

# BENT AXIS PISTON MOTORS SERIES HPM3 FLANGE ISO 7653-D

## HPM3



### VERSIONS CODING

FLANGE TYPE		SHAFT		REAR COVER & PORTINGS	DISPLACEMENT		VARIANTS
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Flange type	OMFB code	Shaft type	OMFB code	Rear cover and portings	OMFB code		
ISO 7653 4 holes Ø80	201	DIN 5462 8x32x36 (ISO 14)	001	BSPP (GAS) 40°	01	012	
				BSPP (GAS) 90° + LATERAL	02	017	
				UN 40°	05	025	
				SAE 6000 - 40° METRIC SCREWS VERTICAL	10	034	
				SAE 6000 - 40° METRIC SCREWS HORIZONTAL	11	040	
				SAE 6000 - 90° METRIC SCREWS VERTICAL	12	047	
				SAE 6000 - 90° METRIC SCREWS HORIZONTAL	13	055	
				SAE 6000 - METRIC SCREWS LATERAL	14	064	
				SAE 6000 - 40° UNC SCREWS VERTICAL	20	084	
				SAE 6000 - 40° UNC SCREWS HORIZONTAL	21	108	
						130	

HPM code	Description	
20100101064	Flange	ISO 7653 4 holes Ø80
	Shaft	DIN 5462 8x32x36 (ISO 14)
	Portings	BSPP (GAS) 40°
	Displacement	064 cc

### CODING EXAMPLE

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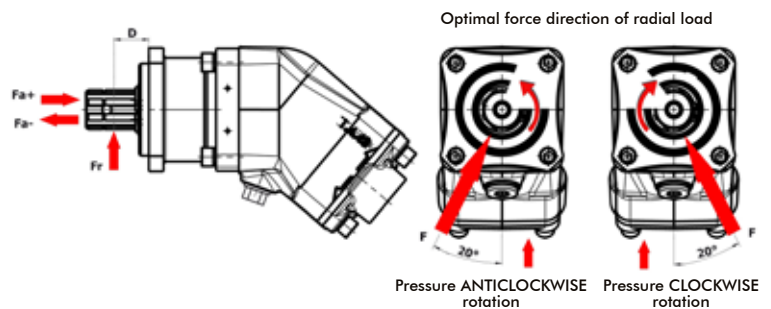
## TECHNICAL FEATURES

### BENT AXIS PISTON MOTORS SERIES "HPM" FLANGE ISO 7653-D

TECHNICAL FEATURES														
Displacement	cm³/rev		12	17	25	34	40	47	55	64	84	108	130	
Working pressure	bar	Max. intermittent	400										270	
		Max. continuous	350										250	
Rotation speed	rpm	Max. intermittent	3000				2500				2000			
		Max. continuous	2300				1900				1500			
		Min. continuous	100											
Power	kW	Max. intermittent	24	34	50	68	67	78	92	107	112	144	117	
		Max. continuous	8	11	17	23	22	26	31	36	38	48	39	
Torque	Nm/bar		0,26	0,33	0,43	0,56	0,63	0,7	0,83	0,97	1,3	1,6	1,8	
Mass inertial moment (x 10 <sup>-4</sup> )	kg m²		11,5		12,5		35,5				61			
Max. pressure in the housing	bar		20											
Weight	kg		8,8				13,2				18,2			

### SHAFT LOADS

The lifetime of the motor depends on how the bearings are working. Operational parameters such as speed, pressure, oil viscosity and grade of cleanness when are dimensioned and applied correctly can guarantee a longer lifetime to the motor along with higher performances and reduced noise level. Also external factors such as dimensions, weight and position of the external load on the shaft can influence the lifetime of the bearings. For different conditions and/or check of your working conditions please contact our technical/sales department.



MAX RECOMMENDED SHAFT LOADS		DISPLACEMENT											
		12	17	25	34	40	47	55	64	84	108	130	
Fr (radial) max	kN	7,5			4,2	9	8	3,5	2	10,75		12,5	
Distance D (to point of force)	mm	32				32				32			
Fa (axial) + (at standstill/ 0 bar pressure) max	kN	3				4				4	5		
Fa (axial) - (at standstill/ 0 bar pressure) max	kN	4	5	7		7		10	11	13	16	19	
Fa (axial) + (at 350 bar pressure) max *	kN	6	8	10,8	12	16		20		13	16	19	
Fa (axial) - (at 350 bar pressure) max *	kN	1,2		2,08		2,8		3,5	1,8	4,16	5,16		

\* Fa (axial) + Will increase bearing life

\* Fa (axial) - Will decrease bearing life

### HOSE SIZING

The recommended flow of the delivery hose should not exceed a fluid maximum speed of 5m/s.

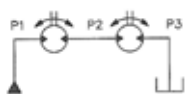
### FILTRATION

We recommend a cleanness grade according to ISO 4406-1999

- code 19/17/14 up to 140 bar.
- code 18/16/13 from 140 bar to 200 bar.
- code 17/15/12 over 200 bar.

Thread	Max. fittings tightening torque
M10 x 1	50 Nm
M12 x 1,5	80 Nm
G 1/2	80 Nm
G 3/4	100-120 Nm
G 1	180-200 Nm
G 1-1/4	310-330 Nm

### SERIES CONNECTION OF HPM MOTORS



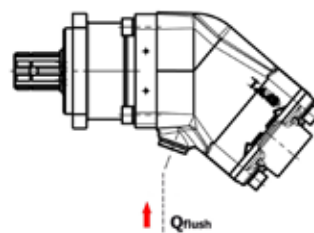
The maximum allowed pressure on the ports is 350 bar continuous and 400 bar intermittent. In case of series connection we recommend to limit the total working pressure P1 + P2 always to 350 bar continuous and 400 bar intermittent.

## TEMPERATURE/COOLING OF MOTOR CASING

High oil temperature reduces the lifetime of shaft oil seal and can lower the oil viscosity below the recommended level- The temperature of the system shall not exceed 60°C while temperature of return line shall not exceed 90°C.  
Cooling/flushing of motor casing might be necessary to keep return temperature within the recommended level.

MOTOR	FLUSHING	CONT.
12-34	2-8 l/min.	≥ 2800 rev/min.
40-64	4-10 l/min.	≥ 2500 rev/min.
84-130	6-12 l/min.	> 2200 rev/min.

Reference value for motor casing flushing.



The motor casing flushing can be achieved by means of a flushing valve or directly from the return hose. Too low return pressure must be compensated by a back-pressure valve. The tank hose must be connected into the highest point as shown in the picture.

## TYPES OF FLUID

The table below shows the main types of hydraulic fluid as set out in ISO 6743-4 standard.

### - HL RECOMMENDED

(For other type of fluid please contact our sales/technical dept).

Mineral oil-based fluids	
HH	Additive-free
HL	Anticorrosive, antioxidant (RECOMMENDED)
HM	HL and anti-wear additives
HV	HM additives and viscosity controls
Flame-resitant fluids	
HFA	Oil-based emulsion in water (water > 90%)
HFB	Water-based emulsion in oil (water > 40%)
HFC	Water in glycol solution (polyhydrate alcohols)
HFD	Water-free synthetic fluids (phosphoric esters)
Organic fluids	
HETG	Vegetable-based fluids
HEPG	Synthetic polyglycol-based fluids
HEE	Synthetic ester-based fluids

## VISCOSITY INDEX

The optimum viscosity of the fluid  $V_{opt}$  at the operating temperature (temperature of the tank for open circuits or temperature of the circuit for closed circuits) must fall between the minimum and maximum values shown in the table below. The minimum viscosity  $V_{min}$  shown in the table is permitted in extreme conditions and for short periods. This value refers to a maximum fluid temperature of 90°C (temperature of drainage fluid). The maximum viscosity  $V_{max}$  for short intervals and during cold starts is shown in the table below. The temperature of the fluid must never exceed a maximum of +90°C and a minimum of -25°C.

	$V_{opt}$ (cSt)	$V_{min}$ (cSt)	$V_{max}$ (cSt)
HPM	15+40	10	800

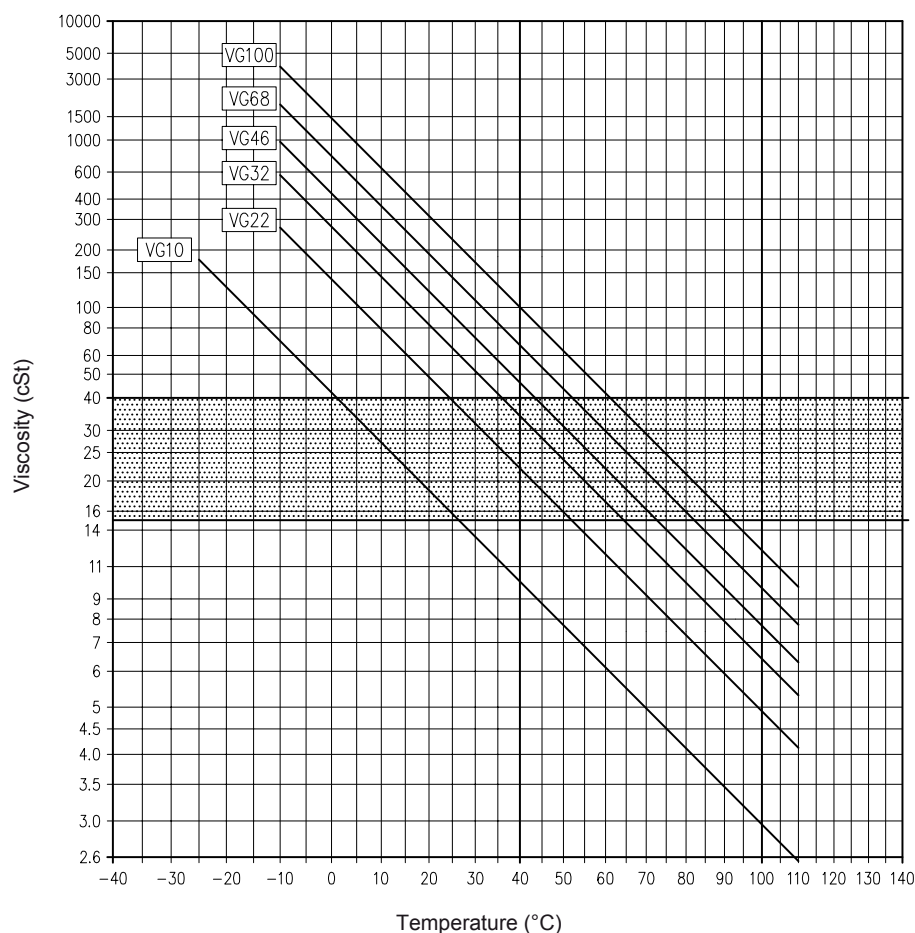
## VISCOSITY GRADES

Under the ISO standard, hydraulic fluids are divided into 6 grades of viscosity (see table below). Viscosity grades are shown by the letters VG followed by the viscosity of the fluid in cSt at a temperature of 40 °C.

VISCOSITY GRADES ISO	V (40°) (cSt)
VG 10	9+11
VG 22	19.8+24.2
VG 32	28.8+35.2
VG 46	41.4+50.6
VG 68	61.2+71.5
VG 188	90+110

In order to choose the correct type of fluid, it is essential to know the operating temperature of the fluid (temperature of the tank for open circuits or temperature of the circuit for closed circuits) and its viscosity index. At the operating temperature, the viscosity of the fluid must fall within the optimum viscosity values ( $V_{opt}$ ). The diagram below shows the variations of viscosity at various temperatures of a class of fluids sharing the same viscosity index.

Viscosity - temperature diagram\*



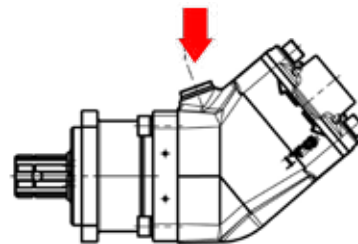
\* The diagram is only an example. It shows the viscosity temperature characteristics of typical fluids with different viscosities but sharing the same viscosity index. Ask to your hydraulic fluid supplier for the real viscosity-temperature diagram of the fluid used in your system.

## TECHNICAL FEATURES

### PRELIMINARY OPERATION

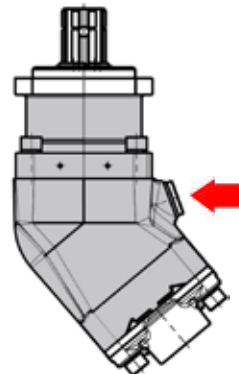
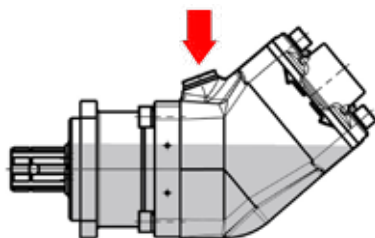


Before to start up the motor please fill-up the the casing with oil.  
We recommend the highest level of cleanness during the operations of oil filling-up and change.  
Plugs tightening torque: 20-25 Nm



Connect the drain line before using the motor.

Use always the upper drain port according to the motor position and in any case always use the drain port that can ensure the casing being filled-up.



It is essential to drain the motor to relief the shaft seal from excessive pressure. The maximum internal pressure allowed depends on the rotating speed of the motor. However, we can take into consideration the following values:

- Max internal pressure independent from the rotating speed (continue): 4 bar.
- Max internal pressure independent from the rotating speed (peak): 5.5 bar.

## FORMULAS FOR MOTORS

### INPUT HYDRAULIC POWER

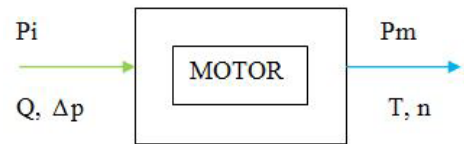
In a motor the input hydraulic power is proportional to the pressure difference between the ports and to the flow according to the ratio where

$P_i$  is the hydraulic power in kW

$Q$  is the flow in l/min

$\Delta p$  is the pressure difference in bar between the ports

$$P_i = \frac{Q \cdot \Delta p}{600}$$



### MECHANICAL POWER TO THE SHAFT

In a motor the mechanical power available is proportional to the torque at the shaft and to the angular speed of the shaft according to the ratio where

$P_m$  is the mechanical power in kW

$T$  is the torque in Nm

$n$  is the rpm

$$P_m = \frac{T \cdot n}{9550}$$

### INPUT FLOW FOR ROTATING THE SHAFT AT SPEED $n$

where:

$Q$  is the flow in l/min

$n$  is the rpm

$c$  is the displacement of the motor in cc/rev

$\eta_v$  is the volumetric efficiency of the motor

$$Q = \frac{n \cdot c}{1000 \cdot \eta_v}$$

### MOTOR SPEED WHEN IN INPUT YOU HAVE FLOW $Q$

where

$Q$  is the flow in l/min

$n$  is the rpm

$c$  is the displacement of the motor in cc/rev

$\eta_v$  is the volumetric efficiency of the motor

$$n = 1000 \cdot \frac{Q}{c} \cdot \eta_v$$

### TORQUE TO THE SHAFT WITH A PRESSURE DIFFERENCE $p$ BETWEEN THE PORTS

where

$T$  is the torque in Nm

$c$  is the displacement of the motor in cc/rev

$\Delta p$  is the pressure difference in bar between the ports

$\eta_m$  is the mechanical efficiency of the motor

$$T = \frac{c \cdot \Delta p}{62.8} \eta_m$$

### PRESSURE DIFFERENCE REQUIRED BETWEEN INPUT PORTS TO OBTAIN TORQUE $T$ AT THE SHAFT

where

$\Delta p$  is the pressure difference in bar between the ports

$T$  is the torque in Nm

$c$  is the displacement of the motor in cc/rev

$\eta_m$  is the mechanical efficiency of the motor

$$\Delta p = 62.8 \cdot \frac{T}{c \cdot \eta_m}$$

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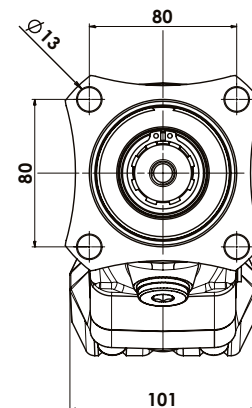
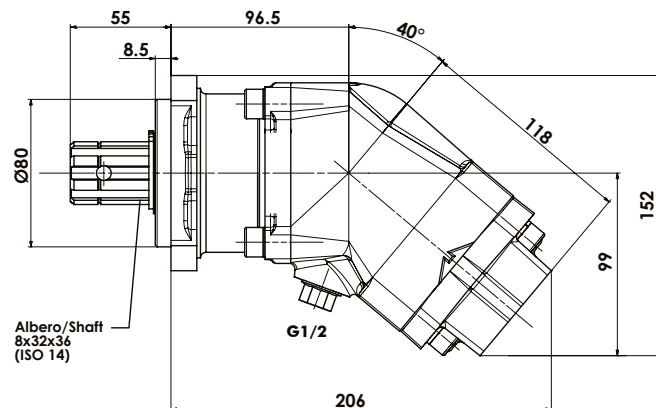
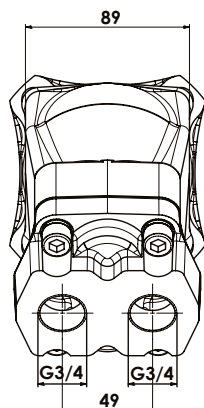
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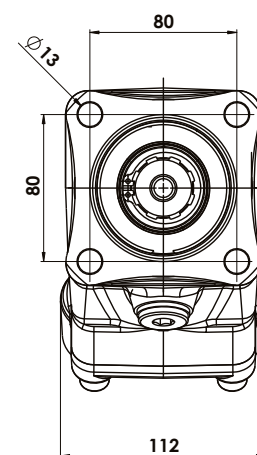
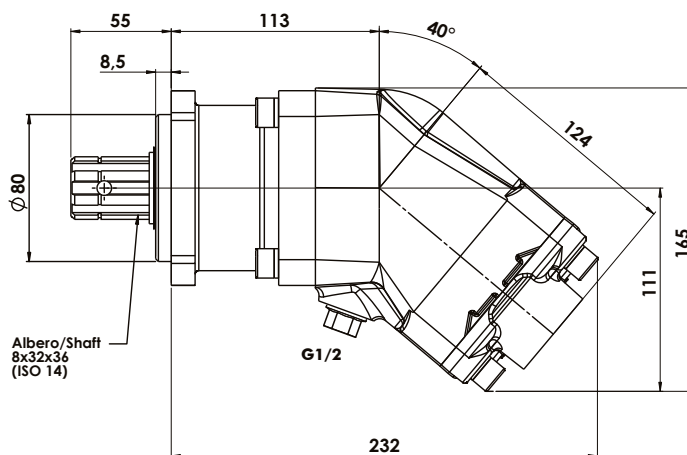
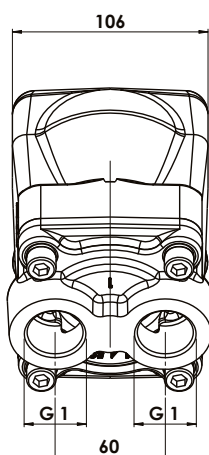
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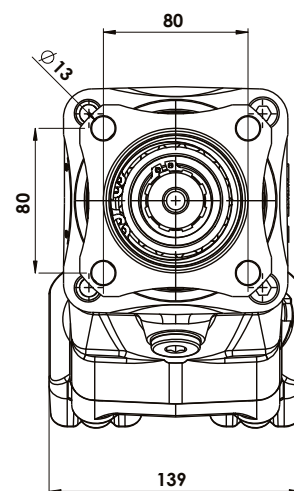
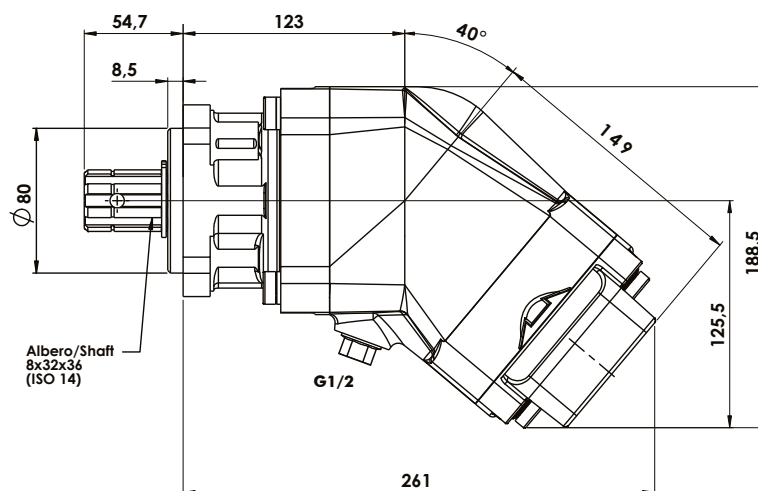
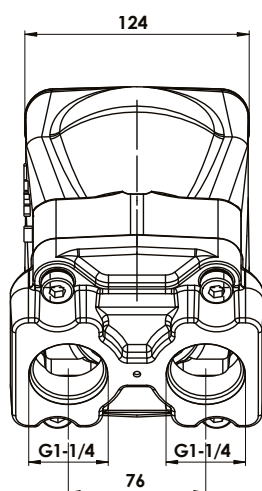
## OVERALL MOTORS DIMENSIONS



**BSPP (GAS) 40° - G 3/4 - DISPLACEMENT 12-17-25-34**



**BSPP (GAS) 40° - G 1 - DISPLACEMENT 40-47-55-64**



**BSPP (GAS) 40° - G 1-1/4 - DISPLACEMENT 84-108-130**

Codice fascicolo: 997-400-24411

Data: Lunedì 20 novembre 2017

Codice foglio: 997-244-00021 Rev: AB

# **BENT AXIS PISTON MOTORS SERIES HPM3 SPARE PARTS FLANGE ISO 7653-D**

<b>GASKETS KIT</b>	
<b>CODE</b>	<b>DESCRIPTION</b>
20190000013	HPM3 motors gaskets kit - Flange 201 - Shaft 001 - Displacements 12/17/25/34
20190000022	HPM3 motors gaskets kit - Flange 201 - Shaft 001 - Displacements 40/47/55/64
20190000031	HPM3 motors gaskets kit - Flange 201 - Shaft 001 - Displacements 84/108/130

Codice fascicolo: 997-400-24411

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Rev: AB

Codice foglio: 997-244-00021