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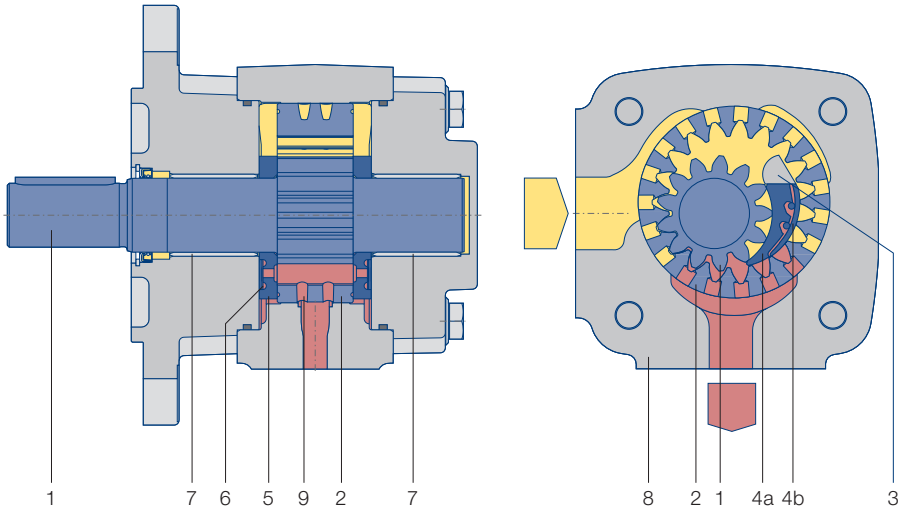
IPVAP High-pressure internal gear pumps for variable speed drives

Product data sheet

Advantages

+ Very good controllability and pressure hold function
+ Very good pulsation behavior
+ Very high overall efficiency
+ Low noise emission
+ Multiple flow capable

Function



1 Pinion shaft
2 Internal gear
3 Filler pin
4a Filler segment carrier
4b Filler sealing segment
5 Axial disc
6 Axial pressure area
7 Plain bearings
8 Housing
9 Hydrostatic bearing
Suction chamber
Pressure chamber

By rotation of the gears inside the pump, the pressure fluid (usually hydraulic oil) is drawn into the cavity between the pinion and internal gear. Optimized cross-sectional areas on suction side as well as on pressure side allow operation over a wide range of speed.

In the radial direction, the gear chambers are closed by gear meshing and the filler piece. In the axial direction, the axial plates seal the pressure chamber with the minimal possible gap. This design minimizes volume losses and increases efficiency.

Calculations

Pump flow $Q = V_{g\,th} \cdot n \cdot \eta_v \cdot 10^{-3}$ [l/min]

Power $P = \frac{Q \cdot \Delta p}{600 \cdot \eta_g}$ [kW]

$V_{g\,th}$	pump volume per revolution [cm³]
n	Speed [rpm]
η_v	Volumetric efficiency
η_g	Overall efficiency
Δp	Differential pressure [bar]

Technical data

Design	Internal gear pump with radial and axial sealing gap compensation
Type	IPVAP
Mounting types	SAE hole flange; ISO 3019/1
Line mounting	SAE suction and pressure flange J 518 C Code 61
Sense of rotation	Right hand rotation
Mounting position	any
Shaft load	For details please contact your J.M. Voith SE & Co. KG representative
Input pressure	0.8 … 3 bar absolute pressure
Pressure fluid	HLP mineral oils DIN 51524, part 2 or 3
Viscosity range of the pressure fluid	10 … 300 mm^2s^{-1} (cSt), up to n = 1800 rpm 10 … 100 mm^2s^{-1} (cSt), up to n_{max}
Permissible start viscosity	max. 2000 mm^2s^{-1} (cSt)
Permissible temperature of the pressure fluid	-10 … +80 °C
Required purity of the pressure fluid according to NAS 1638	Class 19/17/14 (ISO 4406), Class 8 (NAS 1638)
Filtration	Filtration quotient min. $\beta_{20} \geq 75$, recommended $\beta_{10} \geq 100$ (longer life time)
Permissible ambient temperature	-10 … +60 °C

Static characteristics

Type, Size – delivery	Displacement per revolution [cm³]	Speed min. [rpm]	Speed max. [rpm]	Delivery at 1500 rpm [l/min]	Continuous pressure [bar]	Peak pressure at 1 500 rpm [bar]	Moment of inertia [kg cm²]
IPVAP 3 – 3.5	3.6	400	3600	5.4	300	320	0.34
IPVAP 3 – 5	5.2	400	3600	7.8	300	320	0.42
IPVAP 3 – 6.3	6.4	400	3600	9.6	300	320	0.49
IPVAP 3 – 8	8.2	400	3600	12.3	300	320	0.58
IPVAP 3 – 10	10.2	400	3600	15.3	300	320	0.70
IPVAP 4 – 13	13.3	400	3600	19.9	300	320	2.25
IPVAP 4 – 16	15.8	400	3600	23.7	300	320	2.64
IPVAP 4 – 20	20.7	400	3600	31.0	300	320	3.29
IPVAP 4 – 25	25.4	400	3600	38.1	300	320	3.70
IPVAP 4 – 32	32.6	400	3600	48.9	250	280	4.44
IPVAP 5 – 32	33.1	400	3000	49.6	300	320	8.62
IPVAP 5 – 40	41.0	400	3000	61.5	300	320	10.20
IPVAP 5 – 50	50.3	400	3000	75.4	280	315	11.60
IPVAP 5 – 64	64.9	400	3000	97.3	230	250	14.40
IPVAP 6 – 64	64.1	400	2600	96.1	300	320	25.73
IPVAP 6 – 80	80.7	400	2600	121.0	280	315	30.90
IPVAP 6 – 100	101.3	400	2600	151.9	250	300	36.10
IPVAP 6 – 125	126.2	400	2600	189.3	210	250	43.70

The values given apply for

- Pumping of mineral oils with a viscosity of 20…40 mm^2s^{-1}
- An input pressure of 0.8 … 3.0 bar absolute

Notes

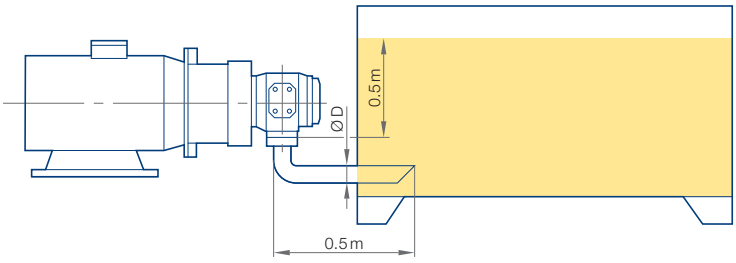
- Peak pressures apply for 15 % of operating time with a maximum cycle time of 1 minute.
- Please inquire about peak pressures at non-standard speeds.
- Due to production tolerances, the pump volume may be reduced by up to 1.5 %.
- The values for min. and max. speed are dependent on pressure! Please see exact dates on the diagrams from the following pages. At speeds below 400 rpm the pressure must be reduced according to the curve. At high speeds this may be the case as well.
- The pump can be temporarily operating below the specified minimum speed in pressure-hold function. The holding time and the rotational speed required for this purpose is obtained in dependence of the viscosity and of the operating pressure levels. For design details please contact J.M. Voith SE & Co. KG.

Dynamic characteristics

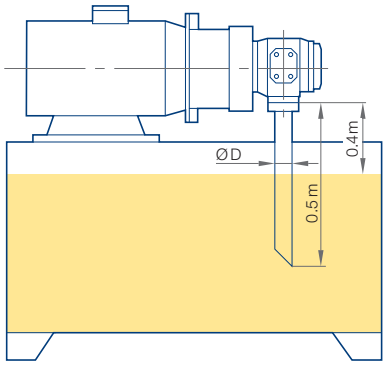
Admissible acceleration [rad/s²]

Size	Delivery	Operation mode A	Operation mode B	Size	Delivery	Operation mode A	Operation mode B	Size	Delivery	Operation mode A	Operation mode B
IPVAP 3	3,5	4 200	4 200	IPVAP 4	13	6 908	4 170	IPVAP 5	32	8 911	5 582
	5	4 200	4 200		16	6 923	4 199		40	7 129	4 442
	6,3	4 200	4 200		20	6 140	3 715		50	9 628	6 067
	8	4 200	4 200		25	6 241	3 801		64	7 403	4 643
	10	4 200	4 200		32	8 985	5 606				
IPVAP 6	64	7 533	4 739								
	80	5 937	3 718								
	100	7 552	4 768								
	125	6 026	3 792								

Operation mode A



Operation mode B



Ø D = Diameter suction flange pump housing

The values given apply for

- Dimensioning of the suction port according to operating case A or B
- Pumping of mineral oils with a viscosity of 20 … 60 $mm^2 s^{-1}$ (cSt)

Notes

- Pressure can be built up from standstill when the pump is fully vented. System-related emptying of the pump must be prevented after initial startup.
- The volumetric flow can be freely adjusted via the speed; attention must be paid to the respective pump-specific characteristics.
- Highly dynamic deceleration can be realized, the pressure at the suction side must not exceed the limit value.
- It can be reversed in a highly dynamic manner to reduce pressure peaks or to realize a generator operation. The pressure on the pressure side must not fall below the applied suction pressure.
- The maximum acceleration must be adapted to the installation situation, the viscosity and the suction pressure. Please consult table dynamic characteristics.
- High pressures can be generated at low speeds, attention must be paid to the temperature of the pump. The permissible temperature of the hydraulic fluid must never be exceeded.
- To ensure safe operation, the cycle at the pump should be tested for critical operating points using appropriate sensors and at least 1 kHz sampling rate.

Diagram IPVAP 3, IPVAP 4 – Continuous pressure depending on the speed

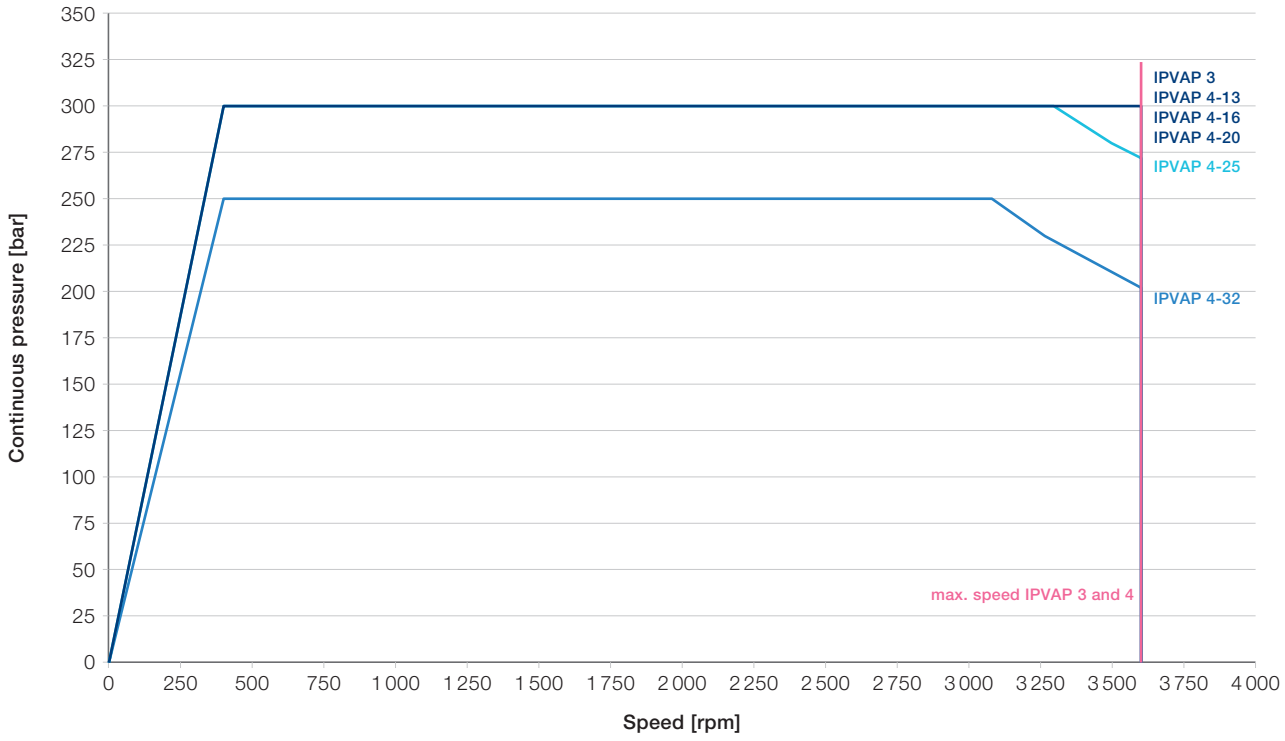


Diagram IPVAP 5 – Continuous pressure depending on the speed

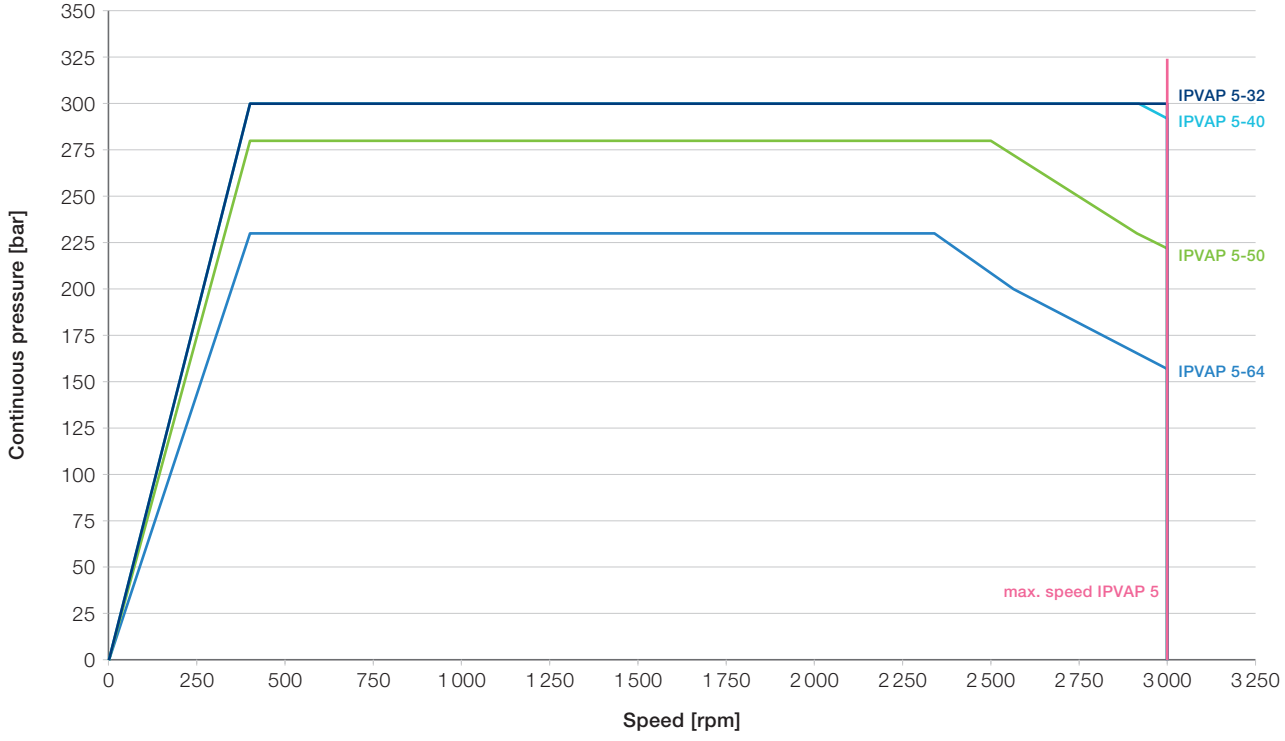
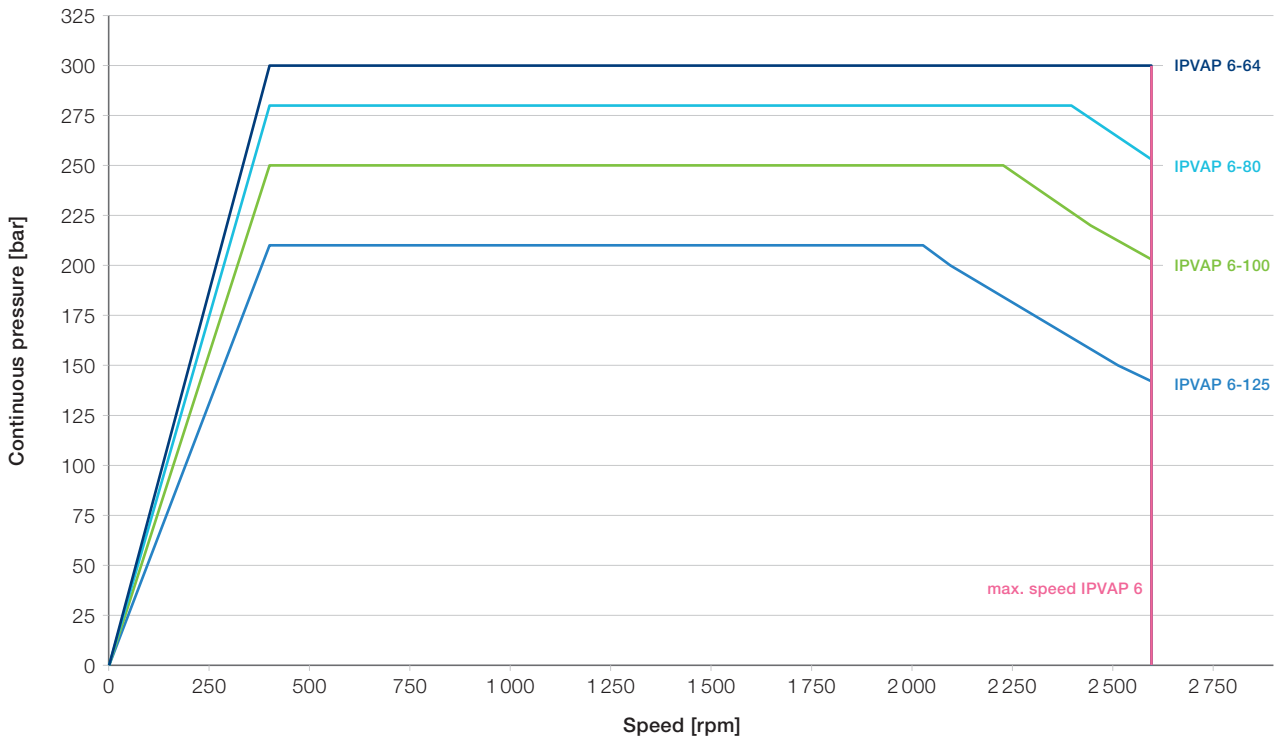
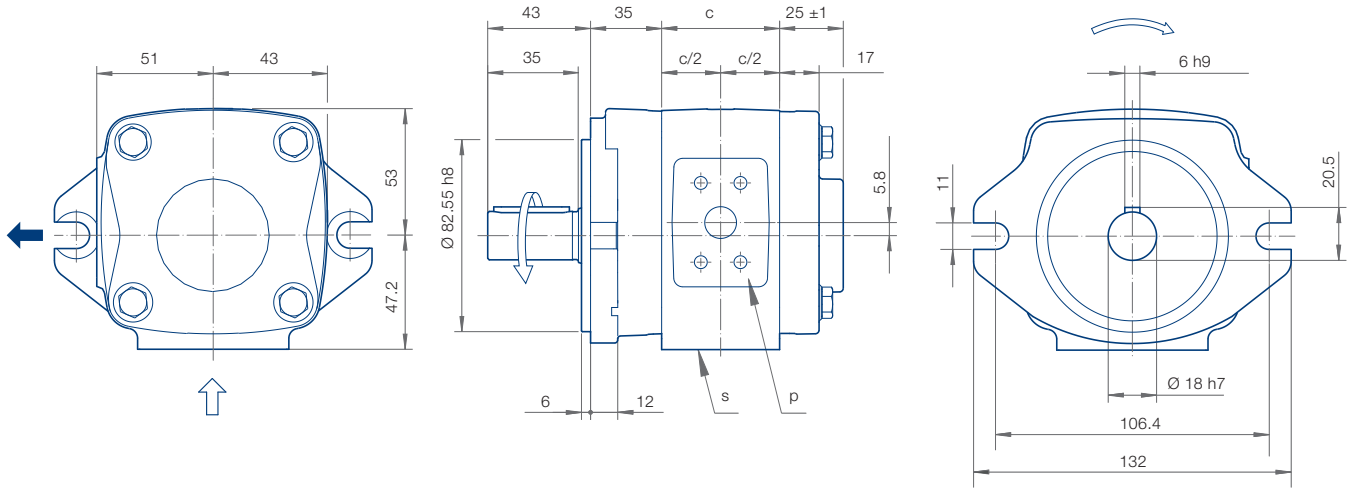


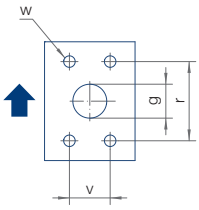
Diagram IPVAP 6 – Continuous pressure depending on the speed



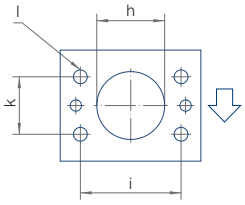
IPVAP 3. rotation and dimensions



Pressure port (P)

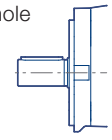
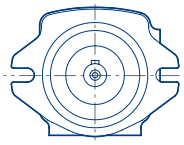
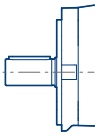


Suction port (S)

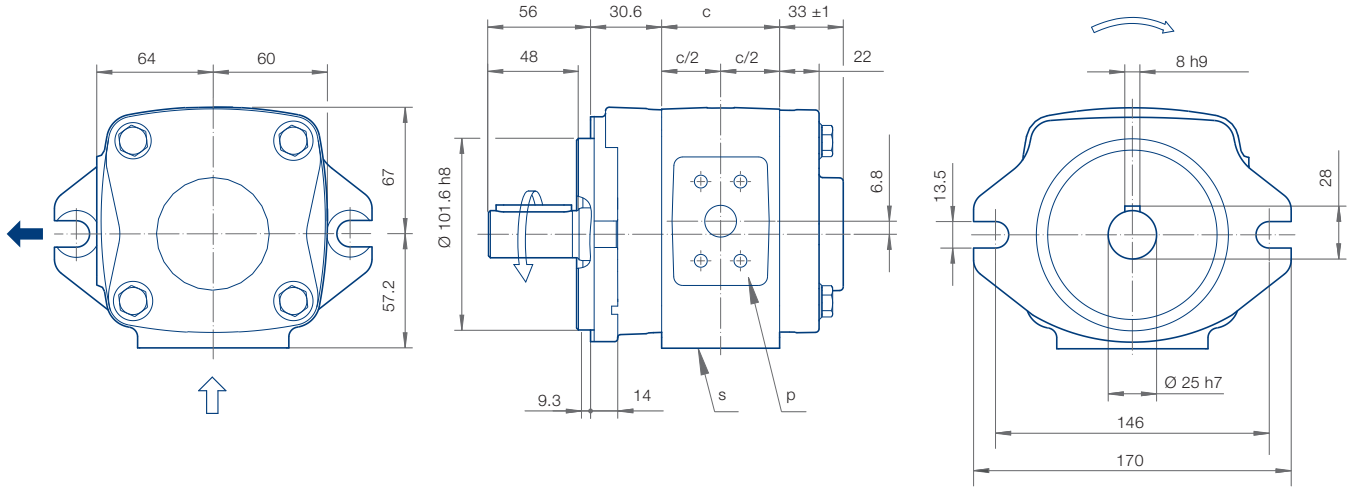


Type / Delivery	c [mm]	g [mm]	h [mm]	i [mm]	k [mm]	l Thread	r [mm]	v [mm]	w Thread	Weight [kg]	SAE Flange No. ↑	SAE Flange No. ↓
IPVAP 3 – 3.5	35	9	14	38.1	17.5	M8x13	38.1	17.5	M8x13	3.4	10	10
IPVAP 3 – 5	39	11	14	38.1	17.5	M8x13	38.1	17.5	M8x13	3.6	10	10
IPVAP 3 – 6.3	42	11	19	47.6	22.3	M10x15	38.1	17.5	M8x13	3.8	10	11
IPVAP 3 – 8	46.5	13	19	47.6	22.3	M10x15	38.1	17.5	M8x13	4.0	10	11
IPVAP 3 – 10	51.5	13	21	52.4	26.2	M10x15	38.1	17.5	M8x13	4.2	10	12

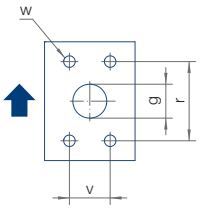
IPVAP 3, design

Rotation		Mounting flange			Shaft end		
Standard							
Rotation clockwise		**1**	SAE 2-hole flange	 	**0**	Parallel shaft with keyway connection	 **1**

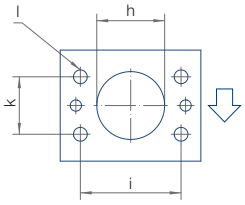
IPVAP 4. rotation and dimensions



Pressure port (P)

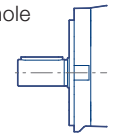
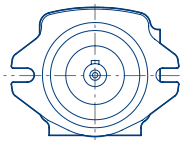
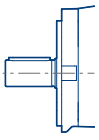


Suction port (S)

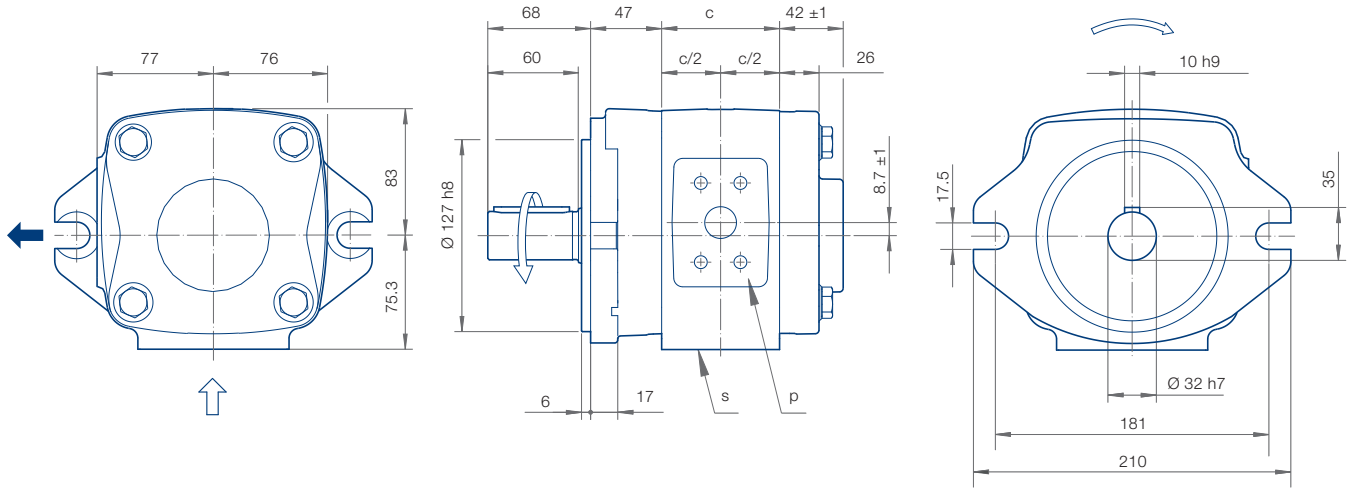


Type / Delivery	c [mm]	g [mm]	h [mm]	i [mm]	k [mm]	l Thread	r [mm]	v [mm]	w Thread	Weight [kg]	SAE Flange No. ↑	SAE Flange No. ↓
IPVAP 4 – 13	48.5	13	23	52.4	26.2	M10x15	38.1	17.5	M8x13	7.1	10	12
IPVAP 4 – 16	52.5	14	25	52.4	26.2	M10x15	38.1	17.5	M8x13	7.3	10	12
IPVAP 4 – 20	58	18	27	58.7	30.2	M10x15	47.6	22.3	M10x15	7.9	11	13
IPVAP 4 – 25	64	18	30	58.7	30.2	M10x15	47.6	22.3	M10x15	8.3	11	13
IPVAP 4 – 32	73	18	32	58.7	30.2	M10x15	47.6	22.3	M10x15	9.1	11	13

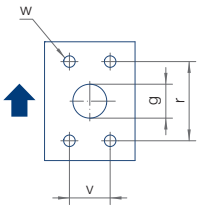
IPVAP 4, design

Rotation		Mounting flange			Shaft end		
Standard							
Rotation clockwise		1	SAE 2-hole flange	 	7	Parallel shaft with keyway connection	 1

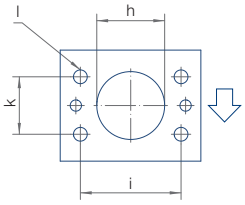
IPVAP 5. rotation and dimensions



Pressure port (P)

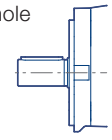
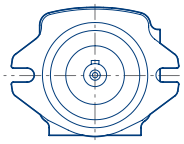
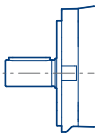


Suction port (S)

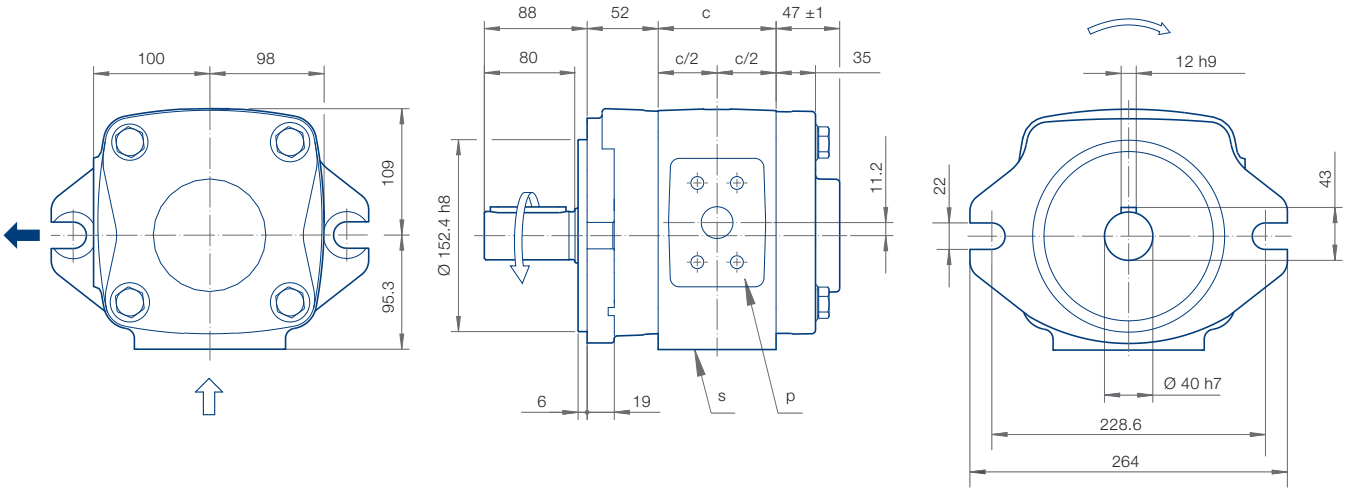


Type / Delivery	c [mm]	g [mm]	h [mm]	i [mm]	k [mm]	l Thread	r [mm]	v [mm]	w Thread	Weight [kg]	SAE Flange No. ⇧	SAE Flange No. ⇩
IPVAP 5 – 32	65	18	32	58.7	30.2	M10x15	47.6	22.3	M10x15	13.0	11	13
IPVAP 5 – 40	71	19	35	69.9	35.7	M12x20	52.4	26.2	M10x15	14.1	12	30
IPVAP 5 – 50	78	21	40	69.9	35.7	M12x20	52.4	26.2	M10x15	15.9	12	30
IPVAP 5 – 64	89	23	40	69.9	35.7	M12x20	52.4	26.2	M10x15	17.3	12	30

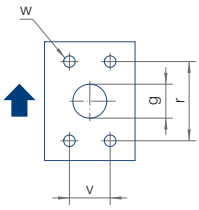
IPVAP 5, design

Rotation		Mounting flange			Shaft end		
Standard							
Rotation clockwise		1	SAE 2-hole flange			0	Parallel shaft with keyway connection 	1

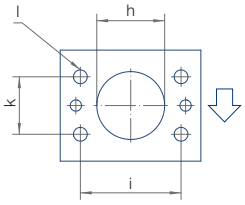
IPVAP 6. rotation and dimensions



Pressure port (P)

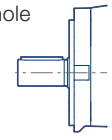
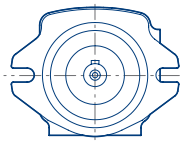
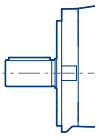


Suction port (S)



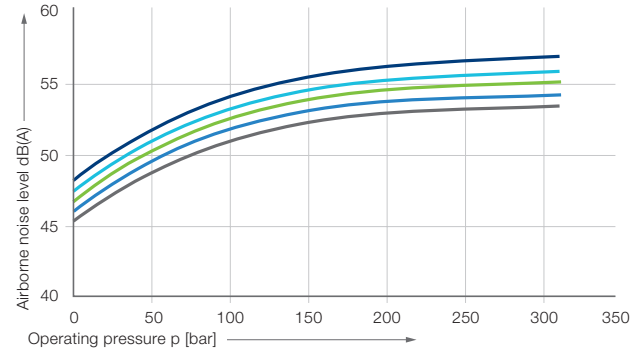
Type / Delivery	c [mm]	g [mm]	h [mm]	i [mm]	k [mm]	l Thread	r [mm]	v [mm]	w Thread	Weight [kg]	SAE Flange No. ⇧	SAE Flange No. ⇩
IPVAP 6 – 64	80	23	40	69.9	35.7	M12x20	52.4	26.2	M10x15	26.3	12	30
IPVAP 6 – 80	88	23	45	77.8	42.9	M12x20	69.9	35.7	M12x20	27.9	14	15
IPVAP 6 – 100	98	27	50	77.8	42.9	M12x20	69.9	35.7	M12x20	31.2	14	15
IPVAP 6 – 125	110	30	50	77.8	42.9	M12x20	69.9	35.7	M12x20	34.0	14	15

IPVAP 6, design

Rotation		Mounting flange			Shaft end	
Standard						
Rotation clockwise	 1	SAE 2-hole flange		 0	Parallel shaft with keyway connection	 1

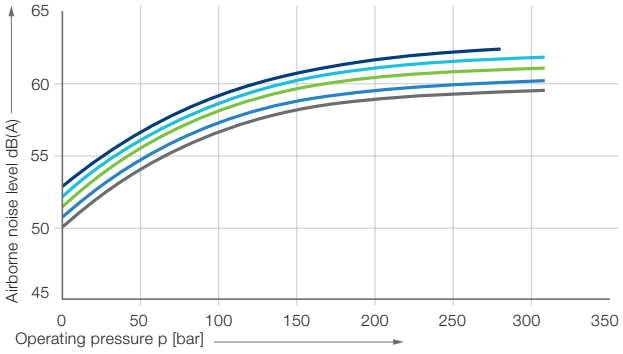
Measurement values – Airborne noise level (measuring location 1 m axial)

IPVAP 3



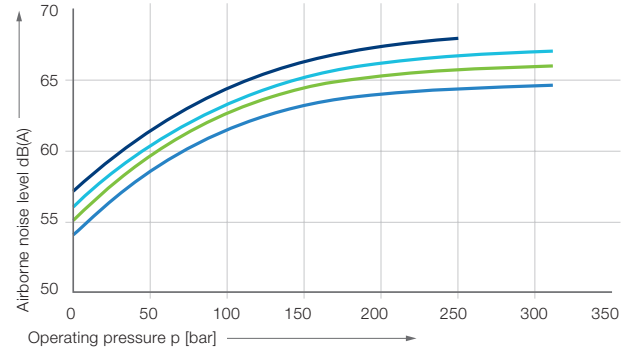
IPVAP 3 – 10 IPVAP 3 – 6.3 IPVAP 3 – 3.5
IPVAP 3 – 8 IPVAP 3 – 5

IPVAP 4



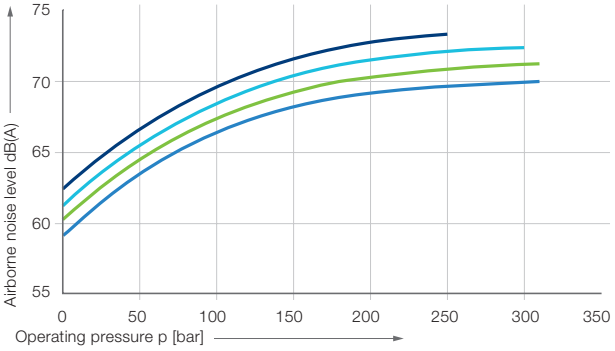
IPVAP 4 – 32 IPVAP 4 – 20 IPVAP 4 – 13
IPVAP 4 – 25 IPVAP 4 – 16

IPVAP 5



IPVAP 5 – 64 IPVAP 5 – 40
IPVAP 5 – 50 IPVAP 5 – 32

IPVAP 6



IPVAP 6 – 125 IPVAP 6 – 80
IPVAP 6 – 100 IPVAP 6 – 64

Measurement conditions

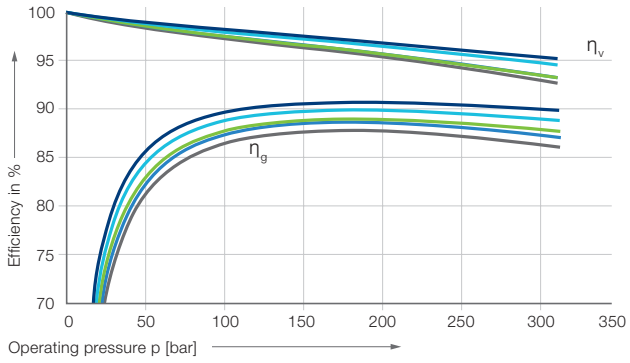
- Speed: 1500 rpm
- Viscosity of pressure fluid: 46 mm^2s^{-1}
- Operating temperature: 40 °C

Note

Measurement taken in a low-noise room. In a anechoic room, the measurements are approx. 5 dB(A) lower.

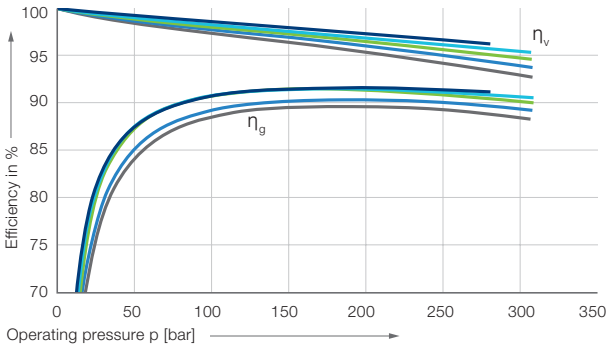
Measurement values – Efficiency η_v and η_g

IPVAP 3



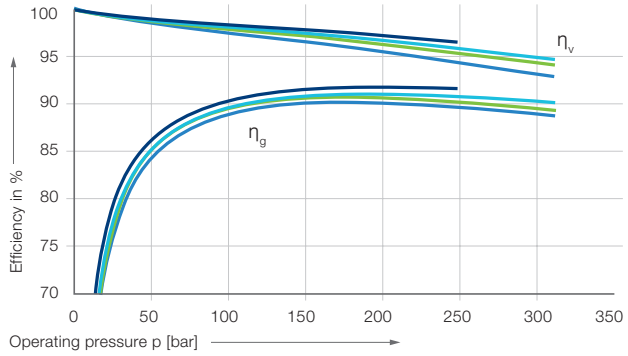
IPVAP 3 – 10 IPVAP 3 – 6.3 IPVAP 3 – 3.5
IPVAP 3 – 8 IPVAP 3 – 5

IPVAP 4



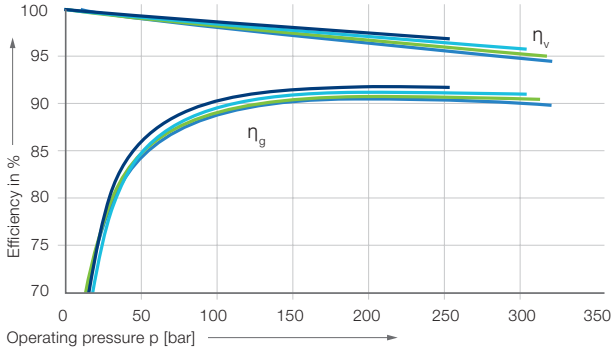
IPVAP 4 – 32 IPVAP 4 – 20 IPVAP 4 – 13
IPVAP 4 – 25 IPVAP 4 – 16

IPVAP 5



IPVAP 5 – 64 IPVAP 5 – 40
IPVAP 5 – 50 IPVAP 5 – 32

IPVAP 6

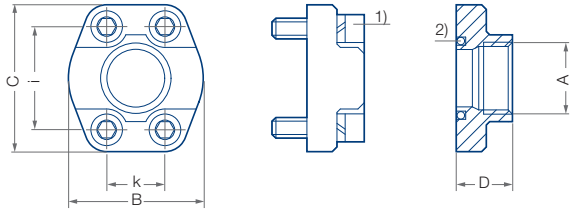


IPVAP 6 – 125 IPVAP 6 – 80
IPVAP 6 – 100 IPVAP 6 – 64

Measurement conditions

- Speed: 1500 rpm
- Viscosity of pressure fluid: 46 mm^2s^{-1}
- Operating temperature: 40 °C

Suction and pressure flange according to SAE...



Wrench torque for screws according to ISO 6162

[1] Screw EN ISO 4762

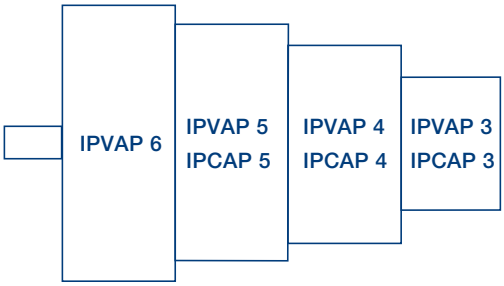
[2] Round seal ring (O-Ring) ISO-R 1629 NBR

[3] Special design. Deviation from SAE J 518 C Code 61

SAE flange no.		A Thread	B [mm]	C [mm]	D [mm]	E[1] Seal ring	i [mm]	k [mm]	S[2] Thread	Max. pressure [bar]
SAE J 518 C Code 61	**10**	G ½	46	54	36	18.66 – 3.53	38.1	17.5	M8	345
	11	G ¾	50	65	36	24.99 – 3.53	47.6	22.3	M10	345
	12	G 1	55	70	38	32.92 – 3.53	52.4	26.2	M10	345
	13	G 1-¼	68	79	41	37.69 – 3.53	58.7	30.2	M10	276
	14[3]	G 1-½	82	98	50	47.22 – 3.53	69.9	35.7	M12	345[3]
	30	G 1-½	78	93	45	47.22 – 3.53	69.9	35.7	M12	207
	15	G 2	90	102	45	56.74 – 3.53	77.8	42.9	M12	207
	16	G 2-½	105	114	50	69.44 – 3.53	88.9	50.8	M12	172
	17	G 3	124	134	50	85.32 – 3.53	106.4	61.9	M16	138
	17/2	G 3-½	136	152	48	98.02 – 3.53	120.7	69.9	M16	35
	18	G 4	146	162	48	110.72 – 3.53	130.2	77.8	M16	34
SAE J 518 C Code 62	**50**	G ½	46	54	36	18.66 – 3.35	40.5	18.2	M8	414
	51	G ¾	55	71	35	24.99 – 3.53	50.8	23.8	M10	414
	52	G 1	65	81	42	32.92 – 3.53	57.2	27.8	M12	414
	53a	G 1-¼	78	95	45	37.69 – 3.53	66.6	31.8	M14	414
	54	G 1-½	94	112	112	47.22 – 3.53	79.3	36.5	M16	414
	55	G 2	114	134	65	56.75 – 3.53	96.8	44.5	M20	400
	56	G 2-½	152	180	80	69.45 – 3.53	123.8	58.8	M24	400

Multi-flow pumps, pump combinations

Sequence in order of type and size



Pump combinations

- IPVAP and IPCAP pumps of identical or different sizes can be combined in multiflow pumps.
- All sizes of the relevant pump volume are available as two- or three-flow pumps; four-flow pumps must be designed by J.M. Voith SE & Co. KG
- The pumps are arranged in increasing order according to frame size and delivery.

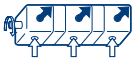
Selection

1. Determine pressure ranges and define the appropriate pump serie(s)
2. Determine pump volume and select the appropriate size
3. Define sequence of the pumps
4. Check the torques

Mounting, assembly

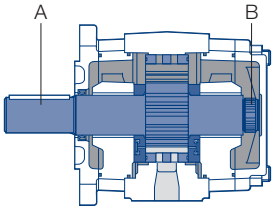
Multi-flow pumps are generally mounted to the drive by means of a flange.

Designs

Rotation and suction		Mounting flange	Shaft end
clockwise (cw)			
	1		
	1	0 SAE-2-hole-flange	1
		SAE-2-hole-flange (variant)	
Special design	4	7	

Allowed input torques

Size	A [Nm]	B [Nm]
3	160	80
4	335	190
5	605	400
6	1 050	780



Type code

IPVAP 3 - 3.5 1 0 1

Shaft end
1 Parallel shaft with keyway

Mounting flange
0 SAE 2-hole
7 SAE 2-hole, variant

Rotation, suction port
1 Clockwise rotation, radial suction port radial

Delivery

Site	Delivery				
3	3.5	5	6.3	8	10
4	13	16	20	25	32
5	32	40	50	64	
6	64	80	100	125	

Size

Type of internal gear pump

Type code for multiple flow capable variants

IPVAP 4/ - 20/ 1 7 1

following multiple flow capable pump stage of the same size, freely selectable delivery volumes

IPVAP 4/3 - 20/ 1 7 1

following multiple flow capable predetermined pump stage of the same or smaller size, freely selectable delivery volumes

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