VOITH TURBO

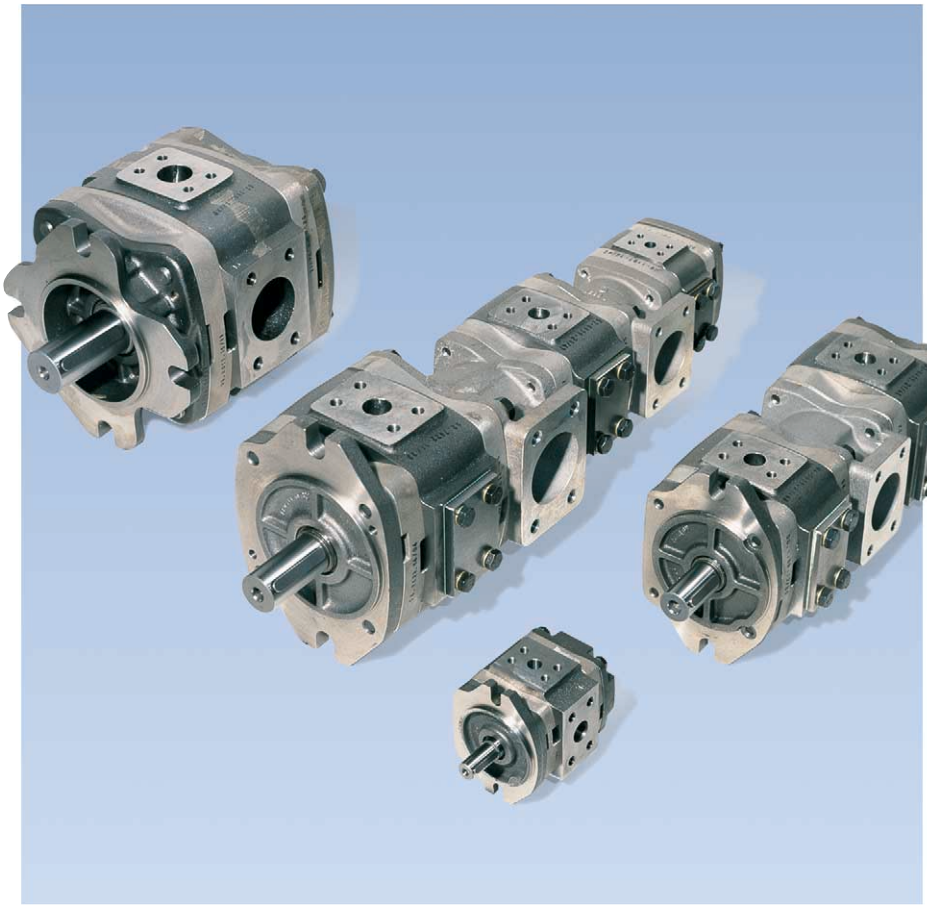
High pressure internal gear pumps type IPV

Extremely silent-running pumps –
well-priced, also suitable for speed-controlled drives
compact
economical

Principle

IPV internal gear pumps are a further development of the approved Voith IPC medium pressure pump series with radial and axial sealing gap compensation. As a result of special design features and an effective hydrostatic force balance, these pumps are suitable for operating pressures up to 345 bar with high overall efficiency.

Thanks to the reliable volume-optimized involute gearing, IPV pumps are much smaller in outside dimensions than comparable IPH high-pressure internal gear pumps.



Features

- High overall efficiency
- High volumetric efficiency due to radial and axial compensation
- Very low noise level (e.g. 64 dB (A) at 345 bar, 48 l/min. and 1500 rpm)
- Long service life due to plain bearings and axial and radial force balancing
- Excellent suction behaviour (up to 0.6 bar at a section flange of the pump)
- Low delivery and pressure pulsation
- Favourable ratio of pump size to displacement
- Complete range of models from 3.6 to 251.7 cm^3/revolution delivery
- Wide viscosity range
- Wide speed range
- Suitable for speed-controlled drives
- Can be combined to multiple flow pumps
- Can be combined with Voith IPC and IPN pumps
- Compact design
- Simple design
- Any desired mounting position
- Radial loading of drive shaft is possible under certain conditions without supplementary bearing

Applisations

IPV pumps are used in the high and medium pressure range at continuous operating pressures from 210 to 330 bar dependent on the displacement. IPV pumps are also suitable for speed-controlled drives.

The very low noise emission of the IPV high pressure pumps considerably reduces the noise level of the hydraulic installation.

Combination

IPV pumps of similar or different sizes can be combined to double or multiple flow pumps.

A particularly wide range of application is offered by the fact that IPV pumps can be combined with Voith medium pressure pumps and low pressure pumps.

Design and Mode of Operation

Design and mode of operation are described with reference to fig. 1.
Pinion shaft *1* is driven, and by virtue of its gear teeth drives the ring gear *2*. The pinion shaft is supported in specially designed sleeve bearings in casing *8*. The ring gear is also supported in the casing; radial forces exerted on the ring gear under pressure load are largely absorbed in the hydrostatic bearing *9*.

The filler is comprised essentially of segment carrier *4a* and segment *4b*. Between these two components are sealing rollers which separate pressure and suction zones. Axially, the ring gear is guided by the axial discs *5* on its sides. These discs are carried by the pinion shaft.

When the pair of gears rotate, oil is drawn into the casing and consequently into the space between pinion and ring gear. The two gears rotate completely freely which illustrates the reason for the outstanding suction behaviour of this pump. The tooth chambers are therefore filled at a low flow velocity.

In peripheral direction the tooth chambers are closed by tooth engagement or the filler. Due to an almost gap-free sealing of tooth chambers of pinion and ring gear against the filler and axial discs, the oil is displaced almost without loss radially into the pressure port of the casing. In the interest of low bearing and friction forces, the pressure chamber is maintained as small as possible by the special design of the filler. As a result of this, sealing members such as the axial discs and filler are very small, and relatively low bearing loads are obtained. The construction features of the IPV pumps are as follows:

Axial compensation
The axial compensation forces F_A (Fig. 2) are generated by pressmised areas *6* in the axial discs and are proportional to operating pressure. The axial discs are pressing with a small excess force in the area of the pressure chamber against the sides of the ring gear, pinion and filler. As a result, the axial leak gaps between the rotating and stationary parts are extremely small. Due to the exactly determined compensation the pressure chamber has the best possible axial sealing under all operating conditions, even after an extended period of service.

Radial compensation
The radial compensation force F_R (Fig. 2) is exerted both on the segment carrier and the filler segment. Proportional to the operating pressure, these two filler parts are pressed against the outside diameters of pinion shaft and ring gear teeth. The areas and the position of the two sealing rolls between the filler segments are designed to press the two parts of the filler always against the tips of the teeth under a light excess force. This force is so that under all operating conditions sealing is effected without wear. In this way the sealing gaps are kept to a minimum.

In order that the filler segments are pressed against the tips of teeth even under very low pressure, appropriate spring elements are arranged beneath the sealing rollers.

Bearings
A hydraulic force acts to the pinion shaft, which is absorbed by the plain bearings *7*. The plain bearings on the pinion shaft guarantee a long service life and have a positive effect on the noise level of IPV pumps.

The hydraulic force also acts onto the ring gear. This force is absorbed by a hydrostatically unloaded sleeve bearing *9* in casing *8*. The combination of a hydrodynamic bearing with hydrostatic unloading has a positive effect on service life, efficiency, and noise.

Gearing
IPV gearing is of the involute type. The long contact path results in low flow and pressure pulsation. These low pulsation rates contribute extensively to the low operating noise of IPV pumps.

Suction capacity
The suction capacity of these internal gear pumps is extraordinarily good. They are fully self-priming throughout the entire permissible speed range. An absolute pressure of 0.6 bar is allowed as minimum intake pressure at the suction port ot the pump. In continuous operation, pressure should not be lower than 0.8 bar. Single pumps suck in via the radial intake in the pump casing. Tandem and multiple flow pumps in take via the adaptor housing.

Characteristic data

Design	Internal gear pump
Mounting	SAE J 744 c/VDMA
Pipe fixing	SAE J 518 c code 61
Direction of rotation	Clockwise or anti-clockwise
Suction pressure	0.6 up to 3 bar absolute pressure
Continuous pressure	210 bar – 330 bar
Peak pressure	250 bar – 345 bar
Volumetric efficiency	Up to 97 % at 345 bar
Overall efficiency	Up to 92 % at 345 bar
Displacement	3.6 up to 251.7 cm^3/rev
Pressure medium	Mineral oil as per DIN 51524 Part 2 or 3
Temperature of pressure medium	- 20° C up to + 80° C

Fig. 3

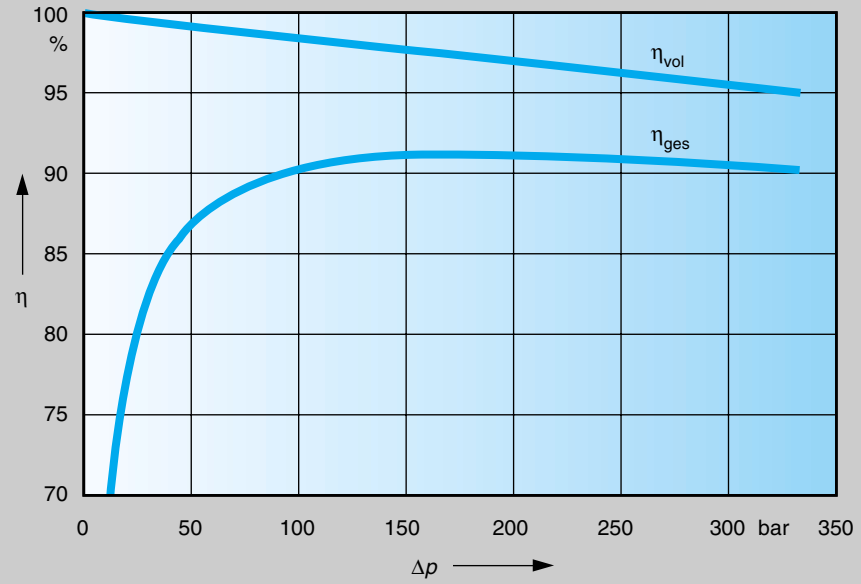


Fig. 4

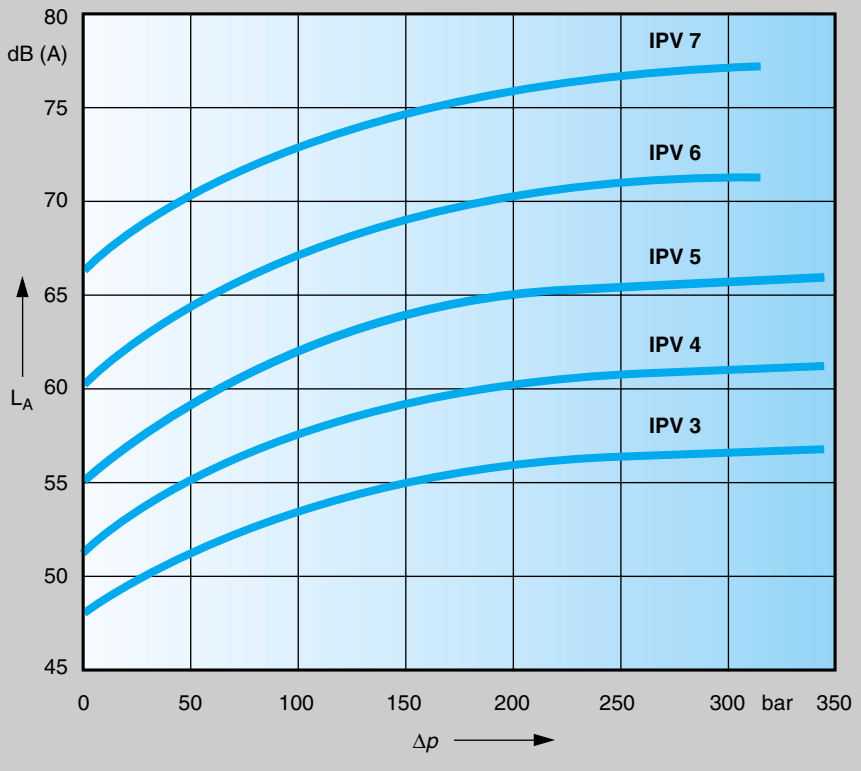


Fig. 3
Efficiency curve of an IPV 4-25

Test conditions:
Operating temperature t = *40° C*
η_v = *volumetric efficiency*
Viscosity v = *46 cSt*
η_g = *overall efficiency*
Speed n = *1465 rpm*

Fig. 4
Noise level values at test conditions:

Speed *1500 rpm*
Measuring point *1 m distance from the pump in axial direction*
Measuring room *Voith sound measuring room (not totally anechoic. If measured in an anechoic room, values will be 5 dB (A) lower.)*

Values and dimensions

Basic model Delivery size	Displacem. cm^3/rev.	Speed rpm		Delivery litres/min	Pressure bar		Weight kp	Main dimensions mm			
	(*)	(P_{max}) min**	max	at 1500 rpm	Conti press.	Peak press.		*d*	*a*	*c*	*e*
IPV 3-3.5	3.6	400	3600	5.4	330	345	4.0	18_{h7}	19,5	66	20,5
IPV 3-5	5,2	400	3600	7.8	330	345	4.2	18_{h7}	19.5	70	20.5
IPV 3-6.3	6.4	400	3600	9.6	330	345	4.4	18_{h7}	19.5	73	20.5
IPV 3-8	8.2	400	3600	12.3	330	345	4.6	18_{h7}	19.5	77.5	20.5
IPV 3-10	10.2	400	3600	15.3	330	345	4.8	18_{h7}	19.5	82.5	20.5
IPV 4-13	13,3	400	3600	19.9	330	345	8.6	25_{h7}	26	88.5	31
IPV 4-16	16.3	400	3400	24.4	330	345	9.0	25_{h7}	26	92.5	31
IPV 4-20	20.7	400	3200	31.0	330	345	9.6	25_{h7}	26	98	31
IPV 4-25	25.4	400	3000	38.1	300	330	10.2	25_{h7}	26	104	31
IPV 4-32	32.6	400	2800	48.9	250	280	11.0	25_{h7}	26	113	31
IPV 5-32	33.1	400	3000	49.6	315	345	15.5	32_{h7}	20	119	36
IPV 5-40	41.0	400	2800	61.5	315	345	16.3	32_{h7}	20	125	36
IPV 5-50	50.3	400	2500	75.4	280	315	17.4	32_{h7}	20	132	36
IPV 5-64	64.9	400	2200	97.3	230	250	18.7	32_{h7}	20	143	36
IPV 6-64	64.1	400	2600	96.1	300	330	29.2	40_{h7}	22	140	40
IPV 6-80	80.7	400	2400	121.0	280	315	30.7	40_{h7}	22	148	35
IPV 6-100	101.3	400	2100	151.9	250	300	32.6	40_{h7}	22	158	35
IPV 6-125	126.2	400	1800	189.3	210	250	35.0	40_{h7}	22	170	40
IPV 7-125	125.8	400	2200	188.7	300	330	46.5	50_{h7}	63	152	48
IPV 7-160	160.8	400	2000	241.2	280	315	50	50_{h7}	63	162	48
IPV 7-200	202.7	400	1800	304.0	250	300	54	50_{h7}	63	174	46
IPV 7-250	251.7	400	1800	377.5	210	250	59	50_{h7}	63	188	42

*) Due to manufacturing tolerances, delivery can be up to 1.5 % less.

***) For applications with variable speed drives there can be reduction of the allowable pressure at speed lower than 400 rpm. Please contact manufacturer.*

The permissible peak pressure are based on a swtich-on time of 15 % with a maximum cycle time of 1 minute.

In the event of radial load on the drive shaft, please contact manufacturer.

The permanent and peak values stated apply to the speed range from 400 to 1500 rpm. Little reductions can result at input speeds of 1500 rpm up to the max admissible input speed. Please contact the manufacturer.

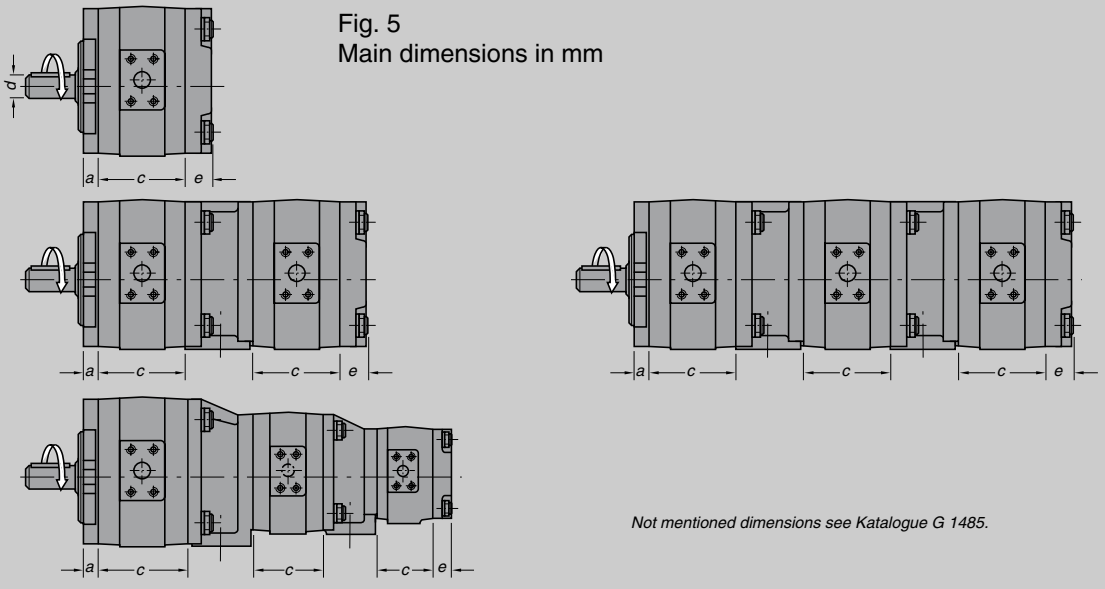


Fig. 5
Main dimensions in mm

Not mentioned dimensions see Katalogue G 1485.

Design of the IPV pumps

Fig. 1
Simplified view shows the design of the IPV pumps

1 Pinion shaft
2 Ring gear
3 Filler pin
4a Filler, segment carrier
4b Filler, segment
5 Axial disc
6 Axial pressure area
7 Plain bearings
8 Casing
9 Hydrostatically unloaded bearing
10 Cover with bleeder screw

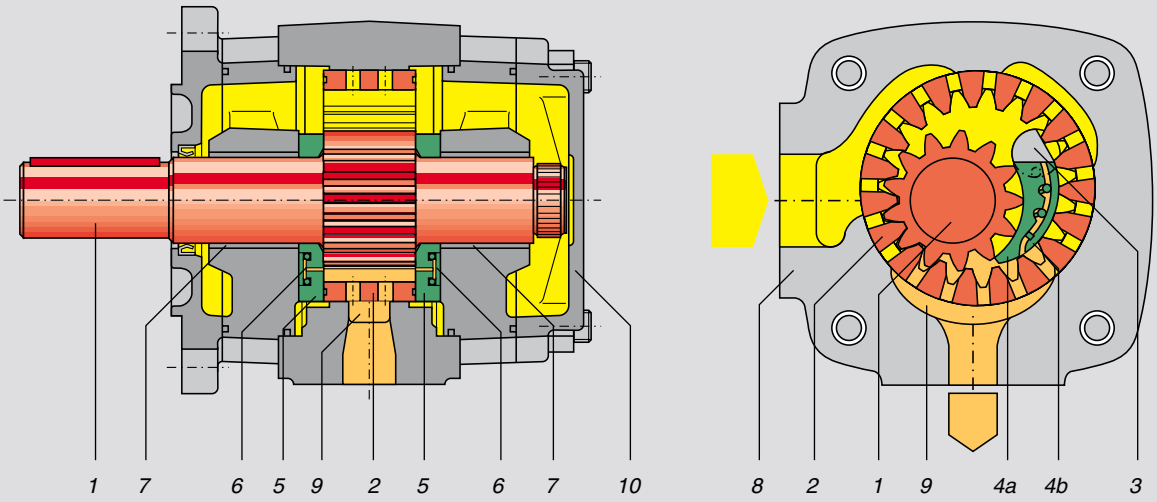
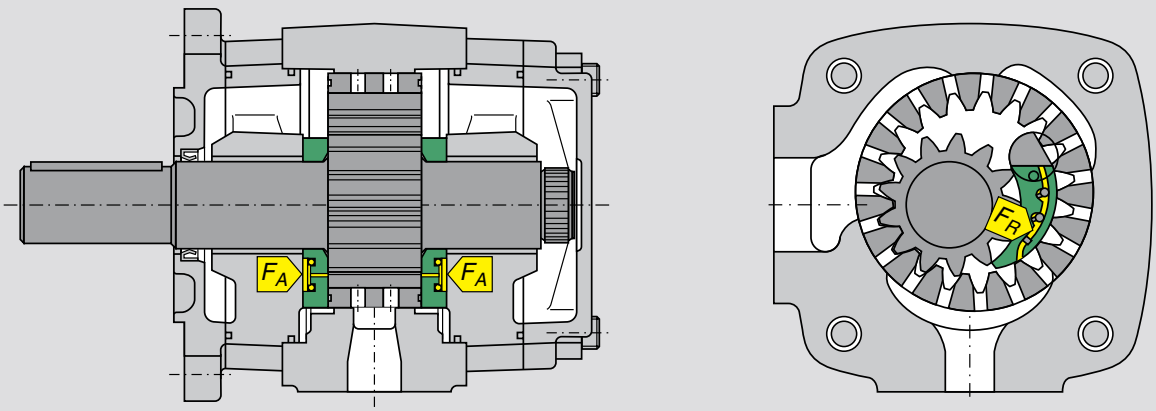


Fig. 2
Illustration of axial compensation and radial compensation

Axial compensation

Radial compensation



Certified Voith quality

The Voith high-pressure, medium-pressure and low-pressure pumps with internal gears are certified to DIN/ISO 9001.

ZERTIFIKAT

TÜV MANAGEMENT SERVICE

Die Zertifizierungsstelle der TÜV Management Service GmbH

bescheinigt,
dass das Unternehmen

Voith Turbo GmbH & Co. KG
Antriebstechnik
Alexanderstrasse 2
D-89522 Heidenheim

für den Geltungsbereich

Marktbereiche:
Strasse: Nutzfahrzeuggetriebe, Retarder, Fahrzeugelektronik
Schiene: Turbogetriebe, Radsatzgetriebe, Kühlanlagen
Industrie: Hydrostatik, Transmit,
VC-Produkte: Anfahr-Komponenten / Regelbare Antriebe
Elektrische Leit- und Antriebstechnik einschließlich
Standort Essen

ein Qualitätsmanagementsystem eingeführt hat und anwendet.

Durch ein Audit, Bericht-Nr. **950 097 909**

wurde der Nachweis erbracht, dass die Forderungen der

DIN EN ISO 9001:1994

erfüllt sind.

Zertifikat-Registrier-Nr. **70 100 F 1020 TMS**

Mannheim, 07. September 1999

Deutscher Akkreditierungs Rat DAR

TGA-ZM-07-92-00-0

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Responsible agent

Voith Turbo GmbH & Co. KG
Product group Hydrostatics
P.O. Box 2030
D-89510 Heidenheim
Tel. +49/73 21-37-45 73
Fax +49/73 21-37-78 09
E-Mail hydrostatik@voith.com
www.voithturbo.com

VOITH
GROUP OF COMPANIES

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