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Product Manual

MARATHON

EN395-6h 2009

One partner all over the world

Hägglunds Drives is one of the worlds leading manufacturer of heavy duty hydraulic drive systems. If what you need is low speed and high torque, then Hägglunds Drives should be your partner. If what you need is a durable drive system that will work under the toughest conditions with a minimum of maintenance, then Hägglunds Drives should be your partner. We develop, manufacture & market complete drive-systems and components of the highest quality, based upon our unique radial piston motors. Our industrial and marine customers are to be found all over the world. They know that when they need solutions, support or service, they have in us a partner they can trust. Hägglunds Drives main office and manufacturing plant is situated in Mellansel, Sweden. In Addition Hägglunds Drives is represented in 40 countries worldwide.

Original EN395-5h, 2002

The content in this manual is subject to change without notice or obligation, unless certified referring to a certain purchase order. Information contained herein should be confirmed before placing orders.

Features

High torques
The Marathon motor is a high-torque motor which is mounted directly on the shaft or a driven machine without intermediate gears.

Low speeds
The Marathon motor is a low-speed motor and can run for practically an unlimited time from zero (stalling) to its maximum speed.

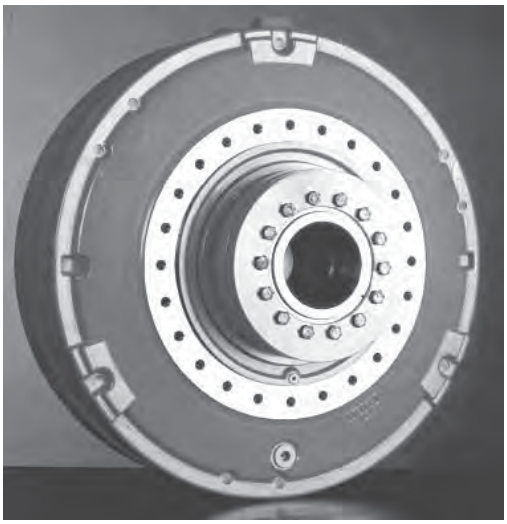
High efficiency
The mechanical efficiency of the Marathon motor is 97% within the motors optimal working range.

Reduces shock loads
The moment of inertia of the Marathon motor is very low compared to electro-mechanical drives. Thus, the shock loads on the driven machine are significantly reduced.

Severe environments
The design of the Marathon motor makes it highly resistant to severe working environments. The moving parts of the motor are completely enclosed in hydraulic fluid, which has good lubrication quality. Thousands of Marathon motors are installed in explosive and chemically corrosive industrial environments, in extreme heat, or freezing cold throughout the world.

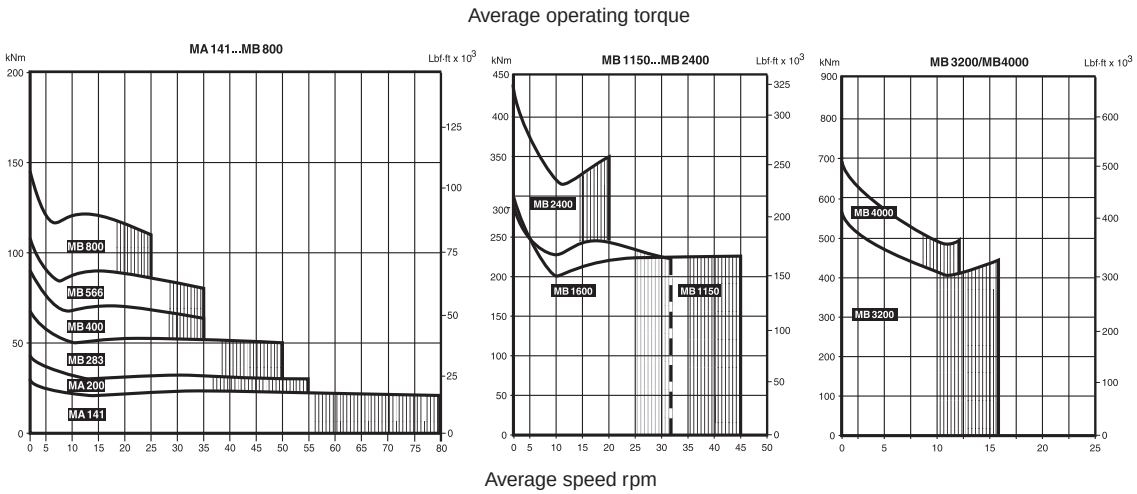
Both driving and braking
The Marathon motor can drive and brake in both directions, this is known as a four-quadrant drive. When the motor is braking it acts as a pump.

Variable speed control
The speed and direction of rotation of a Marathon motor are easily controlled by varying the flow. Response is fast due to the extremely low moment of inertia. Also limitation of the output torque can easily be achieved by controlling the pressure level.



Quick selection diagram for Marathon motors

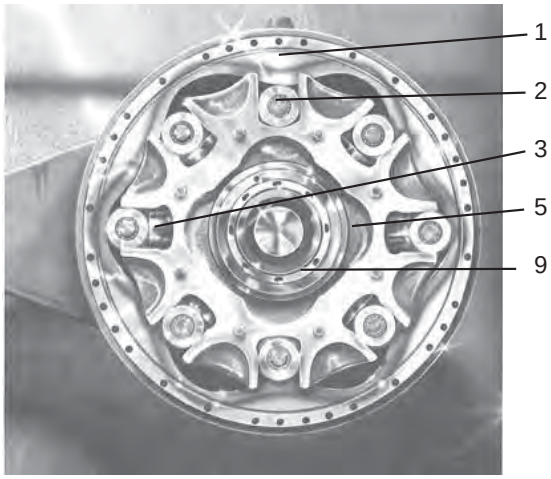
The curves below represent the torque and speed, corresponding to a basic rating life L_{10h} = 40 000 hours. Oil viscosity in the motor case 40 cSt (187 SSU).



For operation in- or outside line screened area and for final selection, please contact your Hägglunds representative.

Functional description

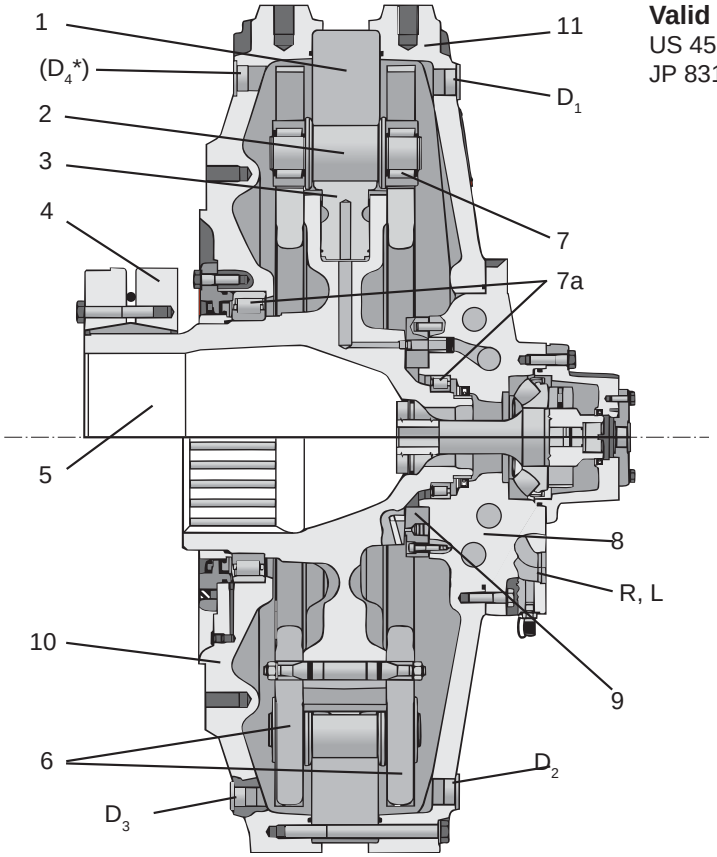
Hägglunds Drives hydraulic industrial motor MARATHON is of the radial-piston type with a rotating cylinder block/hollow shaft and a stationary case. The cylinder block is mounted in fixed roller bearings in the case. An even number of pistons are radially located in bores inside the cylinder block, and the valve plate directs the incoming and outgoing oil to and from the working pistons. Each piston is working against a cam roller. When the hydraulic pressure is acting on the pistons, the cam rollers are pushed against the slope on the cam ring that is rigidly connected to the case, thereby producing a torque. The reaction force is transferred by the guide roller bearings on the cam rollers shaft ends to the two guide plates which are connected to the cylinder block/hollow shaft. Rotation therefore occurs, and the torque available is proportional to the pressure in the system. Oil main lines are connected to ports R and L in the connection block and drain lines to ports D_1, D_2, D_3 or D_4* in the port end housing. The motor is connected to the shaft of the driven machine through the hollow shaft of the cylinder block.The torque is transmitted by using a mechanical shaft coupling, or alternatively by splines.



Quality

To assure our quality we maintain a Quality Assurance System, certified to standard ISO 9001, EN 29001 and BS 5750; Part 1.

Fig. 1 **Marathon motor**



Valid patents

US 4522110, SE 456517, EP 0102915, JP 83162704, GB 1385693, EU 0524437.

1. Cam ring
2. Cam roller
3. Piston
4. Shaft coupling
5. Cylinder block / hollow shaft
6. Guide plates
7. Guide roller bearing

7a. Cylinder block bearing

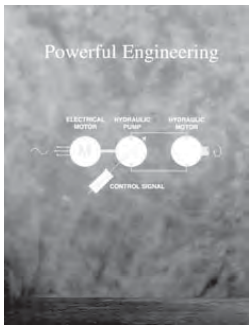
8. Connection block
9. Valve plate
10. Shaft end housing
11. Port end housing

R = inlet or outlet port »R«
L = inlet or outlet port »L«
D_1, D_2, D_3 and D_4* = drain ports

*D_4 = MB 1150 - MB 4000

Calculation fundamentals

Output power	$P = \frac{T \cdot n}{9549}$ (kW) on driven shaft	$P = \frac{T \cdot n}{5252}$ (hp) on driven shaft
Output torque* (η_m=98%)	$T = T_s \cdot (p - \Delta p_l - p_c) \cdot \eta_m$ (Nm)	$T = \frac{T_s \cdot (p - \Delta p_l - p_c) \cdot \eta_m}{1000}$ (lbf·ft)
Pressure required (η_m=98%)	$p = \frac{T}{T_s \cdot \eta_m} + \Delta p_l + p_c$ (bar)	$p = \frac{T \cdot 1000}{T_s \cdot \eta_m} + \Delta p_l + p_c$ (psi)
Flow rate required	$q = \frac{n \cdot V_i}{1000} + q_l$ (l/min)	$q = \frac{n \cdot V_i}{231} + q_l$ (gpm)
Output speed	$n = \frac{q - q_l}{V_i} \cdot 1000$ (rpm)	$n = \frac{q - q_l}{V_i} \cdot 231$ (rpm)
Inlet power	$P_{in} = \frac{q \cdot (p - p_c)}{600}$ (kW)	$P_{in} = \frac{q \cdot (p - p_c)}{1714}$ (hp)



For more information
See Powerful Engineering (EN347-4).

Quantity	Symbol		Metric	US
Power	P	=	kW	hp
Output torque	T	=	Nm	lbf·ft
Specific torque	T_s	=	Nm/bar	lbf·ft/1000 psi
Rotational speed	n	=	rpm	rpm
Required pressure	p	=	bar	psi

Quantity	Symbol		Metric	US
Pressure loss	Δp_l	=	bar	psi
Charge pressure	p_c	=	bar	psi
Flow rate required	q	=	l/min	gpm
Total volumetric loss	q_l	=	l/min	gpm
Displacement	V_i	=	cm³/rev	in³/rev
Mechanical efficiency	η_m	=	0,97	

Data

Metric Motor type	S index	Displacement	Specific torque	Rated speed*	Max. speed	Max pressure**	Max. output power intermittent.
		V_i	T_s	n	n	p	P
MA 141		8890	141	56	80	350	254
MA 200		12575	200	38	55	350	254
MB 283		17768	283	38	50	350	390
MB 800-283 [1)]	20	17768	283	80	130	350	515
MB 400		25145	400	28	35	350	390
MB 800-400 [3)]		25145	400	36	50	350	515
MB 800-400 [1)]	20	25145	400	56	95	350	515
MB 1150-400 [1)]		25145	400	90	125	350	1031
MB 566		35561	566	28	35	350	515
MB 1150-566 [1)]		35561	566	70	110	350	1031
MB 800-575 [1)]	20	36121	575	42	65	350	515
MB 800		50265	800	18	25	350	515
MB 800-800 [2)]	20	50265	800	28	45	350	515
MB 1150-683 [1)]		42899	683	62	90	350	1031
MB 1150-800 [1)]		50258	800	55	75	350	1031
MB 1150-975 [1)]		61249	975	40	62	350	1031
MB 1150		72241	1150	38	53	350	1031
MB 1600-1375 [1)]		86392	1375	30	43	350	1031
MB 1600		100529	1600	28	38	350	1031
MB 2400-1725 [1)]		108383	1725	22	33	350	1546
MB 2400-1950 [1)]		122520	1950	22	30	350	1546
MB 2400-2175 [1)]		136657	2175	18	27	350	1546
MB 2400		150794	2400	16	24	350	1546
MB 3200		201059	3200	10	16	350	1580
MB 4000		251323	4000	8	12	350	1580

* Spec. considerations regarding charge pressure, cooling and choice of hydr. system for speeds above rated.
** The motors are designed according to DNV-rules. Test pressure 420 bar/6000 psi. Peak/transient pressure 420 bar/6000 psi maximum, allowed to occur 10000 times.
[1] High speed, Magnum port end and standard or lower displacement.
[2] High speed, Magnum port end.
[3] Lower displacement.

Data

US Motor type	S index	Displacement	Specific torque	Rated speed*	Max. speed	Max. pressure**	Max. output power intermittent.
		V_i	T_S	n	n	p	P
MA 141		542	7170	56	80	5000	340
MA 200		767	10170	38	55	5000	340
MB 283		1084	14390	38	50	5000	523
MB 800-283 [1)]	20	1084	14380	80	130	5000	690
MB 400		1534	20340	28	35	000	523
MB 800-400 [3)]		1534	20340	36	50	5000	690
MB 800-400 [1)]	20	1534	20340	56	95	5000	690
MB 1150-400 [1)]		1534	20340	90	125	5000	1382
MB 566		2170	28780	28	35	5000	690
MB 1150-566 [1)]		2170	28780	70	110	5000	1382
MB 800-575 [1)]	20	2204	29240	42	65	5000	690
MB 800		3066	40680	18	25	5000	690
MB 800-800 [2)]	20	3066	40680	28	45	5000	690
MB 1150-683 [1)]		2618	34720	62	90	5000	1382
MB 1150-800 [1)]		3067	40680	55	75	5000	1382
MB 1150-975 [1)]		3738	49570	40	62	5000	1382
MB 1150		4408	58480	38	53	5000	1382
MB 1600-1375 [1)]		5270	69920	30	43	5000	1382
MB 1600		6132	81360	28	38	5000	1382
MB 2400-1725 [1)]		6611	87700	22	33	5000	2072
MB 2400-1950 [1)]		7473	99150	22	30	5000	2072
MB 2400-2175 [1)]		8336	110600	18	27	5000	2072
MB 2400		9198	122050	16	24	5000	2072
MB 3200		12265	162750	10	16	5000	2117
MB 4000		15330	203440	8	12	5000	2117

* Spec. considerations regarding charge pressure, cooling and choice of hydr. system for speeds above rated.
** The motors are designed according to DNV-rules. Test pressure 420 bar/6000 psi. Peak/transient pressure 420 bar/6000 psi maximum, allowed to occur 10000 times.
(1 High speed, Magnum port end and standard or lower displacement.
(2 High speed, Magnum port end.
(3 Lower displacement.

Definitions

Rated speed[x)]
Rated speed is the highest allowed speed for a charge pressure of 12 bar (175 psi) above case pressure. When a closed loop system is used, a minimum of 15% of oil is to be exchanged in the main loop. Special considerations are necessary regarding charge pressure, cooling and choice of hydraulic system for speeds above rated.

[x)]Operating above rated conditions requires engineering approval.

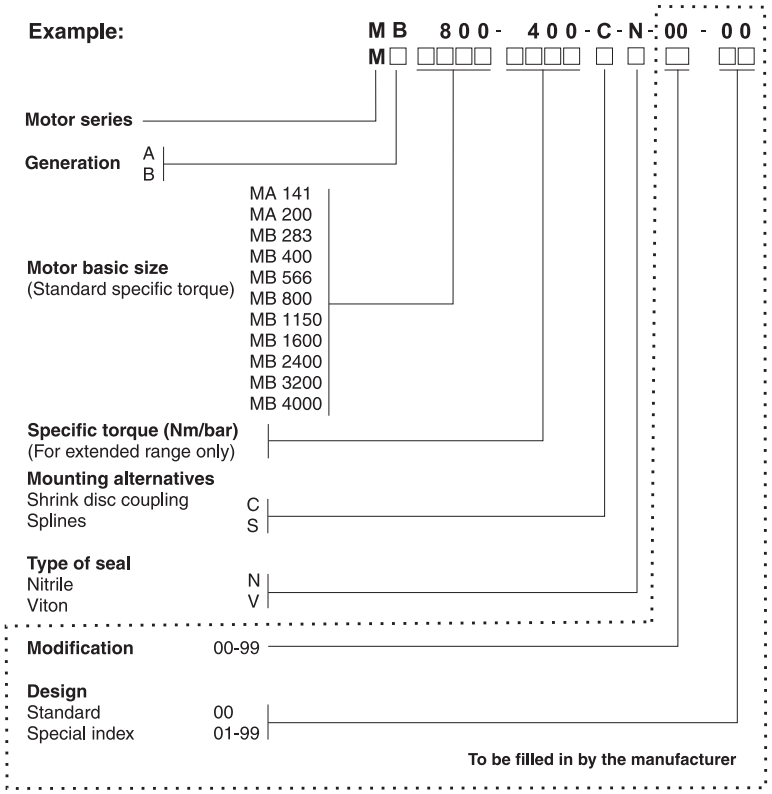
Max speed
Maximum speed is the maximum allowed speed.

Accepted conditions for standard type of motor:
1. Oil viscosity 20 - **40** - 10000 cSt (98 - **187** - 4650 SSU). See page 19.
2. Temperature -35°C to +70°C (-31°F to +158°F).
3. Running case pressure 0-3 bar (0-45 psi).
   Max case pressure 8 bar (116 psi)
4. Charge pressure (see diagram).
5. Volumetric losses (see diagram).

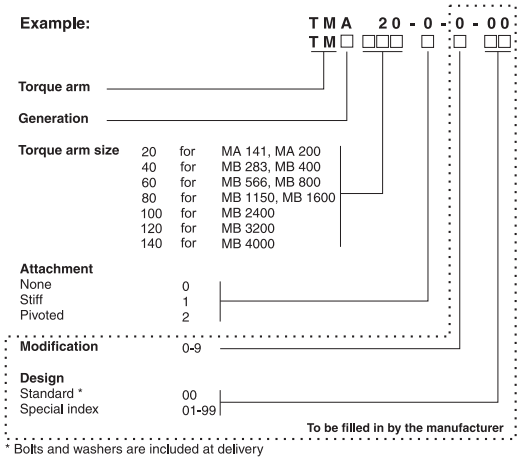
Ordering codes

In order to identify Hägglunds Drives equipment exactly, the following ordering code is used. These ordering codes should be stated in full in all correspondence e.g. when ordering spare parts.

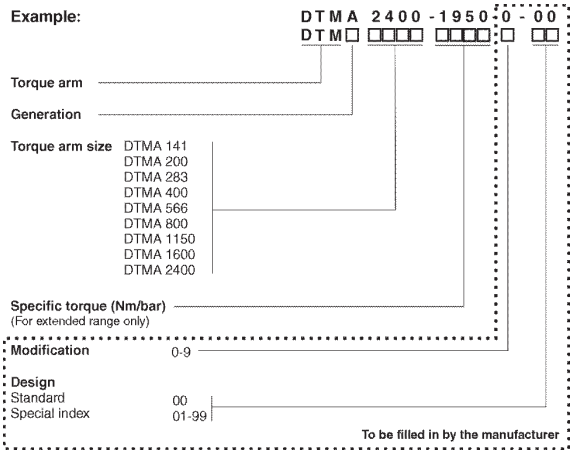
Marathon motors



Torque arm, TMA



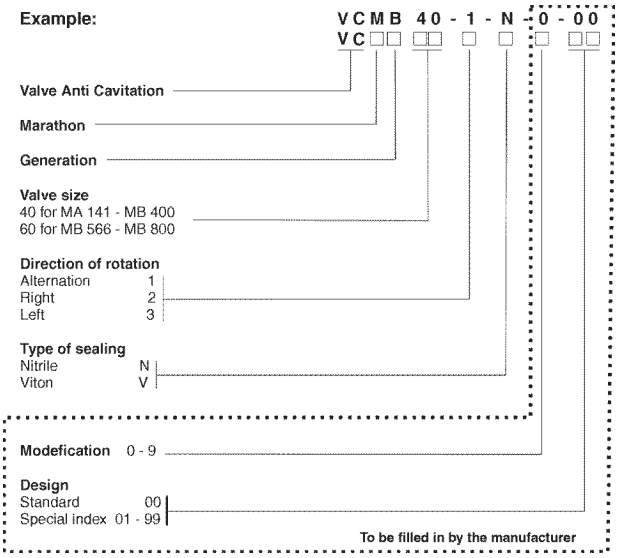
Double torque arm, DTMA



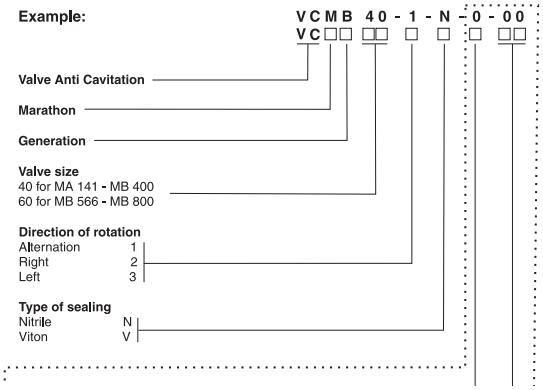
Ordering codes

In order to identify Hägglunds Drives equipment exactly, the following ordering code is used. These ordering codes should be stated in full in all correspondence e.g. when ordering spare parts.

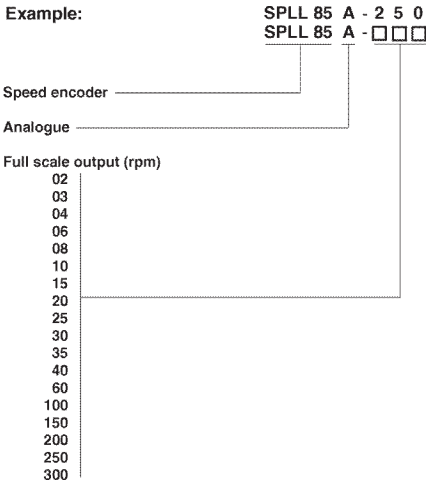
Shock load manifold, VCMB



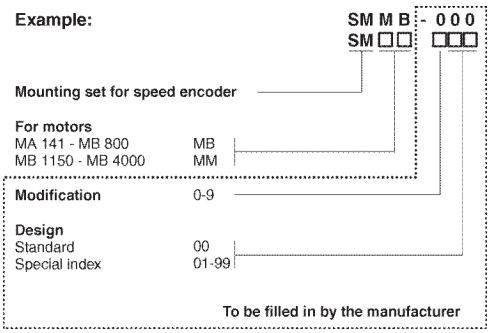
Emergency stop manifold, VEMB



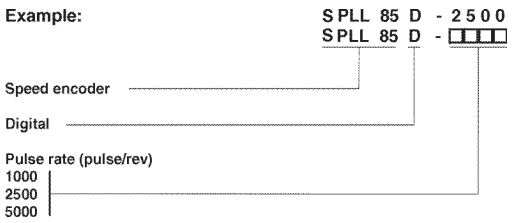
Speed encoder, SPLL 85 A



Mounting set for speed encoder



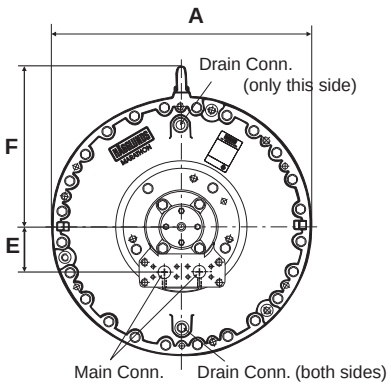
Speed encoder, SPLL 85 D



Dimensions

With hollow shaft, shrink disc coupling.

Fig. 2



MA 141
MA 200
MB 283
MB 400
MB 566
MB 800

Fig. 3

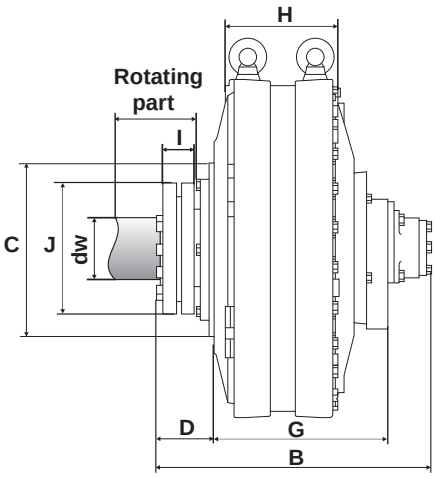
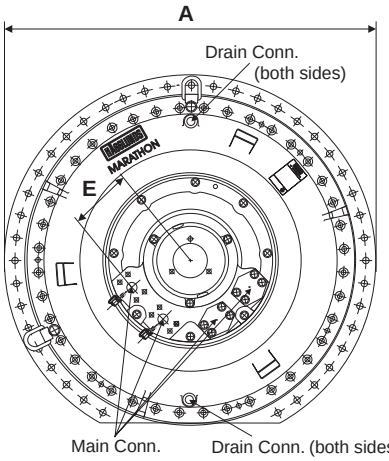


Fig. 4



MB 1150
MB 1600
MB 2400

Fig. 5

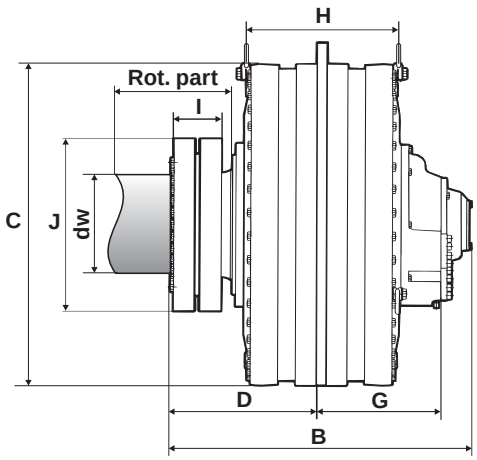


Table 1 **Dimensions for the motor**

Motor	A mm (in)	B mm (in)	C mm (in)	D mm (in)	E mm (in)	F mm (in)	G mm (in)	H mm (in)	I mm (in)	J mm (in)	dw mm (in)	Weight kg (lb)	Main conn.	Drain conn.
MA 141	828 (32,60)	738 (29,05)	460 (18,11)	146 (5,75)	159 (6,26)	522 (20,55)	452,5 (17,81)	288 (11,34)	84 (3,31)	322 (12,68)	140 (5,51)	990 (2183)	SAE 1 1/2"	BSP 1 1/4" (D_1, D_2) BSP 1" (D_3)
MA 200	900 (35,43)	754 (29,64)		145 (5,71)		558 (21,97)	467,5 (18,41)	303 (11,93)		342 (13,64)	155 (6,10)	1130 (2490)		
MA 283	958 (37,72)	795 (30,12)	530 (20,86)	165 (6,50)	172 (6,77)	583 (22,95)	492,5 (19,39)	299 (11,77)	106 (4,17)	397 (15,63)	180 (7,09)	1395 (3076)		
MA 400	1044 (41,10)	783,5 (30,85)		171,5 (6,75)		626 (24,65)	505 (19,88)	320 (12,60)	111 (4,37)	432 (17,01)	200 (7,87)	1625 (3584)		
MB 566	1168 (45,98)	836,4 (32,93)	700 (27,56)	198 (7,79)	201 (7,91)	714 (28,07)	503,5 (19,82)	323 (12,72)	153 (6,02)	512 (20,16)	260 (10,24)	2108 (4647)	SAE 2"	
MB 800	1288 (50,71)	880 (34,65)				774 (30,43)	522 (20,55)	332 (13,07)				2805 (6184)		
MB 1150	1460 (57,48)	1205 (47,44)	1288 (50,17)	567 (22,32)	238 (9,37)	-	492,5 (19,39)	605 (23,82)	215 (8,46)	682 (26,85)	340 (13,38)	4600 (10141)		BSP 1 1/4" (D_{1-4})
MB 1600														
MB 2400		1531 (60,28)		619 (24,57)			765,5 (30,14)	878 (34,57)	257 (10,12)	712 (28,03)	360 (14,17)	6460 (14222)		

Dimensions

With hollow shaft, shrink disc coupling.

Fig. 6

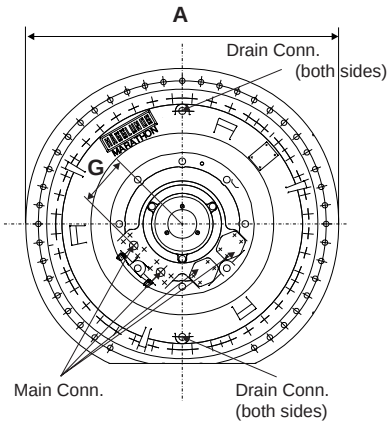


Fig. 7 **Rotating part**

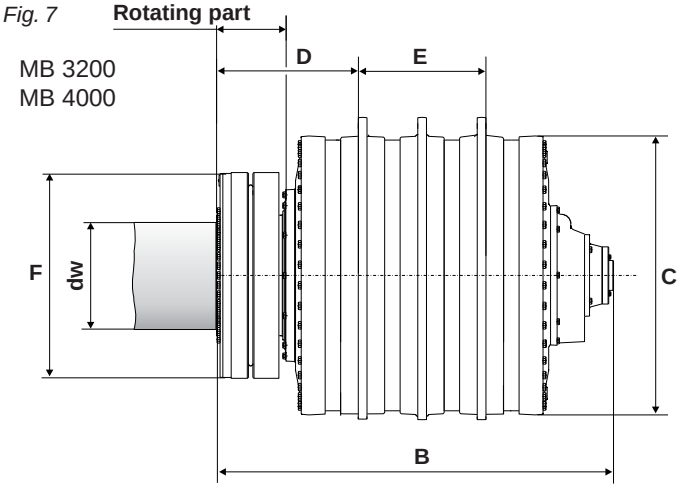


Table 2 **Dimensions**

Motor	A mm (in)	B mm (in)	C mm (in)	D mm (in)	E mm (in)	F mm (in)	G mm (in)	dw mm (in)	Weight kg (lb)	Main conn.	Drain conn.
MB 3200	1460 (57,48)	1822 (71,74)	1288 (50,17)	651 (25,63)	586 (23,07)	950 (37,40)	238 (9,37)	460 (18,11)	8930 (19682)	SAE 2”	BSP 1 1/4” (D_{1-4})
MB 4000		2095 (82,48)			859 (33,82)				10750 (23693)		

With splines for flange mounting.

Fig. 8

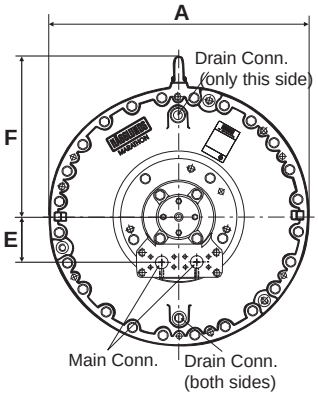
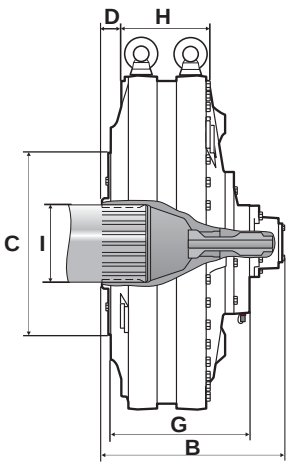


Fig. 9

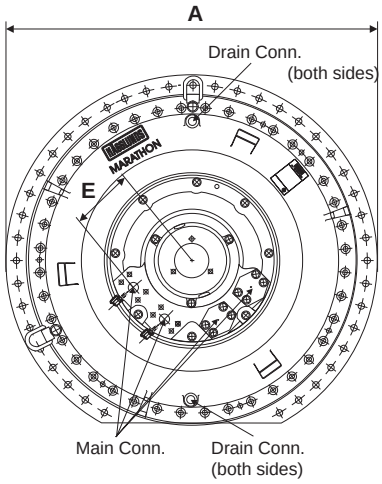
MA 141
MA 200
MB 283
MB 400
MB 566
MB 800



Dimensions

With splines for flange mounting.

Fig. 10



MB 1150
MB 1600
MB 2400
MB 3200
MB 4000

Fig. 11

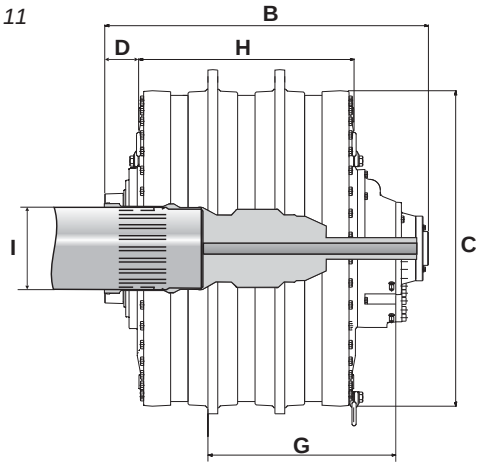


Table 3 **Dimensions**

Motor	A mm (in)	B mm (in)	C mm (in)	D mm (in)	E mm (in)	F mm (in)	G mm (in)	H mm (in)	I	Weight kg (lb)	Main conn.	Drain conn.
MA 141	828 (32,60)	629,5 (24,78)	460 (18,11)	66 (2,60)	159 (6,26)	522 (20,55)	452,5 (17,81)	288 (11,34)	N140x5x-30x26x9H	946 (2086)	SAE 1 1/2"	BSP 1 1/4" (D_1,D_2) BSP 1" (D_3)
MA 200	900 (35,43)	643 (25,31)				558 (21,97)	467,5 (17,41)	303 (11,93)	N150x5x-30x28x9H	1085 (2391)		
MA 283	958 (37,72)	625 (24,61)	530 (20,86)	73 (2,87)	172 (6,77)	583 (22,95)	492,5 (19,39)	299 (11,77)	N180x5x-30x34x9H	1325 (2922)		
MA 400	1044 (41,10)	634,5 (24,98)		65,5 (2,58)		626 (24,65)	505 (19,88)	320 (12,60)	N200x5x-30x38x9H	1520 (3352)		
MA 566	1168 (45,98)	666,5 (26,24)	700 (27,56)	61 (2,40)	201 (7,91)	714 (28,07)	503,5 (19,82)	323 (12,72)	N300x8x-30x36x9H	1950 (4299)	SAE 2"	
MA 800	1288 (50,71)	686 (27,01)		70 (2,76)		774 (30,43)	522 (20,55)	332 (13,07)		2408 (5309)		
MA 1150	1460 (57,48)	1046 (41,18)	1288 (50,17)	72,5 (2,85)	238 (9,37)	-	492,5 (19,39)	605 (23,82)	N360x8x-30x44x9H	4260 (9391)		BSP 1 1/4" (D_{1-4})
MA 1600												
MA 2400		1319 (51,93)		133 (5,24)			765,5 (30,14)	878 (34,57)		6100 (13429)		
MA 3200		1670 (65,75)		216 (8,51)			1038,5 (40,89)	1151 (45,31)	N440x8x-30x54x9H	7980 (17587)		
MA 4000		1943 (76,50)					1311,5 (51,63)	1424 (56,06)		9800 (21600)		

Dimensions

Design of driven shaft end on heavily loaded shaft.

Where the driven shaft is heavily loaded and is subject to high stresses, for example for changes in the direction of rotation and/or load, it is recommended that the driven shaft should have a stress relieving groove; see Fig. 12 and tables 4, 5 and 6.

Normally loaded shaft

In drives with only one direction of rotation and/or load where the stresses in the shaft are moderate, the shaft can be plain, see Fig. 13 and tables 4, 5 and 6.

Fig. 12

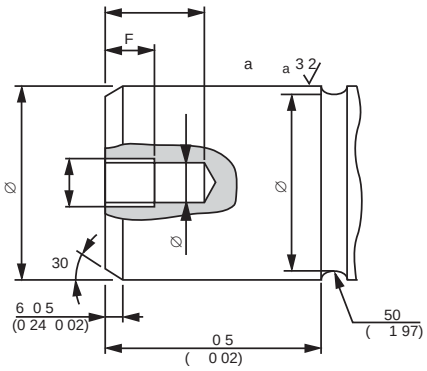


Fig. 13

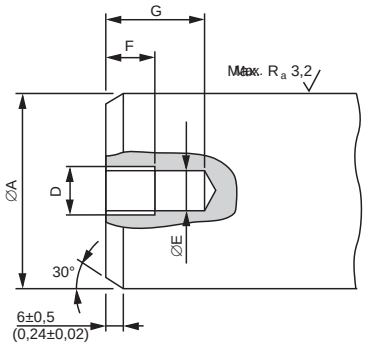


Table 4 **Dimensions for the driven shaft**

Dim	MA 141	MA 200	MB 283	MB 400	MB 566 MB 800	MB 1150 MB 1600	MB 2400	MB 3200 MB 4000
A mm	140 $^{0}_{-0,025}$	155 $^{0}_{-0,025}$	180 $^{-0,014}_{-0,054}$	200 $^{-0,015}_{-0,061}$	260 $^{-0,017}_{-0,069}$	340 $^{-0,018}_{-0,075}$	360 $^{-0,018}_{-0,075}$	460 $^{-0,020}_{-0,083}$
in	5,5118 $^{0}_{-0,00098}$	6,1024 $^{0}_{-0,00098}$	7,0866 $^{-0,00055}_{-0,00213}$	7,8740 $^{-0,00059}_{-0,00240}$	10,2362 $^{-0,00067}_{-0,00272}$	13,3858 $^{-0,00068}_{-0,00292}$	14,1732 $^{-0,00068}_{-0,00292}$	18,1102 $^{-0,00075}_{-0,00323}$
B mm	84	84	106	117	153	215	257	300
in	3,31	3,31	4,17	4,61	6,02	8,46	10,12	11,81
C mm	133	148	174	194	254	334	354	454
in	5,24	5,83	6,85	7,64	10	13,15	13,94	17,87

Note! The dimensions are valid for +20°C (68°F)

Table 5
Alternative thread (fig. 12 & 13)

	MA 141 - MA 200 MB 283 - MB 800*		MB 1150/1600/ 2400/3200/4000	
D	M20	UNC 5/8"	M30	UNC 1"
E	>17 (0,67)	>13,5 (0,53)	>25 (1)	-
F	25 (0,98)	22 (0,87)	40 (1,57)	30 (1,18)
G	50 (1,97)	30 (1,18)	60 (2,36)	-

*MB 800, please contact your Hägglunds representative

Table 6
Recommended material in the shaft

Unidirectional drives
Steel with yield strength Rel_{min}= 300 N/mm^2
Bidirectional drives
Steel with yield strength Rel_{min}= 450 N/mm^2

Dimensions

Splines data for driven shaft

The splines shall be lubricated, either oiled with hydraulic oil at assembly, or filled with transmission oil from the connected gearbox. To avoid wear in the splines, the installation must be within the specified tolerances in fig. 14. For control of spline see table 8.

Fig. 14

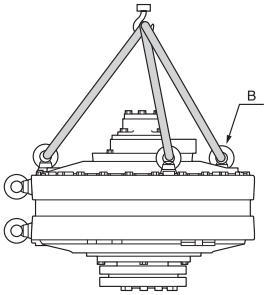


Table 7

Recommended material in the Spline shaft

Unidirectional drives
Steel with yield strength Rel_{min}= 450 N/mm^2
Bidirectional drives
Steel with yield strength Rel_{min}= 700 N/mm^2

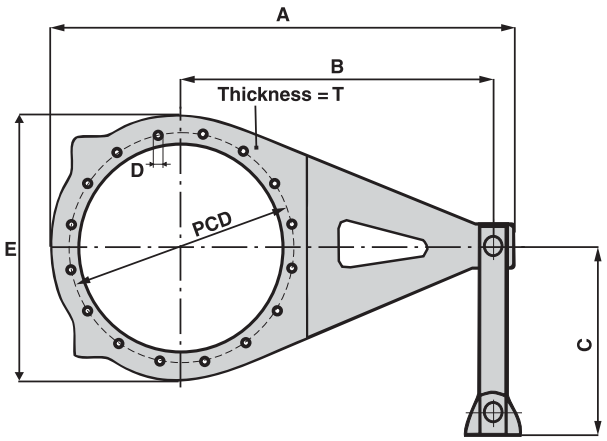
Table 8 **Dimensions for splines**

Motor	**MA 141**	**MA 200**	**MB 283**	**MB 400**	**MB 566 MB 800**	**MB 800 High speed**	**MB 1150 MB 2400**	**MB 3200 MB 4000**
Tooth profile and bottom form	DIN 5480	DIN 5480	DIN 5480	DIN 5480	DIN 5480	DIN 5480	DIN 5480	DIN 5480
Tolerance	8f	8f	8f	8f	8f	8f	8f	8f
Guide	Back	Back	Back	Back	Back	Back	Back	Back
Pressure angel	30°	30°	30°	30°	30°	30°	30°	30°
Module	5	5	5	5	8	5	8	8
Number of teeth	26	28	34	38	36	50	44	54
Pitch diameter	ø 130	ø 140	ø 170	ø 190	ø 288	ø 250	ø 352	ø 432
Minor diameter	ø 128 $^{0}_{-1,178}$	ø 138 $^{0}_{-1,178}$	ø 168 $^{0}_{-1,178}$	ø 188 $^{0}_{-1,201}$	ø 280 $^{0}_{-1,801}$	ø 248 $^{0}_{-1,201}$	ø 340,8 $^{0}_{-1,801}$	ø 420,8 $^{0}_{-1,825}$
Major diameter	ø 139 h11	ø 149 h11	ø 179 h11	ø 199 h11	ø 298,4 h11	ø 259 h11	ø 358,4 h11	ø 438,4 h11
Measure over measuring pins	149,908 $^{-0,085}_{-0,150}$	159,961 $^{-0,085}_{-0,151}$	190,091 $^{-0,087}_{-0,155}$	210,158 $^{-0,088}_{-0,157}$	316,665 $^{-0,102}_{-0,180}$	270,307 $^{-0,103}_{-0,181}$	377,099 $^{-0,107}_{-0,188}$	457,155 $^{-0,121}_{-0,212}$
Diameter of measuring pins	ø 10	ø 10	ø 10	ø 10	ø 16	ø 10	ø 16	ø 16
Addendum modification X M	+2,25	+2,25	+2,25	+2,25	+1,6	+2,25	-0,4	-0,4

Dimensions

Torque arm, TMA

Fig. 16 **Torque arm, TMA**



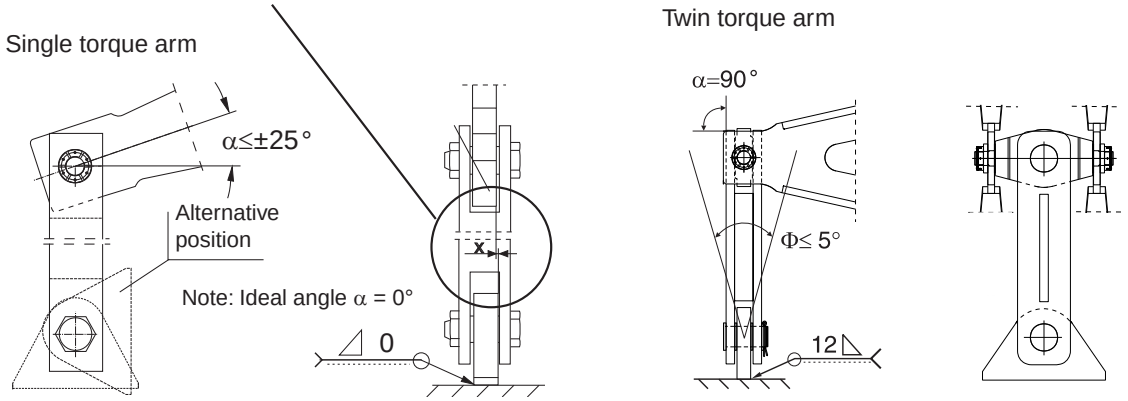
Torque arm	Max. torque, Nm (lbf·ft)	
	For alternating or pulsating torque	At static torque
TMA 20 för MA 141 MA 200	70 000 (51 600)	84 000 (61 900)
TMA 40 för MB 283 MB 400	140 000 (103 200)	170 000 (125 300)
TMA 60 för MB 566 MB 800	280 000 (206 400)	340 000 (250 600)
TMA 80 för MB 1150 MB 1600	560 000 (412 700)	670 000 (493 800)
TMA 100 för MB 2400	840 000 (619 000)	1 010 000 (744 400)
TMA 120 för MB 3200	1 120 000 (825 000)	1 344 000 (990 000)
TMA 140 för MB 4000	1 400 000 (1 032 000)	1 680 000 (1 238 000)

Torque arm	For motor	A mm (in)	B mm (in)	C mm (in)	D mm (in)	PCD mm (in)	E mm (in)	T mm (in)	Weight* kg (lb)
TMA 20	MA 141 MA 200	1175 (46,26)	800 (31,50)	435 (17,12)	24 x 21 (0,83)	520 (20,47)	665 (26,18)		91 (200)
TMA 40	MB 283 MB 400	1680 (66,14)	1250 (49,21)	545 (21,46)	24 x 28 (1,10)	600 (23,62)	750 (29,52)	37 (1,46)	167 (368)
TMA 60	MB 566 MB 800	2050 (80,71)	1500 (59,06)		36 x 28 (1,10)	810 (31,89)	990 (38,98)		241 (531)
TMA 80	MB1150 MB 1600	2870 (112,99)	2000 (78,74)	580 (22,83)	48 x M24	1380 (54,33)	1600 (63,00)	36 (1,42)	465 (1025)
TMA 100	MB 2400	3870 (152,36)	3000 (118,11)						710 (1565)
TMA 120	MB 3200			1300 (21,18)					2175 (4795)
TMA 140	MB 4000								2230 (4916)

*Incl. pivoted attachment

Fig. 17 **Mounting of pivoted attachment**

x = ±2 mm (0,079) misalignment in installation.
x ≤ ±15 mm (0,59) movement when in use.



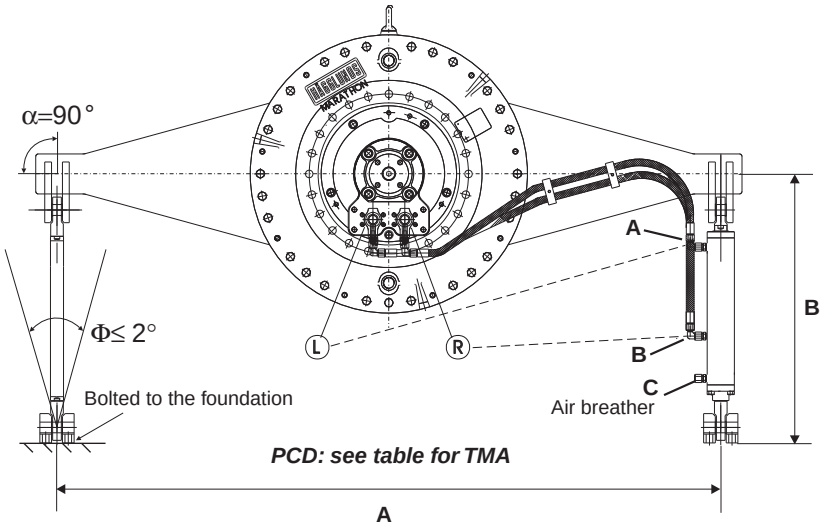
Steel: EN 10113S355N DIN St E39 BS 4360 Grade 50 C
Protected against corrosion, after weldning

Dimensions

Double ended torque arm, DTMA

Double ended torque arm, including double acting hydraulic cylinder and pivoted attachment.

Fig. 18 **Torque arm, DTMA**



Torque arm	A mm (in)	B mm (in)	Weight kg (lb)
DTMA 141	1170 (46,06)	780 (30,71)	200 (440)
DTMA 200	1260 (49,61)	780 (30,71)	205 (452)
DTMA 283	1780 (70,08)	805 (31,69)	240 (529)
DTMA 800-283	2350 (92,52)	780 (30,71)	360 (793)*
DTMA 400	2500 (98,43)	805 (31,69)	360 (793)
DTMA 800-400	2500 (98,43)	900 (35,43)	370 (815)*
DTMA 1150-400	2500 (98,43)	900 (35,43)	380 (837)*
DTMA 1150-283	2350 (92,52	900 (35,43)	370 (815)*
DTMA 566	2120 (83,46)	900 (35,43)	310 (683)
DTMA 1150-566	2120 (83,46)	900 (35,43)	350 (771)*
DTMA 800-575	2150 (84,65)	900 (35,43)	400 (882)*
DTMA 1150-683	2500 (98,43)	900 (35,43)	380 (837)*
DTMA 800	3000 (118,11)	900 (35,43)	500 (1102)
DTMA 800-800	3000 (118,11)	900 (35,43)	700 (1543)*
DTMA 1150-800	3000 (118,11)	900 (35,43)	700 (1543)*
DTMA 1150-975	2350 (92,52)	1185 (40,55)	725 (1598)*
DTMA 1150	2760 (108,66)	1185 (40,55)	870 (1917)
DTMA 1600-1375	2250 (88,59)	1235 (48,62)	850 (1873)*
DTMA 2400-1550	3000 (118,11)	1235 (48,62)	900 (1984)*
DTMA 1600	2600 (102,36)	1235 (48,62)	860 (1895)
DTMA 2400-1725	3250 (127,96)	1235 (48,62)	910 (2006)*
DTMA 2400-1950	3170 (124,81)	1235 (48,62)	910 (2006)*
DTMA 2400-2175	3500 (137,80)	1235 (48,62)	910 (2006)*
DTMA 2400	3900 (153,54)	1235 (48,62)	920 (2028)

*Theoretical values

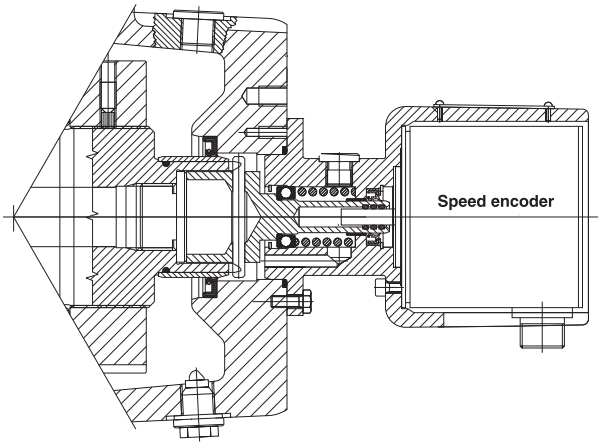
Accessories

Speed encoder with mounting set SMMB and SMMM

Speed encoder with mounting set SMMB/SMMM for mounting on the motor. The Speed encoder could be ordered in 15 different models, full scale output from 2 to 300 rpm.
Mounting set for speed encoder: SMMB for MA 141 - MB 800
SMMM 1 for MB 1150 - MB 4000 (centre mounted)
SMMM 2 for MB 1150 - MB 4000 (off-centre mounted)

Fig. 19 **Speed encoder**

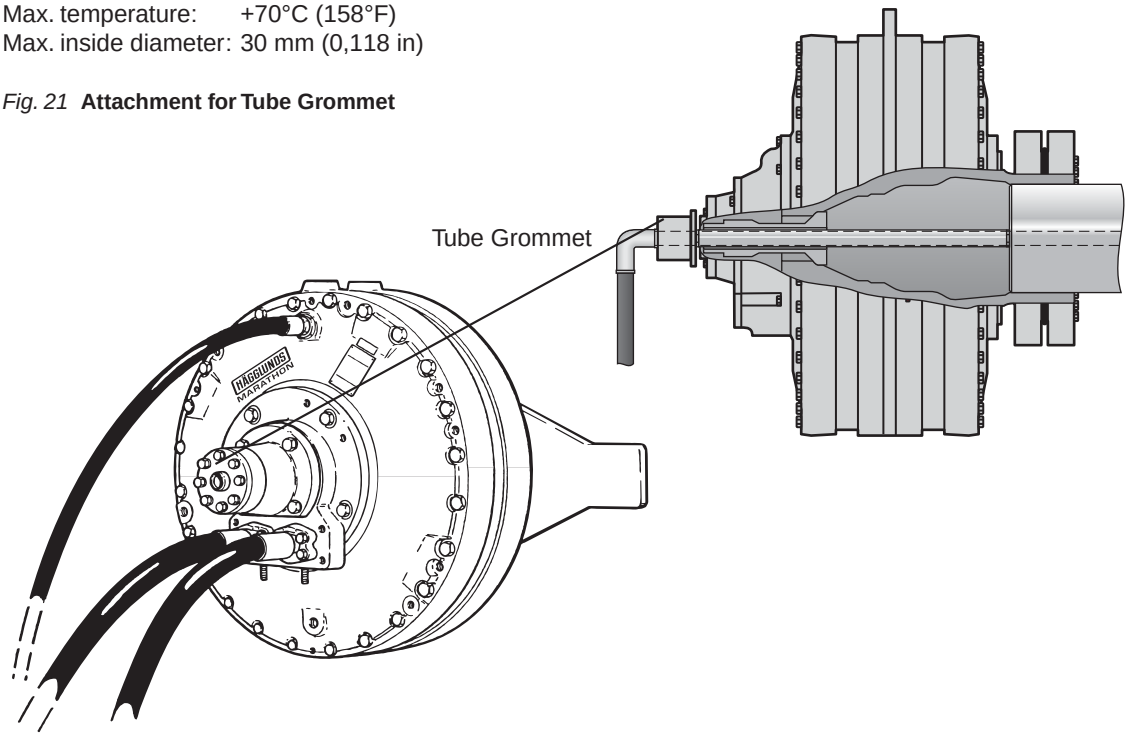
Fig. 20 **Example of mounting on MA 141 - MB 800 (SMMB)**



Attachment for Tube Grommet

This device makes it possible to flush the driven shaft or draw electrical cables through the motor. (MA 141 - MB 800)
Max. pressure: 20 bar (290 psi)
Max. temperature: +70°C (158°F)
Max. inside diameter: 30 mm (0,118 in)

Fig. 21 **Attachment for Tube Grommet**



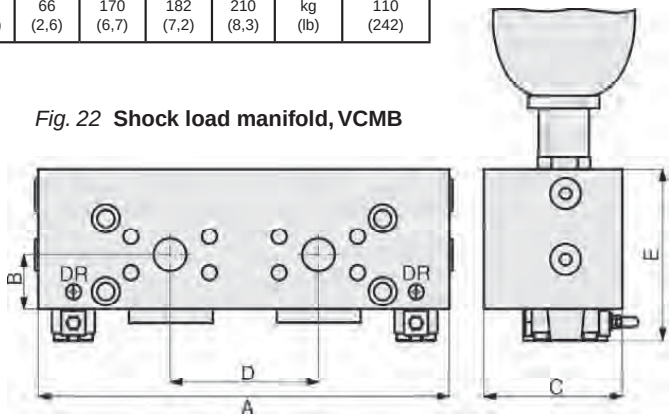
Accessories

Shock load manifold, VCMB

In applications where there are risks of cavitations i.e. shredders or crushers, it is necessary to install the Shock load manifold. The VCMB manifold is designed to be installed directly on the motor, with the accumulator(s) mounted on the top of the manifold. By doing that, all piping between the accumulator(s) and the system is eliminated, and the risk for cavitation is reduced to a minimum.

Type		A	B	C	D	E	Weight	
VCMB 40	mm (in)	426 (16,8)	57 (2,2)	125 (4,9)	120 (4,7)	203 (8,1)	kg (lb)	60 (132)
VCMB 60	mm (in)	506 (19,9)	66 (2,6)	170 (6,7)	182 (7,2)	210 (8,3)	kg (lb)	110 (242)

Fig. 22 **Shock load manifold, VCMB**



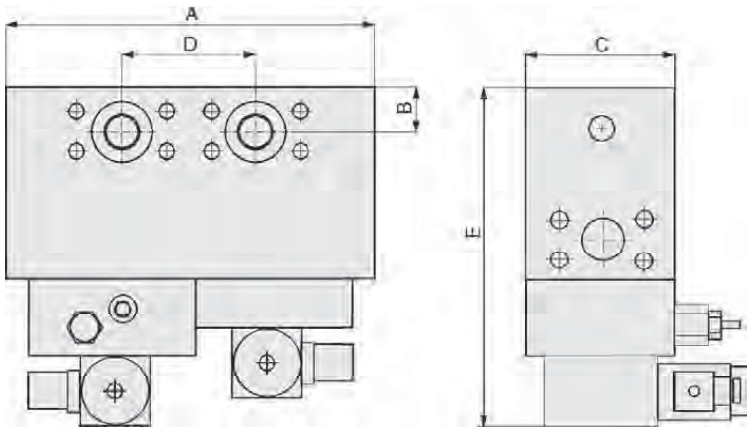
Emergency stop manifold, VEMB

In applications where very quick stops are required, and/or to meet valid safety regulations, the emergency stop manifold should be installed. The VEMB manifold can be mounted directly on the Marathon motor. Two sizes are available, VEMB 40 for MA 141 - MB 400 and VEMB 60 for MB 566 - MB 800. The VEMB manifold can be converted for either clockwise or counter clockwise motor shaft rotation. The VEMB manifold gives a very quick stop and can be integrated in most common control systems.

Type		A	B	C	D	E*	E**	Weight	
VEMB 40	mm (in)	279 (11)	38 (1,5)	140 (5,5)	120 (4,7)	318 (12,5)	352 (13,8)	kg (lb)	55 (121)
VEMB 60	mm (in)	347 (13,7)	47 (1,9)	130 (5,1)	182 (7,2)	343 (13,5)	380 (15,0)	kg (lb)	165 (363)

* Standard ** Explosion proof

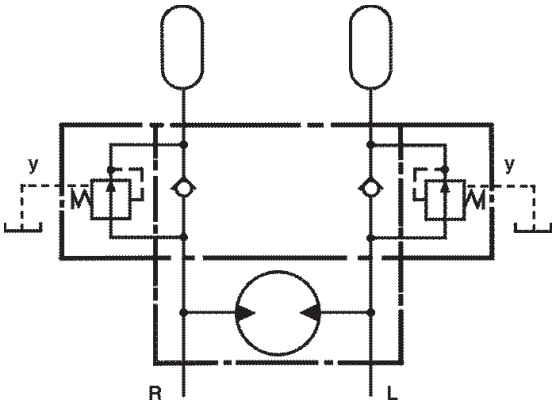
Fig. 23 **Emergency stop manifold, VEMB**



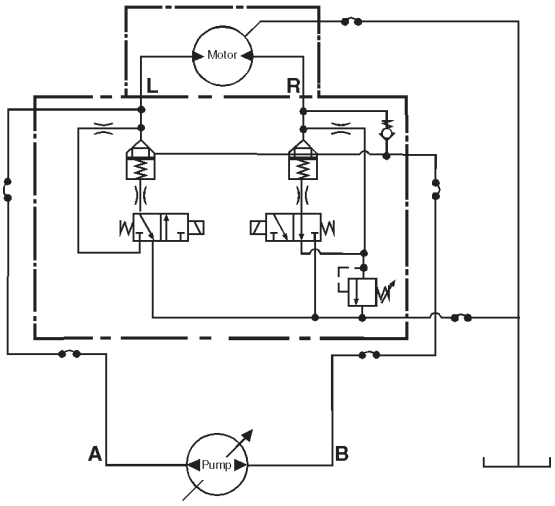
Accessories

Hydraulic circuits

Hydraulic circuit 1 **Shock load manifold, VCMB**



Hydraulic circuit 2 **Emergency stop manifold, VEMB**



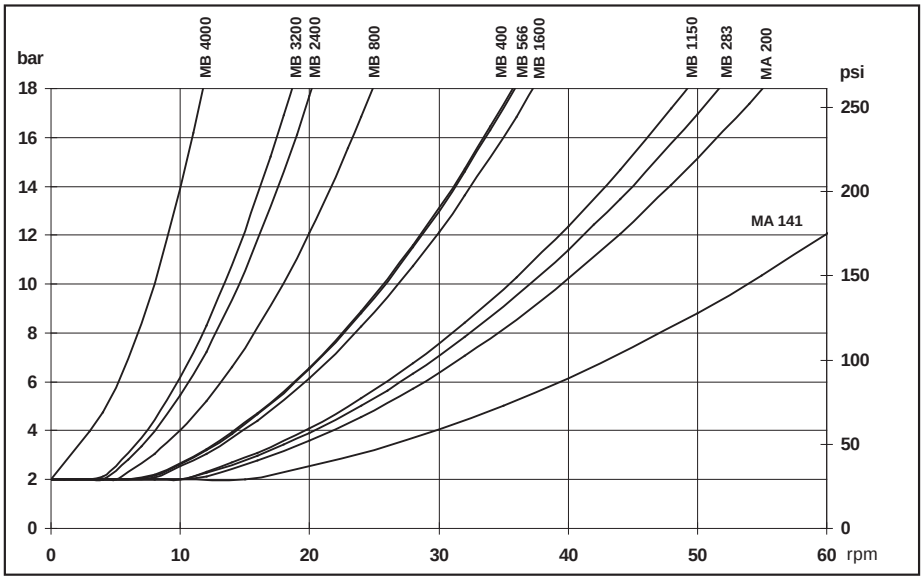
Diagrams for Marathon

Recommended charge pressure

The hydraulic system must be such that the motor will receive sufficient charge pressure at the low pressure port. This applies to all types of installations. There are two distinct cases:

Case 1:
The motor works in braking mode. Required charge pressure at the inlet port is according to diagram below.

Case 2:
The motor works in driving mode only. Required back pressure at the outlet port corresponds to 30% of value given in diagram below, but may not be lower than 2 bar (29 psi).



Oil viscosity 40 cSt (187 SSU).
Valid for 1 bar (15 psi) case pressure. With increasing case pressure the charge pressure must be increased accordingly. Max. case pressure is 3 bar (43,5 psi) (for 1% of the operation time evenly divided, pressure peaks of max. 5 seconds up to 8 bar (116 psi) are allowed). Max. permitted case pressure at stand-still is 8 bar (116 psi).

Diagrams for Marathon

Overall efficiency, oil viscosity 40 cSt/187 SSU, Pc=15 bar (217 psi)

Diagram 1 **MA 141**

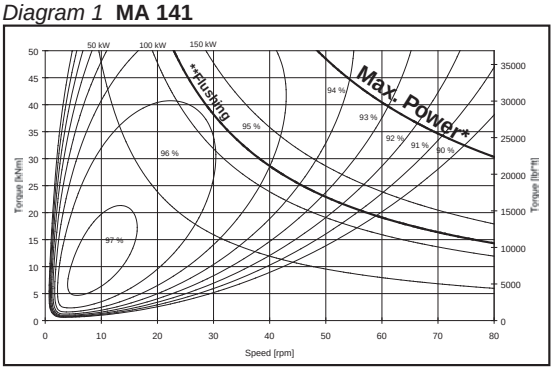


Diagram 2 **MA 200**

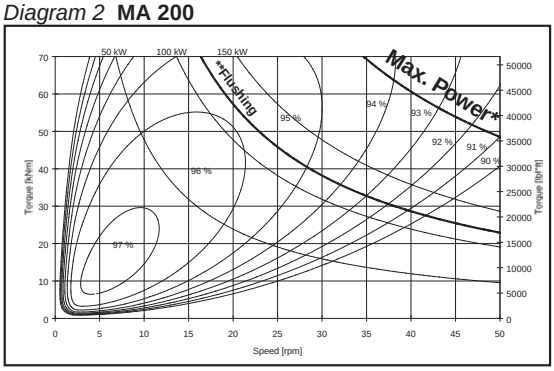


Diagram 3 **MB 283**

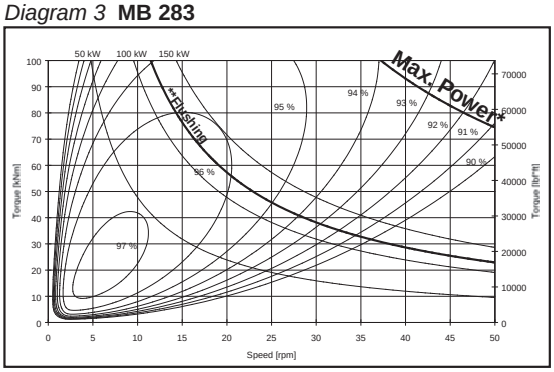


Diagram 4 **MB 400**

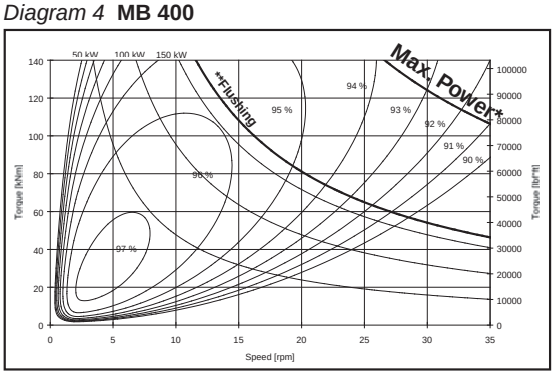


Diagram 5 **MB 566**

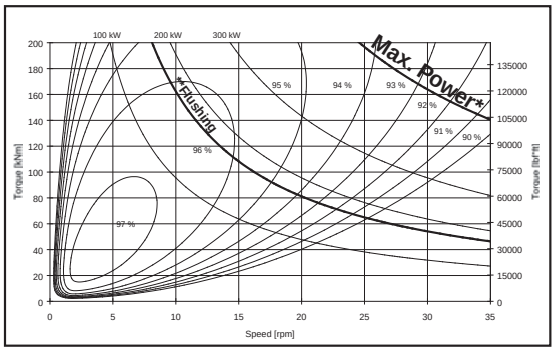


Diagram 6 **MB 800**

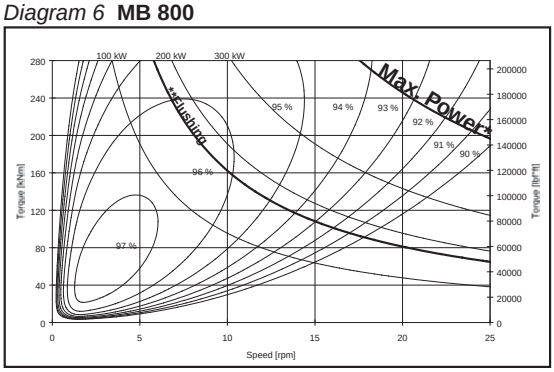


Diagram 7 **MB 1150****

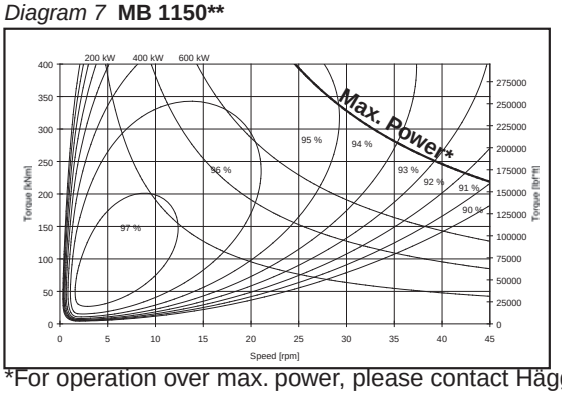
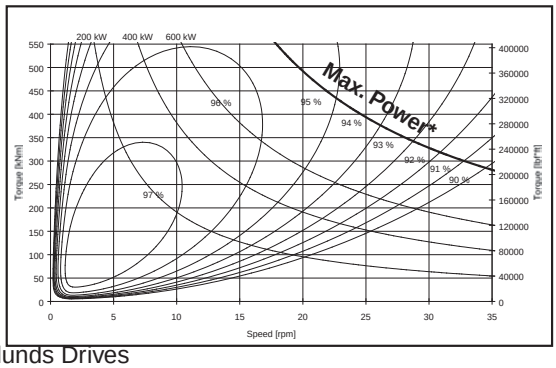


Diagram 8 **MB 1600****



*For operation over max. power, please contact Hägglunds Drives
** See Engineering manual, AM-4.5 Flushing of motor case

Diagrams for Marathon

Overall efficiency, Oil viscosity 40 cSt/187 SSU, Pc=15 bar (217 psi)

Diagram 9 **MB 2400****

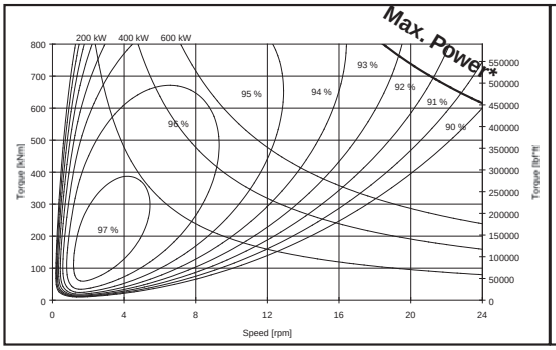


Diagram 10 **MB 3200****

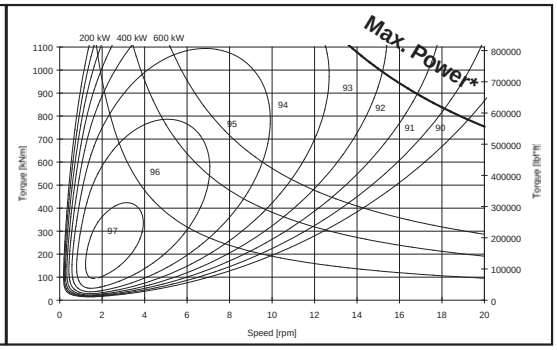
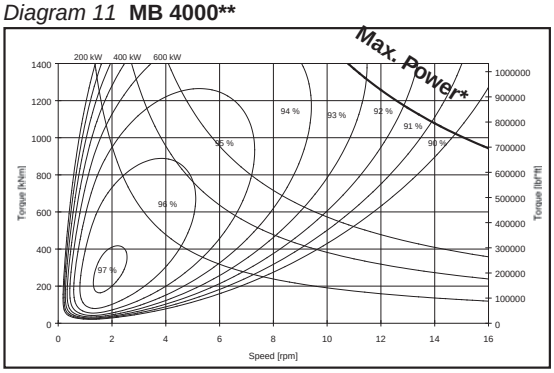


Diagram 11 **MB 4000****

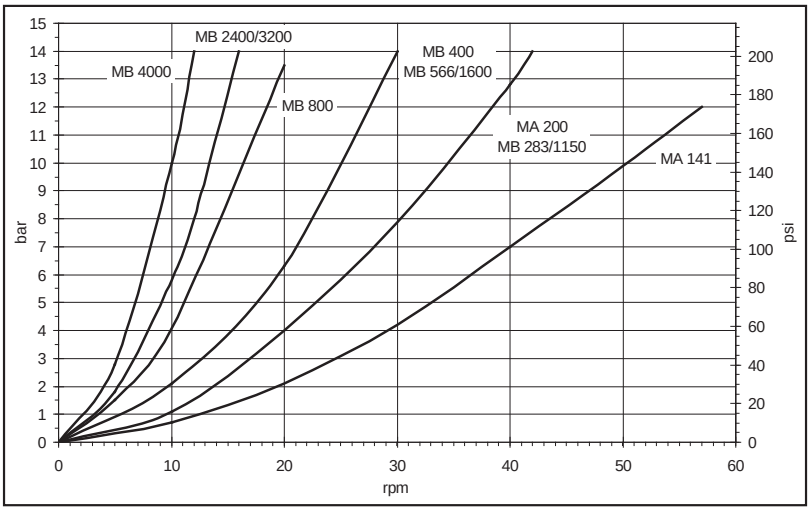


*For operation over max. power, please contact Hägglunds Drives.
** See Engineering manual, AM-4.5 Flushing of motor case.

Pressure loss

Oil viscosity 40 cSt/187 SSU.

Diagram 12 **MA 141 - MB 4000**



Flushing of motor case

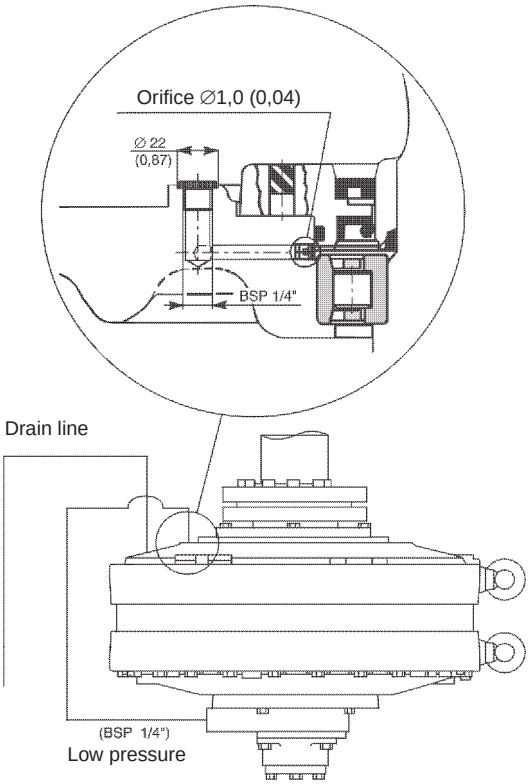
The Marathon motors have very high total efficiency, and they are now frequently used in applications with high power. To avoid high temperature in the motor case the heat must be cooled away, because high temperature gives lower viscosity and that gives reduction in basic rating life. Low viscosity also gives reduced permitted output power from the motor.

- For continuous duty in applications with an ambient temperature of +20°C (68°F), the motor case must be flushed when the output power exceeds the values shown below.

Max power without flushing		
MA 141 - 283	120 kW	(160 hp)
MB 400 - 800	170 kW	(227 hp)
MB 1150 - 2400	250 kW	(335 hp)
MB 3200 - 4000	250 kW	(335 hp)

Note: For cold weather, motor case warmup is needed regardless of max. power. Warm oil can be flushed throughout the motor for a few minutes prior to rotating motor shaft.

Fig. 24 **Flushing connection F**



Volumetric losses

Valid for an oil viscosity of 40 cSt/187 SSU, the diagram shows the average values. When calculating volumetric losses using other viscosities, multiply the value given in the diagram 13 by the factor K.

Diagram 13 **Volumetric losses**

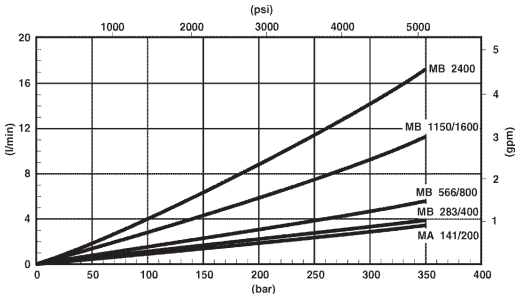
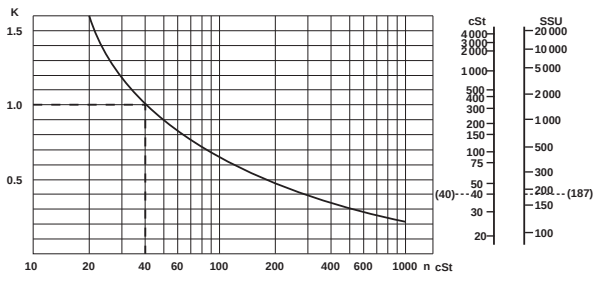


Diagram 14 **Factor K - Variation in Volumetric losses**



Examples of installations

Fig. 25 **Torque arm mounted motor with splines.**

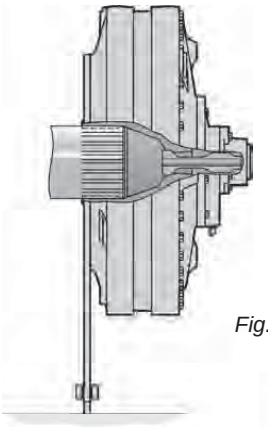


Fig. 26 **Torque arm mounted motor with shrink disc.**

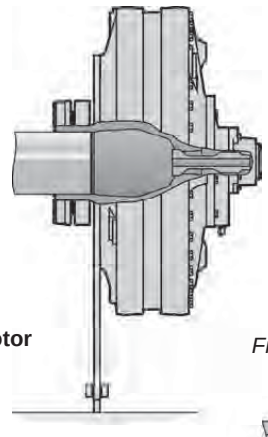


Fig. 27 **Torque arm mounted motor with tube grommet.**

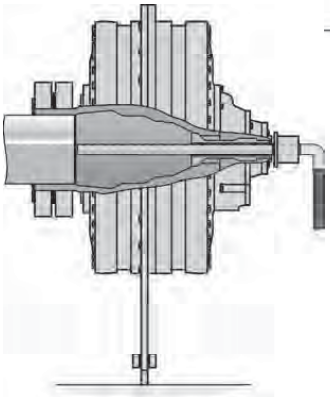
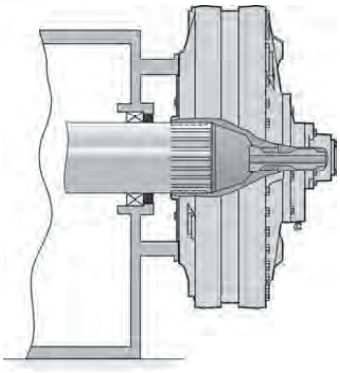


Fig. 28 **Flange mounted motor with splines.**



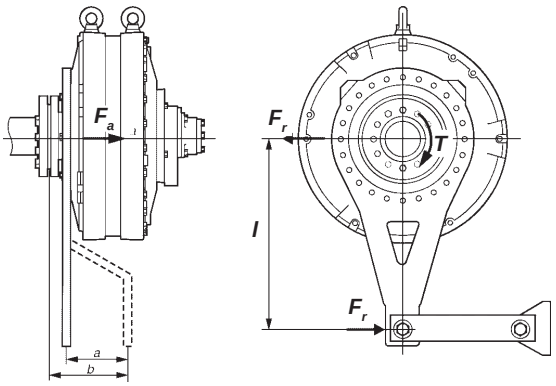
Calculating external loads for Marathon

If standard torque arms type TMA are not used, forces must be checked for main bearings and coupling (fig. 29). The bracket must be designed so it does not give extra external forces to the motor (fig. 30).

F_r = Total radial force on fixed motor mounting
F_a = Axial force acting on motor centerline
T = Output torque for motor
M_b = Bending moment acting on the coupling

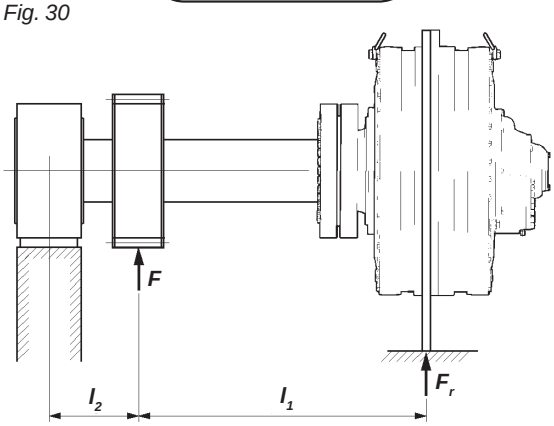
$$F_r = \frac{T}{l} \qquad M_b = F_r \cdot b$$

Fig. 29



$$F_r = F \cdot \frac{l_2}{l_1 + l_2}$$

Fig. 30



Permissible external loads

Fixed shaft - torque arm mounted motor, viscosity 40/40 cSt and speed 0,5 times rated speed. Torque arm is mounted at a = 0 mm on the motor.

Speed: MA 141: 28 rpm
MA 200: 19 rpm
MB 283: 19 rpm
MB 400: 14 rpm
MB 566: 14 rpm
MB 800: 9 rpm

Note: When Bracket mounted motor, please contact Hägglunds Drives representative.

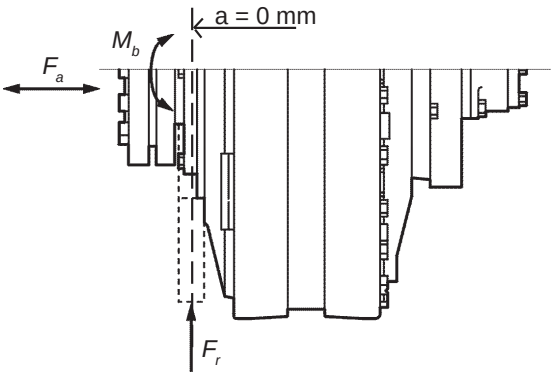


Diagram 15 **Motor type MA 141**

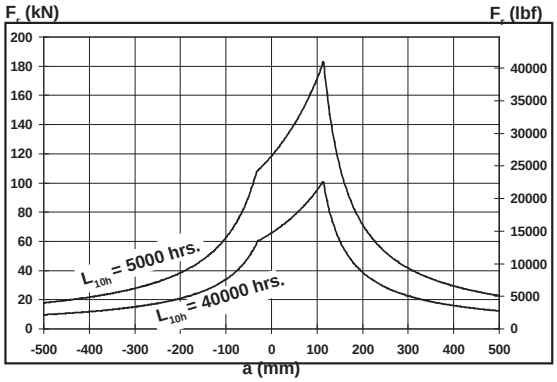


Diagram 16 **Motor type MA 200**

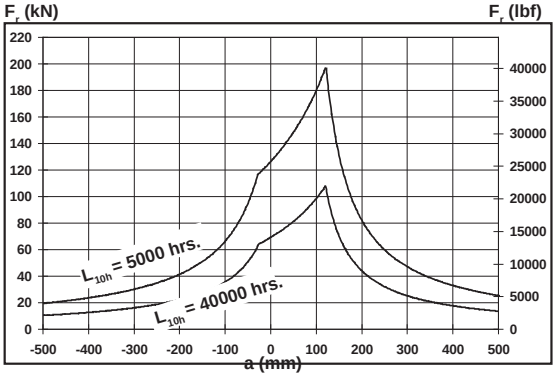


Diagram 17 **Motor type MB 283**

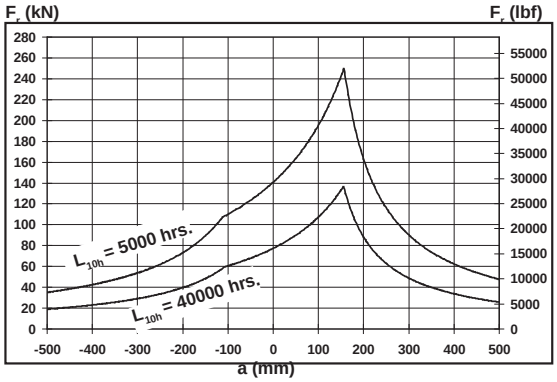


Diagram 18 **Motor type MB 400**

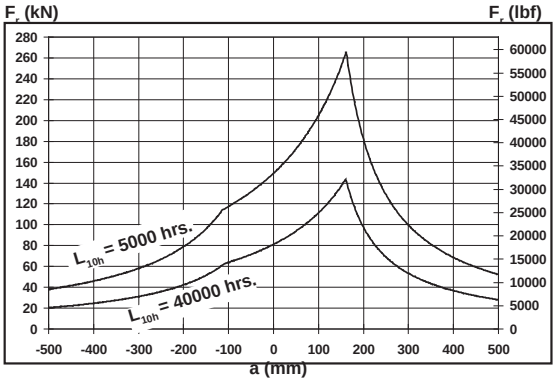


Diagram 19 **Motor type MB 566**

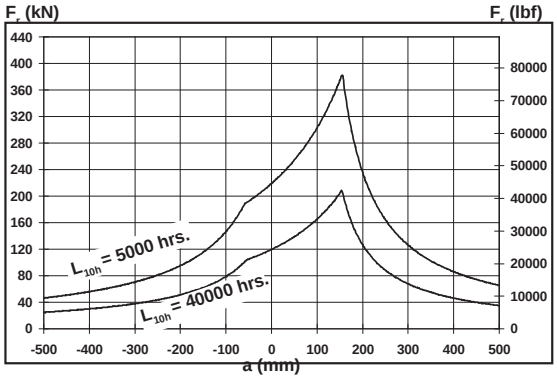
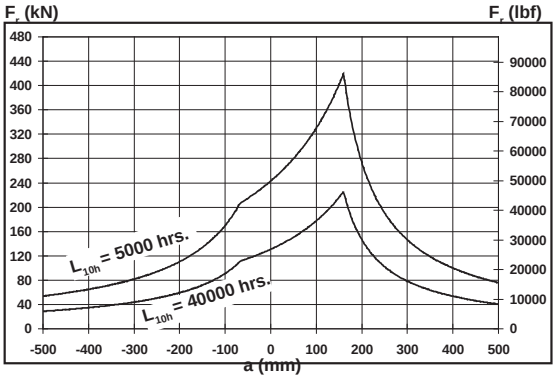


Diagram 20 **Motor type MB 800**



Permissible external loads

Fixed shaft - torque arm mounted motor, viscosity 40/250 cSt and speed 0,5 times rated speed. Torque arm is mounted at a = 0 mm on the motor.

Speed: MB 1150:17 rpm MB 1600:12 rpm
MB 2400: 7 rpm MB 3200: 5 rpm
MB 4000: 4 rpm

Note: When Bracket mounted motor, please contact Hägglunds Drives representative.

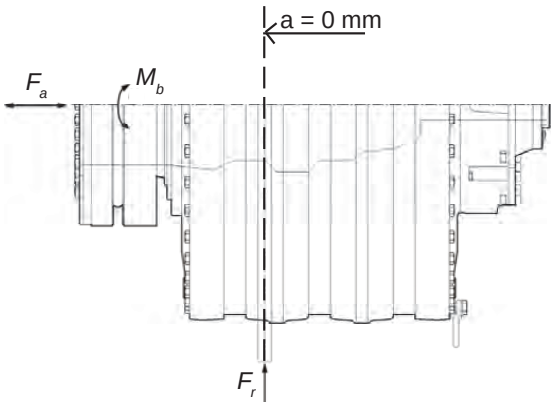


Diagram 21 **Motor type MB 1150**

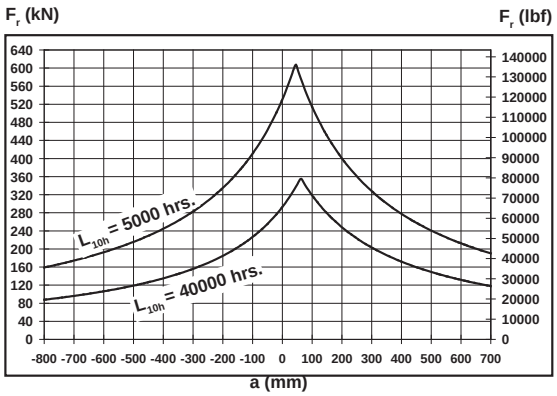


Diagram 22 **Motor type MB 1600**

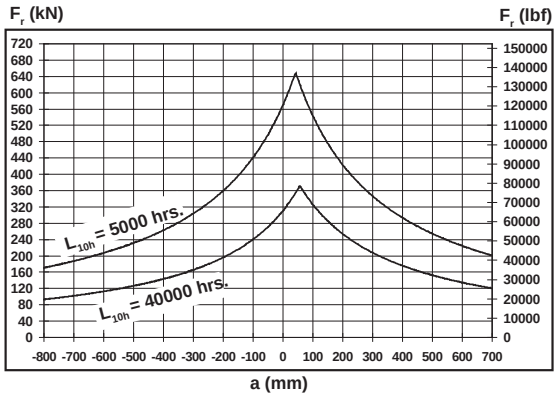
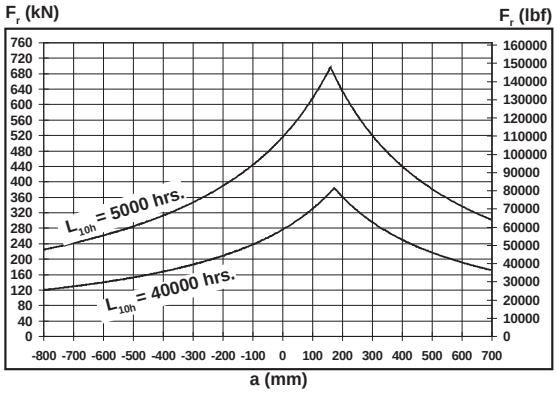


Diagram 23 **Motor type MB 2400**



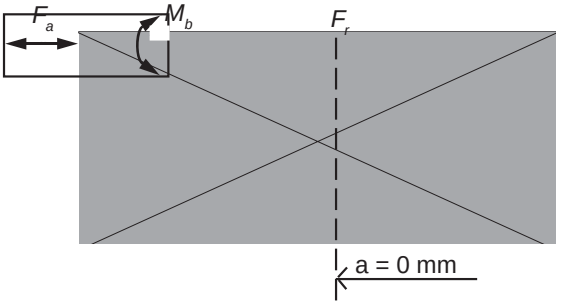


Diagram 24 **Motor type MB 3200**

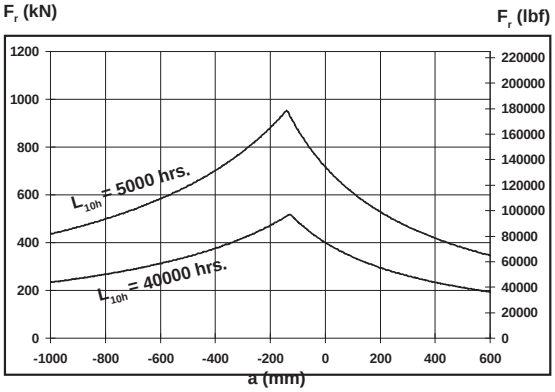
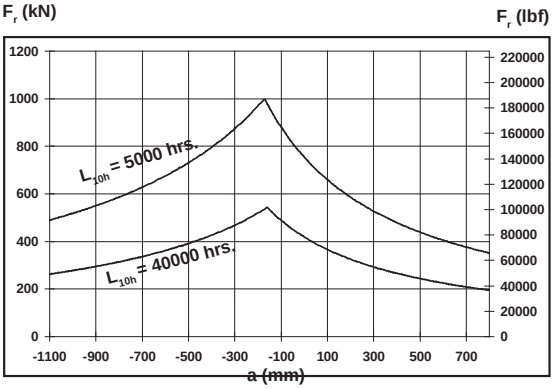


Diagram 25 **Motor type MB 4000**



Choice of hydraulic fluid

The Hägglunds Drives hydraulic motors are primarily designed to operate on conventional petroleum based hydraulic oils. The hydraulic oil can be chosen in consultation with the oil supplier or your local sales office, bearing the following requirements in mind:

General

The oil shall have FZG (90) fail stage minimum 11 described in IP 334 (DIN 51354). The oil must also contain inhibitors to prevent oxidation, corrosion and foaming. The viscosity of mineral oil is highly dependent of the temperature. The final choice of oil must depend on the operating temperature that can be expected or that has been established in the system and not in the hydraulic tank. High temperatures in the system greatly reduce the service life of oil and rubber seals, as well as resulting in low viscosity, which in turn provides poor lubrication. Content of water shall be less than 0,1%. In Industrial applications with high demands for service life, the content of water shall be less than 0,05%.

Recommended viscosity

At operating temperature: 40-150 cSt/187-720 SSU.

Viscosity limits	
Viscosity index	= 100 recommended = 150* for operation with large temperature difference
Min. permitted in continuous duty Min. permitted in intermittent duty Max. permitted	40 cSt/187 SSU 20 cSt/98 SSU** 10000 cSt/48000 SSU

* Many hydraulic fluids with VI-improvers are subject to temperary and permanent reductions of the viscosity.

** **Low viscosity gives reduced basic rating life for the motors and reduction of max allowed power.**

Temperature limits	
Normal operating temperature should be less than +50°C (122°F).	
Nitrile seals (std motor) Viton seals Nitrile seals (low temp)	-35°C to +70°C -20°C to +100°C -50°C to +60°C
Nitrile seals (std motor) Viton seals Nitrile seals (low temp)	-31°F to + 158°F -4°F to + 212°F -58°F to +140°F

Fire resistant fluid

The following fluids are tested for Hägglunds Drives motors (ISO/DP 6071).

Fluid	Approved	Seals	Internal paint
HFA: Oil (3,5%) in water emulsion	No	-	-
HFB: Inverted emulsion 40-45% water in oil	Yes	Nitrile (std motor)	Not painted*
HFC: Water-glycol	Yes	Nitrile (std motor)	Not painted*
HFD Synthetic fluids			
HFD:R - Phosphate esters	Yes	Viton	Not painted*
HFD:S - Chlorinated hydrocarbons	Yes	Viton	Not painted*
HFD:T - Mixture of the above	Yes	Viton	Not painted*
HFD:U - Other compositions	Yes	Viton	Not painted*

* Must be specified in order.

Environmentally acceptable fluids

Fluid	Approved	Seals	internal paint
Vegetable */** Fluid HTG	Yes	Nitrile (std motor)	-
Synthetic ** Esters HE	Yes	Nitrile (std motor)	-

* Vegetable fluids give good lubrication and small change of viscosity with different temperature. Vegetable fluids must be controlled every 3 months and temperature shall be less than +45°C (113°F) to give good service life for the fluid.

** Environmental acceptable fluid gives the same servicelife for the drive, as mineral oil.

Choice of hydraulic fluid

Down rating of pressure data and basic rating life

Down rating of pressure, for motors used in systems with fire resistant fluids, the maximum pressure for motor given on data sheet must be multiplied with following factors:

HFA-fluid	not fit for used
HFB-fluid	0,7 x maximum pressure for motor
HFC-fluid	0,7 x maximum pressure for motor
HFD-fluid	0,9 x maximum pressure for motor

Down rating of basic rating life, for motors used in systems with fire resistant fluids, the "expected basic rated life" must be multiplied with following factors:

HFA-fluid	not fit for use
HFB-fluid	0,26 x expected life with mineral oil
HFC-fluid	0,24 x expected life with mineral oil
HFD-fluid	0,80 x expected life with mineral oil

Filtration

The oil in a hydraulic system must always be filtered and also new oil from your supplier has to be filtered when adding it to the system. The grade of filtration in a hydraulic system is a question of service life v.s. money spent on filtration.
In order to obtain stated service life it is important to follow our recommendations concerning contamination level.
When choosing the filter it is important to consider the amount of dirt particles that the filter can absorb and still operate satisfactory. For that reason we recommend a filter with an indicator that gives a signal when it is time to change the filter cartridge.

Filtering recommendations

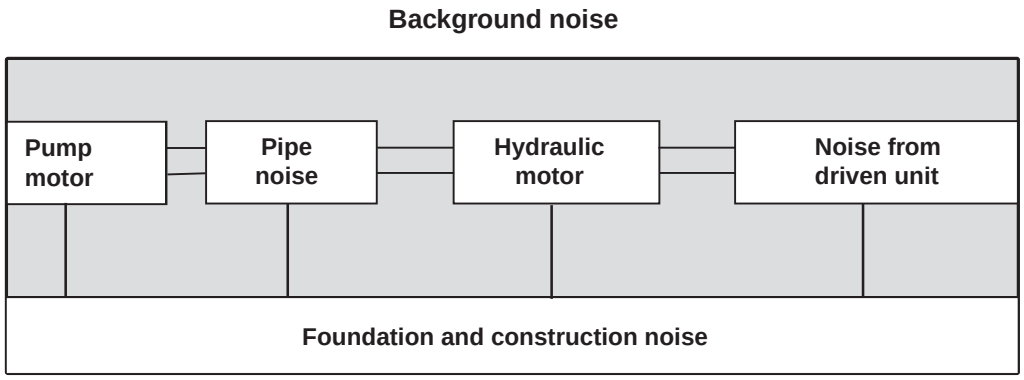
Before start-up, check that the system is thoroughly cleaned.
1. In general the contamination level in our motors should not exceed ISO 4406 19/15 (NAS 10).
2. For heavy-duty applications the contamination level should not exceed ISO 4406 16/13 (NAS 7).
3. When filling the tank and motor case, we recommend the use of a filter with the grade of filtration β**10=75**.

Explanation of "Grade of Filtration"

Grade of filtration β**10=75** indicates the following:
β**10** means the size of particle $\geq$10μm that will be removed by filtration.
=75 means the grade of filtration of above mentioned size of particle. The grade of filtration is defined as number of particles in the oil before filtration in relation to number of particles in the oil after filtration.

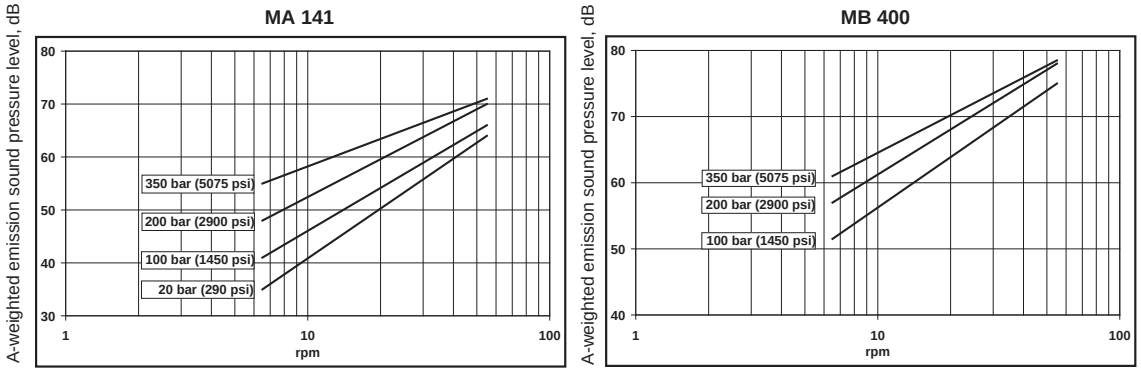
Ex. Grade of filtration is β**10=75**.
Before the filtration the oil contains N number of particles $\geq$10μm and after passing the filter once the oil contains $\frac{N}{\mathbf{75}}$ number of particles $\geq$10μm.
This means that $N - \frac{N}{\mathbf{75}} = \frac{74 \cdot N}{\mathbf{75}}$ number of particles have been filtered (=98,6%).

Noise from a complete installation



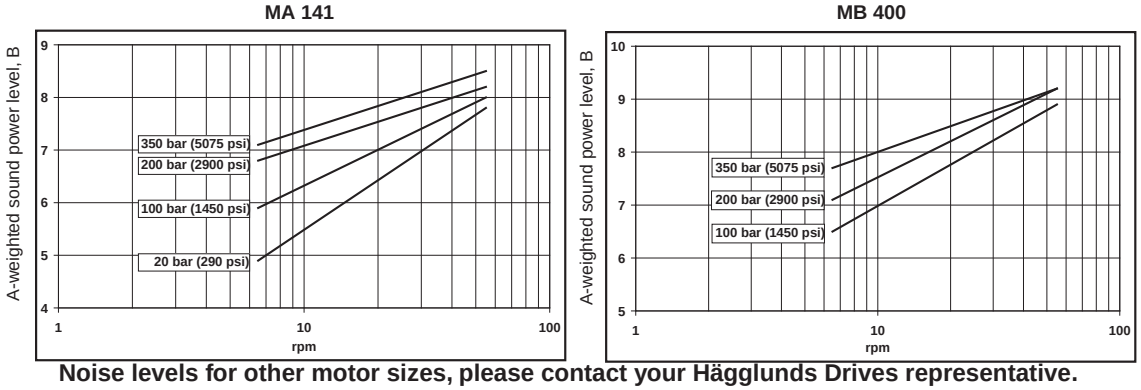
A-weighted mean sound pressure level of Marathon, MA 141 & MB 400

The mean sound pressure level have been calculated for unattended machines.
All values refer to a position of the test object > 1 m (3,28 ft).

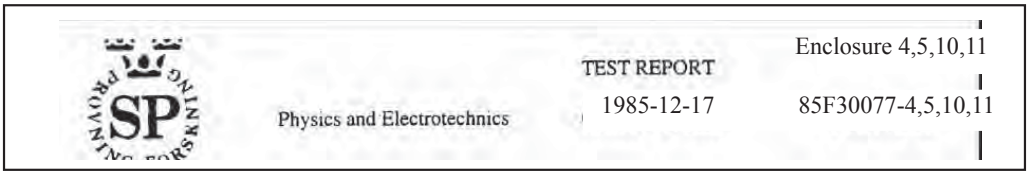


A-weighted sound power level of Marathon, MA 141 & MB 400

The sound power level have been calculated according to ISO/DIS 3747 for unattended machines.
All values refer to a position of the test object > 1 m (3,28 ft).



Noise levels for other motor sizes, please contact your Hägglunds Drives representative.



Declaration of Incorporation

Example of the Declaration of Incorporation given by Hägglunds Drives AB

HÄGGLUNDS

Declaration of Incorporation of partly completed machinery
As defined by the EC Machinery Directive 2006/42/EC, Appendix II B

The manufacturer

Hägglunds Drives AB

hereby declares that the partly completed machinery

Name: Marathon
Function: Hydraulic motor
Model: Marathon
Type: Marathon
Trade name: Marathon

satisfies the following essential requirements of Machinery Directive 2006/42/EC in accordance with the chapter numbers in Appendix I:

General principle no. 1.									
1.1.3	1.1.5	1.3.1	1.3.2	1.3.3	1.3.4	1.3.6	1.3.7	1.5.3	1.5.4
1.5.5	1.5.6	1.5.8	1.5.13	1.6.1	1.6.3	1.7.3	1.7.4		

The requirements are fulfilled provided that the data in the product documentation (fitting instructions, operating instructions, project management and configuration documents) are implemented by the product user. The requirements of Appendix I to Machinery Directive 2006/42/EC not mentioned here are not applied and have no relevance for the product.

It is also declared that the special technical documents for this partly completed machinery have been compiled in accordance with Appendix VII, Part B. These are transferred on request to the market surveillance body in paper-based/electronic format.

Conformity with the provisions of further EU Directives, Standards or Specifications:

SS-EN 892
SS-EN ISO 12100-1
SS-EN ISO 12100-2

The partly completed machinery may only be put into operation when it has been established that the machine into which the partly completed machinery is to be incorporated conforms to the provisions of EC Machinery Directive 2006/42/EC, where relevant according to this directive.

The individual below is authorized to compile the relevant technical files:

Name: Björn Leidelöf
Address: Hägglunds Drives AB, S-890 42 Mellansel

Björn Leidelöf — Mellansel, 2009-12-29

Signature *Place, date*

We reserve the right to make changes to the content of the Declaration of Incorporation. Current issue on request.

The Declaration of Incorporation above, is available on request for deliveries from Hägglunds Drives AB. Translations into other languages are also available.