

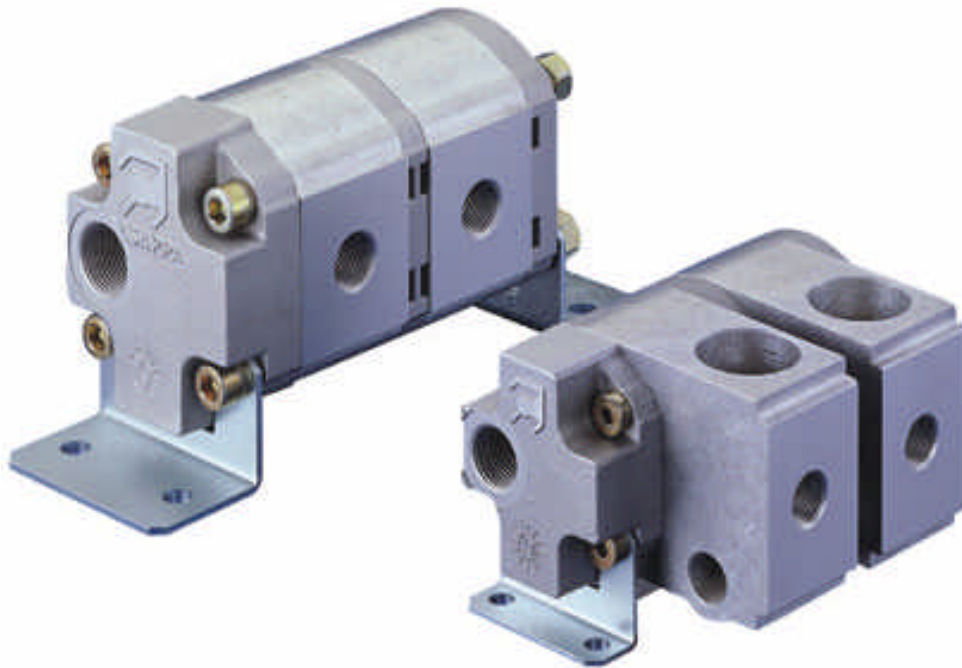


## Gear flow dividers

Replaces: PLD 01 T E - 01/02.2000

### DISPLACEMENTS

From 2 cm<sup>3</sup>/rev  
To 32,6 cm<sup>3</sup>/rev



- Modular design
- Accurate division of flow
- Compact overall dimension
- Built-in relief valve

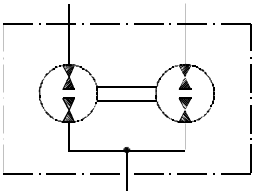
### PRESSURE

Max. continuous 250 bar  
Max. peak 280 bar

Edition: 02/11.2000

**GENERAL FEATURES**

Modern machinery with increasingly complex circuits often needs combinations of separate and independent movements. POLARIS 10 and POLARIS 20 flow dividers provide technically advanced, low cost power transmission and solve application problems wherever hydraulic flow has divided. In line with our policy of simplifying the design of hydraulic circuits, our flow dividers have relief valves built in to limit pressure and prevent cavitation. These components permit hydraulic circuits to be cleverly optimised and reduce installation costs. The POLARIS flow dividers are two or more section dividers with a common internal connecting shaft. This maintains a constant ratio between the flows through each section in accordance with section displacement. Theoretical working of rotary flow dividers do not dissipate energy in fact if the outlet pressure of one section drops below input pressure, that section operates as a motor and takes energy from the fluid. This energy is not wasted but transferred by the common shaft to the other sections which operate as pumps and therefore need outlet pressure to be greater than inlet pressure. In working conditions, overall efficiencies depend on the sum of the single sections efficiency. These products can therefore be used as flow equalizers, flow dividers and pressure intensifiers as shown in the table below.

	Outlet pressure	Sections with same displacement	Sections with different displacement
	Same	Flow equalizers	Flow dividers
	Different	Flow equalizers	Flow dividers
Pressure intensifiers			

Fluid	Mineral oil based hydraulic fluids to DIN 51524. For other fluids please consult our sales department.	
Fluid temperature range	[°C]	-25 ÷ +80 with Buna N seals
		-25 ÷ +110 with Viton V seals
Fluid viscosity range	[mm <sup>2</sup> /s] [cSt]	12 ÷ 100 recommended
		Up to 750 permitted

Filtering requirement	$\Delta p > 200$ bar	$\Delta p < 200$ bar
Contamination class NAS 1638	8	10
Contamination class ISO 4406	17/14	19/16
Achieved with filter $\beta_x = 75$	10 $\mu\text{m}$	25 $\mu\text{m}$

01/02.00

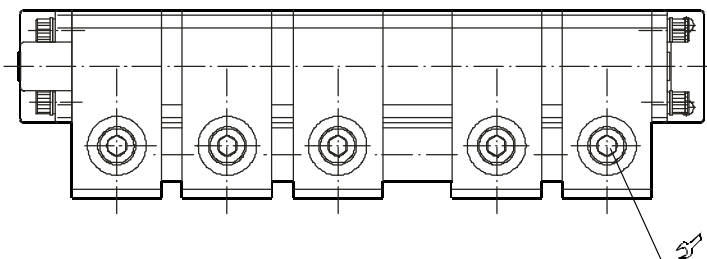
## GENERAL FEATURES OF RELIEF VALVES

Relief valves allow the actuators to realign at the end of each cycle in both flow directions. As an example when the cylinders extend, they may not all reach their end stops exactly at the same time. In this case as soon as one cylinder reaches its stop, the relief valve in that section directs fluid to tank until all the other cylinders reach their stops. While retracting the relief valve acts as check valve and opens to prevent cavitation.

Relief settings valve and their identification code are listed in the table below.

Stamp code	$\Delta p$ nominal setting (10 l/min)	$\Delta p$ minimum begin opening valve
	[bar]	[bar]
34	<b>35</b>	32
4	<b>50</b>	46
22	<b>60</b>	54
23	<b>70</b>	66
6	<b>80</b>	76
7	<b>100</b>	96
17	<b>120</b>	116
8	<b>125</b>	120
9	<b>140</b>	135
26	<b>150</b>	145
10	<b>160</b>	155
11	<b>175</b>	170
35	<b>180</b>	174
12	<b>190</b>	184
33	<b>206</b>	199
14	<b>210</b>	203
15	<b>230</b>	222
16	<b>250</b>	242
27	<b>260</b>	252
20	<b>280</b>	271

Adjustable relief valves are available on request.



**TIGHTENING TORQUE**

**50 Nm**

01/02.00

D024-D62/0200

**GENERAL DATA**
**PLD 10**

Type	Displacement	Max. outlet pressure		Max. outlet $\Delta p$ between sections (1)	Speed		Flow per section	
		$p_1$	$p_2$		min.	max.	min.	max.
	cm <sup>3</sup> /rev	bar		bar	min <sup>-1</sup>		l/min	
<b>PLD 10•2</b>	2	250	280	200	1250	4200	2,65	8,9
<b>PLD 10•3,15</b>	3,1	250	280	200	1205	3990	3,99	13,2
<b>PLD 10•4</b>	4	250	280	200	1175	3840	4,98	16,2
<b>PLD 10•5</b>	4,9	250	280	200	1140	3680	6,04	19,5
<b>PLD 10•6,3</b>	6,2	250	280	200	1100	3500	7,29	23,2

 $p_1$  = Max. continuous pressure

 $p_2$  = Max. peak pressure

(1): Pressure intensifiers can work at higher pressure between sections.

For working conditions outside the recommended limits shown in the table, please consult our sales department.

<b>MAX. FLOW FOR INLET SECTION</b>
<b>35 l/min</b>

01/02.00

**GENERAL DATA**
**PLD 20**

Type	Displacement	Max. outlet pressure		Max. outlet $\Delta p$ between sections (1)	Speed		Flow per section	
		$p_1$	$p_2$		min.	max.	min.	max.
	cm <sup>3</sup> /rev	bar		bar	min <sup>-1</sup>		l/min	
<b>PLD 20•4</b>	4,8	250	280	200	1250	4100	6,16	20,2
<b>PLD 20•6,3</b>	6,5	250	280	200	1235	3970	8,12	26,1
<b>PLD 20•8</b>	8,3	250	280	200	1220	3850	10,05	31,65
<b>PLD 20•11,2</b>	11,1	250	280	200	1200	3660	13,42	40,85
<b>PLD 20•14</b>	14,4	250	280	200	1175	3460	17,03	50,02
<b>PLD 20•16</b>	16,6	200	230	200	1160	3335	19,47	55,88
<b>PLD 20•20</b>	20,8	200	230	200	1130	3125	23,83	65,7
<b>PLD 20•25</b>	26	200	230	200	1100	2900	28,9	76,21
<b>PLD 20•31,5</b>	32,6	200	230	200	1060	2660	34,84	87,39

 $p_1$  = Max. continuous pressure

 $p_2$  = Max. peak pressure

(1): Pressure intensifiers can work at higher pressure between sections.

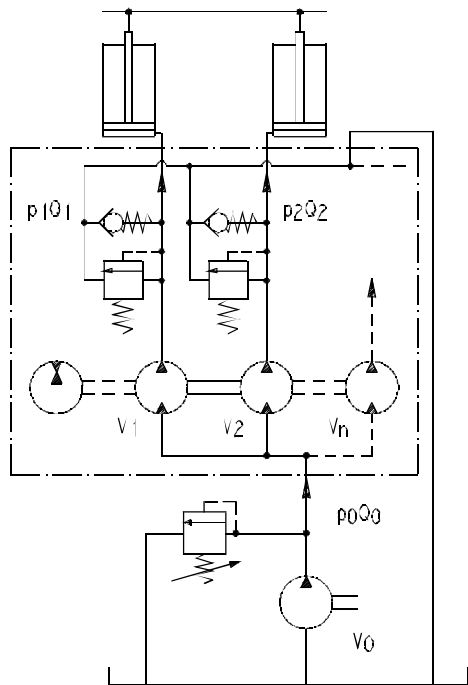
For working conditions outside the recommended limits shown in the table, please consult our sales department.

**MAX. FLOW  
FOR INLET SECTION**
**80 l/min**

01/02.00

**FLOW EQUALIZERS (WITH EQUAL DISPLACEMENTS)**

Flow accuracy equalizers is within  $\pm 2\%$  if they are rotating in the recommended speed range and the differential pressure between sections is less than 100 bar. When several single acting cylinders are operated together, acting on loads have not sufficient mass to win the circuit's resistance, we recommend a further gear section acting as a motor in order to guarantee the cylinders retract. The displacement of this motor should be roughly equal to the sum of the displacements of the other sections. Two typical circuit diagrams of applications where flow equalizers are utilized will be found on page 10.



D024-D02/1099

V = Displacement [cm<sup>3</sup>/rev]

Q = Flow [l/min]

p = Pressure [bar]

n = Speed [min<sup>-1</sup>]

$$Q_0 = Q_1 + Q_2 \dots + Q_n$$

$$p_0 Q_0 = p_1 Q_1 + p_2 Q_2 \dots + p_n Q_n$$

$$V_{(..)} = \frac{1000 Q_{(..)}}{n}$$

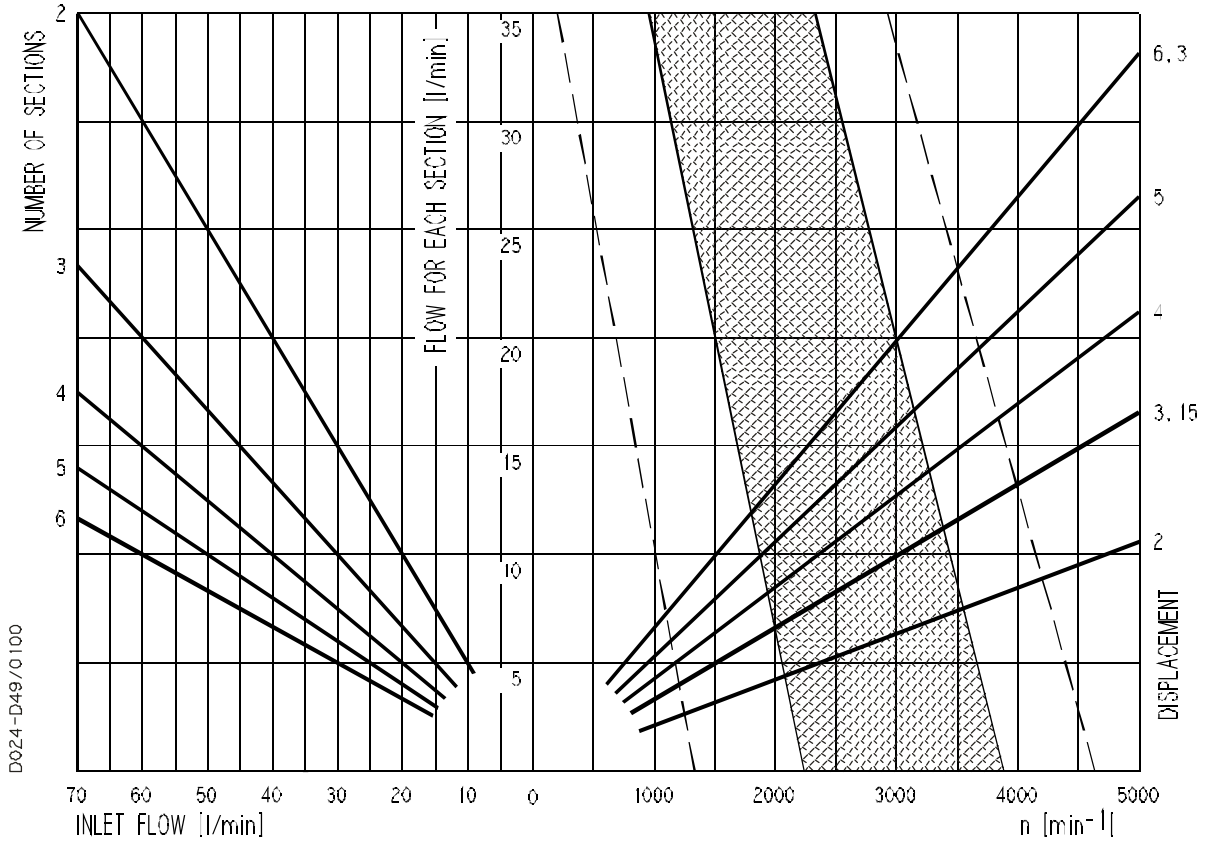
**DISPLACEMENT SELECTION GUIDE EXAMPLE**

Assume that it is necessary to supply power to two cylinders that require a flow rate of 40 [l/min] each. For simplicity's sake we will ignore pressure losses and the compression factor of the fluid. The pump must deliver a flow equal to:  $Q_0 = Q_1 + Q_2 = 80$  [l/min]. To find the displacement of the two sections of the flow equalizer, simply locate the flow rate 80 [l/min] on the X axis and then ascend vertically until the line corresponding to the number of sections (2) is encountered; now trace a horizontal line to the right until encountering the lines referring to displacement. Select the displacement with the point of intersection on the graph that lies nearest to the maximum speed in optimum performance range.

01/02.00

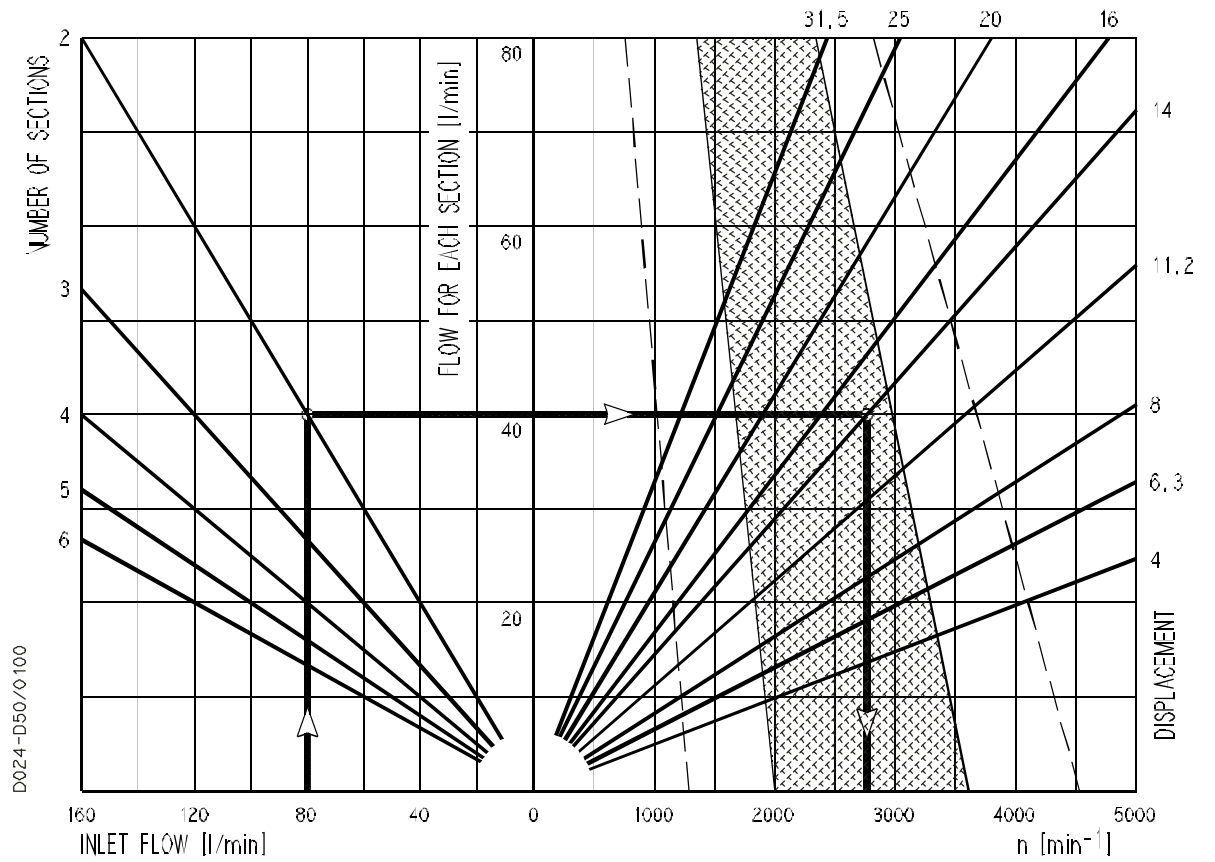
DISPLACEMENT SELECTION GUIDE

PLD 10



D024-D49/0100

PLD 20



D024-D50/0100

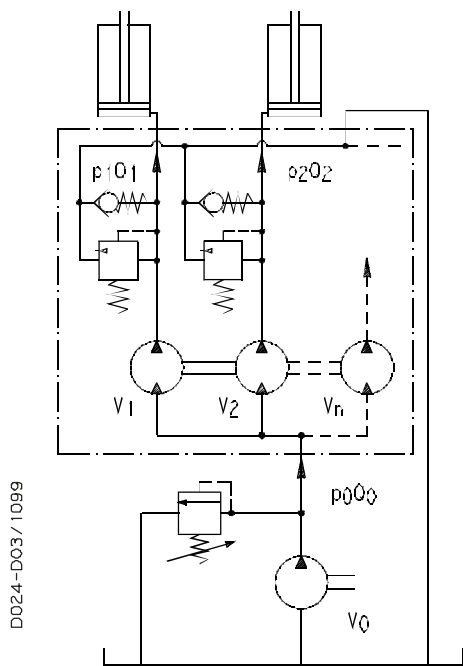
--- Performance range  Optimum performance range

Each curve has been obtained at 50°C, using oil with viscosity 36 mm<sup>2</sup>/s at 40°C..

01/02.00

## FLOW DIVIDERS (WITH UNEQUAL DISPLACEMENTS)

Flow dividers are used where the same pump must drive several different actuators requiring different pressures and flow rates. The displacement of each section must be proportional to the flow rate required by the actuator to which it is connected. Two typical circuit diagrams of applications where flow dividers are utilized will be found on page 11.



$V$  = Displacement [cm<sup>3</sup>/rev]

$Q$  = Flow [l/min]

$p$  = Pressure [bar]

$n$  = Speed [min<sup>-1</sup>]

$$Q_0 = Q_1 + Q_2 \dots + Q_n$$

$$p_0 Q_0 = p_1 Q_1 + p_2 Q_2 \dots + p_n Q_n$$

$$V_{(..)} = \frac{1000 Q_{(..)}}{n}$$

### DISPLACEMENT SELECTION GUIDE EXAMPLE

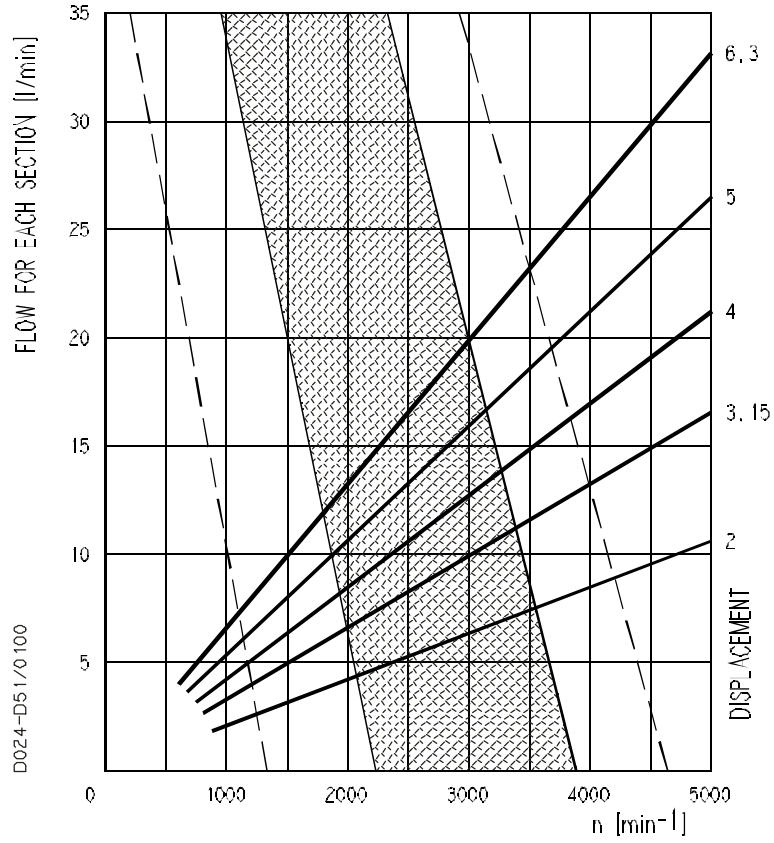
As sume two actuators must be driven using 50 [l/min] and 20 [l/min] respectively. To find the displacement of the flow divider sections, simply locate the flow rates in question on the Y axis and then move across horizontally until the lines corresponding to the displacement are encountered. Select a displacement with points of intersection aligned as near as possible vertically, and the nearest to the maximum speed in optimum performance range.

01/02.00

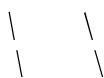
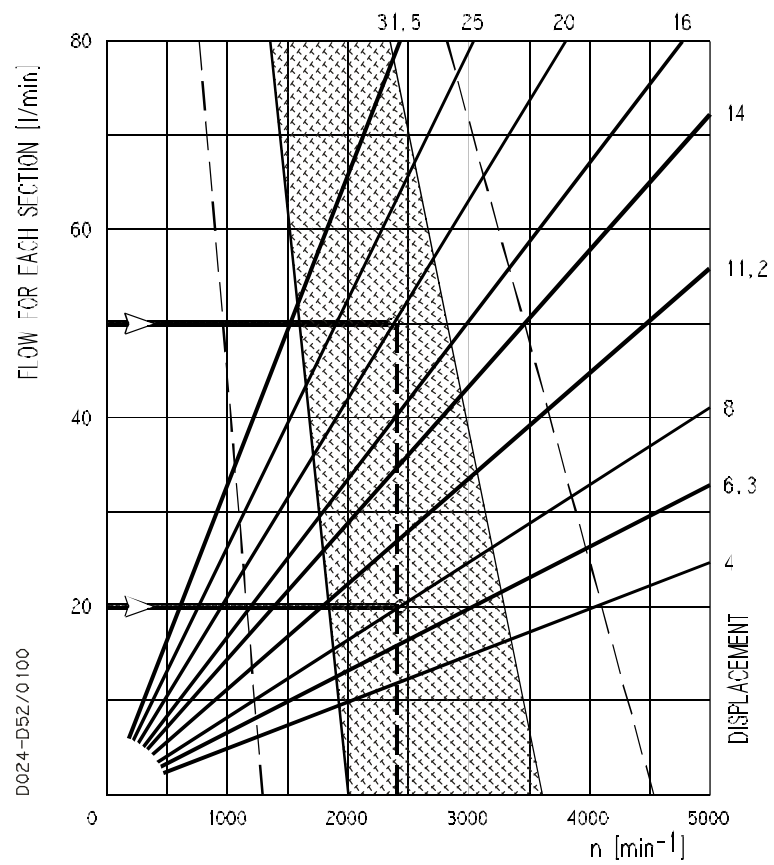


DISPLACEMENT SELECTION GUIDE

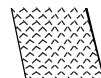
PLD 10



PLD 20



Performance range



Optimum performance range

Each curve has been obtained at 50°C, using oil with viscosity 36 mm<sup>2</sup>/s at 40°C.

01/02.00

TYPICAL CIRCUITS FOR FLOW EQUALIZERS (WITH EQUAL DISPLACEMENTS)

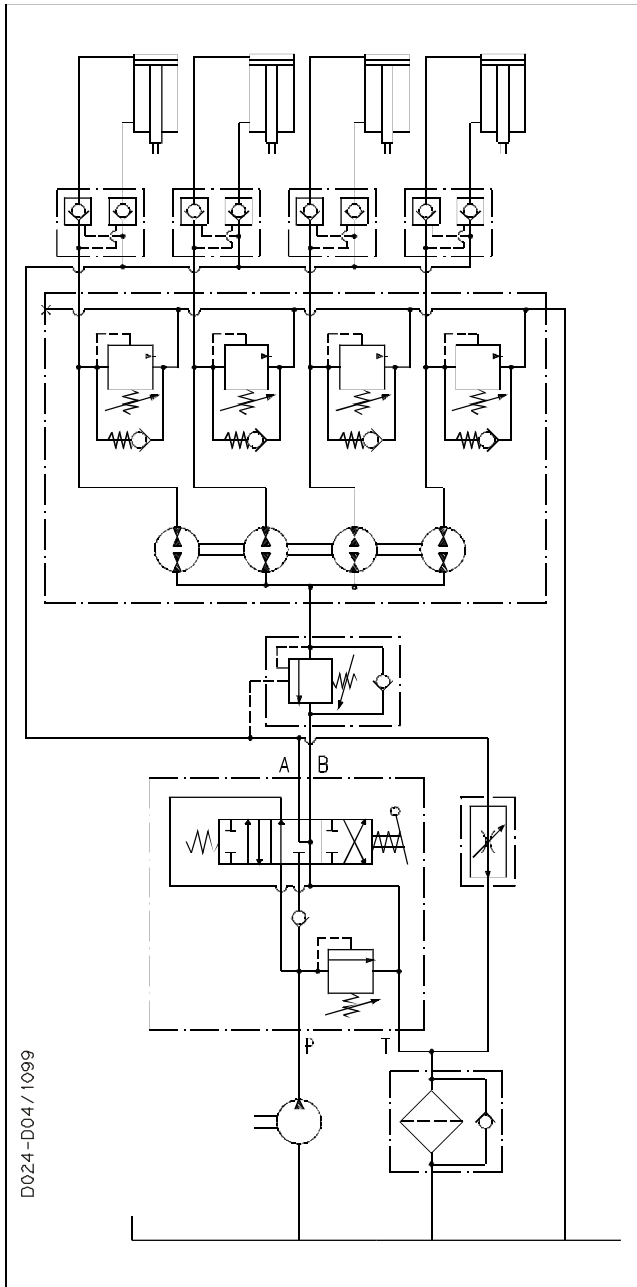


Diagram with a flow equalizer operating double-acting cylinders.

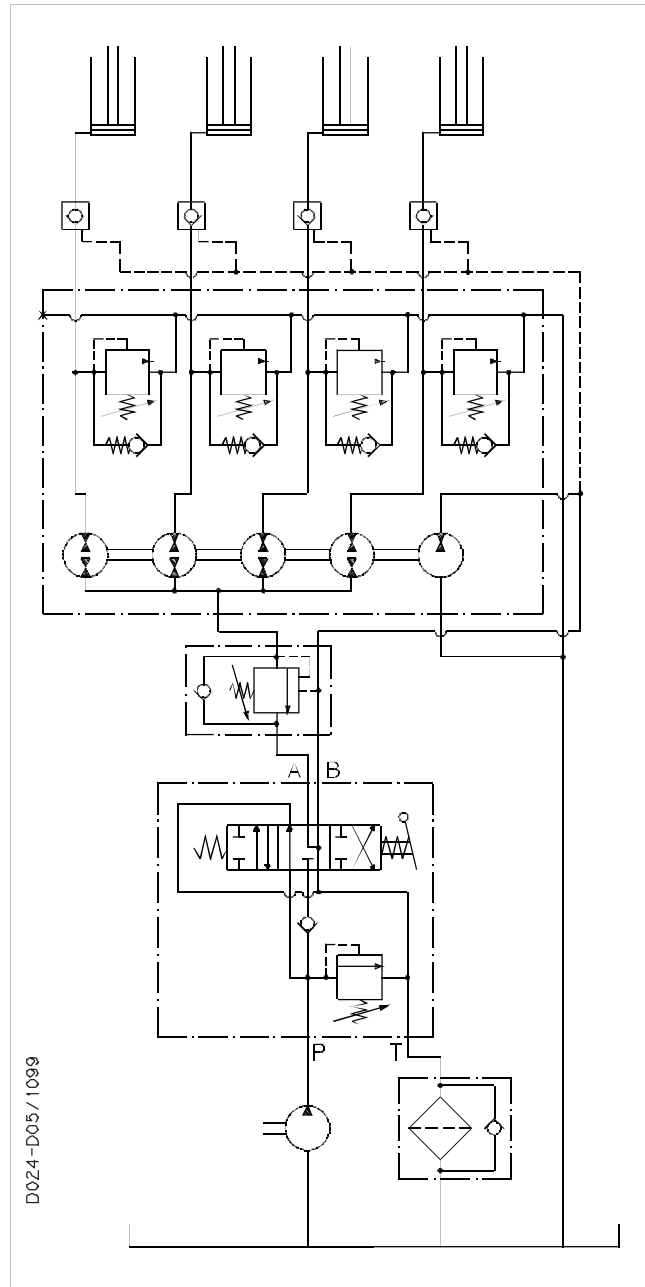


Diagram with a flow equalizer operating single acting cylinders.

01/02.00

TYPICAL CIRCUITS FOR FLOW DIVIDERS (WITH UNEQUAL DISPLACEMENTS)

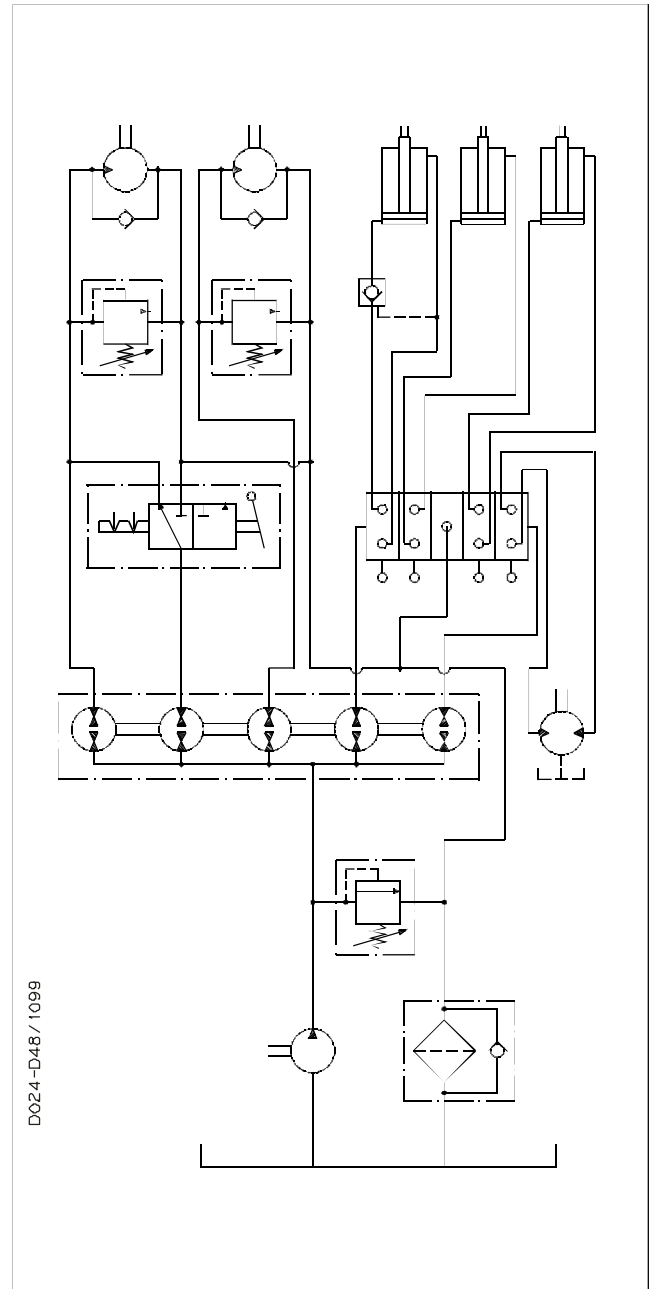
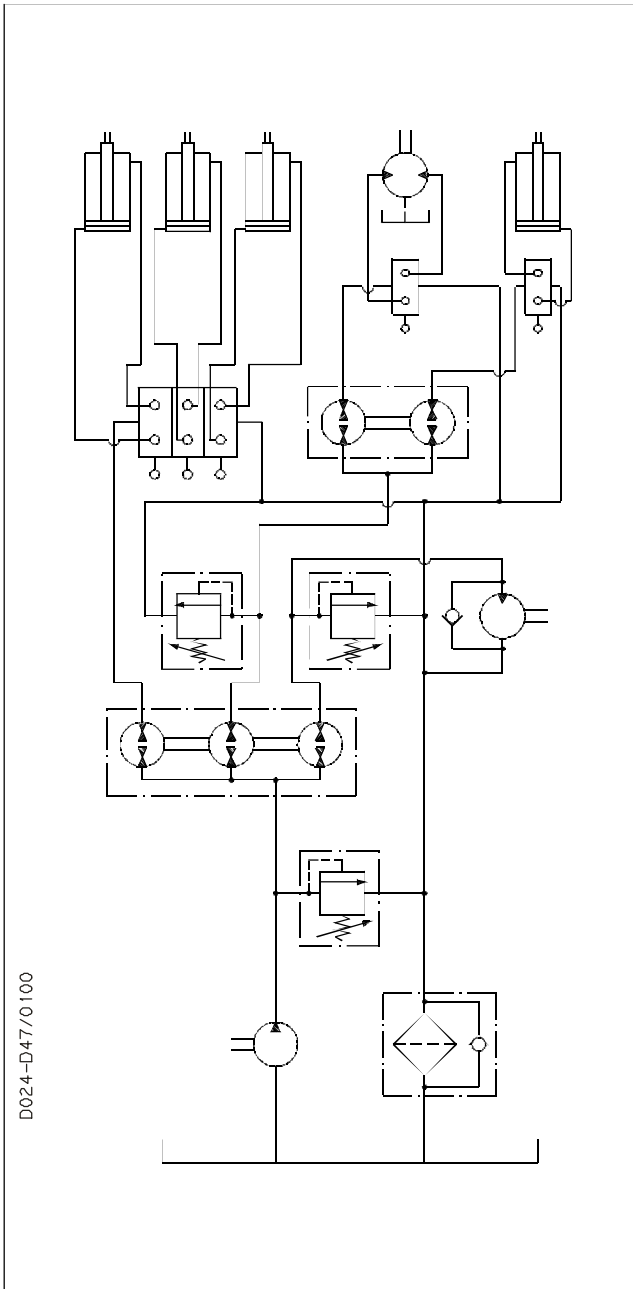


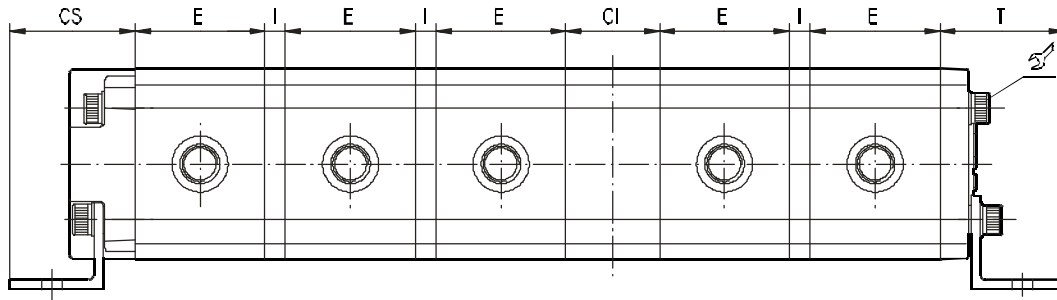
Diagram with a flow divider permitting the use of a single pump to drive a number of different actuators requiring flows at different pressures.

01/02.00

**NOTES ABOUT COMPOSITION**

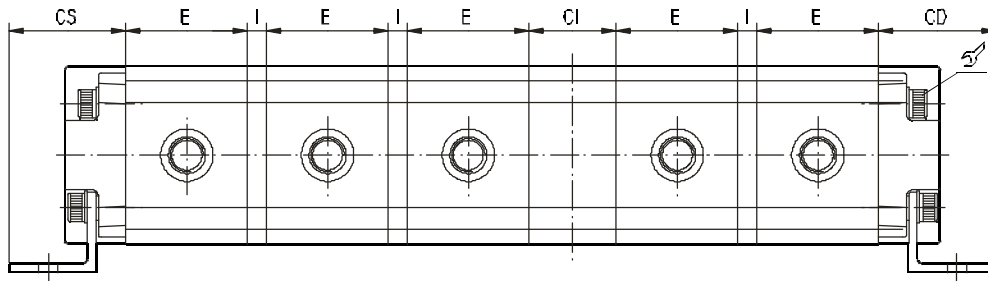
Flow divider sections are arranged in descending displacements or groups with the largest displacement to the left as viewed from the outlet ports side. Standard for mats of flow dividers are given beneath; for different configurations please consult our sales department.

**STANDARD COMPOSITION FOR 5 SECTIONS**



D024-D44/1099

**COMPOSITION WITH ADDITIONAL INLET SECTION**



D024-D25/0100

- CS** . . . . . Left inlet section kit
- E** . . . . . Section
- I** . . . . . Intermediate kit flange
- CI** . . . . . Intermediate inlet section kit
- T** . . . . . End cover kit
- CD** . . . . . Additional right inlet section kit (only for high delivery)

Type	Max. flow for inlet section
	l/min
<b>PLD 10</b>	35
<b>PLD 20</b>	80

Type	Tightening torque
	Nm
<b>PLD 10</b>	25
<b>PLD 20</b>	50

Replaces: 01/02.00

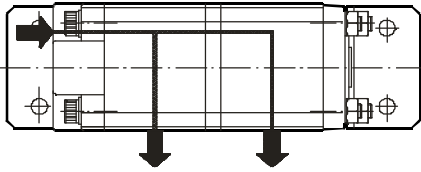
02/11.00

**STANDARD COMPOSITIONS FOR SECTIONS WITH OR WITHOUT VALVE**

Replaces: 01/02.00

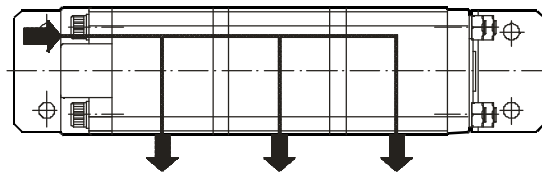
**2 SECTIONS WITH 1 INLET SECTION**

D024-D26/1099



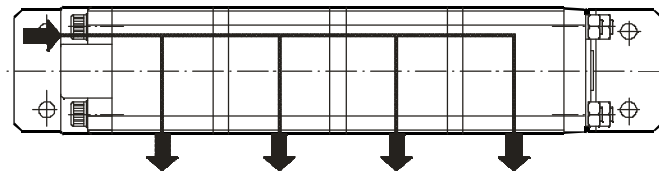
**3 SECTIONS WITH 1 INLET SECTION**

D024-D27/1099



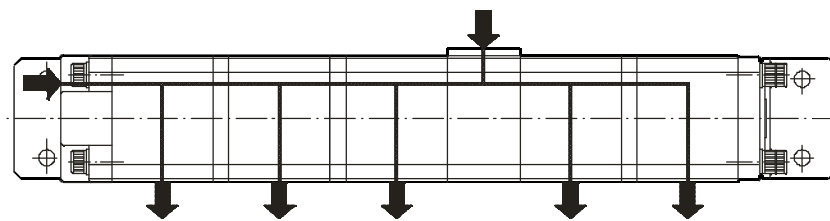
**4 SECTIONS WITH 1 INLET SECTION**

D024-D28/1099



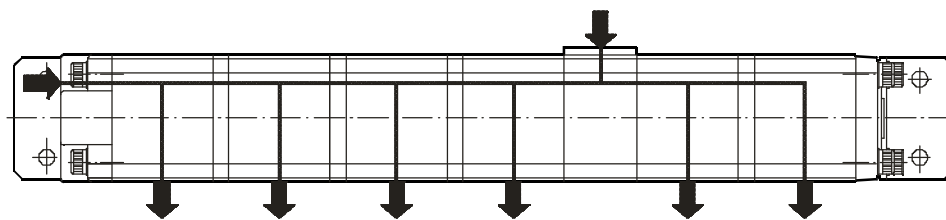
**5 SECTIONS WITH 2 INLET SECTIONS**

D024-D29/1099



**6 SECTIONS WITH 2 INLET SECTIONS**

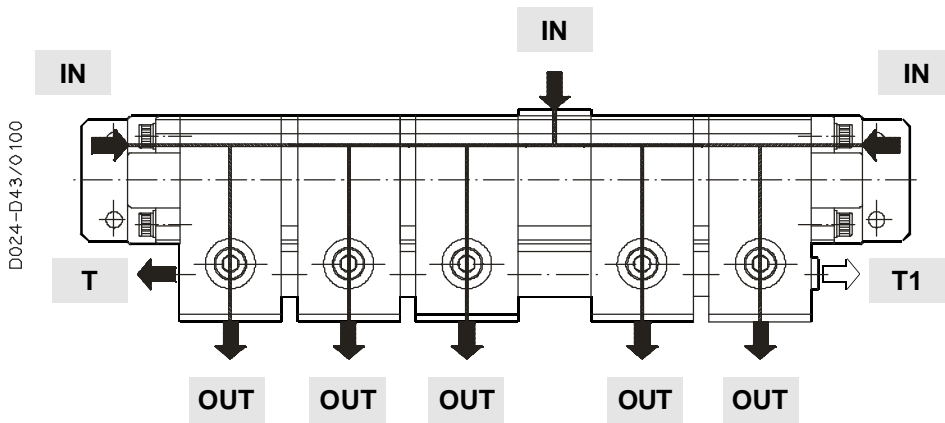
D024-D30/1099



02/11.00

**Note:** Combinations between different groups (PLD10 / PLD20) are available.  
For more informations please consult our technical sales department.

**PORTS DIMENSIONS**



**IN** . . . . Inlet port  
**OUT** . . . . Outlet port  
**T** . . . . Drain port  
**T1** . . . . Additional drain port

PORTS	BSPP			ODT		
	IN	OUT	T - T1	IN	OUT	T - T1
Type						
<b>PLD 10•2</b>						
<b>PLD 10•3,15</b>						
<b>PLD 10•4</b>	GD	GC	GC	OB	OA	OA
<b>PLD 10•5</b>						
<b>PLD 10•6,3</b>						
<b>PLD 20•4</b>						
<b>PLD 20•6,3</b>						
<b>PLD 20•8</b>						
<b>PLD 20•11,2</b>						
<b>PLD 20•14</b>	GE	GD	GD	OD	OC	OB
<b>PLD 20•16</b>						
<b>PLD 20•20</b>						
<b>PLD 20•25</b>						
<b>PLD 20•31,5</b>						

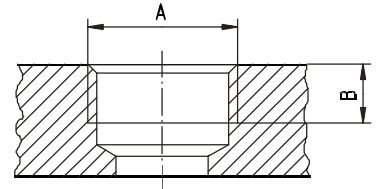
01/02.00

**PORTS DIMENSIONS**

**BRITISH STANDARD PIPE PARALLEL (BSPP)**

Code	Nominal size	A	B
			mm (in)
<b>GC</b>	3/8	G 3/8	14 (0.551)
<b>GD</b>	1/2	G 1/2	14 (0.551)
<b>GE</b>	3/4	G 3/4	18 (0.709)

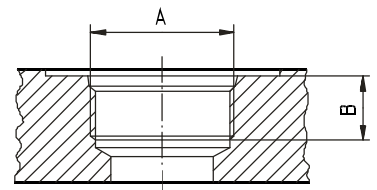
D024-D45 / 1099



**SAE STRAIGHT THREAD PORTS (ODT)**

Code	Nominal size	A	B
			mm (in)
<b>OA</b>	3/8	9/16-18 UNF-2B	15 (0.591)
<b>OB</b>	1/2	3/4-16 UNF-2B	14 (0.551)
<b>OC</b>	5/8	7/8-14 UNF-2B	17 (0.669)
<b>OD</b>	3/4	1-1/16-12 UN-2B	20 (0.787)

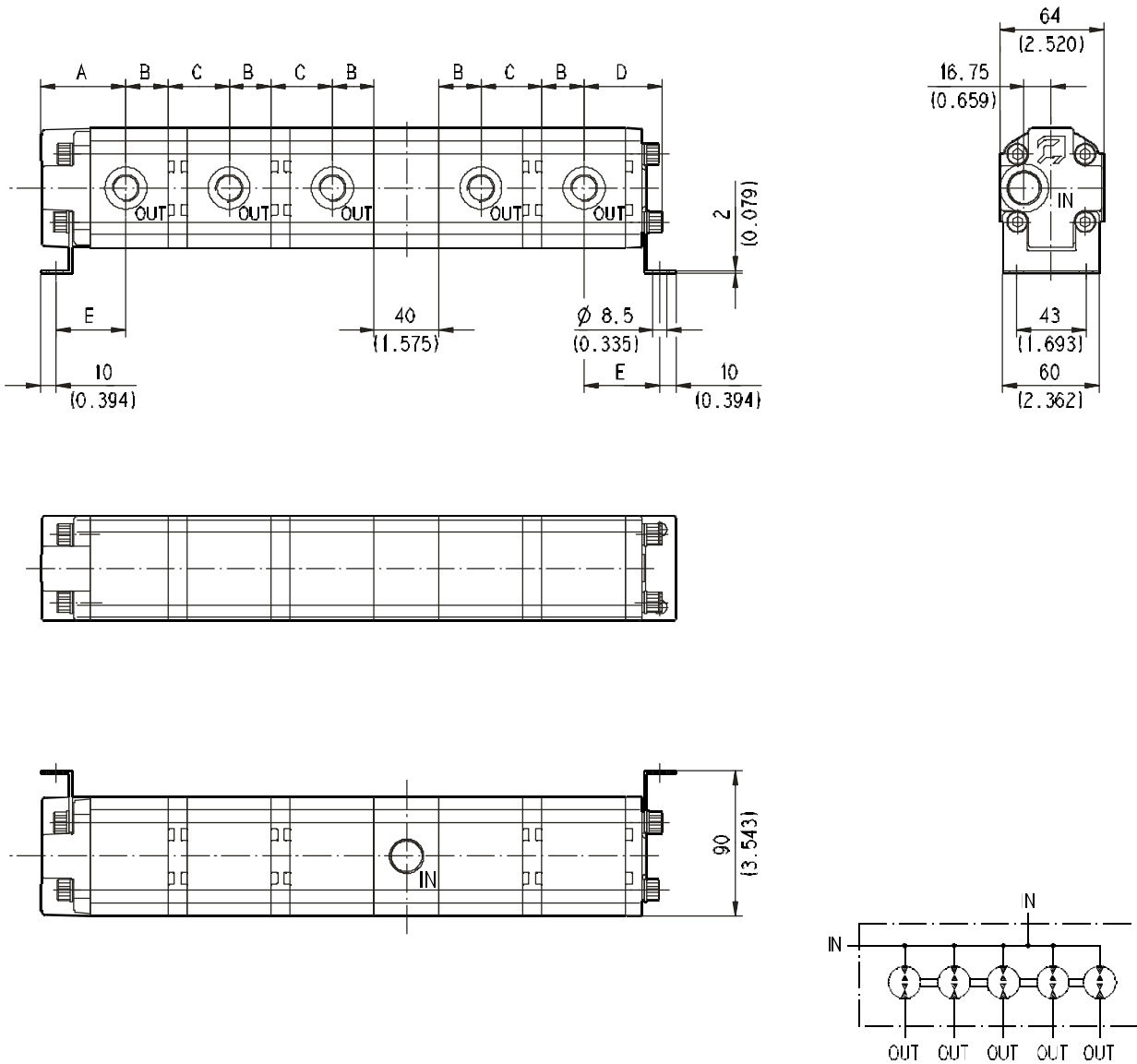
D024-D46 / 1099



01/02.00

SAME GROUP DIMENSIONS

PLD 10



D024-D37/0200

01/02.00

IN and OUT ports dimensions are shown on page 14 and page 15.

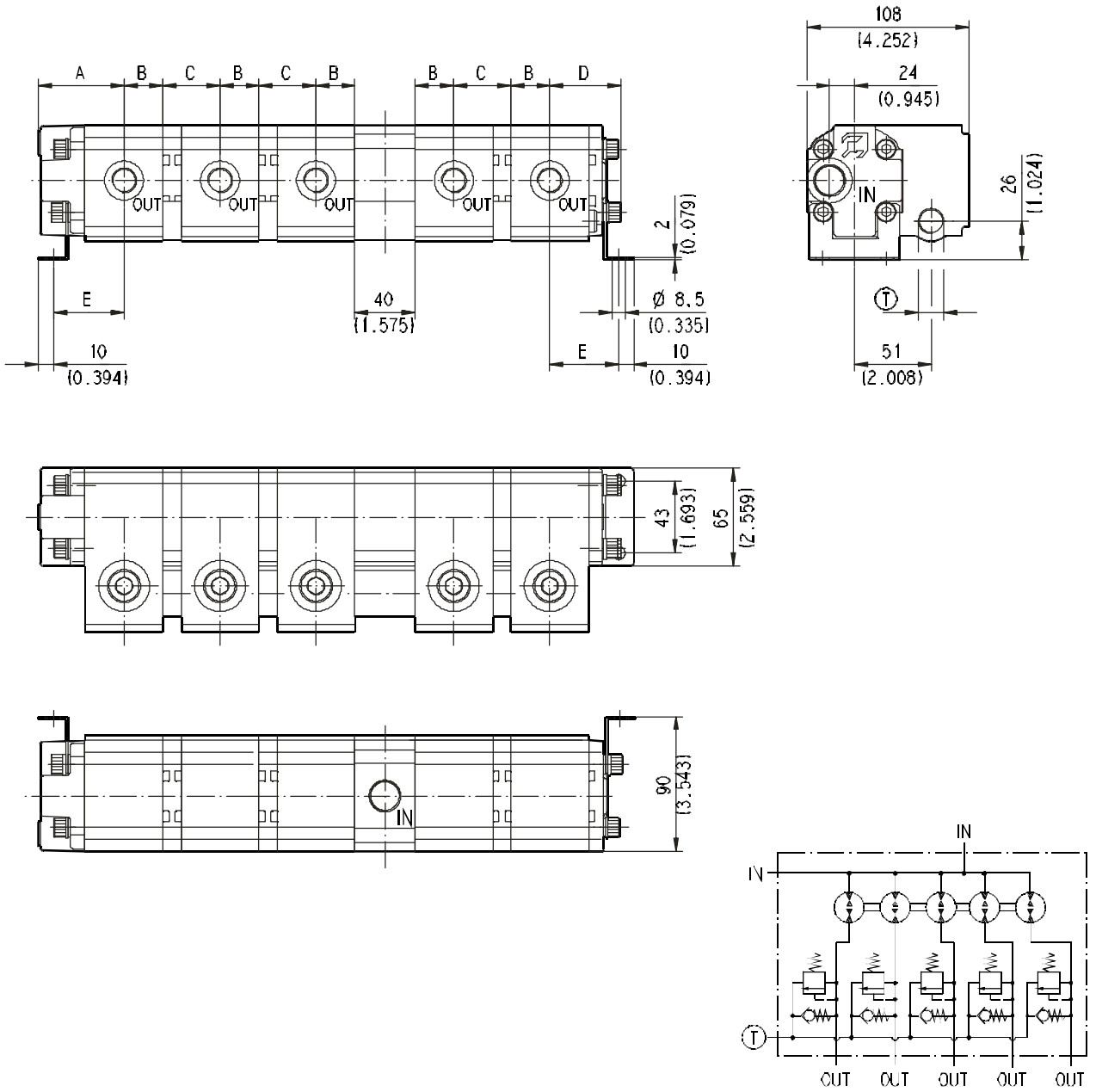
Type	A	B	C	D	E
	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)
<b>PLD 10•2</b>	50,2 (1.976)	19,2 (0.756)	31,2 (1.228)	41,8 (1.646)	40,3 (1.587)
<b>PLD 10•3,15</b>	52 (2.047)	21 (0.827)	33 (1.299)	43,6 (1.717)	42,1 (1.657)
<b>PLD 10•4</b>	53,4 (2.102)	22,4 (0.882)	34,4 (1.354)	45 (1.772)	43,5 (1.713)
<b>PLD 10•5</b>	55 (2.165)	24 (0.945)	36 (1.417)	46,6 (1.835)	45,1 (1.776)
<b>PLD 10•6,3</b>	57 (2.244)	26 (1.024)	38 (1.496)	48,6 (1.913)	47,1 (1.854)



SAME GROUP DIMENSIONS WITH VALVE

PLD 10

D024-D38/0200



IN, OUT and T ports dimensions are shown on page 14 and page 15.

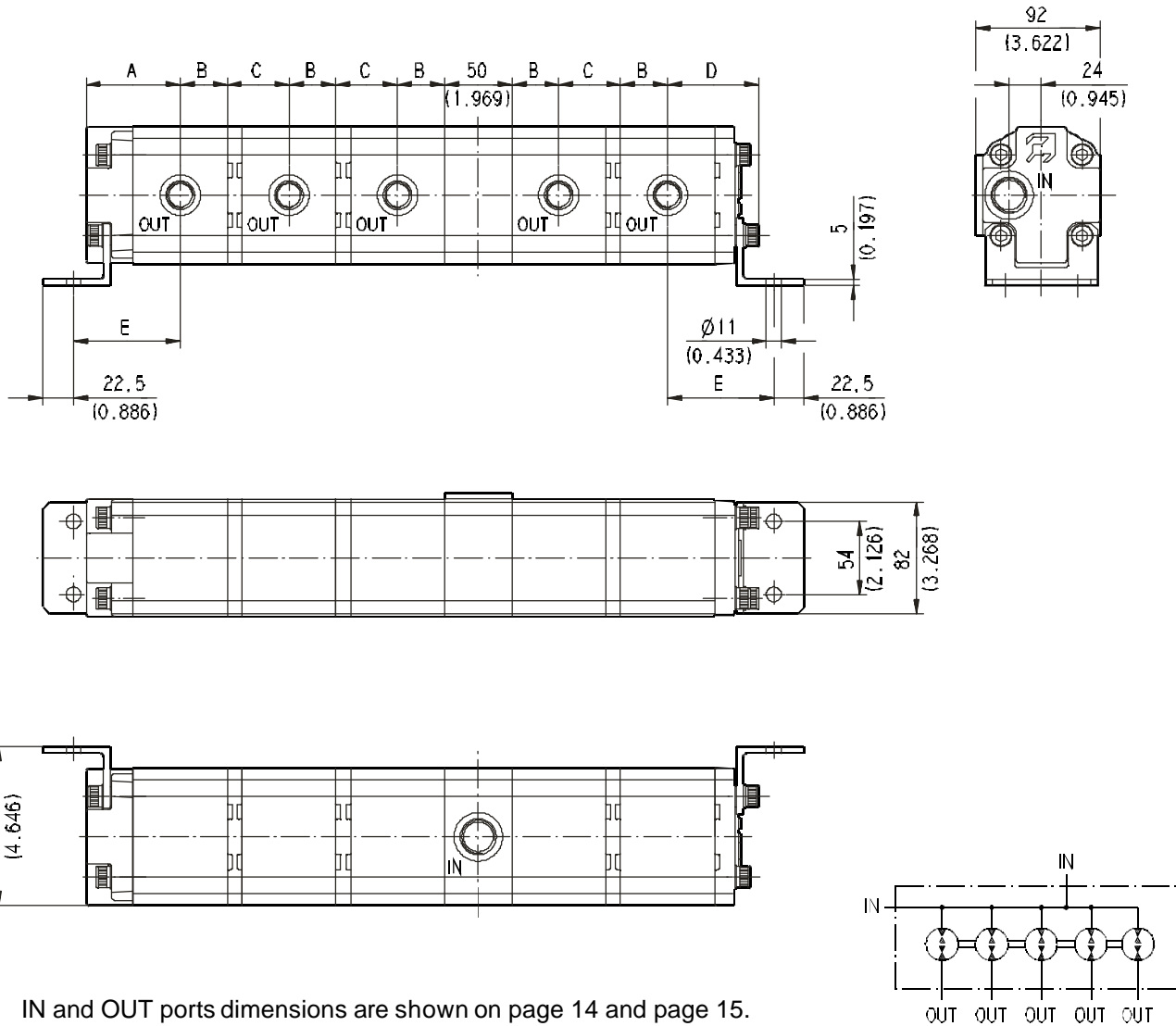
01/02.00

Type	A	B	C	D	E
	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)
<b>PLD 10•2</b>	50,2 (1.976)	19,2 (0.756)	31,2 (1.228)	41,8 (1.646)	40,3 (1.587)
<b>PLD 10•3,15</b>	52 (2.047)	21 (0.827)	33 (1.299)	43,6 (1.717)	42,1 (1.657)
<b>PLD 10•4</b>	53,4 (2.102)	22,4 (0.882)	34,4 (1.354)	45 (1.772)	43,5 (1.713)
<b>PLD 10•5</b>	55 (2.165)	24 (0.945)	36 (1.417)	46,6 (1.835)	45,1 (1.776)
<b>PLD 10•6,3</b>	57 (2.244)	26 (1.024)	38 (1.496)	48,6 (1.913)	47,1 (1.854)

SAME GROUP DIMENSIONS

PLD 20

D024-D31/0200



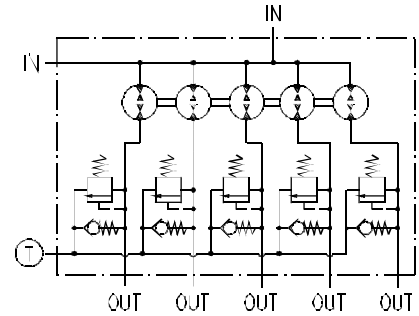
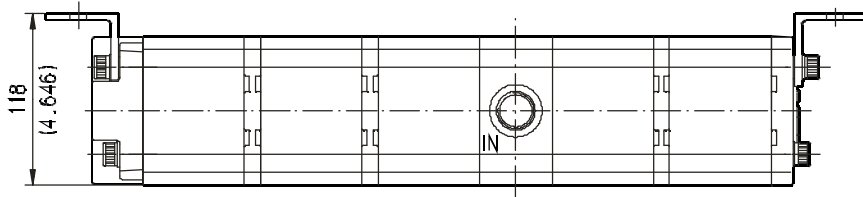
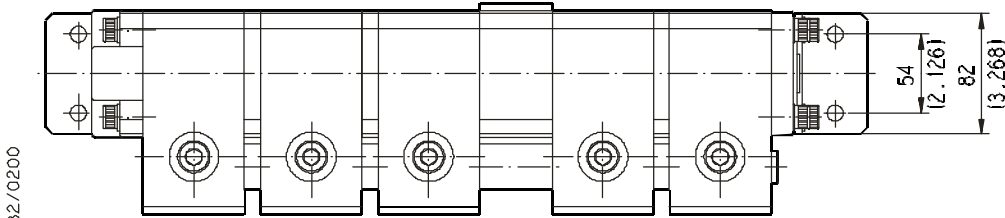
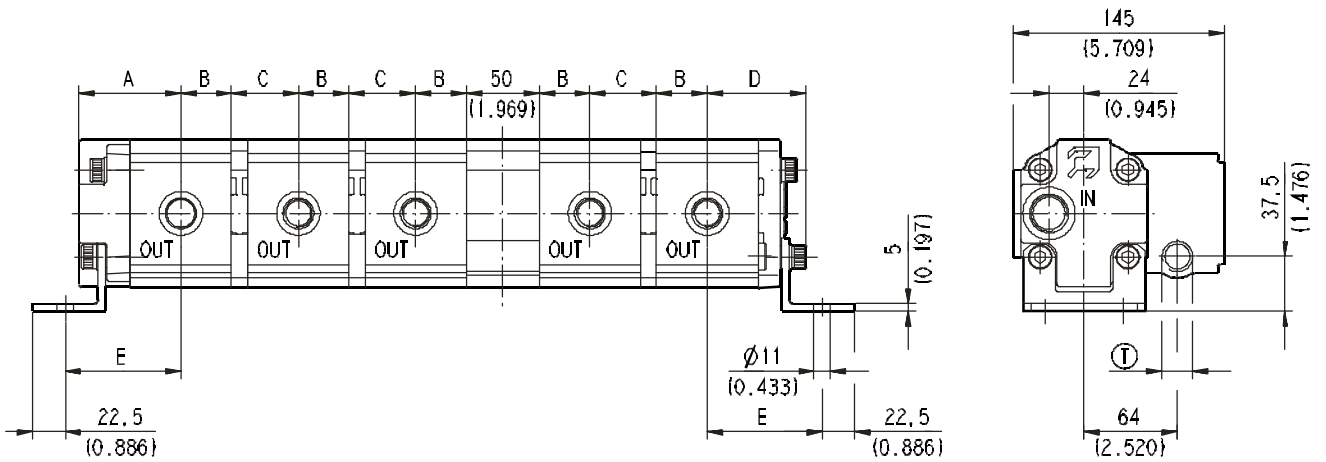
IN and OUT ports dimensions are shown on page 14 and page 15.

Type	A	B	C	D	E
	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)
PLD 20•4	60,8 (2.394)	25,5 (1.016)	36,8 (1.449)	58,8 (2.315)	69,8 (2.748)
PLD 20•6,3	62 (2.441)	27 (1.063)	38 (1.496)	60 (2.362)	71 (2.795)
PLD 20•8	63,3 (2.492)	28,3 (1.114)	39,3 (1.547)	61,3 (2.413)	72,3 (2.846)
PLD 20•9	63,9 (2.516)	28,9 (1.138)	39,9 (1.571)	61,9 (2.437)	72,9 (2.870)
PLD 20•11,2	65,5 (2.579)	30,5 (1.201)	41,5 (1.634)	63,5 (2.500)	74,5 (2.933)
PLD 20•14	68 (2.677)	33 (1.299)	44 (1.732)	66 (2.598)	77 (3.031)
PLD 20•16	69,8 (2.748)	34,8 (1.370)	45,8 (1.803)	67,8 (2.669)	78,8 (3.102)
PLD 20•20	73 (2.874)	38 (1.496)	49 (1.929)	71 (2.795)	82 (3.228)
PLD 20•25	77 (3.031)	42 (1.654)	53 (2.087)	75 (2.795)	86 (3.386)
PLD 20•31,5	82 (3.228)	47 (1.850)	58 (2.283)	80 (3.150)	91 (3.583)

01/02.00

SAME GROUP DIMENSIONS WITH VALVE

PLD 20



IN, OUT and T ports dimensions are shown on page 14 and page 15.

Type	A	B	C	D	E
	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)
PLD 20•4	60,8 (2.394)	25,5 (1.016)	36,8 (1.449)	58,8 (2.315)	69,8 (2.748)
PLD 20•6,3	62 (2.441)	27 (1.063)	38 (1.496)	60 (2.362)	71 (2.795)
PLD 20•8	63,3 (2.492)	28,3 (1.114)	39,3 (1.547)	61,3 (2.413)	72,3 (2.846)
PLD 20•9	63,9 (2.516)	28,9 (1.138)	39,9 (1.571)	61,9 (2.437)	72,9 (2.870)
PLD 20•11,2	65,5 (2.579)	30,5 (1.201)	41,5 (1.634)	63,5 (2.500)	74,5 (2.933)
PLD 20•14	68 (2.677)	33 (1.299)	44 (1.732)	66 (2.598)	77 (3.031)
PLD 20•16	69,8 (2.748)	34,8 (1.370)	45,8 (1.803)	67,8 (2.669)	78,8 (3.102)
PLD 20•20	73 (2.874)	38 (1.496)	49 (1.929)	71 (2.795)	82 (3.228)
PLD 20•25	77 (3.031)	42 (1.654)	53 (2.087)	75 (2.950)	86 (3.386)
PLD 20•31,5	82 (3.228)	47 (1.850)	58 (2.283)	80 (3.150)	91 (3.583)

01/02.00

## HOW TO ORDER

Only for version  
with valve

1
2
3
4
5
6
5
6
7
4
5
6
8
4
9
10
11
12

PLD 20 / 3 / CS - GE / 25 - GD / 25 - GD / CI - GE / 25 - GD / CD - GE / VPEF - 50 - GD - V

Series / 
 Left inlet section / 
 Section / 
 Section / 
 Interm. inlet section / 
 Section / 
 Right inlet section / 
 Relief valve

1	Series	CODE
	Polaris 10	PLD 10
	Polaris 20	PLD 20

2	Number of sections	CODE
	From 2 to 6 sections	2 ... 6

3	Standard side inlet section	CODE
	Left inlet section (1)	CS

4	Inlet port dimensions	CODE
<b>BRITISH STANDARD PIPE PARALLEL (BSPP)</b>		
	PLD 10	GD
	PLD 20	GE
<b>SAE STRAIGHT THREAD PORTS (ODT)</b>		
	PLD 10	OB
	PLD 20	OD

5	Displacement	CODE
	cm <sup>3</sup> /rev	
<b>Polaris 10</b>		
	2	PLD 10-2
	3,1	PLD 10-3,15
	4	PLD 10-4
	4,9	PLD 10-5
	6,2	PLD 10-6,3
<b>Polaris 20</b>		
	4,8	PLD 20-4
	6,5	PLD 20-6,3
	8,3	PLD 20-8
	11,1	PLD 20-11,2
	14,4	PLD 20-14
	16,6	PLD 20-16
	20,8	PLD 20-20
	26,	PLD 20-25
	32,6	PLD 20-31,5

CODE	Outlet port dimensions	6
<b>BRITISH STANDARD PIPE PARALLEL (BSPP)</b>		
GC	PLD 10	
GD	PLD 20	
<b>SAE STRAIGHT THREAD PORTS (ODT)</b>		
OA	PLD 10	
OC	PLD 20	

CODE	Intermediate inlet section (2)	7
CI	Intermediate inlet section	

CODE	Supplementary inlet section (2)	8
CD	Right inlet section (1)	

CODE	Relief alve	9
VPEF	Relief alve	

CODE	Valve setting [bar]	10
....	See page 3	

CODE	T Outlet port dimensions	11
<b>BRITISH STANDARD PIPE PARALLEL (BSPP)</b>		
GC	PLD 10	
GD	PLD 20	
<b>SAE STRAIGHT THREAD PORTS (ODT)</b>		
OA	PLD 10	
OB	PLD 20	

CODE	Seals	12
....	Buna (3)	
V	Viton	

(1) Looking at the sections from the outlet ports side.

(2) Choice the inlet sections number according to the general data on page 4 and 5.

(3) Omit this code for Buna seals.