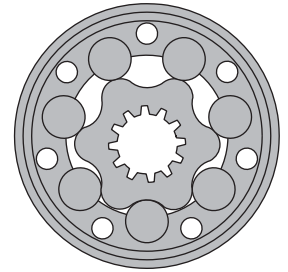


HYDRAULIC MOTORS RW



APPLICATION

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



CONTENTS

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Permissible shaft Seal Pressure ...	91
Permissible shaft loads	91
Shaft extensions	92
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OPTIONS

- » Model - Spool valve, roll-gerotor
- » Wheel mount
- » Shafts - straight and tapered
- » Shaft seal for high and low pressure
- » Metric and BSPP ports
- » Other special features

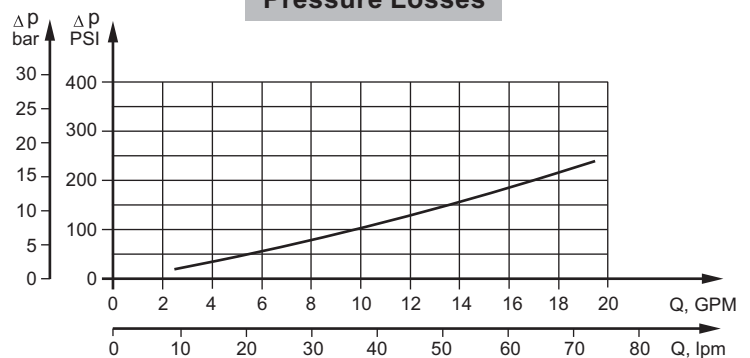
GENERAL

Max. Displacement, cm ³ /rev [in ³ /rev]	397 [24.4]
Max. Speed, [RPM]	1029
Max. Torque, daNm [lb-in]	cont.: 61 [5400] int.: 69 [6100]
Max. Output, kW [HP]	15 [20.1]
Max. Pressure Drop, bar [PSI]	cont.: 175 [2540] int.: 200 [2900]
Max. Oil Flow, lpm [GPM]	90 [23.8]
Min. Speed, [RPM]	10
Pressure fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)
Temperature range, °C [°F]	-40÷140 [-40÷284]
Optimal Viscosity range, mm ² /s [SUS]	20÷75 [98÷347]
Filtration	ISO code 20/16 (Min. recommended fluid filtration of 25 microns)

Oil flow in drain line

Pressure drop bar [PSI]	Viscosity mm ² /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	RW 50	RW 80	RW 100	RW 125	RW 160	RW 200	RW 250	RW 315	RW 400	
Displacement, cm³/rev [in ³ /rev]	51,5 [3.14]	80,3 [4.90]	99,8 [6.09]	125,7 [7.67]	159,6 [9.74]	199,8 [12.19]	250,1 [15.26]	315,7 [19.26]	397 [24.4]	
Max. Speed, [RPM]	Cont.	775	750	600	475	375	300	300	240	190
	Int.*	1029	940	750	600	470	375	360	285	226
Max. Torque daNm [lb-in]	Cont.	10 [900]	20 [1770]	24 [2125]	30 [2655]	39 [3450]	45 [4000]	54 [4780]	55 [4870]	61 [5400]
	Int.*	13 [1150]	22 [1947]	28 [2480]	34 [3010]	43 [3805]	50 [4425]	61 [5400]	69 [6100]	69 [6100]
	Peak**	17 [1505]	27 [2390]	32 [2832]	37 [3275]	46 [4070]	56 [4960]	71 [6280]	84 [7430]	87 [7700]
Max. Output kW [HP]	Cont.	7 [9.5]	12,5 [17]	13 [17.4]	12,5 [16.8]	11,5 [15.4]	11 [14.8]	10 [13.4]	9 [12]	7,8 [10.5]
	Int.*	8,5 [11.9]	15 [20.1]	15 [20.1]	14,5 [19.5]	14 [18.8]	13 [17.4]	12 [16.1]	10 [13.4]	10,6 [14.2]
Max. Pressure Drop bar [PSI]	Cont.	140 [2030]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	135 [1960]	110 [1600]
	Int.*	175 [2540]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	175 [2540]	140 [2030]
	Peak**	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	210 [3045]	175 [2540]
Max. Oil Flow lpm [GPM]	Cont.	40 [10,6]	60 [15,9]	60 [15,9]	60 [15,9]	60 [15,9]	60 [15,9]	75 [19,8]	75 [19,8]	75 [19,8]
	Int.*	50 [13,2]	75 [19,8]	75 [19,8]	75 [19,8]	75 [19,8]	75 [19,8]	90 [23,8]	90 [23,8]	90 [23,8]
Max. Inlet Pressure bar [PSI]	Cont.	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]
	Int.*	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]
	Peak**	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]
Max. Return Pressure with Drain Line bar [PSI]	Cont.	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]
	Int.*	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]
	Peak**	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]
Max. Starting Pressure with Unloaded Shaft, bar [PSI]	10 [145]	10 [145]	10 [145]	9 [130]	7 [102]	5 [73]	5 [73]	5 [73]	5 [73]	
Min. Starting Torque daNm [lb-in]	At max.press.									
	drop Cont.	8 [710]	15 [1330]	20 [1770]	25 [2215]	32 [2832]	41 [3630]	50 [4425]	50 [4425]	50 [4425]
	At max.press. drop Int.*	10 [885]	17 [1505]	23 [2035]	28 [2480]	37 [3275]	46 [4070]	55 [4870]	66 [5840]	61 [5400]
Min. Speed***, [RPM]	10	10	10	10	10	10	10	10	10	
Weight, kg [lb]	9,6 [21.2]	9,7 [21.4]	9,8 [21.7]	10,0 [22.1]	10,3 [22.7]	10,8 [23.8]	11,3 [24.9]	11,8 [26]	12,5 [27.63]	

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

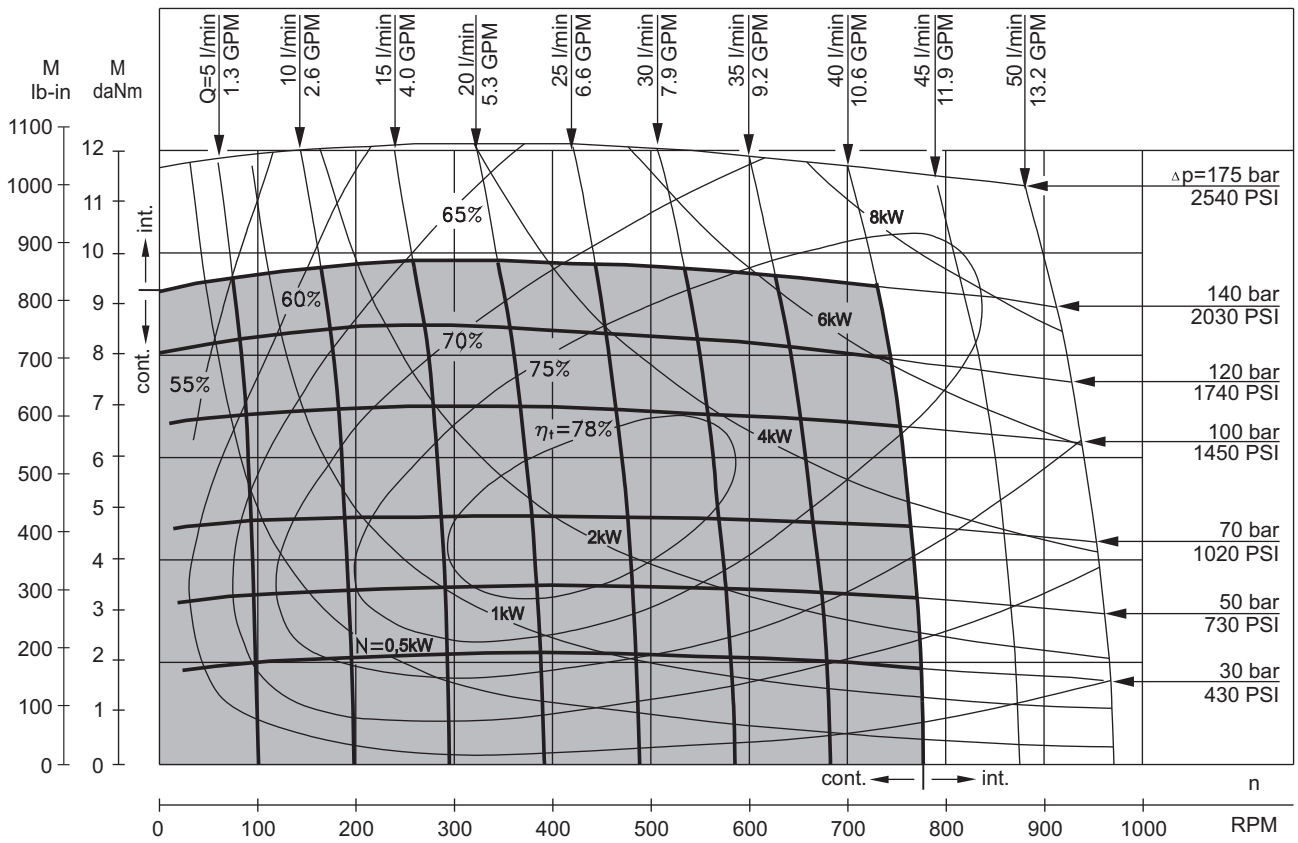
** Peak load: the permissible values may occur for max. 1% of every minute.

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

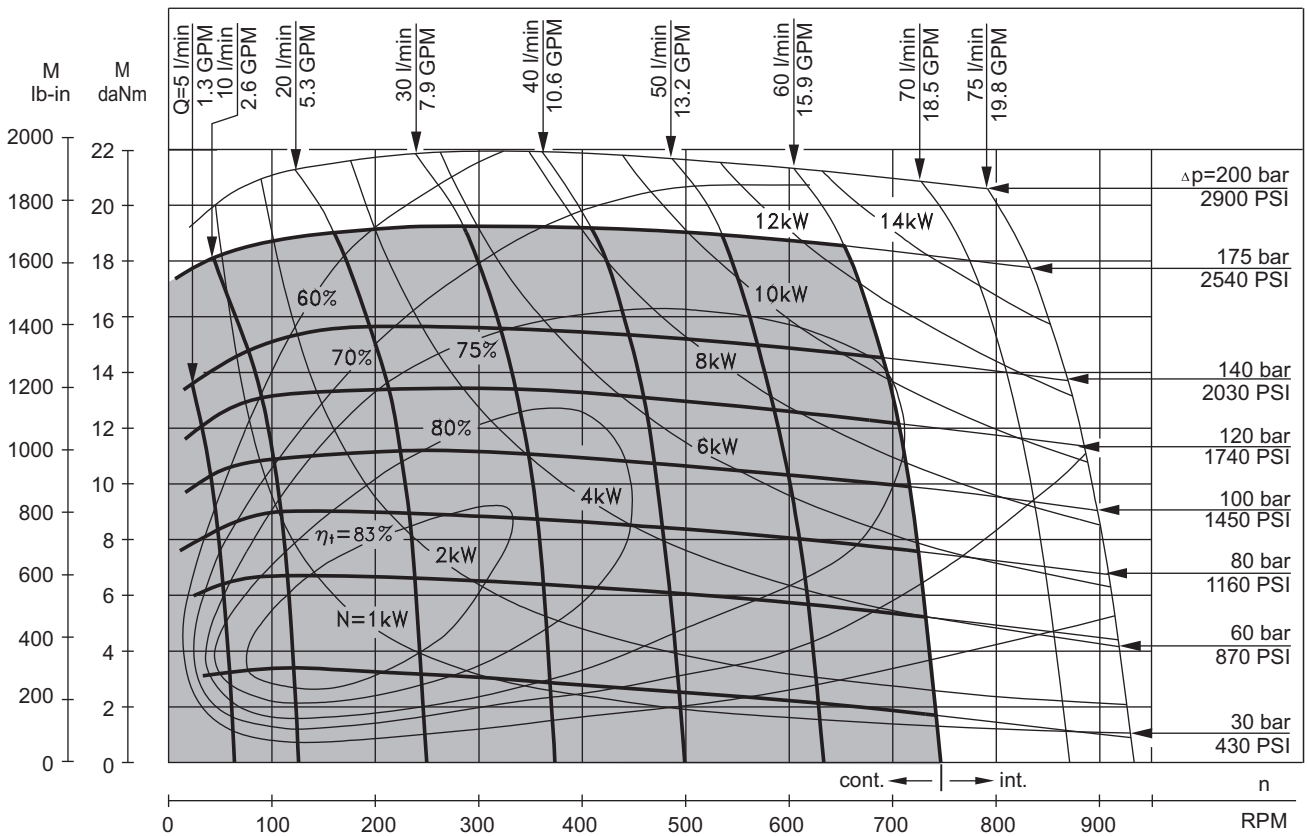
- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP(DIN51524) or HM (ISO 6743/4).
If using synthetic fluids consult the factory for alternative seal materials.
- Recommended minimum oil viscosity 13 mm²/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

RW 50



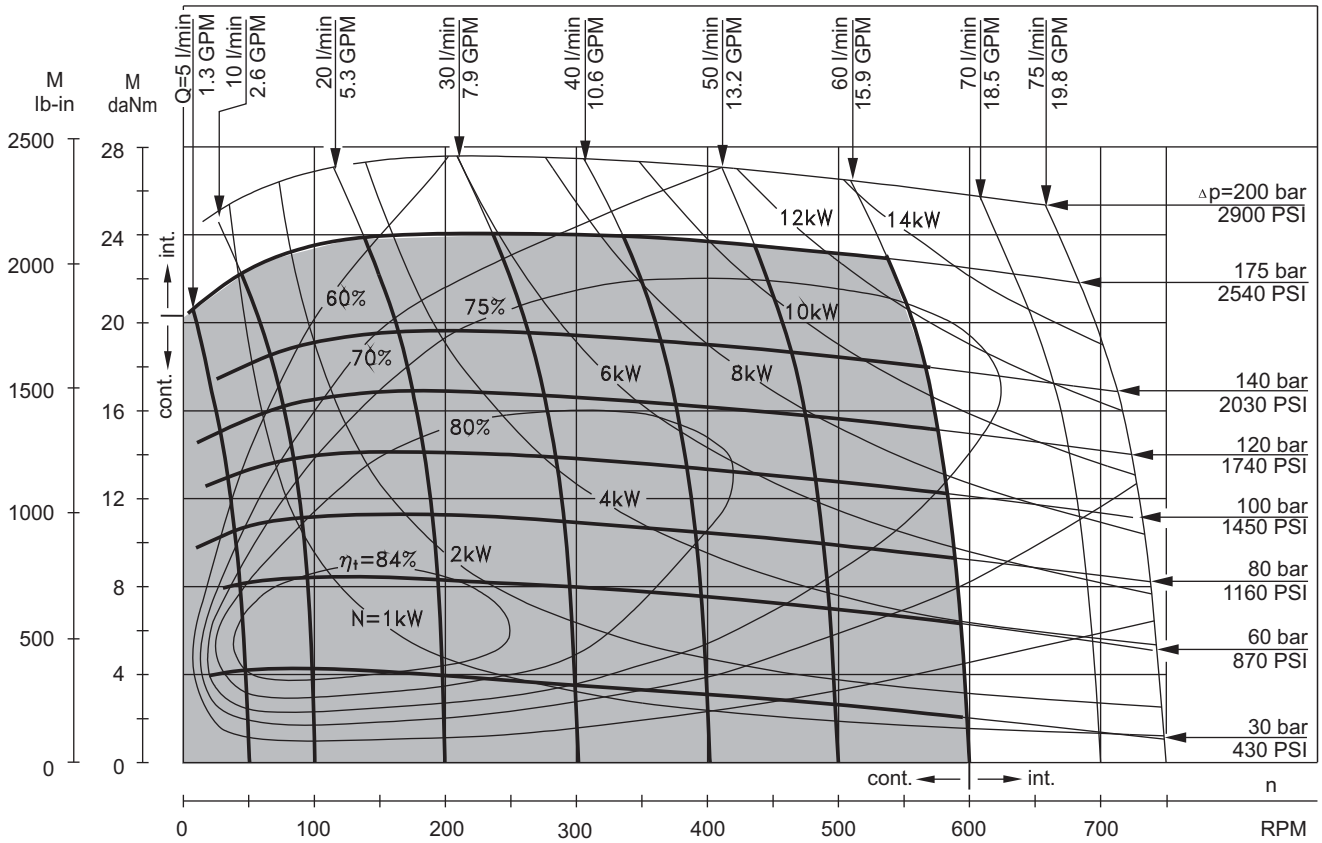
RW 80



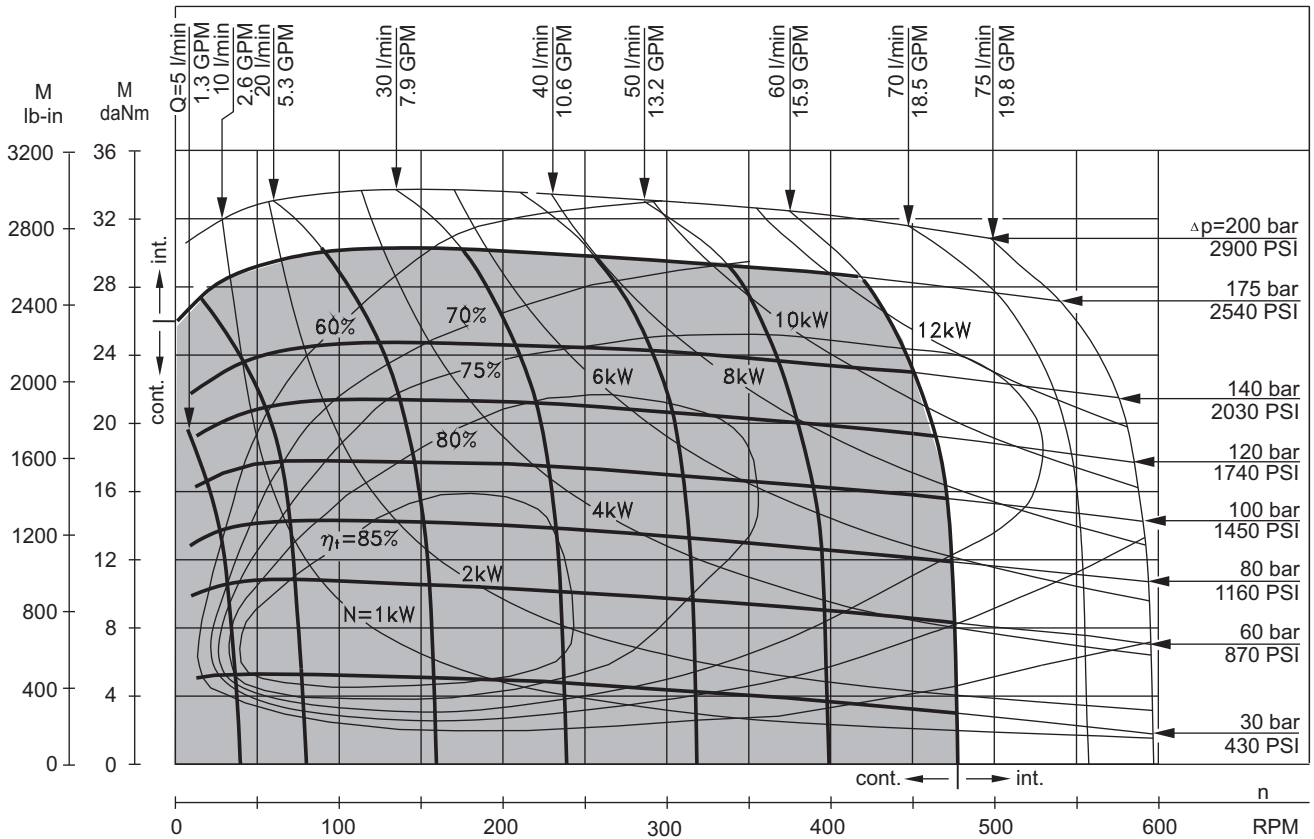
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

RW 100



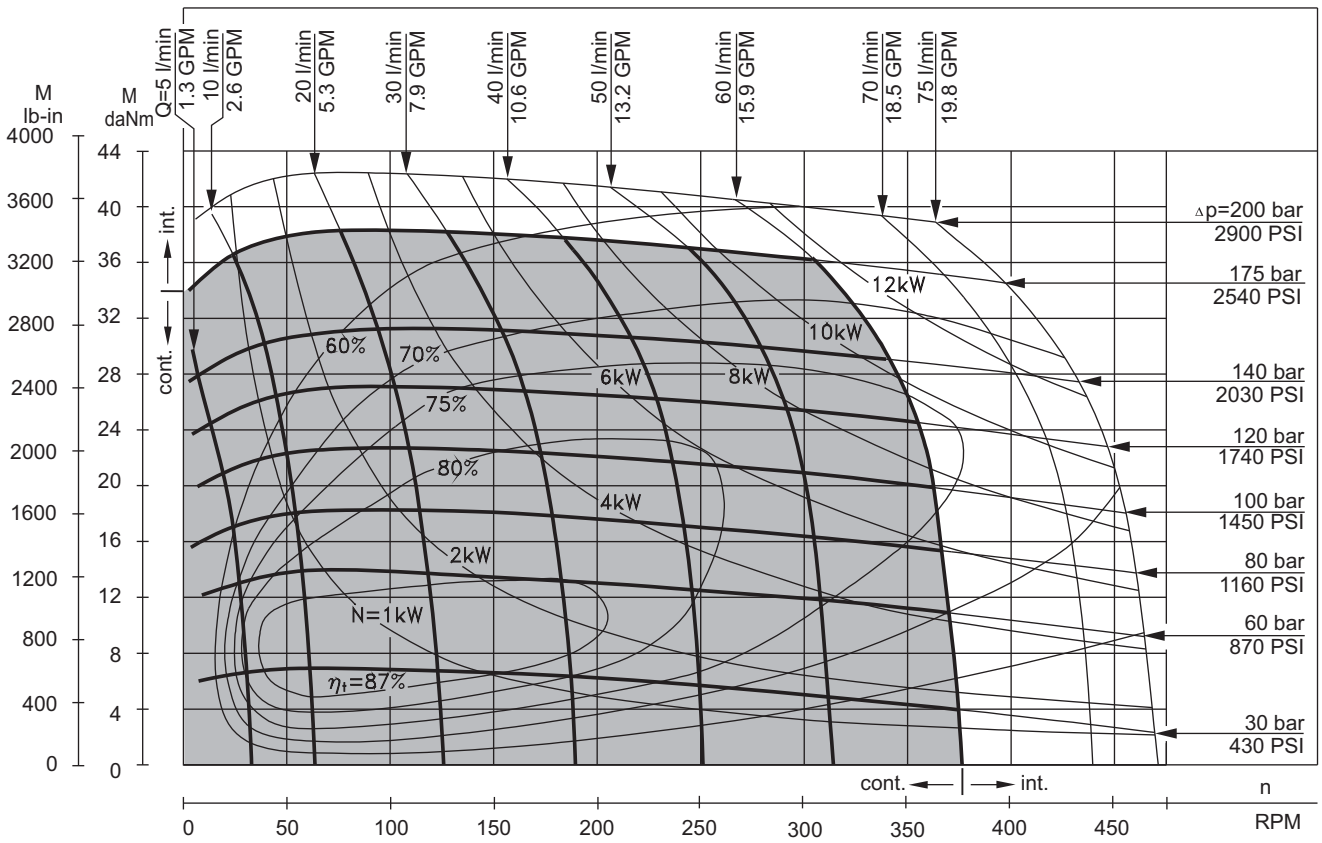
RW 125



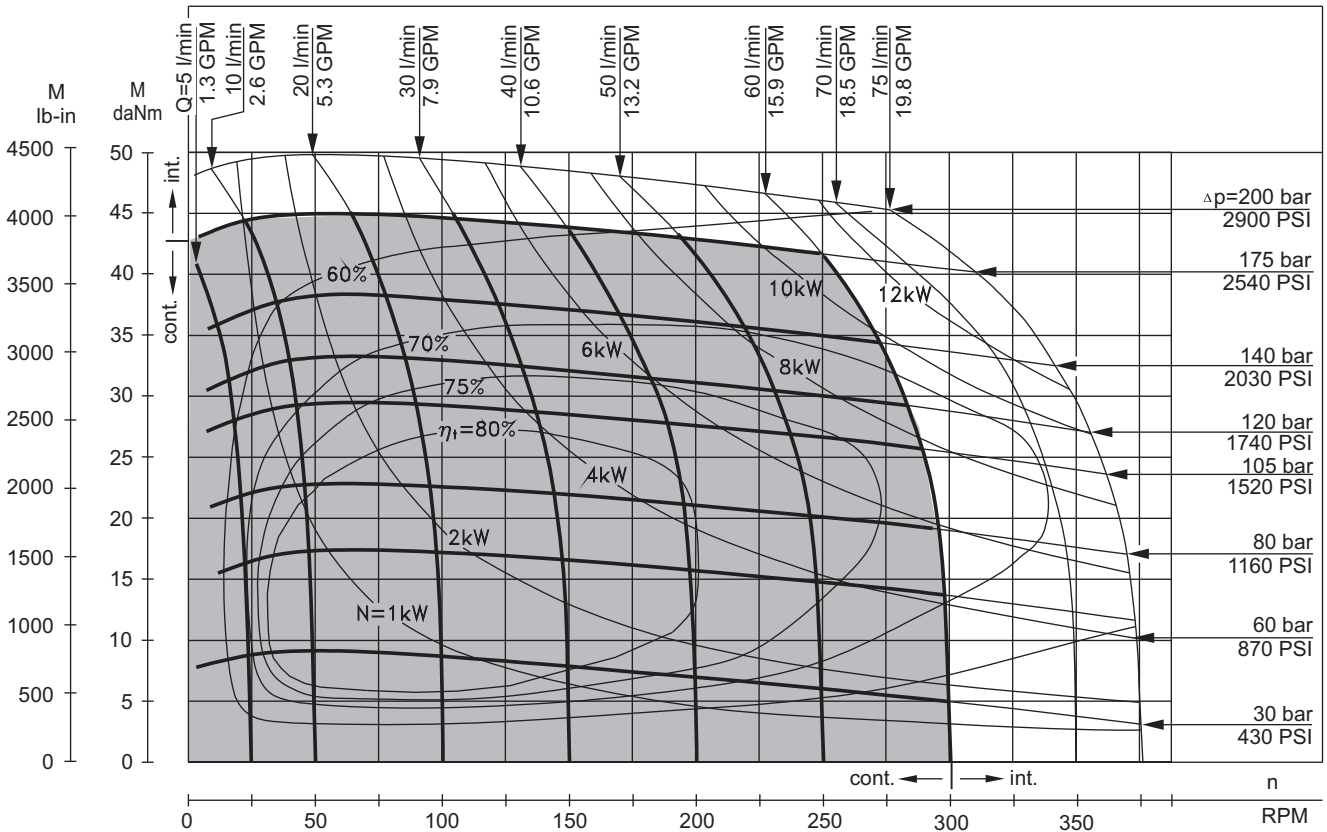
The function diagrams data is for average performance of randomly selected motors at back pressure $5 \div 10$ bar [72.5 ÷ 145 PSI] and oil with viscosity of $32 \text{ mm}^2/\text{s}$ [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

RW 160



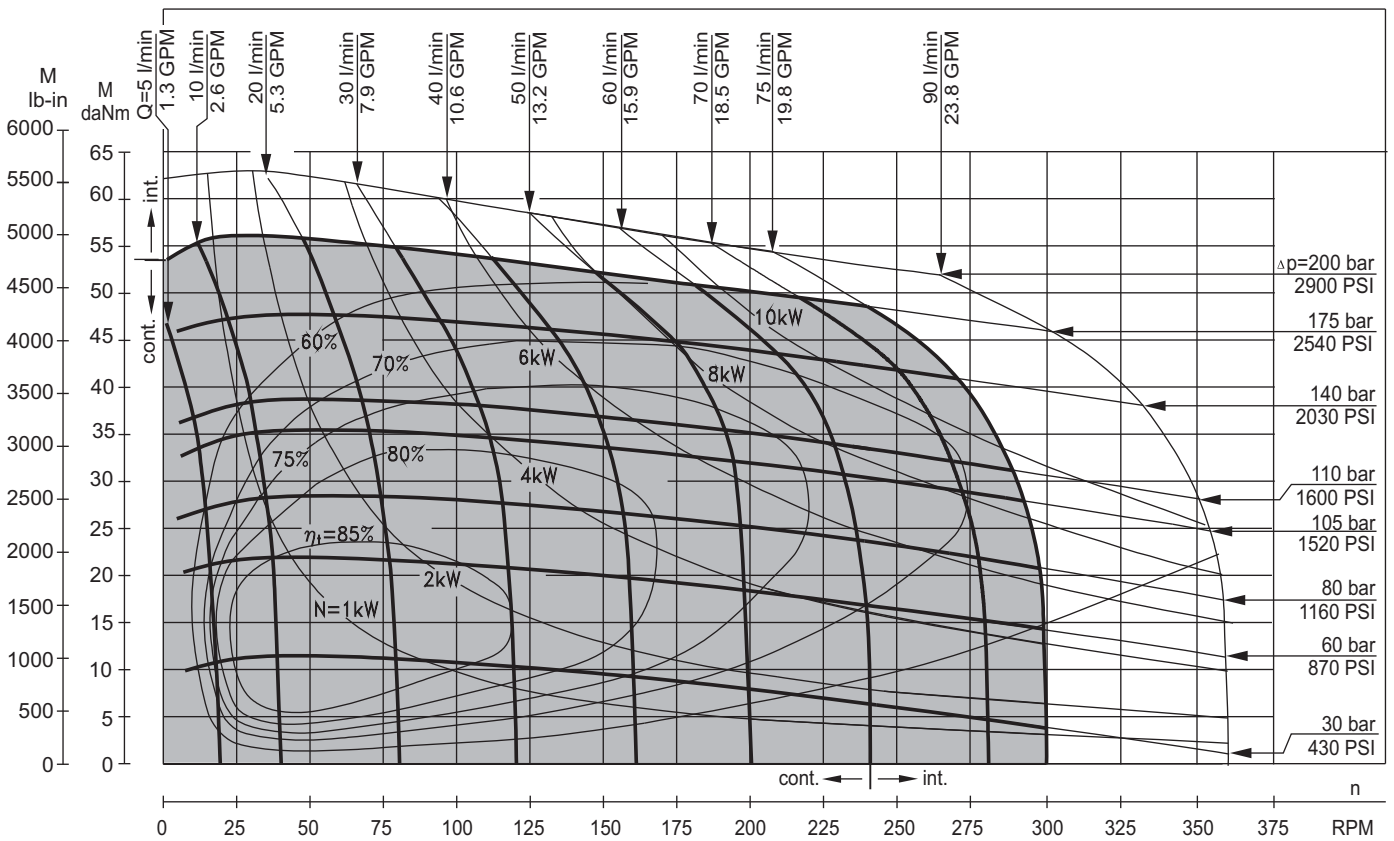
RW 200



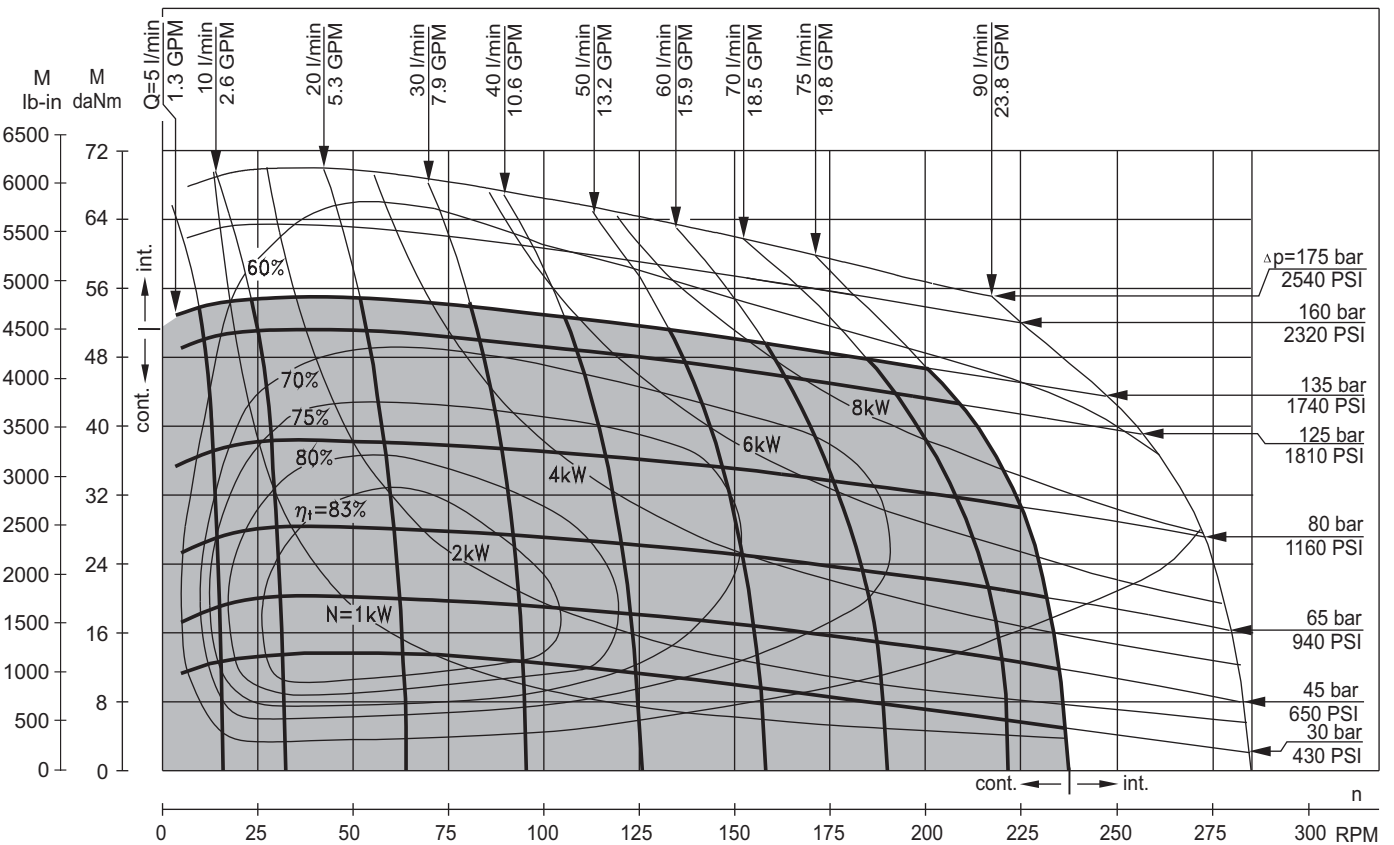
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

RW 250



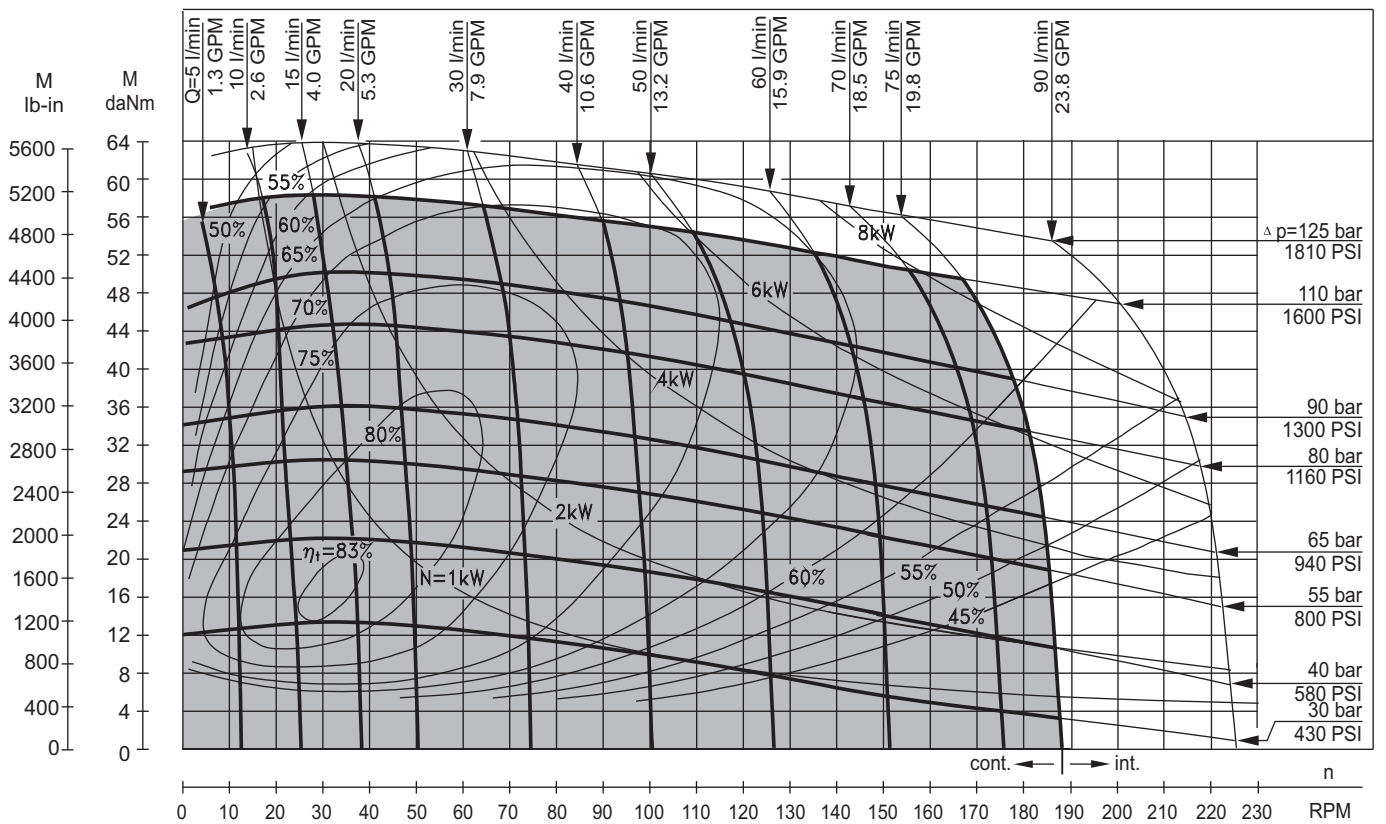
RW 315



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

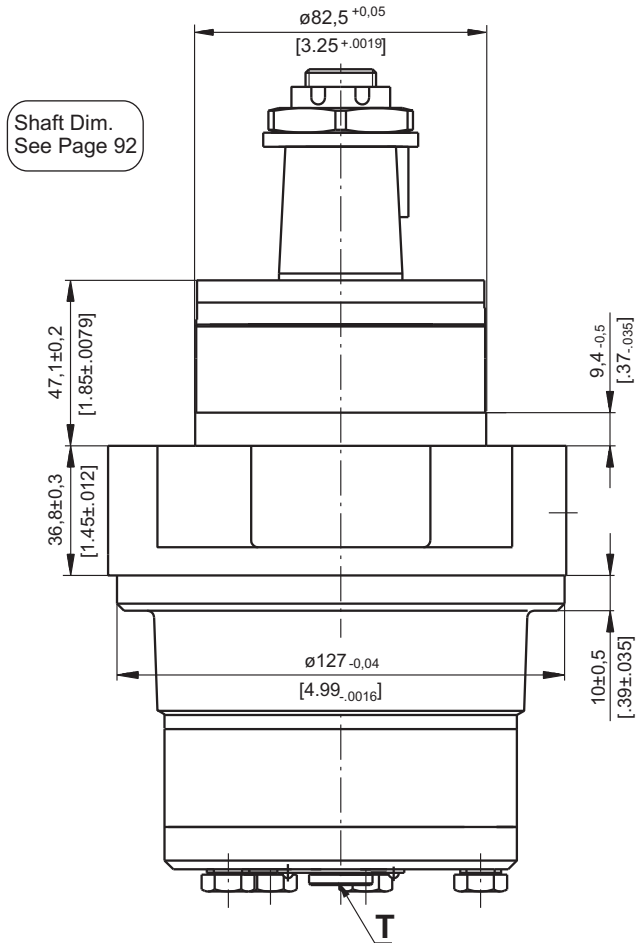
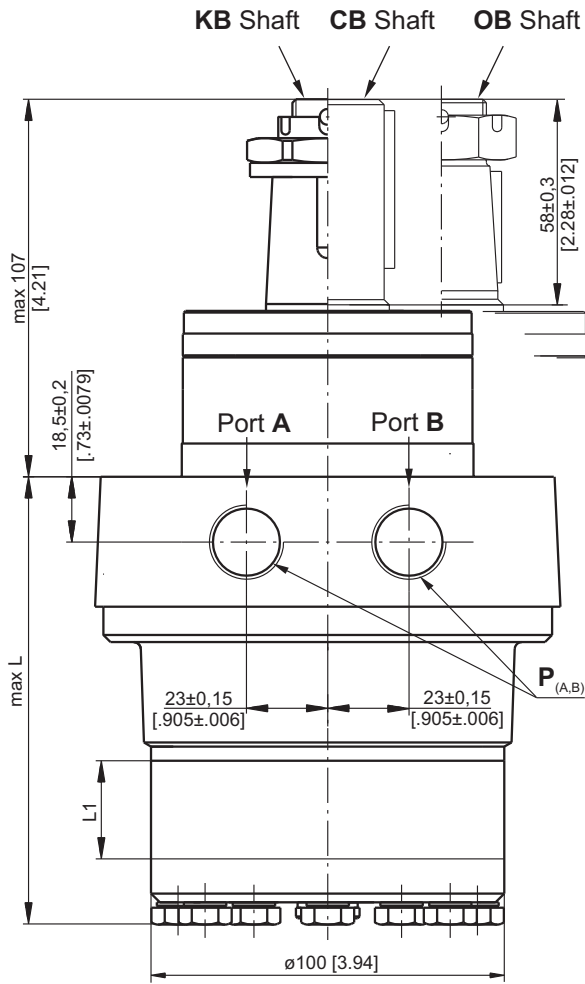
FUNCTION DIAGRAMS

RW 400

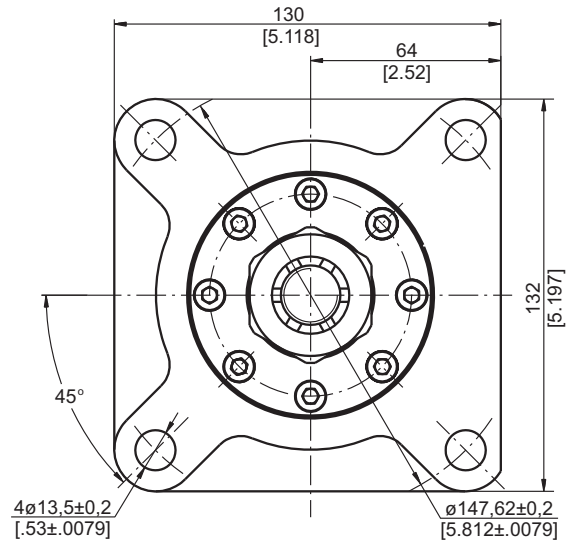


The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

DIMENSIONS AND MOUNTING DATA



Type	L, mm [in]	L1, mm [in]
RW 50	108,0 [4.25]	9,0 [.35]
RW 80	113,0 [4.45]	14,0 [.55]
RW 100	116,5 [4.59]	17,4 [.69]
RW 125	120,5 [4.74]	21,8 [.86]
RW 160	126,5 [4.98]	27,8 [1.09]
RW 200	133,5 [5.26]	34,8 [1.37]
RW 250	142,5 [5.61]	43,5 [1.71]
RW 315	153,5 [6.04]	54,8 [2.16]
RW 400	168,5 [6.63]	69,4 [2.73]



P_(A,B): 2xG1/2 or 2xM22x1,5 - 17 mm [.67 in.] depth
T : G1/4 or M14x1,5 - 12 mm [.47 in.] depth (plugged)

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

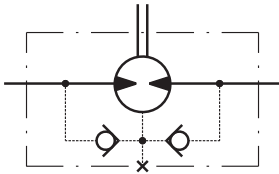
Reverse Rotation
Viewed from Shaft End
Port A Pressurized - **CCW**
Port B Pressurized - **CW**



MAX. PERMISSIBLE SHAFT SEAL PRESSURE

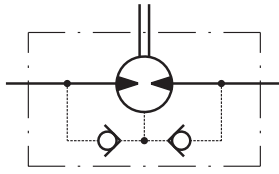
RW...; RW...UK motors with drain connection:

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



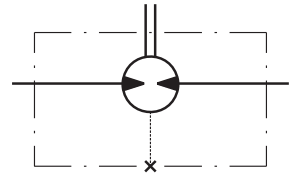
RW...1 motors without drain connection:

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

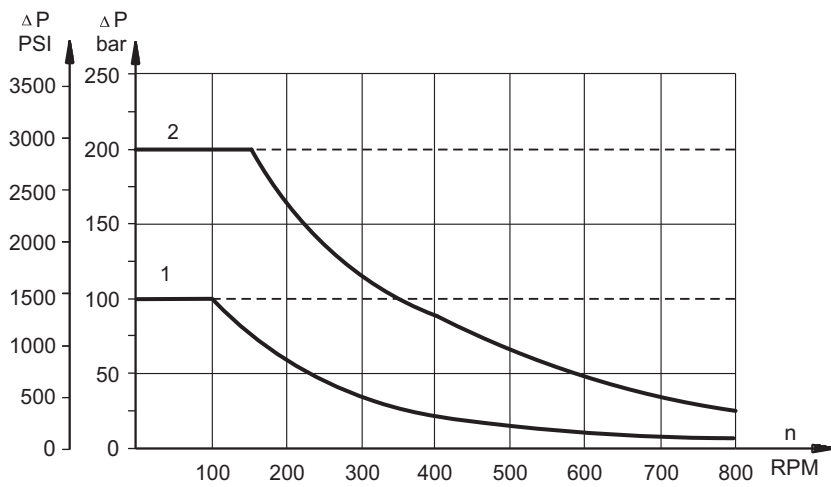


RW...U motors with high pressure seal and drain connection:

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



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

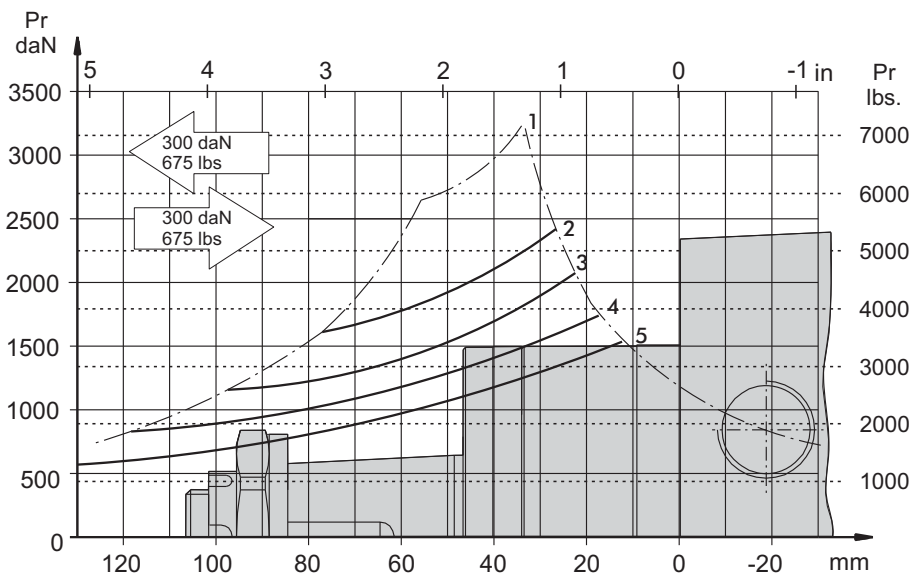


1: Drawing for Standard Shaft Seal
2: Drawing for High Pressure Seal ("U" Seal)

— - continuous operations
- - - - intermittent operations

PERMISSIBLE SHAFT LOADS

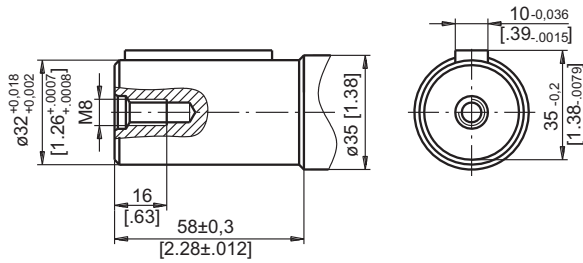
The curve applies to a B10 bearing life of 2000 hours.



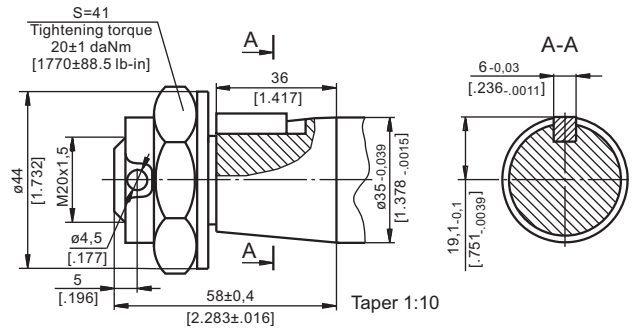
1. Permissible radial shaft load
2. Drawing by n= 50 rpm
3. Drawing by n=100 rpm
4. Drawing by n=200 rpm
5. Drawing by n=400 rpm

SHAFT EXTENSIONS

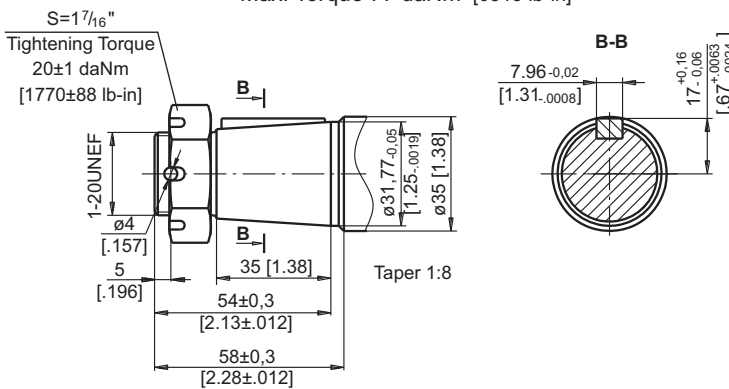
CB - $\varnothing 32$ straight, Parallel key A10x8x45 DIN 6885
Max. Torque 77 daNm [6815 lb-in]



KB - tapered 1:10, Parallel key B6x6x20 DIN 6885
Max. Torque 95 daNm [8400 lb-in]



OB - tapered 1:8 SAEJ 501, Parallel key $5/16$ "x $5/16$ "x $1 1/4$ " BS46
Max. Torque 77 daNm [6815 lb-in]



ORDER CODE

	1	2	3	4	5	6	7
RW							

Pos.1 - Displacement code	
50	- 51,5 cm ³ /rev [3.14 in ³ /rev]
80	- 80,3 cm ³ /rev [4.90 in ³ /rev]
100	- 99,8 cm ³ /rev [6.09 in ³ /rev]
125	- 125,7 cm ³ /rev [7.67 in ³ /rev]
160	- 159,6 cm ³ /rev [9.74 in ³ /rev]
200	- 199,8 cm ³ /rev [12.19 in ³ /rev]
250	- 250,1 cm ³ /rev [15.26 in ³ /rev]
315	- 315,7 cm ³ /rev [19.26 in ³ /rev]
400	- 397,0 cm ³ /rev [24.40 in ³ /rev]
Pos.2 - Shaft Extensions*	
CB	- $\varnothing 32$ straight, Parallel key A10x8x45 DIN6885
KB	- $\varnothing 35$ tapered 1:10, Parallel key B6x6x20 DIN6888
OB	- $\varnothing 1 1/4$ " tapered 1:8, Parallel key $5/16$ "x $5/16$ "x $1 1/4$ " BS46

Pos.3 - Shaft Seal Pressure	
omit	- Standard shaft seal
U	- High pressure shaft seal without check valves
UK	- High pressure shaft seal with check valve
Pos.4 - Drain Port	
omit	- with drain port
1	- without drain port
Pos.5 - Ports	
omit	- BSPP (ISO 228)
M	- Metric (ISO 262)
Pos.6 - Special Features	(see page 119)
Pos.7 - Design Series	
omit	- Factory specified

NOTE:

* The permissible output torque for shafts must not be exceeded!

The hydraulic motors are manganese-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

O	Optional
-	Not applicable
S	Standard

* For sensor ordering see pages 120÷121.

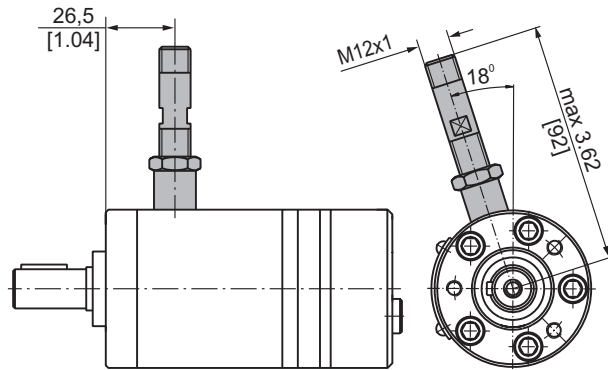
** Colour at customer's request.

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

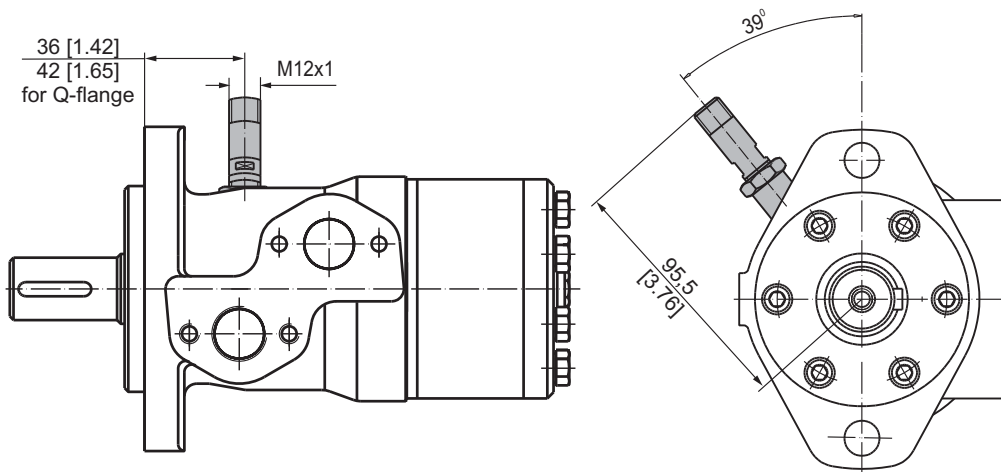
**** Without check valves for "U" shaft seal versions.

MOTORS WITH SPEED SENSOR

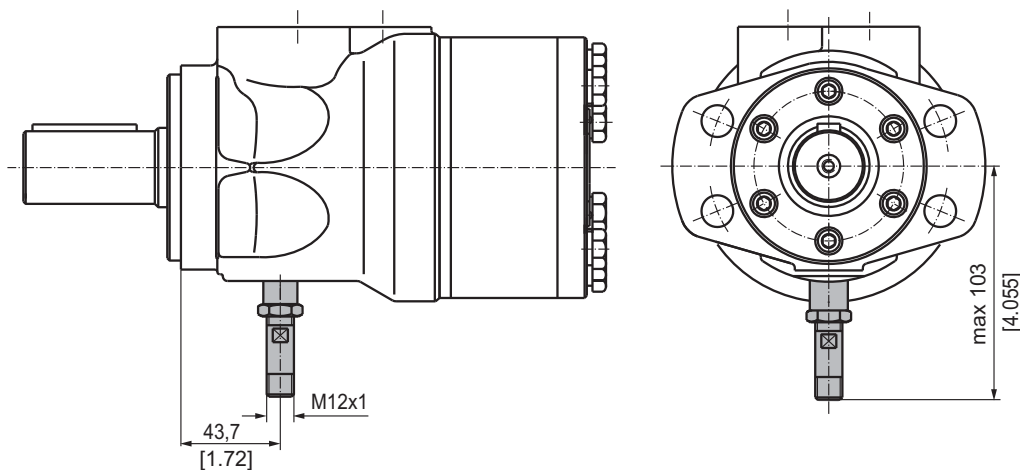
MM...RS



MP...RS and MR...RS



MH...RS

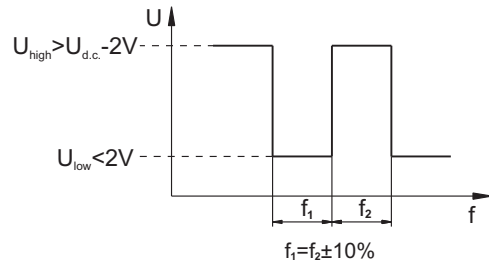


TECHNICAL DATA OF THE SPEED SENSOR

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

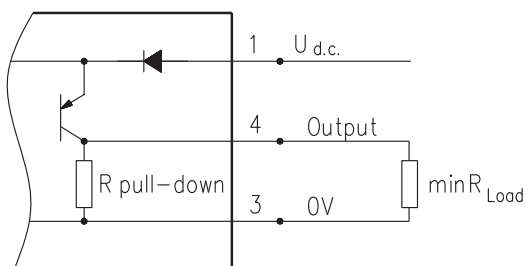


Load max.: $I_{high} = I_{low} < 50\text{mA}$

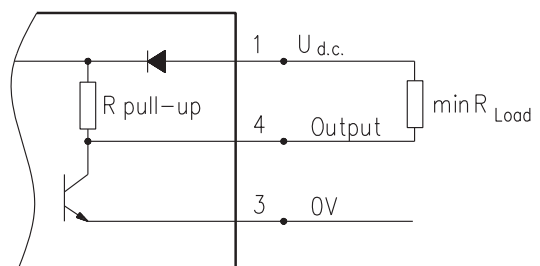
Motor type	MM	MP	MR	MH
Pulses per revolution	30	36	36	42

Wiring diagrams

PNP

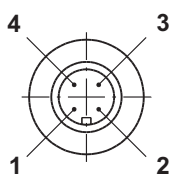


NPN



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

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
RSN	NPN	Connector BINDER 713 series
RSP	PNP	Connector BINDER 713 series
RSNL5	NPN	Cable output 3x0,25; 5 m [196 in] long
RSPL5	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

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

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

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

R_m - wheel rolling radius, m;

R_{in} - 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];

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%	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;

η_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].

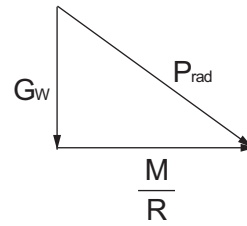
Table 3

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.

