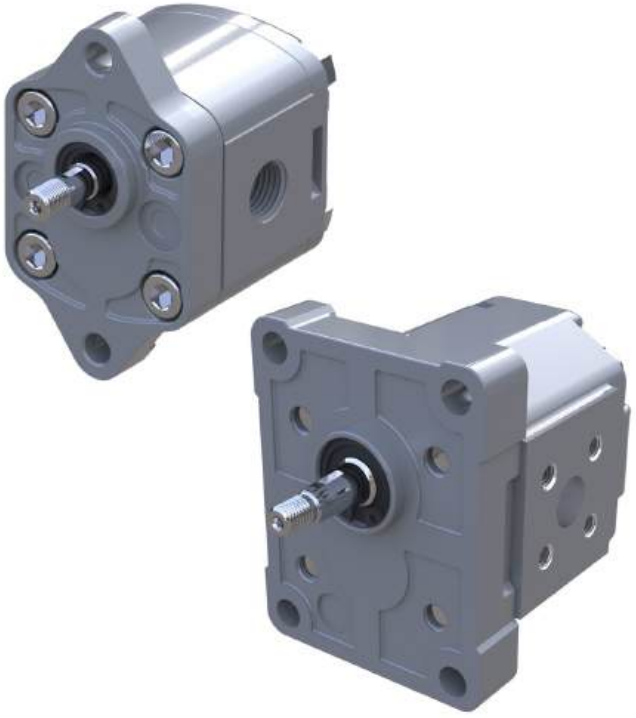
ENGINEERING TOMORROW

Technical Information

GearMe
Aluminum Group 0 and Group 1 Pump



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Revision history

Table of revisions

Date	Changed	Rev
February 2023	Fixed typo	0203
January 2023	Renamed product	0202
April 2021	Content correction throughout document	0201
October 2019	First edition	0101

Contents

Contents

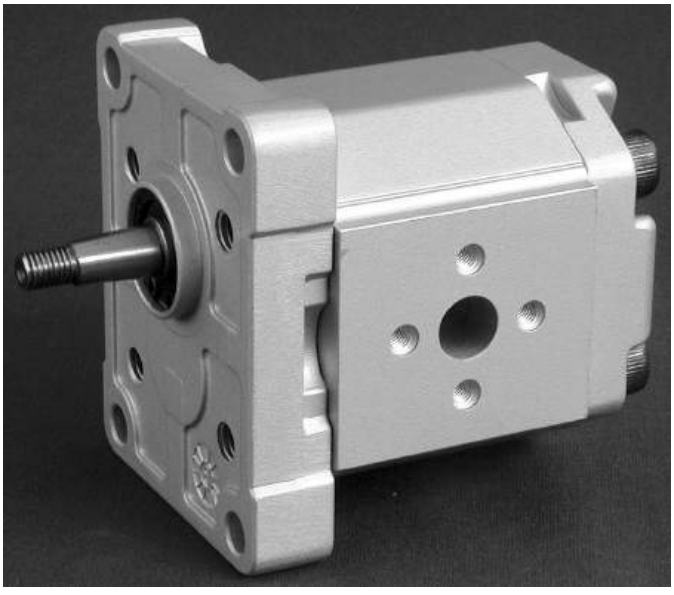
General Information

Overview

The Danfoss Group 0 and Group 1 is a range of peak performance fixed-displacement gear pumps. Constructed of a high strength extruded aluminum body with aluminum cover and flange, all pumps are pressure-balanced for exceptional efficiency. The flexibility of the range, combined with high efficiency and low noise, makes the pumps in this series ideal for a wide range of applications, including: turf care, aerial lifts, material handling, and power packs.

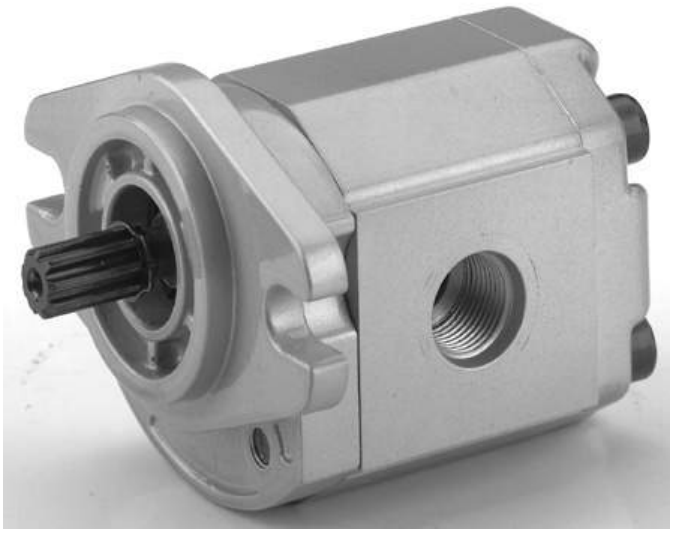
TFP0NN 01FA

SNP1NN 01BA



General Information

SKP1NN 06SA



SNP1NN 03CA

Features and benefits

Gear pump attributes:

- Up to 16 displacements from 0,25 to 12 cm^3/rev [from 0.015 to 0.732 in^3/rev
- Continuous pressure rating up to 250 bar [3625 psi]
- Speeds up to 4000 min^{-1} (rpm)
- SAE, ISO, and DIN mounting flanges and shafts
- Compact, lightweight, quiet operation
- Group 1 units are available as unidirectional and bi-directional motors, also with integral relief valve
- You can combine groups 1, 2 and 3 to make multi-stage pump

Group 0

TFP0NN pumps provide flexibility, numerous displacements, features, and shaft/port options. The TFP0NN series has earned an excellent reputation for rugged, dependable performance at continuous pressures and speeds.

TFP0NN 01FA

TFP0NN pumps are available in five displacements from 0.25 to 1.27 cm^3/rev [0.015 to 0.075 in^3/rev]. Complete information can be found by referring to the specific sections in this technical manual.

Design

Constructed of high strength aluminum, the TFP0NN rotation is either clockwise or counterclockwise.

Features

Special features of Group 0 pumps include:

- Wide range of displacements
- Parallel shaft ends
- Standard mounting flange (European, 2-bolt)
- European port options

Group 0

Technical data – Group 0 gear pumps

		Frame size				
		,25	**,45**	**,57**	**,76**	**1,3**
Displacement	cm^3/rev [in^3/rev]	0.25 [0.015]	0.45 [0.027]	0.57 [0.034]	0.76 [0.045]	1.27 [0.075]
Peak pressure	bar [psi]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]
Rated pressure		180 [2600]	180 [2600]	180 [2600]	180 [2600]	180 [2600]
Minimum pressure at maximum speed		103 [1500]	103 [1500]	103 [1500]	103 [1500]	103 [1500]
Minimum speed at 103 bar [1500 psi]	min^{-1} (rpm)	500	500	500	500	500
Maximum speed		8000	8000	8000	7000	5000
Weight	kg [lb]	0.40 [0.88]	0.45 [1.00]	0.46 [1.01]	0.47 [1.03]	0.48 [1.06]
Moment of inertia of rotating components	x 10-6 $kg•m^2$ [x 10^{-6} $lb•ft^2$]	0.425 [10.09]	0.544 [12.91]	0.621 [14.74]	0.737 [17.49]	1.049 [24.89]
Theoretical flow at maximum speed	l/min [US gal/min]	2.00 [0.53]	3.60 [0.95]	4.56 [1.20]	5.32 [1.41]	6.35 [1.68]

1 $kg•m^2$ = 23.68 $lb•ft^2$

For applications requiring parameters beyond those listed above, contact Danfoss.

Product Code

Model code

A Family

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
•	•	•	•	•	•	/																				/					

TFP0NN	Std gear pump
TFR0NN	Reversible pump

B Displacement

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/	•	•	•																	/					

,25	Displacement 0,25cc
,45	Displacement 0,45cc
,57	Displacement 0,57cc
,76	Displacement 0,76cc
1,3	Displacement 1,3cc

Group 0

C Rotation

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/				•																/					

L	Left rotation
R	Right rotation
B	Reversible pump

D Project version

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/					•															/					

N	Std gear version

E Mounting flange

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/						•	•													/					

Code	Description (Type of flange • Type of drive gear • Preferred ports for configuration)
01	European 2-bolt flange

F Drive gear

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/								•	•											/					

CA	Tang drive 5xØ7
FA	Parallel shaft 7,0 mm [0.276 in]

G Rear cover

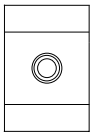
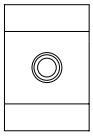
A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/										•	•									/					

P1	Standard cover for pump
R1	Standard cover for reversible pump

H Inlet size; I Outlet size

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/												•	•	•	•					/					

Group 0

D1	M10x1- Threaded metric port	
D3	M14x1,5- Threaded metric port	
F2	1/4 GAS - Threaded BSP port	

J Ports positions & Special body

A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/									• •			/			

NN	Std position from catalog

K Seals

A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/										•		/			

N	Standard Buna seal

L Screws

A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/											•	/			

N	Std screws

M Set valve

A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/												/	• • •		

NNN	No valve

N Type mark

A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/												/		•	

N	Standard Danfoss Marking
A	Standard Danfoss Marking+Customer Code

O Mark position

A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/												/			•

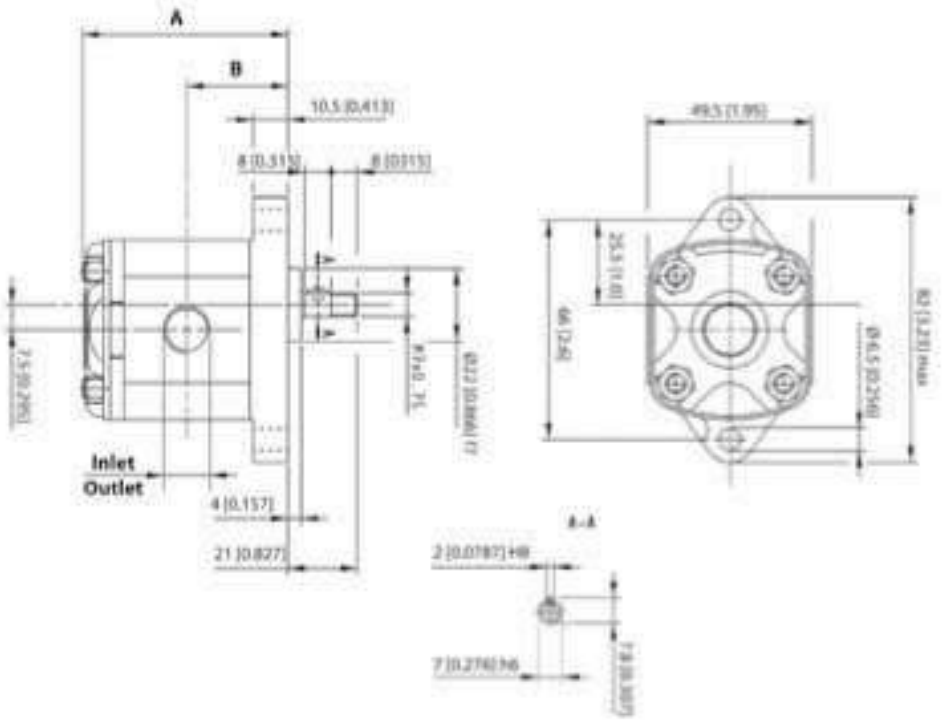
Group 0

N	Std Marking position (on top)
A	Special Marking position on the bottom

Dimensions

TFPONN-01FA

Available 01FA configuration only.



TFP0NN dimensions

Frame size		,25	,45	,57	,76	1,3
Dimension	A	53.5 [2.10]	55.0 [2.16]	56.0 [2.20]	61.5 [2.42]	61.5 [2.42]
	B	26.5 [1.04]	27.3 [1.07]	27.8 [1.09]	30.5 [1.20]	30.5 [1.20]
Inlet/Outlet		M10 x 1				

Model code examples and maximum shaft torque

Flange/drive gear	Model code example	Maximum shaft torque
01FA	TFP0NN/,57RN01FAP1D1D1NNNN/NNNNN	4.5 N•m [39.8 lb•in]

For further details on ordering, see *Product Code* on page 8.

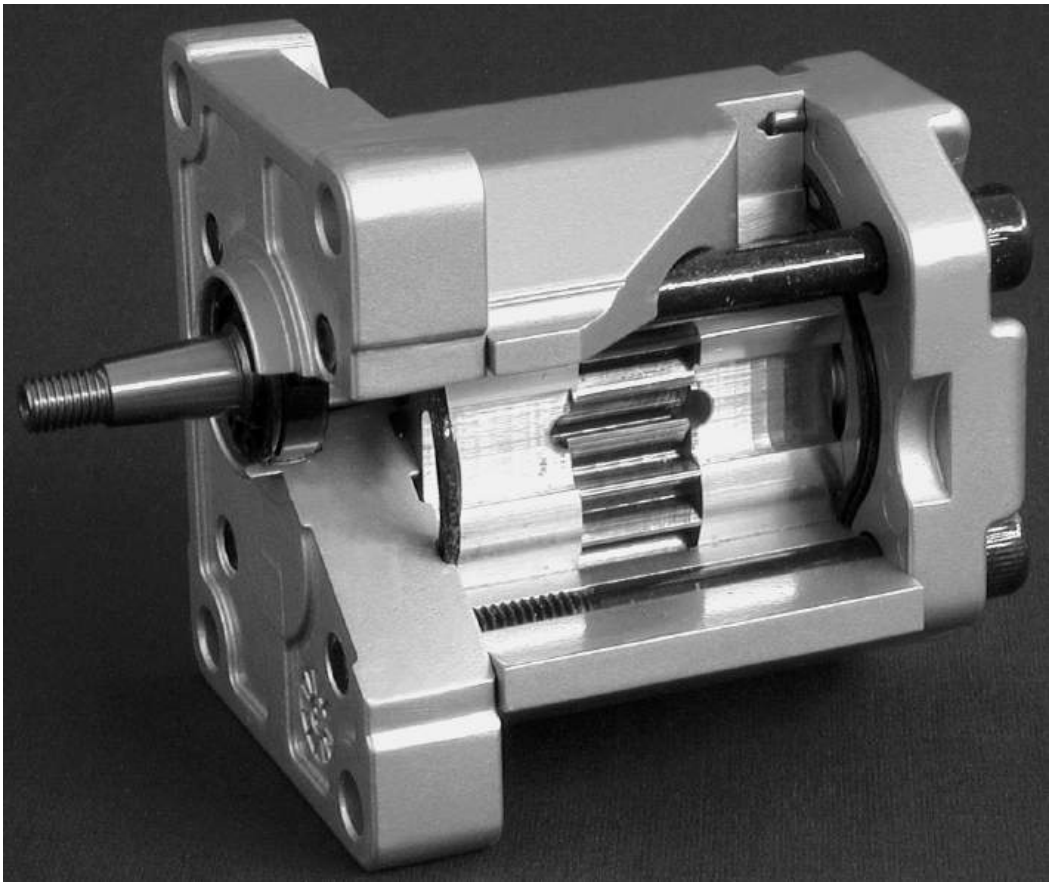
Group 1

Pump design

SNP1NN

SNP1NN pumps only include European flange and shaft configurations (code 01BA, 01DA, and 03CA).

SNP1NN 01BA (cut away)



Group 1

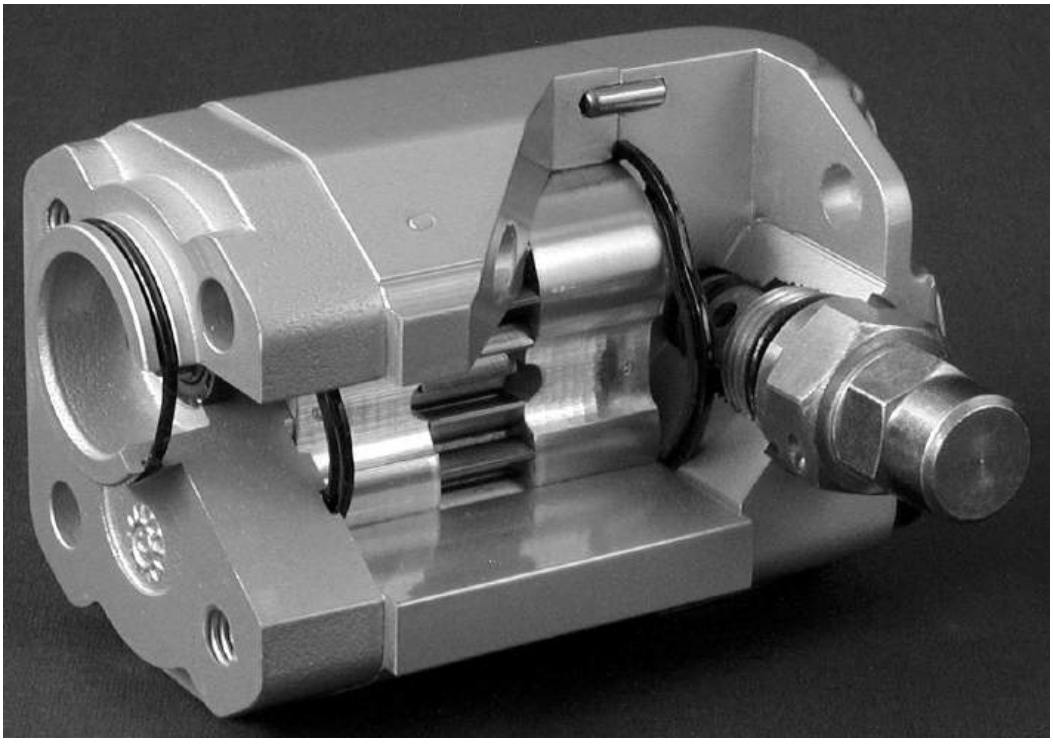
SKP1NN

SKP1NN has a larger diameter shaft than the SNP1NN. It spans the complete displacement range at higher pressures than the SNP1IN and the SNP1NN. Configurations include European and SAE flanges and shafts (code 02BB, 02FA, 06SA, and 06GA).

SKP1IN AND SNP1IN

Danfoss offers an optional integral relief valve integrated in the rear cover. It is drained internally and directs all flow from the pump outlet to the inlet when the outlet pressure reaches the valve setting. SNI1 pumps only include European flange and shaft configurations (code 01BA, 01DA, and 03CA).

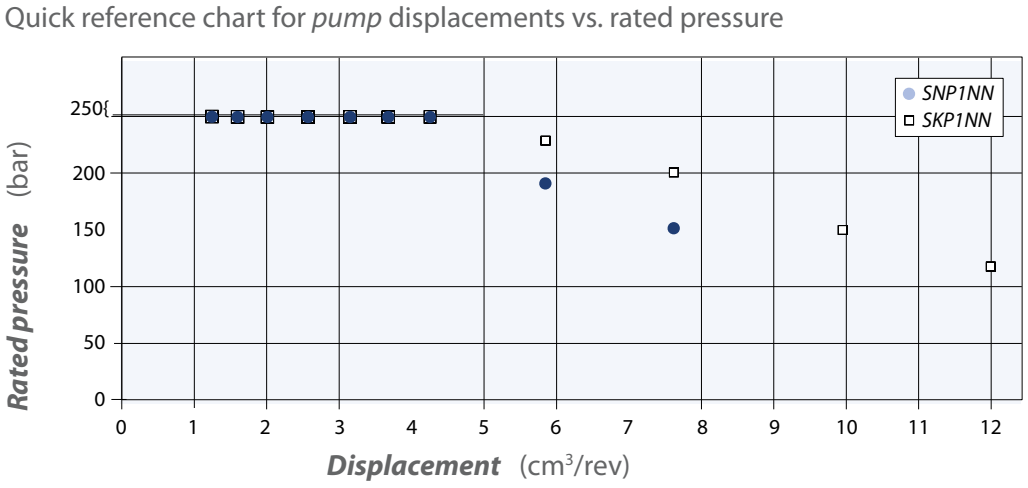
SNP1IN 03CA (cut away)



Group 1

Pump displacements

Quick reference chart for pump displacements vs. rated pressure



General Information

Technical data

		Frame size										
		1,2	**1,7**	**2,2**	**2,6**	**3,2**	**3,8**	**4,3**	**6,0**	**7,8**	**010**	**012**
Displacement	cm^3/rev [in^3/rev]	1.18 [0.072]	1.57 [0.096]	2.09 [0.128]	2.62 [0.160]	3.14 [0.192]	3.66 [0.223]	4.19 [0.256]	5.89 [0.359]	7.59 [0.463]	9.94 [0.607]	12.00 [0.732]
SNP1NN												
Peak pressure	bar [psi]	270 [3915]	270 [3915]	270 [3915]	270 [3915]	270 [3915]	270 [3915]	270 [3915]	210 [3045]	170 [2465]		
Rated pressure		250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	190 [2760]	150 [2175]		
Minimum speed at 0-150 bar	min^{-1} (rpm)	800	800	600	600	600	600	500	500	500	–	–
Min. speed at 150 bar to rated pressure		1200	1200	1000	1000	1000	1000	800	800	800		
Maximum speed		4000	4000	4000	4000	4000	4000	3000	3000	3000		
SKP1NN*												
Peak pressure	bar [psi]	270 [3915]	270 [3915]	270 [3915]	270 [3915]	270 [3915]	270 [3915]	270 [3915]	250 [3625]	220 [3190]	170 [2465]	140 [2030]
Rated pressure		250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	230 [3335]	200 [2900]	150 [2175]	120 [1740]
Minimum speed at 0-150 bar	min^{-1} (rpm)	800	800	800	800	800	800	600	600	600	600	600
Min. speed at 150 bar to rated pressure		1200	1200	1000	1000	1000	1000	1000	800	800	800	–
Maximum speed		4000	4000	4000	4000	4000	4000	3000	3000	3000	2000	2000
All (SNP1NN, SKP1NN)												
Weight	kg [lb]	1.02 [2.26]	1.05 [2.31]	1.09 [2.40]	1.11 [2.45]	1.14 [2.51]	1.18 [2.60]	1.20 [2.65]	1.30 [2.87]	1.39 [3.06]	1.55 [3.42]	1.65 [3.64]
Moment of inertia of rotating components	x 10^{-6} $kg•m^2$ [x 10^{-6} $lb•ft^2$]	3.2 [77]	3.7 [89]	4.4 [105]	5.1 [120]	5.7 [136]	6.4 [152]	7.1 [168]	9.3 [220]	11.4 [271]	14.6 [347]	17.1 [407]
Theoretical flow at maximum speed	l/min [US gal/min]	4.72 [1.25]	6.28 [1.66]	8.36 [2.21]	10.48 [2.77]	12.56 [3.32]	14.64 [3.87]	12.57 [3.32]	17.67 [4.67]	22.77 [6.02]	19.88 [5.25]	24 [6.34]

* SKP1NN is a special version of the SNP1NN. It is designed to accommodate an SAE 9T 20/40 DP tooth splined shaft for higher torque applications.

1 $kg•m^2$ = 23.68 $lb•ft^2$

General Information

Caution

The rated and peak pressure mentioned are for pumps with flanged ports only. When threaded ports are required a derated performance has to be considered. To verify the compliance of an high pressure application with a threaded ports pump apply to a Danfoss representative.

Product Code

Model code

A Family

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
•	•	•	•	•	•	/																				/					

SNB1NN	Gear pump with inlet port on cover and outlet port on flange
SNP1NN	Standard gear pump
SNC1NN	Gear pump with inlet and outlet ports on rear cover
SNP1IN	Gear pump with internal drain relief valve
SKP1NN	High torque gear pump
SKP1IN	High torque gear pump with internal drain relief valve

B Displacement

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/	•	•	•																	/					

1,2	1,18 cc
1,7	1,57 cc
2,2	2,09 cc
2,6	2,62 cc
3,2	3,14 cc
3,8	3,66 cc
4,3	4,19 cc
6,0	5,89 cc
7,8	7,59 cc
010	9,94 cc
012	12,00 cc

C Rotation

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/				•																/					

L	Left rotation
R	Right rotation

D Project version

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/					•															/					

N	Standard gear pump

Product Code

E Mounting flange

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/						•	•													/					

Code	Description (Type of flange • Type of drive gear • Preferred ports for configuration)
01	pilot Ø25,4+4 holes
02	pilot Ø30+4 holes
03	pilot Ø32+O-ring+2 holes through body
04	pilot Ø32+2 holes through body
06	SAE A-A pilot Ø50,8+ 2 holes

F Drive gear

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/								•	•											/					

AA	Taper 1:5-M6-Key 2
BA	Taper 1:8-M7-Key 2,41
BB	Taper 1:8-M10x1-Key 3
CA	Tang 5x Ø10
CE	Tang 6,63x Ø11 - for SKP1xN
CM	Tang 5x Ø10-type 03 + w/o coupling
DA	SplinedZ15-m0,75-alfa 30°-L14 - for SNP1xx
DB	SplinedZ15-m0,75-alfa 30°-L14 - for SKP1xx
FA	Parallel Ø12-Thread M10x1-Key 3
GA	Parallel Ø12,7-Key 3.2
SA	SAE spline J498-9T-20/40

G Rear cover

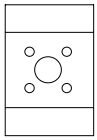
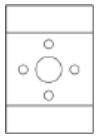
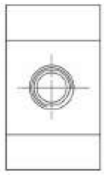
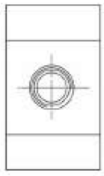
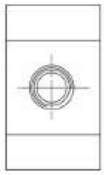
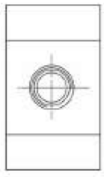
A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/										•	•									/					

03	Cover 03 (used with flange 03-04)
08	Cover 08 with Inlet port 3/8" Gas
C1	Cover pump with front GAS Thread Inlet 3/8 ; Outlet 3/8
I1	Cover pump with relief valve
I3	Cover 03 with relief valve (used with flange 03)
P1	Std Cover pump

H Inlet size; I Outlet size

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/												•	•	•	•					/					

Product Code

NN	Without inlet	
B1	8x30xM6	
B2	13x30xM6	
C1	8x26xM5	
C2	12x26xM5	
C3	13, 5x30xM6	
D3	M14x1,5	
D5	M18x1,5	
D7	M22x1,5	
E3	9/16-18UNF	
E4	¾-16UNF	
E5	7/8-14UNF	
F2	¼ GAS	
F3	3/8 GAS	
F4	½ GAS	
H2	10xM12x1,5-ISO6149	
H4	12xM16x1,5-ISO6149	
H5	12xM18x 1, 5-ISO6149	
H7	13, 5xM22x 1, 5-ISO6149	

J Ports positions & Special body

A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/									• •			/			

NN	Std from catalogue

K Seals

A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/										•		/			

N	Standard NBR seal
A	Without shaft seal
B	With VITON seals

Product Code

L Screws

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																			•	/					

N	Std screws
B	GEOMET screws

M Set valve

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																				/	•	•	•		

NNN	No valve
V*	not defined-pressure no setting :oil ISO VG68-45°

* For details see *Variant codes for ordering integral relief valves* on page 35.

N Type mark

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																				/				•	

N	Standard Danfoss Marking
A	Standard Danfoss Marking+Customer Code
Z	Without Marking

O Mark position

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																				/					•

N	Std Marking position (on top)
A	Special Marking position on the bottom

Determination of Nominal Pump Sizes

Determination of nominal pump sizes

Use these formula to determine the nominal pump size for a specific application:

	Based on SI units	Based on US units
Output flow:	$Q = \frac{Vg \cdot n \cdot \eta_v}{1000}$ l/min	$Q = \frac{Vg \cdot n \cdot \eta_v}{231}$ [US gal/min]
Input torque:	$M = \frac{Vg \cdot \Delta p}{20 \cdot \pi \cdot \eta_m}$ N•m	$M = \frac{Vg \cdot \Delta p}{2 \cdot \pi \cdot \eta_m}$ [lbf•in]
Input power:	$P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t}$ kW	$P = \frac{M \cdot n}{63.025} = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t}$ [hp]

Vg =	Displacement per rev.	cm^3/rev [in^3/rev]
pHD =	Outlet pressure	bar [psi]
pND =	Inlet pressure	bar [psi]
Δp =	pHD – pND	bar [psi]
n =	Speed	min^{-1} (rpm)
ηv =	Volumetric efficiency	
ηm =	Mechanical (torque) efficiency	
ηt =	Overall efficiency (ηv • ηm)	

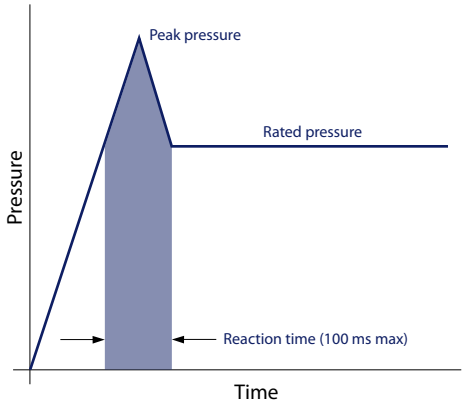
System Requirements

Pressure

The inlet vacuum must be controlled in order to realize expected pump life and performance. The system design must meet inlet pressure requirements during all modes of operation. Expect lower inlet pressures during cold start. It should improve quickly as the fluid warms.

Max. continuous vacuum	bar abs. [in. Hg]	0.8 [23.6]
Max. intermittent vacuum		0.6 [17.7]
Max. pressure		4.0 [118.1]

Peak pressure is the highest intermittent pressure allowed. The relief valve overshoot (reaction time) determines peak pressure. It is assumed to occur for less than 100 ms. The accompanying illustration shows peak pressure in relation to rated pressure and reaction time (100 ms maximum).



Rated pressure is the average, regularly occurring, operating pressure that should yield satisfactory product life. The maximum machine load demand determines rated pressure. For all systems, the load should move below this pressure.

System pressure is the differential of pressure between the outlet and inlet ports. It is a dominant operating variable affecting hydraulic unit life. High system pressure, resulting from high load, reduces expected life. System pressure must remain at, or below, rated pressure during normal operation to achieve expected life.

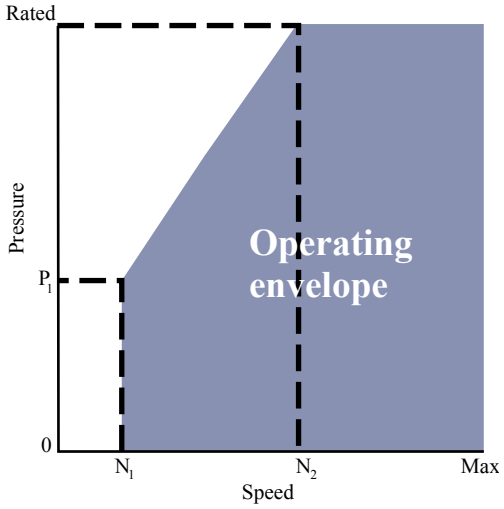
Speed

Maximum speed is the limit recommended by Danfoss for a particular gear pump when operating at rated pressure. It is the highest speed at which normal life can be expected.

The lower limit of operating speed is the **minimum speed**. It is the lowest speed at which normal life can be expected. The minimum speed increases as operating pressure increases. When operating under higher pressures, a higher minimum speed must be maintained, as illustrated here.

System Requirements

Speed versus pressure



Where:

N_1 = Minimum speed at 100 bar

N_2 = Minimum speed at 180 bar

Hydraulic fluids

Ratings and data for SNP1NN, and SKP1NN gear pumps are based on operating with premium hydraulic fluids containing oxidation, rust, and foam inhibitors. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion, and corrosion of internal components. They include:

- Hydraulic fluids following DIN 51524, part 2 (HLP) and part 3 (HVLP) specifications
- API CD engine oils conforming to SAE J183
- M2C33F or G automatic transmission fluids
- Certain agricultural tractor fluids

Use only clean fluid in the pump and hydraulic circuit.

Caution

Never mix hydraulic fluids.

Temperature and viscosity

Temperature and viscosity requirements must be concurrently satisfied. Use petroleum / mineral-based fluids.

High temperature limits apply at the inlet port to the pump. The pump should run at or below the maximum continuous temperature. The peak temperature is based on material properties. Don't exceed it.

Cold oil, generally, doesn't affect the durability of pump components. It may affect the ability of oil to flow and transmit power. For this reason, keep the temperature at 16 °C [60 °F] above the pour point of the hydraulic fluid.

Minimum (cold start) temperature relates to the physical properties of component materials.

Minimum viscosity occurs only during brief occasions of maximum ambient temperature and severe duty cycle operation. You will encounter maximum viscosity only at cold start. During this condition, limit speeds until the system warms up. Size heat exchangers to keep the fluid within these limits. Test regularly to verify that these temperatures and viscosity limits aren't exceeded. For maximum unit efficiency and bearing life, keep the fluid viscosity in the recommended viscosity range.

System Requirements

Fluid viscosity

Maximum (cold start)	mm^2/s [SUS]	1000 [1600]
Recommended range		12-60 [66-290]
Minimum		10 [60]

Temperature (with standard NBR seals)

Minimum (cold start)	°C [°F]	-20 [-4]
Maximum continuous		80 [176]
Peak (intermittent)		90 [194]

Filtration

Filters

Use a filter that conforms to Class 22/18/13 of ISO 4406 (or better). It may be on the pump outlet (pressure filtration), inlet (suction filtration), or reservoir return (return-line filtration).

Selecting a filter

When selecting a filter, please consider:

- contaminant ingression rate (determined by factors such as the number of actuators used in the system)
- generation of contaminants in the system
- required fluid cleanliness
- desired maintenance interval
- filtration requirements of other system components

Measure filter efficiency with a Beta ratio (β_X). For:

- suction filtration, with controlled reservoir ingression, use a $\beta_{35-45} = 75$ filter
- return or pressure filtration, use a pressure filtration with an efficiency of $\beta_{10} = 75$

β_x ratio is a measure of filter efficiency defined by ISO 4572. It is the ratio of the number of particles greater than a given diameter ("$_X$" in microns) upstream of the filter to the number of these particles downstream of the filter.

Fluid cleanliness level and β_x ratio

Fluid cleanliness level (per ISO 4406)	Class 22/18/13 or better
β_x ratio (suction filtration)	$\beta_{35-45} = 75$ and $\beta_{10} = 2$
β_x ratio (pressure or return filtration)	$\beta_{10} = 75$
Recommended inlet screen size	100-125 µm [0.004-0.005 in]

The filtration requirements for each system are unique. Evaluate filtration system capacity by monitoring and testing prototypes.

Reservoir

The **reservoir** provides clean fluid, dissipates heat, removes entrained air, and allows fluid volume changes associated with fluid expansion and cylinder differential volumes. A correctly sized reservoir accommodates maximum volume changes during all system operating modes. It promotes deaeration of the fluid as it passes through, and accommodates a fluid dwell-time between 60 and 180 seconds, allowing entrained air to escape.

System Requirements

Minimum reservoir capacity depends on the volume required to cool and hold the oil from all retracted cylinders, allowing for expansion due to temperature changes. A fluid volume of 1 to 3 times the pump output flow (per minute) is satisfactory. The minimum reservoir capacity is 125% of the fluid volume.

Install the suction line above the bottom of the reservoir to take advantage of gravity separation and prevent large foreign particles from entering the line. Cover the line with a 100-125 micron screen. The pump should be below the lowest expected fluid level. Put the return-line below the lowest expected fluid level to allow discharge into the reservoir for maximum dwell and efficient deaeration. A baffle (or baffles) between the return and suction lines promotes deaeration and reduces fluid surges.

Line sizing

Choose pipe sizes that accommodate minimum fluid velocity to reduce system noise, pressure drops, and overheating. This maximizes system life and performance.

Design inlet piping that maintains continuous pump inlet pressure above 0.8 bar absolute during normal operation. The line velocity should not exceed the values in this table:

Maximum line velocity

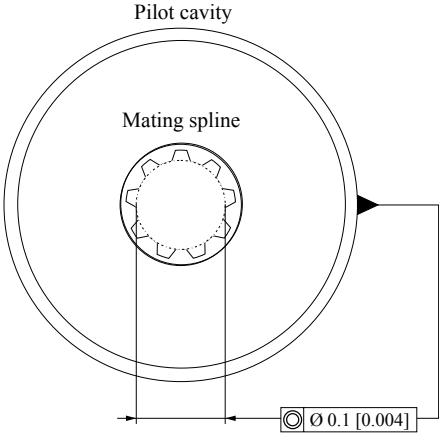
Inlet	m/s [ft/sec]	2.5 [8.2]
Outlet		5.0 [16.4]
Return		3.0 [9.8]

Most systems use hydraulic oil containing 10% dissolved air by volume. Under high inlet vacuum conditions the oil releases bubbles. They collapse when subjected to pressure, resulting in cavitation, causing adjacent metal surfaces to erode. **Over-aeration** is the result of air leaks on the inlet side of the pump, and flow-line restrictions. These include inadequate pipe sizes, sharp bends, or elbow fittings, causing a reduction of flow line cross sectional area. This problem will not occur if inlet vacuum and rated speed requirements are maintained, and reservoir size and location are adequate.

Pump drive

Shaft options for Group 1 gear pumps include tapered, tang, splined, or parallel shafts. They are suitable for a wide range of direct and indirect drive applications for radial and thrust loads.

Plug-in drives, acceptable only with a splined shaft, can impose severe radial loads when the mating spline is rigidly supported. Increasing spline clearance does not alleviate this condition.



Use **plug-in drives** if the concentricity between the mating spline and pilot diameter is within 0.1 mm [0.004 in]. Lubricate the drive by flooding it with oil. A 3-piece coupling minimizes radial or thrust shaft loads.

System Requirements

Caution

In order to avoid spline shaft damages it is recommended to use carburized and hardened steel couplings with 80-82 HRA surface hardness.

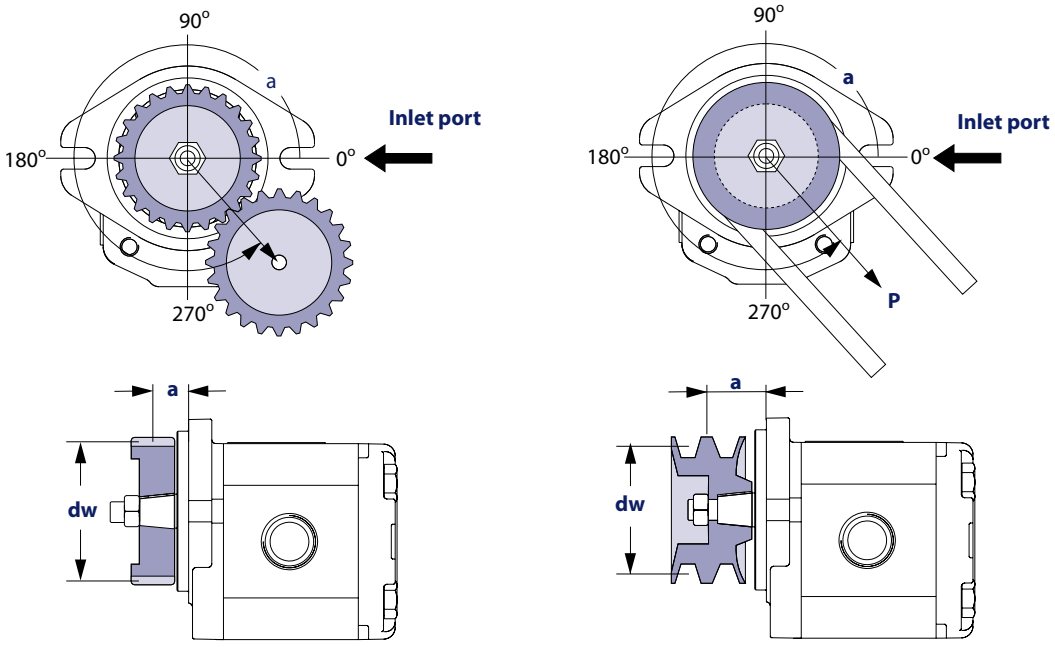
Allowable **radial shaft loads** are a function of the load position, load orientation, and operating pressure of the hydraulic pump. All external shaft loads have an effect on bearing life, and may affect pump performance.

In applications where external shaft loads can't be avoided, minimize the impact on the pump by optimizing the orientation and magnitude of the load. Use a tapered input shaft; don't use splined shafts for belt or gear drive applications. A spring-loaded belt tension-device is recommended for belt drive applications to avoid excessive tension. Avoid thrust loads in either direction.

Pump drive data form

Contact Danfoss if continuously applied external radial or thrust loads occur. Fill out this page and send the complete form to your Danfoss representative for an assistance in applying pumps with belt or gear drive. This illustration shows a pump with counterclockwise orientation:

Optimal radial load position



Application data

Item		Value	Unit
Pump displacement			cm^3/rev [in^3/rev]
Rated system pressure			bar psi
Relief valve setting			
Pump shaft rotation			left right
Pump minimum speed			min^{-1} (rpm)
Pump maximum speed			
Drive gear helix angle (gear drive only)			degree
Belt type (gear drive only)			V notch
Belt tension (gear drive only)	**P**		N lbf

System Requirements

Application data (continued)

Item		Value	Unit
Angular orientation of gear or belt to inlet port	**α**		degree
Pitch diameter of gear or pulley	**dw**		mm in
Distance from flange to center of gear or pulley	**a**		

Pump Life

Pump life is a function of speed, system pressure, and other system parameters (such as fluid quality and cleanliness).

All Danfoss gear pumps use hydrodynamic journal bearings that have an oil film maintained between the gear/shaft and bearing surfaces at all times. If the oil film is sufficiently sustained through proper system maintenance and operating within recommended limits, long life can be expected.

B_{10} life expectancy number is generally associated with rolling element bearings. It does not exist for hydrodynamic bearings.

High pressure, resulting from high loads, impacts pump life. When submitting an application for review, provide machine duty cycle data that includes percentages of time at various loads and speeds. We strongly recommend a prototype testing program to verify operating parameters and their impact on life expectancy before finalizing any system design.

Sound levels

Noise is unwanted sound. Fluid power systems create noise. There are many techniques available to minimize noise. Understanding how it's generated and transmitted is necessary to apply these methods effectively.

Noise energy is transmitted as fluid borne noise (pressure ripple) or structure borne noise. **Pressure ripple** is the result of the number of pumping elements (gear teeth) delivering oil to the outlet and the pump's ability to gradually change the volume of each pumping element from low to high pressure. Pressure ripple is affected by the compressibility of the oil as each pumping element discharges into the outlet of the pump. Pressure pulsations travel along hydraulic lines at the speed of sound (about 1400 m/s in oil) until there is a change in the system (as with an elbow fitting). Thus, the pressure pulsation amplitude varies with overall line length and position.

Structure borne noise may be transmitted wherever the pump casing is connected to the rest of the system.

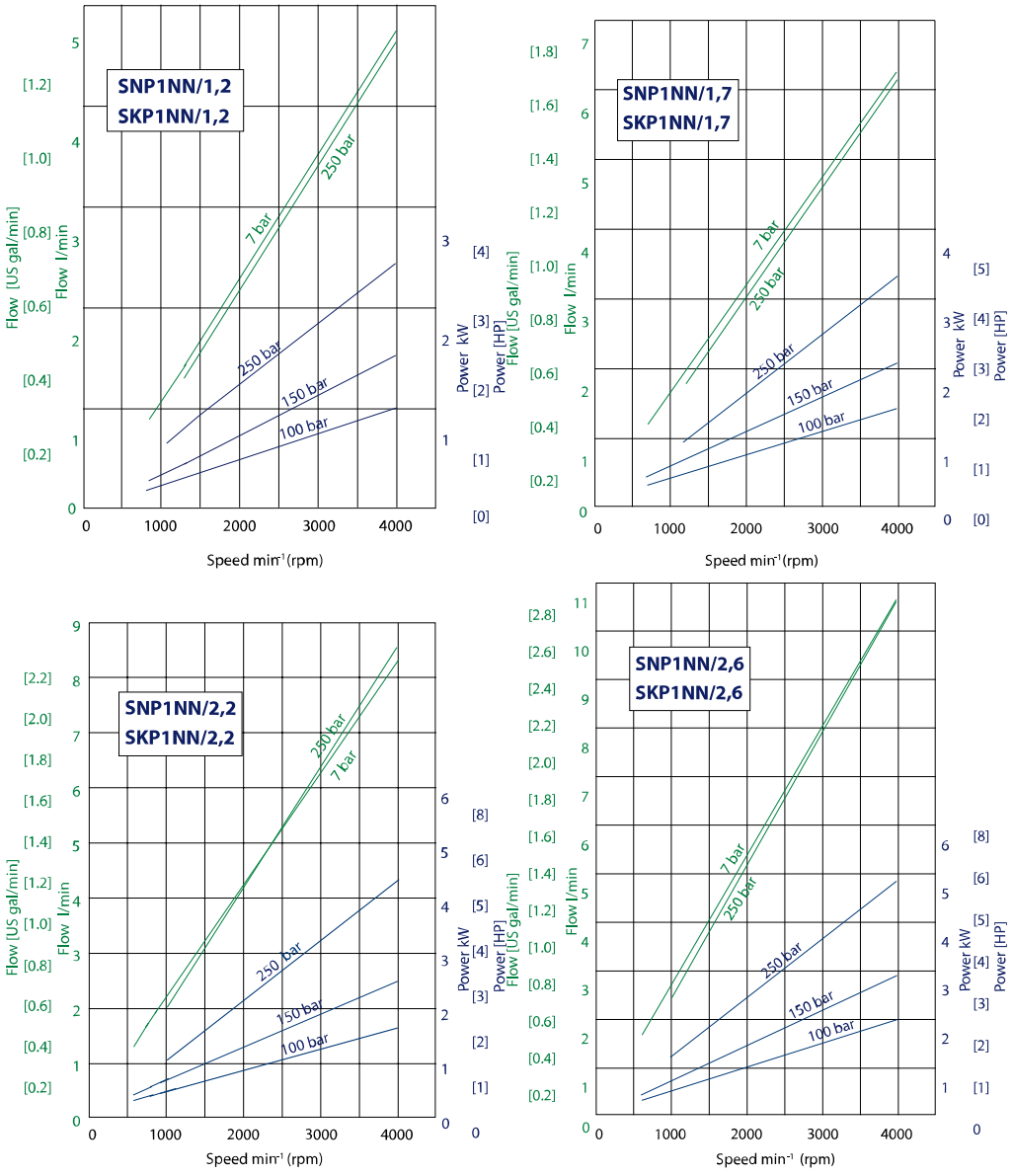
The way circuit components respond to excitation depends on their size, form, and mounting. Because of this, a system line may actually have a greater noise level than the pump. To minimize noise, use:

- flexible hoses (if you must use steel plumbing, clamp the lines).
- flexible (rubber) mounts to minimize other structure borne noise.

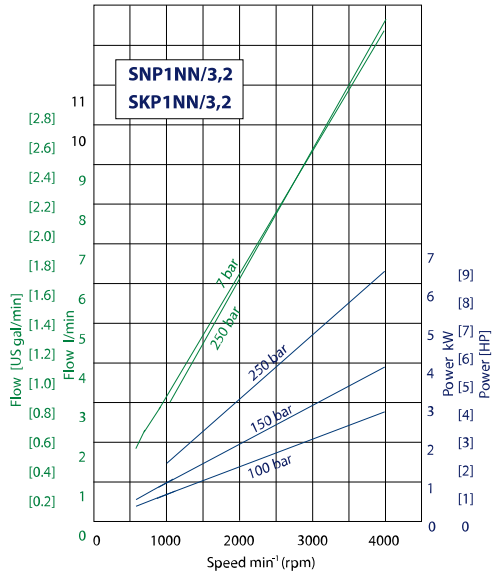
Pump Performance

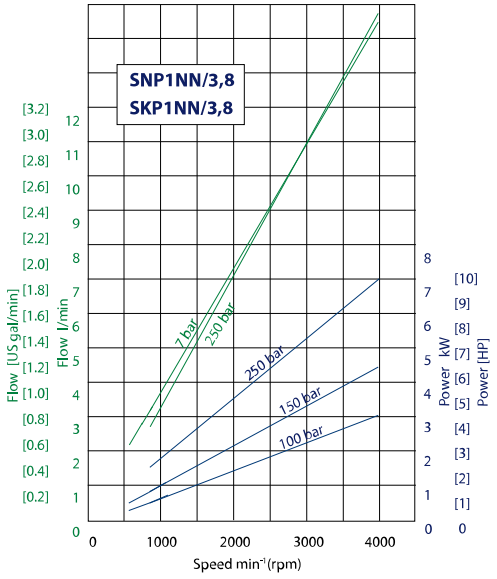
Pump performance graphs

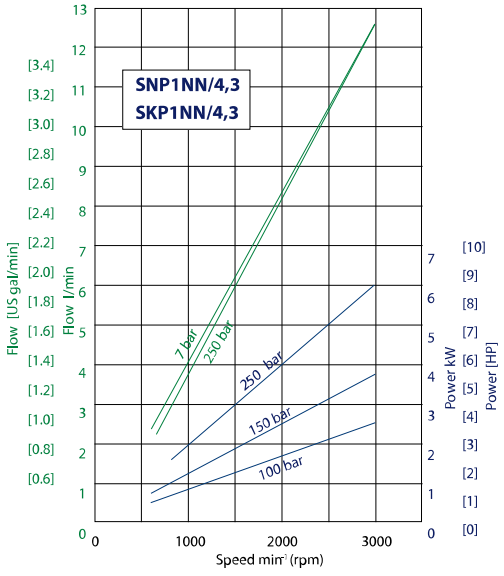
The following graphs provide typical output flow and input power for Group 1 pumps at various working pressures. Data were taken using ISO VG46 petroleum /mineral based fluid at 50°C (viscosity at 28 mm^2/s [cSt]).

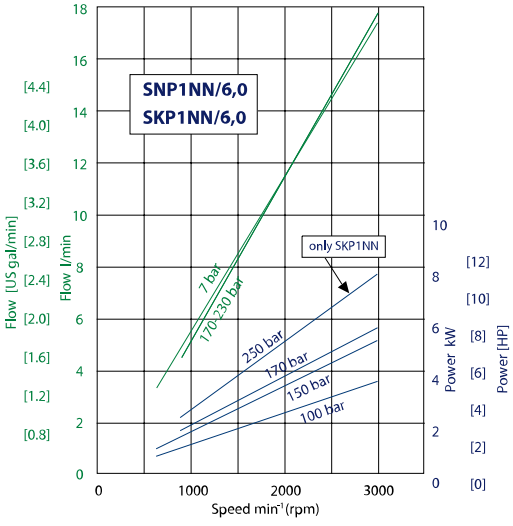


Pump Performance

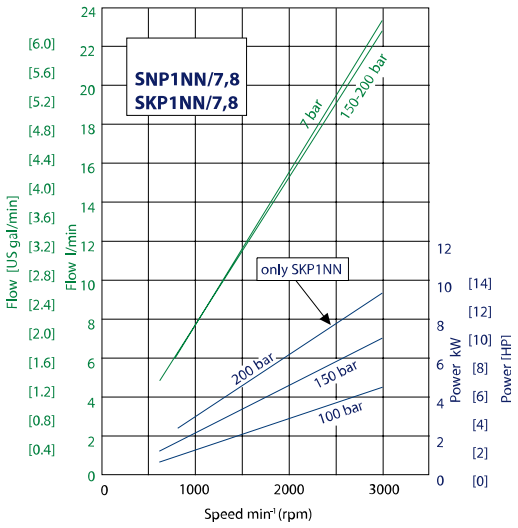


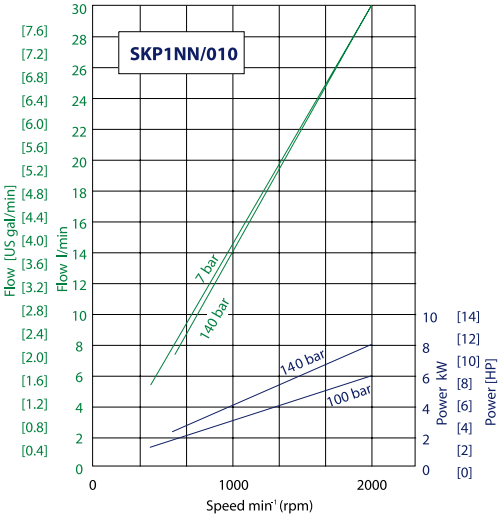


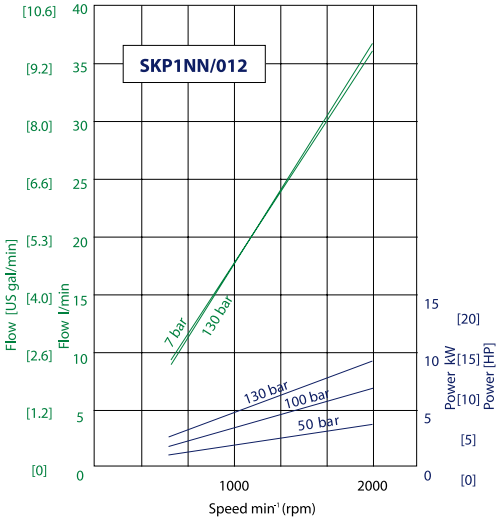




Pump Performance

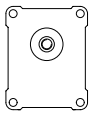
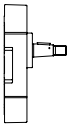
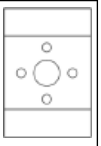
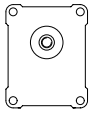
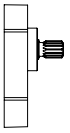
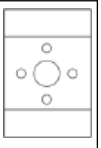
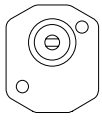
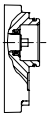
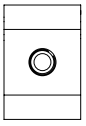




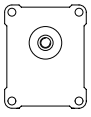
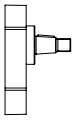
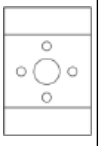
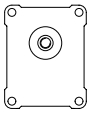
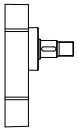
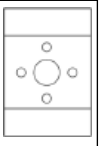
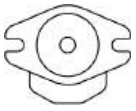
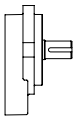
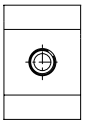
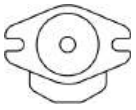
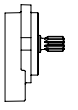
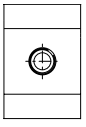


Product Options

Flange, shaft and port configurations

Code	Flange		Shaft		Port	
01BA	25.4 mm [1.0 in] pilot Ø European 4-bolt		1:8 tapered		European flanged in + pattern	
01DA	25.4 mm [1.0 in] pilot Ø European 4-bolt		15-teeth splined m = 0.75 a = 30o		European flanged in + pattern	
03CA	pilot Ø32 + O-ring + 2 holes through body		Danfoss tang		Threaded metric port	
04AA	pilot Ø32 + O-ring + 2 holes through body		1:5 tapered		Threaded metric port	

Flange, shaft and port configurations for SKP1NN

Code	Flange		Shaft		Port	
02BB	30 mm [1.181] pilot Ø European 4-bolt		1:8 tapered		European flanged in + pattern	
02FA	30 mm [1.181] pilot Ø European 4-bolt		12 mm [0.472 in] parallel		European flanged in + pattern	
06GA	SAE A-A 2-bolt		12.7 mm [0.5 in] parallel		Threaded SAE O-Ring boss	
06SA	SAE A-A 2-bolt		9-teeth splined SAE spline J 498-9T-20/40DP		Threaded SAE O-Ring boss	

Shaft options

Direction is viewed facing the shaft. Group 1 pumps are available with a variety of tang, splined, parallel, and tapered shaft ends. Not all shaft styles are available with all flange styles.

Shaft availability and nominal torque capability

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/								•	•											/						

Product Options

Shaft		Mounting flange code with maximum torque in Nm [lb•in]				
Code	Description	01	02	03	04	06
AA	Taper 1:5-M6				25 [221]	
BA	Taper 1:8-M7	25 [221]				
BB	Taper 1:8-M10		50 [442]			
CA	Tang 5x Ø10			14 [124]		
CE	Tang 6,63x Ø11					21 [186]
CM	Tang 5x Ø10-type 03 + w/o coupling			14 [124]		
DA	Splined Z15-m0,75-alfa 30°-L14	35 [309]				
DB	Splined Z15-m0,75-alfa 30°-L14		35 [309]			
FA	Parallel Ø12-Thread M10x1		24 [212]			
GA	Parallel Ø12,7-Key 3.2					32 [283]
SA	SAE spline J498-9T-20/40					34 [301]

Danfoss recommends mating splines conform to SAE J498 or DIN 5482.

Danfoss external SAE splines have a flat root side fit with circular tooth thickness reduced by 0.127 mm [0.005 in] in respect to class 1 fit. Dimensions are modified to assure a clearance fit with the mating spline.

Caution

Shaft torque capability may limit allowable pressure. Torque ratings assume no external radial loading. Applied torque must not exceed these limits, regardless of stated pressure parameters. Maximum torque ratings are based on shaft torsional fatigue strength.

Various port configurations are available on Group 1 pumps. They include:

- European standard flanged ports
- German standard flanged ports
- Gas threaded ports (BSPP)
- O-Ring boss (following SAE J1926/1 [ISO 11926-1] UNF threads, standard)

For a table of dimensions, see *Ports* on page 33.

Inlet/Outlet port configurations

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/												•	•	•	•					/					

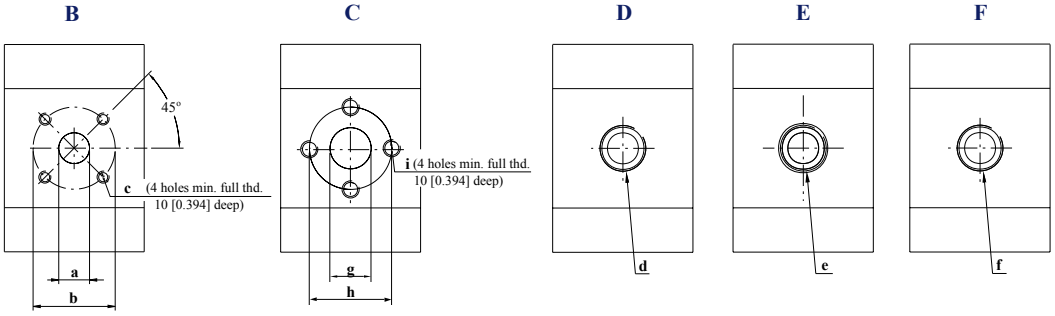
B1	8x30xM6	Flanged port with threaded holes in **X** pattern, in center of body
B2	13x30xM6	
C1	8x26xM5	Flanged port with threaded holes in **+** pattern (European standard ports)
C2	12x26xM5	
C3	13,5x30xM6	
D3	M14x1,5	Threaded metric port
D5	M18x1,5	
D7	M22x1,5	

Product Options

E3	9/16-18UNF	Threaded SAE, O-Ring boss port
E4	¾ -16UNF	
E5	7/8-14UNF	
F2	¼ GAS	Threaded GAS (BSPP) port
F3	3/8 GAS	
F4	½ GAS	
H2	M12x1,5	Threaded metric port ISO 6149
H4	M16x1,5	
H5	M18x1,5	
H7	M22x1,5	

Ports

Available ports



Dimensions of Group 1 pump ports

Port type		B			C			D	E	F
Port dimension		a	b	c	g	h	i	d	e	f
1,2	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	8 [0.315]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M14x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)
1,7	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	8 [0.315]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M14x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)
2,2	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	8 [0.315]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M14x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)
2,6	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	8 [0.315]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M14x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)
3,2	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	8 [0.315]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M14x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)
3,8	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	8 [0.315]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)
4,3	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	8 [0.315]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)
6,0	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)

Product Options

Dimensions of Group 1 pump ports (continued)

Port type		B			C			D	E	F
Port dimension		a	b	c	g	h	i	d	e	f
7,8	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)
010	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)
012	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	¾–16UNF–2B	3/8 Gas (BSPP)
	Outlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	9/16–18UNF–2B	3/8 Gas (BSPP)

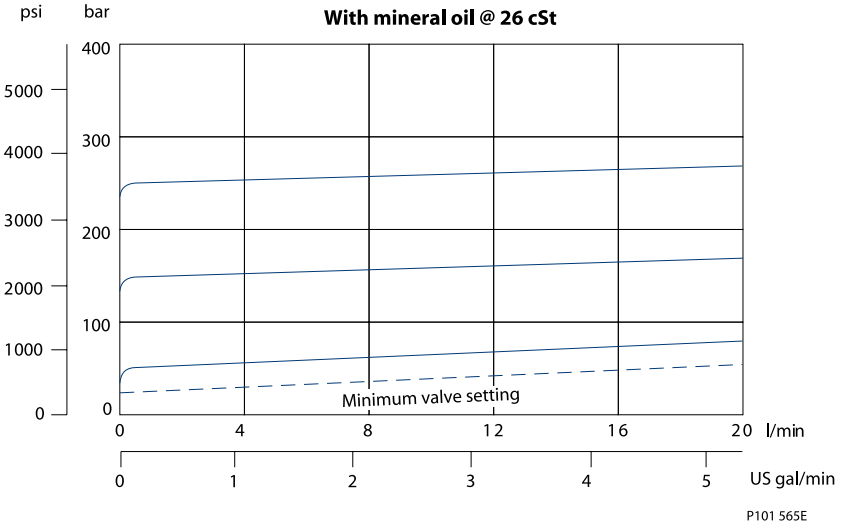
SNP1IN

Danfoss offers an optional integral relief valve integrated in the rear cover. It is drained internally and directs all flow from the pump outlet to the inlet when the outlet pressure reaches the valve setting.

Caution

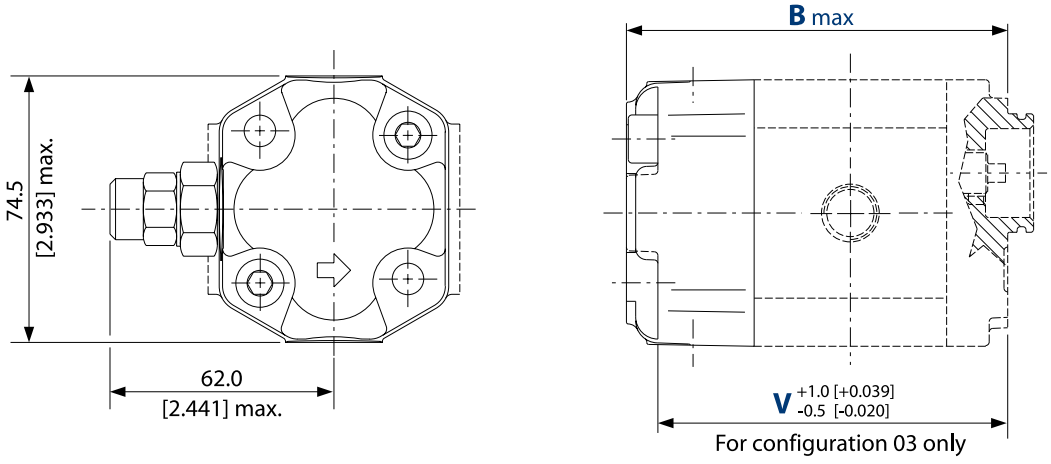
When the relief valve is operating in bypass condition, rapid heat generation occurs. If this bypass condition continues, the pump prematurely fails. The reason for this is that it is a rule, not an exception.

Valve performance graph



Product Options

Dimensions



For configuration 06 (SAE A-A) dimension B and V have to be increased 4.5 mm [0.177 in].

Integral relief valve and covers dimensions

Type (displacement)		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6,0	7,8	010	012
Dimensions mm [in]	B	95.5 [3.760]	97 [3.819]	99 [3.989]	101 [3.976]	103 [4.055]	105 [4.134]	107 [4.213]	113.5 [4.468]	120 [4.724]	129 [5.079]	137 [5.394]
	V	85.0 [3.346]	86.5 [3.406]	88.5 [3.484]	90.5 [3.563]	92.5 [3.642]	94.5 [3.720]	96.5 [3.799]	103.0 [4.055]	109.5 [4.311]	118.5 [4.665]	126.5 [4.980]

Variant codes for ordering integral relief valves

These tables detail the various codes for ordering integral relief valves:

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																				/	•	•	•		

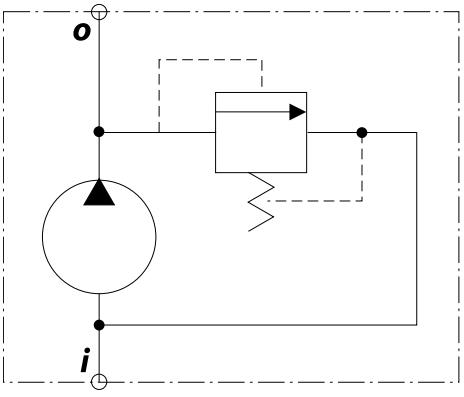
Code	Pump speed for RV setting min-1 (rpm)
A	Not defined
C	500
E	1000
F	1250
G	1500
K	2000
I	2250
L	2500
M	2800
N	3000
O	3250

Product Options

Code	Pressure setting bar [psi]
A	No setting
B	No valve
C	18 [261]
D	25 [363]
E	30 [435]
F	35 [508]
G	40 [580]
K	50 [725]
L	60 [870]
M	70 [1015]
N	80 [1160]
O	90 [1305]
P	100 [1450]
Q	110 [1595]
R	120 [1740]
S	130 [1885]
T	140 [2030]
U	160 [2320]
V	170 [2465]
W	180 [2611]
X	210 [3045]
Y	240 [3480]
Z	250 [3626]

Integral relief valve schematic

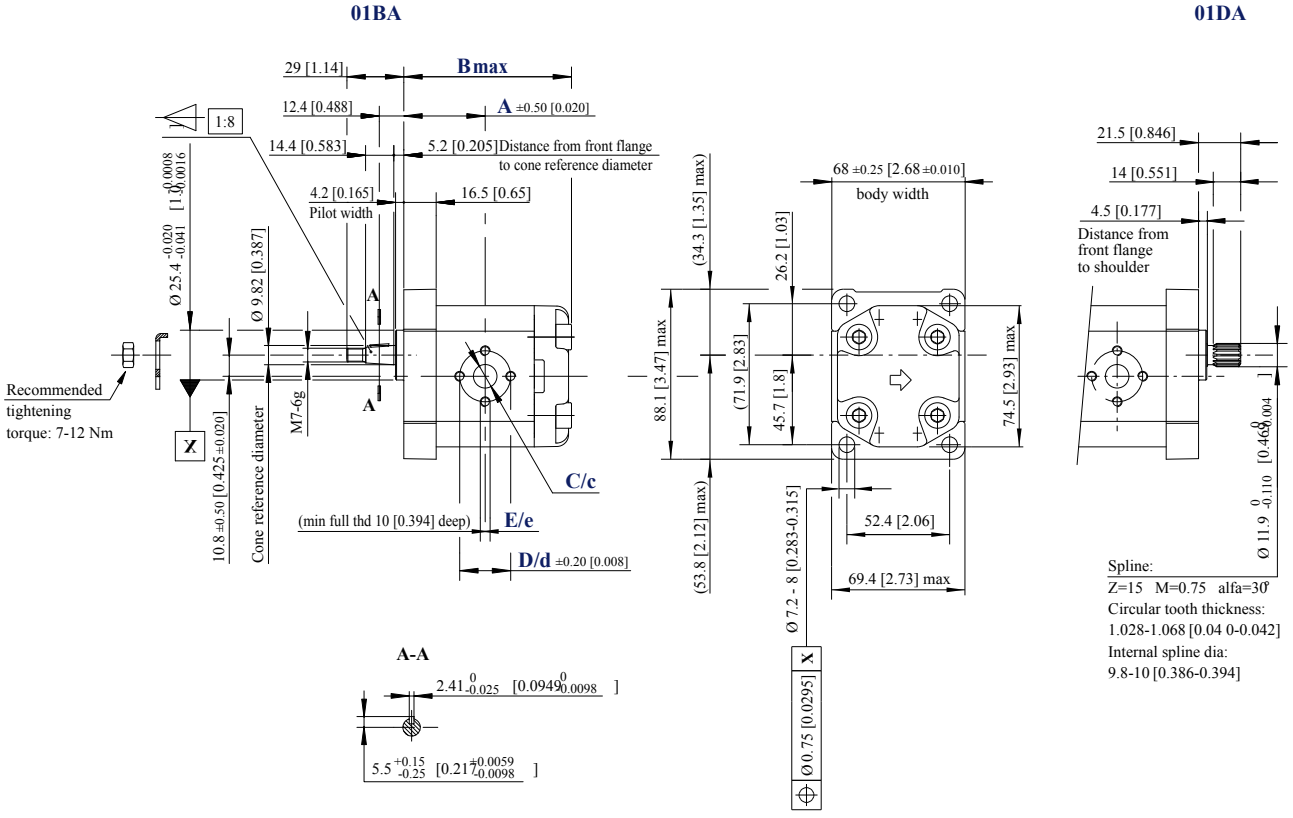
Valve schematic



Dimensions

SNP1NN - 01BA and 01DA

This drawing shows the standard porting for 01BA and 01DA. Available in Series SNP1NN only.



SNP1NN – 01BA and 01DA dimensions

Frame size		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6,0	7,8
Dimension	**A**	37.75 [1.486]	38.5 [1.516]	39.5 [1.555]	40.5 [1.634]	41.5 [1.634]	42.5 [1.673]	43.5 [1.713]	46.75 [1.841]	50.0 [1.969]
	B	79.5 [3.130]	81.0 [3.189]	83.0 [3.268]	85.0 [3.346]	87.0 [3.425]	89.0 [3.504]	91.0 [3.583]	97.5 [3.839]	104.0 [4.094]
Inlet/Outlet	**C/c**	12 [0.472]								
	D/d	26 [1.024]								
	E/e	M5								

Model code examples and maximum shaft torque

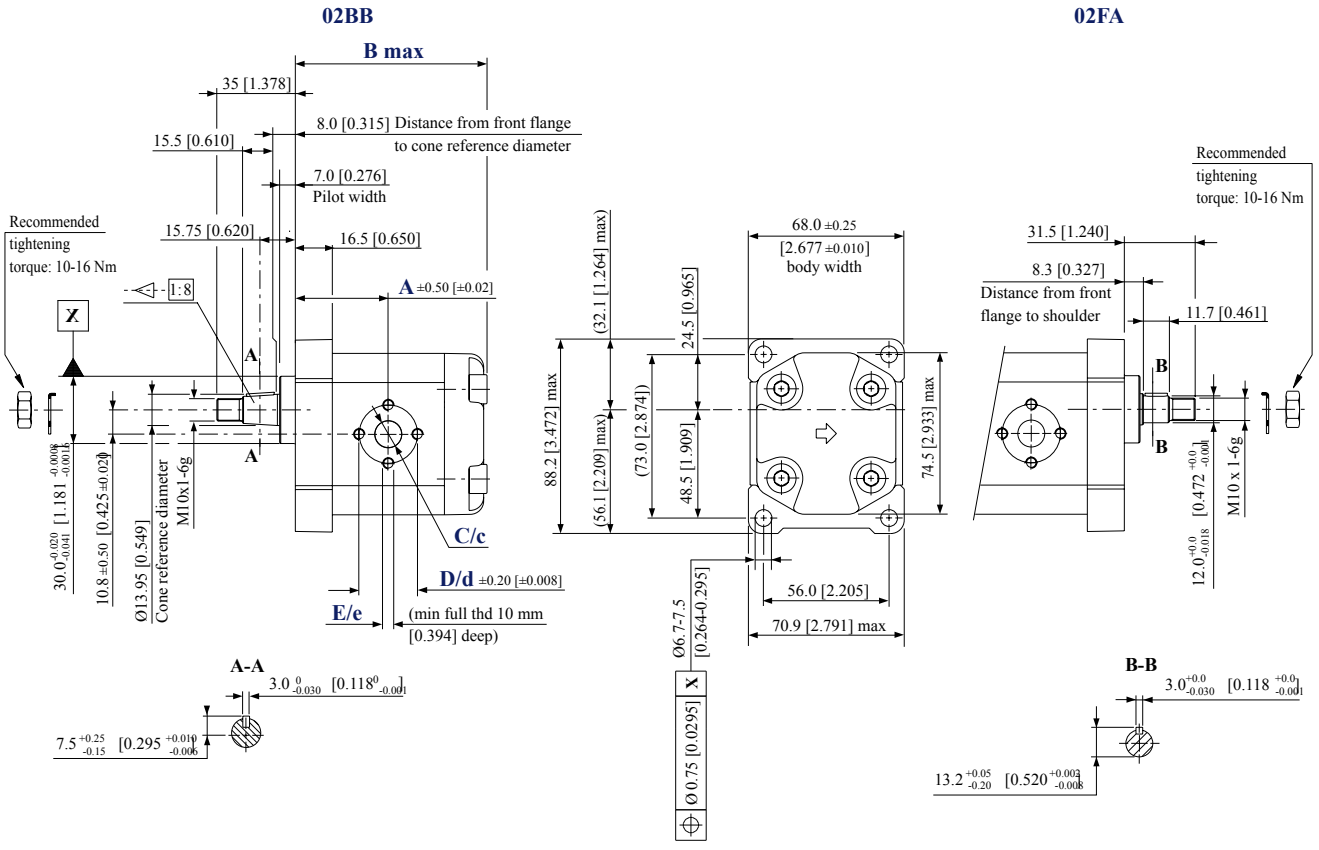
Flange/drive gear	Model code example	Maximum shaft torque
01BA	SNP1NN/3,8RN01BAP1C2C2NNNN/NNNNN	25 N•m [221 lb•in]
01DA	SNP1NN/6,0LN01DAP1C2C2NNNN/NNNNN	35 N•m [310 lb•in]

For further details on ordering, see *Model code*.

Dimensions

SKP1NN – 02BB and 02FA

This drawing shows the standard porting for 02BB and 02FA. Available in Series SKP1NN only.



SKP1NN – 02BB and 02FA dimensions

Frame size		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6,0	7,8	010	012
Dimension	**A**	37.75 [1.486]	38.5 [1.516]	39.5 [1.555]	40.5 [1.634]	41.5 [1.634]	42.5 [1.673]	43.5 [1.713]	46.75 [1.841]	50.0 [1.969]	54.5 [2.146]	58.5 [2.303]
	B	79.5 [3.130]	81.0 [3.189]	83.0 [3.268]	85.0 [3.346]	87.0 [3.425]	89.0 [3.504]	91.0 [3.583]	97.5 [3.839]	104.0 [4.094]	113.0 [4.449]	121.0 [4.764]
Inlet/Outlet	**C/c**	12 [0.472]										
	D/d	26 [1.024]										
	E/e	M5										

Model code examples and maximum shaft torque

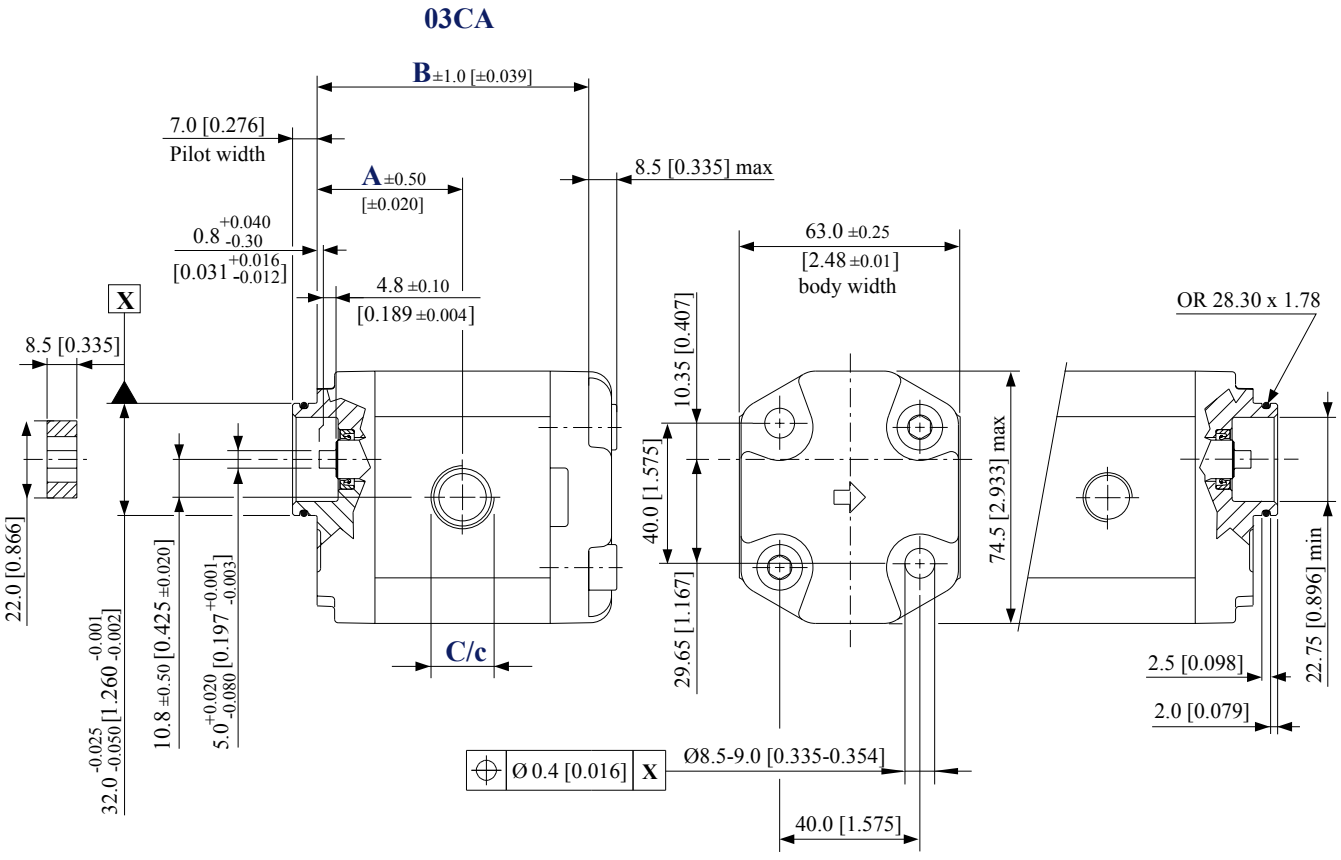
Flange/drive gear	Model code example	Maximum shaft torque
02BB	SKP1NN/6,0RN02BBP1C2C2NNNN/NNNNN	50 N•m [442 lb•in]
02FA	SKP1NN/ 2,2LN02FAP1C2C2NNNN/NNNNN	24 N•m [212 lb•in]

For further details on ordering, see *Model code*.

Dimensions

SNP1NN – 03CA

This drawing shows the standard porting for 03CA.



SNP1NN – 03CA dimensions

Frame size		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6,0	7,8
Dimension	**A**	37.75 [1.486]	38.5 [1.516]	39.5 [1.555]	40.5 [1.634]	41.5 [1.634]	42.5 [1.673]	43.5 [1.713]	46.75 [1.841]	50 [1.969]
	B	70 [2.756]	71.5 [2.815]	73.5 [2.894]	75.5 [2.972]	77.5 [3.051]	79.5 [3.130]	81.5 [3.209]	88.0 [3.465]	94.5 [3.720]
Inlet	**C**	M18 x 1.5 THD 12 [0.472] deep								
Outlet	**c**	M14 x 1.5, THD 12 [0.472] deep					M18 x 1.5, THD 12 [0.472] deep			

Model code examples and maximum shaft torque

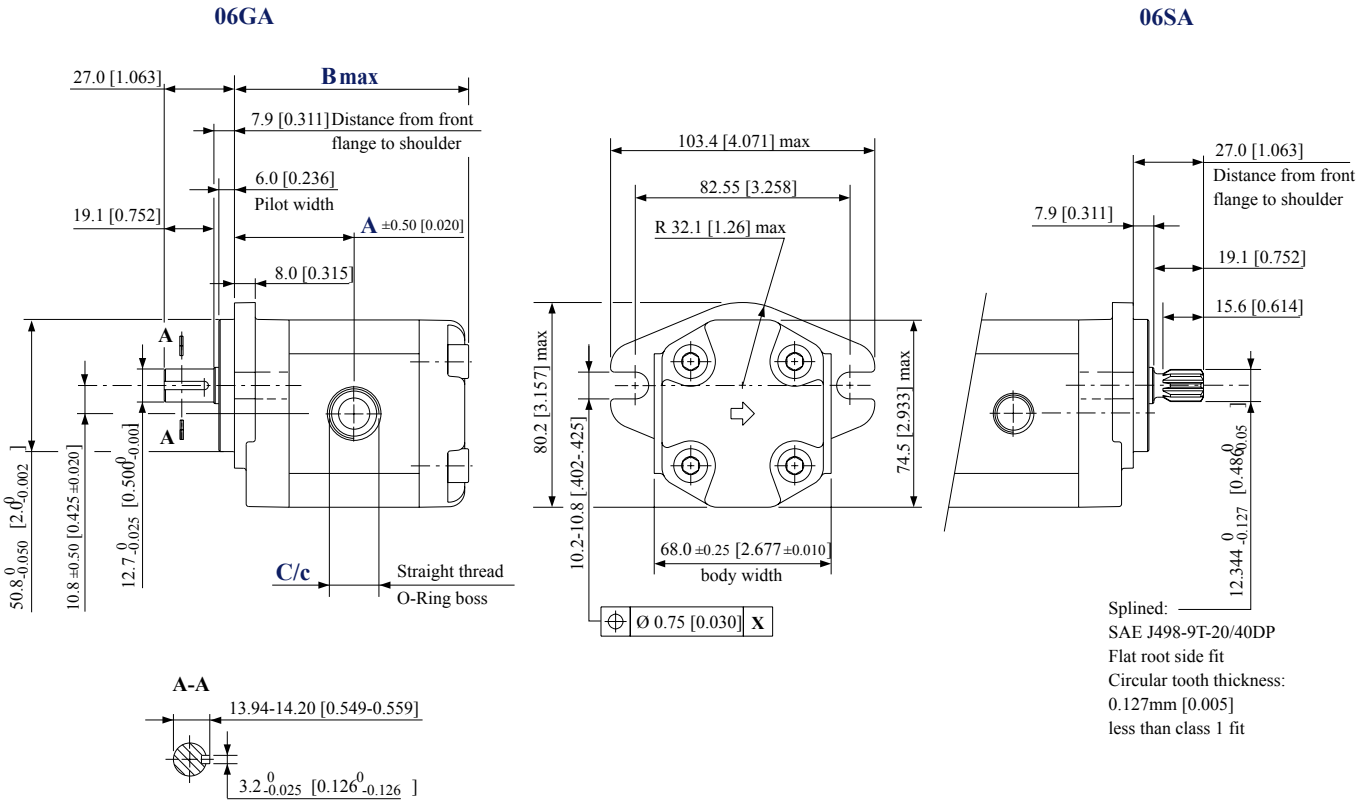
Flange/drive gear	Model code example	Maximum shaft torque
03CA	SNP1NN/1,7RN03CA03D5D3NNNN/NNNNN	14 N•m [124 lb•in]

For further details ordering, see *Model code*.

Dimensions

SKP1NN – 06GA and 06SA

This drawing shows the standard porting for 06GA and 06SA. Available in Series SKP1NN only.



SKP1NN – 06GA and 06SA dimensions

Frame size		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6,0	7,8	010	012
Dimension	A	42.25 [1.663]	43 [1.693]	44 [1.732]	45.0 [1.772]	46.0 [1.811]	47 [1.850]	48 [1.890]	51.25 [2.018]	54.5 [2.146]	59 [2.323]	63.5 [2.50]
	B	84 [3.307]	85.5 [3.366]	87.5 [3.445]	89.5 [3.524]	91.5 [3.602]	93.5 [3.681]	95.5 [3.760]	102 [4.016]	108.5 [4.272]	117.5 [4.626]	125.5 [4.941]
Inlet	C	¾–16UNF–2B, THD 14.3 [0.563] deep										
Outlet	c	9/16–18UNF–2B, THD 12.7 [0.500] deep										

Flange/drive gear	Model code example	Maximum shaft torque
06GA	SKP1NN/3,2RN06GAP1E4E3NNNN/NNNNN	32 N•m [283 lb•in]
06SA	SKP1NN/012LN06SAP1E4E3NNNN/NNNNN	34 N•m [301 lb•in]

For further details on ordering, see *Model code*.

ENGINEERING TOMORROW

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Technical Information

GearMe
Aluminum Group 2 Pump

www.danfoss.com

Revision history

Table of revisions

Date	Changed	Rev
February 2023	Fixed typo	0105
January 2023	Renamed product	0104
April 2021	Minor revisions to product codes, illustrations	0103
November 2019	Corrected Product Codes	0102
October 2019	First edition	0101

Contents

Contents

General information

Overview

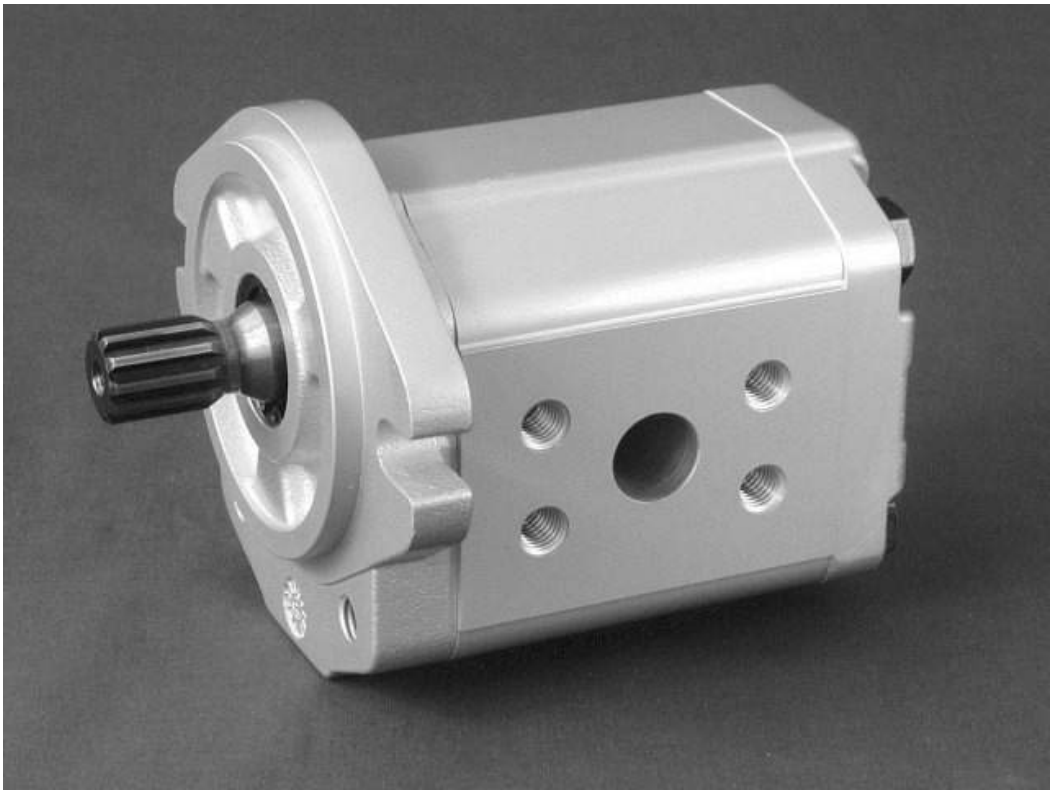
Danfoss aluminum gear pumps are ideal for a wide range of applications for:

- Small vehicles, such as aerial lifts, greens and fairway mowers and electric forklifts. These needs are served by the pumps in the SKP2NN range with integral valves and pressure balanced design for high efficiency, and extruded aluminum bodies for high strength.
- Medium and large off-highway vehicles, like tractors, backhoe loaders, dumpers, and telescopic handlers, we offer the SNP2NN.

Many combinations of the pumps mentioned are available as multiple units made to fit any need Danfoss provides standard pumps for use in industrial applications, including power packs.

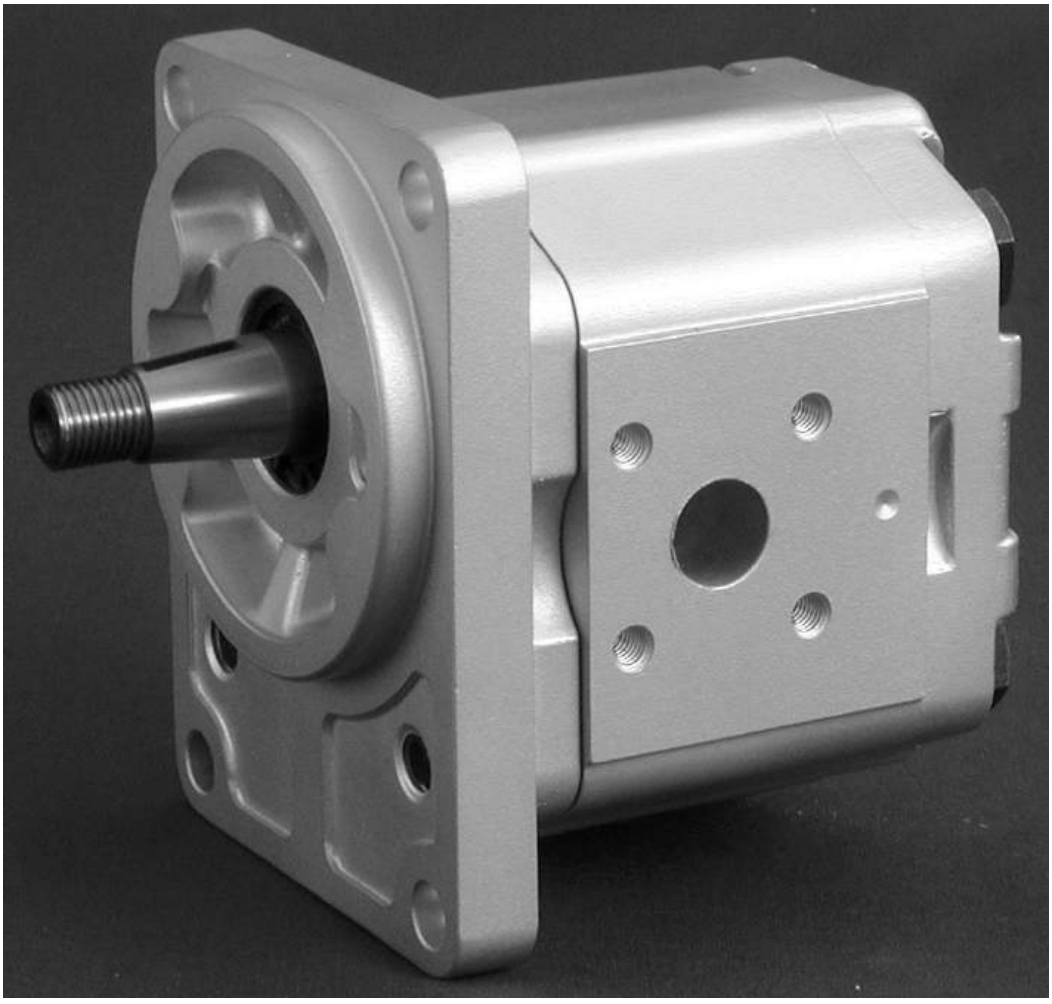
Group 2 gear pumps representatives:

SKP2NN 06SB



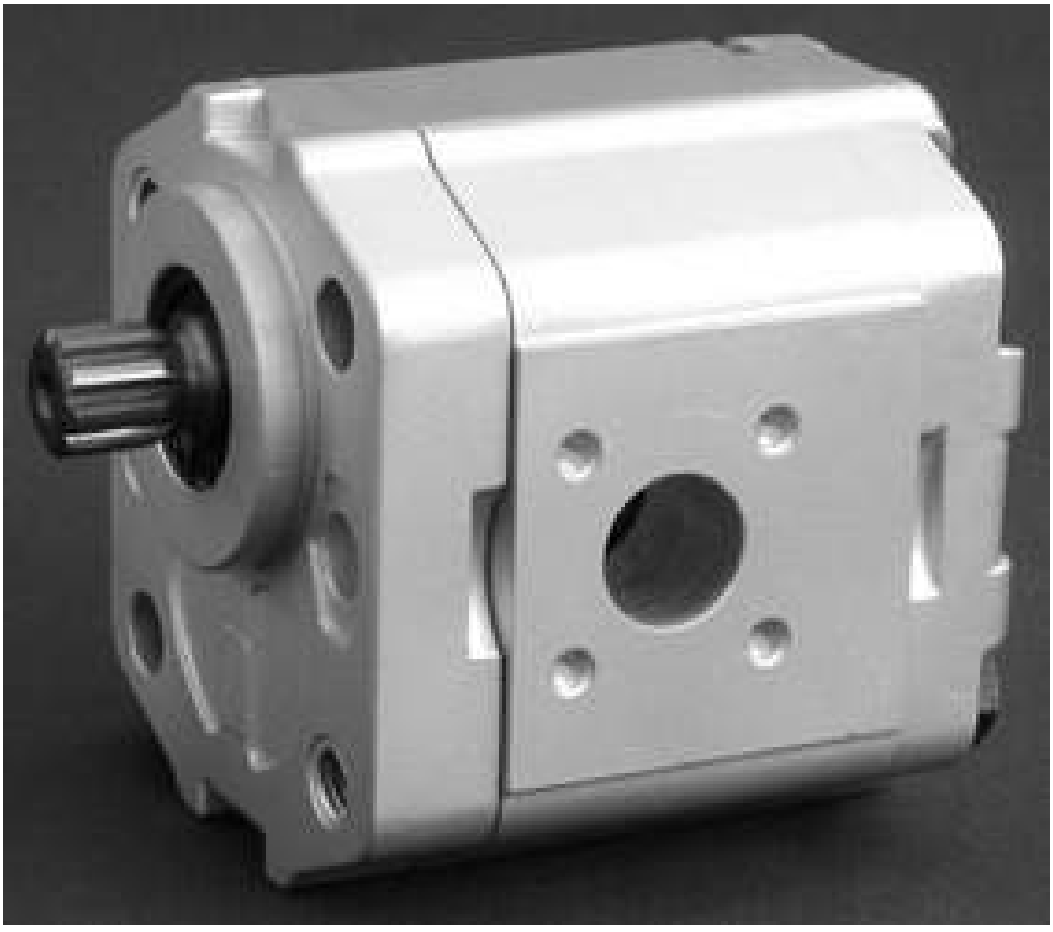
General information

SNP2NN 02AA



General information

SNP2NN 04DA



General information

SNP2NN 03CA

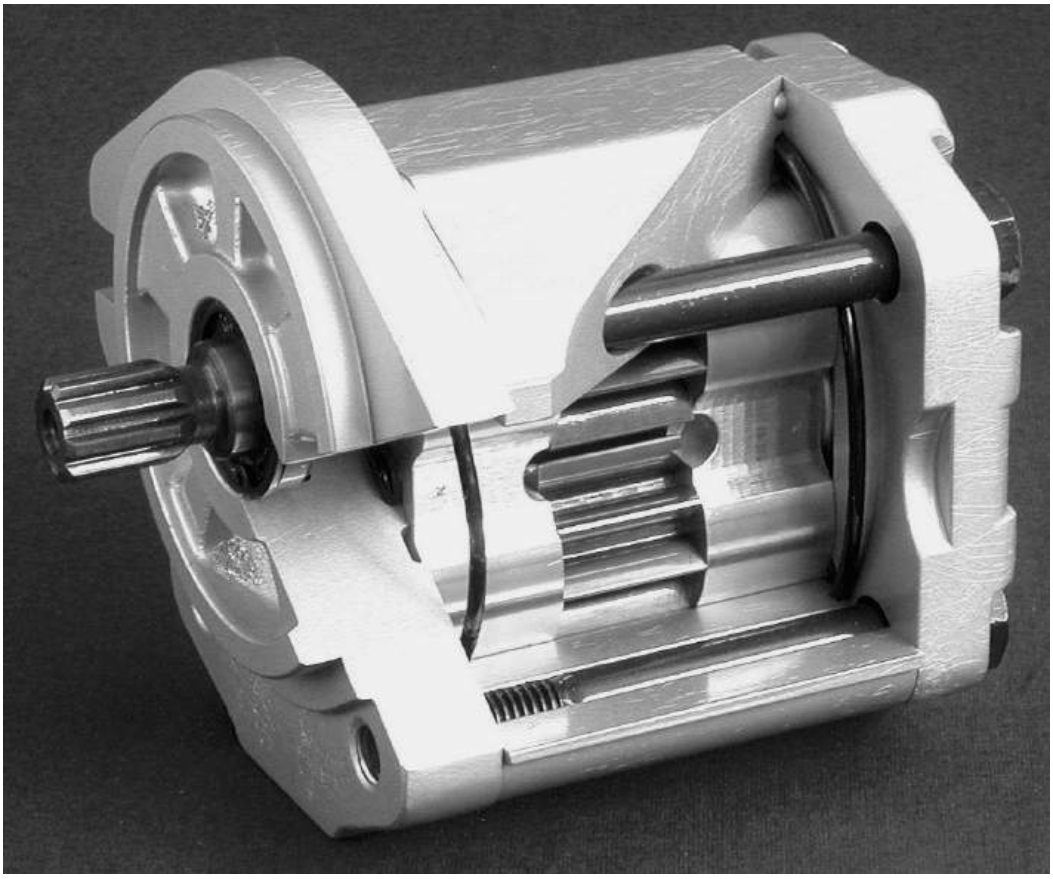
Pump design

Danfoss high performance gear pumps are fixed displacement pumps which consist of the pump housing, drive gear, driven gear, DU bushings, rear cover and front flange, shaft seal and inner/ outer seals, as shown in the following image. The pressure balanced design of the pumps provides high efficiency for the entire series.

The SNP2NN pump accommodates SAE 9-tooth and the SKP2NN is a special version of the SNP2NN. It is designed to accommodate an SAE 11T 16/32 DP tooth splined shaft for higher torque applications.

General information

SNP2NN 06SA cut-away



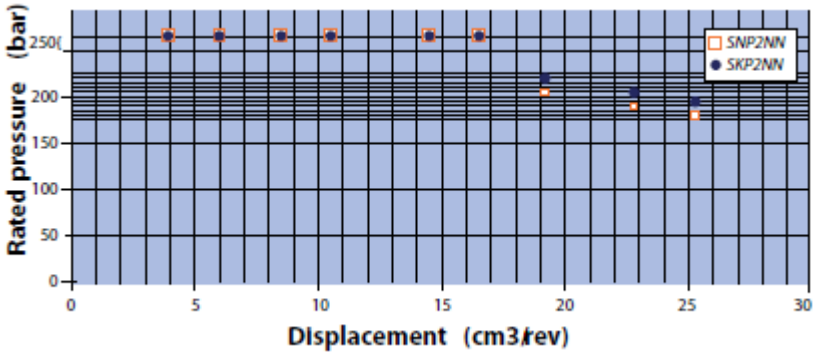
Features and benefits

- Wide range of displacements from 3.9 to 25.2 cm^3/rev [from 0.24 to 1.54 in^3/rev]
- Continuous pressure rating up to 250 bar [3625 psi]
- Speeds up to 4000 min-1 (rpm)
- SAE, DIN and European standard mounting flanges and shafts
- Compact, lightweight
- Multiple pump configurations in combination with SNP1NN, SNP2NN, SKP2NN and SNP3NN
- Quiet operation
- Available with integral relief valve

General information

Pump displacements

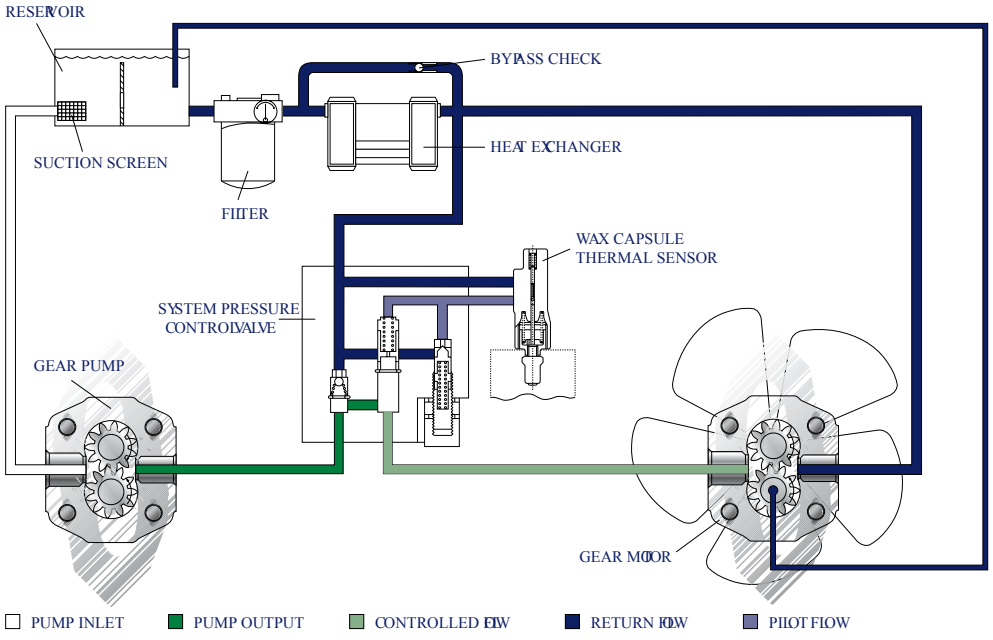
Quick reference chart for pump displacements vs. rated pressure



Gear pump in circuit

This typical circuit shows an SNP2NN gear pump driving an SNM2NN gear motor through a system pressure control valve. The system pressure control valve regulates motor speed based on input from the wax capsule thermal sensor. Discharge from the gear motor is then returned to the reservoir through a heat exchanger, which is equipped with a bypass check valve. Oil in this circuit is cleaned by a return line filter placed between the heat exchanger and the reservoir. A suction screen in the reservoir covers the inlet line.

Hydraulic schematic example



Technical Data

Technical data

Frame size		4,0	6,0	8,0	011	014	017	019	022	025
Displacement	cm^3/rev [in^3/rev]	3.9 [0.24]	6.0 [0.37]	8.4 [0.51]	10.8 [0.66]	14.4 [0.88]	16.8 [1.02]	19.2 [1.17]	22.8 [1.39]	25.2 [1.54]
SNP2NN										
Peak pressure	bar [psi]	280 [4060]	280 [4060]	280 [4060]	280 [4060]	280 [4060]	280 [4060]	230 [3335]	200 [2900]	175 [2638]
Rated pressure		250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	210 [3045]	180 [2610]	160 [2320]
Minimum speed at 0-100 bar	min^{-1} (rpm)	600	600	600	500	500	500	500	500	500
Minimum speed at 100-180 bar		1200	1200	1000	800	750	750	700	700	700
Min. speed at 180 bar to rated pressure		1400	1400	1400	1200	1000	1000	1000	800	–
Maximum speed		4000	4000	4000	4000	3500	3000	3000	3000	3000
SKP2NN										
Peak pressure	bar [psi]	280 [4060]	280 [4060]	280 [4060]	280 [4060]	280 [4060]	280 [4060]	260 [3770]	230 [3335]	200 [2900]
Rated pressure		250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	240 [3480]	210 [3045]	190 [2755]
Minimum speed at 0-100 bar	min^{-1} (rpm)	600	600	600	500	500	500	500	500	500
Minimum speed at 100-180 bar		1200	1200	1000	800	750	750	700	700	700
Min. speed at 180 bar to rated pressure		1400	1400	1400	1200	1000	1000	1000	800	800
Maximum speed		4000	4000	4000	4000	3500	3000	3000	3000	3000
Both (SNP2NN, SKP2NN)										
Weight	kg [lb]	2.3 [5.1]	2.4 [5.3]	2.5 [5.5]	2.7 [5.8]	2.9 [6.3]	3.0 [6.5]	3.1 [6.7]	3.2 [7.0]	3.3 [7.3]
Moment of inertia of rotating components	x 10^{-6} $kg•m^2$ [x 10^{-6} $lb•ft^2$]	21.3 [505]	26.5 [629]	32.4 [769]	38.4 [911]	47.3 [1122]	53.3 [1265]	59.2 [1405]	68.1 [1616]	74.1 [1758]
Theoretical flow at maximum speed	l/min [US gal/min]	15.6 [4.1]	24.0 [6.3]	33.6 [8.9]	43.2 [11.4]	50.4 [13.3]	50.4 [13.3]	57.6 [15.2]	68.4 [18.0]	75.6 [20.0]

1 $kg•m^2$ = 23.68 $lb•ft^2$

Caution

The rated and peak pressure mentioned are for pumps with flanged ports only. When threaded ports are required a de-rated performance must be considered. To verify the compliance of a high pressure application with a threaded ports pump apply to a Danfoss representative.

Product Code

Model code

A Family

A							B				C	D	E		F		G		H		I			J		K	L		M				N	O
•	•	•	•	•	•	/																							/						

SNP2NN	Std Group 2 Pump
SNP2EN	Std Group 2 Pump + External Drain RV
SNP2IN	Std Group 2 Pump + Internal Drain RV
SNC2NN	StdGroup 2 Pump Inlet & Outlet in the Cover
SKP2NN	HighTorque Group 2 Pump
SKP2EN	HighTorque Group 2 Pump + Ext.Drain RV
SKP2IN	HighTorque Group 2 Pump + Int.Drain RV
SKC2NN	HighTorque Group 2 Pump Inlet & Outlet on Cover

B Displacement

A				B			C	D			E			F		G		H		I			L	M	N	O			P	Q	R
				•	•	•																									

4,0	Displacement 3,9 cc
6,0	Displacement 6,0cc
8,0	Displacement 8,4 cc
011	Displacement 10,8 cc
014	Displacement 14,4 cc
017	Displacement 16,8 cc
019	Displacement 19,2 cc
022	Displacement 22,8 cc
025	Displacement 25,2 cc

Other frame sizes and displacements are available upon request.

C Rotation

A				B			C	D			E			F		G		H		I			L	M	N	O			P	Q	R
							•																								

R	Right (Clockwise)
L	Left (Counterclockwise)

D Project version

A							B				C	D	E		F		G		H		I			J		K	L		M				N	O
						/						•																	/						

N	Standard gear pump

Product Code

E Mounting Flange

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/						•	•													/					

Code	Description(Type of flange • Type of drive gear • Preferred ports for configuration)
01	pilot Ø36,5+4 holes
02	pilot Ø80+4 holes
03	pilot Ø52+O-ring+4 holes through body
04	pilot Ø50+2 holes through body
A4	pilotØ50+2 holes through body+seal on pilot
05	pilot Ø50+2 holes through body
06	SAE A pilot Ø82,55+2 holes
A6	SAE A pilot Ø82,55+2 holes+seal on pilot
09	pilot Ø52,34+2 threaded holes
91	Outrig. Type 01+taper shaft 1:8-M12x1,25-Key4 - Outrigger bearing
94	Outrig. Type 04+taper shaft 1:5-M12x1,25-Key3 - Outrigger bearing
9A	Outrig. Type 01+taper shaft 1:8-M12x1,25-Key3.2 - Outrigger bearing
9F	Outrig. Type 02+taper shaft 1:5-M14x1,5-Key4 - Outrigger bearing
9H	Outrig. Type 06 + taper shaft 1:8-M12x1,25-Key4
9J	Outrig. Type 06 with parallel shaft Ø3/4 (Ø19.05 mm) - Outrigger bearing

F Gear drive

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/								•	•											/					

AA	Taper 1:5-M12x1,25-Key 3
AB	Taper 1:5-M12x1,5-Key 3
BA	Taper 1:8-M12x1,25-Key 4
BB	Taper 1:8-M12x1,25-Key 4/3,2
CA	Tang 8x17,8xL6,5 FR03
DA	Spline DIN 5482 B17x14-L10
DB	Spline DIN 5482 B17x14-L14
FA	Parallel Ø15-L30+Key 4x25
GA	Parallel SAE Ø15,875-L23,8-Key 4x18
GB	Parallel SAE Ø15,875-L50,8-Key 4x40
SA	Spline SAE J498-9T-16/32
SB	Spline SAE J498-11T-16/32 (Only for SKP2)

G Rear Cover

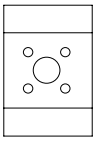
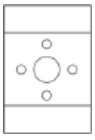
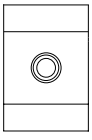
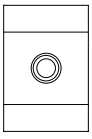
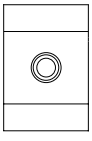
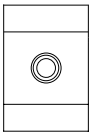
A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/										•	•									/					

Product Code

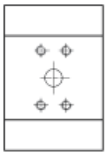
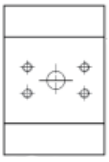
C1	Cover pump front BSP ports : Inlet 3/4 Gas ; Outlet 1/2 Gas
C6	Cover pump front SAE Thred ports:In.1-1/16-12UN;Out.7/8-14UNF
C7	Cover pump front SAE Thred ports:In.3/4-16UNF-2B;Out.3/4-16UNF-2B
D1	Cover pump with Outlet port 1/2 Gas
D6	Cover pump with Outlet port 7/8-14UNF-2B
E1	Cover pump with relief valve with external drain 3/8 Gas
E2	Cover pump for RV with ext. drain M12x1.5-CCW rot.idle side;CW rot. drive side
E3	Cover pump for RV with ext. drain 3/8 Gas with M5 Holes
E4	Cover pump for RV with ext. drain 3/4-16UNF-2B with M5 Holes
E6	Cover pump for RV with ext. drain 3/4-16UNF-2B
I1	Cover pump for RV with int. drain
I3	Cover pump for RV with int. drain with M5 Holes
P1	Standard cover for pump
P3	Standard cover for pump with M5 Holes

H Inlet size; I Outlet size

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/												•	•	•	•					/						

B5	15x35xM6	
B6	15x40xM6	
B7	20x40xM6	
C3	13,5x30xM6	
C5	13,5x40xM8	
C7	20x40xM8	
D5	M18x1,5	
D7	M22x1,5	
E4	3/4-16UNF	
E5	7/8-14UNF	
E6	1-1/16-12UN	
F3	3/8 GAS	
F4	1/2 GAS	
F5	3/4 GAS	
H5	M18x1,5-ISO6149	
H7	M22x1,5-ISO6149	
H8	M27x2-ISO6149	
H9	M33x2-ISO6149	

Product Code

M1	12x17, 48x38, 1xM6	
M2	12x17, 48x38, 1xM8	
M3	18,5x17, 48x38, 1xM8	
MB	12x38, 1x17, 48xM8 (=)	
MC	18,5x47, 63x22, 23xM6 (=)	
MD	18,5x47, 63x22, 23xM8 (=)	
ME	18,5x47, 63x22, 23xM10 (=)	
MG	25/20x52, 37x26, 19xM19 (=)	
NN	Without outlet port	

J Ports positions & Special body

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																•	•			/						

NN	Std from catalogue
YY	PortBx-Bx with flange SAE-A;off-set to rear cover to install fitting screws
ZZ	Port Bx-Bx in the center of the body - Option

K Seals

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																		•		/						

N	Standard NBR seals
B	VITON seals (Only for SNP2 pumps)
D	VITON shaft seal with dust lip

L Screws

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																			•	/						

N	Std burnished screws
A	Zinc plated screws
B	Geomet screws

M Set valve

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																				/	•	•	•			

NNN	No valve
V*	Integral relief valve pressure setting

* For details see *Variant codes for ordering integral relief valves* on page 30

Product Code

N Type mark

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																				/				•	

N	Standard Danfoss Marking
A	Standard Danfoss Marking+Customer Code
Z	Without Marking

O Position

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																				/					•

N	Std Marking position (on top)
A	Special Marking position on the bottom

Determination of nominal pump sizes

Based on SI units / Based on US units

Use these formulae to determine the nominal pump size for a specific application.

	Based on SI units	Based on US units
Output flow	$Q = \frac{Vg \cdot n \cdot \eta_v}{1000}$ l/min	$Q = \frac{Vg \cdot n \cdot \eta_v}{231}$ [US gal/min]
Input torque	$M = \frac{Vg \cdot \Delta p}{20 \cdot \pi \cdot \eta_m}$ N•m	$M = \frac{Vg \cdot \Delta p}{2 \cdot \pi \cdot \eta_m}$ [lbf•in]
Input power	$P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t}$ kW	$P = \frac{M \cdot n}{63.025} = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t}$ [hp]

Variables: *SI units [US units]*

Vg =	Displacement per rev.	cm3/rev [in^3/rev]
p_{HD} =	Outlet pressure	bar [psi]
p_{ND} =	Inlet pressure	bar [psi]
Δp =	$p_{HD} - p_{ND}$	bar [psi]
n =	Speed	min^{-1} (rpm)
ηv =	Volumetric efficiency	
ηm =	Mechanical (torque) efficiency	
ηt =	Overall efficiency (ηv • ηm)	

System Requirements

Pressure

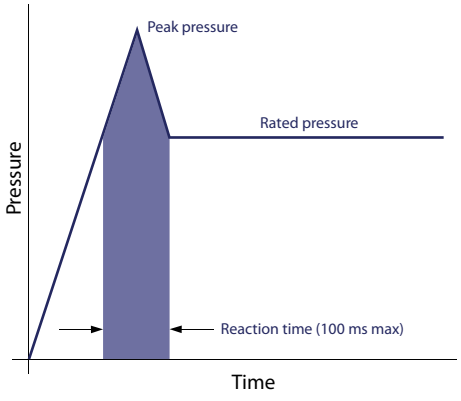
The inlet vacuum must be controlled in order to realize expected pump life and performance. The system design must meet inlet pressure requirements during all modes of operation. Expect lower inlet pressures during cold start. It should improve quickly as the fluid warms.

Max. continuous vacuum	bar abs. [in. Hg]	0.8 [23.6]
Max. intermittent vacuum		0.6 [17.7]
Max. pressure		4.0 [118.1]

Peak pressure

Peak pressure is the highest intermittent pressure allowed. The relief valve overshoot (reaction time) determines peak pressure. It is assumed to occur for less than 100 ms. The following illustration shows peak pressure in relation to rated pressure and reaction time (100 ms maximum).

Time versus pressure



Rated pressure

Rated pressure is the average, regularly occurring, operating pressure that should yield satisfactory product life. The maximum machine load demand determines rated pressure. For all systems, the load should move below this pressure.

System pressure

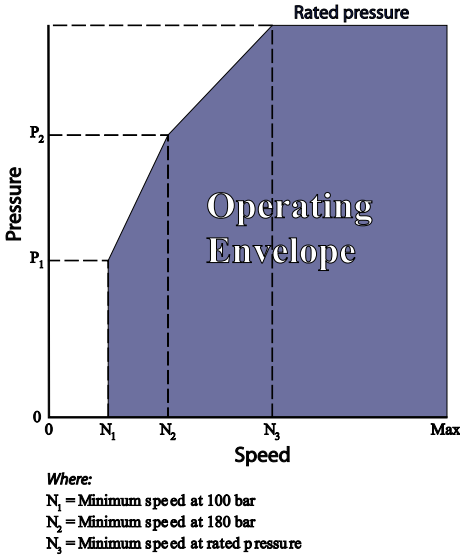
System pressure is the differential of pressure between the outlet and inlet ports. It is a dominant operating variable affecting hydraulic unit life. High system pressure, resulting from high load, reduces expected life. System pressure must remain at, or below, rated pressure during normal operation to achieve expected life.

Speed

Maximum speed is the limit recommended by Danfoss for a particular gear pump when operating at rated pressure. It is the highest speed at which normal life can be expected. The lower limit of operating speed is the minimum speed. It is the lowest speed at which normal life can be expected. The minimum speed increases as operating pressure increases. When operating under higher pressures, a higher minimum speed must be maintained, as illustrated to the right.

System Requirements

Speed versus pressure



Where:
N_1 = Minimum speed at 100 bar
N_2 = Minimum speed at 180 bar
N_3 = Minimum speed at rated pressure

Hydraulic fluids

Ratings and data for SNP2NN and SKP2NN gear pumps are based on operating with premium hydraulic fluids containing oxidation, rust, and foam inhibitors. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion, and corrosion of internal components. They include:

- Hydraulic fluids following DIN 51524, part 2 (HLP) and part 3 (HVLP) specifications
- API CD engine oils conforming to SAE J183
- M2C33F or G automatic transmission fluids
- Certain agricultural tractor fluids

Use only clean fluid in the pump and hydraulic circuit.

Caution

Never mix hydraulic fluids.

Temperature and viscosity

Temperature and viscosity requirements must be concurrently satisfied. Use petroleum / mineral-based fluids.

High temperature limits apply at the inlet port to the pump. The pump should run at or below the maximum continuous temperature. The peak temperature is based on material properties. Don't exceed it.

Cold oil, generally, doesn't affect the durability of pump components. It may affect the ability of oil to flow and transmit power. For this reason, keep the temperature at 16 °C [60 °F] above the pour point of the hydraulic fluid.

Minimum (cold start) **temperature** relates to the physical properties of component materials.

Minimum viscosity occurs only during brief occasions of maximum ambient temperature and severe duty cycle operation. You will encounter maximum viscosity only at cold start. During this condition, limit speeds until the system warms up. Size heat exchangers to keep the fluid within these limits. Test regularly to verify that these temperatures and viscosity limits aren't exceeded. For maximum unit efficiency and bearing life, keep the fluid viscosity in the recommended

System Requirements

Fluid viscosity

Maximum (cold start)	mm2/s [SUS]	1600 [7273]
Recommended range		12-100 [66-456]
Minimum		10 [60]

Temperature (with standard NBR seals)

Minimum (cold start)	°C [°F]	-20 [-4]
Maximum continuous		80 [176]
Peak (intermittent)		90 [194]

Filtration

Filters

Use a filter that conforms to Class 22/18/13 of ISO 4406 (or better). It may be on the pump outlet (pressure filtration), inlet (suction filtration), or reservoir return (return-line filtration).

Selecting a filter

When selecting a filter, please consider:

- Contaminant ingression rate (determined by factors such as the number of actuators used in the system)
- Generation of contaminants in the system
- Required fluid cleanliness
- Desired maintenance interval
- Filtration requirements of other system components

Measure filter efficiency with a Beta ratio (β_x). For:

- Suction filtration, with controlled reservoir ingression, use a $\beta_{35\text{-}45} = 75$ filter
- Return or pressure filtration, use a pressure filtration with an efficiency of $\beta_{10} = 75$.

βx ratio is a measure of filter efficiency defined by ISO 4572. It is the ratio of the number of particles greater than a given diameter ("x" in microns) upstream of the filter to the number of these particles downstream of the filter.

Fluid cleanliness level and βx ratio

Fluid cleanliness level (per ISO 4406)	Class 22/18/13 or better
β_x ratio (suction filtration)	$\beta_{35\text{-}45} = 75$ and $b_{10} = 2$
β_x ratio (pressure or return filtration)	$\beta_{10} = 75$
Recommended inlet screen size	100-125 mm [0.004-0.005 in]

The filtration requirements for each system are unique. Evaluate filtration system capacity by monitoring and testing prototypes.

Reservoir

The **reservoir** provides clean fluid, dissipates heat, removes entrained air, and allows fluid volume changes associated with fluid expansion and cylinder differential volumes. A correctly sized reservoir accommodates maximum volume changes during all system operating modes. It promotes deaeration of the fluid as it passes through, and accommodates a fluid dwell-time between 60 and 180 seconds, allowing entrained air to escape.

System Requirements

Minimum reservoir capacity depends on the volume required to cool and hold the oil from all retracted cylinders, allowing for expansion due to temperature changes. A fluid volume of 1 to 3 times the pump output flow (per minute) is satisfactory. The minimum reservoir capacity is 125% of the fluid volume.

Install the suction line above the bottom of the reservoir to take advantage of gravity separation and prevent large foreign particles from entering the line. Cover the line with a 100-125 micron screen. The pump should be below the lowest expected fluid level. Put the return-line below the lowest expected fluid level to allow discharge into the reservoir for maximum dwell and efficient deaeration. A baffle (or baffles) between the return and suction lines promotes deaeration and reduces fluid surges.

Line sizing

Choose pipe sizes that accommodate minimum fluid velocity to reduce system noise, pressure drops, and overheating. This maximizes system life and performance.

Design inlet piping that maintains continuous pump inlet pressure above 0.8 bar absolute during normal operation. The line velocity should not exceed the values in this table:

Maximum line velocity

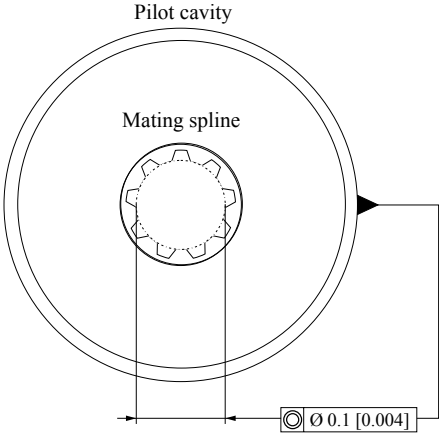
Inlet	m/s [ft/sec]	2.5 [8.2]
Outlet		5.0 [16.4]
Return		3.0 [9.8]

Most systems use hydraulic oil containing 10% dissolved air by volume. Under high inlet vacuum conditions the oil releases bubbles. They collapse when subjected to pressure, resulting in cavitation, causing adjacent metal surfaces to erode. **Over-aeration** is the result of air leaks on the inlet side of the pump, and flow-line restrictions. These include inadequate pipe sizes, sharp bends, or elbow fittings, causing a reduction of flow line cross sectional area. This problem will not occur if inlet vacuum and rated speed requirements are maintained, and reservoir size and location are adequate.

Pump drive

Shaft options for Group 2 gear pumps include tapered, tang, splined, or parallel shafts. They are suitable for a wide range of direct and indirect drive applications for radial and thrust loads.

Plug-in drives, acceptable only with a splined shaft, can impose severe radial loads when the mating spline is rigidly supported. Increasing spline clearance does not alleviate this condition.



Use plug-in drives if the concentricity between the mating spline and pilot diameter is within 0.1 mm [0.004 in]. Lubricate the drive by flooding it with oil. A 3-piece coupling minimizes radial or thrust shaft loads.

System Requirements

Caution

In order to avoid spline shaft damages it is recommended to use carburized and hardened steel couplings with 80-82 HRA surface hardness.

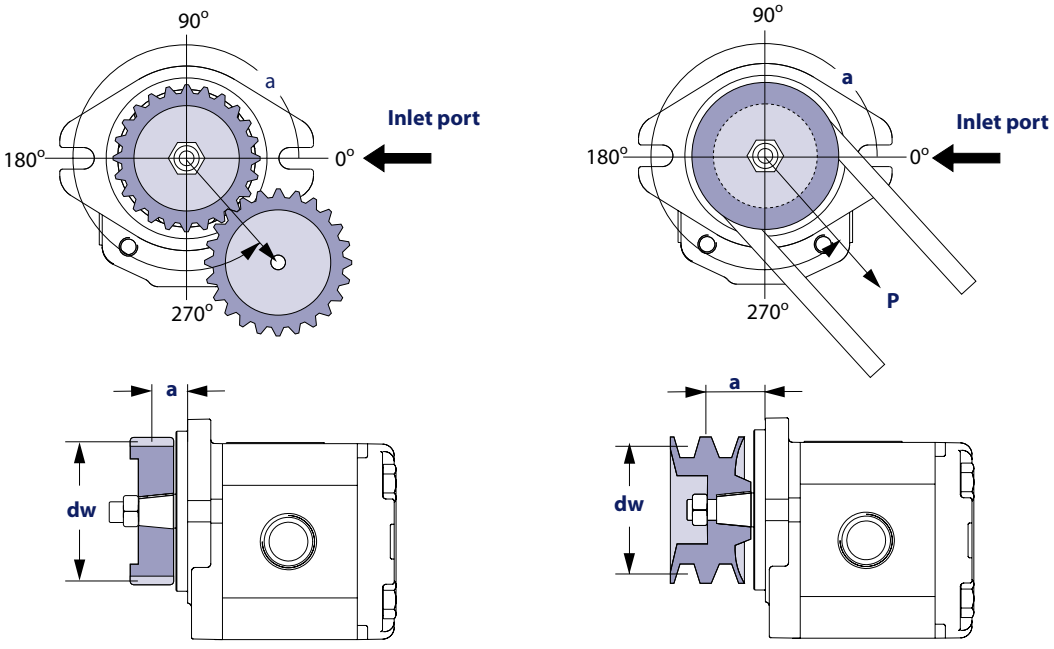
Allowable radial shaft loads are a function of the load position, load orientation, and operating pressure of the hydraulic pump. All external shaft loads have an effect on bearing life, and may affect pump performance.

In applications where external shaft loads can't be avoided, minimize the impact on the pump by optimizing the orientation and magnitude of the load. Use a tapered input shaft; don't use splined shafts for belt or gear drive applications. A spring-loaded belt tension-device is recommended for belt drive applications to avoid excessive tension. Avoid thrust loads in either direction. Contact Danfoss if continuously applied external radial or thrust loads occur.

Photocopy this page and fax the complete form to your Danfoss representative for an assistance in applying pumps with belt or gear drive.

Pump drive data form

Optimal radial load position



Application data

Item		Value	Unit
Pump displacement			cm3/rev [in3/rev]
Rated system pressure			☒bar ☒psi
Relief valve setting			
Pump shaft rotation			☒left ☒right
Pump minimum speed			min-1 (rpm)
Pump maximum speed			
Drive gear helix angle (gear drive only)			degree
Belt type (gear drive only)			☒V ☒notch
Belt tension (gear drive only)	**P**		☒N ☒lbf

System Requirements

Application data (continued)

Item		Value	Unit
Angular orientation of gear or belt to inlet port	**a**		degree
Pitch diameter of gear or pulley	$\mathbf{d_w}$		☒mm ☒in
Distance from flange to center of gear or pulley	**a**		

Pump life

Pump life is a function of speed, system pressure, and other system parameters (such as fluid quality and cleanliness).

All Danfoss gear pumps use hydrodynamic journal bearings that have an oil film maintained between the gear/shaft and bearing surfaces at all times. If the oil film is sufficiently sustained through proper system maintenance and operating within recommended limits, long life can be expected.

B_{10} life expectancy number is generally associated with rolling element bearings. It does not exist for hydrodynamic bearings.

High pressure, resulting from high loads, impacts pump life. When submitting an application for review, provide machine duty cycle data that includes percentages of time at various loads and speeds. We strongly recommend a prototype testing program to verify operating parameters and their impact on life expectancy before finalizing any system design.

Sound levels

Fluid power systems are inherent generators of noise. As with many high power density devices, noise is an unwanted side affect. However, there are many techniques available to minimize noise from fluid power systems. To apply these methods effectively, it is necessary to understand how the noise is generated and how it reaches the listener. The noise energy can be transmitted away from its source as either fluid borne noise (pressure ripple) or as structure borne noise.

Pressure ripple is the result of the number of pumping elements (gear teeth) delivering oil to the outlet and the pump's ability to gradually change the volume of each pumping element from low to high pressure. In addition, the pressure ripple is affected by the compressibility of the oil as each pumping element discharges into the outlet of the pump. Pressure pulsations will travel along the hydraulic lines at the speed of sound (about 1400 m/s in oil) until affected by a change in the system such as an elbow fitting. Thus the pressure pulsation amplitude varies with overall line length and position.

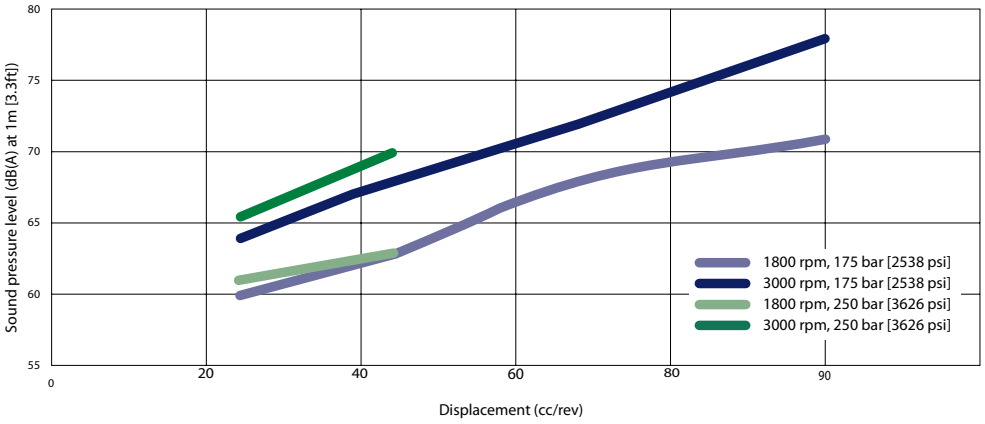
Structure borne noise may be transmitted wherever the pump casing is connected to the rest of the system. The manner in which one circuit component responds to excitation depends on its size, form, and manner in which it is mounted or supported. Because of this excitation, a system line may actually have a greater noise level than the pump. To reduce this excitation, use flexible hoses in place of steel plumbing. If steel plumbing must be used, clamping of lines is recommended. To minimize other structure borne noise, use flexible (rubber) mounts.

The accompanying graph shows typical sound pressure levels for SNP2NN pumps (with SAE A flange, and spline shaft in plug in drive) measured in dB (A) at 1 m [3.28 ft] from the unit in a semi anechoic chamber. Anechoic levels can be estimated by subtracting 3 dB (A) from these values.

Contact your Danfoss representative for assistance with system noise control.

System Requirements

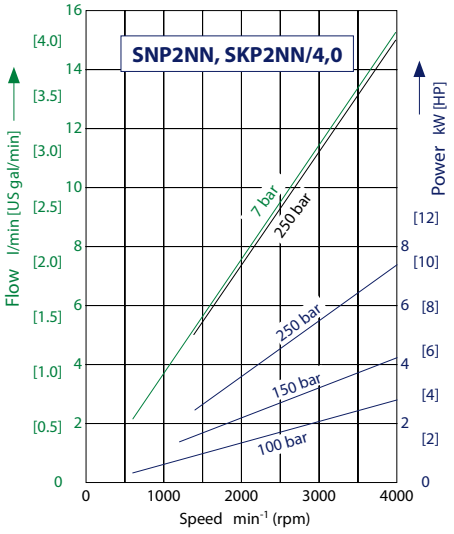
Sound levels graph

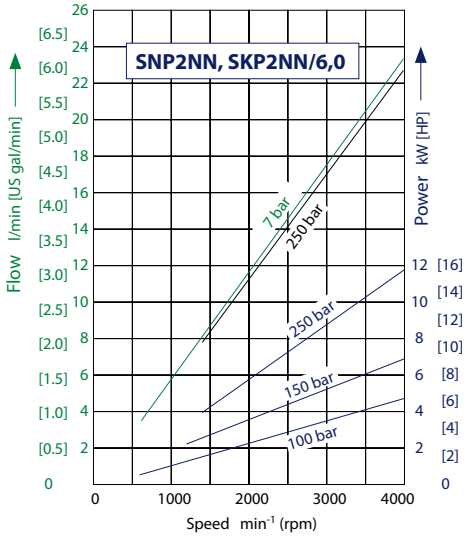


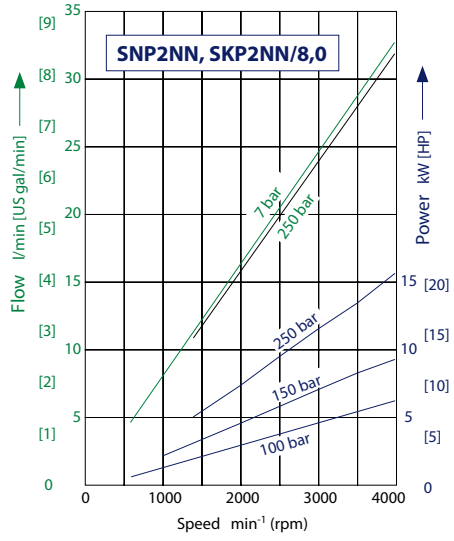
Pump Performance

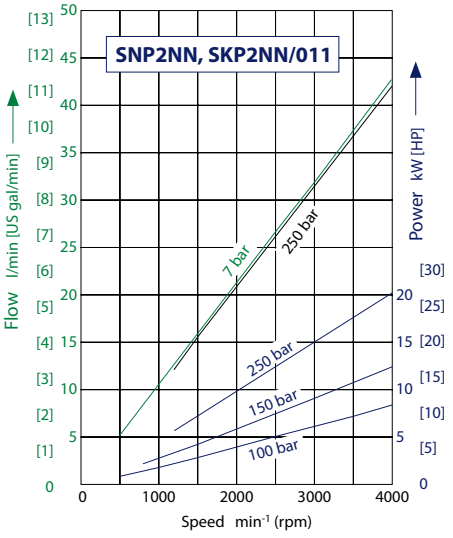
Performance graphs

The graphs on the next pages provide typical output flow and input power for Group 2 pumps at various working pressures. Data were taken using ISO VG46 petroleum /mineral based fluid at 50 °C (viscosity at 28 mm^2/s [cSt]).

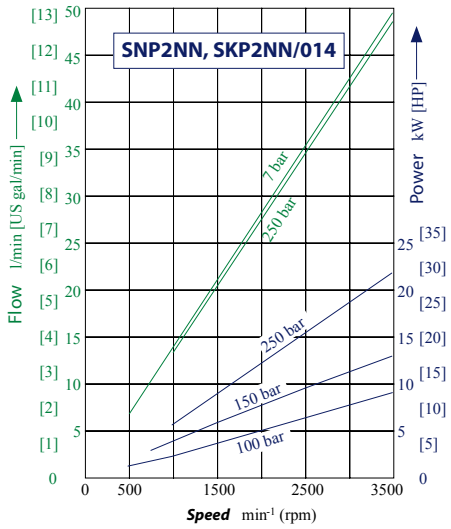


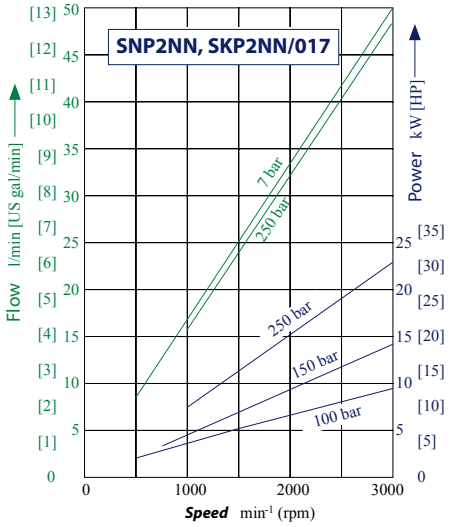


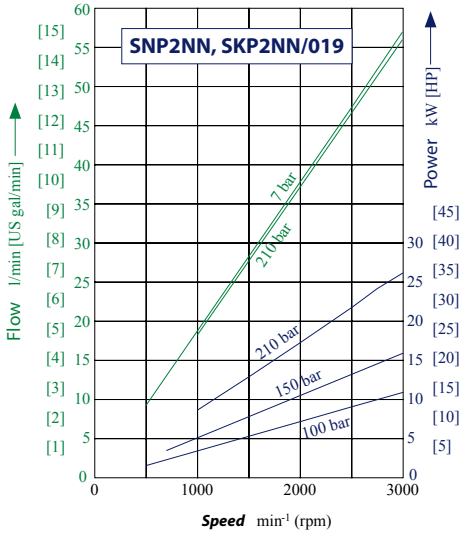


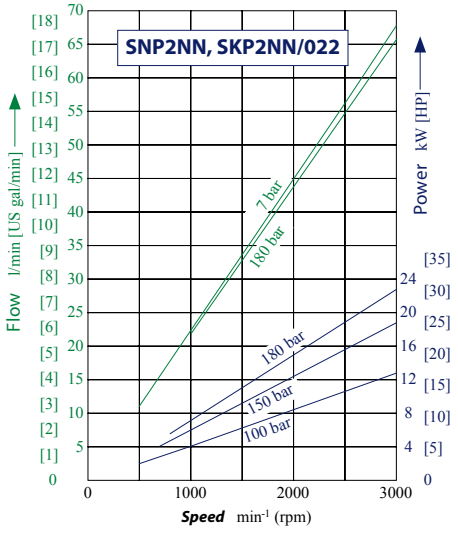


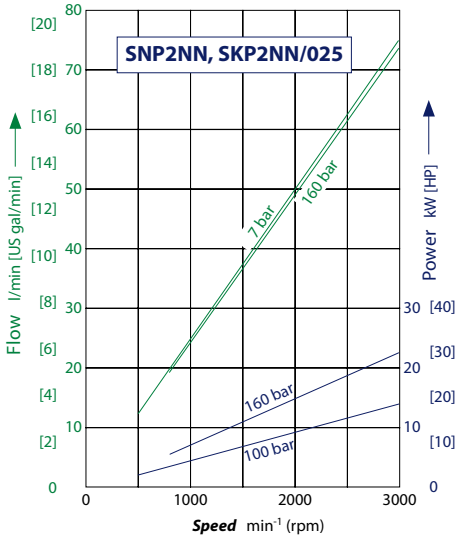
Pump Performance





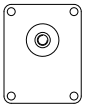
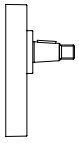
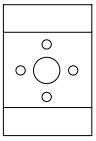
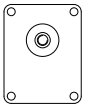
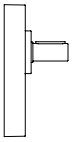
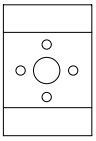
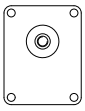
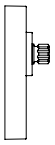
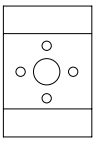
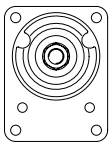
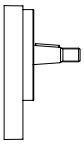
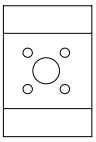
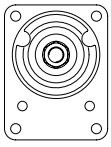
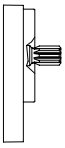
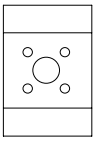
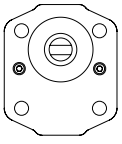
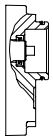
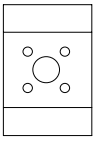
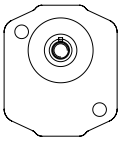
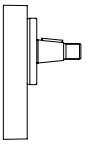
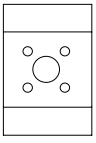
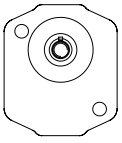
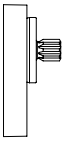
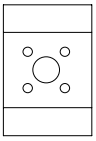
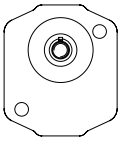
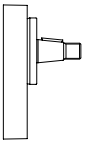
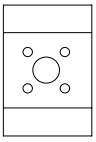
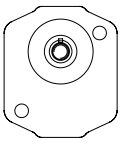
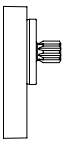
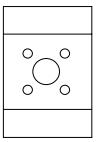




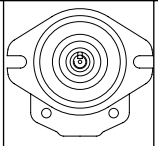
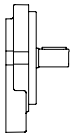
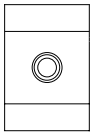
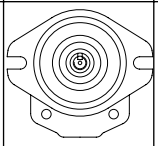
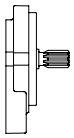
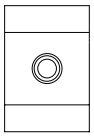
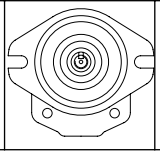
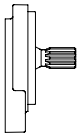
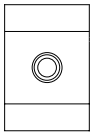


Product Options

Flange, shaft and ports configurations

Code	Flange		Shaft		Ports	
01BA	pilot Ø 36.5 mm [1.438 in]European 01, 4-bolt		1:8 tapered		European flanged, + pattern	
01FA	pilot Ø 36.5 mm [1.438 in]European 01, 4-bolt		Ø 15 mm [0.59 in] parallel		European flanged, + pattern	
01DA	pilot Ø 36.5 mm [1.438 in]European 01, 4-bolt		Splined 9T - m 1.60 DIN 5482-B17x14		European flanged, + pattern	
02AA	pilot Ø 80 mm [3.15 in] German PTO, 4-bolt		1:5 tapered		German std, × pattern	
02DB	pilot Ø 80 mm [3.15 in] German PTO, 4-bolt		Splined 9T - m 1.60 DIN 5482-B17x14		German std, × pattern	
03CA	Danfoss 03		Danfoss tang		German std, × pattern	
04AA	pilot Ø 50 mm [1.969 in] German PTO, 2-bolt		1:5 tapered		German std, × pattern	
04DB	pilot Ø 50 mm [1.969 in] German PTO, 2-bolt		Splined 9T - m 1.60 DIN 5482-B17x14		German std, × patter	
05AA	pilot Ø 50 mm [1.969 in] German PTO, 2-bolt		1:5 tapered		German std, × pattern	
05DB	pilot Ø 50 mm [1.969 in] German PTO, 2-bolt		Splined 9T - m 1.60 DIN 5482-B17x14		German std, × pattern	

Product Options

Code	Flange		Shaft		Ports	
06GA	pilot Ø 82.55 mm [3.25 in] SAE A, 2-bolt		Ø 15.875 mm [0.625 in] parallel		Threaded SAE O-Ring boss	
06SA	pilot Ø 82.55 mm [3.25 in] SAE A, 2-bolt		9-teeth splined SAE spline J 498-9T-16/32D P		Threaded SAE O-Ring boss	
06SB	pilot Ø 82.55 mm [3.25 in] SAE A, 2-bolt		11-teeth splined SAE spline J		Threaded SAE O-Ring boss	

Shaft options

Direction is viewed facing the shaft. Group 2 pumps are available with a variety of tang, splined, parallel, and tapered shaft ends. Not all shaft styles are available with all flange styles.

Shaft versus flange availability and torque capability

A							B			C	D	E	F		G		H		I		J		K	L		M			N	O
						/							•	•											/					

Shaft		Mounting flange code with maximum torque in N•m [lbf•in]					
Description	***Code***	**01**	**02**	**03**	**04**	**05**	**06**
Taper 1:5	**AA**	–	140 [1239]	–	140 [1239]	140 [1239]	–
Taper 1:8	**BA**	150 [1328]	–	–	–	–	–
DIN spline B17x14	**DA**	90 [797]	–	–	–	–	–
DIN spline B17x14	**DB**	–	130 [1151]	–	130 [1151]	130 [1151]	–
SAE spline 9T 16/32p	**SA**	–	–	–	–	–	75 [646]
SAE spline 11T 16/32p	**SB**	–	–	–	–	–	150 [1328]
Parallel 15 mm [0.590 in]	**FA**	90 [797]	–	–	–	–	–
Parallel 15.875 mm [0.625 in]	**GA**	–	–	–	–	–	80 [708]
Danfoss Tang	**CA**	–	–	70 [620]	–	–	–

Recommended mating splines for Group 2 splined output shafts should be in accordance with SAE J498 or DIN 5482. Danfoss external SAE splines are flat root side fit with circular tooth thickness reduced by 0.127 mm [0.005 in] in respect to class 1 fit. The external DIN splines have an offset increased by 0.1 mm [0.004 in.] These dimensions are modified in order to assure a clearance fit with the mating spline.

Other shaft options may exist. Contact your Danfoss representative for availability.

Caution

Shaft torque capability may limit allowable pressure. Torque ratings assume no external radial loading. Applied torque must not exceed these limits, regardless of stated pressure parameters. Maximum torque ratings are based on shaft torsional fatigue strength.

Product Options

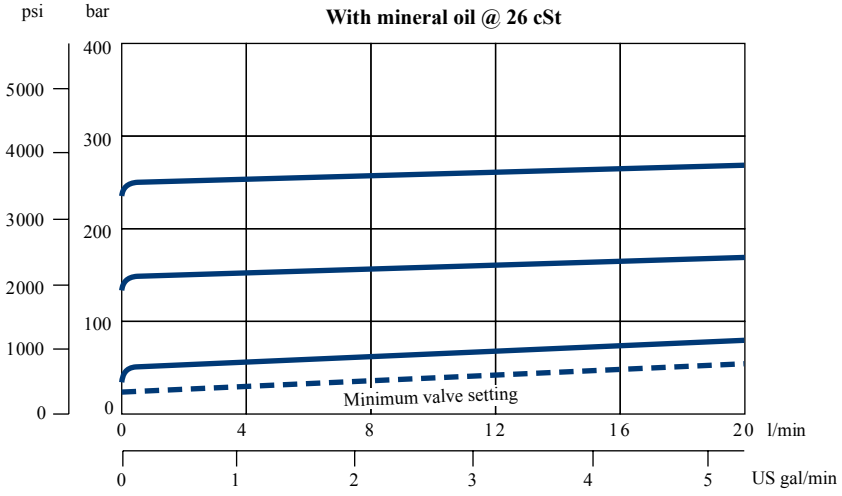
Pumps with integral relief valve - SNP2EN and SNP2IN

Group 2 pumps are offered with an optional integral relief valve in the rear cover . This valve can have an internal (SNP2IN) or external (SNP2EN) drain. This valve opens directing all flow from the pump outlet to the internal or external drain when the pressure at the outlet reaches the valve setting. This valve can be ordered preset to the pressures shown in the table below. Valve performance curve, rear cover cross-section and schematics are shown below.

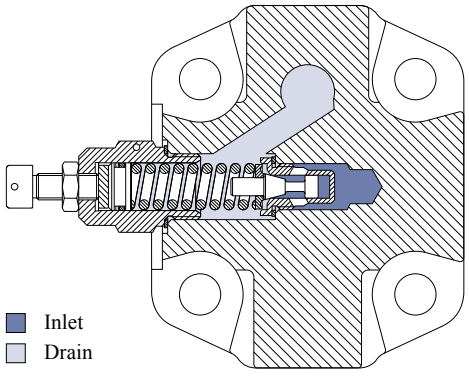
Caution

When the relief valve is operating in bypass condition, rapid heat generation occurs. If this bypass condition continues, the pump prematurely fails. The reason for this is that it is a rule, not an exception. When frequent operation is required, external drain option (SNP2EN) must be used.

Valve performance graph



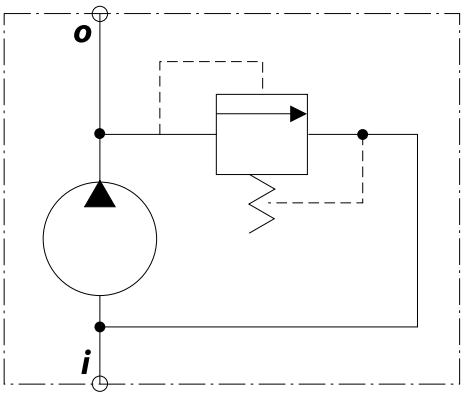
Integral relief valve cross-section



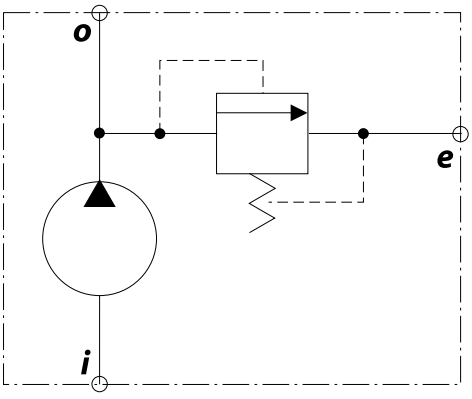
Product Options

Integral relief valve schematics

Integral relief valve (internal drain)



Integral relief valve (external drain)



P101 563E

Where:

i = inlet

o = outlet

e = external drain

Variant codes for ordering integral relief valves

The following tables detail the various codes for ordering integral relief valves in L section of model code.

A							B			C	D	E	F	G	H	I	J	K	L		M			N	O
S	N	P	2	E	N	/															/	V	•			
S	N	P	2	I	N	/															/	V	•			

Code	Pump speed for RV setting
A	Not defined
C	500 min^{-1} (rpm)
E	1000 min^{-1} (rpm)
F	1250 min^{-1} (rpm)
G	1500 min^{-1} (rpm)
K	2000 min^{-1} (rpm)
I	2250 min^{-1} (rpm)
L	2500 min^{-1} (rpm)
M	2800 min^{-1} (rpm)
N	3000 min^{-1} (rpm)
O	3250 min^{-1} (rpm)

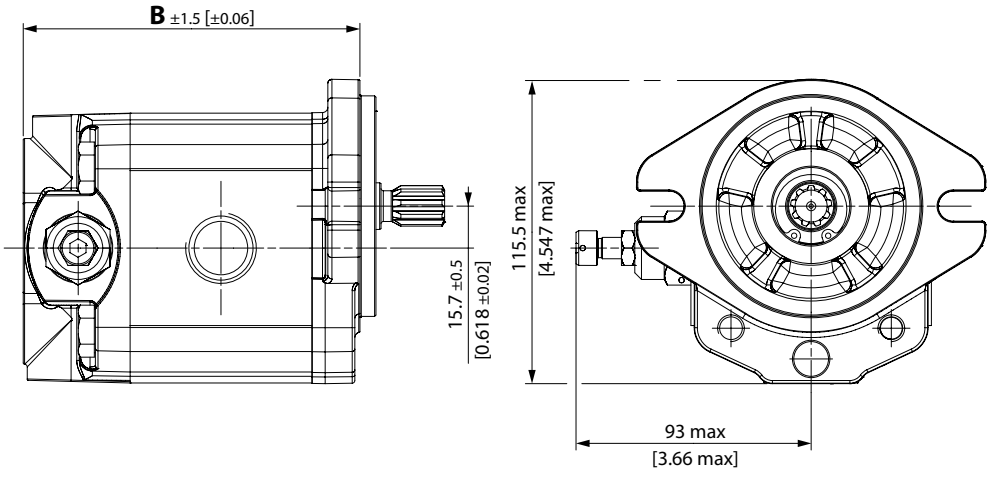
A							B			C	D	E	F	G	H	I	J	K	L		M			N	O
S	N	P	2	E	N	/															/	V		•		
S	N	P	2	I	N	/															/	V		•		

Product Options

Code	Pressure setting
A	No setting
B	No valve
C	18 bar [261 psi]
D	25 bar [363 psi]
E	30 bar [435 psi]
F	35 bar [508 psi]
G	40 bar [580 psi]
K	50 bar [725 psi]
L	60 bar [870 psi]
M	70 bar [1015 psi]
N	80 bar [1160 psi]
O	90 bar [1305 psi]
P	100 bar [1450 psi]
Q	110 bar [1595 psi]
R	120 bar [1740 psi]
S	130 bar [1885 psi]
T	140 bar [2030 psi]
U	160 bar [2320 psi]
V	170 bar [2465 psi]
W	180 bar [2611 psi]
X	210 bar [3046 psi]
Y	240 bar [3480 psi]
Z	250 bar [3626 psi]

For pressures higher than 210 bar [3046 psi] and lower than 40 bar [580 psi] apply to your Danfoss representative.

Integral relief valve covers SNP2IN



Product Options

Dimensions of integral relief valve cover with SAE flange

Type	4,0	6,0	8,0	011	014	017	019	022	025
B mm [in]	110.0 [4.33]	113.5 [4.47]	117.5 [4.63]	121.5 [4.78]	127.5 [5.02]	131.5 [5.18]	135.5 [5.33]	141.5 [5.57]	145.5 [5.73]

Outrigger bearing

An outrigger bearing is available for applications with high radial or thrust loads on the shaft. This option is used primarily for applications with high shaft loads such as to belt or chain drives. The design utilizes roller bearings in the front mounting flange. These bearings absorb the radial and thrust loads on the shaft so that the life of the pump is not affected. The use of roller bearings allows life to be described in B_{10} hours.

Available configurations

Codes **9ADB**, **9FDB**, **94DB**, **9HDB** and **9JDB** represent assembly (pump complete with outrigger bearing).

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/						•	•													/					

Code	Shaft	Mounting flange
9A	Taper 1:8	European 4-bolts
9F	Taper 1:5	German PTO
94	Taper 1:5	German 4-bolts
9H	Taper 1:8	SAE A
9J	Parallel	SAE A

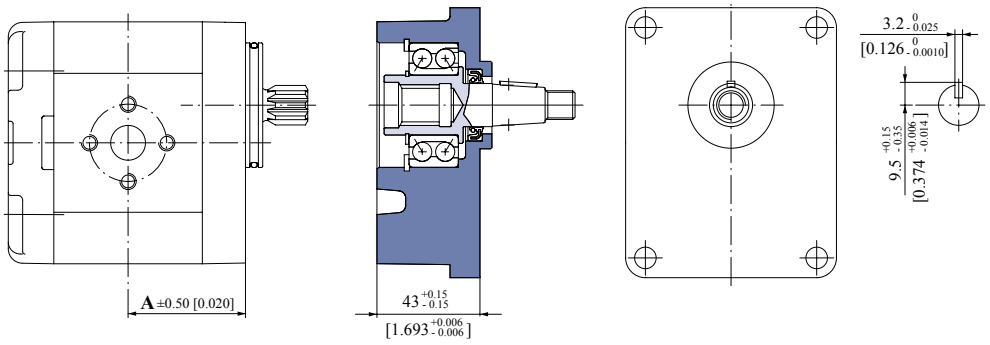
Product Options

Outrigger bearing assembly

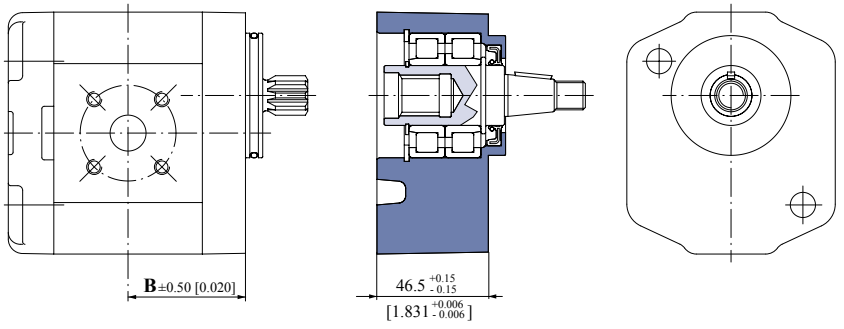
Dimensions

mm [in]

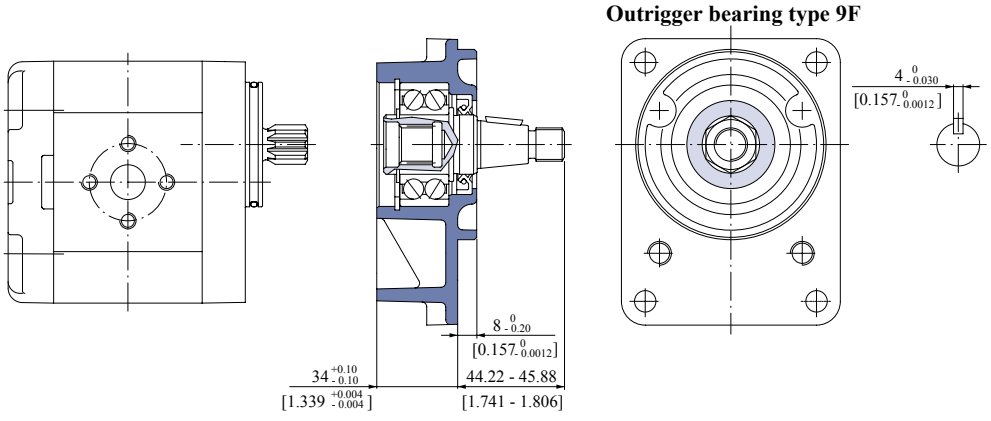
Outrigger bearing type 9A



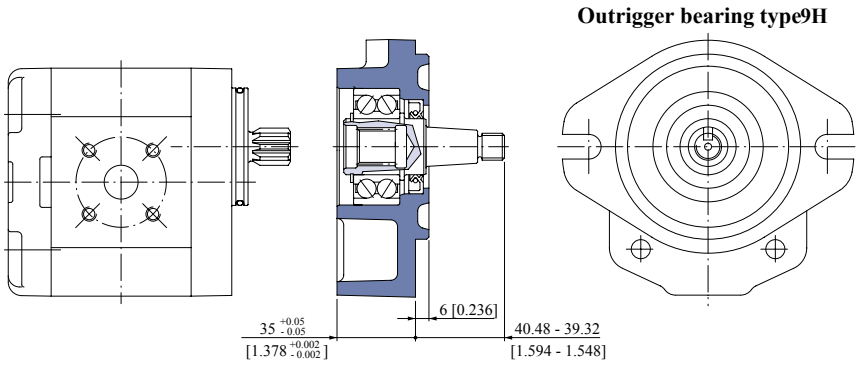
Outrigger bearing type 94

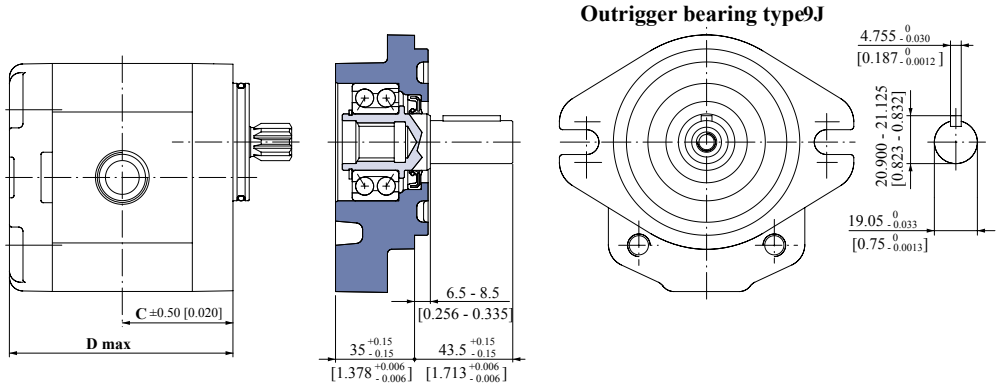


Outrigger bearing type 9F



Product Options





Type (displacement)	4,0	6,0	8,0	011	014	017	019	022	025
A	43.25 [1.703]	45.0 [1.772]	47.0 [1.850]	49.0 [1.929]	52.0 [2.047]	54.0 [2.126]	56.0 [2.205]	59.0 [2.323]	61.0 [2.402]
B	128.5 [5.059]	132 [5.197]	136 [5.354]	140 [5.512]	146 [5.748]	150 [5.906]	154 [6.063]	160 [6.299]	164 [6.457]
Inlet C	1.063 (1 1/16) 12UN - 2B; 18 mm [0.709 in] deep								
Outlet c	0.875 (7/8) - 14UNF - 2B; 16.7 mm [0.658 in] deep								

Auxillary mounting pads

SAE A auxiliary mounting pads are available for all Group 2 pumps with SAE A front flange and coupling 9 teeth 16/32 pitch. These pads are used for mounting auxiliary hydraulic pumps or creating special tandem gear pumps.

To order pumps with SAE A auxiliary mounting flange:

- Specify 06SL in field E of the model code as shown below
- Order the auxiliary mounting pad kit, part number 818.20.079.0K

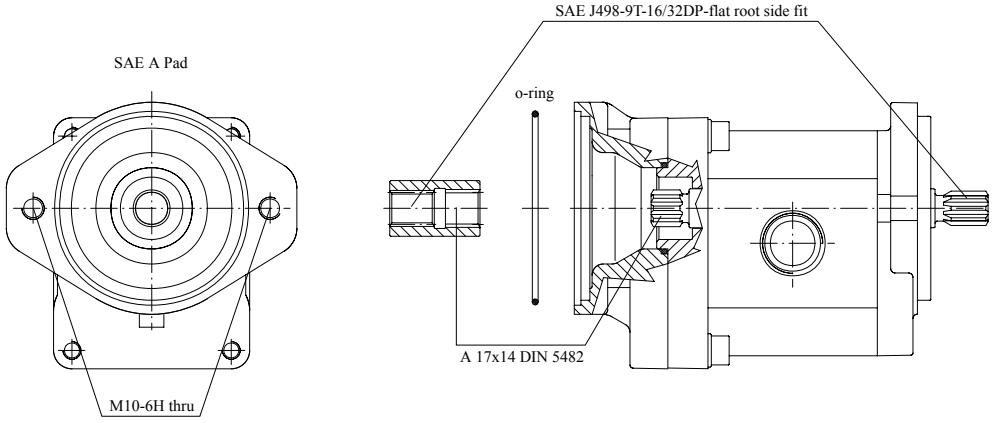
A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/						0	6	S	L											/					

Since the drive coupling is lubricated with oil from the main pump inlet, an O-ring must be used to seal the auxiliary pump-mounting flange to the pad.

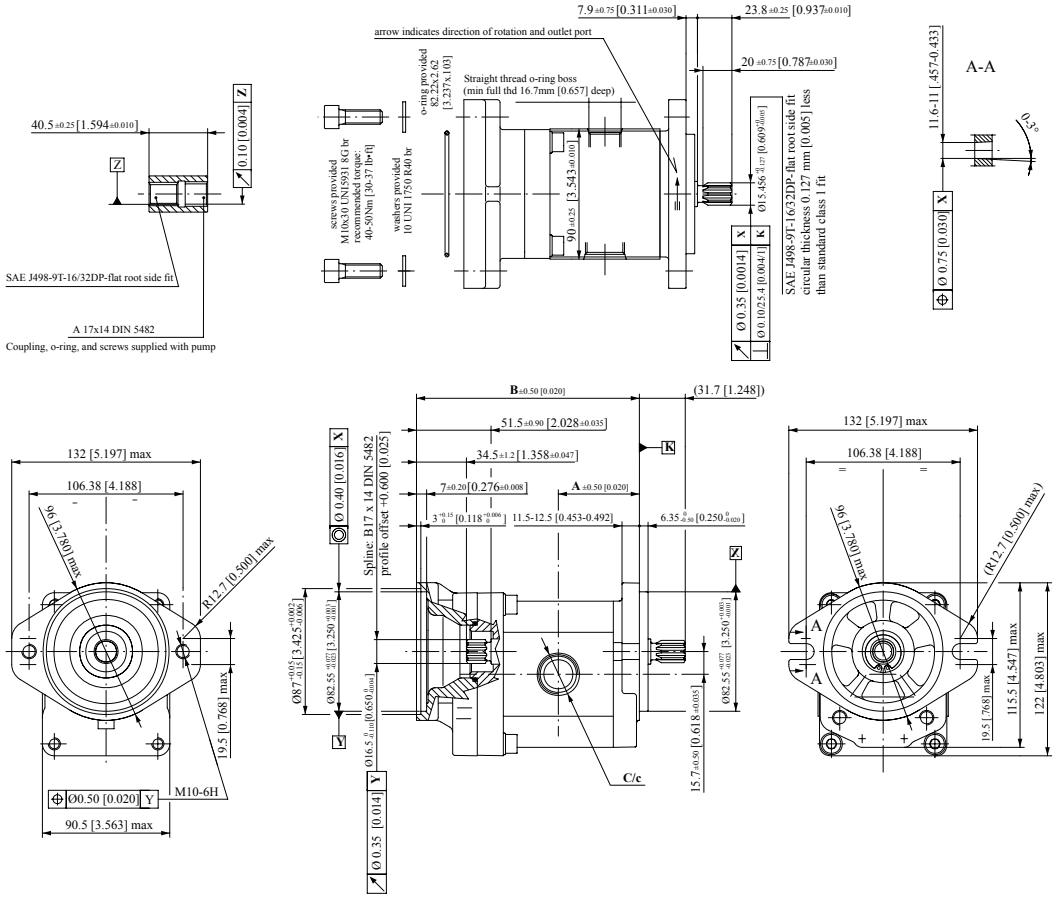
Product Options

- The combination of auxiliary mounting pad shaft torque, plus the main pump torque should not exceed the maximum pump input shaft rating 75 N•m [664 lbf•in].
- All torque values assume a 58 HRC shaft spline hardness on mating pump shaft.

Outline drawing with the dimensions of the auxiliary pump mounting flange and shaft



Dimensions for SNP2NN / 06SL flange/shaft option with auxiliary mounting pad kit installed



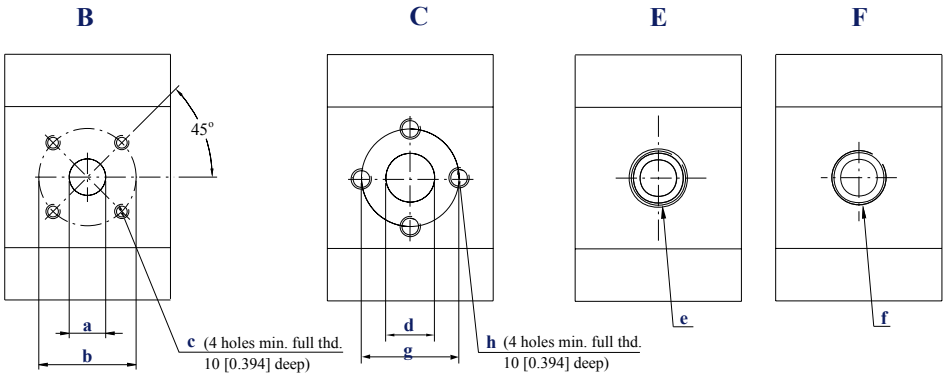
Product Options

Dimensions

Type (displacement)	4,0	6,0	8,0	011	014	017	019	022	025
A	43.25 [1.703]	45.0 [1.772]	47.0 [1.850]	49.0 [1.929]	52.0 [2.047]	54.0 [2.126]	56.0 [2.205]	59.0 [2.323]	61.0 [2.402]
B	128.5 [5.059]	132 [5.197]	136 [5.354]	140 [5.512]	146 [5.748]	150 [5.906]	154 [6.063]	160 [6.299]	164 [6.457]
Inlet C	1.063 (1 1/16) 12UN - 2B; 18 mm [0.709 in] deep								
Outlet c	0.875 (7/8) - 14UNF - 2B; 16.7 mm [0.658 in] deep								

Pump ports

Available pump ports



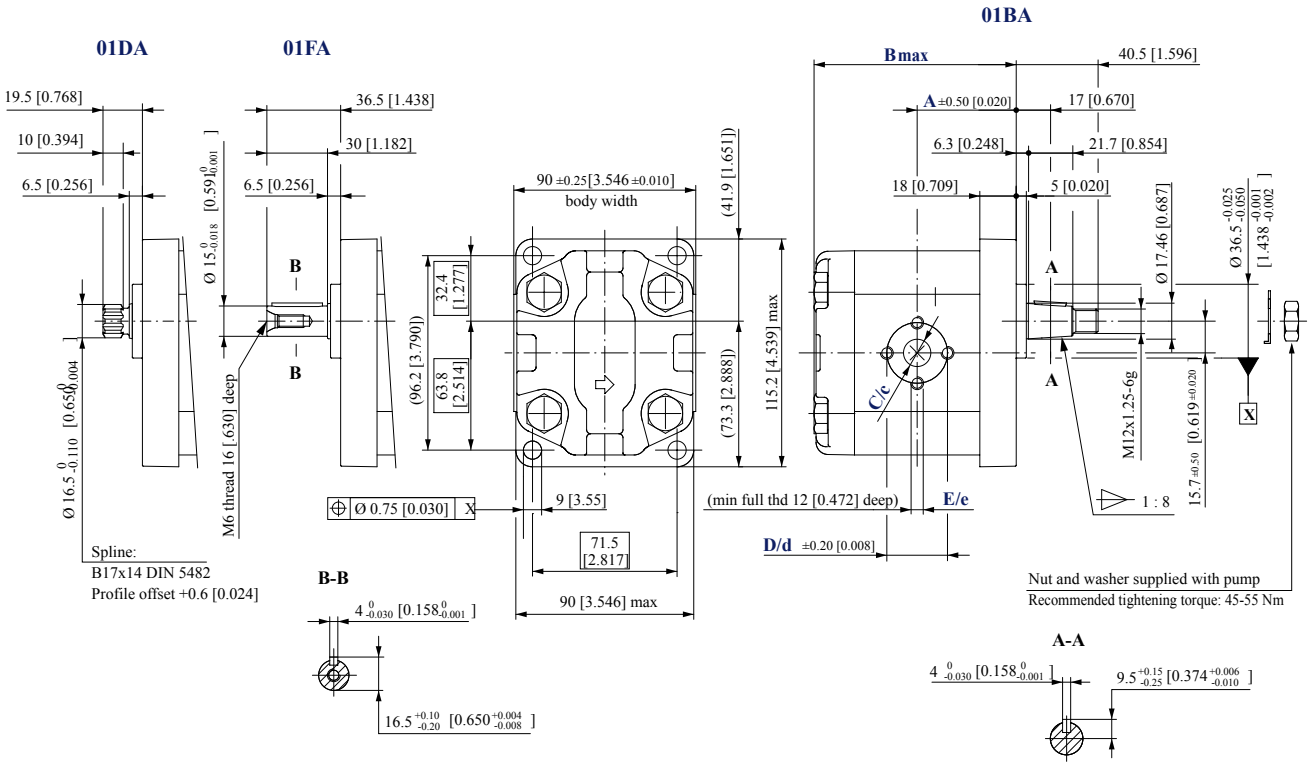
Dimensions of pumps ports

Port type			B Style			C Style			E Style	F Style
Port dimensions			a	b	c	d	g	h	e	f
Frame size	4,0	Inlet	15 [0.591]	40 [1.575]	M6	13.5 [0.531]	30 [1.181]	M6	1 1/16–12UNF–2B	½ Gas (BSPP)
		Outlet	15 [0.591]	35 [1.378]	M6	13.5 [0.531]	30 [1.181]	M6	7/8–14UNF–2B	½ Gas (BSPP)
	6,0	Inlet	15 [0.591]	40 [1.575]	M6	13.5 [0.531]	30 [1.181]	M6	1 1/16–12UNF–2B	½ Gas (BSPP)
		Outlet	15 [0.591]	35 [1.378]	M6	13.5 [0.531]	30 [1.181]	M6	7/8–14UNF–2B	½ Gas (BSPP)
	8,0	Inlet	20 [0.787]	40 [1.575]	M6	13.5 [0.531]	30 [1.181]	M6	1 1/16–12UNF–2B	½ Gas (BSPP)
		Outlet	15 [0.591]	35 [1.378]	M6	13.5 [0.531]	30 [1.181]	M6	7/8–14UNF–2B	½ Gas (BSPP)
	011	Inlet	20 [0.787]	40 [1.575]	M6	13.5 [0.531]	30 [1.181]	M6	1 1/16–12UNF–2B	¾ Gas (BSPP)
		Outlet	15 [0.591]	35 [1.378]	M6	13.5 [0.531]	30 [1.181]	M6	7/8–14UNF–2B	½ Gas (BSPP)
	014	Inlet	20 [0.787]	40 [1.575]	M6	20.0 [0.787]	40 [1.575]	M8	1 1/16–12UNF–2B	¾ Gas (BSPP)
		Outlet	15 [0.591]	35 [1.378]	M6	13.5 [0.531]	30 [1.181]	M6	7/8–14UNF–2B	½ Gas (BSPP)
	017	Inlet	20 [0.787]	40 [1.575]	M6	20.0 [0.787]	40 [1.575]	M8	1 1/16–12UNF–2B	¾ Gas (BSPP)
		Outlet	15 [0.591]	35 [1.378]	M6	13.5 [0.531]	30 [1.181]	M6	7/8–14UNF–2B	½ Gas (BSPP)
	019	Inlet	20 [0.787]	40 [1.575]	M6	20.0 [0.787]	40 [1.575]	M8	1 1/16–12UNF–2B	¾ Gas (BSPP)
		Outlet	15 [0.591]	35 [1.378]	M6	13.5 [0.531]	30 [1.181]	M6	7/8–14UNF–2B	½ Gas (BSPP)
	022	Inlet	20 [0.787]	40 [1.575]	M6	20.0 [0.787]	40 [1.575]	M8	1 1/16–12UNF–2B	¾ Gas (BSPP)
		Outlet	15 [0.591]	35 [1.378]	M6	13.5 [0.531]	30 [1.181]	M6	7/8–14UNF–2B	½ Gas (BSPP)
	025	Inlet	20 [0.787]	40 [1.575]	M6	23.5 [0.925]	40 [1.575]	M8	1 1/16–12UNF–2B	1 Gas (BSPP)
		Outlet	15 [0.591]	35 [1.378]	M6	20.0 [0.787]	40 [1.575]	M8	7/8–14UNF–2B	¾ Gas (BSPP)

Dimensions

SNP2NN - 01DA, 01FA and 01BA

Standard porting for 01DA, 01FA and 01BA



SNP2NN – 01BA, 01FA and 01DA dimensions

Frame size		4,0	6,0	8,0	011	014	017	019	022	025
Dimension	A	43.25 [1.703]	45 [1.772]	45 [1.772]	49 [1.929]	52 [2.047]	52 [2.047]	56 [2.205]	59 [2.323]	59 [2.323]
	B	90.0 [3.543]	93.0 [3.681]	97.5 [3.839]	101.5 [3.996]	107.5 [4.232]	111.5 [4.390]	115.5 [4.574]	121.5 [4.783]	125.5 [4.941]
Inlet	C	13.5 [0.531]	13.5 [0.531]	13.5 [0.531]	13.5 [0.531]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	23.5 [0.925]
	D	30 [1.181]	30 [1.181]	30 [1.181]	30 [1.181]	40 [1.575]	40 [1.575]	40 [1.575]	40 [1.575]	40 [1.575]
	E	M6				M8				
Outlet	c	13.5 [0.531]								20 [0.787]
	d	30 [1.181]								40 [1.575]
	e	M6								M8

Model code examples and maximum shaft torque

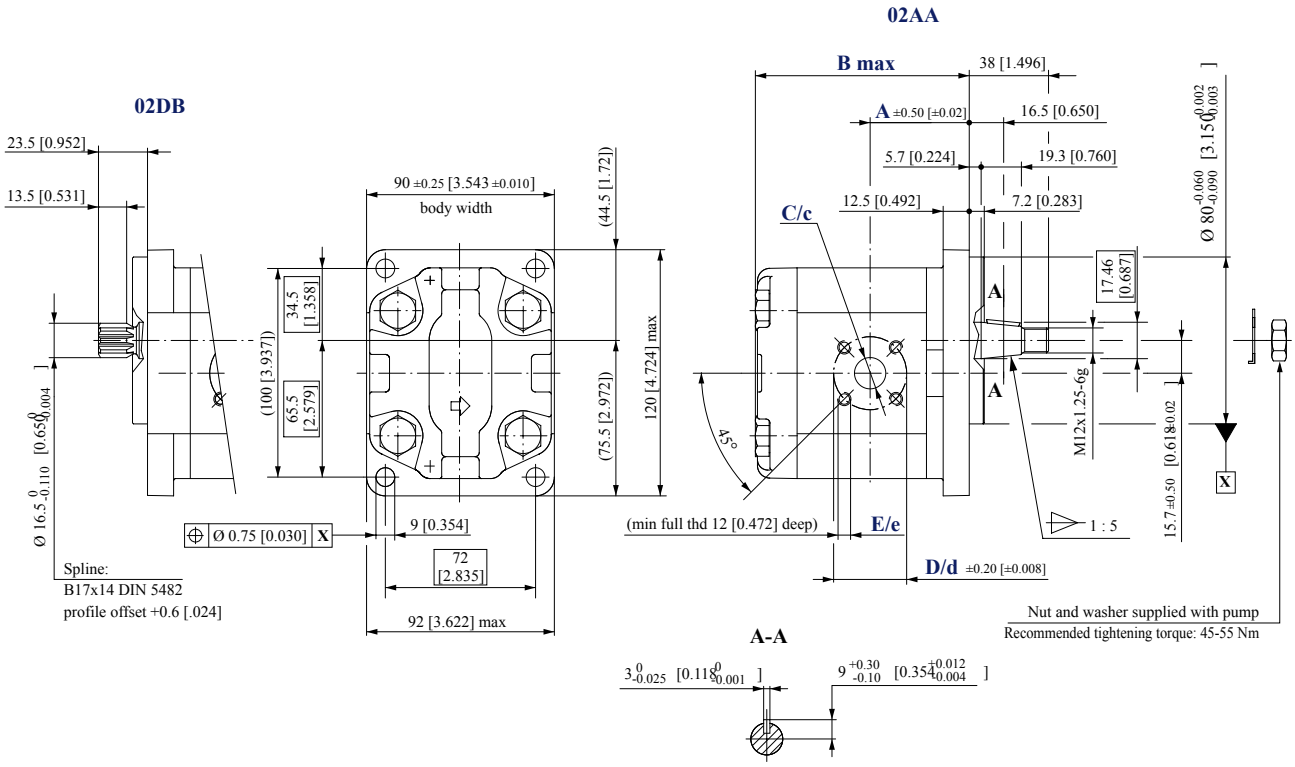
Flange/drive gear	Model code example	Maximum shaft torque
01DA	SNP2NN/014LN01DAP1C7C3NNNN/NNNNN	90 N•m [797 lbf•in]
01FA	SNP2NN/019LN01FAP1C7C3NNNN/NNNNN	90 N•m [797 lbf•in]
01BA	SNP2NN/8,0LN01BAP1C3C3NNNN/NNNNN	150 N•m [1328 lbf•in]

For further details on ordering, please see *Model code* on page 12.

Dimensions

SNP2NN - 02DB and 02AA

Standard porting for 02DB and 02AA



SNP2NN – 02DB and 02AA dimensions

Frame size		4,0	6,0	8,0	011	014	017	019	022	025
Dimension	A	39.8 [1.567]	41.1 [1.618]	43.1 [1.697]	47.5 [1.870]	47.5 [1.870]	47.5 [1.870]	47.5 [1.870]	55 [2.165]	64.5 [2.539]
	B	92.5 [3.642]	96 [3.780]	100 [3.937]	104 [4.094]	110 [4.331]	114 [4.488]	118 [4.646]	124 [4.882]	128 [5.039]
Inlet	C	15 [0.591]	15 [0.591]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]
	D	40 [1.575]								
	E	M6								
Outlet	c	15 [0.591]								
	d	35 [1.378]								
	e	M6								

Model code examples and maximum shaft torque

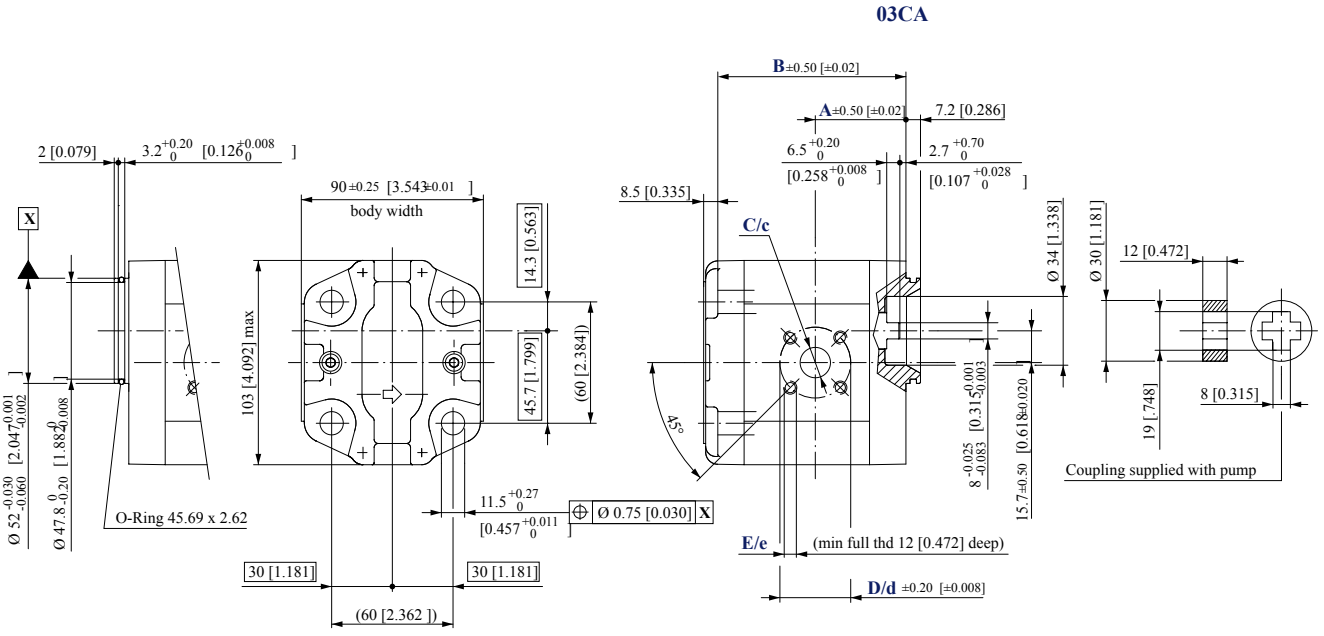
Flange/drive gear	Model code example	Maximum shaft torque
02DB	SNP2NN/017LN02DBP1B7B5NNNN/NNNNN	130 N•m [1151 lbf•in]
02AA	SNP2NN/6,0RN02AAP1B6B5NNNN/NNNNN	140 N•m [1239 lbf•in]

For further details on ordering, please see *Model code* on page 12.

Dimensions

SNP2NN - 03CA

Standard porting for 03CA



SNP2NN – 03CA dimensions

Frame size		4,0	6,0	8,0	011	014	017	019	022	025
Dimension	**A**	37.3 [1.469]	38.6 [1.520]	40.6 [1.598]	45 [1.772]	45 [1.772]	45 [1.772]	45 [1.772]	52.5 [2.067]	62 [2.441]
	B	81.5 [3.209]	85 [3.346]	89 [3.504]	93 [3.661]	99 [3.897]	103 [4.055]	107 [4.212]	113 [4.448]	117 [4.606]
Inlet	**C**	15 [0.591]	15 [0.591]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]
	D	40 [1.575]								
	E	M6								
Outlet	**c**	15 [0.591]								
	d	35 [1.378]								
	e	M6								

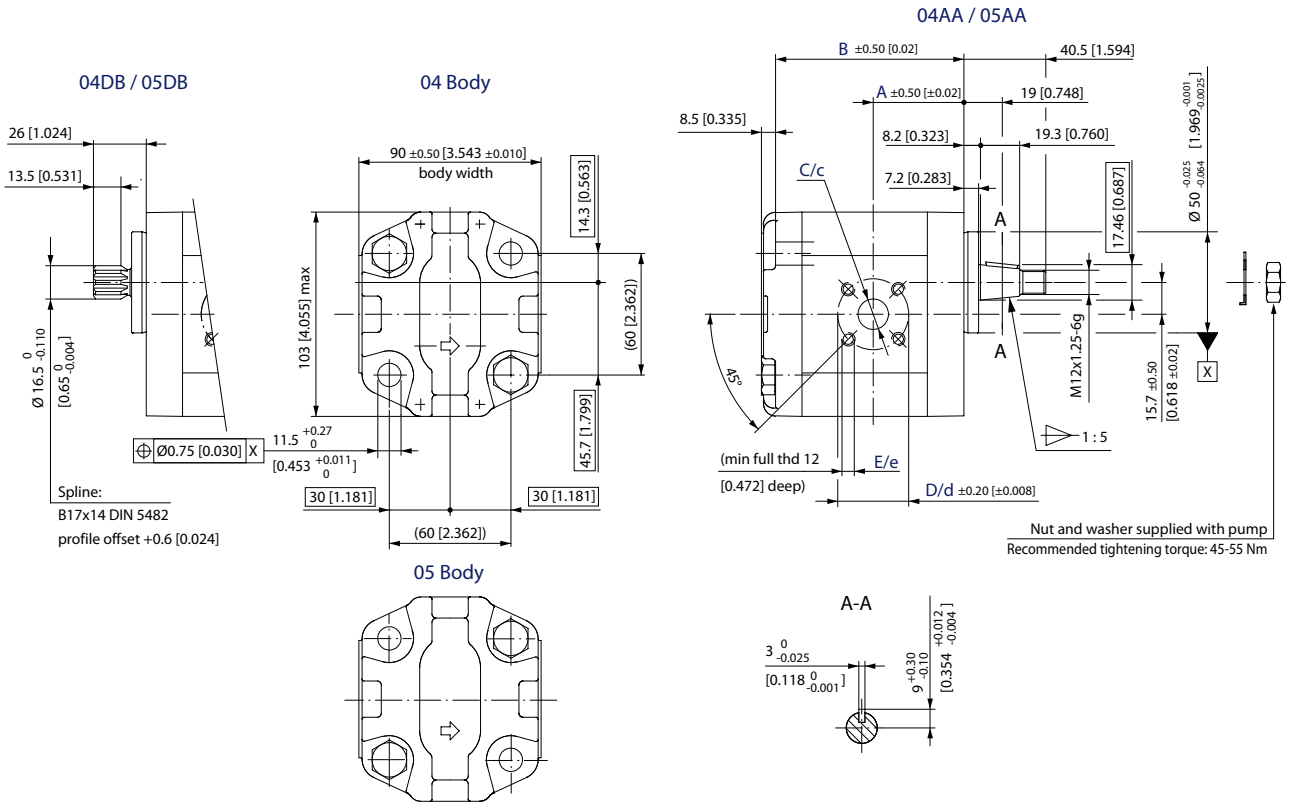
Flange/drive gear	Model code example	Maximum shaft torque
03CA	SNP2NN/014RN03CAP3B7B5NNNN/NNNNN	70 N•m [620 lbf•in]

For further details on ordering, please see *Model code* on page 12.

Dimensions

SNP2NN - 04/05DB and 04/05AA

Standard porting for 04/05DB and 04/05AA



SNP2NN – 04/05DB and 04/05AA dimensions

Frame size		4,0	6,0	8,0	011	014	017	019	022	025
Dimension	**A**	37.3 [1.469]	38.6 [1.520]	40.6 [1.598]	45 [1.772]	45 [1.772]	45 [1.772]	45 [1.772]	52.5 [2.067]	62 [2.441]
	B	81.5 [3.208]	85 [3.364]	89 [3.503]	93 [3.661]	99 [3.897]	103 [4.055]	107 [4.212]	113 [4.448]	117 [4.606]
Inlet	**C**	15 [0.591]	15 [0.591]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]
	D	40 [1.575]								
	E	M6								
Outlet	**c**	15 [0.591]								
	d	35 [1.378]								
	e	M6								

Model code examples and maximum shaft torque

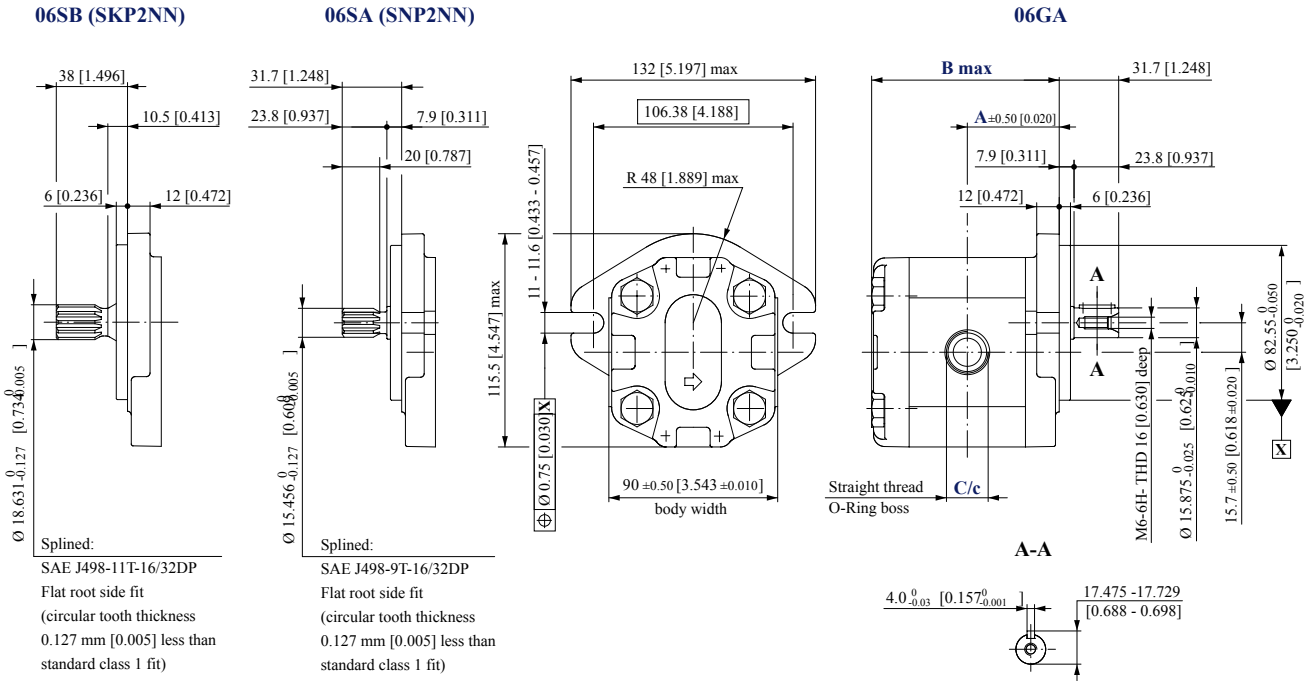
Flange/drive gear	Model code example	Maximum shaft torque
04DB	SNP2NN/8,0LN04DBP1B7B5NNNN/NNNNN	130 N•m [1151 lbf•in]
05DB	SNP2NN/022RN05DBP1B7B5NNNN/NNNNN	
04AA	SNP2NN/6,0LN04AAP1B6B5NNNN/NNNNN	140 N•m [1239 lbf•in]
05AA	SNP2NN/014RN05AAP1B7B5NNNN/NNNNN	

For further details on ordering, please see *Model code* on page 12.

Dimensions

SKP2NN - 06SB and SNP2NN - 06SA, 06GA

Standard porting for 06SB (SKP2NN), and 06SA, 06GA (SNP2NN)



Frame size		4,0	6,0	8,0	011	014	017	019	022	025
Dimension	**A**	43.25 [1.703]	45 [1.772]	47 [1.850]	49 [1.920]	52 [2.047]	54 [2.205]	56 [2.205]	59 [2.323]	61 [2.402]
	B	90 [3.543]	93.5 [3.681]	97.5 [3.839]	101.5 [3.996]	107.5 [4.232]	111.5 [4.390]	115.5 [4.547]	121.5 [4.783]	125.5 [4.941]
Inlet	**C**	11/16–12UNF–2B, 18.0 [0.709] deep								
Outlet	**c**	7/8–14UNF–2B, 16.7 [0.658] deep								

Model code examples and maximum shaft torque

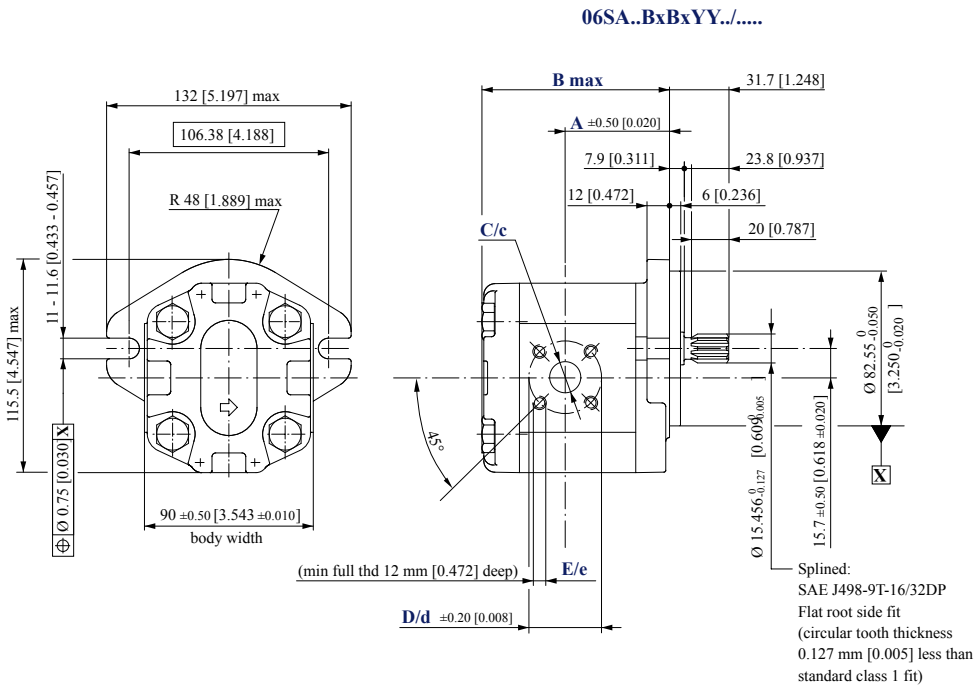
Flange/drive gear	Model code example	Maximum shaft torque
06GA	SNP2NN/6,0RN06GAP1E6E5NNNN/NNNNN	80 N•m [708 lbf•in]
06SA (SNP2NN)	SNP2NN/011LN06SAP1E6E5NNNN/NNNNN	75 N•m [664 lbf•in]
06SB (SKP2NN)	SKP2NN/022RN06SBP1E6E5NNNN/NNNNN	150 N•m [1328 lbf•in]

For further details on ordering, please see *Model code* on page 12.

Dimensions

SNP2NN - 06SA..BxBxBxYY../....

Standard porting for 06SA with port type Bx offset from center of the body



SNP2NN – 06SA..BxBxYY../..... dimensions

Frame size		4,0	6,0	8,0	011	014	017	019	022	025
Dimension	A	49.2 [1.937]	51.4 [2.023]	53.4 [2.102]	53.0 [2.087]	59.0 [2.322]	63.0 [2.480]	67.0 [2.637]	65.5 [2.579]	60.0 [2.326]
	B	90 [3.543]	93.5 [3.681]	97.5 [3.839]	101.5 [3.996]	107.5 [4.232]	111.5 [4.390]	115.5 [4.547]	121.5 [4.783]	125.5 [4.941]
Inlet	C	15 [0.591]	15 [0.591]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]
	D	40 [1.575]								
	E	M6								
Outlet	c	15 [0.591]								
	d	35 [1.378]								
	e	M6								

Model code examples and maximum shaft torque

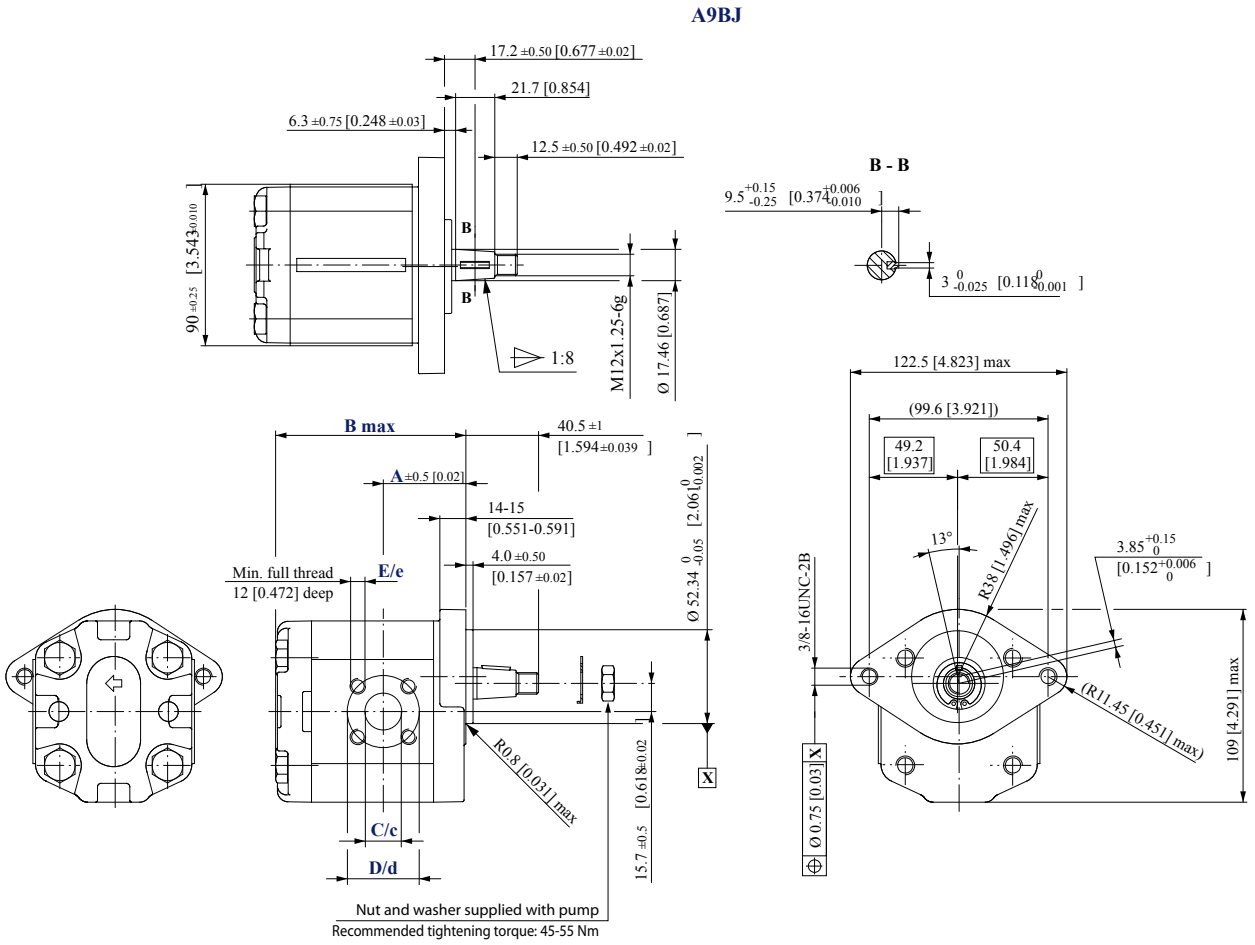
Flange/drive gear	Model code example	Maximum shaft torque
06SA..BxBxYY../.....	SNP2NN/019RN06SAP1B7B5YYNN/NNNNN	75 N•m [646 lbf•in]

For further details on ordering, please see *Model code* on page 12.

Dimensions

SNP2NN - A9BJ

Standard porting for A9BJ



Frame size		4,0	6,0	8,0	011	014	017	019	022	025
Dimension	A	37.3 [1.469]	38.6 [1.520]	40.6 [1.598]	45.0 [1.772]	45.0 [1.772]	45.0 [1.772]	45.0 [1.772]	52.5 [2.067]	62 [2.441]
	B	90 [3.543]	93.5 [3.681]	97.5[3.839]	101.5 [3.996]	107.5 [4.232]	111.5 [4.390]	115.5 [4.547]	121.5 [4.783]	125.5 [4.941]
Inlet	C	15 [0.591]	15 [0.591]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]	20 [0.787]
	D	40 [1.575]								
	E	M6								
Outlet	c	15 [0.591]								
	d	35 [1.378]								
	e	M6								

Model code example and maximum shaft torque

Flange/drive gear	Model code example	Maximum shaft torque
A9BJ	SNP2NN/011RNA9BJP1C7C3NNNN/NNNNN	150 N•m [1328 lbf•in]

For further details on ordering, please see *Model code* on page 12.

ENGINEERING TOMORROW

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Shanghai, China 201206
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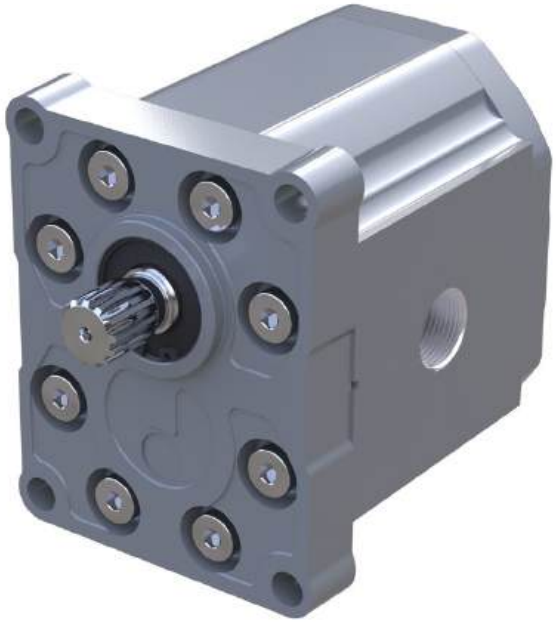
ENGINEERING
TOMORROW

Technical Information

GearMe
Aluminum Group 3 Pump



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Revision history

Table of revisions

Date	Changed	Rev
February 2023	Fixed typo	0202
January 2023	Renamed product; corrected incorrect values in various tables; slightly reformatted	0201
February 2020	Obsolete pump removed; displacement values updated; other coding corrected	0102
October 2019	First edition	0101

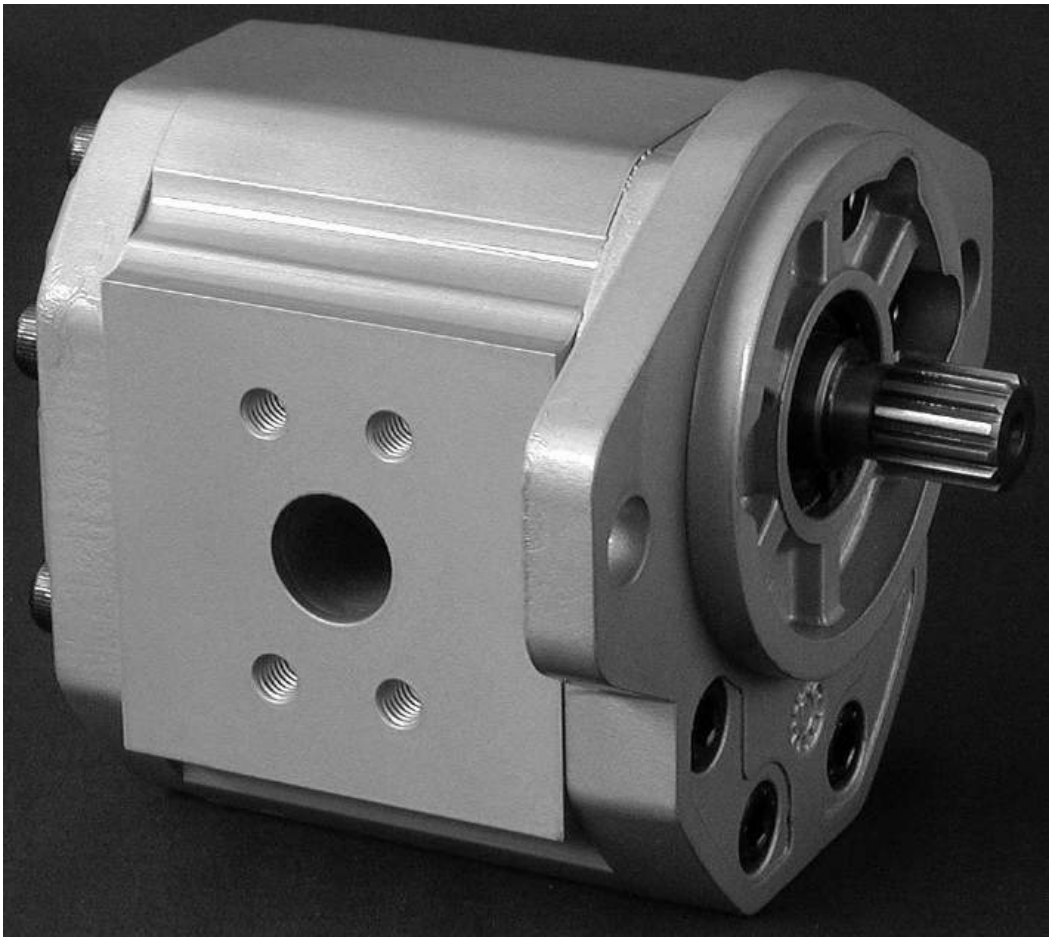
Contents

General Information

Overview

The Danfoss Group 3 is a range of peak performance fixed-displacement gear pumps. Constructed of a high-strength extruded aluminum body with aluminum cover and flange, all pumps are pressure-balanced for exceptional efficiency.

SNP3NN 07SA



General Information

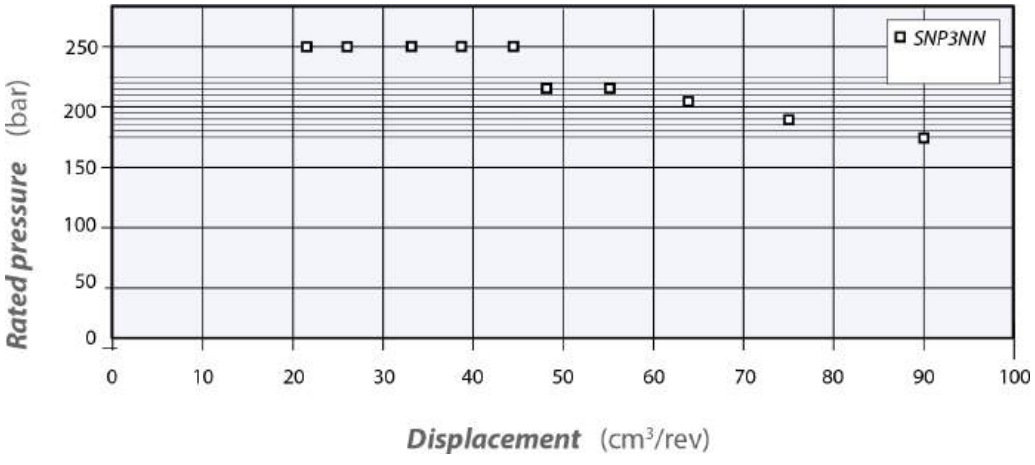
SNP3NN 01BA

Group 3 gear pumps' attributes

- Wide range of displacements from 22 to 90 cm^3/rev [from 1.34 to 5.49 in^3/rev]
- Continuous pressure rating up to 250 bar [3625 psi]
- Speeds up to 3000 min-1 (rpm)
- SAE, DIN and European standard mounting flanges
- High quality case hardened steel gears
- Multiple pump configurations in combination with SNP1NN, SNP2NN and SNP3NN

Pump displacements

Quick reference chart for pump displacements vs. rated pressure



General Information

Technical data for SNP3NN

SNP3NN pump model		Frame size									
		022	026	033	038	044	048	055	063	075	090
Displacement	cm3/rev [in3/rev]	22.1 [1.35]	26.2 [1.60]	33.1 [2.02]	37.9 [2.32]	44.1 [2.69]	48.3 [2.93]	55.1 [3.36]	63.4 [3.87]	74.4 [4.54]	88.2 [5.38]
Peak pressure	bar [psi]	270 [3910]	270 [3910]	270 [3910]	270 [3910]	270 [3910]	250 [3625]	250 [3625]	230 [3350]	200 [2910]	170 [2465]
Rated pressure		250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]	230 [3350]	230 [3350]	210 [3045]	180 [2610]	150 [2175]
Minimum speed	min-1 (rpm)	800	800	800	800	800	800	800	600	600	600
Maximum speed		3000	3000	3000	3000	3000	3000	2500	2500	2500	2500
Weight	kg [lb]	6.8 [15.0]	6.8 [15.0]	7.2 [15.8]	7.3 [16.1]	7.5 [16.5]	7.6 [16.8]	7.8 [17.3]	8.1 [17.9]	8.5 [18.7]	8.9 [19.6]
Moment of inertia of	x 10-6 kg•m2	198	216	246	267,2	294,2	312,2	342,3	378,3	426,4	486,5
rotating components	[x 10-6 lbf•ft2]	[4698]	[5126]	[5838]	[6340]	[6891]	[7408]	[8123]	[8977]	[10118]	[11545]
Theoretical flow at	l/min	66.3	78.6	99.3	113.7	132.3	144.9	137.8	158.5	186	220.5
maximum speed	[US gal/min]	[17.5]	[20.8]	[26.2]	[30.0]	[35.0]	[38.3]	[36.4]	[41.8]	[49.1]	[58.3]

Caution

The rated and peak pressure mentioned are for pumps with flanged ports only. When threaded ports are required a de-rated performance must be considered. To verify the compliance of an high pressure application with a threaded ports pump apply to a Danfoss representative.

General Information

Determination of nominal pump sizes

Use these formula to determine the nominal pump size for a specific application:

	Based on SI units	Based on US units
Output flow:	$Q = \frac{Vg \cdot n \cdot \eta_v}{1000}$ l/min	$Q = \frac{Vg \cdot n \cdot \eta_v}{231}$ [US gal/min]
Input torque:	$M = \frac{Vg \cdot \Delta p}{20 \cdot \pi \cdot \eta_m}$ N•m	$M = \frac{Vg \cdot \Delta p}{2 \cdot \pi \cdot \eta_m}$ [lbf•in]
Input power:	$P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t}$ kW	$P = \frac{M \cdot n}{63.025} = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t}$ [hp]

Vg =	Displacement per rev.	cm^3/rev [in^3/rev]
pHD =	Outlet pressure	bar [psi]
pND =	Inlet pressure	bar [psi]
Δp =	pHD – pND	bar [psi]
n =	Speed	min^{-1} (rpm)
ηv =	Volumetric efficiency	
ηm =	Mechanical (torque) efficiency	
ηt =	Overall efficiency (ηv • ηm)	

Product Coding

Model code

A Family

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
•	•	•	•	•	•	/																				/					

SNP3NN	Std Gr3 Pump

B Displacement

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/	•	•	•																	/					

022	22,1 cc
026	26,2 cc
033	33,1 cc
038	37,9 cc
044	44,1 cc
048	48,3 cc
055	55,2 cc
063	63,4 cc
075	74,4 cc
090	88,2 cc

C Rotation

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/				•																/					

L	Left rotation
R	Right rotation

D Project version

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/					•															/					

N	Std Version of Project

E Mounting flange

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/						•	•													/					

Code	Description (Type of flange • Type of drive gear • Preferred ports for configuration)
01	European four bolt flange (98,4x128,1) - Pilot Ø50,8
02	European four bolt flange (98,4x137) - Pilot Ø50,8
03	European four bolt flange (114,3x149,5) - Pilot Ø60,3

Product Coding

Code	Description (Type of flange • Type of drive gear • Preferred ports for configuration)
06	German four bolt flange (102,0x145,0) - Pilot Ø105
07	SAE B-Pilot Ø101,6+2 holes
08	SAE C-Pilot Ø127+4 holes
09	SAE A-Pilot Ø82,55+2 holes
91	Outrigger bearing with European four bolt flange Pilot Ø50,8 -Taper 1:8 M14x1,5 key 4x7,5
D7	SAE B-Pilot Ø101,6+2 holes+special for double shaft seal - Special

F Drive gear

A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/					• •							/			

AA	Taper 1:5-M16x1,5-Key 5
BA	Taper 1:8-M14x1,5-Key 4
BB	Taper 1:8-M16x1,5-Key 4,79
CA	Tang 8xØ22,2 - Special
DA	DIN 5482 B22x19 L24 (for flange 01)
DD	DIN 5482 B28x25 L28 (for flange 06)
FA	ParallelØ20-Key 5x5 L30 (for flange 01-02)
FB	Parallel Ø22-Key 5x5 L40 (for flange 03)
GA	ParallelØ22,225 x L25,4-Key 6,375x6,375 L25,4
SA	SAE J498-13T-16/32-SAE B
SB	SAE J498-13T-16/32-SAE A (for flange 09)
RA	SAEJ498-14T-12/24-SAE C-4 bolt (for flange 08)
SH	SAE J498-15T-16/32-SAE B - Special

G Rear cover

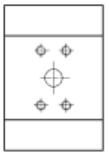
A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/						• •						/			

P1	Standard cover for pump

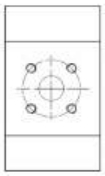
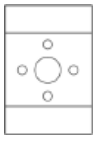
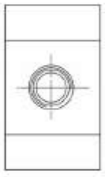
H Inlet size; I Outlet size

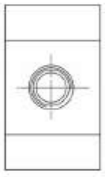
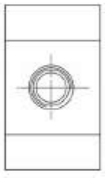
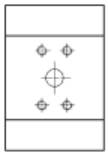
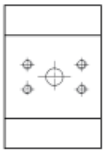
A		B	C	D	E	F	G	H	I	J	K	L		M	N	O
	/							• • • •					/			

A2	18,5x22,23x47,63x3/8-16UNC
A3	25x26,19x52,37x3/8-16UNC
A4	31x30,18x58,72x7/16-14UNC
A5	37,5/27x35,71x69,85x1/2-13UNC



Product Coding

BA	18x55xM8	
BB	27x55xM8	
BC	36/27x55xM8	
C7	20x40xM8	
CA	27x51xM10	
CD	36x62xM10	
E6	1-1/16-12UN	
E8	1-5/16-12UN	
E9	1-5/8-12UN	
EA	1-7/8-12UN	

H8	M27x2-ISO6149	
H9	M33x2-ISO6149	
HA	M42x2-ISO6149	
F5	BSP 3/4 GAS	
F6	BSP 1 GAS	
F7	BSP 1-1/4 GAS	
M5	25x52,37x26,19xM10	
M6	31x30,18x58,72xM10	
M7	37,5x35,71x69,85xM12	
MG	25/20x52,37x26,19xM10(=) - Special	
MH	31x30,18x58,72xM10 deep18 (=)	
MN	31x30,18x58,72xM10 deep12 (=)	
MR	37,5x35,71x69,85xM12 deep20 (=)	

J Ports positions & Special body

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																•	•			/						

NN	Std from catalogue
ZZ	Port type Bx-Bx in the center of the body

Product Coding

K Seals

A							B			C	D	E		F		G		H		I		J	K	L		M			N	O
						/																	•		/					

N	Standard NBR seals
D	NBR seals + VITON shaft seal with dust lip
I	Two opposite shaft seal

L Screws

A							B			C	D	E		F		G		H		I		J	K	L		M			N	O
						/																		•	/					

N	Std burnished screws
B	Anticorrosion screws

M Set valve

A							B			C	D	E		F		G		H		I		J	K	L		M			N	O
						/																			/	•	•	•		

NNN	No valve

N Type mark

A							B			C	D	E		F		G		H		I		J	K	L		M			N	O
						/																			/				•	

N	Standard Danfoss Marking
A	Standard Danfoss Marking+Customer Code
Z	Without Marking

O Mark position

A							B			C	D	E		F		G		H		I		J	K	L		M			N	O
						/																			/					•

N	Std Marking position (on top)
A	Special Marking position on the bottom

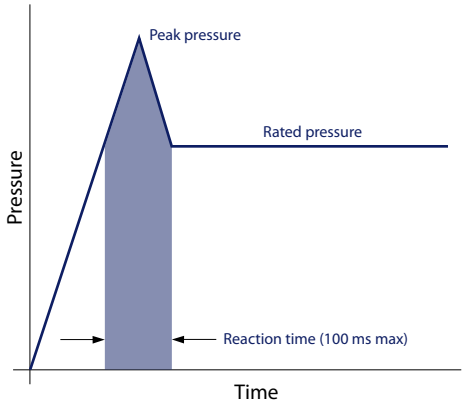
System Requirements

Pressure

The inlet vacuum must be controlled in order to realize expected pump life and performance. The system design must meet inlet pressure requirements during all modes of operation. Expect lower inlet pressures during cold start. It should improve quickly as the fluid warms.

Max. continuous vacuum	bar abs. [in. Hg]	0.8 [23.6]
Max. intermittent vacuum		0.6 [17.7]
Max. pressure		4.0 [118.1]

Peak pressure is the highest intermittent pressure allowed. The relief valve overshoot (reaction time) determines peak pressure. It is assumed to occur for less than 100 ms. The accompanying illustration shows peak pressure in relation to rated pressure and reaction time (100 ms maximum).



Rated pressure is the average, regularly occurring, operating pressure that should yield satisfactory product life. The maximum machine load demand determines rated pressure. For all systems, the load should move below this pressure.

System pressure is the differential of pressure between the outlet and inlet ports. It is a dominant operating variable affecting hydraulic unit life. High system pressure, resulting from high load, reduces expected life. System pressure must remain at, or below, rated pressure during normal operation to achieve expected life.

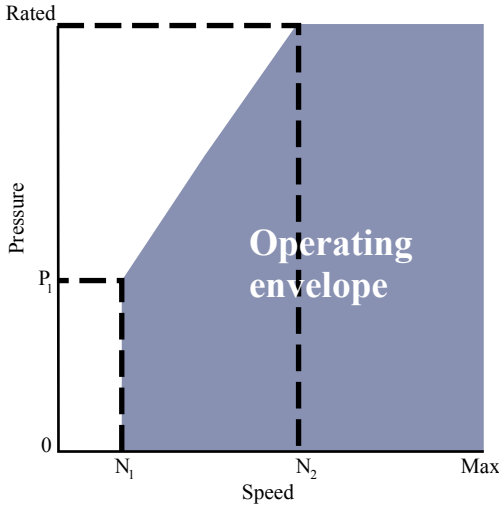
Speed

Maximum speed is the limit recommended by Danfoss for a particular gear pump when operating at rated pressure. It is the highest speed at which normal life can be expected.

The lower limit of operating speed is the **minimum speed**. It is the lowest speed at which normal life can be expected. The minimum speed increases as operating pressure increases. When operating under higher pressures, a higher minimum speed must be maintained, as illustrated here.

System Requirements

Speed versus pressure



Where:

N_1 = Minimum speed at 100 bar

N_2 = Minimum speed at 180 bar

Hydraulic fluids

Ratings and data for SNP3NN and SHP3NN gear pumps are based on operating with premium hydraulic fluids containing oxidation, rust, and foam inhibitors. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion, and corrosion of internal components. They include:

- Hydraulic fluids following DIN 51524, part 2 (HLP) and part 3 (HVLP) specifications
- API CD engine oils conforming to SAE J183
- M2C33F or G automatic transmission fluids
- Certain agricultural tractor fluids

Use only clean fluid in the pump and hydraulic circuit.

Caution

Never mix hydraulic fluids.

Temperature and viscosity

Temperature and viscosity requirements must be concurrently satisfied. Use petroleum / mineral-based fluids.

High temperature limits apply at the inlet port to the pump. The pump should run at or below the maximum continuous temperature. The peak temperature is based on material properties. Don't exceed it.

Cold oil, generally, doesn't affect the durability of pump components. It may affect the ability of oil to flow and transmit power. For this reason, keep the temperature at 16 °C [60 °F] above the pour point of the hydraulic fluid.

Minimum (cold start) temperature relates to the physical properties of component materials.

Minimum viscosity occurs only during brief occasions of maximum ambient temperature and severe duty cycle operation. You will encounter maximum viscosity only at cold start. During this condition, limit speeds until the system warms up. Size heat exchangers to keep the fluid within these limits. Test regularly to verify that these temperatures and viscosity limits aren't exceeded. For maximum unit efficiency and bearing life, keep the fluid viscosity in the recommended viscosity range.

System Requirements

Fluid viscosity

Maximum (cold start)	mm^2/s [SUS]	1000 [1600]
Recommended range		12-60 [66-290]
Minimum		10 [60]

Temperature (with standard NBR seals)

Minimum (cold start)	°C [°F]	-20 [-4]
Maximum continuous		80 [176]
Peak (intermittent)		90 [194]

Filtration

Filters

Use a filter that conforms to Class 22/18/13 of ISO 4406 (or better). It may be on the pump outlet (pressure filtration), inlet (suction filtration), or reservoir return (return-line filtration).

Selecting a filter

When selecting a filter, please consider:

- contaminant ingression rate (determined by factors such as the number of actuators used in the system)
- generation of contaminants in the system
- required fluid cleanliness
- desired maintenance interval
- filtration requirements of other system components

Measure filter efficiency with a Beta ratio (β_X). For:

- suction filtration, with controlled reservoir ingression, use a $\beta_{35-45} = 75$ filter
- return or pressure filtration, use a pressure filtration with an efficiency of $\beta_{10} = 75$

β_x ratio is a measure of filter efficiency defined by ISO 4572. It is the ratio of the number of particles greater than a given diameter ("$_X$" in microns) upstream of the filter to the number of these particles downstream of the filter.

Fluid cleanliness level and β_x ratio

Fluid cleanliness level (per ISO 4406)	Class 22/18/13 or better
β_x ratio (suction filtration)	$\beta_{35-45} = 75$ and $\beta_{10} = 2$
β_x ratio (pressure or return filtration)	$\beta_{10} = 75$
Recommended inlet screen size	100-125 µm [0.004-0.005 in]

The filtration requirements for each system are unique. Evaluate filtration system capacity by monitoring and testing prototypes.

Reservoir

The **reservoir** provides clean fluid, dissipates heat, removes entrained air, and allows fluid volume changes associated with fluid expansion and cylinder differential volumes. A correctly sized reservoir accommodates maximum volume changes during all system operating modes. It promotes deaeration of the fluid as it passes through, and accommodates a fluid dwell-time between 60 and 180 seconds, allowing entrained air to escape.

System Requirements

Minimum reservoir capacity depends on the volume required to cool and hold the oil from all retracted cylinders, allowing for expansion due to temperature changes. A fluid volume of 1 to 3 times the pump output flow (per minute) is satisfactory. The minimum reservoir capacity is 125% of the fluid volume.

Install the suction line above the bottom of the reservoir to take advantage of gravity separation and prevent large foreign particles from entering the line. Cover the line with a 100-125 micron screen. The pump should be below the lowest expected fluid level. Put the return-line below the lowest expected fluid level to allow discharge into the reservoir for maximum dwell and efficient deaeration. A baffle (or baffles) between the return and suction lines promotes deaeration and reduces fluid surges.

Line sizing

Choose pipe sizes that accommodate minimum fluid velocity to reduce system noise, pressure drops, and overheating. This maximizes system life and performance.

Design inlet piping that maintains continuous pump inlet pressure above 0.8 bar absolute during normal operation. The line velocity should not exceed the values in this table:

Maximum line velocity

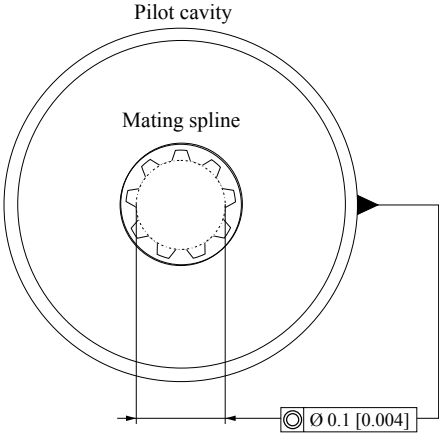
Inlet	m/s [ft/sec]	2.5 [8.2]
Outlet		5.0 [16.4]
Return		3.0 [9.8]

Most systems use hydraulic oil containing 10% dissolved air by volume. Under high inlet vacuum conditions the oil releases bubbles. They collapse when subjected to pressure, resulting in cavitation, causing adjacent metal surfaces to erode. **Over-aeration** is the result of air leaks on the inlet side of the pump, and flow-line restrictions. These include inadequate pipe sizes, sharp bends, or elbow fittings, causing a reduction of flow line cross sectional area. This problem will not occur if inlet vacuum and rated speed requirements are maintained, and reservoir size and location are adequate.

Pump drive

Shaft options for Group 3 gear pumps include tapered, tang, splined, or parallel shafts. They are suitable for a wide range of direct and indirect drive applications for radial and thrust loads.

Plug-in drives, acceptable only with a splined shaft, can impose severe radial loads when the mating spline is rigidly supported. Increasing spline clearance does not alleviate this condition.



Use **plug-in drives** if the concentricity between the mating spline and pilot diameter is within 0.1 mm [0.004 in]. Lubricate the drive by flooding it with oil. A 3-piece coupling minimizes radial or thrust shaft loads.

System Requirements

Caution

In order to avoid spline shaft damages it is recommended to use carburized and hardened steel couplings with 80-82 HRA surface hardness.

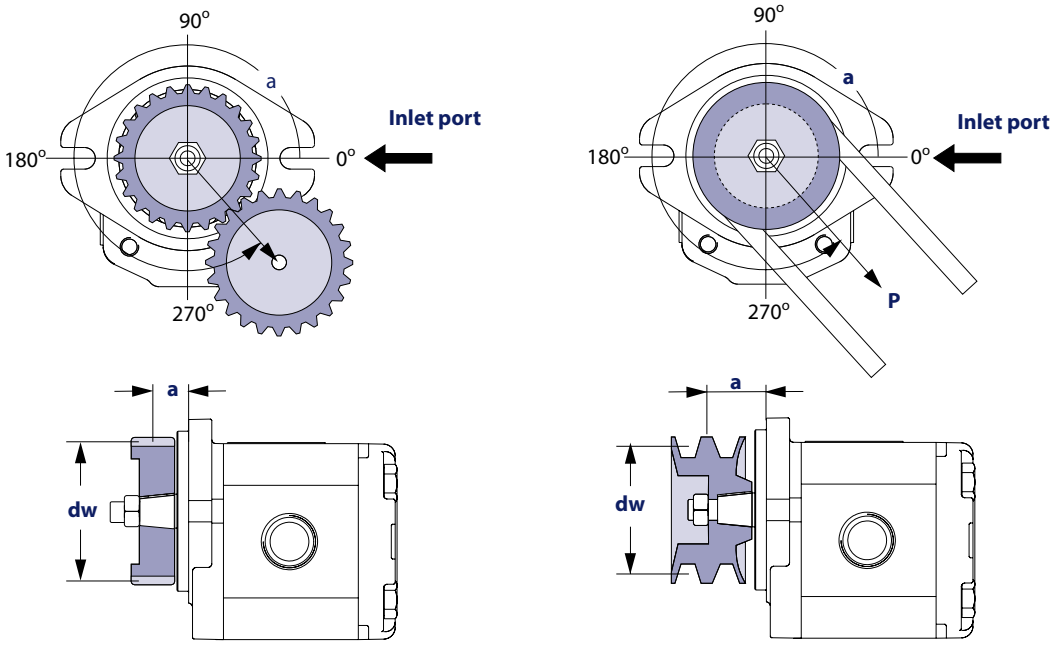
Allowable **radial shaft loads** are a function of the load position, load orientation, and operating pressure of the hydraulic pump. All external shaft loads have an effect on bearing life, and may affect pump performance.

In applications where external shaft loads can't be avoided, minimize the impact on the pump by optimizing the orientation and magnitude of the load. Use a tapered input shaft; don't use splined shafts for belt or gear drive applications. A spring-loaded belt tension-device is recommended for belt drive applications to avoid excessive tension. Avoid thrust loads in either direction.

Pump drive data form

Contact Danfoss if continuously applied external radial or thrust loads occur. Fill out this page and send the complete form to your Danfoss representative for an assistance in applying pumps with belt or gear drive. This illustration shows a pump with counterclockwise orientation:

Optimal radial load position



Application data

Item		Value	Unit
Pump displacement			cm^3/rev [in^3/rev]
Rated system pressure			bar psi
Relief valve setting			
Pump shaft rotation			left right
Pump minimum speed			min^{-1} (rpm)
Pump maximum speed			
Drive gear helix angle (gear drive only)			degree
Belt type (gear drive only)			V notch
Belt tension (gear drive only)	**P**		N lbf

System Requirements

Application data (continued)

Item		Value	Unit
Angular orientation of gear or belt to inlet port	**α**		degree
Pitch diameter of gear or pulley	**dw**		mm in
Distance from flange to center of gear or pulley	**a**		

Pump Life

Pump life is a function of speed, system pressure, and other system parameters (such as fluid quality and cleanliness).

All Danfoss gear pumps use hydrodynamic journal bearings that have an oil film maintained between the gear/shaft and bearing surfaces at all times. If the oil film is sufficiently sustained through proper system maintenance and operating within recommended limits, long life can be expected.

B_{10} life expectancy number is generally associated with rolling element bearings. It does not exist for hydrodynamic bearings.

High pressure, resulting from high loads, impacts pump life. When submitting an application for review, provide machine duty cycle data that includes percentages of time at various loads and speeds. We strongly recommend a prototype testing program to verify operating parameters and their impact on life expectancy before finalizing any system design.

Sound levels

Fluid power systems are inherent generators of noise. As with many high power density devices, noise is an unwanted side affect. However, there are many techniques available to minimize noise from fluid power systems. To apply these methods effectively, it is necessary to understand how the noise is generated and how it reaches the listener. The noise energy can be transmitted away from its source as either fluid borne noise (pressure ripple) or as structure borne noise.

Pressure ripple is the result of the number of pumping elements (gear teeth) delivering oil to the outlet and the pump's ability to gradually change the volume of each pumping element from low to high pressure. In addition, the pressure ripple is affected by the compressibility of the oil as each pumping element discharges into the outlet of the pump. Pressure pulsations will travel along the hydraulic lines at the speed of sound (about 1400 m/s in oil) until affected by a change in the system such as an elbow fitting. Thus the pressure pulsation amplitude varies with overall line length and position.

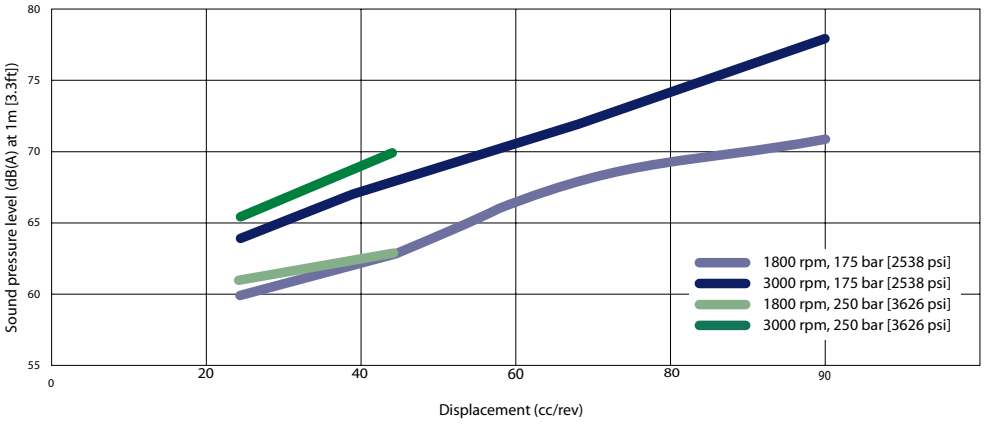
Structure borne noise may be transmitted wherever the pump casing is connected to the rest of the system. The manner in which one circuit component responds to excitation depends on its size, form, and manner in which it is mounted or supported. Because of this excitation, a system line may actually have a greater noise level than the pump. To reduce this excitation, use flexible hoses in place of steel plumbing. If steel plumbing must be used, clamping of lines is recommended. To minimize other structure borne noise, use flexible (rubber) mounts.

The accompanying graph shows typical sound pressure levels for SNP3NN pumps (with SAE A flange, and spline shaft in plug in drive) measured in dB (A) at 1 m [3.28 ft] from the unit in a semi anechoic chamber. Anechoic levels can be estimated by subtracting 3 dB (A) from these values.

Contact your Danfoss representative for assistance with system noise control.

System Requirements

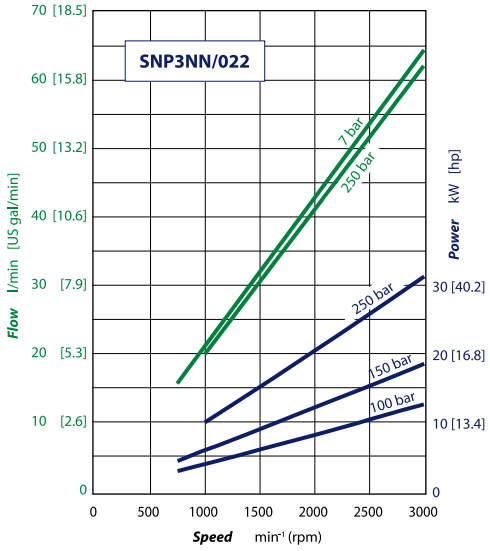
Sound levels graph

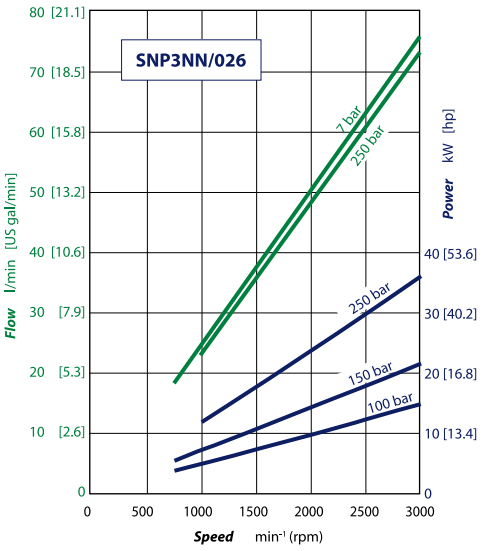


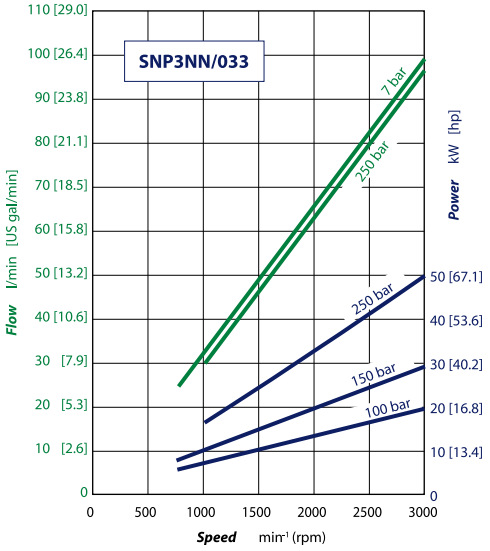
Pump Performance

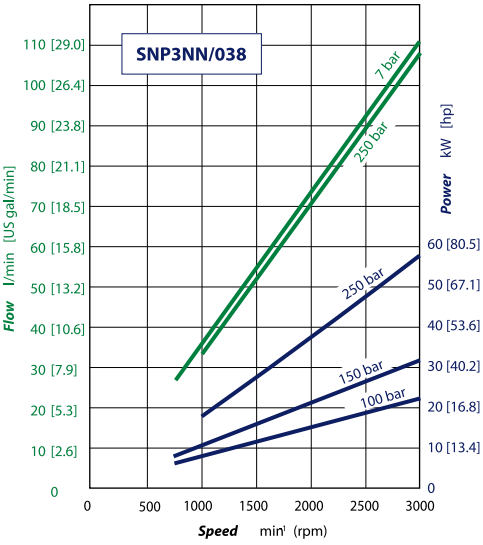
Pump performance graphs

The following graphs provide typical output flow and input power for Group 3 pumps at various working pressures. Data were taken using ISO VG46 petroleum /mineral based fluid at 50 °C [122 °F] (viscosity = 28 mm^2/s [132 SUS]).

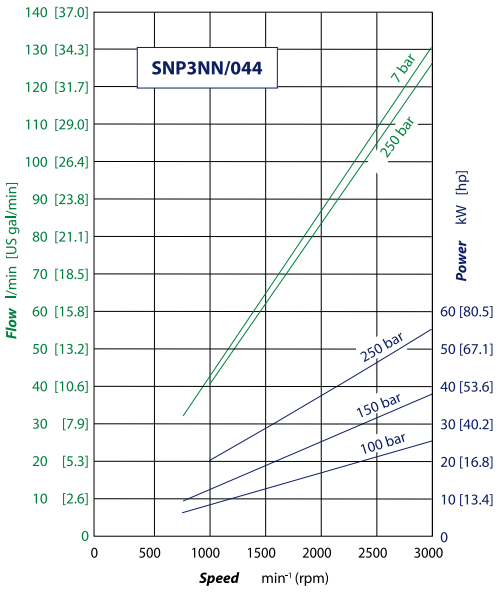


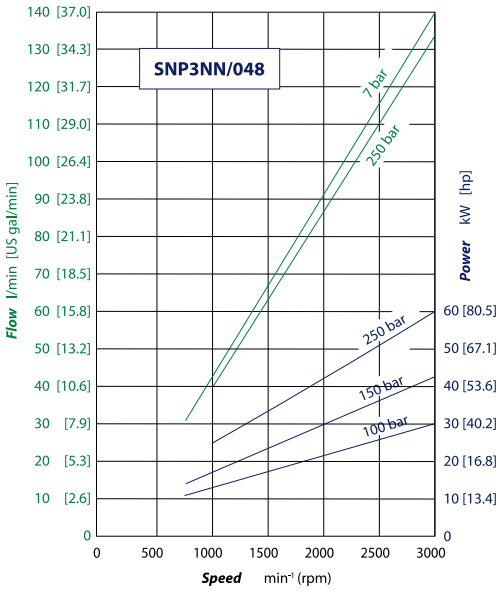


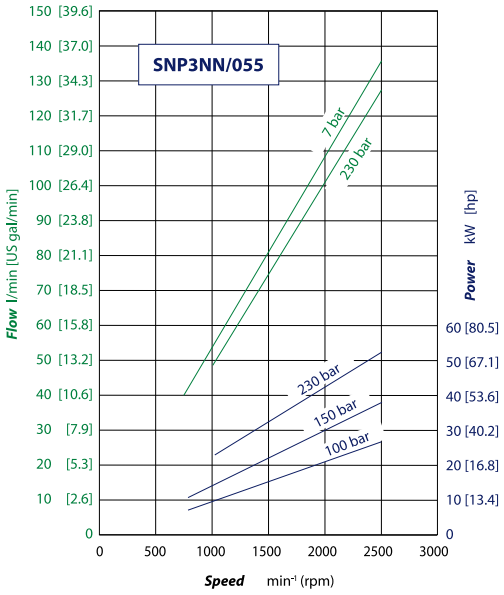


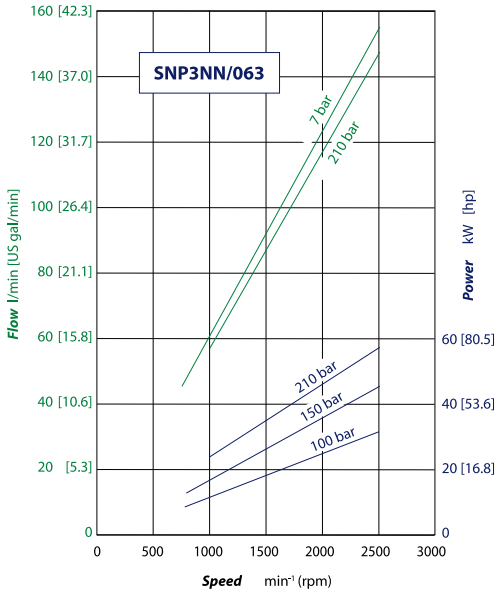


Pump Performance

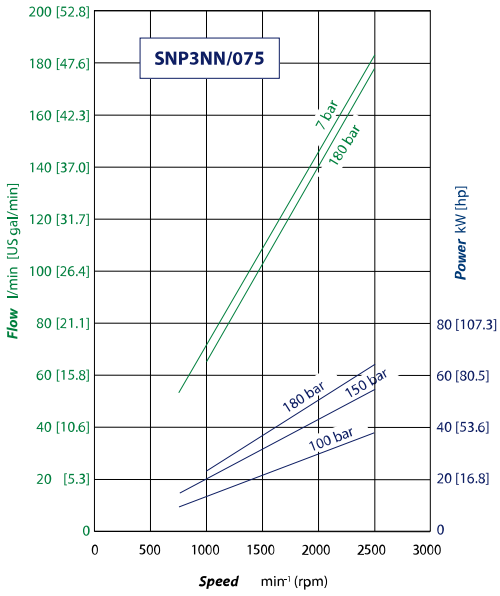


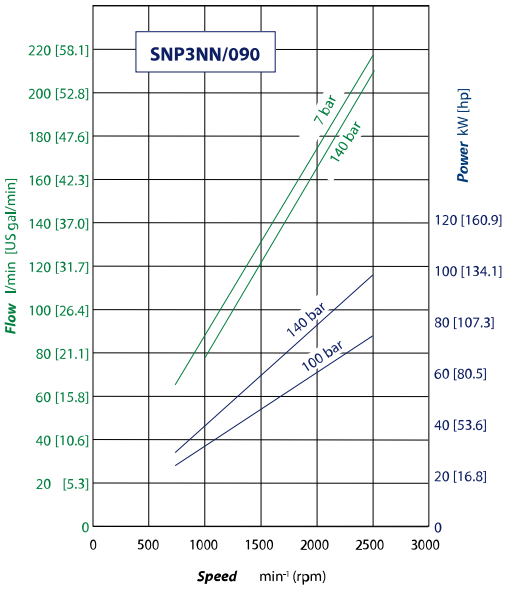






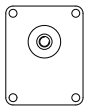
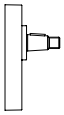
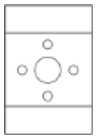
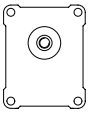
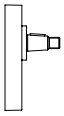
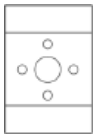
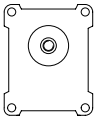
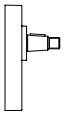
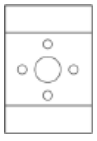
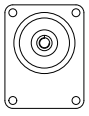
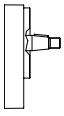
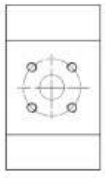
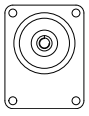
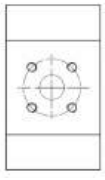
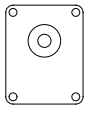
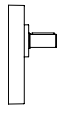
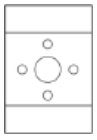
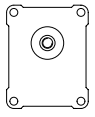
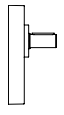
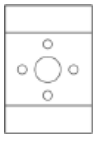
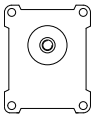
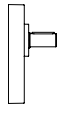
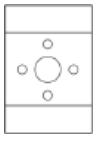
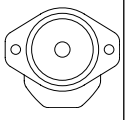
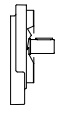
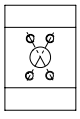
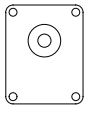
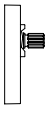
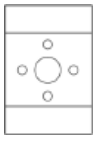
Pump Performance



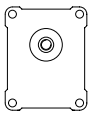
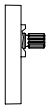
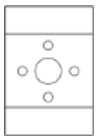
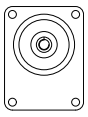
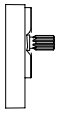
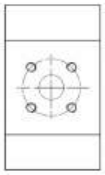
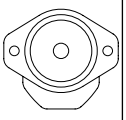
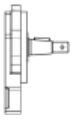
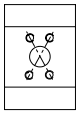
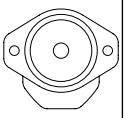
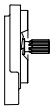
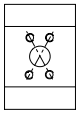
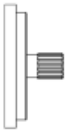
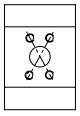
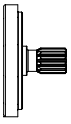
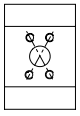
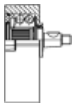
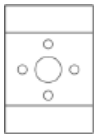
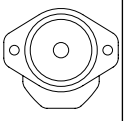
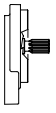
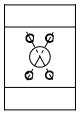


Product Options

Shaft, flange, and port configurations

Pump	Code	Flange		Shaft		Port	
SNP3NN	**01BA**	pilot Ø 50.8 mm [2.0 in] European 01, 4-bolt		1:8 tapered		European flanged port + pattern	
SNP3NN	**02BA**	pilot Ø 50.8 mm [2.0 in] European 02, 4-bolt		1:8 tapered		European flanged port + pattern	
SNP3NN	**03BB**	pilot Ø 60.3 mm [2.374 in] European 03, 4-bolt		1:8 tapered		European flanged port + pattern	
SNP3NN	**06AA**	pilot Ø 105 mm [4.133 in] German, 4-bolt		1:5 tapered		German std ports port X pattern	
SNP3NN	**06CA**	pilot Ø 105 mm [4.133 in] German, 4-bolt		Tang 8 x Ø 22,2		German std ports port X pattern	
SNP3NN	**01FA**	pilot Ø 50.8 mm [2.0 in] European 01 4-bolt		Ø 20 mm [0.787 in] parallel		European flanged port + pattern	
SNP3NN	**02FA**	pilot Ø 50.8 mm [2.0 in] European 02 4,- bolt		Ø 20 mm [0.787 in] parallel		European flanged port + pattern	
SNP3NN	**03FB**	pilot Ø 60.3 mm [2.374 in] European 03, 4-bolt		Ø 22 mm [0.866 in] parallel		European flanged port + pattern	
SNP3NN	**07GA**	pilot Ø 101.6 mm SAE B, 2-bolt		Ø 22.225 mm [0.875 in] parallel		Vertical four bolt flanged port	
SNP3NN	**01DA**	pilot Ø 50.8 mm [2.0 in] European 01, 4-bolt		Splined shaft 13T – m 1.60 DIN 5482 – B22 x 19		European flanged port + pattern	

Product Options

Pump	Code	Flange		Shaft		Port	
SNP3NN	**02DA**	pilot Ø 50.8 mm [2.0 in] European 02, 4-bolt		Splined shaft 13T – m 1.60 DIN 5482 – B22 x 19		European flanged port + pattern	
SNP3NN	**06DD**	pilot Ø 105 mm [4.133 in] German 4-bolt		Splined shaft 15T – m 1.60 DIN 5482 – B28 x 25		German std ports port X pattern	
SNP3NN	**07BC**	pilot Ø 101.6 SAE B, 2-bolt		1:8 tapered - 5/8 - 18 UNF - 2A		Vertical four bolt flanged port	
SNP3NN	**07SA**	pilot Ø 101.6 mm SAE B, 2-bolt		Splined shaft SAE J498 13T – 16/32DP		Vertical four bolt flanged port	
SNP3NN	**08RA**	pilot Ø 127 mm [5.0 in] SAE C, 4-bolt		Splined shaft SAE J498 14T - 12/24DP		Vertical four bolt flanged port	
SNP3NN	**09SB**	pilot Ø 82.55 mm [3.25 in] SAE A, 2-bolt		Splined shaft SAE J498 13T - 16/32DP		Vertical four bolt flanged port	
SNP3NN	**91BA**	Outrigger bearing with European four bolt flange Pilot Ø50,8		Taper 1:8 M14x1,5 key 4x7,5		European flanged port + pattern	
SNP3NN	**D7SA**	pilot Ø 101.6 mm [4.0 in] SAE B, 2-bolt, special for double shaft seal		Splined shaft SAE J498 13T - 16/32DP		Vertical four bolt flanged port	

Mounting flanges

Danfoss offers many types of industry standard mounting flanges. This table shows order codes for each available mounting flange and its intended use:

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/						•	•													/						

Code	Description
01	European 50.8 mm [2.0 in] 4-bolt
02	
03	European 60.3 mm [2.374 in] 4-bolt

Product Options

Code	Description
06	German 105 mm [4.134 in] 4-bolt
07/D7	SAE B 2-bolt
08	SAE C 4-bolt
09	SAE A-Pilot Ø82,55+2 holes

Shaft options

Direction is viewed facing the shaft. Group 3 pumps are available with a variety of splined, parallel, and tapered shaft ends. Not all shaft styles are available with all flange styles.

A							B			C	D	E		F		G		H		I		J	K	L		M			N	O
						/								•	•										/					

Shaft		Mounting flange code with maximum torque in Nm [lb•in]							
Code	**Description**	**01**	**02**	**03**	**06**	**07**	**08**	**09**	**D7**
AA	Taper 1:5-M16x1,5-Key 5				300				
BA	Taper 1:8-M14x1,5-Key 4	350	350						
BB	Taper 1:8-M16x1,5-Key 4,79			500					
BC	Taper 1:8-5/8-18UNF-2A-Key 6,375					300			
BD	Taper 1:8-M14x1,5-Key 4 + thd hole M8 - Special					300			
BP	Taper 1:8-5/8-18UNF-2A-Key 6,375 with NUT & WASHER (for SAE B flange)					300			
CA	Tang 8xØ22,2 - Special				90				
DA	DIN 5482 B22x19 L=24 (for flange 01)	290	290						
DD	DIN 5482 B28x25 L28 (for flange 06)				450				
FA	Parallel Ø20-Key 5x5 L30 (for flange 01-02)	210	210						
FB	Parallel Ø22-Key 5x5 L40 (for flange 03)			300					
GA	Parallel Ø22,225 x L25,4-Key 6,375x6,375 L25,4					230			
GB	Parallel Ø22,225xL25,4-Key 6,375x6,375x25,4+thd hole:1/4- 20UNC-2B					230			
GC	Parallel Ø22,225xL25,4-Key 6,375x6,375x25,4+thd hole:5/16- 18UNC-2B - Special					230			
SA	SAE J498-13T-16/32-SAE B					270			270
SB	SAE J498-13T-16/32-SAE A (for flange 09)							270	
RA	SAE J498-14T-12/24-SAE C-4 bolt (for flange 08)						400		
SH	SAE J498-15T-16/32-SAE B - Special					400			

Danfoss recommends mating splines conform to SAE J498 or DIN 5482. Danfoss external SAE splines have a flat root side fit with circular tooth thickness reduced by 0.127 mm [0.005 in] in respect to class 1 fit. Dimensions are modified to assure a clearance fit with the mating spline.

Product Options

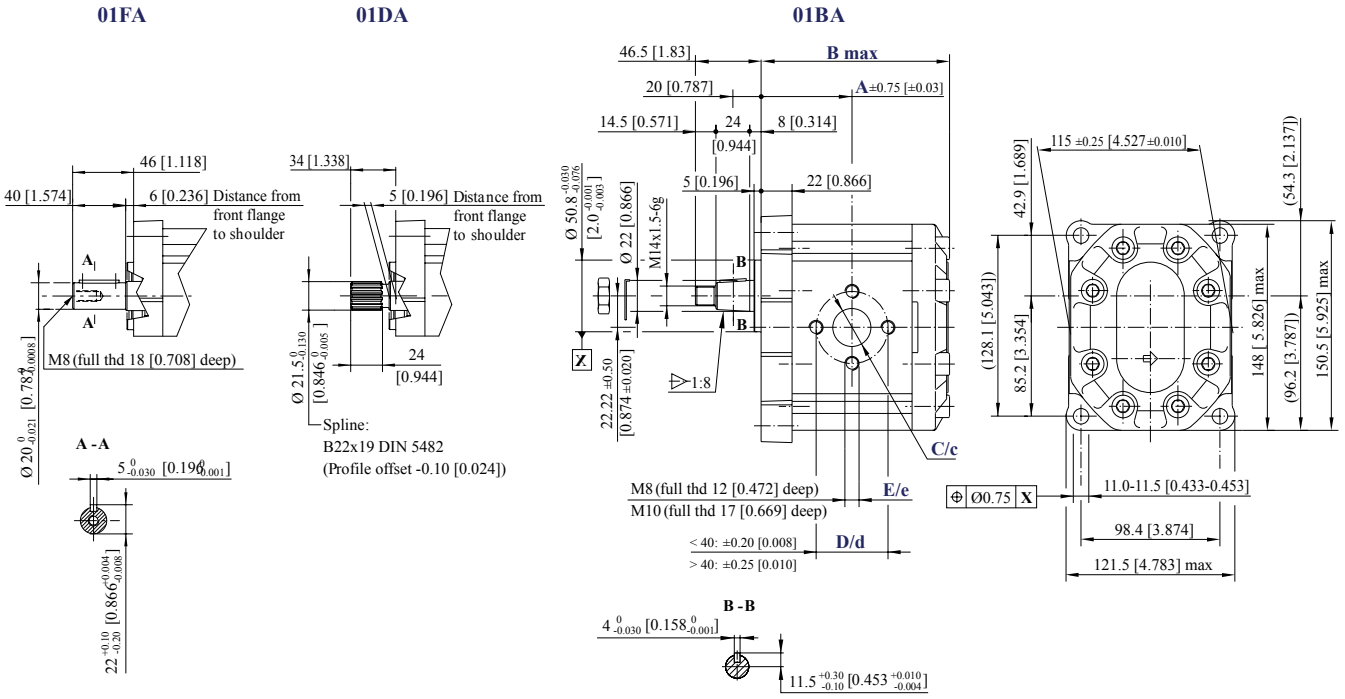
Caution

Shaft torque capability may limit allowable pressure. Torque ratings assume no external radial loading. Applied torque must not exceed these limits, regardless of stated pressure parameters. Maximum torque ratings are based on shaft torsional fatigue strength.

Dimensions

SNP3NN - 01FA, 01DA, 01BA

The drawing shows the SNP3NN standard porting for 01FA, 01DA and 01BA.



SNP3NN – 01FA, 01BA, 01DA

Frame size		022	026	033	038	044	048	055	063	075	090
Dimension	**A**	63 [2.480]	64.5 [2.539]	67 [2.637]	68.8 [2.708]	71 [2.795]	72.5 [2.854]	75 [2.952]	78 [3.07]	82 [3.228]	87 [3.425]
	B	132.5 [5.216]	135.5 [5.334]	140.5 [5.531]	144 [5.669]	148.5 [5.846]	151.5 [5.964]	156.5 [6.161]	162.5 [6.397]	170.5 [6.712]	180.5 [7.106]
Inlet	**C**	20 [0.787]		27 [1.063]				36 [1.417]			
	D	40 [1.575]		51 [2.007]				62 [2.441]			
	E	M8		M10							
Outlet	**c**	20 [0.787]				27 [1.063]					
	d	40 [1.575]				51 [2.001]					
	e	M8				M10					

Model code examples and maximum shaft torque

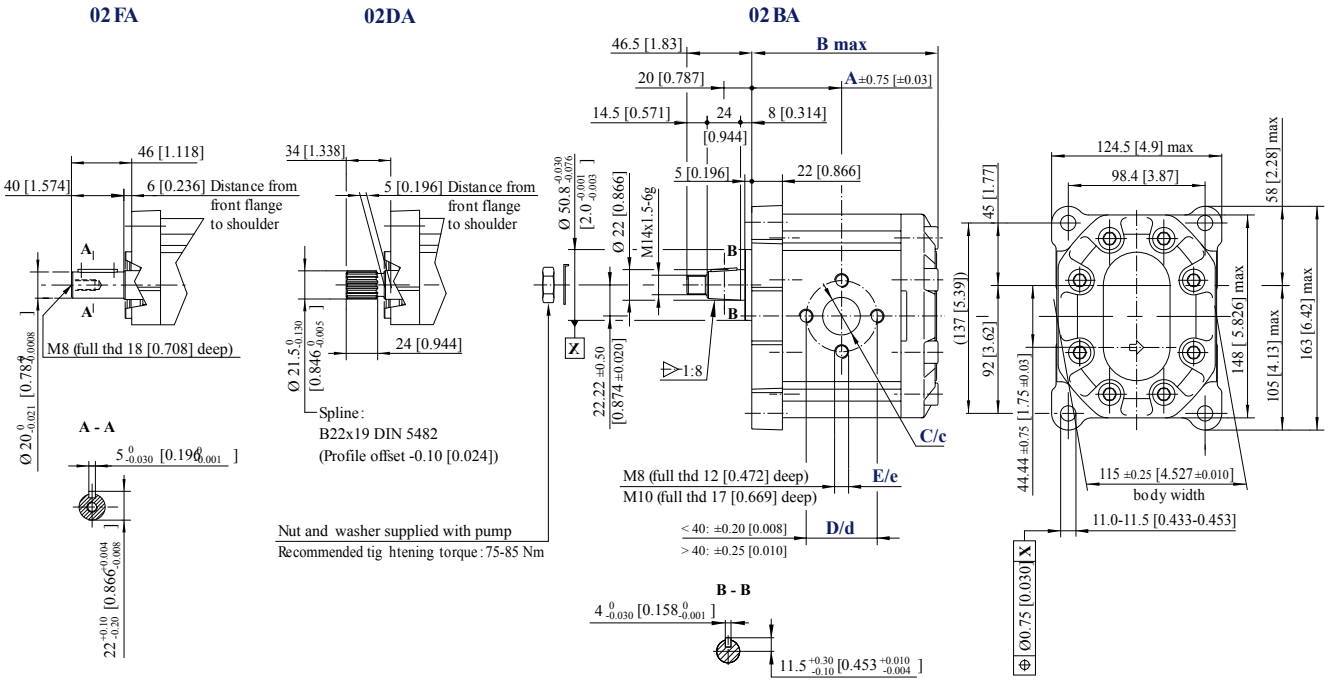
Flange/drive gear	Model code example	Maximum shaft torque
01DA	SNP3NN/075LN01DAP1CDCANNNN/NNNNN	290 N•m [2566 lb•in]
01FA	SNP3NN/033RN01FAP1CAC7NNNN/NNNNN	210 N•m [1858 lb•in]
01BA	SNP3NN/022RN01BAP1C7C7NNNN/NNNNN	350 N•m [3097 lb•in]

For further details on ordering, see *Model code* on page 8.

Dimensions

SNP3NN - 02FA,02DA and 02BA

This drawing shows the standard porting for 02FA, 02DA and 02BA.



SNP3NN - 02FA, 02DA AND 02BA dimensions

Frame size		022	026	033	038	044	048	055	063	075	090
Dimension	**A**	63 [2.480]	64.5 [2.539]	67 [2.637]	68.8 [2.708]	71 [2.795]	72.5 [2.854]	75 [2.952]	78 [3.07]	82 [3.228]	87 [3.425]
	B	132.5 [5.216]	135.5 [5.334]	140.5 [5.531]	144 [5.669]	148.5 [5.846]	151.5 [5.964]	156.5 [6.161]	162.5 [6.397]	170.5 [6.712]	180.5 [7.106]
Inlet	**C**	20 [0.787]		27 [1.063]				36 [1.417]			
	D	40 [1.575]		51 [2.007]				62 [2.441]			
	E	M8		M10							
Outlet	**c**	20 [0.787]				27 [1.063]					
	d	40 [1.575]				51 [2.001]					
	e	M8				M10					

Model code examples and maximum shaft torque

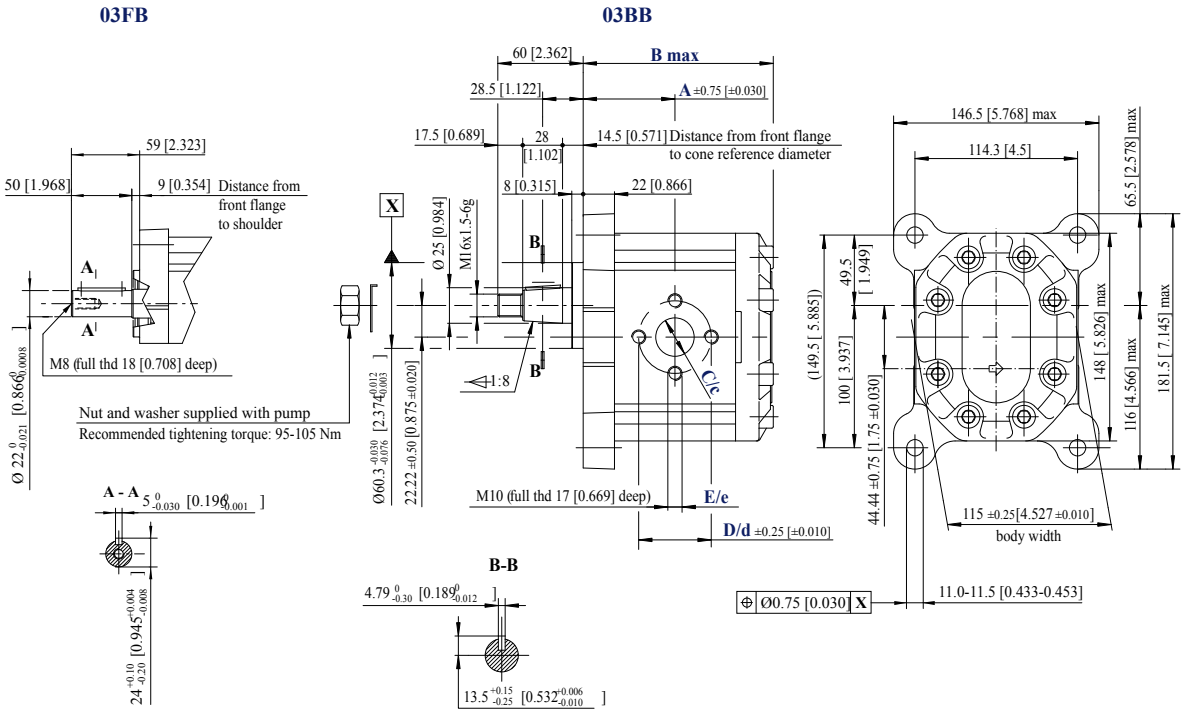
Flange/drive gear configuration	Model code example	Maximum shaft torque N•m [lb•in]
02FA	SNP3NN/044RN02FAP1CACANNNN/NNNNN	210 [1858]
02DA	SNP3NN/033RN02DAP1CAC7NNNN/NNNNN	290 [2566]
02BA	SNP3NN/026LN02BAP1C7C7NNNN/NNNNN	350 [3097]

For further details on ordering, see *Model code* on page 8.

Dimensions

SNP3NN - 03FB, 03BB

This drawing shows the standard porting for 03FB and 03BB.



SNP3NN – 03FB and 03BB dimensions

Type (displacement)		022	026	033	038	044	048	055	063	075	090
Dimension	**A**	63.0 [2.480]	64.5 [2.539]	67.0 [2.637]	68.8 [2.708]	71.0 [2.795]	72.5 [2.854]	75.0 [2.952]	78.0 [3.070]	82.0 [3.228]	87.0 [3.425]
	B	132.5 [5.216]	135.5 [5.334]	140.5 [5.531]	144.0 [5.669]	148.5 [5.846]	151.5 [5.964]	156.5 [6.161]	162.5 [6.397]	170.5 [6.712]	180.5 [7.106]
Inlet	**C**	20 [0.787]		27 [1.063]				36 [1.417]			
	D	40 [1.575]		51 [2.007]				62 [2.441]			
	E	M8		M10							
Outlet	**c**	20 [0.787]				27 [1.063]					
	d	40 [1.575]				51 [2.001]					
	e	M8				M10					

Model code examples and maximum shaft torque

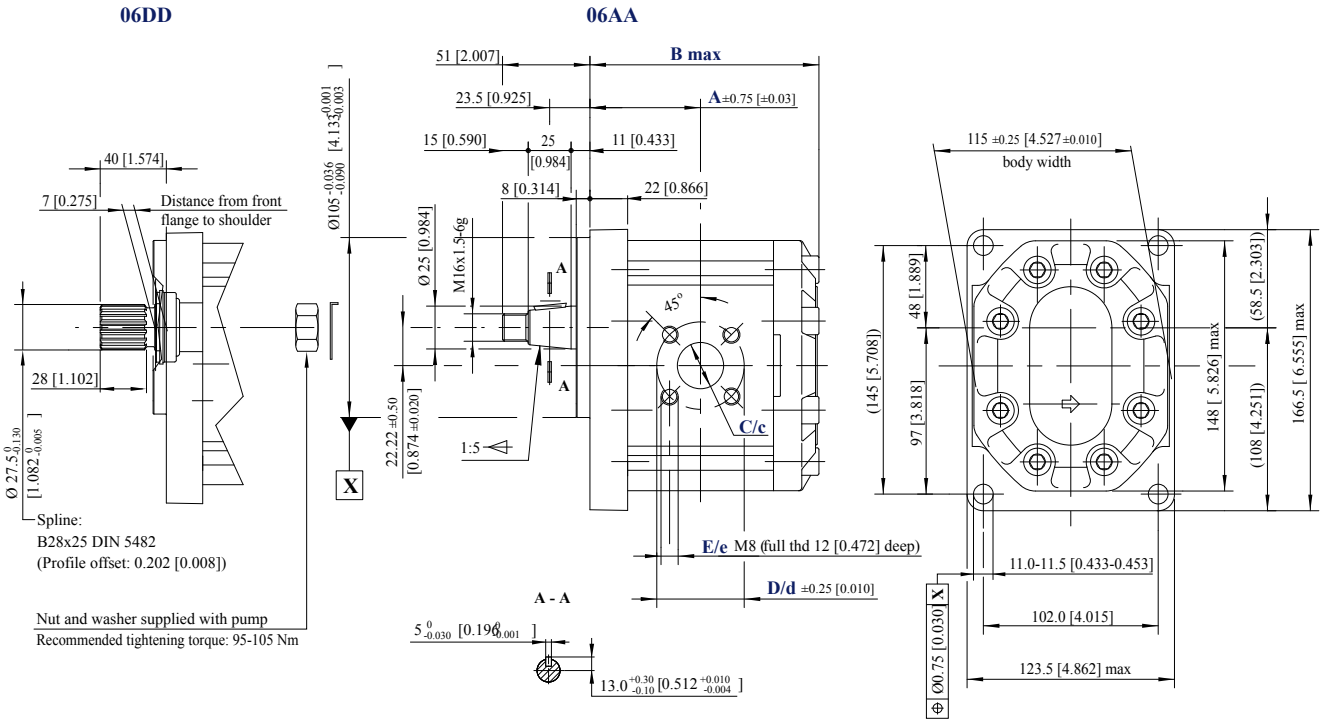
Flange/drive gear configuration	Model code example	Maximum shaft torque N•m [lb•in]
03FB	SNP3NN/044LN03FBP1CACANNNN/NNNNN	300 [2655]
03BB	SNP3NN/090RN03BBP1CDCANNNN/NNNNN	500 [4425]

For further details on ordering, see *Model code* on page 8.

Dimensions

SNP3NN - 06DD, 06AA

This drawing shows the standard porting for 06DD and 06AA.



SNP3NN – 06DD and 06AA dimensions

Type (displacement)		022	026	033	038	044	048	055	063	075	090
Dimension	**A**	63.0 [2.480]	64.5 [2.539]	67.0 [2.637]	68.8 [2.708]	71.0 [2.795]	72.5 [2.854]	75.0 [2.952]	78.0 [3.070]	82.0 [3.228]	87.0 [3.425]
	B	132.5 [5.216]	135.5 [5.334]	140.5 [5.531]	144.0 [5.669]	148.5 [5.846]	151.5 [5.964]	156.5 [6.161]	162.5 [6.397]	170.5 [6.712]	180.5 [7.106]
Inlet	**C**	27 [1.063]							36 [1.417]		
	D	55 [2.165]									
	E	M8									
Outlet	**c**	18 [0.708]							27 [1.063]		
	d	55 [2.165]									
	e	M8									

Model code examples and maximum shaft torque

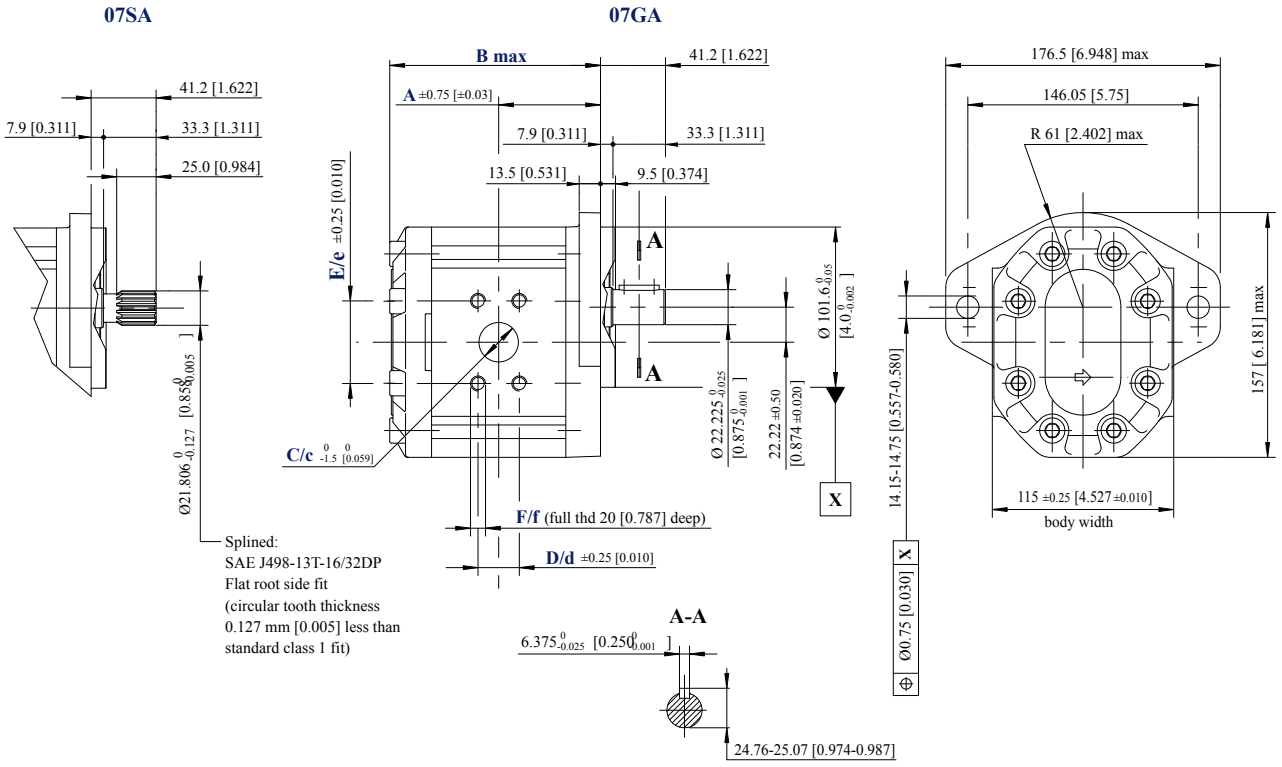
Flange/drive gear configuration	Model code example	Maximum shaft torque N•m [lb•in]
06DD	SNP3NN/044RN06DDP1BBBANNNN/NNNNN	450 [3982]
06AA	SNP3NN/026LN06AAP1BBBANNNN/NNNNN	300 [2655]

For further details on ordering, see *Model code* on page 8.

Dimensions

SNP3NN - 07SA, 07GA

The drawing shows the SNP3NN standard porting for 07SA and 07GA.



SNP3NN – 07SA and 07GA dimensions

Type (displacement)		022	026	033	038	044	048	055	063	075	090
Dimension	**A**	63.0 [2.480]	64.5 [2.539]	67.0 [2.637]	68.8 [2.708	71.0 [2.795]	72.5 [2.854]	75.0 [2.952]	78.0 [3.070]	82.0 [3.228]	87.0 [3.425]
	B	132.5 [5.216]	135.5 [5.334]	140.5 [5.531]	144.0 [5.669]	148.5 [5.846]	151.5 [5.964]	156.5 [6.161]	162.5 [6.397]	170.5 [6.712]	180.5 [7.106]
Inlet	**C**	25.4 [1]		31.8 [1.251]				38.1 [1.5]			
	D	26.19 [1.031]		30.18 [1.188]				35.71 [1.405]			
	E	52.37 [2.061]		58.72 [2.311]				69.85 [2.75]			
	F	3/8–16UNC–2B		7/16–14UNC–2B				½–13UNC–2B			
Outlet	**c**	19.1 [0.751]		25.4 [1.0]				31.8 [1.251]			
	d	22.23 [0.875]		26.19 [1.031]				30.18 [1.188]			
	e	47.63 [1.875]		52.37 [2.061]				58.72 [2.311]			
	f	3/8–16UNC–2B		3/8–16UNC–2B				7/16–14UNC–2B			

Model code examples and maximum shaft torque

Flange/drive gear configuration	Model code example	Maximum shaft torque N•m [lb•in]
07SA	SNP3NN/063LN07SAP1A5A4NNNN/NNNNN	270 [2389]
07GA	SNP3NN/026LN07GAP1A3A2NNNN/NNNNN	230 [2035]

For further details on ordering, see *Model code* on page 8.

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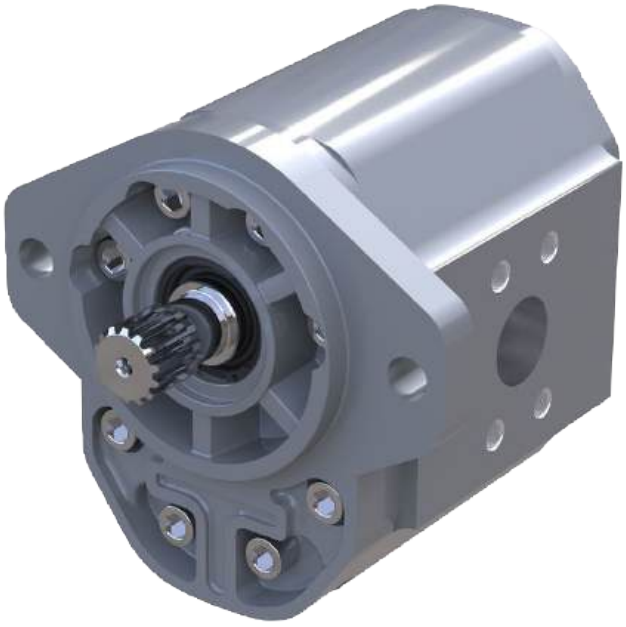
Technical Information

GearMe
Aluminum Group 4 Pump



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Revision history

Table of revisions

Date	Changed	Rev
February 2023	Fixed typo	0103
January 2023	Renamed product	0102
October 2019	First edition	0101

Contents

General Information

Overview

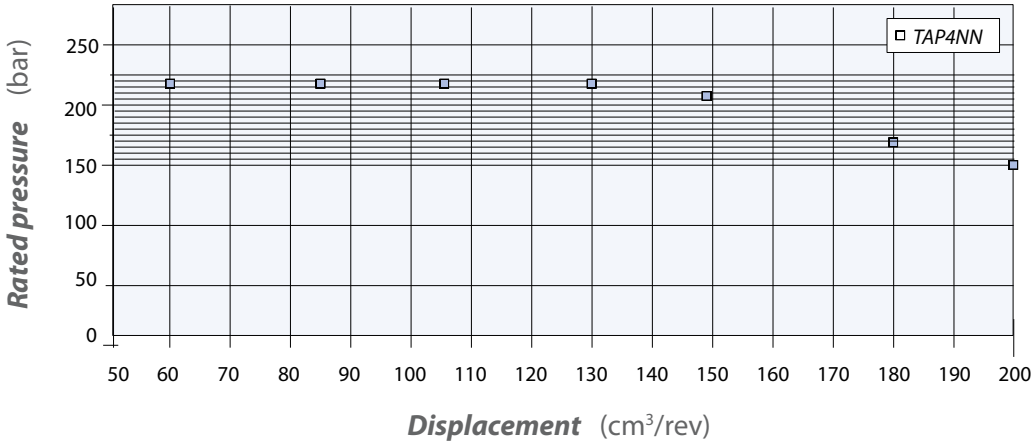
The Danfoss Group 4 is a range of peak performance fixed-displacement gear pumps. Constructed of a high-strength extruded aluminum body with aluminum cover and flange, all pumps are pressure-balanced for exceptional efficiency.

Group 4 gear pumps attributess

- Wide range of displacements from 60 to 200 cm^3/rev [from 3.66 to 12.2 in^3/rev]
- Continuous pressure rating up to 220 bar [3191 psi]
- Speeds up to 3000 min^{-1} (rpm)
- SAE and European standard mounting flanges
- High quality case hardened steel gears
- Multiple pump configurations in combination with SNP1NN, SNP2NN and SNP3NN

Pump displacements

Quick reference chart for pump displacements vs. rated pressure



General Information

Pump design

TAP4NN

The TAP4NN gear pump is available in a displacement range from 60.0 to 200.0 cm^3/ rev [from 3.66 to 12.2 in^3/rev]. Suitable for applications where the pressure is lower than 220 bar[3191 psi] continuous, the TAP4NN range is released into SAE and European configurations.

TAP4NN 01BA

Technical data for TAP4NN

TAP4NN pump model		Frame size						
		60	**85**	**106**	**130**	**148**	**180**	**200**
Displacement	cm^3/rev [in^3/rev]	58.0 [3.54]	83.3 [5.08]	103.4 [6.31]	126.1 [7.69]	143.8 [8.77]	174.1 [10.62]	194.3 [11.86]
Peak pressure	bar [psi]	230 [3335]	230 [3335]	230 [3335]	230 [3335]	220 [3190]	180 [2610]	160 [2320]
Rated pressure		220 [3190]	220 [3190]	220 [3190]	220 [3190]	210 [3045]	170 [2465]	150 [2175]
Minimum speed	min^{-1} (rpm)	650	650	600	550	500	500	480
Maximum speed		3000	3000	2500	2500′	2400	2400	2400
Weight	kg [lb]	13.45 [29.65]	14.4 [31.75]	14.9 [32.85]	15.75 [34.72]	17.2 [37.92]	17.25 [38.03]	18 [39.68]
Moment of inertia ofrotating components	x 10^{-6} kg•m^2 [x 10^{-6} lbf•ft^2]	682,7 16193,6	839 19901,1	965,2 22894,5	1106,5 26246,2	1216,4 28853,0	1216,4 28853,0	1530,3 36298,7
Theoretical flow at maximum speed	l/min [US gal/min]	174.0 [46.0]	249.9 [66.0]	258.5 [68.3]	315.2 [83.3]	345.1 [91.2]	417.8 [110.4]	466.3 [123.2]

Caution

The rated and peak pressure mentioned are for pumps with flanged ports only. When threaded ports are required a derated performance must be considered. To verify the compliance of an high pressure application with a threaded ports pump apply to a Danfoss representative.

General Information

Determination of nominal pump sizes

Use these formula to determine the nominal pump size for a specific application:

	Based on SI units	Based on US units
Output flow:	$Q = \frac{Vg \cdot n \cdot \eta_v}{1000}$ l/min	$Q = \frac{Vg \cdot n \cdot \eta_v}{231}$ [US gal/min]
Input torque:	$M = \frac{Vg \cdot \Delta p}{20 \cdot \pi \cdot \eta_m}$ N•m	$M = \frac{Vg \cdot \Delta p}{2 \cdot \pi \cdot \eta_m}$ [lbf•in]
Input power:	$P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t}$ kW	$P = \frac{M \cdot n}{63.025} = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t}$ [hp]

Vg =	Displacement per rev.	cm^3/rev [in^3/rev]
pHD =	Outlet pressure	bar [psi]
pND =	Inlet pressure	bar [psi]
Δp =	pHD – pND	bar [psi]
n =	Speed	min^{-1} (rpm)
ηv =	Volumetric efficiency	
ηm =	Mechanical (torque) efficiency	
ηt =	Overall efficiency (ηv • ηm)	

Product Code

Model code

A Family

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
•	•	•	•	•	•	/																				/					

TAP4NN	Group 4 pumps from 60 up to 200 cc

B Displacement

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/	•	•	•																	/					

060	58 cc
085	83,3 cc
106	103,4 cc
130	126,1 cc
148	143,8 cc
180	174,1 cc
200	194,3 cc

C Rotation

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/				•																/					

L	Left rotation
R	Right rotation

D Project version

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/					•															/					

N	Std Version of Project

E Mounting flange

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/						•	•													/					

Code	Description (Type of flange • Type of drive gear • Preferred ports for configuration)
01	European 4 bolt - Pilot Ø63,5
02	SAE C 2 bolt - Pilot Ø127
F1	European 4 bolt - Pilot Ø63,5 (special FIAT-ALLIS)

Product Code

F Drive gear

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/								•	•											/					

BA	Taper 1:8-M20x1,5-Key 6,375
DA	Spline DIN 5482 B35x31xL44
FA	Parallel Ø30-Key 8x7xL50
GA	Parallel Ø31,75-Key 7,962x7x36
RA	Splined-SAE J498-14T-12/24-SAE C 2 bolt

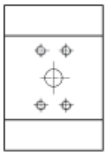
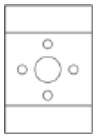
G Rear cover

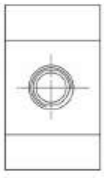
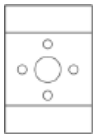
A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/										•	•									/					

P1	Standard cover for pump

H Inlet size; I Outlet size

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/												•	•	•	•					/					

A4	31x30,18x58,72x7/16-14UNC	
A5	37,5x35,71x69,85x1/2-13UNC	
A6	50x42,88x77,77x1/2-13UNC	
CB	30x56xM10	
CC	32x62xM10	
CD	36x62xM10	
CE	32x62xM12	
CF	38x72,5xM12	
CG	40x72,5xM12	
CH	45x72,5xM12	
CK	48x72,5xM12	
CL	56x92xM12	

F7	1-1/4 GAS	
F8	1-1/2 GAS	
F9	1-3/4 GAS	
GE	32x62x7/16-14UNC	
GF	38x72,5x1/2-13UNC	
GK	48x72,5x1/2-13UNC	

Product Code

J Ports positions & Special body

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																•	•			/						

NN	Std position from cataloge
SD	Body width side ports=151mm (Std for 02 Flange)
G9	Ports distance from flange=79 - Special
I5	Ports distance from flange =95 - Special
L0	Ports distance from flange =100 - Special
LI	Ports distance from flange =104,5 - Special

K Seals

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																		•		/						

N	Standard NBR seals

L Screws

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																			•	/						

N	Std burnished screws

M Set valve

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																				/	•	•	•			

NNN	No valve

N Type mark

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																				/				•	

N	Standard Danfoss Marking
A	Standard Danfoss Marking+Customer Code
Z	Without Marking

O Mark position

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/																				/					•

N	Std Marking position (on top)
A	Special Marking position on the bottom

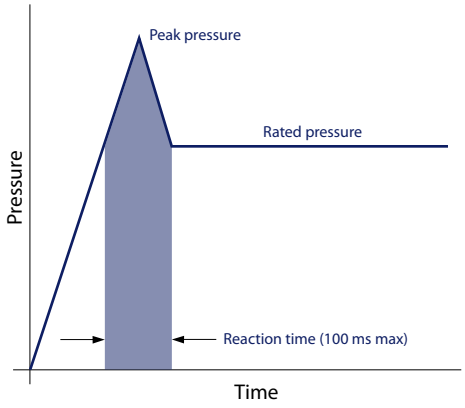
System Requirements

Pressure

The inlet vacuum must be controlled in order to realize expected pump life and performance. The system design must meet inlet pressure requirements during all modes of operation. Expect lower inlet pressures during cold start. It should improve quickly as the fluid warms.

Max. continuous vacuum	bar abs. [in. Hg]	0.8 [23.6]
Max. intermittent vacuum		0.6 [17.7]
Max. pressure		4.0 [118.1]

Peak pressure is the highest intermittent pressure allowed. The relief valve overshoot (reaction time) determines peak pressure. It is assumed to occur for less than 100 ms. The accompanying illustration shows peak pressure in relation to rated pressure and reaction time (100 ms maximum).



Rated pressure is the average, regularly occurring, operating pressure that should yield satisfactory product life. The maximum machine load demand determines rated pressure. For all systems, the load should move below this pressure.

System pressure is the differential of pressure between the outlet and inlet ports. It is a dominant operating variable affecting hydraulic unit life. High system pressure, resulting from high load, reduces expected life. System pressure must remain at, or below, rated pressure during normal operation to achieve expected life.

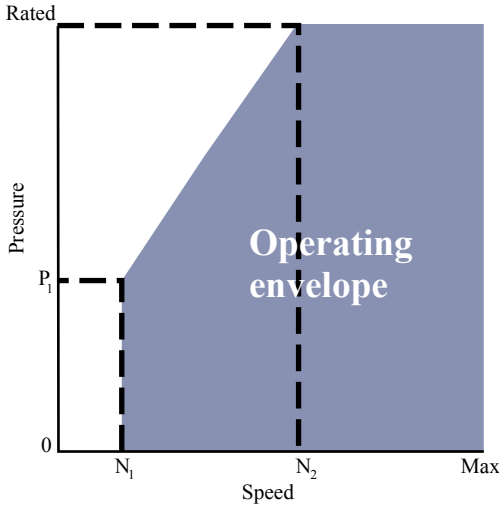
Speed

Maximum speed is the limit recommended by Danfoss for a particular gear pump when operating at rated pressure. It is the highest speed at which normal life can be expected.

The lower limit of operating speed is the **minimum speed**. It is the lowest speed at which normal life can be expected. The minimum speed increases as operating pressure increases. When operating under higher pressures, a higher minimum speed must be maintained, as illustrated here.

System Requirements

Speed versus pressure



Where:

N_1 = Minimum speed at 100 bar

N_2 = Minimum speed at 180 bar

Hydraulic fluids

Ratings and data for TAP4NN gear pumps are based on operating with premium hydraulic fluids containing oxidation, rust, and foam inhibitors. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion, and corrosion of internal components. They include:

- Hydraulic fluids following DIN 51524, part 2 (HLP) and part 3 (HVLP) specifications
- API CD engine oils conforming to SAE J183
- M2C33F or G automatic transmission fluids
- Certain agricultural tractor fluids

Use only clean fluid in the pump and hydraulic circuit.

Caution

Never mix hydraulic fluids.

Temperature and viscosity

Temperature and viscosity requirements must be concurrently satisfied. Use petroleum / mineral-based fluids.

High temperature limits apply at the inlet port to the pump. The pump should run at or below the maximum continuous temperature. The peak temperature is based on material properties. Don't exceed it.

Cold oil, generally, doesn't affect the durability of pump components. It may affect the ability of oil to flow and transmit power. For this reason, keep the temperature at 16 °C [60 °F] above the pour point of the hydraulic fluid.

Minimum (cold start) temperature relates to the physical properties of component materials.

Minimum viscosity occurs only during brief occasions of maximum ambient temperature and severe duty cycle operation. You will encounter maximum viscosity only at cold start. During this condition, limit speeds until the system warms up. Size heat exchangers to keep the fluid within these limits. Test regularly to verify that these temperatures and viscosity limits aren't exceeded. For maximum unit efficiency and bearing life, keep the fluid viscosity in the recommended viscosity range.

System Requirements

Fluid viscosity

Maximum (cold start)	mm^2/s [SUS]	1000 [1600]
Recommended range		12-60 [66-290]
Minimum		10 [60]

Temperature (with standard NBR seals)

Minimum (cold start)	°C [°F]	-20 [-4]
Maximum continuous		80 [176]
Peak (intermittent)		90 [194]

Filtration

Filters

Use a filter that conforms to Class 22/18/13 of ISO 4406 (or better). It may be on the pump outlet (pressure filtration), inlet (suction filtration), or reservoir return (return-line filtration).

Selecting a filter

When selecting a filter, please consider:

- contaminant ingression rate (determined by factors such as the number of actuators used in the system)
- generation of contaminants in the system
- required fluid cleanliness
- desired maintenance interval
- filtration requirements of other system components

Measure filter efficiency with a Beta ratio (β_X). For:

- suction filtration, with controlled reservoir ingression, use a $\beta_{35-45} = 75$ filter
- return or pressure filtration, use a pressure filtration with an efficiency of $\beta_{10} = 75$

β_x ratio is a measure of filter efficiency defined by ISO 4572. It is the ratio of the number of particles greater than a given diameter ("$_X$" in microns) upstream of the filter to the number of these particles downstream of the filter.

Fluid cleanliness level and β_x ratio

Fluid cleanliness level (per ISO 4406)	Class 22/18/13 or better
β_x ratio (suction filtration)	$\beta_{35-45} = 75$ and $\beta_{10} = 2$
β_x ratio (pressure or return filtration)	$\beta_{10} = 75$
Recommended inlet screen size	100-125 µm [0.004-0.005 in]

The filtration requirements for each system are unique. Evaluate filtration system capacity by monitoring and testing prototypes.

Reservoir

The **reservoir** provides clean fluid, dissipates heat, removes entrained air, and allows fluid volume changes associated with fluid expansion and cylinder differential volumes. A correctly sized reservoir accommodates maximum volume changes during all system operating modes. It promotes deaeration of the fluid as it passes through, and accommodates a fluid dwell-time between 60 and 180 seconds, allowing entrained air to escape.

System Requirements

Minimum reservoir capacity depends on the volume required to cool and hold the oil from all retracted cylinders, allowing for expansion due to temperature changes. A fluid volume of 1 to 3 times the pump output flow (per minute) is satisfactory. The minimum reservoir capacity is 125% of the fluid volume.

Install the suction line above the bottom of the reservoir to take advantage of gravity separation and prevent large foreign particles from entering the line. Cover the line with a 100-125 micron screen. The pump should be below the lowest expected fluid level. Put the return-line below the lowest expected fluid level to allow discharge into the reservoir for maximum dwell and efficient deaeration. A baffle (or baffles) between the return and suction lines promotes deaeration and reduces fluid surges.

Line sizing

Choose pipe sizes that accommodate minimum fluid velocity to reduce system noise, pressure drops, and overheating. This maximizes system life and performance.

Design inlet piping that maintains continuous pump inlet pressure above 0.8 bar absolute during normal operation. The line velocity should not exceed the values in this table:

Maximum line velocity

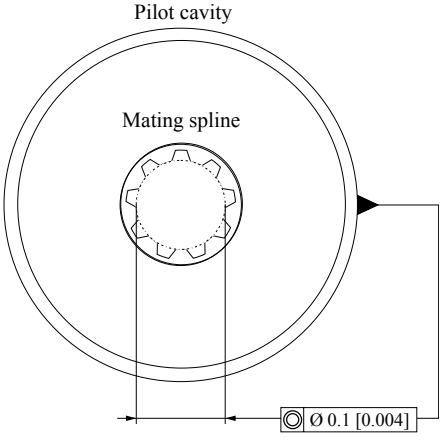
Inlet	m/s [ft/sec]	2.5 [8.2]
Outlet		5.0 [16.4]
Return		3.0 [9.8]

Most systems use hydraulic oil containing 10% dissolved air by volume. Under high inlet vacuum conditions the oil releases bubbles. They collapse when subjected to pressure, resulting in cavitation, causing adjacent metal surfaces to erode. **Over-aeration** is the result of air leaks on the inlet side of the pump, and flow-line restrictions. These include inadequate pipe sizes, sharp bends, or elbow fittings, causing a reduction of flow line cross sectional area. This problem will not occur if inlet vacuum and rated speed requirements are maintained, and reservoir size and location are adequate.

Pump drive

Shaft options for Group 4 gear pumps include tapered, splined, or parallel shafts. They are suitable for a wide range of direct and indirect drive applications for radial and thrust loads.

Plug-in drives, acceptable only with a splined shaft, can impose severe radial loads when the mating spline is rigidly supported. Increasing spline clearance does not alleviate this condition.



Use **plug-in drives** if the concentricity between the mating spline and pilot diameter is within 0.1 mm [0.004 in]. Lubricate the drive by flooding it with oil. A 3-piece coupling minimizes radial or thrust shaft loads.

System Requirements

Caution

In order to avoid spline shaft damages it is recommended to use carburized and hardened steel couplings with 80-82 HRA surface hardness.

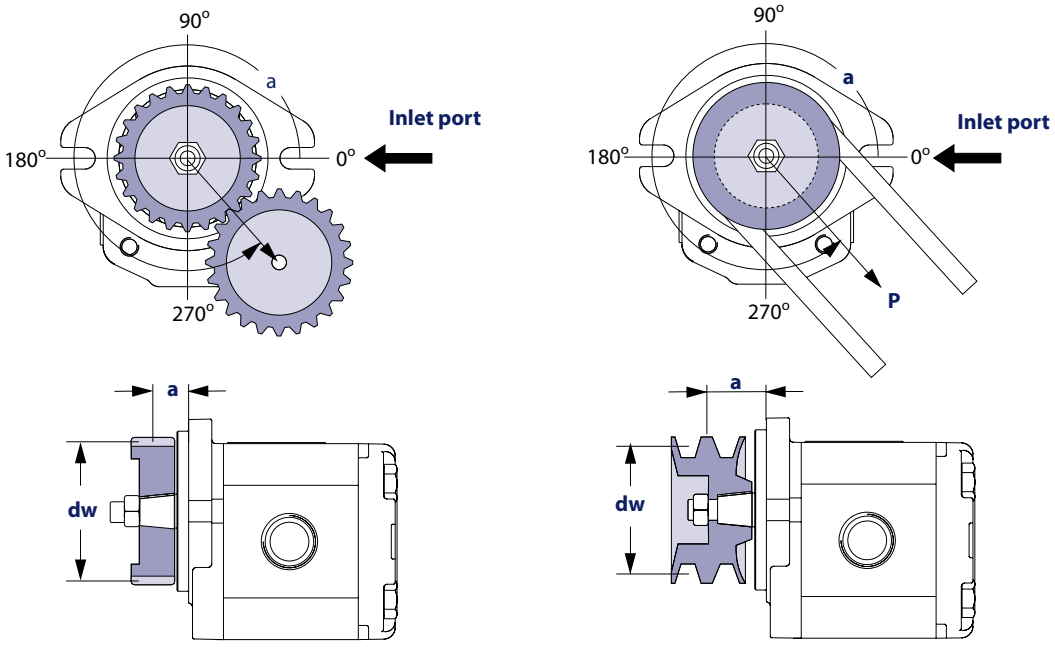
Allowable **radial shaft loads** are a function of the load position, load orientation, and operating pressure of the hydraulic pump. All external shaft loads have an effect on bearing life, and may affect pump performance.

In applications where external shaft loads can't be avoided, minimize the impact on the pump by optimizing the orientation and magnitude of the load. Use a tapered input shaft; don't use splined shafts for belt or gear drive applications. A spring-loaded belt tension-device is recommended for belt drive applications to avoid excessive tension. Avoid thrust loads in either direction.

Pump drive data form

Contact Danfoss if continuously applied external radial or thrust loads occur. Fill out this page and send the complete form to your Danfoss representative for an assistance in applying pumps with belt or gear drive. This illustration shows a pump with counterclockwise orientation:

Optimal radial load position



Application data

Item		Value	Unit
Pump displacement			cm^3/rev [in^3/rev]
Rated system pressure			bar psi
Relief valve setting			
Pump shaft rotation			left right
Pump minimum speed			min^{-1} (rpm)
Pump maximum speed			
Drive gear helix angle (gear drive only)			degree
Belt type (gear drive only)			V notch
Belt tension (gear drive only)	**P**		N lbf

System Requirements

Application data (continued)

Item		Value	Unit
Angular orientation of gear or belt to inlet port	**α**		degree
Pitch diameter of gear or pulley	**dw**		mm in
Distance from flange to center of gear or pulley	**a**		

Pump Life

Pump life is a function of speed, system pressure, and other system parameters (such as fluid quality and cleanliness).

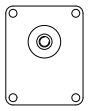
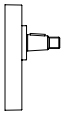
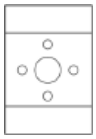
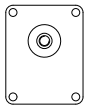
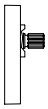
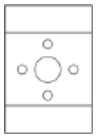
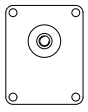
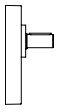
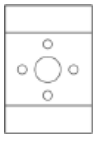
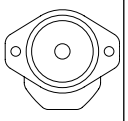
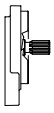
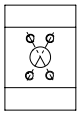
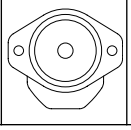
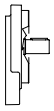
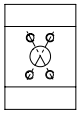
All Danfoss gear pumps use hydrodynamic journal bearings that have an oil film maintained between the gear/shaft and bearing surfaces at all times. If the oil film is sufficiently sustained through proper system maintenance and operating within recommended limits, long life can be expected.

B_{10} life expectancy number is generally associated with rolling element bearings. It does not exist for hydrodynamic bearings.

High pressure, resulting from high loads, impacts pump life. When submitting an application for review, provide machine duty cycle data that includes percentages of time at various loads and speeds. We strongly recommend a prototype testing program to verify operating parameters and their impact on life expectancy before finalizing any system design.

Product Options

Shaft, flange, and port configurations

Motor	Code	Flange		Shaft		Port	
TAP4NN	**01BA**	pilot Ø 63.5 mm [2.5 in] European 01, 4-bolt		1:8 tapered		European flanged port + pattern	
TAP4NN	**01DA**	pilot Ø 63.5 mm [2.5 in] European 01, 4-bolt		Spline DIN 5482 B35x31xL44		European flanged port + pattern	
TAP4NN	**01FA**	pilot Ø 63.5 mm [2.5 in] European 01, 4-bolt		Parallel Ø30-Key 8x7xL50		European flanged port + pattern	
TAP4NN	**02RA**	pilot Ø 127 mm [5.0 in] SAE C, 2-bolt		Splined-SAE J498-14T		Vertical four bolt flanged port	
TAP4NN	**02GA**	pilot Ø 127 mm [5.0 in] SAE C, 2-bolt		Parallel Ø31,75-Key 7,962x7x36		Vertical four bolt flanged port	

Mounting flanges

Danfoss offers many types of industry standard mounting flanges. This table shows order codes for each available mounting flange and its intended use:

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/						•	•													/					

Code	Description
01	European 4 bolt - PilotØ63,5
02	SAE C 2 bolt - Pilot Ø127
F1	European 4 bolt - Pilot Ø63,5 (special FIAT-ALLIS)

Shaft options

Direction is viewed facing the shaft. Group 4 pumps are available with a variety of splined, parallel, and tapered shaft ends. Not all shaft styles are available with all flange styles.

A							B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/								•	•											/					

Shaft		Mounting flange code with maximum torque in Nm [lb•in]	
Code	**Description**	**01**	**02**
BA	Taper 1:8-M20x1,5-Key 6,375	970 [8585]	
DA	Spline DIN 5482 B35x31xL44	850 [7523]	

Product Options

Shaft		Mounting flange code with maximum torque in Nm [lb•in]	
Code	**Description**	**01**	**02**
FA	Parallel Ø30-Key 8x7xL50	710 [6284]	
GA	Parallel Ø31,75-Key 7,962x7x36		750 [6638]
RA	Splined-SAE J498-14T-12/24-SAE C 2 bolt		800 [7080]

Danfoss recommends mating splines conform to SAE J498 or DIN 5482. Danfoss external SAE splines have a flat root side fit with circular tooth thickness reduced by 0.127 mm [0.005 in] in respect to class 1 fit. Dimensions are modified to assure a clearance fit with the mating spline.

Caution

Shaft torque capability may limit allowable pressure. Torque ratings assume no external radial loading. Applied torque must not exceed these limits, regardless of stated pressure parameters. Maximum torque ratings are based on shaft torsional fatigue strength.

Port configurations

Various port configurations are available on Group 4 pumps. They include:

- SAE split flange ports
- European standard flanged ports
- Gas threaded ports (BSPP)

For a table of dimensions see *Porting* on page 18.

Available port configurations

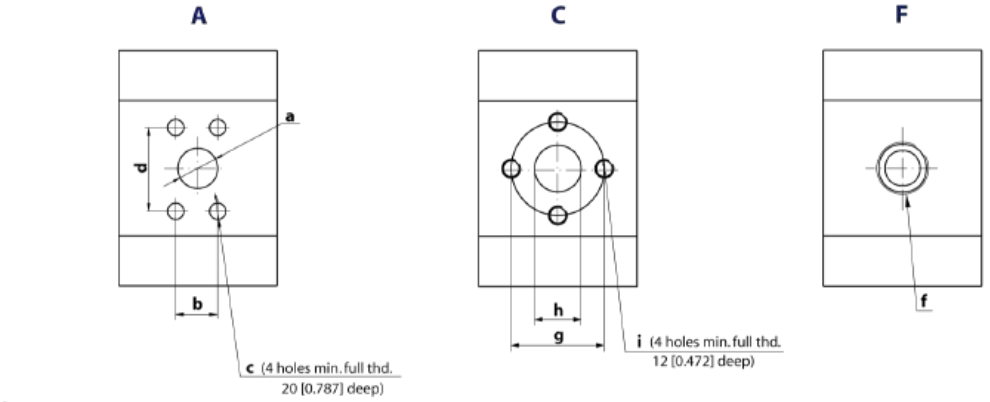
A								B			C	D	E		F		G		H		I		J		K	L		M			N	O
						/													•	•	•	•					/						

Code	Description	
A4	31x30,18x58,72x7/16-14UNC	SAE flanged port
A5	37,5x35,71x69,85x1/2-13UNC	
A6	50x42,88x77,77x1/2-13UNC	
CB	30x56xM10	Flanged port with thd holes in + pattern
CC	32x62xM10	
CD	36x62xM10	
CE	32x62xM12	
CF	38x72,5xM12	
CG	40x72,5xM12	
CH	45x72,5xM12	
CK	48x72,5xM12	
CL	56x92xM12	
F7	1-1/4 GAS	Threaded GAS (BSPP)
F8	1-1/2 GAS	
F9	1-3/4 GAS	

Product Options

GE	32x62x7/16-14UNC	Flanged port with the holes in + pattern UN thread
GF	38x72,5x1/2-13UNC	
GK	48x72,5x1/2-13UNC	

Porting



Ports dimensions

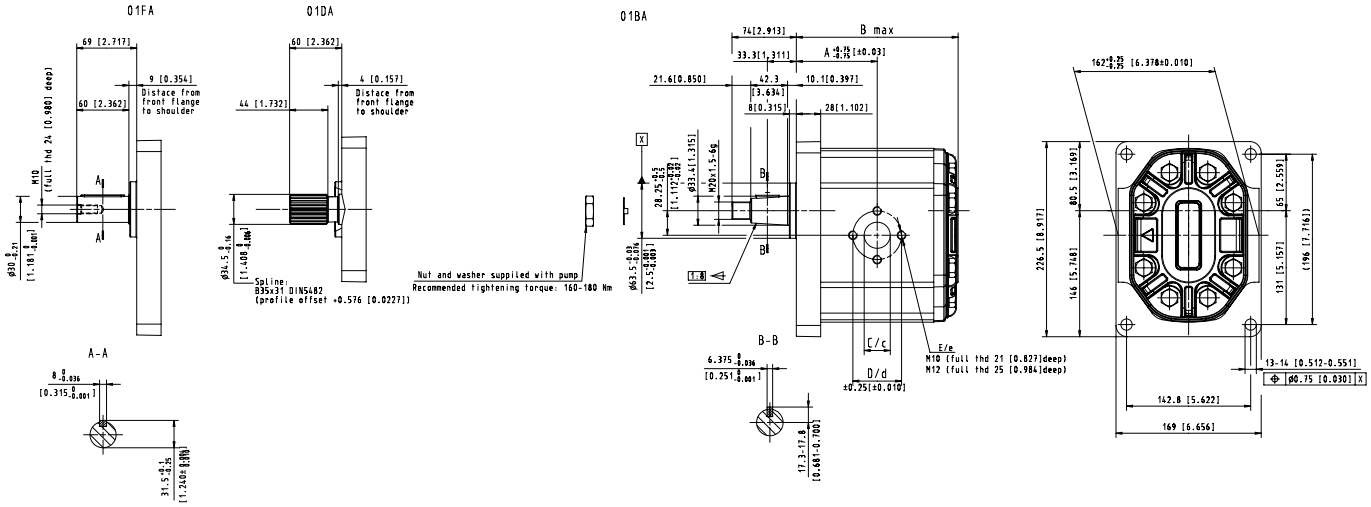
Port type			**A**				**C**			**E**
Dimensions			**a**	**b**	**d**	**c**	**g**	**h**	**i**	**f**
Type (displacement)	**060**	Inlet	38.1 [1.5]	35.71 [1.4]	69.85 [2.75]	1/2 -13 UNC	62 [2.44]	36 [1.42]	M10	1-1/2 Gas (BSPP)
		Outlet	31.8 [1.25]	30.18 [1.19]	58.72 [2.31]	7/16 - 14UNC	56 [2.2]	30 [1.18]	M10	1-1/4 Gas (BSPP)
	085	Inlet	38.1 [1.5]	35.71 [1.4]	69.85 [2.75]	1/2 -13 UNC	62 [2.44]	36 [1.42]	M10	1-1/2 Gas (BSPP)
		Outlet	31.8 [1.25]	30.18 [1.19]	58.72 [2.31]	7/16 - 14UNC	56 [2.2]	30 [1.18]	M10	1-1/4 Gas (BSPP)
	106	Inlet	50.8 [2.0]	42.88 [1.69]	77.77 [3.06]	1/2 -13 UNC	62 [2.44]	36 [1.42]	M10	1-1/2 Gas (BSPP)
		Outlet	38.1 [1.5]	35.71 [1.4]	69.85 [2.75]	1/2 -13 UNC	56 [2.2]	30 [1.18]	M10	1-1/4 Gas (BSPP)
	130	Inlet	50.8 [2.0]	42.88 [1.69]	77.77 [3.06]	1/2 -13 UNC	72.5 [2.85]	45 [1.77]	M12	1-3/4 Gas (BSPP)
		Outlet	38.1 [1.5]	35.71 [1.4]	69.85 [2.75]	1/2 -13 UNC	62 [2.44]	36 [1.42]	M10	1-1/2 Gas (BSPP)
	148	Inlet	50.8 [2.0]	42.88 [1.69]	77.77 [3.06]	1/2 -13 UNC	72.5 [2.85]	45 [1.77]	M12	1-3/4 Gas (BSPP)
		Outlet	38.1 [1.5]	35.71 [1.4]	69.85 [2.75]	1/2 -13 UNC	62 [2.44]	36 [1.42]	M10	1-1/2 Gas (BSPP)
	180	Inlet	50.8 [2.0]	42.88 [1.69]	77.77 [3.06]	1/2 -13 UNC	92 [3.62]	56 [2.2]	M12	N/A
		Outlet	38.1 [1.5]	35.71 [1.4]	69.85 [2.75]	1/2 -13 UNC	72.5 [2.85]	45 [1.77]	M12	N/A
	200	Inlet	50.8 [2.0]	42.88 [1.69]	77.77 [3.06]	1/2 -13 UNC	92 [3.62]	56 [2.2]	M12	N/A
		Outlet	38.1 [1.5]	35.71 [1.4]	69.85 [2.75]	1/2 -13 UNC	72.5 [2.85]	45 [1.77]	M12	N/A

Dimensions

TAP4NN - 01FA, 01DA, and 01BA

The drawing shows the TAP4NN standard porting for 01FA, 01DA and 01BA.

mm
[in]



TAP4NN – 01FA, 01DA, 01BA dimensions

Frame size		060	085	106	130	148	180	200
Dimension	**A**	84 [3.3]	89 [3.5]	93 [3.66]	97.5 [3.84]	101 [3.98]	107 [4.21]	111 [4.37]
	B	168 [6.61]	178 [7.0]	186 [7.32]	195 [7.68]	202 [7.95]	214 [8.42]	222 [8.74]
Inlet	**C**	36 [1.42]			45 [1.77]		56 [2.2]	
	D	62 [2.44]			72.5 [2.85]		92 [3.62]	
	E	M10			M12		M12	
Outlet	**c**	30 [1.18]			36 [1.42]		45 [1.77]	
	d	56 [2.2]			62 [2.44]		72.5 [2.85]	
	e	M10			M10		M12	

Model code examples and maximum shaft torque

Flange/drive gear	Model code example	Maximum shaft torque
01DA	TAP4NN/106LN01DAP1CDCBNNNN/NNNNN	850 [7523]
01FA	TAP4NN/148RN01FAP1CHCDNNNN/NNNNN	710 [6284]
01BA	TAP4NN/180RN01BAP1CLCH NNNN/NNNNN	970 [8585]

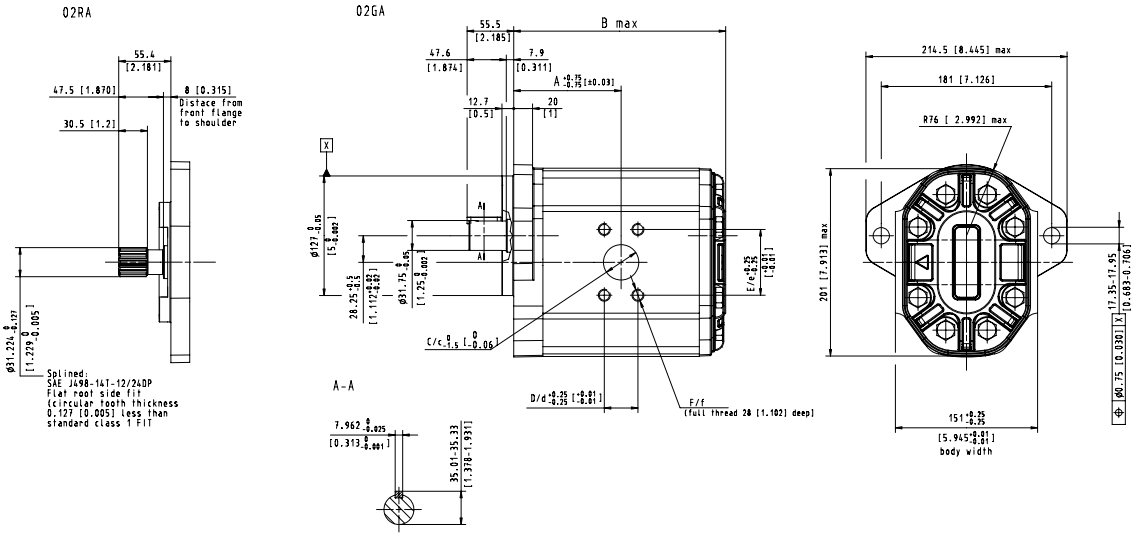
For further details on ordering, see *Model code* on page 7.

Dimensions

TAP4NN - 02RA, and 02GA

This drawing shows the standard porting for 02RA and 02GA.

mm
[in]



TAP4NN – 02RA, 02GA dimensions

Frame size		060	085	106	130	148	180	200
Dimension	**A**	87 [3.42]	92 [3.62]	96 [3.78]	100.5 [3.96]	104 [4.1]	110 [4.33]	114 [4.49]
	B	171 [6.73]	181 [7.13]	189 [7.44]	198 [7.79]	205 [8.07]	217 [8.54]	225 [8.86]
Inlet	**C**	38.1 [1.5]		50.8 [2.0]				
	D	35.71 [1.4]		42.88 [1.69]				
	E	69.85 [2.75]		77.77 [3.06]				
	F	1/2-13UNC		1/2-13UNC				
Outlet	**c**	31.8 [1.25]		38.1 [1.5]				
	d	30.18 [1.19]		35.71 [1.4]				
	e	58.72 [2.31]		69.85 [2.75]				
	f	7/16-14UNC		1/2-13UNC				

Flange/drive gear configuration	Model code example	Maximum shaft torque N•m [lb•in]
02RA	TAP4NN/060RN02RAP1A5A4SDNN/NNNNN	800 [7080]
02GA	TAP4NN/130LN02GAP1A6A5SDNN/NNNNN	750 [6638]

For further details on ordering, see *Model code* on page 7.

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