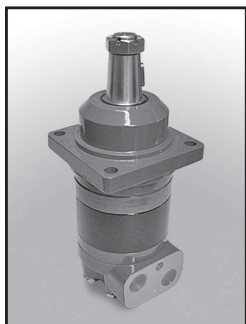
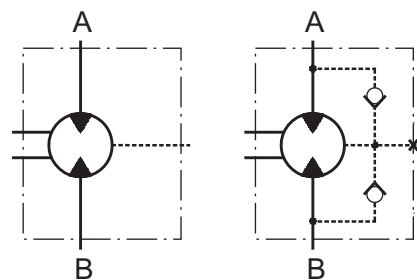


HYDRAULIC MOTORS MTK



APPLICATION

- » Conveyors
- » Metal working machines
- » Agricultural machines
- » Road building machines
- » Mining machinery
- » Food industries
- » Special vehicles
- » Plastic and rubber machinery etc.



CONTENTS

Specification data.....	8
Function diagrams.....	9÷11
Dimensions and mounting.....	12÷15
Shaft extensions.....	16
Permissible shaft loads	17
Order code	17

OPTIONS

- » Model - Disc valve, roll-gerotor
- » Flange with wheel mount
- » Side and rear ports
- » Shafts - straight, splined and tapered
- » Metric, SAE and BSPP ports
- » Other special features

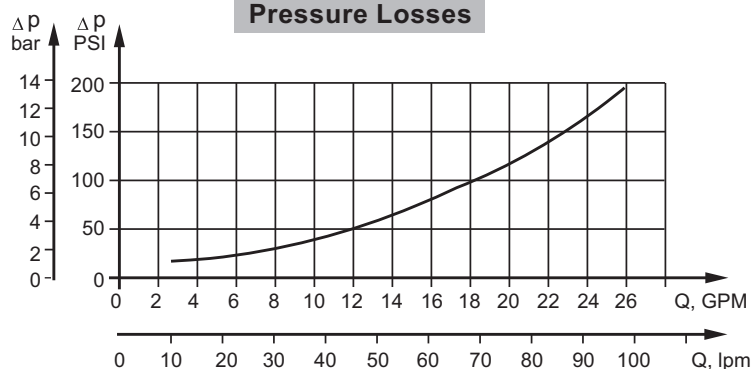
GENERAL

Max. Displacement, in ³ /rev [cm ³ /rev]	30.65 [502,4]
Max. Speed, [RPM]	630
Max. Torque, lb-in [daNm]	cont.: 9648 [109] int.: 12037 [136]
Max. Output, HP [kW]	36.2 [27]
Max. Pressure Drop, PSI [bar]	cont.: 3626 [250] int.: 4714 [325]
Max. Oil Flow, GPM [lpm]	26.4 [100]
Min. Speed, [RPM]	10
Permissible Shaft Loads, lbs [daN]	P _a =13488 [6000]
Pressure fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)
Temperature range, °F [°C]	-40÷284 [-40÷140]
Optimal Viscosity range, SUS [mm²/s]	98÷347 [20÷75]
Filtration	ISO code: 18/16/13 According to ISO 4406-1999

Oil flow in drain line

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

Pressure Losses



SPECIFICATION DATA

Type		MTK 160	MTK 200	MTK 250	MTK 315	MTK 400	MTK 470	MTK 500
Displacement, in ³ /rev [cm ³ /rev]		9.63 [157,9]	12.28 [201,3]	15.38 [252,2]	19.2 [314,9]	24.2 [396,8]	28.7 [470,5]	30.65 [502,4]
Max. Speed, [RPM]	Cont.	505	400	320	255	200	170	159
	Int.*	630	500	400	315	250	210	199
Max. Torque, lb-in [daNm]	Cont.	5045 [57]	6373 [72]	8055 [91]	9293 [105]	9470 [107]	9028 [102]	9648 [109]
	Int.*	6420 [72,5]	8143 [92]	9470 [107]	11595 [131]	12390 [140]	11772 [133]	12037 [136]
Max. Output, HP [kW]	Cont.	29.5 [22]	29.5 [22]	28.2 [21]	26.8 [20]	23.5 [17,5]	18.8 [14]	18.8 [14]
	Int.*	36.2 [27]	36.2 [27]	33.5 [25]	31.5 [23,5]	29.5 [22]	23.5 [17,5]	22.8 [17]
Max. Pressure Drop, PSI [bar]	Cont.	3626 [250]	3626 [250]	3626 [250]	3626 [250]	2900 [200]	2320 [160]	2320 [160]
	Int.*	4714 [325]	4714 [325]	4350 [300]	4350 [300]	3626 [250]	2900 [200]	2900 [200]
Max. Inlet Pressure, PSI [bar]	Cont.	250 [3626]						
	Int.*	350 [5077]						
Max. Oil Flow, GPM [lpm]	Cont.	80 [21.1]						
	Int.*	100 [26.4]						
Max. Starting Pressure with Unloaded Shaft, PSI [bar]		116 [8]	116 [8]	102 [7]	102 [7]	102 [7]	102 [7]	102 [7]
Min. Starting Torque, lb-in [daNm]	at max. pressure drop cont.	3806 [43]	4780 [54]	6020 [68]	6992 [79]	7080 [80]	7346 [83]	7435 [84]
	at max. pressure drop int.*	4824 [54.5]	6107 [69]	7080 [80]	8720 [98,5]	9294 [105]	9294 [105]	9294 [105]
Min. Speed****, RPM		10						
Max. Return Pressure without Drain Line, PSI [bar]		see diagram						
Max. Return Pressure with Drain Line, PSI [bar]	Cont.	2030 [140]						
	Int.*	2540 [175]						
	Peak*	3046 [210]						
Weight, kg [lb]	MTKW	35.3 [16,0]	36.4 [16,5]	37.5 [17,0]	38.6 [17,5]	39.7 [18,0]	40.8 [18,5]	41.9 [19,0]
	MTKC	37.3 [16,9]	38.4 [17,4]	39.5 [17,9]	40.6 [18,4]	41.7 [18,9]	42.8 [19,4]	43.9 [19,9]
	MTKF	31.3 [14,2]	32.4 [17,7]	33.5 [15,2]	34.6 [15,7]	35.7 [16,2]	36.8 [16,7]	37.9 [17,2]

- *

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 of 5 RPM lower than given, consult factory or your regional manager
- ****

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.

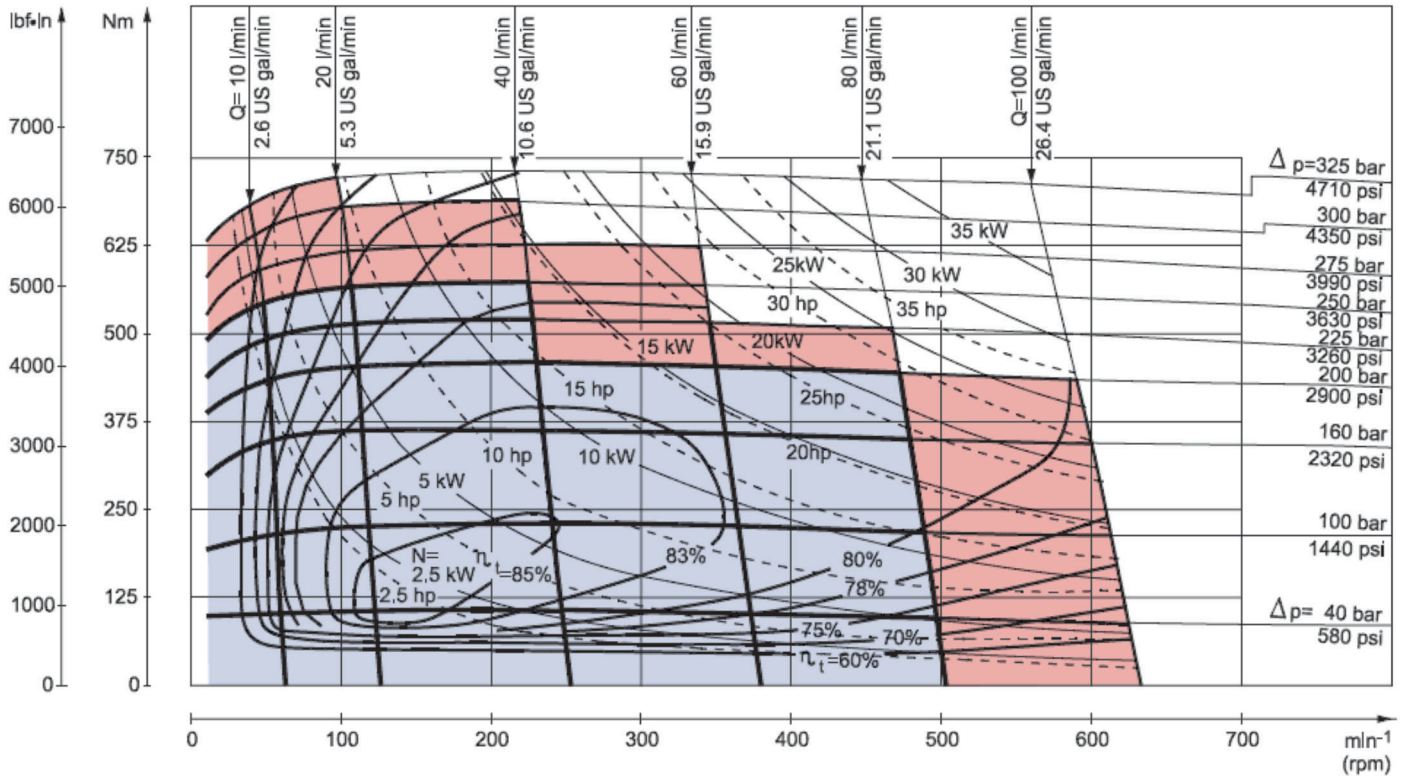
Recommended minimum oil viscosity 70 SUS [13 mm²/s] at 122°F [50°C].
5.

Recommended maximum system operating temperature is 180°F [82°C].
6.

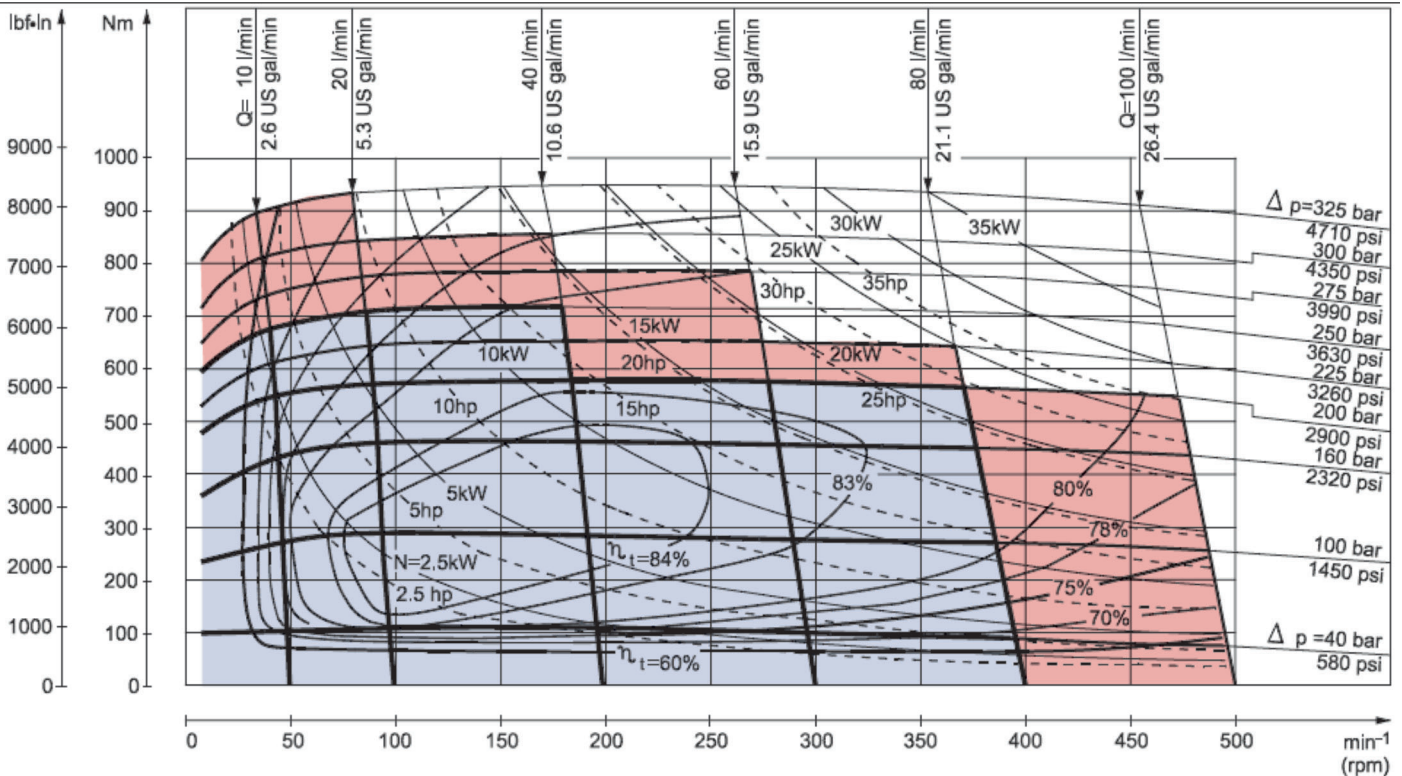
To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

FUNCTION DIAGRAMS

MTK 160



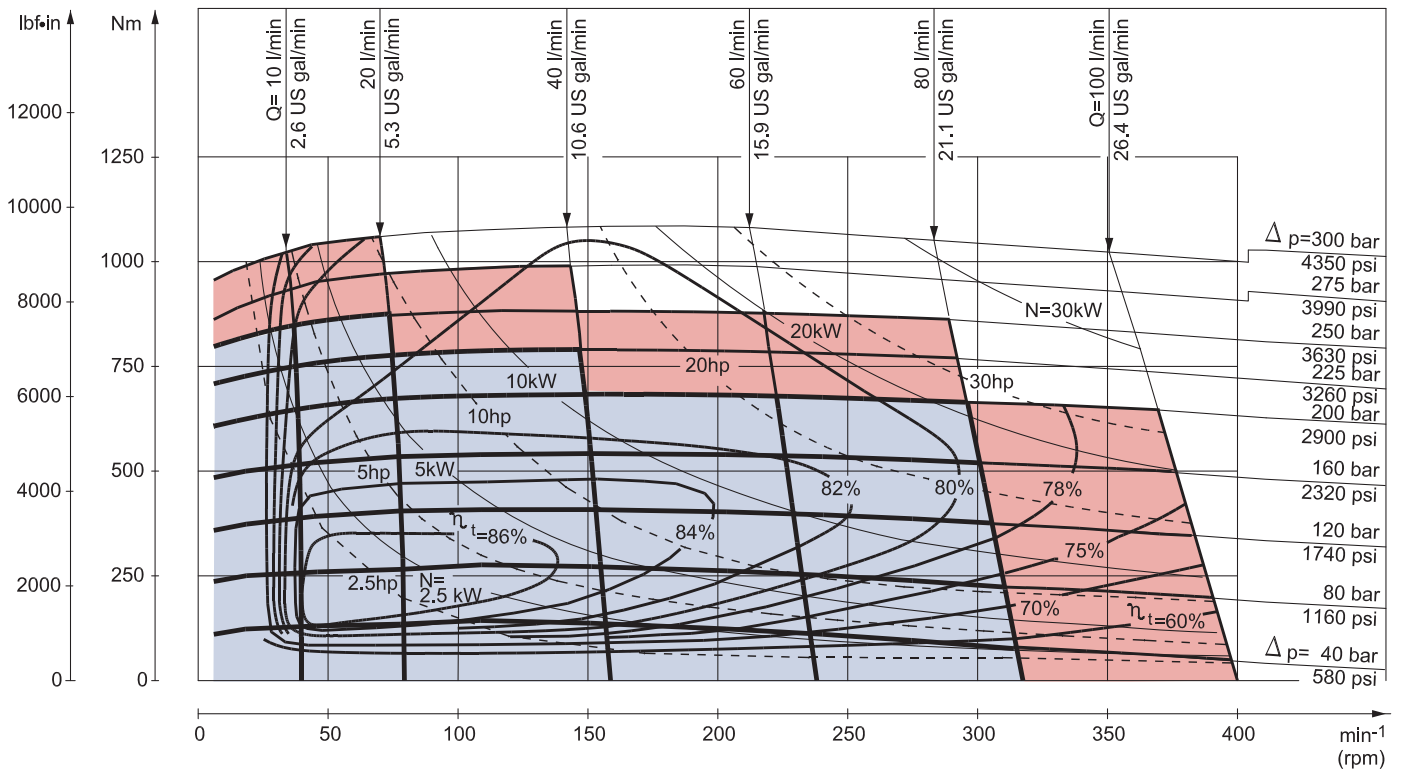
MTK 200



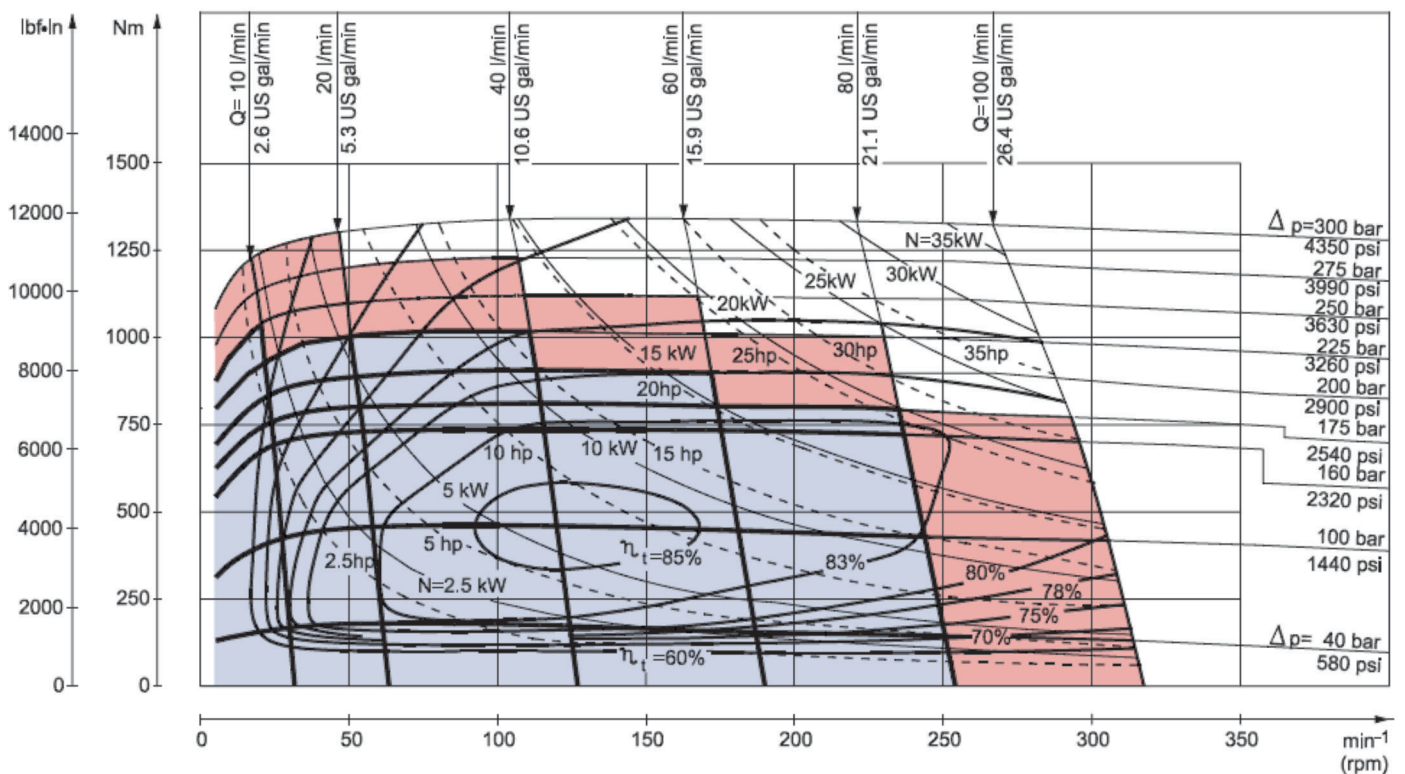
The function diagrams data is for average performance of randomly selected motors at back pressure 72.5 PSI÷145 PSI [5÷10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

FUNCTION DIAGRAMS

MTK 250



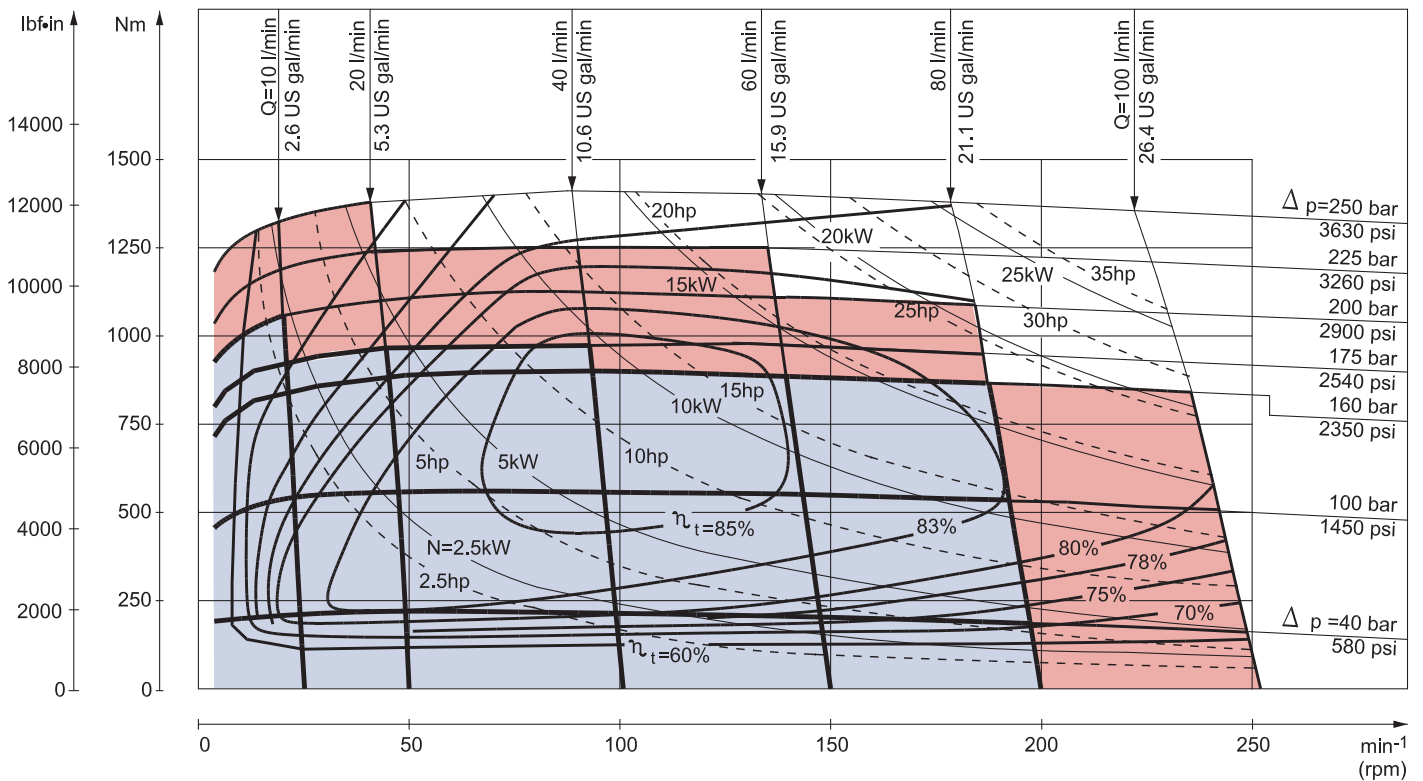
MTK 315



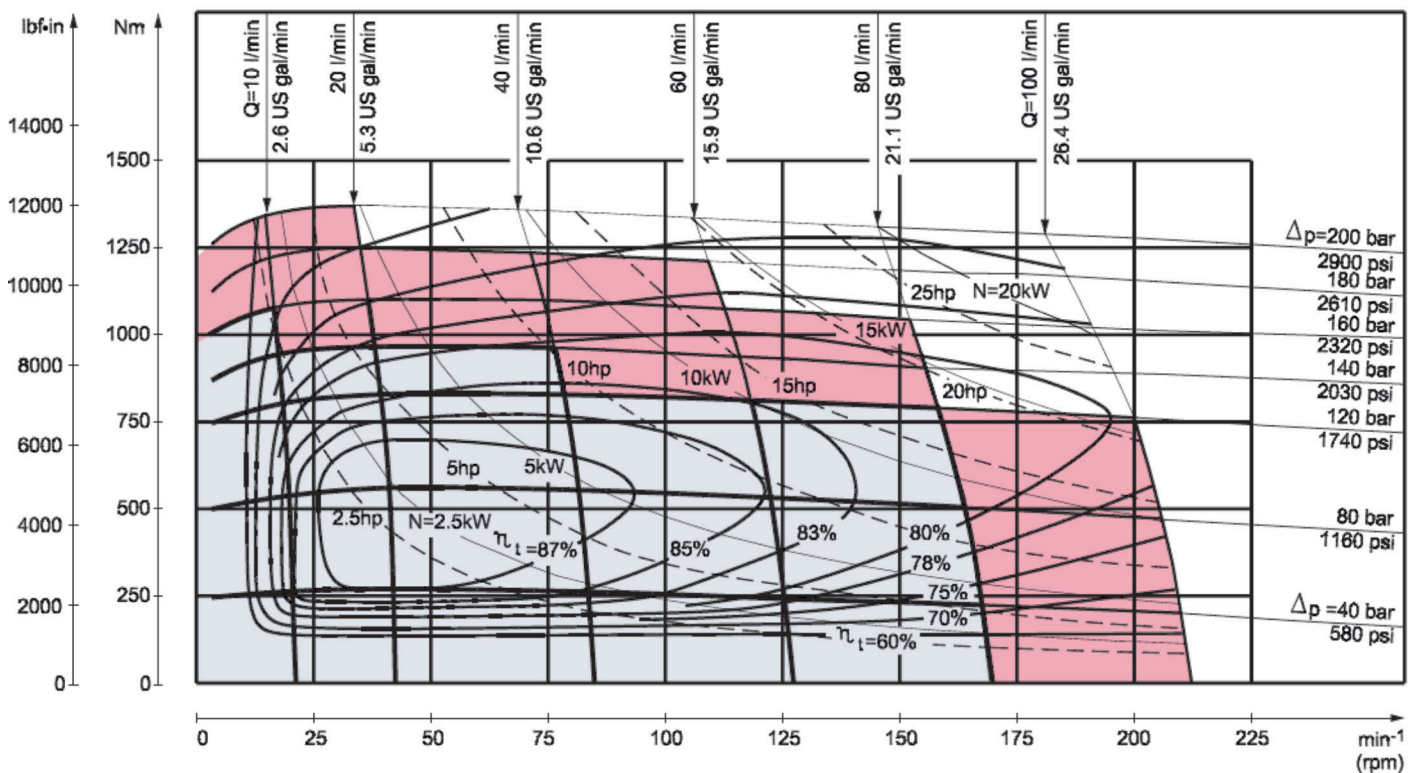
The function diagrams data is for average performance of randomly selected motors at back pressure 72.5 PSI $\pm$ 145 PSI [5 $\pm$ 10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

FUNCTION DIAGRAMS

MTK 400

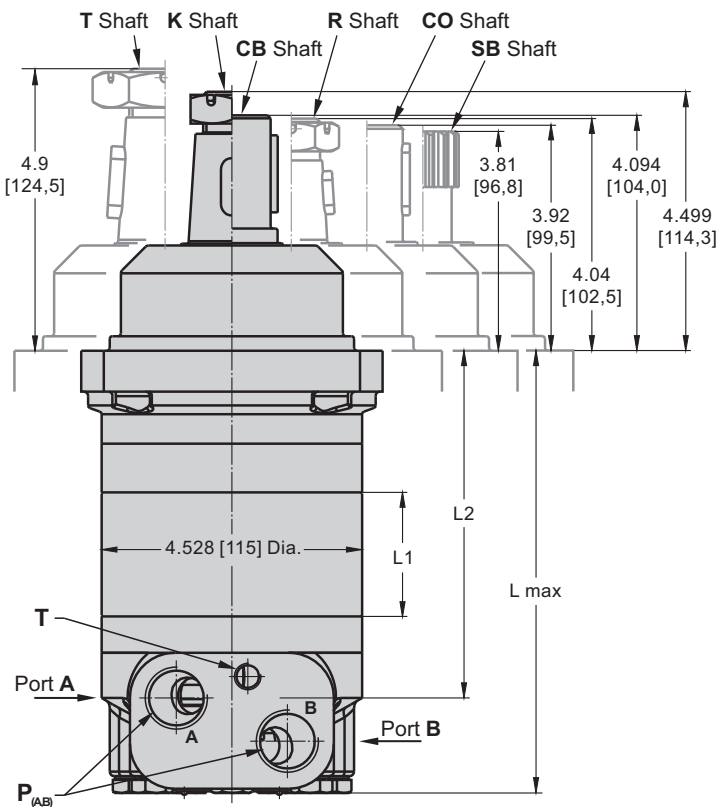


MTK 470

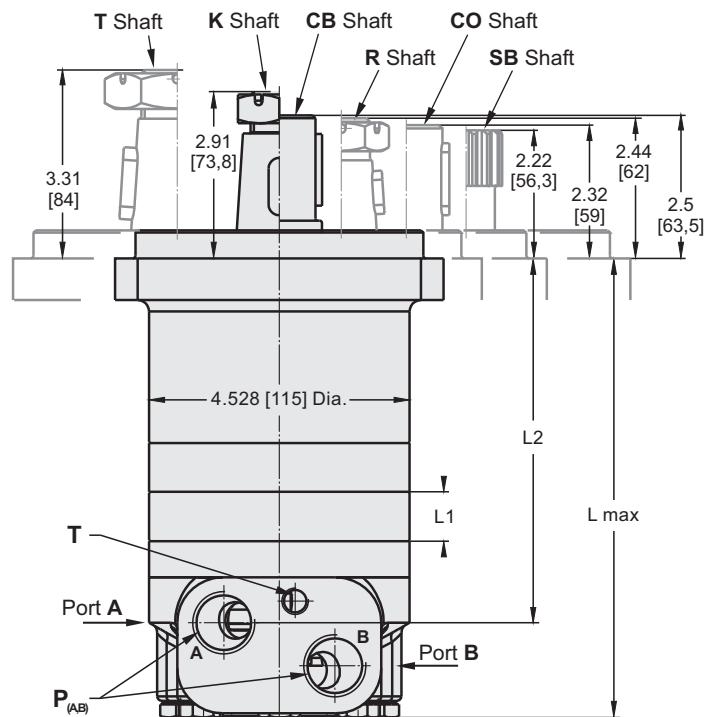


The function diagrams data is for average performance of randomly selected motors at back pressure 72.5 PSI÷145 PSI [5÷10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

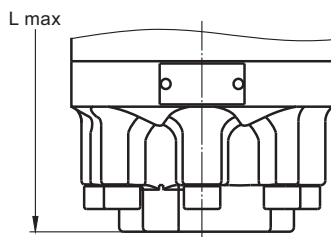
DIMENSIONS - MTK W and MTK C



Shaft Dim.
See Page 15



E Rear ports



Flange Dim.
See Page 14

Rear Ports Dim.
See Page 15



Warning: Drain line should always be used (if no check valves)!

Standard Rotation

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

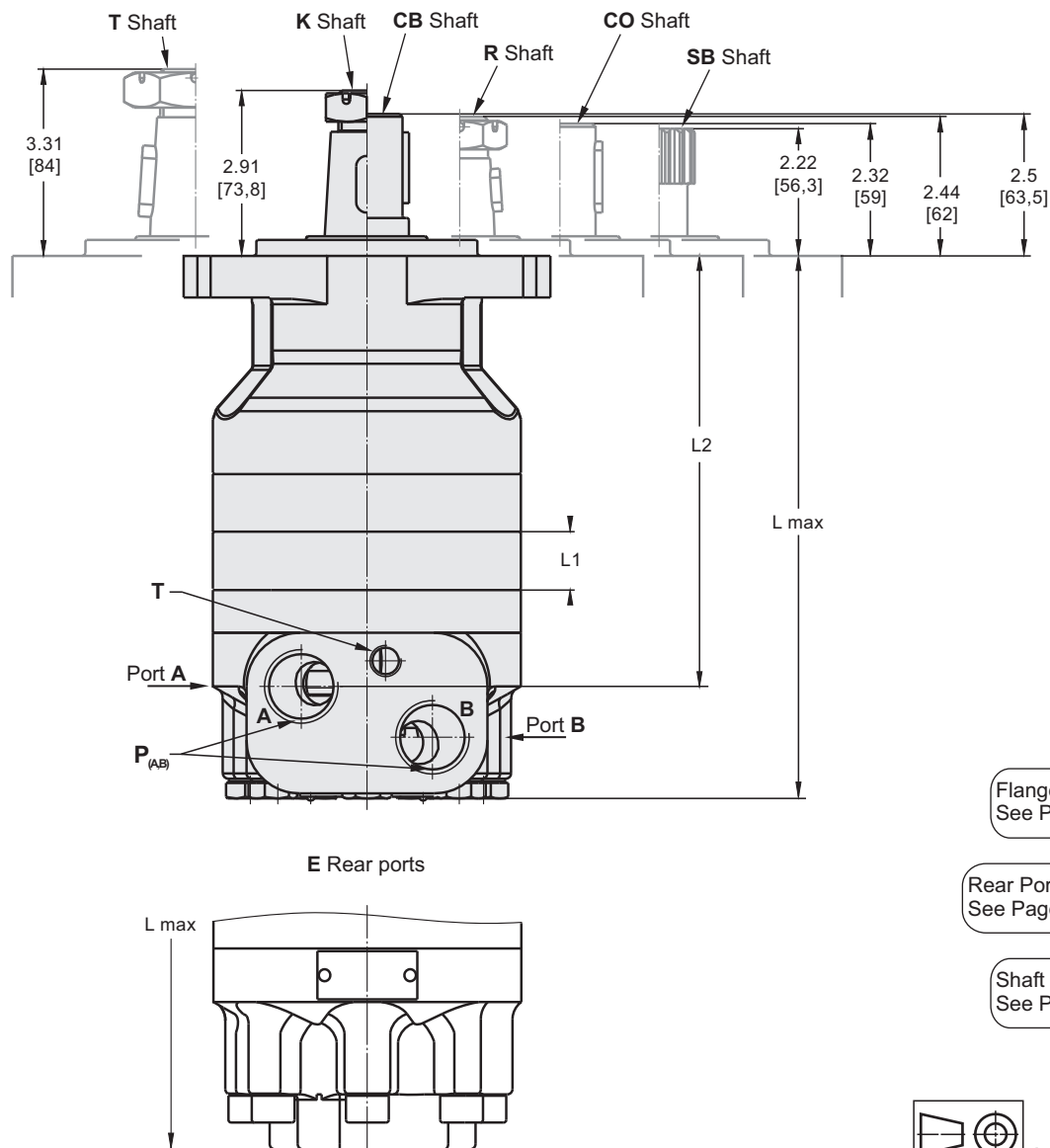
Reverse Rotation

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

	Versions				
	Side			Rear	
	2	3	4	6	8
P _(A,B)	2xG3/4 .67 in [17 mm] depth	2xM27x2 .67 in [17 mm] depth	2x1 ¹ / ₁₆ -12UN .59 in [15 mm] depth	2xG1/2 .59 in [15 mm] depth	2x ⁷ / ₈ -14UNF .67 in [17 mm] depth
T	G ¹ / ₄ .472 in [12 mm] depth	M14x1,5 .472 in [12 mm] depth	⁷ / ₁₆ -20UNF .472 in [12 mm] depth	G ¹ / ₄ .472 in [12 mm] depth	⁷ / ₁₆ -20UNF .472 in [12 mm] depth

Type	L _{max} , in [mm]	L ₂ , in [mm]	*L _E , in [mm]	Type	L _{max} , in [mm]	L ₂ , in [mm]	*L _E , in [mm]	L ₁ , in [mm]
MTKW160	6.41 [162,7]	4.74 [120,3]	6.94 [176,3]	MTKC160	8.00 [203,2]	6.33 [160,8]	8.54 [216,8]	.86 [21,8]
MTKW200	6.64 [168,7]	4.97 [126,3]	7.18 [182,3]	MTKC200	8.24 [209,2]	6.57 [166,8]	8.77 [222,8]	1.09 [27,8]
MTKW250	6.92 [175,7]	5.25 [133,3]	7.45 [189,3]	MTKC250	8.51 [216,2]	6.84 [173,8]	9.05 [229,8]	1.37 [34,8]
MTKW315	7.22 [183,4]	5.59 [142,0]	7.79 [198,0]	MTKC315	8.85 [224,9]	7.19 [182,5]	9.39 [238,5]	1.71 [43,5]
MTKW400	7.70 [195,7]	6.04 [153,3]	8.24 [209,3]	MTKC400	9.29 [236,2]	7.63 [193,8]	9.83 [249,8]	2.16 [54,8]
MTKW470	8.12 [205,9]	6.44 [163,5]	8.64 [219,5]	MTKC470	9.70 [246,4]	8.03 [204,0]	10.24 [260,0]	2.56 [65,0]
MTKW500	8.24 [209,3]	6.61 [167,9]	8.81 [223,9]	MTKC500	9.87 [250,8]	8.20 [208,4]	10.41 [264,4]	2.73 [69,4]

DIMENSIONS - MTK F



Flange Dim.
See Page 14

Rear Ports Dim.
See Page 15

Shaft Dim.
See Page 16



Warning: Drain line should always be used (if no check valves)!

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

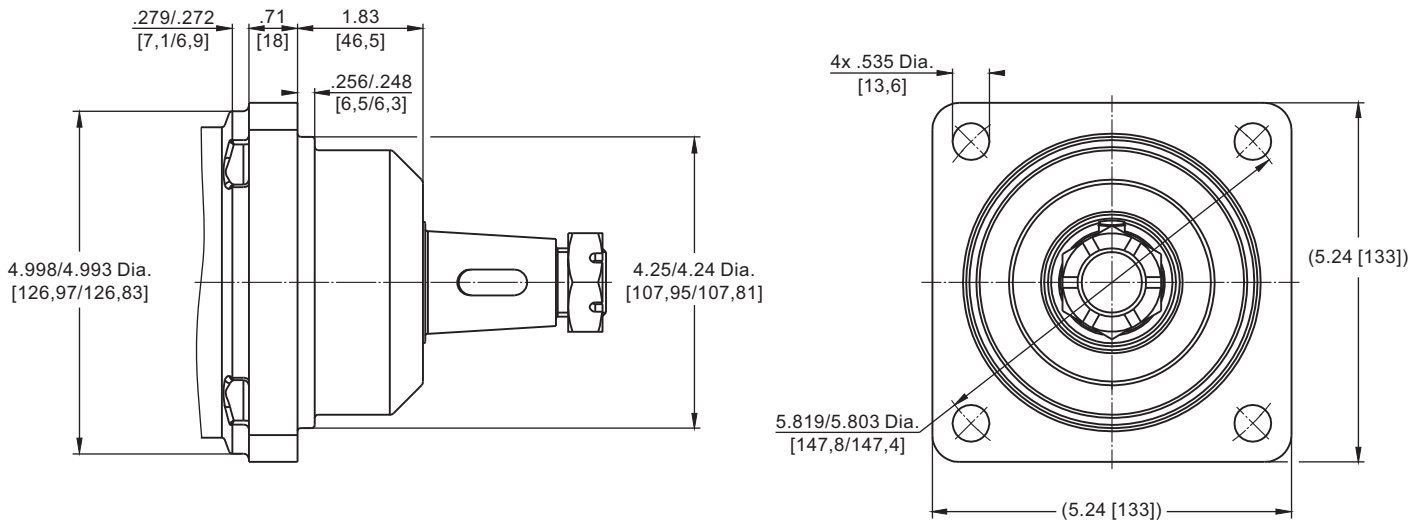
Reverse Rotation
 Viewed from Shaft End
 Port **A** Pressurized - **CCW**
 Port **B** Pressurized - **CW**

	Versions				
	Side			Rear	
	2	3	4	6	8
P_(A,B)	2xG3/4 .67 in [17 mm] depth	2xM27x2 .67 in [17 mm] depth	2x1 ¹ / ₁₆ -12UN .59 in [15 mm] depth	2xG1/2 .59 in [15 mm] depth	2x ⁷ / ₈ -14UNF .67 in [17 mm] depth
T	G ¹ / ₄ .472 in [12 mm] depth	M14x1,5 .472 in [12 mm] depth	⁷ / ₁₆ -20UNF .472 in [12 mm] depth	G ¹ / ₄ .472 in [12 mm] depth	⁷ / ₁₆ -20UNF .472 in [12 mm] depth

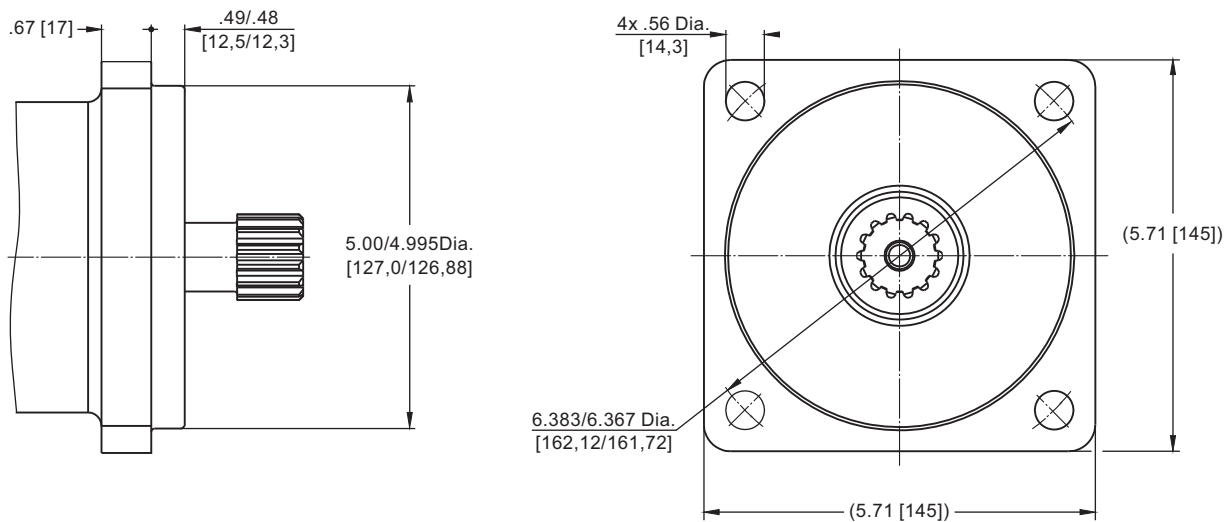
Type	L _{max} , in [mm]	L ₂ , in [mm]	*L _E , in [mm]	L ₁ , in [mm]
MTKF 160	8.00 [203,2]	6.33 [160,8]	8.54 [216,8]	.86 [21,8]
MTKF 200	8.24 [209,2]	6.57 [166,8]	8.77 [222,8]	1.09 [27,8]
MTKF 250	8.51 [216,2]	6.84 [173,8]	90.5 [229,8]	1.37 [34,8]
MTKF 315	8.85 [224,9]	7.19 [182,5]	9.39 [238,5]	1.71 [43,5]
MTKF 400	9.29 [236,2]	7.63 [193,8]	9.83 [249,8]	2.16 [54,8]
MTKF 470	9.70 [246,4]	8.03 [204,0]	10.24 [260,0]	2.56 [65,0]
MTKF 500	9.87 [250,8]	8.20 [208,4]	10.41 [264,4]	2.73 [69,4]

MOUNTING

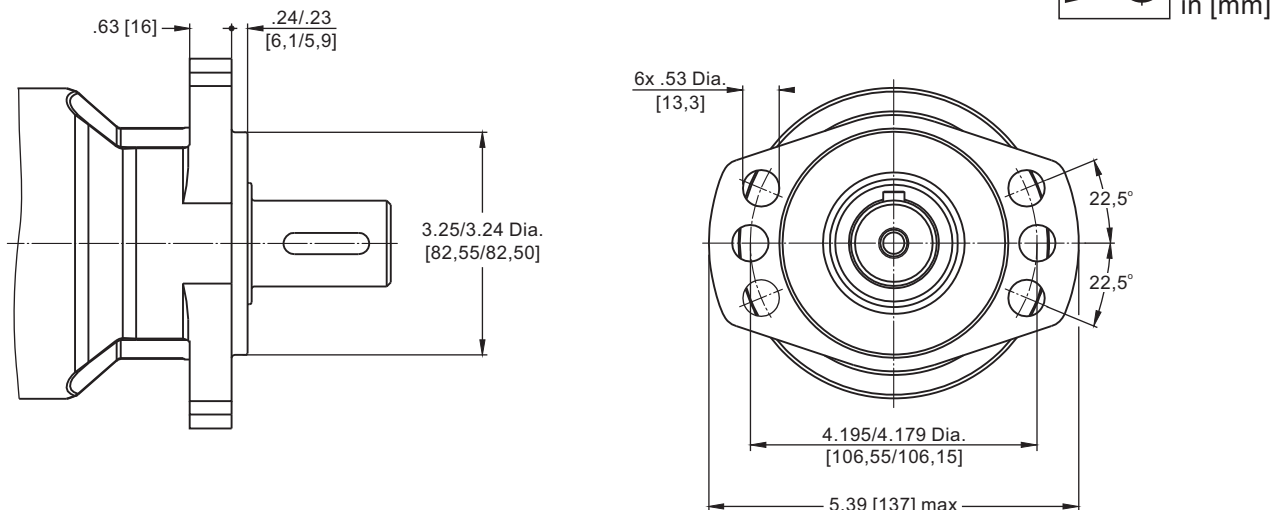
W Wheel Mount (4 Holes)



C Square Mount (4 Holes)

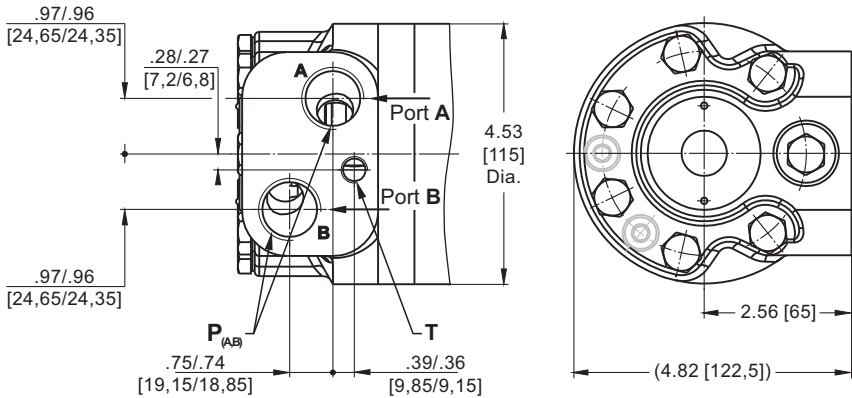


F Magneto Mount (6 Holes)

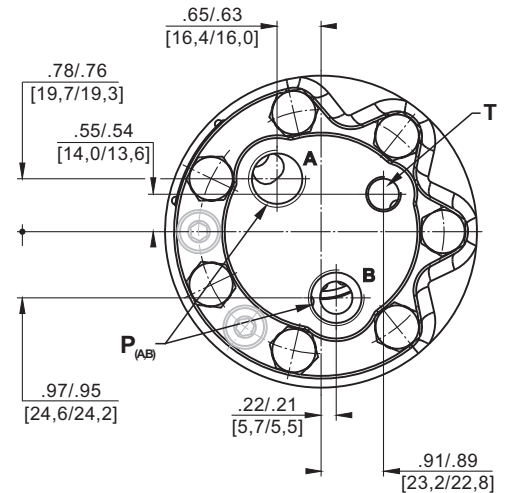


PORTS

Versions **2** **3** **4**



Versions **6** **8**

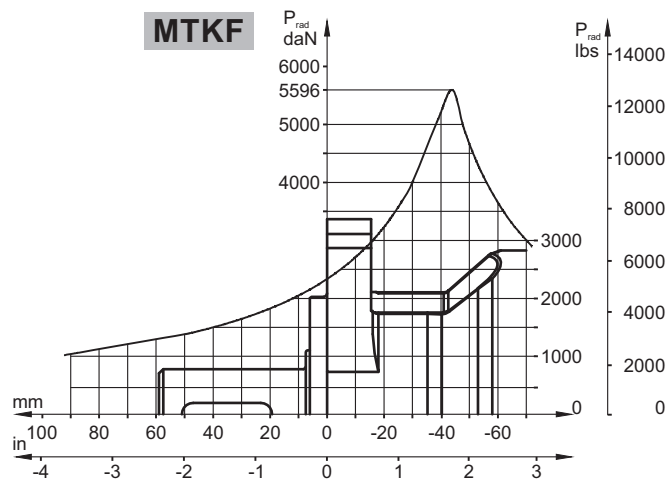


	Versions				
	Side			Rear	
	2	3	4	6	8
P_(A,B)	2xG3/4 .67 in [17 mm] depth	2xM27x2 .67 in [17 mm] depth	2x1 ¹ / ₁₆ -12UN .59 in [15 mm] depth	2xG1/2 .59 in [15 mm] depth	2x ⁷ / ₈ -14UNF .67 in [17 mm] depth
T	G ¹ / ₄ .472 in [12 mm] depth	M14x1,5 .472 in [12 mm] depth	⁷ / ₁₆ -20UNF .472 in [12 mm] depth	G ¹ / ₄ .472 in [12 mm] depth	⁷ / ₁₆ -20UNF .472 in [12 mm] depth



PERMISSIBLE SHAFT LOADS

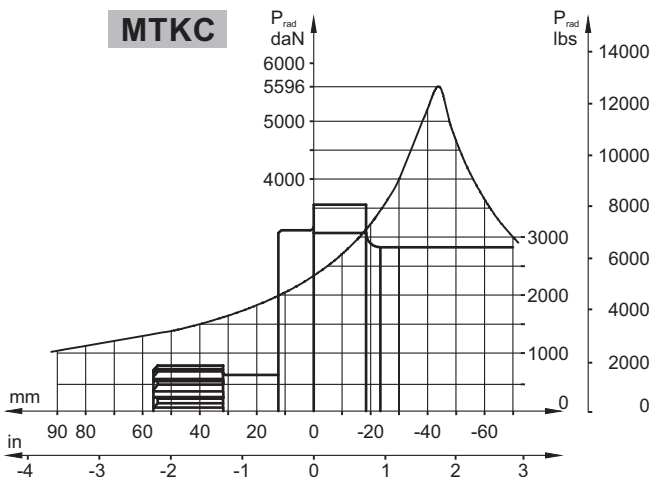
MTKF



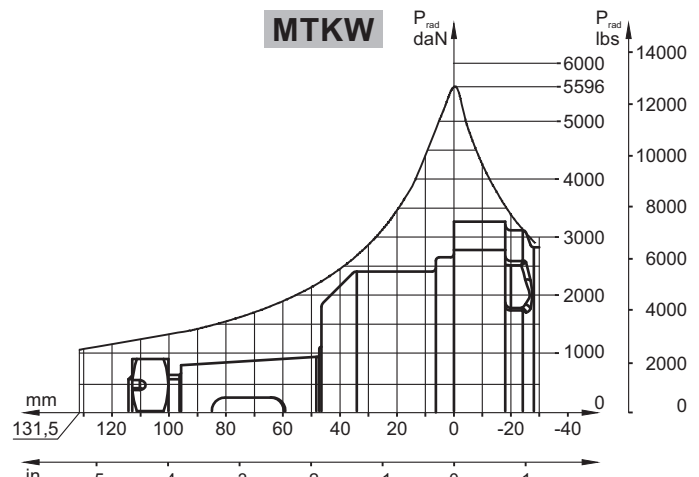
The curves apply to a B10 bearing life (ISO281) of 2000 hours at 100 RPM.

The curves apply to a B10 bearing life (ISO281) of 2000 hours at 100 RPM.

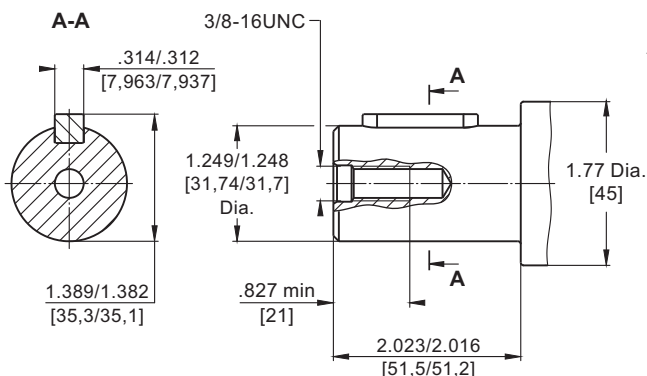
MTKC



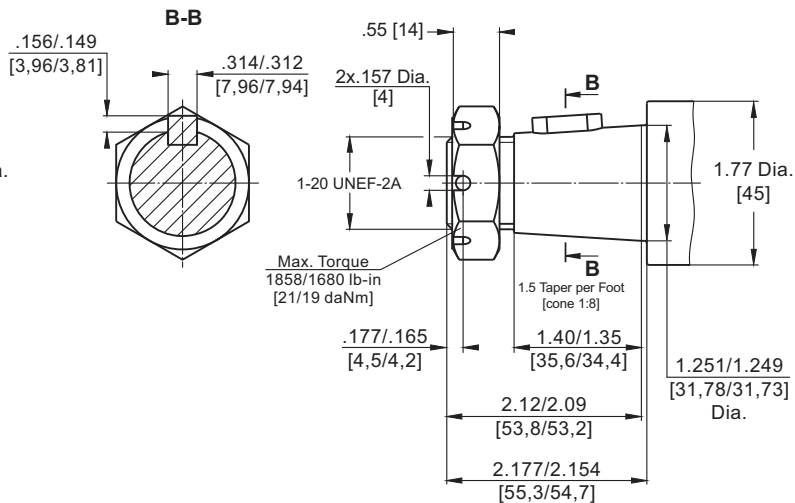
MTKW



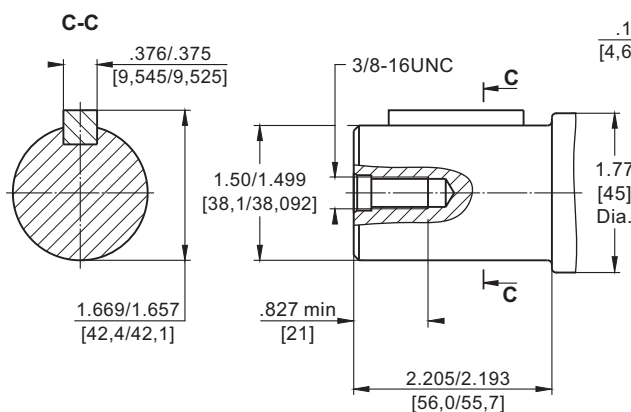
CO - $\varnothing 1\frac{1}{4}$ " [31,75] straight, Parallel key $\frac{5}{16}" \times \frac{5}{16}" \times 1\frac{1}{4}"$
Max. Torque 77 daNm [6815 lb-in]



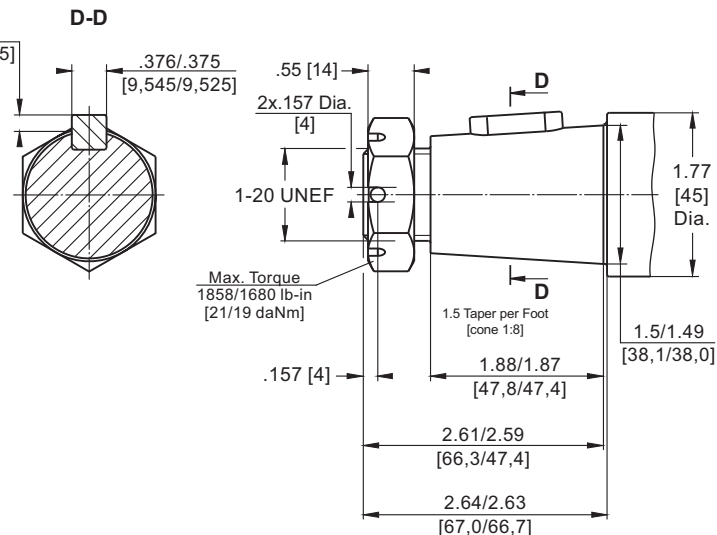
R - $\varnothing 1\frac{1}{4}$ " [31,75] tapered 1:8, Parallel key $\frac{5}{16}" \times \frac{5}{16}" \times \frac{3}{4}"$
Max. Torque 77 daNm [6815 lb-in]



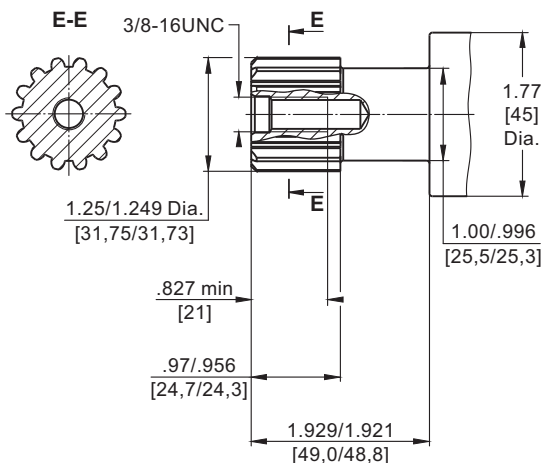
CB - $\varnothing 1\frac{1}{2}$ " [38,1] straight, Parallel key $\frac{3}{8}" \times \frac{3}{8}" \times 1\frac{1}{4}"$ BS46
Max. Torque 132,8 daNm [11755 lb-in]



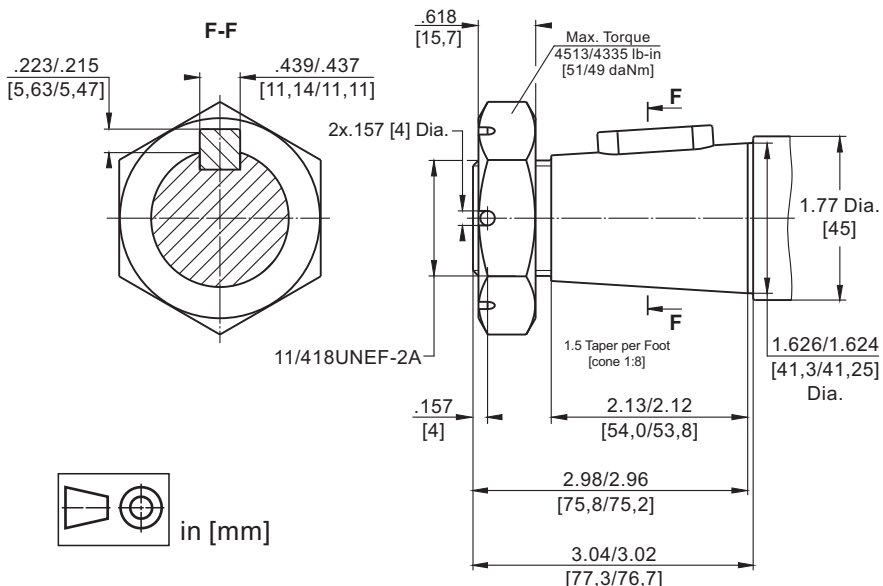
K - $1\frac{1}{2}"$ [38,1] tapered 1:8, Parallel key $\frac{3}{8}" \times \frac{3}{8}" \times 1"$
Max. Torque 89 daNm [7878 lb-in]



SB - $\varnothing 1\frac{1}{4}$ " [31,75] 14T splined ANSI B92.1-1970, 12/24
Max. Torque 77 daNm [6815 lb-in]

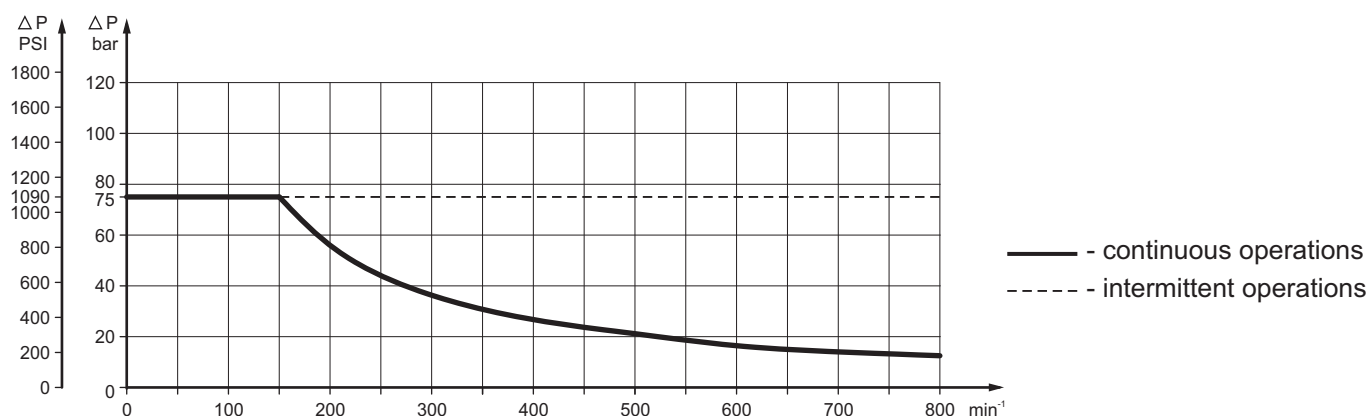


T - $\varnothing 1\frac{1}{16}"$ [41,275] tapered 1:8, Parallel key $\frac{7}{16}" \times \frac{7}{16}" \times 1\frac{1}{4}"$
Max. Torque 100 daNm [8850 lb-in]



MAX. PERMISSIBLE SHAFT SEAL PRESSURE for MTK motors

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



ORDER CODE

	1	2	3	4	5	6	7	8
MTK							HD	

Pos.1 - Mounting Flange

- W** - 4-Bolt flange, Wheel Motor spigot diameter 2.25 in [107,9 mm] - BC 5.81 in [147,6 mm]
- C** - 4-Bolt flange, spigot diameter 4.99 in [127 mm] - BC 6.375 in [161,92 mm]
- F** - Bolt flange, spigot diameter 3.25 in [82,5mm] - BC 4.19 in [106,35 mm]

Pos.2 - Port type

- omit - Side ports
- E** - Rear ports

Pos.3 - Displacement code

- 160** - 9.63 in³/rev [157,9 cm³/rev]
- 200** - 12.28 in³/rev [201,3 cm³/rev]
- 250** - 15.38 in³/rev [252,2 cm³/rev]
- 315** - 19.20 in³/rev [314,9 cm³/rev]
- 400** - 24.20 in³/rev [396,8 cm³/rev]
- 470** - 28.70 in³/rev [470,5 cm³/rev]
- 500** - 30.65 in³/rev [502,4 cm³/rev]

CB - ø1½" [38,1] straight, Parallel key 3/8"x3/8"x1¼" B S46

Pos.4 - Shaft Extensions*

- CO** - ø1.25" [31,75] straight, Parallel key 5/16"x5/16"x1 1/4", 3/8-16 UNC
- CB** - ø1.5" [38,1] straight, Parallel key 3/8"x3/8"x1 1/4" BS46
- SB** - ø1.25" [31,75] 14T Splined ANSI B92.1-1970, 12/24, 3/8-16 UNC
- R** - ø1.25" [31,75] Tapered 1:8, Parallel key 5/16"x5/16"x3/4", 1-20 UNEF
- K** - ø1.5" [38,1] Tapered 1:8, Parallel key 3/8"x3/8"x1", 1-20 UNEF
- T** - ø1.625" [41,275] Tapered 1:8, Parallel key 7/16"x7/16"x1 1/4", 1 1/4-18 UNEF

Pos.5 - Port Size/Type

- 2** - side ports, 2xG 3/4, G1/4 BSP (ISO 228)
- 3** - side ports, 2xM27x2, M14x1,5 - 6H (ISO 262)
- 4** - side ports, 2x1 1/16-12 UN, 7/16-20 UNF
- 6** - rear ports, 2xG 1/2, G1/4 BSP (ISO 228)
- 8** - rear ports, 2x7/8-14 UNF, 7/16-20 UNF

Pos.6 - Check Valves

- omit - without check valves
- 1** - with check valves

Pos.7 - Additional Options

- HD** - Reinforced motor HD**
- For other **Additional Options** see page 69

Pos.8 - Design Series

- omit - Factory specified

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

** Drain line should always be used.

The hydraulic motors are mangano phosphatized as standard.

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.

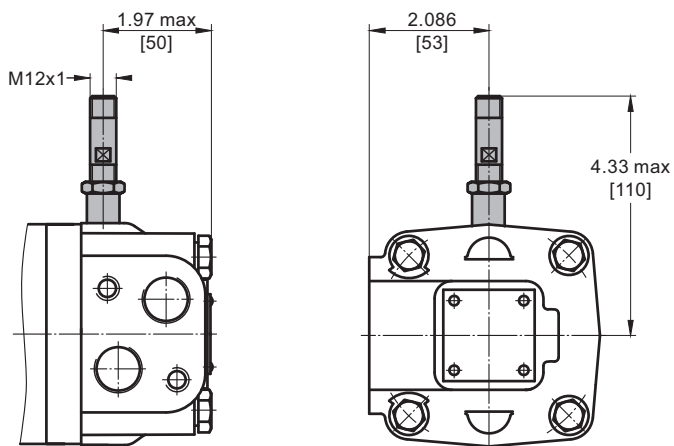
** Colour at customer's request.

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

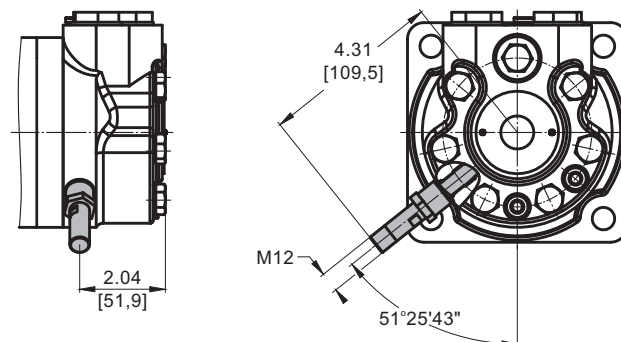
 For more information about **HD** option please contact with "M+S Hydraulic".

MOTORS WITH SPEED SENSOR

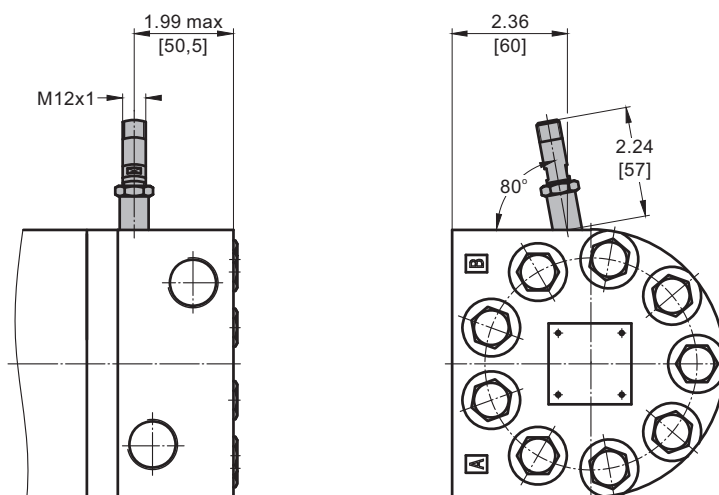
MLHSEM...RS



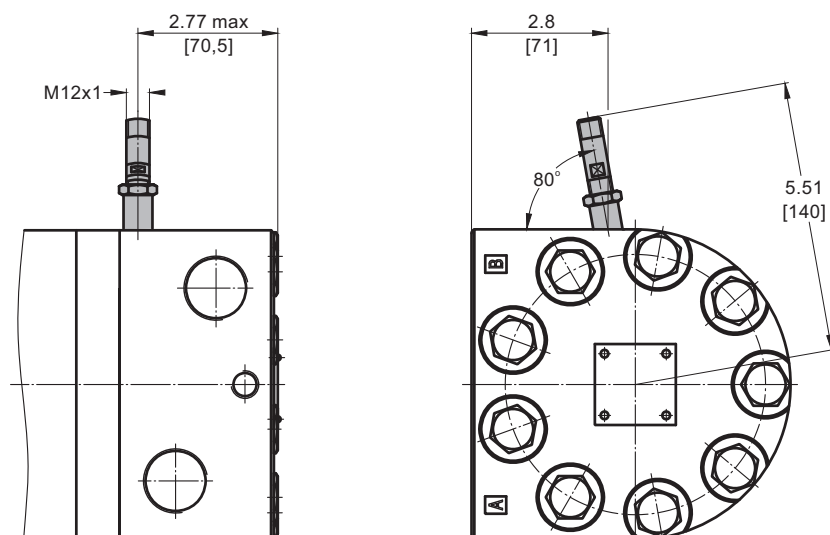
MTK...RS



**MLHTM...RS
TMF...RS**

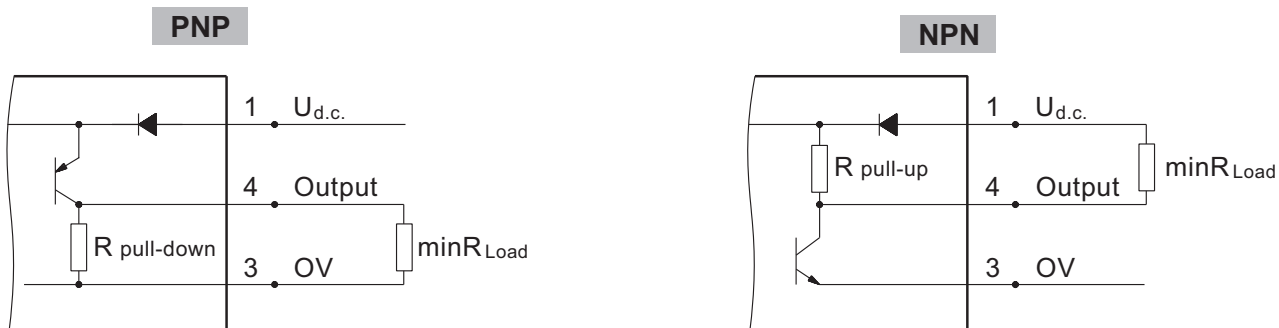


**MVM...RS
VMF...RS**



TECHNICAL DATA of the SPEED SENSOR

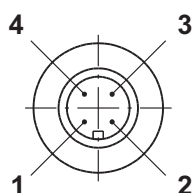
Wiring diagrams



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

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]

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

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

V_{ml} - 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 , 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%	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 , lbs [daN]

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

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

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;

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

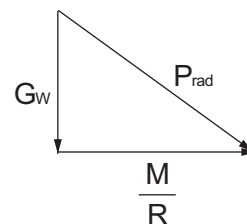
9. Radial motor loading: P_{rad} , lbs [daN]

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

G_w - weight held by wheel;

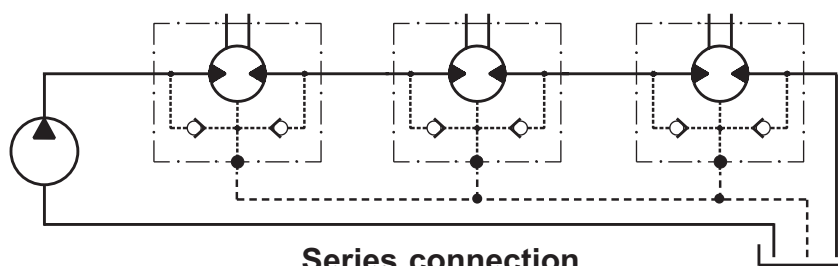
P_{rad} - total radial loading of motor shaft;

M/R - motion force.

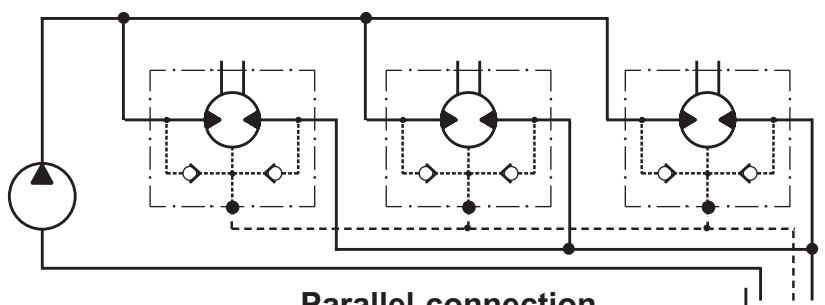


$$P_{rad} = \sqrt{G_w^2 + \left(\frac{M}{R}\right)^2}$$

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



Series connection



Parallel connection