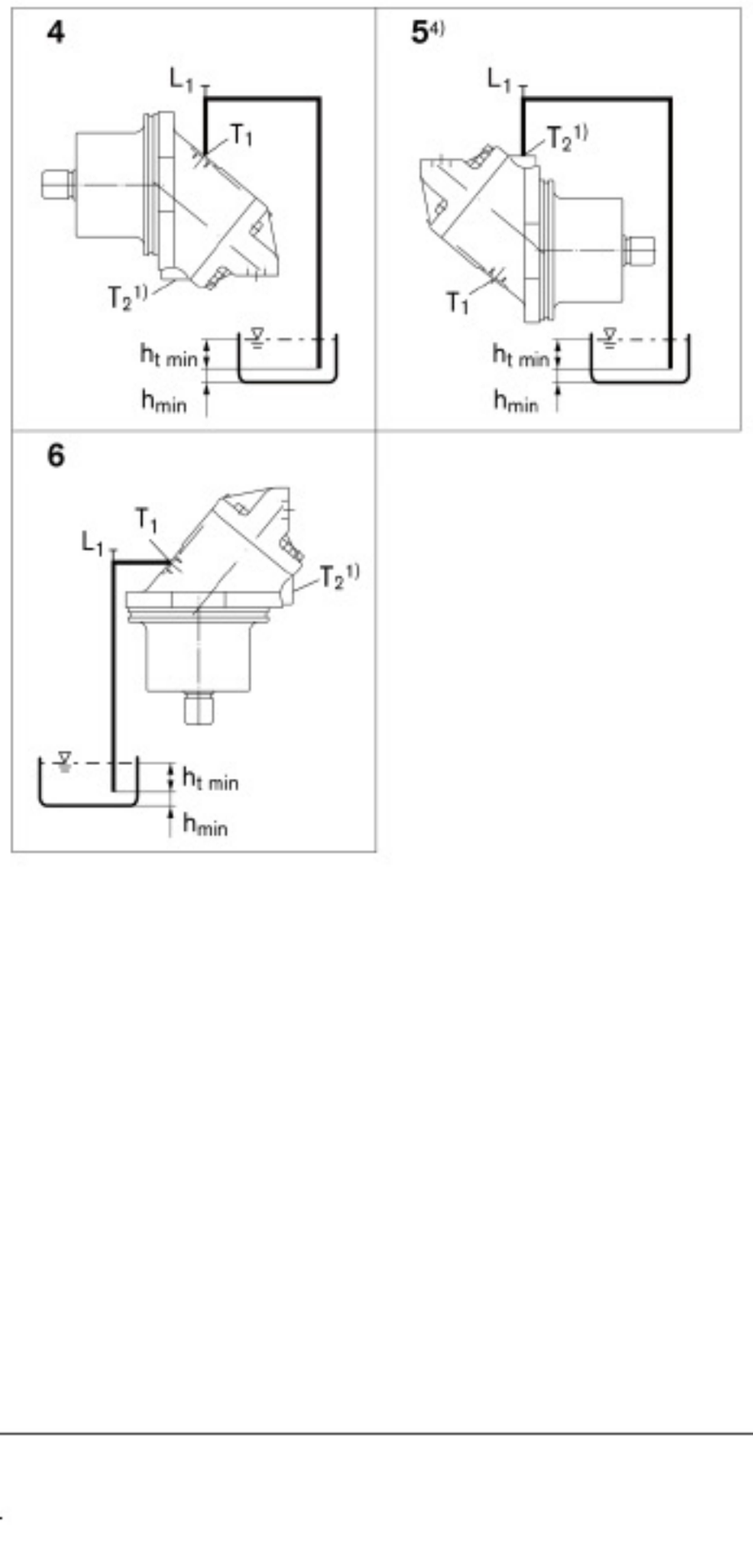
■ 在油箱下方安装（标准）：

□ 标准马达安装时进出油口应该低于油箱中油液的最低液位。



■ 在油箱上方安装：

□ 马达安装在油箱中油液的最低液位之上



■ 常规操作指南：

- HD-A2FM 泵设计用于开式和闭式回路中。
- 轴向柱塞泵的项目规划、组装和调试必须由合格人员进行。
- 在使用轴向柱塞单元前，请完整阅读相应的说明手册。如有必要，可以咨询华德液压。
- 运行期间及运行后不久，轴向柱塞泵可能存在造成灼伤的风险。 应采取适当的安全措施（ 例如：穿着防护服)。
- 根据轴向柱塞泵的不同工作条件（ 工作压力、油液温度)，特性可能会改变。
- 工作管路油口：
  - 油口和固定螺纹设计用于最大规定压力。机器或系统制造商必须确保连接元件和管路的安全系数满足规定的工作条件（压力、流量、液压油、温度)。
  - 工作管路油口和功能油口仅设计用于液压管路。
- 必须遵循此处包含的数据和说明。
- 该产品未被认证为满足 DIN EN ISO 13849 的通用机器安全概念要求的部件。
- 在液压系统中安装溢流阀。
- 采用以下紧固扭矩：
- 接头：
  - 有关所使用接头的紧固扭矩，请参见制造商说明。
- 安装螺栓：
  - 对于符合 DIN 13 的 ISO 公制螺纹标准和符合 ASME B1.1 的螺纹标准的安装螺栓，我们建议根据 VDI 2230 单独检查紧固扭矩。
- 轴向柱塞泵的螺纹孔：
  - 最大允许紧固扭矩 $M_{G\,max}$ 对于螺纹孔是最大值，不得超过该值。有关数值请参见下表。
- 锁紧螺钉：
  - 对于与轴向柱塞单元一起提供的金属锁紧螺钉，需要施加紧固扭矩 M_V 有关数值请参见下表。

■ 油口螺纹规格和锁紧螺钉的紧固扭矩：

油口		内螺纹最大允许紧固扭矩	锁紧螺钉所需的紧固扭矩	锁紧螺钉内六角规格
螺纹规格	标准	M_{Gmax}	M_v 1)	WAF
DIN 3852	M12 x 1.5	50 Nm	25 Nm 2)	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M20 x 1.5	170 Nm	80 Nm	10 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M26 x 1.5	230 Nm	120 Nm	12 mm
	M27 x 2	330 Nm	135 Nm	12 mm
	M30 x 2	420 Nm	215 Nm	17 mm
	M33 x 2	540 Nm	225 Nm	17 mm
DIN ISO 228	G 1/4	40 Nm	–	–

1）螺纹的紧固扭矩是针对收货清空状态和轻压油状态安装。
2）在轻压油状态，对 M12×1.5 的 M_v 减少 17Nm

■ 液压泵常见故障分析与排除方法：

故障现象	原因分析	消除方法
□ 不出油 □ 出油量不足 □ 压力上不去	□ 电动机转向不对。 □ 吸油管或过滤器堵塞。 □ 轴向间隙或径向间隙过大。 □ 连接处泄漏，混入空气。 □ 介质粘度太大或温升太高 。	□ 检查电动机转向。 □ 疏通管道，清洗过滤器，更换新的工作介质。 □ 检查更换有关零件。 □ 紧固各连接处螺钉，避免泄漏，严防空气混入。 □ 正确选用工作介质，控制温升。
□ 噪音严重 □ 压力波动厉害	□ 吸油管及过滤器堵塞或过滤器容量小。 □ 吸油管密封处漏气或介质中有气泡。 □ 泵与联轴节不同心。 □ 油位低、油温低或粘度高。 □ 泵轴承损坏。	□ 清洗过滤器使其吸油管通畅，正确选用过滤器。 □ 在连接部位或密封处加点油，如噪音减小，可以拧紧接头处或更换密封圈；回油管口应在油箱油面以下，与吸油管要有一定距离。 □ 调整泵与联轴节同心。 □ 加油液，把油液加热到适当的温度。 □ 检查（用手触感）泵轴承部分温升。
□ 泵轴颈油封漏油	□ 漏油管道阻力过大，使泵体内压力升高到超过油封许用的耐压值	□ 检查柱塞泵泵体上的泄油口是否用单独油管直接接通油箱。 □ 若发现把几台柱塞泵的泄漏油管并联在一根同直径的总管后再接通油箱，或者把柱塞泵的泄油管接到回油管上，则应予改正。 □ 最好在泵泄漏口接个压力表，以检查泵体内的压力，其值应小于 0.08 Mpa

■ 液压马达常见故障分析与排除方法：

故障现象	原因分析		消除方法
□ 转速低转矩小	□ 液压泵供油量不足	□ 电动机转速不够 □ 吸油过滤器滤网堵塞 □ 油箱中油量不足或吸油管通径过小造成吸油困难 □ 密封不严，有泄漏，空气侵入内部。 □ 油的粘度过大 □ 液压泵轴向及径向间隙过大、内泄增大。	□ 找出原因，进行调整。 □ 清洗或更换滤芯 □ 加足油量、适当加大管径，使液压泵吸油通畅。 □ 拧紧有关接头，防止泄漏或空气侵入。 □ 选择粘度小的油液 □ 适当修复液压泵
	□ 液压泵输出油压不足	□ 液压泵效率太低，供油量不足。 □ 溢流阀调整压力不足或发生故障 □ 油管阻力过大（管道过长或过细） □ 油的粘度较小，内部泄漏较大。	□ 检查液压泵故障，并加以排除。 □ 检查溢流阀故障，排除后重新调高压力。 □ 更换孔径较大的管道或尽量减少长度 □ 检查内泄漏部位的密封情况，更换油液或密封。
	□ 液压马达泄漏	□ 液压马达结合面没有拧紧或密封不好，有泄漏。 □ 液压马达内部零件磨损，泄漏严重。	□ 拧紧接合面，检查密封情况或更换密封圈。 □ 检查其损伤部位，并修磨或更换零件。
	□ 失效	□ 配油盘的支承弹簧疲劳，失去作用。	□ 检查、更换支承弹簧。
□ 泄漏	□ 内部泄漏	□ 配油盘磨损严重 □ 轴向间隙过大 □ 配油盘与缸体端面磨损，轴向间隙过大 □ 弹簧疲劳 □ 柱塞与缸体磨损严重	□ 检查配油盘接触面，并加以修复。 □ 检查并将轴向间隙调至规定范围 □ 修磨缸体及配油盘端面 □ 更换弹簧 □ 研磨缸体孔、重配柱塞。
	□ 外部泄漏	□ 油端密封，磨损。 □ 盖板处的密封圈损坏 □ 结合面有污物或螺栓未拧紧 □ 管接头密封不严	□ 更换密封圈并查明磨损原因 □ 更换密封圈 □ 检查、清除并拧紧螺栓。 □ 拧紧管接头
□ 噪声		□ 密封不严，有空气侵入内部。 □ 液压油被污染，有气泡混入。 □ 联轴器不同心 □ 液压油粘度过大 □ 液压马达的径向尺寸严重磨损 □ 柱塞已磨损 □ 柱塞与配油盘接触不良，有冲撞现象。 □ 配油盘磨损	□ 检查有关部位的密封，紧固各连接处。 □ 更换清洁的液压油 □ 校正同心 □ 更换粘度较小的油液 □ 修磨缸孔，重配柱塞。 □ 尽可能修复或更换 □ 进行修整 □ 进行修复或更换。

销售服务热线 400-000-6987

本公司通过：

- 【ISO9001质量管理体系认证】
- 【ISO14001环境管理体系认证】
- 【OH SAS18001职业健康安全管理体系认证】
- 【CE认证】

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华德液压

北京华德液压工业集团有限责任公司

BEIJING HUADE HYDRAULIC INDUSTRIAL GROUP CO., LTD.

2012 年 10 月编制

A8V

华德液压





Axial Piston-Bent Axis Design
Variable Displacement DoublePump

斜轴式轴向柱塞
变量双泵

技术样本







北京华德液压工业集团有限责任公司

BEIJING HUADE HYDRAULIC INDUSTRIAL GROUP CO.,LTD.

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Variable Displacement Double Pump A8V

注意事项

1. 为了保证无故障的高效工作，在设计系统期间应根据工况仔细选择液压系统的液压油，所有矿物油基液压油均在某种程度上适用于轴向柱塞元件，它们的应用时基本划分取决于上述的水、粘度与温度关系，并考虑氧化和腐蚀保护、材料相容性、空气和水分离特性。

2. 为了保证设备有长的使用寿命，必须进行良好而可靠的过滤。油液中的硬颗粒污染不得超过以下等级：

等级9——按NAS1638

等级6——按 SAE

等级18/15——按ISO/DIS 4406

在油液温度很高时，最低清洁度为：

等级8——按NAS1638

等级5——按SAE

等级17/14——按ISO/DIS 4406

3. 为了正确选择液压油，必须知道与环境温度有关的工作温度；在闭式回路中这是回路温度，在开式回路中这是油箱温度。

4. 注意：漏油 (壳体泄油)温度受压力和转速的影响，总是高于回路温度，然而要求回路中任何点温度不得超过90℃。

如果由于极端的工作参数或较高的环境温度，而不能维持上述条件，订货时请询问我公司。

5. 泵的进油口压力（绝对压力）处须≥0.08MPa,及泄油压力(壳体内允许的最高压力)为0.2MPa(绝对压力),壳体内压力值必须等于或高于作用在轴密封上的外部压力值。

6. 安装位置：一般要求液压泵/马达安装位置、壳体上边缘低于油箱最低液面。若安装需在油面以上，请在订货时提出。

《样本》所述技术资料，仅供参考。若有特殊要求请与我集团公司技术部门咨询，若有更改，恕不通知。

The technical information in the eatalog is for your reference. Please consult our technical Dept. , if you have any special requirements.

NOTES

1. In order to guarantee trouble-free and efficient operation, the hydraulic fluid in a hydrostatic system should be selected carefully according to the actual working conditions during the design of the system. All mineral oil based fluids are suitable to a greater or lesser degree for application in axial piston units. Their basic classification of application results from what has already been said due to the water , viscosity and temperature relationships, with consideration of oxidization and corrosion protection, material compatibility , air and water separation characteristics.

2. In order to guarantee a long service life for the installation, good and reliable filtration is necessary. The hard particle contamination of fluid may not exceed a level determined by:
Class 9 to NAS 1638
Class 6 to SAE
Class 18/15 to ISO/DIS 4406
When the fluid temperature is too high, the required minimum degree of cleanliness is:
Class 8 to NAS 1638
Class 5 to SAE
Class 17/14 to ISO/DIS 4406

3. In order to select the correct fluid, it is necessary to know the operating temperature in the circuit in relation to the ambient temperature-in an open circuit and the tank temperature.

4. Important: The leakage oil (case drain oil) temperature is influenced by pressure and pump speed and is always higher than the circuit temperature. However, at no point in the circuit may the temperature exceed 90℃.
If it is not possible to comply with the above conditions because of extreme operating parameters or high ambient temperatures, please consult us.

5. The minimum pressure at the suction port of the pump ≥0.08 Mpa(absolute pressure), and the drain pressure (max. permissible casing pressure) is 0.2 MPa(absolute pressure). The pressure in the housing must be the same or greater than the external pressure on the shaft seal.

6. Installation position: in general, the upper point on the pump/motor housing must be below the minimum oil level of the tank. If you would like to install it above the minimum oil level, please indicate when order.

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A8V变量双泵 Variable Displacement Double Pump A8V

用于开式回路 For open circuits

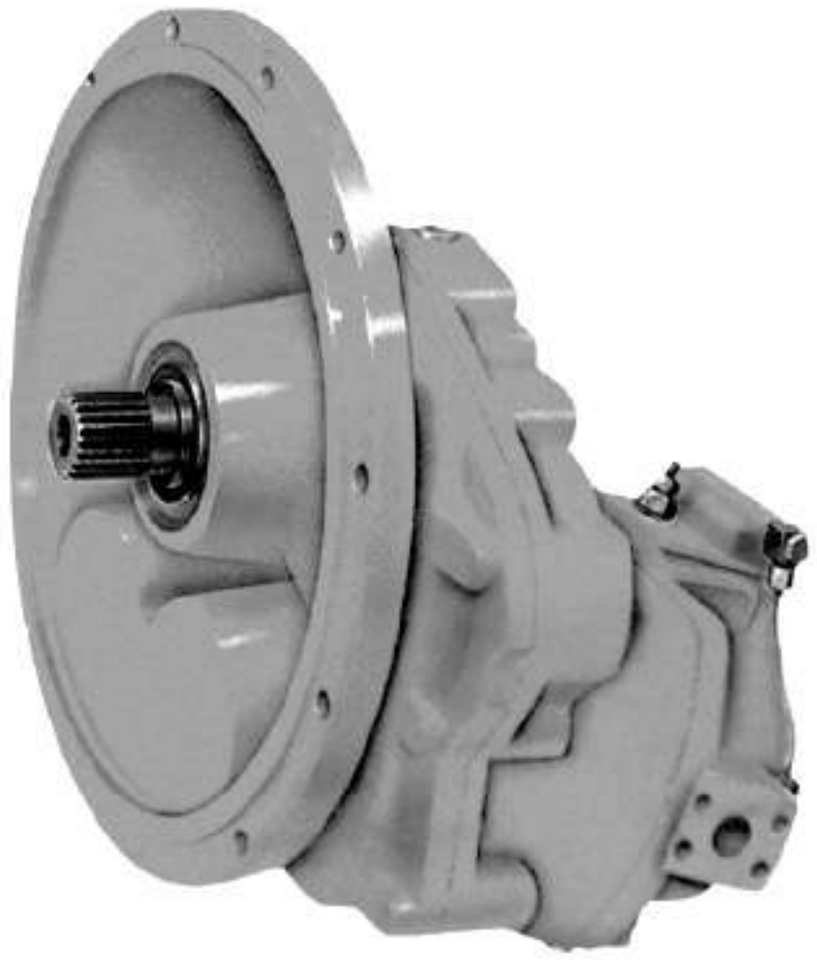
斜轴式轴向柱塞结构 axial tapered piston, bent axis design

RC92300/12.2004

规格 Size 28-160

高压范围 Peak pressure 至 up to40MPa

替代：ReplaceRC92300/09.2003



说明：

- 主要部件有共用一个外壳的两个变量泵，分动箱，直接安装在原动机上的SAE法兰及控制装置–通常是叠加HP控制。
- 流量与转速和排量成正比，并可通过改变倾角来无级变化。

Description

Two variable pumps in a common housing，the splitter box，an SAE flange for direct mounting on to the prime mover and the control device–usually summation HP control.
Flow is proportional to speed by change the swivel angle.

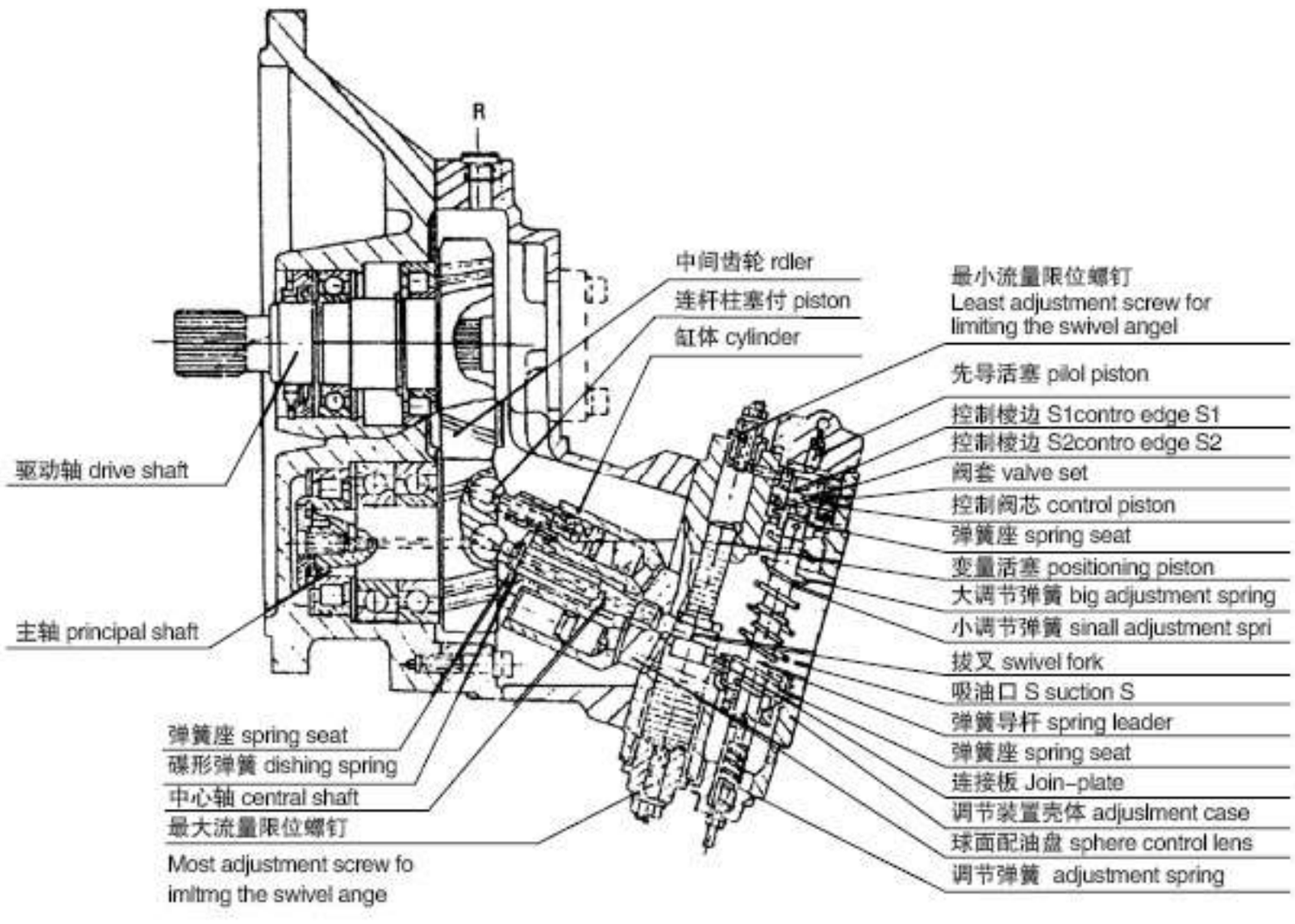
特点：

- 带有辅助驱动的不同结构方案及多回路控制的可能性，使它可与各种驱动应用最佳匹配。
- 结构紧凑，易于安装与保养。
- 压力高、耐冲击，工作寿命长。

Special Features

The various design options with auxiliary drive and the possibility of multi–circuit control allow optimum matching to individual drive applications.

剖视图：



A8V变量双泵 Variable Displacement Double Pump A8V

型号说明 Ordering Code

A8V	55	SR	1.1	R	1	0	1	F	1

泵型号 Pump Type

变量双泵 Variable Displacement Double Pump

规格 Size

8.1−28.1ml/r	28
15.8−54.8ml/r	55
0−58ml/r	58
23.1−80ml/r	80
30.8−107ml/r	107
21.8−125ml/r	125
46.2−160ml/r	160

(每个旋转组件的排量 $V_{gmin}-V_{gmax}$)

(Displacement $V_{gmin}-V_{gmax}$ perrotary group)

只有 DM.LL 控制方式

Only exist control device DM.LL

控制方式 Control Device

总功率变量 Summation HP control	SR
分功率变量 Individual power control	LL
分功率交叉变量 Cross−sensing control	LLC
恒压手动变量 Constant pressure and manual control	DM

结构 Design

见下 See below	1.1
	1.2
	2
	3
	4
	5

行程限位 Stroke Limiter

固定的 fixed	1
液控的 hydraulic	2
机械的 mechanical	3

(2.3 不用于规格 28)

(2.3not for Size 28)

压油口连接 Pressure Connection

螺纹(用于规格 28)	G
法兰 SAE SAE flange connection	F

吸油口连接 Suction Connection

SAE 法兰 SAE flange	1

速比 Gear Ratio

规格 size	28	55	58	80	107	125	160	
代号 Ratio	0	−	1.00	−	1.00	1.00	1.00	1.00	0
代号 Ratio	1	0.73	0.75	0.87	0.87	0.85			1
代号 Ratio	2	0.86	0.93	1.06	1.06	1.08			2
代号 Ratio	3	−	1.17	−	1.35	1.23			3
代号 Ratio	4	−	0.84	0.81	−	−			4
代号 Ratio	5	−	1.05	−	1.18	−			5

系列 Series

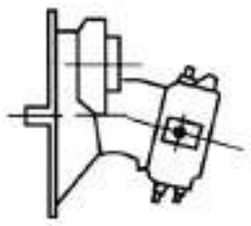
1

旋转方向(从轴端看) Direction of Rotation(View ed on shaft end)

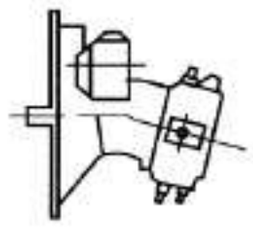
顺时针 Clock wise	R

A8V变量双泵 Variable Displacement Double Pump A8V

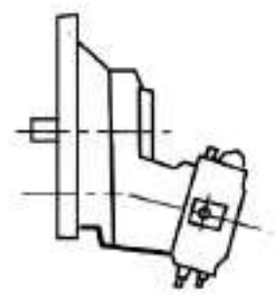
结构 Design 1.1–5



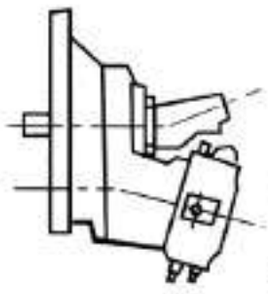
1.1 不带减速齿轮
带辅助驱动
without adaptor gear
with auxiliary drive



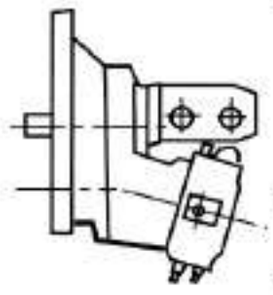
1.2不带减速齿轮
带辅助驱动
without adaptor gear
with auxiliary drive



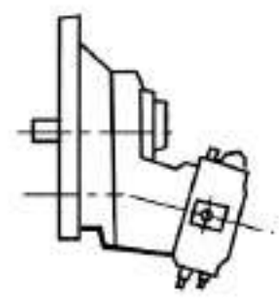
2 带减速齿轮
不带辅助驱动
withadaptor gear
without auxiliary drive



3 减速齿轮
带辅助驱动和安装
A2F 23.28
(带花键轴)的联轴节
with adaptor gear with
auxiliary drive and
coupling for mounting of
a fixed pump A2F 23. 28
(with Splined shaft)



4 带减速齿轮带辅助驱动
和安装齿轮泵带锥轴
with adaptor gear
with auxiliary drive and
coupling for mounting of
a gear pump with
tapered shaft and bolton)



5 带减速齿轮
带辅助驱动、有盖板
with adaptor gear
with auxiliary drive,
plugged.
(with cover)

订货示例：

A8V，55，SR，1.1，R，1，0，1，F，1
变量双泵A8V，规格55，总功率变量，结构1.1，顺时针旋转，1系列，速比1.00，吸油口1，SAE压力油口，固定行程限位器。
用于辅助驱动的泵应在订货时单独列出。

Ordering Example

A8V，55，SR，1.1，R，1，0，1，F，1
Variable Displacement Double Pump A8V，Size55，Summation HP Control，Design1.1，Clockwise rotation，Series 1，gear ratio 1.00，Suction Connection 1，SAE Pressure connection，fixed stroke limiter. Pimps for auxiliary drive should be listed separately when ordering.

技术参数 Technical Data

工作压力范围：Operating Pressure Range:

A或B口压力：Pressure at port A or B.
额定压力：Nominal pressure _____ P_n=35MPa
最高压力：Peak pressure _____ P_{max}=40MPa
吸油口S的绝对压力：Absolute pressure on the suction inlet S
P_{absmin} _____ 0.08MPa
P_{absmax} _____ 0.2MPa

油温范围：Fluid Temperature Rage:

t_{min} _____ –25℃
t_{max} _____ 80℃

粘度范围：Optimum Operating Viscosity Range:

γ_{min} _____ 10mm²/s
γ_{max} _____ (短时)(for short periods)100mm²/S

最佳工作粘度：Optimum Operating Viscosity:

γ_{opt} _____ 16–36mm²/S

油液选择：Fluid Recommendation

工作温度 推荐粘度等级符合DIN 51519
Operating Recommended Viscosity grade temperature to DIN51519 range ISO(VG)

30–40℃	VG22=22mm²/S	在 at40℃
40–50℃	VG32=32mm²/S	在 at40℃
50–60℃	VG46=46mm²/S	在 at40℃
60–70℃	VG68=68mm²/S	在 at40℃
70–80℃	VG100=100mm²/S	在 at40℃

液压油的过滤：Filtration of Hydraulic Fluid

推荐过滤精度为10μm。亦可使用25–40μm。使用10μm的可以延长使用寿命(降低磨损)。
Recommended filtration 10μm. Coarser filtration of 25 to 40μm is possible，however longer service life is achieved with filtration of 10μm(reduced wear).

转速范围：Speed Range

最低转速没有限制，最高转速n_{Amax}见下表
No limitation on minimum speed n_{min}.
See data table for max.permissible speeds n_{Amax}.

安装位置：Mounting Position

驱动轴水平安装。其它位置也可以，但事先应询问本厂
Horizontal，as referred to the drive shaft；other positions are possible，but require prior consultation with us.
辅助驱动的输出转速与输入转速n_A相同。(结构3，4，5)
Output speed of the auxiliary drive is the same as input speed n_A (Design 3，4，5)
辅助驱动速比：Auxiliary Drive Gear Ratio

结构	规格 Size				
Design 1.1	55	80	107	125	160
	1.244	1.333	1.256		
1.2	1.00	1.00	1.00	1.00	1.00

旋转方向(从轴端看)：Direction of rotation(Viewed on Shaft)

结构1.1(Design 1.1)：逆时针(anti–Clockwise)
结构1.2(Design 1.2)：顺时针(Clockwise)

A8V变量双泵 Variable Displacement Double Pump A8V

技术参数表

(理论值、未考虑 η_{mh} 和 η_v，数值经过园整)

Technical Data

(theoretical Values, without considering mb and v, Values rounded off)

规格 Size	单侧泵排量 V_{gmax} Displacement of double pump per rotary group V_{gmax}(ml/r)	分动箱齿轮速比 Splitter box gear ratio	最大驱动转速n_{Amax}(r/min)当吸油口绝对压力为P及排量为V_{gmax}时 Max.drive speed n_{Amax}(r/min)for (absolute)pressure P at suction inlet S and max.displ. V_{gmax}			双泵最大流量Q_{max}(l/min)(考虑3%的容积损失)在对应转速下 Max.flowQ_{max}(l/min)of double pump(displacement losses of 3%included)at speed			双泵驱动功率 P(KW) Drive power P(kw)of doubl pump，with△p1+△p2=35MPa (start of control)and Q_{max} at speed			惯性矩 J(kgm²) Moment of inertia J(kgm²)	重量 kg Weight Kg
			n0.09	n0.1	n0.15	n0.09	n0.1	n0.15	0.09	n0.1	n0.15		
28	28.1	0.729	2040	2185	2350	2×76	2×82	2×88	46	49	53	0.014020	54
		0.860	2410	2580	2770							0.009351	
55	54.8	1.000	2360	2500	2640	2×125	2×133	2×140	75	80	84	0.012475	100
		0.745	1760	1860	1965							0.03743	
		0.837	1975	2090	2210							0.02818	
		0.9318	2200	2330	2460							0.02175	
		1.051	2480	2625	2775							0.01639	
		1.1714	2765	2930	3090							0.012977	
58	58.8	0.8125	2315	2435	2720	2×165	2×174	2×194				0.06189	130
		0.8667	2470	2600	2900							0.05590	
		1.054	3000	3160	3530							0.3579	
80	80	1.000	2120	2240	2370	2×164	2×174	2×184	99	105	111	0.02680	130
		0.8666	1840	1940	2055							0.05590	
		1.054	2235	2360	2500							0.03579	
		1.181	2505	2645	2800							0.02797	
		1.3448	2850	3010	3185							0.02137	
107	107	1.000	1900	2000	2135	2×197	2×208	2×222	119	125	133	0.03625	165
		0.8431	1600	1685	1800							0.08257	
		1.075	2040	2150	2295							0.047012	
		1.2285	2335	2455	2625							0.035353	
125	125	1.000	1900	2000	2135	2×230	2×242	2×258	139	146	156	0.055	180
160	160	1.000	1750	1900	2100	2×271	2×284	2×325	164	178	196	0.064	200

$i=\frac{n_A}{n_p}$ P=0.09MPaP=0.1MPaP=0.15MPa

A8V变量双泵 Variable Displacement Double Pump A8V

总功率变量

SR总功率变量是一种与压力有关的先导控制，可无级同步调节双泵的倾角，从而在V_{gmax}至V_{gmin}范围内调节泵的排量，流量与系统压力成反比，以保持液压功率恒定。

总功率变量是以两个压力之和(P_1+P_2)来进行控制的，因此，当一个泵要较小功率时，其余功率可作用于另一个泵。在极端情况下，任一个泵都可得到最大功率。

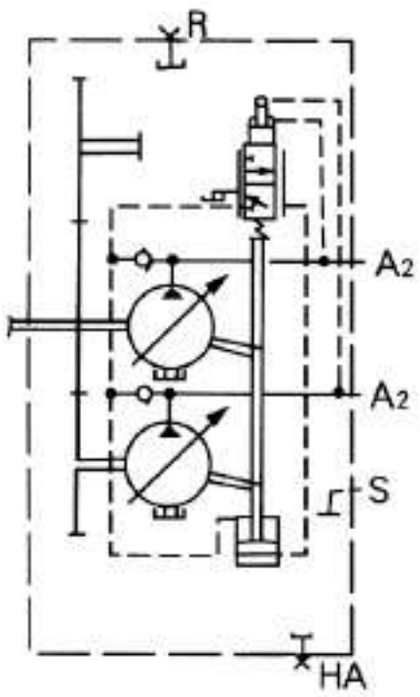
Summation HP Control

Summation HP control SR is a pressure related, pilot operated control which steplessly adjusts the swivel angle, and thus the displacement, of the under-coupled pumps in the range V_{gmax} to V_{gmin} · Flow is inversely proportional to system pressures, thereby maintaining hydraulic power constant.

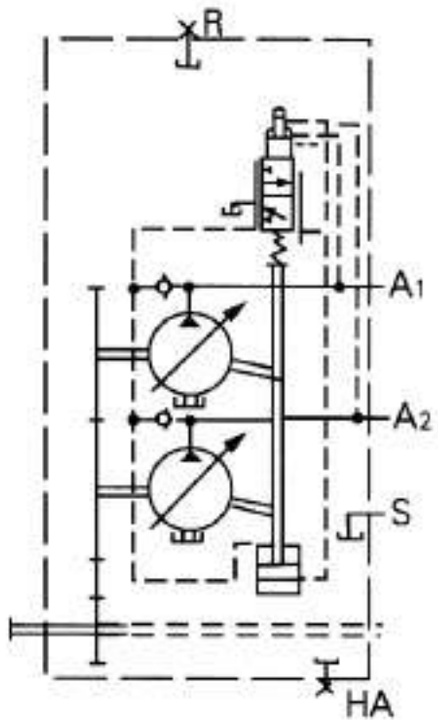
Summation HP control means control using the sum of the two pressure(P_1+P_2).If one pump requires less power, then the remaining power is available to the other pump.In extreme cases, either pump can be supplied with the maximum power.

$$P=\frac{(P_1+P_2)\cdot Q}{60\cdot \eta_t}=\text{恒量}$$ constant

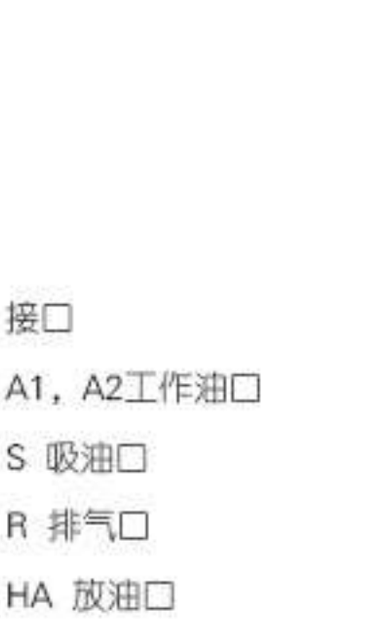
P= 驱动功率	drive power	[kw]
P_1P_2= 压力	pressure	[MPa]
η_t= 总效率	overall efficiency	
Q= 流量	flow	[L/min]



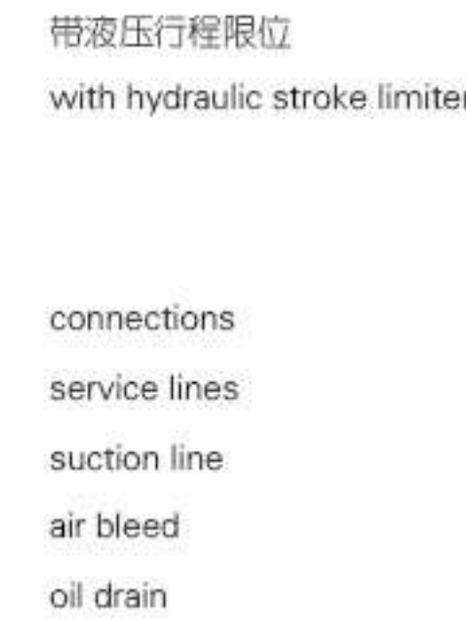
A8V…SR
结构 Design1.1



A8V…SR
结构 Design2–5



A8V…SR
结构 Design1.2



A8V…SR
结构 Design2–5
带液压行程限位
with hydraulic stroke limiter

接口	connections
A1，A2工作油口	service lines
S 吸油口	suction line
R 排气口	air bleed
HA 放油口	oil drain
X 先导压力口	pilot pressure

辅助装置：行程限位器Auxiliary Device：Stroke Limiter固定的—用限位螺钉把最大流量固定于所需的V_{gmax}上(订货时注明数值)。

机械的——通过机械行程 限位可无级地改变或限制最大排量，调节范围从V_{gmax}到V_{gmin}。

液压的——用附加的液压行程限位器，可无级地改变或限制最大排量，调节范围从V_{gmax}(固定设置)到V_{gmin}。

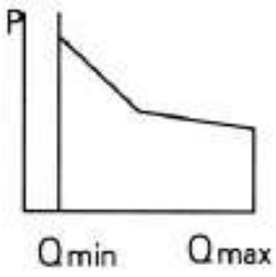
液压行程限位器所需先导压力(x油口)不低于工作压力(P_1+P_2)的1/14，但x口的最低压力不低于0.7MPa，最高允许压力为5MPa(所有规格)。

The fixed setting of the max. flow at the required value V_{gmax} is made by means of a stop screw(please indicate require value in clear text when ordering). By means of mechanical stroke limiter, the max. displacement can be steplessly varied of limited. Adjustment range from V_{gmax} to V_{gmin}.

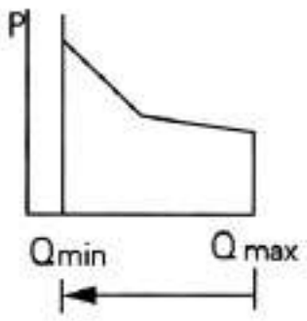
By means of an additional hydraulic stroke limiter, the max. displacement can be steplessly varied of limited Adjustment range is from V_{gmax}(fixedsetting)to V_{gmin}.

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A pilot pressure(port X) of at least 1/14 of the operating pressure (P1+P2)is required for the hydraulic stroke limiter; however, min. pressure at port X must not 0.7MPa.Max. Permissible pressure is 5MPA(for all Sizes)



固定的 fixed setting



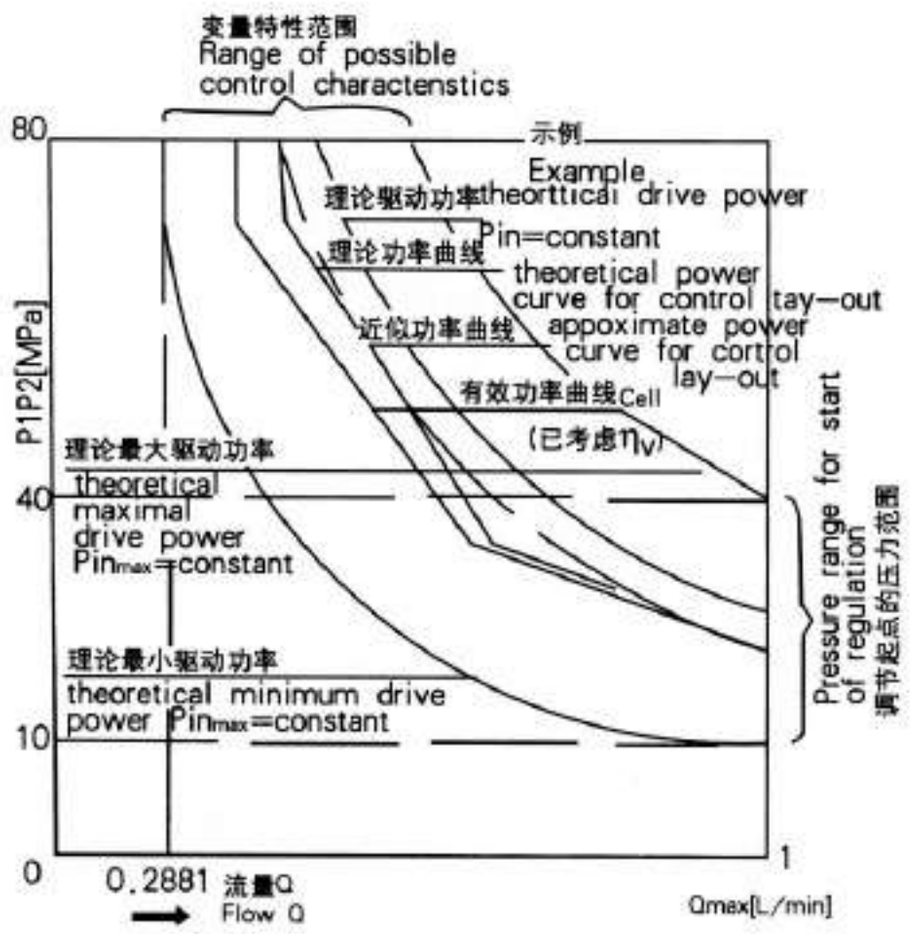
调节范围
adjustment range
机械的mechanical
液压的hydraulic

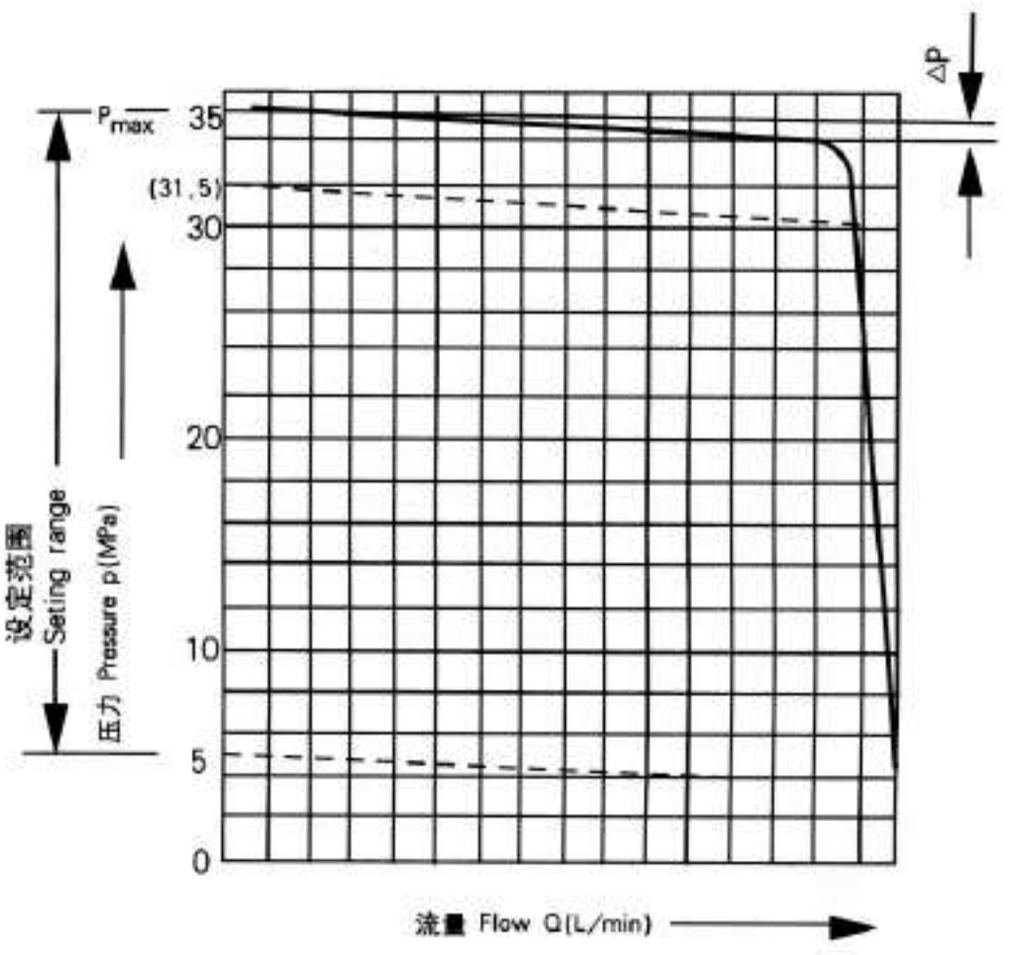
恒压手动变量是一种分功率调节控制，一泵为恒压变量泵，一泵为手动变量泵，排量在0-58ml范围内可调，恒压变量在其变量范围内保持系统压力恒定，不受泵流量变化的影响，变量泵仅供应工作必须的油液体积。如果压力超过设定值，则泵自动摆回小角度。压力设定范围5-35MPa。△Pmax=1MPa。

Constant pressure and manual control DM is an individual power control. One pump is a constant pressure control, the other pump is a manual control, and the displacement is adjustable is the range 0 to 58ml.

The constant pressure control maintains the pressure in a hydraulic system constant within its control range in spite of changing pump flow requirements. The variable pump supplies only the volume of fluid required by the services. Should operating pressure exceed the set pressure, the pump is automatically swivelled back to a smaller angle.Setting range from 5 to 35MPa.△Pmax=1MPa.

通用变量特性曲线 Control Curve(general)



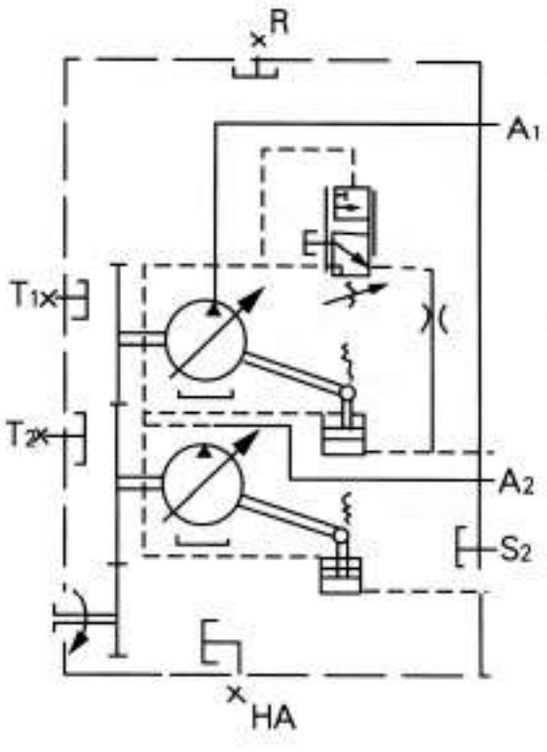


变量起点的压力范围10-40MPa为两泵之压力总和，P1=泵1的压力，P2=泵2的压力，每个驱动均有一个特定的功率曲线。

Pressure range at start of control 10-40MPa total summated pressure P1=pressure from pump 1,P2=pressure from pump 2.
Special curves are produced for each individual drive.

恒压手动变量

Constant Pressure and Manual Control DM



接口	Connections
A1,A2工作油口	service lines
S吸油口	suction line
R排气口	air bleed
HA放油口	oil drain
T1,T2冷却冲洗口	connection for flushing fluid

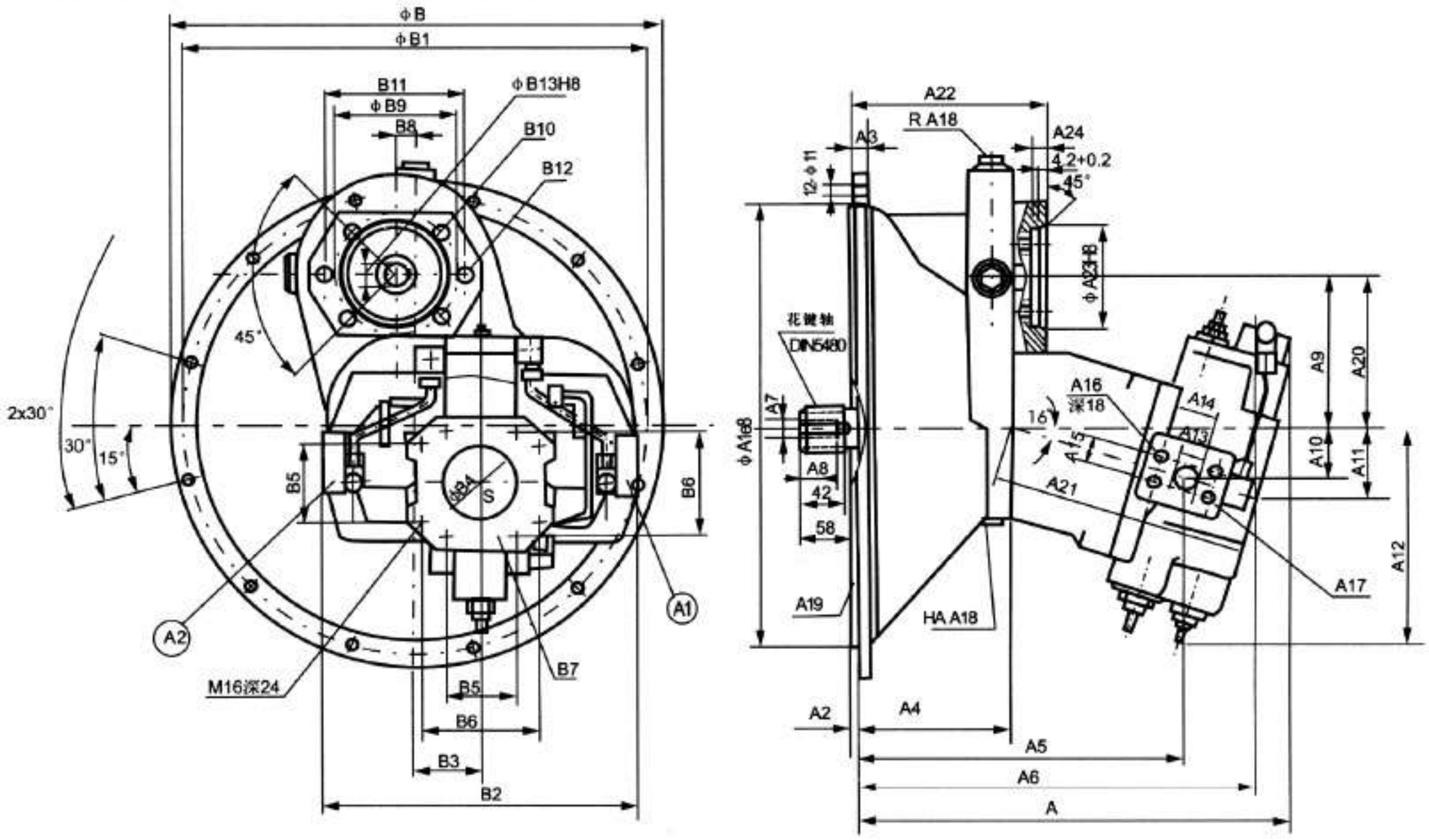
DM恒压手动变量 Constant pressure and manual control DM

元件尺寸，规格55、80和107　Unit Dimensions,Size 55、88 and 107

结构1.1　Design 1.1

不带减速齿轮　With out adaptor gear

带辅助驱动　With auxiliary drive



A1:A2工作油口　Service lines

S= 吸油油口　Suction line

R= 排气口(堵死)　air bleed(plugged)

HA= 泄油口(堵死)　oil drain(plugged)

规格 Size	A	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	深 deep	A17法兰 Flange	
55	361	361.95	5	12	130	273	331	M12	28	92	41	57.6	179.5	20	50.8	23.8	M10	17	SAE3 / 4"	42MPa(6000Psi)
80	418	409.575	6	12	144	310	383	M16	36	107.3	47.2	68.5	214.3	25	57.2	27.8	M12	17	SAE1"	42MPa(6000Psi)
107	443	447.7	6	16	157	335	407	M16	36	115.6	51	71.6	216.3	25	57.2	27.8	M12	18	SAE1"	42MPa(6000Psi)

规格 Size	A18	A19法兰 Flange	A20	A21	A22	A23	A24	B	B1	B2	B3	B4	B5	B6	B7法兰 Flange	B8	B9
55	M18×1.5	SAE4	116	209	66.5	80	11.5	407	381	270	54.25	76	61.9	106.4	SAE3"	3.5MPa		
80	M22×1.5	SAE3	140.08	248.5	180	100	12	456	428.625	290	60.5	102	77.8	130.2	SAE4"	3.5MPa	20	125
107	M22×1.5	SAE2	150	260	192	100	12	495	466.7	320	67	102	77.8	130.2	SAE4"	3.5MPa	20	125

规格 Size	B10	深deep	B11	B12	深 deep	B13	平键CB1096 Keyed	花键DIN5480 Splined	重量 Weight Kg
55			109	M10	16	18	键 6×25	W40×2×18×9g	72
80	M10	16	140	M14	20	25	键 8×15	W45×2×21×9g	100
107	M10	16	140	M14	20	25	键 8×15	W50×2×24×9g	135

元件尺寸，规格55、80、107、125和160

结构1.2

不带减速齿轮

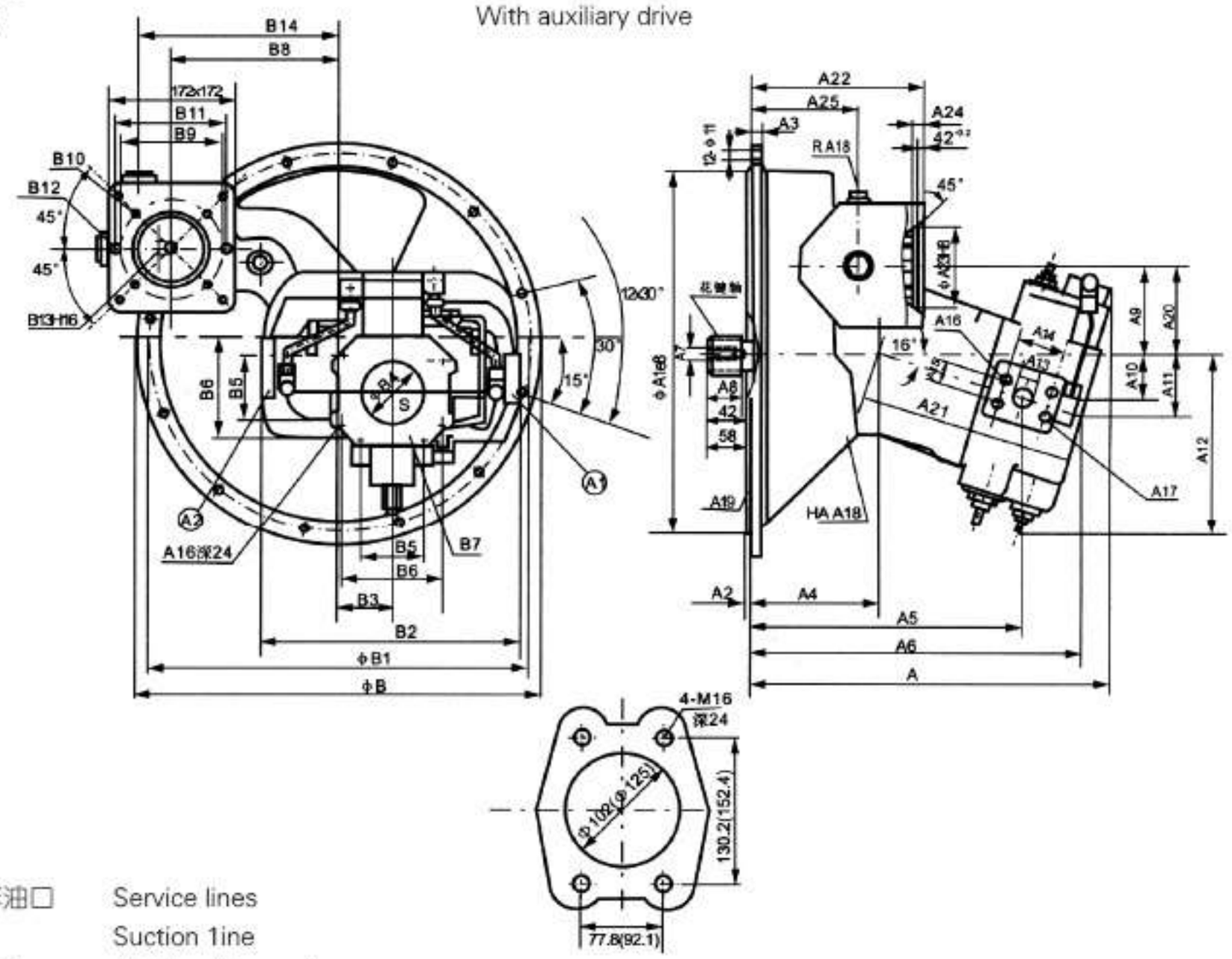
带辅助驱动

Unit Dimensions,Size55、80、107、125 and 160.

Design1.2

Without adaptor gear

With auxiliary drive



A8V125(160)吸油口 Suction line

A1，A2= 工作油口 Service lines

S= 吸油口 Suction 1ine

R= 排气口(堵死) Air bleed(plugged)

HA= 泄油口(堵死) Oil drain(plugged)

规格 size	A	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	深 Deep	A17法兰 Flange
55	361	361.95	5	12	130	273	331	M12	28	92	41	57.6	179.5	20	50.8	23.8	M10	17SAE3/4"	42MPa(6000Psi)
80	418	409.575	6	12	144	310	383	M16	36	107.3	47.2	68.5	214.3	25	57.2	27.8	M12	17SAE1/4"	42MPa(6000Psi)
107	443	447.7	6	16	157	335	407	M16	36	115.6	51	71.6	216.3	25	57.2	27.8	M12	18SAE1/4"	42MPa(6000Psi)
125	426	447.7	6	16	157	307.7	354.4	M16	36	272	47.5	62.2	222	25	57.2	27.8	M12	18SAE1"	42MPa(6000Psi)
160	542	511.2	6	20	221	421	473	M20	42	224	57	72	257	32	31.8	66.7	M14	19SAE1 1/4"	42MPa(6000Psi)

规格 size	A18	A19法兰 Flange	A20	A21	A22	A23	A24	A25	B	B1	B2	B3	B4	B5	B6	B7法兰 Flange	
55	M18×1.5	SAE4							407	381	270	54.25	76	61.9	106.4	SAE3"	3.5MPa
80	M22×1.5	SAE3	110	240.5	211	100	12	127	456	428.625	290	60.5	102	77.8	103.2	SAE4"	3.5MPa
107	M22×1.5	SAE2	108	260	214	100	12	137	495	466.7	320	67	102	77.8	130.2	SAE4"	3.5MPa
125	M22×1.5	SAE2	108	157	214	100	12	137	495	466.7	320	67	102			SAE4"	3.5MPa
160	M22×1.5	SAEl	162.6	208	280	110	25		555	530.2	384	85.5	125			SAE5"	3.5MPa

规格 Size	B8	B9	B10	深 deep	B11	B12	深 deep	B13	平键CB1096 Keyed	花键DIN5480 Splined	重量Kg Weight
55										W40×2×18×9g	80
80	175	125	M10	16	140	M14	20	25	8×36	W45×2×21×9g	110
107	198.5	125	M10	16	140	M14	20	25	8×45	W50×2×24×9g	145
125	198.5	125	M10	16	140	M14	20	25	8×45	W50×2×24×9g	180
160	202.8	138	M10	16	160	M14	20	25	8×45	W60×2×28×9g	200

元件尺寸，规格55，80和107　Unit Dimensions Size 55、80 and 107

结构2-5
结构2
带减速齿轮
不带辅助驱动

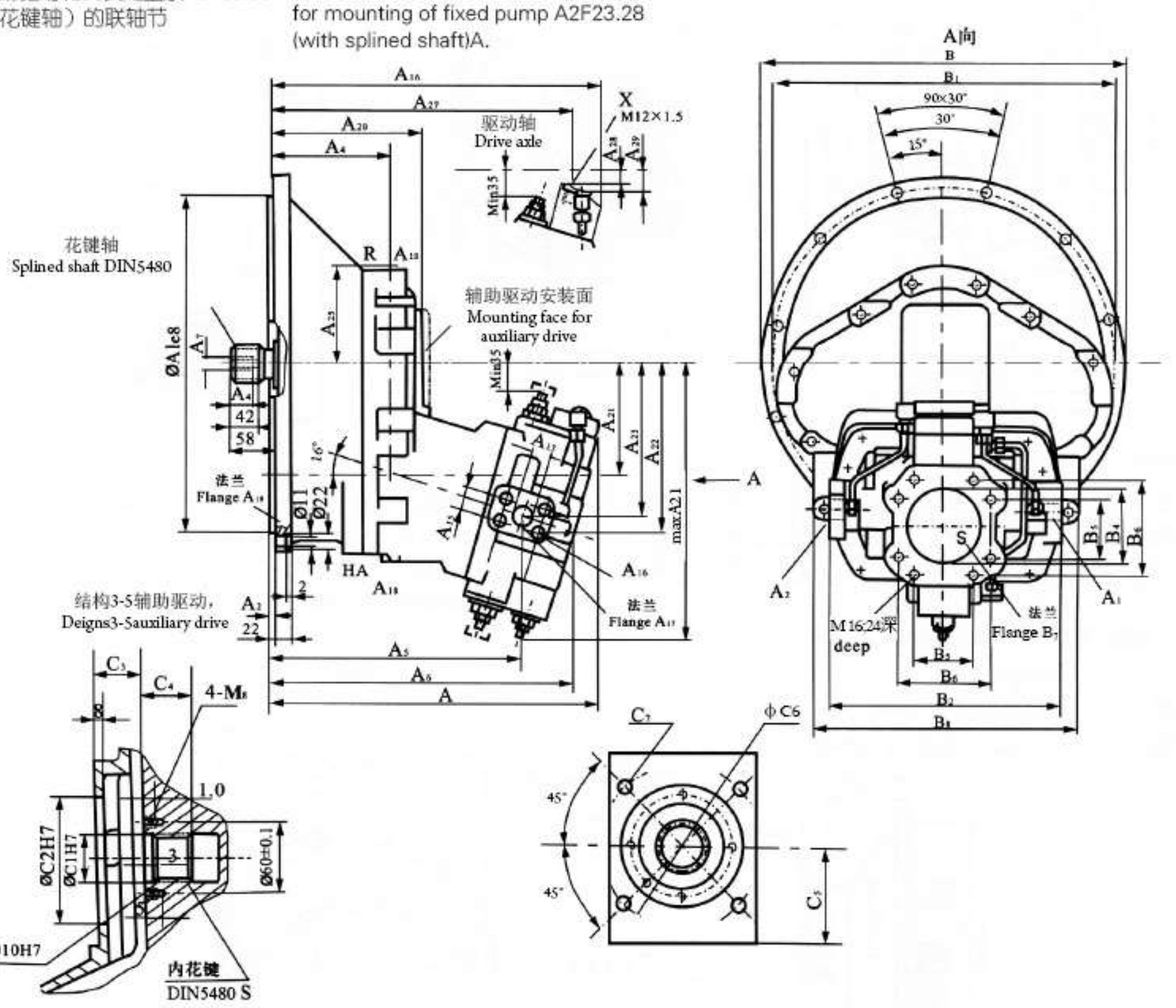
Designs 2–5
Design 2
with adaptor gear
without auxiliary drive

结构3
带减速齿轮
带辅助驱动和安装定量泵A2F23.28（带花键轴）的联轴节

Design 3
with adaptor gear
with auxiliary drive and coupling for mounting of fixed pump A2F23.28 (with splined shaft)A.

结构4
带减速齿轮
带辅助驱动和安装齿轮泵(带锥轴和螺钉固定)的联轴节

Design 4
with adaptor gear
with auxiliary drive and coupling for mounting of gear pump (with tapered shaft and bolt–on fixing)



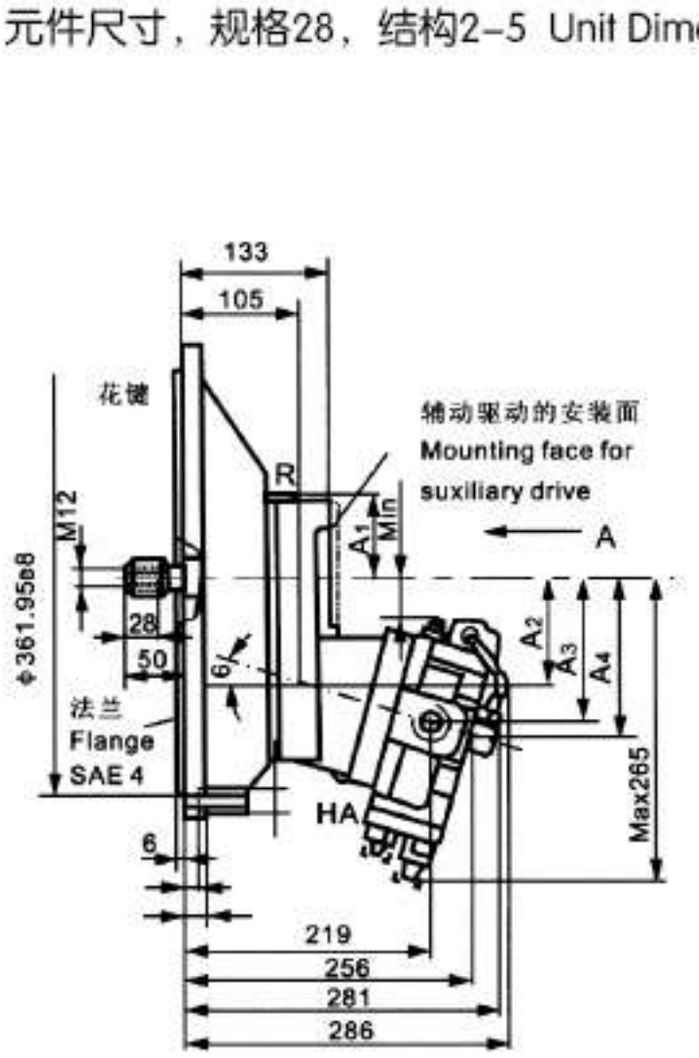
A1,A2 = 工作油口　Service lines
S = 吸油口　Suction line
R = 排气口(堵死)　Air bleed(plugged)
HA = 泄油口(堵死)　Oil drain(plugged)
X = 先导口　pilot port

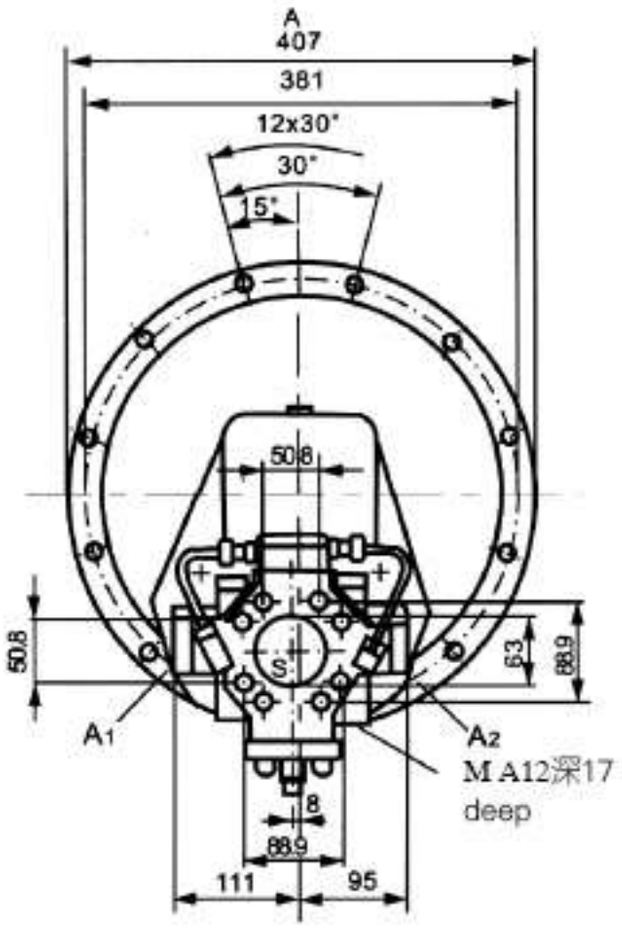
规格 Size	C1	C2	C3	C4	C5	C6	C7	内花键DIN5480 Splined hub Profile
55	34	80	42.5	33	55	100	M8深17	N30×2×14×9H
80	40	105	42.5	41	60	125	M10深12.5	N35×2×16×9H
107	40	105	42	41	62	125	M10深12.5	N35×2×16×9H

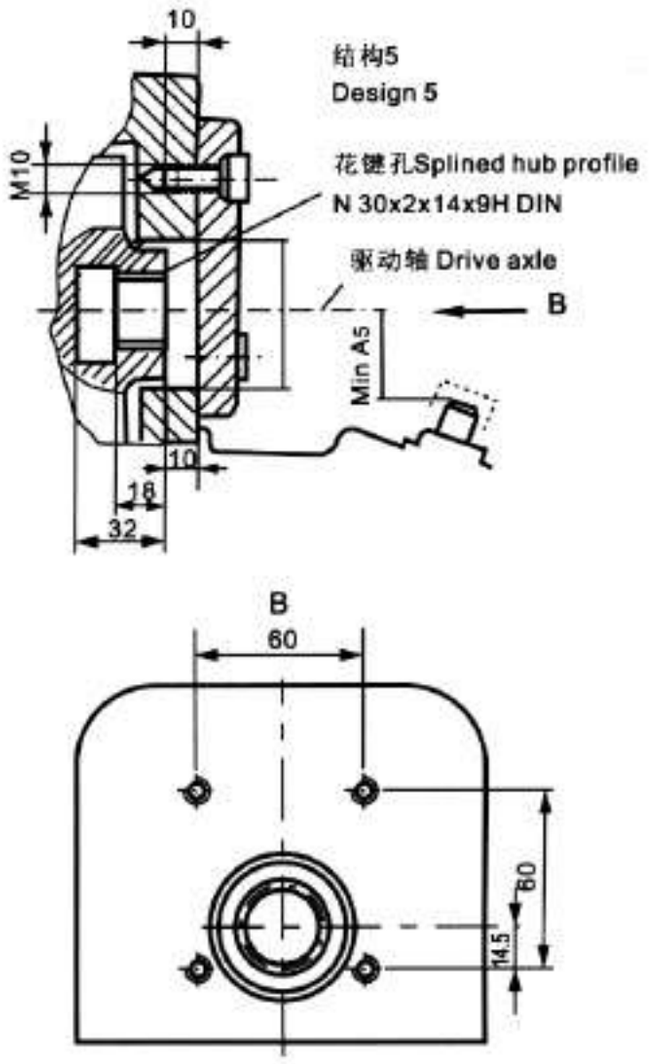
规格 size	A	A1	A2	A4	A5	A6	A7	A8	A13	A14	A15	A16	深 deep	A17法兰 Flange	A18	A19法兰 Flange	A20	A21
55	361	361.95	5	130	273	331	M12	28	20	50.8	23.8	M10	17	SAE 3/4" 42MPa(6000Psi)	M18×1.5	SAE4	176	312
80	418	409.575	6	144	310	383	M16	36	25	57.2	27.8	M12	17	SAE" 42MPa(6000Psi)	M22×1.5	SAE3	191	344
107	443	447.7	6	157	335	407	M16	36	25	57.2	27.8	M12	17	SAEI" 42MPa(6000Psi)	M22×1.5	SAE2	204	360

规格 Size	A22	A23	A24	A25	A26	A27	A28	A29	B	B1	B2	B4	B5	B6	B7法兰 flange	B8	花键 Splined Shaft DIN 5480	重量 Weight Kg
55	181	164.3	123.3	115	370	322	6	8	407	381	270	76	61.9	106.4SAE3"	3.5MPa(500Psi)	320	W40×2×18×9g	100
80	198.2	177.5	129.7	115	420	382	7	12.5	456	428.625	290	102	77.8	130.2SAE4"	3.5MPa(500Psi)	340	W45×2×21×9g	130
107	215.3	194.7	143.7	128	453	406	21.5	27	495	466.7	320	102	77.8	130.2SAE4"	3.5MPa(500Psi)	360	W50×2×24×9g	165

元件尺寸，规格28，结构2–5 Unit Dimensions，Size28，Designs 2–5.





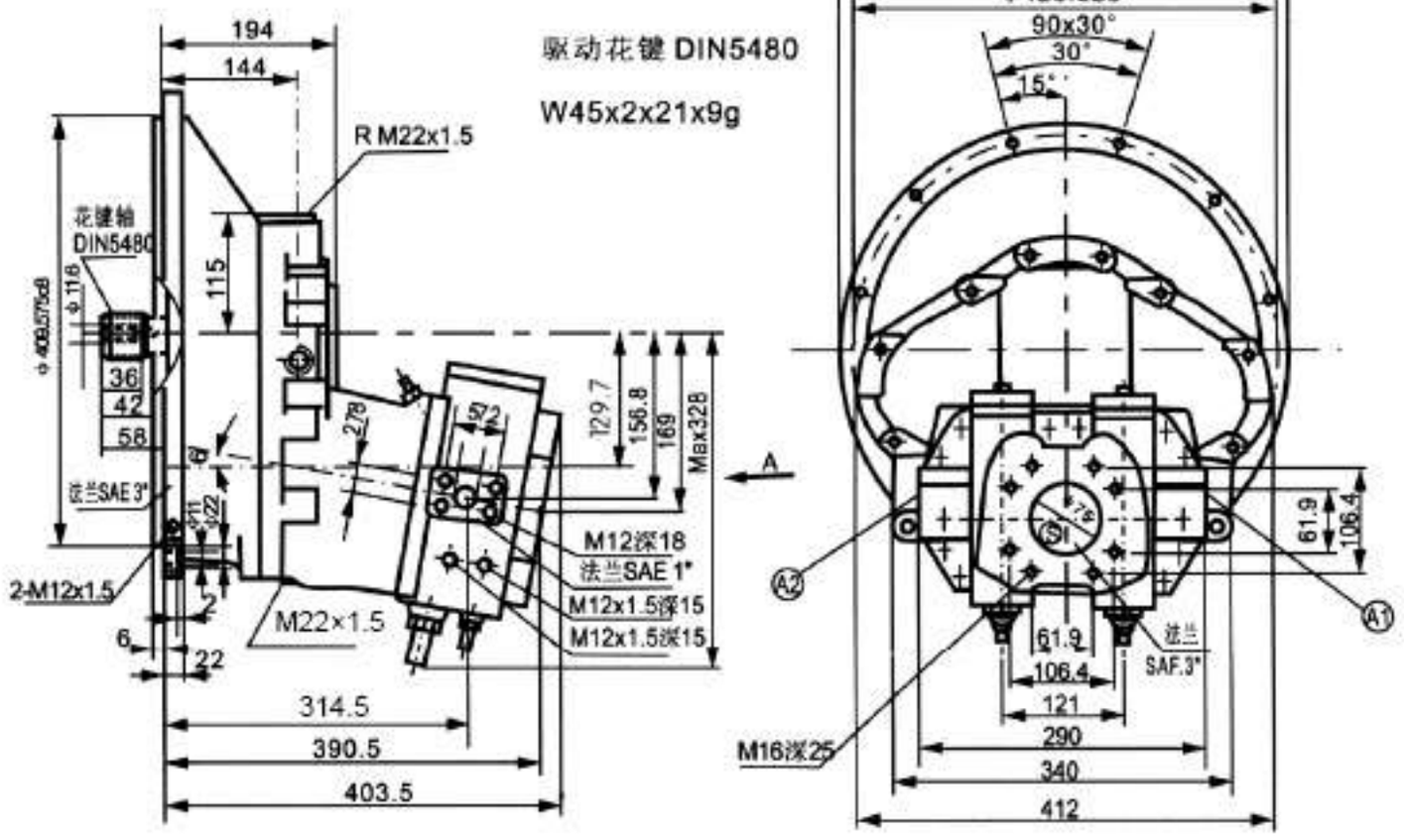


重量 速比	Weight Gear Ratio	A1	A2	A3	A4	A5	kg
速比1	Ration 1	83	100	133	143	42	54
速比2	Ration 2	73.5	91	124	134	33	54

A1,A2 = 工作油口 M33×2 — Service lines
S = 吸油口 21/2.SAE,21MPa(3000psi) — Suction line
R = 排气口 M14×1.5(堵死) — air bleed(plugged)
HA = 泄油口 M14×1.5(堵死) — oil drain(plugged)

元件尺寸，规格58，Unit Dimensions,Size58.

结构2 Design 2
带减速齿轮 with adaptor gear
不带辅助驱动 without auxiliary drive



A1,A2 = 工作油口 M33×2 — Service lines
S = 吸油口 21/2.SAE,21MPa(3000psi) — Suction line
R = 排气口 M14×1.5(堵死) — air bleed(plugged)
HA = 泄油口 M14×1.5(堵死) — Oil drain(plugged)
T1,T2 = 冷却冲洗口 — flushing port

☎ 销售服务热线 400-000-6987

本公司通过：

- 【ISO9001质量管理体系认证】
- 【ISO14001环境管理体系认证】
- 【OH SAS18001职业健康安全管理体系认证】
- 【CE认证】

编制： 华德液压技术中心

华德液压

北京华德液压工业集团有限责任公司

BEIJING HUADE HYDRAULIC INDUSTRIAL GROUP CO., LTD.

2012 年 10 月编制

A6V

华德液压





Axial Piston-Bent Axis Design Variable Displacement Motor

斜轴式轴向柱塞变量马达

技术样本







北京华德液压工业集团有限责任公司

BEIJING HUADE HYDRAULIC INDUSTRIAL GROUP CO.,LTD.

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Variable Displacment Motor A6VG

3 A6VE内藏式变量马达 21

Plug—In Variable Displacment Motor A6VE

华德

注意事项

1．为了保证无故障的高效工作，在设计系统期间应根据工况仔细选择液压系统的液压油，所有矿物油基液压油均在某种程度上适用于轴向柱塞元件，它们的应用时基本划分取决于上述的水、粘度与温度关系，并考虑氧化和腐蚀保护、材料相容性、空气和水分离特性。

2．为了保证设备有长的使用寿命，必须进行良好而可靠的过滤。油液中的硬颗粒污染不得超过以下等级：

等级9——按 NAS1638

等级6——按 SAE

等级18 / 15——按 ISO / DIS 4406

在油液温度很高时，最低清洁度为：

等级8——按 NAS1638

等级5——按 SAE

等级17 / 14——按 ISO / DIS 4406

3．为了正确选择液压油，必须知道与环境温度有关的工作温度；在闭式回路中这是回路温度，在开式回路中这是油箱温度。

4．注意：漏油(壳体泄油)温度受压力和转速的影响，总是高于回路温度，然而要求回路中任何点温度不得超过90℃。

如果由于极端的工作参数或较高的环境温度，而不能维持上述条件，订货时请询问我公司。

5．泵的进油口压力(绝对压力)处须≥0.08MPa，及泄油压力（壳体内允许的最高压力）为0.2MPa（绝对压力），壳体内压力值必须等于或高于作用在轴密封上的外部压力值。

6．安装位置：一般要求液压泵 / 马达安装位置、壳体上边缘低于油箱最低液面。若安装需在油面以上，请在订货时提出。

《样本》所述技术资料，仅供参考。若有特殊要求请与我集团公司技术部门咨询，若有更改，恕不通知。

The technical information in the catalog is for your reference. Please consult our technical Dept.,if you have any special requirements.

NOTES

1. In order to guarantee trouble-free and efficient operation, the hydraulic fluid in a hydrostatic system should be selected carefully according to the actual working conditions during the design of the system. All mineral oil based fluids are suitable to a greater or lesser degree for application in axial piston units. Their basic classification of application results from what has already been said due to the water, viscosity and temperature relationships, with consideration of oxidization and corrosion protection, material compatibility, air and water separation characteristics.

2. In order to guarantee a long service life for the installation, good and reliable filtration is necessary. The hard particle contamination of fluid may not exceed a level determined by:
Class 9 to NAS 1638
Class 6 to SAE
Class 18/15 to ISO/DIS 4406
When the fluid temperature is too high, the required minimum degree of cleanliness is:
Class 8 to NAS 1638
Class 5 to SAE
Class 17/14 to ISO/DIS 4406

3. In order to select the correct fluid, it is necessary to know the operating temperature in the circuit in relation to the ambient temperature-in an open circuit and the tank temperature.

4. Important: The leakage oil(case drain oil)temperature is influenced by pressure and pump speed and is always higher than the circuit temperature. However, at no point in the circuit may the temperature exceed 90℃。
If it is not possible to comply with the above conditions because of extreme operating parameters or high ambient temperatures, please consult us.

5. The minimum pressure at the suction port of the pump≥0.08 Mpa(absolute pressure), and the drain pressure(max. permissible casing pressure)is 0.2 MPa(absolute pressure). The pressure in the housing must be the same or greater than the external pressure on the shaft seal.

6. Installation position: in general, the upper point on the pump/ motor houdng must be below the minimum oil level of the tank. If you would like to install计above the minimum oil level, please indicate when order.

北京华德液压工业集团有限责任公司
BEIJING HUADE HYDRAULIC INDUSTRIAL GROUP CO. ,LTD.

A6V 变量马达 Variable Displacement Motor A6V

用于开式和闭式回路 斜轴式轴向柱塞结构
For open and closed circuits axial tapered piston,bent axis design

RC91100/12.2004

规格 Size 28-500 | 高压范围 Peak pressure 至 up to 35MPa | 替代： ReplaceRC91100/09.2003



说明：

- 该变量马达是专为带次级控制的静液驱动设计的。
- 配有最大调节范围V_{max}/V_{min}=3.47的整套控制总成。

特点：

- 用静液传动时有较大的调节范围
- 次级控制和带有各种控制装置的调节
- 在较小的倾角下提高最高输出转速
- 由于可用较小的泵而节省费用
- 省掉多速比齿轮驱动
- 高功率密度
- 允许高的外界轴载荷
- 任选安装位置
- 高效率
- 优秀的起动特性
- 小惯量

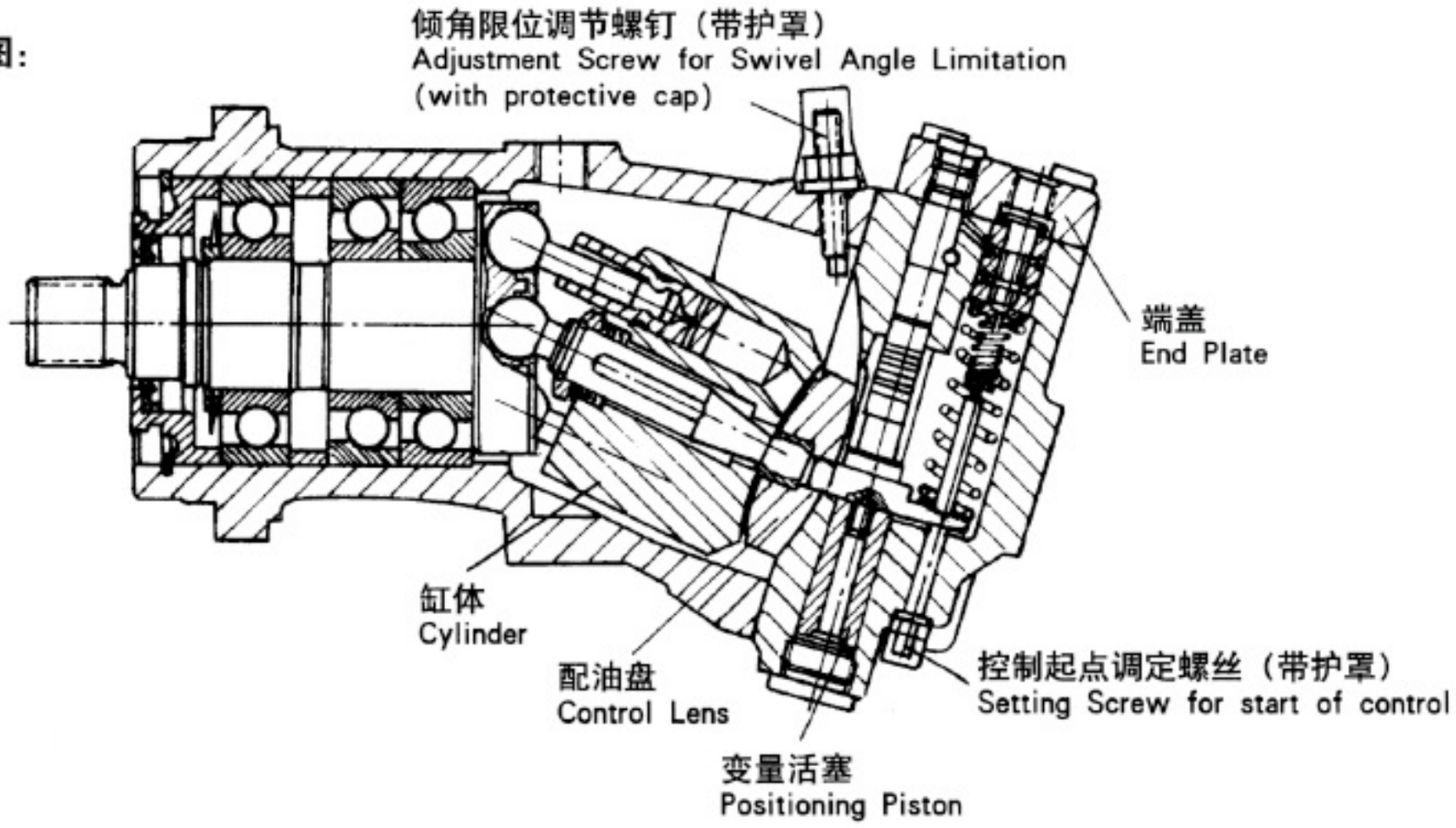
Description

The variable displacement motor was designed especially for hydrostatic drives with secondary controls.
A complete control assembly for a maximum swivel range of V_{max}/V_{min}=3.47 is fitted。

Special Characteristics

Large control range with hydrostatic transmissions.
Secondary control regulation with various control devices.
Increased maximum output. speeds at reduces swivel angle.
Cost-saving due to the possibility of using smaller pumps
Obviates the multispeed ratio gear drives.
High power density.
Optional mounting position.
High efficient.
Excellent starting characteristics.
Low inertia.

剖视图：



A6V 变量马达 Variable Displacement Motor A6V

型号 Type Code

A6V	80	HA2	2	F	Z	2	–	039

马达型号 Motor Type

变量马达 Variable displacement motor — A6V

规格 Size

8.1–28.1ml/r	28
15.8–54.8ml/r	55
23–80ml/r	80
30.8–107ml/r	107
46–160ml/r	160
64.8–225ml/r	225
137–500ml/r	500

(排量 V_{gmin}–V_{gmax}) Displacement

变量方式 Control Device

液控变量 Hydraulic control, pilot pressure related	控制压差△p=1MPa Pilot pressure increase	HD1
	带恒压控制△p=1MPa With pressusre control	HD1D
	控制压差△p=2.5MPa Pilot pressure increase	HD2
	带恒压控制△p=1MPa With pressusre control	HD2D
液控双速变量 Hydraulic 2–speed control pilot pressure related	控制起点 Start of control 0.2–2MPa	HS1
	控制起点 Start of control 0.5–5MPa	HS2
高压自动变量 Automatic control, high pressure related	恒压 Constant pressure	HA1
	不带超调 Without override	HA1H
	带超调 With override	HA2
	升压 Pressure increase △p=10MPa	
	不带超调 Without override	HA2H
	带超调 With override	
转速液控变量	Hydraulic control, speed related	DA
电控双速变量	Electrical 2–speed control 12V	ES1
	(with switching solenoid)24V	ES2
电控比例变量	Electrical control 12V	EP1
	(with proportional solenoid) 24V	EP2
扭矩变量	Mooring control	MO
手动变量	Manual control (with handwheel)	MA

最小排量设定值 Min.Swept Volume Setting

例： Example.

Vgmin=39ml/r — 039

起重机系列产品专用(带单向节流阀) For crane products

–

装配型式 Assembly Type

解释见变量说明及元件尺寸	For explanation see description of control device and unit dimensions	1 / 2

轴伸 Shaft End

平键 GB 1096–79	Keyed parallel shaft	P
花键 DIN 5480	Splined shaft	Z
花键 GB 3478.1–83	Splined shaft	S

油口连接 Pipe Connections

SAE法兰，侧面	SAE flange,on side	F
螺纹连接，侧面	Metric threads,on side	G

结构型式 Series

结构2，规格28–225	Series 2,sizes 28–225	2
结构5，规格250–500	Series 5,size 250–500	5

订货示例：A6V80HD12FZ2-039

Ordering Example A6V80HD12FZ2-039

斜轴变量马达A6V，规格80，液控变量，△p=1MPa，结构2，侧面SAE法兰连接，德标花键，第2种装配型式，最小排量 V_{gmin}=39ml/r

Axial piston variable displacement motor A6V,size 80,with hydraulic control,pilot pressure related, △p=1MPa, series 2.SAE flange connections on side,splined shaft, assembly type 2,min.swept volume setting V_{gmin}=39ml/r

A6V 变量马达 Variable Displacement Motor A6V

技术参数 Technical Data

工作压力范围： Operating Pressure Range

A或B口压力： Pressure at port A or B

额定压力 Nominal pressure P_n=31.5MPa

最高压力 Peak pressure P_{max}=35MPa

A、B油口压力总和不得超过63MPa，每侧油口压力最高35MPa。 The sum of the pressures at ports A and B should not exceed 63MPa. (Individual pressure at either port max.35MPa

泄油压力： Leakage oil Pressure：

允许T口最大泄油压力 MaXimum permissible leakage oil pressure (at Port T)

P_{abs} 0.2MPa

油温范围： Fluid Temperature Range

t_{min} -25℃

t_{max} +80℃

粘度范围： Viscosity Range：

V_{min} 10mm²/S

V_{max} (短时)(for short periods)1000mm²/s

最佳工作粘度： Optimum Operating Viscosity：

V_{opt} 16-36mm²/s

油液选择： Fluid Recommendation

工作温度 Operating Recommended

推荐粘度等级符合DIN51519 Viscosity grade temperature to DIN51519 range ISO(VG)

30-40℃	VG22=22mm²/s	at40℃
40-50℃	VG32=32mm²/s	at40℃
50-60℃	VG46=46mm²/s	at40℃
60-70℃	VG68=68mm²/s	at40℃
70-80℃	VG100=100mm²/s	at40℃

液压油的过滤：

推荐过滤精度为10μm。亦可使用25-40μm的，但使用10μm的可以延长使用寿命(降低磨损)。

转速范围：

最低转速没有限制，在要求十分均匀的转速时，n_{min}不小于50r/min 最高转速由来自泵的最大流量和变量马达的最小排量确定。最小排量则由一个调节螺钉限位，所以变量马达不会超速运转。

最高允许转速见技术参数表。

Filtration of Hvdraulic Fluid

Recommended filtration 10μm. Coarser filtration of 25 to 40μm is possible, however longer service life is achieved with filtration of 10μm. (reduced wear).

Speed Range

No limitation on minimum Speed n_{min}. Where very even speeds are required. n_{min} should not be less than 50r/min. The maximum flow from the pump and the minimum swept volume of the variable motor together determine the maximum output speed.

The min swept volume is limited mechanically by means of an adiustment screw so that the max. permissible speeds(of the variable motor and the driven unit)cannot be exceeded. See date table for max.permissible speeds.

规格计算： Calculation of size

流量 Swept Volume $Q=\frac{V_g \cdot n}{1000 \cdot \eta_v}$ [L/min]

输出转速 Output Speed $n=\frac{Q \cdot 1000 \cdot \eta v}{V_g}$ [r/min]

输出扭矩 Output Torque $M=\frac{V_g \cdot \triangle p \cdot \eta_{mh}}{2\pi}$

$\frac{1.59 V_g \cdot \triangle p \cdot \eta_{mh}}{10}$ [Nm]

或 or $M=\frac{K_M \cdot \triangle p \cdot \eta_{mh}}{10}$ [Nm]

输出功率 Output Power $P=\frac{M \cdot n}{9549}$

$=\frac{Q \cdot \triangle p}{60} \cdot \eta_t$ [KW]

V_g=最大排量(ml/r) max geometry displacement[ml/r]

M=扭矩(Nm) torque[Nm]

△p=压差(MPa) differential pressure[MPa]

n=转速(r/min) speed[r/min]

η_v=容积效率 volumetric efficiency

η_{mh}=机械效率 mechanical-hydraulic efficiency

η_t=总效率 overall efficiency

技术参数 Technical Data

规格	Size			28	55	80	107	160	225	500
变量方式	Control Device									
HD 液控变量	Hydraulic control pilot pressure related			•	•	•	•	•	•	•
HD1D 液控恒压变量	Hydraulic control pilot pressure related				•	•	•	•		
HS 液控（双速）变量	Hydraulic control(two speed), pilot pressure related			•	•	•	•	•	•	•
HA 高压自动变量	Automatic control,high pressure related			•	•	•	•	•	•	
DA 转速液控变量	Hydraulic control.speed related			•	•	•	•	•		
ES 电控（双速）变量	Electric control (two speed)			•	•	•	•	•		
EP 电控（比例）变量	Electric control (proportional)			•	•	•	•	•		
MO 扭矩变量	Mooring control			•	•	•	•	•	•	
MA 手动变量	Manual control									
排量	Displacement	V_{gmax}	ml/r	28.1	54.8	80	107	160	225	500
		V_{gmax}	ml/r	8.1	15.8	23	30.8	46	64.8	137
最大允许流量	Max.Permissible.Swept volome	Q_{gmax}	L/min	133	206	268	321	424	530	950
最高转速	Max.speeds	n_{max} 在 at V_{gmax}	r/min	4750	3750	3350	3000	2650	2360	1900
	(在 at Q_{max} 下)	n_{max} 在 at $V_g<V_{gmax}$	r/min	6250	5000	4500	4000	3500	3100	2500
扭矩常数	Torque constants	M_x 在 at V_{gmax}	Nm/MPa	4.463	8.701	12.75	16.97	25.41	35.71	79.577
		M_x 在 at V_{gmin}	Nm/MPa	1.285	2.511	3.73	4.9	7.35	10.30	21.804
最大扭矩	Max.torque	M_{max} 在 at V_{gmax}	Nm	156	304	446	594	889	1250	2782
	(在 at △p=35MPa)	M_{max} 在 at V_{gmin}	Nm	45	88	130	171	257	360	763
最大输出功率(在 35MPa 和 Q_{max} 下)Max.output power(at 35MPa and Q_{max})			kW	78	120	156	187	247	309	507
惯性矩	Moment		kgm²	0.0017	0.0052	0.0109	0.0167	0.0322	0.0532	
重量	Weight		kg	18	27	39	52	74	103	223

HD液控变量

按外控油源的先导压力来无极的控制马达的排量

标准结构：按第2种装配型式供货

控制起点在V_{gmax}(最大扭矩、最低转速)

控制终点在V_{gmin}(最小扭矩、最高转速)

对于第一种装配型式，控制功能相反：

控制起点在V_{gmin} 控制终点在V_{gmax}。

变量机构的设定

有两种方案供选用：

1．HD1-先导压力压差(由$V_{gmax}\rightarrow V_{gmin}$) - △Ps=1MPa

控制起点可调从0.2-2MPa

标准设定值：控制起点压力为0.3MPa，控制终点压力1.3MPa

2．HD2-先导压力压差(由$V_{gmax}\rightarrow V_{gmin}$) - △Ps=2.5MPa

控制起点可调　从0.5-5MPa

标准设定值：控制起点压力为1MPa，控制终点压力为3.5MPa，当用HD作双速控制时，最高先导压力可到7.5MPa

外控口x处的供油量：约0.5L/min.

当工作压力＜1.5MPa时，必须在G口供人1.5MPa的辅助压力。

Hvdraulic Control Pilot Pressure Related,HD

Stepless control of the motor capacity dependent on a pilot pressure signal.

Standard model:assemblv tvpe 2

Start of control at Vgmax(max.torque，mil.speed)

End of control at Vgmax(min.torque，max.speed)

For assembly type 1，the control function is reversed:

Start of control at Vgmin，end of control at Vgmin

Setting of Regulator

Two options are available:

1．HD1

Pilot pressure increase adjustable(V_{gmax}-V_{gmin})-△Ps=1MPa

Start of control adjustable-from 0.2-2MPa

Standard setting：start of control at 0.3MPa(end of control at 1.3MPa)

2．HD2

Pilot pressure increase(V_{gmax}-V_{gmin})-△Ps=2.5MPa

Start of control adjustable-from 0.5-5MPa

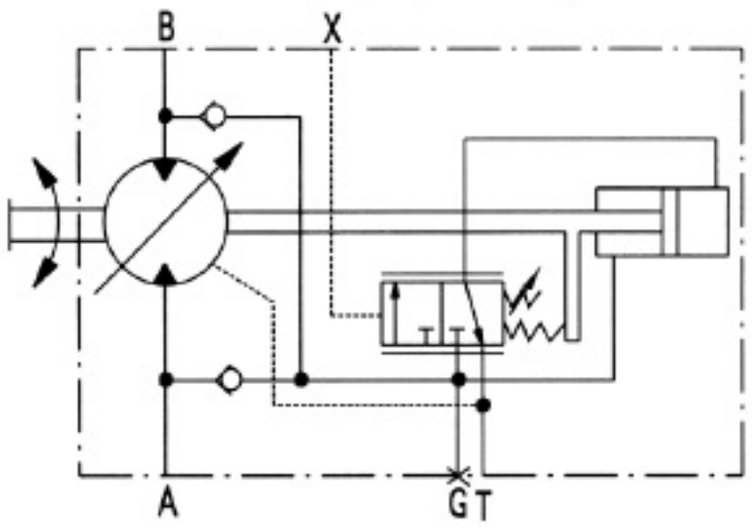
Standard setting:start of control at 1.0MPa(end of control at 3.5MPa)

When using the HD control as a two-point control a max.pilot pressure of 7.5MPa is permissible.

The max oil flow at pilot X is approx 0.5L/min.

Should the available operating pressure be＜1.5MPa then an auxiliary pressure of 1.5MPa must be applied at port G.

HD. 液控变量(HD1，HD2)



HD1D液控恒压变量

恒压控制是在HD功能基础上增加的。

如果系统压力由于负载扭矩缘故或由于马达摆角减小而升高，则达到恒压控制的设定值时，马达摆出到较大的摆角。

由于增大排量和减小压力，控制偏差消失。

通过增大排量，马达在恒压下产生较大扭矩。

恒压控制阀的设定范围为8-35MPa.

标准型：按第二种装配型式供货。

控制起点在V_{gmax}(最大扭矩、最低转速)

控制终点在V_{gmin}(最小扭矩、最高转速)

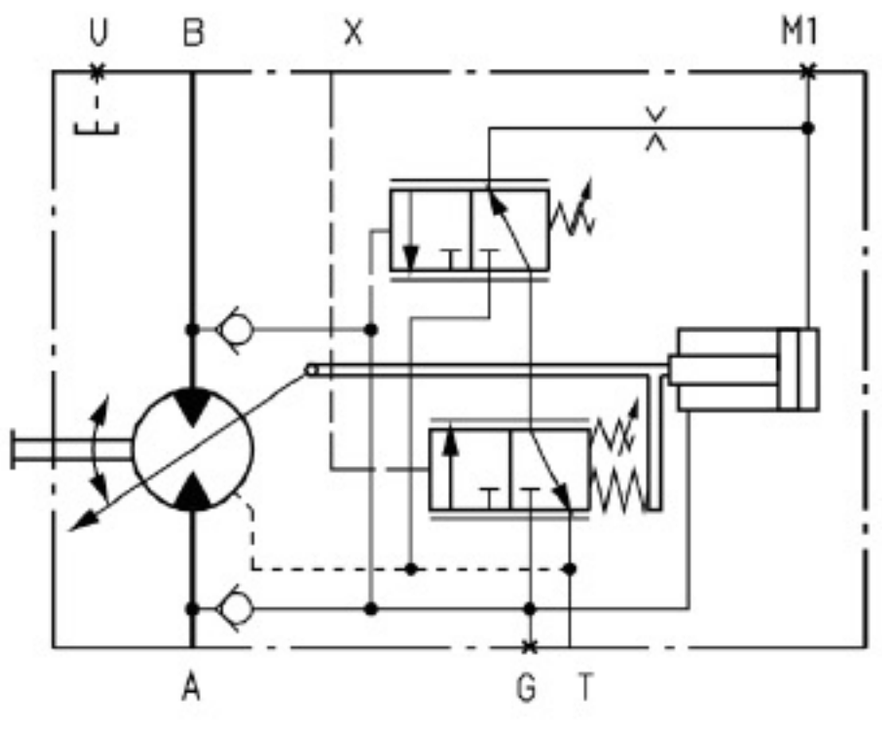
HD1D:Constant pressure control

The constant pressure control is superimposed on the HD function.

Should system psressure rise aS a result of the load torque or reduction of the motor swivel angle，When the setting swivelled out to a higher angle.

As a result of the increased displacement and consequent pressure reduction，the control debiation is eliminated. By increaseing the displacement the motor produces a higher torque at a constant pressure.

Setting range of constant pressure control valve：8-35MPA



HS液控双速变量

按外控油源的先导压力来两点式的控制马达排量

标准结构：按第2种装配型式供货。

控制起点在V_{gmax}(最大扭矩、最低转速)

控制终点在V_{gmin}(最小扭矩、最高转速)

对于第一种装配型式，控制功能相反：

控制起点在V_{gmin}控制终点在V_{gmax}.

变量机构的设定

有两种方案供选用

1．HS1 —控制起点可调-从0.2-2MPa

2．HS2 —控制起点可调-从0.5-5MPa

(由V_{gmin}→V_{gmax})-△p≤0.2MPa

外控口x处的供油量：约0.5L/min.

当工作压力＜1.5MPa时，必须在G口供人1.5MPa的辅助压力。

Hydraulic Control, 2-Speed Pilot Pressure Related, HS

Two point Control of the motor capacity dependent on a pilot pressure signal.

Standard model：assembly type 2

Start of control at V_{gmax}(max.torque, min speed)

End of control at V_{gmin}(min.torque, max, speed)

For assembly type 1，the control function is reversed：

start of control at V_{gmin}，end of control at V_{gmax}.

Setting of Regulator

Two options are available：

1．HSl-Start of control adjustable-from 0.2-2MPa

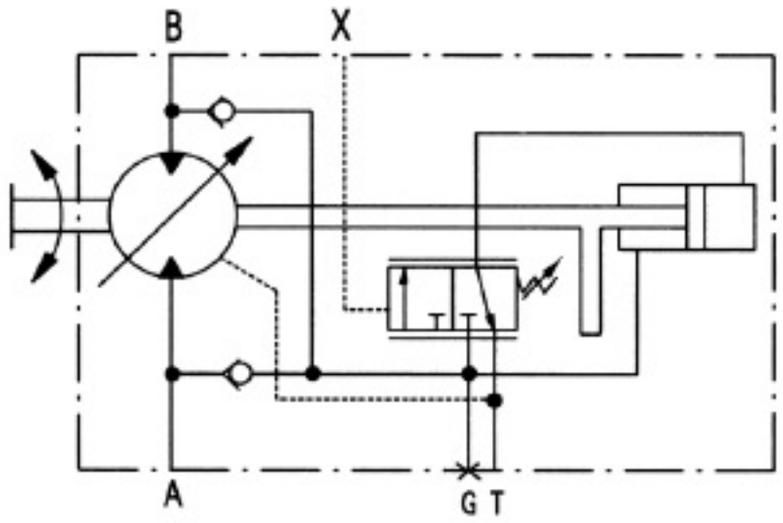
2．HS2-Start of control adjustable-from 0.5-5MPa

(V_{gmin}-V_{gmax})—△P≤0.2MPa

The max oil flow at pilot X is approx 0.5L/min.

Should the available operating pressure be＜1.5MPa then an auxiliary pressure of 1.5MPa must be applied at port G.

HS. 液控双速变量(HS1，HS2)



HA高压自动变量

按工作压力自动控制马达排量

标准结构：按第1种装配型式供货

控制起点在V_{gmin}(最小扭矩、最高转速)

控制终点在V_{gmax}(最大扭矩、最低转速)

此种变量方式，当A或B口的内部工作压力达到设定值时，马达由最小排量V_{gmin}向最大排量V_{gmax}转变。

控制起点在8至35MPa间可调，

有两种方式供选用：

1．HAl-在控制范围内，工作压力保持恒定。△P=1MPa

从V_{gmin}变至V_{gmax}时，压力升高约为1MPa。

2．HA2-在控制范围内，工作压力升高。△P=10MPa

从V_{gmin}(7℃)变至V_{gmax}(25°)时，压力升高10MPa。

HA变量可在X口进行外控(即带有超调)，在这种情况下，变量机构的压力设定值(工作压力)按每0.1MPa先导(外控)压力下降1.6MPa的比率降低。

例如：

变量机构起始变量压力设定值为30MPa。

先导压力(X口)：0MPa时变量起点在30MPa。

先导压力(X口)：1MPa时变量起点变为14MPa。

(30MPa-10×1.6MPa；14MPa)

Automatic Control,High Pressure Related,HA

Automatic,control of motor capacity dependent on operating pressure.

Assembly type 1 Standard model：assembly type 1

Start of control at V_{gmin}(min.torque，max speed)

End of control at V_{gmax}(max.torque，min speed)

This control device measures the internal operating pressure at port A or B (no pilot line required)，and when the set operating pressure is reached，swivels the motor from min. capacity(V_{gmin})to max.capacity(V_{gmax}).

Start of control is adjustable between 8MPa and 35MPa.

Two options are available：

1．HAl-Within the control range，the operating pressure is held practically constant. △P=1MPa Pressure increase between V_{gmin} and V_{gmax} is approx 1MPa.

2．HA2-Within the control range，with pressure increase △P=10MPa from V_{gmin}(7°)to V_{gmax}(25°).

The HA control can be overridden at port X.In this case，the set value of pressure at the regulator(operating pressure)is reduced 1.6MPa per 0.1MPa pfiot

pressure.

Example：

Reguiator setting：30MPa.

Pilot pressure(at X)：0MPa start of control at 30MPa

Pilot pressure(at X)：1MPa start of control at 14MPa

(30MPa-10×1.6MPa=14MPa)

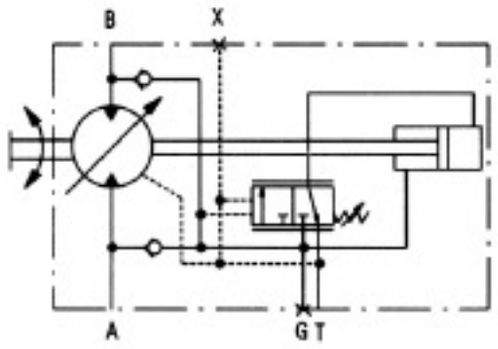
带有超调的HA，变量有两种方式供选用：

1．HA1H–在控制范围内，工作压力保持恒定，△P=1MPa。
2．HA2H–在控制范围内，工作压力升高，△P=1OMPa。
如果控制仅需达到最大排量，则允许先导压力最高为5MPa。
外控口X处的供油量0.5L/min。

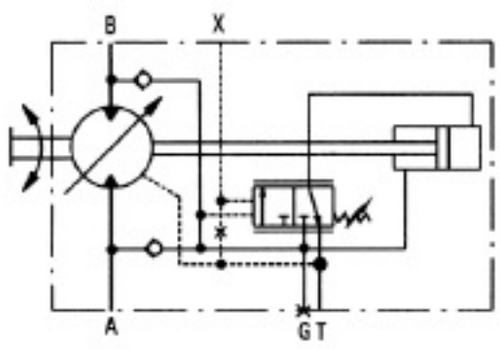
Two options are available for HA control with override.

1．HA1H–With in the control range，the operating pressure is held，practically constant，△P=1MPa。
2．HA2H–With in the control range，the operating pressure in crease，△P=10MPa。
If override is only required to set max.capacity(swivelling the motor to V_{gmax})，a pilot pressure of up to 5MPa max is permissible.
The max oil flow at X is approx 0.5L/min.

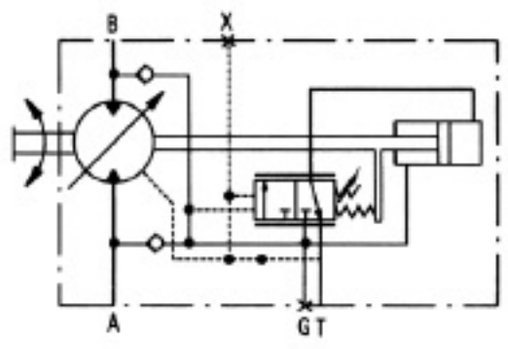
HA. 高压自动变量 (HA1)



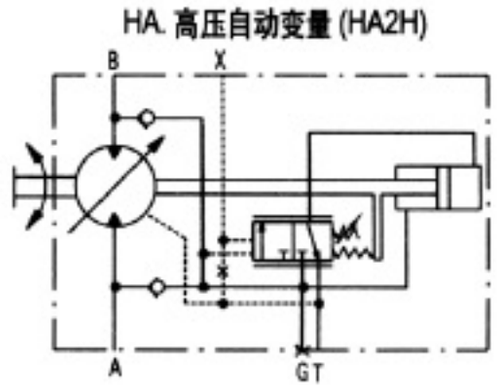
HA. 高压自动变量 (HA1H)



HA. 高压自动变量 (HA2)



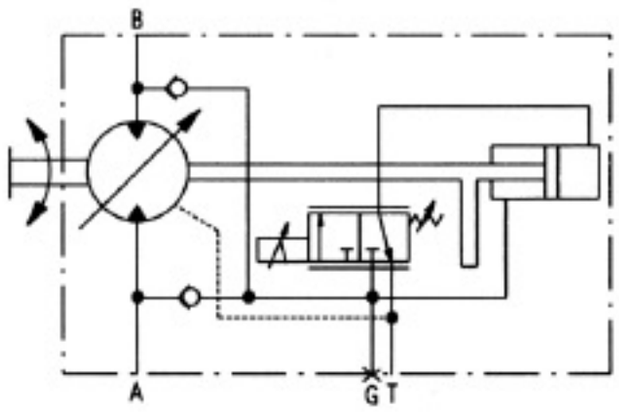
HA. 高压自动变量 (HA2H)



ES，电控双速变量

达排量处于V_{gmin}或V_{gmax}是由控制电磁铁通断来实现。
标准结构：按第2种装配型式供货
控制起点在V_{gmax}(最大扭矩、最低转速)
控制终点在V_{gmin}(最小扭矩、最高转速)
对于第一种装配型式，控制功能相反：
有四种方案供选用：
ES1–控制电压12VDC（电磁铁为法兰连接）
ES2–控制电压24VDC（电磁铁为法兰连接）
ES3–控制电压12VDC（电磁铁为螺纹连接）
ES4–控制电压24VDC（电磁铁为螺纹连接）

ES. 电控双速变量



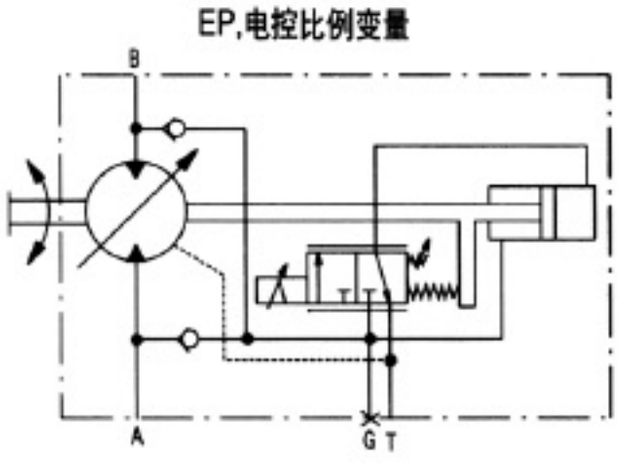
ES,Electrical 2-Speed Control

The motor capacity is set to V_{gmin} or V_{gmax} by switching on or off an electrical current at the switching solenoid.
Standard model：assembly type 2
Start of control at V_{gmax}(max.torque min speed)
End of control at V_{gmin}(min.torque max speed)
For assembly type 1 the control function is reversed.
Two options are available：
ESl–control voltage 12VDC (solenoid connected by bolts)
ES2–control voltage 24VDC (solenoid connected by bolts)
ES3–control voltage 12VDC (solenoid connected by threads)
ES4–control voltage 24VDC (solenoid connected by threads)

EP，电控比例变量

根据电信号无级的或双点的控制马达排量
标准结构：按第2种装配型式供货
控制起点在V_{gmax}(最大扭矩、最低转速)
控制终点在V_{gmin}(最小扭矩、最高转速)
对于第一种装配型式，控制功能相反：
能过比例电磁铁操纵液压控制。
有两种方案供选用：
1．EPl–控制电压12VDC 400mA–900mA
2．EP2一控制电压24VDC 200mA–450mA
如果仅要求变量马达作双点(双速)控制，则只要使
电流通断即可得到这两个位置(对第2种装配型式在V_{gmax}断电，对第1种装配型式在V_{gmin}断电)。
如果工作压力低于1.5MPa，则在G口要求引入1.5MPa的辅助压力。

EP,电控比例变量



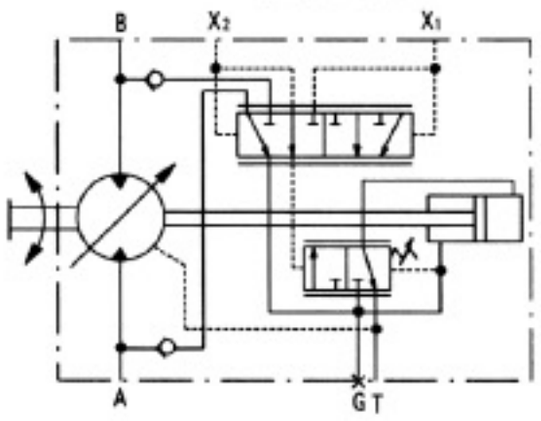
EP Electrical Proportional Control

For two–speed control of the motor capacity，or for two point control dependent on an electrical signal.
Standard model：assembly type 2
Start of control at V_{gmax}(max.torque，min.speed)
End of control at V_{gmin}(min.torque，max.speed)
For assembly type 1，the control function is reversed.
The hydraulic control is operated by a proportional solenoid.
Two options are available：
1．EPl–control voltage 12VDC
2．EP2–control voltage 24VDC
Should the variable motor only be required for two point control，simply switching the current on and off is sufficient to attain these two positiohs(for assembly type 2:deenergise at V_{gmax}, for assembly type 1:deenergise at V_{gmin}.
if the operating pressure is less than 15MPa，then an auxiliary pressure of 15MPa is required at port G.

DA.转速液控变量

转速液控变量只用于与变量泵A4V.DA合用的传动系统。
装配型：2
变量起点，按先导压力：在V_{gmax}(到V_{gmin})
按工作压力：在V_{gmin}(到V_{gmax})
起点在V_{gmax}(最大扭矩)。
由A4V变量泵确定的先导压力(提高原动机转速=提高变量泵转速=提高先导压力)引到X1或X2口，视行驶方向而定，使马达向减小排量方向转变(扭矩减小，转速增加)。
若工作压力升高到超过变量机构设定的压力值，则马达向增大量排量方向转变(扭矩增大，转速降低)。
先导压力与高压保持定值：Pst/PH=3/100.
先导压力变化0.3MPa(升或降)相应使工作压力升、降10MP。
设计带DA变量的驱动时，必须考虑A4V．DA变量泵的技术数据。

DA.转速液控变量



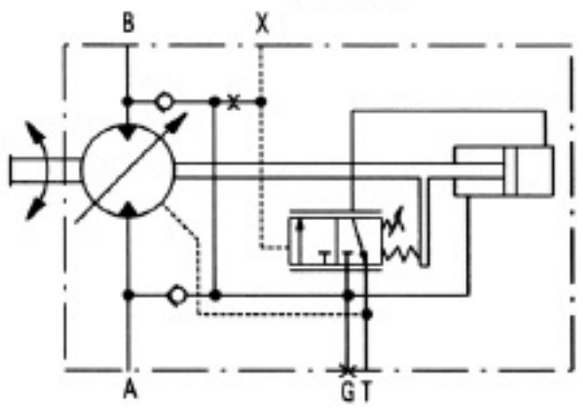
DA Hvdraulic Control.Speed Related.

Speed related hydraulic control is used exclusively for transmission drives in conjunction with variable pump A4V.DA.
Assembly design 2
Start of control，pilot pressure dependent at V_{gmax}(to V_{gmin})，high pressure dependent at V_{gmin}(to V_{gmax}).
Start point at V_{gmax}(max.torque).
The pilot pressure，which is determined by the variable pump A4V (increasing speed of prime mover=increasing speed of variable pump=increasing pilot pressure)is directed to ports X1 or X2 dependent on the direction of travel，and causes a swivelling towards smaller motor capacity(10wer torque，higher speed).
Should the operating pressure rise above the set pressure value at the regulator，the variable motor swivels to a higher capacity(higher torque，lower speed).
Pilot pressure and high pressure remain in a fixed relationship Pst/PH=3/100.
0.3MPa variation pilot pressure(rise or fall)gives a pressure rise or fall of 10MPa in operating pressure.
When designing a drive with a DA control the technical data of the variable pump type A4V.DA must be considered.

MO.扭矩变量

扭矩变量，主要用来驱动绞车，产生恒定的牵引力。
装配型式：第1种装配型式
控制起点在V_{gmin}(最小扭矩、最高转速)
变量机构的设定：
先导压力升高(V_{gmin}-V_{gmax})△p=5MPa，控制起点从8-35MPa，可调(订货时注明)。
通过改变马达的排量可以得到恒定的扭矩，它可根据需要进行改变，使铰车产生恒定的牵引力。如果卷筒上没有拉力，则马达在较低的压力下工作，从而先导压力也较低，马达排量减小，转速增加，铰车加速运转，直至达到铰车的拉力时保持拉力并停止运转。为限制马达的最高转速，在回中马达前面应设有流量阀或尖似元件。
作为扭矩变量本身的先导控制，可采用一个溢流阀调节。X口最大供油量约为5L/min，随先导压力与工作压力差的降低，先导油液流量也减小。

MO.扭矩变量



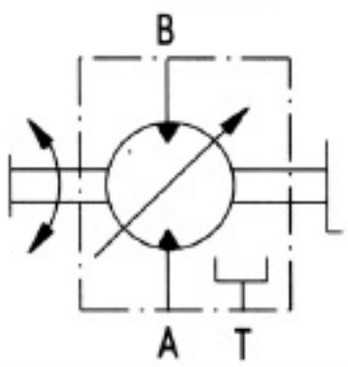
MO.Mooring Control

The mooring control is used mainly for the drive of winches，to generate a constant line pull.
Assembly type 1
Start of control at V_{gmin}(min.torque，max.speed)
Setting of Regulator
Pilot pressure increase(V_{gmin}-V_{gmax})△p=5MPa.
Start of control adjustable from 8 to 35MPa(must be indicated in c1eat text when ordering).
A constant torque，which may be altered according to requirements in order to generate a constant line pull at the winch is achieved by varying the capacity of the variable motor.If there is no pull at the drum，the variable motor requires a lower operating pressure and therefore generates a smarter pilot pressure．The variable motor moves to a min.capacity(V_{gmin})．The higher motor speed thus resulting(warping speed)causes rapid operation of the winch until the mooring pull required of the winch is reached and set.
In order to limit the maximum speed of the variable motor，aflow limiting valve，or other such suitable，must be placed in the circuit before the motor.
As a pilot control for the mooring control itself，a variable pressure relief valve mav be used.The max.oil flow at port X is approx5L/min．The pilot oil flow reduces With lower differential pressure between pilot pressure and operating pressure.

MA手动变量

通过手轮驱动螺杆以调节马达的排量。装配型式：第1种装配型式

MA.手动变量



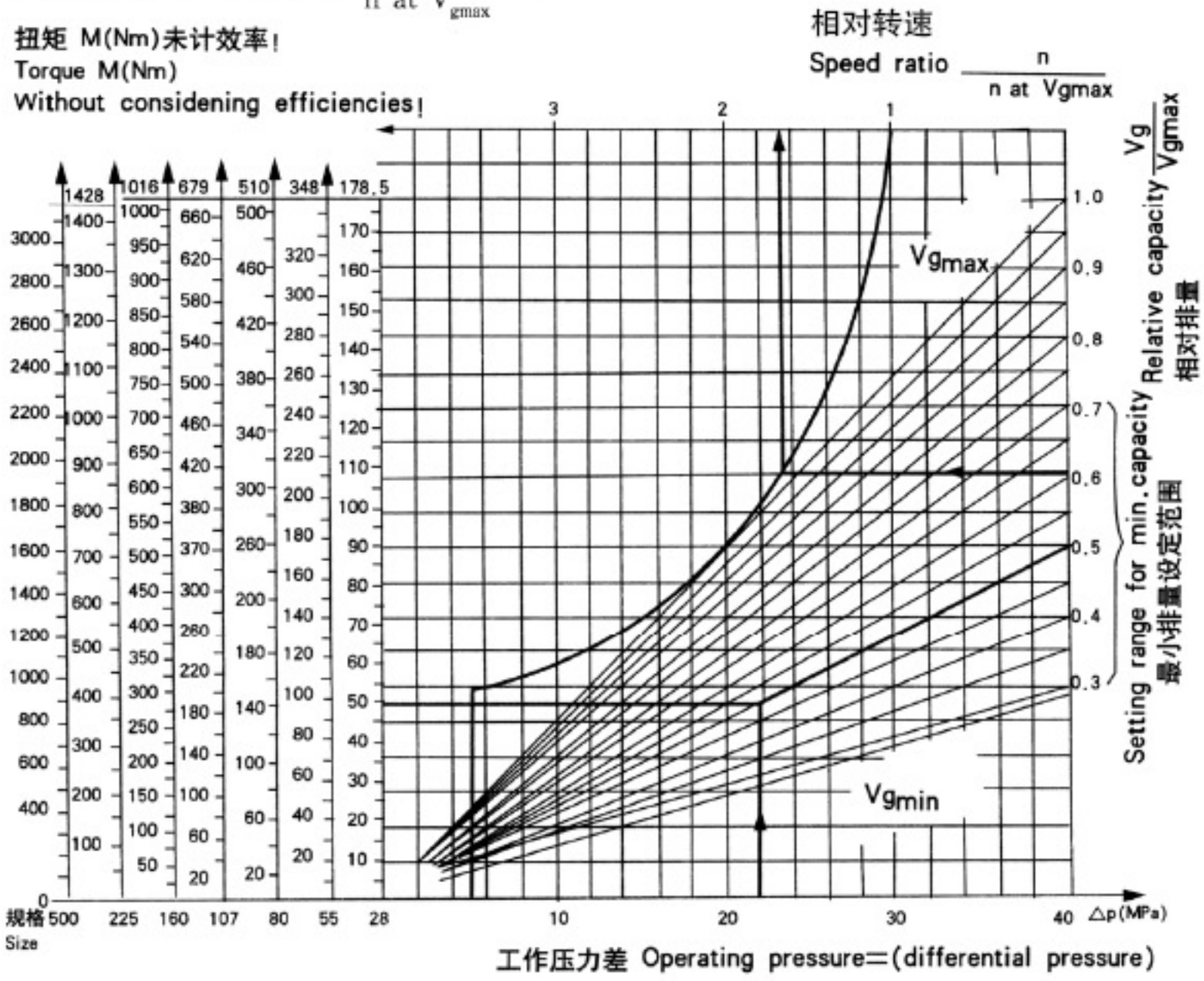
MA,Manual Control

Adjustment of motor capacity dependent on the position of a threaded spindle-hand operation. Assembly design 1

通用特性曲线 General Operating Curve

(P−M) 和 (V_g n / n 在 V_{gmax} 时) 特 性

Characteristic (P−M)and(V_g n / n at V_{gmax})



应用示例 1

规格 55:压差 △P=22MPa

排量 V_g=27.4ml/r

求：输出扭矩 M

解：相对排量

$\frac{V_g}{V_{gmax}}=\frac{27.4}{54.8}=0.5$

在图表即可按 $V_g=0.5V_{gmax}$，△P=22MPa

查出 M=96Nm.

Example 1

Size 55

Differential pressure △P=22MPa

Capacity V_g=27.4ml/r

Required:Output torque M

Solution:Capacity V_g=27.4Ml/r

$\frac{V_g}{V_{gmax}}=\frac{27.54}{54.8}=0.5$

$0.5V_{gmax}$ at 22 MPa gives an output torque M of 96Nm.

应用示例 2

规格 55 排量 V_g=32.9ml/r

求：相对转速

由 $\frac{V_g}{V_{gmax}}=\frac{32.9}{54.8}=0.6$

据此由图表中查出相对转速：

$\frac{n}{n_{max}}=1.666$

即可同样流量下，马达转速是最大排量(V_{gmax})时的 1.666 倍。

Example 2

Size 55

Capacity V_g=32.9ml/r

Required:Speed ratio

Solution:Capacity V_g=32.9ml/r

$\frac{V_g}{V_{gmax}}=\frac{32.9}{54.8}=0.6$

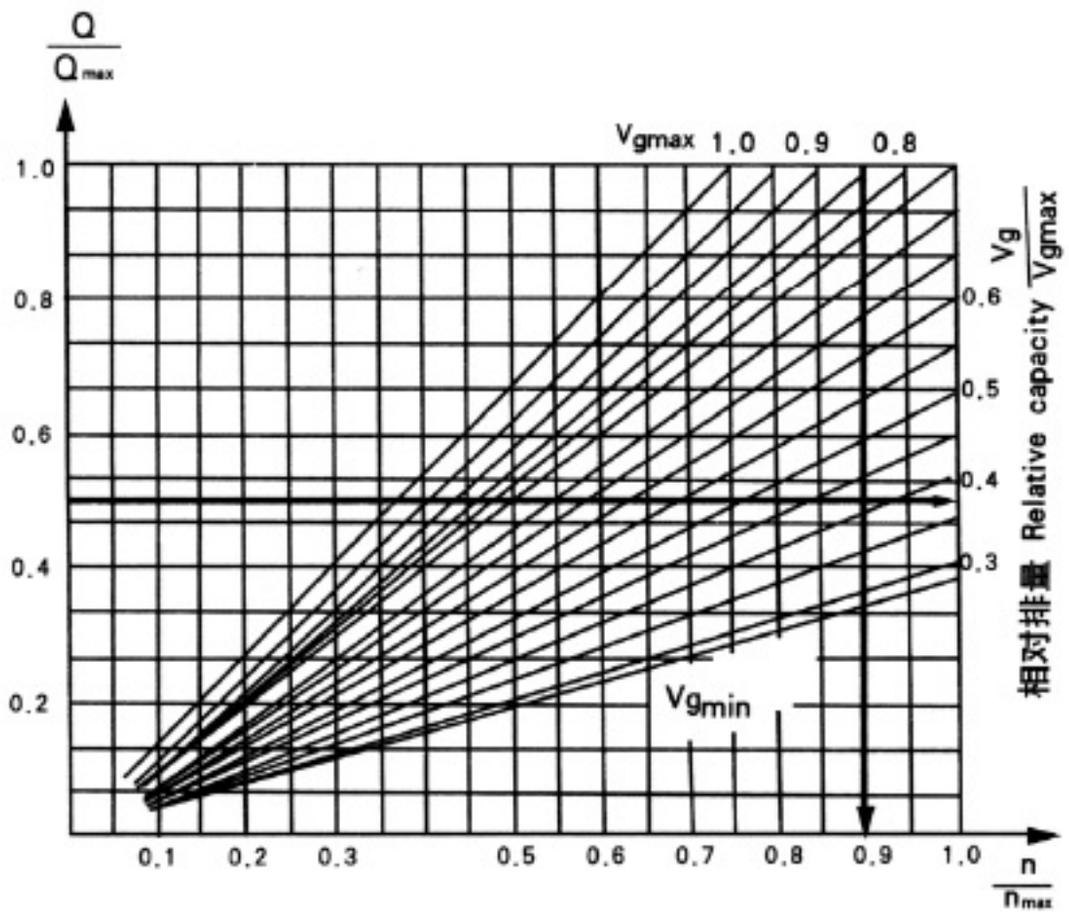
$0.6V_{gmax}$ gives a a speed ratio of

$\frac{n}{n_{max}}=1.666$

I.e.at the same flow, the variable motor speed of rotation at factor of 1.666 times the speed at max capacity(V_{gmax}).

转速与排量的极限值

Limiting values for speed and capacity



应用示例 1

规格 107

流量 Q=160.5L/min

求：不超过马达允许最高转速的最小排量（当 $V_g<V_{gmax}$）

解：规格 107 的允许最大流量是：Q_{max}=321L/min.因此

$\frac{Q}{Q_{max}}=\frac{160.5}{321}=0.5$

由表查出相对排量为：

$\frac{V_g}{V_{gmax}}=0.375$

因此马达最小排量为：

$0.375\times V_{gmax}=0.375\times 107$

$=40.125ml/r$

应用示例 2

规格 107

马达排量 V_g=91ml/r<V_{gmax}

求：允许最高转速 n

解：

相对排量

$\frac{V_g}{V_{gmax}}=\frac{91}{107}=0.85$

据此在图表中查出对应的相对转速：

$\frac{n}{n_{max}}=0.9$

$\therefore n=0.9n_{max}$

$=0.9\times 4000=3600r/min$

Example 1

Size 107

Oil flow Q−160.5L/min

Required: Minimum permissible capacity in order not to exceed the maximum permissible motor speed

(at $V_g<V_{gmax}$)

Solution:Max permissible oil flow for size 107 is 321L/min,therefore

$\frac{Q}{Q_{max}}=\frac{160.5}{321}=0.5$

This gives a capacity of :

$\frac{V_g}{V_{gmax}}=0.375$

The minimum motor capacity is therefore

$0.375\times V_{gmax}=0.375\times 107=40.125ml/r$

Example 2

Size 107

Motor capacity V_g= 91ml/r<V_{gmax}

Required:

Maximum permissible speed n

Solution:Motor capacity

V_g=91ml $\therefore \frac{V_g}{V_{gmax}}=\frac{91}{107}=0.85$

The motor capacity $0.85V_{gmax}$ gives

$\frac{n}{n_{max}}=0.9$

$n=0.9\times n_{max}=0.9\times 4000$

$=3600r/min$

HD 特性曲线 Control curve

(P–M)和 $(V_g - \frac{n}{n\text{ 在 }V_{max}\text{ 时}})$ 特性

Characteristic (P–M) and $(V_g - \frac{n}{n \text{ at } V_{max}})$

扭矩 Torque M(Nm)

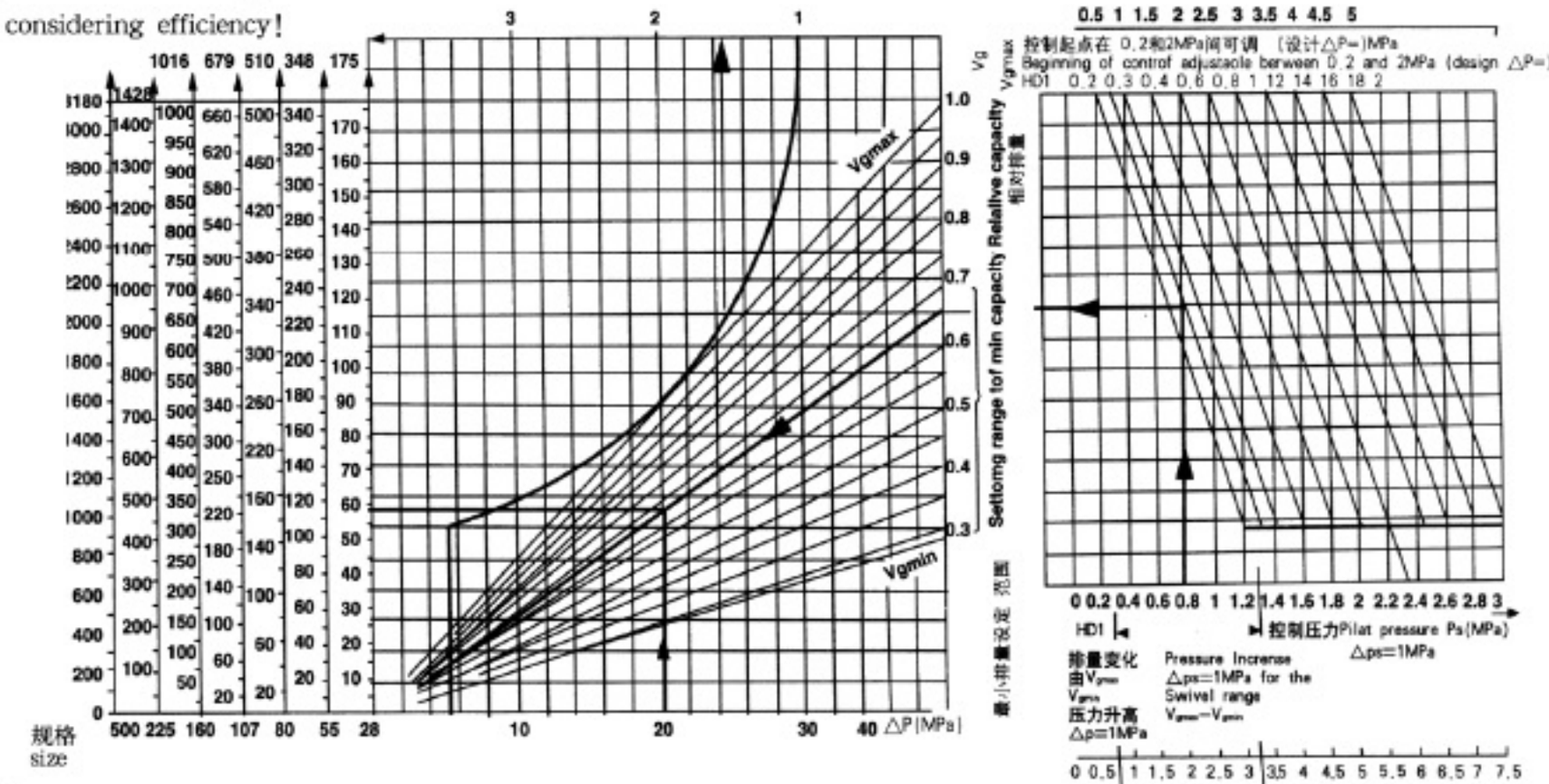
未计效率! Without considering efficiency!

相对转速

Speed ratio $\frac{n}{n \text{ at } V_{max}}$

控制起点在 0.5 和 5MPa 间可调（设计△Ps=2.5MPa）

Beginning of control adjustable between 0.5 and 5MPa (design △Ps=2.5MPa)



应用示例：
规格 55：HDI；$\triangle P_s$=1MPa
当 P_s=0.8MPa 及 △P=20MPa 时
求：输出扭矩和相对转速
解：
Ps=0.8MFa 对应的 $\frac{V_x}{V_{gmax}}$ =0.65
和 $\frac{n}{n\text{ 在 }V_{gmax}}$ =1.54
V_g=0.65 × V_{gmax}=0.65 × 54.8
=35.6ml/r
在△P=20MPa 时的扭矩
M=114Nm.

Example
size 55.HDI
Start of control at pilot pressure increase
$\triangle P_s$=1MPa
available pilot pressure main pressure
P_s=0.8MPa and △P=20MPa
Required: Output torque and speed ratio

Solution: At a Pilot pressure of 0.8 MPa
a capacity ratio $\frac{V_x}{V_{gmax}}$ =0.65
and speed ratio $\frac{n}{n \text{ at } V_{gmax}}$ =1.54
$\frac{V_g}{V_{gmax}}$ =0.65 sives a capacity of
0.65V_{gmax}=0.65 × 54.8=35.6ml/r
At a main pressure (differential pressure) of △P=20MPa the output torque will be approximatei approxi 114Nm

EP 特性曲线 Control Curve

(P–M)和$(V_g - \frac{n}{n\text{ 在 }V_{gmax}\text{ 时}})$ 特性

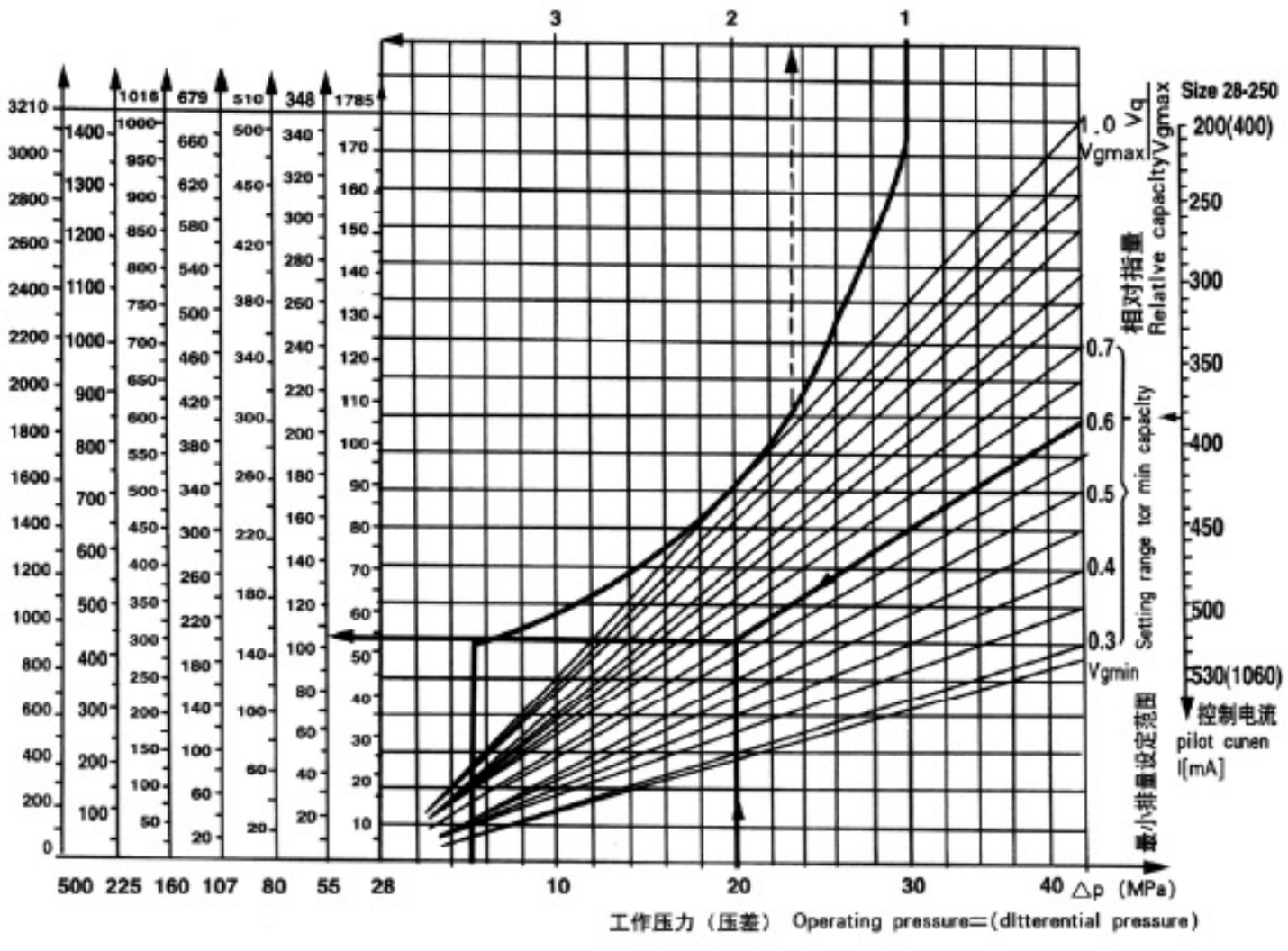
Characteristic (P–M) and $(V_g - \frac{n}{n \text{ at } V_{gmax}})$

扭矩 Torque M(Nm)

未计效率! Without considering efficiency!

相对转速

Speed ratio $\frac{n}{n \text{ at } V_{max}}$



应用示例：
规格 55：控制电流 385mA(24V)
工作压力△P=20MPa
求：输出扭矩和相对转速
解：查表得 385mA 时的相对排量
$\frac{V_g}{V_{gmax}}$ =0.6
其对应的转速比
$\frac{n}{n\text{ 在 }V_{gmax}\text{ 时}}$ = 1.666
即在相同的流量下，马达转速是最大排量 V_{gmax} 时的 1.666 倍。
由表中可以查出相对排量
$\frac{V_q}{V_{gmax}}$ =0.6
则 V_g=0.6V_{gmax}
=0.6 × 54.8
=32.9ml/r
在△P=20MPa 时的输出扭矩
M=105Nm

Example:
Size 55
Pilot current 385 mA(24V)
Operating pressure △P=20MPa
Required: Output torque and speed ration
Solution: At a pilot current of 385 mA.
a capacity ratio $\frac{V_q}{V_{gmax}}$ =0.6 and a speed ratio of
$\frac{n}{n \text{ at } V_{gmax}}$ =1.666
is obtainedi.e. for same oil flow the variable motor rotates at a factor of 1.666 faster than at max capacity V_{gmax}. The capacity
ratio $\frac{V_q}{V_{gmax}}$ =0.6
gives a capacity of 0.6V_{gmax}=0.6 × 54.8=32.9ml/r. At an operating pressure of △P=20MPa the output torque is approx 105Nm.

HA 特性曲线 Control Curve

(P–M) 和 (V_g – $\frac{n}{n\ 在V_{gmax}时}$)特性

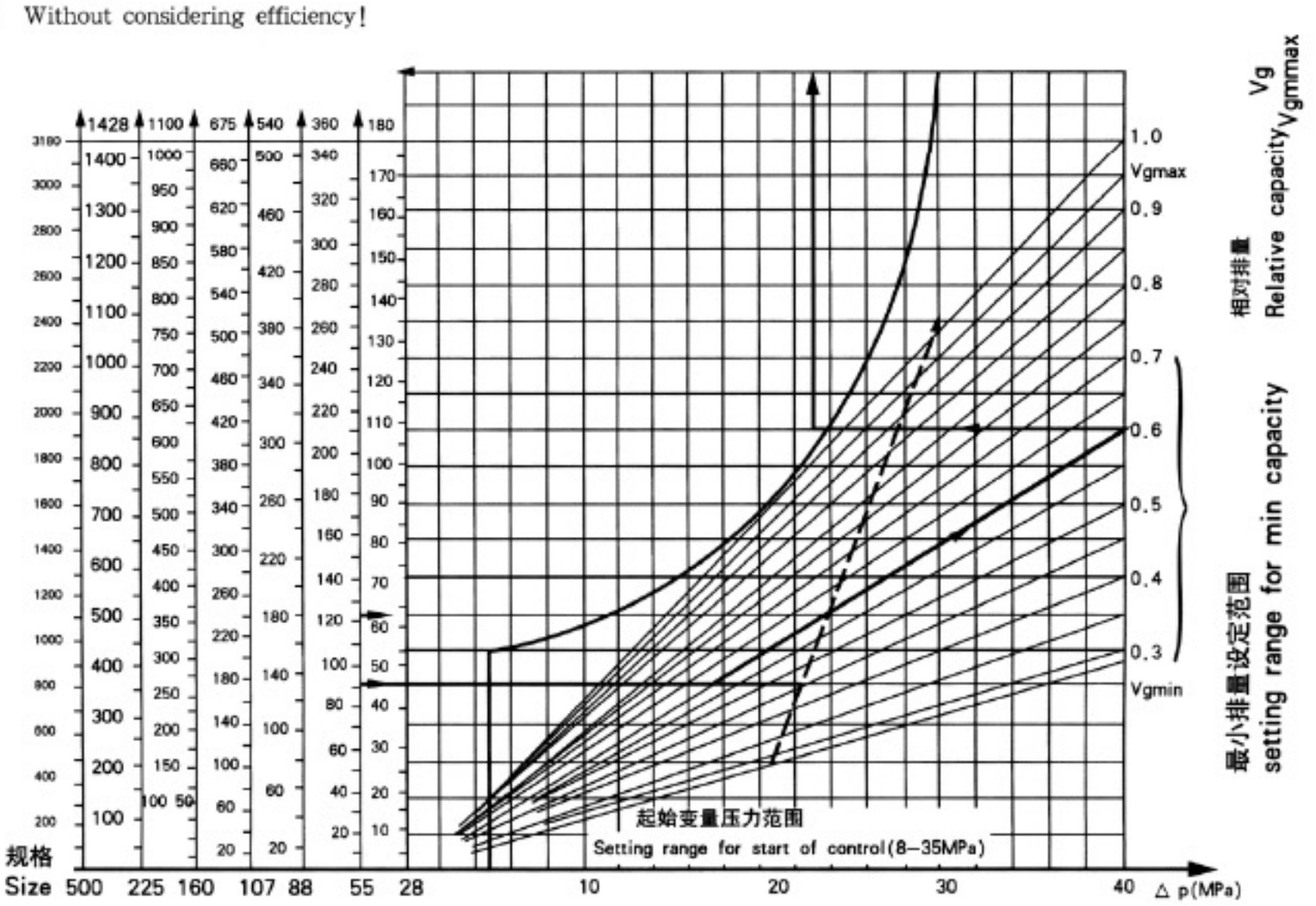
Characteristic (P–M) and (V_g – $\frac{n}{n\ at\ V_{gmax}}$)

相对转速

Speed ratio $\frac{n}{n\ at\ V_{max}}$

扭矩 Torque M(Nm)

未计效率! Without considering efficiency!



工作压力（压差）Operating pressure=(differential pressure)

应用示例 1

规格 55:HA1

变量起点压力设定为 17MPa 从 V_{gmin} 到 V_{gmax} 压力恒定，输出扭矩 M=90Nm，

求：马达排量和相对转速。

解：

对于 M=90Nm 和△P=17MPa 由图表 查出相对排量为

$\frac{V_m}{V_{gmax}}=0.6$

和相对转速 $\frac{n}{n\ 在V_{gmax}时}=1.666.$

即在相同流量下马达的转速是在最大排量时约 1.666 倍。

这时的排量

$V_g=0.6\times V_{gmax}=0.6\times 54.89$

$=32.9ml/r$

应用示例 2

规格 55:HA2

变量起点压力设定为 20MPa 从 V_{gmin} 到 V_{gmax} 压力升高 10MPa;输出扭矩 M=122Nm;

求：马达排量工作压力和相对转速。

解：对 HA 的变量马达按下述步骤求解

先找出起始变量压力 20MPa 时与 V_{gmin} 线的交点和变量终点压力 20MPa 时与 V_{gmin} 线的交点和变量终点压力 20 + 10 = 30MPa 与 V_{gmin} 线的交点，该两点的连线即为该马达的变量特性曲线。

当 M=122Nm 时对应于该点的工作压力△P=23.5MPa;相对排量为：

$\frac{V_g}{V_{gmax}}=0.6$

相对转速为 $\frac{n}{n\ 在V_{gmax}时}=1.666$

排量 $V_g=0.6\times V_{gmax}$

$=0.6\times 54.89$

$=32.9ml/r$

Example 1

Size 55;HA 1

Start control set at 17MPa

Model without pressure increase from V_{gmin} to V_{gmax}.

Output torque M=90Nm

Required:Motor capacity and speed ratio

Solution:For a required output torque of 90 Nm and an operating pressure △P=17MPa a capacity ratio

$\frac{V_g}{V_{gmax}}=0.6$ and a speed ratio

$\frac{n}{n\ at\ V_{gmax}}=1.666$,is obtained i.e.

at the same oil flow,the variable motor rotates at a factor of 1.666 faster than at max capacity V_{gmax}.

The capacity ratio

$V_g=0.6\times V_{gmax}=0.6\times 54.89$

$=32.9ml/r$

Example 2

Size 55;HA2

Start of control set at 20MPa Model with pressure increase from V_{gmin} to V_{gmax} 10MPa.Required output torque M=122Nm.

Required:Motor capacity operating pressure and speed ratio.

Solution:For variable motor HA2 with pressure increase,other characteristics apply.

These are obtained as follows.

The intersection point between line V_{gmin} and the pressure line for the end of control (e.g.start of control 20 MPa pressure increase 10MPa=end of control 30 MPa) is taken.

These two points are joined by a straight line.This is the correct characteristic line .For the required output torque of 122 Nm in the example, an operating pressure of approx 23.5 MPa 3.5MPa pressure increase) and a capacity ratio of

$\frac{V_g}{V_{gmax}}=0.6$

is obtained together with a speed ratio

$\frac{n}{n\ at\ V_{gmax}}=1.666.$

The capacity ratio

$V_g=0.6\times V_{gmax}$

$=0.6\times 54.89$

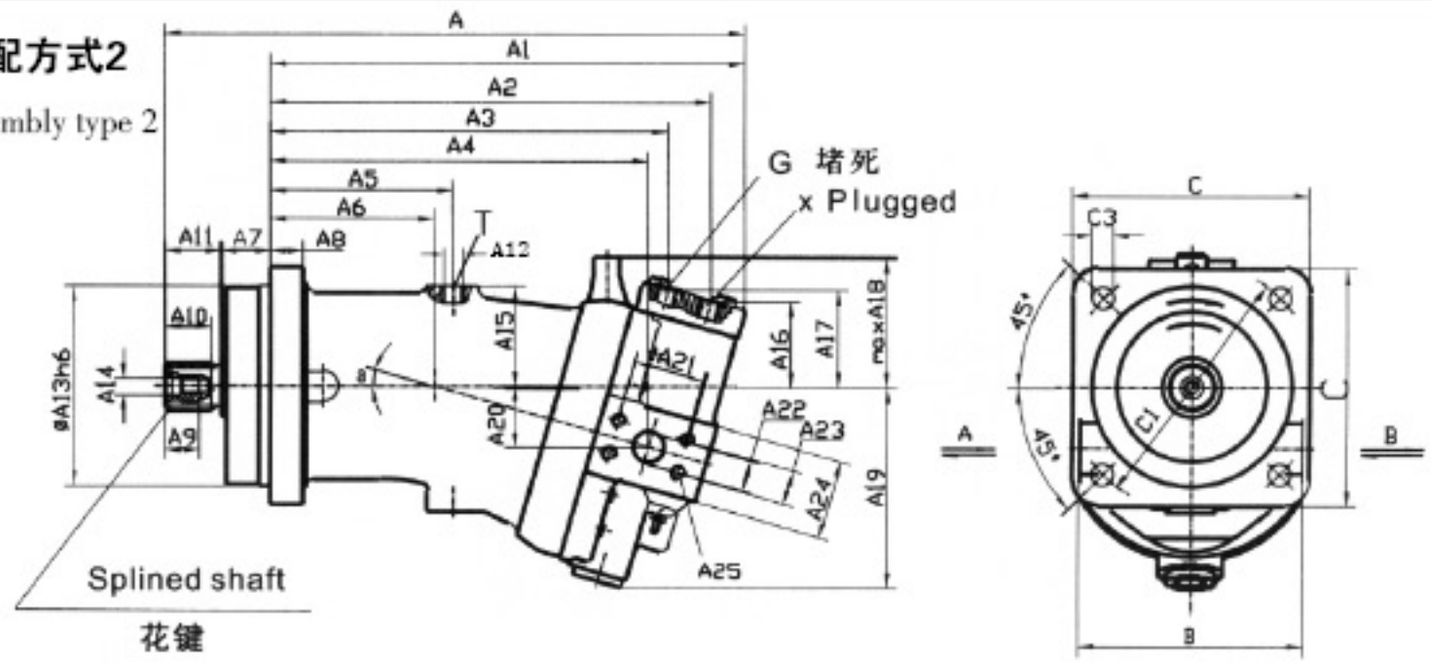
$=32.9ml/r$

外形尺寸 Unit Dimensions 装配方式2

规格 Size 28–225

Assembly type 2

HD、HS变量 Control

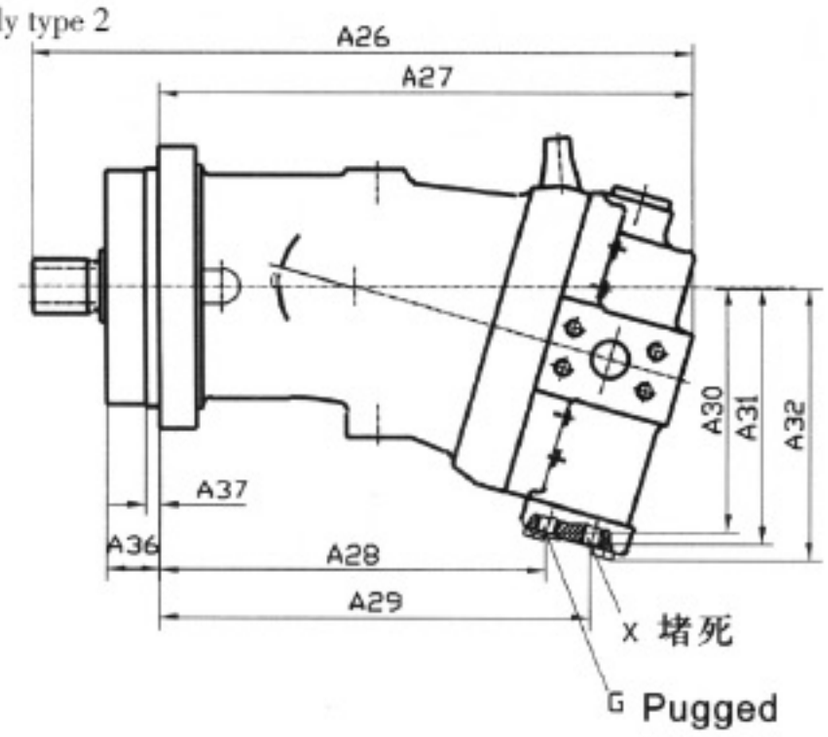




规格 Size 28–225

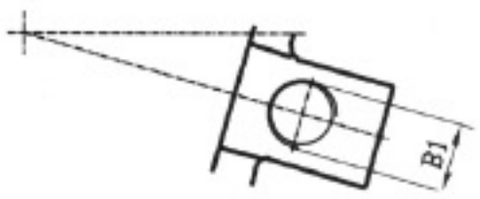
装配方式2 Assembly type 2

HD、HS变量 Control



SAE 法兰连接（压力油口） SAE pressure port

螺纹连接（压力油口） Threaded pressure port



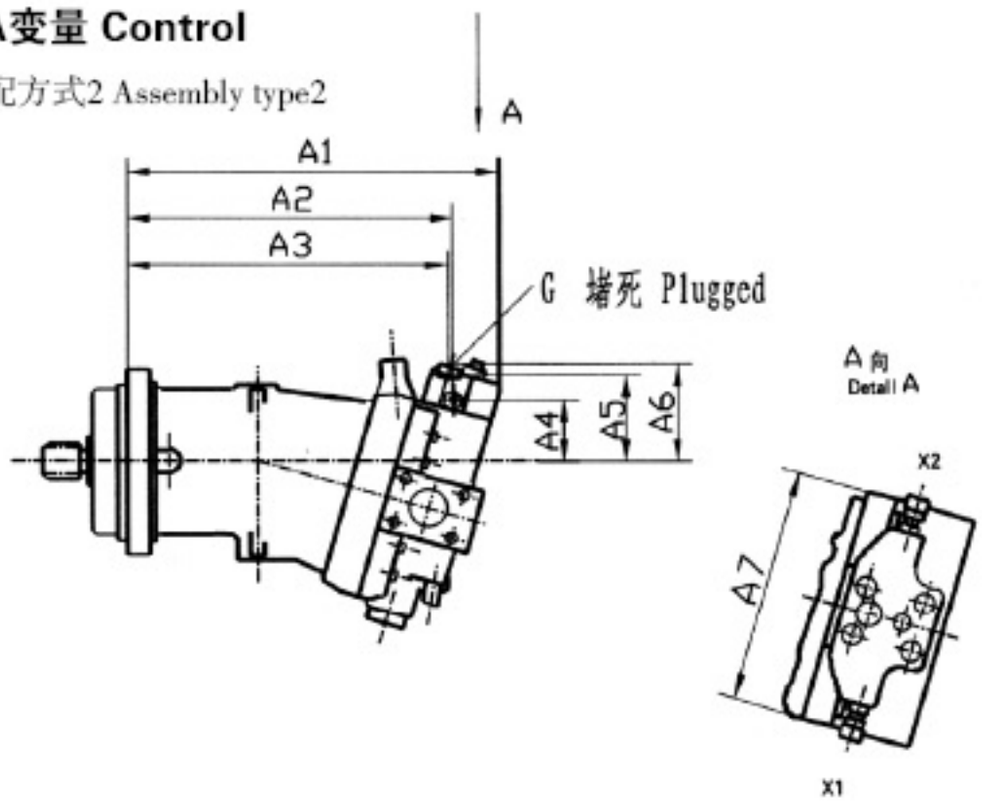
A,B,工作油口	service port
G 多元件同步控制和遥控压力油口	port for synchronous control of multiple units and for remote control pressure.
X 先导（外控）油口	pilot pressure
T 壳体 · 油口	case drain

规格 Size	A	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}	A_{16}	A_{17}	A_{18}	A_{19}	A_{20}	A_{21}	A_{22}	A_{23}	A_{24}	A_{25}	深 deep	A_{26}	A_{27}	A_{28}
28	317	249	230	206	189	107	75	25	16	19	28	43	M16 × 1.5	100	M8	50	57	64	81	110	33	50.8	20	23.8	45	M10	17	298	230	152
55	379	312	291	264	249	123	108	32	20	28	28	35	M18 × 1.5	125	M12	63	52	60	84	132	40	50.8	20	23.8	53	M10	17	368	301	208
80	440	368	345	316	297	152	137	32	23	28	33	40	M18 × 1.5	140	M12	71	59	68	99	150	46	57.2	25	27.8	64	M12	18	425	353	252
107	463	378	356	326	301	145	130	40	25	28	37.5	45	M18 × 1.5	160	M12	80	63	71	104	162	49	57.2	25	27.8	64	M12	18	442	357	259
160	530	440	412	377	354	213	156	40	28	36	42.5	50	M22 × 1.5	180	M16	88	66	77	108	182	57	66.7	32	31.8	70	M14	19	513	423	302.5
225	573	468	441	405	375	222	162	50	32	36	43.5	55	M22 × 1.5	200	M16	96	74	85	121	199	61	66.7	32	31.8	70	M14	21	546	441	324

规格 Size	A_{29}	A_{30}	A_{31}	A_{32}	A_{33}	A_{34}	A_{35}	A_{36}	A_{37}	B	B_1	C	C_1	C_2	C_3	平键 keyed GB1096–79	花键 splined DIN 5480	花键 splined GB3478.1–83	G	X
28	176	124	131	139	27.9	25	50	23	8	116	M27 × 2	118	125	12	11	键 8 × 50	W25 × 1.25 × 18 × 9g	EXT18Z × 1.25M × 30P × 5h	M12 × 1.5	M14 × 1.5
55	235	133	141	153	32.9	30	60	29	10	142	M33 × 2	150	160	16	13.5	键 8 × 50	W30 × 2 × 14 × 9g	EXT14Z × 2m × 30P × 5h	M14 × 1.5	M14 × 1.5
80	282	152	161	177	38	35	70	29.5	10	172	M42 × 2	165	180	16	13.5	键 10 × 56	W35 × 2 × 16 × 9g	EXT16Z × 2m × 30P × 5h	M14 × 1.5	M14 × 1.5
107	288	164	173	188	43.1	40	80	35	10	178	M42 × 2	190	200	20	17.5	键 12 × 63	W40 × 2 × 18 × 9g	EXT18Z × 2m × 30P × 5h	M14 × 1.5	M14 × 1.5
160	338	182.5	193	201	48.5	45	90	36.5	11.5	208	M48 × 2	210	224	20	17.5	键 14 × 70	W45 × 2 × 21 × 9g	EXT21Z × 2m × 30P × 5h	M14 × 1.5	M14 × 1.5
225	359	201	211	219	53.5	50	100	50	12	226	M48 × 2	236	250	25	22	键 14 × 80	W50 × 2 × 24 × 9g	EXT24Z × 2m × 30P × 5h	M14 × 1.5	M14 × 1.5

DA变量 Control

装配方式2 Assembly type2



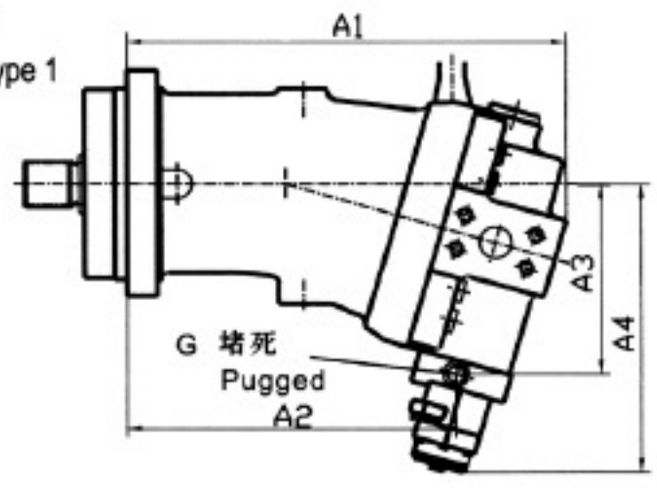
规格 Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	X_1、X_2
28	253	212	209	53	73	81	144	M14 × 1.5
55	317	272	268	49	70	77	146	M14 × 1.5
80	371	326	322	56	77	83	152	M14 × 1.5
107	380	336	332	59	81	88	152	M14 × 1.5
160	442	387	383	65	86	94	158	M14 × 1.5
225	471	416	411	73	95	103	158	M14 × 1.5

其余尺寸见 HD/HA.

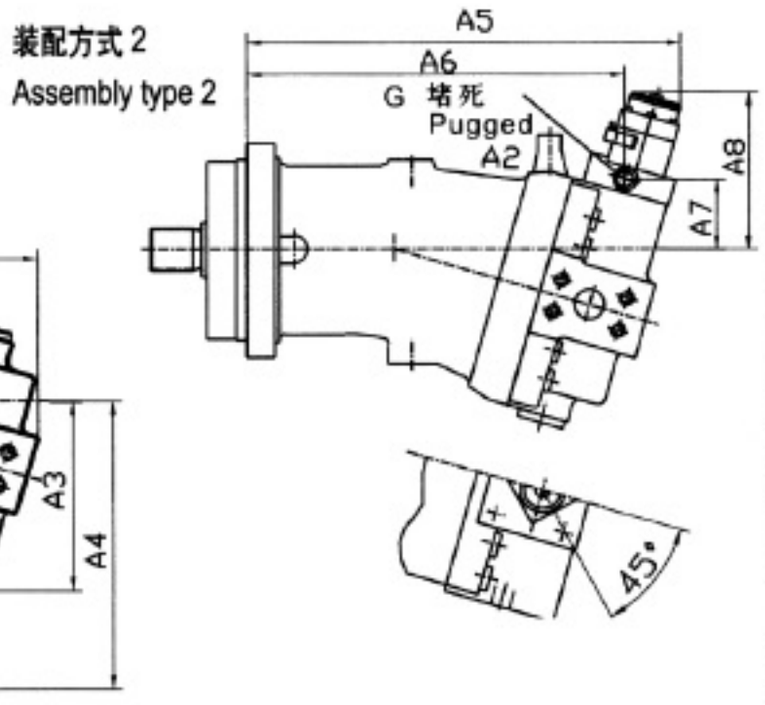
Other dimensions see HD/HA.

EP 变量 Control

装配方式 1
Assembly type 1



装配方式 2
Assembly type 2



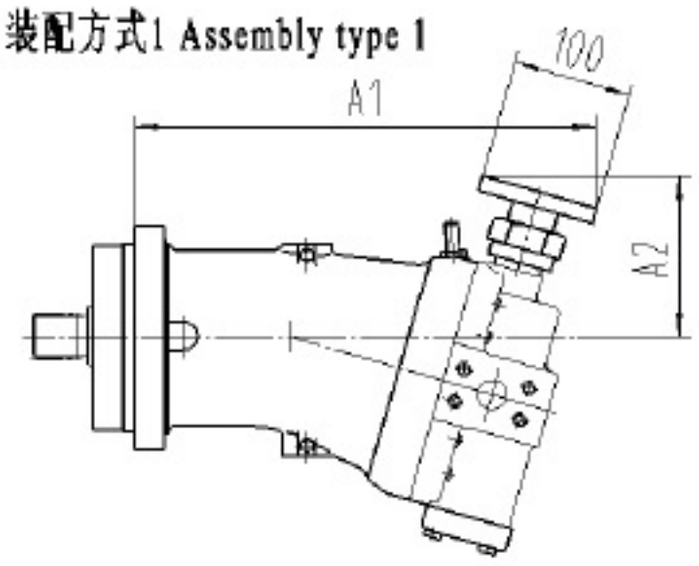
规格 Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8
28	230	164	119	204	266	212	53	131
55	301	223	129	213	334	274	48	124
80	353	267	148	240	392	326	56	137
107	357	269.5	160	254	393	333	61.5	144
160	423	313	177	265	452	386	70	139
225	441	334	196	284	481	414	74.5	147

其余尺寸见 HD/HA.

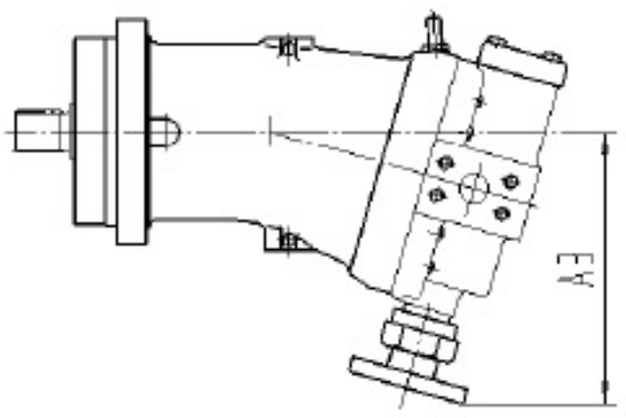
Other dimensions see HD/HA

MA 变量 Control

装配方式1 Assembly type 1



装配方式2 Assembly type 2

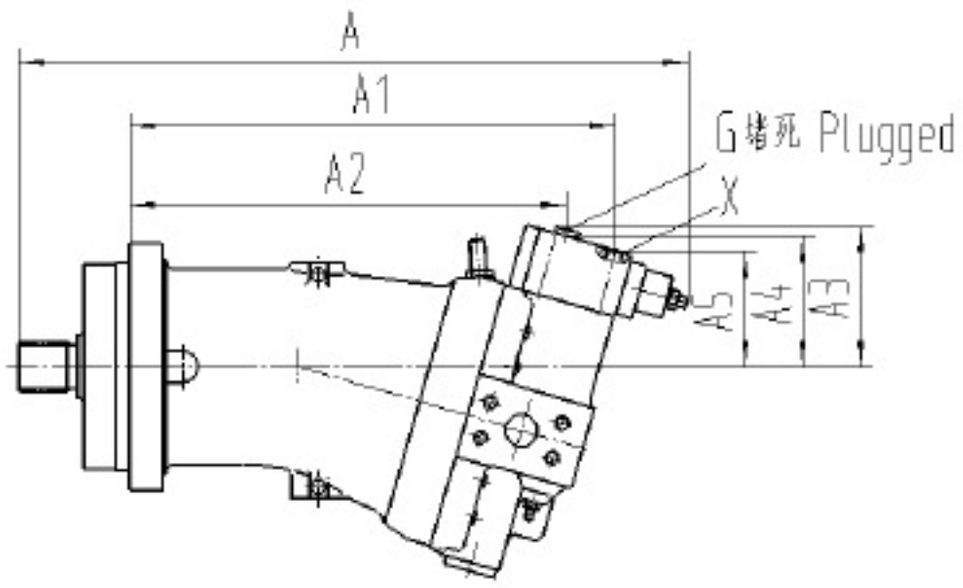


规格 Size	A1	A2	A3
28	269	128	188
55	329	134	208
80	381	138	223
107	390	137	230
160	441	149	254
225	470	155	272

其余尺寸见HD/HA

Other dimensions see HD/HA

HD1D 变量 Control



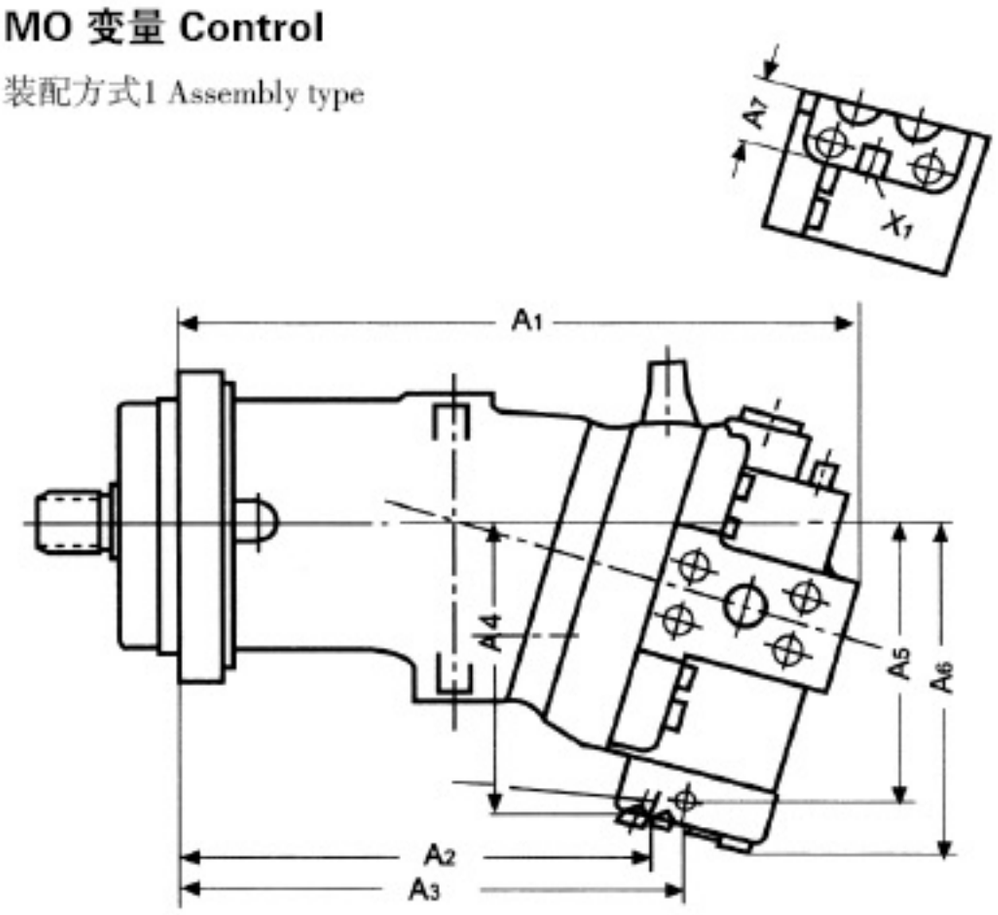
规格 Size	A	A1	A2	A3	A4	A5	X
80	491	363	325	105	97	85	G1/4
107	514	373	336	108	100	88	G1/4
160	576	421	386	118	109	98	G1/4

其余尺寸见HD/HA

Other dimensions see HD/HA

MO 变量 Control

装配方式1 Assembly type



规格 Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	X_1
55	301	208	224	138	130	155	30	M14 × 1.5
80	353	252	268	157	149	177	33	M14 × 1.5
107	357	257	273	169	161	188	33	M14 × 1.5
160	423	300	312	187	178	206	34	M14 × 1.5
225	441	322	334	206	197	225	34	M14 × 1.5

其余尺寸见 HD/HA.

Other dimensions see HD/HA.

外形尺寸 Unit Dim dimensions

规格 Size 500

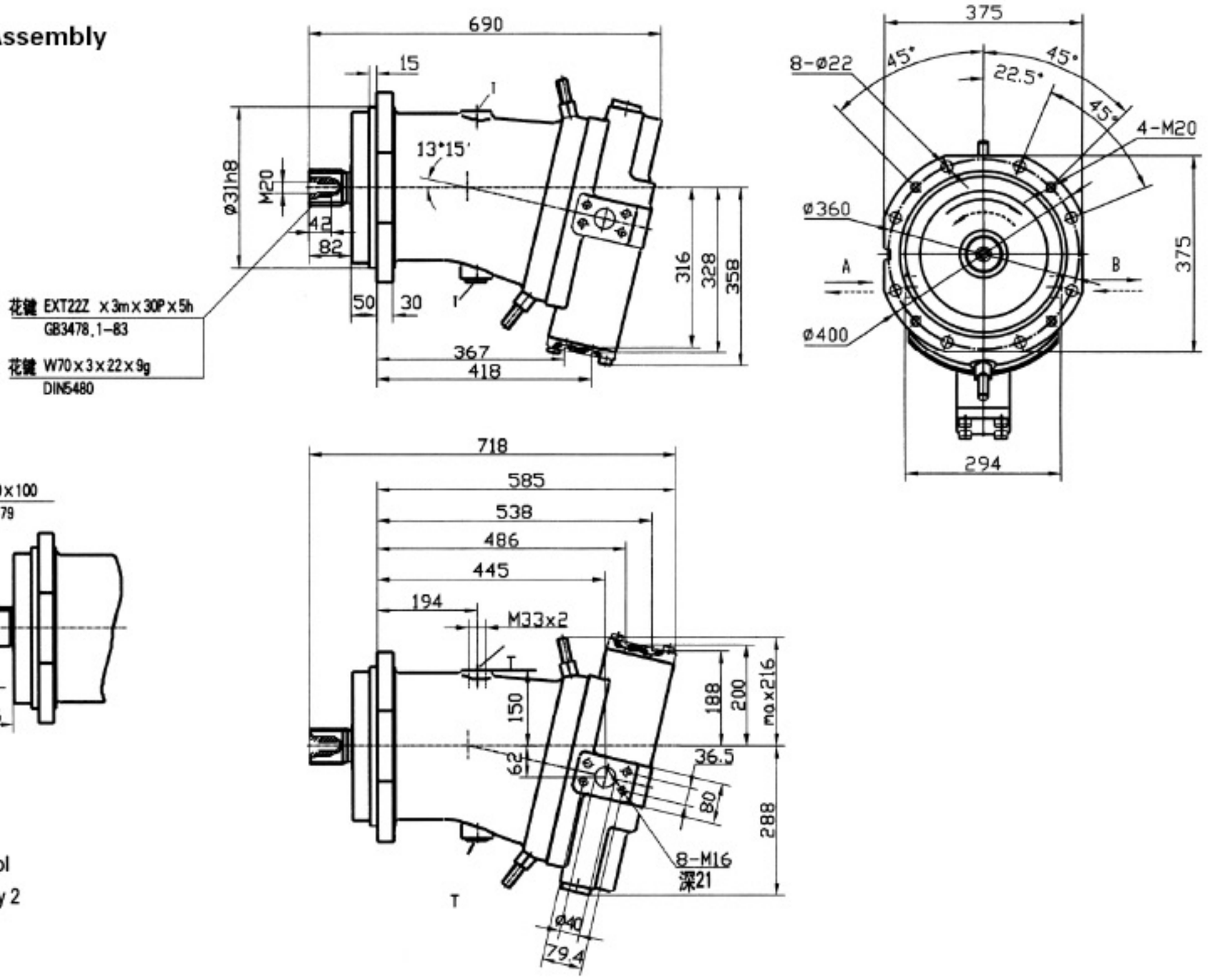
HA 变量 Control

花键 Splined

W70 × 3 × 22 × 9g

(DIN 5480)

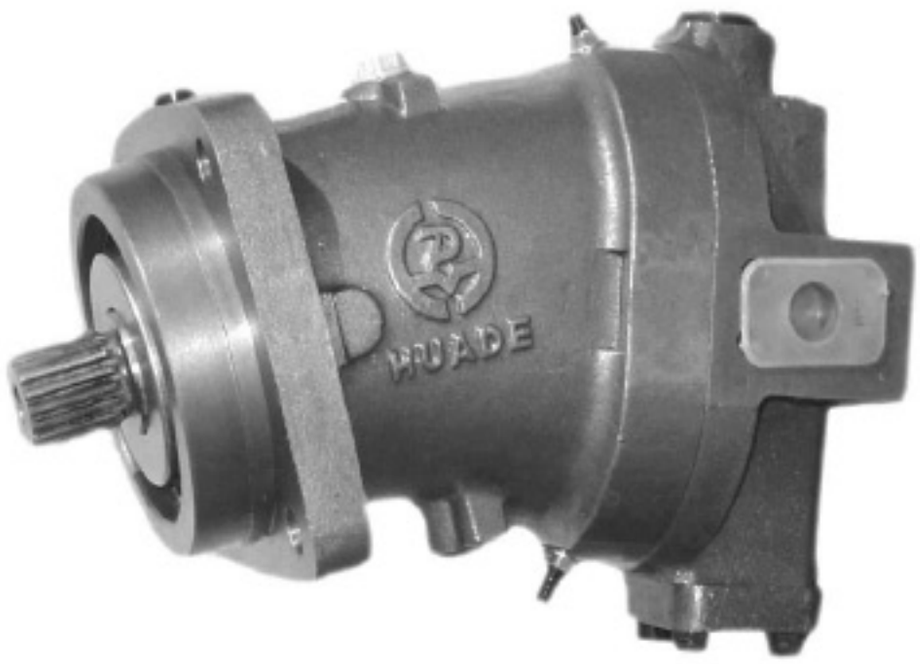
装配方式1 Assembly



HD 变量 Control

装配方式 2 Assembly 2

北京华德液压工业集团有限责任公司 BEIJING HUADE HYDRAULIC INDUSTRIAL GROUP CO. ,LTD.	A6VG 变量马达 Variable Displacement Motor A6VG 用于开式和闭式回路 斜轴式轴向柱塞结构 For open and closed circuits axial tapered piston,bent axis design	RC91010/12.2004
	规格 Size 107-125 高压范围 Peak pressure 至 up to 40MPa	替代： Replace



说明：

弯轴结构的轴向柱塞变量马达，可用于开式和闭式液压传动回路。
这种马达适合于行走机械及工业中应用。
控制范围宽的变量马达能满足高转速和大扭矩的要求。
流量在V_{gmax}/V_{gmin}=4.85范围内无级可调，最大排量达125mlr。
输出转速与流量成正比而与排量成反比。输出扭矩随马达上高低压侧压
降的加大而增大，并随排量的增大而加大。

特点：

——用于液压驱动的宽控制范围
——多种多样的控制及调节装置
——由于省去齿轮箱并可用较小的泵而节省费用
——紧凑的、牢固的长寿命轴承系统
——与原型产品相比，轴向尺寸缩短了
——最大、最小摆角均为可调式设计
——单位功率小
——良好的启动特性
——惯量小

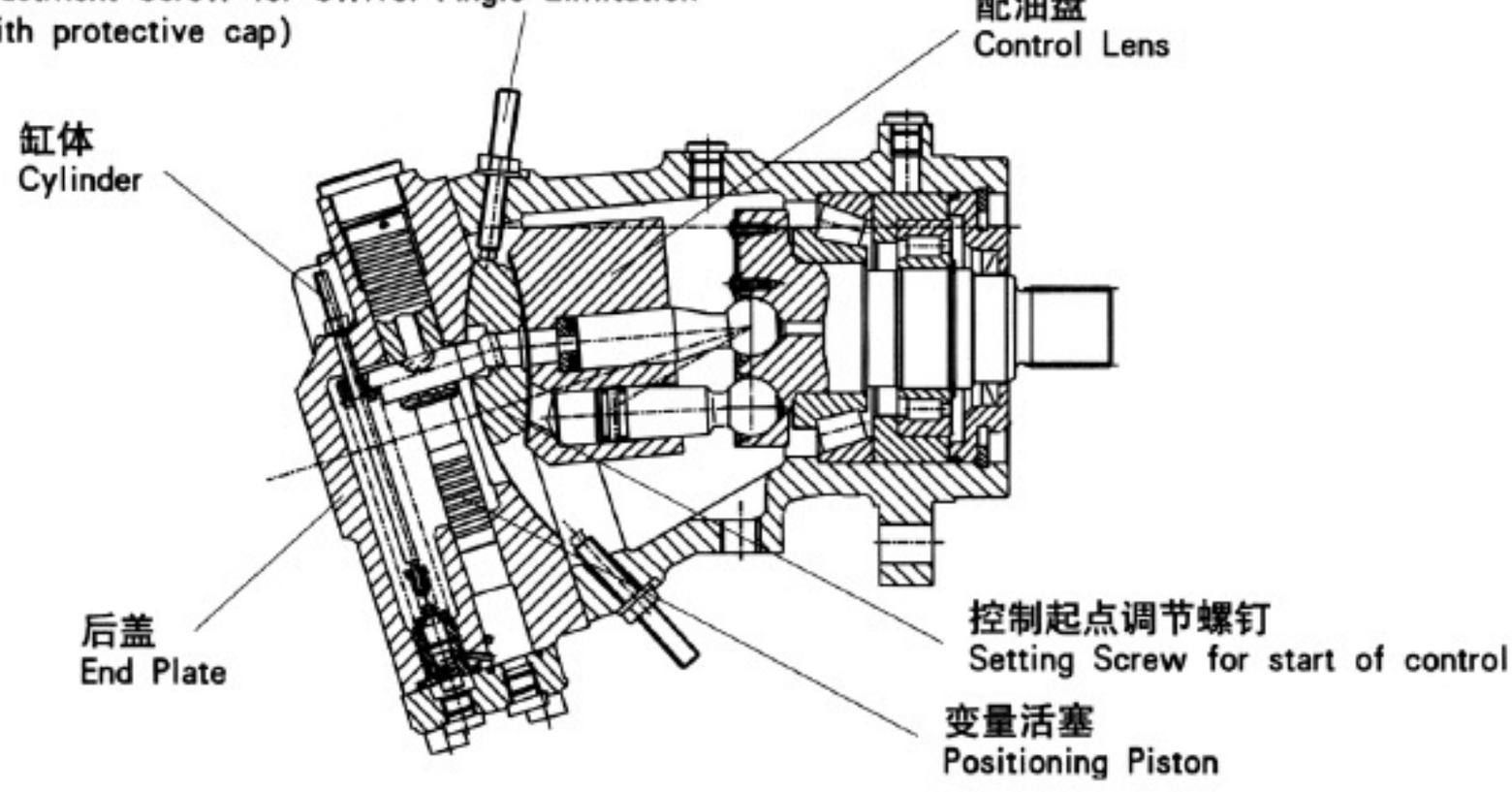
Description

Variable displacement motor with axial piston rotary group of bent axis design，for hydrostatic drives in open and closed circuits.
The motor is suitable for both mobile and industrial applications.
The wide control range of the variable displacement motor allows is to meet the requirements of high speed and high torque.
The flow is infinitely variable in the range V_{gmax}/V_{gmin}=4.85，the max. displacement is 125ml/r.
Output speed is proportional to floW and inversely proportional to displacement. The output torque increases with the pressure drop between the high and low pressure sides and with increasing displacement.

Special Features:

Wide control range for hydrostatic drives
Various control and regulating devices
Cost saving through elimination of gearbox and possibility of using smaller motors
Compact，robust bearing system with long service life
20% Comparing with antetype product，the measure of axes' direction has shortened 20%
The max. and the min. displacement are variable design
Low unit power
Good starting characteristics
Low inertia

剖视图：



A6VG 变量马达 Variable Displacement Motor

型号 Type Code

A6V	G	107	HA1	6	F	Z	2	21.8

马达型号 Motor Type

变量马达 Variable displacement motor — A6V

改进型 Ameliorate — G

规格 Size

21.8−107ml/r	107
21.8−125ml/r	125

变量方式 Control Device

高压自动变量 Automatic control, high pressure related	恒压	Constant pressure	
	不带超调	Without override	HA1
	带超调	With override	HA1H
	升压	Pressure increase △p=10MPa	
	不带超调	Without override	HA2
	带超调	With override	HA2H
液控变量 Hydraulic control, high pressure related	控制压差	△p=1MPa Pilot pressure Increase	HD1
	控制压差	△p=2.5MPa Pilot pressure Increase	HD2
	控制压差	△p=1MPa Pilot pressure Increase	HD1D
手动变量		Manual control (with handwheel)	MA

最小排量设定值

Min.Swept Volume Setting

例： Example：

V_{gmin}=21.8ml/r — 21.8

装配型式 Assembly Type

解释见变量说明及元件尺寸 For explanation see description of control device and unit dimensions

轴伸 Shaft End

平键 GB 1096−79	Keyed parallel shaft	P
花键 DIN 5480	Splined shaft	Z
花键 GB 3478.1−83	Splined shaft	S

油口连接 Pipe Connections

SAE法兰，侧面	SAE flange,on side	F
螺纹连接，侧面	Metric threads,on side	G

结构型式 Series

结构6，规格107 Series 1,sizes 107

订货示例：A6VG.107HA1.6.F.Z.2.21.8

斜轴变量马达A6VG，规格107，液控变量，△p=1MPa，结构2,侧面SAE法兰连接,德标花键，第2种装配型式，最小排量 V_{gmin}=21.8ml/r

Ordering Example A6VG.107HA1.6.F.Z.2.21.8

Axial piston variable displacement motor A6VG, size 107,with hydraulic control, pilot pressure related,△p=1MPa, series 2,SAE flange connections on side, splined shaft, assembly type 2,min.swept volume setting V_{gmin}=21.8ml/r

技术参数 Technical Data

工作压力范围： Operating Pressure Range

A或B口压力：Pressure at port A or B

额定压力 Nominal pressure P_n=31.5MPa

最高压力 Peak pressure P_{max}=40MPa

A、B油口压力总和不得超过63MPa，每侧油口压力最高40MPa。

The sum of the pressures at ports A and B should not exceed 63MPa. (Individual pressure at either port max.40MPa)

泄油压力：Leakage oil Pressure：

允许T口最大泄油压力

Maximum permissible leakage oil pressure (at Port T)

P_{abs} 0.2MPa

油温范围： Fluid Temperature Range

t_{min} −25℃

t_{max} +80℃

粘度范围： Viscosity Range：

u_{min} 10mm²/s

u_{max} (短时)(for short periods)1000mm²/s

最佳工作粘度： Optimum Operating Viscosity：

V_{opt} 16−36mm²/s

油液选择： Fluid Recommendation

工作温度 Operating temperature range	推荐粘度等级符合DIN51519 Recommended Viscosity grade to DIN51519 ISO(VG)	
30−40℃	VG22=22mm²/s	at40℃
40−50℃	VG32=32mm²/s	at40℃
50−60℃	VG46=46mm²/s	at40℃
60−70℃	VG68=68mm²/s	at40℃
70−80℃	VG100=100mm²/s	at40℃

液压油的过滤：

推荐过滤精度为10μm。亦可使用25−40μm的，但使用10μm的可以延长使用寿命(降低磨损)。

Filtration of Hydraulic Fluid

Recommended filtration 10μm. Coarser filtration of 25 to 40μm is possible, however longer service life is achieved with filtration of 10μm. (reduced wear).

转速范围：

最低转速没有限制，在要求十分均匀的转速时，n_{min}不小于50r/min最高转速由来自泵的最大流量和变量马达的最小排量确定。最小排量则由一个调节螺钉限位，所以变量马达不会超速运转。

最高允许转速见技术参数表。

Speed Range

No limitation on minimum speed n_{min}. Where very even speeds are required. n_{min} should not be less than 50r/min.

The maximum flow from the pump and the minimum swept volume of the variable motor together determine the maximum output speed. The min swept volume is limited mechanically by means of an adiustment screw so that the max. permissible speeds(of the variable motor and the driven unit)cannot be exceeded. See date table for max.permissible speeds.

规格计算： Calculation of size

流量 Swept Volume $Q=\frac{V_g \cdot n}{1000 \cdot \eta_v}$ [L/min]

输出转速 Output Speed $N=\frac{Q \cdot 1000 \cdot \eta v}{V_g}$ [r/min]

输出扭矩 Output Torque $M=\frac{V_g \cdot \Delta p \cdot \eta_{mh}}{2\pi}$

$=\frac{1.59 \times V_g \cdot \Delta p \cdot \eta_{mh}}{10}$ [Nm]

或 or $M=\frac{K_M \cdot \Delta p \cdot \eta_{mh}}{10}$ [Nm]

输出功率 Output Power $P=\frac{2\pi \cdot M \cdot n}{60000}=\frac{M \cdot n}{9549}$

$=\frac{Q \cdot \Delta p}{60} \cdot \eta_t$ [KW]

V_g=最大排量(ml/r) max geometry displacement[ml/r]

M=扭矩(Nm) torque[Nm]

△p=压差(MPa) differential pressure[MPa]

n=转速(r/min) speed[r/min]

η_v=容积效率 volumetric efficiency

η_{mh}=机械效率 mechanical−hydraulic efficiency

η_t=总效率 overall efficiency

技术参数表 Technical Data

规格	Size				
变量方式	Control Device			107	125
HD1D 液控变量	Hydraulic control, pilot pressure related			•	•
HA 高压自动变量	Automatic control,high pressure related			•	•
MA 手动变量	Manual control			•	•
排量	Displacement	V_{gmax}	ml/r	107	125
		V_{gmin}	ml/r	30.8	21.8
最大允许流量	Max.Permissible.Swept volome	Q_{gmax}	L/min	342	400
最高转速	Max.speeds	n_{max} 在at V_{gmax}	r/min	3200	3200
	(在at Q_{max} 下)	n_{max} 在 at $V_g<V_{gmax}$	r/min	4200	4200
扭矩常数	Torque constants	M_x 在at V_{gmax}	Nm/MPa	1.70	1.70
		M_x 在at V_{gmin}	Nm/MPa	0.35	0.34
最大扭矩	Max.torque	M_{max} 在at V_{gmax}	Nm	594	696
	(在at △p=35MPa)	M_{max} 在at V_{gmin}	Nm	171	201
最大输出功率(在35MPa和Q_{max}下)Max.output		power(at 35MPa and Q_{max})	KW	187	199
惯性矩	Moment		kgm²	0.0127	0.0127
重量 Weight			kg	46.5	46.5

HD 液压控制

与液控压力有关

与液控压力有关的液压控制方式允许马达的排量随液控压力信号无级变化。控制功能与作用在油口X上的液控压力成正比。

HD Hydroulic Control.

Pilot Pressure Related

The pilot pressure related hydroulic control allows infinite variation of the motor displacement in relation toa poilot pressure signal. Thecontrol function is proportional to the pilot pressure applied at port X.

标准型

控制起点在V_{gmax}(最大扭矩、最低转速)

控制起点在V_{gmin}(最小扭矩、最高转速)

Standard model

Start of control at V_{gmax}(max.torque, min.speed)

Start of control at V_{gmax}(min.torque, max.speed)

控制的设定

HDl

液控压力提高(V_{gmax}-V_{gmin})_____△Ps=1MPa

控制起点可调 0.2-2MPa之间

标准设定值：控制起点为0.3MPa(控制终点为1.3MPa)

HD2

液控压力提高(V_{gmax}-V_{gmin})_____△Ps=2.5MPa

控制起点可调 0.5-5MPa之间

标准设定值：控制起点为1MPa(控制终点为3.5MPa)

定货时，请用文字注明所需的控制起点。

例如：控制起点为0.3MPa

Control setting

HDl

Pilot pressure increace(V_{gmax}-V_{gmin})_____△Ps=10MPa

Start of control, setting range between_____2 and 20MPa

Standard setting:start of control at 0.3MPa(end of control at 1.3MPa)

HD2

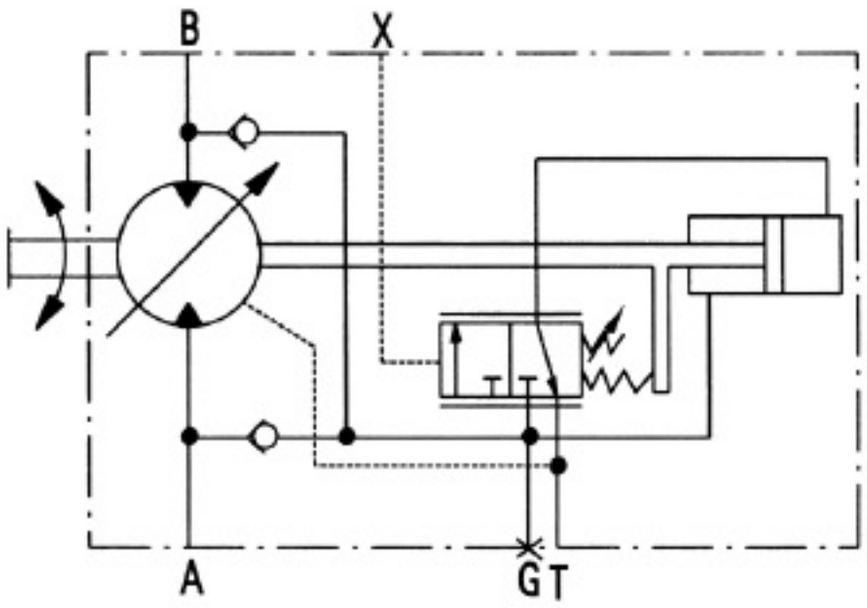
Pilot pressure increace(V_{gmax}-V_{gmin})_____△Ps=25MPa

Start of control, setting range_____0.5 and 5MPa

Standard setting:start of control at 1MPa(end of control at 3.5MPa)

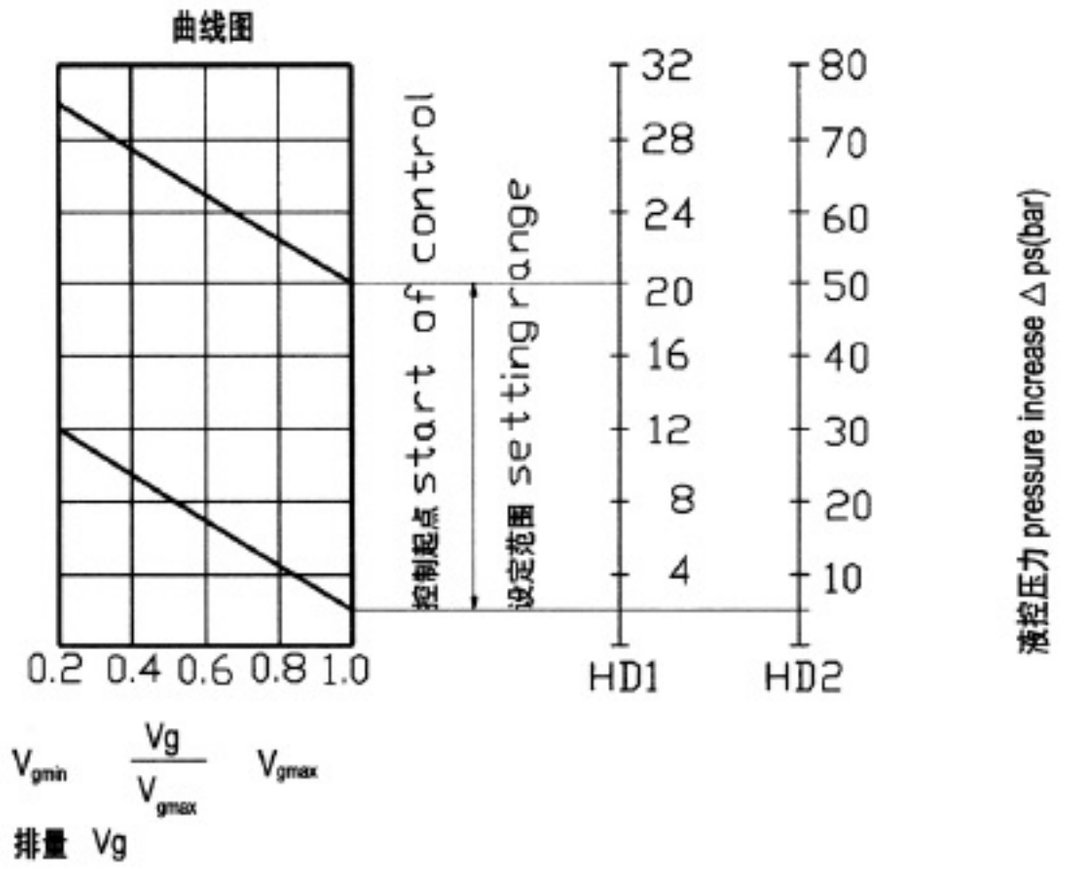
When ordering please state required start of control in clear text, e.g.start of control at 0.3MPa.

HD.液控变量 (HD1, HD2)



所需的控制油来自高压侧，因此，必需最低的工作压力为1.5MPa。
假如需要在工作压力＜1.5MPa进行控制工作，需外加一台单向阀，使作用在油口G上升压压力最低值为1.5MPa。最高允许的液控压力_____10MPa。

The required control oil is taken from the high pressure side, for this, a minimum operating pressure of 1.5MPa is necessary. If it is necessary to operate the control at an operating pressure of ＜1.5 MPa, a boost pressure of min.1.5MPa must be apphed at port G via an external check valve.
Max.perm.pilot pressure_____10MPa.

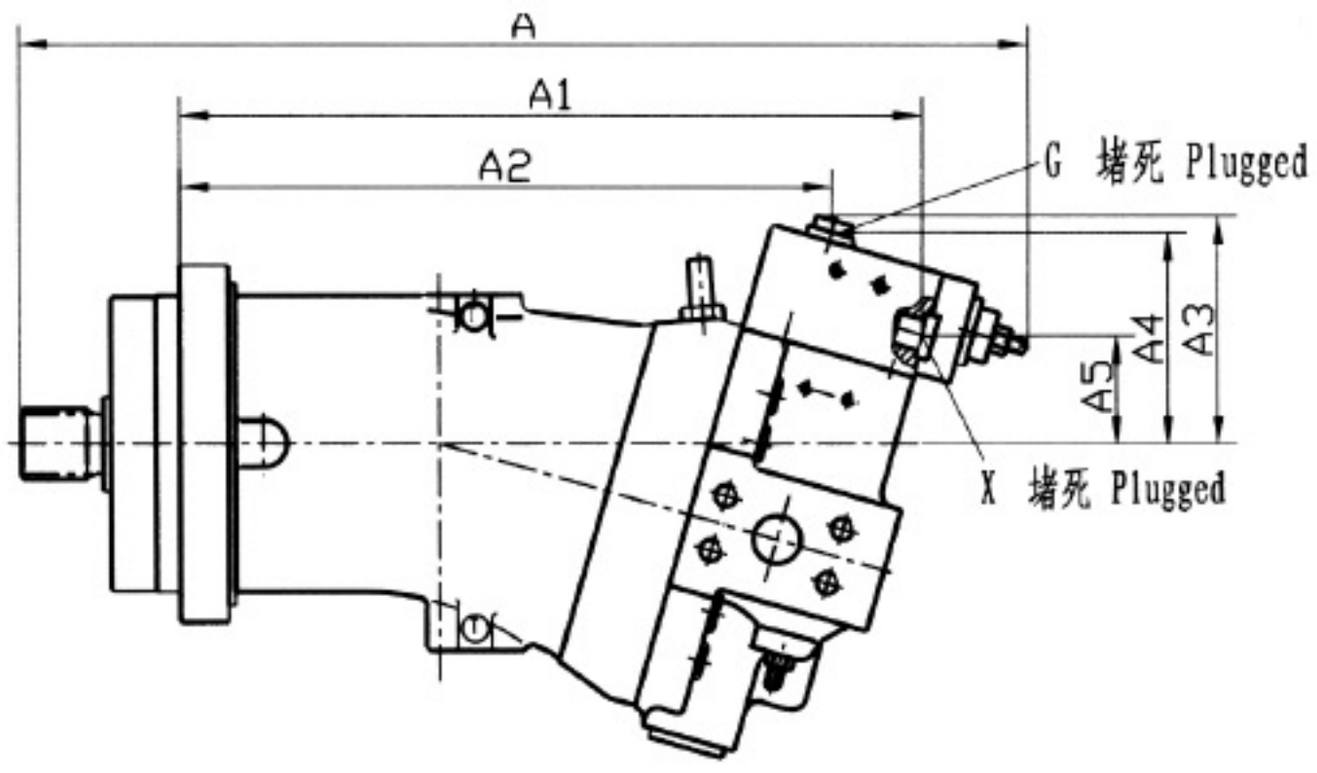


HD1D液控恒压变量

恒压控制是在HD功能基础上增加的。
如果系统压力由于负载扭矩缘故或由于马达摆角减小而升高，则达到恒压控制的设定值时，马达摆出到较大的摆角。
由于增大排量和减小压力，控制偏差消失。
通过增大排量，马达在恒压下产生较大扭矩。
通过在油口G2处施加一压力信号可得到第二个恒压设定压力。
(如起身和下降)，该信号须在2-5MPa之间。
恒压控制阀的设定范围为8-40MPa.
标准型：按第二种装配型式供货。
控制起点在V_{gmax}(最大扭矩、最低转速)
控制起点在V_{gmin}(最小扭矩、最高转速)

HD1D:Constant pressure control

The constant pressure control is superimposed on the HD function.
Should system psressure rise as a result of the load torque or reduction of the motor swivel angle, When the setting swivelled out to a higher angle.
As a result of the increased displacement and consequent pressure reduction, the control debiation is eliminated.By increaseing the displacement the motor produces a higher torque at a constant pressure.
Throw a pressure signal at port G2 will receive the second consstant setting pressure.
(for example rise and drop), the signal between 2 and 5MPa.
Setting range of constant pressure control valve:8-40MPa



HA高压自动变量

按工作压力自动控制马达排量

标准结构：按第一种装配型式供货

控制起点在V_{gmin}(最小扭矩、最高转速)

控制终点在V_{gmax}(最大扭矩、最低转速)

此种变量方式，当A或B口的内部工作压力达到设定值时，马达由最小排量V_{gmin}向最大排量V_{gmax}转变。

控制起点在8至35MPa间转变。

Automatoc Control,High Pressure Related,HA

Automatic control of motor capacity dependent on operating pressure.

Assembly type 1

Start of control at V_{gmin}(min.torque，max speed)

End of control at V_{gmax}(max.torque，min speed)

This control device measuresthe internal operating pressure at port A or B(no pilot line required)，and when the set operating pressure is reached，swivels the motor from min. Ocapacity(V_{gmin})to max. capacitu(V_{gmax}).

Start of contro;is adjutable between 8MPa and 35MPa.

有两种方式供选用：

1．HAl——在控制范围内，工作压力保持恒定。△P=1MPa

从V_{gmin}变至V_{gmax}时，压力升高约为1MPa。

2．HA2——在控制范围内，工作压力保持恒定。△P=10MPa

从V_{gmin}变至V_{gmax}时，压力升高约为10MPa。

HA变量可在X口进行外控(即带有超调)，在这种情况下，变量机构的压力设定值(工作压力)按每0.1MPa先导(外控)压力下降1.6MPa的比率降低。

例如：

变量机构起始变量压力设定值为30MPa

先导压力(X口)：0MPa时变量起点在30MPa。

先导压力(X口)：1MPa时变量起点在14MPa。

(30MPa-10 X 1.6MPa=14MPa)

Two options are available：

1．HAl——Within the control range，the operating pressure held practically constant．Pressure increase between Vgmin and Vgmax is approx.1MPa

2．HA2——Within the control range，with pressure increase △P=10MPa from Vgmin to Vgmax.

The HA control can be overridden at port X.In this case，set value of pressure at the regulator(operating pressure)is reduced 1.6MPa per 0.1MPa pilot pressure.

Example：

Regulator setting:30MPa.

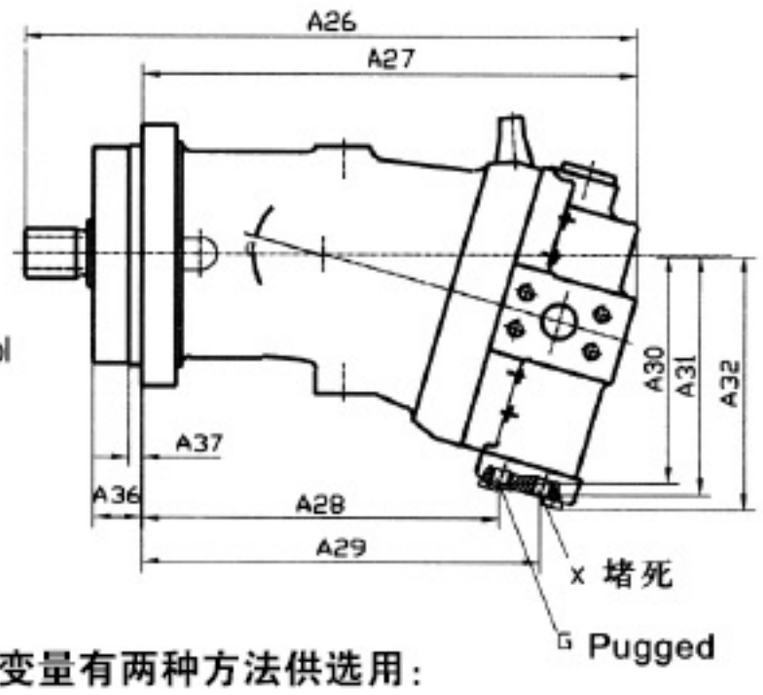
Pilot pressure(at X):0MPa start of control at 30MPa

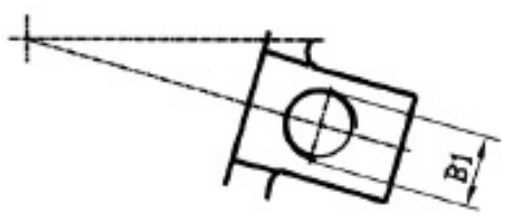
Pilot pressure(at X):1MPa start of control at 14MPa

(30MPa-10 X 1.6MPa=14MPa)

装配方式 1

Assembly type 1





带有超调的HA，变量有两种方法供选用：

1．HA1H——在控制范围内，工作压力保持恒定，△P=1MPa。

2．HA2H——在控制范围内，工作压力保持恒定，△P=10MPa。

如果控制仅需要达到最大排量，则允许先导压力最高为5MPa。

外控口X处的供油量：约0.5L/min。

Two options are available for HA Control with override.

1．HA1H-Within the control range．the operatina pressure is held，practically constant.△P=1MPa

2．HA2H-Within the control range．the operating pressure is held，practically constant.△P=10MPa

lf override is only required to set max.capacity(swivelling the motor toV_{gmax})，a pilot pressure of up to 5MPa max is permissible.

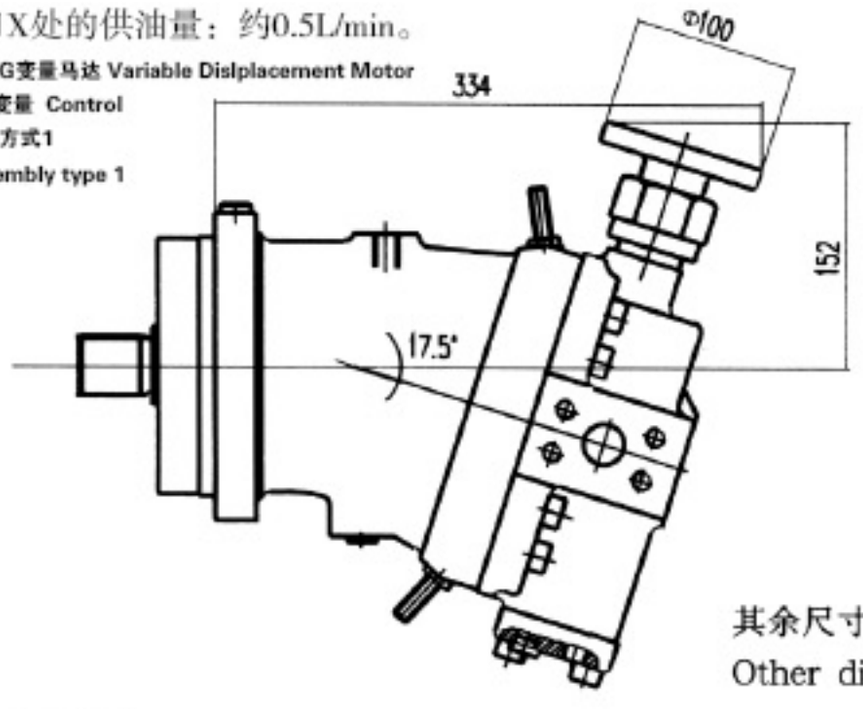
The max oil flow at piolt X is approx 0.5L/min

A6VG变量马达 Variable Dislplacement Motor

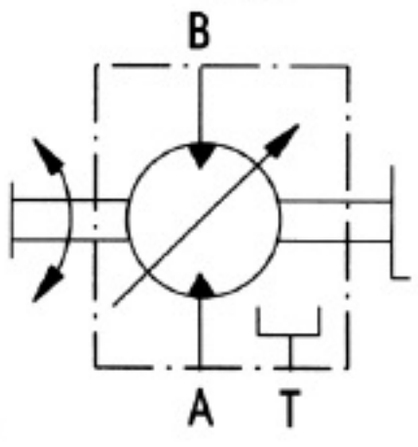
MA变量 Control

装配方式1

Assembly type 1



MA.手动变量



其余尺寸见 HD/HA

Other dimensions see HD/HA

MA手动变量

通过手轮驱动螺杆以调节马达的排量。装配型式：第一种装配型式

MA,Manual Control

Adjustment of motor capacity dependent on the position of a threaded spindle-hand operation. Assembly design 1

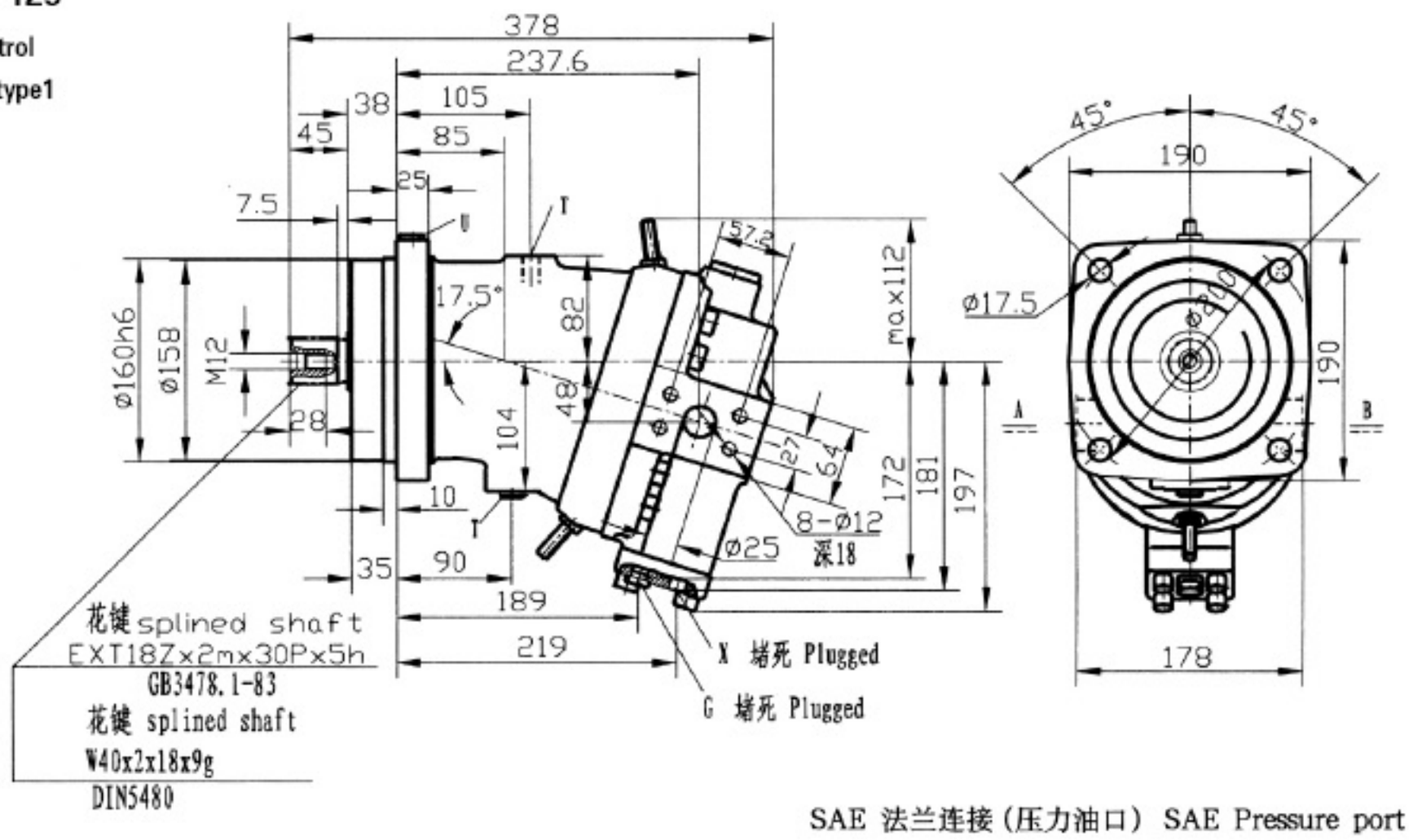
外形尺寸 Unit Dimensions

规格Size 107、125

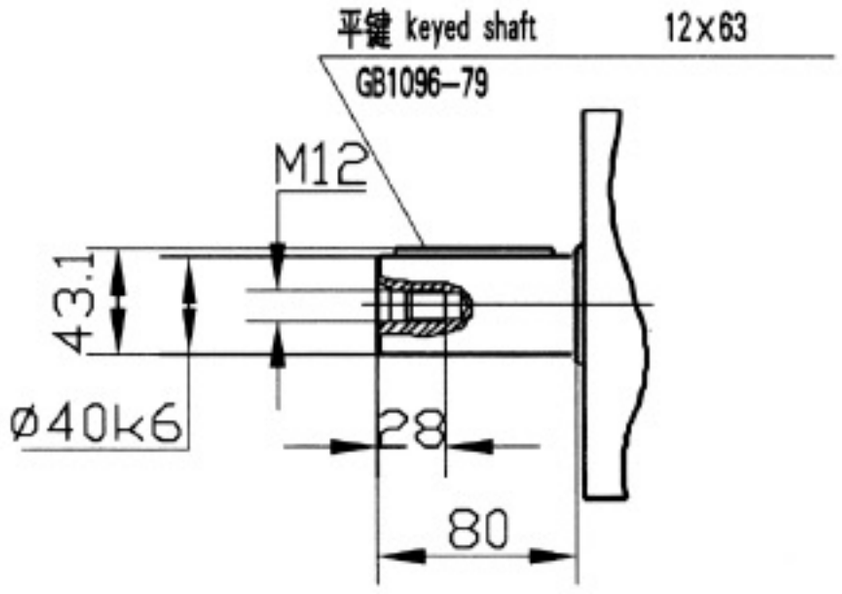
HA 高压自动变量 Control

装配形式1 Assembly type1

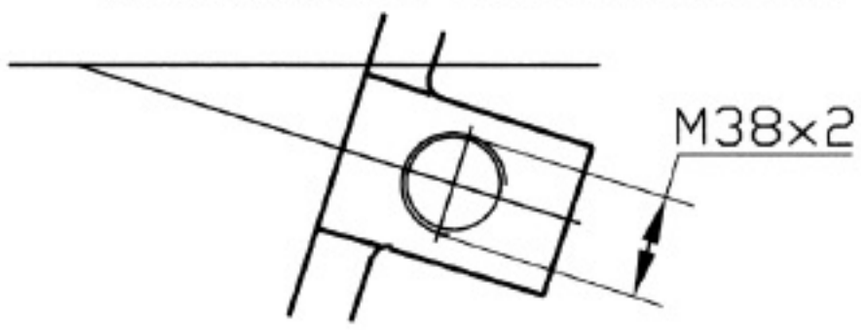
SAE 法兰连接（压力油口）
SAE pressure port



SAE 法兰连接（压力油口） SAE Pressure port



螺纹连接（压力油口） Threaded pressure port



A,B, 工作油口 service port

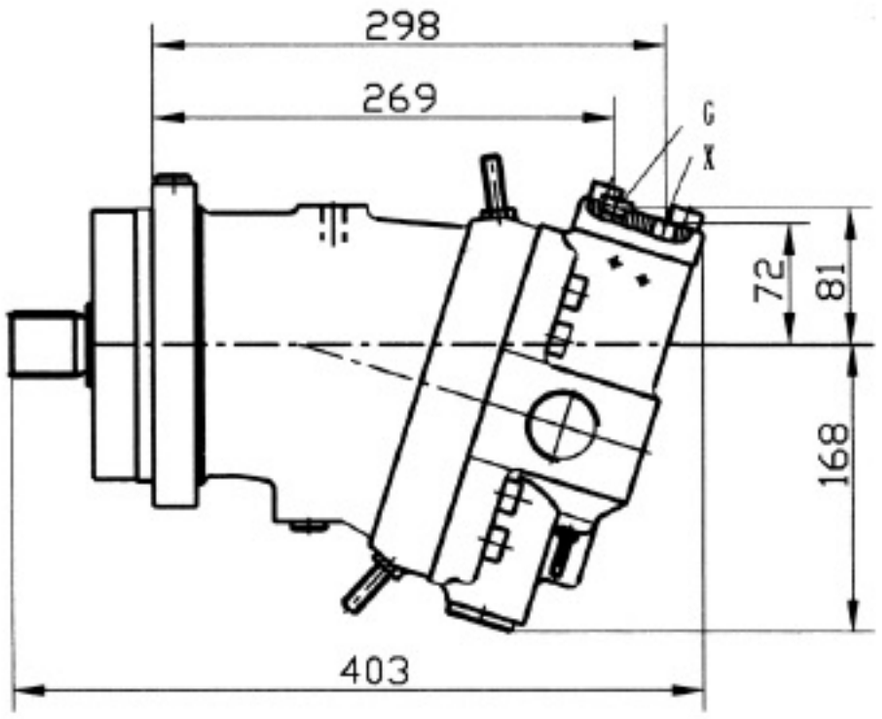
G 多元件同步 port for synchronous control
控制和遥控 of multiple units and for
压力油口 remote control pressure

X 先导（外控）油口 Polot pressure

t 壳体、油口 case drain

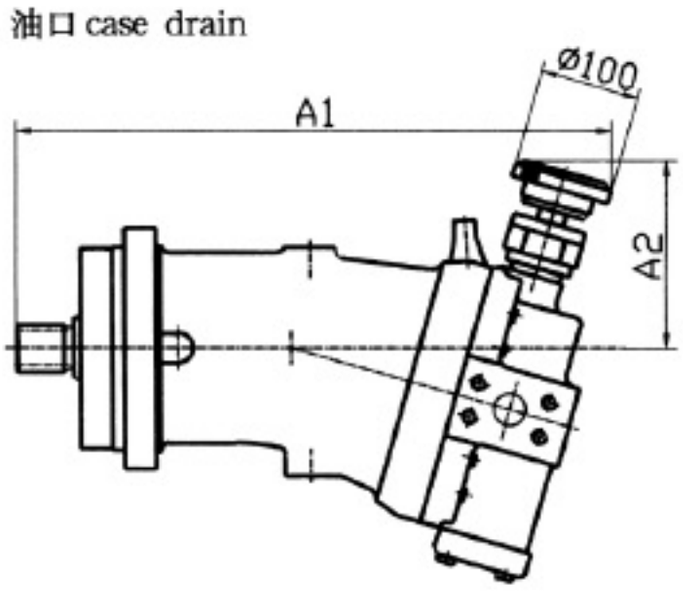
HA 高压自动变量 Control

装配形式1 Assembly type1



MA 变量 Control

装配方式 1 Assembly type1



其余尺寸见 HD/HA Other dimensions see HD/HA

北京华德液压工业集团有限责任公司 BEIJING HUADE HYDRAULIC INDUSTRIAL GROUP CO. ,LTD.	A6VE内藏式变量马达 Plug-In Variable Displacement Motor A6VE 弯轴结构轴向锥形柱塞元件 axial tapered piston rotary group of bent axis design 用于安装在机械齿轮箱中 for mounting in mechanial gearboxes		RC91200/12.2004
	规格 Size 55-160	公称压力31.5MPa最高压力35MPa Nominal Pressure Peak press	替代：ReplaceRC91200/09.2003



A6VE内藏式变量马达装有一套弯轴结构的标准轴向锥形柱塞旋转组件。

液压内藏式马达主要用来安装在机械齿轮箱中，例如，履带驱动轮箱。

马达的安装法兰设计在壳体的中间，这种结构允许马达几乎完全装进机械齿轮箱，从而提供一个十分紧凑的部件。

内藏式马达部件的特殊优点是：

- 整个部件，已组装和试验
- 易于组装，仅需“插入”机械齿轮箱
- 不需要考虑安装公差

The variable displacement plug-in motor A6VE is equipped with a standard axial tapered piston rotary group of benta xis design.

Hydrostatic plug-in motors are intended primarily for installationl in mechanical gearboxes，e.g.track drive gear boxes.

The desing of the motor with the mounting flange in the center of the housing allows it to be almost fully integrated into a mechanical gearbox to give an extremely compact unit.

The particular advantages of the plug-in motor over kit designsl are:

- complete unit，ready assembled and tested.
- easy assembly simply plug-in to mechanical gearboxes.
- no installation tolerances to consider.

型号说明 Type Code

A6V	E	80	HA1	2	F	Z	1	039

马达型号 Motor Type

变量马达	Variable displacement motor	A6V

安装型式 Mounting Type

内藏式E	plug-in E	E

规格 Size

排量/ml/r	displacement	
	1.5-54.8ml/r	55
	23-80ml/r	80
	30.8-107ml/r	107
	46-160ml/r	160

变量方式 Control Device

液控变量 Hydraulic control, pilot pressure related	控制压差 △p=1MPa Pilot pressure Increase	HD1
	控制压差 △p=2.5MPa Pilot pressure Increase	HD2
	恒压 Constant pressure	
高压自动变量 Automatic control, high pressure related	不带超调 With out override	HA1
	升压 Pressure increase △p=10MPa	HA2
	不带超调 With out override	
电控双速变量	Electrical 2-speed 12v control(with switching solenoid)24	ES1
		ES2
电控比例变量	Electrical control 12v (with proportional solenoid) 24v	EP1
		EP2
手动变量	Manual control (with handwheel)	MA

最小排量设定值 Min.Swept Volume Setting

例： Example.

V_{gmin}=39ml/r 039

例： Example.

V_{gmin}=54ml/r 054

装配型式 Assembly Type

解释见变量说明及元件尺寸	For explanation see description of control device and unit dimensions	1 2

轴伸 Shaft End

平键GB 1096-79	Keyed parallel shaft	P
花键 DIN 5480	Splined shaft	Z
花键 GB 3478.1-83	Splined shaft	S

油口连接 Pipe Connections

SAE法兰，侧面	SAE flange,on side	F
螺纹连接，侧面	Metric threads,on side	G

结构型式 Series

结构2，规格 55.80.107.160	Series 2,sizes	2

订货示例：A6V.E.80.HDI.2.F.Z.2.039

斜轴变量马达A6V，内藏式E，规格80，液控变量，△p=1MPa，结构2，侧面SAE法兰连接，德标花键，第2种装配型式。
最小排量 V_{gmin}=39ml/r

Ordering Example A6V.E.80.HDI.2.F.Z.2.039

Axial-piston-variable displacement motor A6V, plug-in E size 80,with hydraulic control,pilot pressure related, △p=1MPa,series 2.
SAE flange connections on side,splined shaft,assembly type 2,min.swept volume setting V_{gmin}=39ml/r

技术参数 Technical Data

工作压力范围： Operating Pressure Range

A或B口压力：Pressure at port A or B

额定压力 Nominal pressure P_n=31.5MPa

最高压力 Peak pressure P_{max}=35MPa

A、B油口压力总和不得超过63MPa，每侧油口压力最高40MPa。

The sum of the pressures at ports A and B should not exceed 63MPa. (Individual pressure at either port max.35MPa)

泄油压力：Leakage oil Pressure：

允许T口最大泄油压力

MaXimum permissible leakage oil pressure (at Port T)

P_{abs} 0.2MPa

油温范围： Fluid Temperature Range

t_{min} −25℃

t_{max} +80℃

粘度范围： Viscosity Range：

u_{min} 10mm²/s

u_{max} (短时)(for short periods)1000mm²/s

最佳工作粘度： Optimum Operating Viscosity：

V_{opt} 16−36mm²/s

油液选择： Fluid Recommendation

工作温度 Operating temperature range	推荐粘度等级符合DIN51519 Recommended Viscosity grade to DIN51519 ISO(VG)
30−40℃	VG22=22mm²/s at40℃
40−50℃	VG32=32mm²/s at40℃
50−60℃	VG46=46mm²/s at40℃
60−70℃	VG68=68mm²/s at40℃
70−80℃	VG100=100mm²/s at40℃

液压油的过滤：

推荐过滤精度为10μm。亦可使用25−40μm的，但使用10μm的可以延长使用寿命(降低磨损)。

Filtration of Hydraulic Fluid

Recommended filtration 10μm. Coarser filtration of 25 to 40μm is possible, however longer service life is achieved with filtration of 10μm. (reduced wear).

转速范围：

最低转速没有限制，在要求十分均匀的转速时，n_{min}不小于50r/min。最高转速由来自泵的最大流量和变时马达的最小排量确定。最小排量则由一个调节螺钉限位，所以变量马达不会超速运转。

最高允许转速见技术参数表。

Speed Range

No limitation on minimum Speed n_{min}. Where very even speeds are required. n_{min} should not be less than 50r/min.

The maximum flow from the pump and the minimum swept volume of the variable motor together determine the maximum output speed.

The min swept volume is limited mechanically by means of an adiustment screw so that the max.permissible speeds(of the variable motor and the driven unit)cannot be exceeded. See date table for max. permissible speeds.

流量 Swept Volume

$$Q=\frac{V_g \cdot n}{1000 \cdot \eta_V} \quad [L/min]$$

输出转速 Output Speed

$$n=\frac{Q \cdot 1000 \cdot \eta_v}{V_g} \quad [r/min]$$

输出扭矩 Output Torque

$$M=\frac{V_g \cdot \Delta p \cdot \eta_{mh}}{2\pi}$$

$$\frac{1.59 V_g \cdot \Delta p \cdot \eta_{mh}}{10} \quad [Nm]$$

或 or

$$M=\frac{K_M \cdot \Delta p \cdot \eta_{mh}}{10} \quad [Nm]$$

输出功率 Output Power

$$P=\frac{M \cdot n}{9549}$$

$$=\frac{Q \cdot \Delta p}{60} \cdot \eta_t \quad [KW]$$

V_g=最大排量(ml/r)	max geometry displacement[ml/r]
M=扭矩(Nm)	torque[Nm]
△p=压差(MPa)	differential pressure[MPa]
n=转速(r/min)	speed[r/min]
η_v=容积效率	volumetric efficiency
η_{mh}=机械效率	mechanical−hydraulic efficiency
η_t=总效率	overall efficiency

技术参数表 Technical Data

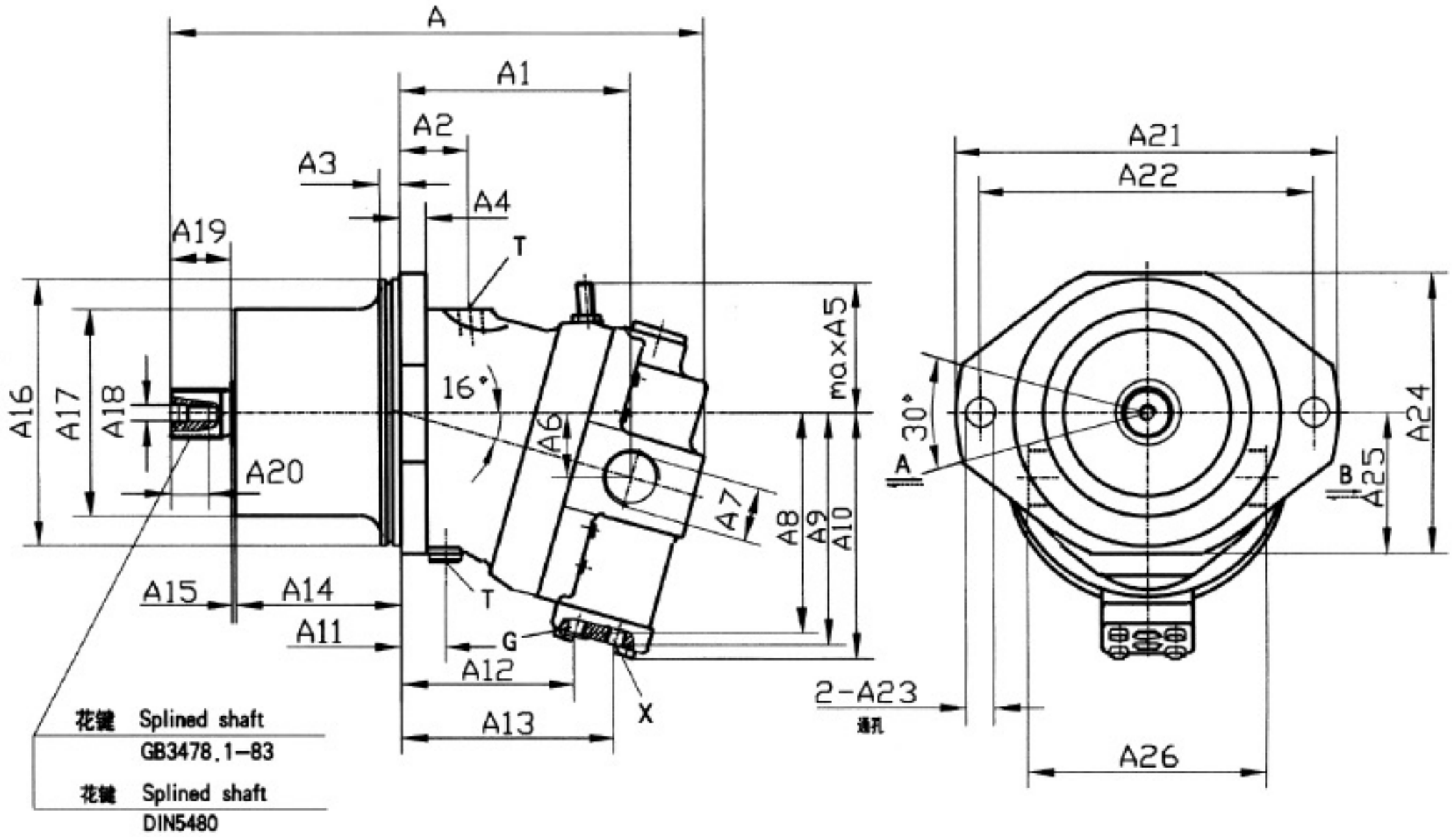
规格	size			55	80	107	160
排量	Displacement	V_{gmax}	ml/r	54.8	80	107	160
		V_{gmax}	ml/r	15.8	23	30.8	46
最大允许流量	Max.Permissible.Swept volume	Q_{gmax}	l/min	206	268	321	424
最高转速	Max.speeds	n_{max} 在at V_{gmax}	r/min	3750	3350	3000	2650
	(在at Q_{max} 下)	n_{max} 在 at $V_g<V_{gmax}$	r/min	5000	4500	4000	3500
扭矩常数	Torque constants	M_x 在at V_{gmax}	Nm/MPa	8.701	12.75	16.97	25.41
		M_x 在at V_{gmin}	Nm/MPa	2.511	3.73	4.9	7.35
最大扭矩	Max.torque	M_{max} 在at V_{gmax}	Nm	304	446	594	889
	(在at △p=35MPa)	M_{max} 在at V_{gmax}	Nm	88	130	171	257
最大输出功率(在35MPa和Q_{max}下)Max.output power(at 35MPa and Q_{max})			kW	120	156	187	247
惯性矩	Moment		kgm²	0.0042	0.008	0.0127	0.0253
重量	Weight		kg	26	34	45	64

外形尺寸 Unit Dimensions

规格Size 55–160

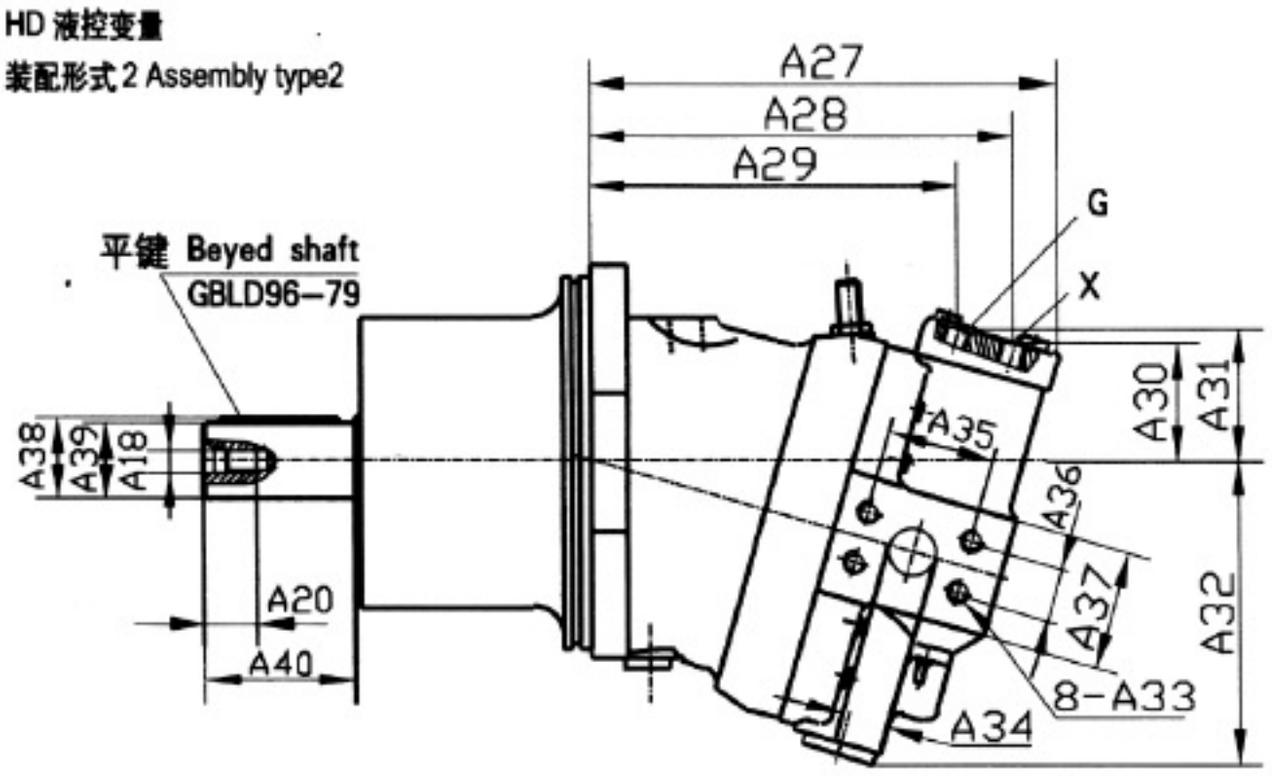
HA 高压自动变量 Control

装配形式1 Assembly type1



HD 液控变量

装配形式2 Assembly type2



A,B 工作油口	service port
G 多元件同步控制和遥控压力油口 M14 × 1.5	port for synchronous control of multiple units and for remote control pressure
X 先导油口 M22 × 1.5	pilot pressure
T 壳体、泄油口 M14 × 1.5	case drain

规格

Size	A	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
55	319.1	141	18	15	18	75	40	33	133	141	153	18	100	127	90	1.1	160	120	M12
80	382	160	18	15	20	95	46	42	152	161	177	25	115	145	108	3	190	139.3	M12
107	395	171	20	15	20	98	49	42	164	173	188	20	129	158	121.8	1.2	200	155	M12
160	447.2	200.4	59.4	15	20	108	57	48	182.5	193	201	23.3	148.9	184.4	121.7	3.5	200	170	M16

规格 深

size	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30	A31	A32	A33	deep	A34	A35	A36
55	35	28	235	200	18	166	83	142	204	183	156	52	60	132	M10	17	20	50.8	23.8
80	53	28	260	224	22	196	98	172	229.5	208	179	59	68	137	M12	18	25	57.2	27.8
107	45	28	286	250	22	208	104	178	248	226	196	63	71	162	M12	18	25	57.2	27.8
160	55	36	290	250	22	224	120	208	286.4	258.4	223.4	66	77	182	M14	21	32	66.7	31.8

规格								平键	花键	花键		
								Keyed	splined	splined		
size	A37	A38	A39	A40	A	B	T	GB1096-79	DIN580	GB3478.1-83		
55	53	32.9	30	60	M33×2	M33×2	M18×1.5	键8×50	W30×2×1×9g	EXT14Z×2m×30p×5h		
80	64	38	35	70	M42×2	M42×2	M18×1.5	键10×56	W35×2×16×9g	EXT16Z×2m×30p×5h		
107	64	43.1	40	80	M42×2	M42×2	M18×1.5	键12×63	W40×2×18×9g	EXT18Z×2m×30p×5h		
160	70	53.5	50	100	M48×2	M48×2	M22×1.5	键14×80	w50×2×24×9g	EXT24Z×2m×30R×5h		

规格	G	X
size		
55	M14×1.5	M14×1.5
80	M14×1.5	M14×1.5
107	M14×1.5	M14×1.5
160	M14×1.5	M14×1.5

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本公司通过：

- 【ISO9001质量管理体系认证】
- 【ISO14001环境管理体系认证】
- 【OH SAS18001职业健康安全管理体系认证】
- 【CE认证】

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华德液压

北京华德液压工业集团有限责任公司
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