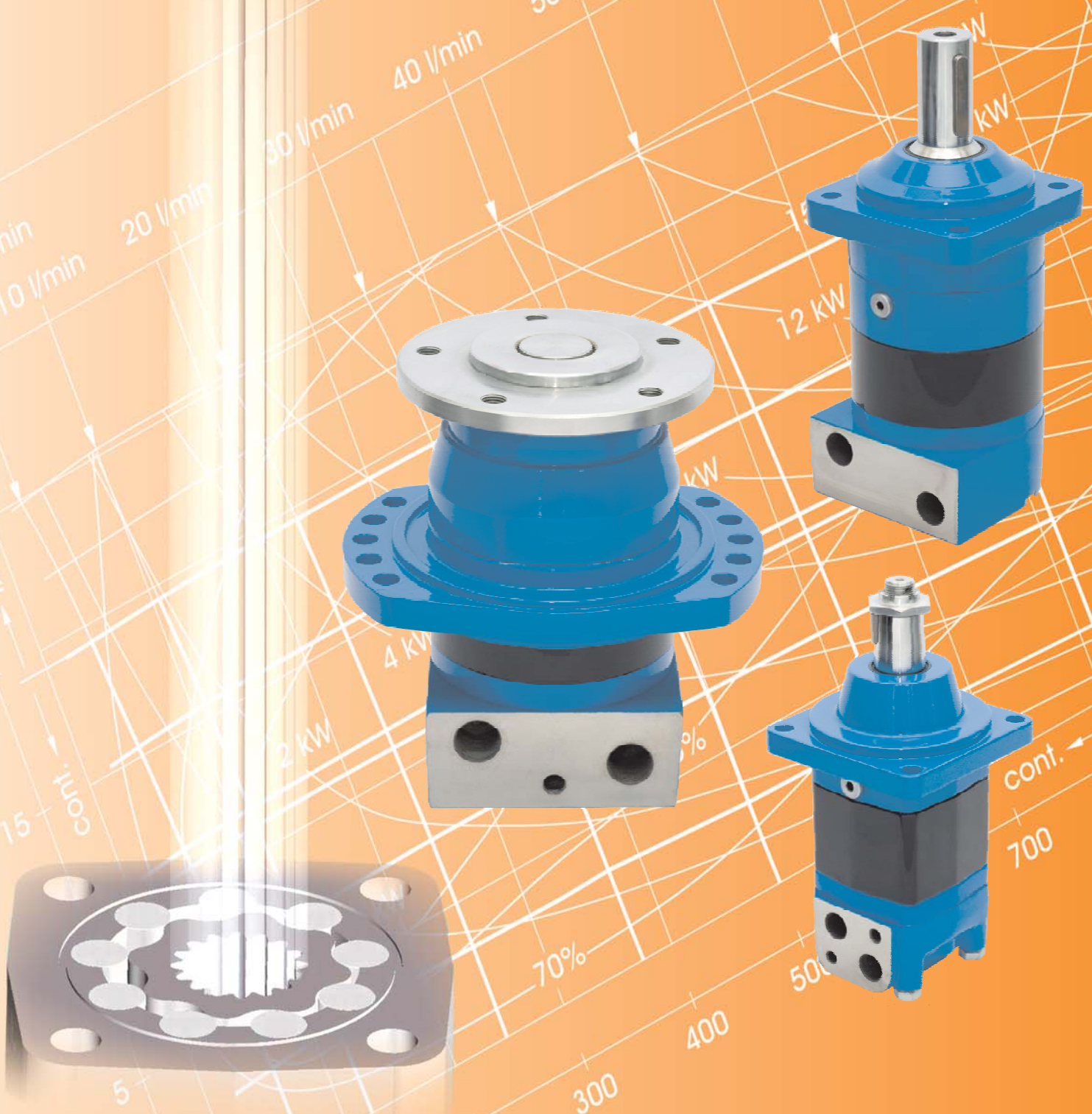




M+S HYDRAULIC



HEAVY DUTY MOTORS



HEAVY DUTY HYDRAULIC MOTORS

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DISC VALVE HYDRAULIC MOTORS

GENERAL INFORMATION:

Orbit motors convert hydraulic energy (pressure, oil flow) into mechanical energy (torque, speed). Hydraulic orbit motors operate on the principle of an internal gear (rotor) rotating within a fixed external gear (stator). The internal gear transmits the torque generated by the application of pressure from hydraulic oil fed into motor which is then delivered via the motor's output shaft. Orbit motors have high starting torque and constant output torque at wide speed range. The output shaft runs on tapered roller bearings and can absorb high axial and radial forces.

DISTRIBUTOR VALVE

MSWM, MTK, MTM, TMF, MVM, MVMC, VMF series motors have disk valve: the distributor valve has been separated from output shaft and is driven by short cardan shaft. A balance plate counterbalances the hydraulic forces around the distributor valve. It gives the motors high efficiency - even at high pressures, and good starting characteristics.

GEAR WHEEL SET

There are two forms of gear wheel set: Gerotor set has plain teeth and Roll-gerotor set with teeth fitted with rollers.

MSWM, MTK, MTM, TMF, MVM, MVMC, VMF series motors have roll-gerotor set. The rollers reduce local stress and the tangential reaction forces on the rotor reducing friction to a minimum. This gives long operating life and better efficiency even at continuous high pressures.

FEATURES:

Standard Motor

The standard motor mounting flange is located as close to the output shaft as possible. This type of mounting supports the motor close to the shaft load. This mounting flange is also compatible with many standard gear boxes.

Wheel Motor

The wheel motor mounting flange is located near the center of the motor which permits part or all of the motor to be located inside the wheel or roller hub. In traction drive applications, loads can be positioned over the motor bearings for best bearing life. This wheel motor mounting flange provides design flexibility in many applications.

Short Motor

This motor is assembled without the output shaft, bearings and bearing housing and has the same drive components as the standard motors. The short motor is especially suited for applications such as gear boxes, winch, reel and roll drives. Short motor applications must be designed with a bearing supported internal spline to mate with the short motor drive. Product designs using these hydraulic motors provide considerable cost savings.

Low Leakage

LL Series hydraulic motors are designed to operate at the whole standard range of working conditions (pressure drop and frequency of rotation), but with considerable decreased volumetric losses in the drain ports. This motors are suitable for hydraulic systems with series-connected motors with demands for low leakage.

Low Speed Valve

LSV feature optimizes the motor for low-speed performance. Motors with this valving provide very low speed while maintaining high torque. They are designed to run continuously at low speed (up to 200 RPM) at normal pressure drop and reduced flow. Optimal run is guaranteed at frequency of rotation from 20 to 50 RPM. Motors with this valving have an increased starting pressure and are not recommended for using at pressure drop less than 40 bar [580 PSI].

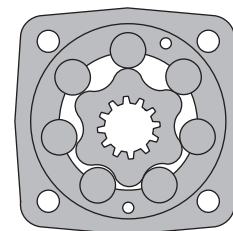
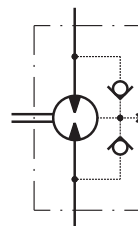
Motors with Speed Sensor

Motors are available with integrated inductive speed sensor. The output signal is a standardized voltage signal that can be used to control the speed of a motor. The torque and the radial load of the motor are not affected by the installation of speed sensor.



APPLICATION

- » Sawmill machines
- » Woodworking machines
- » Metal working machines
- » Agriculture machines
- » Road building machines
- » Mining machinery
- » Food industries
- » Special vehicles etc.



CONTENTS

Specification data	5
Dimensions and mounting	6
Permissible shaft loads	6
Shaft extensions	7
Order code	7

OPTIONS

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

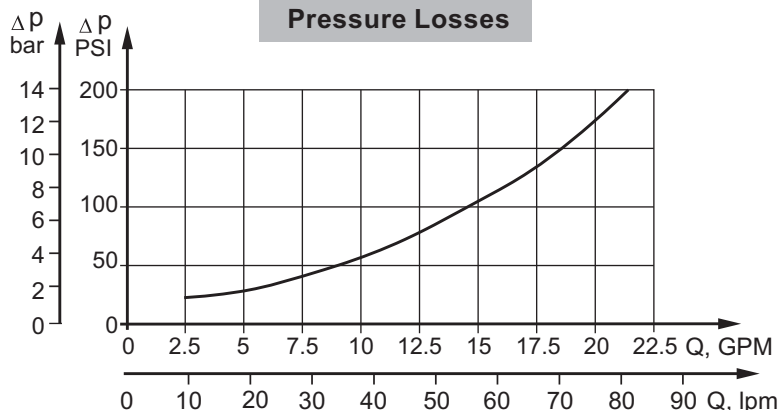
GENERAL

Max. Displacement, cm ³ /rev [in ³ /rev]	397 [24.2]
Max. Speed, [RPM]	560
Max. Torque, daNm [lb-in]	cont.: 90 [7965] int: 110 [9735]
Max. Output, kW [HP]	24 [32.2]
Max. Pressure Drop, bar [PSI]	cont.: 200 [2900] int: 225 [3270]
Max. Oil Flow, lpm [GPM]	90 [24]
Min. Speed, [RPM]	5
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 micron)

Oil flow in drain line

Pressure drop bar [PSI]	Viscosity mm ² /s [SUS]	Oil flow in drain line lpm [GPM]
140 [2030]	20 [98]	1,5 [.396]
	35 [164]	1 [.264]
210 [3045]	20 [98]	3 [.793]
	35 [164]	2 [.528]

Pressure Losses



SPECIFICATION DATA

Type		MSWM 160	MSWM 200	MSWM 250	MSWM 315	MSWM 400
Displacement, cm ³ /rev [in ³ /rev]		159,7 [9.74]	200 [12.2]	250 [15.3]	314,9 [19.2]	397 [24.2]
Max. Speed, [RPM]	Cont.	470	375	300	240	185
	Int.*	560	450	360	285	225
Max. Torque daNm [lb-in]	Cont.	46 [4070]	56,6 [5010]	70,8 [6270]	90,0 [7965]	90,0 [7965]
	Int.*	51,5 [4560]	64,5 [5710]	80,6 [7135]	96,0 [8500]	97,0 [8585]
	Peak**	51,5 [4560]	65 [5755]	80,6 [7135]	108 [9560]	110 [9735]
Max. Output kW [HP]	Cont.	18,6 [24.9]	18,1 [24.3]	18,0 [24.1]	17,0 [22.8]	11,0 [14.7]
	Int.*	24,0 [32.2]	24,0 [32.2]	23,8 [31.9]	20,2 [27.1]	12 [16.1]
Max. Pressure Drop bar [PSI]	Cont.	200 [2900]	200 [2900]	200 [2900]	200 [2900]	160 [2320]
	Int.*	225 [3270]	225 [3270]	225 [3270]	220 [3190]	175 [2540]
	Peak**	225 [3270]	225 [3270]	225 [3270]	225 [3270]	200 [2900]
Max. Oil Flow lpm [GPM]	Cont.	75 [20]	75 [20]	75 [20]	75 [20]	75 [20]
	Int.*	90 [24]	90 [24]	90 [24]	90 [24]	90 [24]
Max. Inlet Pressure bar [PSI]	Cont.	210 [3045]	210 [3045]	210 [3045]	210 [3045]	210 [3045]
	Int.*	250 [3625]	250 [3625]	250 [3625]	250 [3625]	250 [3625]
	Peak**	300 [4350]	300 [4350]	300 [4350]	300 [4350]	300 [4350]
Max. Return Pressure with Drain Line bar [PSI]	Cont.	140 [2030]	140 [2030]	140 [2030]	140 [2030]	140 [2030]
	Int.*	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]
	Peak**	210 [3045]	210 [3045]	210 [3045]	210 [3045]	210 [3045]
Max. Starting Pressure with Unloaded Shaft, bar [PSI]		10 [145]	10 [145]	10 [145]	10 [145]	10 [145]
Min. Starting Torque daNm [lb-in]		36,9 [3270]	46,2 [4090]	58,0 [5135]	73,8 [6530]	72,0 [6370]
Min. Speed***, [RPM]		6	6	6	5	5
Weight, kg [lb]		15,3 [33.7]	15,7 [34.6]	16,2 [35.7]	16,9 [37.3]	17,8 [39.2]

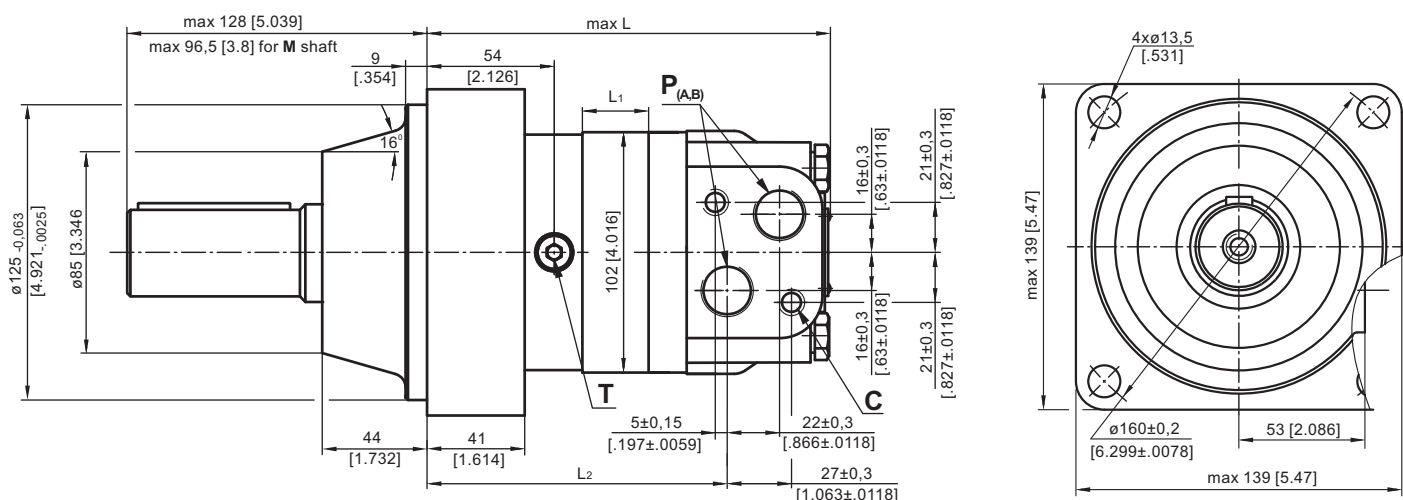
* Intermittent operation: the permissible values may occur for max. 10% of every minute.

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

*** For speeds 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.

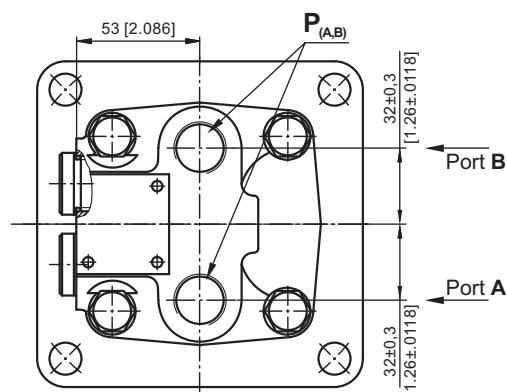
DIMENSIONS AND MOUNTING DATA



C: 2xM10-12 mm [.47 in] depth
P_(A,B): 2xG1/2 or 2xM22x1,5-15 mm [.59 in] depth
T: G ¼ or M14x1,5- 12 mm [.47 in] depth (plugged)

Type	L, mm [in]	L ₂ , mm [in]	L ₁ , mm [in]
MSWM 160	170,5[6.71]	129,3[5.09]	27,8 [1.09]
MSWME 160	177,5[6.99]		
MSWM 200	177,5[6.99]	136,3[5.37]	34,8 [1.37]
MSWME 200	184,5[7.26]		
MSWM 250	186,0[7.32]	145,0[5.71]	43,5 [1.71]
MSWME 250	193,0[7.60]		
MSWM 315	197,5[7.78]	157,3[6.19]	54,8 [2.16]
MSWME 315	206,5[8.13]		
MSWM 400	212,0[8.35]	171,0[6.73]	69,4 [2.73]
MSWME 400	219,0[8.62]		

E Rear Ports



Standard Rotation

Viewed from Shaft End

Port A Pressurized - CW

Port B Pressurized - CCW

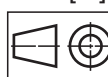
Reverse Rotation

Viewed from Shaft End

Port A Pressurized - CCW

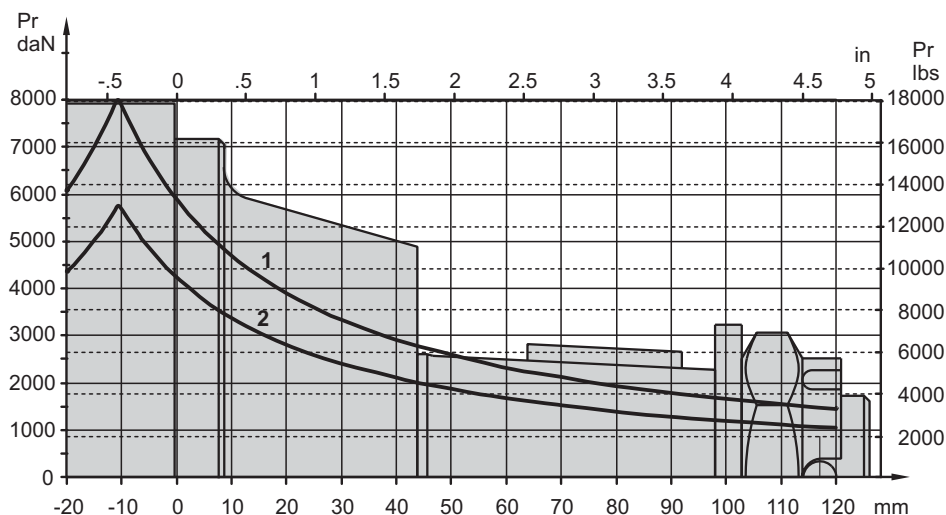
Port B Pressurized - CW

mm [in]



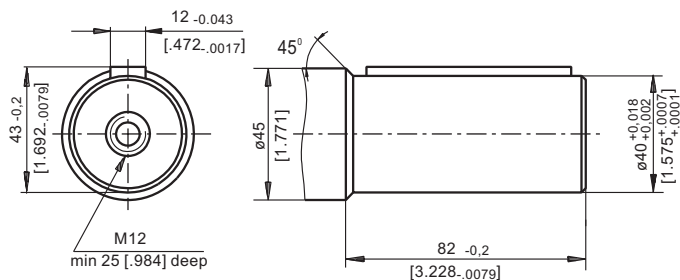
PERMISSIBLE SHAFT LOADS

The output shaft runs in tapered bearings that permit high axial and radial forces. Curve "1" shows max. radial shaft load at bearing life of 2000 hours at 100 RPM. Curve "2" shows max. radial shaft load at bearing life of 3000 hours at 200 RPM.

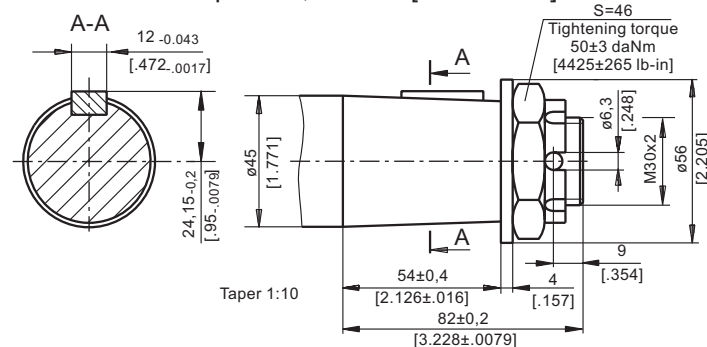


SHAFT EXTENSIONS

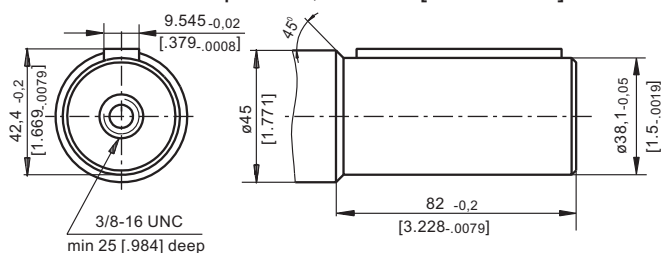
C - $\varnothing 40$ straight, Parallel key A12x8x70 DIN 6885
Max. Torque 132,8 daNm [11755 lN-in]



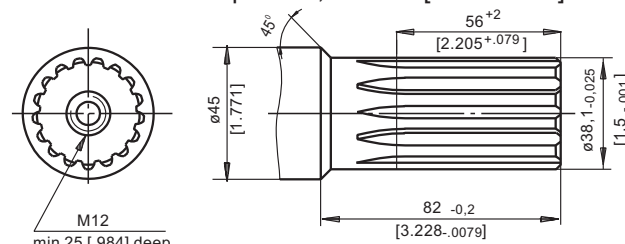
K - tapered 1:10, Parallel key B12x8x28 DIN 6885
Max. Torque 210,7 daNm [18650 lN-in]



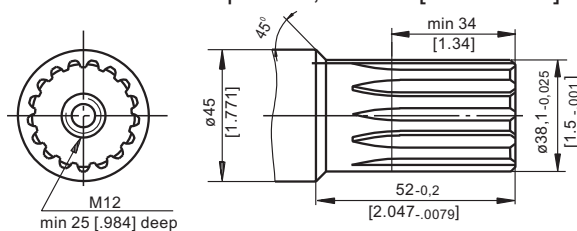
CO - $\varnothing 1\frac{1}{2}$ " straight, Parallel key $\frac{3}{8}$ "x $\frac{3}{8}$ "x $2\frac{1}{4}$ " BS46
Max. Torque 132,8 daNm [11755 lN-in]



SH - $\varnothing 1\frac{1}{2}$ " splined 17T, DP 12/24 ANSI B92.1-1976
Max. Torque 132,8 daNm [11755 lN-in]



M - $\varnothing 1\frac{1}{2}$ " splined 17T, DP 12/24 ANSI B92.1-1976
Max. Torque 132,8 daNm [11755 lN-in]



ORDER CODE

1	2	3	4	5	6
M S W M					

Pos.1 - Port type

omit - Side ports

E - Rear ports

Pos.2 - Displacement code

160 - 159,7 cm³/rev [9.74 in³/rev]

200 - 200,0 cm³/rev [12.20 in³/rev]

250 - 250,0 cm³/rev [15.30 in³/rev]

315 - 314,9 cm³/rev [19.20 in³/rev]

400 - 397,0 cm³/rev [24.20 in³/rev]

Pos.4 - Shaft Extensions*

C - $\varnothing 40$ straight, Parallel key A12x8x70 DIN6885

CO - $\varnothing 1\frac{1}{2}$ " straight, Parallel key $\frac{3}{8}$ "x $\frac{3}{8}$ "x $2\frac{1}{4}$ " BS46

K - $\varnothing 45$ tapered 1:10, Parallel key B12x8x28 DIN6885

SH - $\varnothing 1\frac{1}{2}$ " splined 17T ANS B92.1-1976

M - $\varnothing 1\frac{1}{2}$ " splined 17T ANS B92.1-1976

Pos.4 - Ports

omit - BSPP (ISO 228)

M - Metric (ISO 262)

Pos.5 - Special Features (see page 58)

Pos.6 - Design Series

omit - Factory specified

NOTES:

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

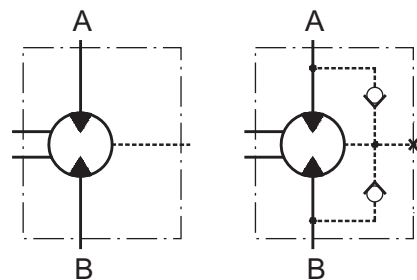
The hydraulic motors are mangano-phosphatized as standard.

HYDRAULIC MOTORS MTK



APPLICATION

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



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Specification data	9
Function diagrams	10÷12
Dimensions and mounting	13÷16
Permissible shaft seal	15
Shaft extensions	17
Permissible shaft loads	18
Order code	18

OPTIONS

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

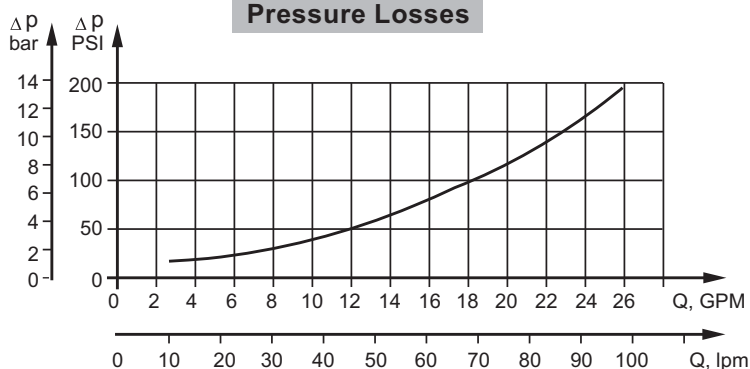
GENERAL

Displacement,	cm ³ /rev [in ³ /rev]	157,9÷502,4 [9.63÷30.7]
Max. Speed,	RPM	159÷505
Max. Torque,	daNm [lb-in]	57÷109 [5045÷9650]
Max. Output,	kW [HP]	22 [30]
Max. Pressure Drop,	bar [PSI]	160÷250 [2320÷3626]
Max. Oil Flow,	lpm [GPM]	80 [21]
Min. Speed,	RPM	5÷10
Permissible Shaft Loads,	daN [lb]	Pa=1000 [2250]
Pressure fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)	
Temperature range,	°C [°F]	-30÷90 [-22÷194]
Optimal Viscosity range,	mm ² /s [SUS]	20÷75 [98÷347]
Filtration	ISO code 20/16 (Min. recommended fluid filtration of 25 micron)	

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		MTK 160	MTK 200	MTK 250	MTK 315	MTK 400	MTK 470	MTK 500
Displacement, cm³/rev [in³/rev]		157,9 [9.63]	201,3 [12.28]	252,2 [15.38]	314,9 [19.2]	396,8 [24.2]	470,5 [28.7]	502,4 [30.65]
Max. Speed, [RPM]	Cont.	505	400	320	255	200	170	159
	Int.*	630	500	400	315	250	210	199
Max. Torque, daNm [lb-in]	Cont.	57 [5045]	72 [6373]	91 [8055]	105 [9293]	107 [9470]	102 [9028]	109 [9648]
	Int.*	72,5 [6420]	92 [8143]	107 [9470]	131 [11595]	140 [12390]	133 [11772]	136 [12037]
Max. Output, kW [HP]	Cont.	22 [29.5]	22 [29.5]	21 [28.2]	20 [26.8]	17,5 [23.5]	14 [18.8]	14 [18.8]
	Int.*	27 [36.2]	27 [36.2]	25 [33.5]	23,5 [31.5]	22 [29.5]	17,5 [23.5]	17 [22.8]
Max. Pressure Drop, bar [PSI]	Cont.	250 [3626]	250 [3626]	250 [3626]	250 [3626]	200 [2900]	160 [2320]	160 [2320]
	Int.*	325 [4714]	325 [4714]	300 [4350]	300 [4350]	250 [3626]	200 [2900]	200 [2900]
Max. Inlet Pressure, bar [PSI]	Cont.	250 [3626]						
	Int.*	350 [5077]						
Max. Oil Flow, lpm [GPM]	Cont.	80 [21.1]						
	Int.*	100 [26.4]						
Max. Starting Pressure with Unloaded Shaft, bar [PSI]		8 [116]	8 [116]	7 [102]	7 [102]	7 [102]	7 [102]	7 [102]
Min. Starting Torque, daNm [lb-in]	at max. pressure							
	drop cont.	43 [3806]	54 [4780]	68 [6020]	79 [6992]	80 [7080]	83 [7346]	84 [7435]
	at max. pressure							
	drop int.*	54.5 [4824]	69 [6107]	80 [7080]	98,5 [8720]	105 [9294]	105 [9294]	105 [9294]
Min. Speed****, RPM		10						
Max. Return Pressure without Drain Line, bar [PSI]		see diagram						
Max. Return Pressure with Drain Line, bar [PSI]	Cont.	140 [2030]						
	Int.*	175 [2540]						
	Peak*	210 [3046]						

* 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.

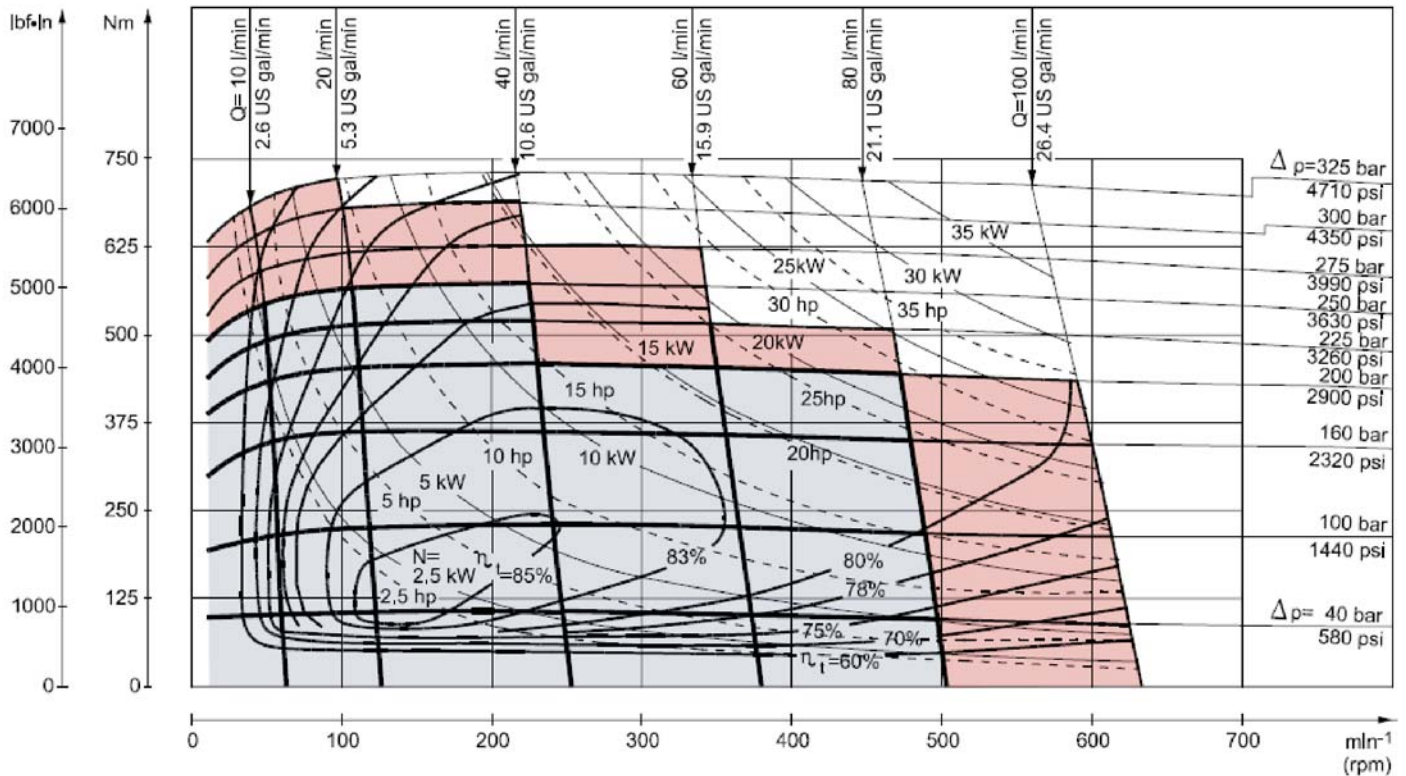
*** For speeds of 5 RPM lower than given, consult factory or your regional manager.

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

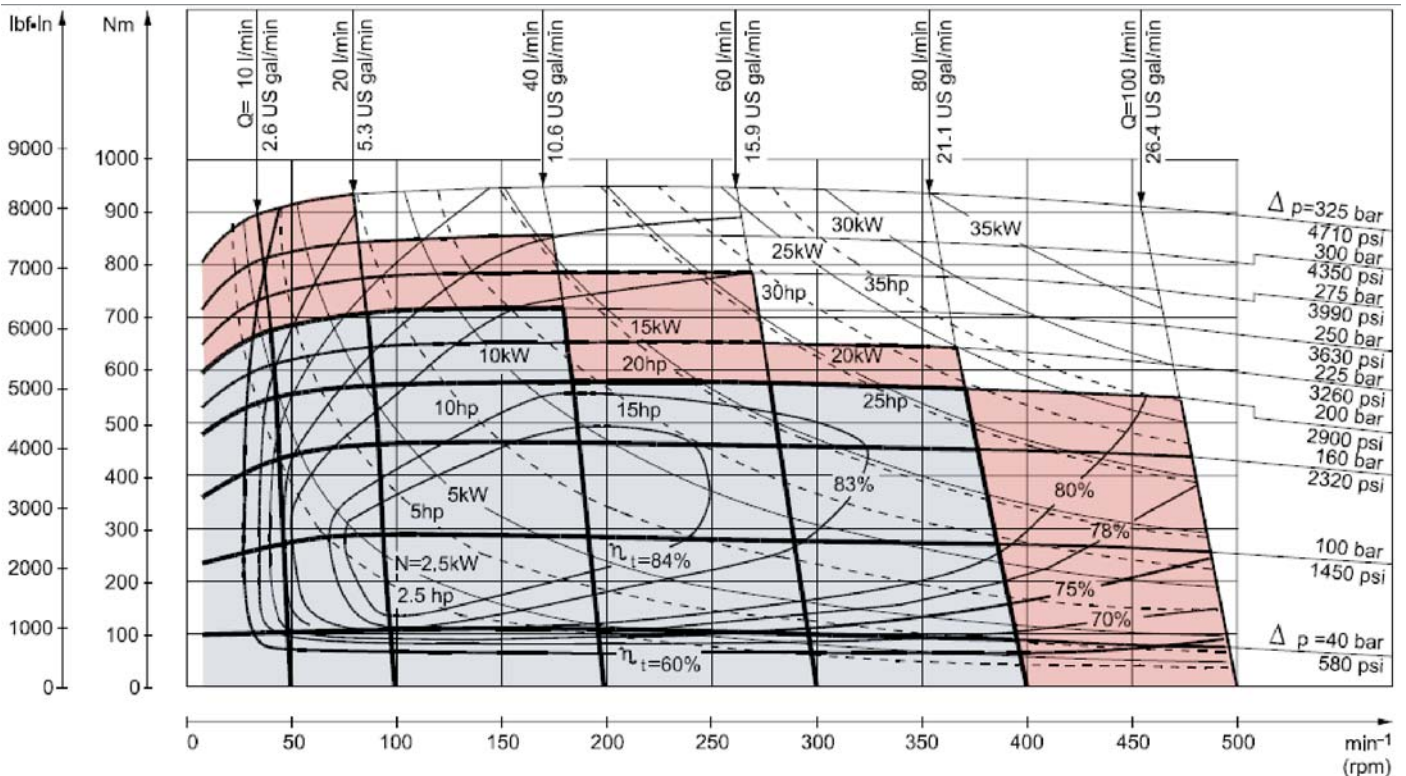
- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil, HLP(DIN51524) or HM(ISO6743/4).
If using synthetic fluids consult the factory for alternative seal materials.
- Recommended minimum oil viscosity 70 SUS [13 cSt/s] at 122°F [50°C].
- Recommended maximum system operating temperature is 180°F [82°C].
- 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



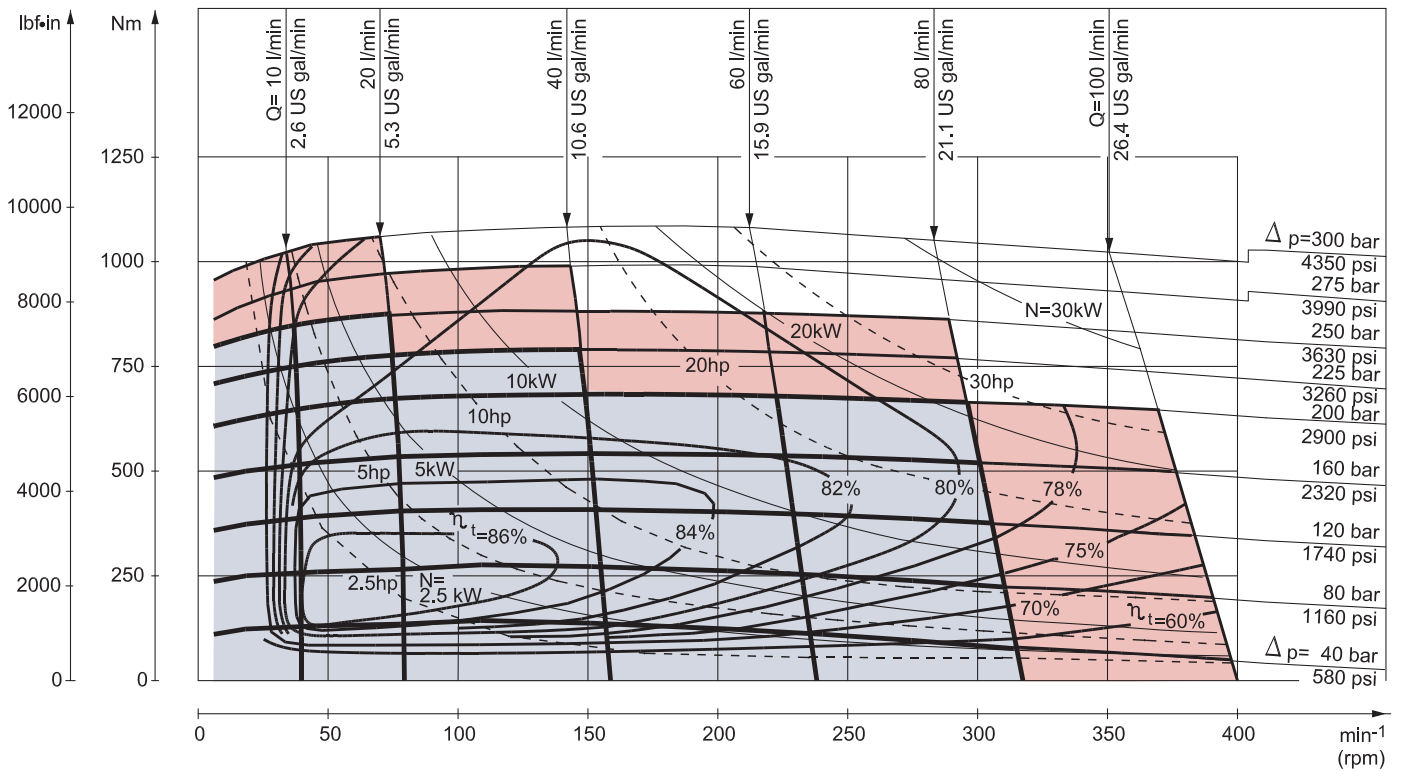
MTK 200



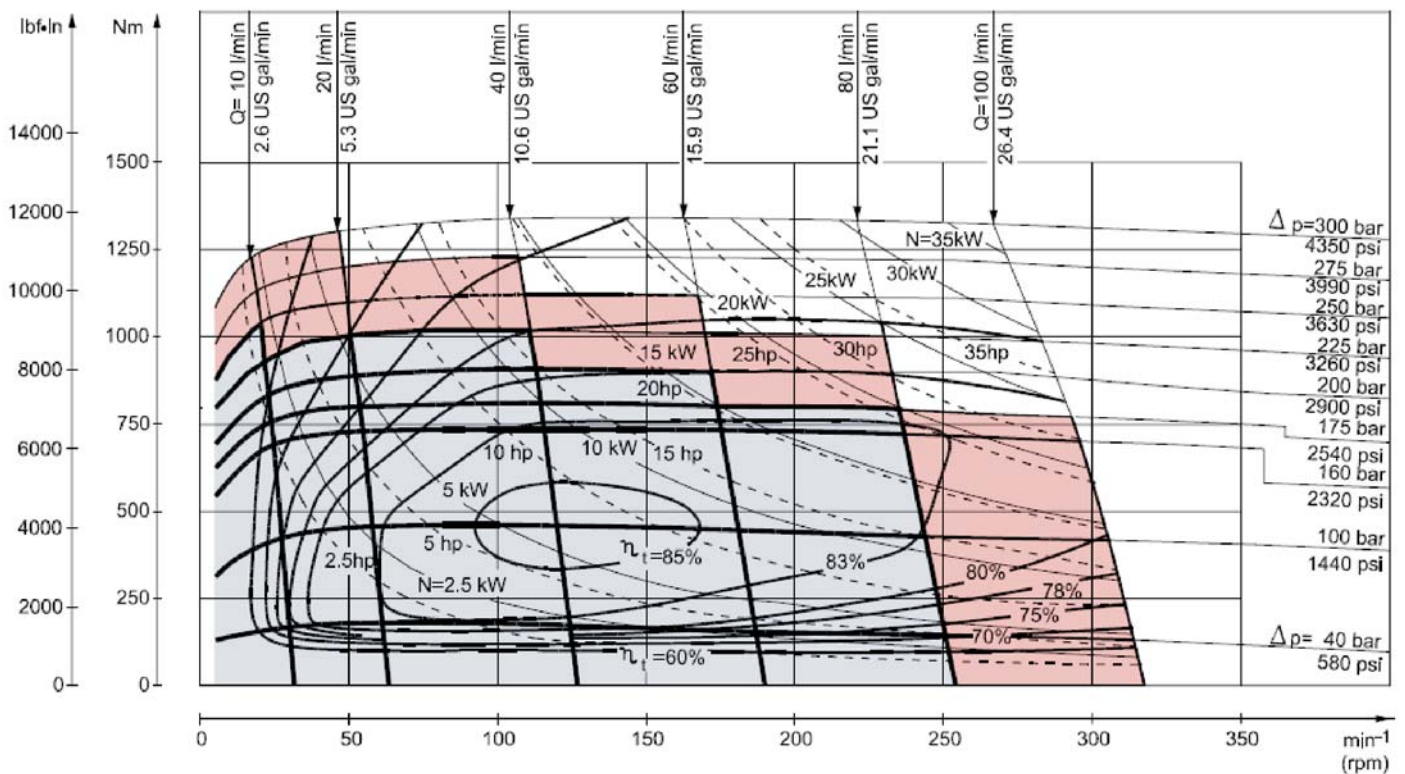
The function diagrams data was collected at back pressure 5±10 bar (72.5PSI±145PSI) and oil with viscosity of 32 mm²/s [150SUS] at 50° C [122°F].

FUNCTION DIAGRAMS

MTK 250



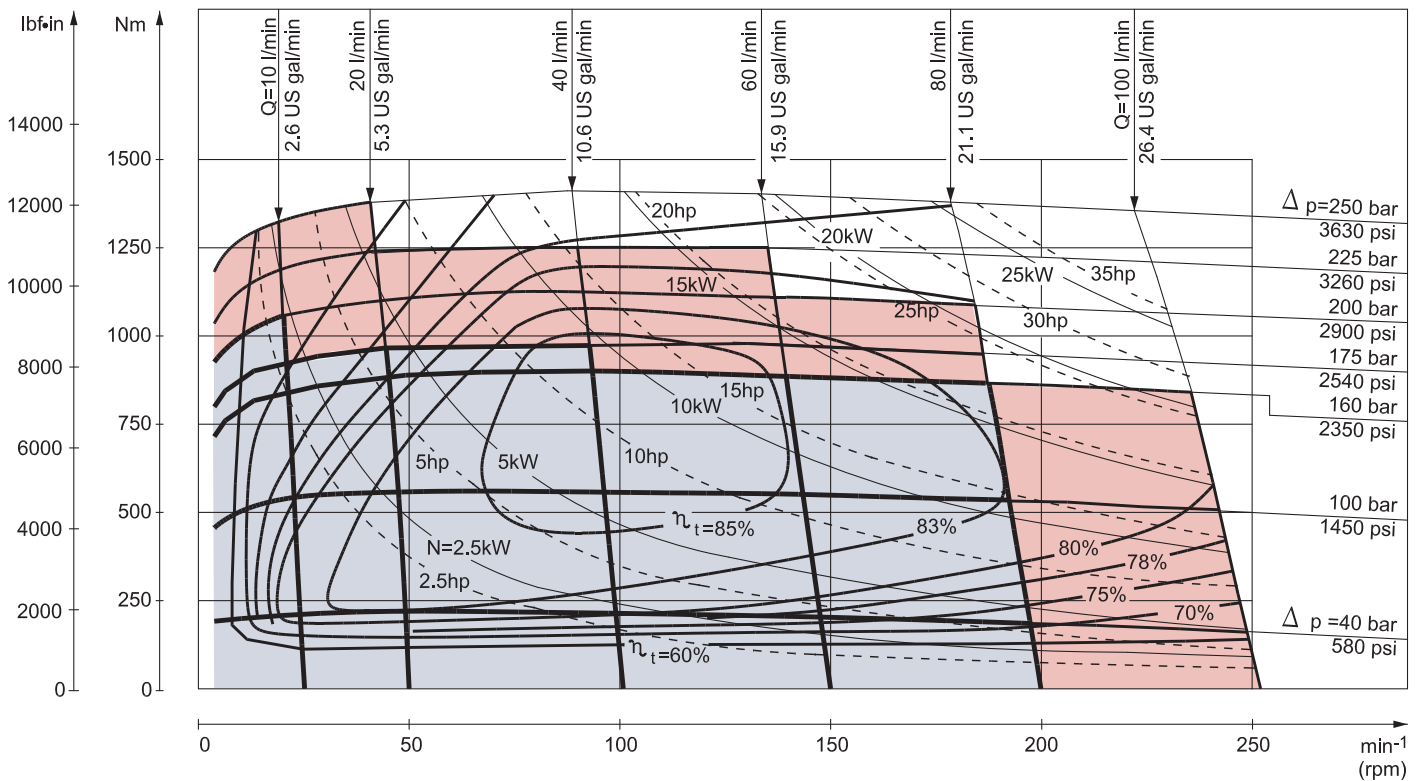
MTK 315



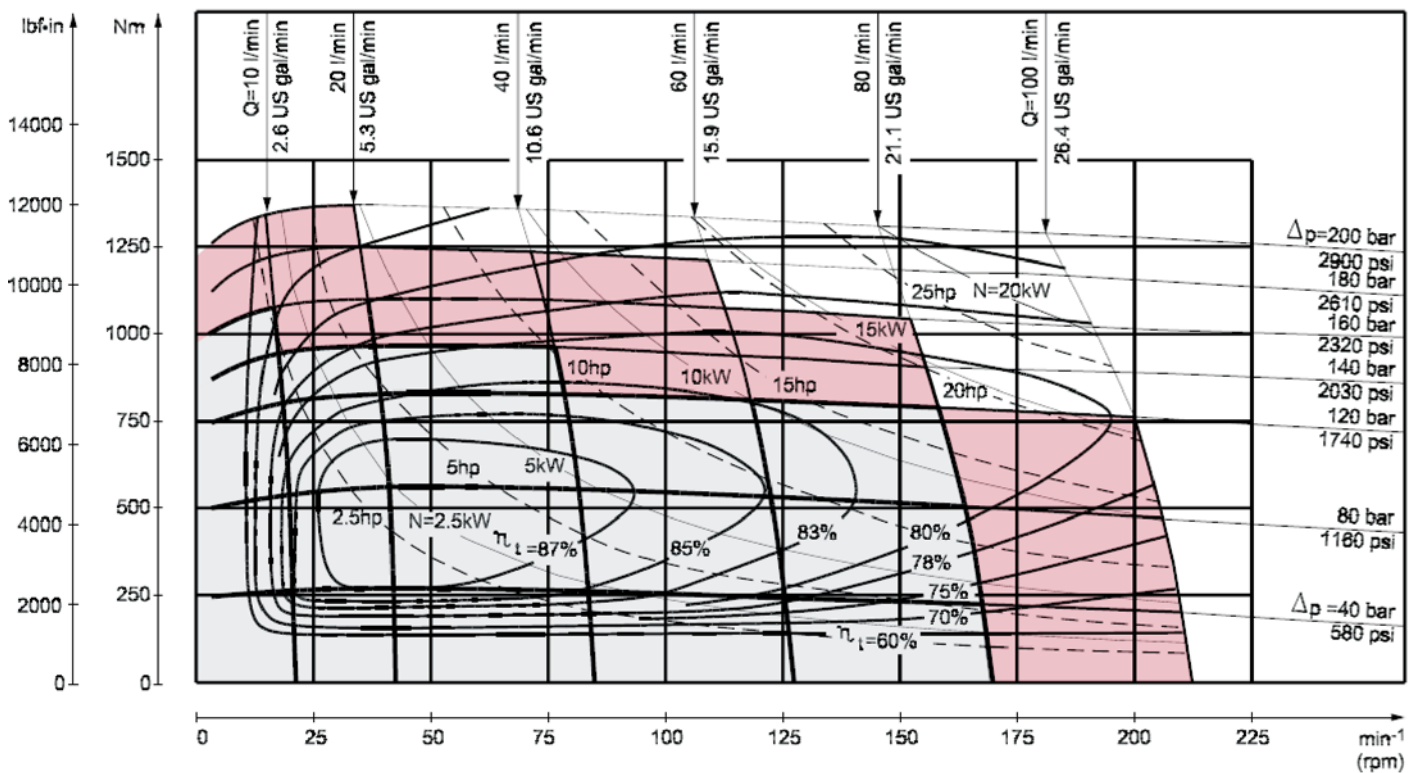
The function diagrams data was collected at back pressure 5÷10 bar (72.5PSI÷145PSI) and oil with viscosity of 32 mm²/s [150SUS] at 50° C [122°F].

FUNCTION DIAGRAMS

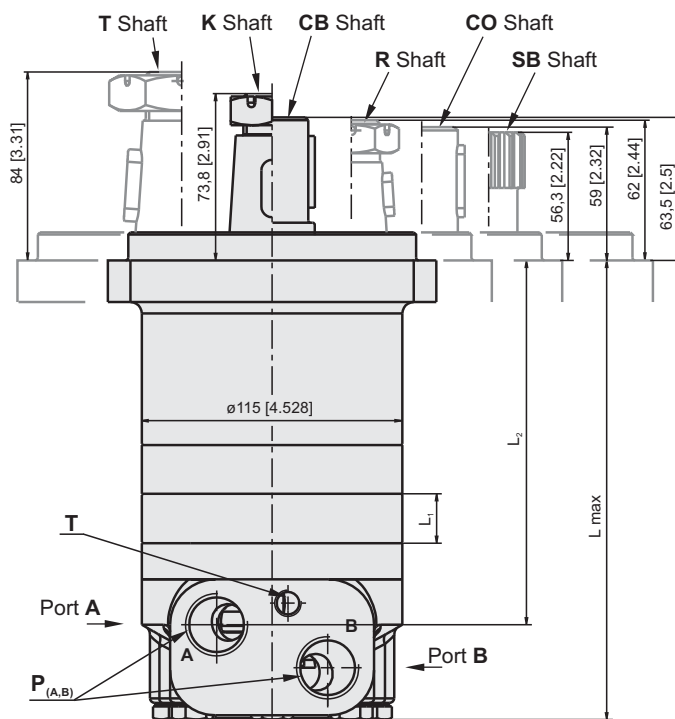
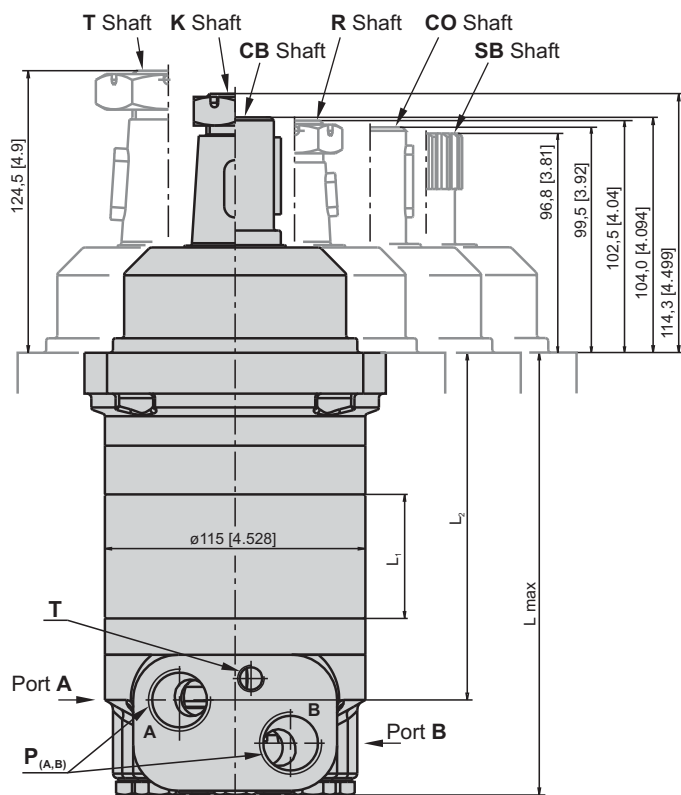
MTK 400



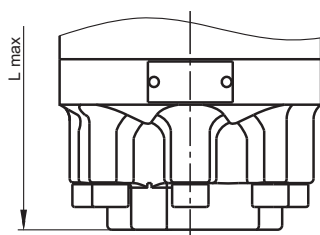
MTK 470



The function diagrams data was collected at back pressure 5÷10 bar (72.5PSI÷145PSI) and oil with viscosity of 32 mm²/s [150SUS] at 50° C [122°F].



E Rear ports



Flange Dim.
See Page 15

Ports Dim.
See Page 16

Shaft Dim.
See Page 17

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**

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

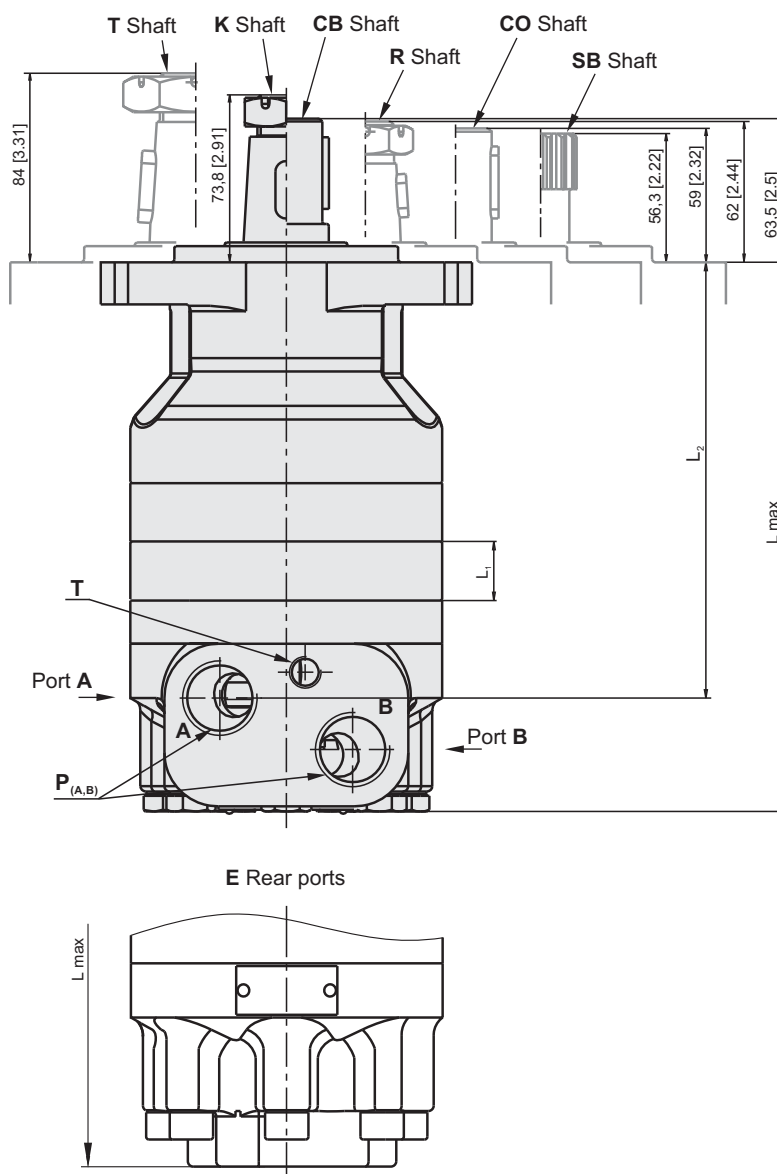
Reverse Rotation
Viewed from Shaft End
Port A Pressurized - **CCW**
Port B Pressurized - **CW**



	Versions				
	Side			Rear	
	2	3	4	6	8
P (A,B)	2xG 3/4	2xM27x2	2x1 $\frac{1}{16}$ -12UN	2xG 1/2	2x $\frac{7}{8}$ -14UNF
T	G 1/4	M14x1,5	$\frac{7}{16}$ -20UNF	G 1/4	$\frac{7}{16}$ -20UNF

Type	Lmax, mm [in]	L ₂ , mm [in]	*L _{E1} , mm [in]	Type	Lmax, mm [in]	L ₂ , mm [in]	*L _{E1} , mm [in]	L ₁ , mm [in]
MTKW160	162,7 [6.41]	120,3 [4.74]	176,3 [6.94]	MTKC160	203,2 [8.00]	160,8 [6.33]	216,8 [8.54]	21,8 [.86]
MTKW200	168,7 [6.64]	126,3 [4.97]	182,3 [7.18]	MTKC200	209,2 [8.24]	166,8 [6.57]	222,8 [8.77]	27,8 [1.09]
MTKW250	175,7 [6.92]	133,3 [5.25]	189,3 [7.45]	MTKC250	216,2 [8.51]	173,8 [6.84]	229,8 [9.05]	34,8 [1.37]
MTKW315	183,4 [7.22]	142,0 [5.59]	198,0 [7.79]	MTKC315	224,9 [8.85]	182,5 [7.19]	238,5 [9.39]	43,5 [1.71]
MTKW400	195,7 [7.70]	153,3 [6.04]	209,3 [8.24]	MTKC400	236,2 [9.29]	193,8 [7.63]	249,8 [9.83]	54,8 [2.16]
MTKW470	205,9 [8.12]	163,5 [6.44]	219,5 [8.64]	MTKC470	246,4 [9.70]	204,0 [8.03]	260,0 [10.24]	65,0 [2.56]
MTKW500	209,3 [8.24]	167,9 [6.61]	223,9 [8.81]	MTKC500	250,8 [9.87]	208,4 [8.20]	264,4 [10.41]	69,4 [2.73]

DIMENSIONS - MTK F



Flange Dim.
See Page 15

Ports Dim.
See Page 16

Shaft Dim.
See Page 17

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**

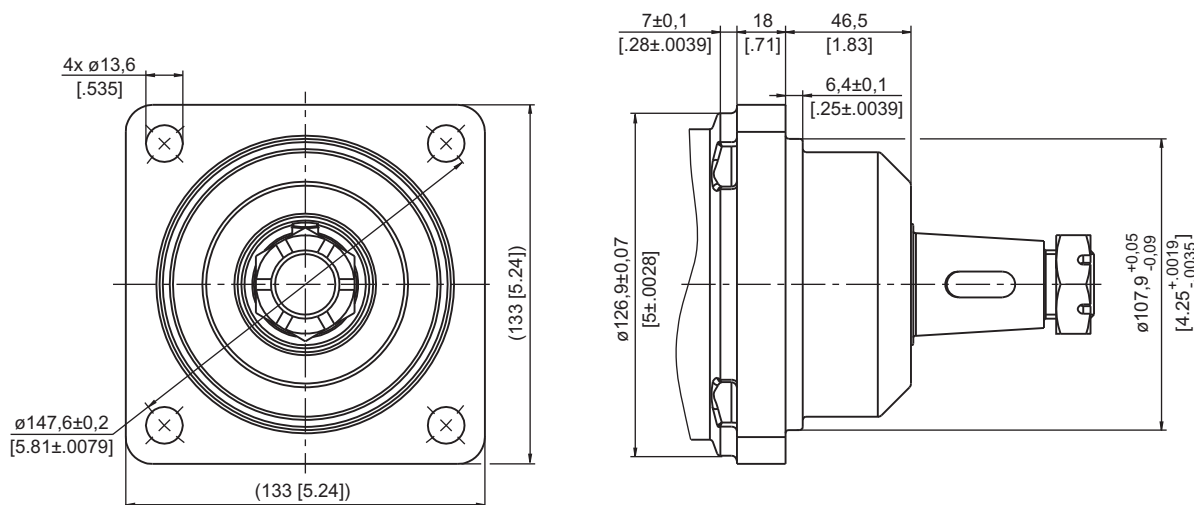
	Versions				
	Side			Rear	
	2	3	4	6	8
P (A,B)	2xG 3/4	2xM27x2	2x1 1/16-12UN	2xG 1/2	2x 7/8-14UNF
T	G 1/4	M14x1,5	7/16-20UNF	G 1/4	7/16-20UNF

Type	Lmax, mm [in]	L ₂ , mm [in]	*L _E , mm [in]	L ₁ , mm [in]
MTKF 160	203,2 [8.00]	160,8 [6.33]	216,8 [8.54]	21,8 [.86]
MTKF 200	209,2 [8.24]	166,8 [6.57]	222,8 [8.77]	27,8 [1.09]
MTKF 250	216,2 [8.51]	173,8 [6.84]	229,8 [9.05]	34,8 [1.37]
MTKF 315	224,9 [8.85]	182,5 [7.19]	238,5 [9.39]	43,5 [1.71]
MTKF 400	236,2 [9.29]	193,8 [7.63]	249,8 [9.83]	54,8 [2.16]
MTKF 470	246,4 [9.70]	204,0 [8.03]	260,0 [10.24]	65,0 [2.56]
MTKF 500	250,8 [9.87]	208,4 [8.20]	264,4 [10.41]	69,4 [2.73]

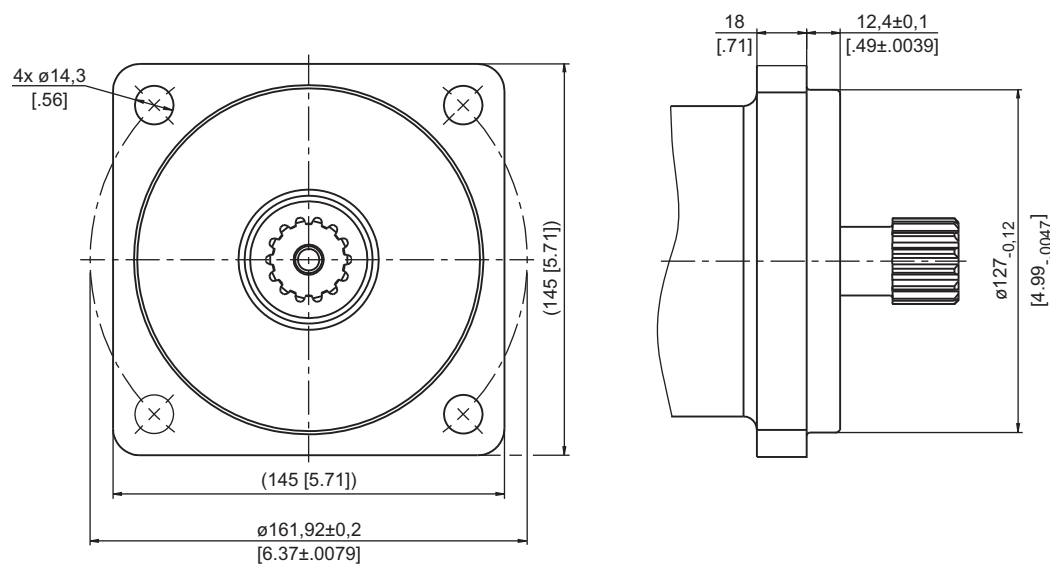


MOUNTING

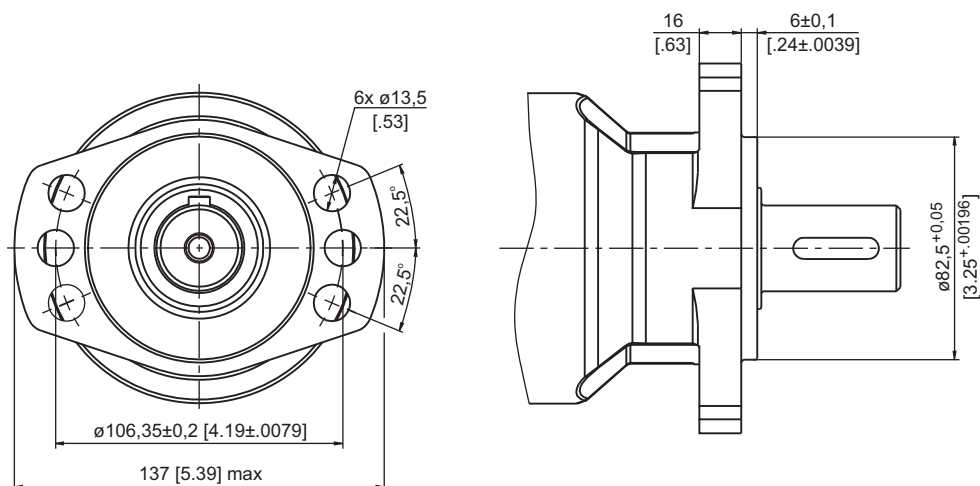
W - Wheel Mount (4 Holes)



C - Square Mount (4 Holes)



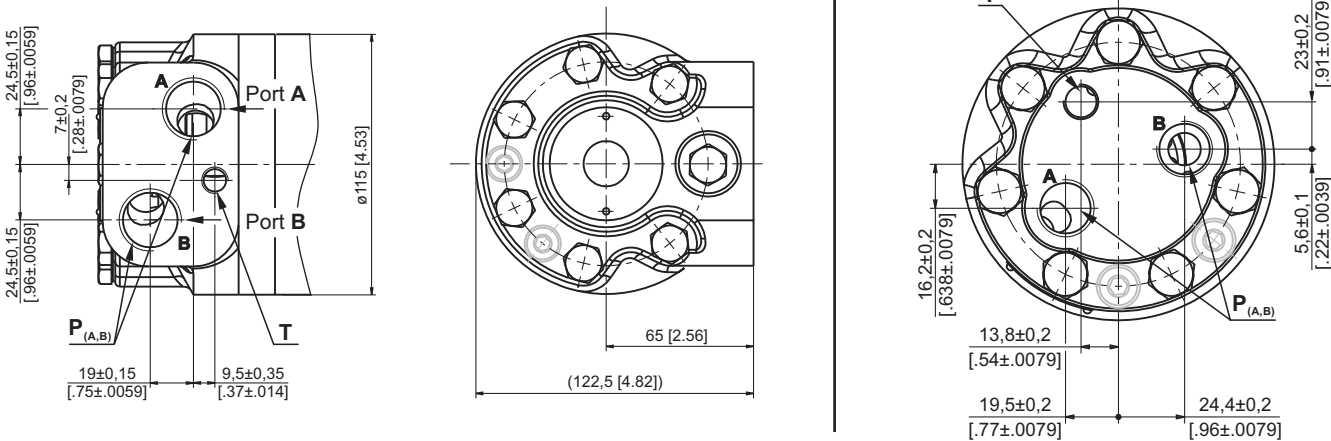
F - Magneto Mount (6 Holes)



PORTS

Versions 2 3 4

Versions 6 8



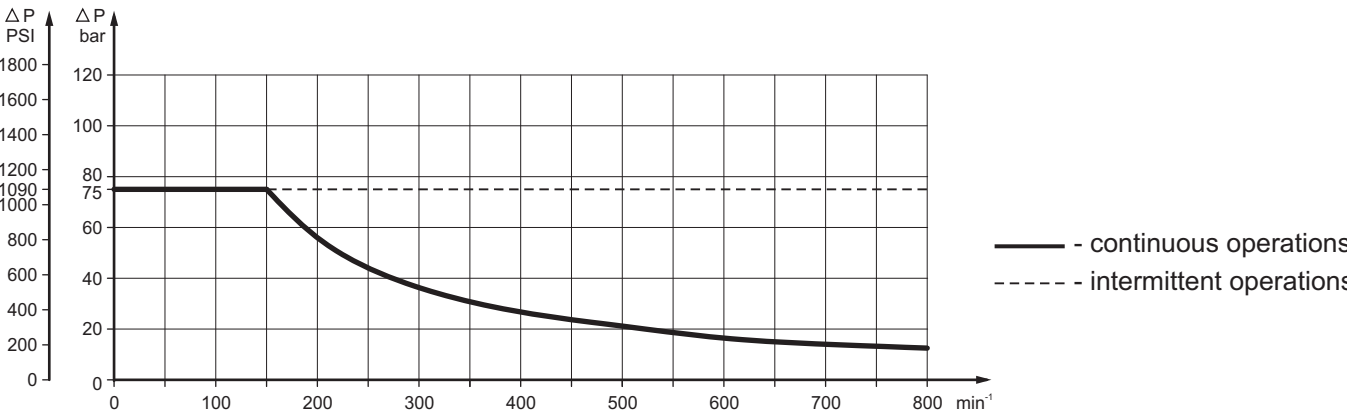
	Versions				
	Side			Rear	
	2	3	4	6	8
P (A,B)	2xG 3/4	2xM27x2	2x1 ¹ / ₁₆ -12UN	2xG 1/2	2x ⁷ / ₈ -14UNF
T	G 1/4	M14x1,5	⁷ / ₁₆ -20UNF	G 1/4	⁷ / ₁₆ -20UNF



MAX. PERMISSIBLE SHAFT SEAL PRESSURE for MTK motors

Max. return pressure without drain line or

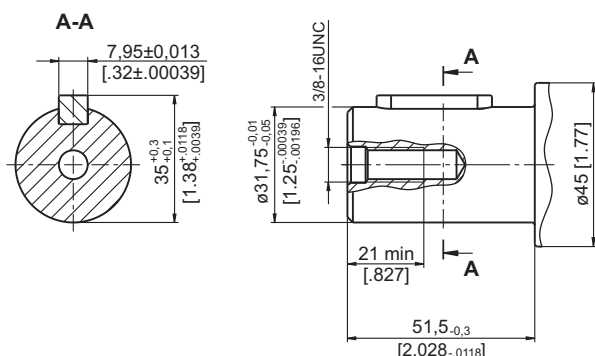
max. pressure in the drain line



SHAFT EXTENSIONS

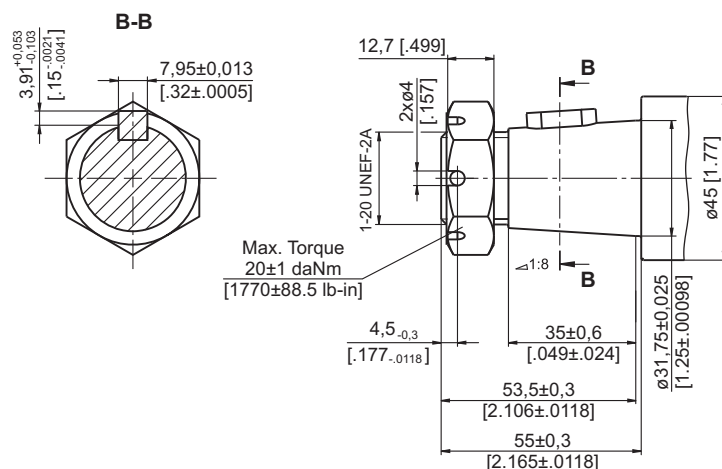
CO

ø1¼" [31,75] straight, Parallel key 5/16"x5/16"x1¼"
Max. Torque 77 daNm [6815 lb-in]



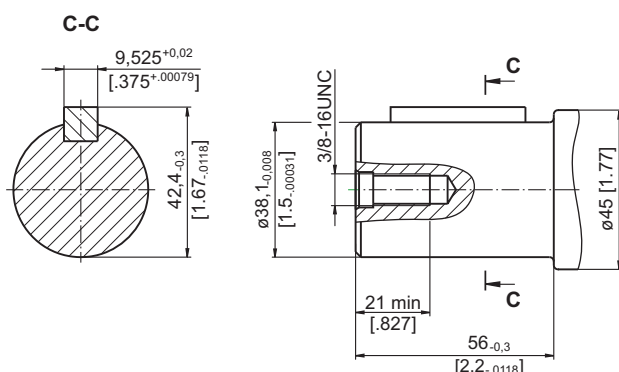
R

ø1¼" [31,75] tapered 1:8, Parallel key 5/16"x5/16"x¾"
Max. Torque 77 daNm [6815 lb-in]



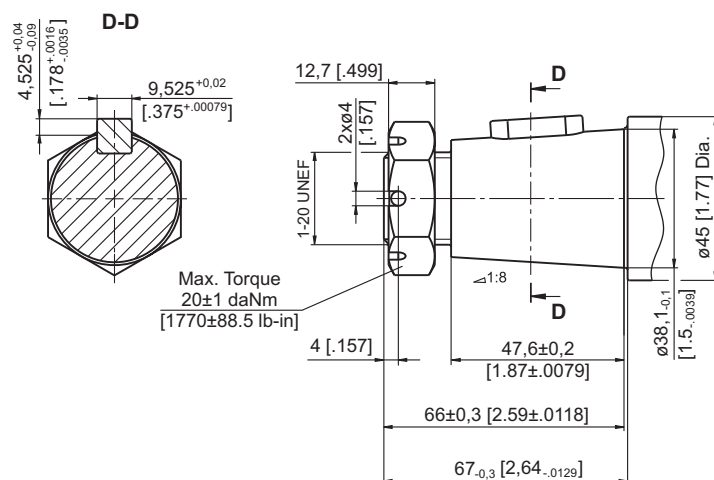
CB

ø1½" [38,1] straight, Parallel key 3/8"x3/8"x1¼" BS46
Max. Torque 132,8 daNm [11755 lb-in]



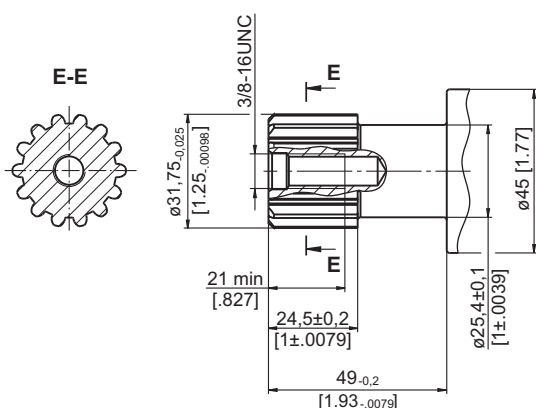
K

ø1½" [38,1] tapered 1:8, Parallel key 3/8"x3/8"x1"
Max. Torque 89 daNm [7878 lb-in]



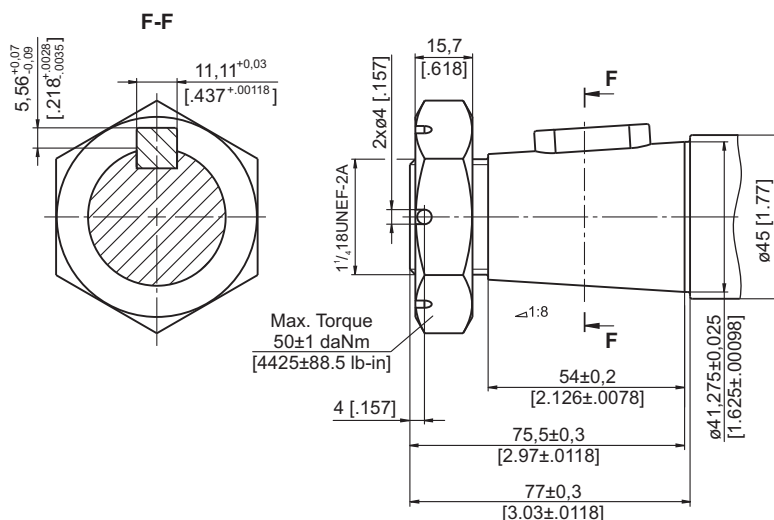
SB

ø1¼" [31,75] 14T Splined ANSI B92.1-1970, 12/24
Max. Torque 77 daNm [6815 lb-in]

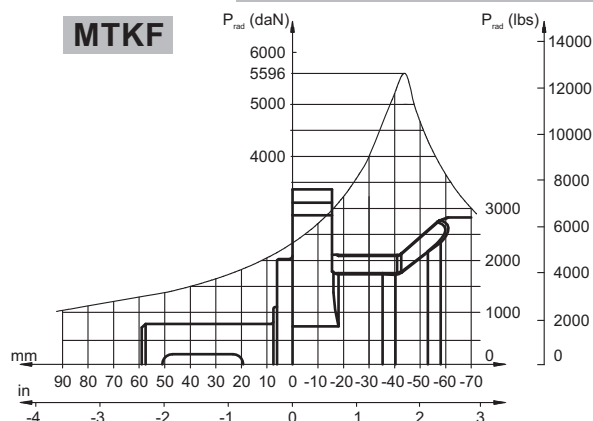


T

ø1½" [41,275] tapered 1:8, Parallel key 7/16"x7/16"x1¼"
Max. Torque 100 daNm [8850 lb-in]

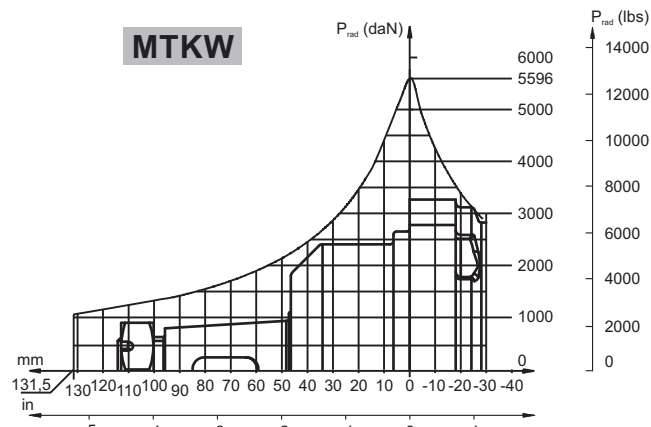
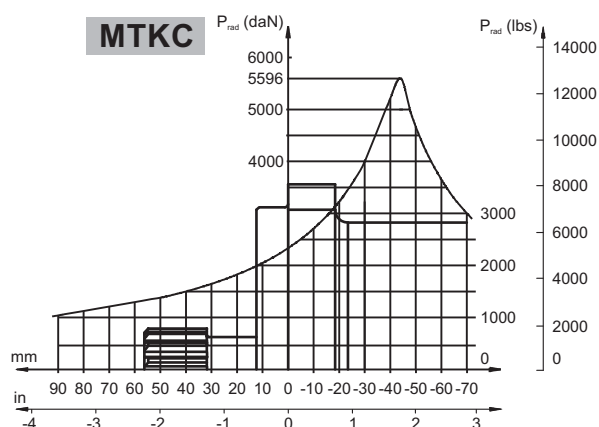


PERMISSIBLE SHAFT LOADS



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.



ORDER CODE

1	2	3	4	5	6	7	8
MTK						HD	

Pos.1 - Mounting Flange

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

Pos.2 - Port type

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

Pos.3 - Displacement code

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

Pos.4 - Shaft Extensions*

- CO** - $\varnothing 1\frac{1}{4}$ " [31,75] straight, Parallel key $\frac{5}{16}$ "x $\frac{5}{16}$ "x1 $\frac{1}{4}$ ", 3/8-16 UNC
- CB** - $\varnothing 1\frac{1}{2}$ " [38,1] straight, Parallel key $\frac{3}{8}$ "x $\frac{3}{8}$ "x1 $\frac{1}{4}$ " BS46
- SB** - $\varnothing 1\frac{1}{4}$ " [31,75] 14T Splined ANSI B92.1-1970, 12/24
- R** - $\varnothing 1\frac{1}{4}$ " [31,75] tapered 1:8, Parallel key $\frac{5}{16}$ "x $\frac{5}{16}$ "x $\frac{3}{4}$ ", 1-20 UNEF
- K** - $\varnothing 1\frac{1}{2}$ " [38,1] tapered 1:8, Parallel key $\frac{3}{8}$ "x $\frac{3}{8}$ "x1", 1-20 UNEF
- T** - $\varnothing 1\frac{1}{16}$ " [41,275] tapered 1:8, Parallel key $\frac{7}{16}$ "x $\frac{7}{16}$ "x1 $\frac{1}{4}$ "

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 - Special Features

- HD** - Reinforced motor HD**

For Other Special Features [see page 58](#)

Pos.8 - Design Series

- omit - Factory specified

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

** Drain line should always be used.

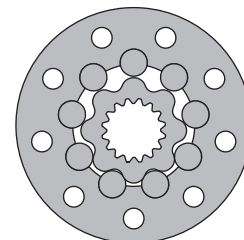
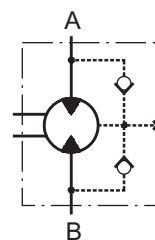
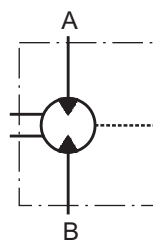
The hydraulic motors are mangano phosphatized as standard.

HYDRAULIC MOTORS MTM



APPLICATION

- » Skid Steer Loaders
- » Metal working machines
- » Trenchers
- » Augers
- » Agriculture machines
- » Road building machines
- » Special vehicles
- » Mine machines
- » Woodworking and sawmill machinery
- » Conveyors etc.



CONTENTS

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Dimensions and mounting	25÷27
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Permissible shaft loads	28
Dimensions and mounting- MTMV	29
Dimensions and mounting- MTM6V	30
Permissible shaft seal pressure	31
Internal Spline data	33
Order code	33

OPTIONS

- » Model- Disc valve, roll-gerotor
- » Flange with wheel mount
- » Short motor
- » Side ports
- » Shafts- straight, splined and tapered
- » BSPP ports;
- » Other special features.

EXCELLENCE

- » High torque and pressure drop
- » High inlet pressure
- » High starting torque
- » Improved efficiency at high pressure drop
- » Smooth operation at low speed

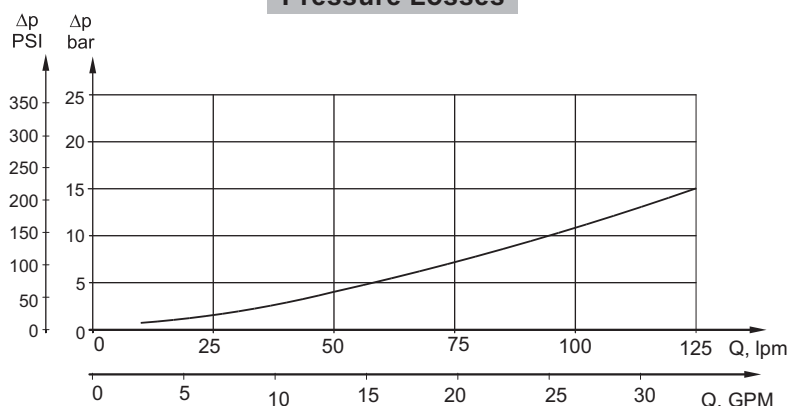
GENERAL

Max. Displacement, cm ³ /rev [in ³ /rev]	724,3 [44.2]
Max. Speed, [RPM]	750
Max. Torque, daNm [lb-in]	cont.: 183 [16200] int.: 229 [20270]
Max. Output, kW [HP]	70 [94]
Max. Pressure Drop, bar [PSI]	cont.: 250 [3600] int.: 350 [5080]
Max. Oil Flow, lpm [GPM]	150 [40]
Min. Speed, [RPM]	5
Permissible Shaft Loads daN [lbs]	P _a =1000 [2250]
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]
140 [2030]	20 [98]	2,5 [.660]
	35 [164]	1,5 [.396]
210 [3045]	20 [98]	5 [1.321]
	35 [164]	3 [.793]

Pressure Losses



SPECIFICATION DATA

Type		MTM 200	MTM 250	MTM 315	MTM 400	MTM 470	MTM 500	MTM 630	MTM 725
Displacement, cm³/rev [in³/rev]		201,4 [12.29]	251,8 [15.36]	326,3 [19.9]	410,9 [25.06]	475 [28.97]	523,6 [31.95]	631,2 [38.52]	724 [44.2]
Max. Speed, [RPM]	Cont.	625	500	380	305	260	240	190	170
	Int.*	750	600	460	365	315	285	230	215
Max. Torque daNm [lb-in]	Cont.	74 [6550]	90[7965]	116[10265]	147[13010]	171[15135]	172[15225]	183[16200]	160[14160]
	Int.*	102[9030]	128[11330]	163[14425]	206[18232]	215[16030]	215[16030]	229[20270]	192[17000]
	Peak**	115[10180]	144[12745]	186[16460]	235[20800]	240[21240]	240[21240]	274[24250]	240[21240]
Max. Output kW [HP]	Cont.	41 [55]	41 [55]	41 [55]	41 [55]	41 [55]	37,5[50]	28 [37,5]	26 [35]
	Int.*	70 [94]	70 [94]	70 [94]	70 [94]	55 [74]	51 [68]	42 [56]	40 [54]
Max. Pressure Drop bar [PSI]	Cont.	250[3600]	250[3600]	250[3600]	250[3600]	250[3600]	230[3340]	200[2900]	160[2320]
	Int.*	350[5080]	350[5080]	350[5080]	350[5080]	315[4570]	280[4060]	250[3625]	210[3045]
	Peak**	400[5800]	400[5800]	400[5800]	400[5800]	350[5080]	320[4640]	300[4350]	260[3770]
Max. Oil Flow lpm [GPM]	Cont.	125[33]	125[33]	125[33]	125[33]	125[33]	125[33]	125[33]	125[33]
	Int.*	150[40]	150[40]	150[40]	150[40]	150[40]	150[40]	150[40]	150[40]
Max. Inlet Pressure bar [PSI]	Cont.	270[3920]	270[3920]	270[3920]	270[3920]	270[3920]	270[3920]	270[3920]	270[3920]
	Int.*	370[5370]	370[5370]	370[5370]	370[5370]	370[5370]	370[5370]	370[5370]	370[5370]
	Peak**	420[6100]	420[6100]	420[6100]	420[6100]	420[6100]	420[6100]	420[6100]	420[6100]
Max. Return Pressure without Drain Line or Max. Pressure in Drain Line, bar [PSI]	Cont. 0-100 RPM	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]
	Cont. 100-300 RPM	40 [580]	40 [580]	40 [580]	40 [580]	40 [580]	40 [580]	40 [580]	40 [580]
	Cont. >300 RPM	20 [290]	20 [290]	20 [290]	20 [290]	20 [290]	-	-	-
	Int.* 0-max. RPM	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]
Max. Return Pressure with Drain Line bar [PSI]	Cont.	140 [2000]	140 [2000]	140 [2000]	140 [2000]	140 [2000]	140 [2000]	140 [2000]	140 [2000]
	Int.*	175 [2500]	175 [2500]	175 [2500]	175 [2500]	175 [2500]	175 [2500]	175 [2500]	175 [2500]
	Peak**	210 [3000]	210 [3000]	210 [3000]	210 [3000]	210 [3000]	210 [3000]	210 [3000]	210 [3000]
Max. Starting Pressure with Unloaded Shaft, bar [PSI]		6 [90]	6 [90]	6 [90]	6 [90]	6 [90]	6 [90]	6 [90]	6 [90]
Min. Starting Torque daNm [lb-in]		60[5310]	75[6640]	97[8585]	122[10800]	142[12570]	143[12655]	145[12830]	148[13100]
Min. Speed***, [RPM]		5	5	5	5	5	5	5	5
Weight, kg [lb]	MTM	26,9 [59.3]	27,3 [60.2]	28,1 [62]	29 [64]	29,7 [65.5]	30,2 [66.6]	29,7 [65.5]	31 [68.4]
	MTMW	27,4 [60.4]	27,8 [61.3]	28,6 [63.1]	29,5 [65.1]	30,2 [66.6]	30,7 [67.7]	30,2 [66.6]	31,5 [69.5]
	MTMV	15,7 [34.6]	16,1 [35.5]	16,9 [37.3]	17,8 [39.3]	18,5 [40.8]	19 [41.9]	18,5 [40.8]	19,8 [43.7]

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

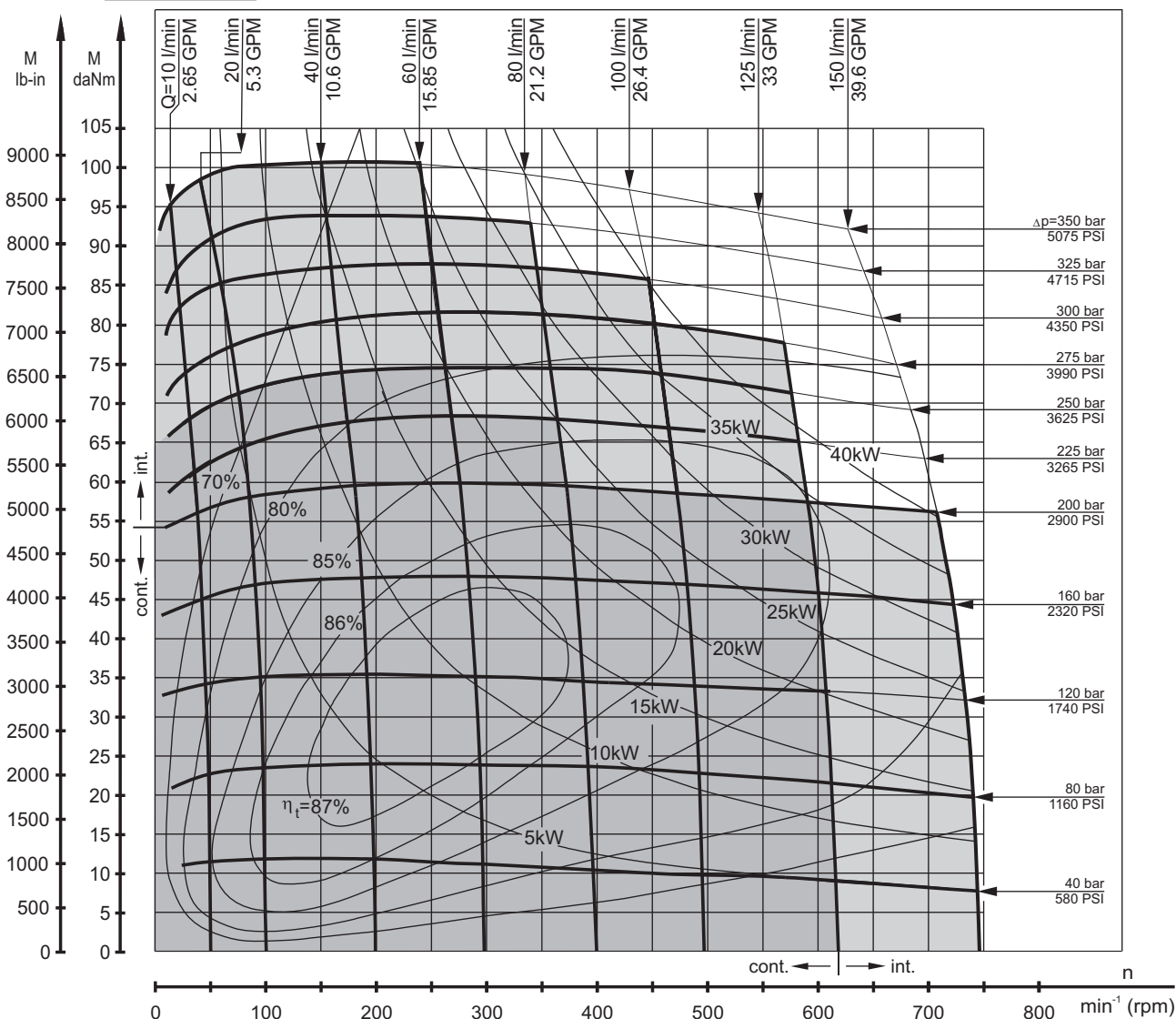
** Peak load: the permissible values may occur for max. 1% of every minute.

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

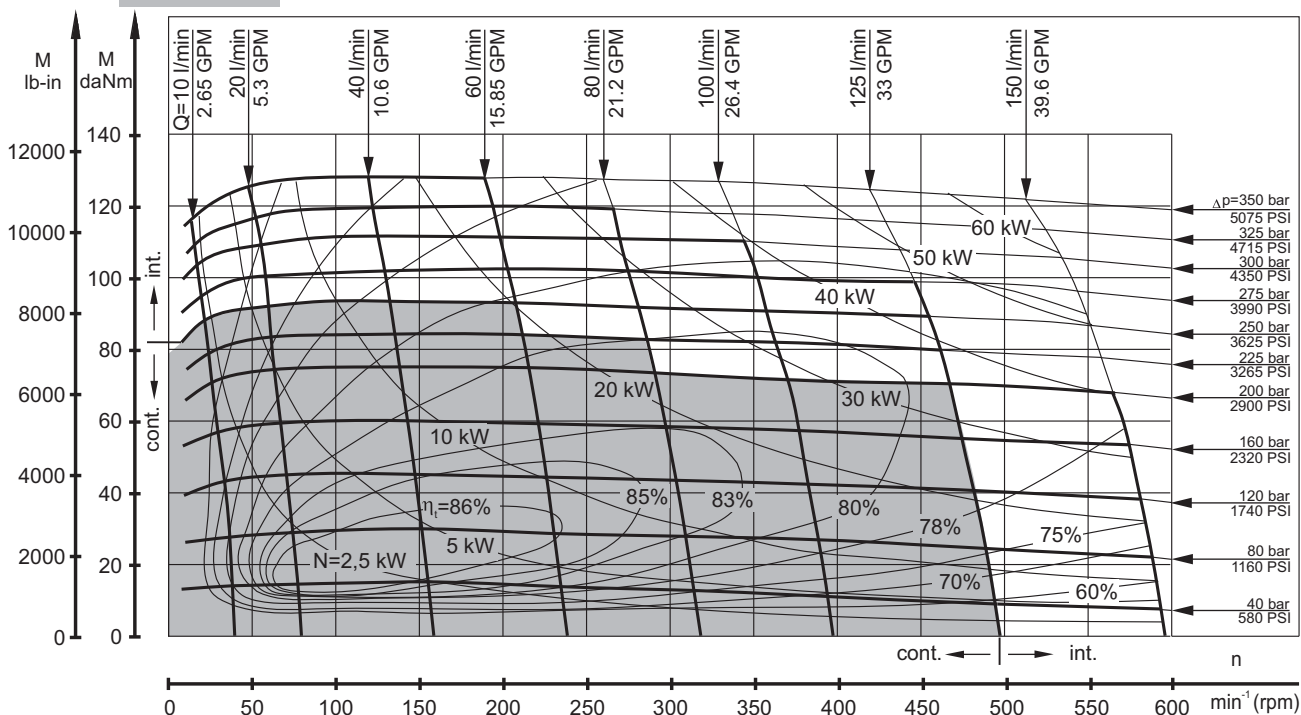
- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil, HLP(DIN51524) or HM(ISO6743/4). If using 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.

MTM 200

FUNCTION DIAGRAMS



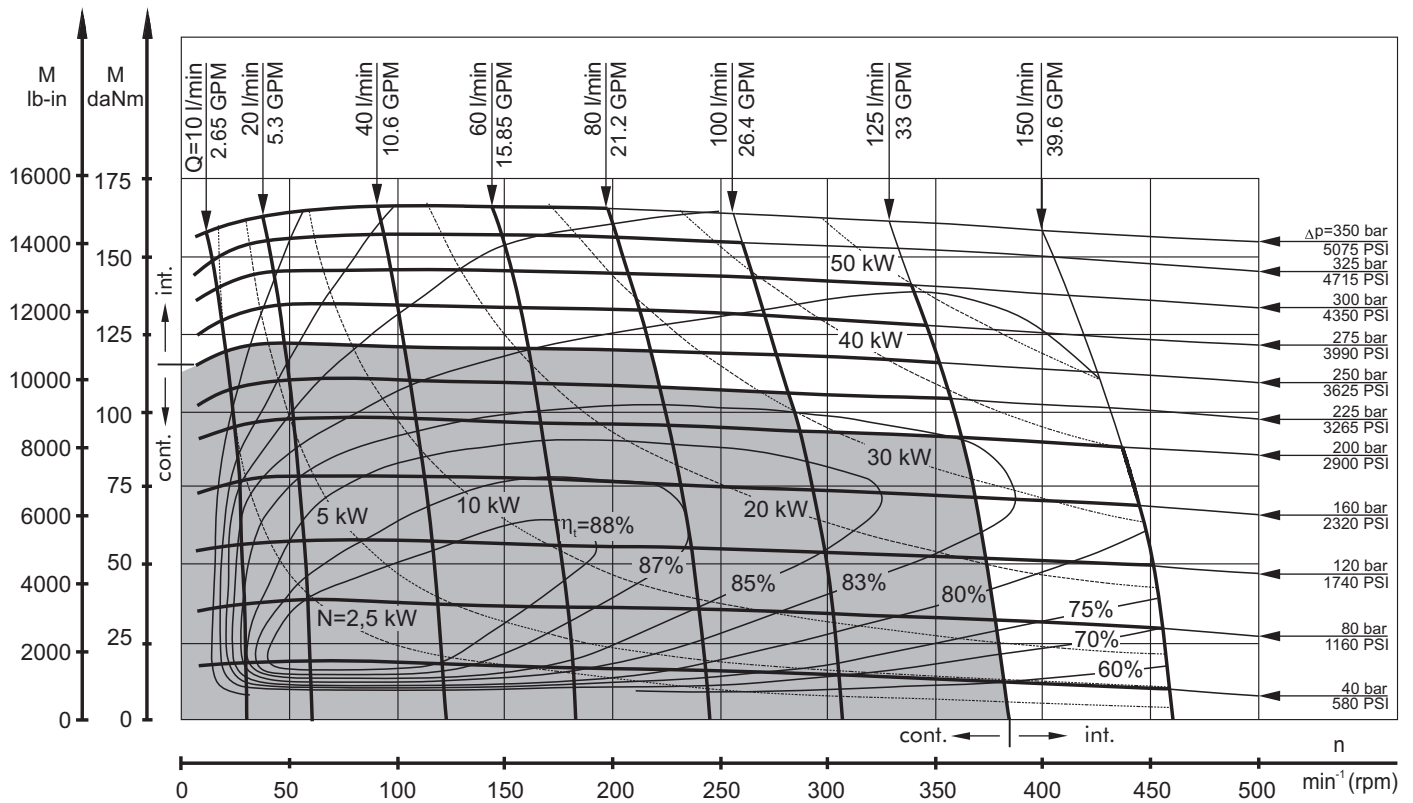
MTM 250



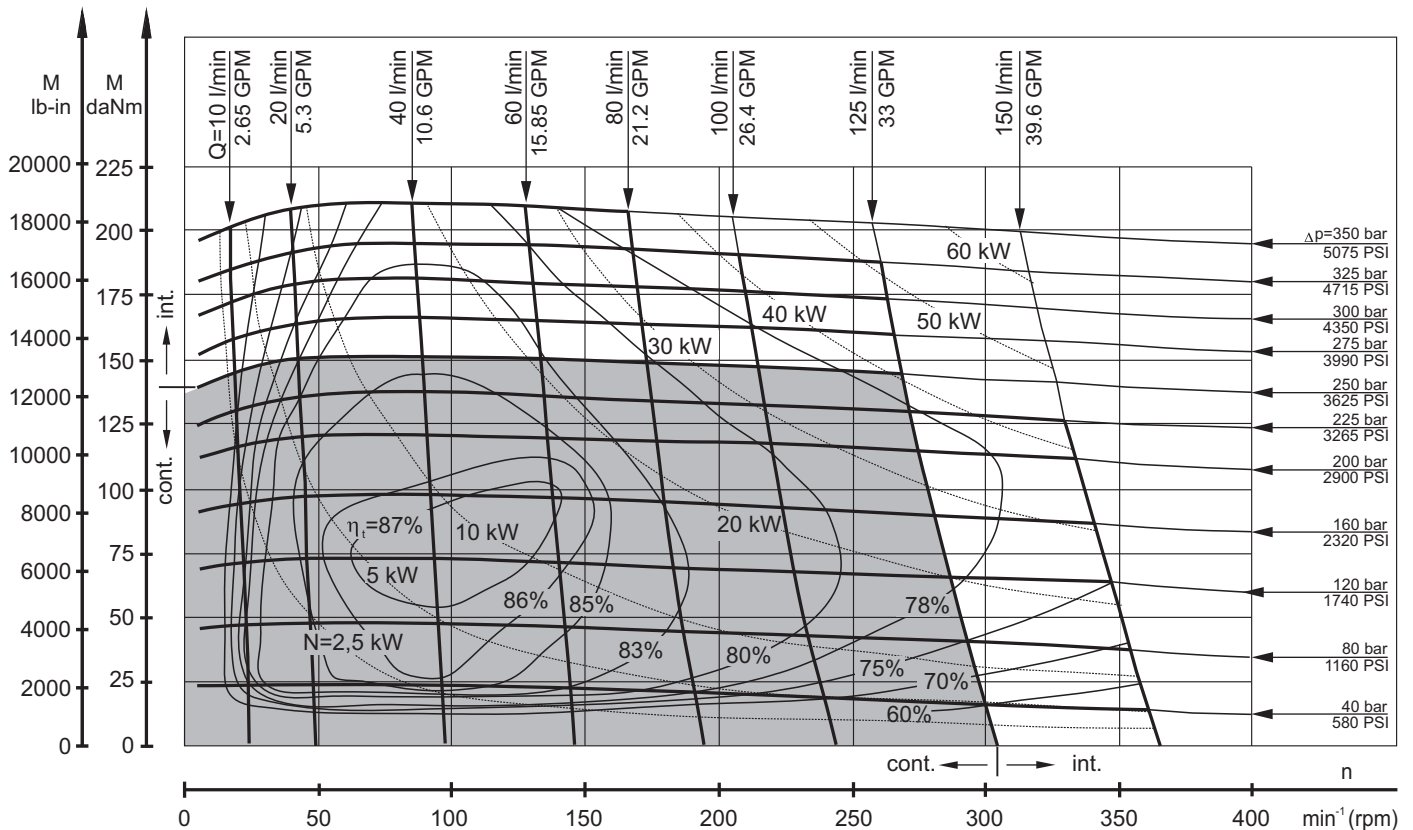
The function diagrams data was collected at back pressure 5÷10 bar (72.5÷145 PSI) and oil with viscosity of 32 mm²/s [150 SUS] at 50° C [122°F].

FUNCTION DIAGRAMS

MTM 315



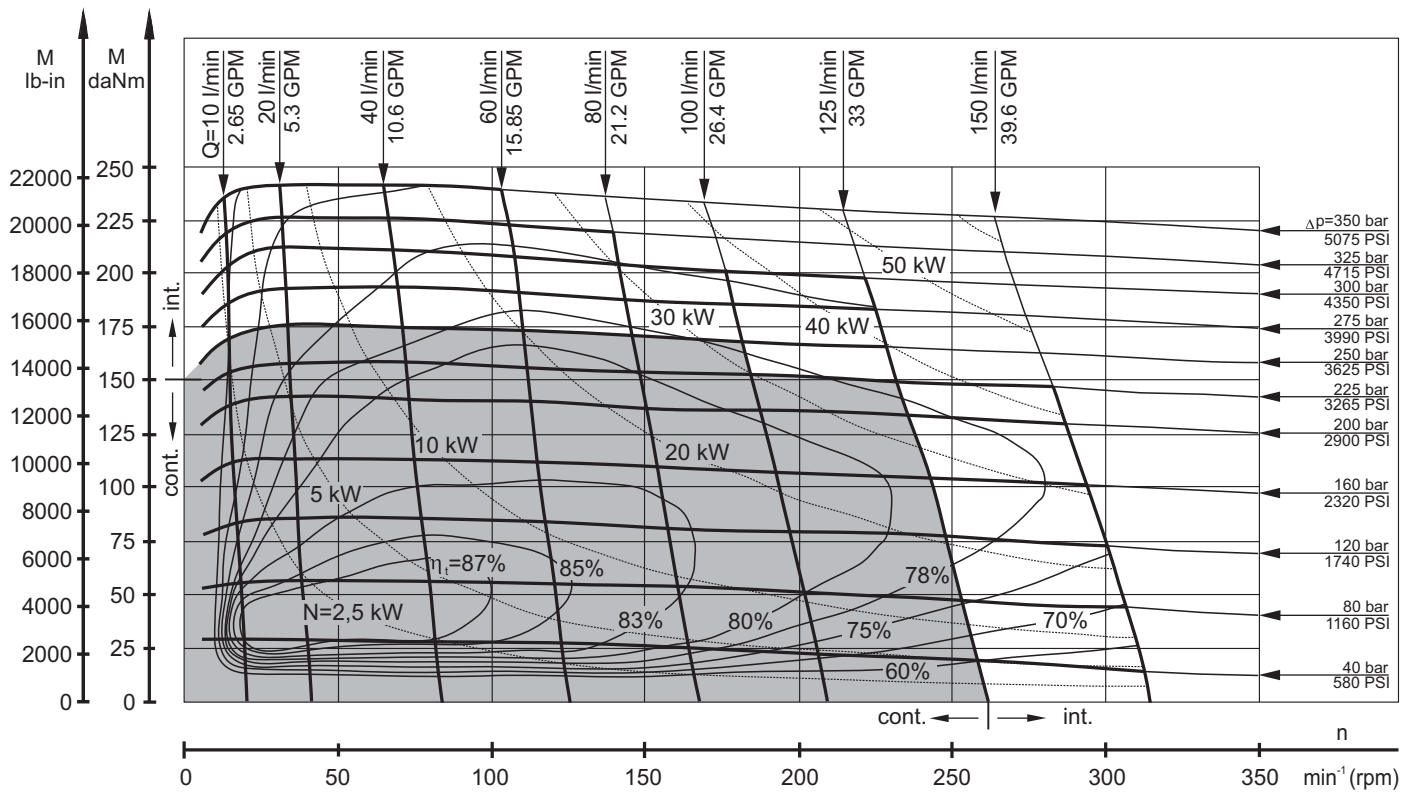
MTM 400



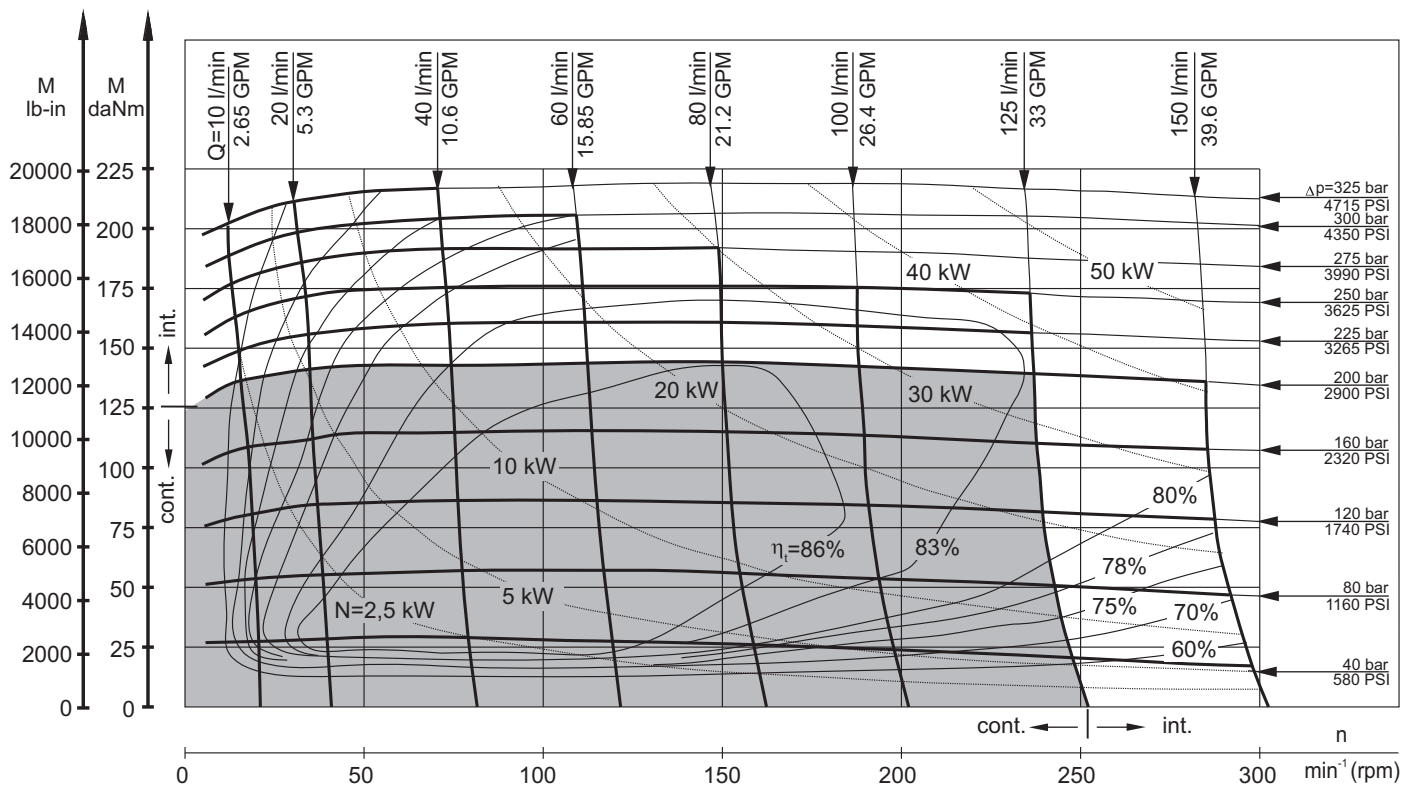
The function diagrams data was collected at back pressure 5÷10 bar (72.5÷145 PSI) and oil with viscosity of 32 mm²/s [150 SUS] at 50° C [122°F].

FUNCTION DIAGRAMS

MTM 470



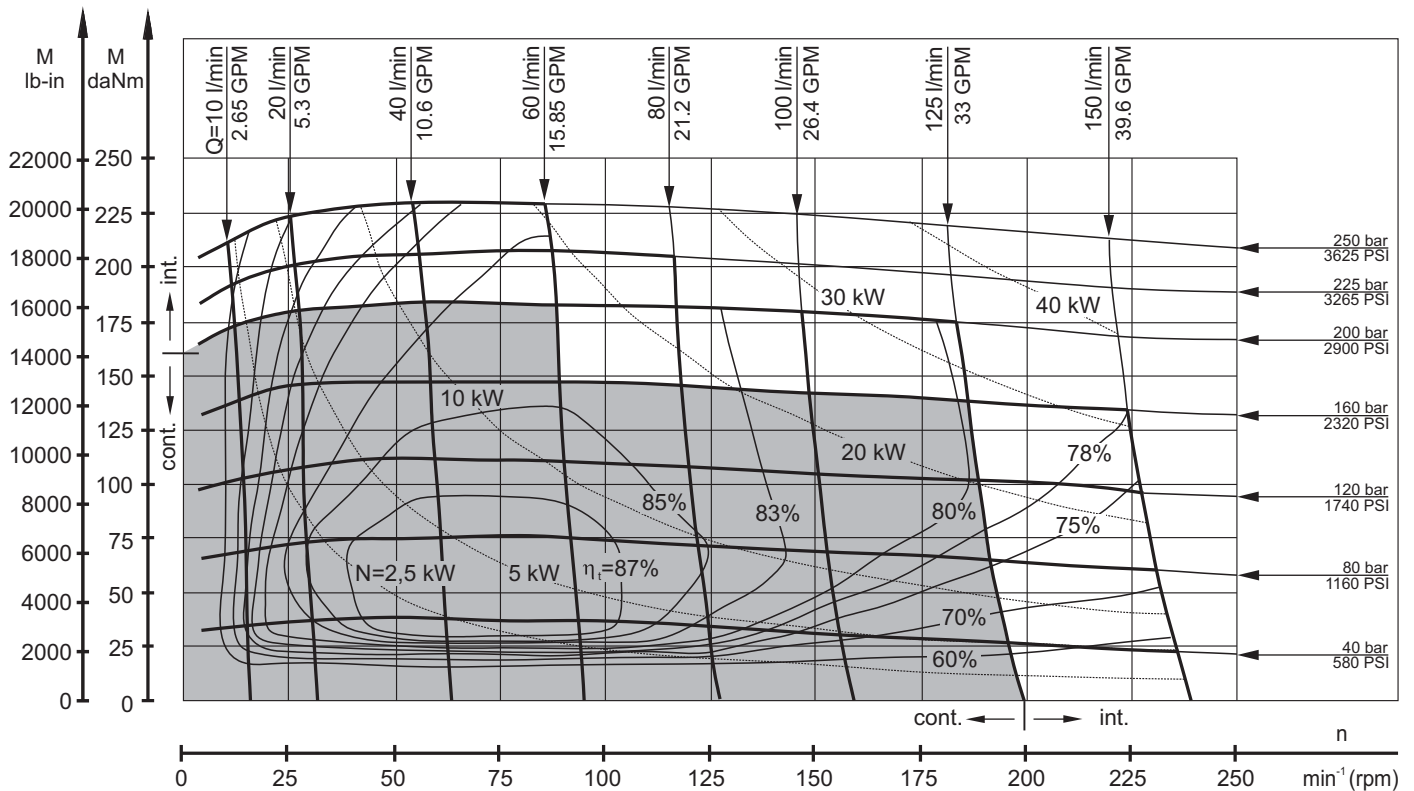
MTM 500



The function diagrams data was collected 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].

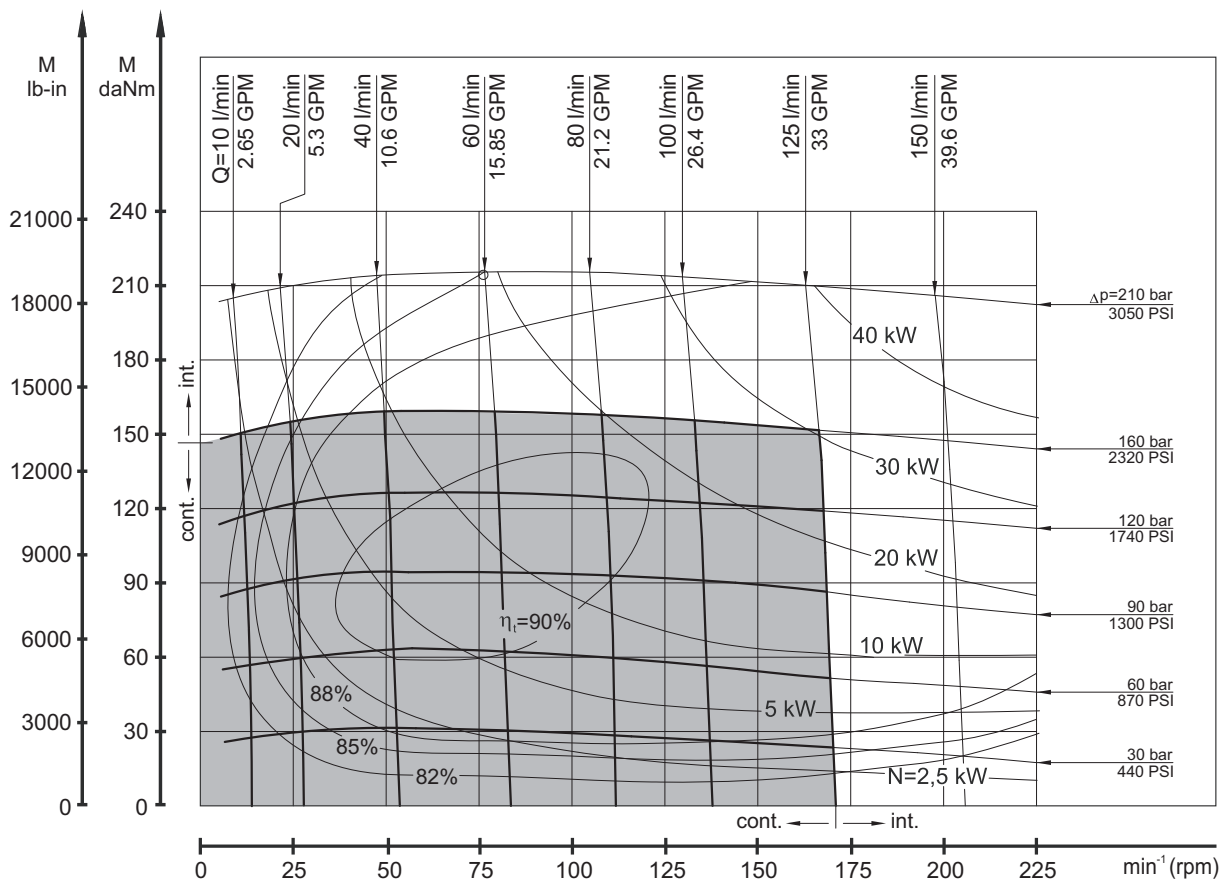
FUNCTION DIAGRAMS

MTM 630



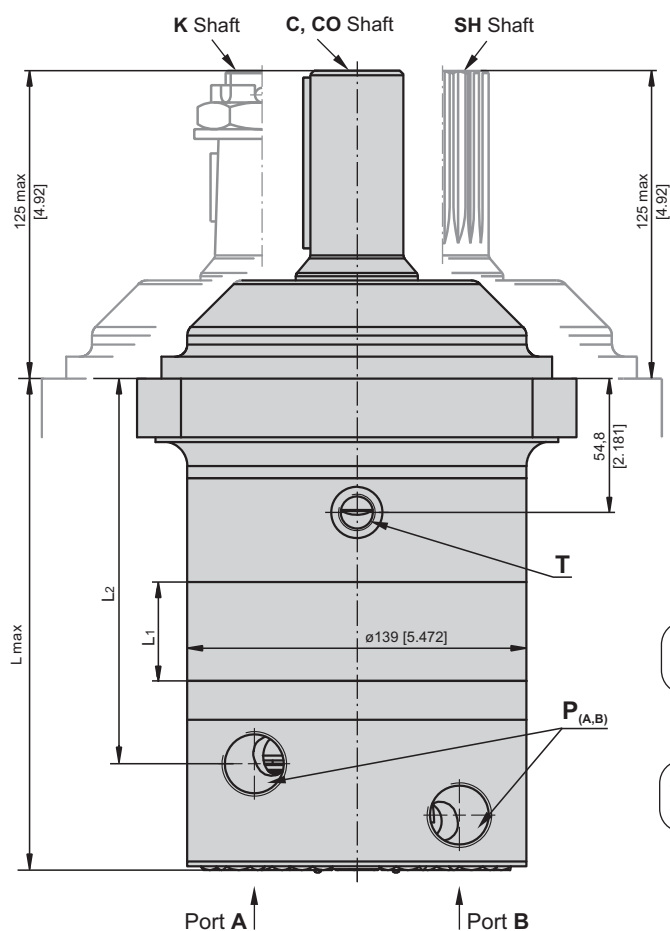
The function diagrams data was collected at back pressure 5÷10 bar (72.5÷145 PSI) and oil with viscosity of 32 mm²/s [150 SUS] at 50° C [122°F].

MTM 725



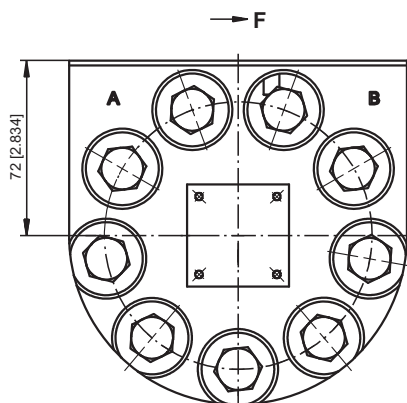
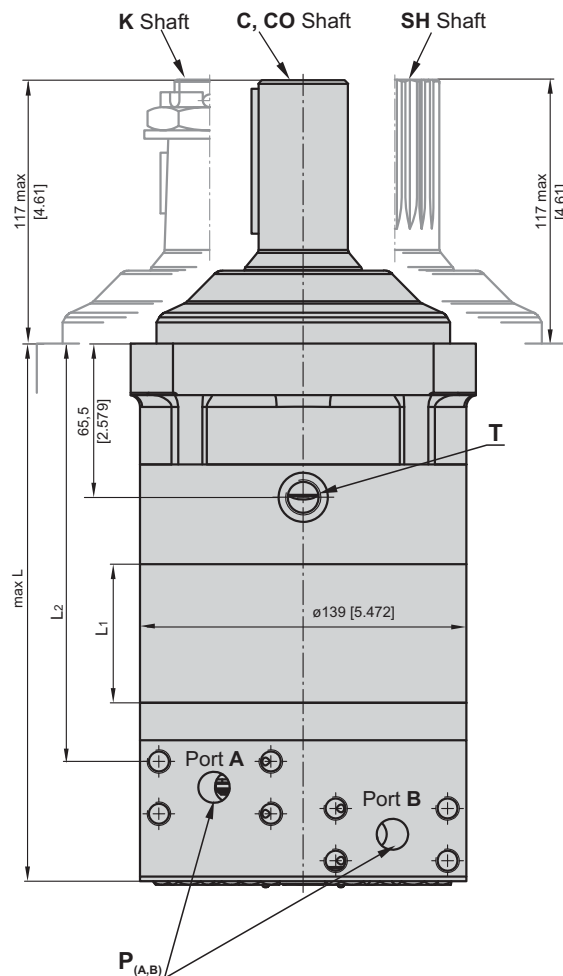
The function diagrams data was collected at back pressure 5÷10 bar (72.5÷145 PSI) and oil with viscosity of 32 mm²/s [150 SUS] at 50° C [122°F].

DIMENSIONS AND MOUNTING DATA for MTM and MTMC - versions ..., 4, 5



Flange Dim.
See Page 27

Shaft Dim.
See Page 28



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

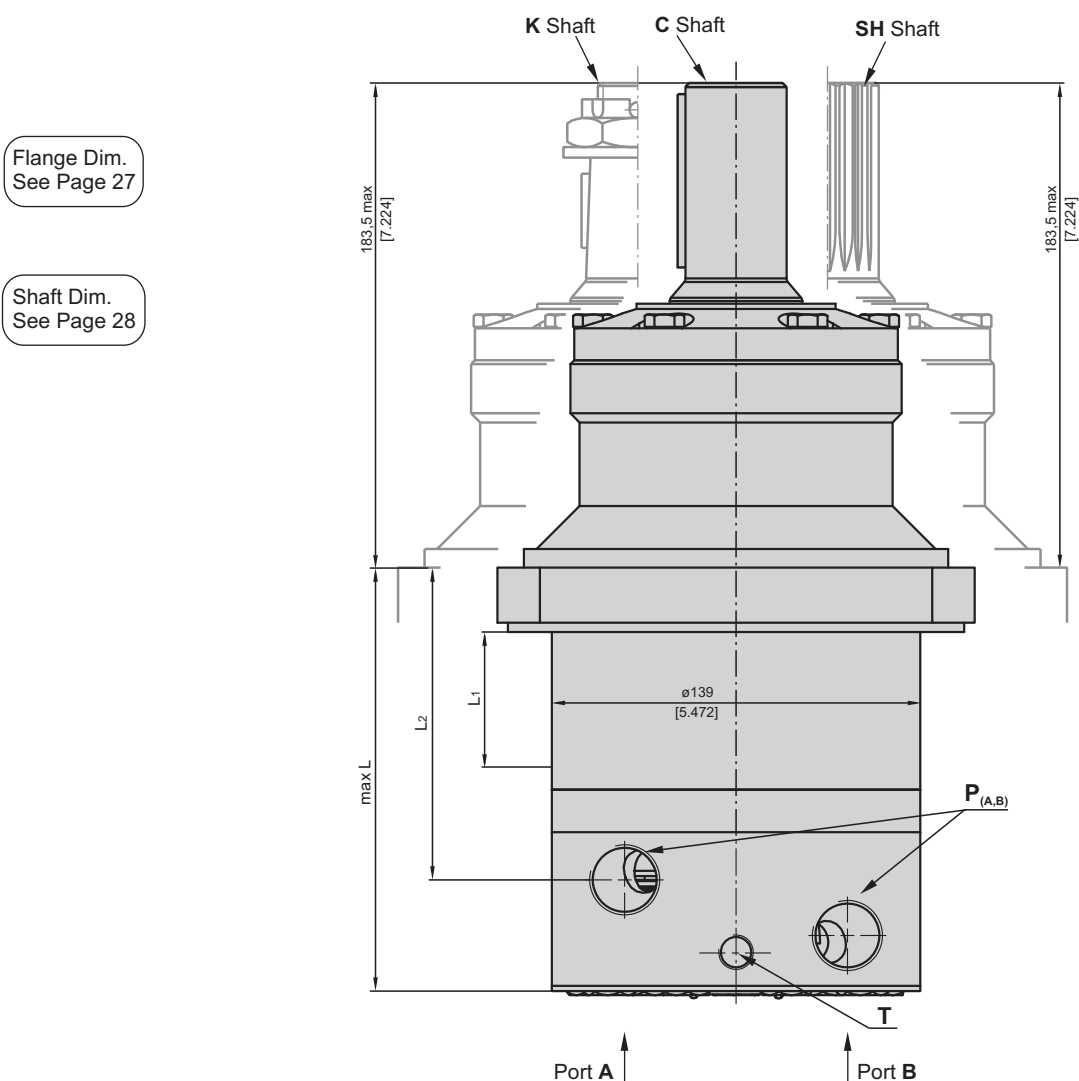


Standard Rotation
Viewed from Shaft End
Port A Pressurized - CW
Port B Pressurized - CCW

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

	Versions		
	-	4	5
P _(A,B)	2xG 3/4	2x1 ¹ / ₁₆ -12UN O-ring	2x3/4"SAE PSI3000 with 8xM10 threads
T	G 1/4	⁹ / ₁₆ -18UNF	G 1/4

Type	L, mm [in]	L ₂ , mm [in]	Type	L, mm [in]	L ₂ , mm [in]	Type	L, mm [in]	L ₂ , mm [in]	Type	L, mm [in]	L ₃ , mm [in]	L ₁ , mm [in]
MTM200 ...4	188 [7.40]	142,3 [5.60]	MTMC200 ...4	198 [7.79]	153 [6.02]	MTM200 5	188 [7.40]	133,5 [5.26]	MTMC200 5	198 [7.79]	144 [5.67]	25 [0.98]
MTM250 ...4	194 [7.64]	148,6 [5.85]	MTMC250 ...4	204,5 [8.05]	159,3 [6.27]	MTM250 5	194 [7.64]	139,5 [5.49]	MTMC250 5	204,3 [8.04]	150,3 [5.92]	31,3 [1.23]
MTM315 ...4	203 [7.99]	157,8 [6.21]	MTMC315 ...4	213,5 [8.40]	168,5 [6.63]	MTM315 5	203 [7.99]	149,0 [5.87]	MTMC315 5	213,5 [8.41]	159,5 [6.28]	40,5 [1.59]
MTM400 ...4	214 [8.43]	168,3 [6.63]	MTMC400 ...4	224 [8.82]	179 [7.04]	MTM400 5	214 [8.43]	159,5 [6.28]	MTMC400 5	224 [8.82]	170 [6.69]	51 [2.01]
MTM470 ...4	222 [8.74]	176,3 [6.94]	MTMC470 ...4	232 [9.13]	187 [7.36]	MTM470 5	222 [8.74]	167,5 [6.59]	MTMC470 5	232 [9.13]	178 [7.01]	59 [2.32]
MTM500 ...4	228 [8.98]	182,3 [7.18]	MTMC500 ...4	238 [9.37]	193 [7.60]	MTM500 5	228 [8.98]	173,5 [6.83]	MTMC500 5	238 [9.37]	184 [7.24]	65 [2.56]
MTM630 ...4	224 [8.82]	178,3 [7.02]	MTMC630 ...4	234 [9.21]	189 [7.44]	MTM630 5	224 [8.82]	169,5 [6.67]	MTMC630 5	234 [9.21]	180 [7.09]	61 [2.40]
MTM725 ...4	233 [9.17]	187,3 [7.37]	MTMC725 ...4	243 [9.56]	198 [7.79]	MTM725 5	233 [9.17]	178,5 [7.03]	MTMC725 5	243 [9.57]	189 [7.44]	70 [2.76]



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**

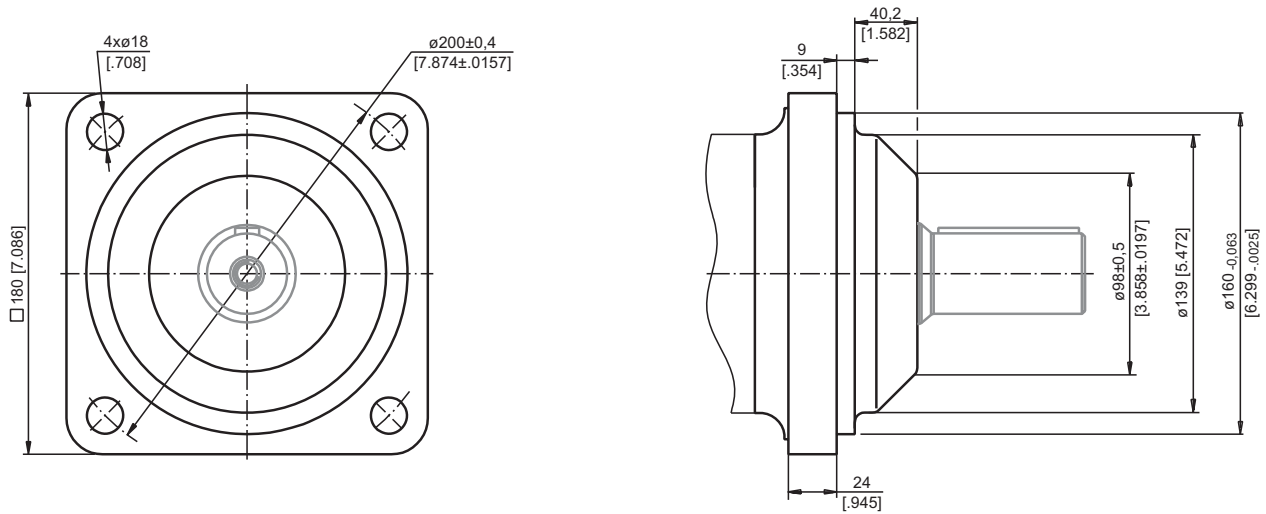
	Versions	
	-	4
P _(A,B)	2xG 3/4	2x1 ¹ / ₁₆ -12UN, O-ring
T	G 1/4	⁹ / ₁₆ -18UNF

Type	L, mm [in]	L ₂ , mm [in]	L ₁ , mm [in]
MTMW 200 ...,4	129 [5.08]	83,8 [3.30]	25 [.98]
MTMW 250 ...,4	135 [5.32]	90,1 [3.55]	31,3 [1.23]
MTMW 315 ...,4	144 [5.67]	99,3 [3.91]	40,5 [1.59]
MTMW 400 ...,4	155 [6.10]	109,8 [4.32]	51 [2.01]
MTMW 470 ...,4	163 [6.42]	117,8 [4.64]	59 [2.32]
MTMW 500 ...,4	169 [6.65]	123,8 [4.87]	65 [2.56]
MTMW 630 ...,4	165 [6.50]	119,8 [4.72]	61 [2.40]
MTMW 725 ...,4	174 [6.85]	128,8 [5.07]	70 [2.76]

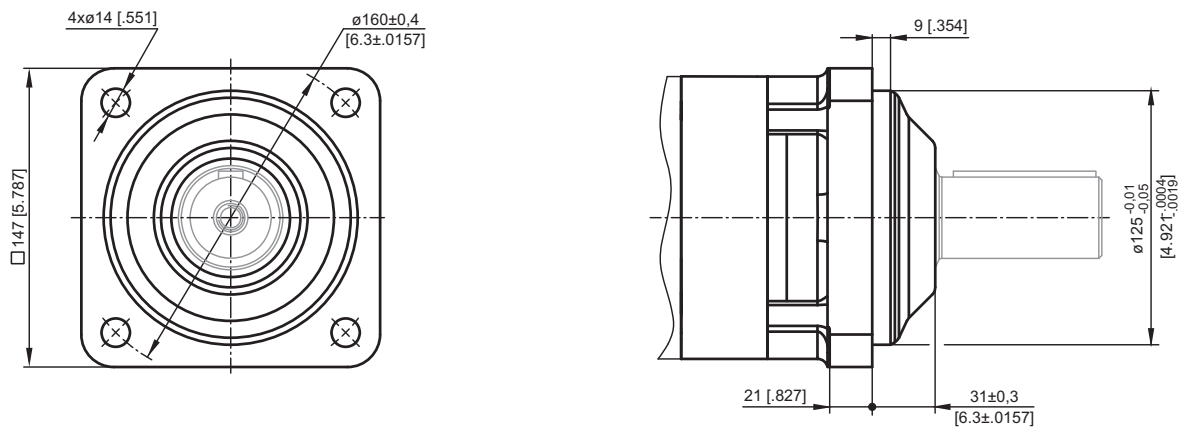


MOUNTING

4-Bolt flange
spigot diameter $\varnothing 160$ mm [6.3 in] - BC $\varnothing 200$ [7.874 in] mm



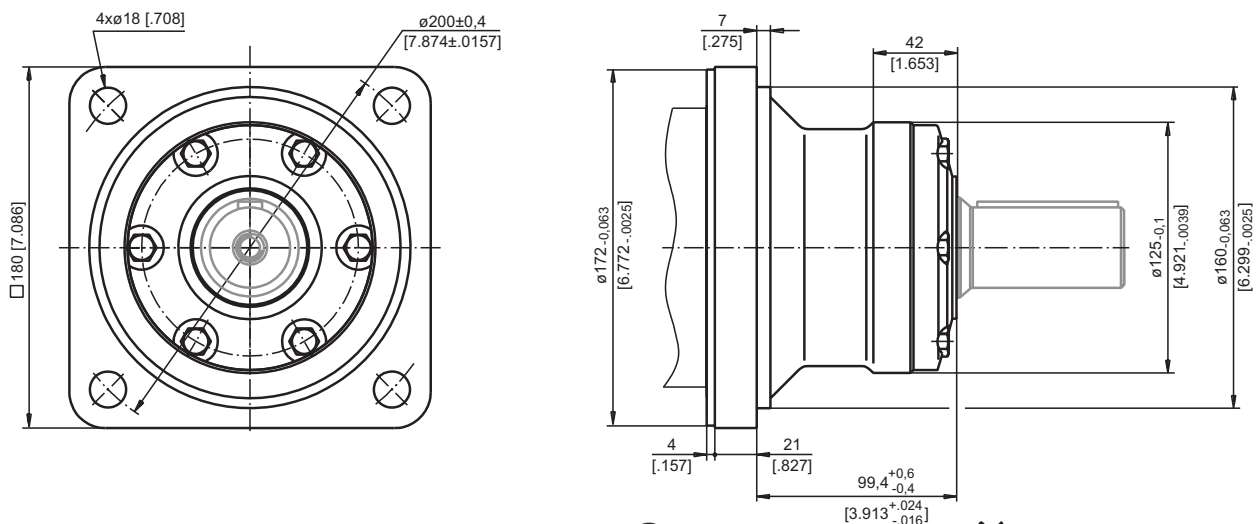
C 4-Bolt flange
spigot diameter $\varnothing 125$ mm [4.921 in] - BC $\varnothing 160$ mm [6.3 in]



W 4-Bolt flange, Wheel Motor
spigot diameter $\varnothing 160$ mm [6.3 in] - BC $\varnothing 200$ mm [7.874 in]

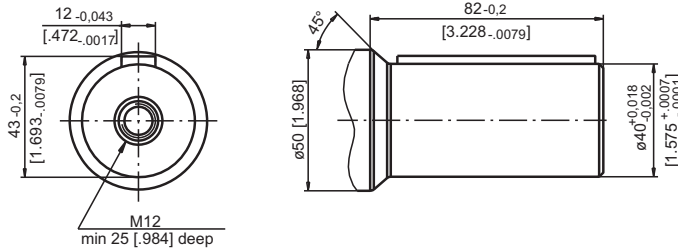


mm [in]

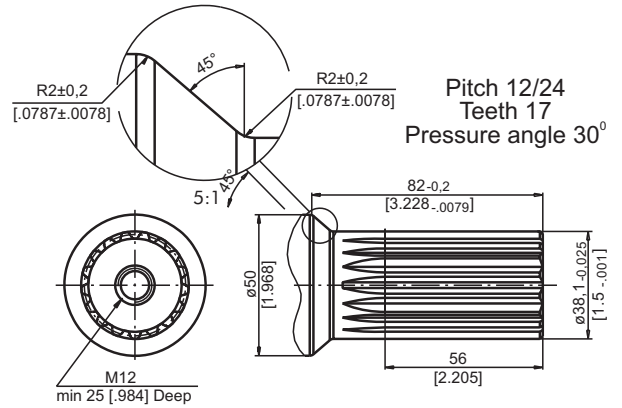


SHAFT EXTENSIONS

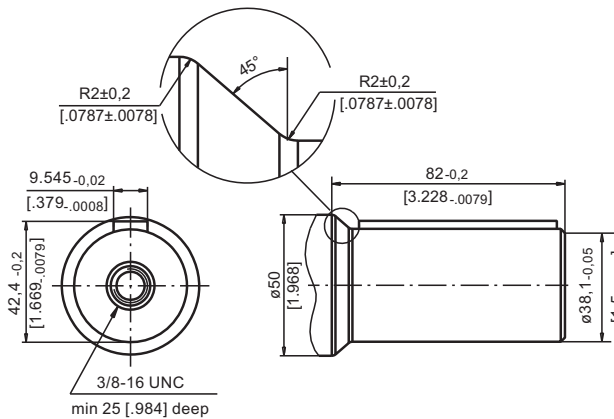
C - $\varnothing 40$ straight, Parallel key A12x8x70 DIN 6885
Max. Torque 132,8 daNm [11755 lb-in]



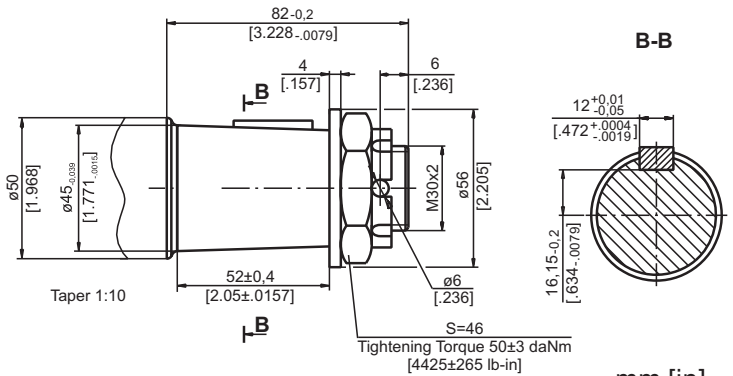
SH - $\varnothing 1\frac{1}{2}$ " splined 17T, DP 12/24 ANSI B92.1-1976
Max. Torque 132,8 daNm [11755 lb-in]



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

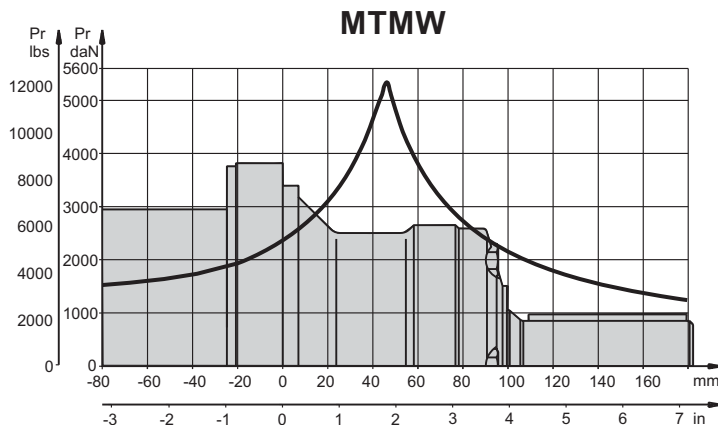
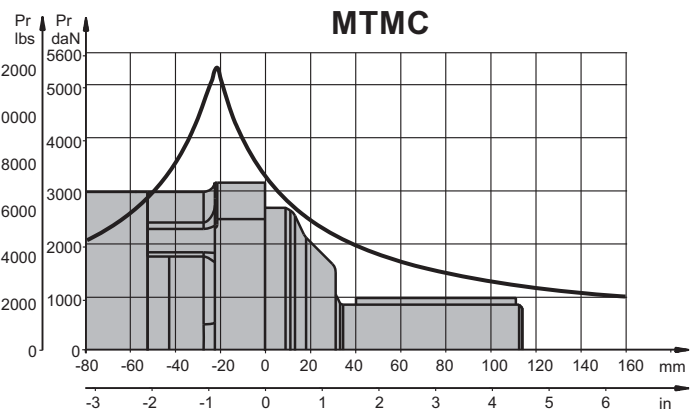
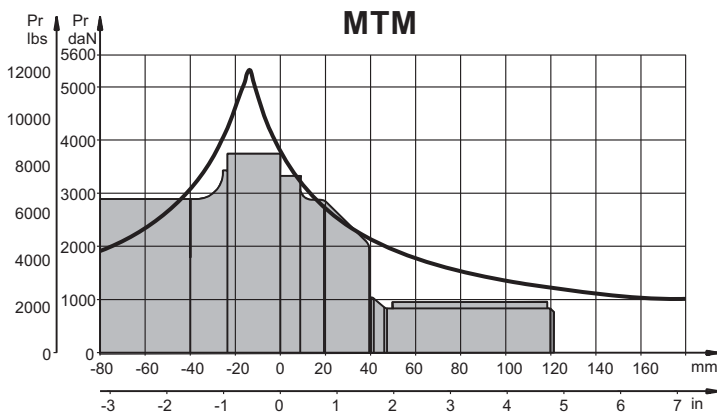


K - tapered 1:10, Parallel key B12x8x28 DIN 6885
Max. Torque 210,7 daNm [18650 lb-in]

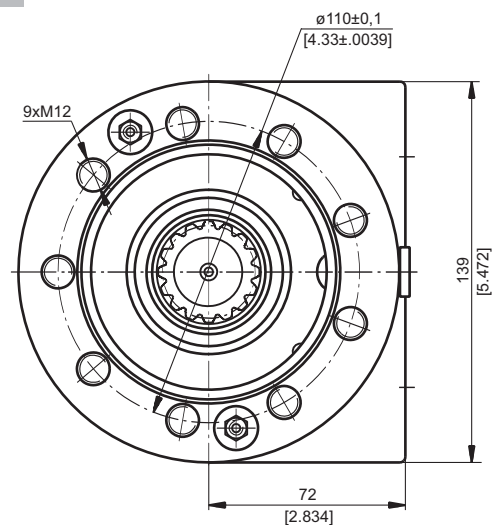
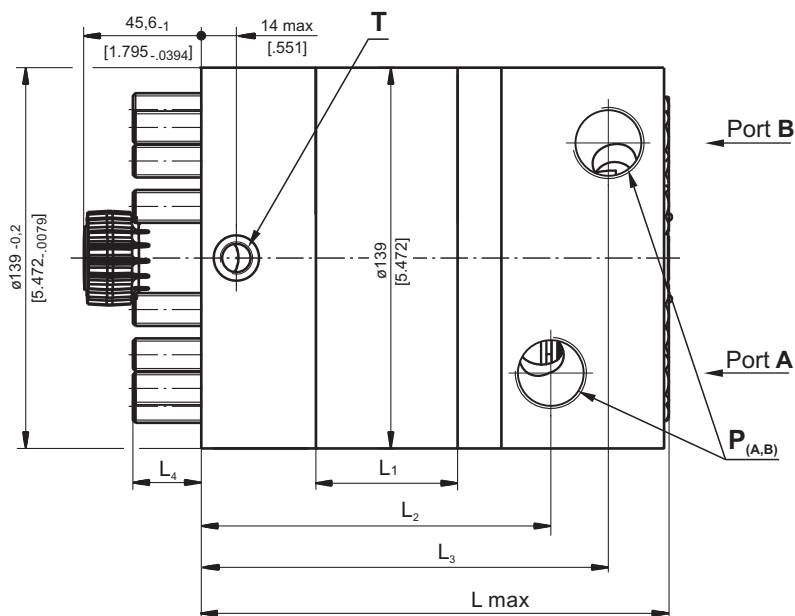


PERMISSIBLE SHAFT LOADS

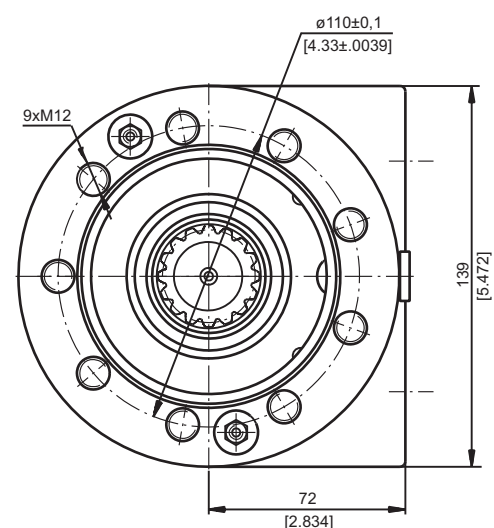
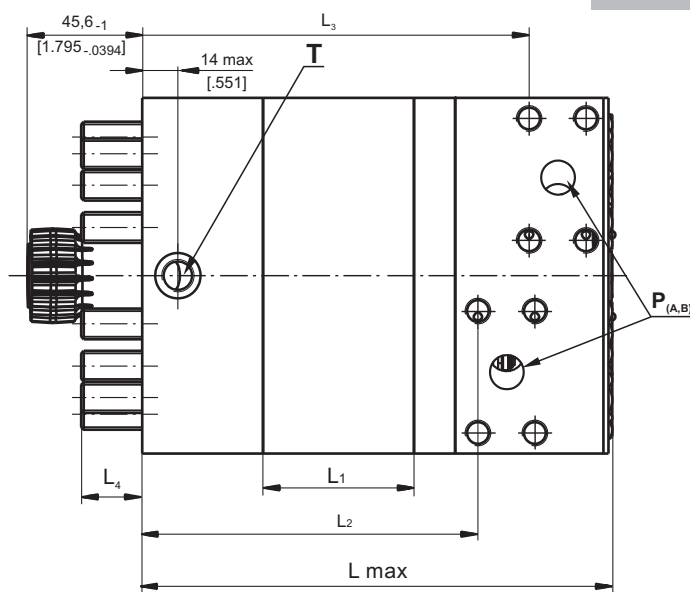
The curves apply to a B10 bearing life (ISO281) of 2000 hours at 200 RPM.



MTMV... and MTMV...4



MTMV...5



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**

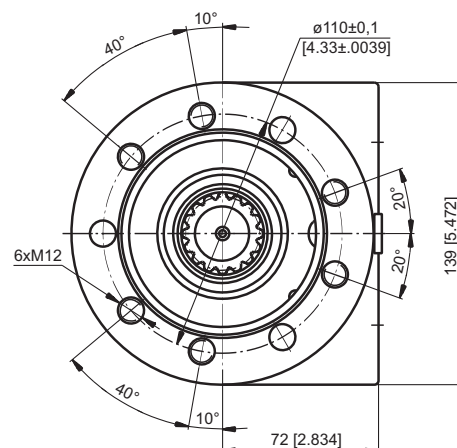
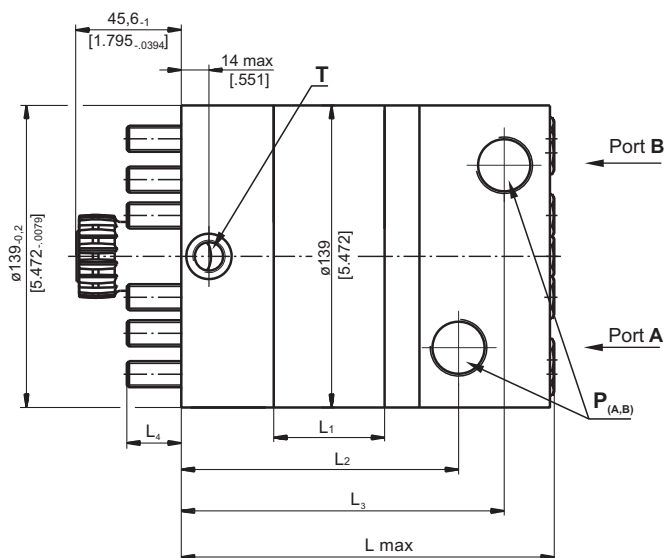
Reverse Rotation

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

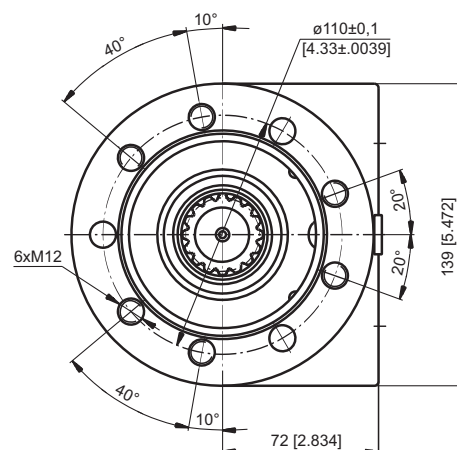
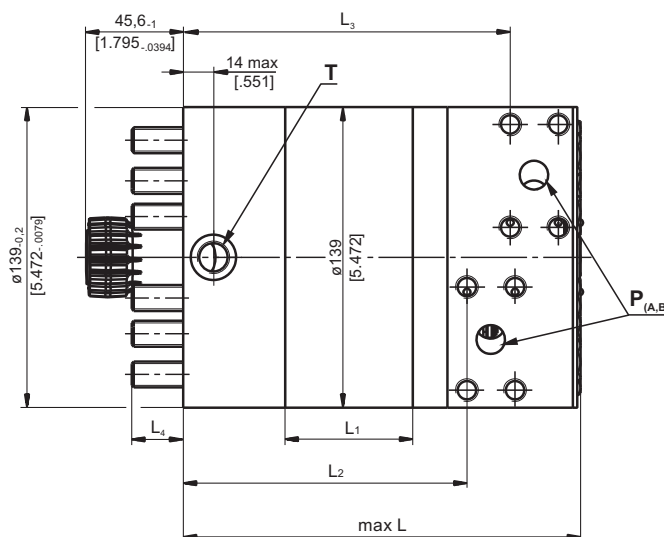
	Versions		
	-	4	5
P_(A,B)	2xG 3/4	2x1 1/16-12UN O-ring	2x3/4"SAE PSI3000 with 8xM10 threads
T	G 1/4	9/16-18UNF	G 1/4

Type	L ₂ , mm [in]	L ₃ , mm [in]	Type	L ₂ , mm [in]	L ₃ , mm [in]	L ₄ , mm [in]	L, mm [in]	L ₁ , mm [in]
MTMV 200...(4)	97,2 [3.827]	117,2 [4.614]	MTMV 200...5	127,5 [5.019]	106,5 [4.193]	27,8 [1.094]	151 [5.945]	25 [.98]
MTMV 250...(4)	103,5 [4.075]	123,5 [4.862]	MTMV 250...5	133,8 [5.268]	112,8 [4.441]	26,5 [1.043]	157 [6.181]	31,3 [1.23]
MTMV 315...(4)	112,7 [4.437]	132,7 [5.224]	MTMV 315...5	143,0 [5.629]	122,0 [4.803]	22,3 [.878]	167 [6.575]	40,5 [1.59]
MTMV 400...(4)	123,2 [4.850]	143,2 [5.638]	MTMV 400...5	153,5 [6.043]	132,5 [5.217]	21,8 [.858]	177 [6.968]	51 [2.01]
MTMV 470...(4)	131,2 [5.165]	151,2 [5.953]	MTMV 470...5	161,5 [6.358]	140,5 [5.531]	23,8 [.937]	185 [7.283]	59 [2.32]
MTMV 500...(4)	137,2 [5.402]	157,2 [6.189]	MTMV 500...5	167,5 [6.594]	146,5 [5.768]	27,8 [1.094]	191 [7.520]	65 [2.56]
MTMV 630...(4)	133,2 [5.244]	153,2 [6.031]	MTMV 630...5	163,5 [6.437]	142,5 [5.610]	21,8 [.858]	187 [7.362]	61 [2.40]
MTMV 725...(4)	142,2 [5.598]	162,2 [6.386]	MTMV 725...5	172,5 [6.791]	151,5 [5.965]	22,8 [.898]	196 [7.717]	70 [2.76]

MTM6V... and MTM6V...4



MTM6V...5



	Versions		
	-	4	5
P_(A,B)	2xG 3/4	2x1 ¹ / ₁₆ -12UN O-ring	2x3/4"SAE PSI3000 with 8xM10 threads
T	G 1/4	⁹ / ₁₆ -18UNF	G 1/4

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

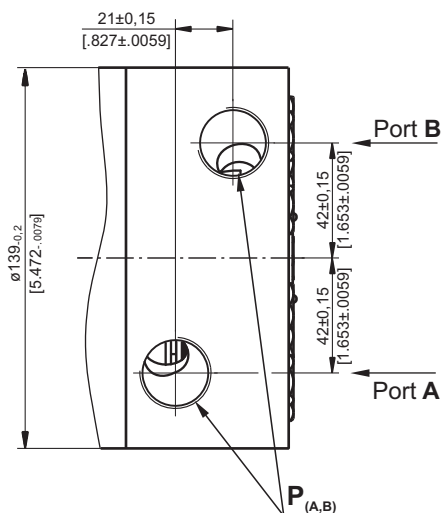
Viewed from Shaft End
Port **A** Pressurized - **CCW**
Port **B** Pressurized - **CW**

Type	L ₂ , mm [in]	L ₃ , mm [in]	Type	L ₂ , mm [in]	L ₃ , mm [in]	L ₄ , mm [in]	L, mm [in]	L ₁ , mm [in]
MTM6V 200...(4)	97,2 [3.827]	117,2 [4.614]	MTM6V 200...5	106,5 [4.193]	127,5 [5.019]	27,8 [1.094]	151 [5.945]	25 [.98]
MTM6V 250...(4)	103,5 [4.075]	123,5 [4.862]	MTM6V 250...5	112,8 [4.441]	133,8 [5.268]	26,5 [1.043]	157 [6.181]	31,3 [1.23]
MTM6V 315...(4)	112,7 [4.437]	132,7 [5.224]	MTM6V 315...5	122,0 [4.803]	143,0 [5.629]	22,3 [.878]	167 [6.575]	40,5 [1.59]
MTM6V 400...(4)	123,2 [4.850]	143,2 [5.638]	MTM6V 400...5	132,5 [5.217]	153,5 [6.043]	21,8 [.858]	177 [6.968]	51 [2.01]
MTM6V 470...(4)	131,2 [5.165]	151,2 [5.953]	MTM6V 470...5	140,5 [5.531]	161,5 [6.358]	23,8 [.937]	185 [7.283]	59 [2.32]
MTM6V 500...(4)	137,2 [5.402]	157,2 [6.189]	MTM6V 500...5	146,5 [5.768]	167,5 [6.594]	27,8 [1.094]	191 [7.520]	65 [2.56]
MTM6V 630...(4)	133,2 [5.244]	153,2 [6.031]	MTM6V 630...5	142,5 [5.610]	163,5 [6.437]	21,8 [.858]	187 [7.362]	61 [2.40]
MTM6V 725...(4)	142,2 [5.598]	162,2 [6.386]	MTM6V 725...5	151,5 [5.965]	172,5 [6.791]	22,8 [.898]	196 [7.717]	70 [2.76]

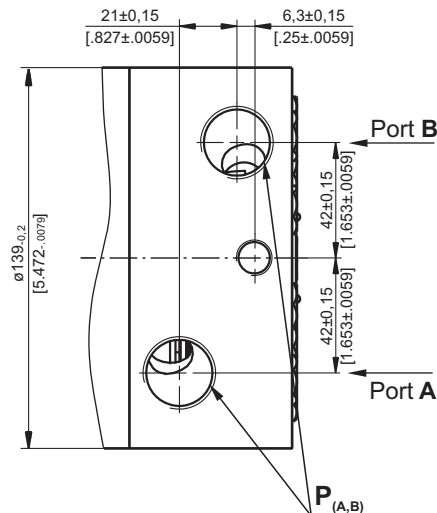
PORTS

Versions - **4**

For **MTM** and **MTMC**

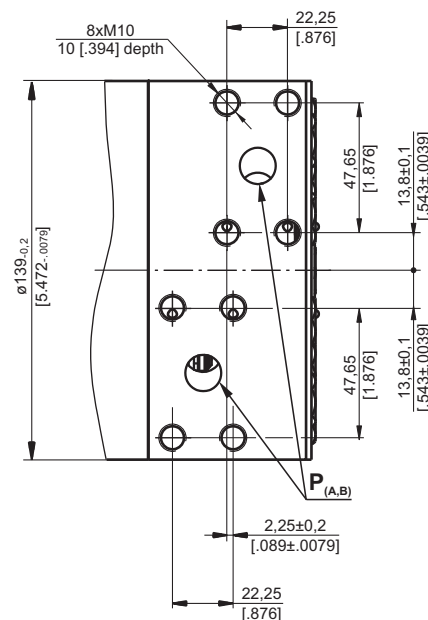


For **MTMW**



Version **5**

For **MTM** and **MTMC**

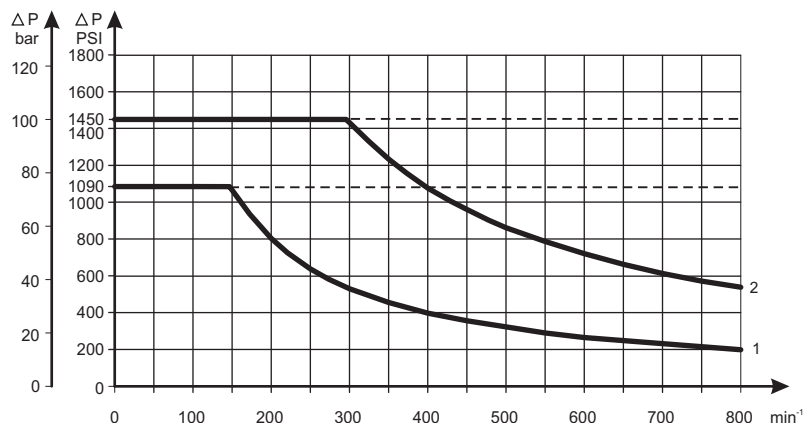


	Versions		
	-	4	5
P_(A,B)	2xG 3/4	2x1 ¹ / ₁₆ -12UN O-ring	2x3/4"SAE PSI3000 with 8xM10 threads
T	G 1/4	⁹ / ₁₆ -18UNF	G 1/4



MAX. PERMISSIBLE SHAFT SEAL PRESSURE

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

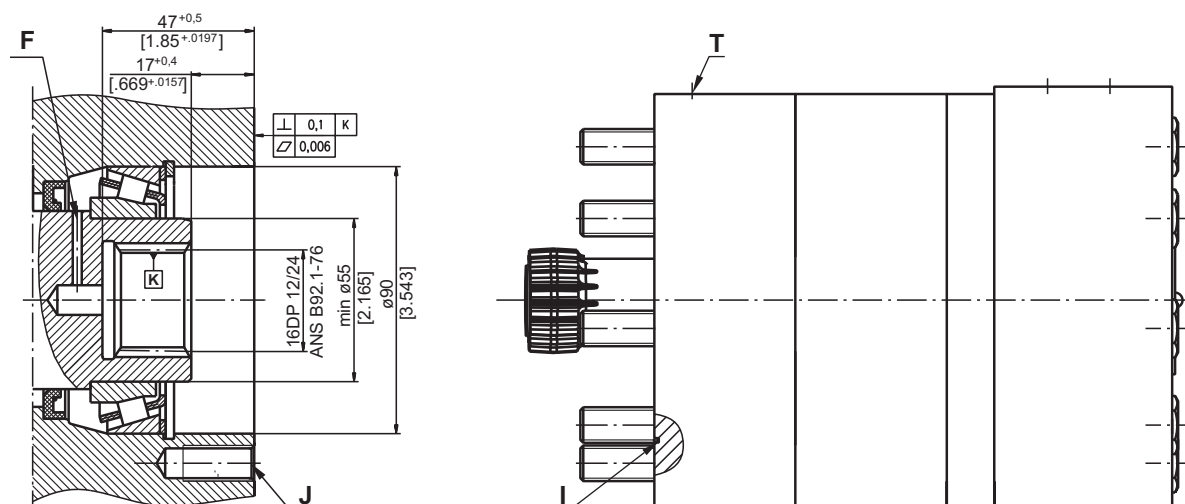


1: Drawing for Standard Shaft Seal

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

— - continuous operations
- - - - - intermittent operations

DIMENSIONS OF THE ATTACHED COMPONENT



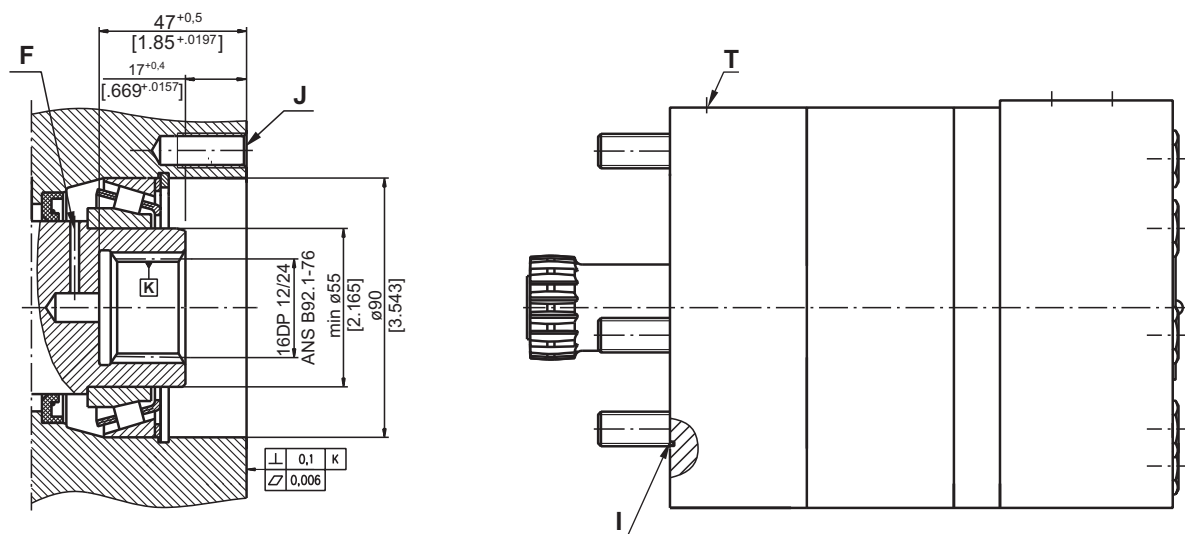
F: Oil circulation hole

J: 9xM12-30 mm [1.181 in] depth, 40°, ø110±0,1 [4.33±.0039]

I: O- Ring 93x1,5 mm [3.661x.059 in]

T: Drain connection G1/4

DIMENSIONS OF THE ATTACHED COMPONENT FOR MTM6V



F: Oil circulation hole

J: 9xM12-30 mm [1.181 in] depth, 40°, ø110±0,1 [4.33±.0039] or 6xM12-30 mm [1.181 in] depth, situated in accordance with the bolts M12, shown on Fig.1, ø110±0,1 [4.33±.0039]

I: O- Ring 93x1,5mm [3.661x.059 in]

T: Drain connection G1/4



mm [in]

DRAIN CONNECTION

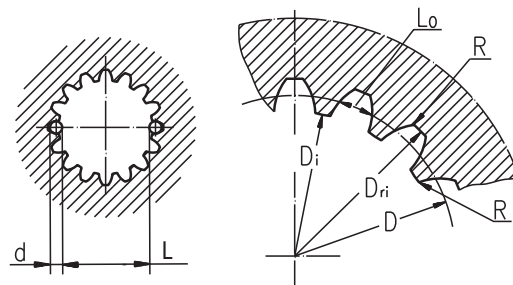
A drain line ought to be used when pressure in the return line can exceed the permissible pressure. It can be connected at the drain connection of the attached component. The maximum pressure in the drain line is limited by the attached component and its shaft seal.

The drain line must be possible for oil to flow freely between motor and attached component and must be led to the tank. The maximum pressure in the drain line is limited by the attached component and its seal.

INTERNAL SPLINE DATA FOR THE ATTACHED COMPONENT

Standard *ANS B92.1-1976, class 5*
[*m=2.1166; corrected x.m=+1,0*]

Fillet Root Side Fit		inch	mm
Number of Teeth	z	16	16
Diametral Pitch	DP	12/24	12/24
Pressure Angle		30 ⁰	30 ⁰
Pitch Dia.	D	1.3333	33,8656
Major Dia.	D _{ri}	1.5118÷1.5275	38,4 ^{+0,4}
Minor Dia.	D _i	1.2657÷1.2673	32,15 ^{+0,04}
Circular Space Width	L _o	.1763÷.1791	4,516±0,037
Fillet Radius	R	.02	0,5
Dimension Between Two Pins	L	1.063÷1.059	26,9 ^{+0,10}
Pin Dia.	d	.19026÷.19034	4,835±0,001



Hardening Specification:
HV=750±50 on the surface.
HV=560 at 0,7±0,2 [.035±.019] case depth
Material: 20 MoCr4 EN 10084 or SAE8620.

ORDER CODE

	1	2	3	4	5	6	7	8
MTM								

Pos.1 - Mounting Flange

omit - 4-Bolt flange, spigot dia. ø160, BC ø200

C - 4-Bolt flange, spigot dia. ø125, BC ø160

W* - Wheel motor

V - Very short mount, 9xM12 mounting bolts

6V - Very short mount, 6xM12 mounting bolts

Pos.2 - Displacement code

200 - 201,4 cm³/rev [12.29 in³/rev]

250 - 251,8 cm³/rev [15.36 in³/rev]

315 - 326,3 cm³/rev [19.90 in³/rev]

400 - 410,9 cm³/rev [25.06 in³/rev]

470 - 475,0 cm³/rev [28.97 in³/rev]

500 - 523,6 cm³/rev [31.95 in³/rev]

630 - 631,2 cm³/rev [38.52 in³/rev]

725 - 724,3 cm³/rev [44.20 in³/rev]

Pos.3 - Shaft Extensions**

C - ø40 straight, Parallel key A12x8x70 DIN6885

CO - ø1½" straight, Parallel key 3/8"x3/8"x2¼" BS46

K - ø45 tapered 1:10, Parallel key B12x8x28 DIN6885

SH - ø1½" splined 17T ANSI B92.1-1976

Pos.4 - Shaft Seal Version (see page 31)

omit - Low pressure seal

U - High pressure seal

Pos.5 - Check Valves

omit - without check valves

1 - with check valves

Pos.6 - Ports

omit - 2xG3/4, G1/4, BSPP (ISO 228)

4 - 2x1½"-12 UN, O-ring, 9/16"-18 UNF

5 - 2x3/4"SAE PSI3000 with 8xM10 threads, G1/4

Pos.7 - Special Features (see page 58)

Pos.8 - Design Series

omit - Factory specified

NOTES:

* Not applicable for "5" version.

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

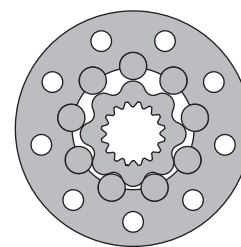
The hydraulic motors are mangano-phosphatized as standard.

HYDRAULIC MOTORS TMF



APPLICATION

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



CONTENTS

Specification data	35
Function diagrams	36÷39
Dimensions and mounting TMF.....	40
Dimensions and mounting TMFA	41
Permissible shaft loads	42
Order code	42

OPTIONS

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

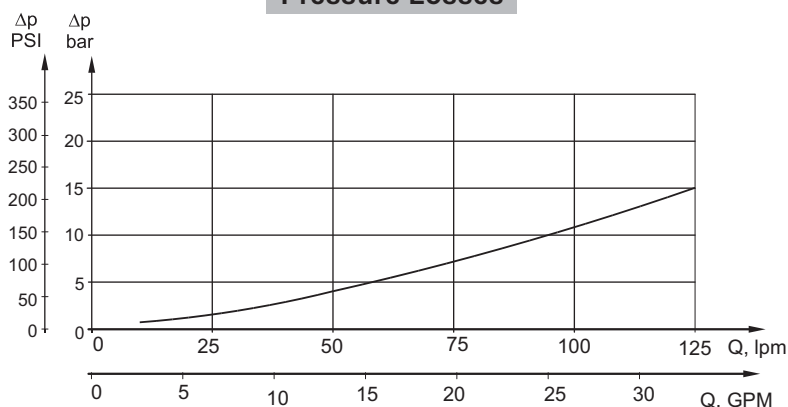
GENERAL

Max. Displacement, cm ³ /rev [in ³ /rev]	724,3 [44.2]
Max. Speed, [RPM]	750
Max. Torque, daNm [lb-in]	cont.: 175 [15490] int.: 215 [16030]
Max. Output, kW [HP]	70 [94]
Max. Pressure Drop, bar [PSI]	cont.: 250 [3600] int.: 350 [5080]
Max. Oil Flow, lpm [GPM]	150 [40]
Min. Speed, [RPM]	5
Permissible Shaft Loads daN [lbs]	P _a =1000 [2250]
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 micron)

Oil flow in drain line

Pressure drop bar [PSI]	Viscosity mm ² /s [SUS]	Oil flow in drain line lpm [GPM]
200 [2900]	20 [98]	2,5 [.660]
	35 [164]	1,5 [.400]
275 [3990]	20 [98]	4 [1.057]
	35 [164]	2,5 [.660]

Pressure Losses



SPECIFICATION DATA

Type		TMF 200	TMF 250	TMF 315	TMF 400	TMF 470	TMF 500	TMF 630	TMF 725
Displacement, cm ³ /rev [in ³ /rev]		201,4 [12.29]	251,8 [15.36]	326,3 [19.9]	410,9 [25.06]	475 [28.97]	523,6 [31.95]	631,2 [38.52]	724 [44.2]
Max. Speed, [RPM]	Cont.	625	500	380	305	260	240	185	170
	Int.*	750	600	460	365	315	285	225	215
Max. Torque daNm [lb-in]	Cont.	74 [6550]	90[7965]	116[10265]	147[13010]	171[15135]	172[15225]	175[15490]	160[14160]
	Int.*	102 [9030]	128[11330]	163[14425]	206[18232]	215[16030]	215[19030]	215[19030]	192[17000]
	Peak**	115[10180]	144[12745]	186[16460]	235[20800]	240[21240]	240[21240]	250[21225]	240[21240]
Max. Output kW [HP]	Cont.	41 [55]	41 [55]	41 [55]	41 [55]	41 [55]	37,5 [50]	28 [37,5]	26 [35]
	Int.*	65 [87]	70 [94]	70 [94]	70 [94]	55 [74]	51 [68]	42 [56]	40 [54]
Max. Pressure Drop bar [PSI]	Cont.	250[3600]	250[3600]	250[3600]	250[3600]	250[3600]	230[3340]	185[2680]	160[2320]
	Int.*	350[5080]	350[5080]	350[5080]	350[5080]	350[5080]	280[4060]	225[3260]	210[3045]
	Peak**	400[5800]	400[5800]	400[5800]	400[5800]	400[5800]	320[4640]	270[3915]	260[3770]
Max. Oil Flow lpm [GPM]	Cont.	125[33]	125[33]	125[33]	125[33]	125[33]	125[33]	125[33]	125[33]
	Int.*	150[40]	150[40]	150[40]	150[40]	150[40]	150[40]	150[40]	150[40]
Max. Inlet Pressure bar [PSI]	Cont.	270[3920]	270[3920]	270[3920]	270[3920]	270[3920]	270[3920]	270[3920]	270[3920]
	Int.*	370[5370]	370[5370]	370[5370]	370[5370]	370[5370]	370[5370]	370[5370]	370[5370]
	Peak**	420[6100]	420[6100]	420[6100]	420[6100]	420[6100]	420[6100]	420[6100]	420[6100]
Max. Return Pressure without Drain Line or Max. Pressure in Drain Line, bar [PSI]	Cont. 0-100 RPM	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]
	Cont. 100-300 RPM	40 [580]	40 [580]	40 [580]	40 [580]	40 [580]	40 [580]	40 [580]	40 [580]
	Cont. >300 RPM	20 [290]	20 [290]	20 [290]	20 [290]	20 [290]	-	-	-
	Int.* 0-max. RPM	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]	75 [1100]
Max. Return Pressure with Drain Line bar [PSI]	Cont.	140[2000]	140[2000]	140[2000]	140[2000]	140[2000]	140[2000]	140[2000]	140[2000]
	Int.*	175[2500]	175[2500]	175[2500]	175[2500]	175[2500]	175[2500]	175[2500]	175[2500]
	Peak**	210[3000]	210[3000]	210[3000]	210[3000]	210[3000]	210[3000]	210[3000]	210[3000]
Max. Starting Pressure with Unloaded Shaft, bar [PSI]		6 [90]	6 [90]	6 [90]	6 [90]	6 [90]	6 [90]	6 [90]	6 [90]
Min. Starting Torque daNm [lb-in]		60[5310]	75[6640]	97[8585]	122[10800]	142[12570]	143[12655]	145[12830]	148[13100]
Min. Speed***, [RPM]		5	5	5	5	5	5	5	5
Weight, kg [lb]		26,9[59.3]	27,3[60.2]	28,1[62]	29 [64]	29,7[65.5]	30,2[66.6]	29,7[65.5]	31[68.4]

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

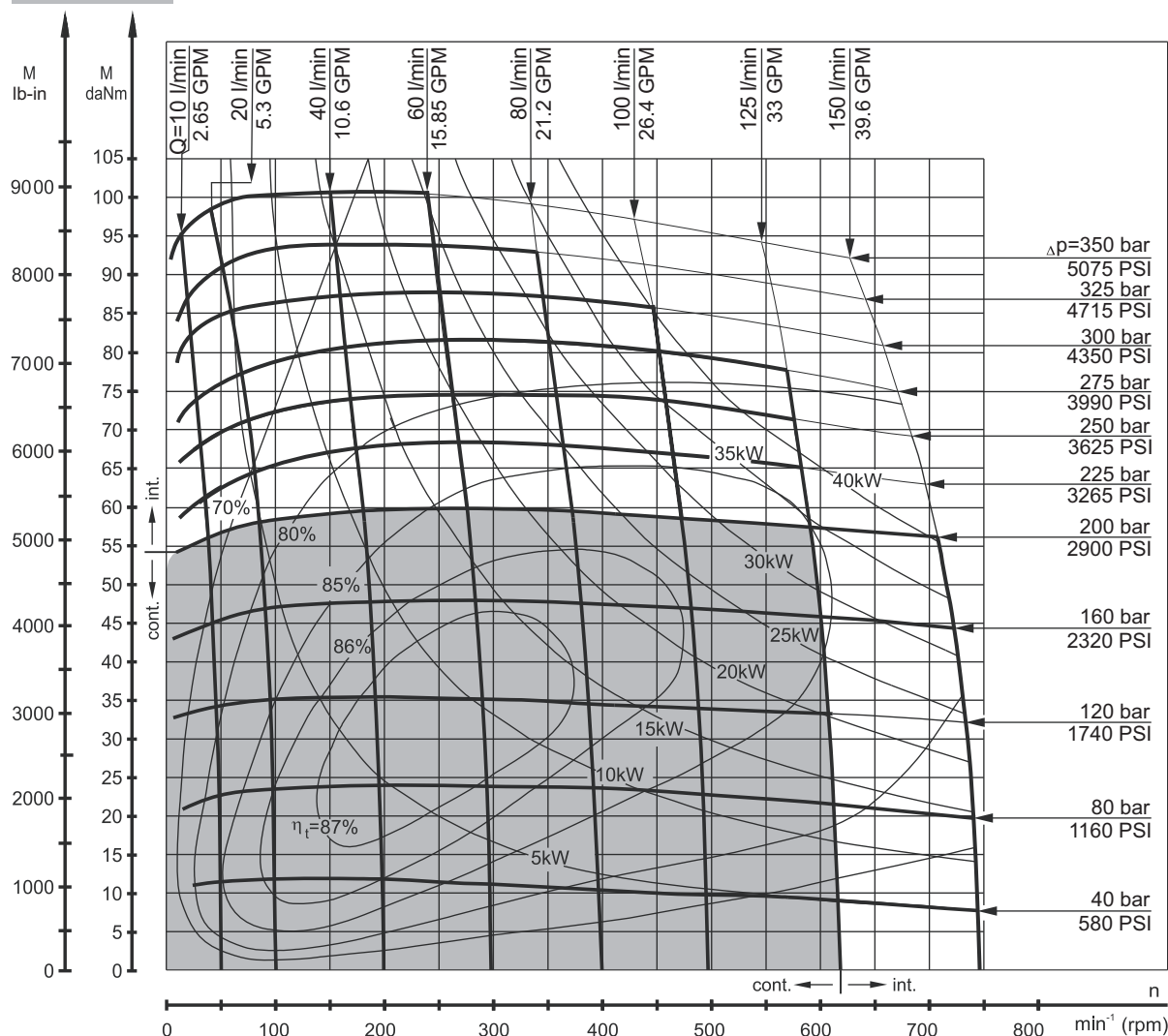
** Peak load: the permissible values may occur for max. 1% of every minute.

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

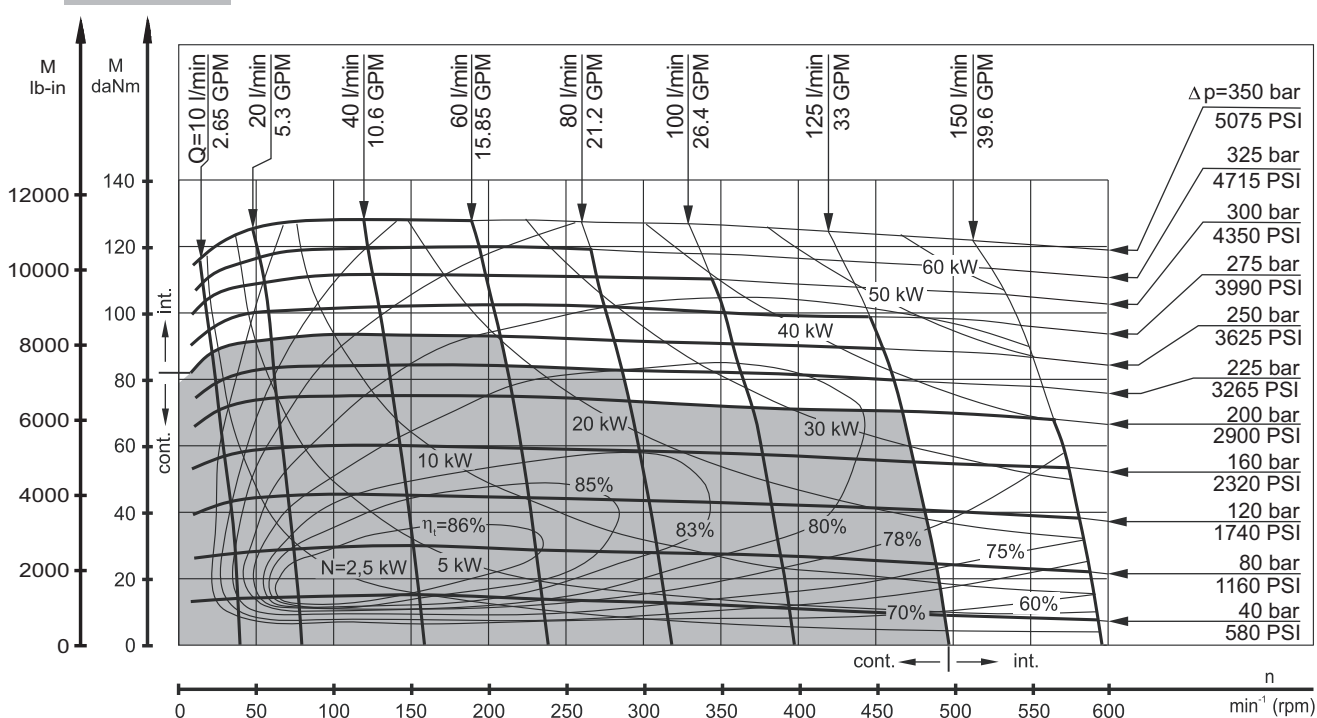
- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil, HLP(DIN51524) or HM(ISO6743/4). If using synthetic fluids consult the factory for alternative seal materials.
- Recommended minimum oil viscosity 70 SUS [13 cm²/s] 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

TMF 200



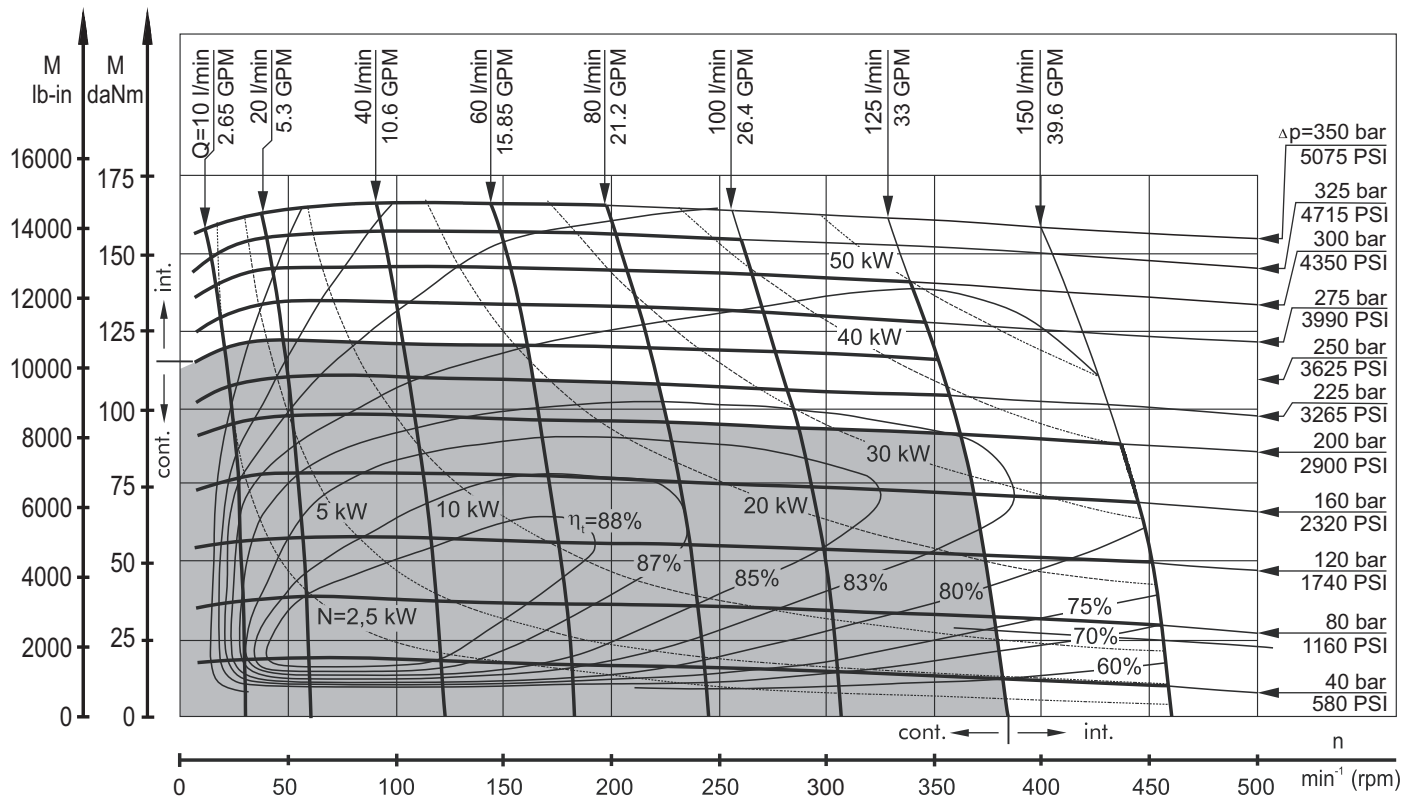
TMF 250



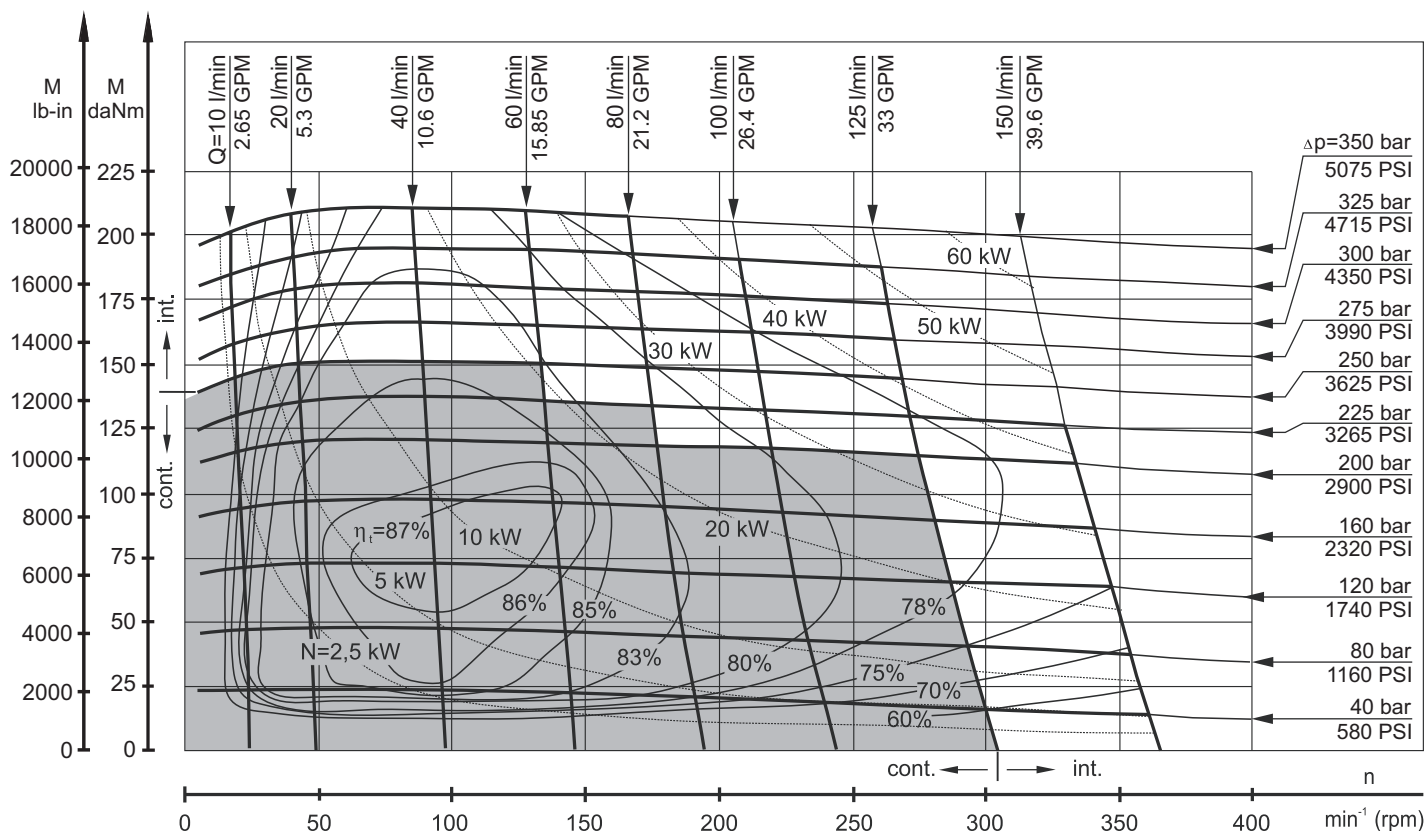
The function diagrams data was collected at back pressure 5÷10 bar (72.5 PSI÷145 PSI) and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

TMF 315



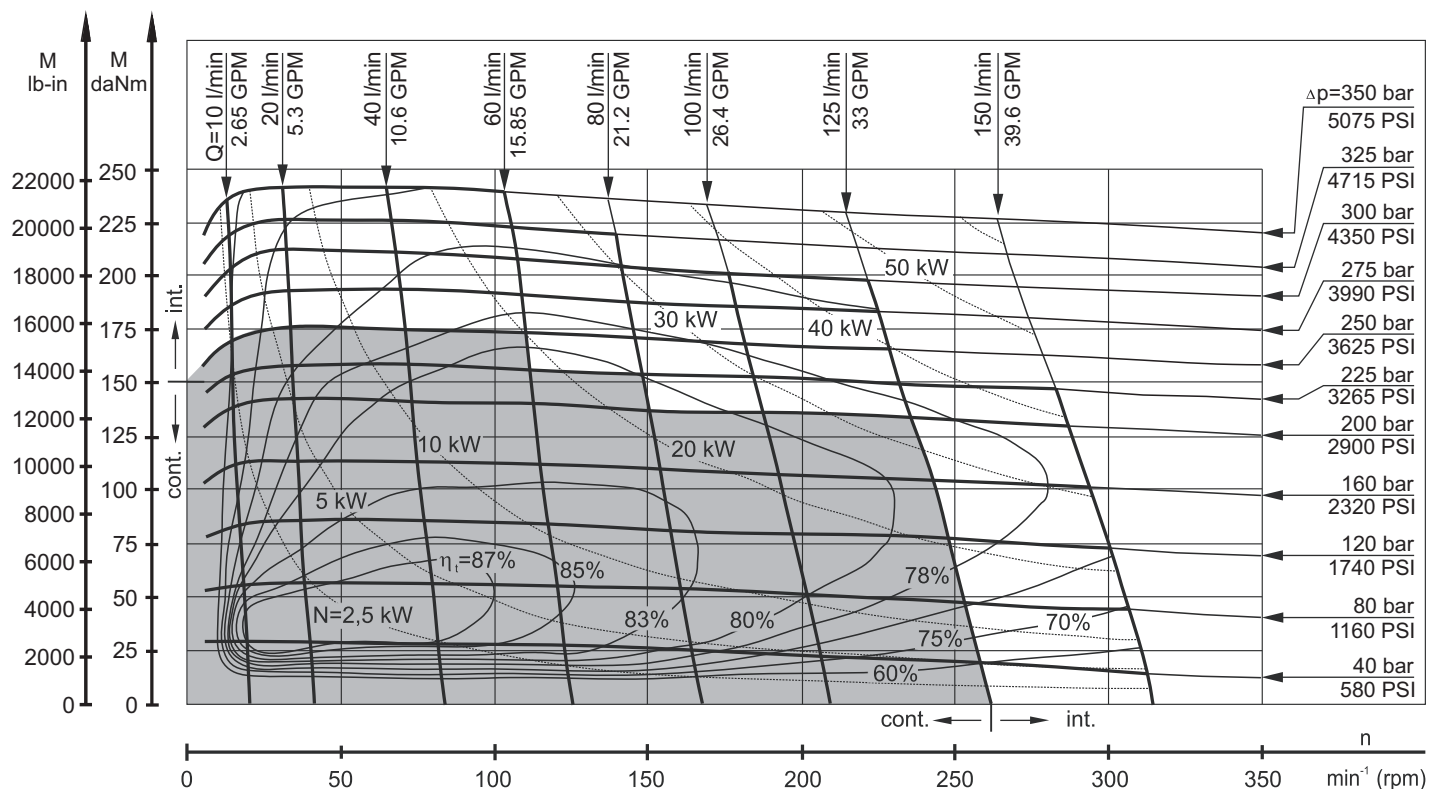
TMF 400



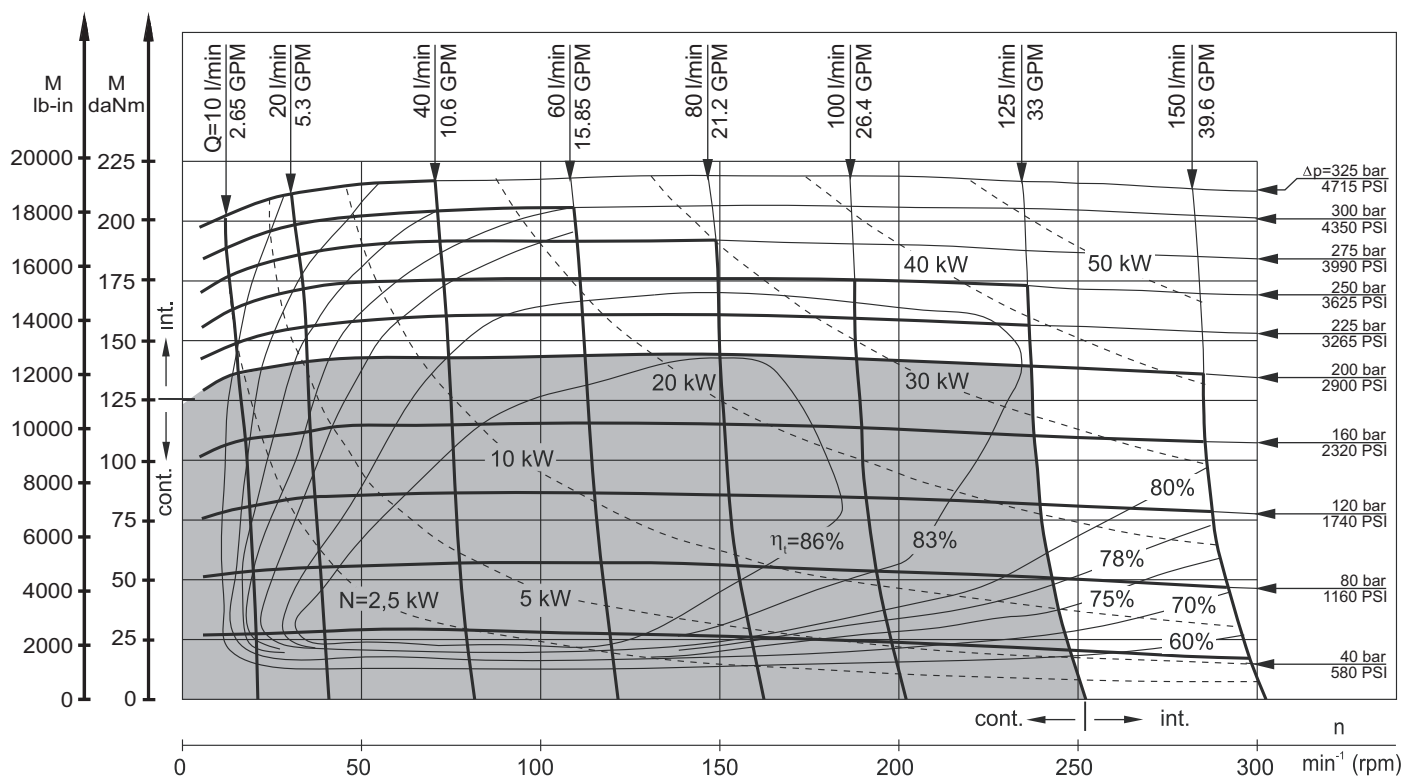
The function diagrams data was collected at back pressure 5÷10 bar (72.5 PSI÷145 PSI) and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

TMF 470



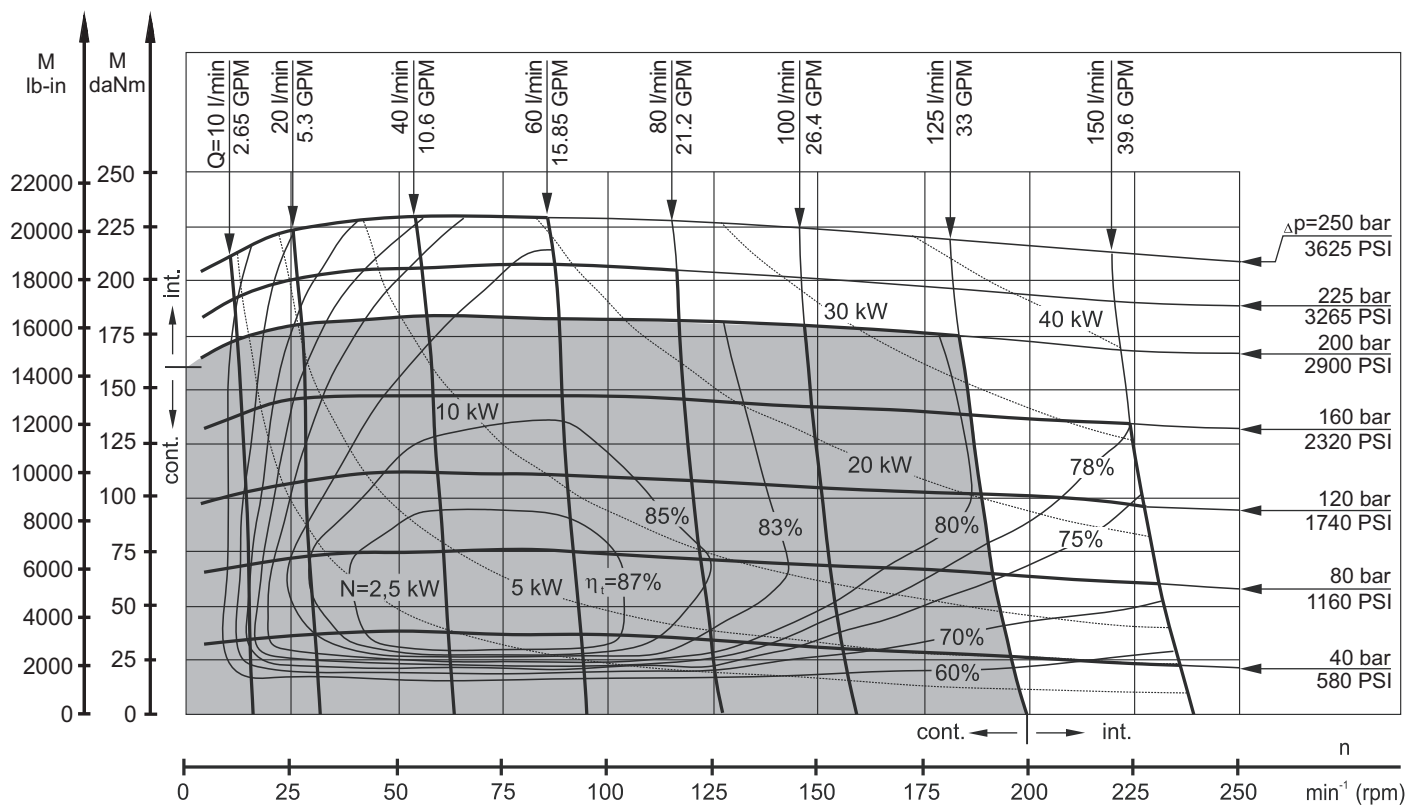
TMF 500



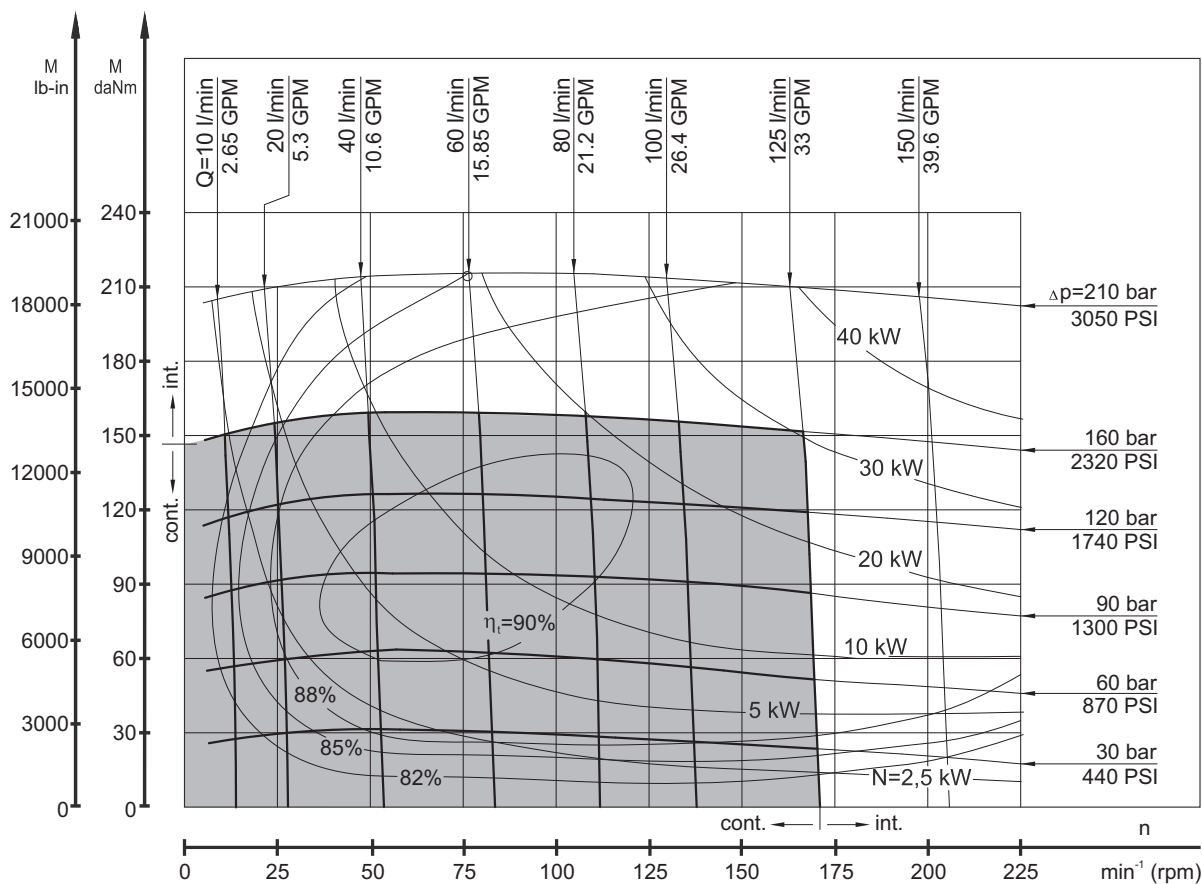
The function diagrams data was collected at back pressure 5÷10 bar (72.5 PSI÷145 PSI) and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

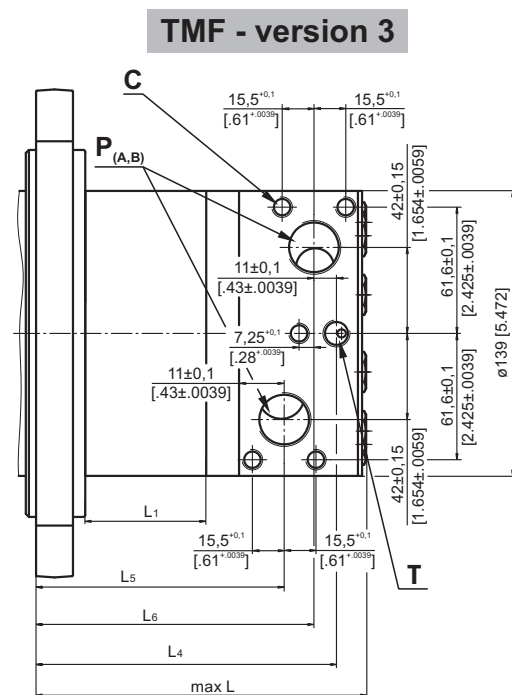
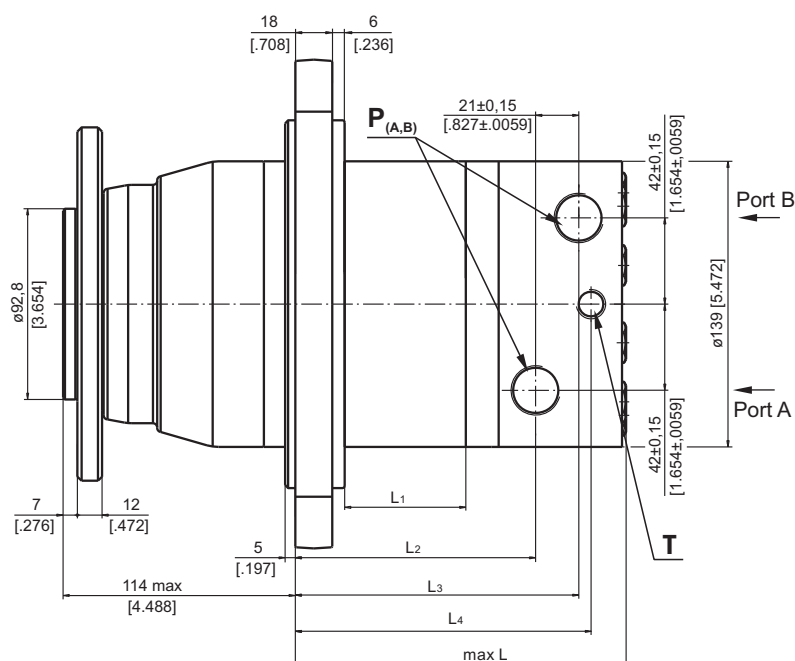
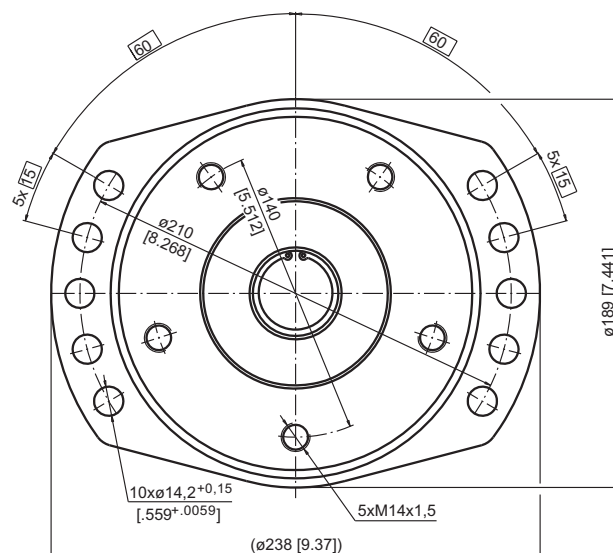
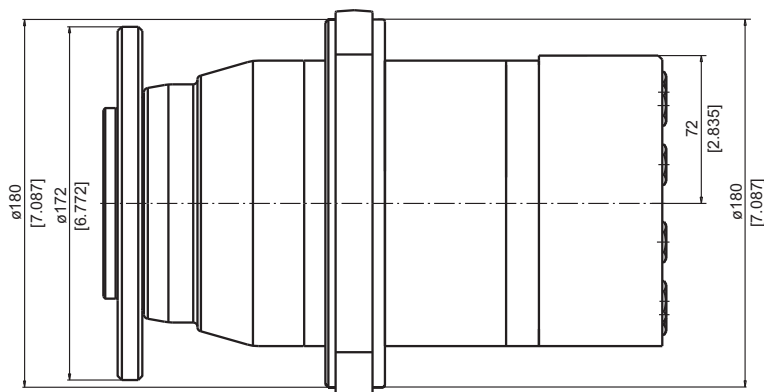
TMF 630



TMF 725



The function diagrams data was collected at back pressure 5÷10 bar (72.5 PSI÷145 PSI) and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].



Warning: Drain line should always be used.

	Versions		
	2	3	4
P_(A,B)	2xG3/4 17 mm [.669 in] depth	2xG3/4 17 mm [.669 in] depth	2x1 1/16-12 UN 17 mm [.669 in] depth O-ring
T	G1/4 12 mm [.472 in] depth	G1/4 12 mm [.472 in] depth	9/16-18 UN 12 mm [.472 in] depth O-ring
C	-	5xM10 17 mm [.669 in] depth	-

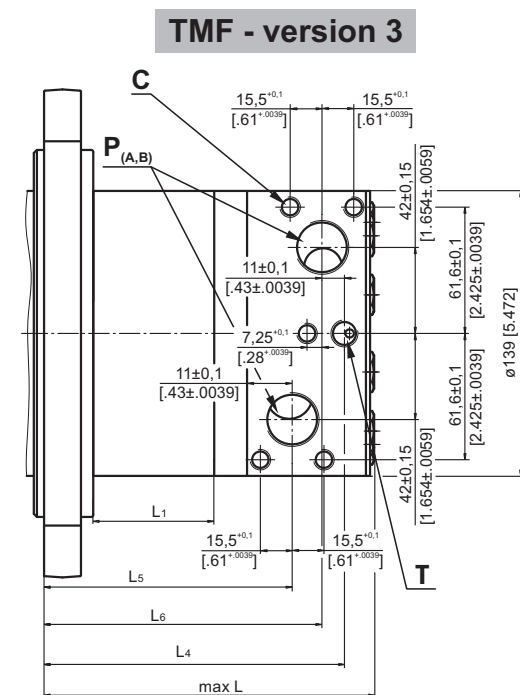
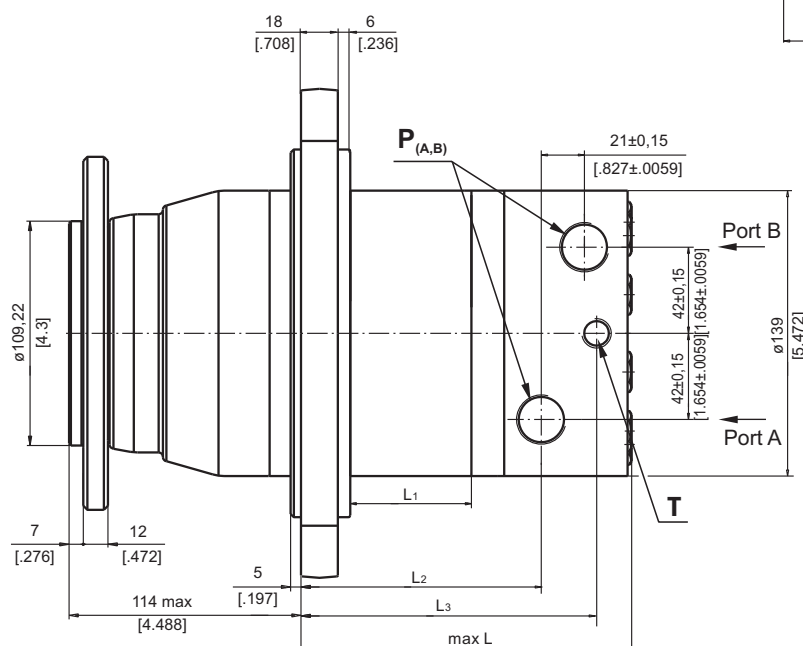
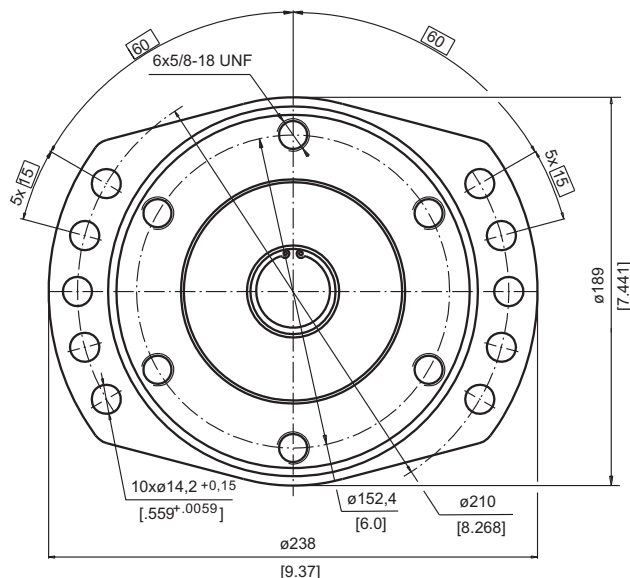
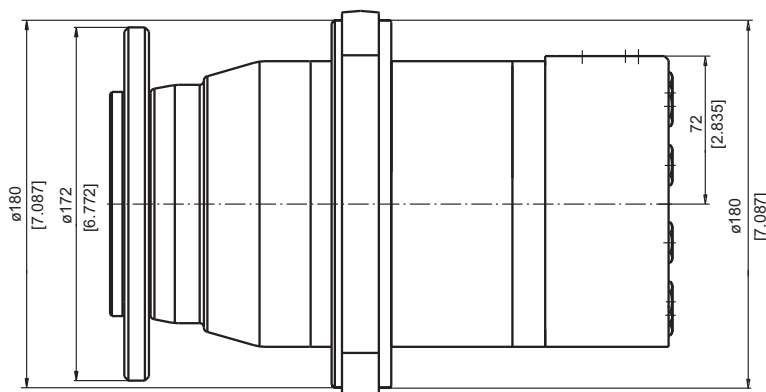


Standard Rotation
Viewed from Shaft End
Port A Pressurized - **CW**
Port B Pressurized - **CCW**

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

Type	L, mm [in]	L ₁ , mm [in]	L ₂ , mm [in]	L ₃ , mm [in]	L ₄ , mm [in]	L ₅ , mm [in]	L ₆ , mm [in]
TMF 200	126 [4.96]	25,0 [.98]	83,0 [3.27]	104,0 [4.09]	110,3 [4.34]	87,0 [3.43]	101,5 [3.99]
TMF 250	133 [5.24]	31,3 [1.23]	89,3 [3.52]	110,3 [4.34]	116,6 [4.59]	93,5 [3.68]	108,0 [4.25]
TMF 315	142 [5.59]	40,5 [1.59]	98,5 [3.88]	119,5 [4.70]	125,8 [4.95]	102,5 [4.04]	117,0 [4.61]
TMF 400	152 [5.98]	51,0 [2.01]	109,0 [4.29]	130,0 [5.12]	136,3 [5.37]	113,0 [4.45]	127,5 [5.02]
TMF 470	161 [6.34]	59,0 [2.32]	117,0 [4.61]	138,0 [5.43]	144,3 [5.68]	121,0 [4.76]	135,0 [5.33]
TMF 500	166 [6.54]	65,0 [2.56]	123,0 [4.84]	144,0 [5.67]	150,3 [5.92]	127,0 [5.00]	141,5 [5.57]
TMF 630	162 [6.38]	61,0 [2.40]	119,0 [4.69]	140,0 [5.51]	146,3 [5.76]	123,0 [4.84]	137,5 [5.41]
TMF 725	171 [6.73]	70,0 [2.76]	128,0 [5.04]	149,0 [5.87]	155,3 [6.11]	132,0 [5.20]	146,5 [5.77]

DIMENSIONS AND MOUNTING DATA - TMFA



Warning: Drain line should always be used.

	Versions		
	2	3	4
P_(A,B)	2xG3/4 17 mm [.669 in] depth	2xG3/4 17 mm [.669 in] depth	2x1 1/16-12 UN 17 mm [.669 in] depth O-ring
T	G1/4 12 mm [.472 in] depth	G1/4 12 mm [.472 in] depth	9/16-18 UN 12 mm [.472 in] depth O-ring
C	-	5xM10 17 mm [.669 in] depth	-



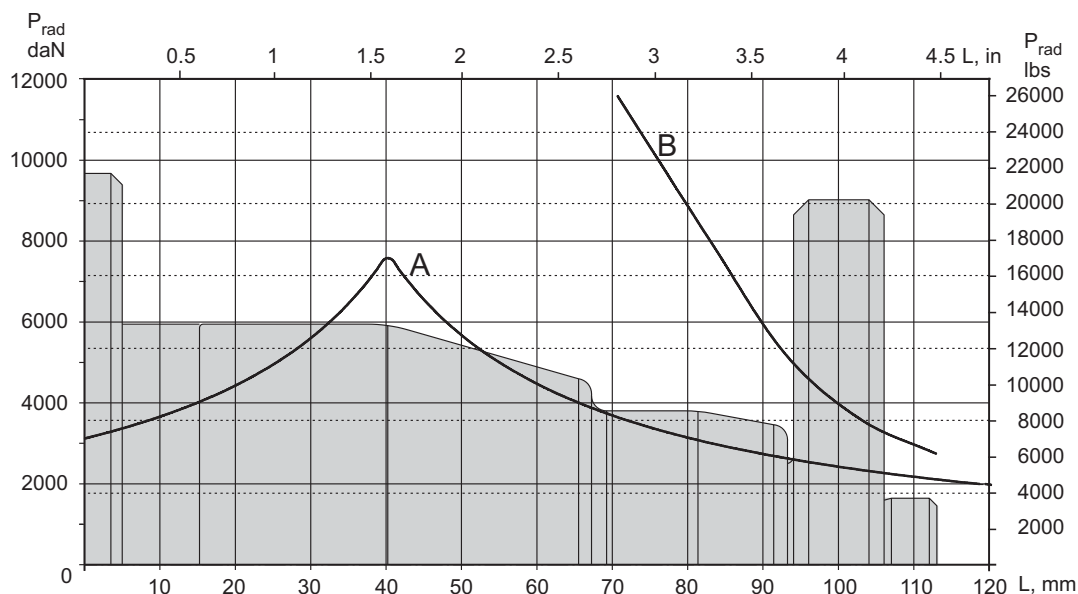
Standard Rotation
Viewed from Shaft End
Port A Pressurized - **CW**
Port B Pressurized - **CCW**

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

Type	L, mm [in]	L ₁ , mm [in]	L ₂ , mm [in]	L ₃ , mm [in]	L ₄ , mm [in]	L ₅ , mm [in]	L ₆ , mm [in]
TMF 200	126 [4.96]	25,0 [.98]	83,0 [3.27]	110,3 [4.34]	112,5 [4.43]	87,0 [3.43]	101,5 [3.99]
TMF 250	133 [5.24]	31,3 [1.23]	89,3 [3.52]	116,6 [4.59]	118,8 [4.68]	93,5 [3.68]	107,8 [4.24]
TMF 315	142 [5.59]	40,5 [1.59]	98,5 [3.88]	125,8 [4.95]	128,0 [5.04]	102,5 [4.04]	117,0 [4.61]
TMF 400	152 [5.98]	51,0 [2.01]	109,0 [4.29]	136,3 [5.37]	138,5 [5.45]	113,0 [4.45]	127,5 [5.02]
TMF 470	161 [6.34]	59,0 [2.32]	117,0 [4.61]	144,3 [5.68]	146,5 [5.77]	121,0 [4.76]	135,0 [5.33]
TMF 500	166 [6.54]	65,0 [2.56]	123,0 [4.84]	150,3 [5.92]	152,5 [6.00]	127,0 [5.00]	141,5 [5.57]
TMF 630	162 [6.38]	61,0 [2.40]	119,0 [4.69]	146,3 [5.76]	148,5 [5.85]	123,0 [4.84]	137,5 [5.41]
TMF 725	171 [6.73]	70,0 [2.76]	128,0 [5.04]	155,3 [6.11]	157,5 [6.20]	132,0 [5.20]	146,5 [5.77]

PERMISSIBLE SHAFT LOADS

The load diagram is valid for an average bearings life of 2000 hours at 100 RPM



A - Permissible radial shaft load.

B - Max. radial shaft load. Any shaft load exceeding the values shown in the curve will involve a risk of breakage.

ORDER CODE

1	2	3	4	5
TMF			HD	

Pos.1 - Mounting Flange

omit - Thread hole flange, 5xM14x1,5 on ø140 [5.512]

A - Thread hole flange, 6x5/8-18 UNF on ø152,4 [6.0]

Pos.2 - Displacement code

200 - 201,4 cm³/rev [12.29 in³/rev]

250 - 251,8 cm³/rev [15.36 in³/rev]

315 - 326,3 cm³/rev [19.90 in³/rev]

400 - 410,9 cm³/rev [25.06 in³/rev]

470 - 475,0 cm³/rev [28.97 in³/rev]

500 - 523,6 cm³/rev [31.95 in³/rev]

630 - 631,2 cm³/rev [38.52 in³/rev]

725 - 724,3 cm³/rev [44.20 in³/rev]

Pos.3 - Ports

2 - side ports, 2xG3/4, G1/4, BSP thread, ISO 228

3 - side ports, 2xG3/4, G1/4, 5xM10
BSP thread, ISO 228

4 - side ports, 2x1 1/16-12 UN, O-ring, 9/16-18 UNF

Pos.4 - Special Features

HD - Reinforced motor HD*

For Other **Special Features** see page 58

Pos.5 - Design Series

omit - Factory specified

NOTES: * Drain line should always be used.

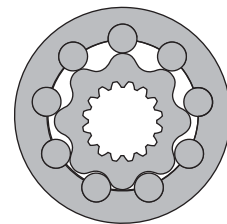
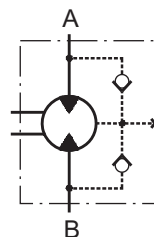
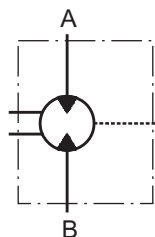
The hydraulic motors are mangano-phosphatized as standard.

HYDRAULIC MOTORS MVM



APPLICATION

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



CONTENTS

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Function diagrams	45-47
Dimensions and mounting MVM	48
Mounting Flanges	49
Port Types	49
Shaft extensions	50
Permissible shaft Seal Pressure	51
Order code	51

OPTIONS

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

EXCELLENCE

- » High torque and pressure drop
- » High inlet pressure
- » High starting torque
- » Improved efficiency at high pressure drop and frequent reversing
- » Smooth operation at low speed
- » High radial and axial bearing capacity

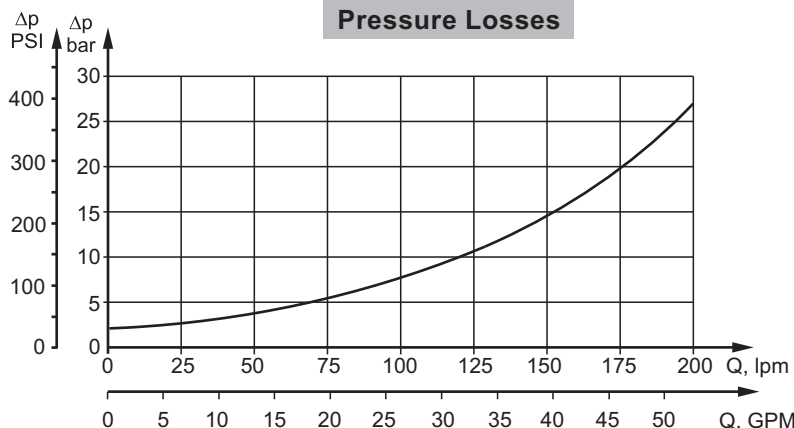
GENERAL

Max. Displacement, cm ³ /rev [in ³ /rev]	801,8 [48.91]
Max. Speed, [RPM]	763
Max. Torque, daNm [lb-in]	cont.: 259 [22920] int.: 340 [30090]
Max. Output, kW [HP]	112 [150]
Max. Pressure Drop, bar [PSI]	cont.: 250 [3630] int.: 350 [5080]
Max. Oil Flow, lpm [GPM]	240 [63.4]
Min. Speed, [RPM]	5
Permissible Shaft Loads, daN [lbs]	Pa=1500 [3370]
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]
140 [2030]	20 [98]	3 [.793]
	35 [164]	2 [.528]
210 [3045]	20 [98]	6 [1.585]
	35 [164]	4 [1.057]

Pressure Losses



SPECIFICATION DATA

Type		MVM 315	MVM 400	MVM 500	MVM 630	MVM 800
Displacement, cm ³ /rev [in ³ /rev]		314,5 [19.19]	400,9 [24.5]	499,6 [30.5]	629,1 [38.38]	801,8 [48.91]
Max. Speed, [RPM]	cont.	636	500	400	315	250
	Int.*	763	600	480	380	300
Max. Torque daNm [lb-in]	cont.	115 [10180]	144 [12745]	180 [15930]	227 [20090]	259 [22920]
	Int.*	160 [14160]	200 [17700]	260 [23010]	310 [27440]	340 [30090]
	peak**	180 [15930]	230 [20355]	286 [25315]	360 [31860]	402 [35580]
Max. Output kW [HP]	cont.	67 [90]	67 [90]	67 [90]	67 [90]	67 [90]
	int.*	112 [150]	112 [150]	112 [150]	112 [150]	112 [150]
Max. Pressure Drop bar [PSI]	cont.	250 [3630]	250 [3630]	250 [3630]	250 [3630]	225 [3263]
	Int.*	350 [5080]	350 [5080]	350 [5080]	350 [5080]	300 [4350]
	peak**	400 [5800]	400 [5800]	400 [5800]	400 [5800]	350 [5080]
Max. Oil Flow lpm [GPM]	cont.	200 [52.8]	200 [52.8]	200 [52.8]	200 [52.8]	200 [52.8]
	Int.*	240 [63.4]	240 [63.4]	240 [63.4]	240 [63.4]	240 [63.4]
Max. Inlet Pressure bar [PSI]	cont.	270 [3915]	270 [3915]	270 [3915]	270 [3915]	270 [3915]
	Int.*	370 [5365]	370 [5365]	370 [5365]	370 [5365]	370 [5365]
	peak**	420 [6090]	420 [6090]	420 [6090]	420 [6090]	420 [6090]
Max. Return Pressure with Drain Line bar [PSI]	cont.	140 [2030]	140 [2030]	140 [2030]	140 [2030]	140 [2030]
	Int.*	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]
	peak**	210 [3045]	210 [3045]	210 [3045]	210 [3045]	210 [3045]
Max. Starting Pressure with Unloaded Shaft, bar [PSI]		5 [70]	5 [70]	5 [70]	5 [70]	5 [70]
Min. Starting Torque daNm [lb-in]		92 [8140]	115 [10180]	144 [12745]	180 [15930]	205 [18145]
Min. Speed***, [RPM]		10	6	8	6	5
Weight, kg [lb]	MVM	41,3 [91]	42,1 [93]	43 [95]	44,5 [98]	46 [101.4]
	MVMC	43,8 [96.6]	44,9 [99]	45,8 [101]	48,3 [106.5]	50,4 [111.1]

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

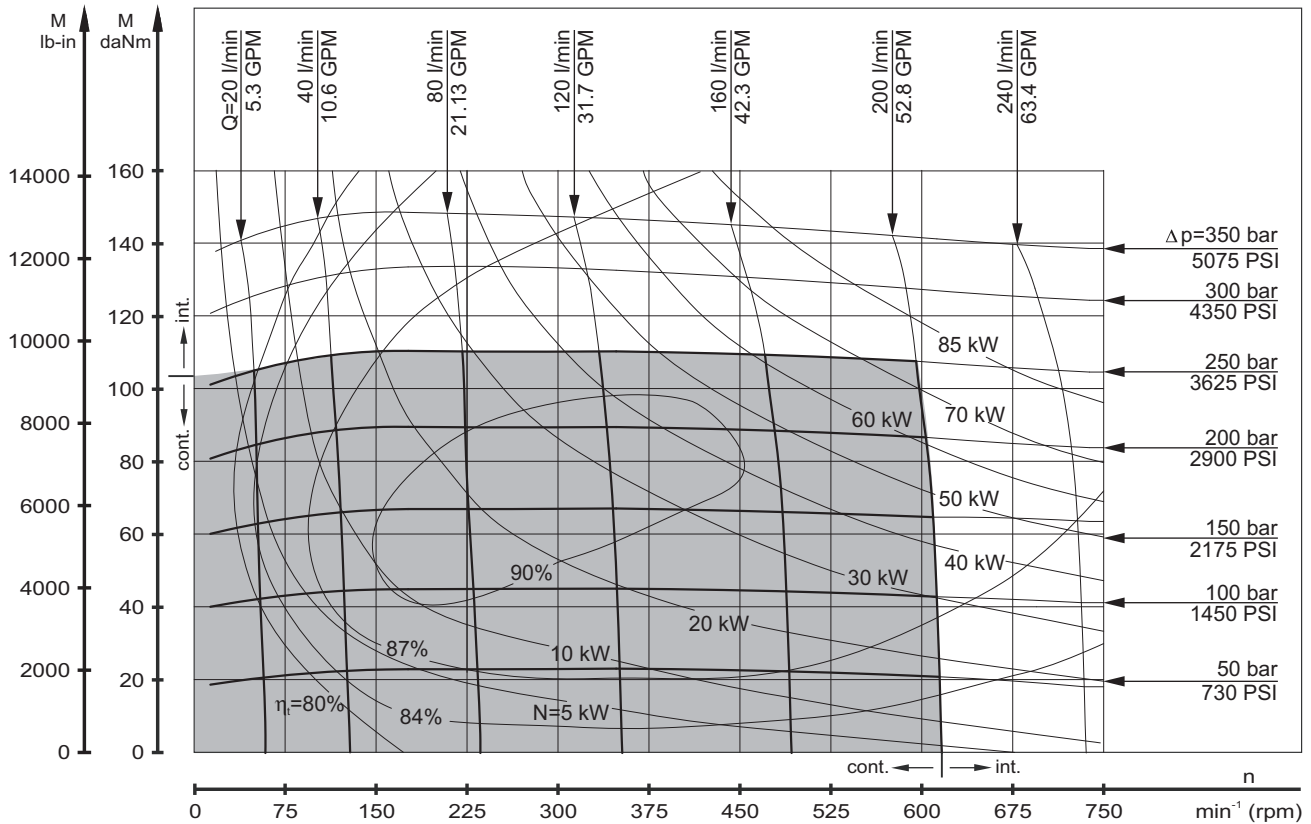
** Peak load: the permissible values may occur for max. 1% of every minute.

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

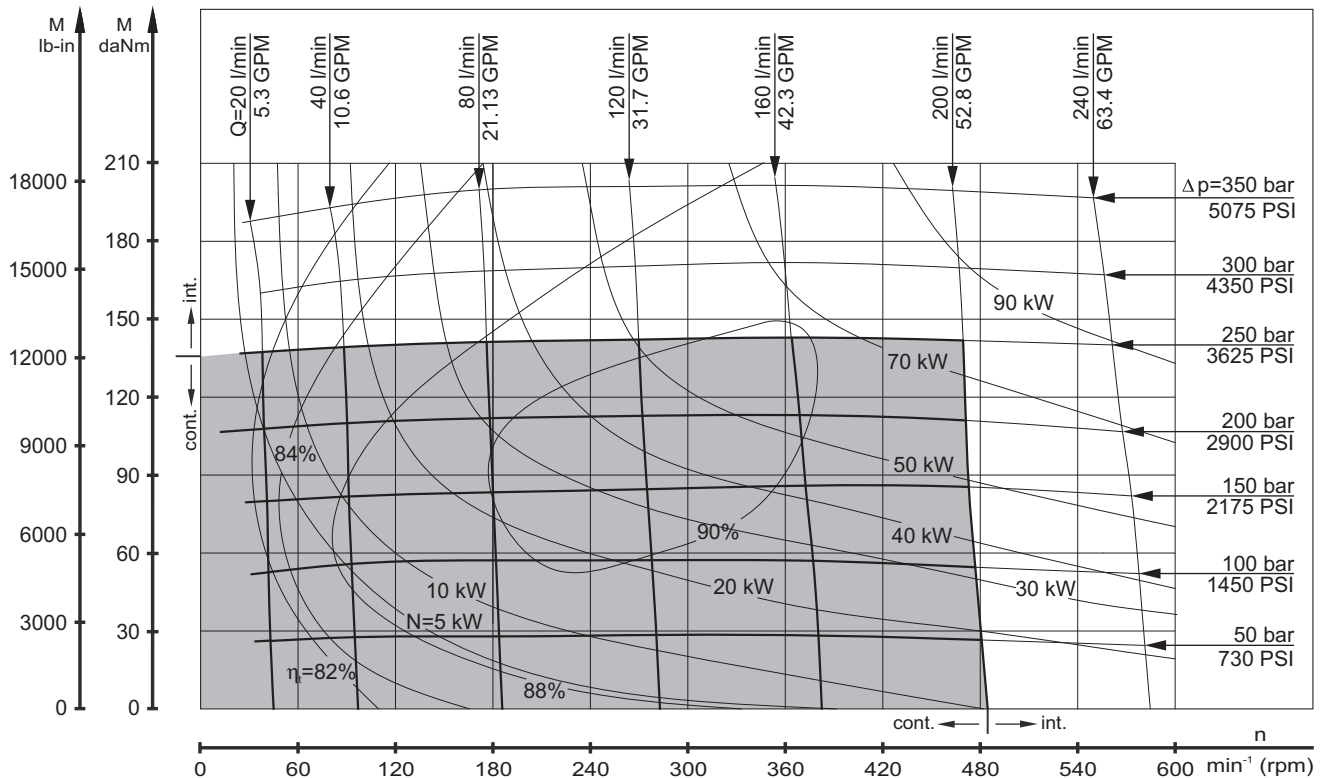
- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP(DIN51524) or HM (ISO 6743/4). If using 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

MVM 315



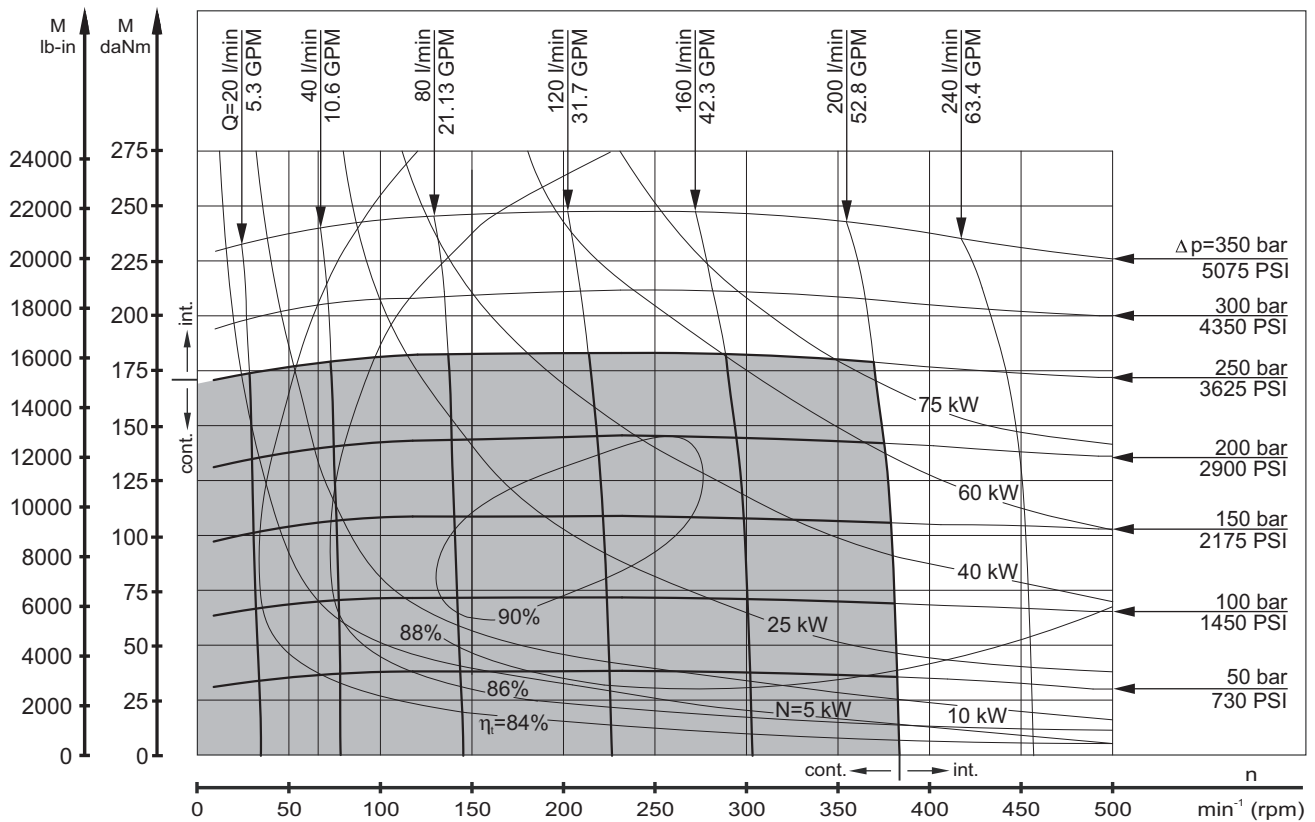
MVM 400



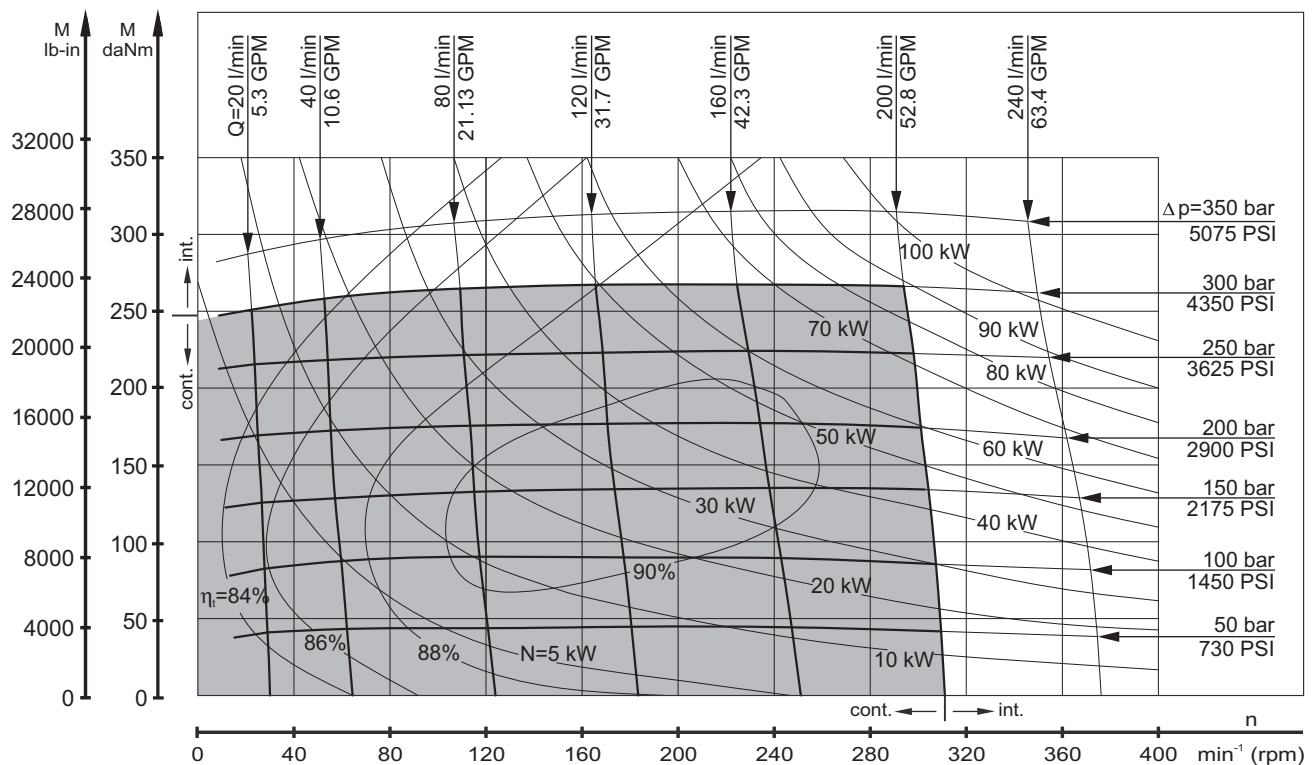
The function diagrams data was collected at back pressure 5÷10 bar (72.5PSI÷145PSI) and oil with viscosity of 32 mm²/s [150SUS] at 50° C [122°F].

FUNCTION DIAGRAMS

MVM 500



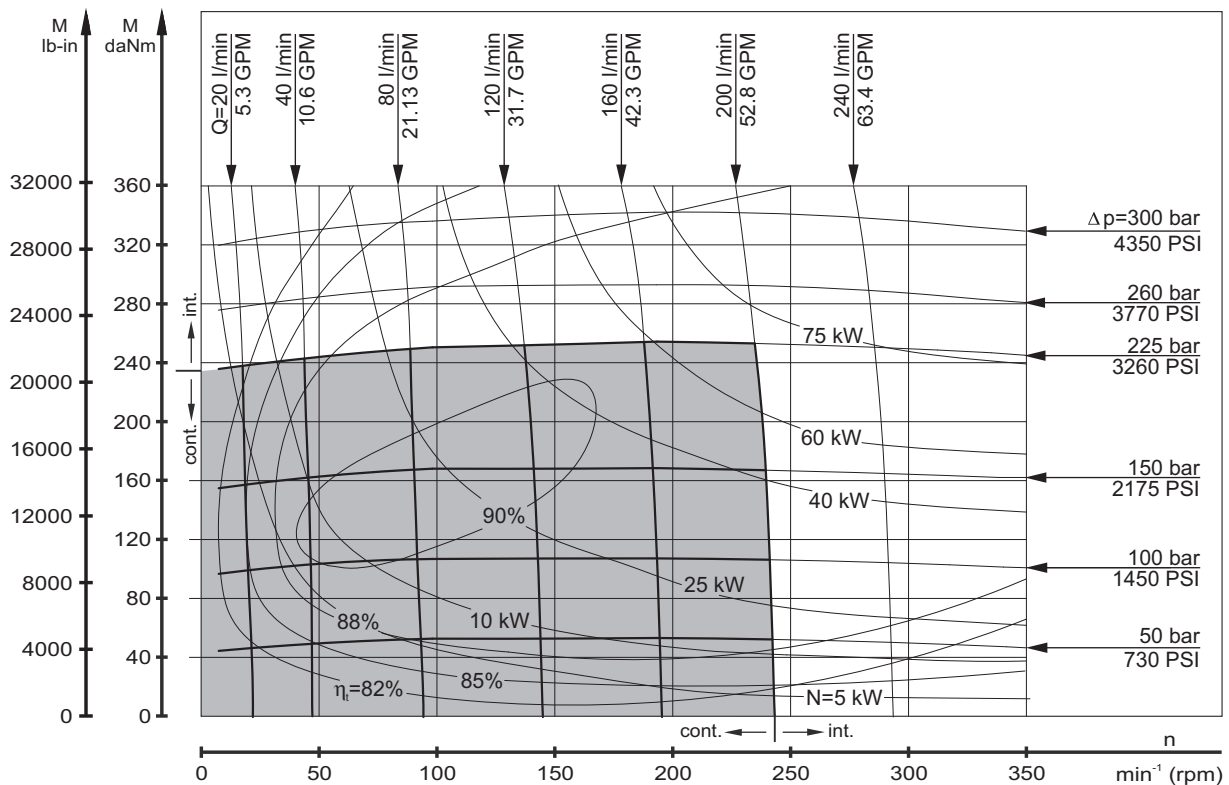
MVM 630



The function diagrams data was collected at back pressure 5÷10 bar (72.5PSI÷145PSI) and oil with viscosity of 32 mm²/s [150SUS] at 50° C [122°F].

FUNCTION DIAGRAMS

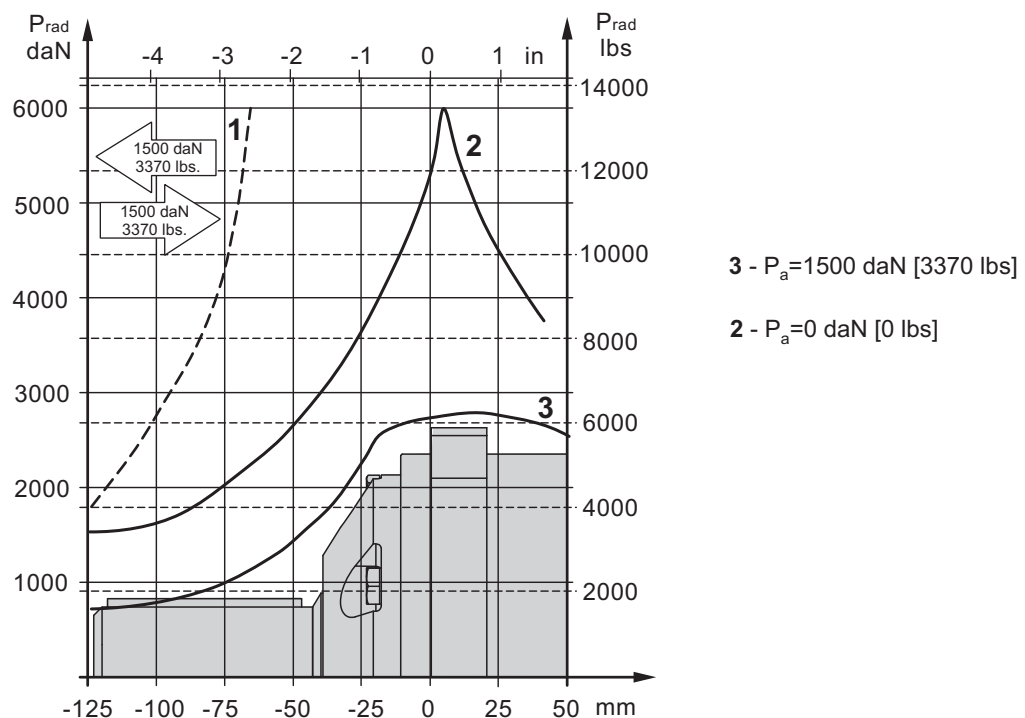
MVM 800



The function diagrams data was collected at back pressure 5÷10 bar (72.5PSI÷145PSI) and oil with viscosity of 32 mm²/s [150SUS] at 50° C [122°F].

PERMISSIBLE SHAFT LOADS

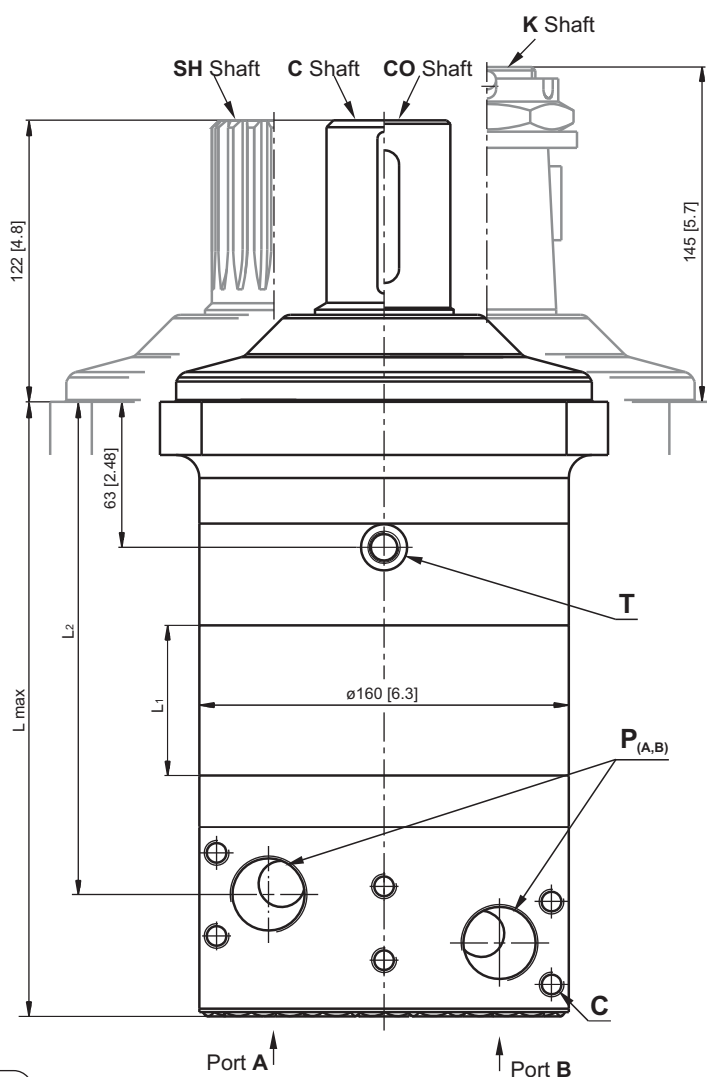
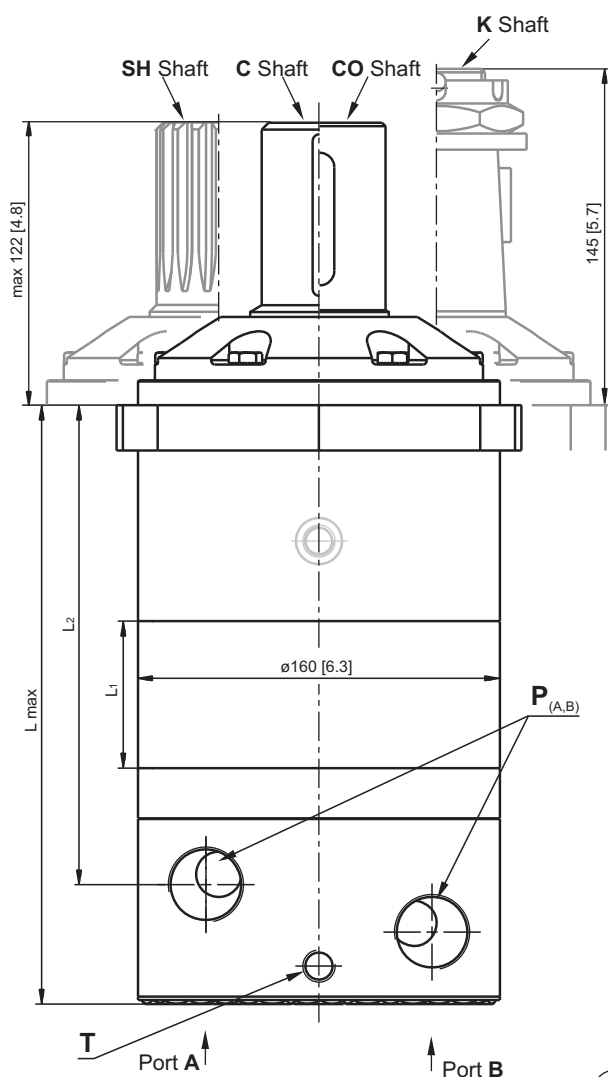
The output shaft runs in tapered bearings that permit high axial and radial forces. Curve "1" shows max. radial shaft load. Any shaft load exceeding the values shown by the curve will seriously reduce motor life. The two other curves apply to a B10 bearing life of 3000 hours at 200 RPM.



3 - P_a=1500 daN [3370 lbs]

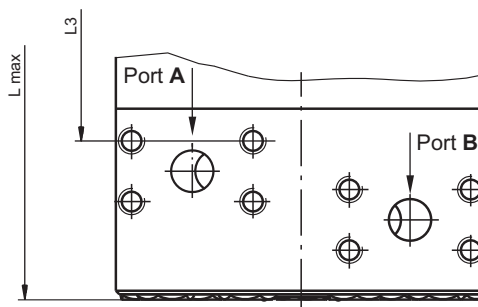
2 - P_a=0 daN [0 lbs]

DIMENSIONS AND MOUNTING DATA MVM and MVMC



Port Dim.
See Page 49

Shaft Dim.
See Page 50



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

	Versions			
	2	3	4	5
P _(A,B)	2xG1	2xG1	2x1 ⁵ / ₁₆ -12UN	2x1" (SAE PSI3000)
T	G ¹ / ₄	G ¹ / ₄	⁹ / ₁₆ -18UNF	G ¹ / ₄
C	-	6xM10	-	8xM10

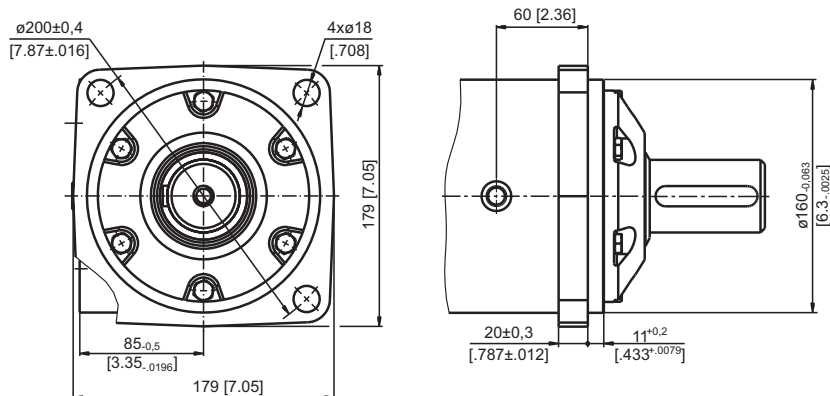
Standard Rotation
Viewed from Shaft End
Port A Pressurized - **CW**
Port B Pressurized - **CCW**

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

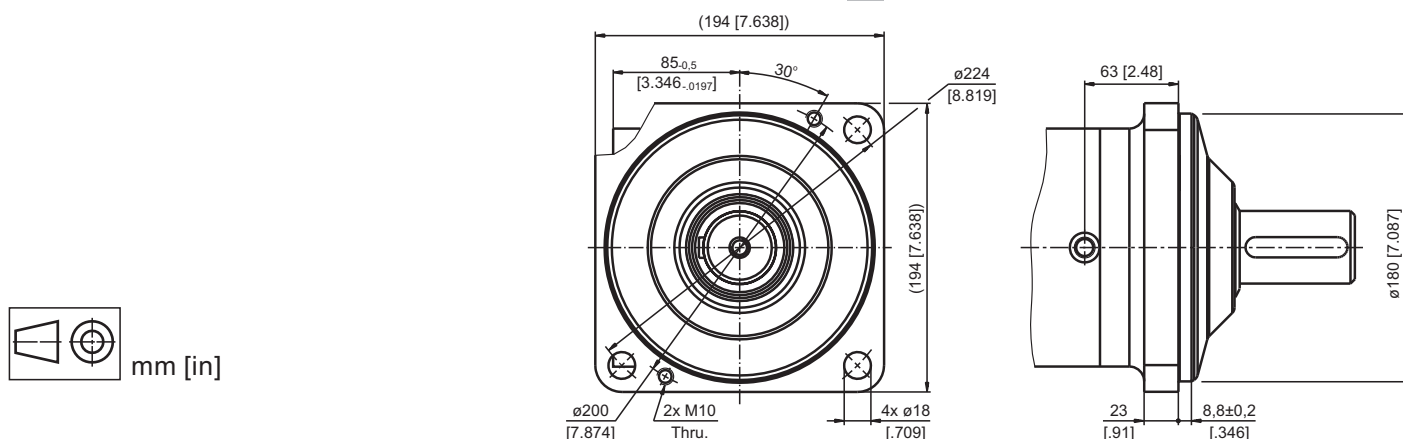
Type	Lmax, mm [in]	L2, mm [in]	L3, mm [in]	Type	Lmax, mm [in]	L2, mm [in]	L3, mm [in]	L1, mm [in]
MVM 315	226,5 [8.92]	172,5 [6.79]	157,4 [6.20]	MVMC 315	227,5 [8.957]	173,8 [6.84]	158,7 [6.25]	25,5 [1.00]
MVM 400	233,5 [9.19]	179,5 [7.07]	164,4 [6.47]	MVMC 400	234,5 [9.232]	180,8 [7.12]	165,7 [6.52]	32,5 [1.28]
MVM 500	241,5 [9.51]	187,5 [7.38]	172,4 [6.79]	MVMC 500	242,5 [9.547]	188,8 [7.43]	173,7 [6.84]	40,5 [1.59]
MVM 630	252,0 [9.92]	198,0 [7.79]	182,9 [7.20]	MVMC 630	253,0 [9.961]	199,3 [7.85]	184,2 [7.25]	51,0 [2.01]
MVM 800	266,0 [10.47]	212,0 [8.35]	196,9 [7.75]	MVMC 800	267,0 [10.518]	213,3 [8.39]	198,2 [7.80]	65,0 [2.56]

MOUNTING

Square Mount (4 Holes)



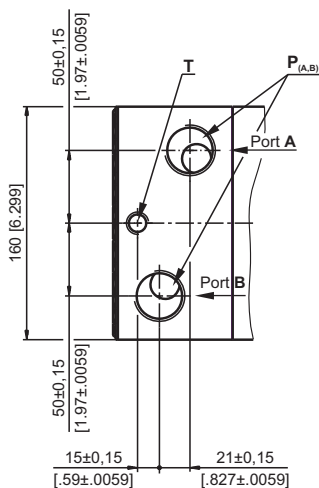
C Square Mount (four holes)



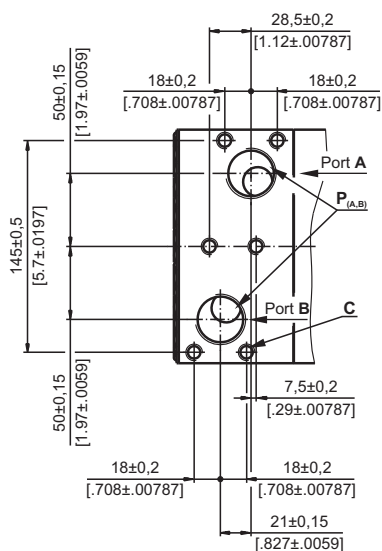
PORTS

Side Ports

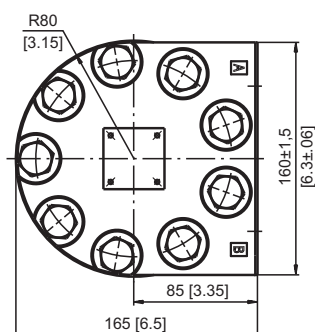
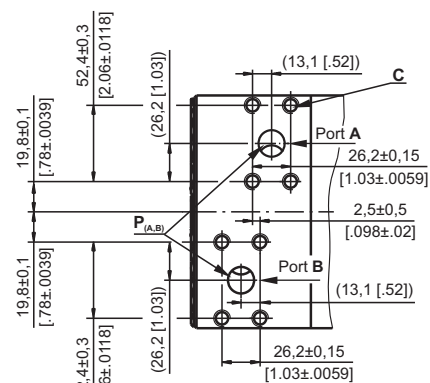
Versions **2** **4**



Versions **3**



Versions **5**



Standard Rotation

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

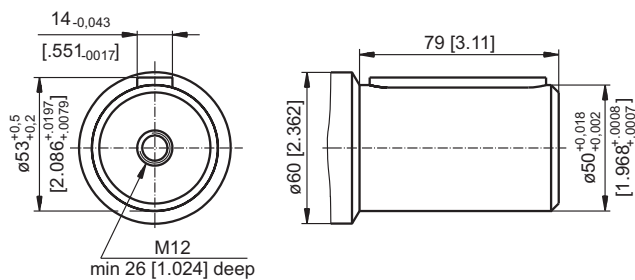
Reverse Rotation

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

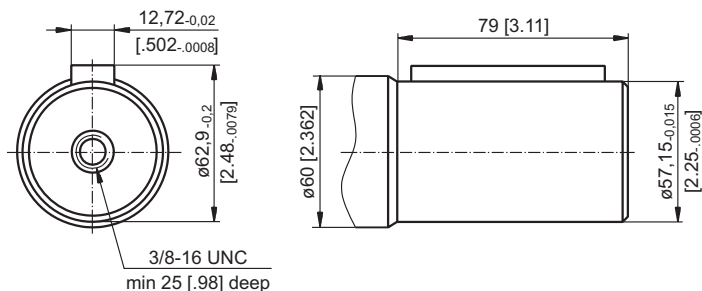
	Versions			
	2	3	4	5
P(A,B)	2xG1	2xG1	2x1 ⁵ / ₁₆ -12UN	2x1" (SAE PSI3000)
T	G ¹ / ₄	G ¹ / ₄	9 ¹⁶ / ₁₆ -18UNF	G ¹ / ₄
C	-	6xM10	-	8xM10

SHAFT EXTENSIONS

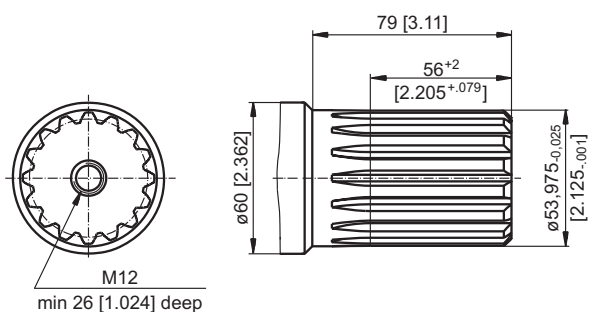
C - $\varnothing 50$ straight, Parallel key A14x9x70 DIN 6885



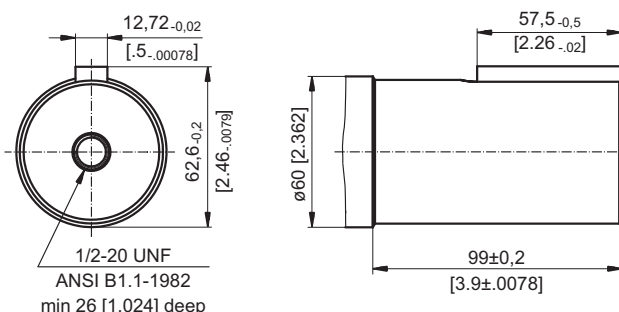
CO - $\varnothing 2\frac{1}{4}$ [57,15] straight
Parallel key $\frac{1}{2}$ "x $\frac{1}{2}$ "x $\frac{1}{4}$ " BS46



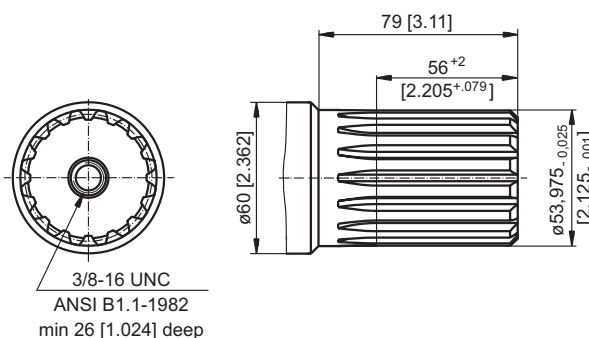
SH - $\varnothing 2\frac{1}{8}$ (53,975) splined
16 DP 8/16 ANS B92.1-1976



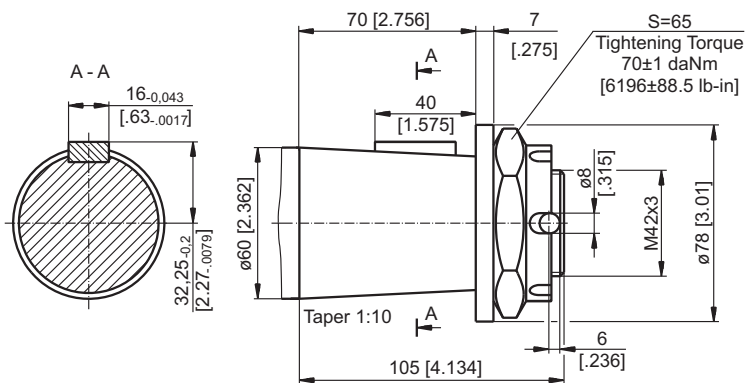
B - $\varnothing 2\frac{1}{4}$ [57,15] straight
Parallel key $\frac{1}{2}$ "x $\frac{1}{2}$ "x $\frac{1}{4}$ " BS46



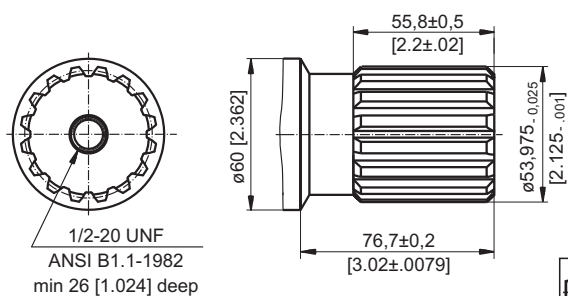
G - $\varnothing 2\frac{1}{8}$ [53,975] splined
16 DP 8/16 ANS B92.1-1976



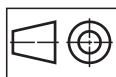
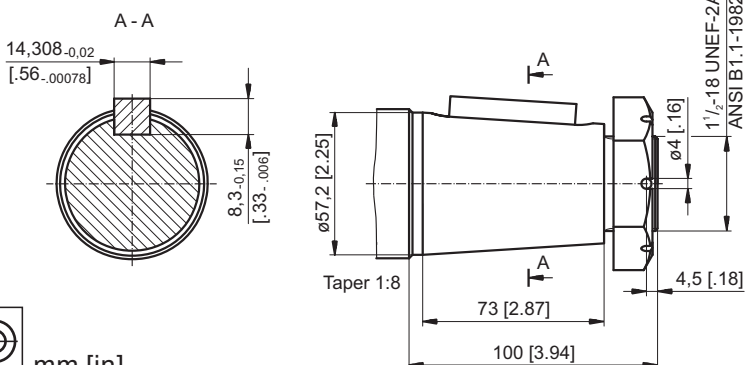
K - $\varnothing 60$, tapered 1:10
Parallel key B16x10x32 DIN 6885



S - $\varnothing 2\frac{1}{8}$ [53,975] splined
16 DP 8/16 ANS B92.1-1976



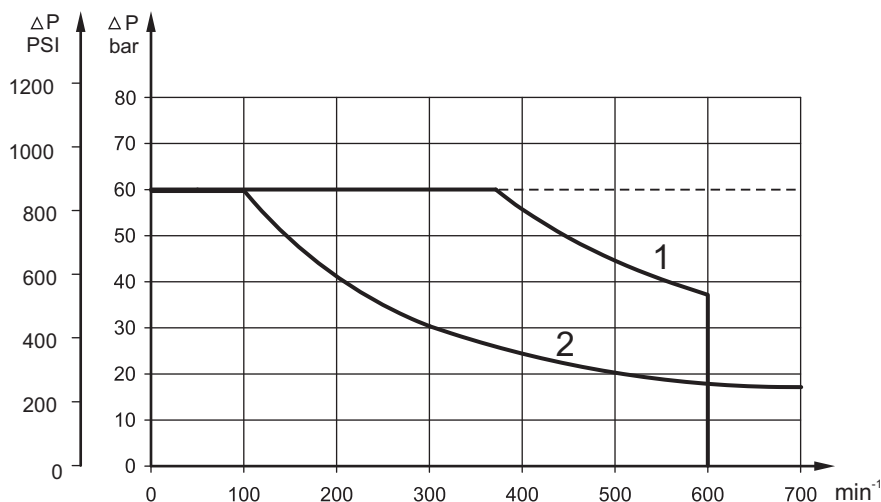
T - $\varnothing 2\frac{1}{4}$ [57,15] SAE J501, tapered 1:8
key $\frac{9}{16}$ "x $\frac{9}{16}$ "x2" BS46



mm [in]

MAX. PERMISSIBLE SHAFT SEAL PRESSURE

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



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

2: Drawing for Standard Shaft Seal

— - continuous operations

- - - - - intermittent operations

ORDER CODE

	1	2	3	4	5	6	7	8
M V M							HD	

Pos.1 - Mounting Flange

omit - Standard square mount, four holes

C - Square mount, four holes

Pos.2 - Displacement code

315 - 314,5 cm³/rev [19.80 in³/rev]

400 - 400,9 cm³/rev [24.45 in³/rev]

500 - 499,6 cm³/rev [30.48 in³/rev]

630 - 629,1 cm³/rev [38.38 in³/rev]

800 - 801,8 cm³/rev [48.91 in³/rev]

Pos.3 - Shaft Extensions*

C - ø50 straight, Parallel key A14x9x70 DIN6885

CO - ø2¼" [57,15] straight, Parallel key ½"x½"x2¼" BS46

B - ø2¼" [57,15] straight, Parallel key ½"x½"x2¼" BS46

SH - ø2⅞" [53,975] splined, 16DP 8/16 ANS B92.1-1976

G - ø2⅞" [53,975] splined, 16DP 8/16 ANS B92.1-1976

S - ø2⅞" [53,975] splined, 16DP 8/16 ANS B92.1-1976

K - ø60 tapered 1:10, Parallel key B16x10x32 DIN6885

T - ø2¼" [57,15] SAE J501, tapered 1:8,

key ⅞"x⅞"x2" BS46

Pos.4 - Ports

2 - side ports 2xG1, G1/4, BSP thread, ISO 228

3 - side ports 2xG1, G1/4, BSP thread, ISO 228, 6xM10

4 - side ports 2x1 5/16-12 UN, O-ring, 9/16-18 UNF

5 - side ports 2x1" (SAE PSI3000), G1/4, BSP thread, ISO 228, 8xM10

Pos.5 - Check Valves

omit - without check valves

1 - with check valves

Pos.6 - Shaft Seal Version (see page 50)

omit - Low pressure shaft seal

U - High pressure shaft seal

Pos.7 - Special Features

HD - Reinforced motor HD**

For Other **Special Features** see page 58

Pos.8 - Design Series

omit - Factory specified

NOTES:

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

** Drain line should always be used (if no check valves).

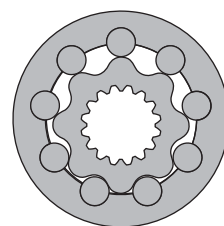
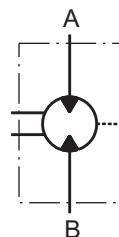
The hydraulic motors are manganophosphatized as standard.

HYDRAULIC MOTORS VMF



APPLICATION

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



CONTENTS

Specification data	53
Function diagrams	54-56
Permissible shaft loads	56
Dimensions and mounting	57
Permissible shaft seal pressure	57
Order code	57

OPTIONS

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

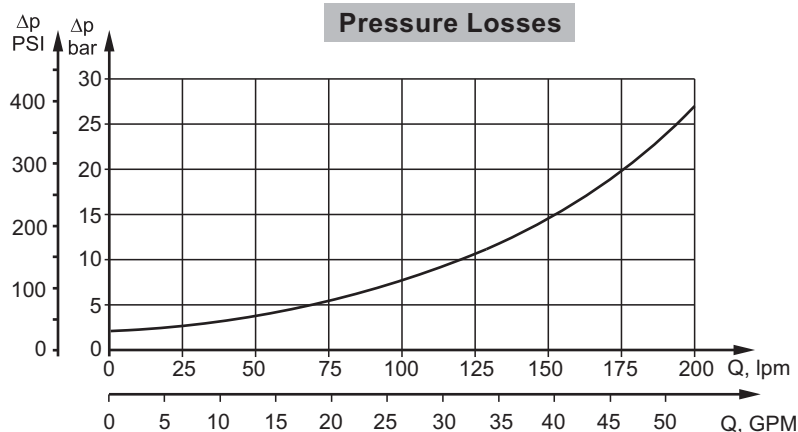
GENERAL

Max. Displacement, cm ³ /rev [in ³ /rev]	801,8 [48.91]
Max. Speed, [RPM]	736
Max. Torque, daNm [lb-in]	cont.: 259 [22920] int.: 340 [30090]
Max. Output, kW [HP]	112 [150]
Max. Pressure Drop, bar [PSI]	cont.: 250 [3630] int.: 350 [5080]
Max. Oil Flow, lpm [GPM]	240 [63.4]
Min. Speed, [RPM]	5
Permissible Shaft Loads, daN [lbs]	Pa=1500 [3370]
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]
140 [2030]	20 [98]	3 [.793]
	35 [164]	2 [.528]
210 [3045]	20 [98]	6 [1.585]
	35 [164]	4 [1.057]

Pressure Losses



SPECIFICATION DATA

Type		VMF 315	VMF 400	VMF 500	VMF 630	VMF 800
Displacement, cm ³ /rev [in ³ /rev]		314,5 [19.18]	400,9 [24.5]	499,6 [30.5]	629,1 [38.38]	801,8 [48.91]
Max. Speed, [RPM]	cont.	636	500	400	315	250
	Int.*	736	600	480	380	300
Max. Torque daNm [lb-in]	cont.	115 [10180]	144 [12745]	180 [15930]	227 [20090]	259 [22920]
	Int.*	160 [14160]	200 [17700]	260 [23010]	310 [27440]	340 [30090]
	peak**	180 [15930]	230 [20355]	286 [25315]	360 [31860]	402 [35580]
Max. Output kW [HP]	cont.	67 [90]	67 [90]	67 [90]	67 [90]	67 [90]
	int.*	112 [150]	112 [150]	112 [150]	112 [150]	112 [150]
Max. Pressure Drop bar [PSI]	cont.	250 [3630]	250 [3630]	250 [3630]	250 [3630]	225 [3263]
	Int.*	350 [5080]	350 [5080]	350 [5080]	350 [5080]	300 [4350]
	peak**	400 [5800]	400 [5800]	400 [5800]	400 [5800]	350 [5080]
Max. Oil Flow lpm [GPM]	cont.	200 [52.8]	200 [52.8]	200 [52.8]	200 [52.8]	200 [52.8]
	Int.*	240 [63.4]	240 [63.4]	240 [63.4]	240 [63.4]	240 [63.4]
Max. Inlet Pressure bar [PSI]	cont.	270 [3915]	270 [3915]	270 [3915]	270 [3915]	270 [3915]
	Int.*	370 [5365]	370 [5365]	370 [5365]	370 [5365]	370 [5365]
	peak**	420 [6090]	420 [6090]	420 [6090]	420 [6090]	420 [6090]
Max. Return Pressure with Drain Line bar [PSI]	cont.	140 [2030]	140 [2030]	140 [2030]	140 [2030]	140 [2030]
	Int.*	175 [2540]	175 [2540]	175 [2540]	175 [2540]	175 [2540]
	peak**	210 [3045]	210 [3045]	210 [3045]	210 [3045]	210 [3045]
Max. Starting Pressure with Unloaded Shaft, bar [PSI]		5 [70]	5 [70]	5 [70]	5 [70]	5 [70]
Min. Starting Torque daNm [lb-in]		92 [8140]	115 [10180]	144 [12745]	180 [15930]	205 [18145]
Min. Speed***, [RPM]		10	6	8	6	5
Weight, kg [lb]		46 [101.4]	47,2 [104,1]	48,5 [106.9]	50 [110.2]	51,5 [113.5]

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

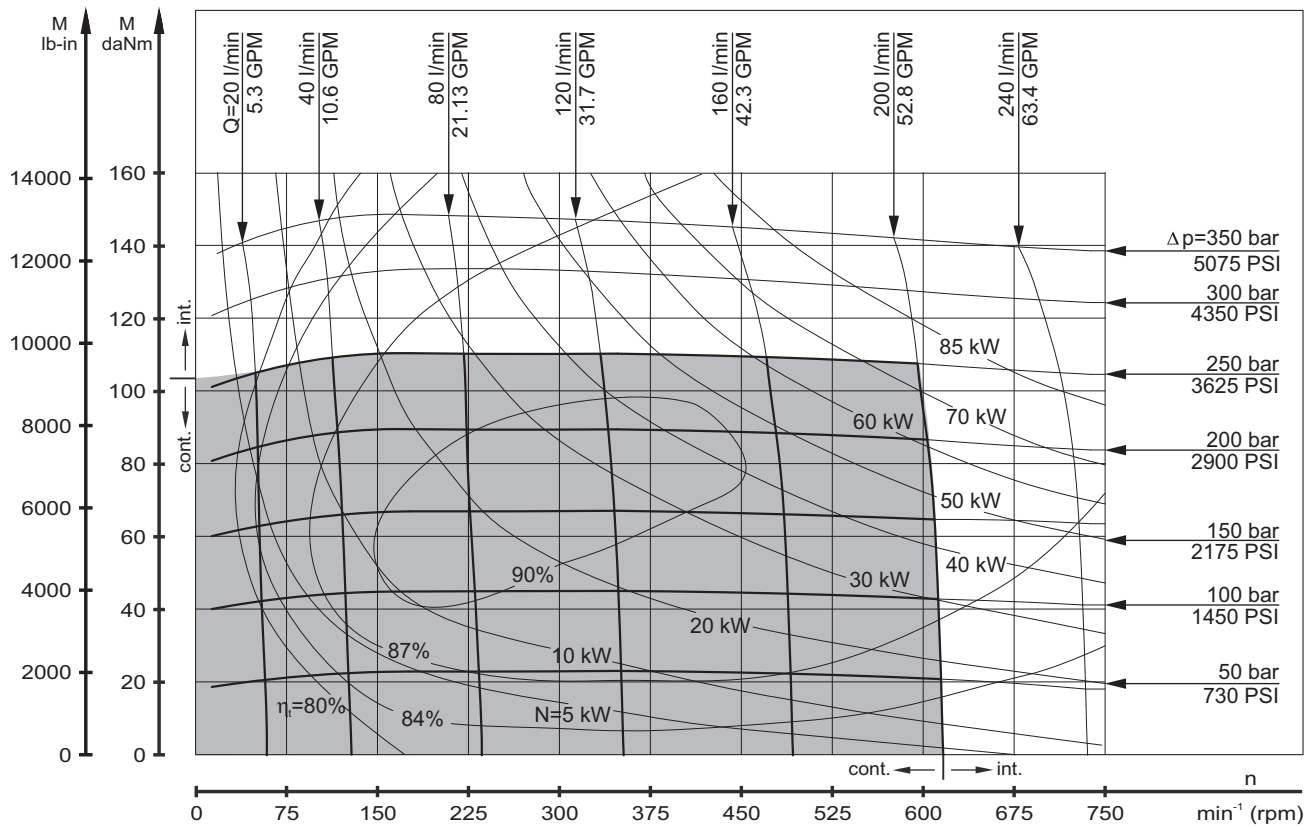
** Peak load: the permissible values may occur for max. 1% of every minute.

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

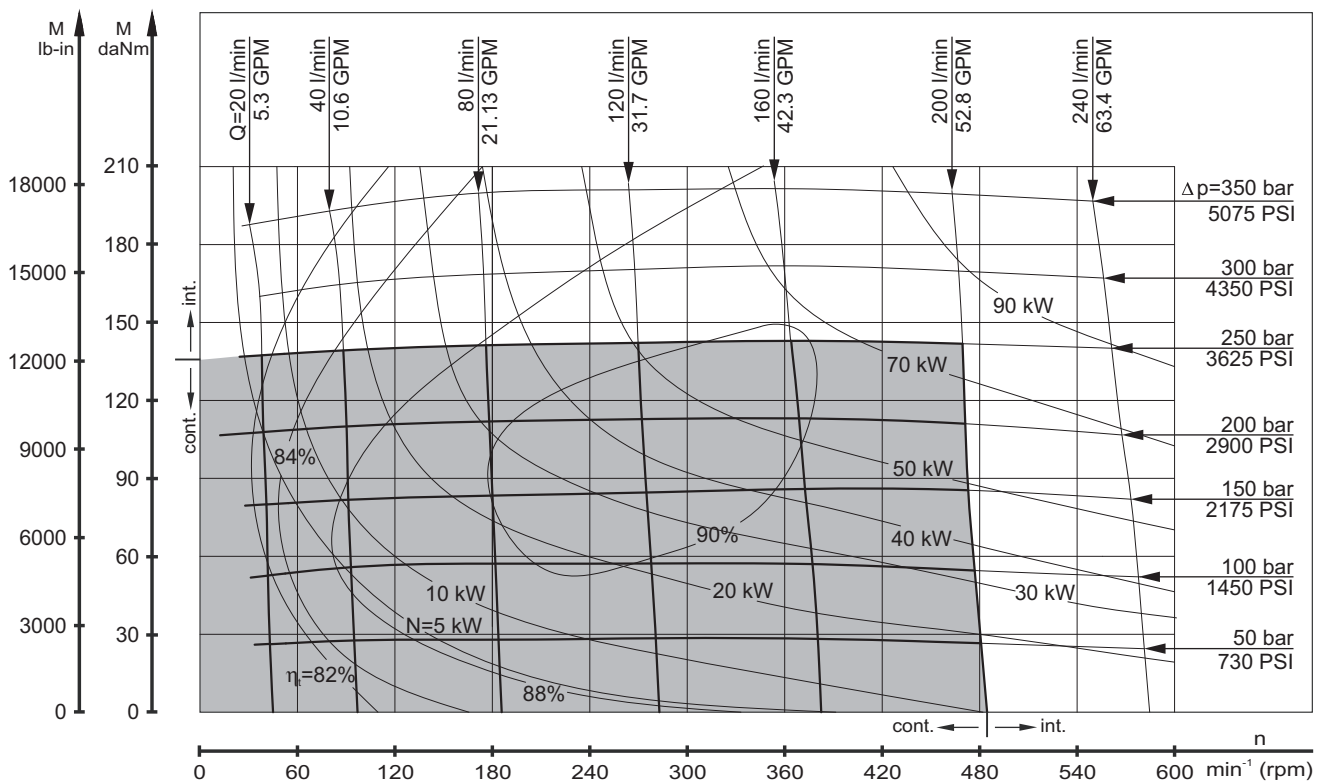
- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP(DIN51524) or HM (ISO 6743/4).
If using 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

VMF 315



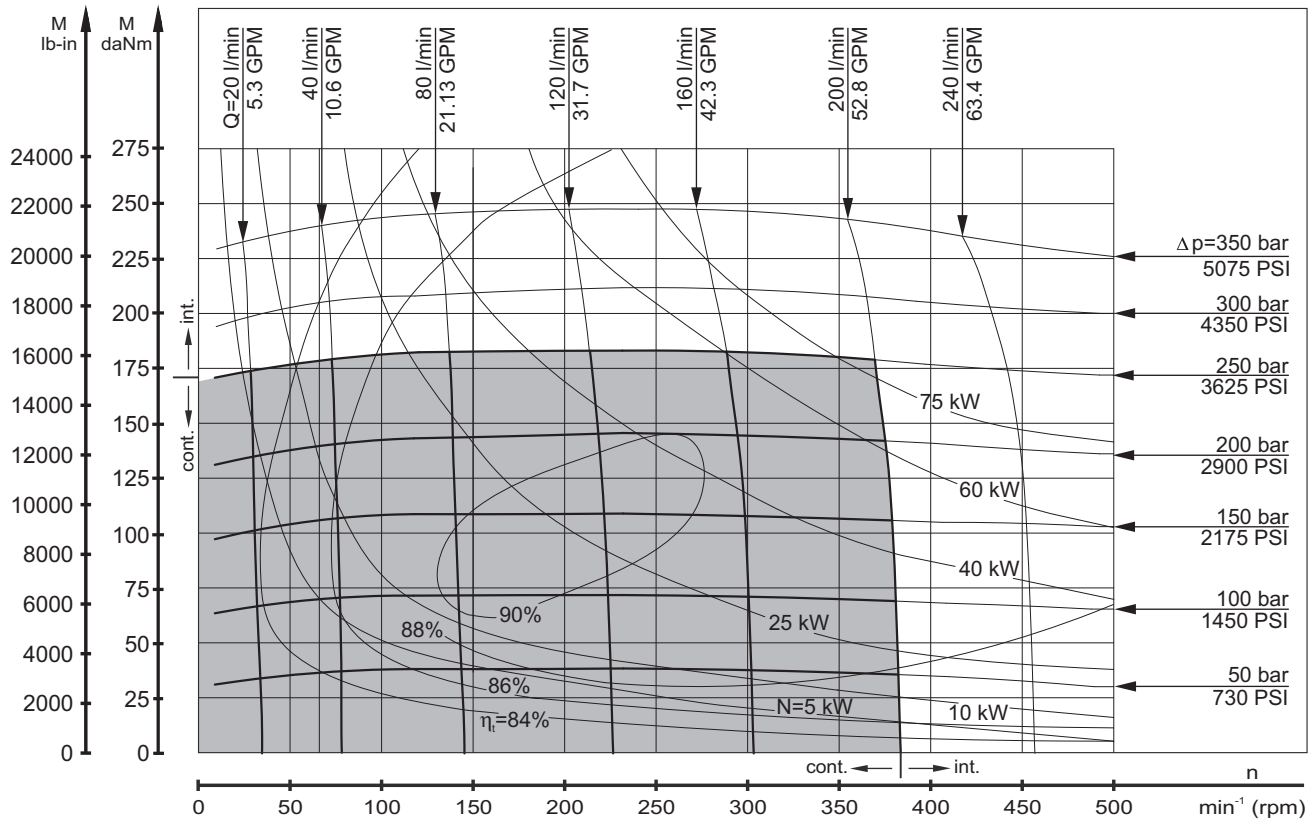
VMF 400



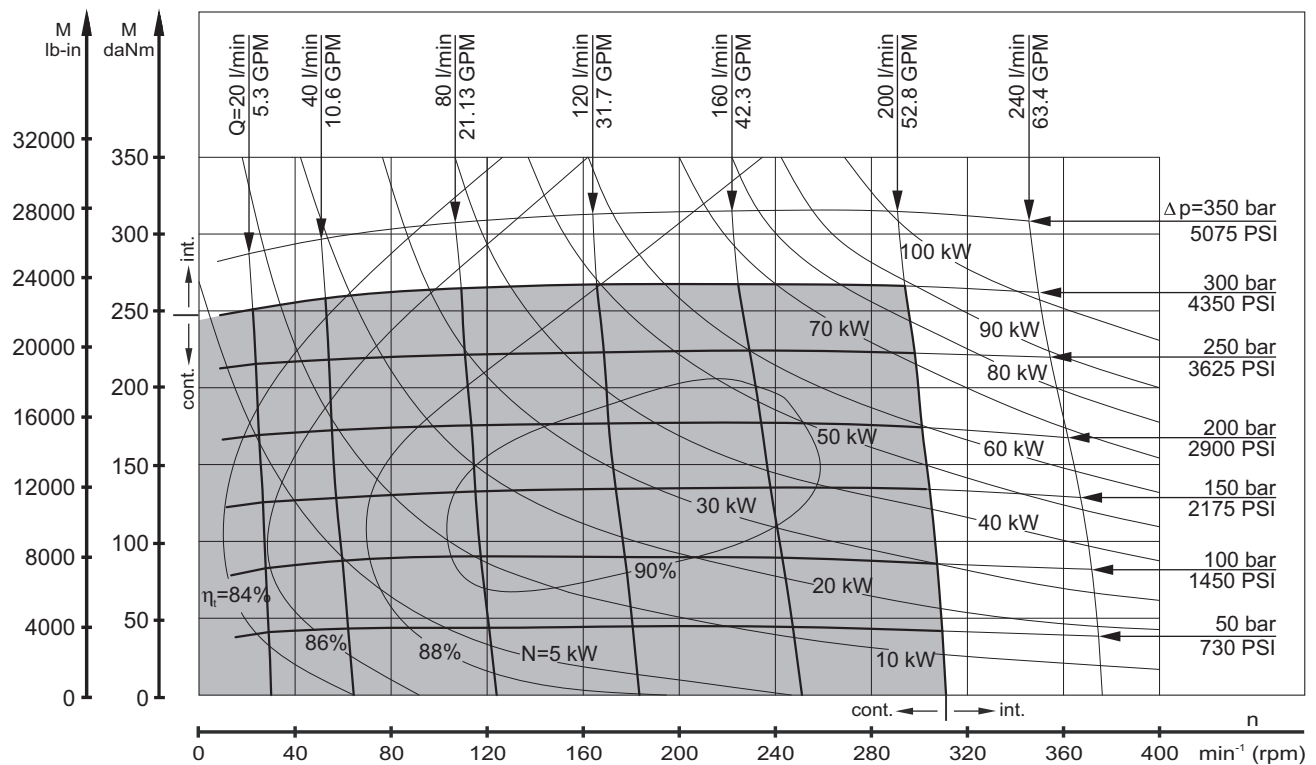
The function diagrams data was collected at back pressure 5÷10 bar (72.5PSI÷145PSI) and oil with viscosity of 32 mm²/s [150SUS] at 50° C [122°F].

FUNCTION DIAGRAMS

VMF 500



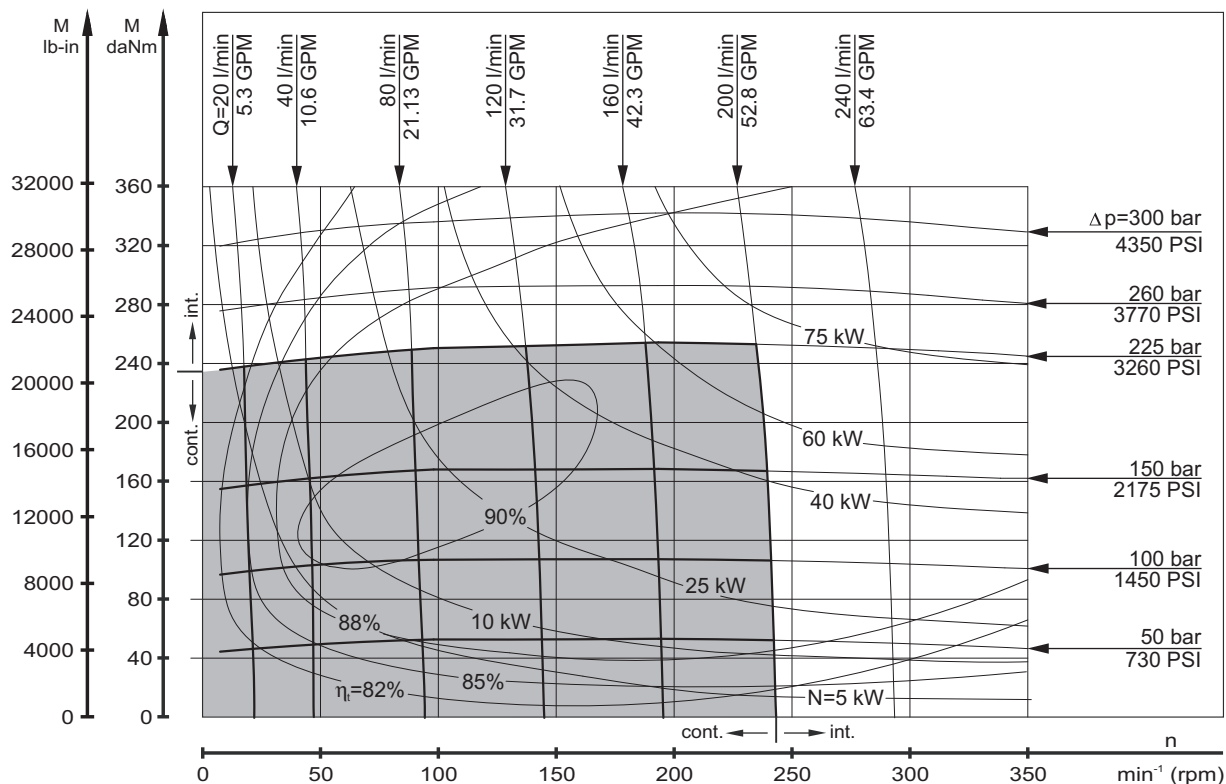
VMF 630



The function diagrams data was collected at back pressure 5÷10 bar (72.5PSI÷145PSI) and oil with viscosity of 32 mm²/s [150SUS] at 50° C [122°F].

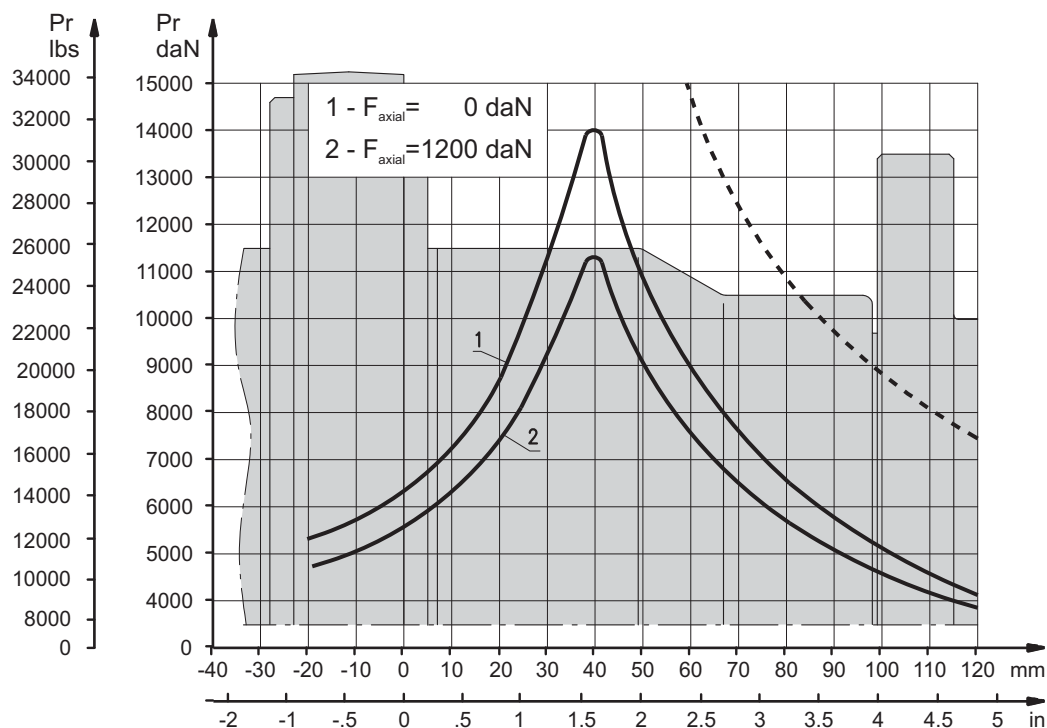
FUNCTION DIAGRAMS

VMF 800



The function diagrams data was collected at back pressure 5÷10 bar (72.5PSI÷145PSI) and oil with viscosity of 32 mm²/s [150SUS] at 50° C [122°F].

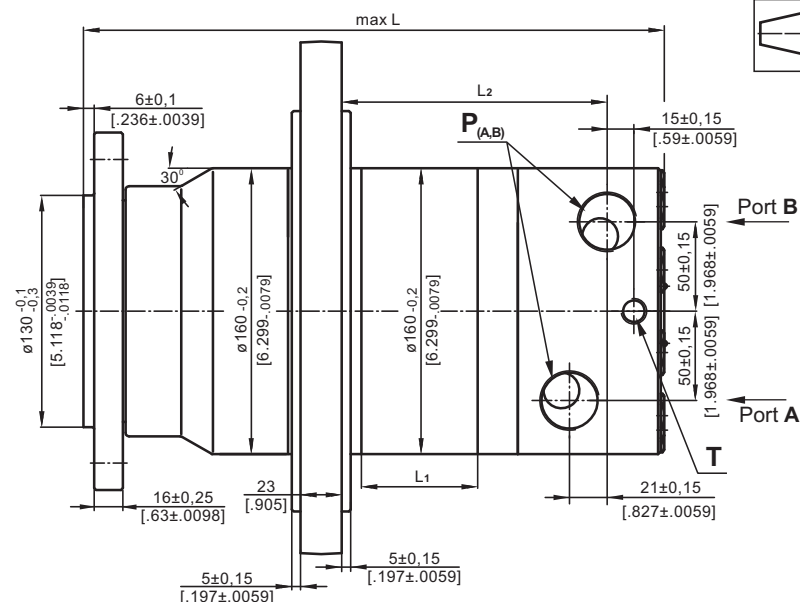
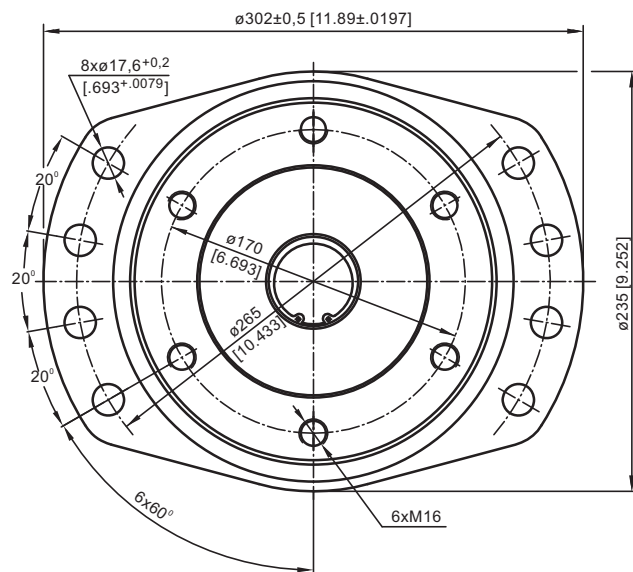
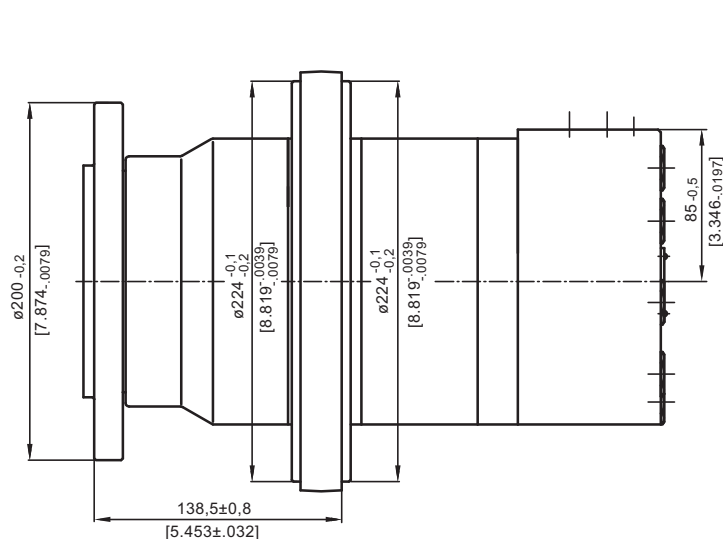
PERMISSIBLE SHAFT LOADS



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	G ¹ / ₄	⁹ / ₁₆ -18UNF

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

ORDER CODE

1	2	3	4
VMF		HD	

Pos.1 - Displacement code

315	- 314,5 cm ³ /rev [19.18 in ³ /rev]
400	- 400,9 cm ³ /rev [24.45 in ³ /rev]
500	- 499,6 cm ³ /rev [30.48 in ³ /rev]
630	- 629,1 cm ³ /rev [38.38 in ³ /rev]
800	- 801,8 cm ³ /rev [48.91 in ³ /rev]

Pos.2 - Ports

2	- side ports, 2xG1, G ¹ / ₄ , BSP thread, ISO 228
4	- side ports, 2x1 ⁵ / ₁₆ -12 UN, O-ring, ⁹ / ₁₆ -18 UNF

Pos.3 - Special Features

HD	- Reinforced motor HD*
	- For Other Special Features see page 58

Pos.4 - Design Series

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

* Drain line should always be used.

Warning: Drain line should always be used.

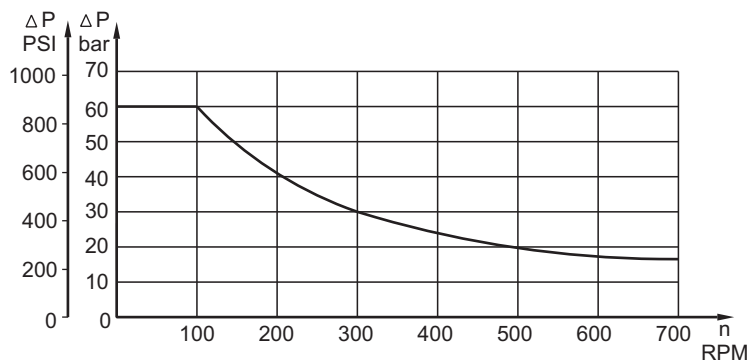
Standard Rotation

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



The hydraulic motors are manganophosphatized as standard.

MOTOR SPECIAL FEATURES

Special Feature Description	Order Code	Motor type						
		MSWM	MTK	MTM	TMF	MVM	MVMC	VMF
Speed Sensor*	RS	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	-
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 59÷60.

** Colour at customer's request.

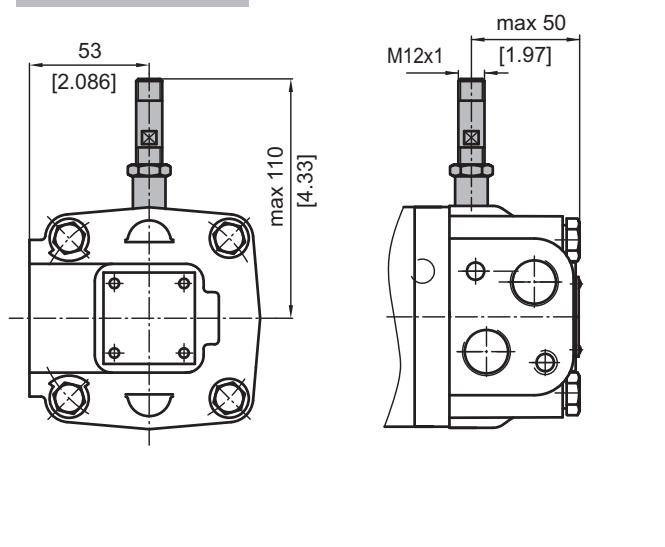
*** Non painted feeding surfaces, colour at customer's request.



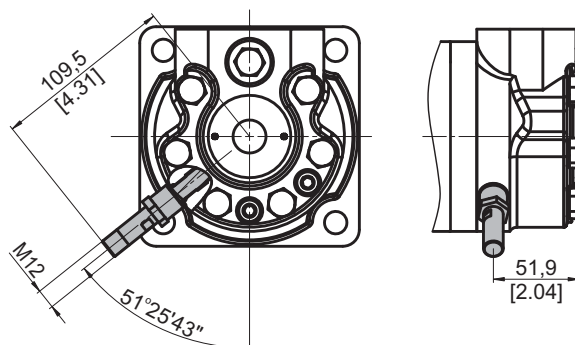
For more information about **HD** option please contact with "M+S Hydraulic".

MOTORS WITH SPEED SENSOR

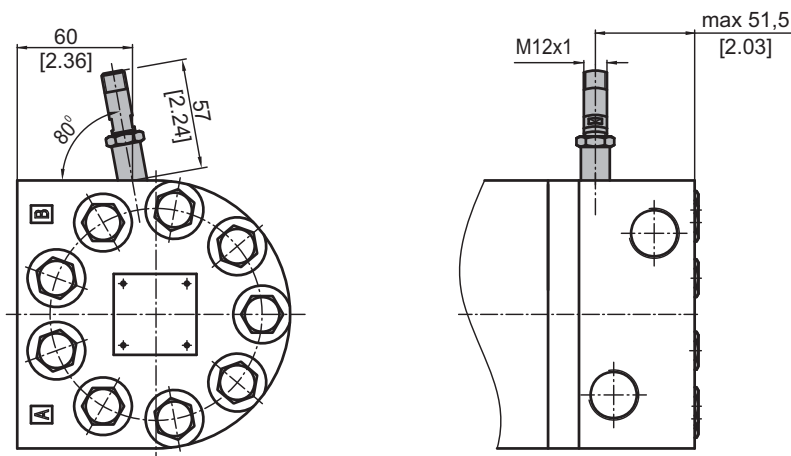
MSWM...RS



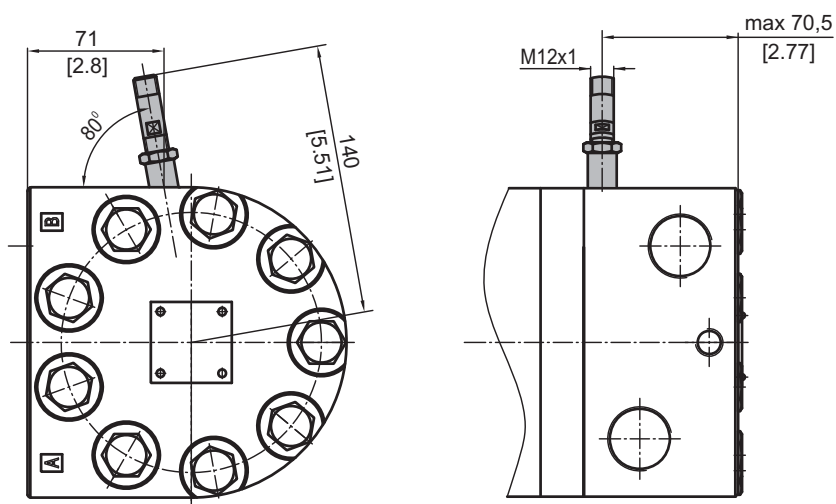
MTK...RS



MTM...RS TMF...RS

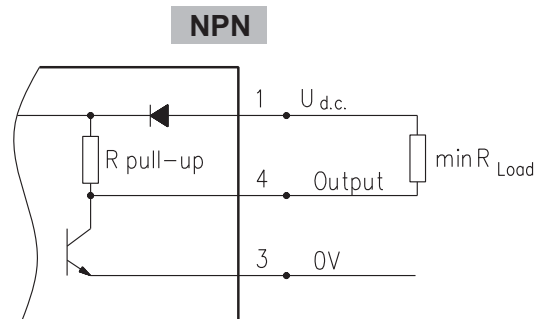
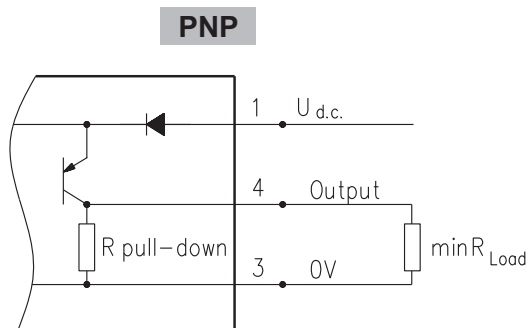


MVM...RS VMF...RS



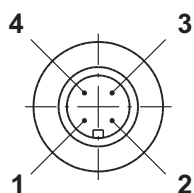
TECHNICAL DATA OF THE SPEED SENSOR

Wiring diagrams



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

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; 2,5 m [98 in] long
RSL3,5	Cable output 3x0,25; 3,5 m [138 in] long
RSL5	Cable output 3x0,25; 5 m [196 in] long
RSL10	Cable output 3x0,25; 10 m [394 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:

$$RR = G \times p$$

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

p - rolling resistance coefficient (Table 1).

Table 1

Rolling resistance coefficient In case of rubber tire rolling on different surfaces	
Surface	p
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]

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

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:

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

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 [lb-in]

Necessary torque moment for every hydraulic motor:

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

N - motor numbers;

h_m - mechanical gear efficiency (if it is available).

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

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

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

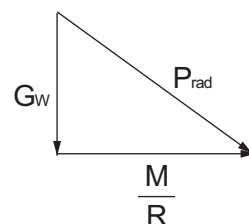
9.Radial motor loading: P_{rad} , daN [lbs]

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.

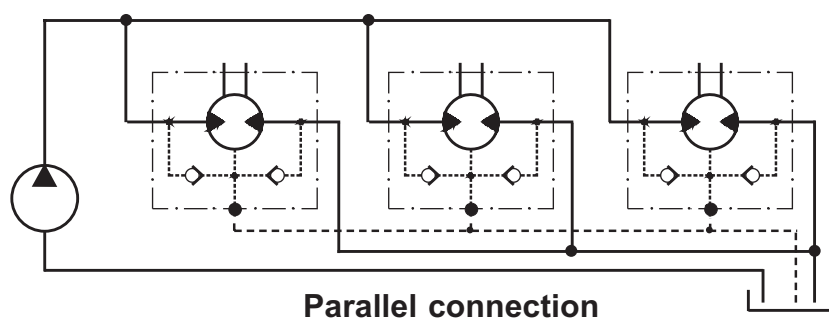
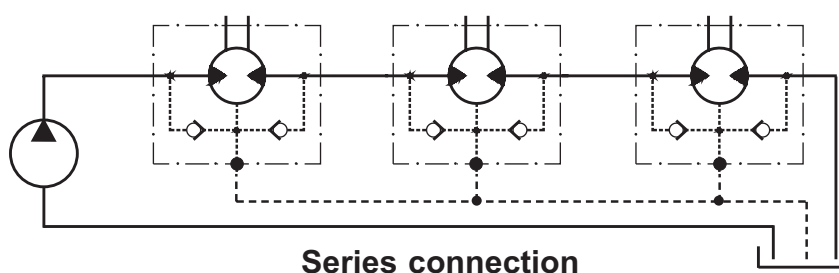


$$P_{rad} = \sqrt{G_w^2 + \left(\frac{M}{R}\right)^2}$$

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.



WARRANTY

M+S Hydraulic warrants, that its products, supplied directly to original equipment manufacturer, authorized distributor or other customer, will be free of defects in material or workmanship at the time of shipment from M+S Hydraulic and will conform to the products technical documentation (drawings and specifications) under sale agreement with Buyer.

This warranty will apply only to defects appearing within applicable Warranty period, mentioned below. If Buyer notifies M+S Hydraulic within the Warranty period about any such defects, M+S, at its sole option will replace or repair the defective products or their parts found by M+S Hydraulic to be defective in material or workmanship.

THE FOREGOING LIMITED WARRANTY IS AVAILABLE ONLY IF "M+S HYDRAULIC" IS PROMPTLY NOTIFIED IN WRITTEN OF THE ALLEGED DEFECT AND DOES NOT COVER FAILURE TO FUNCTION CAUSED BY DAMAGE TO THE PRODUCT, IMPROPER INSTALLATION, UNREASONABLE USE OR ABUSE OF THE PRODUCT, FAILURE TO PROVIDE OR USE OF IMPROPER MAINTENANCE OR USUAL, DEGRADATION OF THE PRODUCT DUE TO PHYSICAL ENVIRONMENTS OF AN USUAL NATURE. THE FOREGOING REMEDIES ARE THE SOLE AND EXCLUSIVE REMEDIES AVAILABLE TO CUSTOMER. To facilitate the inspection, M+S Hydraulic may require return of the product/part, which Buyer claims to be defective.

M+S Hydraulic shall not be liable for labor costs or any other expenses incurred during the disassembling or reinstalling of the product/part.

In case the claimed products are returned to M+S Hydraulic in bad condition: dirty, disassembled, with damaged or missing parts during transportation, the warranty will be considered as not applicable and the products will not be liable to repair.

Warranty periods

New products: The Warranty period is limited to 24 consecutive months (2 years) from the date of production of the product.

Repaired products: If the product is repaired in M+S Hydraulic during its warranty period, the warranty period of the repaired item shall continue for the balance of original Warranty period or for a period equal to 50% of the original new product Warranty period, whichever is later.

Spare parts: The Warranty period for Spare parts is 12 consecutive months (1 year) from the dispatch date of such parts from M+S Hydraulic.

LIMITATION OF LIABILITY M+S Hydraulic's liability for claim of any kind, for loss or damage arising out of, connected with or resulting from an order, or from the performance or branch thereof, or from the design, manufacture, sale delivery, operation or use of any of its products shall be limited to, at M+S 's sole option, replacement, repair of any defective product or the issuance of a credit to Customer against any future purchases. Cash refunds will not be made under any circumstances and Customer will not be entitled to recover any damages of any kind against M+S Hydraulic, including but not limited to incidental or consequential damages, whether direct or indirect, known or unknown, foreseen or unforeseen.