



# Axial Piston Variable Pump HMVP Series 01

Size: 28 mL/r  
Rated pressure: 28 MPa  
Max. pressure: 35 MPa



## Features



- Axial variable pump of swashplate design for hydrostatic drives in open circuits
- The flow is proportional to the drive speed and displacement and is infinitely varied
- The drive shaft allows axial and radial loading  
Various control options to satisfy different operating requirements
- High power to weight ratio
- Excellent suction characteristics
- Diverse control options, short control response time
- Compact structure, small size, low noise

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> Model Code

	A	B	I	J	K	M	N	P	R	S	X	Z
HMVP			/ 01			-						-

**Axial piston unit**

—	Swashplate design, variable piston pump	HMVP
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**Displacement**

A	Geometric displacement, in mL/r	28
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**Variable control method**

B			28			
	Pressure control	hydraulic control		●	DR	
		flow control	hydraulic	X-T open	●	DFR
				X-T plugged with flushing	●	DFR1
		With pressure cut-off	hydraulic	remote control	○	DRG
		power control	hydraulic		●	DLR
Pressure、Flow、Power control		hydraulic	●	DFLR		

**Series**

I	Series 01	01
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**Oil port type**

J			28	
	UN/UNF,O-ring seal,with standards SAE J1926		●	S
	Drain Port: BSPP,O-ring seal,with standards JIS B2351-1G Control Por: BSPP,ED seal,with standards ISO 1179-1		●	G
	Metric,ED seal,with standards ISO 9974-1		●	I

**Direction of rotation (viewed on drive shaft)**

K			28	
	CW		●	R
	CCW		○	L

**Sealing material**

M			28	
	NBR seal + FKM shaft seal		○	N
	NBR seal		○	P
	FKM shaft		●	V

**Drive shaft**

N			28	
	SAE J744 3/4"	11T 16/32DP	○	S0
	SAE J744 7/8"	13T 16/32DP	●	S1



> Model Code

	A	B		I	J	K		M	N	P	R	S	X		Z
HMVP			/	01			-							-	

Mounting flange

P												28	
	ISO 3019-2,2 hole											●	A
	SAE J744,2 hole											●	C

Working ports

R												28	
	SAE port flange, metric fastening thread		side		used for through drive						●	12	
	SAE port flange, UNC fastening thread		side		used for through drive						○	62	

Through drive

S	UNC flange SAE J744											28	
	Without through drive											●	N00
	82-2(A)		SAE J744 5/8"		9T		16/32DP				○	K01	
			SAE J744 3/4"		11T		16/32DP				○	K52	
	101-2(B)		SAE J744 7/8"		13T		16/32DP				○	K68	

Solenoid connector

X												28	
	Without connector (without solenoid, only for hydraulic control, without code)											●	
	DEUTSCH DT04-2P, 2-pin plastic connector, without diode suppressor (electric control)											○	P
	AMP 17454-2, 2-pin plastic connector											○	A

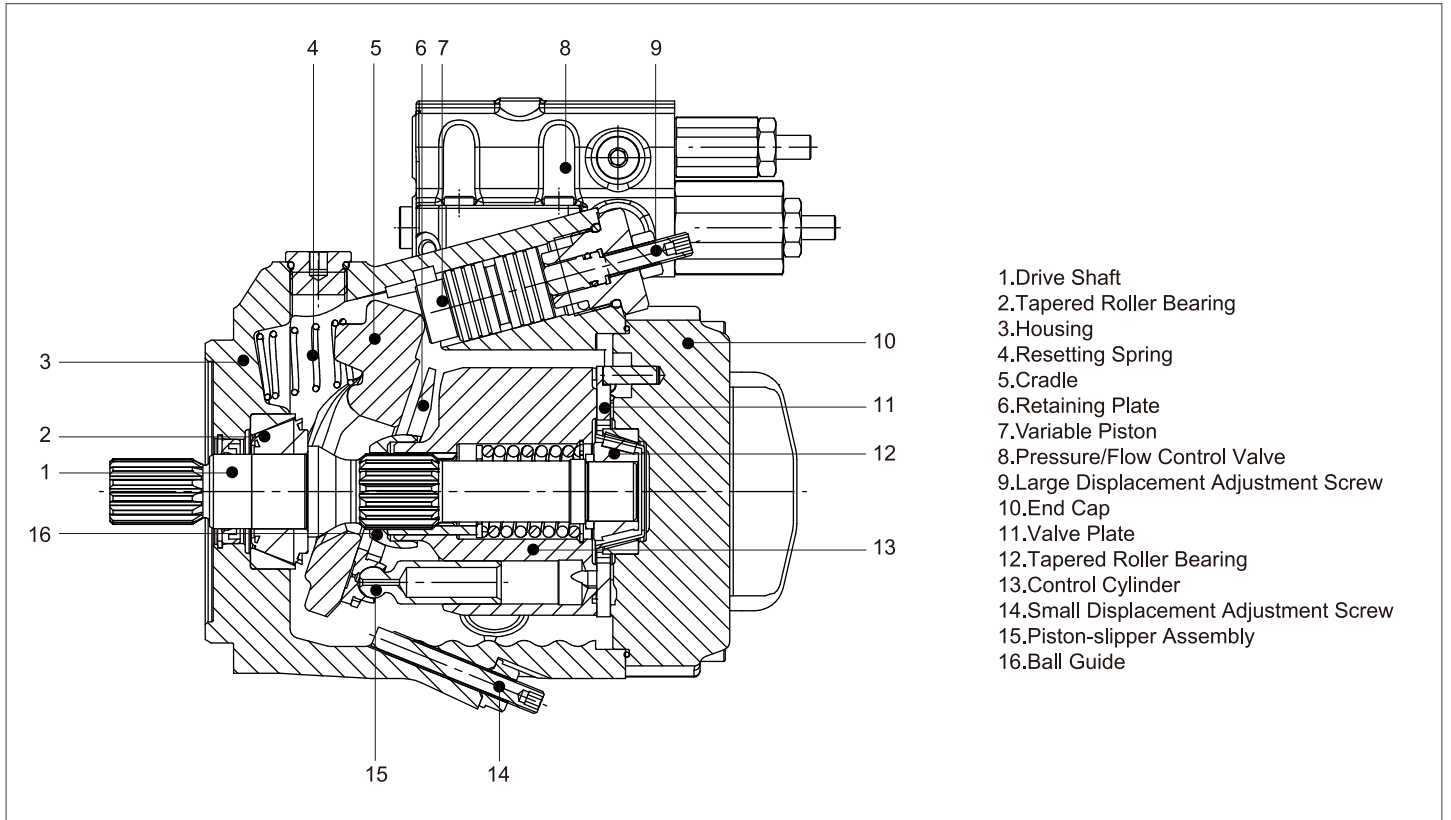
Special configuration

Z												28	
	Without special configuration (without code)											●	
	Special configuration											○	S***

● Available    ○ On request    — Not available    ■ Recommended model



> Structure





### ➤ Hydraulic Fluid

Mineral oil HL or HLP hydraulic oil with DIN 51524 standard.

### ➤ Working Viscosity

In order for the optimum efficiency and service life, it is recommended to select the working viscosity at working temperature within the range below:

$$V_{opt} = \text{optimal working viscosity } 16...36 \text{ mm}^2/\text{s}$$

It is subject to the reservoir temperature of an open circuit.

### ➤ Limit Viscosity

Limit viscosity:

$$V_{min} = 10 \text{ mm}^2/\text{s}$$

Short-term operation, at permissible maximum leakage temperature of 90 °C

$$V_{max} = 1000 \text{ mm}^2/\text{s}$$

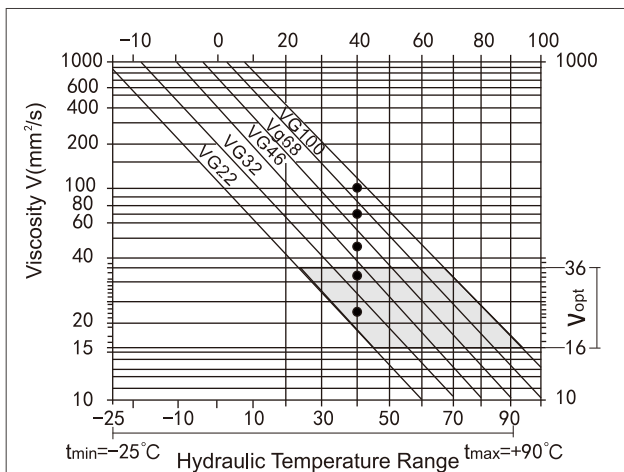
Short-term operation, cold start

### ➤ Temperature Range

$$t_{min} = -25^\circ\text{C}$$

$$t_{max} = 90^\circ\text{C}$$

### ➤ Selection Diagram



### ➤ Instructions on Selection of Hydraulic Fluid

The working temperature dependent on the ambient temperature is required for correct selection of hydraulic fluid. It refers to the circuit temperature of a closed circuit and the reservoir temperature of an open circuit.

The hydraulic fluid should be so selected that the working viscosity in the working range is within the optimum range ( $V_{opt}$ , the shaded area on the selection diagram). The higher viscosity is recommended under the same conditions.

For example:

At an ambient temperature of X °C, the working temperature of the circuit is 60 °C. The viscosity within the optimum range ( $V_{opt}$ , shaded area) is VG46 or VG68 and the latter should be selected.

Note:

The case drain temperature depends on the pressure and speed, and it is always higher than the circuit temperature. The temperature at any point within the system should not exceed +90 °C. Please contact us if the above condition cannot be maintained due to extreme working conditions.

### ➤ Filtration

Finer filtration improves the cleanliness level of the hydraulic fluid, thus increasing the service life of the axial piston unit. To ensure normal operation of the axial piston unit, a cleanliness level of at least

NAS 1638,9

ISO 4406 20/18/15

Due to the high-temperature operating condition (90°C to 115°C), the minimum required cleanliness level is

ISO 4406 19/17/14

If this cleanliness level cannot be achieved, please contact us.

### ➤ Working Pressure Range

Input

Absolute pressure at port S

$$p_{abs \text{ min}} \text{ _____ } 0.8 \text{ bar}$$

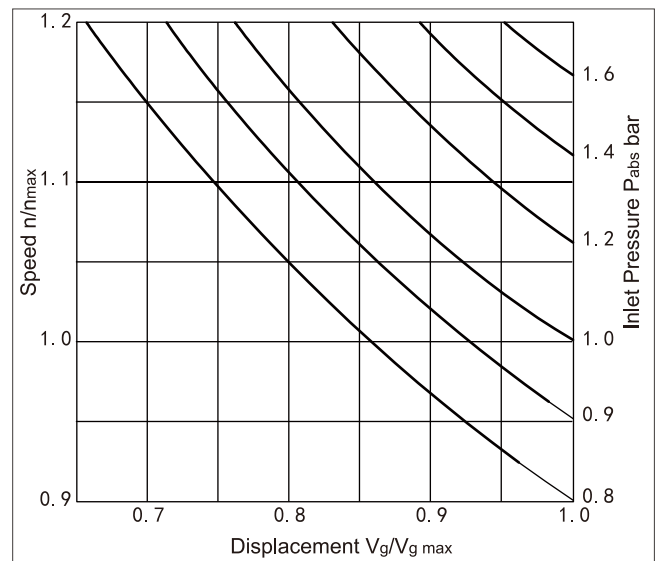
$$p_{abs \text{ max}} \text{ _____ } 5 \text{ bar}$$

Output

Absolute pressure at port B

$$p_{nom} \text{ _____ } 280 \text{ bar}$$

$$p_{max} \text{ _____ } 350 \text{ bar}$$



### ➤ Case Drain Pressure

Maximum permissible pressure at drain port (L1, L2, L3, L4)

Maximum 0.5 bar higher than inlet pressure at port S

No higher than 2 bar absolute pressure

### ➤ Flow Direction

From port S to B



► Technical Data

Size				28
Displacement	Variable pump	$V_{g \max}$	mL/r	28
Pressure	Rated pressure	$P_{\text{nom}}$	MPa	28
	Maximum pressure	$P_{\text{max}}$	MPa	35
Speed <sup>1)</sup>	$V_{g \max}$	$n_{\text{nom}}$	rpm	3000
	$V_g < V_{g \max}$	$n_{\text{max}}$	rpm	3600
Flow	$n_{\text{nom}}$ and $V_{g \max}$ 时	$q_v$	L/min	84
Power	$n_{\text{nom}}$ and $V_{g \max}$ , $\Delta p=28\text{MPa}$	$n_{\text{min}}$	KW	39
Torque	$V_{g \max}$ , $\Delta p=28\text{MPa}$	$T_{\text{max}}$	Nm	125
Case volume			L	0.7
Weight			KG	15
Hydraulic oil temperature range			℃	-25℃~110℃
Hydraulic oil viscosity range			mm <sup>2</sup> /s	16-36mm <sup>2</sup> /S

1) The above data is valid only when the inlet pressure at port S is 0.1 MPa absolute pressure.

► Specification Calculation

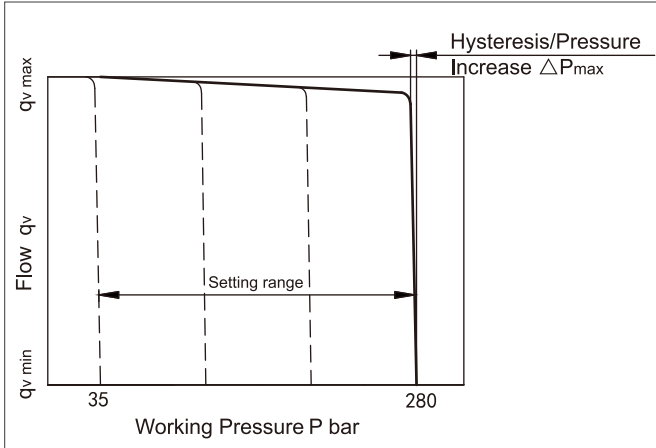
Flow	$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$	[L/min]	$V_g$ = Displacement, mL/r
			$\Delta p$ = Differential pressure, MPa
Torque	$T = \frac{V_g \cdot \Delta p}{2 \cdot \pi \cdot \eta_{mh}}$	[Nm]	$n$ = Speed, rpm
			$\eta_v$ = Volumetric efficiency
Power	$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{60 \cdot \eta_t}$	[KW]	$\eta_{mh}$ = Mechanical-hydraulic efficiency
			$\eta_t$ = Total efficiency



## DR-Pressure Control

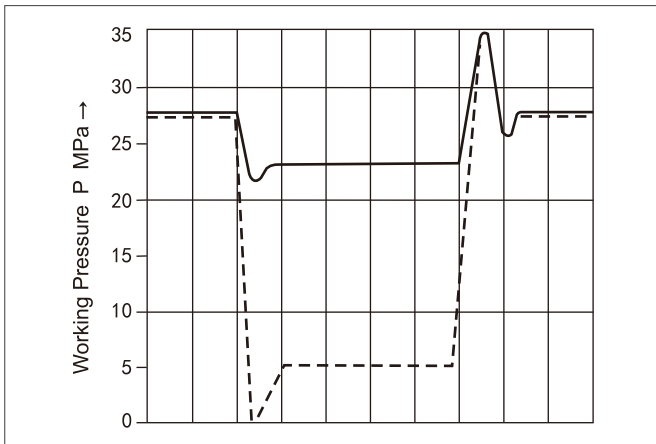
The pressure controller can maintain constant pressure of the hydraulic system within its control range despite changes in the flow. The variable pump only supplies as much hydraulic fluid as required by the actuator. If the working pressure exceeds the set point of the integrated pressure control valve, the pump will automatically swivel back until the pressure deviation is corrected.

**Static characteristic curve** ( $n_1=1500\text{rpm}$ ,  $t_{oil}=50^\circ\text{C}$ )



### Dynamic Characteristic Curve

The average value measured when the pump is installed in the fuel tank during the test state.  $n_1=1500\text{rpm}$ ,  $t_{oil}=50^\circ\text{C}$ , overflow valve setting 35MPa, the overflow valve is 1m away from the outlet flange of the pump.



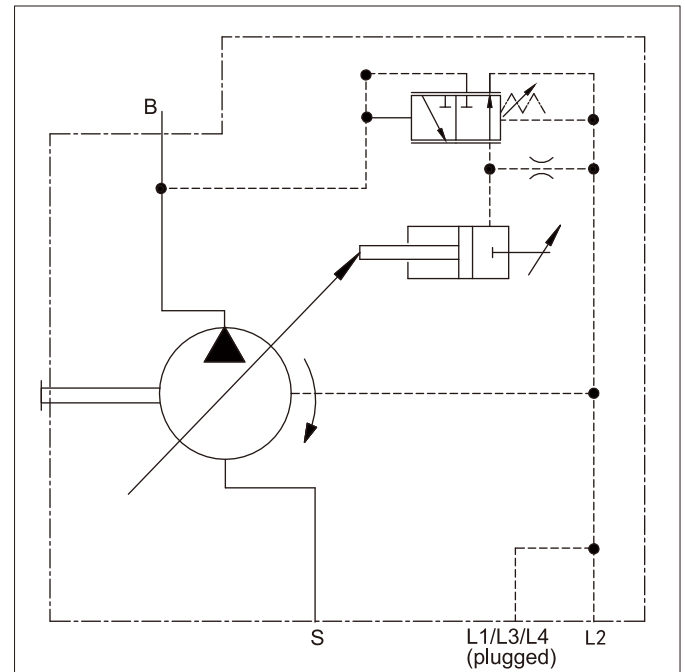
### Controller data

Hysteresis  $\Delta p$  \_\_\_\_\_ Maximum 0.3MPa  
 Pressure increase  $\Delta p$  \_\_\_\_\_ Maximum 0.4MPa  
 Pilot fluid consumption \_\_\_\_\_ Maximum 3L/min

### Controller time

Size	$t_{SA}(\text{ms})$	$t_{SE}(\text{ms})$
28	150	40

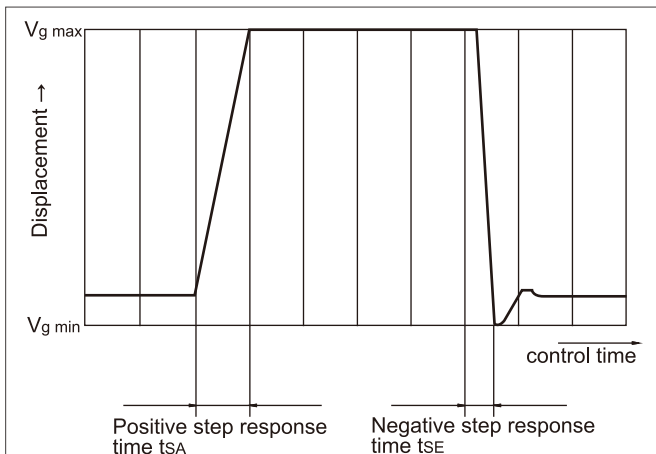
### Hydraulic Circuit Diagram



### Port

B \_\_\_\_\_ Drain port  
 S \_\_\_\_\_ Suction port  
 L1/L2/L3/L4 \_\_\_\_\_ Case drain port

### Dynamic Flow Control Characteristic Curve





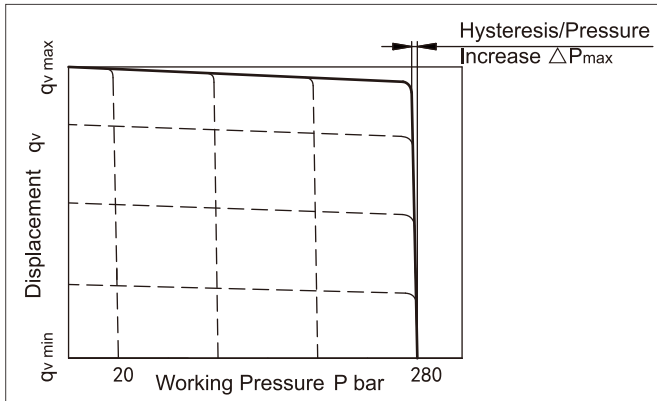
### ► DFR/DFR1-Pressure/Flow Control

In addition to the pressure controller function, an adjustable orifice is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual hydraulic fluid quantity required by the consumer.

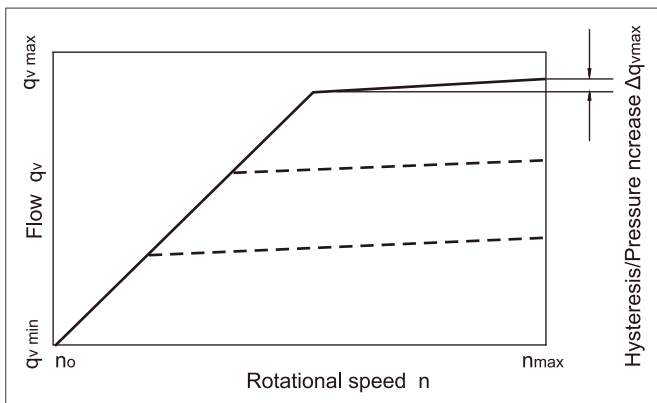
The pressure control function takes priority over the flow control function. The DFR1 and DRSC versions have no unloading from X to the reservoir. The LS must thus be unloaded in the system.

Because of the flushing function sufficient unloading of the flow controller in DFR1 control valve X-line must also be provided.

#### Static Characteristic Curve ( $n_1=1500\text{rpm}$ , $t_{oil}=50^\circ\text{C}$ )



#### Characteristic Curve at Variable Rotational Speed



#### Controller data

Controller data see DR

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

$\Delta q_{v\text{max}}$  \_\_\_\_\_ 1.0L/min

DRF Pilot fluid consumption \_\_\_\_\_ Maximum 3-4.4L/min

DRF1 Pilot fluid consumption \_\_\_\_\_ Maximum 3L/min

Differential pressure  $\Delta p$

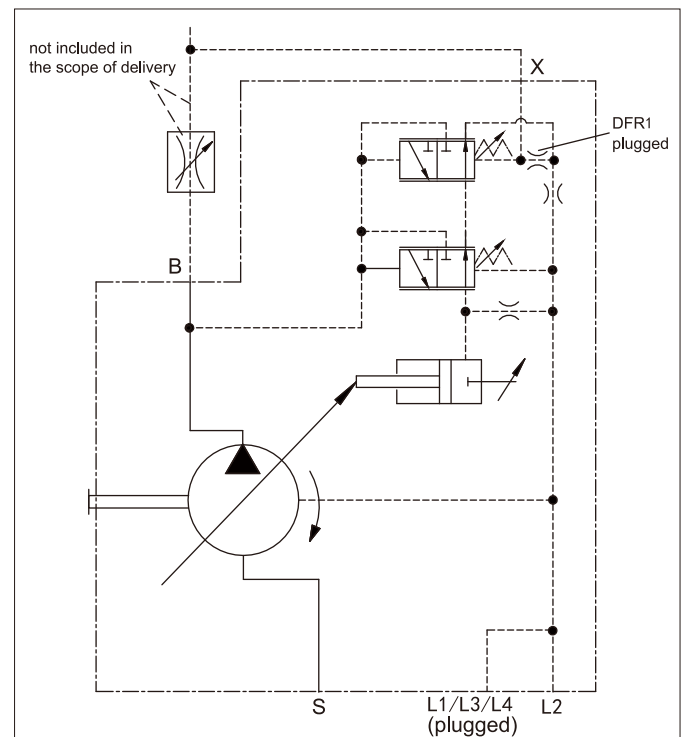
Standard setting: 14-22bar

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

Unloading port X to the reservoir results in a zero stroke pressure

$P=1.8\pm 0.2\text{MPa}$ (standby)

#### Hydraulic Circuit Diagram



#### Port

B \_\_\_\_\_ Drain port

S \_\_\_\_\_ Suction port

L1/L2/L3/L4 \_\_\_\_\_ Case drain port

X \_\_\_\_\_ Pilot pressure port

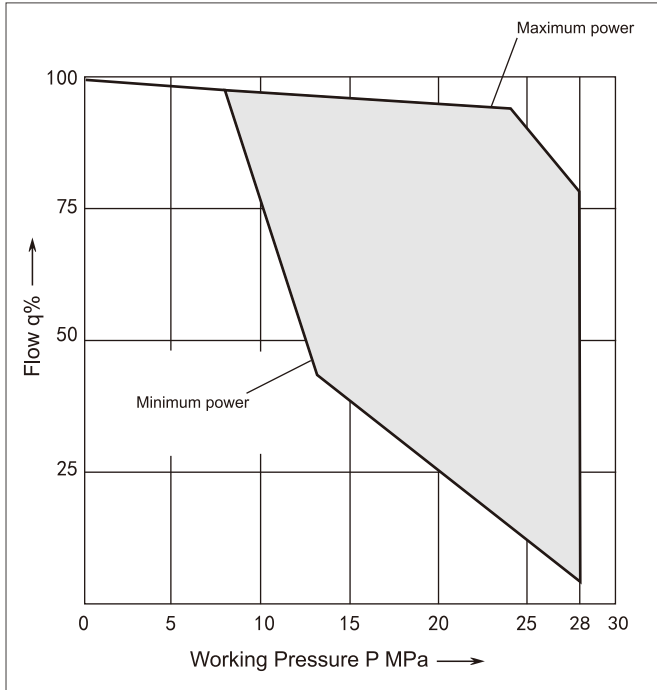


➤ **DFLR-Pressure/Flow/Constant Power Control; DLR-Pressure/Constant Power Control**

Under various working pressures, in order to obtain a constant driving torque, the swing angle and flow rate of the axial piston pump also change accordingly, thereby maintaining the product of pressure and flow rate at a constant value.

Flow control can only be below the constant power control curve.

**Static Characteristic Curve**



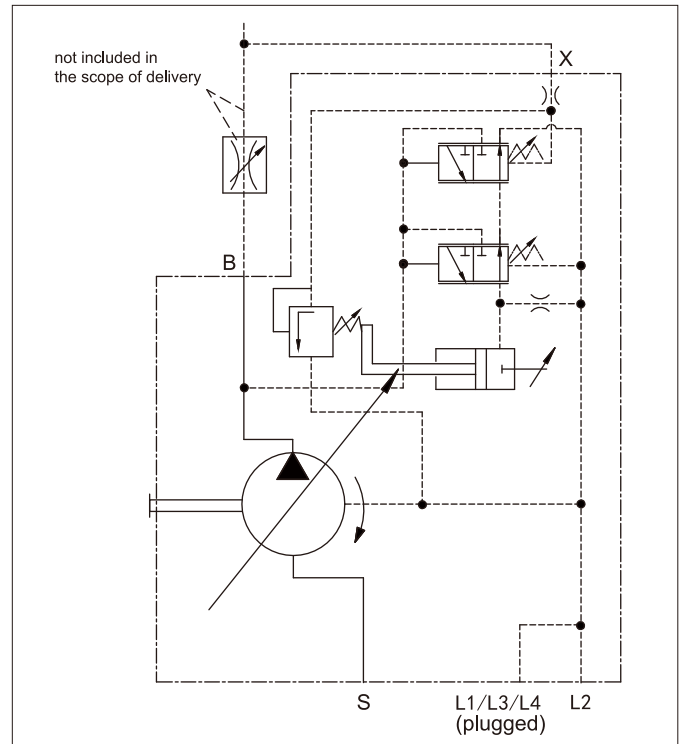
Factory settings, please state in clear text.  
20kw at 1500rpm.

**Controller reference**

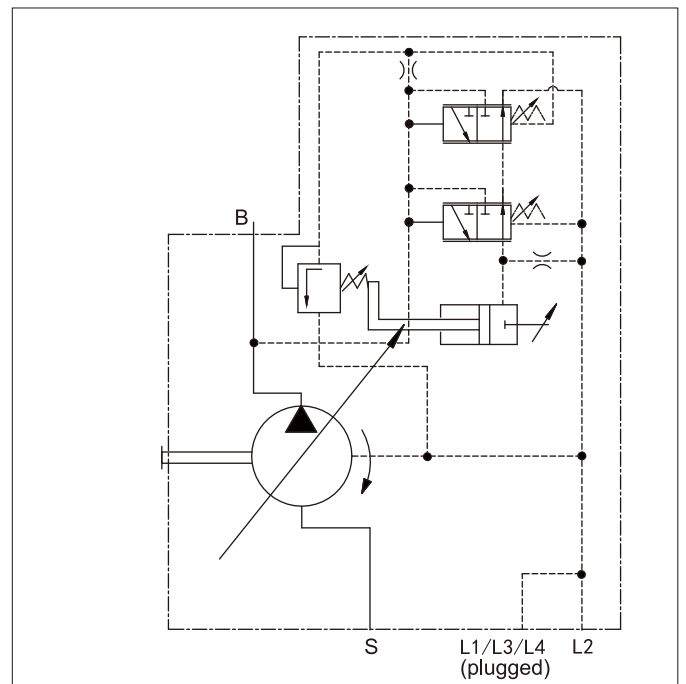
Pressure control see DR  
Flow control see DRDFR/DFR1

Control the starting \_\_\_\_\_ from 5MPa  
Control consumption \_\_\_\_\_ Maximum 5.5L/min

**Hydraulic Circuit Diagram,DFLR**



**Hydraulic Circuit Diagram,DLR**



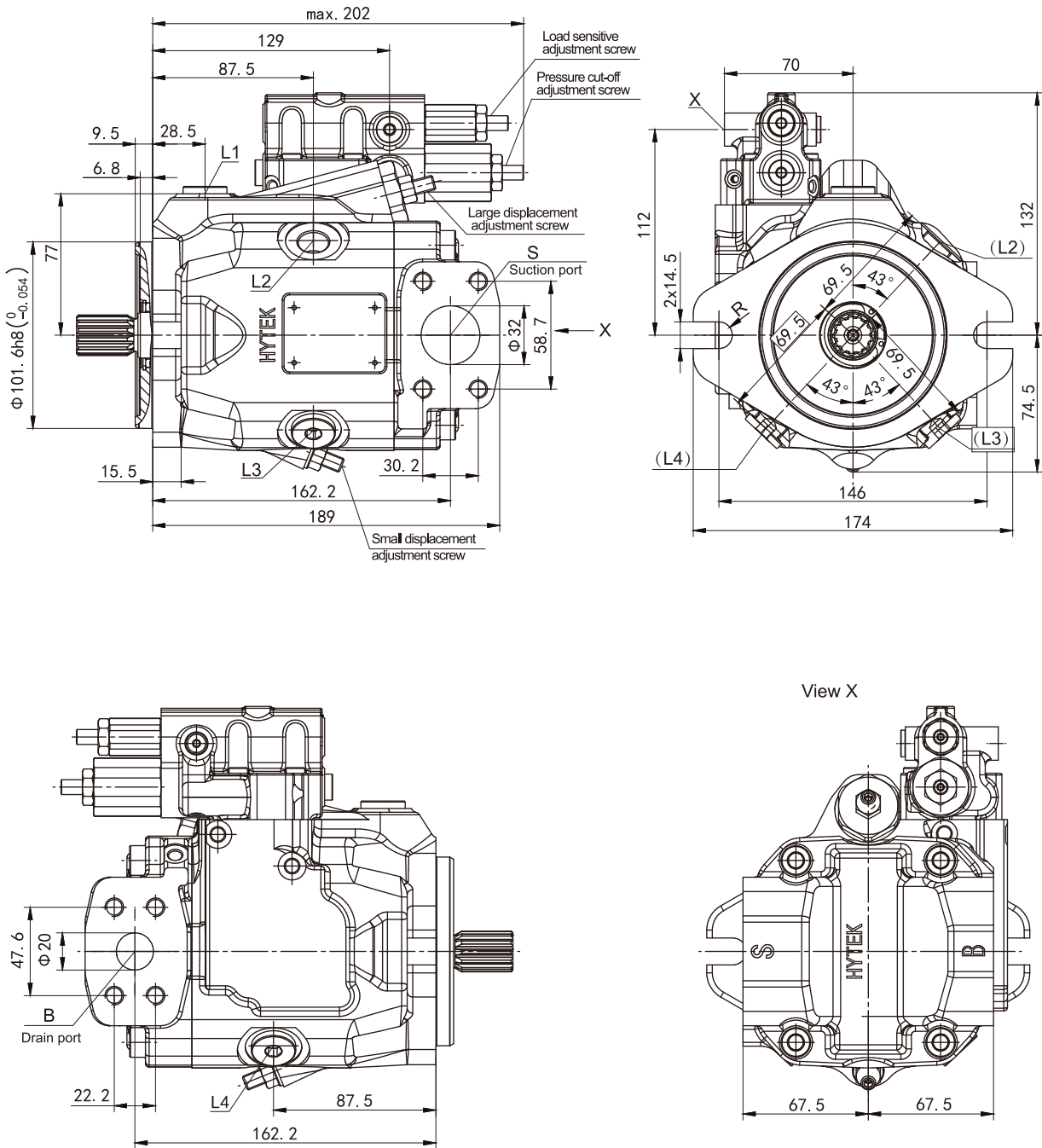
**Port**

- B \_\_\_\_\_ Drain port
- S \_\_\_\_\_ Suction port
- L1/L2/L3/L4 \_\_\_\_\_ Case drain port
- X \_\_\_\_\_ Pilot pressure port



► Installation Dimensions, 28

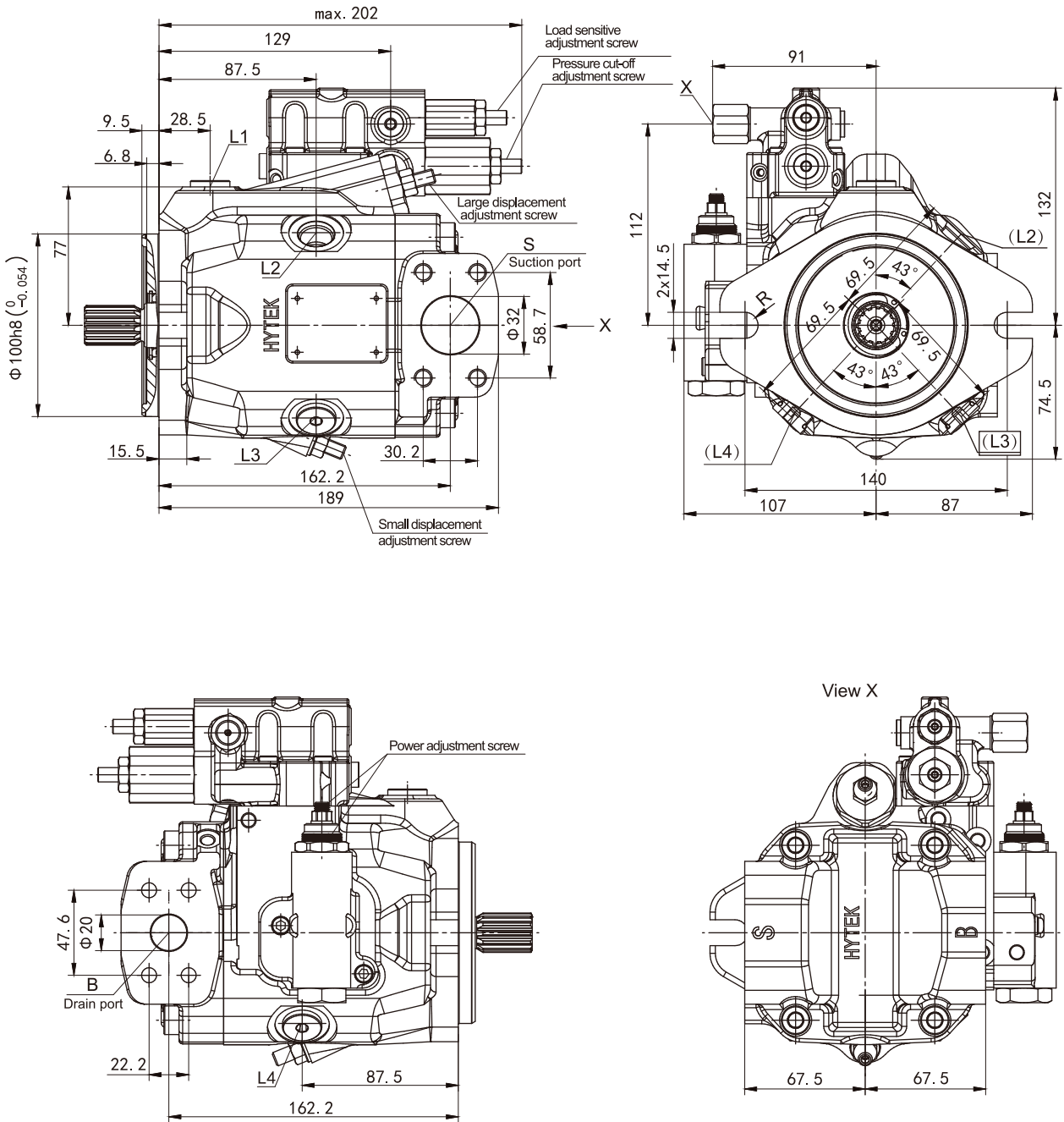
DFR/DFR1-Pressure/Flow controller, clockwise rotation, mounting flange C





► Installation Dimensions, 28

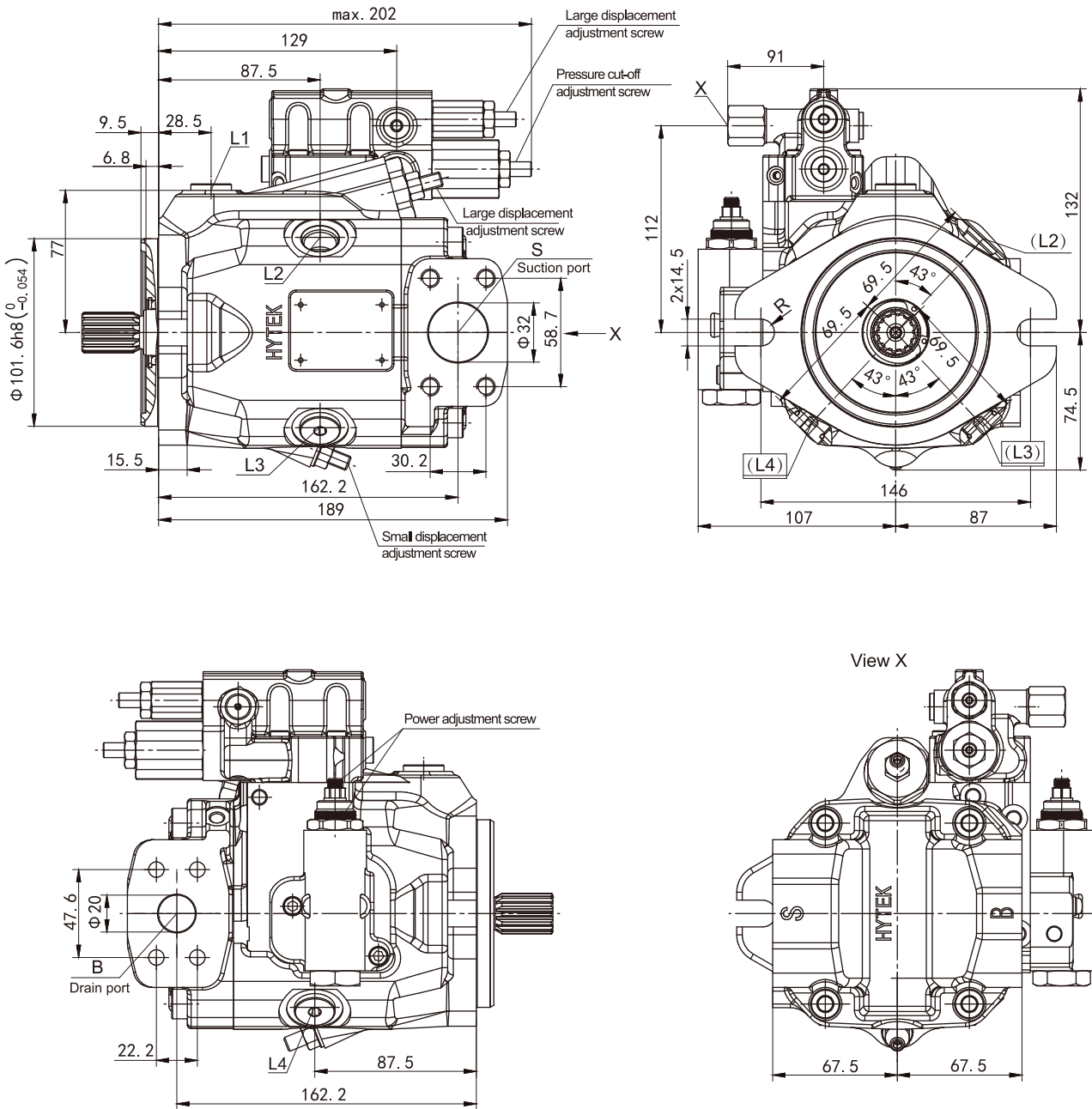
DFLR-Pressure/Flow/Power controller, clockwise rotation, mounting flange A





► Installation Dimensions, 28

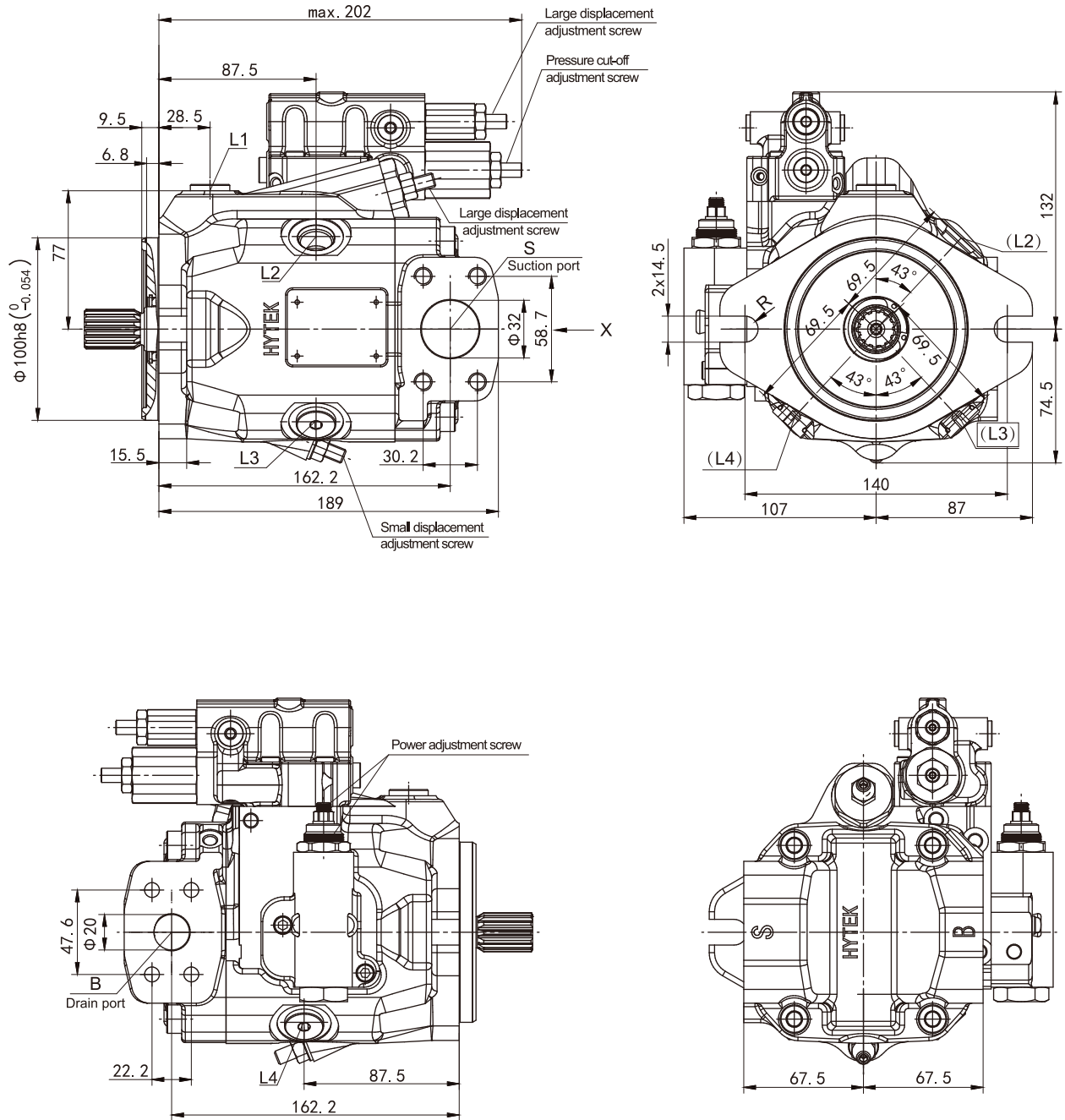
DFLR-Pressure/Flow/Power controller, clockwise rotation, mounting flange C





► Installation Dimensions, 28

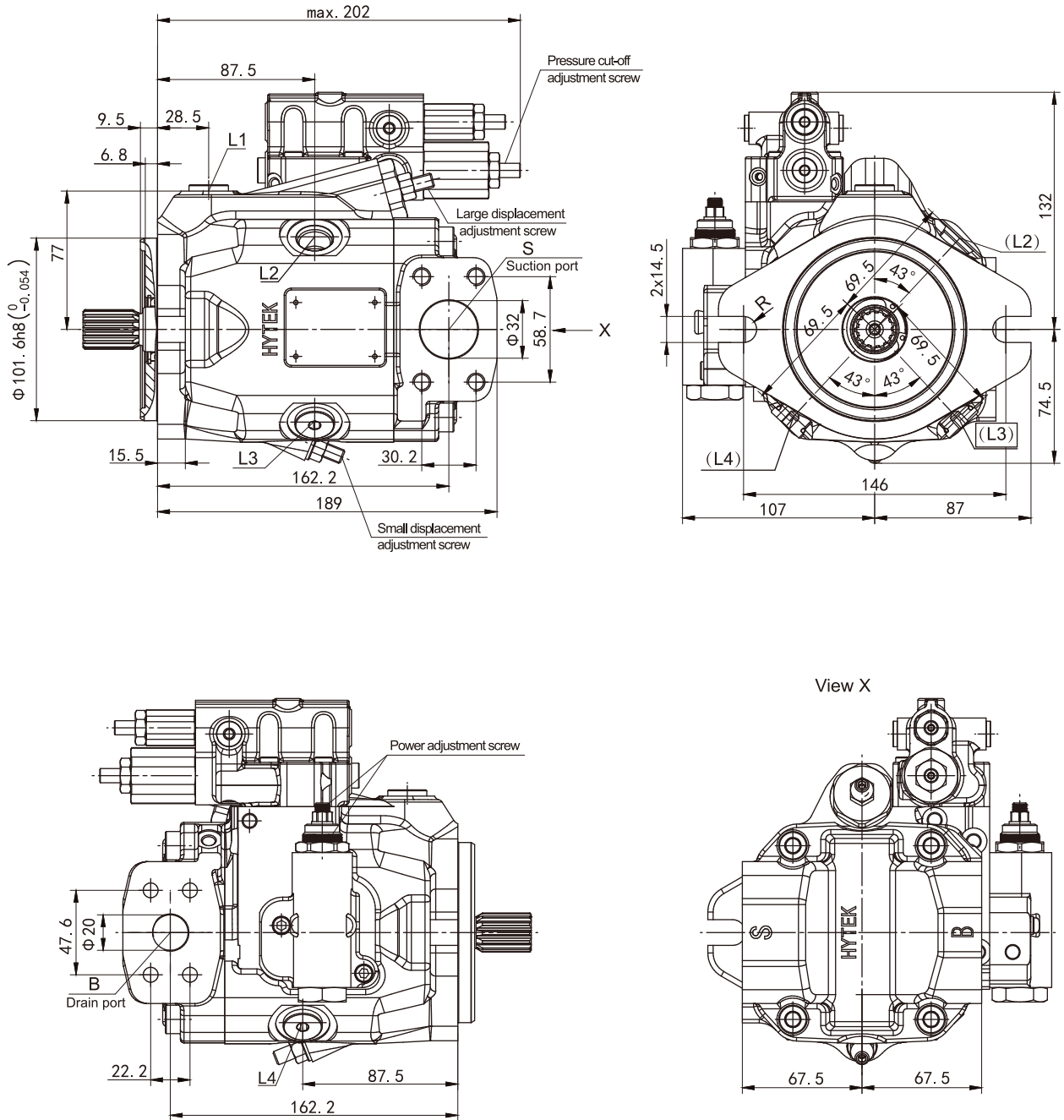
DLR-Pressure/Power controller, clockwise rotation, mounting flange A





► Installation Dimensions, 28

DLR-Pressure/Power controller, clockwise rotation, mounting flange C

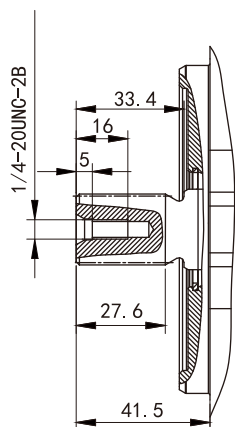




► Installation Dimensions, 28

Drive shaft

Splined shaft  
 Maximum allowable input torque 198Nm  
 SAE J744 7/8" S1-13T 16/32DP



Port type

Port		Standard	Size	Torque(Nm)	Code
L1/L2/L3/L4	Drain port	SAE J1926-1	3/4-16UNF-2B,13deep,O-ring seal	85	S
X	Pilot pressure	SAE J1926-1	7/16-20UNF-2B,11.5deep,O-ring seal	20	
L1/L2/L3/L4	Drain port	JIS B2351-1G	G1/2,20.5deep,O-ring seal	95	G
X	Pilot pressure	ISO 1179	G1/4,12deep,ED seal	30	
L1/L2/L3/L4	Drain port	ISO 9974-1	M18×1.5,13deep,ED seal	60	I
X	Pilot pressure(M)	ISO 9974-1	M14×1.5,12deep,ED seal	35	

Working port

Port		Standard	Size	Torque(Nm)	Code
B	Drain port	SAE J518C	Φ20,M10,17deep	57	12
S	Suction port		Φ32,M10,17deep		



### > Installation Instructions

#### General

The pump must be filled with hydraulic fluid during commissioning and operation.

To reduce noise, all connecting lines (inlet line, pressure line and case drain line) must be isolated from the reservoir with flexible components.

Do not install any check valve in the case drain line.

You must consult us before implementation in special cases.

### > Vertical Installation (drive shaft upwards)

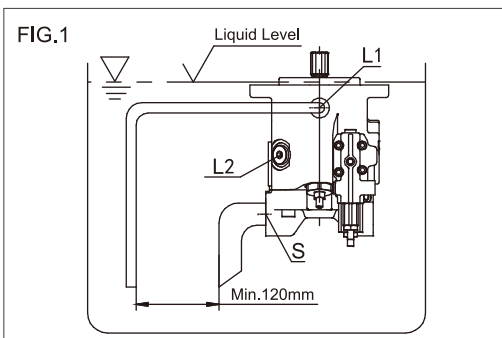
The installation below is for your reference:

#### a. Inside-reservoir installation

Fill the pump and lay it horizontal before installation.

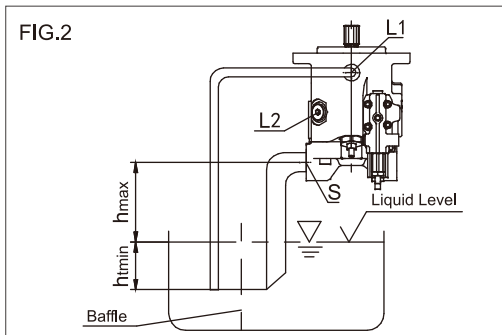
a) If the minimum fluid level of the reservoir is equal to or higher than the mounting flange surface of the pump, plug port L2, and open ports L1 and S; connect pipes to ports L1 and S as shown in FIG. 1.

b) If the minimum fluid level of the reservoir is below the mounting flange surface of the pump, connect pipes to ports L1 and S as shown in FIG. 2.



#### b. Outside-reservoir installation

Fill the pump and lay it horizontal before installation. See FIG. 2 for above-reservoir installation.



Restriction: Minimum inlet pressure under static and dynamic conditions  $P_{absmin}=0,8bar$ .

Note: Do not install the pump above the reservoir as far as possible to reduce noise.

The permissible suction height  $h$  results from the total pressure loss, but it should not exceed  $h_{max}=800mm$ (pipe immersion depth  $h_{min}=200mm$ ).

### > Horizontal Installation

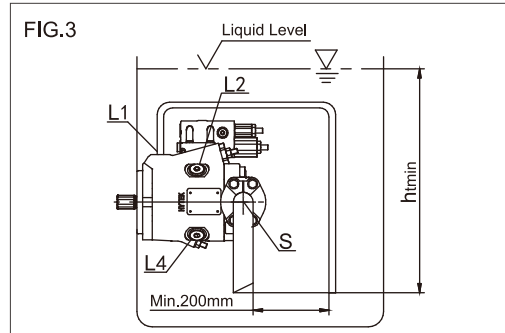
For horizontal installation, set port L1 on the top.

The installation below is for your reference:

#### a. Inside-reservoir installation

a) If the minimum fluid level of the reservoir is above the top of the pump, plug port L2 and L4; you may open ports L1 and S, and connect pipes to the two ports (as shown in FIG. 3).

b) If the minimum fluid level of the reservoir is below the top of the pump, plug port L2 and L4; see FIG.4 for pipe connection of port L1 and possibly port S.

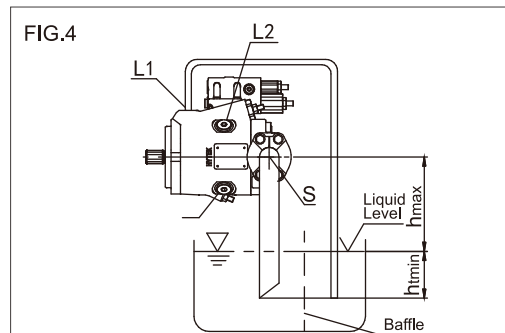


#### b. Outside-reservoir installation

Fill the pump before commissioning.

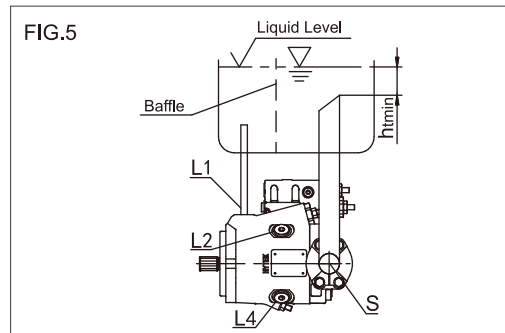
Connect pipes to port S and the top port L1.

a) See FIG. 4 for above-reservoir installation.



b) Below-reservoir installation

See FIG. 5 for pipe connection of ports L1 and S. Port L2 is plugged.











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If there are any other modifications, no further notice will be given.