ENGINEERING
TOMORROW

User guide

Vickers® by Danfoss
V2020H Square Vane Pump

Up to 204 bar (3000psi)
15.8-41.7 cc/rev, (5 - 13 gpm @ 1200 rpm)



VICKERS
by Danfoss

BC498361101409en-000103

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Introduction

Series V2020H fixed displacement pumps are of Vickers "balanced vane type" construction. V2020H double pumps have capacities of 5 to 13 USgpm for their shaft-end and cover-end pumps.

Double pumps provide a single power source capable of serving two separate hydraulic circuits, or of providing greater volume through the combined delivery of both sections. In either type of application, two pumps in a single housing result in a more compact,simple installation and can be driven through a single shaft coupling.

All models are designed for use with oil or synthetic fire-resistant fluids. Shaft rotation is either clockwise or counterclockwise, but can be changed by changing the assembly of internal parts.

SAE 2-bolt mounting flanges are standard, and foot-mounting brackets are optional. Many electric motor manufacturers can supply drip-proof or totally enclosed, fan cooled motors with end bells on which the pumps can be mounted.

Features and Benefits

Unmatched Durability

Whether in heavy duty industrial machinery or mobile applications, Vickers by Danfoss vane pumps are built to endure the toughest operating conditions. The design and build materials are field proven, with years of service in the most rugged applications. This longevity not only minimizes maintenance requirements but also maximizes uptime, contributing to overall operational efficiency.

High Performance

Low vane tip/ring loading allows high pressure operation. High speeds are possible because the inlet flow paths are designed to give uniform oil acceleration, and thus better filling characteristics, particularly at low inlet pressures.

Extended Product Life

Vickers Vane Pump advanced design includes features that contribute to efficient fluid handling and reduced wear to deliver the consistent performance needed for optimal system functionality over time.

Low Cost

Vickers' optimized design requires less horsepower per dollar invested, providing the industry with an unparalleled price-to-performance ratio.

Versatility

High flow, pressure and speed capabilities enable these pumps to meet the hydraulic circuit needs of many types of modern machinery.

Basic Performance Data

Typical operating characteristics at 1200 r/min with petroleum oil

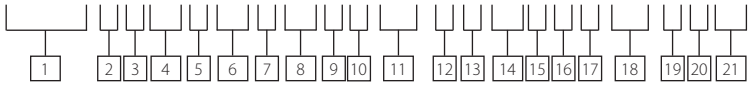
V2020H double pump		Data based on performance at oil temperature of 49° C (120° F), viscosity 32 cSt at 38° C (150 SUS at 100° F)							
		7 bar (100 psi)		69 bar (1000 psi)		138 bar (2000 psi)		204 bar (3000 psi)	
	Ring size	Lpm (USgpm)	Input kW (hp)	Lpm (USgpm)	Input kW (hp)	Lpm (USgpm)	Input kW (hp)	Lpm (USgpm)	Input kW (hp)
	5	18.4 (4.9)	0.2 (0.3)	16.6 (4.4)	1.9 (2.5)	14.9 (3.9)	3.43 (4.6)	13.4 (3.5)	4.6 (6.2)
	6	22.3 (5.9)	0.3 (0.3)	20.8 (5.5)	2.4 (3.2)	19.6 (5.2)	4.5 (6.0)	18.1 (4.8)	6.1 (8.2)
	7	26.3 (6.9)	0.3 (0.4)	25.1 (6.6)	2.9 (3.9)	24.2 (6.4)	5.56 (7.5)	22.8 (6.0)	7.9 (10.6)
Shaft-end	8	30.2 (8.0)	0.4 (0.5)	28.4 (7.5)	3.3 (4.4)	26.9 (7.1)	6.18 (8.3)	25.1 (6.6)	8.6 (11.6)
pump	9	34.1 (9.0)	0.4 (0.5)	31.8 (8.4)	3.7 (4.9)	29.5 (7.8)	6.79 (9.1)	27.3 (7.2)	9.4 (12.6)
	10	38.0 (10.1)	0.4 (0.6)	35.4 (9.4)	4.1 (5.5)	32.8 (8.7)	7.54 (10.1)	30.3 (8.0)	10.4 (14.0)
	11	42.0 (11.1)	0.5 (0.6)	39.1 (10.3)	4.5 (6.0)	36.1 (9.5)	8.29 (11.1)	33.2 (8.8)	11.5 (15.4)
	12	45.6 (12.1)	0.5 (0.7)	42.3 (11.2)	4.9 (6.5)	39.3 (10.4)	9.03 (12.1)	36.0 (9.5)	12.4 (16.7)
	13	49.3 (13.0)	0.6 (0.8)	45.5 (12)	5.2 (7.0)	42.5 (11.2)	9.76 (13.1)	38.8 (10.3)	13.4 (18.0)
	5	18.4 (4.9)	0.2 (0.3)	16.6 (4.4)	1.9 (2.5)	14.9 (3.9)	3.43 (4.6)	13.4 (3.5)	4.6 (6.2)
	6	22.3 (5.9)	0.3 (0.3)	20.8 (5.5)	2.4 (3.2)	19.6 (5.2)	4.5 (6.0)	18.1 (4.8)	6.1 (8.2)
	7	26.3 (6.9)	0.3 (0.4)	25.1 (6.6)	2.9 (3.9)	24.2 (6.4)	5.56 (7.5)	22.8 (6.0)	7.9 (10.6)
Cover-end	8	30.2 (8.0)	0.4 (0.5)	28.4 (7.5)	3.3 (4.4)	26.9 (7.1)	6.18 (8.3)	25.1 (6.6)	8.6 (11.6)
pump	9	34.1 (9.0)	0.4 (0.5)	31.8 (8.4)	3.7 (4.9)	29.5 (7.8)	6.79 (9.1)	27.3 (7.2)	9.4 (12.6)
	10	38.0 (10.1)	0.4 (0.6)	35.4 (9.4)	4.1 (5.5)	32.8 (8.7)	7.54 (10.1)	30.3 (8.0)	10.4 (14.0)
	11	42.0 (11.1)	0.5 (0.6)	39.1 (10.3)	4.5 (6.0)	36.1 (9.5)	8.29 (11.1)	33.2 (8.8)	11.5 (15.4)
	12	45.6 (12.1)	0.5 (0.7)	42.3 (11.2)	4.9 (6.5)	39.3 (10.4)	9.03 (12.1)	36.0 (9.5)	12.4 (16.7)
	13	49.3 (13.0)	0.6 (0.8)	45.5 (12)	5.2 (7.0)	42.5 (11.2)	9.76 (13.1)	38.8 (10.3)	13.4 (18.0)

NOTE: For special fluid (e.g. fire-resistant) specifications please contact technical support.

V2020H Double Pumps

Model Codes

V2020 H S 01 F 05 B 05 S B 001 A A 00 J A L 000 A Z 31



Note: Some options may require additional lead time. Please contact sales representative for details.

1 **Product Type**
V2020 – V2020 Double series vane pump

2 **Pressure Type**
H – High Pressure

3 **Cover Type**
S – Standard Cover
P – Priortiy Valve Cover with RV
F – Flow Control Cover with RV
N – Flow control with internal drain cover with RV
D – Directional control valve manifold
R – Pressure relief cover

4 **Mounting Flange Type**
01 – 2 Bolt flange SA -A size
02 – Foot Bracket
04 – Face mounting
06 – 2 Bolt flange SAE-B Size

5 **Inlet Port Type**
F – 4 Bolt flange

6 **Ring Capacity Shaft End**
05 – 5 USgpm
06 – 6 USgpm
07 – 7 USgpm
08 – 8 USgpm
09 – 9 USgpm
10 – 10 USgpm
11 – 11 USgpm
12 – 12 USgpm
13 – 13 USgpm

7 **Outlet Port Type Shaft End**
B – G 0.750 BSPF Thread
E – 4 Bold Flange
P – .750 NPT Thread
S – 1.0625-12 UN-2B Thread

8 **Ring Capacity Cover End**
05 – 5 USgpm
06 – 6 USgpm
07 – 7 USgpm
08 – 8 USgpm
09 – 9 USgpm
10 – 10 USgpm
11 – 11 USgpm
12 – 12 USgpm
13 – 13 USgpm

9 **Outlet Port Type Cover End**
S – 1.062-12 UN-2B Straight thread (For STD Cover)
B – G3/4 BSP
E – 4 Bolt Flange
P – P Port-.750-16 UN-2B ,T Port -.500 NPT
A – P Port -.750-16 UN-2B , T Port-1.0625-12 UN-2B (For F Cover)
C – Primary Port .750-16 THD, Secondary Port -.875-14 THD, Tank- .750-16 THD (For P Cover)
T – P Port-.750-16 UN-2B ,T Port -.750-16 UN-2B (F Cover).

10 **Shaft Seal and Bearing**
B – Single lip seal and sealed bearing
D – Dual lip seal and sealed bearing
S – Dual lip seal and open bearing

11 **Shaft Type**
001 – Straight keyed , DIA-.750", Length-2.66", shaft #1
003 – Key threaded .875-18 UNS-2A, DIA-.9380", length- 2.8", shaft #3
011 – Involute splined 11T 16/32 pitch, major DIA-.733", length- 2.935", shaft #11
038 – Involute splined 11T 16/32 pitch, major DIA-.733", length- 1.25", shaft #38
NOTE: Underlined shaft options denotes standard options

12 **Outlet Cover Port Orientation Shaft End**
A – Opposite to inlet port
B – 90° CCW From inlet port
C – Inline with inlet port
D – 90° CW from inlet port

13 **Outlet Cover Port Orientation Cover Side**
A – Opposite to inlet port
B – 90° CCW From inlet port
C – Inline with inlet port
D – 90° CW from inlet port

14 **Flow Rate Thru Orifice Cover**
00 – No Flow Control
01 – 1 USgpm
02 – 2 USgpm
25 – 2.5 USgpm
03 – 3 USgpm
04 – 4 USgpm
05 – 5 USgpm
06 – 6 USgpm
07 – 7 USgpm
08 – 8 USgpm
09 – 9 USgpm
10 – 10 USgpm
11 – 11 USgpm
12 – 12 USgpm

15 **Relief Pressure Setting**
A – 250 PSI
B – 500 PSI
C – 750 PSI
D – 1000 PSI
E – 1250 PSI
F – 1500 PSI
G – 1750 PSI
H – 2000 PSI
M – 2150 PSI
J – 2250 PSI
R – 2300 PSI
P – 2400 PSI
K – 2500 PSI
L – 2750 PSI
N – 3000 PSI
Z – No pressure setting

Model code continued next page

V2020H Double Pumps

Model Code Continued

16 **Seals Type**
A – Standard Seal
B – Viton Seal

17 **Shaft Rotation**
L – LH CCW Rotation viewed from shaft end
R – RH CW Rotation viewed from shaft end

18 **Special Feature Suffix**
000 – No Special Feature

19 **Paint Type**
A – Standard black per 504H0335
Z – No Paint

20 **Customer Identification**
Z – Non-specific

21 **Design Code**
31 – Design Code

Specifications

V2020H Typical Performance Data : 1200 RPM
Based on using petroleum oil at 49° C (120° F), viscosity 32 cSt at 38° C (150 SUS at 100° F), and 0 psi inlet pressure

Model series	Ring size	Displ.	Max. Speed	Maximum pressure	Typical delivery	Typical input power	Weight
	(Delivery USgpm @ 1200 r/min & 100 psi)	cm^3/r (in^3/r)	r/min	bar (psi)	L/min (USgpm) @ max. speed & pressure	kW (hp) @ max. speed & pressure	kg (lb)
	5	15.8 (1.0)	3400	204 (3000)	47.1 (12.4)	16.2 (21.8)	
	6	19.1 (1.2)	3400	204 (3000)	59.3 (15.7)	20.4 (27.4)	
	7	22.4 (1.4)	3000	204 (3000)	62.6 (16.5)	21.6 (29.0)	
	8	25.6 (1.6)	2800	204 (3000)	65.2 (17.2)	22.5 (30.1)	14.9-16.8
V2020H	9	28.9 (1.8)	2800	204 (3000)	72.2 (19.1)	24.9 (33.4)	(33-37)
	10	32.4 (2.0)	2500	204 (3000)	70.7 (18.7)	24.4 (32.7)	
	11	36.0 (2.2)	2500	204 (3000)	77.4 (20.4)	26.7 (35.8)	
	12*	38.7 (2.4)	2400	204 (3000)	80.0 (21.1)	27.6 (37.0)	
	13*	41.7 (2.5)	2400	204 (3000)	85.6 (22.6)	29.5 (39.6)	

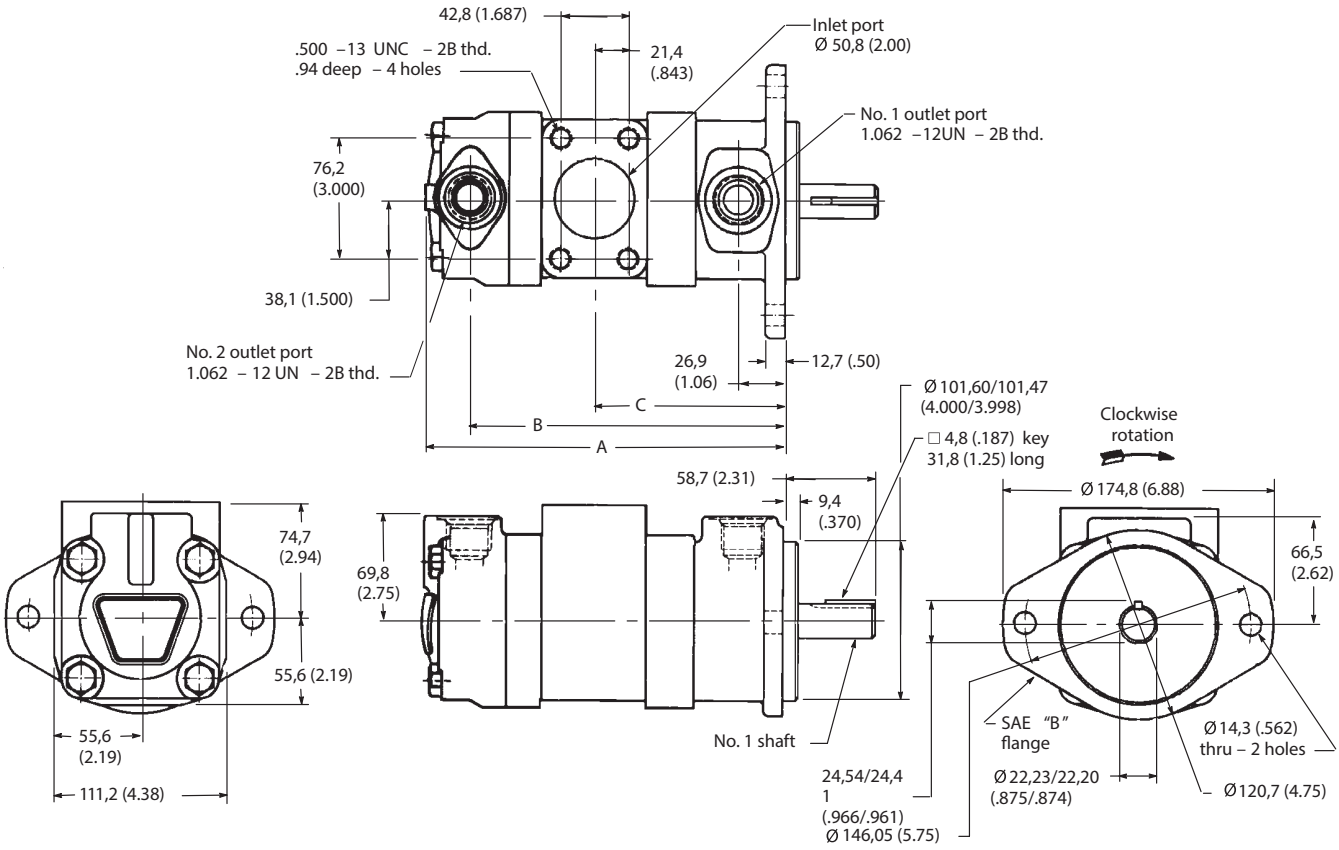
NOTE: Maximum speed is controlled by the largest ring in the unit.

* - Any combination of these displacements may need to be de-rated. Please contact Danfoss customer service for specified values.

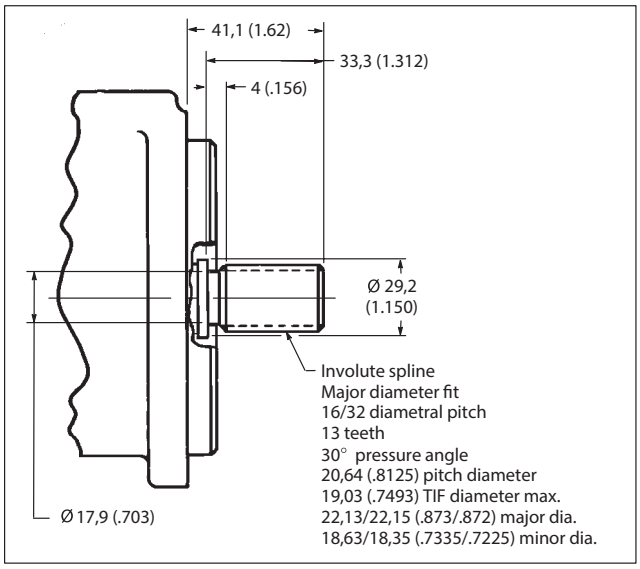
Double Pumps

V2020H Dimensions

Millimeters (inches)



Number 11 shaft

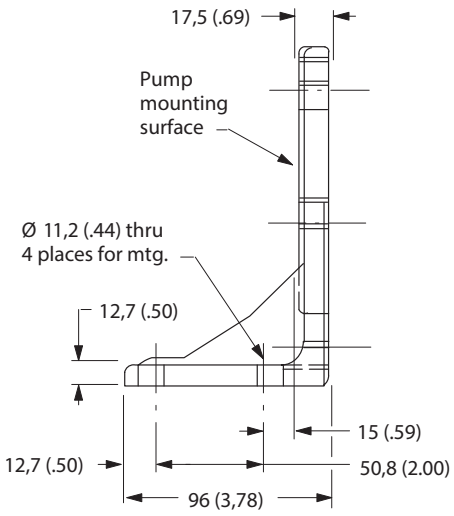


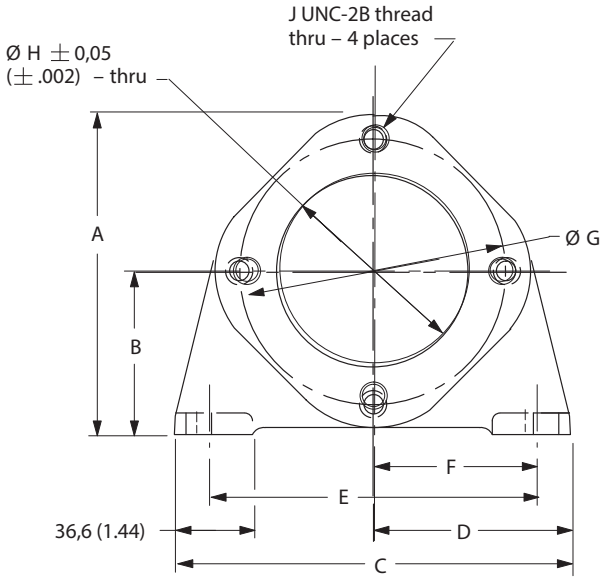
Ring size		Dimensions		
Cover end	**Shaft end**	**A**	**B**	**C**
5, 6	5, 6	206.9 (8.14)	180.9 (7.12)	107.3 (4.22)
5, 6	7, 8, 9	213.2 (8.39)	187.3 (7.37)	113.6 (4.47)
5, 6	10, 11	218.2 (8.59)	192.3 (7.57)	118.6 (4.67)
5, 6	12, 13	221.7 (8.73)	195.8 (7.71)	122.1 (4.81)
7, 8 or 9	5, 6	213.2 (8.39)	187.3 (7.37)	107.3 (4.22)
7, 8 or 9	7, 8, 9	219.5 (8.64)	193.6 (7.62)	113.6 (4.47)
7, 8 or 9	10, 11	224.6 (8.84)	198.6 (7.82)	118.6 (4.67)
7, 8 or 9	12, 13	228.1 (8.98)	202.2 (7.96)	122.1 (4.81)
10, 11	5, 6	218.2 (8.59)	192.3 (7.57)	107.3 (4.22)
10, 11	7, 8, 9	224.6 (8.84)	198.6 (7.82)	113.6 (4.47)
10, 11	10, 11	229.6 (9.05)	203.6 (8.02)	118.6 (4.67)
10, 11	12, 13	233.1 (9.18)	207.2 (8.16)	122.1 (4.81)
12, 13	5, 6	221.7 (8.73)	195.8 (7.71)	107.3 (4.22)
12, 13	7, 8, 9	228.1 (8.98)	202.2 (7.96)	113.6 (4.47)
12, 13	10, 11	233.1 (9.18)	207.2 (8.16)	118.6 (4.67)
12, 13	12, 13	236.6 (9.31)	210.7 (8.29)	122.1 (4.81)

Foot Bracket Kit

Dimensions

Millimeters (inches)



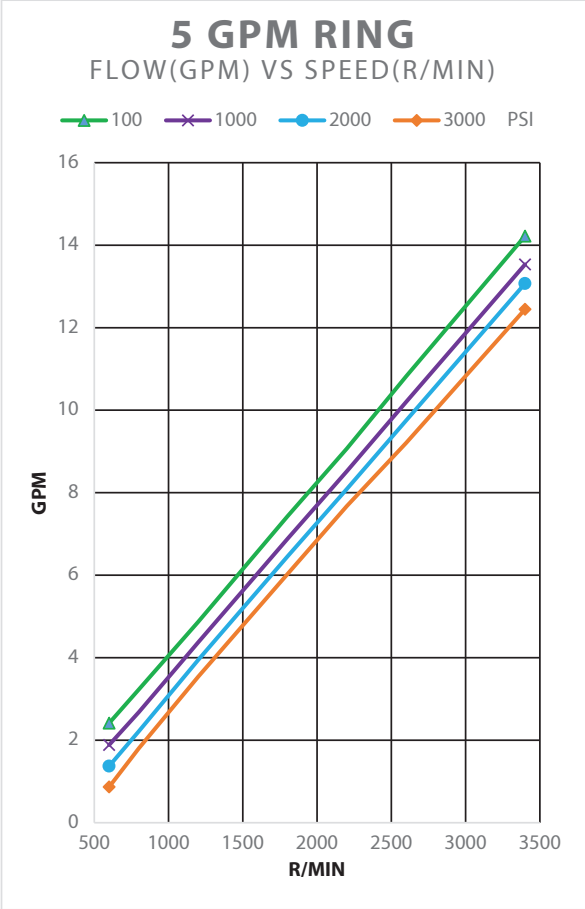


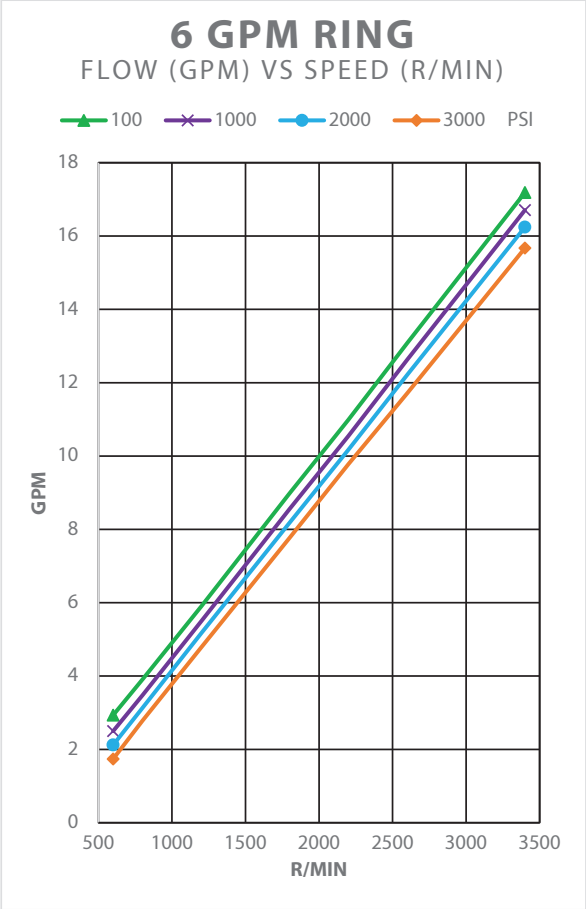
Note: Each kit includes screws for mounting pump to bracket.

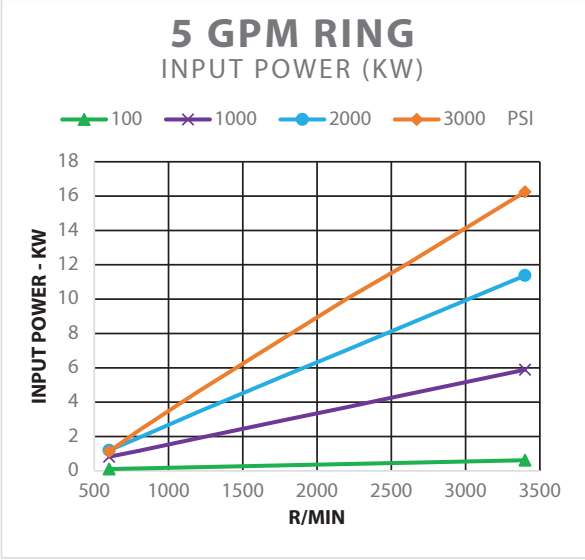
Model	A	B	C	D	E	F	øG	øH	J
FB-A-10	134.9 (5.31)	69.8 (2.75)	152.4 (6.00)	76.2 (3.00)	127.0 (5.00)	63.5 (2.50)	106.37 (4.188)	82.63 (3.253)	.375-16
FB-B-10	180.8 (7.12)	92.2 (3.63)	171.4 (6.75)	85.7 (3.38)	146.0 (5.75)	73.1 (2.88)	146.0 (5.75)	101.68 (4.003)	.500-13

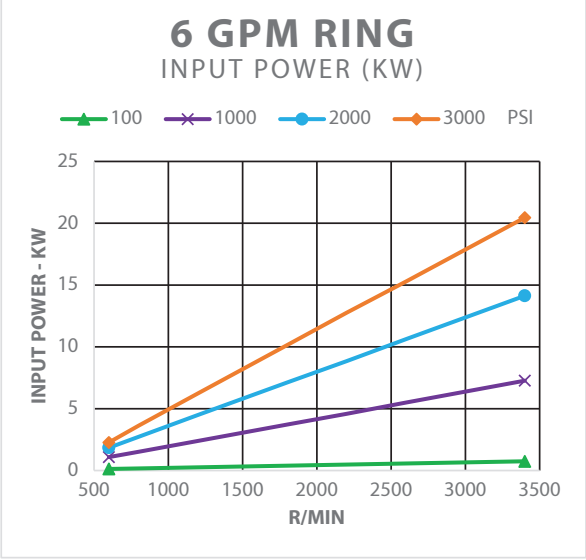
V2020H Typical Performance

Oil temp. 49°C (120°F), viscosity 32 cSt (150 SUS) @ 38°C (100°F), inlet pressure zero



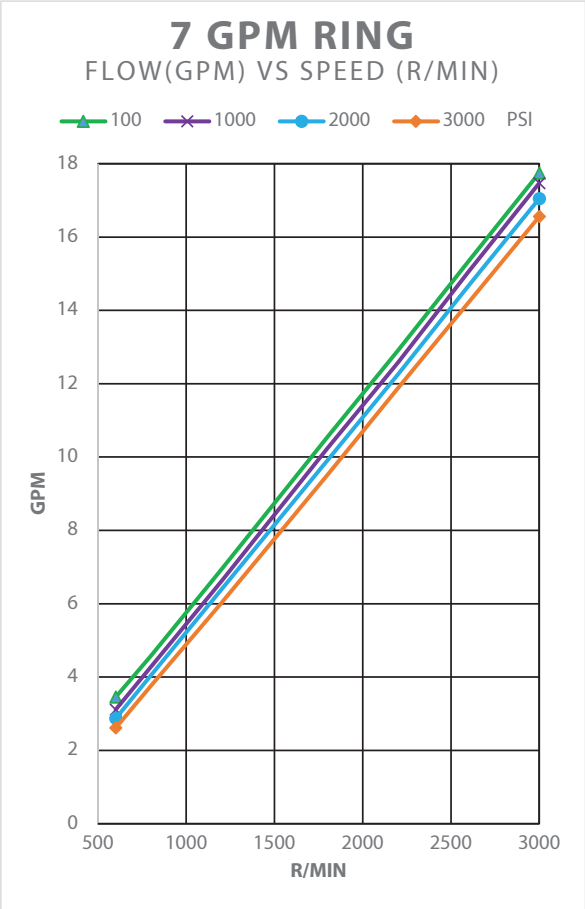


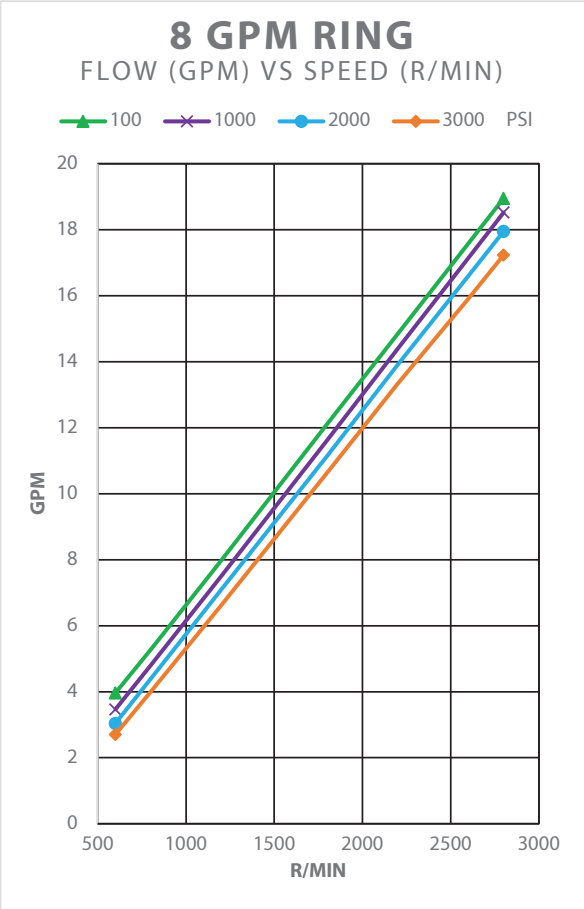


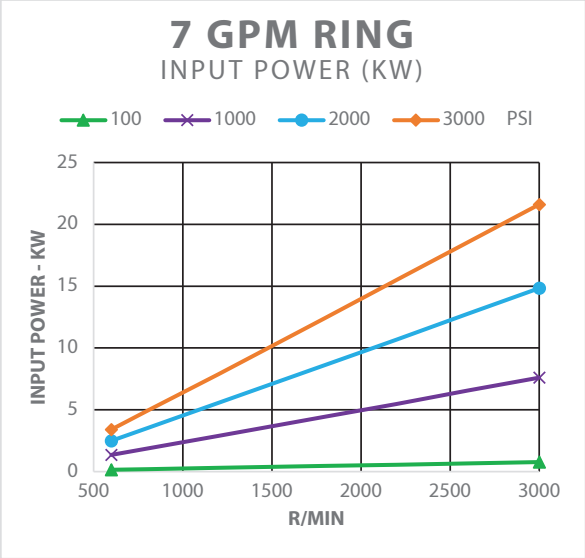


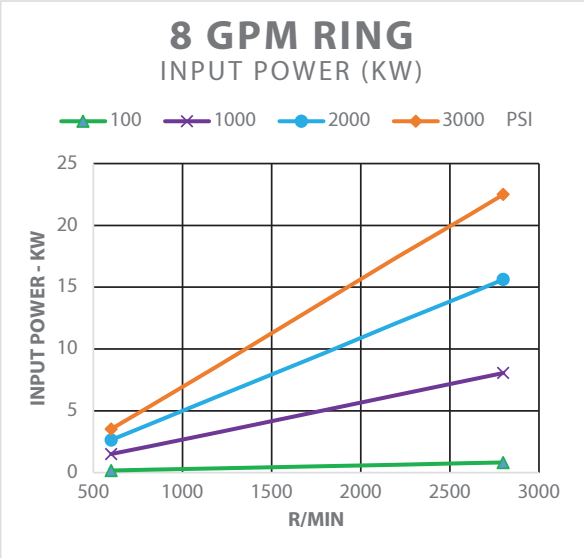
V2020H Typical Performance

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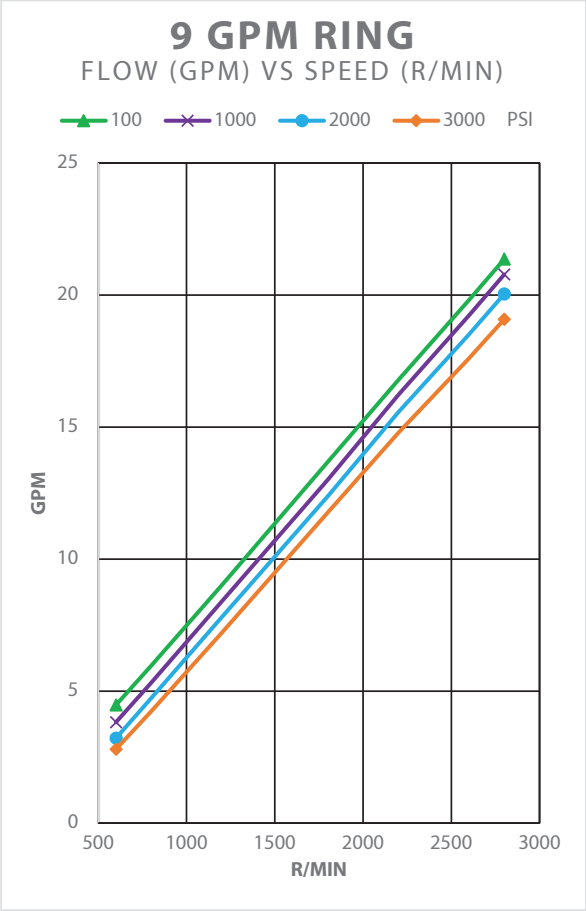


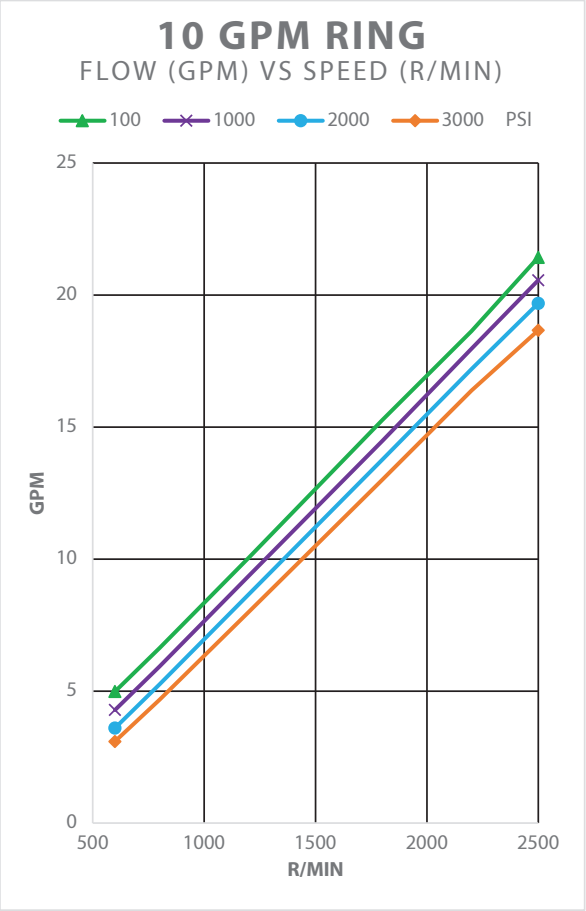


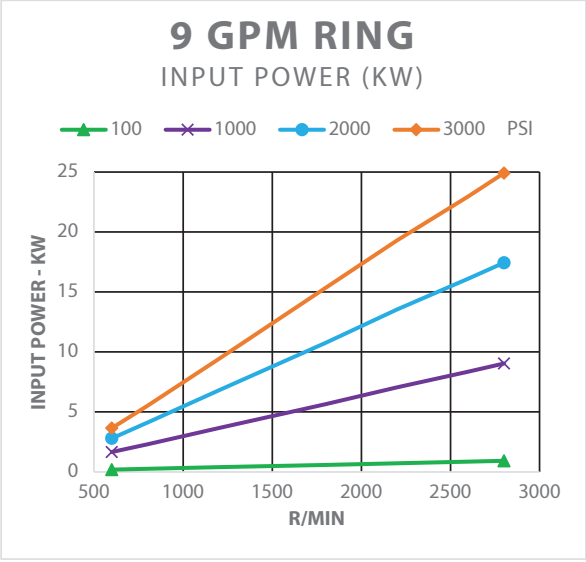


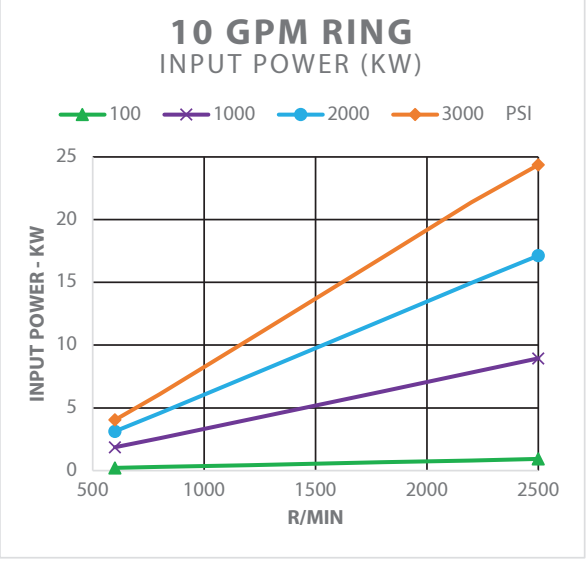
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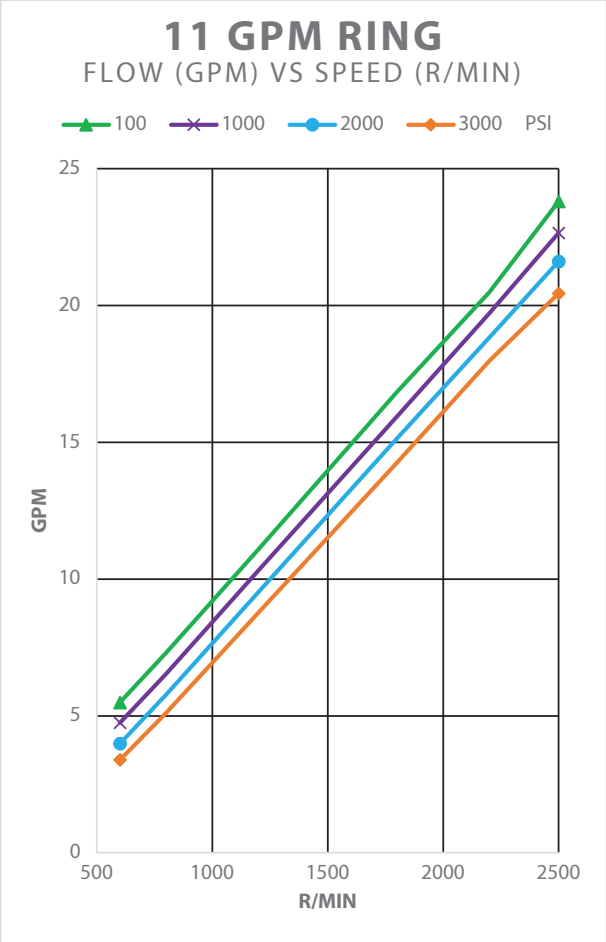


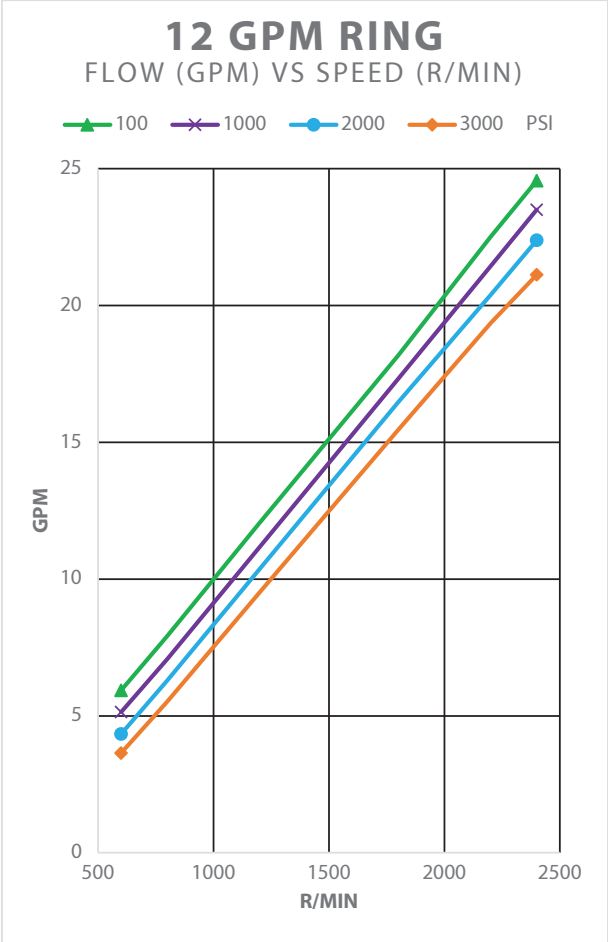


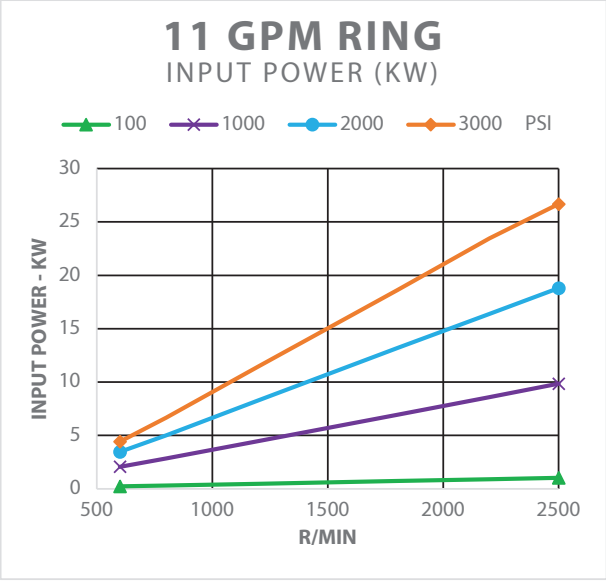


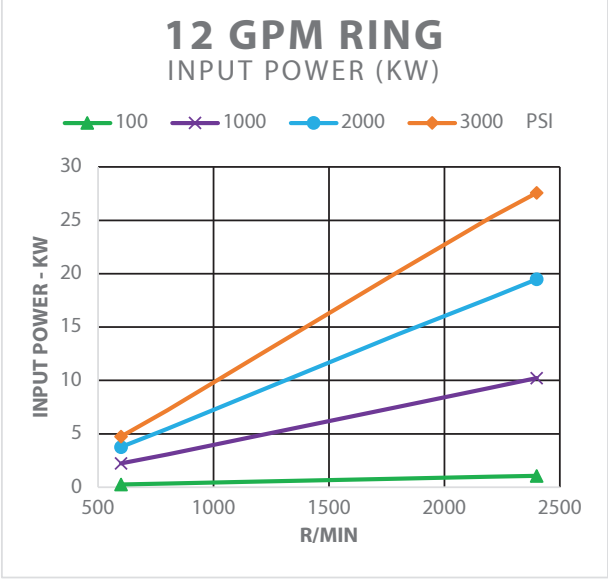
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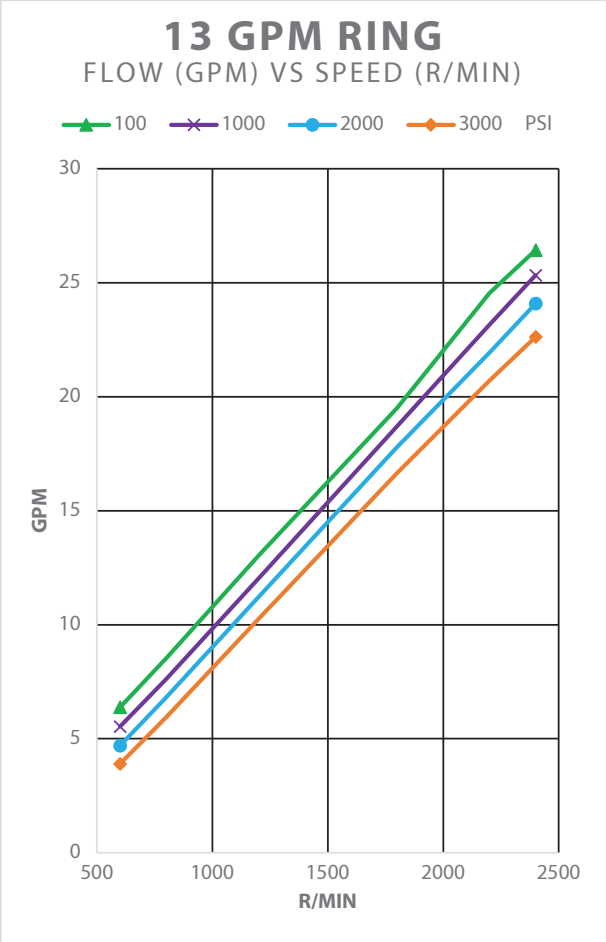


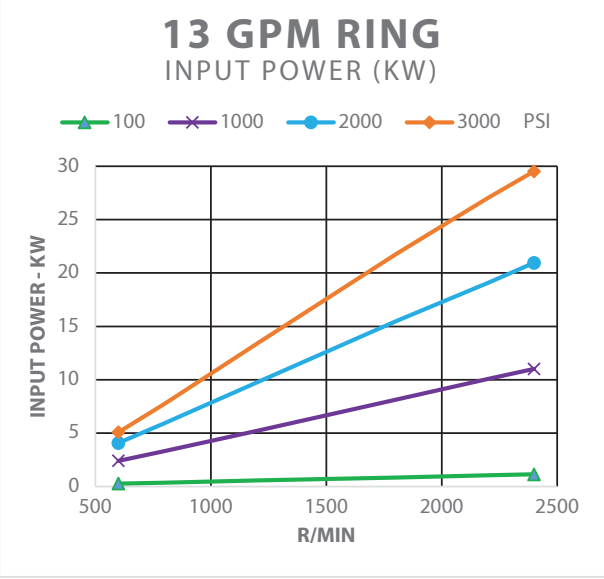




V2020H Typical Performance

Oil temp. 49°C (120°F), viscosity 32 cSt (150 SUS) @ 38°C (100°F), inlet pressure zero





Application and Service Information

Minimum Speed

Minimum recommended starting speed is generally 600 r/min. However, the pump size, system characteristics and environmental conditions can raise or lower this speed. A lower speed can often be achieved after the pump has primed.

If low starting or operating speeds are required, consult your Danfoss representative.

Inlet Pressure

Recommended inlet pressure is 0 to 0.34 bar (0 to 5 psi) gauge at maximum operating speeds. Inlet pressure should not exceed 0,69 bar (10 psi). Inlet depressions should not exceed 5 inches of Hg with petroleum oil, or 3 inches of Hg with all other fluids.

A pressurized reservoir system does not always assure a positive (supercharge) pressure at the pump inlet. Vacuum at the pump inlet can result during cold start-ups. Avoid high speeds until the circuit has warmed and supercharge pressure actually exists at the pump inlet.

Drives

Vickers by Danfoss pumps are designed for use on direct coaxial drives. If drives imposing radial or axial loads are being considered, consult your Danfoss representative for additional information.

Concentricity and angular alignment of shafts are important to pump life. Misalignment can induce heavy loads on bearings, causing premature failure.

Flexible coupling halves must be aligned according to the coupling manufacturer's recommendations.

When using double universal joint couplings, the shafts must be parallel and the yokes must be in line. The offset should be kept as low as possible. Maximum allowable offset will, of course, vary with application conditions. The pump shaft to universal joint diametral fit should be close (major diameter fit) with no looseness.

Mounting Dimensions

Concentricity of the customer's female pilot diameter relative to the effective axis of the female drive must be within 0.10 mm (.004 in.) total indicator reading. The clearance between the male and female pilot diameters must be +0.01 to +0.05 mm (+.0005 to +.0020 in.).

The customer's mounting face to which the pump is affixed must be square to the axis of the female drive within 0.04 mm per mm (.0015 in. per in.).

Dimensions of the customer's keyed shaft receiver must be between +0.003 and +0.025 mm (+.0001 and +.0010 in.) of the maximum shaft diameter shown on the Vickers installation drawing.

Valves and Circuitry

Protect against hydraulic surge pressures (inlet or outlet) applied to or generated by the pump. Relief valves must prevent these surges from exceeding published pressure ratings.

Never assume a relief valve setting is the maximum pressure a pump experiences. Shock conditions may exist which can exceed circuit and pump limitations.

Shaft Loading

Never assume pumps in a double pump assembly can be simultaneously loaded to rated pressure. Shaft loading must be checked for excessive torque and side loads.

Piping

Hydraulic lines should be as short and have as large an inside diameter as possible. Where lines are long, it is desirable to adapt to a larger capacity line than a unit's ports specify. Inlet, outlet and drain lines should not be smaller than the nominal port size shown on installation drawings. A "Y" shaped inlet should not be used to feed two separate pumps because one may be starved and cavitate.

There should be as few bends and fittings in lines as possible. High-pressure lines and fittings are restrictive to flow and may result in excessive pressure drop through the system. They should be used only where necessary in a pressure line.

Hose

When installing a hose, allow enough slack to avoid kinking. A taut hose will not allow movement with pressure surges. Slack in the line compensates for surges, relieving strain. The hose should not be twisted during installation or while in operation. Twisting will weaken the hose and loosen connections.

A neater installation is usually obtainable by using extra fittings to minimize unusually long loops in a line. Hoses should be clamped to prevent rubbing and entanglement with moving parts. Where hoses are subject to chafing, they should be run through protective neoprene hose or shielded metallic guards.

Application and Service Information

Hydraulic Fluids

Pumps can be used with anti-wear hydraulic oil, or automotive type crankcase oil (designations SC, SD, SE, SF, or SG) per SAE J183 202007. Fire-resistant fluids can also be used, but may require the use of special seals as explained in the following "Seals" section.

The viscosity range of petroleum oil, with the pump running, should be 13-54 cSt (70-250 SUS). The oil viscosity at 38° C (100° F) should be 32-48 cSt (150-225 SUS).

Fire-resistant fluids should have a viscosity as close as possible to that of petroleum oil as described above. A maximum specific gravity of 1.3 is suggested for fire-resistant fluids.

An operating temperature of 49° C (120° F) is recommended. The maximum temperature for oil should be 65° C (150° F), and the maximum for water-containing fluids should be 130° F.

For additional fluid and temperature information, reach out to your Danfoss sales representative.

Seals

Nitrile seals are suitable for use with petroleum, water-glycol, water-in-oil emulsion, polyolester, and high-water-base fluids. Phosphate ester fluids require the use of fluorocarbon seals, which are identified in model codes.

Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials and additives for protection against wear of components, elevated viscosity and inclusion of air.

Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles, or personnel safety considerations are cause for adjustment of these cleanliness codes.

Vickers by Danfoss products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified. Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

Product	System Pressure Level – bar (psi)		
	<70 (<1000)	**70-210 (1000-3000)**	**210+ (3000+)**
Vane Pumps – Fixed	**20/18/15**	**19/17/14**	**18/16/13**

Application and Service Information

Aeration

Reservoir and circuit design must prevent aeration of the fluid. Particular care must be used to employ joints, seals and gaskets that will not leak or deteriorate. This is especially important in low pressure and suction lines. Connections should always be tight to prevent air from entering the system.

It is best to use windows and sight glasses in the reservoir and inlet lines during prototype evaluation to determine whether significant amounts of air are present in the fluid. Any opaqueness or milky appearance of the fluid in the lines or reservoir indicates excessive aeration. Bubbles on the surface of the reservoir fluid may indicate that excessive aeration is present.

Reservoir

The oil level of the reservoir should be as high as possible above the pump suction line opening. All return lines should discharge near the tank bottom, always below the oil level, and as far from the pump inlet as possible.

Reservoirs should incorporate a sight gauge, dipstick or other means for easy checking of the oil level. Without these devices, the oil level often goes unchecked and, should a leak occur, the pump can be starved and damaged from loss of lubrication.

Preferably, reservoirs should be located above pumps. This creates a flooded pump inlet which reduces the possibility of pump cavitation.

Pump suction and tank return lines should be attached to the reservoir by flanges or welded heavy-duty coupling. If the suction line is connected to the bottom of the reservoir, the coupling should extend above the bottom inside the tank. This prevents residual dirt from getting into the suction line when the tank is cleaned. The seals used on all suction line connections should be such that they will not deteriorate and leak.

A baffle plate in the reservoir is desirable to separate the suction and return lines. The plate causes return oil to circulate around the outer wall of the reservoir for cooling before it re-enters the pump. It also helps provide time for entrained air to separate from the oil. Baffle plate openings should be designed so that cascade effects and resultant air entrainment are minimized.

Most reservoirs are vented to the atmosphere through an opening that lets air leave or enter the space above the oil as the oil level rises or falls. A filler/breather unit containing an air filtering element is often used as the vent. It must be large enough to handle the air flow required to maintain atmospheric pressure whether the tank is full or empty.

Startup

Before starting, fill the pump with system fluid through the uppermost port. The housing must be kept full at all times to provide internal lubrication.

At initial startup, it may be necessary to bleed air from the pump outlet to permit priming and reduce noise. Bleed by loosening an outlet connection until a solid stream of fluid appears. An air bleed valve for this purpose is available through your Danfoss representative.

Application Guidance

To ensure optimum pump performance in conjunction with your specific application, consult your Danfoss representative if your:

- Application requires an indirect drive
- Fluid does not meet specifications
- Mounting attitude is other than horizontal
- Oil viscosity at operating temperature is not within 13-54cSt
- (70-250 SUS)
- Oil viscosity at startup is in excess of 220 cSt (1000 SUS)
- Needs require application assistance

Service Information

Refer to powesource.danfoss.com for service information.

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