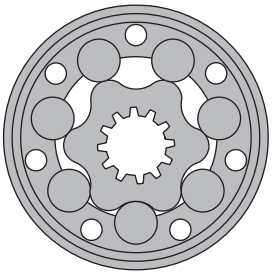
HYDRAULIC MOTORS MLHR

APPLICATION

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



CONTENTS

OPTIONS

» Model - Spool valve, roll-gerotor
» Flange mount
» Motor with needle bearing
» Side and rear ports
» Shafts - straight, splined and tapered
» SAE, Metric and BSPP ports
» Speed sensoring
» Other special features

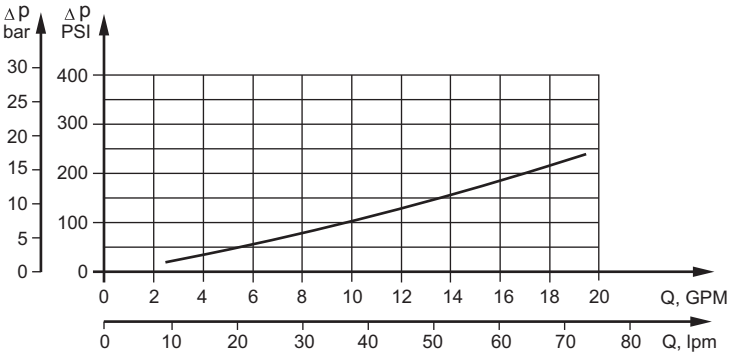
GENERAL

Max. Displacement, in^3/rev [cm^3/rev]	24.4 [397]
Max. Speed, [RPM]	970
Max. Torque, lb-in [daNm]	cont.: 5400 [61] int.: 6100 [69]
Max. Output, HP [kW]	20.1 [15]
Max. Pressure Drop, PSI [bar]	cont.: 2540 [175] int.: 2900 [200]
Max. Oil Flow, GPM [lpm]	19.8 [75]
Min. Speed, [RPM]	10
Pressure fluid	Mineral based - HLP(DIN 51524) or HM(ISO 6743/4)
Temperature range, ^{o}F [^{o}C]	-40 ÷ 284 [-40 ÷ 140]
Optimal Viscosity range, SUS [mm^2/s]	98 ÷ 347 [20 ÷ 75]
Filtration	ISO code 20/16 (Min. recommended fluid filtration of 25 microns)

Oil flow in drain line

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

Pressure Losses



SPECIFICATION DATA

Specification Data for MLHR... motors with **C, D, G, H, M, S** and **T** shafts.

(1.124 [28,56] sealing diameter)

Type		MLHR 50	MLHR 63	MLHR 80	MLHR 100	MLHR 125	MLHR 160	MLHR 200	MLHR 250	MLHR 315	MLHR 400
Displacement, in³/rev [cm³/rev]		3.14 [51,5]	3.87 [63,45]	4.90 [80,3]	6.09 [99,8]	7.67 [125,7]	9.74 [159,6]	12.19 [199,8]	15.26 [250,1]	19.26 [315,7]	24.4 [397]
Max. Speed, [RPM]	Cont.	775	630	750	600	475	375	300	240	190	150
	Int.*	970	788	940	750	600	470	375	300	240	190
Max. Torque, lb-in [daNm]	Cont.	900 [10,1]	1100 [12,4]	1725 [19,5]	2125 [24]	2655 [30]	3450 [39]	3410 [38,5]	3450 [39]	3450 [39]	3360 [38]
	Int.*	1150 [13]	1400 [15,8]	1947 [22]	2480 [28]	3010 [34]	3805 [43]	4070 [46]	5150 [58]	5045 [57]	5310 [60]
	Peak**	1505 [17]	1870 [21,1]	2390 [27]	2832 [32]	3275 [37]	4070 [46]	4960 [56]	6280 [71]	7400 [83]	7700 [87]
Max. Output, HP [kW]	Cont.	9.4 [7]	9.4 [7]	17 [12,5]	17.4 [13]	16.8 [12,5]	15.4 [11,5]	12 [9]	8.7 [6,5]	8 [6]	6.4 [4,8]
	Int.*	11.4 [8,5]	11.4 [8,5]	20.1 [15]	20.1 [15]	19.5 [14,5]	18.8 [14]	15.4 [11,5]	14.1 [10,5]	12.9 [9,6]	11.8 [8,8]
Max. Pressure Drop, PSI [bar]	Cont.	2030 [140]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2030 [140]	1600 [110]	1300 [90]	1020 [70]
	Int.*	2540 [175]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2540 [175]	2540 [175]	2030 [140]	1670 [115]
	Peak**	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3045 [210]	2540 [175]
Max. Oil Flow, GPM [lpm]	Cont.	10.5 [40]	10.6 [40]	15.8 [60]	15.8 [60]	15.8 [60]	15.8 [60]	15.8 [60]	15.8 [60]	15.8 [60]	15.8 [60]
	Int.*	13.2 [50]	13.2 [50]	19.8 [75]	19.8 [75]	19.8 [75]	19.8 [75]	19.8 [75]	19.8 [75]	19.8 [75]	19.8 [75]
Max. Inlet Pressure, PSI [bar]	Cont.	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]
	Int.*	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]
	Peak**	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]
Max. Return Pressure with Drain Line, PSI [bar]	Cont.	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]
	Int.*	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]
	Peak**	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]
Max. Starting Pressure with Unloaded Shaft, PSI [bar]		145 [10]	145 [10]	145 [10]	145 [10]	130 [9]	102 [7]	73 [5]	58 [4]	44 [3]	44 [3]
Min. Starting Torque, lb-in [daNm]	At max. press. drop Cont.	710 [8]	885 [10]	1330 [15]	1770 [20]	2215 [25]	2832 [32]	2920 [33]	2740 [31]	2920 [33]	2650 [30]
	At max. press. drop Int.*	885 [10]	1330 [15]	1505 [17]	2035 [23]	2480 [28]	3275 [37]	3540 [40]	4250 [48]	5220 [58]	4425 [50]
Min. Speed*, [RPM]**		10	10	10	10	10	10	10	10	10	10
Weight, lb [kg] For rear ports +1.433 [0,650]	MLHR (F)(N)	15 [6,8]	15 [6,8]	15,2 [6,9]	15.9 [7,2]	16.1 [7,3]	15.2 [7,5]	17.6 [8]	18.5 [8,4]	20 [9,1]	21.6 [9,8]
	MLHRQ (M)(N)	13.7 [6,2]	13.7 [6,2]	13.9 [6,3]	14.6 [6,6]	15 [6,8]	15 [6,8]	14.7 [7,2]	17.2 [7,8]	19 [8,6]	20.5 [9,3]

* 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.

1. Intermittent speed and intermittent pressure must not occur simultaneously.
2. Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
3. Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP (DIN51524) or HM (ISO 6743/4). If using synthetic fluids consult the factory for alternative seal materials.
4. Recommended minimum oil viscosity 70 SUS [13 mm²/s] at 122°F [50°C].
5. Recommended maximum system operating temperature is 180°F [82°C].
6. To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

SPECIFICATION DATA (continued)

Specification Data for MLHR... motors with **B, K, R** and **L** shafts.
(1.378 [35] sealing diameter)

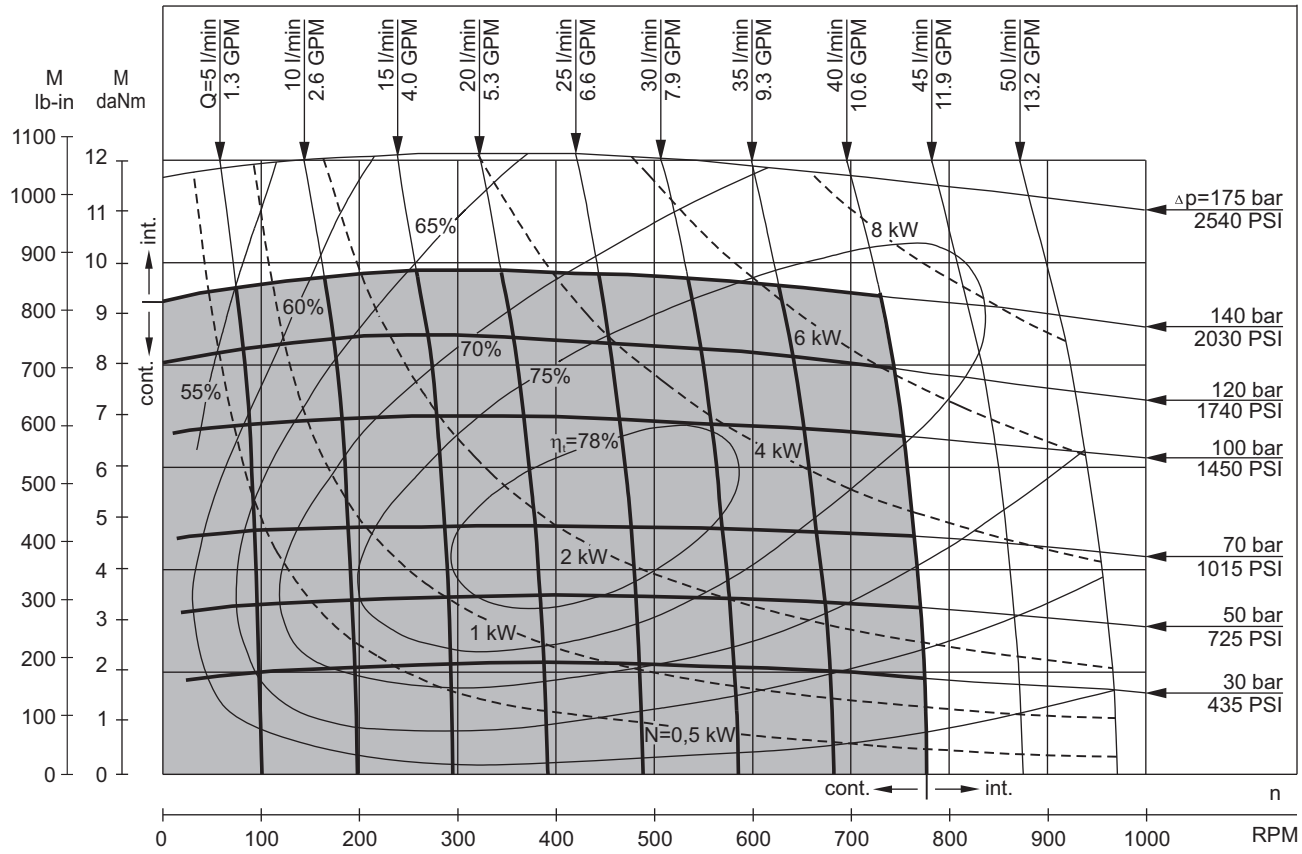
Type		MLHR 50	MLHR 63	MLHR 80	MLHR 100	MLHR 125	MLHR 160	MLHR 200	MLHR 250	MLHR 315	MLHR 400
Displacement, in³/rev [cm³/rev]		3.14 [51,5]	3.87 [63,45]	4.90 [80,3]	6.09 [99,8]	7.67 [125,7]	9.74 [159,6]	12.19 [199,8]	15.26 [250,1]	19.26 [315,7]	24.4 [397]
Max. Speed, [RPM]	Cont.	775	630	750	600	475	375	300	240	190	150
	Int.*	970	788	940	750	600	470	375	300	240	190
Max. Torque, lb-in [daNm]	Cont.	900 [10,1]	1100 [12,4]	1725 [19,5]	2125 [24]	2655 [30]	3450 [39]	4000 [45]	4780 [54]	4870 [55]	5400 [61]
	Int.*	1150 [13]	1400 [15,8]	1947 [22]	2480 [28]	3010 [34]	3805 [43]	4425 [50]	5400 [61]	5580 [63]	6100 [69]
	Peak**	1505 [17]	1870 [21,1]	2390 [27]	2832 [32]	3275 [37]	4070 [46]	4960 [56]	6280 [71]	7350 [83]	7700 [87]
Max. Output, HP [kW]	Cont.	9.5 [7]	9.4 [7]	17 [12,5]	17.4 [13]	16.8 [12,5]	15.4 [11,5]	14.8 [11]	13.4 [10]	12 [9]	10.5 [7,8]
	Int.*	11.9 [8,5]	11.4 [8,5]	20.1 [15]	20.1 [15]	19.5 [14,5]	18.8 [14]	17.4 [13]	16.1 [12]	14.8 [11]	14.2 [10,6]
Max. Pressure Drop, PSI [bar]	Cont.	2030 [140]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	1960 [135]	1670 [115]
	Int.*	2540 [175]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2320 [160]	2030 [140]
	Peak**	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3045 [210]	2540 [175]
Max. Oil Flow, GPM [lpm]	Cont.	10.5 [40]	10.6 [40]	15.8 [60]	15.8 [60]	15.8 [60]	15.8 [60]	15.8 [60]	15.8 [60]	15.8 [60]	15.8 [60]
	Int.*	13.2 [50]	13.2 [50]	19.8 [75]	19.8 [75]	19.8 [75]	19.8 [75]	19.8 [75]	19.8 [75]	19.8 [75]	19.8 [75]
Max. Inlet Pressure, PSI [bar]	Cont.	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]
	Int.*	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]
	Peak**	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]
Max. Return Pressure with Drain Line, PSI [bar]	Cont.	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]
	Int.*	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]
	Peak**	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]
Max. Starting Pressure with Unloaded Shaft, PSI [bar]		145 [10]	145 [10]	145 [10]	145 [10]	130 [9]	102 [7]	73 [5]	58 [4]	44 [3]	44 [3]
Min. Starting Torque, lb-in [daNm]	At max. press. drop Cont.	710 [8]	885 [10]	1330 [15]	1770 [20]	2215 [25]	2832 [32]	3630 [41]	4000 [45]	4000 [45]	4340 [49]
	At max. press. drop Int.*	885 [10]	1330 [15]	1505 [17]	2035 [23]	2480 [28]	3275 [37]	4070 [46]	4870 [55]	5840 [66]	5400 [61]
Min. Speed*, [RPM]**		10	10	10	10	10	10	10	10	10	10
Weight, lb [kg] For rear ports +1.433 [0,650]		15.2 [6,9]	15.2 [6,9]	15.4 [7]	16.1 [7,3]	16.3 [7,4]	15.4 [7,6]	18.9 [8,1]	18.7 [8,5]	20.3 [9,2]	21.8 [9,9]

* 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.

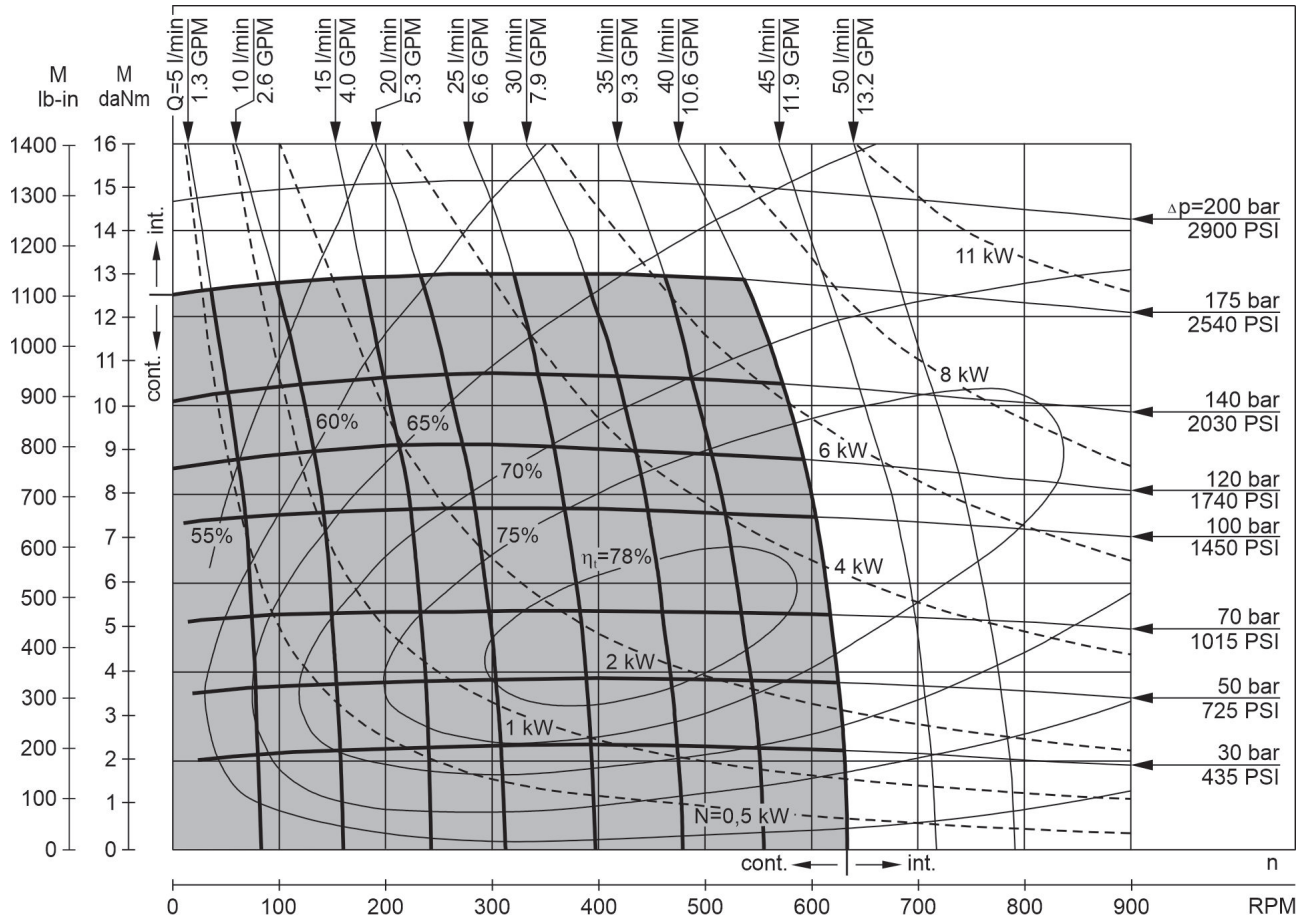
1. Intermittent speed and intermittent pressure must not occur simultaneously.
2. Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
3. Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP (DIN51524) or HM (ISO 6743/4). If using synthetic fluids consult the factory for alternative seal materials.
4. Recommended minimum oil viscosity 70 SUS [13 mm²/s] at 122°F [50°C].
5. Recommended maximum system operating temperature is 180°F [82°C].
6. To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

FUNCTION DIAGRAMS

MLHR 50



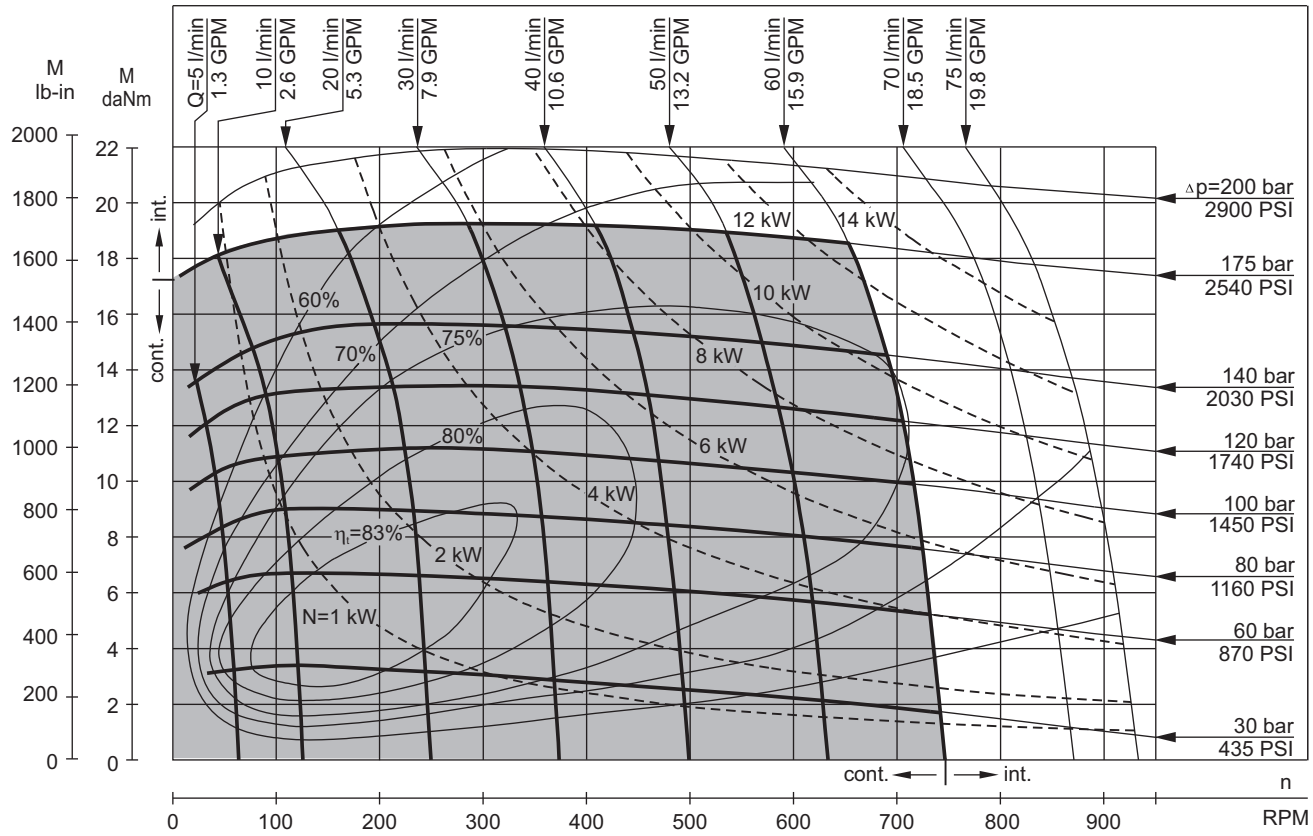
MLHR 63



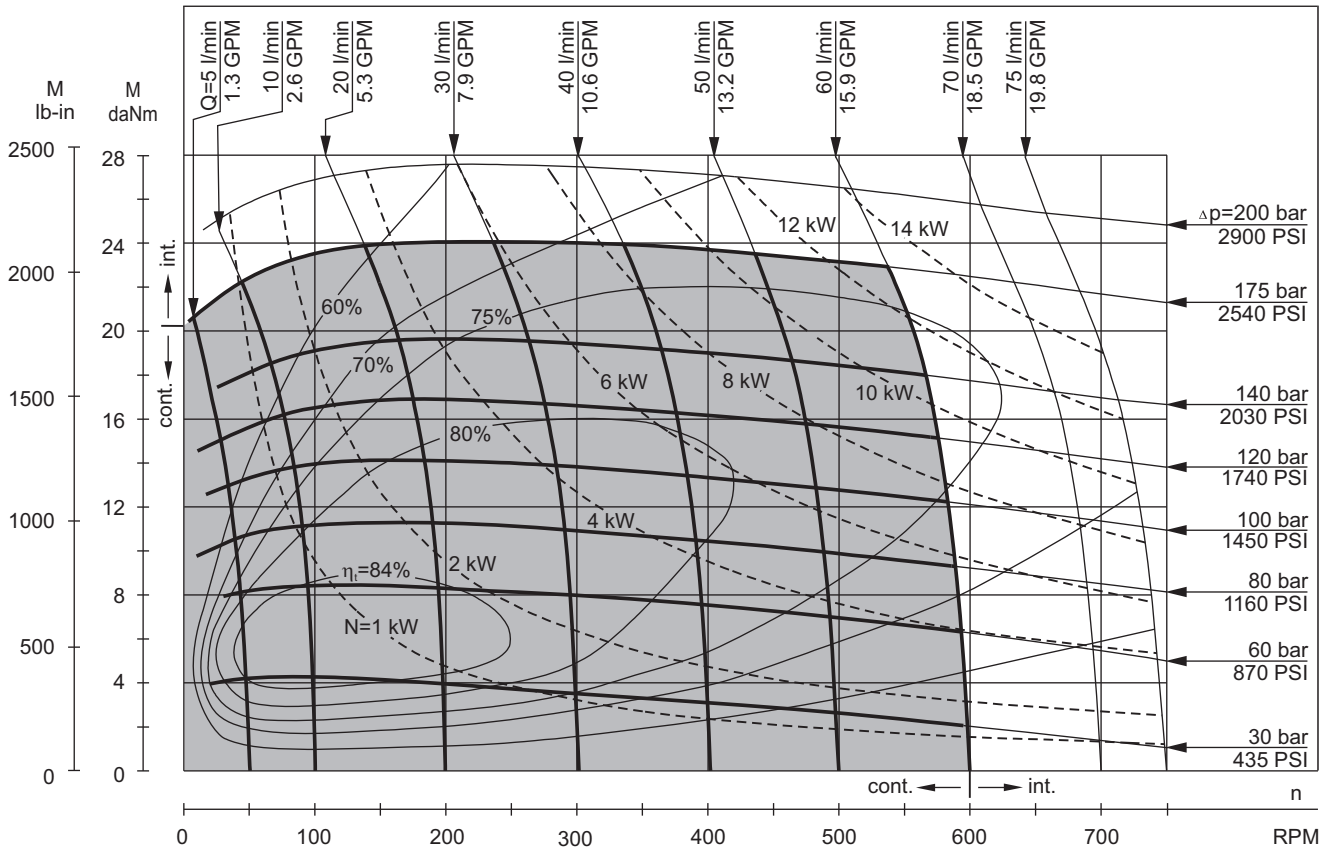
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5 PSI÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

MLHR 80



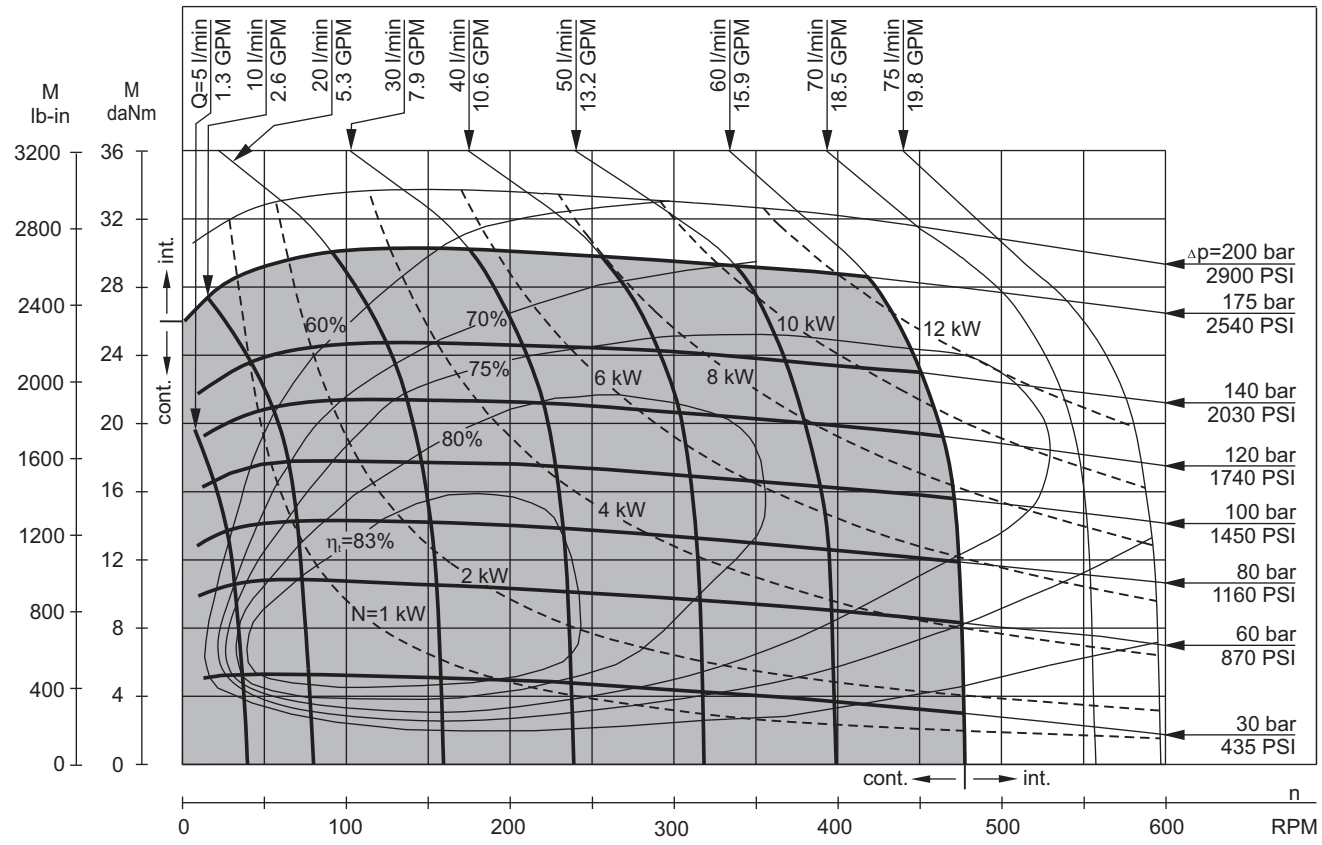
MLHR 100



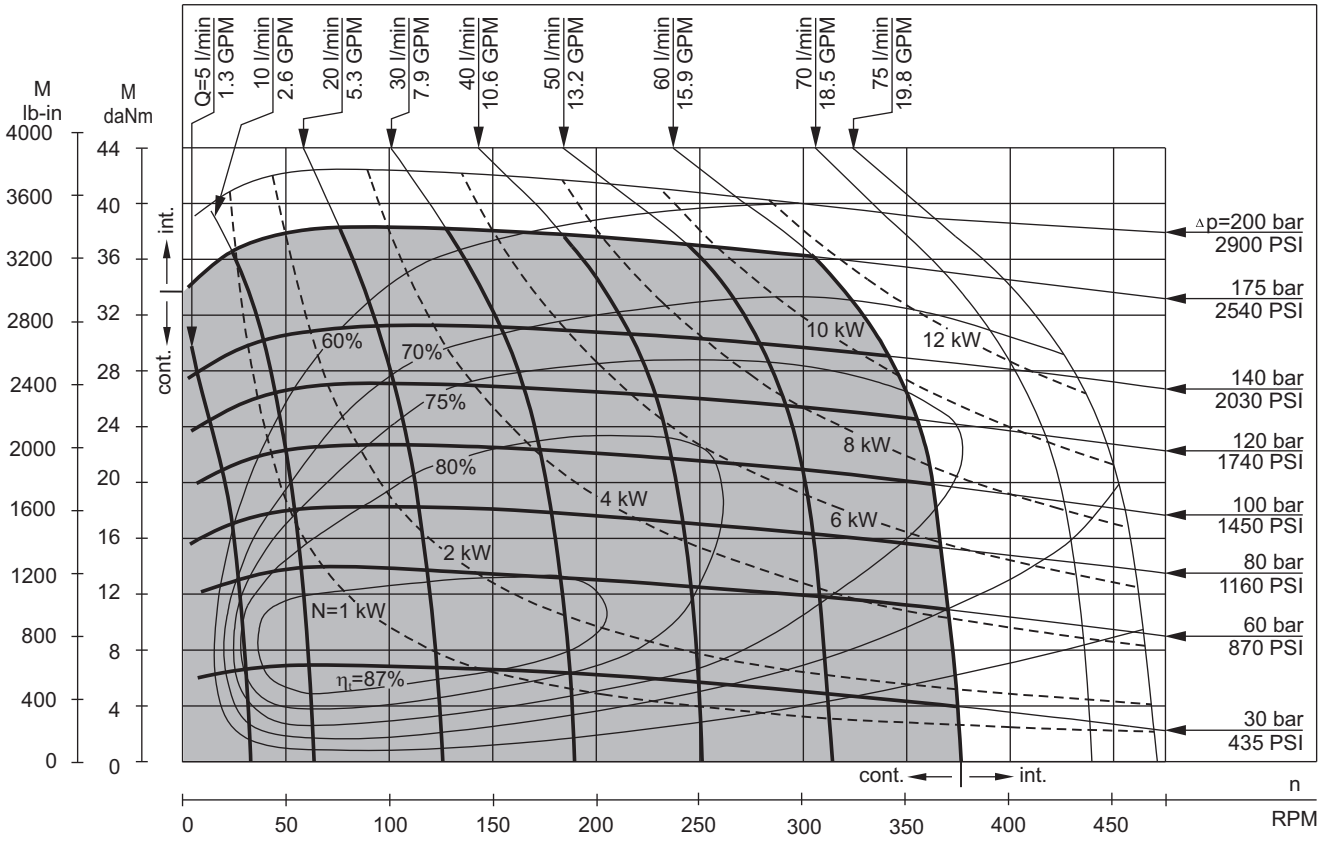
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5 PSI÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

MLHR 125



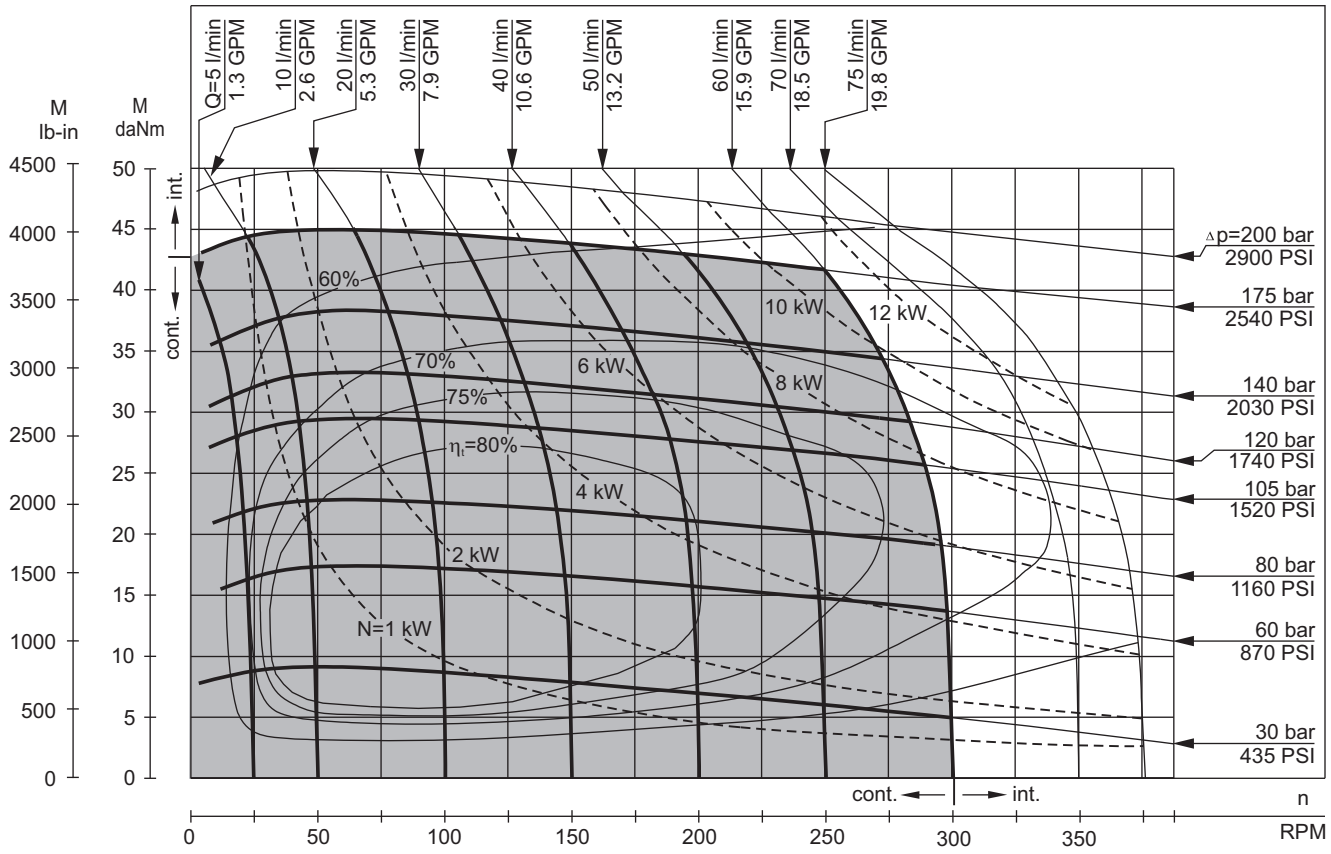
MLHR 160



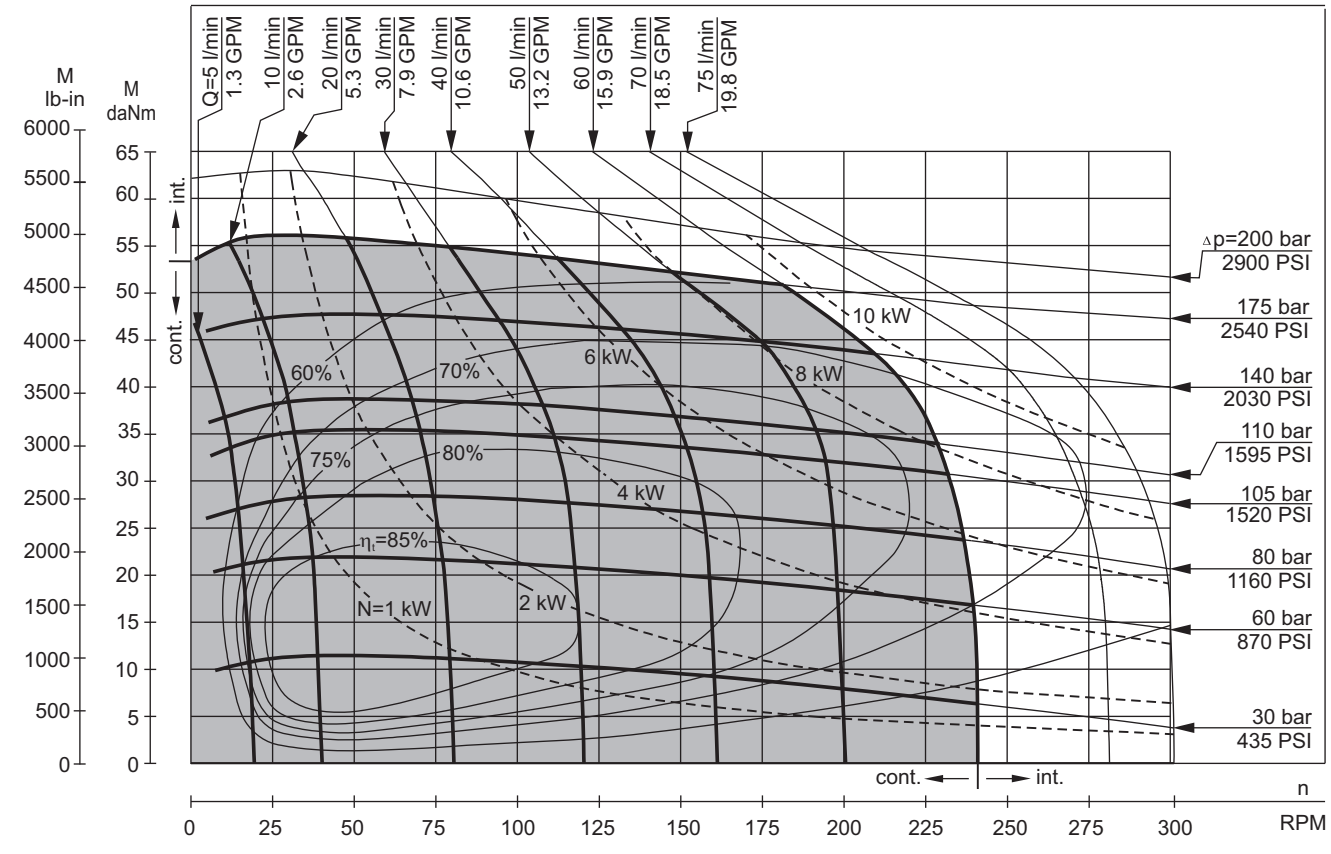
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5 PSI÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

MLHR 200



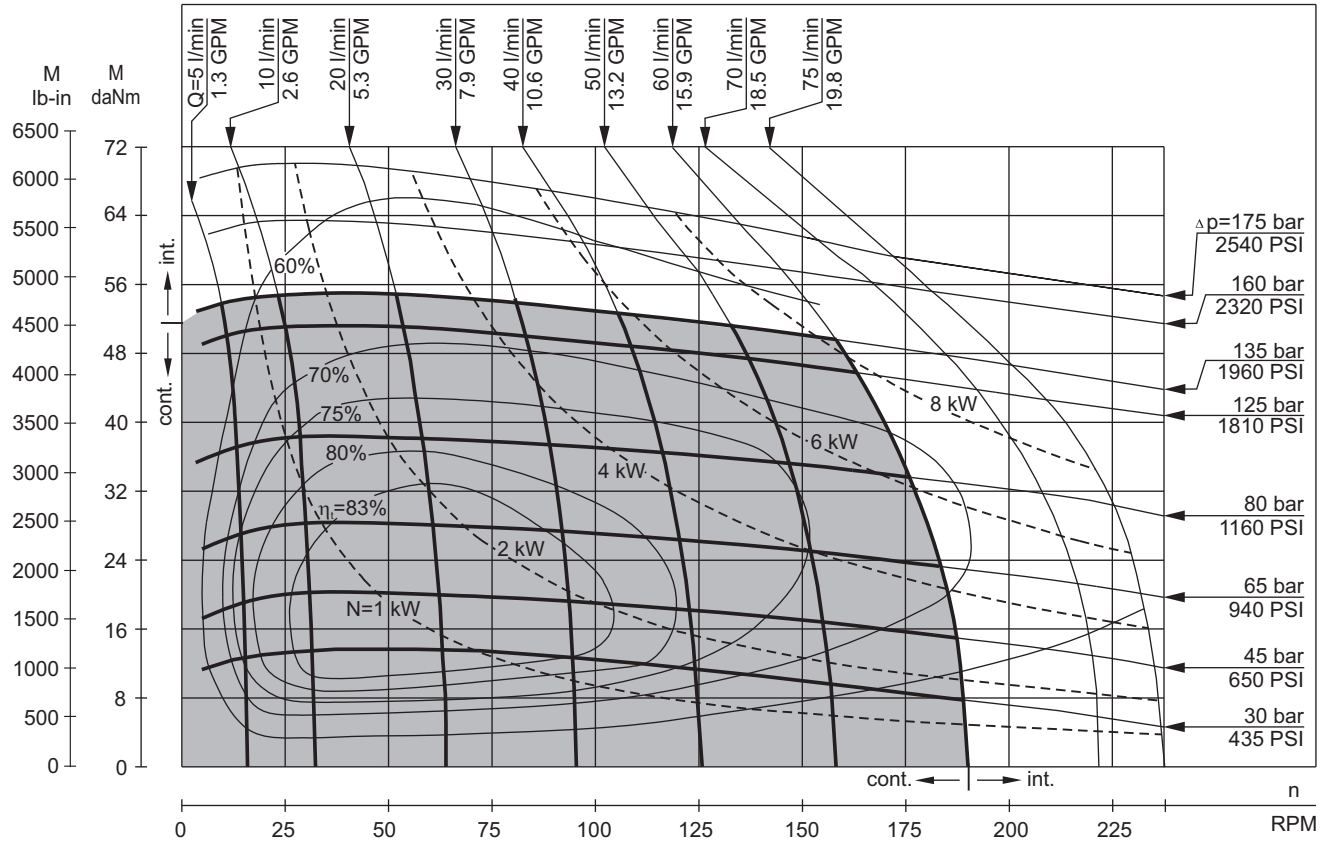
MLHR 250



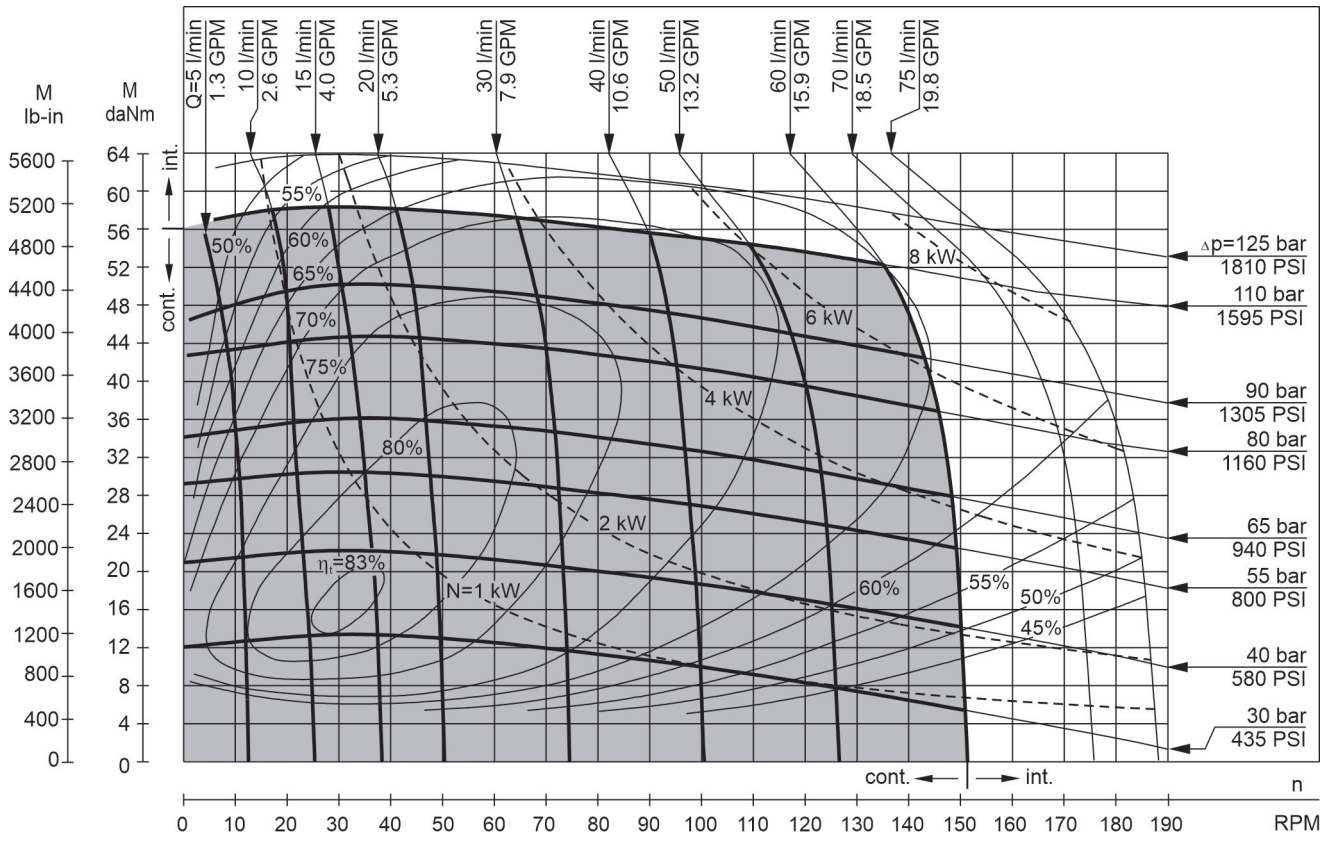
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5 PSI÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

MLHR 315



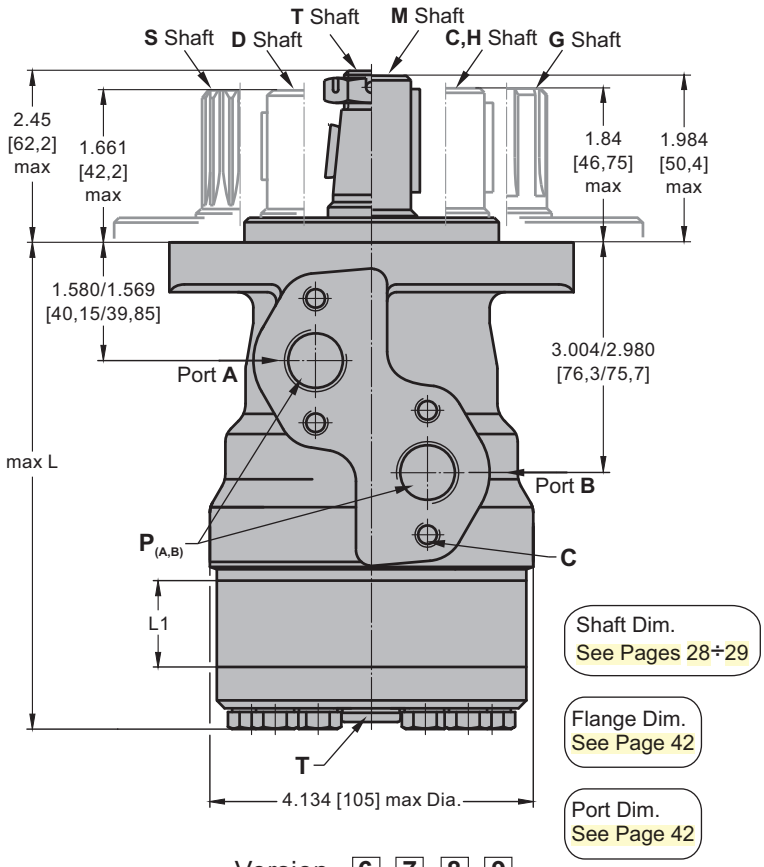
MLHR 400



The function diagrams data is for average performance of randomly selected motors 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].

DIMENSIONS and MOUNTING DATA

MLHR, MLHRF

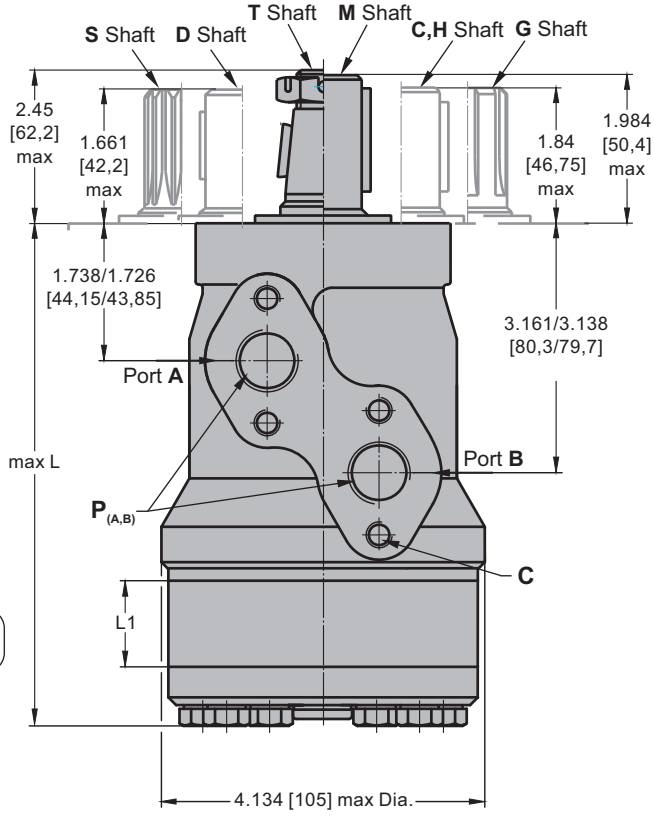


Shaft Dim. See Pages 28÷29

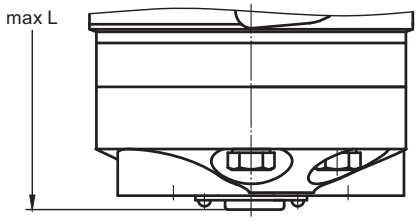
Flange Dim. See Page 42

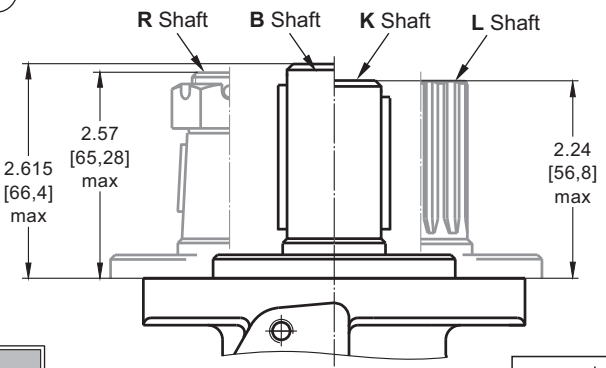
Port Dim. See Page 42

MLHRQ, MLHRM



Version 6 7 8 9
Rear ports





	Versions			
	2, 6	3, 9	4, 7	5, 8
C	4xM8	4xM8	4x 5/16 - 18 UNF	4x 5/16 - 18 UNF
P(A,B)	2xG½	2xM22x1,5	2x 7/8 - 14 UNF	2x½ - 14 NPTF
T	G¼	M14x1,5	7/16 - 20 UNF	7/16 - 20 UNF

in [mm]

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

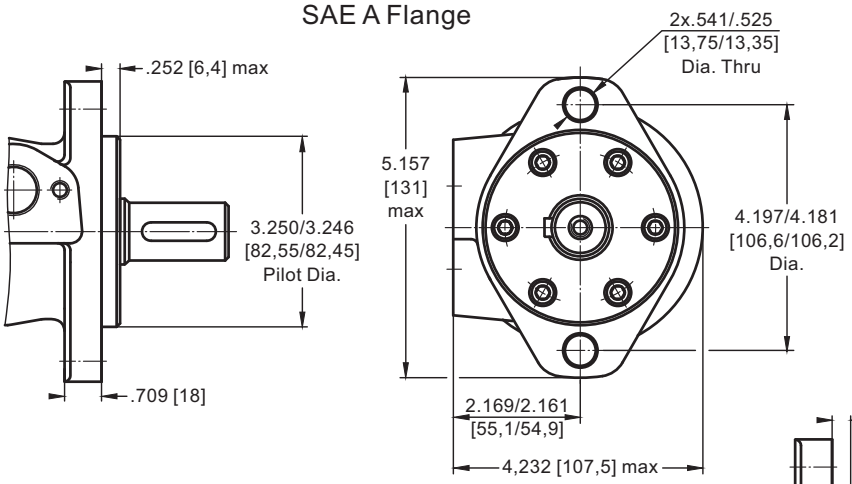
Reverse Rotation
Viewed from Shaft End
Port **A** Pressurized - **CCW**
Port **B** Pressurized - **CW**

Type	Lmax, in [mm]		Type	Lmax, in [mm]		L1, in [mm]
	Versions 2,3,4,5	*Versions 6,7,8,9		Versions 2,3,4,5	*Versions 6,7,8,9	
MLHR(F) 50	5.51 [140,0]	6.14 [156,0]	MLHRQ(M) 50	5.67 [144,0]	6.30 [160,0]	.35 [9,0]
MLHR(F) 63	5.51 [140,0]	6.14 [156,0]	MLHRQ(M) 63	5.67 [144,0]	6.30 [160,0]	.35 [9,0]
MLHR(F) 80	5.71 [145,0]	6.34 [161,0]	MLHRQ(M) 80	5.87 [149,0]	6.50 [165,0]	.55 [14,0]
MLHR(F) 100	5.85 [148,5]	6.48 [164,5]	MLHRQ(M) 100	6.00 [152,5]	6.63 [168,5]	.69 [17,4]
MLHR(F) 125	6.00 [152,5]	6.63 [168,5]	MLHRQ(M) 125	6.18 [157,0]	6.81 [173,0]	.86 [21,8]
MLHR(F) 160	6.24 [158,5]	6.87 [174,5]	MLHRQ(M) 160	6.42 [163,0]	7.05 [179,0]	1.09 [27,8]
MLHR(F) 200	6.52 [165,5]	7.15 [181,5]	MLHRQ(M) 200	6.69 [170,0]	7.32 [186,0]	1.37 [34,8]
MLHR(F) 250	6.87 [174,5]	7.50 [190,5]	MLHRQ(M) 250	7.03 [178,5]	7.60 [194,5]	1.71 [43,5]
MLHR(F) 315	7.30 [185,5]	7.93 [201,5]	MLHRQ(M) 315	7.48 [190,0]	8.11 [206,0]	2.16 [54,8]
MLHR(F) 400	7.89 [200,5]	8.52 [216,5]	MLHRQ(M) 400	8.05 [204,5]	8.68 [220,5]	2.73 [69,4]

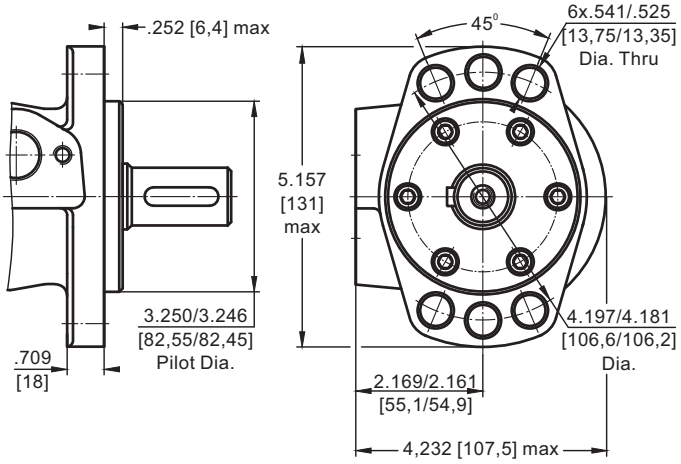
* - For Rear Ported Motors

MOUNTING

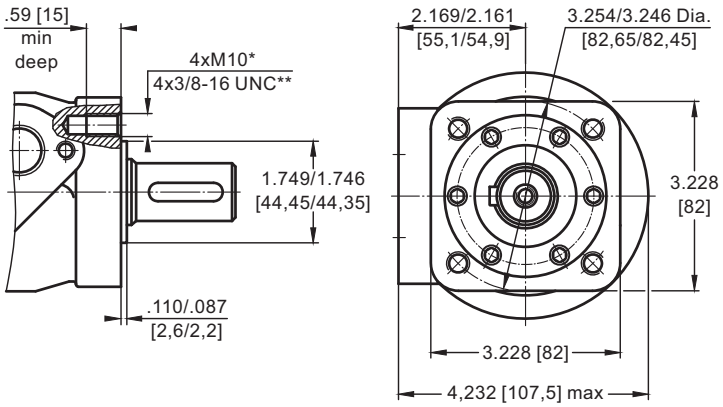
SAE A Flange



F - Magneto Flange



M and **Q** - Square Flange

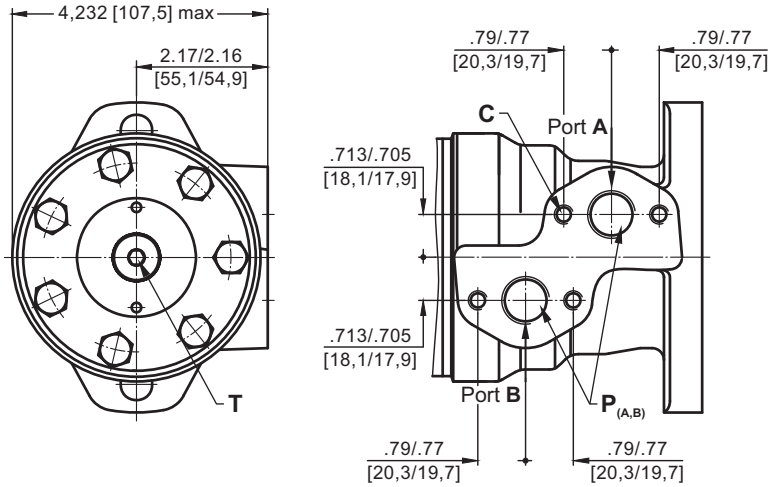


* For **M** Flange
** For **Q** Flange

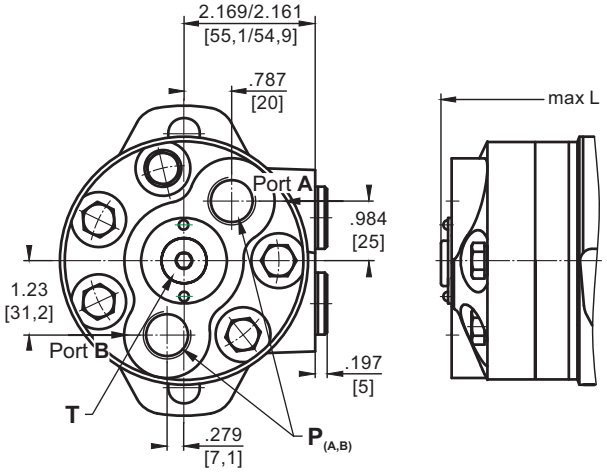
in [mm]

PORTS

Side Ports
Version 2 3 4 5



Rear Ports
Version 6 7 8 9



	Versions			
	2 , 6	3 , 9	4 , 7	5 , 8
C	4xM8	4xM8	4x 5/16 - 18 UNF	4x 5/16 - 18 UNF
P(A,B)	2xG½	2xM22x1,5	2x 7/8 - 14 UNF	2x½ - 14 NPTF
T	G¼	M14x1,5	7/16 - 20 UNF	7/16 - 20 UNF

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

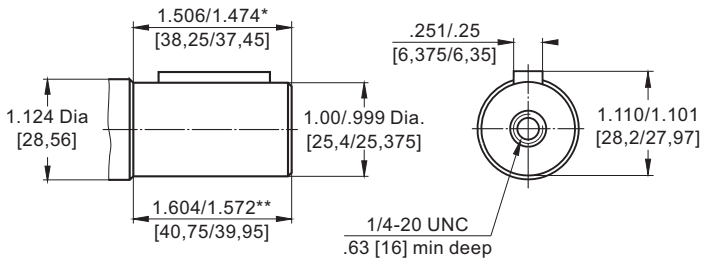
Reverse Rotation
Viewed from Shaft End
Port **A** Pressurized - **CCW**
Port **B** Pressurized - **CW**

SHAFT EXTENSIONS for MLHP and MLHR MOTORS

1.124 [28,56] sealing diameter

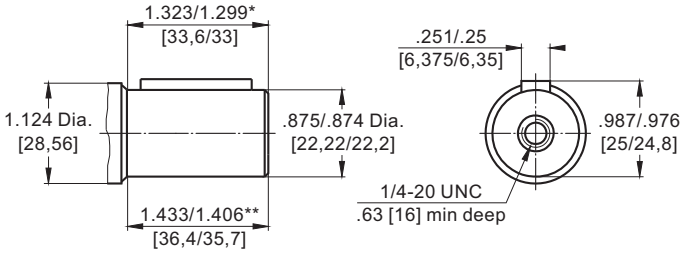
C

1" [25,4] straight, Parallel key ¼"x¼"x1¼" BS 46
Max. Torque 3009 lb-in [34 daNm]



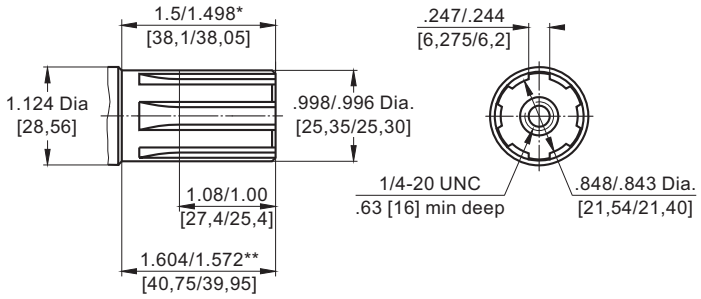
D

7/8" [22,2] straight, Parallel key ¼"x¼"x1" BS 46
Max. Torque 3200 lb-in [36 daNm]



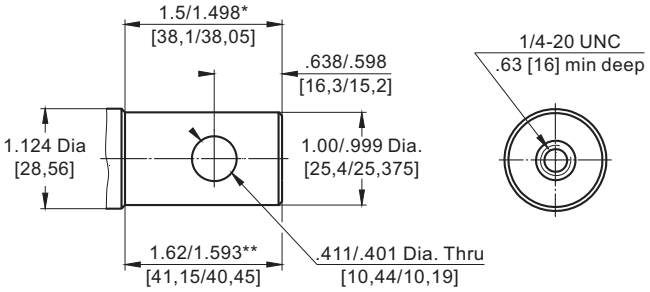
G

1" [25,4], SAE 6B Splined
Max. Torque 3540 lb-in [40 daNm]



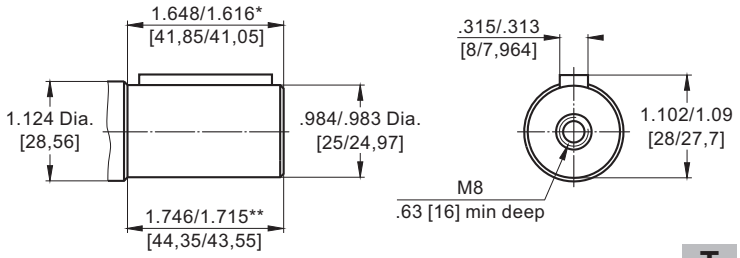
H

1" [25,4] straight, w/ .406 [10,3] Crosshole
Max. Torque 3009 lb-in [34 daNm]



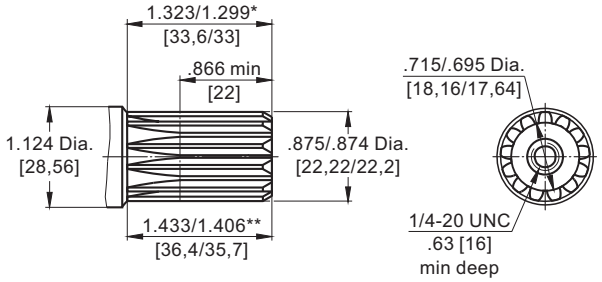
M

ø25 straight, Parallel key A8x7x32 DIN 6885
Max. Torque 3009 lb-in [34 daNm]



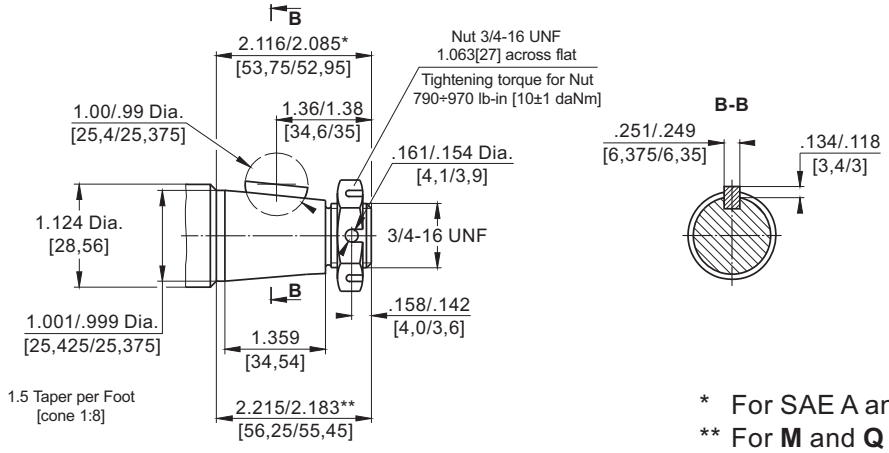
S

13 T Splined, 7/8" [22,2], ANS B 92.1-1976
Max. Torque 3200 lb-in [36 daNm]



T

1" [25,4], SAE J501 Tapered
Woodruff key ¼"x1" SAE J502
Max. Torque 3540 lb-in [40 daNm]



in [mm]

* For SAE A and **F** Flange
** For **M** and **Q** Flange

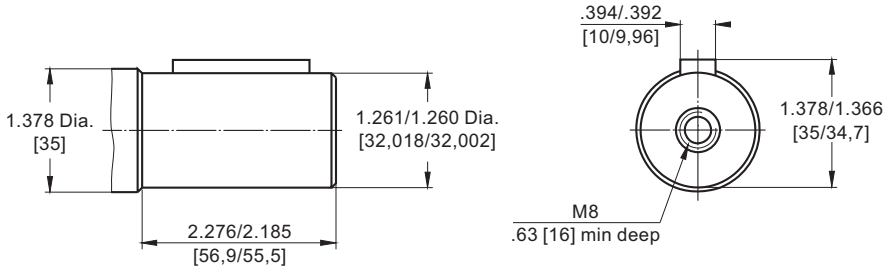
Requirement max. Torque must not be exceeded.

SHAFT EXTENSIONS for MLHP and MLHR MOTORS (continued)

1.378 [35] sealing diameter

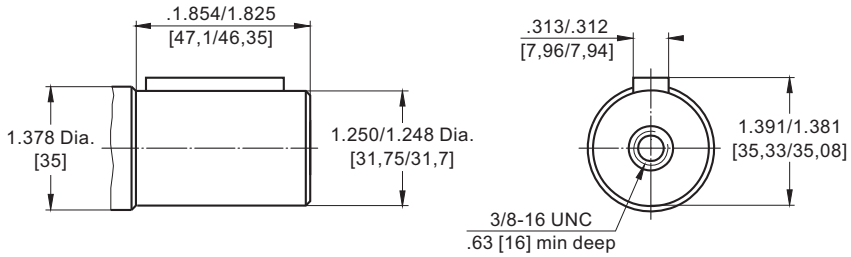
B

ø32 straight, Parallel key A10x8x45 DIN 6885
Max. Torque 6815 lb-in [77 daNm]



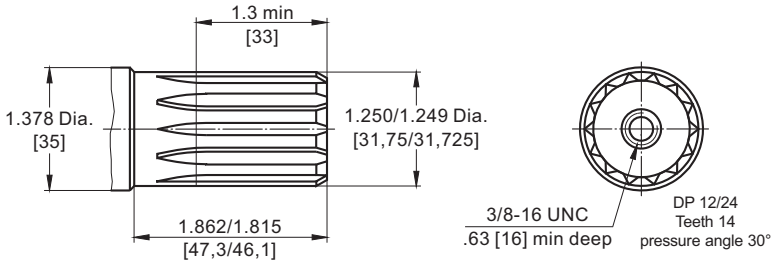
K

1¼" [31,75] straight, Parallel key 5/16"x5/16"x1¼" BS 46
Max. Torque 6815 lb-in [77 daNm]



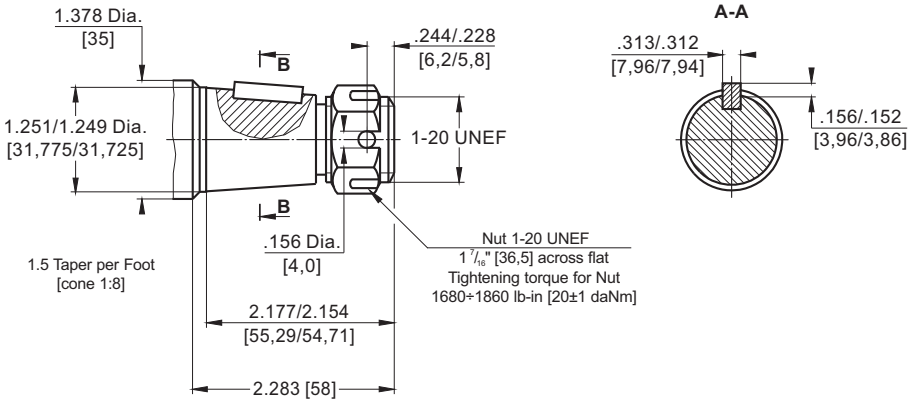
L

14T Splined,1¼" [31,75], ANS B 92.1-1976
Max. Torque 6815 lb-in [77 daNm]



R

1¼" [31,75],SAE J501 Tapered, Parallel key 5/16"x5/16"x1"
Max. Torque 6815 lb-in [77 daNm]

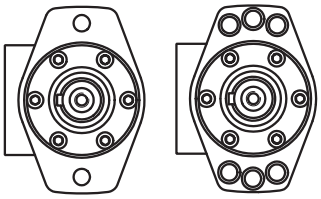
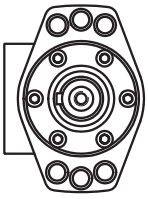
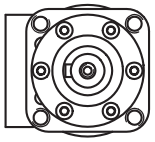


in [mm]

Requirement max. Torque must not be exceeded.

PERMISSIBLE SHAFT LOADS for MLHP and MLHR MOTORS

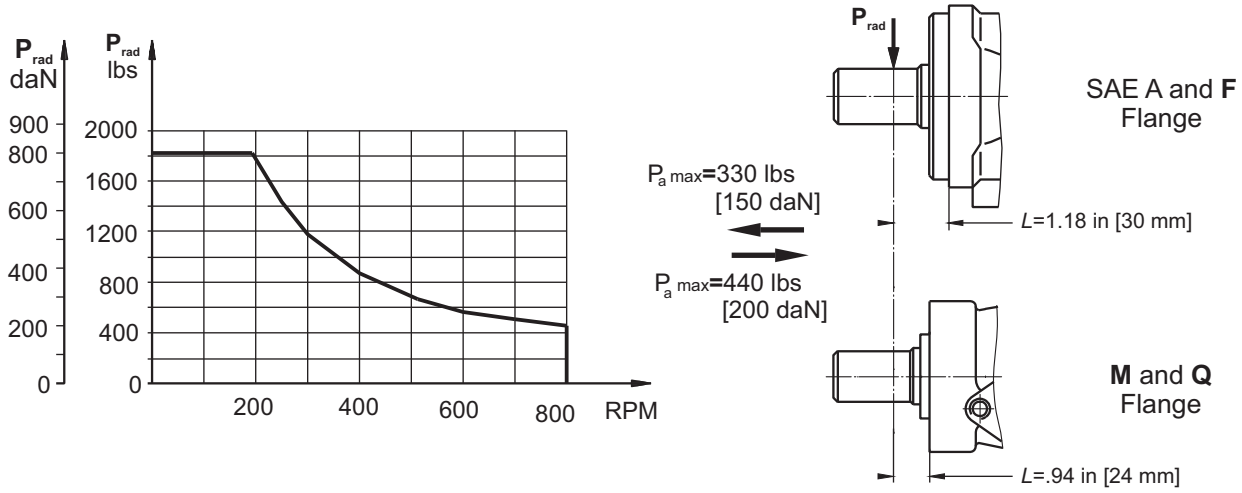
The permissible radial shaft load P_{rad} depends on the speed **n**, RPM, mounting flange, distance **L** from the point of load to the mounting flange and shaft version.

Mounting Flange			
Shaft Version	Keyed **C** Splined **G**	Keyed **B** Splined **L**	Keyed **C** Splined **G**
Radial Shaft Load P_{rad}, in **mm**	$\frac{800}{n} \times \frac{25000}{95+L}$, daN*	$\frac{800}{n} \times \frac{18750}{95+L}$, daN*	$\frac{800}{n} \times \frac{25000}{101+L}$, daN*
Radial Shaft Load P_{rad}, in **inch**	$\frac{800}{RPM} \times \frac{2215}{3.74+L}$, lbs*	$\frac{800}{RPM} \times \frac{1660}{3.74+L}$, lbs*	$\frac{800}{RPM} \times \frac{2215}{3.98+L}$, lbs*

* n < 200 RPM; max Prad=1800 lbs [800 daN]
n ≥ 200 RPM; L < 2.2 in [55 mm]

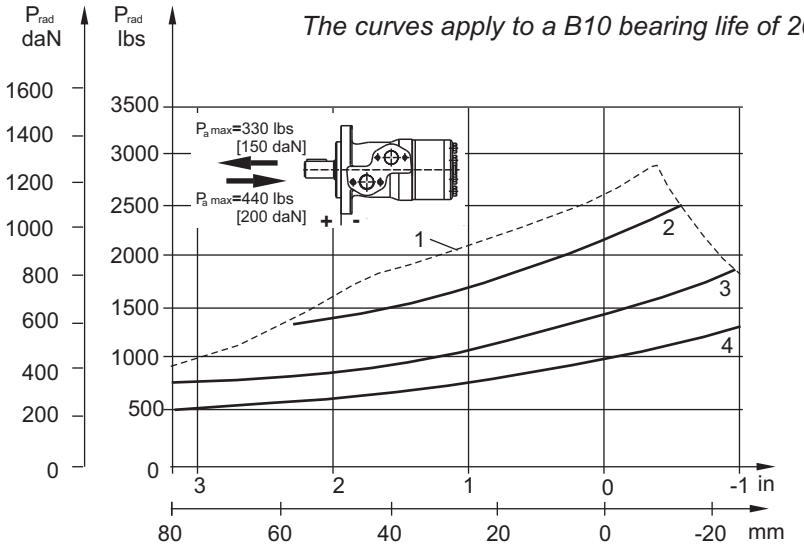
MLHP and MLHR

Radial Shaft Load P_{rad} for C, G Shaft Extensions by L=1.18 in [30 mm] (.94 in [24 mm])

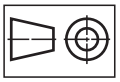


MLHPN and MLHRN

The curves apply to a B10 bearing life of 2000 hours.



1. Max. radial shaft load
2. n= 50 RPM
3. n=200 RPM
4. n=800 RPM

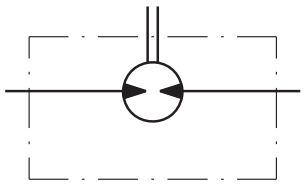
 in [mm]

MAX. PERMISSIBLE SHAFT SEAL PRESSURE for MLHP and MLHR MOTORS

MLHP/MLHR...U1 motors with high pressure seal and without drain connection:

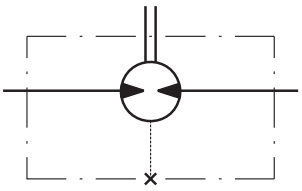
The shaft seal pressure equals the average of input pressure and return pressure.

$$P_{seal} = \frac{P_{input} + P_{return}}{2}$$



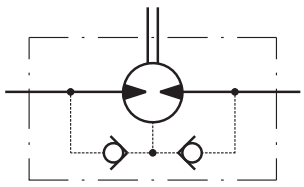
MLHP/MLHR...U motors with high pressure seal and drain connection:

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



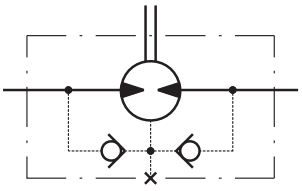
MLHP/MLHR...1 motors with standard shaft seal and without drain connection:

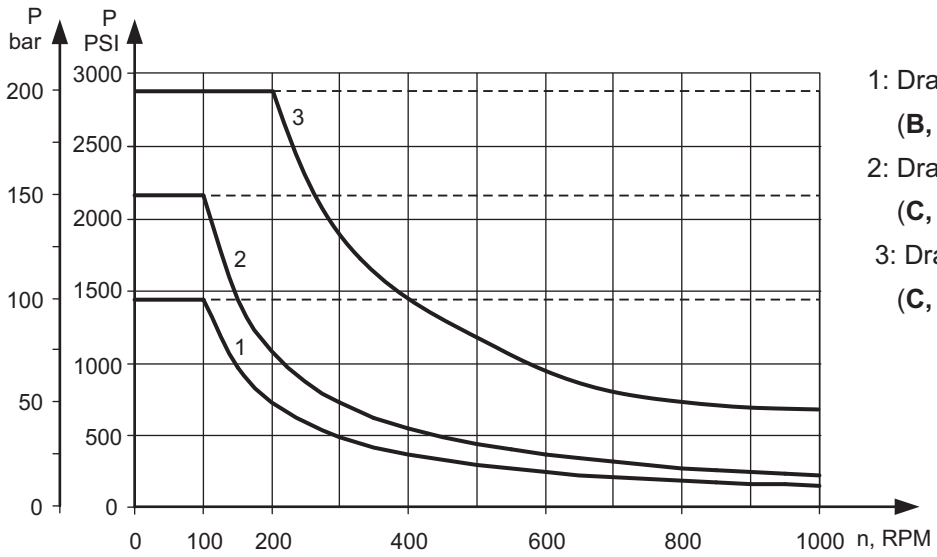
The shaft seal pressure never exceeds the pressure in the return line.



MLHP/MLHR... motors with standard shaft seal and with drain connection:

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





1: Drawing for Standard Shaft Seal (**B, K, L, R** shafts)
2: Drawing for Standard Shaft Seal (**C, G, D, H, M, S, T** shafts)
3: Drawing for High Pressure Seal ("**U**" Seal) (**C, G, D, H, M, S, T** shafts)

——— - continuous operations
- - - - - - - intermittent operations

ORDER CODE

	1	2	3	4	5	6	7	8	9
M L H R									

Pos.1 - **Mounting Flange**

omit - SAE A, two holes
F - Magneto, six holes
M - Square metric, four bolts M10
Q - Square, four bolts

Pos.2 - **Displacement code**

50 - 3.14 in^3/rev [51,5 cm^3/rev]
63 - 3.87 in^3/rev [63,45 cm^3/rev]
80 - 4.90 in^3/rev [80,3 cm^3/rev]
100 - 6.09 in^3/rev [99,8 cm^3/rev]
125 - 7.67 in^3/rev [125,7 cm^3/rev]
160 - 9.74 in^3/rev [159,6 cm^3/rev]
200 - 12.19 in^3/rev [199,8 cm^3/rev]
250 - 15.26 in^3/rev [250,1 cm^3/rev]
315 - 19.26 in^3/rev [315,7 cm^3/rev]
400 - 24.40 in^3/rev [397,0 cm^3/rev]

Pos.3 - **Shaft Extensions*** [see pages 28 and 29]

C - 1" [25,4] straight, Parallel key
VC - 1" [25,4] straight, Parallel key w/ corrosion resistant protection

D - $^7/_8$" [22,2] straight, Parallel key
G - 1" [25,4] SAE 6B Splined
H - 1" [25,4] straight w/ .406 [10,3] Crosshole
M - 25 mm straight, Parallel key
VM - 25 mm straight, Parallel key w/ corrosion resistant protection

S - $^7/_8$" [22,2] 13T Splined
T - 1" [25,4] SAE J501 Tapered
B - 32 mm straight, Parallel key
K - 1¼" [31,75] straight, Parallel key
L - 1¼" [31,75] 14T Splined
R - 1¼" [31,75] SAE J501 Tapered

Pos.4 - **Option** [needle bearings]

omit - none
N - with needle bearings

Pos.5 - **Port Size/Type** [standard manifold to each]

2 - side ports, 2xG1/2, G1/4, BSP thread, ISO 228
3 - side ports, 2xM22x1,5, M14x1,5, metric thread, ISO 262
4 - side ports, 2x7/8-14 UNF, O-ring, 7/16-20 UNF
5 - side ports, 2x1/2-14 NPTF, 7/16-20 UNF
6 - rear ports, 2xG1/2, G1/4, BSP thread, ISO 228
7 - rear ports, 2x7/8-14 UNF, O-ring, 7/16-20 UNF
8 - rear ports, 2x1/2-14 NPTF, 7/16-20 UNF
9 - rear ports, 2xM22x1,5, M14x1,5, metric thread, ISO 262

Pos.6 - **Shaft Seal Version** [see page 31]

omit - 150 bar pressure seal /recommended for medium pressure and high speed and high radial load/
U - 200 bar pressure seal /recommended for high pressure and low speed of rotation and medium radial load/ (without check valves)

Pos.7 - **Drain Port**

omit - with drain port
1 - without drain port

Pos.8 - **Additional Options** [see page 110]

Pos.9 - **Design Series**

omit - Factory specified

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

The following combinations are not allowed: - **Q** and **M** flange with **B**, **K**, **L**, **R** shafts;
- **N** option with **B**, **K**, **L**, **R** shafts, **U** option or **RS** option;
- **B**, **K**, **L**, **R** shafts with **U** option.

The hydraulic motors are mangano-phosphatized as standard.

MOTOR ADDITIONAL OPTIONS

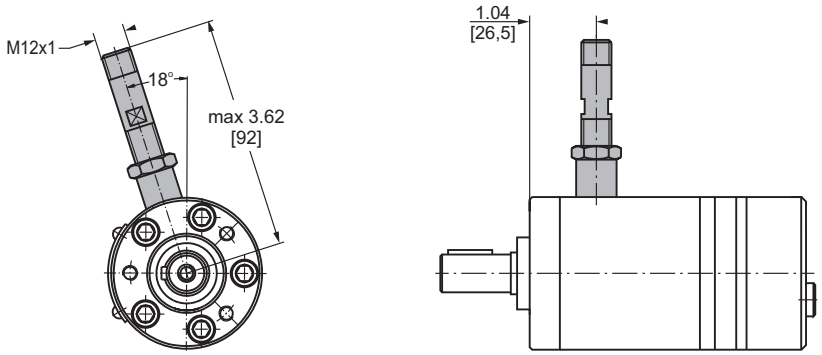
Additional Options Description	Order Code	Motor type											
		MLHM	MLHP	MLHPW, MLHP(W)N	HP	MLHR	MLHRN	HR	MLHPL	MLHRL	MLHRW	MLHH	HW
Speed Sensor*	**RS**	O	O	-	O	O	-	O	-	-	-	O	O*****
Low Leakage	**LL**	O	-	-	-	O	O	O	-	O	O	O	O
Low Speed Valving	**LSV**	-	-	-	-	O	-	-	-	-	-	O	O
Free Running	**FR**	O	O	O	O	O	O	O	O	O	O	O	O
Reverse Rotation	**R**	O	O	O	O	O	O	O	O	O	O	O	O
Paint**	**P**	O	O	O	O	O	O	O	O	O	O	O	O
Corrosion Protected Paint**	**PC**	O	O	O	O	O	O	O	O	O	O	O	O
Special Paint***	**PS**	O	O	O	O	O	O	O	O	O	O	O	O
	PCS												
Check Valves		S	S****	S	O	S****	S	O	S	S	S****	S****	S

O	Optional
-	Not applicable
S	Standard

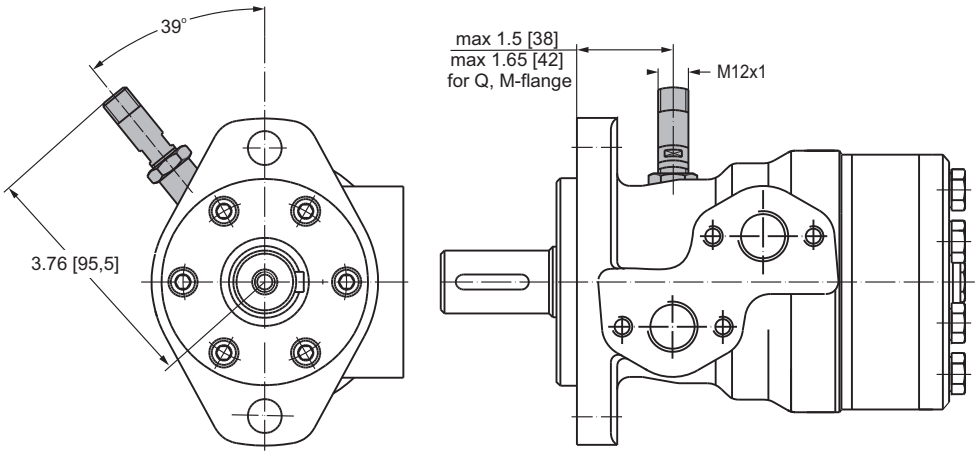
* For sensor ordering see pages 111÷112.
** Colour at customer's request.
*** Non painted feeding surfaces, colour at customer's request.
**** Without check valves for "**U**" shaft seal versions.
***** RS option is not available at HW...R (with relief valves).

MOTORS WITH SPEED SENSOR

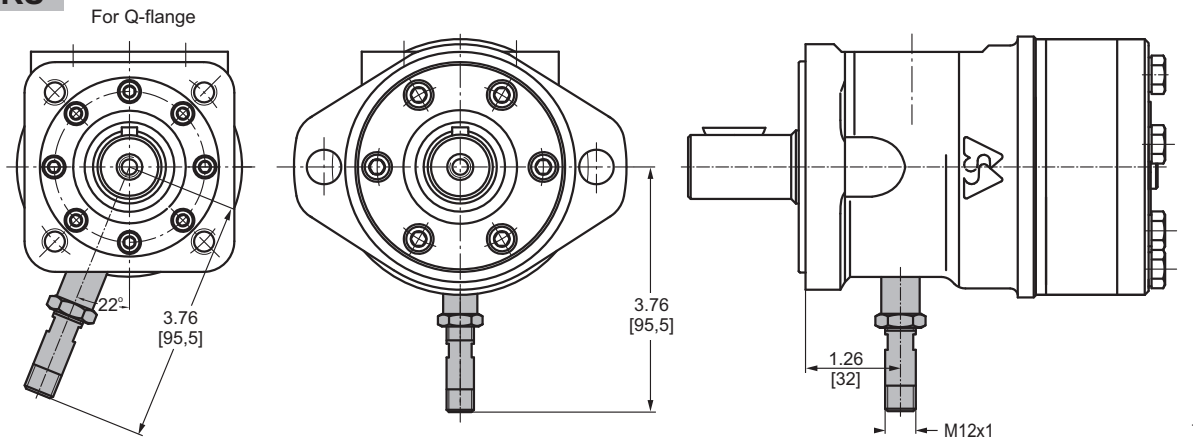
MLHM...RS



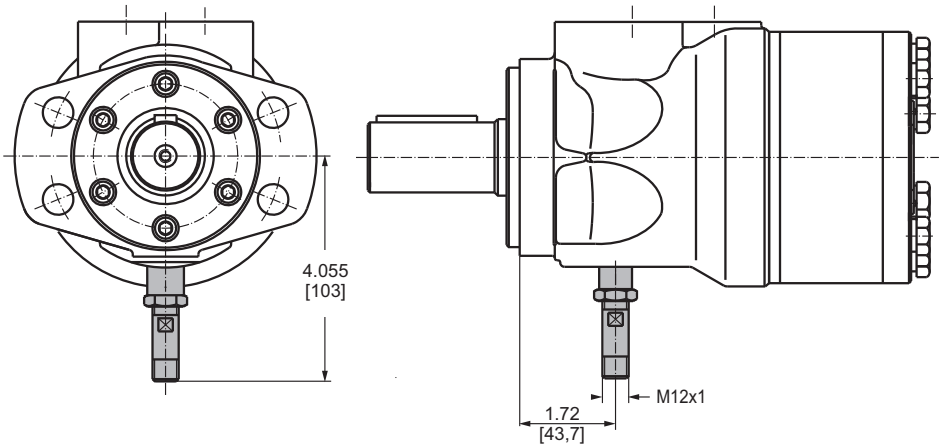
MLHP...RS
MLHR...RS



HP...RS
HR...RS



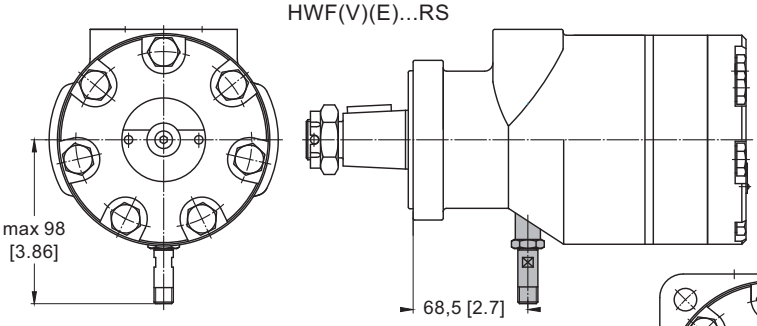
MLHH...RS



in [mm]

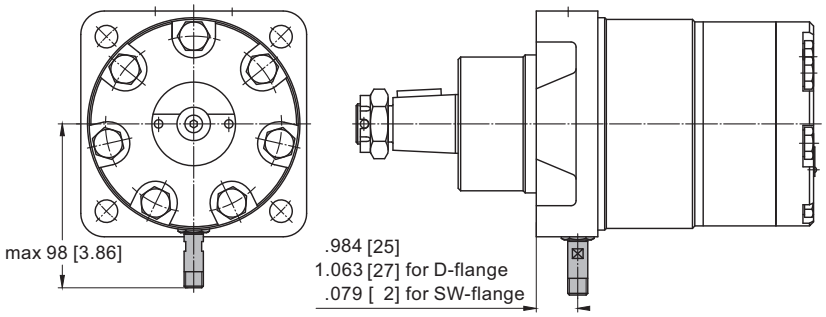
HW...RS

HWF(V)(E)...RS



RS option is not available at HW...R (with relief valves).

HW(S)(D)(SW)(V)(E)...RS



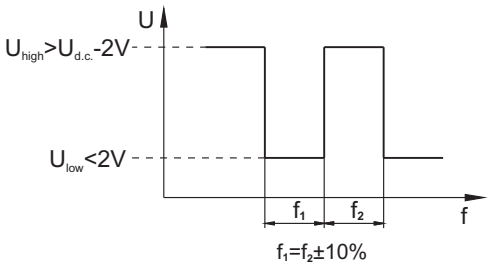
in [mm]

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^{0}C [-40...+257^{0}F]
Protection	IP 67
Plug connector	M12-Series
Mounting principle	ISO 6149

Output signal

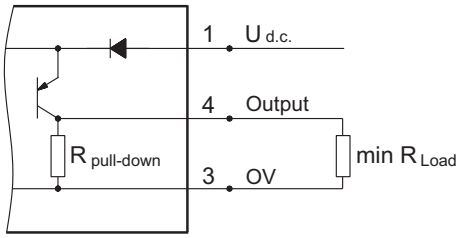


Load max.:$I_{high}=I_{low}$<50mA

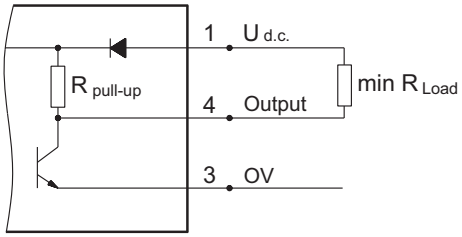
Motor type	MLHM	MLHP	MLHR	HP, HR	MLHH	HW
Pulses per revolution	30	36	36	36	42	12

Wiring diagrams

PNP

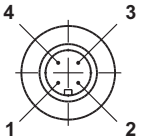


NPN



R_{Load} [kΩ]=$U_{d.c.}$ [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; 98 in [2,5 m] long
RSL3,5	Cable output 3x0,25; 138 in [3,5 m] long
RSL5	Cable output 3x0,25; 196 in [5 m] long
RSL10	Cable output 3x0,25; 394 in [10 m] long

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

APPLICATION CALCULATION

VEHICLE DRIVE CALCULATIONS

1.Motor speed: n, RPM

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

v_{km} - vehicle speed, km/h;
v_{mi} - vehicle speed, mile/h;
R_m - wheel rolling radius, m;
R_{in} - wheel rolling radius, in;
i - gear ratio between motor and wheels.
If no gearbox, use i=1.

2.Rolling resistance: RR, lbs [daN]
The resistance force resulted in wheels contact with different surfaces:

$$RR = G \times \rho$$

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

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

α - gradient negotiation angle (Table 2)

Table 2

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

4. Acceleration force: FA, lbs [daN]
Force **FA** necessary for acceleration from 0 to maximum speed **v** and time **t** can be calculated with a formula:

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

FA- acceleration force, lbs [daN];
t- time, [s].

5.Tractive effort: DP, lbs [daN]
Tractive effort DP is the additional force of trailer. This value will be established as follows:
-acc.to constructor's assessment;
-as calculating forces in items 2, 3 and 4 of trailer; the calculated sum corresponds to the tractive effort requested.

6.Total tractive effort: TE, lbs [daN]
Total tractive effort **TE** is total effort necessary for vehicle motion; that the sum of forces calculated in items from 2 to 5 and increased with 10 % because of air resistance.

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

RR - force acquired to overcome the rolling resistance;
GR - force acquired to slope upwards;
FA - force acquired to accelerate (acceleration force);
DP - additional tractive effort (trailer).

7.Motor Torque moment: M, lb-in [daNm]
Necessary torque moment for every hydraulic motor:

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

N- motor numbers;
η_M - mechanical gear efficiency (if it is available).

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

$$M_W = \frac{G_W \times f \times R_{in}[R_m]}{i \times \eta_M}$$

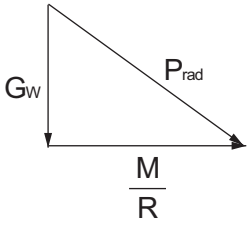
To avoid wheel slipping, the following condition should be observed $M_W > M$
f - frictional factor;
G_w - total weight over the wheels, lbs [daN].

Table 3

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

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

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



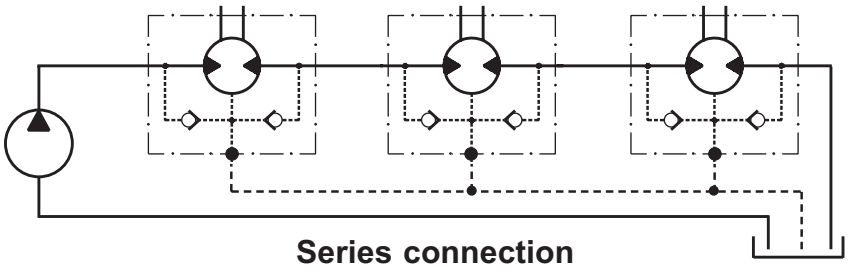
$$P_{rad}=\sqrt{G_w^2+\left(\frac{M}{R}\right)^2}$$

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

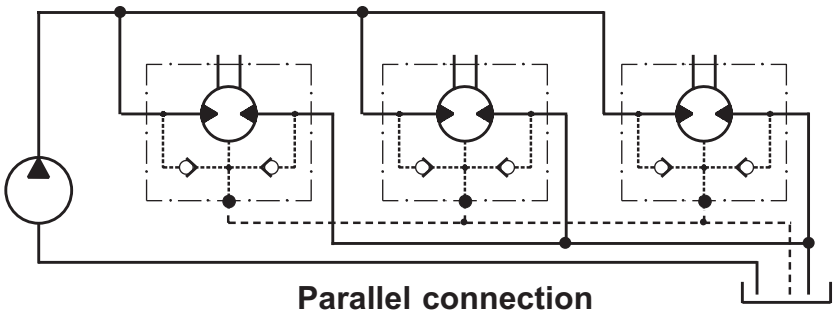
In accordance with calculated loadings the suitable motor from the catalogue is selected.

DRAINAGE SPACE AND DRAINAGE PRESSURE

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



Series connection



Parallel connection