1-1 Pump Options

	1	2	3	4	5	6	7	8	9	10	11	12
Model Code	K3VLS	105	-	1	BB	R	CC	S	-	L1	A	A	M1

1. K3VLS Series Pump
K3VLS Series, Variable Displacement,
Axial Piston, Open Loop Pump

2. Pump Size

		50	65	85	105	150
Maximum Displacement	cm^3	●	●	●	●	●

3. O-ring Material

-	NBR (Orings:Nitrile rubber, Oil Seal: Fluoro rubber)
V	Viton (Orings: Fluoro rubber, Oil Seal: Fluoro rubber)

4. Series Type Code

1	Standard Type

5. Through Drive and Porting

		50	65	85	105	150
0	w/o Through Drive, Side Ported	●	●	●	●	●
A	SAE-A Through Drive, Side Ported	●	●	●	●	—
B	SAE-B Through Drive, Side Ported	●	●	●	●	●
BB	SAE-BB Through Drive, Side Ported	●	●	●	●	●
C	SAE-C, 2/4 bolt, Through Drive, Side Ported	—	●	●	●	●
CC	SAE-CC, 2/4 bolt, Through Drive, Side Ported	—	—	—	●	●
N	w/ Through Drive Shaft, w/o Coupling, Closed w/ Steel Cover, Side Ported	●	●	●	●	●
R	w/o Through Drive, Rear Ported	●	●	●	○	○

6. Direction of Rotation

		50	65	85	105	150
R	Clockwise	●	●	●	●	●
L	Counterclockwise	●	●	●	●	●

7. Mounting Flange and Shaft

		50	65	85	105	150
B	SAE-B Mount & SAE B Spline	●	●	—	—	—
BB	SAE-B Mount & SAE BB Spline	●	●	—	—	—
C	SAE-C Mount & SAE C Spline (Only SAE C-4 mount for K3VLS65 & 150)	—	●	●	●	●
CC	SAE-C Mount & SAE CC Spline (Only SAE C-4 mount for K3VLS150)	—	—	—	●	●
D	SAE-D Mount & SAE D Spline (for K3VLS150, w/ Torque Limit Control is not available)	—	—	—	—	●
K2	SAE-B Mount & SAE BB Keyed Shaft (for K3VLS50 & 65)	◆	◆	—	—	—
K3	SAE-C Mount & SAE C Keyed Shaft (for K3VLS65 & 85)	—	◆	◆	—	—
K4	SAE-C Mount & SAE CC Keyed Shaft (for K3VLS105)	—	—	—	◆	—

8. Flange / Mounting Fixing Thread (Suction-Delivery, Through Drive)

	Flange Thread Suction- Delivery	Mounting Thread Through Drive	50	65	85	105	150
S	Unified	Metric	●	●	●	●	●
H	Metric	Metric	●	●	●	●	●

● : Available
○ : Please contact Kawasaki
— : Not available
◆ : Only available in Europe/US

1. Ordering Code

1-2 Regulator Options

	1	2	3	4	5	6	7	8		9	10	11	12		13
Model Code	K3VLS	105	-	1	BB	R	CC	S	-	L1	A	A	M1	-	T***

9. Flow Control

	Load Sense	Pressure Cut-Off Control	50	65	85	105	150
L0	w/ LS, w/ Bleed-off Orifice	w/ Pressure Cut-Off	●	●	●	●	●
L1	w/ LS, w/o Bleed-off Orifice	w/ Pressure Cut-Off	●	●	●	●	●
P0	w/o LS	w/ Pressure Cut-Off	●	●	●	●	●

	Electric Inverse Proportional Pressure Control	50	65	85	105	150
PR2	PR2 : w/o LS, w/ Pressure Cut-Off – Electric Inverse Proportional Pressure Control (24V, Deutsch Connector)	●	●	●	●	●

10. Differential Pressure Setting Range (For the details see page 14)

		50	65	85	105	150
Blank	In case PR2 is chosen at "9"	●	●	●	●	●
A	Standard Setting Range (1.0 - 3.0MPa)	●	●	●	●	●
C	High Setting Range (1.5 - 4.0MPa)	●	●	●	●	●

11. Additional Control Options

(For the additional control options "11", only one option per column is acceptable.)

		50	65	85	105	150
Blank	w/o Any Additional Control or in case PR2 is chosen at "9"	●	●	●	●	●

	Torque Limit Control	50	65	85	105	150
00	w/o Any Additional Control, w/ cover plate for Torque Limit	◆	◆	◆	◆	◆
A	w/o Power Shift Control	●	●	●	●	●
B	w/ Power Shift Control Pilot Operated	●	●	●	●	●
	w/ Electric Proportional Reducing Valve,					
C2	Voltage:24V, Deutsch Connector	●	●	●	●	●
C3	Voltage:12V, Deutsch Connector	●	●	●	●	●

	Electric Displacement Control (Positive Control)	50	65	85	105	150
	w/ Fail-safe Function					
E2	Voltage:24V, Deutsch Connecter	●	●	—	—	—
E3	Voltage:12V, Deutsch Connecter	●	●	—	—	—
	w/o Fail-safe Function,					
F2	Voltage:24V, Deutsch Connecter	●	●	—	—	—
F3	Voltage:12V, Deutsch Connecter	●	●	—	—	—

● : Available
○ : Please contact Kawasaki
— : Not available
◆ : Only available in Europe/US

1-2 Regulator Options

	1	2	3	4	5	6	7	8		9	10	11	12		13
Model Code	K3VLS	105	-	1	BB	R	CC	S	-	L1	A	A	M1	-	T***

12. Torque Limit Setting (Available only with the attachment of Torque Limiter)

		50	65	85	105	150
Blank	w/o Any Torque Limit Setting	●	●	●	●	●
H1	H Spring, Corner Torque 85%	●	●	●	●	●
H2	H Spring, Corner Torque 75%	●	●	●	●	●
H3	H Spring, Corner Torque 65%	●	●	●	●	●
H4	H Spring, Corner Torque 55%	●	●	●	●	●
M1	M Spring, Corner Torque 70%	●	●	●	●	●
M2	M Spring, Corner Torque 60%	●	●	●	●	●
M3	M Spring, Corner Torque 50%	●	●	●	●	●
M4	M Spring, Corner Torque 40%	●	●	●	●	●
M5	M Spring, Corner Torque 30%	●	●	●	●	●

Code H1 to H4: for torque limit control with power shift control (Additional Control Option Code [11]: "B", "C2", and "C3")
Code M1 to M5: for torque limit control without power shift control (Additional Control Option Code [11]:"A")

13. Special Suffix

T***	Special Suffix

● : Available
○ : Please contact Kawasaki
— : Not available
◆ : Only available in Europe/US

2 Technical Information

2-1 Specifications

Size			50	65	85	105	150
Displacement		cm^3	50	65	85	105	150
Pressure	Rated	MPa	28				
	Peak	MPa	35				
Allowable case pressure		MPa	0.1 continuous / 0.4 peak				
Speed	Self prime*1	min^{-1}	2,700	2,600	2,500	2,300	2,200
	Maximum*2	min^{-1}	3,250	3,000	3,000	2,640	2,400
Case volume		L	0.8	1.0	1.2	1.7	2.3
Temperature range		°C	−20 to +95				
Viscosity range		cSt	10 to 1,000				
Maximum contamination level			ISO 4406 -/18/15				
Allowable through drive torque Nm	SAE A		123	123	123	123	–
	SAE B		380	380	380	380	380
	SAE BB		435	435	435	435	435
	SAE C		–	435	435	558	435
	SAE CC		–	–	–	702	899
	SAE D		–	–	–	–	–
Mass		kg	21	25	31	37	52
Moment of inertia		$kg\ m^2$	2.89×10^{-3}	5.30×10^{-3}	6.77×10^{-3}	9.85×10^{-3}	1.82×10^{-2}
Torsional stiffness		Nm/rad	4.56×10^{4}	5.26×10^{4}	6.79×10^{4}	1.32×10^{5}	1.99×10^{5}
Coating			Red synthetic resin primer				

*1 : Self prime speed is the maximum operating speed under the self priming condition at maximum displacement. Steady state inlet pressure should be greater or equal to 0 MPa gauge.

*2 : Maximum speed is the maximum operating speed that can run without damage to the pump under restriction of operating conditions.

■ Allowable maximum input torque

1. SAE spline shaft

	SAE B	SAE BB	SAE C	SAE CC	SAE D
Spline specifications	13T 16/32 DP	15T 16/32 DP	14T 12/24 DP	17T 12/24 DP	13T 8/16 DP
Allowable maximum input torque (Nm)	200	315	630	1,060	1,490
Pump size	K3VLS50 K3VLS65	K3VLS50 K3VLS65	K3VLS65 K3VLS85 K3VLS105 K3VLS150	K3VLS105 K3VLS150	K3VLS150

(Note) Maximum pressure must be reduced to operate within the allowable maximum input torque as below when the torque limit control is not used.
SAE B spline K3VLS50: 24 MPa K3VLS65: 18 MPa
SAE C spline K3VLS150: 25 MPa

For above options, if 28 MPa is needed, use the torque limit control.

2-1 Specifications

2. SAE keyed shaft

	SAE BB	SAE C	SAE CC
Keyed Width (mm)	6.35	7.94	9.53
Allowable maximum input torque (Nm)	230	430	700
Pump size	K3VLS50 K3VLS65*	K3VLS65 K3VLS85	K3VLS105

*(Note) Maximum pressure must be reduced to operate within allowable maximum input torque as below when the torque limit control is not used.
SAE BB Key K3VLS65: 22 MPa

For above options, if 28 MPa is needed, use the torque limit control.(Power shift H1 & H2 not available)

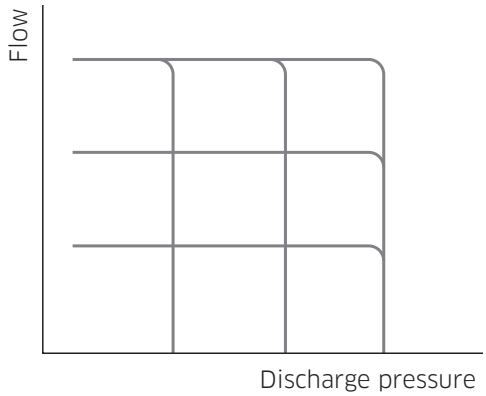
2-2 Functional Description of Regulator

Load Sensing and Pressure Cut-off
(Ordering Code [9]: L0 / L1)

This regulator has function of flow and pressure control (i.e. load sensing control and pressure cut-off control.)
To control flow a variable orifice is used. (A variable orifice is not included in the pump and shall be prepared separately.) Pump displacement is controlled to maintain the differential pressure across the orifice constant. The flow is controlled to a required flow regardless of pump delivery pressure. In addition, there is a pressure cut off function incorporated into the control. The pressure cut-off function overrides the flow control function.

L0 control: with a bleed off orifice
L1 control: without a bleed off orifice

Releasing the pressure at port PL results in standby condition, which provides zero flow at unloading condition. The unloading pressure is typically 0.1 to 0.2 MPa higher than differential pressure setting.



Flow, Pressure control curve

■ Differential pressure setting
Standard setting at factory : 1.5 +0.3/-0.2 MPa
Load sensing differential pressure range can be selected from two setting ranges.

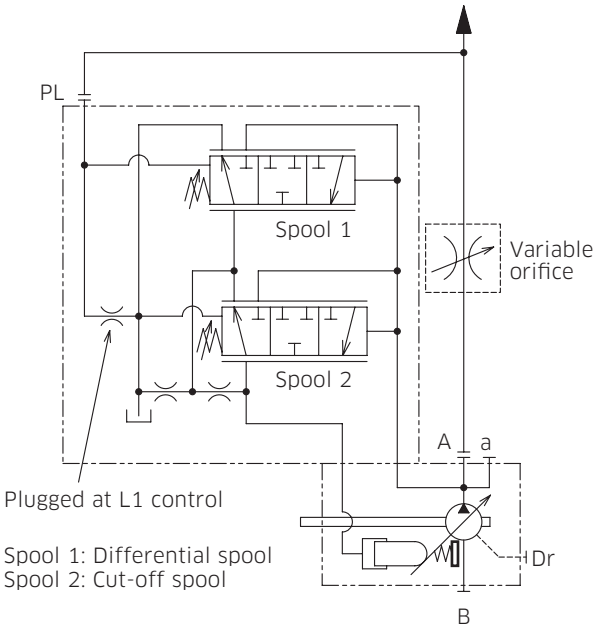
unit: MPa

Code	Adjustment range	Adjustment sensitivity
A	1.0 to 3.0	1.3 / turn
C	1.5 to 4.0	2.5 / turn

■ Pressure cut-off setting
Standard setting at factory : 28 0/-1.5 MPa
Pressure cut -off setting range is from 5 MPa to 28 MPa.

unit: MPa

Adjustment range	Adjustment sensitivity
5.0 to 28.0	8.0 / turn



Hydraulic circuit

2-2 Functional Description of Regulator

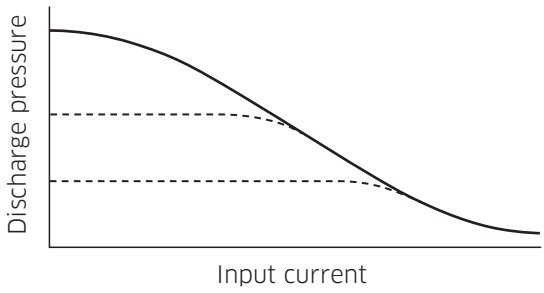
Electric Inverse Proportional Pressure Control -Voltage:24V, Deutsch Connecter (Ordering Code [9]: PR2)

This regulator is Electro-hydraulic pressure control type of regulator. A current is input from the controller to the solenoid of the regulator, and the pressure is controlled by the inverse proportional solenoid valve. Since the regulator tries maintaining the pressure which is set by the valve, the pump discharge is controlled according to the load of the actuator. Thus, the pump supplies only the amount of hydraulic oil required by the actuator. Even if the input current to the solenoid becomes zero at the electric failure of the machine, the pressure set will be maximum, and the pump displacement will be also maximum, so it functions as electric fail-safe.

The pressure of cut-off valve can be set between 28MPa and 10MPa. The control effective range of the solenoid is decided by the cut-off valve setting. (e.g. in case the cut-off setting is 20MPa, the control range is 230mA - 500mA.)

■ Recommended dither condition for the input current
Dither frequency: 200 Hz
Dither amplitude: 200 mA_{p-p}

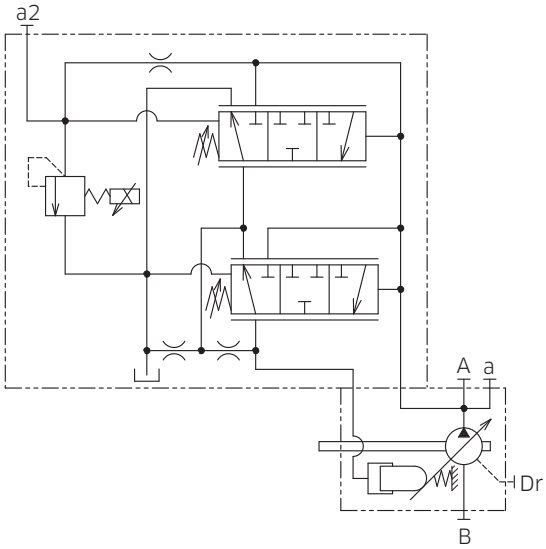
	PR2
Rated current [mA]	700
Coil resistance (at 20℃) [Ω]	26.2
Power consumption (at cold) [W]	22
Connector type	Ladd Distribution DT04-2P
Water proof	IP69K



Input current – Discharge pressure curve

Max. pressure setting	Input current control range
28 MPa	120 - 500 mA
26 MPa	150 - 500 mA
24 MPa	180 - 500 mA
22 MPa	210 - 500 mA
20 MPa	230 - 500 mA
18 MPa	250 - 500 mA
16 MPa	275 - 500 mA
14 MPa	300 - 500 mA
12 MPa	325 - 500 mA
10 MPa	350 - 500 mA

Control effective range



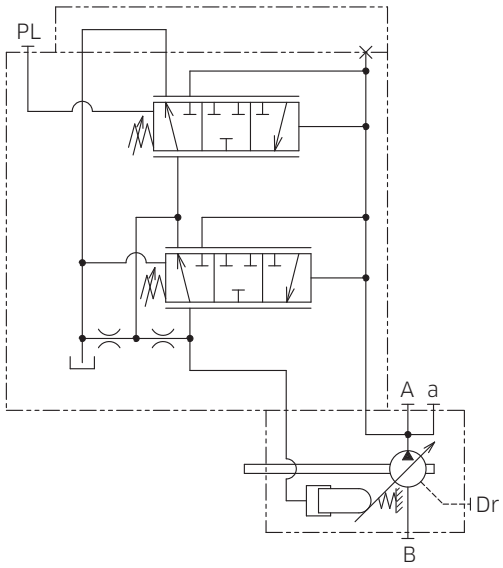
Hydraulic circuit

2-2 Functional Description of Regulator

w/o Any Additional Control, w/cover plate for Torque Limit (Ordering Code [11]: 00)

When the "00" option is selected in section 11 of the model code the K3VLS pump is supplied as a torque limit ready pump. The pump has a blanking plate fitted instead of the torque limiter. This offers better flexibility to configure the pump as required.

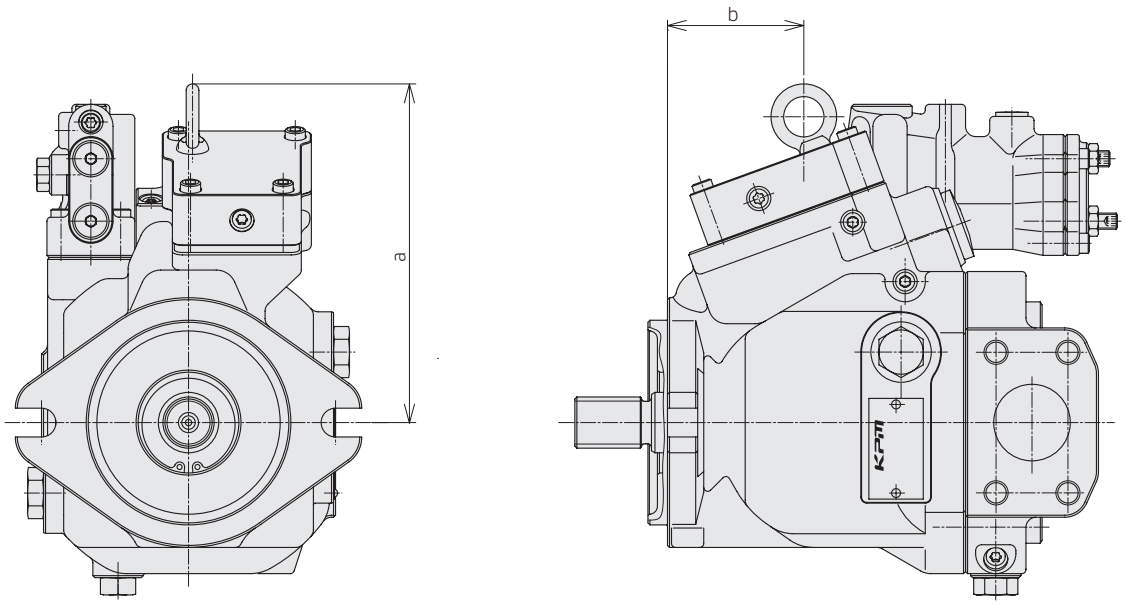
The pump as ordered will function as a load sense or pressure compensated pump depending on your selection of flow control in section 9 of the model code. If the torque limit blanking cover is then replaced with a torque limit regulator the pump has the torque limit control functionality. Note that the torque limit regulator would need to be set.



Hydraulic circuit

2-2 Functional Description of Regulator

w/o Any Additional Control, w/cover plate for Torque Limit
(Ordering Code [11]: 00)



	a	B
K3VLS50	168	68
K3VLS65	180	74
K3VLS85	182	81
K3VLS105	200	81
K3VLS150	210	94

2-2 Functional Description of Regulator

Pressure Cut-off (Ordering Code [9]: P0)

This regulator has function of pressure control. As discharge pressure rises to the cut-off setting, the pump displacement is reduced to prevent the discharge pressure from exceeding and keep the set pressure. It is imperative that a safety relief valve be installed in the system.
By connecting the Pc port to a remote pressure control relief valve, variable pump pressure control can be achieved.
The remote pressure control relief valve is to be set to 1.5 MPa below to the required system pressure.

The remote control relief valve is out of scope of supply.

■ Differential pressure setting
Standard setting at factory : 1.5 +0.3/-0.2 MPa
Load sensing differential pressure range can be selected from two setting ranges.

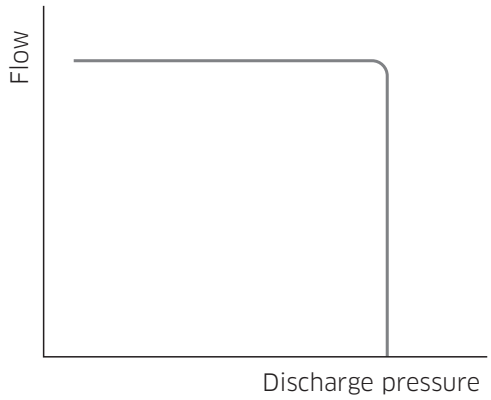
unit: MPa

Code	Adjustment range	Adjustment sensitivity
A	1.0 to 3.0	1.3 / turn
C	1.5 to 4.0	2.5 / turn

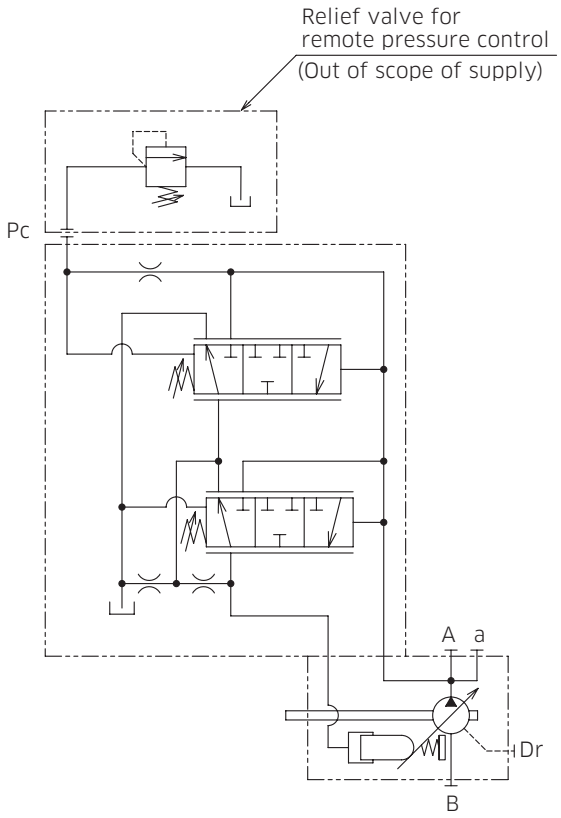
■ Pressure cut-off setting
Standard setting at factory ： 28 0/-1.5 MPa
Pressure cut –off setting range is from 5 MPa to 28 MPa.

unit: MPa

Adjustment range	Adjustment sensitivity
5.0 to 28.0	8.0 / turn



Flow, Pressure control curve



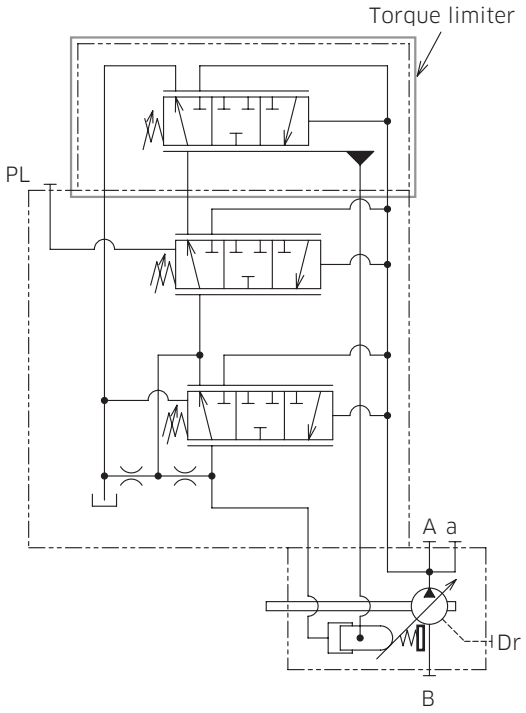
Hydraulic circuit

2-2 Functional Description of Regulator

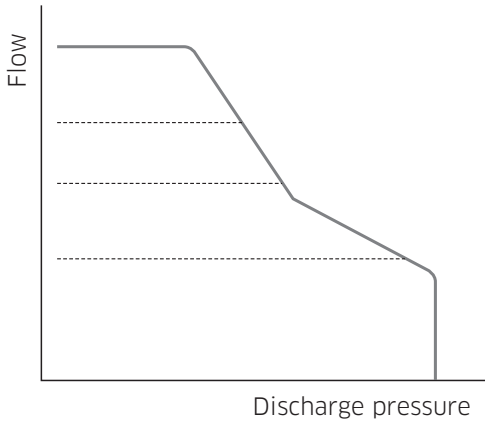
Torque Limiter
(Ordering Code [11]: A)

L0/L1 control functions as previously noted. In response to a rise in delivery pressure the swash plate angle is decreased, restricting the input torque. This regulator prevents excessive load against the prime mover.
The torque limiter is comprised of two springs that oppose the spool force generated by the system pressure. By turning the adjustment screws, the appropriate input torque limit can be set.

Torque limiter control setting is shown in the attached table, and the torque limiter can be adjusted by the torque value of the table. Refer to the instruction manual for adjustment.



Hydraulic circuit

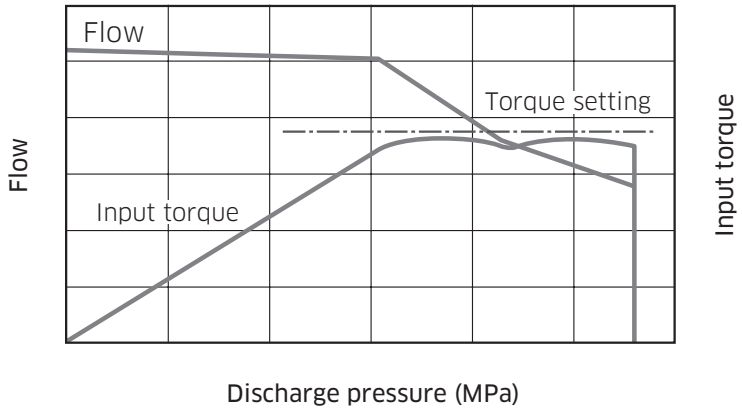


Torque limiter control curve

2-2 Functional Description of Regulator

◆ Torque Limiter Settings
(Ordering Code [11]: A)

■ Pump control curve (sample)



■ Torque setting without power shift function

	Ordering code [12]				
Pump size	M1	M2	M3	M4	M5
K3VLS50	155	135	110	90	65
K3VLS65	200	175	145	115	85
K3VLS85	265	227	190	150	115
K3VLS105	330	281	235	190	140
K3VLS150	470	400	335	265	-

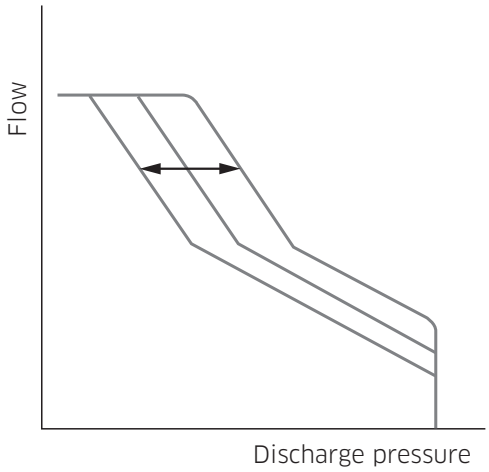
Unit : Nm

2-2 Functional Description of Regulator

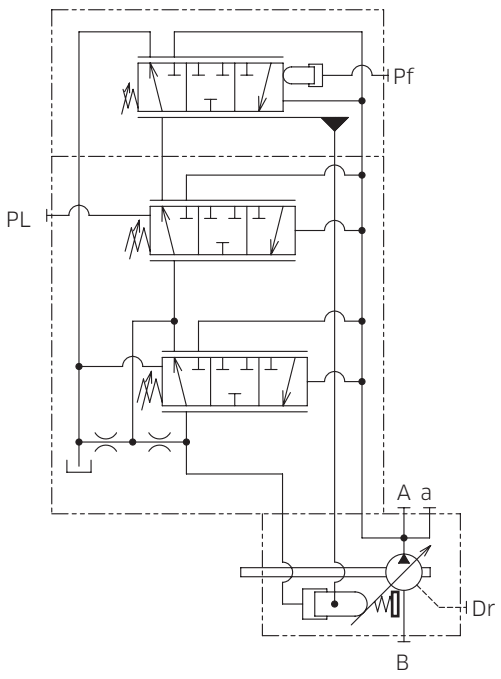
Torque Limiter with Power Shift
(Ordering Code [11]: B, C2, C3)

Torque limiter is available with variable torque limit control. Torque limit setting can be varied by the external pilot pressure supply (code “B”) or the integrated electric proportional control valve with the external servo pressure supply (code “C”). Code “B” and “C” enable to shift the power control setting as shown in the following torque limiter control characteristic curve.

See the table (page 19) for torque setting according to the external pilot pressure or the input current to the integrated proportional valve. Required servo pressure to the solenoid is 3.5 to 4.5 MPa.

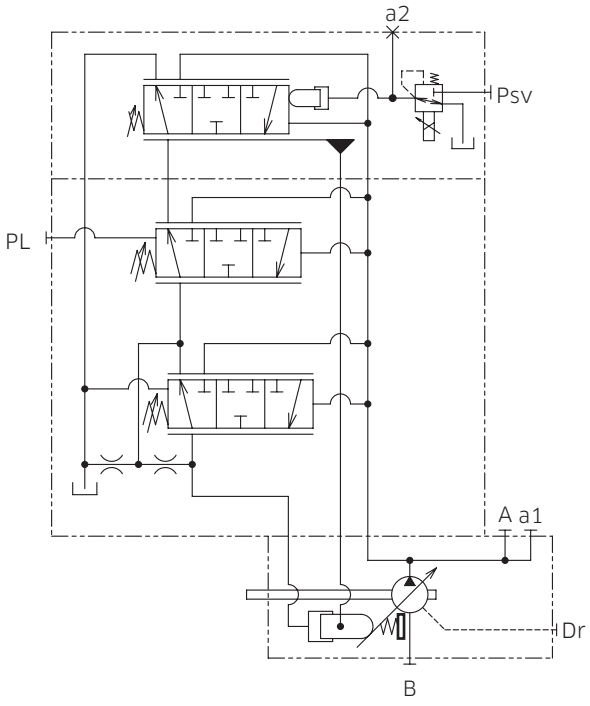


Torque limiter control curve



External pilot pressure (Pf) range: 0 to 4.0 MPa

Hydraulic circuit, code B



Required servo pressure (Psv): 3.5 to 4.5 MPa

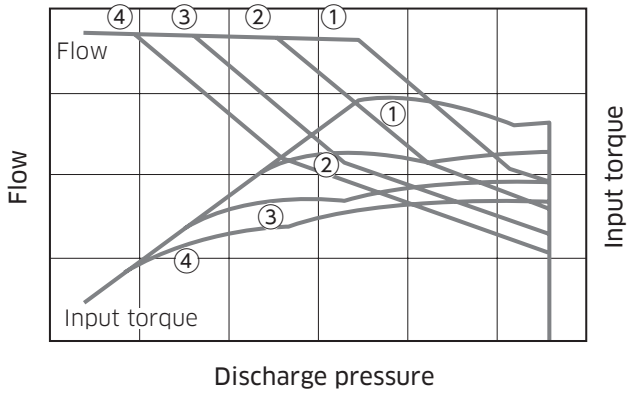
Hydraulic circuit, code C

2. Technical Information

2-2 Functional Description of Regulator

◆ Torque Limiter and Power Shift Settings
(Ordering Code[11] : B, C2, C3)

■ **Pump control curve with power shift (sample)**



■ Recommended dither condition for the input current
Dither frequency: 100 Hz
Dither amplitude: for C2 200 mA_{p-p}
for C3 400 mA_{p-p}

	C2	C3
Rated current [mA]	750	1,500
Coil resistance [Ω]	20.8	4.7
Power consumption (at 100℃) [W]	19	
Connector type	Ladd Distribution DT04-2P	
Water proof	IP6K6/IPX9K	

■ **Table. Torque Setting with power-shift function**

Ordering code [11]		Code : B	Code : C2, C3					
					Ordering code [12]			
Pump size		Pf (MPa)	Current (mA)		Max. Input torque (Nm)			
			24V C2	12V C3	H1	H2	H3	H4
K3VLS50	①	0.00	0		220	200	170	150
	②	0.75	290	570	190	170	145	125
	③	2.00	490	970	165	140	120	100
	④	3.30	690	1,370	135	115	95	80
K3VLS65	①	0.00	0		285	250	220	190
	②	0.75	290	570	245	215	185	160
	③	2.00	490	970	210	180	150	130
	④	3.30	690	1,370	175	145	120	100
K3VLS85	①	0.00	0		375	330	290	245
	②	0.75	290	570	325	285	245	205
	③	2.00	490	970	280	240	200	165
	④	3.30	690	1,370	230	195	160	125
K3VLS105	①	0.00	0		455	405	360	310
	②	0.75	290	570	395	350	305	260
	③	2.00	490	970	340	295	250	210
	④	3.30	690	1,370	280	235	200	160
K3VLS150	①	0.00	0		655	585	510	440
	②	0.75	290	570	570	500	435	370
	③	2.00	490	970	475	410	355	295
	④	3.30	690	1,370	385	330	275	225

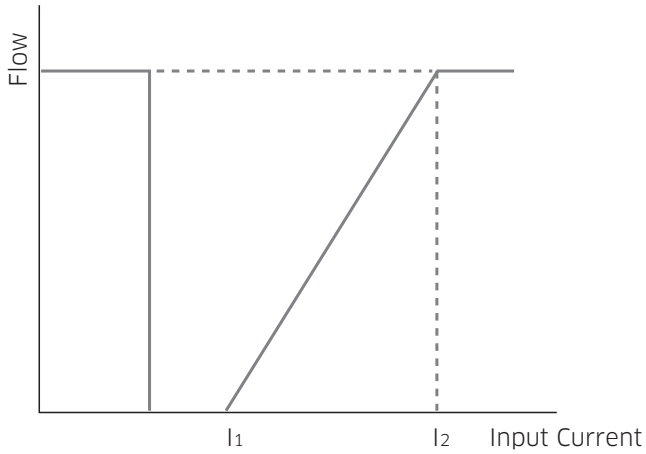
Input torque in the above table is planned value and for reference.
Displacement ratio (%) = Displacement / Max. Displacement

2-2 Functional Description of Regulator

◆ Electric Displacement Control (Positive Control)

- With Fail-safe Function (Ordering Code[11]: E2, E3)
- Without Fail-safe Function (Ordering Code[11]: F2, F3)

The electric displacement control enables the pump displacement to be changed according to the change of input current to the solenoid. The pump displacement can be adjusted in proportion to the input current between the input current of I_1 and I_2 (refer to control curve).
With fail-safe function, at loss of input current in such case of brakage of electric wires, the pump displacement becomes maximum automatically. Even under this condition the load sensing and pressure cut-off control can be operated.
The fail-safe function is designed only for usage in short period for emergency. Necessary repair is to be made in the soonest opportunity.
For the hydraulic circuit refer to page 26.



Control curve

Unit: mA

Ordering code	I_1	I_2
E2, F2	200	600
E3, F3	400	1,200

■ Note for pumps with fail-safe

■ Note for start up
Due to its structure, the electric displacement control requires larger input current than I_2 at start up, then normal proportional control can be achieved between I_1 and I_2.

■ Minimum operating pressure
With fail-safe function, in order to ensure safety and repeatability of control the minimum operating pressure of 5 MPa is to be secured. This avoids switching the pump to fail-safe mode unexpectedly.

■ Input current ramp time requirement
With fail-safe function (Ordering code: E2, E3), ramp time of 200 msec or larger is to be secured.

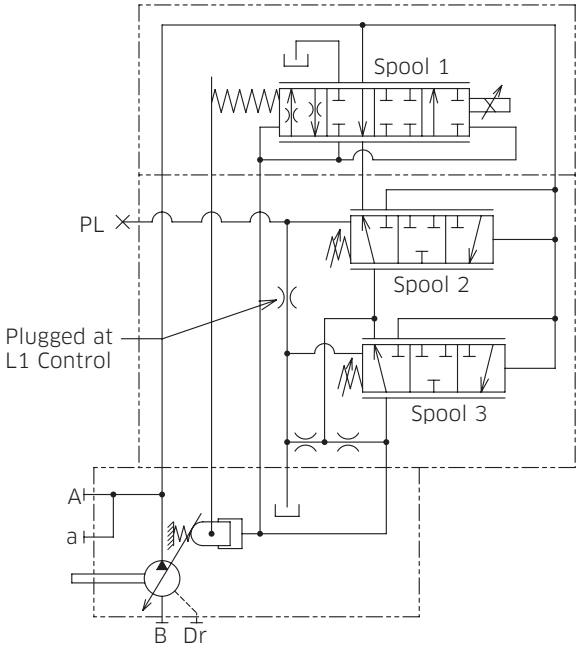
■ Recommended dither condition for the input current
Dither frequency: 150 Hz
Dither amplitude: for E2, F2 200 mA_{p-p}
for E3, F3 400 mA_{p-p}

	E2, F2	E3, F3
Rated current [mA]	700	1,400
Coil resistance (at 20℃) [Ω]	22.6	5.7
Power consumption (at 20℃) [W]	11.2	11.2
Connector type	Ladd Distribution DT04-2P	
Water proof	IP67	

2-2 Functional Description of Regulator

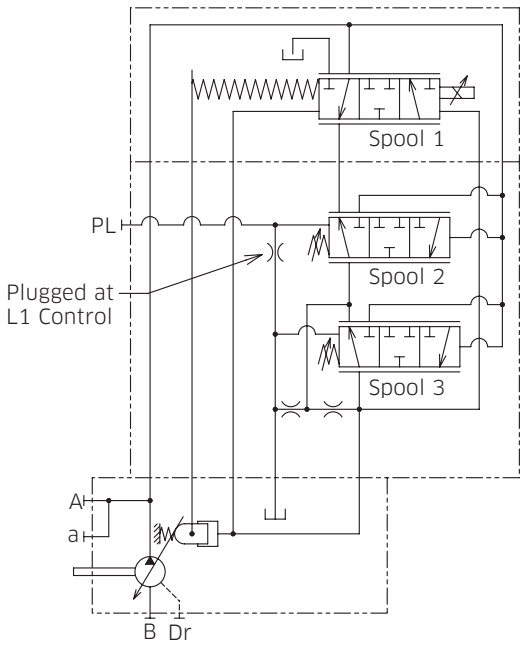
◆ Electric Displacement Control (Positive Control)

- With Fail-safe Function (Ordering Code[11]: E2, E3)
- Without Fail-safe Function (Ordering Code[11]: F2, F3)



Spool 1: Electric Flow Control Valve
Spool 2: Differential Spool
Spool 3: Cut-off Spool

Hydraulic Circuit With Fail-safe Function



Spool 1: Electric Flow Control Valve
Spool 2: Differential Spool
Spool 3: Cut-off Spool

Hydraulic Circuit Without Fail-safe Function

2-3 Functional Description of Pump

◆ Change Pump Maximum Displacement (Ordering Code : None)

Pump Maximum displacement can be changed to the below list by the replacement of the Qmax. stopper. It can be applied to Standard type and with Horsepower control. Refer to the instruction manual for replacement procedures.

	Qmax. Stopper (for Standard type · with Horsepower control)					
Pump Size	Default	- 5 cm^3	- 10 cm^3	- 15 cm^3	- 20 cm^3	- 25 cm^3
K3VLS50	50	45	40	35	–	–
K3VLS65	65	60	55	–	–	–
K3VLS85	85	80	75	70	–	–
K3VLS105	105	100	95	90	–	–
K3VLS150	150	145	140	–	130	125

Unit : cm^3