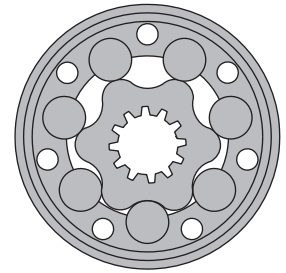


# HYDRAULIC MOTORS MH



## APPLICATION

- » Conveyors
- » Feeding mechanism of robots and manipulators
- » Metal working machines
- » Textile machines
- » Agricultural machines
- » Food industries
- » Mining machinery etc.



## CONTENTS

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## OPTIONS

- » Model - Spool valve, roll-gerotor
- » Flange mount
- » Shafts - straight, splined and tapered
- » Metric and BSPP ports
- » Other special features

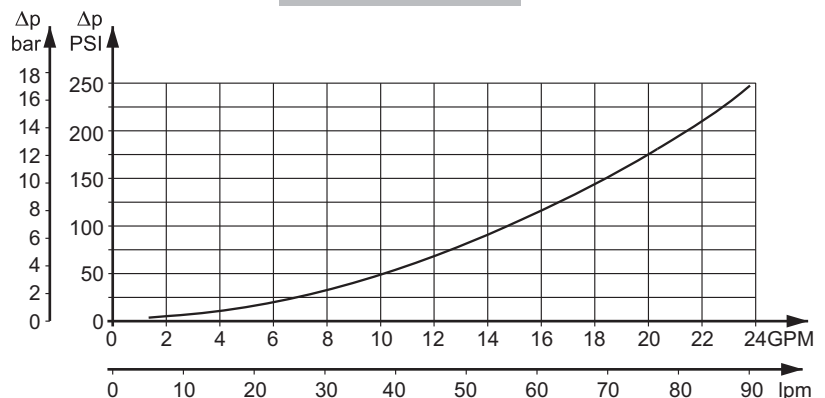
## GENERAL

<b>Max. Displacement,</b> cm <sup>3</sup> /rev [in <sup>3</sup> /rev]	502,4 [30.7]
<b>Max. Speed,</b> [RPM]	445
<b>Max. Torque,</b> daNm [lb-in]	cont.: 84 [7434] int.: 104 [9204]
<b>Max. Output,</b> kW [HP]	18,5 [24.8]
<b>Max. Pressure Drop,</b> bar [PSI]	cont.: 175 [2540] int.: 200 [2900]
<b>Max. Oil Flow,</b> lpm [GPM]	90 [23.78]
<b>Min. Speed,</b> [RPM]	5
<b>Pressure fluid</b>	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)
<b>Temperature range,</b> °C [°F]	-40÷140 [-40÷284]
<b>Optimal Viscosity range,</b> mm <sup>2</sup> /s [SUS]	20÷75 [98÷347]
<b>Filtration</b>	ISO code 20/16 (Min. recommended fluid filtration of 25 microns)

### Oil flow in drain line

Pressure drop bar [PSI]	Viscosity mm <sup>2</sup> /s [SUS]	Oil flow in drain line lpm [GPM]
100 [1450]	20 [98]	2,5 [.660]
	35 [164]	1,8 [.476]
140 [2030]	20 [98]	3,5 [.925]
	35 [164]	2,8 [.740]

### Pressure Losses



## SPECIFICATION DATA

Type		MH 200	MH 250	MH 315	MH 400	MH 500
<b>Displacement, cm<sup>3</sup>/rev [in<sup>3</sup>/rev]</b>		201,3 [12.3]	252 [15.4]	314,9 [19.2]	396,8 [24.2]	502,4 [30.7]
<b>Max. Speed, [RPM]</b>	Cont.	370	295	235	185	150
	Int.*	445	350	285	225	180
<b>Max. Torque daNm [lb-in]</b>	Cont.	51 [4510]	61 [5398]	74 [6548]	84 [7434]	82 [7257]
	Int.*	58 [5130]	70 [6195]	82 [7257]	98 [8673]	104 [9204]
	Peak**	64 [5064]	79 [6992]	98 [8673]	109 [9647]	117 [10350]
<b>Max. Output kW [HP]</b>	Cont.	16 [21]	16 [21]	14 [18.7]	12,5 [16.7]	11 [14.7]
	Int.*	18,5 [24.8]	18,5 [24.8]	15,5 [20.7]	15 [20.1]	14 [18.7]
<b>Max. Pressure Drop bar [PSI]</b>	Cont.	175 [2540]	175 [2540]	175 [2540]	155 [2240]	125 [1810]
	Int.*	200 [2900]	200 [2900]	200 [2900]	190 [2750]	160 [2320]
	Peak**	225 [3260]	225 [3260]	225 [3260]	210 [3045]	180 [2610]
<b>Max. Oil Flow lpm [GPM]</b>	Cont.	75 [19.81]	75 [19.81]	75 [19.81]	75 [19.81]	75 [19.81]
	Int.*	90 [23.78]	90 [23.78]	90 [23.78]	90 [23.78]	90 [23.78]
<b>Max. Inlet Pressure bar [PSI]</b>	Cont.	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]
	Int.*	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]
	Peak**	250 [3626]	250 [3626]	250 [3626]	250 [3626]	250 [3626]
<b>Max. Starting Pressure with Unloaded Shaft, bar [PSI]</b>		5 [72]	5 [72]	5 [72]	5 [72]	5 [72]
<b>Min. Starting Torque, daNm [lb-in]</b>	At max.press.dropCont	39 [3450]	52 [4600]	66 [5840]	72 [6370]	72 [6370]
	At max.press.drop Int.*	45 [3980]	59 [5221]	73 [6460]	88 [7788]	88 [7788]
<b>Min. Speed***, [RPM]</b>		10	10	8	5	5
<b>Weight, kg [lb]</b>		10,5 [23.2]	11 [24.3]	11,5 [25.4]	12,3 [27.1]	13 [28.7]

\* Intermittent operation: the permissible values may occur for max. 10% of every minute.

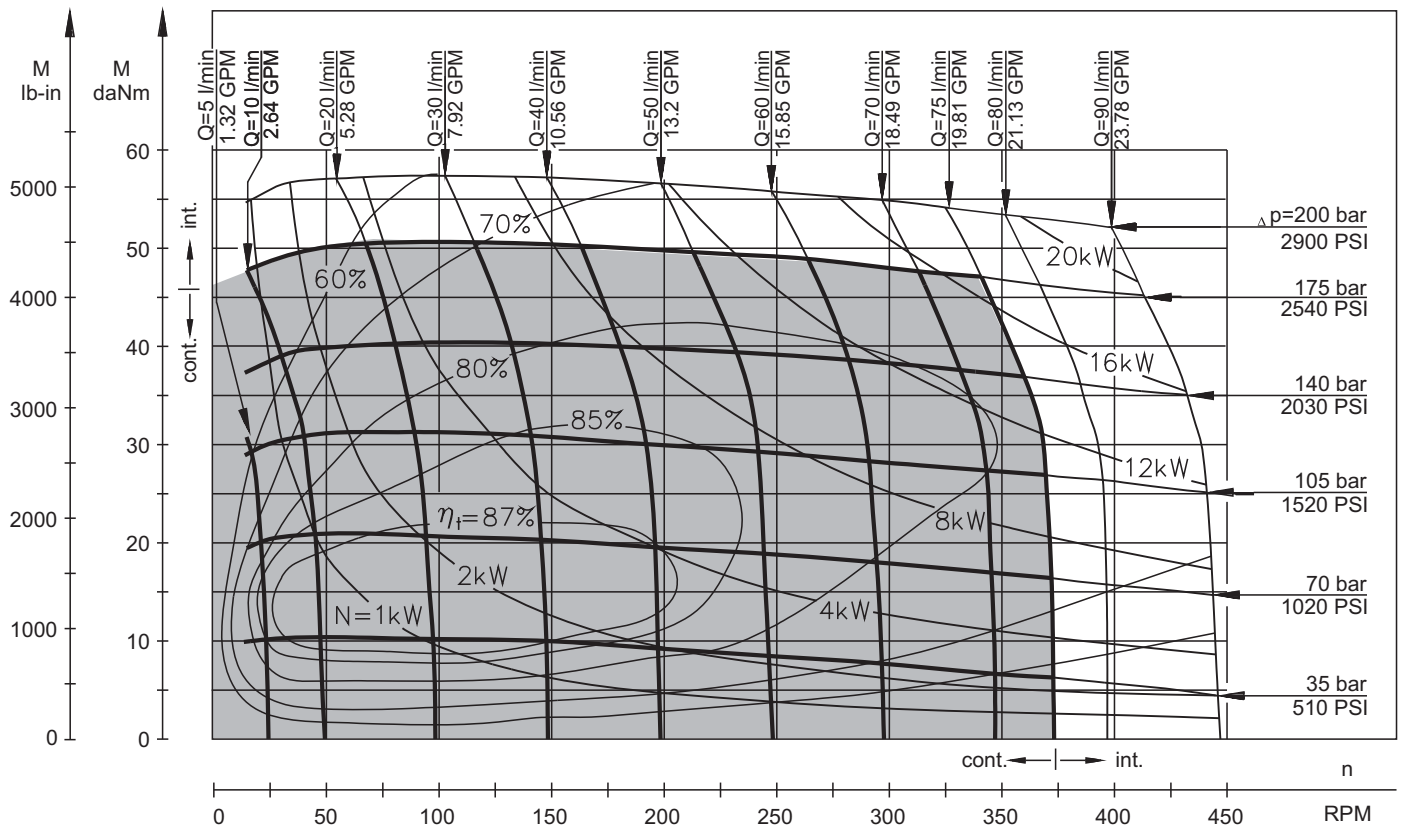
\*\* Peak load: the permissible values may occur for max. 1% of every minute.

\*\*\* For speeds lower than given, consult factory or your regional manager.

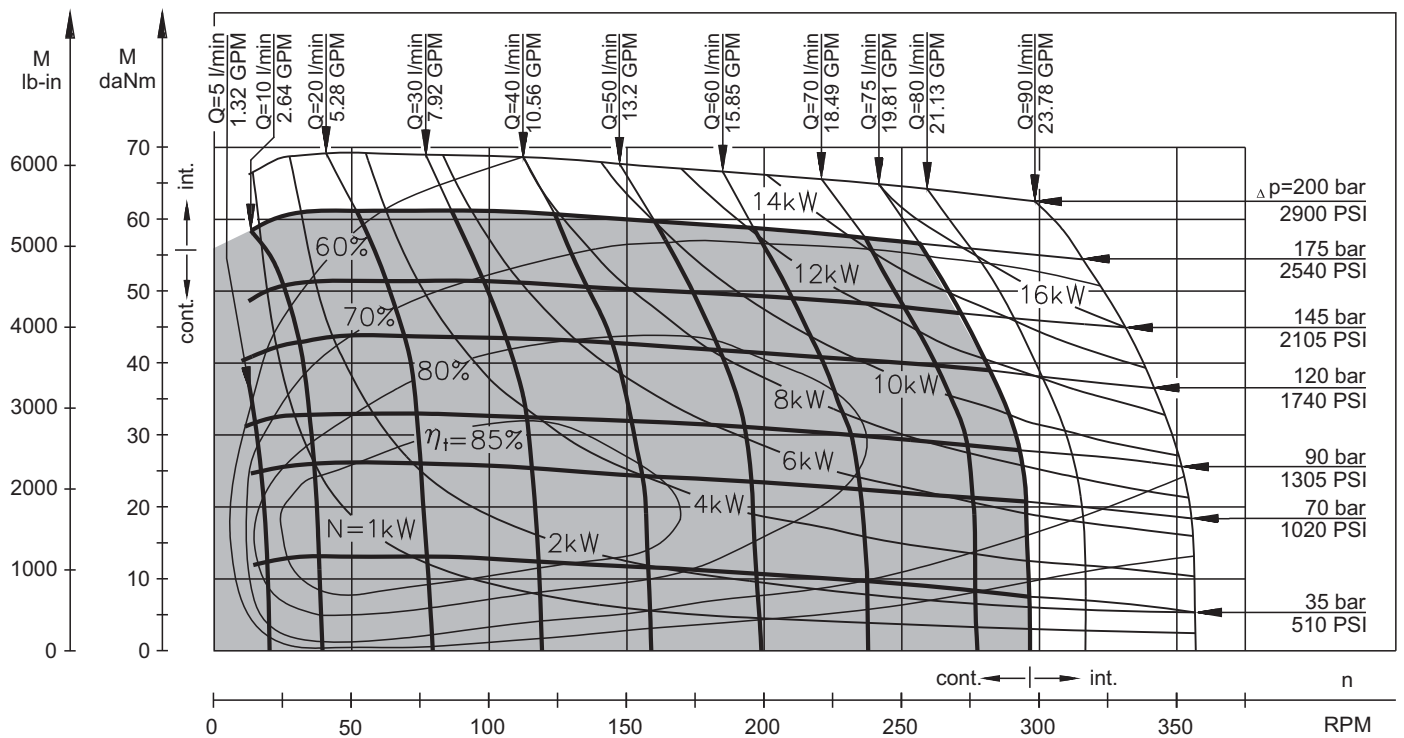
- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP(DIN51524) or HM (ISO 6743/4).  
If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

**FUNCTION DIAGRAMS**

**MH 200**



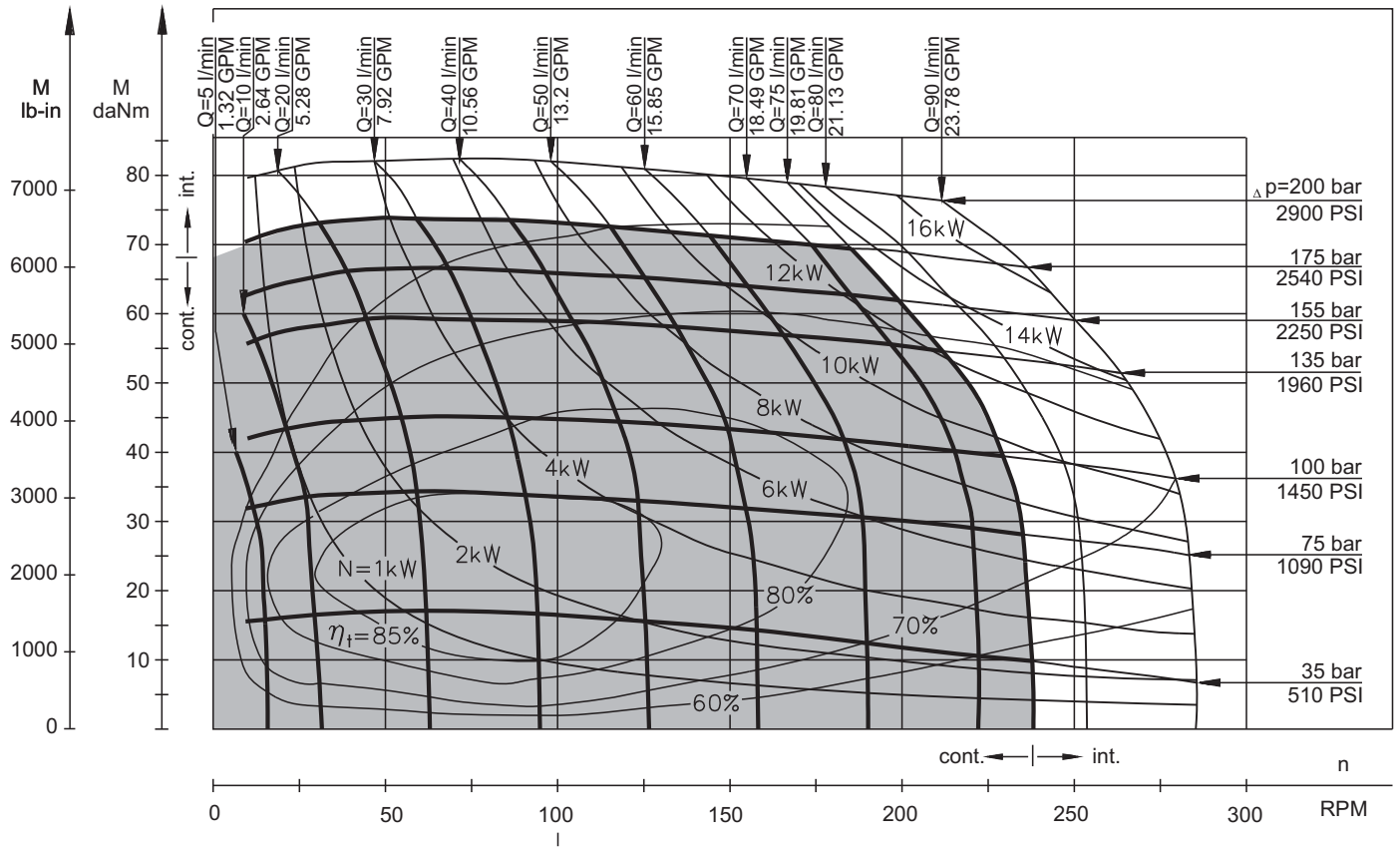
**MH 250**



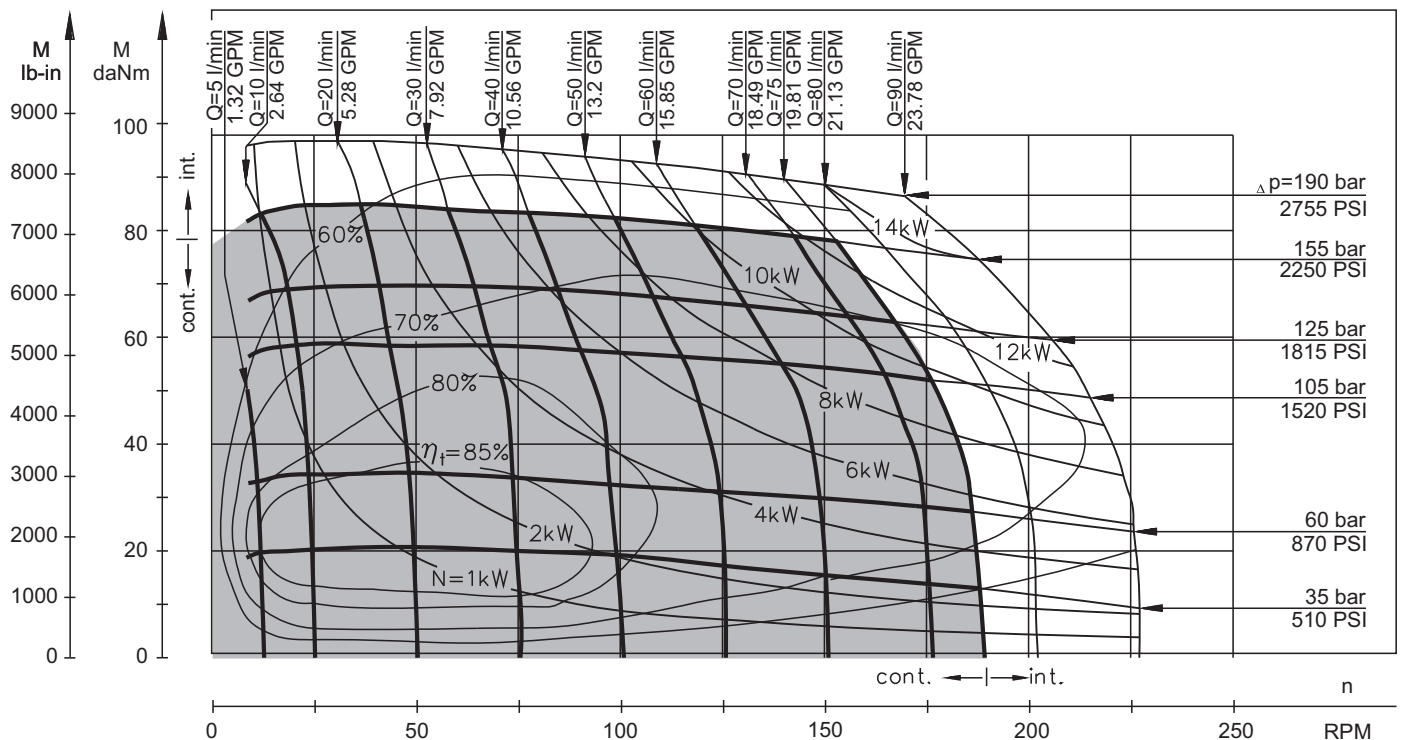
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm<sup>2</sup>/s [150 SUS] at 50°C [122°F].

## FUNCTION DIAGRAMS

### MH 315



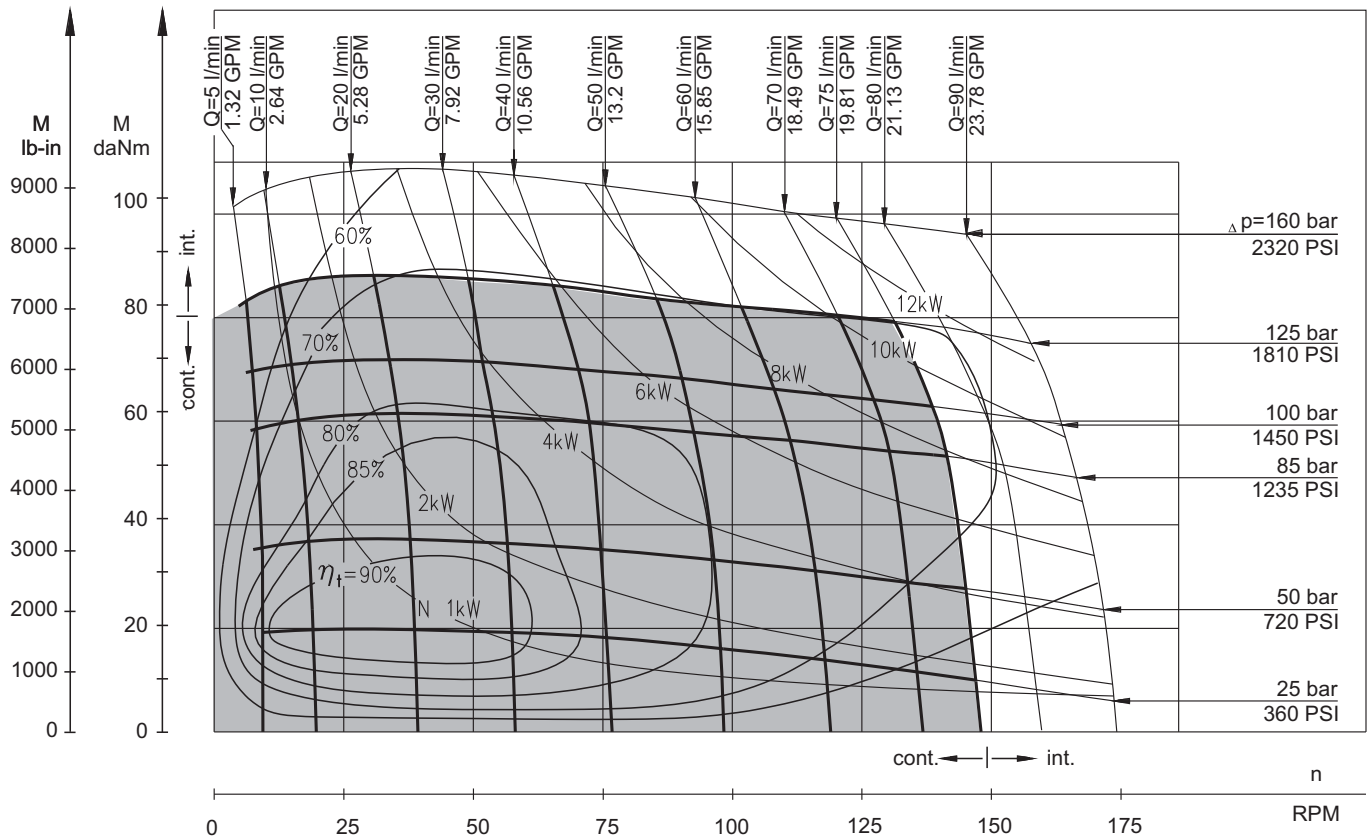
### MH 400



The function diagrams data is for average performance of randomly selected motors at back pressure  $5 \div 10$  bar [72.5 ÷ 145 PSI] and oil with viscosity of  $32 \text{ mm}^2/\text{s}$  [150 SUS] at  $50^\circ\text{C}$  [122°F].

## FUNCTION DIAGRAMS

### MH 500



The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm<sup>2</sup>/s [150 SUS] at 50°C [122°F].

### PERMISSIBLE SHAFT LOADS FOR MH MOTORS

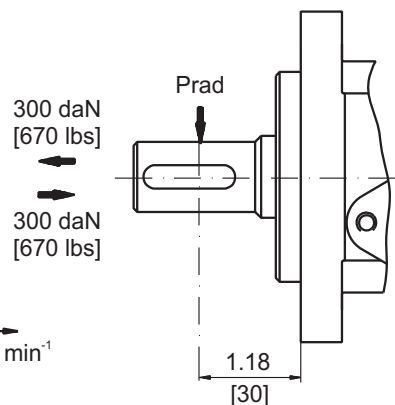
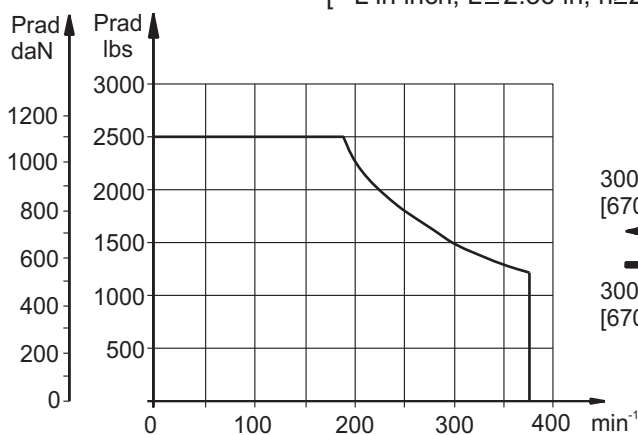
The permissible radial shaft load  $P_{rad}$  depends on the speed (RPM) and distance (L) from the point of load to the mounting flange.

$$\text{Radial Shaft Load } P_{rad} = \frac{1100}{n} \times \frac{25000}{103,5+L}, \text{ daN*}$$

[\*L in mm; L ≤ 60 mm; n ≥ 200 RPM]

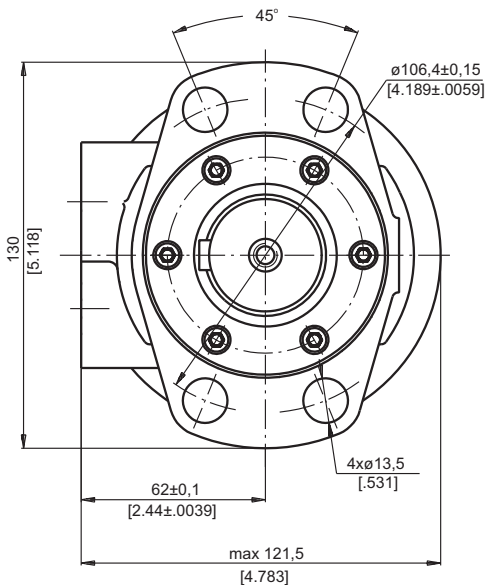
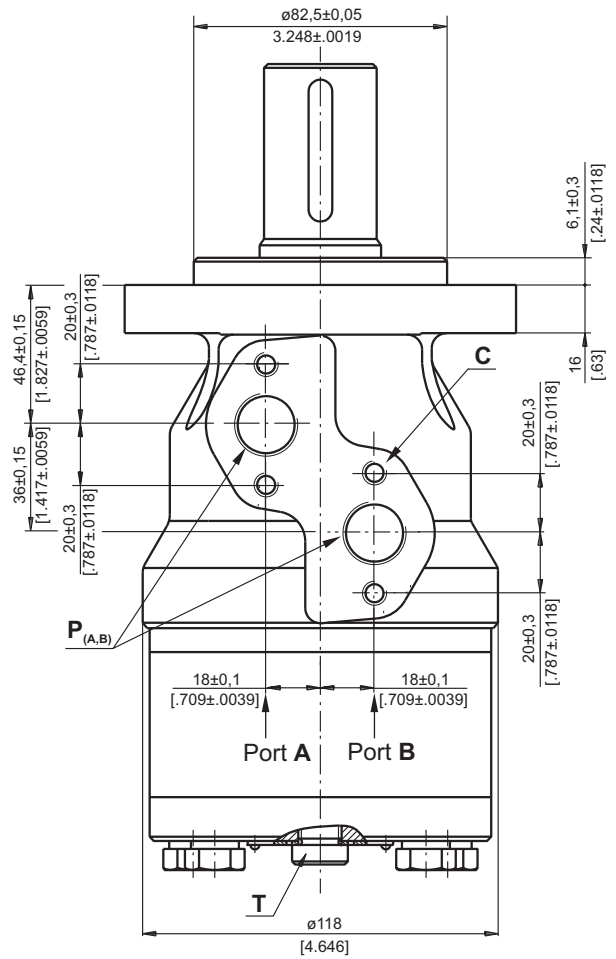
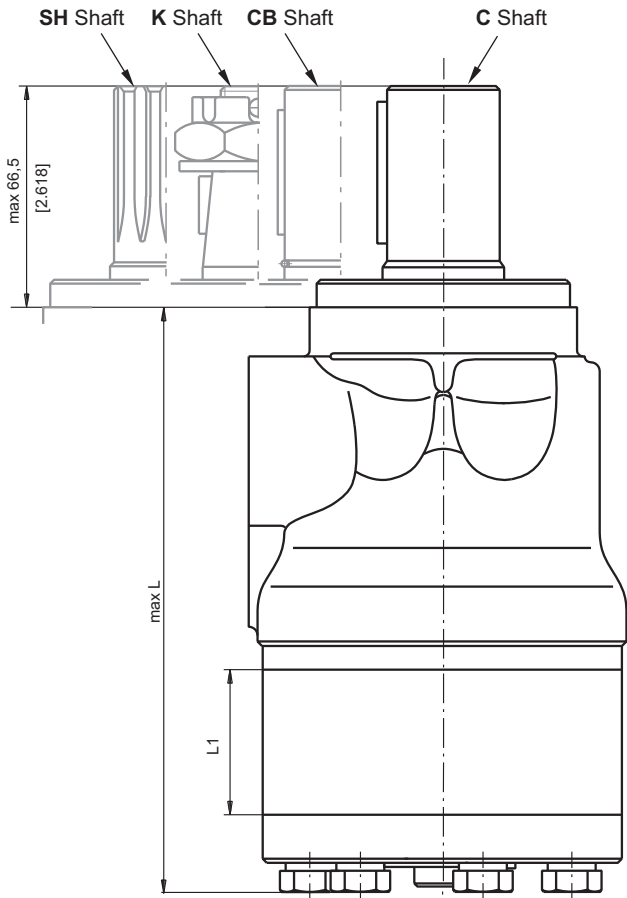
$$\text{Radial Shaft Load } P_{rad} = \frac{1100}{\text{RPM}} \times \frac{2215}{4.075+L}, \text{ lbs**}$$

[\*\*L in inch; L ≤ 2.36 in; n ≥ 200 RPM]



## DIMENSIONS AND MOUNTING DATA

### Magneto Mount (4 holes)



Type	L, mm [in.]	L <sub>1</sub> , mm [in.]
MH 200	169 [6.65]	27,8 [1.09]
MH 250	176 [6.93]	34,8 [1.37]
MH 315	184 [7.24]	43,5 [1.71]
MH 400	196 [7.72]	54,8 [2.16]
MH 500	211 [8.31]	69,4 [2.73]

- C** : 4xM8-13 mm [.51 in] depth
- P<sub>(A,B)</sub>**: 2xG1/2 or 2xM22x1,5-15 mm [.59 in] depth
- T** : G1/4 or M14x1,5-12 mm [.47 in] depth (plugged)

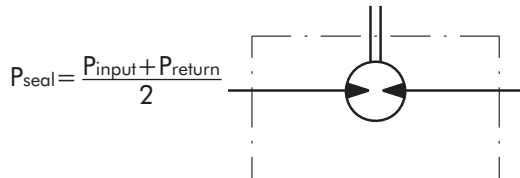
<b>Standard Rotation</b> Viewed from Shaft End Port A Pressurized - <b>CW</b> Port B Pressurized - <b>CCW</b>	<b>Reverse Rotation</b> Viewed from Shaft End Port A Pressurized - <b>CCW</b> Port B Pressurized - <b>CW</b>
--	---



**MAX. PERMISSIBLE SHAFT SEAL PRESSURE FOR MH MOTORS**

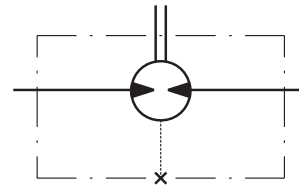
**MH...U1 motors with high pressure seal and without drain connection:**

The shaft seal pressure equals the average of input pressure and return pressure.



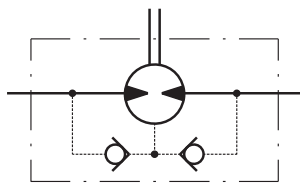
**MH...U motors with high pressure seal and drain connection:**

The shaft seal pressure equals the pressure in the drain line.



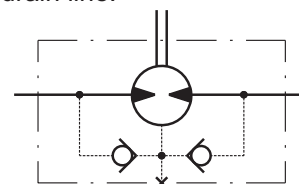
**MH...1 motors with standard shaft seal and without drain connection:**

The shaft seal pressure never exceeds the pressure in the return line.

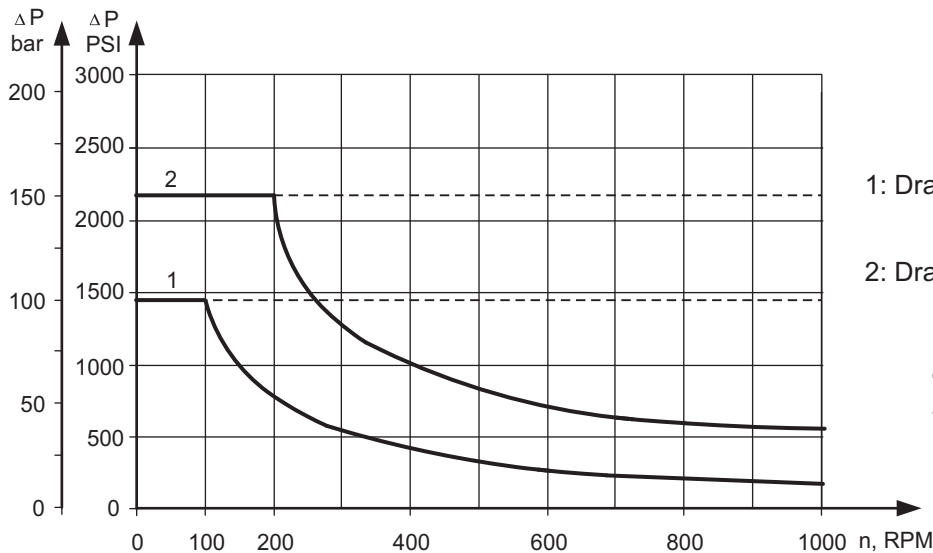


**MH... motors with standard shaft seal and with drain connection:**

The shaft seal pressure equals the pressure in the drain line.



**Max. return pressure without drain line or max. pressure in the drain line**



1: Drawing for Standard Shaft Seal

2: Drawing for High Pressure Seal ("U" Seal)

— - continuous operations

- - - - - intermittent operations







## ORDER CODE

	1	2	3	4	5	6	7
M H							

### Pos.1 - Displacement code

<b>200</b>	- 201,3 cm <sup>3</sup> /rev [12.3 in <sup>3</sup> /rev]
<b>250</b>	- 252,0 cm <sup>3</sup> /rev [15.4 in <sup>3</sup> /rev]
<b>315</b>	- 314,9 cm <sup>3</sup> /rev [16.4 in <sup>3</sup> /rev]
<b>400</b>	- 396,8 cm <sup>3</sup> /rev [24.2 in <sup>3</sup> /rev]
<b>500</b>	- 502,4 cm <sup>3</sup> /rev [30.7 in <sup>3</sup> /rev]

### Pos.2 - Shaft Extensions\*

<b>C</b>	- ø32 straight, Parallel key A10x8x45 DIN 6885
<b>SH</b>	- ø1¼" splined 14T ANSI B92.1-1970
<b>CB**</b>	- ø35 straight, Parallel key A10x8x45 DIN 6885
<b>K</b>	- ø35 tapered 1:10, Parallel key B6x6x20 DIN 6885

### Pos.3 - Shaft Seal Version

omit	- Standard shaft seal
<b>U</b>	- High pressure shaft seal (without check valves)

### Pos.4 - Drain Port

omit	- with drain port
<b>1</b>	- without drain port

### Pos.5 - Ports

omit	- BSPP (ISO 228)
<b>M</b>	- Metric (ISO 262)

### Pos.6 - Special Features [\(see page 119\)](#)

### Pos.7 - Design Series

omit	- Factory specified
------	---------------------

**NOTES:** \* The permissible output torque for shafts must not be exceeded!  
 \*\* The following combination is not allowed: "CB" shaft with U shaft seal.

The hydraulic motors are mangano-phosphatized as standard.

# MOTOR SPECIAL FEATURES

Special Feature Description	Order Code	Motor type												
		MM	MP	MP(W)N, MRN	MPW	MR	MRB	SP, SR	PL, RL	PK, RK	PKQ	RW	MH	HW
Speed Sensor*	RS	O	O	-	-	O	-	-	-	-	-	-	O	-
Tacho connection	T	-	-	-	-	O	-	-	-	-	-	-	O	-
Low Leakage	LL	O	O	-	O	O	-	-	O	O	O	O	O	O
Low Speed Valving	LSV	-	-	-	O	O	-	-	-	-	O	O	O	O
Free Running	FR	O	O	-	-	O	-	-	O	O	-	O	O	O
Reverse Rotation	R	O	O	O	O	O	O	O	O	O	O	O	O	O
Paint**	P	O	O	O	O	O	O	O	O	O	O	O	O	O
Corrosion Protected Paint**	PC	O	O	O	O	O	O	O	O	O	O	O	O	O
Special Paint***	PS	O	O	O	O	O	O	-	O	O	O	O	O	O
	PCS	O	O	O	O	O	O	-	O	O	O	O	O	O
Check Valves		S	S****	S	S****	S****	S	S	S	S	S	S	S****	S

<b>O</b>	Optional
<b>-</b>	Not applicable
<b>S</b>	Standard

\* For sensor ordering see pages 120÷121.

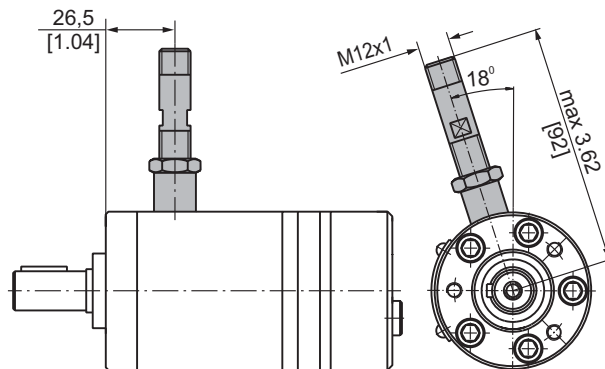
\*\* Colour at customer's request.

\*\*\* Non painted feeding surfaces, colour at customer's request.

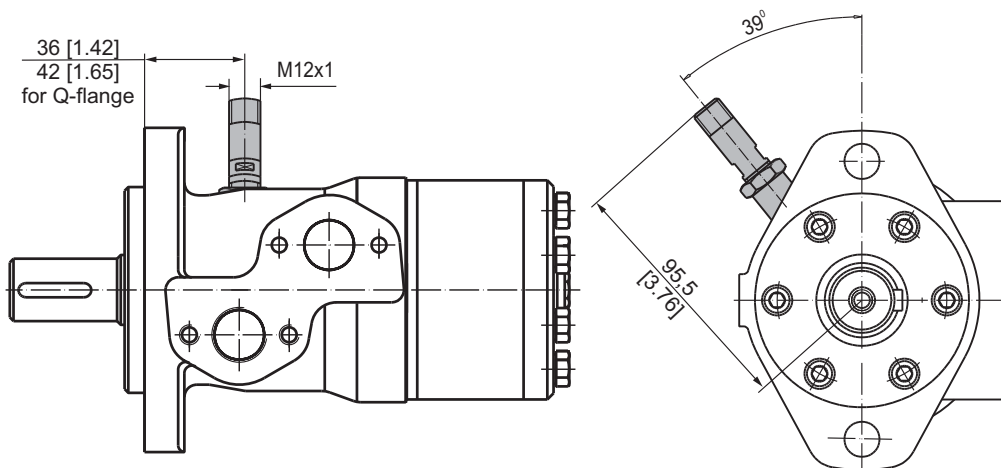
\*\*\*\* Without check valves for "U" shaft seal versions.

# MOTORS WITH SPEED SENSOR

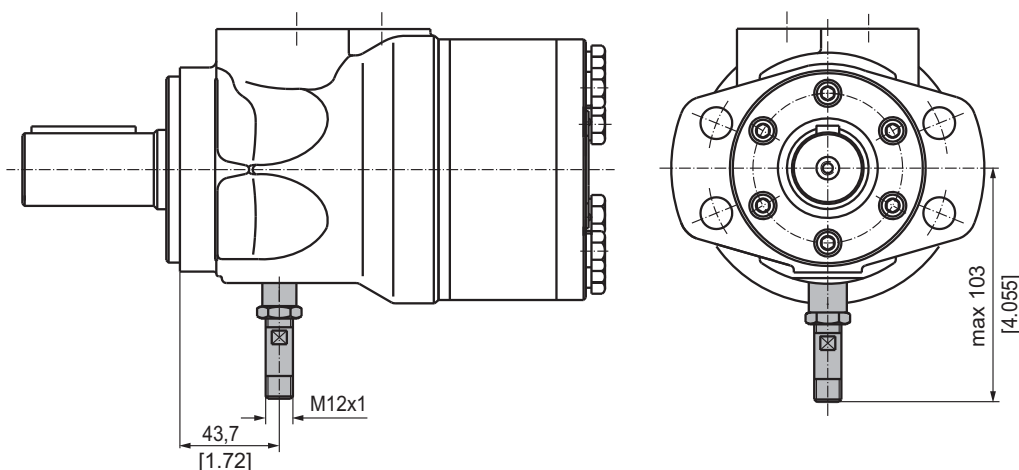
## MM...RS



## MP...RS and MR...RS



## MH...RS

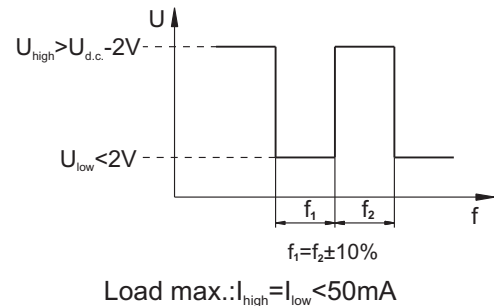


**TECHNICAL DATA OF THE SPEED SENSOR**

**Technical data**

Frequency range	0...15 000 Hz
Output	PNP, NPN
Power supply	10...36 VDC
Current input	20 mA (@24 VDC)
Ambient Temperature	-40...+125°C [-40...+257°F]
Protection	IP 67
Plug connector	M12-Series
Mounting principle	ISO 6149

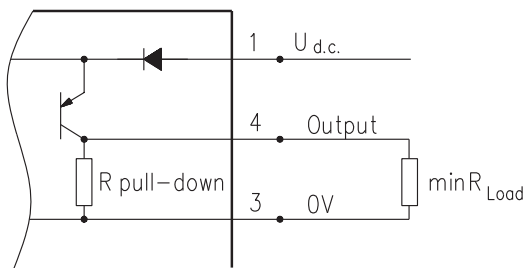
**Output signal**



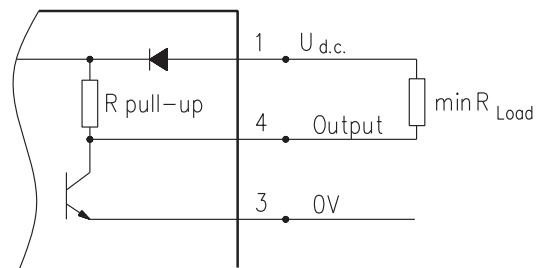
Motor type	MM	MP	MR	MH
Pulses per revolution	30	36	36	42

**Wiring diagrams**

**PNP**

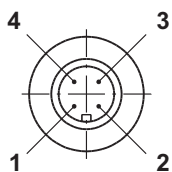


**NPN**



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

**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	Output type	Electric connection
<b>RSN</b>	NPN	Connector BINDER 713 series
<b>RSP</b>	PNP	Connector BINDER 713 series
<b>RSNL5</b>	NPN	Cable output 3x0,25; 5 m [196 in] long
<b>RSPL5</b>	PNP	Cable output 3x0,25; 5 m [196 in] 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

$$n = \frac{2,65 \times v_{km} \times i}{R_m} \quad n = \frac{168 \times v_{mi} \times i}{R_m}$$

$v_{km}$ - vehicle speed, km/h;

$v_{mi}$ - vehicle speed, mil/h;

$R_m$ - wheel rolling radius, m;

$R_m$ - wheel rolling radius, in;

$i$ - gear ratio between motor and wheels.

If no gearbox, use  $i=1$ .

### 2. Rolling resistance: RR, daN [lbs]

The resistance force resulted in wheels contact with different surfaces:

$$RR = G \times \rho$$

$G$ - total weight loaded on vehicle, daN [lbs];

$\rho$ - rolling resistance coefficient (Table 1).

Table 1

Rolling resistance coefficient In case of rubber tire rolling on different surfaces	
Surface	$\rho$
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]

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

$\alpha$ - gradient negotiation angle (Table 2)

Table 2

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

### 4. Acceleration force: FA, daN [lbs]

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

$$FA = \frac{v_{km} \times G}{3,6 \times t}, [daN] \quad FA = \frac{v_{mi} \times G}{22 \times t}, [lbs];$$

$FA$ - acceleration force, daN [lbs];

$t$ - time, [s].

### 5. Tractive effort: DP, daN [lbs]

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, daN [lbs]

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, daNm [in-lb]

Necessary torque moment for every hydraulic motor:

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

$N$ - motor numbers;

$\eta_m$ -mechanical gear efficiency (if it is available).

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

$$M_w = \frac{G_w \times f \times R_{in}[R_m]}{i \times \eta_m}$$

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

$f$  - frictional factor;

$G_w$ - total weight over the wheels, daN [lbs].

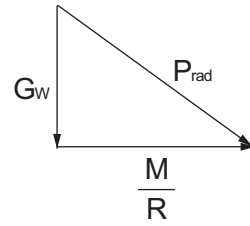
Table 3

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:  $P_{rad}$ , daN [lbs]**

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

- $G_w$  - Weight held by wheel;
- $P_{rad}$  - Total radial loading of motor shaft;
- $M/R$  - Motion force.



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

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

**DRAINAGE SPACE AND DRAINAGE PRESSURE**

Advantages in oil drainage from drain space: Cleaning; Cooling and Seal lifetime prolonging.

