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DESCRIPTION

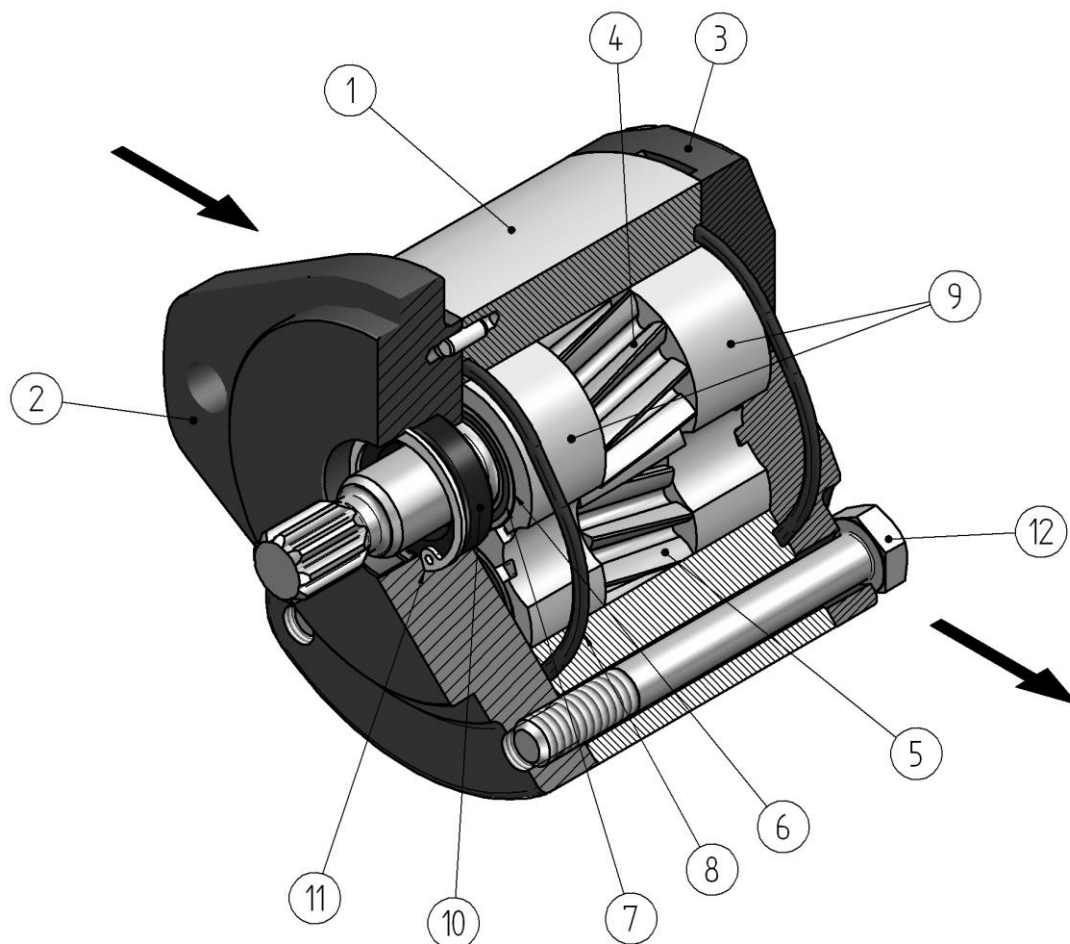
Pumps of 3S series with external helical gearing are applicable for its simple design, compact dimension and a wide range of types, in modern hydraulic systems, handling technologies and mobile hydraulics.

Basic execution is composed from a few parts. The body of pump are produced from heavy duty aluminium alloy. Cover and Flange are from iron grey or aluminium alloy. All flange as well as liquid inlets and outlets (location on side - in body or axial - in cover) comply with all world-recognised standards. Gear wheels with helical gearing are a special designed to achieve a low noise level, are made of ultrahigh-strength steel. Wheel pins with high quality surface are stored in bearings, which are constantly lubricated and cooled with flow working liquid.

Upon requirement on low weight and small size is appropriate a special shortened version (for use by lower continuous pressure) - designation 3SS

Available is also multiple-version pumps with inlets for each section or one common inlet.

BASIC PARTS OF PUMP



1. Body
2. Flange
3. Cover
4. Driving gear
5. Driven gear
6. Balancing sealing

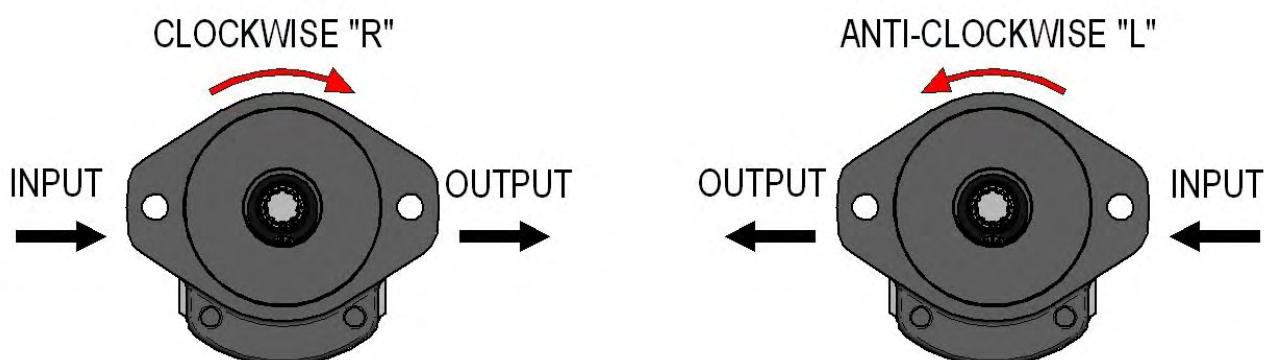
7. Sealing protective plate
8. Peripheral sealing
9. Bearing sleeves
10. Shaft seal
11. Safety ring
12. Connecting bolts

PARAMETER TABLE

Nominal Size Parameters		Sym.	Unit	9	12	14	16	20	25	28	31
Actual displacement		V_g	[cm ³]	9.06	12.08	14.12	16.10	20.12	25.16	28.19	31.21
Rotation speed	nominal	n_n	[min ⁻¹]	1500							
	minimum	n_{min}	[min ⁻¹]	500							
	maximum	n_{max}	[min ⁻¹]	3000	3000	2800	2600	2600	2200	1700	1600
Pressure at inlet *	minimum	p_{1min}	[bar]	0.50							
	maximum	p_{1max}	[bar]	-0.30							
Pressure at outlet **	max. continuous	p_{2n}	[bar]	280	260	260	260	240	200	180	150
	maximum	p_{2max}	[bar]	290	280	280	280	250	220	200	170
	peak	p_3	[bar]	310	300	300	300	270	240	220	190
Nominal flow rate (min.) at n_n and p_{2n}		Q_n	[dm ³ .min ⁻¹]	12.15	16.20	19.32	22.08	28.20	35.25	39.48	43.71
Maximum flow rate at n_{max} and p_{2max}		Q_{max}	[dm ³ .min ⁻¹]	26.46	35.28	38.42	40.77	50.96	53.90	46.65	48.61
Nominal input power (max.) at n_n and p_{2n}		P_n	[kW]	7.78	9.63	10.99	12.56	14.18	14.78	14.89	13.74
Maximum input power at n_{max} and p_{2max}		P_{max}	[kW]	14.80	19.05	20.74	22.01	24.57	22.86	17.99	15.93
Weight		m	[kg]	2.65	2.95	3.0	3.1	3.35	3.5	3.66	3.8

DIRECTION OF ROTATION

Determine direction of rotation by looking at the drive shaft. The pump can only be used in the specified direction of rotation.



FORMULAS USED FOR CALCULATION

Flow rate

$$Q = \frac{V_g \cdot n}{1000} \cdot \eta_v \quad [\text{dm}^3 \cdot \text{min}^{-1}]$$

V_g	$[\text{cm}^3]$	pump displacement
n	$[\text{min}^{-1}]$	rotation speed
η_v	$[-]$	volumetric efficiency

Displacement

$$V_g = \frac{Q \cdot 1000}{n \cdot \eta_v} \quad [\text{cm}^3]$$

Torque

$$M_k = \frac{V_g \cdot p}{20 \cdot \pi \cdot \eta_m} \quad [\text{N.m}]$$

p	$[\text{bar}]$	required pressure at outlet
η_m	$[-]$	mechanical efficiency

Input power

$$P = \frac{V_g \cdot n \cdot p}{600 \cdot 1000 \cdot \eta_t} \quad [\text{kW}]$$

η_t	$[-]$	total efficiency
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PUMP EFFICIENCIES

Volumetric efficiency η_v

It determines the amount of flow losses. Its value is $\eta_v = 0.92 \div 0.98$ (depending on rotation speed, viscosity of working liquid and outlet pressure). It can be expressed as follows:

$$\eta_v = \frac{Q_{act.}}{Q_{theor.}} \quad [-]$$

$Q_{act.}$	$[\text{dm}^3 \cdot \text{min}^{-1}]$	actual flow rate
$Q_{theor.}$	$[\text{dm}^3 \cdot \text{min}^{-1}]$	theoretical flow rate

Mechanical efficiency η_m

It determines mechanical losses. Its value is about $\eta_m = 0.85$. It can be expressed as follows:

$$\eta_m = \frac{M_{theor.}}{M_{act.}} \quad [-]$$

$M_{act.}$	$[\text{N.m}]$	actual torque
$M_{theor.}$	$[\text{N.m}]$	theoretical torque

Total efficiency η_t

It is defined as product of η_v and η_m and determines the difference between theoretical and actual required input power:

$$\eta_t = \eta_v \cdot \eta_m = \frac{P_{theor.}}{P_{act.}} \quad [-]$$

$P_{act.}$	$[\text{kW}]$	actual input power
$P_{theor.}$	$[\text{kW}]$	theoretical input power

WORKING LIQUID

- Mineral oils for hydraulic drives
- Hydraulic liquids based on plant oils suitable for hydraulic drives

Liquid temperature

$$t = -20 \div +80 [^{\circ}\text{C}] \quad \text{when used with FKM (Viton) seal up to } 120 [^{\circ}\text{C}]$$

Cinematic viscosity

Recommended (during continuous operation): $\nu = 20 \div 80 \cdot 10^{-6} [\text{m}^2 \cdot \text{s}^{-1}]$

Maximum (cold starting, at viscosity >1000 , operating pressure <10 bar is permissible, speed $<1500 \cdot \text{min}^{-1}$): $\nu = 1200 \cdot 10^{-6} [\text{m}^2 \cdot \text{s}^{-1}]$

Minimum (operating mode at $10 \cdot 10^{-6}$ up to $20 \cdot 10^{-6}$ should be consulted with manufacturer): $\nu = 10 \cdot 10^{-6} [\text{m}^2 \cdot \text{s}^{-1}]$

Filtration coefficient β_{α}

$\beta_{25} 75 \geq$ (for pressure $p_2 < 200$ bar)

$\beta_{10} 75 \geq$ (for pressure $p_2 > 200$ bar)

Liquid contamination class according to ISO 4406

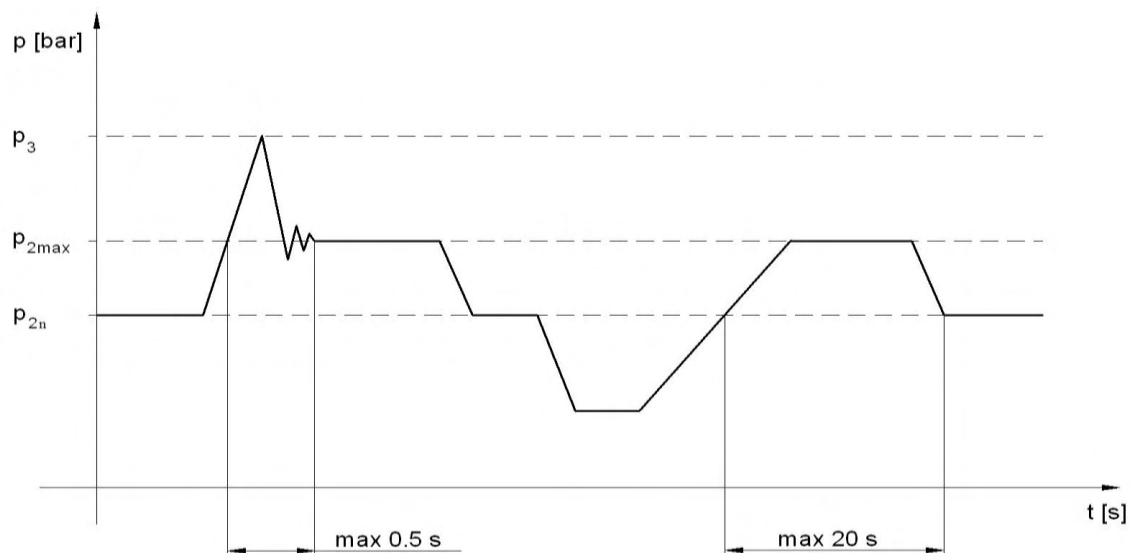
21/18/15 (for pressure $p_2 < 200$ bar)

20/17/14 (for pressure $p_2 > 200$ bar)

Liquid contamination class according to NAS 1638

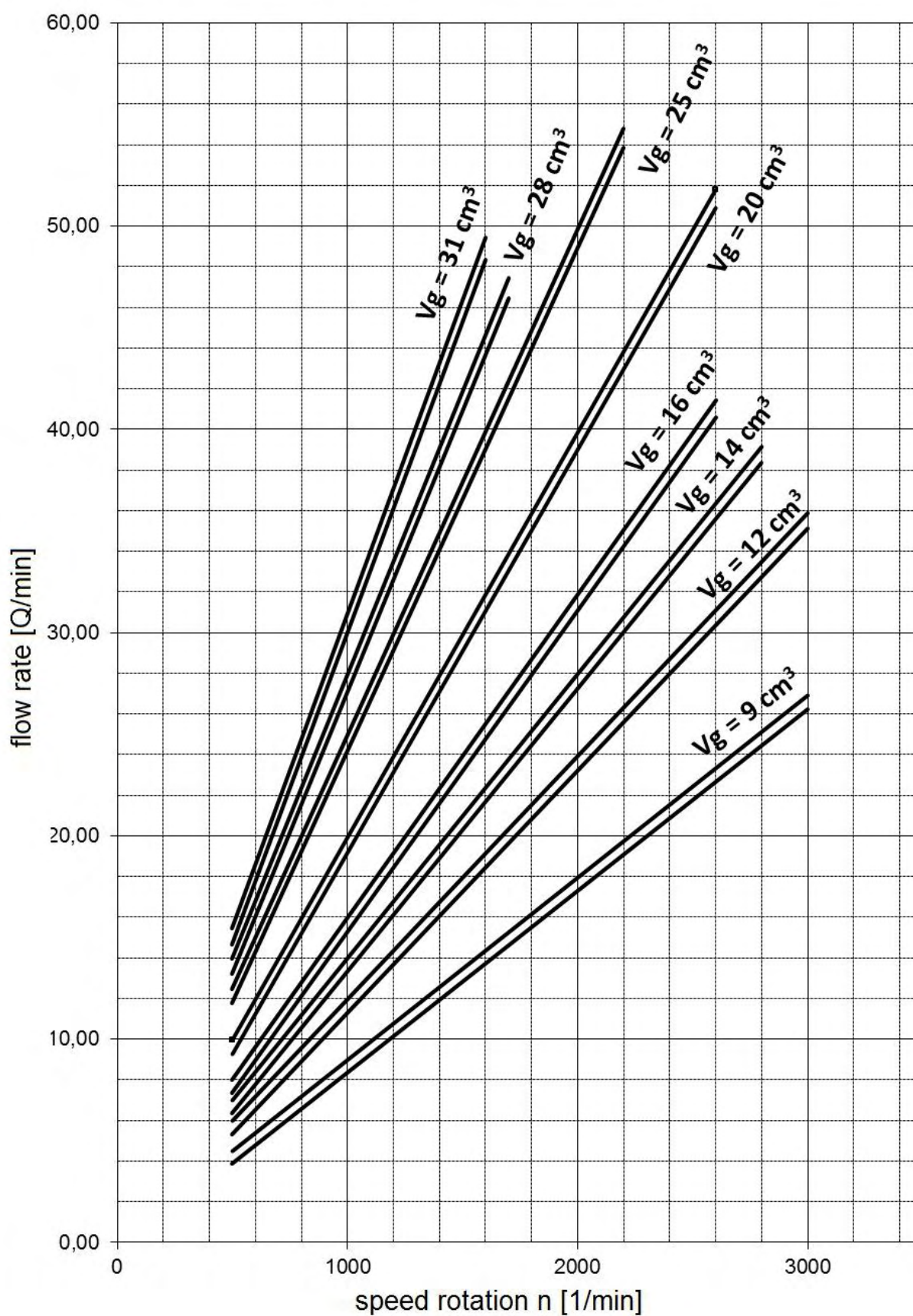
10 (for pressure $p_2 < 200$ bar)

8 (for pressure $p_2 > 200$ bar)

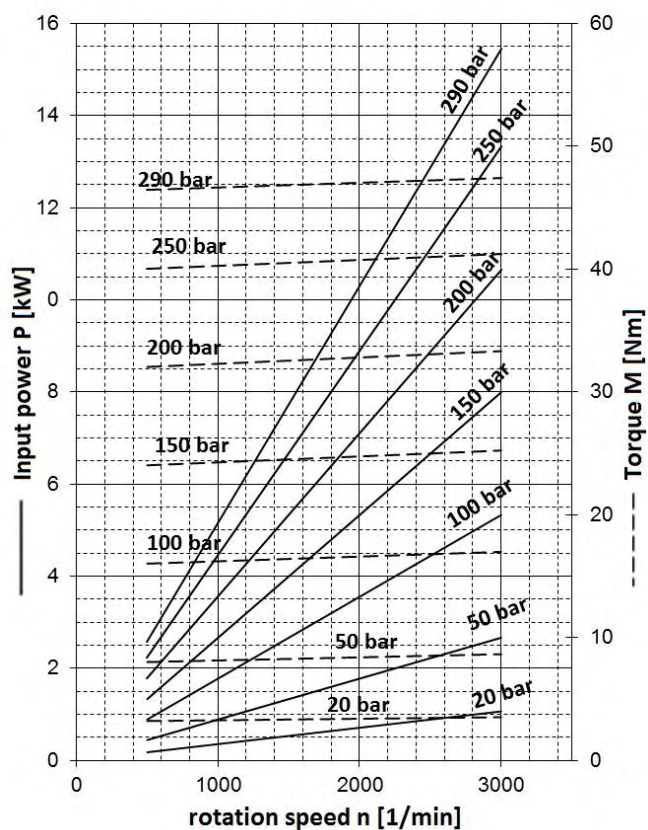
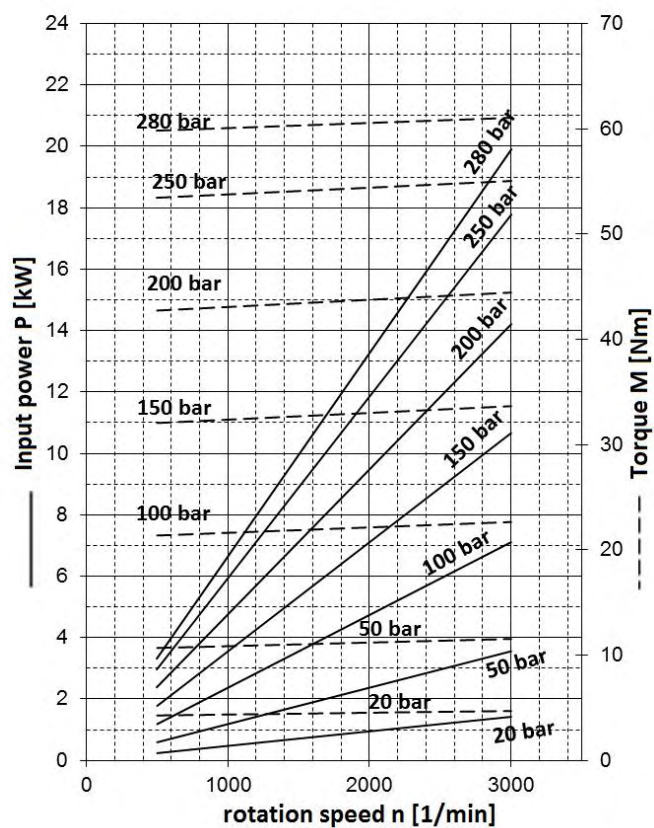
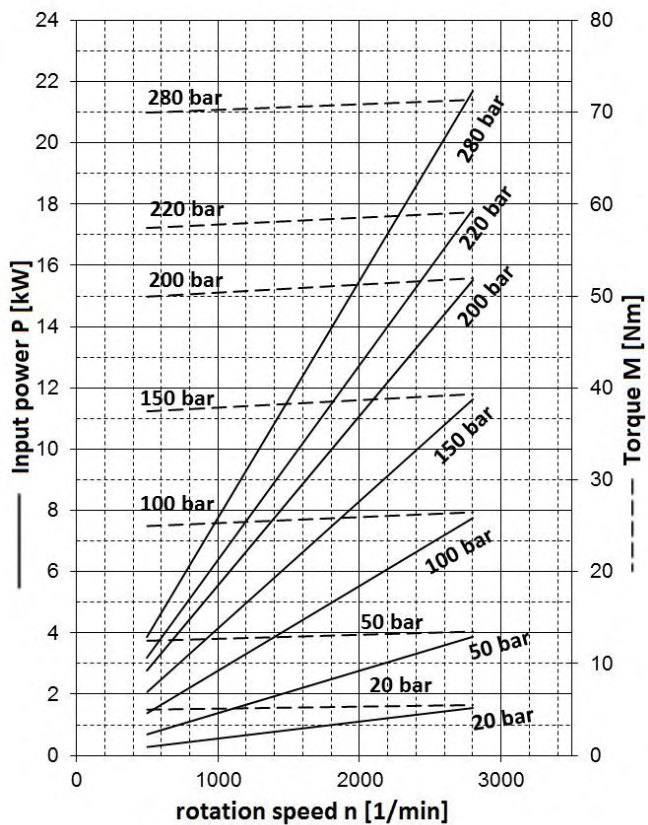
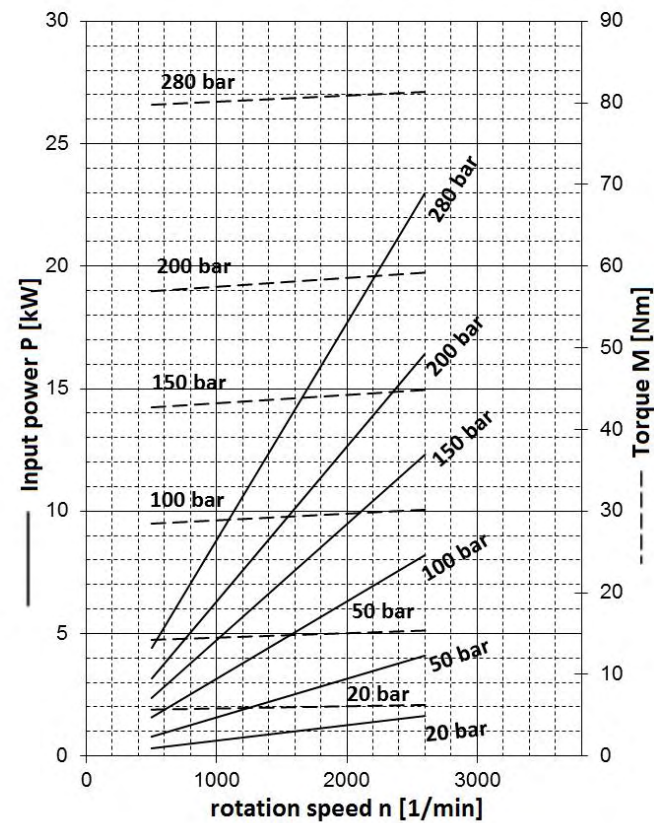
PRESSURE LOAD

p_{2n}	max. contin. pressure	max. working pressure, at which the pump can be operated without time limitation.
p_{2max}	max. pressure	maximum pressure permissible for a short time, max. 20s.
p_3	peak pressure	short-time pressure (fractions of a second) arising in case of a sudden change of the operating mode; any excess of this pressure during operation is impermissible.

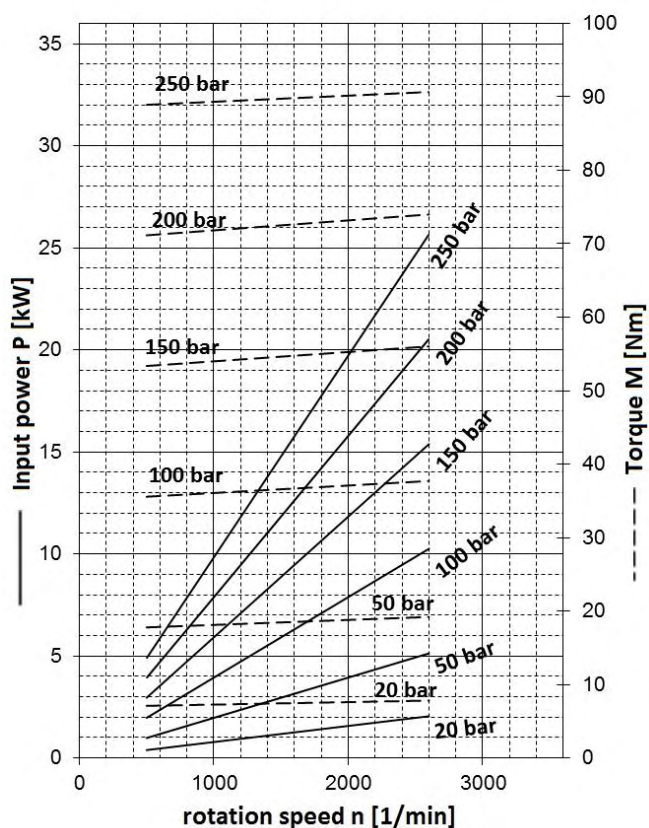
3S FLOW RATE AND POWER CURVES



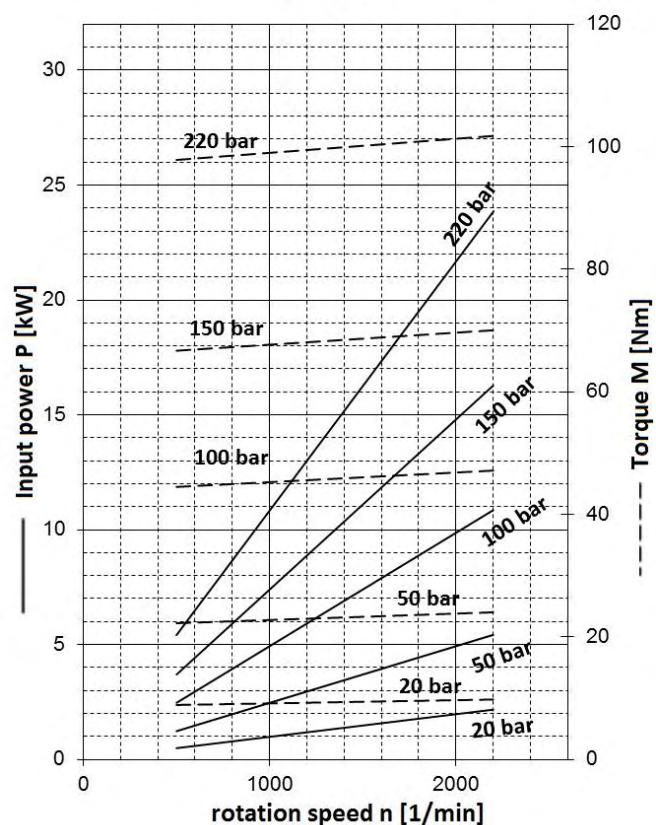
Above curves apply to ISO VG 46 oil at temperature $t = 45^\circ\text{C}$.

9 cm³12 cm³14 cm³16 cm³

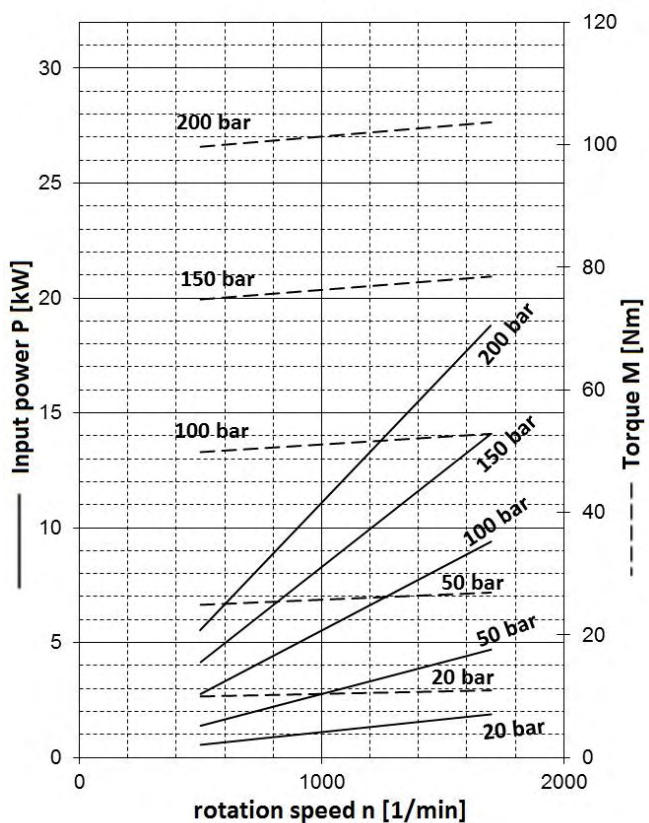
20 cm³



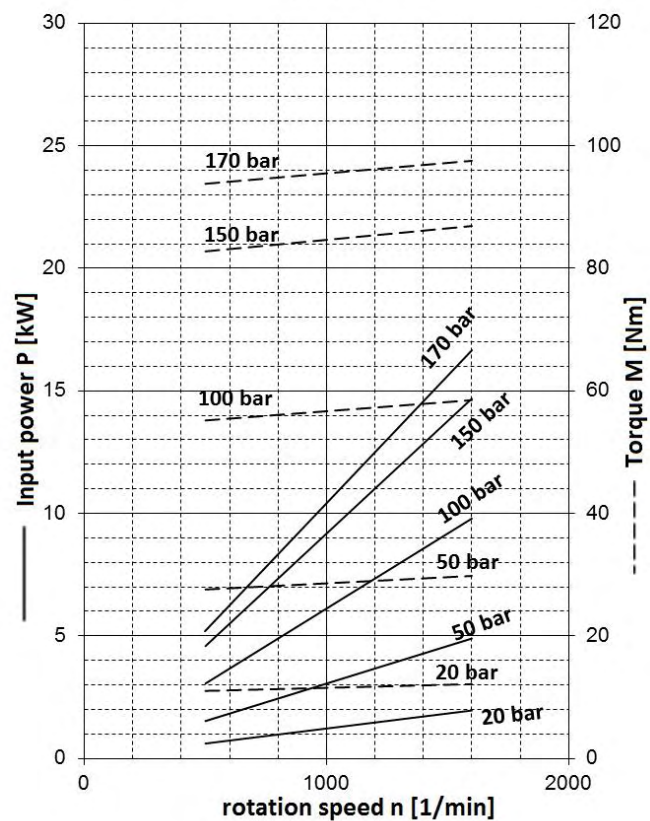
25 cm³



28 cm³



31 cm³



ORDER KEY – SINGLE VERSION

3S - 16 R - S02 D04 - S G04 G03 - V . 001																																					
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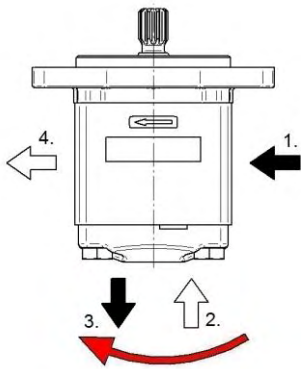
An example of designation for the T3S anti-clockwise pump with displacement of 8 cm³, SAE A flange, SAE 9T spline, BSP inlets in cover and standard NBR seal without special arrangements: **3S-8L-S02D04-RG03G03-N**

3S - 16 / 8 / 8 R - S02 D04 - S G04 G03 / G03 G03 / G03 G03 - V . 001

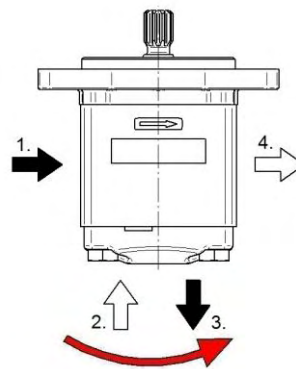
Code	Liquid inlet and outlet connection shape	
M05		Thread M18x1,5
M09		Thread M27x2
G03		Thread BSP G1/2
G04		Thread BSP G3/4
G05		Thread BSP G1"
U04		Thread 7/8-14 UNF-2B
U05		Thread 1-1/16-12 UN-2B
H05		Flanged fitting Ø15 Square 4xM6 Ø35
H06		Flanged fitting Ø20 Square 4xM6 Ø40
H10		Flanged fitting Ø26 Square 4xM8 Ø55
H07		Flanged fitting Ø13,5 Square 4xM6 Ø30
H08		Flanged fitting Ø20 Square 4xM8 Ø40
K01		Flanged fitting Ø13,5 Cross 4xM6 Ø30
K02		Flanged fitting Ø20 Cross 4xM8 Ø40
K07		Flanged fitting Ø14 Cross 4xM8 Ø38
K08		Flanged fitting Ø19 Cross 4xM8 Ø38
Z		Special design

ver 01/2015

Note: In case of combination inlets, with the code "C" is respected following sequence of inlets and outlets:



For clockwise and reverse gear pump,
in direction clockwise



For anti-clockwise gear pump,
in direction anti-clockwise

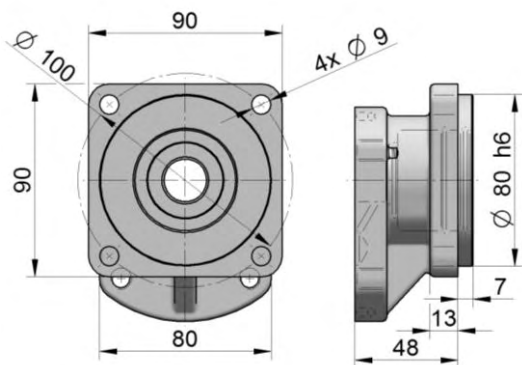
For. ex.: 3-12R-S02D04-CG04G04G03G03-N
 1. 2. 3. 4.

COMBINATIONS OF FLANGES AND SHAFTS

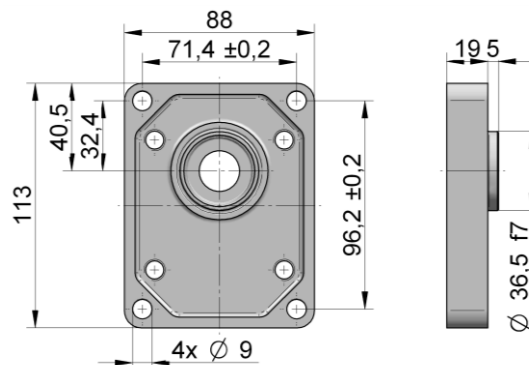
DRIVE SHAFTS		FLANGES DESIGN									
		F02	R05	R06	R07	S02	S03	A07	A08	A09	A10
C07			●								
C08			●								
C09			●								
C10				●				●	●		
D04						●	●				
D06						●	●				
D07						●	●				
D08			●								
D09				●				●	●		
D10		●									
D11					●						
K05										●	●
V09						●	●				
V11			●								
V12						●	●				
V13		●									

FLANGES DESIGN

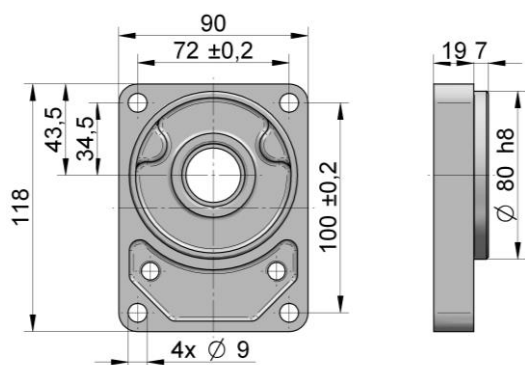
F02:



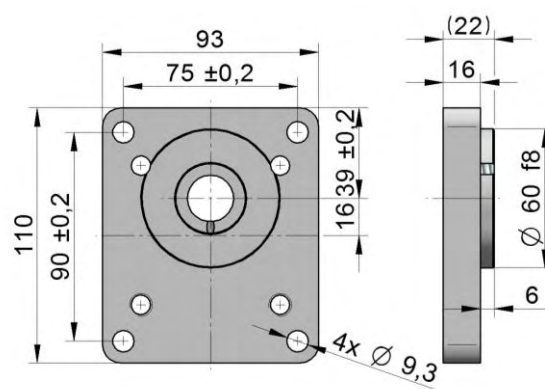
R05:



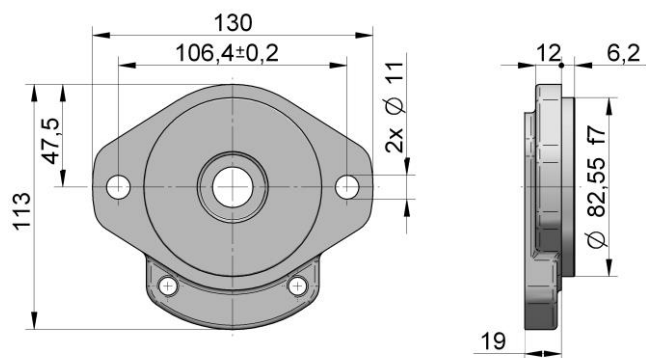
R06:



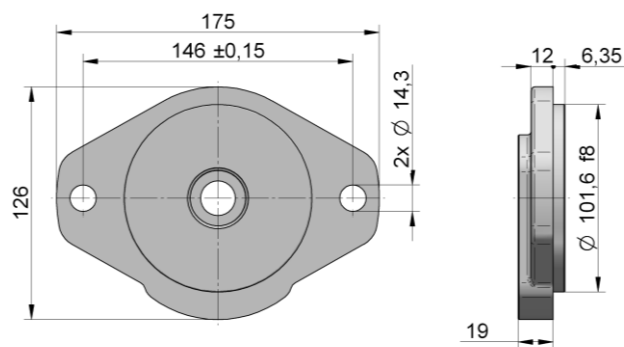
R07:



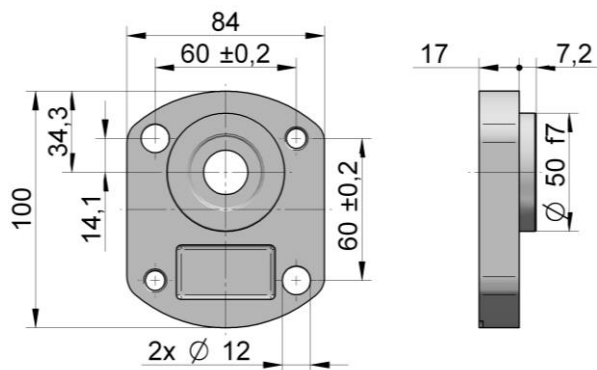
S02:



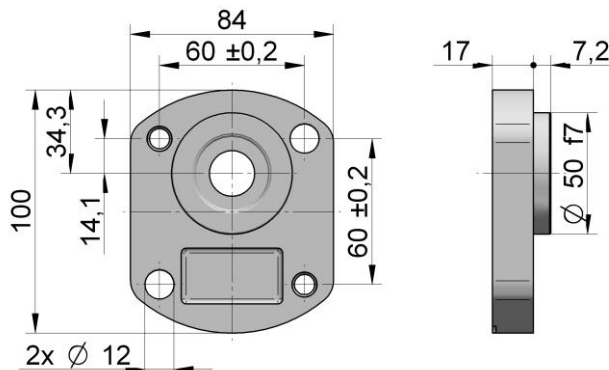
S03:



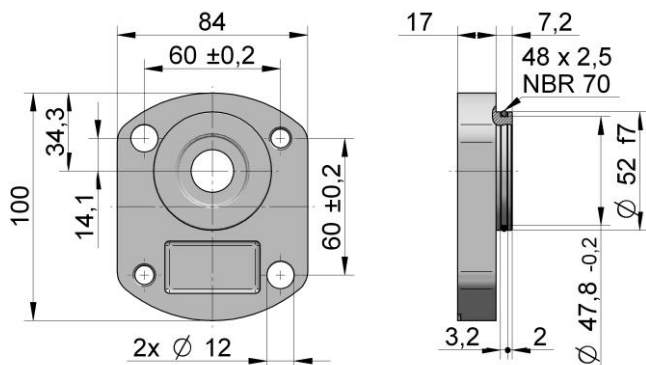
A07:



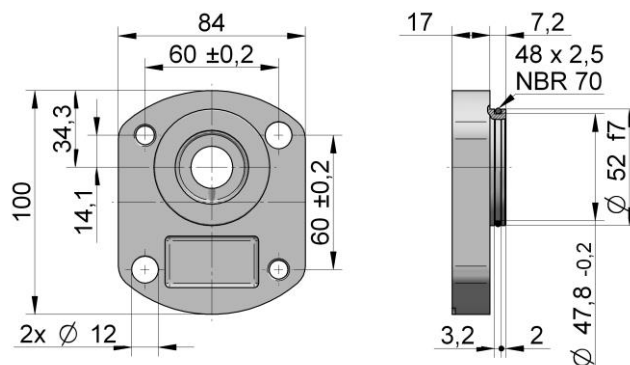
A08:



A09:



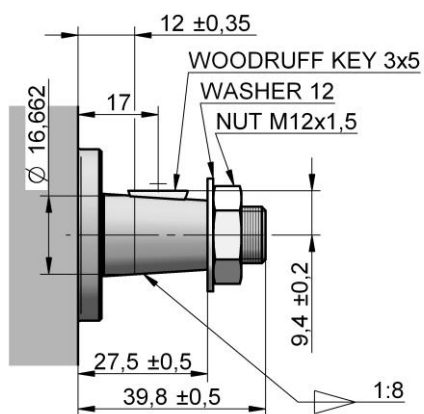
A10:



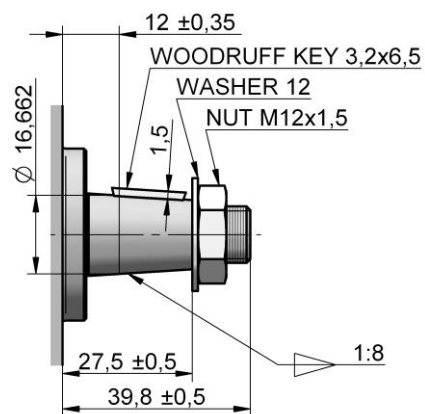
DRIVE SHAFT

Note: maximum allowed torque on a drive shaft is 100 Nm.

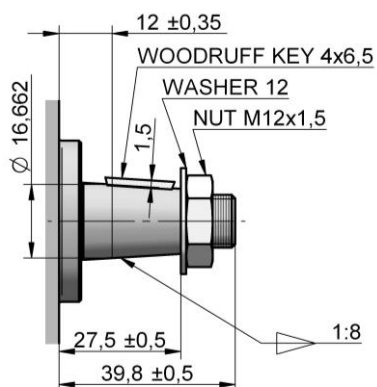
C07:



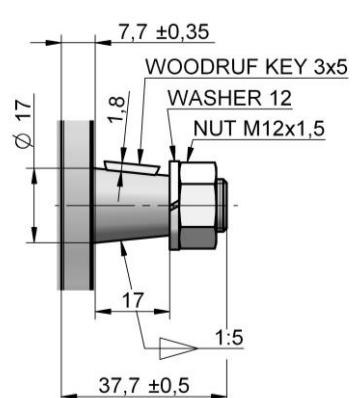
C08:



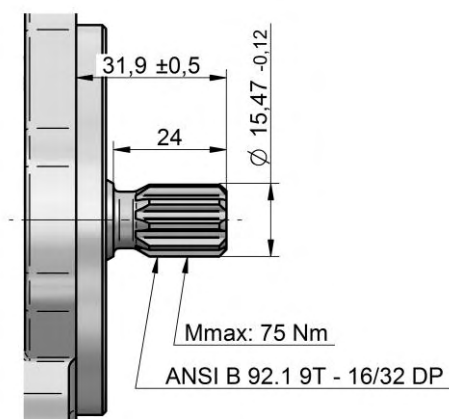
C09:



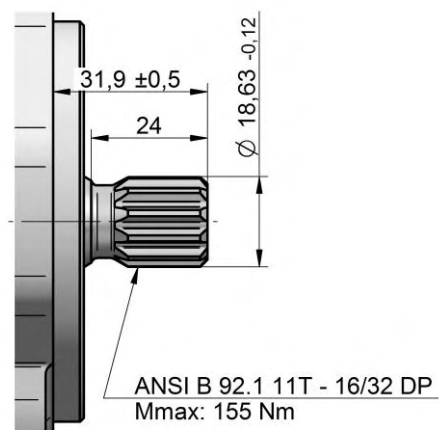
C10:



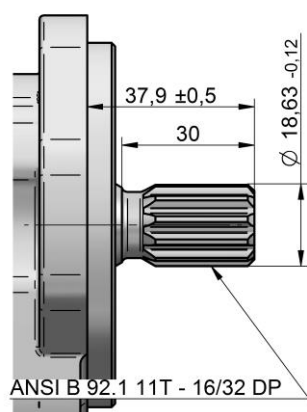
D04:



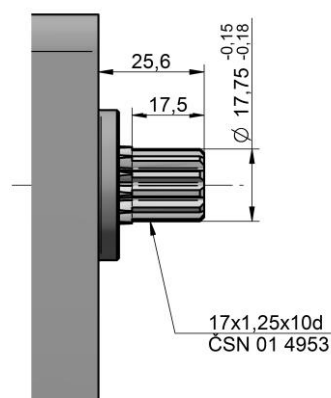
D06:



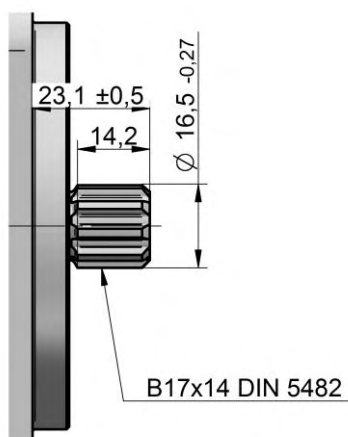
D07:



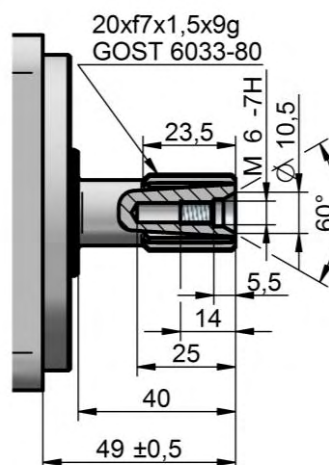
D08:

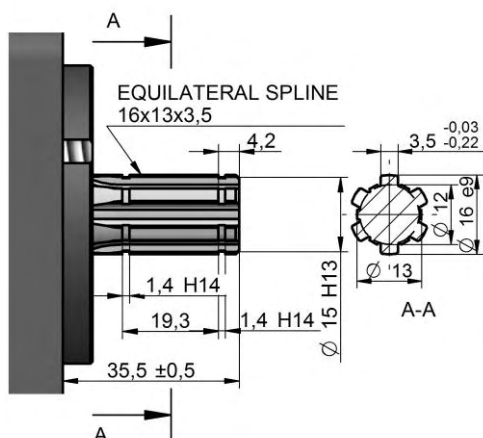
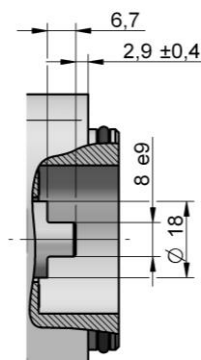
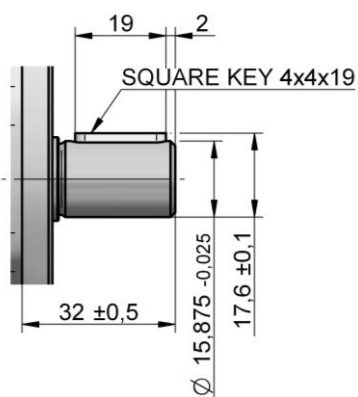
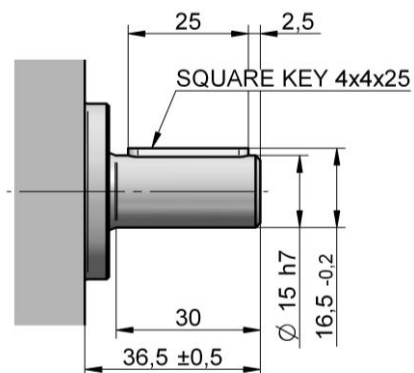
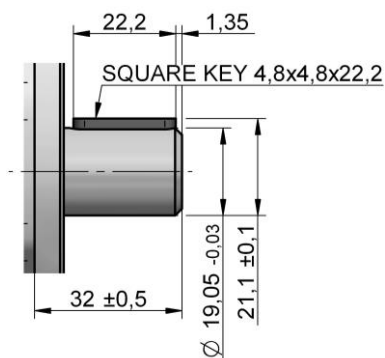
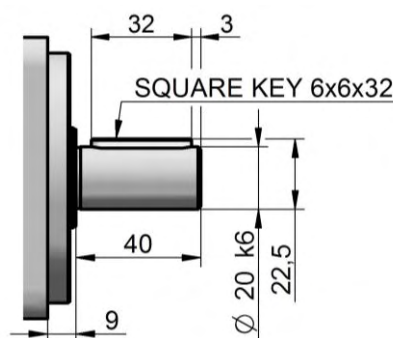


D09:



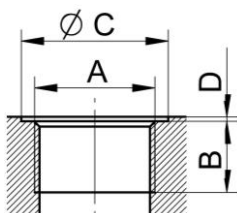
D10:



D11:**K07****V09:****V11:****V12:****V13:**

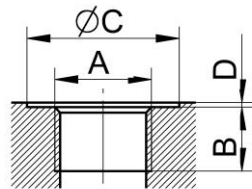
LIQUID INLET AND OUTLET CONNECTION

Metric thread according to ISO 6149



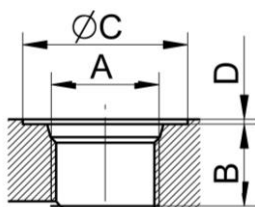
Displacement [cm ³]	Inlet					Outlet				
	Code	A	B	C	D	Code	A	B	C	D
all	M09	M 27x2	16	33	1	M05	M18x1,5	14	24	1

BSPP pipe thread according to ISO 228 - 1



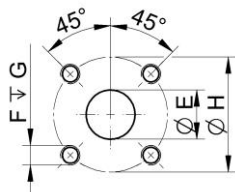
Displacement [cm³]	Inlet					Outlet				
	Code	A	B	C	D	Code	A	B	C	D
to 10	G03	G1/2	14	33	1	G03	G1/2	14	33	1
10 - 25	G04	G3/4	16	39						
above 25	G05	G1"	18	45		G04	G3/4	16	39	

UNF thread according to SAE



Displacement [cm ³]	Inlet					Outlet				
	Code	A	B	C	D	Code	A	B	C	D
to 10	U04	7/8-14 UNF-2B	17	34	1	U04	7/8-14 UNF-2B	17	34	1
11 - 31	U05	1-1/16-12 UNF-2B	19	41						

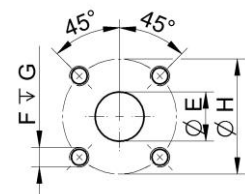
Flanged fittings according to DIN 8901/8902



Displacement [cm ³]	Inlet					Outlet				
	Code	E	F	G	H	Code	E	F	G	H
all	H06	20	M6	13	40	H05	15	M6	13	35
	H10	25	M8	13	55					

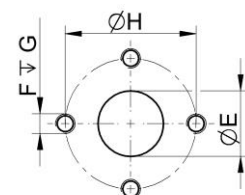
Note: H10H05 – for multiple version with one common inlet

Flanged fittings, - „square“



Displacement [cm ³]	Inlet					Outlet				
	Code	E	F	G	H	Code	E	F	G	H
all	H08	20	M8	13	40	H07	13,5	M6	13	30

Flanged fittings- „cross“

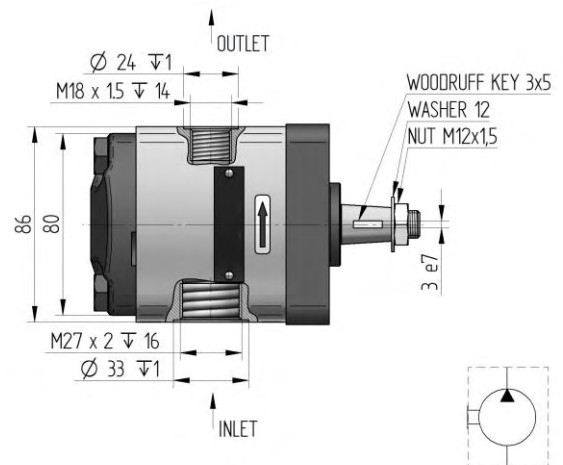
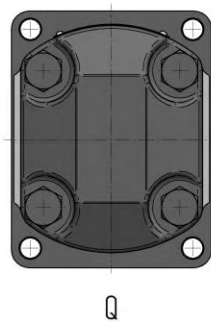
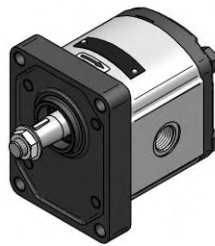
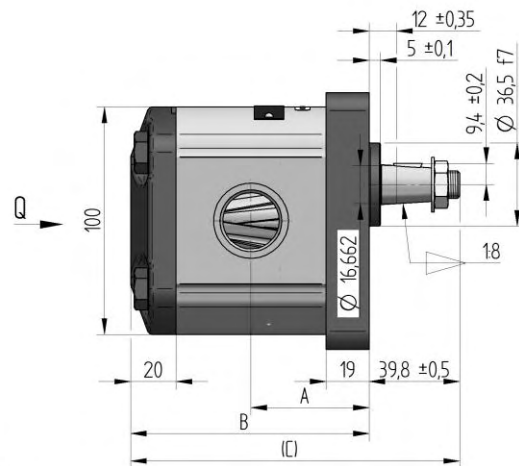
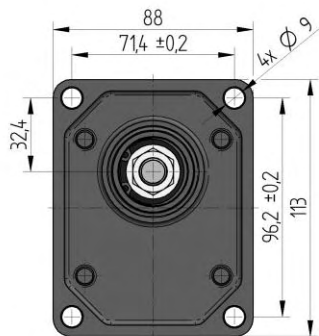


Displacement [cm³]	Inlet					Outlet					
	Code	E	F	G	H	Code	E	F	G	H	
all	K02	20	M8	13	40	K01	13,5	M6	13	30	
to 10	K07	14			38	K07	14	M8		38	
above 10	K08	19									

Drains:

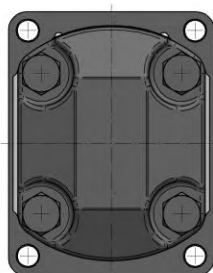
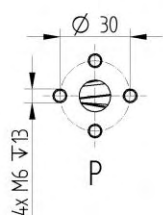
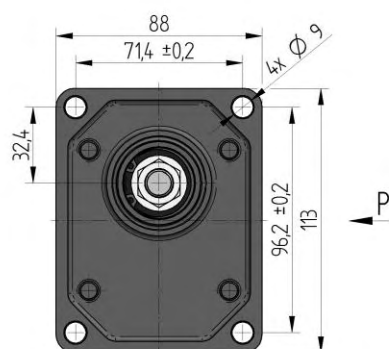
Displacement [cm ³]	Code	Outlet			
		A	B	C	D
all	M02	M12x1,5	12	20	1
	G01	G1/4	12	45	
	U01	7/16-20 UNF-2B	13	21	
	U02	9/16-18 UNF-2B	14	25	

CATALOGUE SHEETS OF 3S SERIES BASIC DESIGNS

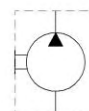
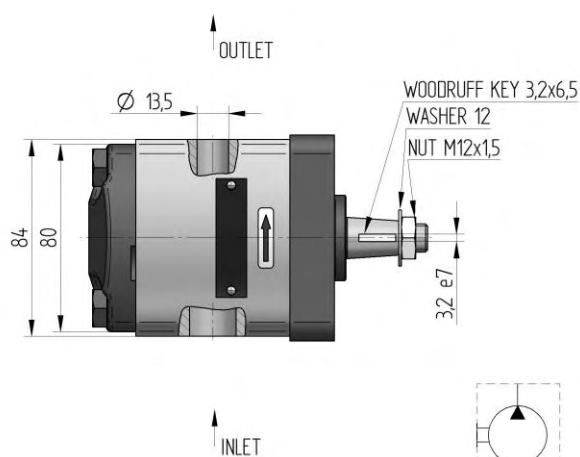
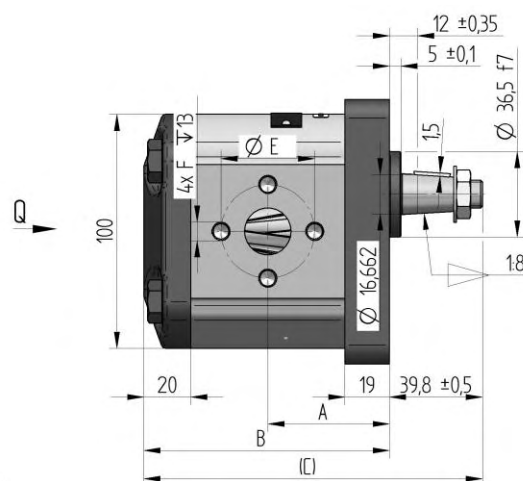
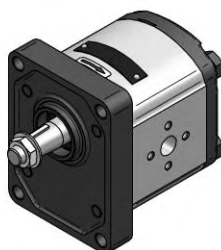


THE CLOCKWISE PUMP IS SHOWN

3S-25R- R05C07-SM09M05-N		R	25	200	500	2 600	59.9	120.8	160.6			
3S-25L- R05C07-SM09M05-N		L										
3S-20R- R05C07-SM09M05-N		R	20	240	500	3 000	55.8	112.7	152.5			
3S-20L- R05C07-SM09M05-N		L										
3S-16R- R05C07-SM09M05-N		R	16	260	500	3 200	52.7	106.5	146.3			
3S-16L- R05C07-SM09M05-N		L										
3S-12R- R05C07-SM09M05-N		R	12	260	500	3 400	49.6	100.2	140.0			
3S-12L- R05C07-SM09M05-N		L										
3S-8R- R05C07-SM09M05-N		R	8	280	500	3 500	46.4	93.9	133.7			
3S-8L- R05C07-SM09M05-N		L										
3S-6R- R05C07-SM09M05-N		R	6	280	500	3 600	44.9	90.7	130.5			
3S-6L- R05C07-SM09M05-N		L										
ORDER KEY	PURCH. CODE	DIRECT. OF ROT.	DISPLA- CEMENT [cm³ /l]	NOM. PRES. [bar]	MIN SPEED [min⁻¹]	A	B	C	DIMENSIONS [mm]			

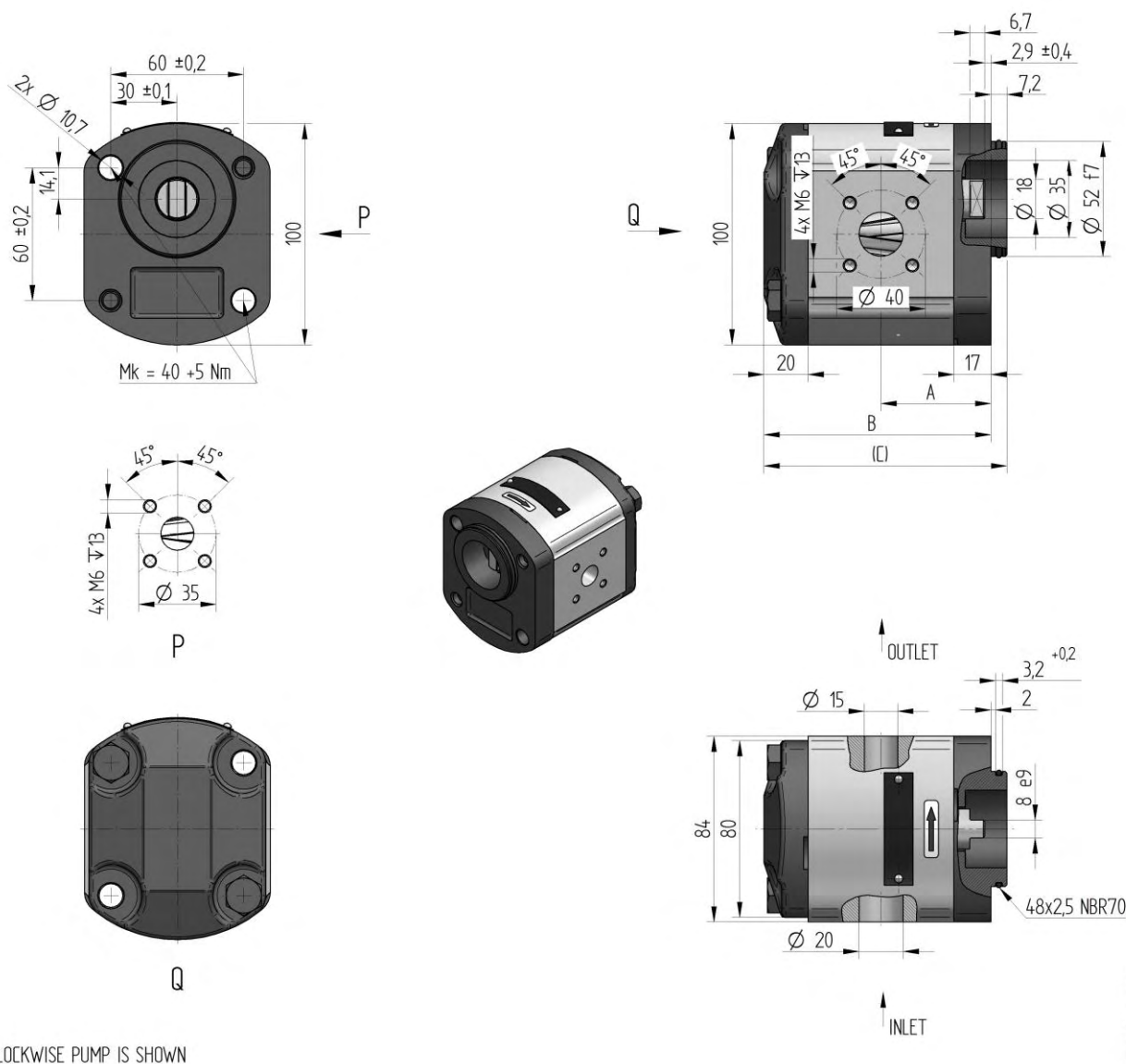


Q



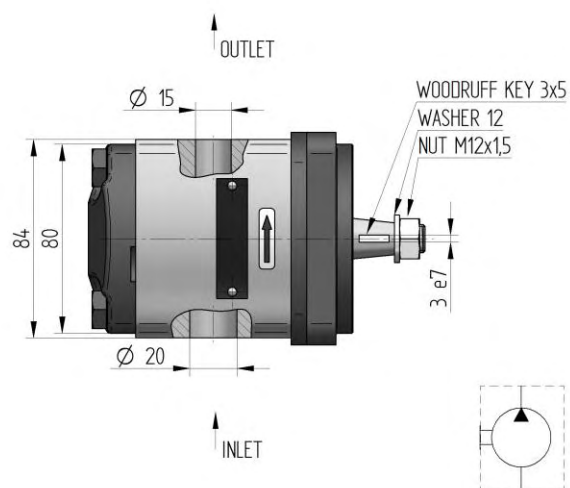
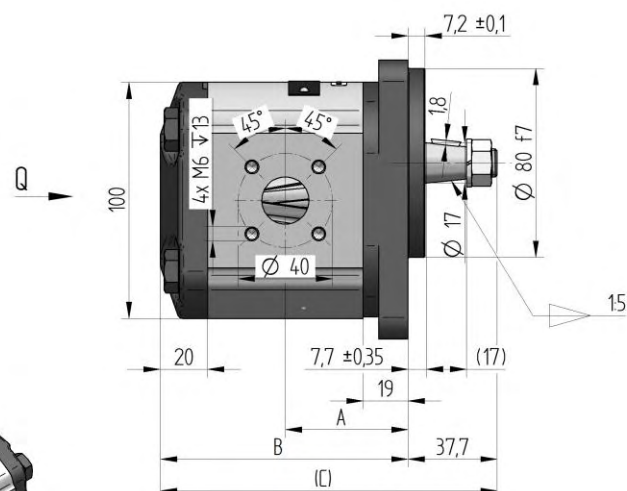
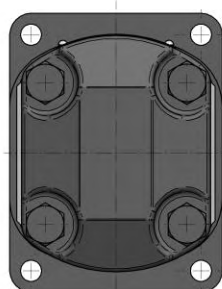
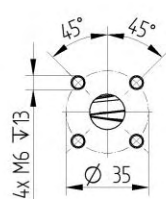
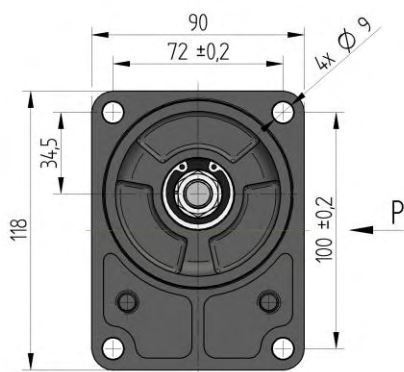
THE CLOCKWISE PUMP IS SHOWN

3S-25R-R05C2-SK02K01-N		R	25	200	500	2 600	59.9	120.8	160.6	Ø 20	Ø 40	M8
3S-25L- R05C2-SK02K01-N		L	25	200	500	2 600	59.9	120.8	160.6	Ø 20	Ø 40	M8
3S-20R- R05C2-SK02K01-N		R	20	240	500	3 000	55.8	112.7	152.5	Ø 20	Ø 40	M8
3S-20L- R05C2-SK02K01-N		L	20	240	500	3 000	55.8	112.7	152.5	Ø 20	Ø 40	M8
3S-16R- R05C2-SK02K01-N		R	16	260	500	3 200	52.7	106.5	146.3	Ø 20	Ø 40	M8
3S-16L- R05C2-SK02K01-N		L	16	260	500	3 200	52.7	106.5	146.3	Ø 20	Ø 40	M8
3S-12R- R05C2-SK02K01-N		R	12	260	500	3 400	49.6	100.2	140.0	Ø 20	Ø 40	M8
3S-12L- R05C2-SK02K01-N		L	12	260	500	3 400	49.6	100.2	140.0	Ø 20	Ø 40	M8
3S-8R- R05C2-SK01K01-N		R	8	280	500	3 500	46.4	93.9	133.7	Ø 13.5	Ø 30	M6
3S-8L- R05C2-SK01K01-N		L	8	280	500	3 500	46.4	93.9	133.7	Ø 13.5	Ø 30	M6
3S-6R- R05C2-SK01K01-N		R	6	280	500	3 600	44.9	90.7	130.5	Ø 13.5	Ø 30	M6
3S-6L- R05C2-SK01K01-N		L	6	280	500	3 600	44.9	90.7	130.5	Ø 13.5	Ø 30	M6
ORDER KEY	PURCH. CODE	DIRECT. OF ROT.	DISPLACEMENT [cm³/l]	NOM. PRES. [bar]	MIN SPEED [min⁻¹]	ORDER SPEED [min⁻¹]	A	B	C	D	E	F
DIMENSIONS [mm]												



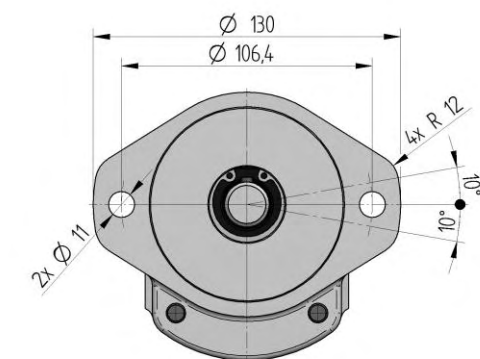
THE CLOCKWISE PUMP IS SHOWN

3S-25R- A09K07-SH06H05-N.004		R	25	200	500	2 600	57.9	118.8	126.0		
3S-25L- A09K07-SH06H05-N.004		L									
3S-20R- A09K07-SH06H05-N.004		R	20	240	500	3 000	53.8	110.7	117.9		
3S-20L- A09K07-SH06H05-N.004		L									
3S-16R- A09K07-SH06H05-N.004		R	16	260	500	3 200	50.7	104.5	111.7		
3S-16L- A09K07-SH06H05-N.004		L									
3S-12R- A09K07-SH06H05-N.004		R	12	260	500	3 400	47.6	98.2	105.4		
3S-12L- A09K07-SH06H05-N.004		L									
3S-8R- A09K07-SH06H05-N.004		R	8	280	500	3 500	44.4	91.9	99.1		
3S-8L- A09K07-SH06H05-N.004		L									
3S-6R- A09K07-SH06H05-N.004		R	6	280	500	3 600	42.9	88.7	95.9		
3S-6L- A09K07-SH06H05-N.004		L									
ORDER KEY	PURCH. CODE	DIRECT. OF ROT.	DISPLACEMENT [cm ³ /1]	NOM. PRESS. [bar]	MIN SPEED [min ⁻¹]	ORDER SPEED [min ⁻¹]	A	B	C	DIMENSIONS [mm]	

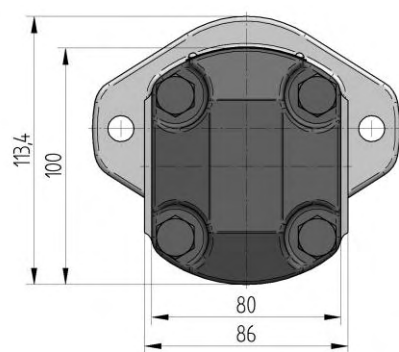
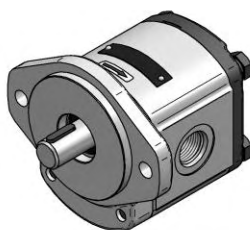
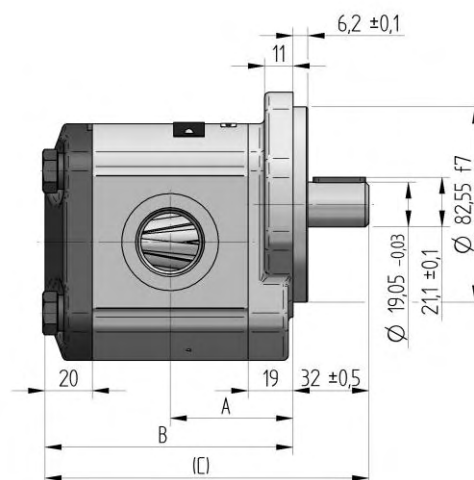


THE CLOCKWISE PUMP IS SHOWN

3S-25R- R06C10-SH06H05-N		R	25	200	500	2 600	59.9	120.8	158.5			
3S-25L- R06C10-SH06H05-N		L										
3S-20R- R06C10-SH06H05-N		R	20	240	500	3 000	55.8	112.7	150.4			
3S-20L- R06C10-SH06H05-N		L										
3S-16R- R06C10-SH06H05-N		R	16	260	500	3 200	52.7	106.5	144.2			
3S-16L- R06C10-SH06H05-N		L										
3S-12R- R06C10-SH06H05-N		R	12	260	500	3 400	49.6	100.2	137.9			
3S-12L- R06C10-SH06H05-N		L										
3S-8R- R06C10-SH06H05-N		R	8	280	500	3 500	46.4	93.9	131.6			
3S-8L- R06C10-SH06H05-N		L										
3S-6R- R06C10-SH06H05-N		R	6	280	500	3 600	44.9	90.7	128.4			
3S-6L- R06C10-SH06H05-N		L										
ORDER KEY	PURCH. CODE	DIRECT. OF ROT.	DISPLACEMENT [cm³/l]	NOM. PRESS. [bar]	SPEED [min⁻¹]		A	B	C	DIMENSIONS [mm]		

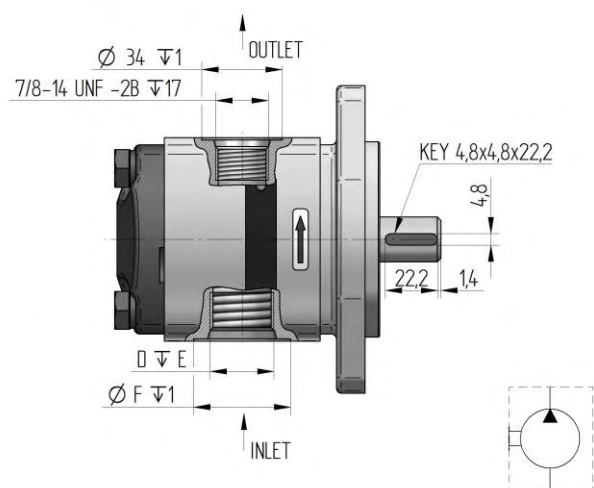


Q

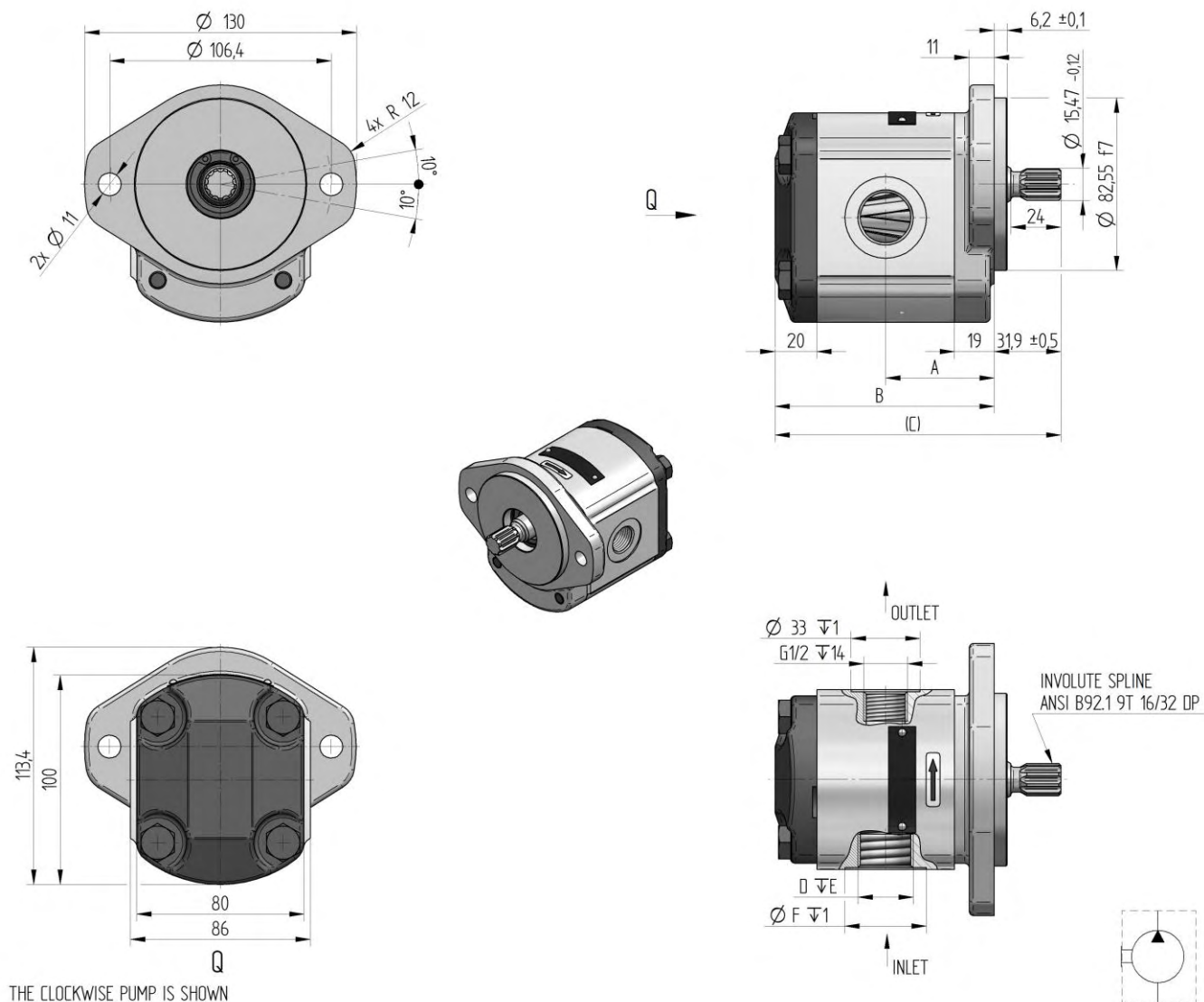


Q

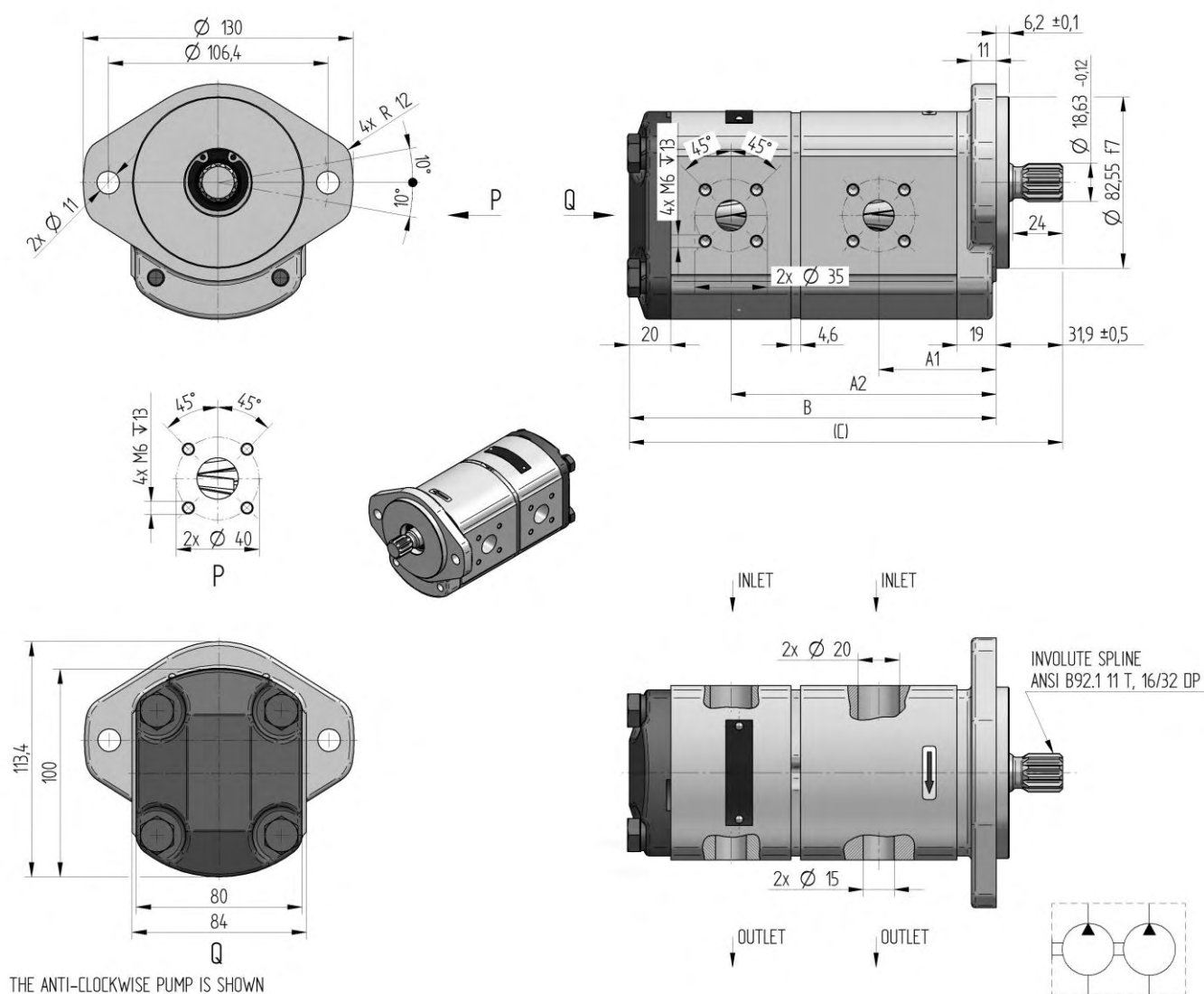
THE CLOCKWISE PUMP IS SHOWN



3S-25R- S02V12-SU05U04-N		R	25	200	500	2 600	59.9	120.8	152.8	1-1/16-12 UN-2B	19	41	
3S-25L- S02V12-SU05U04-N		L											
3S-20R- S02V12-SU05U04-N		R	20	240	500	3 000	55.8	112.7	144.7	1-1/16-12 UN-2B	19	41	
3S-20L- S02V12-SU05U04-N		L											
3S-16R- S02V12-SU05U04-N		R	16	260	500	3 200	52.7	106.5	138.5	1-1/16-12 UN-2B	19	41	
3S-16L- S02V12-SU05U04-N		L											
3S-12R- S02V12-SU05U04-N		R	12	260	500	3 400	49.6	100.2	132.2	1-1/16-12 UN-2B	19	41	
3S-12L- S02V12-SU05U04-N		L											
3S-8R- S02V12-SU04U04-N		R	8	280	500	3 500	46.4	93.9	125.9	7/8-14 UNF-2B	17	34	
3S-8L- S02V12-SU04U04-N		L											
3S-6R- S02V12-SU04U04-N		R	6	280	500	3 600	44.9	90.7	122.7	7/8-14 UNF-2B	17	34	
3S-6L- S02V12-SU04U04-N		L											
ORDER KEY	PURCH. CODE	DIR. OF ROT.	DISPLACEMENT [cm³/l]	NOM. PRESS. [bar]	MIN SPEED [min⁻¹]	MAX SPEED [min⁻¹]	A	B	C	D	E	F	
DIMENSIONS [mm]													



3S-25R-S02D04-SG04G03-N		R	25	200	500	2 600	59.9	120.8	152.7	G 3/4	16	39
3S-25L- S02D04-SG04G03-N		L										
3S-20R- S02D04-SG04G03-N		R	20	240	500	3 000	55.8	112.7	144.6	G 3/4	16	39
3S-20L- S02D04-SG04G03-N		L										
3S-16R- S02D04-SG04G03-N		R	16	260	500	3 200	52.7	106.5	138.4	G 3/4	16	39
3S-16L- S02D04-SG04G03-N		L										
3S-12R- S02D04-SG04G03-N		R	12	260	500	3 400	49.6	100.2	132.1	G 3/4	16	39
3S-12L- S02D04-SG04G03-N		L										
3S-8R- S02D04-SG03G03-N		R	8	280	500	3 500	46.4	93.9	125.8	G 1/2	14	33
3S-8L- S02D04-SG03G03-N		L										
3S-6R- S02D04-SG03G03-N		R	6	280	500	3 600	44.9	90.7	122.6	G 1/2	14	33
3S-6L- S02D04-SG03G03-N		L										
ORDER KEY	PURCH. CODE	DIRECT. OF ROT.	DISPLACEMENT [cm ³ /l]	NOM. PRESS. [bar]	MIN	MAX	A	B	C	D	E	F
DIMENSIONS [mm]												



Other combinations are available after consultation

ORDER KEY	PURCH. CODE	DIRECT OF ROT.	DISPLACEMENT [cm³/l]	NOM. PRESS. [bar]	MIN SPEED [min⁻¹]	MAX SPEED [min⁻¹]	A1	A2	B	C	DIMENSIONS [mm]
3S-20/6R- S02D06-SH06H05/H06H05-N		R	20/6	240/280	500	3 000	55.8	123.1	169.0	200.9	
3S-20/6L- S02D06-SH06H05/H06H05-N		L									
3S-12/6R- S02D06-SH06H05/H06H05-N		R	12/6	260/280	500	3 400	49.6	110.6	156.5	188.4	
3S-12/6L- S02D06-SH06H05/H06H05-N		L									
3S-8/8R- S02D06-SH06H05/H06H05-N		R	8/8	280	500	3 500	46.4	105.9	153.4	185.3	
3S-8/8L- S02D06-SH06H05/H06H05-N		L									
3S-6/6R- S02D06-SH06H05/H06H05-N		R	6/6	280	500	3 600	44.8	101.1	147.0	178.9	
3S-6/6L- S02D06-SH06H05/H06H05-N		L									

[illegible]