Gesamtkatalog für Hydraulikteile Fabrikat Duplomatic Oleodinamica (Stand 2015)

Pumpen, Druckventile, Stromventile, Rückschlagventile, Wegeventile, Zwischenplattenventile, Zylinder, Elektronik, Proportionalventile, Servoventile, Aggregate, Filter und Zubehör

Ihr Partner für Hydraulik und Pneumatik:

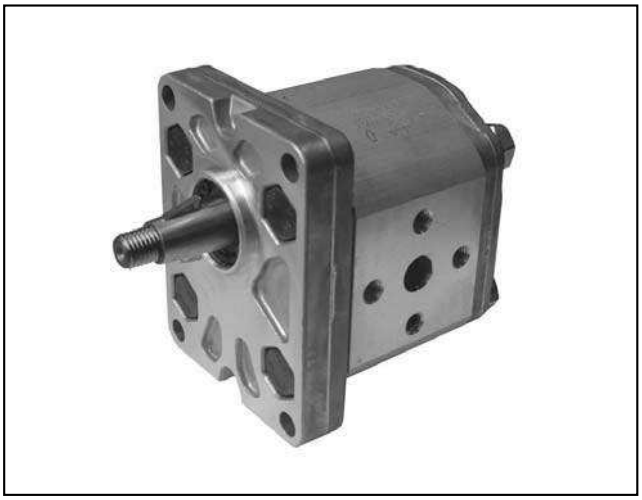
Hydro Ass Hydraulik – Steuerungstechnik GmbH

Am Brichelberg 3, 66271 Kleinblittersdorf

Tel.: 06805/2049901; Fax: 06805/2049903

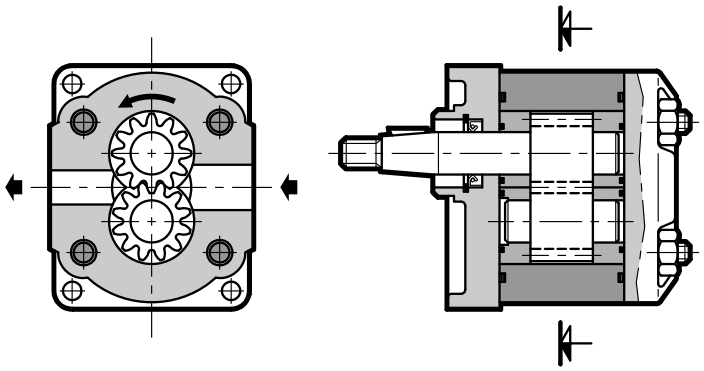
info@hydro-ass.de

www.hydro-ass.de – www.hydraulikhandel-saarland.de



GP
EXTERNAL GEAR PUMPS
SERIES 20

OPERATING PRINCIPLE



— The GP pumps are fixed displacement external gear pumps with axial clearance compensation.

— They give high volumetric flows even with high operating pressures, a low noise level, and they have a high endurance thanks to the balancing system of the loads on the guide bushings.

— They are divided into three size groups, with displacements of up to 9,1 - 27,9 and 87,6 cm^3/rev respectively, and with operating pressures of up to 250 bar (standard) and up to 310 bar (version for high pressures H).

— They are available with clockwise, anticlockwise and reversible rotation, with tapered shaft (standard). Other kind of shaft are available upon request.

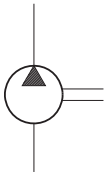
— They are available in multiple versions, and can be combined in multi-flow groups, with a splined connection motion system that guarantees high power performances.

TECHNICAL SPECIFICATIONS

GP PUMP SIZE		GP1	GP2	GP3
Displacement range	cm^3/rev	1.3 ÷ 9.1	7 ÷ 27.9	20.7 ÷ 87.6
Flow rate and operating pressures		see table 3 - Performances		
Rotation speed		see table 3 - Performances		
Rotation direction		clockwise, anticlockwise or reversible (seen from the shaft side)		
Loads on the shaft		radial and axial load are not allowed		
Max torque applicable to the shaft		see paragraph 14.1		
Hydraulic connection		flanged fittings (see paragraph 16)		
Type of mounting		4 hole flange - rectangular type		
Mass: standard version version H	kg	1.2 ÷ 1.6 1.9 ÷ 2.3	2.6 ÷ 3.5 3.8 ÷ 4.7	6 ÷ 8.5 8.7 ÷ 11.2

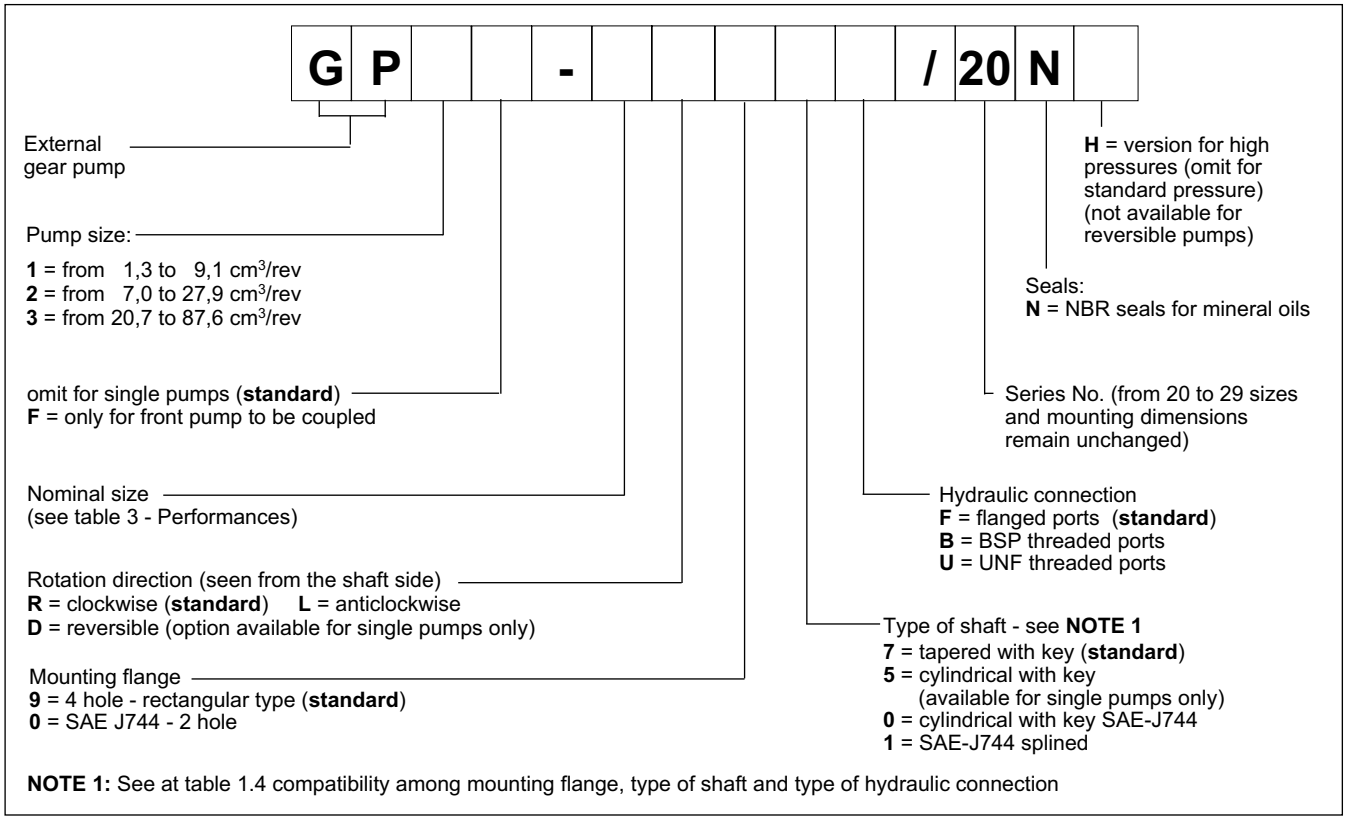
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-15 / +80
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	25 ÷ 100

HYDRAULIC SYMBOL



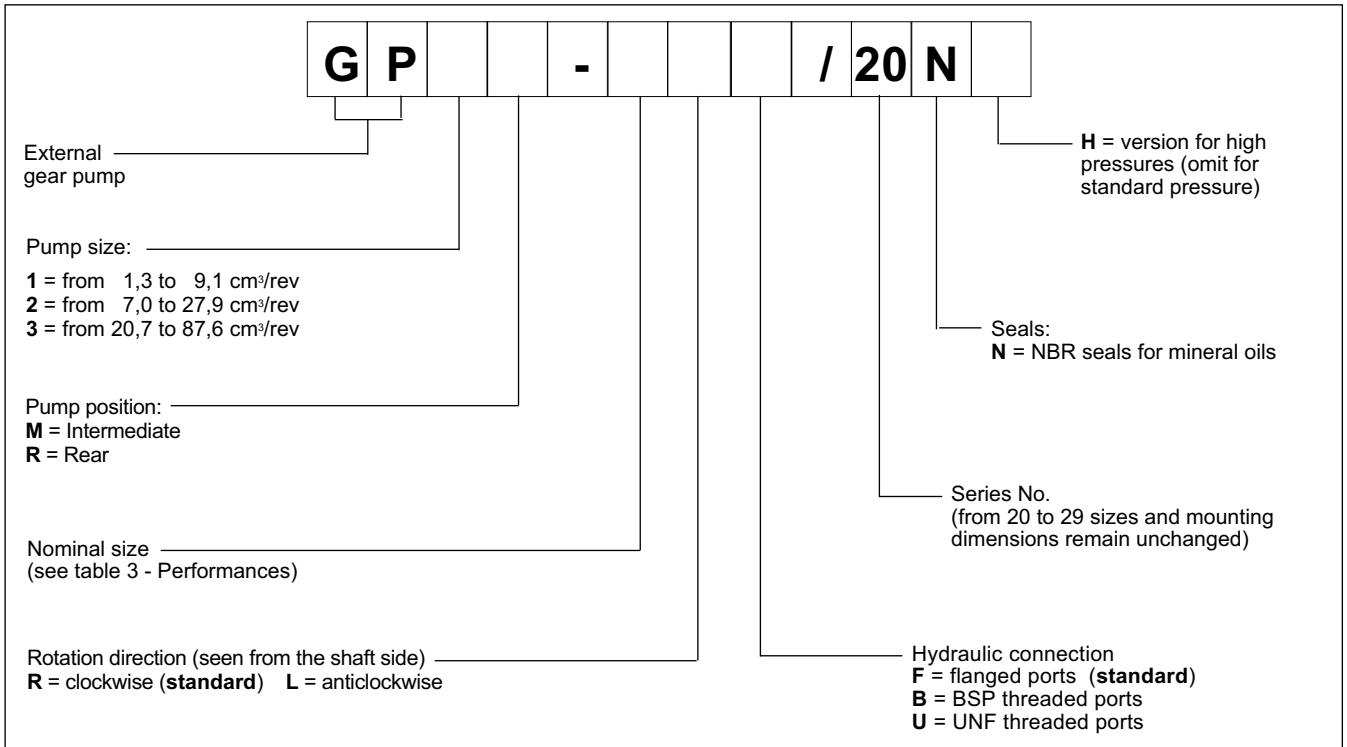
1 - IDENTIFICATION CODE

1.1 - Identification code for single and front pumps



NOTE 1: See at table 1.4 compatibility among mounting flange, type of shaft and type of hydraulic connection

1.2 - Identification code for intermediate and rear pumps



NOTE 2: Front, intermediate or rear pumps for multiple groups are supplied without mating joint, which must be ordered separately (see paragraph 1.5). To order a group of one or more pumps completely assembled see paragraph 1.3.

1.3 - Identification code for multiple pumps

identification code front pump **+** identification code intermediate pump (omit for double pumps) **+** identification code rear pump

1.4 - Compatibility among mounting flange, type of shaft and type of hydraulic connection

FLANGE CODE	SHAFT CODE				HYDRAULIC CONNECTION CODE		
	7	5	0	1	F	B	U
9	yes	yes	no	no	yes	yes	no
0	no	no	yes	yes	yes	no	yes

1.5 - Identification code for mating joints

FIRST PUMP	SECOND PUMP		
	GP1	GP2	GP3
GP1	3101100003	-	-
GP2	3101100004	3101100005	-
GP3	3101100006	3101100007	3101100008

1.6 - Examples

a) single pump size 1 - 1,3 cm^3/rev - anticlockwise rotation - standard flange and shaft
GP1-0013L97F/20N

b) single pump size 2 - 14 cm^3/rev - clockwise rotation - standard flange and shaft
GP2-0140R97F/20N

c) single pump size 3 - 22,5 cm^3/rev - clockwise rotation - SAE flange and shaft
GP3-0225R01F/20N

d) double pump made of: - pump size 2 - 7 cm^3/rev
- pump size 1 - 2 cm^3/rev - high pressure
GP2F-0070R97F/20N + GP1R-0020RF/20NH

e) triple pump made of: - pump size 3 - 22,5 cm^3/rev
- pump size 2 - 14 cm^3/rev
- pump size 1 - 2 cm^3/rev
GP3F-0225R97F/20N + GP2M-0140RF/20N + GP1R-0020RF/20N

2 - HYDRAULIC FLUID

2.1 Type of fluid

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives, in conformity with the requisites of the following standards:
- FZG test - 11th stage
- DIN 51525
- VDMA 24317

For use with other types of fluid (water glycol, phosphate esters and others), consult our technical dept.

Operation with fluid at a temperature greater than 80°C causes a premature deterioration of the fluid quality and of the seals.
The physical and chemical properties of the fluid must be maintained.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	12 cSt	referred to the maximum fluid temperature of 80 °C
optimum viscosity	25 ÷ 100 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	600 cSt	limited to only the start-up phase of the pump

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with $\beta_{20} \geq 75$ is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with $\beta_{10} \geq 100$ is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 13. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

3 - PERFORMANCE RATINGS (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

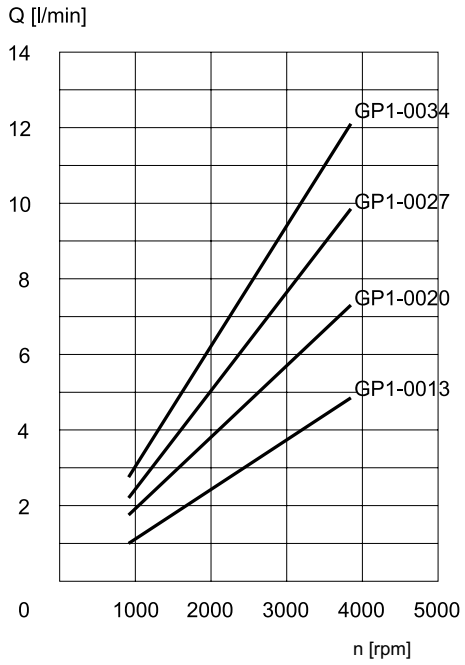
The nominal dimensions indicated in the table are those available for standard pumps.

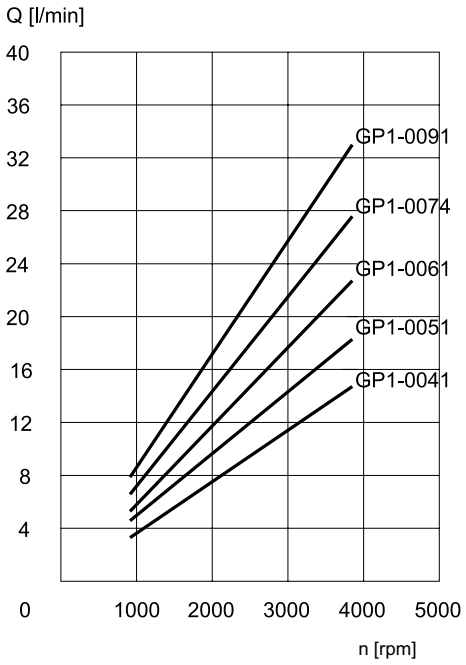
PUMP SIZE	NOMINAL SIZE	DISPLACEMENT [cm3/rev]	MAX FLOW RATE (at 1500 rpm) [l/min.]	MAX OPERATING PRESSURE (at 1500 rpm) [bar]	MAX PEAK PRESSURE (at 1500 rpm) [bar]	MAX ROTATION SPEED [rpm]	MIN ROTATION SPEED [rpm]
GP1	**0013**	1,3	2,0	250 (270)	290 (310)	6000	800
	0020	2,0	3,0				
	0027	2,7	4,0			5000	
	0034	3,4	5,1				
	0041	4,1	6,1			4000	
	0051	5,1	7,6	230 (260)	260 (290)		
	0061	6,1	9,1			3800	
	0074	7,4	11,1	200	230	3200	600
	0091	9,1	13,6	180	210	2600	
GP2	**0070**	7,0	10,5	250 (280)	290 (310)	4000	600
	0095	9,5	14,2			3000	
	0113	11,3	16,9	230 (260)	270 (300)	4000	
	0140	14,0	21,0				
	0158	15,8	23,7	210 (260)	240 (290)		500
	0178	17,8	26,7			3600	
	0208	20,8	31,2	180 (230)	210 (260)	3200	
	0234	23,4	35,1			3000	
	0279	27,9	41,8	170 (200)	200 (230)	2500	
GP3	**0207**	20,7	31,0	230 (280)	270 (310)	3500	500
	0225	22,5	33,7				
	0264	26,4	39,6			3000	
	0337	33,7	50,5				
	0394	39,4	59,1	220 (260)	260 (290)		
	0427	42,7	64,0	210 (250)	250 (280)	2800	400
	0514	51,4	77,1	200 (230)	240 (260)	2400	
	0600	60,0	90,0	190	220	2800	
	0696	69,6	104,4	170	200	2500	
	0776	77,6	116,4	160	190	2300	
	0876	87,6	131,4	140	170	2000	

NOTE: The values in parentheses refer to the version **H,** for high pressures.

4 - CURVES AND CHARACTERISTIC DATA OF GROUP GP1 PUMPS (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

4.1 - Flow rate curves Q=f (n) obtained with operating pressure 0 bar





4.2 - Efficiencies

PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
0013	0,90	0,82
0020	0,90	0,85
0027	0,95	0,90
0034	0,91	0,87
0041	0,94	0,90
0051	0,96	0,92
0061	0,96	0,92
0074	0,96	0,90
0091	0,96	0,88

The volumetric and total efficiencies for the various nominal dimensions of the Group GP1 pumps, measured at 1500 rpm and with 150 bar operating pressure, are shown in the table.

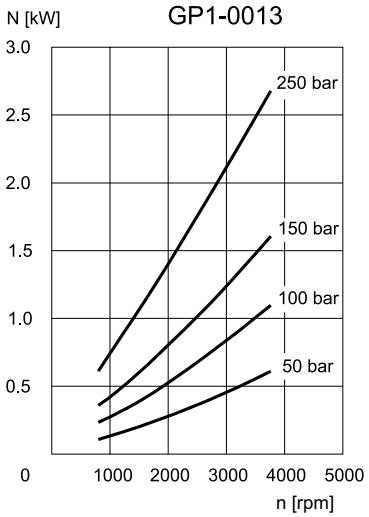
The total efficiency considers the volumetric efficiency and the mechanical efficiency of the pump in the specified operating conditions.

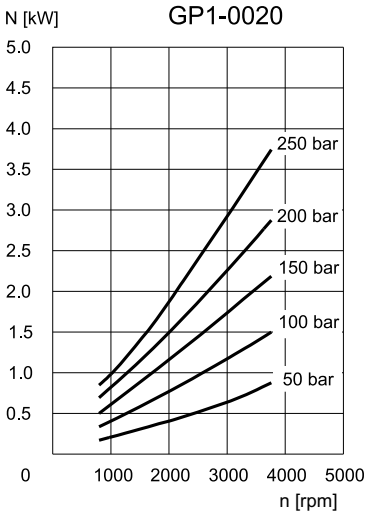
4.3 - Noise level

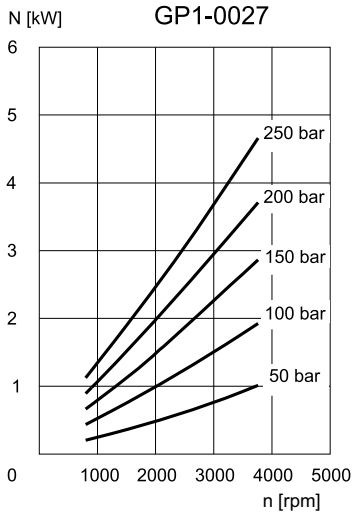
PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
0013	65
0020	66
0027	68
0034	68
0041	70
0051	73
0061	73
0074	73
0091	77

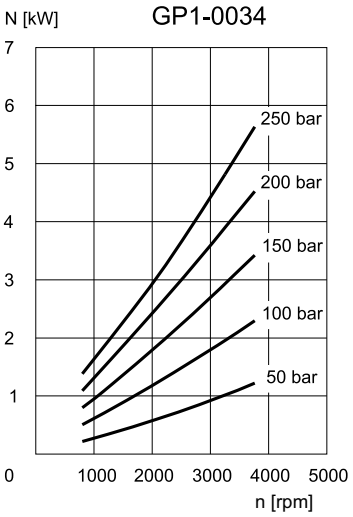
The noise levels for the various nominal dimensions of the Group GP1 pumps, measured at 1500 rpm, with 150 bar operating pressure and measured at a distance of 1 metre from the pump, are shown in the table.

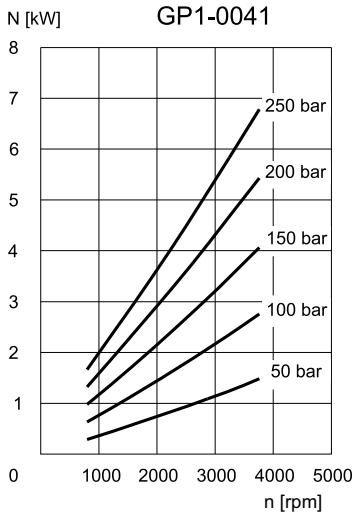
4.4 - Absorbed power curves N=f (n), measured with operating pressures from 50 to 250 bar

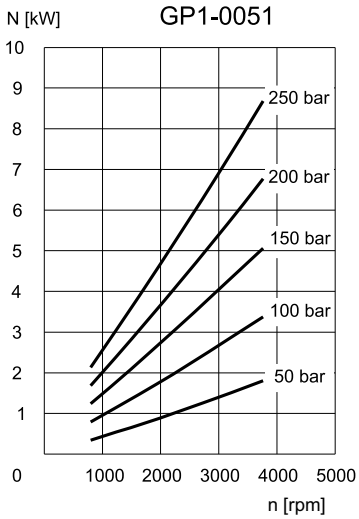


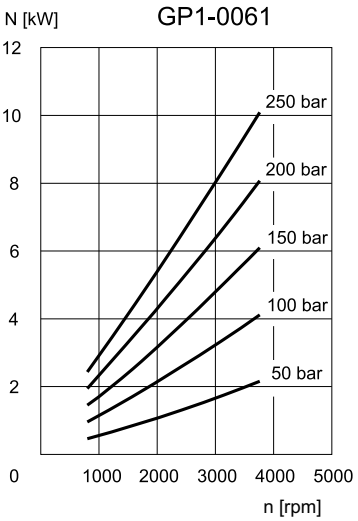


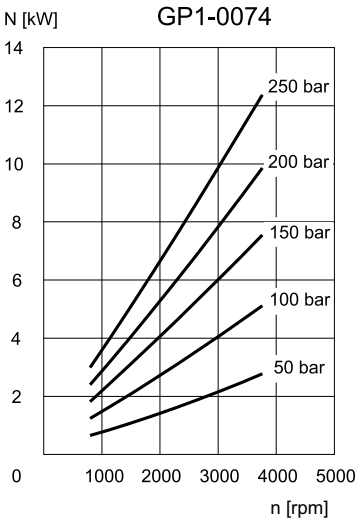


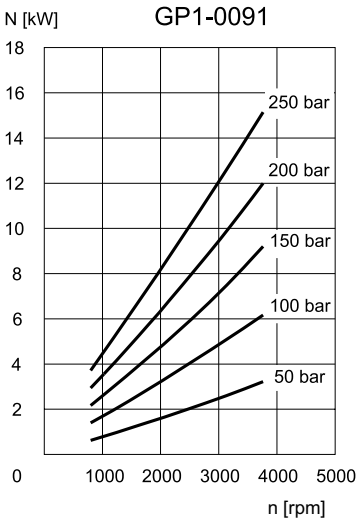






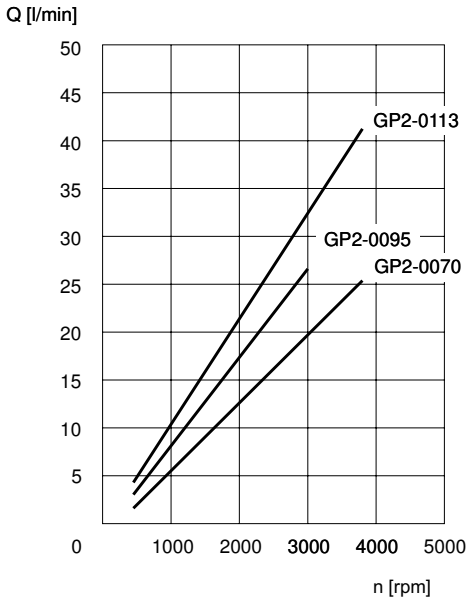


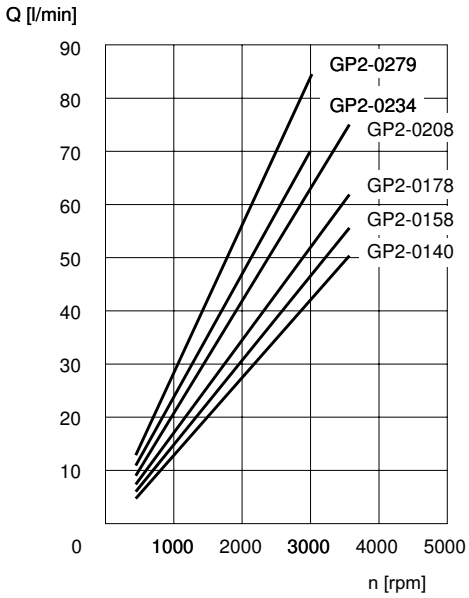




5 - CURVES AND CHARACTERISTIC DATA OF GROUP GP2 PUMPS (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

5.1 - Flow rate curves Q=f (n) obtained with operating pressure 0 bar





5.2 - Efficiencies

PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
0070	0,92	0,87
0095	0,95	0,88
0113	0,95	0,87
0140	0,93	0,87
0158	0,95	0,86
0178	0,93	0,85
0208	0,93	0,88
0234	0.97	0,89
0279	0,94	0,85

The volumetric and total efficiencies for the various nominal dimensions of the Group GP2 pumps, measured at 1500 rpm and with 150 bar operating pressure, are shown in the table.

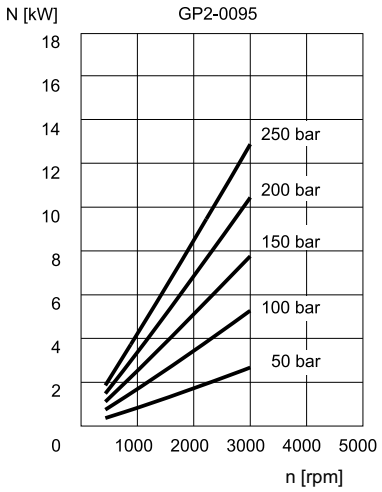
The total efficiency considers the volumetric efficiency and the mechanical efficiency of the pump in the specified operating conditions.

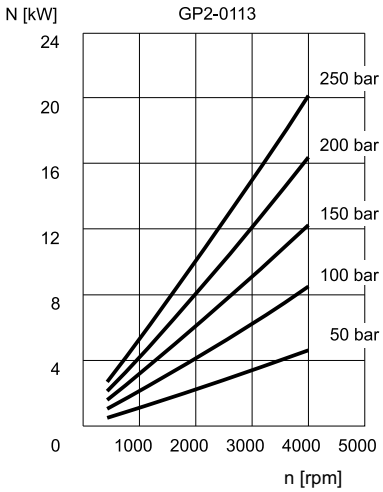
5.3 - Noise level

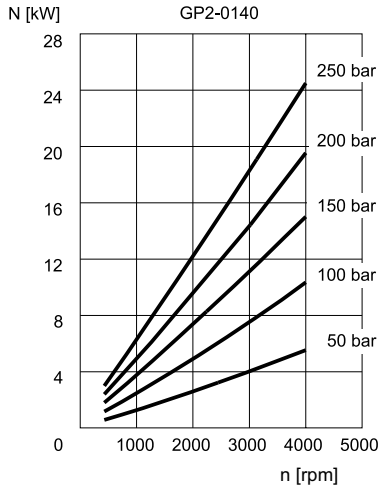
PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
0070	75
0095	77
0113	77
0140	72
0158	72
0178	73
0208	74
0234	76
0279	76

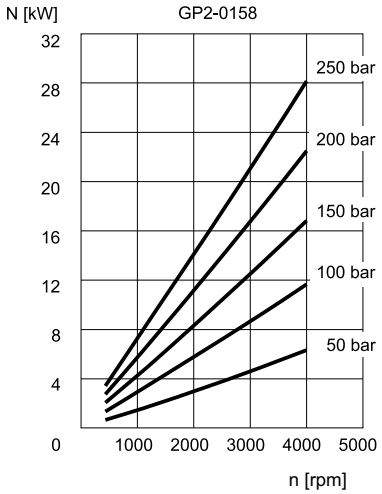
The noise levels for the various nominal dimensions of the Group GP2 pumps, measured at 1500 rpm, with 150 bar operating pressure and measured at a distance of 1 metre from the pump, are shown in the table.

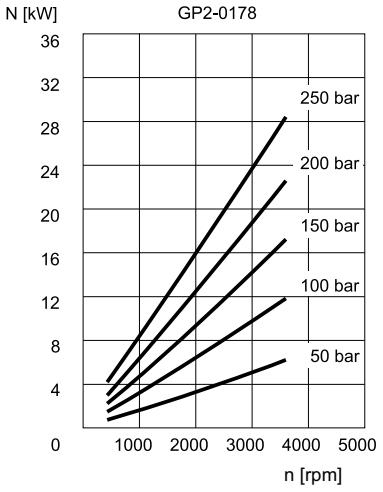
5.4 - Absorbed power curves N=f (n), measured with operating pressures from 50 to 250 bar

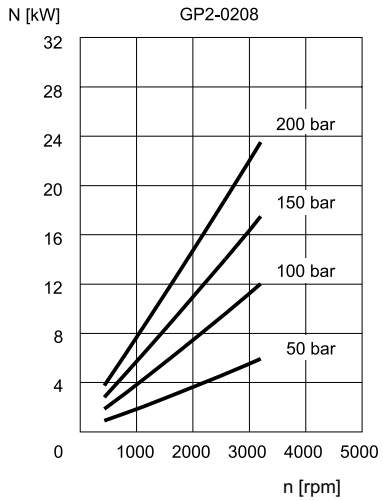


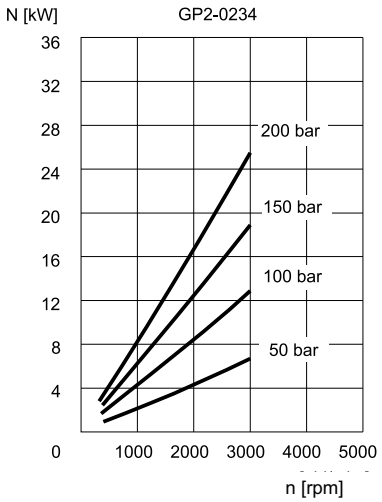


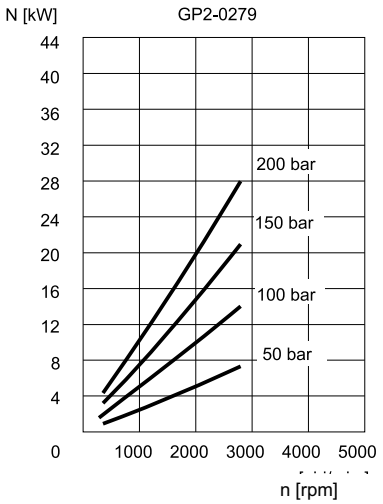






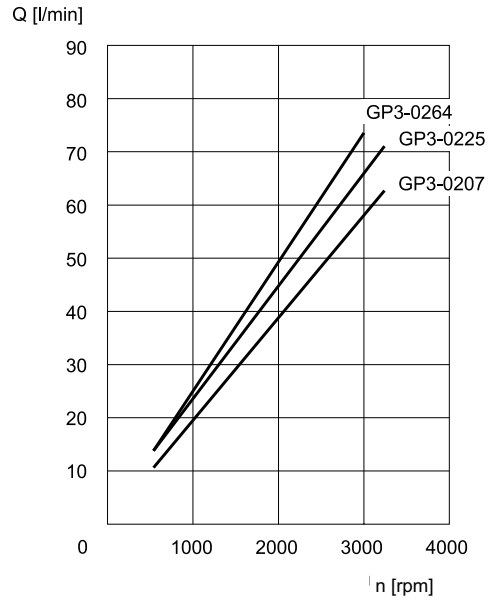


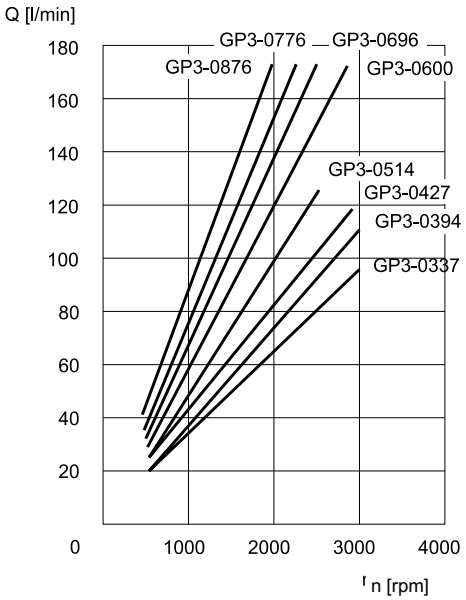




6 - CURVES AND CHARACTERISTIC DATA OF GROUP GP3 PUMPS (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

6.1 - Flow rate curves Q=f (n) obtained with operating pressure 0 bar





6.2 - Efficiencies

PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
0207	0,88	0,83
0225	0,97	0,92
0264	0,90	0,84
0337	0,92	0,87
0394	0,91	0,86
0427	0,92	0,82
0514	0,93	0,83
0600	0,85	0,82
0696	0,95	0,90
0776	0,93	0,87
0876	0,89	0,84

The volumetric and total efficiencies for the various nominal dimensions of the Group GP3 pumps, measured at 1500 rpm and with 150 bar operating pressure, are shown in the table.

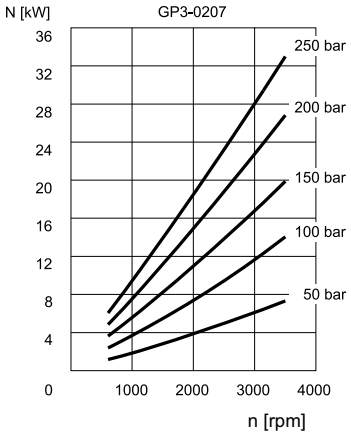
The total efficiency considers the volumetric efficiency and the mechanical efficiency of the pump in the specified operating conditions.

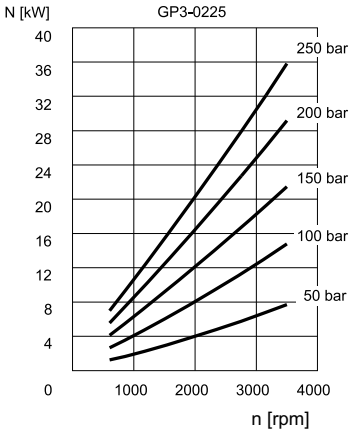
6.3 - Noise level

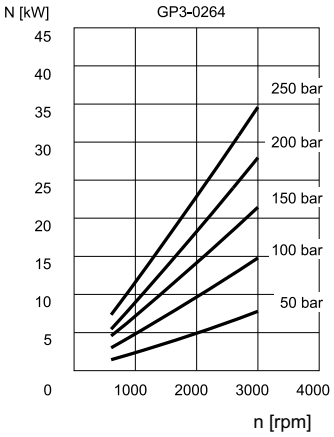
PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
0207	75
0225	75
0264	76
0337	72
0394	72
0427	73
0514	75
0600	77
0696	77
0776	76
0876	78

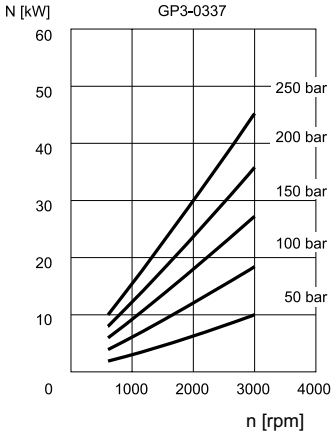
The noise levels for the various nominal dimensions of the Group GP3 pumps, measured at 1500 rpm, with 150 bar operating pressure and measured at a distance of 1 metre from the pump, are shown in the table.

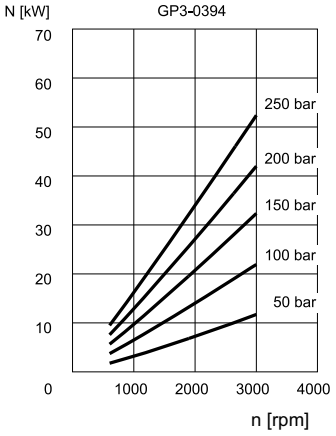
6.4 - Absorbed power curves N=f (n), measured with operating pressures from 50 to 250 bar

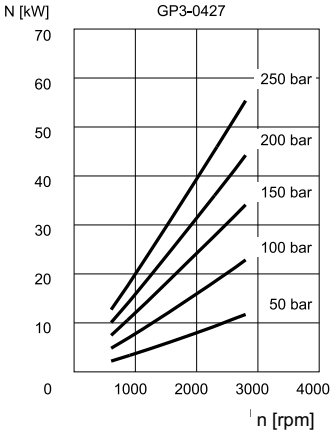


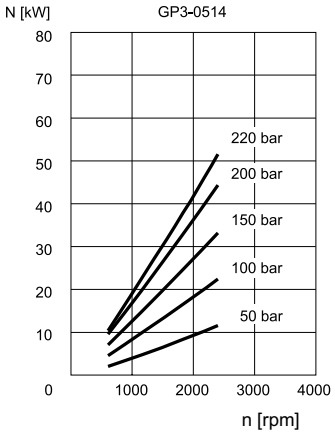


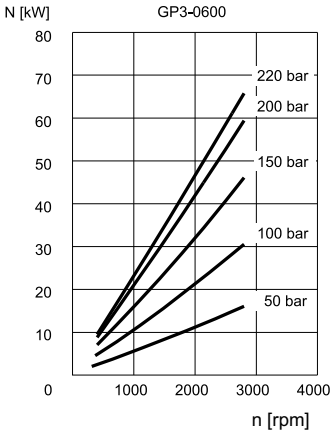


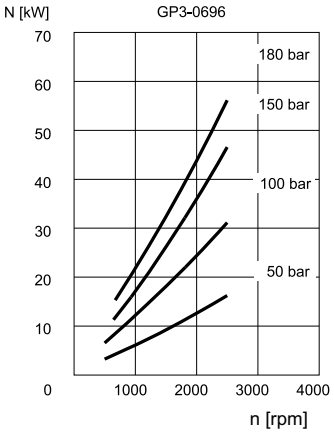


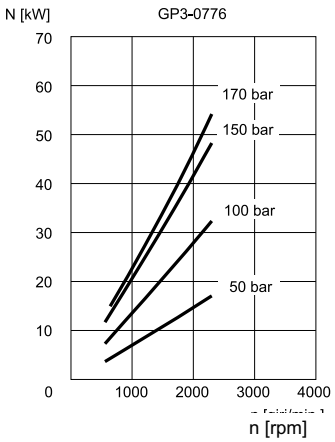


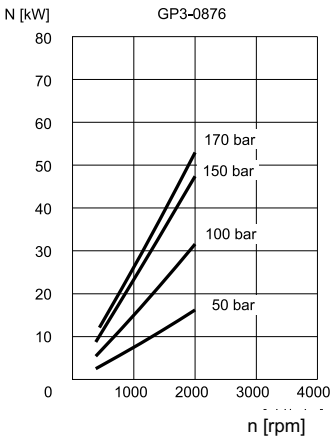






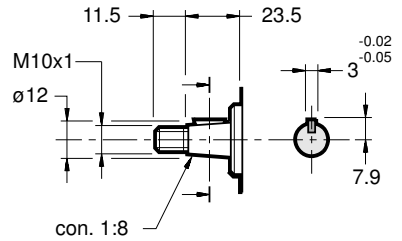




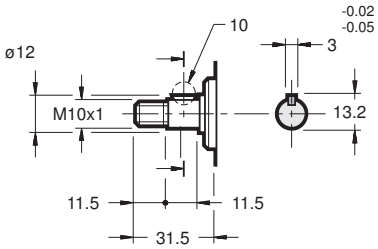


7 - GROUP GP1 PUMPS OVERALL AND MOUNTING DIMENSIONS with standard flange

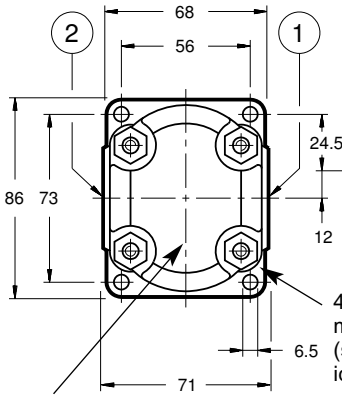
dimensions in mm



tapered shaft end
(standard, identification code **7**)

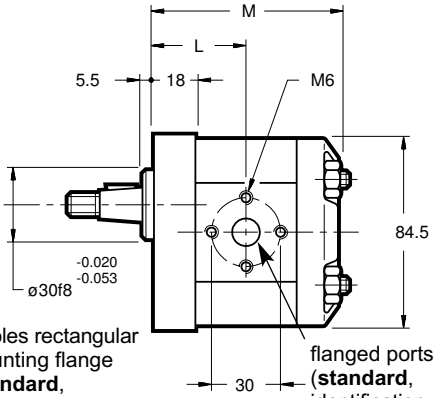


cylindrical with key shaft end
(identification code: **5**)



drainage port 1/4" BSP on reversible pump only

4 holes rectangular mounting flange (**standard**, identification code **9**)



flanged ports (**standard**, identification code **F**)

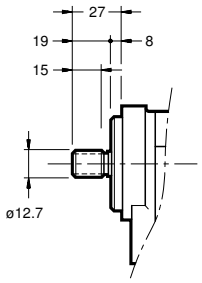
also available with BSP ports (identification code **B**)

pump nominal dimension	L	M	1 suction port clockwise rotation		2 delivery port clockwise rotation	
			flange	BSP	flange	BSP
0013	40	80,5	Ø13	1/2"	Ø13	3/8"
0020	41	82,5				
0027	42	84,5				
0034	43	86,5				
0041	44	88,5				1/2"
0051	45,5	91,5				
0061	47	94,5				
0074	49	98,5				
0091	51,5	103,5				

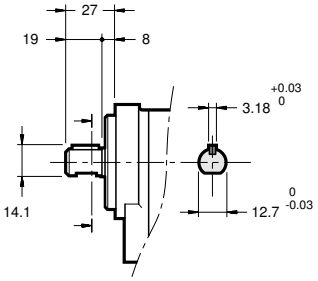
NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

8 - GROUP GP1 PUMPS OVERALL AND MOUNTING DIMENSIONS with SAE flange

splined shaft end
SAE J744 20/40 d.p. - 9T
(standard, id. code **1**)



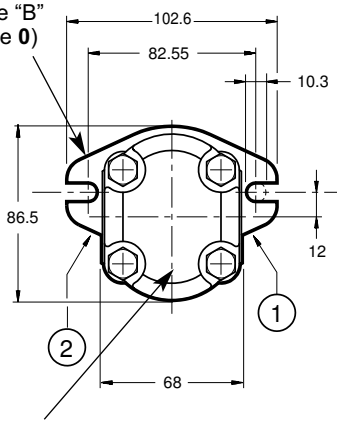
cylindrical shaft end SAE J744
(identification code: **0**)



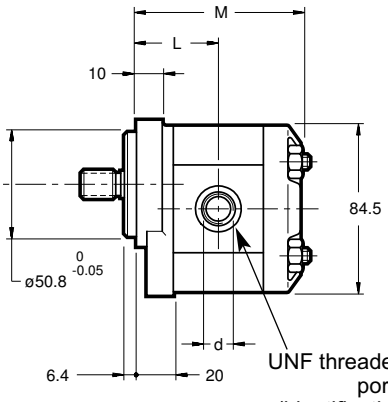
NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

2 holes SAE J744 flange - type "B" (identification code **0**)

dimensions in mm



drainage port 1/4" BSP on reversible pump only

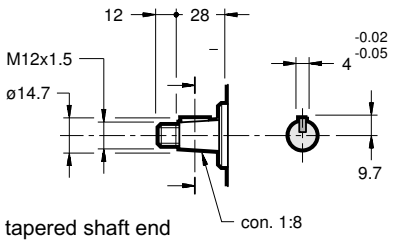


UNF threaded ports (identification code **U**)

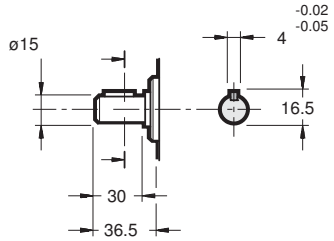
Pump nominal dimension	L	M	1 suction port clockwise rotation		2 delivery port clockwise rotation	
			flange	UNF	flange	UNF
0013	42	82,5	∅ 13	3/4" - 16 UNF	∅ 13	9/16" - 18 UNF
0020	43	84,5				
0027	44	86,5				
0034	45	88,5				
0041	46	90,5				
0051	47,5	93,5				
0061	49	96,5				
0074	51	100,5		7/8" - 14 UNF		3/4" - 16 UNF
0091	53,5	105,5				

9 - GROUP GP2 PUMPS OVERALL AND MOUNTING DIMENSIONS with standard flange

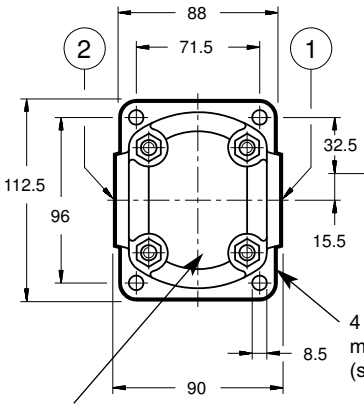
dimensions in mm

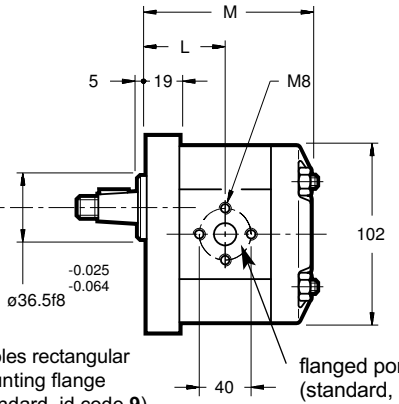


tapered shaft end
(standard, id. code **7**)



cylindrical with key shaft end
(id code: **5**)



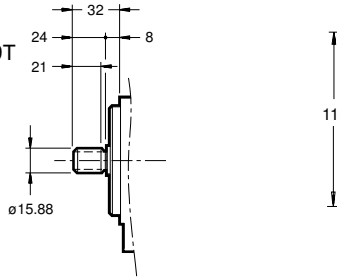


NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

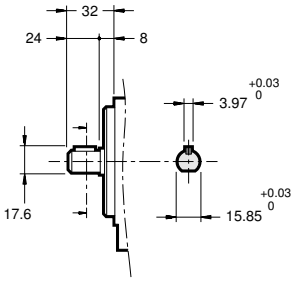
pump nominal dimension	L	M	1 suction port clockwise rotation		2 delivery port clockwise rotation	
			flange	BSP	flange	BSP
0070	47,5	97,5	Ø13	1/2"	Ø13	1/2"
0095	49,5	101,5				
0113	51	104,5	Ø19	3/4"		
0140	53	108,5				
0158	54,5	111,5				
0178	56	114,5				
0218	58,5	119,5			Ø19	
0234	60,5	123,5				
0279	64	130,5				

10 - GROUP GP2 PUMPS OVERALL AND MOUNTING DIMENSIONS with SAE flange

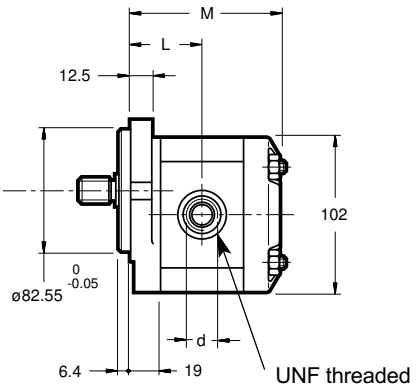
dimensions in mm



splined shaft end
SAE J744 6/32 d.p. - 9T
(standard, id. code **1**)



cylindrical shaft end
SAE J744
(id. code: **0**)

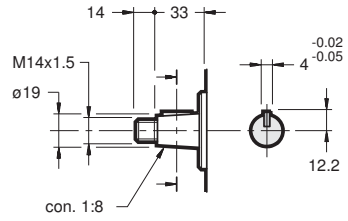


NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

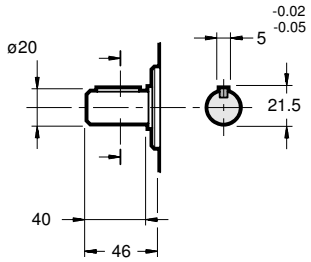
Pump nominal dimension	L	M	1 suction port clockwise rotation		2 delivery port clockwise rotation	
			flange	UNF	flange	UNF
0070	47,5	97,5	∅ 13	11/16" 12 UNF	∅ 13	7/8" 14 UNF
0095	49,5	101,5				
0113	51	104,5	∅ 19			
0140	53	108,5				
0158	54,5	111,5				
0178	56	114,5				
0208	58,5	119,5			∅ 19	
0234	60,5	123,5				
0279	64	130,5				

11 - GROUP GP3 PUMPS OVERALL AND MOUNTING DIMENSIONS with standard flange

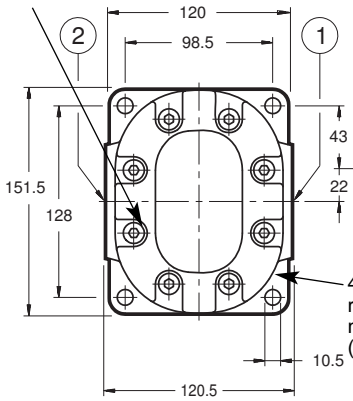
tapered shaft end
(standard, id. code **7**)

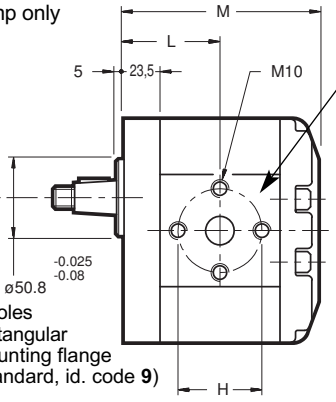


cylindrical with key shaft end
(id. code: **5**)



drainage port 3/8" BSP on reversible pump only





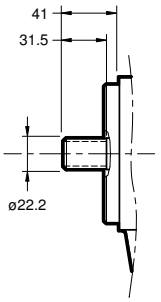
dimensions in mm

Pump nominal dimension	L	M	H	1suction port clockwise rot.		2 delivery port clockwise rot.	
				flange	BSP	flange	BSP
0207	64	129,5	56	∅ 27	3/4"	∅ 19	3/4"
0225	64,5	130,5	56				
0264	66	133,5	56		1"		
0337	68,5	138,5	56				
0394	70,5	142,5	56				
0427	72	145,5	51		1 1/4"	∅ 27	1"
0514	75	151,5	56				
0600	78	157,5	62*	∅ 33			
0696	81,5	164,5	62*		1 1/2"		1 1/4"
0776	84	169,5	62*				
0876	87	175,5	62*				

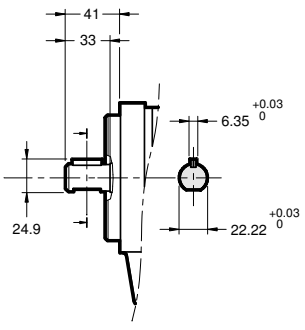
NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction
3. On dimension H, the values marked with * refer to the suction port only, whereas the delivery port dimension is 51 mm

12 - GROUP GP3 PUMPS OVERALL AND MOUNTING DIMENSIONS with SAE flange

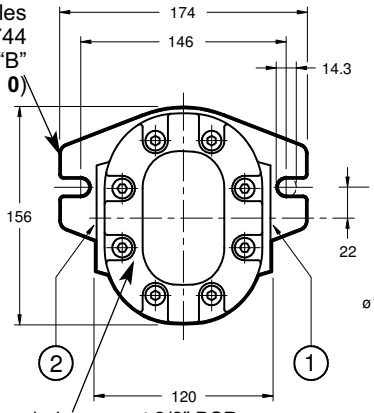
SAE J744 splined shaft end
16/32 d.p. - 13T
(standard, id. code **1**)



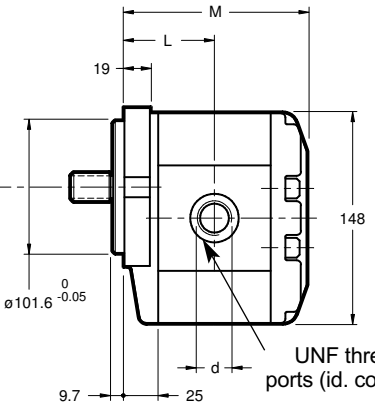
SAE J744 cylindrical shaft end
(id. code: **0**)



2 holes
SAE J744
flange type "B"
(id.code **0**)



drainage port 3/8" BSP on
reversible pump only



dimensions in mm

Pump nominal dimension	L	M	1suction port clockwise rot.		2 delivery port clockwise rot.	
			flange	UNF	flange	UNF
0207	65	130,5	∅ 27	15/16" 12 UNF	∅ 19	11/16" 12 UNF
0225	65,5	131,5				
0264	67	134,5				
0337	69,5	139,5				
0394	71,5	143,5		15/8" 12 UNF	∅ 27	15/16" 12 UNF
0427	73	146,5				
0514	76	152,5				
0600	79	158,5	∅ 33	17/8" 12 UNF		
0696	82,5	165,5				
0776	85	170,5				
0876	88	176,5				

NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

13 - INSTALLATION

- The GP gear pumps can be installed with the shaft oriented in any position.
- Be sure the control rotation direction corresponds to the direction of the arrow marked on the pump before putting the pump into operation.
- **Before starting, the pump body has to be filled with the fluid.**
- It is necessary to vent the air from the delivery connection before operating it the first time.
- The pump start up, especially at a cold temperature, should occur with the pump unloading.
- The suction line must be suitably sized to facility the flow of the oil. Bends and restrictions or an excessive line length can impede correct operation of the pump. It is advisable that the speed of 1 ÷ 2 m/sec is not exceeded in the suction line.
- The minimum suction pressure allowed is -0,3 bar relative. The pumps can not function with suction pressure.
- The gear pumps must not operate with a rotation rating of less than the minimum rotation speed (see table 3 - performance ratings). They must be filled with the same plant operation oil before installation. Filling is done through the connection lines. If necessary, rotate the pump manually.
- The motor-pump connection must be carried out directly with a flexible coupling able to compensate any offsets. Couplings that generate axial or radial loads on the pump shaft are not allowed.

14 - MULTIPLE PUMPS

The possibility to couple several pumps makes it possible to create multi-flow groups with independent hydraulic circuits.
While sizing coupled pumps, it is necessary to make reference to the following conditions:

- The coupling can be carried out between pumps with the same dimensions or to a size of decreasing order.
- The max. rotation speed is determined by the pump with the lowest speed.
- The values of the max. applicable torque can not be exceeded.

14.1 - Maximum applicable torque

The input torque (M) for each pump is given by the following ratio:

$$M = \frac{9550 \cdot N}{n} = [Nm]$$

where the absorbed power (N) is given by:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta\,tot} = [kW]$$

n = rotation speed [rpm]

Q = flow rate [l/min]

Δp = differential pressure between the pump suction and delivery [bar]

η_{tot} = total efficiency (see diagrams in par. 4.2 - 5.2 - 6.2).

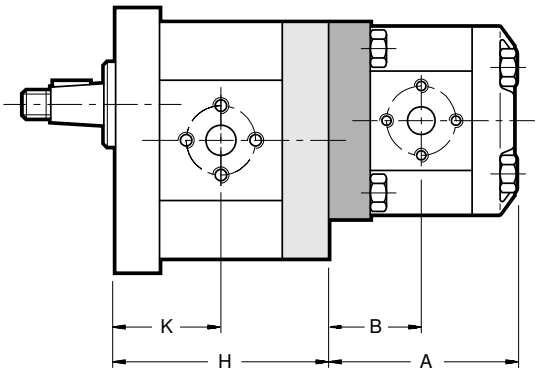
or it can be obtained from the diagrams ABSORBED POWER (see paragraphs 4.4 - 5.4 - 6.4).

If several pumps are coupled, the torque of each single pump has to be added to the torque of subsequent pumps when they are loaded simultaneously.
The obtained torque value for each pump has to be lower than the value specified in the table below.

If the obtained torque values are higher than the ones stated in the table, it is necessary to reduce the working pressure value or to replace the overloaded pump with a pump suitable to bear the required torque.

	MAX TORQUE APPLICABLE TO THE SHAFT OF THE FRONT PUMP [Nm]			**MAX APPLICABLE TORQUE [Nm] (not simultaneously to the front pump)**		
FRONT PUMP SIZE	tapered shaft with key code **7**	SAE J744 splined shaft code **1**	SAE J744 cylindrical shaft cod. **0**	PUMP TO BE MATED		
				GP1	**GP2**	**GP3**
GP1	100	100	60	50	-	-
GP2	200	185	140		100	
GP3	300	600	450			220

15 - MULTIPLE PUMPS OVERALL DIMENSIONS



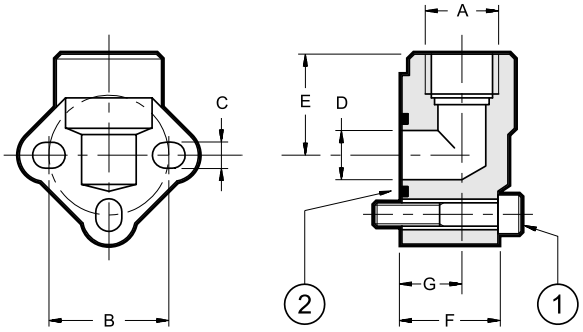
dimensions in mm

PUMP SIZE	NOMINAL SIZE	FRONT PUMP		REAR PUMP	
		H	K	A	B
GP1	0013	86	40	86,5	46
	0020	88	41	88,5	47
	0027	90	42	90,5	48
	0034	92	43	92,5	49
	0041	94	44	94,5	50
	0051	97	45,5	97,5	51,5
	0061	100	47	100,5	53
	0074	104	49	104,5	55
	0091	109	51,5	109,5	57,5
GP2	0070	101	47,5	103,5	53,5
	0095	105	49,5	107,5	55,5
	0113	108	51	110,5	57
	0140	112	53	114,5	59
	0158	115	54,5	117,5	60,5
	0178	118	56	120,5	62
	0208	123	58,5	125,5	64,5
	0234	127	60,5	129,5	66,5
	0279	134	64	136,5	70
GP3	0207	135,5	64	137	71,5
	0225	136,5	64,5	138	72
	0264	139,5	66	141	73,5
	0337	144,5	68,5	146	76
	0394	148,5	70,5	150	78
	0427	151,5	72	153	79,5
	0514	157,5	75	159	82,5
	0600	163,5	78	165	85,5
	0696	170,5	81,5	172	89
	0776	175,5	84	177	91,5
	0876	181,5	87	183	94,5

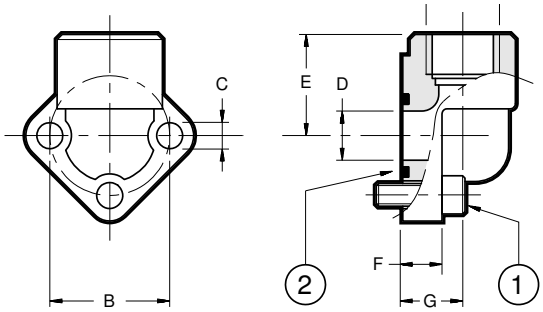
NOTE: For the dimensions of groups composed of three or more pumps, please consult our Technical Dept.

16 - CONNECTION FLANGES

dimensions in mm



ALUMINIUM FLANGES
TYPE **RP**



STEEL FLANGES
TYPE **RPA**

Fastening bolt and O-rings included

ALUMINIUM FLANGES TYPE RP

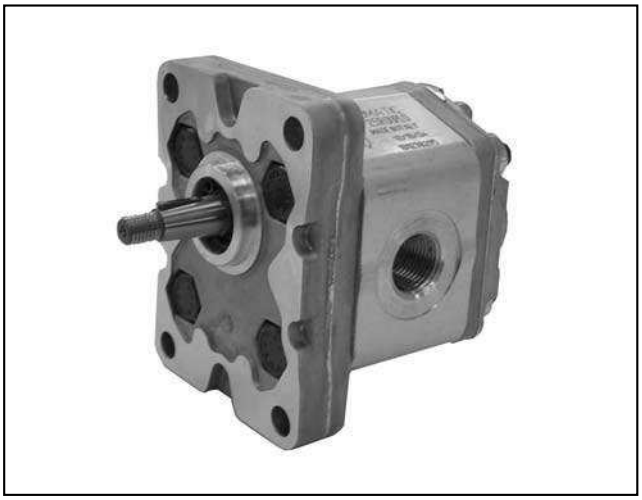
	Flange code	Flange description	p_{max} [bar]	ØA	B	C	ØD	E	F	G	(1) SHC bolts	(2) seals
GP1	0610506	RP1 - 38	180	3/8" BSP	30	6,5	12,5	30	26	18	n°3 - M6x35	OR 121 (15.88x2.62)
	0610248	RP1 - 12		1/2" BSP	30	6,5	12,5	30	26	18		
GP2	0610508	RP2 - 12		1/2" BSP	40	8,5	18,5	40	31	20	n°3 - M8x45	OR 130 (22.22x2.62)
	0610249	RP2 - 34		3/4" BSP	40	8,5	18,5	40	31	20		
GP3	0610717	RP3 - 34		3/4" BSP	51	10,5	25	46	43	26	n°3 - M10x60	OR 4118 (29.75x3.53)
	0610250	RP3 - 100		1" BSP	56	10,5	25	46	43	26		

STEEL FLANGES TYPE RPA

	Flange code	Flange description	p_{max} [bar]	ØA	B	C	ØD	E	F	G	(1) SHC bolts	(2) seals
GP1	0771048	RPA1 - 38	315	3/8" BSP	30	6,5	12	24	17	9,5	n°3 - M6x20	OR 121 (15.88x2.62)
	0771049	RPA1 - 12		1/2" BSP	30	6,5	12	24	17	9,5		
GP2	0771050	RPA2 - 12		1/2" BSP	40	8,5	20	36	22	11,5	n°3 - M8x25	OR 132 (23.81x2.62)
	0770615	RPA2 - 34		3/4" BSP	40	8,5	20	36	22	11,5		
GP3	0771051	RPA3 - 34A		3/4" BSP	51	10,5	24	46	26	13	n°3 - M10x30	OR 3125 (31.42x2.62)
	0770617	RPA3 - 100A		1" BSP	51	10,5	24	46	26	13		
	0770618	RPA3 - 34B		3/4" BSP	56	10,5	24	46	26	13		
	0770619	RPA3 - 100B		1" BSP	56	10,5	24	46	26	13		
	0771052	RPA35 - 114A		1" ¼ BSP	62	13	31	55	35	17	n°3 - M10x35	

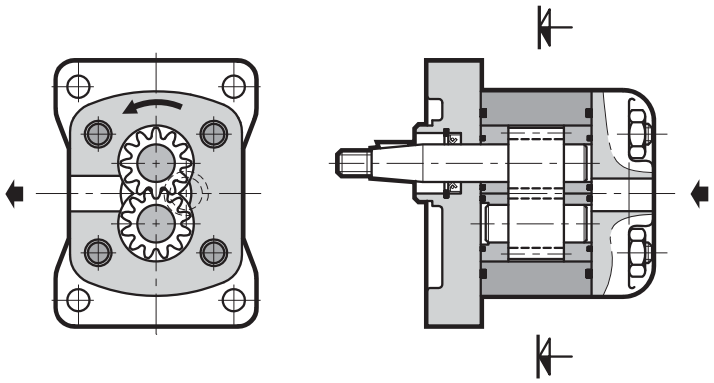
DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com



1P
EXTERNAL GEAR PUMPS
SERIES 11

OPERATING PRINCIPLE



— The 1P pumps are fixed displacement external gear pumps with axial clearance compensation.

— They give high volumetric flows even with high operating pressures, a low noise level, and they have a high endurance thanks to the balancing system of the loads on the guide bushings.

— They are available with displacements going from 1,1 to 8,0 cm^3/rev and with operating pressures of up to 230 bar.

— They are available with clockwise rotation direction and with tapered shaft.

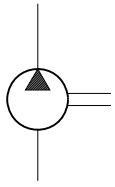
— The hydraulic connection is with BSP threaded ports type.

TECHNICAL SPECIFICATIONS

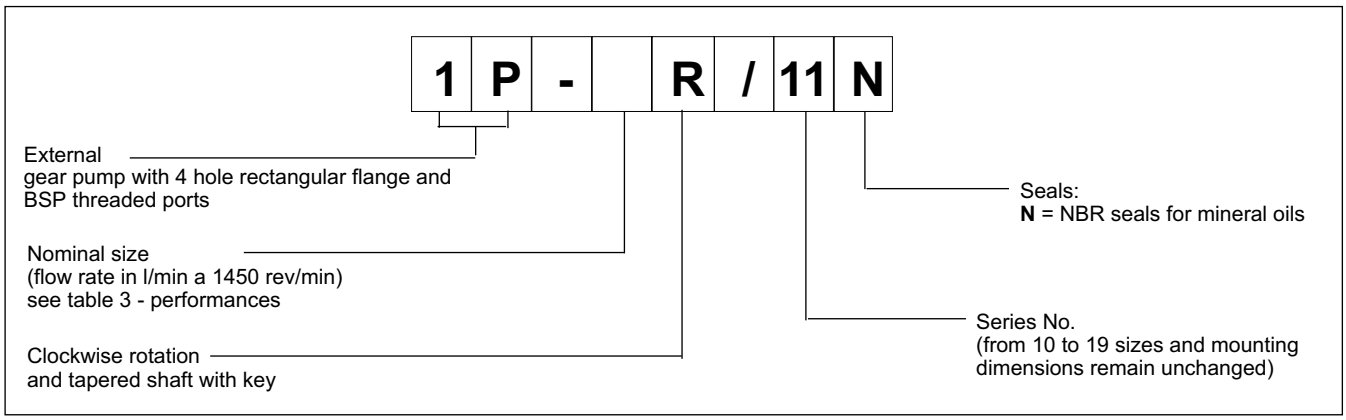
PUMP SIZE		1P
Displacement range	cm^3/rev	1,1 ÷ 8,0
Flow rate and operating pressures		see table 3 - Performances
Rotation speed		see table 3 - Performances
Rotation direction		clockwise (seen from the shaft side)
Loads on the shaft		radial and axial load are not allowed
Hydraulic connection		threaded ports BSP
Type of mounting		4 hole flange - rectangular type
Mass	kg	approx. 1,6

Ambient temperature range	°C	–20 / +50
Fluid temperature range	°C	–15 / +80
Fluid viscosity range	see par. 2.2	
Recommended viscosity	cSt	25 ÷ 100
Degree of fluid contamination	see par. 2.3	

HYDRAULIC SYMBOL



1 - CODIFICATION



2 - HYDRAULIC FLUID

2.1 Type of fluid

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives, in conformity with the requisites of the following standards:
- FZG test - 11th stage - DIN 51525 - VDMA 24317

For use with other types of fluid (water glycol, phosphate esters and others), consult our technical dept.

Operation with fluid at a temperature greater than 80°C causes a premature deterioration of the fluid quality and of the seals. The physical and chemical properties of the fluid must be maintained.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	12 cSt	referred to the maximum fluid temperature of 80 °C
optimum viscosity	25 ÷ 100 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1600 cSt	limited to only the start-up phase of the pump

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with $\beta_{20} \geq 75$ is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with $\beta_{10} \geq 100$ is recommended.

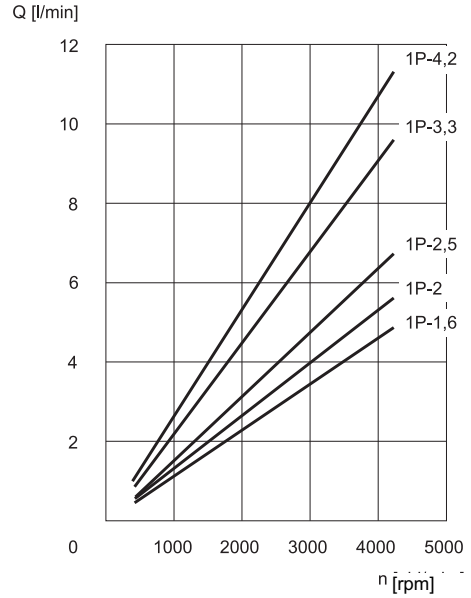
If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 6. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

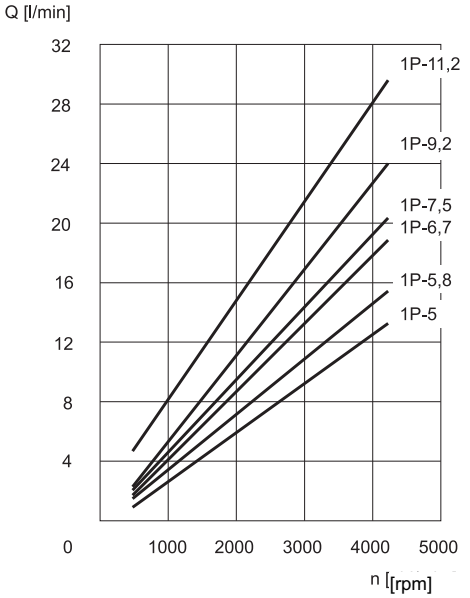
3 - PERFORMANCES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

PUMP SIZE	NOMINAL SIZE	DISPALCEMENT [cm³/rev]	MAX. FLOW RATE (at 1500 rpm) [l/min.]	MAX. OPERATING PRESSURE (ar 1500 rpm) [bar]	MAX. PEAK PRESSURE (at 1500 rpm.) [bar]	MAX.ROTATION SPEED [rpm]	MIN.ROTATION SPEED [rpm]
1P	**1,6**	1,1	1,6	230	270	6000	1000
	2	1,3	2,0				
	2,5	1,6	2,4				
	3,3	2,1	3,2				
	4,2	2,7	4,0				800
	5	3,2	4,8	210	250	5000	
	5,8	3,7	5,6			4500	
	6,7	4,2	6,4			4000	
	7,5	4,8	7,2	190	230	3500	600
	9,2	5,8	8,7			3000	
	11,5	8,0	11,9	160	200	2100	

4 - CURVES AND CHARACTERISTIC DATA OF GROUP 1P PUMPS (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

4.1 - Flow rate curves Q=f (n) obtained with operating pressure 0 bar





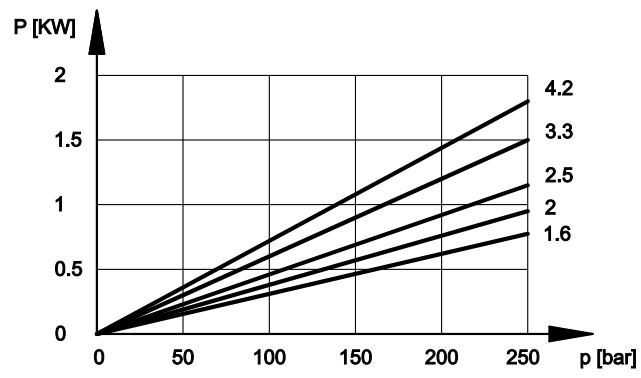
4.2 - Efficiencies

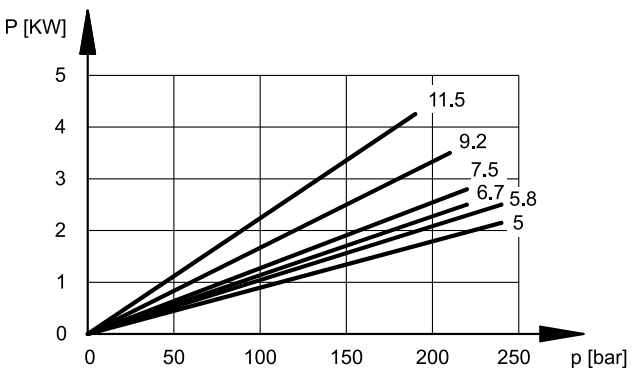
PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
1,6	0,96	0,85
2	0,94	0,87
2,5	0,94	0,87
3,3	0,96	0,90
4,2	0,96	0,90
5	0,96	0,90
5,8	0,96	0,89
6,7	0,97	0,92
7,5	0,97	0,93
9,2	0,95	0,89
11,5	0,94	0,89

4.3 - Noise level (at 1500 rpm)

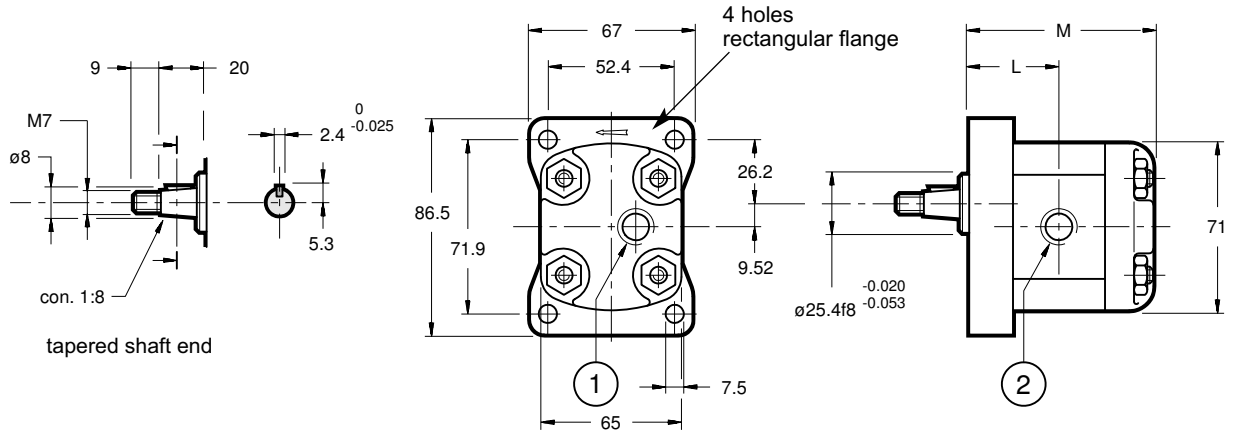
PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
1,6	55
2	58
2,5	58
3,3	60
4,2	65
5	66
5,8	66
6,7	68
7,5	72
9,2	72
11,5	74

4.4 - Absorbed power / pressure (at 1500 rpm)





5 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

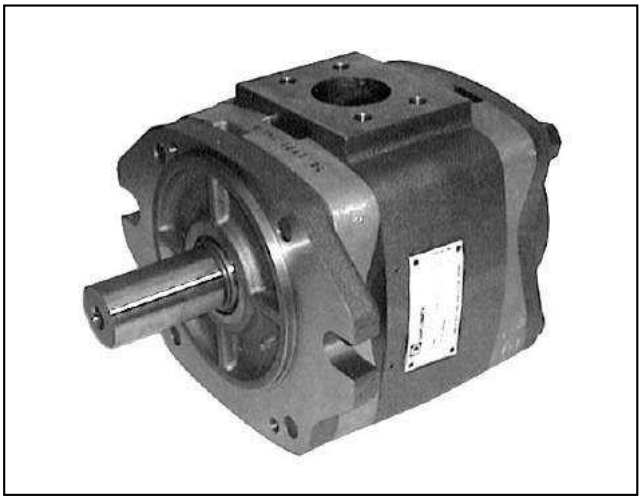
Pump code	Pump nominal dimension	L	M	1	2
0710842	1P-1,6	34	75	suction port: 3/8" BSP clockwise rotation direction	delivery port: 3/8" BSP clockwise rotation direction
0710843	1P-2	34,5	76		
0710844	1P-2,5	35	77		
0710845	1P-3,3	36	79		
0710846	1P-4,2	37	81		
0710847	1P-5	38	83		
0710848	1P-5,8	39	85		
0710849	1P-6,7	40	87		
0710850	1P-7,5	41	89		
0710851	1P-9,2	43	93		
0710852	1P-11,5	47	101		

6 - INSTALLATION

- The 1P gear pumps can be installed with the shaft oriented in any position.
- Be sure the control rotation direction corresponds to the direction of the arrow marked on the pump before putting the pump into operation.
- It is necessary to vent the air from the delivery connection before operating it the first time.
- The pump start up, especially at a cold temperature, should occur with the pump unloading.
- The suction line must be suitably sized to facility the flow of the oil. Bends and restrictions or an excessive line length can impede correct operation of the pump. It is advisable that the speed of 1 ÷ 2 m/sec is not exceeded in the suction line.
- The minimum suction pressure allowed is -0,3 bar relative. The pumps can not function with suction pressure.
- The gear pumps must not operate with a rotation rating of less than the minimum rotation speed (see table 3 - performances). They must be filled with the same plant operation oil before installation. Filling is done through the connection lines. If necessary, rotate the pump manually.
- The motor-pump connection must be carried out directly with a flexible coupling able to compensate any offsets. Couplings that generate axial or radial loads on the pump shaft are not allowed.

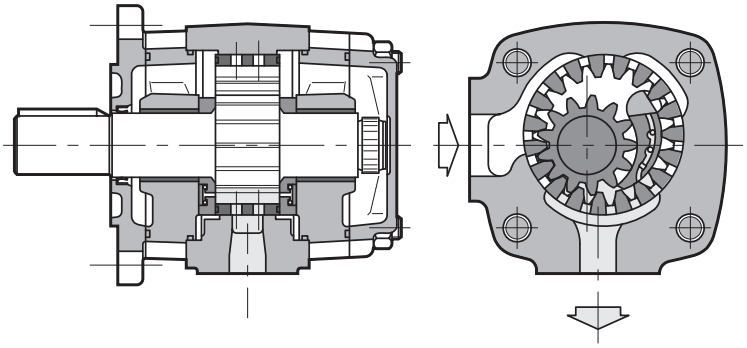
DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com



IGP
INTERNAL GEAR PUMPS
SERIES 10

OPERATING PRINCIPLE



— IGP pumps are volumetric displacement pumps with internal gears, available in five sizes, each divided into a range of different displacement.

— The pumps feature high volumetric performance levels, thanks to both radial and axial compensation in proportion to operating pressure, in addition to low noise levels.

— Optimal load distribution and special friction bearings enable continuous duty at high pressures and ensure extended pump lifetime.

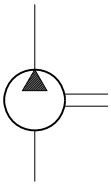
— IGP pumps are also available in multiple versions which can be combined to make multi-flow groups.

TECHNICAL SPECIFICATIONS

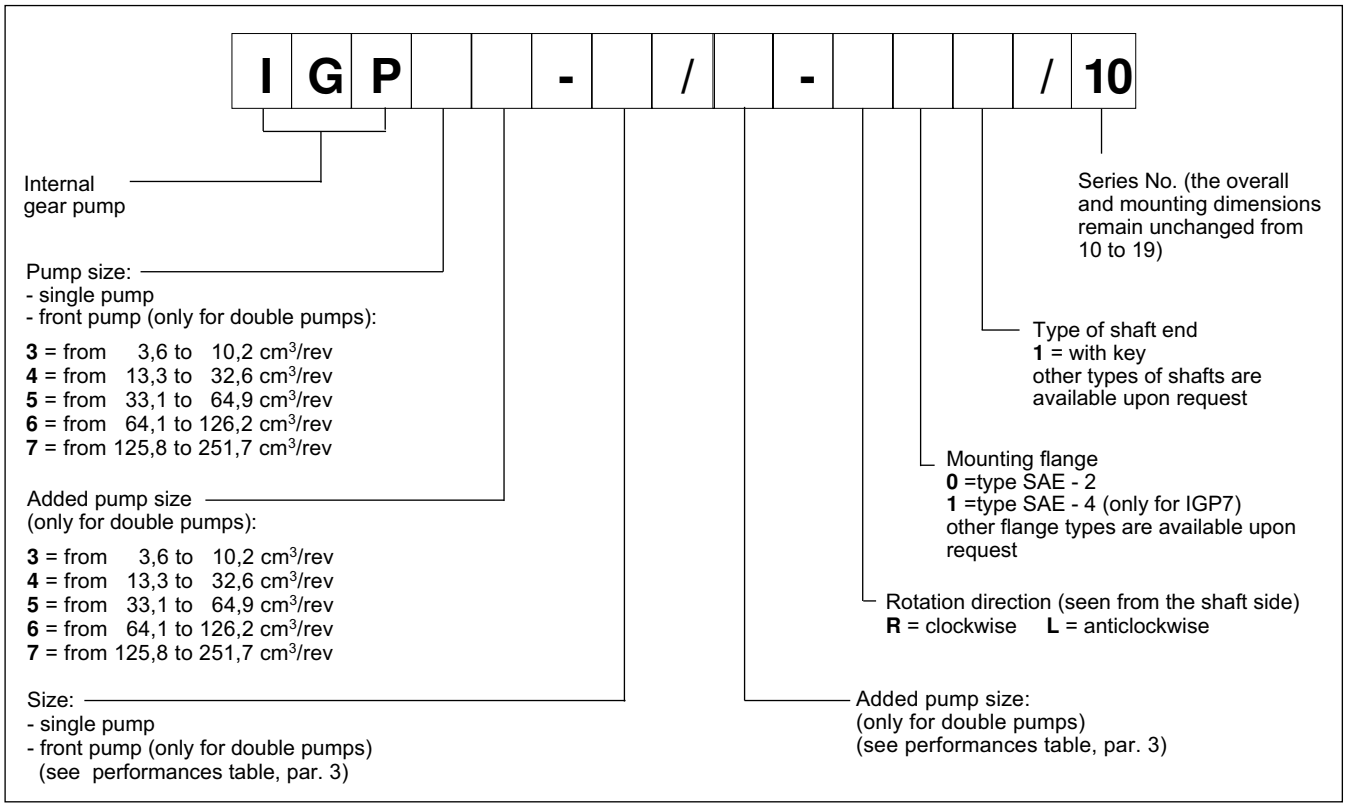
IGP PUMP SIZE		3	4	5	6	7
Displacement range	cm^3/rev	3,6 ÷ 10,2	13,3 ÷ 32,6	33,1 ÷ 64,9	64,1 ÷ 126,2	125,8 ÷ 251,7
Flow rate range (at 1.500 rpm)	l/min.	5,4 ÷ 15,3	19,9 ÷ 48,9	49,6 ÷ 97,3	96,1 ÷ 189,3	188,7 ÷ 377,5
Operating pressures		see table 3 - performances				
Rotation speed		see table 3 - performances				
Rotation direction		clockwise or anticlockwise (seen from the shaft side)				
Loads on the shaft		consult our technical department for the extent of axial and radial loads				
Hydraulic connection		flanged fittings SAE J518 c code 61 (see par. 28)				
Type of fastening		flanged SAE J744 c				
Mass (single pump)	kg	4 ÷ 4,8	8,6 ÷ 11	15,5 ÷ 18,7	29,2 ÷ 35	46,5 ÷ 59

Ambient temperature range	°C	–10 / +60
Fluid temperature range	°C	–10 / +80
Fluid viscosity range	see par. 2.2	
Recommended true viscosity	cSt	25 ÷ 100
Degree of fluid contamination	see par. 2.3	

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE



2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives.
For use with other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for authorization of use.

FLUID TYPE	NOTES
HFC (water glycol solution with proportion of water ≤ 40 %)	- The performances shown in the table in par. 3 must be reduced of 20%. - The maximum speed of the fluid in the suction line must not exceed 1 m/s. - The suction pressure must not be less than 0,8 bar absolute. - The maximum fluid temperature must be less than 50°C.
HFD (phosphate esters)	Operation with this type of fluid is not allowed.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to the maximum fluid temperature of 80 °C
optimum viscosity	25 ÷ 100 cSt	referred to the fluid working temperature in the tank
maximum viscosity	2000 cSt	limited to only the start-up phase of the pump

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with $\beta_{20} \geq 75$ is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with $\beta_{10} \geq 100$ is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 3.
The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

3 - PERFORMANCES (obtained with mineral oil with viscosity in the range of 25 ÷ 100 cSt)

PUMP SIZE	NOMINAL DIMENSION	DISPLACEMENT [cm³/rev] (note 2)	MAX. FLOW RATE (at 1500 rpm) [l/min.]	PRESSURE [bar] (note 3) steady/peak		MAX. ROTATION SPEED [rpm]	MIN. ROTATION SPEED [rpm] (note 4)
IGP3	003	3,6	5,4	330	345	3600	400
	005	5,2	7,8				
	006	6,4	9,6				
	008	8,2	12,3				
	010	10,2	15,3				
IGP4	013	13,3	19,9	330	345	3600	400
	016	15,8	23,7			3400	
	020	20,7	31,0			3200	
	025	25,4	38,1	300	330	3000	
	032	32,6	48,9	250	280	2800	
IGP5	032	33,1	49,6	315	345	3000	400
	040	41	61,5			2800	
	050	50,3	75,4	280	315	2500	
	064	64,9	97,3	230	250	2200	
IGP6	064	64,1	96,1	300	330	2600	400
	080	80,7	121,0	280	315	2400	
	100	101,3	151,9	250	300	2100	
	125	126,2	189,3	210	250	1800	
IGP7	125	125,8	188,7	300	330	2200	400
	160	160,8	241,2	280	315	2000	
	200	202,7	304,0	250	300	1800	
	250	251,7	377,5	210	250		

Note 1) In continuous operating conditions, the maximum suction pressure is 2 bar while the minimum pressure must not be less than -0,2 bar. A minimum suction pressure of - 0,4 bar is allowed for brief periods of time (the pressure values are to be considered relative).

Note 2) The working tolerances can reduce the displacement by 1,5% max. The flow rate at 1500 rpm shown in the table considers operation with pressure of 10 bar.

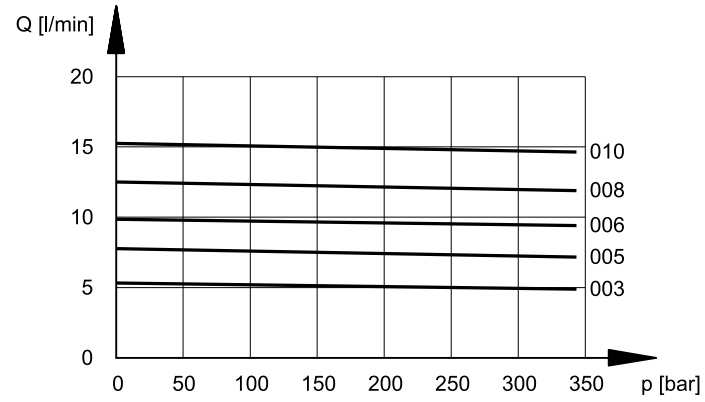
Note 3) The steady and peak pressures shown above are valid in the speed range of 400-1500 rpm.
For speeds greater than 1500 rpm, the extent of the peak pressure must be reduced.

Note 4) For use at variable speed in the range less than 400 rpm or greater than 1500 rpm, there are limitations of the allowable pressures. Contact our technical department for applications outside this range.

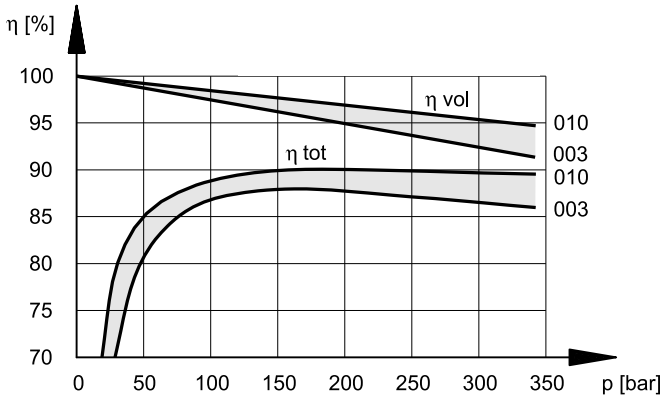
4- IGP3 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

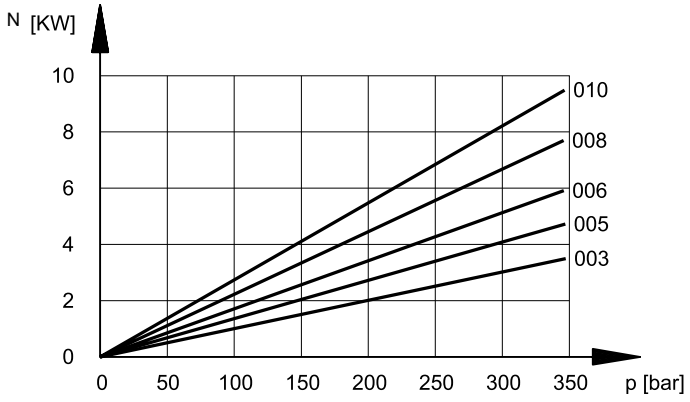
FLOW RATE/PRESSURE CURVES



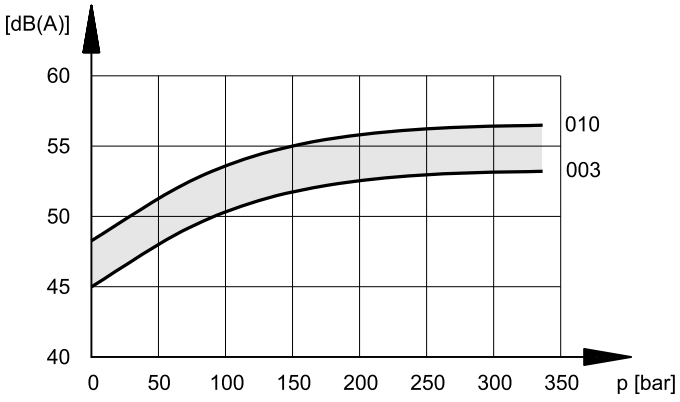
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

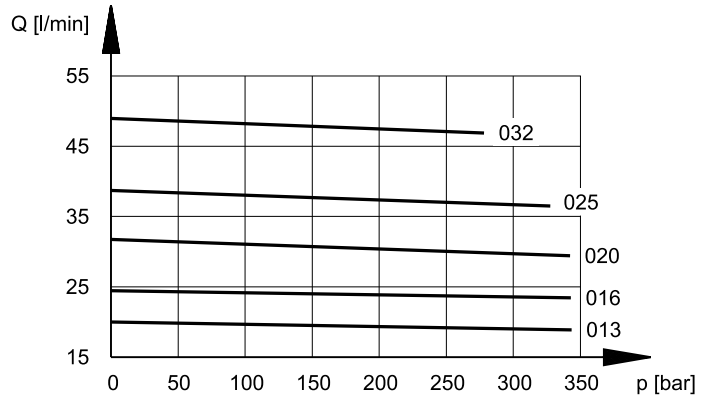


The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

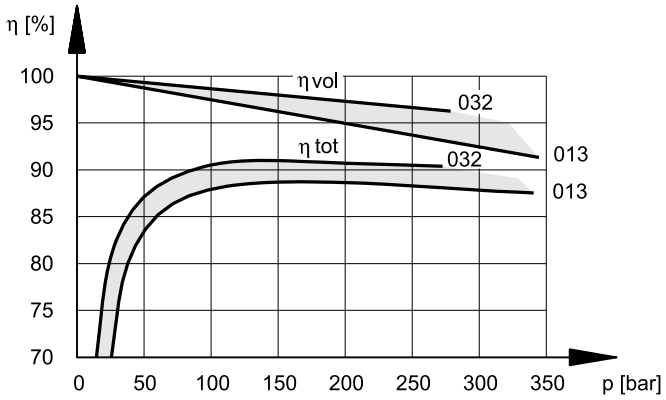
5- IGP4 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

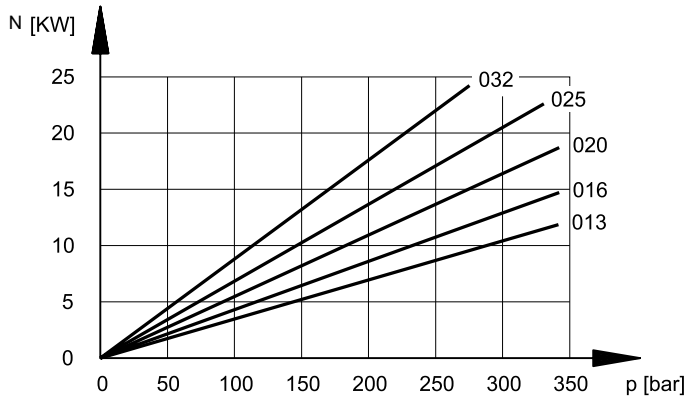
FLOW RATE/PRESSURE CURVES



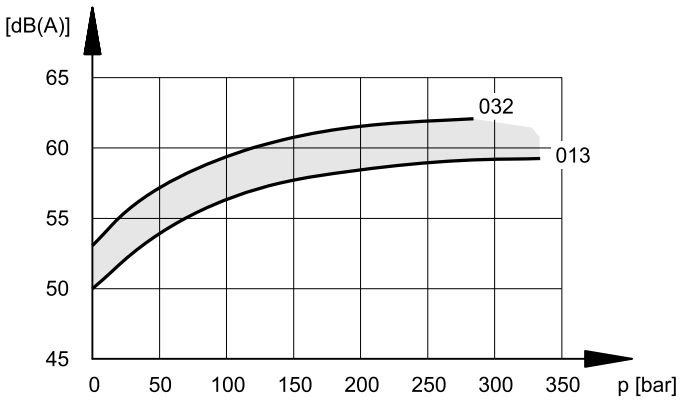
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

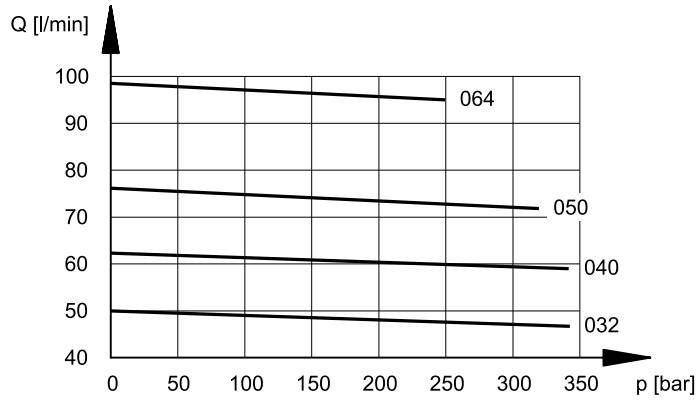


The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

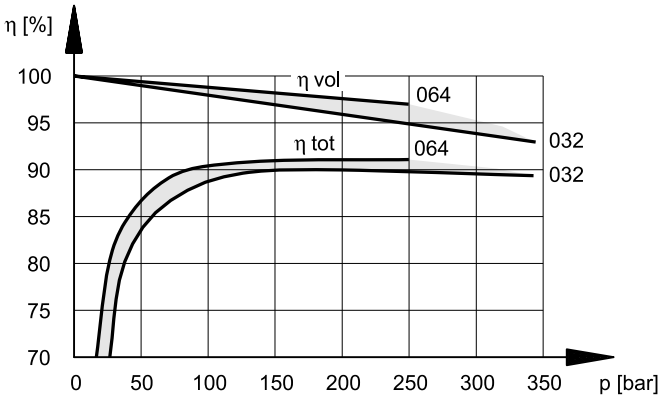
6- IGP5 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

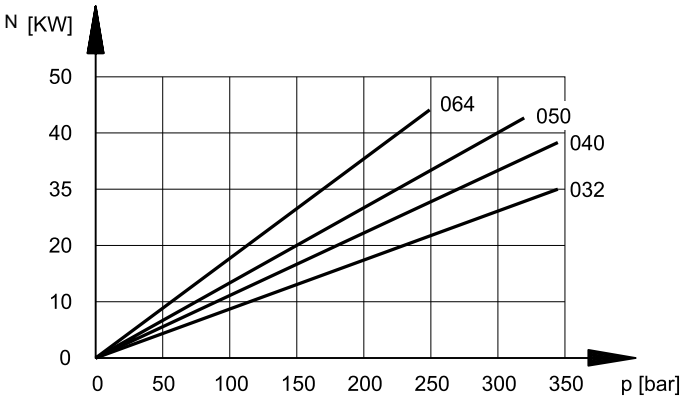
FLOW RATE/PRESSURE CURVES



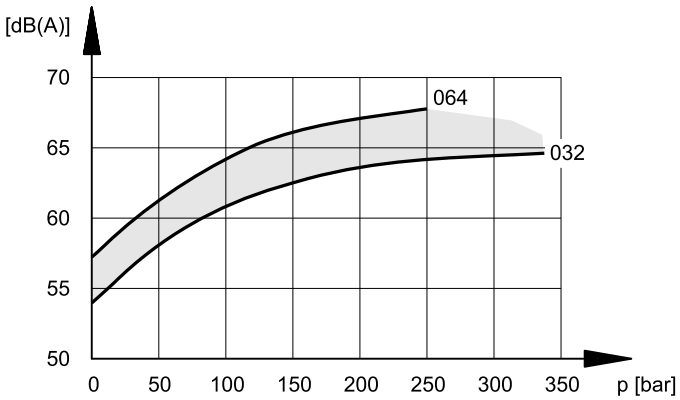
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

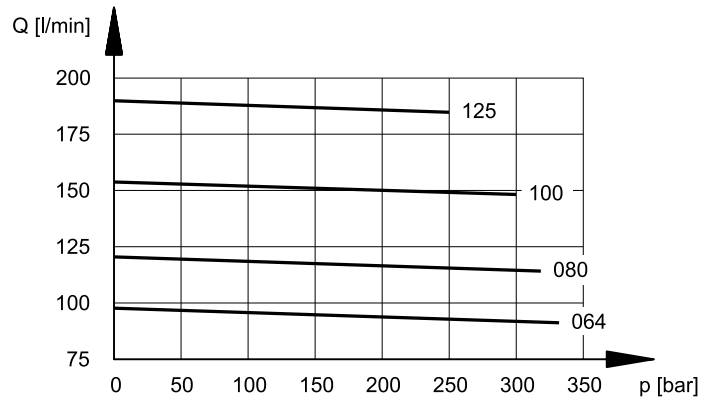


The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

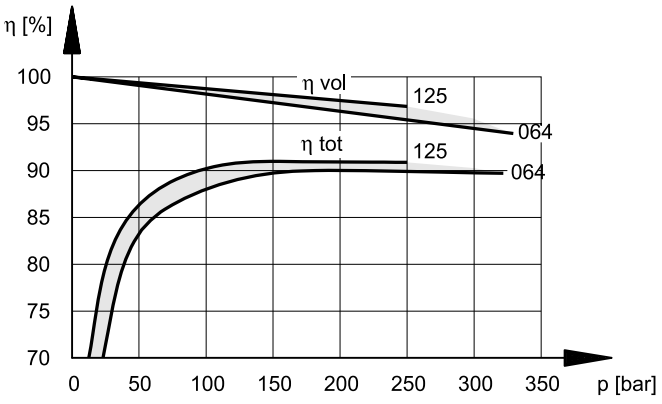
7- IGP6 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

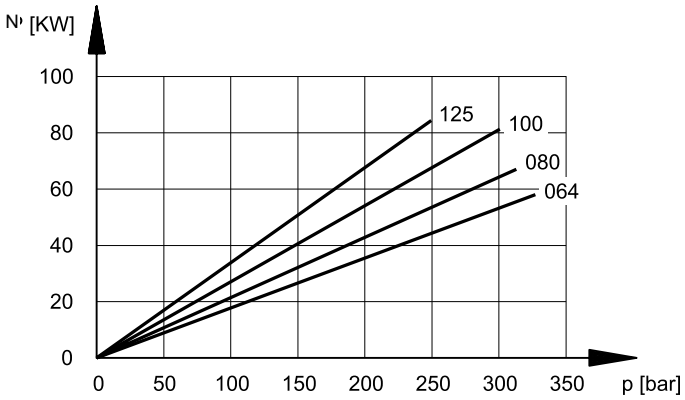
FLOW RATE/PRESSURE CURVES



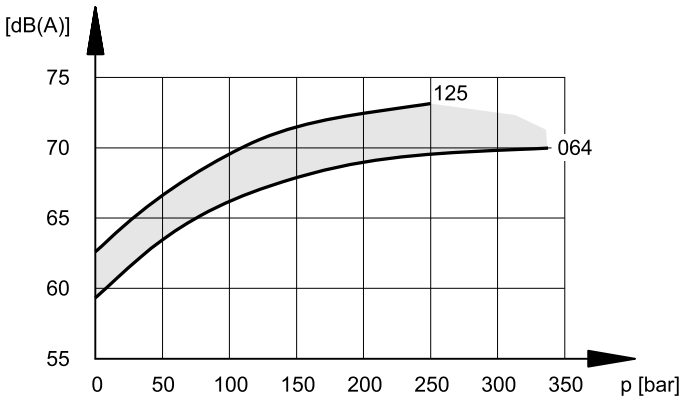
VOLUMETRIC AND TOTAL EFFICIENCIES



ABSORBED POWER



NOISE LEVEL

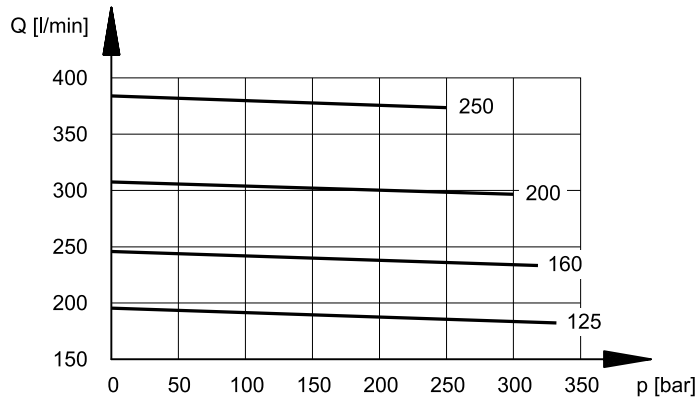


The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

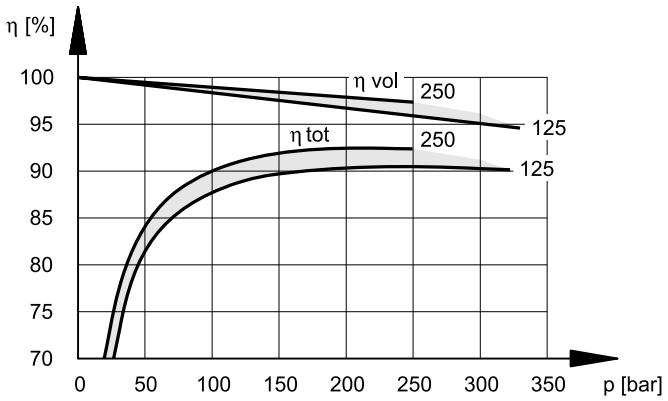
8- IGP7 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

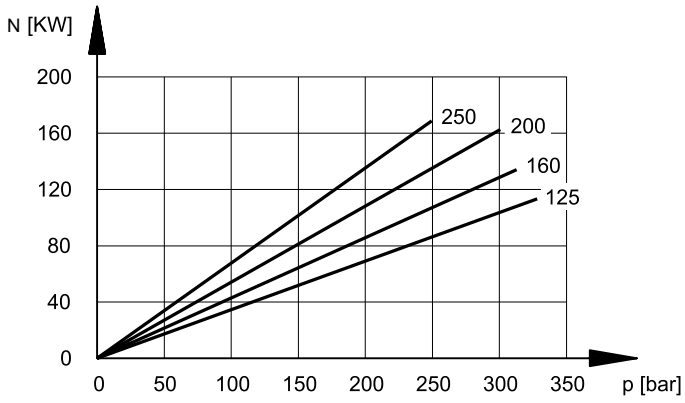
FLOW RATE/PRESSURE CURVES



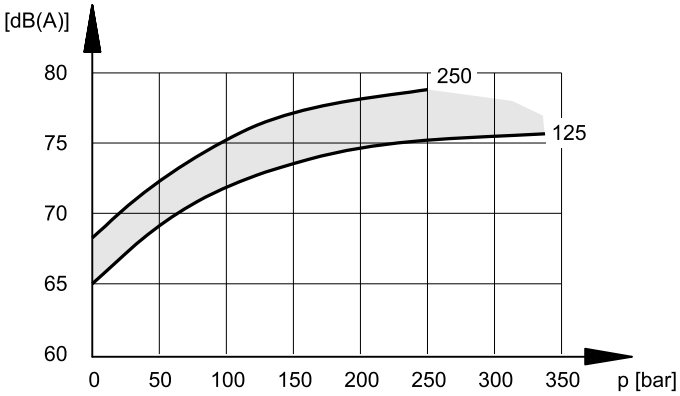
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



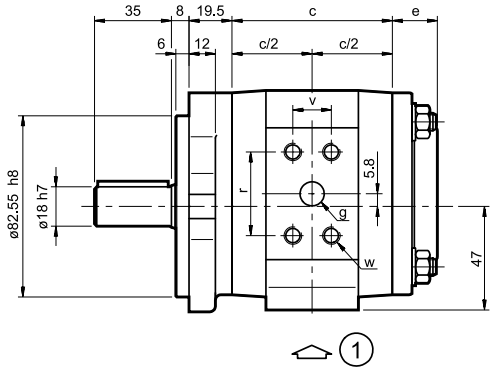
NOISE LEVEL

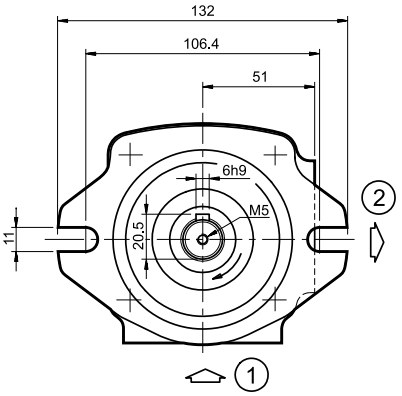


The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

9 - IGP3 PUMP OVERALL AND MOUNTING DIMENSIONS

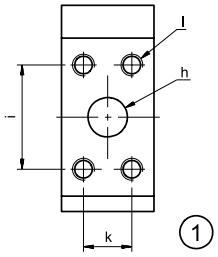
dimensions in mm





1	Suction port
2	Delivery port

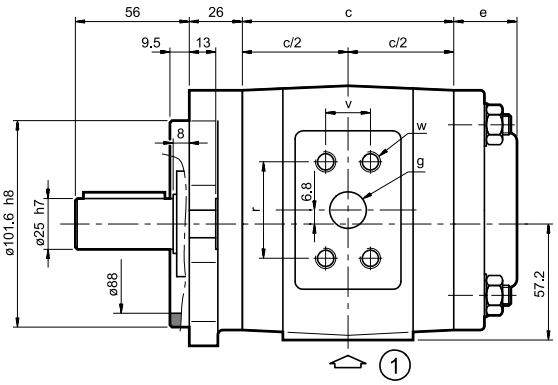
NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery port, 2), is on the opposite side of the pump

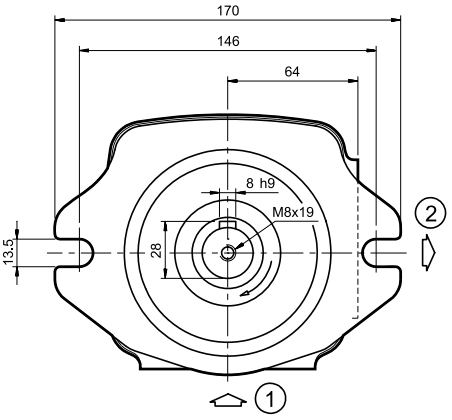


											CONNECTION FLANGE (see par. 28)	
	c	e	g	h	i	k	l	r	v	w	DELIVERY	SUCTION
IGP3-003	66	20,5	9	14	38,1	17,5	M8x13	38,1	17,5	M8x13	0610718	0610718
IGP3-005	70	20,5	11	14	38,1	17,5	M8x13	38,1	17,5	M8x13	0610718	0610718
IGP3-006	73	20,5	11	19	47,5	22	M10x15	38,1	17,5	M8x13	0610718	0610719
IGP3-008	77,5	20,5	13	19	47,5	22	M10x15	38,1	17,5	M8x13	0610718	0610719
IGP3-010	82,5	20,5	13	21	52,4	26,2	M10x15	38,1	17,5	M8x13	0610718	0610713

10 - IGP4 PUMP OVERALL AND MOUNTING DIMENSIONS

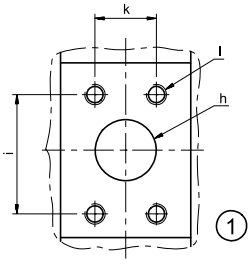
dimensions in mm





1	Suction port
2	Delivery port

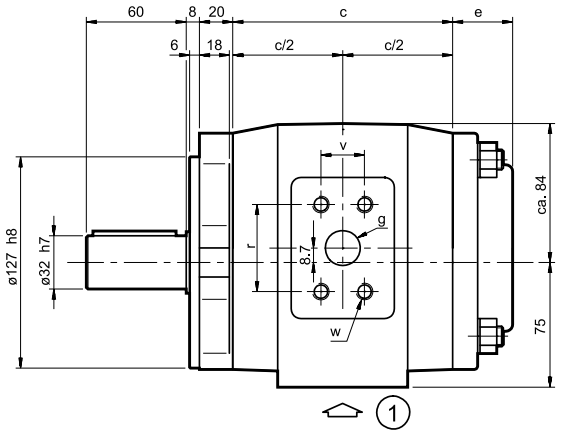
NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery port, 2), is on the opposite side of the pump

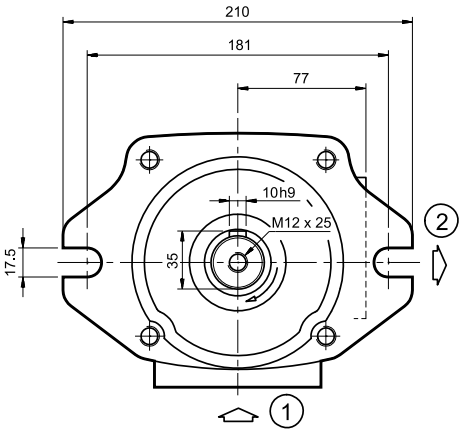


											CONNECTION FLANGE (see par. 28)	
	c	e	g	h	i	k	l	r	v	w	DELIVERY	SUCTION
IGP4-013	88,5	31	13	23	52,4	26,2	M10x15	38,1	17,5	M8x13	0610718	0610713
IGP4-016	92,5	31	14	25	52,4	26,2	M10x15	38,1	17,5	M8x13	0610718	0610713
IGP4-020	98	31	18	27	58,7	30,2	M10x15	47,5	22	M10x15	0610719	0610720
IGP4-025	104	31	18	30	58,7	30,2	M10x15	47,5	22	M10x15	0610719	0610720
IGP4-032	113	31	18	32	58,7	30,2	M10x15	47,5	22	M10x15	0610719	0610720

11- IGP5 PUMP OVERALL AND MOUNTING DIMENSIONS

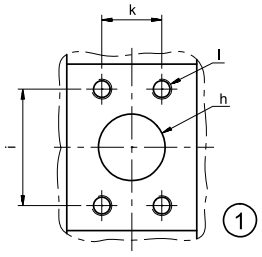
dimensions in mm





1	Suction port
2	Delivery port

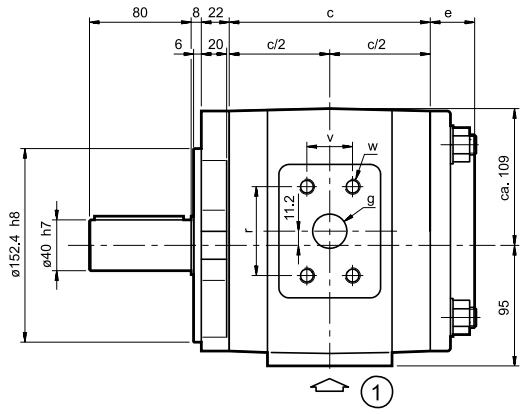
NOTE: the pump is represented in the clockwise rotation configuration
For the anticlockwise configuration, the delivery port, 2), is on the opposite side of the pump

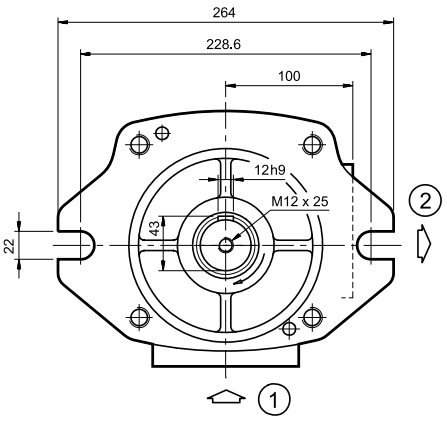


											CONNECTION FLANGES (see par. 28)	
	c	e	g	h	i	k	l	r	v	w	DELIVERY	SUCTION
IGP5-032	119	36	18	32	58,7	30,2	M10x15	47,5	22	M10x15	0610719	0610720
IGP5-040	125	36	19	35	70	36	M12x20	52,4	26,2	M10x15	0610713	0610714
IGP5-050	132	36	21	40	70	36	M12x20	52,4	26,2	M10x15	0610713	0610714
IGP5-064	143	36	23	40	70	36	M12x20	52,4	26,2	M10x15	0610713	0610714

12- IGP6 PUMP OVERALL AND MOUNTING DIMENSIONS

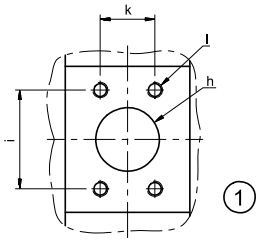
dimensions in mm





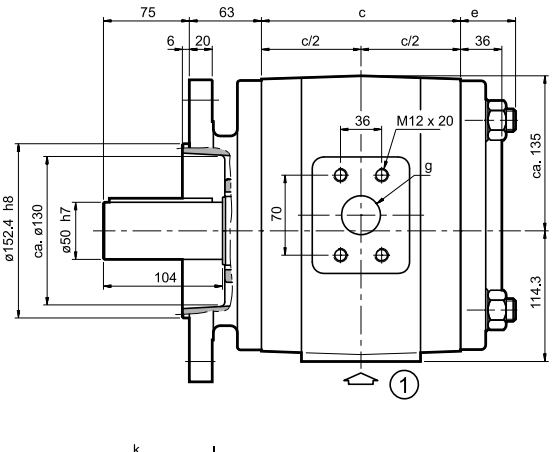
1	Suction port
2	Delivery port

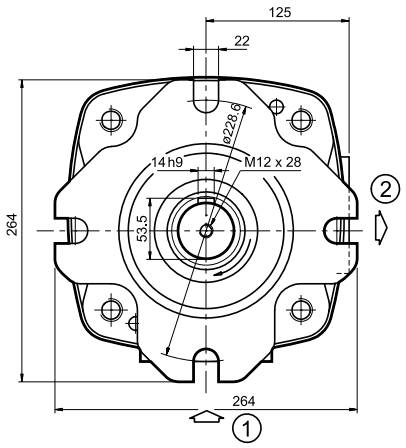
NOTE: the pump is represented in the clockwise rotation configuration
For the anticlockwise configuration, the delivery port, 2), is on the opposite side of the pump



											CONNECTION FLANGES (see par. 28)	
	c	e	g	h	i	k	l	r	v	w	DELIVERY	SUCTION
IGP6-064	140	40	23	40	70	36	M12x20	52,4	26,2	M10x15	0610713	0610714
IGP6-080	148	35	23	45	77,8	42,9	M12x20	70	36	M12x20	0610714 note 5	0610721
IGP6-100	158	35	27	50	77,8	42,9	M12x20	70	36	M12x20	0610714 note 5	0610721
IGP6-125	170	40	30	50	77,8	42,9	M12x20	70	36	M12x20	0610714 note 5	0610721

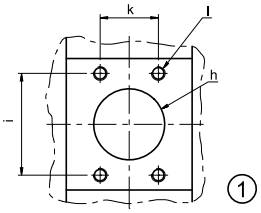
13- IGP7 PUMP OVERALL AND MOUNTING DIMENSIONS





dimensions in mm

1	Suction port
2	Delivery port

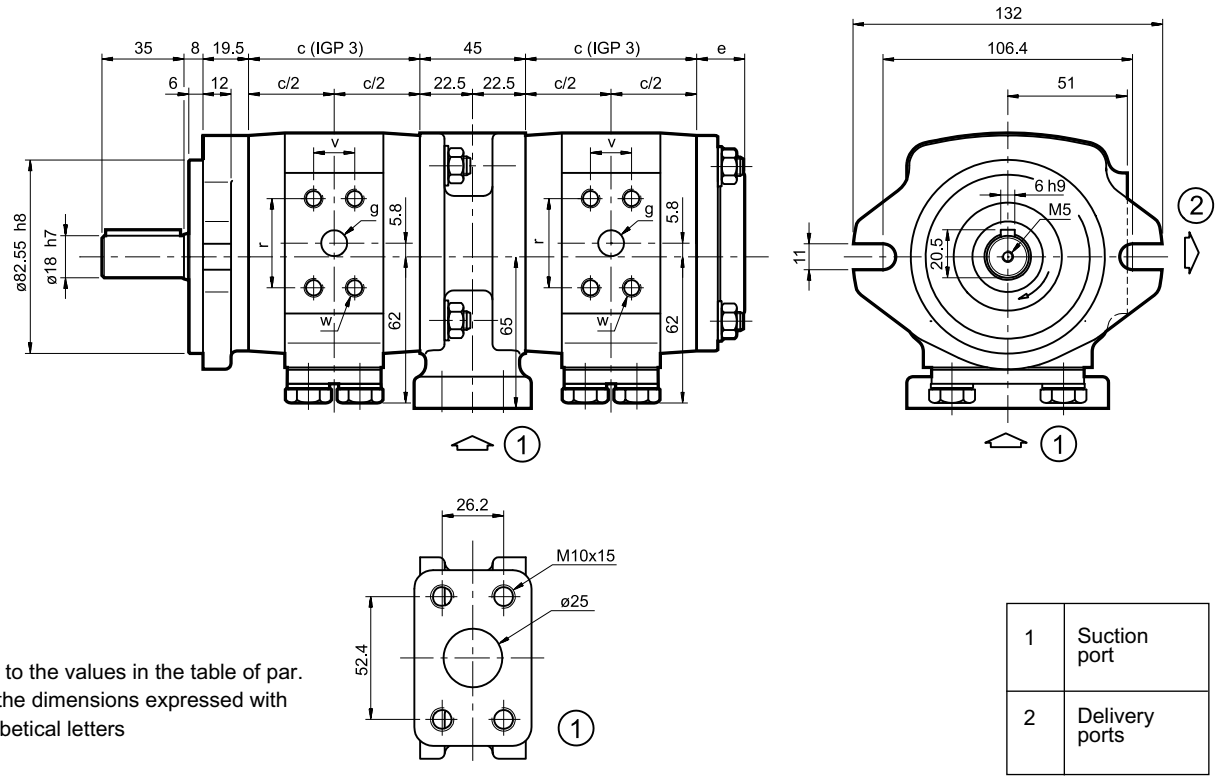


NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery port, 2), is on the opposite side of the pump

											CONNECTION FLANGES (see par. 28)	
	c	e	g	h	i	k	l	r	v	w	DELIVERY	SUCTION
IGP7-125	152	48	30	50	77,8	42,9	M12x20	70	36	M12x20	0610714 note 5	0610721
IGP7-160	162	48	30	56	89	50,8	M12x20	70	36	M12x20	0610714 note 5	0610722
IGP7-200	174	46	34	62	89	50,8	M12x20	70	36	M12x20	0610714 note 5	0610722
IGP7-250	188	42	38	72	106,3	62	M16x25	70	36	M12x20	0610714 note 5	0610723

NOTE 5: For applications with delivery pressure greater than 200 bar, it is necessary to use the special connection flange, code 0610725.

14 - IGP33 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



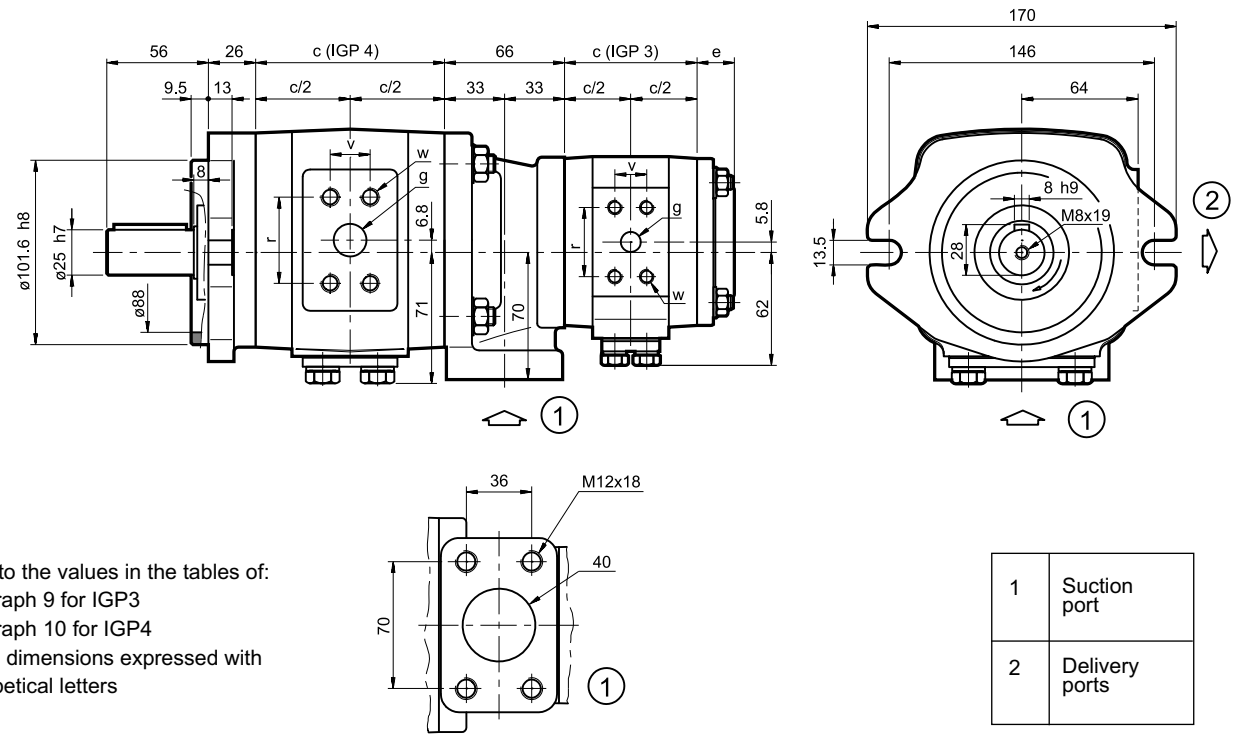
Refer to the values in the table of par. 9 for the dimensions expressed with alphabetical letters

1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

15 - IGP43 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



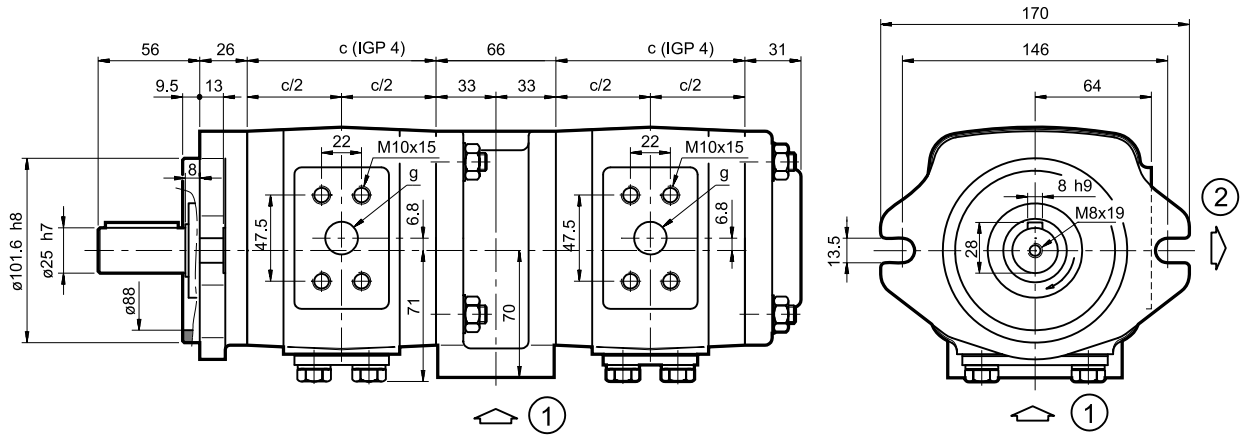
Refer to the values in the tables of:
paragraph 9 for IGP3
paragraph 10 for IGP4
for the dimensions expressed with alphabetical letters

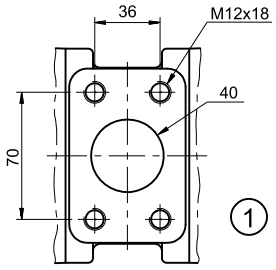
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

16 - IGP44 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





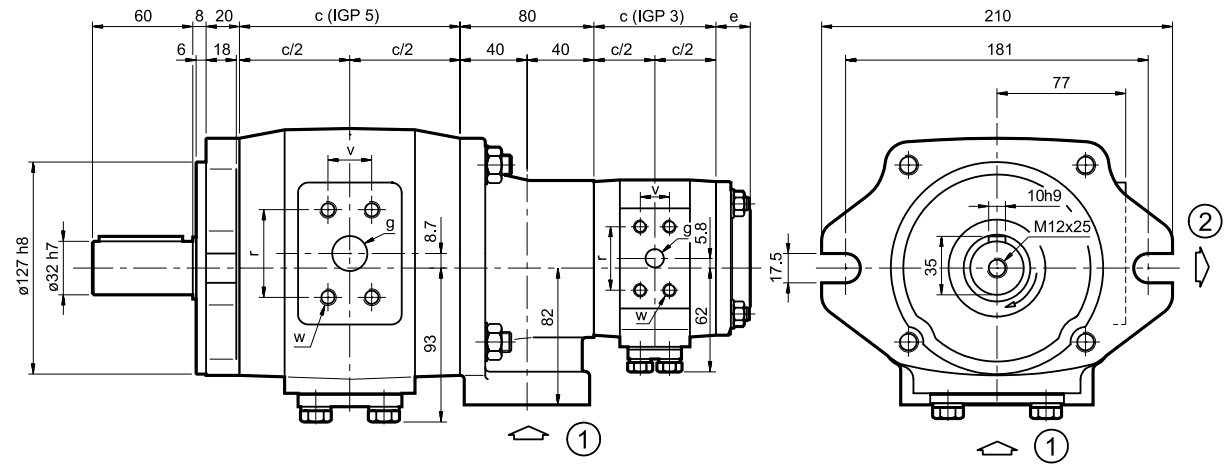
Refer to the values in the table of par. 10 for the dimensions expressed with alphabetical letters

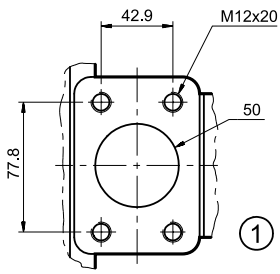
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

17 - IGP53 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





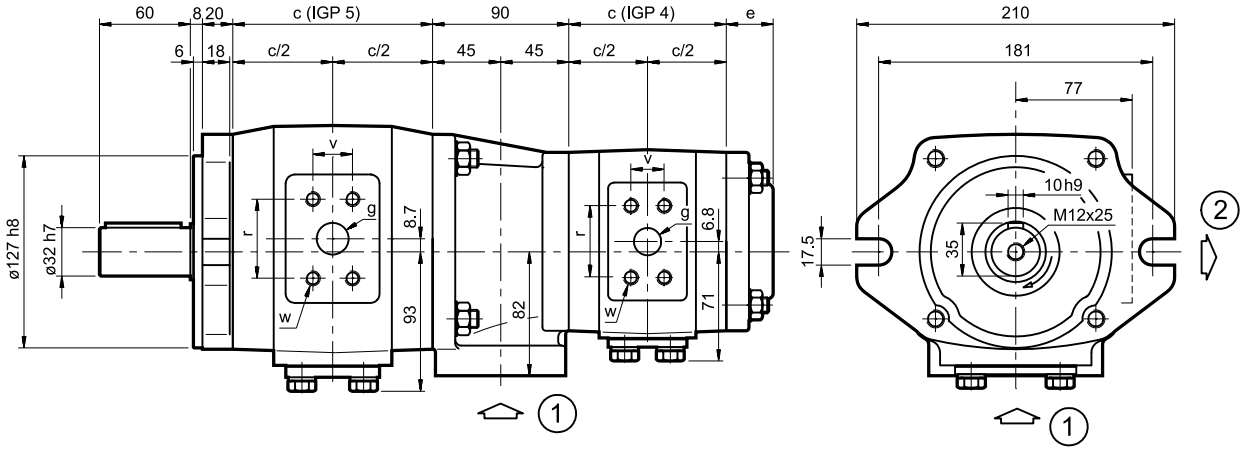
Refer to the values in the tables of:
paragraph 9 for IGP3
paragraph 11 for IGP5
for the dimensions expressed with alphabetical letters

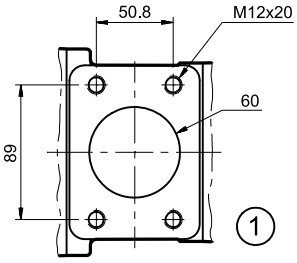
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

18 - IGP54 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





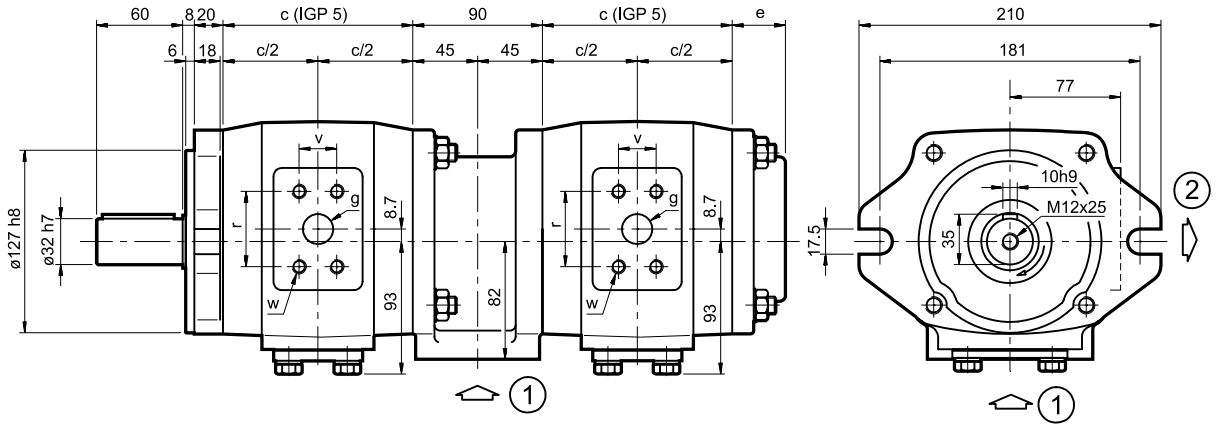
Refer to the values in the tables of:
paragraph 10 for IGP4
paragraph 11 for IGP5
for the dimensions expressed with alphabetical letters

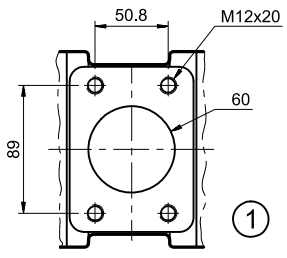
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

19 - IGP55 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





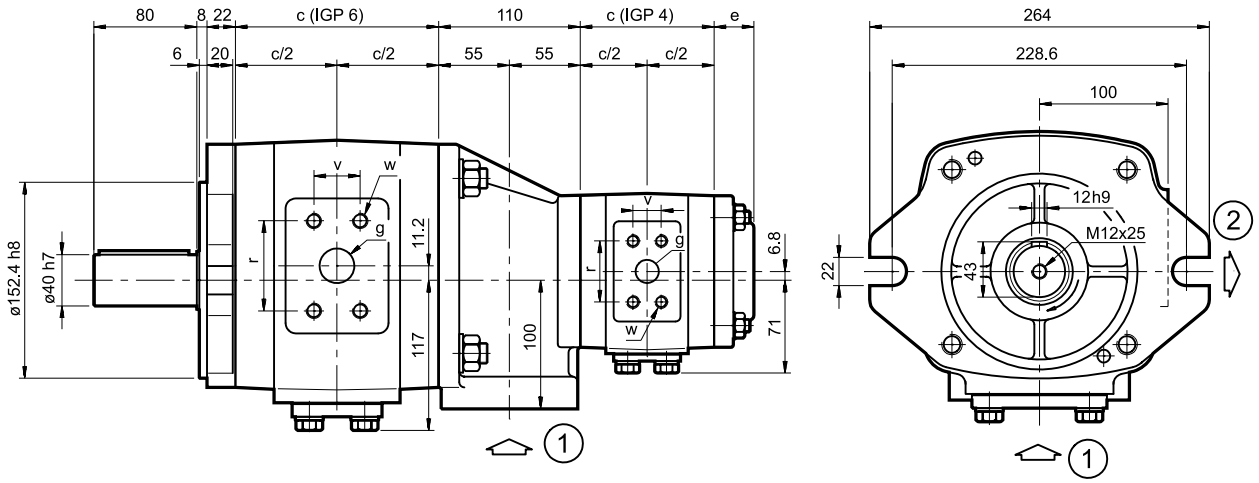
Refer to the values in the table of par. 11 for the dimensions expressed with alphabetical letters

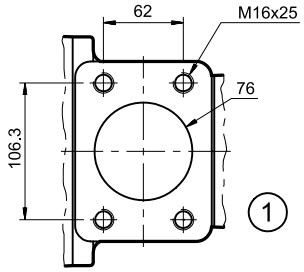
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

20 - IGP64 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





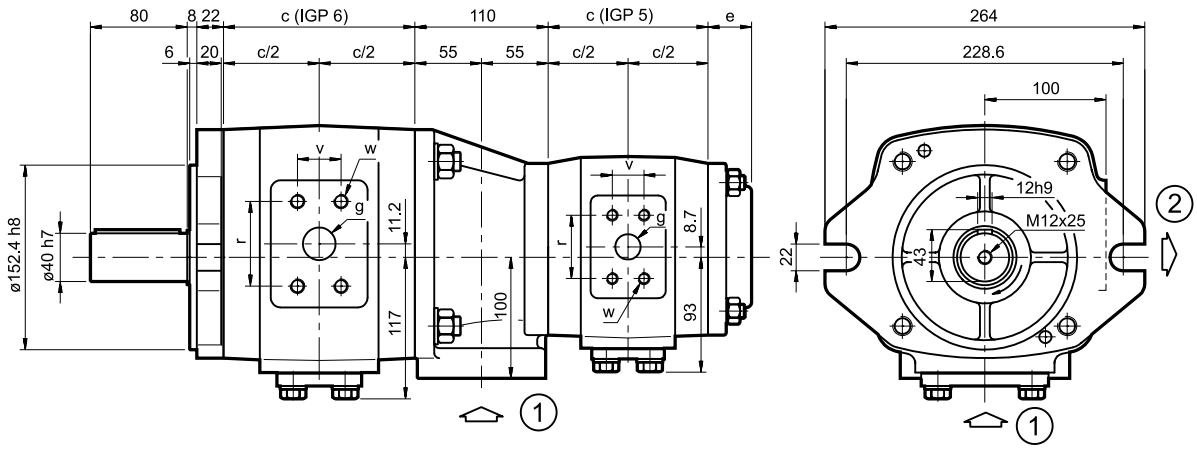
Refer to the values in the tables of:
paragraph 10 for IGP4
paragraph 12 for IGP6
for the dimensions expressed with alphabetical letters

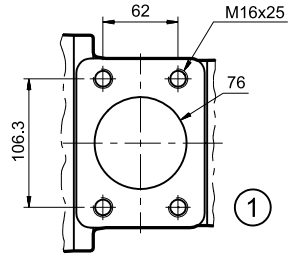
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

21 - IGP65 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





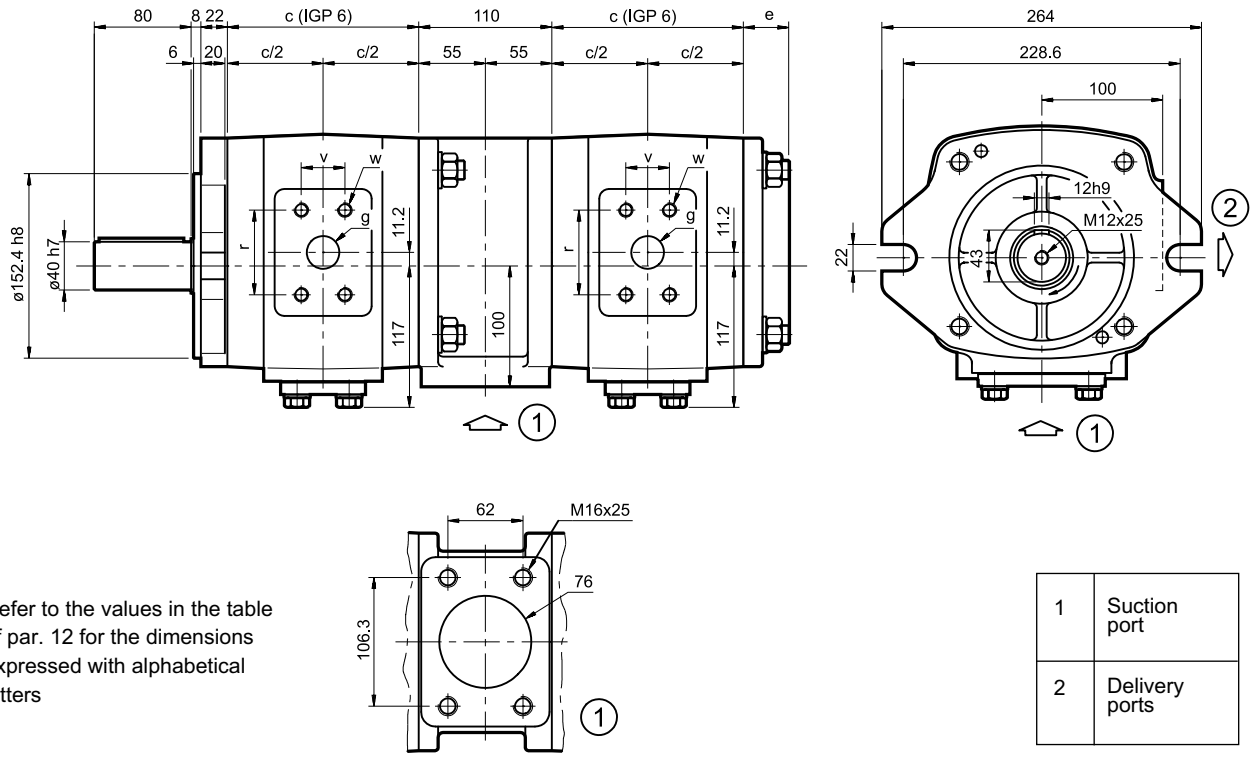
Refer to the values in the tables of:
paragraph 11 for IGP5
paragraph 12 for IGP6
for the dimensions expressed with alphabetical letters

1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

22 - IGP66 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



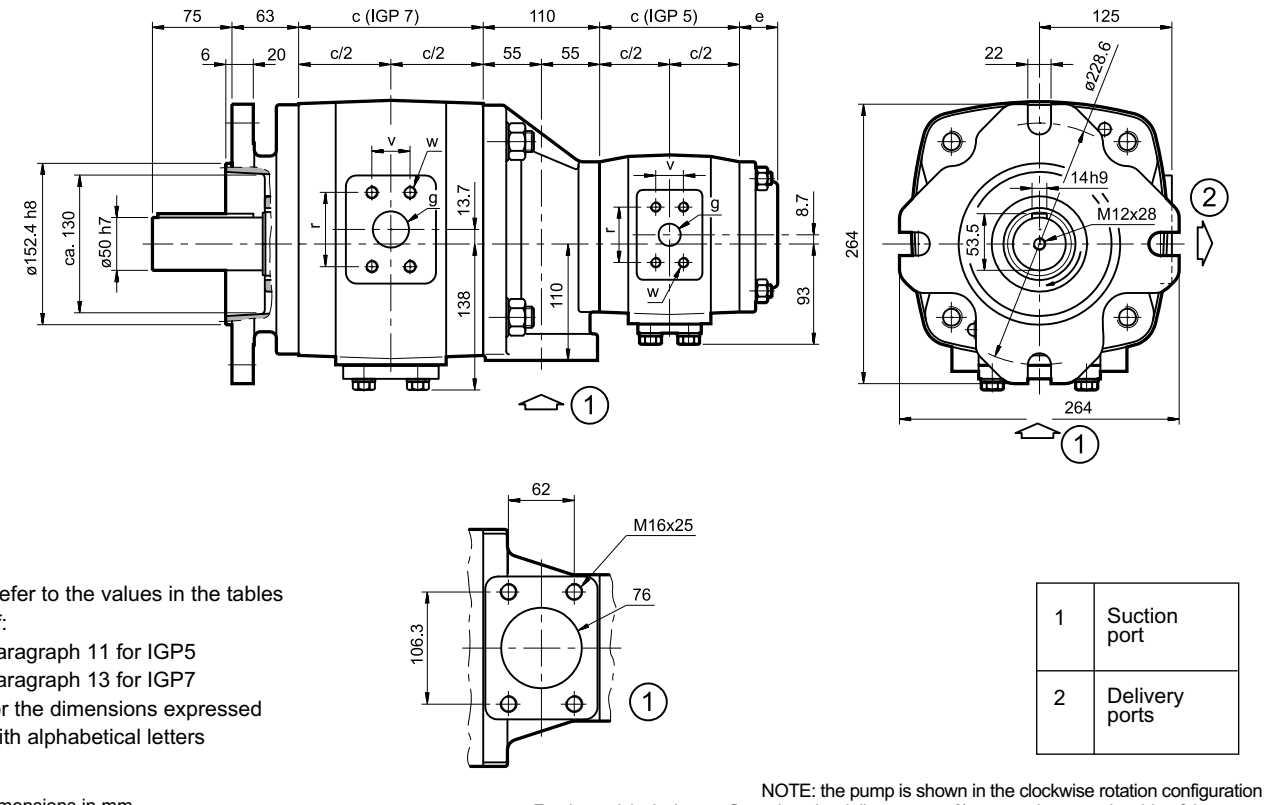
Refer to the values in the table of par. 12 for the dimensions expressed with alphabetical letters

1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

23 - IGP75 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



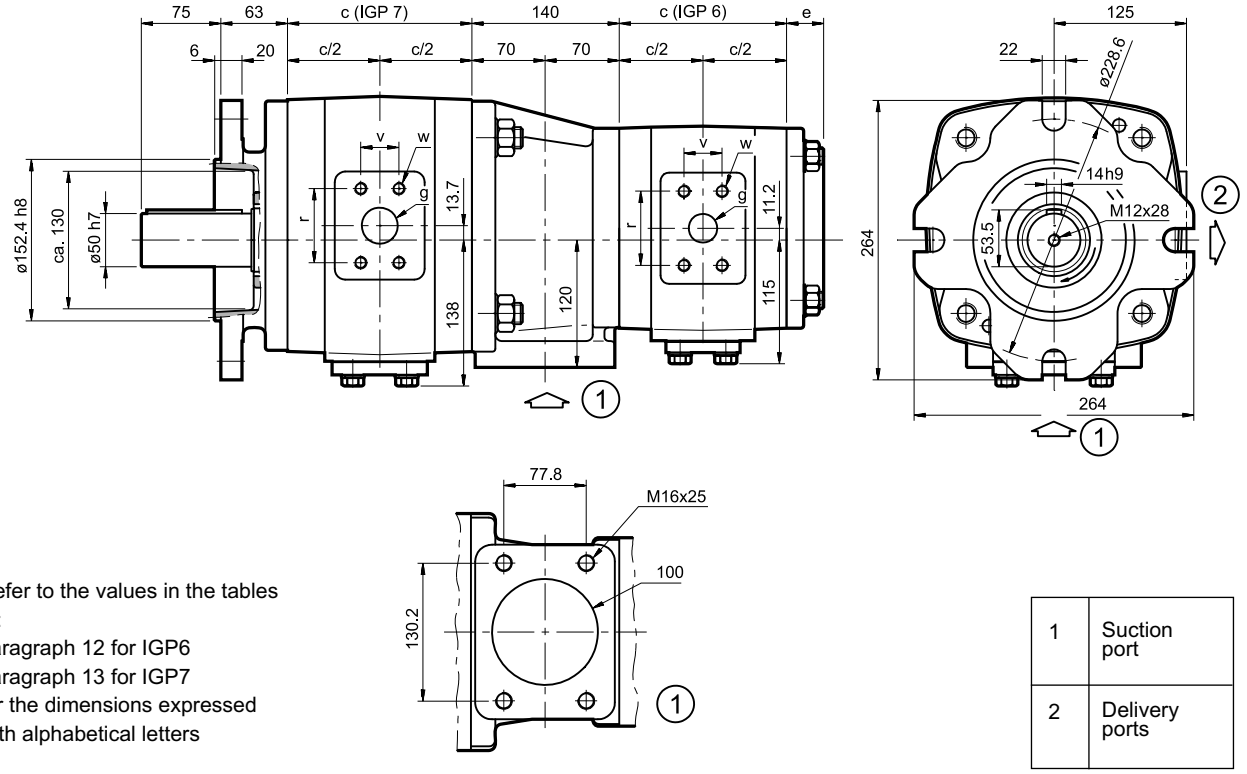
Refer to the values in the tables of:
paragraph 11 for IGP5
paragraph 13 for IGP7
for the dimensions expressed with alphabetical letters

1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

24- IGP76 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



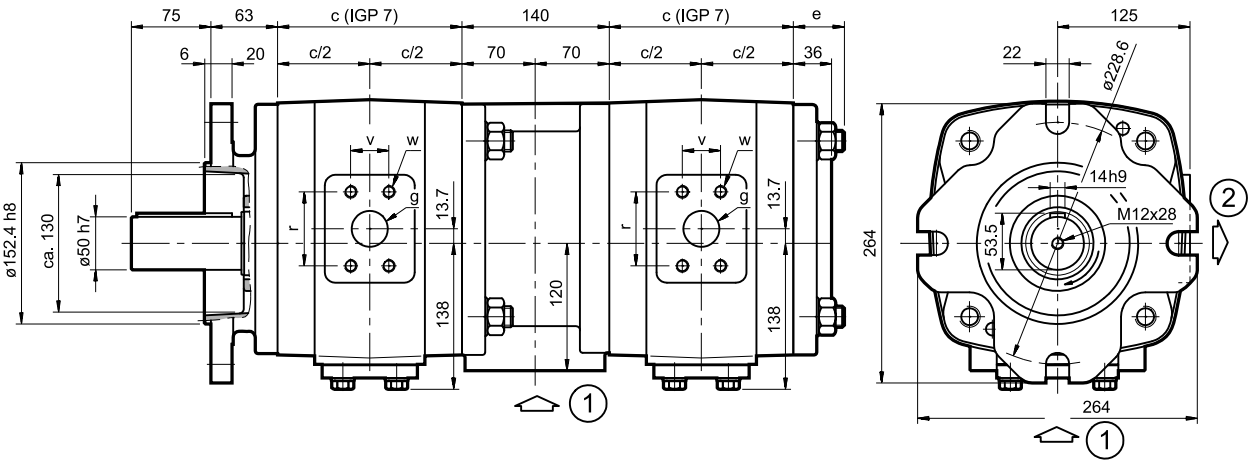
Refer to the values in the tables of:
paragraph 12 for IGP6
paragraph 13 for IGP7
for the dimensions expressed with alphabetical letters

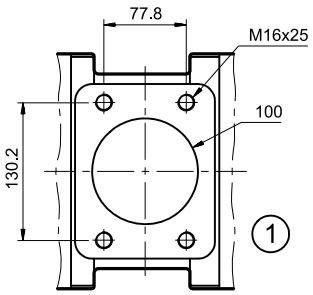
dimensions in mm

1	Suction port
2	Delivery ports

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

25- IGP77 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





Refer to the values in the table of par. 13 for the dimensions expressed with alphabetical letters

dimensions in mm

1	Suction port
2	Delivery ports

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

26 - INSTALLATION

— The IGP pumps can be installed with the shaft oriented in any position.

— Prior to putting the pump into operation, check that the rotation direction of the motor is according to the direction of the arrow marked on the pump body.

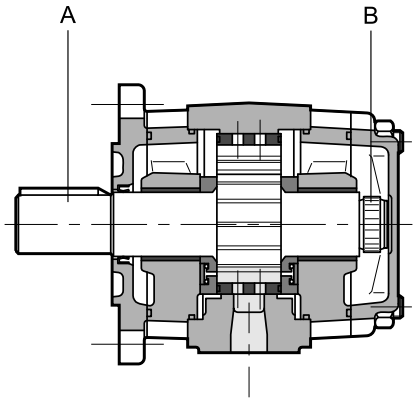
— The suction line must be sized so that the speed of the fluid does not exceed 1 m/s (1,5 m/s with positive pressure at the pump inlet).
The pump start up, especially at a cold temperature, should occur with the pump unloading.
Any bends and restrictions or an excessive line length can impair correct working of the pump.
The height of suction from the bottom of the tank must not be less than 50 mm.

— The IGP pumps are self-priming in the entire operating speed range specified. At the first start-up of the pump, it is necessary to vent the air from the delivery line.
If a check valve with cracking pressure of >1 bar is installed on the delivery line, it is necessary to vent the air from the circuit branch between the check valve and the pump at the time of start-up.

— The motor-pump connection must be carried out directly with a flexible coupling.
Consult our technical dept. for installations that generate axial or radial loads on the pump shaft.
The coupling must be mounted without axially forcing the pump shaft. Be sure that the joint coupling diameter be made with a K7 tolerance.

— Refer to paragraph 2.3 for the characteristics and installation of the filtering elements.

27 - MAXIMUM APPLICABLE TORQUE



PUMP SIZE	MAX. TORQUE APPLIED TO THE SHAFT [Nm]	
	PRIMARY SHAFT **A**	SECONDARY SHAFT **B**
IGP3	160	80
IGP4	335	190
IGP5	605	400
IGP6	1050	780
IGP7	1960	1200

NOTE: The pumps must be connected in order of decreasing displacement and size.

27.1 - Maximum applicable torque for double pumps

In the case of double pumps, even of the same displacement, each pump can operate at the maximum performances specified in par. 3.

27.2 - Maximum applicable torque for multiple pumps

The torque (M) at the inlet of each pump is given from the following equation:

$$M = \frac{9549 \cdot N}{n} = [Nm]$$

where the absorbed power (N) is given from:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta_{tot}} = [kW]$$

n = rotation speed [rpm]
Q = delivery [l/min]
Δp = differential pressure on the pump [bar]
η_{tot} = total efficiency (noted from the relative diagrams in par. 4-5-6-7-8)

or is calculated from the ABSORBED POWER diagrams (see par. 4-5-6-7-8).

In the case of multiple pumps, the torque of the single pump must be added to the torque generated by the downstream pumps.

The torque value thus calculated for each pump must be less than the relative value specified in the above table, taking the following into consideration:

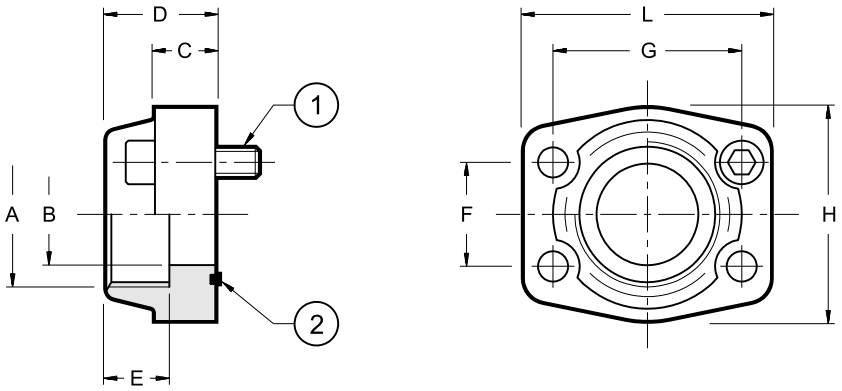
1st pump = refer to the specified values for primary shaft A

2nd, 3rd, 4th pump = refer to the specified values for secondary shaft B

In the event the calculated torque values are greater than the values shown in the table, it is necessary to reduce the operating pressure or substitute the overloaded pump with one that can support the required torque.

28 - SAE J518 c code 61 CONNECTION FLANGES

dimensions in mm

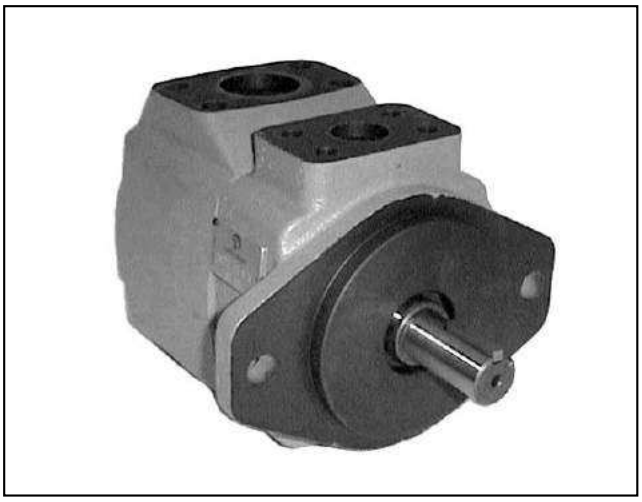


Flange code	Flange description	pmax [bar]	∅A	∅B	C	D	E	F	G	H	L	1 4 bolts	2
0610718	SAE - 1/2"	345	1/2" BSP	13	16	36	19	17,5	38,1	46	54	M8 x 30	OR 4075
0610719	SAE - 3/4"	345	3/4" BSP	19	18	36	19	22,2	47,6	50	65	M10 x 35	OR 4100
0610713	SAE - 1"	345	1" BSP	25	18	38	22	26,2	52,4	55	70		OR 4131
0610720	SAE - 1 1/4"	276	1 1/4" BSP	32	21	41	22	30,2	58,7	68	79		OR 4150
0610714	SAE - 1 1/2"	207	1 1/2" BSP	38	25	45	24	35,7	70	78	94	M12 x 45	OR 4187
0610725	SAE - 1 1/2"	345	1 1/2" BSP	38	36	50	25	36	70	80	95	M12 x 55 12K	OR 4187
0610721	SAE - 2"	207	2" BSP	51	25	45	30	43	77,8	90	102	M12 x 45	OR 4225
0610722	SAE - 2 1/2"	172	2 1/2" BSP	63	25	50	30	50,8	89	105	116		OR 4275
0610723	SAE - 3"	138	3" BSP	73	27	50	34	62	106,4	124	134	M16 x 50	OR 4437
0610726	SAE - 4"	34	4" BSP	99	27	48	34	77,8	130,2	146	162		OR 4437

The fastening bolts and the O-Rings must be ordered separately.

DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

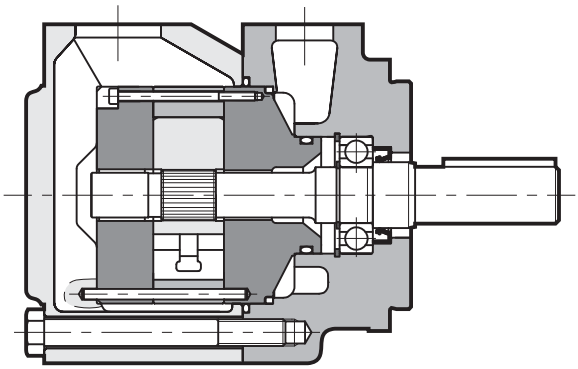


DFP

FIXED DISPLACEMENT VANE PUMPS

SERIES 20

OPERATING PRINCIPLE



— The DFP pumps are fixed displacement vane pumps made in four different sizes, each size having five different nominal displacement. They are available with one pumping element (single pump) or with double pumping element (double pump). See par. 15 ÷ 20 for the combinations of double pumps.

— The pumping group is composed of a cartridge type compact element that contains the rotor, the vanes, the cam ring and the head disks. The cartridge is easily removable without the need to disconnect the pump from the hydraulic circuit, thus simplifying the maintenance operations.

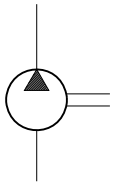
— The special elliptical profile of the cam ring, with double suction and delivery chambers one against the other, eliminates the radial thrusts on the rotor, decisively reducing wear of the pump. In addition, the use of a 12-vane rotor reduces the delivery pressure pulsations, suppressing the vibrations and noise level of the pump.

TECHNICAL SPECIFICATIONS

DFP PUMP SIZE		1	2	3	4
Displacement range	cm^3/rev	18 ÷ 45,9	40,1 ÷ 67,5	69 ÷ 121,6	138,6 ÷ 193,4
Flow rate range (at 1.500 rpm)	l/min.	26,1 ÷ 69,6	58,8 ÷ 99,8	101,4 ÷ 177,3	203,4 ÷ 285
Operating pressures		see table 3 - performances			
Rotation speed		see table 3 - performances			
Rotation direction		clockwise or anticlockwise (seen from the shaft side)			
Loads on the shaft		axial loads are not allowed			
Hydraulic connection		flange fittings SAE J518 (see par. 22)			
Type of fastening		flanged SAE			
Mass (single pump)	kg	12	15	23	34

Ambient temperature range	°C	–20 / +50
Fluid temperature range (see par. 4)	°C	–10 / +70
Fluid viscosity range	see par. 4.2	
Recommended true viscosity	cSt	25 ÷ 50
Degree of fluid contamination	see par. 4.3	

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

D	F				-		/		-					/	20	/	

Fixed displacement vane pump

Pump type
P = single pump
DP = double pump
C = shaft side cartridge or for single pump
CC= cover side cartridge

Pump size:
- single pump
- shaft side pump
(only for double pumps):

1 = from 18 to 45,9 cm³/rev
2 = from 40,1 to 67,5 cm³/rev
3 = from 69 to 121,6 cm³/rev
4 = from 138,6 to 193,4 cm³/rev

Added pump size
(only for double pumps):

1 = from 18 to 45,9 cm³/rev
2 = from 40,1 to 67,5 cm³/rev
3 = from 69 to 121,6 cm³/rev

NOTE: the cover side pump must be at least one size smaller than the shaft side pump

Size:
- single pump
- shaft side pump
- shaft side cartridge
(see performances table, par. 3)

Size (only for double pumps)
- cover side pump
- cover side cartridge
(see performances table, par. 3)

Rotation direction (seen from the shaft side)
R = clockwise **L** = anticlockwise

Suction opening orientation compared with the delivery (omit for cartridges)
A = aligned on the same side
B = at 90°
C = opposed to each other
D = at 270°
} see par. 2

Cover side delivery port orientation compared with the shaft side delivery - for double pumps (omit for single pumps or cartridges)
A = aligned on the same side
B = at 90°
C = opposed to each other
D = at 270°
} see par. 2

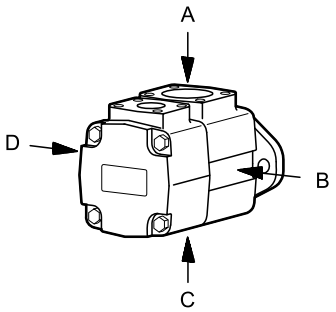
Type of shaft end
1 = with key
other shaft types are available upon request

Series No.
(the overall and mounting dimensions remain unchanged from 20 to 29)

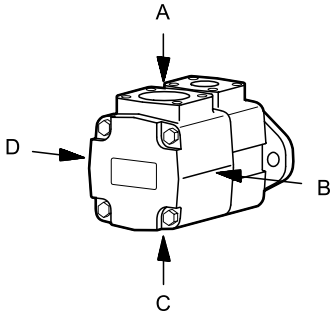
Seals: omit for mineral oils
V = viton for special fluids

2 - PORTS ORIENTATION

SINGLE PUMPS



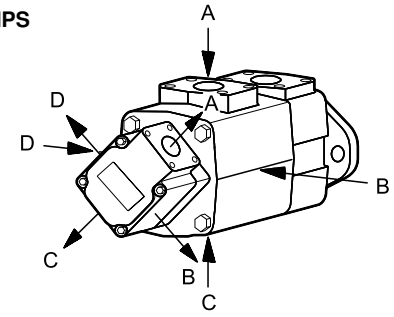
DFP1

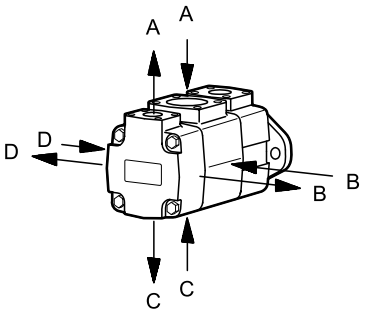


DFP2
DFP3
DFP4

DOUBLE PUMPS

DFP21
DFP31
DFP32
DFP41
DFP42





DFP43

3 - PERFORMANCES (obtained with mineral oil with viscosity of 32 cSt at 40°C)

PUMP SIZE	NOMINAL DIMENSION	DISPLACEMENT [cm³/rev]	MAX. FLOW RATE (at 1500 rpm) [l/min.]	MAX. OPERATING PRESSURE (at 1500 rpm) [bar]	MAX. ROTATION SPEED [rpm] (see par. 5)	MIN. ROTATION SPEED [rpm]
DFP1	05	18	26,1	210	2700	600
	08	27,4	39,4			
	11	36,4	52,6			
	12	39,5	58,7	160		
	14	45,9	69,6	140		
DFP2	12	40,1	58,8	210	2500	600
	14	45,4	65,7			
	17	55,2	80,2			
	19	60,1	88,7			
	21	67,5	99,8			
DFP3	21	69	101,4	210	2400	600
	25	81,6	120,1			
	30	97,7	141,2			
	35	112,7	167,2			
	38	121,6	177,3			
DFP4	42	138,6	203,4	175	2200	600
	47	153,5	222,7			
	50	162,2	234			
	57	183,4	267			
	60	193,4	285			

4 - HYDRAULIC FLUID

4.1 Fluid type

TYPE OF FLUID	MAXIMUM PRESSURE (bar)				MAXIMUM SPEED (rpm)				MAXIMUM FLUID TEMPERATURE [°C]
	DFP1	DFP2	DFP3	DFP4	DFP1	DFP2	DFP3	DFP4	
HFD PHOSPHATE ESTERS	175	175	175	175	1200	1200	1200	1200	≤ 70
HFC WATER GLYCOL	140	140	140	140	1500	1500	1500	1500	≤ 50

NOTE 1: The maximum suction pressure allowed, with all fluid types, is 1,4 bar. The minimum suction pressure varies from -0,2 bar with mineral oil to -0,1 bar with the other fluid types (the pressure values are to be considered relative).

The pressures, the maximum allowed speeds and the recommended temperatures according to the different types of hydraulic fluids used are shown in the table.

4.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	16 cSt	referred to the maximum temperature of 80 °C of the fluid
optimum viscosity	25 ÷ 50 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	800 cSt	limited to only the pump start-up phase

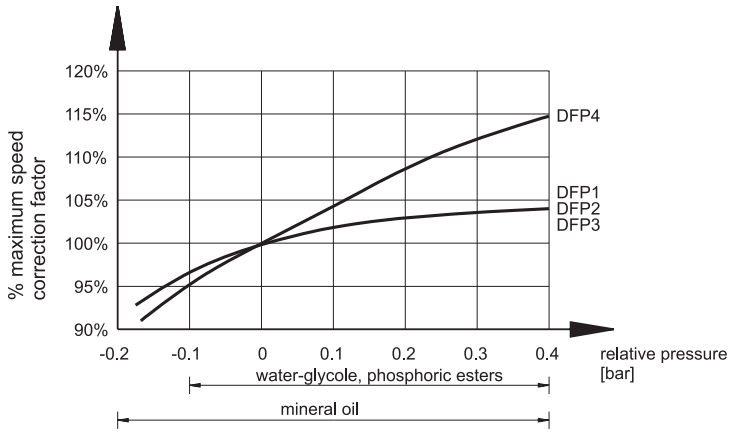
When choosing the fluid type, verify that the true viscosity at the operating temperature is within the above range.

4.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with $\beta_{20} \geq 75$ is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with $\beta_{10} \geq 100$ is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in the note 1, at paragraph 3. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

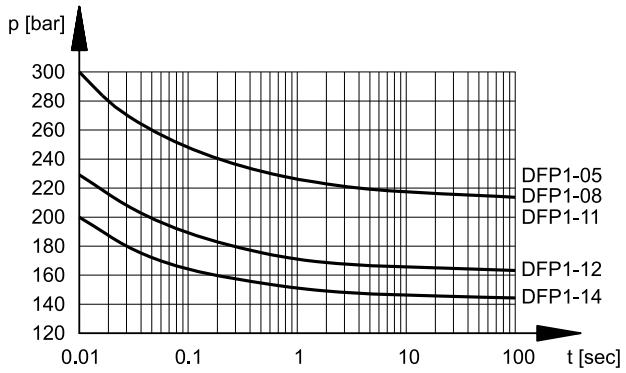
5 - MAXIMUM SPEED CORRECTION FACTOR

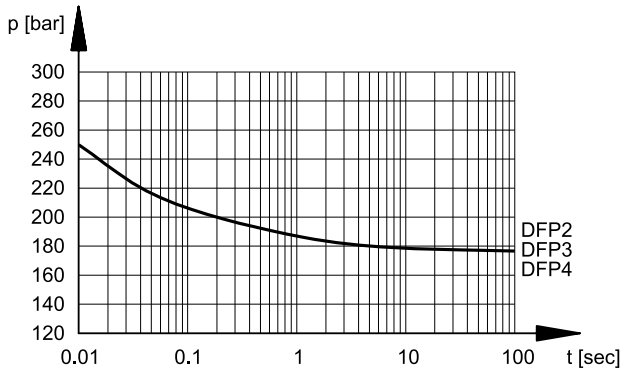


If the pressure in the suction line is different than zero, the maximum rotation speed shown in table 3 must be multiplied by the correction factor obtained from the diagram seen on the left.

6 - PRESSURE PEAK (values obtained with mineral oil with viscosity of 32 cSt at 40°C, delivery pressure 140 bar and suction pressure 0 bar)

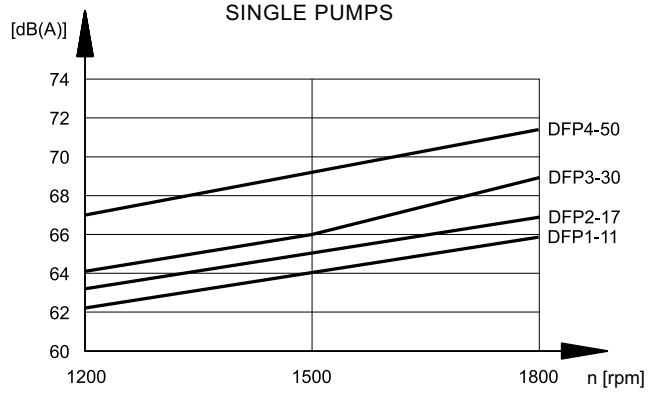
The maximum allowed over pressure on the pump delivery according to the pressure peak residency time is shown in the diagrams. The curves are valid for both single pumps and double pumps.

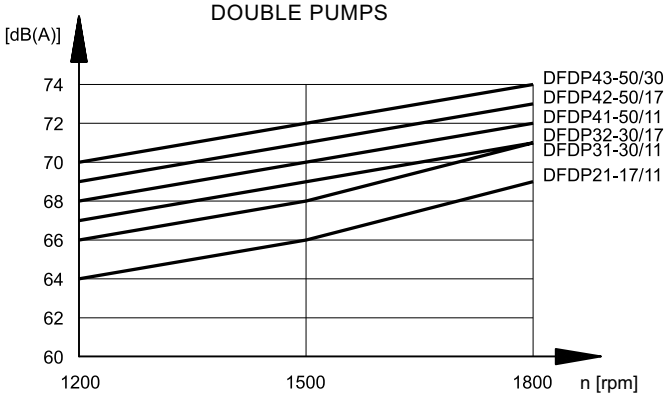




7- NOISE LEVEL (values obtained with mineral oil with viscosity of 32 cSt at 40°C, delivery pressure 140 bar and suction pressure 0 bar)

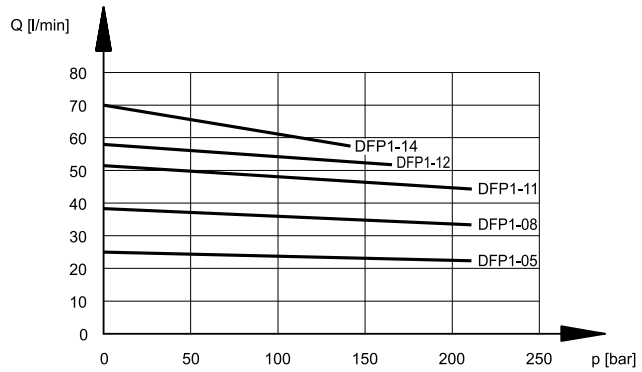
The diagram curves were measured in a semi-anechoic room according to ISO 4412/1 at a distance of 1 m from the pump. The values refer to the intermediate size pump.



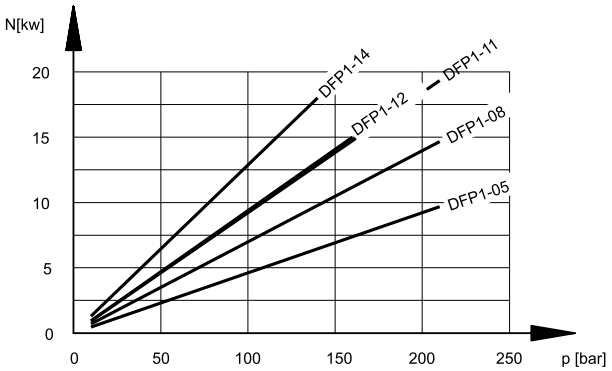


8 - DFP1 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 32 cSt at 40°C)

FLOW RATE/PRESSURE CURVES (measured at 1500 rpm)

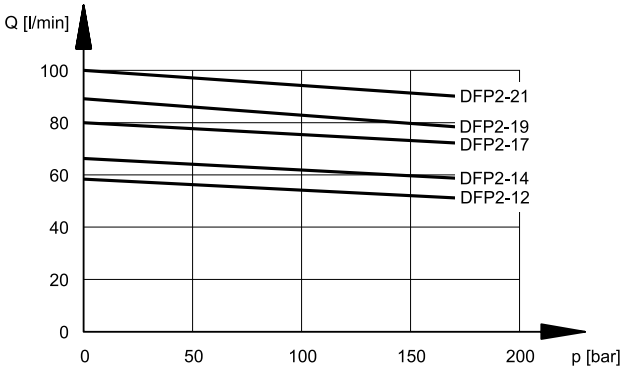


ABSORBED POWER/PRESSURE CURVES (measured at 1500 rpm)

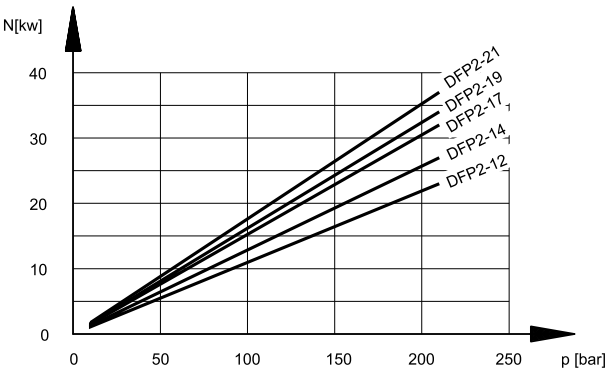


8 - DFP2 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 32 cSt at 40°C)

FLOW RATE/PRESSURE CURVES (measured at 1500 rpm)

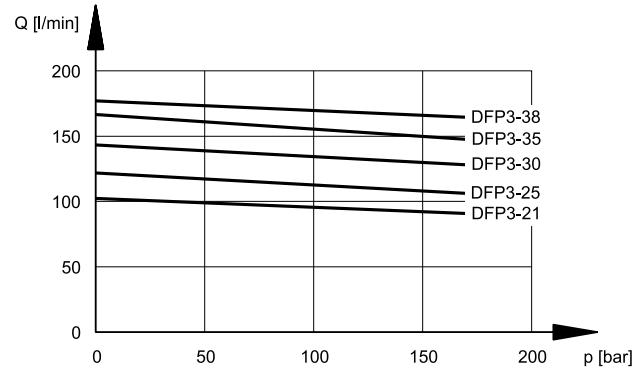


ABSORBED POWER/PRESSURE CURVES (measured at 1500 rpm)

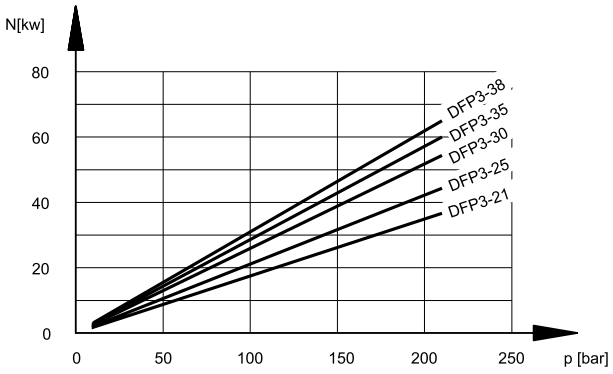


9 - DFP3 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 32 cSt at 40°C)

FLOW RATE/PRESSURE CURVES (measured at 1500 rpm)

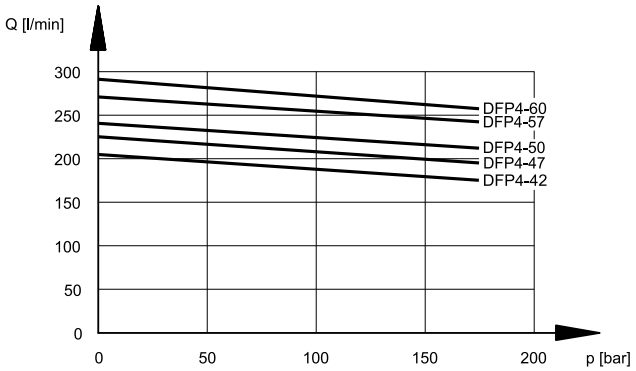


ABSORBED POWER/PRESSURE CURVES (measured at 1500 rpm)

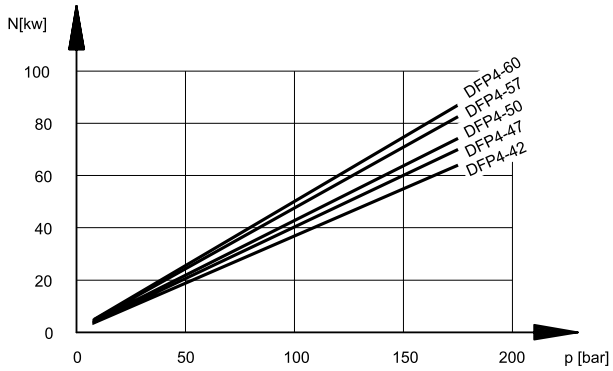


10 - DFP4 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 32 cSt at 40°C)

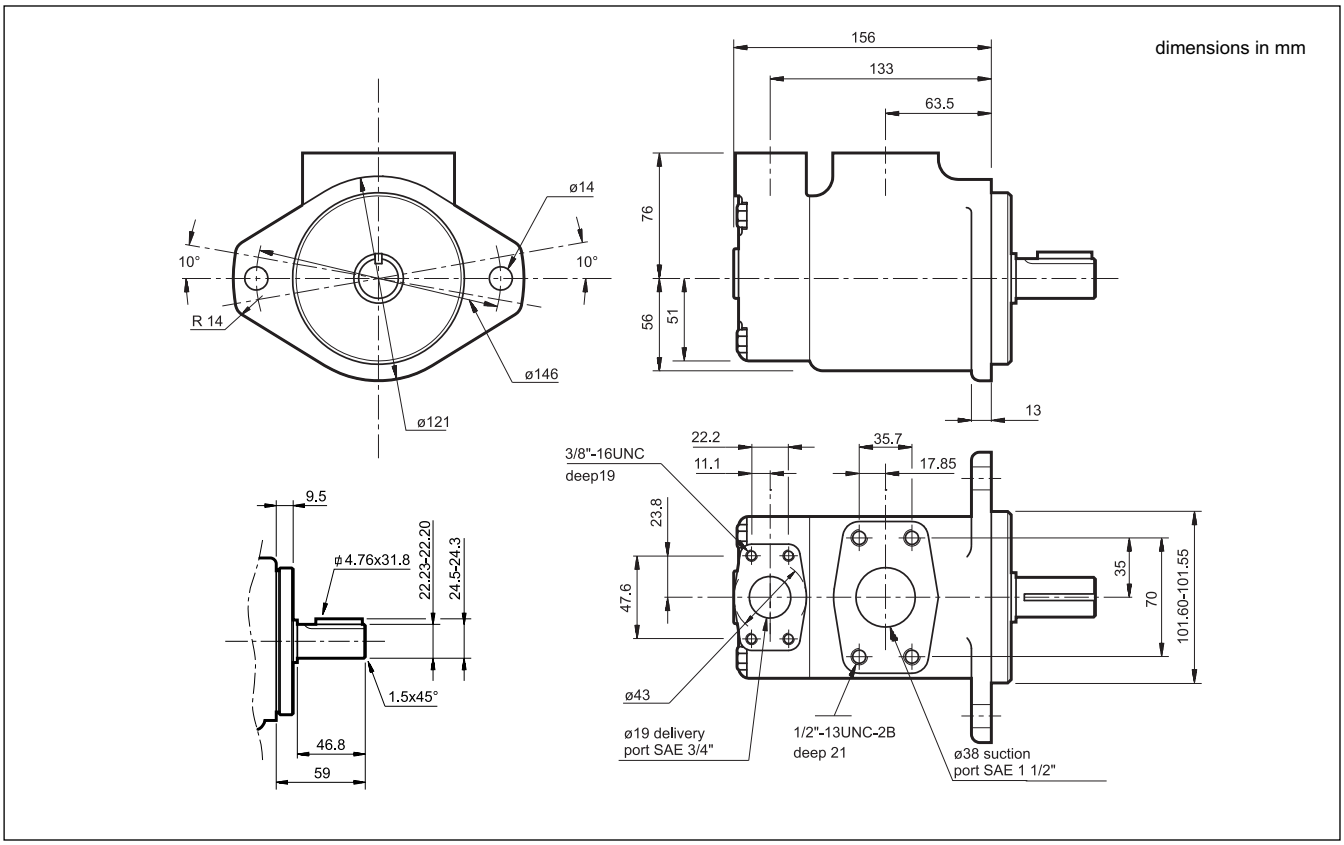
FLOW RATE/PRESSURE CURVES (measured at 1500 rpm)



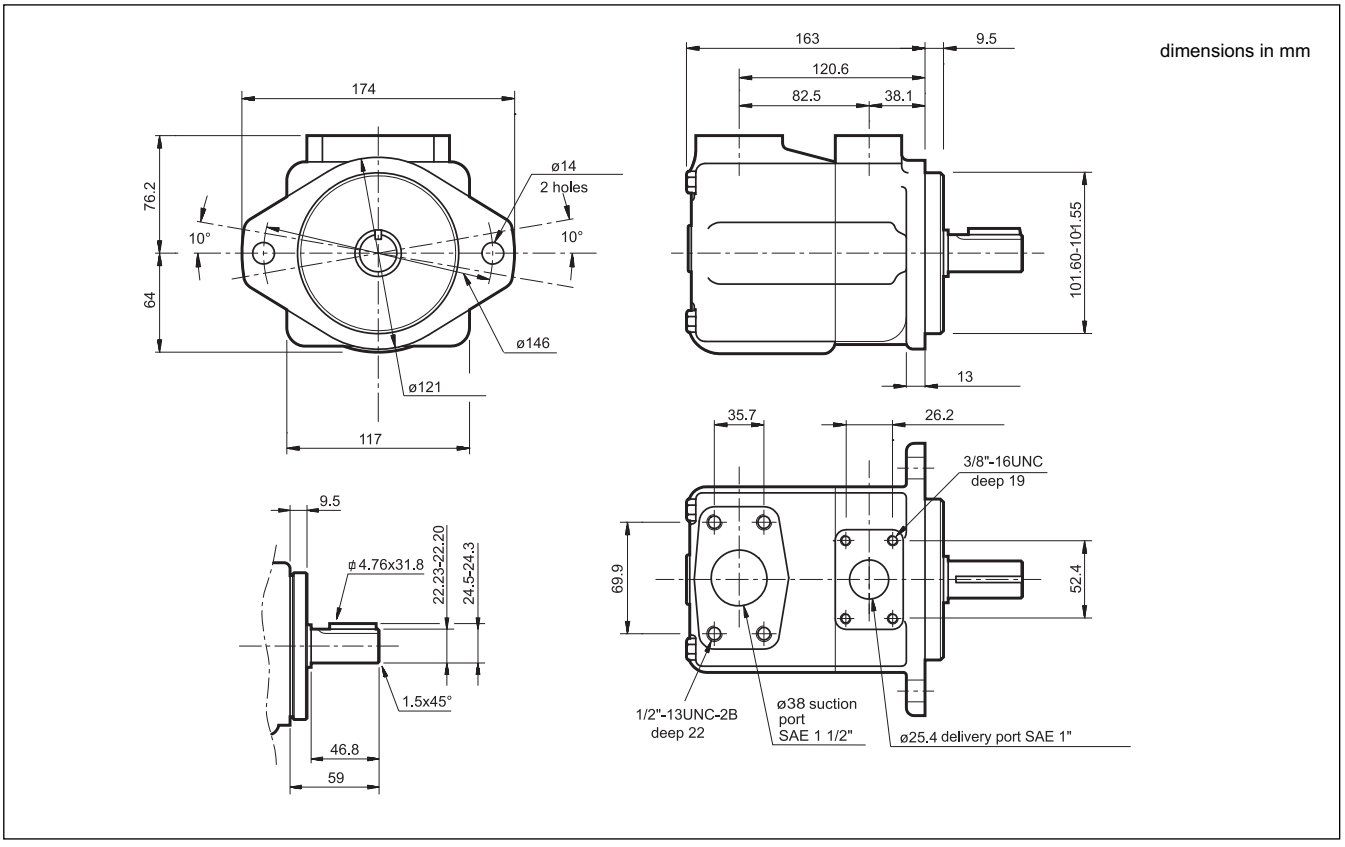
ABSORBED POWER/PRESSURE CURVES (measured at 1500 rpm)



11 - DFP1 PUMP OVERALL AND MOUNTING DIMENSIONS

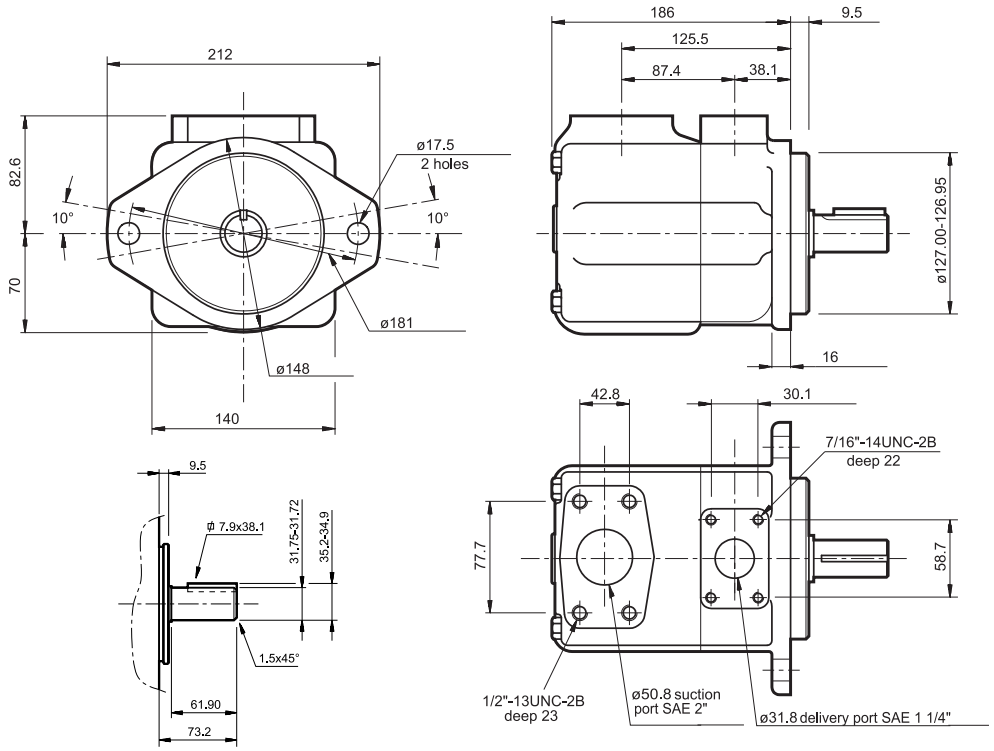


12 - DFP2 PUMP OVERALL AND MOUNTING DIMENSIONS



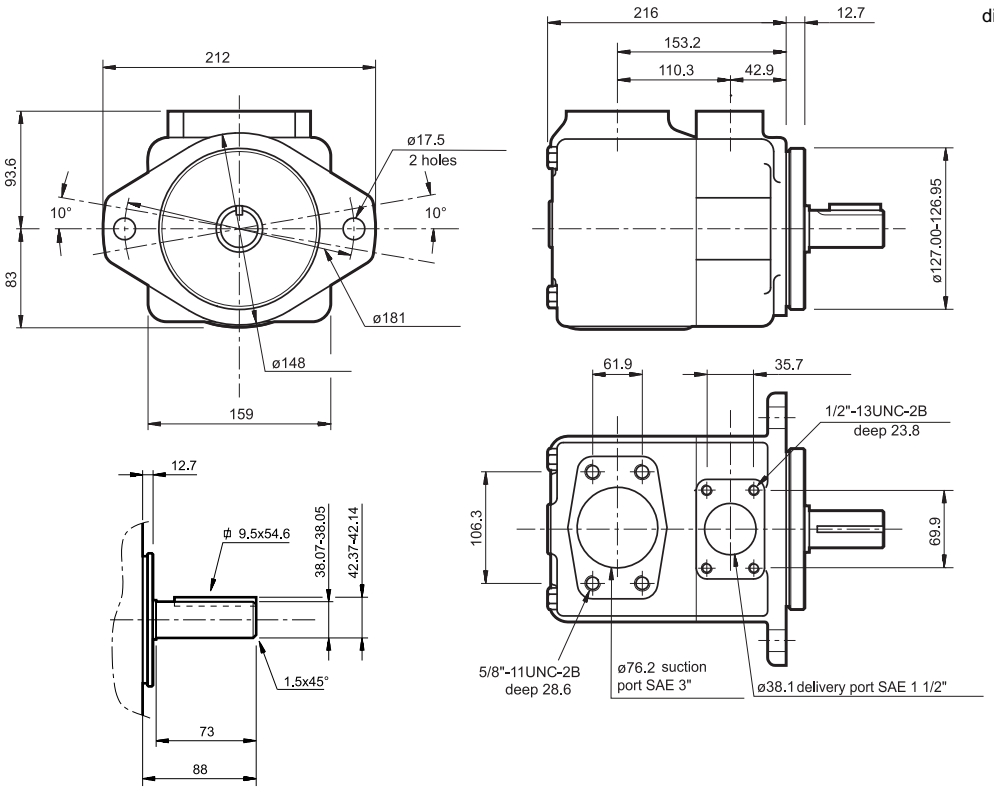
13 - DFP3 PUMP OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



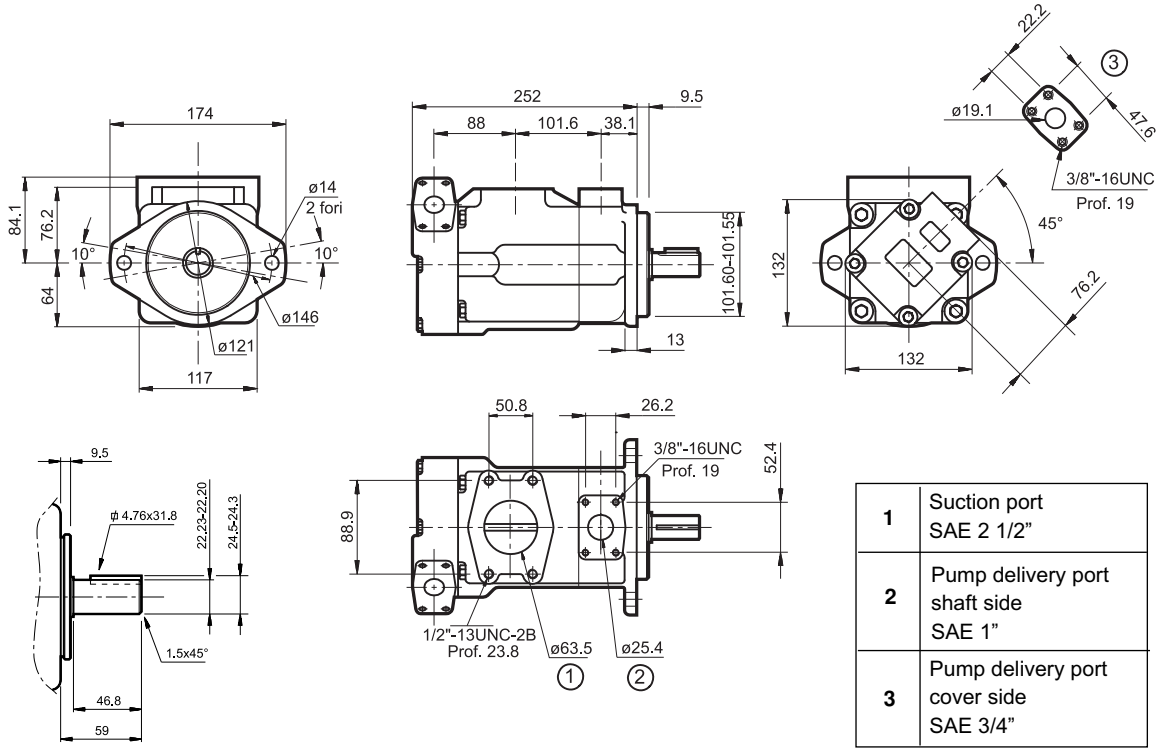
14 - DFP4 PUMP OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



15 - DFDP21 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

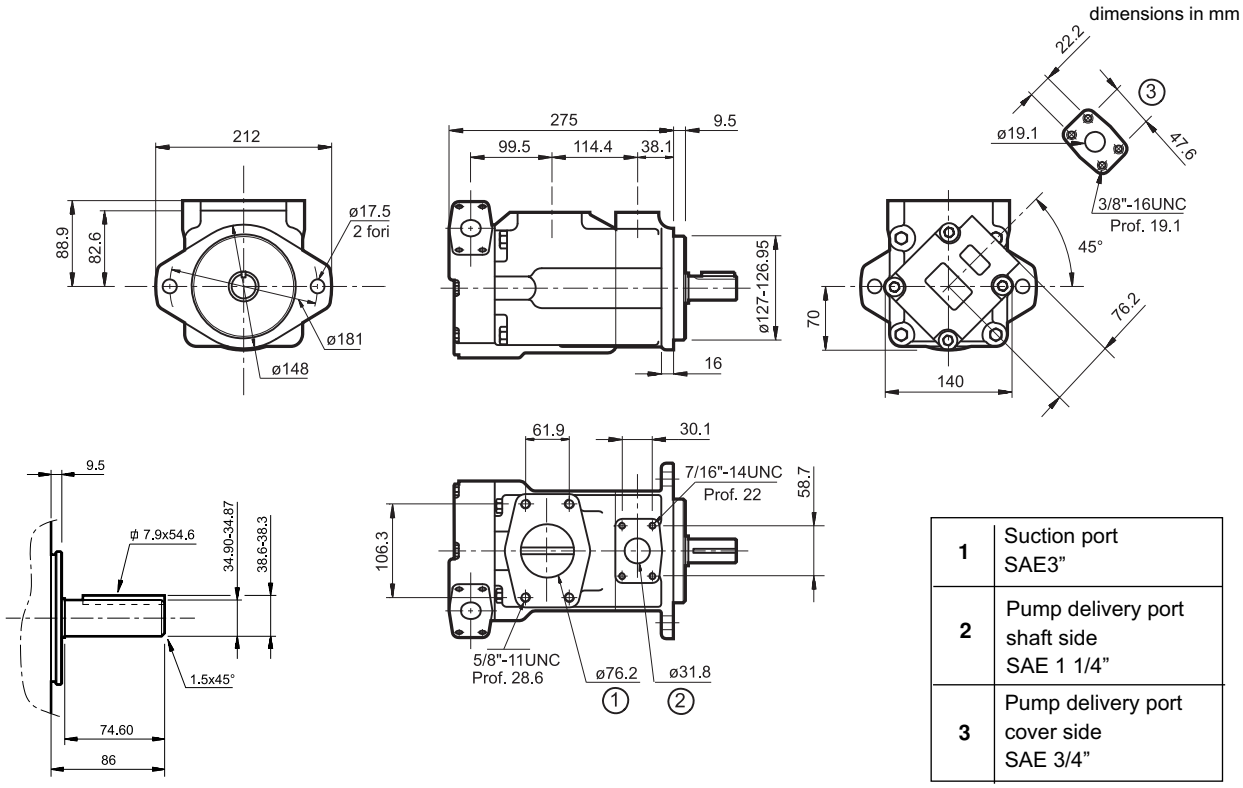
dimensions in mm



1	Suction port SAE 2 1/2”
2	Pump delivery port shaft side SAE 1”
3	Pump delivery port cover side SAE 3/4”

16 - DFDP31 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

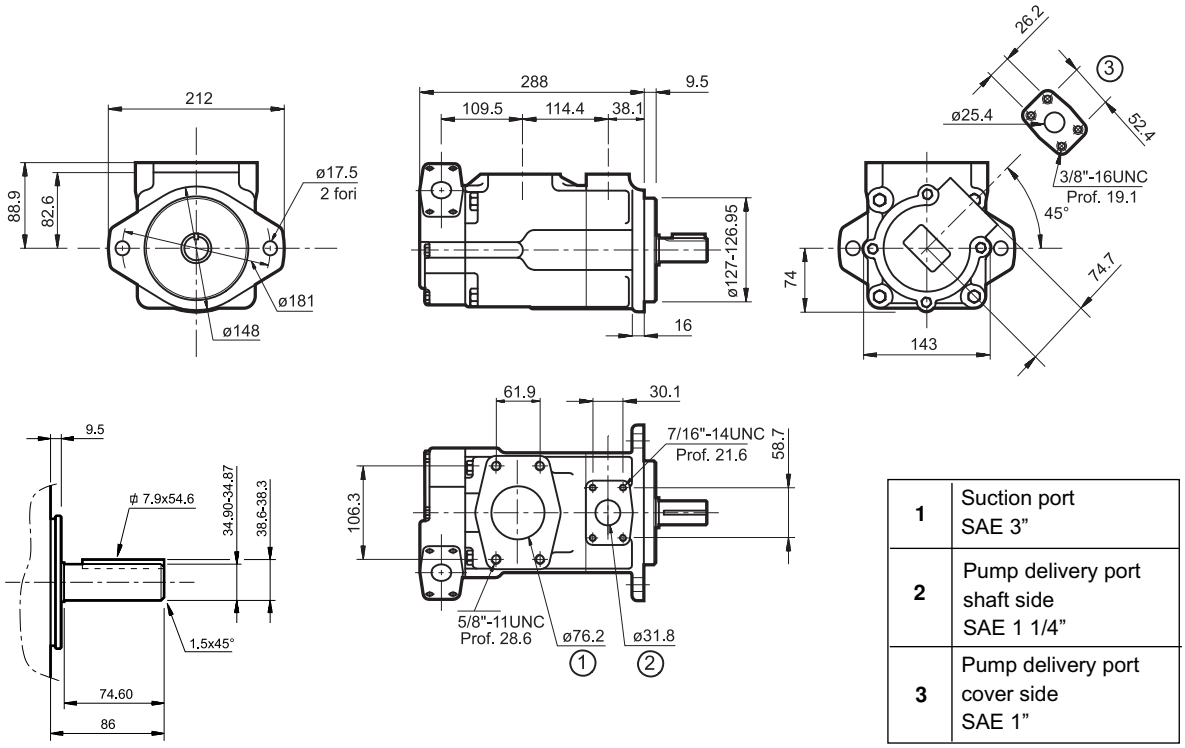
dimensions in mm



1	Suction port SAE3”
2	Pump delivery port shaft side SAE 1 1/4”
3	Pump delivery port cover side SAE 3/4”

17 - DFDP32 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

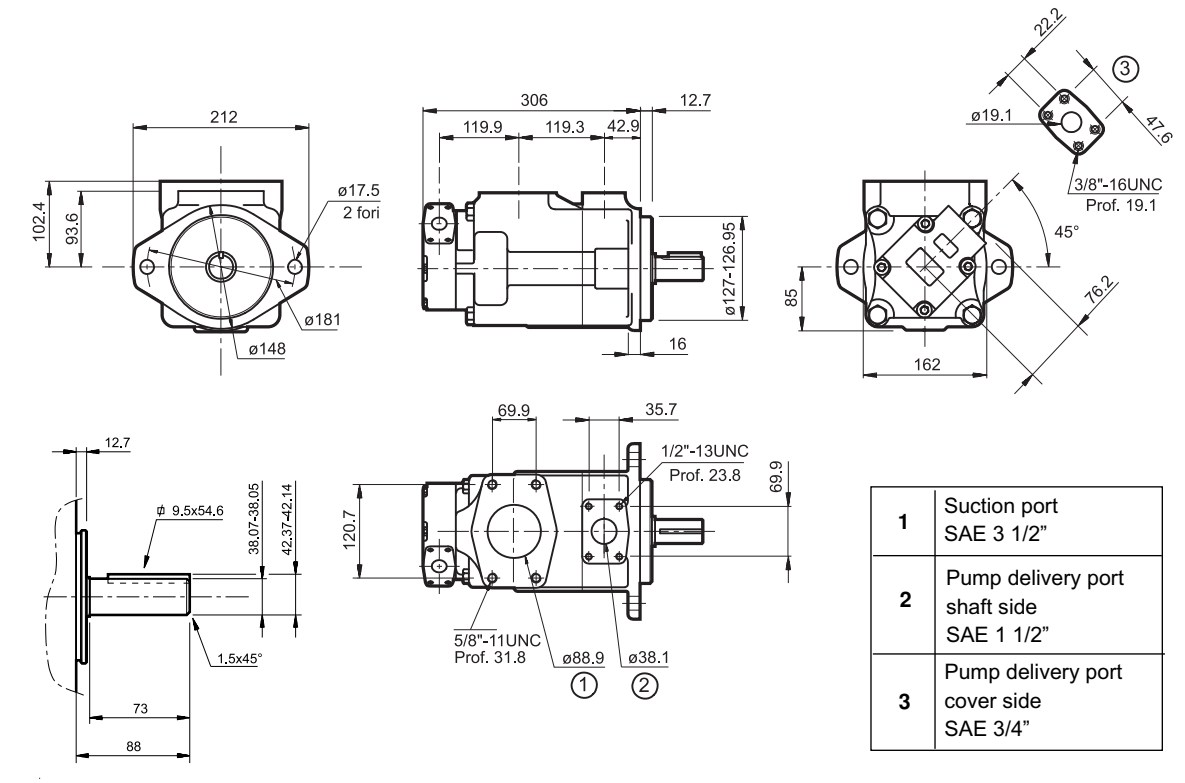
dimensions in mm



1	Suction port SAE 3”
2	Pump delivery port shaft side SAE 1 1/4”
3	Pump delivery port cover side SAE 1”

18 - DFDP41 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

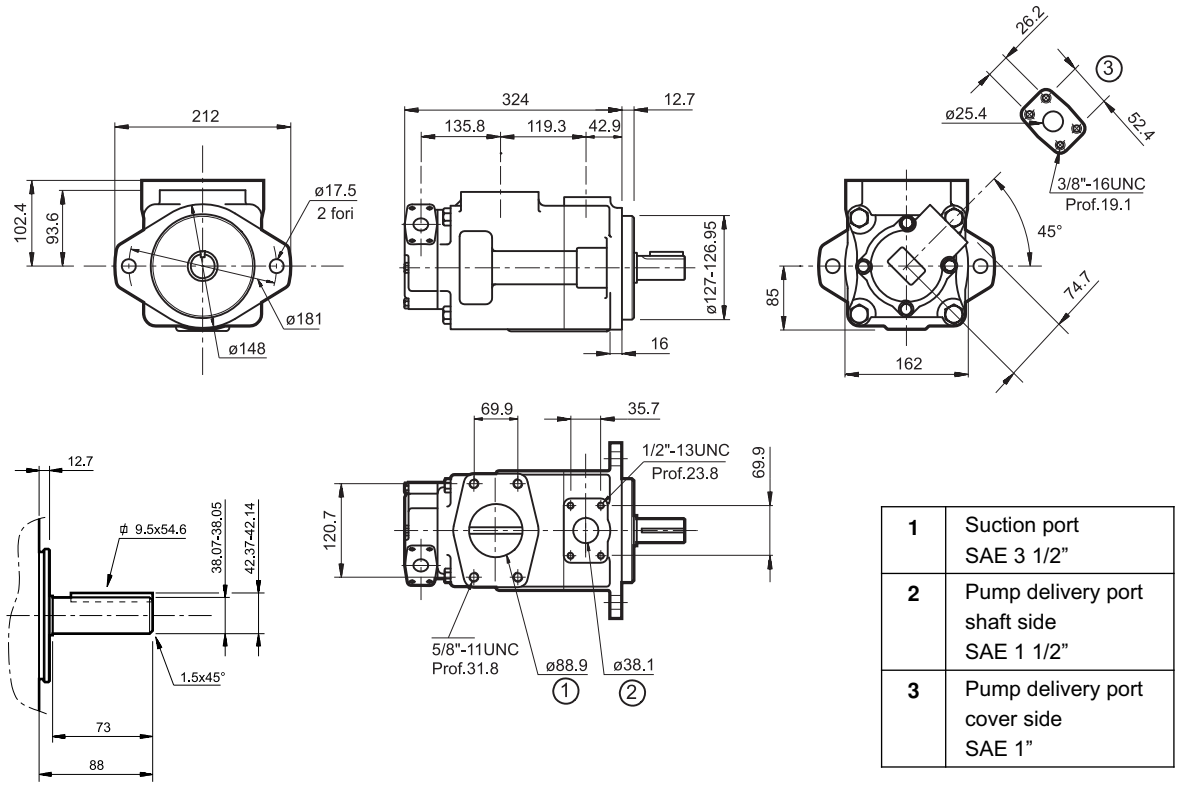
dimensions in mm



1	Suction port SAE 3 1/2”
2	Pump delivery port shaft side SAE 1 1/2”
3	Pump delivery port cover side SAE 3/4”

19 - DFDP42 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

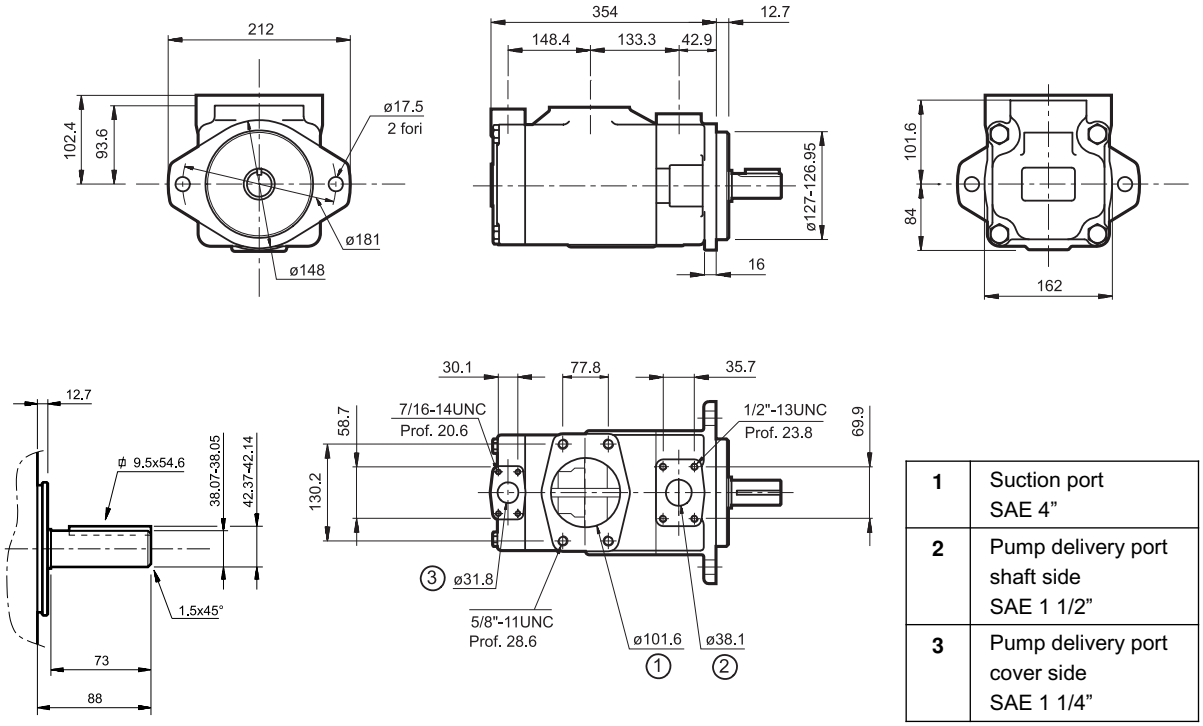
dimensions in mm



1	Suction port SAE 3 1/2”
2	Pump delivery port shaft side SAE 1 1/2”
3	Pump delivery port cover side SAE 1”

20 - DFDP43 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Suction port SAE 4”
2	Pump delivery port shaft side SAE 1 1/2”
3	Pump delivery port cover side SAE 1 1/4”

21 - INSTALLATION

— The DFP pumps can be installed with the shaft oriented in any position.

— Check that the rotation direction of the motor is according to the rotation direction of the pump before start up.

— The pump start up, especially at a cold temperature, should occur with the pump unloading.

— The suction line must be suitably sized to facilitate the flow of oil.
Bends and restrictions or an excessive line length can impair correct functioning of the pump.

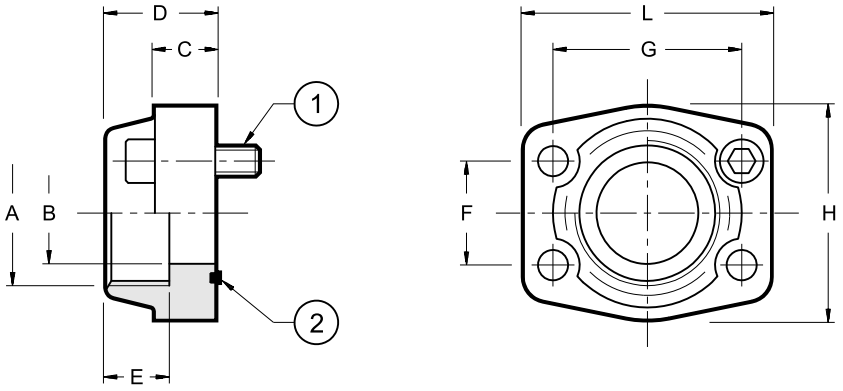
— The pumps are normally positioned directly above the oil tank.
Flooded suction port installation of the pumps is advisable in the case of circuits with high flow rates and pressures.

— The motor-pump coupling must be made directly with a flexible coupling.
Couplings that generate axial or radial loads on the pump shaft are not allowed.

— Refer to paragraph 4.3 for the characteristics and installation of the filtering elements.

22 - SAE J518 CONNECTION FLANGES

dimensions in mm



Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	1 N. 4 SHC bolts	Bolts code	2
0610719	SAE - 3/4”	345	3/4” BSP	19	18	36	19	22,2	47,6	50	65	3/8” UNC x 1 1/2”	0530612	OR 4100
0610713	SAE - 1”	345	1” BSP	25	18	38	22	26,2	52,4	55	70			OR 4131
0610720	SAE - 1 1/4”	276	1 1/4” BSP	32	21	41	22	30,2	58,7	68	79	7/16” UNC x 1 1/2”	0530613	OR 4150
0610714	SAE - 1 1/2”	207	1 1/2” BSP	38	25	45	24	35,7	70	78	93	1/2” UNC x 1 3/4”	0530638	OR 4187
0610721	SAE - 2”	207	2” BSP	51	25	45	30	43	77,8	90	102			OR 4225
0610722	SAE - 2 1/2”	172	2 1/2” BSP	63	25	50	30	50,8	89	105	116			OR 4175
0610723	SAE - 3”	138	3” BSP	73	27	50	34	62	106,4	116	134	5/8” UNC x 2”	0530658	OR 4337
0610724	SAE - 3 1/2”	34	3 1/2” BSP	89	27	48	34	69,8	120,7	136	152			OR 4387
0773528	SAE - 4”	34	4” BSP	99	27	48	34	77,77	130,18	146	162			OR 4437

The fastening bolts and the O-Rings must be ordered separately.

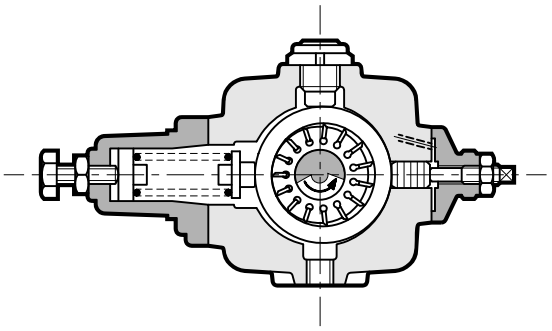
DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

PVD

VARIABLE DISPLACEMENT VANE PUMPS WITH DIRECT PRESSURE ADJUSTER

OPERATING PRINCIPLE



— The PVD pumps are variable displacement vane pumps with a mechanical type of pressure compensator.

— They allow instantaneous adjustment of the flow rate according to the circuit requirements. The consequence is that energy consumption is reduced and adequate in every phase of the cycle.

— The pump group is complete with hydrostatic axial compensation distribution plates that improve the volumetric efficiency and reduce wear of the components.

— The pressure compensator keeps the cam ring of the pumping group in the eccentric position with use of an adjustable load spring. When the delivery pressure equals the pressure corresponding to the spring setting, the cam ring is moved toward the center, adjusting the flow rate to the values required by the plant.

— In zero flow demand conditions, the pump delivers oil only to compensate any possible bleedings and pilotings, keeping the circuit pressure constant.

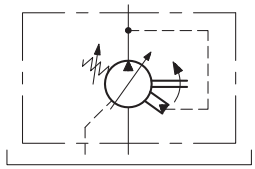
— The compensator response times are very low such as to allow elimination of the pressure relief valve.

PERFORMANCE RATINGS (measured with mineral oil with viscosity of 36 cSt at 50°C)

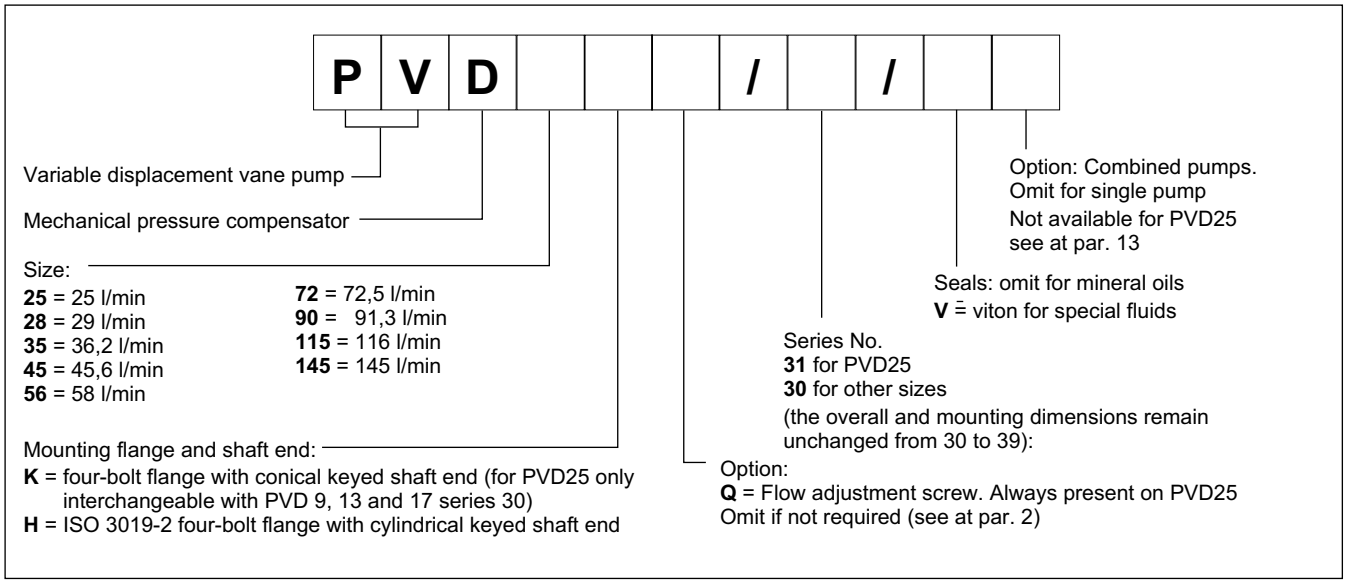
PVD sizes		**25**	**28**	**35**	**45**	**56**	**72**	**90**	**115**	**145**
Geometric displacement (UNI ISO 3662)	cm^3/rev	16	20	25	31,5	40	50	63	80	100
Actual displacement	cm^3/rev	17,9	22,1	26,9	34,5	42,8	53,1	69	86,2	105,5
Maximum flow at 1450 rpm and p = 80 bar	l/min	25	29	36,2	45,6	58	72,5	91,3	116	145
Max working pressure	bar	120	100		100			80		
Pressure adjustment range	bar	20 ÷ 120	30 ÷ 100		30 ÷ 100			30 ÷ 80		
Maximum drain port pressure allowed	bar	1								
Rotation speed range	rpm	800 ÷ 1800								
Rotation direction		clockwise (seen from the outlet shaft side)								
Shaft loads		radial and axial loads are not allowed								
Max applicable torque on shaft: version H version K	Nm	110 70	197 -		400 -			740 -		
Mass	kg	7,3	12		32			44		

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-10 / +50
Fluid viscosity range	see paragraph 3.2	
Recommended viscosity	cSt	22 ÷ 68
Degree of fluid contamination	see paragraph 3.3	

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE



2 - VOLUME ADJUSTMENT SCREW - PVD*Q

The volume adjuster is fitted as standard on PVD25 pumps, while is optional on the other sizes .It consists of an adjustment screw and a small balanced piston that limit the maximum eccentricity of the pumping group cam ring, changing the displacement. The maximum flow is reduced by turning the adjustment screw clockwise.

Size		**25**	**28**	**35**	**45**	**56**	**72**	**90**	**115**	**145**
Reduced displacement for screw turn	cm^3	9,7	9,7	9,7	16,4	16,4	16,4	23,8	23,8	23,8
MIN displacement	cm^3/rev	3,1	7,6	11,7	1,6	9,9	20,9	9,7	26,9	45,5

Tools required for adjustment:

PVD 25: adjustment screw hexagon socket key 5. Locking nut spanner 17.
PVD 28 to 145: square head screw, spanner 7, tooth retainer KM1 type, to loosen with hook wrench.

3 - HYDRAULIC FLUID

3.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives. For use of other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for approval.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water ≤ 40%)	-The values shown in the performance ratings table must be reduced by at least 50% - The pump rotation speed must be limited to 1000 rpm. - Use NBR seals only
HFD (phosphate esters)	There are no particular limitations with this kinds of fluids. Operation with a fluid viscosity as close as possible to the optimum viscosity range specified in par. 3.2 is recommended. - Use FPM (Viton) seals only

3.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	16 cSt	referred to the maximum drainage fluid temperature of 50 °C
optimum viscosity	22 ÷ 68 cSt	referred to the fluid working temperature in the tank
maximum viscosity	400 cSt	limited to only the start-up phase of the pump

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

3.3 - Degree of fluid contamination

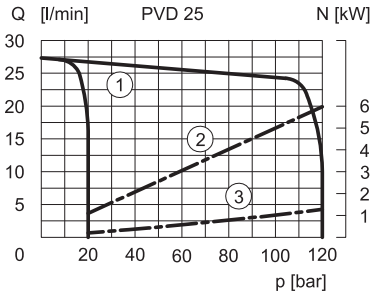
The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with $\beta_{20} \geq 75$ is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance

of the pump. Hence, use of a filter with $\beta_{10} \geq 100$ is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 12. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

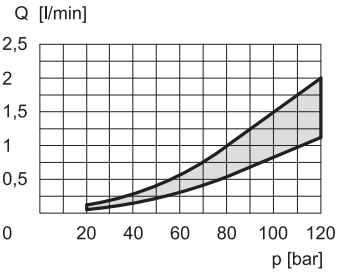
4 - PVD25 CHARACTERISTIC CURVES (obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER

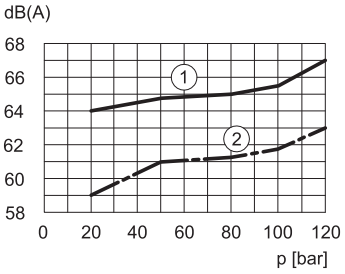


1) Flow rate - pressure curves, measured at 1500 rpm
2) Absorbed power at the maximum flow rate
3) Absorbed power at zero flow rate

DRAINAGE FLOW RATE



NOISE LEVEL

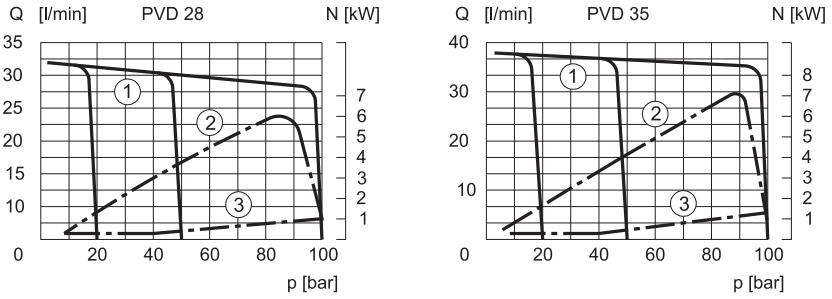


Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

1) noise at max flow
2) noise with zero flow

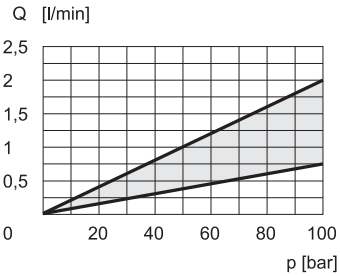
5 - PVD28, PVD35 CHARACTERISTIC CURVES (obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER

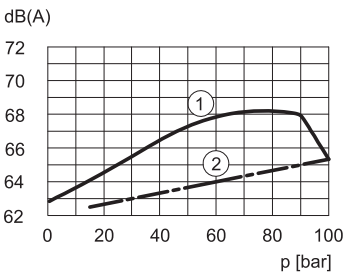


1) Flow rate - pressure curves, measured at 1450 rpm
2) Absorbed power at the maximum flow rate
3) Absorbed power at zero flow rate

DRAINAGE FLOW RATE



NOISE LEVEL

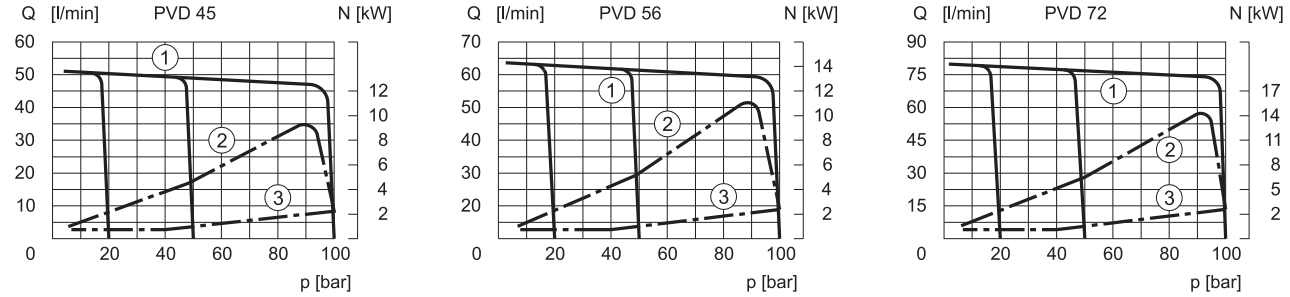


Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

1) noise at max flow
2) noise with zero flow

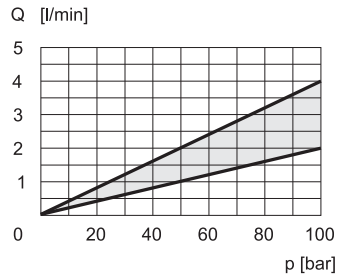
6 - PVD45, PVD56 and PVD72 CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER

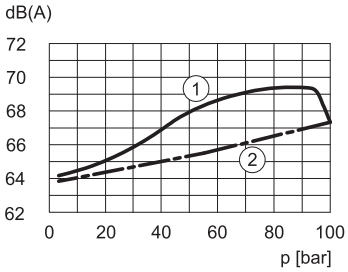


1) Flow rate - pressure curves, measured at 1450 rpm
2) Absorbed power at the maximum flow rate
3) Absorbed power at zero flow rate

DRAINAGE FLOW RATE



NOISE LEVEL

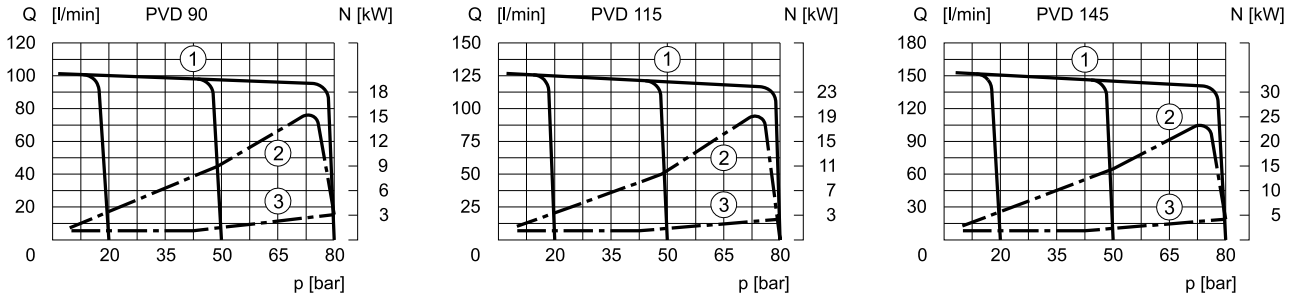


Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

1) noise at max flow
2) noise with zero flow

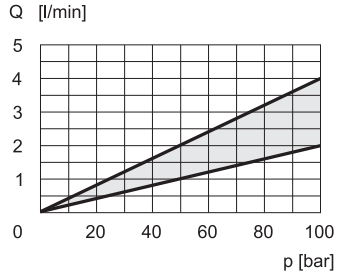
7 - PVD90, PVD115 and PVD145 CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER

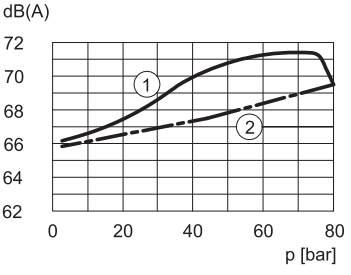


1) Flow rate - pressure curves, measured at 1450 rpm
2) Absorbed power at the maximum flow rate
3) Absorbed power at zero flow rate

DRAINAGE FLOW RATE



NOISE LEVEL



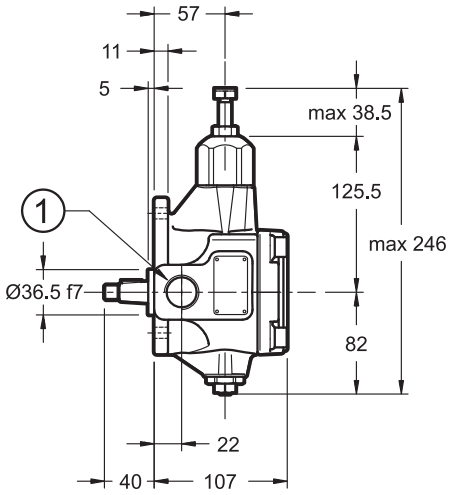
Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

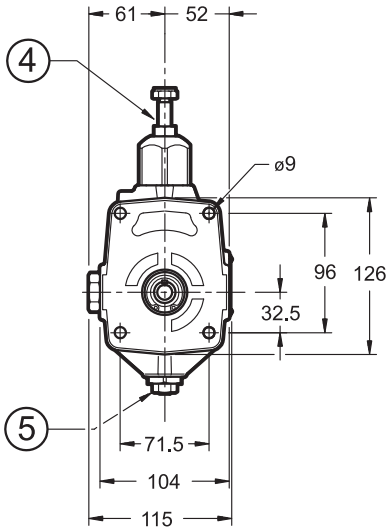
1) noise at max flow
2) noise with zero flow

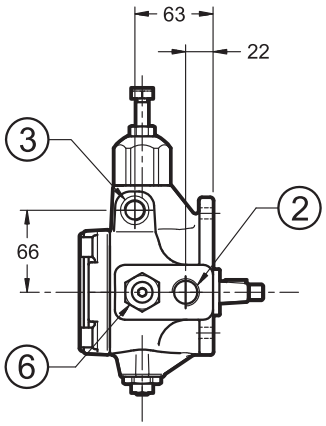
8 - PVD25 OVERALL AND MOUNTING DIMENSIONS

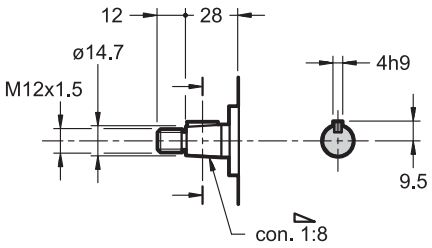
dimensions in mm

PVD25K

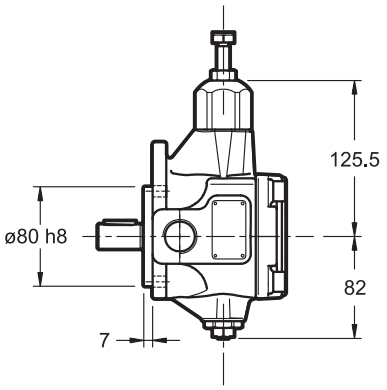


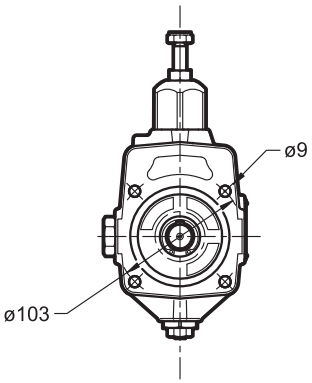




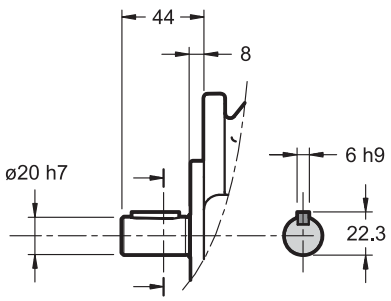


PVD25H



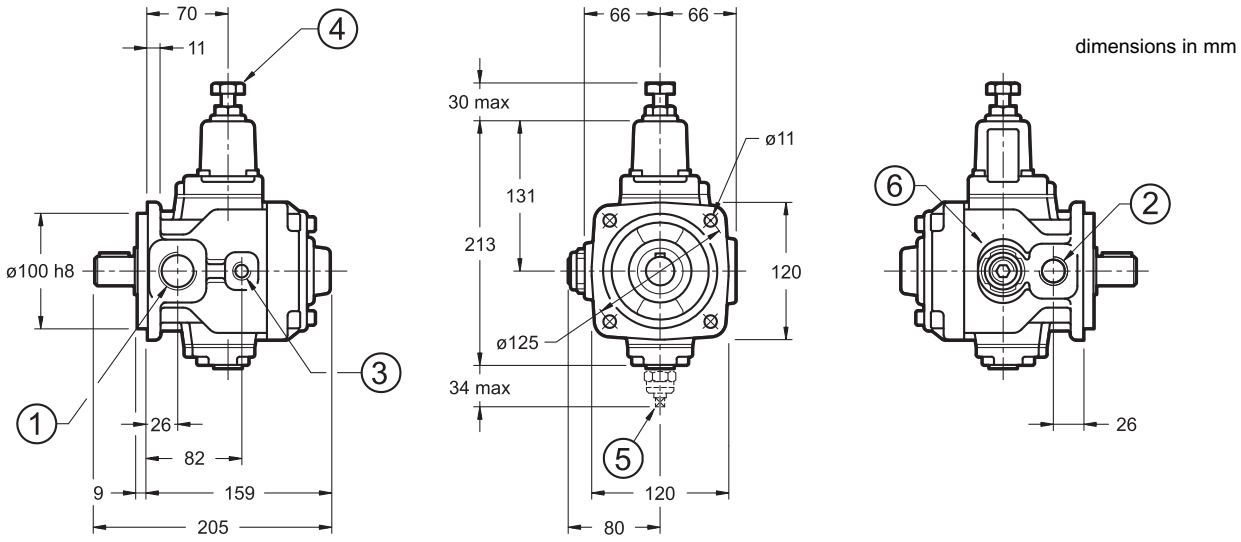


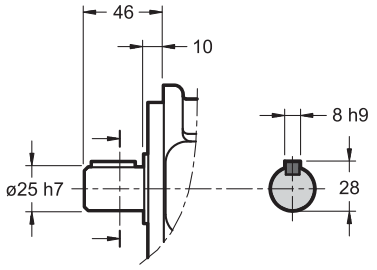
for non quoted dimensions
refer to the drawing PVD25K



1	Suction port: 3/4” BSP
2	Delivery port: 1/2” BSP
3	Drainage port: 3/8” BSP
4	Pressure adjustment screw. Rotate clockwise to increase pressure. Spanner 17. Locking nut : spanner 17.
5	Flow adjustment screw. Rotate clockwise to decrease flow. socket hex screw, hex key 5.Locking nut: spanner 17.
6	Guide block balancing adjustment screw. **Do not tamper.**

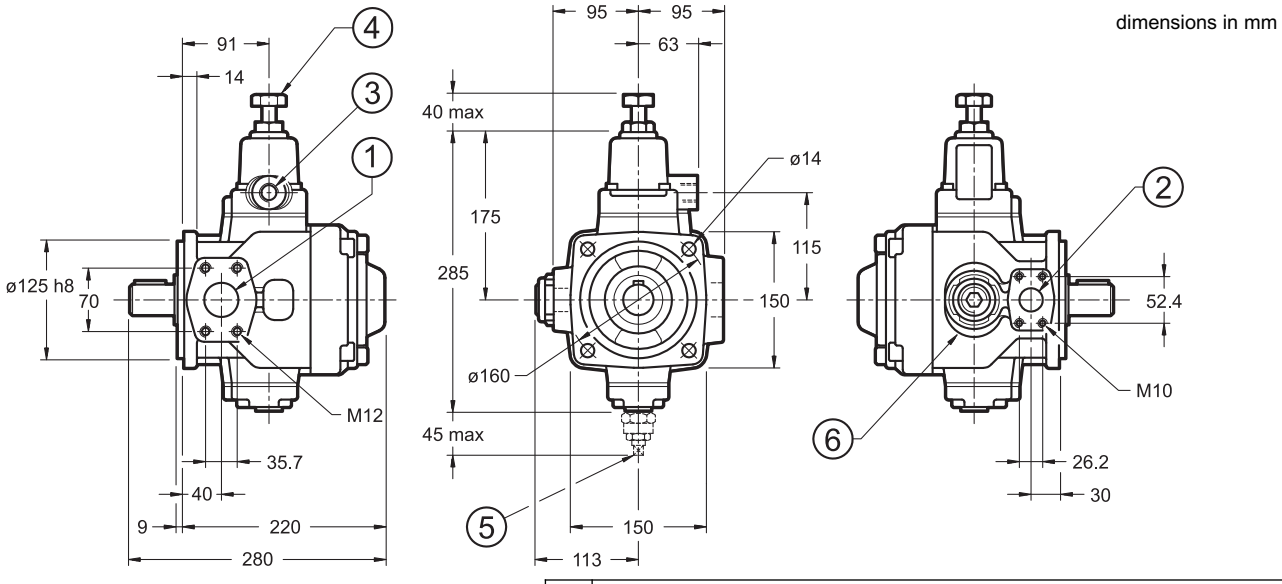
9 - PVD28, PVD35 OVERALL AND MOUNTING DIMENSIONS

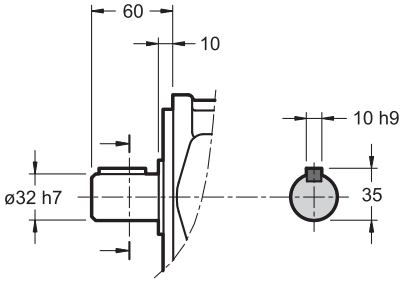




1	Suction port: 1” BSP
2	Delivery port: 3/4” BSP
3	Drainage port: 3/8” BSP
4	Pressure adjustment screw. Rotate clockwise to increase pressure. Spanner 17. Locking nut : spanner 17.
5	Flow adjustment screw. Rotate clockwise to decrease flow. square head screw, spanner n° 7. Retainer KM1 type.
6	Guide block balancing adjuster. **Do not tamper.**

10 - PVD45, PVD56 AND PVD72 OVERALL AND MOUNTING DIMENSIONS

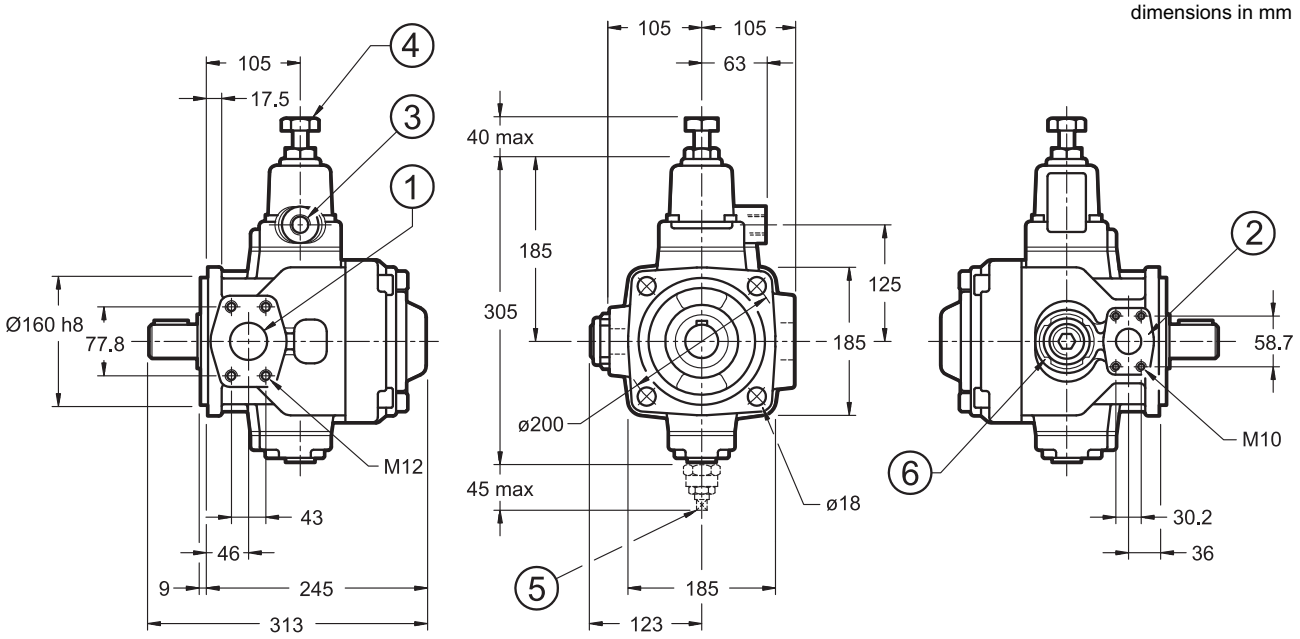




1	Suction port: SAE 1 1/2”
2	Delivery port: SAE 1”
3	Drainage port: 1/2” BSP
4	Pressure adjustment screw. Rotate clockwise to increase pressure. Spanner 22. Locking nut : spanner 22.
5	Flow adjustment screw. Rotate clockwise to decrease flow. square head screw, spanner n° 7. Retainer KM1 type.
6	Guide block balancing adjuster. **Do not tamper.**

11 - PVD90, PVD115 AND PVD145 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Suction port: SAE 2”
2	Delivery port: SAE 1 ¼”
3	Drainage port: 1/2” BSP
4	Pressure adjustment screw. Rotate clockwise to increase pressure. spanner 22. Locking nut : spanner 22.
5	Flow adjustment screw. Rotate clockwise to decrease flow. square head screw, spanner 7. Retainer KM1 type.
6	Guide block balancing adjuster. **Do not tamper.**

12 - INSTALLATION

— The instruction manual for the installation and commissioning of the pumps is always included in the packaging with the pump. Observe restrictions in this document and follow the instructions.

— The PVD pumps up to size 35 can be installed with the axis oriented in any position. For other sizes the pump must be installed with the axis in horizontal position and with the pressure compensator upward.

— The motor-pump connection must be carried out directly with a flexible coupling. Couplings that generate axial or radial loads on the pump shaft are not allowed.

— The suction line must be short, with end pipe cut at 45 ° and suitably sized: the minimum cross-section of the tube should reflect that of the thread on the inlet port of the pump to facilitate the oil flow. Bends and restrictions or an excessive line length can impair correct operation of the pump.
Suction pressure should be between 0.8 and 1.5 bar absolute

— The drainage pipe must be connected directly to the tank by a line separate from other discharges, located as far as possible from the suction line and lengthened to below the minimum oil level in order to avoid foaming.

— The tank must be suitably sized in order to allow the cooling of the fluid. It should be good that the fluid in the tank do not exceed 50°C. If necessary, consider the installation of a heat exchanger on the drain line.

— The pump start up must be done in full displacement (P→T) with flow to the tank, to purge the air.

— It’s essential that the difference between the fluid temperature and the ambient (pump body) temperature doesn’t exceed 20°C

— The pumps are usually placed directly upon the oil tank. Flooded suction port installation of the pumps is recommended in the case of circuits with high flow rates and pressures.

13 - MULTIPLE PUMPS

The PVD pumps from size 28 and up are designed to be connected one to the other in decreasing order of displacement. They can be combined also with PVA type pumps (see catalogue 14 200) and with GP1 and GP2 size gear pumps (see catalogue 11 100). The torque on the shaft must be further reduced after the second pump. Consult our technical department for this type of applications .

IDENTIFICATION CODE FOR MULTIPLE PUMPS

Fill the ordering code, following the coupling sequence of the pumps. Insert the suffix that shows the pump position at the end of each PVD pump identification code.

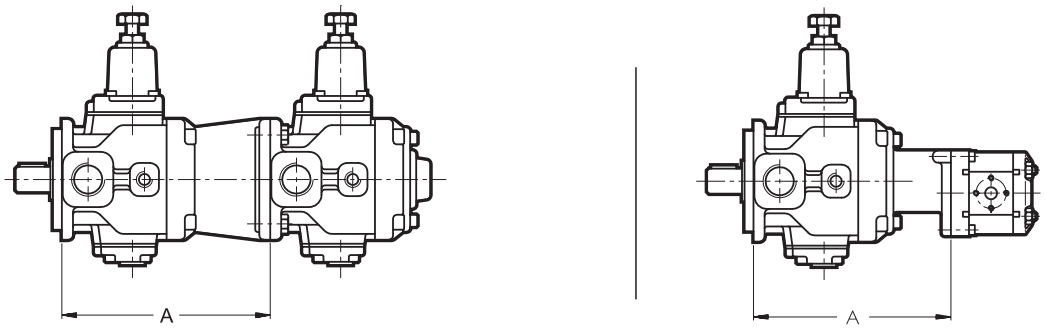
/	30	

pump location:
/A = Front
/I = Intermediate
/P = Rear

identification code 1st pump + identification code 2nd pump + identification code 3rd pump (omit for single pumps)

Double pump identification example: PVD35HQ/30/V **/A +** PVD28H/30/V **/P**
Triple pump identification example: PVD90H/30 **/A +** PVD35HQ/30 **/I +** PVD28H/30 **/P**
PVD pump + GP pump identification example: PVD35HQ/30 **/A +** GP1-0061R97F/20N

NOTE: for the single pump identification codes see: cat. 11 100 par. 1 for GP pumps - cat. 14 200 par. 1 for PVA pumps

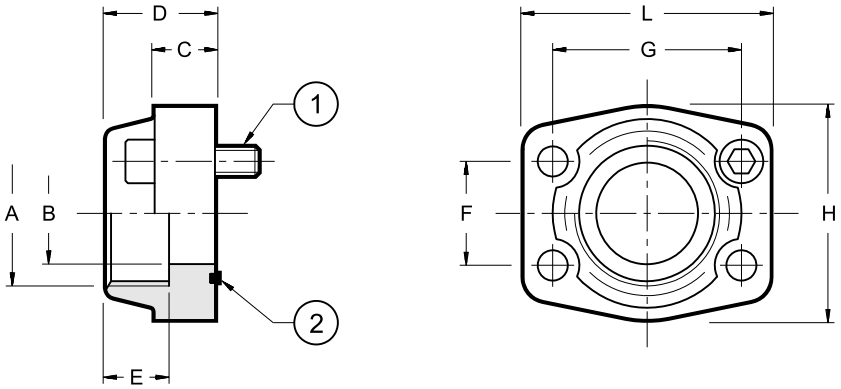


Max. torque applied to the shaft of the second pump (Nm)		
size group Primary pump	Second pump (same size group)	Second pump (smaller size group)
PVD 28/35	43	-
PVD 45/56/72	113	113
PVD 90/115/145	186	113

dimension A (mm)		
with PVD pump (same size group)	With gear pump type:	
207	GP1 and GP2	196
275	GP1 and GP2	262
315	GP1 and GP2	287

14 - CONNECTION FLANGES

dimensions in mm



The fastening bolts and the O-Rings must be ordered separately.

flange code	flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	(1) bolts	(2)
0610713	SAE - 1”	345	1” BSP	25	18	38	22	26.2	52.4	22	70	N. 4 SHC M10x35	OR 4131 (32.93x3.53)
0610720	SAE - 1 1/4”	276	1 1/4” BSP	32	21	41	22	30.2	58.7	68	79		OR 4150 (37.69x3.53)
0610714	SAE - 1 1/2”	207	1 1/2” BSP	38	25	44	24	35.7	70	78	93	N. 4 SHC M12x45	OR 4187 (47.22x3.53)
0610721	SAE - 2”	207	2” BSP	51	25	45	30	43	77.8	90	102		OR 4225 (56.74x3.53)

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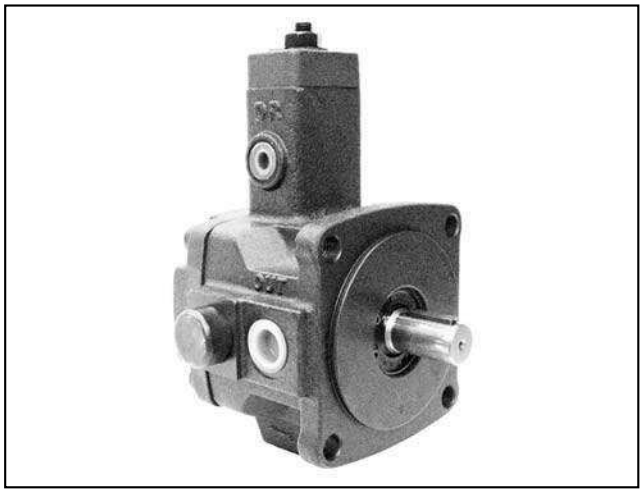
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

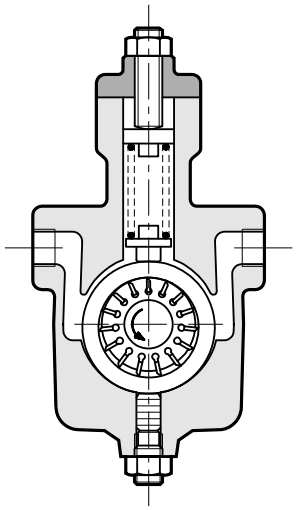


PVE

VARIABLE DISPLACEMENT VANE PUMPS WITH DIRECT PRESSURE ADJUSTMENT

SERIES 30

OPERATING PRINCIPLE



— The PVE pumps are variable displacement vane pumps with direct pressure regulator.

— The pump group is complete with hydrostatic axial compensation distribution plates that improve the volumetric efficiency and reduce wear of the components.

— The pressure regulator adjustable load spring keeps the pump group cam ring in eccentric position.

When the delivery pressure equals the pressure corresponding to the spring setting, the cam ring is moved so to reduce the displacement, adjusting the flow rate to the values required by the plant.

In zero flow demand conditions, the pump delivers oil only to compensate any possible bleedings, keeping the circuit pressure constant.

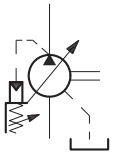
— The PVE pumps are available in four dimensions with maximum displacement from 6,6 to 22,2 cm^3/rev and with pressure regulator max setting values up to 35 bar and 70 bar (standard).

TECHNICAL SPECIFICATIONS

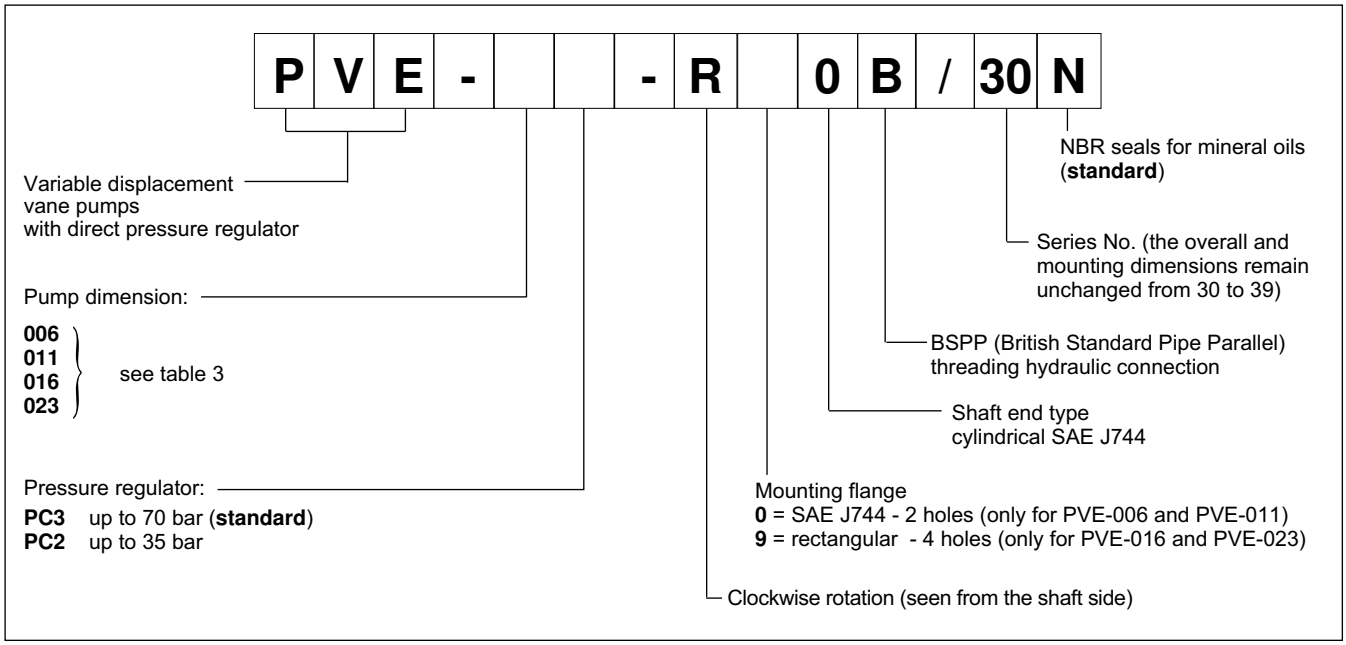
PUMP SIZE		**006**	**011**	**016**	**023**
Displacement	cm^3/rev	6,6	11,1	16,6	22,2
Flow rate (at 1.500 rpm and with 3.5 bar delivery pressure)	l/min	10,0	16,7	25,0	33,3
Operating pressure	bar	70			
Rotation speed	rpm	min 800 - max 1800			
Rotation direction		clockwise (seen from the shaft side)			
Shaft loads	N	radial and axial loads are not allowed			
Hydraulic connection		BSPP (parallel) threading fittings			
Type of mounting		SAE flange J744 - 2 holes		rectangular flange - 4 holes	
Mass	kg	5	6	9	9

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-10 / +70
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	25 ÷ 50

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE



2 - HYDRAULIC FLUID

2.1 - Fluid type

Use only HL and HLP mineral oil based hydraulic fluids according to ISO 6743/4.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	16 cSt	referred to the maximum drainage fluid temperature of 70 °C.
optimum viscosity	25 ÷ 50 cSt	referred to the fluid working temperature in the tank.
maximum viscosity	800 cSt	limited to only the start-up phase of the pump.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with $\beta_{20} \geq 75$ is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with $\beta_{10} \geq 100$ is recommended.

The filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

3 - PERFORMANCES (obtained with viscosity of 46 cSt at 40°C)

PUMP	REGULATOR	DISPLACEMENT [cm³/rev]	MAX FLOW RATE [l/min]		PRESSURE ADJUSTMENT RANGE [bar]		ROTATION SPEED [rpm]	
			1500 rev	1800 rev	min	max	min	max
PVE-006	PC2	6,6	10	12	15	35	800	1800
	PC3				50	70		
PVE-011	PC2	11,1	16,7	20	15	35		
	PC3				50	70		
PVE-016	PC2	16,6	25	30	15	35		
	PC3				50	70		
PVE-023	PC2	22,2	33,3	40	15	35		
	PC3				50	70		

NOTE: Flow rate values are obtained with delivery pressure = 3.5 bar

4 - NOISE LEVEL

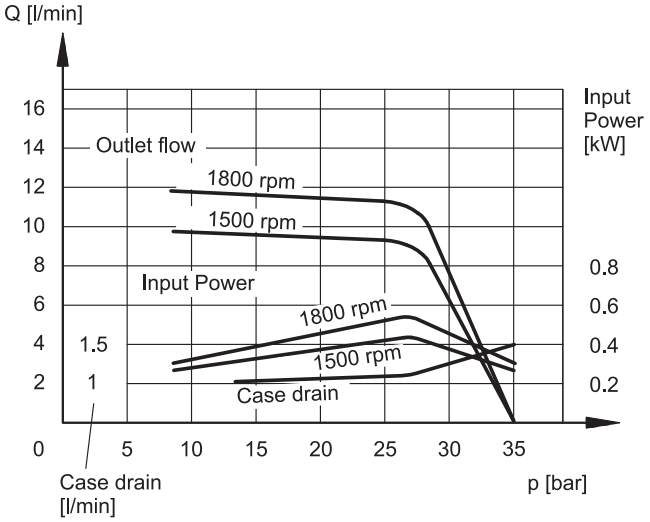
PUMP	NOISE LEVEL [dB (A)] null displacement	full displacement
PVE-006	61	63
PVE-011	62	65
PVE-016	64	68
PVE-023	64	70

The noise pressure levels were measured in a semi-anechoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

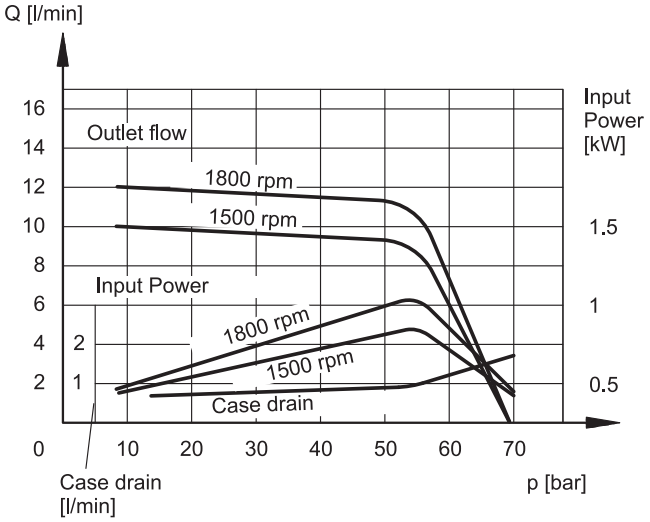
5 - CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The diagram curves were measured with a pump rotation speed of 1500 and 1800 rev/min.

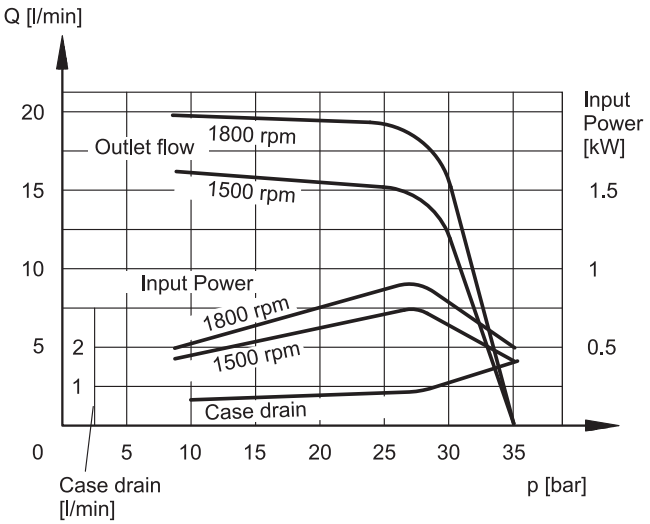
PVE-006PC2



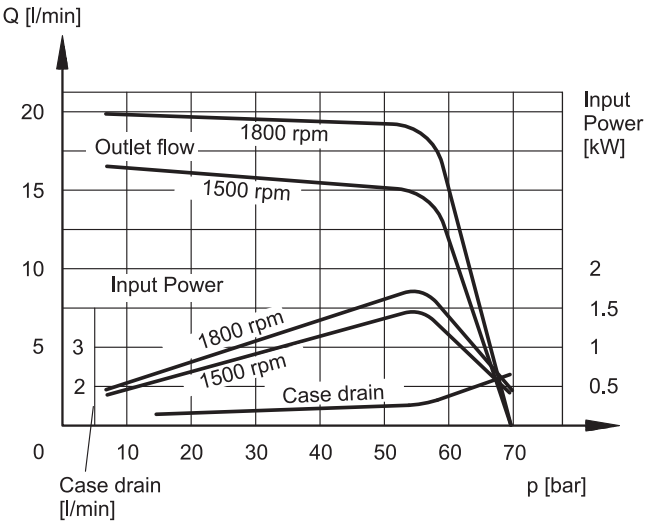
PVE-006PC3



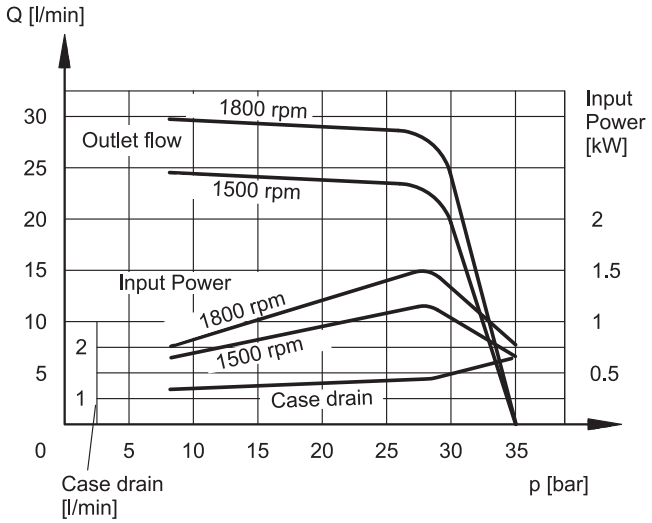
PVE-011PC2



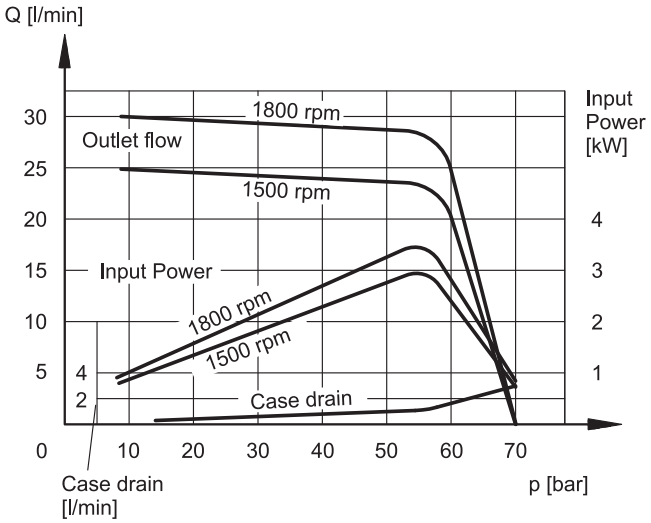
PVE-011PC3



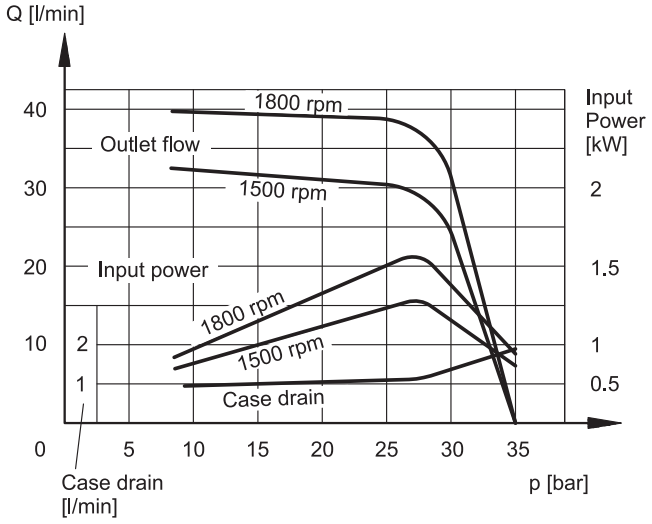
PVE-016PC2



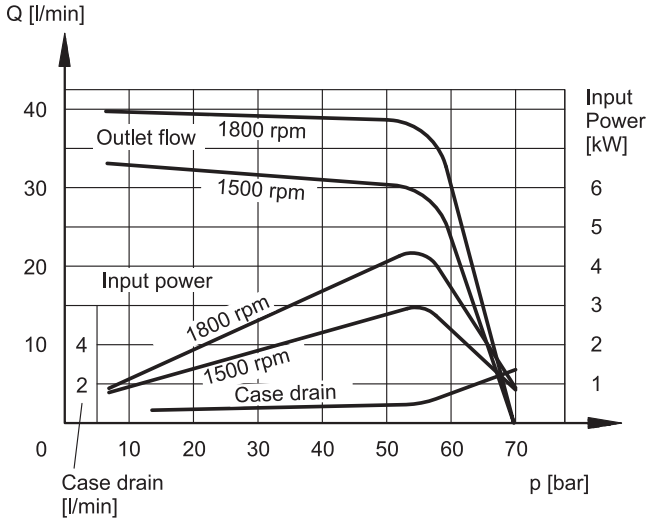
PVE-016PC3



PVE-023PC2

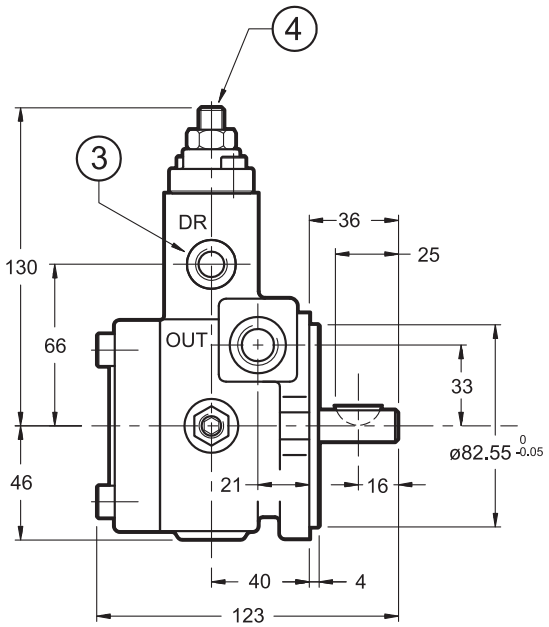


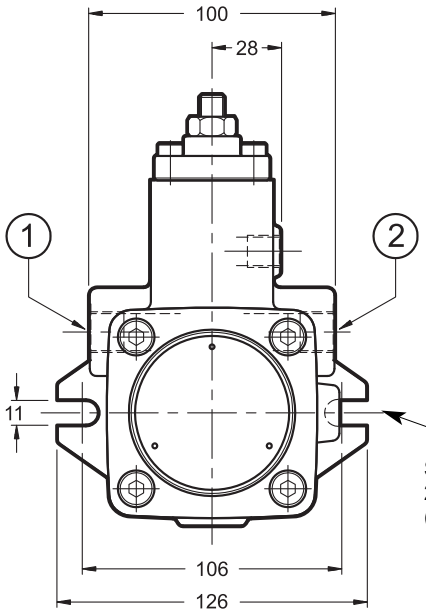
PVE-023PC3



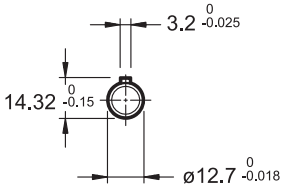
6 - OVERALL AND MOUNTING DIMENSIONS PVE-006

dimensions in mm





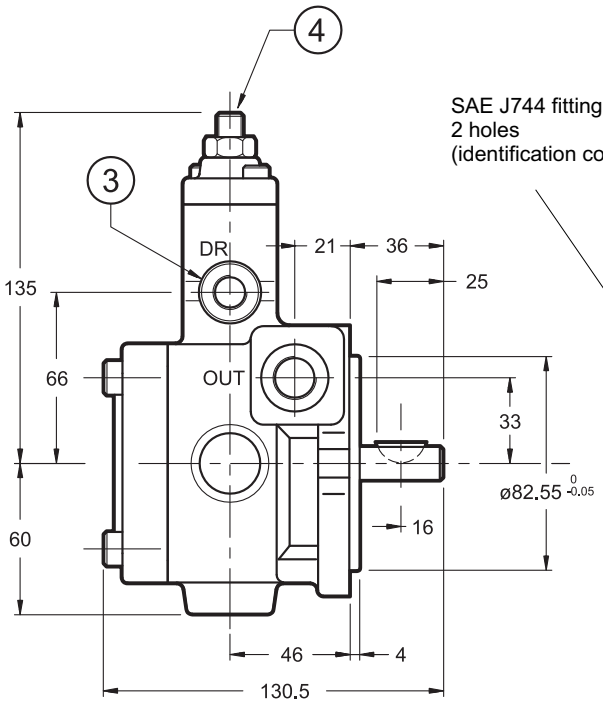
Cylindrical with
key shaft end SAE J744
(identification code: **0**)



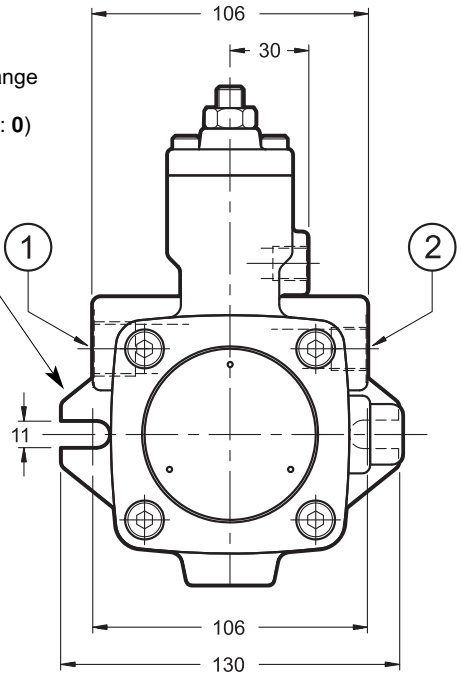
1	Suction port: 3/8” BSPP (parallel)
2	Delivery port: 3/8” BSPP (parallel)
3	Case drainage port: 1/4” BSPP (parallel)
4	Pressure compensator. Clockwise rotation to higher pressure.

7 - OVERALL AND MOUNTING DIMENSIONS PVE-011

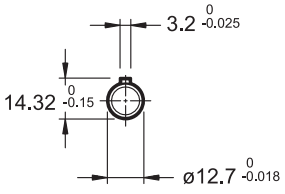
dimensions in mm



SAE J744 fitting flange
2 holes
(identification code: **0**)

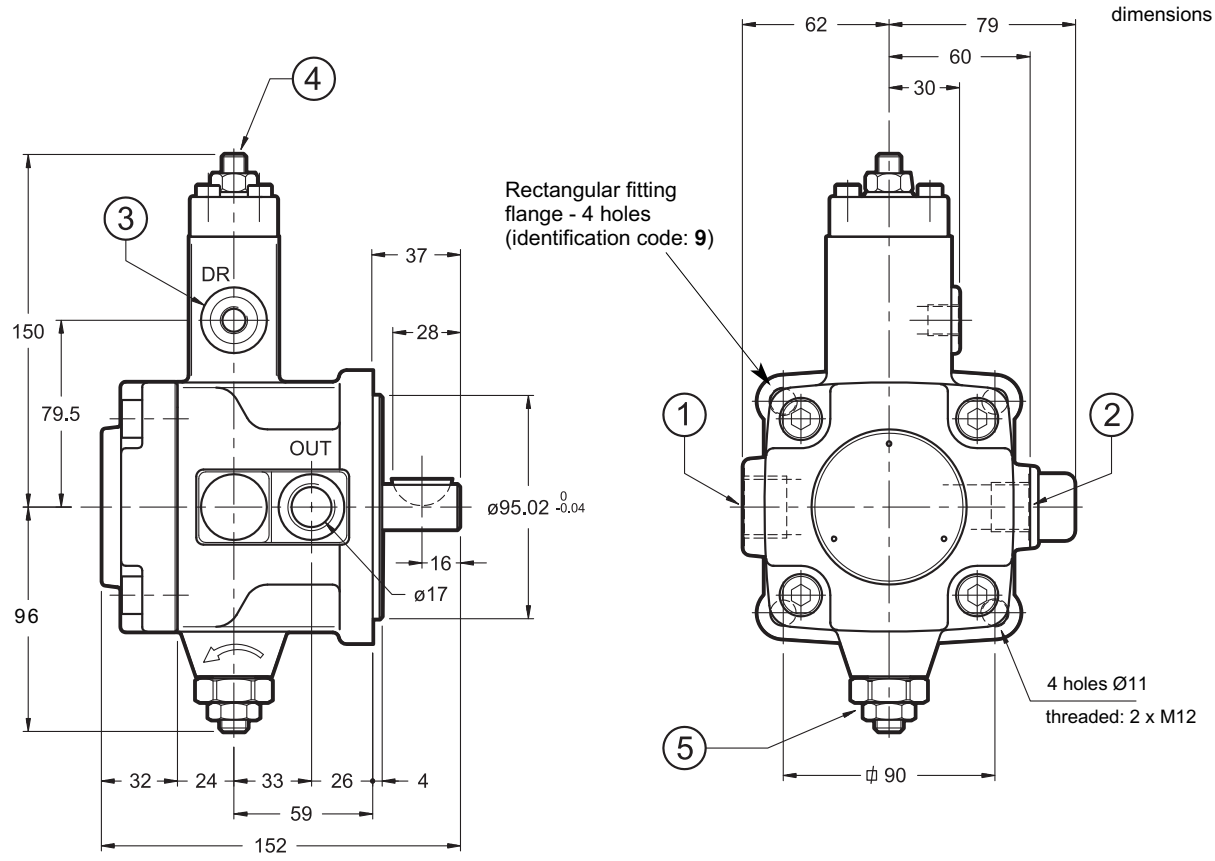


Cylindrical with key shaft end
SAE J744
(identification code: **0**)



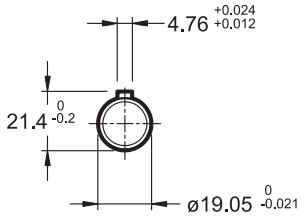
1	Suction port: 1/2” BSPP (parallel)
2	Delivery port: 3/8” BSPP (parallel)
3	Case drainage port: 1/4” BSPP (parallel)
4	Pressure compensator. Clockwise rotation to higher pressure.

8 - OVERALL AND MOUNTING DIMENSIONS PVE-016 AND PVE-023



Cylindrical with key shaft end
SAE J744

(identification code: **0**)



1	Suction port: 3/4” BSPP (parallel)
2	Delivery port: 1/2” BSPP (parallel)
3	Case drainage port: 1/4” BSPP (parallel)
4	Pressure compensator. Clockwise rotation to higher pressure.
5	Volume adjustment. Clockwise rotation to reduce flow.

9 - INSTALLATION

— The PVE pumps can be installed with the axis oriented in any position.

— The suction tube has to be suitably sized so that the suction pressure is never lower than -0.3 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.

— The drainage port must be connected directly to the tank by a line separate from other discharges, located far from the suction line and lengthened to below the minimum oil level so as to avoid formation of foam.

— **Before starting, the pump body has to be filled with the fluid.** The pump start up, especially at a cold temperature, should occur with the pump unloading. Start and stop motor several time in order to purge the air from pump and pipelines.

— The pumps are normally positioned directly above the oil tank. Flooded suction port installation of the pumps is advisable in the case of circuits with high flow rates and pressures.

— The drainage tube has to be sized so that the pressure inside the pump body is always lower than 0.3 bars (relative), even during the dynamic change and flow rate phases. The drainage tube has to unload inside the tank far from the suction area. We suggest to interpose a screen between the two lines.

— The motor-pump connection must be carried out directly with a flexible coupling. Couplings that generate axial or radial loads on the pump shaft are not allowed.

10 - MULTIPLE PUMPS

PVE-016 and PVE-023 pumps can be connected to external gear pumps (see available displacements in the table at par. 10.3). The possibility to couple two pumps makes possible to create multi-flow groups with independent hydraulic circuits.

10.1 - Maximum applicable torque

While sizing coupled pumps, consider that the shaft of the front pump must bear the torque generated by both pumps when they are loaded simoultaneusly.

NOTE: The maximum applicable torque at the shaft of the front pump is 62 Nm.

The input torque (M) for each pump is given by the following ratio:

$$M = \frac{9550 \cdot N}{n} = [Nm]$$

n = rotation speed [rpm]

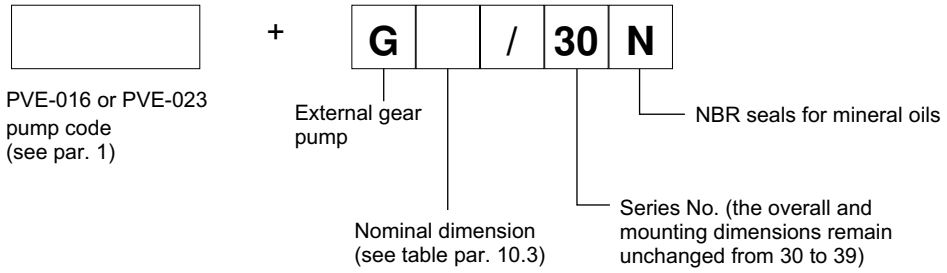
where the absorbed power (N) is given by:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta_{tot}} = [kW]$$

Q = flow rate [l/min]
Δp = differential pressure between the pump suction and delivery [bar]
η_{tot} = total efficiency (coefficient = 0.8)

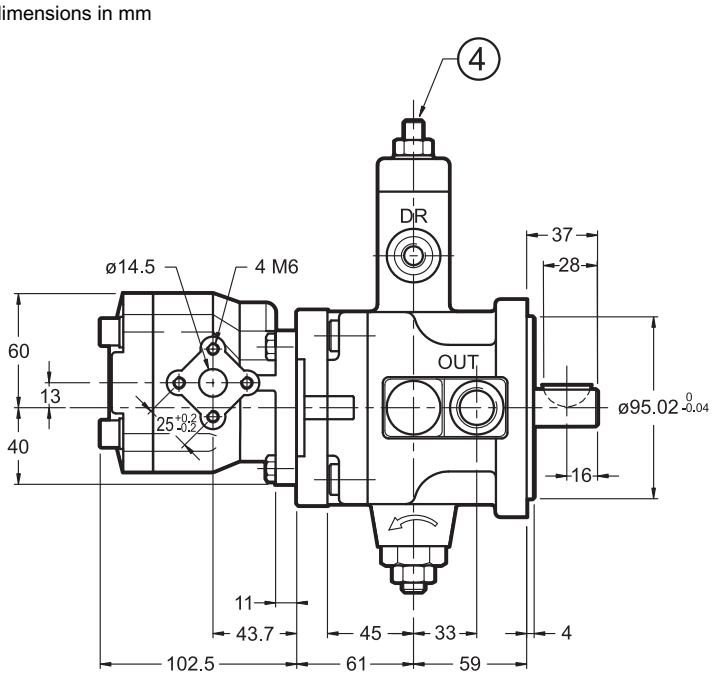
If the total of the obtained torques is higher than 62 Nm, it is necessary to reduce the working pressure / flow value of one or both the pumps until the total torque becomes lower than the maximum value indicated.

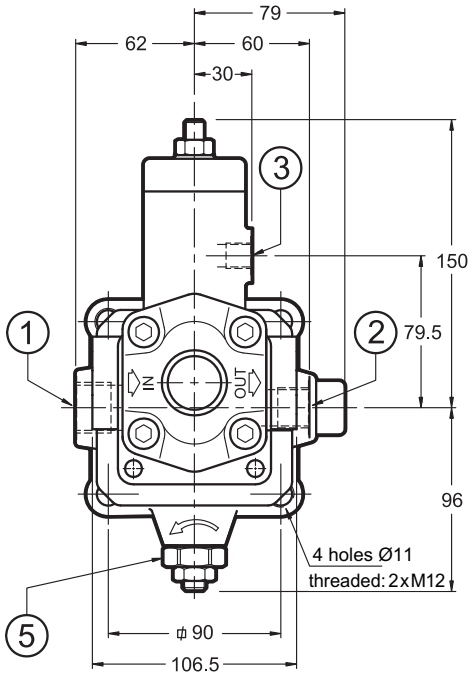
10.2 - Multiple pumps identification code



10.3 - Multiple pumps overall and mounting dimensions

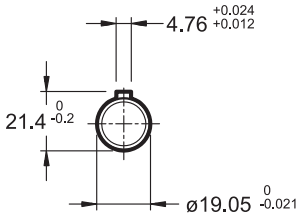
dimensions in mm





Cylindrical with key shaft end
SAE J744

(identification code: **0**)



AVAILABLE GEAR PUMPS

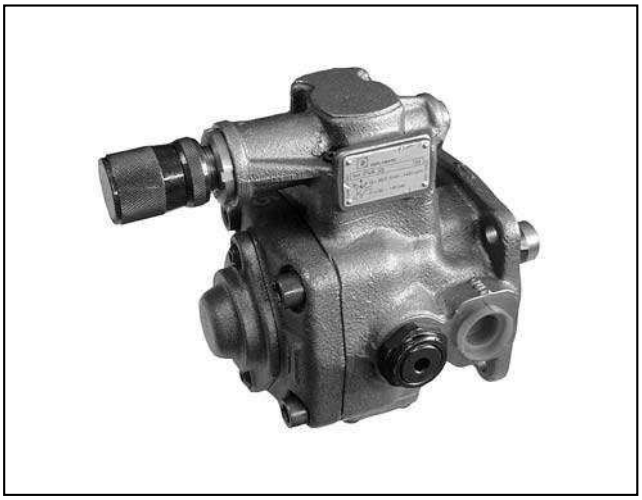
Nominal dimension	Displacement [cm³/rev]	Max working pressure [bar]	Peak pressure [bar]	Min speed [rev/min]
0020	2	210	250	900
0025	2.5			850
0030	3			
0040	4			800
0050	5			
0060	6			
0075	7.5			
0090	9			
0105	10.5			
0120	12	175	210	

Gear pump weight: 1.7 kg

1	Suction port: 3/4” BSPP (parallel)
2	Delivery port: 1/2” BSPP (parallel)
3	Case drainage port: 1/4” BSPP (parallel)
4	Pressure compensator. Clockwise rotation to higher pressure.
5	Volume adjustment. Clockwise rotation to reduce flow.

DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

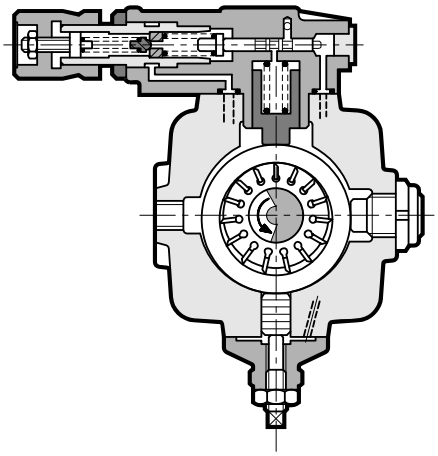


PVA

VARIABLE DISPLACEMENT VANE PUMPS

SERIES 30

OPERATING PRINCIPLE



— The PVA pumps are variable displacement vane pumps with piloted type hydraulic pressure compensator.

— They permit instantaneous adjustment of the flow rate according to the circuit requirements.The consequence is that energy consumption is reduced and adequate in every cycle phase.

— The pumping group is complete with hydrostatic axial compensation distribution plates that improve the volumetric efficiency and reduce wear of the components.

— The pressure compensator operates with the principle of keeping the cam ring of the pumping group in the eccentric position with use of a piston controlled hydraulically by a pressure pilot stage.

— When the delivery pressure equals the pressure corresponding to the pilot stage setting, the cam ring is moved toward the center adjusting the flow rate to the plant requirements.

— In zero flow demand conditions, the pump delivers oil only to compensate any possible bleedings and pilotings, keeping the circuit pressure constant.

— The compensator response times are very restrained and such as to allow elimination of the pressure relief valve.

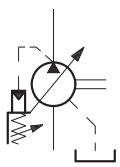
— Also available are the versions with maximum flow adjustment PVA***Q and with the device for selection of two independent pressure values with solenoid valve PVA***M.

TECHNICAL SPECIFICATIONS (measured with mineral oil with viscosity of 36 cSt at 50°C)

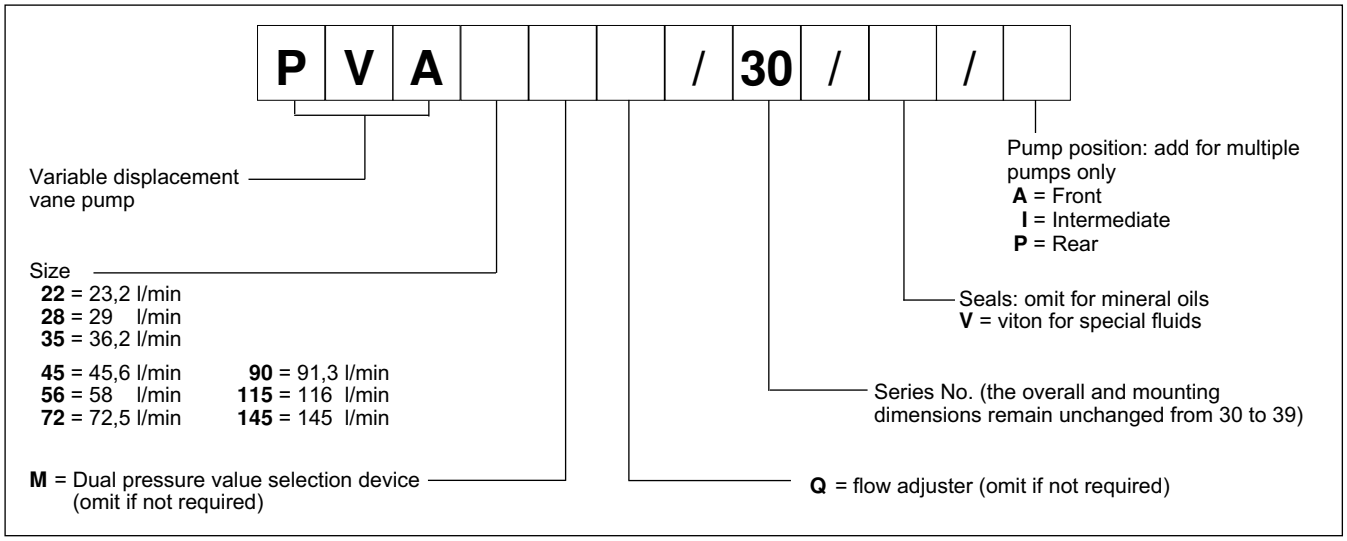
PUMP SIZE		22	28	35	45	56	72	90	115	145
Displacement	cm^3/rev	16	20	25	31,5	40	50	63	80	100
Nominal flow rate (at 1450 rpm)	l/min	23,2	29	36,2	45,6	58	72,5	91,3	116	145
Maximum operating range	bar	160						150		
Pressure adjustment range	bar	30 ÷ 160						30 ÷ 150		
Maximum pressure on drain port	bar	1								
Rotation speed range	rpm	800 ÷ 1800								
Rotation direction		clockwise (seen from the outlet shaft side)								
Loads on the shaft:		loads radial and axial not allowed								
Maximum applicable shaft torque	Nm	197			400			740		
Mass	kg	13			33			45		

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-10 / +70
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	25 ÷ 50

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE



2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives. For use of other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for authorization of use.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water ≤ 40 %)	- The values shown in the performance ratings table must be reduced by at least 50% . - The pump rotation speed must be limited to 1000 rpm. - The maximum fluid temperature must be less than 50°C.
HFD (phosphate esters)	There are no particular limitations with respect to the values shown in the performance ratings table. Operation with a fluid viscosity as close as possible to the optimum viscosity range specified in par. 2.2 is recommended.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	16 cSt	referred to the maximum drainage fluid temperature of 70 °C
optimum viscosity	25 ÷ 50 cSt	referred to the fluid working temperature in the tank
maximum viscosity	800 cSt	limited to only the start-up phase of the pump

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

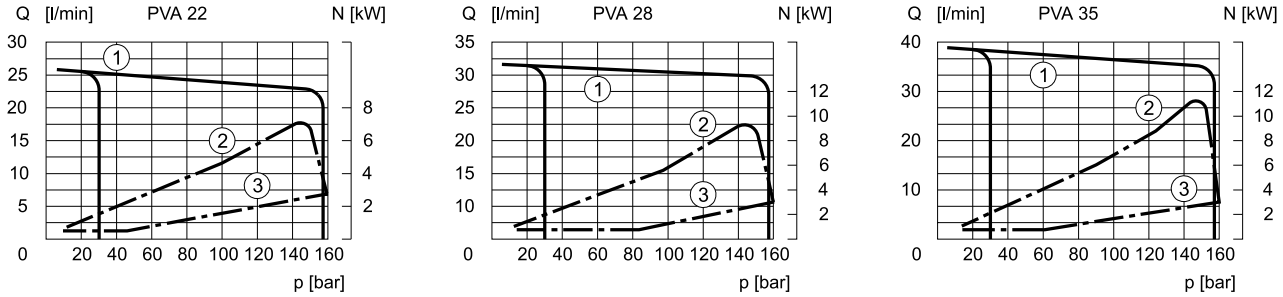
2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with $\beta_{20} \geq 75$ is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with $\beta_{10} \geq 100$ is recommended.

The filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

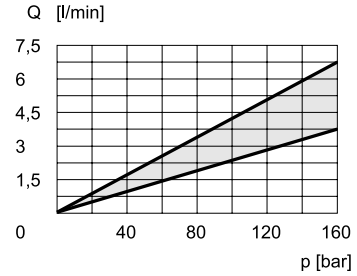
3 - PVA - 22/28/35 CHARACTERISTIC CURVES (obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER



(1) Flow rate - pressure curves, measured at 1450 rpm
(2) Absorbed power at the maximum flow rate
(3) Absorbed power at the zero flow rate

DRAINAGE FLOW RATE



RESPONSE TIMES AND PRESSURE PEAK

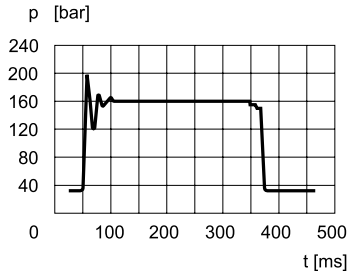
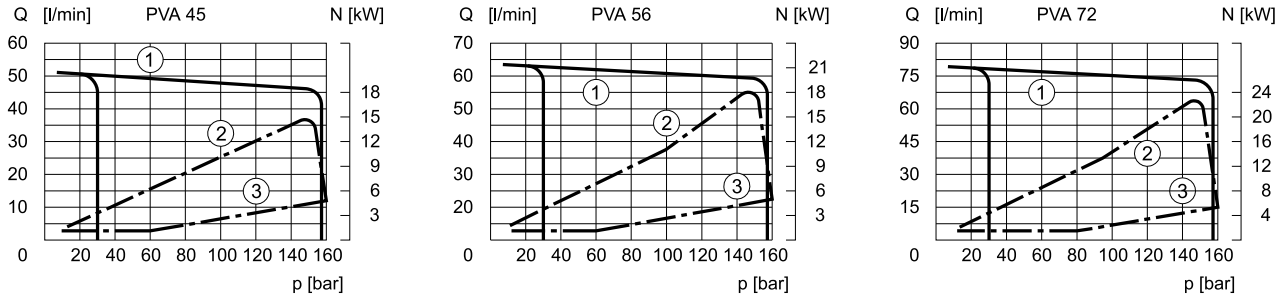


Diagram noted passing from maximum flow rate to zero flow rate and vice versa

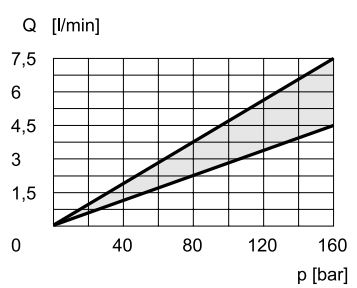
4 - PVA - 45/56/72 CHARACTERISTIC CURVES (obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER



(1) Flow rate - pressure curves, measured at 1450 rpm
(2) Absorbed power at the maximum flow rate
(3) Absorbed power at the zero flow rate

DRAINAGE FLOW RATE



RESPONSE TIMES AND PRESSURE PEAK

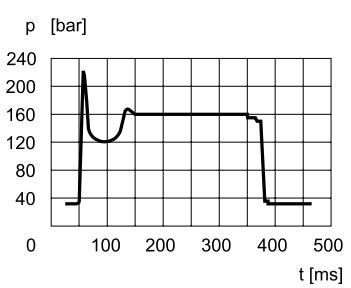
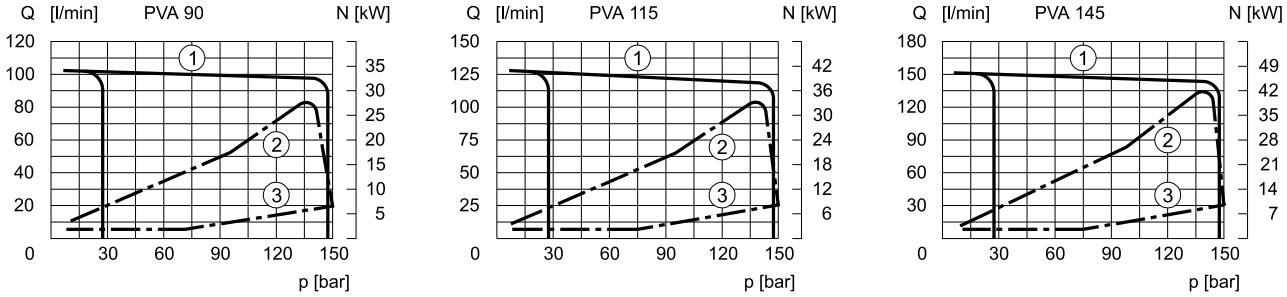


Diagram noted passing from maximum flow rate to zero flow rate and vice versa

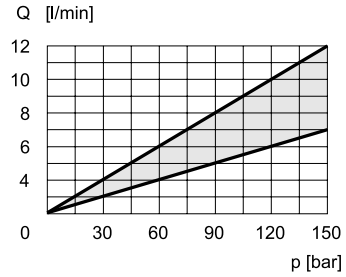
5 - PVA - 90/115/145 CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER



(1) Flow rate - pressure curves, measured at 1450 rpm
(2) Absorbed power at the maximum flow rate
(3) Absorbed power at zero flow rate

DRAINAGE FLOW RATE



RESPONSE TIMES AND PRESSURE PEAK

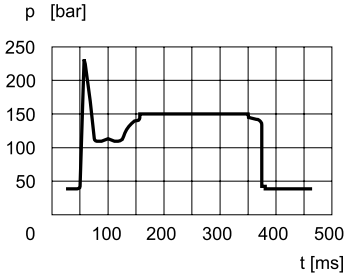
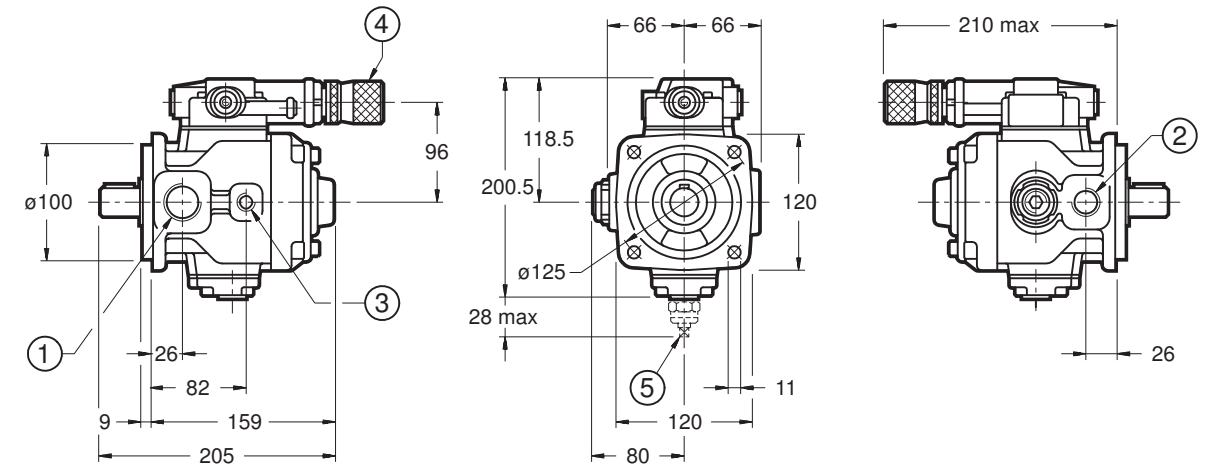
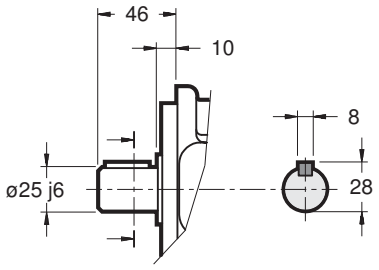


Diagram noted passing from maximum flow rate to zero flow rate and vice versa

6 - PVA - 22/28/35 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

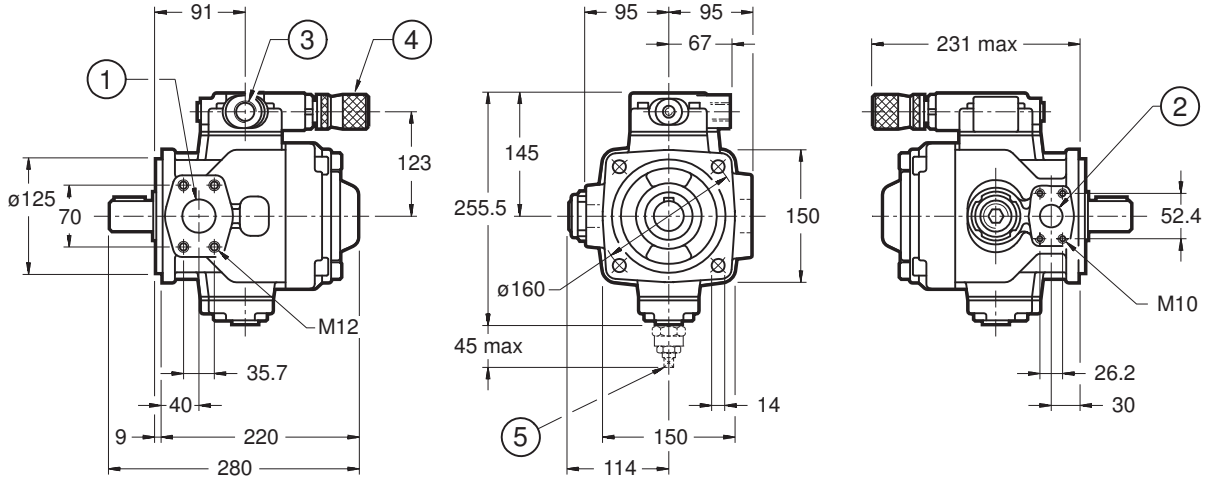


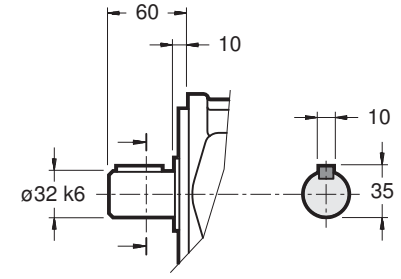


1	Suction port: 1” BSP
2	Delivery port: 3/4” BSP
3	Drainage port: 3/8” BSP
4	Pressure compensator. Clockwise rotation to increase pressure.
5	Flow adjuster

7 - PVA - 45/56/72 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

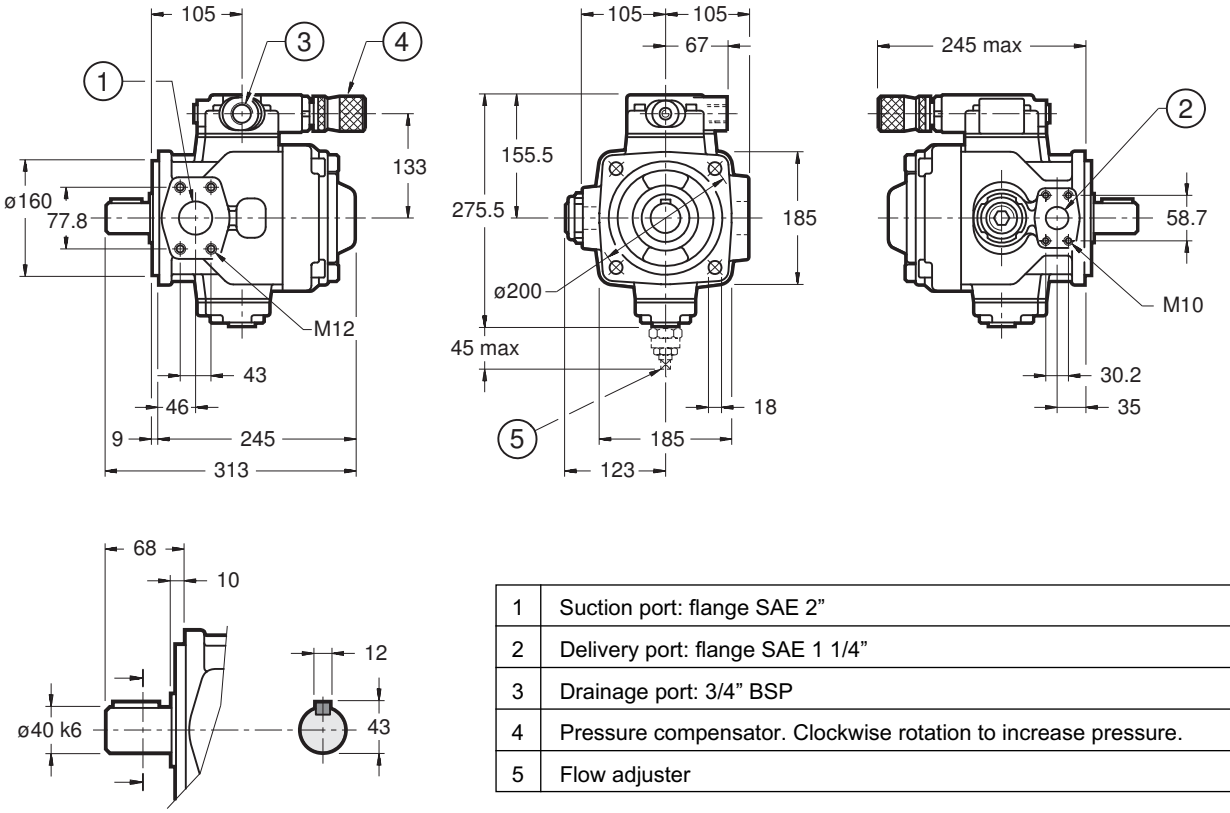




1	Suction port: flange SAE 1 1/2”
2	Delivery port: flange SAE 1”
3	Drainage port: 3/4” BSP
4	Pressure compensator. Clockwise rotation to increase pressure.
5	Flow adjuster

8 - PVA - 90/115/145 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Suction port: flange SAE 2”
2	Delivery port: flange SAE 1 1/4”
3	Drainage port: 3/4” BSP
4	Pressure compensator. Clockwise rotation to increase pressure.
5	Flow adjuster

9 - INSTALLATION

— The PVD pumps up to size 35 can be installed with the axis oriented in any position. For other sizes the pump must be installed with the axis in horizontal position.

— The suction line must be suitably sized to facility the flow of oil.
Bends and restrictions or an excessive line length can impair correct operation of the pump.

— The drainage port must be connected directly to the tank by a line separate from other discharges, located far from the suction line and lengthened to below the minimum oil level so as to avoid formation of foam.

— The pump start up, especially at a cold temperature, should occur with the pump unloading.

— The pumps are normally positioned directly above the oil tank.
Flooded suction port installation of the pumps is advisable in the case of circuits with high flow rates and pressures.

— The motor-pump connection must be carried out directly with a flexible coupling.
Couplings that generate axial or radial loads on the pump shaft are not allowed.

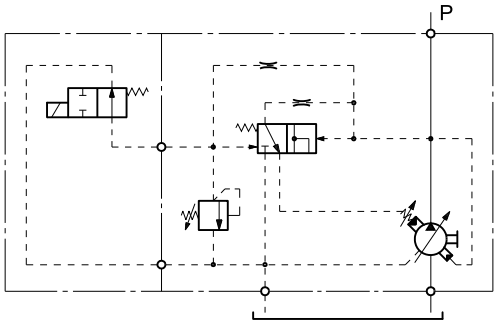
10 - PVA***Q FLOW ADJUSTER

The flow adjustment group, supplied upon request, consists of an adjustment screw and a small balanced piston that limit the maximum eccentricity of the pumping group cam ring, changing the displacement.
The screw is supplied with square head, spanner 7, that allows assembly of an adjustment handwheel or the attachment for remote control.
The maximum flow is reduced by turning the adjustment screw clockwise.

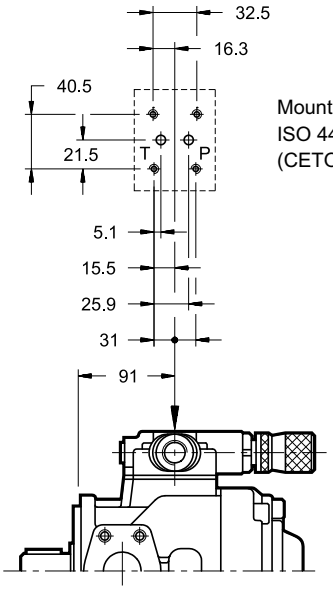
11 - PVA**M DUAL PRESSURE VALUE SELECTION DEVICE

This version permits selection of two different set pump pressure values with a solenoid valve.
The main pressure compensator is equipped with a iISO 4401-03 (CETOP 03) mounting interface for mounting the control valve of the second pressure value and of the selection solenoid valve. **NOTE**: The valves are not included in the supply.
It is possible to make different pump set pressure control circuits and some examples are outlined in paragraph 13.

DUAL PRESSURE VALUE PUMP
OPERATING DIAGRAM



dimensions in mm



Mounting interface
ISO 4401-03
(CETOP 03)

12 - MULTIPLE PUMPS

The PVA pumps are designed to be connected one to the other in descending order of displacement. They can be connected also with PVD type pumps (see catalogue 14 100) and with GP1 and GP2 size gear pumps (see catalogue 11 100).

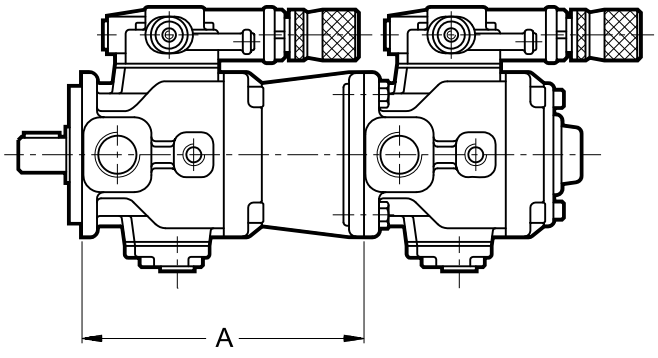
The torque on the shaft must be further reduced after the second pump.

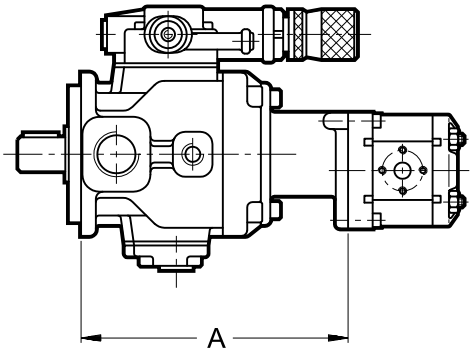
Consult our technical department for applications of this type.

IDENTIFICATION CODE FOR MULTIPLE PUMPS
identification code + identification code + identification code
1st pump 2nd pump 3rd pump
(omit for double pumps)

Double pump identification example: **PVA 35 Q / 30 A + PVA 22 / 30/P**
Triple pump identification example: **PVA 56 / 30 / A + PVA 35 Q / 30/I + PVD 22 H/30/P**
PVA pump + GP pump identification example: **PVA35Q/30/A + GP1-0061R97F/20N**

NOTE: for the identification codes of the single pumps see:
cat. 11 100 par. 1 for GP pumps
cat. 14 100 par. 1 for PVD pumps
cat. 14 200 par. 1 for PVA pumps

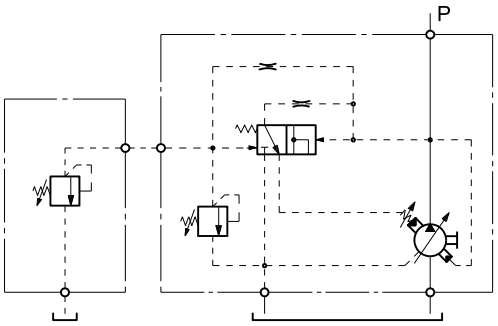




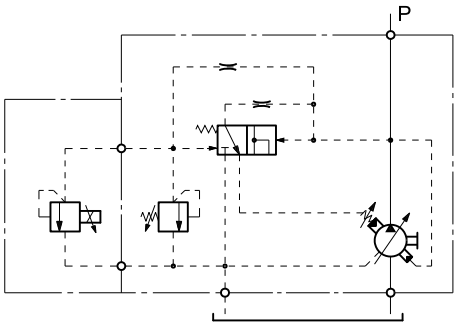
Max. torque applied to the shaft of the second pump (Nm)			Dimension A (mm)		
Size Group First pump	Second pump (same size group)	Second pump (smaller size group)	With PVA pump (same size group)	With gear pump type:	
PVA 22/28/35	43	-	207	GP1	203
PVA 45/56/72	113	113	275	GP1 and GP2	262
PVA 90/115/145	186	113	315	GP1 and GP2	287

13 - SET PRESSURE CONTROL CIRCUIT EXAMPLES

PUMP WITH REMOTE PRESSURE ADJUSTMENT

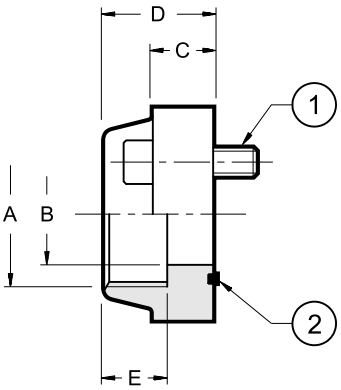


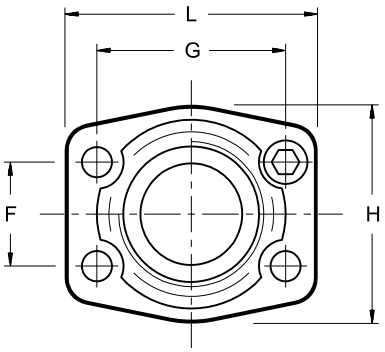
PUMP WITH PROPORTIONAL PRESSURE ADJUSTMENT



14 - CONNECTION FLANGES

dimensions in mm



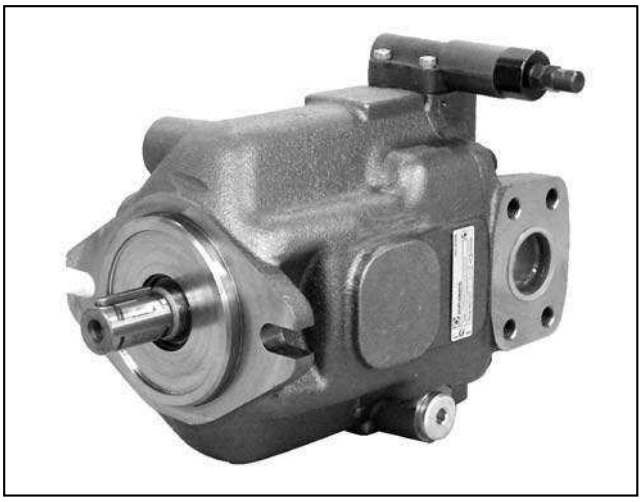


The fastening bolts and the O-Rings must be ordered separately.

Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	(1)	(2)
0610713	SAE - 1”	345	1” BSP	25	18	38	22	26.2	52.4	22	70	N. 4 TCEI M10x35	OR 4131 (32.93x3.53)
0610720	SAE - 1 1/4”	276	1 1/4” BSP	32	21	41	22	30.2	58.7	68	79		OR 4150 (37.69x3.53)
0610714	SAE - 1 1/2”	207	1 1/2” BSP	38	25	44	24	35.7	70	78	93	N. 4 TCEI M12x45	OR 4187 (47.22x3.53)
0610721	SAE - 2”	207	2” BSP	51	25	45	30	43	77.8	90	102		OR 4225 (56.74x3.53)

DUPLOMATIC OLEODINAMICA

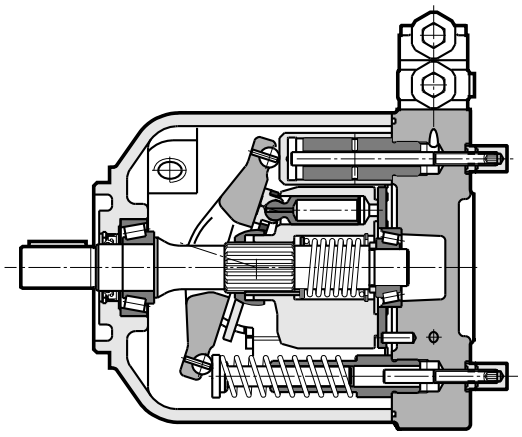
DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com



VPPM

VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS

OPERATING PRINCIPLE



— The VPPM pumps are variable displacement axial-piston pumps with variable swash plate, suitable for applications with open circuits.

— They are available in three different frame sizes with maximum displacements up to 29, 46, 73 and 87cm^3/rev.

— The pump flow rate is proportional to the rotation speed and to the angle of the swash plate, which can be continuously modulated. The maximum and minimum angle can be limited mechanically via suitable regulating screws.

— The pumps feature medium-high working pressures (up to 280 bar constant and 350 bar peak). Thanks to some particular design features, these pumps are able to bear high axial and radial loads on the shaft.

— They are usually supplied with a ISO 3019/2 mounting flange, with the exception of the rear and intermediate pumps, if multiple pumps, which are only available with a SAE J744 2-holes flange and a SAE J744 splined shaft (see paragraph 16).

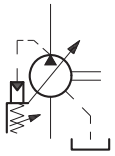
— They are available with seven different types of regulating control, each according to the application needs (see paragraphs 8 ÷ 14).

TECHNICAL SPECIFICATIONS

PUMP SIZE		**029**	**046**	**073**	**087**
Maximum displacement	cm^3/rev	29	46	73	087
Max. delivery pressure (relative): - continuous - intermittent (**NOTE 1**) - peak	bar		280 315 350		250 280 315
Maximum rotation speed at maximum displacement (**NOTE 2**)	rpm	3000	2600	2200	1850
Rotation direction		clockwise or anticlockwise (looking at the drive shaft)			
Hydraulic connection		SAE flange fittings (see paragraph 24)			
Type of mounting (single pump)		ISO 3019/2 flange			
Mass (empty single pump)	kg	18	24	33	33

Ambient temperature range	°C	-15 / +70
Fluid temperature range	°C	-25 / +80
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	15 ÷ 35

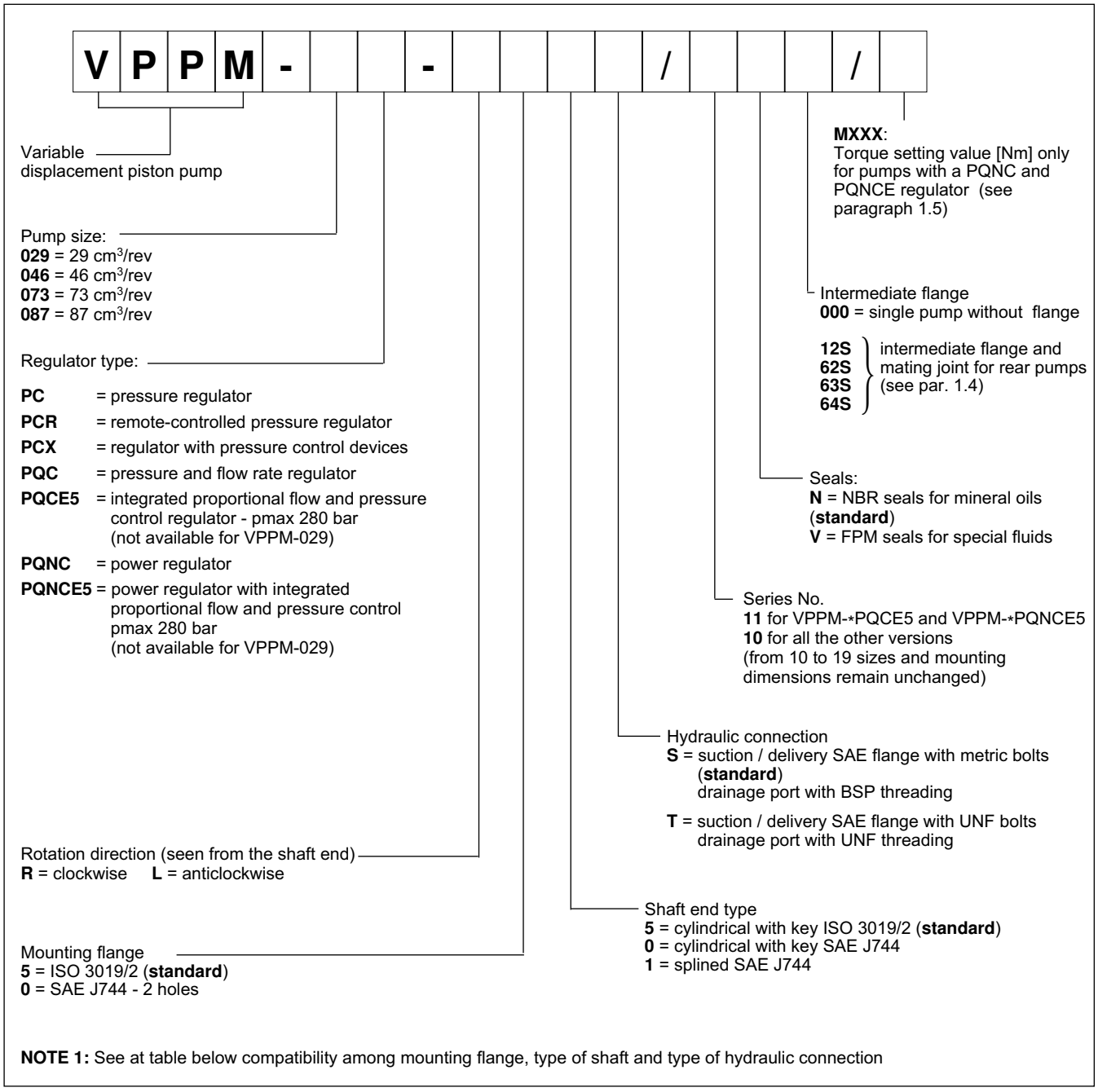
HYDRAULIC SYMBOL



NOTE 1: Allowed intermittent duty pressures with a duration equal to 6 seconds per minute.
NOTE 2: Values referring to a zero bar pressure (relative) on the suction port.

1 - IDENTIFICATION CODES

1.1 - Identification code for single and front pumps with a through output shaft



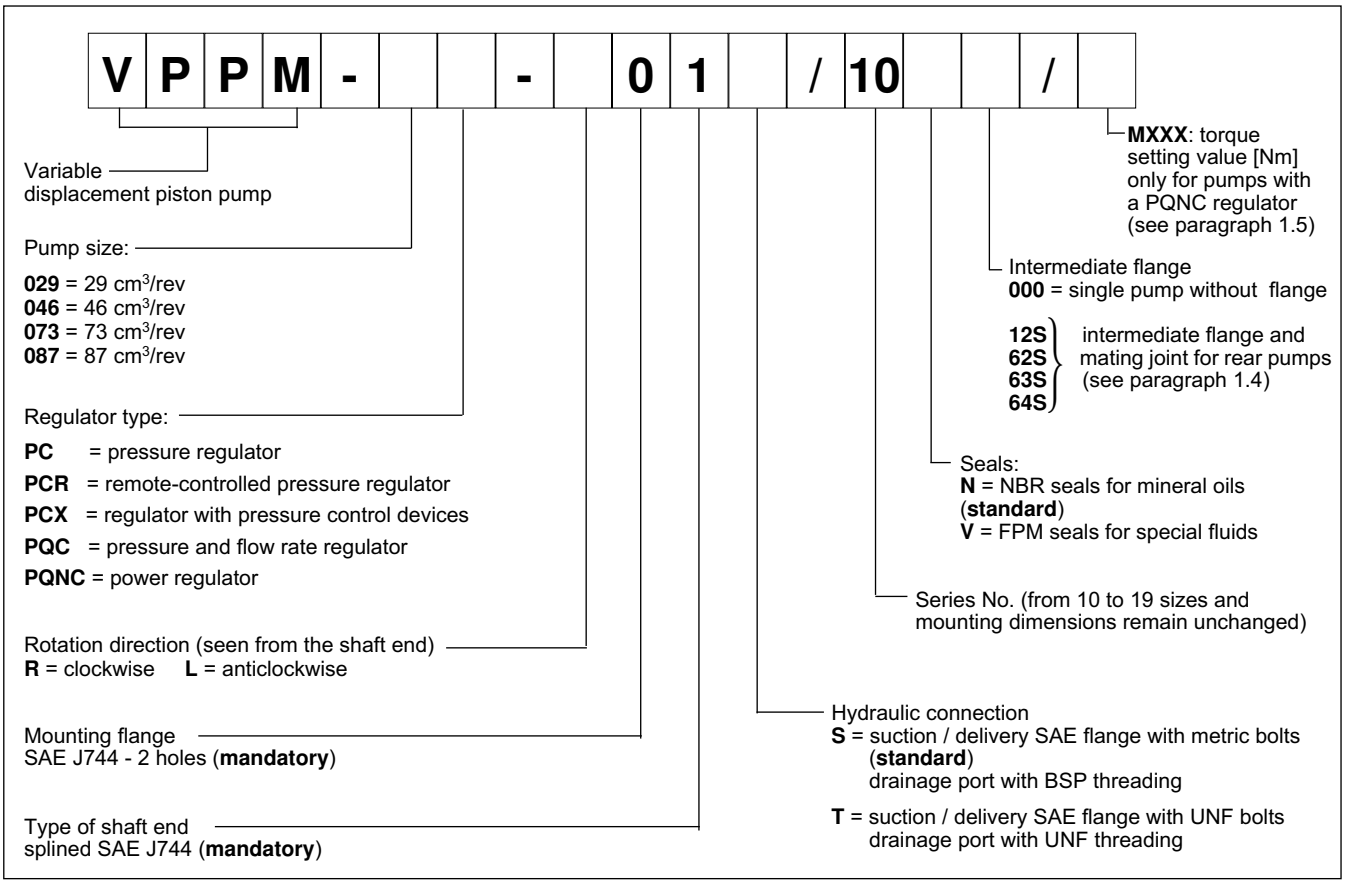
NOTE 1: See at table below compatibility among mounting flange, type of shaft and type of hydraulic connection

Compatibility among mounting flange, type of shaft and type of hydraulic connection

FLANGE CODE	SHAFT CODE			HYDRAULIC CONNECTION CODE	
	5	0	1	S	T
5	yes	no	no	yes	no
0	no	yes	yes	yes	yes

VPPM pumps are supplied as standard with mechanical minimum and maximum displacements limit controls.
These devices are not available for front and intermediate pumps with a through output shaft.

1.2 - Identification code for intermediate pumps with a through output shaft and rear pumps



1.3 - Identification code for double pumps

identification code + identification code
1st pump 2nd pump

1.4 - Identification code for intermediate flange and mating joint for pumps with a through output shaft

According to the pump to be coupled, it is necessary to define, into the identification code, the flange and mating joint type to be applied to the pump with a through output shaft.
The following table states the flange and joint reference code according to the different pump types to be pulled, stating also the possible coupling combinations.

Identification code for intermediate flange + mating joint	intermediate flange	mating joint	pump to be mated	possible combinations for VPPM pump with a through output shaft			
				29	46	73	87
12S	SAE J744 2 holes - type “A”	SAE J744 splined 16/32 D.P. - 9T	GP 2 external gear	yes	yes	yes	yes
62S	SAE J744 2 holes - type “B”	SAE J744 splined 16/32 D.P. - 13T	GP 3 external gear VPPM-029	yes	yes	yes	yes
63S	SAE J744 2 holes - type “B”	SAE J744 splined 16/32 D.P. - 15T	VPPM-046	no	yes	yes	yes
64S	SAE J744 2 holes - type “C”	SAE J744 splined 12/24 D.P. - 14T	VPPM-073	no	no	yes	yes
64S	SAE J744 2 holes - type “C”	SAE J744 splined 12/24 D.P. - 14T	VPPM-087	no	no	no	yes

NOTE: For the flange type and dimensions see paragraph 20.

1.5 - Standardized torque values for PQNC and PQNCE regulators

ELECTRICAL MOTOR 4 POLES		VPPM-029		VPPM-046		VPPM-073		VPPM-087	
Power [kW]	N [rpm]	**torque [Nm]**	p regulation start. [bar]	**torque [Nm]**	p regulation start. [bar]	**torque [Nm]**	p regulation start. [bar]	**torque [Nm]**	p regulation start. [bar]
4	1425	**26 (#)**	46	**-**	-	**-**	-	**-**	-
5,5	1440	**36 (#)**	62	**36 (#)**	41	**-**	-	**-**	-
7,5	1450	**50**	84	**50 (#)**	56	**-**	-	**-**	-
9,2	1460	**60**	103	**60 (#)**	68	**60 (#)**	44	**-**	-
11	1455	**72**	124	**72**	82	**72 (#)**	53	**-**	-
15	1460	**98**	168	**98**	111	**98 (#)**	72	**-**	-
18,5	1460	**-**	-	**122**	137	**122**	89	**-**	-
22	1465	**-**	-	**144**	163	**144**	105	**-**	-
30	1470	**-**	-	**-**	-	**196**	143	**196**	126
37	1470	**-**	-	**-**	-	**240**	175	**240**	156
45	1470	**-**	**-**	**-**	**-**	**-**	**-**	**293**	190
55	1475	**-**	**-**	**-**	**-**	**-**	**-**	**356**	231

(#) With this adjustment value the pump is in venting position with a pressure lower than 280 bar.

1.6 - Identification examples

a) 29 cm^3/rev single pump with pressure regulator - ISO mounting flange and shaft (standard)
VPPM-029PC-R55S/10N000

b) 46 cm^3/rev single pump with pressure regulator with remote control - SAE mounting flange and SAE splined shaft
VPPM-046PCR-R01S/10N000

c) 73 cm^3/rev single pump with pressure control devices - ISO mounting flange and shaft (standard)
VPPM-073PCX-R55S/10N000

d) 46 cm^3/rev single pump with integrated proportional flow and pressure control regulator - pressure regulation up to 280 bar
VPPM-046PQCE5-R55S/11N000

e) 46 cm^3/rev single pump with power regulator set at 18,5 kW at 1460 rpm (torque = 122 Nm)
VPPM-046PQNC-R55S/10N000/M122

f) 73 cm^3/rev single pump with power regulator with integrated proportional flow and pressure control - power regulator set at 98 Nm - pressure regulation up to 280 bar
VPPM-073PQNCE5-R55S/11N000/M098

g) 73 cm^3/rev front pump with pressure regulator, ready to mate to a VPPM-029 pump
VPPM-073PC-R55S/10N62S

h) double pump made of: - 46 cm^3/rev front pump with pressure and flow rate regulator
- 29 cm^3/rear pump with pressure regulator
VPPM-046PQC-R55S/10N62S + VPPM-029PC-R01S/N000

i) triple pump made of: - 73 cm^3/rev front pump with flow rate and pressure regulator
- 46 cm^3/rev intermediate pump with pressure regulator
- 14 cm^3/rev rear gear pump group 2
VPPM-073PQC-R55S/10N63S + VPPM-046PC-R01S/10N12S + GP2-0140R01F/20N

2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives according to the DIN 51524 norm.
For use with other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for authorization of use.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water ≤ 40%)	The performance ratings shown in the table 'PERFORMANCES' must be reduced as follows: max continuous pressure: 170 bar max peak pressure: 200 bar max rotation speed: VPPM-029 = 2100 rpm VPPM-046 = 2000 rpm VPPM-073 and VPPM-087 = 1700 rpm - The suction pressure must be lower than 0,8 absolute bars (-0,2 relative bars) - The fluid maximum temperature must be between 0°C and 50°C. - Use NBR seals only.
HFD (phosphate esters)	Such fluids do not require any particular performance limitation. It is suggested to operate with continuous duty pressures not higher than 200 bar and pressure peaks not higher than 240 bar. - The operating temperature must be between -10°C and 90°C. - Use VITON seals

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 90 °C for the drainage fluid
optimum viscosity	15÷ 35 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1000 cSt	limited only to the cold start-up of the pump, which has to be carried out with the plant at minimum pressure.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore the use of a delivery or return filter with $\beta_{10\,(c)} \geq 75$ is suggested.

A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, the use of a filter with $\beta_{10\,(c)} \geq 100$ is recommended.

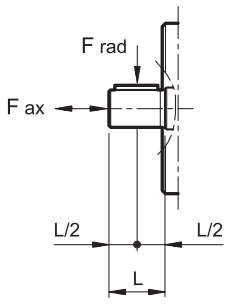
In the event that the filter is installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in the table of paragraph 3.

The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator and should be oversized to avoid cavitation problems.

3 - PERFORMANCES (measured with mineral oil with viscosity of 36 cSt at 50°C)

PUMP SIZE		029	046	073	087
Maximum displacement	cm^3/rev	29	46	73	87
Maximum flow rate: - at 1500 rpm - at max rotation speed	l/min	43,5 87	69 119,6	109,5 160,5	131,9 162,6
Input pressure (absolute): - min - max	bar (abs)	0,8 25			
Max. delivery pressure (absolute): - continuous - intermittent (**NOTE 1**) - peak		280 315 350			250 280 315
Max pressure on drainage port	bar (abs)	2			
Maximum power (Δp = 280 bar): - at 1500 rpm - at max rotation speed	kW	20,3 40,6	32,2 55,8	51,1 74,9	54,9 67,8
Max velocity at maximum displacement	rpm	3000	2600	2200	1850
Moment of inertia on the shaft	kgm^2	0,0020	0,0030	0,0080	0,0080
Max absorbed torque: - Δp = 100 bar - Δp = 280 bar	Nm	46,2 129,3	73,2 205	116,2 325,3	139,9 349,8
Max operating pressure with NBR seals - minimum - continuous - peak	°C	-25 80 100			
Max operating pressure with Viton seals - minimum - continuous - peak	°C	-10 110 125			
Oil volume in the pump body	lt	0,7	0,9	1,5	1,5

NOTE 1: Allowed intermittent duty pressures with a duration equal to 6 seconds per minute.

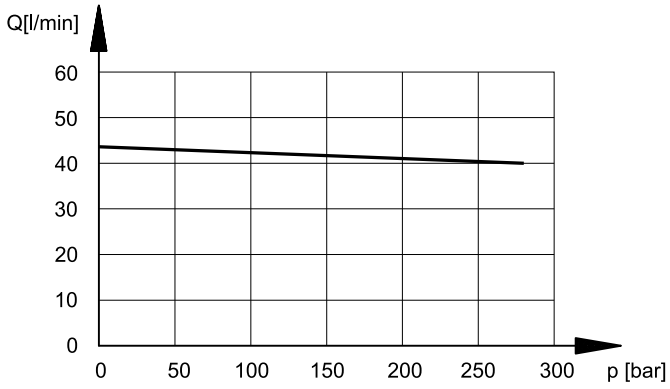


Loads on the shaft: - axial load (F_{ax}) - radial load (F_{rad})	N	1000 1500	1500 1500	2000 3000	2000 3000

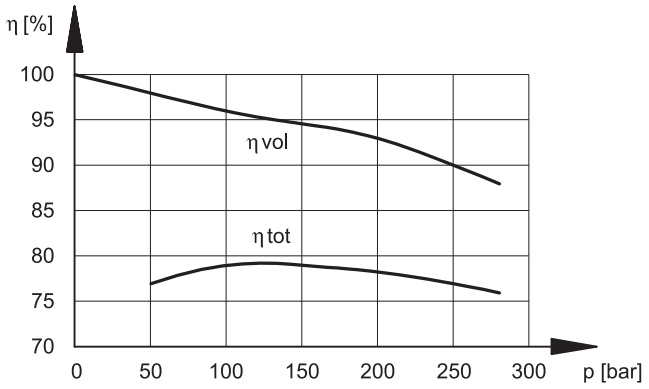
4 - VPPM-029 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

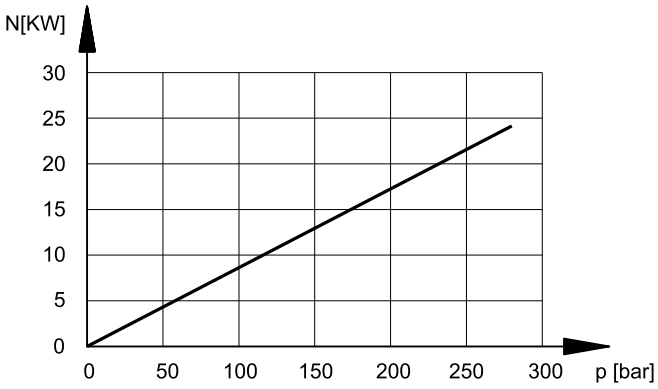
FLOW RATE/PRESSURE CURVES



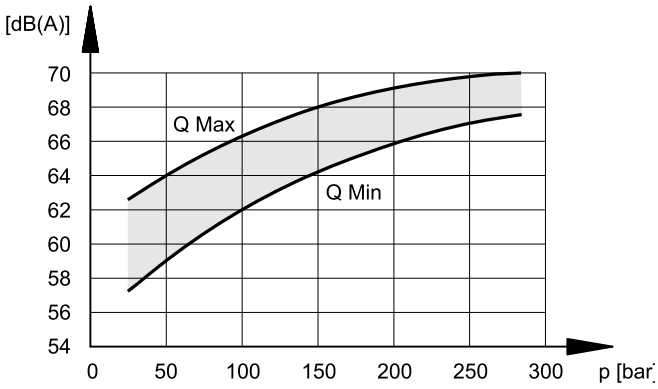
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

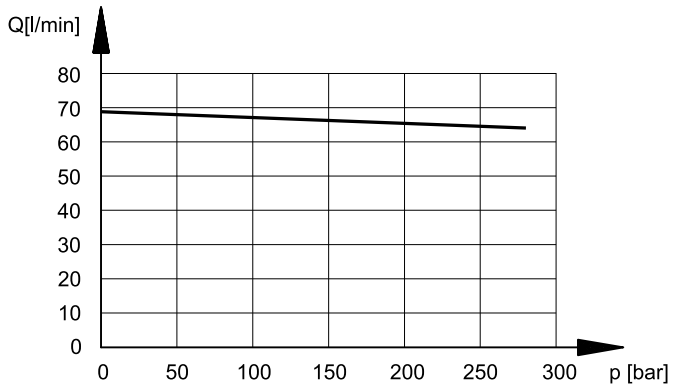


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

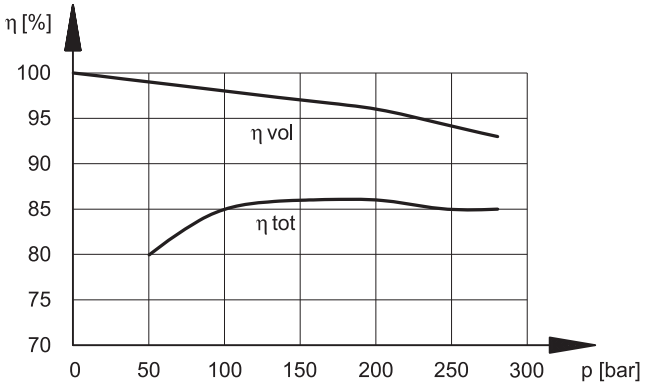
5 - VPPM-046 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

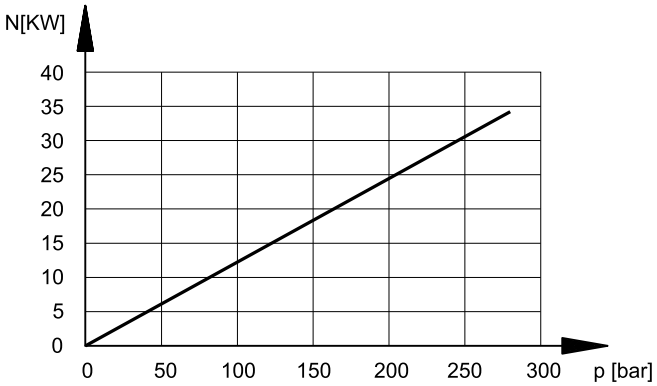
FLOW RATE/PRESSURE CURVES



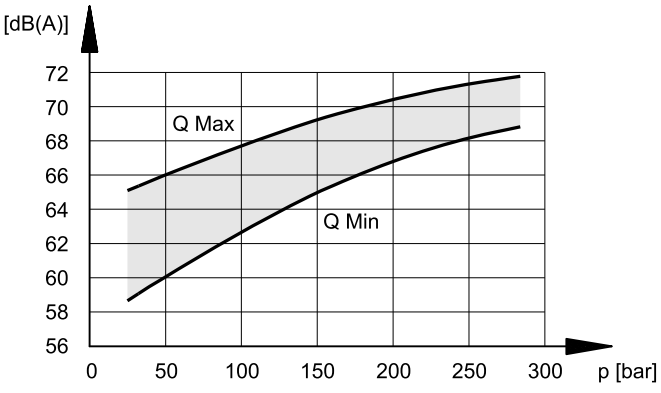
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

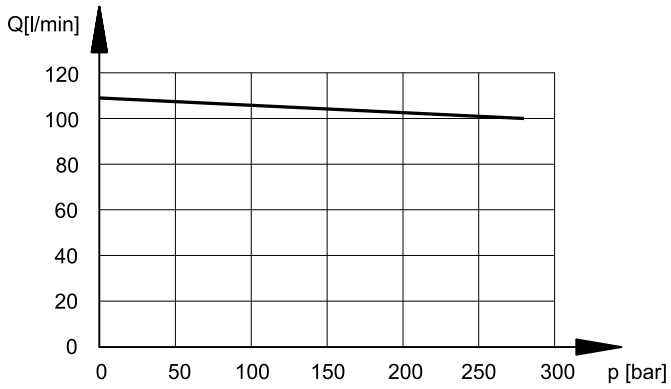


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

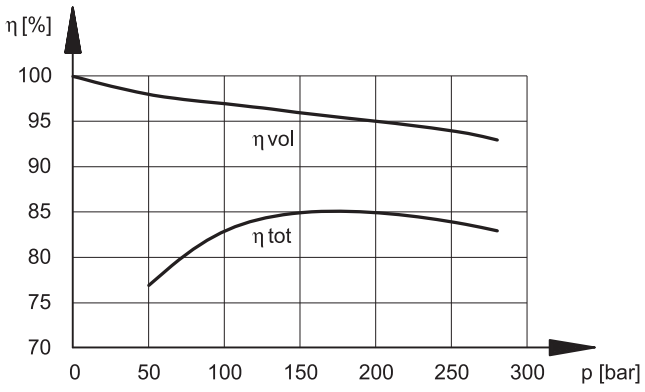
6 - VPPM-073 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

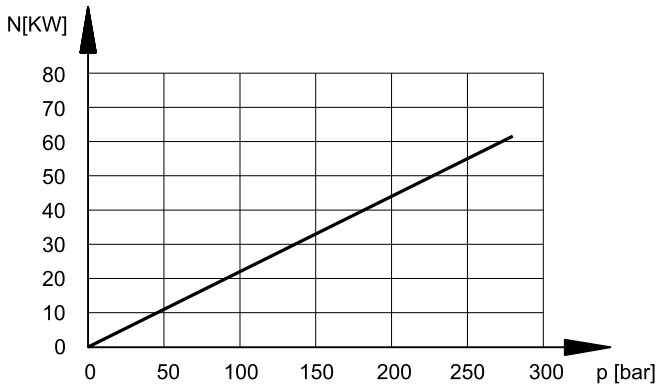
FLOW RATE/PRESSURE CURVES



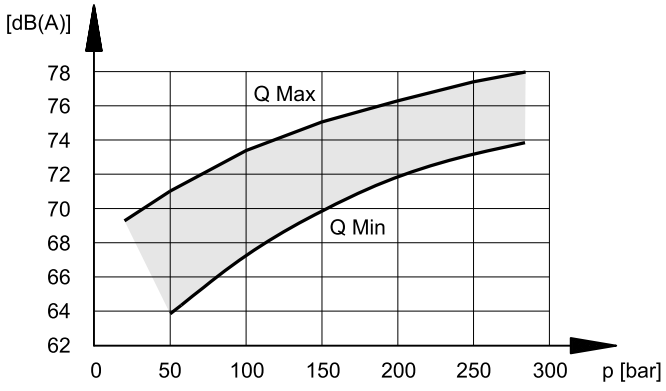
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

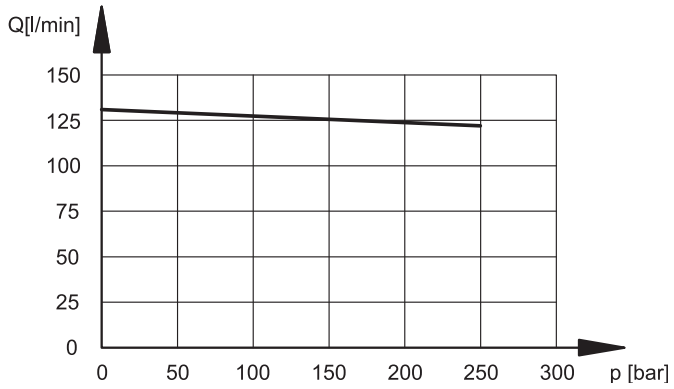


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

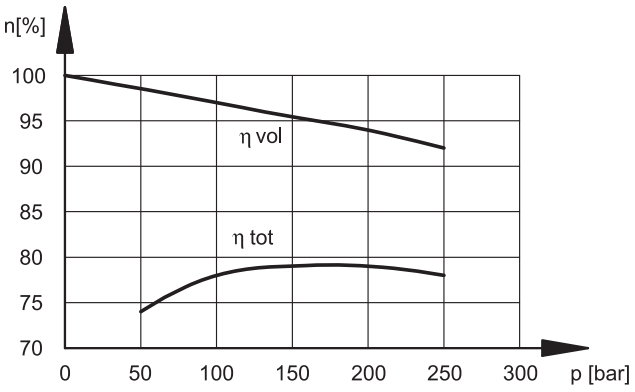
7 - VPPM-087 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

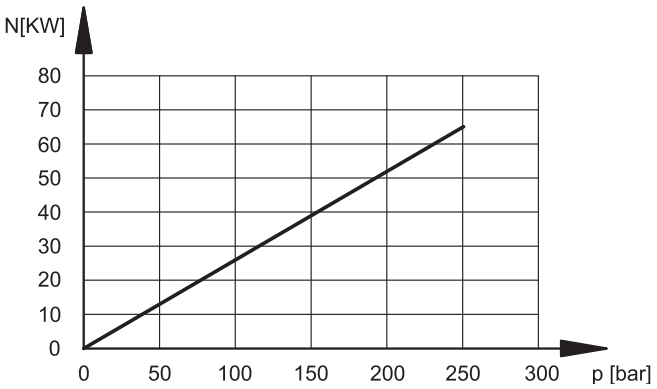
FLOW RATE/PRESSURE CURVES



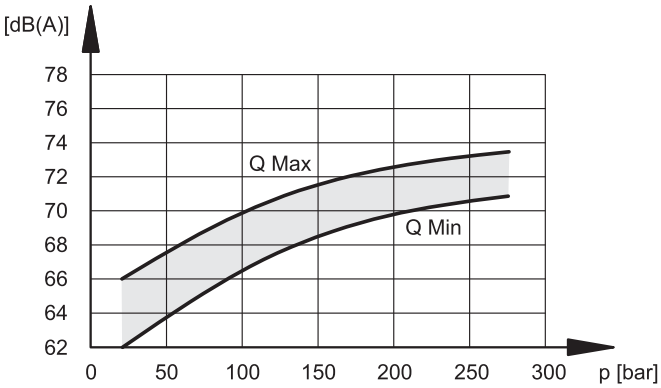
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



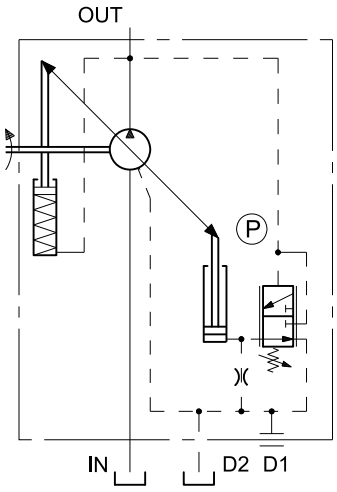
NOISE LEVEL



The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

8 - PRESSURE REGULATOR: PC

FUNCTIONAL DIAGRAM



The PC pressure regulator keeps the pressure at a constant set level in the circuit, thus adjusting automatically the pump flow rate according to the real need of the system.
The desired pressure can be set by manually adjusting the (P) regulation valve.

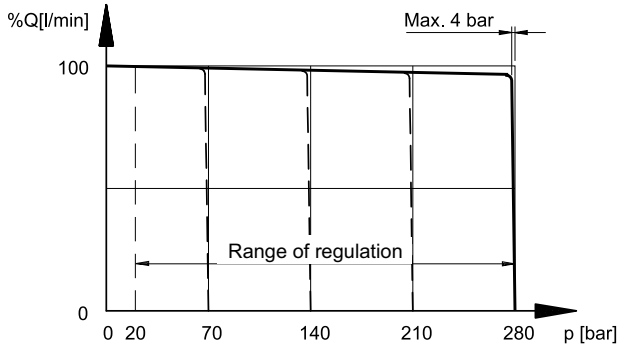
FEATURES OF THE PC REGULATOR:

- pressure regulating range (P) = 20 ÷ 350 bars
- default setting (P) = 280 bars

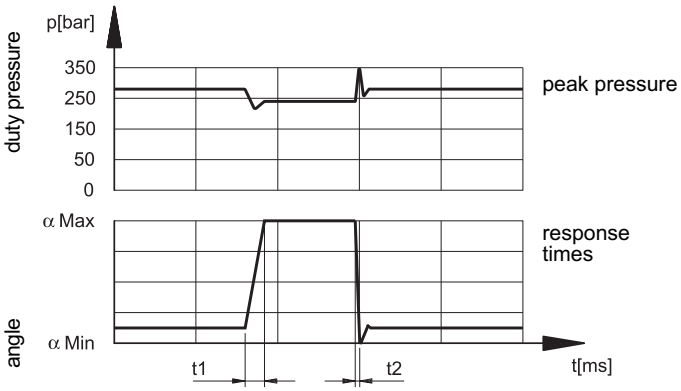
8.1 - Characteristic curves of the PC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

FLOW RATE/PRESSURE FEATURE



RESPONSE TIMES AND PEAK PRESSURE



t1 = response time for a change from a min. to a max. displacement.
t2 = response time for a change from a max. to a min. displacement.

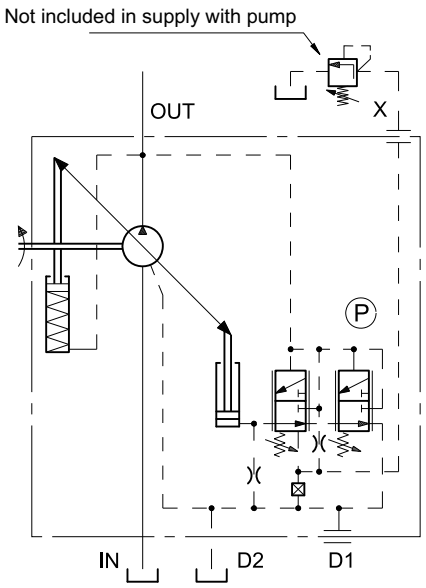
PC pressure regulator set at 280 bars

pump size	t1 [ms]	t2 [ms]
029	30	20
046	45	25
073	50	30
087	53	28

The values stated in the table are obtained from the opening until the instant the delivery level is achieved, by using a maximum pressure valve set at 350 bars for a load simulation, placed at a distance of 1 m from the pump delivery port.

9 - REMOTE-CONTROLLED PRESSURE REGULATOR: PCR

FUNCTIONAL DIAGRAM



The PCR regulator, apart from limiting the line maximum pressure (P valve), allows a remote-control of the device via a remote control connected to the X port (typical application for submerged pumps). In case a pressure regulating valve is used for the remote-control, it is suggested to use a direct operated valve with a size suitable to 1,5 l/min pilot flow rate.

N.B. The maximum length of the connection between the valve and the pump X port must not be longer than 2 m.

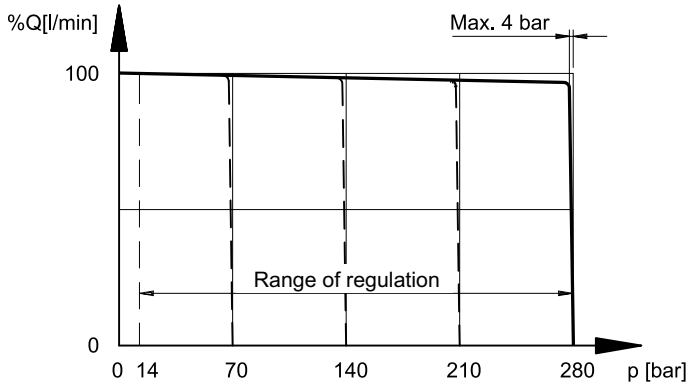
PCR FEATURES:

- pressure regulating range (P) = 20 ÷ 350 bars
- default setting (P) = 280 bars
- remote-regulated pressure range = 14 ÷ 315 bars
- flow rate available on the X port for the remote-control = about 1,5 l/min

9.1- Characteristic curves of the PCR regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

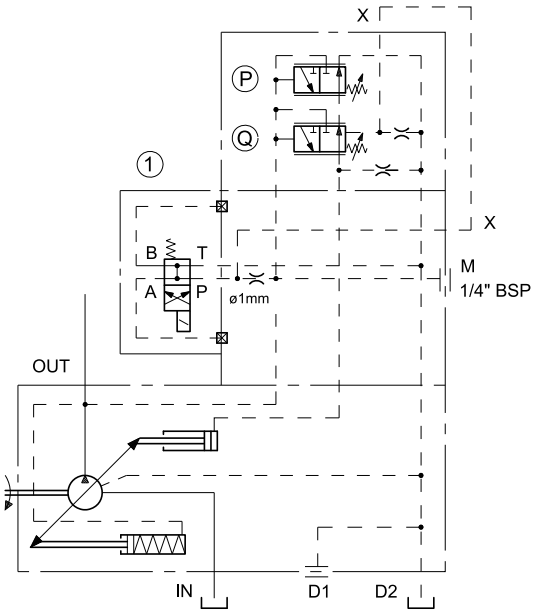
FLOW RATE / PRESSURE FEATURE



10 - REGULATOR WITH PRESSURE CONTROL DEVICES: PCX

10.1 - Electrical unloading

FUNCTIONAL DIAGRAM



The PCX regulator, mated to a suitable two-position solenoid valve, allows the electrical switching of the pump displacement in null condition and with minimum delivery pressure.

This function is useful for the pump unloading at the start-up or to operate at minimum pressure in the system during the machine cycle pause, with considerable energy saving.

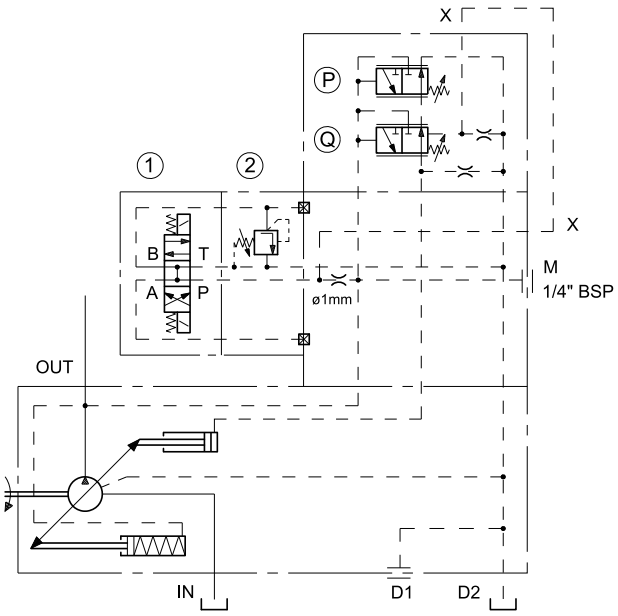
The pressure switching is made by means of a solenoid valve (to be ordered separately) installed on the pump regulator directly.

PCX FEATURES (electrical unloading):

- solenoid switching valve (1) = DS3-SA2 (to be ordered separately see cat. 41 150)
- solenoid valve OFF = pump at null displacement and delivery pressure = 20 bar
- solenoid valve ON = maximum displacement and delivery pressure set on regulator (P).
- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

10.2 - Two pressure settings + unloading

FUNCTIONAL DIAGRAM



This type of regulator allows to select, by means of a three-position solenoid valve, two different working pressures; it allows also the pump unloading.

The solenoid valve (1) and the relief valve (2) for the intermediate pressure setting are directly installed on the pump regulator and they are to be ordered separately.

PCX FEATURES (two pressure settings + unloading):

- solenoid switching valve (1) = DS3-S2 (to be ordered separately see catalogue 41 150)
- solenoid valve OFF = pump unloading - delivery pressure = 20 bar
- solenoid side “a” ON = maximum displacement and delivery pressure set on relief valve (2) (intermediate value)
- solenoid side “b” ON = maximum displacement and delivery pressure set on regulator (P) (maximum value)

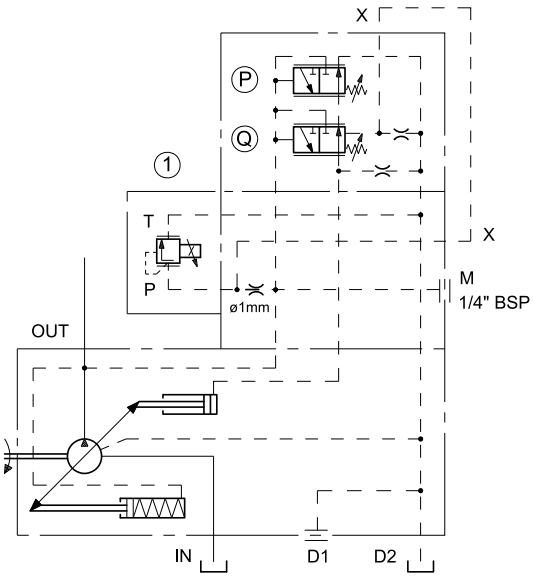
- pressure relief valve (2) = MCD*-SBT (to be ordered separately - see cat. 61 200)
- pressure regulating range (2) = MCD3-SBT 20 ÷ 100 bar
  MCD5-SBT 20 ÷ 250 bar

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

NOTE: For PCX regulators characteristic curves (with two pressure settings + unloading functions), see PC regulator diagrams at paragraph 8.1.

10.3 - Pressure regulation with electric proportional control

FUNCTIONAL DIAGRAM



The PCX regulator mated with a proportional pressure relief valve, allows a continuous control and modulation of the system pressure.

The proportional pressure relief valve (to be ordered separately) is installed on the pump regulator directly.

PCX FEATURES (proportional pressure regulation):

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

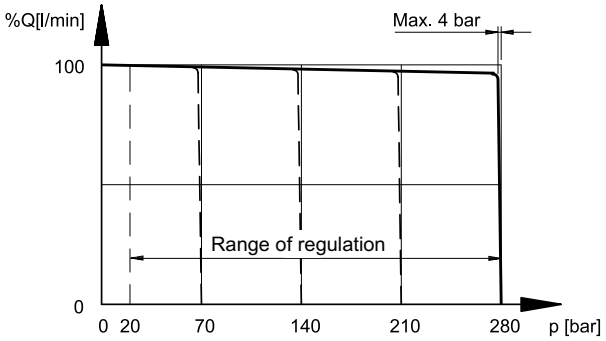
- proportional pressure relief valve (1) = PRED3 (to be ordered separately with its relative electronic control unit - see catalogue 81 210)
- proportional pressure regulating range:
  PRED3-070 20 ÷ 100 bar
  PRED3-210 20 ÷ 240 bar

Hysteresis = < 5% of p nom
Repeatability = < ± 1,5% of p nom

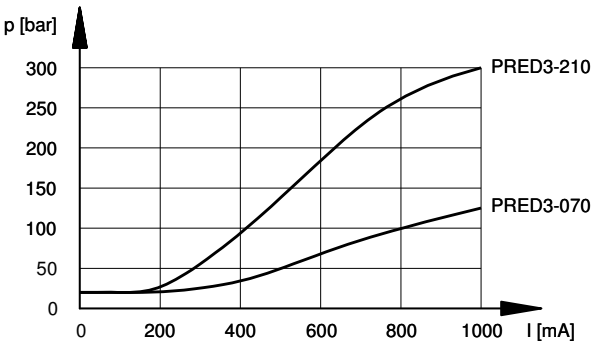
10.3.1 - Characteristic curves (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

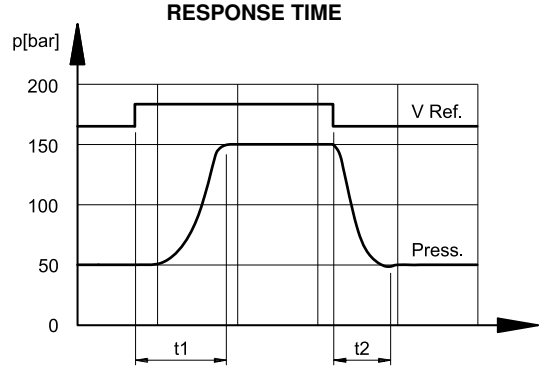
FLOW RATE / PRESSURE FEATURE



CURRENT / PRESSURE FEATURE



RESPONSE TIME

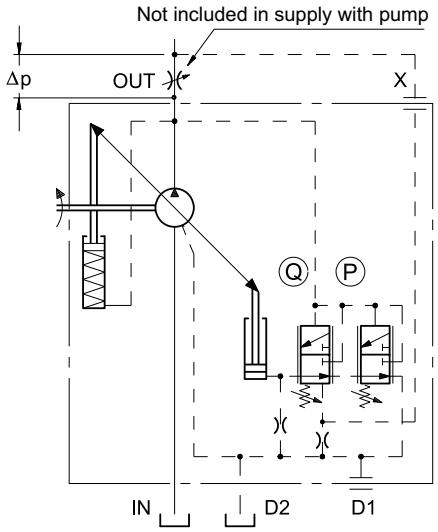


The response times are obtained with a VPPM-046 pump, by changing the reference signal (V Ref) on the proportional valve in order to have a line pressure variation from 50 to 150 bar and vice versa, with an oil volume of 5 lt.

t1 = 80 ms (response time for an increasing pressure change)
t2 = 60 ms (response time for a decreasing pressure change)

11 - FLOW RATE AND PRESSURE REGULATOR: PQC

FUNCTIONAL DIAGRAM



This regulator, apart from regulating the pressure (as for the PC model), allows the pump flow rate to be regulated according to the Δp pressure drop measured on either side of a throttle valve installed on the user line. The connection pipe between the X port and the flow line downstream the restrictor (or valve) must always be made (customer charge).

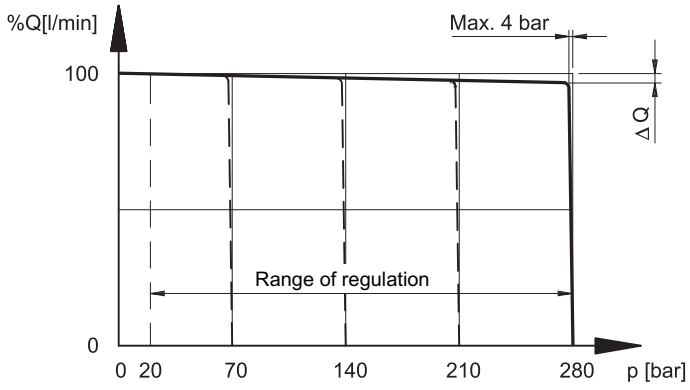
PQC FEATURES:

- pressure regulating range (P) = 20 ÷ 350
- default setting (P) = 280 bar
- differential pressure regulating range (Q) = 10 ÷ 40 bars
- default setting = 14 bar
- Min. discharge head = 18 ± 2 bar
  (with a zero flow rate, X discharge pilot and with a default (Q) setting of the differential regulator)

11.1 - Characteristic curves of the PQC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

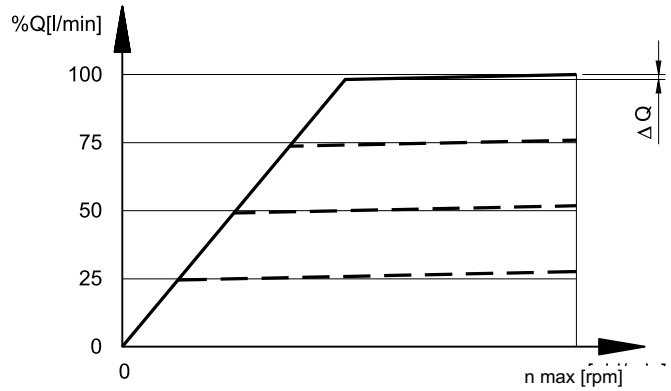
FLOW RATE / PRESSURE FEATURE



Flow variation between minimum and maximum pressure with pump set at max displacement

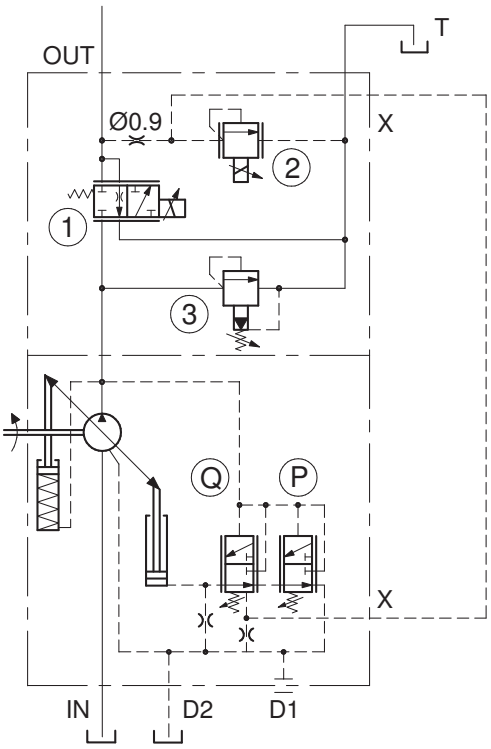
pump size	ΔQ max [l/min]
029	0.9
046	1.7
073	2.5
087	2.5

FLOW RATE / ROTATION SPEED STATIC FEATURE



12 - INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL REGULATOR: PQCE5

FUNCTIONAL DIAGRAM



This regulator allows an independent regulation of the pump flow and pressure, both with an electric proportional control.

The pump flow is regulated through the proportional valve (1) which operates directly on the pump delivery, while the system pressure is controlled by means of the proportional relief valve (2) working as a pilot stage of the differential regulator (Q).

The maximum system pressure is limited by the regulator (P). The regulator is also equipped of a built-in pressure relief valve (3) with manual adjustment, which limits the pressure peak due to quick flow variations in the system.

PQCE5 FEATURES

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

- differential pressure regulating range (Q) = 10 ÷ 30 bar
- default setting = 16 bar

- proportional pressure regulating range:
  20 ÷ 250 bar (for VPPM-*PQCE5 pump)

- proportional flow regulating range:
  0 ÷ 69 l/min (for VPPM-046 PQCE5 pump)
  0 ÷ 109,5 l/min (for VPPM-073 PQCE5 pump)
  0 ÷ 132 l/min (for VPPM-073 PQCE5 pump)

PERFORMANCES and ELECTRICAL CHARACTERISTICS

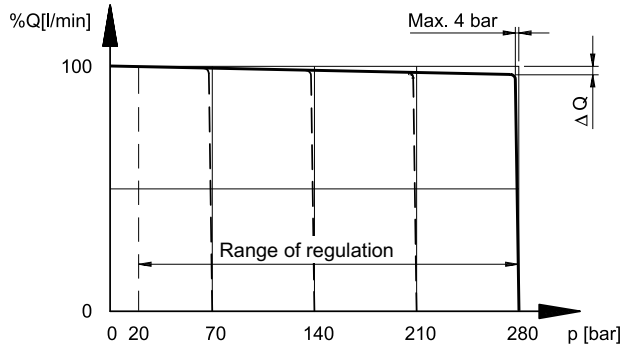
	FLOW REGULATION (1) (DSE5 valve)	PRESSURE REGULATION (2) (CRE valve)
HYSTERESIS	< 6% of Q max	< 5% of p nom
REPEATABILITY	< ±1,5% of Q max	< ±1,5% of p nom
NOMINAL VOLTAGE	24 VDC	24 VDC
COIL RESISTANCE (at 20°C)	8,65 Ω	16,6 Ω
MAXIMUM CURRENT	1,6 A	0,85 A
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CEE	
DEGREE OF PROTECTION : Atmospheric agents (CEI EN 60529)	IP 65	
ELECTRONIC CONTROL UNITS for proportional valves	EDM-M3312 see cat. 89 250	

12.1 - Characteristic curves of the PQCE5 regulator

(values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

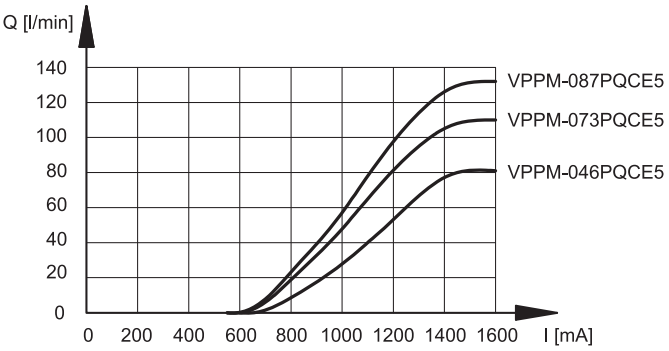
FLOW RATE / PRESSURE CURVE



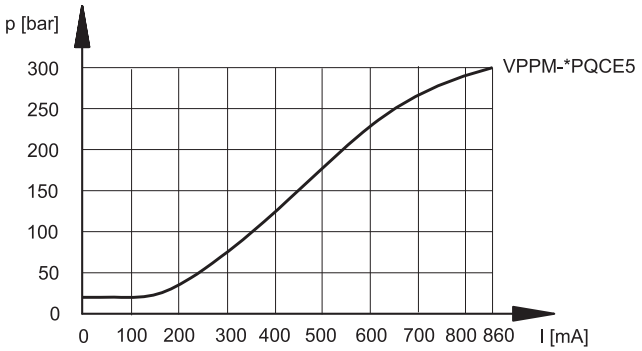
Flow variation between minimum and maximum pressure with pump set at max displacement

pump size	ΔQ max [l/min]
046	1.7
073	2.5
087	2.5

CURRENT / FLOW CURVE

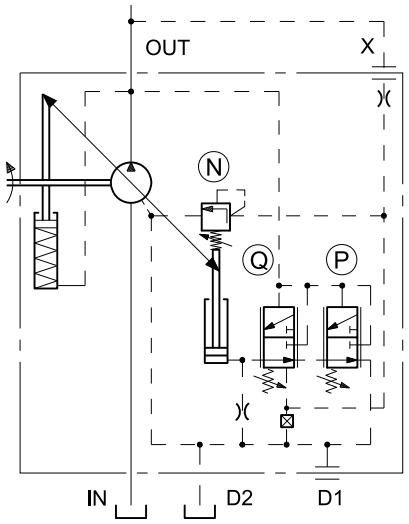


CURRENT / PRESSURE CURVE



13 - POWER REGULATOR: PQNC

FUNCTIONAL DIAGRAM



Such regulator keeps the pump torque at a constant level by changing the displacement according to the delivery pressure, so that the ratio p x (Q) (absorbed power) remains unchanged. The functions limiting the (P) maximum pressure and regulating the (Q) flow rate are always present, if a restrictor has been installed on the user line.

In the 1/8" BSP coupling supplied for the X port, there is a restrictor of Ø0,8 orifice.

Note: The connection pipe between the X port and the pump outlet must always be made (customer charge).

PQNC FEATURES:

- pressure regulating range (P) = 20 ÷ 350
- default setting (P) = 280 bar

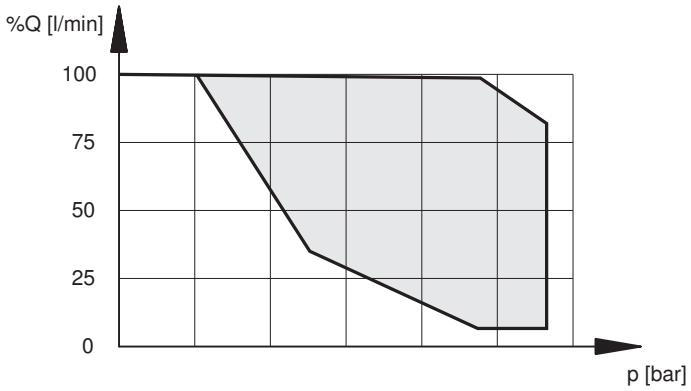
- differential pressure regulating range (Q) = 10 ÷ 30 bar
- default setting = 16 bar

- min. discharge head = 18 ± 2 bar
  (with a zero flow rate, X discharge pilot and with a default Q setting of the differential regulator)
- the power regulator is factory set. The setting value has to be specified with the order, by stating into the identification code the Nm torque value (see paragraph 1).
- Start of the regulation: looking at values table of paragraph 1.5

13.1 - Characteristic curves of the PQNC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

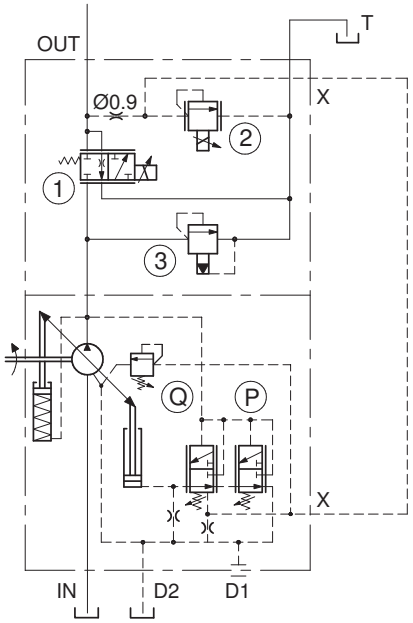
The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

FLOW RATE / PRESSURE CURVE



14 - POWER REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL: PQNCE5

FUNCTIONAL DIAGRAM



This system combines all the functions of the constant power control as a standard PQNC5 regulator, and moreover it allows the independent proportional regulation of the pump flow and pressure at values behind the power curve characteristic set on the regulator (N).

PQNCE5 FEATURES

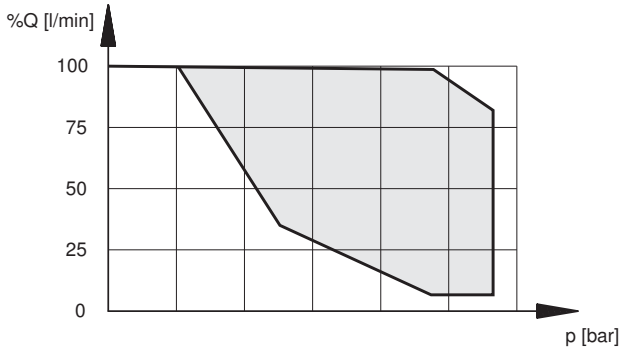
For technical characteristics and settings of regulator, see paragraph 13.

14.1 - Characteristic curves of the PQNCE5 regulator

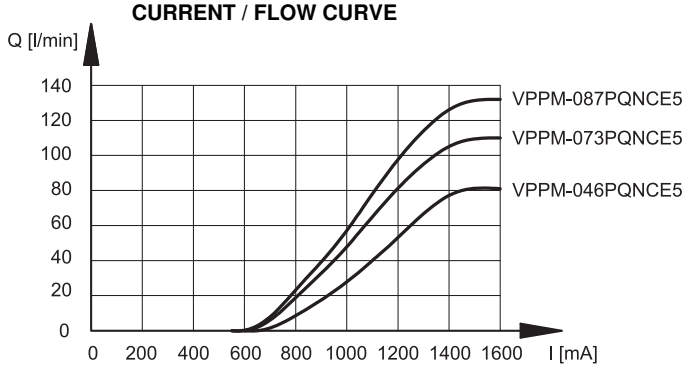
(values obtained with mineral oil with viscosity of 36 cSt at 50°C with driver EDM-M3312)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

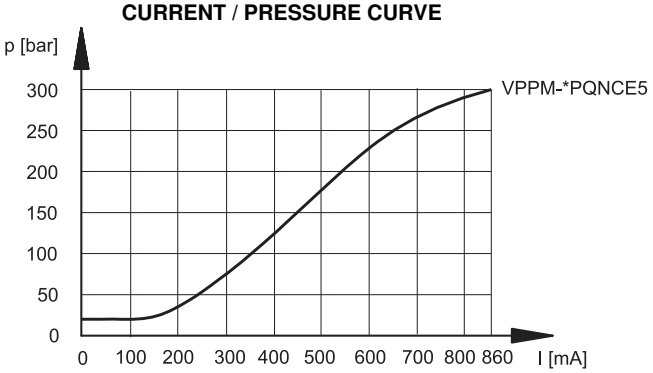
FLOW RATE / PRESSURE CURVE



CURRENT / FLOW CURVE

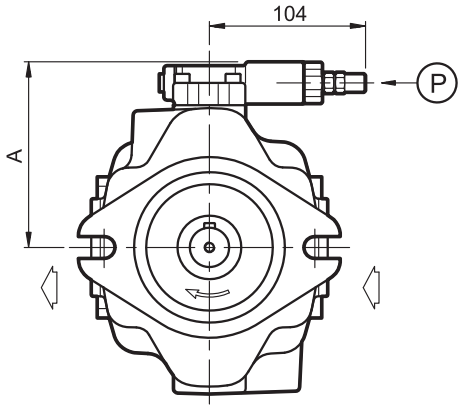


CURRENT / PRESSURE CURVE



15 - REGULATOR OVERALL DIMENSIONS

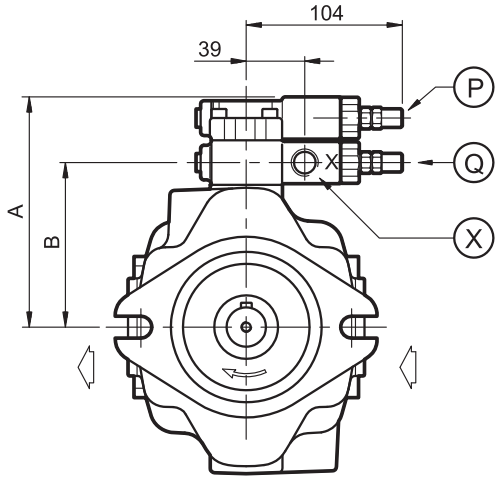
dimensions in mm



PRESSURE REGULATOR PC

pump size	A [mm]
029	114
046	123
073 / **087**	136

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13

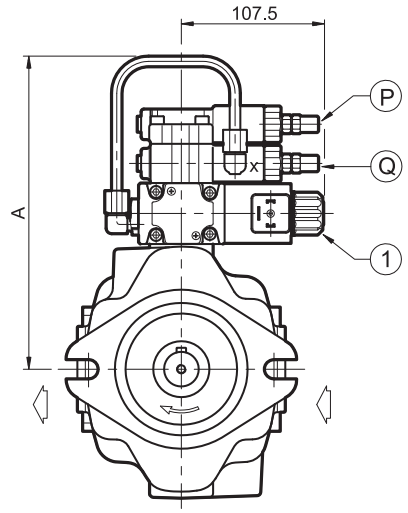


REMOTE-CONTROLLED PRESSURE REGULATOR PCR

pump size	A [mm]	B [mm]
029	144	100
046	153	109
073 / **087**	165	122

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilot port for remote control X: 1/8” BSP

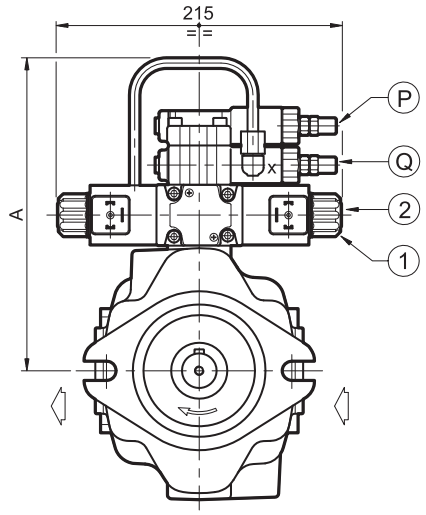
dimensions in mm



PCX REGULATOR WITH ELECTRICAL UNLOADING

pump size	A [mm]
029	244
046	253
073 / **087**	265

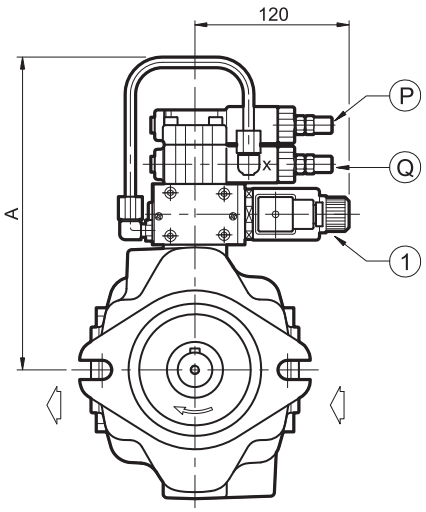
P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Solenoid switching valve type DS3-SA2



PCX REGULATOR WITH TWO PRESSURE SETTINGS + UNLOADING

pump size	A [mm]
029	244
046	253
073 / **087**	265

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Solenoid switching valve type DS3-S2
2	Relief valve for the intermediate pressure setting MCI*-SBT

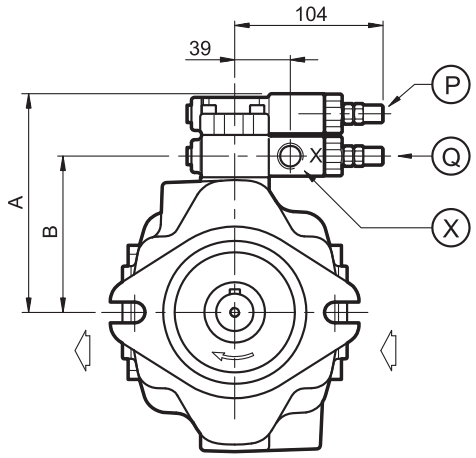


PCX REGULATOR FOR PRESSURE REGULATION WITH ELECTRIC PROPORTIONAL CONTROL

pump size	A [mm]
029	244
046	253
073 / **087**	265

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Proportional pressure relief valve PRED3 type

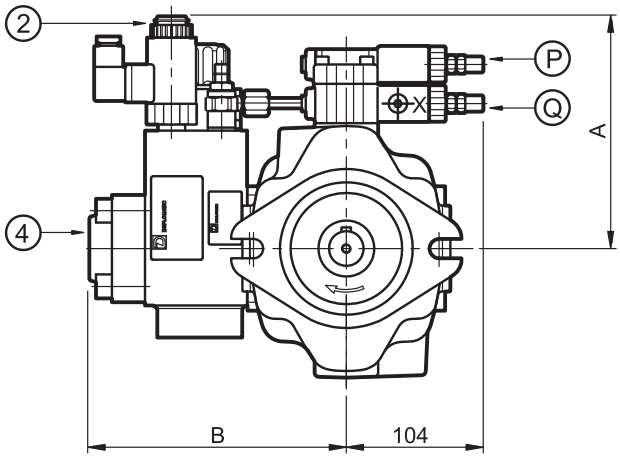
dimensions in mm



FLOW RATE AND PRESSURE REGULATOR PQC

pump size	A [mm]	B [mm]
029	144	100
046	153	109
073 / **087**	165	122

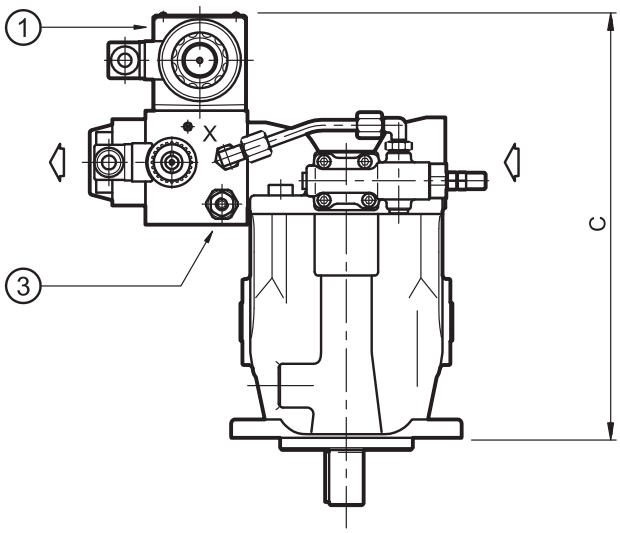
P	Pressure regulator countersunk hex adjustment screw: Spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilotage port X: 1/8” BSP (see paragraph 11)



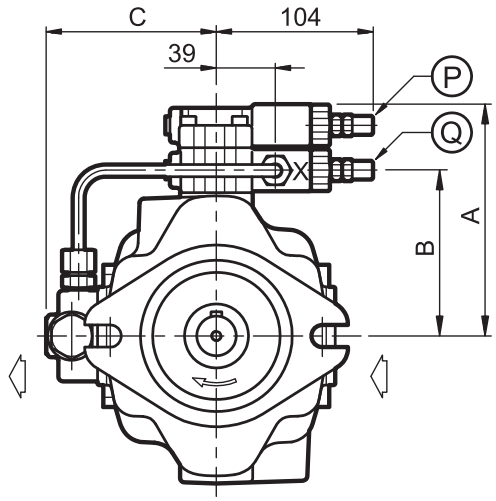
PQCE REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL

pump size	A [mm]	B [mm]	C [mm]
046	175	194	337
073 / **087**	181	207	345

P	Pressure regulator countersunk hex adjustment screw: Spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Proportional flow control valve type: DSE5-P070B - DSE5-P110SB
2	Proportional pressure valve type: CRE-250
3	Safety pressure relief valve
4	Delivery port SAE 6000 flange 1” for VPPM-046 - 1 ¼” for VPPM-073 and -087



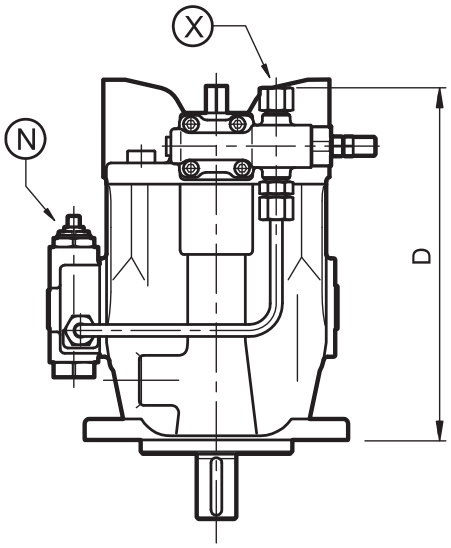
dimensions in mm



POWER REGULATOR PQNC

pump size	A [mm]	B [mm]	C [mm]	D [mm]
029	144	100	104	211
046	153	109	111	235
073 / **087**	165	122	120	258

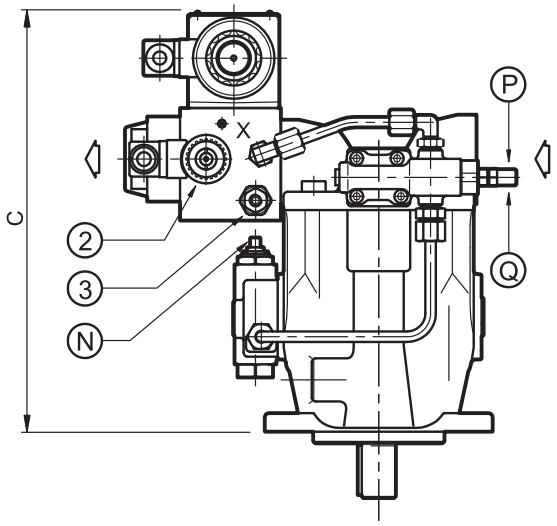
P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilotage port X: 1/8" BSP (restrictor with Ø0,8 orifice included - see paragraph 13)
N	Power regulator

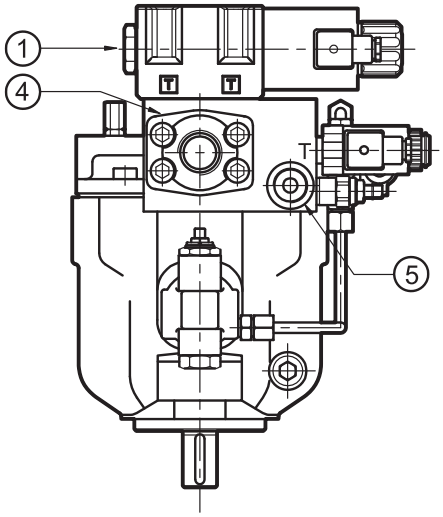


POWER REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL PQNCE5

(for dimensions see PQCE5 page 22)

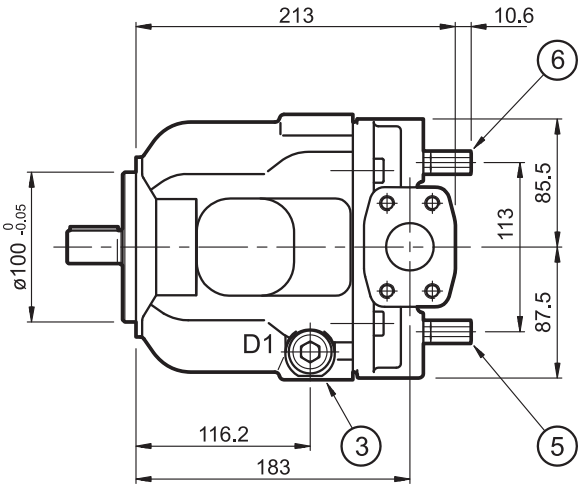
P	Pressure regulator countersunk hex adjustment screw: spanner 4. Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
N	Power regulator
1	Proportional flow control valve type: DSE5-P070SB - DSE5-P110SB
2	Proportional pressure control valve type: CRE-250
3	Safety pressure relief valve
4	Delivery port SAE 6000 flange: 1" for VPPM-046 - 1 ¼" for VPPM-073 and -087
5	Outlet port T: 3/4" BSP

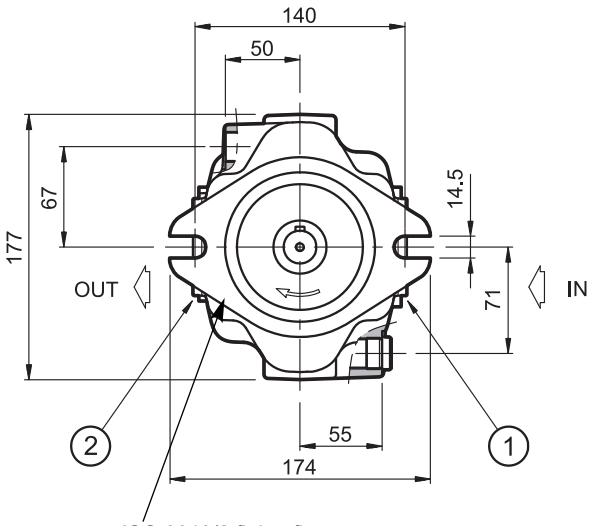




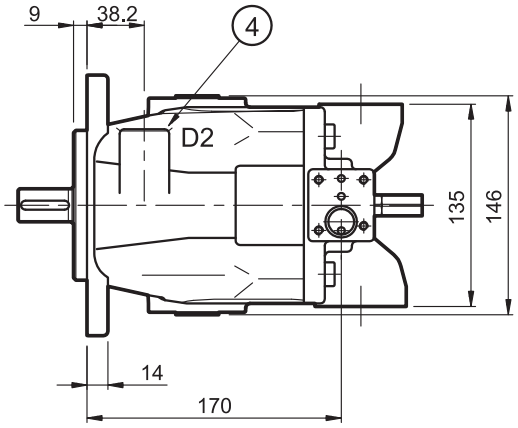
16 - VPPM-029 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



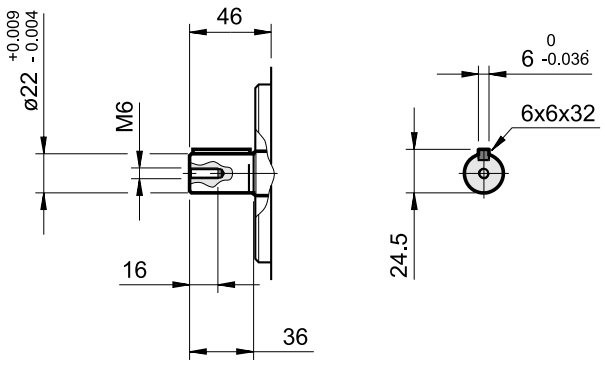


ISO 3019/2 fitting flange
(standard, identification code **5**)



1	Suction port: IN flange SAE 3000 1¼" (for overall dimensions see paragraph 24)
2	Delivery port: OUT flange SAE 6000 3/4" (for overall dimensions see paragraph 24)
3	Additional port drainage D1: 1/2" BSP (closed)
4	Drainage port D2: 1/2" BSP
5	Minimum displacement limit control (**NOTE**) - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - displacement regulation range: 0 ÷ 50 % max. displacement
6	Maximum displacement limit control - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - torque: 10 Nm - displacement regulation range: 100 ÷ 70% max. displacement Δ displacement / screw round = 1,5 cm^3

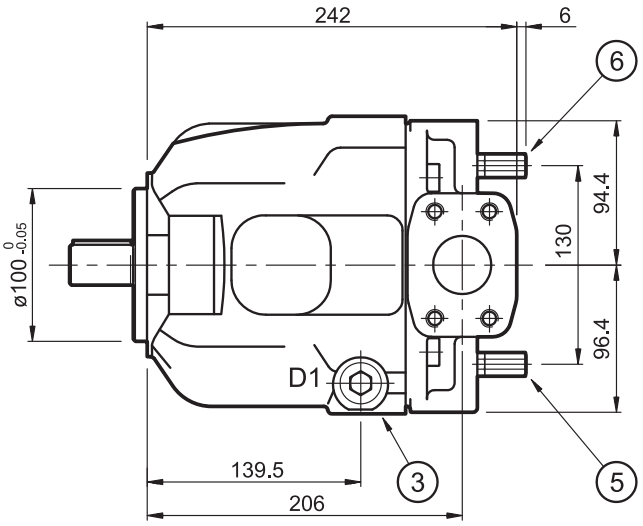
Cylindrical shaft end with ISO 3019/2 key
(standard, identification code **5**)

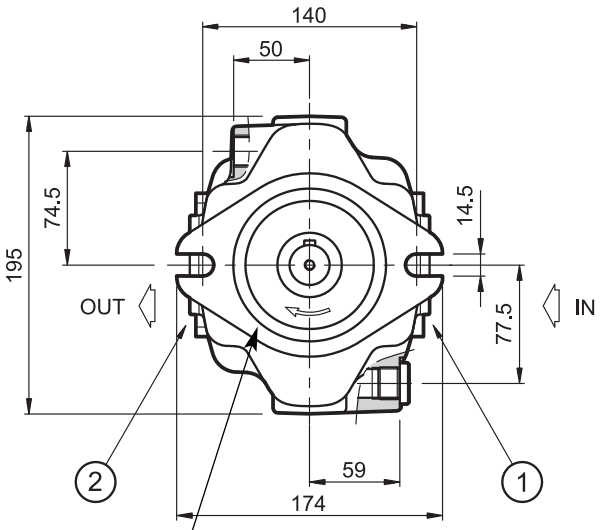


NOTE: The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.
Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

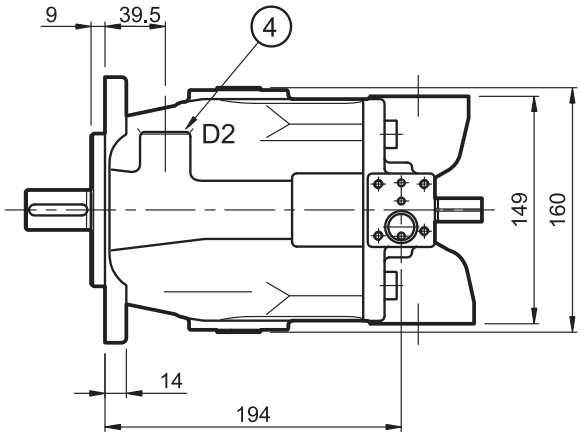
17 - VPPM-046 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



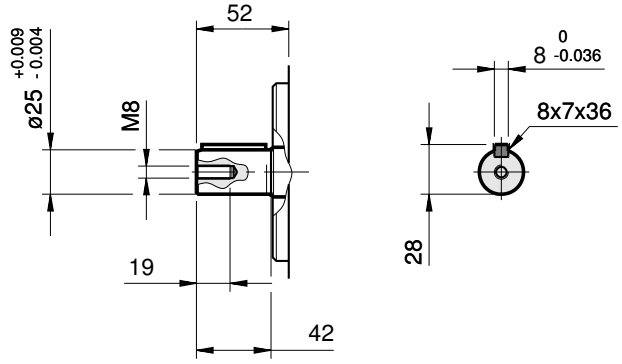


ISO 3019/2 fitting flange
(standard, identification code **5**)



1	Suction port: IN flange SAE 3000 1½” (for overall dimensions see paragraph 24)
2	Delivery port: OUT flange SAE 6000 1” (for overall dimensions see paragraph 24)
3	Additional port drainage D1: 1/2” BSP (closed)
4	Drainage port D2: 1/2” BSP
5	Minimum displacement limit control (**NOTE**) - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - displacement regulation range: 0 ÷ 50 % max. displacement
6	Maximum displacement limit control - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - torque: 10 Nm - displacement regulation range: 100 ÷ 70% max. displacement Δ displacement / screw round = 2,2 cm^3

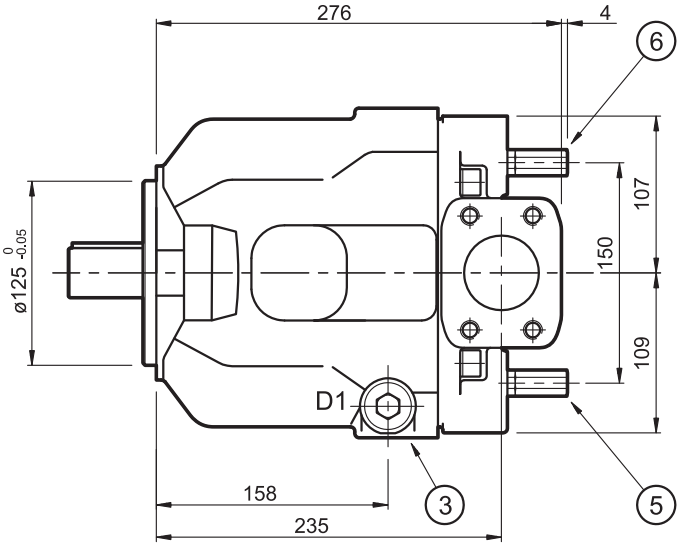
Cylindrical shaft end with ISO 3019/2 key
(standard, identification code **5**)

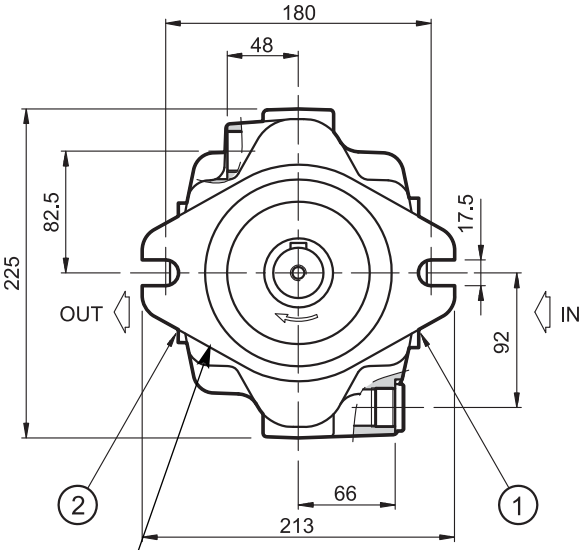


NOTE: The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.
Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

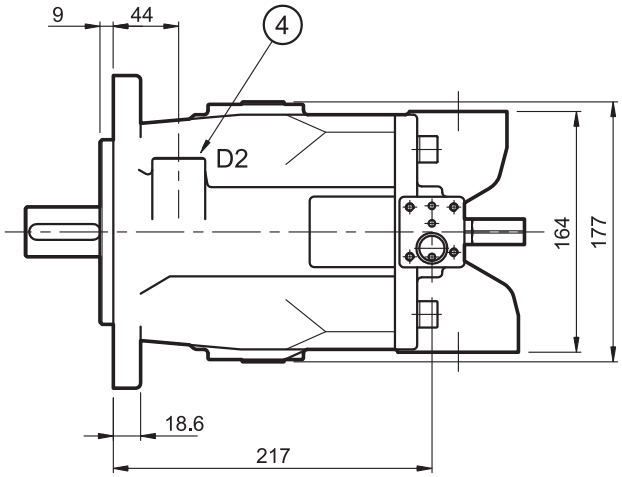
18 - VPPM-073 AND VPPM-087 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

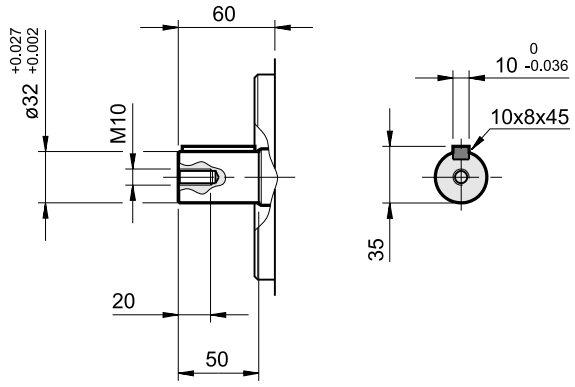




ISO 3019/2 fitting flange
(standard, identification code **5**)



Cylindrical shaft end with ISO 3019/2 key
(standard, identification code **5**)

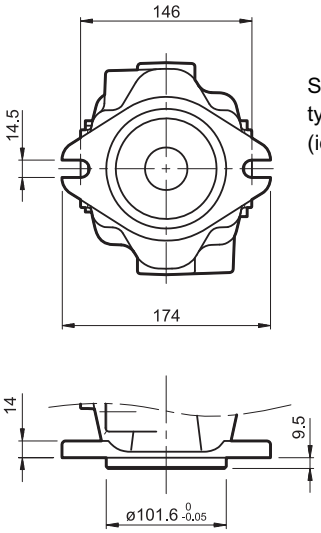


1	Suction port: IN flange SAE 3000 2” (for overall dimensions see paragraph 24)
2	Delivery port: OUT flange SAE 6000 1 ¼” (for overall dimensions see paragraph 24)
3	Additional port drainage D1: 1/2” BSP (closed)
4	Drainage port D2: 1/2” BSP
5	Minimum displacement limit control (**NOTE**) - Locknut: spanner 17 - countersunk hex adjustment screw: spanner 5 - displacement regulation range: 0 ÷ 50 % max. displacement
6	Maximum displacement limit control - Locknut: spanner 17 - countersunk hex adjustment screw: spanner 5 - torque: 10 Nm - displacement regulation range: 100 ÷ 50% max. displacement Δ displacement / screw round = 3,9 cm^3

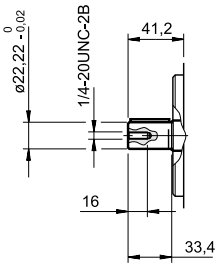
NOTE: The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.
Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

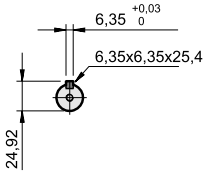
19 - OVERALL DIMENSIONS FOR FLANGES AND SHAFTS TYPE SAE J744

VPPM-029



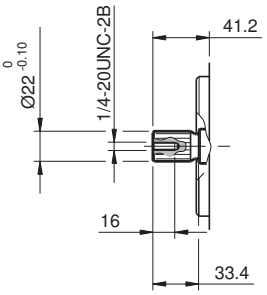
SAE J744 - 2-hole fitting flange
type “B”
(identification code: **0**)





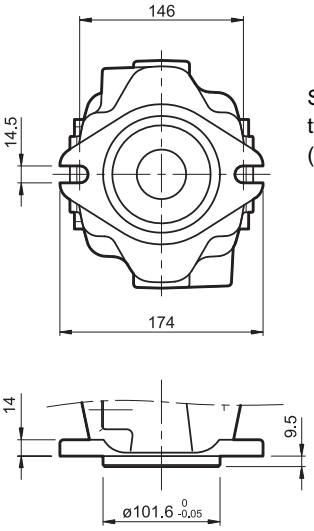
cylindrical with key shaft end
SAE J744
(identification code: **0**)

SAE J744 splined shaft end
16/32 d.p. - 13T
(identification code: **1**)

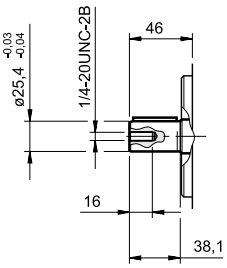


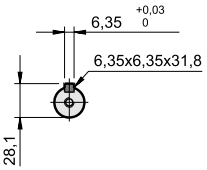
dimensions in mm

VPPM-046



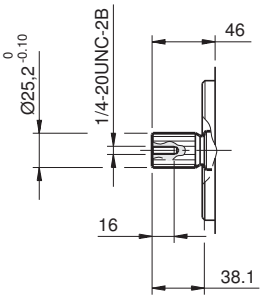
SAE J744 - 2-hole fitting flange
type “B”
(identification code: **0**)





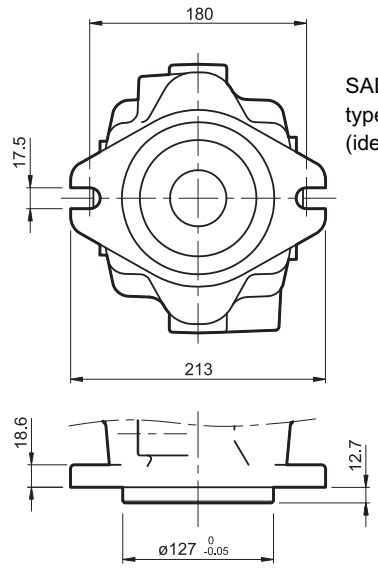
cylindrical with key shaft end
SAE J744
(identification code: **0**)

SAE J744 splined shaft end
16/32 d.p. - 15T
(identification code: **1**)

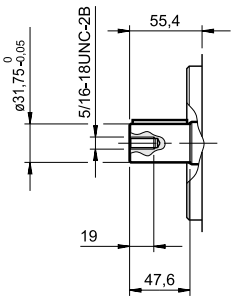


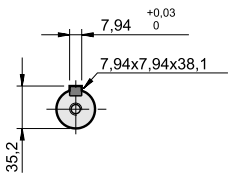
dimensions in mm

VPPM-073
VPPM-087



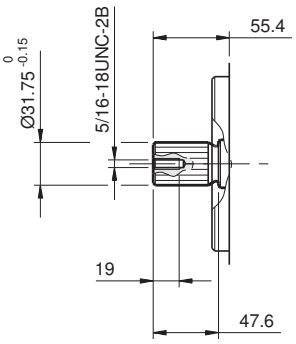
SAE J744 - 2-hole fitting flange
type “C”
(identification code: **0**)





cylindrical with key shaft end
SAE J744
(identification code: **0**)

SAE J744 splined shaft end
12/24 d.p. - 14T
(identification code: **1**)



dimensions in mm

20 - INSTALLATION

- The VPPM pumps can be installed both in a horizontal and vertical position, with the shaft in an upward position.

  N.B.: The drainage port has to be oriented so that the oil level inside the pump body is never lower than 3/4 of its volume (according to the installation use the D1 or D2 drainage ports).

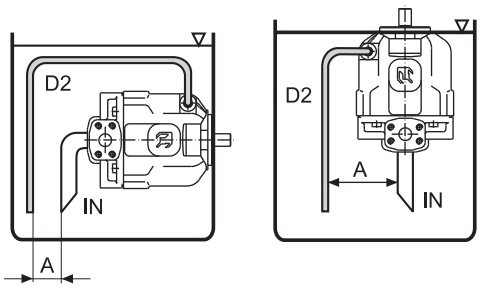
- Installation below the oil reservoir is suggested. As for an installation above the oil level, check that the min. suction pressure is not lower than -0.2 bars (relative). If a low noise emission level is required, the installation inside the tank is suggested.

  In case of an installation inside the tank, with an oil level which does not grant complete pump submersion, it is suggested that the drain tube is adjusted so that the pump higher bearing can be always lubricated.

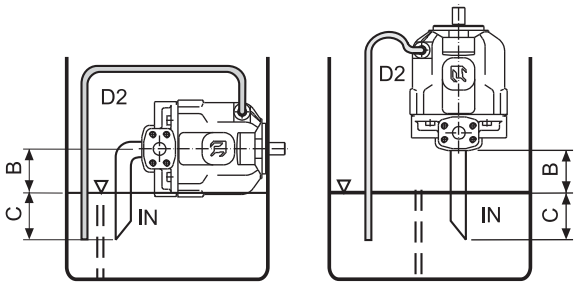
- **Before starting, the pump body has to be filled with the fluid.**
- It is necessary to vent the air from the delivery connection before operating it the first time. The pump start up, especially at a cold temperature, should occur with the plant at minimum pressure.
- The suction tube has to be suitably sized so that the suction pressure is never lower than -0.2 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.
- The drainage tube has to be sized so that the pressure inside the pump body is always lower than 2 bar (absolute), even during the dynamic change and flow rate phases. The drainage tube has to unload inside the tank far from the suction area. We suggest to interpose a screen between the two lines.
- The drain pressure can be max 0.5 bar higher than the suction pressure but it can never exceed the max of 2 bar of absolute pressure.
- No check valves allowed on the suction line.
- The motor-pump connection must be carried out directly with a flexible coupling. Radial and axial loads have to be lower than the values specified in the table at paragraph 3.
- As for details and the installation of filter elements, see par. 2.3.

MOUNTING INSIDE THE TANK

Minimum level of oil in the tank at or above the surface of the pump flange
A ≥ 200 mm

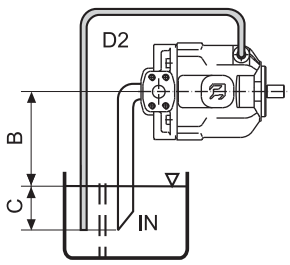


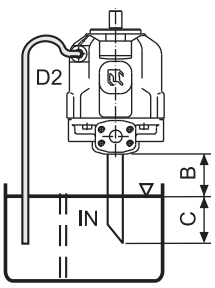
Minimum level of oil in the tank below the surface of the pump flange
Minimum inlet pressure = -0,2 bar (relative)
B ≤ 800 mm C = 200 mm



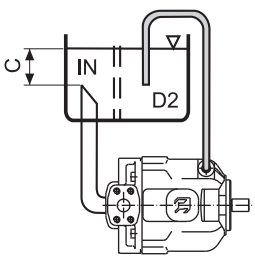
MOUNTING OUTSIDE THE TANK

Minimum inlet pressure = -0,2 bar (relative)
B ≤ 800 mm C = 200 mm





C = 200 mm



21 - THROUGH OUTPUT SHAFT

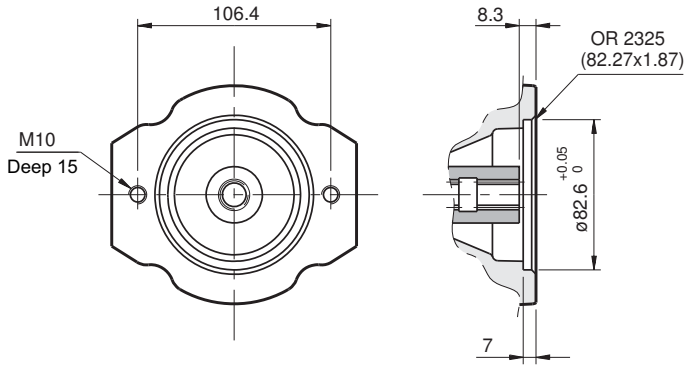
The VPPM pumps can be supplied with a through output shaft, which allows coupling with other pump models.

N.B.: The pumps with a through output shaft are supplied with an intermediate 2-hole flange type SAE J744 - and with a mating joint for splined shaft type SAE J744.

The mechanical adjustment for the min and max displacement are not available on these front or intermediate pumps: VPPM-029 with flange 62S, VPPM-073 with flange 64S, VPPM-087 with flange 64S.

As for identification see par. 1 “Identification code”. For the pump overall dimensions (intermediate flange included) see paragraph 23 “overall dimensions for multiple pumps”.

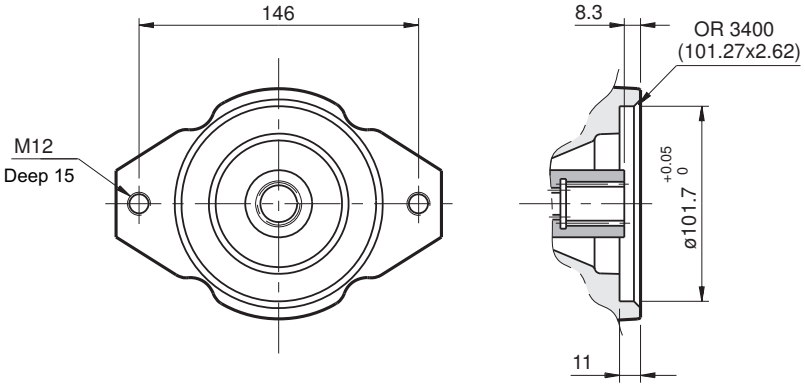
FLANGE + JOINT FOR THE COUPLING OF A GEAR PUMP GROUP 2
identification code **12S**



SAE J744 - 2-hole intermediate flange
type “A”

mating joint for a SAE J744 splined shaft
16/32 D.P. - 9T

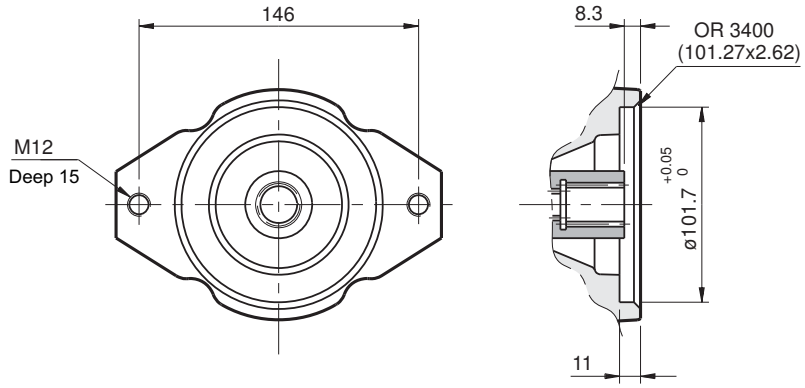
FLANGE + JOINT FOR THE COUPLING OF A PUMP TYPE VPPM-029
OR OF A GEAR PUMP GROUP 3
identification code **62S**



SAE J744 - 2-holes intermediate flange type “B”

mating joint for a SAE J744 splined shaft
16/32 D.P. - 13T

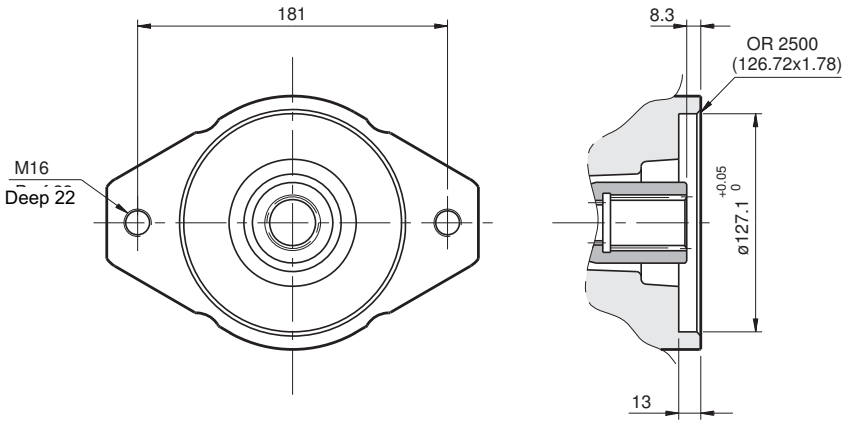
FLANGE + JOINT FOR THE COUPLING OF A PUMP TYPE VPPM-046
identification code **63S**



SAE J744 - 2-holes intermediate flange type“B”

mating joint for a SAE J744 splined shaft
16/32 D.P. - 15T

FLANGE + JOINT FOR THE COUPLING OF A PUMP TYPE VPPM-073
identification code **64S**



SAE J744 - 2-holes intermediate flange type “C”

mating joint for a SAE J744 splined shaft 12/24 D.P. - 14T

22 - MULTIPLE PUMPS

The possibility to couple several pumps makes it possible to create multi-flow groups with independent hydraulic circuits. While sizing coupled pumps, it’s necessary to make reference to the following conditions:

- The coupling can be carried out between pumps with the same dimensions or to a size of decreasing order.
- The max. rotation speed is determined by the pump with the lowest speed.
- The values of the max. applicable torque can not be exceeded.

22.1 - Max. applicable torque

The input torque (M) for each pump is given by the following ratio:

$$M = \frac{9550 \cdot N}{n} = [Nm]$$

where the absorbed power (N) is given by:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta_{tot}} = [kW]$$

n = rotation speed [rpm]

Q = flow rate [l/min]
Δp = differential pressure between the pump suction and delivery [bar]
η_{tot} = total efficiency (obtainable from the diagrams in par. 4-5-6)

or it can be obtained from the diagrams ABSORBED POWER (see par. 4 - 5 - 6 -7).

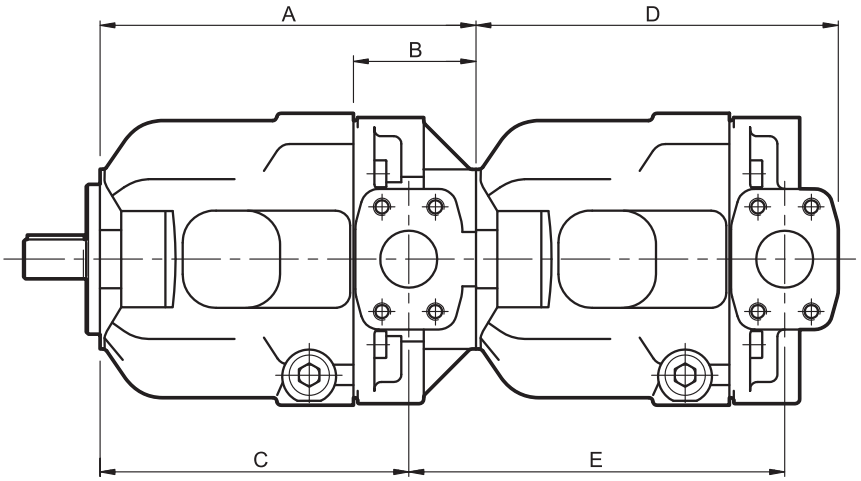
If several pumps are coupled, the torque of each single pump has to be added to the torque of subsequent pumps when they are loaded simultaneously.
The obtained torque value for each pump has to be lower than the value specified in the table below :

pump with a through output shaft	MAXIMUM TORQUE APPLICABLE AT THE FRONT PUMP SHAFT [Nm]			MAXIMUM TORQUE APPLICABLE AT THE PUMP TO BE COUPLED [Nm] (not simultaneously to the front pump)					
	cylindrical ISO 3019/2 (cod. 5)	cylindrical SAE J744 (cod. 0)	splined SAE J744 (cod. 1)	GP2 external gear	GP3 external gear	VPPM-029	VPPM-046	VPPM-073	VPPM-087
VPPM-029	170	200	190	100	135	135	-	-	-
VPPM-046	220	230	330	135	250	250	250	-	-
VPPM-073	450	490	620	135	330	330	400	440	-
VPPM-087	450	490	620	135	330	330	400	440	440

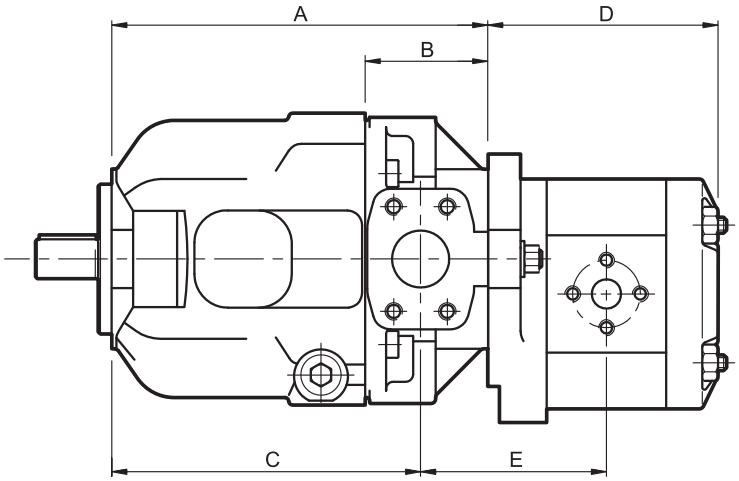
The maximum transmissible torque for those pumps with a through output shaft is determined by the coupling used for the transmission. If the obtained torque values are higher than the ones stated in the table, it is necessary to reduce the working pressure value or to replace the overloaded pump with a pump suitable to bear the required torque.

23 - OVERALL DIMENSIONS FOR MULTIPLE PUMPS

dimensions in mm



	REAR PUMP														
	VPPM-029					VPPM-046					VPPM-073 / 087				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
VPPM-029	222	77	183	213	222	-	-	-	-	-	-	-	-	-	-
VPPM-046	251	82	206	213	220	251	82	206	242	251	-	-	-	-	-
VPPM-073 VPPM-087	291	99	235	213	226	291	99	235	242	249	296	104	235	276	296



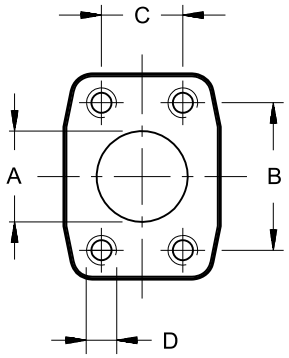
	REAR PUMP									
	external gear GP2					external gear GP3				
	A	B	C	D	E	A	B	C	D	E
VPPM-029	222	77	183	99 ÷121	86 ÷ 97	-	-	-	-	-
VPPM-046	251	82	206	99 ÷121	85 ÷ 96	251	82	206	132 ÷ 147	103 ÷ 110
VPPM-073 VPPM-087	291	99	235	99 ÷121	91 ÷ 102	291	99	235	132 ÷ 147	109 ÷ 116

NOTE: The D and E values in the table make reference to the dimensions of the gear pumps according to the available min. and max. displacement range. For further details apply to our Technical department.

24 - SUCTION AND DELIVERY PORTS DIMENSIONS FOR SAE FLANGES

SUCTION PORT: "IN" (SAE 3000)						
Pump	**nominal size**	**A** mm	**B** mm	**C** mm	**D** threading and depth (mm) METRIC	UNC
VPPM 029	1 ¼"	32	58,7	30,2	M 10x28	7/16 -14 UNC-2B 28
VPPM 046	1 ½"	38,1	70	35,7	M12x26	½ -13 UNC-2B 26
VPPM 073 VPPM 087	2"	50,8	77,8	43	M12x25	½ -13 UNC-2B 25

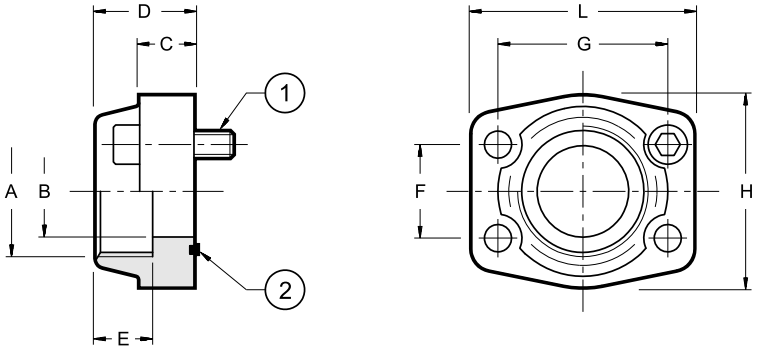
DELIVERY PORT "OUT" (SAE 6000)						
Pump	**nominal size**	**A** mm	**B** mm	**C** mm	**D** threading and depth (mm) METRIC	UNC
VPPM 029	3/4"	19	50,8	23,8	M10x24	⅜ - 16 UNC-2B 24
VPPM 046	1"	25,4	57,1	27,7	M12x20	7/16 -14 UNC-2B 20
VPPM 073 VPPM 087	1 ¼"	32	66,7	31,7	M14x23	½ - 13 UNC-2B 23



25 - CONNECTION FLANGES

dimensions in mm

The fastening bolts and the O-Rings must be ordered separately

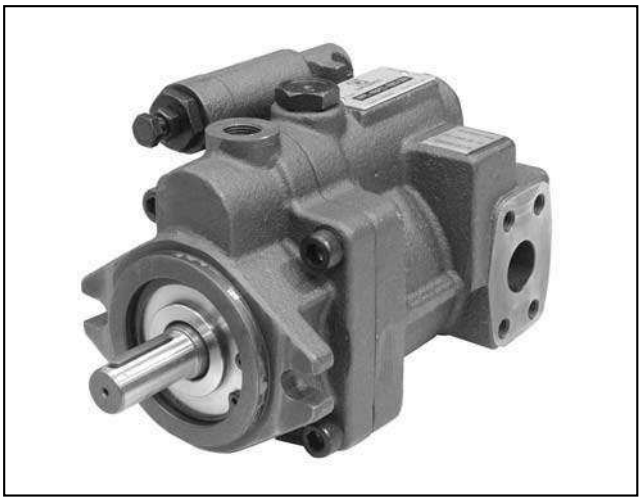


	Flange code	Flange description
SAE 3000	0610720	OR 4150 (37.69x3.53)
	0610714	OR 4187 (47.22x3.53)
	0610721	OR 4225 (56.74x3.53)
SAE 6000	0770075	OR 4100 (24.99x3.53)
	0770092	OR 4131 (32.93x3.53)
	0770106	OR 4150 (37.69x3.53)

	Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	1 metric SHCS	1 UNC SHCS
SAE 3000	0610720	SAE - 1 ¼"	280	1 ¼" BSP	32	21	41	22	30,2	58,7	68	79	n° 4 - M10x35	n° 4 - 7/16 UNC x 1 ½"
	0610714	SAE - 1 ½"	210	1 ½" BSP	38	25	45	24	35,7	70	78	94	n° 4 - M12x45	n° 4 - ½ UNC x 1 ¾"
	0610721	SAE - 2"	210	2" BSP	51	25	45	30	43	77,8	90	102	n° 4 - M12x45	n° 4 - ½ UNC x 1 ¾"
SAE 6000	0770075	SAE - 3/4"	420	3/4" BSP	19	21	35	22	23,8	50,8	55	71	n° 4 - M10x35	n° 4 - ⅜ x 1 ½"
	0770092	SAE - 1"	420	1" BSP	25	25	42	24	27,7	57,1	65	81	n° 4 - M12x45	n° 4 - 7/16 x 1 ¾"
	0770106	SAE - 1 ¼"	420	1 ¼" BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x50	n° 4 - ½ x 1 ¾"

DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

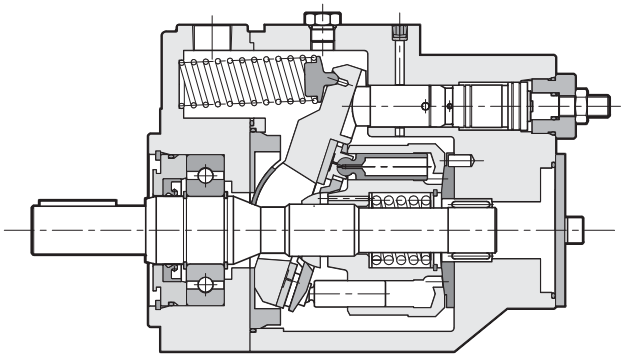


VPPL

VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS FOR INTERMEDIATE PRESSURE

SERIES 20

OPERATING PRINCIPLE



— The VPPL are variable displacement axial-piston pumps with variable swash plate, suitable for applications with open circuits and intermediate pressures.

— They are available in seven nominal sizes, with displacements of 8, 16, 22, 36, 46, 70 and 100 cm^3/rev.

— The pump flow rate is proportional to the rotation speed and to the angle of the swash plate, which can be continuously modulated. The maximum and minimum angle can be limited mechanically via suitable regulating screws.

— They are usually supplied with a SAE J744 2-hole flange and a SAE J744 cylindrical with key shaft.

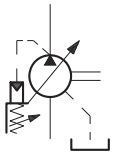
— They are available with four different types of regulating control, each according to the application needs.

TECHNICAL SPECIFICATIONS

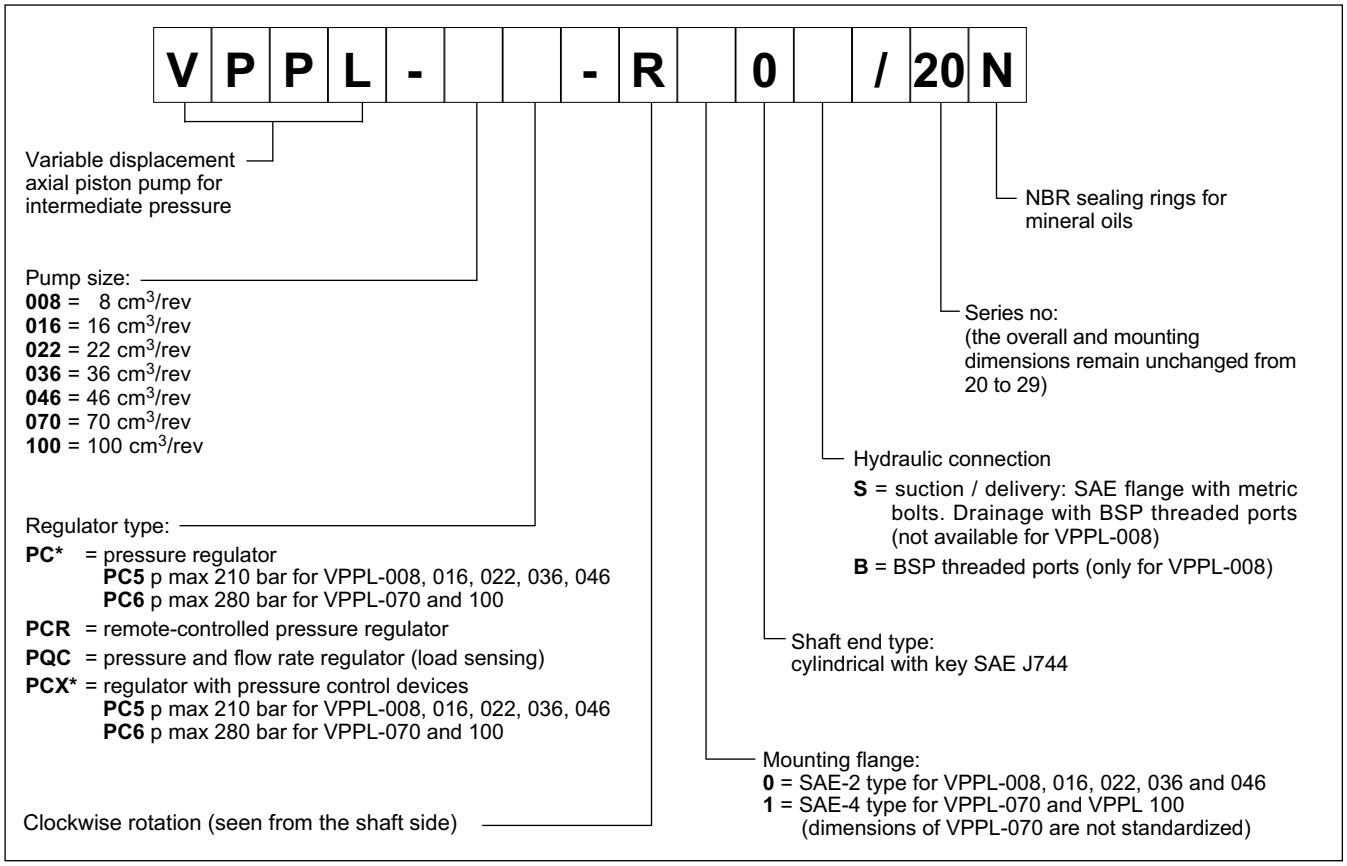
PUMP SIZE		**008**	**016**	**022**	**036**	**046**	**070**	**100**
Maximum displacement	cm^3/rev	8	16	22	36	46	70	100
Flow rate at 1500 rpm	lt/min	12	24	33	54	69	105	150
Operating pressures	bar	210					280	
Rotation speed	rpm	min 500 - max 2000					min 500 - max 1800	
Rotation direction		clockwise (seen from the shaft side)						
Hydraulic connection		SAE flange						
Type of mounting		SAE flange J744 - 2 holes						
Oil volume in the pump body	dm^3	0,2	0,3		0,6		1	1,8
Mass	kg	8	12	12	23	23	41	60

Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-10 / +70
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	20 ÷ 50

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE



2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. With these fluids use NBR seals. Using fluids at temperatures higher than 70 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 90 °C for the drainage fluid
optimum viscosity	20 / 50 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1000 cSt	limited only to the cold start-up of the pump, which has to be carried out with the plant at minimum pressure.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

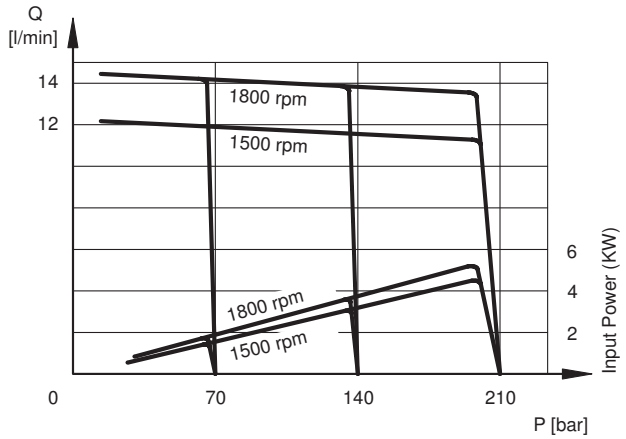
2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore the use of a delivery or return filter with $\beta_{20} \geq 75$ is suggested.
A degree of maximum fluid contamination according to ISO 4406:1999 class 20/16/13 is recommended for optimum endurance of the pump. Hence, the use of a filter with $\beta_{10} \geq 100$ is recommended.
For the installation of filters on the suction line, see paragraph 10. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator and should be oversized to avoid cavitation problems.

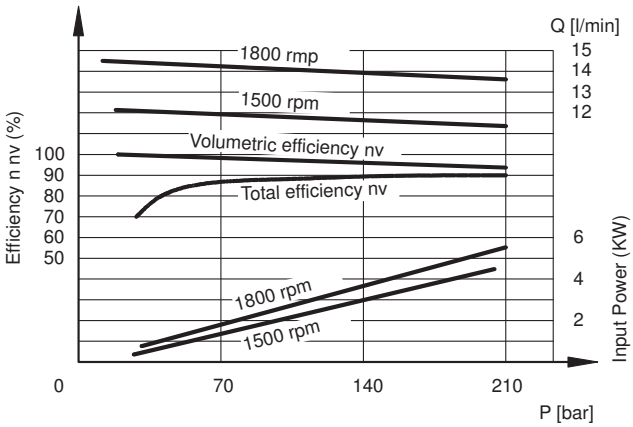
3 - CHARACTERISTIC CURVES

3.1 - VPPL-008 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

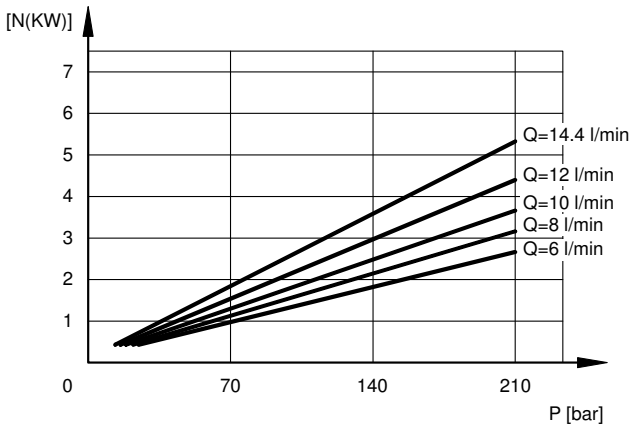
FLOW RATE / PRESSURE CURVES



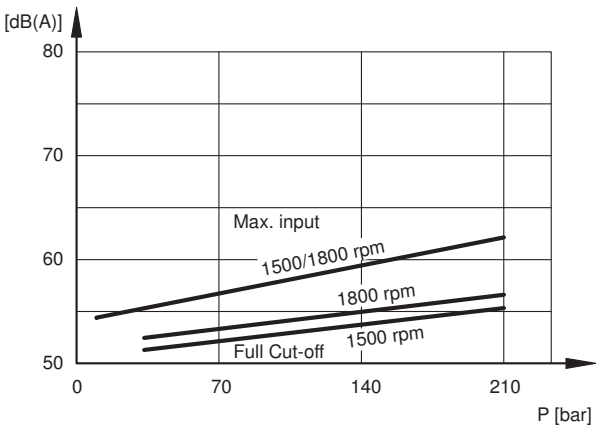
VOLUMETRIC AND TOTAL EFFICIENCY



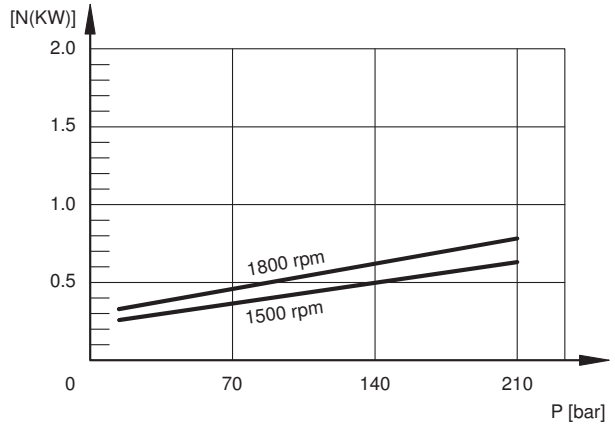
ABSORBED POWER



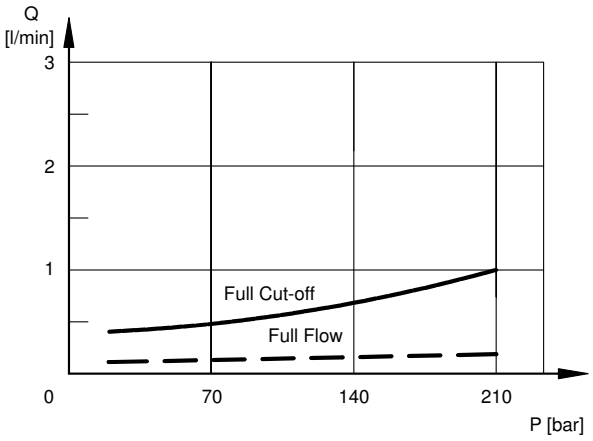
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

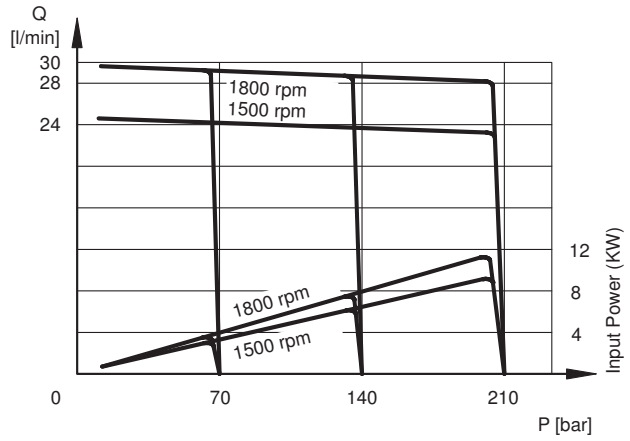


DRAIN FLOW RATE

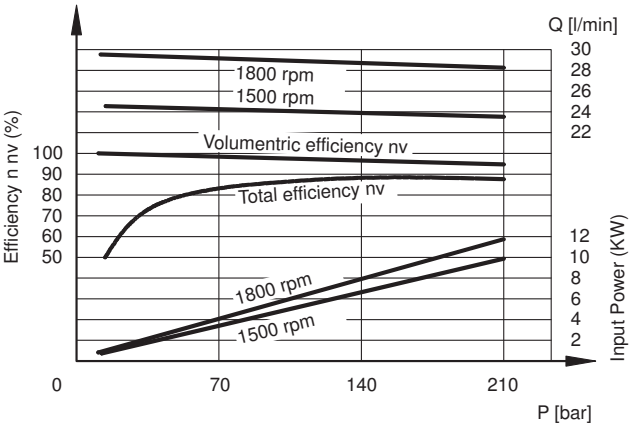


3.2 - VPPL-016 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

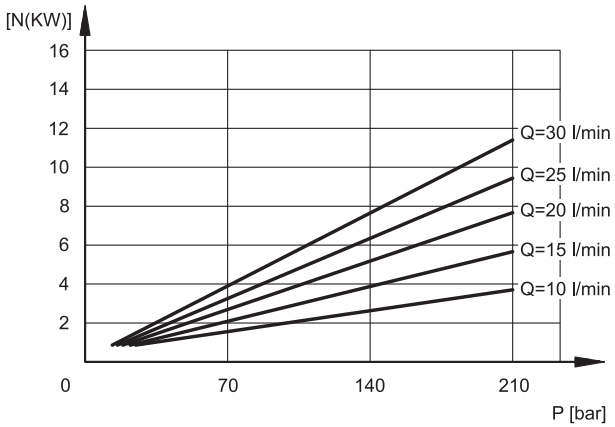
FLOW RATE / PRESSURE CURVES



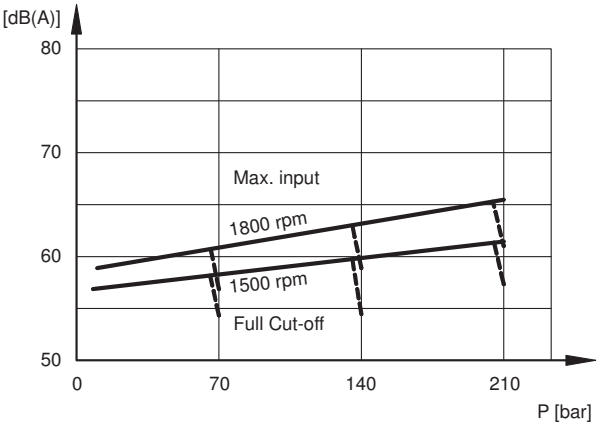
VOLUMETRIC AND TOTAL EFFICIENCY



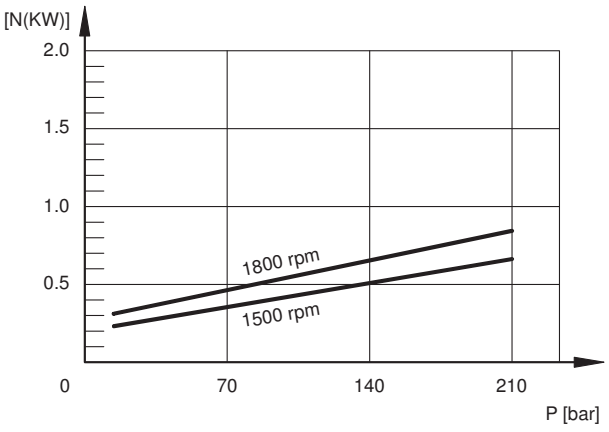
ABSORBED POWER



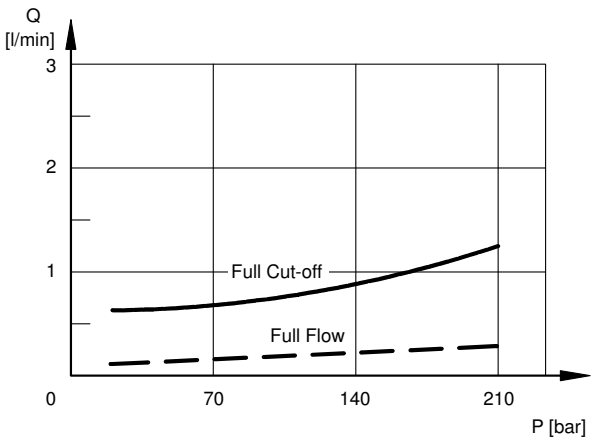
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

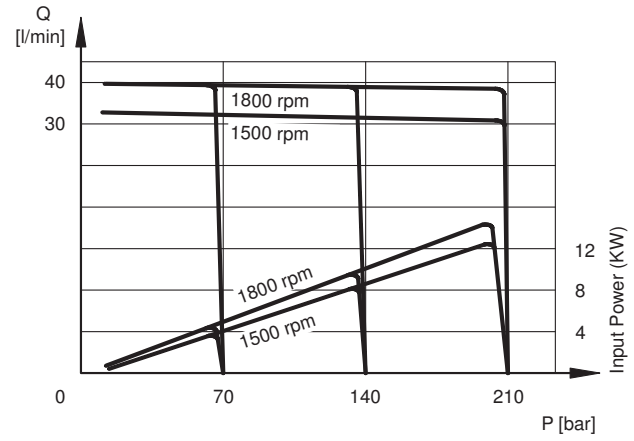


DRAIN FLOW RATE

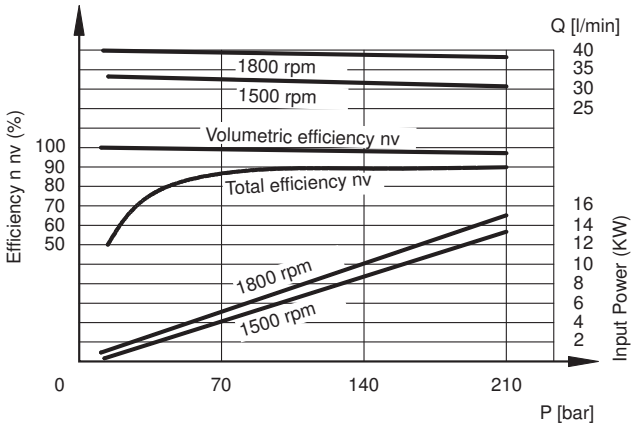


3.3 - VPPL-022 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

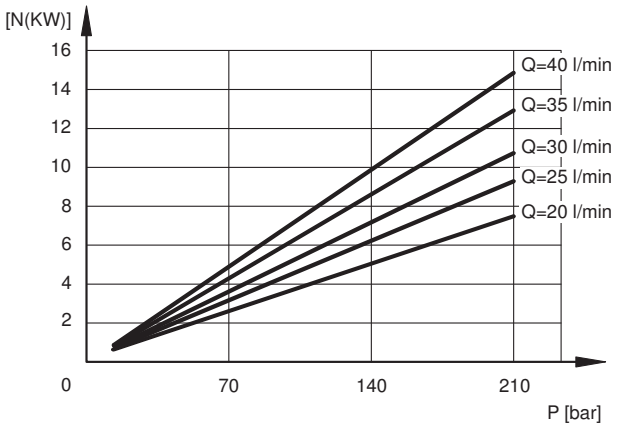
FLOW RATE / PRESSURE CURVES



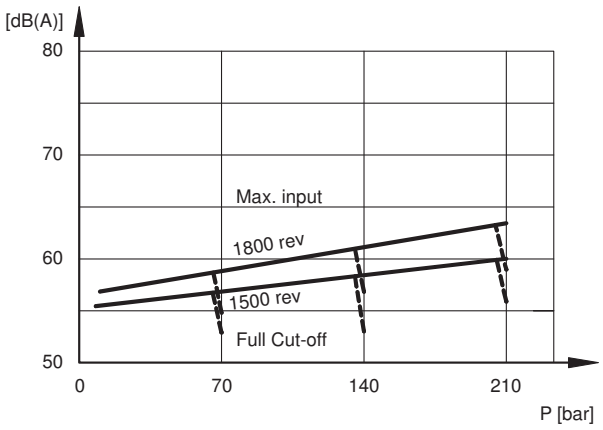
VOLUMETRIC AND TOTAL EFFICIENCY



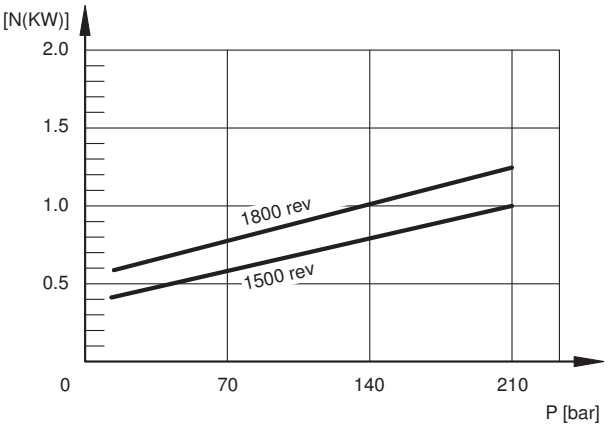
ABSORBED POWER



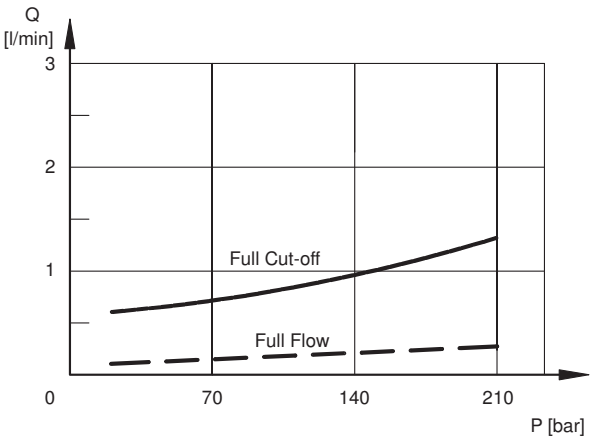
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

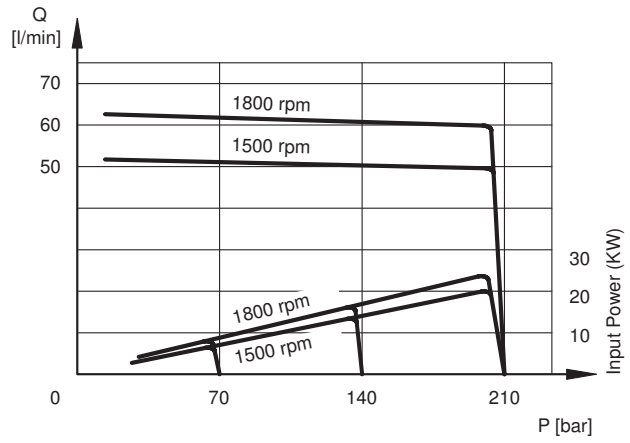


DRAIN FLOW RATE

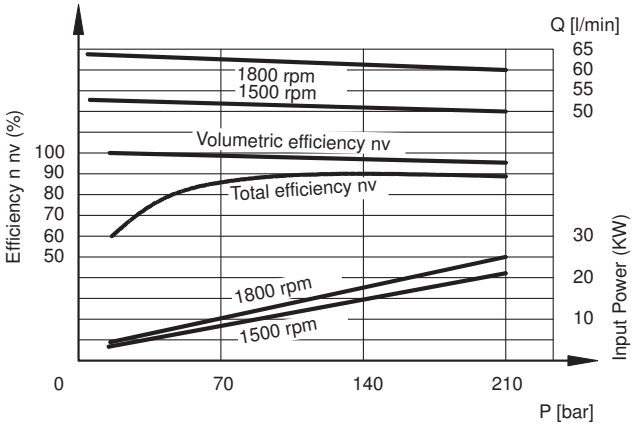


3.4 - VPPL-036 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

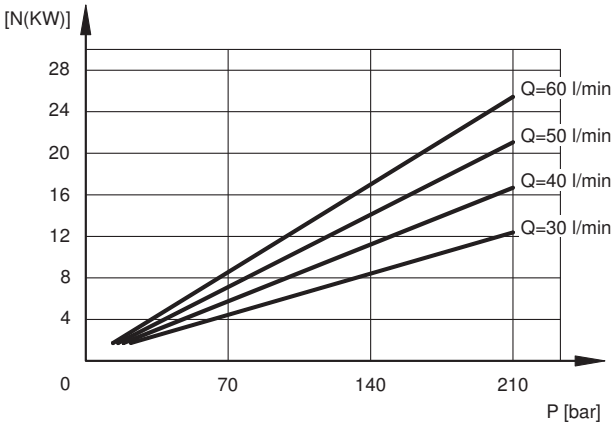
FLOW RATE / PRESSURE CURVES



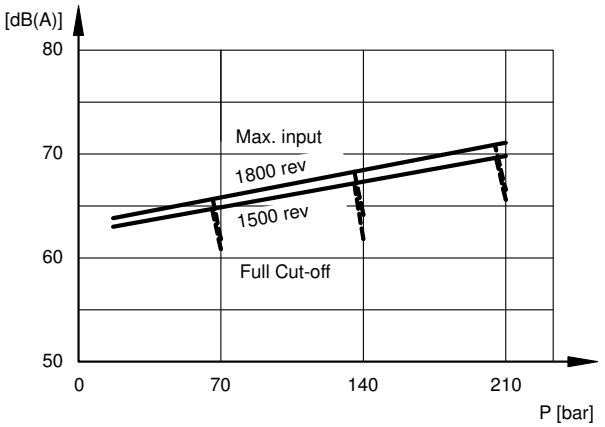
VOLUMETRIC AND TOTAL EFFICIENCY



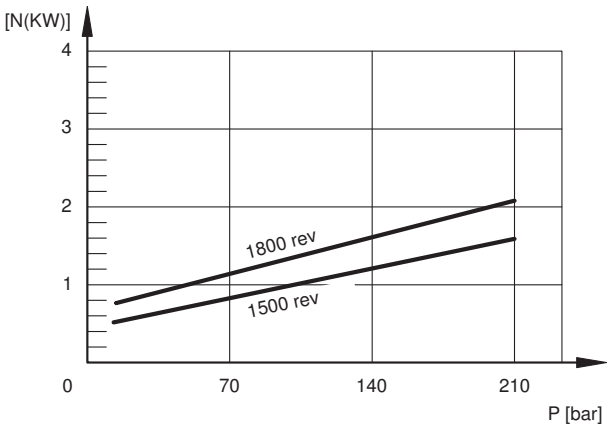
ABSORBED POWER



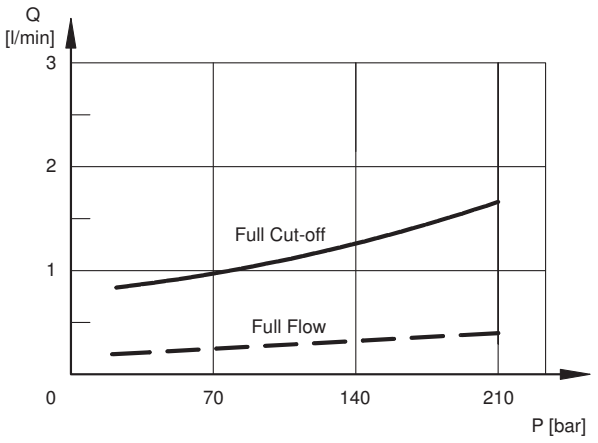
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

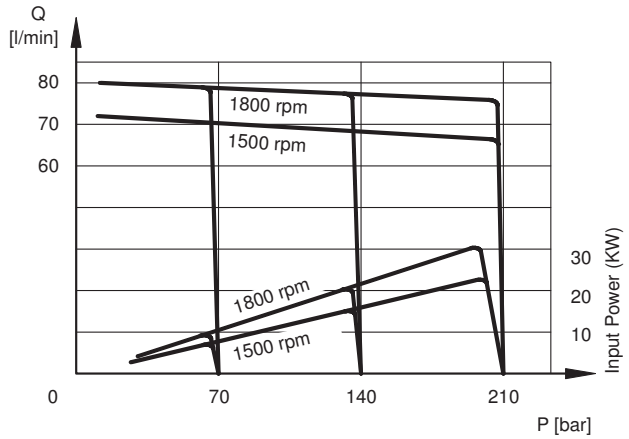


DRAIN FLOW RATE

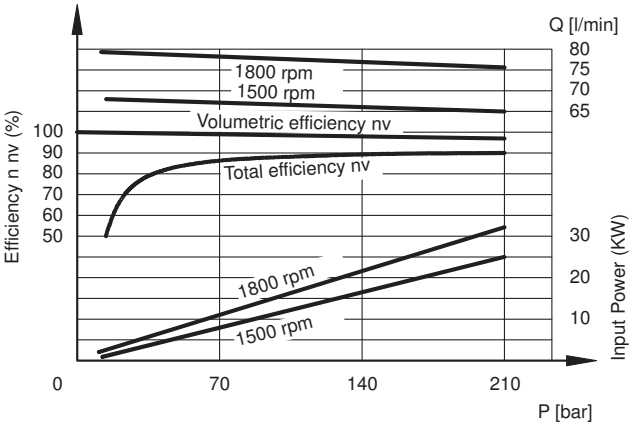


3.5 - VPPL-046 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

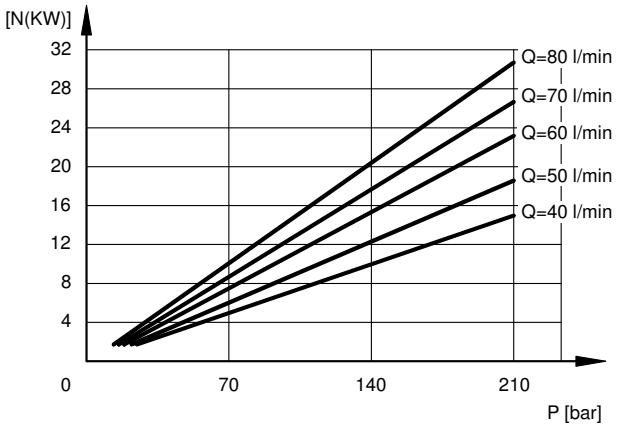
FLOW RATE / PRESSURE CURVES



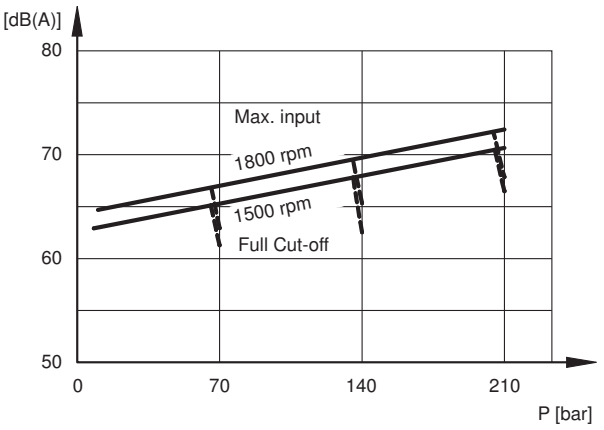
VOLUMETRIC AND TOTAL EFFICIENCY



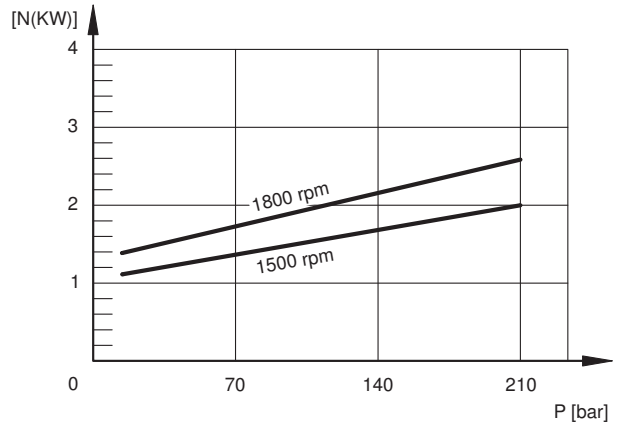
ABSORBED POWER



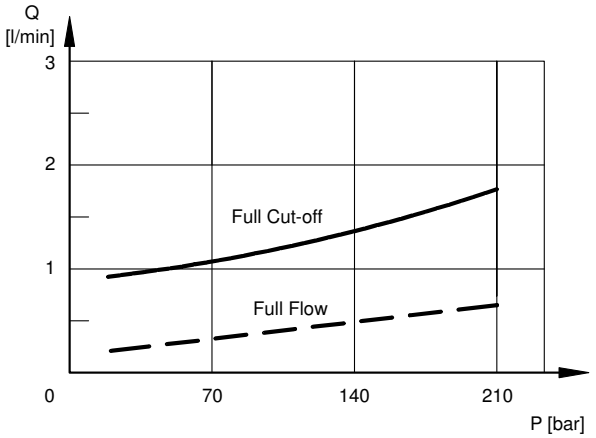
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

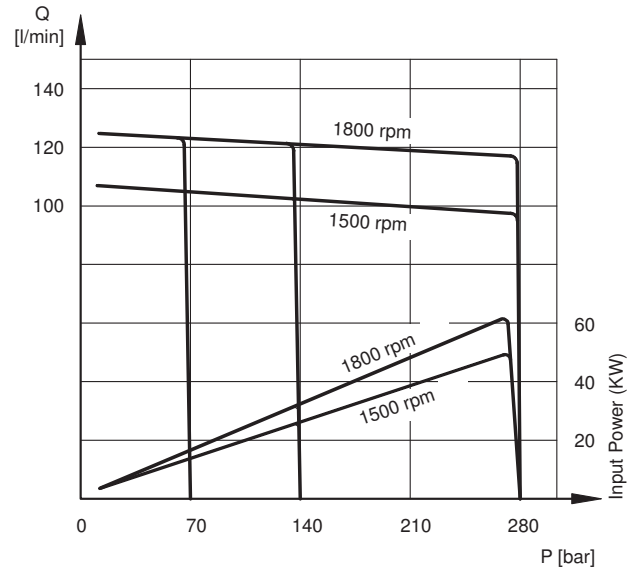


DRAIN FLOW RATE

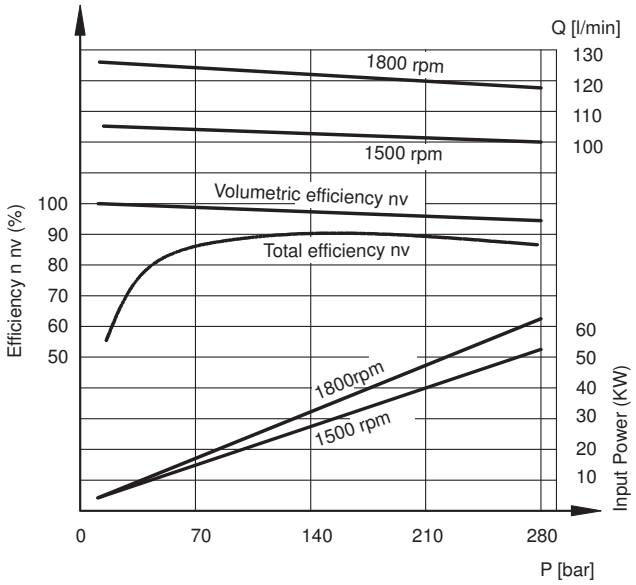


3.4 - VPPL-070 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

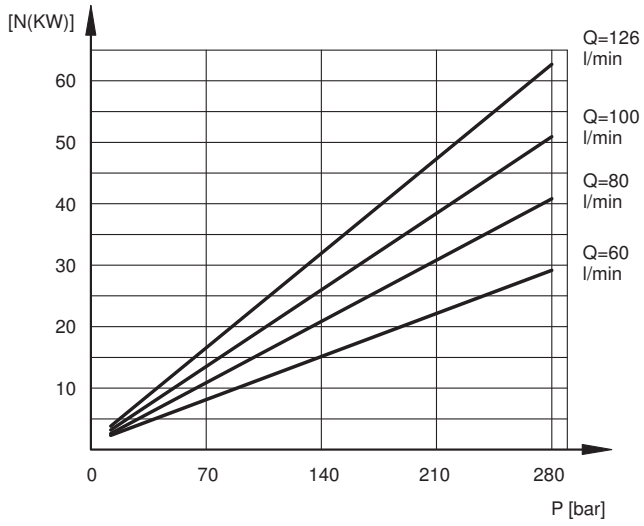
FLOW RATE / PRESSURE CURVES



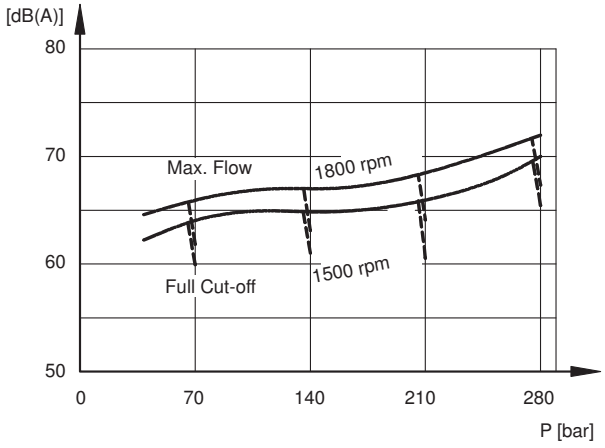
VOLUMETRIC AND TOTAL EFFICIENCY



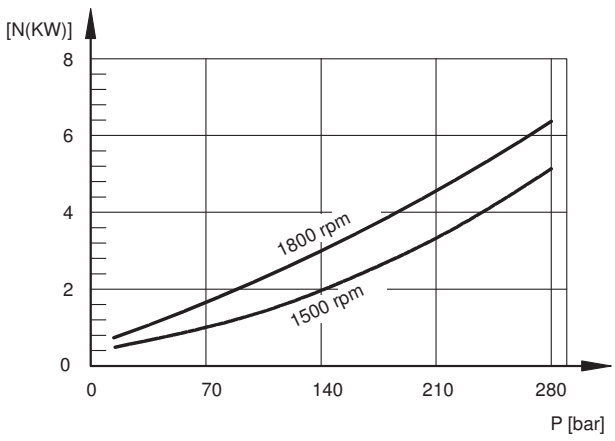
ABSORBED POWER



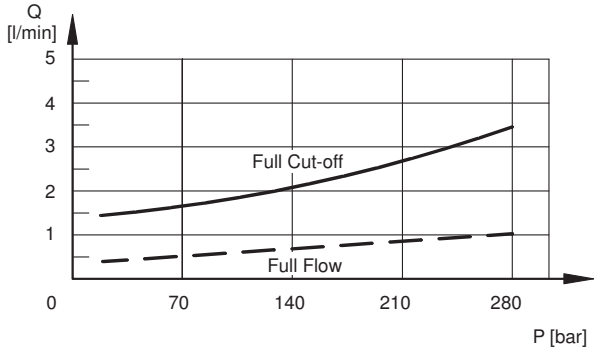
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

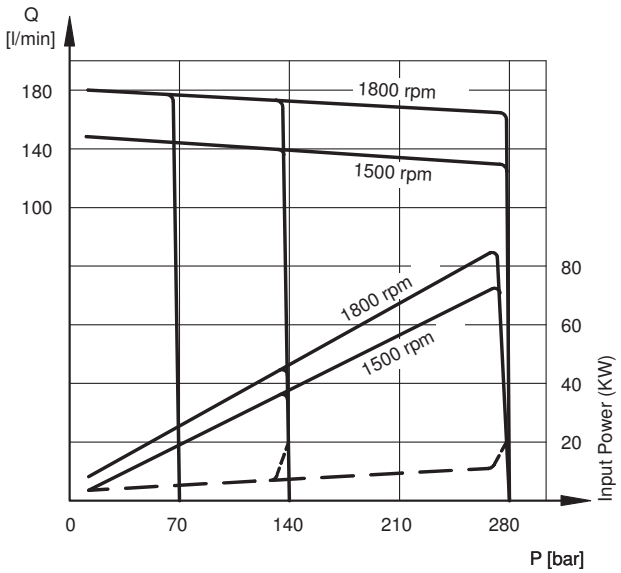


DRAIN FLOW RATE

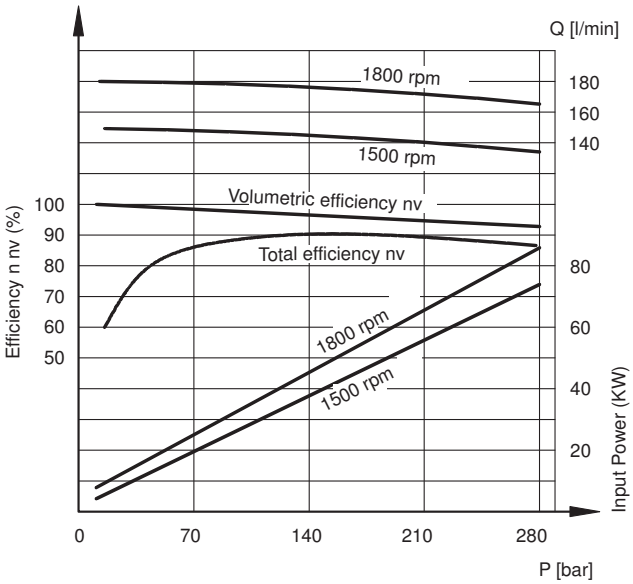


3.5 - VPPL-100 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

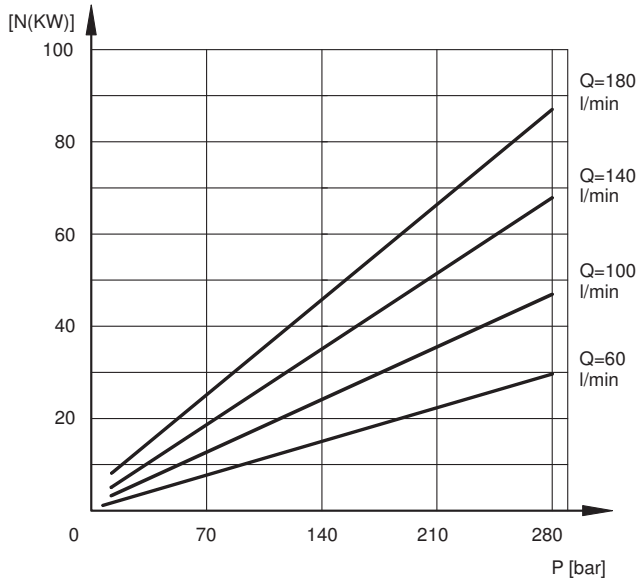
FLOW RATE / PRESSURE CURVES



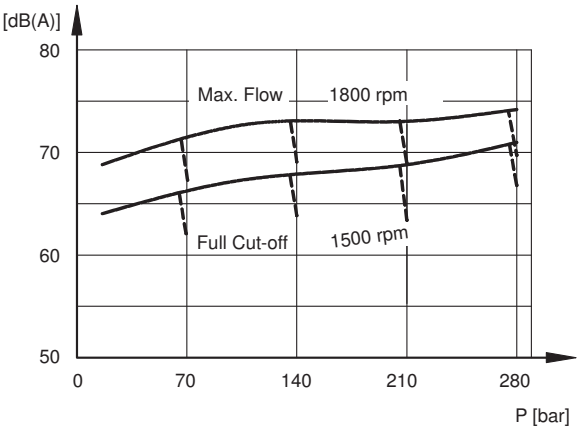
VOLUMETRIC AND TOTAL EFFICIENCY



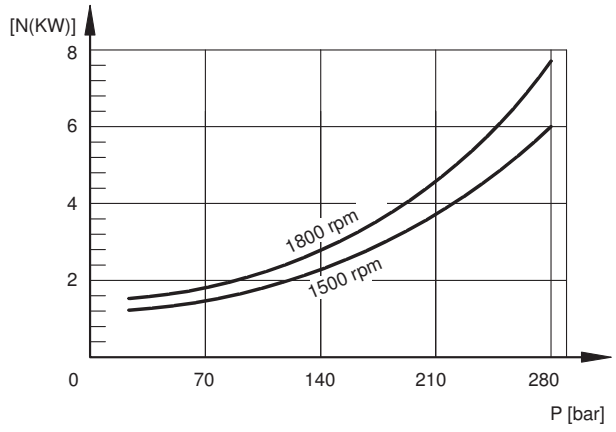
ABSORBED POWER



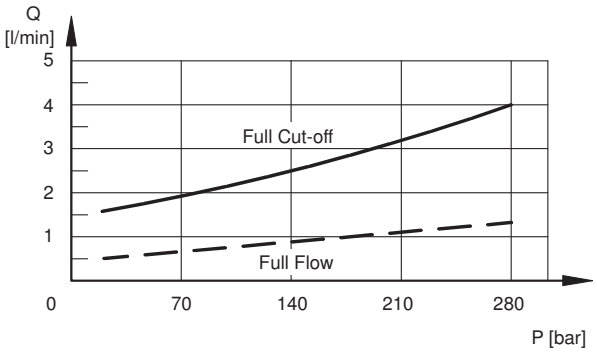
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

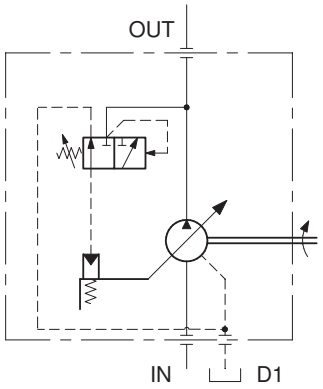


DRAIN FLOW RATE



4 - REGULATORS

4.1 - Pressure regulator: PC*



The PC* pressure regulator keeps the pressure at a constant set level in the circuit, thus adjusting automatically the pump flow rate according to the real need of the system.
The desired pressure can be set by manually adjusting the P regulation valve. The clockwise rotation of the adjustment bolt makes the pressure increase.

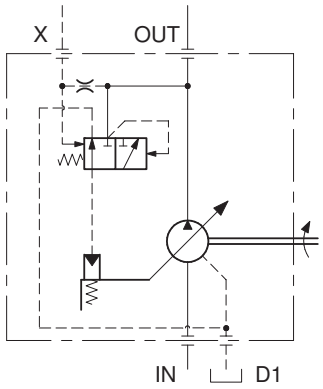
FEATURES OF THE PC REGULATOR:
- pressure adjustment range:
  PC5 = 30 ÷ 210 bar (for VPPL 008, 016, 022, 036 and 046)
  pressure increase/adjustment screw round: 69 bar
  PC6 = 30 ÷ 280 bar (for VPPL 070 and 100)
  pressure increase/adjustment screw round: 78 bar

4.2 - Remote-controlled pressure regulator: PCR

The PCR regulator allows a remote-control of the device via a remote control connected to the X port (typical application for submerged pumps).
In case a pressure regulating valve is used for the remote-control, it is suggested to use a direct operated valve with a size suitable to 1,5 l/min pilot flow rate.
Note: The maximum length of the connection between the valve and X port of the pump must not be longer than 2 m.

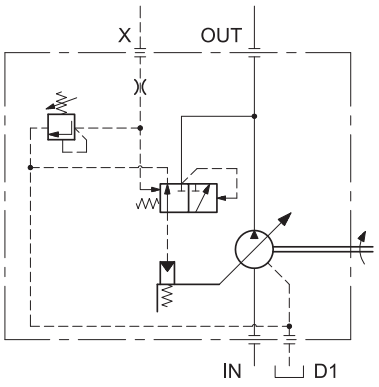
4.2.1 - Remote-controlled pressure regulator: PCR for VPPL 008, 016, 022, 036 e 046

FEATURES OF THE REGULATOR:
- remote-adjustment pressure = 20 ÷ 210 bar
- flow rate available on the X port
  for the remote-control = about 1,5 l/min (approx.)

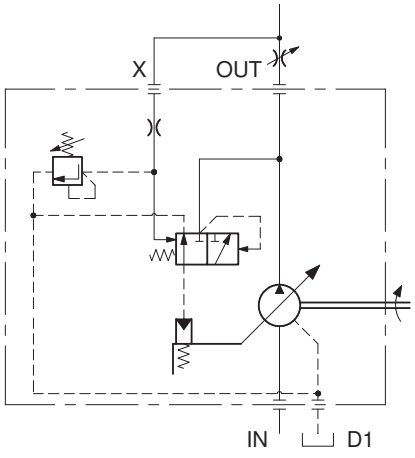


4.2.2 - Remote-controlled pressure regulator: PCR for VPPL 070 e 100

FEATURES OF THE REGULATOR:
It also limits the line maximum pressure.
- pressure regulating range 30 ÷ 280 bar
- pressure increase/adjustment screw round: 78 bar
- remote-regulated pressure range = 20 ÷ 280 bar
- flow rate available on the X port for the remote-control = about 1,5 l/min



4.3 - Pressure and flow rate regulator: PQC

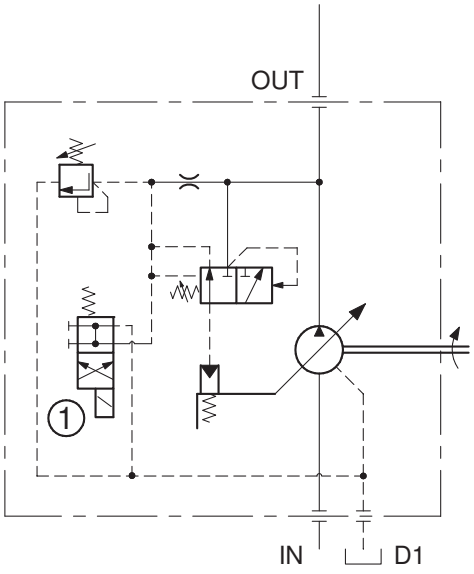


This regulator, in addition to the pressure adjustment (as for the PC* model), allows the pump flow rate control, according to the Δp pressure drop measured on either side of a throttle valve installed on the user line.
Note: The connection pipe between the X port and the flow line downstream the restrictor (or valve) must always be made (customer charge).

FEATURES OF THE PQC REGULATOR:
- pressure adjustment range:
  11 ÷ 190 bar (for VPPL 008, 016, 022, 036 and 046)
  13 ÷ 230 bar (for VPPL 070 and 100)
- pressure increase/adjustment screw round: 78 bar
- differential pressure adjustment range = 15 ÷ 28 bar
- minimum delivery pressure = 15 bar

4.4 - Regulator with pressure control devices: PCX*

4.4.1 - Electrical unloading



The PCX* regulator, mated to a suitable two-position solenoid valve, allows the electrical switching of the pump displacement in null condition and with minimum delivery pressure.

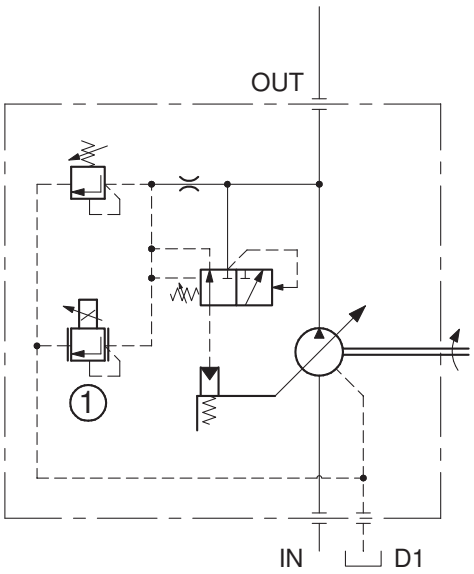
This function is useful for the pump unloading at the start-up or to operate at minimum pressure in the system during the machine cycle pause, with considerable energy saving.

The pressure switching is made by means of a solenoid valve (to be ordered separately) installed on the pump regulator directly.

PCX* FEATURES (electrical unloading):

- solenoid switching valve (1) = DS3-SA2 type
  (to be ordered separately - see cat. 41 150)
- solenoid valve OFF = pump at null displacement and delivery pressure = 20 bar
- solenoid valve ON = maximum displacement and delivery pressure set on regulator.
- pressure regulating range:
  20 ÷ 210 bar for VPPL-008, 016, 022, 036 and 046
  20 ÷ 280 bar for VPPL-070 and 100
- pressure increase/adjustment screw round = 78 bar
- default settings:
  210 bar for VPPL-008, 016, 022, 036 and 046
  280 bar for VPPL-070 and 100

4.4.2 - Pressure regulation with electric proportional control



The PCX regulator mated with a proportional pressure relief valve, allows a continuous control and modulation of the system pressure.

The proportional pressure relief valve (to be ordered separately) is installed on the pump regulator directly.

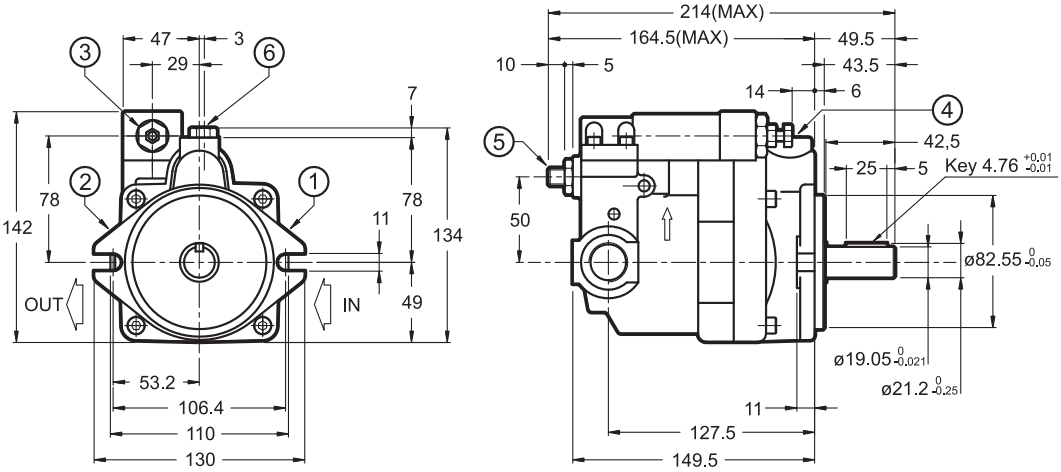
PCX* FEATURES (proportional pressure regulation):

- pressure regulating range:
  PCX5 = 20 ÷ 210 bar for VPPL-008, 016, 022, 036, 046.
  PCX6 = 20 ÷ 280 bar for VPPL-070 and 100
- pressure increase/adjustment screw round = 78 bar
- default setting:
  PCX5 = 210 bar for VPPL-008, 016, 022, 036 and 046
  PCX6 = 280 bar for VPPL-070 and 100
- proportional pressure relief valve (1) = PRED3 type
  (to be ordered with the relative control card separately - see cat. 81 210)
- proportional pressure regulating range :
  PRED3-070 20 ÷ 85 bar
  PRED3-210 20 ÷ 225 bar

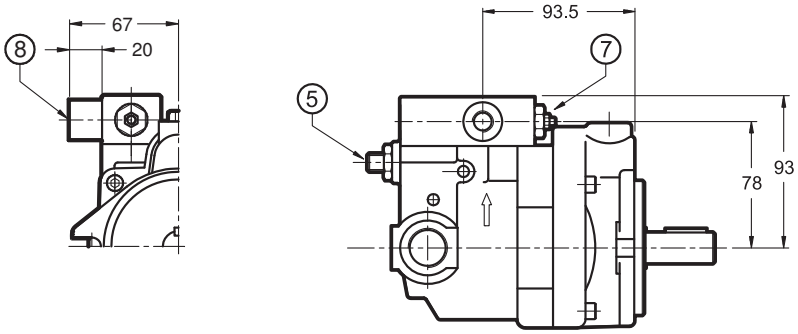
Hysteresis = < 5% of p nom
Repeatability = < ±1,5% of p nom

5 - VPPL-008 PUMPS OVERALL AND MOUNTING DIMENSIONS

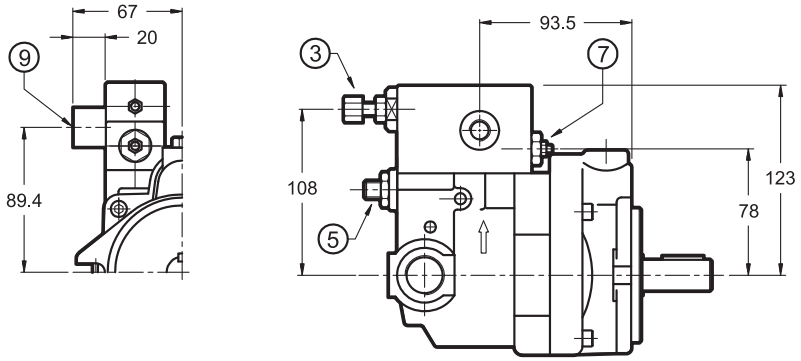
VPPL-008PC5 PUMPS



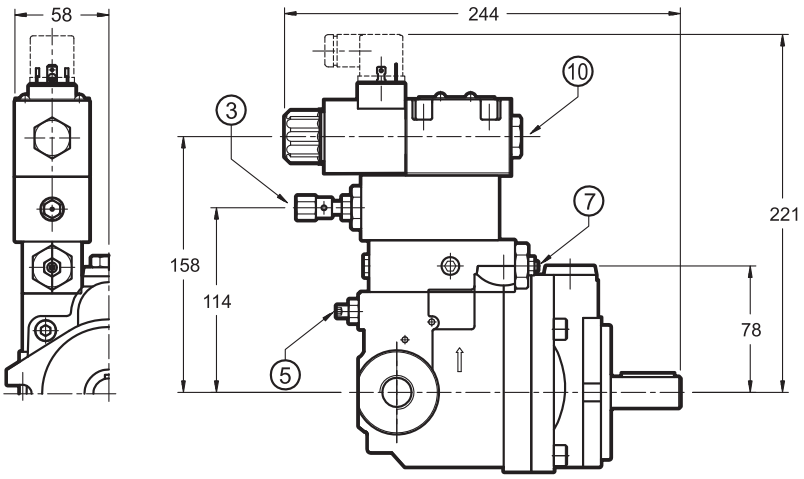
VPPL-008PCR PUMPS



VPPL-008PQC PUMPS



VPPL-008PCX5 PUMPS

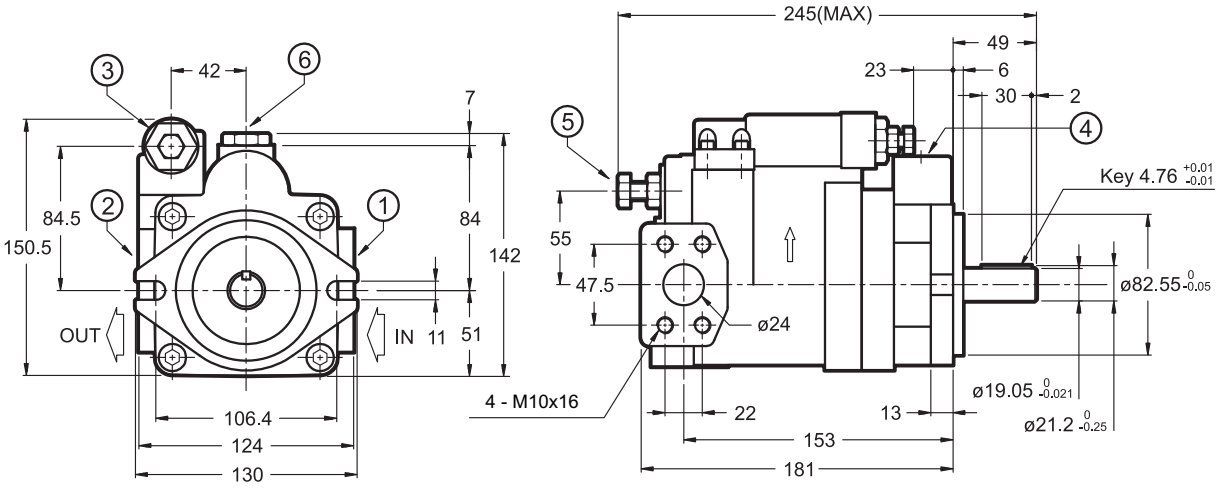


dimensions in mm

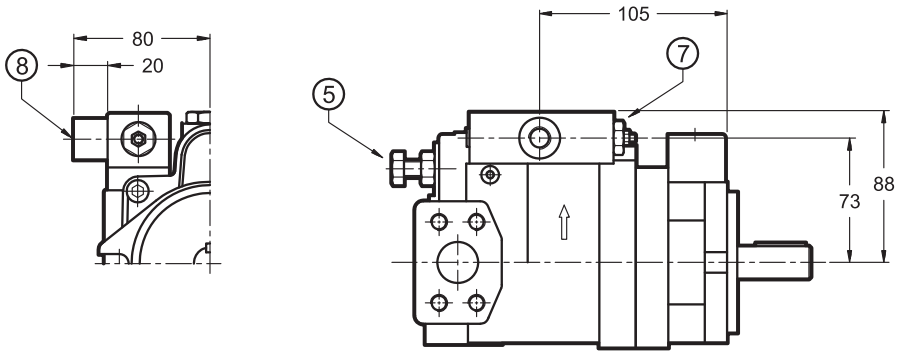
1	Suction port IN: 1/2” BSP
2	Delivery port OUT: 1/2” BSP
3	Pressure adjustment screw
4	Drain port: 3/8” BSP
5	Flow adjustment screw Δ displacement/round = 0,8 cm³
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP
9	Load sensing port: 1/4" BSP
10	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

6 - VPPL-016 and VPPL-022 PUMPS OVERALL AND MOUNTING DIMENSIONS

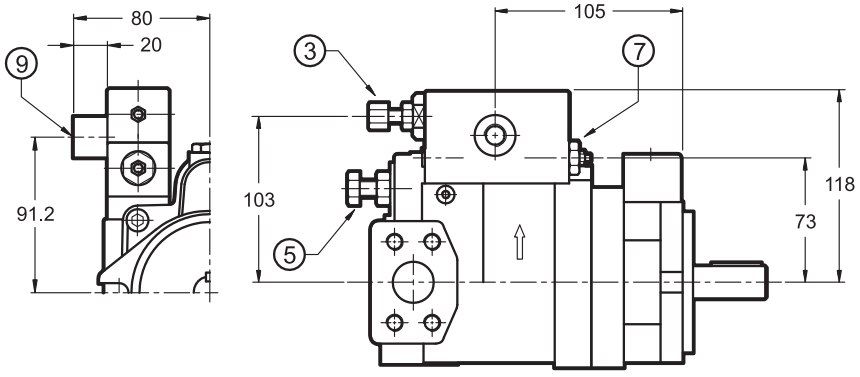
VPPL-016PC5 and VPPL-022PC5 PUMPS



VPPL-016PCR and VPPL-022PCR PUMPS



VPPL-016PQC and VPPL-022PQC PUMPS

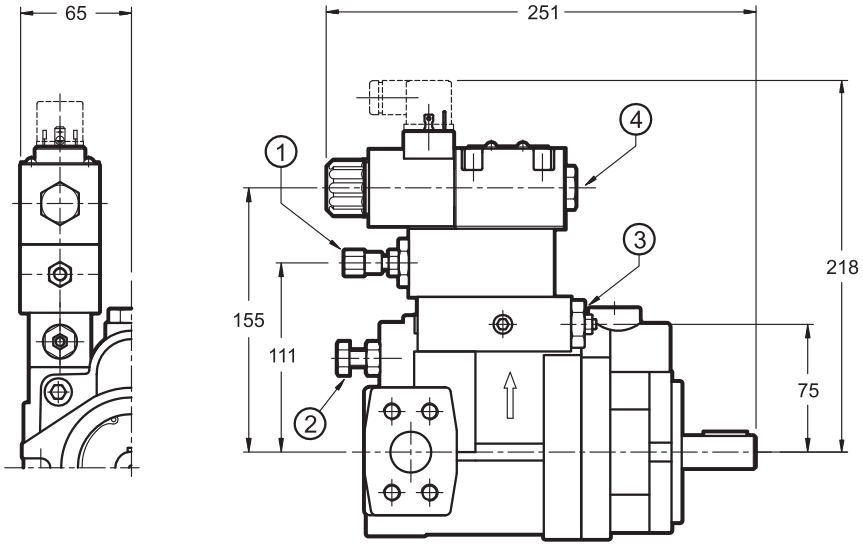


dimensions in mm

1	Suction port IN: SAE 3000 1” flange (see par. 11)
2	Delivery port OUT: SAE 3000 3/4” flange (see par. 11)
3	Pressure adjustment screw
4	Drain port: 3/8” BSP
5	Flow adjustment screw Δ displacement/round: 1,5 cm³ (for VPPL-016) 2,0 cm³ (for VPPL-022)
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP
9	Load sensing port: 1/4" BSP

VPPL-016PCX5 and VPPL-022PCX5 PUMPS

dimensions in mm

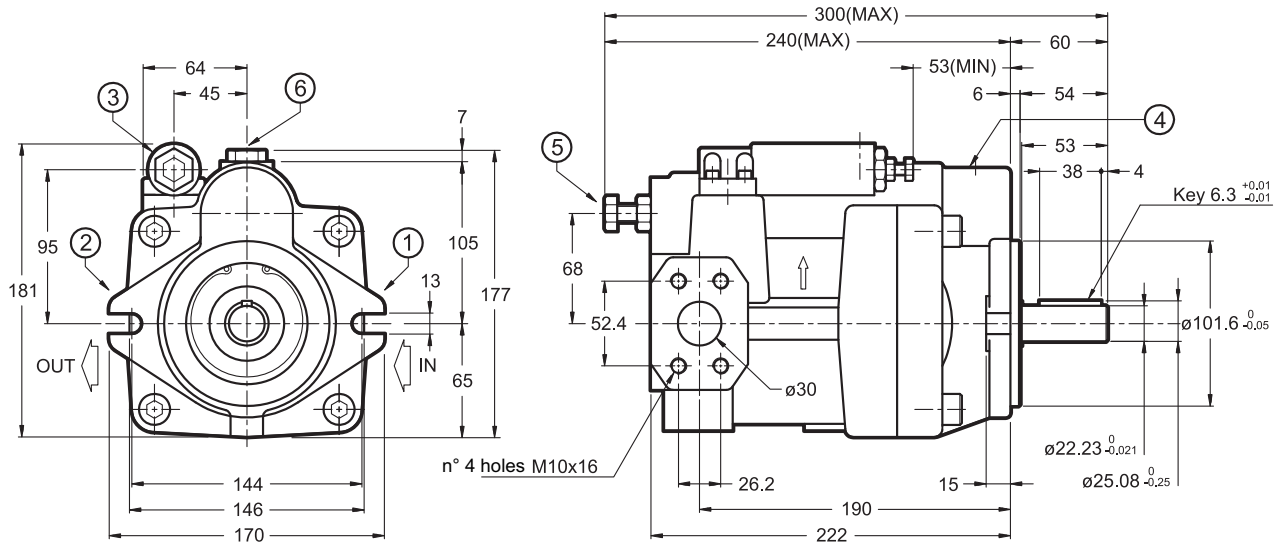


1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round: 1,5 cm³ (for VPPL-016) 2,0 cm³ (for VPPL-022)
3	Differential pressure (not adjustable)
4	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

7 - VPPL-036 and VPPL-046 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPL-036PC5 and VPPL-046PC5 PUMPS

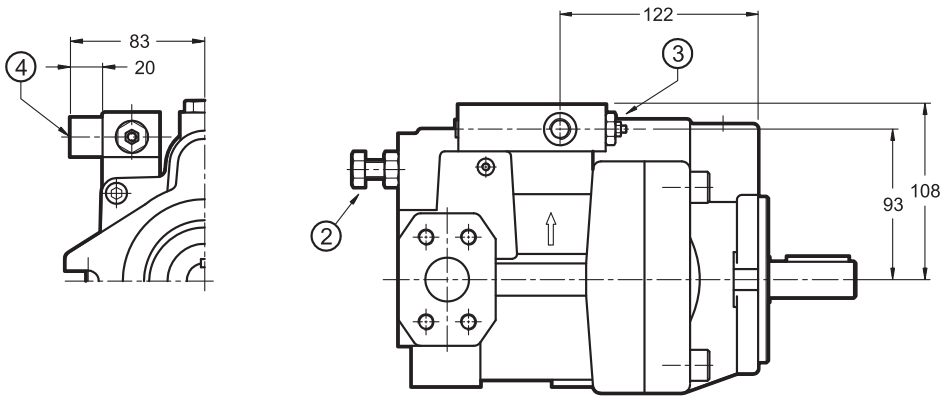
dimensions in mm



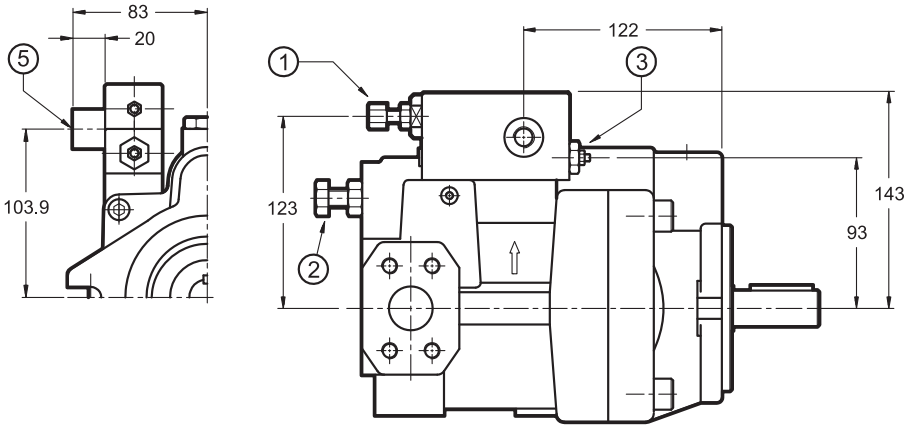
1	Suction port IN: SAE 3000 1 ¼" flange (see par. 11)
2	Delivery port OUT: SAE 3000 1" flange (see par. 11)
3	Pressure adjustment screw
4	Drain port: 1/2" BSP
5	Flow adjustment screw Δ displacement/round: 2,6 cm³ (for VPPL-036) 3,2 cm³ (for VPPL-046)
6	Oil supply port

dimensions in mm

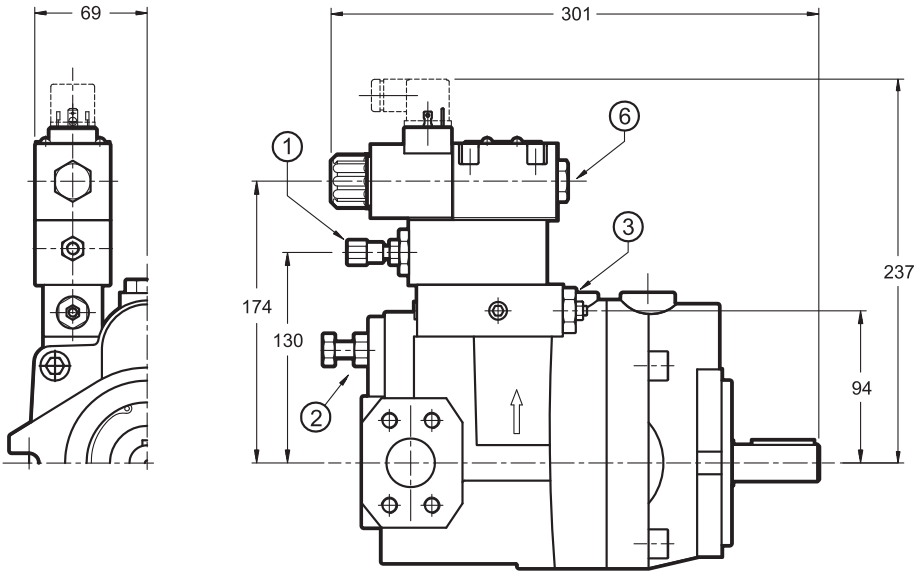
VPPL-036PCR and VPPL-046PCR PUMPS



VPPL-036PQC and VPPL-046PQC PUMPS



VPPL-036PCX5 and VPPL-046PCX5 PUMPS

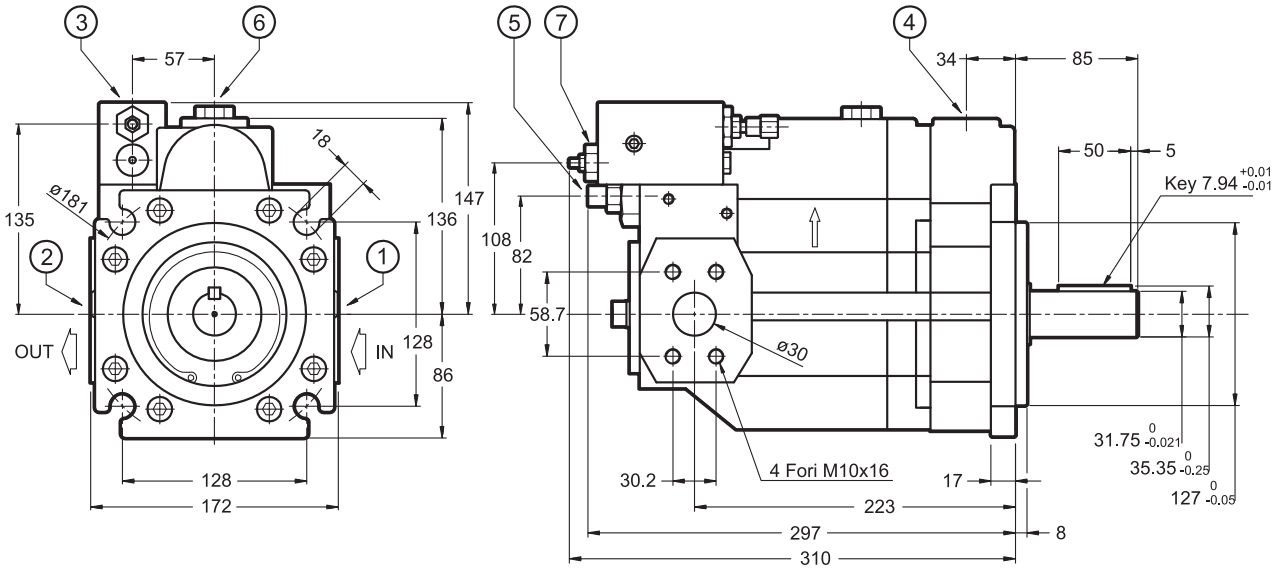


1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round: 2,6 cm³ (per VPPL-036) 3,2 cm³ (per VPPL-046)
3	Differential pressure (not adjustable)
4	Remote pressure control port: 1/4" BSP
5	Load sensing port: 1/4" BSP
6	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

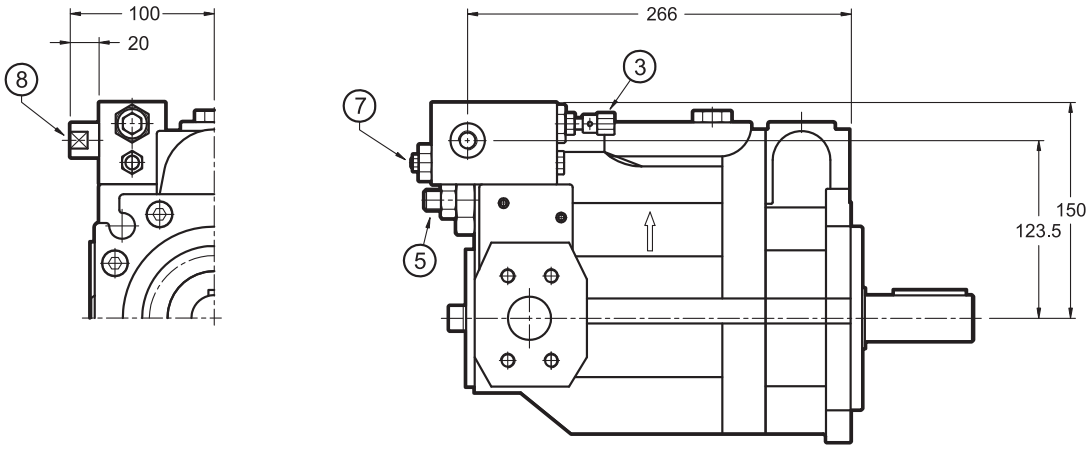
8 - OVERALL AND MOUNTING DIMENSIONS VPPL-070 PUMPS

VPPL-070PC6 PUMP

dimensions in mm



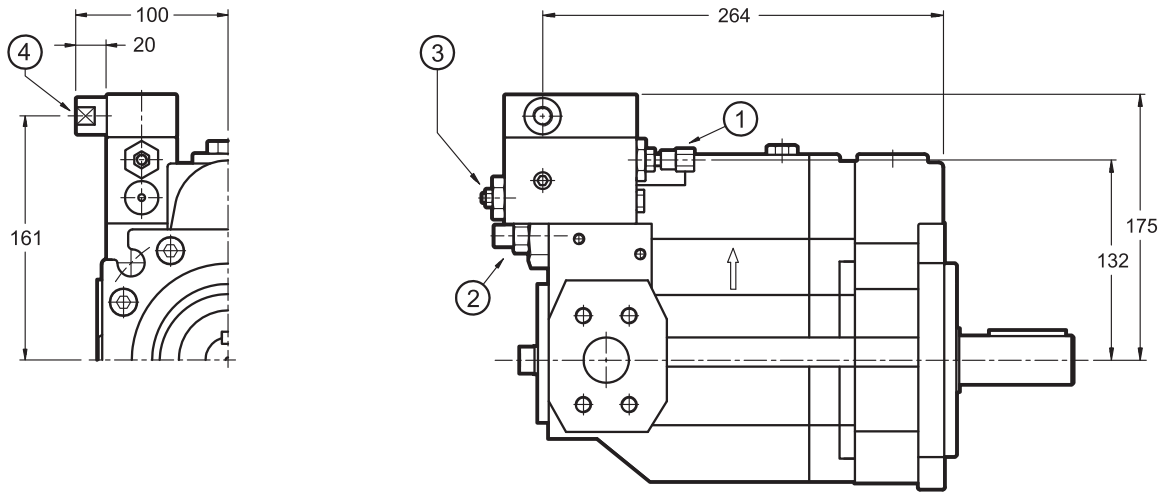
VPPL-070PCR PUMP



1	Suction port IN: SAE 3000 1 ½" flange (see paragraph 11)
2	Delivery port OUT: SAE 3000 1 ¼" flange (see paragraph 11)
3	Pressure adjustment screw
4	Drain port: 3/4" BSP
5	Flow adjustment screw Δ displacement/round = 4,1 cm³
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP

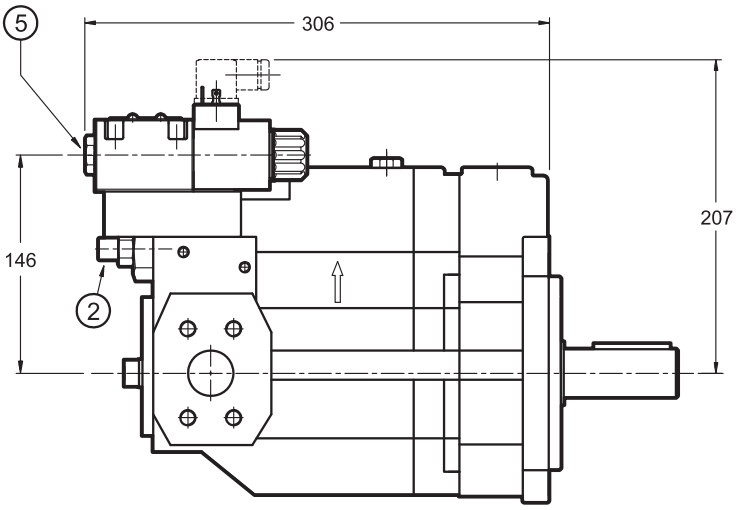
dimensions in mm

VPPL-070PQC PUMP

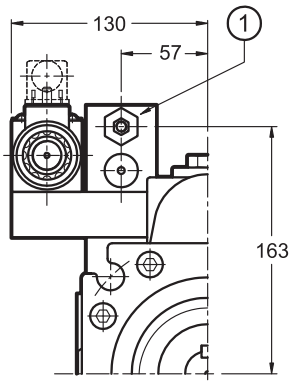


VPPL-070PCX6 PUMP

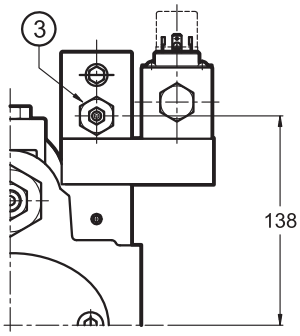
1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round = 4,1 cm³
3	Differential pressure (not adjustable)
4	Load sensing port: 1/4" BSP
5	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150



Shaft side view



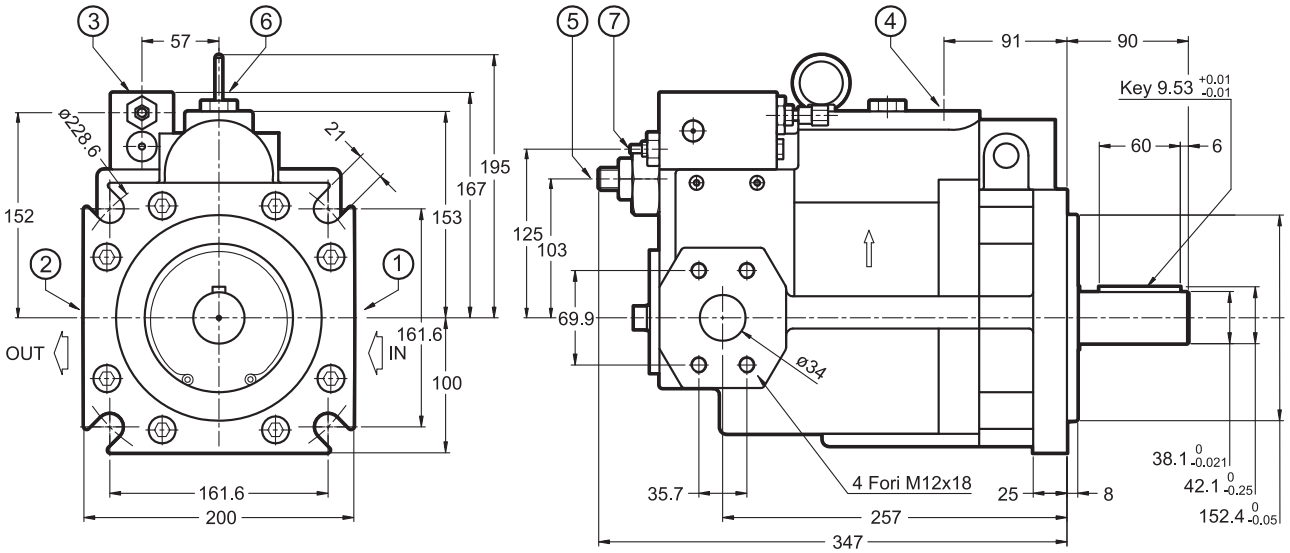
Regulator side view



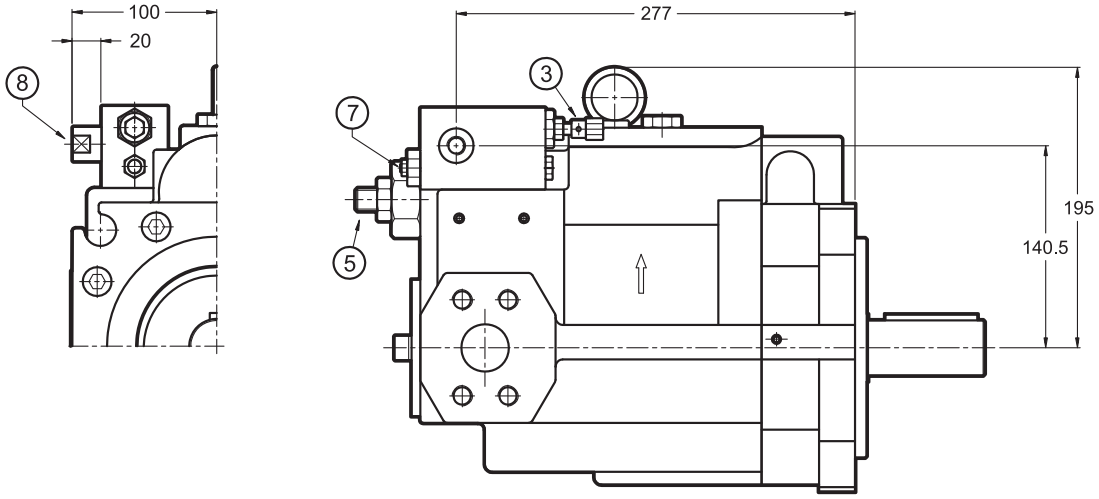
9 - OVERALL AND MOUNTING DIMENSIONS VPPL-100 PUMPS

VPPL-100PC6 PUMP

dimensions in mm



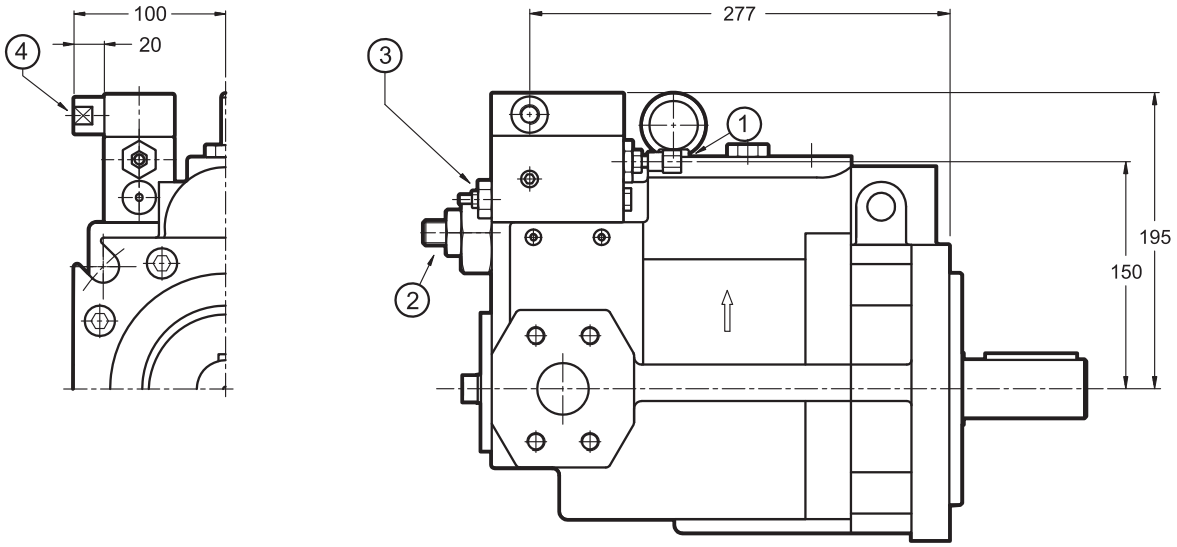
VPPL-100PCR PUMP



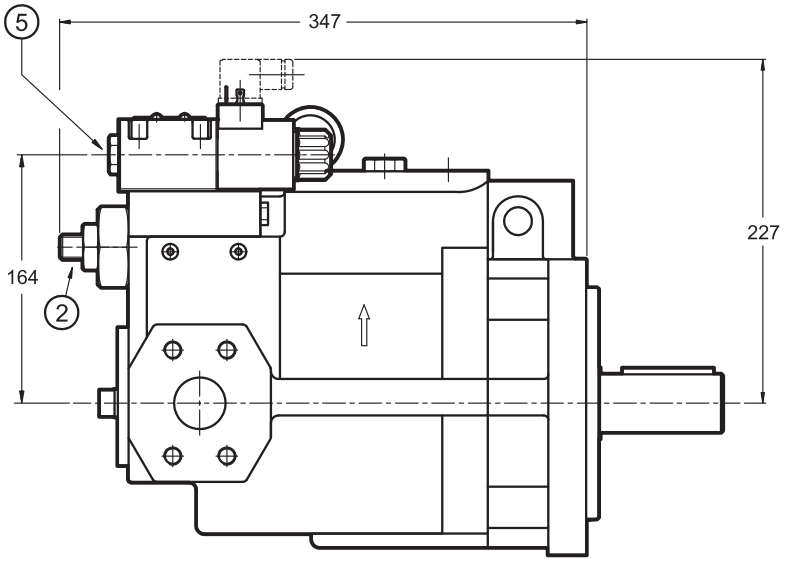
1	Suction port IN: SAE 3000 2” flange (see paragraph 11)
2	Delivery port OUT: SAE 6000 1 ¼” flange (see paragraph 11)
3	Pressure adjustment screw
4	Drain port: 3/4” BSP
5	Flow adjustment screw ∆ displacement/round = 5,1 cm³
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP

VPPL-100PQC PUMP

dimensions in mm

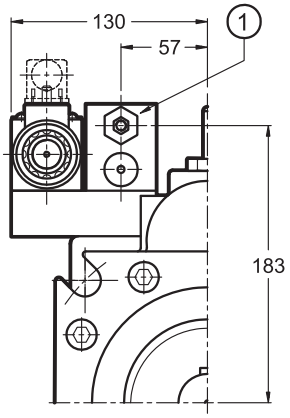


VPPL-100PCX6 PUMP

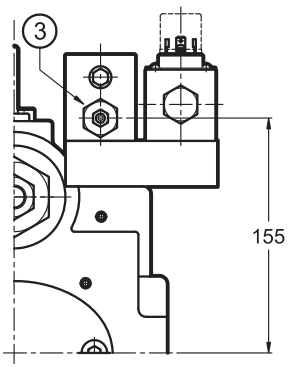


1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round = 5,1 cm³
3	Differential pressure (not adjustable)
4	Load sensing port: 1/4" BSP
5	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150

Shaft side view



Regulator side view



10 - INSTALLATION

- The VPPL pumps can be installed both in a horizontal and vertical position, with the shaft in an upward position.

  Note: the drain port has to be oriented so that the oil level inside the pump body is never lower than 3/4 of its volume.

- In the case of installation above the oil level, check that the minimal inlet pressure is not lower than -0.2 bars (relative). If a low noise emission level is required, the installation inside the tank is suggested.

  In case of an installation inside the tank, with an oil level which does not grant complete pump submersion, it is suggested to adjust thee drain tube so that the pump higher bearing can be always lubricated.

- **Before starting, the pump body has to be filled with the fluid.**

- Check the pump direction of rotation.

- It is necessary to vent the air from the delivery connection before operating it the first time. If the air venting should be difficult, the use of a venting valve is recommended.

  The pump start up should occur with the plant at minimum pressure, especially with low temperatures.

- The suction tube has to be suitably sized so that the suction pressure is never lower than -0.2 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.

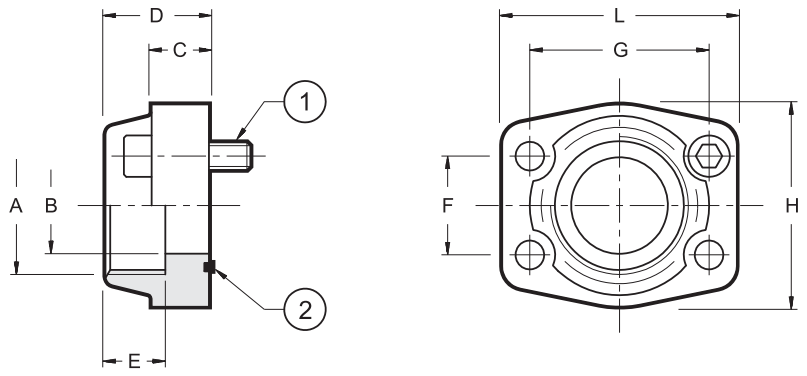
- The drainage tube has to be sized so that the pressure inside the pump body is always lower than 0.5 bars (relative), even during the dynamic change and flow rate phases. The minimum piping size is 3/8" for the pump type 008, 016 and 022, while it should be at least 1/2" for the pumps type 036 and 046, 3/4" for the 070 and 100 pumps type.

  The drain tube has to unload inside the tank far from the suction area.

- No check valves allowed on the suction line. As for details and the installation of filter elements, see paragraph 2.3.

- The motor-pump connection must be carried out directly with a flexible coupling, to reduce at the minimum the axial and radial loads on the pump shaft. The alignment tolerance between the two shafts must be within 0.05 mm.

11 - CONNECTION FLANGES



dimensions in mm

Bolts and O-rings must be ordered separately.

	Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	1 SHC bolts ISO 4762	2
SAE 3000	0610719	SAE - 3/4"	345	3/4" BSP	19	18	36	19	22,2	47,6	50	65	n° 4 - M10x35	OR 4100 (24.99x3.53)
	0610713	SAE - 1"	345	1" BSP	25	18	38	22	26,2	52,4	55	70		OR 4131 (32.93x3.53)
	0610720	SAE - 1 ¼"	276	1 ¼" BSP	32	21	41	22	30,2	58,7	28	79		OR 4150 (37.69x3.53)
	0610714	SAE - 1 ½"	207	1 ½" BSP	38	25	45	24	35,7	69,9	78	93	n° 4 - M12x45	OR 4187 (47.23x3.53)
	0610721	SAE - 2"	207	2" BSP	51	25	45	30	42,9	77,8	90	102	n° 4 - M12x45	OR 4225 (56.74x3.53)
SAE 6000	0770106	SAE - 1 ¼"	420	1 ¼" BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x50	OR 4150 (37.69x3.53)

DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

CR

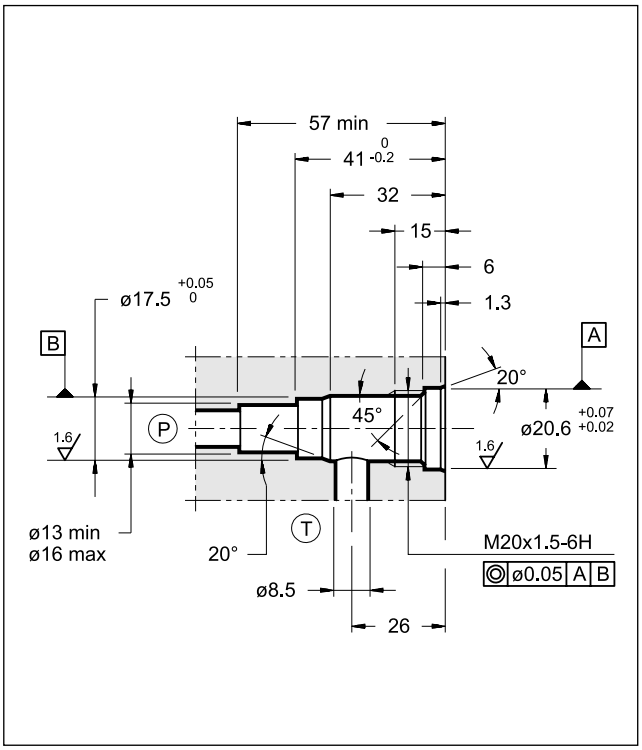
DIRECT OPERATED PRESSURE CONTROL VALVE

SERIES 22

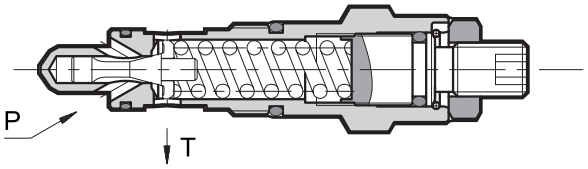
CARTRIDGE TYPE

p max **350** bar
Q max **50** l/min

SEAT DIMENSIONS: D-10B



OPERATING PRINCIPLE



— The CR valve is a direct operated pressure control valve cartridge type that can be used in blocks or panels with type D-10B seat.

— It is normally used to control the maximum pressure in the hydraulic circuits or as a limiting device for pressure peaks generated during hydraulic actuator movement variation.

— It is available in five different pressure control ranges up to 350 bar.

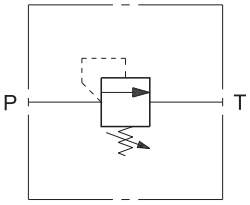
— The circuit pressure acts on the shutter which is directly loaded by a spring on the opposite side. Once the set pressure is reached, the shutter opens, and discharges the excess flow in port T connected directly to the reservoir.

— The pressure can be adjusted by a screw, usually supplied as the countersunk hex type, equipped with locking nut and maximum adjustment limiter.

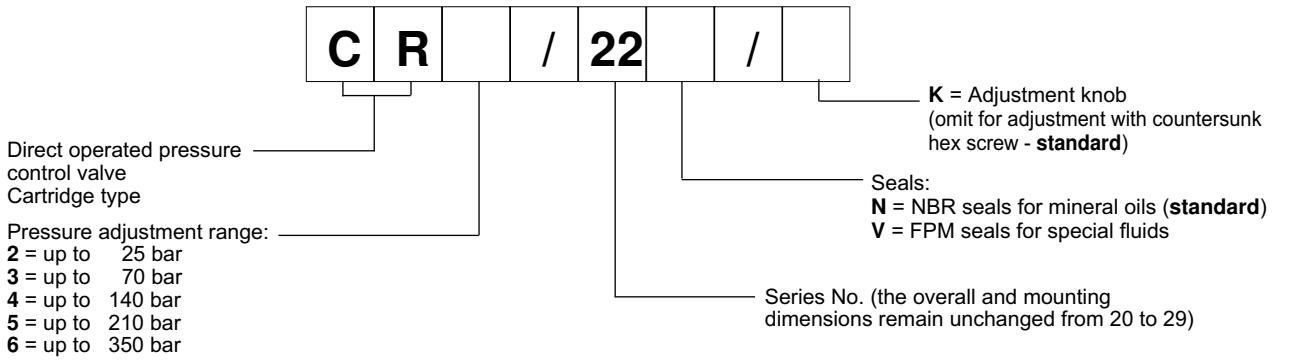
PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Max working pressure	bar	350
Minimum controlled pressure and pressure drop	see diagram	
Maximum flow rate	l/min	50
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,16
Surface treatment: electrolytic zinc covering	Fe // Zn 8 // B EN 12329	

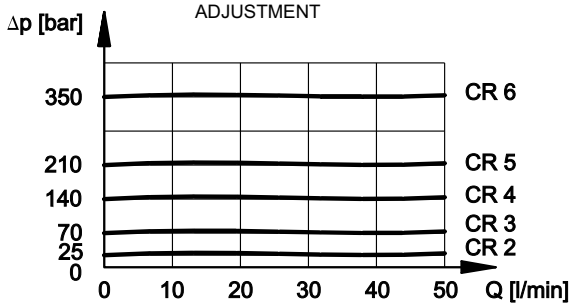
HYDRAULIC SYMBOL

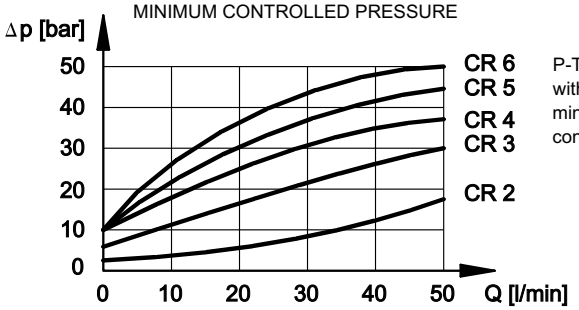


1 - IDENTIFICATION CODE



2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





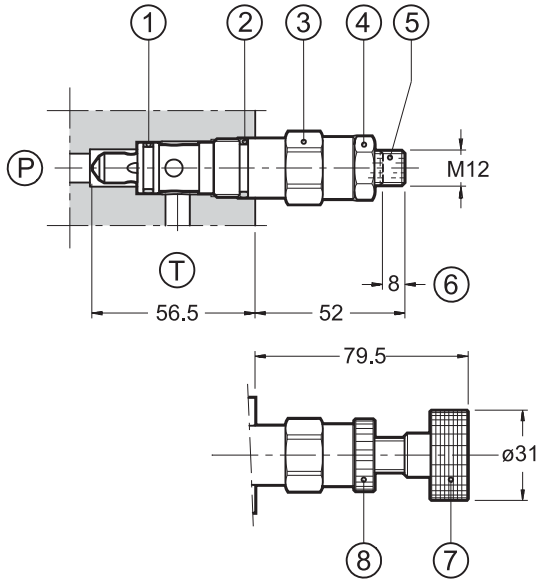
P-T pressure drops with screw set at minimum pressure control

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	OR tipo 2056 (14.00x1.78) 90 Shore
2	OR tipo 3062 (15.54x2.62) 90 Shore
3	Hexagonal: spanner 22 Tightening torque 45 ÷ 50 Nm
4	Locking nut: spanner 19
5	Countersunk hex adjustment screw: spanner 6 (**standard**) Clockwise rotation to increase pressure
6	Maximum screw stroke
7	Adjustment knob: K
8	Locking ring

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20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

CRQ

PILOT OPERATED PRESSURE CONTROL VALVE

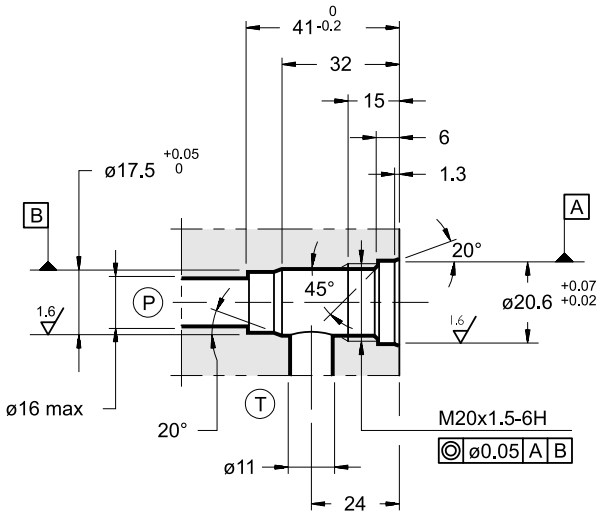
SERIES 12

CARTRIDGE TYPE

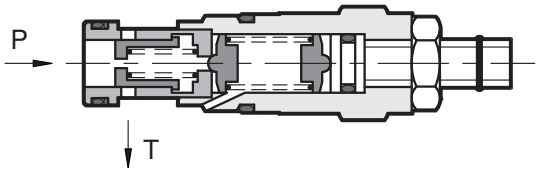
p max **350** bar

Q max **100** l/min

SEAT DIMENSIONS: D-10C



OPERATING PRINCIPLE



— The CRQ valve is a pilot operated pressure control valve cartridge type that can be used in blocks or panels with D-10C type seat.

— It is normally used to control the hydraulic circuit pressure and allows use of the entire flow of the pump even at pressure values near the set value.

— It is available in four different pressure control ranges up to 350 bar.

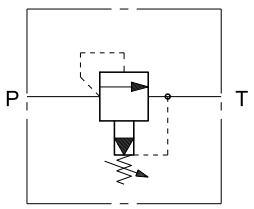
— It consists of a main balanced type spool and a pilot stage. The main spool, normally closed, opens when the circuit pressure exceeds the set value generated by the pilot stage, discharging the excess flow in port T, directly connected to the tank.

— The pressure is adjustable with a screw, usually supplied as the countersunk hex type, equipped with locking nut and with maximum adjustment limiter.

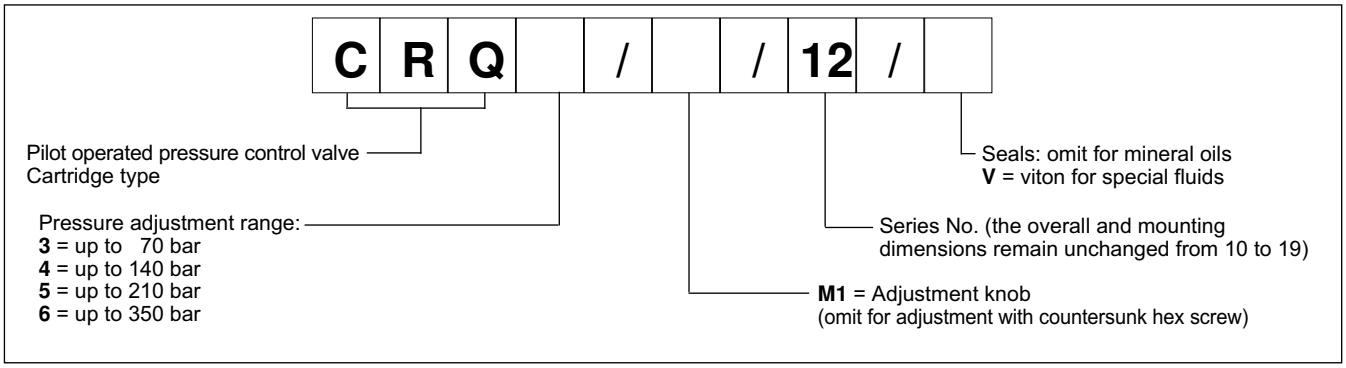
PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Max working pressure	bar	350
Minimum controlled pressure and pressure drop	see diagram	
Maximum flow rate	l/min	100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,16
Surface treatment:electrolytic zinc covering	Fe // Zn 8 // B EN 12329	

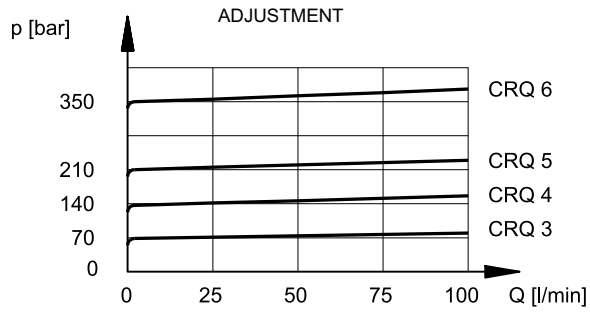
HYDRAULIC SYMBOL

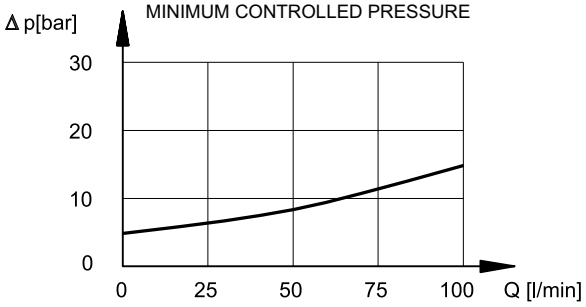


1 - IDENTIFICATION CODE



2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

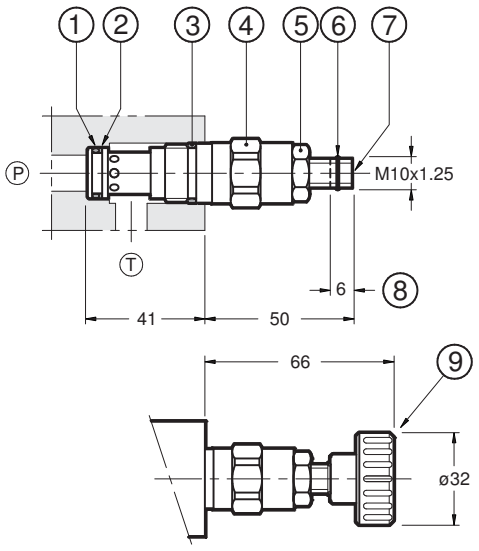




3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

1	OR type 2056 (14.00x1.78) 90 Shore
2	Parbak 8-015 (14.81x1.14x1.35)
3	OR type 3062 (15.54x2.62) 90 Shore
4	Hexagonal: spanner 22 Tightening torque 45 ÷ 50 Nm
5	Locking nut: spanner 17
6	Maximum adjustment limiting device
7	Countersunk hex adjustment screw: spanner 5 Clockwise rotation to increase pressure
8	Maximum screw stroke
9	Adjustment knob: M1

DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com