MAKING MODERN LIVING POSSIBLE

Technical Information

Orbital Motor

VMP

powersolutions.danfoss.com

Revision History

Table of Revisions

Date	Changed	Rev
Feb 2014	New dimension drawings. Converted to Danfoss layout _ DITA CMS	BA
May 2013	First version	AA

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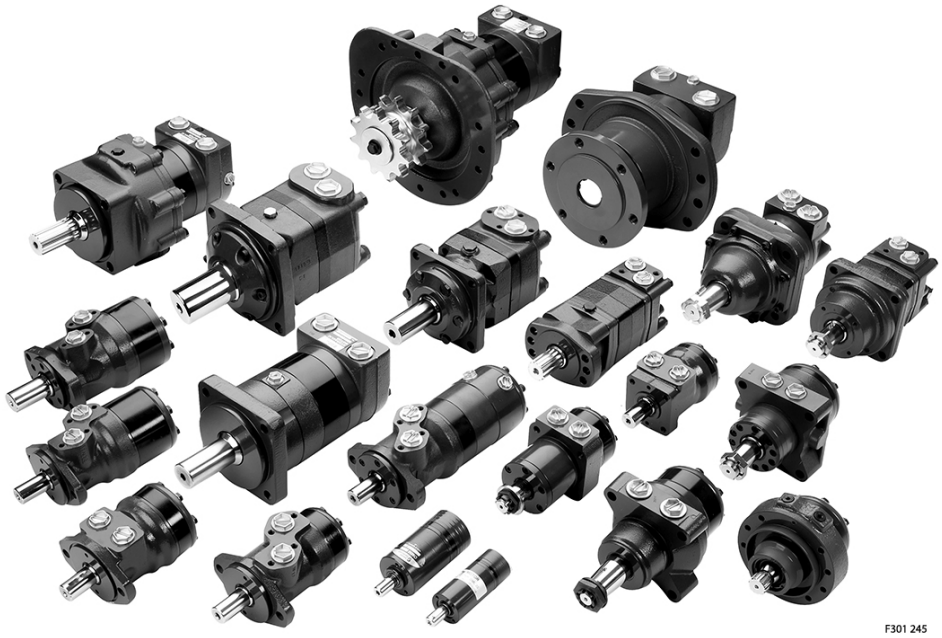
A wide range of Orbital Motors

Characteristic, features and application areas of Orbital Motors



Danfoss is a world leader within production of low speed orbital motors with high torque. We can offer more than 3000 different orbital motors, categorised in types, variants and sizes (incl. different shaft versions).

The motors vary in size (rated displacement) from 8 cm^3 [0.50 in^3] to 800 cm^3 [48.9 in^3] per revolution.

Speeds range up to approx. 2500 min^{-1} (rpm) for the smallest type and up to approx. 600 min^{-1} (rpm) for the largest type.

Maximum operating torques vary from 13 N•m [115 lbf•in] to 2700 N•m [24.000 lbf•in] (peak) and maximum outputs are from 2.0 kW [2.7 hp] to 70 kW [95 hp].

Characteristic features of Danfoss Orbital Motors

- Smooth running over the entire speed range
- Constant operating torque over a wide speed range
- High starting torque
- High return pressure without the use of drain line (High pressure shaft seal)
- High efficiency
- Long life under extreme operating conditions
- Robust and compact design
- High radial and axial bearing capacity
- For applications in both open and closed loop hydraulic systems
- Suitable for a wide variety of hydraulics fluids

Technical features of Danfoss Orbital Motor

The programme is characterised by technical features appealing to a large number of applications and a part of the programme is characterised by motors that can be adapted to a given application. Adaptions comprise the following variants among others:

A wide range of Orbital Motors

- Motors with corrosion resistant parts
- Wheel motors with recessed mounting flange
- OMP, OMR- motors with needle bearing
- OMR motor in low leakage version
- OMR motors in a super low leakage version
- Short motors without bearings
- Ultra short motors
- Motors with integrated positive holding brake
- Motors with integrated negative holding brake
- Motors with integrated flushing valve
- Motors with speed sensor
- Motors with tacho connection
- All motors are available with black finish paint

The Danfoss Orbital Motors are used in the following application areas:

- Construction equipment
- Agricultural equipment
- Material handling & Lifting equipment
- Forestry equipment
- Lawn and turf equipment
- Special purpose
- Machine tools and stationary equipment
- Marine equipment

Survey of literature with technical data on Danfoss Orbital Motors

Detailed data on all Danfoss Orbital Motors can be found in our motor catalogue, which is divided into more individual subcatalogues:

- General information on Danfoss Orbital Motors: function, use, selection of orbital motor, hydraulic systems, etc.
- Technical data on small motors: OML and OMM
- Technical data on medium sized motors: OMP, OMR, OMH
- Technical data on medium sized motors: DH and DS
- Technical data on medium sized motors: OMEW
- Technical data on medium sized motors: VMP
- Technical data on medium sized motors: VMR
- Technical data on large motors: OMS, OMT and OMV
- Technical data on large motors: TMT
- Technical data on large motors: TMV

A general survey brochure on Danfoss Orbital Motors gives a quick motor reference based on power, torque, speed and capabilities.

Data survey

Introduction

By introducing the VMP, Danfoss is introducing an Orbital Motor in the new V-Series. In order to meet the demands for motors that have the right duty cycle and efficiency capabilities for a given function, Danfoss now has 3 Orbital Motor Series:

T-Series – The Highest Torque

Leading performance with a long lifetime makes light work of the heaviest duties. Offering pressure capability up to 350 bar [5076 psi] and high starting torque, the T-Series is the energy-efficient choice for the toughest working environments.

O-Series – The Flexible Choice

The O-Series is flexible beyond compare. Delivering premium power across the board, these motors cover small to large, medium to heavy-duty needs with pressure capability up to 275 bar [3990 psi]. Robust, reliable and designed to fulfill the latest emissions standards.

V-Series – The Core Solution

The V-Series is your quality benchmark in the medium duty market. Based on proven technology, these reliable motors will reduce your overall system costs while adding value to your machine. Perfect for many tasks.

VMP features

- High pressure shaft seal
- Proven orbital motor design
- 3-chamber motor design
- Suitable for medium and low duty

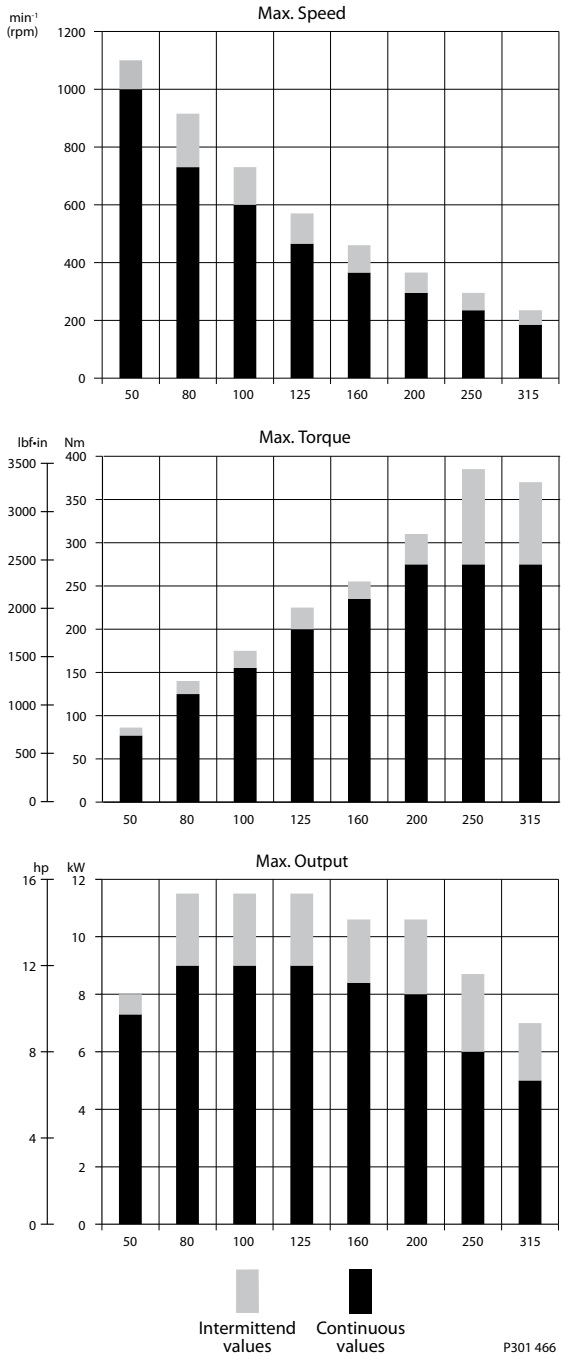
Speed, torque and output

Speed, torque and output

The bar diagrams, are useful for a quick selection of relevant motor size for the application. The final motor size can be determined by using the *function diagram*.

The function diagrams are based on actual tests on a representative number of motors from our production. The diagrams apply to a return pressure between 5 and 10 bar [75 and 150 psi] when using mineral based hydraulic oil with a viscosity of 35 mm^2/s [165 SUS] and a temperature of 50°C [120°F]. For further explanation concerning how to read and use the function diagrams, please consult the paragraph "Selection of motor size" in the technical information "General" 520L0232.

Speed, torque and output



Versions

Versions and code numbers

Versions

Mounting flange	**2 hole oval flange (A2 - flange)**						**Square flange (C-flange)**	
Spigot diameter	**Ø 82.5 mm [3.25 in]**						**Ø 44.4 mm [1.75 in]**	
Bolt circle diameter (BC)	**Ø 106.4 mm [4.20 in]**						**Ø 82.5 mm [3.25 in]**	
Shaft	Cyl. 25 mm Parallel key DIN 6885		Cyl. 1 in Parallel key BS 46		Splined, 1 in SAE 6B	Cyl. 1 in, Woodruff key	Splined 1 in SAE 6B	Cyl. 1 in, Woodruff key
Thread in shaft	M8 18 [0.71] deep		M8 18 [0.71] deep		1/4-20 UNC 14 [0.55] deep	1/4-20 UNC 14 [0.55] deep	1/4-20 UNC 14 [0.55] deep	1/4-20 UNC 14 [0.55] deep
Port size	G 1/2		7/8-14 UNF		7/8-14 UNF	7/8-14 UNF	7/8-14 UNF	7/8-14 UNF
Drain port	G1/4	G1/4	7/16-20 UNF	7/16-20 UNF	7/16-20 UNF	7/16-20 UNF	7/16-20 UNF	7/16-20 UNF
European version	X	X						
US version			X	X	X	X	X	X
Check valve					X	X	X	X
Painted Black		X		X				
Code numbers								
VMP 50	11118244	11118253	11129680	11129860	11144410[1)]	11144814	11144860[1)]	11144271
VMP 80	11118245	11118254	11129681	11129861	11144411[1)]	11144815	11144861[1)]	11144453
VMP 100	11118246	11118255	11129683	11129872	11144412[1)]	11144816	11144862[1)]	11144454
VMP 125	11118247	11118256	11129692	11129873	11144413[1)]	11144817	11144863[1)]	11144455
VMP 160	11118248	11115010	11129693	11129874	11144414[1)]	11144818	11144864[1)]	11144456
VMP 200	11118249	11118257	11129716	11129875	11144415[1)]	11144819	11144865[1)]	11144457
VMP 250	11118250	11118258	11129717	11129876	11144416	11144820	11144866[1)]	11144458
VMP 315	11118251	11118259	11129718	11129877	11144417[1)]	11144821	11144867	11144459

1) To be defined on request

Technical data

Technical data for VMP

Technical data for VMP with 25 mm, 1 in cylindrical and 1 in splined shaft

Type Motorsize			VMP 50	VMP 80	VMP 100	VMP 125	VMP 160	VMP 200	VMP 215	VMP 315
Geometric displacement	cm^3 [in^3]		48.6 [2.97]	77.8 [4.76]	97.3 [5.95]	125.0 [7.65]	155.7 [9.53]	194.6 [11.91]	242.3 [14.83]	306.1 [18.73]
Max. speed	min^{-1} [rpm]	cont.	1000	730	600	465	365	295	235	185
		int.[1)]	1100	915	730	570	460	365	295	235
Max. torque	Nm [lbf•in]	cont.	77 [680]	125 [1105]	155 [1330]	200 [1770]	235 [2090]	275 [2435]	275 [2435]	275 [2435]
		int.[1)]	86 [760]	140 [1240]	175 [1550]	225 [1990]	255 [2255]	310 [2745]	385 [3410]	370 [3275]
Max. output	kW [hp]	cont.	7.3 [9.8]	9 [12.1]	9 [12.1]	9 [12.1]	8.4 [11.3]	8 [10.7]	6 [8.0]	5 [6.7]
		int.[1)]	8.0 [10.7]	11.5 [15.4]	11.5 [15.4]	11.5 [15.4]	10.6 [14.2]	10.6 [14.2]	8.7 [11.7]	7 [9.4]
Max. pressure drop	bar [psi]	cont.	125 [1815]	125 [1815]	125 [1815]	125 [1815]	120 [1740]	115 [1670]	90 [1305]	75 [1090]
		int.[1)]	140 [2030]	140 [2030]	140 [2030]	140 [2030]	130 [1885]	130 [1885]	125 [1815]	100 [1450]
Max. oil flow	l/min [US gal/min]	cont.	50 [13.2]	60 [15.9]	60 [15.9]	60 [15.9]	60 [15.9]	60 [15.9]	60 [15.9]	60 [15.9]
		int.[1)]	55 [14.5]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]	75 [19.8]
Max. starting pressure with unloaded shaft	bar [psi]		10 [145]	10 [145]	10 [145]	10 [145]	10 [145]	7 [100]	7 [100]	7 [100]
Min starting torque	at max. Press-drop Nm [lbf•in]	cont.	68 [600]	110 [975]	135 [1195]	175 [1550]	210 [1860]	250 [2215]	245 [2170]	255 [2255]
		int.[1)]	76 [675]	120 [1060]	150 [1330]	195 [1725]	225 [1990]	280 [2480]	340 [3010]	340 [3010]

Type			Max inlet pressure	Max inlet pressure with drain line
VMP 50-315	bar [psi]	cont.	140 [2030]	140 [2030]
		int.[1)]	160 [2320]	160 [2320]

[1)] Intermittent operation: the permissible values may occur for max. 10% of every minute.

Recommendation:

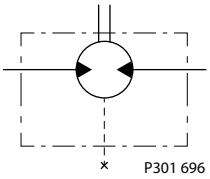
To assure best motor performance, run motor for approximatley one hour at 30% of rated pressure before running at full load.

Shaft seal

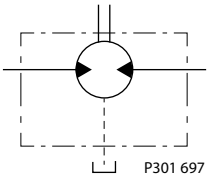
VMP with High Pressure Shaft Seal (HPS)

VMP with HPS and without drain connected: The shaft seal pressure equals the average of input pressure and return pressure.

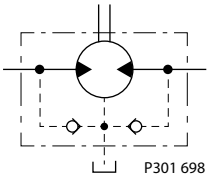
$$P_{seal} = \frac{P_{in} + P_{return}}{2}$$



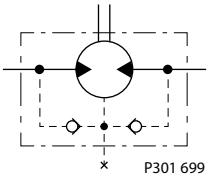
VMP with HPS and drain connected: The shaft seal pressure equals the pressure in the drain line.

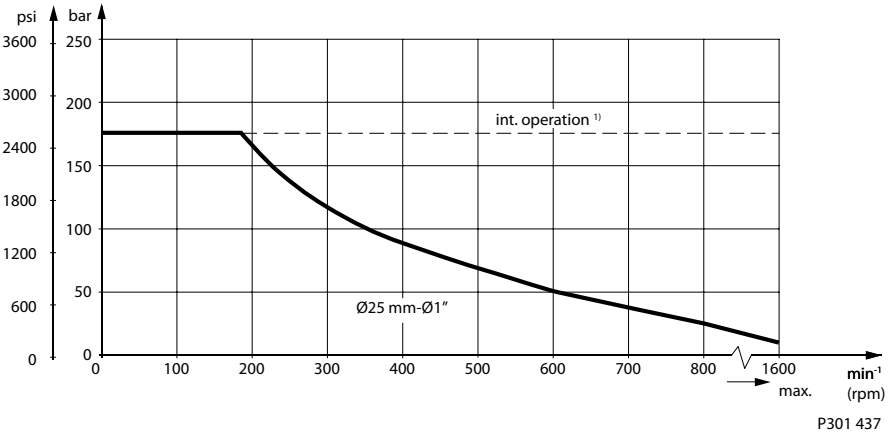


VMP with check valves and drain connected: The shaft seal pressure equals the pressure in the drain line.



VMP with check valves and *without* drain connected: The shaft seal pressure equals the pressure in the return line + 10 bar [145 psi].

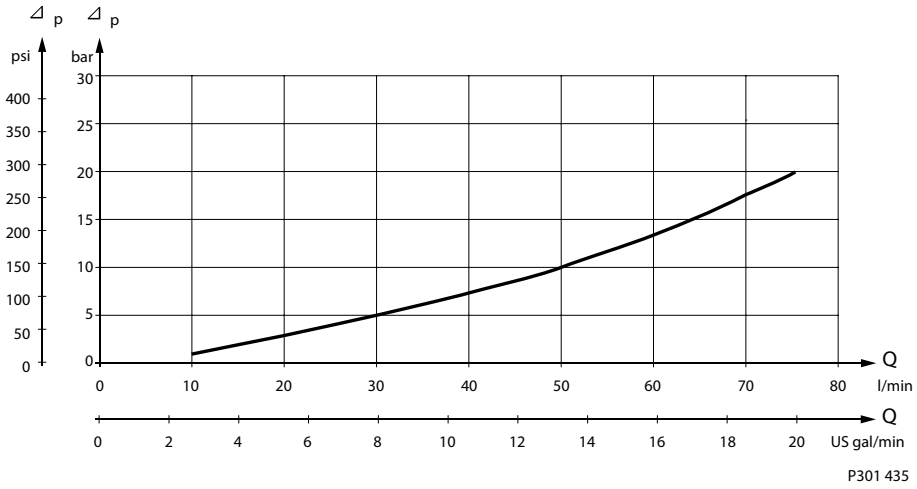




Please check motor pressure according to data under *Technical data for VMP*.

Pressure drop

Pressure drop in motor



The curve applies to an unloaded motor shaft and an oil viscosity of 35 mm^2/s [165 SUS]

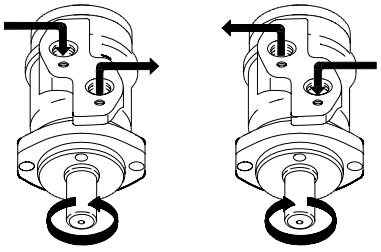
Oil flow

Oil flow in drain line

The table shows the max. oil flow in the drain line at a return pressure less than 5-10 bar [75-150 psi].

Pressure drop bar [psi]	Viscosity mm^2/s [SUS]	Oil flow in drain line l/min [US gal/min]
100 [1450]	20 [100]	2.5 [0.66]
	35 [165]	1.8 [0.78]
140 [2030]	20 [100]	3.5 [0.93]
	35 [165]	2.8 [0.74]

Direction of shaft rotation



151-1836.10 L

Shaft load

Permissible shaft load

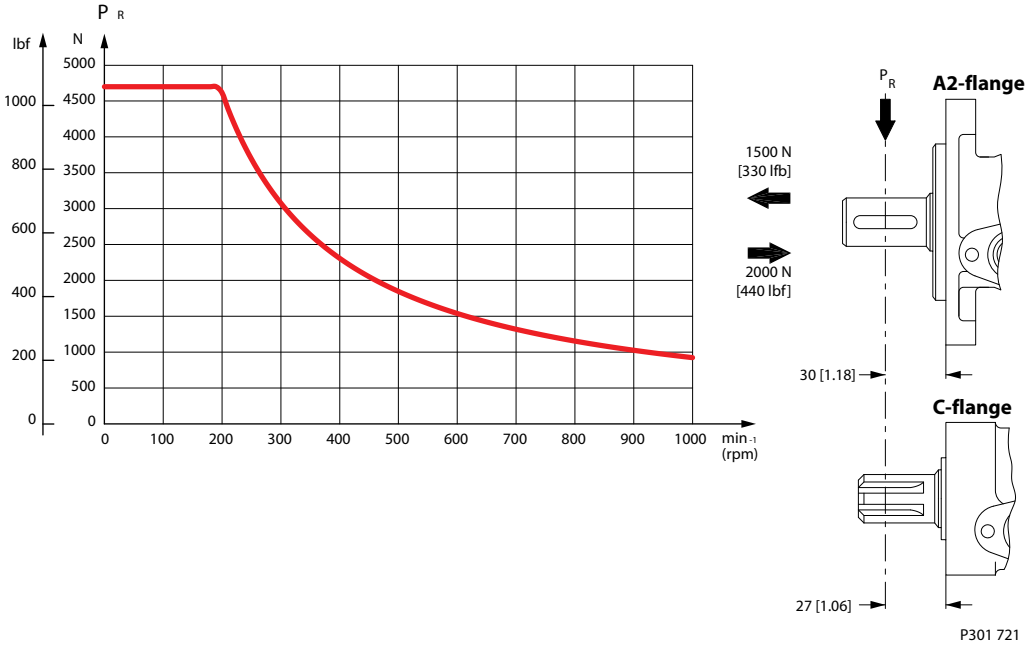
The permissible radial shaft load (P_R) depends on

- n = Speed (min^{-1})
- L = Distance from the point of load to the mounting flange (mm, in)

	A2-flange	C-flange
Permissible shaft load (P_R) - L in mm	$\frac{800}{n} \cdot \frac{150000\ N^*}{100 + L}$	$\frac{800}{n} \cdot \frac{150000\ N^*}{103 + L}$
Permissible shaft load (P_R) - L in inch	$\frac{800}{n} \cdot \frac{1330\ lbf^*}{3.94 + L}$	$\frac{800}{n} \cdot \frac{1330\ lbf^*}{4.06 + L}$

* $n \geq 200\ min^{-1}$ [rpm]; $L \leq 55$ mm [2.2 in]

$n < 200\ min^{-1}$ [rpm]; = > P_{Rmax} = 4615 N [1037 lbf]



Function diagrams

Function diagrams

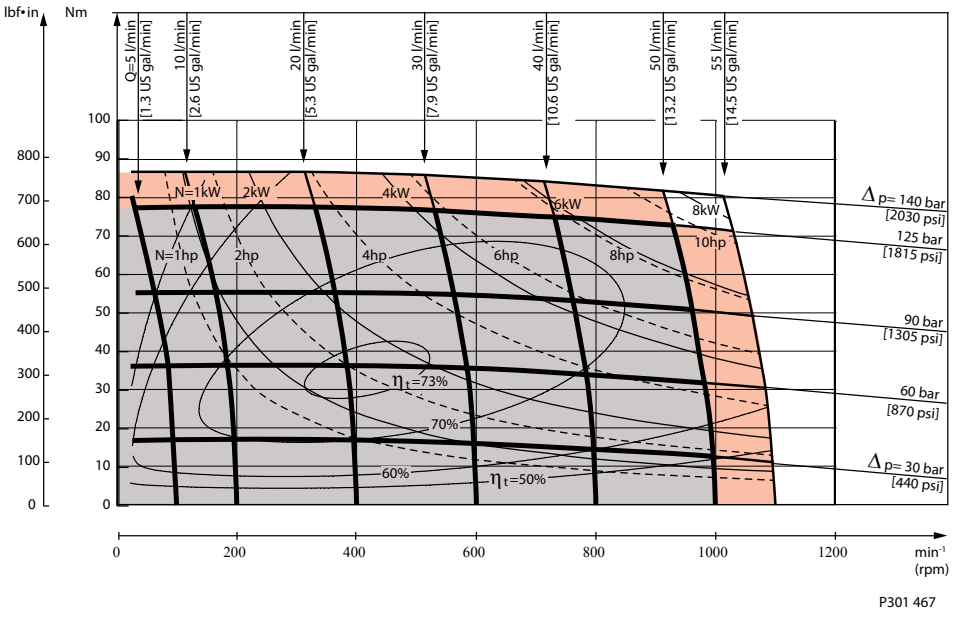
Explanation of function diagram use, basis and conditions can be found under *Speed, torque and output*.

Light grey = Continuous range

Light red = Intermittent range (max. 10% operation every minute)

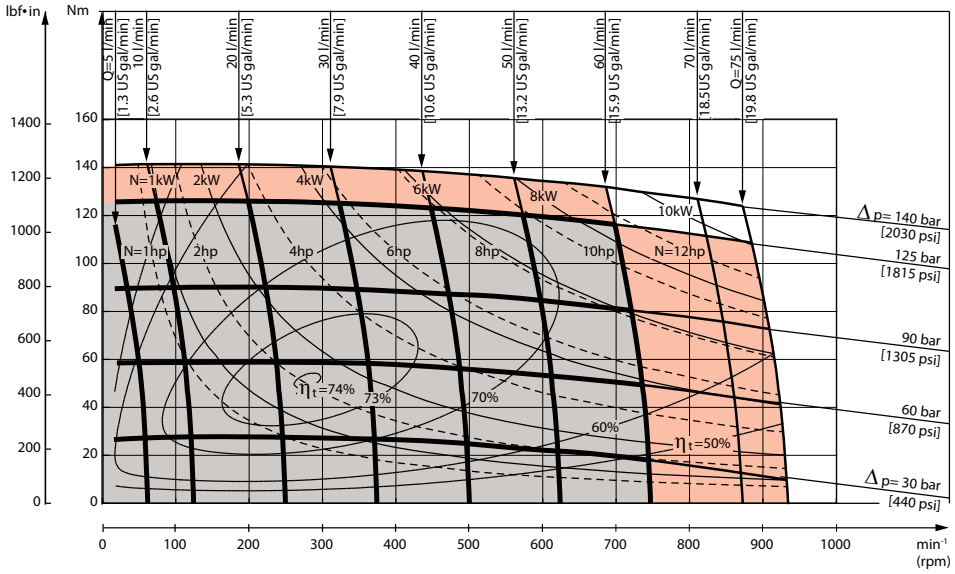
Intermittent pressure drop and oil flow must not occur simultaneously.

VMP 50 function diagram

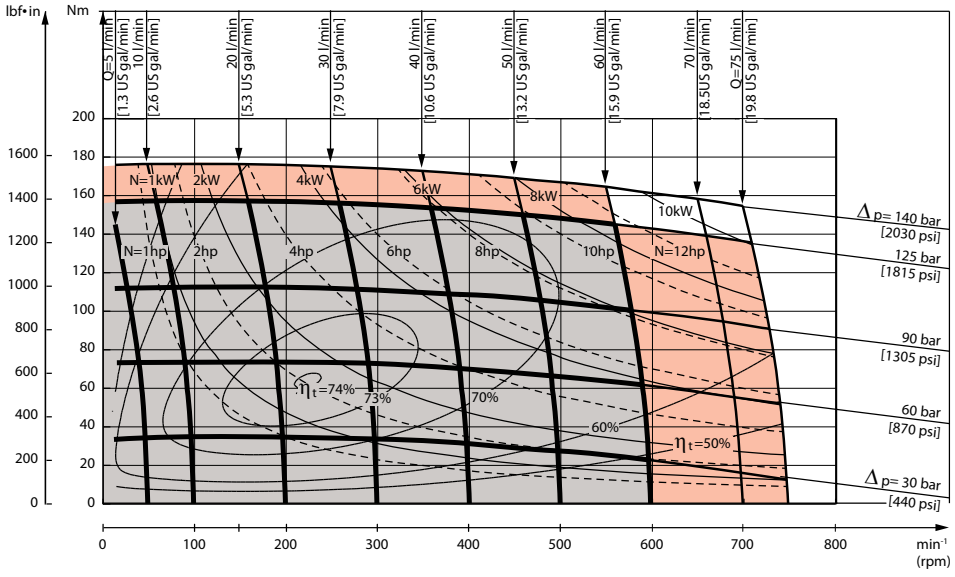


Function diagrams

VMP 80 function diagram

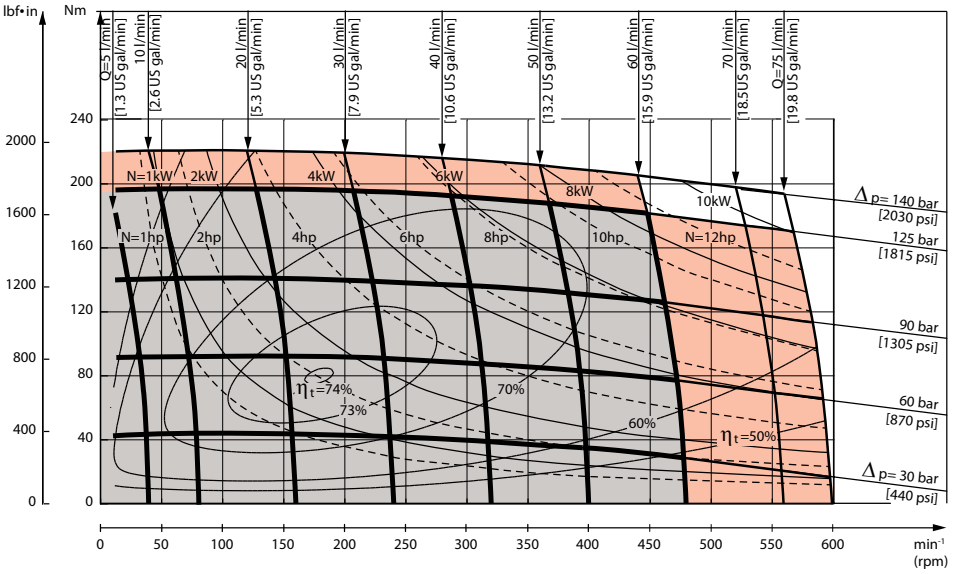


VMP 100 function diagram

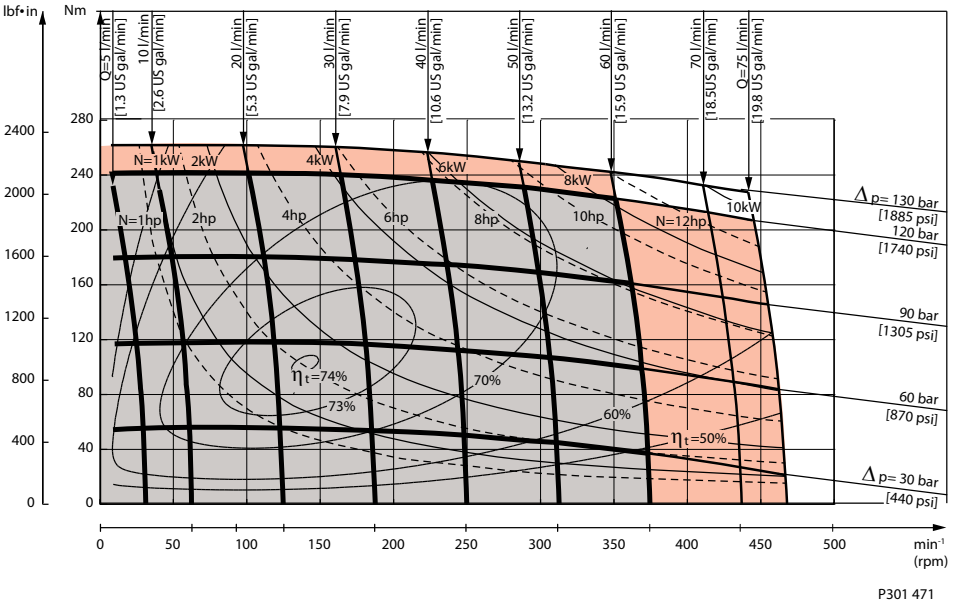


Function diagrams

VMP 125 function diagram

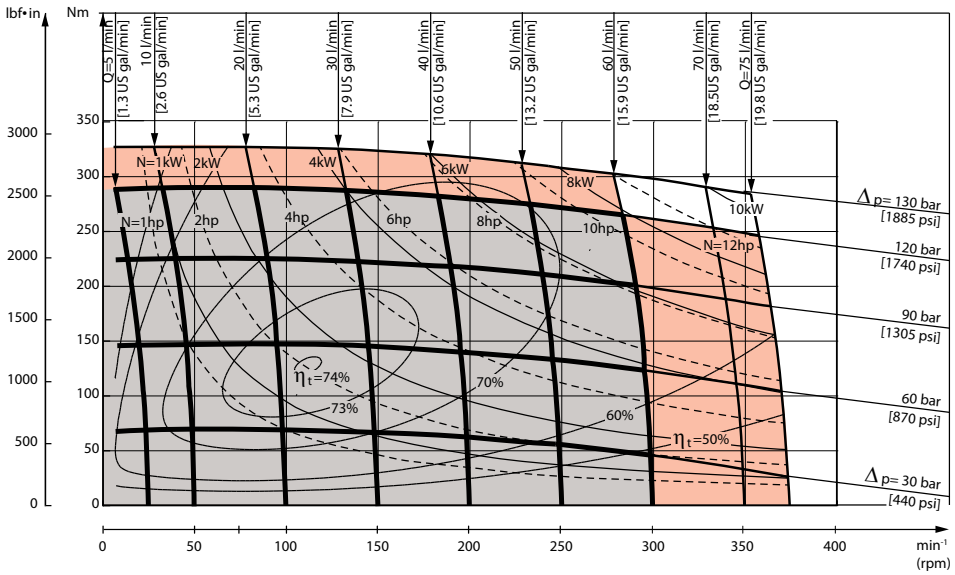


VMP 160 function diagram

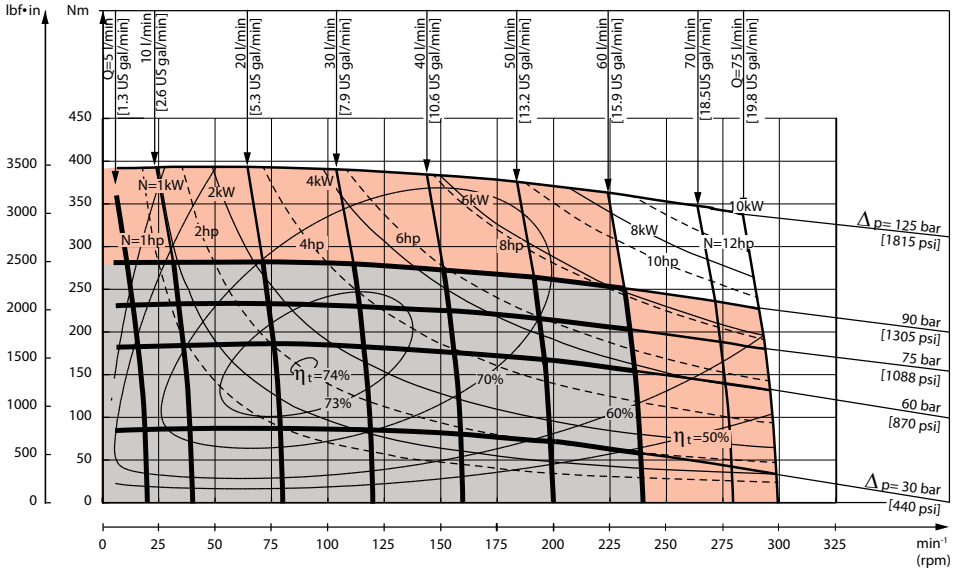


Function diagrams

VMP 200 function diagram

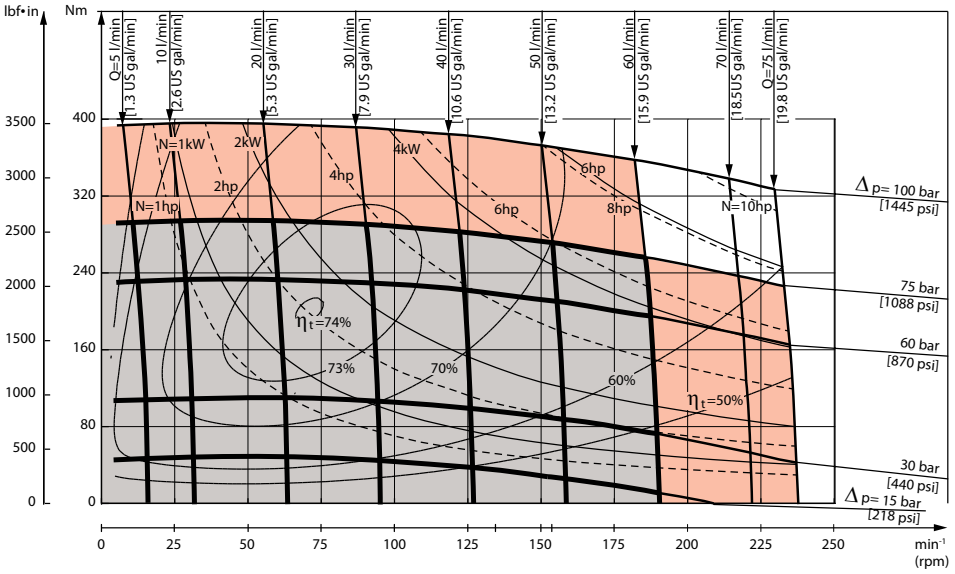


VMP 250 function diagram



Function diagrams

VMP 315 function diagram



Shaft

Shaft version

EU version

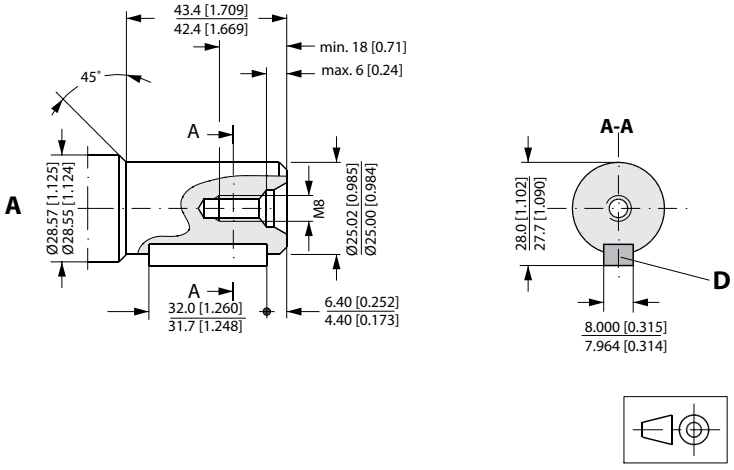
A: Cylindrical shaft

25 mm

D: Parallel key

A 8 x 7 x 32

DIN 6885



P301 667

EU version

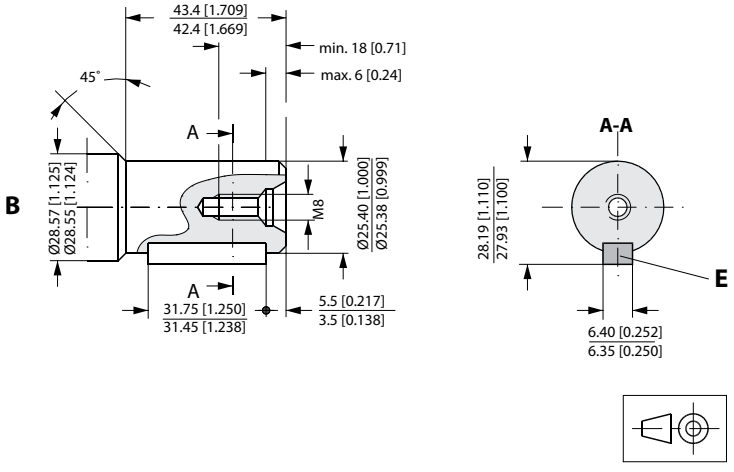
B: Cylindrical shaft

1 in

E: Parallel key

1/4 x 1/4 x 1 1/4 in

B.S. 46



P301 668

US version

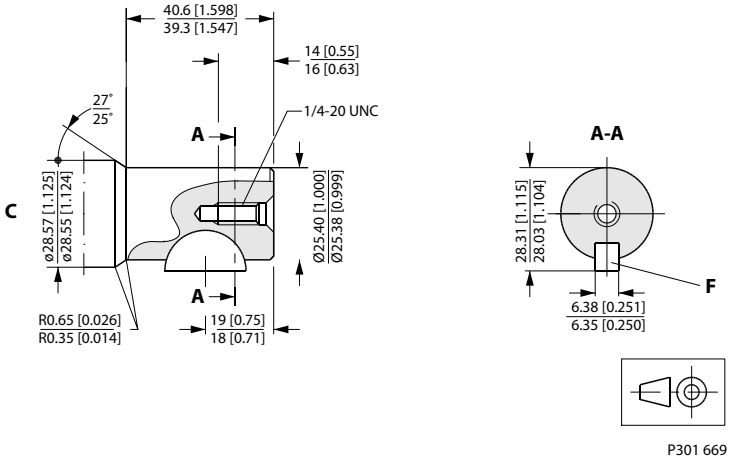
A: Cylindrical shaft

1 in

F: Woodruff key

1/4 × 1 in

SAE J502



P301 669

Shaft

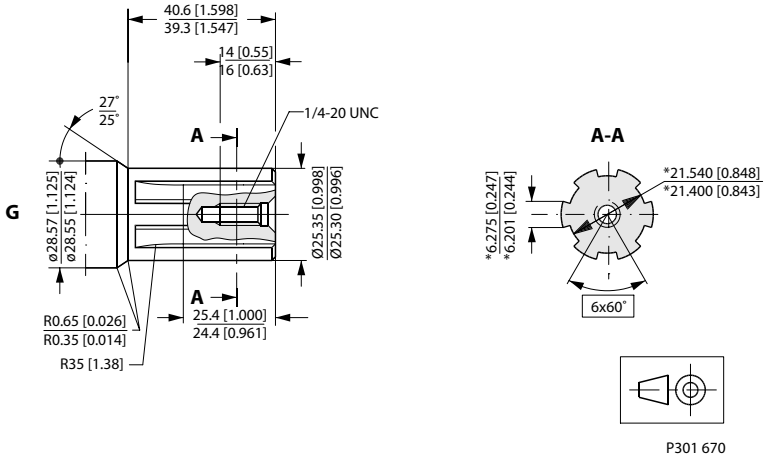
US version

G: Splined shaft

1 in

SAE 6B

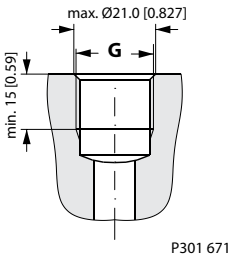
* Deviates from B.S. 2059 (SAE 6B)



Port

Port thread versions

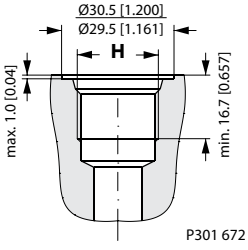
A



A: G main ports

G: ISO 228/1 - G1/2

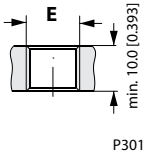
B



B: UNF main ports

H: 7/8 - 14 UNF O-ring boss port

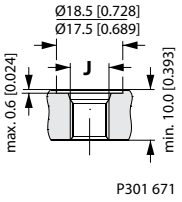
D



D: G drain port

E: ISO 228/1 - G1/4

F

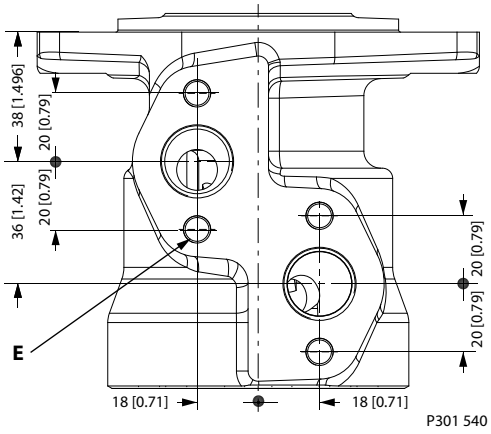


F: UNF drain port

J: 7/16 - 20 UNF O-ring boss port

Manifold mount VMP

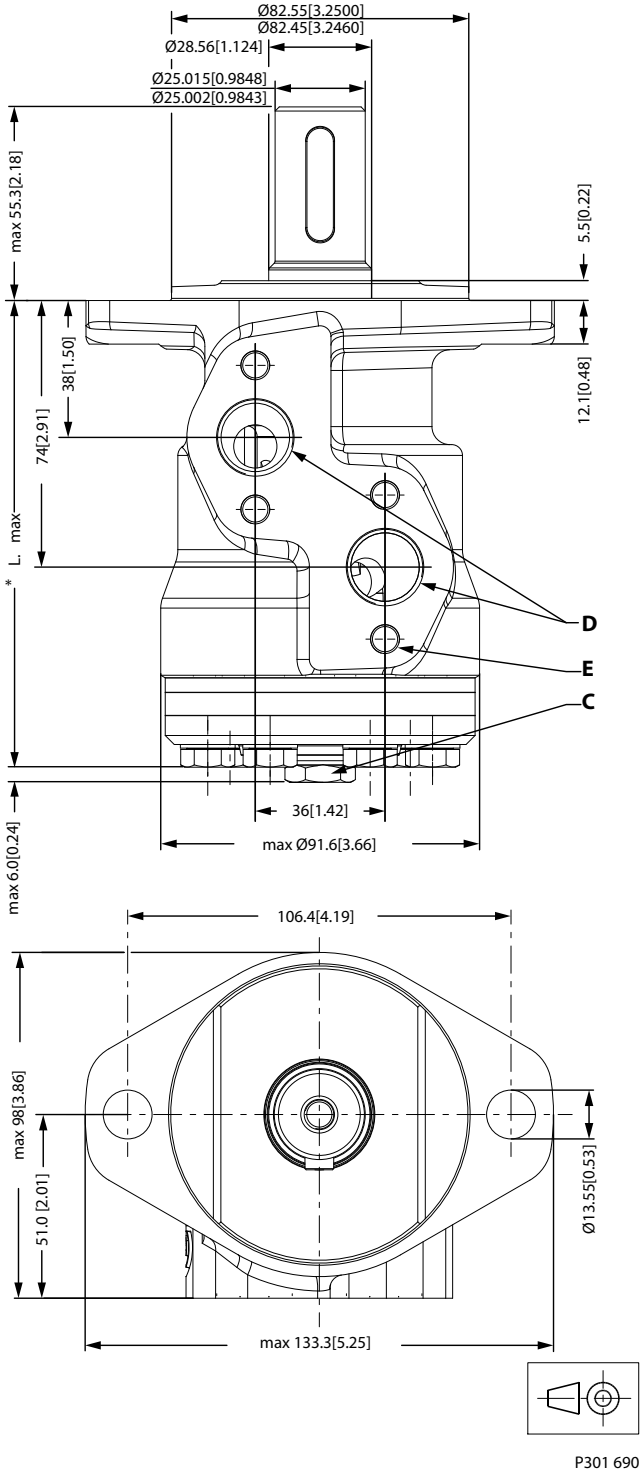
European version



E: M8; 13 [0.51] deep (4 pcs)

Dimensions, VMP European version, cyl. 25 mm shaft, A2 flange and side ports

VMP European version, cyl. 25 mm shaft, A2 flange



C: Drain connection G 1/4; Min. 10 [0.39] deep

D: G 1/2; Min 15 [0.59] deep

E: M8; 13 [0.51] deep (4 pcs)

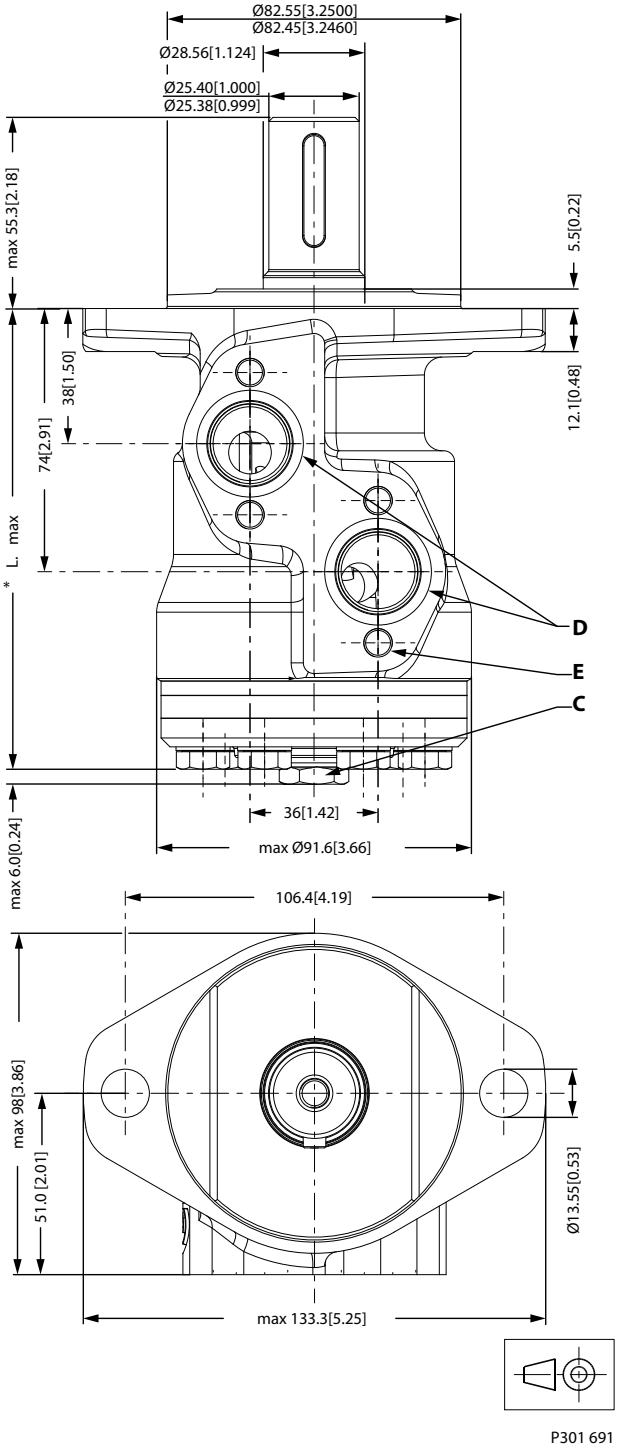
Dimensions, VMP European version, cyl. 25 mm shaft, A2 flange and side ports

Weight and dimensions

Type	*L_{max} mm [in]	Weight kg [lb]
VMP 50	max 132.0 [5.20]	4.9 [10.8]
VMP 80	max 136.0 [5.35]	5.0 [11.0]
VMP 100	max 138.5 [5.45]	5.2 [11.5]
VMP 125	max 142.2 [5.60]	5.3 [11.7]
VMP 160	max 146.3 [5.76]	5.5 [12.1]
VMP 200	max 151.5 [5.96]	5.7 [12.6]
VMP 250	max 158.0 [6.22]	5.9 [13.0]
VMP 315	max 166.5 [6.56]	6.2 [13.7]

Dimensions, VMP, cyl. 1 inch version, A2 flange and side ports

VMP, cyl. 1 inch version, A2 flange



C: Drain connection 7/16-20 UNF; Min. 10 [0.39] deep

D: Port connection 7/8-14 UNF; 16.7 [0.66] deep

E: M8; 13 [0.51] deep (4 pcs)

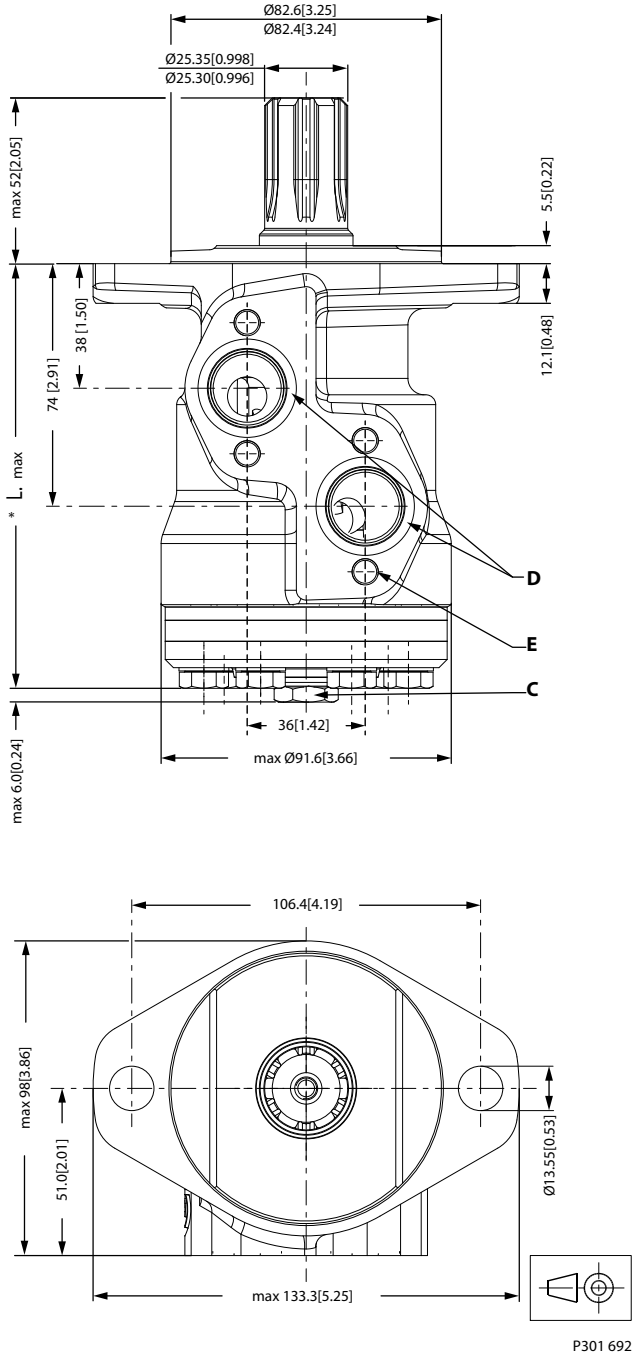
Dimensions, VMP, cyl. 1 inch version, A2 flange and side ports

Weight and dimensions

Type	*L_{max} mm [in]	Weight kg [lb]
VMP 50	max 132.0 [5.20]	4.9 [10.8]
VMP 80	max 136.0 [5.35]	5.0 [11.0]
VMP 100	max 138.5 [5.45]	5.2 [11.5]
VMP 125	max 142.2 [5.60]	5.3 [11.7]
VMP 160	max 146.3 [5.76]	5.5 [12.1]
VMP 200	max 151.5 [5.96]	5.7 [12.6]
VMP 250	max 158.0 [6.22]	5.9 [13.0]
VMP 315	max 166.5 [6.56]	6.2 [13.7]

Dimensions, VMP SAE version, 1 inch splined shaft, A2 flange and side ports

VMP SAE version, 1 inch splined shaft, A2 flange



C: Drain connection 7/16-20 UNF; Min. 10 [0.39] deep

D: Port connection 7/814 UNF; 16.7 [0.66] deep

E: M8; 13 [0.51] deep (4 pcs)

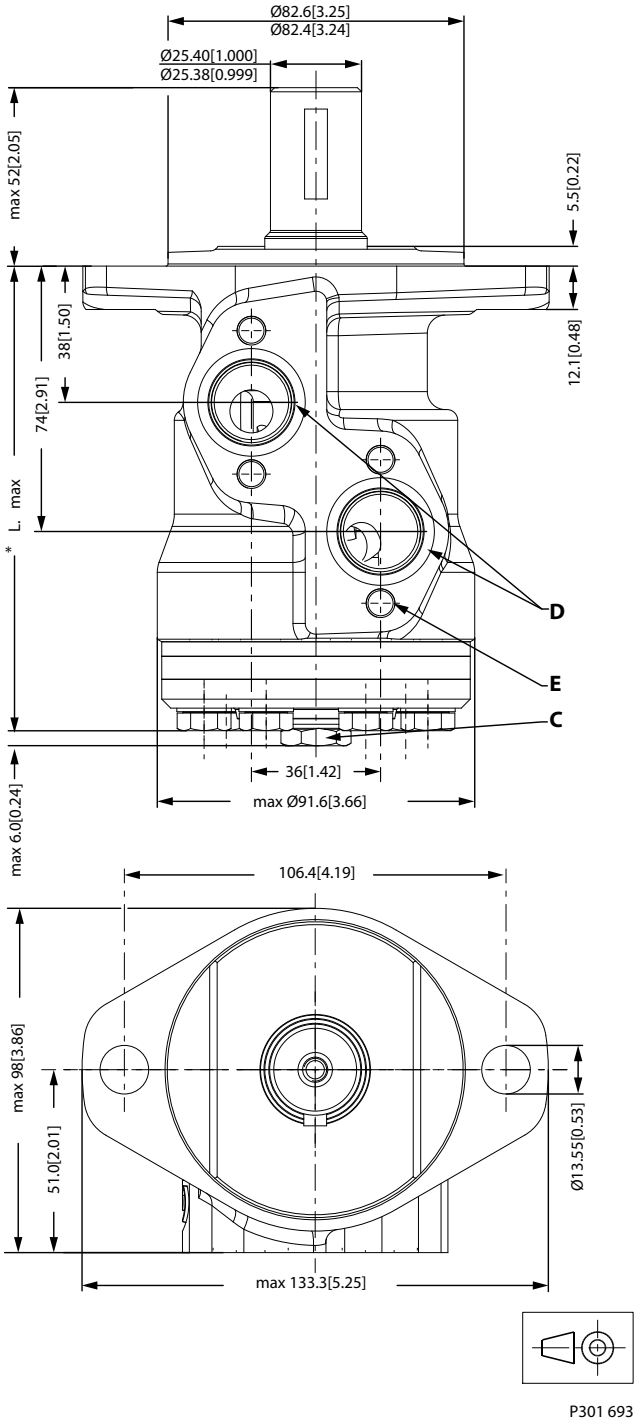
Dimensions, VMP SAE version, 1 inch splined shaft, A2 flange and side ports

Weight and dimensions

Type	*L_{max} mm [in]	Weight kg [lb]
VMP 50	max 132.0 [5.20]	4.9 [10.8]
VMP 80	max 136.0 [5.35]	5.0 [11.0]
VMP 100	max 138.5 [5.45]	5.2 [11.5]
VMP 125	max 142.2 [5.60]	5.3 [11.7]
VMP 160	max 146.3 [5.76]	5.5 [12.1]
VMP 200	max 151.5 [5.96]	5.7 [12.6]
VMP 250	max 158.0 [6.22]	5.9 [13.0]
VMP 315	max 166.5 [6.56]	6.2 [13.7]

Dimensions, VMP SAE version, cyl. 1 inch shaft, Woodruff key, A2 flange and side ports

VMP SAE version, cyl. 1 inch shaft, Woodruff key, A2 flange



C: Drain connection 7/16-20 UNF; Min. 10 [0.39] deep

D: Port connection 7/8-14 UNF; 16.7 [0.66] deep

E: M8; 13 [0.51] deep (4 pcs)

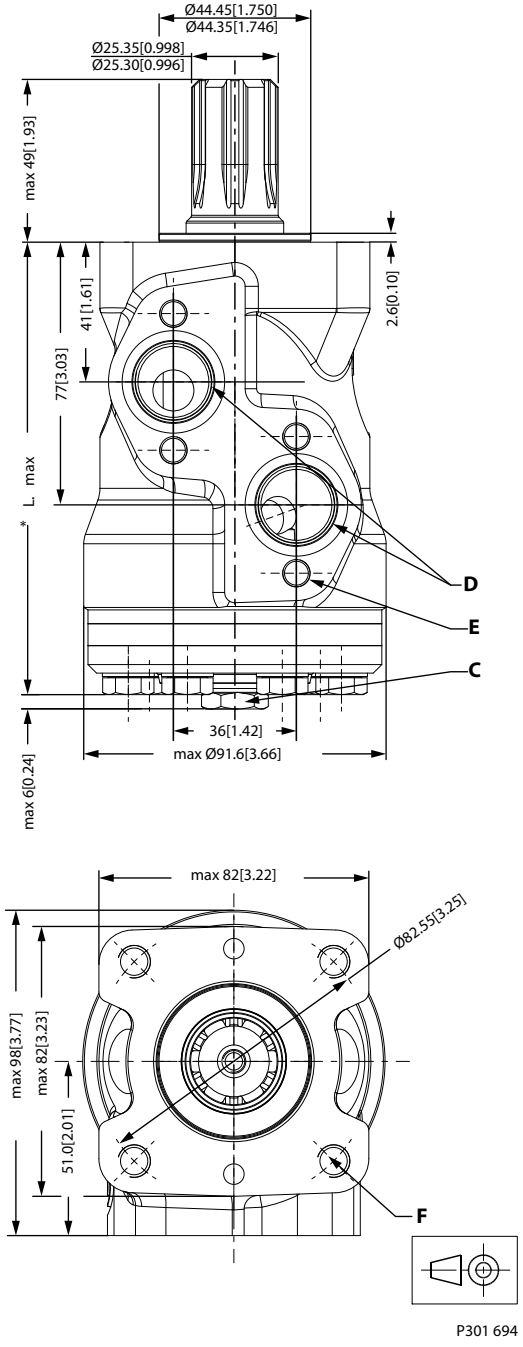
Dimensions, VMP SAE version, cyl. 1 inch shaft, Woodruff key, A2 flange and side ports

Weight and dimensions

Type	*L_{max} mm [in]	Weight kg [lb]
VMP 50	max 132.0 [5.20]	4.9 [10.8]
VMP 80	max 136.0 [5.35]	5.0 [11.0]
VMP 100	max 138.5 [5.45]	5.2 [11.5]
VMP 125	max 142.2 [5.60]	5.3 [11.7]
VMP 160	max 146.3 [5.76]	5.5 [12.1]
VMP 200	max 151.5 [5.96]	5.7 [12.6]
VMP 250	max 158.0 [6.22]	5.9 [13.0]
VMP 315	max 166.5 [6.56]	6.2 [13.7]

Dimensions, VMP SAE version, 1 inch splined shaft, C flange and side ports

VMP SAE version, 1 inch splined shaft, C flange



C: Drain connection 7/16-20 UNF; Min. 10 [0.39] deep

D: Port connection 7/8-14 UNF; 16.7 [0.66] deep

E: M8; 13 [0.51] deep (4 pcs)

F: 3/8-16 UNC 26.5 [1.04] deep (4 pcs)

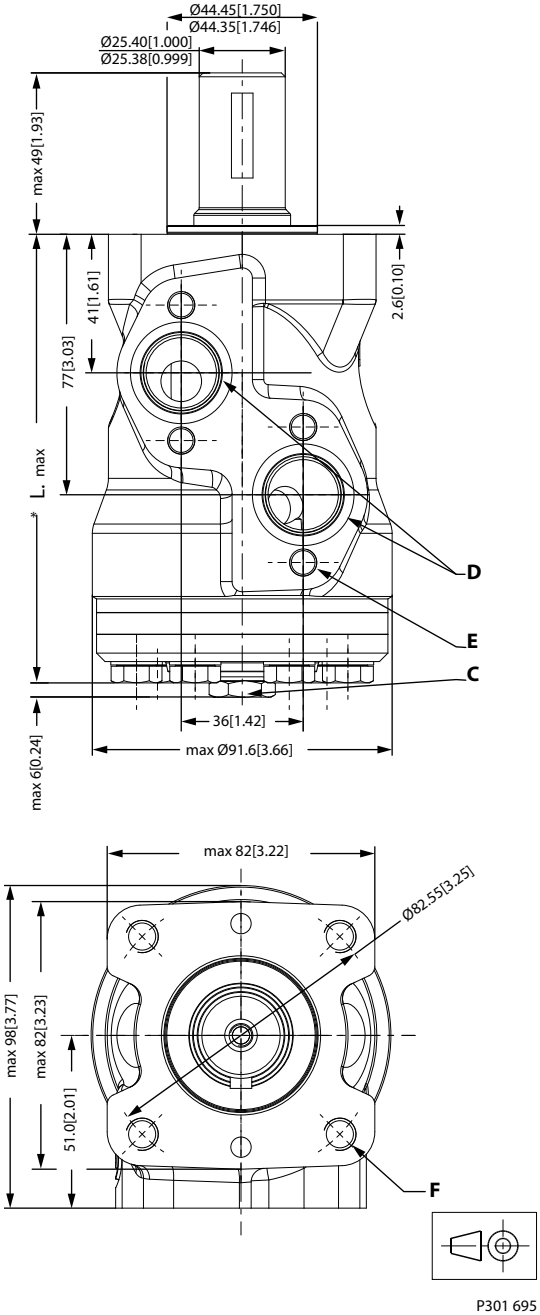
Dimensions, VMP SAE version, 1 inch splined shaft, C flange and side ports

Weight and dimensions

Type	*L_{max} mm [in]	Weight kg [lb]
VMP 50	max 134.9 [5.31]	4.9 [10.8]
VMP 80	max 138.8 [5.46]	5.0 [11.0]
VMP 100	max 141.4 [5.57]	5.2 [11.5]
VMP 125	max 145.1 [5.71]	5.3 [11.7]
VMP 160	max 149.2 [5.87]	5.5 [12.1]
VMP 200	max 154.4 [6.08]	5.7 [12.6]
VMP 250	max 160.9 [6.33]	5.9 [13.0]
VMP 315	max 169.3 [6.67]	6.2 [13.7]

Dimensions, VMP SAE version, cyl. 1 inch shaft, Woodruff key, C flange and side ports

VMP SAE version, cyl. 1 inch shaft, Woodruff key, C flange



C: Drain connection 7/16-20 UNF; Min. 10 [0.39] deep

D: Port connection 7/8-14 UNF; 16.7 [0.66] deep

E: M8; 13 [0.51] deep (4 pcs)

F: 3/8-16 UNC 26.5 [1.04] deep (4 pcs)

Dimensions, VMP SAE version, cyl. 1 inch shaft, Woodruff key, C flange and side ports

Weight and dimensions

Type	*L_{max} mm [in]	Weight kg [lb]
VMP 50	max 134.9 [5.31]	4.9 [10.8]
VMP 80	max 138.8 [5.46]	5.0 [11.0]
VMP 100	max 141.4 [5.57]	5.2 [11.5]
VMP 125	max 145.1 [5.71]	5.3 [11.7]
VMP 160	max 149.2 [5.87]	5.5 [12.1]
VMP 200	max 154.4 [6.08]	5.7 [12.6]
VMP 250	max 160.9 [6.33]	5.9 [13.0]
VMP 315	max 169.3 [6.67]	6.2 [13.7]

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