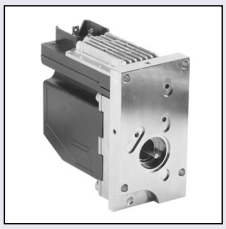
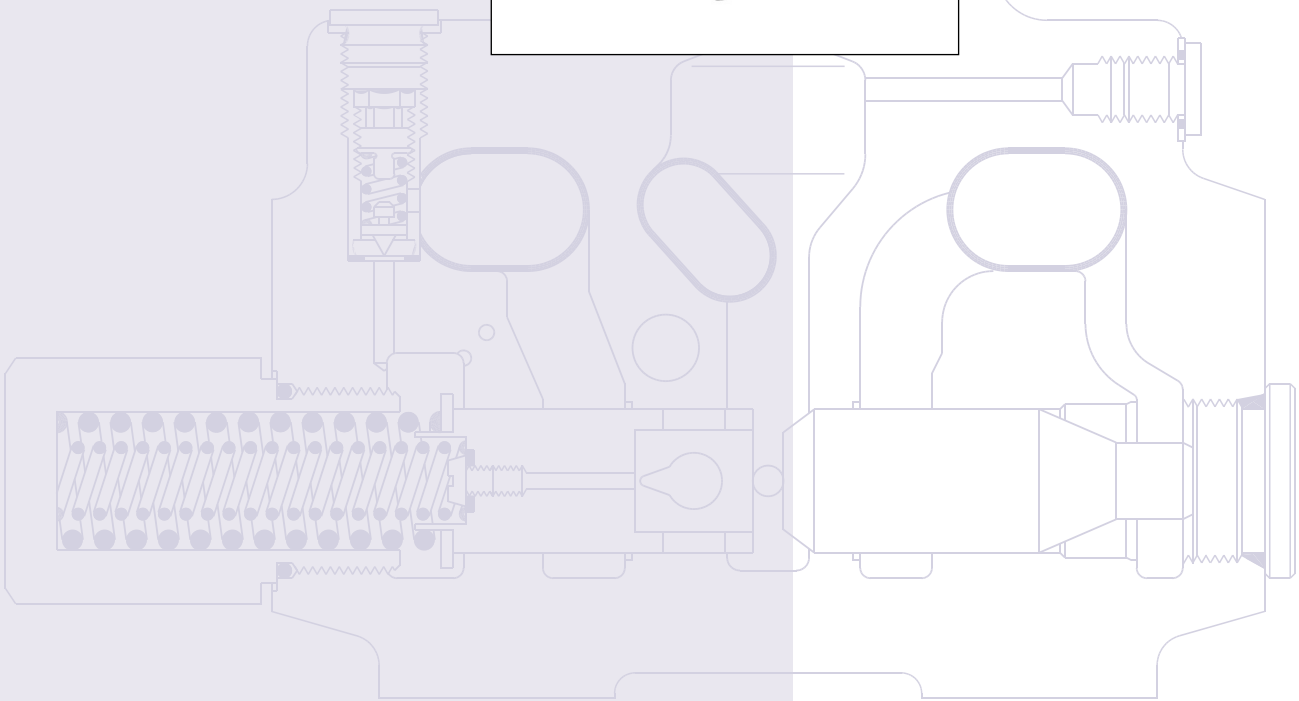
SAUER DANFOSS

PVG 120
Proportional Valves

Technical Information





PVG 120 Proportional Valve
Technical Information
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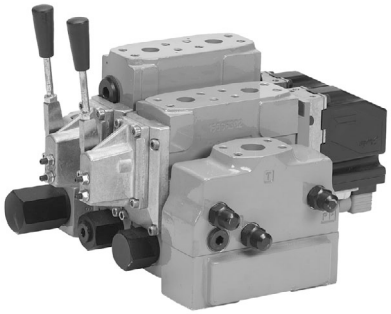
GENERAL

Valve system
Load sensing proportional valve type PVG 120 is a combined directional and flow control valve which is supplied as a valve group consisting of modules specified to match particular customer needs. The flexible nature of this valve will allow an existing valve bank to be easily adapted to suit changes in requirements.



P300011.TIF

General characteristics
- Load-independent flow control:
  - Oil flow to an individual function is independent of the load of this function
  - Oil flow to one function is independent of the load pressure of other functions
- Good regulation characteristics
- Central pilot supply built in when the valves are actuated electrohydraulically
- Energy-saving
- Up to eight basic modules per valve group

Pump side module – PVP
- Built-in pressure relief valve
- System pressure up to 400 bar [5800 psi]
- Pressure gauge connection
- Versions:
  - Open centre version for systems with fixed displacement pumps
  - Open centre version prepared for an extra relief module
  - Closed centre version for systems with variable displacement pumps
  - Closed centre version without system pressure relief valve for variable displace ment pumps with built-in pressure relief valve.

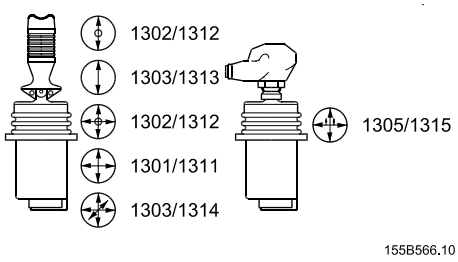
Basic module – PVB
- Integrated pressure compensator in channel P
- Interchangeable spools
- Depending on requirements the basic module can be supplied with:
  - Shock/suction valves
  - Adjustable LS pressure limiting valve for ports A and B
  - LS connection
  - Module for oil flows exceeding 180 l/min [47.6 gpm]
  - Different spool variants

Actuation modules
The basic module is always fitted with mechanical actuation PVM, which can be combined with the following as required:
- Electrical actuation (12 V ⎓ or 24 V ⎓)
  - PVEH- proportional, high performance
  - PVEO - On/off
- Cover for hydraulic remote control, PVH
- Cover for mechanically actuated valve group, PVMD

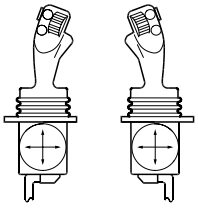
GENERAL

Remote controls units

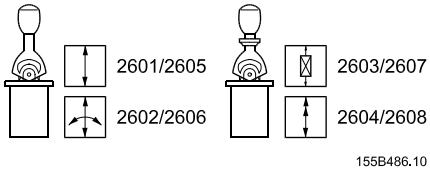
- PVRE, electrical control unit, 162F…



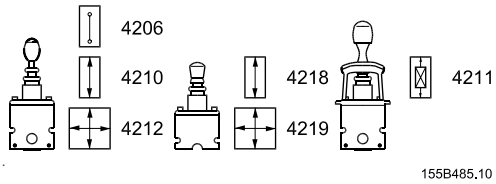
- Prof 1, 162F…



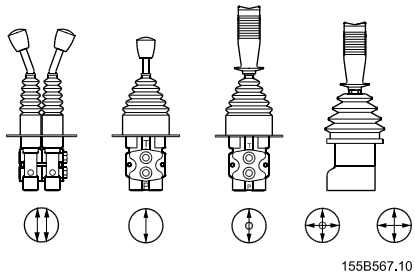
- PVREL, electrical control unit, 155U…



- PVRES, electrical control unit, 155B…



- PVRH, hydraulic control unit, 155N…



Electronic accessories

- EHF, low adjustment unit
- EHR, ramp generator
- EHS, speed control
- EHSC, closed loop speed control
- EHA, alarm logic
- EHC, closed loop position control

PVG 120 WITH OPEN CENTRE PVP

When the pump is started and the main spools (1) in the individual basic modules are in neutral position, oil flows from the pump, through connection P, across the pressure adjustment spool (2) to tank.
The oil flow led across the pressure adjustment spool determines the pump pressure (stand-by pressure). If a reduced stand-by pressure is required, an extra relief valve PVPH or PVPE can be used in PVP (see characteristics for neutral flow pressure, page 25).

When the main spools are actuated the highest load pressure is distributed across the shuttle valve circuit (3) to the spring chamber behind the pressure adjustment spool (2) and completely or partly closes the connection to tank.

The pump pressure is applied to the right-hand side of the pressure adjustment spool (2). The pressure relief valve (4) opens when the load pressure exceeds the set value, allowing pump flow to be diverted back to tank.

In the basic module the compensator (5) maintains a constant pressure drop across the main spool – both when the load changes and when a module with a higher load pressure is activated.

Shock and suction valves with a fixed setting (7) and the suction valves (8) on ports A and B are used to protect individual working functions against overload.

In the basic module it is possible to build in an adjustable LS pressure relief valve (6) to limit the pressure from each working function.
The LS pressure limiting valve saves energy:

- Without LS pressure limiting valve 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 of the valves.
- With LS pressure limiting valve an oil flow of only 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 120 WITH CLOSED CENTRE PVP

In the closed centre version an orifice (9) has been fitted instead of the plug. This means that the pressure adjustment spool (2) will only open to tank when the pressure in channel P exceeds the pressure relief valve setting (4).

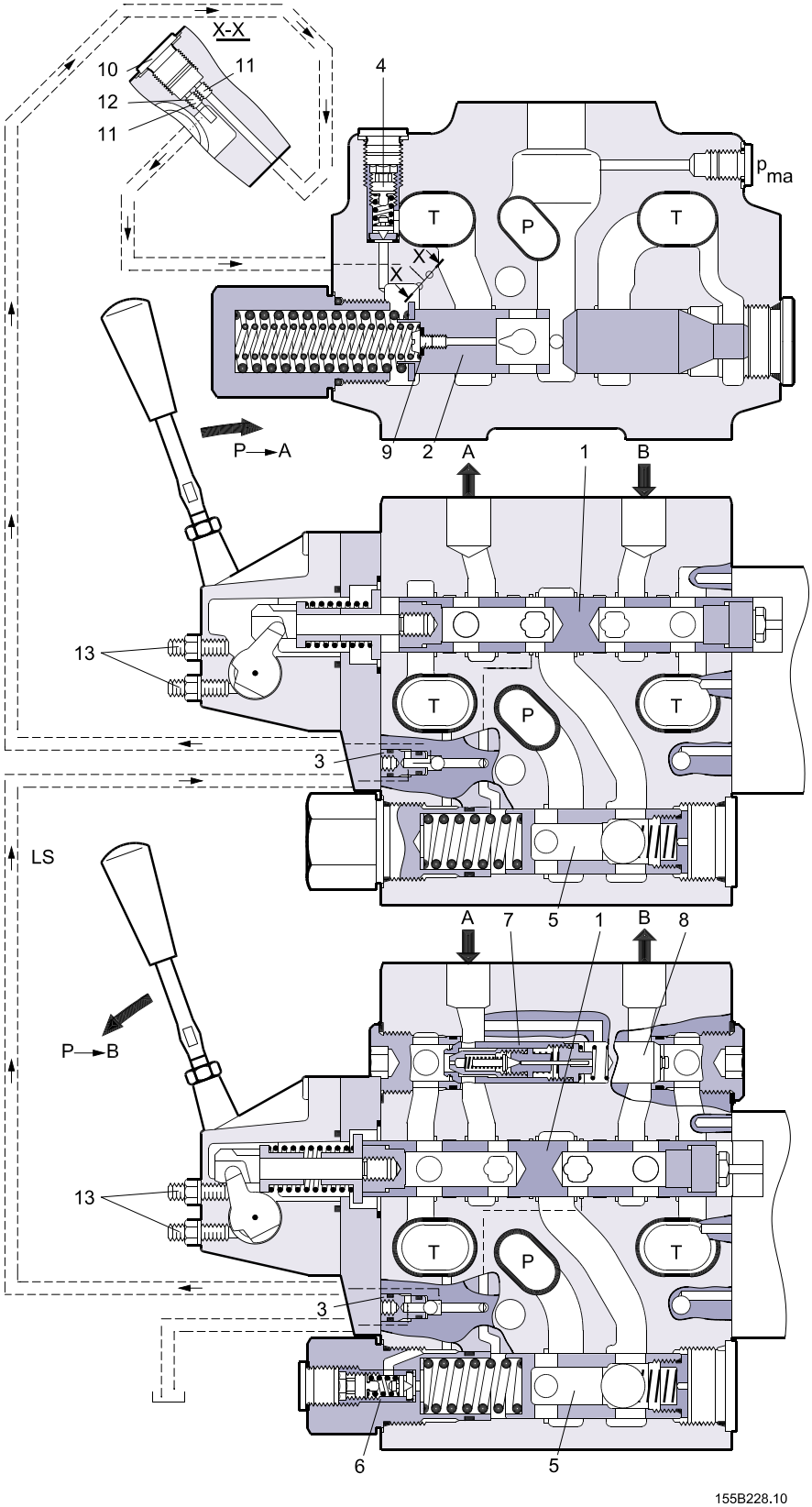
In load sensing systems the load pressure is led to the pump regulator via the LS connection (10). So the orifices (11) have been removed, and a plug (12) has been fitted instead of one of the orifices.

In neutral position the pump regulator will set the displacement so that leakage in the system is just compensated for.

When a main spool is activated, the pump regulator will adjust the displacement so that the set differential pressure between P and LS is maintained.

The pressure relief valve (4) in PVP is set for a pressure of about 30 bar [435 psi] above maximum system pressure (set at the pump or an external pressure relief valve).
If the system or the pump regulation has a pressure relief valve, it is possible to use a PVPV pump side module, without integrated pressure adjustment spool and pressure relief valve.

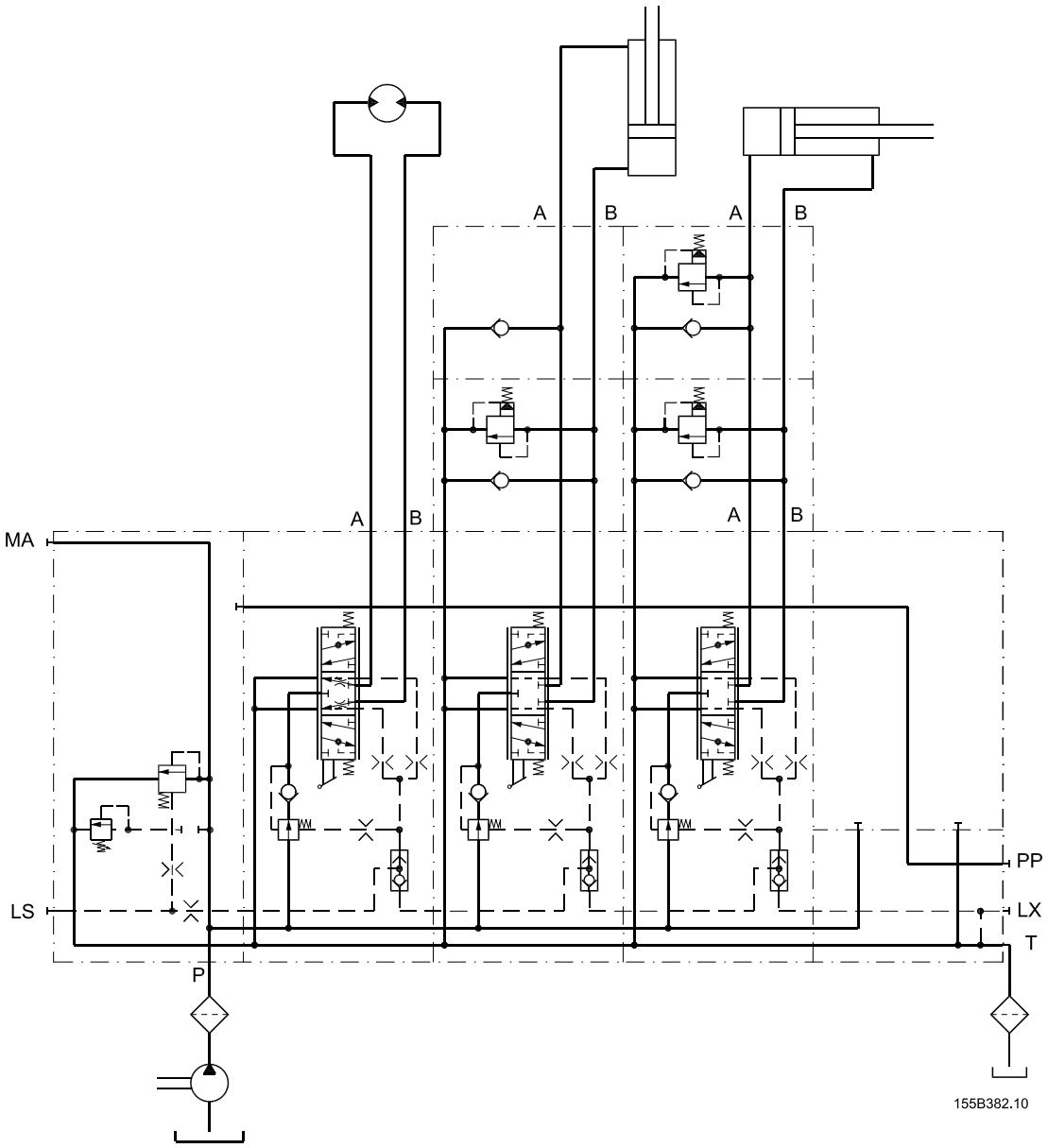
PVG 120
SECTIONAL DRAWING



1. Main spool
2. Pressure adjustment spool in PVP
3. Shuttle valve
4. Pressure relief valve in PVP
5. Pressure compensator in PVB
6. LS pressure relief valve in PVB
7. Shock and suction valve PVLP
8. Suction valve PVLA
9. Orifice, closed centre PVP
   Plug, open centre PVP
10. LS connection

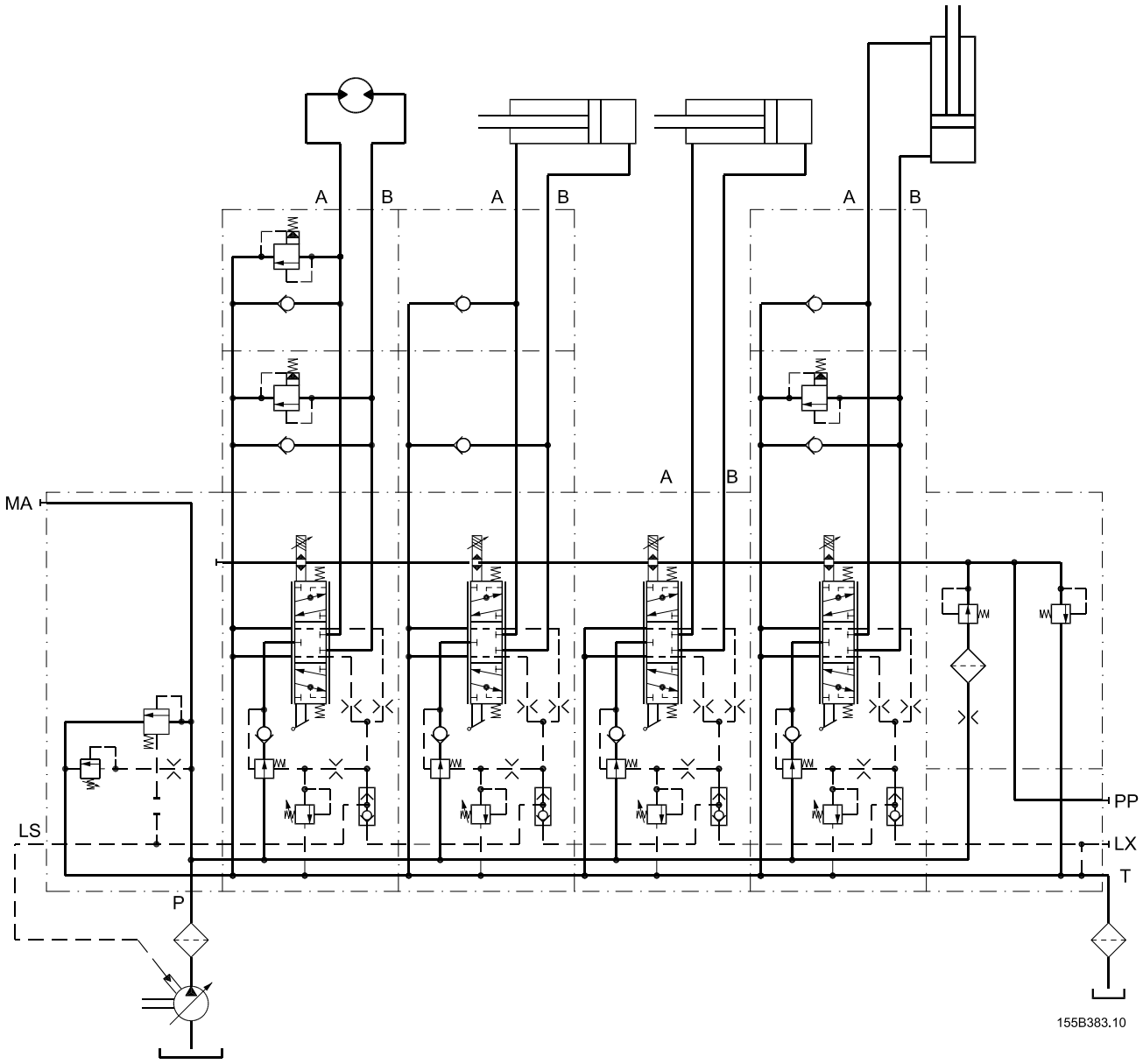
EXAMPLES

PVG 120 with fixed displacement pump



EXAMPLES

PVG 120 with variable displacement pump



Technical data

PVG 120 VALVE GROUP

	Port P	continuous	350 bar	[5075 psi]
		intermittent[1]	400 bar	[5800 psi]
Max. pressure	Port A/B		400 bar	[5800 psi]
	Port T, static/dynamic		25 bar/40 bar	[365/580 psi]
Oil flow, (see characteristics 15)	Port P, rated max.		240/300 l/min	[63.4/79.3 gpm]
	Port A/B		65/95/130/180/ 210/240 l/min [2]	[17.2/25.1/34.3/47.6/ 55.5/63.4 gpm [2]]
Spool travel			± 8 mm	[± 0.32 in]
Dead band (± 25%)			± 2 mm	[± 0.08 in]
Max. internal leakage at 100 bar, 21 mm^2/s	A/B→T, without shockvalve		90 cm^3/min	[5.5 in^3/min]
	A/B→ T, with shockvalve		95 cm^3/min	[5.6 in^3/min]
Oil temperature (inlet temperature)	Recommended temperature		30 to 60°C	[86 to 140°F]
	Min. temperature		–30°C	[–22°F]
	Max. temperature		+90°C	[+194°F]
Ambient temperature			–30 to +60°C	[–22 to +140°F]
Oil viscosity	Operating range		12 to 75 mm^2/s	[65 SUS to 347 SUS]
	Min. viscosity		4 mm^2/s	[39 SUS]
	Max. viscosity		460 mm^2/s	[2128 SUS]
Filtering (See page 38)	Max. contamination (ISO 4406)		19/16	[19/16]
Oil consumption in pressure reduction valve for PVT at PVE pilot-oil supply			0.4 l/min	[0.1 gpm]

1) Intermittent operation: the permissible values may occur for max. 10% of every minute.
2) See page 24 regarding the ordering or conversion of valve groups for oil flows exceeding 180 l/min [47.6 gpm].

MECHANICAL ACTUATION PVM

Regulation range, control lever		±19,5°	
Operating force		Neutral position	Max. spool travel
	PVM + PVMD	1.8 ± 3.0 N [4.0 ± 0.7 lbf]	2.5 ± 3.0 N [5.6 ± 0.7 lbf]
	PVM + PVE 1)	1.8 ± 3.0 N [4.0 ± 0.7 lbf]	2.5 ± 3.0 N [5.6 ± 0.7 lbf]
	PVM + PVH	2.4 ± 3.0 N [5.40 ± 0.7 lbf]	8.5 ± 3.0 N [19.1 ± 0.7 lbf]
Possible control lever positions (see page 18)	Number	2 × 5	

1) without voltage PVE

HYDRAULIC ACTUATION PVH

Control range	5 to 15 bar	[75 to 220 psi]
Max. pilot pressure, static	35 bar	[510 psi]
Max. pressure on port T 1)	3 bar	[45 psi]

1) It is recommended that the tank connection from the hydraulic remote control unit PVRH is taken direct to tank.

PVE
ELECTRICAL ACTUATION

Actuation			PVEO ON/OFF	PVEH Proportional High
Hysteresis (applies to the electrical actuation only) [1]		Typical	-	4%
Reaction time from neutral position to max. spool travel		Typical	250 ms	250 ms
		Max.	350 ms	280 ms
Reaction time from max. spool travel to neutral position[2]		Typical	240 ms	150 ms
		Max.	330 ms	200 ms
Pilot oil flow pr. PVE	Neutral position without voltage		0 l/min / [US/gal min]	
	Locked with voltage [3]		0 l/min / [US/gal min]	
Enclosure to IEC 529			IP 65	

1) The hysteresis is stated at rated and f = 0,02 Hz for a cycle. One cycle includes the movement from neutral position to max. spool travel direction A, via neutral position to max. spool travel in direction B, and back to neutral position. Further information can be obtained by contacting the Sales Organization for Sauer-Danfoss.
2) Reaction times for PVEH is reduced by 20 by 30 ms if the voltage is not interrupted during the neutral positioning (remote control lever without neutral position switch).
3) Total oil consumtion for a spool movement from N to full A or B: 0.0035 l [0.0009 US gal]

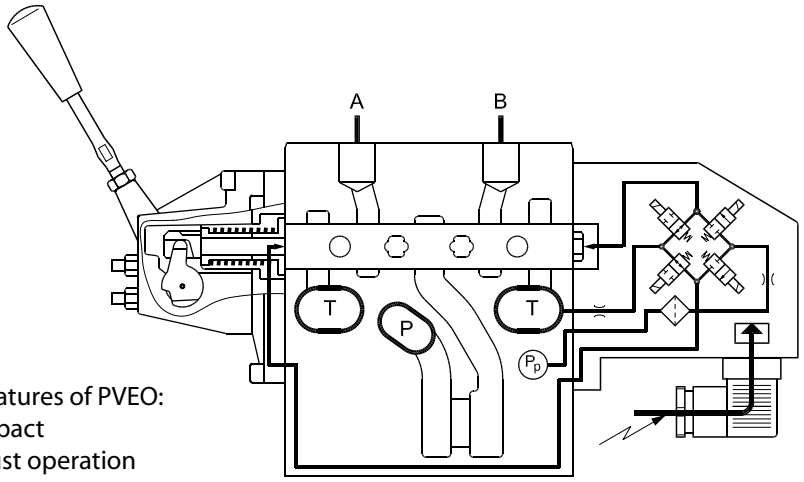
Actuation		PVEO, ON/OFF PVEH, Proportional High	
Rated voltage		12 V ⎓	24 V ⎓
Supply voltage (U_{DC})	Range	11 to 15 V	22 to 30 V
	Max. ripple (PVEH)	5%	
Current consumtion at rated voltage		0.65 A	0.33 A
Signal voltage (PVEH)	Neutral	$0.5 \times U_{DC}$	
	Regulating	$0.25 \times U_{DC}$ to $0.75 \times U_{DC}$	
Signal current at rated voltage (PVEH)		0.25 mA	0.5 mA
Input impedance at $0,5 \times U_{DC}$ (PVEH)		12 kW	
Power consumption		8 W	
Fault monitoring (PVEH aktiv)	Max. load	–100 mA	–60 mA
	Reaction time at fault	500 ms	
Fault monitoring (PVEH passiv)	Reaction time at fault	250 ms	

Technical data

PVPE, ELECTRICAL RELIEF VALVE, NORMALLY OPEN

Max. operation pressure		350 bar [5085 psi]	
Max. pressure drop a an flow of 0.20 l/min. [0.053 US gal/min]		1.2 bar [17 psi]	
Oil temperature (inlet temperature)	Recommended temperature	30 to 60°C [86 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 to +60°C [–22 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 pressure relief to tank		600 ms	
Enclosure to. IEC 529		IP 65	
Rated voltage		12 V	24 V
Max.permissible deviation from rated supply voltage		± 10 %	± 10 %
Current consumption at rated voltage	at 22°C [72°F] coil temperature	1.55 A	0.78 A
	at 85°C [230°F] coil temperature	1.00 A	0.50 A
Power consumption	at 22°C [72°F] coil temperature	19 W	19 W
	at 85°C [230°F] coil temperature	12 W	12 W

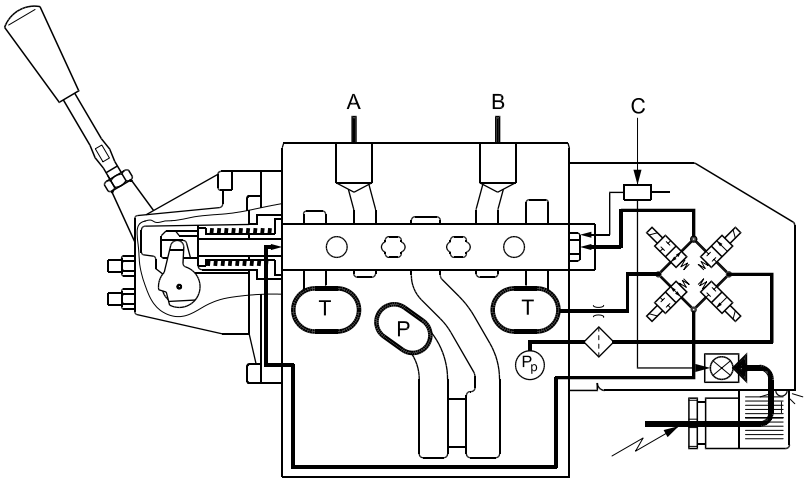
PVEO, ON-OFF



155B432.10

Main features of PVEO:
- Compact
- Robust operation

PVEH, PROPORTIONAL HIGH



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PVEH adjusts the main spool position so that it corresponds to an electrical control signal – for example from a remote control unit.

The control signal (set-point signal) is converted into a hydraulic pressure which moves the main spool. The position of the main spool is converted in the positional transducer (C) to an electric signal (feed-back signal). This signal is registered by the electronics.

The variation between the set-point signal and feed-back signal actuates the solenoid valves. Thus the hydraulic pressure moves the main spool into the correct position.

Special features of PVEH:
- Inductive transducer, see page 13
- Integrated pulse width modulation, see page 13
- Short reaction time
- Low hysteresis
- Fault monitoring, see page 13 and 14
- Transistor output for signal source, see page 13 and 14

PVEH, LVDT-TRANSDUCER

LVDT, Inductive transducer
(Linear Variable Differential Transformer).
When the main spool is moved a voltage is induced proportional to the spool position. The use of LVDT gives contact-free (proximity) registration of the main spool position. This means an extra-long working life and no limitation as regards the type of hydraulic fluid used. In addition, LVDT gives a precise position signal of high resolution.

PVEH, PULSE WIDTH MODULATION

Integrated pulse width modulation
Positioning of the main spool in PVEH is based on the pulse width modulation principle. As soon as the main spool reaches the required position, modulation stops and the spool is locked in position.

PVEH, FAULT MONITORING

The fault monitoring system
A fault monitoring system is provided in all PVEH models. The system is available in two versions:

- The active fault monitoring type, which provides a warning signal and deactivates the solenoid valves, and:
- the passive fault monitoring type, which provides a warning signal only. See figure below.

Both active and passive fault monitoring systems are triggered by 3 main events:

Input signal monitoring:
The input signal voltage is continuously monitored. The legal range is between 15% and 85% of the supply voltage. Outside the range and this section will switch into an active error state.

Transducer supervision:
If one of the wires to the LVDT sensor is broken or shorted, this section will switch into an active error state.

Supervision of the closed loop:
The actual position must always correspond to the demanded position (input signal). When the distance from neutral to the actual position is longer than the demanded distance, the system detects an error and will switch into an active error state. On the other hand, a situation where the actual position is closer to neutral than that demanded will not cause an error state. This situation is considered as "in control".
When an active error state occurs, the fault monitoring logic will be triggered:

Note:
The neutral deadband prevents the output signal from releasing the fault monitoring logic, thus stopping the function until the required pilot oil pressure has been developed.

Active fault monitoring:

- A delay of 500 ms before anything happens.
- The solenoid valve bridge will be disabled – all solenoids will be released.
- An alarm signal is sent out through the connector.
- This state is memorized and continues until the system is actively reset (by turning off the supply voltage).

PVEH, FAULT MONITORING (CONTINUED)

Passive fault monitoring:

- A delay of 250 ms before anything happens.
- An alarm signal is sent out through the connector.
- This state is not memorized. When the erroneous state disappears, the alarm signal will turn to passive again. However, the signal will always be active for a minimum of 100 ms when triggered.

To prevent the electronics from going into an undefined state, a general supervision of the power supply and the internal clock frequency is made:

High supply voltage:
The solenoid valves are disabled when the supply voltage is exceeded by 50% (18 V for a 12 V PVE and 36 V for a 24 V PVE).

Low supply voltage:
The solenoid valves are disabled when the supply voltage falls below 8 V.

Internal clock:
The solenoid valves are disabled when the internal clock frequency fails.

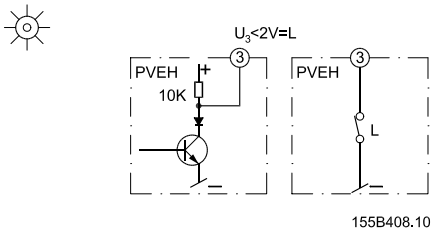
All three states are triggered automatically when the fault conditions cease.

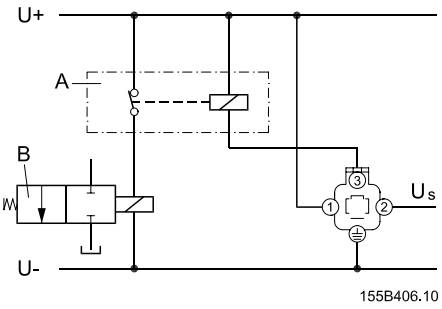
Note:
Different degrees of safety are described on pages 33 to 36.
The fault monitoring does not work if the supply voltage to PVEH is cut off - for example by a neutral position switch (see page 33).
When using PVEH with passive fault monitoring it is up to the customer to decide on the degree of safety required for the system (see page 33).

PVEH, CONNECTION TO FAULT MONITORING OUTPUT

Normal

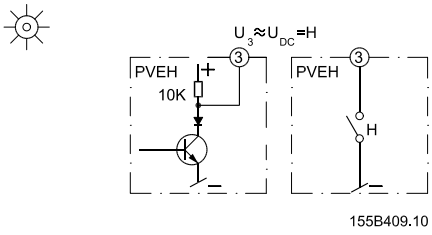
Green

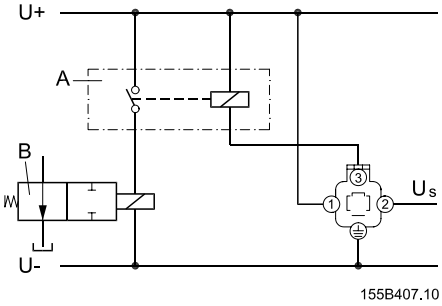




Fault

Red





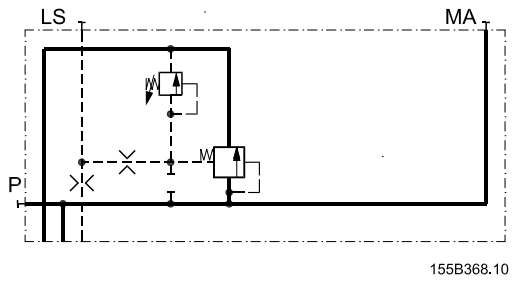
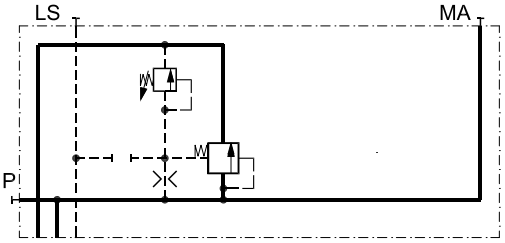
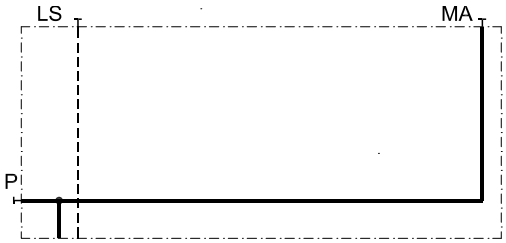
A: External relay
B: Solenoid valve (e.g. PVPE)

A: External relay
B: Solenoid valve (e.g. PVPE)

Via an external relay pin 3 can be connected to an electrically actuated valve which will relieve pump oil flow to tank, e.g. PVPE.

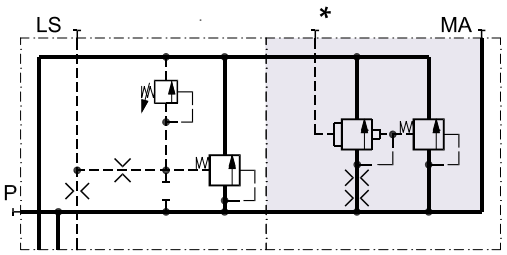
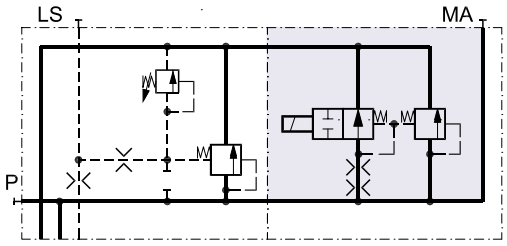
Other connections possible:
- a valve to relieve the LS signal
- a signal lamp, an alarm horn
- pump cut-out, etc.

PVP AND PVPV, PUMP SIDE MODULES

Symbol	Description		Code number
 155B368.10	Open centre PVP for pumps with fixed displacement. Pressure gauge connection.	Metric flange	155G5021
		SAE flange	155G5037
		O-ring boss	155G5023
	Open centre PVP for oil flow exceeding 180 l/min. [47.55 US gallon/min] For pumps with fixed displacement. Pressure gauge connection.	Metric flange	155G5027
		SAE flange	155G5029
		O-ring boss	155G5028
 155B371.10	Closed centre PVP for pumps with variable displacement. Pressure gauge connection.	Metric flange	155G5020
		SAE flange	155G5022
		O-ring boss	155G5038
 155B372.10	Closed centre PVPV without pressure relief valve. For pumps with variable displacement. Pressure gauge connection	Metric flange	155G5030
		SAE flange	155G5031
		O-ring boss	155G5032

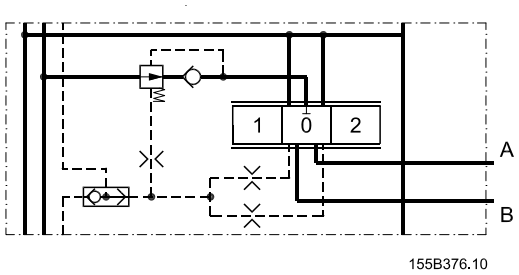
Port connections: P = 1 in SAE flange (415 bar [6020 psi]); MA = G $^{1}/_{4}$; LS = G $^{3}/_{8}$
P = 1 $^{1}/_{16}$ - 12 UN O-ring Boss 6020 psi; MA = $^{1}/_{2}$ - 20 UNF O-ring Boss; LS = $^{3}/_{4}$ - 16 UNF O-ring Boss

PVP,
ACCESSORIES FOR OPEN CENTRE PUMP SIDE MODULES

Symbol	Description		Code number
	Prop, PVPD		155G5041
 155B369.10	PVEH, hydraulically actuated relief valve		155G5061*
 155B370.10	PVPE, electrically actuated relief valve. Normally open solenoid valve	(12 V ⎓)	155G5052
		(24 V ⎓)	155G5054

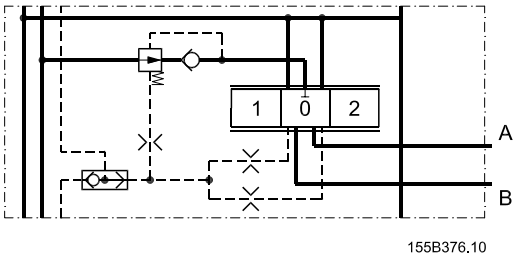
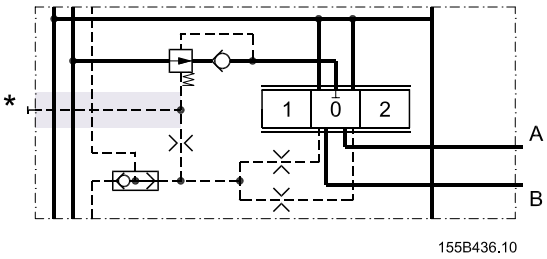
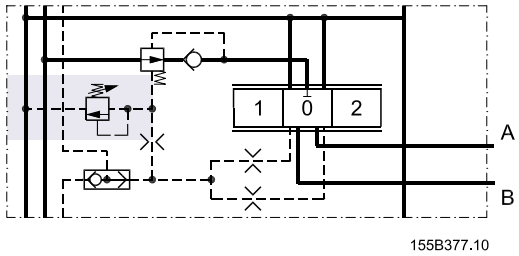
* Connection for external pilot pressure: only available with G $^{1}/_{4}$ thread

PVB, BASIC MODULES

Symbol	Description		Code number	
			No facilities for shock valves A/B (low modules)	Facilities for shock valves A/B (high modules)
	Pressure compensated basic module	Metric flange	155G6014	155G6005
		SAE flange	155B6016	155B6007
		O-ring boss	155G6015	155B6006

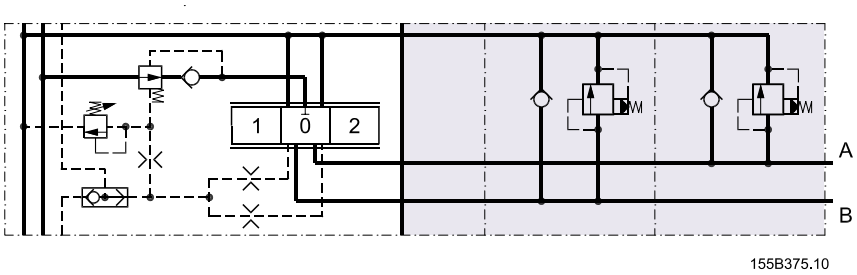
Port connections: A/B: $^{3}/_{4}$ in SAE flange 415 bar (6020 psi);
A/B: 1 $^{1}/_{16}$ - 12 UN O-ring Boss 415 bar (6020 psi)

PVB,
ACCESSORIES FOR BASIC MODULES

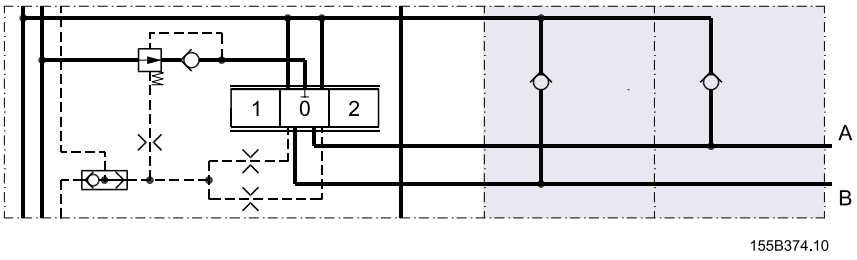
Symbol	Description	Code number
	PVBP, plug	155G6081
	PVBU, module for oil flow exceeding 180 l/min [47.6 US gallon/min]. Connection for external LS pressure relief. PVBC, connection for external LS pressure relief.	155G6035 155G6082
	PVBR, LS-pressure relief valve for ports A/B-port	155G6080

Port connections: G 1/4: only available with G 1/4 thread

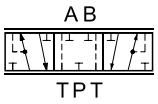
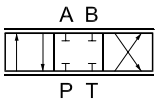
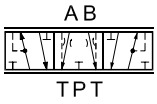
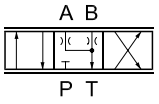
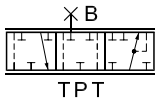
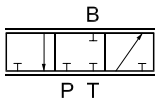
PVLP,
SHOCK AND SUCTION VALVES FOR A AND B PORT CONNECTIONS

Symbol	Fixed setting bar	Fixed setting [psi]	Code number
	50	[725]	155G0050
	75	[1100]	155G0075
	100	[1450]	155G0100
	125	[1800]	155G0125
	150	[2200]	155G0150
	175	[2550]	155G0175
	200	[2900]	55G0200
	225	[3240]	155G0225
	250	[3650]	155G0250
	275	[4000]	155G0275
	300	[4350]	155G0300
	325	[4700]	155G0325
	350	[5100]	155G0350
	375	[5450]	155G0375
	400	[5800]	155G0400

PVLA,
SUCTION VALVE

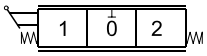
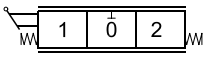
Symbol	Code number
	155G1065

PVBS, MAIN SPOOLS

Symbol	ISO Symbol	Description	Code number Size			
			A 65 l/min [17.2 US gal/min]	B 95 l/min [25.1 US gal/min]	C 130 l/min [34.3 US gal/min]	D[1] 180 l/min [47.6 US gal/min]
 155B235.10	 155B384.10	4-way, 3-position. Closed neutral position	155G6452	155G6454	155G6456	155G6458
 155B236.10	 155B385.10	4-way, 3-position. Throttled, open neutral position		155G6464	155G6466	155G6468
 155B226.10	 155B386.10	3-way, 3-position P → B			155G6476	155G6478

1) Main spool D is used for oil flow exceeding 180 l/min [47.6 US gal/min]

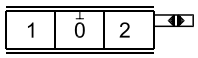
PVM, MECHANICAL ACTUATION

Symbol	Description		Code number
 155B387.10	PVM, standard, spring centered mechanical actuation. Individual oil flow adjustment to ports A and B.	22.5° 37,5°	155G3040 155G3041
 155B387.10	PVM, mechanical actuation for hydraulically operated valves. Individual oil flow adjustment to ports A and B.	22,5° 37,5°	155G3050 155G3051

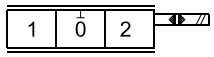
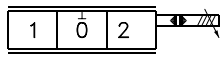
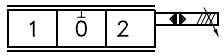
PVMD, COVER FOR MECHANICAL ACTUATION

Symbol	Description	Code number
	PVMD, cover for purely mechanically operated valve.	155G4061

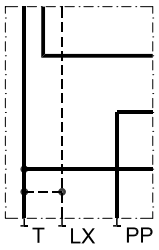
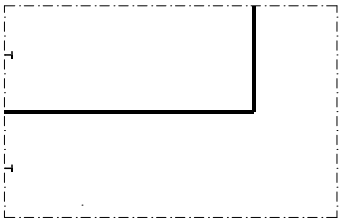
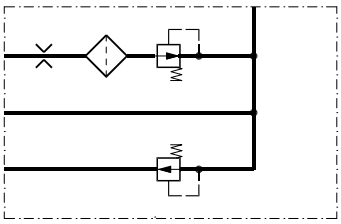
PVH, HYDRAULIC ACTUATION

Symbol	Description		Code number
 155B339.10	PVH, cover for hydraulically operated valve.	G $^1/_4$ $^1/_2$ in-20 UNF	155G4022 155G4021

PVE, ELECTRICAL ACTUATION

Symbol	Description		Code number
 155B388.10	PVEO; ON/OFF	12 V 24 V	155G4272 155G4274
 155B389.10	PVEH, proportional high. Pulse width modulation, short reaction time, low hysteresis, **active** fault monitoring, inductive transducer.	12 V 24 V	155G4072 155G4074
 155B389.10	PVEH, proportional high. Pulse width modulation, short reaction time, low hysteresis, **passive** fault monitoring, inductive transducer.	12 V 24 V	155G4172 155G4174

PVT, TANK SIDE MODUL

Symbol	Description		Code number
Upper part 	Upper part: Without active elements	Metric flange	155G7020
		SAE flange	155G7022
		O-ring boss	155G7021
	Upper part: With LX connection	Metric flange	155G7023
		SAE flange	155G7025
		O-ring boss	155G7024
Lower part 	Lower part: Without active elements	Mounting thread metric	155G7060
		Mounting thread UNF	155G7062
Lower part 	Lower part: PVE, pilot oil supply for electrical actuations. Filter mesh: 125µm	Mounting thread metric	155G7040[1)]
		Mounting thread UNF	155G7042[1)]

1) Tank module 155G7040/155G7042 can easily be rebuilt to be used for pilot oil supply to hydraulically actuated valve. Rebuilding kit 155G7041 contains the necessary springs, spring stops, and O-rings. The remote control unit P port is connected to the PP connection in the tank module.

Port connections: T = 1 in SAE flange flange 210 bar [3045 psi]; PP = G $^{3}/_{8}$ [$^{3}/_{8}$ in SAE]; LX = G $^{3}/_{8}$ [$^{3}/_{8}$ in SAE].
T = $^{15}/_{16}$ - 12 UN O-ring Boss 3045 psi; PP = $^{3}/_{4}$ - 16 UNF O-ring Boss; LX = $^{3}/_{4}$ - 16 UNF O-ring Boss

PVAS, ASSEMBLY KIT

Description	Description							
	1 PVB	2 PVB	3 PVB	4 PVB	5 PVB	6 PVB	7 PVB	8 PVB
Tie bolts and seals	155G8031	155G8032	155G8033	155G8034	155G8035	155G8036	155G8037	155G8038

MODULES FOR OIL FLOW EXCEEDING 180 L/MIN [47.6 US GAL/MIN]

Pump with fixed displacement

1. Ordering:
   Order accessory module 155G6035, main spool D, and pump side modules 155G5027/155G5028/155G5029.

2. Conversion:
   In open centre systems a max. oil flow exceeding 180 l/min [47.6 US gal/min] is achieved by changing the following parts in the pump side and basic modules:
   – Open centre pump side module
   a) Pressure adjustment spool
   b) The springs behind the pressure adjustment spool
   c) The plug behind the pressure adjustment spool
   Parts from kit 155G5035 may be used.
   – Closed centre pump side module
   A closed centre pump side module can be changed into an upgraded open centre pump side module by means of kit 155G5035.
   – Basic module
   a) Spring behind pressure compensator
   b) The plug behind the pressure compensator
   Spring and plug with code number 155G6035 (PVBU, accessory module).

Pump with variable displacement

1. Ordering:
   Order accessory module 155G6035 and main spool D.
2. Conversion:
   In closed centre systems a max. oil flow exceeding 180 l/min [47.6 US gal/min] can be achieved by changing the following basic module parts:
   a) Spring behind pressure compensator
   b) The plug behind the pressure compensator
   The code number of the spring and plug is 155G6035 (PVBU, accessory module).

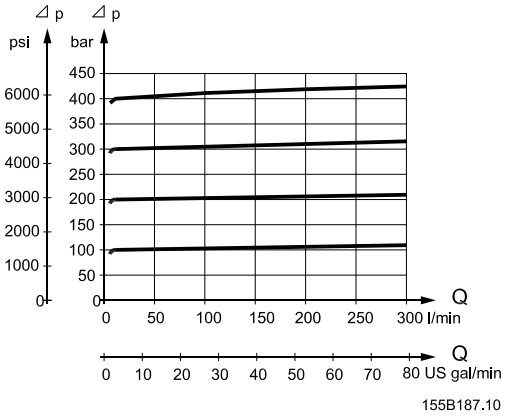
GENERAL

All characteristics and values in this Technical Information are typical measured results. For the hydraulic system a mineral based hydraulic oil with a viscosity of 21mm^2/s [102 SUS] and a temperature of 50°C [122°F] was used.

PVP, PUMP SIDE MODULE

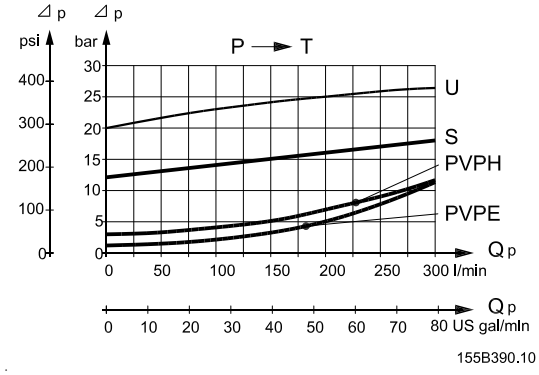
PVP, pressure relief valve characteristic

The pressure relief valve is adjustable within the 50-400 bar [725-6225 psi] range by means of a screw.



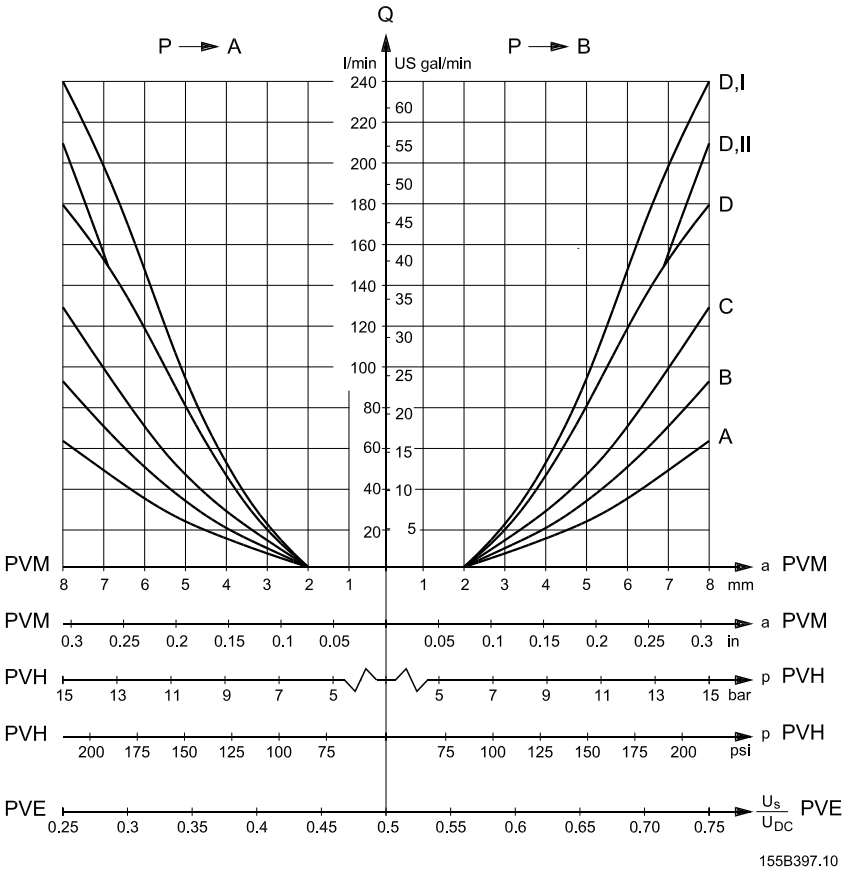
PVP, neutral flow pressure in PVP, open centre

U = PVP for PVB oil flow > 180 l/min [47.6 US gal/min]
S = PVP, standard



PVB, BASIC MODULE

Oil flow characteristics

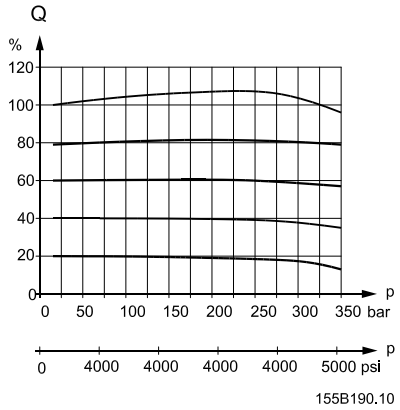


A : 65 l/min [17.2 US gal/min] rated oil flow
B : 95 l/min [25.1 US gal/min] rated oil flow
C : 130 l/min [34.3 US gal/min] rated oil flow
D : 180 l/min [47.6 US gal/min] rated oil flow
D.I : 240 l/min [63.4 US gal/min] rated oil flow
(Closed centre system with basic module for oil flow > 180 l/min [47.6 US gal/min])
D.II : 210 l/min [55.5 US gal/min] rated oil flow
(Open centre system with basic module for oil flow > 180 l/min [47.6 US gal/min] and pump side module 155G5027/155G5028/155G5029).
U_S = Signal voltage
U_{DC} = Supply voltage

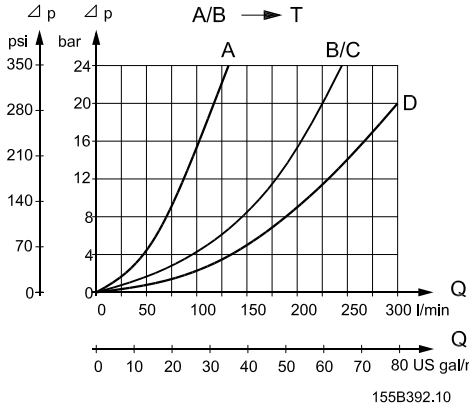
PVB, BASIC MODULE

Load independent oil flow
Pressure drop (Q) T in neutral position (spools with open neutral position) (p)

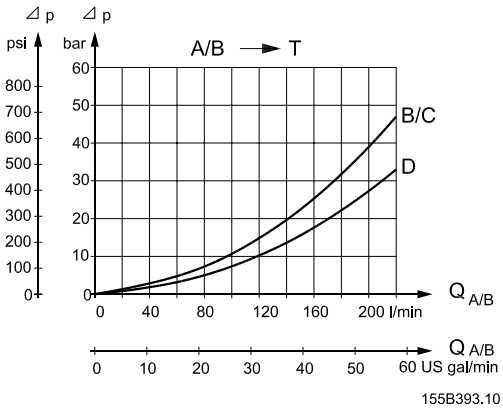
The oil flow (Q) is shown as a function of the load (p).



Pressure drop A/B → T at full spool travel

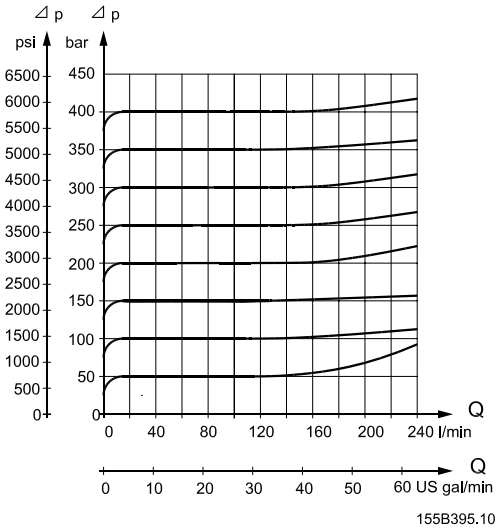


Pressure drop A/B → T in neutral position (spools with open neutral position)



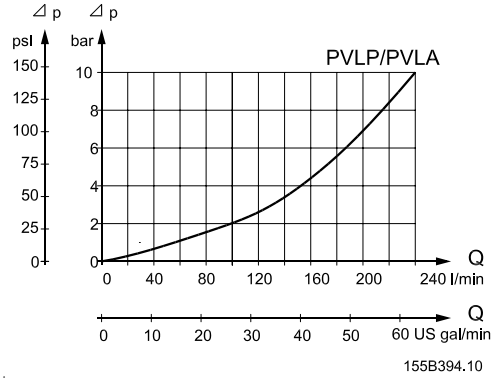
PVLP, SHOCK VALVE (PRESSURE RELIEF VALVE IN PVLP)

PVLP,
shock valve characteristics



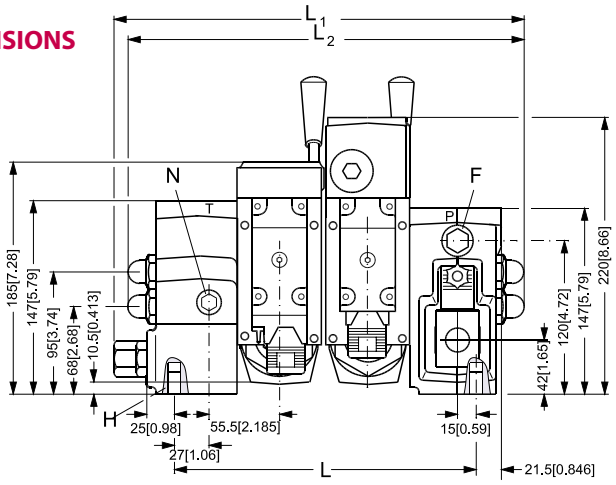
PVLP/PVLA, SUCTION FUNCTION

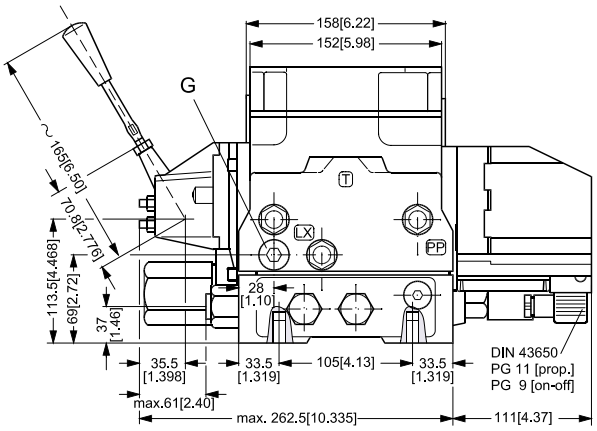
PVLP/PVLA,
suction function characteristics

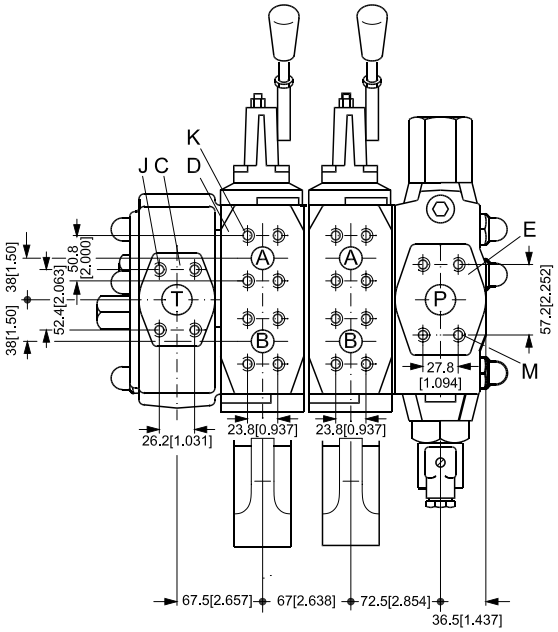


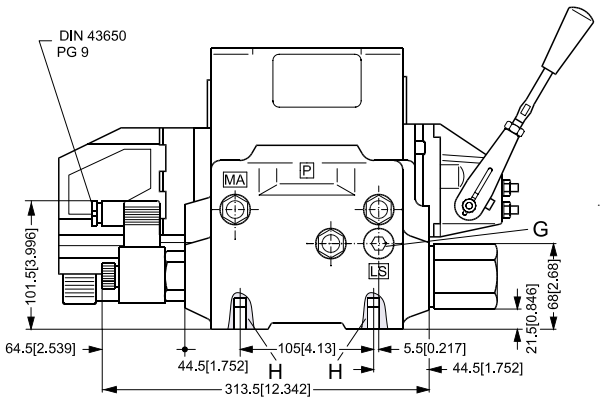
Dimensions

VALVE DIMENSIONS

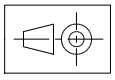








155B418.10



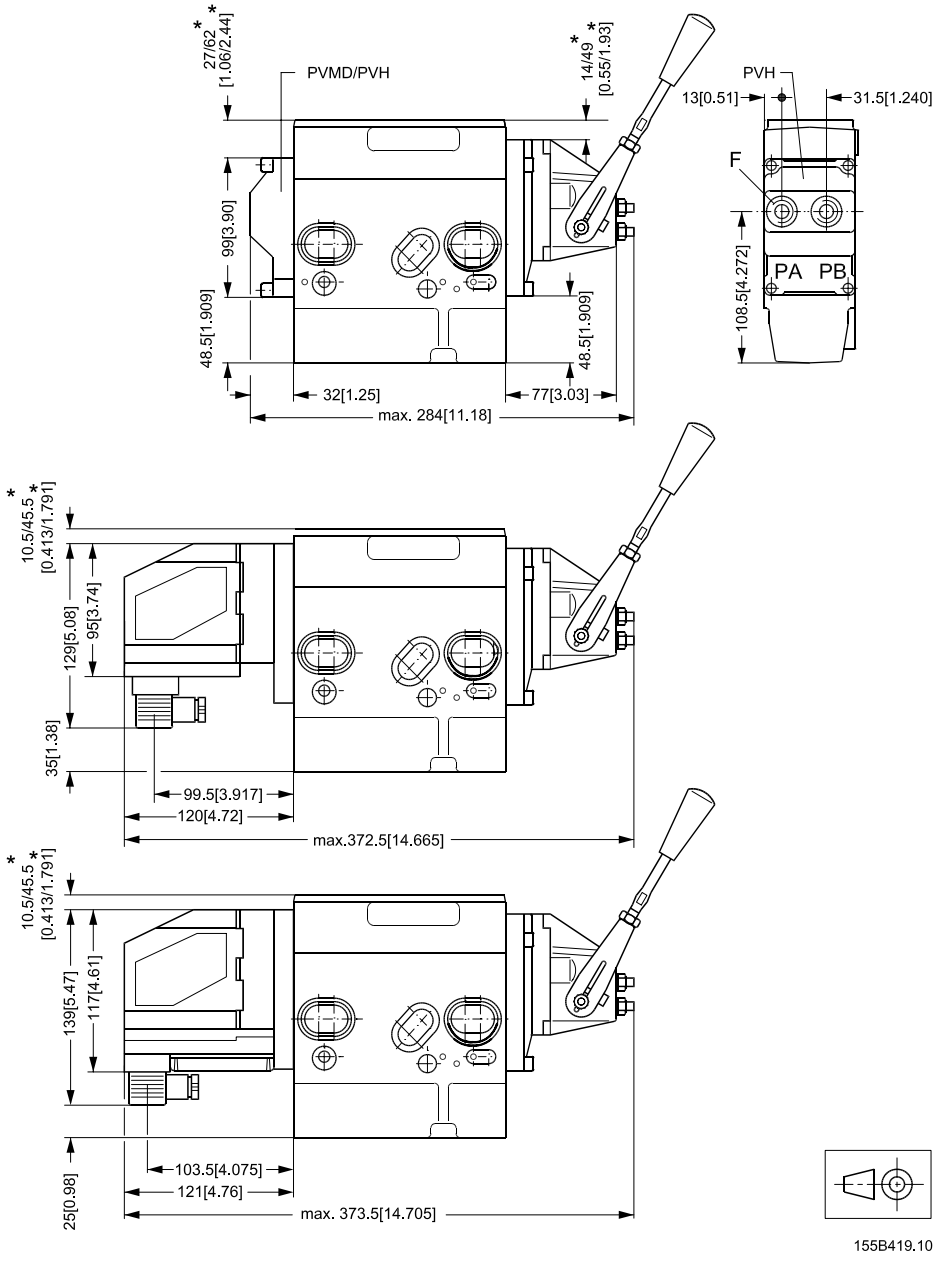
155B417.10

C : 1 in SAE flange (210 bar) – [1 in SAE flange/1 5/16 - 12 UN O-ring Boss (3045 psi)]
D : 3/4 in SAE flange (415 bar) – [3/4 in SAE flange/1 1/16 - 12 UN O-ring Boss (6020 psi)]
E : 1 in SAE flange (415 bar) – [1 in SAE flange/1 5/16 - 12 UN O-ring Boss (6020 psi)]
F : G 1/4 – [1/2 in - 20 UNF]
G : G 3/8 – [3/4 in - 16 UNF]
H : M12; 18 mm deep – [7/16 - 14 UNC; 0.7 in deep]
J : M10; 17 mm deep – [3/8 - 16 UNC; 0.7 in deep]
K : M10; 17 mm deep – [3/8 - 16 UNC; 0.7 in deep]
M : M12; 18 mm deep – [7/16 - 14 UNC; 0.7 in deep]
N : G 3/8 – [3/4 in - 16 UNF]

PVB		1	2	3	4	5	6	7	8
L	mm	168	235	302	369	436	503	570	637
	in	[6.62]	[9.26]	[11.90]	[14.54]	[17.18]	[19.82]	[22.46]	[25.10]
L1	mm	263.5	330.5	397.5	464.5	531.5	598.5	665.5	732.5
	in	[10.38]	[13.02]	[15.66]	[18.30]	[20.94]	[23.58]	[26.22]	[28.86]
L2	mm	255	322	389	456	523	590	657	724
	in	[10.05]	[12.69]	[15.33]	[17.97]	[20.61]	[23.25]	[25.89]	[28.53]

Dimensions

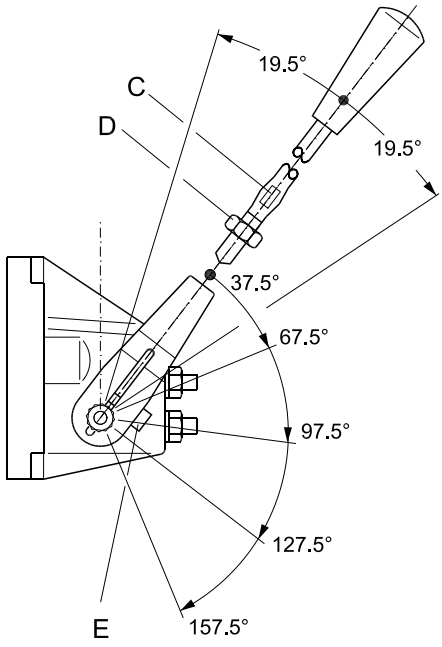
GENERAL DIMENSIONS



F : G $^{1}/_{4}$ [$^{1}/_{2}$ in - 20 UNF]
* Dimensions in parenthesis apply to high basic modules

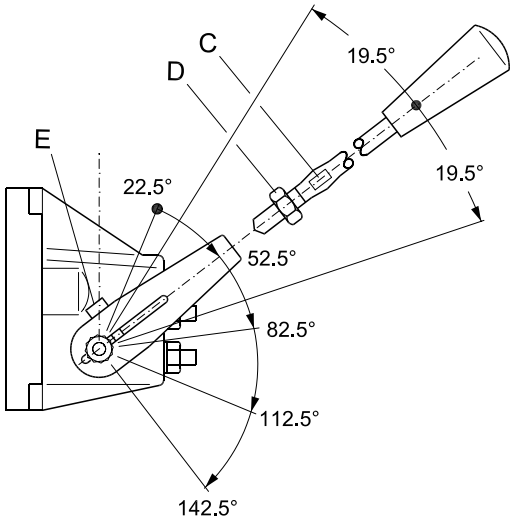
**PVM,
LEVER POSITIONS**

Base with an angle of 37.5°



155B433.10

Base with an angle of 22.5°



155B434.10

BUILDING IN SAFETY

All makes and all types of directional control valves (incl. proportional valves) can fail. So for each application the necessary protection against the consequences of function failure should be built in.

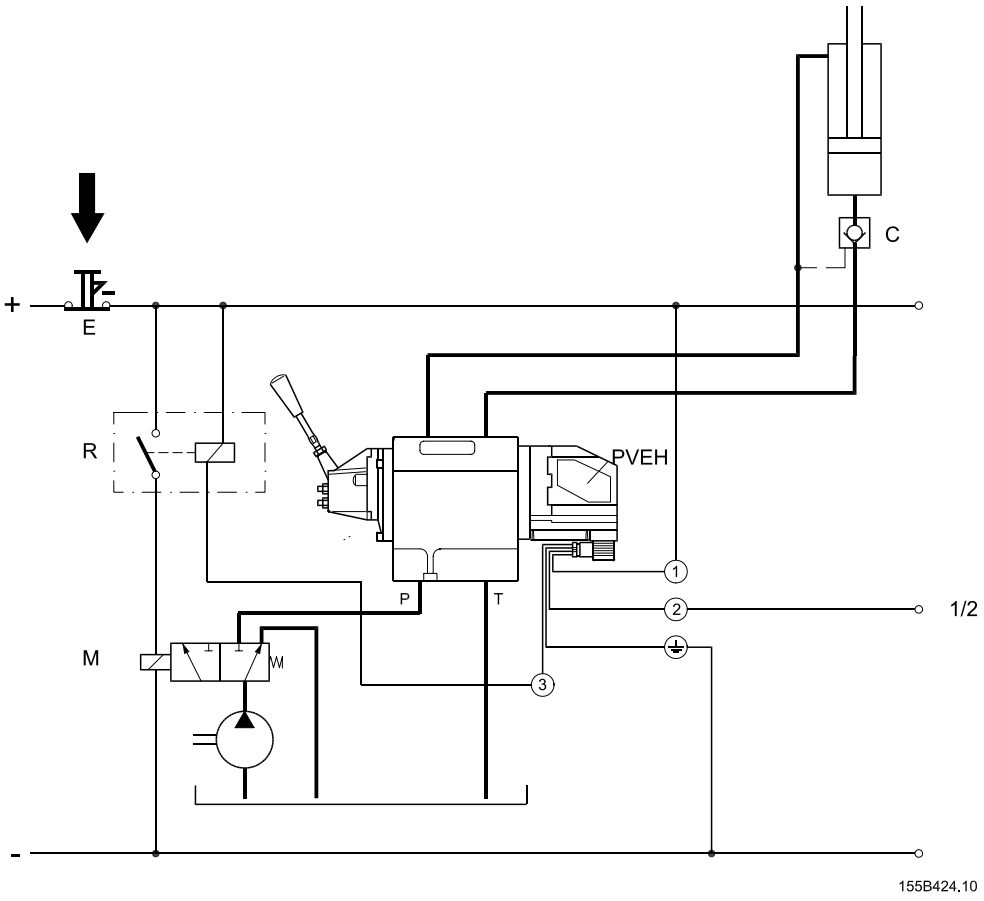
For each application an assessment should be made of the consequences of pressure failure and uncontrolled or blocked movements.

To determine the degree of protection that ought to be built into the system, Sauer-Danfoss makes the following distinctions:

1. Maximum safety demands
2. High safety demands
3. Average safety demands
4. Limited safety demands

See examples on pages 33, 34 , 35 and 36.

1. MAXIMUM SAFETY DEMANDS

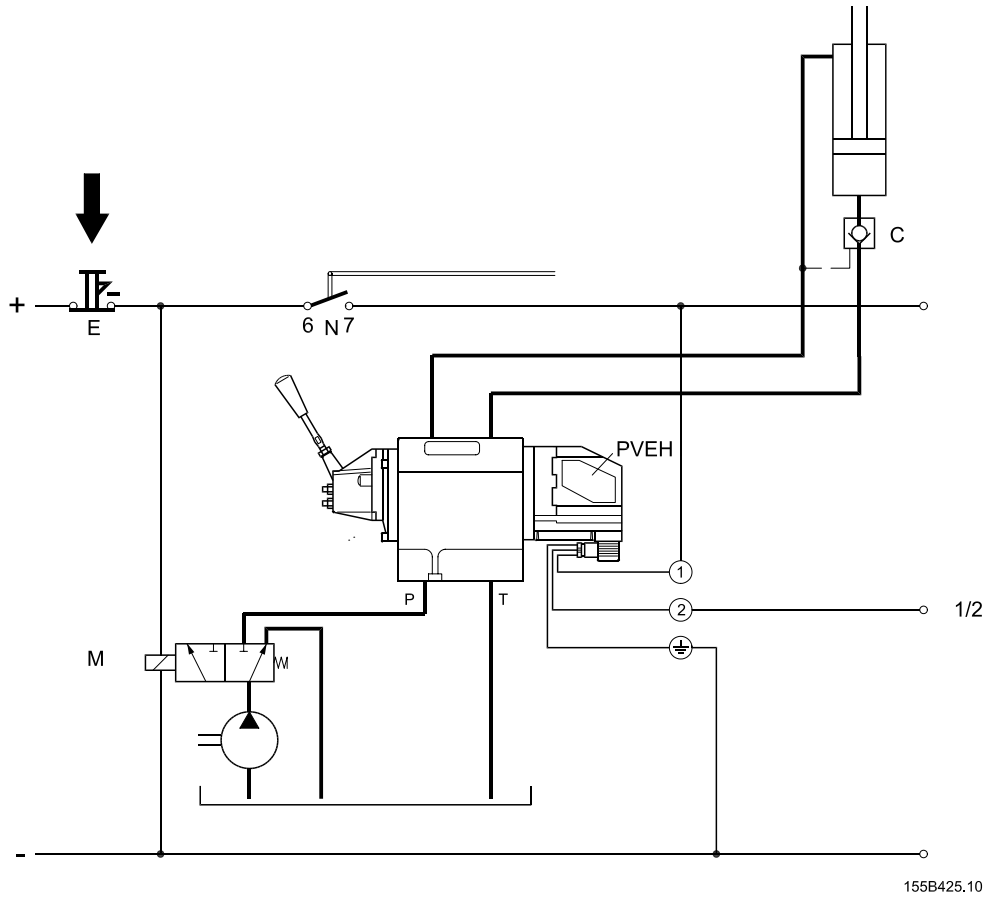


When the fault monitoring system in PVEH is connected, the reaction to electrical and mechanical faults (e.g. a spool seizure) is fast and operator-independent. See page 13 "fault monitoring".
A system can be protected against many electrical, hydraulic and mechanical faults by building in components as shown in the diagram:
R: Alarm logic EHA (or relay) connected to the fault monitoring system in PVEH
E: Electrical emergency stop
M: Solenoid valve
C: Pilot-operated check valve

The alarm logic EHA (or relay) cuts off current to the solenoid valve (M) when PVEH monitoring registers a fault.
The solenoid valve then leads the oil flow direct from pump to tank. Thus all functions are without operating pressure, i.e. locked in position, because there is no pilot pressure on the pilot operated check valve (C).
Activation of the emergency switch (E) cuts off current to the proportional valve and the solenoid valve (M).
Activation in this case is manual, but the result is the same as just described.
Stopping or disconnecting the pump drive motor is another safety measure, if the system reaction time can be accepted.

Note:
The neutral position switch in the remote control units should not be used.
PVEH with fault monitoring must have a constant voltage supply.

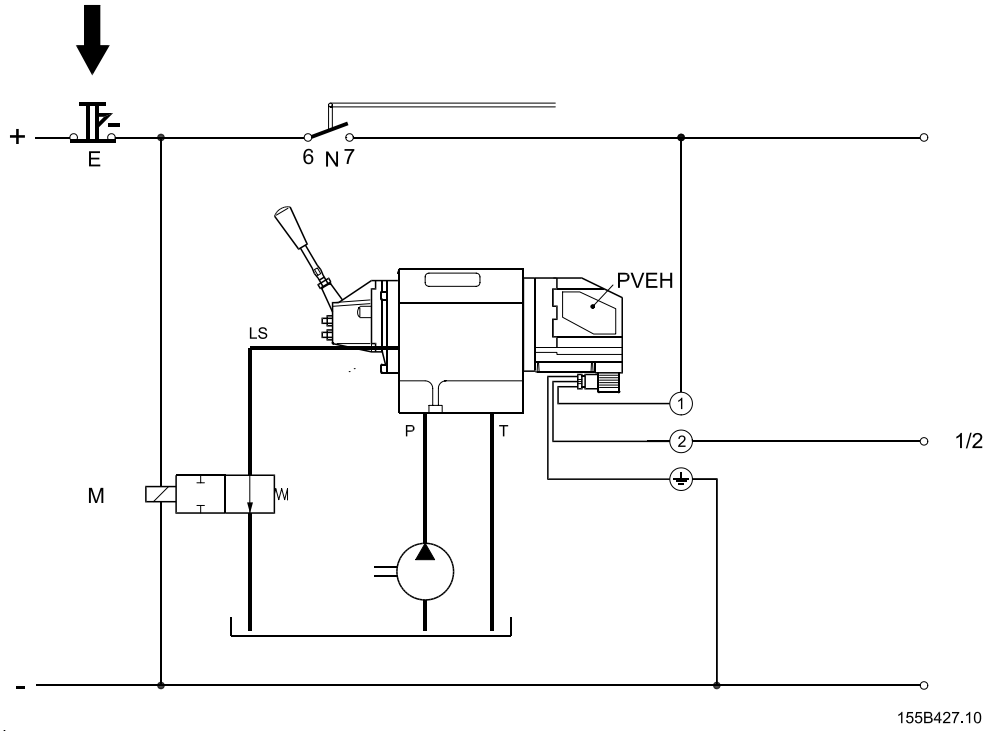
2.
HIGH SAFETY DEMANDS



Compared with the safety method previously described (1) this is operator-dependent and includes a neutral position switch (N).

The neutral position switch cuts off current to the proportional valve automatically when the remote control lever is in neutral position. At the same time the neutral position switch cuts off fault monitoring in PVEH. So PVEH does not give a fault signal when for example the neutral positioning of the main spool fails.

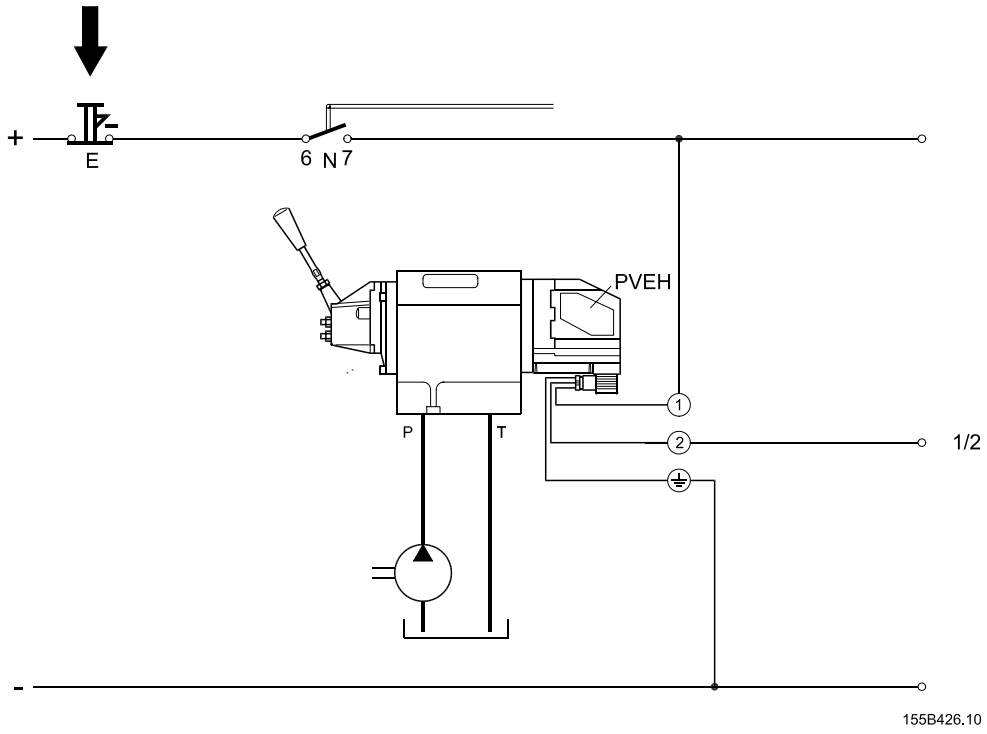
3. AVERAGE SAFETY DEMANDS



The difference in method now is that the LS signal from the proportional valve is led direct to tank when the emergency switch (E) is activated. The diagram shows the method used in a system with a fixed displacement pump, i.e. with open centre version proportional valve.

Activation of the emergency switch makes the system pressure drop to 12-18 bar [175-260 psi].
For valve groups with oil flows > 180 l/min [47.6 US gal/min]) the system pressure drop to (20-26 bar [290-380 psi]
All functions requiring a higher operating pressure will stop. In LS systems with a variable displacement pump and closed centre proportional valve, the pressure after the LS relief depends on the pump stand-by pressure.

4. LIMITED SAFETY DEMANDS



This safety system can consist of an emergency switch (E) and a neutral position switch (N) if protection against electrical failure is the only requirement. Here, there is no protection against hydraulic and mechanical faults (e.g. spool seizure in extreme position).

OIL

The main duty of the oil in a hydraulic system is to transfer energy; but 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 problem-free operation and long working life.

Mineral oil
For systems with PVG 120 valves Sauer-Danfoss recommends the use of mineral-based hydraulic oil containing additives: Type H-LP (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 Organisation if the PVG 120 valve is to be used with phosphate-esters.
The following fluids should only be used according to agreement with the Sales Organisation for Sauer-Danfoss:

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

Biodegradable oils
PVG 120 valves can be used in systems using rape-seed oil. The use of rape-seed oil is conditional on

- it complying with the demands on viscosity, temperature and filtration etc. (see chapters below and technical data page 9).
- the operating conditions being adapted to the recommendations of the oil supplier.

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

PARTICLE CONTENT, DEGREE OF CONTAMINATION

Oil filtration must prevent the particle content from exceeding an acceptable level, i.e. an acceptable degree of contamination.
Maximum contamination for PVG 120 is 19/16 (see ISO 4406).
Calibration in accordance with the ACFTD method.

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

FILTERING

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 them.

System filters
Where demands for 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 19/16 is not exceeded. See "Particle content, degree of contamination".
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 120 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 that protects the pilot supply in the tank side module has a mesh of 125 µm. It is obtainable as a spare part and is easy to replace.

The filter protecting the essential PVE parts has a mesh of 125 µm.

CONVERSION FACTORS

1 Nm	=	885.1 lbf·in
1 N	=	22.48 lbf·in
1 bar	=	14.50 psi
1 mm	=	0.0394 in
1 cm^3	=	0.061 in^3
1 l	=	0.22 gallon, UK
1 l	=	0.264 gallon, US
°F	=	1.8 × °C + 32

ORDER FORM

An order form for Sauer-Danfoss PVG 120 hydraulic valve is shown on next page.
The form can be obtained from the Sauer-Danfoss Sales Organisation.
The module selection chart on the next page and the order form are divided into fields.

Each module has its own field:

0: PVP, pump side modules
d: PVPD, PVPH and PVPE, accessory modules
1-8: PVB, basic modules
e: PVBS, main spools
f: PVBP, PVBR, PVBU and PVBC, accessory modules
a: PVM, mechanical actuation
c: PVMD, cover for mechanical operation
PVH, cover for hydraulic operation
PVEO and PVEH, electrical actuations
b: PVLP, shock and suction valve
PVLA, suction valve
9: PVT, tank side module
10: PVAS, assembly kit

Please state:

- Code numbers of all modules required
- Required setting (p) for pump side module
- Required setting of $LS_{A/B}$ pressure relief valves, if accessory module PVBR is ordered.

ORDER FORM

PVG 120
Specification Sheet

Subsidiary/Dealer		**PVG No.**	
Customer		**Customer No.**	
Application		**Revision No.**	

Function	A-Port				B-Port	
		0 155G	155G	**d**		
		p =	bar			
	a 155G	**1** 155G	155G	**e**	155G	**c**
	b 155G	**f** 155G	LS_{AB}	bar	155G	**b**
	a 155G	**2** 155G	155G	**e**	155G	**c**
	b 155G	**f** 155G	LS_{AB}	bar	155G	**b**
	a 155G	**3** 155G	155G	**e**	155G	**c**
	b 155G	**f** 155G	LS_{AB}	bar	155G	**b**
	a 155G	**4** 155G	155G	**e**	155G	**c**
	b 155G	**f** 155G	LS_{AB}	bar	155G	**b**
	a 155G	**5** 155G	155G	**e**	155G	**c**
	b 155G	**f** 155G	LS_{AB}	bar	155G	**b**
	a 155G	**6** 155G	155G	**e**	155G	**C**
	b 155G	**f** 155G	LS_{AB}	bar	155G	**B**
	a 155G	**7** 155G	155G	**e**	155G	**C**
	b 155G	**f** 155G	LS_{AB}	bar	155G	**B**
	a 155G	**8** 155G	155G	**e**	155G	**C**
	b 155G	**f** 155G	LS_{AB}	bar	155G	**B**
Remarks:		**9** 155G				
		10 155G				
		11 155G				

Filled in by	Date

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.

Note:
If PVG 120 is to be used with phosphate-esters this must be stated on the order form (see also page xx, "Non-flammable fluids").

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NOTES

Module selection chart

PVB, high basic module

	SAE flange	O-ring Boss	Metric flange	Weight kg [lb]
Facilities for shock valves AB	155G6007	155G6006	155G6005	10.2 [22.5]

PVB, low basic module

	SAE flange	O-ring Boss	Metric flange	Weight kg [lb]
No facilities for shock valves AB	155G6016	155G6015	155G6014	8.9 [19.6]

Accessory modules for PVB

		Weight kg [lb]
Plug, PVBP	155G6081	0.4 [0.9]
$LS_{A/B}$ press. relief valve, PVBR	155G6080	0.4 [0.9]
External LS connection, PVBC	155G6082	0.4 [0.9]
Module for oil flow > 180 l/min [47.6 US gal/min], PVBU	155G6035	0.4 [0.9]

PVBS, mechanical actuation

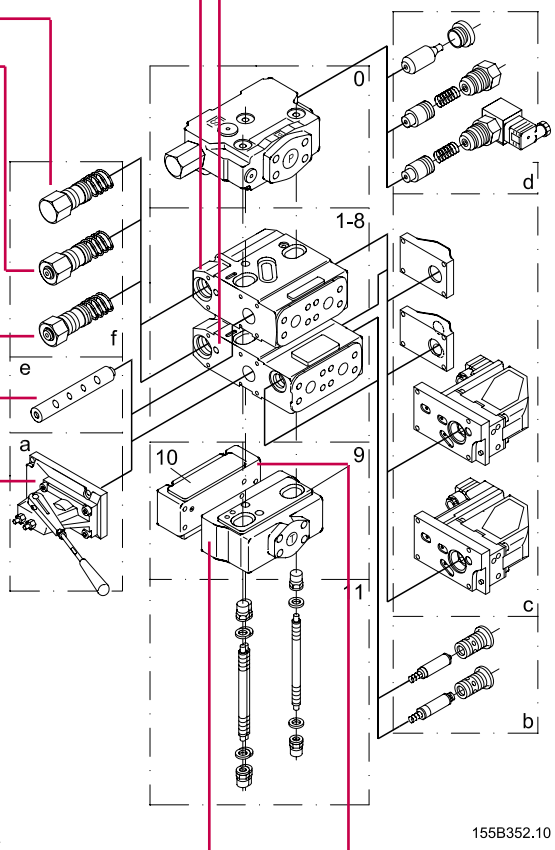
Oil flow l/min / US gal / Symbol	A 65 [17.2]	B 95 [25.1]	C 130 [34.3]	D 180 [47.6]
A B P T 155B384.10	155G6452	155G6454	155G6456	155G6458
A B P T 155B385.10		155G6464	155G6466	155G6468
B P T 155B386.10			155G6476	155G6478
Weight (kg) [lb]	0.35 [0.8]	0.35 [0.8]	0.35 [0.8]	0.35 [0.8]

PVM, mechanical actuation

PVM + PVMD or PVM + PVE	155G3040 155G3041	22.5° 37.5°
PVM + PVH	155G3050 155G3051	22.5° 37.5°
Weight kg [lb]	0.5 [1.1]	

PVT, tank side module

	SAE flange	O-ring Boss	Metric flange	Weight kg [lb]
Upper part excl. LX connection	155G7022	155G7021	155G7020	4.6 [10.1]
Upper part incl. LX connection	155G7025	155G7024	155G7023	4.6 [10.1]
Lower part incl. pilot oil supply PVE for	155G7042		155G7040	4.4 [9.7]
Lower part excl. pilot oil supply for PVE	155G7062		155G7060	4.4 [9.7]



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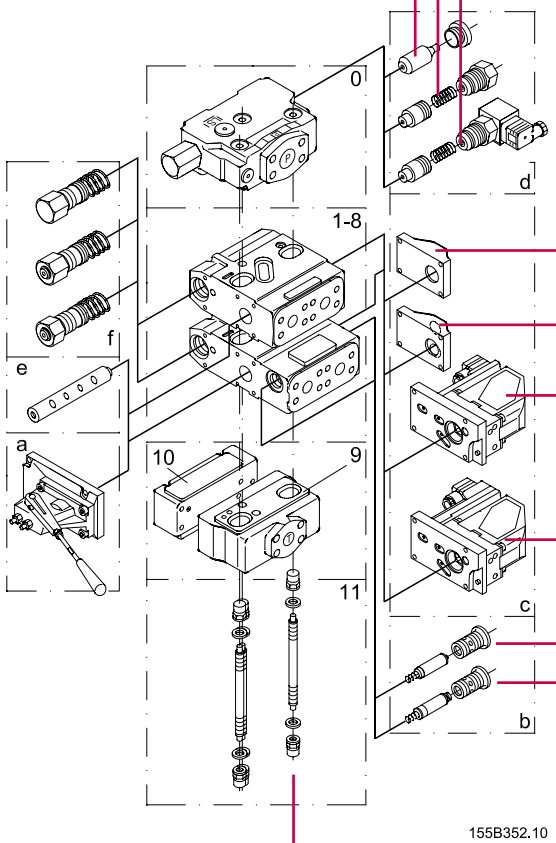
Module selection chart

PVP, pump side module

		O-ring Boss	SAE flange	Metric flange	Weight kg	[lb]
Open centre	Excl. PVPD, PVPH, PVPE	155G5023	155G5037	155G5021	10.0	[22.1]
	For PVB-oil flow > 180 l/min [47.6 US gal/min] Excl. PVPD, PVPH, PVPE	155G5028	155G5029	155G5027	10.0	[22.1]
Closed centre	Incl. pressure relief valve and plug PVPD	155G5022	155G5038	155G5020	10.2	[22.5]
	Excl. pressure relief valve	155G5031	155G5032	155G5030	11.0	[24.3]

Accessory modules for open centre PVP

			Weight kg	[lb]
Plug, PVPD		155G5041	0.4	[0.9]
Hydraulic relief valve, PVEH		155G5061	0.5	[1.1]
Electrical relief valve, PVPE	12 V	155G5052	0.7	[1.5]
	24 V	155G5054	0.7	[1.5]



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PVMD, cover for PVM

		155G4061
Weight	(kg)	0.3
	[lb]	[0.7]

PVH, cover for PVRH

	Weight kg	[lb]
155G4021	0.4	[0.9]
155G4022	0.4	[0.9]

Electrical actuation PVE

	PVEH	PVEH	PVEO
	Fault monitoring		
	Active	Passive	
12 V	155G4072	155G4172	155G4272
24 V	155G4074	155G4174	155G4274
Weight (kg)	1.25	1.25	1.0
[lb]	[2.76]	[2.76]	[2.2]

PVLP, shock and suction valve A/B

Pressure setting (bar)	[psi]	
50	725	155G0050
75	1100	155G0075
100	1450	155G0100
125	1800	155G0125
150	2200	155G0150
175	2550	155G0175
200	2900	155G0200
225	3250	155G0225
250	3650	155G0250
275	4000	155G0275
300	4350	155G0300
325	4700	155G0325
350	5100	155G0350
375	5400	155G0375
400	5800	155G0400
Weight (kg)		0.175
[lb]		[0.386]

PVLA suction valve A/B

		155G1065
Weight	(kg)	0.2
	[lb]	[0.4]

PVAS, assembly kit

PVB's	1	2	3	4	5	6	7	8
	155G8031	155G8032	155G8033	155G8034	155G8035	155G8036	155G8037	155G8038
Weight (kg)	0.8	1.0	1.1	1.2	1.4	1.7	1.9	2.1
[lb]	[1.8]	[2.2]	[2.4]	[2.6]	[3.1]	[3.7]	[4.2]	[4.6]

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