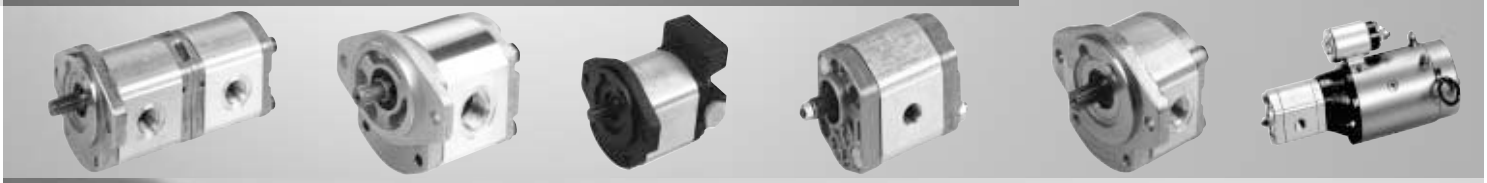
Rexroth
Bosch Group

Program Information
External Gear Pumps & Motors

The Drive Control Company



Technology with many advantages

When it comes to quality, performance and choice of design, the external gear products from Rexroth set standards. For decades, we at the Mobile Hydraulics Division have successfully been working on the development and production of this efficient, value-for-money technology. The result is external gear products which perform with universal reliability in the most varied branches and which, as a pump or motor, can offer the right configuration for every application.

Tried and tested technology

The external gear pump uses the most popular pumping method in hydraulics. The products are compact in design and extremely reliable in operation. The price/performance ratio of this method of pressure generation is unrivalled. Proven designs, stringent endurance tests, along with incorporating specially developed materials, guarantee products of the very highest quality. Our intensive system of quality control is one of the crucial factors in the successful employment of Rexroth external gear products.
We manufacture these products all over the world in large numbers for the most varied spectrum of applications that our customers desire. There is scarcely any other type of pump that can satisfy so many different requirements with so little problem as the external gear product.

The advantages of Rexroth external gear products:

- Low costs over the product's life
- Modular constructions
- Compact design
- Optimum efficiency
- Multiple pump technology available
- Option of a single intake port for several pump sections
- Valve functions can be integrated
- High quality standard through large-scale production all over the world using uniform manufacturing processes
- Low air-borne noise levels
- Rapid availability

Rexroth provides:

- A global presence
- Top quality through the use of automotive quality standards
- State-of-the-art production technology
- Constant quality control during production
- Maximum commitment to delivery deadlines

The applications: as diverse as our range

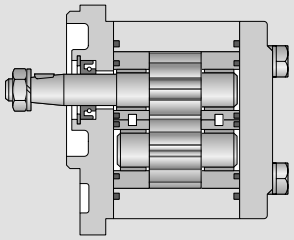
Rexroth external gear products are suitable for applications using operating pressures of up to 300 bar. And depending on the size of the pump, they can also cope with rotational speeds of up to more than 6000 rpm. The range of hydraulic fluids with which they can work is extremely broad and encompasses all the fluids commonly in use today. Thanks to the modular construction of Rexroth external gear products, they can be used for a virtually unlimited number of customized applications. The principle uses of external gear products are, among others: in agricultural machines, commercial vehicles, industrial trucks and construction machinery.

The modular system for a wide variety of applications

External gear pumps and motors are hydrostatic displacement machines that are produced in large numbers all over the world. This is due, on the one hand, to the unrivalled price/performance ratio of this method of displacement. Another key factor is that Rexroth standard components provide opportunities for a multitude of customized applications.

So Rexroth has developed a modular system with which a huge range of requirements can be satisfied without problem. In addition to a dense range of individual pumps of different sizes, this modular system also contains multiple pumps offering a variety of combinations, pumps with valve technology, plus diverse mounting flanges and line connections.

Technical Information (Pump Series B,F,N,G)



Fixed displacement pumps

Standard design

Nominal pressure 250 bar

- → Bushing type bearings for heavy duty applications
- → Drive shafts to SAE or ISO
- → Combination of several pumps possible
- → Line connections: split flange or threaded

Standard, frame size B	**Size**		**1**	**2**	**3**	**4**	**5**
Displacement	$V_{g\,max}$	in^3	.06	.12	.18	.23	.28
Operating pressure continuous	p	bar	210	210	210	190	140
Max. peak pressure	P_{max}	bar	250	250	250	230	180
Max. speed[1)]	n	rpm	6000	5000	4000	4000	4000
Weight	m	lb	1.8	1.9	2.0	2.0	2.0

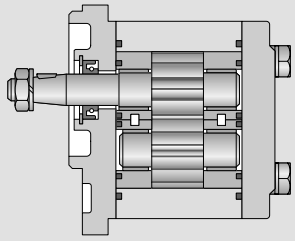
Standard, frame size F	**Size**		**4**	**5**	**8**	**11**	**14**	**16**	**19**	**22**	**25**	**28**
Displacement	$V_{g\,max}$	in^3	.25	.34	.50	.69	.88	1.00	1.20	1.40	1.53	1.71
Operating pressure continuous	p	bar	250	250	250	250	250	250	210	180	200	170
Max. peak pressure	P_{max}	bar	300	300	300	300	300	300	250	230	240	210
Max. speed[1)]	n	rpm	4000	4000	4000	3500	3000	3000	3000	2500	3000	3000
Weight	m	lb	6.2	6.3	6.4	6.6	7.0	7.5	8.0	8.4	8.8	9.3

Standard, frame size N	**Size**		**20**	**22**	**25**	**28**	**32**	**36**
Displacement	$V_{g\,max}$	in^3	1.22	1.37	1.53	1.71	1.95	2.20
Operating pressure continuous	p	bar	230	230	230	210	180	160
Max. peak pressure	P_{max}	bar	270	270	270	250	220	200
Max. speed[1)]	n	rpm	3000	3000	3000	2800	2800	2600
Weight	m	lb	11.9	12.1	12.3	12.6	13.0	13.2

Standard, frame size G	**Size**		**22**	**28**	**32**	**38**	**45**	**56**
Displacement	$V_{g\,max}$	in^3	1.37	1.71	1.95	2.32	2.75	3.42
Operating pressure continuous	p	bar	210	210	210	200	180	160
Max. peak pressure	P_{max}	bar	270	270	270	270	250	220
Max. speed[1)]	n	rpm	3000	3000	2800	2800	2600	2300
Weight	m	lb	19.8	20.3	20.7	21.4	21.8	22.9

[1)] Min. speed 500-750 rpm. Please contact factory

Technical Information (Pump Series F, Silence Design)



Fixed displacement pumps

Silence version

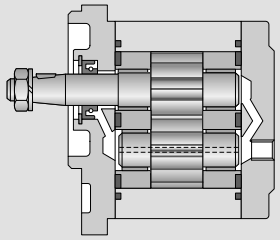
Nominal pressure 250 bar

- → Bushing type bearings for heavy duty applications
- → Drive shafts to SAE or ISO
- → Combination of several pumps possible
- → Line connections: split flange or threaded
- → Optimized pressure pulsation reduces noise levels and oscillations in the system
- → Reinforced shaft and housing for distinctly longer service life

Silence version	Size		4	5	8	11	14	16	19	22	25	28
Displacement	$V_{g\ max}$	in^3	.25	.34	.50	.69	.88	1.00	1.20	1.40	1.53	1.71
Operating pressure continuous	p	bar	250	250	250	250	250	250	250	220	200	170
Max. peak pressure	P_{max}	bar	300	300	300	300	300	300	300	270	240	210
Max. speed[1)]	n	rpm	4000	4000	4000	3500	3000	3000	3000	3000	3000	3000
Weight	m	lb	6.2	6.3	6.4	6.6	7.0	7.5	8.0	8.4	8.8	9.3

[1)] Min. speed 500 rpm

Technical Information (Motor Series F,G)



Fixed displacement motors

Nominal pressure 250 bar

- → Motors for one direction of rotation
- → Motors for bi-directional rotation
- → Large variety of design versions available
- → Bushing type bearings for heavy duty applications
- → Drive shafts to SAE or ISO
- → Line connections: split flange or threaded

Frame size F	Size		8	11	14	16	19	22
Displacement	$V_{g\,max}$	in^3	.50	.69	.88	1.00	1.20	1.40
Max. continuous pressure	P_1	bar	250	250	250	250	180	180
Max. starting pressure	P_2	bar	280	280	280	280	210	210
Min. speed	n	rpm	500	500	500	500	500	500
Max. speed at P_1	n	rpm	4000	3500	3000	3000	3000	3000
Weight	m	lb	6.4	6.6	7.0	7.5	8.0	8.4

Frame size G	Size		22	28	32	38	45
Displacement	$V_{g\,max}$	in^3	1.37	1.71	1.95	2.32	2.75
Max. continuous pressure	P_1	bar	180	180	180	180	180
Max. starting pressure	P_2	bar	250	250	250	250	230
Min. speed	n	rpm	500	500	500	500	500
Max. speed at P_1	n	rpm	3000	3000	2800	2600	2600
Weight	m	lb	19.8	20.3	20.7	21.4	21.8

Ordering Code (Pump Series B)

Features
- High pressures combined with small size and low weight
- Large speed ranges
- Broad viscosity and temperature ranges

Customer benefits
- Value-for-money method of pressure generation
- Consistent high quality due to large-scale production
- Different versions available on request

A Z - P - B - 1 X - 0 0 5 - R C P 0 2 M B

Function

P = Pump

Size (B)

.06 in³ (1.0 cm³) = 001
.12 in³ (2.5 cm³) = 002
.18 in³ (3.0 cm³) = 003
.23 in³ (3.8 cm³) = 004
.28 in³ (4.6 cm³) = 005

Direction of rotation

Right = R
Left = L

End cover

Standard = B
Rear ports = A

Seals

NBR = M
NBR, shaft seal in FPM = K

Drive shafts

		Matching front flange
C	Conical 1:5 (Tapered key)	P
N	Dog (Tang)	M

Front flange

P	Transmission flange Centring Ø 32 mm
M	Transmission flange Centring Ø 32 mm with O-ring

Line connections

20	Rectangular flange
01	BSP Pipe thread ISO 228
02	Metric thread DIN 3852, T1

Note: Consult Factory for Availability

Ordering Code (Pump Series F)

Features
- High pressures combined with small size and low weight
- Large speed ranges
- Broad viscosity and temperature ranges

Customer benefits
- Value-for-money method of pressure generation
- Consistent high quality due to large-scale production
- Large number of different versions available

AZ - P - F - 1X or 2X - 016 - R C B 20 M B

Function
P = Pump

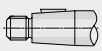
Size (F)
.25in³ (4.0 cm³)1X = 004
.34in³ (5.5 cm³)1X = 005
.50in³ (8.0 cm³)1X = 008
.69in³ (11.0 cm³)1X = 011
.88in³ (14.0 cm³)1X = 014
1.00 in³ (16.0 cm³)1X = 016
1.20 in³ (19.0 cm³)1X = 019
1.40 in³ (22.5 cm³)1X = 022
1.53 in³ (25.0 cm³)2X = 025
1.71 in³ (28.0 cm³)2X = 028

Direction of rotation
Right = R
Left = L

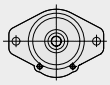
End cover
Standard = B Rear ports = A
Pressure relief valve on request
Flow control valve on request

Seals
NBR = M
FPM = P
NBR, shaft seal in FPM = K

Drive shafts

			Matching front flange	
C	Conical 1:5 (Tapered key)		B	P
S	Conical 1:5 for flange A (Tapered key)		A	
H	Conical 1:8 (Tapered key)		O	
N	Dog (Tang)		M	
A	Cylindrical (Straight key) ISO Ø 18mm		B	
Q	Cylindrical (Straight key) SAE A 5/8”		R	
R	Spline shaft SAE A 9T		R	C
P	Spline shaft SAE 11T		R	C
F	Splne shaft DIN 5482 B17x14		B	P

Front flange

B	Square flange Centring Ø 80 mm	
R	SAE A 2-bolt	
P	Transmission flange Centring Ø 50 mm	
O	Square flange Centring Ø 36.47 mm	
C	SAE B 2-bolt	
M	Transmission flange Centring Ø 52 mm with O-ring	
A	Outrigger bearing Centring Ø 80 mm (outboard bearing)	

Line connections

20	Rectangular flange	
12	Thread (UN-2B) SAE O-ring BOSS	
01	BSP Pipe thread ISO 228	
30	Rectangular flange	
07	Split flange SAE Code 61 Metric bolts	
40	Split flange SAE Code 61 UNC bolts	

Ordering Code (Motor Series F)

Features
- High pressures combined with small size and low weight
- Large speed ranges
- Broad viscosity and temperature ranges
- Bi-directional motors

Customer benefits
- Consistent high quality due to large-scale production
- Large number of different versions available

A Z - M - F - 1 X - 0 1 6 - R C B 2 0 M B

Function

M = Motor

Size (F)

.50in³ (8.0 cm³) = 008
.69in³ (11.0 cm³) = 011
.88in³ (14.0 cm³) = 014
1.00 in³ (16.0 cm³) = 016
1.20 in³ (19.0 cm³) = 019
1.40 in³ (22.5 cm³) = 022

Direction of rotation

Right = R
Left = L
Universal = U (Bi-rotational)

End cover

Standard = B Rear ports = A
Case drain port = L
Internal case drain = L-SO018

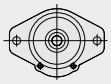
Seals

NBR = M
FPM = P
NBR, shaft seal in FPM = K

Drive shafts

		Matching front flange	
C	Conical 1:5 (Tapered key)	B	P
S	Conical 1:5 for flange A (Tapered key)	A	
N	Dog (Tang)	M	
F	Spline shaft DIN 5482 B17x14	B	
R	Spline shaft SAE A 9T	R	C
P	Spline shaft SAE 11T	R	C
Q	Cylindrical (Straight key) SAE A 5/8"	R	

Front flange

B	Square flange Centring Ø 80 mm	
P	Transmission flange Centring Ø 50 mm	
M	Transmission flange Centring Ø 52 mm with O-ring	
A	Outrigger bearing Centring Ø 80 mm (outboard bearing)	
R	SAE A 2-bolt	
C	SAE B 2-bolt	

Line connections

20	Rectangular flange	
12	Thread (UN-2B) SAE O-ring BOSS	
07	Split flange SAE Code 61 Metric bolts	
40	Split flange SAE Code 61 UNC bolts	

Note: Consult Factory for Availability

Ordering Code (Pump Series N)

Features
- High pressures combined with small size and low weight
- Large speed ranges
- Broad viscosity and temperature ranges

Customer benefits
- Value-for-money method of pressure generation
- Consistent high quality due to large-scale production
- Further different versions available on request

A Z - P - N - 1 X - 0 3 2 - R C B 2 0 M B

Function

P = Pump

Size (N)

1.22 in³ (20.0 cm³) = 020
1.37 in³ (22.0 cm³) = 022
1.53 in³ (25.0 cm³) = 025
1.71 in³ (28.0 cm³) = 028
1.95 in³ (32.0 cm³) = 032
2.20 in³ (36.0 cm³) = 036

Direction of rotation

Right = R
Left = L

End cover

Standard = B

Seals

NBR = M
FPM = P
NBR, shaft seal in FPM = K

Drive shafts

		Matching front flange
C	Conical 1:5 (Tapered key)	B
N	Dog (Tang)	M
D	Spline shaft SAE B 13T	C
P	Spline shaft SAE 11T	R C

Front flange

B	Square flange Centring Ø 100 mm
C	SAE B 2-bolt
M	Transmission flange Centring Ø 52 mm with O-ring
R	SAE A 2-bolt

Line connections

20	Rectangular flange
12	Thread (UN-2B) SAE O-ring BOSS
07	Split flange SAE Code 61 Metric bolts
40	Split flange SAE Code 61 UNC bolts

Note: Consult Factory for Availability

Ordering Code (Motor Series N)

Features
- High pressures combined with small size and low weight
- Large speed ranges
- Broad viscosity and temperature ranges

Customer benefits
- Consistent high quality due to large-scale production
- Further different versions available on request

A Z - M - N - 1 X - 0 3 2 - R C B 2 0 M B

Function
M = Motor

Size (N)
1.22 in³ (20.0 cm³) = 020
1.37 in³ (22.0 cm³) = 022
1.53 in³ (25.0 cm³) = 025
1.71 in³ (28.0 cm³) = 028
1.95 in³ (32.0 cm³) = 032
2.20 in³ (36.0 cm³) = 036

Direction of rotation
Right = R
Left = L

End cover
Standard = B

Seals
NBR = M
FPM = P
NBR, shaft seal in FPM = K

Drive shafts

		Matching front flange
C	Conical 1:5 (Tapered key)	B
D	Spline shaft SAE B 13T	C

Front flange

B	Square flange Centring Ø 100 mm	
C	SAE B 2-bolt	

Line connections

20	Rectangular flange
12	Thread (UN-2B) SAE O-ring BOSS
07	Split flange SAE Code 61 Metric bolts
40	Split flange SAE Code 61 UNC bolts

Note: Consult Factory for Availability

Ordering Code (Pump Series G)

Features
- High pressures combined with small size and low weight
- Large speed ranges
- Broad viscosity and temperature ranges

Customer benefits
- Value-for-money method of pressure generation
- Consistent high quality due to large-scale production
- Large number of different versions available

A Z - P - G - 1 X - 0 3 8 - R C B 2 0 M B

Function
P = Pump

Size (G)
1.37 in³ (22.5 cm³) = 023
1.71 in³ (28.0 cm³) = 028
1.99 in³ (32.6 cm³) = 032
2.32 in³ (38.0 cm³) = 038
2.75 in³ (45.0 cm³) = 045
3.42 in³ (56.0 cm³) = 056

Direction of rotation
Right = R
Left = L

End cover
Standard = B

Seals
NBR = M
FPM = P
NBR, shaft seal in FPM = K

Drive shafts

		Matching front flange
C	Conical 1:5 (Tapered key)	B
S	Conical 1:5 for flange A (Tapered key)	A
H	Conical 1:8 (Tapered key)	O
N	Dog (Tang)	M
Q	Cylindrical (Straight Key) SAE B 7/8"	C
D	Spline shaft SAE B 13T	C
F	Spline shaft DIN 5482 B17x14	B

Note: Consult Factory for Availability

Front flange

B	Square flange Centring Ø 105 mm
O	Square flange Centring Ø 50.78 mm
C	SAE B 2-bolt
M	Transmission flange Centring Ø 52 mm with O-ring
A	Outrigger bearing Centring Ø 105 mm (outboard bearing)

Line connections

20	Rectangular flange
30	Rectangular flange
07	Split flange SAE Code 61 Metric bolts
40	Split flange SAE Code 61 UNC bolts

Ordering Code (Motor Series G)

Features
- High pressures combined with small size and low weight
- Large speed ranges
- Broad viscosity and temperature ranges

Customer benefits
- Consistent high quality due to large-scale production
- Further different versions available on request

A Z - M - G - 1 X - 0 3 2 - R C B 2 0 M B

Function
M = Motor

Size (G)
1.37 in³ (22.5 cm³) = 023
1.95 in³ (32.6 cm³) = 032
2.75 in³ (45.0 cm³) = 045

Direction of rotation
Right = R
Left = L

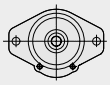
End cover
Standard = B

Seals
NBR = M
FPM = P
NBR, shaft seal in FPM = K

Drive shafts

		Matching front flange
C	Conical 1:5 (Tapered key)	B
D	Spline shaft SAE B 13T	C
Q	Cylindrical (Straight Key) SAE B 7/8"	C

Front flange

B	Square flange Centring Ø 105 mm	
C	SAE B 2-bolt	

Line connections

20	Rectangular flange	
07	Split flange SAE Code 61 Metric bolts	
40	Split flange SAE Code 61 UNC bolts	

Note: Consult Factory for Availability

Ordering Code (Pump Series F, Silence Design)

Features
- Low flow pulsation
- High pressures combined with small size and low weight

Customer benefits
- Optimized pressure pulsation, which reduces noise levels and vibration excitation in the system
- Consistent high quality
- Considerably longer life due to reinforced shaft and housing

A Z - P - S - 1 X - 0 1 6 - R C B 2 0 M B

Function
P = Pump

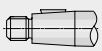
Size (S)
.25 in³ (4.0 cm³) = 004
.34 in³ (5.5 cm³) = 005
.50 in³ (8.0 cm³) = 008
.69 in³ (11.0 cm³) = 011
.88 in³ (14.0 cm³) = 014
1.00 in³ (16.0 cm³) = 016
1.20 in³ (19.0 cm³) = 019
1.40 in³ (22.5 cm³) = 022
1.53 in³ (25.0 cm³) = 025
1.71 in³ (28.0 cm³) = 028

Direction of rotation
Right = R
Left = L

End cover
Standard = B
Pressure relief valve on request
Flow control valve on request

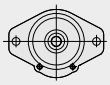
Seals
NBR = M
FPM = P
NBR, shaft seal in FPM = K

Drive shafts

			Matching front flange	
C	Conical 1:5 (Tapered key)		B	P
H	Conical 1:8 (Tapered key)		O	
N	Dog (Tang)		M	
Q	Cylindrical 39 SAE A 5/8"		R	
R	Spline shaft SAE A 9T (Straight key)		R	C
P	Spline shaft SAE 11T		R	C
F	Spline shaft DIN 5482 B17x14		B	P

Note: Consult Factory for Availability

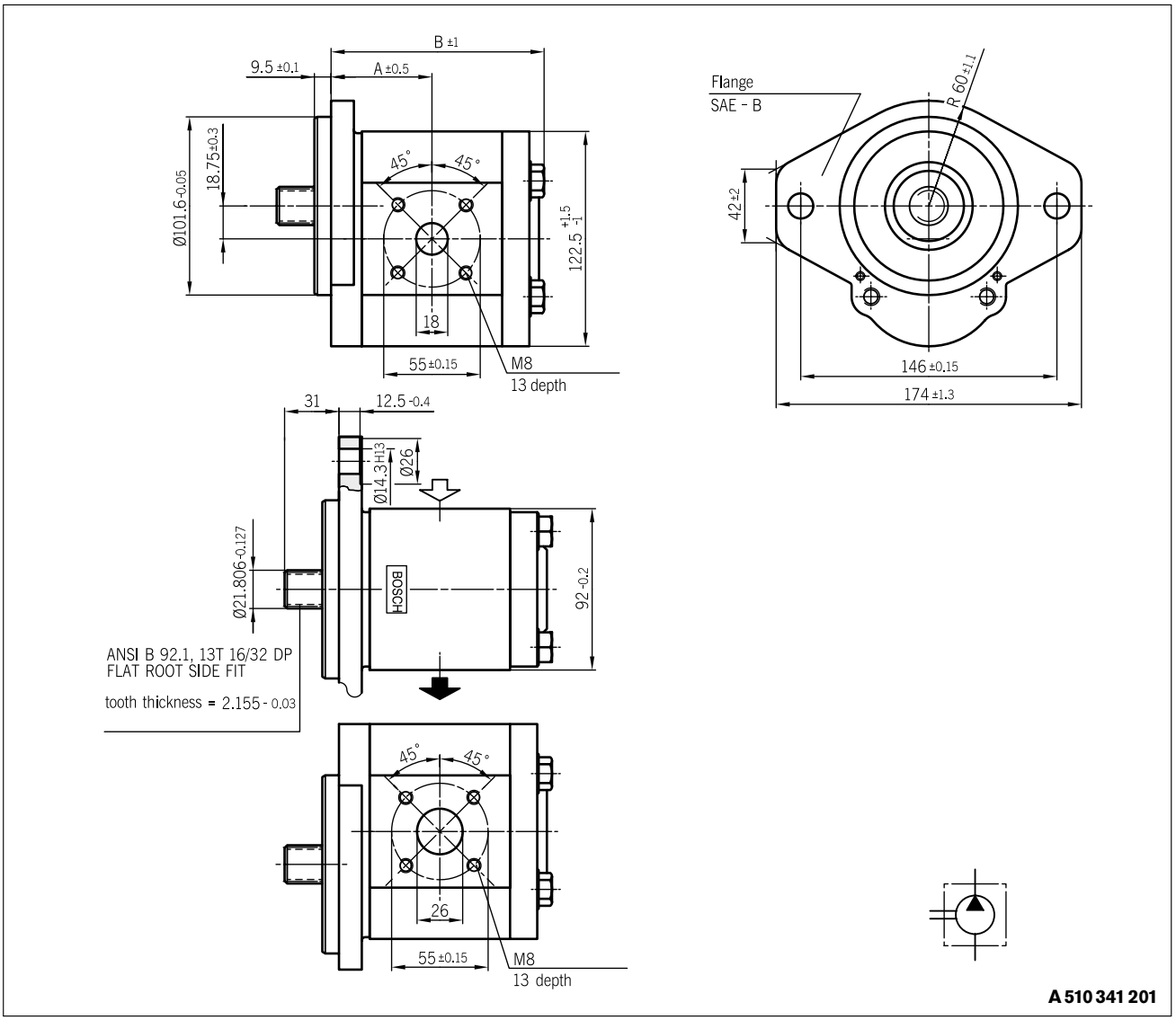
Front flange

B	Square flange Centring Ø 80 mm	
R	SAE A 2-bolt	
P	Transmission flange Centring Ø 50 mm	
O	Square flange Centring Ø 36.47 mm	
C	SAE B 2-bolt	
M	Transmission flange Centring Ø 52 mm with O-ring	

Line connections

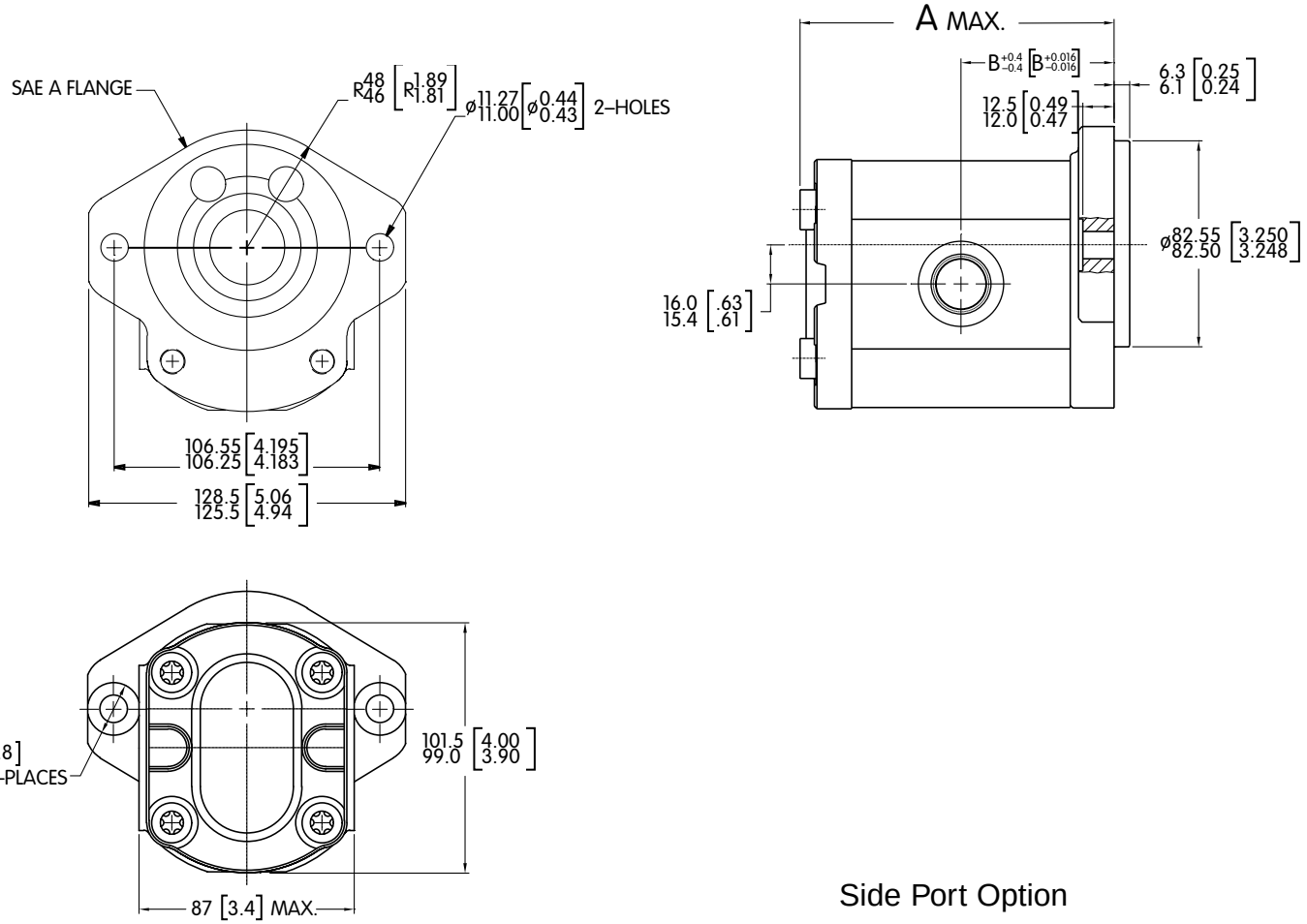
20	Rectangular flange	
12	Thread (UN-2B) SAE O-ring BOSS	
30	Rectangular flange	

Installation Drawings (Pump Series N)

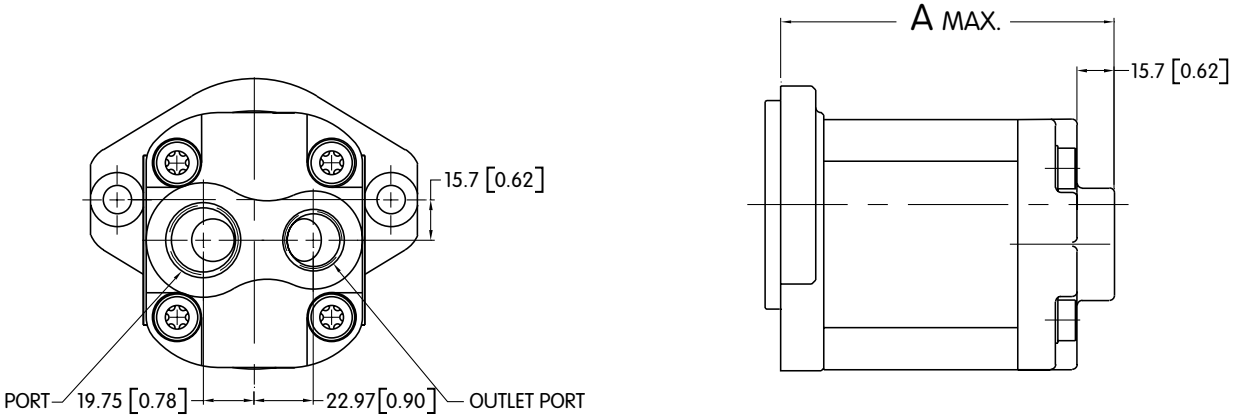


Type code AZ-P-N-IX-	Displacement V [in³/rev](cm³)	Dimension A	 B				lbs
025 L/R DC20MB	**1.53 in³ (25)**	55	116.1				13.2
028 R DC20MB	**1.71 in³ (28)**	56.5	119.1				13.4
036 L DC20MB	**2.20 in³ (36)**	61	128.1				13.2

Installation Drawings (Pump Series F)



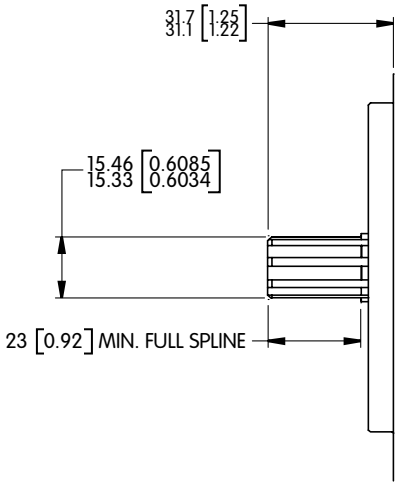
Side Port Option



Rear Port Option

			SIDE PORTED				REAR PORTED		
	Displacement		A Dim.	B Dim.	Inlet Port	Outlet Port	A Dim.	Inlet Port	Outlet Port
Size	cm^3/rev	in^3/rev	mm (in)	mm (in)	SAE O-Ring Boss	SAE O-Ring Boss	in (mm)	SAE O-Ring Boss	SAE O-Ring Boss
004	4.1	0.25	85 (3.35)	39.9 (1.57)	.875-14UNF	.750-16UNF	100.9 (3.97)	1.062-12UN	.875-14UNF
005	5.6	0.34	85.6 (3.37)	41.1 (1.62)	.875-14UNF	.750-16UNF	103.4 (4.07)	1.062-12UN	.875-14UNF
008	8.2	0.50	91.6 (3.61)	43.2 (1.70)	1.062-12UN	.875-14UNF	107.5 (4.23)	1.062-12UN	.875-14UNF
011	11.3	0.69	96.6 (3.80)	47.0 (1.85)	1.062-12UN	.875-14UNF	112.5 (4.43)	1.062-12UN	.875-14UNF
014	14.4	0.88	101.6 (4.00)	47.5 (1.87)	1.062-12UN	.875-14UNF	117.5 (4.63)	1.062-12UN	.875-14UNF
016	16.5	1.00	105.0 (4.13)	49.9 (1.96)	1.312-12UN	.875-14UNF	120.9 (4.76)	1.062-12UN	.875-14UNF
019	19.6	1.20	110.0 (4.33)	52.4 (2.06)	1.312-12UN	.875-14UNF	126.9 (5.00)	1.062-12UN	.875-14UNF
022	22.9	1.40	115.4 (4.54)	55.1 (2.17)	1.312-12UN	.875-14UNF	131.3 (5.17)	1.062-12UN	.875-14UNF

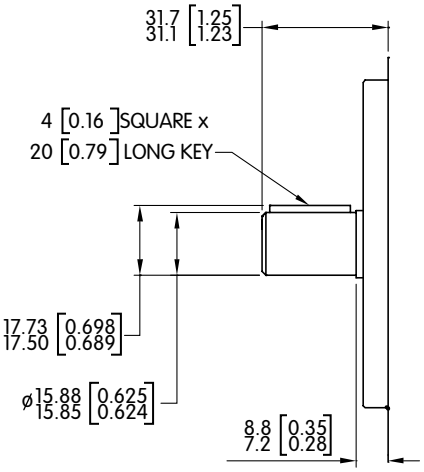
Input Shaft Information



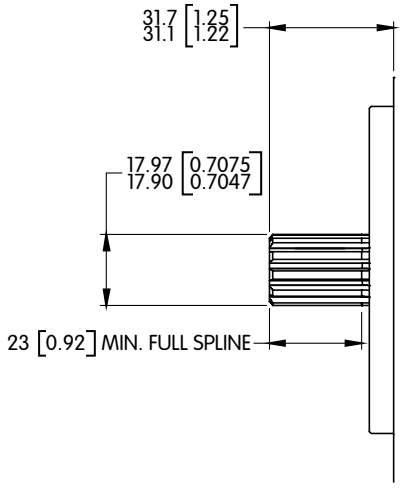
1…Spline Shaft, Type R

EXTERNAL INVOLUTE SPLINE

Spline type:	Flat Root, Side Fit
Number of teeth:	9
Spline pitch:	16/32



2…Keyed Shaft, Type Q

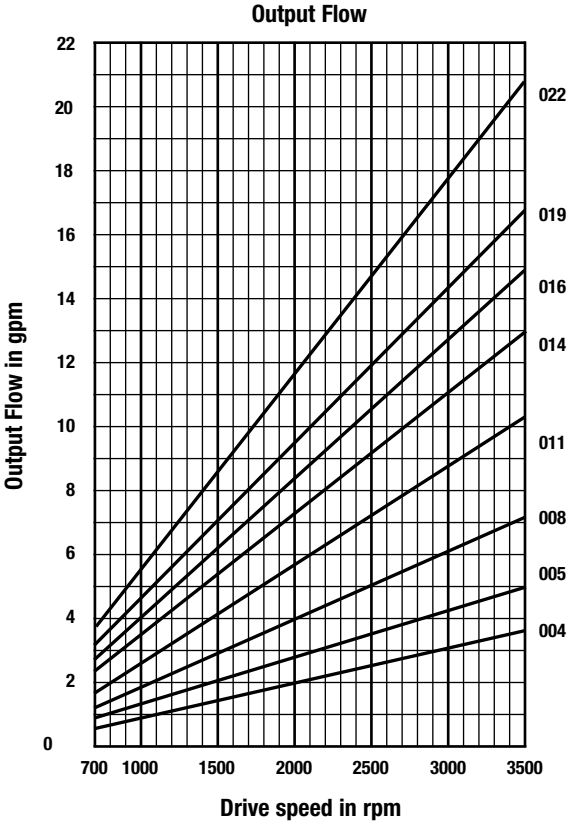


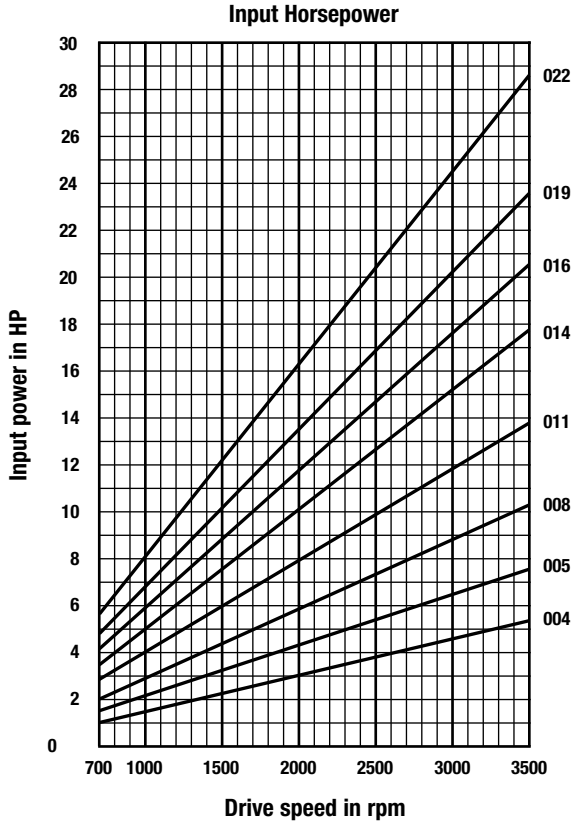
3…Spline Shaft, Type P

EXTERNAL INVOLUTE SPLINE

Spline type:	Flat Root, Side Fit, Class 1
Number of teeth:	11
Spline pitch:	16/32

Operating Curves…Measured at 115 SUS, 120 °F, and 2000 psi





Application Information

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiences such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships. They include correction factors for adapting the parameters to the usual units encountered in practice.

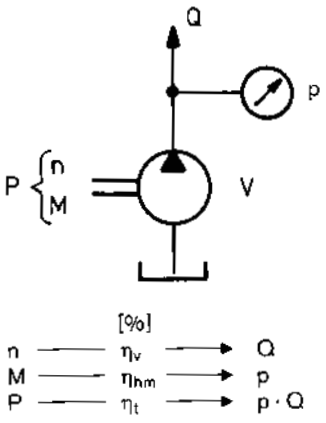
Note: Diagrams providing approximate selection data will be found on subsequent pages.

Installation and commissioning
- Fill the pump with fluid before installing.
- Check the direction of rotation.
- Before installing the pump, clean the pipes thoroughly of all dirt, scale, sand, swarf, etc. Welded pipes in particular must be pickled or flushed out.
- Before starting up the pump for the first time, the entire hydraulic system must be thoroughly purged of air.
- Cover the shaft seal when spraying or brush-painting the equipment.
- Pay close attention to the specification, especially speeds, pressures and suction vacuum.

Filter recommendations
By far the largest number of premature failures or gear pumps are due to contaminated fluid.
Since our guarantee does not apply to wear resulting from dirt in the system, we recommend filtering which reduces the size and concentration of the contamination particles to a permitted minimum.

Operating pressure [bar]	>160	<160
Contamination class NAS 1638	9	10
Contamination class ISO 4406	18/15	19/16
Achieved with filter $\beta_X = 75$	20	25

Full-flow filtering is always recommended.
The initial contamination of the fluid with which the system is filled must not exceed Class 10 to NAS 1638. Past experience has shown that even brand new fluids often exceed this value. In such cases a filter incorporating a special filter will have to be used.



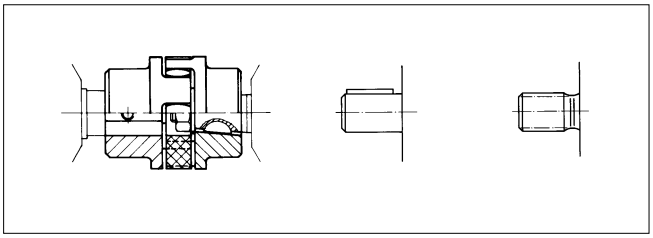
$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$	$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$	$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$
$p = \frac{M \cdot \eta_{hm}}{1{,}59 \cdot V}$	$V = \frac{M \cdot \eta_{hm}}{1{,}59 \cdot p}$	$M = 1{,}59 \cdot V \cdot p \frac{1}{\eta_{hm}}$
$P = \frac{p \cdot Q}{6 \cdot \eta_t} = \frac{p \cdot Q}{600}$	$Q = \frac{6 \cdot P \cdot \eta_t}{p}$	$p = \frac{6 \cdot P \cdot \eta_t}{Q}$
V [cm³/U] Q [l/min] p [bar] n [U/min] P [kW] M [Nm]	Note Attention η [%]	z.B. e.g. 95 [%] p.e.

Drive Information

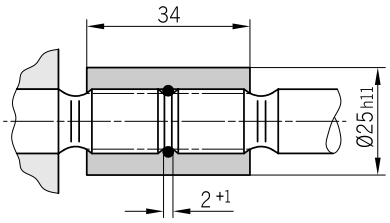
Drive arrangements

1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft spigot is 0.2 mm. Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.



2. Sleeve couplings
Used on shafts with DIN or SAE splining. **Note:** There must be no radial or axial forces exerted on the pump or sleeve coupling.
The sleeve must be free to move axially.
The distance between the pump shaft and drive shaft must be 2^{+1}.
Oil-bath or oil-mist lubrications is necessary.



Size **F**
B 17 x 14 DIN 5482
M_{max} = 190 Nm
Ⓑ 1 516 334 008

3. Drive shaft with dog
For the close-coupling of the pumps to engines, gearboxes, etc. the pump shaft has a special drive dog which combines with a centre coupling ③ (included with the pumps). There is no shaft seal.

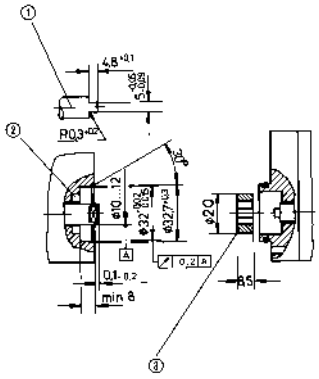
The recommended arrangements and dimensions for the drive end and sealing are as follows.

① **Drive shaft**
Case-hardening steel DIN 17 210
e.g. 20 Mn CrS 5
case-hardened 0.6 deep; HRc 60 ±3.
Surface for sealing ring
ground without rifling $R_t \leqq 4\mu m$

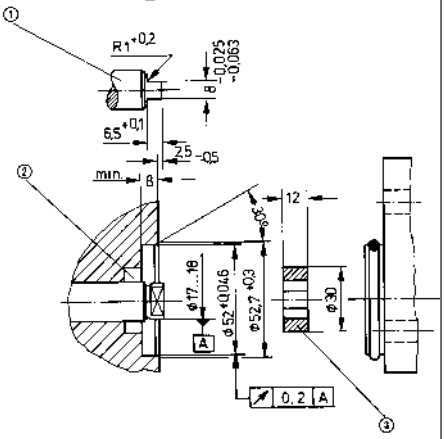
② **Radial shaft seal**
Rubber-covered seal (see DIN 3760, Type AS or double-lipped ring).
Cut 15° chamfer or fit shaft seal with protective sleeve.

M_{max} [Nm]	V [$cm^3/_{rev}^U$]	$p_{max.}$ [bar]
65	16 19 22.5	230 190 160

Series B

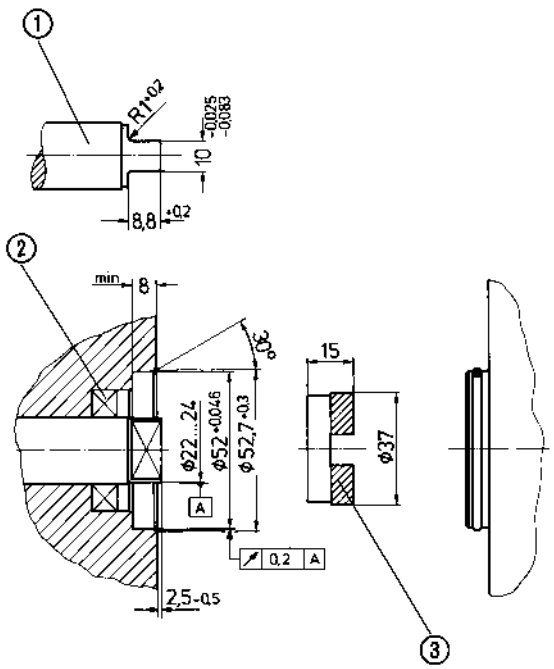


Series F

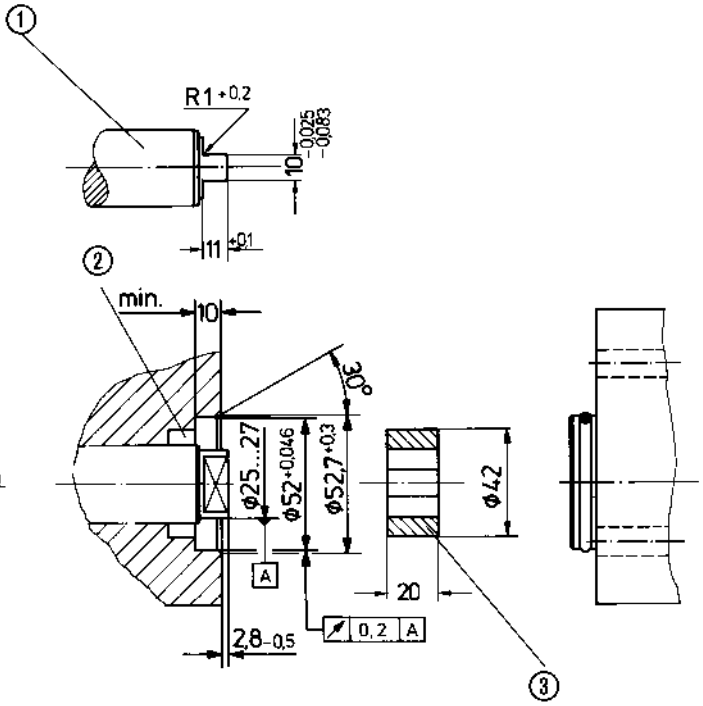


Drive Information

Series N

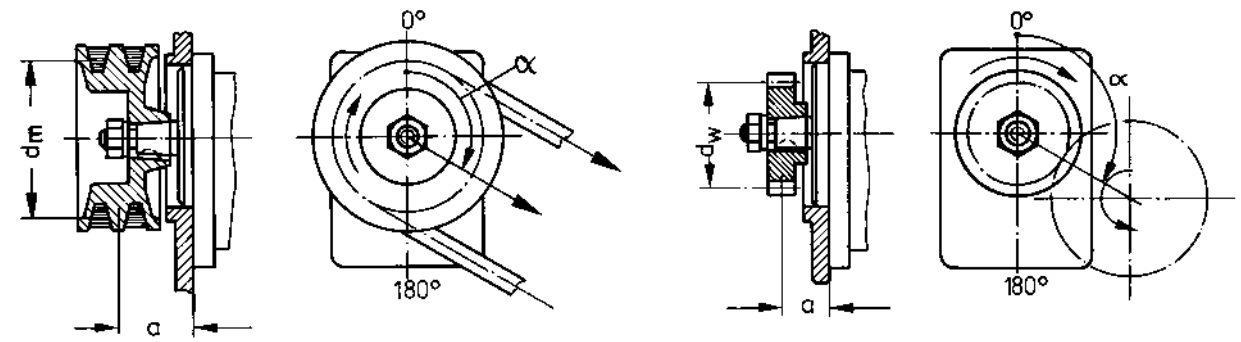


Series G



4. V-belts and gearwheels without outrigger bearings

When proposing to use V-belt or gearwheel drive, please submit details of the application for our comments (especially dimensions a, d_m, d_w and angle α).

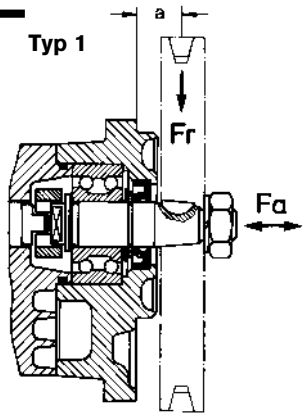


Drive Information

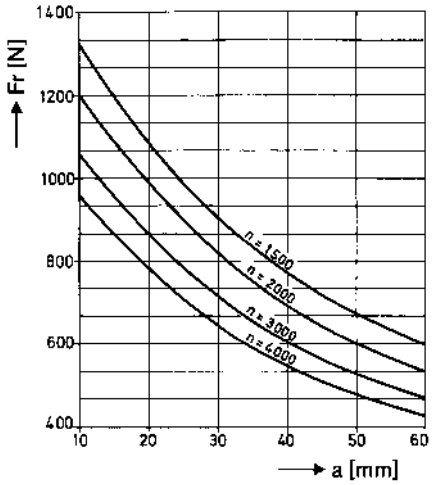
5. Outrigger bearings

Outrigger bearings eliminate possible problems when the pumps are driven by V-belts or gearwheels. The diagrams below show the maximum overhung and thrust loads thast can be tolerated referred to a bearing life of L_H = 1000 hours.

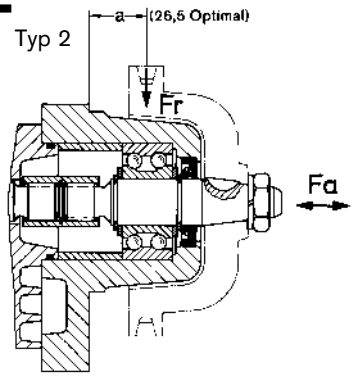
Series F Typ 1



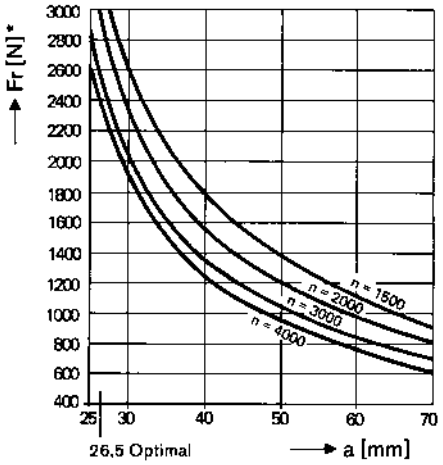
$M_{max.}$ [Nm]	V [$cm^3/_{rev}^{U}$]	$p_{max.}$ [bar]
65	16	230
	19	190
	22,5	160



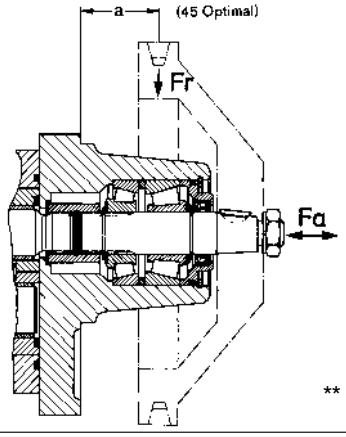
Series **F** Typ 2



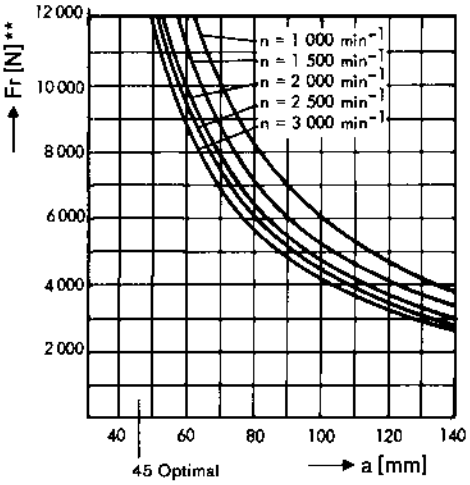
* Fr is reduced by 0.7 Fa when axail loading Fa is applied



Series G Typ 3



** For Fa ≦ 2000N



Drive Information

Multiple gear pumps

Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump and sometimes a third pump in the same manner. A coupling is fitted between each pair of pumps. In most cases each pump is isolated from its neighbour, i. e. the suction and delivery ports are separate.

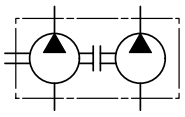
Note: Basically, the specifications for the individual pumps apply, but with certain restrictions:

Max. speed: This is determined by the highest rated pump speed in use.

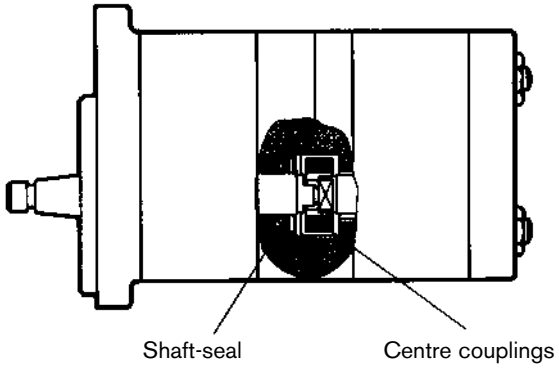
Pressures: These are restricted by the strength of the drive shaft, the transmissions and the couplings. Appropriate data is given in the dimensional drawings and the graph on the following page.

Standard transmission

Combinations



	M_{max}	
B	12	**B**
F	12	**B**
F	65	**F**
N	65	**F**
N	95	**N**
G	65	**F**
G	130	**G**



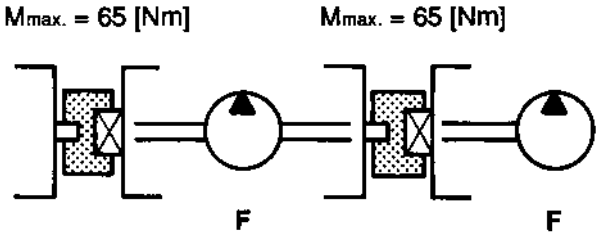
Combination Pumps

Pressure restrictions during standard transmission

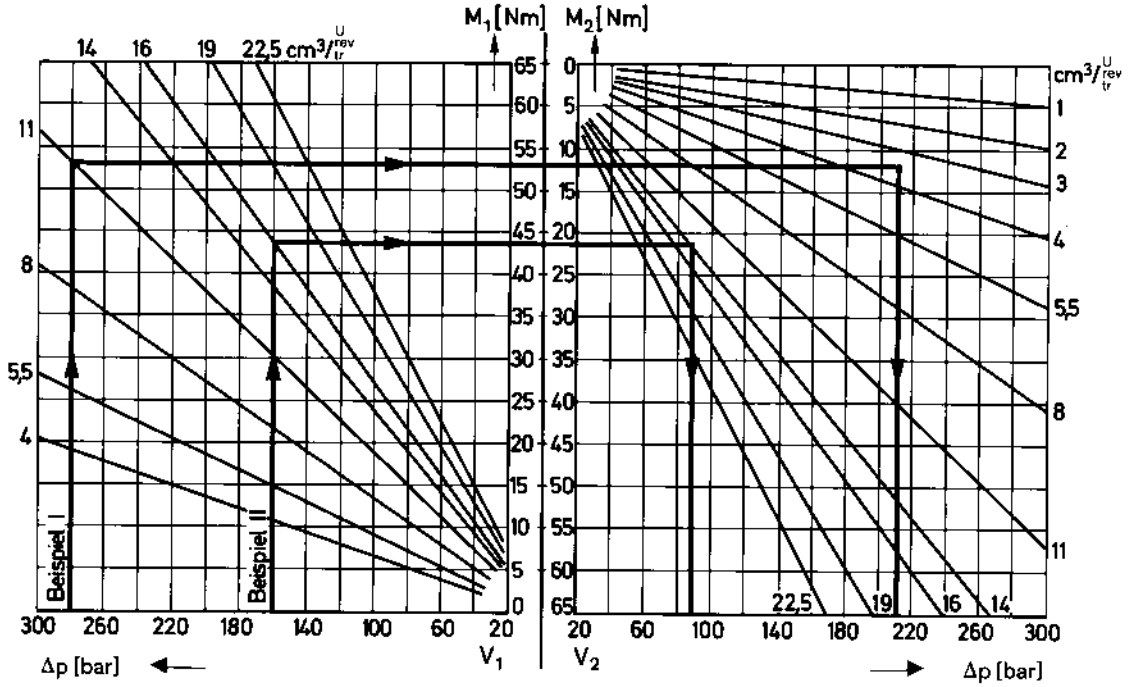
In the case of Size F the centre coupling for the second pump can carry a load of up to M_{max} = 65 Nm, i. e. the pressure restriction for the second pump is as follows:

V [cm³/rev]	P_{max} [bar]
16	230
19	190
22.5	160

In the first pump is driven through a dog and centre coupling or Type 1 outrigger bearing, the pressure restrictions for both pumps are as indicated in the diagram below.
In the case of applications with high numbers of load cycles please check.



Reinforced transmissions are available for applications with higher transfer torques and/or torsional vibrations. Customized designs available on request.



Example

Seal Information

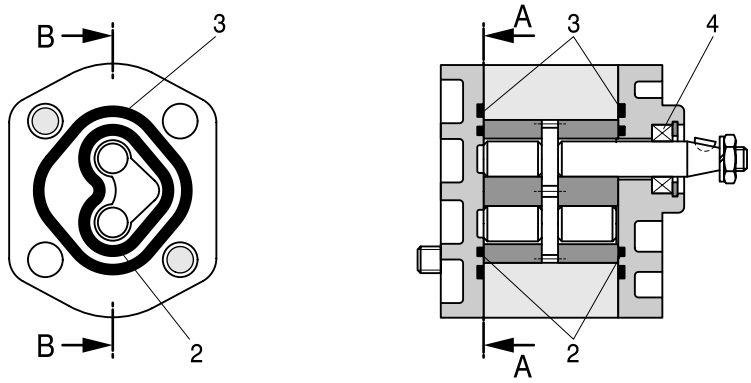
Series		Set of seals Pos. 1, 2, 3	Shaft seal Pos. 4 		O-ring Pos. 5, (6) 		Material
B		Ⓗ 1 517 010 188	Ⓗ 1 510 283 007	10 x 19 x 7	Ⓗ 1 900 210 127	28 x 2	NBR (Perbunan®)*
		Ⓗ 1 517 010 188	Ⓗ 1 510 283 032	10 x 22 x 7	Ⓗ 1 900 210 127	28 x 2	NBR (Perbunan®)*
F		Ⓗ 1506-635-001[3])	Ⓗ 1 510 283 035	17 x 30 x 7/8	Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)
		Ⓗ 1506-635-003[3])	Ⓗ 1 510 283 037	18 x 30 x 7/8			NBR (Perbunan®)
		Ⓗ 1 517 010 152	Ⓗ 1 510 283 009	20 x 40 x 7/8	Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)*
		Ⓗ 1 517 010 152	Ⓗ 1 510 283 022	17.46 x 28.7 x 7/8		(Pos. 1, 2, 3) (Pos. 4)	NBR (Perbunan®)* FPM (Viton®)**
		Ⓗ 1 517 010 193	Ⓗ 1 510 283 027	17 x 30 x 7/8	Ⓗ 1 520 210 101	45 x 2.5	FPM (Viton®)**
		Ⓗ 1 517 010 193	Ⓗ 1 510 283 015	20 x 40 x 7/8	Ⓗ 1 520 210 101	45 x 2.5	FPM (Viton®)**
N		Ⓗ 1 517 010 194	Ⓗ 1 510 283 023	22 x 40 x 7			NBR (Perbunan®)*
		Ⓗ 1 517 010 197	Ⓗ 1 510 283 028	22 x 40 x 7			FPM (Viton®)**
G		Ⓗ 1 517 010 190			Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)*
		Ⓗ 1 517 010 190	Ⓗ 1 510 283 010	25 x 40 x 9/11	Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)*
		Ⓗ 1 517 010 190	Ⓗ 1 510 283 014	28 x 40 x 9/11			NBR (Perbunan®)*
		Ⓗ 1 517 010 190	Ⓗ 2 510 283 008	35 x 52 x 6/6.5	Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)*
		Ⓗ 1 517 010 203[1])	Ⓗ 1 510 283 025	25 x 40 x 9/11	Ⓗ 1 510 210 145	45 x 2.5	FPM (Viton®)**
		Ⓗ 1 517 010 190	Ⓗ 1 510 283 010	25 x 40 x 9/11	Ⓗ 1 900 210 152 Pos. 6	55 x 3	NBR (Perbunan®)*
F+B	V_1	Ⓗ 1 517 010 152	Ⓗ 1 510 283 008 Ⓗ 1 510 283 008	17 x 30 x 7/8			NBR (Perbunan®)
	V_1	Ⓗ 1 517 010 152	Ⓗ 1 510 283 009 Ⓗ 1 510 283 008	20 x 40 x 7/8 17 x 30 x 7/8	Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)*
	V_2	Ⓗ 1 517 010 188			Ⓗ 1 900 210 127	28 x 2	NBR (Perbunan®)*
F+F	V_1	Ⓗ 1206-635-014[3])	Ⓗ 1 510 283 035	17 x 30 x 7/8			NBR (Perbunan®)
		Ⓗ 1206-635-016[3])	Ⓗ 1 510 283 037	18 x 30 x 7/8			NBR (Perbunan®)
	V_1	Ⓗ 1 517 010 152	Ⓗ 1 510 283 009 Ⓗ 1 510 283 008	20 x 40 x 7/8 17 x 30 x 7/8	Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)*
	V_1	Ⓗ 1 517 010 193	Ⓗ 1 510 283 022 Ⓗ 1 510 283 027	17.46 x 28.7 x 7/8 17 x 30 x 7/8			FPM (Viton®)**
	V_1	Ⓗ 1 517 010 193	Ⓗ 1 510 283 027 Ⓗ 1 510 283 027	17 x 30 x 7/8 17 x 30 x 7/8			FPM (Viton®)**
	V_1	Ⓗ 1 517 010 193	Ⓗ 1 510 283 015 Ⓗ 1 510 283 027	20 x 40 x 7/8 17 x 30 x 7/8	Ⓗ 1 520 210 101	45 x 2.5	FPM (Viton®)**
	V_2	Ⓗ 1 517 010 152			Ⓗ 1 900 210 145 Ⓗ 1 900 210 154	45 x 2.5 60 x 2.5[2])	NBR (Perbunan®)*
	V_2	Ⓗ 1 517 010 193			Ⓗ 1 520 210 101 Ⓗ 1 510 210 043	45 x 2.5 60 x 2.5[2])	FPM (Viton®)**
N+F	V_1	Ⓗ 1 517 010 194	Ⓗ 1 510 283 023	22 x 40 x 7			NBR (Perbunan®)*
	V_1	Ⓗ 1 517 010 197	Ⓗ 1 510 283 028	22 x 40 x 7	Ⓗ 1 510 210 043	60 x 2.5[2])	FPM (Viton®)**
	V_2	Ⓗ 1 517 010 152			Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)*
	V_2	Ⓗ 1 517 010 193			Ⓗ 1 520 210 101	45 x 2.5	FPM (Viton®)**
G+F	V_1	Ⓗ 1 517 010 190			Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)*
	V_1	Ⓗ 1 517 010 190	Ⓗ 1 510 283 010 Ⓗ 1 510 283 010	25 x 40 x 9/11 25 x 40 x 9/11			NBR (Perbunan®)*
	V_1	Ⓗ 1 517 010 190	Ⓗ 1 510 283 025 Ⓗ 1 510 283 025	25 x 40 x 9/11	Ⓗ 1 510 210 041 Pos. 3 Viton	90 x 3	(Perbunan/* FPM Viton®)**
	V_2	Ⓗ 1 517 010 152			Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)*
	V_2	Ⓗ 1 517 010 193			Ⓗ 1 520 210 101	45 x 2.5	FPM (Viton®)**
G+G	V_1	Ⓗ 1 517 010 190	Ⓗ 1 510 283 010 Ⓗ 1 510 283 010	25 x 40 x 9/11			NBR (Perbunan®)*
	V_1	Ⓗ 1 517 010 190	Ⓗ 1 510 283 014 Ⓗ 1 510 283 010	28 x 40 x 9/11 25 x 40 x 9/11			NBR (Perbunan®)*
	V_1	Ⓗ 1 517 010 190	Ⓗ 1 510 283 025 Ⓗ 1 510 283 025	25 x 40 x 9/11	Ⓗ 1 510 210 041 Pos. 3, Viton	90 x 3	(Perbunan/* Viton®)**
	V_2	Ⓗ 1 517 010 190			Ⓗ 1 900 210 145	45 x 2.5	NBR (Perbunan®)*
	V_2	Ⓗ 1 517 010 190			Ⓗ 1 510 210 141 Pos. 3, Viton	90 x 3	(Perbunan/* Viton®)**

[1]) only Pos. 3 FMP (Viton®) [2]) see page 27 Pos. 5/1 [3]) kit includes Pos. 4 *® Bayer **® Dupont

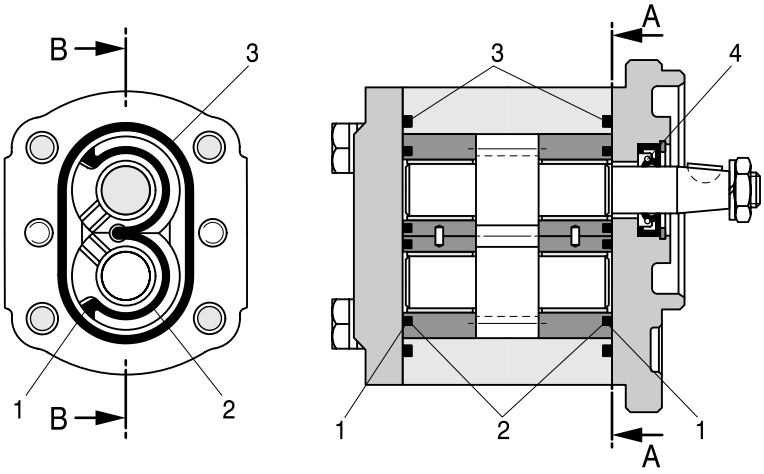
Seal Information

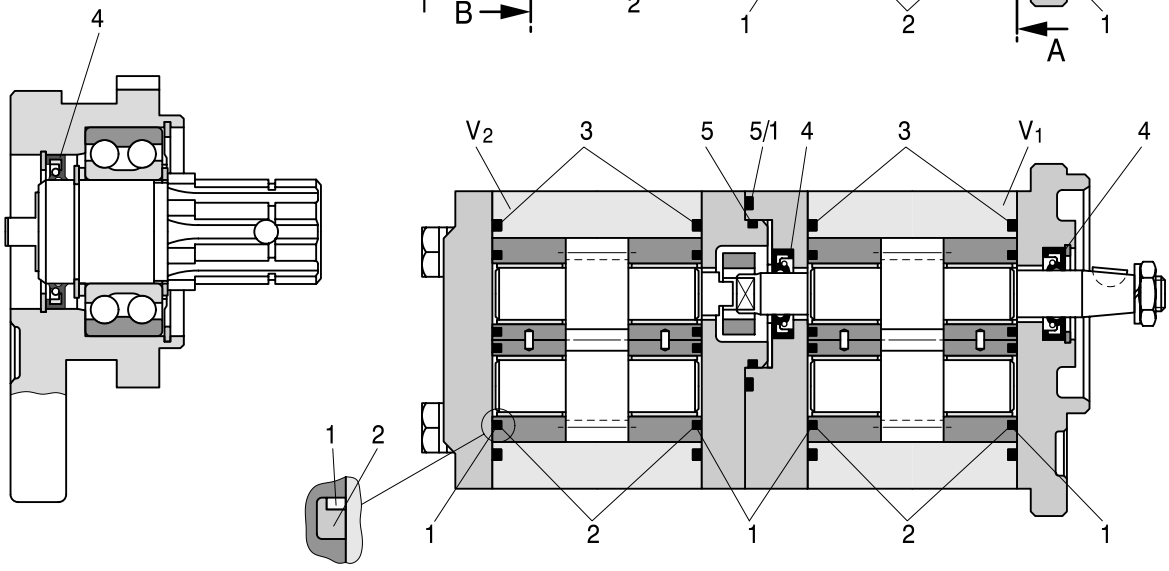
Series

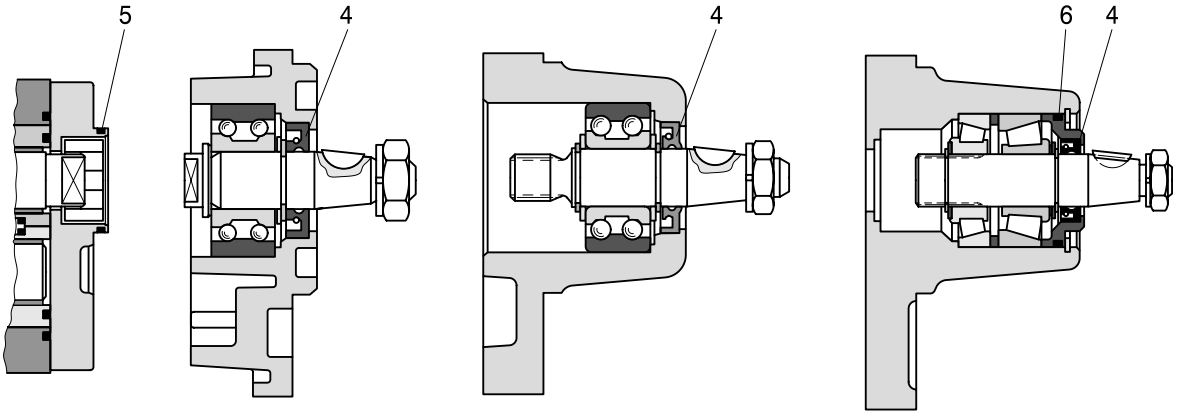
B



F.N.G.

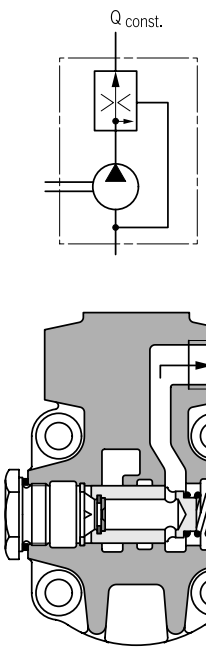




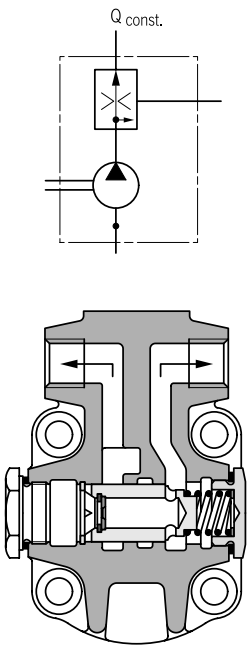


Valve Options

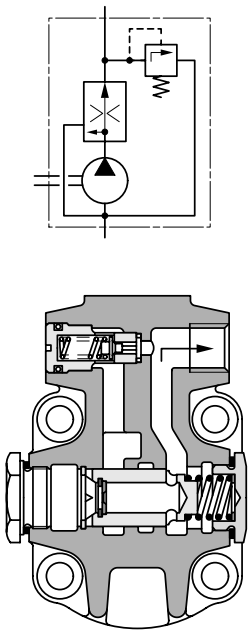
In order to reduce external pipework it is possible to incorporate a flow control valve or pressure relief valve in the end cover of the pump. A typical application of this is in power-assisted steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction or distributed externally to other items of equipment.



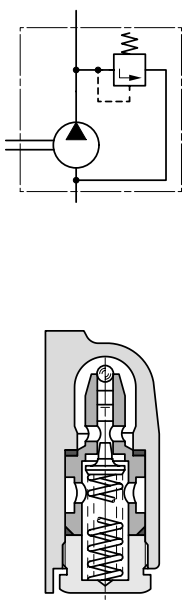
3-way flow control valve. Excess flow returned to suction



3-way flow control valve. Excess flow distributed externally; loadable



3-way flow control valve with pressure relief valve. Excess flow returned to suction



Pressure relief valve. Discharge returned to suction

Electrohydraulic Pumps

Drive unit for vehicles and materials handling systems

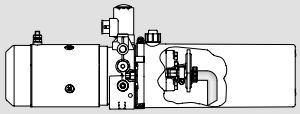
- → Compact assembly
- → Silence version with distinctly reduced flow pulsation
- → Combination of several pumps possible
- → Line connections: connecting flanges or screw thread

Detailed information:

Data sheet Order No. 1 987 760 401

Electric motor, frame size I		**Power rating 1.5 ... 2.0 kW**												
Voltage	U	V					12. 24. 48							
Nominal pump displacement	$V_{g\ max}$	cm^3	1	2	3	3.8	4	5.5	8	11	14	16	19	
Flow	Q	L/min	Depending on motor/pump combination, see data sheet											
Pressure, intermittent	p	bar	230	230	230	180	230	230	280	280	280	280	230	
Electric motor, frame size K		**Power rating 1.5 ... 3.0 kW**												
Voltage	U	V					24. 48. 72							
Nominal pump displacement	$V_{g\ max}$	cm^3			3	3.8	4	5.5	8	11	14	16	19	
Flow	Q	L/min	Depending on motor/pump combination, see data sheet											
Pressure, intermittent	p	bar			230	180	280	280	280	280	280	280	230	
Electric motor, frame size Q		**Power rating 2.5 ... 5.5 kW**												
Voltage	U	V					24. 48. 80							
Nominal pump displacement	$V_{g\ max}$	cm^3					4	5.5	8	11	14	16	19	
Flow	Q	L/min	Depending on motor/pump combination, see data sheet											
Pressure, intermittent	p	bar					280	280	280	280	280	280	230	
Electric motor, frame size T		**Power rating 4.8 ... 8.1 kW**												
Voltage	U	V					24. 48							
Nominal pump displacement	$V_{g\ max}$	cm^3						5.5	8	11	14	16	19	
Flow	Q	L/min	Depending on motor/pump combination, see data sheet											
Pressure, intermittent	p	bar						280	280	280	280	280	230	

Compact Power Units



Compact assembly comprising a gear pump, electric motor, valve block and oil reservoir

- → Large variety of design versions
- → Precision control through proportional lowering function
- → Drive unit in vehicles and materials handling systems, primarily for lifting and lowering

Detailed information:
Data sheet Order No. 1 987 760 405

Pumps: frame size B	**Size**		**1**	**2**	**2.6**	**3**	**4**	**5**	
Displacement	$V_{g\ max}$	cm^3	1	2	2.6	3	3.8	4.6	
Operating pressure	p_{max}	bar	230	230	230	230	210	160	
Power at 1450 rpm	P_{hyd}	hp	.67	1.34	3.08	2.01	2.32	2.14	
Speeds	n	rpm	Depending on operating pressure						
Valve block versions	**Size**		**S8**	**S12**	**S12**	**S12**	**S19**		
Pressure relief valve	p_{max}	bar	180 (others on request)						
Directly operated			x	x	x	x	x		
Lowering valve	gpm			.53	1.57	2.91			
Electric motors	**Size**		**0.37**	**0.55**	**0.75**	**1.1**	**1.5**	**2**	**3**
3-phase motor:									
400 V, 1500 rpm	P	kW	.5	.74	1.0	1.48	2.01	2.95	4.02
400 V, 3000 rpm	P	kW							4.02
AC motor:									
230 V, 1500 rpm	P	kW	.5	.74	1	1.48			
DC motor:									
12, 24, 48 V	P	kW					2.14	2.95	4.02
Type of protection				IP 54 (IP 66)					
Oil reservoir	**Size**		**0.8**	**1**	**2**	**3**	**5**	**7**	
Nominal capacity	G		.21	.24	.53	.79	1.32	1.85	

Hydrostatic Fan Drives

Used in materials handling systems, construction machinery, buses, HGV and passenger cars with proportional speed control. Comprises the following parts:

- External gear motor with proportional pressure relief valve
- Single or multi-channel electronics
- Temperature sensors for liquid and air

→ For fan ratings up to 20 kW
→ Proportional fan speed control
→ Fail-safe response following power failures
→ Little hydraulic energy loss
→ Precise coolant temperature control

Further information on fan drives (up to 250 kW) RE 98065

Gear motor with proportional pressure relief valve									
Size			**5**	**8**	**11**	**14**	**16**	**19**	**22**
Displacement	V_{max}	cm^3	5.5	8	11	14	16	19	22.5
Max. speed at p_1	n	rpm	4000	4000	3500	3000	3000	3000	3000
Min. speed at p_1	n	rpm			500				
Prop. pressure relief valve, flow rate	Q_{max}	gpm			39.6				
Prop. pressure relief valve, operating pressure	p_{max}	bar			210				
Solenoid voltage	U	V			12. 24				
Power consumption. solenoid	P	W			18				
Weight	m	lb	7.6	7.7	7.9	8.4	8.8	9.3	9.7
Single-channel electronics									
Analog control amplifier with voltage controller, one analog input. adjustment of working range and one power output with short-circuit protection for one proportional valve.									
Electrical connection			6-pin						
Operating voltage			11…36 V = (battery)						
Multi-channel electronics									
Analog control amplifier with voltage controller, comparison of setpoint and actual value for three analog inputs. one switch input and one power output with short-circuit protection for one proportional valve.									
Electrical connection			15-pin						
Operating voltage			11…36 V = (battery)						
PTC temperature sensor for liquids									
Measuring range			-30 °C…130 °C						
PTC temperature sensor for air									
Measuring range			-40 °C…160 °C						

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Printed in the United States
RA 98 241/05.03