Danfoss GearMe single-stage hydraulic gear pump 111.19.102.X0

Manufacturer: Danfoss

Manufacturer part number / published order designation: 111.19.102.X0

Published model: XEP2NN-/-011-L-N-01-BB-P1-C7-C3-NN-N-N-/-NNN-N-N

About this compilation

Prepared by Hydmaster from selected manufacturer documentation. Original technical pages follow without cropped drawings, rewritten data or altered units. This cover and index are Hydmaster editorial material, not a manufacturer-issued exact-execution datasheet.

Coverage: applicable family/component reference. Exact execution documentation remains incomplete. Do not treat standard component or stage drawings as approval of the complete custom assembly.

Execution notes and conditions

Exact manufacturer installation/cover/port drawing for this execution.

Published SEP2NN/XEP2NN family is not named by current standard Group2 coding table. Similar01BA/01BB interfaces do not establish equivalent full-body geometry.

Source-page index

Source page numbers below are physical pages of each complete original PDF. The original printed page labels and technical content remain unchanged. Compiled page numbers count this cover/index.

Source A: Danfoss Gearme Group Two Gear Pumps Technical Information

Original pages	Compiled pages	Relevant content
12-15	2-5	Group2 family, nominal-size, rotation and project-version code; Actual shaft/flange definitions; Actual cover and port code definitions; Seal, port position and no-valve code context
18-23	6-11	Inlet pressure and pressure definitions; Pressure/speed duty-envelope conditions; Fluid viscosity, temperature and fluid requirements; Reservoir, cleanliness and filtration; Drive/coupling, shaft loading and mounting; Continued loading/application limits
28	12	Shaft/flange torque constraints

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

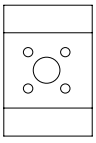
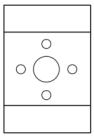
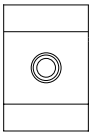
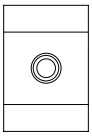
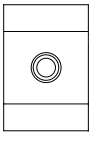
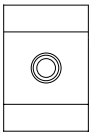
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Product Code

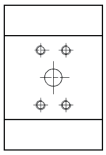
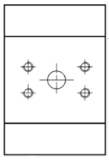
C1	Cover pump front BSP ports : Inlet 3/4 Gas ; Outlet 1/2 Gas
C6	Cover pump front SAE Thred ports:In.1-1/16-12UN;Out.7/8-14UNF
C7	Cover pump front SAE Thred ports:In.3/4-16UNF-2B;Out.3/4-16UNF-2B
D1	Cover pump with Outlet port 1/2 Gas
D6	Cover pump with Outlet port 7/8-14UNF-2B
E1	Cover pump with relief 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

System Requirements

Pressure

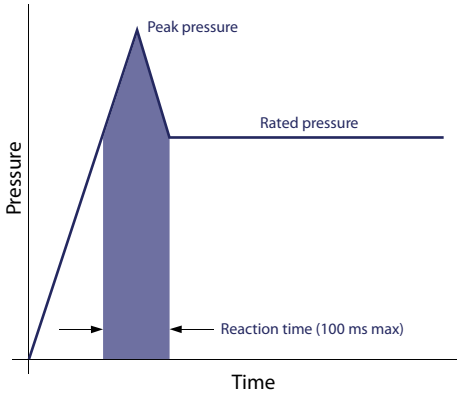
The inlet vacuum must be controlled in order to realize expected pump life and performance. The system design must meet inlet pressure requirements during all modes of operation. Expect lower inlet pressures during cold start. It should improve quickly as the fluid warms.

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

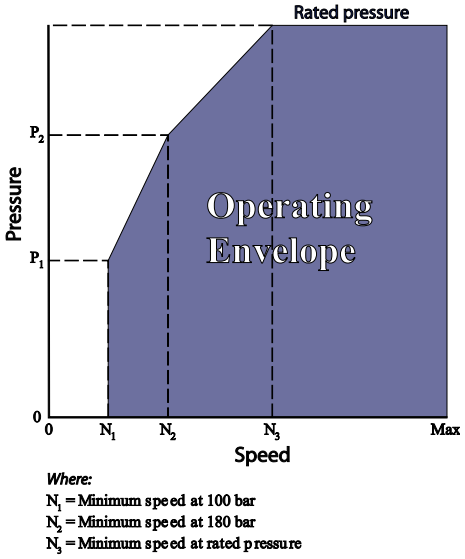
System pressure is the differential of pressure between the outlet and inlet ports. It is a dominant operating variable affecting hydraulic unit life. High system pressure, resulting from high load, reduces expected life. System pressure must remain at, or below, rated pressure during normal operation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

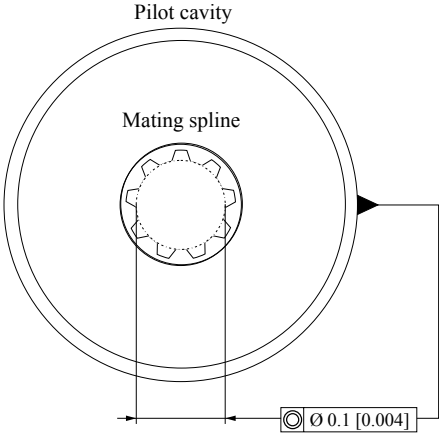
Inlet	m/s [ft/sec]	2.5 [8.2]
Outlet		5.0 [16.4]
Return		3.0 [9.8]

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.

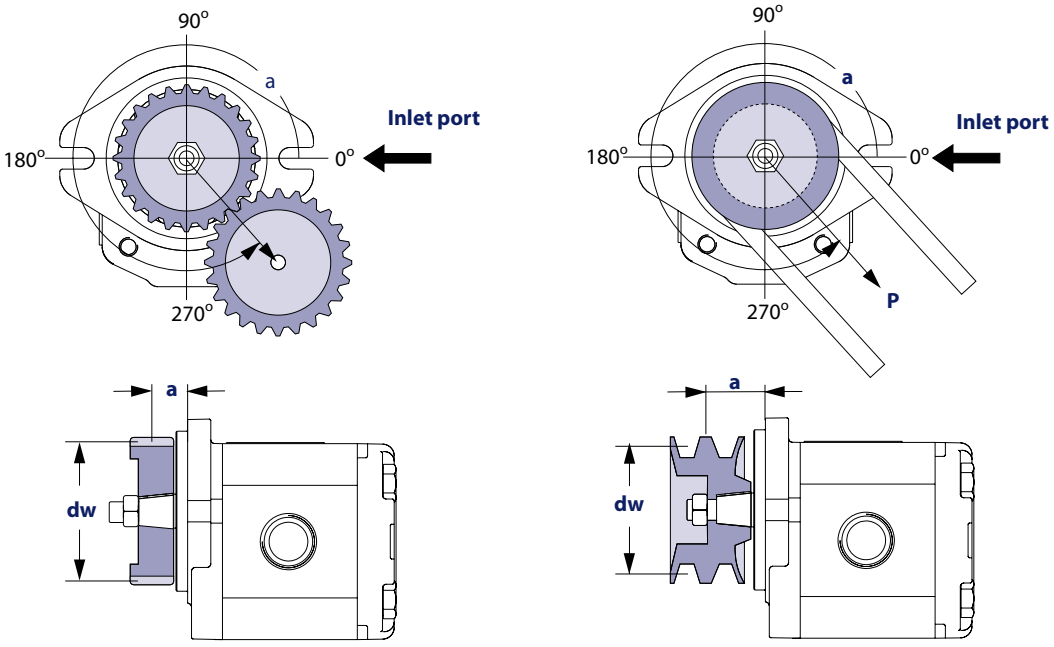
Allowable radial shaft loads are a function of the load position, load orientation, and operating pressure of the hydraulic pump. All external shaft loads have an effect on bearing life, and may affect pump performance.

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.

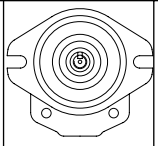
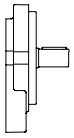
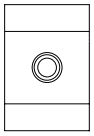
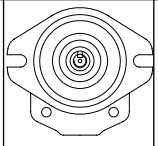
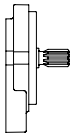
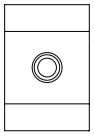
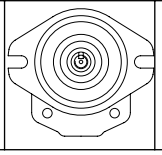
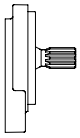
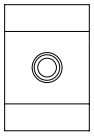
Pressure ripple is the result of the number of pumping elements (gear teeth) delivering oil to the outlet and the pump's ability to gradually change the volume of each pumping element from low to high pressure. In addition, the pressure ripple is affected by the compressibility of the oil as each pumping 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.

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.