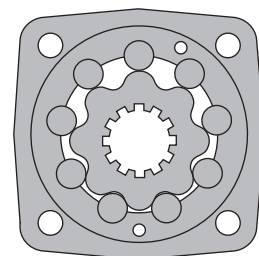
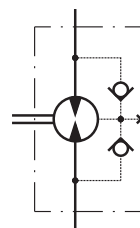


# HYDRAULIC MOTORS MT



## APPLICATION

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



## CONTENTS

Specification data .....	26÷27
Function diagrams .....	28+31
Dimensions and mounting .....	32+33
Shaft extensions .....	34
Permissible Shaft Seal pressure .....	34
Dimensions and mounting- MTS, V .....	35+36
Internal Spline data .....	37
Permissible shaft loads .....	37
Tacho connection .....	38
Order code .....	38

## OPTIONS

- » Model - Disc valve, roll-gerotor
- » Flange with wheel mount
- » Short motor
- » Tacho connection
- » Speed sensing
- » Side and rear ports
- » Shafts - straight, splined and tapered
- » Metric and BSPP ports
- » Other special features

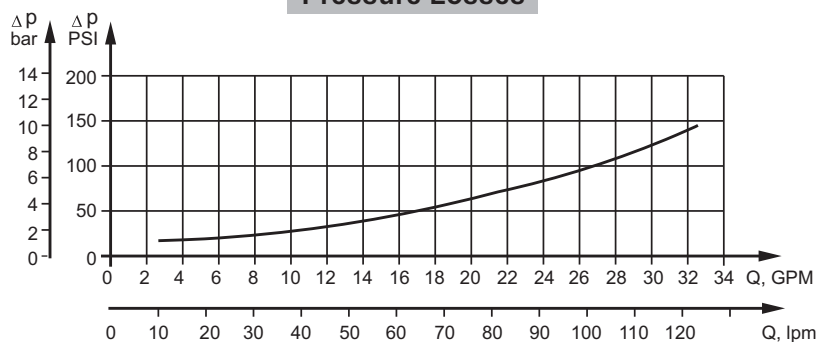
## GENERAL

<b>Max. Displacement,</b> cm <sup>3</sup> /rev [in <sup>3</sup> /rev]	724,3 [44.2]
<b>Max. Speed,</b> [RPM]	775
<b>Max. Torque,</b> daNm [lb-in]	cont.: 130 [11500] int.: 148 [13100]
<b>Max. Output,</b> kW [HP]	40 [54]
<b>Max. Pressure Drop,</b> bar [PSI]	cont.: 200 [2900] int. 240 [3480]
<b>Max. Oil Flow,</b> lpm [GPM]	150 [39.6]
<b>Min. Speed,</b> [RPM]	5
<b>Permissible Shaft Loads</b> daN [lbs]	P <sub>a</sub> =1000 [2250]
<b>Pressure fluid</b>	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)
<b>Temperature range,</b> °C [°F]	-40÷140 [-40÷284]
<b>Optimal Viscosity range,</b> mm <sup>2</sup> /s [SUS]	20 ÷ 75 [98 ÷ 347]
<b>Filtration</b>	ISO code 20/16 (Min. recommended fluid filtration of 25 microns)

### Oil flow in drain line

Pressure drop bar [PSI]	Viscosity mm <sup>2</sup> /s [SUS]	Oil flow in drain line lpm [GPM]
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		MT 160	MT 200	MT 250	MT 315
<b>Displacement,</b> cm <sup>3</sup> /rev [in <sup>3</sup> /rev]		161,1 [9.83]	201,4 [12.29]	251,8 [15.36]	326,3 [19.90]
<b>Max. Speed,</b> [RPM]	Cont.	622	620	496	382
	Int.*	775	752	601	461
<b>Max. Torque</b> daNm [lb-in]	Cont.	47 [4160]	59 [5220]	73 [6460]	95 [8410]
	Int.*	56 [4960]	71 [6285]	88 [7790]	114[10090]
	Peak**	66 [5840]	82 [7260]	102[9030]	133[11770]
<b>Max. Output</b> kW [HP]	Cont.	26,5 [36]	33,5 [45]	33,5 [45]	33,5 [45]
	Int.*	32 [43]	40 [54]	40 [54]	40 [54]
<b>Max. Pressure Drop</b> bar [PSI]	Cont.	200[2900]	200 [2900]	200[2900]	200 [2900]
	Int.*	240[3480]	240 [3480]	240[3480]	240 [3480]
	Peak**	280[4050]	280 [4050]	280[4050]	280 [4050]
<b>Max. Oil Flow</b> lpm [GPM]	Cont.	100 [26]	125 [33]	125 [33]	125 [33]
	Int.*	125[33]	150 [39.6]	150 [39.6]	150 [39.6]
<b>Max. Inlet Pressure</b> bar [PSI]	Cont.	210[3050]	210 [3050]	210[3050]	210 [3050]
	Int.*	250[3600]	250 [3600]	250[3600]	250 [3600]
	Peak**	300[4350]	300 [4350]	300[4350]	300 [4350]
<b>Max. Return Pressure</b> with Drain Line bar [PSI]	Cont.	140[2030]	140 [2030]	140[2030]	140 [2000]
	Int.*	175[2540]	175 [2540]	175[2540]	175 [2500]
	Peak**	210[3050]	210 [3050]	210[3050]	210 [3000]
<b>Max. Starting Pressure with Unloaded Shaft, bar [PSI]</b>		10 [150]	10 [150]	10 [150]	10 [150]
<b>Min. Starting Torque</b> daNm [lb-in]	At max. press. drop Cont.	34 [3010]	43 [3800]	53 [4690]	74 [6550]
	At max. press. drop Int.*	41 [3630]	52 [4600]	63 [5580]	89 [7880]
<b>Min. Speed***, [RPM]</b>		10	9	8	7
<b>Weight, kg [lb]</b> <b>For Rear Ports</b> <b>+0,450[.992]</b>	MT	20 [44.1]	21,5[47.4]	21 [46.3]	22 [48.5]
	MTW	22 [48.5]	22,5[49.6]	23 [50.7]	24 [52.9]
	MTS	15 [33.1]	15,5[34.2]	16 [35.3]	17 [37.5]
	MTV	11 [24.3]	11,5 [25.4]	12 [26.5]	13 [28.7]

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

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

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

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

## SPECIFICATION DATA (continued)

Type		MT 400	MT 500	MT 630	MT 725
<b>Displacement, cm<sup>3</sup>/rev [in<sup>3</sup>/rev]</b>		410,9 [25.06]	523,6 [31.95]	631,2 [38.52]	724,3 [44.2]
<b>Max. Speed, [RPM]</b>	Cont.	304	238	197	172
	Int.*	368	289	234	209
<b>Max. Torque daNm [lb-in]</b>	Cont.	108 [9560]	122 [10800]	130 [11500]	127 [11240]
	Int.*	126 [11150]	137 [12125]	148 [13100]	147 [13010]
	Peak**	144 [12745]	160 [14160]	176 [15580]	175 [15490]
<b>Max. Output kW [HP]</b>	Cont.	30 [40]	26,5 [36]	24,3 [33]	20,2 [27]
	Int.*	35 [47]	30 [40]	27,5 [37]	26,8 [36]
<b>Max. Pressure Drop bar [PSI]</b>	Cont.	180 [2610]	160 [2320]	140 [2010]	120 [1740]
	Int.*	210 [3050]	180 [2610]	160 [2320]	140 [2010]
	Peak**	240 [3480]	210 [3050]	190 [2760]	165 [2395]
<b>Max. Oil Flow lpm [GPM]</b>	Cont.	125 [33]	125 [33]	125 [33]	125 [33]
	Int.*	150 [39.6]	150 [39.6]	150 [39.6]	150 [39.6]
<b>Max. Inlet Pressure bar [PSI]</b>	Cont.	210 [3050]	210 [3050]	210 [3600]	210 [3050]
	Int.*	250 [3600]	250 [3600]	250 [4350]	250 [3600]
	Peak**	300 [4350]	300 [4350]	300 [2000]	300 [4350]
<b>Max. Return Pressure with Drain Line bar [PSI]</b>	Cont.	140 [2000]	140 [2000]	140 [2500]	140 [2000]
	Int.*	175 [2500]	175 [2500]	175 [3000]	175 [2500]
	Peak**	210 [3000]	210 [3000]	210 [3000]	210 [3000]
<b>Max. Starting Pressure with Unloaded Shaft, bar [PSI]</b>		10 [150]	10 [150]	10 [150]	10 [150]
<b>Min. Starting Torque daNm [lb-in]</b>	At max. press. drop Cont.	84 [7435]	95 [8410]	95 [8410]	95 [8410]
	At max. press. drop Int.*	97 [8585]	106 [9380]	110 [9740]	115 [10180]
<b>Min. Speed***, [RPM]</b>		6	5	5	5
<b>Weight, kg [lb] For Rear Ports +0,450[.992]</b>	MT	23 [50.7]	24 [52.9]	23,5 [51.8]	24,5 [54.0]
	MTW	25 [55.1]	26 [57.3]	25,5 [56.2]	26,5 [58.4]
	MTS	18 [39.7]	19 [41.9]	18,5 [40.8]	19,5 [43.0]
	MTV	14 [30.9]	15 [33.1]	14,5 [32.0]	15,5 [34.2]

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

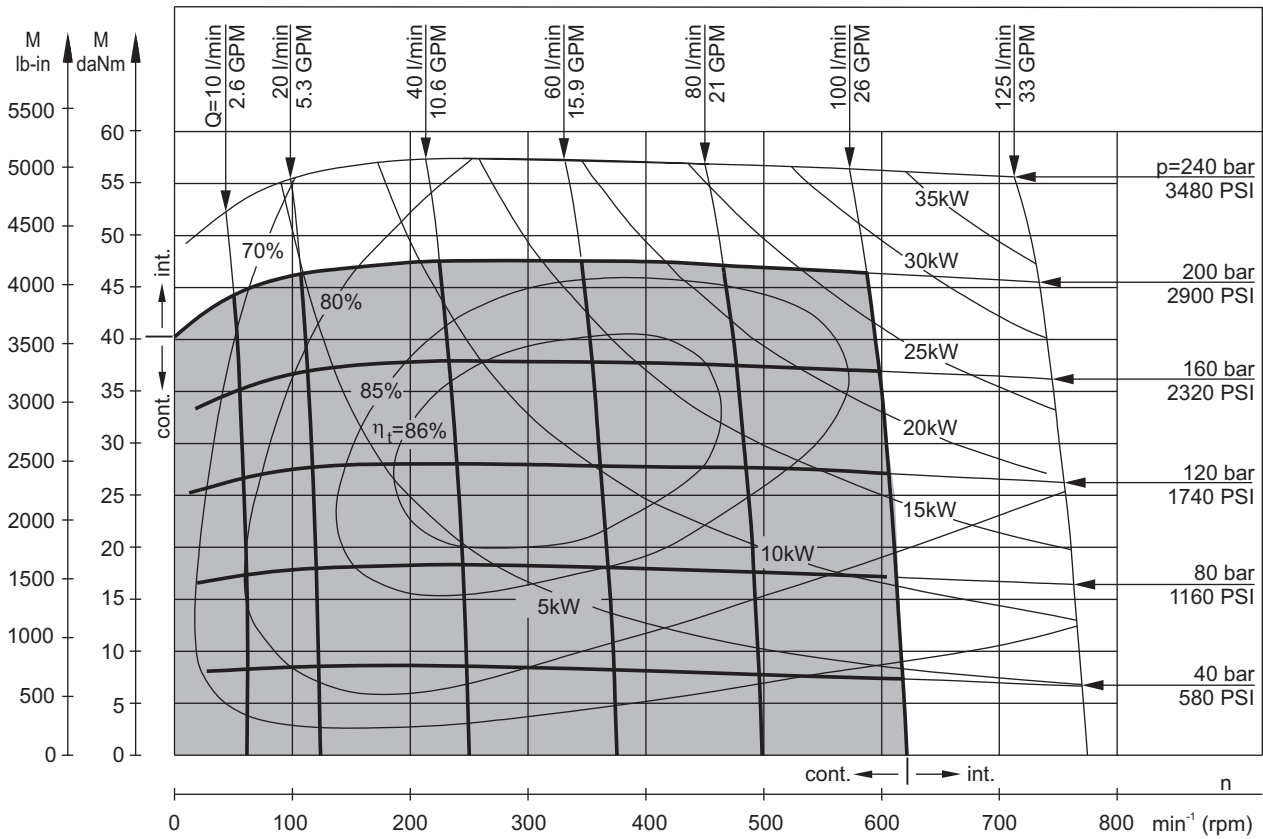
\*\* Peak load: the permissible values may occur for max. 1% of every minute.

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

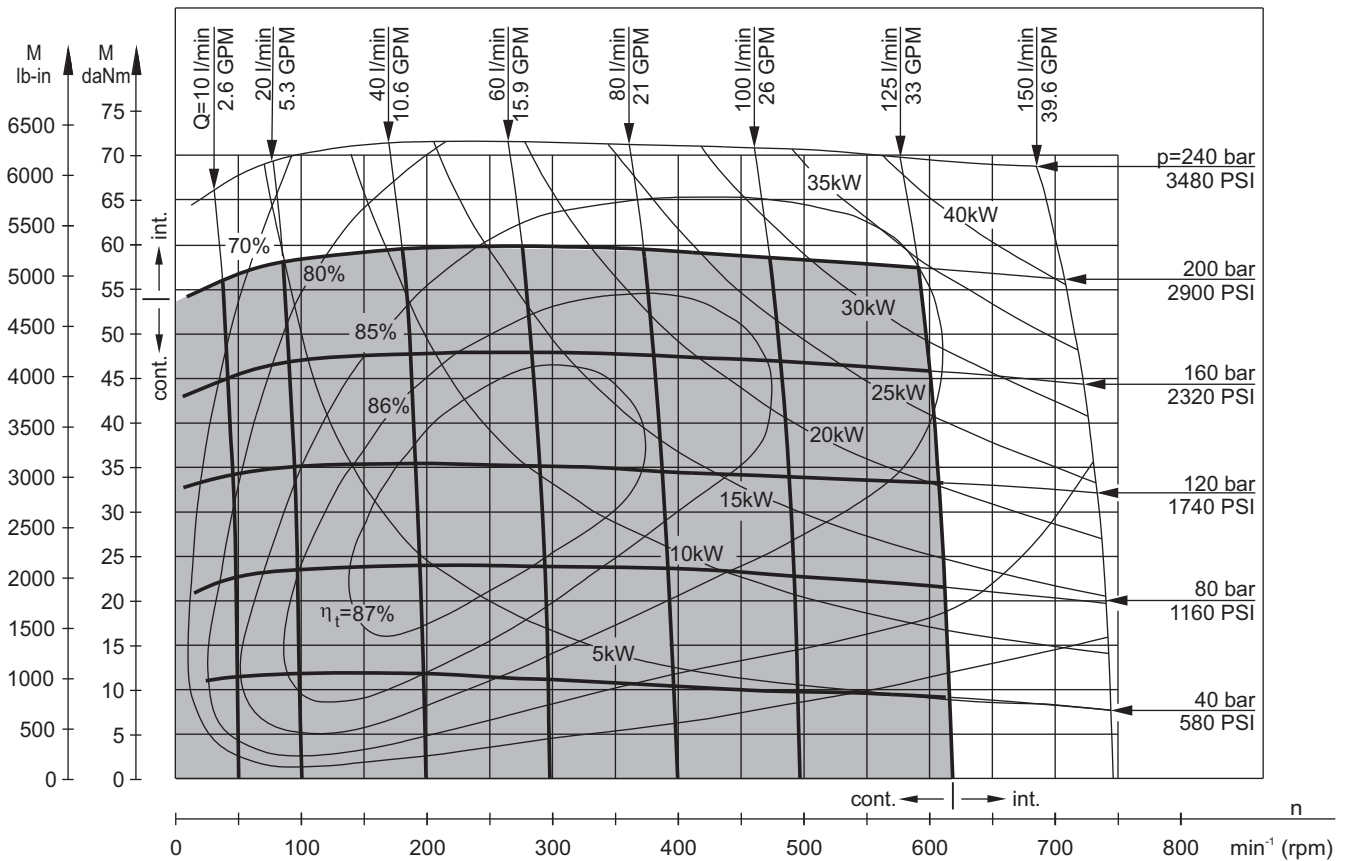
- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP(DIN51524) or HM (ISO 6743/4).  
If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

**FUNCTION DIAGRAMS**

**MT 160**



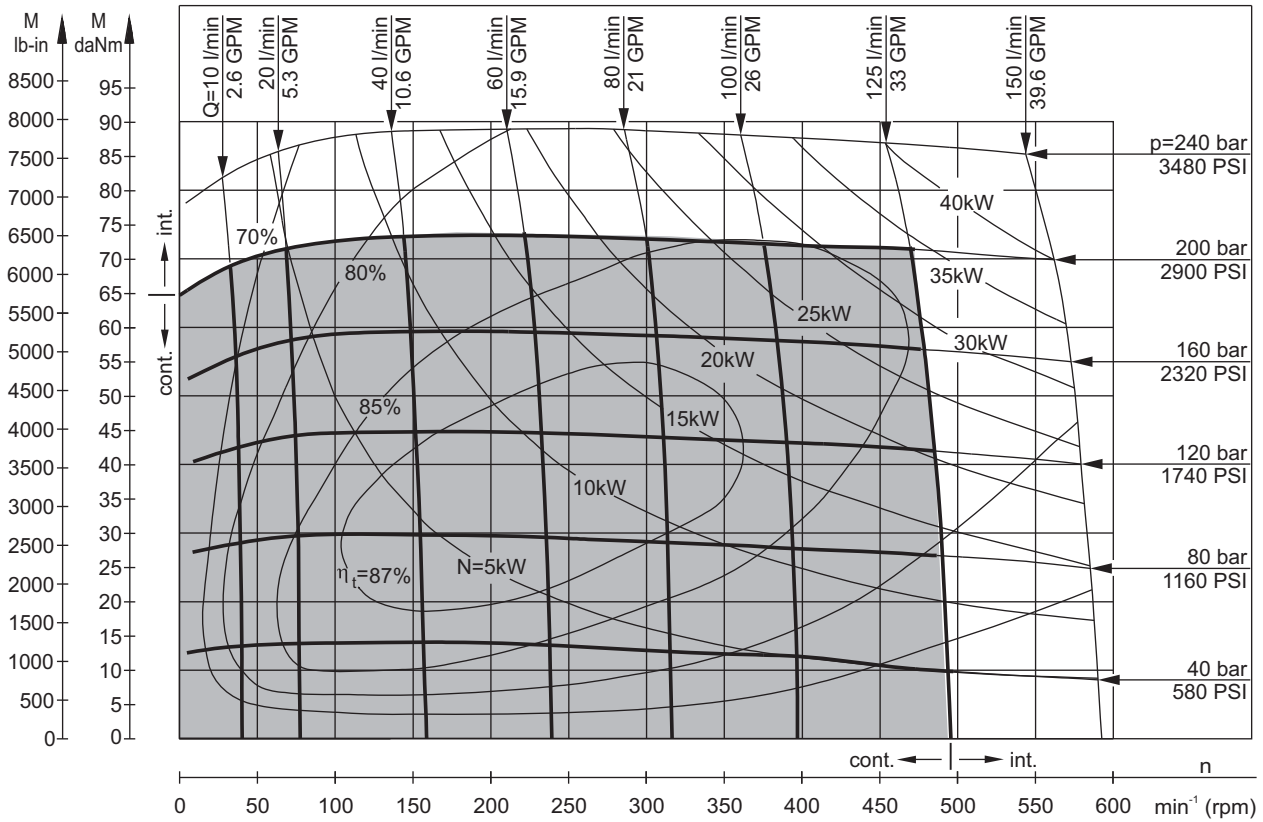
**MT 200**



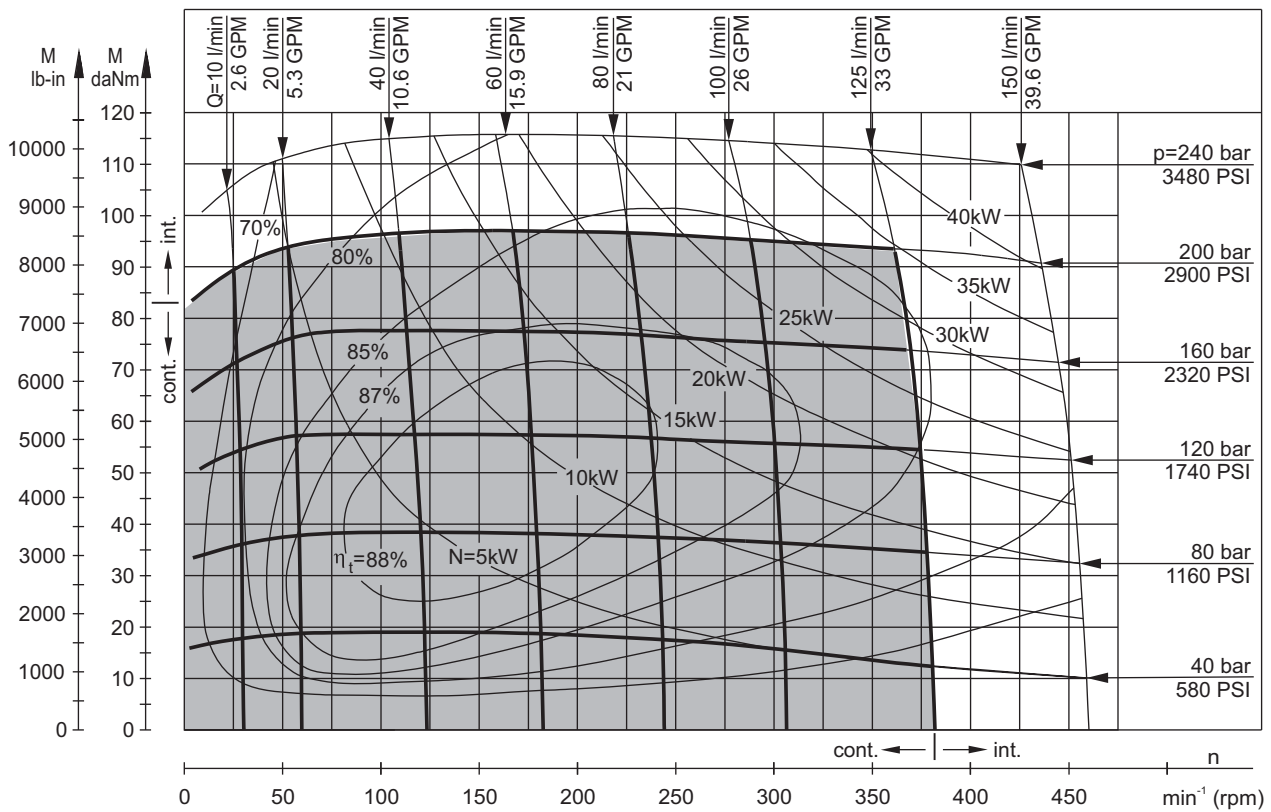
The function diagrams data is for average performance of randomly selected motors at back pressure  $5 \pm 10$  bar [72.5-145 PSI] and oil with viscosity of  $32 \text{ mm}^2/\text{s}$  [150 SUS] at  $50^\circ\text{C}$  [122°F].

**FUNCTION DIAGRAMS**

**MT 250**



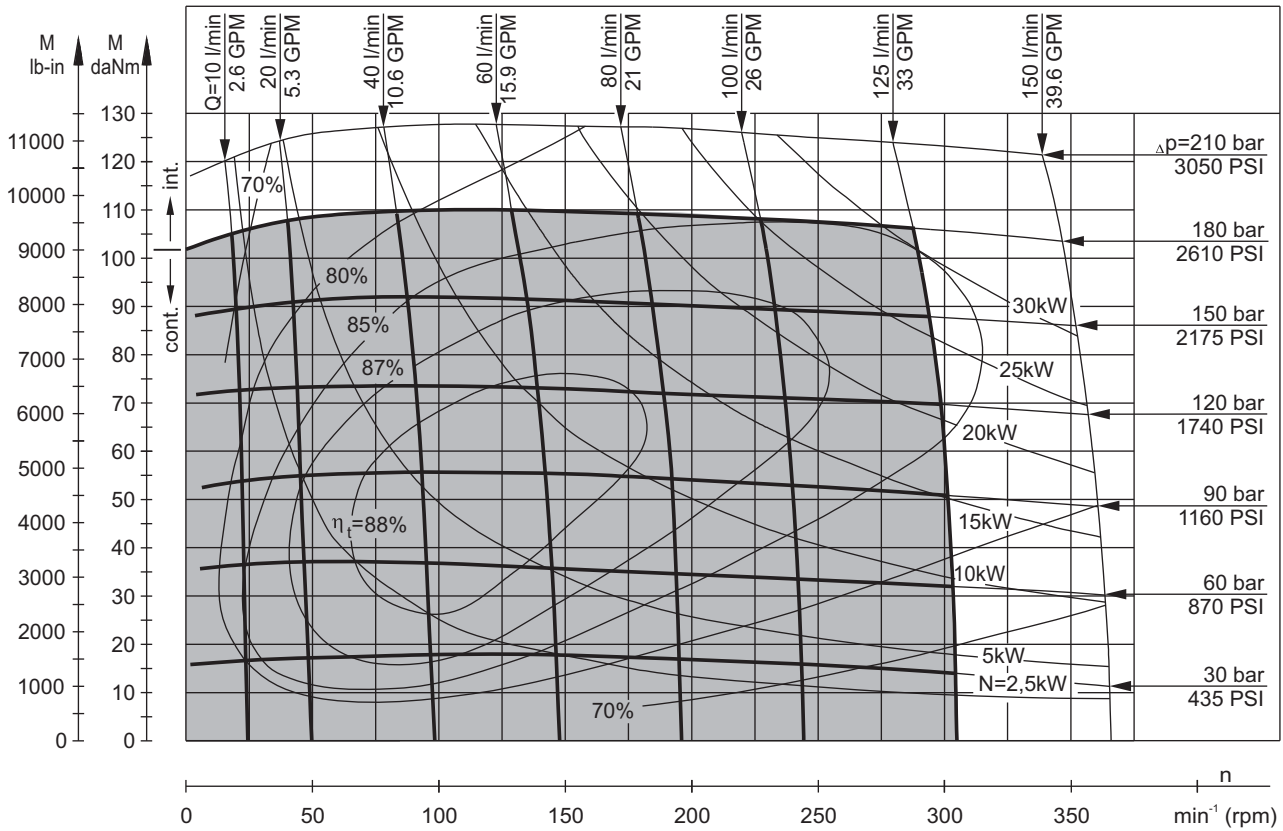
**MT 315**



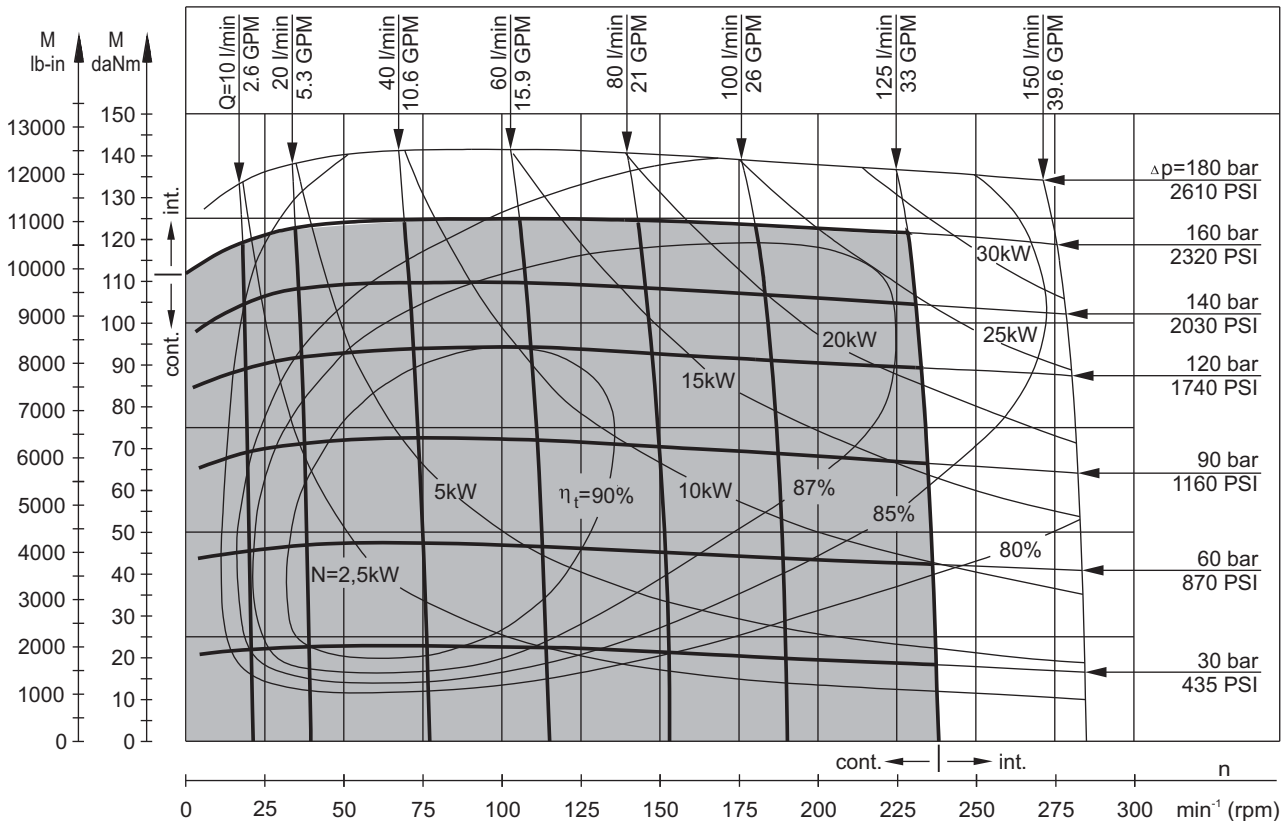
The function diagrams data is for average performance of randomly selected motors at back pressure 5±10 bar [72.5±145 PSI] and oil with viscosity of 32 mm<sup>2</sup>/s [150 SUS] at 50°C [122°F].

**FUNCTION DIAGRAMS**

**MT 400**



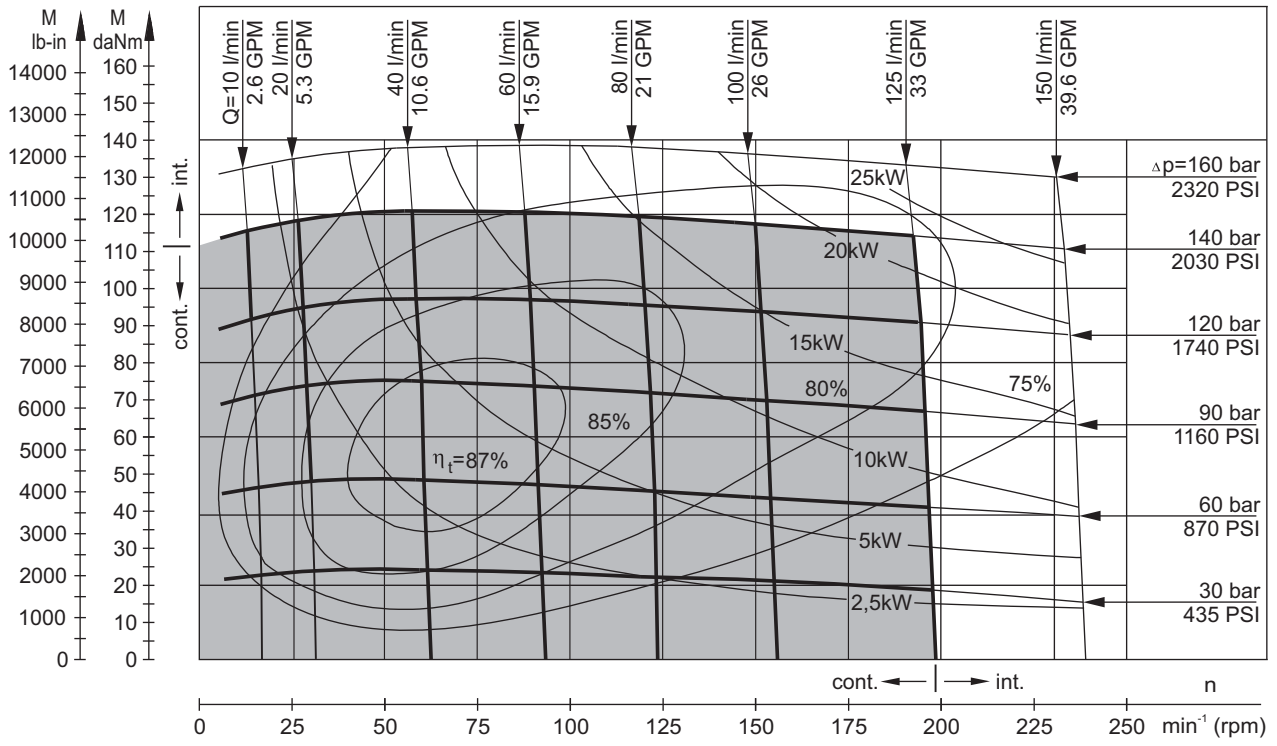
**MT 500**



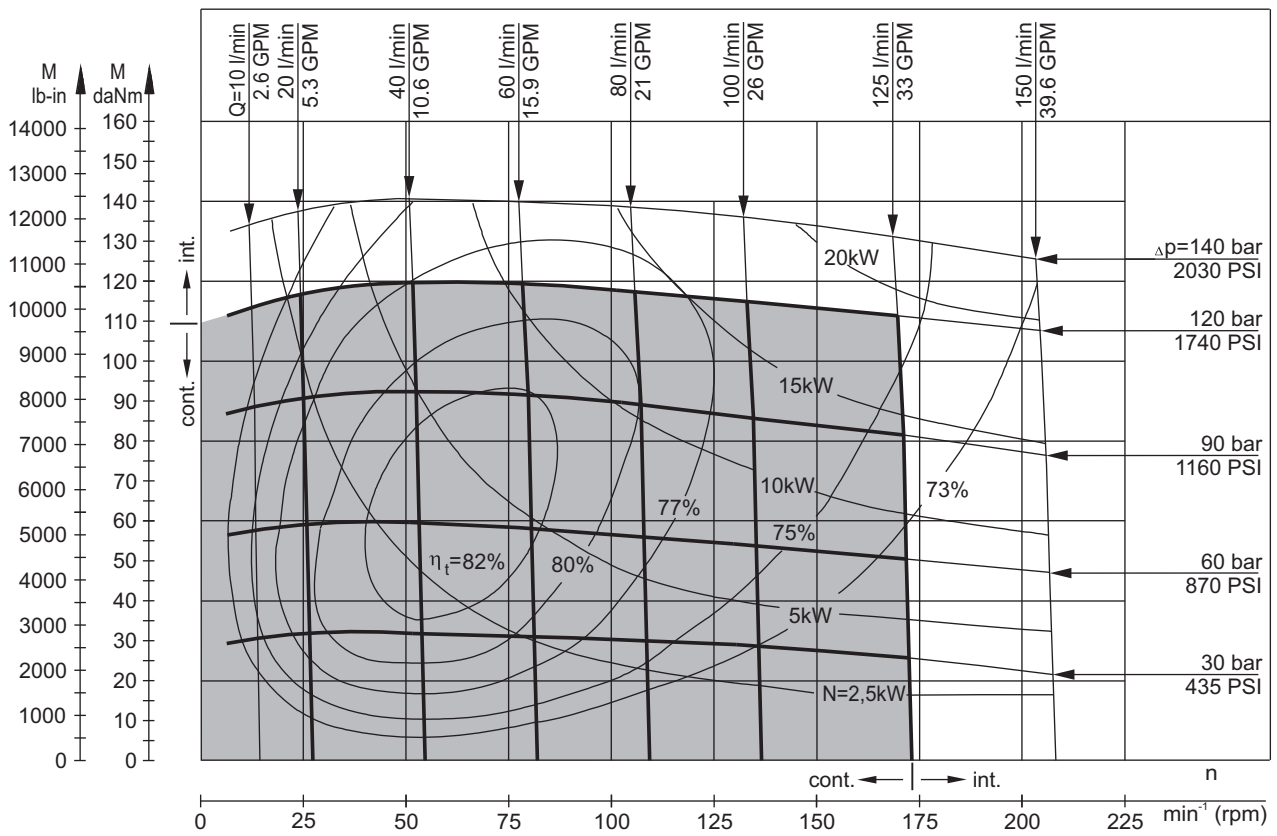
The function diagrams data is for average performance of randomly selected motors at back pressure  $5 \pm 10$  bar [72.5  $\pm$  145 PSI] and oil with viscosity of 32 mm<sup>2</sup>/s [150 SUS] at 50°C [122°F].

**FUNCTION DIAGRAMS**

**MT 630**

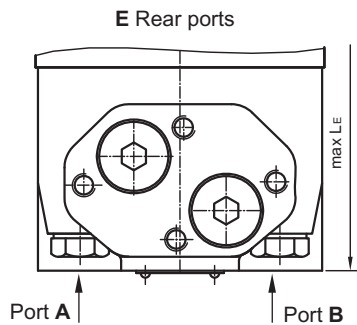
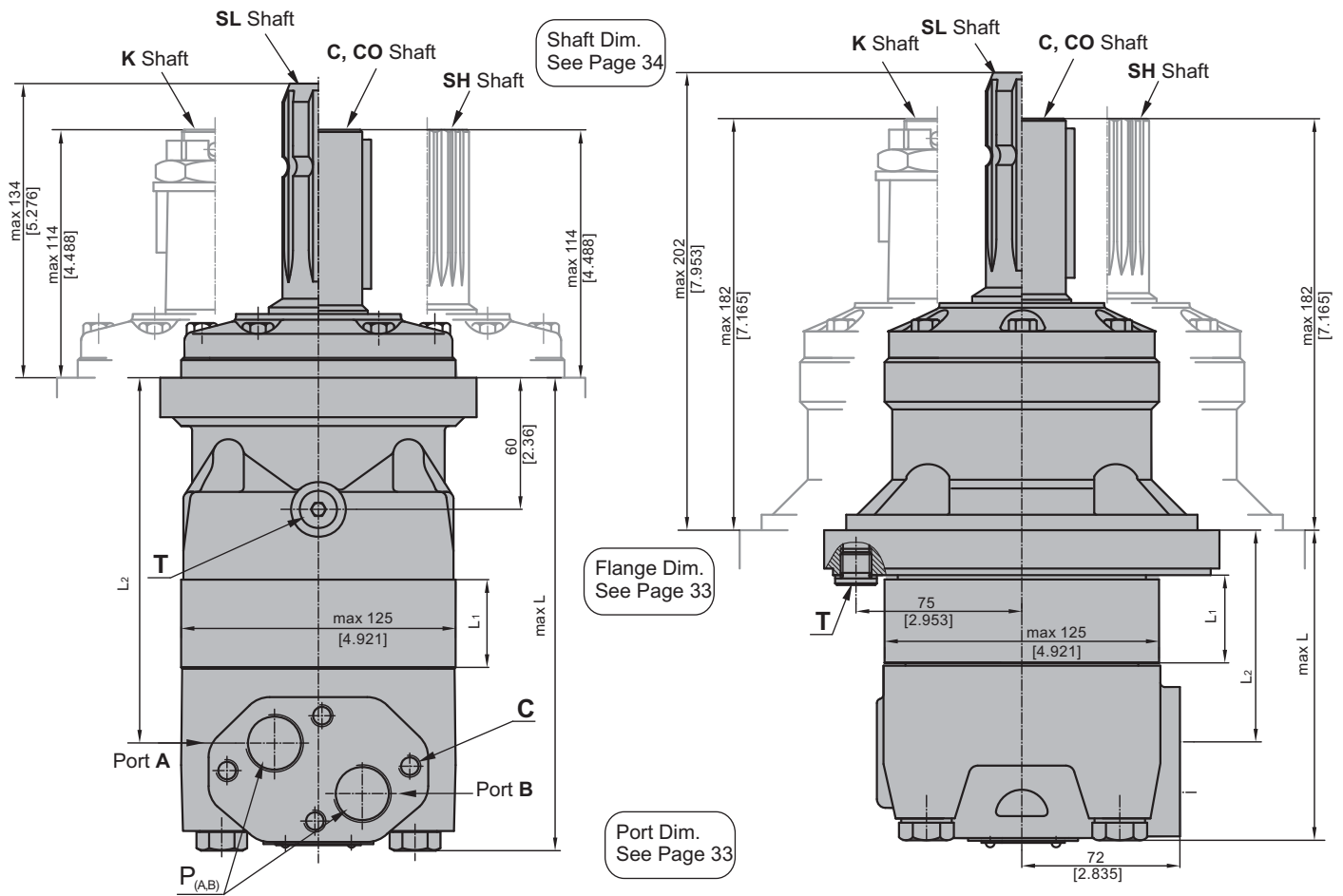


**MT 725**



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

**DIMENSIONS AND MOUNTING DATA**



- C:** 4xM10-10 mm [.39 in] depth
- P<sub>(A,B)</sub>:** 2xG3/4 or 2xM27x2-17 mm [.67 in] depth
- T:** G 1/4 or M14x1,5 - 12 mm [.47 in] depth (plugged)

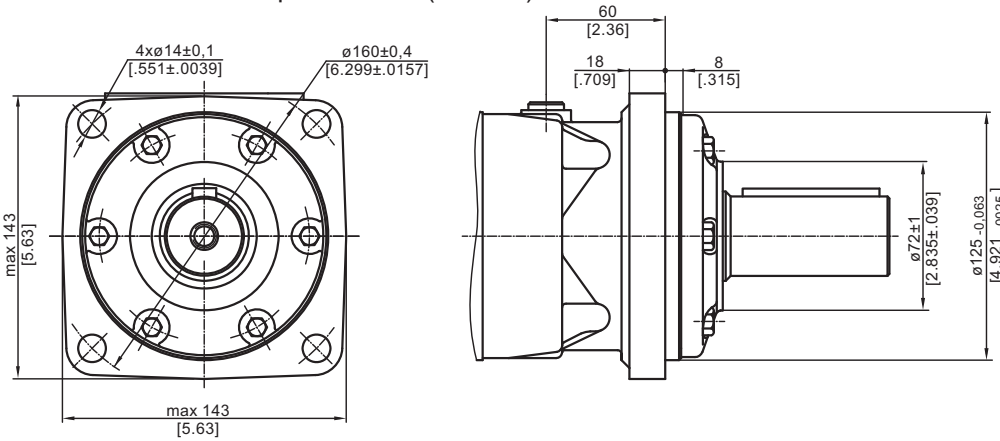
- |  |   |
|--|---|
| <b>Standard Rotation</b><br>Viewed from Shaft End<br>Port A Pressurized - <b>CW</b><br>Port B Pressurized - <b>CCW</b> | <b>Reverse Rotation</b><br>Viewed from Shaft End<br>Port A Pressurized - <b>CCW</b><br>Port B Pressurized - <b>CW</b> |
|--|---|

Type	L, mm [in]	L2, mm [in]	**LE, mm [in]	Type	L, mm [in]	L2, mm [in]	**LE, mm [in]	*L1, mm [in]
MT 160	190 [7.48]	140 [5.51]	200 [7.87]	MTW 160	123 [4.84]	73 [2.87]	133 [5.23]	16,5 [.65]
MT 200	195 [7.68]	145 [5.71]	205 [8.07]	MTW 200	128 [5.04]	78 [3.07]	138 [5.43]	21,5 [.85]
MT 250	201 [7.91]	151 [5.95]	211 [8.31]	MTW 250	134 [5.28]	84 [3.31]	144 [5.67]	27,8 [1.09]
MT 315	211 [8.31]	161 [6.34]	221 [8.70]	MTW 315	144 [5.67]	94 [3.70]	154 [6.02]	37,0 [1.46]
MT 400	221 [8.70]	171 [6.73]	231 [9.09]	MTW 400	154 [6.06]	104 [4.09]	164 [6.45]	47,5 [1.87]
MT 500	235 [9.25]	185 [7.28]	245 [9.64]	MTW 500	168 [6.61]	118 [4.65]	178 [6.61]	61,5 [2.42]
MT 630	231 [9.09]	181 [7.13]	241 [9.49]	MTW 630	164 [6.46]	114 [4.49]	174 [6.85]	57,5 [2.26]
MT 725	240 [9.45]	190 [7.48]	250 [9.84]	MTW 725	173 [6.81]	123 [4.84]	183 [7.21]	66,5 [2.62]

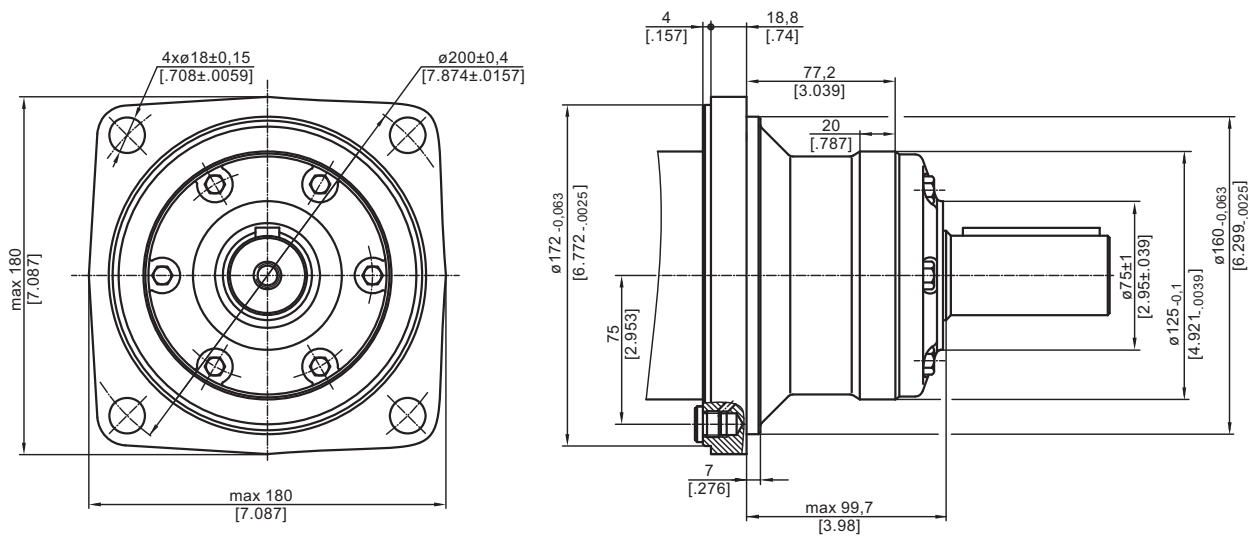
\* - The width of the roll-gerotor is 3,5 mm [.138 in] greater than L<sub>1</sub>.  
\*\* - For Rear Ported Motors.

**MOUNTING**

**Square Mount (4 Holes)**

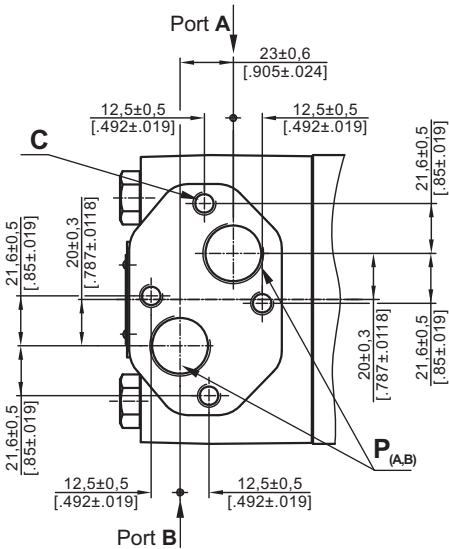


**W Wheel Mount**

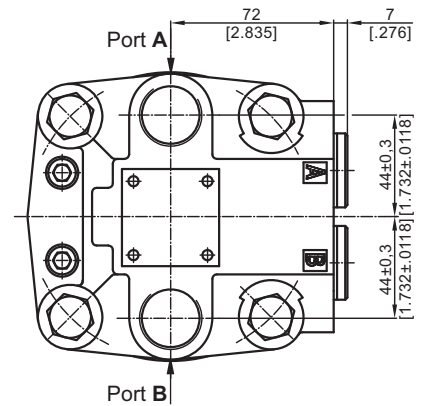


**PORTS**

**Side Ports**



**E Rear Ports**



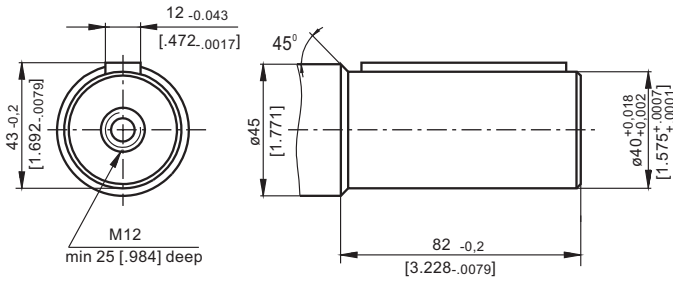
**Standard Rotation**  
Viewed from Shaft End  
Port A Pressurized - **CW**  
Port B Pressurized - **CCW**

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

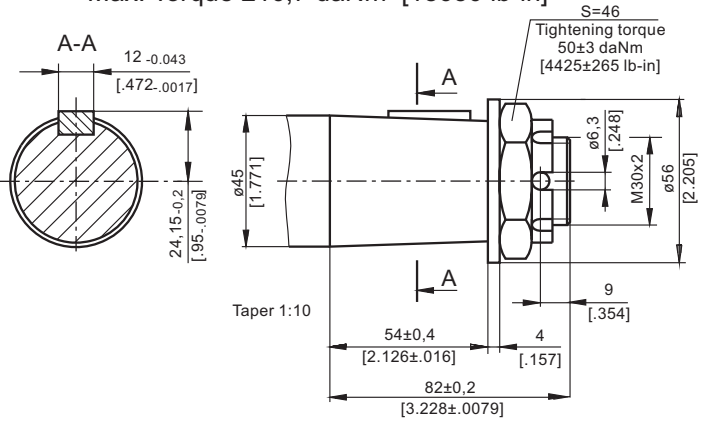
**C:** 4xM10-10 mm [.39 in] depth  
**P<sub>(A,B)</sub>:** 2xG3/4 or 2xM27x2-17 mm [.67 in] depth  
**T:** G 1/4 or M14x1,5 - 12 mm [.47 in] depth (plugged)

**SHAFT EXTENSIONS**

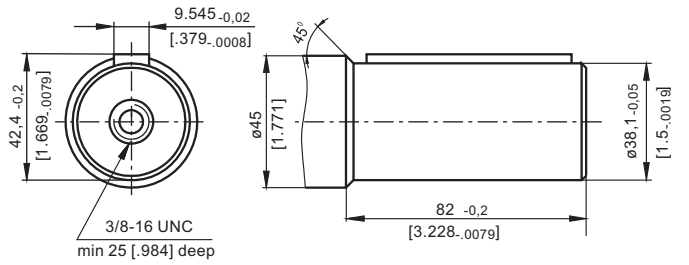
**C** - $\varnothing 40$  straight, Parallel key A12x8x70 DIN 6885  
Max. Torque 132,8 daNm [11755 lb-in]



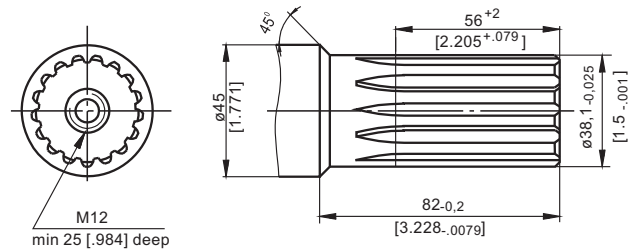
**K** -tapered 1:10, Parallel key B12x8x28 DIN 6885  
Max. Torque 210,7 daNm [18650 lb-in]



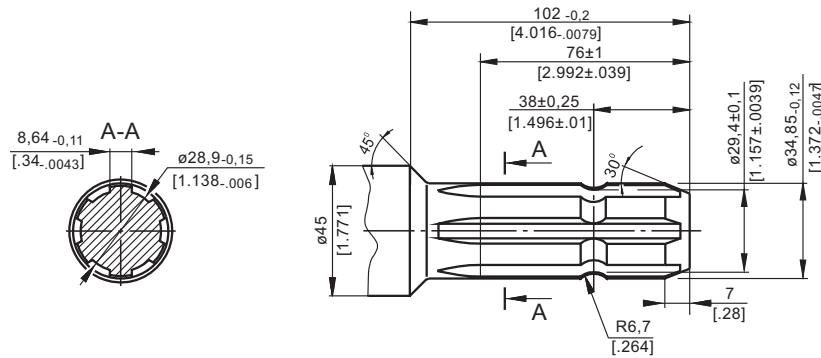
**CO** - $\varnothing 1\frac{1}{2}$ " straight, Parallel key  $\frac{3}{8}$ "x  $\frac{3}{8}$ "x  $2\frac{1}{4}$ " BS46  
Max. Torque 132,8 daNm [11755 lb-in]



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

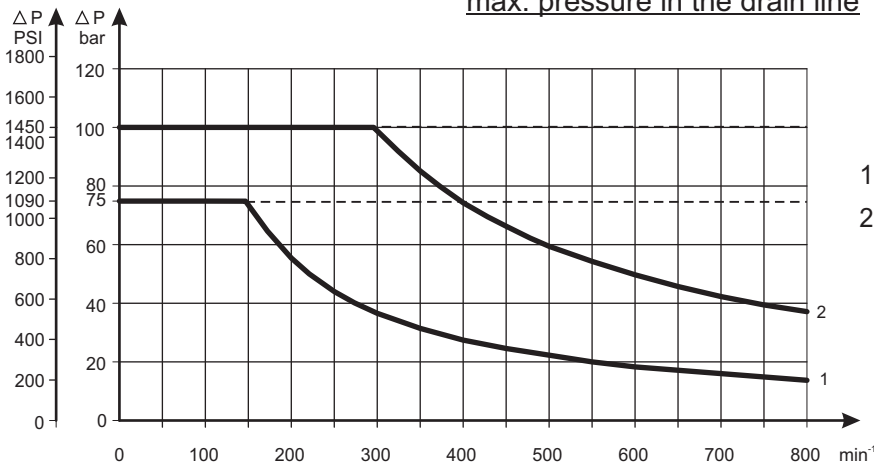


**SL** - $\varnothing 34,85$  p.t.o. DIN 9611 Form 1  
Max. Torque 77 daNm [6815 lb-in]



**MAX. PERMISSIBLE SHAFT SEAL PRESSURE for MT motors**

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

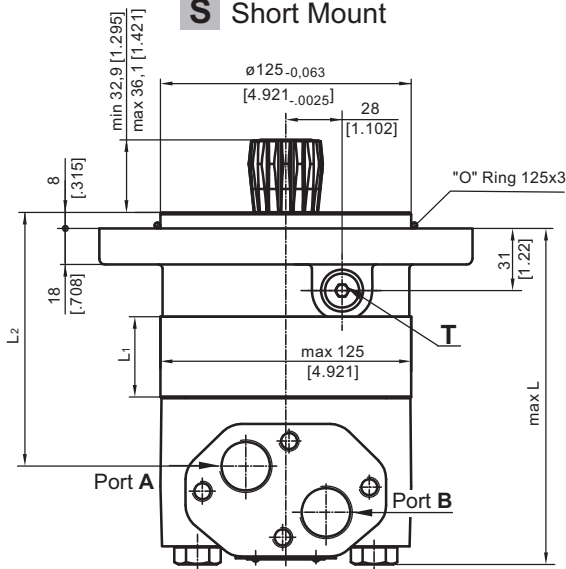


- 1: Drawing for Standard Shaft Seal
- 2: Drawing for High Pressure Seal ("U" Seal)

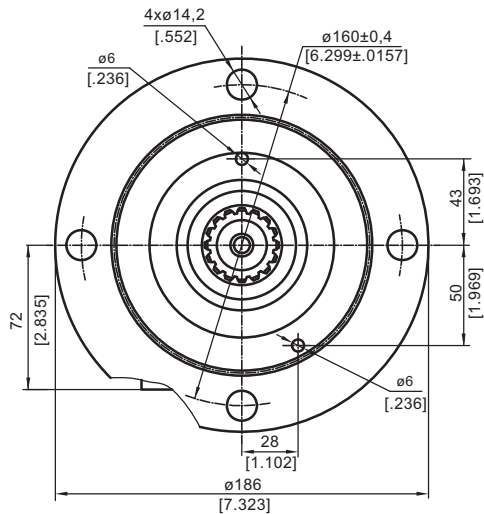
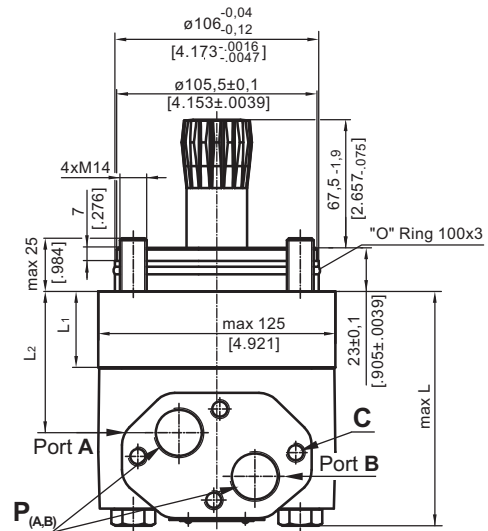
— - continuous operations  
- - - - intermittent operations

**DIMENSIONS AND MOUNTING DATA - MTS and MTV**

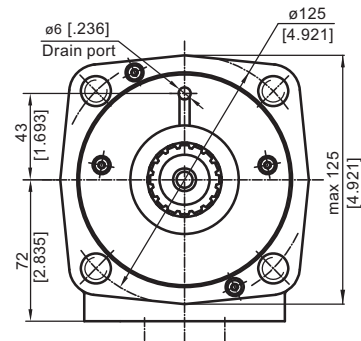
**S Short Mount**



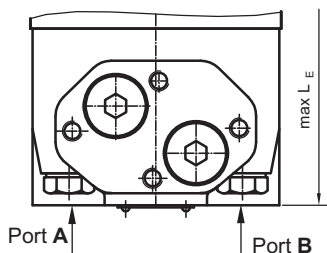
**V Very Short Mount**



Port Dim.  
See Page 33



**E Rear ports**



- C:** 4xM10-10 mm [.39 in] depth
- P<sub>(A,B)</sub>:** 2xG3/4 or 2xM27x2-17 mm [.67 in] depth
- T:** G 1/4 or M14x1,5 - 12 mm [.47 in] depth (plugged)

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

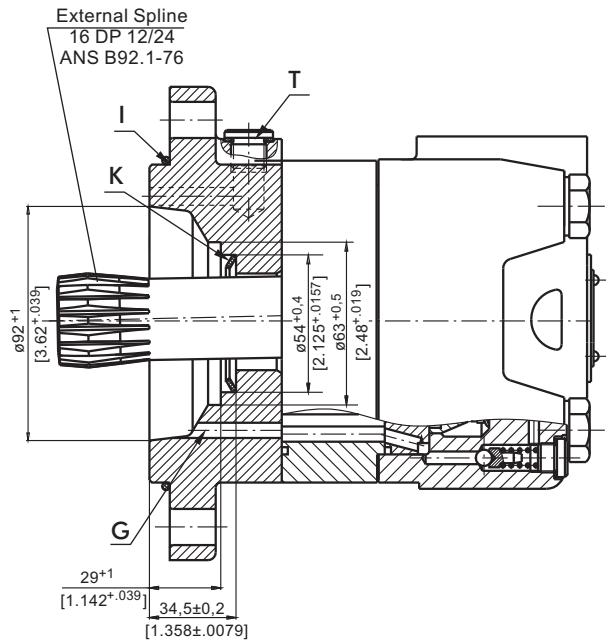
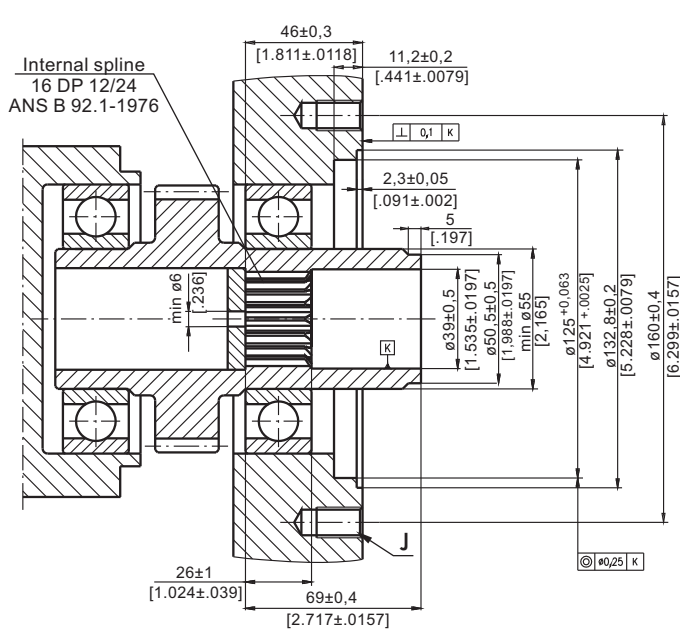
**Reverse Rotation**  
Viewed from Shaft End  
Port A Pressurized - **CCW**  
Port B Pressurized - **CW**

Type	L, in.[mm]	L <sub>2</sub> , in.[mm]	**L <sub>E</sub> ,mm [in.]	Type	L, in.[mm]	L <sub>2</sub> , in.[mm]	**L <sub>E</sub> ,mm [in.]	*L <sub>1</sub> ,mm [in.]
MTS 160	146 [5.75]	96 [3.78]	156 [6.14]	MTV 160	101 [3.98]	51,5 [2.02]	111 [4.37]	16,5 [ .65]
MTS 200	151 [5.95]	101 [3.98]	161 [6.33]	MTV 200	106 [4.17]	56,5 [2.22]	116 [4.57]	21,5 [ .85]
MTS 250	157 [6.18]	107 [4.21]	167 [6.57]	MTV 250	112 [4.41]	62,8 [2.47]	122 [4.80]	27,8 [1.09]
MTS 315	166 [6.53]	116 [4.56]	176 [6.93]	MTV 315	121 [4.76]	72,0 [2.83]	131 [5.16]	37,0 [1.46]
MTS 400	177 [6.97]	127 [5.00]	187 [7.36]	MTV 400	132 [5.19]	82,5 [3.25]	142 [5.59]	47,5 [1.87]
MTS 500	191 [7.52]	142 [5.59]	201 [7.91]	MTV 500	146 [5.75]	96,5 [3.80]	156 [6.14]	61,5 [2.42]
MTS 630	187 [7.36]	138 [5.43]	197 [7.76]	MTV 630	142 [5.59]	92,5 [3.64]	152 [5.98]	57,5 [2.26]
MTS 725	196 [7.72]	147 [5.79]	206 [8.11]	MTV 725	151 [5.95]	101,5 [4.00]	161 [6.34]	66,5 [2.62]

\* - The width of the roll-gerotor is 3,5 mm [.138 in] greater than L<sub>1</sub>.  
\*\* - For Rear Ported Motors.

**DIMENSIONS OF THE ATTACHED COMPONENT**

**MTS**

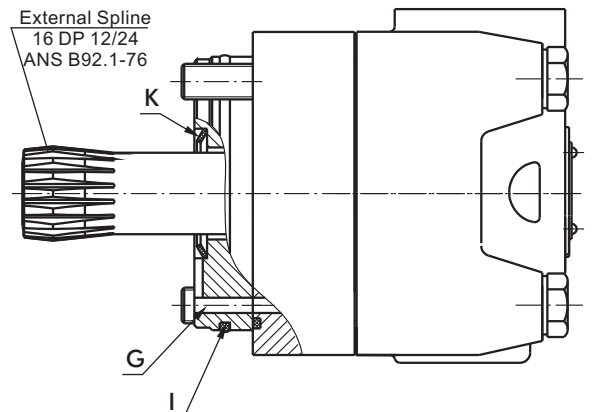
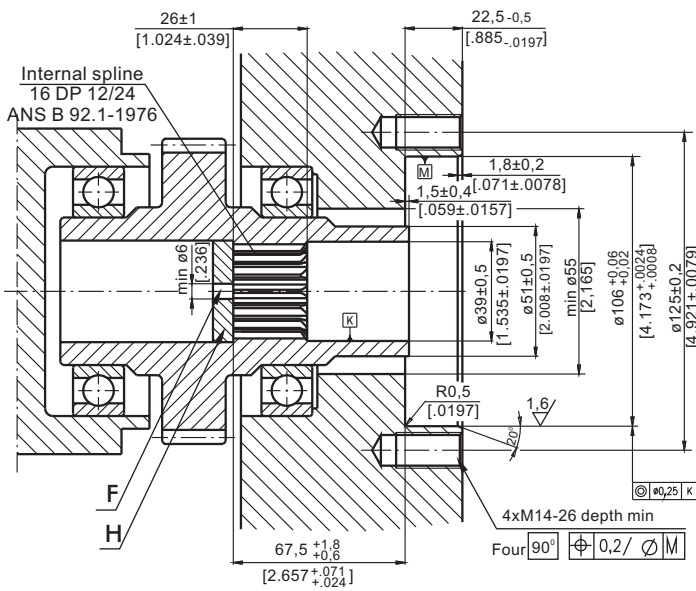


**F:** Oil circulation hole  
**G:** Internal drain channel  
**H:** Hardened stop plate

**I:** O-Ring 125x3 mm [4.921x.118 in]  
**J:** 4xM12-18 mm [.71 in] depth, 90°  
**K:** Conical seal ring  
**T:** Drain connection G1/4 or M14x1,5



**MTV**



**F:** Oil circulation hole  
**G:** Internal drain channel

**H:** Hardened stop plate  
**I:** O-Ring 100x3 mm [3.94x.12 in]  
**K:** Conical seal ring

**DRAIN CONNECTION**

The drain line has to be used when pressure in the return line can exceed the permissible pressure. It can be connected:

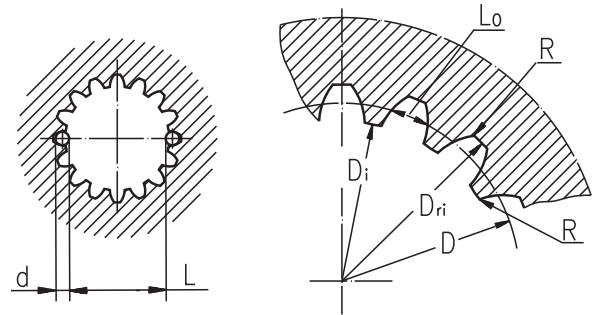
- For MTS at the drain port of the motor;
- For MTV at the drain connection of the attached component. The maximum pressure in the drain line is limited by the attached component and its shaft seal.

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  $x.m=1$ ]

Fillet Root Side Fit		mm	inch
Number of Teeth	z	16	16
Diametral Pitch	DP	12/24	12/24
Pressure Angle		30°	30°
Pitch Dia.	D	33,8656	1.3333
Major Dia.	D <sub>ri</sub>	38,4 <sup>+0,4</sup>	1.5118±1.5275
Minor Dia.	D <sub>i</sub>	32,15 <sup>+0,04</sup>	1.2657±1.2673
Space Width [Circular]	L <sub>o</sub>	4,516±0,037	.1763±.1791
Fillet Radius	R	0,5	.02
Max. Measurement between Pins	L	26,9 <sup>+0,10</sup>	1.063±1.059
Pin Dia.	d	4,835±0,001	.19026±.19034



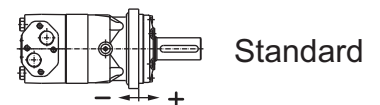
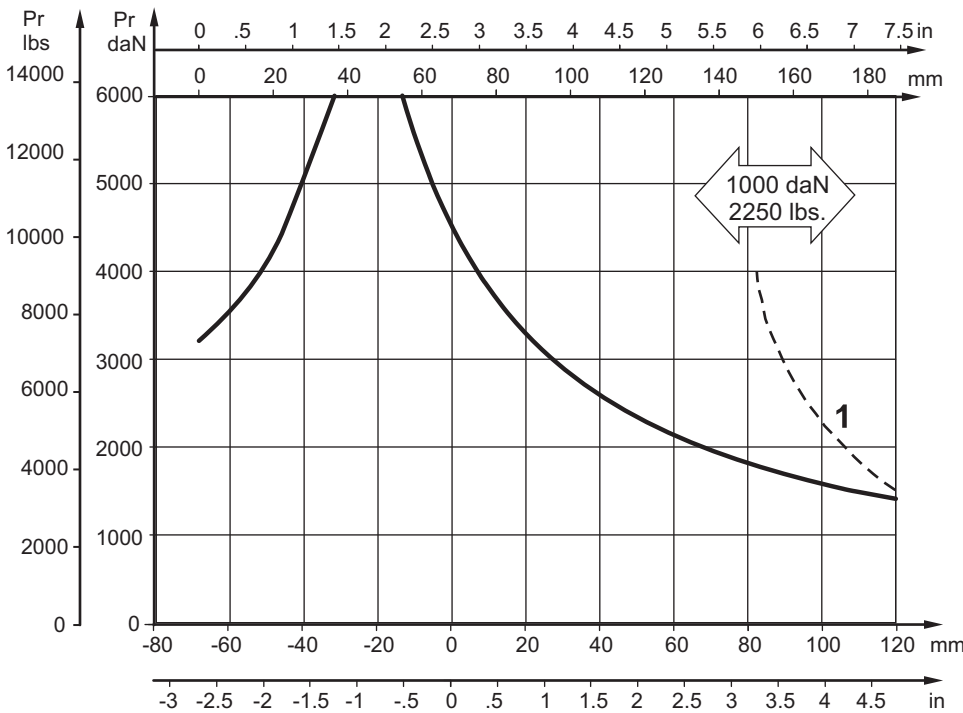
**Hardening Specification:**  
 HV=750±50 on the surface.  
 HV=560 at 0,7±0,2 mm [.035±.019in] case depth  
 Material: 20 MoCr4 EN 10084 or SAE8620.

**PERMISSIBLE SHAFT LOADS**

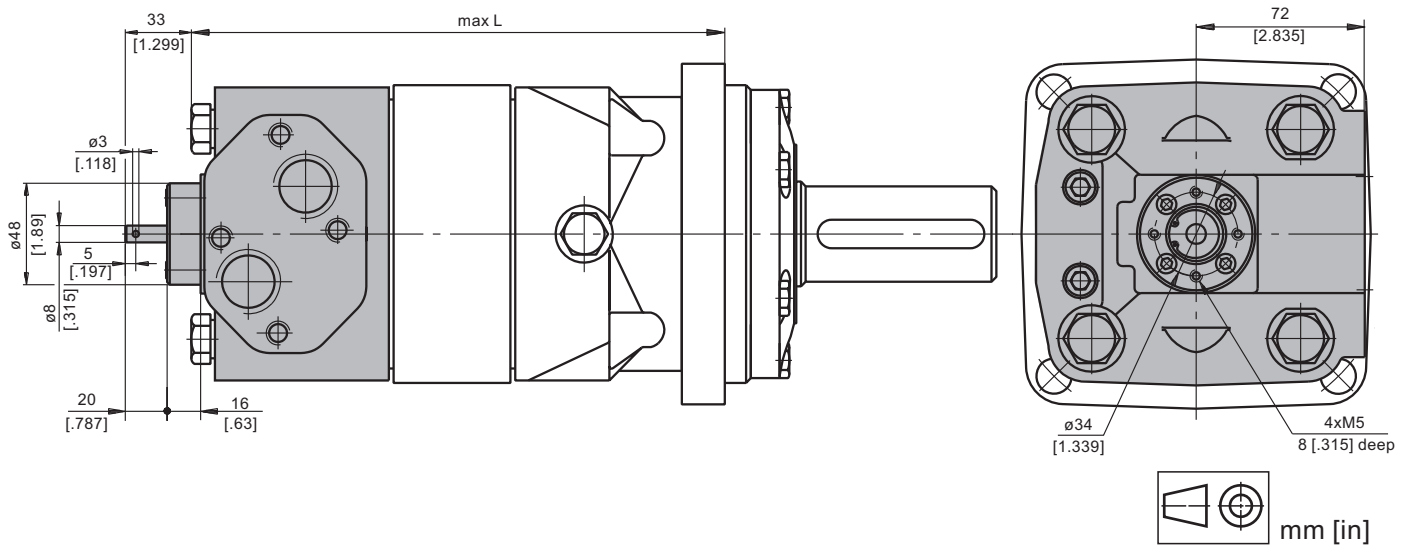
The output shaft runs in tapered bearings that permit high axial and radial forces. The permissible radial load on the shaft is shown for an axial load of 0 N as function of the distance from the mounting flange to the point of load application. The curves apply to a B10 bearing life of 2000 hours at 100 RPM .

Curve "1" shows max. radial shaft load. Any shaft load exceeding the values shown by the curve will seriously reduce motor life.

**Mounting Flange:**



**MOTORS WITH TACHO CONNECTION**



**ORDER CODE**

	1	2	3	4	5	6	7	8
<b>MT</b>								

**Pos.1 - Mounting Flange**

- omit - Square mount, four holes
- S** - Short mount
- V** - Very short mount
- W** - Wheel mount

**Pos.2 - Port type**

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

**Pos.3 - Displacement code**

- 160** - 61,6 cm<sup>3</sup>/rev [9.83 in<sup>3</sup>/rev]
- 200** - 201,4 cm<sup>3</sup>/rev [12.29 in<sup>3</sup>/rev]
- 250** - 251,8 cm<sup>3</sup>/rev [15.36 in<sup>3</sup>/rev]
- 315** - 326,3 cm<sup>3</sup>/rev [19.90 in<sup>3</sup>/rev]
- 400** - 410,9 cm<sup>3</sup>/rev [25.06 in<sup>3</sup>/rev]
- 500** - 523,6 cm<sup>3</sup>/rev [31.95 in<sup>3</sup>/rev]
- 630** - 631,2 cm<sup>3</sup>/rev [38.52 in<sup>3</sup>/rev]
- 725** - 724,3 cm<sup>3</sup>/rev [44.20 in<sup>3</sup>/rev]

**Pos.4 - Shaft Extensions\***

- omit - for **S** and **V** mounting flange
- 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
- SL** - ø34,85 p.t.o. DIN 9611 Form 1
- SH** - ø1½" splined 17T ANS B92.1-1976

**Pos.5 - Shaft Seal Version** (see page 34)

- omit - Low pressure seal
- U** - High pressure seal

**Pos.6 - Ports**

- omit - BSPP (ISO 228)
- M** - Metric (ISO 262)

**Pos.7 - Special Features** (see page 51)

**Pos.8 - Design Series**

- omit - Factory specified

**NOTES:**

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

The hydraulic motors are mangano-phosphatized as standard.

# MOTOR SPECIAL FEATURES

Special Feature Description	Order Code	Motor type		
		MS	MT	MV
Speed Sensor*	RS	O	O	O
Tacho Connection**	T	O	O	O
Reinforced motor	HD	-	O	O
Low Leakage	LL	O	O	O
Low Speed Valving	LSV	O	O	O
Reverse Rotation	R	O	O	O
Paint***	P	O	O	O
Corrosion Protected Paint***	PC	O	O	O
Special Paint****	PS	O	O	O
	PCS			
Check Valves		S	S*****	S*****

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

\* For sensor ordering see pages 52÷53.

\*\* For side ports only!

\*\*\* Colour at customer's request.

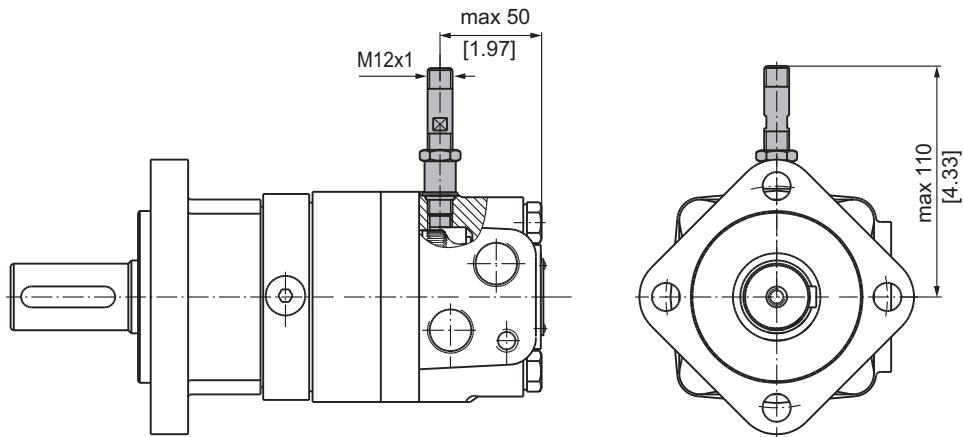
\*\*\*\* Non painted feeding surfaces, colour at customer's request.

\*\*\*\*\* Without check valves for "HD" option.

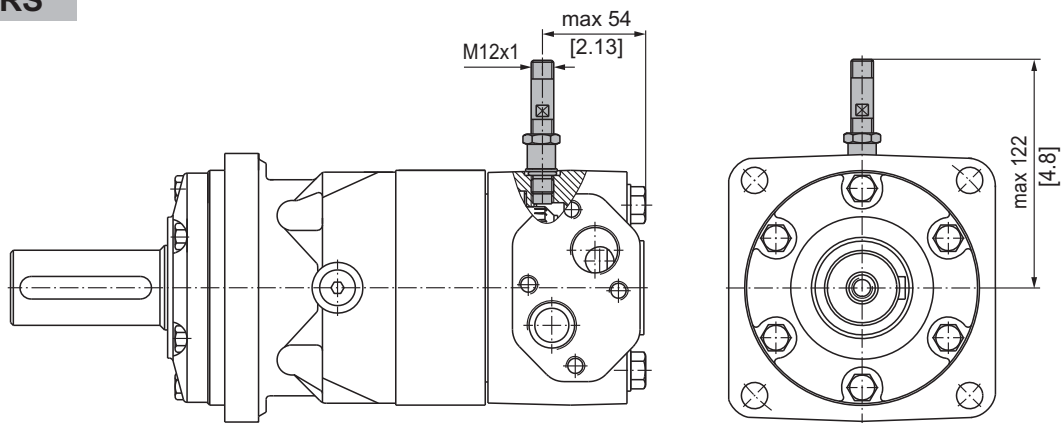
△ For more information about HD option please contact with "M+S Hydraulic".

# MOTORS WITH SPEED SENSOR

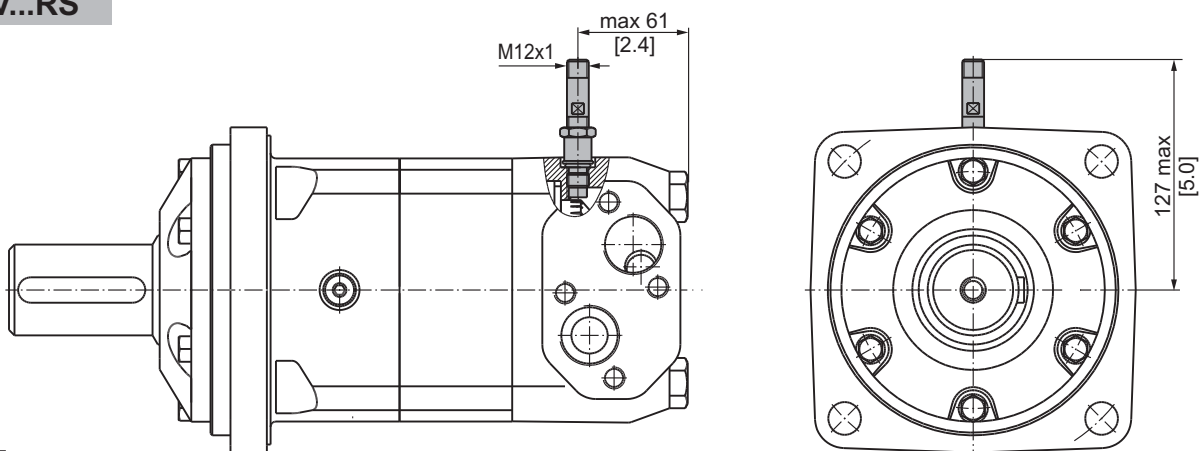
## MS...RS



## MT...RS



## MV...RS

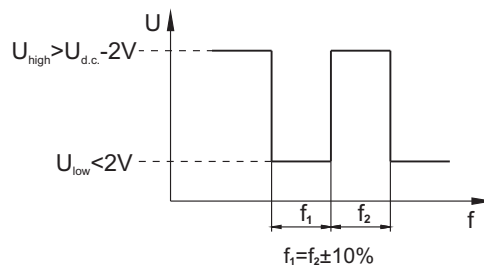


**TECHNICAL DATA OF THE SPEED SENSOR**

**Technical data**

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

**Output signal**

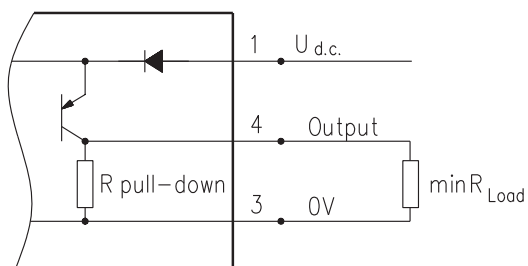


Load max.:  $I_{high} = I_{low} < 50\text{mA}$

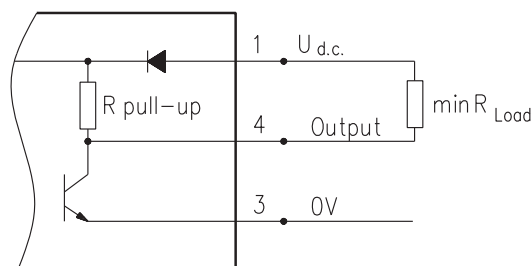
Motor type	<b>MS</b>	<b>MT</b>	<b>MV</b>
Pulses per revolution	54	84	102

**Wiring diagrams**

**PNP**

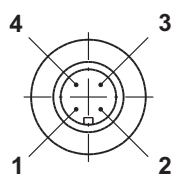


**NPN**



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

**Stick type**



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

**Order Code for Speed Sensor**

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

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

# APPLICATION CALCULATION

## VEHICLE DRIVE CALCULATIONS

### 1. Motor speed: n, RPM

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

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

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

$R_m$ - wheel rolling radius, m;

$R_{in}$ - wheel rolling radius, in;

$i$ - gear ratio between motor and wheels.

If no gearbox, use  $i=1$ .

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

The resistance force resulted in wheels contact with different surfaces:

$$RR = G \times \rho$$

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

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

Table 1

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

### 3. Grade resistance: GR, daN [lbs]

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

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

Table 2

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

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

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

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

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

$t$ - time, [s].

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

Tractive effort  $DP$  is the additional force of trailer. This value will be established as follows:

-acc.to constructor's assessment;

-as calculating forces in items 2, 3 and 4 of trailer; the calculated sum corresponds to the tractive effort requested.

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

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

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

$RR$ - force acquired to overcome the rolling resistance;

$GR$ - force acquired to slope upwards;

$FA$ - force acquired to accelerate (acceleration force);

$DP$ - additional tractive effort (trailer).

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

Necessary torque moment for every hydraulic motor:

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

$N$ - motor numbers;

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

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

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

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

$f$  - frictional factor;

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

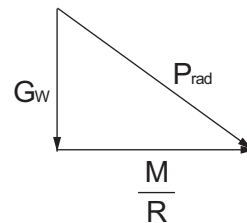
Table 3

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

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

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

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



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

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

**DRAINAGE SPACE AND DRAINAGE PRESSURE**

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

