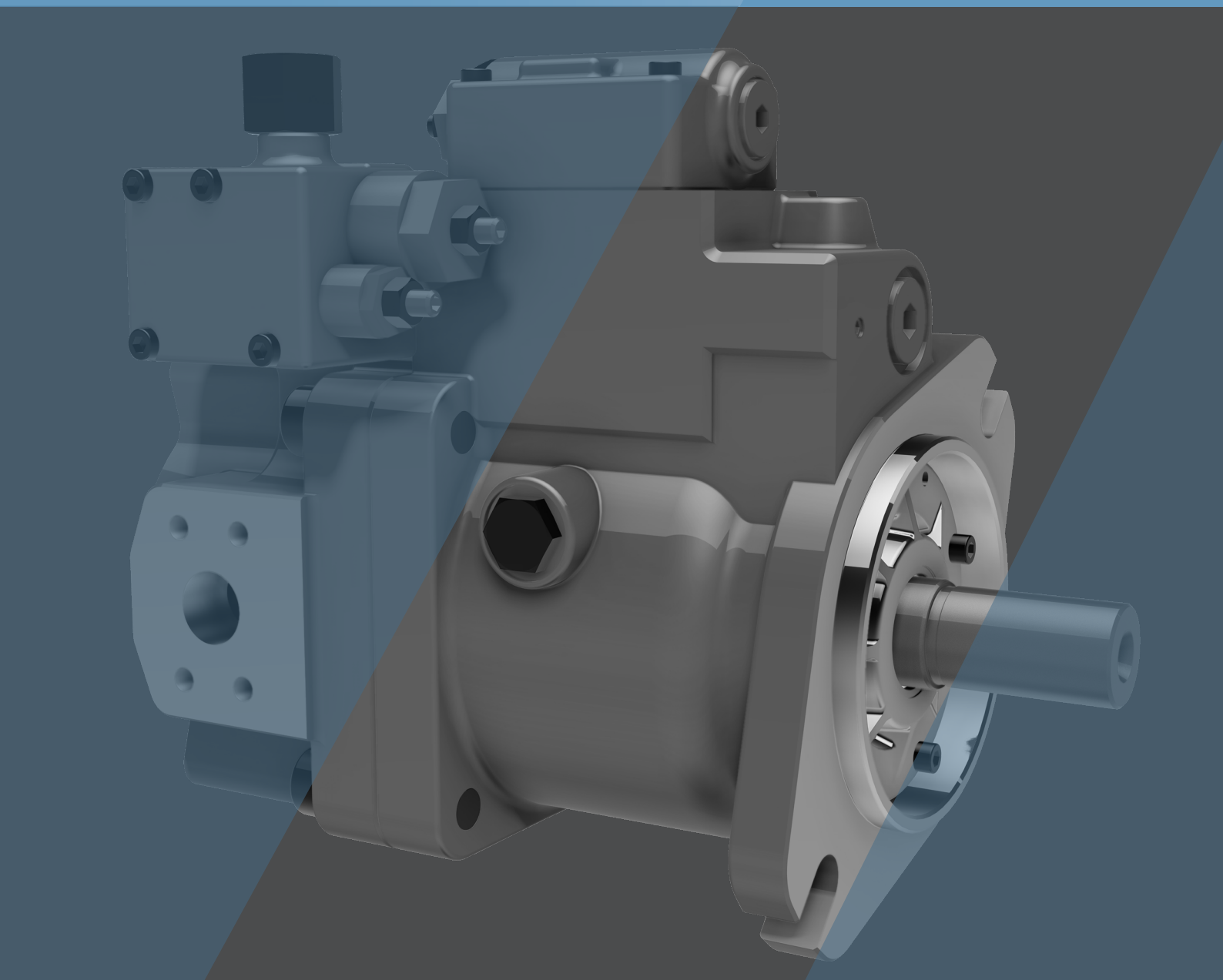
Kawasaki
Powering your potential

K3VL Series Axial Piston Pumps Service Manual



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Applications/Product Usage

The following must be taken into consideration before use.

1. The operating condition of the products shown in this catalog varies depending upon each application. Therefore, the product suitability must be judged by the designer of the hydraulic system and/or the person who finalizes the technical specifications of the machine after analysis and testing. The product specification shall be determined based on the latest catalog and technical documents. The system must be designed taking into account the possibility of machine failure to ensure that all safety, warning, and application requirements are met.

2. For the proper use of the products, descriptions given in the SAFETY PRECAUTIONS must be observed.

3. The technical information in this catalog represents typical characteristics and performance of the products as of the published date.

4. If the intended use of the products is included in the following, please consult with Kawasaki in advance.
   (1) Use the product in the operating conditions or environments other than those described in the technical documents.
   (2) Use the product in the nuclear sector, aviation sector, medical sector, and/or food sector.
   (3) Use the product in applications which may cause substantial harm to others and their property, and especially in applications where ensuring safety is a requirement.

5. The information described in this catalog is subject to change without notice. For the latest information, please contact Kawasaki.

Safety Precautions

Before using the product, you MUST read this catalog and MUST fully understand how to use the product. To use the product safely, you MUST carefully read all Warnings and Cautions in this catalog.

1. Cautions related to operation

- Use the personal protective equipment to prevent injury when the product is in operation.

- Some components are heavy. Handle the product carefully not to hurt your hands and lower back.

- Do not step on, hit or drop , or apply strong force to the product, as these actions may cause operation failure, product damage, or oil leakage.

- Wipe off any oil on the product or the floor completely, as oil can create slippery conditions that may cause drop of the product and personal injury.

2. Warnings and cautions related to installation and removal of the product

- Installation, removal, piping, and wiring must be done by a qualified technician.

- Make sure that the hydraulic power unit is turned off and that the electric motor or engine has completely stopped before starting installation or removal. You must also check that the system pressure has dropped to zero.

- Make sure that the power source is turned off before installing electric components to reduce the risk of electric shock.

- Clean the threads and the mounting surface to prevent damage or oil leakage. Inadequate cleaning may cause insufficient torque and broken seals.

- Use the designated bolts and fasten them with prescribed torque when installing the product. Use of undesignated bolts, and excessive or insufficient tightening torque may induce operation failure, damage, or oil leakage.

3. Warnings and cautions for operation

- Always equip the product with explosion or ignition protection if it is used in potentially explosive or combustible atmospheres.

- Shield rotary parts, such as the motor and pump shaft, to avoid injury.

- Stop operation immediately, and take proper measures when the abnormality such as unusual noise, oil leakage, and smoke is found. Continuing operation under such condition may bring about damage, a fire hazard, or injury.

- Make sure that all pipes, hoses, and connecting points with pipes or hoses, are correctly connected and tightened before starting operation.

- Use the product under the operating conditions and limitations described in the catalog, drawings, and specification sheets.

- Do not touch the product in operation. to reduce the risk of skin burn.

- Use the proper hydraulic oil and maintain the filtration at the recommended level to prevent premature wear and damage.

4. Cautions related to maintenance

- Never modify the product without approval from Kawasaki.

- Disassembly of the product may void the warranty.

- Keep the product clean and dry when storing or transporting.

- The seals may need to be replaced if the product has been stored for an extended period of time.

- Making adjustments of this product will result in the warranty being null and void.

Handling Precautions

1. Operating Fluid and Temperature Range

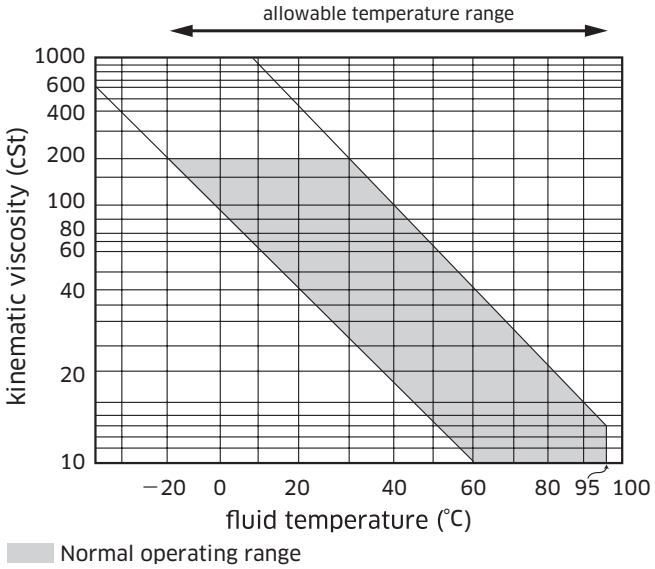
1) Operating Fluid

Values shown in this catalog are based upon using mineral oil based anti-wear hydraulic fluid. To ensure optimal performance use of mineral oil based anti-wear hydraulic fluid is recommended.

2) Viscosity and temperature range

To minimize both oil and seal deterioration, a maximum operating temperature of 60°C should be considered. Please note that the regulator may become slow to respond when operating at low temperatures (below 20°C) in extreme cold environments. At such low temperature it is strongly suggested that a warm up cycle is introduced until an operating temperature of 20°C is achieved.

	Normal operating range	Allowable range
Viscosity [mm²/s(cSt)]	10 to 200	10 to 1,000
Fluid temperature [°C (°F)]	-20 to +95 (-4 to +203)	



2. Filtration and Contamination Control

1) Filtration of working oil

The most important means to prevent premature damage to the pump and associated equipment and to extend its working life, is to ensure that hydraulic fluid contamination control of the system is working effectively.

This begins by ensuring that at the time of installation that all piping, tanks etc. are rigorously cleaned in a sanitary way. Flushing should be provided using an off line filtration system and after flushing the filter elements should be replaced.

A full flow return line filter of 10 micron nominal should be utilised to prevent contaminant ingress from the external environment, a 5 to 10 micron filter with the tank's breather is also recommended.

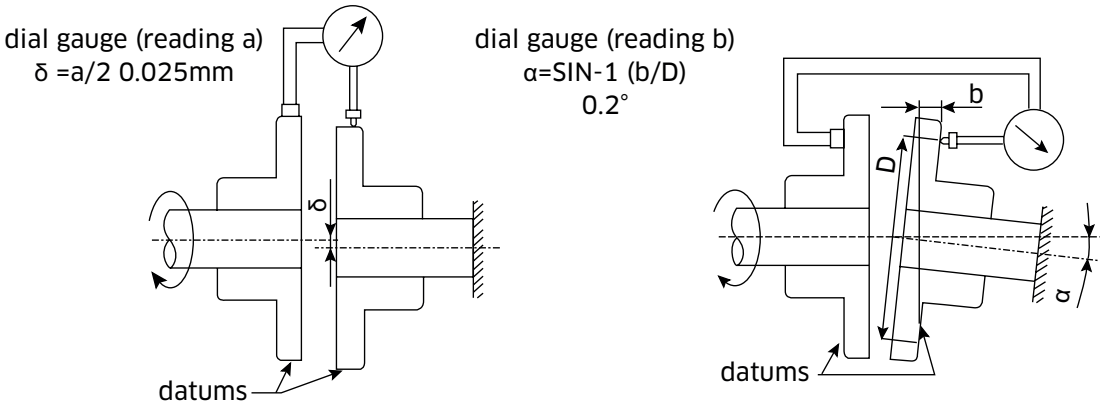
2) Suggested acceptable contamination level

The relationship between contamination level and pump life is very difficult to predict as it depends on the type and nature of the contaminant present in the system. Sand or Silica in particular, due to its abrasive nature, does significantly reduce the expected life of a pump. Based on the precondition that there is no significant presence of Silica type substances then a minimum Cleanliness level of -/18/15 ISO 4406 or SAE AS 4059E Table 1 Class 9 (NAS 1638 Class 9).

3. Drive Shaft Coupling

Alignment between the prime mover and the pump shaft should be within 0.05 mm TIR*. In case the pump is directly coupled to the engine flywheel, use a flexible coupling.

*TIR = Total Indicator Reading



4. Oil Filling and Air Bleeding

1) Pump case filling

Be sure to fill the pump casing with oil through the drain port, filling only the suction line with oil is totally in-sufficient. The pump contains bearings and high-speed sliding parts including pistons with shoes and a spherical bush that need to be continuously lubricated. Part seizure or total premature failure will occur very quickly if this procedure is not rIgidly followed.

2) Air bleeding

Run the pump unloaded for a period to ensure that all residual air within the system is released.

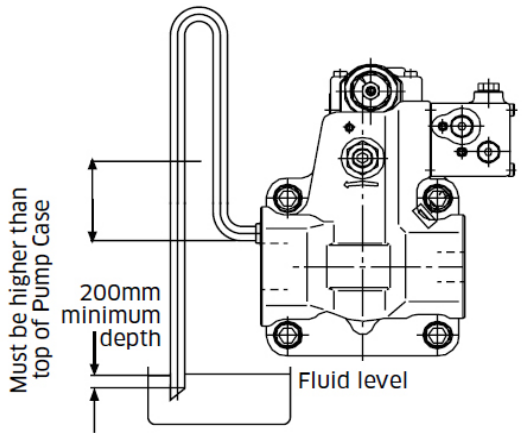
3) Long term out of usage

It is undesirable to leave the pump out of use for a long period e.g. a year or more. In such a situation it is recommended that the pump is run for a short period on a more frequent basis even if it is just unloaded. With regard to a pump held in storage then rotating the shaft on a frequent basis is sufficient. If the pump is left out for more than the suggested time it will require a service inspection.

5. Drain Piping

1) Installation of drain line

It is the preferred option to mount the pump with the case drain piping initially rising above the pump before continuing to the tank. Do not connect the drain line to the inlet line.



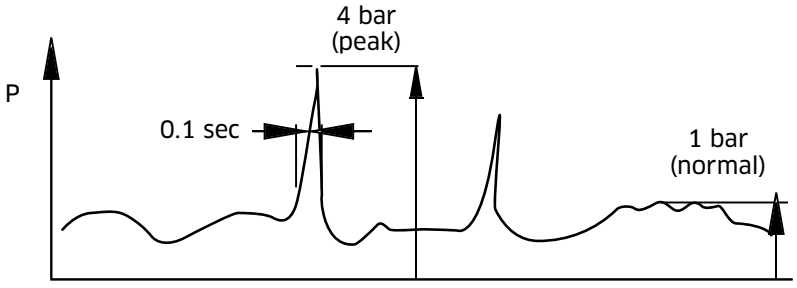
Cautions

A) Inlet and drain pipes must be immersed by 200 mm minimum from the lowest level under operating conditions.

B) Height from the oil level to the centre of the shaft must be within 1 meter maximum.

C) The oil in the pump case must be refilled when the pump has not been operated for one month or longer.

The uppermost drain port should be used and the drain piping must be larger in size than the drain port to minimise pressure in the pump case. The pump case pressure must not exceed 1 bar as shown in the illustration below. (Peak pressure must never exceed 4 bar.)

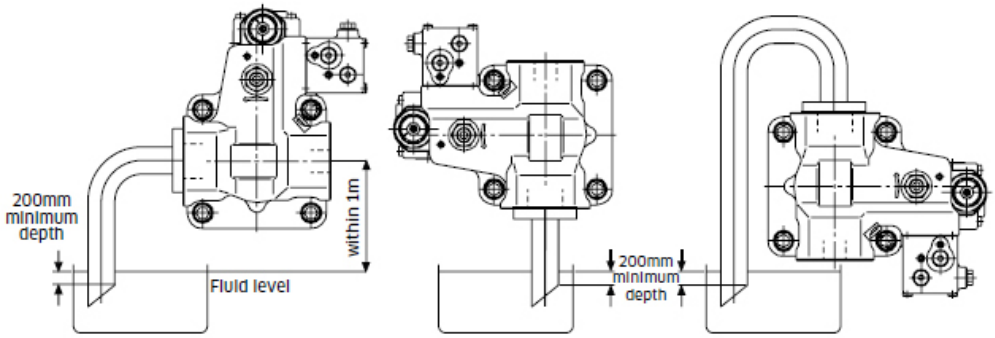


2) Size of drain hose or drain pipe

The internal bore size of the drain hose or drain pipe must be larger than that of the drain port. Arrange the drain line as short as possible.

6. Mounting the Pump Above the Tank

Suction line.



7. Mounting the Pump Vertically (shaft up)

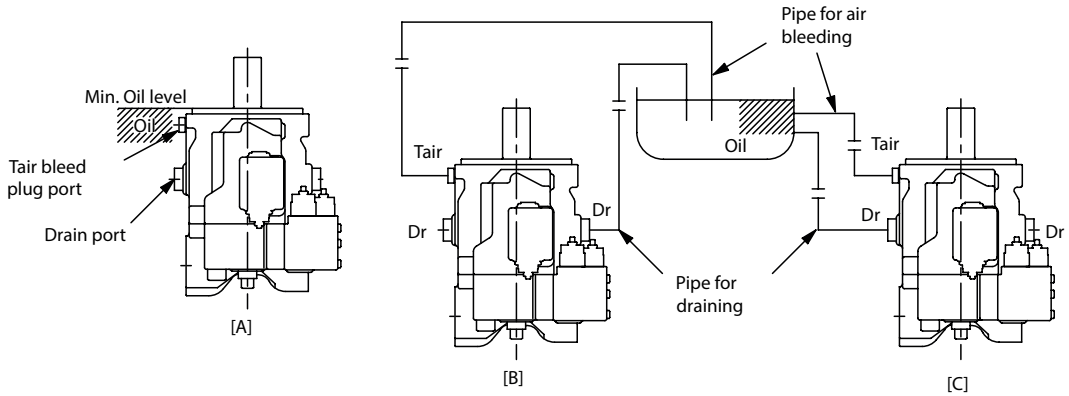
Note: Both the Tair and one case drain port must be used.

For applications requiring vertical installation (shaft up) please remove the Tair bleed plug and connect piping as shown in the illustration below.

When installing the pump in the tank and submerged in the oil, open the drain port and Tair bleed port to provide adequate lubrication to the internal components. See illustration [A].

The oil level in the tank should be higher than the pump-mounting flange as shown in illustration [A] below. If the oil level in the tank is lower than the pump mounting flange then forced lubrication is required through the Tair bleed port 1 ~ 2 l/min.

If the drain or Tair bleed piping rise above the level of oil (see illustration [B]). Fill the lines with oil before operation, then confirm pump case pressure is within specification during commissioning. When installing the pump outside the tank, run piping for the drain and Tair bleed ports to tank (see illustration [C])



8. Shaft Loading and Bearing Life

Although K3VL pumps are equipped with bearings that can accept some external thrust and radial forces, application of such loads will affect bearing life. Depending on the load magnitude , the load position, and the load orientation, bearing life may be significantly reduced.

Conversion Factors, Formula and Definition

Conversion Factors

	Formula	Note
Displacement	1 cm^3 = 0.061 in^3	
Pressure	1 MPa - 145 psi	
Flow	1 L/min = 0.264 gpm	US gallon
Torque	1 Nm = 0.74 lb ft	
Power	1 kW = 1.341 hp	
Weight	1 kg = 2.205 lb	

Formula

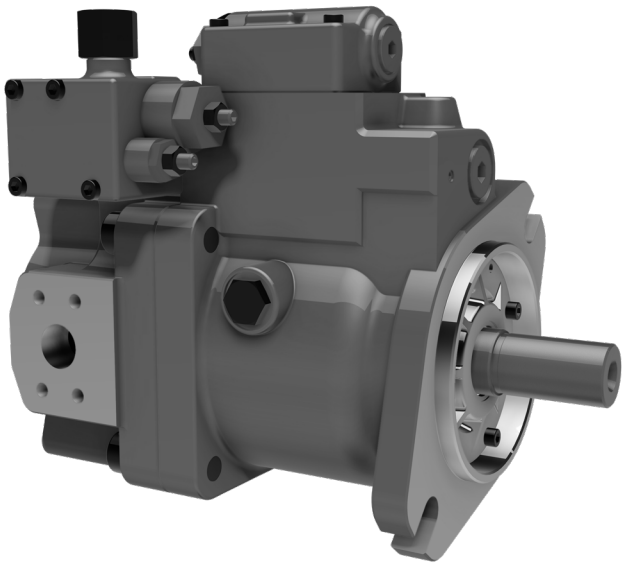
	Metric system		Imperial system	
Output flow	Q = q x N x η_v / 1000	L/min	Q = q x N x η_v / 231	gal/min
Input torque	T = q x ΔP / 2π / η_m	Nm	T = q x ΔP / 24π / η_m	lbf ft
Input power	L = T x N / 9550 = Q x ΔP / 60 / η_t	kW	L = T x N / 5252 = Q x ΔP / 1714 / η_t	hp

Definition

q	= Pump displacement	cm^3 (in^3)
L	= Input power	kW (hp)
N	= Speed	min^{-1} (rpm)
ΔP	= P_d - P_s	MPa (psi)
P_d	= Pump delivery pressure	MPa (psi)
P_s	= Pump suction pressure	MPa (psi)
P_L	= Load sensing pressure	MPa (psi)
P_{dr}	= Pump case pressure	MPa (psi)
P_f	= Power shift pressure	MPa (psi)
P_{sv}	= Servo pressure	MPa (psi)
T	= Input torque	Nm (lbf-ft)
T_{max}	= Maximum input torque	Nm (lbf-ft)
η_v	= Pump volumetric efficiency	
η_m	= Pump mechanical efficiency	
η_t	= Pump total efficiency	

K3VL Series

Swash-plate Axial Piston Pump



General Descriptions

The K3VL series Swash Plate Type Axial Piston Pumps are designed to satisfy the marine, mobile and industrial markets where a medium/high pressure variable displacement pump is required.

K3VL pumps are available in nominal displacements ranging from 28 to 200 cm^3/rev with various pressure, torque limiter, and combination of load sensing control options.

Pump Type	Capacity (cm^3/rev)	Rated pressure (bar)	Maximum self-priming speed (rpm)
K3VL28	28	320	3,000
K3VL45	45	320	2,700
K3VL80	80	320	2,400
K3VL112	112	320	2,300
K3VL140	140	320	2,200
K3VL200	200	320	1,900
K3VL200H	200	320	2,200

Features

320 bar continuous pressure rating

350 bar peak pressure

High overall effciency (>90% peak)

Exceptional self priming capability

SAE and ISO mounting and shaft

Excellent reliability and very long service life

High power to weight ratio

Numerous control options

Highly responsive controls

Low pulsation and noise emissions

Integral unloading or proportional pressure relief valves available

High speed version with integral impeller (K3VL200H)

1 Ordering Code

1-1 Pump Options

1	2		3	4	5	6	7	8	9		10	11	12	13	14	15
K3VL	**200**	**/**	**B**	**-**	**1**	**N**	**R**	M	M	-	LN	24D	B	/1	-H**	

1. K3VL Series Pump		Preferred product range
K3VL Series, Variable Displacement, Axial Piston, Open Loop Pump	●	AVAILABLE
	◐	NOT AVAILABLE IN COUNTER CLOCKWISE
	○	PLEASE CONTACT KPM UK
	-	NOT AVAILABLE

2. Pump Size								
Maximum Displacement cm³/rev (H-Impeller)		28	45	80	112	140	200	200H
		●	●	●	●	●	●	●

3. Design Series								
B	Series	-	●	●	●	●	●	●
C	Series	●	-	-	-	-	-	-

4. Hydraulic Fluid Type								
-	Mineral Oil, Nitrile seal + Viton Shaft Seal	●	●	●	●	●	●	●
V	Viton Seal Throughout	○	○	●	●	●	○	○
W	Water Glycol (Nitrile Seal & Nitrile Shaft Seal) *1	-	○	○	○	○	-	-

5. Circuit Type								
1	Open Circuit	●	●	●	●	●	●	●

6. Through Drive & Porting								
0	Without Through Drive	◐	◐	◐	◐	◐	◐	-
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 Bolt, Through Drive, Side Ported	-	-	●	●	●	●	●
C4	SAE-C, 4 Bolt, Through Drive, Side Ported	-	-	●	●	●	●	●
CC	SAE-CC, 2 Bolt, Through Drive, Side Ported	-	-	-	●	●	●	●
D	SAE-D Through Drive, Side Ported	-	-	-	●	●	●	●
E	SAE-E Through Drive, Side Ported	-	-	-	-	-	●	●
R	Single Pump, Rear Ported	-	●	●	●	●	-	-
N	Single Pump with Steel Cover, Side Ported	●	●	●	●	●	●	●

7. Direction of Rotation								
R	Clockwise Rotation	●	●	●	●	●	●	●
L	Counter Clockwise Rotation	●	●	●	●	●	●	●

*1 : Non through drive only

1-1 Pump Options

1	2		3	4	5	6	7	**8**	**9**		**10**	**11**	12	13	14	15
K3VL	200	/	B	-	1	N	R	**M**	**M**	**-**	**LN**	**24D**	B	/1	-H**	

8. Mounting Flange & Shaft		28	45	80	112	140	200	200H
K	SAE Key & Mount	●	●	●	●	●	●	-
M	ISO Key & Mount	-	●	●	●	●	-	-
S	SAE Spline & Mount	●	●	●	●	●	●	●
R	SAE-C Spline & SAE-D Mount	-	-	-	●	●	-	-
C	SAE-C Spline & SAE-C2 Mount	-	-	-	●	●	-	-
X	SAE-C Key & SAE-C2 Mount	-	-	-	●	●	-	-
Y	SAE-CC Key & SAE-C2 Mount	-	-	-	●	●	-	-
W	SAE-CC Spline & SAE-C2 Mount	-	-	-	●	●	-	-
F	SAE-F Spline & SAE-E Mount	-	-	-	-	-	●	●
T	SAE-B Spline & SAE-B, 2 Bolt Mount	-	●	-	-	-	-	-
	SAE-CC Spline & SAE-D, 4 Bolt Mount	-	-	-	●	●	-	-

9. Porting Threads								
M	Metric Threads	●	●	●	●	●	●	●
S	UNC Thread (Not Available with 'M' ISO Key Shaft & Mount)	●	●	●	●	●	●	●

10. Regulator Type								
L0	Load Sense + Pressure Cut-Off (With LS Bleed)	●	●	●	●	●	●	●
L1	Load Sense + Pressure Cut-Off (With LS Bleed Blocked)	●	●	●	●	●	●	●
LM	Load Sense & Intergral Unload (Normally Open)	-	●	●	●	●	●	●
LN	Load Sense & Intergral Unload (Normally Closed)	-	●	●	●	●	●	●
LV	Load Sense & Intergral Proportional Relief	-	●	●	●	●	●	●
LV2	Load Sense & Intergral Proportional Relief	-	●	●	●	●	●	●
P0	Pressure Cut-Off	●	●	●	●	●	●	●
PM	Pressure Cut-Off & Intergral Unload (Normally Open)	-	●	●	●	●	●	●
PN	Pressure Cut-Off & Intergral Unload (Normally Closed)	-	●	●	●	●	●	●
PV	Pressure Cut-Off & Intergral Proportional Relief	-	●	●	●	●	●	●
PV2	Pressure Cut-Off & Intergral Proportional Relief	-	●	●	●	●	●	●
PR	Inverse Proportional Electronic Pressure Control (Only with 24V DC)	○	○	○	-	-	-	-

11. Unloader Solenoid								
Blank	For all other options except PN/PM/LN/LM/PV2/LV2	-	●	●	●	●	●	●
115A	115V AC, 50, 60 Hz - DIN 43650 Plug	-	○	○	○	○	○	○
230A	230V AC, 50, 60 Hz - DIN 43650 Plug	-	○	○	○	○	○	○
12D	12V DC - DIN 43650 Plug	-	●	●	●	●	●	●
24D	24V DC - DIN 43650 Plug	-	●	●	●	●	●	●

1-1 Pump Options

1	2		3	4	5	6	7	8	9		10	11	**12**	**13**	**14**	**15**
K3VL	200	/	B	-	1	N	R	M	M	-	LN	24D	**B**	**/1**	**-H****	

12. Additional Control Options		28	45	80	112	140	200	200H
Blank		-	●	●	●	●	●	●
A	With Deutsch Connector (Only for PV2/LV2)	-	●	●	●	●	●	●
B	With DIN Connector (Only for PV2/LV2)	-	●	●	●	●	●	●

13. Additional Control Options								
Blank	Without Additional Control	-	●	●	●	●	●	●
/1	Torque Limiter (with provision for torque limiter or displacement control)	-	●	●	●	●	●	●
/2	Torque Limiter & Hydraulic Power Shift	-	-	●	●	●	●	●
/3	Torque Limiter & Electrical Power Shift, 24V DC - DIN 43650 Plug	-	-	●	●	●	●	●

14. Torque Limiting & Displacement Control								
Blank	Without Additional Control	-	●	●	●	●	●	●
-00	Blanking Plate (only for '/1' type)	-	●	●	●	●	●	●
-S#	Low Setting Range (available for '/1' type only)	-	●	●	●	●	●	●
-L#	Low Setting Range (available for '/1' type only)	-	●	●	●	●	●	●
-M#	Medium Setting Range (available for '/1' type only)	-	●	●	●	●	●	●
-H#	High Setting Range (available for all '/1', '/2' & '/3' options)	-	●	●	●	●	●	●
-E0	Electric Displacement Control (Pilot Pressure Required) AMP Flying Lead 24V DC	-	●	●	●	●	●	●
-E1	Electric Displacement Control (Pilot Pressure Required) AMP Moulded 24V DC	-	○	○	○	○	○	○
-E2	Electric Displacement Control (Pilot Pressure Required) Deutsch Moulded 24V DC	-	○	○	○	○	●	●
-E3	Electric Displacement Control (Pilot Pressure Required) Deutsch Moulded 12V DC	-	○	○	●	●	○	○
-Q0	Pilot Operated Displacement Control	-	●	●	●	●	●	●

15. Special Suffix								
Contact KPM UK								

2 Technical Information

2-1 Specifications

Pump Model			K3VL28	K3VL45	K3VL80	K3VL112	K3VL140	K3VL200	K3VL200H
Capacity		cc/rev	28	45	80	112	140	200	200
Pressure ratings	Rated	bar	320/350						
	Peak *1	bar							
Speed ratings	Self prime *2	rpm	3,000	2,700	2,400	2,200	2,200	1,900	2,200
	Max. boosted*3	rpm	3,600	3,250	3,000	2,700	2,500	2,200 *5	2,200
Minimum operating speed		rpm	600						
Case drain pressure	Max. continuous	bar	1						
	Peak	bar	4						
Weight		kg	20	27	35	65	65	95	130
Case fill capacity		L	0.6	0.6	0.8	1.5	1.5	3.0	3.2
Temperature range		^{0}C	-20 to 95						
Viscosity range		cSt	10 to 1,000 - viscosities greater than 200 will require a no load warm up						
Maximum contamination level			ISO 4406 18/15						
Standard SAE mounting flange and shaft		Mounting	2 - bolt SAE B		2 - bolt SAE C	4 - bolt SAE D		4 - bolt SAE E	
		Shaft	SAE B spline or key	SAE B-B spline or key	SAE C spline or key	SAE D spline or key		SAE D	
								spline or key	spline
Optional SAE mounting flange and shaft		Mounting	-			2 - bolt SAE C		-	
		Shaft	-	SAE B spline	-	SAE C or C-C spline or key		SAE F spline	
Standard ISO mounting flange and shaft		Mounting	-	2 bolt ISO 100	2 bolt ISO 100	4 bolt ISO 180		-	
		Shaft	-	ISO 25mm key	ISO 25mm key	ISO 45mm key		-	
Input shaft torque rating			refer to table on page 16						
Through drive torque rating (Nm)		SAE A	61	123					
		SAE B	155	290	340				
		SAE B-B	-	290	550				
		SAE C	-		400	700		990	
		SAE C-C	-			700		990	
		SAE D	-			700		990	
		SAE E *4	-					990	

*1 : The instant allowable surge pressure as defined by DIN24312. Life and durability of the pump will be affected.

*2 : Steady state inlet pressure should be greater or equal to 0.9 bar absolute.

*3 : Steady state inlet pressure should be greater or equal to 1.3 bar absolute. The maximum boost pressure should not exceed 10 bar.

*4 : SAE E through drive uses the SAE D shaft.

*5 : Please contact KPM UK to operate at speeds of above 1900 rpm for design suffix to be created.

2-1 Specifications (cont)

Input Shaft Torque Ratings

SAE Splined Shafts						
Shaft Designation	SAE B	SAE B-B	SAE C	SAE C-C	SAE D/E	SAE F
Input Torque Rating (Nm)	171	272	552	925	1,470	1,950

SAE Keyed Shafts					
Shaft Designation	SAE B	SAE B-B	SAE C	SAE C-C	SAE D/E
Input Torque Rating (Nm)	145	230	430	700	1,250

ISO Keyed Shafts			
Shaft Designation	ISO 25mm	ISO 32mm	ISO 45 mm
Input Torque Rating (Nm)	230	430	980

Note:
The shaft surface will have a finite life due to wear unless adequate lubrication is provided.

#1 Maximum allowable shaft torques are based on achieving an infinite life for a coupling assembly that is lubricated and completely clamped and utilises the full spline/key length as engagement.

The following points therefore need to be fully considered:-

i) Lubrication of shaft couplings should be in accordance with the coupling manufacturers instructions.

ii) The maximum allowable input shaft torque is based on ensuring an infinite life condition by limiting the resultant combined shaft bending and torsional stress.

iii) This allowable input shaft torque can be further increased dependant on the resultant surface stress at the spline interface which is highly dependant on coupling selection and the provision of adequate spline lubrication.

If you have an application that requires higher input torque please consult KPM UK.

#2 Allowable through drive torques are based on the achieving an infinite life for a fully lubricated coupling and full spline engagement with a mineral oil based anti-wear hydraulic fluid.

2-1 Specifications (cont)

Notes:

Rated Pressure
Pressure at which life and durability will not be affected.

Peak Pressure
The instant allowable surge pressure as defined by BS ISO 2944:2000. Life and durability however will be shortened.

Maximum Self Priming Speed
Values are valid for an absolute suction pressure of 0.9 bar. If the flow is reduced and the inlet pressure is increased the speed may also be increased.

Maximum Boosted Speed
Values stated are the absolute maximum permitted speed for which an increased inlet pressure will be required.

Weight
Approximate dry weights, dependant on exact pump type.

Hydraulic Fluid
Mineral anti wear hydraulic fluid - for other fluid types please consult KPM UK.

Viscosity Range
If viscosity is in range 200 to 1,000 cSt, then warming up is necessary before commencing full scale running.

Standard Settings
Mineral oil
Pressure compensator 320 bar - Range 50 - 320 bar
Water Glycol 210 bar
Differential (LS) pressure 15 bar –
K3VL45/80 Range 10 – 30 bar (Standard), 10 – 45 bar (Heavy Duty)
K3VL112/140/200 Range 10 – 30 bar (Standard), 15 – 65 bar (Heavy Duty)

Application Notes
For setting pressure compensation at lower pressures than the following, 170 bar for K3VL45/80 and 100 bar for K3VL112/140/200, consideration is needed with regard to system operation. If the function of switching from a pressure compensated state to a stand-by (unloaded) state is needed then please contact Kawasaki for information.

2-2 Technical Data (cont)

Working Fluid Types

Anti-Wear Type Hydraulic fluid

It is generally recommended to use an anti-wear hydraulic fluid like mineral oil when the operating pressure exceeds 210 bar.

Fire-resistant Fluids

Some kind of fire-resistant fluids require special materials for seals, paint and metal finishing. Please consult KPM UK and provide details of the particular fluid specification and the working conditions so that any special requirements can be ascertained.

In general, fire-resistant fluids have a low viscosity index and their viscosity also changes significantly with operating temperature and service life. For this reason, the circuit should be provided with an adequately sized cooler or forced cooling so that temperatures can be stabilised. Due to the inherent water content of some of these fluids the minimum allowable suction pressure will be higher than that of an equivalent mineral oil and so needs to be fully evaluated by KPM UK. The following table provides an overview of the precautions and characteristics that can be expected with these types of fluids.

Fluid Type / Parameter	Mineral Oil	Water Glycol
Maximum Pressure (bar)	320	210
Recommended Temperature Range (deg C)	20 ~ 60	10 ~ 50
Cavitation susceptability	○	△
Expected life expectancy compared to mineral oil	100%	20-80%

○ recommended △ usable (higher density)

Pump Start Up Precautions

Piping & Circuit Checking

Check to see that the piping and full hydraulic circuit is completed and that any gate valves etc. are open.

Direction of Rotation

Check to ensure that direction of rotation is correct and that the inlet and delivery lines are connected correctly.

Start Up

Jog start the motor and check once more for correct rotation. Run the pump unloaded for a period to ensure that all residual air within the system is released. Check for external leakage, abnormal noise and vibrations.

End of Life

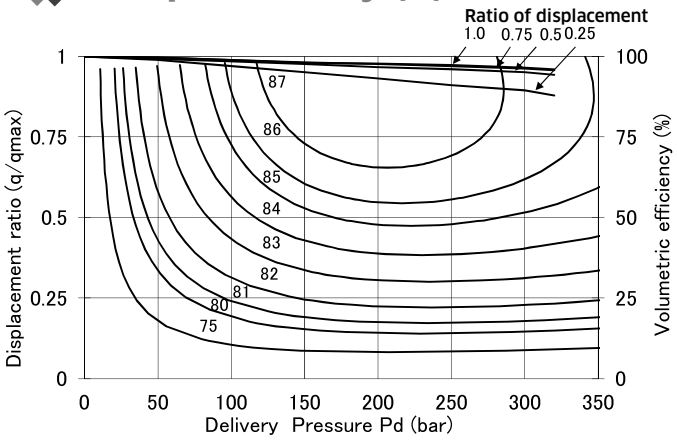
The pump unit, hydraulic fluid and packaging must be disposed of carefully to avoid pollution to the environment. The pump unit must be completely empty upon disposal, it must be disposed of according to national regulations and you must also follow safety information for disposal of the hydraulic fluid.

All individual parts of the pump unit must be recycled. Separate the pump unit parts according to: cast parts, steel, aluminium, non-ferrous metal, electronic waste, plastic, and seals.

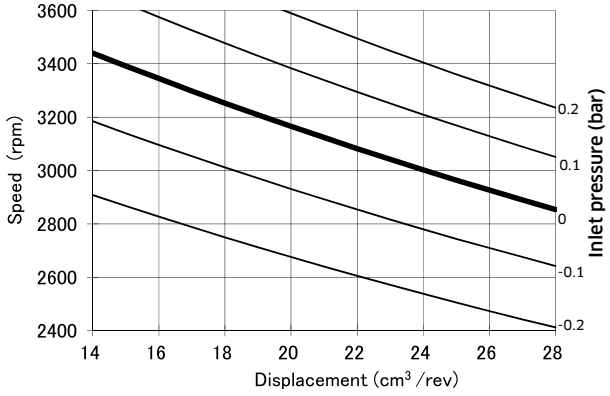
2-3 Performance Data

K3VL28

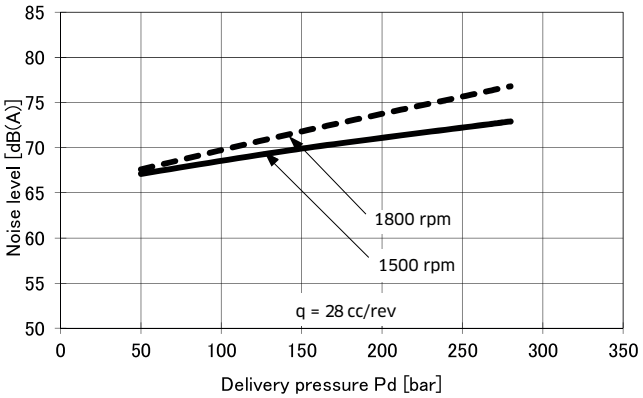
Pump Efficiency (%)



Self Priming Capability



Noise Levels



Noise level measured in an anechoic chamber where distance from microphone to pump is 1 metre. Measurement accuracy +/- 2 dB(A)

Performance Note:

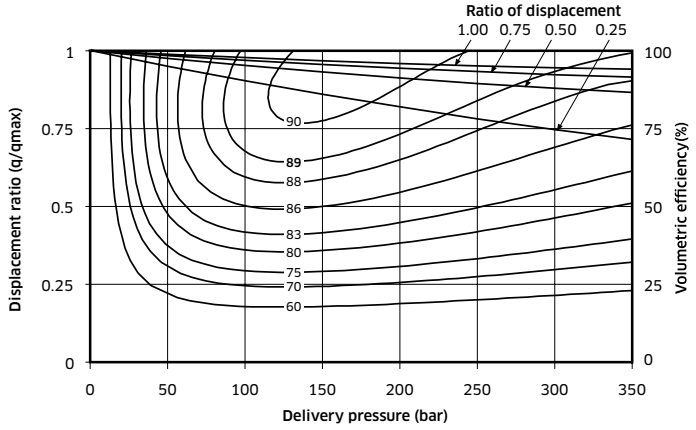
All performance curves are based on the following conditions:

- 1,500 rpm
- ISO VG46 mineral oil
- 50°C oil temperature
- Atmospheric inlet condition (0 bar)

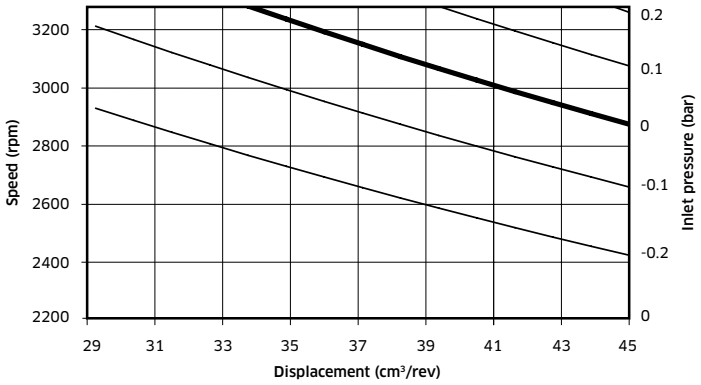
2-3 Performance Data (cont)

K3VL45

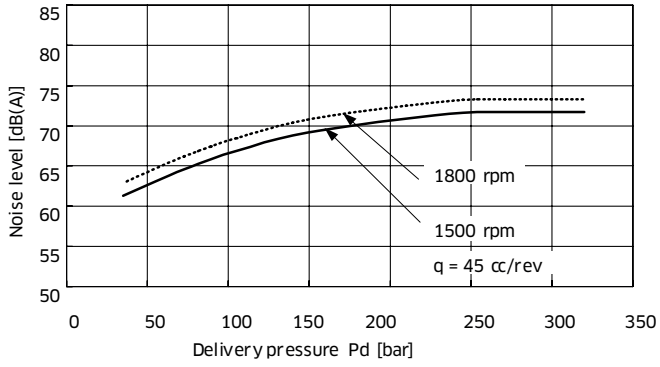
Pump Efficiency (%)



Self Priming Capability



Noise Levels



Noise level measured in an anechoic chamber where distance from microphone to pump is 1 metre. Measurement accuracy +/- 2 dB(A)

Performance Note:

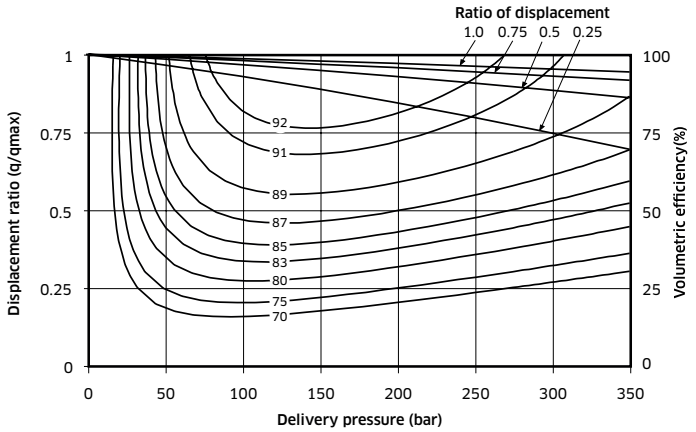
All performance curves are based on the following conditions:

- 1,500 rpm
- ISO VG46 mineral oil
- 50°C oil temperature
- Atmospheric inlet condition (0 bar)

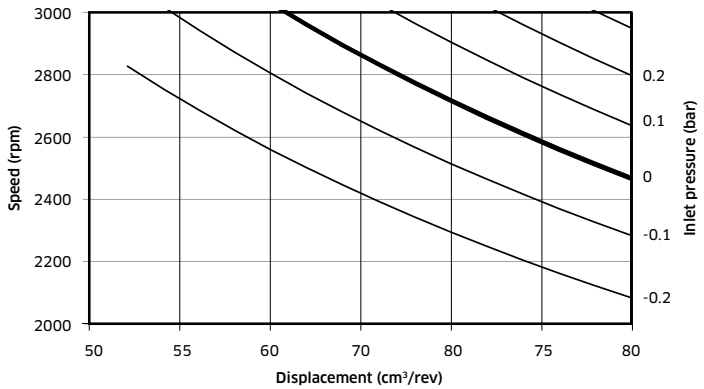
2-3 Performance Data (cont)

K3VL80

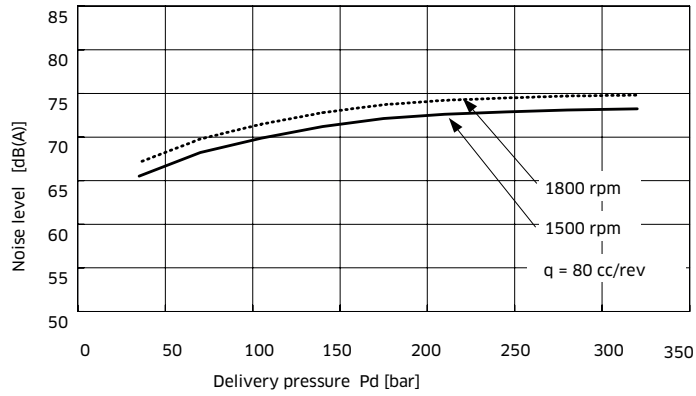
Pump Efficiency (%)



Self Priming Capability



Noise Levels



Noise level measured in an anechoic chamber where distance from microphone to pump is 1 metre. Measurement accuracy +/- 2 dB(A)

Performance Note:

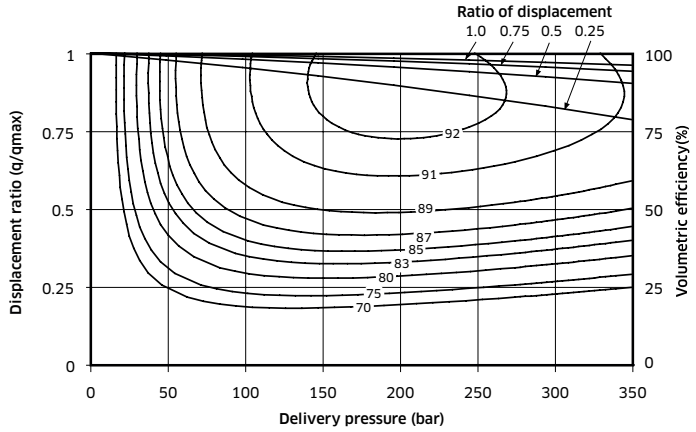
All performance curves are based on the following conditions:

- 1,500 rpm
- ISO VG46 mineral oil
- 50°C oil temperature
- Atmospheric inlet condition (0 bar)

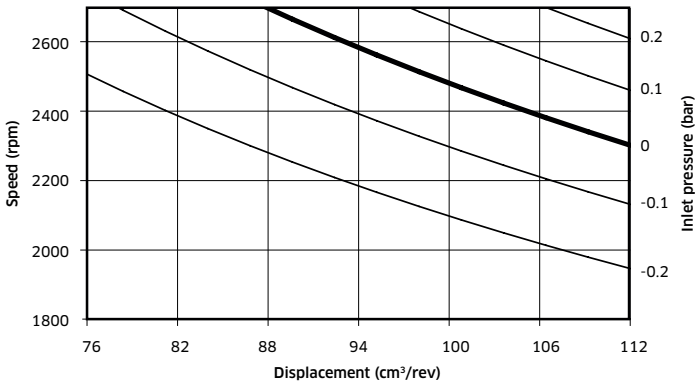
2-3 Performance Data (cont)

K3VL112

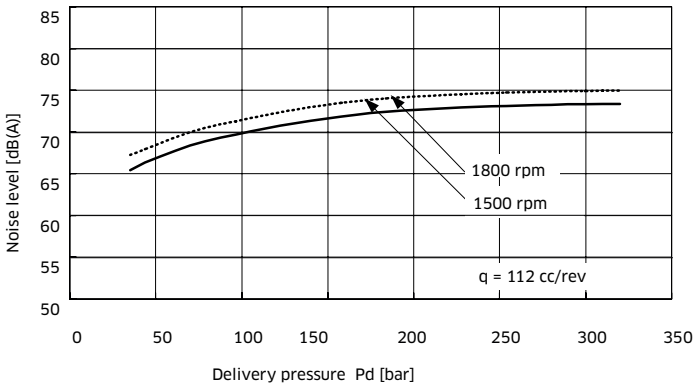
Pump Efficiency (%)



Self Priming Capability



Noise Levels



Noise level measured in an anechoic chamber where distance from microphone to pump is 1 metre. Measurement accuracy +/- 2 dB(A)

Performance Note:

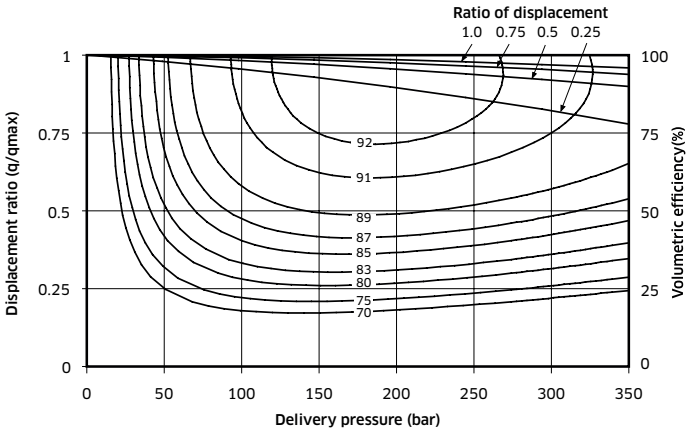
All performance curves are based on the following conditions:

- 1,500 rpm
- ISO VG46 mineral oil
- 50°C oil temperature
- Atmospheric inlet condition (0 bar)

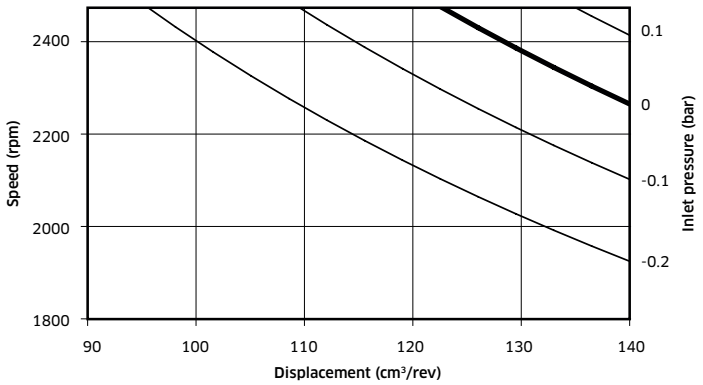
2-3 Performance Data (cont)

K3VL140

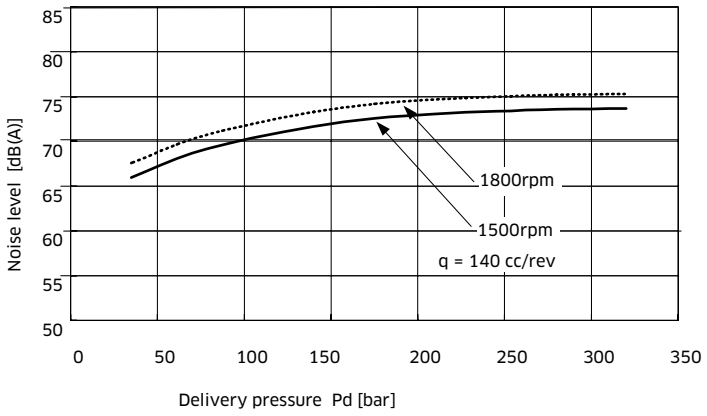
Pump Efficiency (%)



Self Priming Capability



Noise Levels



Noise level measured in an anechoic chamber where distance from microphone to pump is 1 metre. Measurement accuracy +/- 2 dB(A)

Performance Note:

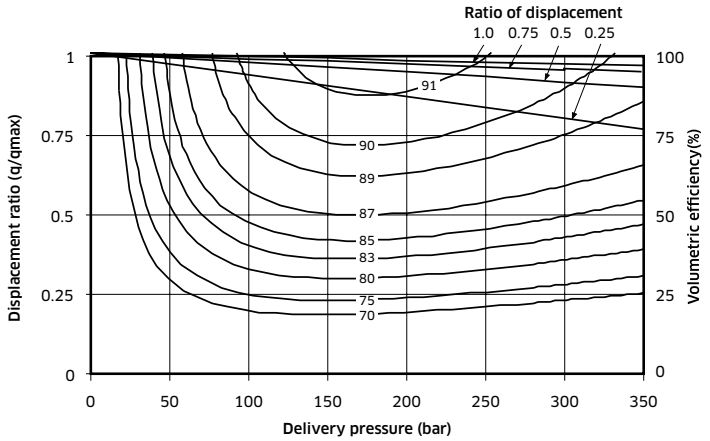
All performance curves are based on the following conditions:

- 1,500 rpm
- ISO VG46 mineral oil
- 50°C oil temperature
- Atmospheric inlet condition (0 bar)

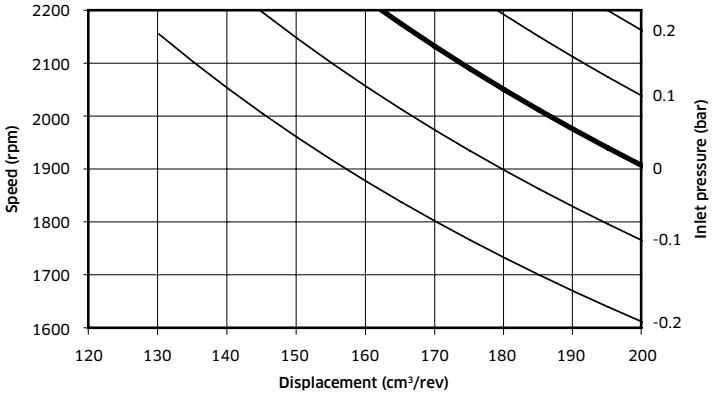
2-3 Performance Data (cont)

K3VL200

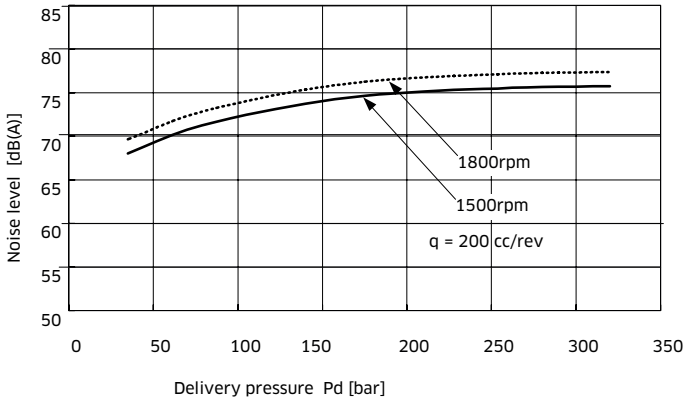
Pump Efficiency (%)



Self Priming Capability



Noise Levels



Noise level measured in an anechoic chamber where distance from microphone to pump is 1 metre. Measurement accuracy +/- 2 dB(A)

Performance Note:

All performance curves are based on the following conditions:

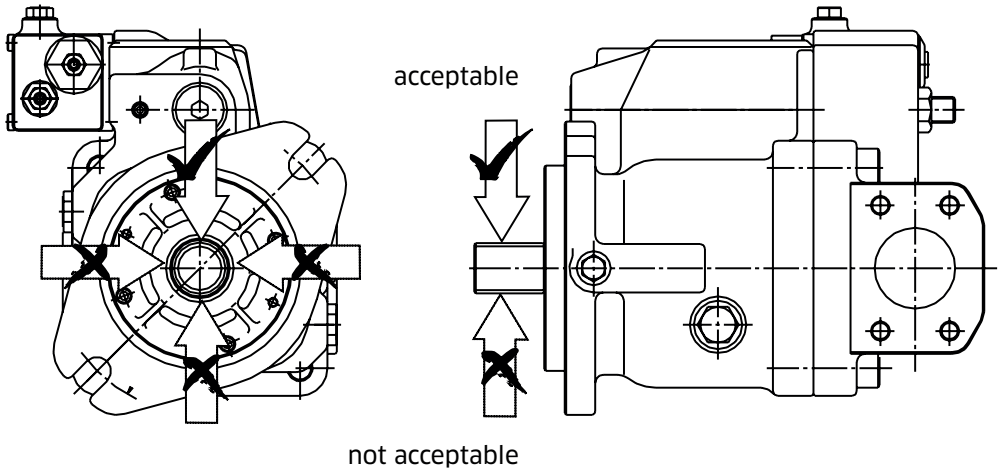
- 1,500 rpm
- ISO VG46 mineral oil
- 50°C oil temperature
- Atmospheric inlet condition (0 bar)

2-4 Radial Loading Capacity

No axial shaft loading posible, radial loading is achievable but in specific orientation:-

Radial shaft loading can be allowed provided that its orientation is such that the front bearing takes the additional load (see diagram below).

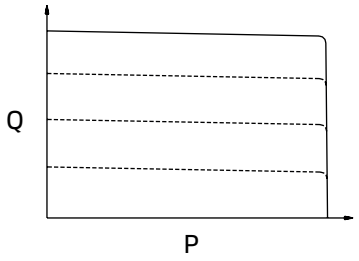
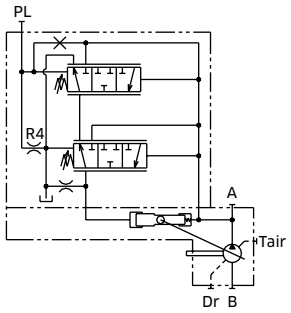
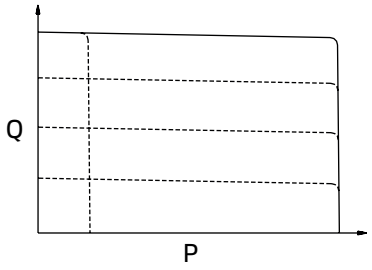
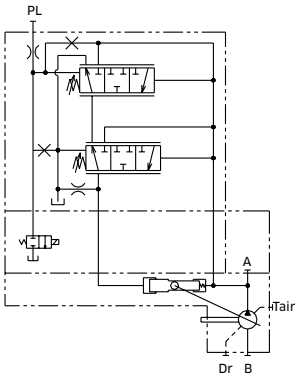
Note: In this case bearing life will be reduced.



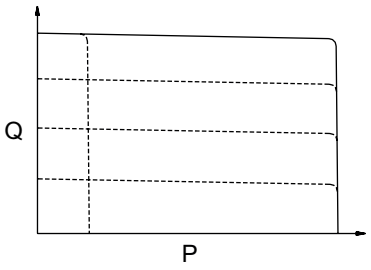
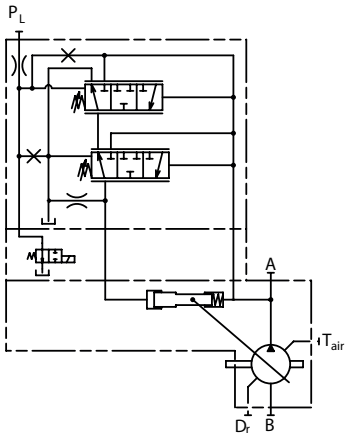
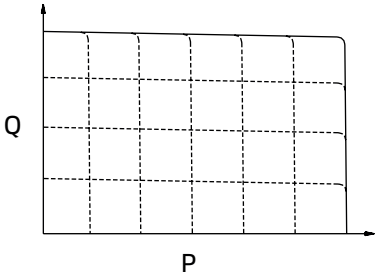
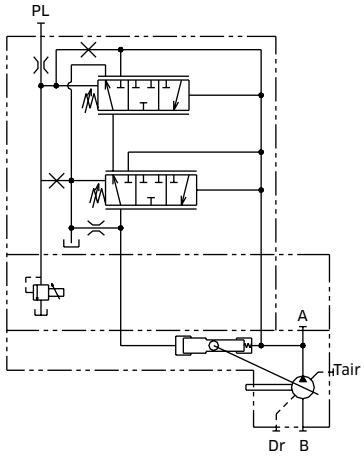
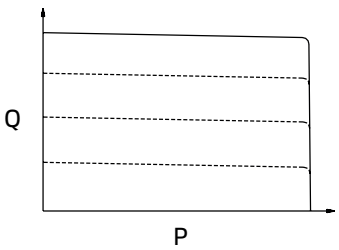
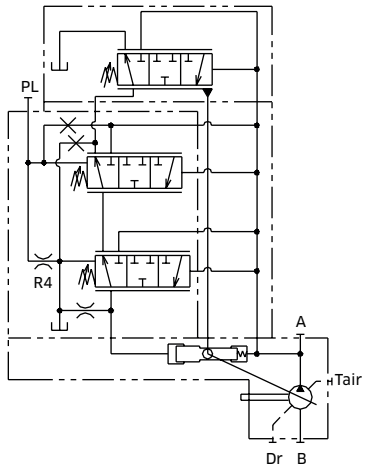
2-5 Functional Description of Regulator

Key to Hydraulic Circuit Annotations	
Annotations	**Description**
A	Main pump delivery
A1	Auxillary pump delivery
B1	Gear pump inlet
B	Main pump inlet
Dr	Drain
Pc	Remote pilot port, Pressure compensator
Pl	Pilot port displacement control
PL	Load sense port
Tair	Air bleed port
P_f	Hydraulic power shift
P_{sv}	Servo assist

2-5 Functional Description of Regulator (cont)

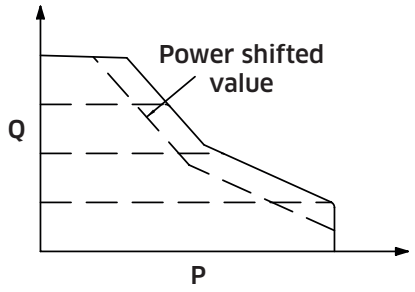
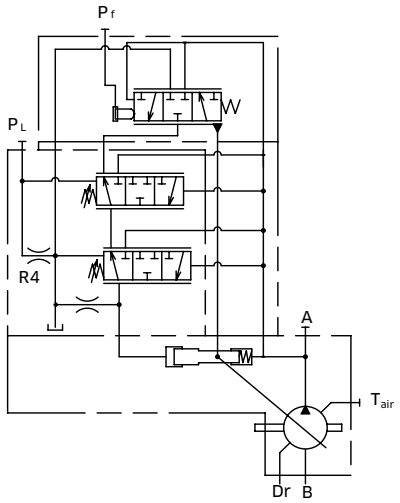
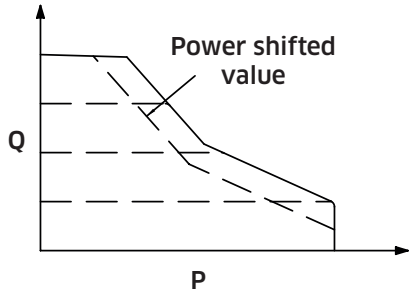
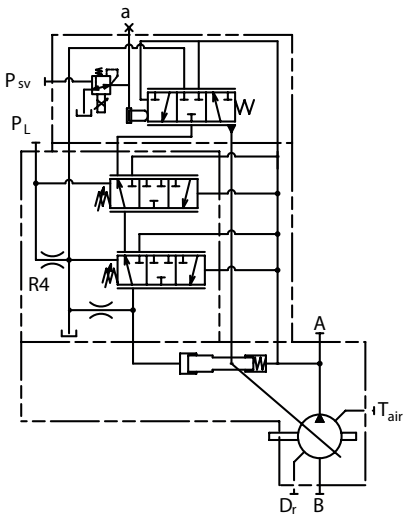
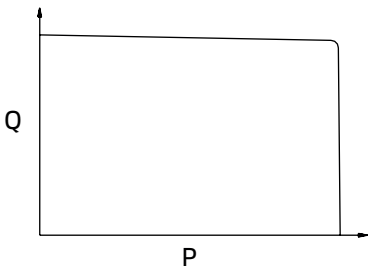
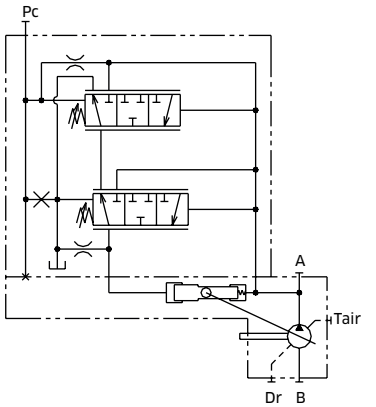
Regulator Code	Control Curves	Hydraulic Circuit
L0/L1 Load Sense and Pressure Cut-off Pump displacement is controlled to match the flow requirement as a function of the system differential pressure (load pressure vs delivery pressure). In addition, there is a pressure cut off function incorporated into the control with the L1 option, the bleed-off orifice R4 is plugged.		
LN Load Sense and Pressure Cut-off with Integrated Unloading Valve (Normally Closed) An integrated unloading valve is sandwiched between the Load Sense regulator and pump to effectively de-stroke and swashplate when an electric signal is provided.		

2-5 Functional Description of Regulator (cont)

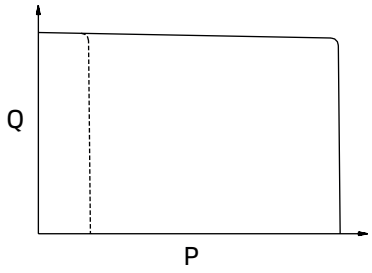
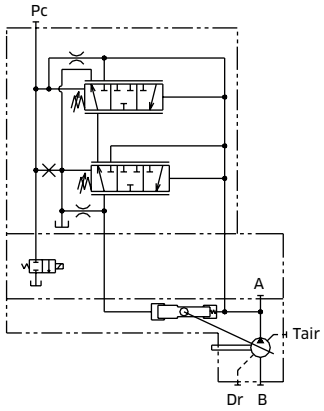
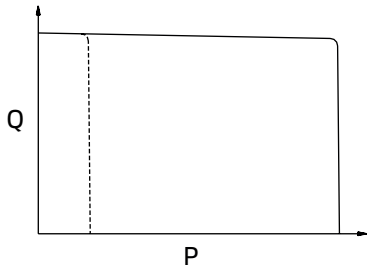
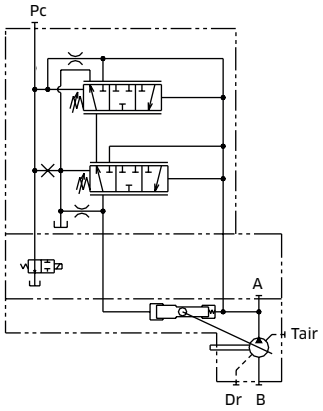
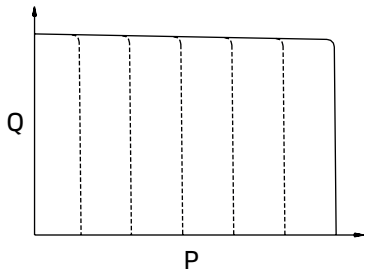
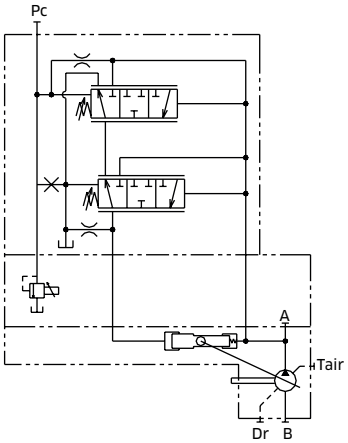
Regulator Code	Control Curves	Hydraulic Circuit
LM Load Sense and Pressure Cut-off with Integrated Unloading Valve (Normally Open) An integrated unloading valve is sandwiched between the Load Sense regulator and the pump. An electrical signal must be provided to prevent the Load Sense line from draining.		
LV/LV2 Load Sense and Pressure Cut-off with Integrated Proportional Relief Valve An integrated proportional relief valve is sandwiched between the Load Sense regulator and pump to control the maximum pressure setting by varying an electric signal to the valve. A separate amplifier is required. Note: LV has improved control characteristic.		
L0/1 Load Sense and Pressure Cut-off with Torque Limiting In response to a rise in delivery pressure the swashplate angle is decreased, restricting the input torque. This regulator prevents excessive load against the prime mover. The torque limit control module is comprised of two springs that oppose the spool force generated by the system pressure. By turning an outer and inner spring adjustment screw, the appropriate input torque limit can be set.		 *1

*1 : L0/L1 control functions are stated on page 27.

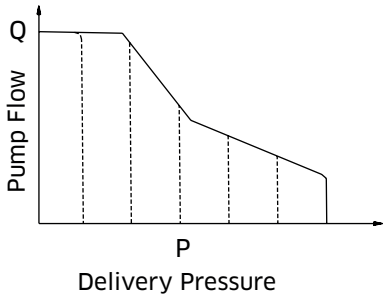
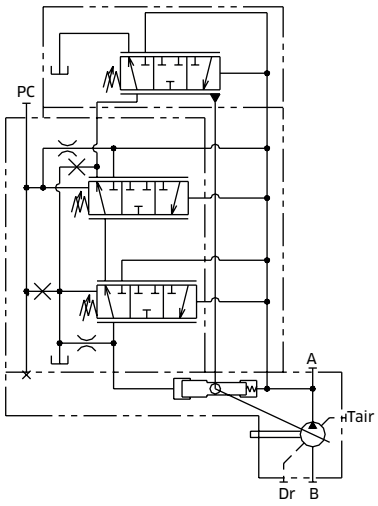
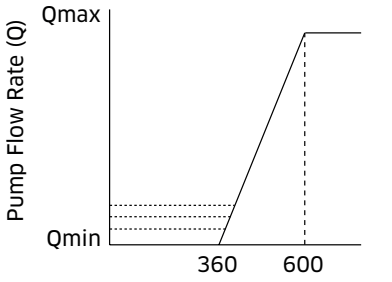
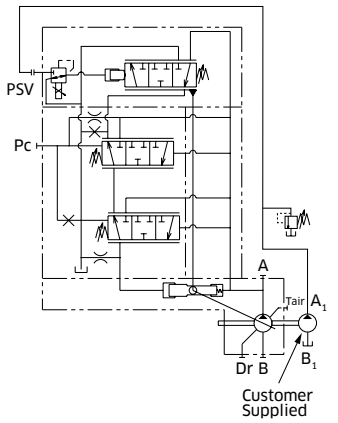
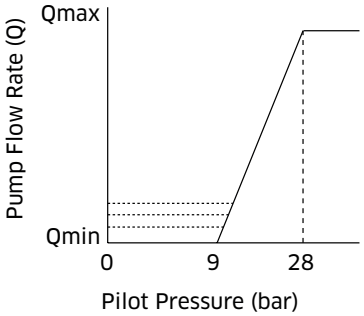
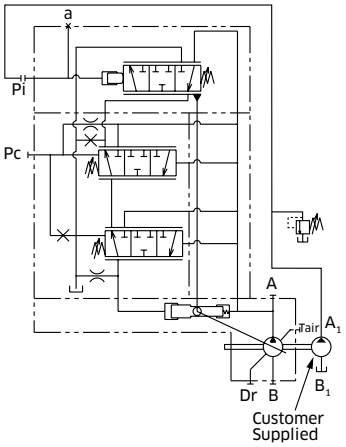
2-5 Functional Description of Regulator (cont)

Regulator Code	Control Curves	Hydraulic Circuit
/2- Hydraulic Power Shift with Load Sensing** This function, as with the /1 type can be used with Pressure compensation, Load sense and additional control options such as unloader functions. The control has the same function as standard torque limit option. In response to a rise in delivery pressure the swashplate angle is reduced, restricting input torque. However if a pilot pressure is applied to the Pf port on the regulator, the torque setting can be further reduced proportionally to the pilot pressure applied. The input torque can be reduced by approximately 40% .		 *1
/3- Electronic Power Shift with Load Sensing** This function, as with the /1 type can be used with Pressure compensation, Load sense and additional control options such as unloader functions. The control has the same function as standard torque limit. In response to a rise in delivery pressure the swash-plate angle is reduced, restricting input torque. However a constant pressure of 40 bar is required, applied to the Psv port of the regulator. The torque setting can be further reduced proportion-ally to a 24VDC electrical signal applied to the proportional valve on the regulator.		 *1
P0 Pressure Cut-off As system pressure rises to the cutoff setting, the swashplate de-strokes to prevent the system pressure from exceeding the compensator setting. It is imperative that a safety relief valve be installed in the system. Note: By connecting the Pc port to a remote pressure control, variable pump pressure control can be achieved.		

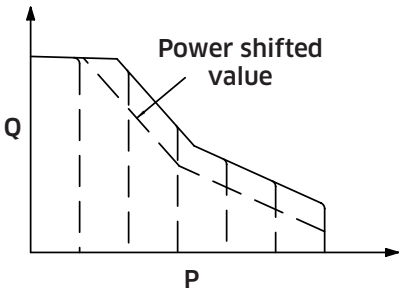
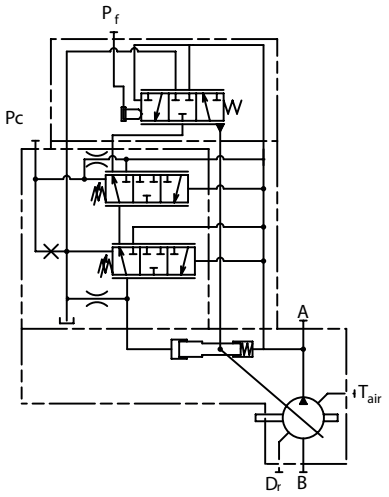
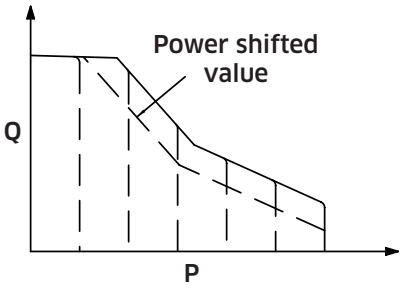
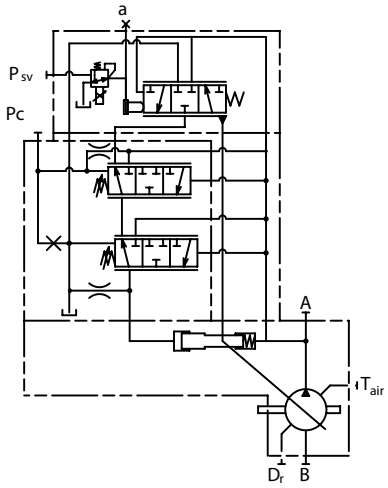
2-5 Functional Description of Regulator (cont)

Regulator Code	Control Curves	Hydraulic Circuit
PN Pressure Cut-off with Integrated Unloading Valve (Normally Closed) An integrated unloading valve is sandwiched between the Pressure Cut-off regulator and pump to effectively de-stroke the swashplate when an electric signal is provided.		
PM Pressure Cut-off with Integrated Unloading Valve (Normally Open) An integrated unloading valve is sandwiched between the Pressure Cut-off regulator and the pump. An electrical signal must be provided to prevent the Pc line from draining.		
PV/PV2 Pressure Cut-off with Integrated Proportional Relief Valve An integrated proportional relief valve is sandwiched between the Pressure Cut-off regulator and the pump to control the maximum pressure setting by varying an electric signal to the valve. A separate amplifier is required. Note: PV has improved control characteristic		

2-5 Functional Description of Regulator (cont)

Regulator Code	Control Curves	Hydraulic Circuit
P0/1 Pressure Cut-off with Torque Limiting P0/1 control functions as previously noted. In response to a rise in delivery pressure the swashplate angle is reduced, restricting the input torque. This regulator prevents excessive load against the prime mover. Note: By connecting the Pc port to a remote pressure control, variable pump pressure control can be achieved.		
/1-E0 Electrical Displacement Control Varying the input current signal to the pump controller's electronic proportional pressure reducing valve (PPRV) allows the user to control the pump displacement. As the current signal to the PPRV increases, the pump displacement increases proportionally. Note: An external pressure supply of 40 bar is required at the PSV Port (50 bar max).		
/1-Q0 Pilot Operated Displacement Control Varying the input pressure signal to the Pi port allows the user to control the pump displacement. As the pressure signal to the Pi increases, the pump displacement increases proportionally. Note: An external pressure supply of up to 40 bar is required at the Pi Port (50 bar max).		

2-5 Functional Description of Regulator (cont)

Regulator Code	Control Curves	Hydraulic Circuit
/2- Hydraulic Power Shift with Pressure Compensation** This function, as with the /1 type can be used with Pressure compensation, Load sense and additional control options such as unloader functions. The control has the same function as standard torque limit option. In response to a rise in delivery pressure the swashplate angle is reduced, restricting input torque. However if a pilot pressure is applied to the Pf port on the regulator, the torque setting can be further reduced proportionally to the pilot pressure applied. The input torque can be reduced by approximately 40% .		
/3- Electronic Power Shift with Pressure Compensation** This function, as with the /1 type can be used with Pressure compensation, Load sense and additional control options such as unloader functions. The control has the same function as standard torque limit. In response to a rise in delivery pressure the swashplate angle is reduced, restricting input torque. However a pilot pressure of 40 bar is required, applied to the PSV port of the regulator. The torque setting can be further reduced proportionally to a 24VDC electrical signal applied to the proportional valve on the regulator.		

2-6 Torque Limiter Settings

The following tables show the power limitation at various electric motor speeds for a specific frame size of pump. When selecting a control setting please ensure that the power limitation of a particularly sized electric motor to your national standard is not exceeded.

K3VL45				
KW	**970**	**1150**	**1450**	**1750**
3.7	S3	S4	-	-
5.5	L3	S1	S3	S4
7.5	L1	L2	L4	S2
11	M1	M3	L1	L2
15	H3	H4	M2	M4
18.5	-	H2	H4	M2
22	-	-	H3	H4
30	-	-	-	H1
37	-	-	-	-
45	-	-	-	-
55	-	-	-	-
75	-	-	-	-
90	-	-	-	-
110	-	-	-	-
132	-	-	-	-

K3VL80				
KW	**970**	**1150**	**1450**	**1750**
3.7	-	-	-	-
5.5	S2	S4	-	-
7.5	L6	S1	S3	-
11	L2	L4	L6	S1
15	M4	L1	L3	L5
18.5	M1	M3	L1	L3
22	H3	M1	M4	L1
30	H1	H2	H4	M2
37	-	-	H2	H4
45	-	-	H1	H2
55	-	-	-	H1
75	-	-	-	-
90	-	-	-	-
110	-	-	-	-
132	-	-	-	-

K3VL112				
KW	**970**	**1150**	**1450**	**1750**
3.7	-	-	-	-
5.5	-	-	-	-
7.5	S5	S6	-	-
11	S1	S3	S5	S6
15	L3	L4	S2	S4
18.5	M4	L2	L4	S2
22	M2	M4	L3	L4
30	H4	M1	M3	L1
37	H2	H3	M1	M3
45	-	H2	H4	M1
55	-	-	H2	H4
75	-	-	-	H1
90	-	-	-	-
110	-	-	-	-
132	-	-	-	-

K3VL140				
KW	**970**	**1150**	**1450**	**1750**
3.7	-	-	-	-
5.5	-	-	-	-
7.5	-	-	-	-
11	S2	S4	-	-
15	L6	S1	S3	-
18.5	L3	L5	S1	S3
22	L1	L3	L6	S1
30	M2	M3	L2	L4
37	H4	M1	M3	L2
45	H2	H4	M2	M3
55	-	H2	H4	M2
75	-	-	H1	H3
90	-	-	-	H1
110	-	-	-	-
132	-	-	-	-

K3VL200				
KW	**970**	**1150**	**1450**	**1750**
3.7	-	-	-	-
5.5	-	-	-	-
7.5	-	-	-	-
11	-	-	-	-
15	-	-	-	-
18.5	S1	-	-	-
22	L4	S1	-	-
30	L2	L3	L5	S2
37	M3	L1	L3	L5
45	M1	M3	L2	L3
55	H5	M1	M3	L2
75	H1	H3	H6	M2
90	-	H1	H4	H6
110	-	-	H2	H4
132	-	-	-	H2

2-6 Torque Limiter Settings (cont)

Torque Limiter Control - Setting Table

K3VL frame size	Prime Mover Input Torque (Nm)																														
	30	36	41	46	49	53	61	73	82	91	100	107	121	146	154	163	182	200	216	246	298	307	367	409	450	492	540	610	618	711	752
45	S4	S3	S2	S1	L4	L3	L2	L1	M4	M3	M2	M1	H4	H3	H2	H1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80	-	-	-	S4	S3	S2	S1	L6	L5	L4	L3	L2	L1	M4	M3	M2	M1	H4	H3	H2	H1	-	-	-	-	-	-	-	-	-	-
112	-	-	-	-	-	-	S6	S5	S4	S3	S2	S1	L4	L3	L2	L1	M4	M3	M2	M1	H4	H3	H2	H1	-	-	-	-	-	-	-
140	-	-	-	-	-	-	-	-	-	S4	S3	S2	S1	L6	L5	L4	L3	L2	L1	M3	M2	M1	H4	H3	H2	H1	-	-	-	-	-
200 & 200H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S2	S1	L5	L4	L3	L2	L1	M3	M2	M1	H6	H5	H4	H3	H2	H1

Note: Highlighted options show power shift

Power Shift Control - Setting Table

/2 Hydraulic Spring Setting		K3VL80				K3VL112				K3VL140				K3VL200(H)					
		H4	H3	H2	H1	H4	H3	H2	H1	H4	H3	H2	H1	H6	H5	H4	H3	H2	H1
Pf Pressure (bar)	0	200	216	246	298	298	307	367	409	367	409	450	492	492	540	610	618	711	752
	10	167	183	209	252	252	255	309	349	309	349	383	421	421	453	517	524	610	648
	20	138	152	175	210	210	208	256	292	256	292	322	356	356	374	432	439	517	553
	30	111	123	145	173	173	167	209	241	209	241	266	298	298	303	355	361	433	465

/3 Electric Spring Setting		K3VL80				K3VL112				K3VL140				K3VL200(H)					
		H4	H3	H2	H1	H4	H3	H2	H1	H4	H3	H2	H1	H6	H5	H4	H3	H2	H1
Current (mA)	0	200	216	246	298	298	307	367	409	367	409	450	492	492	540	610	618	711	752
	336	167	183	209	252	252	255	309	349	309	349	383	421	421	453	517	524	610	648
	473	138	152	175	210	210	208	256	292	256	292	322	356	356	374	432	439	517	553
	595	111	123	145	173	173	167	209	241	209	241	266	298	298	303	355	361	433	465

2-7 Installation

Moment of Inertia and Torsional Stiffness

Frame Size	Moment of Inertia		Torsional Stiffness (N m/rad)
	I (kg.m²)	GD² (kgf.m²)	
K3VL28	2.09×10^{-3}	$8.36\text{-}10^{-3}$	2.20×10^{4}
K3VL45	3.85×10^{-3}	$1.54\text{-}10^{-2}$	3.59×10^{4}
K3VL80	7.30×10^{-3}	$2.92\text{-}10^{-2}$	4.83×10^{4}
K3VL112	2.02×10^{-2}	$8.06\text{-}10^{-2}$	9.33×10^{4}
K3VL140	2.02×10^{-2}	$8.06\text{-}10^{-2}$	9.33×10^{4}
K3VL200	4.58×10^{-2}	$1.83\text{-}10^{-1}$	1.54×10^{5}
K3VL200H	4.58×10^{-2}	$1.83\text{-}10^{-1}$	1.54×10^{5}

Through Drive Limitations

Pump over all length (LPX) (mm)	
Frame size	Single pump type N
K3VL28	219
K3VL45	244
K3VL80	272
K3VL112	307
K3VL140	307
K3VL200	359
K3VL200H	424

Frame size	Maximum Permisable Bending Moment
K3VL28	137
K3VL45	137
K3VL80	244
K3VL112	462
K3VL140	462
K3VL200	930
K3VL200H	930

2-7 Installation (cont)

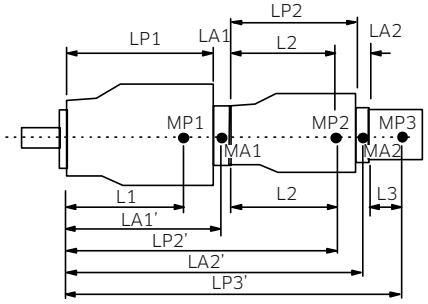
Through Drive Limitations (cont)

Frame size	Pump approx weight (MPX)(Kg)	
	Single pump type N	
	Without Torque Limitor	With Torque Limitor
K3VL28	20	na
K3VL45	27	29
K3VL80	35	37
K3VL112	65	67
K3VL140	65	67
K3VL200	95	97
K3VL200H	130	132

Frame size	Pump CofG from mount (Lx) (mm)
	Single pump type N
K3VL28	115
K3VL45	120
K3VL80	130
K3VL112	150
K3VL140	150
K3VL200	190
K3VL200H	223

Adaptor Kits Weights (MAX) & Width (LAX)			
Frame Size	Adaptor Kit	Weight (MAX) Kg	Width (LAX) mm
K3VL28	SAE 'A'	0	0
	SAE 'B'	2	20
K3VL45	SAE 'A'	0	0
	SAE 'B' & 'BB'	2	20
K3VL80	SAE 'A'	0	0
	SAE 'B' & 'BB'	3	20
	SAE 'C', 'CC' & 'C4'	4	24.5
K3VL112 & 140	SAE 'A'	0	0
	SAE 'B' & 'BB'	3	25
	SAE 'C', 'CC' & 'C4'	5	30
	SAE 'D'	10	43
K3VL200	SAE 'A'	1	6
	SAE 'B' & 'BB'	8	25
	SAE 'C', 'CC' & 'C4'	8	30
	SAE 'D'	10	38
	SAE 'E'	15	38

Apart from predefined maximum throughput limitations, one must also ensure that to prevent a possible excessive bending moment occurring that the maximum combined bending moment of the combination is not exceeded as determined in the following expression.



MPX = mass of pump [kg]
LPX = length of pump [mm]
Lx = distance of CofG from pump mounting face [mm]
MAX = mass of adaptor kit [kg]
LAX = width of adaptor kit [mm]

Bending Moment = ((L1.mP1) + (LA1'.mA1) + (LP2'.mP2) +(LA2'.mA2) +LP3'.mP3) +...)/102[Nm]

((L1.mP1)
+ (LP1+(LA1/2)).mA1
+ (LP1+LA1+L2).mP2
+ (LP1+LA1+LP2(LA2/2)).mA2)
+ (LP1+LA1+LP2+LA2).mP3)
+.....)/102

2-7 Installation (cont)

Response times

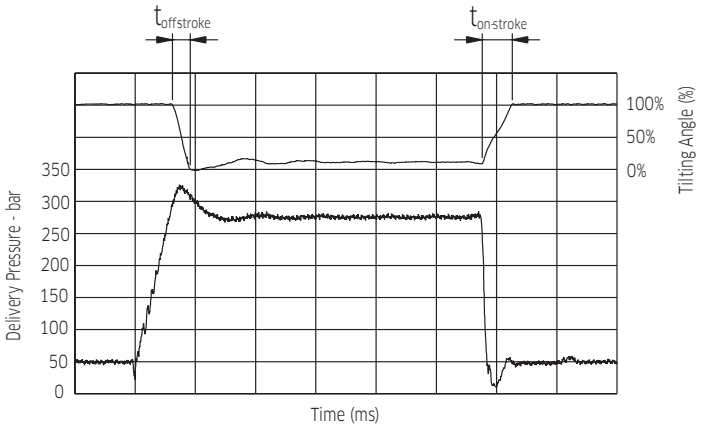
Pressure Cut-off Dynamic Response

50 to 280 bar

	$t_{off\text{-}stroke}$	$t_{on\text{-}stroke}$
Unit	mS	
K3VL28	20	40
K3VL45	60	100
K3VL80	95	170
K3VL112/140	90	140
K3VL200/H	110	210

Test conditions:

Pump speed	= 1800 rpm
Inlet Condition	= 0 bar
Oil Type	= ISO VG46
Oil Temperature	= 50°C
Compressed oil volume	= 5 litres

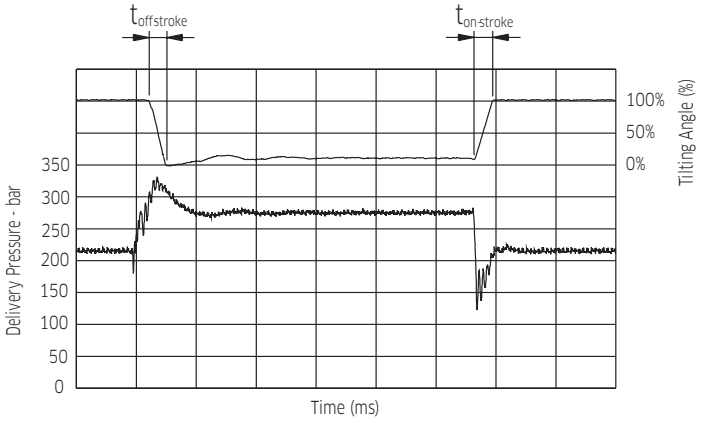


220 to 280 bar

	$t_{off\text{-}stroke}$	$t_{on\text{-}stroke}$
Unit	mS	
K3VL28	20	40
K3VL45	60	70
K3VL80	100	110
K3VL112/140	100	120
K3VL200/H	110	220

Test conditions:

Pump speed	= 1800 rpm
Inlet Condition	= 0 bar
Oil Type	= ISO VG46
Oil Temperature	= 50°C
Compressed oil volume	= 5 litres



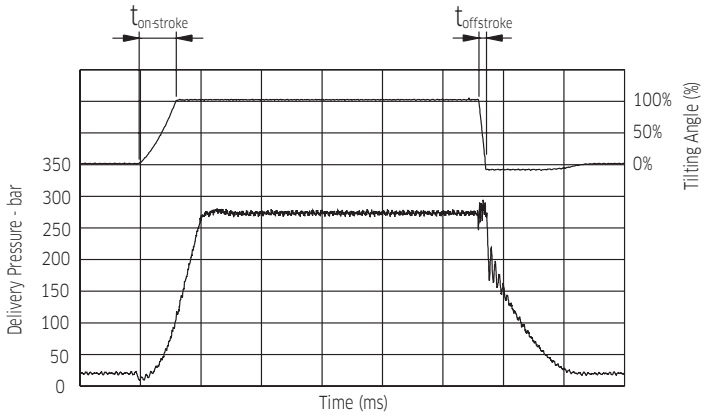
Load Sensing Dynamic Response

20 to 280 bar

	$t_{off\text{-}stroke}$	$t_{on\text{-}stroke}$
Unit	mS	
K3VL28	20	70
K3VL45	20	115
K3VL80	55	155
K3VL112/140	55	195
K3VL200/H	65	190

Test conditions:

Pump speed	= 1800 rpm
Inlet Condition	= 0 bar
Oil Type	= ISO VG46
Oil Temperature	= 50°C
Compressed oil volume	= 5 litres



Note:
The response values shown in the table above are typical of those experienced in the laboratory.
Actual reposnse time will vary with different hydraulic circuits.

2-7 Installation (cont)

Electrical and Pilot Operated Displacement Control (Type E0, E1, E2, E3 & Q0)

Type E0 - In order for the electronic displacement control to function, a pilot pressure of 40 bar must be supplied to the Pi port on the regulator. A gear pump attached to the rear of the K3VL pump or an external pressure source can be used to provide the required pilot pressure.

Type Q0 - In order for the Q0 displacement control to function, a variable pilot pressure between 0 and 40 bar is requiredto be supplied to the Pi port on the regulator.

Proportional Pressure Reducing Valve Specification

Maximum Pilot Pressure : 50 bar (if higher pressure required contact KPM UK)
Max Flow: : 10 l/min
Hydraulic oil : Mineral oil
Oil temp range : -20~+90°C
Viscosity range : 5~500 cSt

Electrical Specifications

	E0, E1, E2 24V DC	E3 12V DC
Rated Current	700 mA	1,400 mA
Recommended Dither	80 Hz/200 mAp-p	80 Hz/200 mAp-p
Coil Resistance	17.5 Ω	3.2 Ω
Ambient Temperature Range	-30 ~+95°C	-30 ~+95°C
Water Resistance	According to JIS D 0203 S2 SAE J575	According to JIS D 0203 S2 SAE J575
IP Rating	IPX6	IPX6