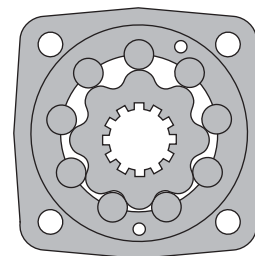
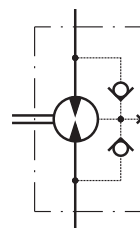


HYDRAULIC MOTORS MT



APPLICATION

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



CONTENTS

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Tacho connection	38
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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

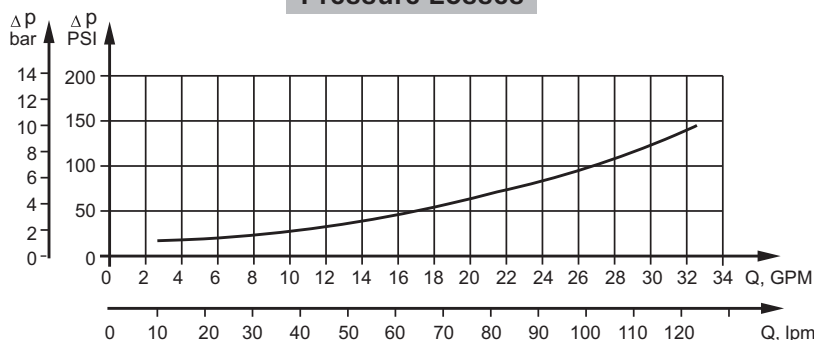
GENERAL

Max. Displacement, cm ³ /rev [in ³ /rev]	724,3 [44.2]
Max. Speed, [RPM]	775
Max. Torque, daNm [lb-in]	cont.: 130 [11500] int.: 148 [13100]
Max. Output, kW [HP]	40 [54]
Max. Pressure Drop, bar [PSI]	cont.: 200 [2900] int. 240 [3480]
Max. Oil Flow, lpm [GPM]	150 [39.6]
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		MT 160	MT 200	MT 250	MT 315
Displacement, cm³/rev [in³/rev]		161,1 [9.83]	201,4 [12.29]	251,8 [15.36]	326,3 [19.90]
Max. Speed, [RPM]	Cont.	622	620	496	382
	Int.*	775	752	601	461
Max. Torque 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]
Max. Output kW [HP]	Cont.	26,5 [36]	33,5 [45]	33,5 [45]	33,5 [45]
	Int.*	32 [43]	40 [54]	40 [54]	40 [54]
Max. Pressure Drop 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]
Max. Oil Flow lpm [GPM]	Cont.	100 [26]	125 [33]	125 [33]	125 [33]
	Int.*	125 [33]	150 [39.6]	150 [39.6]	150 [39.6]
Max. Inlet Pressure 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]
Max. Return Pressure 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]
Max. Starting Pressure with Unloaded Shaft, bar [PSI]		10 [150]	10 [150]	10 [150]	10 [150]
Min. Starting Torque 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]
Min. Speed***, [RPM]		10	9	8	7
Weight, kg [lb] For Rear Ports +0,450[.992]	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 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.

SPECIFICATION DATA (continued)

Type		MT 400	MT 500	MT 630	MT 725
Displacement, cm³/rev [in³/rev]		410,9 [25.06]	523,6 [31.95]	631,2 [38.52]	724,3 [44.2]
Max. Speed, [RPM]	Cont.	304	238	197	172
	Int.*	368	289	234	209
Max. Torque daNm [lb-in]	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]
Max. Output kW [HP]	Cont.	30 [40]	26,5 [36]	24,3 [33]	20,2 [27]
	Int.*	35 [47]	30 [40]	27,5 [37]	26,8 [36]
Max. Pressure Drop bar [PSI]	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]
Max. Oil Flow lpm [GPM]	Cont.	125 [33]	125 [33]	125 [33]	125 [33]
	Int.*	150 [39.6]	150 [39.6]	150 [39.6]	150 [39.6]
Max. Inlet Pressure bar [PSI]	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]
Max. Return Pressure with Drain Line bar [PSI]	Cont.	140 [2000]	140 [2000]	140 [2500]	140 [2000]
	Int.*	175 [2500]	175 [2500]	175 [2500]	175 [2500]
	Peak**	210 [3000]	210 [3000]	210 [3000]	210 [3000]
Max. Starting Pressure with Unloaded Shaft, bar [PSI]		10 [150]	10 [150]	10 [150]	10 [150]
Min. Starting Torque daNm [lb-in]	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]
Min. Speed***, [RPM]		6	5	5	5
Weight, kg [lb] For Rear Ports +0,450[.992]	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.

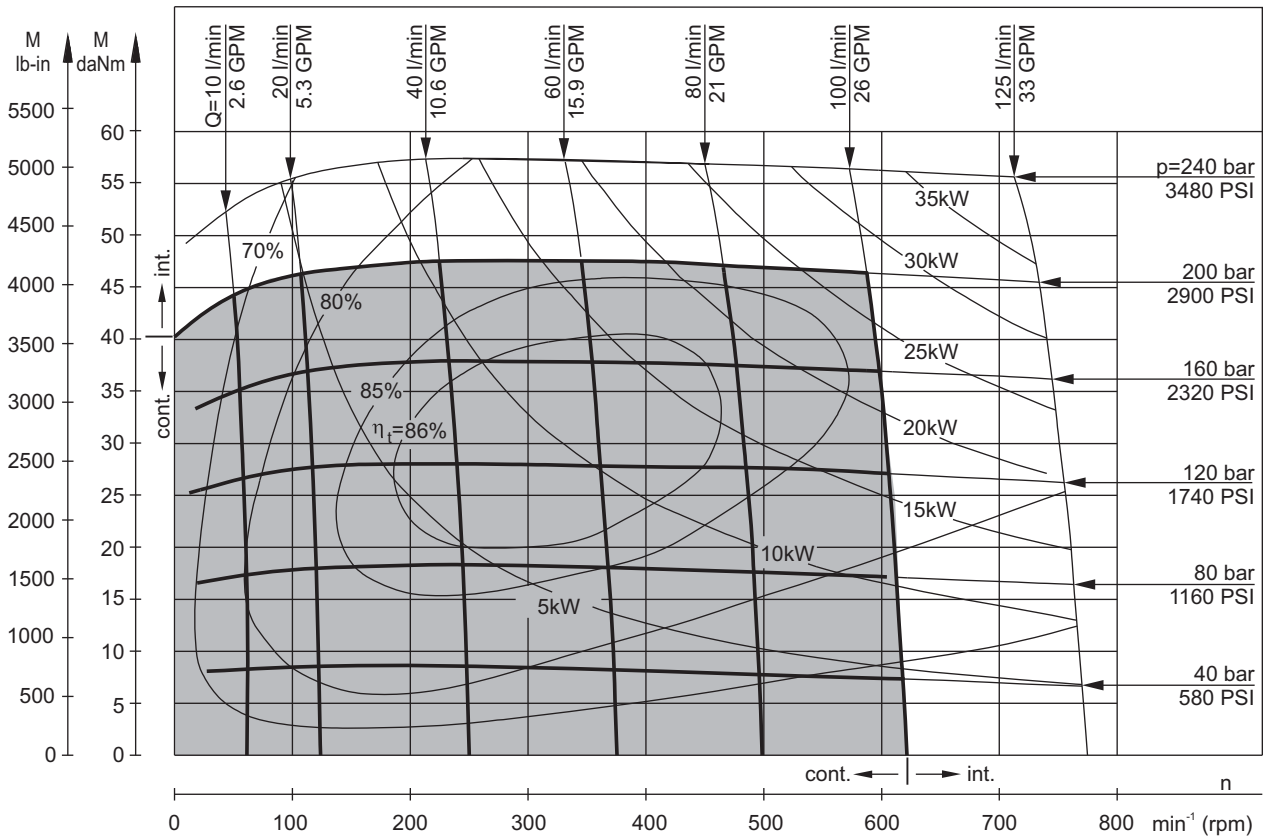
** Peak load: the permissible values may occur for max. 1% of every minute.

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

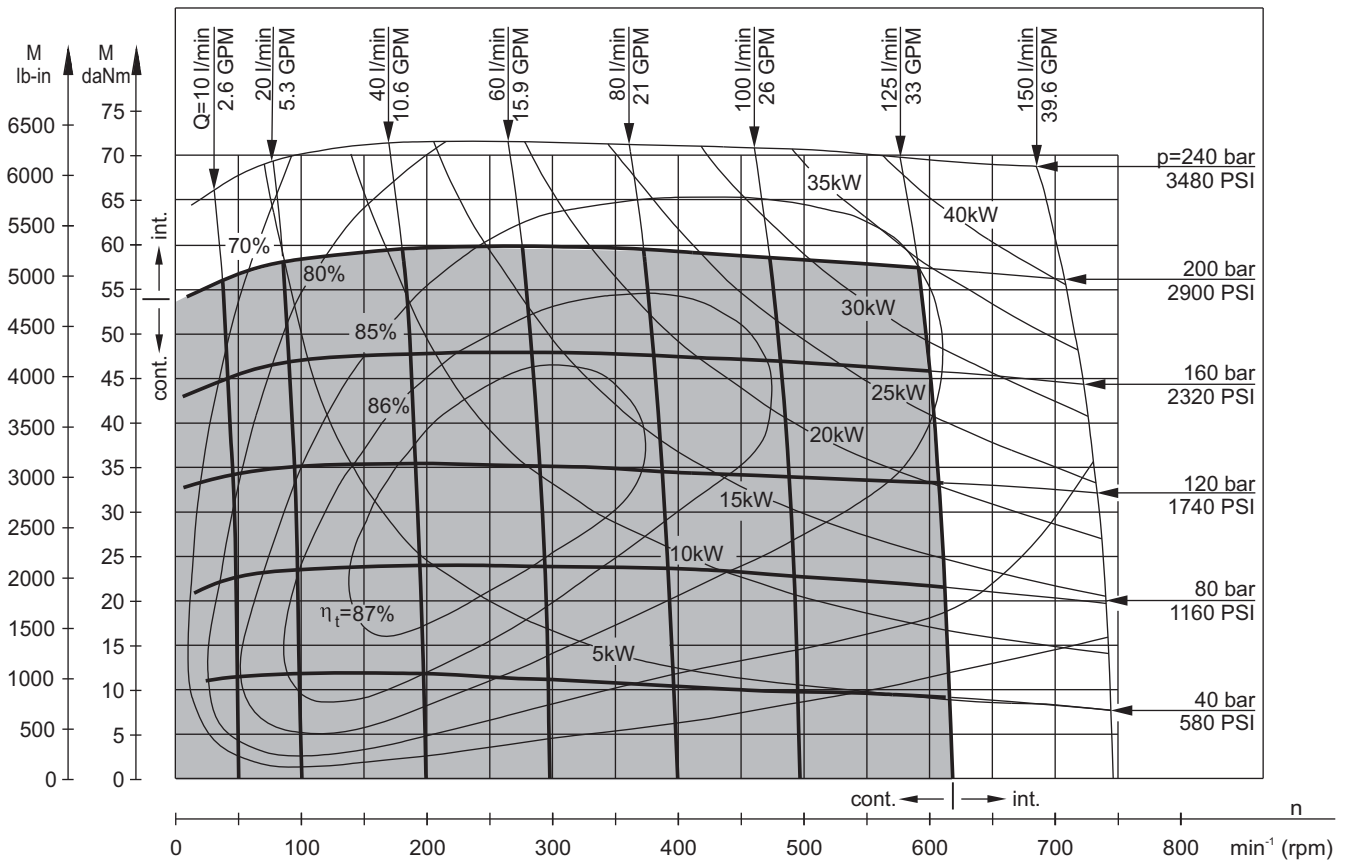
- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP(DIN51524) or HM (ISO 6743/4).
If using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

MT 160



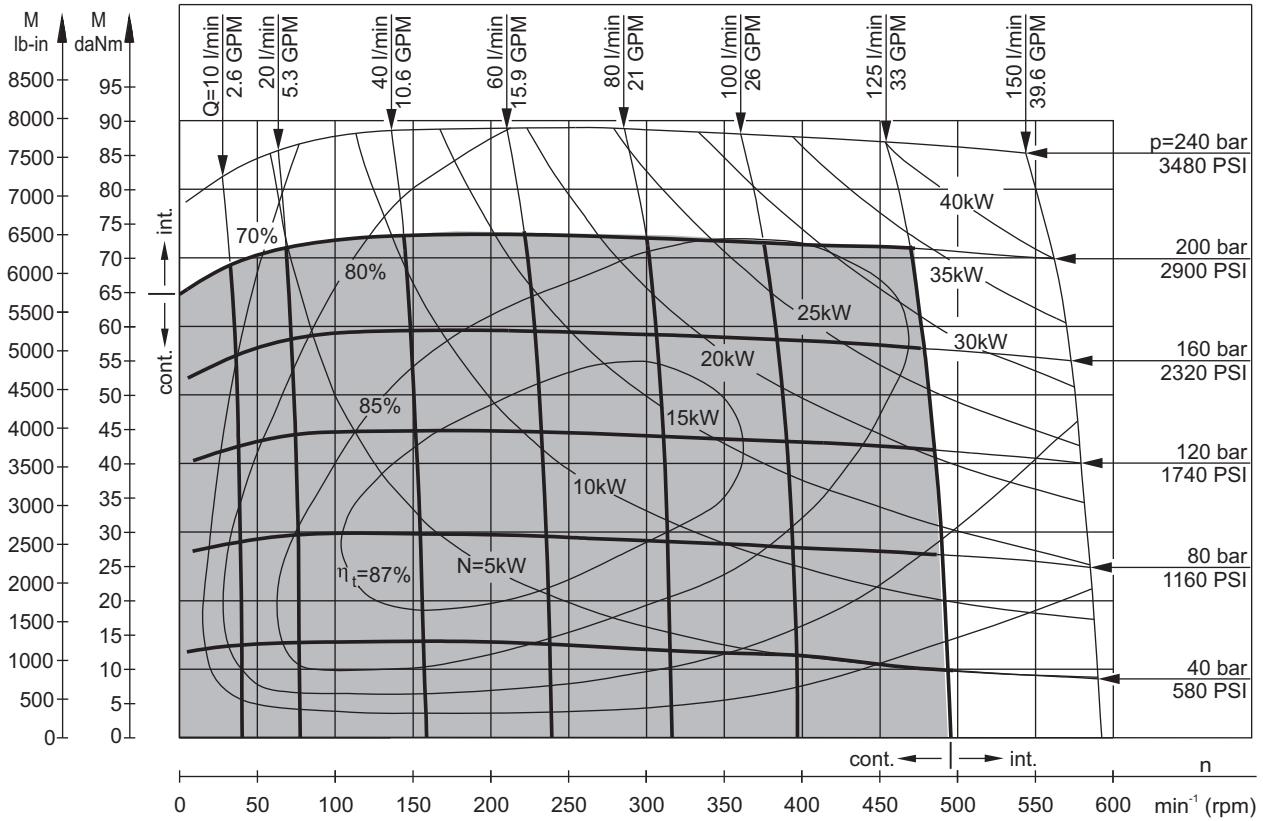
MT 200



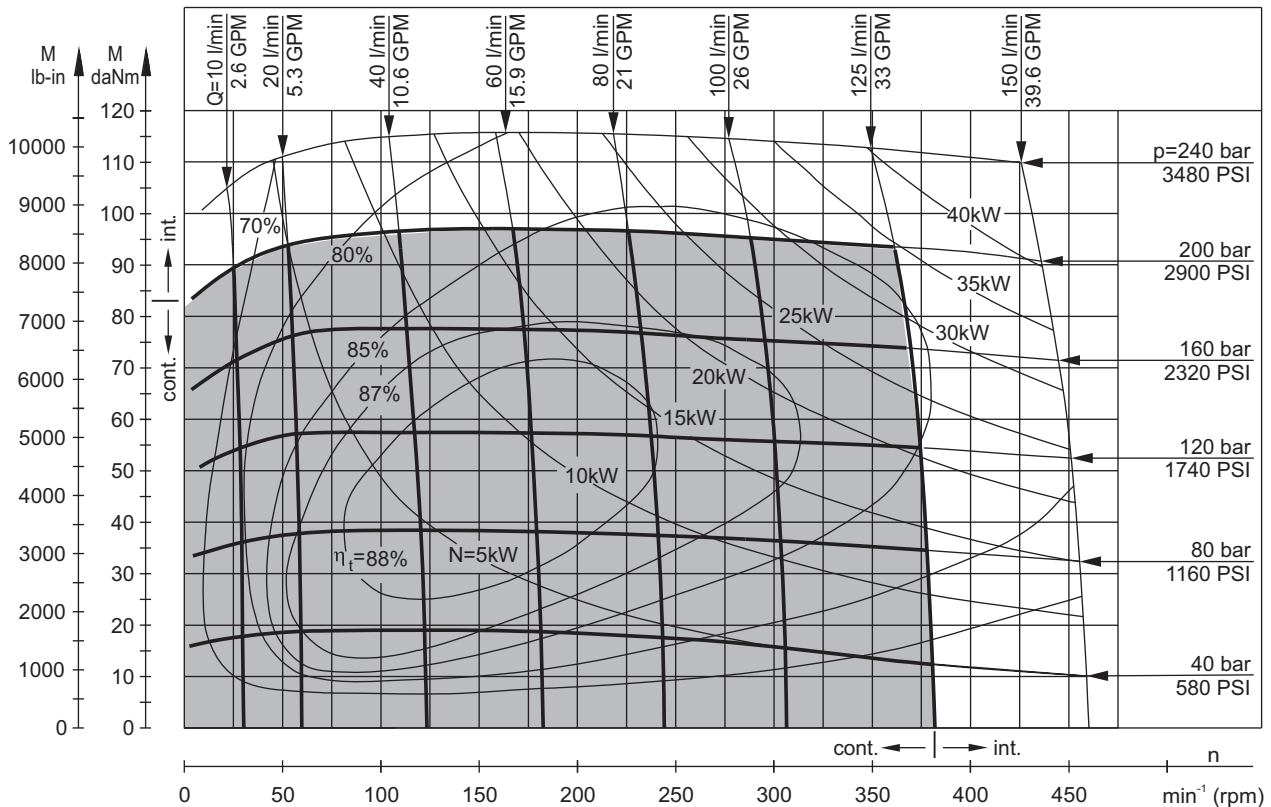
The function diagrams data is for average performance of randomly selected motors at back pressure 5 ± 10 bar [72.5 \pm 145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

MT 250



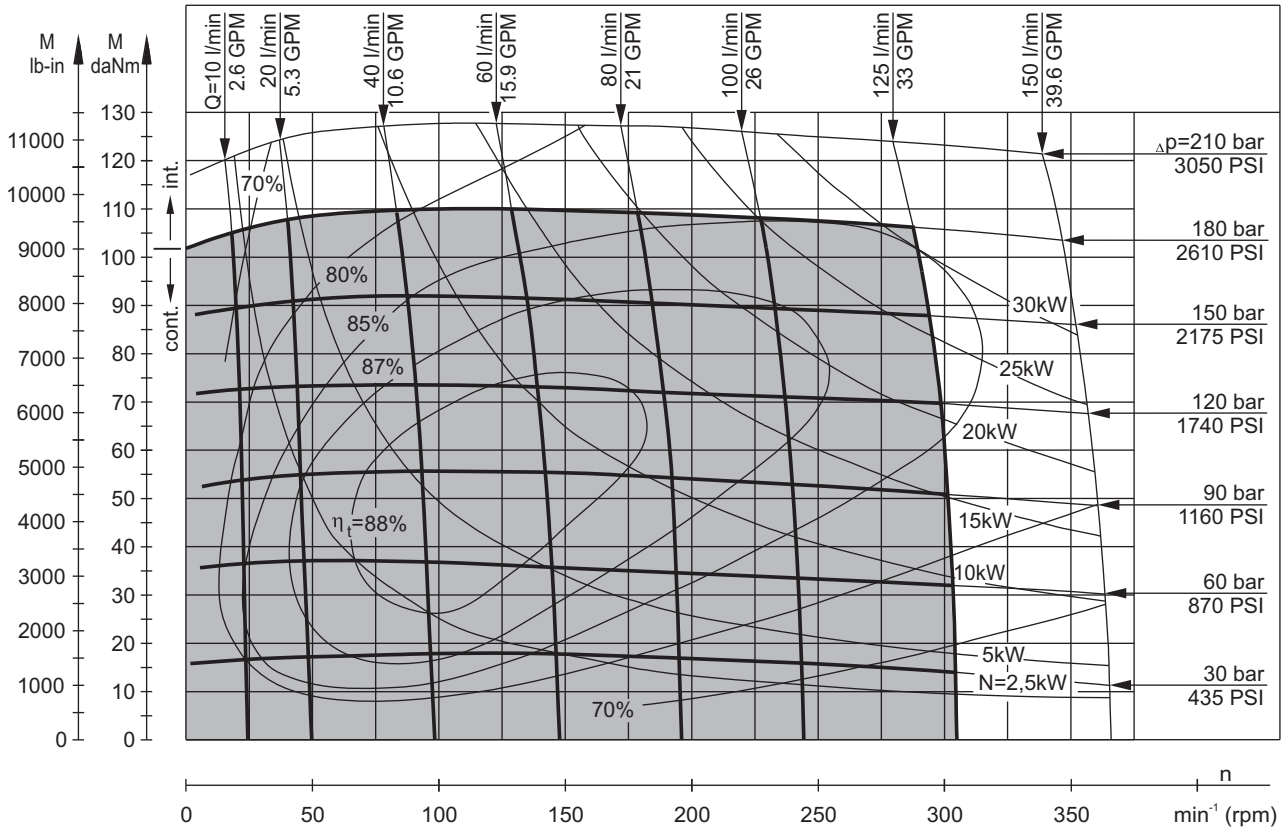
MT 315



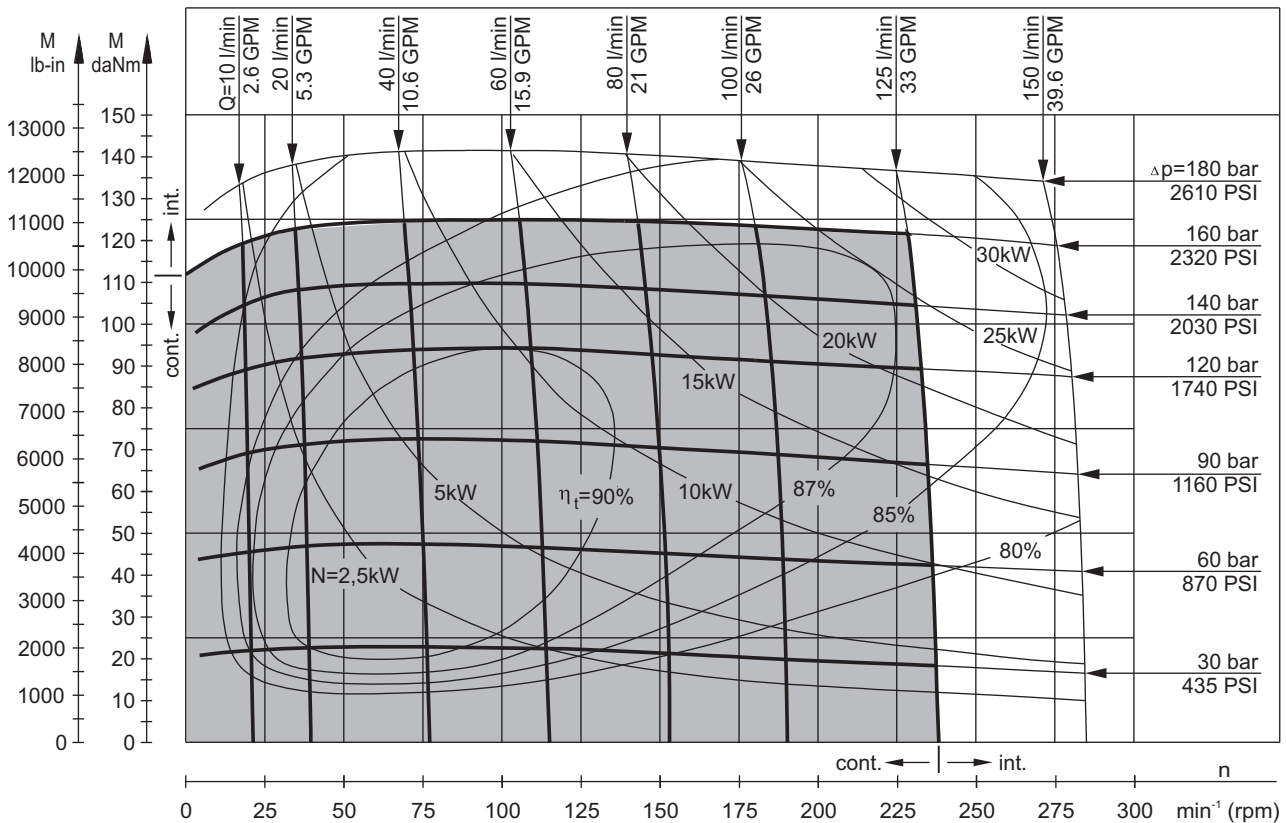
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

MT 400



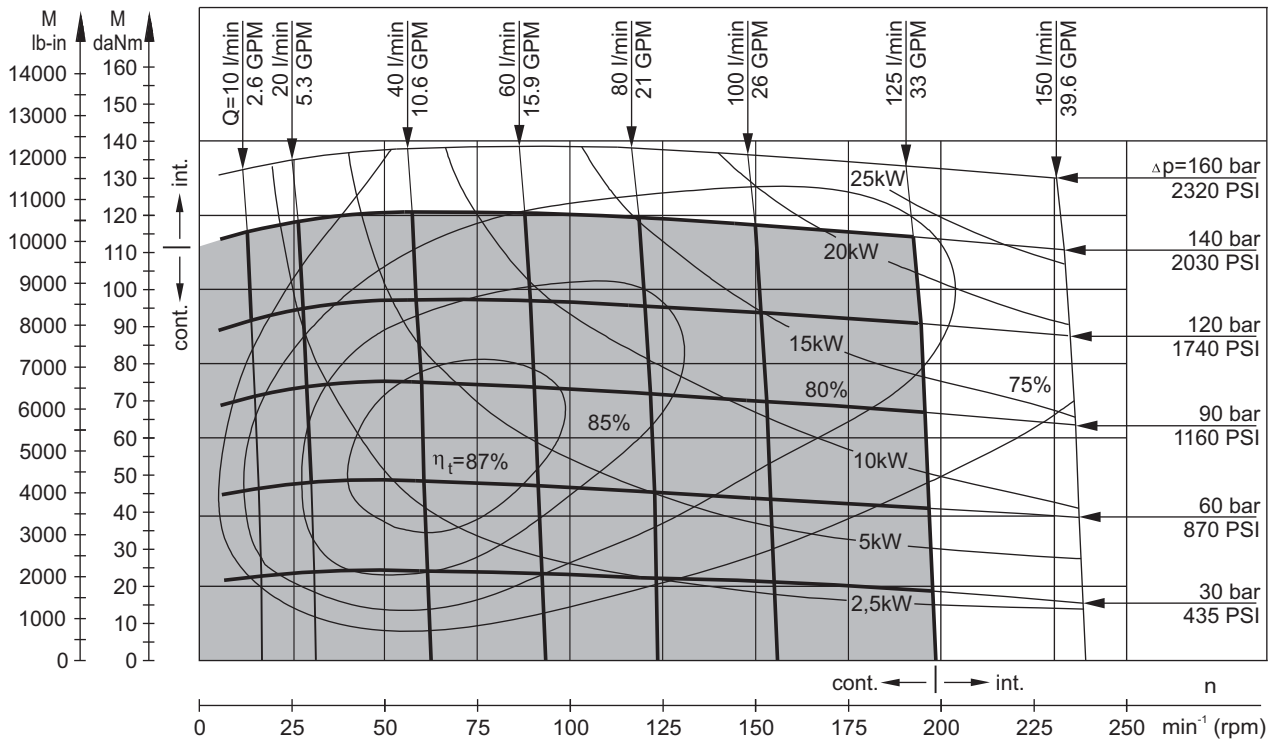
MT 500



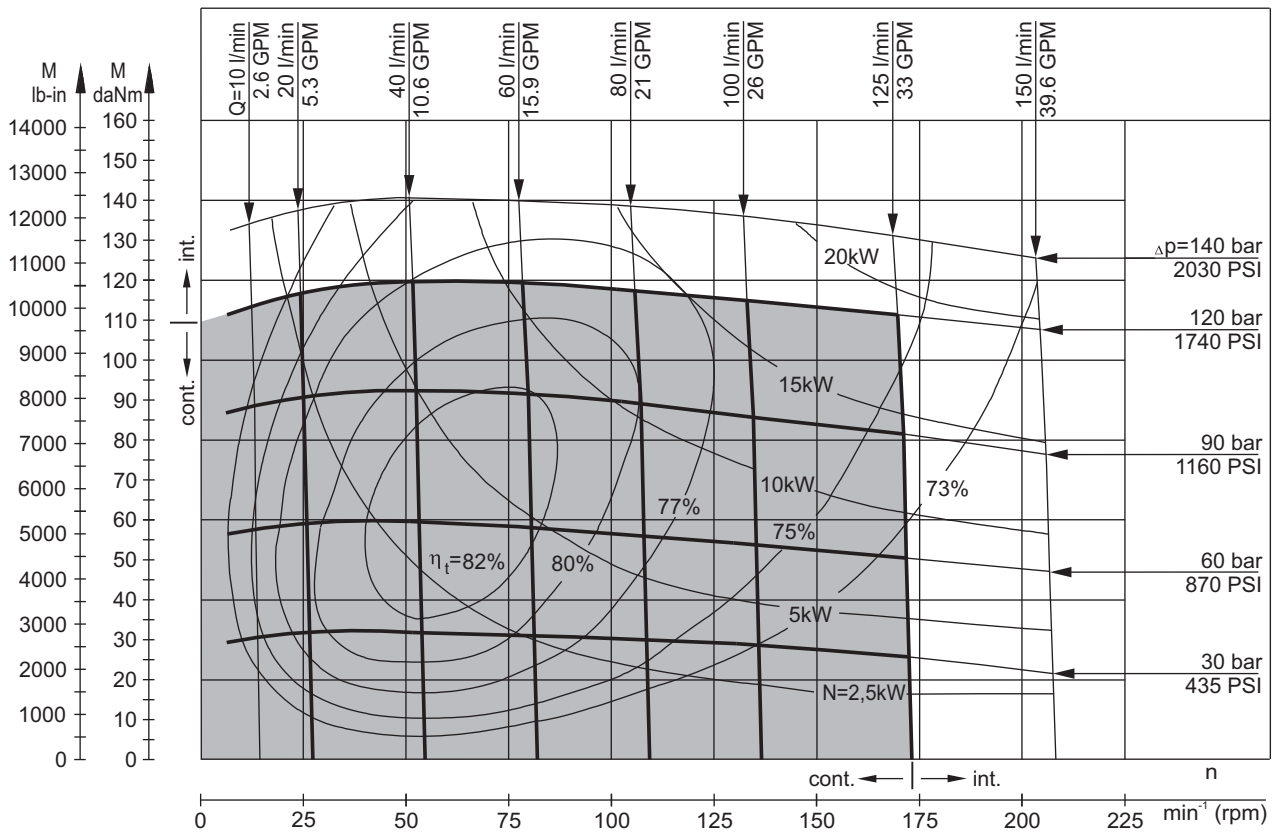
The function diagrams data is for average performance of randomly selected motors at back pressure $5 \div 10$ bar [72.5 \div 145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

MT 630

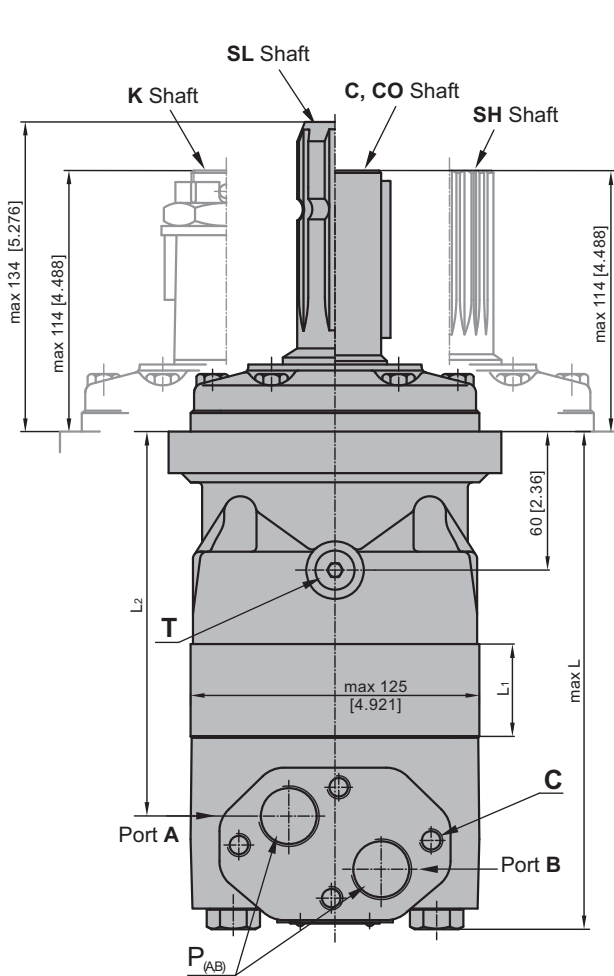


MT 725

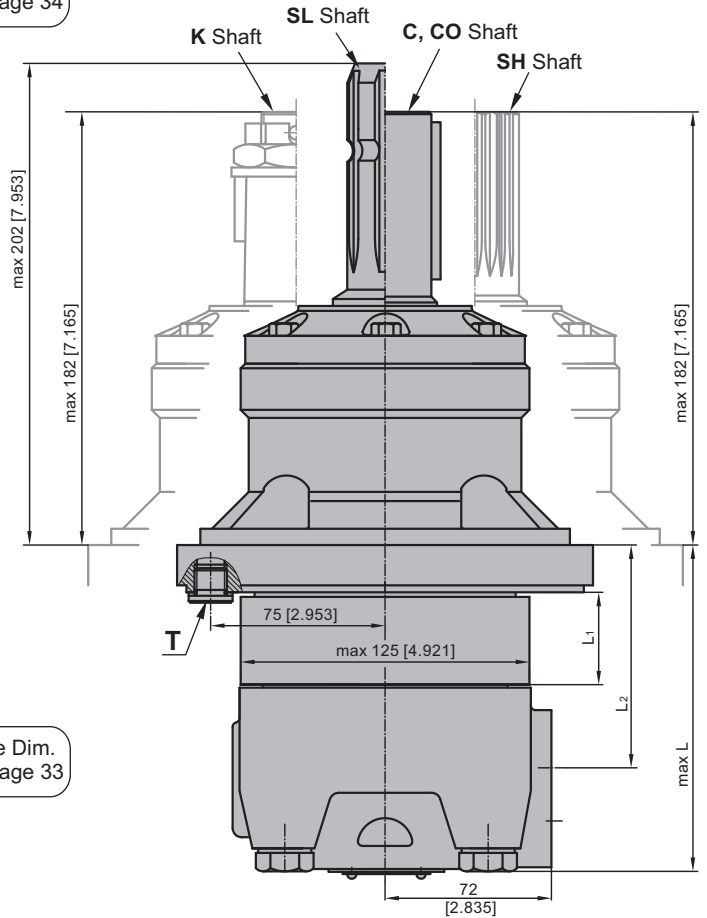


The function diagrams data is for average performance of randomly selected motors at back pressure $5 \div 10$ bar [72.5÷145 PSI] and oil with viscosity of $32 \text{ mm}^2/\text{s}$ [150 SUS] at 50°C [122°F].

DIMENSIONS AND MOUNTING DATA



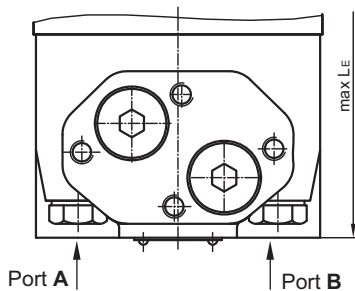
Shaft Dim.
See Page 34



Flange Dim.
See Page 33

Port Dim.
See Page 33

E Rear ports



- C** : 4xM10-10 mm [.39 in] depth
- P_(A,B)** : 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**

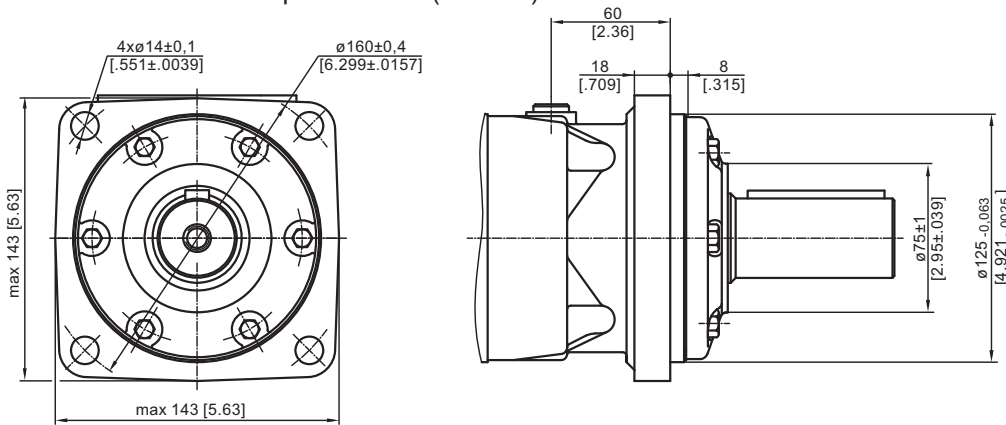
Type	L, mm [in]	L ₂ , mm [in]	**L _E , mm [in]	Type	L, mm [in]	L ₂ , mm [in]	**L _E , mm [in]	*L ₁ , mm [in]
MT 160	193,1 [7.60]	143,5 [5.65]	203,1 [8.00]	MTW 160	124,1 [4.89]	74,3 [2.93]	134,1 [5.28]	16,5 [.65]
MT 200	198,1 [7.80]	148,5 [5.85]	208,1 [8.19]	MTW 200	129,1 [5.08]	79,3 [3.12]	139,1 [5.48]	21,5 [.85]
MT 250	204,4 [8.05]	154,8 [6.09]	214,4 [8.44]	MTW 250	135,4 [5.33]	85,6 [3.37]	145,4 [5.72]	27,8 [1.09]
MT 315	213,6 [8.41]	164,0 [6.46]	223,6 [8.80]	MTW 315	144,6 [5.69]	94,8 [3.73]	154,6 [6.09]	37,0 [1.46]
MT 400	224,1 [8.82]	174,5 [6.87]	234,1 [9.22]	MTW 400	155,1 [6.11]	105,3 [4.15]	165,1 [6.50]	47,5 [1.87]
MT 500	238,1 [9.37]	188,5 [7.42]	248,1 [9.77]	MTW 500	169,1 [6.66]	119,3 [4.70]	179,1 [7.05]	61,5 [2.42]
MT 630	234,1 [9.22]	184,5 [7.26]	244,1 [9.61]	MTW 630	165,1 [6.50]	115,3 [4.54]	175,1 [6.89]	57,5 [2.26]
MT 725	243,1 [9.57]	193,5 [7.62]	253,1 [9.96]	MTW 725	174,1 [6.85]	124,3 [4.89]	184,1 [7.25]	66,5 [2.62]

* - The width of the roll-gerotor is 3,5 mm [.138 in] greater than L₁.

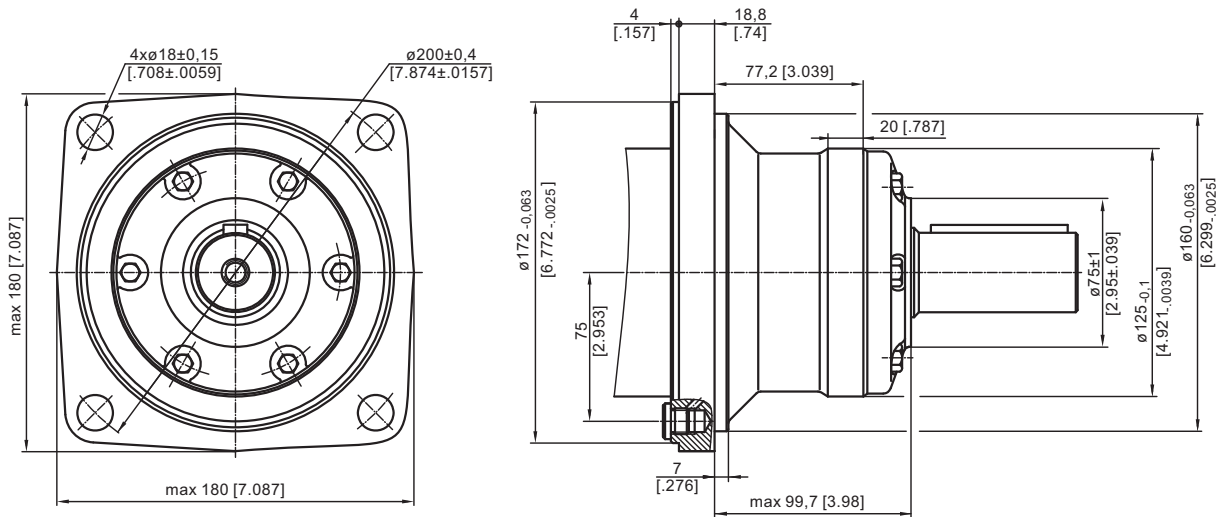
** - For Rear Ported Motors.

MOUNTING

Square Mount (4 Holes)

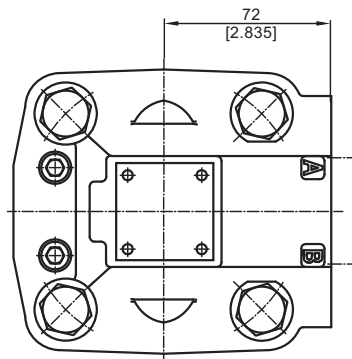
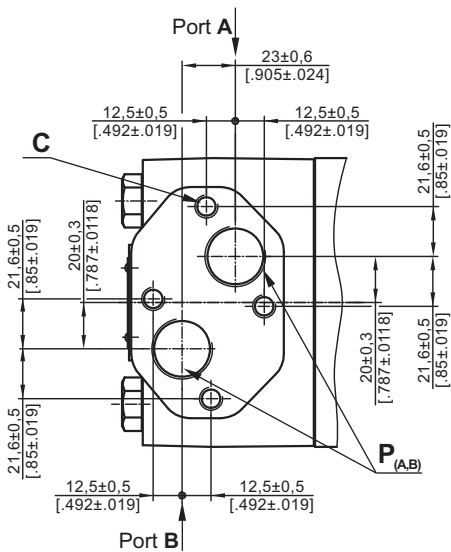


W Wheel Mount

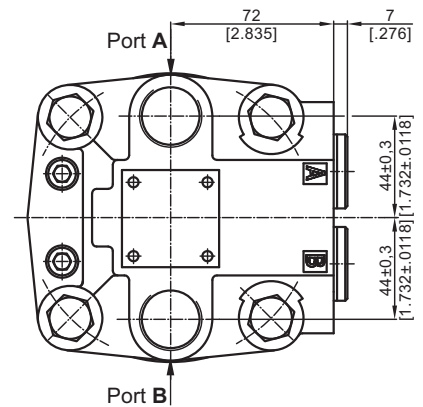


PORTS

Side Ports



E Rear Ports



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

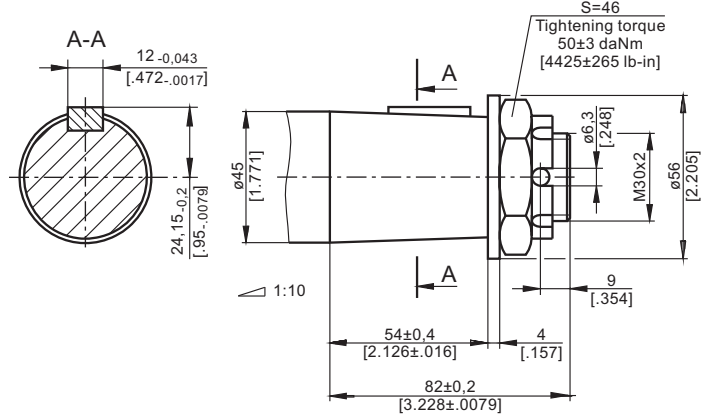
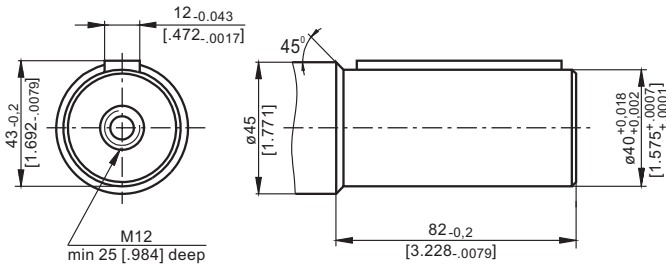
Reverse Rotation
Viewed from Shaft End
Port A Pressurized - CCW
Port B Pressurized - CW

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

SHAFT EXTENSIONS

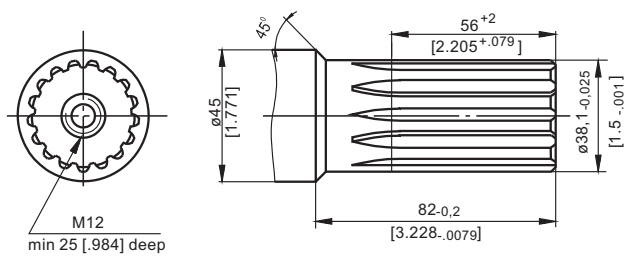
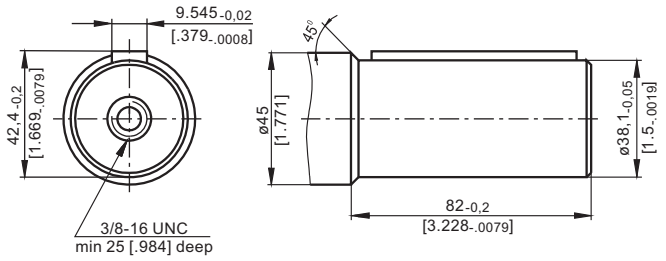
C - ϕ 40 straight, Parallel key A12x8x70 DIN 6885
Max. Torque 132,8 daNm [11755 lb-in]

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

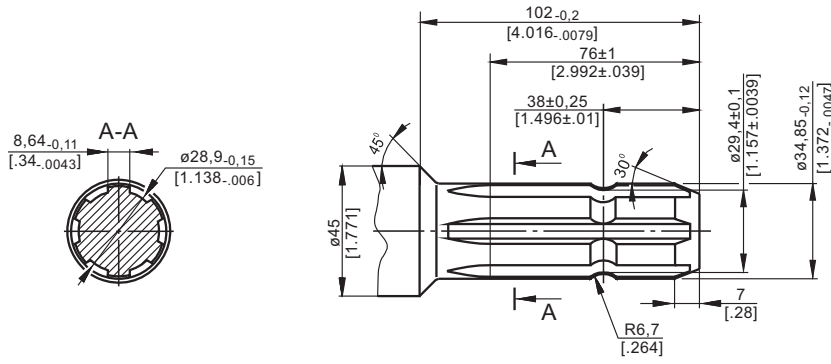


CO - ϕ 1½" straight, Parallel key 3/8" x 3/8" x 2¼" BS46
Max. Torque 132,8 daNm [11755 lb-in]

SH - ϕ 1½" splined 17T, DP 12/24 ANSI B92.1-1976
Max. Torque 132,8 daNm [11755 lb-in]

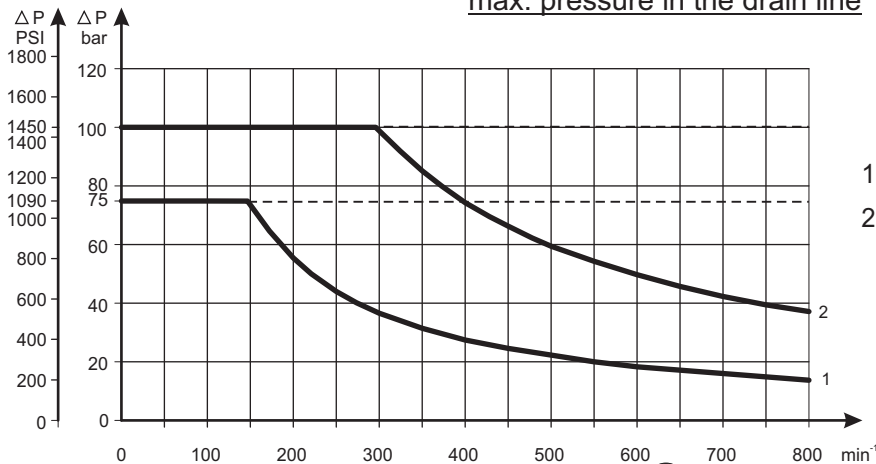


SL - ϕ 34,85 p.t.o. DIN 9611 Form 1
Max. Torque 77 daNm [6815 lb-in]



MAX. PERMISSIBLE SHAFT SEAL PRESSURE for MT motors

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

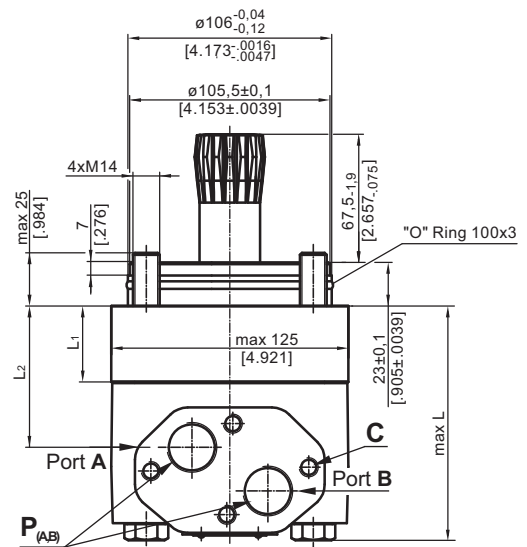
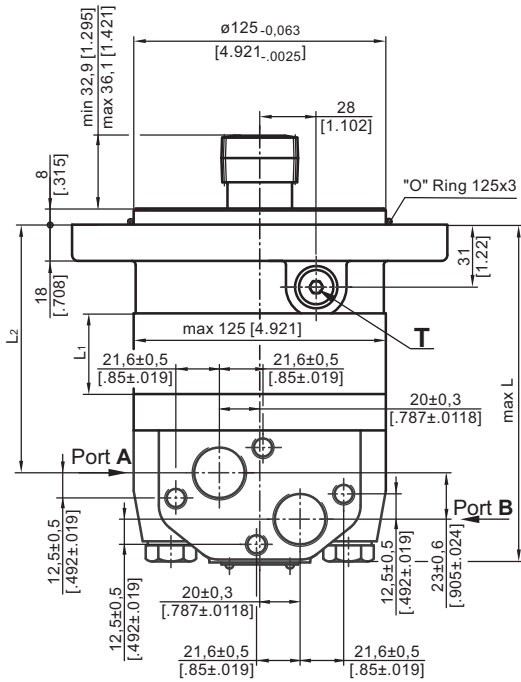


- 1: Drawing for Standard Shaft Seal
- 2: Drawing for High Pressure Seal ("U" Seal)

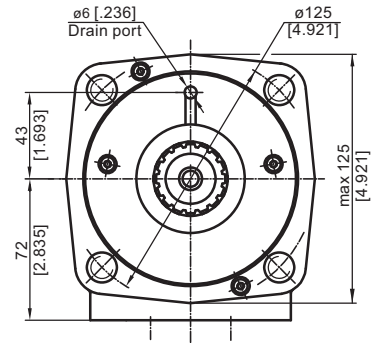
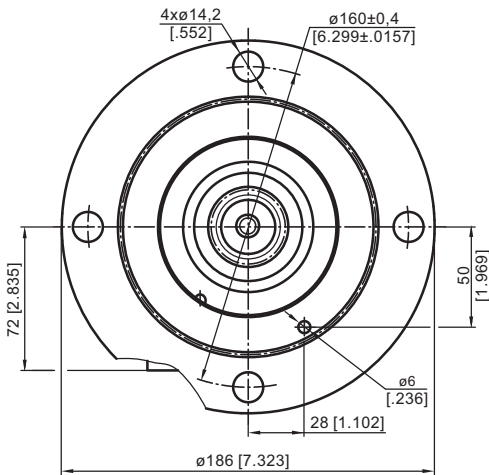
— - continuous operations
- - - - intermittent operations

S Short Mount

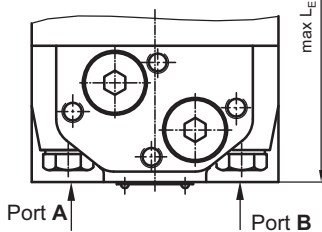
V Very Short Mount



Port Dim.
See Page 33



E Rear ports



- C:** 4xM10-10 mm [.39 in] depth
- P_(A,B):** 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**

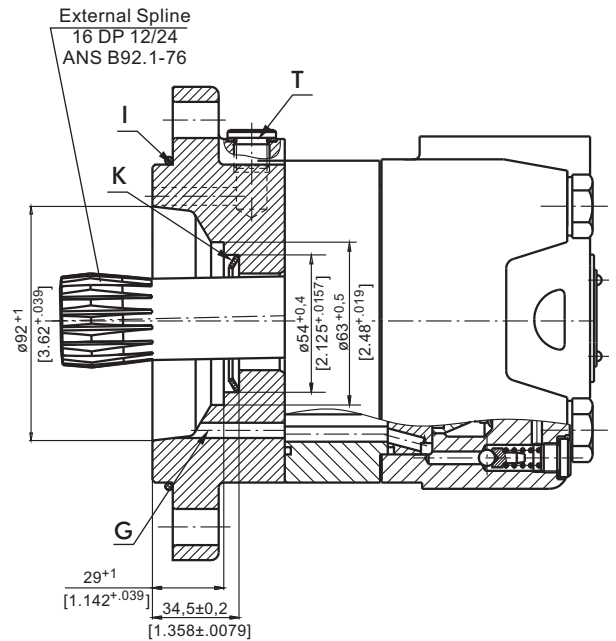
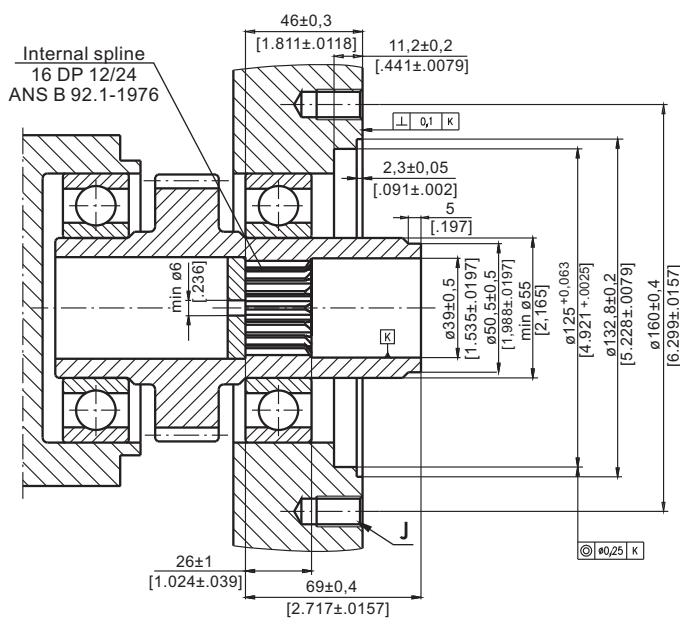
Type	L, mm [in]	L ₂ , mm [in]	**L _E , mm [in]	*L ₁ , mm [in]	Type	L, mm [in]	L ₂ , mm [in]	**L _E , mm [in]	*L ₁ , mm [in]
MTS 160	150 [5.90]	103,5 [4.07]	155 [6.10]	20,0 [.79]	MTV 160	100,8 [3.97]	51,5 [2.02]	110,8 [4.36]	16,5 [.65]
MTS 200	155 [6.10]	108,5 [4.27]	160 [6.30]	25,0 [.98]	MTV 200	105,8 [4.17]	56,5 [2.22]	115,8 [4.56]	21,5 [.85]
MTS 250	161 [6.34]	114,8 [4.52]	167 [6.57]	31,3 [1.23]	MTV 250	112,1 [4.41]	62,8 [2.47]	122,1 [4.81]	27,8 [1.09]
MTS 315	170 [6.69]	124,0 [4.88]	176 [6.93]	40,5 [1.59]	MTV 315	121,3 [4.76]	72,0 [2.83]	131,3 [5.17]	37,0 [1.46]
MTS 400	181 [7.13]	134,5 [5.30]	186 [7.32]	51,0 [2.01]	MTV 400	131,8 [5.19]	82,5 [3.25]	141,8 [5.58]	47,5 [1.87]
MTS 500	195 [7.68]	148,5 [5.85]	200 [7.87]	65,0 [2.56]	MTV 500	145,8 [5.74]	96,5 [3.80]	155,8 [6.13]	61,5 [2.42]
MTS 630	191 [7.52]	144,5 [5.69]	196 [7.72]	61,0 [2.40]	MTV 630	141,8 [5.58]	92,5 [3.64]	151,8 [5.98]	57,5 [2.26]
MTS 725	200 [7.87]	153,5 [6.04]	205 [8.07]	70,0 [2.76]	MTV 725	150,8 [5.94]	101,5 [4.00]	160,8 [6.33]	66,5 [2.62]

* - The width of the roll-gerotor is 3,5 mm [.138 in] greater than L₁.

** - For Rear Ported Motors.

DIMENSIONS OF THE ATTACHED COMPONENT

MTS

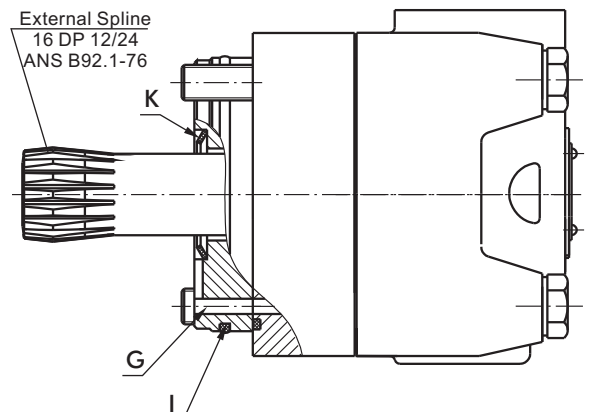
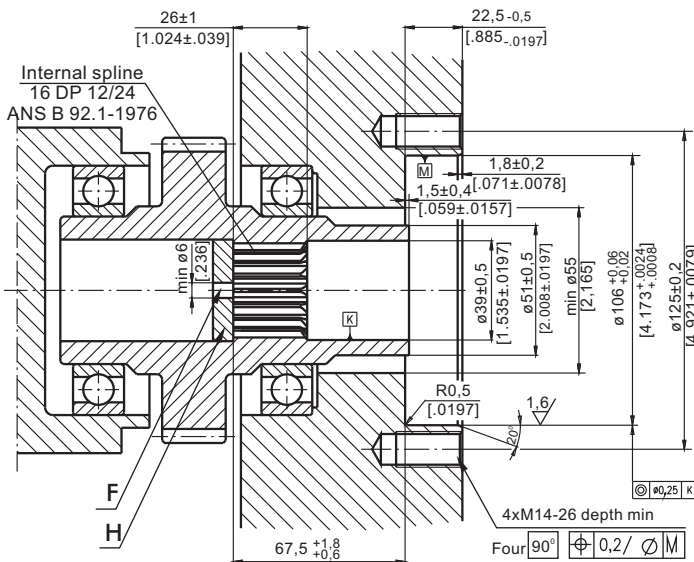


F: Oil circulation hole
G: Internal drain channel
H: Hardened stop plate

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:

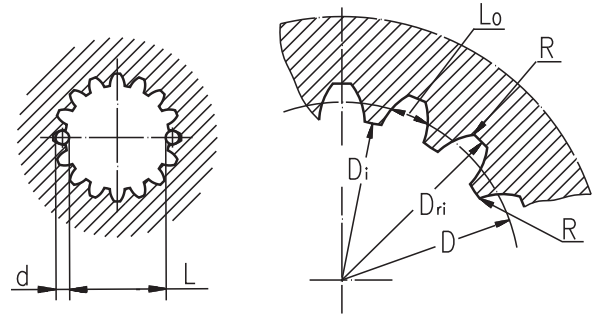
- For MTS at the drain port of the motor;
- For MTV at the drain connection of the attached component. The maximum pressure in the drain line is limited by the attached component and its shaft seal.

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 $x.m=1$]

Flat 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 _{ri}	38,4 ^{+0,4}	1.5118±1.5275
Minor Dia.	D _i	32,15 ^{+0,04}	1.2657±1.2673
Space Width [Circular]	L _o	4,516±0,037	.1763±.1791
Fillet Radius	R	0,5	.02
Max. Measurement between Pins	L	26,9 ^{+0,10}	1.063±1.059
Pin Dia.	d	4,835±0,001	.19026±.19034

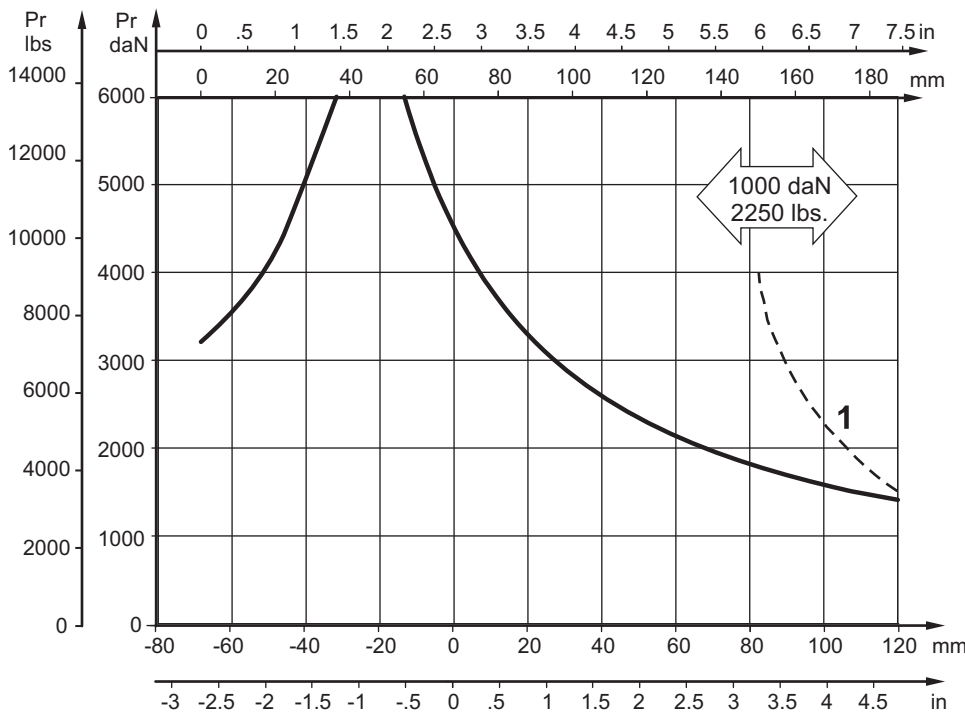


Hardening Specification:
 HV=750±50 on the surface.
 HV=560 at 0,7±0,2 mm [.035±.019in] case depth
 Material: 20 MoCr4 EN 10084 or SAE8620.

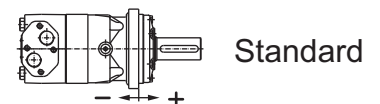
PERMISSIBLE SHAFT LOADS

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 .

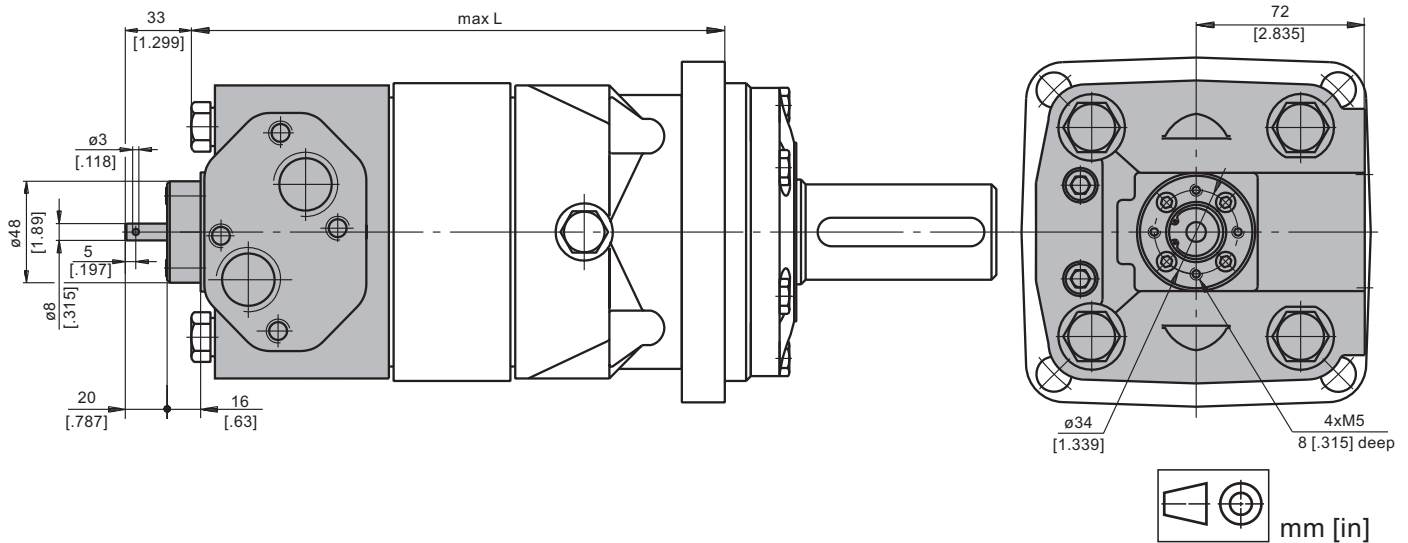
Curve "1" shows max. radial shaft load. Any shaft load exceeding the values shown by the curve will seriously reduce motor life.



Mounting Flange:



MOTORS WITH TACHO CONNECTION



ORDER CODE

	1	2	3	4	5	6	7	8
MT								

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 cm³/rev [9.83 in³/rev]

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]

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.4 - Shaft Extensions*

omit - for **S** and **V** mounting flange

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

CO - $\varnothing 1\frac{1}{2}$ " straight, Parallel key $\frac{3}{8}$ "x $\frac{3}{8}$ "x2 $\frac{1}{4}$ " BS46

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

SL - $\varnothing 34,85$ p.t.o. DIN 9611 Form 1

SH - $\varnothing 1\frac{1}{2}$ " 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*****

O	Optional
-	Not applicable
S	Standard

* For sensor ordering see pages 52+53.

** For side ports only!

*** Colour at customer's request.

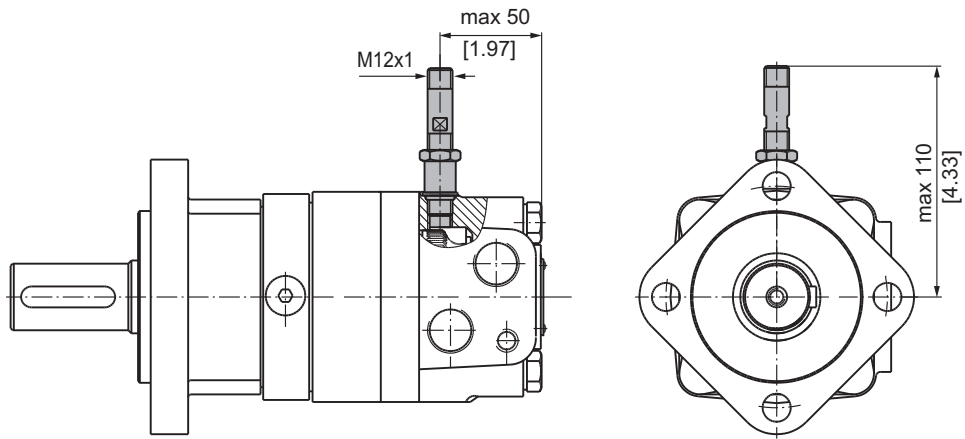
**** Non painted feeding surfaces, colour at customer's request.

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

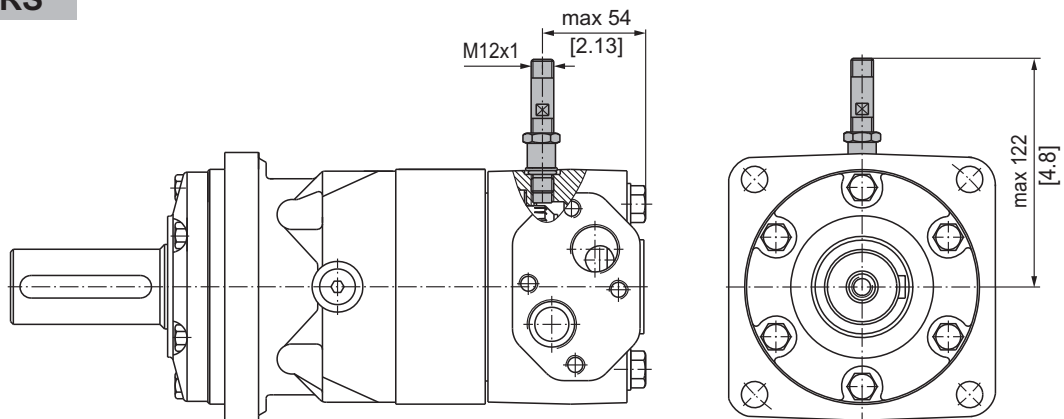
⚠ For more information about HD option please contact with "M+S Hydraulic".

MOTORS WITH SPEED SENSOR

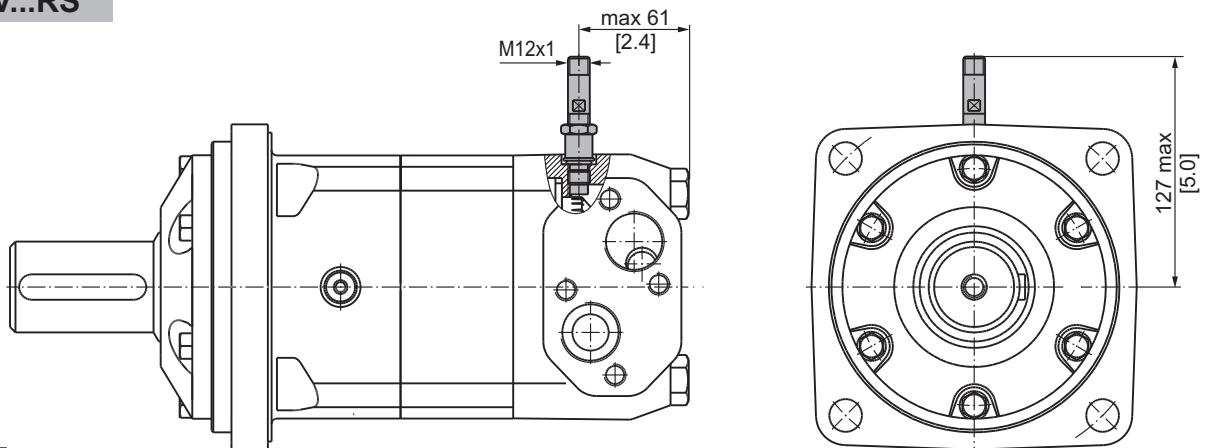
MS...RS



MT...RS



MV...RS

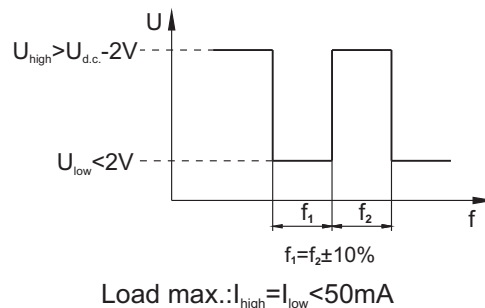


TECHNICAL DATA OF THE SPEED SENSOR

Technical data

Frequency range	0...15 000 Hz
Output	Universal PUSH PULL
Power supply	10-30 VDC
Current input	<20 mA (@24 VDC)
Maximum output current	500 mA
Ambient Temperature	-40...+125°C [-40...+257°F]
Protection	IP 67
Plug connector	M12-Series
Mounting principle	ISO 6149

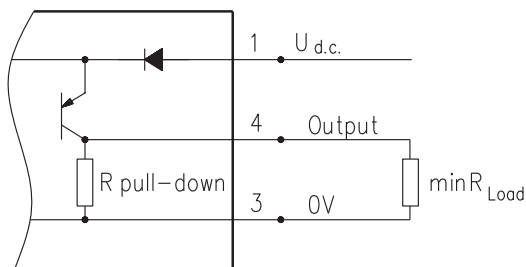
Output signal



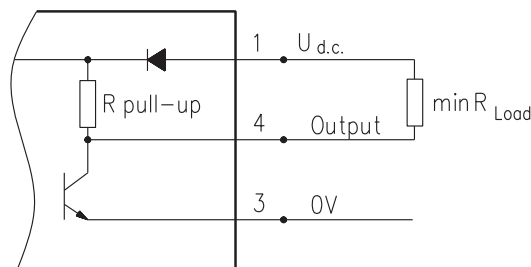
Motor type	MS	MT	MV
Pulses per revolution	54	84	102

Wiring diagrams

PNP



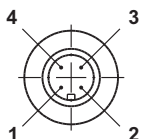
NPN



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

Stick type

Order Code for Speed Sensor



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

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:

$$RR = G \times \rho$$

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

ρ - rolling resistance coefficient (Table 1).

Table 1

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

3. Grade resistance: GR, daN [lbs]

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

α - gradient negotiation angle (Table 2)

Table 2

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

4. Acceleration force: FA, daN [lbs]

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

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

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:

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

N - motor numbers;

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

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

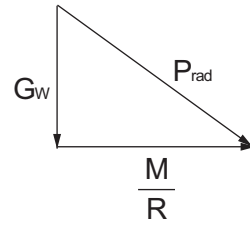
Table 3

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.

