PVBS, main spool

Flow control, spool characteristic

The spool is directly controlling the oil flow to and from the work ports. This flow is directly proportional with the spool travel. The spool travel is made up of 1.5 mm [0.06 in] dead band and 3.5 mm [0.14 in] active region in each direction giving 0-full flow. An additional 2.5 mm [0.1 in] travel in one direction in order to accommodate float functionality can be used dependant on choice of PVM.

Flow control

The spools are designed in such a way that the oil flow coming from the pump to the work ports are controlled by the spool travel. When the spool is moved it forms a variable orifice between the P-gallery and one work port and between the other work port and the T-gallery. The size of the orifice is directly linked to the traveled distance of the spool.

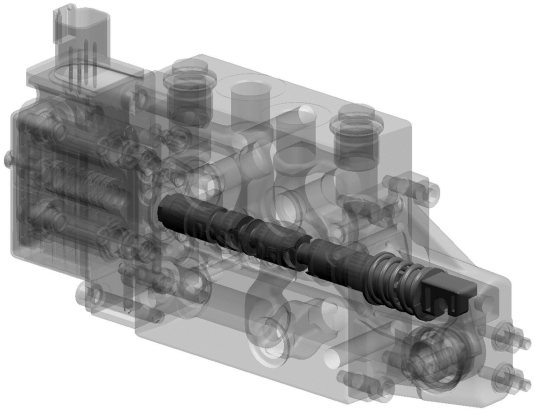
Spools characteristic

The spools characteristic is linear with a soft start. The spool will have a progressive behavior from neutral to 10% of the full flow. From there it will be linear all the way to maximum flow.

Versions available:

1. Different flow versions
2. Open/closed in neutral
3. Float
4. Asymmetric spools

Sectional view – spool shown



Versions available:

Different flow versions

All the spools are flow controlled 4/4 spools. The spool comes in 5 different flow versions, all with a symmetrical flow: 5 l/min [1.32 US gal/min], 10 l/min [2.64 US gal/min], 25 l/min [6.60 US gal/min], 40 l/min [10.57 US gal/min], 65 l/min [17.17 US gal/min].

The flow specified is at 10 bar [145 psi] with 21 mm^2/ sec [97 SUS].

Open/closed in neutral

The main spools for the PVG 16 are available with two different functions in neutral – open or closed. *Open in neutral* means that there is a throttled open connection across the main spool from both work ports A and B to the T-gallery. Open in neutral is generally used together with hydraulic motors. *Closed in neutral* means that there is no connection from work port A or B to the T-gallery across the main spool. Closed in neutral spools are generally used together with cylinders.

Warning

Using *closed in neutral* spools together with a hydraulic motor can cause a sudden and abrupt stop of the rotation.

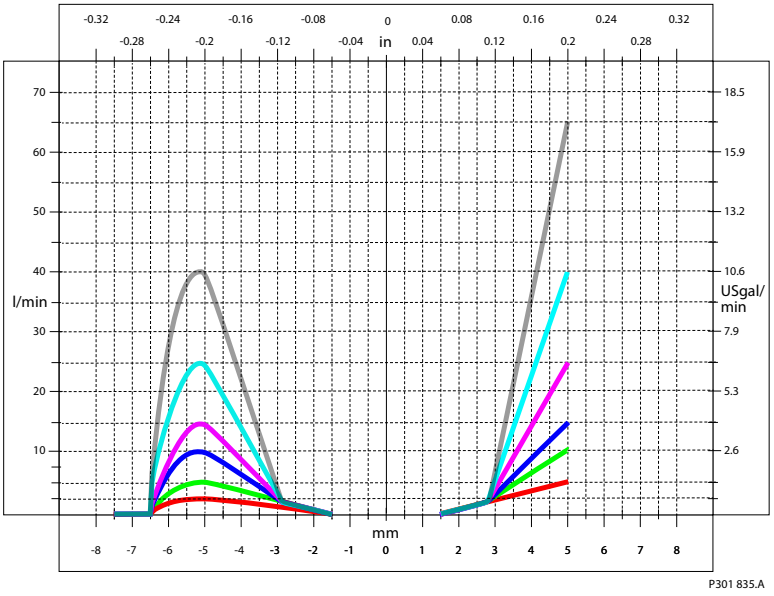
PVBS, main spool

Float

A spool with float function as well as normal actuation is capable of opening a connection between both work ports A and B to the T-gallery. This makes it possible for the oil in the e.g. cylinder to flow freely to the tank and the oil in the tank to flow freely from the tank to the work ports. This connection is opened when actuating 7.5 mm to the B direction (normal proportional control ends at 5 mm). Float is used if an application is to move freely back and forth to e.g. follow rough terrain.

Asymmetric spools

Asymmetrical main spools (PVBS) are designed for use with cylinders whose rod and piston sides differ greatly in volume. When operating with a symmetrical main spool, the difference in volume causes the cylinder's speed to be different in lifting versus lowering situations, given the same set point. If you want the same speed both in lifting and in lowering situations, you need an asymmetrical main spool. Asymmetrical spools have a linear flow characteristic with a progressive soft start. The soft start guarantees a good resolution in the low flow area where fine metering is needed.



PVBS, main spool

How to select the correct spool

1. Calculate your cylinder's piston-rod ratio using $\frac{D_1^2}{D_1^2 - D_2^2}$

2. Use the result to find the right asymmetrical main spool in the table

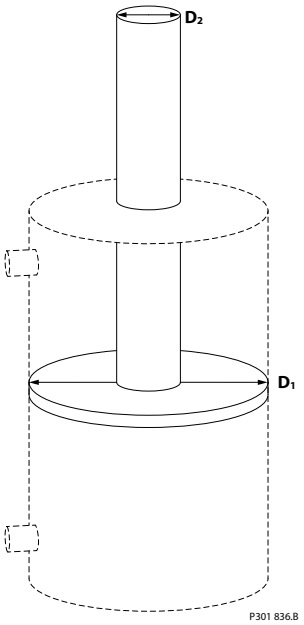
Example

- flow request = 25 l/min
- use with PVE
- piston diameter = 150 mm = D_1
- rod diameter = 100 mm = D_2

1. Calculate your cylinder's piston-rod ratio

Equation: $\frac{D_1^2}{D_1^2 - D_2^2} = \frac{(150\ mm)^2}{(150\ mm)^2 - (100\ mm)^2} = 1.8$

2. Use the result to find the right asymmetrical main spool A piston-rod ratio of 1.8 for spools with a 25 l/min flow cannot be found in the table with code numbers. Therefore, we round to the nearest ratio (1.6). The spool with a 25 l/min flow and a cylinder ratio of 1.6 has the code number *11109645*.

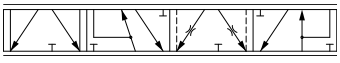
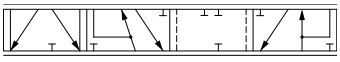


Actuation

The main spool in the PVG 16 can be actuated by one of three means. One is a lever for manual actuation, the second is electrically by a PVE and the third is hydraulically by a PVH. By actuating the main spool with a PVM or PVE the return spring of the spool will act with a force equivalent to 77 N [12.5 bar]. By actuating the main spool with a PVH the return spring will act with a force equivalent to 268 N [23 bar].

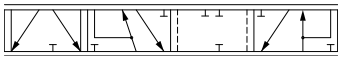
PVBS hydraulic schematics and code numbers

Symmetrical main spools

Symbol	Description	Code number according to flow l/min [US gal/min]				
		5 [1.32]	10 [2.64]	25 [6.60]	40 [10.57]	65 [17.17]
	PVBS Main spool Throttled open neutral position PVM/PVE actuation With float in B-direction	11105537	11105538	11105539	11105540	11105541
	PVBS Main spool Throttled open neutral position PVH actuation With float in B- direction	11109637	11109638	11109639	11109640	11109641
	PVBS Main spool Closed neutral position PVM/PVE actuation With float in B-direction	11105532	11105533	11105534	11105535	11105536
	PVBS Main spool Closed neutral position PVH actuation With float in B-direction	11109632	11109633	11109634	11109635	11109636

PVBS, main spool

Asymmetrical main spools

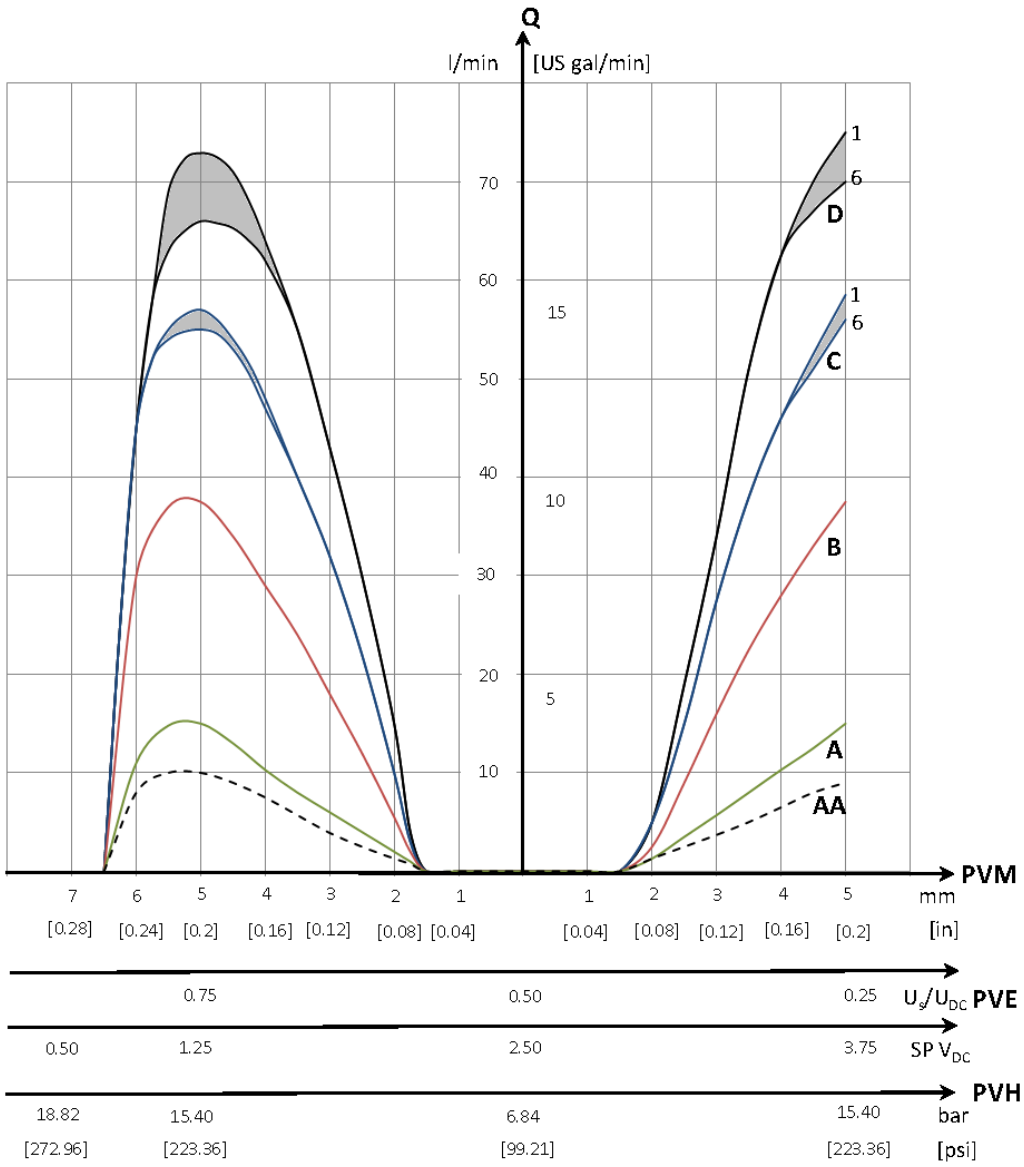
Symbol	Description	Code number according to flow l/min [US gal/min]					
		5/2.5 [1.32/0.66]	**10/5 [2.64/1.32]**	**25/10 [6.60/2.64]**	**25/15 [6.60/3.96]**	**40/15 [10.57/3.96]**	**40/25 [10.57/6.60]**
	Cylinder ratio	**2.0**	**2.0**	**2.5**	**1.6**	**2.7**	**1.6**
	PVBS Main spool Closed neutral position PVM/PVE actuation With float in B-direction	11109642	11109643	11109644	11109645	11109646	11109647
	PVBS Main spool Closed neutral position PVH actuation With float in B- direction	11146752	11146753	11146754	11146755	11146756	11146757

PVBS oil flow characteristics

The letters AA, A, B, C and D denotes the spool flow sizes ranging from 5 l/min to 65 l/min [1.32 to17.17 US gal/min]. All tests are done by using Tellus32 @ 21mm^2/s.

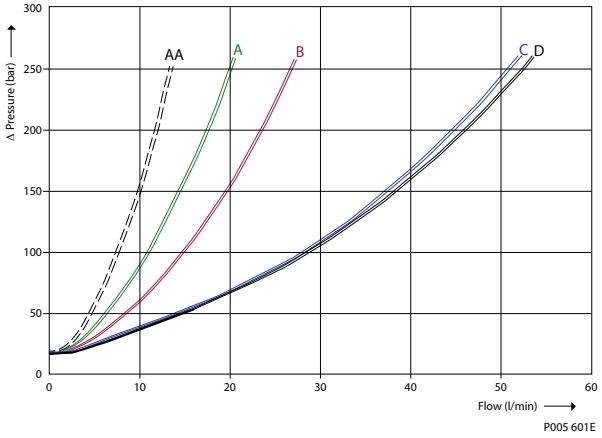
PVBS, main spool

Oil flow as a function of spool travel

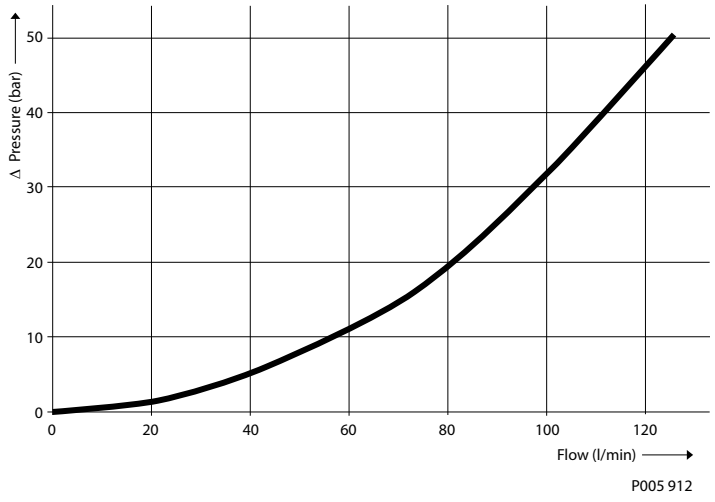


PVBS, main spool

Pressure drop to tank for open spool in neutral



Pressure drop at full spool stroke



Pressure drop in float