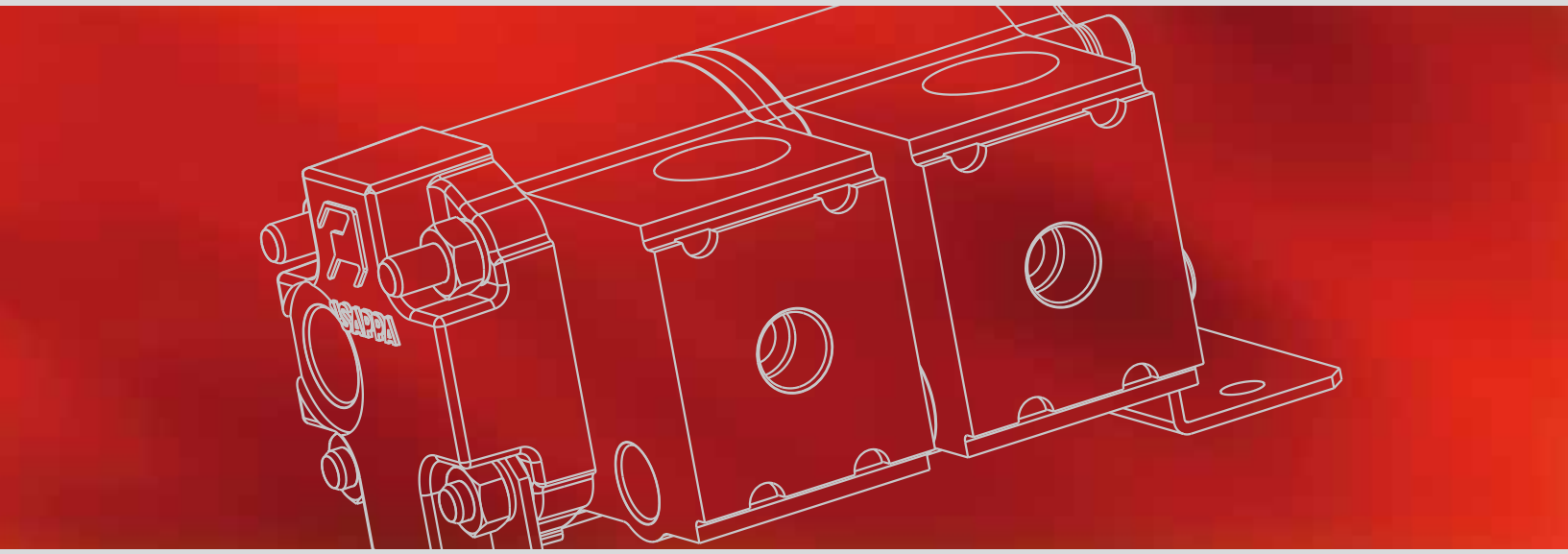
CASAPPA®
FLUID POWER DESIGN



GEAR FLOW DIVIDERS

POLARIS®

INDEX

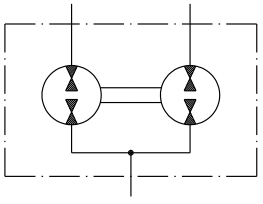
03/01.2013

o Modification from former edition.

GENERAL FEATURES

Replaces: 02/11.2000

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 into 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	

DISLPACEMENTS

From 0.122 in³/rev (2 cm³/rev)
To 1.99 in³/rev (32,6 cm³/rev)

PRESSURE

Max. continuous 3600 psi (250 bar)
Max. peak 4000 psi (280 bar)

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

Fluid		Mineral oil based hydraulic fluids to DIN 51524. For other fluids please consult our sales department.
Fluid temperature range	°F (°C)	-13 (-25) to +176 (+80) with Buna N seals
		-13 (-25) to +230 (+110) con guarnizioni in Viton V
Fluid viscosity range	SSU (mm²/s cSt)	55 (12) to 455 (100) recommended
		Up to 3409 (750) permitted

o 03/01.2013

o

Working pressure psi (bar)	Δp < 2030 Δp < (140)	2030 < Δp < 3045 (140) < Δp < (200)	Δp > 3045 Δp > (210)
Contamination class NAS 1638	10	9	8
Contamination class ISO 4406:1999	21/19/16	20/18/15	19/17/14
Achieved with filter $ß_{10}$ (c) ≥ 75 according to ISO 16889	-	10 µm	10 µm
Achieved with filter $ß_{25}$ (c) ≥ 200 according to ISO 16889	25 µm	-	-

Casappa consiglia i filtri della propria produzione:

IKRON® Fluid Filtration

GENERAL FEATURES OF RELIEF VALVES

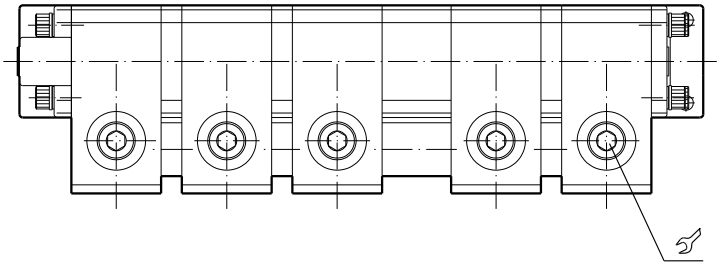
Relief valves allow the actuators to realign at the end of each cycle in both flow directions. As an example when the cylinders extend, they may not all reach their end stops exactly at the same time. In this case as soon as one cylinder reaches its stop, the relief valve in that section directs fluid to tank until all the other cylinders reach their stops. While retroacting 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	Δp nominal setting 2.64 US gpm (10 l/min)	Δp minimum begin opening valve
	psi (bar)	psi (bar)
34	**508 (35)**	465 (32)
4	**725 (50)**	667 (46)
22	**870 (60)**	783 (54)
23	**1015 (70)**	957 (66)
6	**1160 (80)**	1102 (76)
7	**1450 (100)**	1392 (96)
17	**1740 (120)**	1682 (116)
8	**1813 (125)**	1740 (120)
9	**2030 (140)**	1958 (135)
26	**2175 (150)**	2103 (145)
10	**2320 (160)**	2248 (155)
11	**2538 (175)**	2465 (170)
35	**2610 (180)**	2523 (174)
12	**2755 (190)**	2668 (184)
33	**2987 (206)**	2886 (199)
14	**3045 (210)**	2944 (203)
15	**3335 (230)**	3219 (222)
16	**3625 (250)**	3509 (242)
27	**3770 (260)**	3654 (252)
20	**4060 (280)**	3930 (271)

Adjustable felief valves are available on request.

D024-D62/0200



Tightening torque	
	442 lbf in (50 Nm)

02/11.2000

GENERAL DATA

Type	Displacement	Max. outlet pressure		Max. outlet Δp between sections (1)	Speed		Flow per section	
		p_1	p_2		min.	max.	min.	max.
	in^3/rev (cm^3/rev)	psi (bar)		psi (bar)	min^{-1}		US gpm (l/min)	
PLD 10•2	0.12 (2)	3600 (250)	4000 (280)	3000 (200)	1250	4200	0.70 (2,65)	2.35 (8,9)
PLD 10•3,15	0.19 (3,1)	3600 (250)	4000 (280)	3000 (200)	1205	3990	1.05 (3,99)	3.49 (13,2)
PLD 10•4	0.24 (4)	3600 (250)	4000 (280)	3000 (200)	1175	3840	1.32 (4,98)	4.28 (16,2)
PLD 10•5	0.30 (4,9)	3600 (250)	4000 (280)	3000 (200)	1140	3680	1.60 (6,04)	5.15 (19,5)
PLD 10•6,3	0.38 (6,2)	3600 (250)	4000 (280)	3000 (200)	1100	3500	1.93 (7,29)	6.13 (23,2)
PLD 20•4	0.29 (4,8)	3600 (250)	4000 (280)	3000 (200)	1250	4100	1.63 (6,16)	5.34 (20,2)
PLD 20•6,3	0.39 (6,5)	3600 (250)	4000 (280)	3000 (200)	1235	3970	2.15 (8,12)	6.90 (26,1)
PLD 20•8	0.50 (8,3)	3600 (250)	4000 (280)	3000 (200)	1220	3850	2.66 (10,05)	8.36 (31,65)
PLD 20•11,2	0.67 (11,1)	3600 (250)	4000 (280)	3000 (200)	1200	3660	3.55 (13,42)	10.79 (40,85)
PLD 20•14	0.87 (14,4)	3600 (250)	4000 (280)	3000 (200)	1175	3460	4.50 (17,03)	13.22 (50,02)
PLD 20•16	1.01 (16,6)	3000 (200)	3300 (280)	3000 (200)	1160	3335	5.14 (19,47)	14.76 (55,88)
PLD 20•20	1.27 (20,8)	3000 (200)	3300 (280)	3000 (200)	1130	3125	6.30 (23,83)	17.36 (65,7)
PLD 20•25	1.58 (26)	3000 (200)	3300 (280)	3000 (200)	1100	2900	7.64 (28,9)	20.13 (76,21)
PLD 20•31,5	1.99 (32,6)	3000 (200)	3300 (280)	3000 (200)	1060	2660	9.20 (34,84)	23.09 (87,39)

p_1 = Max. continuous pressure

p_2 = Max. peak pressure

(1): Pressure intensifiers can work at high pressure betweem sections.

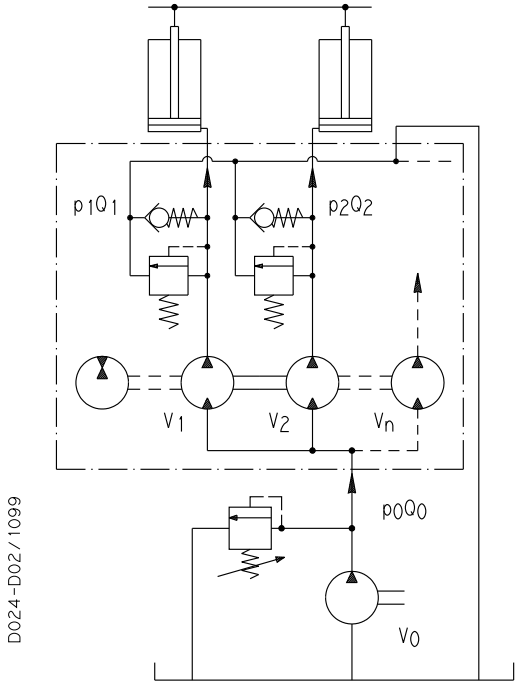
For working conditions outside the recommended limits shown in the table, please consult our sales department.

	Max. flow for inlet section
	l/min
PLD 10	9.25 US gpm (35 l/min)
PLD 20	21.14 US gpm (80 l/min)

03/01.2013

FLOW EQUALIZERS (WITH EQUAL DISPLACEMENTS)

Flow accuracy equalizers is within ± 2 % if they are rotating in the recommended speed range and the differential pressure between sections is less than 1450 psi (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.



V	in³/rev (cm³/rev)	Displacement
Q	US gpm (l/min)	Flow
p	psi (bar)	Pressure
n	min⁻¹	Speed

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

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

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

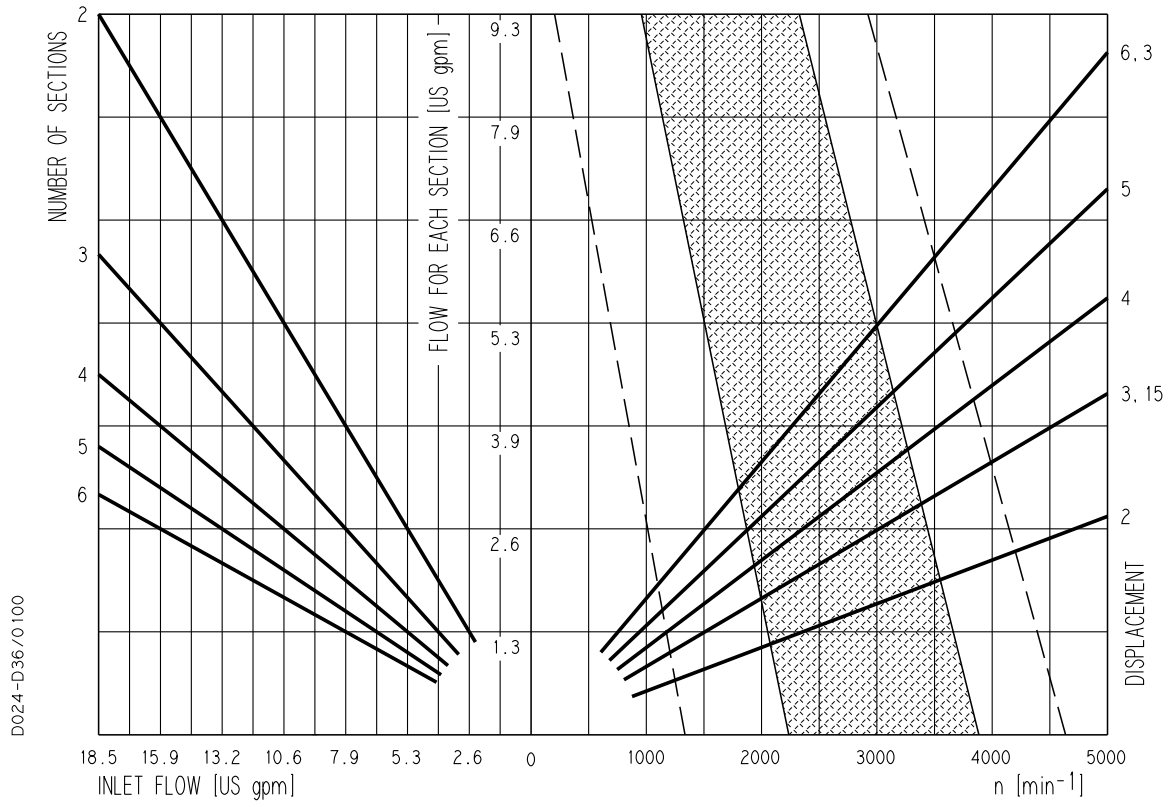
DISPLACEMENT SELECTION GUIDE EXAMPLE

Assume that it is necessary to supply power to two cylinders that require a flow rate of 10.6 US gpm (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: $Q_0 = Q_1 + Q_2 = 21.2$ US gpm (80 l/min). To find the displacement of the two sections of the flow equalizer, simply locate the flow rate 21.2 US gpm (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.

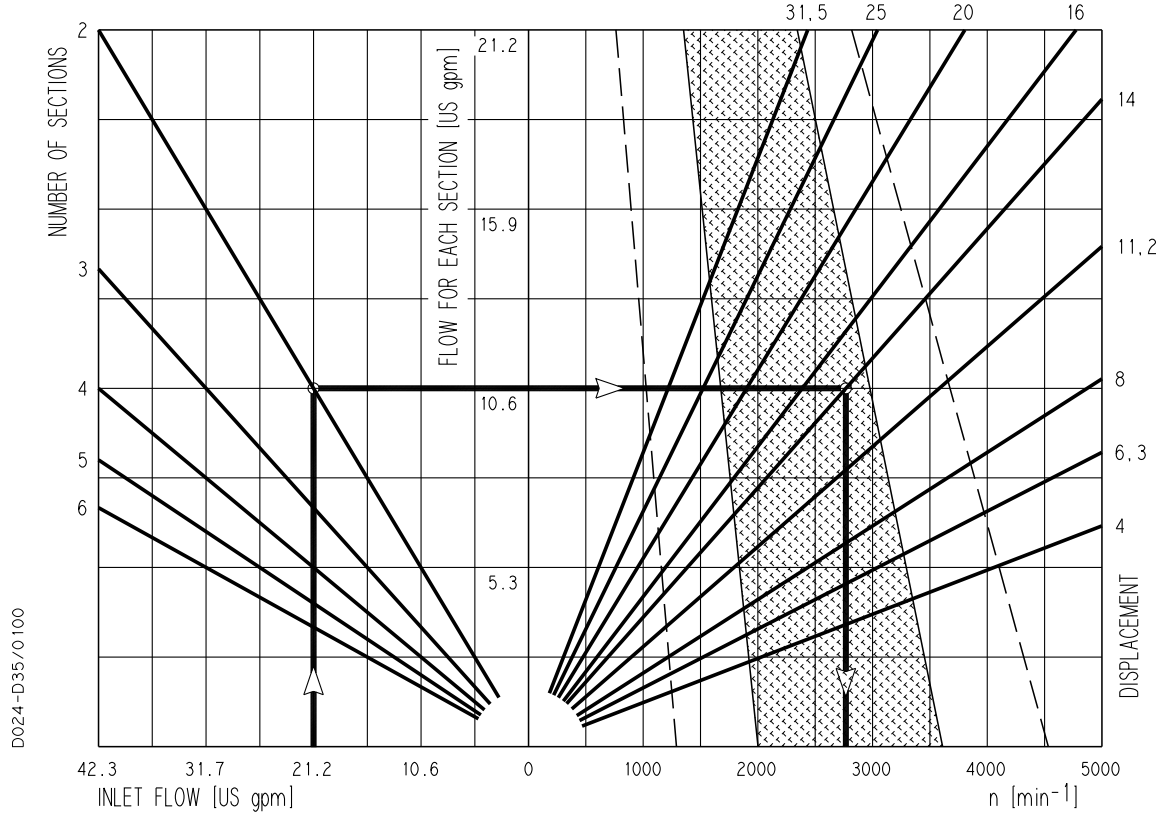
02/11.2000

DISPLACEMENT SELECTION GUIDE

PLD 10



PLD 20



Performance range

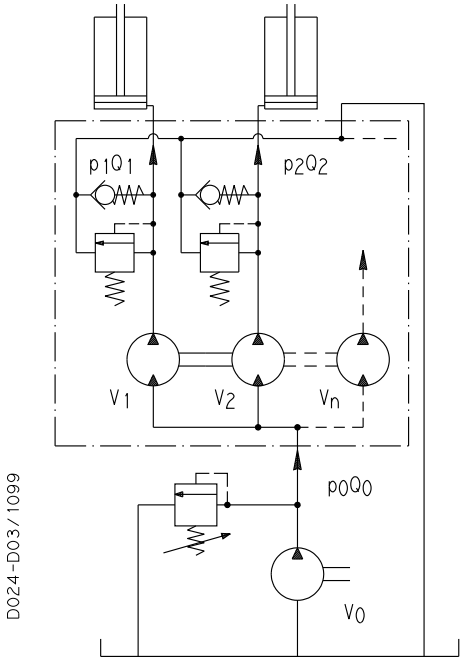
Optimum performance range

Each curve has been obtained at 122°F (50°C), using oil with viscosity 212 SSU (36 mm²/s) at 104°F (40°C).

02/11.2000

FLOW DIVIDERS (WITH UNEQUAL DISLPACEMENTS)

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	in^3/rev (cm^3/rev)	Displacement
Q	US gpm (l/min)	Flow
p	psi (bar)	Pressure
n	min^{-1}	Speed

$$\mathbf{Q_0} = Q_1 + Q_2 \ldots\ldots + Q_n$$

$$\mathbf{p_0 Q_0} = p_1 Q_1 + p_2 Q_2 \ldots\ldots + p_n Q_n$$

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

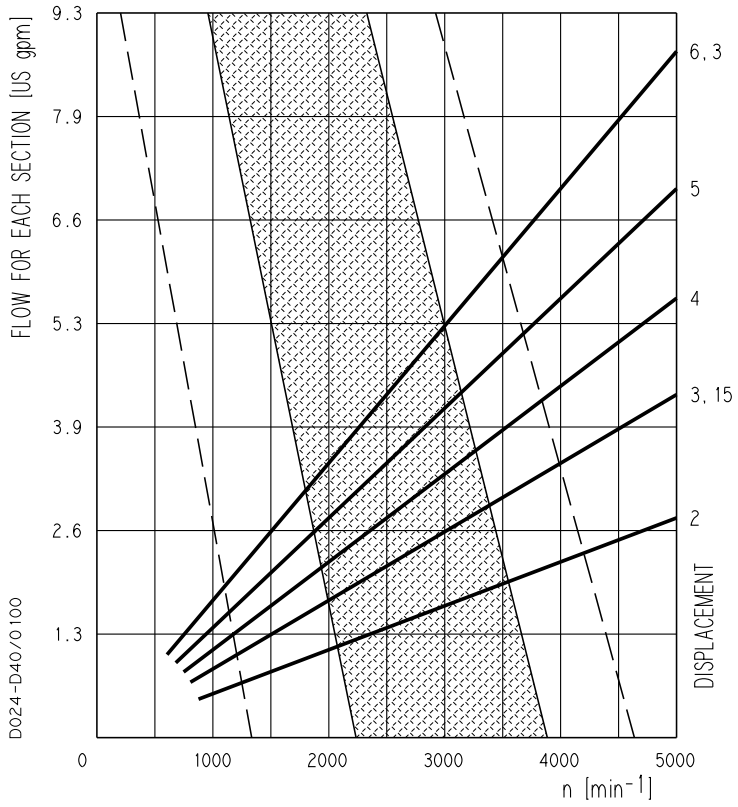
DISPLACEMENT SELECTION GUIDE EXAMPLE

Assume two actuators must be driven using 13.2 US gpm (50 l/min) and 5.3 US gpm (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.

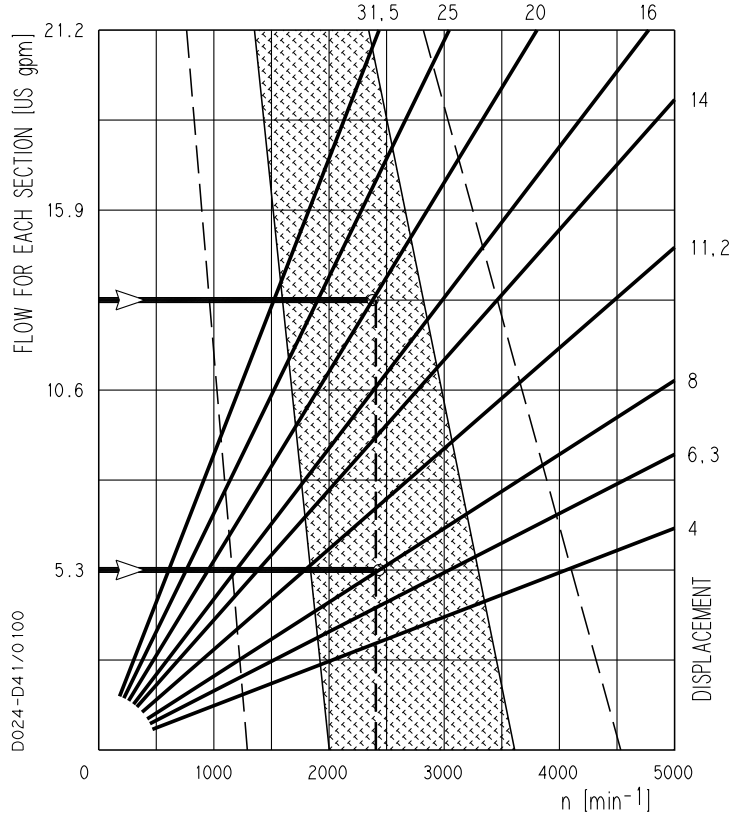
02/11.2000

DISPLACEMENT SELECTION GUIDE

PLD 10



PLD 20



Performance range

Optimum performance range

Each curve has been obtained at 122°F, using oil with viscosity 212 SSU at 104°F.

02/11.2000

TYPICAL CIRCUITS FOR FLOW EQUALIZERS (WITH EQUAL DISPLACEMENTS)

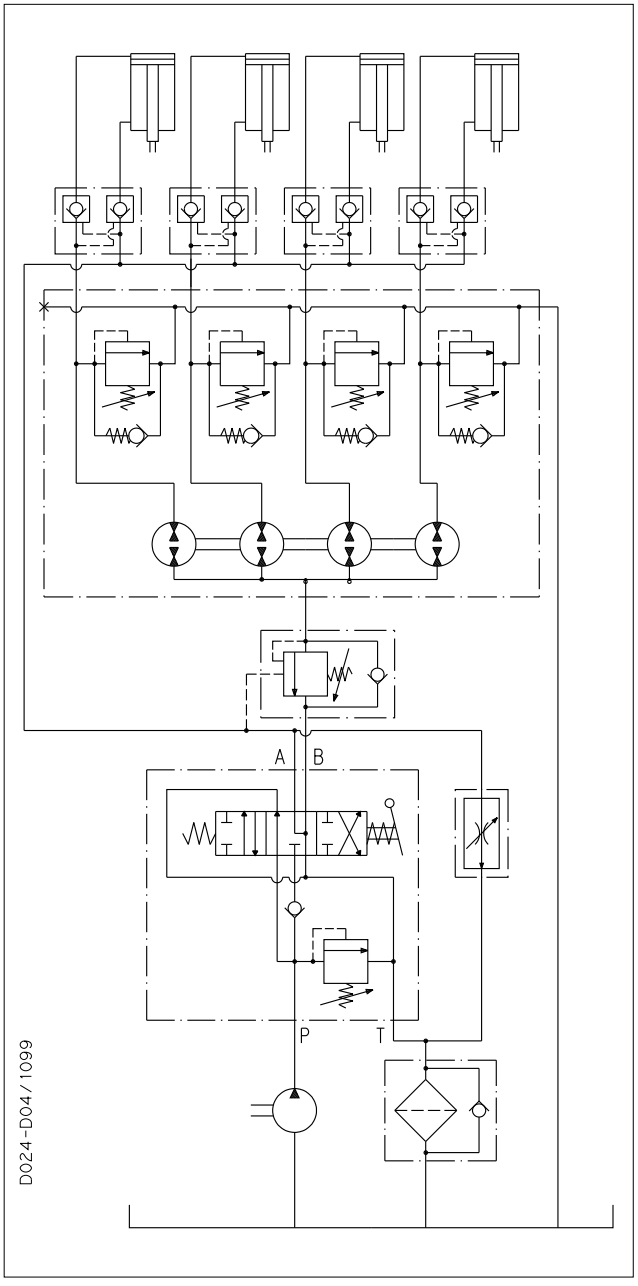


Diagram with a flow equalizer operating double acting cylinders.

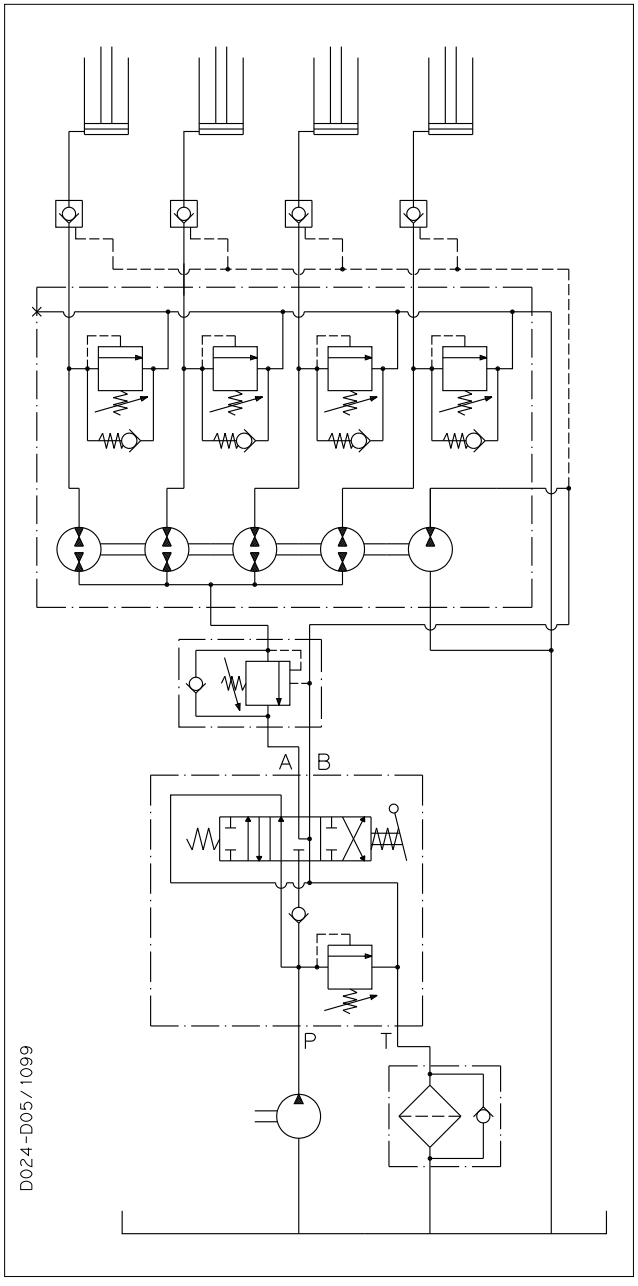
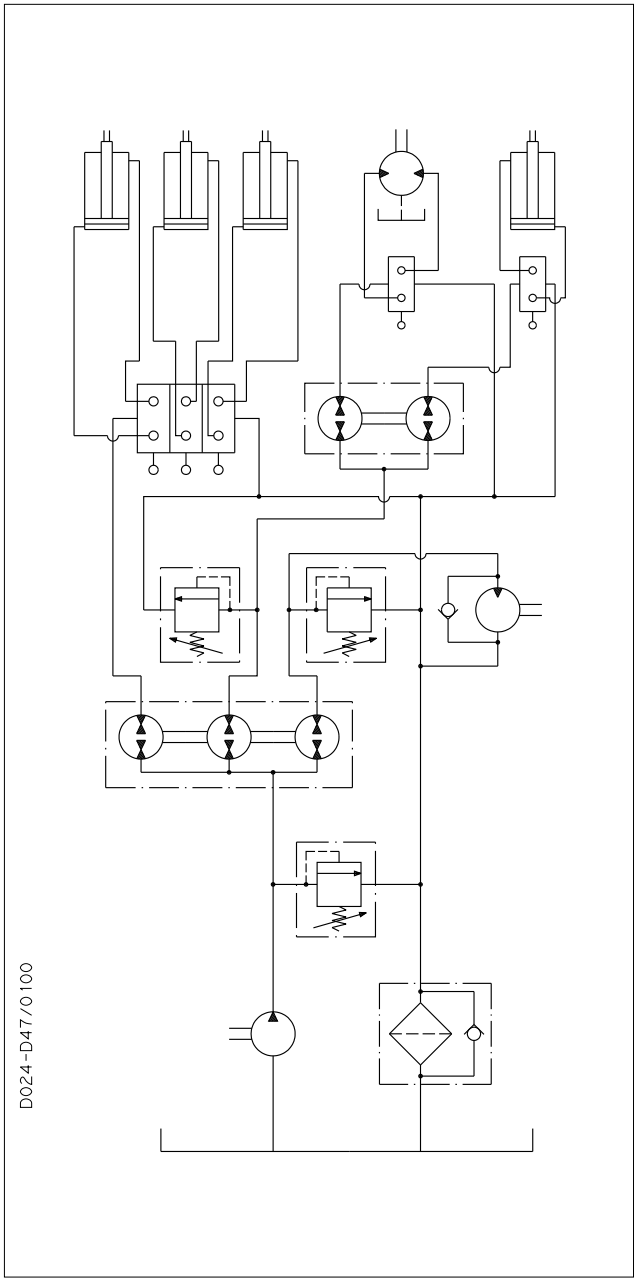
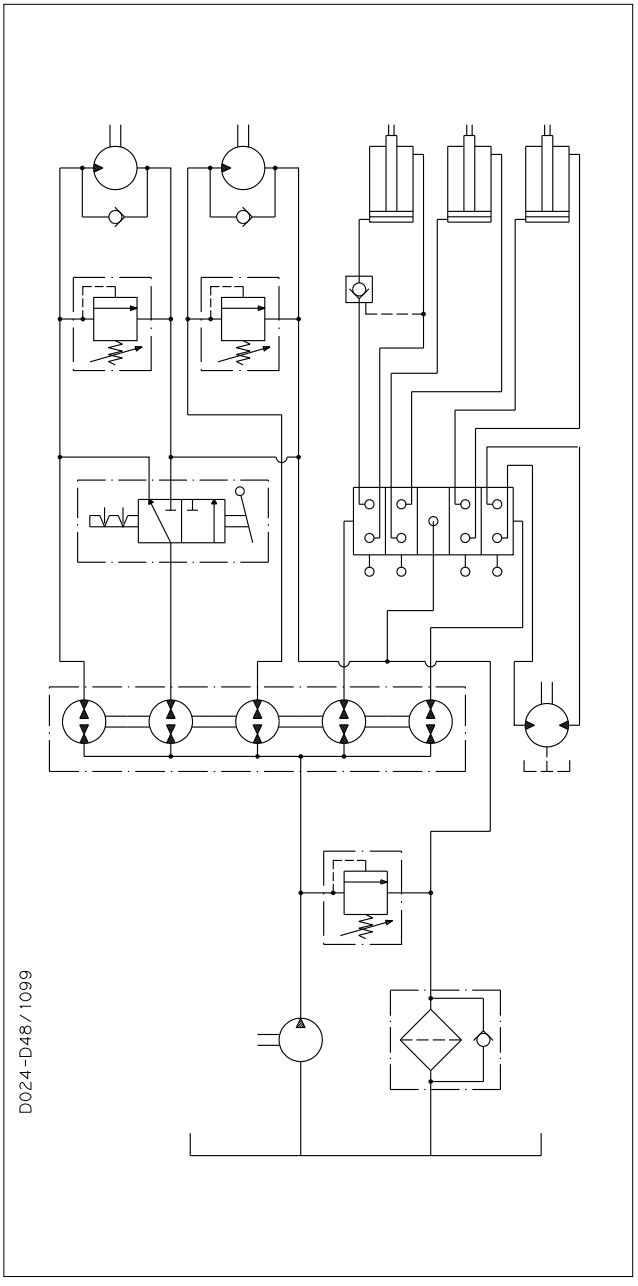


Diagram with a flow equalizer operating single acting cylinders.

02/11.2000

TYPICAL CIRCUITS FOR FLOW DIVIDERS (WITH UNEQUAL DISPLACEMENTS)





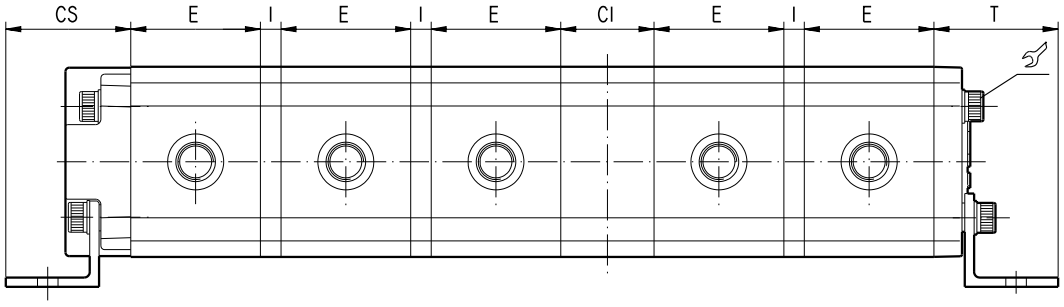
02/11.2000

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

NOTES ABOUT COMPOSITION

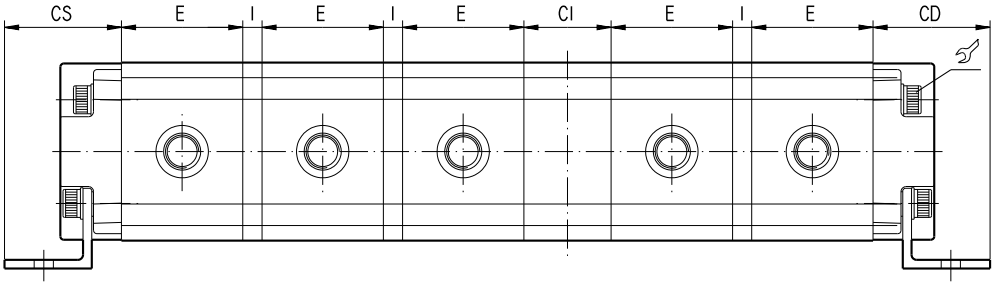
Flow divider sections are arranged in descending displacements or groups with the largest displacement to the left as viewed from the outlet ports side. Standard formats of flow dividers are given beneath; for different configurations please consult our sales department.

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)

	Max. flow for inlet section
	l/min
PLD 10	35
PLD 20	80

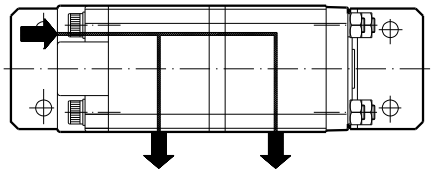
	Tightening torque
	lbf in (Nm)
PLD 10	221 (25)
PLD 20	442 (50)

02/11.2000

STANDARD COMPOSITIONS FOR SECTIONS WITH OR WITHOUT VALVE

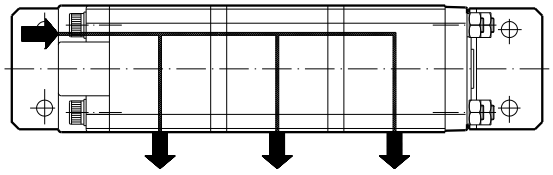
2 SECTIONS WITH 1 INLET SECTION

D024-D26/1099



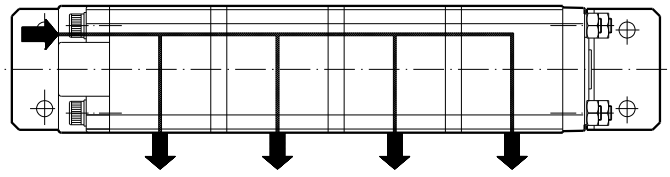
3 SECTIONS WITH 1 INLET SECTION

D024-D27/1099



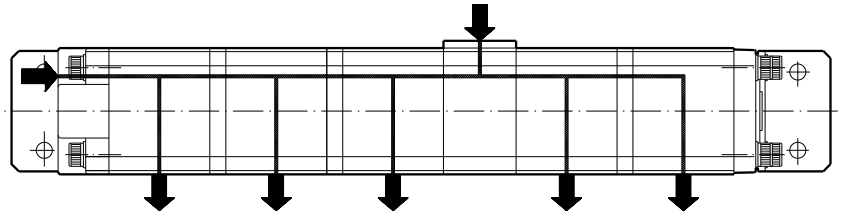
4 SECTIONS WITH 1 INLET SECTION

D024-D28/1099



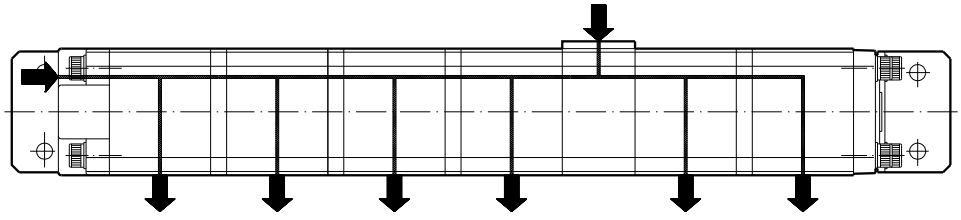
5 SECTIONS WITH 2 INLET SECTIONS

D024-D29/1099



6 SECTIONS WITH 2 INLET SECTIONS

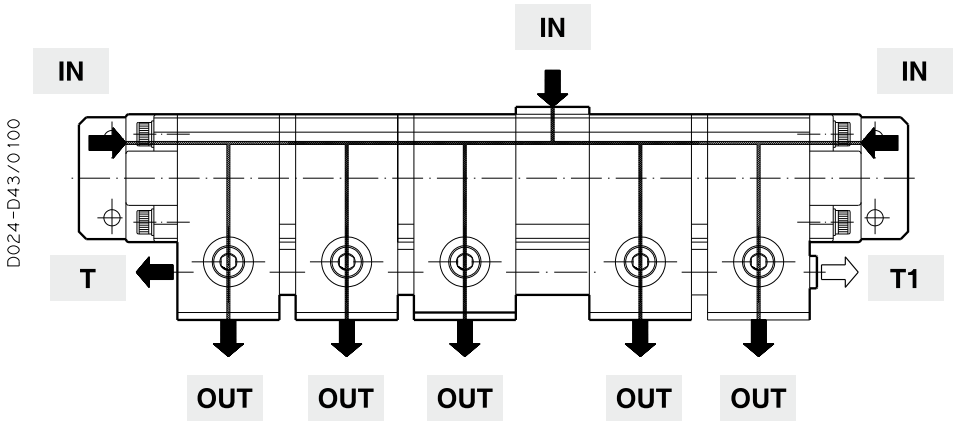
D024-D30/1099



02/11.2000

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 TYPE	GAS BSPP			SAE ODT		
	IN	OUT	T - T1	IN	OUT	T - T1
PLD 10•2	GD	GC	GC	OB	OA	OA
PLD 10•3,15						
PLD 10•4						
PLD 10•5						
PLD 10•6,3						
PLD 20•4	GE	GD	GD	OD	OC	OB
PLD 20•6,3						
PLD 20•8						
PLD 20•11,2						
PLD 20•14						
PLD 20•16						
PLD 20•20						
PLD 20•25						
PLD 20•31,5						

02/11.2000

PORTS DIMENSIONS

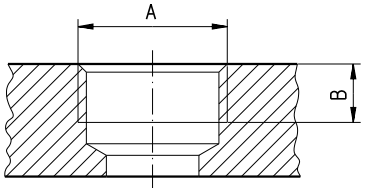
Tightening torque for low pressure side port

Tightening torque for high pressure side port [values obtained at 5075 psi (350 bar)]

Replaces: 02/11.2000

GAS STRAIGHT THREAD PORTS — BSPP

British standard pipe parallel (55°) conforms to UNI - ISO 228



D024-D45/1099

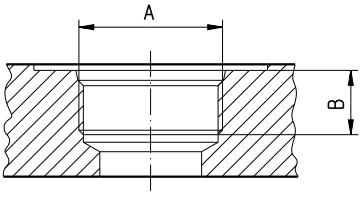
O

CODE	Nominal size	A	Ø B mm (in)	Nm (lbf in)	Nm (lbf in)
GC	3/8”	G 3/8	14 (0.551)	15 +1 (133 ÷ 142)	25 +1 (221 ÷ 230)
GD	1/2”	G 1/2	14 (0.551) 17 (◆) (0.669)	20 +1 (177 ÷ 186)	50 +2,5 (443 ÷ 465)
GE	3/4”	G 3/4	18 (0.709)	—	90 +5 (797 ÷ 841)

(◆) For POLARIS 20

SAE STRAIGHT THREAD PORTS J514 — ODT

American straight thread UNC-UNF 60° conforms to ANSI B 1.1



D024-D46/1099

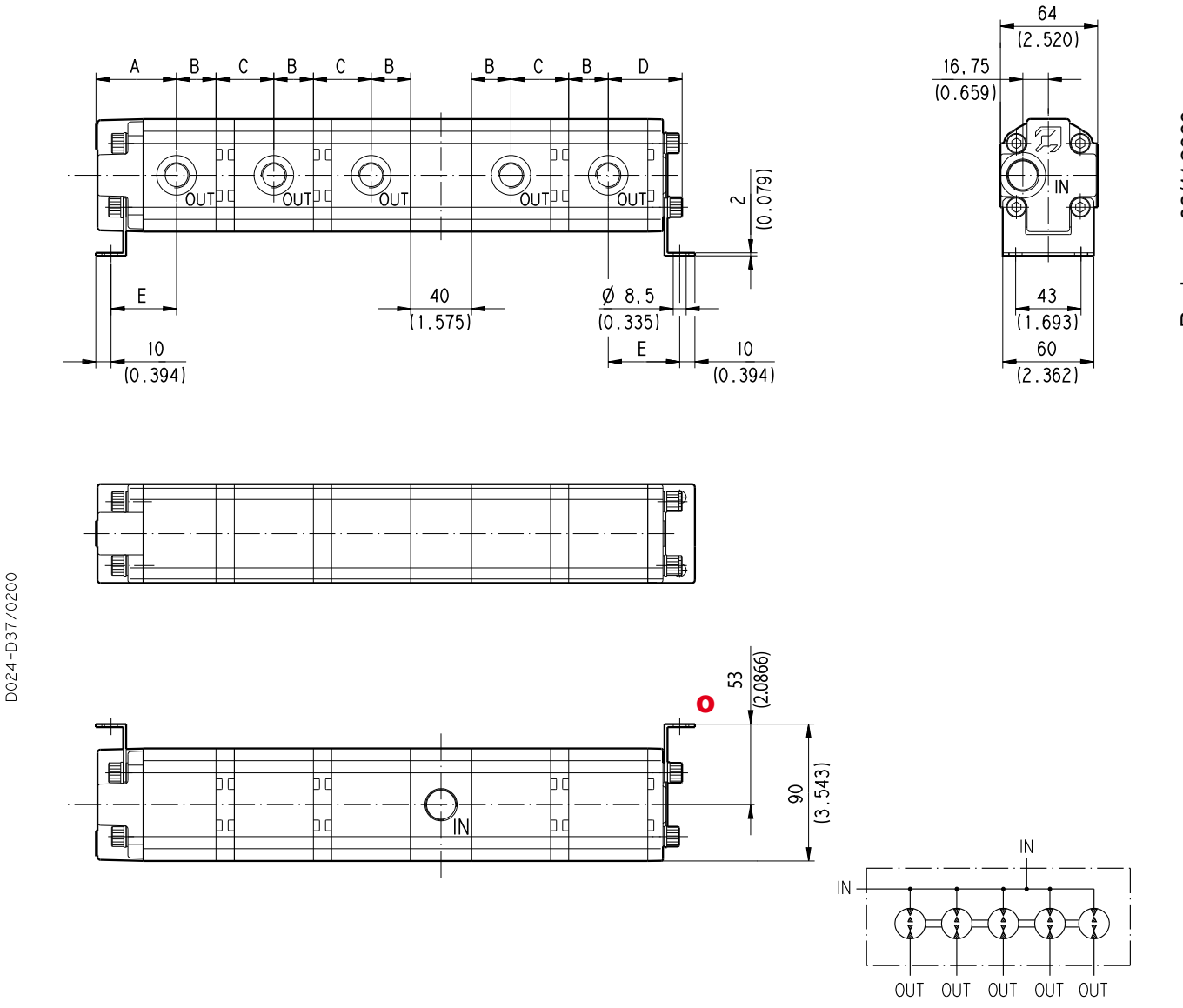
O

CODE	Nominal size	A	Ø B mm (in)	Nm (lbf in)	Nm (lbf in)
OA	3/8”	9/16” - 18 UNF - 2B	15 (0.591)	15 +1 (133 ÷ 142)	25 +1 (221 ÷ 230)
OB	1/2”	3/4” - 16 UNF - 2B	15 (0.591)	20 +1 (177 ÷ 186)	45 +2,5 (398 ÷ 420)
OC	5/8”	7/8” - 14 UNF - 2B	17 (0.669)	—	70 +5 (620 ÷ 664)
OD	3/4”	1 1/16” - 12 UNF - 2B	20 (0.787)		120 +10 (1062 ÷ 1151)

O 03/01.2013

SAME GROUP DIMENSIONS

PLD 10



D024-D37/0200

Replaces: 02/11.2000

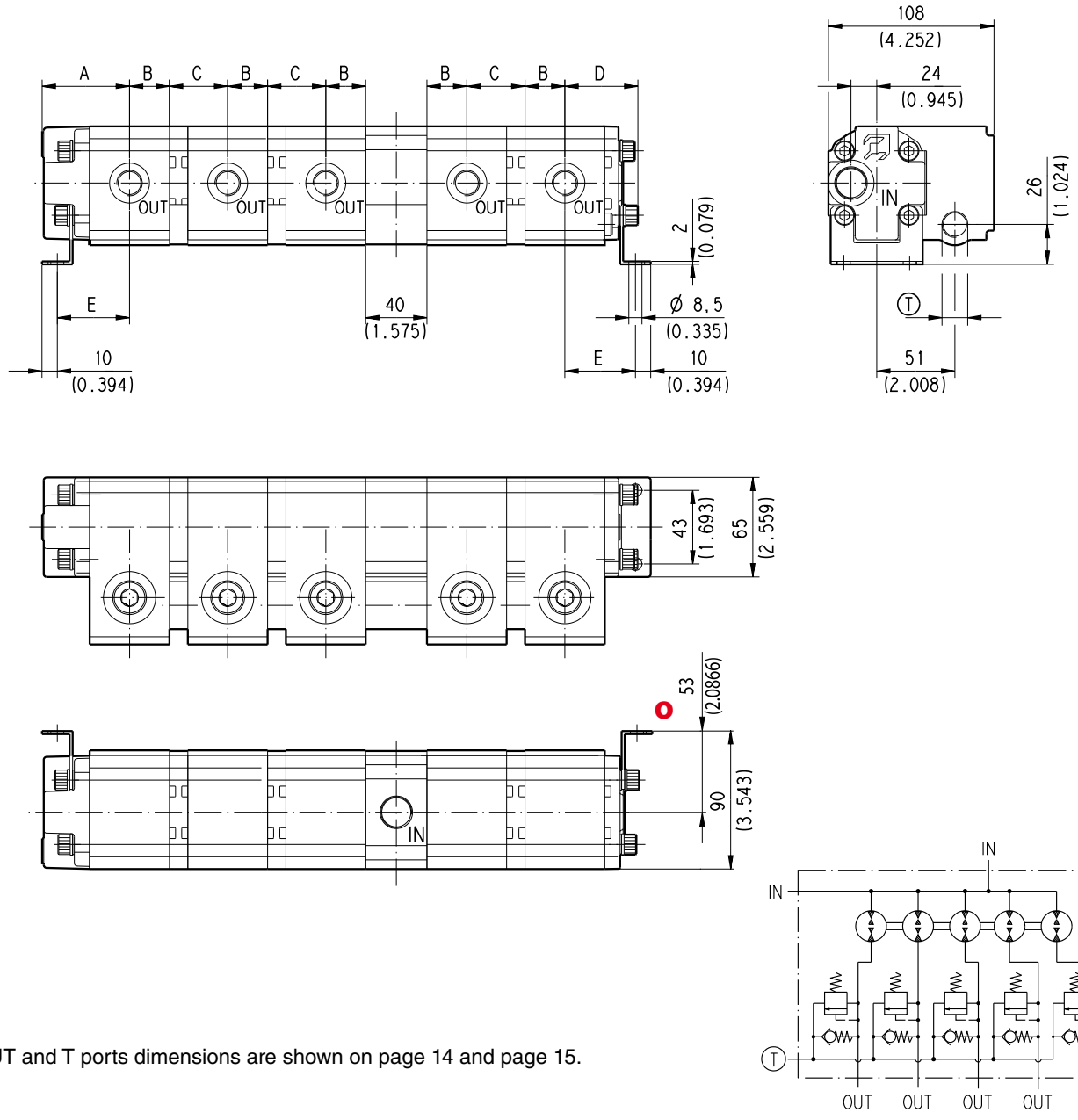
IN and OUT ports dimensions are shown on page 14 and page 15.

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

O 03/01.2013

SAME GROUP DIMENSIONS WITH VALVE PLD 10

Replaces: 02/11.2000



D024-D38/0200

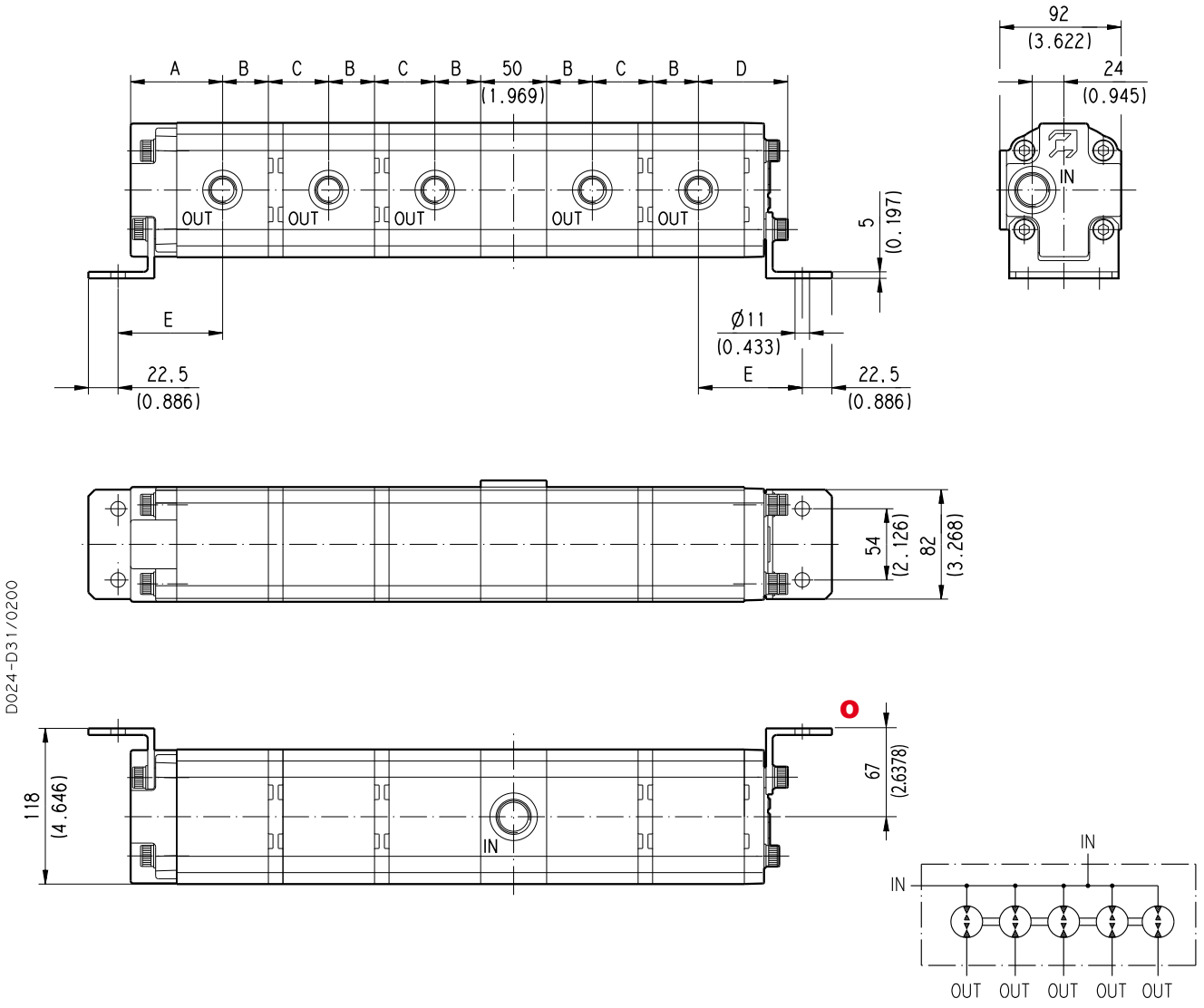
IN, OUT and T ports dimensions are shown on page 14 and page 15.

O 03/01.2013

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

SAME GROUP DIMENSIONS

PLD 20



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

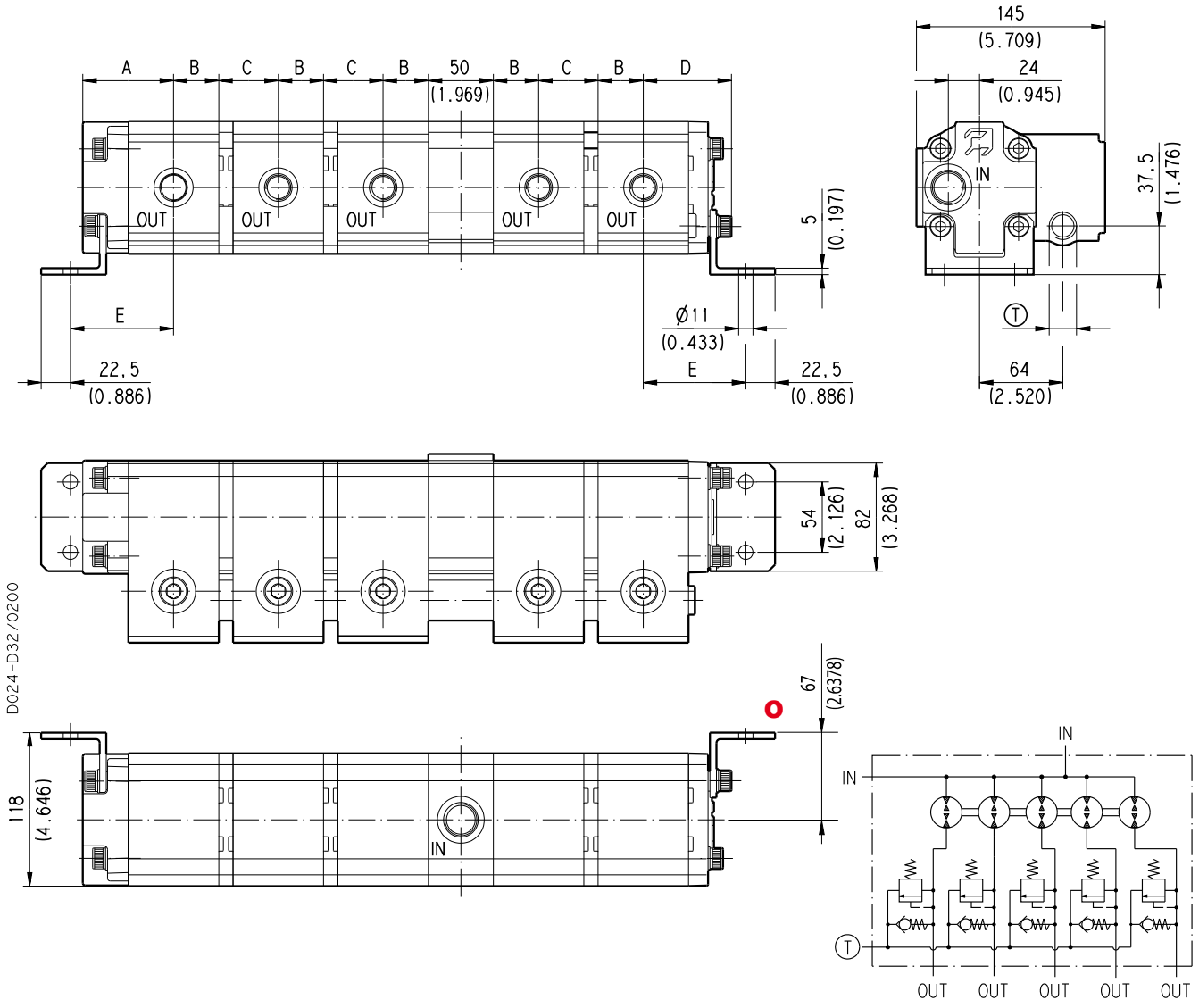
Type	A	B	C	D	E
	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)
PLD 20•4	60,8 (2.394)	25,5 (1.016)	36,8 (1.449)	58,8 (2.315)	69,8 (2.748)
PLD 20•6,3	62 (2.441)	27 (1.063)	38 (1.496)	60 (2.362)	71 (2.795)
PLD 20•8	63,3 (2.492)	28,3 (1.114)	39,3 (1.547)	61,3 (2.413)	72,3 (2.846)
PLD 20•9	63,9 (2.516)	28,9 (1.138)	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)

Replaces: 02/11.2000

O 03/01.2013

SAME GROUP DIMENSIONS WITH VALVE PLD 20

Replaces: 02/11.2000



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 (2.795)	86 (3.386)
PLD 20•31,5	82 (3.228)	47 (1.850)	58 (2.283)	80 (3.150)	91 (3.583)

O 03/01.2013

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
GAS STRAIGHT THREAD PORTS (BSPP)	
PLD 10	GD
PLD 20	GE
SAE STRAIGHT THREAD PORTS (ODT)	
PLD 10	OB
PLD 20	OD

5 Displacement	Code
PLD 10	
0.12 in³/rev (2 cm³/rev)	PLD 10•2
0.19 in³/rev (3,1 cm³/rev)	PLD 10•3,15
0.24 in³/rev (4 cm³/rev)	PLD 10•4
0.30 in³/rev (4,9 cm³/rev)	PLD 10•5
0.38 in³/rev (6,2 cm³/rev)	PLD 10•6,3
PLD 20	
0.29 in³/rev (4,8 cm³/rev)	PLD 20•4
0.39 in³/rev (6,5 cm³/rev)	PLD 20•6,3
0.50 in³/rev (8,3 cm³/rev)	PLD 20•8
0.67 in³/rev (11,1 cm³/rev)	PLD 20•11,2
0.88 in³/rev (14,4 cm³/rev)	PLD 20•14
1.01 in³/rev (16,6 cm³/rev)	PLD 20•16
1.27 in³/rev (20,8 cm³/rev)	PLD 20•20
1.58 in³/rev (26 cm³/rev)	PLD 20•25
1.99 in³/rev (32,6 cm³/rev)	PLD 20•31,5

Code	6 Outlet port dimensions
GAS STRAIGHT THREAD PORTS (BSPP)	
GC	PLD 10
GD	PLD 20
SAE STRAIGHT THREAD PORTS (ODT)	
OA	PLD 10
OC	PLD 20

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

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

Code	9 Relief valve
VPEF	Relief valve

Code	10 Valve setting [bar]
...	See page 4

Code	11 T outlet port dimensions
GAS STRAIGHT THREAD PORTS (BSPP)	
GC	PLD 10
GD	PLD 20
SAE STRAIGHT THREAD PORTS (ODT)	
OA	PLD 10
OB	PLD 20

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

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

(2) Choice the inlet selections number according to the general data on page 12 and 13.

(3) Omit this code for Buna seals.

02/11.2000

Our policy is one of continuous improvement in product. Specification of items may, therefore, be changed without notice.

NOTES

NOTES

Our policy is one of continuous improvement in product. Specification of items may, therefore, be changed without notice.

PLD 03 T A Edition: 03/01.2013 Replaces: PLD 02 T A

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FLUID POWER DESIGN

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