



Hydraulic gear pumps

two piece cast iron housing

Replaces: F 01 T A

DISPLACEMENTS

From 0.50 in³/rev
(8,26 cm³/rev)
To 9.20 in³/rev
(150,79 cm³/rev)



MAX. SPEED

3000 min⁻¹

PRESSURE

Max. continuous	4205 psi (290 bar)
Max. intermittent	4568 psi (315 bar)
Max. peak	4713 psi (325 bar)

- Two piece cast iron housing
- High performance at very low speed
- Ideal for truck applications

FORMULA designates a CASAPPA gear pump range specifically designed for applications requiring high pressure levels also at low speed; applications such as truck-mounted cranes, tripper trucks and lift-trucks etc. Special design features and an exclusive CASAPPA patent have perfected a sophisticated mechanism which makes FORMULA a highly reliable unit, proven by years of service in the specific field of use. The versatility offered by the range of Italian (triangular) European (ISO) and American (SAE) mounting flanges allows to the FORMULA pumps to be used in several applications.

Edition: 02/07.2008



INDEX

Section	Description	Page
FEATURES		1
	PERFORMANCE CURVES	7
	FP 20 ISO STANDARD	16
	FP 20 ITALIAN STANDARD	17
	FP 30 ISO STANDARD	21
SINGLE GEAR PUMPS	FP 30 ITALIAN STANDARD	22
	FP 30 SAE STANDARD	25
	FP 40 ISO STANDARD	29
	FP 40 ITALIAN STANDARD	30
	FP 40 SAE STANDARD	31
	GENERALITY	35
	FP 20 ITALIAN STANDARD	42
MULTIPLE GEAR PUMPS FP	30 ITALIAN STANDARD	44
	FP 40 ITALIAN STANDARD	50
	FP 40 SAE STANDARD	60
PORTS CONNECTORS TIGHTENING TORQUE		63
	SUPPORT (ISO STANDARD)	64
SUPPORT	KIT TO ASSEMBLE FORMULA PUMPS WITH SUPPORT	65
	APPLICATIONS	66
CHANGING ROTATION		68
INSTRUCTIONS		69

01/08.2005


Modification from former edition.

FEATURES

GUARANTEE

CASAPPA provides a two years guarantee for FORMULA pumps on industrial vehicles if used in accordance with the applications and conditions indicated in this technical catalogue.

WARNING !

Failure or improper use of the product can cause damage at the same product or system. Make sure that this is the last issue.

Replaces: 01/08.2005

Construction	External gear type pumps
Mounting	ISO (ZF), ITALIAN (triangular) and SAE flanges
Line connections	Screw
Direction of rotation (looking at the drive shaft)	Anti-clock (S) - clockwise (D) - reversible (R or B)
Inlet pressure range for pumps	10 ÷ 44 psi - [0,7 ÷ 3 bar (abs.)]
Fluid temperature range	See table (1)
Fluid	Mineral oil based hydraulic fluids to ISO/DIN and fire resistant fluids [see table (1)]. For other fluids please consult our technical sales department.
Viscosity range	From 60 to 456 SSU [12 to 100 mm ² /s (cSt)] recommended
	Up to 3410 SSU [750 mm ² /s (cSt)] permitted
Filtering requirement	See table (2)

Tab. 1							
Type	Fluid composition	Max pressure psi - (bar)	Max speed min ⁻¹	Temperature °F - (°C)			Seals (◆)
				Min	Max continuous	Max peak	
ISO/DIN	Mineral oil based hydraulic fluid to ISO/DIN	See page 3	See page 3	-13 (-25)	176 (80)	212 (100)	N
				-13 (-25)	230 (110)	257 (125)	V
HFA	Oil emulsion in water 5 ÷ 15% of oil	725 (50)	1500	36 (2)	131 (55)		N
HFB	Water emulsion in oil 40 % of water	1740 (120)	1500	36 (2)	140 (60)		N
HFC	Water - glycol	1450 (100)	1500	-4 (-20)	140 (60)		N Bz
HFD	Phosphate ester (●)	2175 (150)	1500	14 (-10)	176 (80)		V Bz

(◆) N= Buna N (standard) - V= Viton - **N Bz**= Buna N and Bronze thrust plates - **V Bz**= Viton and Bronze thrust plates.
 (●) For skydrol phosphate esters please consult our technical sales department.

Tab. 2			
Working pressure psi (bar)	$\Delta p < 2030$ (140)	$2030 < \Delta p < 3045$ (140) (210)	$\Delta p > 3045$ (210)
Contamination class NAS 1638	10	9	8
Contamination class ISO 4406:1999	21/19/16	20/18/15	19/17/14
Achieved with filter $\beta_{10(c)} \geq 75$ according to ISO 16889	–	10 μ m	10 μ m
Achieved with filter $\beta_{25(c)} \geq 75$ according to ISO 16889	25 μ m	–	–

Casappa recommends to use its own production filters:



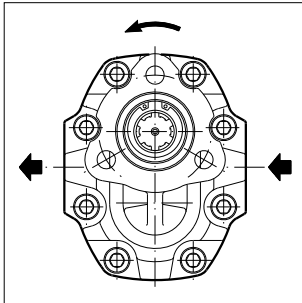
GENERAL NOTES

Available with different inlet and outlet ports. Standard pumps are equipped with BUNAN(N) seals, for particular operating conditions (V) VITON seals and BUNA or VITON seals with bronze thrust plates (N Bz), (V Bz) are available. If you use fire resistant fluids specify the type of them at the order. For more information please consult our technical sales department.

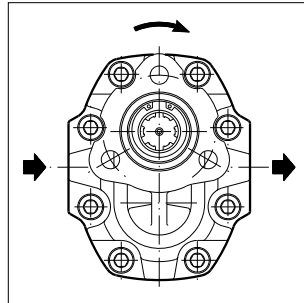
02/07.2008

FEATURES

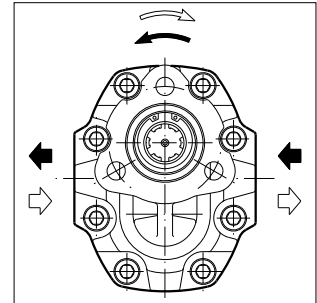
DEFINITION OF ROTATION DIRECTION LOOKING AT THE DRIVE SHAFT



Anti-clock rotation

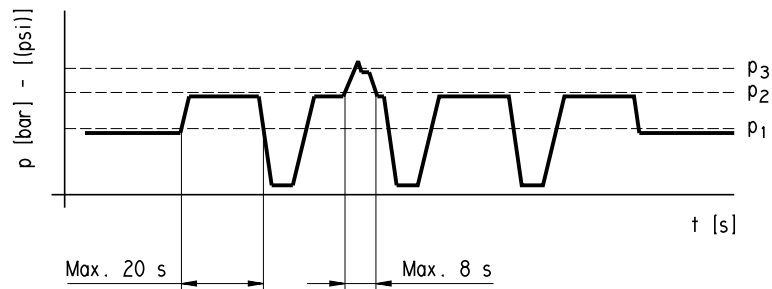


Clockwise rotation



Reversible rotation

PRESSURE DEFINITION



p_1 Max. continuous pressure

p_2 Max. intermittent pressure

p_3 Max. peak pressure

01/08.2005

FORMULA 20 GENERAL DATA PUMPS
FP 20

Pump type	Displacement	Max. pressure			Intermittent max. speed		Min. speed
		p ₁	p ₂	p ₃	At p ₂ press.	Without load	At p ₂ press.
	in ³ /rev (cm ³ /rev)	psi (bar)			min ⁻¹		
FP 20•8 (●)	0.50 (8,26)	4060 (280)	4495 (310)	4713 (325)	2000	4200	300
FP 20•11,2 (●)	0.69 (11,23)	4060 (280)	4495 (310)	4713 (325)	2000	4200	300
FP 20•16	1.03 (16,85)	4060 (280)	4495 (310)	4713 (325)	2000	4200	300
FP 20•20	1.29 (21,14)	3770 (260)	4060 (280)	4205 (290)	2000	4200	300
FP 20•25	1.61 (26,42)	3190 (220)	3625 (250)	3770 (260)	2000	4200	300
FP 20•31,5	2.01 (33,03)	2755 (190)	3045 (210)	3190 (220)	1800	4000	300
FP 20•36 (●)	2.19 (35,94)	2465 (170)	2755 (190)	2900 (200)	1800	4000	300
FP 20•40	2.42 (39,64)	2320 (160)	2610 (180)	2755 (190)	1800	4000	300

(●): Only available in ISO 16 Z0 and ITALIAN 13 T1 version.

p₁= Max. continuous pressure

p₂= Max. intermittent pressure

p₃= Max. peak pressure

The values in the table refer to unidirectional and reversible pumps.

FORMULA 30 GENERAL DATA PUMPS
FP 30

Pump type	Displacement	Max. pressure			Intermittent max. speed		Min. speed
		p ₁	p ₂	p ₃	At p ₂ press.	Without load	At p ₂ press.
	in ³ /rev (cm ³ /rev)	psi (bar)			min ⁻¹		
FP 30•17	1.05 (17,28)	4205 (290)	4568 (315)	4713 (325)	3000	4000	300
FP 30•27	1.63 (26,70)	4205 (290)	4568 (315)	4713 (325)	3000	4000	300
FP 30•34	2.11 (34,56)	4060 (280)	4350 (300)	4495 (310)	2800	4200	300
FP 30•38	2.40 (39,27)	4060 (280)	4350 (300)	4495 (310)	2800	3500	300
FP 30•43	2.68 (43,98)	3915 (270)	4205 (290)	4350 (300)	2500	3500	300
FP 30•51	3.16 (51,83)	3480 (240)	3770 (260)	4060 (280)	2500	3500	300
FP 30•61	3.74 (61,26)	3190 (220)	3480 (240)	3625 (250)	2000	3500	300
FP 30•73	4.50 (73,82)	2900 (200)	3190 (220)	3335 (230)	1800	3500	300
FP 30•82	4.98 (81,68)	2755 (190)	3045 (210)	3190 (220)	1800	3500	300
FP 30•100	6.16 (100,52)	2610 (180)	2900 (200)	3190 (220)	1800	3500	300
FP 30•125	7.67 (125,66)	2320 (160)	2610 (180)	2900 (200)	1800	3500	300

p₁= Max. continuous pressure

p₂= Max. intermittent pressure

p₃= Max. peak pressure

The values in the table refer to unidirectional pumps.

Reversible pump max pressures are 15% lower than those shown in table.

For different working conditions please consult our sales department.

T2 type double shaft flange allow the pumps to work in clockwise or anticlockwise rotation obtaining the reversible advantages and maintaining the general data of unidirectional pumps.

01/08.2005

FORMULA 40 GENERAL DATA PUMPS
FP 40

Pump type	Displacement	Max. pressure			Intermittent max. speed		Min. speed
		p ₁	p ₂	p ₃	At p ₂ press.	Without load	At p ₂ press.
	in ³ /rev (cm ³ /rev)	psi (bar)			min ⁻¹		
FP 40•63	3.75 (61,43)	4205 (290)	4568 (315)	4713 (325)	2700	4200	300
FP 40•73	4.43 (72,60)	4060 (280)	4350 (300)	4568 (315)	2700	4200	300
FP 40•87	5.28 (86,56)	3770 (260)	4060 (280)	4205 (290)	2700	4000	300
FP 40•109	6.64 (108,90)	3480 (240)	3770 (260)	4060 (280)	2700	4000	300
FP 40•133	8.18 (134,03)	3190 (220)	3625 (250)	3770 (260)	2500	4000	300
FP 40•151	9.20 (150,79)	2610 (180)	3045 (210)	3190 (220)	2500	4000	300

p₁= Max. continuous pressure

p₂= Max. intermittent pressure

p₃= Max. peak pressure

The values in the table refer to unidirectional pumps.

Reversible pump max pressures are 15% lower than those shown in table.

For different working conditions please consult our sales department.

T2 type double shaft flange allow the pumps to work in clockwise or anticlockwise rotation obtaining the reversible advantages and maintaining the general data of unidirectional pumps.

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DESIGN CALCULATIONS FOR PUMPS

Q	US gpm (l/min)	Flow
M	lbf in (Nm)	Torque
P	HP (kW)	Power
V	in ³ /rev (cm ³ /rev)	Displacement
n	min ⁻¹	Speed
Δp	psi (bar)	Pressure
$\eta_v = \eta_v (V, \Delta p, n) \quad (\approx 0,98)$		Volumetric efficiency
$\eta_m = \eta_m (V, \Delta p, n) \quad (\approx 0,90)$		Mechanical efficiency
$\eta_t = \eta_v \cdot \eta_m \quad (\approx 0,88)$		Overall efficiency

$$Q = V \text{ (cm}^3\text{/rev)} \cdot \eta_v \cdot n \cdot 10^{-3} \quad (\text{l/min})$$

$$M = \frac{\Delta p \text{ (bar)} \cdot V \text{ (cm}^3\text{/rev)}}{62,83 \cdot \eta_m} \quad (\text{Nm})$$

$$P = \frac{\Delta p \text{ (bar)} \cdot V \text{ (cm}^3\text{/rev)} \cdot n}{600 \cdot 1000 \cdot \eta_t} \quad (\text{kW})$$

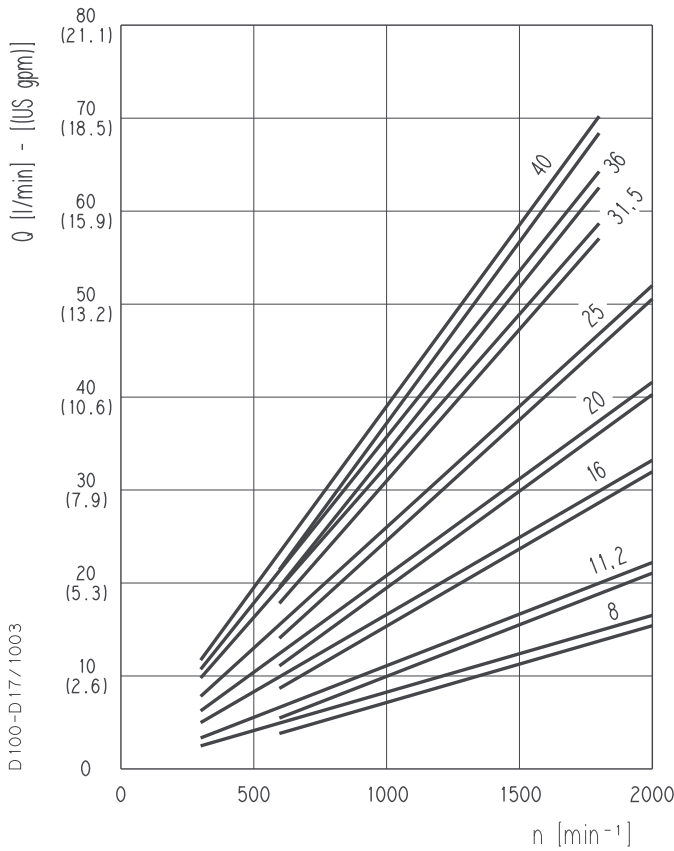
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Note: Diagrams providing approximate selection data will be found on subsequent pages.

FORMULA 20 GEAR PUMPS PERFORMANCE CURVES

FP 20

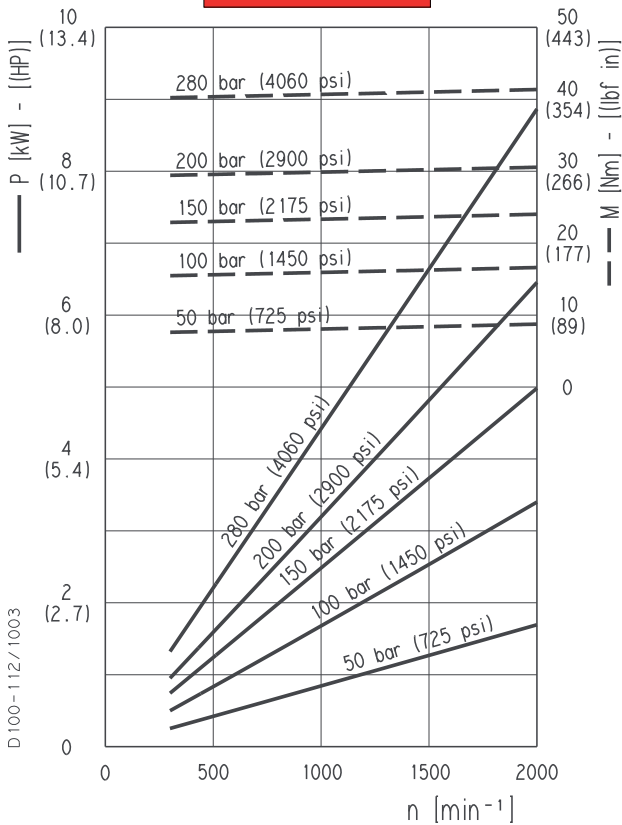
FP 20



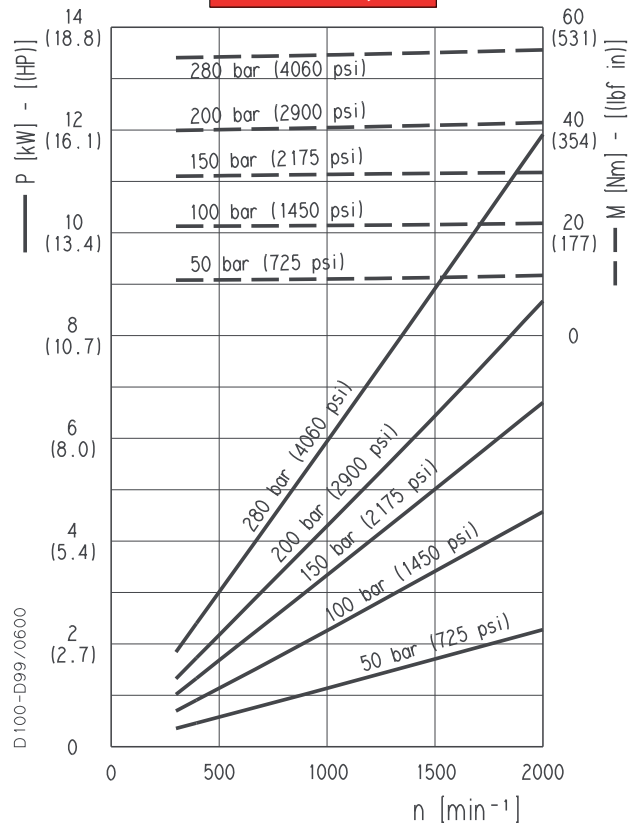
Each curve has been obtained at 122 °F (50 °C), using oil with viscosity 168 SSU (36 cSt) at 104 °F (40 °C) and at these pressures:

- FP 20•8 290-4060 psi (20-280 bar)
- FP 20•11,2 290-4060 psi (20-280 bar)
- FP 20•16 290-4060 psi (20-280 bar)
- FP 20•20 290-3770 psi (20-260 bar)
- FP 20•25 290-3190 psi (20-220 bar)
- FP 20•31,5 290-2755 psi (20-190 bar)
- FP 20•36 290-2465 psi (20-170 bar)
- FP 20•40 290-2320 psi (20-160 bar)

FP 20•8



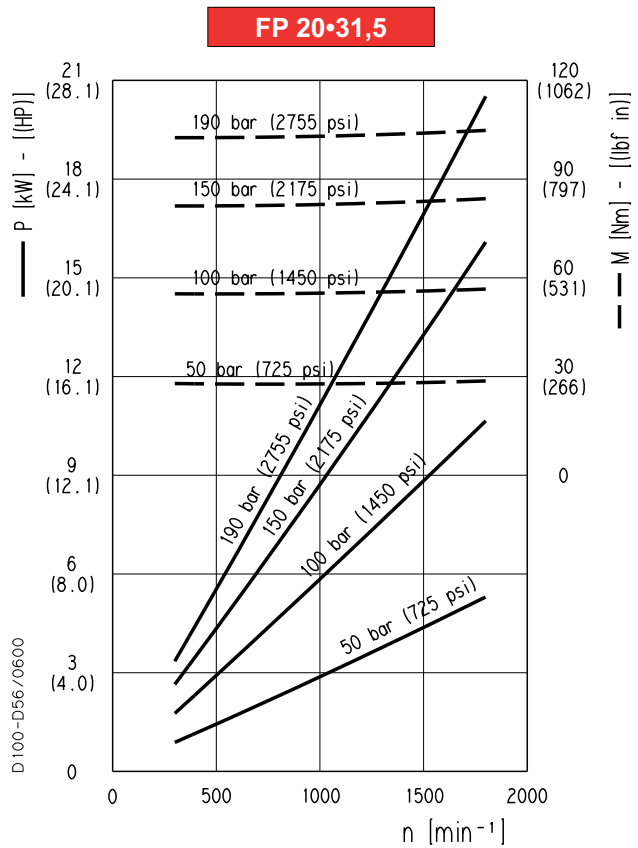
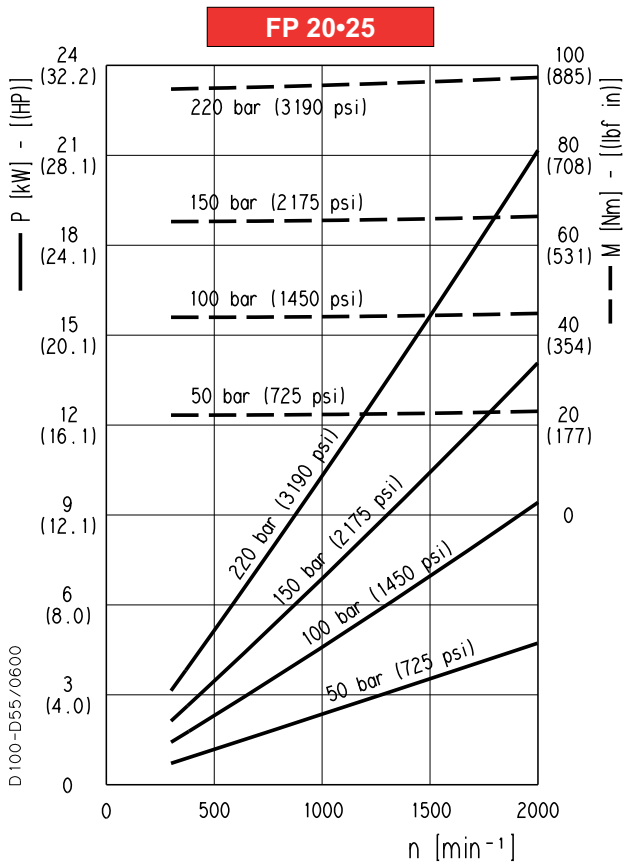
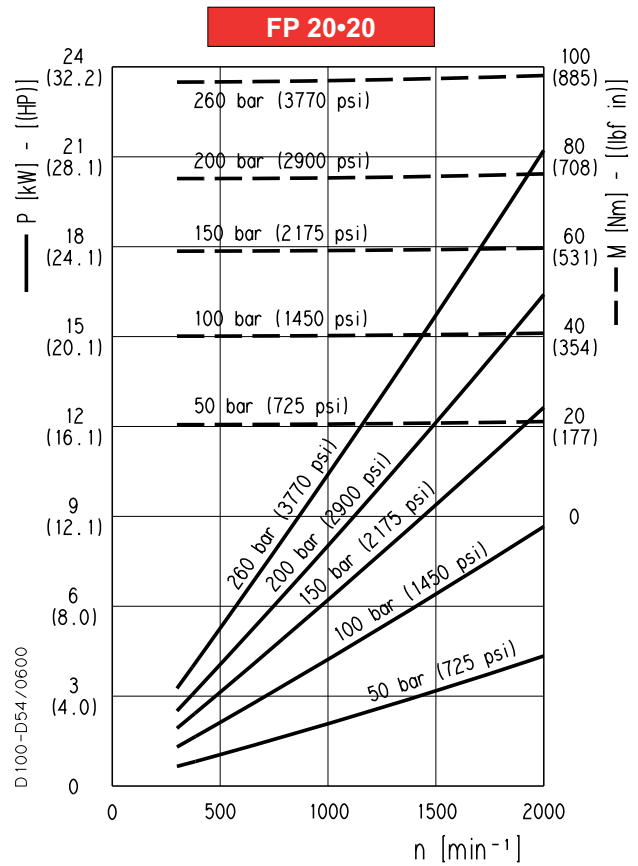
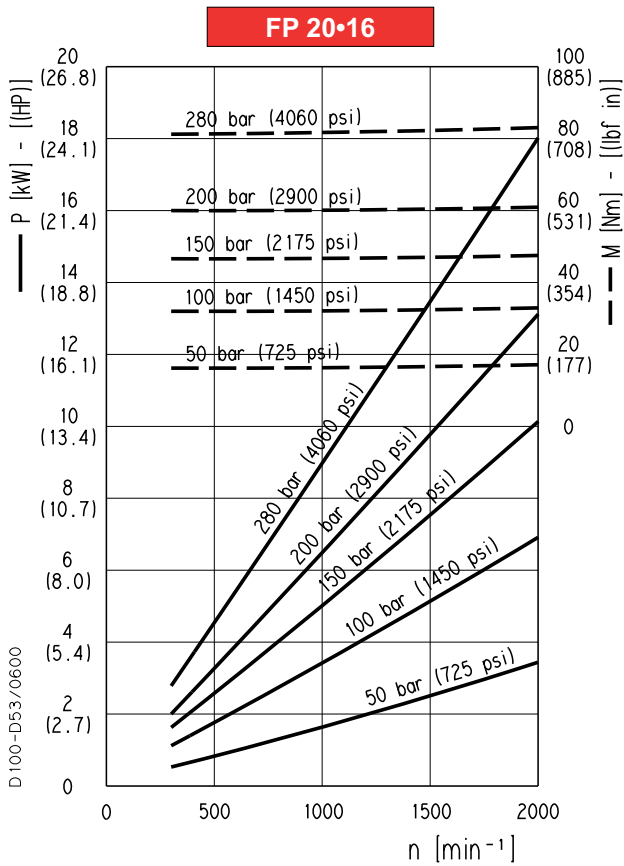
FP 20•11,2



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FORMULA 20 GEAR PUMPS PERFORMANCE CURVES

FP 20

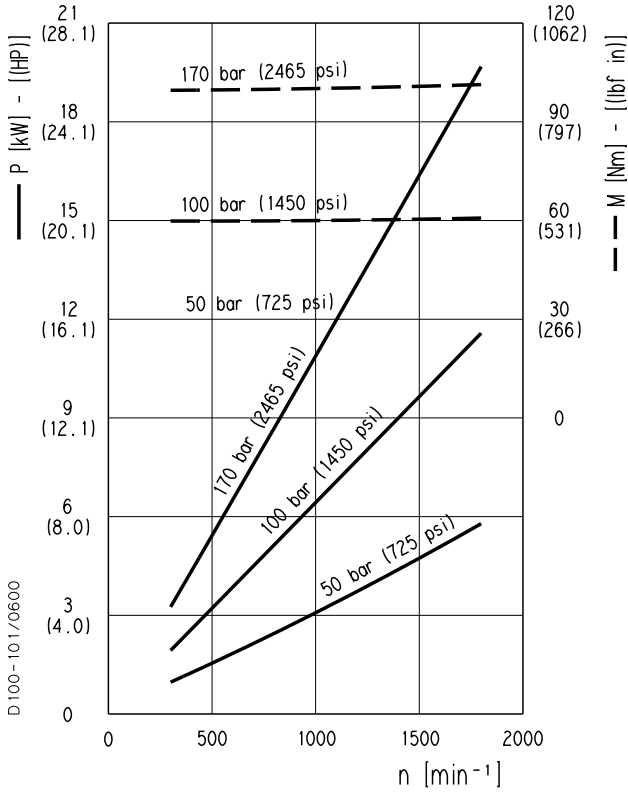


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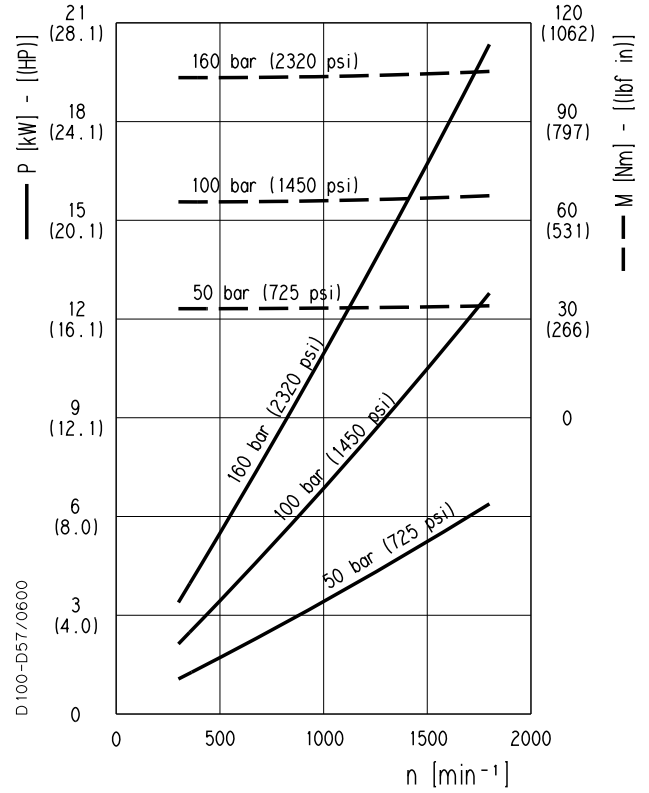
FORMULA 20 GEAR PUMPS PERFORMANCE CURVES

FP 20

FP 20-36



FP 20-40

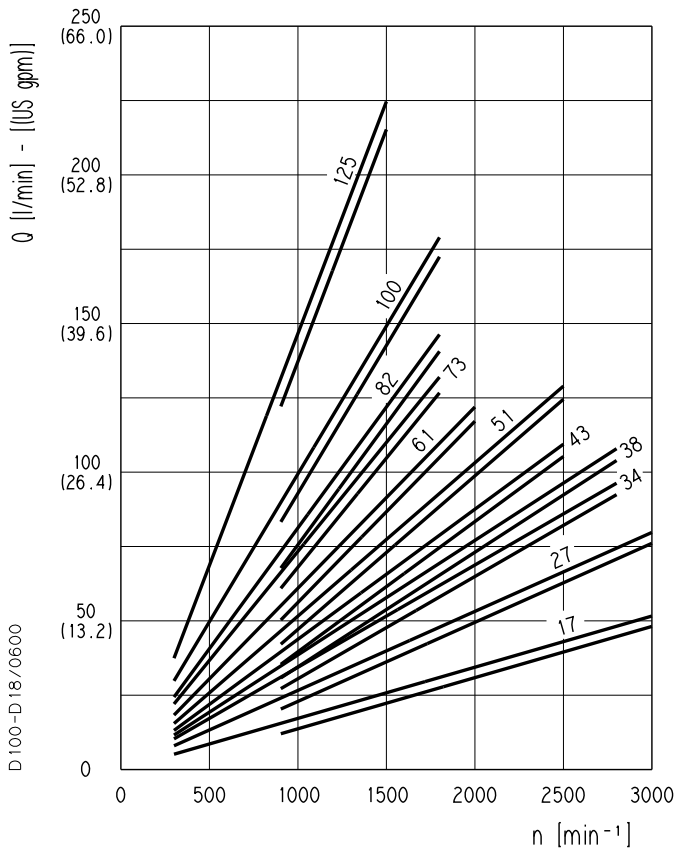


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FORMULA 30 GEAR PUMPS PERFORMANCE CURVES

FP 30

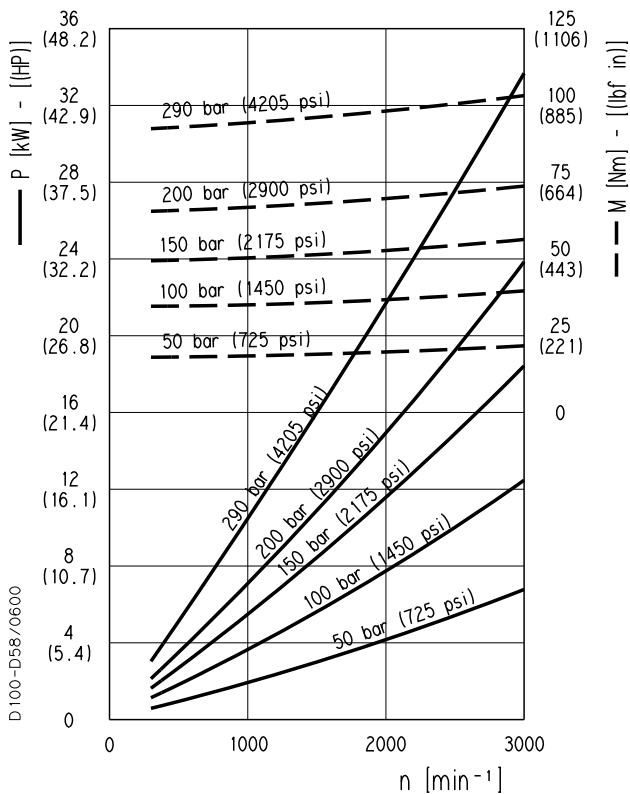
FP 30



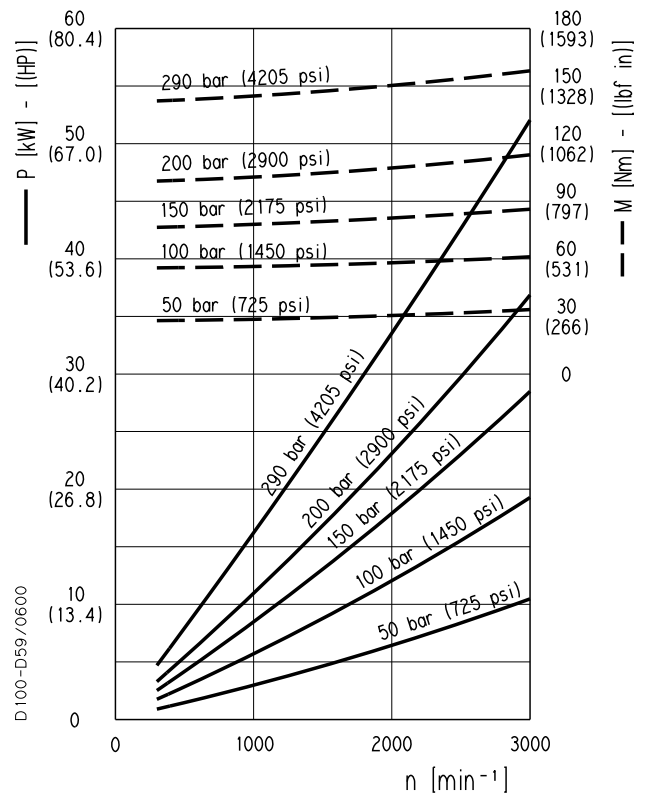
Each curve has been obtained at 122 °F (50 °C), using oil with viscosity 168 SSU (36 cSt) at 104 °F (40 °C) and at these pressures:

- FP 30•17 290-4205 psi (20-290 bar)
- FP 30•27 290-4205 psi (20-290 bar)
- FP 30•34 290-4060 psi (20-280 bar)
- FP 30•38 290-4060 psi (20-280 bar)
- FP 30•43 290-3915 psi (20-270 bar)
- FP 30•51 290-3480 psi (20-240 bar)
- FP 30•61 290-3190 psi (20-220 bar)
- FP 30•73 290-2900 psi (20-200 bar)
- FP 30•82 290-2755 psi (20-190 bar)
- FP 30•100 290-2610 psi (20-180 bar)
- FP 30•125 290-2320 psi (20-160 bar)

FP 30•17



FP 30•27

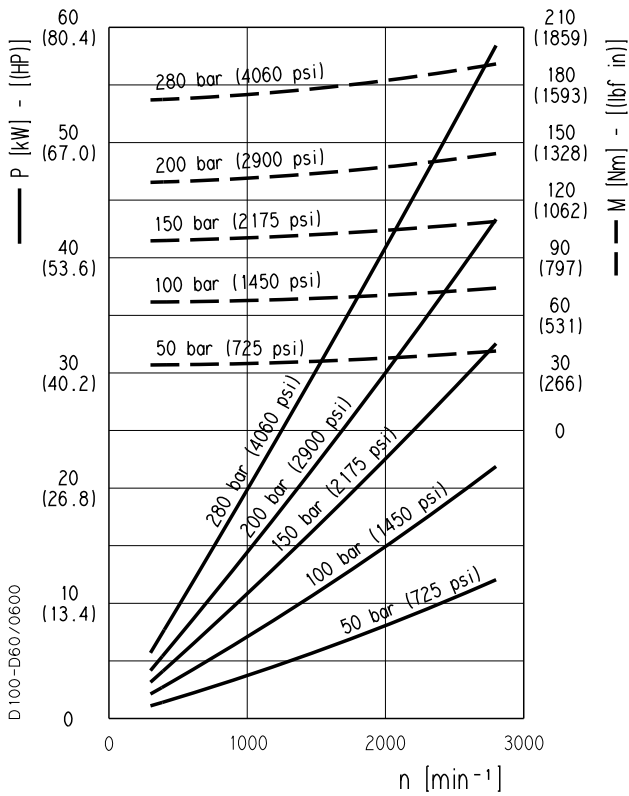


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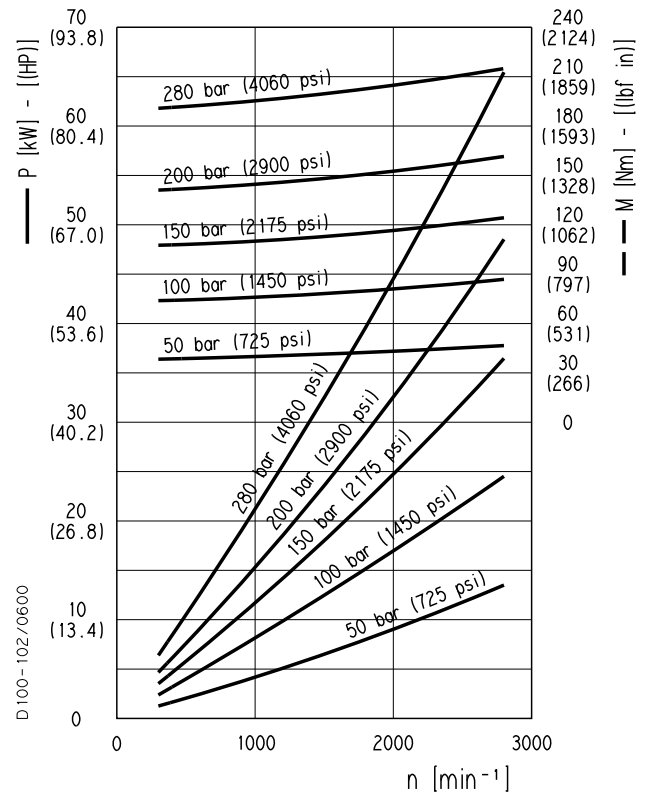
FORMULA 30 GEAR PUMPS PERFORMANCE CURVES

FP 30

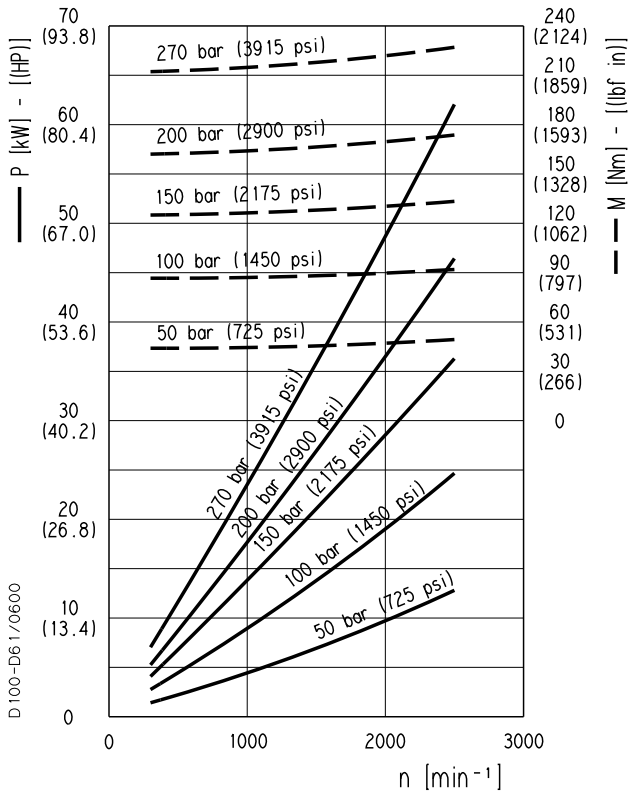
FP 30•34



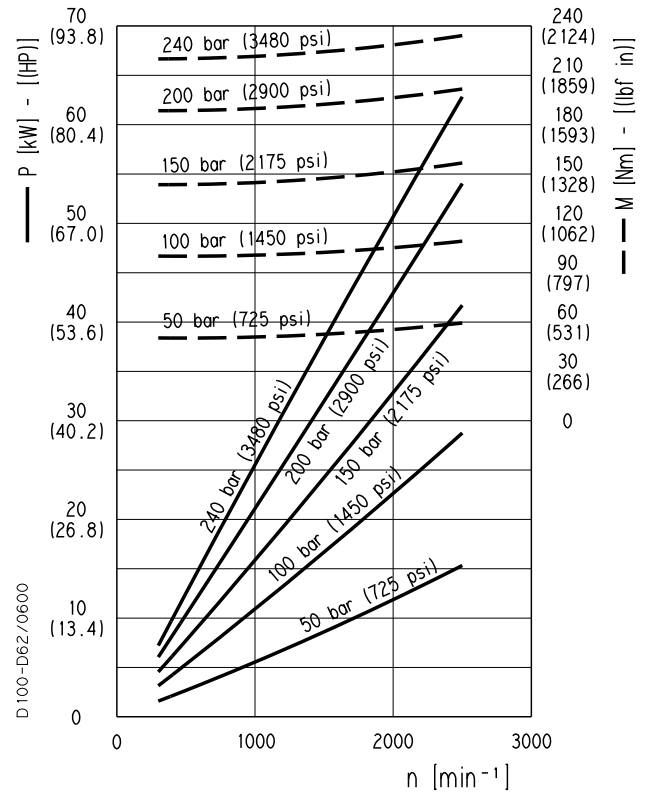
FP 30•38



FP 30•43



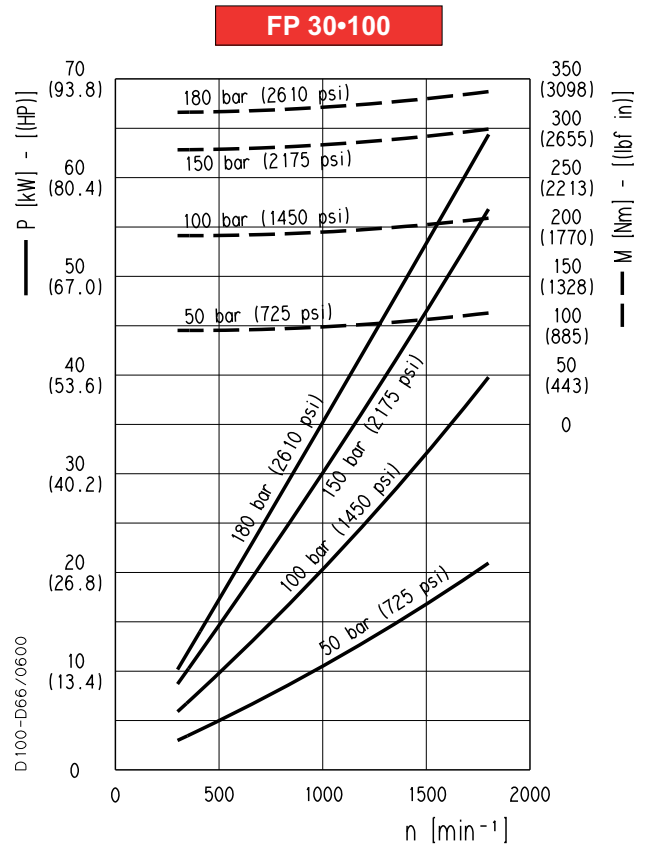
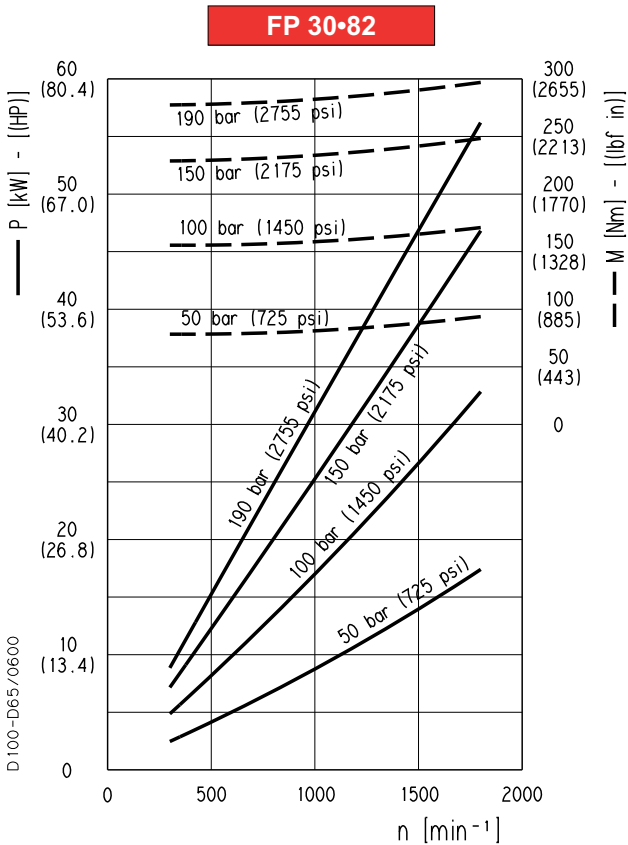
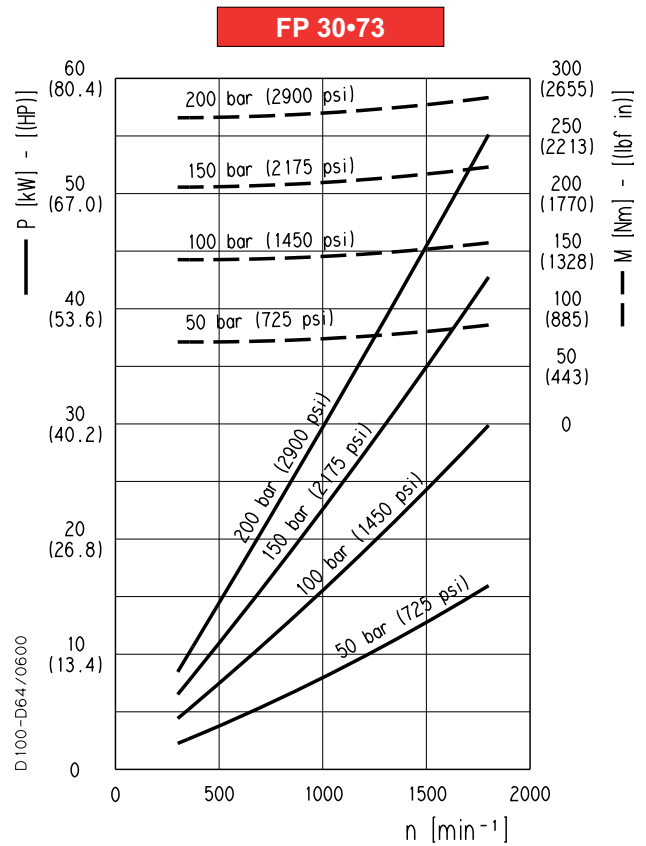
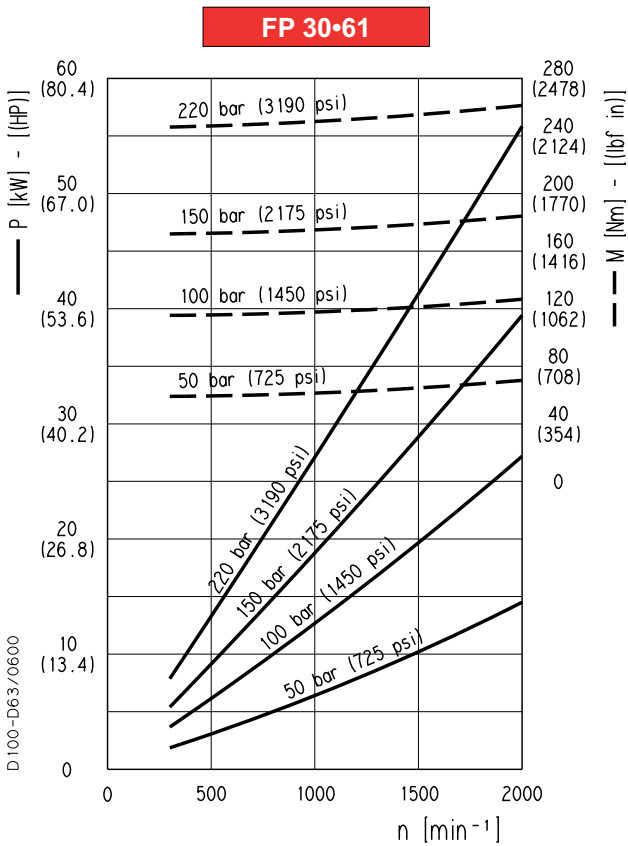
FP 30•51



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FORMULA 30 GEAR PUMPS PERFORMANCE CURVES

FP 30

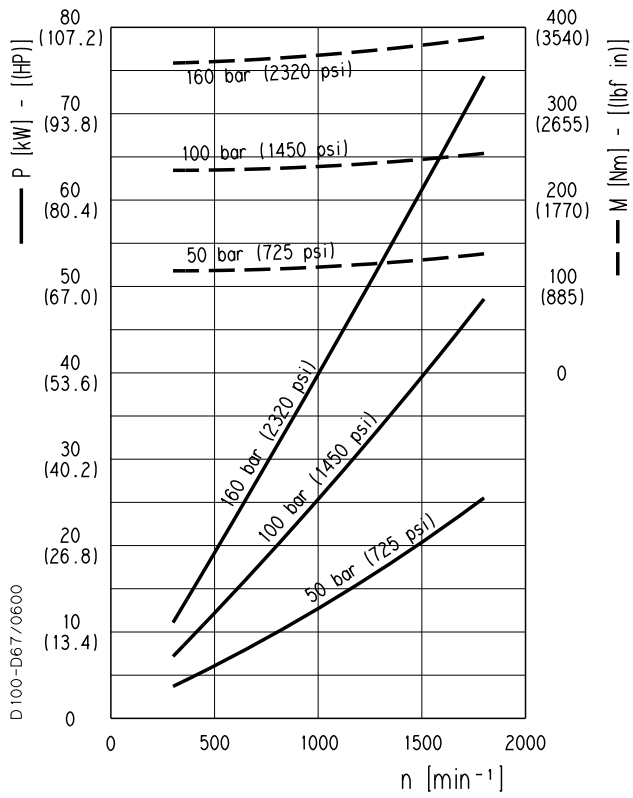


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FORMULA 30 GEAR PUMPS PERFORMANCE CURVES

FP 30

FP 30•125

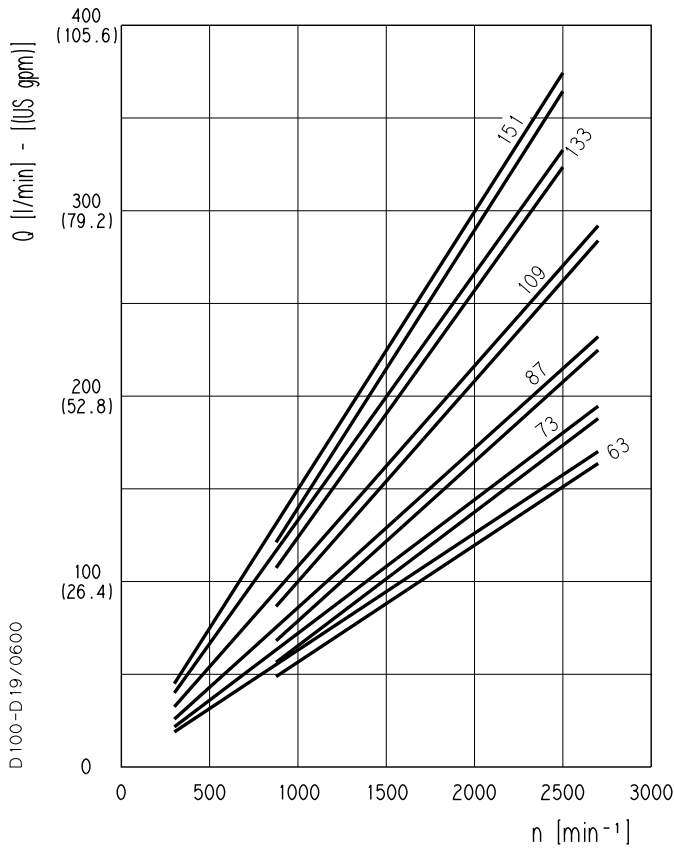


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FORMULA 40 GEAR PUMPS PERFORMANCE CURVES

FP 40

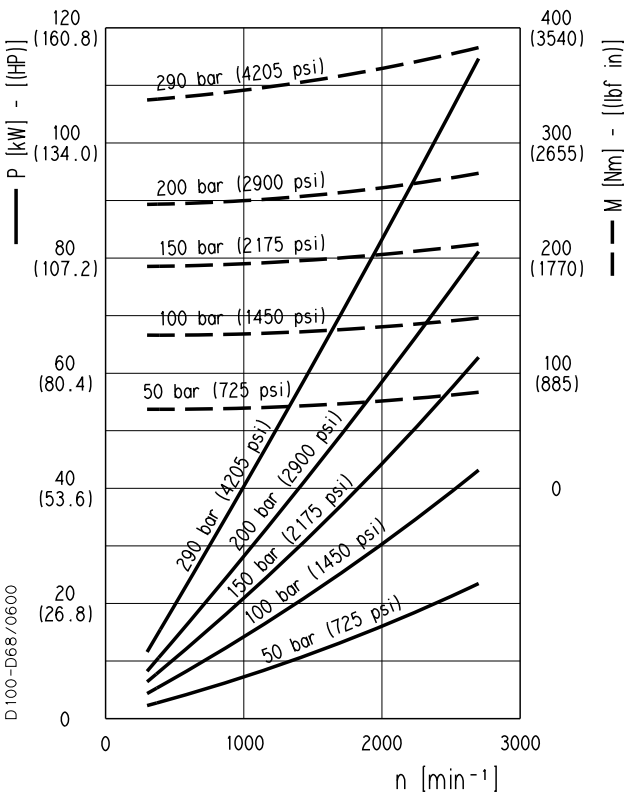
FP 40



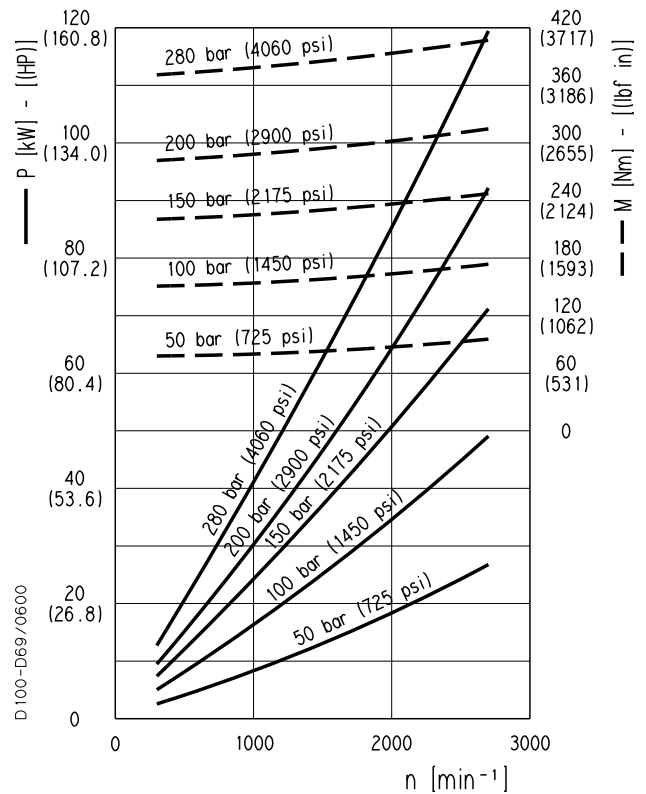
Each curve has been obtained at 122 °F (50 °C), using oil with viscosity 168 SSU (36 cSt) at 104 °F (40 °C) and at these pressures:

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- FP 40•73 290-4060 psi (20-280 bar)
- FP 40•87 290-3770 psi (20-260 bar)
- FP 40•109 290-3480 psi (20-240 bar)
- FP 40•133 290-3190 psi (20-220 bar)
- FP 40•151 290-2610 psi (20-180 bar)

FP 40•63



FP 40•73

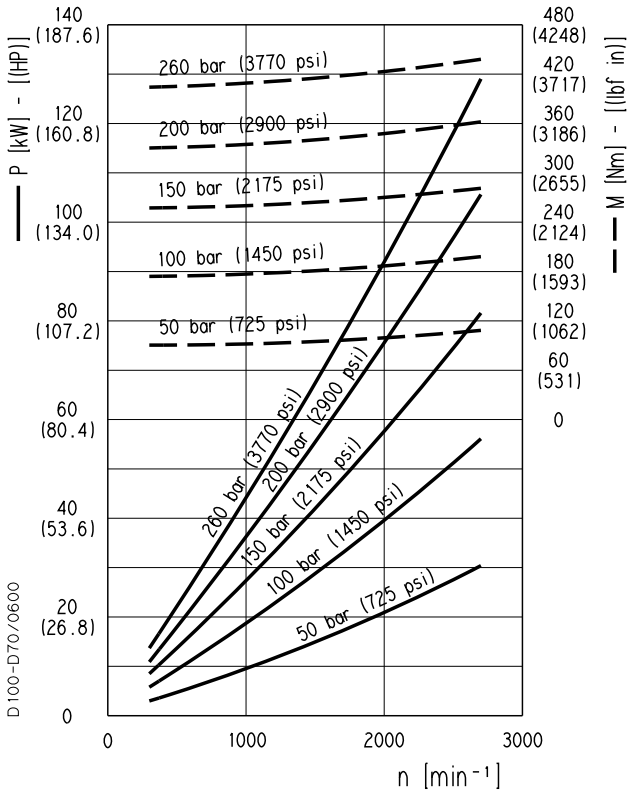


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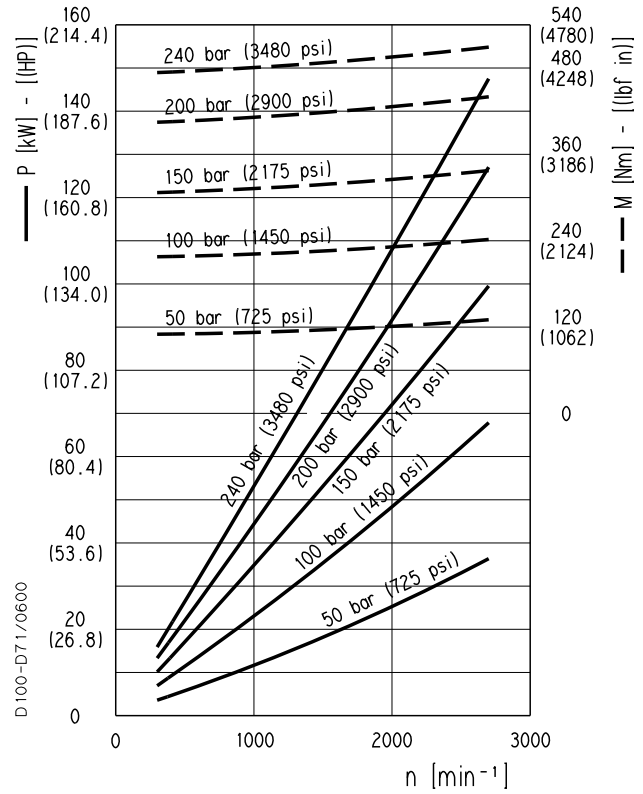
FORMULA 40 GEAR PUMPS PERFORMANCE CURVES

FP 40

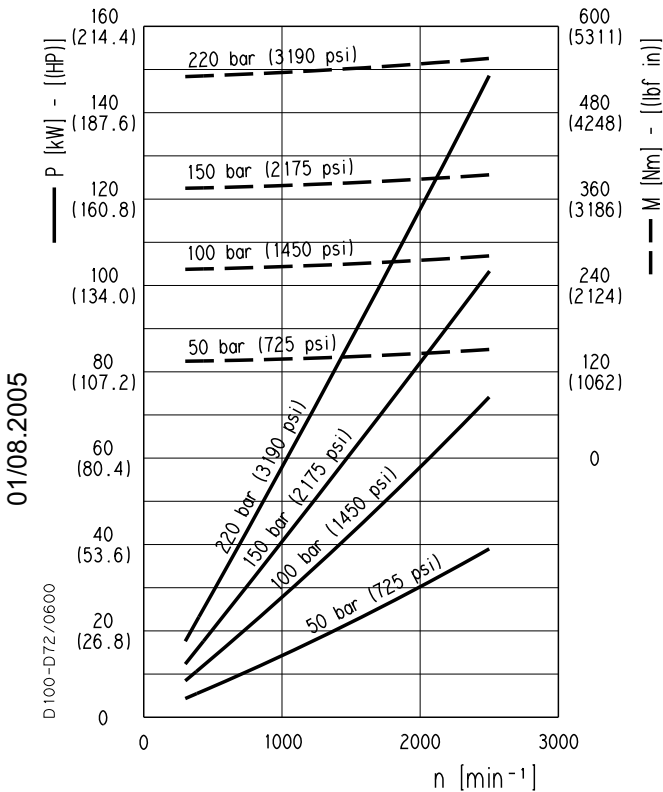
FP 40•87



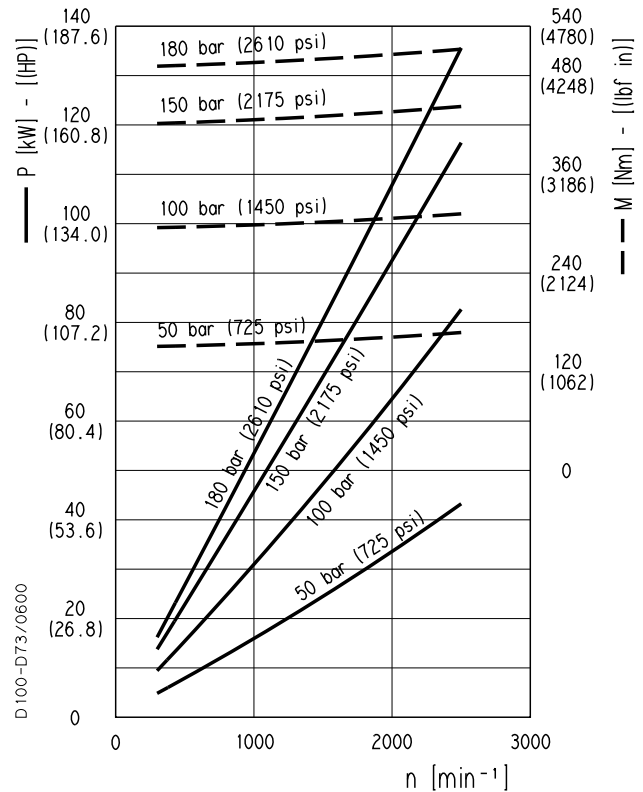
FP 40•109



FP 40•133

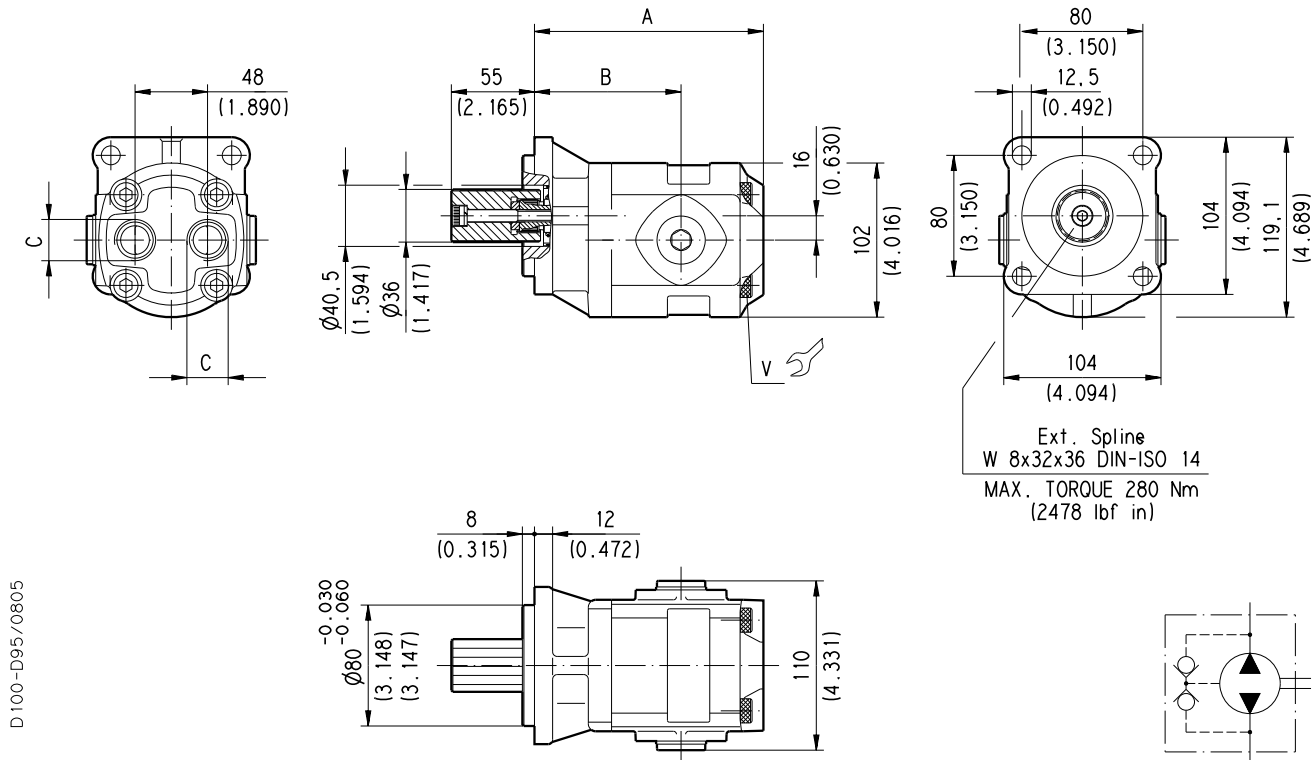


FP 40•151



GAS STRAIGHT THREAD PORTS

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



D 100-D95/0605

Radial and/or axial load are not allowed.

Standard version pumps have reversible rotation and internal drain.

The drawing shows the version with rear ports.

Removing the lateral plugs all possible combination ports are allowed.

V Tightening torque Nm (lbf in)
70 ±7 (558 ± 682)

Pump type	A	B	C	Mass
	mm (in)	mm (in)		kg (lbs)
FP 20•8	104 (4.094)	80 (3.150)	G 1/2	5,31 (11.71)
FP 20•11,2	107,5 (4.232)	83,5 (3.287)		5,70 (12.57)
FP 20•16	117 (4.606)	87,5 (3.445)		6,00 (13.23)
FP 20•20	123,5 (4.862)	94 (3.701)		6,35 (14.00)
FP 20•25	131,5 (5.177)	87 (3.425)	G 3/4	6,80 (14.99)
FP 20•31,5	141,5 (5.571)	97 (3.819)		7,18 (15.83)
FP 20•36	146,4 (5.764)	91,4 (3.598)		7,44 (16.41)
FP 20•40	151,5 (5.965)	97 (3.819)		7,80 (17.20)

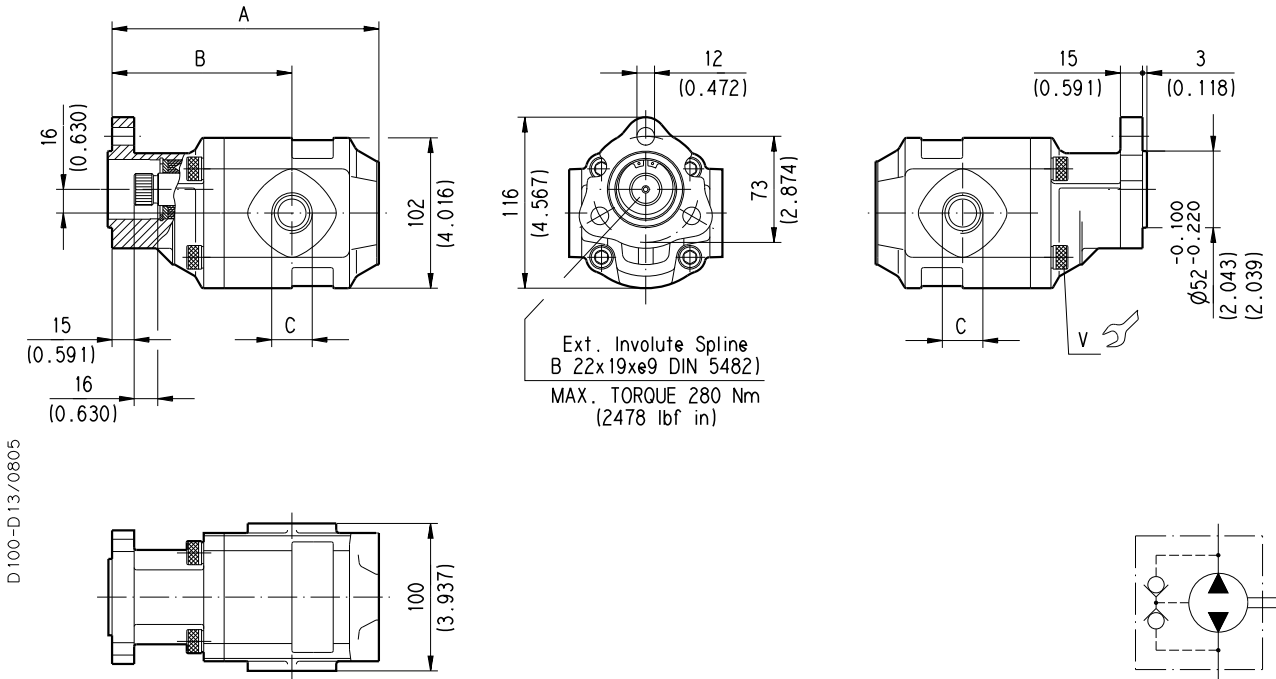
01/08.2005

How to order:

FP 20•8 B0 - 16 Z0 - LP GD/GD - N

GAS STRAIGHT THREAD PORTS

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



D 100-D13/0805

Standard version pumps have reversible rotation and internal drain.

V Tightening torque Nm (lbf in)
70 ^{±7} (558 ÷ 682)

01/08.2005

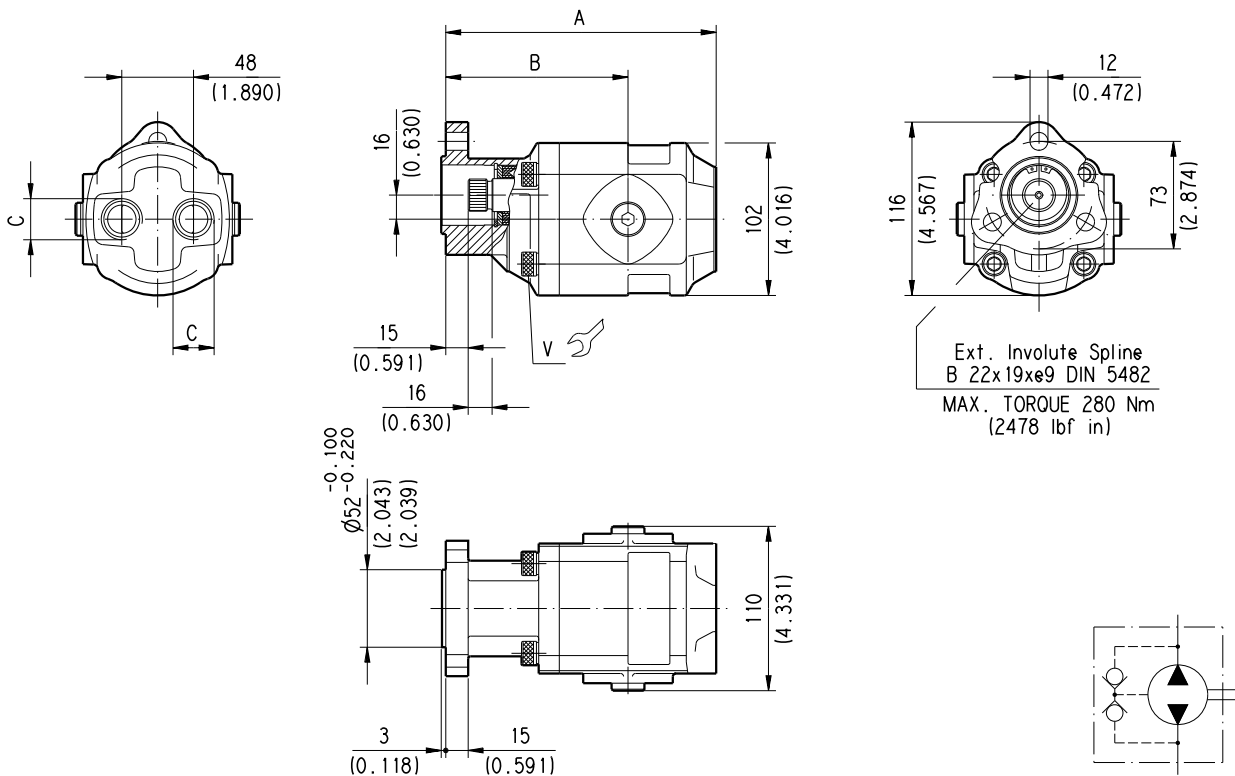
Pump type	A	B	C	Mass
	mm (in)	mm (in)		kg (lbs)
FP 20•8	B0-13 T1-L GD/GD-N	132,5 (5.217)	G 1/2	4,8 (10.58)
FP 20•11,2		136 (5.354)		5 (11.03)
FP 20•16		145,5 (5.728)		5,2 (11.47)
FP 20•20		152 (5.984)		5,3 (11.69)
FP 20•25	B0-13 T1-L GE/GE-N	160 (6.299)	G 3/4	5,9 (13.01)
FP 20•31,5		170 (6.693)		6 (13.23)
FP 20•36		175,5 (6.909)		6,3 (13.89)
FP 20•40		181 (7.126)		6,6 (14.55)

How to order:

FP 20•8 B0 - 13 T1 - L GD/GD - N

GAS STRAIGHT THREAD PORTS

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



D 100-D47/0805

Standard version pumps have reversible rotation and internal drain.

The version with rear ports allow, removing the lateral plugs all possible combination ports.

V Tightening torque Nm (lbf in)
70 ±7 (558 ± 682)

Pump type	A	B	C	Mass
	mm (in)	mm (in)		kg (lbs)
FP 20•8	129 (5.079)	105 (4.134)	G 1/2	4,8 (10.58)
FP 20•11,2	132,5 (5.217)	108,5 (4.272)		5 (11.03)
FP 20•16	142 (5.591)	112,5 (4.429)		5,2 (11.47)
FP 20•20	148,5 (5.846)	119 (4.685)		5,3 (11.69)
FP 20•25	156,5 (6.161)	112 (4.409)	G 3/4	5,9 (13.01)
FP 20•31,5	166,5 (6.555)	122 (4.803)		6 (13.23)
FP 20•36	172,5 (6.791)	116,5 (4.587)		6,3 (13.89)
FP 20•40	178 (7.008)	122 (4.803)		6,6 (14.55)

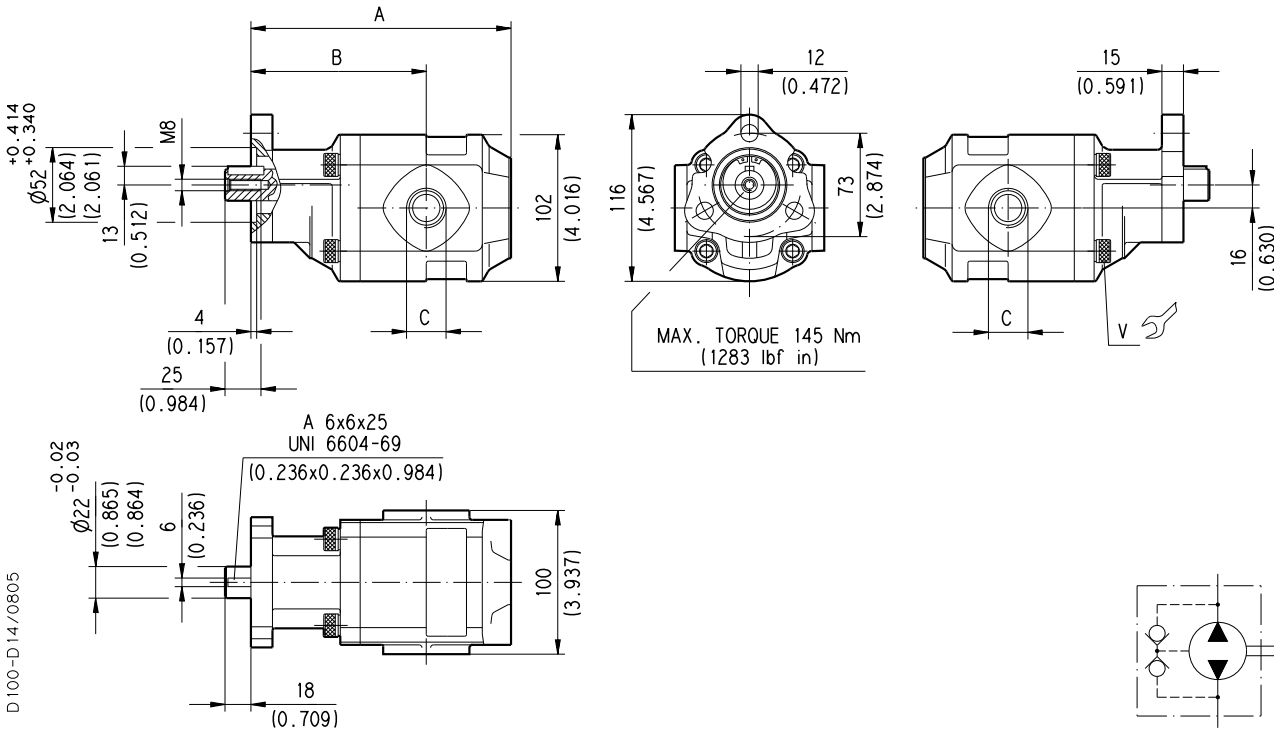
01/08.2005

How to order:

FP 20•11,2 B0 - 13 T1 - P GD/GD - N

GAS STRAIGHT THREAD PORTS

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



Standard version pumps have reversible rotation and internal drain.

V Tightening torque Nm (lbf in)
70 ^{±7} (558 ÷ 682)

01/08.2005

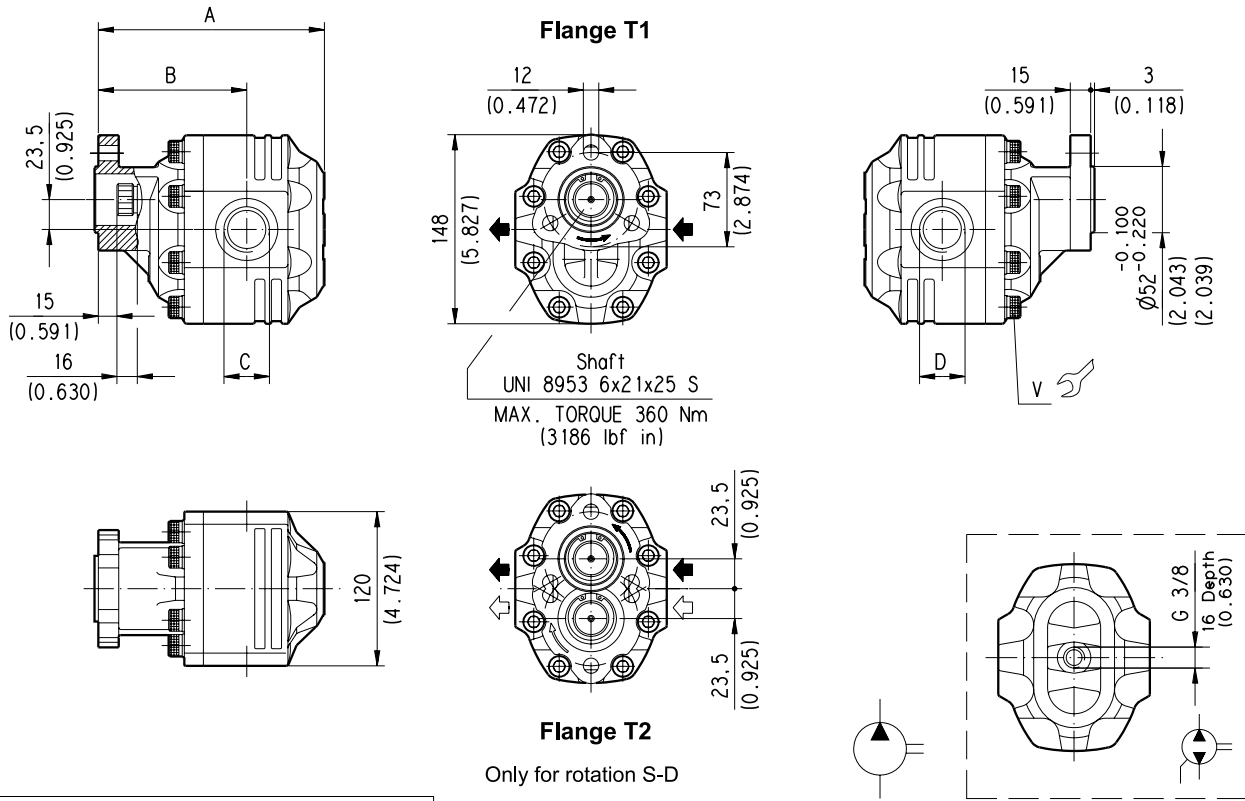
Pump type	A	B	C	Mass
	mm (in)	mm (in)		kg (lbs)
FP 20•16	145,5 (5.728)	112,5 (4.429)	G 1/2	5,2 (11.47)
FP 20•20				5,3 (11.69)
FP 20•25	160 (6.299)	112 (4.409)	G 3/4	5,9 (13.01)
FP 20•31,5				6 (13.23)
FP 20•40				6,6 (14.55)

How to order:

FP 20•16 B0 - 43 T0 - L GD/GD - N

GAS STRAIGHT THREAD PORTS

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



D100-1113/0805

01/08.2005

V Tightening torque Nm (lbf in)
70 ±7 (558 ± 682)

Pump type			A	B	C	D	Mass			
			mm (in)	mm (in)	IN	OUT	kg (lbs)			
S D R B	0-19	T1	L GD/GD-N	150,5 (5.925)	100,5 (3.957)	G 1/2	G 1/2	9 (19.85)		
			L GE/GE-N	156,5 (6.161)	106,5 (4.193)	G 3/4	G 3/4	9,3 (20.51)		
				161,5 (6.358)	106,5 (4.193)			9,6 (21.17)		
				164,5 (6.476)	109,5 (4.311)			9,8 (21.61)		
				167,5 (6.594)	112,5 (4.429)			10 (22.05)		
				T2	L GF/GF-N			172,5 (6.791)	110,5 (4.350)	G 1
		L GG/GF-N	178,5 (7.028)		116,5 (4.587)	10,7 (23.59)				
			186,5 (7.343)		117,5 (4.623)	10,9 (24.03)				
			L GG/GF-N		191,5 (7.539)	122,5 (4.823)	11 (24.26)			
		L GG/GG-N	217 (8.543)		136 (5.354)	G 1 1/4	G 1 1/4	11,5 (25.36)		
			233 (9.173)		152 (5.984)			12,3 (27.12)		

Rotation: S=left - D=right - R=reversible - B=reversible internal drain

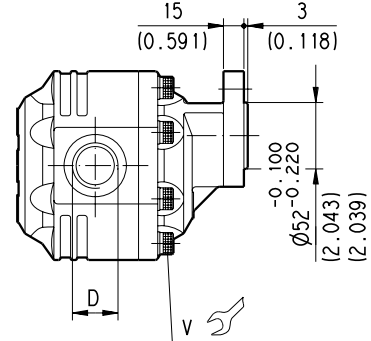
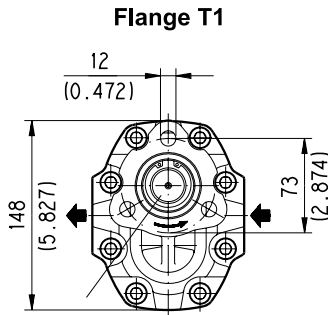
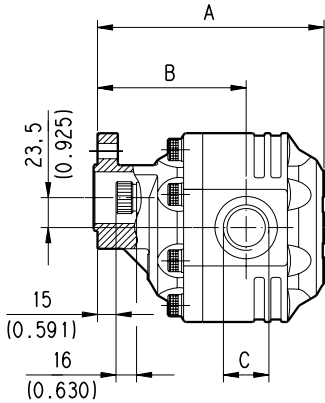
(●) Only available in T1 version.

How to order:

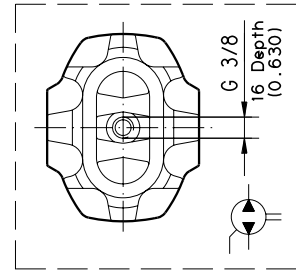
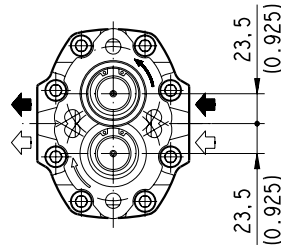
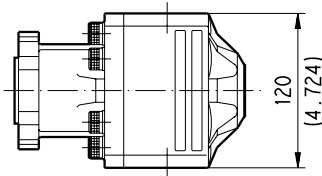
FP 30•17 S0 - 19 T1 - L GD/GD - N

GAS STRAIGHT THREAD PORTS

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



External Involute Spline
B 22x19xe9 DIN 5482
MAX. TORQUE 280 Nm
(2478 lbf in)



D100-D39/0805

V Tightening torque Nm (lbf in)

70 ±7 (558 ± 682)

01/08.2005

Pump type				A	B	C	D	Mass	
				mm (in)	mm (in)	IN	OUT	kg (lbs)	
FP 30•61	S D R B	0-13	T1	L GF/GF-N	178,5 (7.028)	116,5 (4.587)	G 1	G 1	10,7 (23.59)
FP 30•82			T2	L GG/GF-N	191,5 (7.539)	122,5 (4.823)	G 1 1/4		11 (24.26)

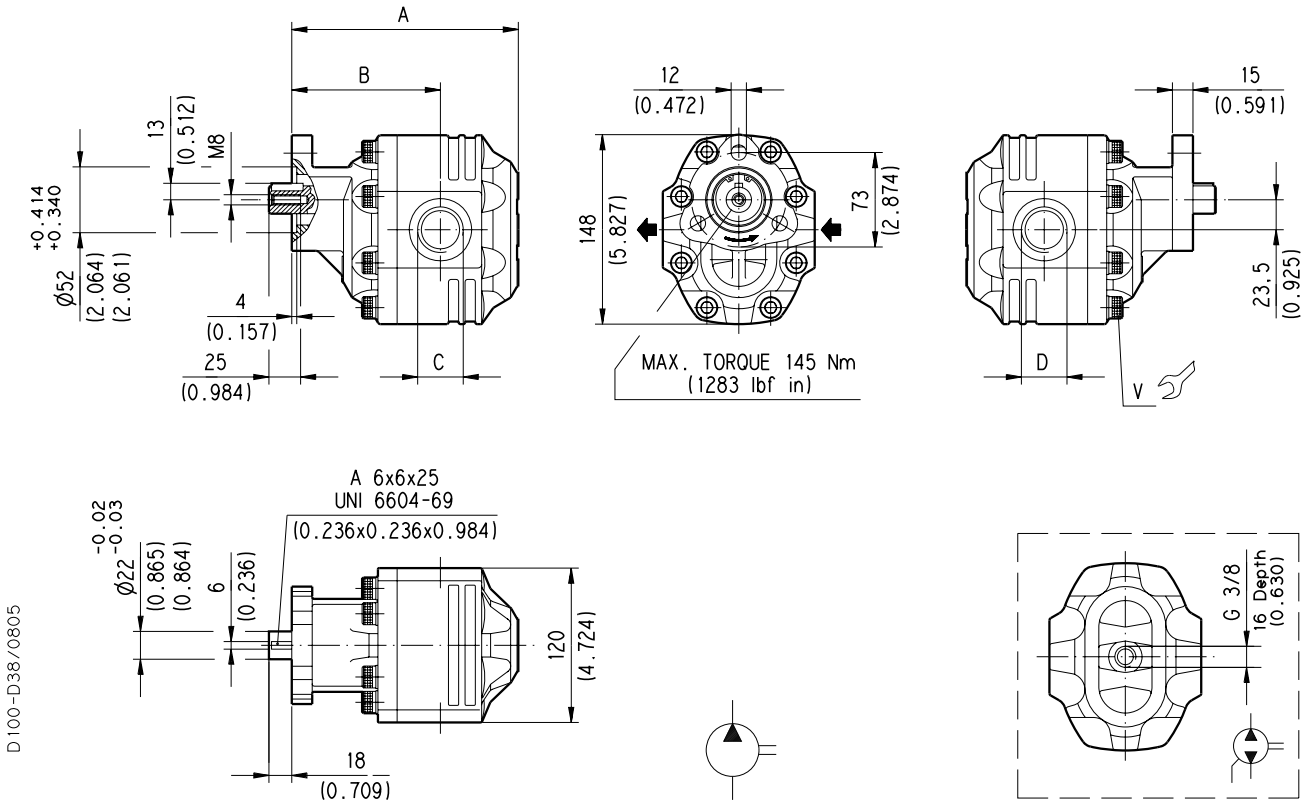
Rotation: S=left - D=right - R=reversible - B=reversible internal drain

How to order:

FP 30•61 S0 - 13 T1 - L GF/GF - N

GAS STRAIGHT THREAD PORTS

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



D 100-D38/0805

V Tightening torque Nm (lbf in)
70 ±7 (558 ± 682)

Pump type			A	B	C	D	Mass
			mm (in)	mm (in)	IN	OUT	kg (lbs)
FP 30•61	S D	0-43 T0-L GF/GF-N	178,5 (7.028)	116,5 (4.587)	G 1	G 1	10,7 (23.59)
		0-43 T0-L GG/GF-N	191,5 (7.539)	122,5 (4.823)	G 1 1/4		11 (24.26)

Rotation: S=left - D=right - R=reversible - B=reversible internal drain

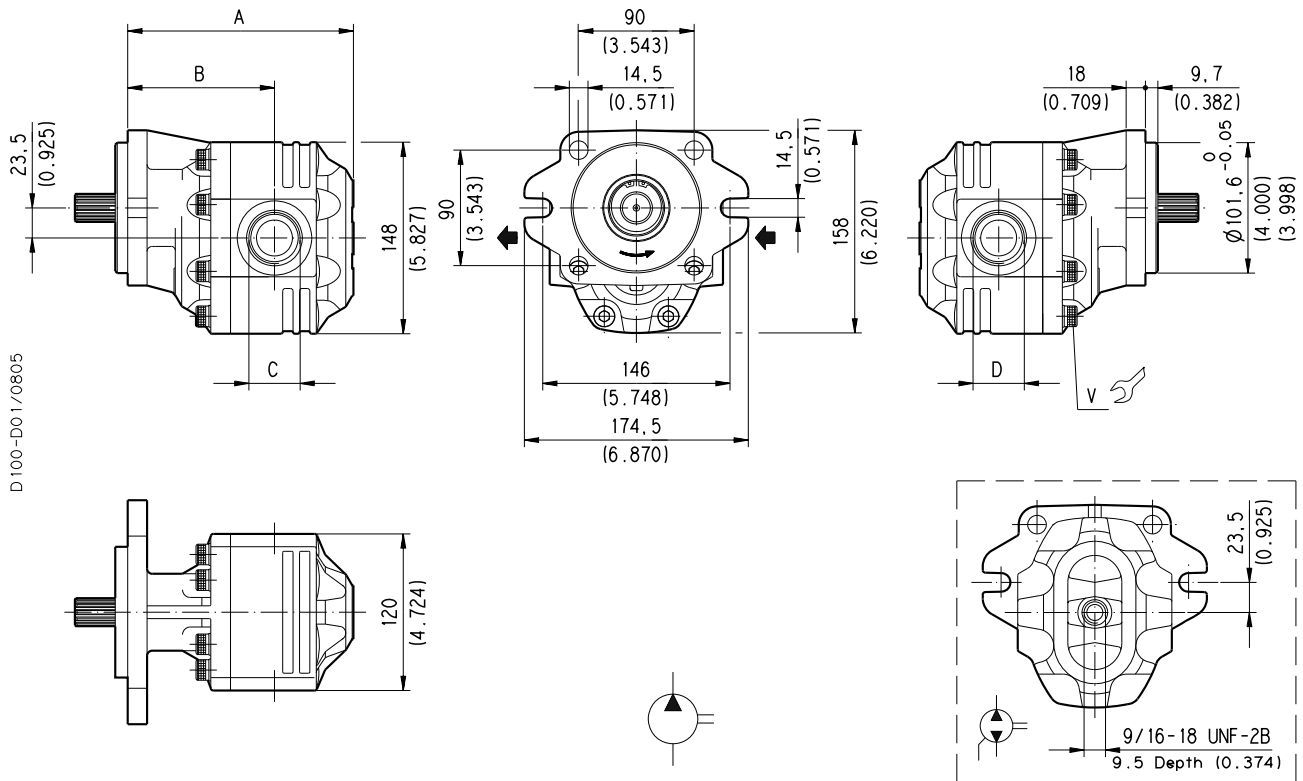
How to order:

FP 30•61 S0 - 43 T0 - L GF/GF - N

01/08.2005

SAE STRAIGHT THREAD PORTS J514

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



To order see page 26 - 28

V Tightening torque Nm (lbf in)
70 ±7 (558 ÷ 682)

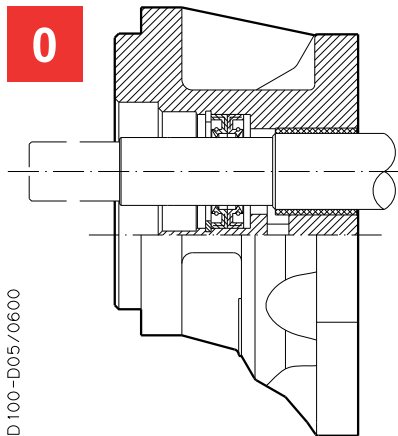
01/08.2005

Pump type	A	B	C	D	Ports code		Mass
	mm (in)	mm (in)	IN	OUT	IN	OUT	kg (lbs)
FP 30•17 (•)	148 (5.827)	98 (3.858)	3/4-16 UNF-2B	3/4-16 UNF-2B	OB	OB	10,4 (22.93)
FP 30•27	154 (6.063)	104 (4.094)	1-1/16-12 UN-2B	1-1/16-12 UN-2B	OD	OD	10,8 (23.81)
FP 30•34	159 (6.260)	104 (4.094)					11,3 (24.92)
FP 30•38	162 (6.378)	107 (4.213)					11,5 (25.36)
FP 30•43	165 (6.496)	110 (4.331)	1-5/16-12 UN-2B	1-3/16-12 UN-2B	OF	OE	11,8 (26.02)
FP 30•51	170 (6.693)	108 (4.252)					12 (26.46)
FP 30•61	176 (6.929)	114 (4.488)	1-5/8-12 UN-2B	1-5/16-12 UN-2B	OG	OF	13 (28.67)
FP 30•73	184 (7.244)	115 (4.528)					13,4 (29.55)
FP 30•82	189 (7.441)	120 (4.724)					13,9 (30.65)

(•) Only available in version 2.

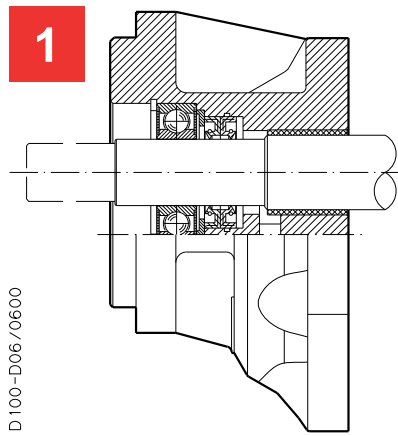
FORMULA 30 SAE VERSION

SAE



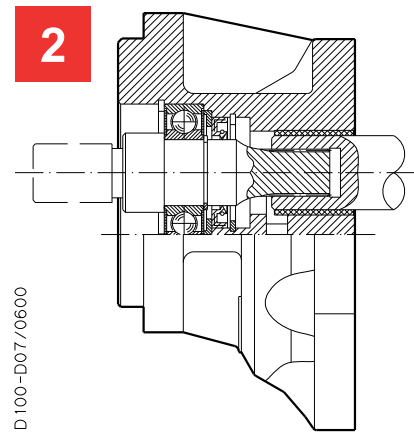
D 100-D05/0600

Version for applications without radial and axial load on the drive shaft.



D 100-D06/0600

Version for applications with low radial load and without axial load on the drive shaft.



D 100-D07/0600

Special version with independent shaft for applications with low radial load and without axial load on the drive shaft.

FORMULA 30 SAE END DRIVE SHAFTS

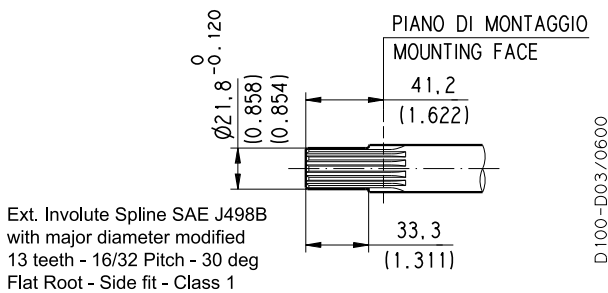
SAE

SAE "B" SPLINE

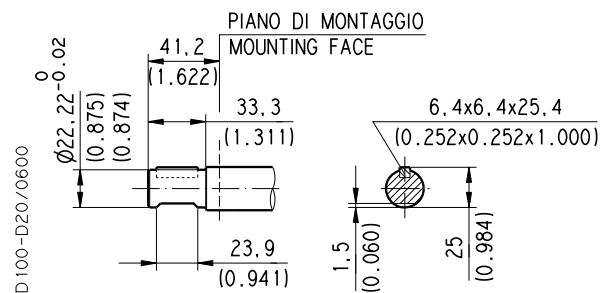
04

SAE "B" STRAIGHT

32



MAX 330 Nm (2921 lbf in) ◆



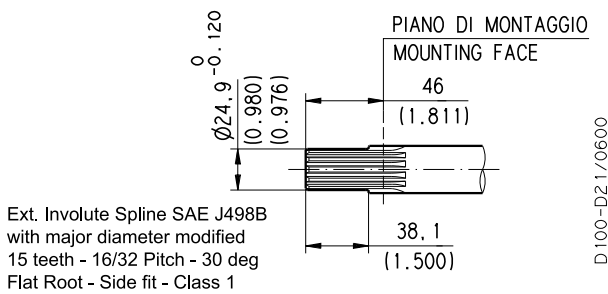
MAX 200 Nm (1770 lbf in) ◆

SAE "BB" SPLINE

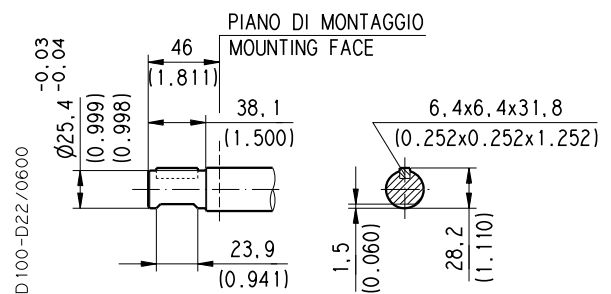
05

SAE "BB" STRAIGHT

33



MAX 500 Nm (4426 lbf in) ◆



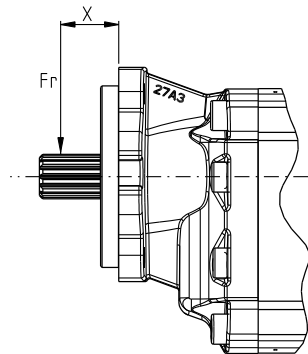
MAX 280 Nm (2478 lbf in) ◆

◆ For "2" version whichever end shaft, the max. torque applicable is M= 170 Nm (1505 lbf in)

01/08.2005

FORMULA 30 PERMISSIBLE RADIAL LOADING

SAE



X = Distance of the radial load result from the mounting flange.

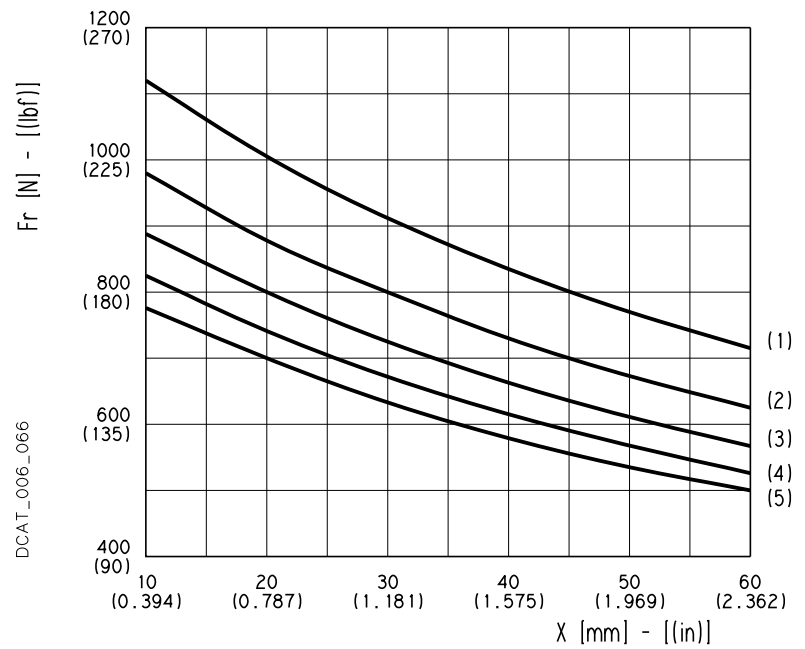
Fatigue life (hours) $L_n = 1000$ [h]

Each curve has been obtained at:

- (1) 1000 min^{-1} (4) 2500 min^{-1}
- (2) 1500 min^{-1} (5) 3000 min^{-1}
- (3) 2000 min^{-1}

VERSION

1 - 2



01/08.2005

HOW TO ORDER SINGLE PUMPS

1	2	3		4	5		6	7		8
Pump type	Rotation	Version	-	Drive shaft	Mounting flange	-	Ports position	Ports IN/OUT	-	Seals
FP30•17	S	0	-	04	S3	-	L	OD/OD	-	N

1	Pump Type	CODE
	in ³ /rev (cm ³ /rev)	
	1.05 (17,28) - (a)	FP 30•17
	1.63 (26,70)	FP 30•27
	2.11 (34,56)	FP 30•34
	2.40 (39,27)	FP 30•38
	2.68 (43,98)	FP 30•43
	3.16 (51,83)	FP 30•51
	3.74 (61,26)	FP 30•61
	4.50 (73,82)	FP 30•73
	4.98 (81,68)	FP 30•82

2	Rotation	CODE
	Left	S
	Right	D
	Reversible	R
	Reversible with internal drain	B

3	Version	CODE
	Without outboard bearing	0
	With outboard bearing	1
	With outboard bearing and indep. shaft	2

4	Drive shaft	CODE
	SAE "B" spline (13 teeth)	04
	SAE "B" straight	32
	SAE "BB" spline (15 teeth)	05
	SAE "BB" straight	33

5	Mounting flange	CODE
	SAE "B" 2-4 holes	S3

(a) Only available in version 2

CODE	Ports position	6
L	Side	

CODE	Ports IN/OUT	7
SAE STRAIGHT THREAD PORTS (ODT)		
	Side	Pump type
OB/OB		FP 30•17
OD/OD		FP 30•27
OD/OD		FP 30•34
OD/OD		FP 30•38
OF/OD		FP 30•43
OF/OE		FP 30•51
OF/OE		FP 30•61
OG/OF		FP 30•73
OG/OF		FP 30•82

CODE	Seals (b)	8
N	Buna N (standard)	
V	Viton	
N Bz	Buna N and Bronze thrust plates	
V Bz	Viton and Bronze thrust plates	

(b) Choose the seals according to the temperature shown on page 1

ORDER EXAMPLE

Standard pump

FP 30•27 S0 - 04 S3 - L OD/OD - N

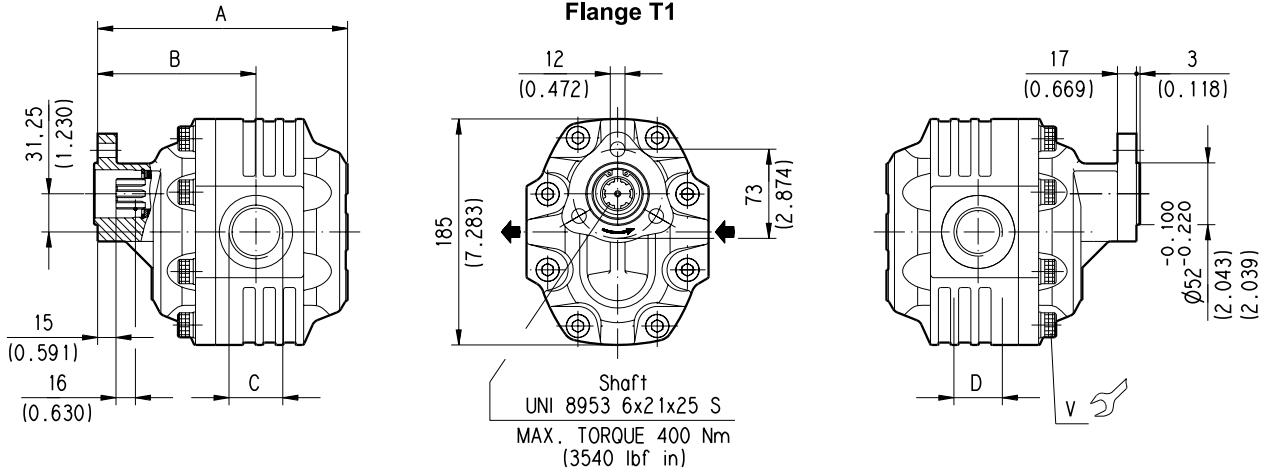
Special version pump

FP 30•17 S2 - 32 S3 - L OB/OB - V Bz

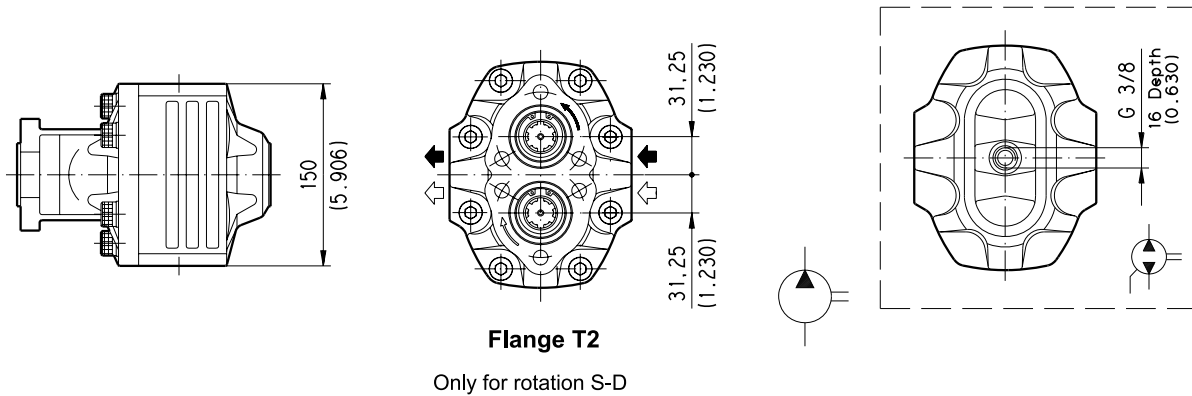
GAS STRAIGHT THREAD PORTS

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

Flange T1



D 100-D10/0805



V Tightening torque Nm (lbf in)
100 ±10 (797 ÷ 974)

Pump type				A	B	C	D	Mass	
				mm (in)	mm (in)	IN	OUT	kg (lbs)	
FP 40•63	S D R B	0-19	T1	L GF/GE-N	187,5 (7.382)	119,5 (4.705)	G 1	G 3/4	16,1 (35.50)
FP 40•73					191,5 (7.539)	123,5 (4.862)			16,5 (36.38)
FP 40•87			T2	L GG/GF-N	G 1 1/4	196,5 (7.736)	128,5 (5.059)	G 1	17 (37.49)
FP 40•109						204,5 (8.051)	129,5 (5.098)		18 (39.69)
FP 40•133					G 1 1/2	L GH/GF-N	213,5 (8.406)	138,5 (5.453)	19,5 (43.00)
FP 40•151							219,5 (8.642)	144,5 (5.689)	20 (44.10)

01/08.2005

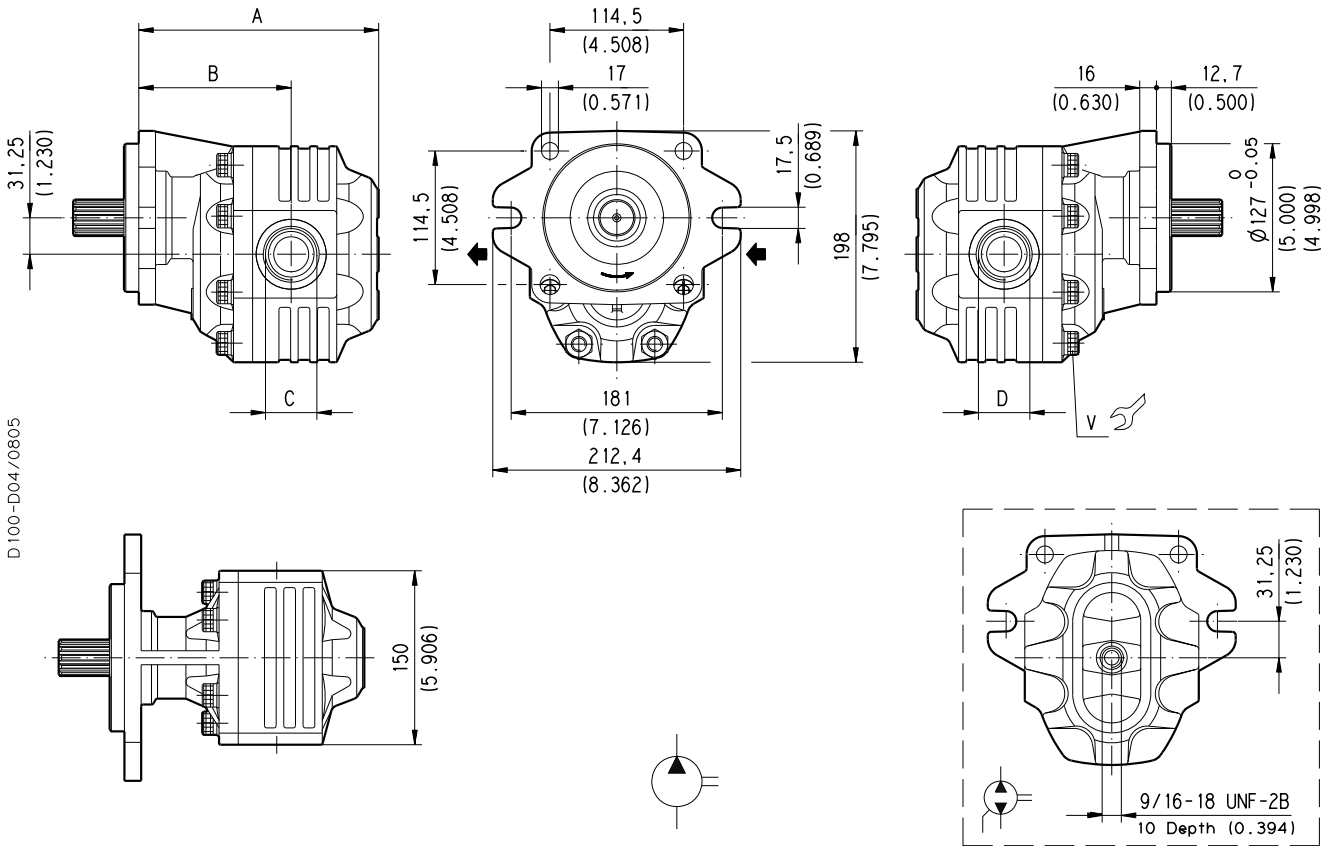
Rotation: S=left - D=right - R=reversible - B=reversible internal drain

How to order:

FP 40•63 S0 - 19 T1 - L GF/GE - N

SAE STRAIGHT THREAD PORTS J514

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



To order see page 32 - 35

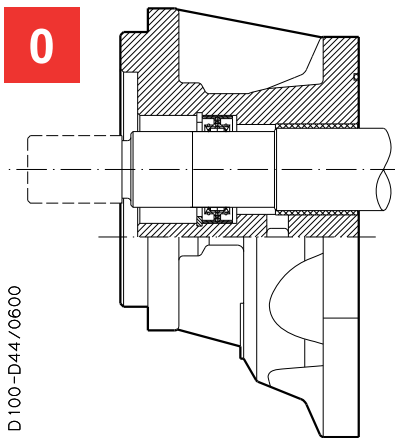
V Tightening torque Nm (lbf in)
100 ±10 (797 ÷ 974)

01/08.2005

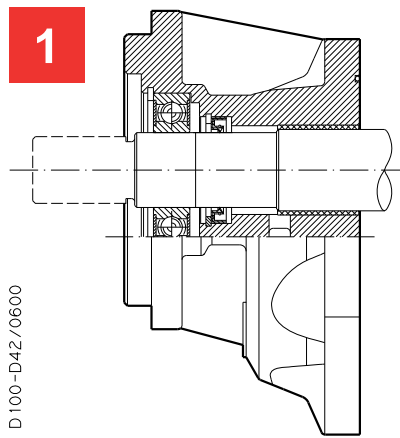
Pump type	A	B	C	D	Ports code		Mass
	mm (in)	mm (in)	IN	OUT	IN	OUT	kg (lbs)
FP 40•63	188,5 (7.421)	120,5 (4.744)	1-5/16-12 UN-2B	1-1/16-12 UN-2B	OF	OD	19,5 (43.00)
FP 40•73	192,5 (7.579)	124,5 (4.902)					20 (44.10)
FP 40•87	197,5 (7.776)	129,5 (5.098)	1-5/8-12 UN-2B	1-5/16-12 UN-2B	OG	OF	20,5 (45.20)
FP 40•109	205,5 (8.091)	130,5 (5.138)					21 (46.31)
FP 40•133	214,5 (8.445)	139,5 (5.492)	1-7/8-12 UN-2B		OH		23 (50.72)
FP 40•151	220,5 (8.681)	145,5 (5.728)					25 (55.13)

FORMULA 40 SAE VERSION

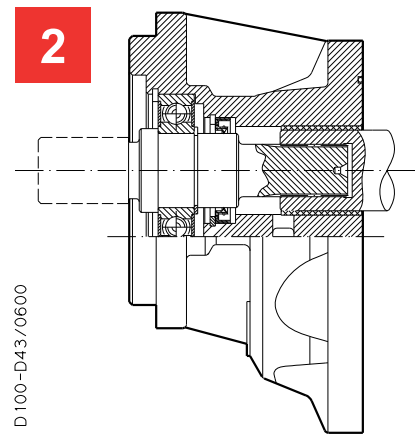
SAE



Version for applications without radial and axial load on the drive shaft.



Version for applications with low radial load and without axial load on the drive shaft.



Special version with independent shaft for applications with low radial load and without axial load on the drive shaft.

FORMULA 40 SAE END DRIVE SHAFTS

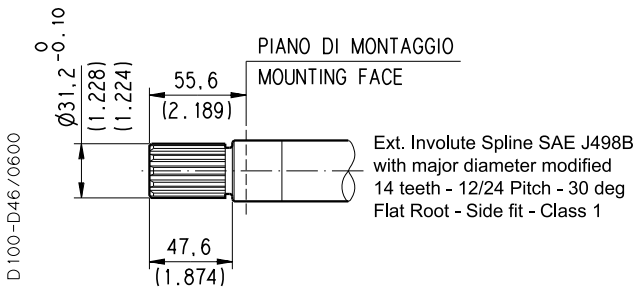
SAE

SAE "C" SPLINE

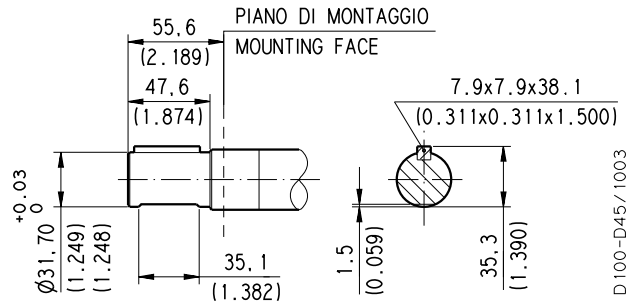
06

SAE "C" STRAIGHT

34



MAX 900 Nm (7966 lbf in) ◆



MAX 600 Nm (5311 lbf in) ◆

◆ For "2" version whichever end shaft, the max. torque applicable is M= 170 Nm (1505 lbf in)

PUMP - VERSION - SHAFT AVAILABILITY TABLE

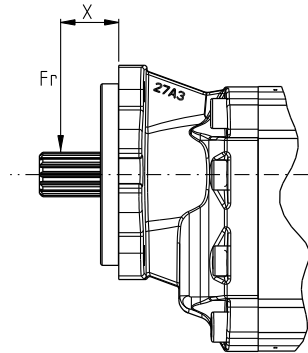
SAE

Pump type	VERSION			SHAFT
	0	1	2	
FP 40•63	06	06	06 - 34	
FP 40•73	06 - 34	06 - 34	06 - 34	
FP 40•87	06 - 34	06 - 34	06 - 34	
FP 40•109	06	06	06 - 34	
FP 40•133	06 - 34	06 - 34	06 - 34	
FP 40•151	06 - 34	06 - 34	06 - 34	

01/08.2005

FORMULA 40 PERMISSIBLE RADIAL LOADING

SAE



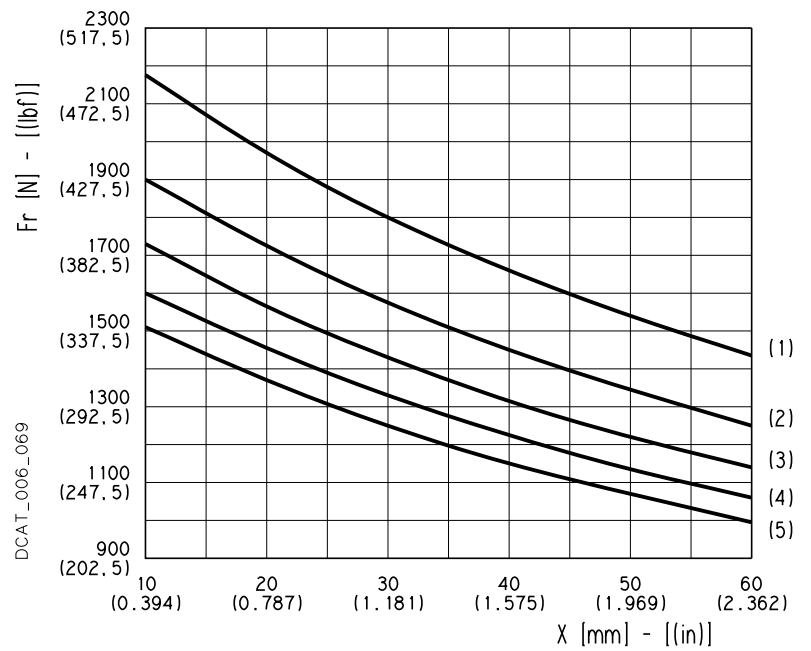
X = Distance of the radial load result from the mounting flange.

Fatigue life (hours) $L_n = 1000$ [h]

Each curve has been obtained at:

- (1) 1000 min^{-1}
- (2) 1500 min^{-1}
- (3) 2000 min^{-1}
- (4) 2500 min^{-1}
- (5) 3000 min^{-1}

VERSION
1 - 2



01/08.2005

HOW TO ORDER SINGLE PUMPS

1	2	3	4	5	6	7	8			
Pump type	Rotation	Version	–	Drive shaft	Mounting flange	–	Ports position	Ports IN/OUT	–	Seals
FP40•63	S	0	–	06	S8	–	L	OF/OD	–	N

1	Pump Type	CODE
	in ³ /rev (cm ³ /rev)	
	3.75 (61,43)	FP 40•63
	4.43 (72,60)	FP 40•73
	5.28 (86,56)	FP 40•87
	6.64 (108,90)	FP 40•109
	8.18 (134,03)	FP 40•133
	9.20 (150,79)	FP 40•151

2	Rotation	CODE
	Left	S
	Right	D
	Reversible	R
	Reversible with internal drain	B

3	Version	CODE
	Without outboard bearing	0
	With outboard bearing	1
	With outboard bearing and indep. shaft	2

4	Drive shaft	CODE
	SAE "C" spline (14 teeth)	06
	SAE "C" straight	34

5	Mounting flange	CODE
	SAE "C" 2-4 holes	S8

CODE	Ports position	6
L	Side	

CODE	Ports IN/OUT	7
SAE STRAIGHT THREAD PORTS (ODT)		
Side	Pump type	
OF/OD	FP 40•63	
OF/OD	FP 40•73	
OG/OF	FP 40•87	
OG/OF	FP 40•109	
OH/OF	FP 40•133	
OH/OF	FP 40•151	

CODE	Seals (a)	8
N	Buna N (standard)	
V	Viton	
N Bz	Buna N and Bronze thrust plates	
V Bz	Viton and Bronze thrust plates	

(a) Choose the seals according to the temperature shown on page 1

ORDER EXAMPLE

Standard pump

FP 40•63 S0 - 06 S8 - L OF/OD - N

Special version pump

FP 40•63 S2 - 34 S8 - L OF/OD - V Bz

MULTIPLE PUMPS

FORMULA series pumps can be coupled together in combination. Where input power requirement of each element varies, that with the greater requirement must be at the drive shaft end, and progressively smaller to the rear.

Features and performances are the same as the corresponding single pumps, but pressures must be limited by the transmissible torque of the drive and connecting shafts. To have appropriate data, use the formula below.

The maximum rotational speed is that of the lowest rated speed of the single units incorporated.

M	lbf in (Nm)	Torque
V	in ³ /rev (cm ³ /rev)	Displacement
Δp	psi (bar)	Pressure
$\eta_m = \eta_m(V, \Delta p, n) \quad (\approx 0,90)$		Mechanical efficiency

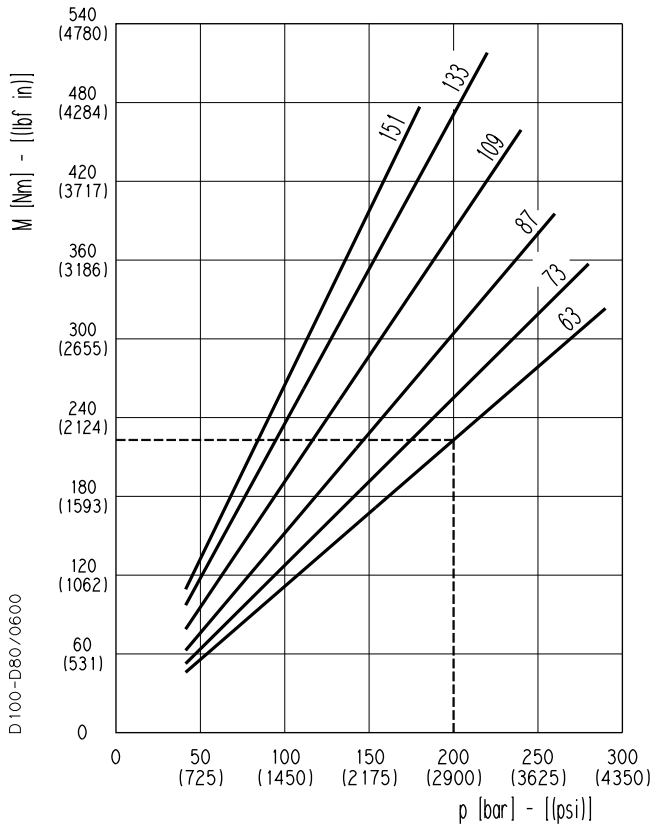
$$M = \frac{\Delta p \text{ (bar)} \cdot V \text{ (cm}^3\text{/rev)}}{62,83 \cdot \eta_m} \quad \text{(Nm)}$$

01/08.2005

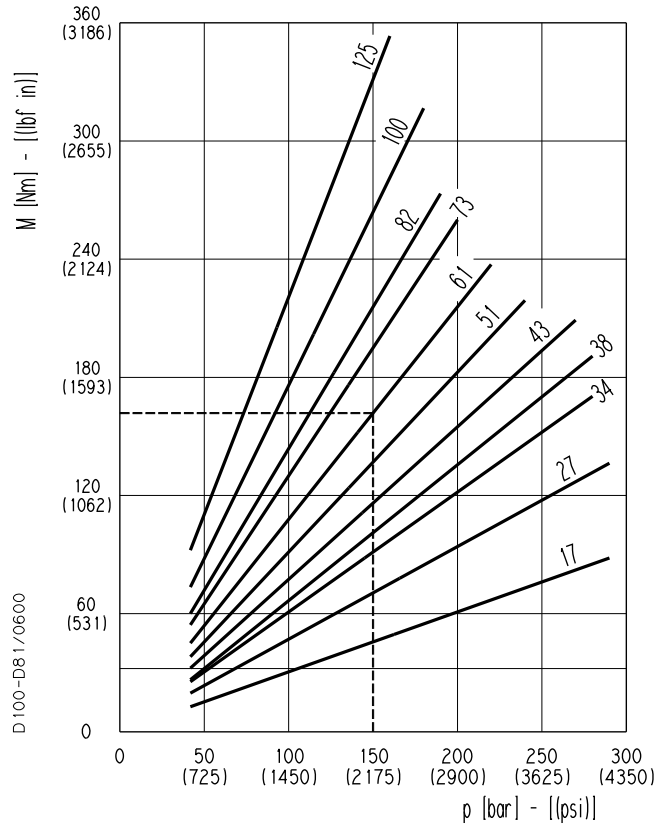
Note: The torque absorbed from the shaft of the first pump results from the sum of the torques due to all single stages. The achieved value must not exceed the maximum torque limit given for the shaft of the first pump. Diagrams providing approximate selection data will be found on page 36.

ABSORBED TORQUE

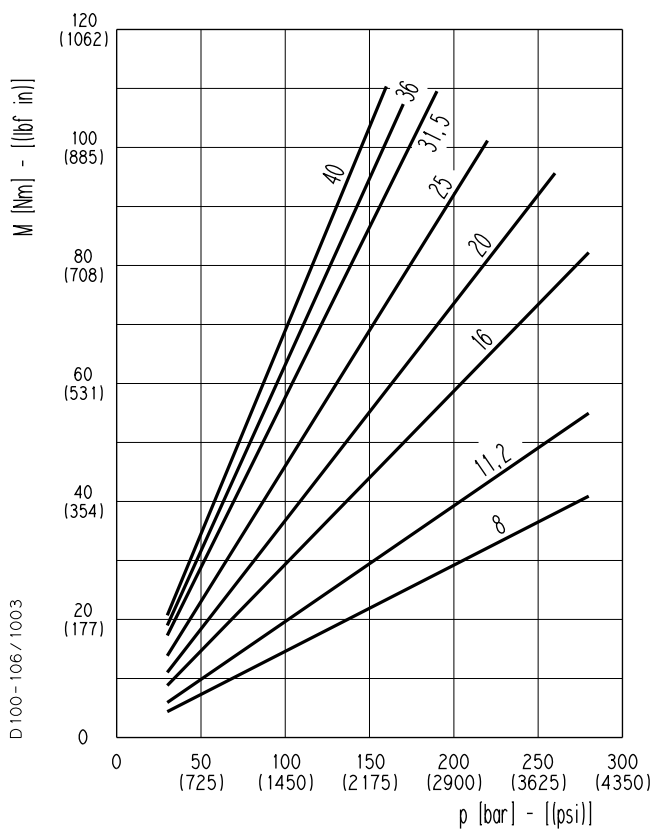
FP 40 1



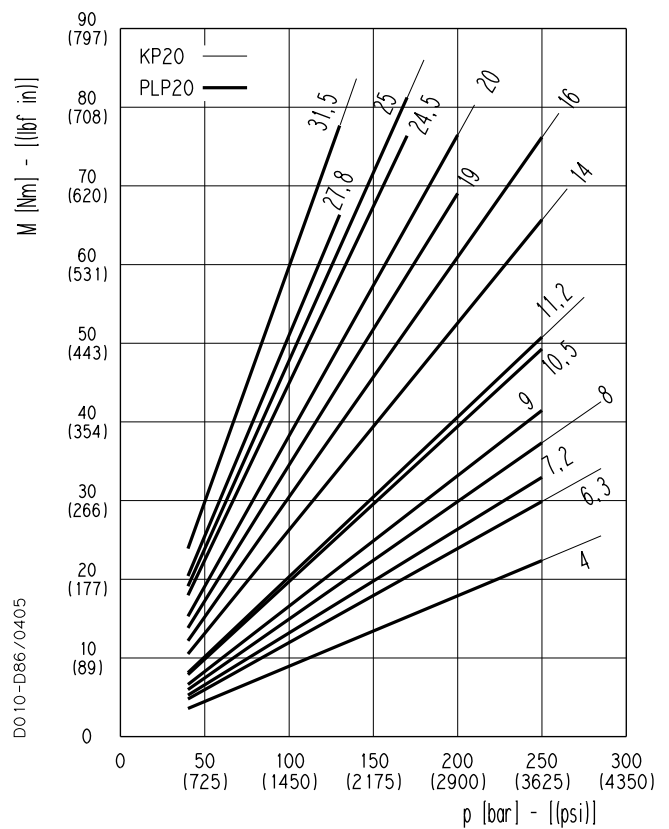
FP 30 2



FP 20 3



KP 20 - PLP 20 4

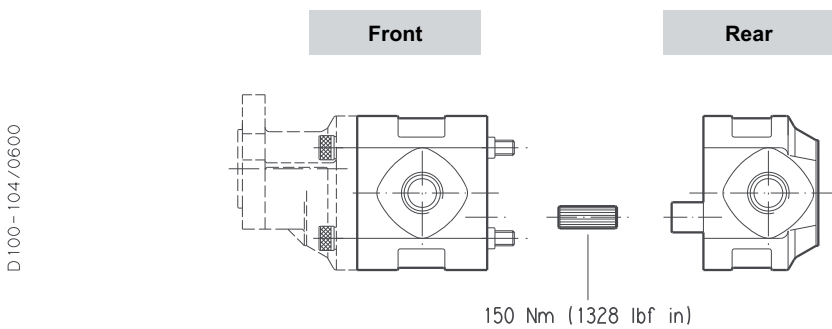


01/08.2005

DRIVE SHAFT SELECTION

Let us consider a double pump FP40•63+ FP30•61. If we suppose that we have to work with the first pump at a pressure of 2900 psi (200 bar) and the second pump at a pressure of 2175 psi (150 bar), the graph 1 shows that the torque absorbed by FP40•63 is 1974 lbf in (223 Nm) and the graph 2 shows that the torque absorbed by FP30•61 is 1416 lbf in (160 Nm) [acceptable value because it don't exceed the maximum drive shaft torque that is 2478 lbf in (280 Nm), see page 40]. The torque to be transmitted by the first drive shaft will thus be 1974+1416=3390 lbf in (223+160= 383 Nm), this value must not exceed the shaft's maximum rated value.

FORMULA 20 + FORMULA 20



FORMULA 20 END DRIVE SHAFT

ITALIAN STANDARD

13



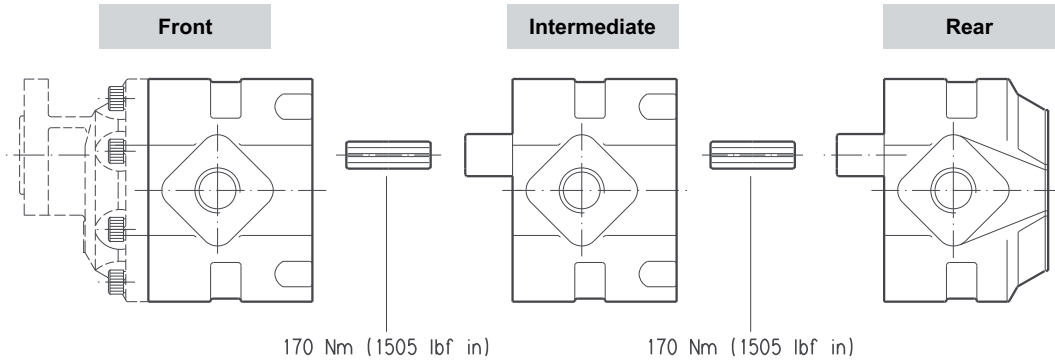
MAX 280 Nm (2478 lbf in)

01/08.2005

Fomula 30 + Formula 30

STANDARD COMBINATION

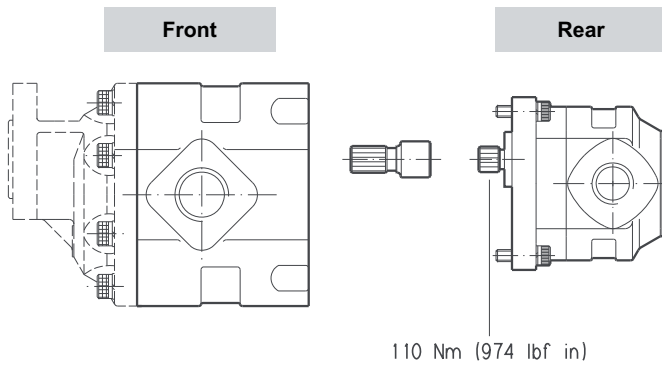
D 100-D26/1003



Fomula 30 + Kappa 20

STANDARD COMBINATION

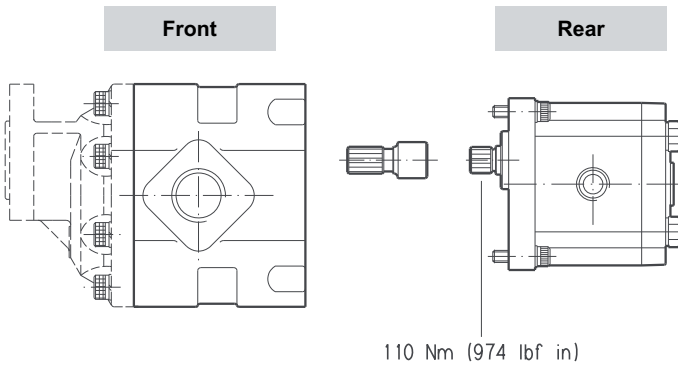
D 100-D78/0600



Fomula 30 + Polaris 20

STANDARD COMBINATION

D 100-D79/0600

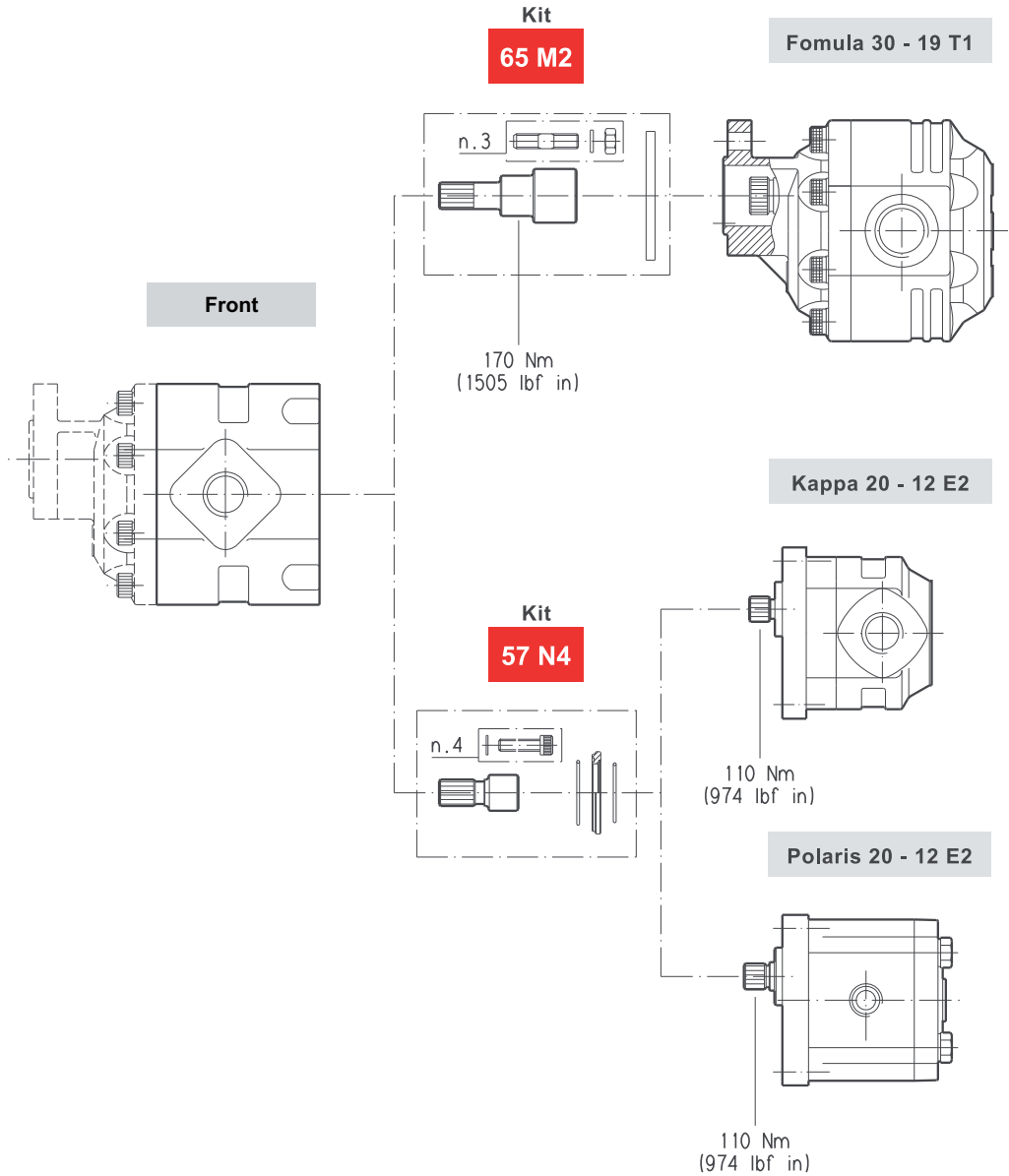


01/08.2005

Fomula 30

SPECIAL COMBINATION

Special front section arranged to fit single pumps.
To order please consult our technical sales department.



D100-110/1003

01/08.2005

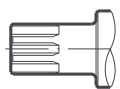
FORMULA 30 END DRIVE SHAFT

ITALIAN STANDARD

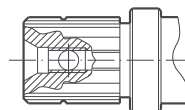
19

ISO STANDARD

16

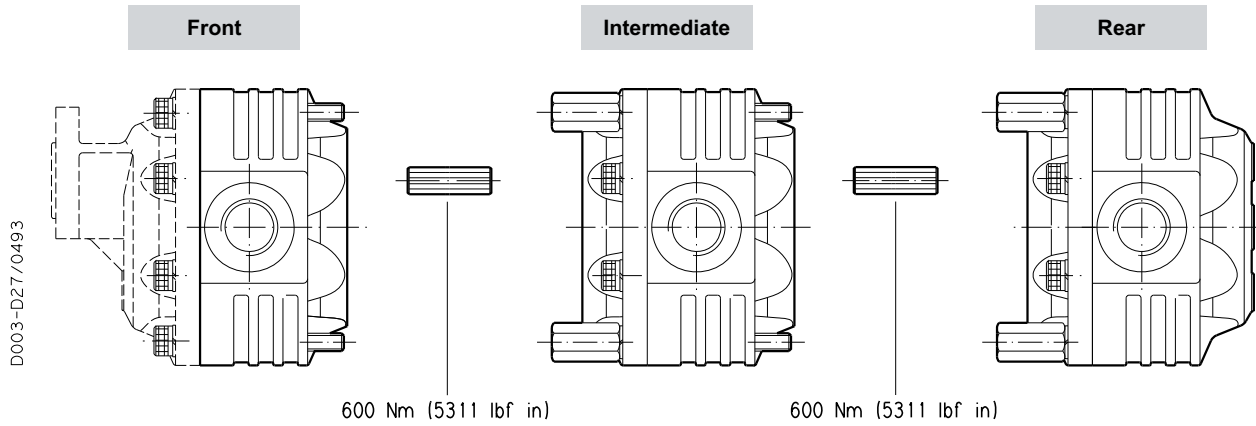


MAX 360 Nm (3186 lbf in)

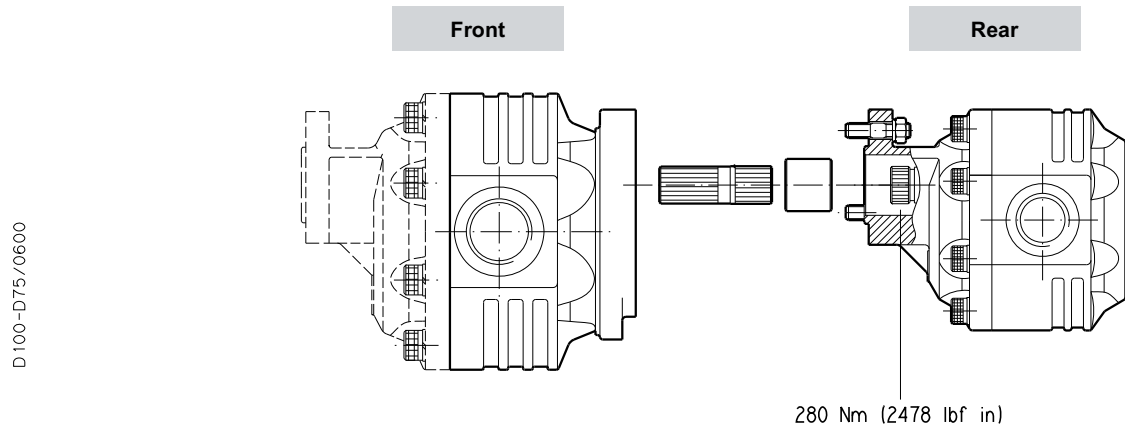


MAX 300 Nm (2655 lbf in)

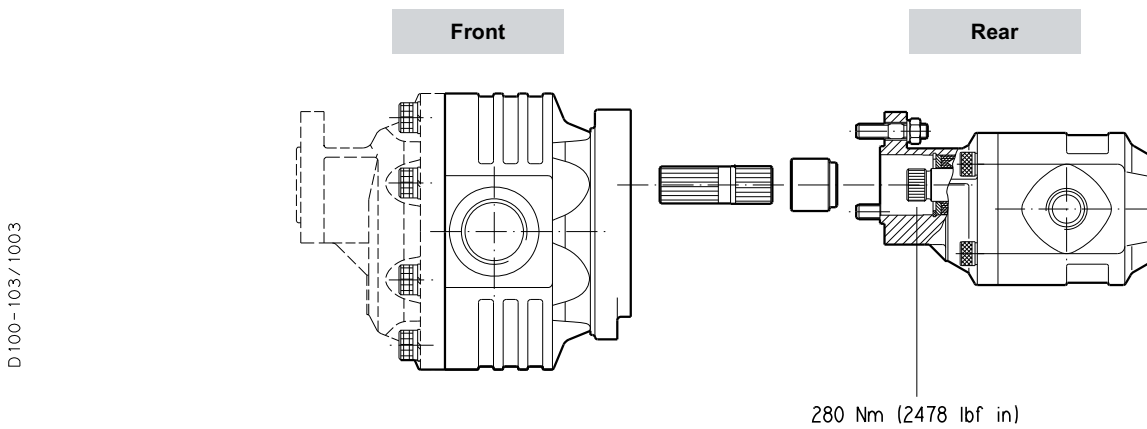
Fomula 40 + Formula 40



Fomula 40 + Fomula 30



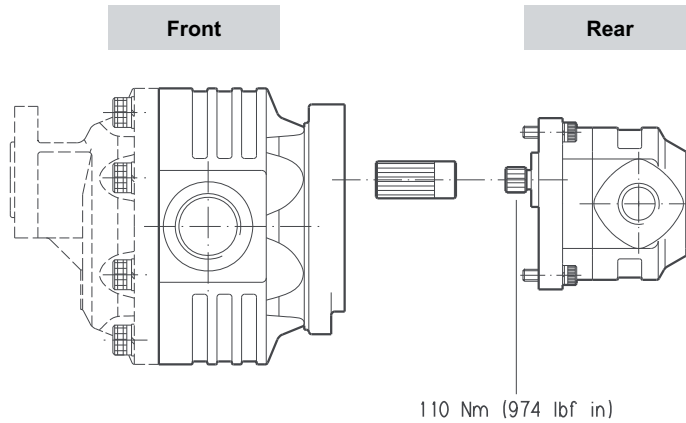
Fomula 40 + Fomula 20



01/08.2005

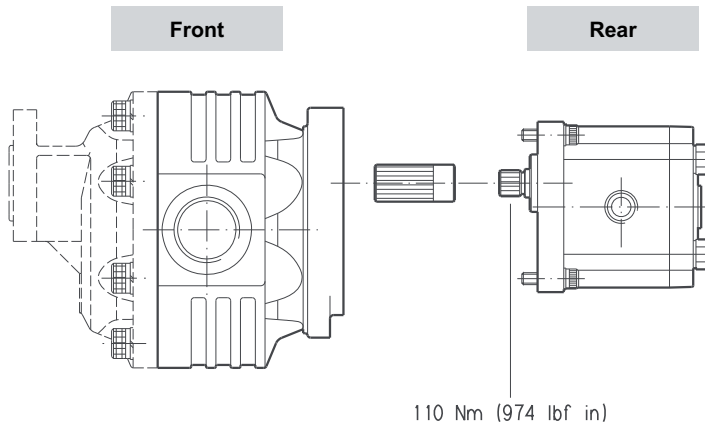
Fomula 40 + kappa 20

D 100-D76/0600



Fomula 40 + Polaris 20

D 100-D77/0600



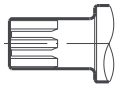
FORMULA 40 END DRIVE SHAFT

ITALIAN STANDARD

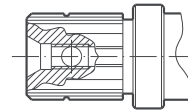
19

ISO STANDARD

16



MAX 400 Nm (3540 lbf in)



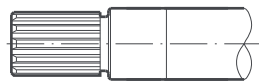
MAX 350 Nm (3098 lbf in)

SPLINE SAE STANDARD

19

STRAIGHT SAE STANDARD

34



MAX 900 Nm (7965 lbf in)

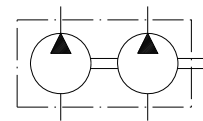
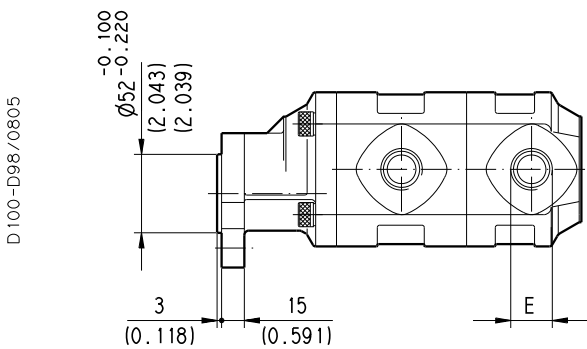
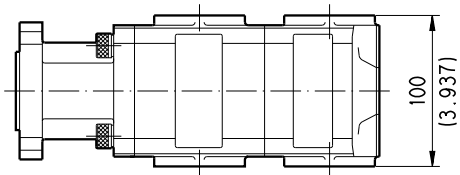
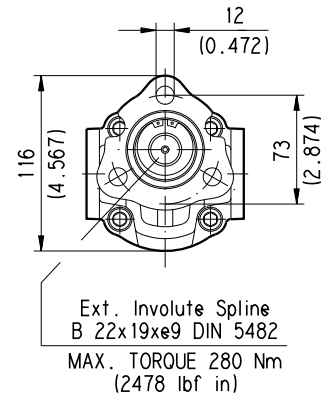
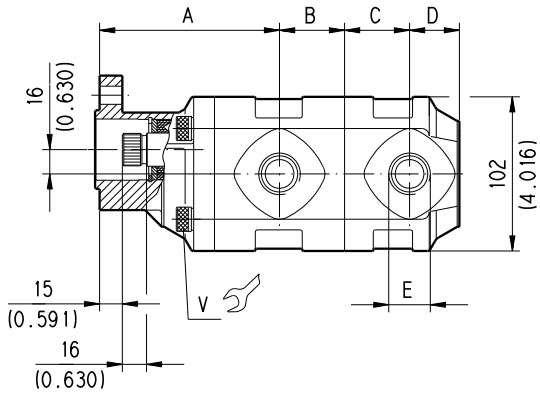


MAX 600 Nm (5310 lbf in)

01/08.2005

GAS STRAIGHT THREAD PORTS

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



Tightening torque Nm (lbf in)
V
70 ±7 (558 ÷ 682)

01/08.2005

Pump type	A	B	C	D	E
	mm (in)	mm (in)	mm (in)	mm (in)	
FP 20•8	105 (4.272)	37,5 (1.476)	29 (1.142)	27,5 (1.083)	G 1/2
FP 20•11,2	108,5 (4.272)	38,5 (1.516)	32,5 (1.280)	27,5 (1.083)	
FP 20•16	112,5 (4.429)	43 (1.693)	36,5 (1.437)	32,5 (1.280)	
FP 20•20	119 (4.685)	43 (1.693)	43 (1.693)	33 (1.299)	
FP 20•25	112 (4.409)	58 (2.283)	36 (1.417)	48 (1.890)	G 3/4
FP 20•31,5	122 (4.803)	58 (2.283)	46 (1.811)	48 (1.890)	

The length of a triple pump is obtained with the sum of the following dimensions: **A+B+C+B+C+D**.

01/08.2005

How to order a triple pump

(for double pump omit the intermediate pump)

Front pump	/	Intermediate pump	/	Rear pump	-	(1) Rotation	-	(2) Seals
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FP20•11,2 / 20•11,2 / 20•11,2 S -

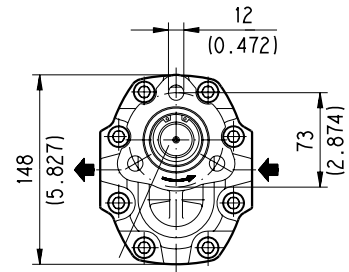
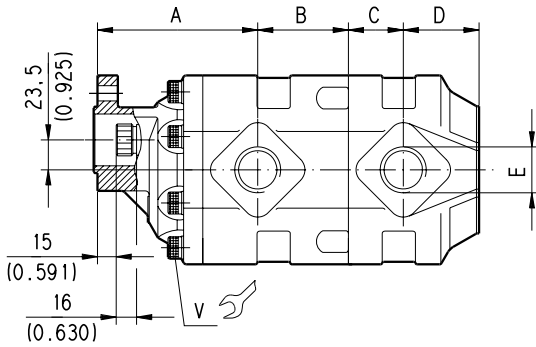
(1) S= Left - D= Right

(2) See page 1 (for Buna N seals no code)

GAS STRAIGHT THREAD PORTS

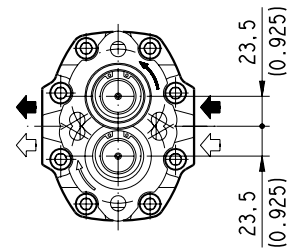
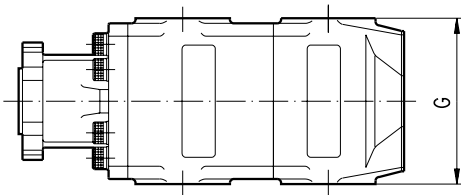
ISO (Z0) and SAE (S3) version available (◆).

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



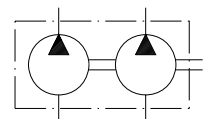
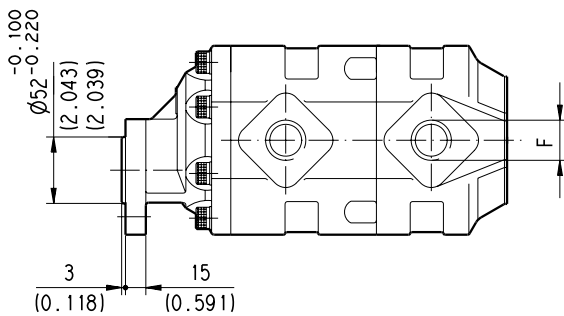
Shaft
UNI 8953 6x21x26 S
MAX. TORQUE 360 Nm
(3186 lbf in)

Flange T1



Flange T2

D100-D08/0805



01/08.2005

Tightening torque Nm (lbf in)
V
70 ±7 (558 ÷ 682)

	◆ Dimension "A". ISO and SAE version
	mm (in)
A (Z0)	A (19 T) + 18 (0.709)
A (S3)	A (19 T) - 2,5 (0.098)

Pump type	A (19 T)	B	C	D	E	F	G
	mm (in)	mm (in)	mm (in)	mm (in)	IN	OUT	mm (in)
FP 30•17	111,5 (4.390)	63 (2.480)	29 (1.142)	49 (1.929)	G 3/4	G 3/4	130 (5.118)
FP 30•27	117,5 (4.626)	63 (2.480)	35 (1.378)	49 (1.929)			
FP 30•34	122,5 (4.823)	63 (2.480)	40 (1.575)	49 (1.929)			
FP 30•38	125,5 (4.941)	63 (2.480)	43 (1.693)	49 (1.929)			
FP 30•43	128,5 (5.059)	63 (2.480)	46 (1.811)	49 (1.929)			
FP 30•51	125,5 (4.941)	71 (2.795)	43 (1.693)	57 (2.244)	G 1	G 1	135 (5.315)
FP 30•61	132,5 (5.217)	70 (2.756)	50 (1.969)	56 (2.205)			
FP 30•73	140,5 (5.531)	70 (2.756)	58 (2.283)	56 (2.205)			
FP 30•82 (●)	145,5 (5.728)	70 (2.756)	—	—	G 1 1/4		

(●) Available only for front and intermediate sections.

The length of a triple pump is obtained with the sum of the following dimensions: **A+B+C+B+C+D**.

01/08.2005

How to order a triple pump

(for double pump omit the intermediate pump)

Front pump	/	Intermediate pump	/	Rear pump	-	(1) Rotation	-	(2) Seals
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FP30•17 / 30•17 / 30•17 S -

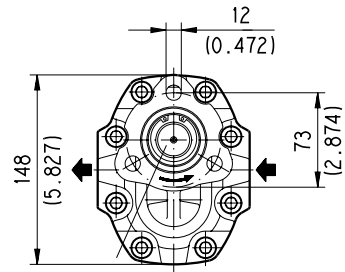
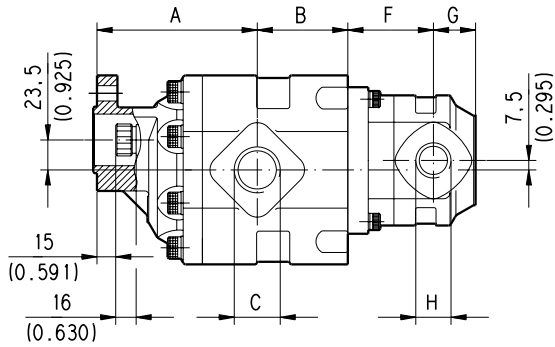
(1) S= Left - D= Right

(2) See page 1 (for Buna N seals no code)

GAS STRAIGHT THREAD PORTS

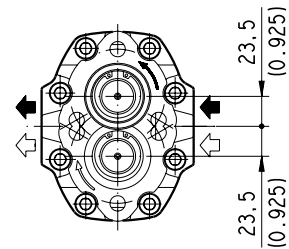
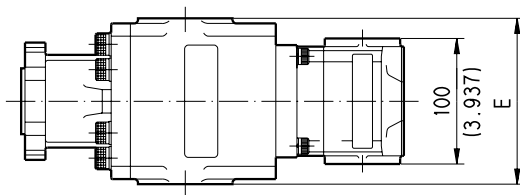
ISO (Z0) and SAE (S3) version available (◆).

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



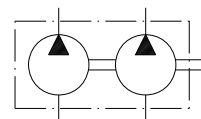
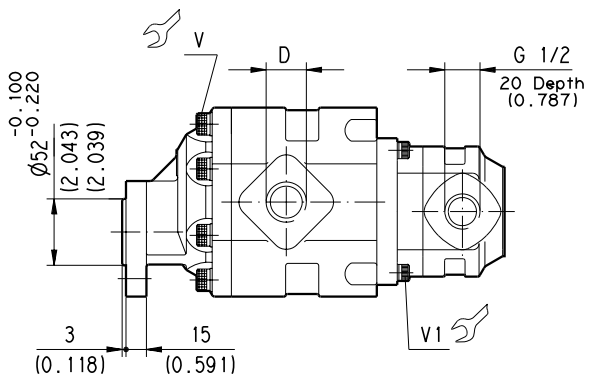
Shaft
UNI 8953 6x21x25 S
MAX. TORQUE 360 Nm
(3186 lbf in)

Flange T1



Flange T2

D100-D33/0805



01/08.2005

Tightening torque Nm (lbf in)	
V	V1
70 ±7 (558 ÷ 682)	70 ±7 (558 ÷ 682)

	(◆) Dimension "A". ISO and SAE version
	mm (in)
A (Z0)	A (19 T) + 18 (0.709)
A (S3)	A (19 T) - 2,5 (0.098)

Pump type	A (19 T)	B	C	D	E
	mm (in)	mm (in)	IN	OUT	mm (in)
FP 30•17	111,5 (4.390)	63 (2.480)	G 3/4	G 3/4	130 (5.118)
FP 30•27	117,5 (4.626)	63 (2.480)			
FP 30•34	122,5 (4.823)	63 (2.480)			
FP 30•38	125,5 (4.941)	63 (2.480)			
FP 30•43	128,5 (5.059)	63 (2.480)			
FP 30•51	125,5 (4.941)	71 (2.795)	G 1	G 1	135 (5.315)
FP 30•61	132,5 (5.217)	70 (2.756)			
FP 30•73	140,5 (5.531)	70 (2.756)			
FP 30•82	145,5 (5.728)	70 (2.756)			

Pump type	F	G	H	Ports code	
	mm (in)	mm (in)	mm (in)	IN	OUT
KP 20•4	60 (2.362)	27,5 (1.083)	G 1/2 Depth 20 (0.787)	GD	GD
KP 20•6,3	62,5 (2.460)	27,5 (1.083)			
KP 20•8	65 (2.559)	27,5 (1.083)			
KP 20•11,2	68,5 (2.697)	27,5 (1.083)			
KP 20•14	67 (2.638)	33 (1.299)	G 3/4 Depth 22 (0.866)	GE	GD
KP 20•16	72,5 (2.854)	33 (1.299)			
KP 20•20	79 (3.110)	33 (1.299)			
KP 20•25	72 (2.835)	48 (1.890)			
KP 20•31,5	82 (3.228)	48 (1.890)			

01/08.2005

How to order

Front pump	/	Rear pump	-	Port position		Port IN/OUT		(1) Rotation	-	(2) Seals
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FP30•17 - 67 / KP20•4 - L GD/GD S -

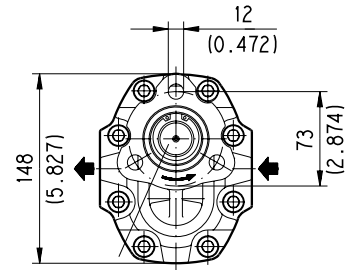
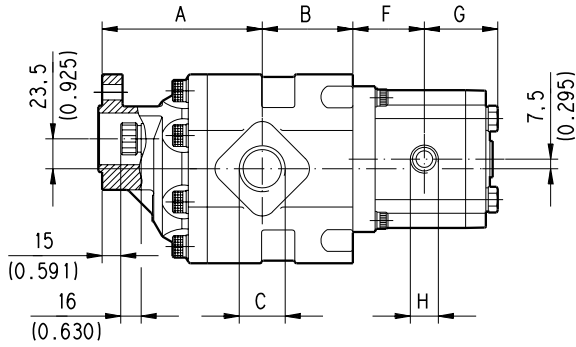
(1) S= Left - D= Right

(2) See page 1 (for Buna N seals no code)

GAS STRAIGHT THREAD PORTS

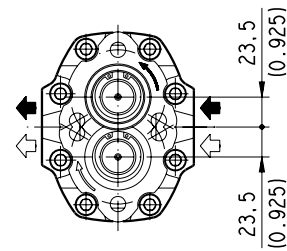
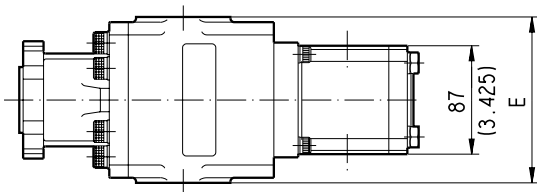
ISO (Z0) and SAE (S3) version available (◆).

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

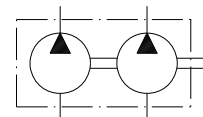
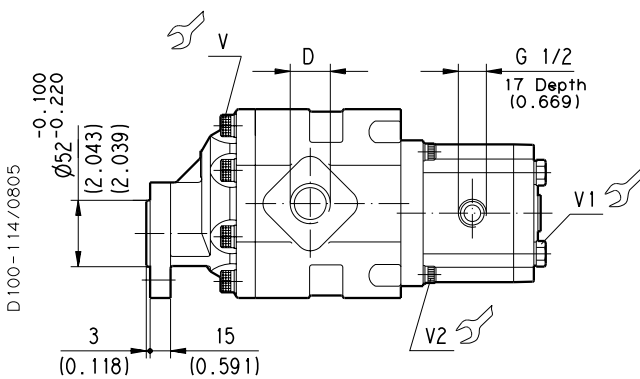


Shaft
UNI 8953 6x21x25 S
MAX. TORQUE 360 Nm
(3186 lbf in)

Flange T1



Flange T2



Tightening torque Nm (lbf in)		
V	V1 (●)	V2
70 ±7 (558 ± 682)	70 ±7 (558 ± 682)	70 ±7 (558 ± 682)

(●) With cast iron front cover.

01/08.2005

	(◆) Dimension "A". ISO and SAE version
	mm (in)
A (Z0)	A (19 T) + 18 (0.709)
A (S3)	A (19 T) - 2,5 (0.098)

Pump type	A (19 T)	B	C	D	E
	mm (in)	mm (in)	IN	OUT	mm (in)
FP 30•17	111,5 (4.390)	63 (2.480)	G 3/4	G 3/4	130 (5.118)
FP 30•27	117,5 (4.626)	63 (2.480)			
FP 30•34	122,5 (4.823)	63 (2.480)			
FP 30•38	125,5 (4.941)	63 (2.480)			
FP 30•43	128,5 (5.059)	63 (2.480)			
FP 30•51	125,5 (4.941)	71 (2.795)	G 1	G 1	135 (5.315)
FP 30•61	132,5 (5.217)	70 (2.756)			
FP 30•73	140,5 (5.531)	70 (2.756)			
FP 30•82	145,5 (5.728)	70 (2.756)			

Pump type	F	G	H	Ports code	
	mm (in)	mm (in)	mm (in)	IN	OUT
PLP 20•4	43,8 (1.722)	49,3 (1.941)	G 1/2 Depth 20 (0.787)	GD	GD
PLP 20•6,3	45 (1.772)	50,5 (1.988)			
PLP 20•7,2	45,5 (1.791)	51 (2.008)			
PLP 20•8	46,3 (1.821)	51,8 (2.039)			
PLP 20•9	46,9 (1.846)	52,4 (2.063)			
PLP 20•10,5	48,3 (1.900)	53,8 (2.118)			
PLP 20•11,2	48,5 (1.909)	54 (2.126)			
PLP 20•14	51 (2.008)	56,5 (2.224)	G 3/4 Depth 22 (0.866)	GE	GD
PLP 20•16	52,8 (2.077)	58,3 (2.295)			
PLP 20•19	54,5 (2.146)	60 (2.553)			
PLP 20•20	56 (2.205)	61,5 (2.421)			
PLP 20•24,5	58,8 (2.315)	64,3 (2.531)			
PLP 20•25	60 (2.362)	65,5 (2.579)			
PLP 20•27,5	61,4 (2.417)	66,9 (2.634)			
PLP 20•31,5	65 (2.559)	70,5 (2.776)			

01/08.2005

How to order

Front pump	/	Rear pump	-	Port position		Port IN/OUT		(1) Rotation	-	(2) Seals
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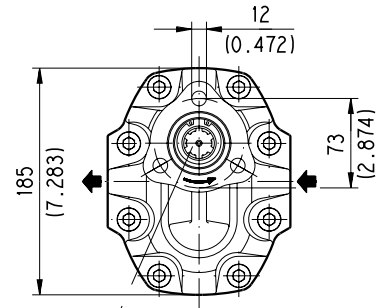
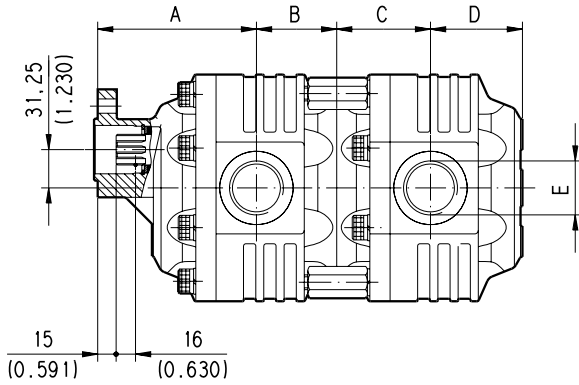
FP30•17 - 67 / PLP20•4 - L GD/GD S -

(1) S= Left - D= Right

(2) See page 1 (for Buna N seals no code)

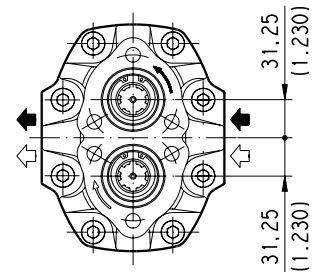
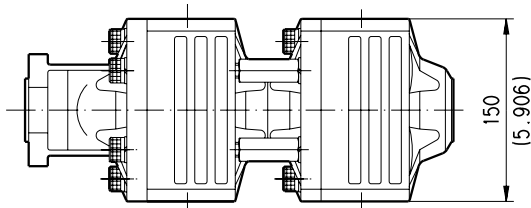
ISO (Z0) version available (◆).
SAE (S8) version on page 60.

GAS STRAIGHT THREAD PORTS
British standard pipe parallel (55°) conforms to UNI - ISO 228

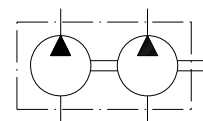
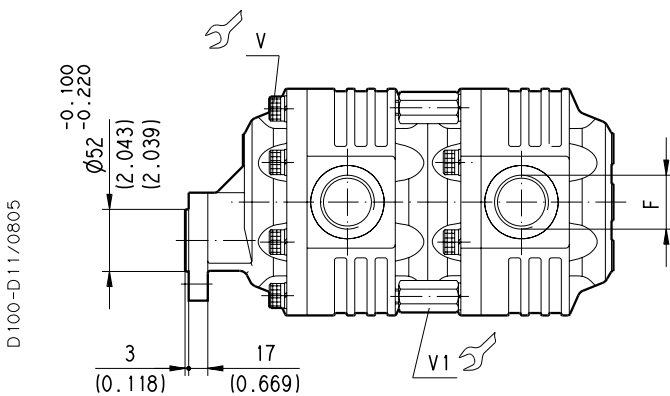


Shaft
UNI 8953 6x21x25 S
MAX. TORQUE 400 Nm
(3540 lbf in)

Flange T1



Flange T2



Tightening torque Nm (lbf in)	
V	V1
100 ±10 (797 ÷ 974)	100 ±10 (797 ÷ 974)

01/08.2005

	(◆) Dimension "A". ISO version
	mm (in)
A (Z0)	A (19 T) + 11,5 (0.453)

Pump type	A (19 T)	B	C	D	E	F
	mm (in)	mm (in)	mm (in)	mm (in)	IN	OUT
FP 40•63	119,5 (4.705)	57,5 (2.264)	65,5 (2.579)	68 (2.677)	G 1	G 3/4
FP 40•73	123,5 (4.862)	57,5 (2.264)	69,5 (2.736)	68 (2.677)		
FP 40•87	128,5 (5.059)	57,5 (2.264)	74,5 (2.933)	68 (2.677)	G 1 1/4	G 1
FP 40•109	129,5 (5.098)	64,5 (2.539)	75,5 (2.972)	75 (2.953)		
FP 40•133	138,5 (5.453)	64,5 (2.539)	84,5 (3.327)	75 (2.953)	G 1	
FP 40•151	144,5 (5.689)	64,5 (2.539)	90,5 (3.563)	75 (2.953)		

The length of a triple pump is obtained with the sum of the following dimensions: **A+B+C+B+C+D**.

01/08.2005

How to order a triple pump

(for double pump omit the intermediate pump)

Front pump	/	Intermediate pump	/	Rear pump	-	(1) Rotation	-	(2) Seals
FP40•63	/	40•63	/	40•63	-	S	-	

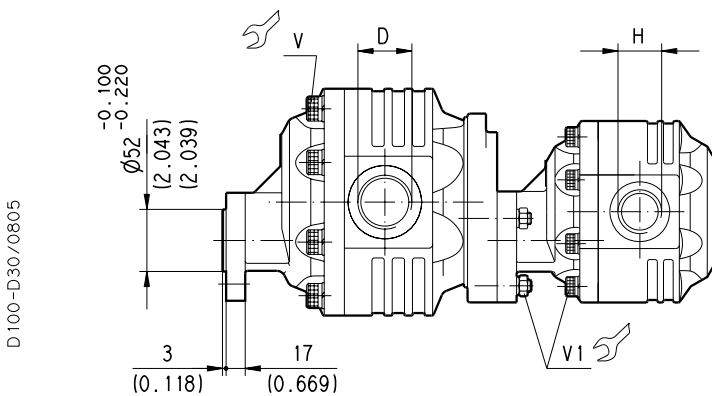
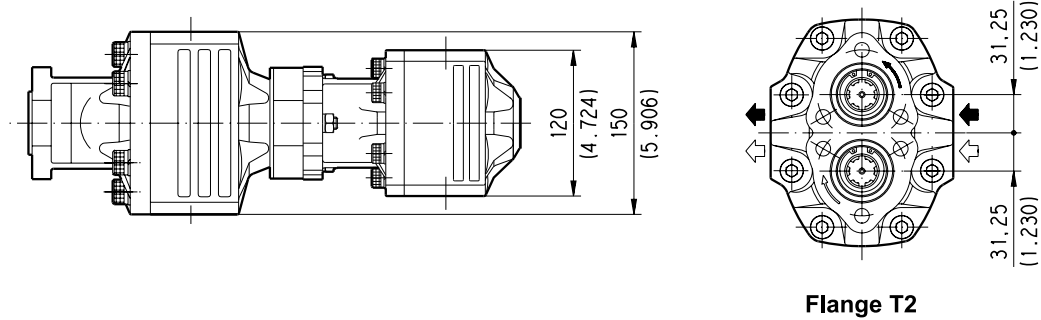
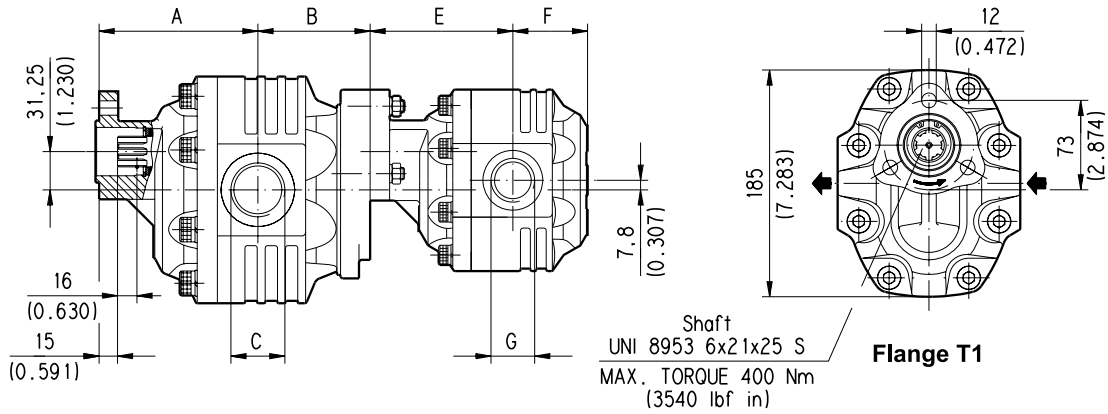
(1) S= Left - D= Right

(2) See page 1 (for Buna N seals no code)

GAS STRAIGHT THREAD PORTS

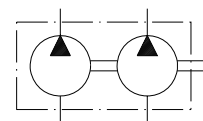
ISO (Z0) and SAE (S3) version available (◆).

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



D1100-D30/0805

01/08.2005



Tightening torque Nm (lbf in)	
V	V1
100 ±10 (797 ÷ 974)	70 ±7 (558 ÷ 682)

	(◆) Dimension "A". ISO and SAE version
	mm (in)
A (Z0)	A (19 T) + 11,5 (0.453)
A (S8)	A (19 T) + 1 (0.039)

Pump type	A (19 T)	B	C	D
	mm (in)	mm (in)	IN	OUT
FP 40•63	119,5 (4.705)	84,5 (3.327)	G 1	G 3/4
FP 40•73	123,5 (4.862)	84,5 (3.327)		
FP 40•87	128,5 (5.059)	84,5 (3.327)	G 1 1/4	G 1
FP 40•109	129,5 (5.098)	91,5 (3.602)		
FP 40•133	138,5 (5.453)	91,5 (3.602)	G 1 1/2	
FP 40•151	144,5 (5.689)	91,5 (3.602)		

Pump type	E	F	G	H
	mm (in)	mm (in)	IN	OUT
FP 30•17	100,5 (5.925)	50 (1.969)	G 1	G 3/4
FP 30•27	106,5 (4.193)	50 (1.969)		
FP 30•34	106,5 (4.193)	55 (2.165)		
FP 30•38	109,5 (4.311)	55 (2.165)		
FP 30•43	112,5 (4.429)	55 (2.165)		
FP 30•51	110,5 (4.350)	62 (2.441)	G 1 1/4	G 1
FP 30•61	116,5 (4.587)	62 (2.441)		
FP 30•73	117,5 (4.623)	69 (2.717)	G 1 1/2	
FP 30•82	122,5 (4.823)	69 (2.717)		

01/08.2005

How to order

Front pump	/	Rear pump	(1) Rotation	-	(2) Seals
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FP40•63 - 53 / FP30•17 S -

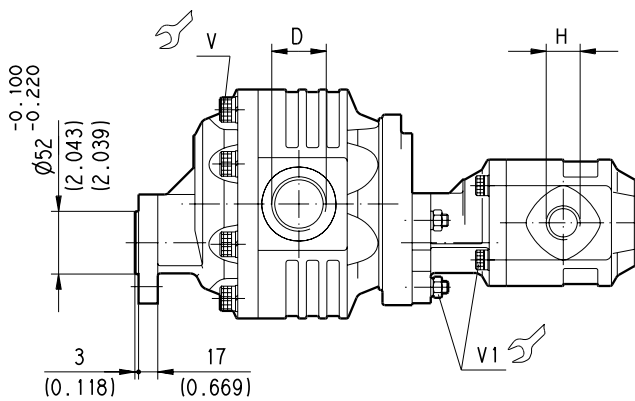
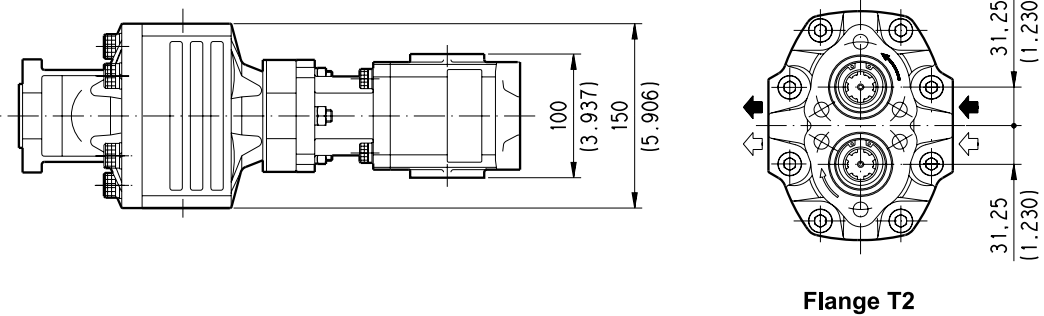
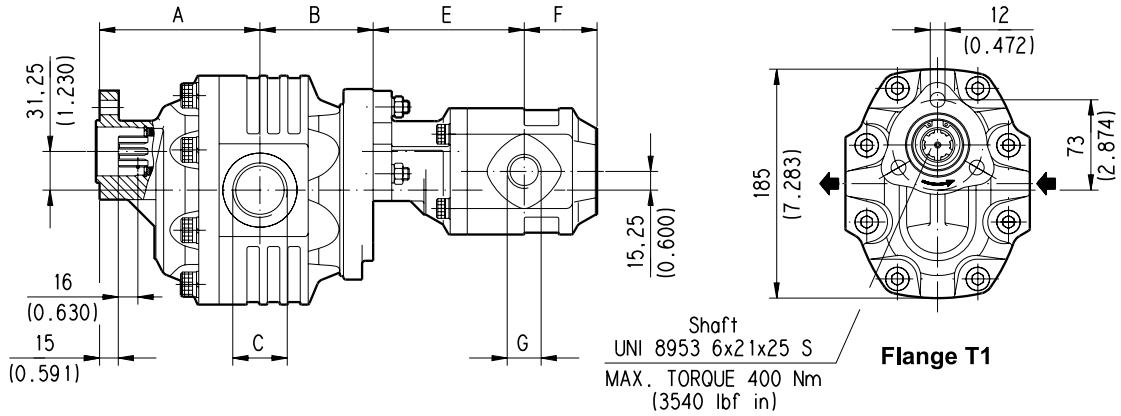
(1) S= Left - D= Right

(2) See page 1 (for Buna N seals no code)

GAS STRAIGHT THREAD PORTS

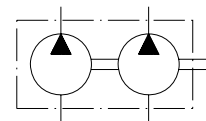
ISO (Z0) and SAE (S3) version available (◆).

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



D 100-D96/0805

01/08.2005



Tightening torque Nm (lbf in)	
V	V1
100 ±10 (797 ÷ 974)	70 ±7 (558 ÷ 682)

	(◆) Dimension "A". ISO and SAE version
	mm (in)
A (Z0)	A (19 T) + 11,5 (0.453)
A (S8)	A (19 T) + 1 (0.039)

Pump type	A (19 T)	B	C	D
	mm (in)	mm (in)	IN	OUT
FP 40•63	119,5 (4.705)	84,5 (3.327)	G 1	G 3/4
FP 40•73	123,5 (4.862)	84,5 (3.327)		
FP 40•87	128,5 (5.059)	84,5 (3.327)	G 1 1/4	G 1
FP 40•109	129,5 (5.098)	91,5 (3.602)		
FP 40•133	138,5 (5.453)	91,5 (3.602)	G 1 1/2	
FP 40•151	144,5 (5.689)	91,5 (3.602)		

Pump type	E	F	G	H
	mm (in)	mm (in)	IN	OUT
FP 20•8	105 (4.272)	27,5 (1.083)	G 1/2	G 1/2
FP 20•11,2	108,5 (4.272)	27,5 (1.083)		
FP 20•16	112,5 (4.429)	33 (1.299)		
FP 20•20	119 (4.685)	33 (1.299)		
FP 20•25	112 (4.409)	48 (1.890)	G 3/4	G 3/4
FP 20•31,5	122 (4.803)	48 (1.890)		
FP 20•36	116,5 (4.587)	59 (2.323)		
FP 20•40	122 (4.803)	59 (2.323)		

01/08.2005

How to order

Front pump	/	Rear pump	(1) Rotation	-	(2) Seals
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FP40•63 - 54 / FP20•11,2 S -

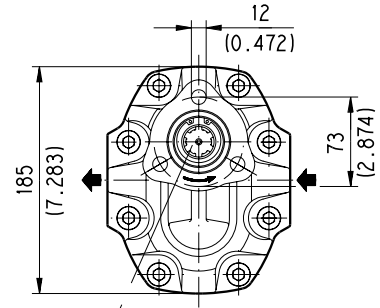
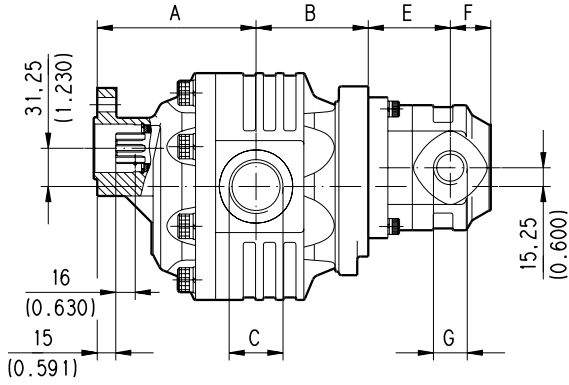
(1) S= Left - D= Right

(2) See page 1 (for Buna N seals no code)

GAS STRAIGHT THREAD PORTS

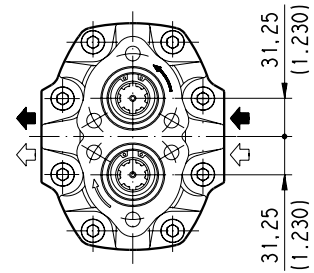
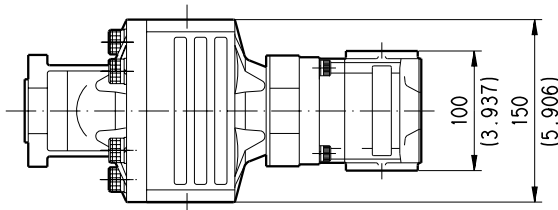
ISO (Z0) and SAE (S3) version available (◆).

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

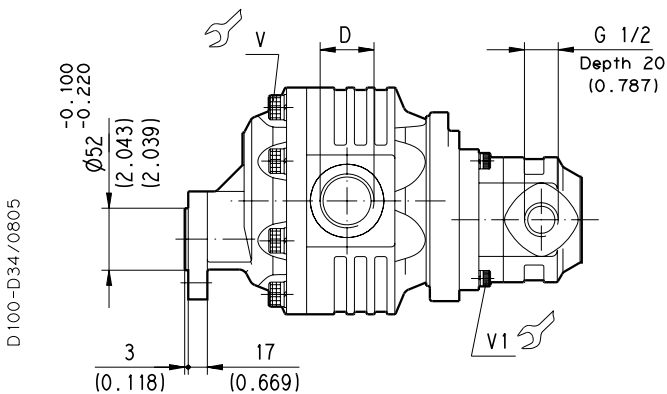


Shaft
UNI 8953 6x21x25 S
MAX. TORQUE 400 Nm
(3540 lbf in)

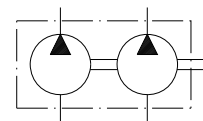
Flange T1



Flange T2



D 100-D34/0805



01/08.2005

Tightening torque Nm (lbf in)	
V	V1
100 ±10 (797 ÷ 974)	70 ±7 (558 ÷ 682)

	(◆) Dimension "A". ISO and SAE version
	mm (in)
A (Z0)	A (19 T) + 11,5 (0.453)
A (S8)	A (19 T) + 1 (0.039)

Pump type	A (19 T)	B	C	D
	mm (in)	mm (in)	IN	OUT
FP 40•63	119,5 (4.705)	84,5 (3.327)	G 1	G 3/4
FP 40•73	123,5 (4.862)	84,5 (3.327)		
FP 40•87	128,5 (5.059)	84,5 (3.327)	G 1 1/4	G 1
FP 40•109	129,5 (5.098)	91,5 (3.602)		
FP 40•133	138,5 (5.453)	91,5 (3.602)	G 1 1/2	
FP 40•151	144,5 (5.689)	91,5 (3.602)		

Pump type	F	G	H	Ports code	
	mm (in)	mm (in)	mm (in)	IN	OUT
KP 20•4	60 (2.362)	27,5 (1.083)	G 1/2 Depth 20 (0.787)	GD	GD
KP 20•6,3	62,5 (2.460)	27,5 (1.083)			
KP 20•8	65 (2.559)	27,5 (1.083)			
KP 20•11,2	68,5 (2.697)	27,5 (1.083)			
KP 20•14	67 (2.638)	33 (1.299)	G 3/4 Depth 22 (0.866)	GE	
KP 20•16	72,5 (2.854)	33 (1.299)			
KP 20•20	79 (3.110)	33 (1.299)			
KP 20•25	72 (2.835)	48 (1.890)			
KP 20•31,5	82 (3.228)	48 (1.890)			

01/08.2005

How to order

Front pump	/	Rear pump	-	Port position		Port IN/OUT		(1) Rotation	-	(2) Seals
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FP40•63 - 52 / KP20•4 - L GD/GD S -

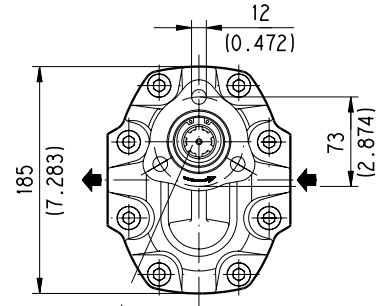
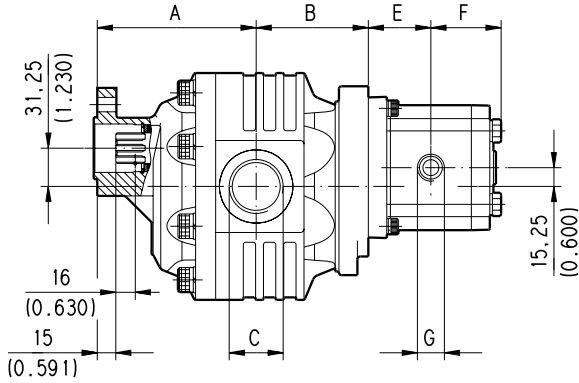
(1) S= Left - D= Right

(2) See page 1 (for Buna N seals no code)

GAS STRAIGHT THREAD PORTS

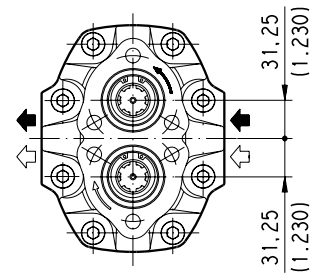
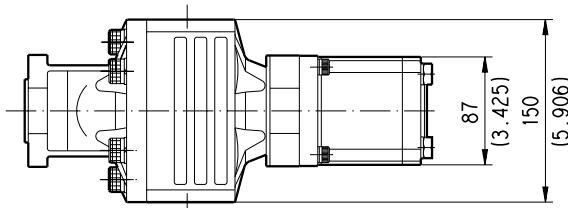
ISO (Z0) and SAE (S3) version available (◆).

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

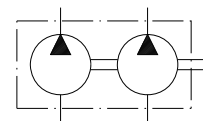
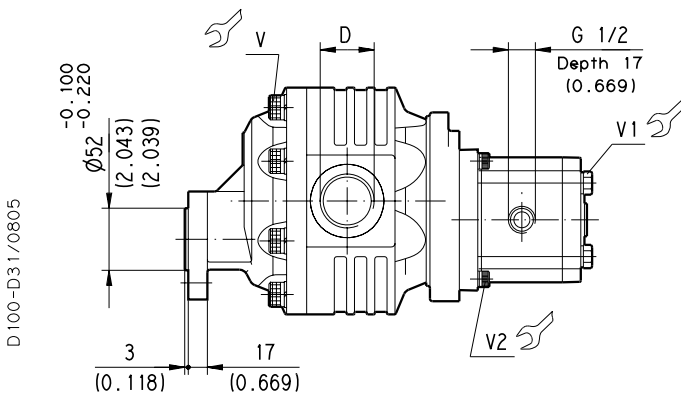


Shaft
UNI 8953 6x21x25 S
MAX. TORQUE 400 Nm
(3540 lbf in)

Flange T1



Flange T2



Tightening torque Nm (lbf in)		
V	V1 (●)	V2
100 ±10 (797 ÷ 974)	70 ±7 (558 ÷ 682)	70 ±7 (558 ÷ 682)

(●) With cast iron front cover.

01/08.2005

	(◆) Dimension "A". ISO and SAE version
	mm (in)
A (Z0)	A (19 T) + 11,5 (0.453)
A (S8)	A (19 T) + 1 (0.039)

Pump type	A (19 T)	B	C	D
	mm (in)	mm (in)	IN	OUT
FP 40•63	119,5 (4.705)	84,5 (3.327)	G 1	G 3/4
FP 40•73	123,5 (4.862)	84,5 (3.327)		
FP 40•87	128,5 (5.059)	84,5 (3.327)	G 1 1/4	G 1
FP 40•109	129,5 (5.098)	91,5 (3.602)		
FP 40•133	138,5 (5.453)	91,5 (3.602)	G 1 1/2	
FP 40•151	144,5 (5.689)	91,5 (3.602)		

Pump type	F	G	H	Ports code	
	mm (in)	mm (in)	mm (in)	IN	OUT
PLP 20•4	43,8 (1.722)	49,3 (1.941)	G 1/2 Depth 17 (0.669)	GD	GD
PLP 20•6,3	45 (1.772)	50,5 (1.988)			
PLP 20•7,2	45,5 (1.791)	51 (2.008)			
PLP 20•8	46,3 (1.821)	51,8 (2.039)			
PLP 20•9	46,9 (1.846)	52,4 (2.063)			
PLP 20•10,5	48,3 (1.900)	53,8 (2.118)			
PLP 20•11,2	48,5 (1.909)	54 (2.126)			
PLP 20•14	51 (2.008)	56,5 (2.224)	G 3/4 Depth 18 (0.709)	GE	
PLP 20•16	52,8 (2.077)	58,3 (2.295)			
PLP 20•19	54,5 (2.146)	60 (2.553)			
PLP 20•20	56 (2.205)	61,5 (2.421)			
PLP 20•24,5	58,8 (2.315)	64,3 (2.531)			
PLP 20•25	60 (2.362)	65,5 (2.579)			
PLP 20•27,5	61,4 (2.417)	66,9 (2.634)			
PLP 20•31,5	65 (2.559)	70,5 (2.776)			

01/08.2005

How to order

Front pump	/	Rear pump	-	Port position		Port IN/OUT		(1) Rotation	-	(2) Seals
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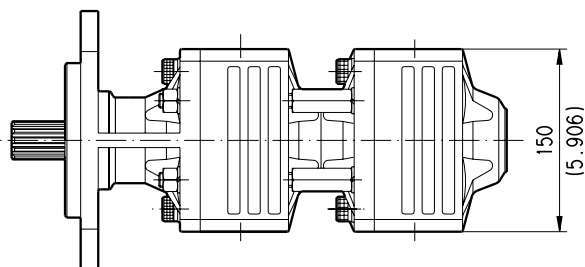
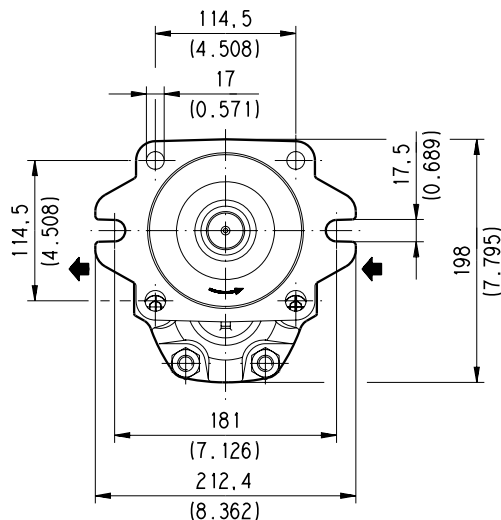
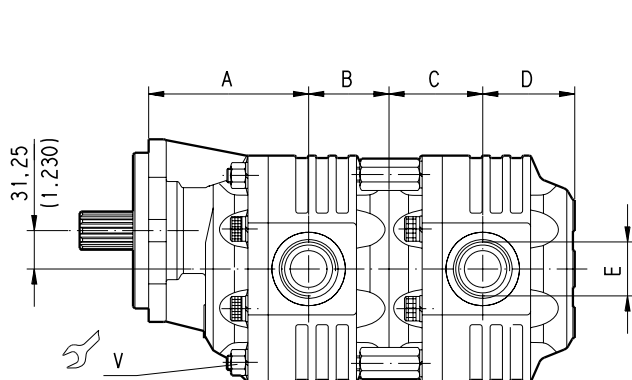
FP40•63 - 52 / PLP20•4 - L GD/GD S -

(1) S= Left - D= Right

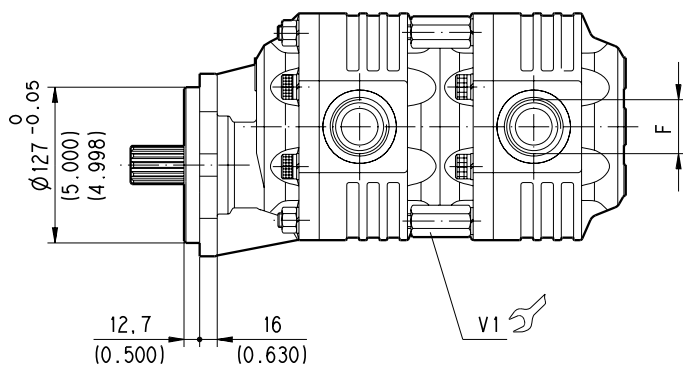
(2) See page 1 (for Buna N seals no code)

SAE STRAIGHT THREAD PORTS J514

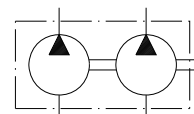
American straight thread UNC-UNF 60° conforms to ANSI B 1.1



D 100-D12/0805



Tightening torque Nm (lbf in)	
V	V1
100 ±10 (797 ÷ 974)	100 ±10 (797 ÷ 974)



To order see page 61 - 62

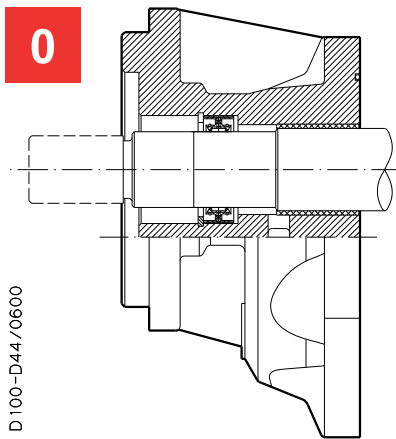
Pump type	A	B	C	D	E	F	Ports code	
	mm (in)	mm (in)	mm (in)	mm (in)	IN	OUT	IN	OUT
FP 40•63	120,5 (4.744)	57,5 (2.264)	65,5 (2.579)	68 (2.677)	1-5/16-12 UN-2B	1-1/16-12 UN-2B	OF	OD
FP 40•73	124,5 (4.902)	57,5 (2.264)	69,5 (2.736)	68 (2.677)				
FP 40•87	129,5 (5.098)	57,5 (2.264)	74,5 (2.933)	68 (2.677)	1-5/8-12 UN-2B	1-5/16-12 UN-2B	OG	OF
FP 40•109	130,5 (5.138)	64,5 (2.539)	75,5 (2.972)	75 (2.953)				
FP 40•133	139,5 (5.492)	64,5 (2.539)	84,5 (3.327)	75 (2.953)	1-7/8-12 UN-2B	1-5/16-12 UN-2B	OH	
FP 40•151	145,5 (5.728)	64,5 (2.539)	90,5 (3.563)	75 (2.953)				

The length of a triple pump is obtained with the sum of the following dimensions: **A+B+C+B+C+D**.

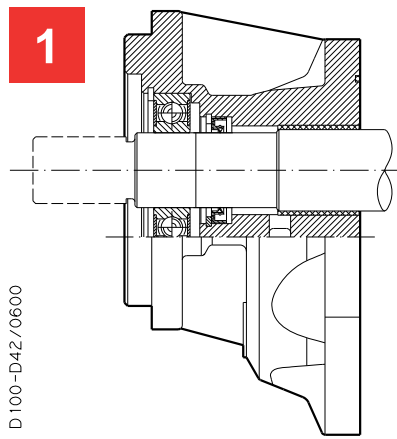
01/08.2005

FORMULA 40 SAE VERSION

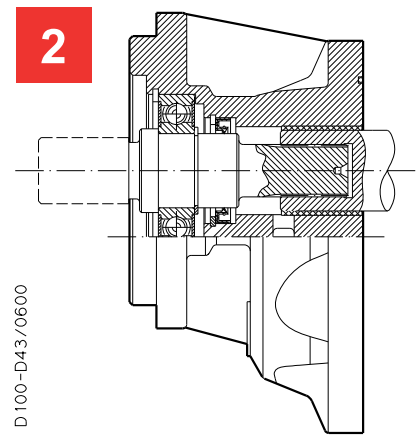
SAE



Version for applications without radial and axial load on the drive shaft.



Version for applications with low radial load and without axial load on the drive shaft.



Special version with independent shaft for applications with low radial load and without axial load on the drive shaft.

FORMULA 40 SAE END DRIVE SHAFTS

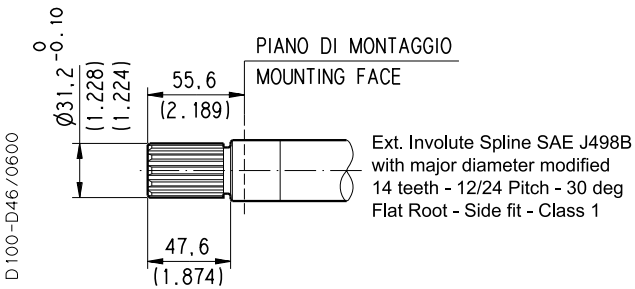
SAE

SAE "C" SPLINE

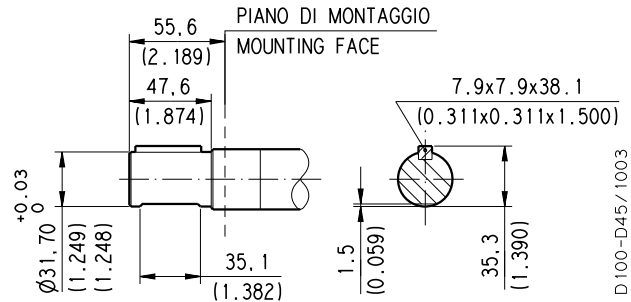
06

SAE "C" STRAIGHT

34



MAX 900 Nm (7966 lbf in) ◆



MAX 600 Nm (5311 lbf in) ◆

◆ For "2" version whichever end shaft, the max. torque applicable is M= 600 Nm (5311 lbf in)

PUMP - VERSION - SHAFT AVAILABILITY TABLE

SAE

01/08.2005

Pump type	VERSION			SHAFT
	0	1	2	
FP 40•63	06	06	06 - 34	
FP 40•73	06 - 34	06 - 34	06 - 34	
FP 40•87	06 - 34	06 - 34	06 - 34	
FP 40•109	06	06	06 - 34	
FP 40•133	06 - 34	06 - 34	06 - 34	
FP 40•151	06 - 34	06 - 34	06 - 34	

HOW TO ORDER MULTIPLE PUMPS

1	2	3	4	5	6	7	8
Pump type	Drive shaft	Mounting flange	Ports position	Ports IN/OUT	Rotation	Version	Seals
FP 40•63	06	S8	L	OF/OD	/		
Front ump							
40•63			L	OF/OD	/		
Intermediate ump							
40•63			L	OF/OD	S	0	N
Rear ump							

1	Pump Type	CODE
	in ³ /rev (cm ³ /rev)	
	3.75 (61,43)	FP 40•63
	4.43 (72,60)	FP 40•73
	5.28 (86,56)	FP 40•87
	6.64 (108,90)	FP 40•109
	8.18 (134,03)	FP 40•133
	9.20 (150,79)	FP 40•151

2	Drive shaft	CODE
	SAE "C" spline (14 teeth)	06
	SAE "C" straight	34

3	Mounting flange	CODE
	SAE "C" 2-4 holes	S8

4	Ports position	CODE
	Side	L

CODE	Ports IN/OUT	5
SAE STRAIGHT THREAD PORTS (ODT)		
Side	Pump type	
OF/OD	FP 40•63	
OF/OD	FP 40•73	
OG/OF	FP 40•87	
OG/OF	FP 40•109	
OH/OF	FP 40•133	
OH/OF	FP 40•151	

CODE	Rotation	6
S	Left	
D	Right	

CODE	Version	7
0	Without outboard bearing	
1	With outboard bearing	
2	With outboard bearing and indep. shaft	

CODE	Seals (a)	8
N	Buna N (standard)	
V	Viton	
N Bz	Buna N and Bronze thrust plates	
V Bz	Viton and Bronze thrust plates	

(a) Choose the seals according to the temperature shown on page 1

01/08.2005

ORDER EXAMPLE

Triple pump **FP 40•63 - 06 S8 - L OF/OD / 40•63 - L OF/OD / 40•63 - L OF/OD S - 0 - N**

PORTS CONNECTORS TIGHTENING TORQUE

Tightening torque for low pressure side port.

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

For reversible rotation, please consult only the tightening torque for high pressure side port.

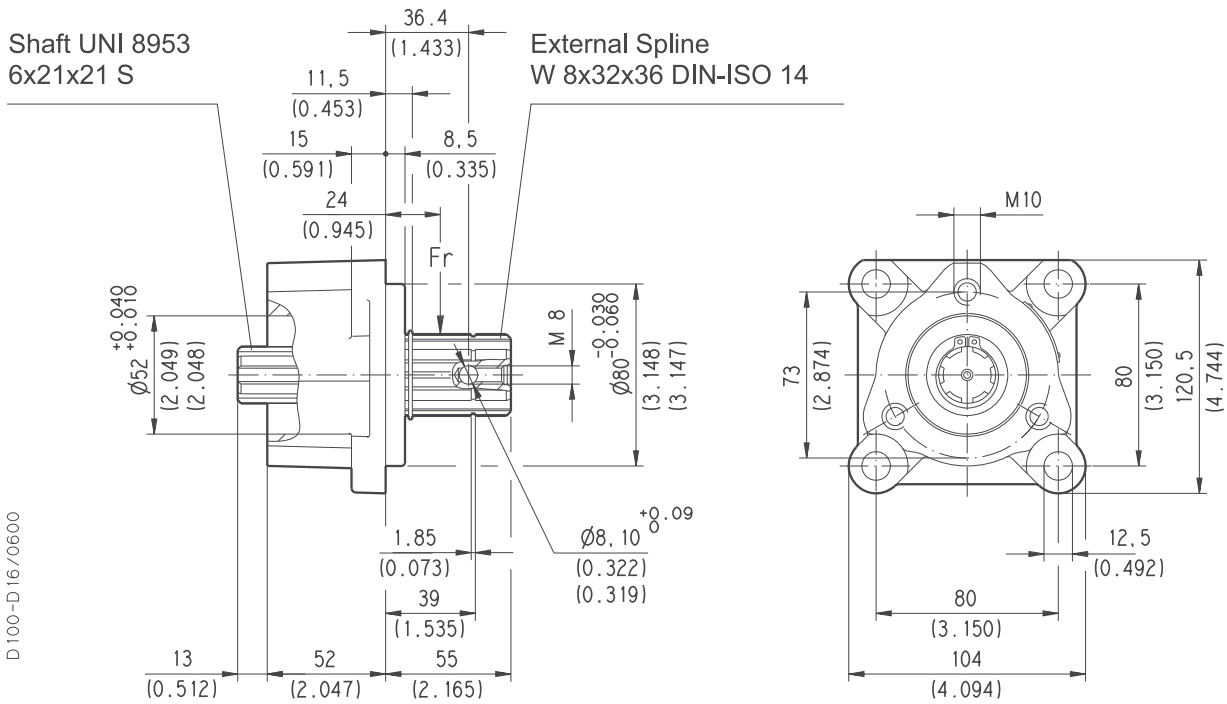
GAS STRAIGHT THREAD POTRS				BSPP
CODE				
	Nm	(lbf in)	Nm	(lbf in)
GC (■)	15 ⁺¹	133 ÷ 142	—	—
GD	20 ⁺¹	177 ÷ 186	50 ^{+2,5}	443 ÷ 465
GE	30 ^{+2,5}	266 ÷ 288	90 ⁺⁵	797 ÷ 841
GF	50 ^{+2,5}	443 ÷ 465	130 ⁺¹⁰	1151 ÷ 1239
GG	60 ⁺⁵	531 ÷ 575	170 ⁺¹⁰ (FP30)	1505 ÷ 1593 (FP30)
			210 ⁺¹⁰ (FP40)	1859 ÷ 1947 (FP30)
GH	70 ⁺⁵	620 ÷ 664	—	—

SAE STRAIGHT THREAD POTRS J514				ODT
CODE				
	Nm	(lbf in)	Nm	(lbf in)
OA (■)	15 ⁺¹	133 ÷ 142	—	—
OB	20 ⁺¹	177 ÷ 186	45 ^{+2,5}	398 ÷ 420
OD	40 ^{+2,5}	354 ÷ 376	120 ⁺¹⁰	1062 ÷ 1151
OE	50 ^{+2,5}	443 ÷ 465	145 ⁺¹⁰	1283 ÷ 1372
OF	60 ⁺⁵	531 ÷ 575	170 ⁺¹⁰	1505 ÷ 1593
OG	70 ⁺⁵	620 ÷ 664	—	—
OH	100 ⁺⁵	885 ÷ 929	—	—

01/08.2005 (■) Drain port: FORMULA 30 and FORMULA 40 rear drain (R).

BEARING SUPPORT FOR COUPLING TO ZF P.T.O. (ISO standard)

SL9 - SR9

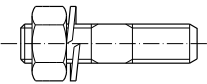




The bearing support allows FORMULA Italian standard pumps to be coupled to P.T.O. of commercial vehicles.

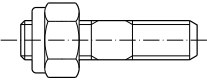

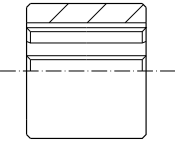
Ordering code	Max. radial load 24 mm (0.945 in) from mounting face (Fr)	Mass
	N	kg (lbf)
SL9	—	2,7 (5.95)
SR9	Low load	

01/08.2005

KIT to assemble FP20 - 13 T1 and FP30 - 13 T pumps with support

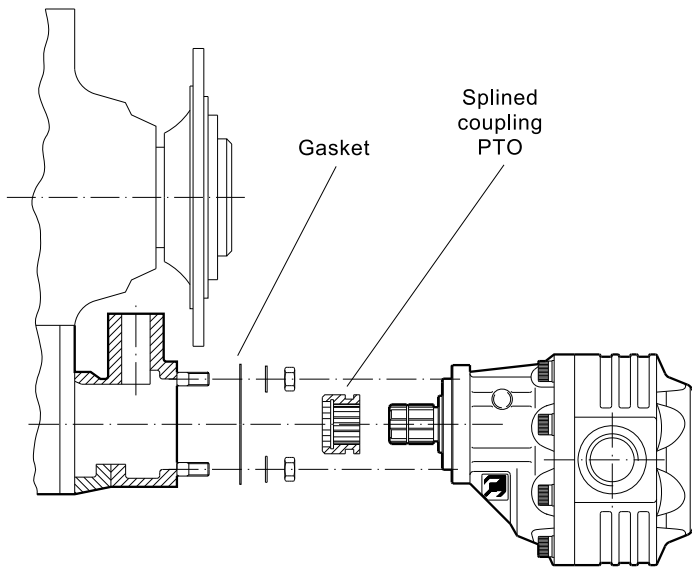
Part	Q.ty	Description	Ordering code
	3	Stud M 10x30 UNI 5911 Nut M 10 Washer 10 DIN 7980	KIT 10 - A
	1	Gasket	
	1	Splined coupling MA 6x21x25 UNI 8953 - A 22x19 DIN 5482 L= 31	

KIT to assemble FP30 - 19 T and FP40 - 19 T pumps with support

Part	Q.ty	Description	Ordering code
	3	Stud M 10x30 UNI 5911 Nut M 10 UNI 7473	KIT 17 - A
	1	Gasket	
	1	Splined coupling MA 6x21x25 UNI 8953 - A 22x19 L= 31	

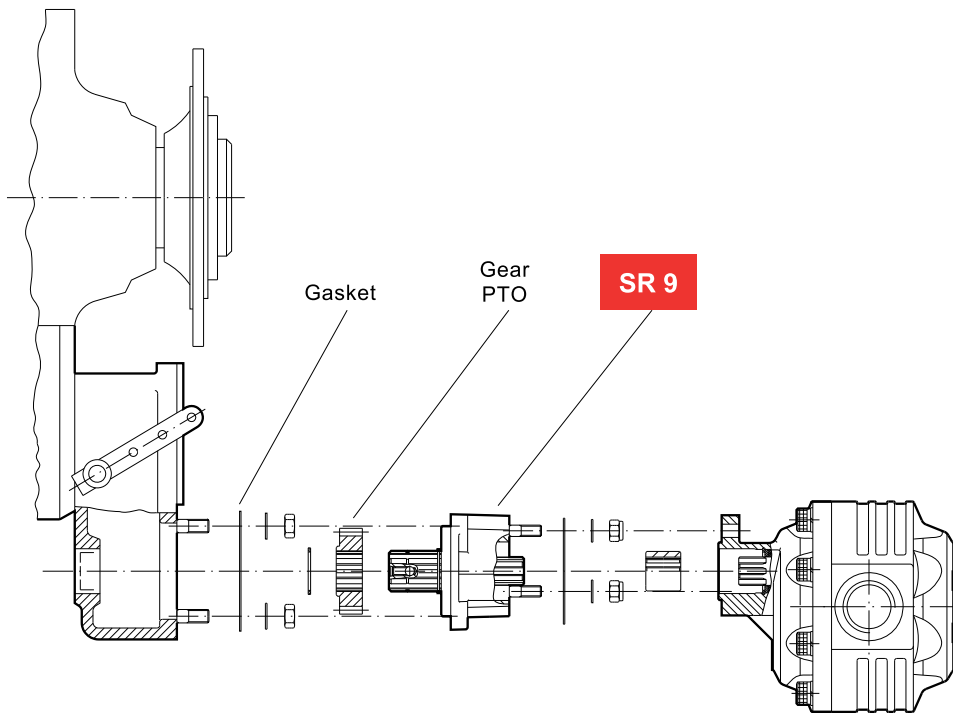
01/08.2005

APPLICATIONS OF FORMULA PUMPS WITH ZF P.T.O. (ISO STANDARD)



D 100-108/1003

The FORMULA pumps in the application with radial load can be directly connected to the "ZF" P.T.O.



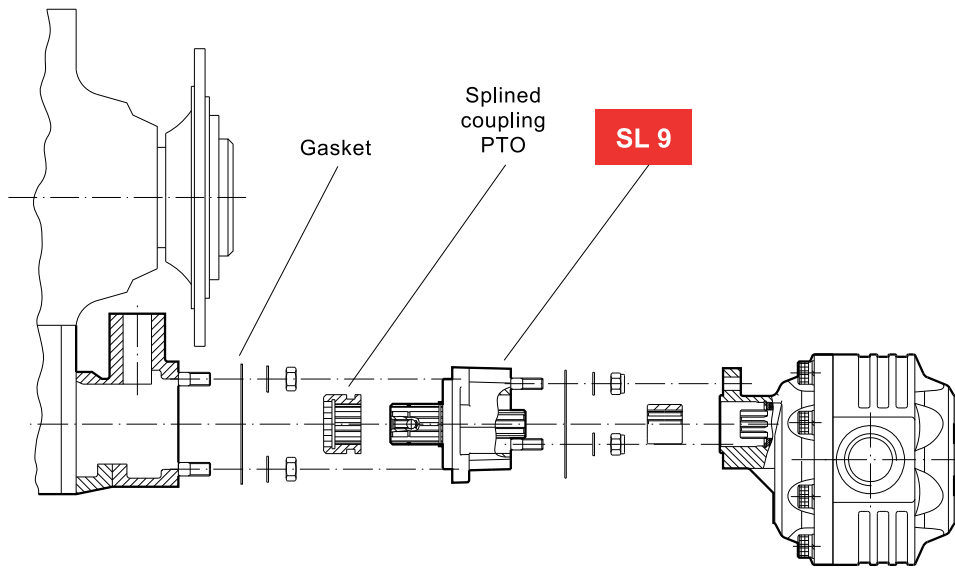
D 100-D85/0493

01/08.2005

The FORMULA pumps in the application with radial load can be directly connected to the "ZF" P.T.O. with straight teeth gear using the SR9 support.

APPLICATIONS OF FORMULA PUMPS WITH ZF P.T.O. (ISO STANDARD)

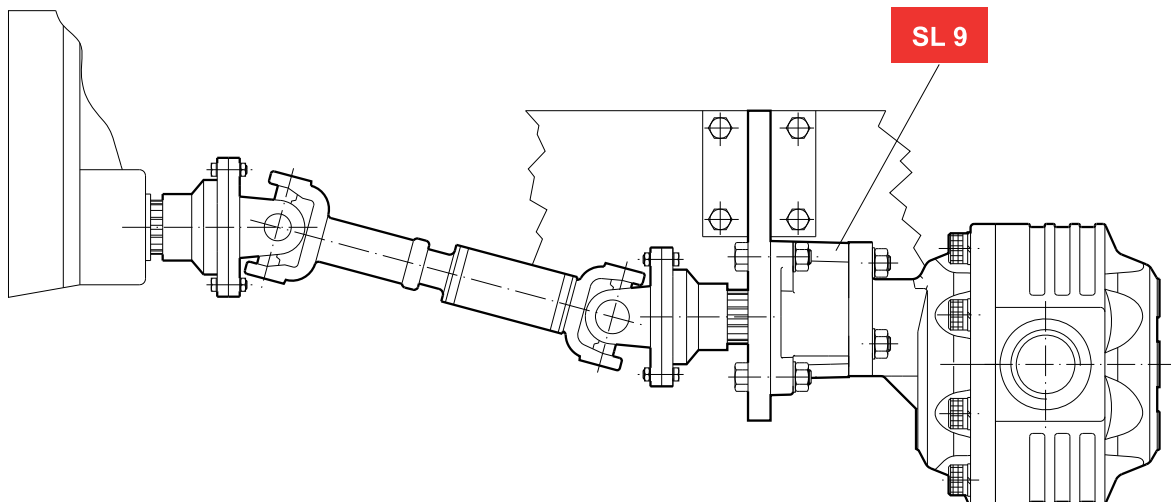
D 100-D84/0493



The FORMULA pumps in the application without radial load can be directly connected to the "ZF" P.T.O. only on self sealed version using the SL9 support.

01/08.2005

D 100-D86/0493



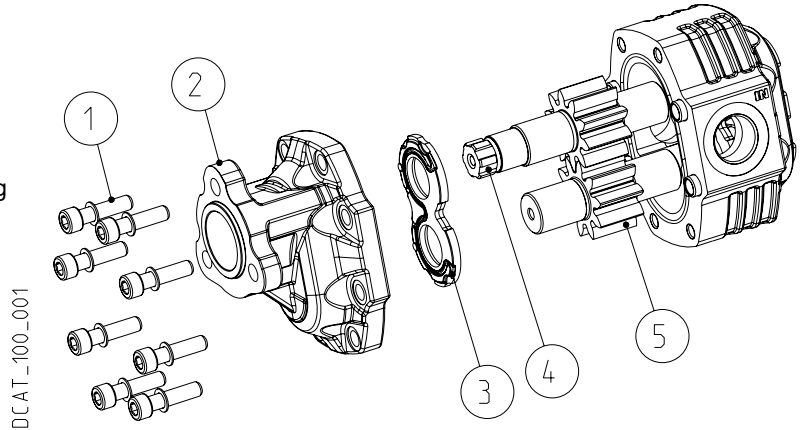
Use SL9 support to apply the universal joint.

CHANGING ROTATION

Example of changing rotation: from FP30 pump counterclockwise to clockwise

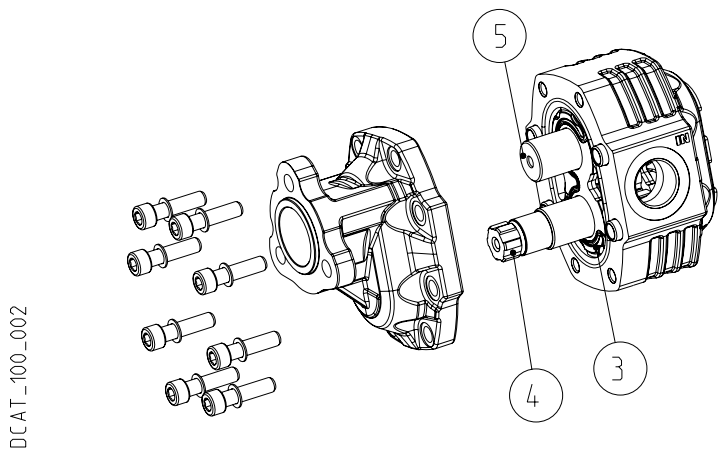
To change rotation of unidirectional pumps is necessary to operate in the following way:

- 1 - Clean the pump externally with care.
- 2 - Loosen, and remove, the clamp bolts (1).
- 3 - Coat the sharp edges of the drive shaft (4) with adhesive tape and smear a layer of clean grease on the shaft end extension to avoid damaging the lip of the shaft seal when removing the mounting flange.
- 4 - Remove the mounting flange (2), taking care to keep the flange as straight as possible during removal. If the flange is stuck, tap around the edge with a fibre or rubber mallet in order to break away from the body. Ensure that while removing the front mounting flange, the drive shaft and other components remain position.

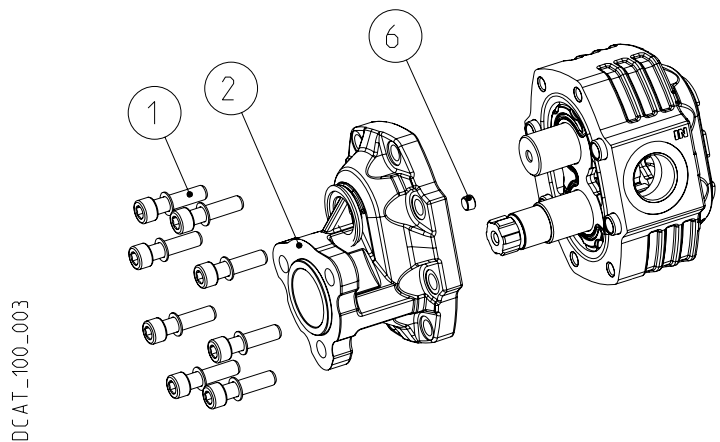


- 5 - Ease the drive gear (4) up to facilitate removal the front plate (3), taking care that the precision ground surfaces do not become damaged, and remove the drive gear.
- 6 - Remove the driven gear (5) without overturning. The rear plate has not to be removed.

- 7 - Re-locate the driven gear (5) in the position previously occupied by the drive gear (4)
- 8 - Re-locate the drive gear (4) in the position previously occupied by the driven gear (5).
- 9 - Replace the front plate (3) in its original position.



- 10 - Remove the grub screw (6) from the mounting flange (2) and re-locate it in the other threaded hole in the same flange.
- 11 - Gently wipe the machined surface of the mounting flange (2) and the body with a flat hand stone.
- 12 - Refit the front mounting flange (2) turned 180° from its original position.
- 13 - Refit the clamp bolts (1) with the washers and tighten in a crisscross pattern to a torque value of 70 ± 7 Nm ($558 \div 682$ lbf in).



- 14 - Check that the pump rotates freely when the drive shaft (4) is turned by hand. If not a pressure plate seal may be pinched.
- 15 - The pump is ready for installation with the original rotation reversed.

01/08.2005

INSTRUCTIONS

INSTALLATION

The direction of rotation of single-rotation pumps must be the same as that of the drive shaft. Check that the coupling flange correctly aligns the transmission shaft and the pump shaft, the connection do not generate an axial or radial load on the pump shaft

TANK

Tank capacity must be sufficient for the system's operating conditions (~ 3 times the amount of oil in circulation) to avoid overheating of the fluid. A heat exchanger should be installed if necessary. The intake and return lines in the tank must be spaced apart (by inserting a vertical divider) to prevent the return-line oil from being taken up again immediately.

LINES

The lines must have a major diameter which is at least as large as the diameter of pump ports, and must be perfectly sealed. To reduce loss of power, the lines should be as short as possible, reducing the sources of hydraulic resistance (elbow, throttling, gate valves, etc.) to a minimum. A length of flexible tubing is recommended to reduce the transmission of vibrations. All return lines must end below the minimum oil level, to prevent foaming. Before connecting the lines, remove any plugs and make sure that the lines are perfectly clean.

FILTERS

We recommend filtering the entire system flow. Filters on suction and return line must be fitted in according to the contamination class as indicated in the first pages of the catalogue. Casappa recommends to use its own production filters:



HYDRAULIC FLUID

Use hydraulic fluid conforming to the table as specified in the first pages of the catalogue. Avoid using mixtures of different oils which could result in decomposition and reduction of the oil's lubricating power.

STARTING UP

Check that all circuit connections are tight and that the entire system is completely clean. Insert the oil in the tank, using a filter. Bleed the circuit to assist in filling. Set the pressure relief valves to the lowest possible setting. Turn on the system for a few moments at minimum speed, then bleed the circuit again and check the level of oil in the tank. Then gradually increase the pressure and speed of rotation until the pre-set operating levels as specified in the catalogue are attained.

PERIODICAL CHECKS - MAINTENANCE

Keep the outside surface clean especially in the area of the drive shaft seal. In fact, abrasive powder can accelerate wear on the seal and cause leakage. Replace filters regularly to keep the fluid clean. The oil level must be checked and oil replaced periodically depending on the system's operating conditions.

01/08.2005

Casappa: Fluid Power Design at 360°



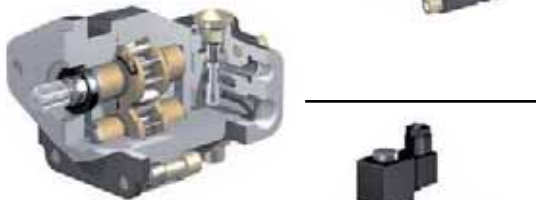
Gear pumps.
High performance, low noise.



Variable displacement axial piston pumps,
for open circuit.



Fixed displacement bent axis piston pumps,
for truck applications.



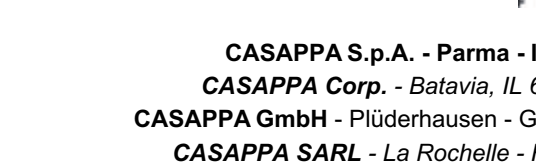
Cast iron gear pumps and
motors of three part construction.



Cast iron gear pumps,
for truck applications.



Cast iron gear pumps and
motors of two part construction.



Gear pumps and
motors in aluminium.



Double acting hydraulic hand pumps
with or without reservoir.



Filters : suction filters, return filters, in line filters spin-on
type, for medium and high pressure filters.



CASAPPA S.p.A. - Parma - Italy - Tel.: + 39 0521 304111 - Fax: + 39 0521 804600
 CASAPPA Corp. - Batavia, IL 60510 U.S.A. - Phone: 630 761-0041 - Fax: 630 761-0048
 CASAPPA GmbH - Plüderhausen - Germany - Tel.: + 49 (0)7181 989830 - Fax: + 49 (0)7181 989831
 CASAPPA SARL - La Rochelle - France - Tel.: + 33 (0)5 46372433 - Fax: + 33 (0)5 46423907
 www.casappa.com
 e-mail: info@casappa.com