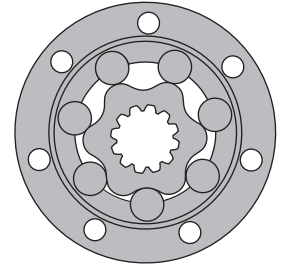


HYDRAULIC MOTORS HW



APPLICATION

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



CONTENTS

Specification data 86÷87
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 Dimensions and mounting 96÷100
 Shaft extensions 101÷102
 Permissible shaft loads 101
 Order code 103

OPTIONS

- » Model - Spool valve, roll-gerotor
- » Wheel and flange mount
- » Shafts - straight, splined and tapered
- » BSPP and SAE ports
- » Other special features

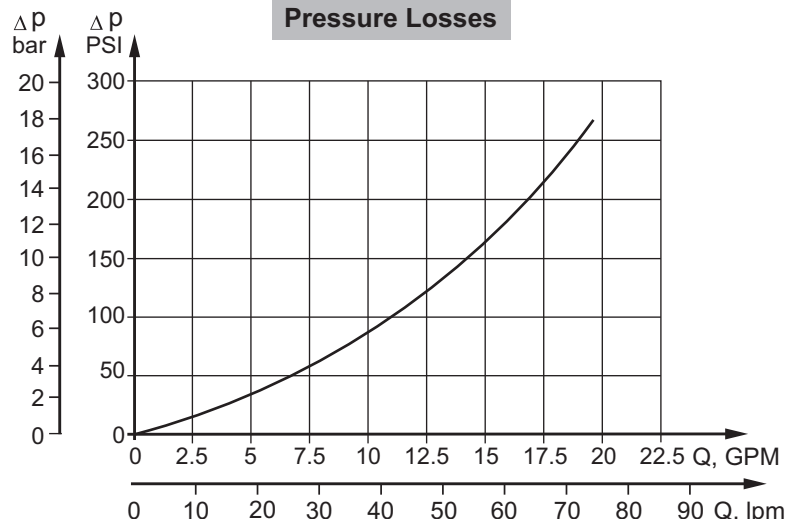
GENERAL

Max. Displacement, in ³ /rev [cm ³ /rev]	33.55 [550]
Max. Speed, [RPM]	497
Max. Torque, lb-in [daNm]	cont.: 8500 [96] int.: 9293 [105]
Max. Output, HP [kW]	31 [23,1]
Max. Pressure Drop, PSI [bar]	cont.: 3000 [205] int.: 3260 [225]
Max. Oil Flow, GPM [lpm]	30.4 [115]
Min. Speed, [RPM]	10
Pressure fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)
Temperature range, °F [°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

Type		HW 125	HW 160	HW 200	HW 235	HW 250	HW 300	HW 315
Displacement, in³/rev [cm³/rev]		7.69 [126]	9.64 [157,8]	12.28 [201,3]	14.33 [235,3]	15.37 [252]	18.3 [300]	19.21 [314,9]
Max. Speed, [RPM]	cont.	357	380	373	319	298	250	238
	int.*	476	475	497	425	397	333	318
Max. Torque in-lb [daNm]	cont.	3098 [35]	3894 [44]	4868 [55]	5710 [64,5]	6107 [69]	7170 [81]	7523 [85]
	int.*	3408 [38,5]	4248 [48]	5310 [60]	6196 [70]	6638 [75]	7877 [89]	8230 [93]
Max. Output, HP [kW]	cont.	21.7 [16,2]	23.6 [17,6]	24.9 [18,6]	24.4 [18,2]	22.5 [16,8]	22 [16,5]	21.9 [16,4]
	int.*	26.6 [19,8]	29 [21,6]	31 [23,1]	30.3 [22,6]	27.9 [20,8]	27.9 [20,8]	27.9 [20,8]
Max. Pressure Drop, PSI [bar]	cont.	2970 [205]	2970 [205]	2970 [205]	2970 [205]	2970 [205]	2970 [205]	2970 [205]
	int.*	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]	3260 [225]
Max. Oil Flow GPM [lpm]	cont.	12 [45]	16 [60]	20 [75]	20 [75]	20 [75]	20 [75]	20 [75]
	int.*	16 [60]	20 [75]	26.4 [100]	26.4 [100]	26.4 [100]	26.4 [100]	26.4 [100]
Max. Inlet Pressure, GPM	cont.	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]
	int.*	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]
Max. Starting Pressure with Unloaded Shaft, GPM		145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]
Min. Starting Torque in-lb [daNm]	at max. press. drop cont.	2540 [28,7]	3186 [36]	3991 [45,1]	4673 [52,8]	5000 [56,5]	5877 [66,4]	6169 [69,7]
	at max. press. drop int.*	2788 [31,5]	3478 [39,3]	49,2 [4355]	5080 [57,4]	5443 [61,5]	6452 [72,9]	6744 [76,2]
Min. Speed**, [RPM]		10	10	10	10	10	10	10
Weight, avg. lb [kg]	HW	31.5 [14,3]	32.2 [14,6]	33.3 [15,1]	34.2 [15,5]	34.6 [15,7]	35.5 [16,1]	35.9 [16,3]
	HWF	28.2 [12,8]	28.9 [13,1]	30.0 [13,6]	30.9 [14,0]	31.3 [14,2]	32.2 [14,6]	32.6 [14,8]
	HWFR(FV)	32.6 [14,8]	33.3 [15,1]	34.4 [15,6]	35.3 [16,0]	35.7 [16,2]	36.6 [16,6]	37.0 [16,8]
	HWS	30.9 [14,0]	31.5 [14,3]	32.6 [14,8]	33.5 [15,2]	34.0 [15,4]	34.8 [15,8]	35.3 [16,0]
	HWSW	30.2 [13,7]	30.86 [14,0]	31.9 [14,5]	32.8 [14,9]	33.3 [15,1]	34.2 [15,5]	34.6 [15,7]
	HWSR	35.3 [16,0]	35.9 [16,3]	37.0 [16,8]	37.9 [17,2]	38.4 [17,4]	39.2 [17,8]	39.7 [18,0]
	HWD	31.9 [14,5]	32.6 [14,8]	33.7 [15,3]	34.6 [15,7]	35.1 [15,9]	35.9 [16,3]	36.4 [16,5]
	HWV	30.86 [14,0]	31.5 [14,3]	32.6 [14,8]	33.5 [15,2]	33.9 [15,4]	34.8 [15,8]	35.2 [16,0]
	HWE	32.4 [14,7]	33.1 [15,0]	34.2 [15,5]	35.1 [15,9]	35.5 [16,1]	36.4 [16,5]	36.8 [16,7]
	HWSE	31.8 [14,4]	32.4 [14,7]	33.5 [15,2]	34.4 [15,6]	34.8 [15,8]	35.7 [16,2]	36.2 [16,4]
HWFE	29.1 [13,2]	29.8 [13,5]	30.86 [14,0]	31.8 [14,4]	32.2 [14,6]	33.1 [15,0]	33.5 [15,2]	

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

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

*** For "E"-option it is not recommendable a flow bigger than 75% of the nominal flow rate.

- 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 70 SUS [13 mm²/s] at 122°F [50°C].
- Recommended maximum system operating temperature is 180°F [82°C].
- To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

SPECIFICATION DATA

Type	HW 350	HW 370	HW 400	HW 470	HW 500	HW 535	HW 550	HW 600	
Displacement, cm³/rev [in³/rev]	21.21 [347,8]	22.51 [369,2]	24.2 [396,8]	28.71 [470,6]	30.65 [502,4]	32.7 [535]	33.55 [550]	36.55 [598,8]	
Max. Speed, [RPM]	cont.	216	203	189	159	149	140	136	125
	int.*	288	271	252	244	229	215	209	192
Max. Torque daNm [in-lb]	cont.	8320 [94]	8497 [96]	8497 [96]	8143 [92]	8054 [91]	7966 [90]	7877 [89]	8054 [91]
	int.*	9028 [102]	9293 [105]	8674 [98]	8939 [101]	8939 [101]	9205 [104]	9293 [105]	9382 [106]
Max. Output, kW [HP]	cont.	22 [16,5]	17.7 [13,2]	16.8 [12,5]	14.2 [10,6]	14.5 [10,8]	12.6 [9,4]	12 [9]	11.7 [8,7]
	int.*	27.9 [20,8]	25.7 [19,2]	24.8 [18,5]	23.3 [17,4]	23.9 [17,8]	22 [16,4]	21.2 [15,8]	20.2 [15,1]
Max. Pressure Drop, bar [PSI]	cont.	2970 [205]	2900 [200]	2680 [185]	2180 [150]	2030 [140]	1885 [130]	1815 [125]	1670 [115]
	int.*	3260 [225]	3200 [220]	2760 [190]	2390 [165]	2250 [155]	2180 [150]	2105 [145]	1960 [135]
Max. Oil Flow lpm [GPM]	cont.	20 [75]	20 [75]	20 [75]	20 [75]	20 [75]	20 [75]	20 [75]	20 [75]
	int.*	26.4 [100]	26.4 [100]	26.4 [100]	26.4 [100]	30.4 [115]	30.4 [115]	30.4 [115]	30.4 [115]
Max. Inlet Pressure, bar [PSI]	cont.	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]	3050 [210]
	int.*	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]	3625 [250]
Max. Starting Pressure with Unloaded Shaft, bar [PSI]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	
Min. Starting Torque daNm [in-lb]	at max. press. drop cont.	6815 [77]	7036 [79,5]	6966 [78,7]	6674 [75,4]	6603 [74,6]	6532 [73,8]	6452 [72,92]	6373 [72,0]
	at max. press. drop int.*	7400 [83,6]	7612 [86]	7107 [80,3]	7328 [82,8]	7328 [82,8]	7540 [85,2]	7470 [84,4]	7617 [83,8]
Min. Speed**, [RPM]	8	8	8	8	8	5	5	5	
Weight, avg. kg [lb]	HW	36.8 [16,7]	37.3 [16,9]	38.1 [17,3]	39.9 [18,1]	40.6 [18,4]	41.5 [18,8]	41.7 [18,9]	44.9 [20,4]
	HWF(FV)	33.5 [15,2]	34.0 [15,4]	34.8 [15,8]	36.6 [16,6]	37.3 [16,9]	38.1 [17,3]	38.3 [17,4]	41.4 [18,8]
	HWFR	37.9 [17,2]	38.4 [17,4]	39.2 [17,8]	41.0 [18,6]	41.7 [18,9]	42.5 [19,3]	42.8 [19,4]	46.3 [21,0]
	HWS	36.2 [16,4]	36.6 [16,6]	37.5 [17,0]	39.2 [17,8]	39.9 [18,1]	40.8 [18,5]	41.0 [18,6]	44.3 [20,1]
	HWSW	35.5 [16,1]	35.9 [16,3]	36.8 [16,7]	38.6 [17,5]	39.2 [17,8]	40.1 [18,2]	40.3 [18,3]	43.7 [19,8]
	HWSR	40.6 [18,4]	41.0 [18,6]	41.9 [19,0]	43.7 [19,8]	44.3 [20,1]	45.2 [20,5]	45.4 [20,6]	48.9 [22,2]
	HWD	37.0 [16,8]	37.7 [17,1]	38.6 [17,5]	40.3 [18,3]	41.0 [18,6]	41.9 [19,0]	42.1 [19,1]	45.4 [20,6]
	HWV	36.2 [16,4]	36.6 [16,6]	37.5 [17,0]	39.2 [17,8]	39.9 [18,1]	40.8 [18,5]	41.0 [18,6]	44.3 [20,1]
	HWE	37.7 [17,1]	38.1 [17,3]	39.0 [17,7]	40.8 [18,5]	41.7 [18,9]	42.3 [19,2]	42.5 [19,3]	45.9 [20,8]
	HWSE	37.0 [16,8]	37.5 [17,0]	38.4 [17,4]	40.1 [18,2]	40.8 [18,5]	41.7 [18,9]	41.9 [19,0]	45.2 [20,5]
HWFE	34.4 [15,6]	34.8 [15,8]	35.7 [16,2]	37.5 [17,0]	38.1 [17,3]	39.0 [17,7]	39.2 [17,8]	42.3 [19,2]	

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

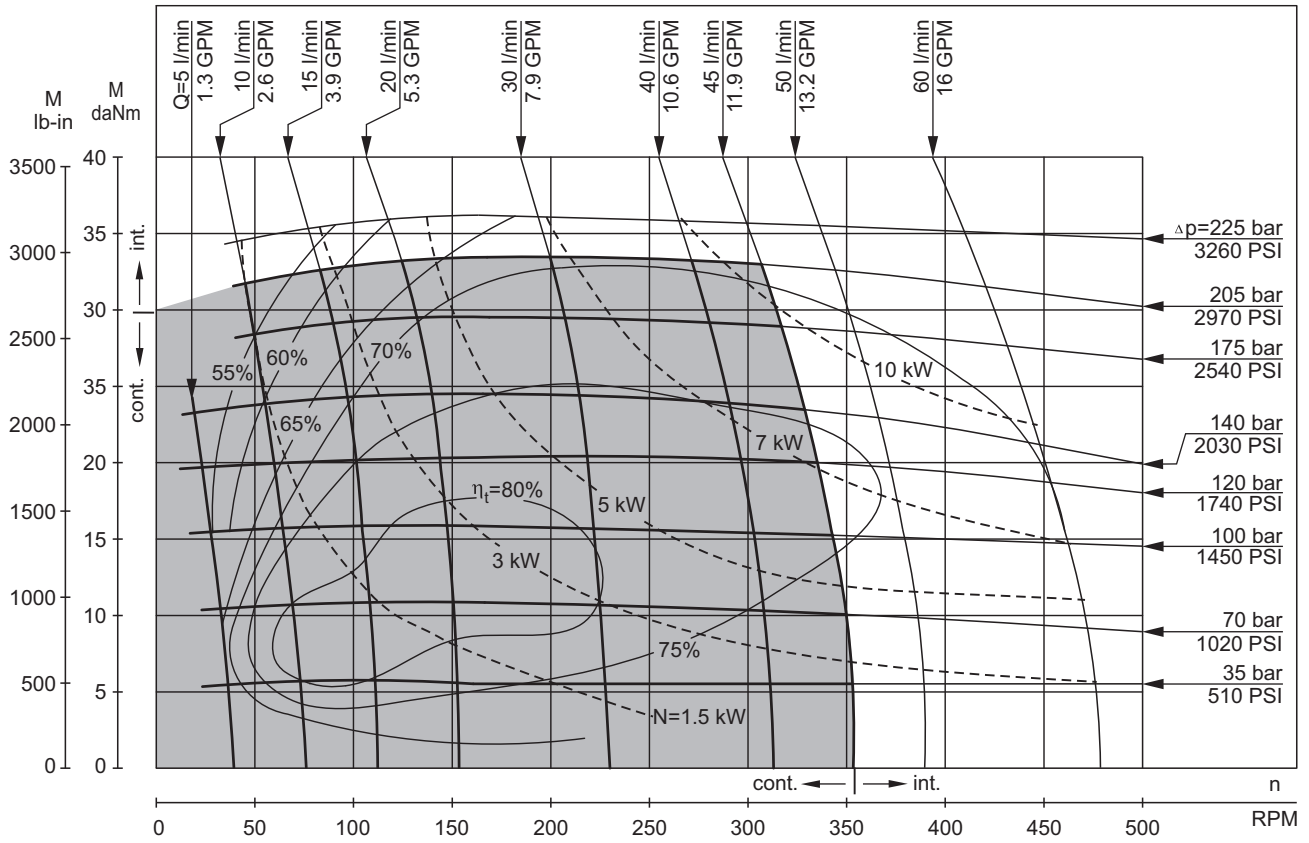
For speeds lower than given, consult factory or your regional manager.

For "E"-option it is not recommendable a flow bigger than 75% of the nominal flow rate.

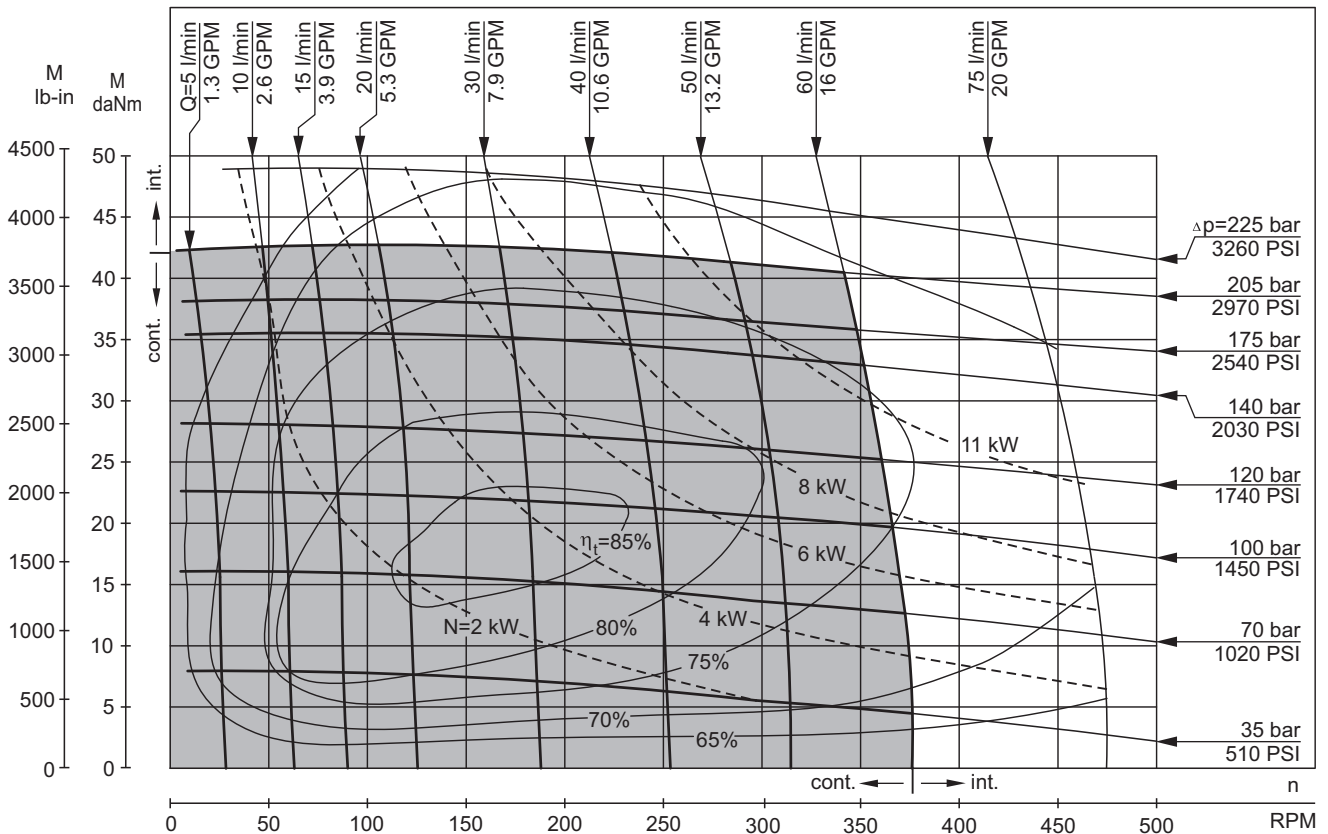
- Intermittent speed and intermittent pressure must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP(DIN51524) or HM (ISO 6743/4).
If using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

FUNCTION DIAGRAMS

HW 125



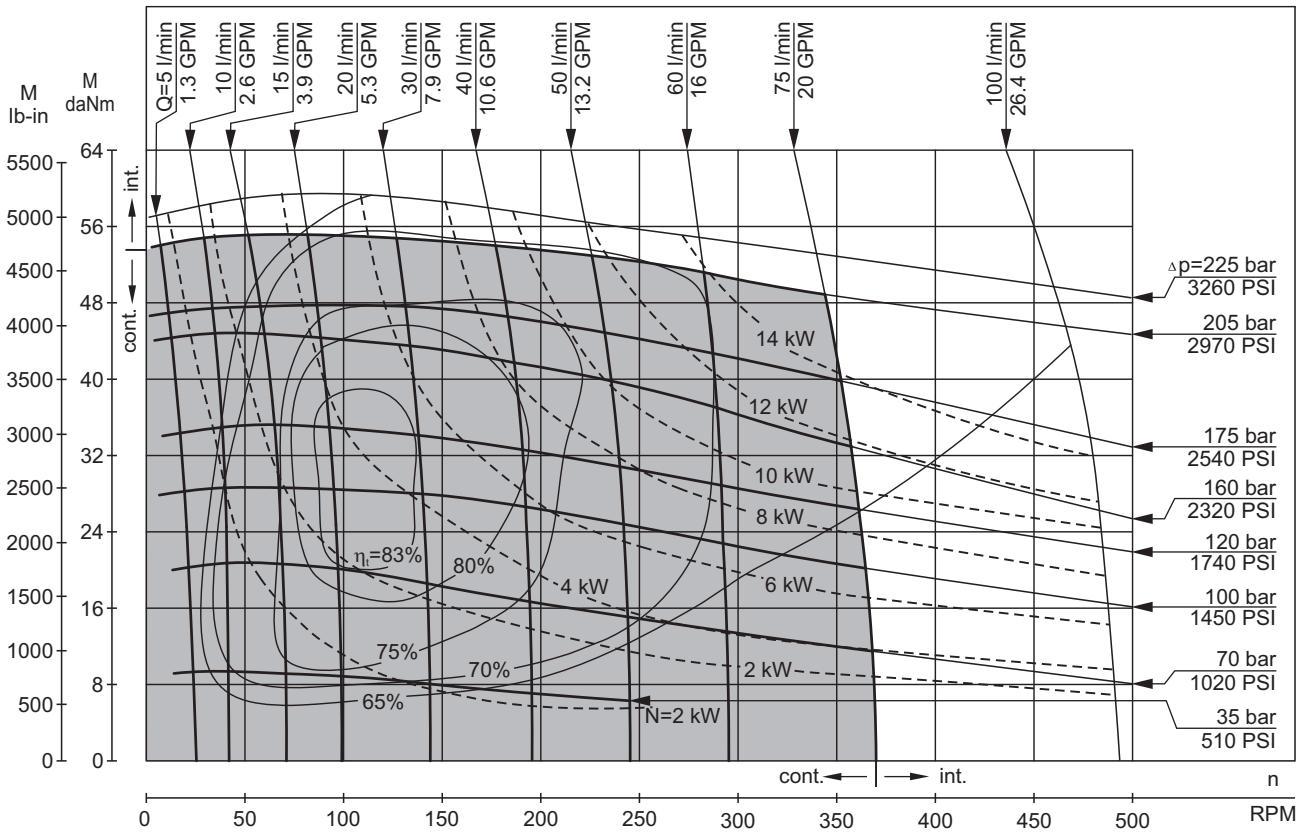
HW 160



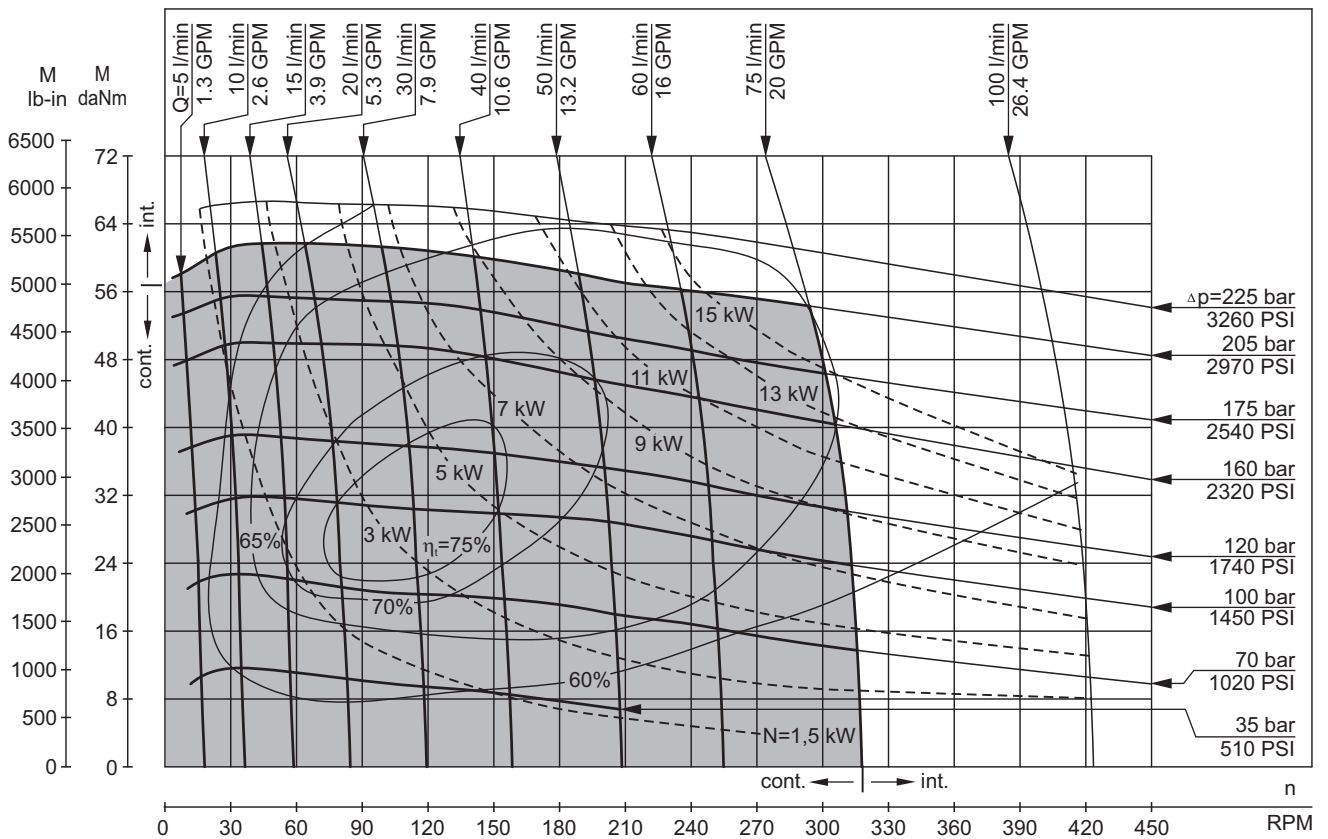
The function diagrams data is for average performance of randomly selected motors at back pressure 72.5 PSI [5-10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

FUNCTION DIAGRAMS

HW 200



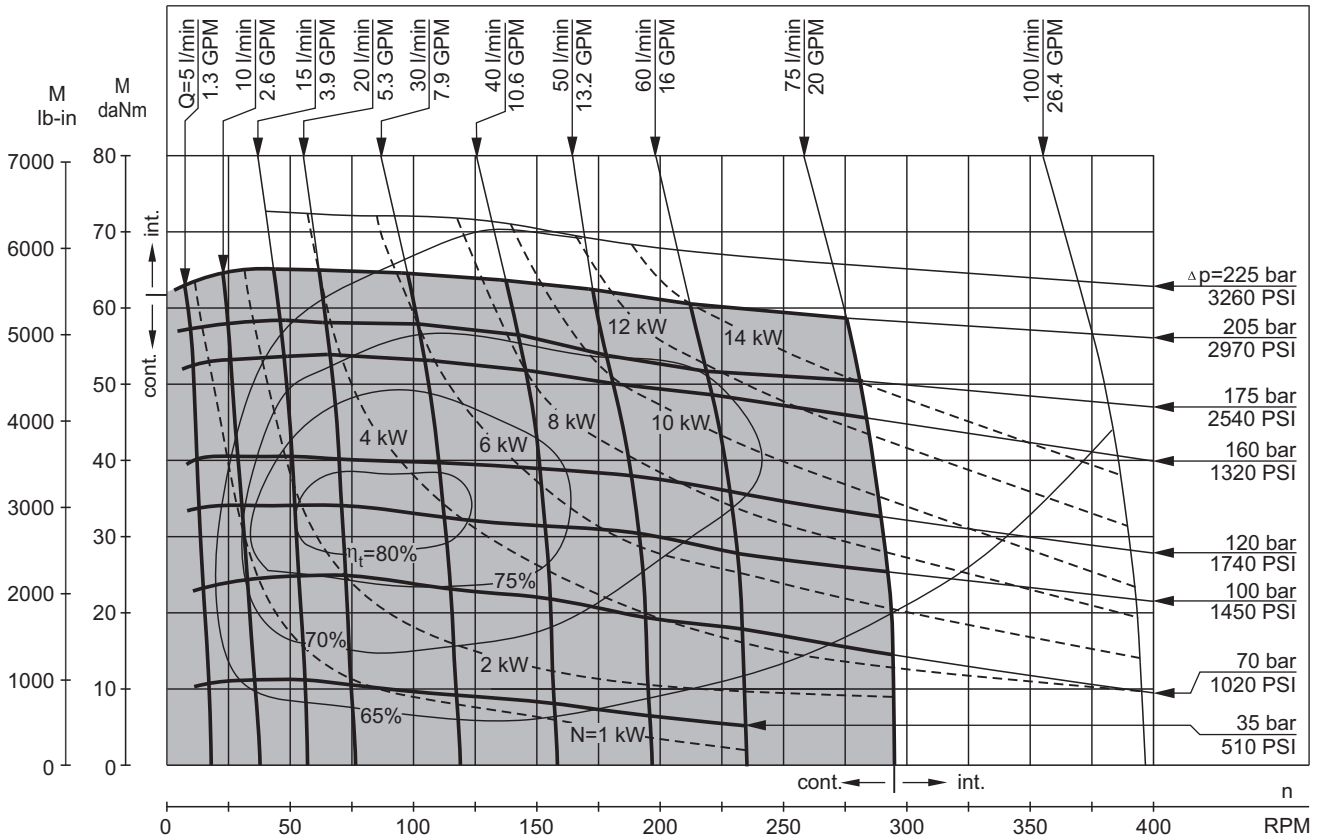
HW 235



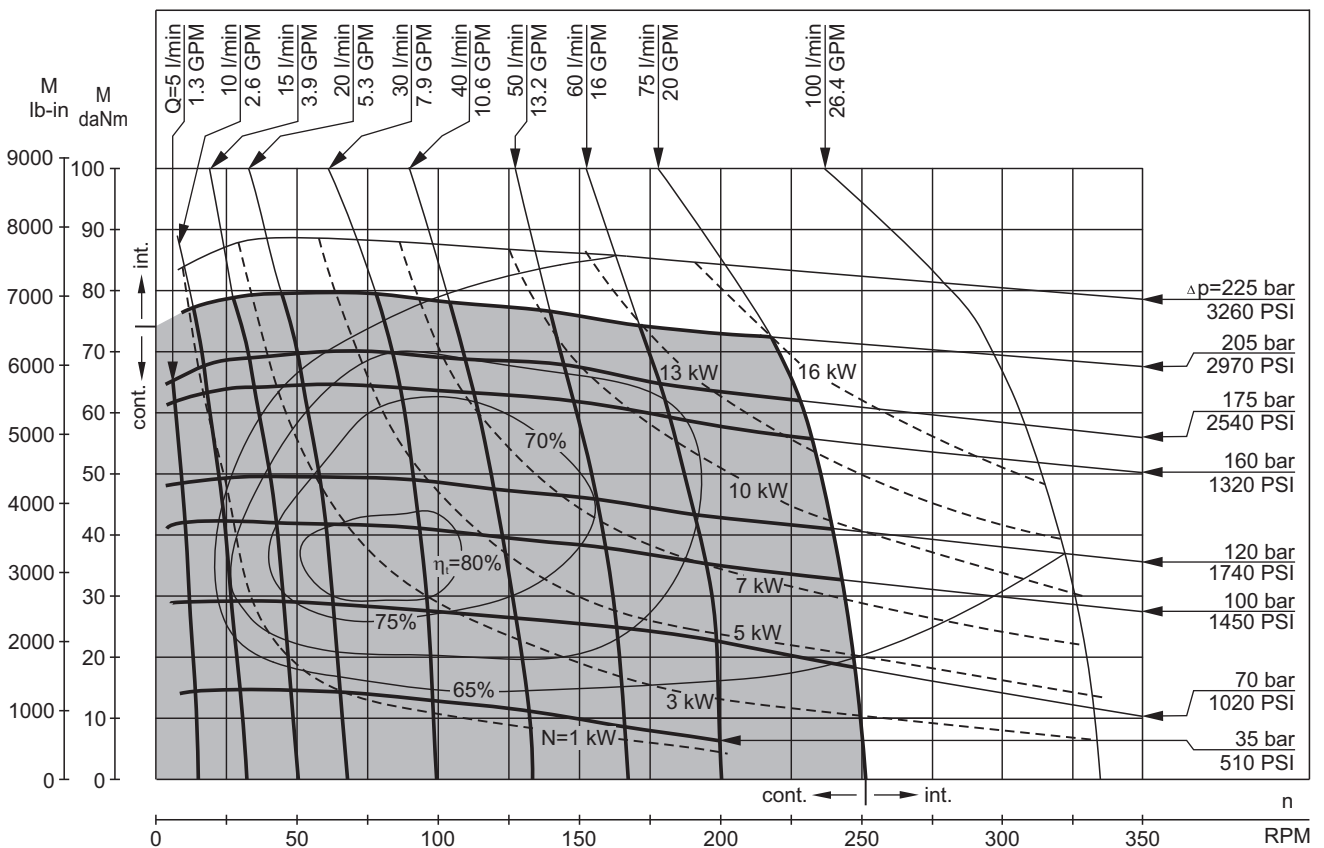
The function diagrams data is for average performance of randomly selected motors at back pressure 72.5 PSI \pm 145 PSI [5 \pm 10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

FUNCTION DIAGRAMS

HW 250



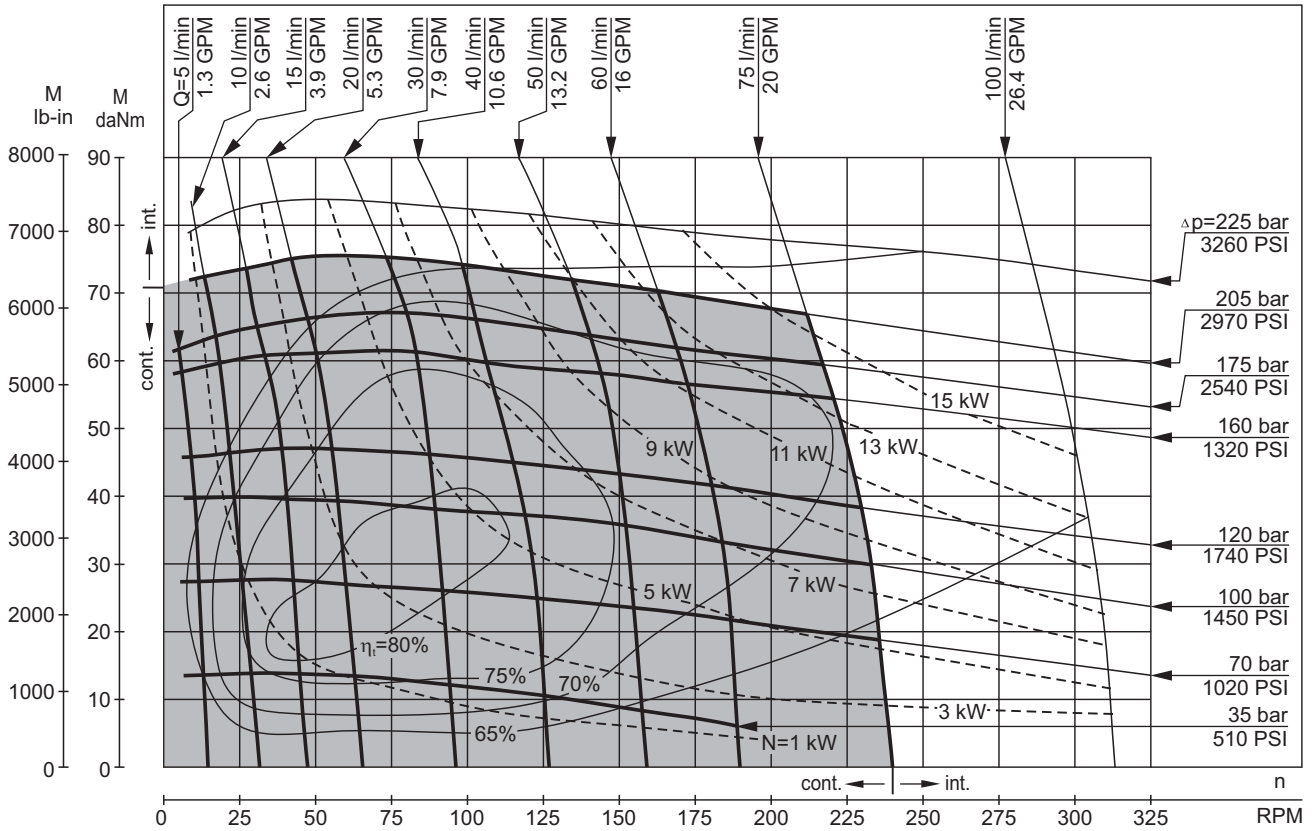
HW 300



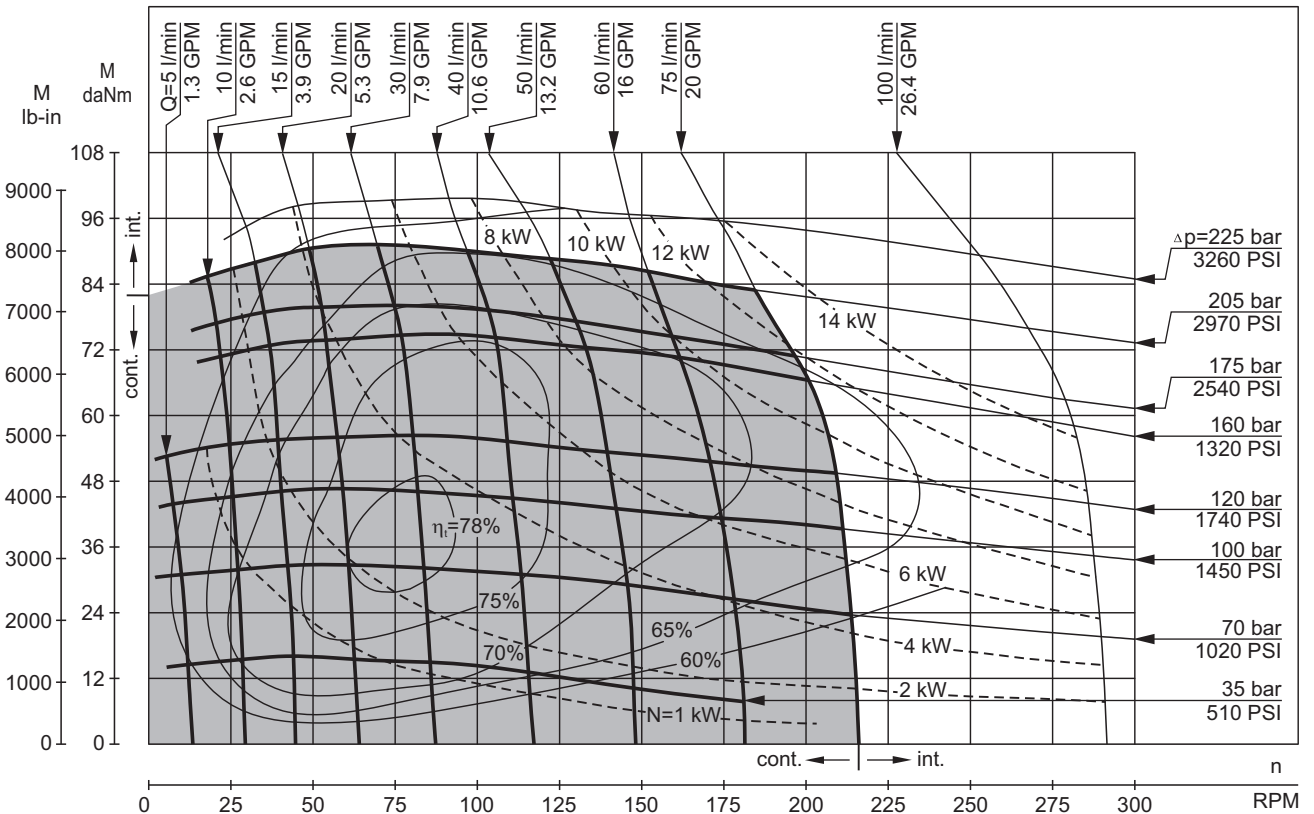
The function diagrams data is for average performance of randomly selected motors at back pressure 72.5 PSI ± 145 PSI [5 ± 10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

FUNCTION DIAGRAMS

HW 315



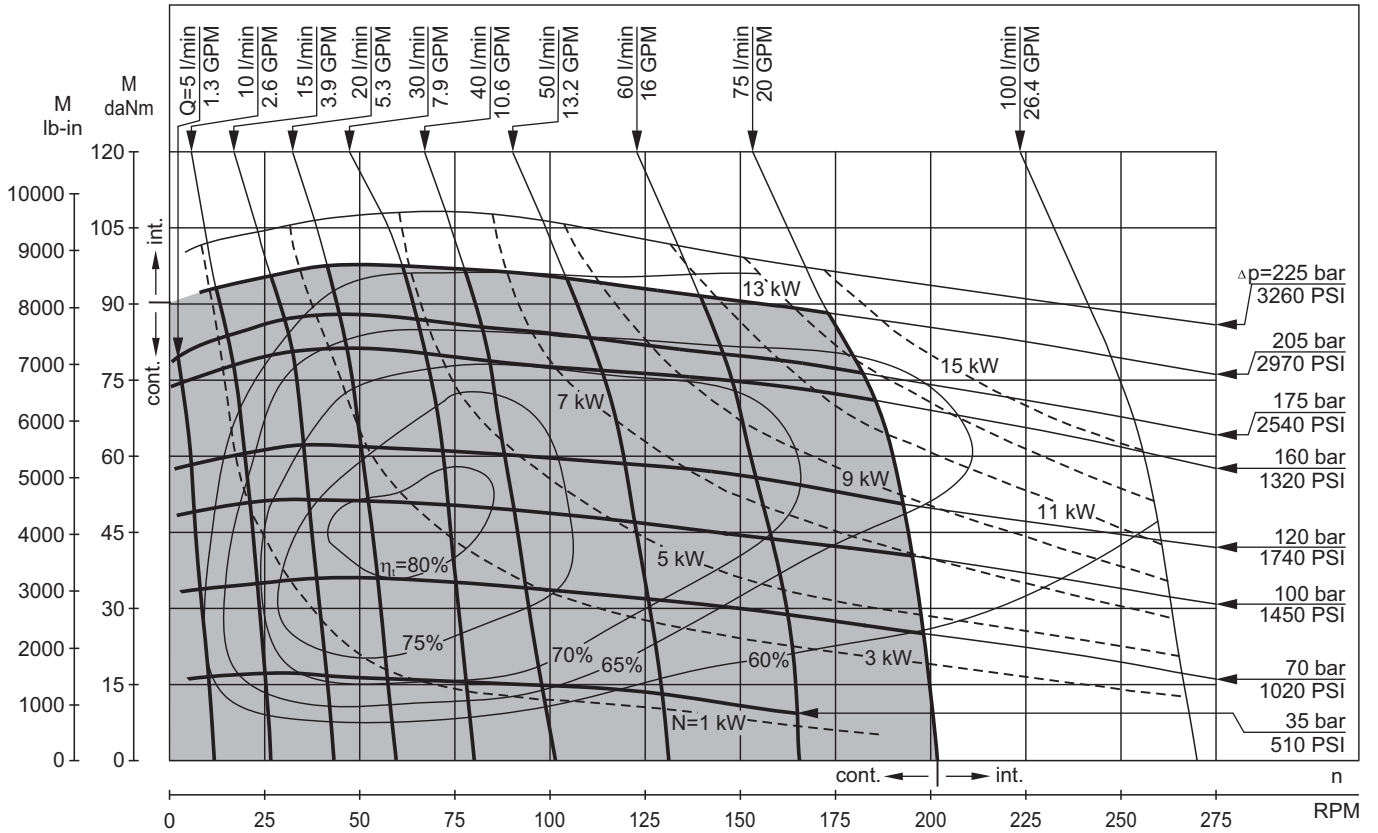
HW 350



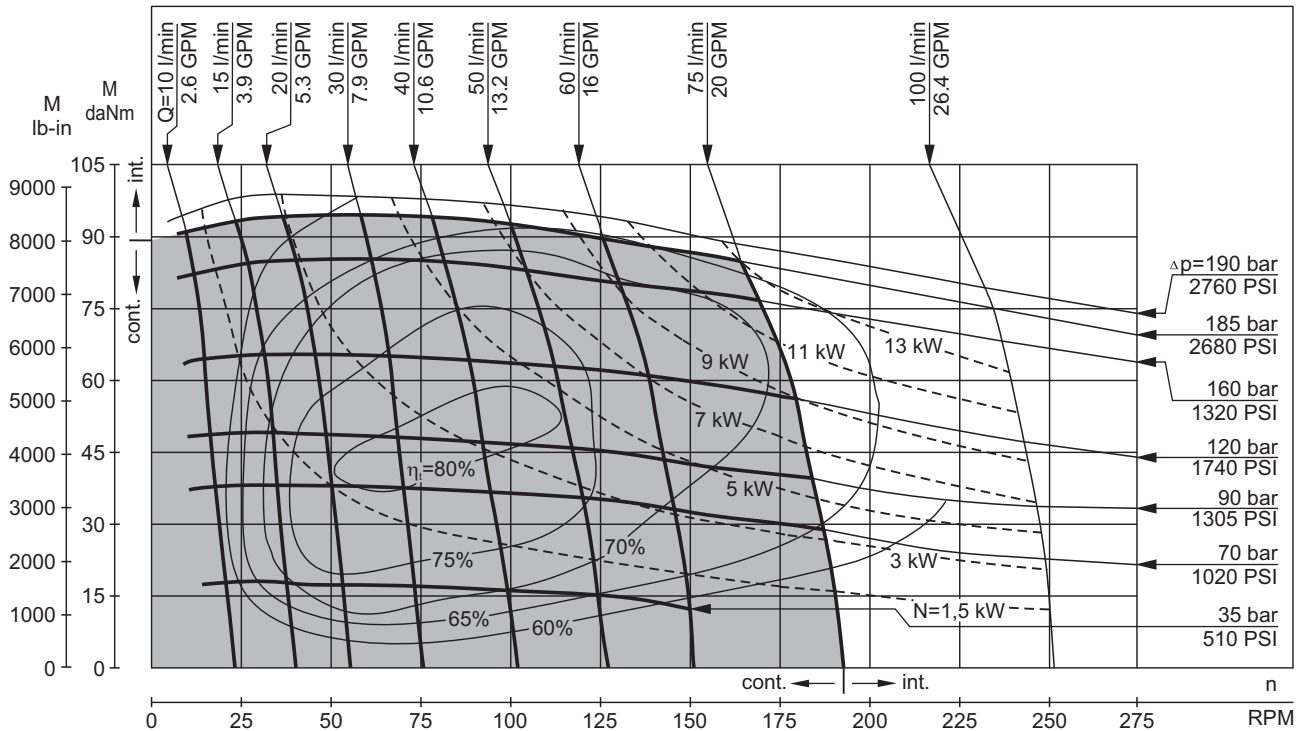
The function diagrams data is for average performance of randomly selected motors at back pressure 72.5 PSI ± 145 PSI [5 ± 10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

FUNCTION DIAGRAMS

HW 370



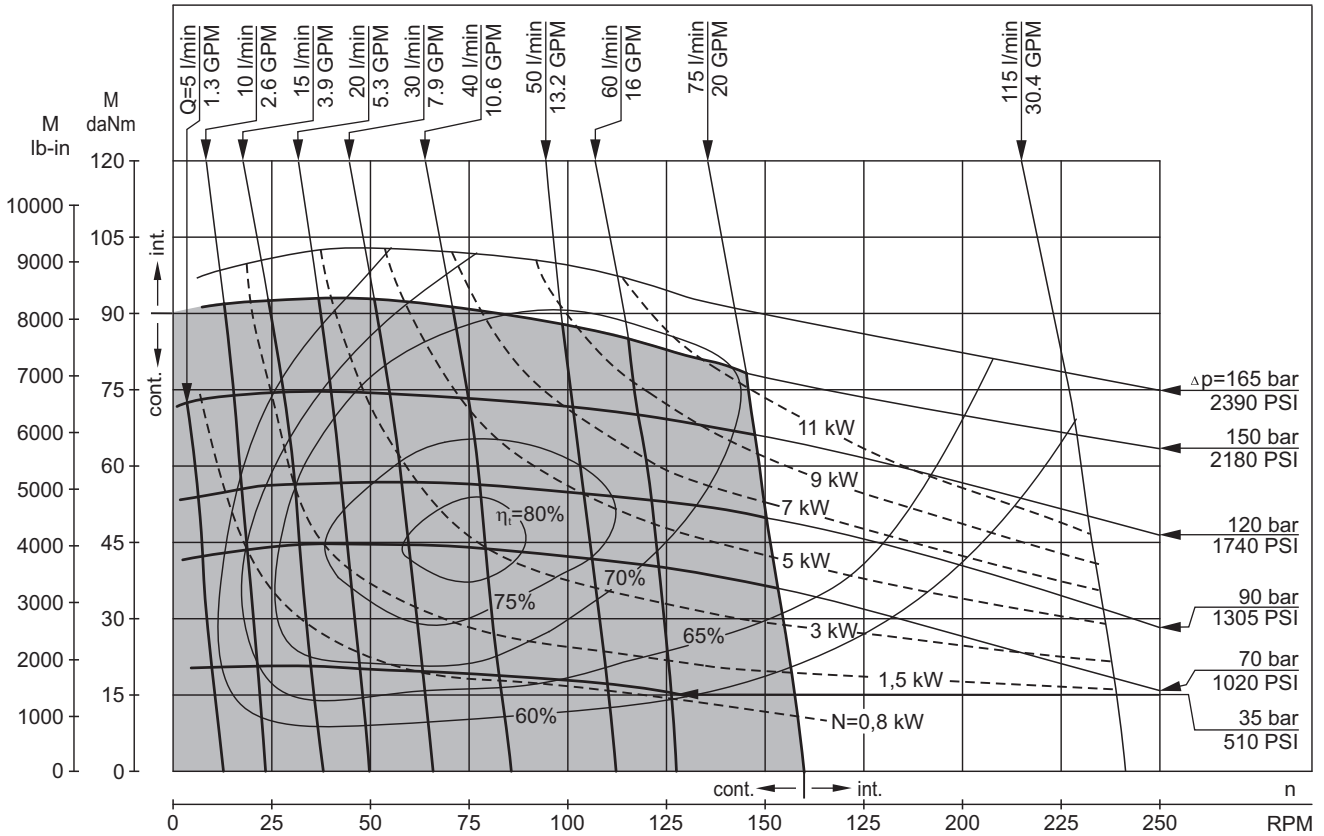
HW 400



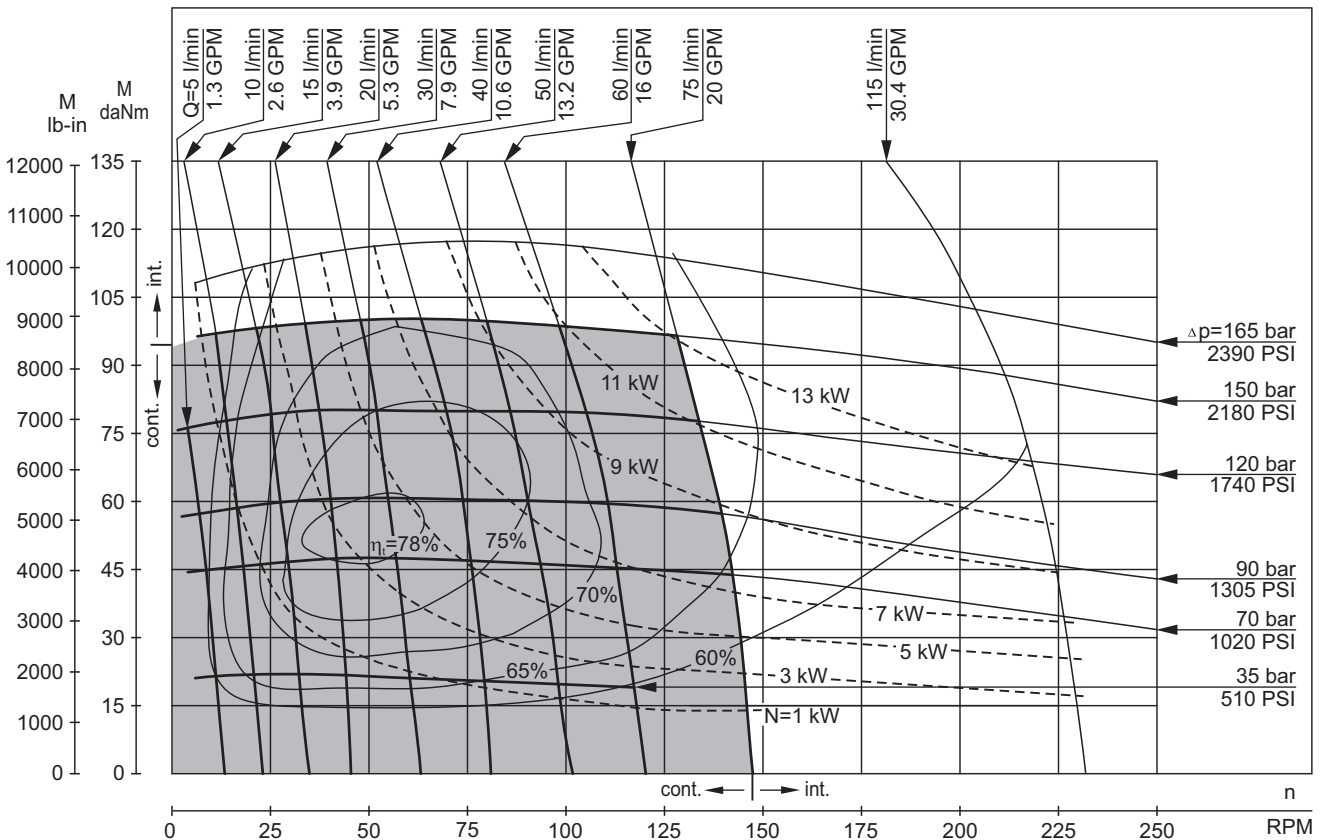
The function diagrams data is for average performance of randomly selected motors at back pressure 72.5 PSI [5-10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

FUNCTION DIAGRAMS

HW 470



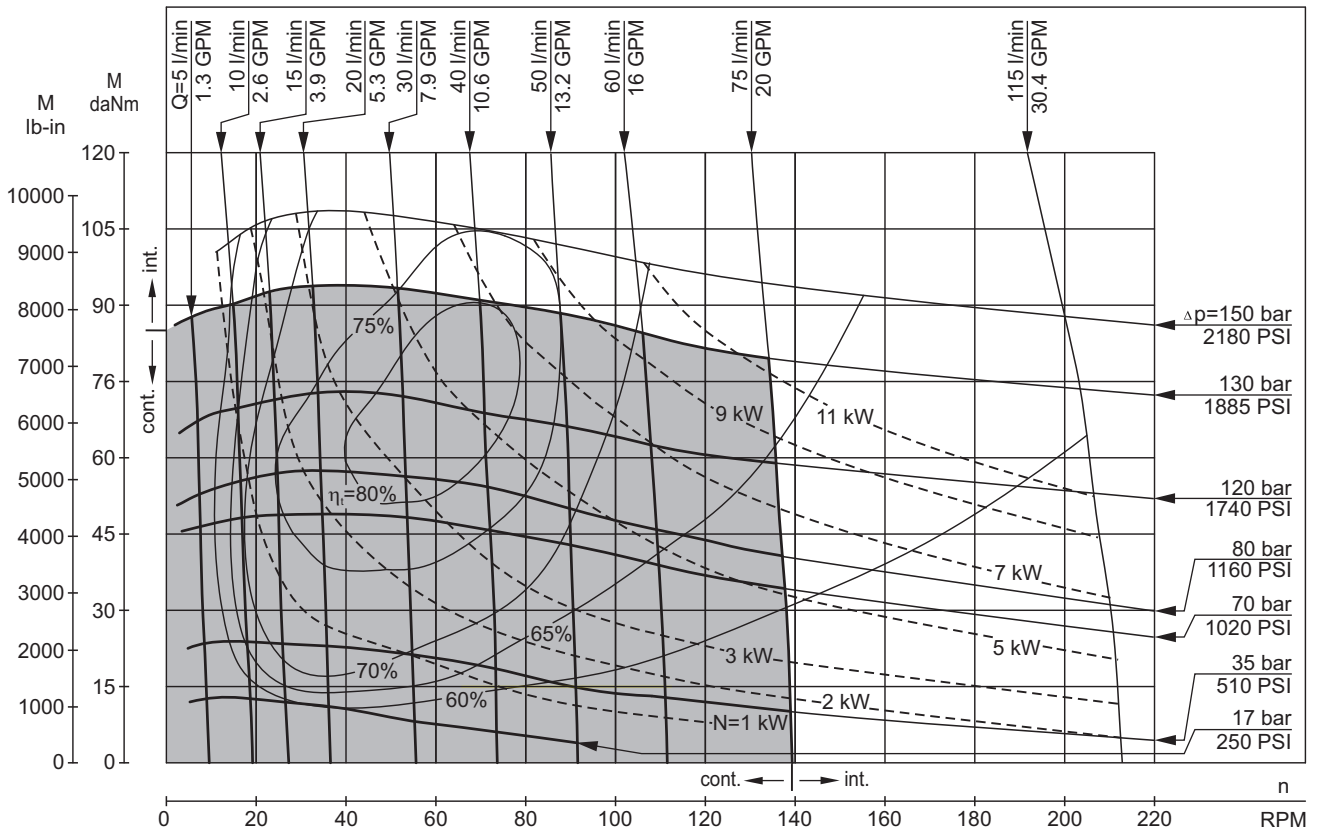
HW 500



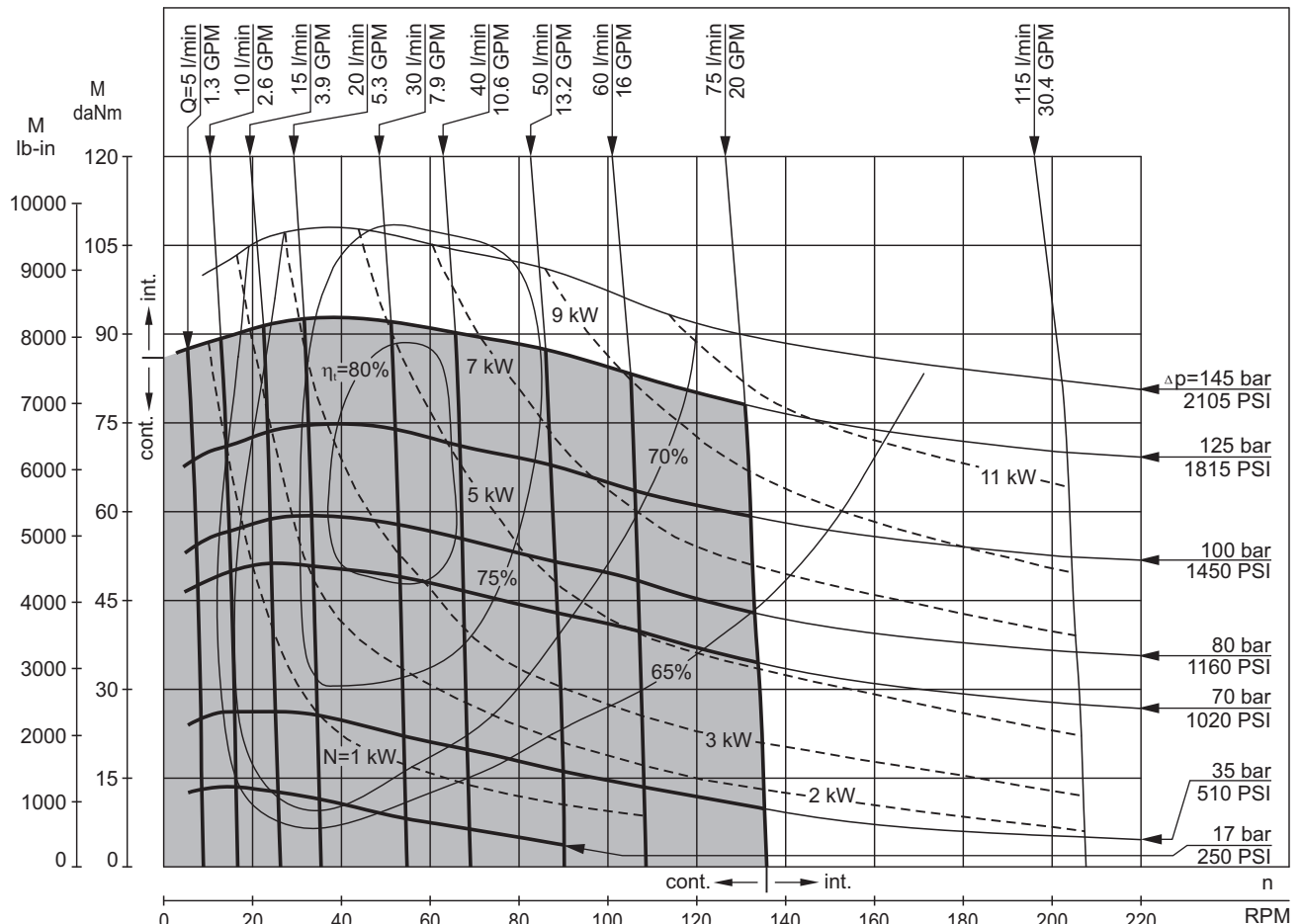
The function diagrams data is for average performance of randomly selected motors at back pressure 72.5 PSI \pm 145 PSI [5 \pm 10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

FUNCTION DIAGRAMS

HW 535



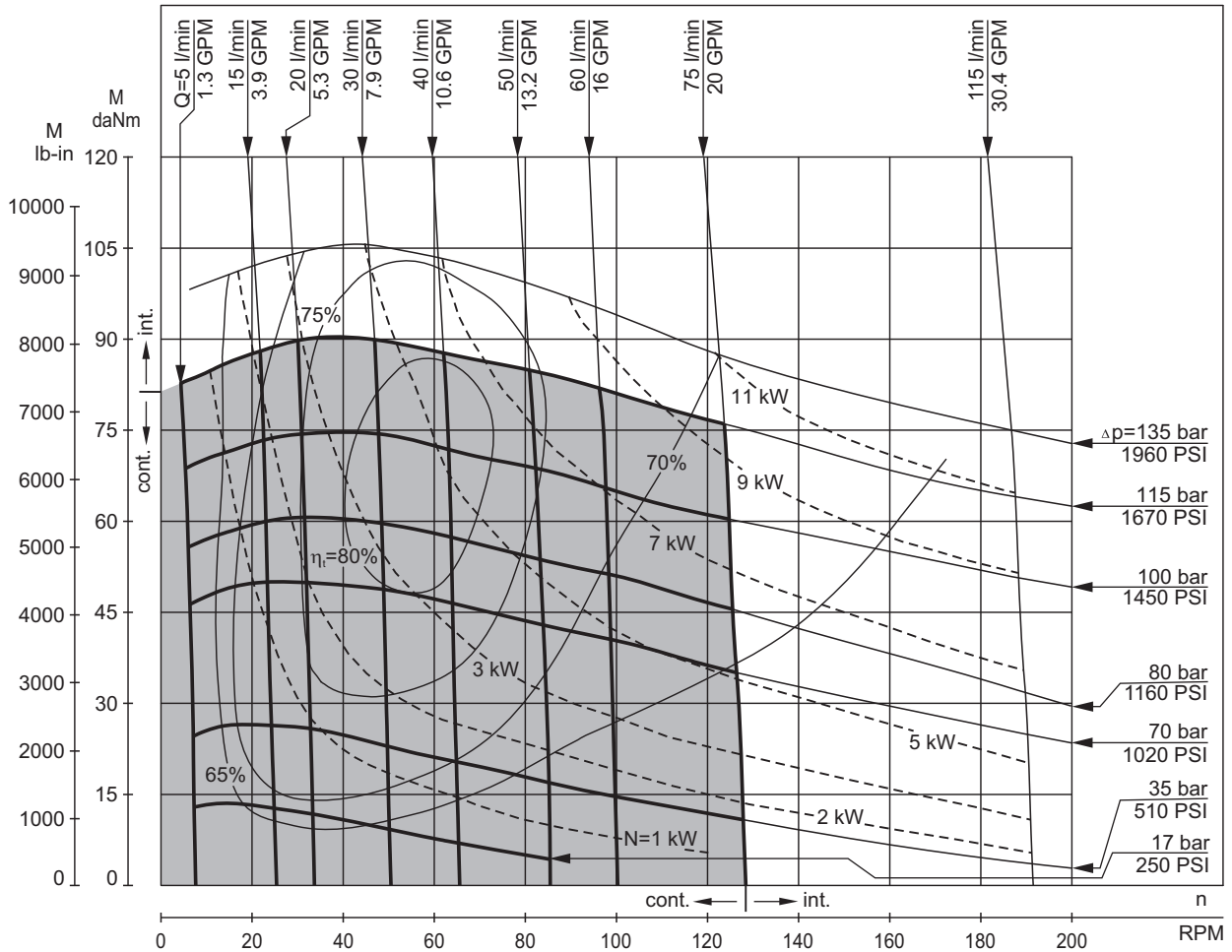
HW 550



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

FUNCTION DIAGRAMS

HW 600



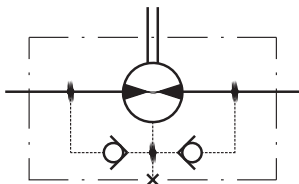
The function diagrams data is for average performance of randomly selected motors at back pressure 72.5 PSI±145 PSI [5±10 bar] and oil with viscosity of 150 SUS [32 mm²/s] at 122°F [50°C].

MAX. PERMISSIBLE SHAFT SEAL PRESSURE

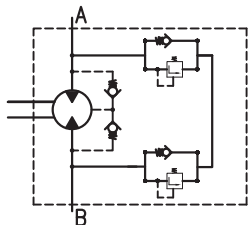
HW... motors with drain connection:

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

HW, HWF, HWS, HWD,
HWV, HWSW

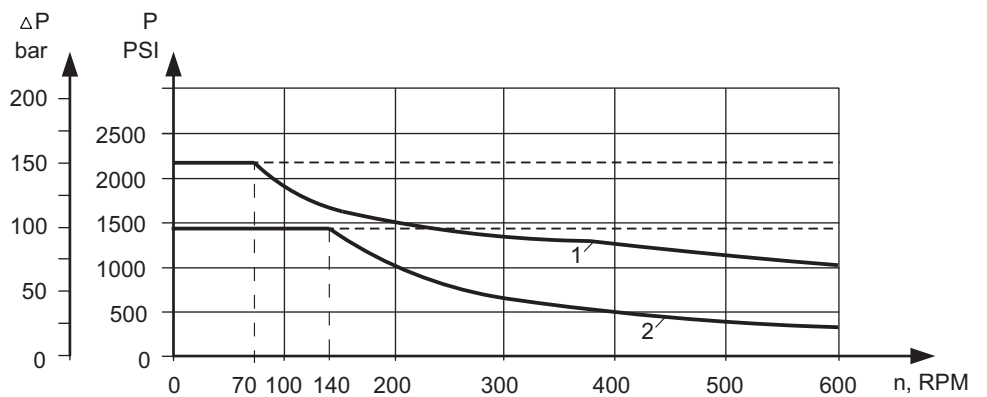


HWFR, HWSR



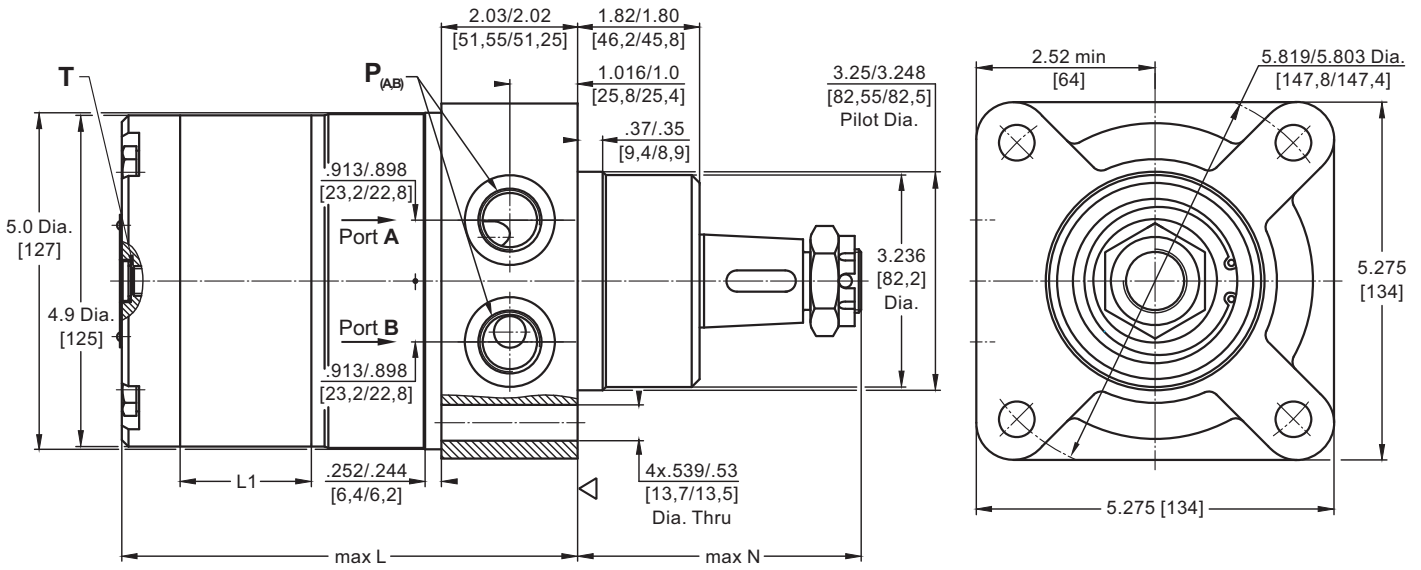
- 1 - standard version
- 2 - shaft "C" version

- - continuous operations
- - - - - intermittent operations

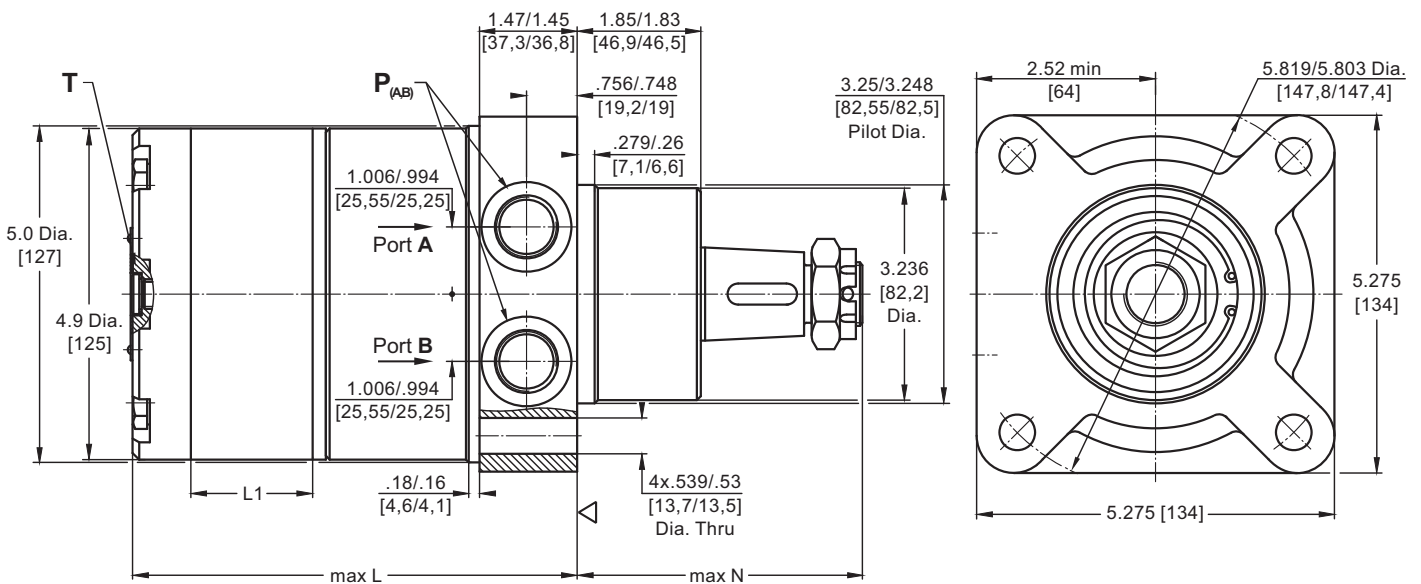


DIMENSIONS AND MOUNTING DATA

HW Wheel mount



HWS Wheel mount



Type	*L, in [mm]	L1, in [mm]
HW(S) 125	5.51 [140,5]	.68 [17,4]
HW(S) 160	5.71 [145,0]	.86 [21,8]
HW(S) 200	5.95 [151,0]	1.09 [27,8]
HW(S) 235	6.12 [155,5]	1.28 [32,5]
HW(S) 250	6.22 [158,0]	1.37 [34,8]
HW(S) 300	6.48 [164,5]	1.63 [41,4]
HW(S) 315	6.56 [166,5]	1.71 [43,5]
HW(S) 350	6.73 [171,0]	1.89 [48,0]
HW(S) 370	6.85 [174,0]	2.01 [51,0]
HW(S) 400	7.01 [178,0]	2.16 [54,8]
HW(S) 470	7.40 [188,0]	2.56 [65,0]
HW(S) 500	7.58 [192,5]	2.73 [69,4]
HW(S) 535	7.76 [197,0]	2.92 [74,1]
HW(S) 550	7.84 [199,0]	2.99 [76,0]
HW(S) 600	8.09 [205,6]	3.25 [82,6]

▽ - Motor Mounting Surface

Note: For N see pages 101÷102.



	Versions	
	2	4
P _(A,B)	2xG $\frac{1}{2}$	2x $\frac{7}{8}$ -14UNF, O-ring
T	G $\frac{1}{4}$	$\frac{7}{16}$ -20UNF, O-ring

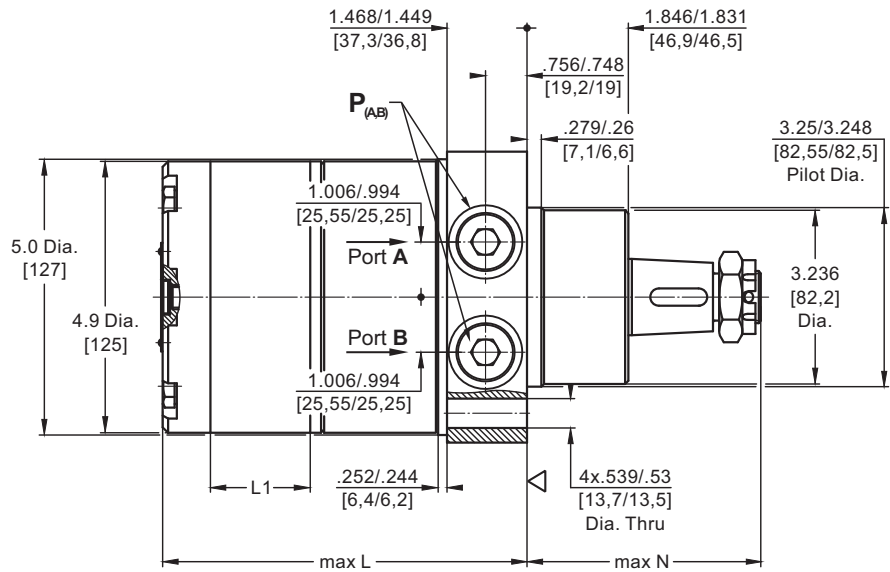
Standard Rotation
Viewed from Shaft End
Port A Pressurized - CW
Port B Pressurized - CCW

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

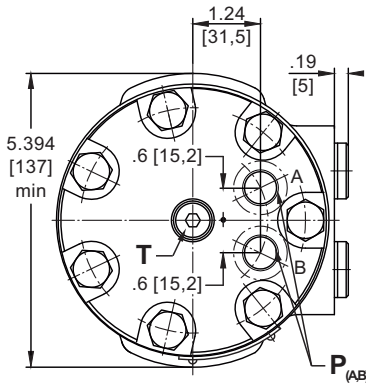
* For LSV option the dimension L is .118 in [3 mm] greater.

DIMENSIONS AND MOUNTING DATA

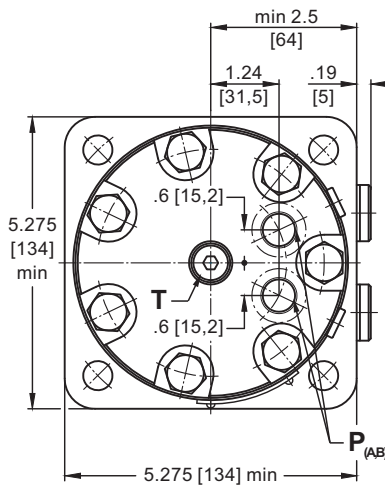
HWSE Wheel mount, rear ports



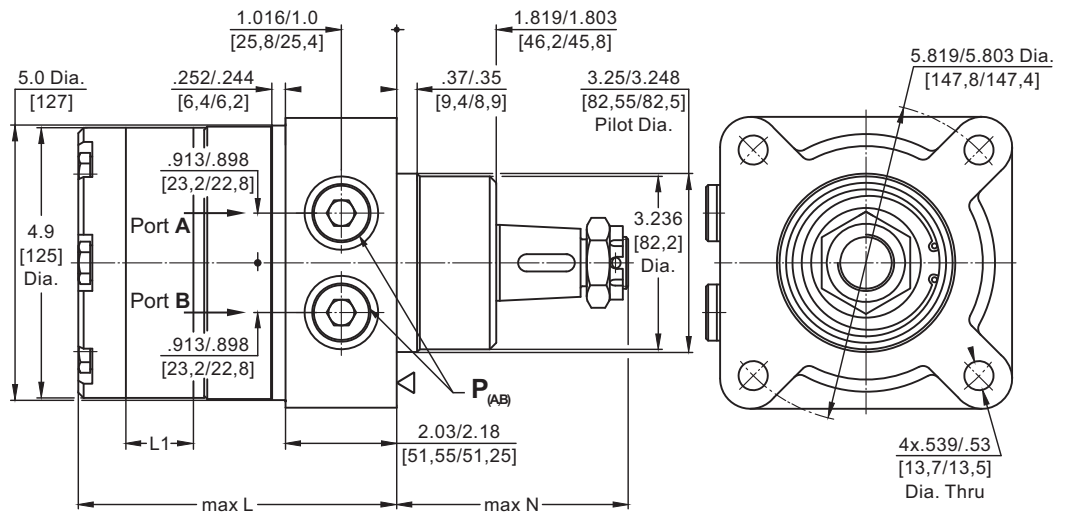
HWFE Magneto mount



HW(S)E



HWE Wheel mount, rear ports



Type	*L, mm [in]		L ₁ , mm [in]
	HWE, HWSE	HWFE	
HW... 125	5.73 [145,5]	7.44 [189,0]	.68[17,4]
HW... 160	5.91 [150,0]	7.62 [193,5]	.86 [21,8]
HW... 200	6.14 [156,0]	7.85 [199,5]	1.09 [27,8]
HW... 235	6.32 [160,5]	8.03 [204,0]	1.28 [32,5]
HW... 250	6.42 [163,0]	8.13 [206,5]	1.37 [34,8]
HW... 300	6.67 [169,5]	8.39 [213,0]	1.63 [41,4]
HW... 315	6.75 [171,5]	8.46 [215,0]	1.71 [43,5]
HW... 350	6.93 [176,0]	8.64 [219,5]	1.89 [48,0]
HW... 370	7.05 [179,0]	8.76 [222,5]	2.01 [51,0]
HW... 400	7.20 [183,0]	8.92 [226,5]	2.16 [54,8]
HW... 470	7.60 [193,0]	9.31 [236,5]	2.56 [65,0]
HW... 500	7.78 [197,5]	9.49 [241,0]	2.73 [69,4]
HW... 535	7.95 [202,0]	9.67 [245,5]	2.92 [74,1]
HW... 550	8.03 [204,0]	9.74 [247,5]	2.99 [76,0]
HW... 600	8.29 [210,6]	10.00 [254,1]	3.25 [82,6]

▽ - Motor Mounting Surface

Note: For N see pages 101+102.

	Versions	
	5	6
P _(A,B)	2xG $\frac{3}{8}$	2x $\frac{3}{16}$ -14UNF, O-ring
T	G $\frac{1}{4}$	$\frac{7}{16}$ -20UNF, O-ring

Standard Rotation

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

Reverse Rotation

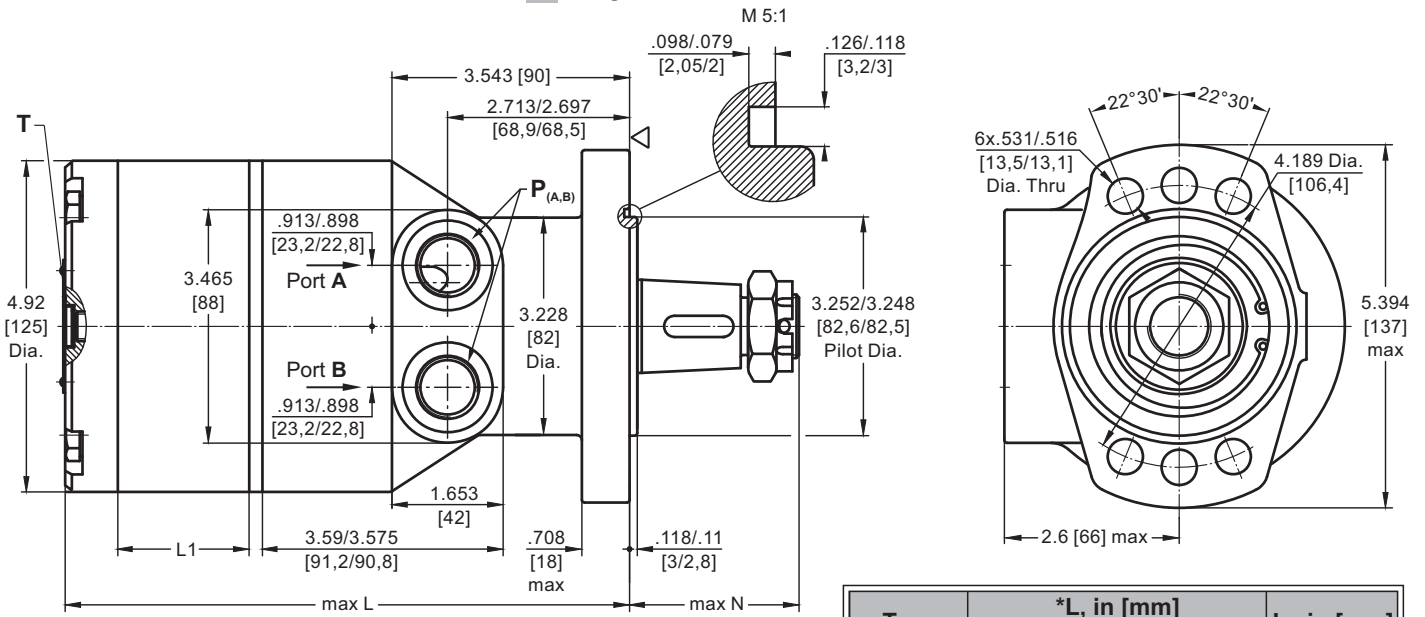
Viewed from Shaft End
Port A Pressurized - **CCW**
Port B Pressurized - **CW**



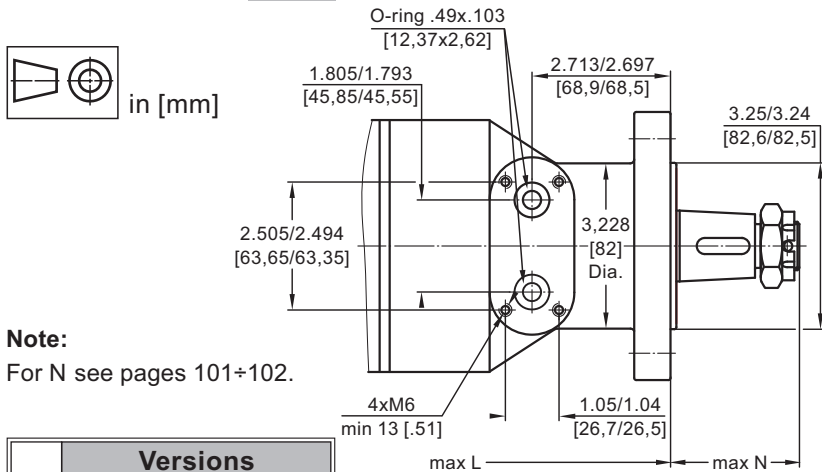
* For LSV option the dimension L is .118 in [3 mm] greater.

DIMENSIONS AND MOUNTING DATA

F Magneto mount, six holes



HWFV Magneto mount, six holes, relief valves



Note:
For N see pages 101+102.

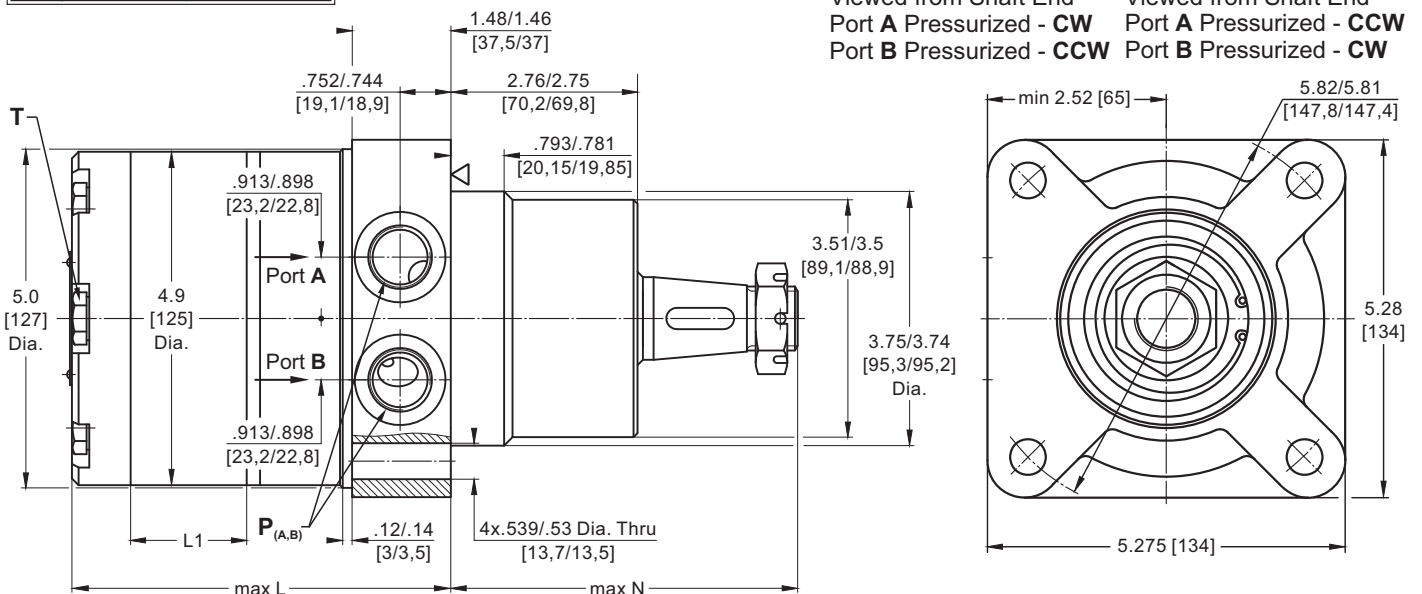
Type	*L, in [mm]		L ₁ , in [mm]
	HWSW	HWF(V)	
HW... 125	4.61 [117,0]	7.24 [184,0]	.68 [17,4]
HW... 160	4.78 [121,5]	7.42 [188,5]	.86 [21,8]
HW... 200	5.00 [127,0]	7.66 [194,5]	1.09 [27,8]
HW... 235	5.20 [132,0]	7.84 [199,0]	1.28 [32,5]
HW... 250	5.30 [134,5]	7.93 [201,5]	1.37 [34,8]
HW... 300	5.55 [141,0]	8.20 [208,0]	1.63 [41,4]
HW... 315	5.63 [143,0]	8.27 [210,0]	1.71 [43,5]
HW... 350	5.81 [147,5]	8.45 [214,5]	1.89 [48,0]
HW... 370	5.94 [151,0]	8.56 [217,5]	2.01 [51,0]
HW... 400	6.08 [154,5]	8.72 [221,5]	2.16 [54,8]
HW... 470	6.48 [164,5]	9.11 [231,5]	2.56 [65,0]
HW... 500	6.65 [169,0]	9.29 [236,0]	2.73 [69,4]
HW... 535	6.85 [174,0]	9.47 [240,5]	2.92 [74,1]
HW... 550	6.91 [175,5]	9.55 [242,5]	2.99 [76,0]
HW... 600	7.16 [182,1]	9.81 [249,1]	3.25 [82,6]

* For LSV option the dimension L is .118 in [3 mm] greater.

	Versions	
	2	4
P _(A,B)	2xG½	2x⅞-14UNF, O-ring
T	G¼	⅞-20UNF, O-ring

▽ - Motor Mounting Surface

HWSW Wheel mount



Standard Rotation

Viewed from Shaft End

Port A Pressurized - CW

Port B Pressurized - CCW

Reverse Rotation

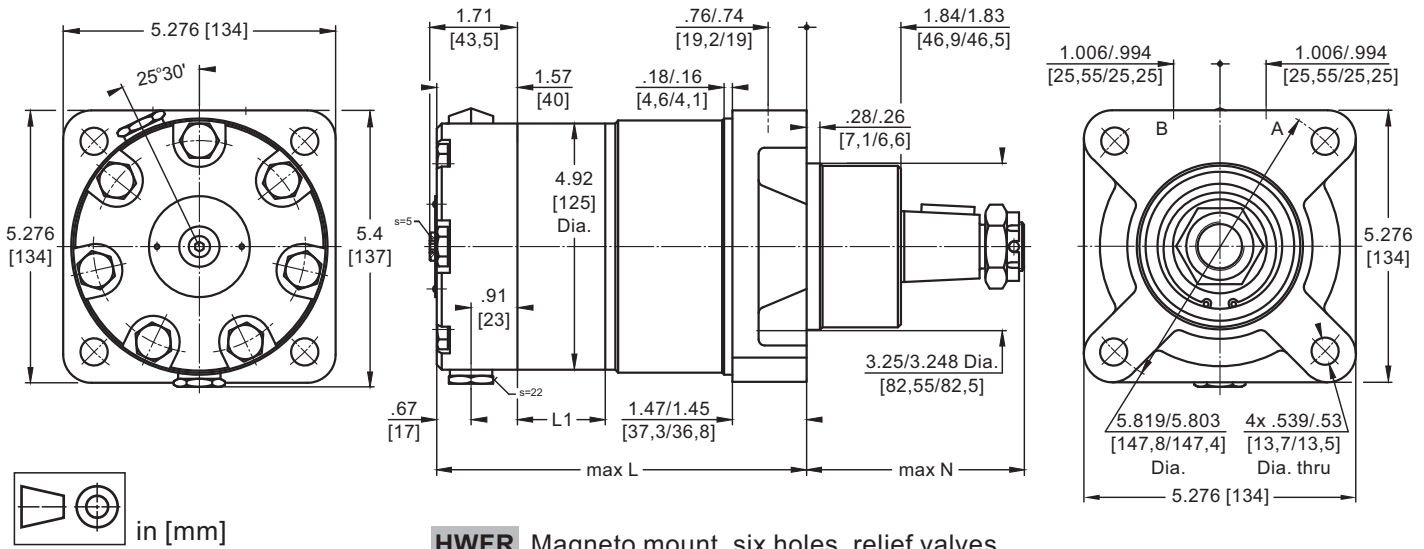
Viewed from Shaft End

Port A Pressurized - CCW

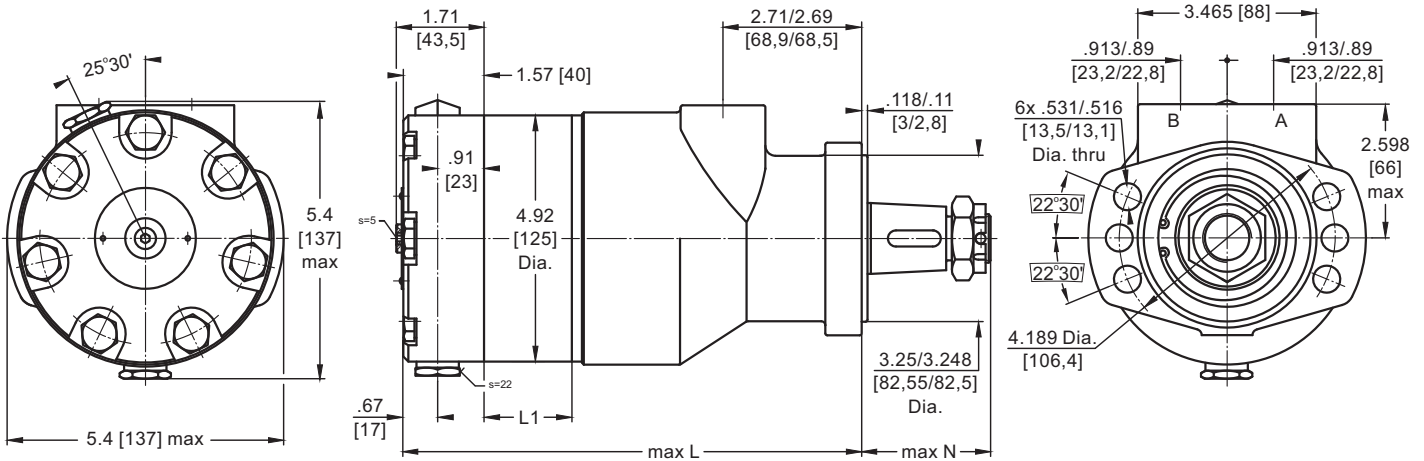
Port B Pressurized - CW

DIMENSIONS AND MOUNTING DATA

HWSR Wheel mount, relief valves



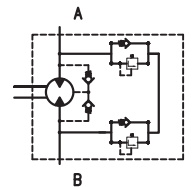
HWFR Magneto mount, six holes, relief valves



Versions		
	2	4
P _(A,B)	2xG½	2x7/8-14UNF, O-ring

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

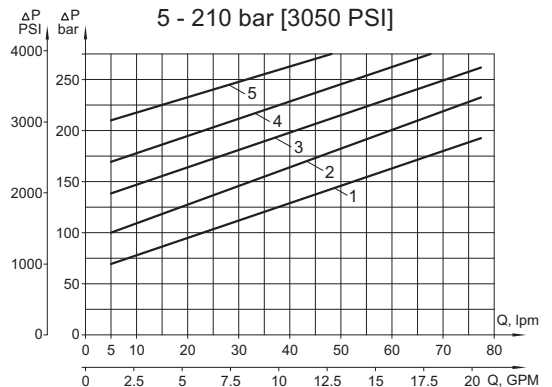


▽ - Motor Mounting Surface

Note: For N see pages 101+102.

**Pressure Settings at Flow Q=1.32 GPM [5 lpm]
150 SUS [32 mm²/s]; 122°F [50°C]**

- 1 - 70 bar [1015 PSI]
- 2 - 100 bar [1450 PSI]
- 3 - 140 bar [2030 PSI]
- 4 - 170 bar [2470 PSI]
- 5 - 210 bar [3050 PSI]

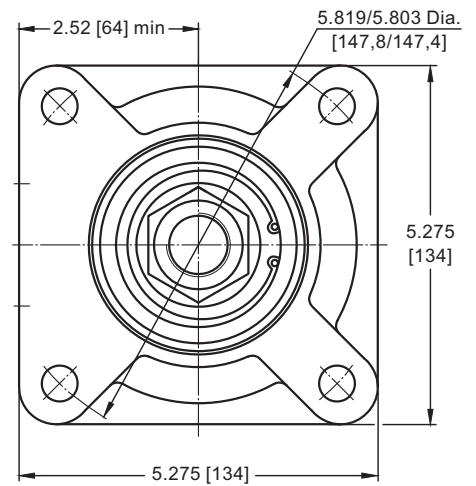
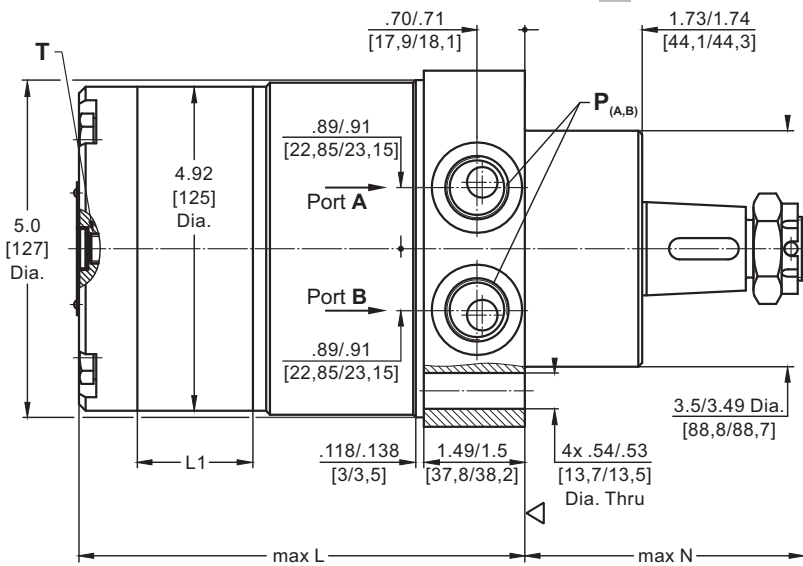


Type	*L, mm [in]		L ₁ , mm [in]
	HWSR	HWFR	
HW... 125	158,5 [6.24]	202,0 [7.95]	17,4 [.68]
HW... 160	163,0 [6.42]	206,5 [8.13]	21,8 [.86]
HW... 200	169,0 [6.65]	212,5 [8.37]	27,8 [1.09]
HW... 235	173,5 [6.83]	217,0 [8.54]	32,5 [1.28]
HW... 250	176,0 [6.93]	219,5 [8.64]	34,8 [1.37]
HW... 300	182,5 [7.19]	226,0 [8.89]	41,4 [1.63]
HW... 315	184,5 [7.26]	228,0 [8.98]	43,5 [1.71]
HW... 350	189,0 [7.44]	232,5 [9.15]	48,0 [1.89]
HW... 370	192,0 [7.56]	235,5 [9.27]	51,0 [2.01]
HW... 400	196,0 [7.72]	239,5 [9.43]	54,8 [2.16]
HW... 470	206,0 [8.11]	249,5 [9.82]	65,0 [2.56]
HW... 500	210,5 [8.29]	254,0 [10.00]	69,4 [2.73]
HW... 535	215,0 [8.46]	258,8 [10.19]	74,1 [2.92]
HW... 550	217,0 [8.54]	260,5 [10.26]	76,0 [2.99]
HW... 600	226,6 [8.92]	267,1 [10.52]	82,6 [3.25]

* For LSV option the dimension L is 3 mm [.118 in] greater.

DIMENSIONS AND MOUNTING DATA

D Wheel mount



Versions		
	2	4
P _(A,B)	2xG $\frac{1}{2}$	2x $\frac{1}{8}$ -14UNF, O-ring
T	G $\frac{1}{4}$	$\frac{1}{16}$ -20UNF, O-ring

▽ - Motor Mounting Surface
Note: For N see pages 101÷102.



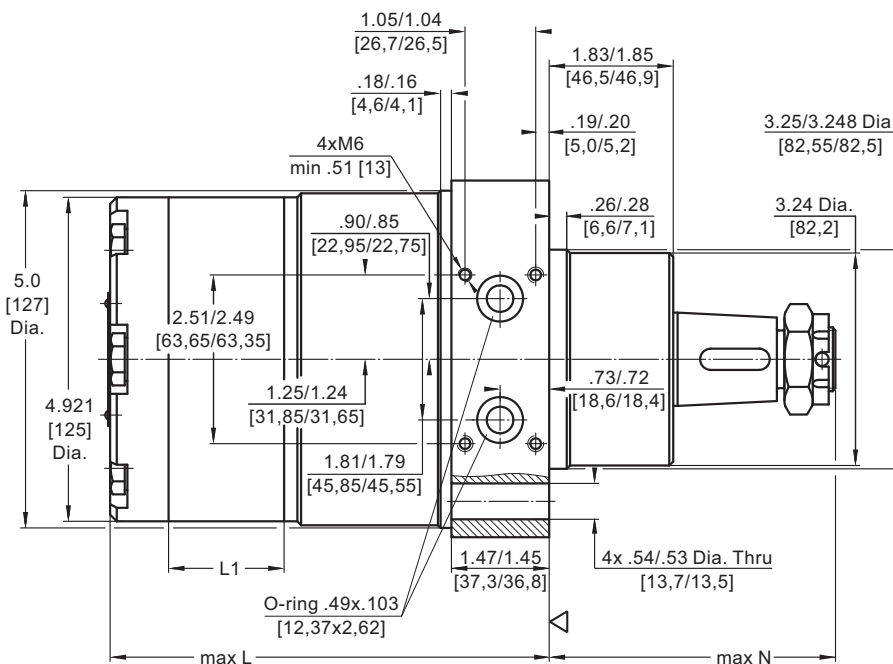
Type	*L, in [mm]		L ₁ , in [mm]
	HWD	HWV	
HW... 125	5.59 [142,0]	5.53 [140,5]	.68 [17,4]
HW... 160	5.79 [147,0]	5.71 [145,0]	.86 [21,8]
HW... 200	6.02 [153,0]	5.94 [151,0]	1.09 [27,8]
HW... 235	6.22 [158,0]	6.12 [155,5]	1.28 [32,5]
HW... 250	6.30 [160,0]	6.22 [158,0]	1.37 [34,8]
HW... 300	6.56 [166,5]	6.46 [164,5]	1.63 [41,4]
HW... 315	6.65 [169,0]	6.56 [166,5]	1.71 [43,5]
HW... 350	6.83 [173,5]	6.73 [171,0]	1.89 [48,0]
HW... 370	6.95 [176,5]	6.85 [174,0]	2.01 [51,0]
HW... 400	7.09 [180,0]	7.01 [178,0]	2.16 [54,8]
HW... 470	7.50 [190,5]	7.40 [188,0]	2.56 [65,0]
HW... 500	7.66 [194,5]	7.58 [192,5]	2.73 [69,4]
HW... 535	7.85 [199,5]	7.76 [197,0]	2.92 [74,1]
HW... 550	7.93 [201,5]	7.83 [199,0]	2.99 [76,0]
HW... 600	8.15 [207,1]	8.09 [205,6]	3.25 [82,6]

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

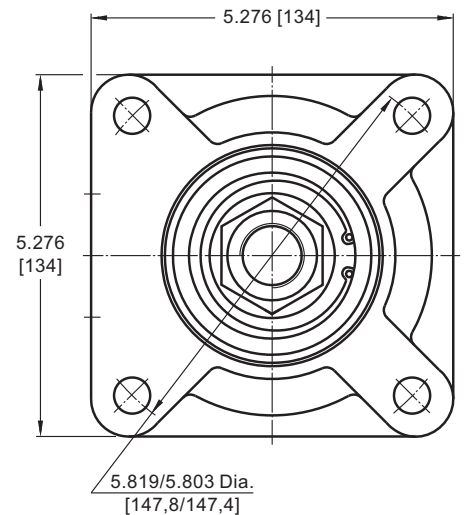
Reverse Rotation
Viewed from Shaft End
Port A Pressurized - **CCW**
Port B Pressurized - **CW**

Versions		
	2	4
T	G $\frac{1}{4}$	$\frac{1}{16}$ -20UNF, O-ring

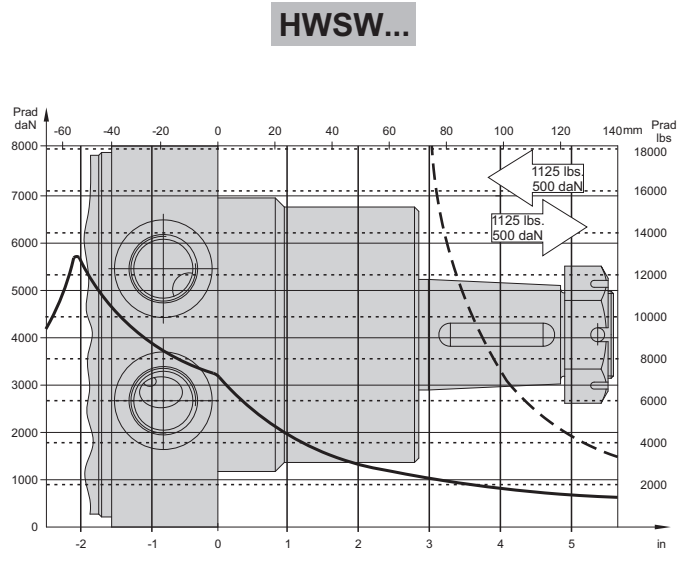
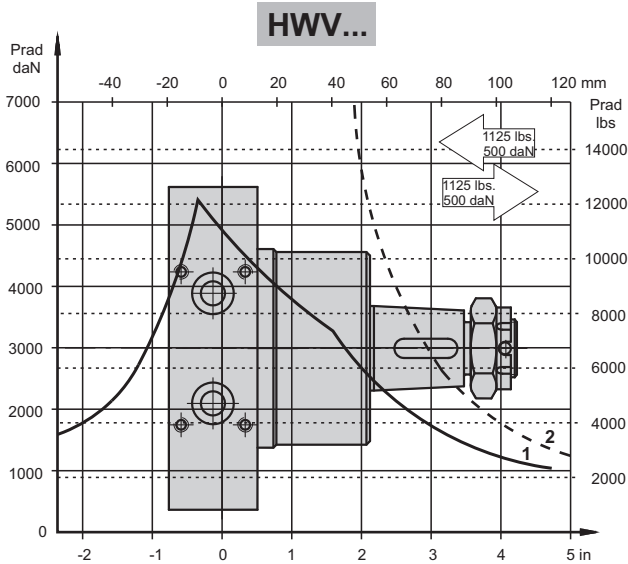
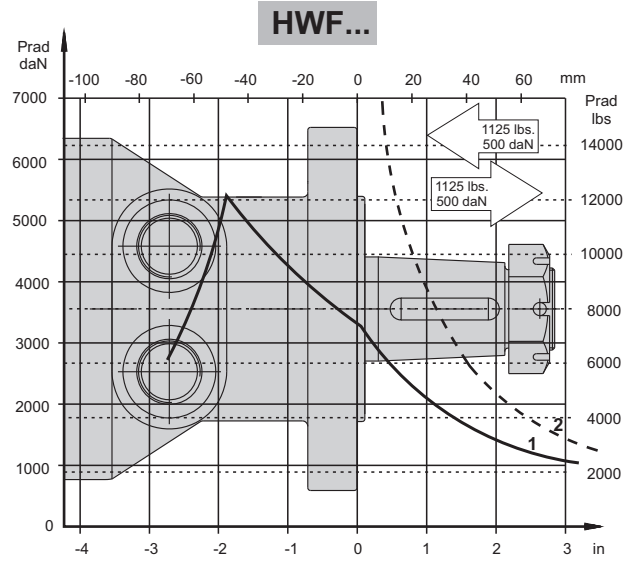
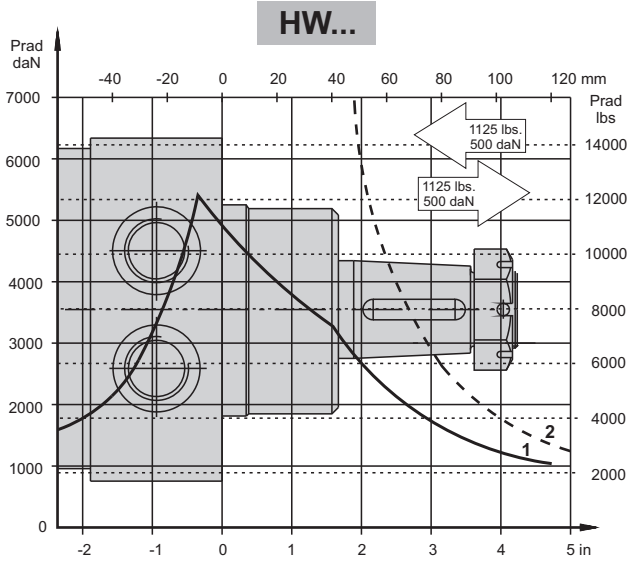
V Wheel mount, four holes, manifold 4xM6



* For LSV option the dimension L is .118 in [3 mm] greater.



PERMISSIBLE SHAFT LOADS

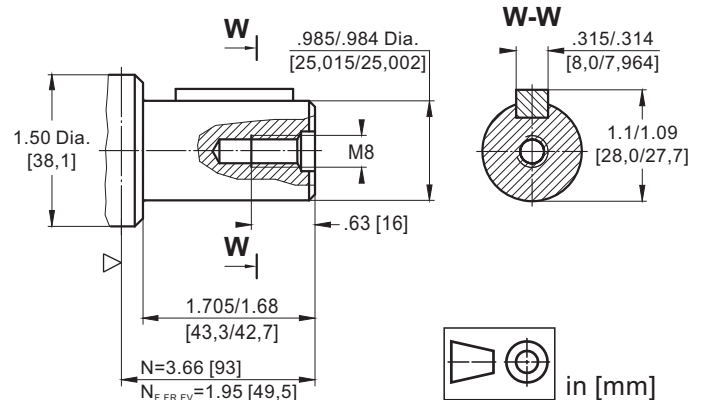
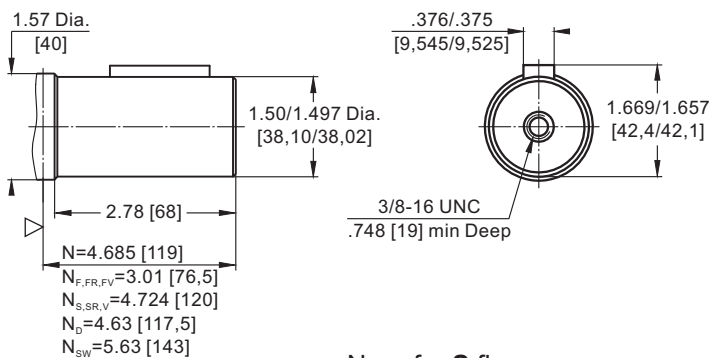


1 - Bearing curve: The curve applies to a B10 bearing life of 2000 hours at 100 RPM.
 2 - Shaft curve: The curve represents Max. permissible radial shaft load with safety factor 3:1.

SHAFT EXTENSIONS

C - 1½" [38,1] straight, Parallel key 3/8"x3/8"x1½" BS46
 Max. Torque 10630 lb-in [120 daNm]

CO - ø25, straight, Parallel key A8x7x32 DIN 6885
 Max. Torque 3540 lb-in [40 daNm]

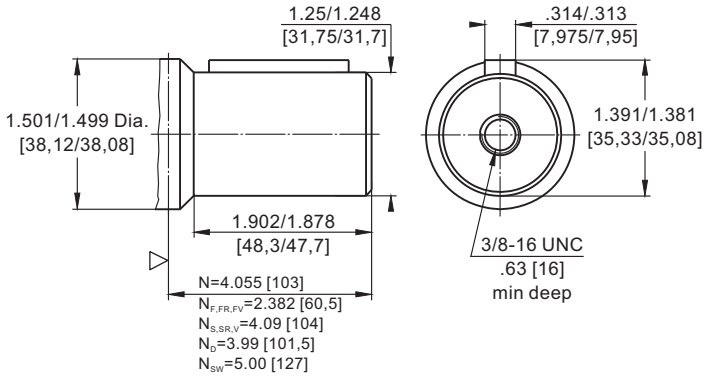


- N - for standard flange
- N_F - for F flange
- N_{FR} - for FR flange
- N_{FV} - for FV flange
- N_S - for S flange
- N_{SR} - for SR flange
- N_D - for D flange
- N_V - for V flange
- N_{SW} - for SW flange

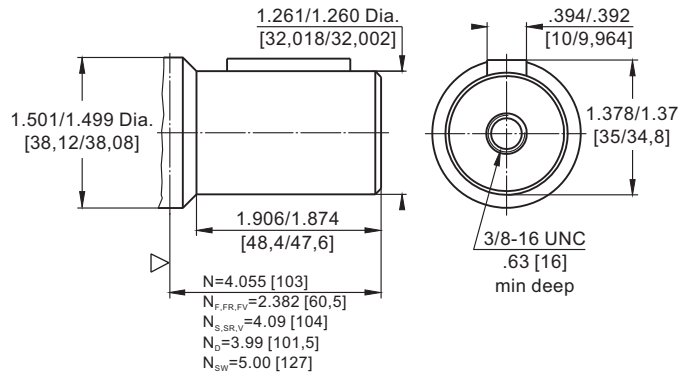
- N=3.66 [93]
- N_{F,FR,FV}=1.95 [49,5]
- N_{S,SR,V}=3.68 [93,5]
- N_D=3.58 [91]
- N_{SW}=4.61 [117]

▽ - Motor Mounting Surface

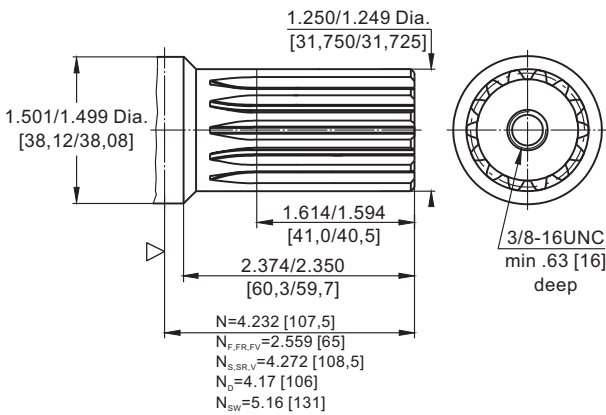
K - 1/4" [31,75] straight, Parallel key 5/16"x 5/16"x1 1/2" BS46
Max. Torque 6815 lb-in [77 daNm]



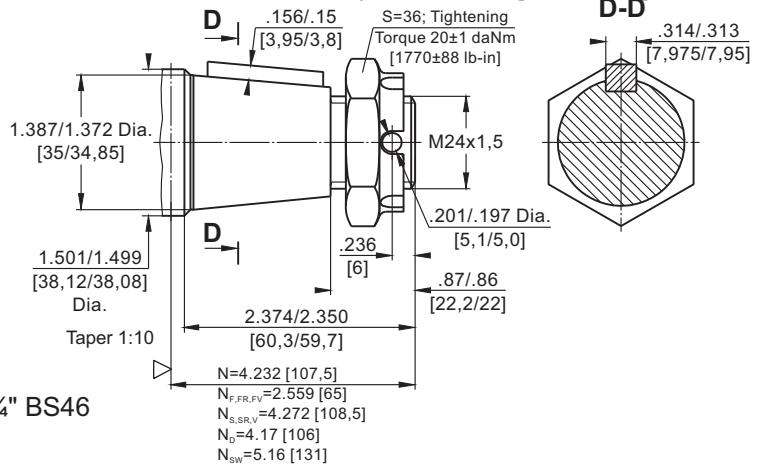
M - ø32 straight, Parallel key A10x8x32 DIN 6885
Max. Torque 6815 lb-in [77 daNm]



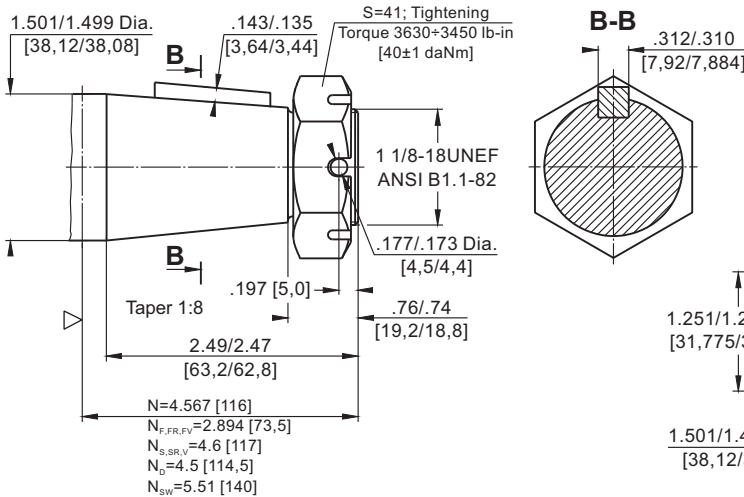
L - ø1 1/4" [31,75] splined 14T, DP12/24 ANSI B92.1-1976
Max. Torque 8410 lb-in [95 daNm]



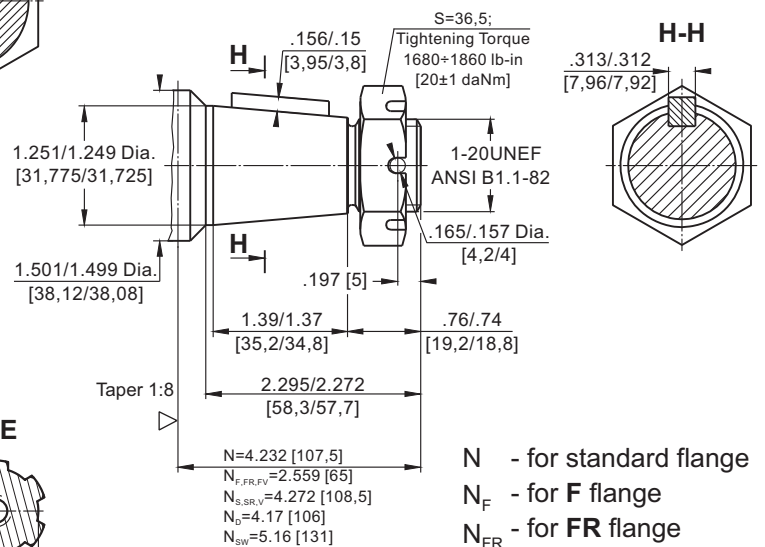
KB - ø35 tapered 1:10, Parallel key 5/16"x 5/16"x1 1/4" BS46
Max. Torque 95 daNm [8410 lb-in]



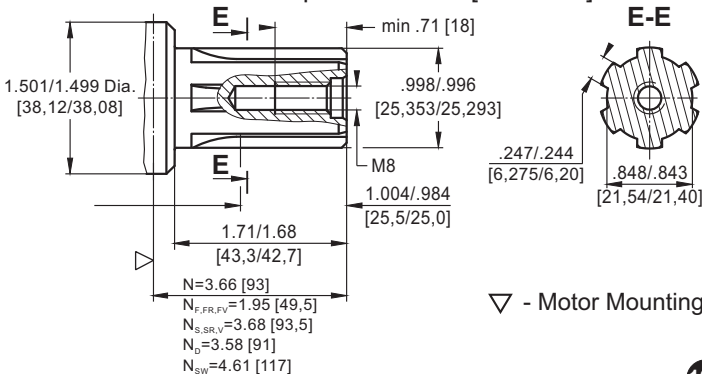
T - 1/2" [38,1] tapered 1:8, Parallel key 5/16"x 5/16"x1 1/4" BS46
Max. Torque 10620 lb-in [120 daNm]



R - 1/4" [31,75] tapered 1:8, Parallel key 5/16"x 5/16"x1" BS46
Max. Torque 8410 lb-in [95 daNm]



SH - ø1" splined BS 2059, SAE 6B
Max. Torque 3540 lb-in [40 daNm]



▽ - Motor Mounting Surface

- N - for standard flange
- N_F - for F flange
- N_{FR} - for FR flange
- N_{FV} - for FV flange
- N_S - for S flange
- N_{SR} - for SR flange
- N_D - for D flange
- N_V - for V flange
- N_{SW} - for SW flange

ORDER CODE

	1	2	3	4	5	6	7	8	9
HW							/		

Pos.1 - Mounting Flange

- omit - Wheel mount, four holes
- E** - Wheel mount, four holes, rear ports
- F** - Magneto mount, six holes
- FR** - Magneto mount, six holes, relief valves
- FV^{1)*}** - Magneto mount, six holes, manifold 4xM6
- FE** - Magneto mount, six holes, rear ports
- S** - Wheel mount, four holes
- SR** - Wheel mount, four holes, relief valves
- SW** - Wheel mount, four holes; mounting on ø95,3 [3.75]
- SE** - Wheel mount, four holes, rear ports
- D** - Wheel mount, four holes; mounting on ø88,8 [3.5]
- V^{1)*}** - Wheel mount, four holes, manifold 4xM6

Pos.2 - Displacement code

- 125** - 7.69 in³/rev [126,0 cm³/rev]
- 160** - 9.64 in³/rev [158,0 cm³/rev]
- 200** - 12.28 in³/rev [201,3 cm³/rev]
- 235** - 14.33 in³/rev [235,0 cm³/rev]
- 250** - 15.37 in³/rev [252,0 cm³/rev]
- 300** - 18.30 in³/rev [300,0 cm³/rev]
- 315** - 19.21 in³/rev [314,9 cm³/rev]
- 350** - 21.21 in³/rev [347,8 cm³/rev]
- 370** - 22.51 in³/rev [369,0 cm³/rev]
- 400** - 24.20 in³/rev [396,8 cm³/rev]
- 470** - 28.71 in³/rev [470,6 cm³/rev]
- 500** - 30.65 in³/rev [502,4 cm³/rev]
- 535** - 32.70 in³/rev [536,0 cm³/rev]
- 550** - 33.55 in³/rev [550,0 cm³/rev]
- 600** - 36.61 in³/rev [598,9 cm³/rev]

Pos.3 - Shaft Extensions^{2)*}

- K** - 1 1/4" [31,75] straight, Parallel key 5/16" x 5/16" x 1 1/2" BS46
- KB** - ø35 tapered 1:10, Parallel key 5/16" x 5/16" x 1 1/4" BS46
- L** - 1 1/4" [31,75] splined 14T, ANSI B92.1-1976
- M** - ø32 straight, Parallel key A10x8x32 DIN 6885
- R** - 1 1/4" [31,75] Tapered 1:8, Parallel key 5/16" x 5/16" x 1" BS46
- T** - 1 1/2" [38,1] Tapered 1:8, Parallel key 5/16" x 5/16" x 1 1/4" BS46
- C** - 1 1/2" [38,1] straight, Parallel key 3/8" x 3/8" x 1 1/2" BS46
- CO** - ø25, straight, Parallel key A8x7x32 DIN 6885
- SH** - ø1" splined BS 2059, SAE 6B

Pos.4 - Ports

- 2** - side ports, 2xG1/2, G1/4, BSP thread, ISO 228
- 4** - side ports, 2x7/8-14 UNF, O-ring, 7/16-20 UNF
- 5^{3)*}** - rear ports, 2xG3/8, G1/4, BSP thread, ISO 228
- 6^{3)*}** - rear ports, 2x9/16-18 UNF, O-ring, 7/16-20 UNF

Pos.5 - Special Features^{4)*, 5)*, 6)*} [see page 104]

Pos.6 - Valves Pressure Range, bar^{7)*}

- /** - 70, 100, 140, 170, 210

Pos.7 - Design Series

- omit - Factory specified

NOTES:

- ^{1)*} Flange **V** and **FV** is for versions 2 and 4 - drainage only!
- ^{2)*} The permissible output torque for shafts must not be exceeded!
- ^{3)*} For **E**-version only!
- ^{4)*} If the code on pos.5 is not specified in the order, it will be considered as LL-option.
- ^{5)*} Colour at customer's request.
- ^{6)*} Non painted feeding surfaces, colour at customer's request.
- ^{7)*} For **SR** and **FR** only!

E-version is not available with **SR** and **FR**!!!

The hydraulic motors are mangano-phosphatized as standard.

MOTOR SPECIAL FEATURES

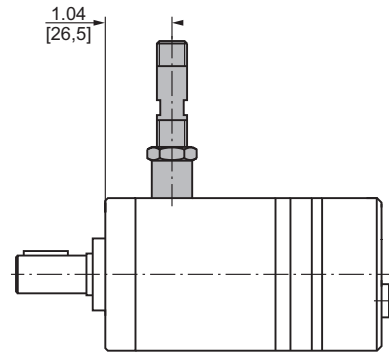
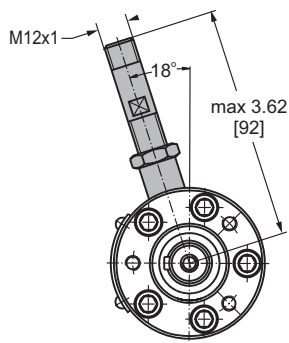
Special Feature Description	Order Code	Motor type											
		MLHM	MLHP	MLHPW, MLHP(W)N	HP	MLHR	MLHRN	HR	MLHPL	MLHRL	MLHRW	MLHH	HW
Speed Sensor*	RS	O	O	-	O	O	-	O	-	-	-	O	O****
Low Leakage	LL	O	-	-	-	O	O	O	-	O	O	O	O
Low Speed Valving	LSV	-	-	-	-	O	-	-	-	-	-	O	O
Free Running	FR	O	O	O	O	O	O	O	O	O	O	O	O
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

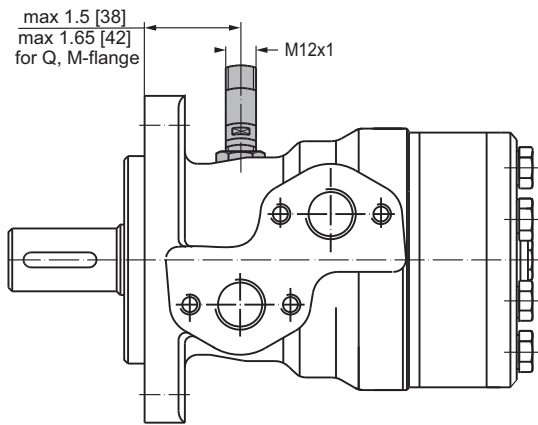
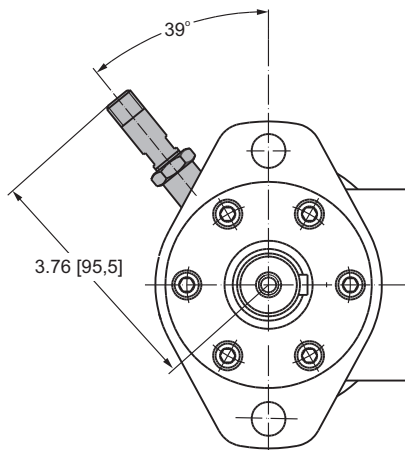
- * For sensor ordering see pages 106÷107.
- ** Colour at customer's request.
- *** Non painted feeding surfaces, colour at customer's request.
- **** Without check valves for "U" shaft seal versions.
- ***** RS option is not available at HW...R (with relief valves).

MOTORS WITH SPEED SENSOR

MLHM...RS

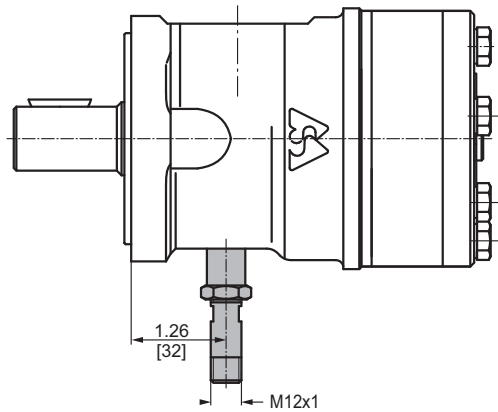
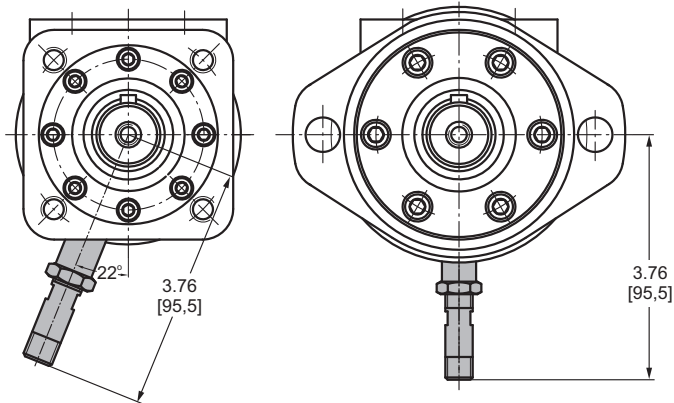


MLHP...RS MLHR...RS

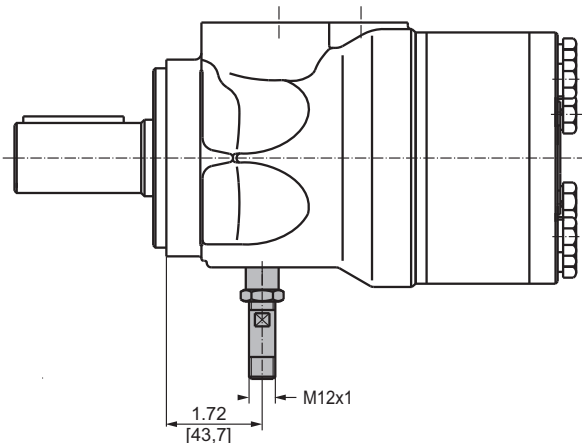
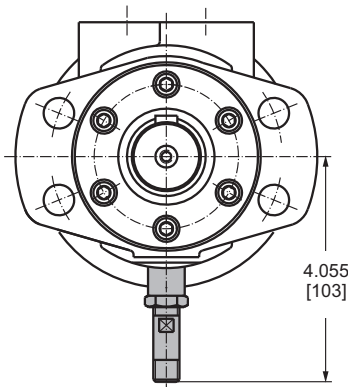


HP...RS HR...RS

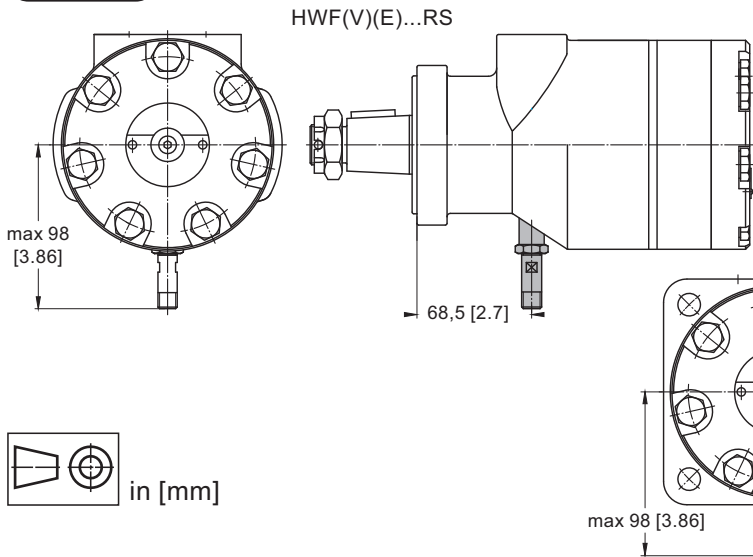
For Q-flange



MLHH...RS

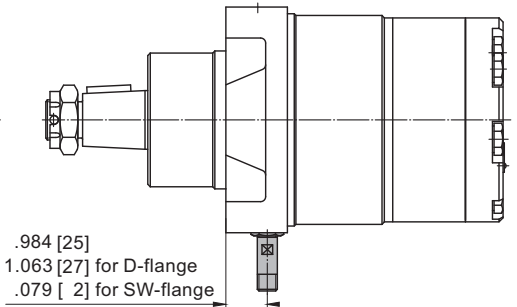


HW...RS



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

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

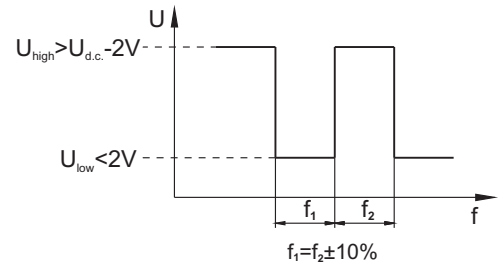


TECHNICAL DATA OF THE SPEED SENSOR

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

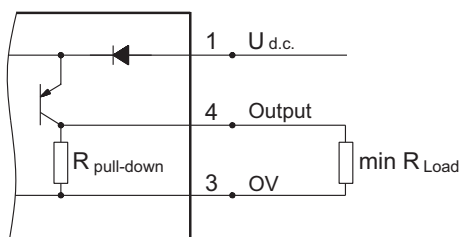


Load max.: $i_{high} = i_{low} < 50\text{mA}$

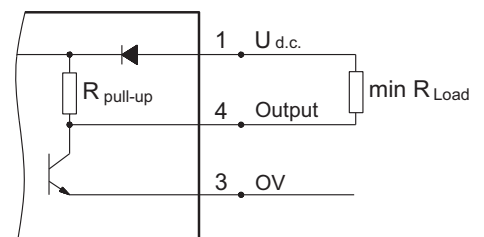
Motor type	MLHM	MLHP	MLHR	HP, HR	MLHH	HW
Pulses per revolution	30	36	36	36	42	12

Wiring diagrams

PNP

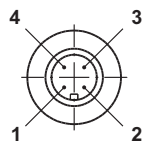


NPN



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

Stick type



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

Order Code for Speed Sensor

Sensor Code	Electric connection
RS	Connector BINDER 713 series
RSL2,5	Cable output 3x0,25; 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

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

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:

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

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

5. Tractive effort: DP, lbs [daN]

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

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

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

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

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

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

Necessary torque moment for every hydraulic motor:

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

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

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

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

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

f - frictional factor;

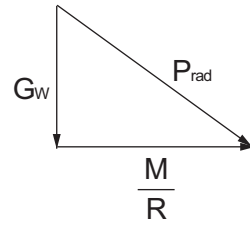
G_w- total weight over the wheels, lbs [daN].

Table 3

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

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

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



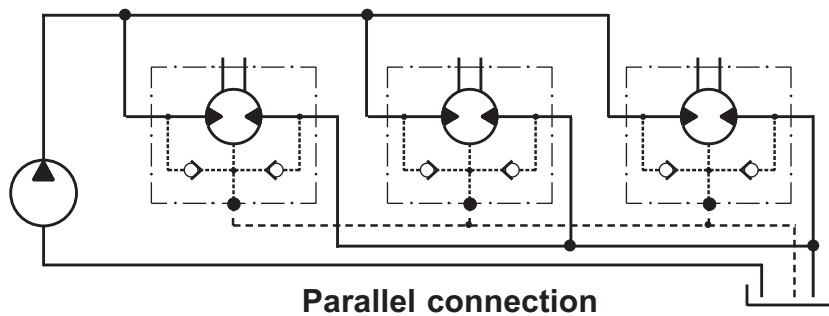
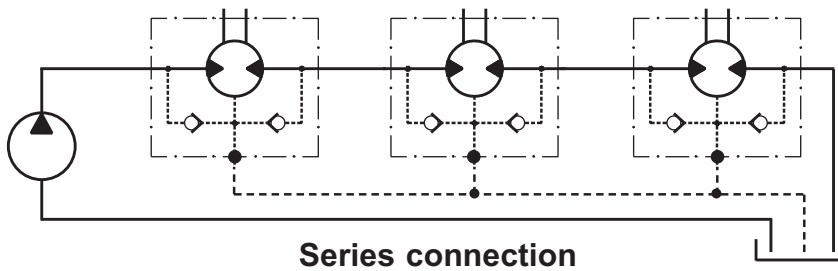
- G_w - Weight held by wheel;
- P_{rad} - Total radial loading of motor shaft;
- M/R - Motion force.

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

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

DRAINAGE SPACE AND DRAINAGE PRESSURE

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



WARRANTY

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

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

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

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

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

Warranty periods

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

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

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

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



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