DESCRIPTION :

- Fixed volume, corrected involute spur gear design External Gear Pump

LOW & MEDIUM PRESSURE APPLICATIONS :

- Mobile cranes
- Agricultural machinery
- Mining machinery
- Forest machinery
- Earth moving equipment
- Lift trucks
- Construction equipment
- Dump trucks, Tipping trucks& Dozers
- Used in hydraulic log splitters
- Fluid power transfer units (Power Packs)

SALIENT FEATURES :

- 240 bar continuous operating pressure
- Compact design
- Good suction characteristics
- Easy to maintain
- Wide varieties of SAE , ISO & ANSI flange mounting options are available
- Ports(Inlet & Pressure ports) -
  - Side ported or Rear ported
  - Threaded ports
    - BSP or UNF or Metric threads
  - Flange ports(Metric or SAE)
    - Metric or UNC threads
  - Shaft Configurations
    - Spline or Keyed (Refer to model wise ordering code)
- Bushings / roller bearing options available for long life & lubrication
- Rotation
  - Clockwise
  - Counter Clockwise
  - Bi directional
- Long seal life & high volumetric efficiency even at high operating temperatures

DESIGN & CONSTRUCTION :

- Gear pumps consists of a pair of gears supported by bushes, a body, a flange and a cover.
- Shaft of the driving gear projecting beyond the mounting flange a twin-lip seal ring.
- Pump body mounting flange and port block are of high strength cast iron.
- Gears are made of steel(Case hardened) and are fine finished to have a high degree of surface finish.
- Proper tooth profile design and geometric proportions ensure low pulsation levels.
- An important feature of the pump is the deflecting pressure balanced wear plates.
- Low friction PTFE coated DU bushes are used to improve performance.

Selecting the appropriate hydraulic pump for an application is always a challenge because of different functional and hydraulic system requirements, such as operating medium, range of pressure, type of drive, etc.

A gear pump is a mechanical device that moves liquids by the use of two meshing gears. Liquid flows under pressure from the pump intake to the discharge in the space formed by the gear teeth. The liquid also serves to lubricate the gears. The small clearances between the walls of the pump chamber and gear teeth create a tight seal, thereby preventing liquid from flowing back through the intake. Unlike other types of pumps, gear pumps do not need to be primed and can be run dry for short periods without damaging the pump.

Gear pumps are capable of producing high internal pressures and they can pump very precise amounts of liquid at high pressures. Thick liquids such as crude oil can also be used in the pump.

VGP
GEN

Product Features :

Features	Descriptions
Pump Type	Heavy duty cast iron , 3 piece construction , External gear pump.
Displacement	See Technical Characteristics
Speed	See Technical Characteristics
Pressure (Inlet)	0.8 to 2 bar abs. 13cm (5 in) Hg Maximum vacuum at operating temperature.
Pressure (Outlet)	See Technical Characteristics
Mounting	SAE , ISO Standard flanges , specials on request.
Ports	Threaded ports , SAE & Metric Split flanges
Shaft end	SAE Splined , Keyed , others on request.
Drive	Flexible coupling is recommended. Axial loading is not recommended.
Inlet flow velocity	**Mineral oil and HFD** • Inlet up to 2.5 m/s • Outlet up to 6.0 m/s **Fire resistant fliuds HFB , HFC** • Inlet up to 1.5 m/s • Outlet up to 4.0 m/s
Hydraulic fluids	**Mineral oils (Petroleum base) ,Bio degradable oil , Fire resistant fluids such as:** • water - oil emulsions 60/40 , HFB • phosphate - easters, HFD (FPM seals required) • water - glycol , HFC
Fluid Viscosity (Mineral oils)	50 SSU minimum @ Operating temperature 7500 SSU maximum @ starting temperature Viscosity range for cold start 1000 to 2000 mm²/s
Fluid temperature	**Operating temperature :** Petroleum base oils with standard seals -20° C to +80°C (0 to 176°F). Temperature for cold start -20 to -15°c Fire resistant fluids HFB, HFC -20° C to + 65° C (0° to 150° F). • Maximum permissible operating pressure is dependant on fluid temperature.
Direction of Rotation	Clock wise , Counter clockwise. Viewed from the shaft end side.
Fluid Filteration	**According to ISO 4406 code :** • 19/16 at 140 bar (2000 psi) • 17/14 at 210 bar (3000 psi) • 15/12 at 275 bar (4000 psi) (For details see page no.8)
Multiple Pump assemblies	• Up to 3 gear sections of the same model,even with different gear widths. • VGP-BB , VGP- CC , VGP - DD • Max. shaft load must be conform to limitations shown in the shaft load rating table in this catalogue • By adding the torque values for each pumping section (that will be simultaneously loaded) will determine the Max. load
Separate or common inlet capability	• Each gear section unit has inlet and outlet ports. • Two gear sets share common inlet.
Piggy back Assemblies	Several models can be mounted together. VGP - C/B, VGP - D/B, VGP - D/C, VGP - E/C, VGP - E/C/B

Components in External Gear Pumps :

The non rotating parts namely Mounting flange, Housing & Port block are made of Cast iron.

Gear shafts :

Veljan Gear shafts are produced with precision manufacturing processes which will have a great effect on overall efficiency & performance of a pump. The manufacturing processes includes:

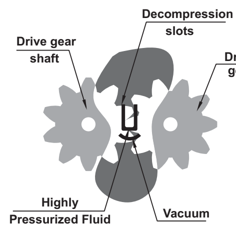
a) Case carburising & hardening in sealed quench furnace

b) Gear tooth profile are finish ground on latest Reishauer gear grinding M/C to maintain geometrical accuracies to DIN 5 quality.

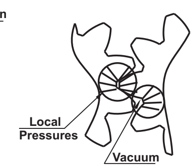
Radial balance design in Gear engagement area :

Radial balance design must also take into account the fact that teeth in mesh cannot fully expel oil. As a result tiny fluid drops are 'squeezed' between the engaging teeth, thus entailing (depending on the incompressibility of the liquid) local over pressures that act in a radial manner. In addition, during gear disengagement, the volume between the teeth suddenly increases.

Consequently, the central part of bushings must have some slots in order to discharge this fluid; these are the only points where delivery and suction areas come into contact and the over-pressure prone fluid discharges in micro-areas subjected to early vacuum.



Radial balance in the gear engagement area



Radial balance in the gear engagement area

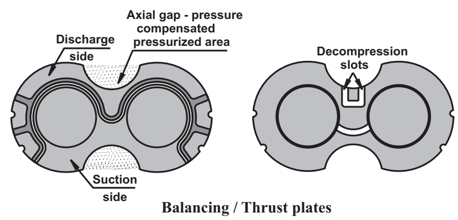
Thrust Plates & Seal assembly :

Each and every component in a Gear Pump plays an important role in its performance. The Axial & Radial compensations are made possible by placing two balancing or compensation bush bearings opposite the plane faces of the gears.

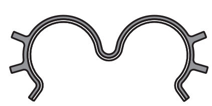
Bushing openings play another important role as they allow leakages to pass from the delivery area to the suction area where the leaked fluid mixes with fluid from the tank.

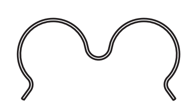
In axial and radial balance, the pressurized fluid, pushed through tiny and accurately measured openings between the outlet and the bushings, exerts a thrust on their two back parts. As a result, gears perfectly mesh bushings while the lubricating film prevents the faces of parts from wearing out.

The 3-shaped seal sets will balance the area and separates the suction area from the delivery area. It is supported by an anti-extrusion ring, with the same shape as the seal, so as to avoid the extrusion of the seal parts where it is not supported due to play.



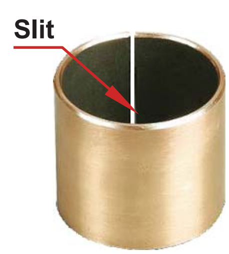
Balancing / Thrust plates


3- Shaped thrust plate seal


Thrust Plate Back up ring

Bush Bearings:

Bushings are positioned in the two covers (Port block & Mounting Flange) where gear shaft revolve; The problem is the accurate positioning of gear plane faces via cover surface plates. If they do not form a perfect right angle with tolerances less than 2-3 thousandths of millimeters, this would promote substantial leakages & early wear.



Roller Bearings :

Roller bearing pumps have these advantages:-
- High strength
- Long life for the roller bearings
- Continuously pressure lubricated even when the pump is under no load
- Can operate at high temperatures
- Units are repairable due to roller bearing design
- Roller bearing construction is relatively insensitive to moderate amounts of contamination

PL Factor :

Each section of a pump or motor should be regarded as a single unit with corresponding power unit requirements. The entire input horsepower is fed through the drive shaft, the power delivered or from the unit is limited by the strength of the shaft. The limit is defined as the "PL" factor. "P" being the operating pressure in psi and "L" is the sum of gear widths in inches.

In multiple units the "PL" must be calculated for each connecting shaft and must include the sum of the gear widths driven by it.

(Each shaft has a unique "PL" factor as can be seen in the table given below)
Pressure(psi) x Total gear width (inches) = PL factor

Pl Factor Must Not Exceed Figure Shown In Chart For Shaft Type :

Shaft Type		Solid Shaft & Gear	Loose Shaft
VGP-B	SAE "A" Spline	4450	-
	SAE "A" Key	3600	-
	SAE "B" Spline	13400	-
	SAE "B" Key	9900	-
	Connecting Shaft	-	5 550
VGP-C	SAE "B" Spline	8450	6250
	SAE "B" Key	6250	6250
	SAE "B-B" Spline	13000	6250
	SAE "B-B" Key	9300	6250
	SAE "C" Spline	-	6250
	SAE "C" Key	-	6250
	Connecting Shaft	-	6250
VGP-D	SAE "B" Spline	6450	6450
	SAE "B" Key	4750	4750
	SAE "B-B" Spline	9900	9900
	SAE "B-B" Key	7100	7100
	SAE "C" Spline	19100	9000
	SAE "C" Key	13900	9000
	Connecting Shaft	-	9000
VGP-E	SAE "B" Spline	5040	5050
	SAE "C" Spline	14900	11950
	SAE "C" Key	10800	10800
	Connecting Shaft	-	11900

Application Guide Lines

Inlet Conditions:

Recommended below should be followed at inlet condition of the pump:

- Never run pumps without oil - Particular care should be taken to open any shut-off valves.
- Use large diameter pipes and fittings and avoid sharp bends, elbows and long length lines.
- Pumps must be mounted below the lowest level of fluid tank as much as possible.
- Ensure that inlet lines are airtight.
- Be carefully in case there is high speed and/or high viscosity fluids are used in system.
- Fluid inlet velocity should not exceed 2.5m/sec (8.0 ft/sec) calculated by:

$V = (21.22*Q)/D^2$ 3/sec	Where V = Velocity (m/sec) Q = Flow range (l/min) D Bore diameter (mm)	$V = 0.0408Q/D^2$ ft/sec	Where V = Velocity (ft/sec) Q = Flow rate (US gal/min) D = bore diameter (inches)

Cavitation:

Hydraulic oil used in the modern hydraulic systems contains approximately 10% dissolved air by volume and this air implodes at certain pressure creating air pockets that can damage on metal surfaces. The main reasons are especially leakages in the suction port, unsuitable pipe sizes, elbow fittings and sudden changes in flow line.

Operating Temperature:

Operating temperatures are the function of fluid visosities, fluid type, and the pump. For cold starts, the pumps should be operated at low speed and pressure until fluid warms up to an acceptable viscosity.
• For NBR seals between 0°C and +80°C continuously and between -20°C and +100°C intermittent.
• For VITON seals between 0°C and +100°C continuously and between -20°C and +120°C intermittent.

Inlet pressure

Under standard working conditions, intake pipe pressure is lower than the atmospheric pressure.The operating inlet pressure should range between 0.7 and 3 bars (absolute).

Hydraulic fluids:

We recommend you to use only mineral oil-based hydraulic fluids having good anti-wear, anti-foaming (rapid de-aeration), antioxidant, anti-corrosion and lubricating properties. The fluids comply with the DIN/ISO or SAE standards Recommended viscosity range is 20/120(cSt) and permitted up to 700(cSt). If Hydraulic oil changes according to that the seals has to be changed.

For Mineral oil (Acc. ISO/ DIN)	- NBR/FPM	at temp.(-15 to + 83°C)	Fluid composition:-
- HFB	- NBR	at temp.(+2 to + 65°C)	HFB - Water - in - oil emulsion 40/60
- HFC	- NBR	at temp.(-15 to + 65°C)	HFC - Water - glycol 40/60
- HFD	- FPM	at temp.(-10 to + 80°C)	HFD - Phosphate ester

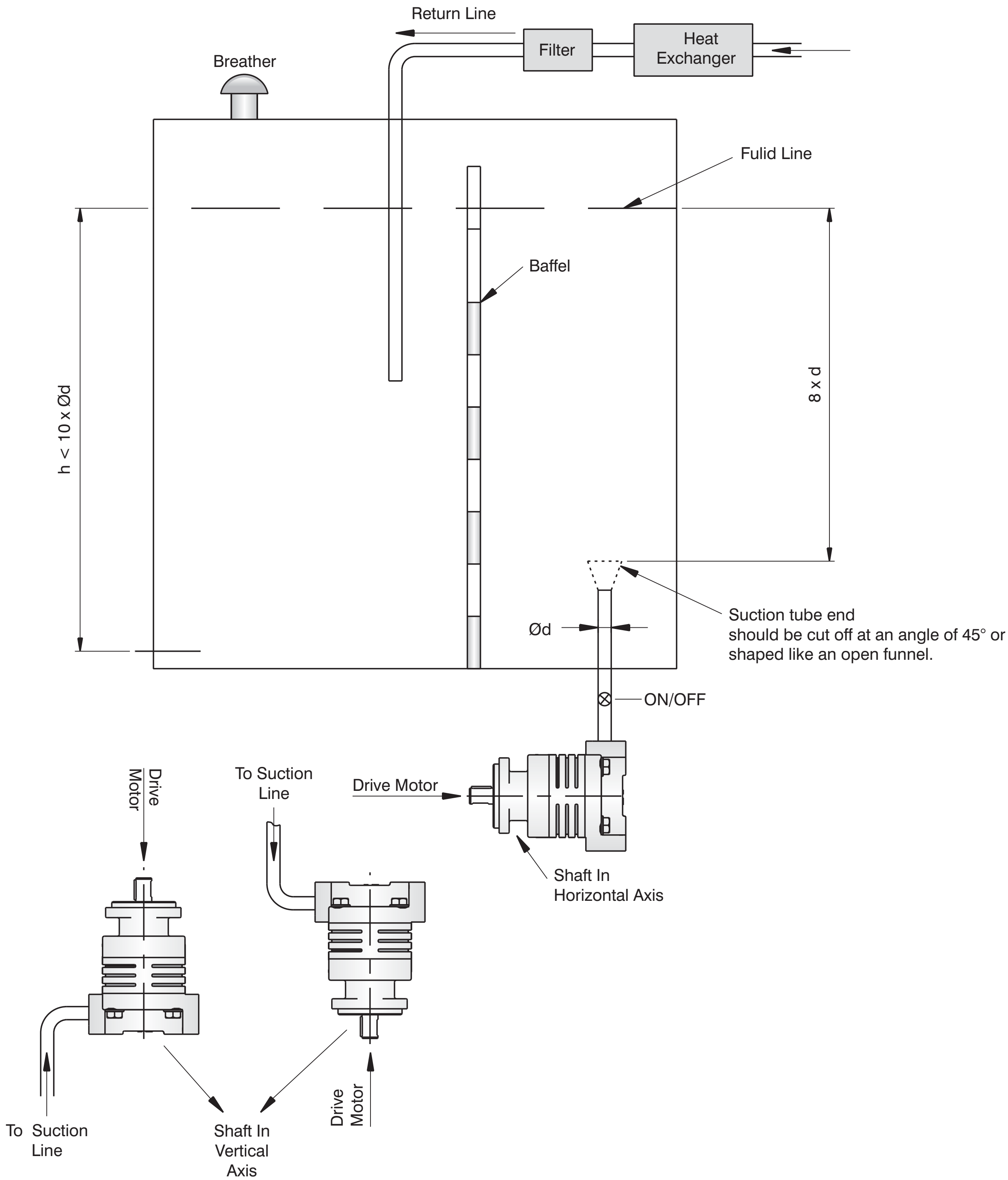
Shaft alignment :

Splined :

1. The permissible maximum misalignment is 0.06 mm (0.002 in) TIR for foot mounted pump and 0.03 mm (0.001 in) in case of flange mounted pump. The angular misalignment between the shaft splines and the coupling internal splines should be less than +/- 0.002 mm per mm diameter of the pump shaft.

Keyed :

1. These are supplied with matching Keys and in case replacement becomes necessary, use only high strength heat treated steel keys with hardness of 27-34 Rc. The key corners must be chamfered properly so that it locates snugly in the keyway.



- Pipe internal diameter must be more than the pump suction flange bore.
- The pipe/tube end of the suction line shall be machined at 45° or provided a funnel like outlet.
- Pipe bending shall be done to maximum possible radius.
- Suction line closer to the pump shall be out of a flexible hose.

These pump facts are certainly useful when discussing the impact of ISO cleanliness on working hydraulic or circulating system components.

National Aerospace Standard (NAS) 1638 :

		CLASS														
		00	0	1	2	3	4	5	6	7	8	9	10	11	12
Particles Size Range	5-15μm	125	250	500	1,000	2,000	4,000	8,000	16,000	32,000	64,000	128,000	256,000	512,000	1,024,000
	15-25μm	22	44	89	178	356	712	1,425	2,850	5,700	11,400	22,800	45,600	91,200	182,400
	25-50μm	4	3	16	32	63	126	253	506	1,012	2,025	4,050	8,100	16,200	32,400
	50-100μm	1	2	3	6	11	22	45	90	180	360	720	1,440	2,880	5,760
	>100μm	0	0	1	1	2	4	8	16	32	64	128	256	512	1,024
Maximum Particles	>5μm	152	304	609	1,217	2,432	4,864	9,731	19,462	38,924	77,849	155,698	311,396	622,792	1,245,584
	>15μm	27	54	109	217	432	864	1,731	3,462	6,924	13,849	27,698	55,396	110,792	221,584

ISO:DIS 4406; SAE J1165:

		ISO solid contamination code														
		8/5	9/6	10/7	11/8	12/9	13/10	14/11	15/12	16/13	17/14	18/15	19/16	20/17	21/18	22/19
Maximum Particles	>5μm	250	500	1000	2000	4000	8000	16000	32000	64000	130,000	250,000	500,000	1,000,000	2,000,000	4,000,000
	>15μm	32	64	130	250	500	1000	2000	4000	8000	16,000	32,000	64,000	130,000	250,000	500,000

Hydraulic fluid- Recommended Seal standards :

Fluid Standard	Description	Seal Standard		
		S - 1	S - 4	S - 5
HF - 0	Premium Hydraulic Oil	R	N	A
HF - 1 / HF - 1A	Petroleum Base Oils	R	N	A
HF - 2 / HF - 2A	Petroleum Base Oils with Anti-wear	R	N	A
HF - 3	Invert Emulsions	R	N	A
HF - 4	Water Glycol	R	N	A
HF - 5	Synthetic fluids: (Phosphate Esters)			
	Skydrol 500B, 500C, 7000, LD	N	R	N
	Pydraul 60, 10F	N	R	N
	Pyrogard 53	N	R	N
	Fyrquel 150, 300	N	A	R
	Houghtosafe 1010, 1055, 1120	N	A	R
	Pyrogard 55, 190, 600	N	A	R
	Pydraul series E (except 10E)	N	A	R
	Fyrquel 220	N	N	R
	Pyrogard 42, 43, 160, 230, 630	N	N	R
	Pydraul (all except 60 & series E)	N	N	R
	Coolanol 25, 35, 45	N	N	R
	MIL-L-23699	N	N	R
	Oronite 8200, 8515, M2-V	N	N	R
	OS45 (Type 3rd & 4th), OS49	N	N	R
	Versilube F- 44, F- 50	N	N	R

Legend : R = Recommended N = Not suitable A = Alternate S-1 : Buna-N S-4 : EPR S-5 : Viton

Hydraulic Formulae

FORMULA FOR	WORD FORMULA	LETTER FORMULA
FLUID PRESSURE, P (lbs/in^2)	PRESSURE $= \frac{\text{Force (lbs)}}{\text{Area (in}^2\text{)}}$	$P = \frac{F}{A}$
CYLINDER AREA (in^2)	AREA $= \frac{\pi}{4}$ x diameter^2	$A = \frac{\pi D^2}{4}$
FORCE (PUSH OR PULL) (lbs)	FORCE = Pressure (psi) x AREA (in^2)	F = P.A
PUMP INPUT POWER (HP)	HORSEPOWER $= \frac{\text{Flow (gpm) x Pressure (psi)}}{\text{1714 x Overall Efficiency}}$	$HP = \frac{Q.P}{1714\ \eta_o}$
VELOCITY or SPEED (ft./sec)	VELOCITY $= \frac{\text{231 x Flow Rate (gpm)}}{\text{12 x 60 x Area (sq. inches)}}$	$u = \frac{231\ Q}{720\ A}$
VOLUME, V (gallons)	VOLUME $= \frac{\pi \text{ x Radius}^2\text{(inches) x Stroke (inches)}}{\text{12 x 60 x Area (sq. inches)}}$	$V = \frac{\pi r^2 L}{231}$
FLOW, Q (gpm)	FLOW $= \frac{\text{Displacement (in}^3\text{/rev) x speed (rpm)}}{231}$	$Q = \frac{d.\ n}{231}$
VOLUMETRIC EFFICIENCY η_v (PUMP)	Vol. Eff $= \frac{\text{Output (gpm)}}{\text{Theoritical (gpm)}}$ x 100	
OVERALL EFFICIENCY, η_o	Ove. Eff $= \frac{\text{Output HP}}{\text{Input HP}}$ x 100	
MOTOR TORQUE (lb inch)	Torque $= \frac{\text{63025 x Horse Power}}{\text{Speed (rpm)}}$	$T = \frac{63025\ HP}{n}$
	$= \frac{\text{36.77 x Flow Rate (gpm) x Pressure (psi)}}{\text{Speed (rpm)}}$	$T = \frac{36.77\ QP}{n}$
MOTOR TORQUE, T/100 psi	TORQUE/ 100 psi $= \frac{\text{Motor Displacement (in}^3\text{/rev.)}}{0.0628}$	T/100 psi $= \frac{d}{0.0628}$
MOTOR SPEED, n (rpm)	SPEED $= \frac{\text{231 x Flow Rate (gpm)}}{\text{Motor Displacement (in}^3\text{/rev.)}}$	$n = \frac{231\ Q}{d}$
MOTOR POWER, HP	HORSE POWER $= \frac{\text{Torque Output (inch pounds) x Speed (rpm)}}{63025}$	$HP = \frac{T.n}{63025}$
VOLUMETRIC EFFICIENCY, η_v (MOTOR)	Vol. Eff $= \frac{\text{Theoritical (gpm)}}{\text{Input (gpm)}}$ x 100	

Pipe volume varies as the square of the diameter; volume in gallons = 0.0034 D^2L

where D = inside diameter of pipe in inches

L = Length in inches

Velocity in feet per second $= \frac{\text{0.320 x flow (gpm)}}{D}$

Specific gravity of oil is approximately 0.85

Thermal expansion of oil is about 1 cu. in. per 1 gallon per 10^0 F rise in temperature

Conversion Factors :

1 HP = 0.746 kw hr 1 bar = 14.5053 psi 1 kg = 2.2045 lbs

1 US gallon = 231 cubic inches. 1 kg = 9.8066 N

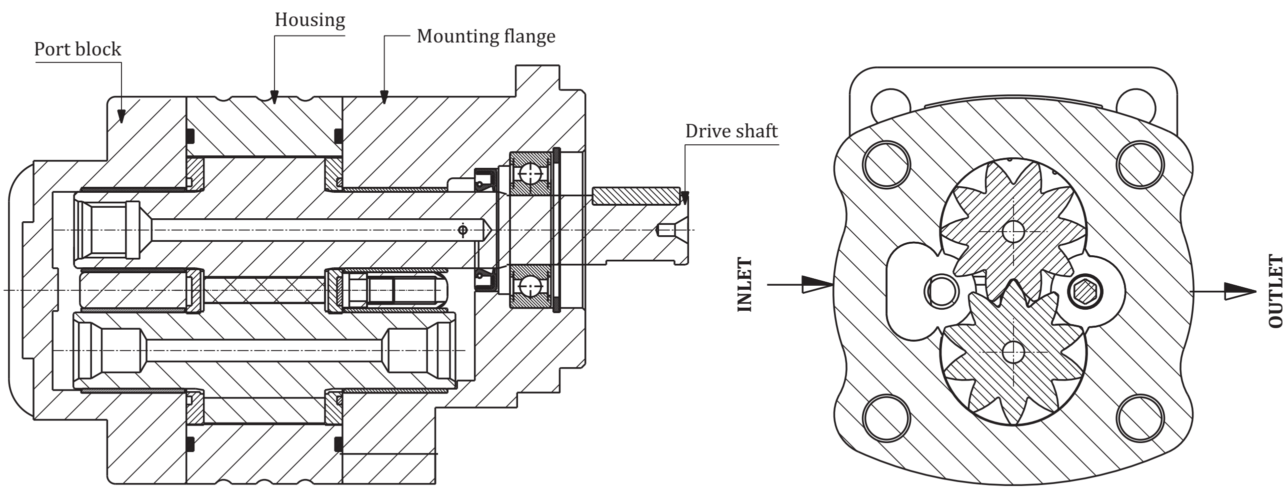
1 gallon/min = 3.8 lpm

Principle of Operation :

The working principle of the external gear pump.

A drive gear (that is driven by a motor) rotates an idler gear in the opposite direction. When the gears rotate, the liquid, which is trapped in the gear teeth spaces between the housing bore and the outside of the gears, is transferred from the inlet side of the pump to the outlet side. It is important to note that the pumped liquid moves around the gears and liquid moves around the gears and not between the gears. The rotating gears continue to deliver a fresh supply of liquid from the suction (inlet) side of the pump to the discharge (outlet) side of the pump, with virtually no pulsations. The meshing of the gears on the discharge side of the pump forces the liquid out of the pump and into the discharge piping.

Another important advantage of the gear pump is its self-priming capability. Gear pumps are capable of self-priming because the rotating gears evacuate air in the suction line. This produces a partial vacuum that allows the atmospheric pressure to force the liquid into the inlet side of the pump. This ability of the gear pump makes it an ideal choice when the application requires that the pump be located above the liquid level, and the liquid must be lifted to the pump. Because a gear pump cannot create a perfect vacuum, the total lift (including pipe friction losses) should not exceed about 7.5 PSI, or about one-half of the atmospheric pressure.



Long shaft journals (hydrodynamic bearing) provide superior bearing surface and premium material selection as well as the minimum number of rotating parts, contribute long efficient service life of VELJAN GEAR PUMPS.

VGP
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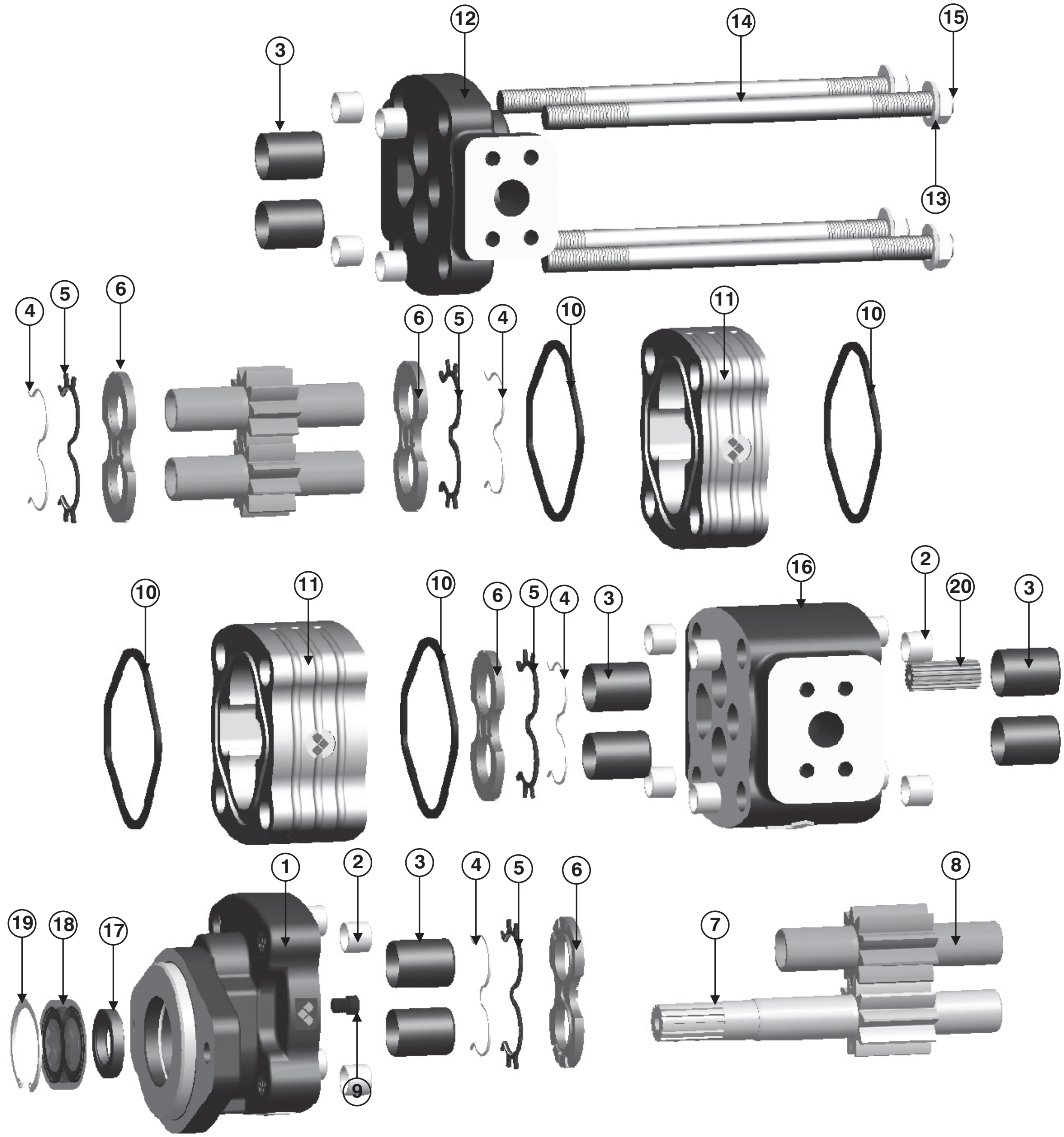
Tandem Pump Exploded View



Item	Part Description	Qty
01	Mounting Flange	01
02	Locating bush	16
03	DU-Bush	08
04	Thrust plate Back up ring	04
05	Thrust plate seal	04

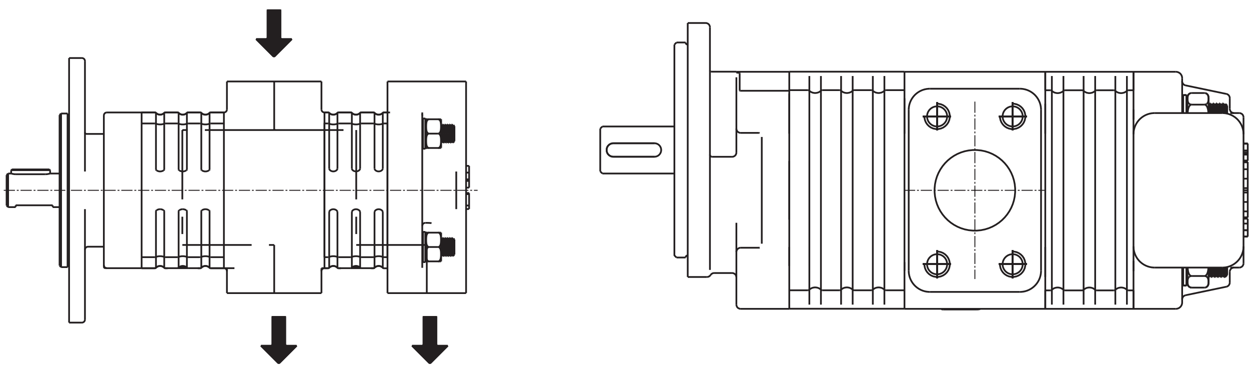
Item	Part Description	Qty
06	Thrust Plate	04
07	Drive Gear Shaft	01
08	Driven gear	03
09	Plug	01
10	O-Ring	04

Item	Part Description	Qty
11	Housing	02
12	Port block	01
13	Washer	04
14	Stud	04
15	Hex.nut	04

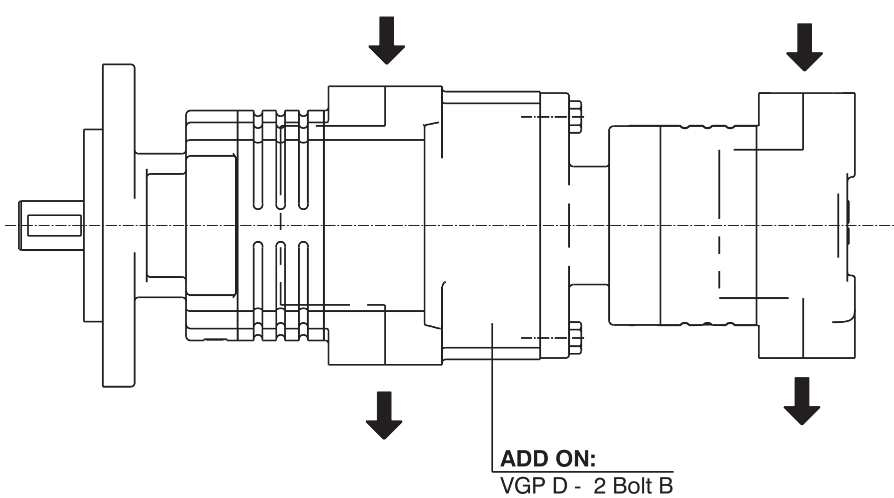
Item	Part Description	Qty
16	Bearing carrier	01
17	Shaft seal	01
18	Deep groove ball Bearing	01
19	Internal Circlip	01
20	Connector	01

PORTS POSITION FOR MULTIPLE PUMPS

COMMON INLET - B1 (One Inlet , Two Outlets) - VGP-BB,CC,DD



SEPERATED STAGES - B3 (Two Inlet , Two Outlets) - VGP - DB,DC



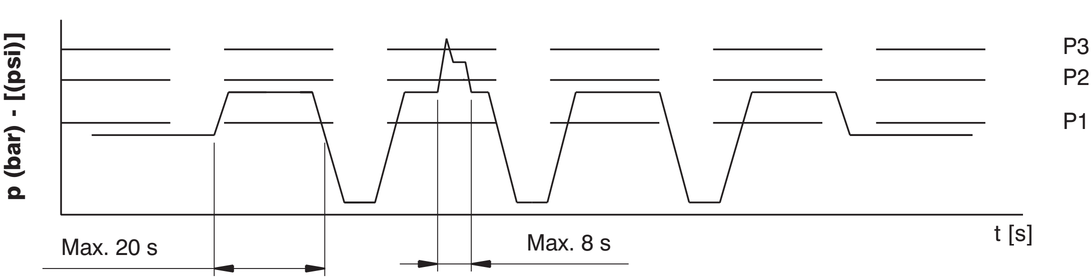
Note: Product details are liable to change without any notice

VGP
GEN

GENERAL DATA PUMPS

Model	Housing width Inch	Theoretical Displacement		Mineral Oil Maximum pressure			
				Continuous		Intermittent	
		in^3/rev	cm^3/rev	psi	bar	psi	bar
VGP - B	0.88	0.59	9.8	3480	240	3916	270
	1.13	0.90	14.9	3480	240	3916	270
	1.38	1.21	19.9	3480	240	3916	270
	1.63	1.47	24.8	3480	240	3770	260
	1.88	1.81	29.8	3190	220	3480	240
	2.13	2.12	34.9	2900	200	3045	210
	2.38	2.43	39.9	2465	170	2683	185
VGP - C	1.00	0.96	15.90	3480	240	3916	270
	1.25	1.46	24.0	3480	240	3916	270
	1.50	1.95	32.0	3480	240	3916	270
	1.75	2.44	40.1	3480	240	3916	270
	2.00	2.93	48.1	3480	240	3770	260
	2.25	3.43	56.3	3190	220	3480	240
	2.50	3.90	64.4	2900	200	3190	220
VGP - D	1.00	1.25	20.5	3480	240	3916	270
	1.25	1.84	30.2	3480	240	3916	270
	1.50	2.44	40.1	3480	240	3916	270
	1.75	3.09	50.8	3480	240	3916	270
	2.00	3.83	62.8	3480	240	3770	260
	2.25	4.42	72.5	3190	220	3480	240
	2.50	5.05	82.8	2900	200	3190	220
	2.75	5.70	93.6	2683	185	2900	200
	3.00	6.35	104.2	2465	170	2683	185
VGP - E	1.25	2.67	43.80	3480	240	3916	270
	1.50	3.59	58.98	3480	240	3916	270
	1.75	4.47	73.30	3480	240	3916	270
	2.00	5.33	87.50	3480	240	3916	270
	2.25	6.19	101.50	3480	240	3916	270
	2.50	7.16	117.50	3480	240	3770	260
	2.75	8.08	132.50	3190	220	3480	240
	3.00	8.93	146.50	2900	200	2190	220

Pressure definition



P1 Max. continuous pressure
P2 Max. intermittent pressure
P3 Max. peak pressure

Note: Product details are liable to change without any notice