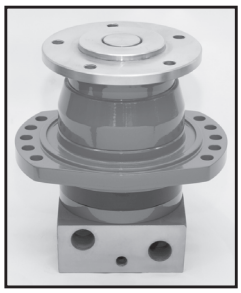
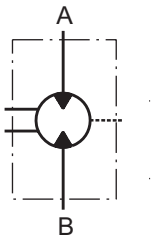
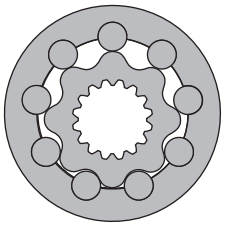
HYDRAULIC MOTORS VMF



APPLICATIONS

» Marine equipment
» Forestry equipment
» Metal working machines
» Agricultural machines
» Road building machines
» Mining machinery
» Special vehicles etc.





CONTENTS

OPTIONS

» Model - Disc valve, roll-gerotor
» Wheel mounting flange
» Side ports
» Shaft - thread hole flange
» SAE and BSPP ports
» Other special features

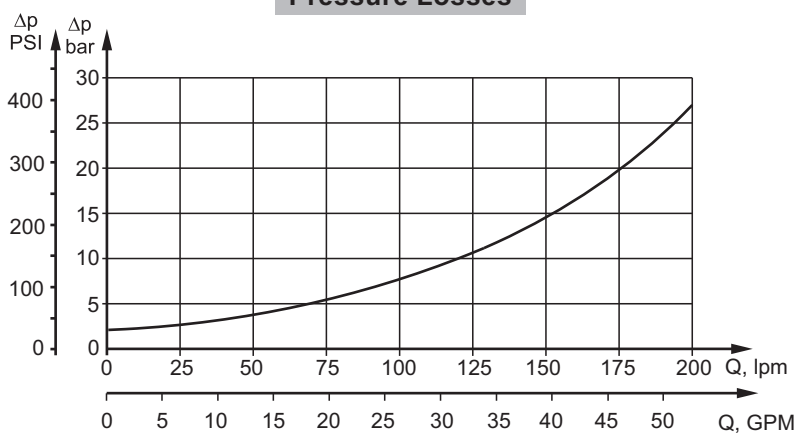
GENERAL

Max. Displacement, in^3/rev [cm^3/rev]	48.91 [801,8]
Max. Speed, [RPM]	736
Max. Torque, lb-in [daNm]	cont.: 22920 [259] int.: 30090 [340]
Max. Output, HP [kW]	150 [112]
Max. Pressure Drop, PSI [bar]	cont.: 3630 [250] int.: 5080 [350]
Max. Oil Flow, GPM [lpm]	63.4 [240]
Min. Speed, [RPM]	5
Permissible Shaft Loads, lbs [daN]	Pa=3370 [1500]
Pressure fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)
Temperature range, ^oF [^oC]	-40÷284 [-40÷140]
Optimal Viscosity range, SUS [mm^2/s]	98÷347 [20÷75]
Filtration	ISO code 20/16 (Min. recommended fluid filtration of 25 microns)

Oil flow in drain line

Pressure drop PSI [bar]	Viscosity SUS [mm^2/s]	Oil flow in drain line GPM [lpm]
2030 [140]	98 [20]	.793 [3]
	164 [35]	.528 [2]
3045 [210]	98 [20]	1.585 [6]
	164 [35]	1.057 [4]

Pressure Losses



SPECIFICATION DATA

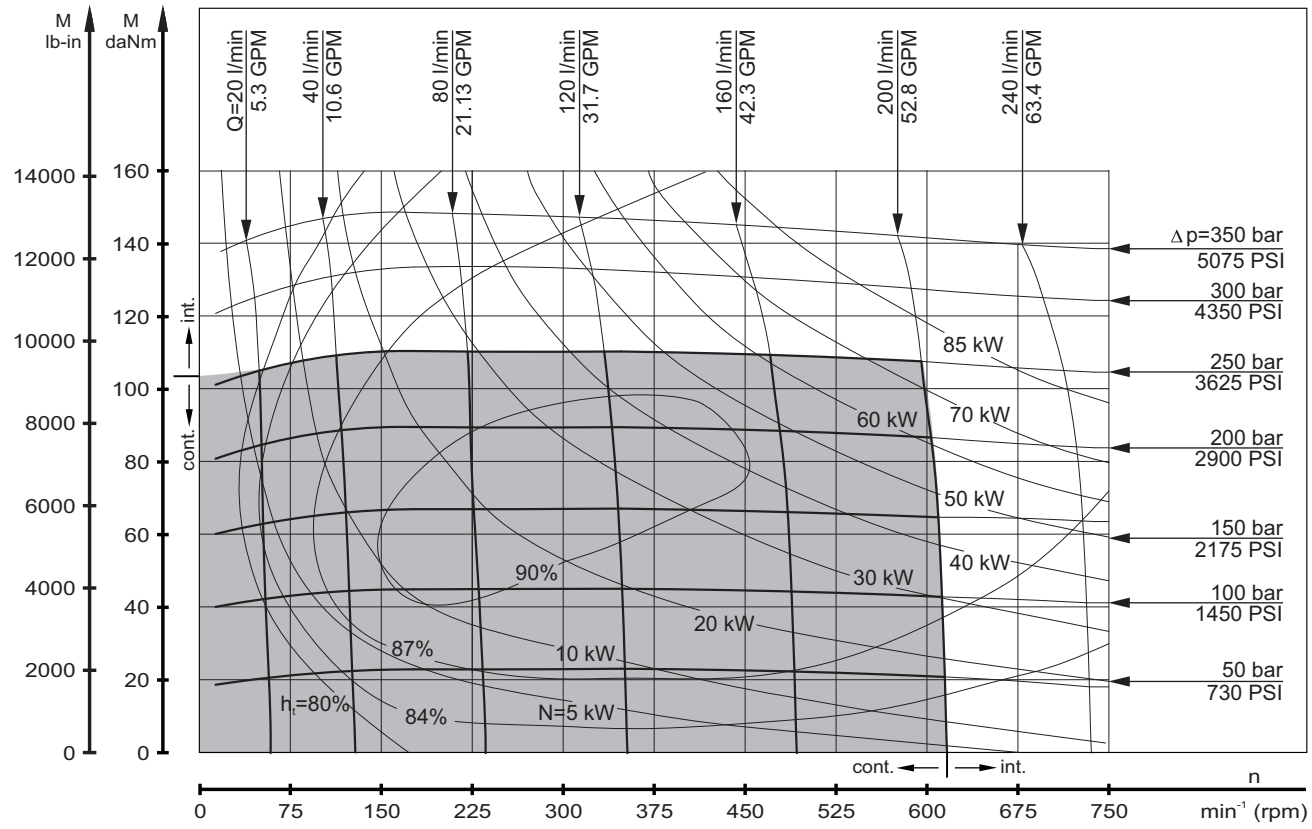
Type		VMF 315	VMF 400	VMF 500	VMF 630	VMF 800
Displacement, in^3/rev [cm^3/rev]		19.18 [314,5]	24.5 [400,9]	30.5 [499,6]	38.38 [629,1]	48.91 [801,8]
Max. Speed,	cont.	636	500	400	315	250
[RPM]	Int.*	736	600	480	380	300
Max. Torque	cont.	10180 [115]	12745 [144]	15930 [180]	20090 [227]	22920 [259]
lb-in [daNm]	Int.*	14160 [160]	17700 [200]	23010 [260]	27440 [310]	30090 [340]
	peak**	15930 [180]	20355 [230]	25315 [286]	31860 [360]	35580 [402]
Max. Output	cont.	90 [67]	90 [67]	90 [67]	90 [67]	90 [67]
HP [kW]	int.*	150 [112]	150 [112]	150 [112]	150 [112]	150 [112]
Max. Pressure Drop	cont.	3630 [250]	3630 [250]	3630 [250]	3630 [250]	3260 [225]
PSI [bar]	Int.*	5080 [350]	5080 [350]	5080 [350]	5080 [350]	4350 [300]
	peak**	5800 [400]	5800 [400]	5800 [400]	5800 [400]	5080 [350]
Max. Oil Flow	cont.	52.8 [200]	52.8 [200]	52.8 [200]	52.8 [200]	52.8 [200]
GPM [lpm]	Int.*	63.4 [240]	63.4 [240]	63.4 [240]	63.4 [240]	63.4 [240]
Max. Inlet Pressure	cont.	3915 [270]	3915 [270]	3915 [270]	3915 [270]	3915 [270]
PSI [bar]	Int.*	5365 [370]	5365 [370]	5365 [370]	5365 [370]	5365 [370]
	peak**	6090 [420]	6090 [420]	6090 [420]	6090 [420]	6090 [420]
Max. Return Pressure	cont.	2030 [140]	2030 [140]	2030 [140]	2030 [140]	2030 [140]
with Drain Line	Int.*	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]
PSI [bar]	peak**	3045 [210]	3045 [210]	3045 [210]	3045 [210]	3045 [210]
Max. Starting Pressure with Unloaded Shaft, PSI [bar]		70 [5]	70 [5]	70 [5]	70 [5]	70 [5]
Min. Starting Torque lb-in [daNm]		8140 [92]	10180 [115]	12745 [144]	15930 [180]	18145 [205]
Min. Speed***, [RPM]		10	6	8	6	5
Weight, lb [kg]		101.4 [46]	104.1 [47,2]	106.9 [48,5]	110.2 [50]	113.5 [51,5]

* Intermittent operation: the permissible values may occur for max. 10% of every minute.
** Peak load: the permissible values may occur for max. 1% of every minute.
*** For speeds lower than given, consult factory or your regional manager.

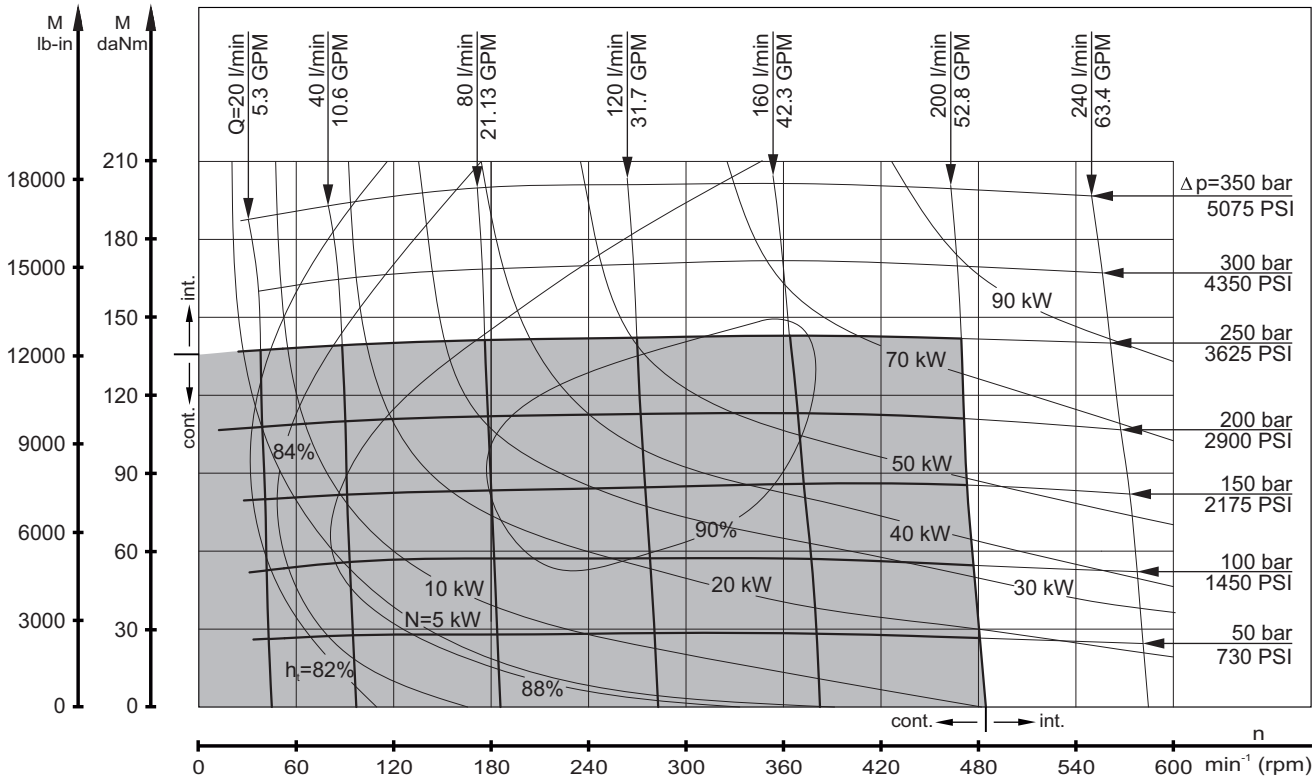
1. Intermittent speed and intermittent pressure must not occur simultaneously.
2. Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
3. Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP (DIN51524) or HM (ISO 6743/4). If using synthetic fluids consult the factory for alternative seal materials.
4. Recommended minimum oil viscosity 70 SUS [13 mm^2/s] at 122°F [50°C].
5. Recommended maximum system operating temperature is 180°F [82°C].
6. To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

FUNCTION DIAGRAMS

VMF 315



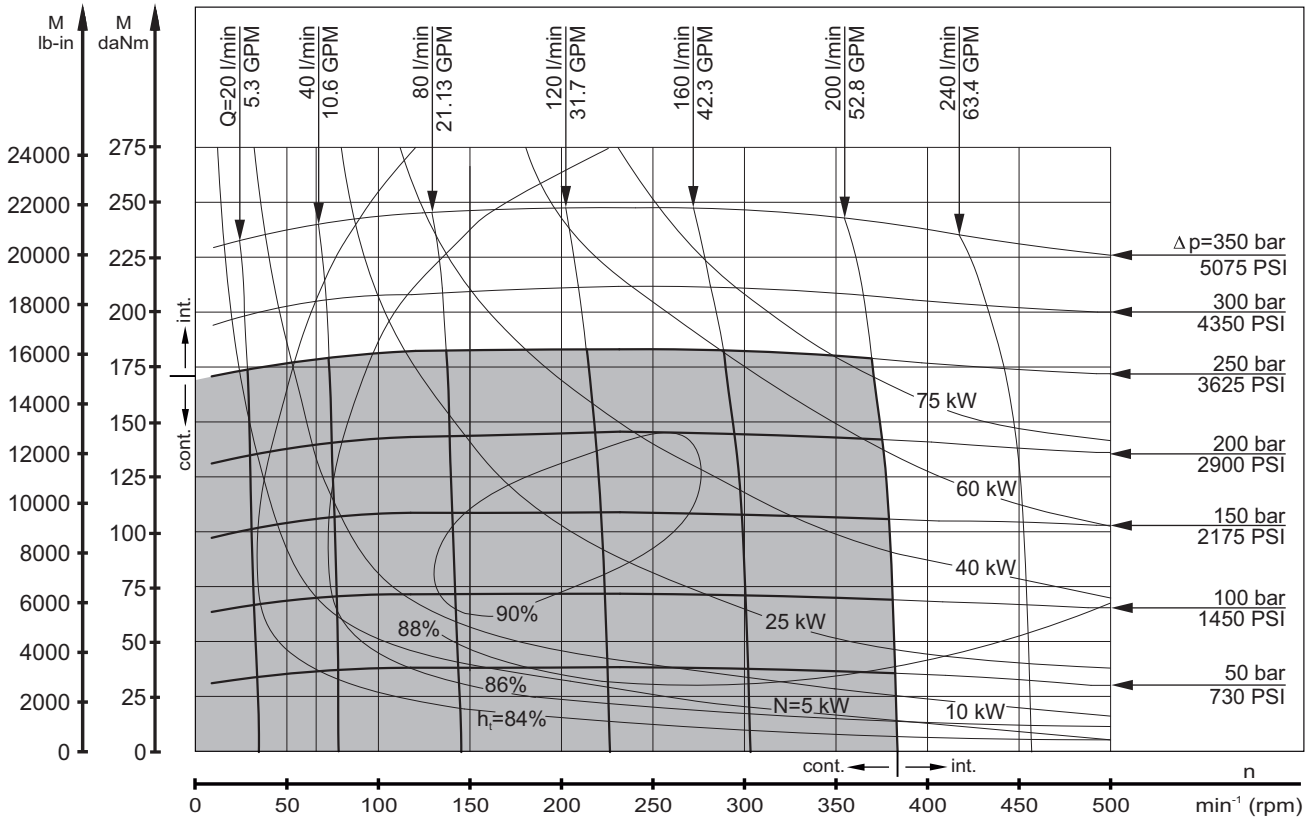
VMF 400



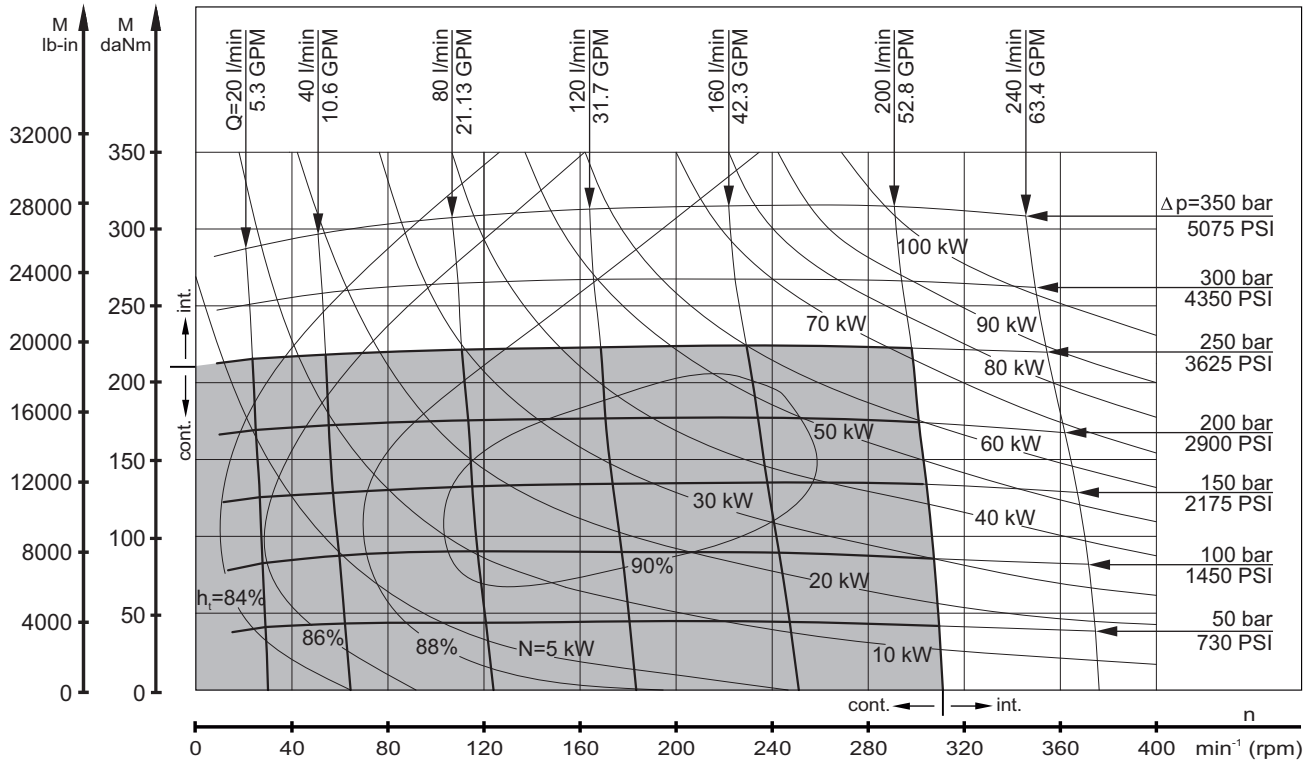
The function diagrams data is for average performance of randomly selected motors at back pressure 72.5÷145 PSI [5÷10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

FUNCTION DIAGRAMS

VMF 500



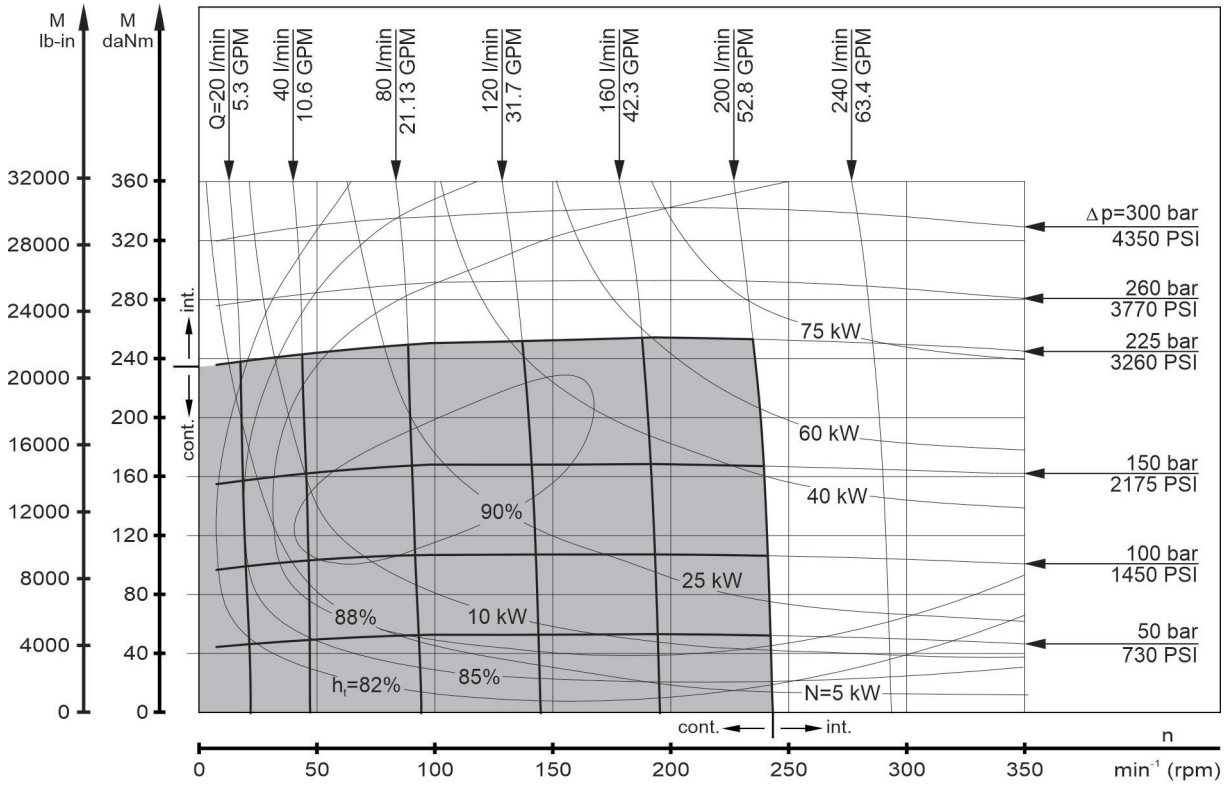
VMF 630



The function diagrams data is for average performance of randomly selected motors at back pressure 72.5÷145 PSI [5÷10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

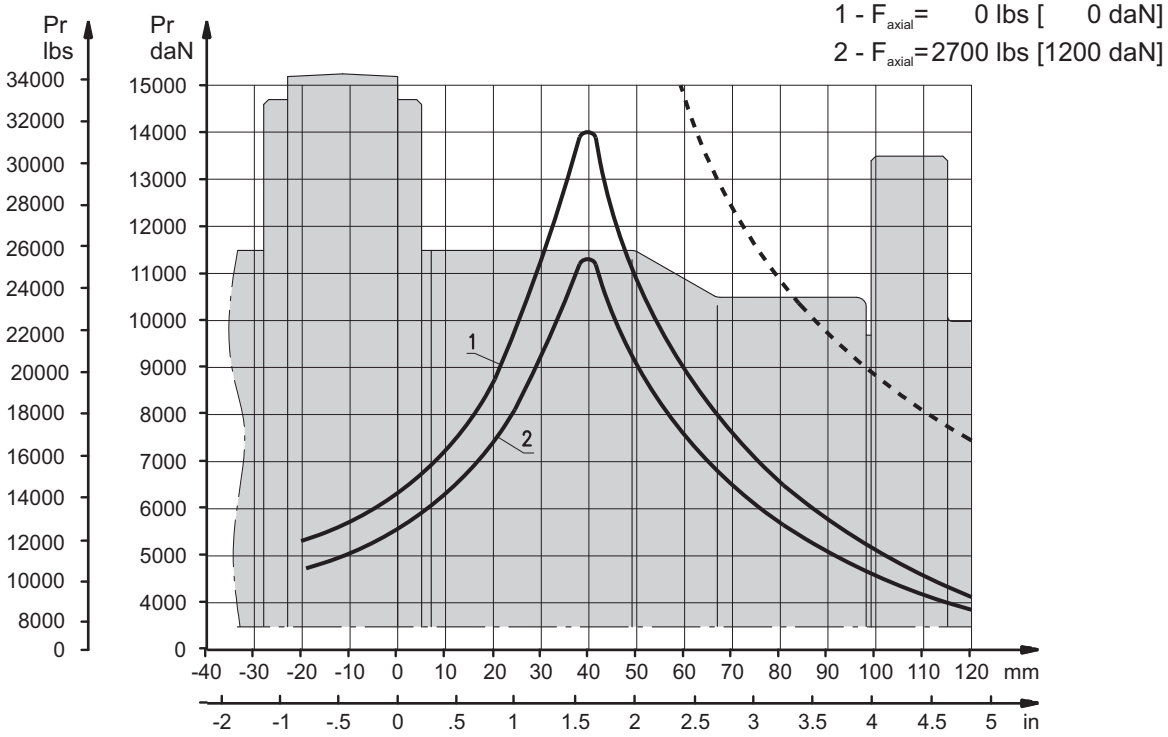
FUNCTION DIAGRAMS

VMF 800



The function diagrams data is for average performance of randomly selected motors at back pressure 72.5÷145 PSI [5÷10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

PERMISSIBLE SHAFT LOADS



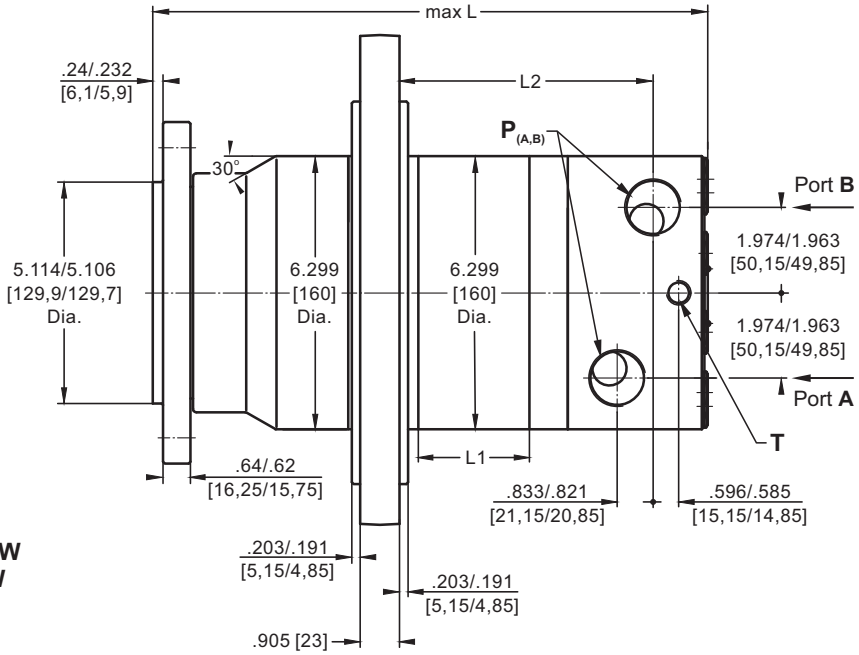
1 - Bearing curve: The curve applies to a B10 bearing life of 2000 hours at 100 RPM.

2 - Shaft curve: The curve represents Max. permissible radial shaft load with safety factor 2:1.

DIMENSIONS AND MOUNTING DATA

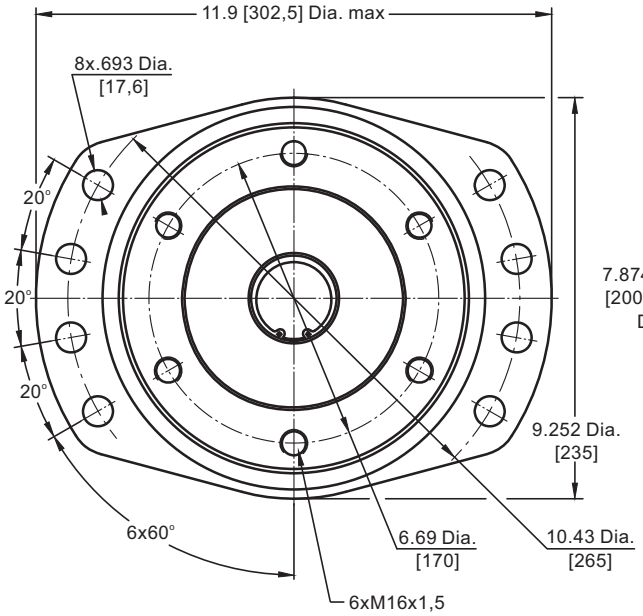
	Versions	
	2	4
P(A,B)	2xG1	2x1 5/16-12UN
T	G¼	9/16-18UNF

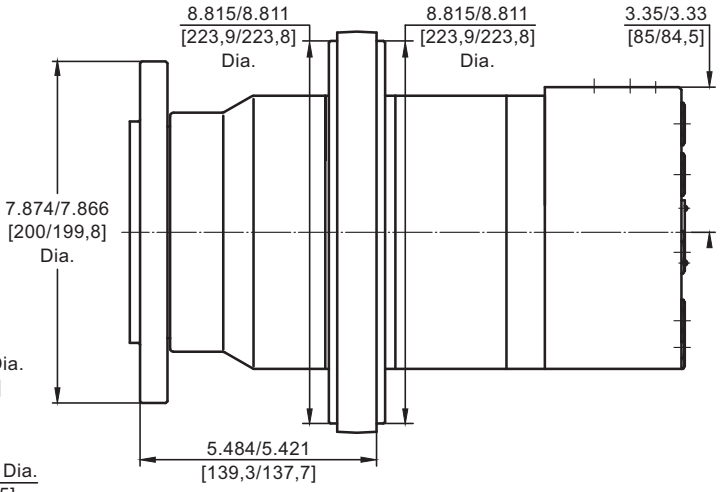
Type	L, in [mm]	L1, in [mm]	L2, in [mm]
VMF 315	11.28 [286,5]	1.00 [25,5]	4.31 [109,5]
VMF 400	11.56 [293,5]	1.28 [32,5]	4.59 [116,5]
VMF 500	11.87 [301,5]	1.59 [40,5]	4.90 [124,5]
VMF 630	12.28 [312,0]	2.01 [51,0]	5.31 [135,0]
VMF 800	12.83 [326,0]	2.56 [65,0]	5.87 [149,0]



Standard Rotation
Viewed from Shaft End
Port **A** Pressurized - **CW**
Port **B** Pressurized - **CCW**

Reverse Rotation
Viewed from Shaft End
Port **A** Pressurized - **CCW**
Port **B** Pressurized - **CW**

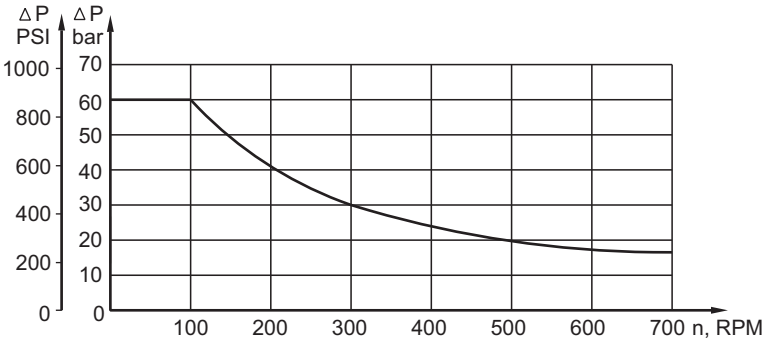




Warning: Drain line should always be used.

in [mm]

MAX. PERMISSIBLE SHAFT SEAL PRESSURE



* Drain line should always be used.
The hydraulic motors are mangano-phosphatized as standard.

ORDER CODE

	1	2	3	4
VMF			HD	

Pos.1 - Displacement code

315	- 19.18 in³/rev [314,5 cm³/rev]
400	- 24.45 in³/rev [400,9 cm³/rev]
500	- 30.48 in³/rev [499,6 cm³/rev]
630	- 38.38 in³/rev [629,1 cm³/rev]
800	- 48.91 in³/rev [801,8 cm³/rev]

Pos.2 - Ports

2	- side ports, 2xG1, G¼, BSP thread, ISO 228
4	- side ports, 2x1 5/16-12 UN, O-ring, 9/16-18 UNF

Pos.3 - Additional Options

HD	- Reinforced motor **HD****

For Other **Additional Options** see page 69

Pos.4 - Design Series

omit - Factory specified

MOTOR ADDITIONAL OPTIONS

Additional Options Description	Order Code	Motor type						
		MLHSEM	MTK	MLHTM	TMF	TMYF	MVM	VMF
Speed Sensor*	RS	O	O	O	O	O	O	O
Reinforced motor	HD	–	S	S	S	S	S	S
Low Leakage	LL	O	O	O	O	O	O	O
Low Speed Valving	LSV	O	O	O	O	O	O	O
Free Running	FR	–	O	O	–	O	O	–
Reverse Rotation	R	O	O	O	O	O	O	O
Paint**	P	O	O	O	O	O	O	O
Corrosion Protected Paint**	PC	O	O	O	O	O	O	O
Special Paint***	PS	O	O	O	O	O****	O	O
	PCS							
Check Valves		S	O	O	–	O	O	–

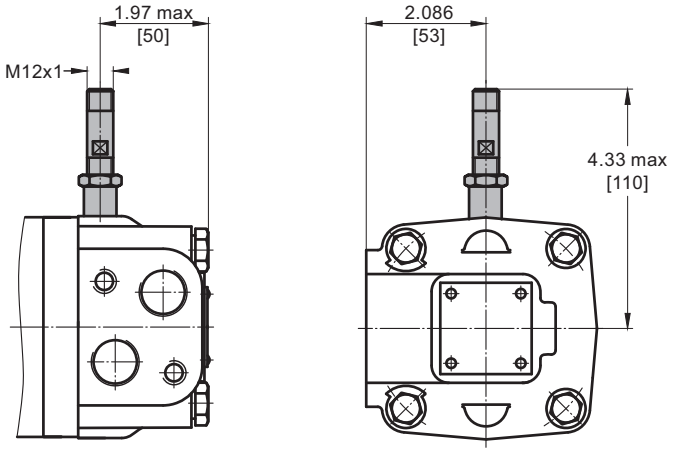
O	Optional
-	Not applicable
S	Standard

* For sensor ordering see pages 70÷71.
** Colour at customer's request.
*** Non painted feeding surfaces, colour at customer's request.

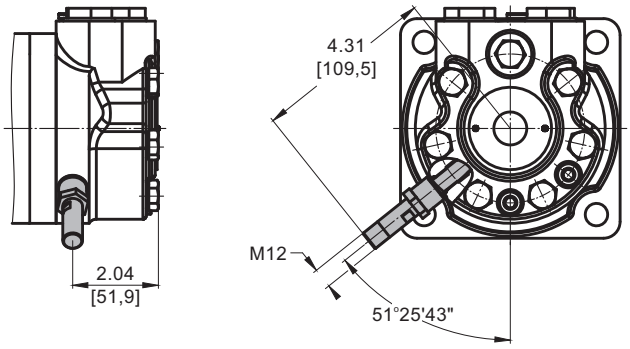
⚠ For more information about **HD** option please contact with "M+S Hydraulic".

MOTORS WITH SPEED SENSOR

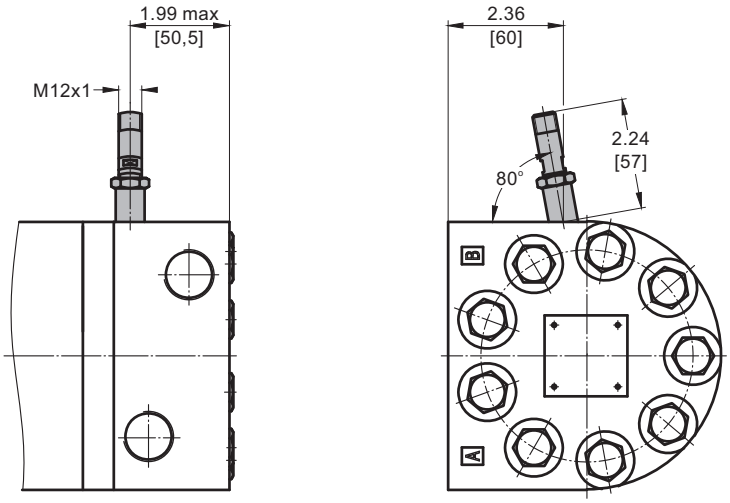
MLHSEM...RS



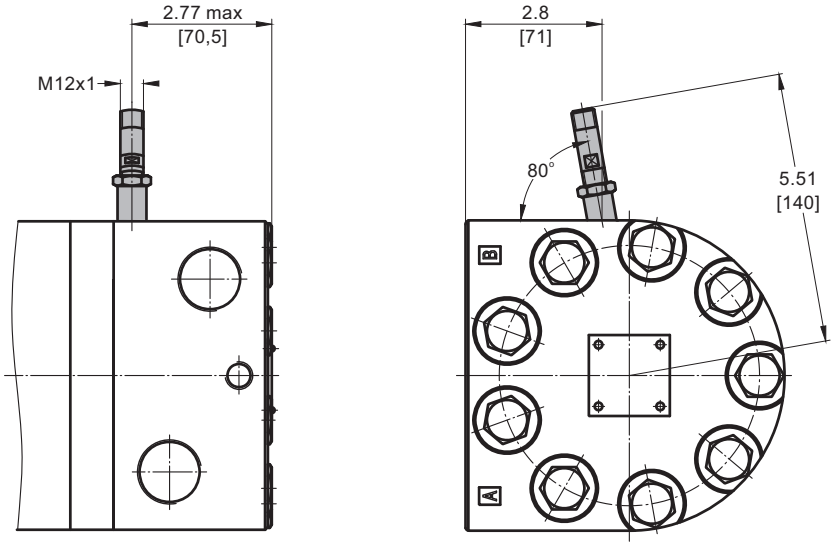
MTK...RS



MLHTM...RS
TMF...RS



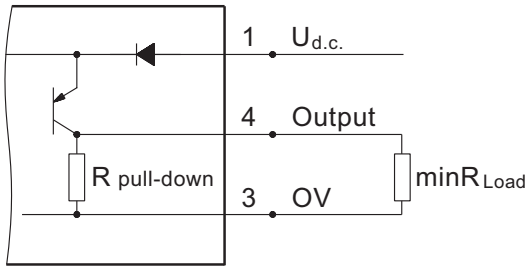
MVM...RS
VMF...RS



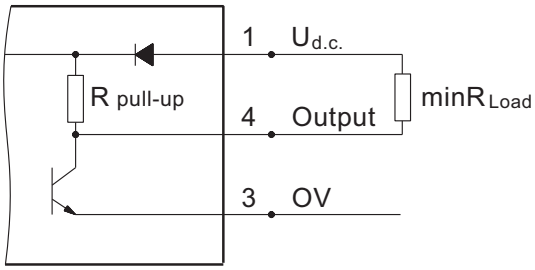
TECHNICAL DATA of the SPEED SENSOR

Wiring diagrams

PNP



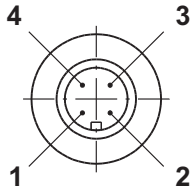
NPN



$R_{Load}\,[k\Omega]=U_{d.c.}\,[V]/I_{max}\,[mA]$

Motor type	MLHSEM MTK	MLHTM TMF	MVM VMF	DW
Pulses per revolution	54	84	102	30

Stick type



Terminal No.	Connection	Cable Output
1	$U_{d.c.}$	Brown
2	No connection	White
3	0V	Blue
4	Output signal	Black

Order Code for Speed Sensor

Sensor Code	Electric connection
RS	Connector BINDER 713 series
RSL2,5	Cable output 3x0,25; 98 in [2,5 m] long
RSL3,5	Cable output 3x0,25; 138 in [3,5 m] long
RSL5	Cable output 3x0,25; 196 in [5 m] long
RSL10	Cable output 3x0,25; 394 in [10 m] long

NOTE: * - The speed sensor is not fitted at the factory, but is supplied in a plastic bag with the motor. For installation see enclosed instructions.

APPLICATION CALCULATION

VEHICLE DRIVE CALCULATIONS

1. Motor speed: n [RPM]

$$n=\frac{168 \times V_{ml} \times i}{R_{in}} \qquad n=\frac{2.65 \times V_{km} \times i}{R_m}$$

$\mathbf{v_{km}}$ - vehicle speed, km/h;
$\mathbf{v_{ml}}$ - vehicle speed, mil/h;
$\mathbf{R_m}$ - wheel rolling radius, m;
$\mathbf{R_{in}}$ - wheel rolling radius, in;
i - gear ratio between motor and wheels. If no gearbox, use i=1.

2. Rolling resistance: RR, lbs [daN]

The resistance force resulted in wheels contact with different surfaces:

$$RR=G \times \rho$$

G - total weight loaded on vehicle, daN [lbs];
ρ - rolling resistance coefficient (Table 1).

Table 1

Rolling resistance coefficient In case of rubber tire rolling on different surfaces	
Surface	**ρ**
Concrete - faultless	0.010
Concrete - good	0.015
Concrete - bad	0.020
Asphalt - faultless	0.012
Asphalt - good	0.017
Asphalt - bad	0.022
Macadam - faultless	0.015
Macadam - good	0.022
Macadam - bad	0.037
Snow - 5 cm	0.025
Snow - 10 cm	0.037
Polluted covering - smooth	0.025
Polluted covering - sandy	0.040
Mud	0.037÷0.150
Sand - Gravel	0.060÷0.150
Sand - loose	0.160÷0.300

3. Grade resistance: GR, daN [lbs]

$$GR=G \times (\sin\alpha + \rho \times \cos\alpha)$$

α - gradient negotiation angle (Table 2).

Table 2

Grade %	α Degrees	Grade %	α Degrees
1%	0º 35'	12%	6º 5'
2%	1º 9'	15%	8º 31'
5%	2º 51'	20%	11º 19'
6%	3º 26'	25%	14º 3'
8%	4º 35'	32%	18º
10%	5º 43'	60%	31º

4. Accelerarion force: FA, lbs [daN]

Force **FA** necessary for acceleration from 0 to maximum speed **v** and time **t** can be calculated with a formula:

$$FA=\frac{V_{ml} \times G}{22 \times t}, \text{[lbs]} \qquad FA=\frac{V_{km} \times G}{36 \times t}, \text{[daN]}$$

FA - acceleration force, lbs [daN];
t - time, [s]

5. Tractive effort: DP, lbs [daN]

Tractive effort **DP** is the additional force of trailer. This value will be established as follows:
- acc. to constructor's assessment;
- as calculating forces in items 2, 3 and 4 of trailer; the calculated sum corresponds to the tractive effort requested.

6. Total tractive effort: TE, lbs [daN]

Total tractive effort **TE** is total effort necessary for vehicle motion; that the sum of forces calculated in items from 2 to 5 and increased with 10% because of air resistance.

$$TE=1,1 \times (RR + GR + FA + DP)$$

RR - force acquired to overcome the rolling resistance;
GR - force acquired to slope upwards;
FA - force acquired to accelerate (acceleration force);
DP - additional tractive effort (trailer).

7. Motor Torque moment: M, lb-in [daNm]

Necessary torque moment for every hydraulic motor:

$$M=\frac{TE \times R_{in}[R_m]}{N \times i \times \eta_M}$$

N - motor numbers;
η_M - mechanical gear efficiency (if it is available).

8. Cohesion between tire and road covering: M_W, lb-in [daNm]

Necessary torque moment for every hydraulic motor:

$$M_W=\frac{G_W \times f \times R_{in}[R_m]}{i \times \eta_M}$$

To avoid wheel slipping, the following condition should be observed $M_W > M$

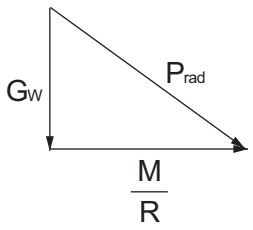
f - frictional factor;
$\mathbf{G_W}$ - total weight over the wheels, lbs [daN].

Table 3

Surface	Frictional factor f
Steel on steel	0.15 ÷ 0.20
Rubber tire on polluted surface	0.5 ÷ 0.7
Rubber tire on asphalt	0.8 ÷ 1.0
Rubber tire on concrete	0.8 ÷ 1.0
Rubber tire on grass	0.4

9. Radial motor loading: P_{rad}, lbs [daN]

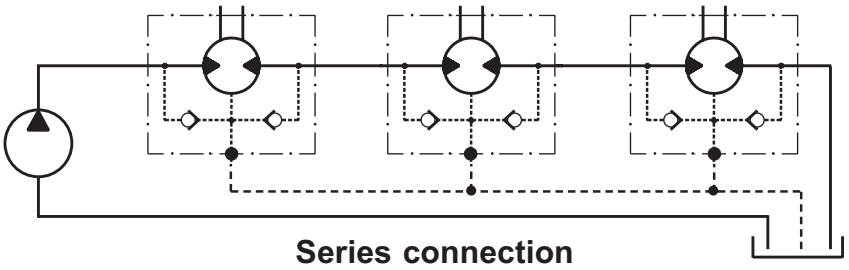
When motor is used for vehicle motion with wheels mounted directly on motor shaft, the total radial loading of motor shaft **Prad** is a sum of motion force and weight force acting on one wheel.



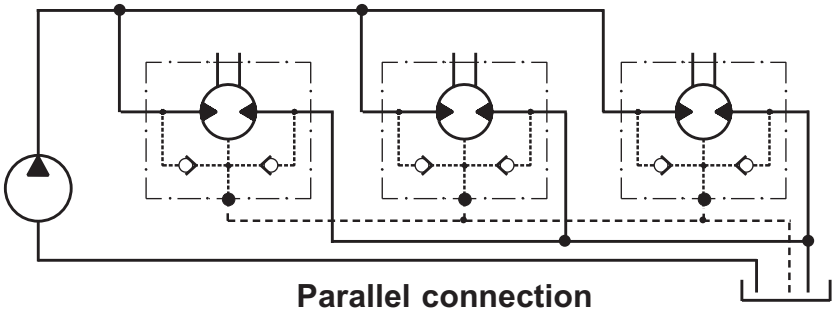
$$P_{rad}=\sqrt{G_W^2+\left(\frac{M}{R}\right)^2}$$

G_w - weight held by wheel;
P_{rad} - total radial loading of motor shaft;
M/R - motion force.

In accordance with calculated loadings the suitable motor from the catalogue is selected.



Series connection



Parallel connection