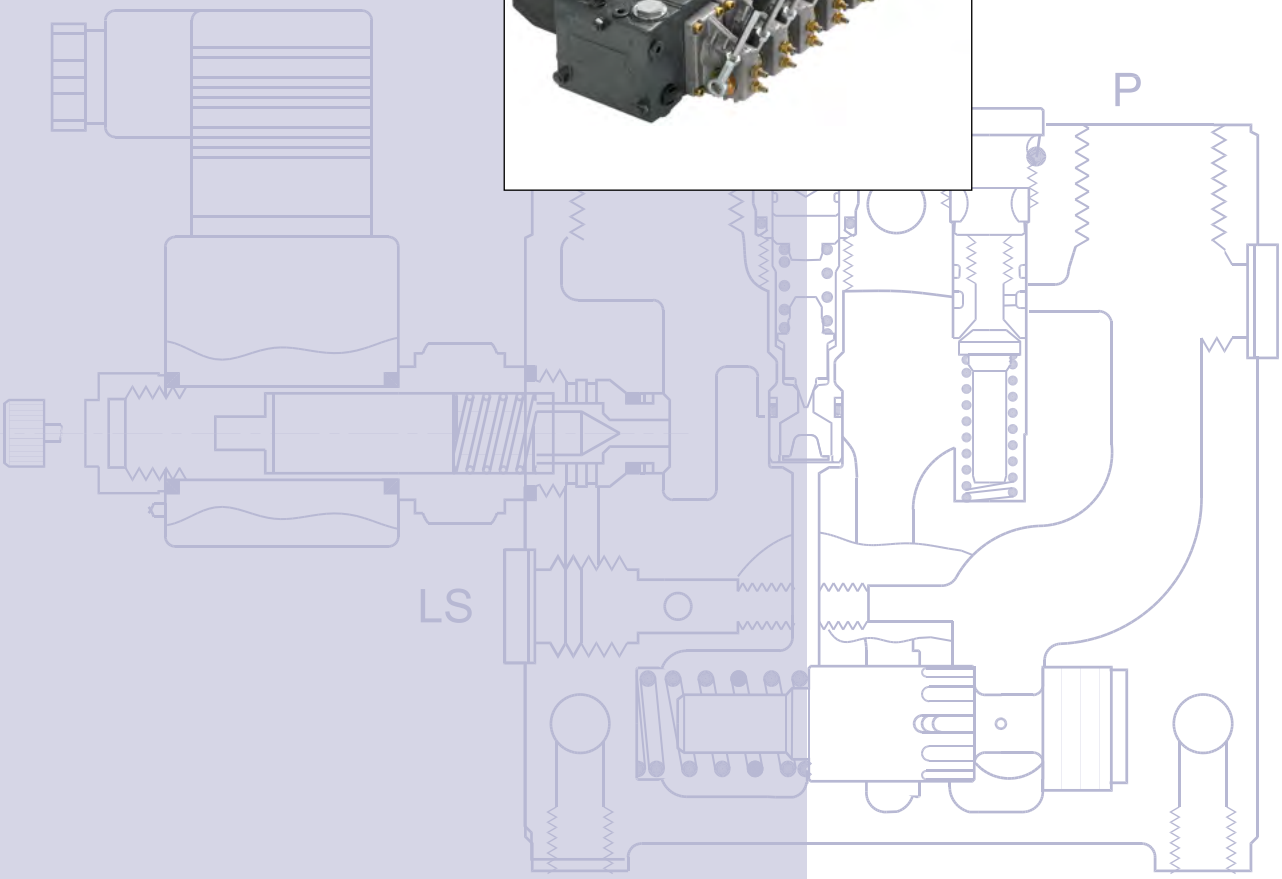
SAUER DANFOSS

# PVG 32
# Proportional Valve Group

## Technical Information



# PVG 32 Proportional Valve Group
# Technical Information
## Revisions, Literature Reference

## Revision History

*Table of revisions*

| Date | Page | Changed | Rev |
|---|---|---|---|
| Jun 2010 | 69 | Code numbers changed | GD |
| Dec 2010 | 80 | New back cover | GE |
| Sep 2012 | All | Major update | HA |
| Oct 2012 | 15,23,24,51,63 | New images, notes | HB |
| Aug 2013 | 62 | New image | HC |

## Literature Reference

*Literature reference for PVG products*

| Title | Type | Order number |
|---|---|---|
| PVG 32 Metric ports | Technical Information | 11051935 |
| PVG 100 | Technical Information | 520L0720 |
| PVG 120 Proportional Valve | Technical Information | 520L0356 |
| Basic Module for PVBZ | Technical Information | 520L0721 |
| PVSK Module with Integrated Diverter Valve and P-disconnect Function | Technical Information | 520L0556 |
| PVED-CC Electrohydraulic actuator | Technical Information | 520L0665 |
| PVED-CX Electrohydraulic actuator, Series 4 | Technical Information | 11070179 |
| PVE Series 4 | Technical Information | 520L0553 |
| PVPV / PVPVM Pump Side Module | Technical Information | 520L0222 |
| Electrohydraulic Actuator Type PVHC for PVG 32 and PVG 100 | Technical Information | 11064912 |
| Combination Module PVGI | Technical Information | 520L0405 |
| PVSP/M Priority Module | Technical Information | 520L0291 |
| PVBM Meter-in Meter-out Module | Datasheet | L1117392 |

This PVG 32 catalog lists modules without T0 facilities, for more information regarding T0 facilities please see *PVG 32 Metric port,* **11051935** and *Basic module PVBZ,* **520L0721.**



Frontpage: F301302, F301306, F301056, Drawing 157-195.

# PVG 32 Proportional Valve Group
# Technical Information
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# Contents

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# PVG 32 Proportional Valve Group
# Technical Information
## Contents

## General Description

PVG 32 is a hydraulic load sensing valve designed to give maximum flexibility. From a simple load sensing directional valve, to an advanced electrically controlled load-independent proportional valve.

The PVG 32 modular system makes it possible to build up a valve group to meet requirements precisely. The compact external dimensions of the valve remain unchanged whatever combination is specified.

## Features of PVG 32

- Load-independent flow control:
  - Oil flow to an individual function is independent of the load pressure of this function
  - Oil flow to one function is independent of the load pressure of other functions
- Good regulation characteristics
- Energy-saving
- Up to 12 basic modules per valve group
- Several types of connection threads
- Low weight
- Compact design and installation

## PVG Modules

### PVP, pump side modules

- Built-in pressure relief valve
- Pressure gauge connection
- Versions:
  - Open center version for systems with fixed displacement pumps
  - Closed center version for systems with variable displacement pumps
  - Pilot oil supply for electrical actuator built into the pump side module
  - Pilot oil supply for hydraulic actuation built into the pump side module
  - Versions prepared for electrical LS unloading valve PVPX

### PVB, basic modules

- Interchangeable spools
- Depending on requirements the basic module can be supplied with:
  - Integrated pressure compensator in channel P
  - Load holding check valve in channel P
  - Shock/suction valves for A and B ports
  - LS pressure limiting valves individually adjustable for ports A and B
  - Different interchangeable spool variants
  - All versions suitable for mechanical, hydraulic and electrical actuation

## PVG Modules (continued)

### Actuation modules

The basic module is always fitted with mechanical actuator PVM and PVMD, which can be combined with the following as required:

- Electrical actuator (11 - 32 V ⎓):
  - PVES – proportional, Super
  - PVEH – proportional, High performance
  - PVEH-F – proportional high performance, Float
  - PVEA – proportional low hysteresis
  - PVEM – proportional, Medium performance
  - PVEO – ON/OFF
  - PVEU – proportional, voltage control, 0-10 V
  - PVED-CC – Digital CAN controlled J1939/ISOBUS
  - PVED-CX – Digital CAN controlled CANopen X-tra safety
  - PVEP – PWM voltage controlled (11-32V)
  - PVHC – High Current actuator for PVG
- PVMR, cover for Mechanical detent
- PVMF, cover for Mechanical Float
- PVH, cover for Hydraulic actuation

## Accessories

### Remote control units

- Electrical remote control units:
  - PVRE, PVRET
  - PVREL
  - PVRES
  - Prof 1
  - Prof 1 CIP
  - JS120
  - JS1000 Ball grip
  - JS1000 PROgrip
  - JS2000
  - JS6000
  - JS7000
- Hydraulic remote control unit:
  - PVRHH

## Safety in Application

All makes and all types of control valves (incl. proportional valves) can fail, thus the necessary protection against the serious consequences of function failure should always be built into the system. For each application an assessment should be made for the consequences of pressure failure and uncontrolled or blocked movements.

To determine the degree of protection that is required to be built into the application, system tools such an FMEA (Failure Mode and Effect Analysis) and Hazard and Risk Analysis can be used.

### FMEA (Failure Mode and Effect Analysis) IEC EN 61508

FMEA is a tool used for analyzing potential risks. This analytical technique is utilized to define, identify, and prioritize the elimination or reduction of known and/or potential failures from a given system before it is released for production.
Please refer to IEC FMEA Standard 61508.

### Hazard and Risk Analysis ISO 12100-1 / 14121

This analysis is a tool used in new applications as it will indicate whether there are special safety considerations to be met according to the machine directives EN 13849. Dependent on the determined levels conformity this analysis will detirmine if any extra requirements for the product design, development process, production process or maintenance, i.e. the complete product life cycle.

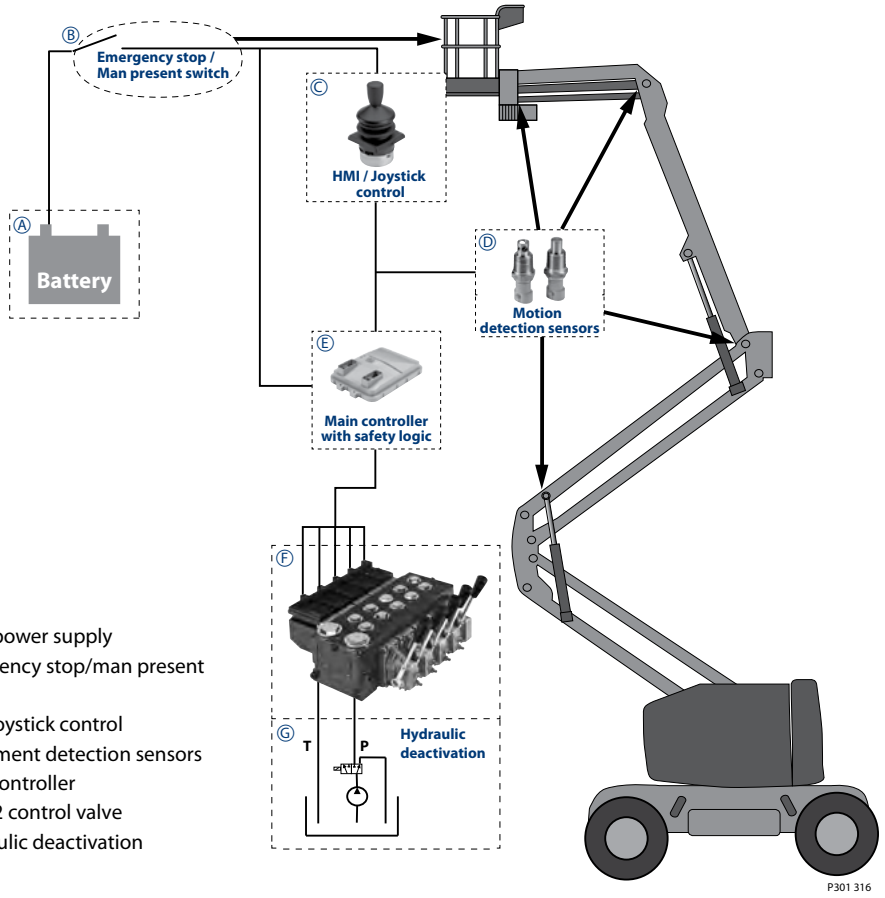
⚠ Warning

All makes/brands and types of directional control valves – inclusive proportional valves – can fail and cause serious damage. It is therefore important to analyze all aspects of the application.
Because the proportional valves are used in many different operation conditions and applications, the manufacturer of the application is alone responsible for making the final selection of the products – and assuring that all performance, safety and warning requirements of the application are met.
The process of choosing the control system – and safety levels – is governed by the machine directives EN 13849 (Safety related requirements for control systems).

## Safety in Application (continued)

### Control System Examples

Example of a control system for manlift using PVE Fault monitoring input signals and signals from external sensors to ensure the PLUS+1™ main controllers correct function of the manlift.

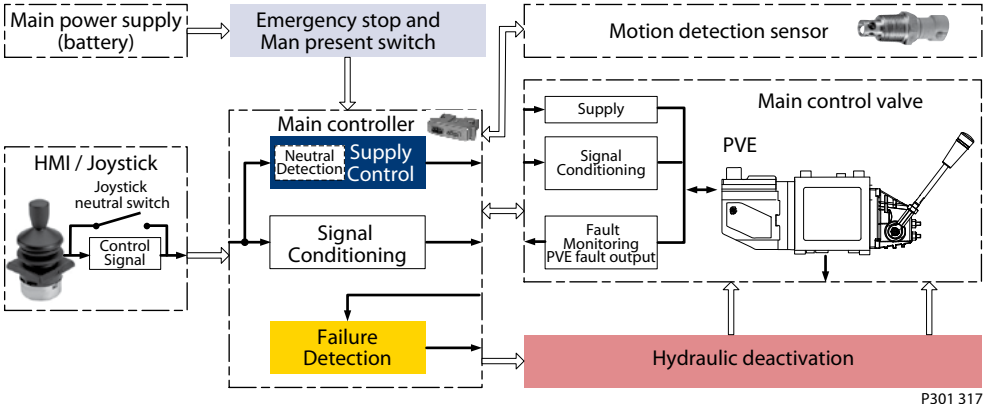



A Main power supply
B Emergency stop/man present switch
C HMI/Joystick control
D Movement detection sensors
E Main controller
F PVG 32 control valve
G Hydraulic deactivation

**⚠ Warning**

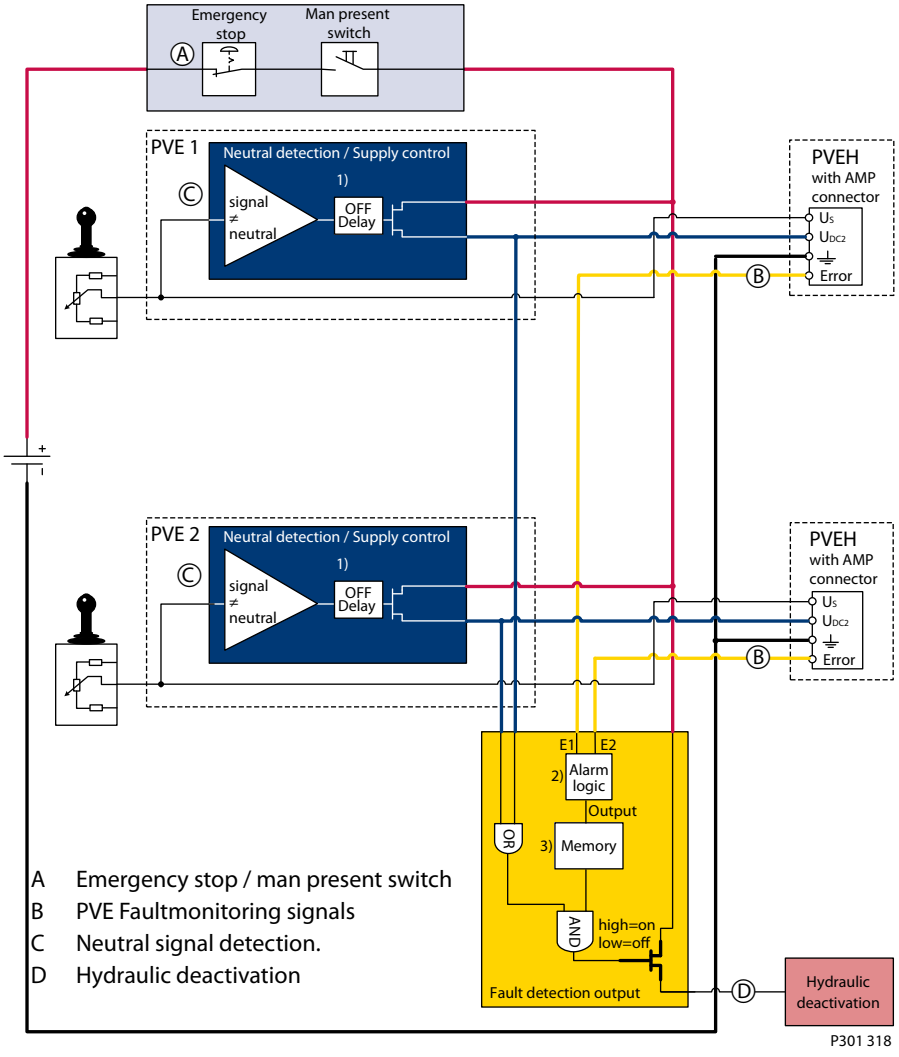
It is the responsibility of the equipment manufacturer that the control system incorporated in the machine is declared as being in confirmity with the relevant machine directives.

*Electrical block diagram for above illustration*



## Safety in Application (continued)

Example of a typical wiring block diagram using PVEH with neutral power off switch and fault monitoring output for hydraulic deactivation.



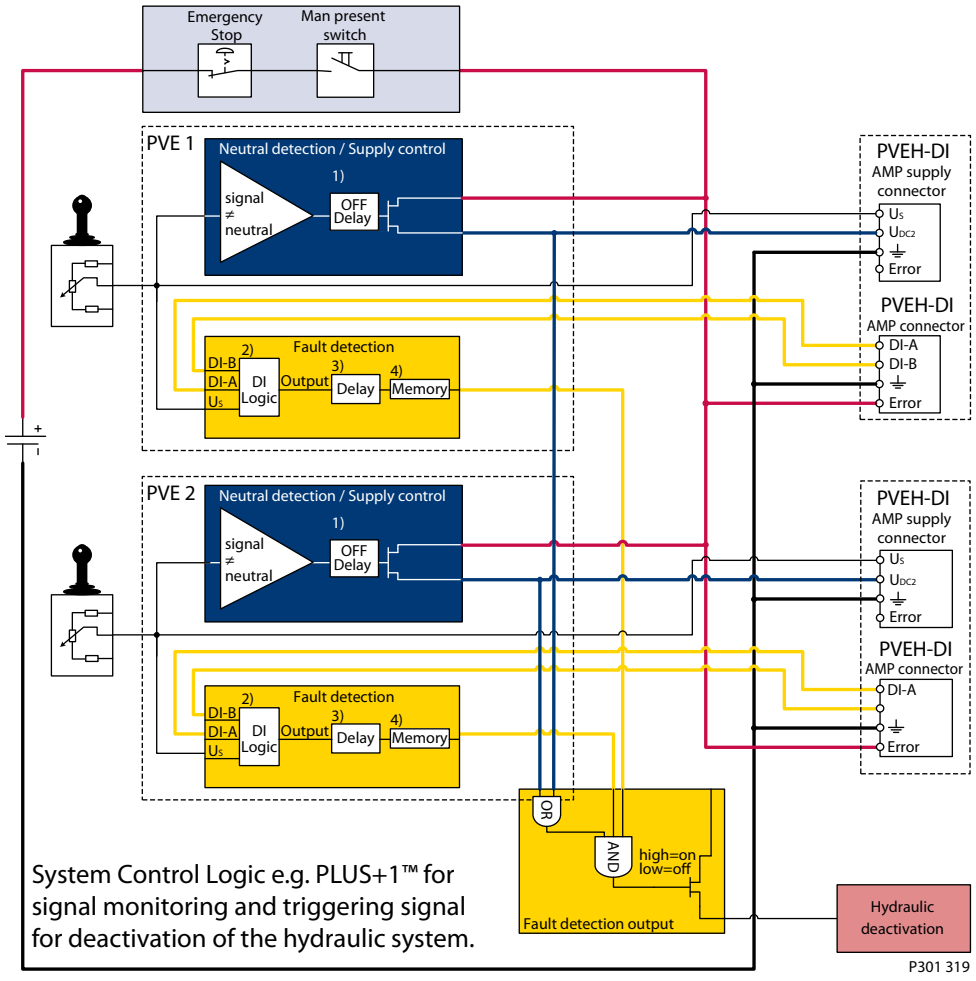

System Control Logic e.g. PLUS+1™ for signal monitoring and triggering signal for deactivation of the hydraulic system.

**⚠ Warning**

It is the responsibility of the equipment manufacturer that the control system incorporated in the machine is declared as being in confirmity with the relevant machine directives.

## Safety in Application (continued)

Example of fault monitoring for deactivation of the hydraulic system with extra fault inputs using the PVE's with DI (Direction Indication) function.




**⚠ Warning**

It is the responsibility of the equipment manufacturer that the control system incorporated in the machine is declared as being in confirmity with the relevant machine directives.

Other modules which can be used in connection with hydraulic deactivation at different levels.

### PVG32 – Mainly used in system with fixed displacement pumps

- PVSK, commonly used in crane application - full flow dump
- PVPX, LS dump to tank

### PVG100 – Alternative LS dump or pilot supply disconnect

- PVPP, pilot oil supply shut off
- External cartridge valve connecting LS Pressure to Tank
- External cartridge valve connecting main Pressure to Tank

### PVG120 – Pump disconnect/block for variable pumps

- PVPE, full flow dump for the PVG 120
- External cartridge valve connecting LS Pressure to Tank

### PVG 32 with Open Center PVP (fixed displacement pump) • PVB with Flow Control Spool

When the pump is started and the main spools in the individual basic modules (11) are in the neutral position, oil flows from the pump, through connection P, across the pressure adjustment spool (6) to tank. The oil flow led across the pressure adjustment spool determines the pump pressure (stand-by pressure).

When one or more of the main spools are actuated, the highest load pressure is fed through the shuttle valve circuit (10) to the spring chamber behind the pressure adjustment spool (6), and completely or partially closes the connection to tank to maintain pump pressure.

Pump pressure is applied to the right-hand side of the pressure adjustment spool (6). The pressure relief valve (1) will open should the load pressure exceed the set value, diverting pump flow back to tank.

In a pressure-compensated basic module the compensator (14) maintains a constant pressure drop across the main spool – both when the load changes and when a module with a higher load pressure is actuated.

With a non pressure-compensated basic module incorporating a load drop check valve (18) in channel P, the check valve prevents return oil flow.

The basic module can be supplied without the load drop check valve in channel P for functions with over-center valves.

The shock valves PVLP (13) with fixed setting and the suction valves PVLA (17) on ports A and B are used for the protection of the individual working function against overload and/or cavitation.

An adjustable LS pressure limiting valve (12) can be built into the A and B ports of pressure-compensated basic modules to limit the pressure from the individual working functions.

Please see *The sectional drawing V310106.A* on the next page for better understanding of this example.

The LS pressure limiting valves save energy compared with the shock valves PVLP:

- with PVLP all the oil flow to the working function will be led across the combined shock and suction valves to tank if the pressure exceeds the fixed setting.
- with LS pressure limiting valves an oil flow of about 2 l/min [0.5 US gal/min] will be led across the LS pressure limiting valve to tank if the pressure exceeds the valve setting.

### PVG 32 with Closed Center PVP (variable displacement pump) • PVB with Flow Control Spool

In the closed center version of PVP an orifice (5) and a plug (7) have been fitted instead of the plug (4). This means that the pressure adjustment spool (6) will only open to tank when the pressure in channel P exceeds the set value of the pressure relief valve (1).

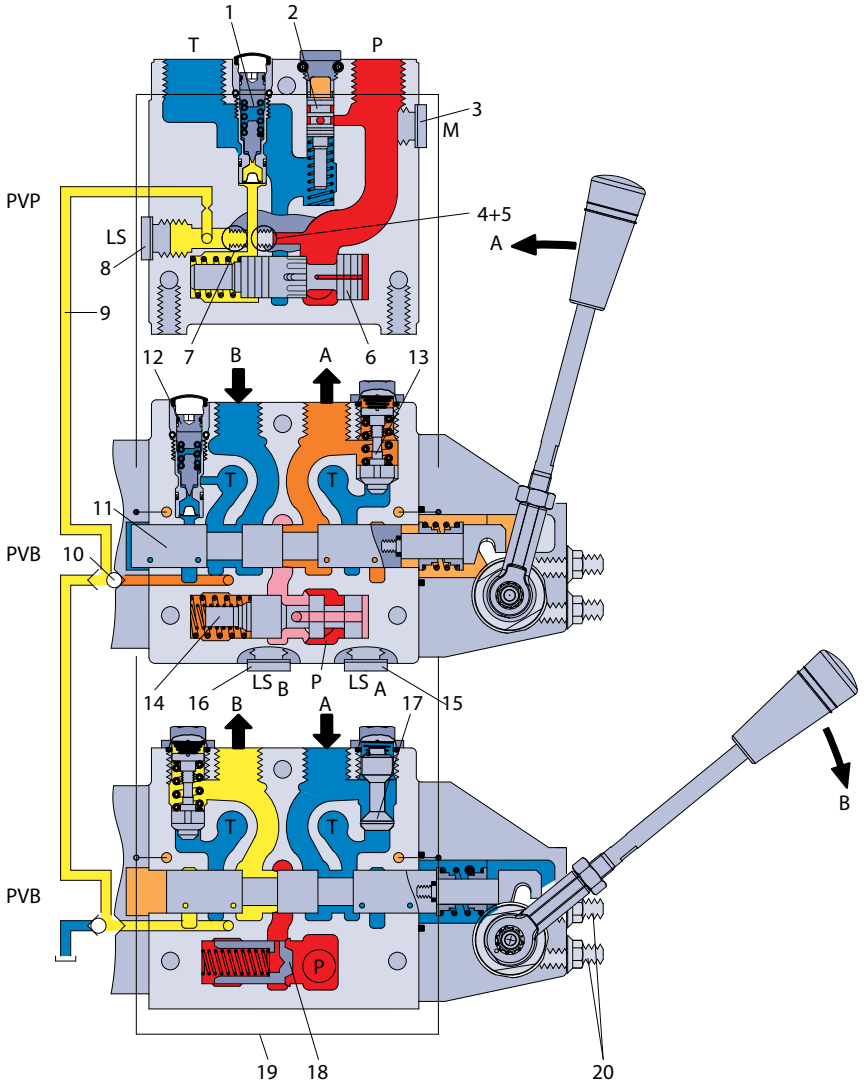
In load sensing systems the load pressure is led to the pump control via the LS connection (8).

In the neutral position the pump load sense control sets the displacement so that leakage in the system is compensated, to maintain the set stand-by pressure.
When a main spool is actuated the pump load sense control will adjust the displacement so that the set differential pressure (margin) between P and LS is maintained.

The pressure relief valve (1) in PVP should be set at a pressure of approx. 30 bar [435 psi] above maximum system pressure (set on the pump or external pressure relief valve).

## PVG 32 Sectional View

*PVG 32 Sectional Drawing*




V310106.A

1. Pressure relief valve
2. Pressure reduction valve for pilot oil supply
3. Pressure gauge connection
4. Plug, open center
5. Orifice, closed center
6. Pressure adjustment spool
7. Plug, closed center
8. LS connection
9. LS signal
10. Shuttle valve
11. Main spool
12. LS pressure limiting valve
13. Shock and suction valve, PVLP
14. Pressure compensator
15. LS connection, port A
16. LS connection, port B
17. Suction valve, PVLA
18. Load drop check valve
19. Pilot oil supply for PVE
20. Max. oil flow adjustment screws for ports A and B

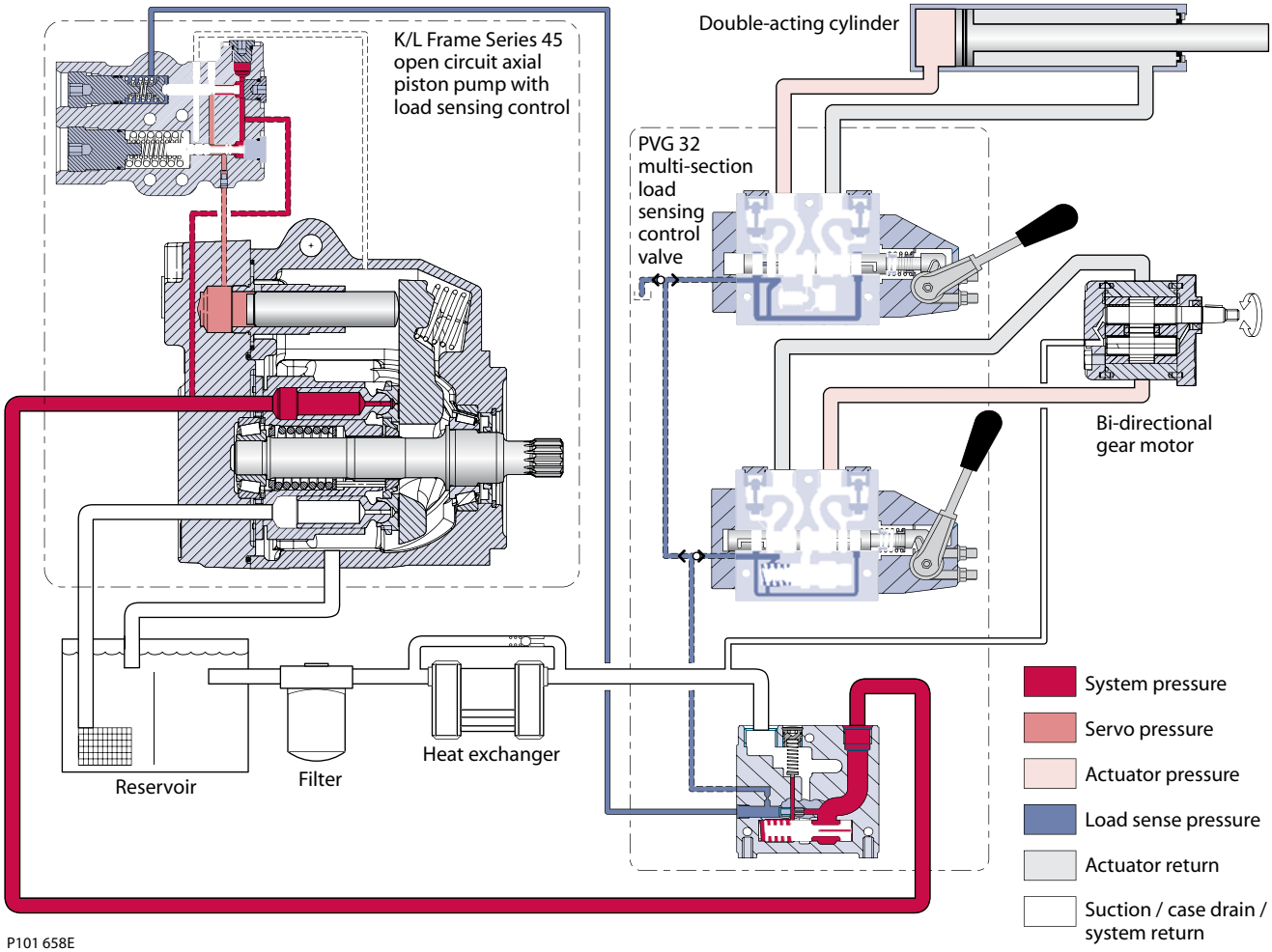
## Load Sensing for Variable Displacement Pump Supply

The pump receives fluid directly from the reservoir through the inlet line. A screen in the inlet line protects the pump from large contaminants. The pump outlet feeds directional control valves such as PVG-32, hydraulic integrated circuits (HIC), and other types of control valves. The PVG valve directs and controls pump flow to cylinders, motors and other work functions. A heat exchanger cools the fluid returning from the valve. A filter cleans the fluid before it returns to the reservoir.

Flow in the circuit determines the speed of the actuators. The position of the PVG valve spool determines the flow demand. A hydraulic pressure signal (LS signal) communicates demand to the pump control. The pump control monitors the pressure differential between pump outlet and the LS signal, and regulates servo pressure to control the swashplate angle. Swashplate angle determines pump flow.

Actuator load determines system pressure. The pump control monitors system pressure and will decrease the swashplate angle to reduce flow if system pressure reaches the pump control setting. A secondary system relief valve in the PVG valve acts as a back-up to control system pressure.

*Pictorial circuit diagram*

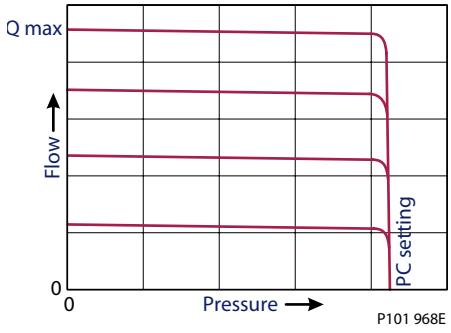



P101 658E

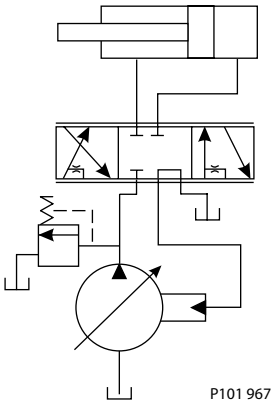
## Load Sensing Controls

The LS control matches system requirements for both pressure and flow in the circuit regardless of the working pressure. Used with a closed center control valve, the pump remains in low-pressure standby mode with zero flow until the valve is opened.
The LS setting determines standby pressure.

*Typical operating curve*




*Load sensing circuit*




Most load sensing systems use parallel, closed center, control valves with special porting that allows the highest work function pressure (LS signal) to feed back to the LS control.

**Margin pressure** is the difference between system pressure and the LS signal pressure. The LS control monitors margin pressure to read system demand. A drop in margin pressure means the system needs more flow. A rise in margin pressure tells the LS control to decrease flow.

*LS control with bleed orifice (do not use with PVG valves)*

The load sense signal line requires a bleed orifice to prevent high-pressure lockup of the pump control. Most load-sensing control valves include this orifice. An optional internal bleed orifice is available, for use with control valves that do not internally bleed the LS signal to tank.

*Integral PC function*

The LS control also performs as a PC control, decreasing pump flow when system pressure reaches the PC setting. The pressure compensating function has priority over the load sensing function.

For additional system protection, install a relief valve in the pump outlet line.

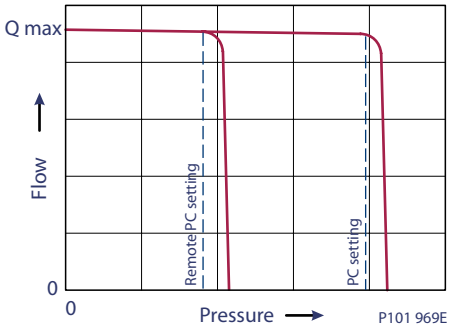
**Load sensing system characteristics:**

- Variable pressure and flow
- Low pressure standby mode when flow is not needed
- System flow adjusted to meet system requirements
- Lower torque requirements during engine start-up
- Single pump can supply flow and regulate pressure for multiple circuits
- Quick response to system flow and pressure requirements

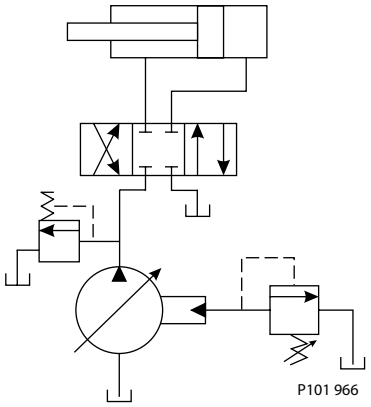
## Remote Pressure Compensated Controls

The remote PC control is a two-stage control that allows multiple PC settings. Remote PC controls are commonly used in applications requiring low and high pressure PC operation.

*Typical operating curve*




*Closed center circuit with remote PC*




The remote PC control uses a pilot line connected to an external hydraulic valve. The external valve changes pressure in the pilot line, causing the PC control to operate at a lower pressure. When the pilot line is vented to reservoir, the pump maintains pressure at the load sense setting. When pilot flow is blocked, the pump maintains pressure at the PC setting. An on-off solenoid valve can be used in the pilot line to create a low-pressure standby mode. A proportional solenoid valve, coupled with a microprocessor control, can produce an infinite range of operating pressures between the low pressure standby setting and the PC setting.

Size the external valve and plumbing for a pilot flow of 3.8 l/min [1 US gal/min]. For additional system protection, install a relief valve in the pump outlet line.

**Remote pressure compensated system characteristics:**

- Constant pressure and variable flow
- High or low pressure standby mode when flow is not needed
- System flow adjusts to meet system requirements
- Single pump can provide flow to multiple work functions
- Quick response to system flow and pressure requirements

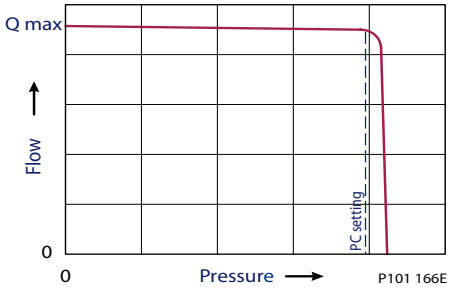
**Typical applications for remote pressure compensated systems:**

- Modulating fan drives
- Anti-stall control with engine speed feedback
- Front wheel assist
- Road rollers
- Combine harvesters
- Wood chippers

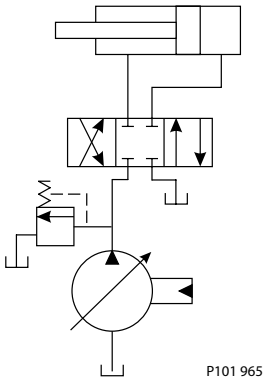
## PVG 32 Main Spool with Pressure Compensated Control

The PC control maintains constant system pressure in the hydraulic circuit by varying the output flow of the pump. Used with a closed center control valve, the pump remains in high pressure standby mode at the PC setting with zero flow until the function is actuated.

*Typical operating curve*




*Simple closed-center circuit*




Once the closed center valve is opened, the PC control senses the immediate drop in system pressure and increases pump flow by increasing the swashplate angle.
The pump continues to increase flow until system pressure reaches the PC setting.
If system pressure exceeds the PC setting, the PC control reduces the swashplate angle to maintain system pressure by reducing flow. The PC control continues to monitor system pressure and changes swashplate angle to match the output flow with the work function pressure requirements. If the demand for flow exceeds the capacity of the pump, the PC control directs the pump to maximum displacement. In this condition, actual system pressure depends on the actuator load.

For additional system protection, install a relief valve in the pump outlet line.
* Do not use the PVG 32 with LB control

### Pressure compensated system characteristics

- Constant pressure and variable flow
- High pressure standby mode when flow is not needed
- System flow adjusts to meet system requirements
- Single pump can provide flow to multiple work functions
- Quick response to system flow and pressure requirements

### Typical applications for pressure compensated systems

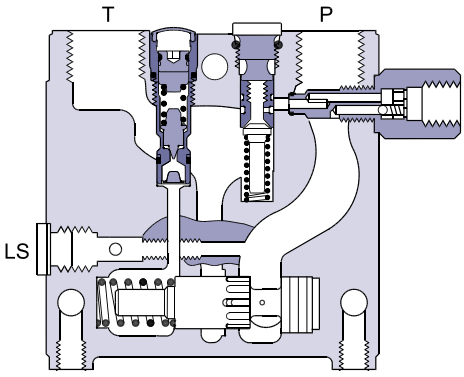
- Constant force cylinders (bailers, compactors, refuse trucks)
- On/off fan drives
- Drill rigs
- Sweepers
- Trenchers

## PVPC Adapter for External Pilot Oil Supply

### PVPC with check valve for open center PVP

PVPC with check valve is used in systems where it is necessary to operate the PVG 32 valve by means of the electrical remote control without pump flow.

When the external solenoid valve is opened, oil from the pressure side of the cylinder is fed via the PVPC through the pressure reducing valve to act as the pilot supply for the electrical actuators. This means that a load can be lowered by means of the remote control lever without starting the pump.



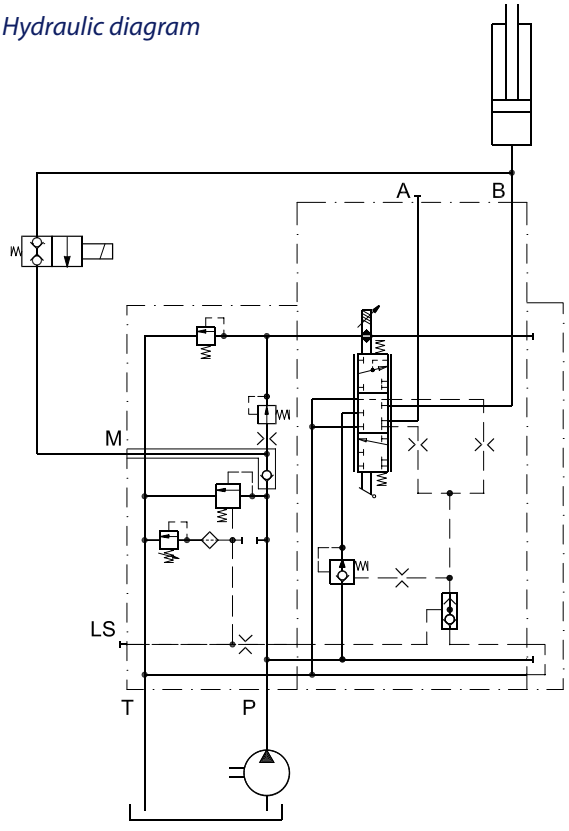

157-114.11

The built-in check valve prevents the oil from flowing via the pressure adjustment spool to tank.

With the pump functioning normally the external solenoid valve is closed to ensure that the load is not lowered due to the pilot supply oil flow requirement of approximately 1 l/min [0.25 US gal/min].

With closed center PVP the external pilot oil supply can be connected to the pressure gauge connection without the use of a PVPC plug.

*Hydraulic diagram*

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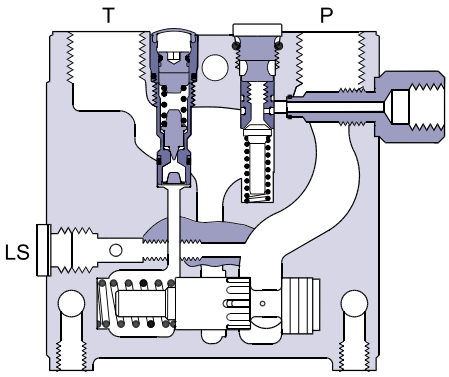
## PVPC Adapter for External Pilot Oil Supply (continued)

### PVPC without check valve for open or closed center PVP

PVPC without check valve is used in systems where it is necessary to supply the PVG 32 valve with oil from a manually operated emergency pump without directing oil flow to the pilot oil supply (oil consumption about 0.5 l/min) [0.13 US gal/min].

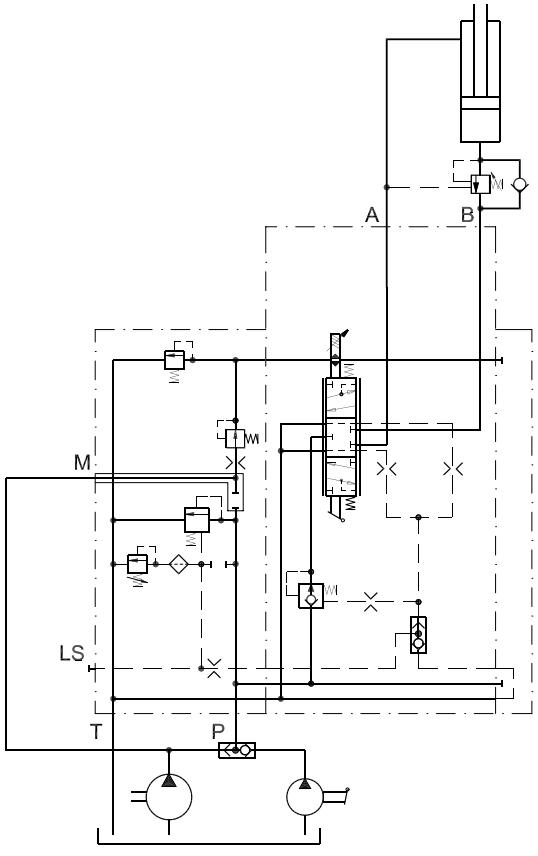
When the main pump is working normally, the oil is directed through the PVPC plug via the pressure reduction valve to the electrical actuators.




157-193.11

When the main pump flow fails, the external shuttle valve ensures that the oil flow from the manually operated emergency pump is used to pilot open the over center valve and lower the load. The load can only be lowered using the mechanical operating lever of the PVG 32 valve.

*Hydraulic diagram*




157-194.11

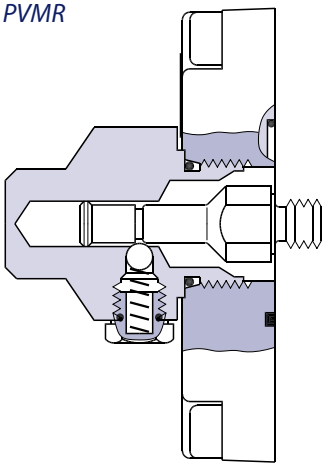
## PVMR, Friction Detent

The friction detent PVMR allows the directional spool to be held in any position, resulting in infinitely variable, reversible, pressure compensated flow.

This can be sustained indefinitely without having to continue to hold the mechanical lever.

PVMR should only be used together with PVB basic modules with pressure compensator.

*PVMR*



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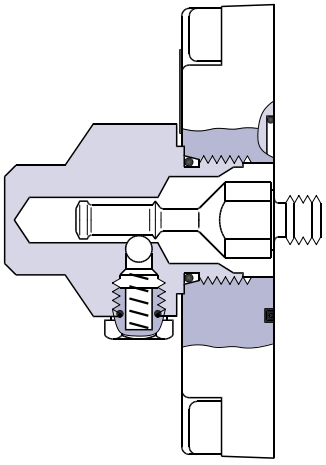
## PVMF, Mechanical Float Position Lock

Allows the float spool to be held in the float position after release of the mechanical handle.

*PVMF*



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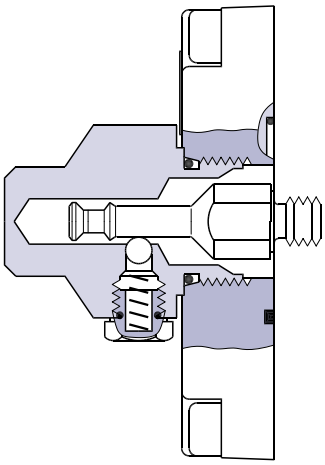
P → A → F

(Standard assembly)



157-206.10

P → B → F

(Standard assembly)

### PVBS, Main Spools for Flow Control (Standard)

When using standard flow control spools, the pump pressure is determined by the highest load pressure. This is done either via the pressure adjustment spool in open center PVP (fixed displacement pumps) or via the pump control (variable displacement pumps).

In this way the pump pressure will always correspond to the load pressure plus the stand-by pressure of the pressure adjustment spool or the pump control. This will normally give optimum and stable adjustment of the oil flow.

### PVBS, Main Spools for Flow Control (with Linear Characteristic)

PVBS main spools with linear characteristic have less dead band than standard spools and a proportional ratio between control signal and oil flow in the range beyond the dead band. PVBS with linear characteristic must never be used together with PVEM electrical actuators.

The interaction between the small dead band of the spools and the hysteresis of the PVEM actuator of 20% involves a risk of building up a LS pressure in neutral position.

In a few systems load sensing pump pressure may result in unstable adjustment of the oil flow and a tendency towards system hunting.

This may be the case with working functions that have a large moment of inertia or over-center valves. In such systems main spools for pressure control can be advantageous.

### PVBS, Main Spools for Pressure Control

The spools are designed in such a way that the pump pressure is controlled by the spool travel. The main spool must be displaced until the pump pressure just exceeds the load pressure before the working function is applied. If the main spool is held in this position, the pump pressure will remain constant – even if the load pressure changes – giving a stable system.
The use of pressure control spools, however, also means that:

- the oil flow is load dependent
- the dead band is load dependent
- the pump pressure can exceed the load pressure by more than is usual
- the pressure drop across main spool varies (energy consumption)

Due to these factors it is recommended that pressure control spools are only used when it is known for certain that problems with stability will arise or already have arisen, and in applications where constant pressure is needed e.g. drill holding.

## PVG 32 Main Spool with Pressure Control (continued)

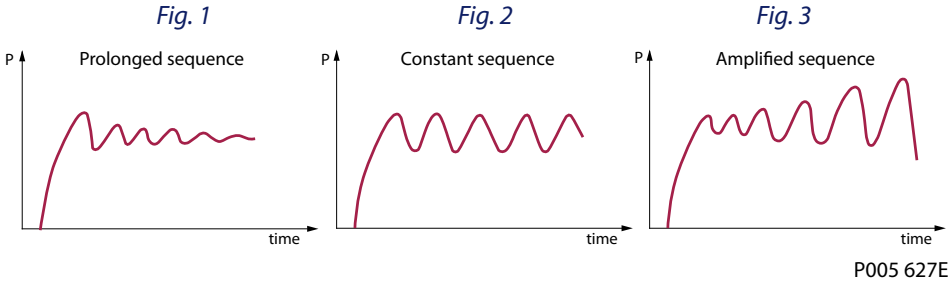
### Background

Instability in load sense control systems in certain applications with oscillations in the range of 1/2 - 2 Hz. can cause severe instability problems while trying to control functions in an application.

Critical applications are usually related to functions with an important inertia torque and/or functions with secondarily fitted pressure controlled components e.g. over-center valves.

Examples; a slewing function and main lifting/lowering function of a crane.

The problem usually manifests itself in prolonged oscillation phenomena (Fig. 1), in a relatively constant sequence of oscillations (Fig. 2) or in the worst case in an amplified sequence of oscillations (Fig. 3).




To control the oscillation phenomena the "pressure control spool" was developed and is a patented system which can minimize most of the oscillation issues described above.

### Principle

The idea was to create a system operating independently of a constantly changing load pressure. Therefore, we changed the well-known LS principle (Fig. 4), so that compensated pump pressure is part of the LS system (Fig. 5) after the pressure compensator and before the metering range of the main spool. Upon actuation of the spool, it will be led via a fixed and a variable orifice.

The opening area of the variable orifice is at maximum at initial actuation and 0 at full stroke of the spool and then the pressure created between the two orifices is led into the LS system in the usual way.

## PVG 32 Main Spool with Pressure Compensated Control (continued)

*Fig. 4 Flow Controlled Spool*

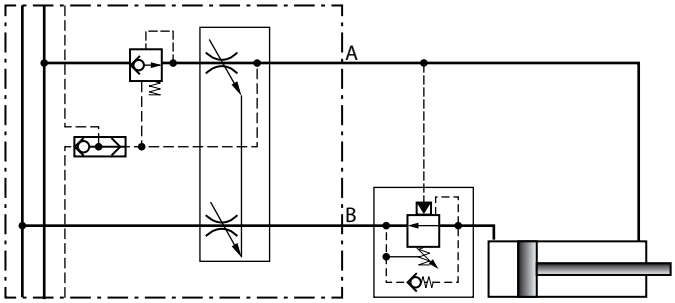
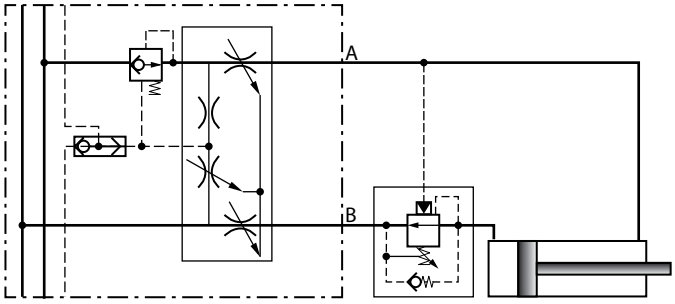


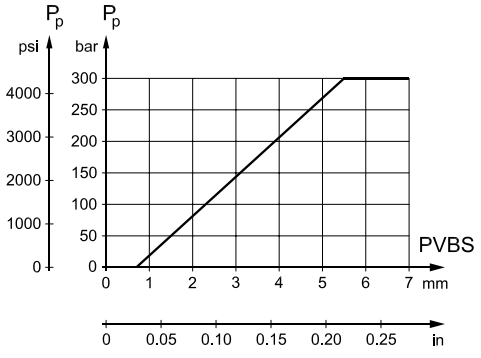

*Fig. 5 Pressure Controlled Spool*




In this way the pump pressure is built up depending on the spool travel, i.e. the spool will then have to be stroked to a position that the pump pressure is higher than the actual load pressure to make the oil flow from P□A/B.

When the load changes for a fixed spool position the flow to for the function will also change.

*The pump pressure vs. the spool travel curve*




The valve section is now a load-dependent valve, but ensuring a constant pump pressure which is important in obtaining a stable function.

## PVG 32 Main Spool with Pressure Compensated Control (continued)

### Application

Pressure controlled spools should in principle only be used when you have stability issues. Typical applications on a crane:

- Lifting/lowering movement
- Slewing movement with cylinders
- For the main lifting/lowering function on a crane it is recommended to fit a "half" pressure control spool. This means that the spool is designed with a normal flow control on the lifting port and pressure control connected to the port where the pilot signal to the over-center valve is acting. You will thus maintain a load-independent lifting movement and achieve a stable but load-depending lowering movement.
- As the load pressure on slewing movements is usually steady - irrespective of the crane being loaded or not – it will be advantageous to use a "full" pressure control spool for A and B port.

In both cases we recommend the use of a basic valve, PVB, with pressure compensator. The pressure compensator will ensure the individual load-independency between the basic valves.
It is further recommended to use the LS pressure relief valves as not only will they ensure individual pressure limitation but also make it possible to adjust the maximum oil flow to the function.
It is not recommended to use shock valves as pressure limiting valves in connection with pressure control spools.

### Sizing

The size of "half" (e.g: P - A = flow control P - B pressure control) pressure control spools is determined on basis of max. flow demand on the lifting port. If e.g. a max. pressure compensated flow of 65 l/min for the lifting movement, you choose a 65 L/min spool (size D). The metering characteristic has then a given size. As it is often requested to limit the use of the crane boom for downward push/force mode and the LS pressure limitation can be used. It will appear from the characteristics enclosed what effect a pressure limitation, $P_{LS}$ will have on max. flow on the lowering port.

The size for a "full" pressure control spool is determined on basis of known load pressure, $P_{LS}$ max, and requested max. flow.
It will appear from the characteristics enclosed that if the load $P_{LS}$ is low and the pump pressure, $P_p$, is high as a result of max. stroked spool you will get a large flow.

If $P_{LS}$ is approaching $P_{LS}$ max. the flow will be reduced and the dead band increased. Max. oil flow can be reduced by approx. 50% without limiting max. pressure.
The reduction is made by limiting the spool travel from 7 mm to 5.5 mm.

### Limitation

If a pressure controlled spool is chosen for stability reasons consideration should be made to features related to the pressure control principle.

Deadband will change according to the load conditions and the valve section will become load-dependent and that the pump pressure may exceed the load pressure. With all of the above in mind, a “pressure controlled spool” will minimize oscillation and obtain a stable function that can be controlled smooth and precise.

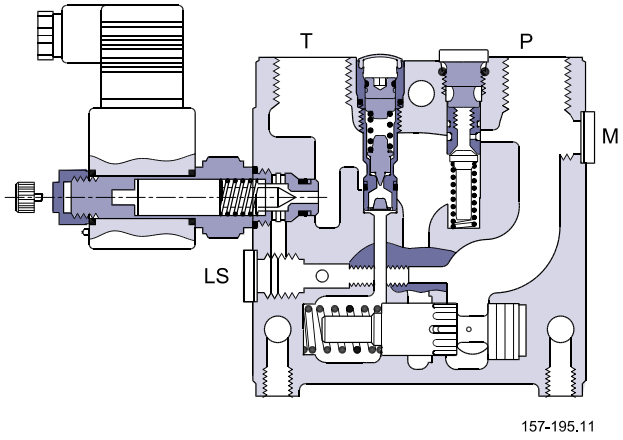
## PVPX, Electrical LS Unloading Valve

PVPX is a solenoid LS unloading valve. PVPX is fitted into the pump side module enabling a connection to be made between the LS and the tank lines. Thus the LS signal can be relieved to tank by means of an electric signal.

For a PVP pump side module in open center version the relief to tank of the LS signal means that the pressure in the system is reduced to the sum of the tank port pressure plus the neutral flow pressure for the pump side module.

For a PVP pump side module in closed center version the relief to tank of the LS signal means that the pressure is reduced to the sum of the tank port pressure for the pump side module plus the stand-by pressure of the pump.

*PVPX*



## PVG 32

The characteristics in this catalog are typical measured values. During measuring a mineral based hydraulic oil with a viscosity of 21 $mm^2/s$ [102 SUS] at a temperature of 50 °C [122 °F] was used.

### Technical data

| | | | |
|---|---|---|---|
| **Max. pressure** | Port P continuous | 350 bar [1] | [5075 psi] |
| | Port P intermittent | 400 bar [5] | [5800 psi] |
| | Port A/B continous | 350 bar | [5075 psi] |
| | Port A/B intermittent | 420 bar [5] | [6090 psi] |
| | Port T, static/dynamic | 25/40 bar | [365/580 psi] |
| **Oil flow rated** | Port P | 140/230 l/min [3] [4] | [37/61 US gal/min] [3] [4] |
| | Port A/B, with press.comp. | 100 l/min [2] | [26.4 US gal/min] [2] |
| | Port A/B witout press.comp. | 125 l/min | [33 US gal/min] |
| **Spool travel, standard** | | ± 7 mm | [± 0.28 in] |
| **Spool travel, float position** | Proportional range | ± 4.8 mm | ± 0.19 in] |
| | Float position | ± 8 mm | [± 0.32 in] |
| **Dead band, flow control spools** | Standard | ±1.5 mm | [± 0.06 in] |
| | Linear characteristic | ± 0.8 mm | [± 0.03 in] |
| **Max. internal leakage at 100 bar [1450 psi] and 21 $mm^2/s$ [102 SUS]** | A/B → T without shock valve | 20 $cm^3$/min | [1.85 $in^3$/min] |
| | A/B → T with shock valve | 25 $cm^3$/min | [2.15 $in^3$/min] |
| **Oil temperature (inlet temperature)** | Recommended temperature | 30 → 60 °C | [86 → 140°F] |
| | Min. temperature | -30 °C | [-22 °F] |
| | Max. temperature | +90 °C | [194 °F] |
| **Ambient temperature** | | -30 → 60 °C | [-22 → 140 °F] |
| **Oil viscosity** | Operating range | 12 - 75 $mm^2/s$ | [65 - 347 SUS] |
| | Min. viscosity | 4 $mm^2/s$ | [39 SUS] |
| | Max. viscosity | 460 $mm^2/s$ | [2128 SUS] |
| **Filtration** *(See chapter Filtration)* | Max. contamination (ISO 4406) | 23/19/16 | 23/19/16 |
| **Oil consumtion in pilot oil pressure reduction valve** | | 0.5 l/min | [0.13 US gal/min] |

1) With PVSI end plate. With PVS end plate max. 300 bar [4351 psi].
2) For 130 l/min contact Product Application Engineering Sauer-Danfoss.
3) In open circuit systems with short P-hoses/tubes, attention should be paid to pressure peaks at flows >100 l/min [26.4 US gal/min] .
4) For system with mid inlet PVPVM.
5) Intermittent pressure at max. 250,000 cycles of full PVG life time cycles, with PVSI end plate. The maximum intermittent pressure at max. 250,000 cycles stresses the need to confirm application duty cycle before proceeding with specification. For further information contact Product Application Engineering Sauer-Danfoss.

### *Rated Pressure*

| Product | Rated pressure |
|---|---|
| PVG 32 with PVS | 300 bar [4351 psi] |
| PVG 32 with PVSI | 350 bar [5076 psi] |
| PVG 32 with PVBZ | 250 bar [3626 psi] |
| PVG 32 with HIC steel | 350 bar [5076 psi] |
| PVG 32 with HIC aluminium | 210 bar [3046 psi] |
| PVG 120/32 with PVS | 300 bar [4351 psi] |
| PVG 120/32 with PVSI | 350 bar [5076 psi] |
| PVG 100/32 with PVS | 300 bar [4351 psi] |
| PVG 100/32 with PVSI | 350 bar [5076 psi] |

Maximum continuous P-port pressure.

## PVH, Hydraulic Actuation

*Technical data for PVH*

| | |
|---|---|
| **Control range pressure** | 5 – 15 bar [75 – 220 psi] |
| **Max. pilot pressure** | 30 bar [435 psi] |
| **Max. pressure on port T*** | 10 bar [145 psi] |

* The hydraulic remote control lever should be connected directly to tank.

## PVM, Mechanical Actuation

*Technical data for PVM*

| **Spool displacement** | **Operating Torque** N•m [lbf•in] | | | | |
|---|---|---|---|---|---|
| | **PVM + PVMD** | **PVM + PVE 1)** | **PVM + PVH** | **PVM + PVMR** | **PVM+PVMF** |
| from neutral position | 2.2 ±0.2 [19.5 ±1.8] | 2.2 ±0.2 [19.5 ±1.8] | 2.5 ±0.2 [22.1 ±1.8] | 17 [3.8] | 22 [5.0] |
| max. spool travel | 2.8 ±0.2 [24.8 ±1.8] | 2.8 ±0.2 [24.8 ±1.8] | 6.9 ±0.2 [61.0 ±1.8] | – | – |
| into float position | – | – | – | – | 60 [13.5] |
| away from float position | – | – | – | – | 28 [6.3] |
| from any other position | – | – | – | 8.5 [73.3] | – |

| | | |
|---|---|---|
| **Control lever position** | No | 2 x 6 |
| **Control range** | control lever | ±19.5° |
| | proportional | ±13.4° |
| | float position | 22.3° |

For PVE please see the *PVE-Series 4 for PVG 32, PVG 100 and PVG 120 Technical Information,* **520L0553**.

## PVE Technical Data

*Technical data for PVEO and PVEM*

| | | | |
|---|---|---|---|
| **Supply voltage $U_{DC}$** | rated | 12 V DC | 24 V DC |
| | range | 11 V to 15 V | 22 V to 30 V |
| | max. ripple | 5% | |
| **Current consumption at rated voltage** | | 0.65 A @ 12 V | 0.33 A @ 24 V |
| **Signal voltage (PVEM)** | neutral | 0.5 x $U_{DC}$ | |
| | A-port ↔ B-port | 0.25 • $U_{DC}$ to 0.75 • $U_{DC}$ | |
| **Signal current at rated voltage (PVEM)** | | 0.25 mA | 0.50 mA |
| **Input impedance in relation to 0.5 • $U_{DC}$** | | 12 KΩ | |
| **Power consumption** | | 8 W | |

*Reaction time for PVEO and PVEM*

| **Supply voltage** | **Function** | | **PVEO ON/OFF s** | **PVEO-R ON/OFF s** | **PVEM Prop. medium s** |
|---|---|---|---|---|---|
| **Disconnected by means of neutral switch** | Reaction time from neutral position to max. spool travel | max. | 0.235 | 0.410 | 0.700 |
| | | rated | 0.180 | 0.350 | 0.450 |
| | | min. | 0.120 | 0.250 | 0.230 |
| **Disconnected by means of neutral switch** | Reaction time from max. spool travel to neutral position | max. | 0.175 | 0.330 | 0.175 |
| | | rated | 0.090 | 0.270 | 0.090 |
| | | min. | 0.065 | 0.250 | 0.065 |
| **Constant voltage** | Reaction time from neutral position to max. spool position | max. | - | - | 0.700 |
| | | rated | - | - | 0.450 |
| | | min. | - | - | 0.230 |
| **Constant voltage** | Reaction time from max. spool travel to neutral position | max. | - | - | 0.700 |
| | | rated | - | - | 0.450 |
| | | min. | - | - | 0.230 |
| **Hysteresis** * | | rated | - | - | 20% |

* Hysteresis (control signal/spool travel) is indicated at rated voltage and f = 0.02 Hz for one cycle. (one cycle = neutral → full A → full B → neutral)

*Technical data for PVEA, PVEH and PVES*

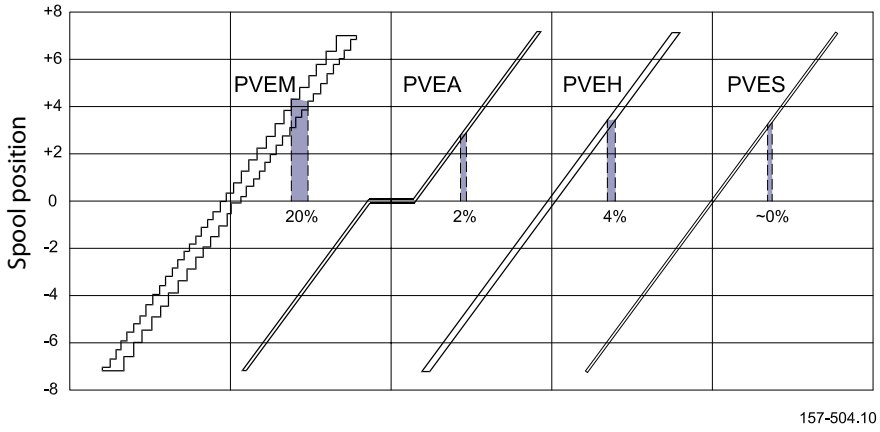
| **PVEA, PVEH and PVES** | | | | |
|---|---|---|---|---|
| **Supply voltage $U_{DC}$** | | rated | 11 V to 32 V | |
| | | range | 11 V to 32 V | |
| | | max. ripple | 5% | |
| **Current consumption at rated voltage** | | PVEH/PVES (PVEA) | 0.57 (0.33) A @ 12 V | 0.3 (0.17) A @ 24 V |
| **Signal voltage** | | neutral | 0.5 x $U_{DC}$ | |
| | | A-port ↔ B-port | 0.25 • $U_{DC}$ to 0.75 • $U_{DC}$ | |
| **Signal current at rated voltage** | | | 0.25 mA to 0.70 mA | |
| **Input impedance in relation to 0.5 • $U_{DC}$** | | | 12 KΩ | |
| **Input capacitor** | | | 100 ηF | |
| **Power consumption** | | PVEH/PVES (PVEA) | 7 (3.5) W | |
| **(PVEH/PVES)** | | Max. load | 100 mA | 60 mA |
| | Active | Reaction time at fault | 500 ms (PVEA: 750 ms) | |
| | Passive | Reaction time at fault | 250 ms (PVEA: 750 ms) | |

## PVE Technical Data (continued)

*Reaction time for PVEA, PVEH and PVES*

| Supply voltage | Function | | PVEA Prop. fine s | PVEH Prop. high s | PVES Prop. super s |
|---|---|---|---|---|---|
| **Disconnected by means of neutral switch** | Reaction time from neutral position to max. spool travel | max. | 0.50 | 0.23 | 0.23 |
| | | rated | 0.32 | 0.15 | 0.15 |
| | | min. | 0.25 | 0.12 | 0.12 |
| **Disconnected by means of neutral switch** | Reaction time from max. spool travel to neutral position | max. | 0.55 | 0.175 | 0.175 |
| | | rated | 0.40 | 0.09 | 0.09 |
| | | min. | 0.30 | 0.065 | 0.065 |
| **Constant voltage** | Reaction time from neutral position to max. spool travel | max. | 0.50 | 0.20 | 0.20 |
| | | rated | 0.32 | 0.12 | 0.12 |
| | | min. | 0.25 | 0.05 | 0.05 |
| **Constant voltage** | Reaction time from max. spool travel to neutral position | max. | 0.25 | 0.10 | 0.10 |
| | | rated | 0.20 | 0.09 | 0.09 |
| | | min. | 0.15 | 0.065 | 0.065 |
| **Hysteresis** * | | rated | 2% | 4% | ~ 0% |

*Typical hysteresis characteristics for control signal vs spool travel af different PVE types**




* Hysteresis (control signal/spool travel) is indicated at rated voltage and f = 0.02 Hz.
(one cycle = neutral → full A → full B → neutral)

The following technical data are from typical test results. For the hydraulic system a mineral based hydraulic oil with a viscosity of 21 $mm^2/s$ [102 SUS] and a temperature of 50 °C [122 °F] were used.

## PVE Technical Data (continued)

*Pilot oil consumption PVEA, PVEH, PVES, PVEO and PVEM*

| Function | PVEA Prop. fine | PVEH Prop. high | PVES Prop. super | PVEO ON/OFF | PVEM Prop. medium |
|---|---|---|---|---|---|
| Neutral without supply voltage | 0 | 0 | 0.3 l/min [0.079 US gal/min] | 0 | 0 |
| Locked with supply voltage | 0.4 l/min [0.106 US gal/min] | 0.1 l/min [0.026 US gal/min] | 0.1 l/min [0.026 US gal/min] | 0.1 l/min [0.026 US gal/min] | 0.1 l/min [0.026 US gal/min] |
| One actuation (neutral → max) with supply voltage | 2 $cm^3$ [0,12 $in^3$] | | | | |
| Continuous actuations with supply voltage | 1 l/min [0.26 US gal/min] | 0.7 l/min [0.185 US gal/min] | 0.8 l/min [0.211 US gal/min] | 0.7 l/min [0.185 US gal/min] | 0.5 l/min [0.132 US gal/min] |

| | | | |
|---|---|---|---|
| **Oil viscosity *** | **recommended range** | 12 - 75 $mm^2/s$ | [65 - 347 SUS] |
| | **minimum** | 4 $mm^2/s$ | [39 SUS] |
| | **maximum** | 460 $mm^2/s$ | [2128 SUS] |
| **Oil temperature** | **recommended range** | 30 - 60°C | [86 -140°F] |
| | **minimum** | -30°C | [-22°F] |
| | **maximum** | 90°C | [194°F] |
| **Ambient temperature** | **recommended range** | -30° → 60°C | [-22° → 140°F] |
| **Filtering in the hydraulic system** | | Max. allowed degree of contamination: 23/19/16 (ISO 4406, 1999 version) | |

* Max. start up viscosity 2500 $mm^2/s$.

## PVPX, Electrical LS Unloading Valve

*Technical data for PVPX*

| | | | |
|---|---|---|---|
| **Max. operating pressure** | | 350 bar [5075 psi] | |
| **Enclosure to IEC 529** | | IP65 | |
| **Max. pressure drop at an oil flow of 0.1 l/min [2.6 US gal/min]** | | 2 bar [30 psi] | |
| **Oil temperature (Inlet)** | Recommended temperature | 30°C to 60°C [86°F to 140°F] | |
| | Min. temperature | -30°C [-22°F] | |
| | Max. temperature | 90°C [194°F] | |
| **Max. coil surface temperature** | | 155°C [311°F] | |
| **Ambient temperature** | | -30°C to 60°C [-22°F to 140°F] | |
| **Oil viscosity** | Operating range | 12 to 75 $mm^2/s$ [65 to 347 SUS] | |
| | Min. viscosity | 4 $mm^2/s$ [39 SUS] | |
| | Max. viscosity | 460 $mm^2/s$ [2128 SUS] | |
| **Response time for LS pressure relief** | | 300 ms | |
| **Rated voltage** | | 12 V | 24 V |
| **Max. premissible deviation from rated supply voltage** | | ± 10% | |
| **Current consumption at rated voltage** | at 22°C [72°F] coil temperature | 1.55 A | 0.78 A |
| | at 110°C [230°F] coil temperature | 1 A | 0.5 A |
| **Power consumption** | at 22°C [72°F] coil temperature | 19 W | |
| | at 110°C [230°F] coil temperature | 12 W | |

## Electrical control of PVG

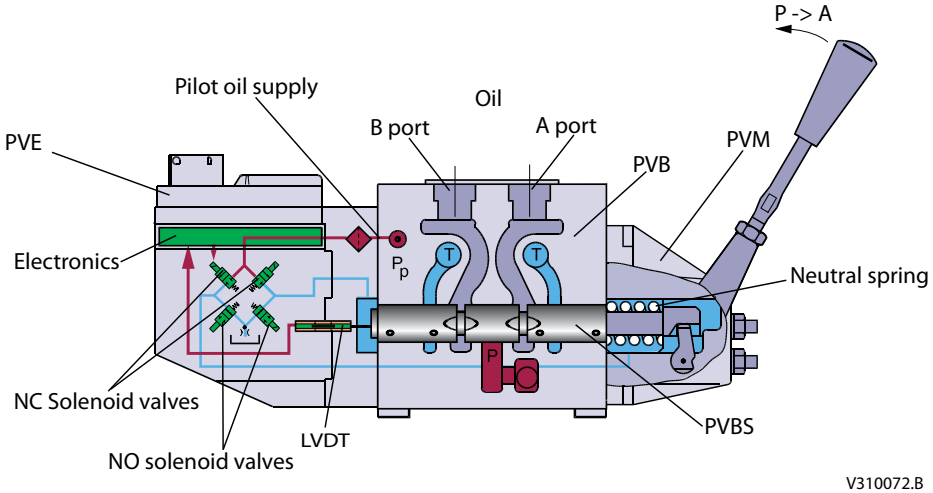
Valve actuation with electrical actuators has been supported by Sauer-Danfoss for a long time. The actuation can be controlled directly by joystick, by a PLUS+1 controller or by a broad range of third part controllers.

The actuator controls the spool by building up pilot oil pressure on the end of the spool. For the PVE a pilot oil pressure between 10 and 15 bar is used. For the PVHC a pilot oil pressure between 20 and 25 bar is used.

*PVG with PVE*

F500113

*Valve section with naming - standard mounted - seen from PVP*




V310072.B

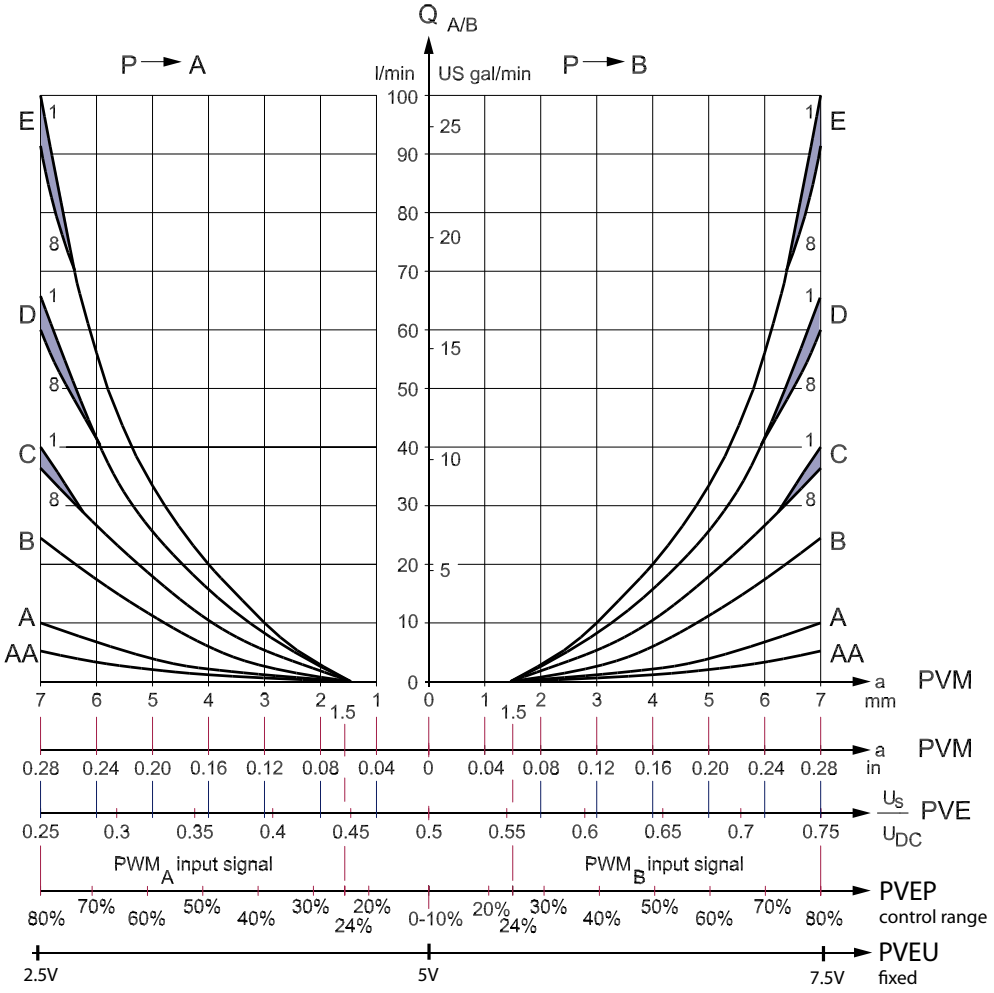
A detailed description of the variants is presented in the *PVE-Series 4 for PVG 32, PVG 100 and PVG 120 Technical Information,* **520L0553**, covers all analogue PVE – PVEO, PVEH, PVES, PVEA, PVEM, PVEU, PVEP – and the current controlled PVHC.

*Electrohydraulic Actuator – PVED-CC Series 4 Technical Information*, **520L0665**, covers the ISOBUS/SAE J1939 CAN controlled PVED-CC.

*Electrohydraulic Actuator – PVED-CX Series 4 Technical Information*, **11070179**, covers the IEC61508 SIL2 certified CANopen controlled PVED-CX.

**Electrical control of PVG (continued)**

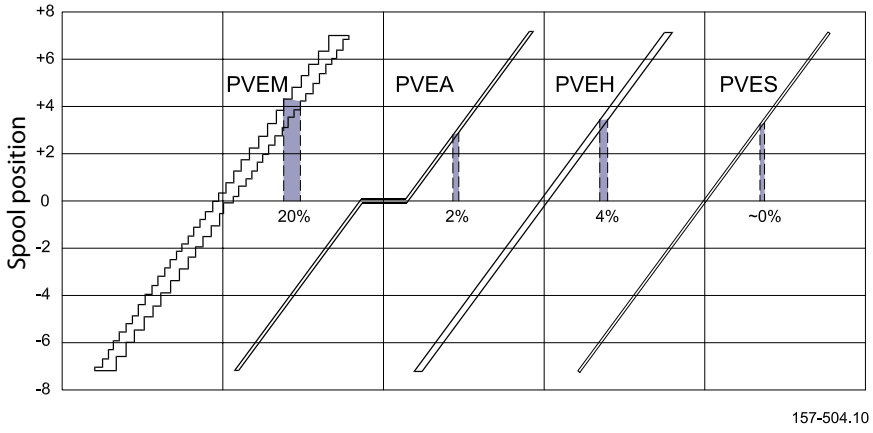
*PVE characteristic – control by voltage*



## Closed loop control

The PVE variants PVEA/H/M/S/U/P and the PVED-CC/-CX has a closed loop control supported by a spool position sensor that ensures integrity towards flow forces and oil viscosity.

*Hysteresis for PVE variants**




Hysteresis (Control signal /spool travel) is indicated at rated voltage and f = 0.02 Hz for one cycle (one cycle = neutral → full A → full B → neutral).

The values are typical test data for exact ranges, see *PVE Technical Information*, **520L0553**.

- PVEU is available with PVEH and PVES hysteresis
- PVEP, PVED-CC and PVED-CX are available with PVES hysteresis

The standard PVE's are proportional activated actuator except PVEO which is on/off. The PVE's have fault-monitoring.

*Fault monitoring overview*

| Type | Fault monitoring | Delay before error out | Error mode | Error output status | Fault output on PVE [1] | LED light | Memory (reset needed) |
|---|---|---|---|---|---|---|---|
| **PVEO PVEM** | No fault monitoring | – | – | – | – | – | – |
| **PVEA PVEH PVEP PVES PVEU** | Active | 500 ms (PVEA: 750 ms) | No fault | Low | < 2 V | Green | – |
| | | | Input signal faults | High | ~$U_{DC}$ | Flashing red | Yes |
| | | | Transducer (LVDT) | | | Constant red | |
| | | | Close loop fault | | | | |
| | Passive | 250 ms (PVEA: 750 ms) | No fault | Low | < 2 V | Green | – |
| | | | Input signal faults | High | ~$U_{DC}$ | Flashing red | No |
| | | | Transducer (LVDT) | | | Constant red | |
| | | | Close loop fault | | | | |
| **PVE Float six pin** | Active | 500 ms | Float not active | High | ~$U_D$ | Constant red | Yes |
| | | 750 ms | Float still active | | | | |

1) Measured between fault output pin and ground.

## PVEO

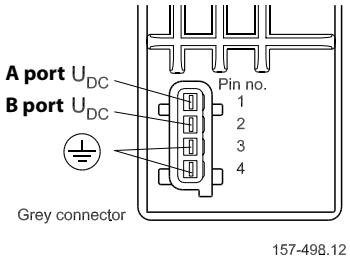
The PVEO is an on/off activated actuator. The PVEO has not fault-monitoring.

*Variants:*
- PVEO-R with a ramp delayed actuation
- PVEO-DI with direction indication feedback
- Anodized aluminum block
- ATEX certified

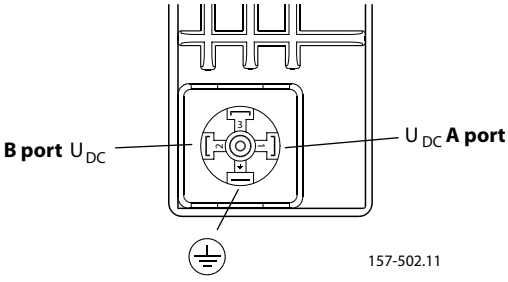
*Power supply:*
- 12V
- 24V

*Connectors*:
- Deutsch
- AMP
- DIN/Hirshmann

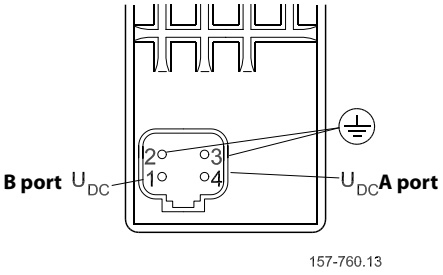
*AMP version of PVEO/PVEO–R*




*Hirschmann/DIN version of PVEO / PVEO–R*




*Deutsch version of PVEO*




## PVEM

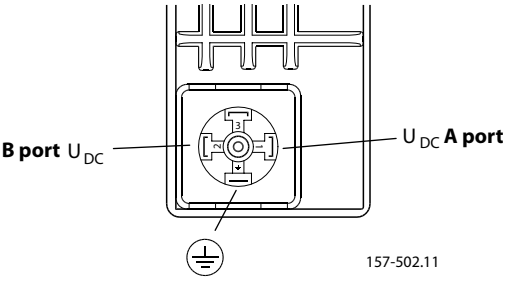
The PVEM is a proportional activated actuator. The PVEM has not fault-monitoring.

*Variants:*
- PVEM -R with a ramp delayed actuation
- PVEM for float in B-direction and max flow B at 4.8mm

*Power supply:*
- 12V
- 24V

*Connectors*:
- DIN/Hirshmann

*Hirschmann/DIN version of PVEO / PVEO–R*



## PVEA/H/S/U

*Variants:*

- -F for float in B-direction and max flow B at 4.8 mm
- -F for float in A-direction and max flow A at 5.5 mm
- PVES-SP with spool position feedback
- Anodized aluminum block
- ATEX certified

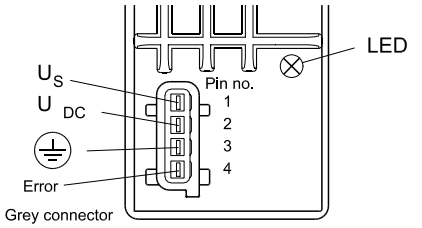
*Power supply:*

- 11-32V

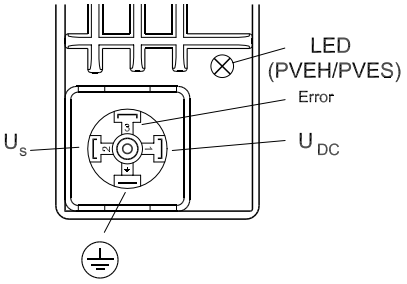
*Connectors:*

- Deutsch
- AMP
- DIN/Hirshmann

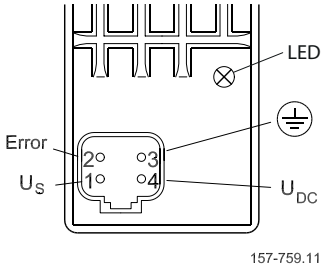
*AMP version PVEA/PVEH/PVES/PVEU/PVEH-Float A*




*Hirschmann/DIN version PVEH/PVEM/ PVES/PVEH float B/PVEM float B*




*Deutsch version PVEA/PVEH/PVES/PVEU/ PVEH-Float B*




## PVEP

The PVEP is controlled with separate PWM control signals for A and B direction. The PVEP has hysteresis and fault monitoring like the PVES.

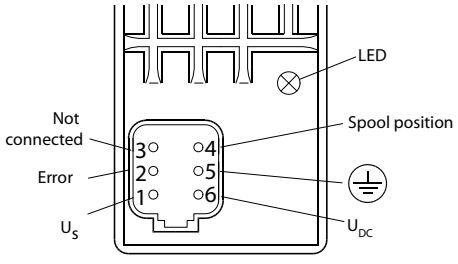
*Power supply:*

- 11-32V

*Connectors:*

- Deutsch

*Deutsch version PVEP*



## PVED-CC and PVED-CX

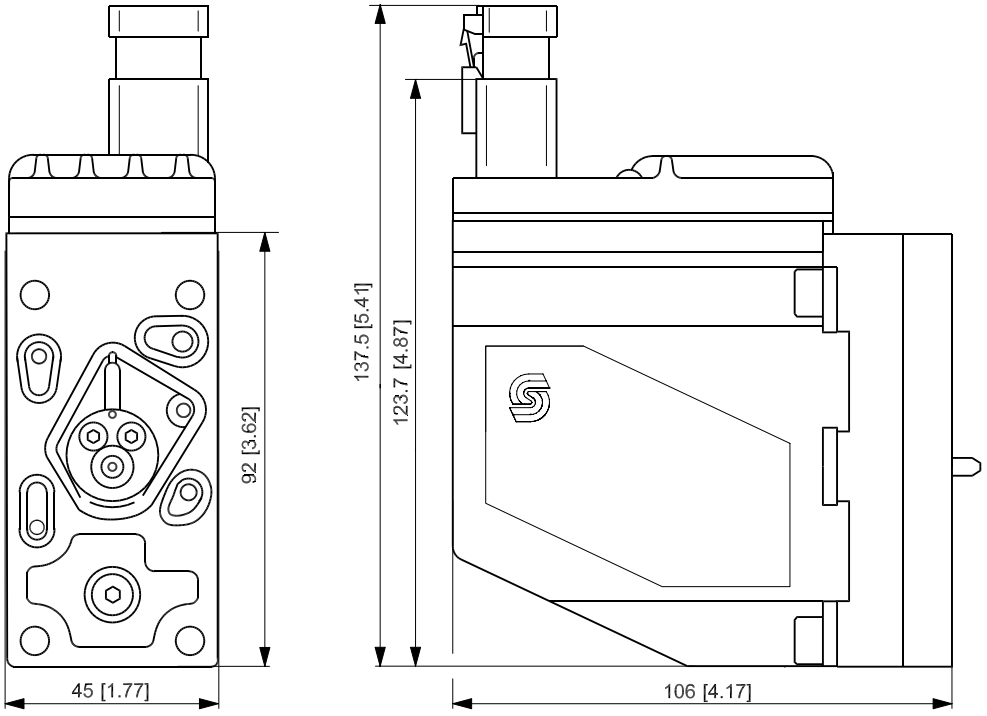
The CAN controlled PVE embedded microcontrollers support the same high spool controllability as the PVES and additional has high quality feedbacks, safety monitoring and detailed diagnostics.

PVED has digital communication, that allows a wide range of feedback, setpoint and highly costumized settings. CAN-Bus serial communication makes wiring much easier. Only one cable per PVG group.

*Power supply:*
- 11-32V

*Connectors*:
- Deutsch
- AMP (PVED-CX only AMP)

*PVE with Deutsch connector incl. female connector*

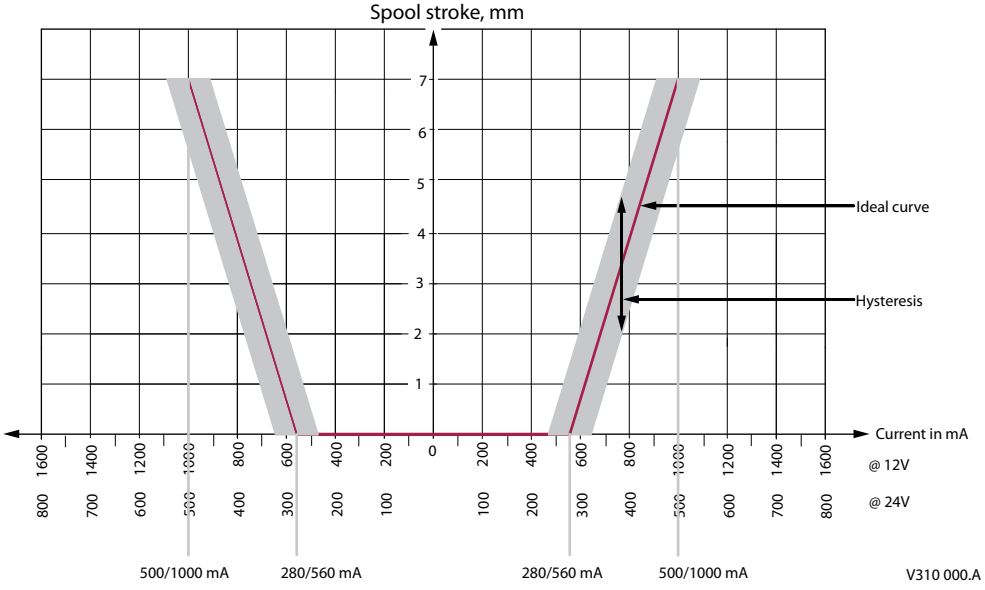



For more information on PVED please see the *Electrohydraulic Actuator - PVED-CC Series 4 Technical Information*, **520L0665**.

## PVHC

The PVHC is controlled with separate PWM control signals for A and B direction. The PVHC has not fault-monitoring nor closed loop spool control.

*Spool stroke vs current*

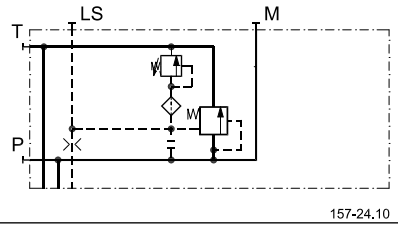
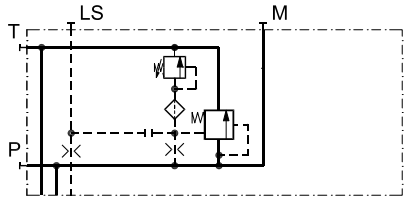
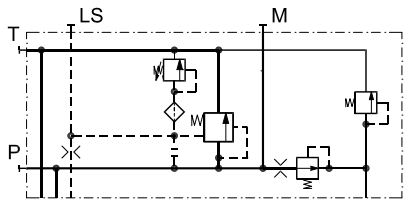
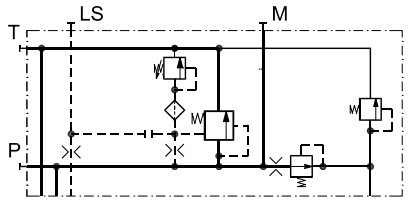
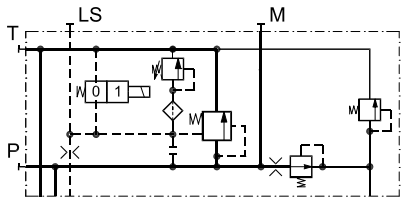
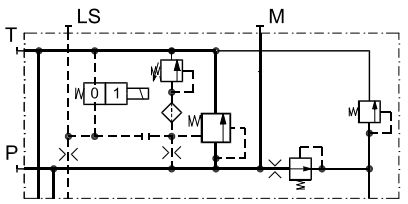



The ideal curve is determined by the main spool neutral spring. The hysteresis is affected by viscosity, friction, flow forces, dither frequency and modulation frequency.

*Power supply:*
- 12V
- 24V

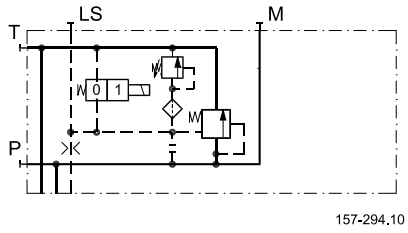
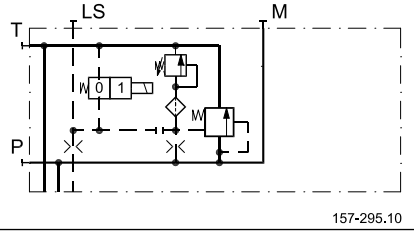
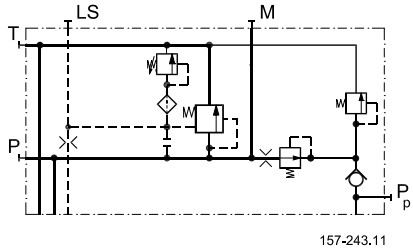
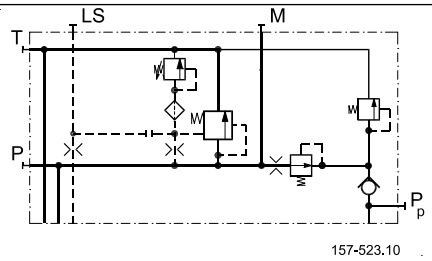
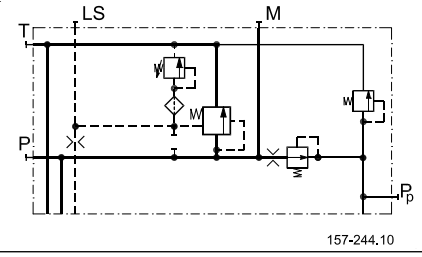
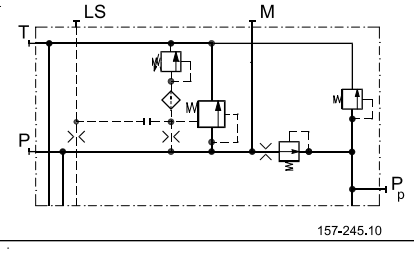
*Connectors:*
- Deutsch
- AMP

## PVP, Pump Side Modules

| Symbol | Description | | Code number |
|---|---|---|---|
|  157-24.10 | Open center pump side module for pumps with fixed displacement.<br>For purely machanically actuated valve groups | P = G ½<br>T = G ¾ | 157B5000 |
| | | P = 7/8–14<br>T = 1 1/16–12 | 157B5200 |
| | | P, T = G ¾ | 157B5100 |
| | | P, T = 1 1/16–12 | 157B5300 |
|  157-23.10 | Closed center pump side module for pumps with vaiable displacement.<br>For purely mechanically actuated valve groups | P = G ½<br>T = G ¾ | 157B5001 |
| | | P = 7/8–14<br>T = 1 1/16–12 | 157B5201 |
| | | P, T = G ¾ | 157B5101 |
| | | P, T = 1 1/16–12 | 157B5301 |
|  157-22.10 | Open center pump side module for pumps with fixed displacement.<br>With pilot oil supply for electrically actuated valves | P = G ½<br>T = G ¾ | 157B5010 |
| | | P = 7/8–14<br>T = 1 1/16–12 | 157B5210 |
| | | P, T = G ¾ | 157B5110 |
| | | P, T = 1 1/16–12 | 157B5310 |
|  157-21.10 | Closed center pump side module pumps with variable displacement.<br>With pilot oil supply for electrically actuated valves | P = G ½<br>T = G ¾ | 157B5011 |
| | | P = 7/8–14<br>T = 1 1/16–12 | 157B5211 |
| | | P, T = G ¾ | 157B5111 |
| | | P, T = 1 1/16–12 | 157B5311 |
|  157-153.11 | Open center pump side module for pumps with fixed displacement.<br>With pilot oil supply for electrically actuated valves<br>Connection for electrical LS unloading valve, PVPX (not incl) | P = G ½<br>T = G ¾ | 157B5012 |
| | | P = 7/8–14<br>T = 1 1/16–12 | 157B5212 |
| | | P, T = G ¾ | 157B5112 |
| | | P, T = 1 1/16–12 | 157B5312 |
|  157-154.10 | Closed center pump side module pumps with variable displacement<br>With pilot oil supply<br>Connection for electrical LS unloading valve, PVPX (not incl) | P = G ½<br>T = G ¾ | 157B5013 |
| | | P = 7/8–14<br>T = 1 1/16–12 | 157B5213 |
| | | P, T = G ¾ | 157B5113 |
| | | P, T = 1 1/16–12 | 157B5313 |

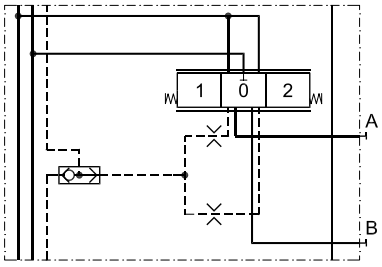
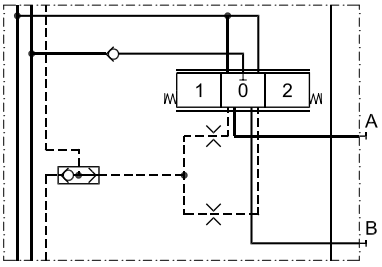
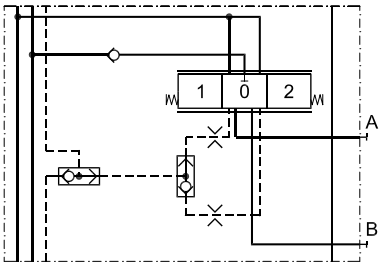
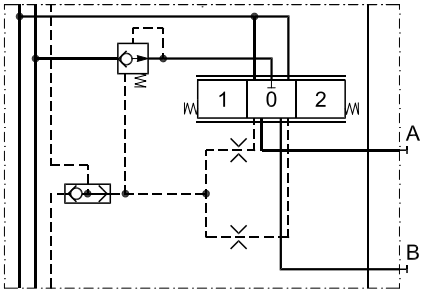
*Connections:*
**P** = G ½ in; 14 mm deep or G ¾ in; 16 mm deep / **LS, M** = G ¼ in; 12 mm deep / **T** = G ¾ in; 16 mm deep.
**P** = 7/8–14; 0.65 in deep or 1 1/16–12; 0.75 in deep / **LS, M** = ½–20; 0.47 in deep / **T** = 1 1/16–12; 0.75 in deep.

## PVP, Pump Side Modules

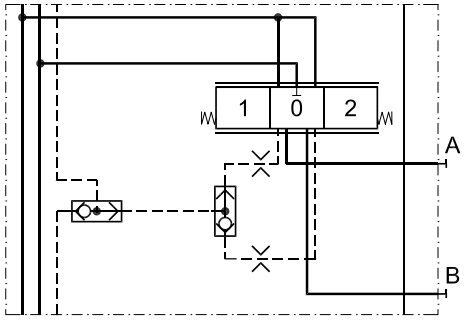
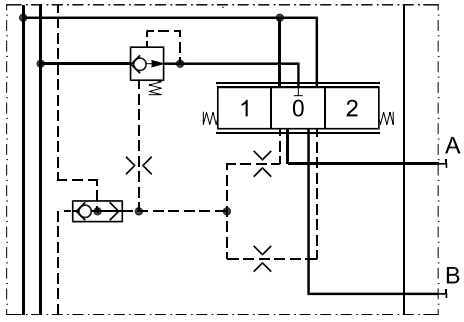
| Symbol | Description | | Code number |
|---|---|---|---|
|  | Open center pump side module for pumps with fixed displacement.<br><br>For mechanical actuated valves.<br><br>Connection for LS unloading valve, PVPX (not incl) | P, T = G ¾ | 157B5102 |
|  | Closed center pump side module for pumps with vaiable displacement.<br><br>For mechanical actuated valves.<br><br>Connection for LS unloading valve, PVPX (not incl) | P, T = G ¾ | 157B5103 |
|  | Open center pump side module for pumps with fixed displacement.<br><br>With pilot oil supply for electrical actuation and connection for pilot oil pressure<br>Incl. check valve | P, T = G ¾ | 157B5180 |
| | | P, T = 1⅛–12<br>LS connection = ⅝–18 | 157B5380 |
|  | Closed center pump side module for pumps with variable displacement.<br><br>With pilot oil supply for electrical actuation and connection for pilot oil pressure<br>Incl. check valve | P, T = G ¾ | 157B5181 |
| | | P, T = 1⅛–12<br>LS connection = ⅝–18 | 157B5381 |
|  | Open center pump side module for pumps with fixed displacement.<br><br>With pilot oil supply for hydraulic actuation and connection for pilot oil pressure | P, T = G ¾ | 157B5190 |
| | | P, T = 1⅛–12<br>LS connection = ⅝–18 | 157B5390 |
|  | Closed center pump side module pumps with variable displacement<br><br>With pilot oil supply for hydraulic actuation and connection for pilot oil pressure | P, T = G ¾ | 157B5191 |
| | | P, T = 1⅛–12<br>LS connection = ⅝–18 | 157B5391 |

*Connections:*
**P, T** = G ¾ in; 16 mm deep / **LS, M** = G ¼ in; 12 mm deep
**P, T** = 1⅛–12; 0.75 in deep / **LS, M** = ½–20; 0.47 in deep.

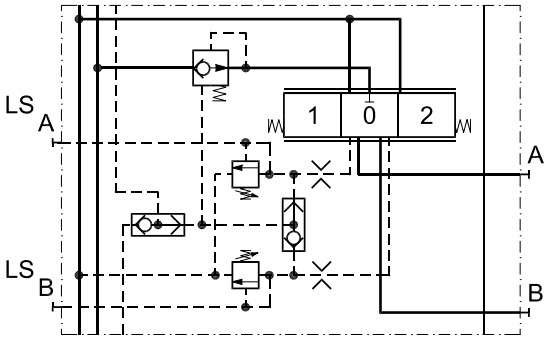
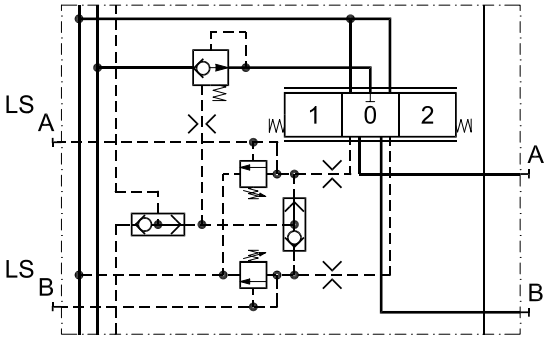
## PVB, Basic Modules – Without Adjustable $LS_{A/B}$ Pressure Limiting Valves

| Symbol | Description | | Code number | |
|---|---|---|---|---|
| | | | No facilities for shock valves A/B | Facilities for shock valves A/B |
|  157-19.10 | Without load drop check valve and pressure compensator.<br><br>Can be used where load holding valves prevent oil from flowing back through channel P. | G ½<br>14 mm deep | 157B6000 | 157B6030 |
| | | ⅞–14<br>0.65 in deep | 157B6400 | 157B6430 |
|  157-20.10 | Load drop check valve. | G ½<br>14 mm deep | 157B6100 | 157B6130 |
| | | ⅞–14<br>0.65 in deep | 157B6500 | 157B6530 |
|  157-196.10 | Load drop check valve.<br><br>$LS_{A/B}$ shuttle valve.<br><br>To be used with float position spoils. | G ½<br>14 mm deep | — | 157B6136 |
| | | ⅞–14<br>0.65 in deep | — | 157B6536 |
|  157-16.10 | Non-damped compensator valve | G ½<br>14 mm deep | 157B6200 | 157B6230 |
| | | ⅞–14<br>0.65 in deep | 157B6600 | 157B6630 |

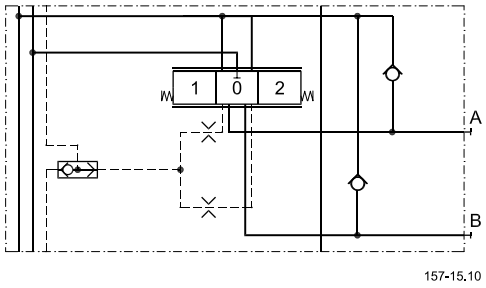
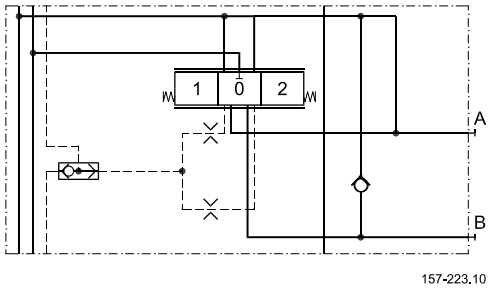
## PVB, Basic Modules - Without Adjustable $LS_{A/B}$ Pressure Limiting Valves

| Symbol | Description | | Code number | |
|---|---|---|---|---|
| | | | No facilities for shock valves A/B | Facilities for shock valves A/B |
|  V310411.A | Without compensator valve | G ½<br>14 mm deep | — | 11071832 |
| | $LS_{A/B}$ shuttle valve | ⅞–14<br>0.65 in deep | — | — |
|  157-16.10 | With damped compensator valve | G ½<br>14 mm deep | 157B6206 | 157B6236 |
| | | ⅞–14<br>0.65 in deep | 11036629 | 11036630 |

## PVB, Basic Modules - With Adjustable $LS_{A/B}$ Pressure Limiting Valves

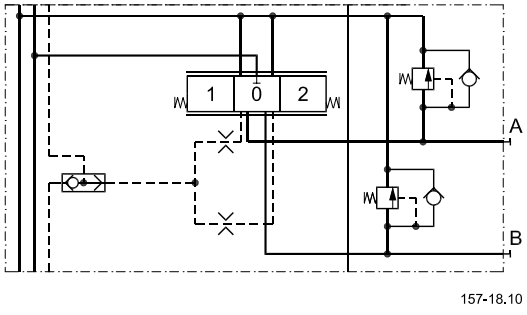
| Symbol | Description | | Code number | |
|---|---|---|---|---|
| | | | No facilities for shock valves A/B | Facilities for shock valves A/B |
|  157-198.10 | With non-damped compensator valve<br>Adjustable $LS_{A/B}$ pressure limiting valves<br>External LS connection port A/B. Also used for float position spools | G ½ 14 mm deep | 157B6203 | 157B6233 |
| | | ⅞–14 0.65 in deep | 157B6603 | 157B6633 |
|  157-17.10 | Damped compensator valve<br>Adjustable $LS_{A/B}$ pressure limiting valves<br>External LS connection port A/B | G ½ 14 mm deep | 157B6208 | 157B6238 |
| | | ⅞–14 0.65 in deep | - | 11036631 |

## PVLA, Suction Valve (fitted in PVB)

| Symbol | Description | Code number |
|---|---|---|
|  | Suction valve for port A and/orB. | 157B2001 |
|  | Plug for connecting the nonactive port to tank, when using a single acting spool. | 157B2002 |

## PVLP, Shock and Suction Valve (Fitted in PVB)

**Symbol / Description**

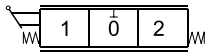



Shock and suction valve for port A and/or B. (Not adjustable). Lifetime 200.000 actuations.

| Code no. | | 157B2032 | 157B2050 | 157B2063 | 157B2080 | 157B2100 | 157B2125 | 157B2140 | 157B2150 | 157B2160 | 157B2175 | 157B2190 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Settings | bar | 32 | 50 | 63 | 80 | 100 | 125 | 140 | 150 | 160 | 175 | 190 |
| | [psi] | 460 | 725 | 914 | 1160 | 1450 | 1813 | 2031 | 2175 | 2320 | 2538 | 2755 |

| Code no. | | 157B2210 | 157B2230 | 157B2240 | 157B2250 | 157B2265 | 157B2280 | 157B2300 | 157B2320 | 157B2350 | 157B2380 | 157B2400 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Settings | bar | 210 | 230 | 240 | 250 | 265 | 280 | 300 | 320 | 350 | 380 | 400 |
| | [psi] | 3045 | 3335 | 3480 | 3625 | 3845 | 4061 | 4351 | 4641 | 5075 | 5511 | 5801 |

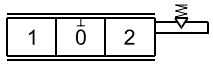
## PVM, Mechanical Actuation

| Symbol | Description | Code number with stop screws | Code number w/o stop screws |
|---|---|---|---|
|  157-10.10 | PVM, Standard, spring centered<br>Individual oil flow adjustment to ports A and B | 157B3171 | 157B3191 |
| | Without actuation lever and base.<br>Shaft for mounting of actuation lever | 157B3173 | 157B3193 |
| | PVM, as standard, witout actuation lever.<br>With base for mounting of actuation lever | 157B3174 | 157B3194 |
| | PVM, Standard, spring. Individual oil flow<br>adjustment to ports A and B. (Anodized) | 157B3184 | - |

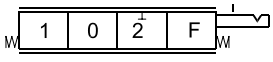
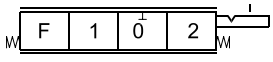
## PVMD, Cover for Mechanical Actuation

| Symbol | Description | Material | Code No. | Anodized |
|---|---|---|---|---|
| — | PVMD, Cover for purely mechanically operated valve | aluminium | 157B0001 | no |
| | | aluminium | 157B0009 | yes |
| | | cast iron | 157B0021 | no |

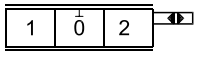
## PVMR, Friction Detent

| Symbol | Description | Material | Code number | Anodized |
|---|---|---|---|---|
|  157-210.10 | PVMR, Friction detent | aluminium | 157B0004 | no |
| | | aluminium | 157B0012 | yes |
| | | cast iron | 157B0024 | - |

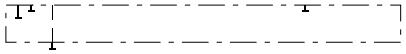
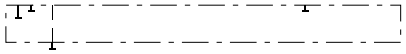
## PVMF, Mechanical Float Position

| Symbol | Description | Material | Code number | Anodized |
|---|---|---|---|---|
|  157-208.10<br>  157-209.10 | PVMF,<br>Mechanical float position lock | aluminium | 157B0005 | no |

## PVH, Hydraulic Actuation

| Symbol | Description | Material | Code number | Anodized |
|---|---|---|---|---|
|  157-199.10 | PVH, Cover for Hydraulic actuation<br>PVH 9/16-18 UNF | aluminium | 157B0007 | no |
| | | aluminium | 157B0010 | yes |
| | | cast iron | 157B0014 | no |
| | PVH, Cover for Hydraulic actuation<br>PVH G1/4 | aluminium | 157B0008 | no |
| | | aluminium | 157B0011 | yes |
| | | cast iron | 157B0016 | no |

## PVS, End Plate

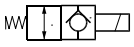
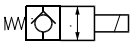
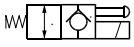
| Symbol | Description | | Mounting threads | Code number |
|---|---|---|---|---|
|  V310062.A | PVS, without active elements. No connections | | BSP | 157B2000 |
| | | | SAE | 157B2020 |
|  LX V310063.A | PVS, without active elements. Max. intermittend LX pressure 250 bar [3625 psi] | G 1/8 10 mm deep | BSP | 157B2011 |
| | | 3/8 in - 24; 0,39 in deep | SAE | 157B2021 |
|  V310062.A | PVSI, without active elements Without connections. | | BSP | 157B2014 |
| | | | SAE | 157B2004 |
|  LX V310063.A | PVSI, without active elements LX connections. Max. intermittend LX pressure: 350 bar [5075 psi] | G 1/4 10 mm deep | BSP | 157B2015 |
| | | 1/2 in - 20; 0,47 in deep | SAE | 157B2005 |

For mounting threats please see chapter "dimensions".

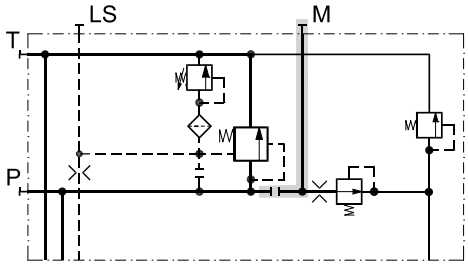
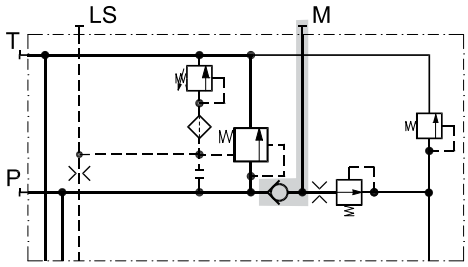
## PVAS, Assembly Kit

| Code no, 157B... | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PVB's | 8000 | 8001 | 8002 | 8003 | 8004 | 8005 | 8006 | 8007 | 8008 | 8009 | 8010 | 8061 | 8062 |
| PVB + PVPVM | - | 8021 | 8022 | 8023 | 8024 | 8025 | 8026 | 8027 | 8028 | 8029 | 8030 | 8081 | 8082 |
| Weight kg [lb] | 0.1[0.2] | 0.15 [0.3] | 0.25 [0.6] | 0.30 [0.7] | 0.40 [0.9] | 0.45 [1.0] | 0.50 [1.1] | 0.60 [1.3] | 0.65 [1.4] | 0.70 [1.6] | 0.80 [1.7] | 0.85 [1.8] | 0.9 [2.0] |

## PVPX, Electrical LS Unloaded Valve

| Symbol | Description | | Code number |
|---|---|---|---|
|  157-150.10 | PVPX, Normally open:<br>LS pressure relieved with no signal to PVPX | 12 V | 157B4236 |
| | | 24 V | 157B4238 |
|  157-151.10 | PVPX, Normally closed:<br>LS pressure relieved with no signal to PVPX | 12 V | 157B4246 |
| | | 24 V | 157B4248 |
|  157-152.10 | PVPX, Normally open with manual override:<br>LS pressure relieved with no signal to PVPX<br>Manual override DE-selects LS-pump | 12 V | 157B4256 |
| | | 24 V | 157B4258 |
| - | Plug | | 157B5601 |

## PVPC, Plug for External Pilot Oil Supply

| Symbol | Description | | Code number |
|---|---|---|---|
|   157-191.10 | PVP,<br>Plug without check valve for open or closed center | G 1/2,<br>12 mm deep | 157B5400 |
| | | 1/2 in - 20;<br>0.47 in deep | - |
|   157-192.10 | PVP,<br>Plug with check valve for open center | G 1/2,<br>12 mm deep | 157B5600 |
| | | 1/2 in - 20;<br>0.47 in deep | 157B5700 |

## General

The characteristics in this catalog are typical measured values. During measuring a mineral based hydraulic oil with a viscosity of 21 $mm^2/s$ [102 SUS] at a temperature of 50°C [122°F] was used.

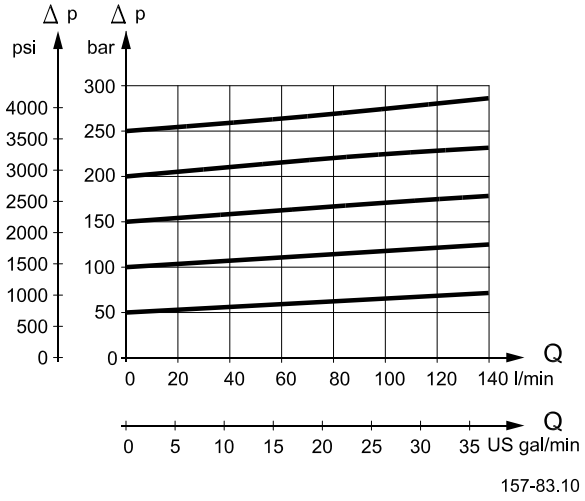
## PVP, Pump Side Module

### Pressure relief valve characteristic in PVP

The pressure relief valve is set at an oil flow of 15 l/min [4.0 US gal/min].
Setting range:

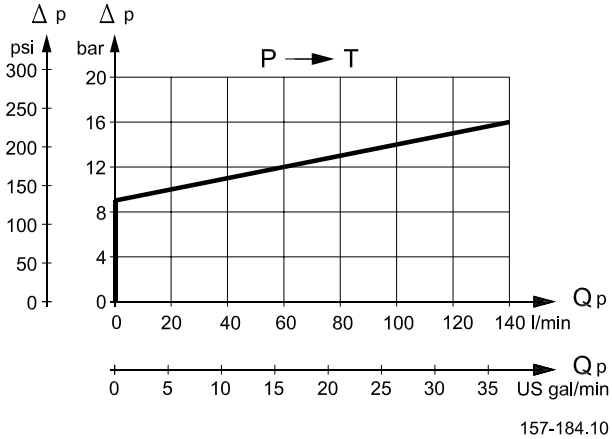
- 30 to 350 bar [435 to 5075 psi] with PVSI end plate
- 30 to 300 bar [435 to 4351 psi] with PVS end plate

*Pressure relief valve characteristic*




157-83.10

*Neutral by-pass pressure drop charastic (open center)*




157-184.10

**PVB**

## Oil flow characteristics

The oil flow for the individual spool depends on:

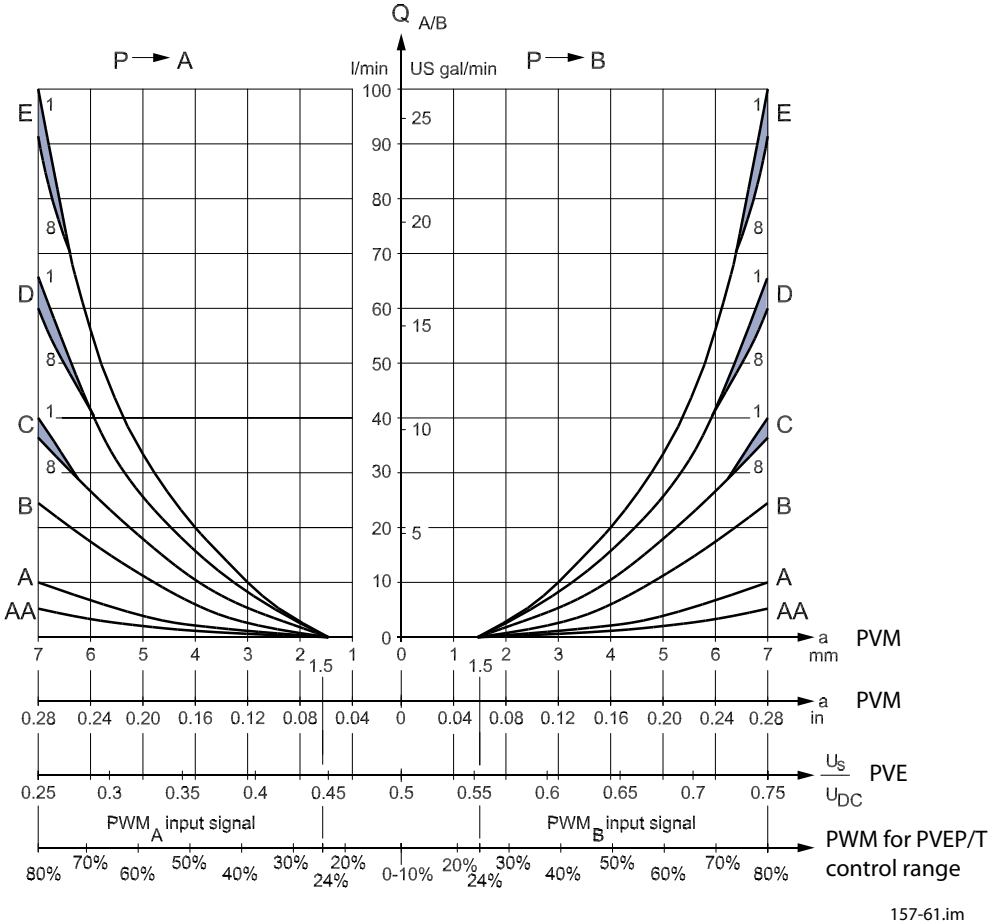
- type of basic module (with/without compensation)
- type of pump (fixed or variable displacement).

## Pressure-compensated PVB, open or closed center PVP

The oil flow is dependent on the supplied pump oil flow. The characteristics are plotted for a pump oil flow, $Q_P$, corresponding to the rated max. spool oil flow, $Q_N$. Increasing the pump oil flow to 1,4 × $Q_N$ will give the same oil flow on the eighth as on the first basic module.

Please note, the letters AA, A, B, etc. denote spool types. The characteristic below is shown for spool travel in both directions. All other characteristics are shown for spool travel in one direction only.

*Progressive oil flow characteristic depending on spool type*

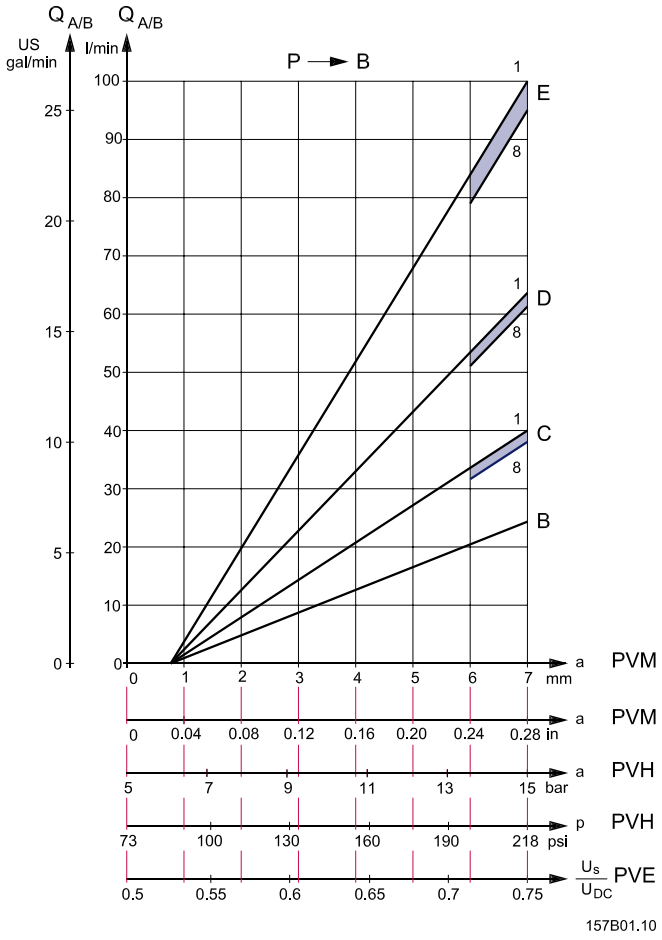



157-61.im

$U_S$ = Signal voltage
$U_{DC}$ = Supply voltage
1 = First PVB after PVP
8 = Eighth PVB after PVP

## PVB, Basic Modules

*Linear oil flow depending on spool type*




$U_S$ = Signal voltage
$U_{DC}$ = Supply voltage
1 = First PVB after PVP
8 = Eighth PVB after PVP

## PVB, Basic Modules (continued)

### PVB without pressure compensation, open center PVP

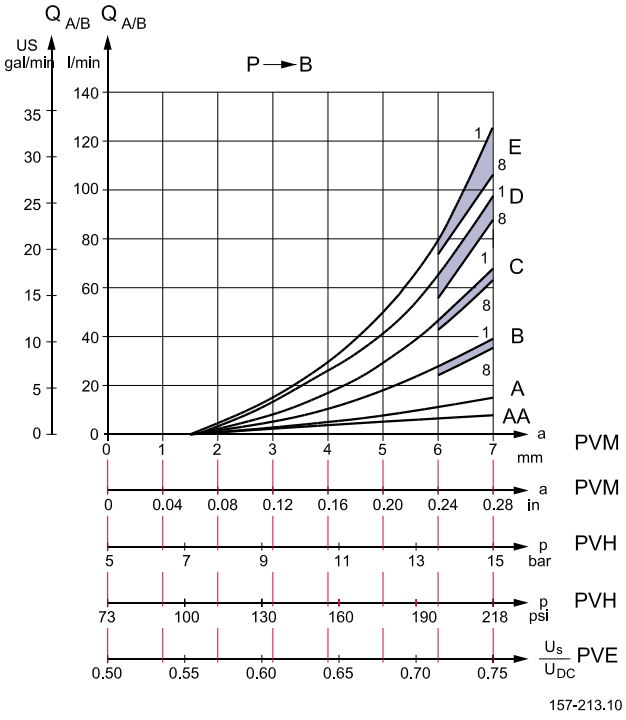
*Oil flow as a function of spool travel*

The spool flow is dependent on the supplied oil flow, $Q_P$.

The characteristics apply to supply oil flow of 130 l/min [34.3 US gal/min] with the actuation of one basic module and the supply flow level.

If several basic modules are activated at the same time, the characteristic depends on the load pressure of the actuated basic modules.

*Oil flow as a function of spool travel characteristic*

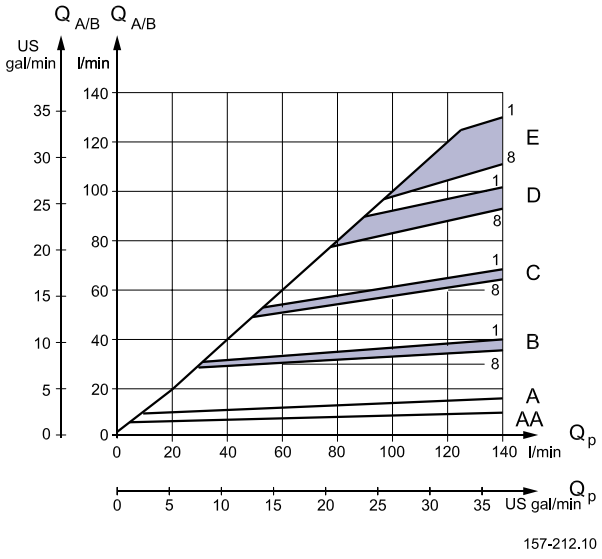


## PVB, Basic Module (continued)

*Oil flow $Q_{A/B}$ as a function of supplied pump oil flow ($Q_P$)*

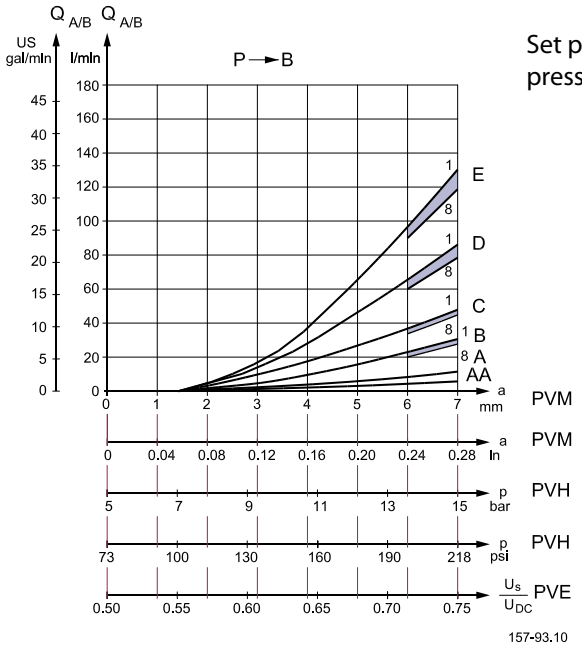
The pressure drop of any oil flowing back to tank ($Q_P$ - $Q_{A/B}$) is read on the curve for neutral flow pressure in PVP.

*Characteristic for fully displaced flow control spools*

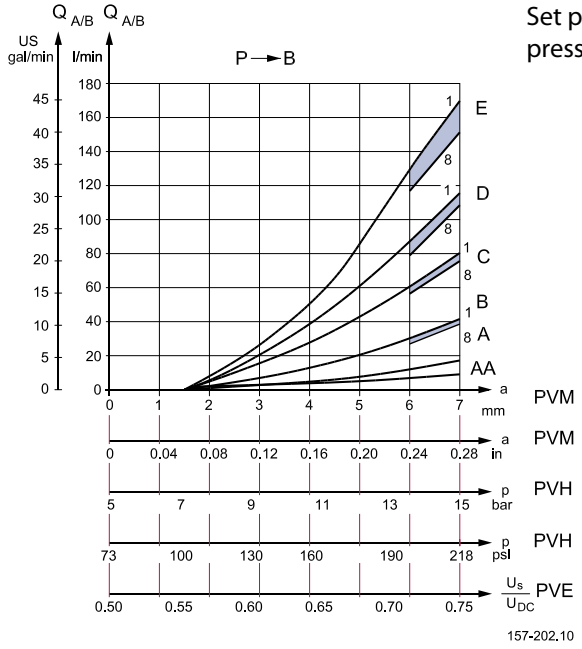


## PVB, Basic Module (continued)

### PVB without pressure compensation, closed center PVP




Set pressure difference between pump pressure and LS signal = 10 bar [145 psi].

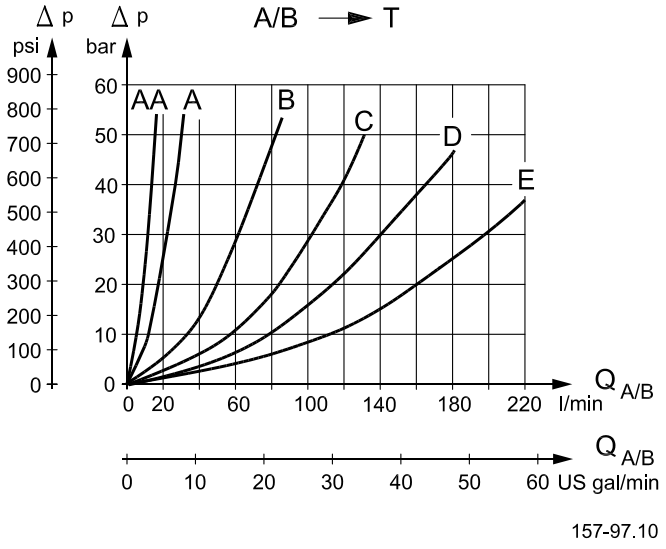



Set pressure difference between pump pressure and LS signal = 20 bar [290 psi].

The oil flow is dependent on the pressure difference between the pump pressure and the LS signal. Normally the pressure difference is set at the LS pump regulator. Also take into consideration pressure drop from the pump to the PVG valve group. e.x. long pipeline.

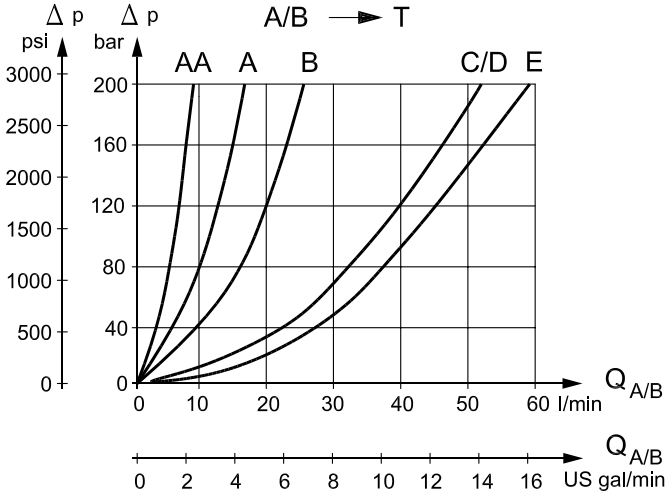
## PVB, Basic Module (continued)

*Characteristic for pressure drop PVB at max. main spool travel*




157-97.10

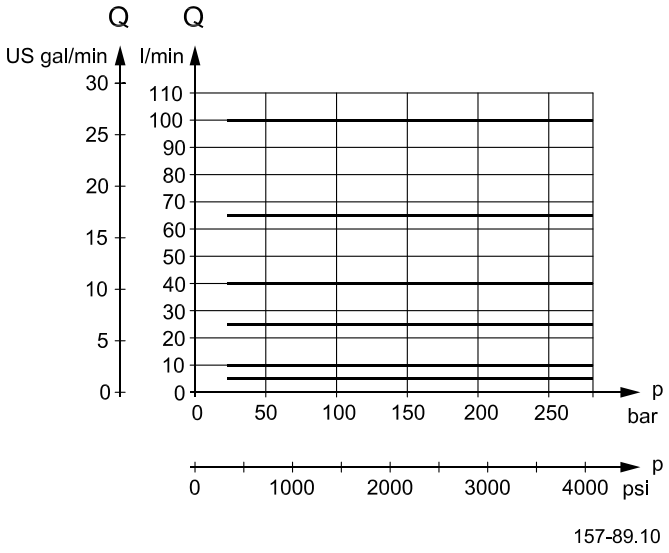
*Characteristic for pressure drop PVB for open spool in neutral position*



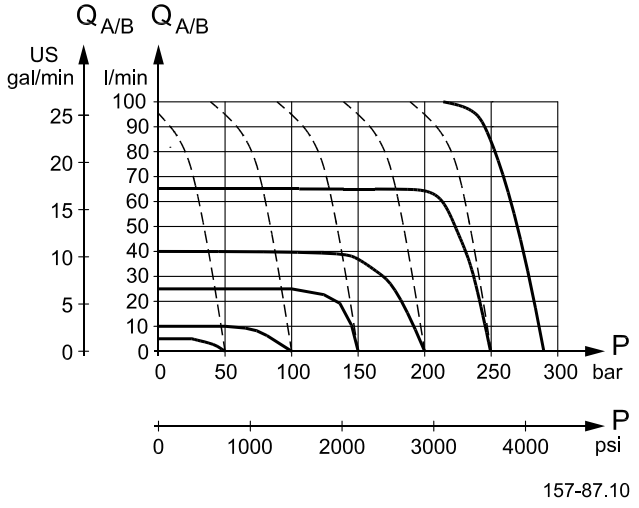

157-203.10

## PVB, Basic Module (continued)

*Load-independent oil flow characteristic, pressure-compensated PVB*




*Oil flow characteristic at LS pressure limiting, pressure-compensated PVB*



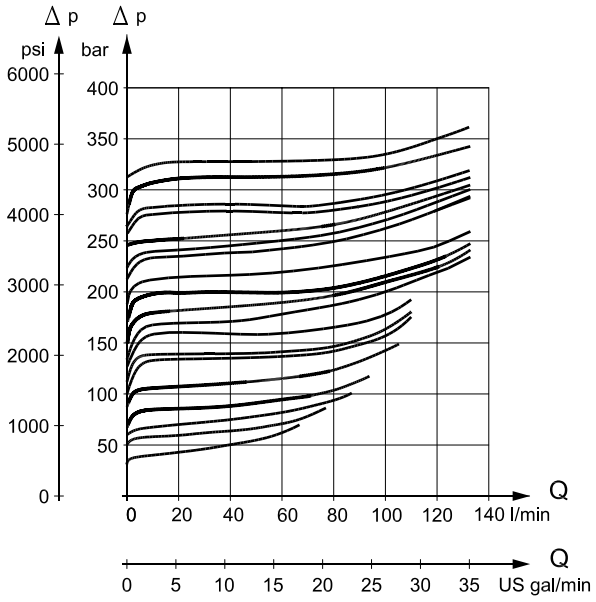
## PVLP, Shock and Suction Valve

### PVLP, shock valve

PVLP is set at an oil flow of 10 l/min [2.6 US gal/min]. The shock valve PVLP is designed to absorb shock effects. Consequently, it should not be used as a pressure relief valve.

If the working function requires the use of a pressure relief valve, a PVB basic module with built-in LSA/B pressure limiting valve should be used.

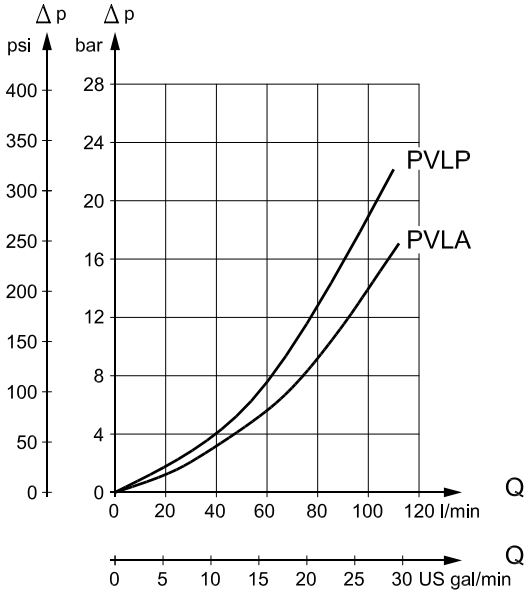
*PVLP, shock valve characteristic*




157-312.10

## PVLA, Suction Valve

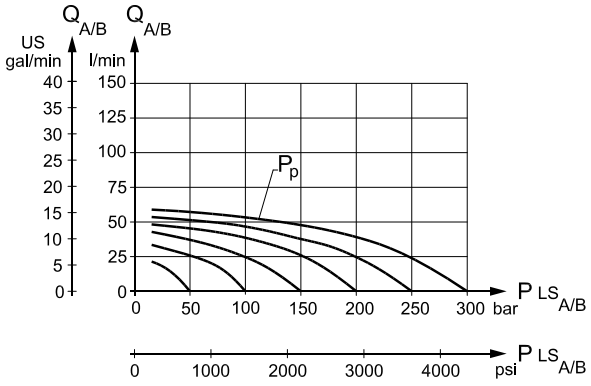
*PVLA, suction valve characteristic*



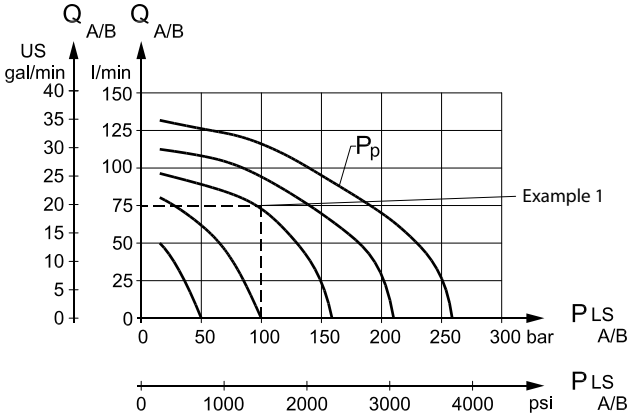

157-313.10

## Pressure Control Spool Flow Characteristics in Various Positions

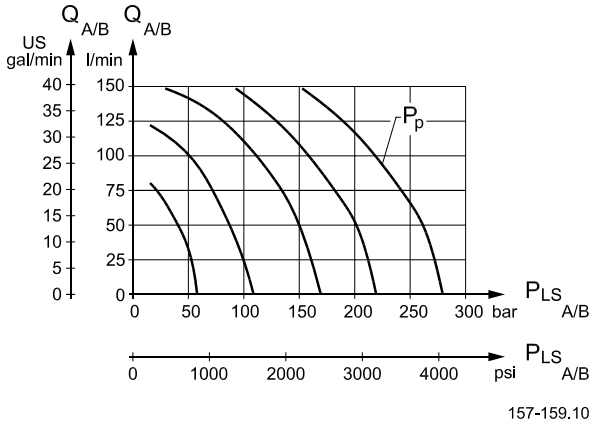
### Size A:



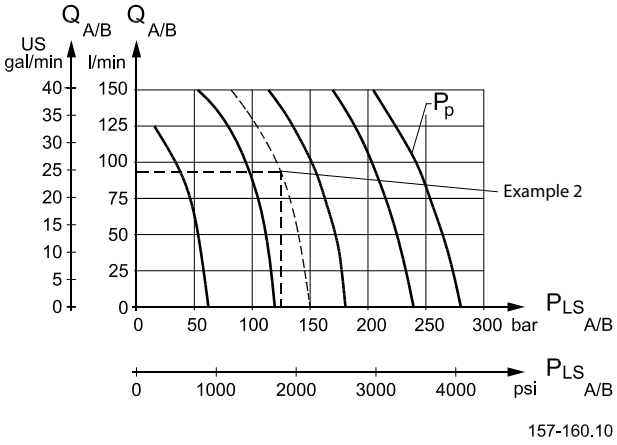

### Size B:



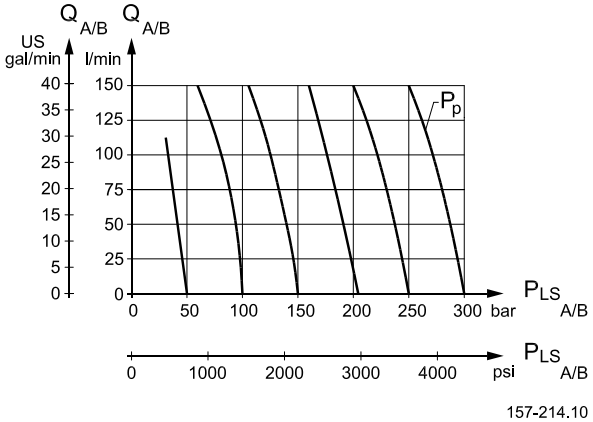

### Size C:




### Size D:

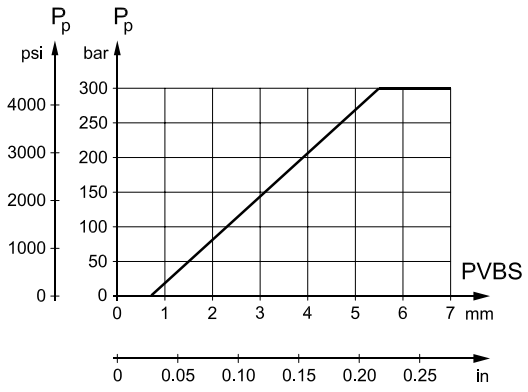



### Size E:



## Pressure Build-up for Pressure Controlled Spools

Max. oil flow can be reduced by about 50% without limitation of maximum pressure by limiting the main spool travel from 7 mm [0.28 in] to 5.5 mm [0.22 in].




157-156.10

## Examples of How To Use the Characteristics for Pressure Control Spools

*Example 1: Determining the oil flow*

- Given:
  - Spool type B
  - Pressure setting $P_{P:}$ 160 bar [2320 psi]
  - Load pressure, $LS_{A/B:}$ 100 bar [1450 psi]
- Result:
  - Oil flow = 75 l/min [19.8 US gal/min]

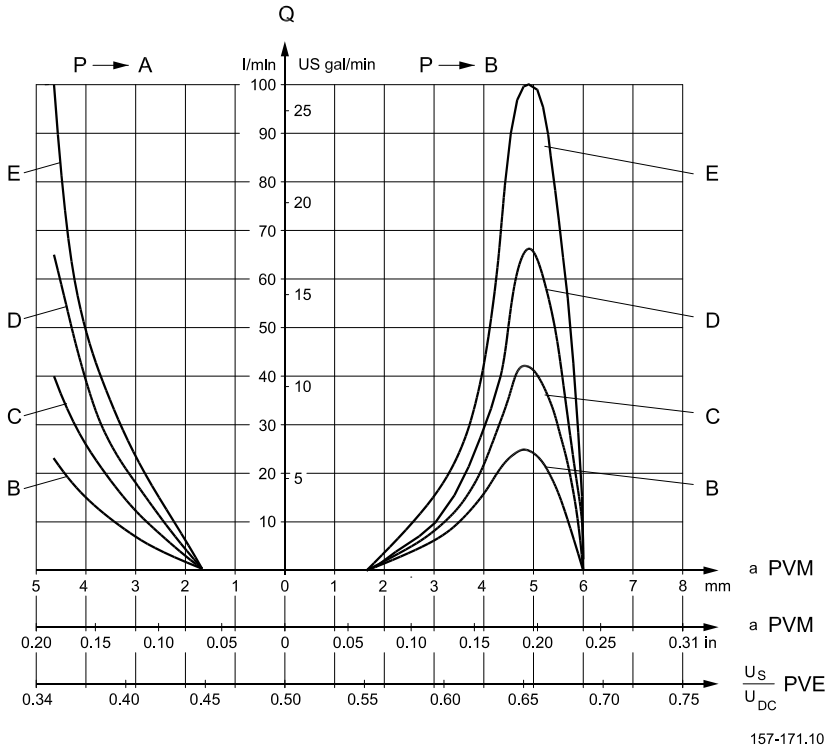
*Example 2: Determining the spool size*

- Given:
  - Max. oil flow, $Q_{A/B}$: 90 l/min [23.8 US gal/min]
  - Pressure setting $P_P$: 150 bar [2175 psi]
  - Load pressure, $P_{LS_A}$: 125 bar [1810 psi]
- Result:
  - D spool (see *previous page, size D*)

Normally a smaller spool can be chosen with pressure control. It is our experience that the spool can be one size smaller than with normal flow control.

## Characteristics for Float Position Main Spools

*Characteristic of oil flow, spool travel and voltage*



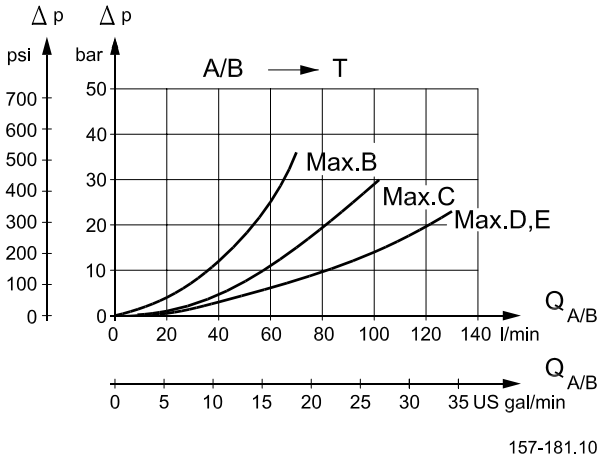

- 4.8 mm [0.19 in] spool displacement in direction A gives max. oil flow to port A
- 4.8 mm [0.19 in] spool displacement in direction B gives max. oil flow to port B
- 8 mm [0.32 in] spool displacement in direction B gives completely open float position A/B → T.

The spools have 4,8 mm spool travel in direction A and 8 mm travel in direction B:

For more information regarding electrical actuation of float spools please see *PVE series 4 Technical Information,* **520L0553.**

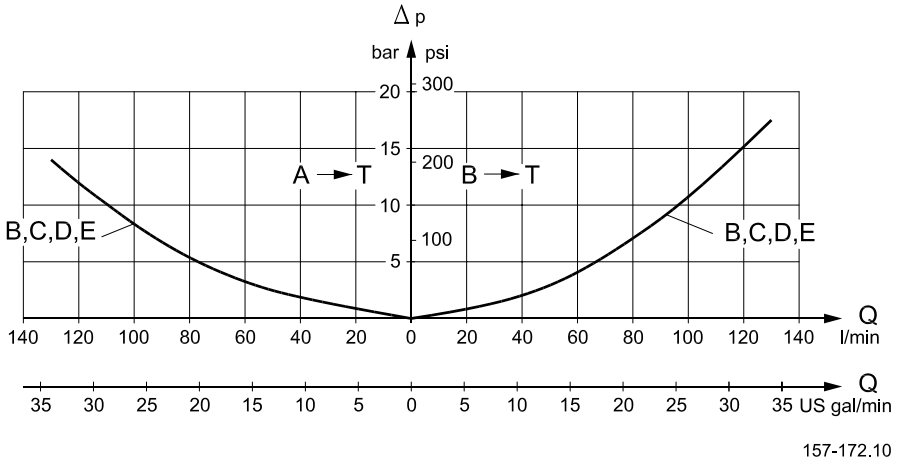
## Characteristics for Float Position Main Spools (continued)

*Pressure drop A/B → T at max. spool travel within the proportional range (4.8 mm) [0.19 in]*



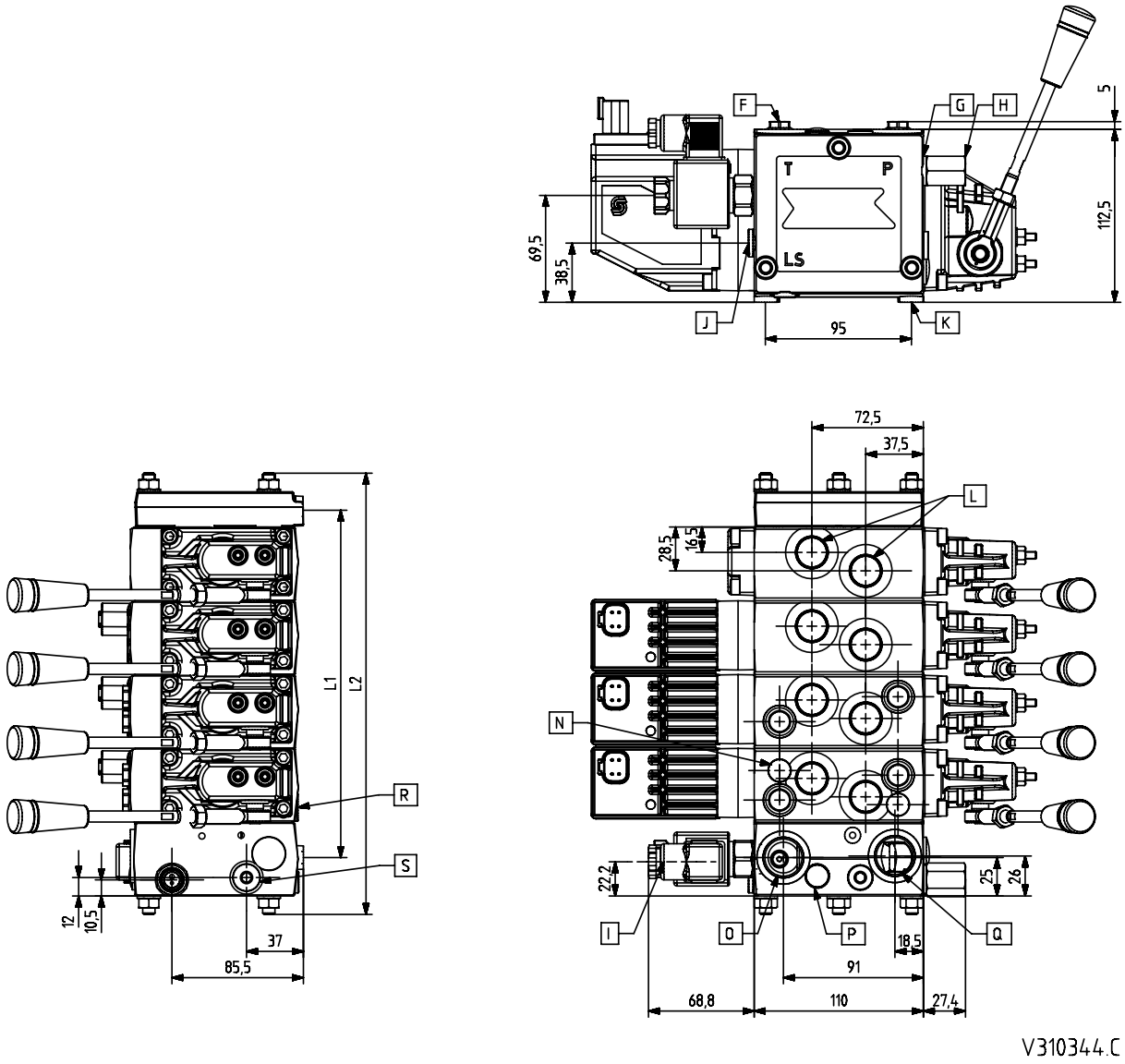

Spools D and E have the same opening area for forward flow and return flow. Spool E can give 100 l/min [26.4 US gal/min] pressure compensated oil flow due to a higher pressure drop across spool E. This occurs during spool actuation only.

*Pressure drop A/B → T in float position*



## Dimensions

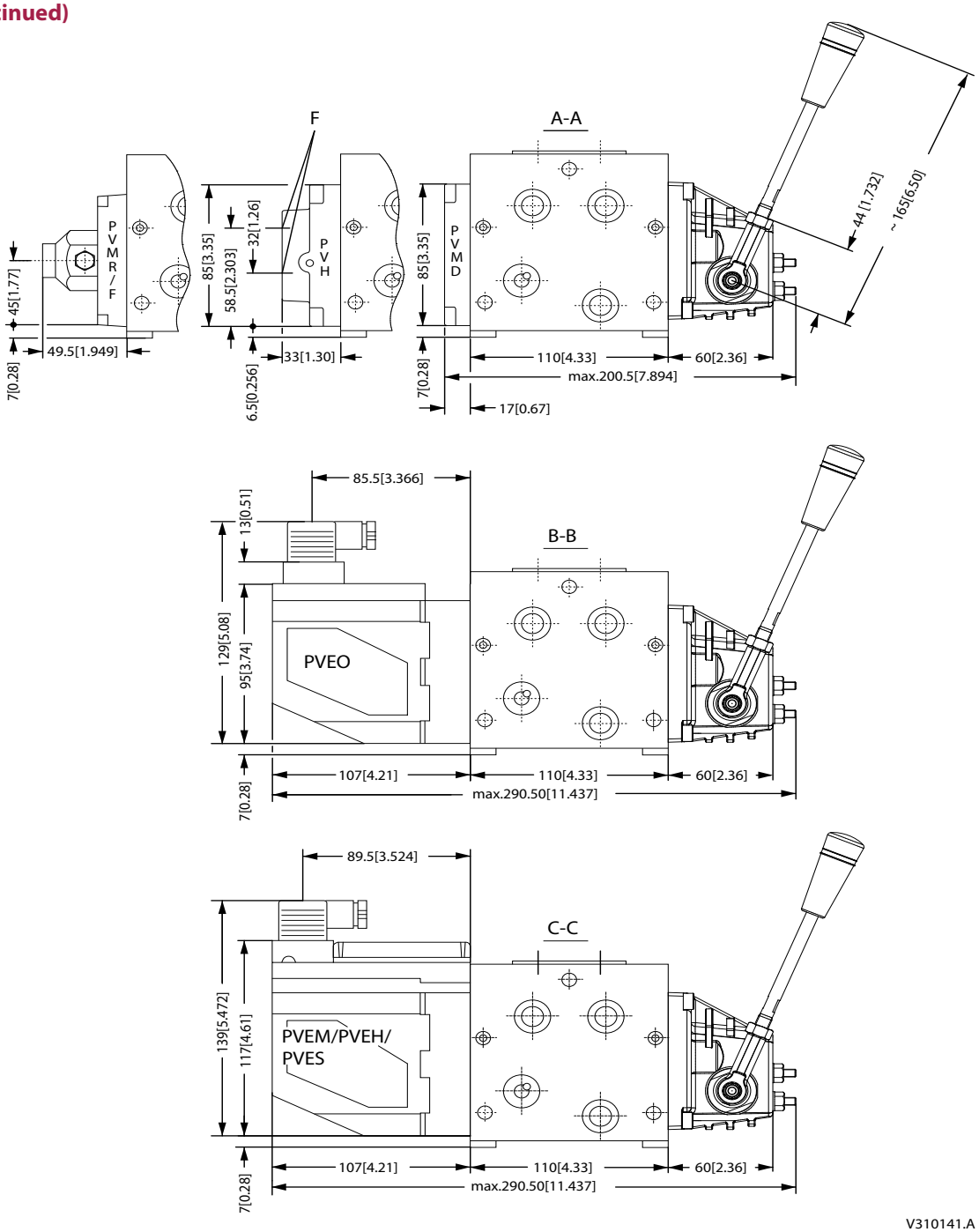
*PVG 32 Dimensions*




F: Shock and suction valve, PVLP
G: Pressure gauge connection: G¼, 12 mm [$^{9}/_{16}$-18, 0.5 in] deep
H: Plug for external pilot oil supply, PVPC: G½, 12 mm [½–20, 0.47 in] deep
I: Electrical LS unloading valve, PVPX
J: LS connection: G¼, 12 mm [½–20; 0.47 in or $^{9}/_{16}$-18, 0.5 in] deep
K: Fixing holes: M8 × min. 10 [$^{5}/_{16}$–18; 0.39 in] deep
L: Port A and B: G½, 14 mm [$^{7}/_{8}$–14; 0.65 in] deep
M: LX connection: PVS; G $^{1}/_{8}$, 10 mm [$^{3}/_{8}$–24; 0.39 in] deep and PVSI; G¼, 12 mm [½ -20; 0.47 in] deep
N: LS pressure limiting valve
O: Tank connection; G¾, 16 mm [1 $^{1}/_{16}$-12; 0.75 in] deep
P: Pressure relief valve
Q: Pump connection; G½, 14 mm [$^{7}/_{8}$-14; 0.65 in] deep or G¾, 16 mm [1 $^{1}/_{16}$-12; 0.75 in] deep
R: $LS_A$ and $LS_B$ connections; G¼, 12 mm deep [$^{9}/_{16}$-18, 0.5 in] deep
S : Pp, pilot pressure connection G¼

| PVB | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | mm | 82 | 130 | 178 | 226 | 274 | 322 | 370 | 418 | 466 | 514 | 562 | 610 |
| | [in] | [3.23] | [5.12] | [7.01] | [8.90] | [10.79] | [12.68] | [14.57] | [16.46] | [18.35] | [20.24] | [562] | [610] |
| L2 | mm | 140 | 189 | 238 | 287 | 336 | 385 | 434 | 483 | 527 | 576 | 622 | 670 |
| | in] | [5.51] | [7.44] | [9.37] | [11.30] | [13.23] | [15.16] | [17.09] | [19.02] | [20.95] | [22.87] | [622] | [670] |

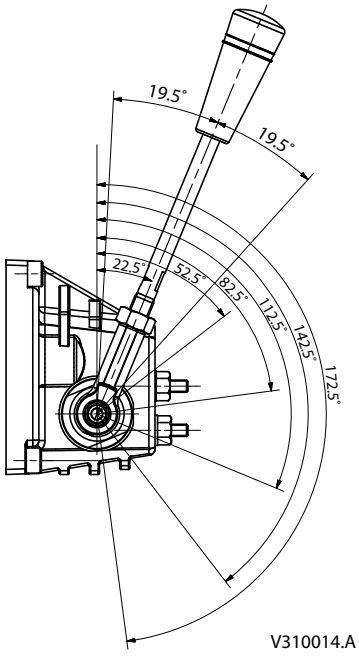
## Dimensions (continued)



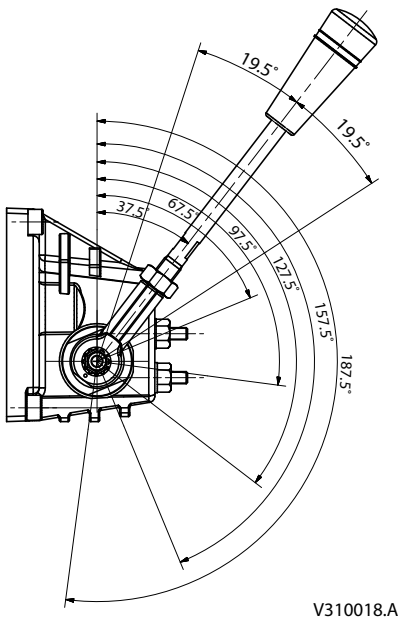

F: G 1/4, 12 mm deep [1/2 in - 20, 0.47 in deep]

## Control Lever Positions

*Mounted with an angle of 22.5°*




*Mounted with an angle of 37.5°*




The angle of the handle is determined by which side of the handle that is mount towards the base. If a 22.5° angle is needed the "dot" on the handle is not visible. If 37.5° is needed the dot should be visible.

## Surface Treatment

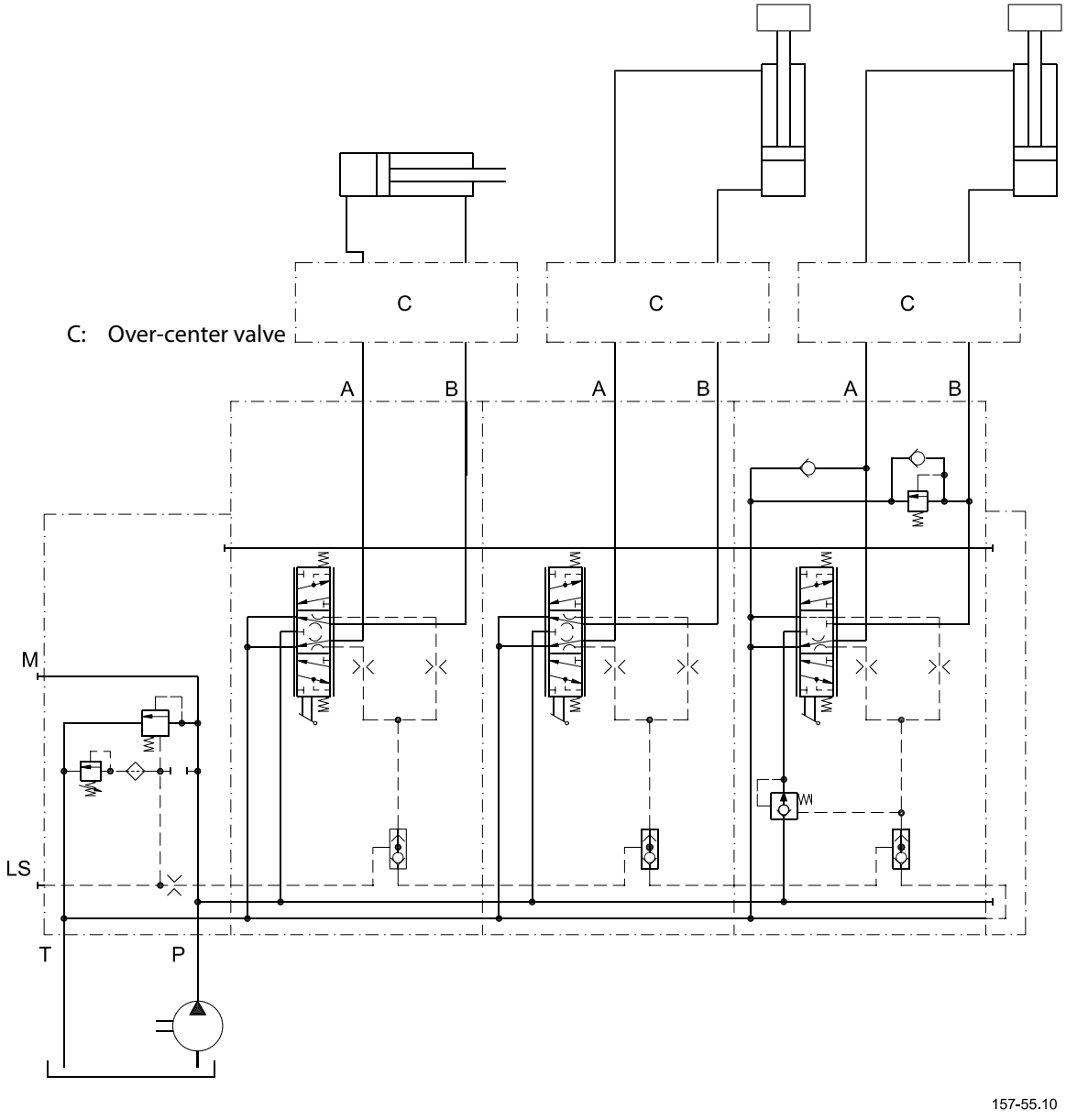
The PVG valve has as standard, an untreated surface. In certain applications, depend on different factors, such as: salty environment, large temperature changes, high humidity, rust can develope on the surface. This will not affect the performance of the PVG valve group.

To prevent/reduce rust development, Sauer-Danfoss recommend, the PVG valve group to be painted.

Rust on the surface is not seen as a valid complaint issue, neither on painted or unpainted PVG valve groups.

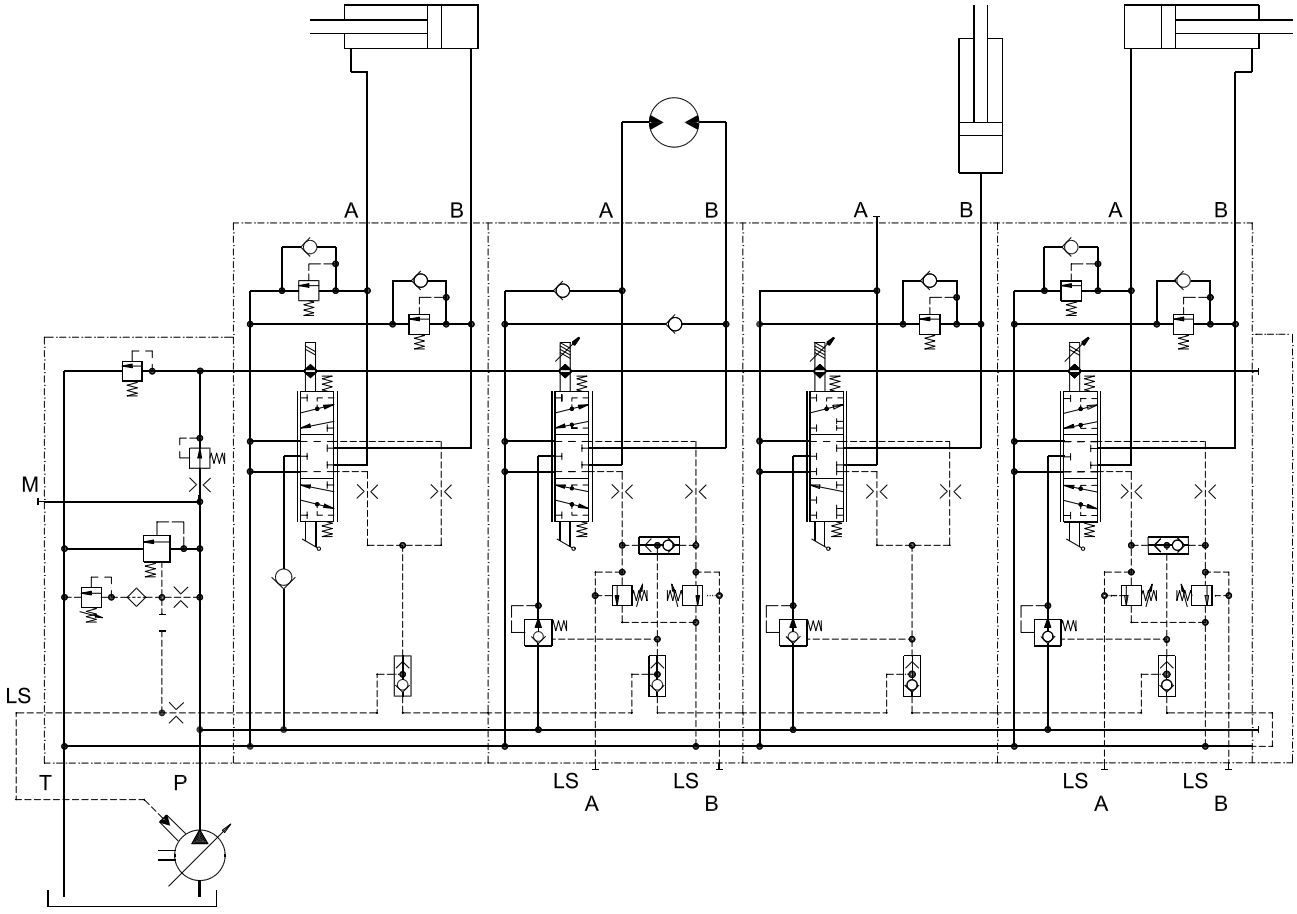
## Manually Actuated PVG 32 – Fixed Displacement Pump

*Example of manually actuated PVG 32 – fixed displacement pump schematic*



## Electrically Actuated PVG 32 – Variable Displacement Pump

*Example of electrically actuated PVG 32 – variable displacement pump (electrical actuator, shock valves, relief valve) schematic*




157-56.10

## Oil

The main duty of the oil in a hydraulic system is to transfer energy. It must also lubricate the moving parts in hydraulic components, protect them against corrosion, and transport dirt particles and heat out of the system. It is therefore important to choose the correct oil with the correct additives. This gives normal operation and long working life.

### Mineral oil

For systems with PVG 32 valves Sauer-Danfoss recommends the use of mineral-based hydraulic oil containing additives: Type HLP (DIN 51524) or HM (ISO 6743/4).

### Non-flammable fluids

Phosphate-esters (HFDR fluids) can be used without special precautions. However, dynamic seals must be replaced with FPM (Viton) seals.
Please contact the Sauer-Danfoss Sales Organization if the PVG 32 valve is to be used with phosphate-esters.
The following fluids should only be used according to agreement with the Sales Organization for Sauer-Danfoss:

- Water-glycol mixtures (HFC fluids)
- Water-oil emulsions (HFB fluids)
- Oil-water emulsions (HFAE fluids)

## Particle Content, Degree of Contamination

### Biodegradable oils

PVG 32 valves can be used in systems with rapeseed oil. The use of rapeseed oil is conditioned by:

- complying with the demands on viscosity, water content, temperature and filtering etc. (see chapters below and technical data).
- adapting the operating conditions to the directions of the oil supplier.

Before using other biodegradable fluids, please consult the Sauer-Danfoss Organization.

Oil filtration must prevent particle content from exceeding an acceptable level, i.e., an acceptable degree of contamination.

Maximum contamination for PVG 32 is 23/19/16 (see ISO 4406. Calibration in accordance with the ACFTD method).

In our experience a degree of contamination of 23/19/16 can be maintained by using a filter fineness as described in the next section.

For more information, please see the Sauer-Danfoss literature:

- *Design Guidelines for Hydraulic Fluid Cleanliness Technical Information,* **520L0467**
- *Hydraulic Fluids and Lubricants Technical Information,* **521L0463**
- *Experience with Bio-Hydraulic Fluids Technical Information,* **521L0465**.

## Filtration

Effective filtration is the most important precondition in ensuring that a hydraulic system performs reliably and has a long working life. Filter manufacturers issue instructions and recommendations. It is advisable to follow these.

### System filters

Where demands on safety and reliability are very high a pressure filter with bypass and indicator is recommended. Experience shows that a 10 µm nominal filter (or finer) or a 20 µm absolute filter (or finer) is suitable.

It is our experience that a return filter is adequate in a purely mechanically operated valve system.

The fineness of a pressure filter must be selected as described by the filter manufacturer so that a particle level of 23/19/16 is not exceeded.

The filter must be fitted with pressure gauge or dirt indicator to make it possible to check the condition of the filter.

In systems with differential cylinders or accumulators the return filter must be sized to suit the max. return oil flow. Pressure filters must be fitted to suit max. pump oil flow.

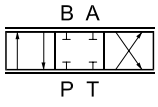
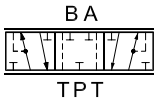
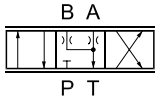
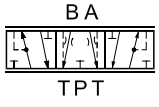
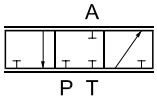
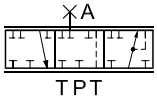
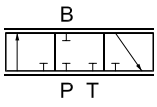
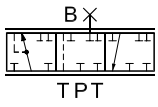
### Internal filters

The filters built into PVG 32 are not intended to filter the system but to protect important components against large particles. Such particles can appear in the system as a result of pump damage, hose fracture, use of quick-couplings, filter damage, starting up, contamination, etc.

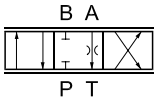
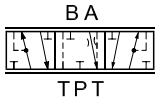
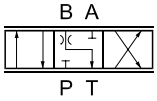
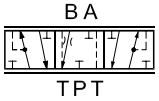
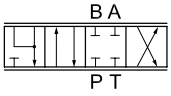
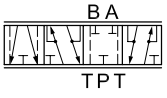
The filter in the electrical actuator PVE protecting the solenoid valves has a mesh of 150 µm.

Bursting pressure drop for internal filters is 25 bar [360 psi].

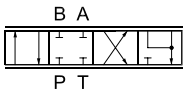
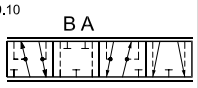
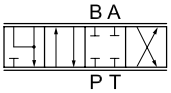
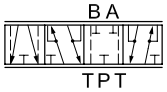
## Standard FC Spools

| To be used when PVB is with $LS_{A/B}$ shuttle valve | | | | | | | Code number 157B.... | | To be used when PVB is without $LS_{A/B}$ shuttle valve | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | | | | | | | | Size | | | | | | |
| Press. compensated flow l/min [US gal/min] | | | | | | | ISO symbol | Symbol | Press. compensated flow l/min [US gal/min] | | | | | | |
| F 130 [34.3] | E 100 [26.4] | D 65 [17.2] | C 40 [10.6] | B 25 [6.6] | A 10 [2.6] | AA 5 [1.3] | | | AA 5 [1.3] | A 10 [2.6] | B 25 [6.6] | C 40 [10.6] | D 65 [17.2] | E 100 [26.4] | F 130 [34.3] |
| 7026 | 7024 | 7023 | 7022 | 7021 | 7020 | 7025 |  157-02.10 |  157-26.10 | 7005 | 7000 | 7001 | 7002 | 7003 | 7004 | 7006 |
| | | | | | | | 4-way, 3-position<br>Closed neutral position | | | | | | | | |
| 7126 | 7124 | 7123 | 7122 | 7121 | 7120 | 7125 |  157-03.10 |  157-27.10 | 7105 | 7100 | 7101 | 7102 | 7103 | 7104 | 7106 |
| | | | | | | | 4-way, 3-position<br>Throttled, open neutral position | | | | | | | | |
| - | - | - | - | - | - | - |  157-04.10 |  157-28.10 | - | 7200 | 7201 | 7202 | 7203 | 7204 | - |
| | | | | | | | 3-way, 3-position<br>Closed neutral position, P → A | | | | | | | | |
| - | - | - | - | - | - | - |  157-05.10 |  157-29.10 | - | - | 7301 | 7302 | 7303 | 7304 | - |
| | | | | | | | 3-way, 3-position<br>Closed neutral position, P → B | | | | | | | | |

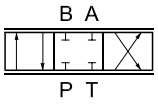
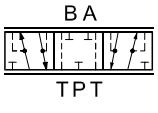
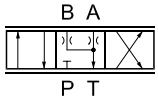
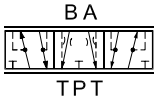
## Standard FC Spools

| To be used when PVB is with $LS_{A/B}$ shuttle valve | | | | | | | Code number 157B.... | | To be used when PVB is without $LS_{A/B}$ shuttle valve | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | | | | | | | | Size | | | | | | |
| Press. compensated flow l/min [US gal/min] | | | | | | | ISO symbol | Symbol | Press. compensated flow l/min [US gal/min] | | | | | | |
| F 130 [34.3] | E 100 [26.4] | D 65 [17.2] | C 40 [10.6] | B 25 [6.6] | A 10 [2.6] | AA 5 [1.3] | | | AA 5 [1.3] | A 10 [2.6] | B 25 [6.6] | C 40 [10.6] | D 65 [17.2] | E 100 [26.4] | F 130 [34.3] |
| - | 7424 | 7423 | 7422 | 7421 | - | - |  157-06.10  157-30.10 4-way, 3-position Throttled, A → T in neutral position | | - | - | 7401 | 7402 | 7403 | 7404 | 7406 |
| - | 7524 | 7523 | 7522 | 7521 | - | - |  157-07.10  157-31.10 4-way, 3-position Throttled, B → T in neutral position | | - | - | 7501 | 7502 | 7503 | 7504 | - |
| - | 7624 | 7623 | 7622 | 7621 | 7620 | - |  157-139.10  157-140.10 4-way, 4-position Closed neutral position Float P → B → F | | - | - | - | - | - | - | - |

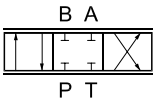
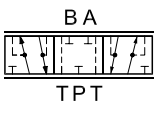
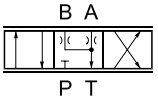
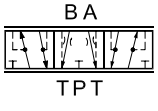
## FC Spools for Mechanical Float Position PVMF

| To be used when PVB is with $LS_{A/B}$ shuttle valve | | | | | | | Code number 157B.... | | To be used when PVB is without $LS_{A/B}$ shuttle valve | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | | | | | | | | Size | | | | | | |
| Press. compensated flow l/min [US gal/min] | | | | | | | ISO symbol | Symbol | Press. compensated flow l/min [US gal/min] | | | | | | |
| F 130 [34.3] | E 100 [26.4] | D 65 [17.2] | C 40 [10.6] | B 25 [6.6] | A 10 [2.6] | AA 5 [1.3] | | | AA 5 [1.3] | A 10 [2.6] | B 25 [6.6] | C 40 [10.6] | D 65 [17.2] | E 100 [26.4] | F 130 [34.3] |
| - | 9824 | 9823 | 9822 | 9821 | 9820 | 9825 |  157-09.10  157-454.10 4-way, 4 position Closed neutral position P → A → F | | - | - | - | - | - | - | - |
| - | 9624 | 623 | 9622 | 9621 | - | - |  157-139.10  157-140.10 4-way, 4-position Closed neutral position Float P → B → F | | - | - | - | - | - | - | - |

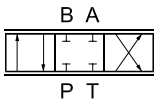
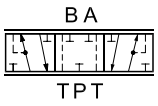
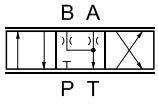
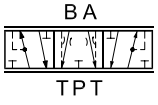
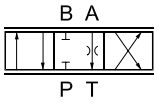
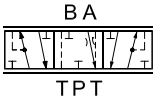
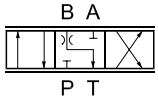
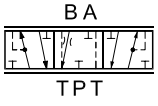
## Standard FC Spools, Hydraulic Actuation

| To be used when PVB is with $LS_{A/B}$ shuttle valve | | | | | | Code number 157B.... | | To be used when PVB is without $LS_{A/B}$ shuttle valve | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | | | | | | | Size | | | | | |
| Press. compensated flow l/min [US gal/min] | | | | | | | | Press. compensated flow l/min [US gal/min] | | | | | |
| E 100 [26.4] | D 65 [17.2] | C 40 [10.6] | B 25 [6.6] | A 10 [2.6] | AA 5 [1.3] | ISO symbol | Symbol | AA 5 [1.3] | A 10 [2.6] | B 25 [6.6] | C 40 [10.6] | D 65 [17.2] | E 100 [26.4] |
| 9024 | 9023 | 9022 | 9021 | 9020 | 9025 |  157-02.10 |  157-117.10 | 9005 | 9000 | 9001 | 9002 | 9003 | 9004 |
| | | | | | | 4-way, 3-position<br>closed neutral position | | | | | | | |
| 9124 | 9123 | 9122 | 9121 | 9120 | 9125 |  157-03.10 |  157-118.10 | 9105 | 9100 | 9101 | 9102 | 9103 | 9104 |
| | | | | | | 4-way, 3-position<br>Throttled open neutral position | | | | | | | |

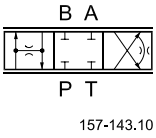
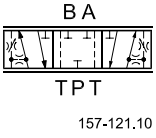
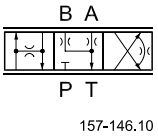
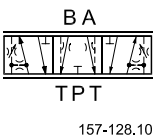
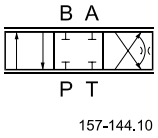
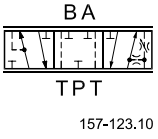
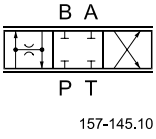
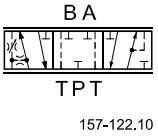
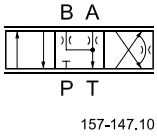
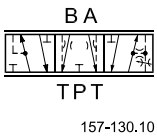
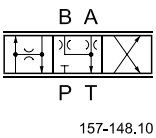
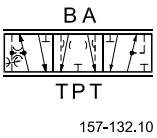
## PVMR, FC Spools for Friction Detent

| To be used when PVB is with $LS_{A/B}$ shuttle valve | | | | | | Code number 157B.... | | To be used when PVB is without $LS_{A/B}$ shuttle valve | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | | | | | | | Size | | | | | |
| Press. compensated flow l/min [US gal/min] | | | | | | | | Press. compensated flow l/min [US gal/min] | | | | | |
| E 100 [26.4] | D 65 [17.2] | C 40 [10.6] | B 25 [6.6] | A 10 [2.6] | AA 5 [1.3] | ISO symbol | Symbol | AA 5 [1.3] | A 10 [2.6] | B 25 [6.6] | C 40 [10.6] | D 65 [17.2] | E 100 [26.4] |
| 9724 | 9723 | 9722 | 9721 | 9720 | - |  157-02.10 |  157-117.10 | - | 9700 | 9701 | 9702 | 9703 | 9704 |
| | | | | | | 4-way, 3-position<br>closed neutral position | | | | | | | |
| 9734 | 9733 | 9732 | 9731 | 9730 | - |  157-03.10 |  157-118.10 | - | 9710 | 9711 | 9712 | 9713 | 9714 |
| | | | | | | 4-way, 3-position<br>Throttled open neutral position | | | | | | | |

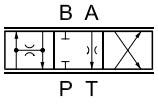
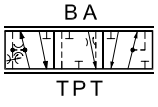
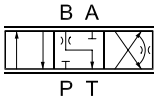
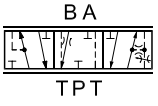
## FC Spools with Linear Flow Characteristic

| To be used when PVB is with $LS_{A/B}$ shuttle valve | | | | | | | Code number 157B.... | | To be used when PVB is without $LS_{A/B}$ shuttle valve | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | | | | | | | | Size | | | | | | |
| Press. compensated flow l/min [US gal/min] | | | | | | | ISO symbol | Symbol | Press. compensated flow l/min [US gal/min] | | | | | | |
| F 130 [34.3] | E 100 [26.4] | D 65 [17.2] | C 40 [10.6] | B 25 [6.6] | A 10 [2.6] | AA 5 [1.3] | | | AA 5 [1.3] | A 10 [2.6] | B 25 [6.6] | C 40 [10.6] | D 65 [17.2] | E 100 [26.4] | F 130 [34.3] |
| - | 9774 | 9773 | 9772 | 9771 | - | - |  157-02.10 |  157-26.10 | - | 9750 | 9751 | 9752 | 9753 | 9754 | - |
| | | | | | | | 4-way, 3-position<br>Closed neutral position | | | | | | | | |
| - | 9784 | 9783 | 9782 | 9781 | - | - |  157-03.10 |  157-27.10 | - | 9760 | 9761 | 9762 | 9763 | 9764 | - |
| | | | | | | | 4-way, 3-position<br>Throttled, open neutral position | | | | | | | | |
| - | - | - | - | - | - | - |  157-06.10 |  157-30.10 | - | - | - | - | - | 9794 | - |
| | | | | | | | 4-way, 3-position<br>Throttled, A → T in neutral position | | | | | | | | |
| - | - | - | - | - | - | - |  157-07.10 |  157-31.10 | - | - | - | - | - | 9804 | - |
| | | | | | | | 4-way, 3-position<br>B → T in neutral position | | | | | | | | |

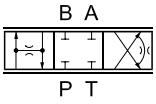
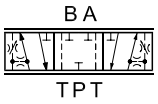
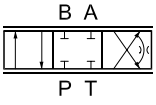
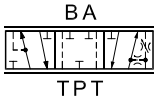
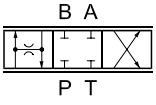
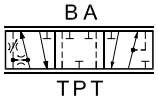
## Standard PC Spools

| To be used when PVB is with $LS_{A/B}$ shuttle valve | | | | | | Code number 157B.... | | To be used when PVB is without $LS_{A/B}$ shuttle valve | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | | | | | | | Size | | | | | |
| Press. compensated flow l/min [US gal/min] | | | | | | ISO symbol | Symbol | Press. compensated flow l/min [US gal/min] | | | | | |
| E 100 [26.4] | D 65 [17.2] | C 40 [10.6] | B 25 [6.6] | A 10 [2.6] | AA 5 [1.3] | | | AA 5 [1.3] | A 10 [2.6] | B 25 [6.6] | C 40 [10.6] | D 65 [17.2] | E 100 [26.4] |
| - | 7033 | 7032 | 7031 | 7030 | 7035 |  |  | 7015 | 7010 | 7011 | 7012 | 7013 | - |
| | | | | | | 4-way, 3-position<br>Closed neutral position, PC → A and B | | | | | | | |
| 7134 | 7133 | 7132 | 7131 | 7130 | 7135 |  |  | 7115 | 7110 | 7111 | 7112 | 7113 | - |
| | | | | | | 4-way, 3-position Throttled, open neutral position, PC → A and B | | | | | | | |
| 7064 | 7063 | 7062 | 7061 | - | - |  |  | - | 7040 | 7041 | 7042 | 7043 | 7044 |
| | | | | | | 4-way, 3-position<br>Closed neutral position, PC → A | | | | | | | |
| 7074 | 7073 | 7072 | 7071 | - | - |  |  | - | 7050 | 7051 | 7052 | 7053 | 7054 |
| | | | | | | 4-way, 3-position<br>Closed neutral position, PC → B | | | | | | | |
| 7164 | 7163 | 7162 | 7161 | - | - |  |  | - | 7150 | 7151 | 7152 | 7153 | 7154 |
| | | | | | | 4-way, 3-position<br>Throttled, open neutral position, PC → A | | | | | | | |
| 7174 | 7173 | 7172 | 7171 | - | - |  |  | - | 7150 | 7151 | 7152 | 7153 | 7154 |
| | | | | | | 4-way, 3-position<br>Throttled, open neutral position, PC → B | | | | | | | |

## Standard PC Spools

| To be used when PVB is with $LS_{A/B}$ shuttle valve | | | | | | Code number 157B.... | | To be used when PVB is without $LS_{A/B}$ shuttle valve | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | | | | | | | Size | | | | | |
| Press. compensated flow l/min [US gal/min] | | | | | | ISO symbol | Symbol | Press. compensated flow l/min [US gal/min] | | | | | |
| **E 100 [26.4]** | **D 65 [17.2]** | **C 40 [10.6]** | **B 25 [6.6]** | **A 10 [2.6]** | **AA 5 [1.3]** | | | **AA** 5 **[1.3]** | **A 10 [2.6]** | **B 25 [6.6]** | **C 40 [10.6]** | **D 65 [17.2]** | **E 100 [26.4]** |
| - | 7473 | 7472 | 7471 | 7470 | - |  157-149.10 |  157-142.10 | - | - | - | 7452 | 7453 | - |
| 4-way, 3-position<br>Throttled, A → T neutral position, PC → B | | | | | | | | | | | | | |
| - | 7563 | 7562 | - | - | - |  157-167.10 |  157-188.10 | - | - | 7541 | 7542 | 7543 | - |
| 4-way, 3-position<br>Throttled, B→ T neutral position , PC → A | | | | | | | | | | | | | |

## Standard PC Spools, Hydraulic Actuation

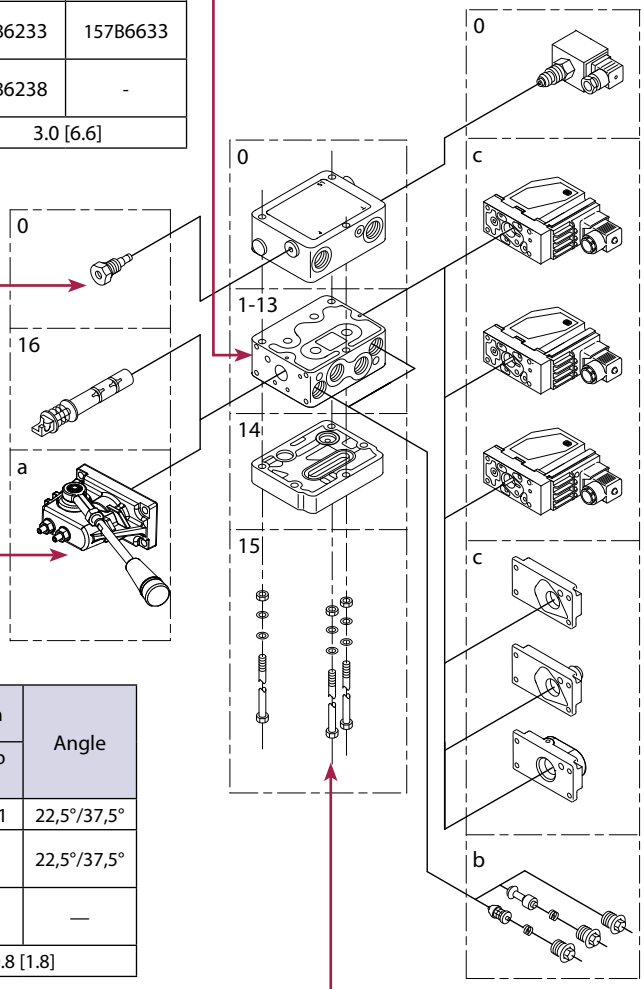
| To be used when PVB is with $LS_{A/B}$ shuttle valve | | | | | | Code number 157B.... | | To be used when PVB is without $LS_{A/B}$ shuttle valve | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | | | | | | | Size | | | | | |
| Press. compensated flow l/min [US gal/min] | | | | | | ISO symbol | Symbol | Press. compensated flow l/min [US gal/min] | | | | | |
| **E 100 [26.4]** | **D 65 [17.2]** | **C 40 [10.6]** | **B 25 [6.6]** | **A 10 [2.6]** | **AA 5 [1.3]** | | | **AA** 5 **[1.3]** | **A 10 [2.6]** | **B 25 [6.6]** | **C 40 [10.6]** | **D 65 [17.2]** | **E 100 [26.4]** |
| - | - | - | - | - | - |  157-143.10  157-121.10 4-way, 3-position Closed neutral position, PC → A and B | | 9015 | 9010 | 9011 | 9012 | - | - |
| - | - | - | - | - | - |  157-144.10  157-123.10 4-way, 3-position Closed neutral position, PC → A | | - | - | - | 9042 | 9043 | 9044 |
| - | - | - | - | - | - |  157-145.10  157-122.10 4-way, 3-position Closed neutral position, PC → B | | - | - | - | 9052 | 9053 | 9054 |

## PVB, basic valves

| Description | No facilities for shock valves A and B | | Facilities for shock valves A and B | |
|---|---|---|---|---|
| | G ½ | ⅞ - 14 UNF | G ½ | ⅞ - 14 UNF |
| Without compensator /check valve | 157B6000 | 157B6400 | 157B6030 | 157B6430 |
| With check valve | 157B6100 | 157B6500 | 157B6130 | 157B6530 |
| With check valve and $LS_{A/B}$ shuttle valve | - | - | 157B6136 | 157B6536 |
| With compensator valve | 157B6200 | 157B6600 | 157B6230 | 157B6630 |
| With damped compensator valve | 157B6206 | - | 157B6236 | - |
| With compensator valve, $LS_{A/B}$ relief valve and $LS_{A/B}$ shuttle valve | 157B6203 | 157B6603 | 157B6233 | 157B6633 |
| With damped compensator valve, $LS_{A/B}$ relief valve and $LS_{A/B}$ shuttle valve | 157B6208 | - | 157B6238 | - |
| Weight kg [lb] | 3.1 [6.8] | | 3.0 [6.6] | |

## PVPC, plugs

| Description | G ½ | ½ in - 20 | Weight kg | Weight [lb] |
|---|---|---|---|---|
| External pilot supply | 157B5400 | — | 0.05 | 0.1 |
| External pilot supply incl. check valve | 157B5600 | 157B5700 | 0.05 | 0.1 |




V310168.A

## PVM, mechanical actuation

| Description | Alu | | Alu anodized | Cast iron | Angle |
|---|---|---|---|---|---|
| | with stop screws | without stop screws | with stop screws | with stop screws | |
| Standard | 157B3171 | 157B3191 | 157B3184 | 157B3161 | 22,5°/37,5° |
| Standard with base, without arm and button | 157B3174 | 157B3194 | — | — | 22,5°/37,5° |
| Standard without base, without arm and button | 157B3173 | 157B3193 | 157B3186 | — | — |
| Weight kg [lb] | 0.4 [0.9] | | | 0.8 [1.8] | |

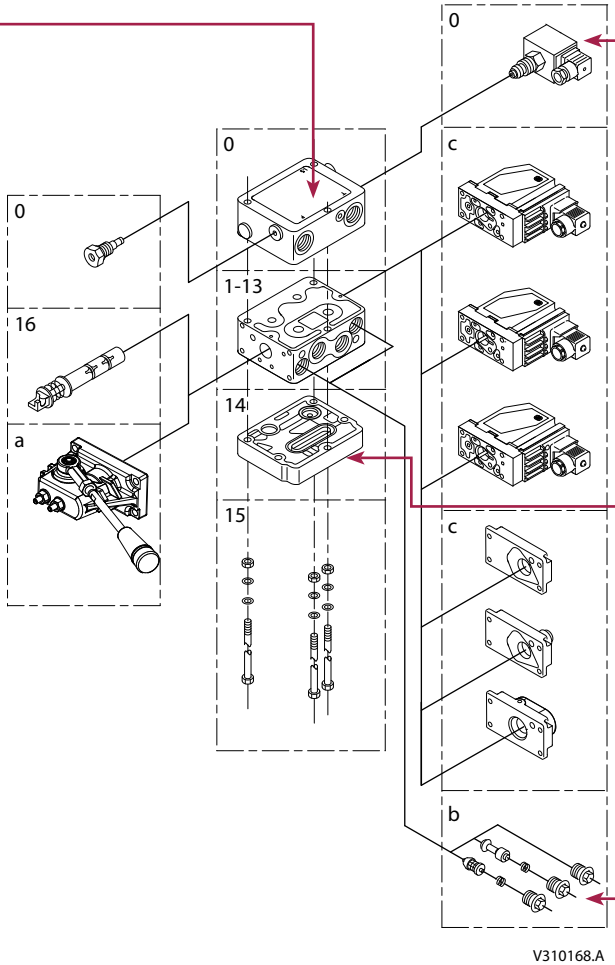
## PVAS, assembly kit

| Code no. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PVB's | 157B8000 | 157B8001 | 157B8002 | 157B8003 | 157B8004 | 157B8005 | 157B8006 | 157B8007 | 157B8008 | 157B8009 | 157B8010 | 157B8061 | 157B8062 |
| PVB + PVPVM | - | 157B8021 | 157B8022 | 157B8023 | 157B8024 | 157B8025 | 157B8026 | 157B8027 | 157B8028 | 157B8029 | 157B8030 | 157B8081 | 157B8082 |
| Weight kg [lb] | 0.1 [0.2] | 0.15 [0.3] | 0.25 [0.6] | 0.30 [0.7] | 0.40 [0.9] | 0.45 [1.0] | 0.50 [1.1] | 0.60 [1.3] | 0.65 [1.4] | 0.70 [1.6] | 0.80 [1.7] | 0.85 [1.8] | 0.9 [2.0] |

# Module Selection Chart

## PVP, pump side module

| Description | | Without pilot supply | | With pilot supply | | | |
|---|---|---|---|---|---|---|---|
| | | for PVE | for PVE with facilit. for PVPX | for PVE | for PVE and facilit. for PVPX | for PVE and pilot oil pressure take-off | for PVH and pilot oil pressure take-off |
| Open center | P = G1/2, T = G3/4 | 157B5000 | - | 157B5010 | 157B5012 | - | - |
| | P = 7/8 -14, T = 1 1/16 -12 | 157B5200 | - | 157B5210 | 157B5212 | - | - |
| | P = G3/4, T = G3/4 | 157B5100 | 157B5102 | 157B5110 | 157B5112 | 157B5180 | 157B5190 |
| | P = 1 1/16 -12, T = 1 1/16 -12 | 157B5300 | - | 157B5310 | 157B5312 | 157B5380 | 157B5390 |
| Closed center | P = G1/2, T = G3/4, | 157B5001 | - | 157B5011 | 157B5013 | - | - |
| | P = 7/8 -14, T = 1 1/16 -12 | 157B5201 | - | 157B5211 | 157B5213 | - | - |
| | P = G3/4, T = G3/4, | 157B5101 | 157B5103 | 157B5111 | 157B5113 | 157B5181 | 157B5191 |
| | P = 1 1/16 -12, T = 1 1/16 -12 | 157B5301 | - | 157B5311 | 157B5313 | 157B5381 | 157B5391 |
| Weight | kg [lb] | 3 [6.6] | | | | | |




## PVPX, electrical LS pressure relief valves

| Description/ Supply voltage | | Code No. Hirsch. | Code No. AMP | Weight kg [lb] |
|---|---|---|---|---|
| Normally open | 12 V | 157B4236 | 157B4981 | 0.3 [0.7] |
| | 24 V | 157B4238 | 157B4982 | |
| Normally closed | 12 V | 157B4246 | 157B4983 | |
| | 24 V | 157B4248 | 157B4984 | |
| Normally open with manual override | 12 V | 157B4256 | 157B4985 | |
| | 24 V | 157B4258 | 157B4986 | |
| Plug | | 157B5601 | | 0.06 [.13] |

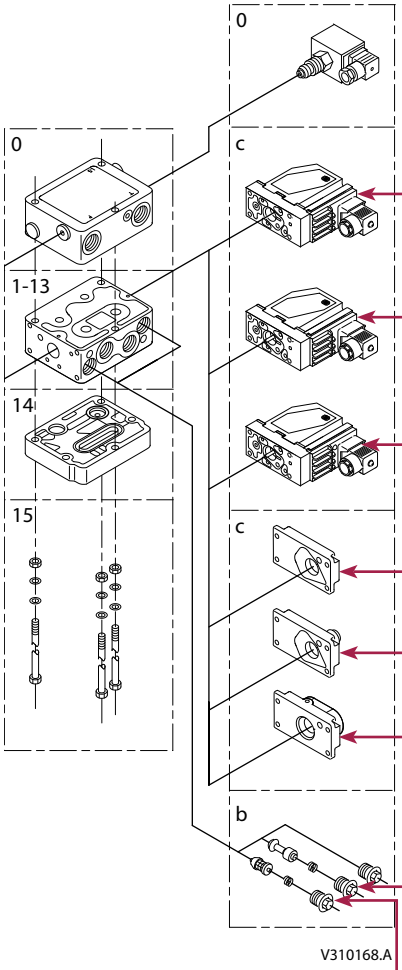
## PVS and PVSI, End plate

| Description | BSP | SAE | Weight kg [lb] |
|---|---|---|---|
| PVS, without connections | 157B2000 | 157B2020 | 0.5 [1.1] |
| PVS, with LX connection G 1/8 [3/8 -24 UNF] | 157B2011 | 157B2021 | |
| PVSI, without connections | 157B2014 | 157B2004 | 1.7 [3.6] |
| PVSI, with LX connections G 1/4 [1/2 -20 UNF] | 157B2015 | 157B2005 | |

## PVLP, shock/ and anti-cavitation valves

| Code no. | | 157B2032 | 157B2050 | 157B2063 | 157B2080 | 157B2100 | 157B2125 | 157B2140 | 157B2150 | 157B2160 | 157B2175 | 157B2190 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Settings | bar | 32 | 50 | 63 | 80 | 100 | 125 | 140 | 150 | 160 | 175 | 190 |
| | [psi] | 460 | 725 | 914 | 1160 | 1450 | 1813 | 2031 | 2175 | 2320 | 2538 | 2755 |
| Weight for all | | 0.05 kg [0.17 lb] | | | | | | | | | | |
| **Code no.** | | 157B2210 | 157B2230 | 157B2240 | 157B2250 | 157B2265 | 157B2280 | 157B2300 | 157B2320 | 157B2350 | 157B2380 | 157B2400 |
| Settings | bar | 210 | 230 | 240 | 250 | 265 | 280 | 300 | 320 | 350 | 380 | 400 |
| | [psi] | 3045 | 3335 | 3480 | 3625 | 3845 | 4061 | 4351 | 4641 | 5075 | 5511 | 5801 |

# Module Selection Chart




## PVE, electrical actuation

| Description | | Code No. Hirsch | Code No. AMP | Code No. Deut. | Weight kg [lb] |
|---|---|---|---|---|---|
| PVEO, on-off | 12 V | 157B4216 | 157B4901 | 157B4291 | 0.6 [1.3] |
| | 24 V | 157B4228 | 157B4902 | 157B4292 | |
| PVEO-R, on/off | 12 V | 157B4217 | 157B4903 | - | |
| | 24 V | 157B4229 | 157B4904 | - | |
| PVEM, prop. medium – Standard | 12 V | 157B4116 | - | - | 0.9 [2.0] |
| | 24 V | 157B4128 | - | - | |
| PVEM, prop. medium – Float -> B | 12 V | 157B4416 | - | - | 1.0 [2.2] |
| | 24 V | 157B4428 | - | - | |
| PVEA, active fault mon. | | - | 157B4734 | 157B4792 | 0.9 [2.0] |
| PVEA, passive fault mon. | | - | 157B4735 | - | |
| PVEA-DI, active fault mon. | | - | 157B4736 | 157B4796 | |
| PVEA-DI, passive fault mon. | | - | 157B4737 | - | |
| PVEH active fault mon. | | 157B4032 | 157B4034 | 157B4092 | 1.0 [2.2] |
| PVEH passive fault mon. | | 157B4033 | 157B4035 | 157B4093 | |
| PVEH float -> B, act. fault | | 157B4332 | - | 157B4392 | |
| PVEH float -> A, act. fault | | - | 157B4338 | - | |
| PVEH- DI active fault mon. | | - | 157B4036 | 157B4096 | |
| PVEH - DI passive fault mon. | | - | 157B4037 | - | |
| PVES, active fault mon. | | 157B4832 | 157B4834 | 157B4892 | |
| PVES, passive fault mon. | | 157B4833 | 157B4835 | - | |

## PVMD, PVMR, PVMF, PVH covers

| Description | Code No. | Material | Anodized | Weight kg [lb] |
|---|---|---|---|---|
| PVMD Cover for PVB | 157B0001 | aluminium | no | 0.1 [0.2] |
| | 157B0009 | | yes | |
| | 157B0021 | cast iron | N/A | 0.9 [2.0] |
| PVMR (Frict. Detent) | 157B0004 | aluminium | no | 0.3 [0.6] |
| | 157B0012 | | yes | |
| | 157B0024 | cast iron | N/A | |
| PVMF (Mech. float position) | 157B0005 | aluminium | no | |
| Hydraulic actuation PVH 9/16-18 UNF | 157B0007 | aluminium | no | 0.2 [0.4] |
| | 157B0010 | | yes | |
| | 157B0014 | cast iron | N/A | |
| Hydraulic actuation PVH G1/4 | 157B0008 | aluminium | no | |
| | 157B0011 | | yes | |
| | 157B0016 | cast iron | N/A | 0.9 [2.0] |

## PVLA, anti-cavitation valve

| Description | Code No. | Weight kg | Weight [lb] |
|---|---|---|---|
| Plug A or B | 157B2002 | 0.04 | 0.09 |
| Valve A or B | 157B2001 | 0.05 | 0.1 |

## Order Specification

An order form for Sauer-Danfoss PVG 32 hydraulic valve is shown on the next page. The form can be obtained from the Sauer-Danfoss Sales Organization.

Both the module selection chart on the previous pages and the order form are divided into fields 0, 1-1-12, 13, 14, 15, a, b, and c.

Each module has its own field:

0:
- Pump side module PVP
- Plug for external pilot oil supply PVPC
- Electrical LS unloading valve PVPX

1-12: Basic valves PVB

13: Main spool PVBS

a: Mechanical actuator PVM (or PVE when option mounted)

c:
- Cover for mechanical actuation PVMD
- Cover for hydraulic actuation PVH
- Electrical actuators PVE (or PVM when option mounted)

b:
- Shock and suction valve PVLP
- Suction valve PVLA

14: End plate PVS

15: Assembly kit PVAS

*Please state*
- Code numbers of all modules required
- Required setting (P) for pump side module
- Required setting of $LS_{A/B}$ pressure limiting valves, see pressure setting guidance below.

### Standard and option assembly

The PVG 32 valve group is assembled the way the module selection chart shows if the code number for PVM is written in field 'a', and the code number for PVMD, PVE or PVH in field 'c'.

The valve group is assembled so that the mechanical actuator is mounted on the opposite end of the basic module, if the code number for PVM is written in field 'c' of the order form and the code numbers for PVMD, PVE or PVH in field 'a'.

### Reordering

The space at the top right-hand corner of the form is for Sauer-Danfoss to fill in. The code number for the whole of the specified valve group (PVG No.) is entered here. In the event of a repeat order all you have to do is enter the number Sauer-Danfoss has given on the initial confirmation of order.

## Order Specification (continued)

### Pressure setting limits

The maximum setting pressure for the pressure limiting valves $LS_A$ or $LS_B$ depends on the chosen pressure setting for shock valve PVLP. The maximum values recommended to avoid interaction can be read in the following table.

The figures in the table have been calculated according to the following expressions:

- PVLP ≤150 bar: $LS_{A/B} \leq 0.8 \times P_{PVLP}$
- PVLP >150 bar: $P_{PVLP} - LS_{A/B} \geq 30$ bar.

*Max. pressure setting of $LS_A$ and $LS_B$ valves relative to PVLP shock valve*

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Setting pressure for PVLP** | bar | 32 | 50 | 63 | 80 | 100 | 125 | 140 | 150 | 160 | 175 | 190 | 210 | 230 | 240 | 250 | 265 | 280 | 300 | 320 | 350 | 380 | 400 |
| | [psi] | 460 | 725 | 914 | 1160 | 1450 | 1813 | 2031 | 2175 | 2320 | 2838 | 2755 | 3045 | 3335 | 3480 | 3625 | 3843 | 4061 | 4351 | 4641 | 5075 | 5511 | 5801 |
| **Max. setting pressure for $LS_{A/B}$** | bar | - | 40 | 50 | 64 | 80 | 100 | 112 | 120 | 130 | 145 | 160 | 180 | 200 | 210 | 220 | 235 | 250 | 270 | 290 | 320 | 350 | 370 |
| | [psi] | - | 580 | 720 | 930 | 1160 | 1450 | 1625 | 1740 | 1885 | 2100 | 2320 | 2610 | 2900 | 3045 | 3190 | 3408 | 3625 | 3915 | 4205 | 4641 | 5075 | 5366 |
| **Min. setting pressure for $LS_{A/B}$** | bar | 30 | | | | | | | | | | | | | | | | | | | | | |
| | [psi] | 435 | | | | | | | | | | | | | | | | | | | | | |

## Order Specification Forms

| | | | |
|---|---|---|---|
| Subsidiary/Dealer | | PVG No. | |
| Customer | | Customer Part No. | |
| Application | | Revision No. | |

| Section v | Function | A-Port v | | | | | B-Port v |
|---|---|---|---|---|---|---|---|
| **0** | | | 157B | | 157B | | |
| | | 157B | p = | bar | 157B | | |
| **1** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **2** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **3** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **4** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **5** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **6** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **7** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **8** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **9** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **10** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **11** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **12** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| | | 157B | | | | | 157B |
| **13** | | **a** 157B | 157B | | 157B | **16** | 157B **c** |
| | | **b** 157B | $LS_A$ | bar | $LS_B$ | bar | 157B **b** |
| **14** | End section | | 157B | | | | |
| **15** | PVAS section | | 157B | | | | |
| | "Reserved for Painting" | | 157B | | | | |
| | Comments: | | | | | | |
| | Filled in by: | | | | | | Date: |

Separate specification pads are available under the literature no. **520L0515**.

# Notes

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