

## GEAR PUMPS

### Group 0 and Group 1 | Technical Information





## History of revisions

Date	Page	Changed	Rev.
24, June 2010	-	First edition	A
24, Feb 2011	1,2,10,68	Covers to blue color, Turolla brand name, Biofluids deleted.	B
30, Sept 2013	ALL	Layout and options lists, Group 0 catalog	C

### Literature reference for gear products

Title	Type	Order number
General Aluminum Gear Pumps and Motors	Technical Information	L1016238
Group 2 Gear Pumps	Technical Information	L1016341
Group 3 Gear Pumps	Technical Information	L1016456
Group 1, 2 and 3 Gear Motors	Technical Information	L1016082
Hydraulic Fluids and Lubricants	Technical Information	L1021414

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## General information

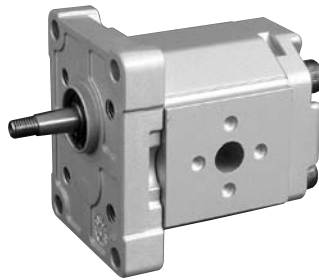
### Overview

The Turolla 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



SKP1NN 06SA



SNP1NN 03CA



### Features and benefits

#### *Gear pump attributes:*

- Up to 16 displacements from 0,25 to 12 cm<sup>3</sup>/rev [from 0.015 to 0.732 in<sup>3</sup>/rev]
- Continuous pressure rating up to 250 bar [3625 psi]
- Speeds up to 4000 min<sup>-1</sup> (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 pumps



## Group 0

OwerTFP0NN 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 pumps are available in five displacements from 0.25 to 1.27 cm<sup>3</sup>/rev [0.015 to 0.075 in<sup>3</sup>/rev]. Complete information can be found by referring to the specific sections in this technical manual.

TFP0NN 01FA



## 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

Technical data – Group 0 gear pumps

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

1 kg·m<sup>2</sup> = 23.68 lb·ft<sup>2</sup>

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



## Product code

## Model code

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

### A Family

<b>TFP0NN</b>	Std gear pump
<b>TFR0NN</b>	Reversible pump

### B Displacement

<b>0,25</b>	Displacement 0,25cc
<b>0,45</b>	Displacement 0,45cc
<b>0,57</b>	Displacement 0,57cc
<b>0,76</b>	Displacement 0,76cc
<b>1,3</b>	Displacement 1,3cc

### C Rotation

<b>R</b>	Right (Clockwise)
<b>L</b>	Left (Counterclockwise)
<b>B</b>	Reversible pump

### D Project version

<b>N</b>	Standard gear version
----------	-----------------------

### E Mounting flange

Code	Description (Type of flange - Type of drive gear - Preferred ports for configuration)
<b>01</b>	Tang drive 5xD7,92/European 2-bolt flange

### F Drive gear

<b>CA</b>	Tang drive 5xØ7,92-European 2-bolt flange
<b>FA</b>	Parallel shaft 7,0 mm [0.276 in]/European 2-bolt flange

### G Rear cover

<b>P1</b>	Standard cover for pump
<b>P3</b>	Standard cover for reversible pump



## H Inlet size    I Outlet size

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

## J Ports positions & Special body

<b>NN</b>	Standard from catalogue
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## K Seals

<b>N</b>	Standard Buna Seal
----------	--------------------

## L Screws

<b>N</b>	Std screws
----------	------------

## M Set valve

<b>NNN</b>	No valve
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## N Type mark

<b>N</b>	Standard Turolla Marking
<b>A</b>	Standard Turolla Marking+Customer Code

## O Mark position

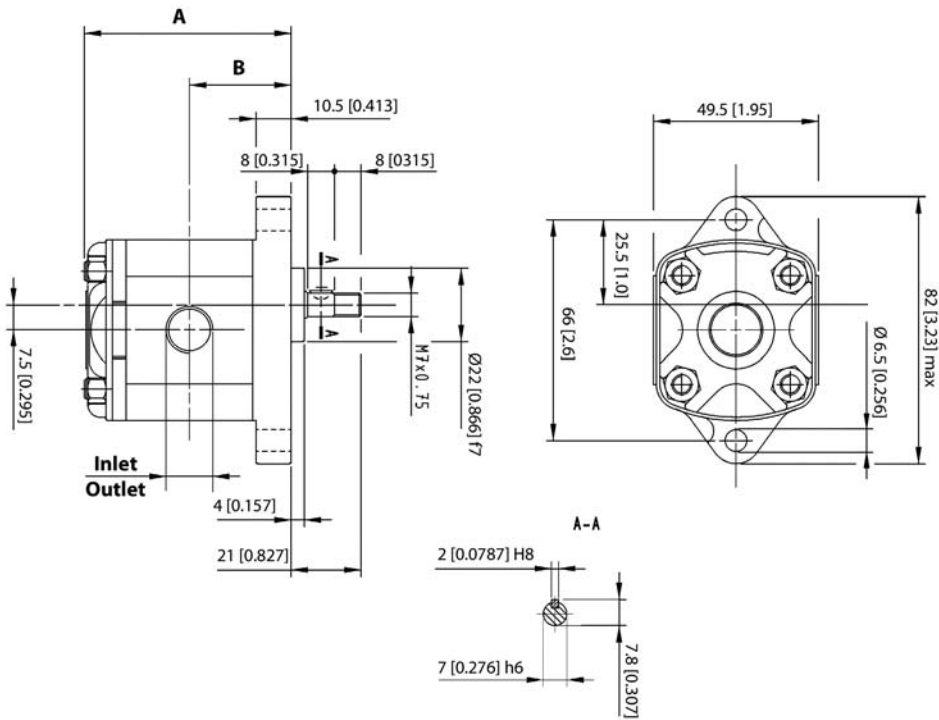
<b>N</b>	Std Marking position (on top)
<b>A</b>	Special Marking position on the bottom



# Dimensions

## TFP0NN – 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 [Model Code](#), pages 6-7.





# Notes



# GROUP 1

## Pump design

### SEP1NN

SEP1NN is available in a limited displacement range. In addition to European flange and shaft configurations (code 01DA, 01BA, and 03CA), the range includes special shafts and flanges for power pack applications. SEP1NN has a lower pressure rating than SNP1NN and SKP1NN.

### SNP1NN

SNP1NN is available in a limited displacement range but with higher-pressure ratings than the SEP1NN. This is because of DU bushings used in its design. SNP1NN pumps only include European flange and shaft configurations (code 01BA, 01DA, and 03CA).

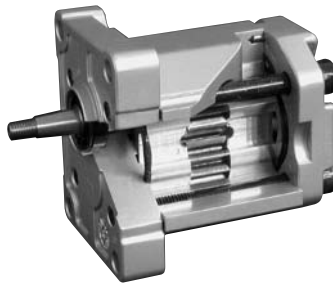
### SKP1NN

SKP1NN has a larger diameter shaft than either the SEP1NN or SNP2. It spans the complete displacement range at higher pressures than the SEP1NN and SNP1NN. Configurations include European and SAE flanges and shafts (code 02BB, 02FA, 06SA, and 06GA).

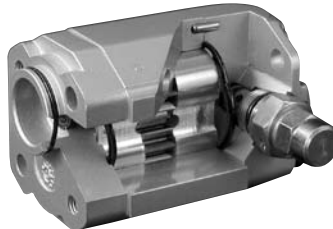
### SNP1IN

Turolla 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. SNP1 pumps only include European flange and shaft configurations (code 01BA, 01DA, and 03CA).

SNP1NN 01BA (cut away)

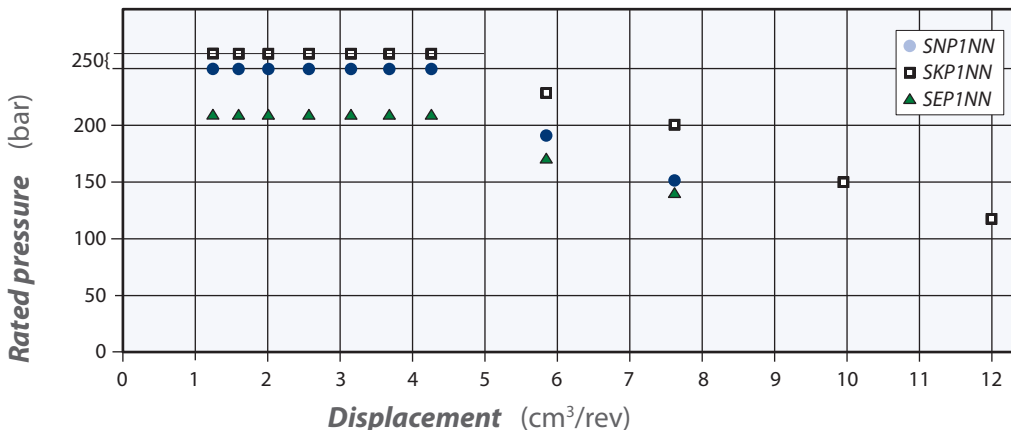


SNP1IN 03CA (cut away)



## Pump displacements

Quick reference chart for *pump* displacements vs. rated pressure





# General Information

## Technical data

Specifications for the SNP1NN, SEP1NN and SKP1NN Group 1 gear pumps.

		Frame size											
		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6,0	7,8	010	012	
Displacement	cm <sup>3</sup> /rev [in <sup>3</sup> /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]	
<b>SNP1NN</b>													
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]	250 [3625]	190 [2760]			150 [2175]
Minimum speed at 0-150 bar	min <sup>-1</sup> (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			
<b>SEP1NN</b>													
Peak pressure	bar [psi]	230 [3335]	230 [3335]	230 [3335]	230 [3335]	230 [3335]	230 [3335]	230 [3335]	190 [2760]	160 [2320]			
Rated pressure		210 [3045]	210 [3045]	210 [3045]	210 [3045]	210 [3045]	210 [3045]	210 [3045]	210 [3045]	170 [2465]			140 [2030]
Minimum speed at 0-150 bar	min <sup>-1</sup> (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			
<b>SKP1NN*</b>													
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]	250 [3625]	230 [3335]	200 [2900]	150 [2175]	120 [1740]
Minimum speed at 0-150 bar	min <sup>-1</sup> (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	1000	800	800	800	-
Maximum speed		4000	4000	4000	4000	4000	4000	4000	3000	3000	3000	2000	2000
<b>All (SNP1NN, SEP1NN, SKP1NN)</b>													
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 <sup>-6</sup> kg·m <sup>2</sup> [x 10 <sup>-6</sup> lb·ft <sup>2</sup> ]	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]	

1 kg·m<sup>2</sup> = 23.68 lb·ft<sup>2</sup>

\* 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.

### ⚠ Caution

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



# Product code

## Model code



### A Family

<b>SEA1NN</b>	Gear pump with inlet port on body and outlet port on flange
<b>SNB1NN</b>	Gear pump with inlet port on cover and outlet port on flange replacement for SEB1 - use SNP1 body profile
<b>SNP1NN</b>	Standard gear pump
<b>SNC1NN</b>	Gear pump with inlet and outlet ports on rear cover
<b>SNP1IN</b>	Gear pump with internal drain relief valve
<b>SKP1NN</b>	High torque gear pump
<b>SKP1IN</b>	High torque gear pump with internal drain relief valve

### B Displacement

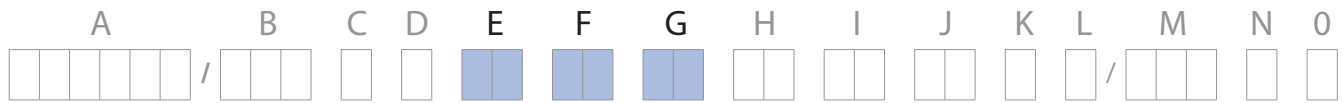
<b>1,2</b>	1,18 cc	<b>3,8</b>	3,66 cc	<b>7,8</b>	7,59 cc
<b>1,7</b>	1,57 cc	<b>4,3</b>	4,19 cc	<b>010</b>	9,94 cc
<b>2,2</b>	2,09 cc	<b>5,5</b>	5,23 cc - special	<b>012</b>	12,00 cc
<b>2,6</b>	2,62 cc	<b>6,0</b>	5,89 cc		
<b>3,2</b>	3,14 cc	<b>6,5</b>	6,54 cc - special		

### C Rotation

<b>L</b>	Left rotation
<b>R</b>	Right rotation

### D Project version

<b>N</b>	Standard gear pump
<b>6</b>	Short version - special



## E Mounting flange

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+0-ring+2 holes through body
04	pilot Ø32+2 holes through body
06	SAE A-A pilot Ø50,8+ 2 holes
08	pilot Ø32+0-ring Outlet port+2 holes through body
B1	pilot Ø25,4+4 holes -special shaft seal slot
V6	SAE A-A pilot Ø45+ 2 holes

## F Drive gear

AA	Taper 1:5-M6-Key 2
BA	Taper 1:8-M7-Key 2,41
BB	Taper 1:8-M10x1-Key 3
BG	Taper 1:8-M7-Key 2,41-shaft for short version
CA	Tang 5x Ø10 FR03
CB	Tang 5x Ø13,5 FR03 - for SEA1NN only
CD	Tang 5x Ø11,5 distance from gear face 47,5 - for SEA1NN and SNB1NN
CE	Tang 6,63x Ø11 - for SKP1xN
CF	Tang 5x Ø11,5 distance from gear face 35
CM	Tang 5x Ø10-type 03 + w/o coupling
DA	Splined Z15-m0,75-alfa 30°-L14 - for SNP1xx
DB	Splined Z15-m0,75-alfa 30°-L14 - for SKP1xx
DC	Splined B12x9-L14-flange protrusion sb22-Z6-m1,60-alfa 30° - special - only for SNP1xx
DD	Splined B12x9-L20-flange protrusion sb40-Z6-m1,75-alfa 30° - special - only for SKP1xx
FA	Parallel Ø12-Thread M10x1-Key 3
GA	Parallel Ø12,7-Key 3.2
SA	SAE spline J498-9T-20/40 Flat Root Side FIT-L15,6
SG	SAE spline J498-8T-16/32 std-shaft for short version

## G Rear cover

03	Cover 03
08	Cover 08 with Inlet port 3/8" Gas
BC	Intermediate flange with screw case and pilot Tipe 01 BCN
C1	Cover pump with front GAS Thread Inlet3/8 ; Outlet3/8
I1	Cover pump with relief valve
I3	Cover 03 with relief valve
P1	Std Cover pump



**H Inlet size**   **I Outlet size**

<b>NN</b>	Without inlet	
<b>B1</b>	8x30xM6	
<b>B2</b>	13x30xM6	
<b>C1</b>	8x26xM5	
<b>C2</b>	12x26xM5	
<b>C3</b>	13,5x30xM6	
<b>D3</b>	M14x1,5	
<b>D5</b>	M18x1,5	
<b>D7</b>	M22x1,5	
<b>E3</b>	9/16-18UNF	
<b>E4</b>	3/4-16UNF	
<b>E5</b>	7/8-14UNF	
<b>F2</b>	1/4 GAS	
<b>F3</b>	3/8 GAS	
<b>F4</b>	1/2 GAS	
<b>H2</b>	10xM12x1,5-ISO6149	
<b>H4</b>	12xM16x1,5-ISO6149	
<b>H5</b>	12xM18x1,5-ISO6149	
<b>H7</b>	13,5xM22x1,5-ISO6149	

**J Ports positions & Special body**

<b>NN</b>	Std from catalogue
<b>DF</b>	Distance from front flange = 41,9 mm
<b>SA</b>	Body width for side ports = 68 mm





## Determination of Nominal Pump Sizes

### Determination of Nominal Pump Sizes

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

#### Based on SI units

$$\text{Output flow: } Q = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad \text{l/min}$$

$$\text{Input torque: } M = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_m} \quad \text{N}\cdot\text{m}$$

$$\text{Input power: } P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t} \quad \text{kW}$$

#### Based on US units

$$Q = \frac{V_g \cdot n \cdot \eta_v}{231} \quad \text{[US gal/min]}$$

$$M = \frac{V_g \cdot \Delta p}{2 \cdot \pi \cdot \eta_m} \quad \text{[lbf}\cdot\text{in]}$$

$$P = \frac{M \cdot n}{63.025} = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t} \quad \text{[hp]}$$

Variables: SI units [US units]

$V_g$	= Displacement per rev.	$\text{cm}^3/\text{rev}$ [ $\text{in}^3/\text{rev}$ ]
$p_{HD}$	= Outlet pressure	bar [psi]
$p_{ND}$	= Inlet pressure	bar [psi]
$\Delta p$	= $p_{HD} - p_{ND}$	bar [psi]
$n$	= Speed	$\text{min}^{-1}$ (rpm)
$\eta_v$	= Volumetric efficiency	
$\eta_m$	= Mechanical (torque) efficiency	
$\eta_t$	= Overall efficiency ( $\eta_v \cdot \eta_m$ )	





## 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.

#### Inlet pressure

<b>Maximum continuous vacuum</b>	bar absolute [in. Hg]	0.8 [23.6]
<b>Maximum intermittent vacuum</b>		0.6 [17.7]
<b>Maximum pressure</b>		3.0 [88.5]

**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 illustration to the right 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.

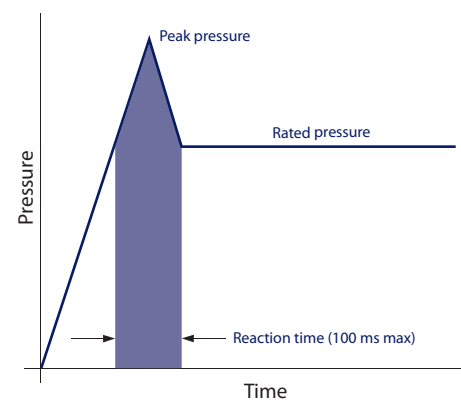
**System pressure** is the differential between the outlet and inlet ports. It is a dominant operating variable affecting hydraulic unit life. High system pressure, resulting from high load, reduces expected life. System pressure must remain at, or below, rated pressure during normal operation to achieve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

### Speed

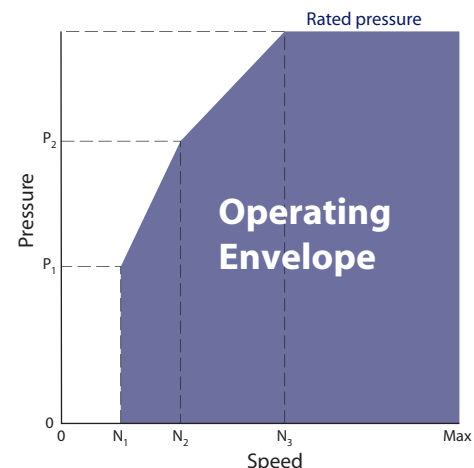
**Maximum speed** is the limit recommended by Turolla for a particular gear pump when operating at rated pressure. It is the highest speed at which normal life can be expected.

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.

Time versus pressure



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 SNP1NN, SEP1NN 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.

Please see Turolla publication [Hydraulic Fluids and Lubricants Technical Information, L1021414](#) for more information.

## 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.

Fluid viscosity

<b>Maximum (cold start)</b>	mm <sup>2</sup> /s [SUS]	1000 [4600]
<b>Recommended range</b>		12-60 [66-290]
<b>Minimum</b>		10 [60]

Temperature

<b>Minimum (cold start)</b>	°C [°F]	-20 [-4]
<b>Maximum continuous</b>		80 [176]
<b>Peak (intermittent)</b>		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 ingress 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 ( $\beta_x$ ). For:

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

$\beta_x$  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 $\beta_x$ ratio

<b>Fluid cleanliness level (per ISO 4406)</b>	Class 22/18/13 or better
<b><math>\beta_x</math> ratio (suction filtration)</b>	$\beta_{35-45} = 75$ and $\beta_{10} = 2$
<b><math>\beta_x</math> ratio (pressure or return filtration)</b>	$\beta_{10} = 75$
<b>Recommended inlet screen size</b>	100-125 $\mu\text{m}$ [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 for 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.

**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

<b>Inlet</b>		2.5 [8.2]
<b>Outlet</b>	m/s [ft/sec]	5.0 [16.4]
<b>Return</b>		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.

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.

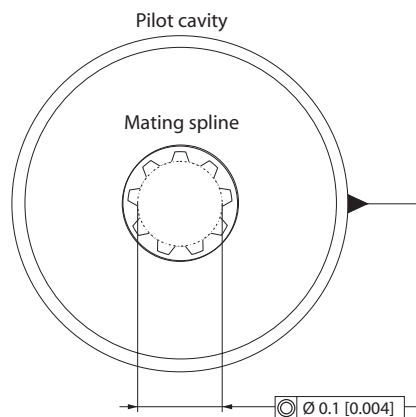
## Pump drive

**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.

### ⚠ Caution

In order to avoid spline shaft damages it is recommended to use carburised 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.

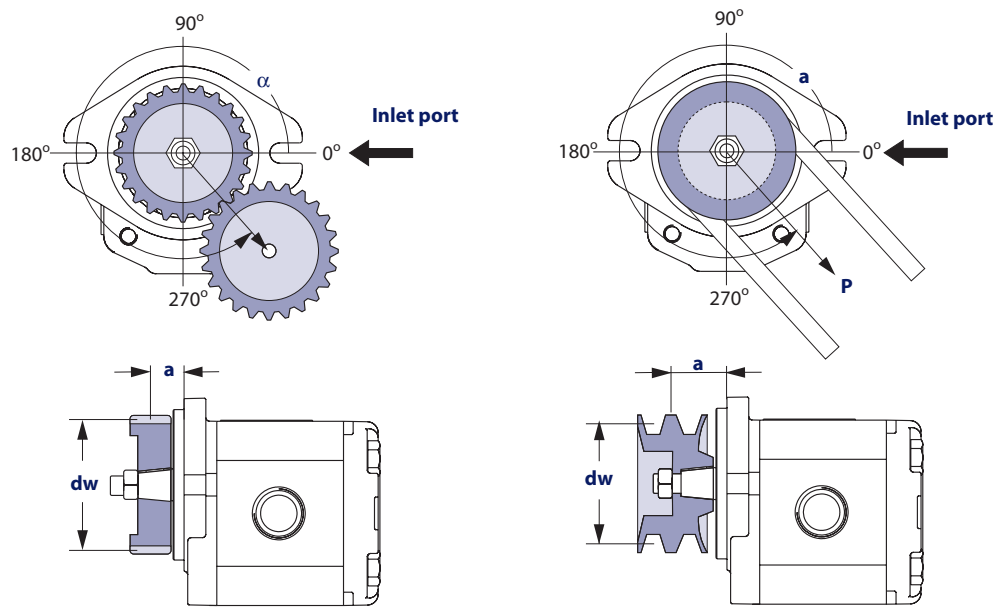
In applications where external shaft loads can't be avoided, minimize the impact on the pump by optimizing the orientation and magnitude of the load. Use a tapered input shaft; don't use splined shafts for belt or gear drive applications. A spring-loaded belt tension-device is recommended for belt drive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



### Pump drive data form

Photocopy this page and fax the complete form to your Turolla 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 <sup>3</sup> /rev [in <sup>3</sup> /rev]
Rated system pressure			<input type="checkbox"/> bar <input type="checkbox"/> psi
Relief valve setting			
Pump shaft rotation			<input type="checkbox"/> left <input type="checkbox"/> right
Pump minimum speed			min <sup>-1</sup> (rpm)
Pump maximum speed			
Drive gear helix angle (gear drive only)			degree
Belt type (gear drive only)			<input type="checkbox"/> V <input type="checkbox"/> notch
Belt tension (gear drive only)	<b>P</b>		<input type="checkbox"/> N <input type="checkbox"/> lbf
Angular orientation of gear or belt to inlet port	<b>α</b>		degree
Pitch diameter of gear or pulley	<b>d<sub>w</sub></b>		<input type="checkbox"/> mm <input type="checkbox"/> in
Distance from flange to center of gear or pulley	<b>a</b>		



## Pump life

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

All Turolla 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.

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

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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.

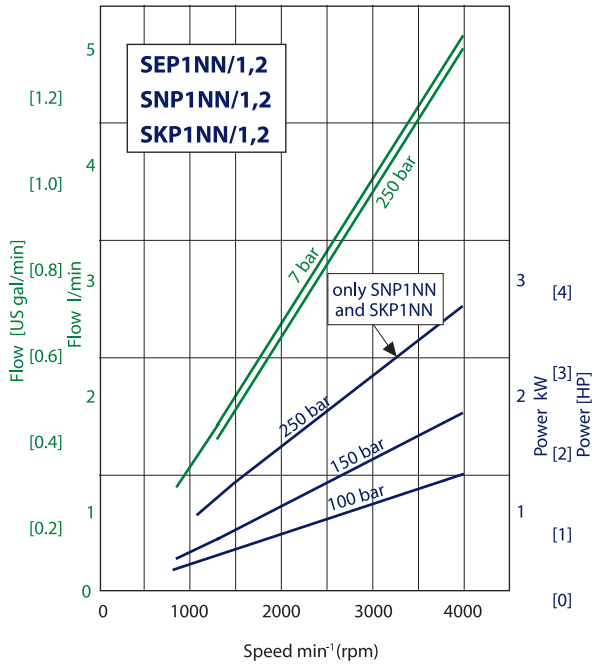


# Pump Performance

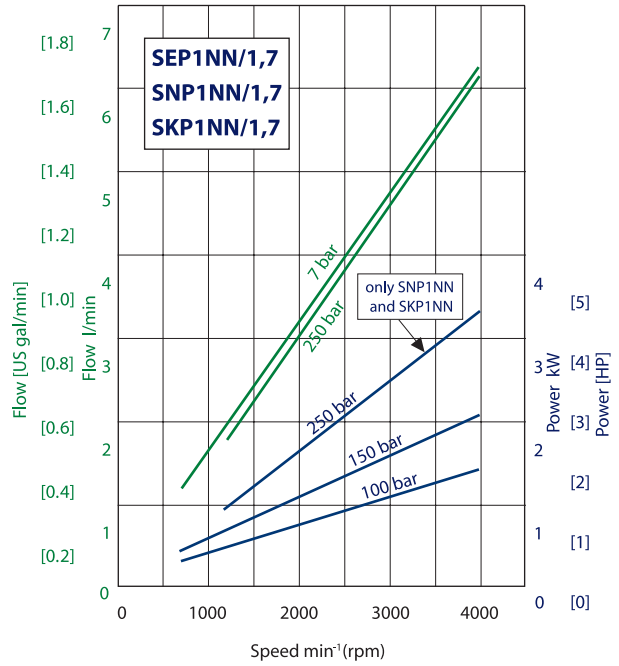
## Pump performance graphs

The graphs on the next few pages 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<sup>2</sup>/s [cSt]).

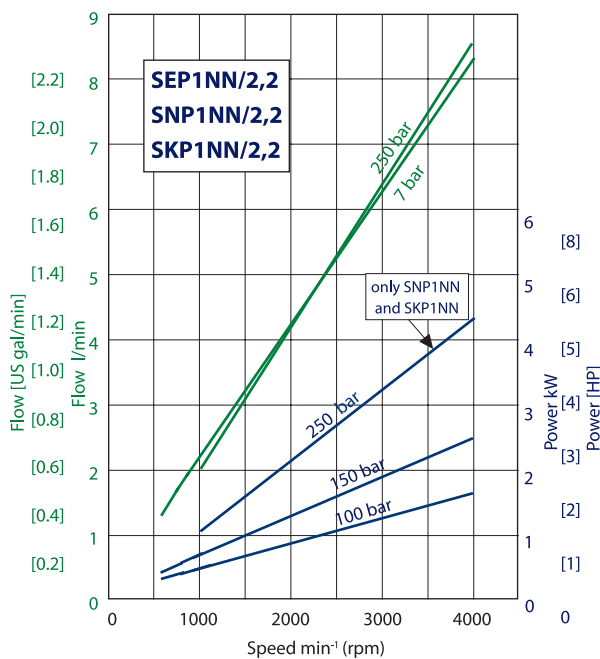
Performance graph for 1.2 frame size



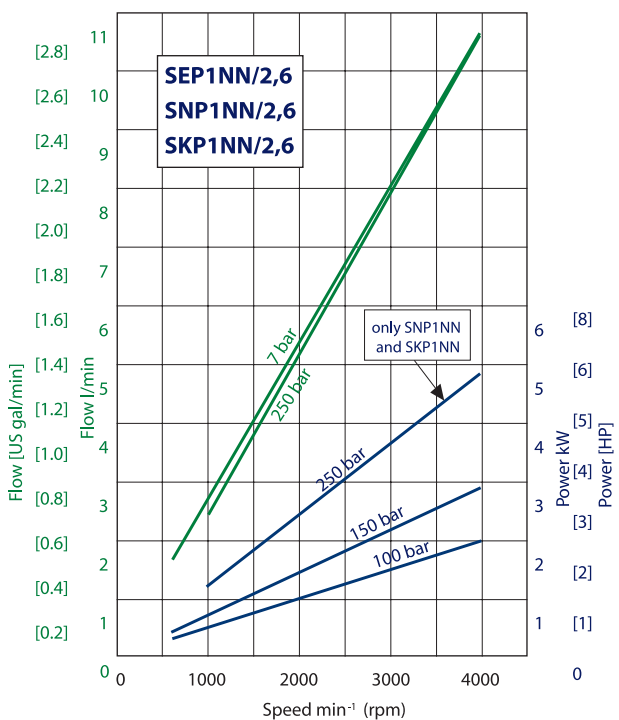
Performance graph for 1.7 frame size



Performance graph for 2.2 frame size

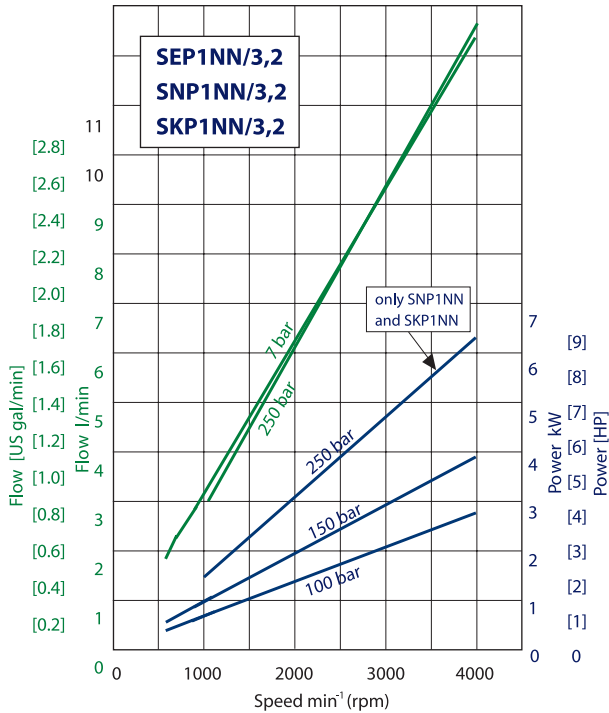


Performance graph for 2.6 frame size

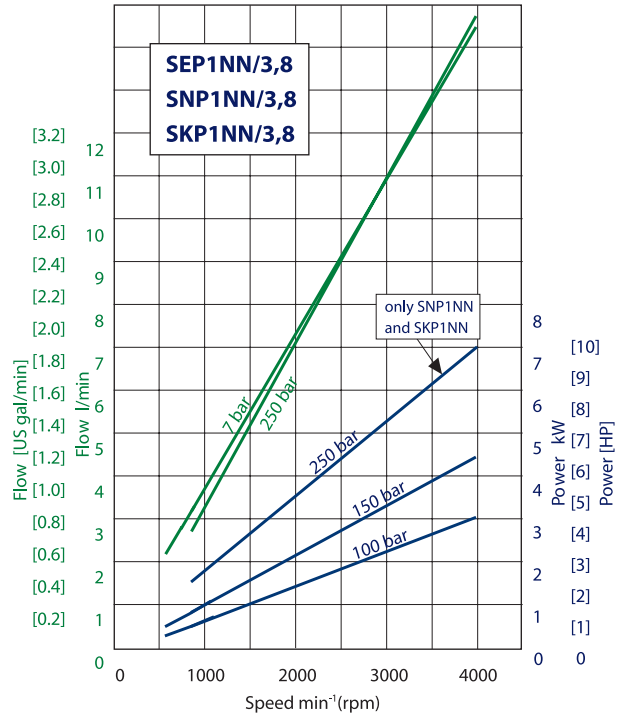




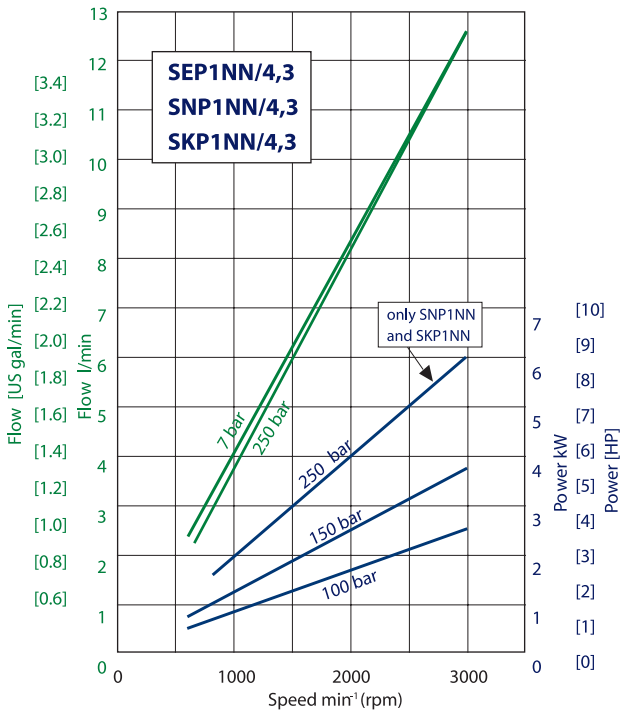
Performance graph for 3.2 frame size



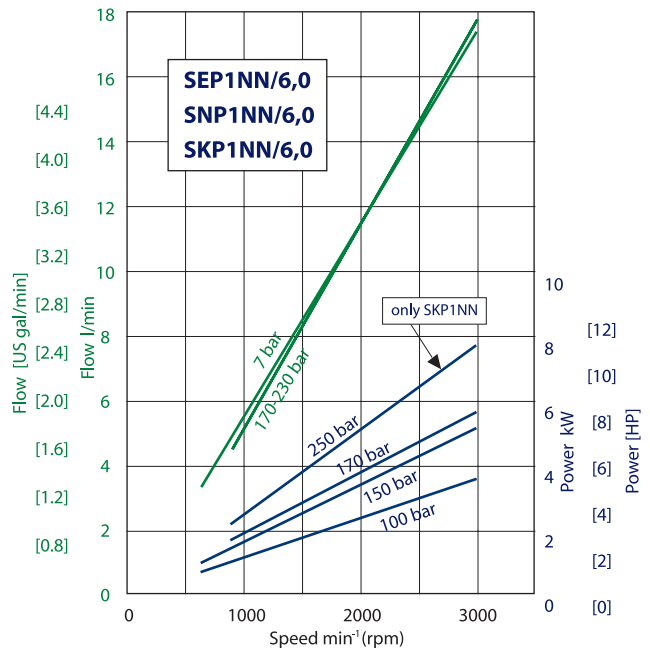
Performance graph for 3.8 frame size



Performance graph for 4.3 frame size



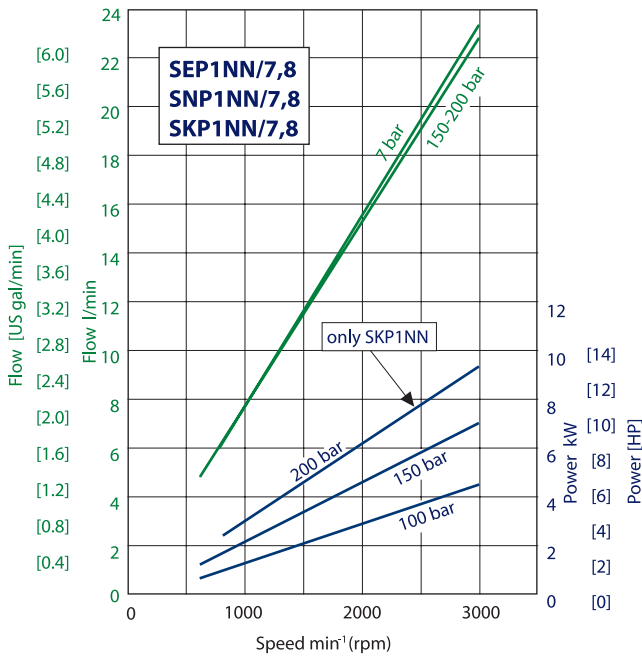
Performance graph for 6.0 frame size



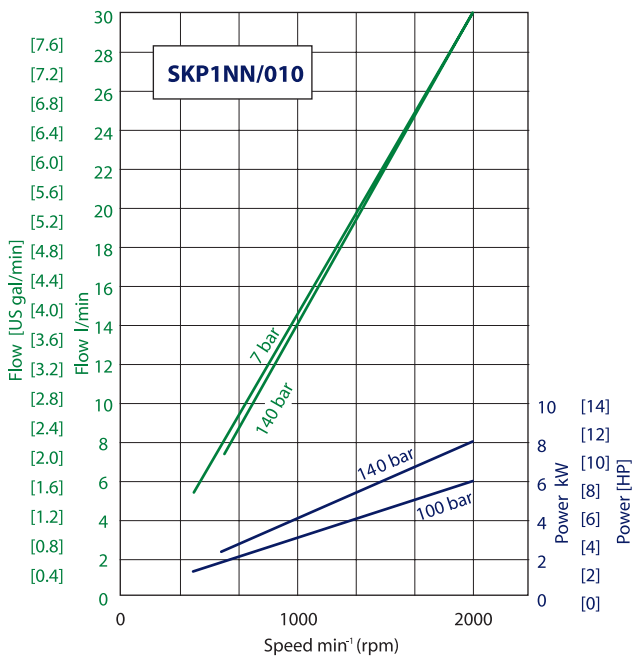




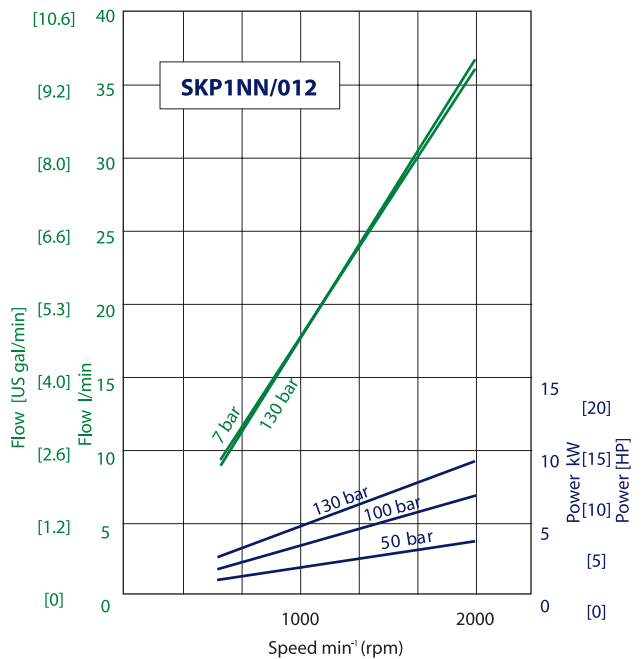
Performance graph for 7.8 frame size



SKP1NN/010 pump performance graph



SKP1NN/012 pump performance graph





## Product options

### Flange, shaft and port configurations

Flange, shaft and port configurations for SEP1NN and SNP1NN

Code	Flange	Shaft	Port
<b>01BA</b>	25.4 mm [1.0 in] pilot Ø European 4-bolt	1:8 tapered	European flanged in + pattern
<b>01DA</b>	25.4 mm [1.0 in] pilot Ø European 4-bolt	15-teeth splined $m = 0.75$ $\alpha = 30^\circ$	European flanged in + pattern
<b>03CA</b>	Turolla tang	Turolla tang	Threaded metric port

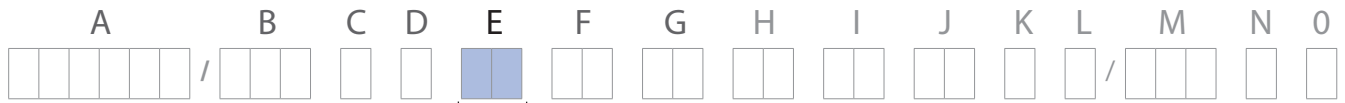
Flange, shaft and port configurations for SKP1NN

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



### Mounting flanges

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



Flange	
Code	Description
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

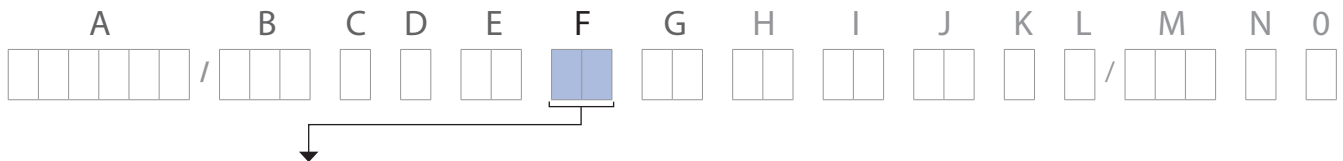
06	SAE A-A pilot Ø50,8+ 2 holes
08	pilot Ø32+O-ring Outlet port+2 holes through body
B1	pilot Ø25,4+4 holes -special shaft seal slot
V6	SAE A-A pilot Ø45+ 2 holes



## 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



Shaft		Mounting flange code with maximum torque in Nm [lb·in]							
Code	Description	01	02	03	04	06	08	B1	V6
AA	Taper 1:5-M6				25 [221]				
BA	Taper 1:8-M7	25 [221]							
BB	Taper 1:8-M10		50 [442]						
BG	Taper 1:8-M7-shaft for short version							25 [221]	
CA	Tang 5x Ø10			14 [124]					
CD	Tang 5x Ø11,5 distance from gear face 47,5						17 [150]		
CE	Tang 6,63x Ø11					21 [186]			
CF	Tang 5x Ø11,5 distance from gear face 35	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]						
DC	Splined B12x9-L14-flange protrusion sb22-Z6-m1,60-alfa 30°	30 [265]							
DD	Splined B12x9-L20-flange protrusion sb40-Z6-m1,75-alfa 30°		30 [265]						
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]			34 [301]
SG	SAE spline J498-8T-16/32-shaft for short version					34 [301]			

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

Turolla 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)

A table of dimensions is on the next page.

### H – Inlet port configuration codes and I – Outlet port configuration codes

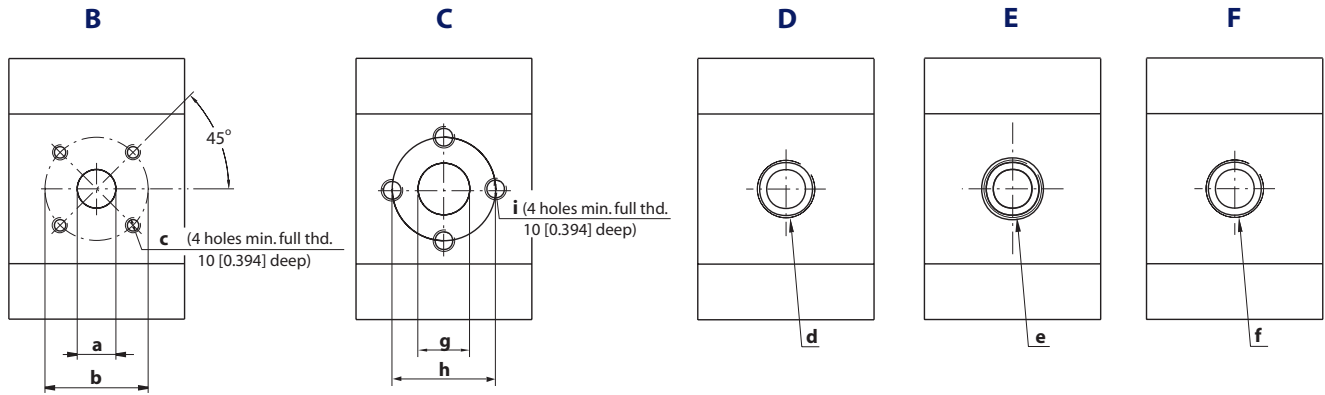


<b>B1</b>	8x30xM6	Flanged port with threaded holes in X pattern, in center of body
<b>B2</b>	13x30xM6	
<b>C1</b>	8x26xM5	Flanged port with threaded holes in + pattern (European standard ports)
<b>C2</b>	12x26xM5	
<b>C3</b>	13,5x30xM6	
<b>D3</b>	M14x1,5	Threaded metric port
<b>D5</b>	M18x1,5	
<b>D7</b>	M22x1,5	
<b>E3</b>	9/16-18UNF	Threaded SAE, O-Ring boss port
<b>E4</b>	3/4 -16UNF	
<b>E5</b>	7/8-14UNF	
<b>F2</b>	1/4 GAS	Threaded GAS (BSPP) port
<b>F3</b>	3/8 GAS	
<b>F4</b>	1/2 GAS	
<b>H5</b>	M18x1,5	Threaded metric port ISO 6149
<b>H7</b>	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	
Type (displacement)	1,2	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	3/4-16UNF-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	3/4-16UNF-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	3/4-16UNF-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	3/4-16UNF-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	3/4-16UNF-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	3/4-16UNF-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	3/4-16UNF-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	3/4-16UNF-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)
	7,8	Inlet	13 [0.512]	30 [1.181]	M6	12 [0.462]	26 [1.024]	M5	M18x1.5	3/4-16UNF-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	3/4-16UNF-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	3/4-16UNF-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)	



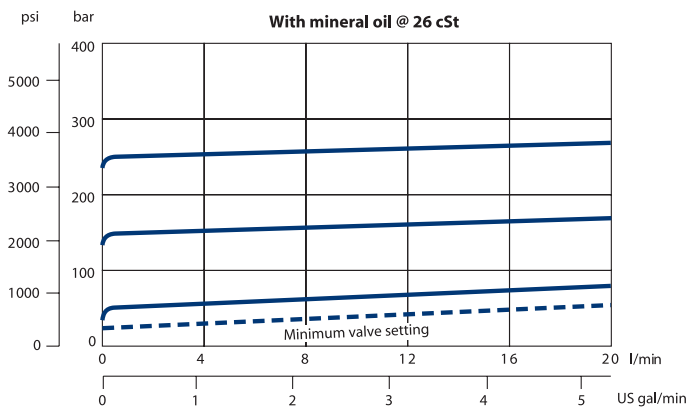
### SNP11N

Turolla 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.

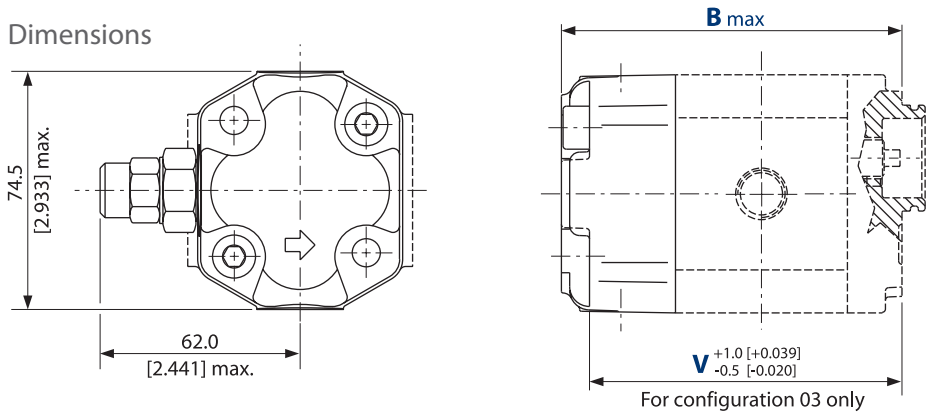
#### ⚠ Caution

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



#### Dimensions



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

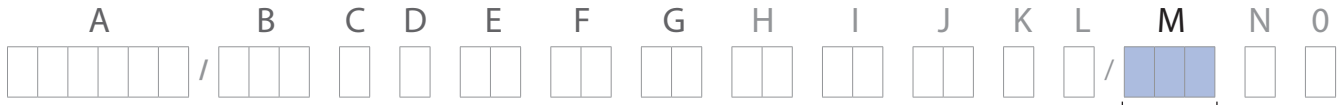
#### Integral relief valve and covers dimensions

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>B</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]
	<b>V</b>	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:

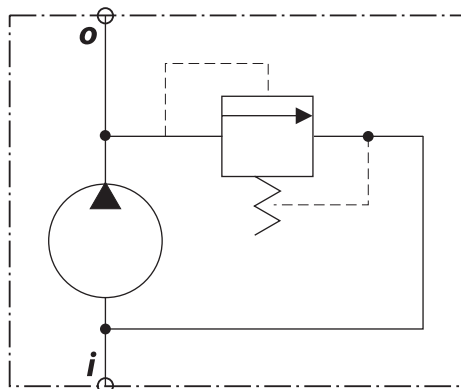


Code	Pump speed for RV setting min <sup>-1</sup> (rpm)
A	Not defined
C	500
E	1000
F	1250
G	1500
K	2000
I	2250
L	2500
M	2800
N	3000
O	3250

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



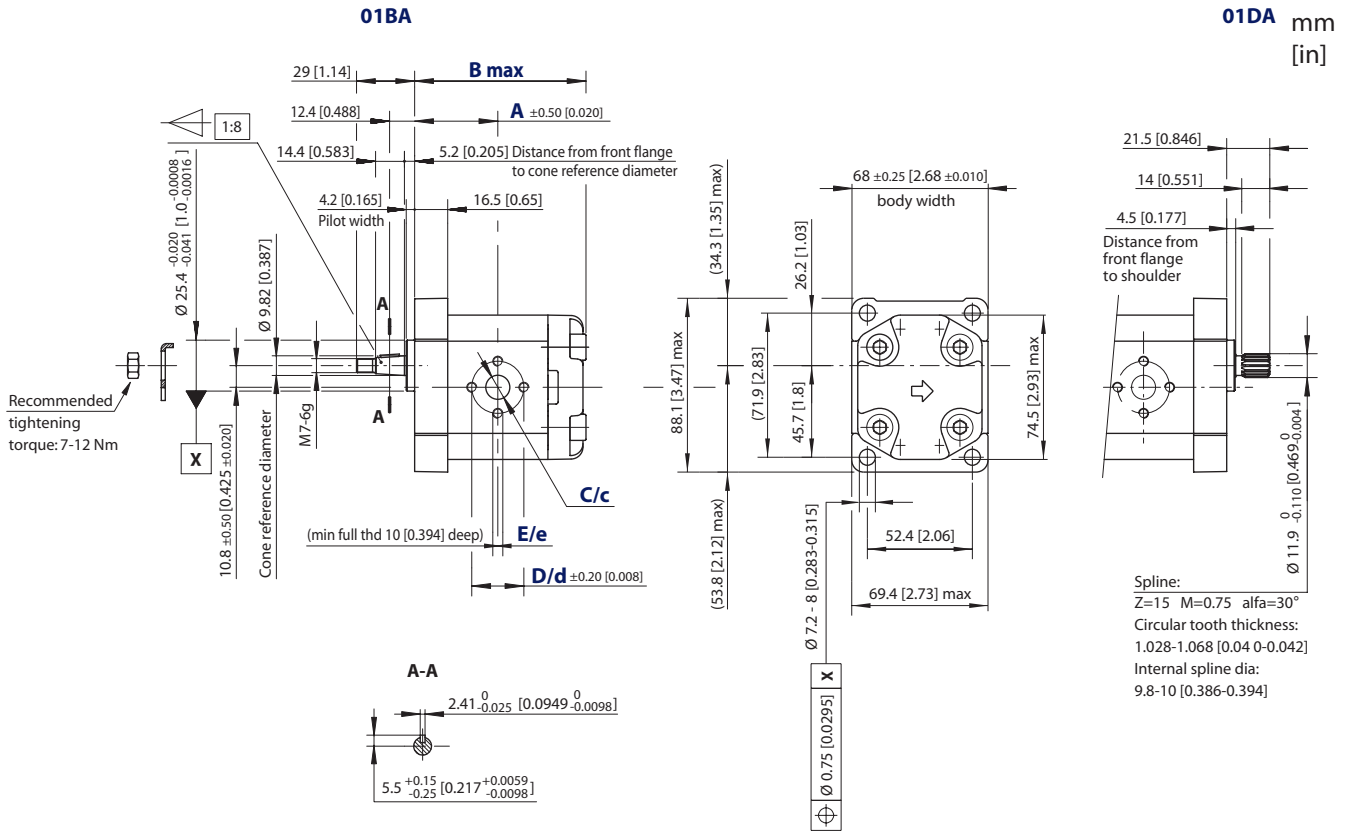
i = inlet  
o = outlet





# 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

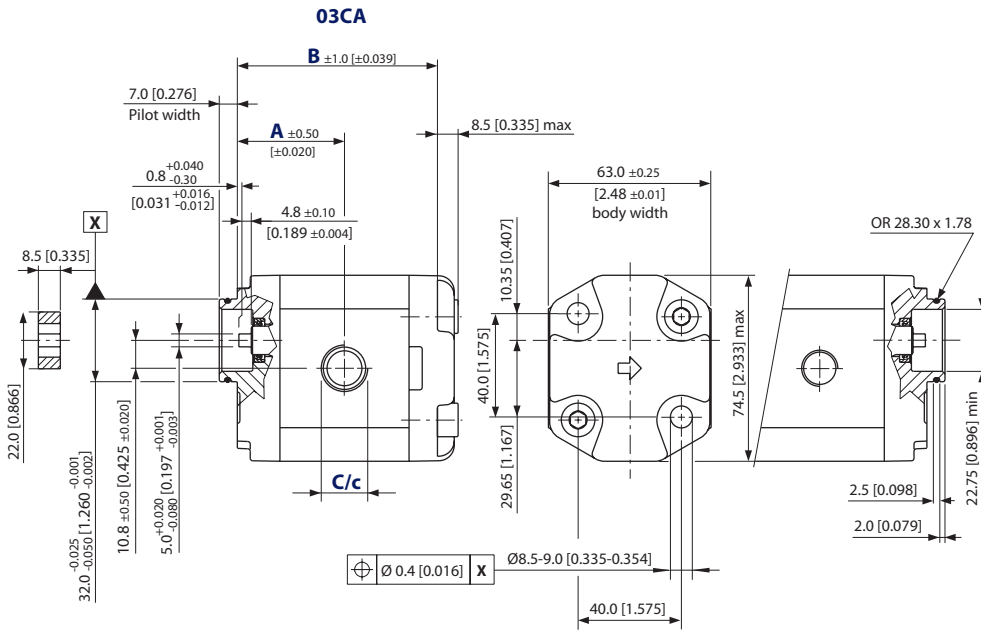
Flange/drive gear	Model code example	Maximum shaft torque
<b>01BA</b>	SNP1NN/3,8RN01BAP1C2C2NNNN/NNNNN	25 N·m [221 lb·in]
<b>01DA</b>	SNP1NN/6,0LN01DAP1C2C2NNNN/NNNNN	35 N·m [310 lb·in]

For further details on ordering, see **Model Code**, pages 12-15.





**SNP1NN, SEP1NN – 03CA** This drawing shows the standard porting for 03CA.



mm  
[in]

SNP1NN, SEP1NN – 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				

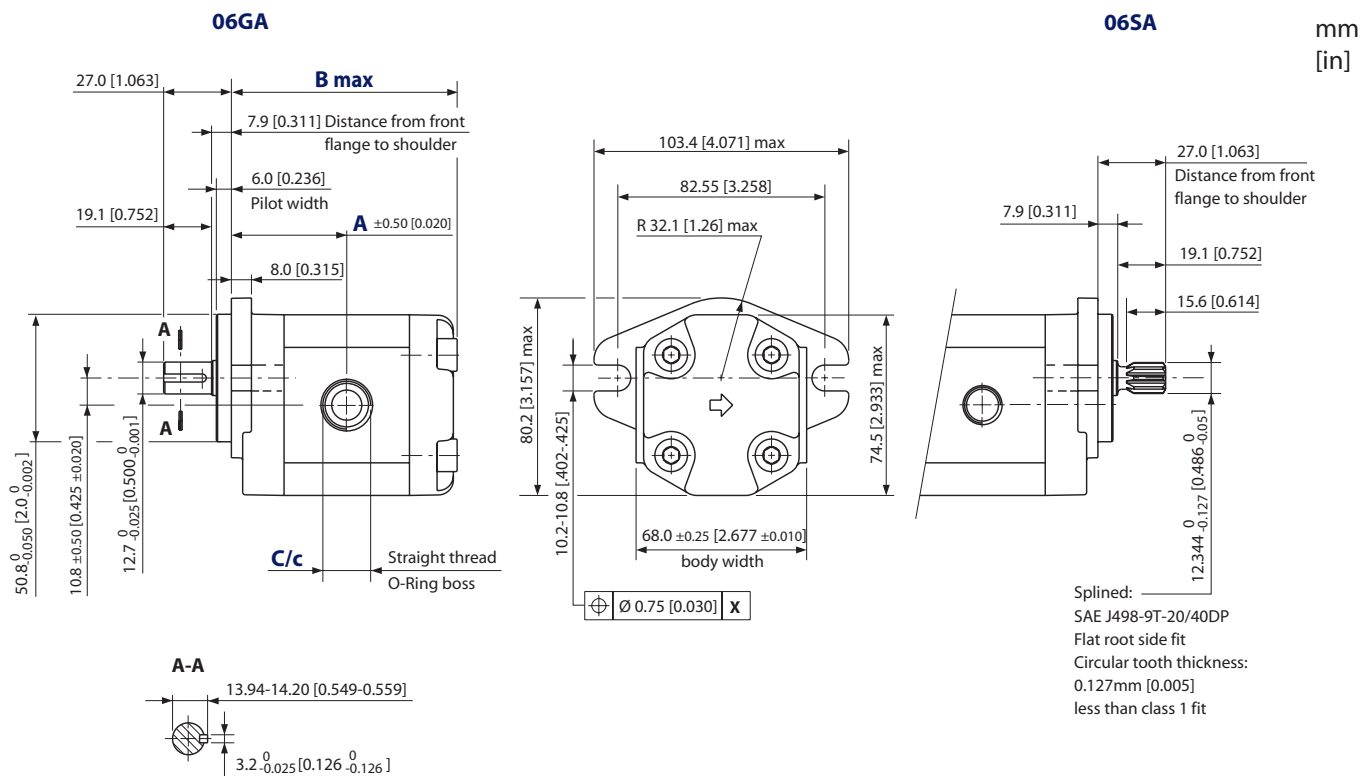
Model code examples and maximum shaft torque

Flange/drive gear	Model code example	Maximum shaft torque
03CA	SNP1NN/1,7RN03CA03D5D3NNNN/NNNN	14 N•m [124 lb•in]
	SEP1NN/2,2LN03CA03D5D3NNNN/NNNN	

For further details on ordering, see [Model Code](#), pages 12-15.



**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										

Model code examples and maximum shaft torque

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

For further details on ordering, see [Model Code](#), pages 12-15.



# Notes



## Notes



# Notes

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