The Drive & Control Company

Rexroth
Bosch Group

Hägglunds MB

Radial piston hydraulic motor

Installation and maintenance manual
EN320-23BR/2011

Supersedes:
EN320-23h/2011
English

The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

Changes in the equipment may occur. We therefore reserve the right to introduce amendments in the manual as we deem necessary without notice or obligations.

This Installation and Maintenance Manual is valid for motors manufactured after 98-01-01. For older motors please contact your nearest Bosch Rexroth representative.

The cover shows an example configuration. The product supplied may therefore differ from the figure shown.

The original operating instructions were prepared in English.

Contents

1 General

1.1 Safety precautions

It is of high importance that the Safety precautions are always followed, if you are unsure about something, please don´t hesitate to contact your nearest HD-office for advice.

- **Warning signs.** In this manual you will find the following signs which indicate a potential hazard, which can or will cause personal injury or substantial property damage. Depending on the probability of the hazard, and how serious the injury or property damage could be, there are three levels of classification.

Warning sign, signal word	Meaning
⚠ DANGER	Indicates a dangerous situation which may cause death or severe personal injuries if not avoided.
⚠ WARNING	Indicates a dangerous situation which may cause death or severe personal injuries if not avoided.
⚠ CAUTION	Indicates a dangerous situation which may cause minor or medium personal injuries if not avoided.
NOTICE	Damage to property: The product or the environment could be damaged.

- **Application area.** All new and rebuild applications, should always be approved and supervised by Hägglunds personnel.
- **Mounting.** Carefully follow the instructions and be aware of the high weights and forces during lifting.
- **Before starting up.** Before starting up new, rebuild or just worked on applications, all accessories and safety arrangements functions, should be controlled/tested.
- **Periodic maintenance.** Notice the intervals in maintenance chart (4.4) and keep a record.
- **Dismounting.** Carefully follow the instructions and be aware of the high weights and forces during lifting.

1.2 Motor data

Table 1.1

Metric	S index	Displace-ment	Specific torque	Rated speed*	Max. speed	Max. pressure**	Max. output power intermittent.
Motor Type		**V_i**	**T_s**	**n**	**n**	**p**	**P**
MA 141		8 890	141	56	80	350	254
MA 200		12 575	200	45	55	350	254
MB 283		17 768	283	40	50	350	390
MB 800-283 [1]	20	17 768	283	80	130	350	515
MB 400		25 145	400	28	35	350	390
MB 800-400 [3]		25 145	400	38	50	350	515
MB 800-400 [1]	20	25 145	400	56	95	350	515
MB 1150-400 [1]		25 145	400	90	125	350	1 031
MB 566		35 561	566	28	35	350	515
MB 1150-566 [1]		35 561	566	70	110	350	1 031
MB 800-575 [1]	20	36 121	575	42	65	350	515
MB 800		50 265	800	20	25	350	515
MB 800-800 [2]	20	50 265	800	28	45	350	515
MB 1150-683 [1]		42 899	683	62	90	350	1 031
MB 1150-800 [1]		50 258	800	55	75	350	1 031
MB 1150-975 [1]		61 249	975	40	62	350	1 031
MB 1150		72 241	1 150	38	53	350	1 031
MB 1600-1375 [1]		86 392	1 375	30	43	350	1 031
MB 1600		100 529	1 600	29	38	350	1 031
MB 2400-1725 [1]		108 383	1 725	22	33	350	1 546
MB 2400-1950 [1]		122 520	1 950	22	30	350	1 546
MB 2400-2175 [1]		136 657	2 175	18	27	350	1 546
MB 2400		150 794	2 400	16	24	350	1 546
MB 3200		201 059	3 200	10	16	350	1 580
MB 4000		251 323	4 000	8	12	350	1 580

* Related to a required pressure of 12 bar/175 psi for motors in braking mode. (Special considerations regarding charge pressure, cooling and choice of hydraulic 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.

Quantity	Symbol		Metric	US
Power	P	=	kW	hp
Displacement	V_i	=	cm^3/rev	in^3/rev
Specific torque	T_s	=	Nm/bar	lbf·ft/1000 psi
Speed	n	=	rpm	rpm
Pressure	p	=	bar	psi

Table 1.2

US Motor Type	S index	Displacement V_i	Specific torque T_s	Rated speed* n	Max. speed n	Max. pressure** p	Max. output power intermittent. P
MA 141		542	7 170	56	80	5 000	340
MA 200		767	10 170	45	55	5 000	340
MB 283		1 084	14 390	40	50	5 000	523
MB 800-283 [1]	20	1 084	14 380	80	130	5 000	690
MB 400		1 534	20 340	28	35	5 000	523
MB 800-400 [3]		1 534	20 340	38	50	5 000	690
MB 800-400 [1]	20	1 534	20 340	56	95	5 000	690
MB 1150-400 [1]		1 534	20 340	90	125	5 000	1 382
MB 566		2 170	28 780	28	35	5 000	690
MB 1150-566 [1]		2 170	28 780	70	110	5 000	1 382
MB 800-575 [1]	20	2 204	29 240	42	65	5 000	690
MB 800		3 066	40 680	20	25	5 000	690
MB 800-800 [2]	20	3 066	40 680	28	45	5 000	690
MB 1150-683 [1]		2 618	34 720	62	90	5 000	1 382
MB 1150-800 [1]		3 067	40 680	55	75	5 000	1 382
MB 1150-975 [1]		3 738	49 570	40	62	5 000	1 382
MB 1150		4 408	58 480	38	53	5 000	1 382
MB 1600-1375 [1]		5 270	69 920	30	43	5 000	1 382
MB 1600		6 132	81 360	29	38	5 000	1 382
MB 2400-1725 [1]		6 611	87 700	22	33	5 000	2 072
MB 2400-1950 [1]		7 473	99 150	22	30	5 000	2 072
MB 2400-2175 [1]		8 336	110 600	18	27	5 000	2 072
MB 2400		9 198	122 050	16	24	5 000	2 072
MB 3200		12 265	162 750	10	16	5 000	2 117
MB 4000		15 330	203 440	8	12	5 000	2 117

* Related to a required pressure of 12 bar/175 psi for motors in braking mode. (Special considerations regarding charge pressure, cooling and choice of hydraulic system for speeds above rated.

** The motors are designed according to DNV-rules. Test pressure 420 bar/6000 psi.
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[3] Lower displacement.

Quantity	Symbol		Metric	US
Power	P	=	kW	hp
Displacement	V_i	=	cm^3/rev	in^3/rev
Specific torque	T_s	=	Nm/bar	lbf·ft/1000 psi
Speed	n	=	rpm	rpm
Pressure	p	=	bar	psi

1.3 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 D1, D2, D3 or (D4)* 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 alterna-tively by splines.

Valid patents

US 4522110, US 005979295A, SE 9101950-5, EP 0102915, JP 83162704, GB 1524437, EP NL 0524437, EP:DE 69211238.3.

Quality

We maintain a Quality Assurance system, certified to standard ISO 9001.

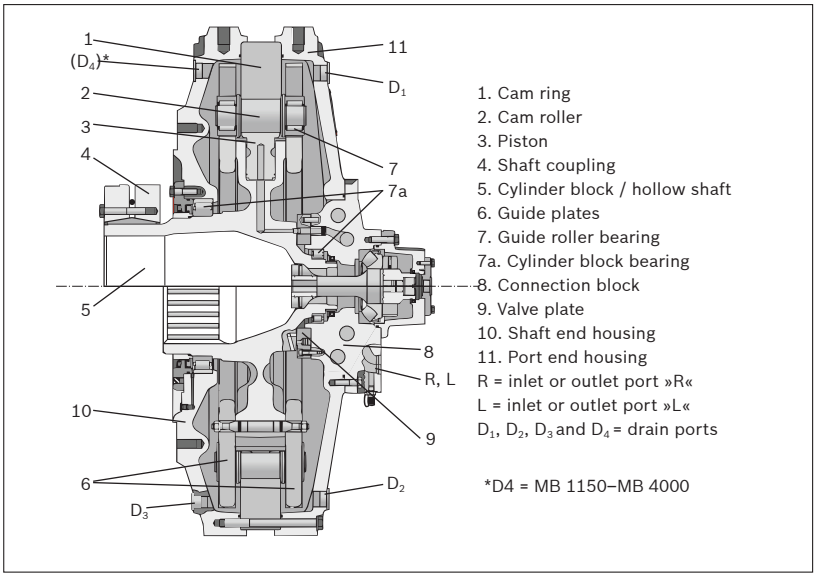


Fig. 1: The Marathon motor

Hägglunds MB, EN320-23BR/2011, Installation and maintenance manual, Bosch Rexroth Mellansel AB

2 Technical data

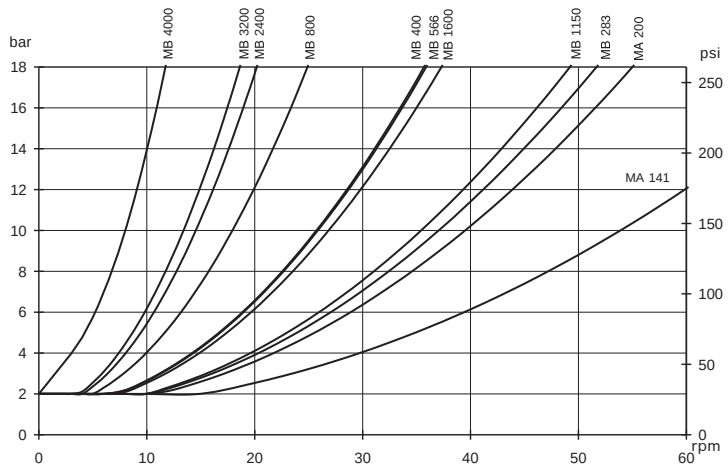
2.1 Recommended charge pressure

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.

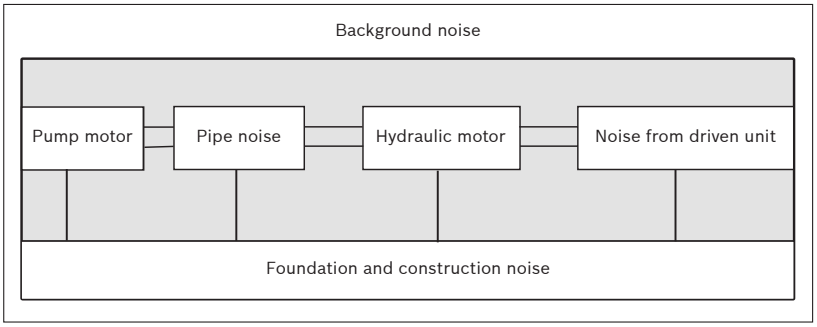
Case 2:
The motor works in driving mode only. Required back pressure at the outlet port corresponds to 30% of value given in diagram below, but may not be lower than 2 bar (29 psi).

Table 2.1: Charge pressure



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).

2.2 Noise level from a complete installation



Remarks:

Background noise

The background noise can not normally be influenced but is usually known or easy to measure.

Pump unit

The pump unit is a known noise level.

Pipe noise

The pipe noise is probably the source of the majority of mistakes in installations: all pipe clamps should be of vibration insulating type secured to concrete ceiling, wall or floor. Securing to non-rigid metal structures or structures is likely to give resonance and should be avoided.

Hydraulic motor

The hydraulic motor is a known noise level. (Tables of sound data – see subsection 4.9 in the Engineering Manual).

Driven unit

The driven unit is an unknown sound source (for us) but can through certain information probably be obtained from the supplier. When securing the torque arm of a hydraulic motor to the foundation or casing of a driven machine, it is highly important to study the construction of the foundation or casing. This may well be the most important factor to consider, since many structures may give rise to resonance, resulting in severe noise problems.

2.3 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 of 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%.

Notice!
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	40 cSt/187 SSU
Min. permitted in intermitted duty	20 cSt/98 SSU**
Max. permitted	10000 cSt/48000 SSU
* Many hydraulic fluids with VI-improvers are subject to temporary and permanent reductions of the viscosity. HD recommendation is always to use the base oil viscosity when calculating the rated life and max allowed power. For heavy-duty applications we recommend synthetic oils.	
** Low viscosity gives reduced service life for the motors and reduction of max. allowed power for “MARATHON”.	

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

Fire resistant fluids

Operating with fire resistant fluids.
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 compossitions	Yes	Viton	Not painted*
* Must be specified in the order.			

IMPORTANT!
Down rating of pressure data and service life must be considered when using fire resistant fluid. The Hägglunds Drives company or its authorised representative must always be contacted for approval in the case of these types of fluids.

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 give the same servicelife for the drive, as mineral oil.
*** The fluid shall have less than 10g/100g according to ASTMD 1958-97/DIN 53241.

Filtration

The oil in a hydraulic system must always be filtered and also the 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. For industrial applications the contamination level should not exceed ISO 4406 16/13 (NAS 7).
2. When filling the tank and motor case, we recommend the use of a filter with the grade of filtration β10=75.

Explanation of "Grade of filtration"

Grade of filtration β10=75 indicates the following:

- β10 means the size of particle ≥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 β10=75.
- Before the filtration the oil contains N number of particles ≥10µm and after passing the filter once the oil contains $\frac{N}{75}$ number of particles ≥10µm.
- This means that $N - \frac{N}{75} = \frac{74 \cdot N}{75}$ number of particles have been filtered (=98.6%).

3 Installation

3.1 Mounting instructions

If the motor is to work properly it must be installed with the greatest possible precision. Every item connected to the motor that does not meet the requirements of the following instructions may result in stresses that ad-versely affect the basic rating life of the motor.
Normally the motor must be completely full of oil. When the motor is installed with the shaft in the horizontal plane, the drain ports must be positioned vertically. The higher of the two drain ports must be used: see Fig. 3.24 “Oil connections”, page 28.
When the motor is mounted with the shaft in the vertical plane, drain outlet D1 or D2 must be connected to the drain hole on the shaft end housing or end cover. A preloaded check valve must be connected in the drain line to ensure that the motor is filled with oil; see Fig. 3.28–3.30 “Draining and venting the motor”, page 30.
The drain line must be dimensioned so that max. 3 bar (43,5 psi) motor case pressure is not exceeded.
The max case pressure is 3 bar (43,5 psi). Brief peaks during operation up to 8 bar (116 psi) are permissible. The permitted case pressure when the motor is stationary is 8 bar (116 psi).
The motor must always be connected in such a way as to give a sufficient boost make-up flow at the low pressure connection. This is particularly important at high speeds and with rapid reversing, see 2.1 “Recommended charge pressure”.

Design of driven shaft end on heavily-loaded shaft

Where the driven shaft is heavily loaded and is subject to high stresses, for example on changes in the direction of rotation, it is recommended that the driven shaft should have a stress relieving groove; see Fig. 3.1 and tables 3.1 and 3.2.

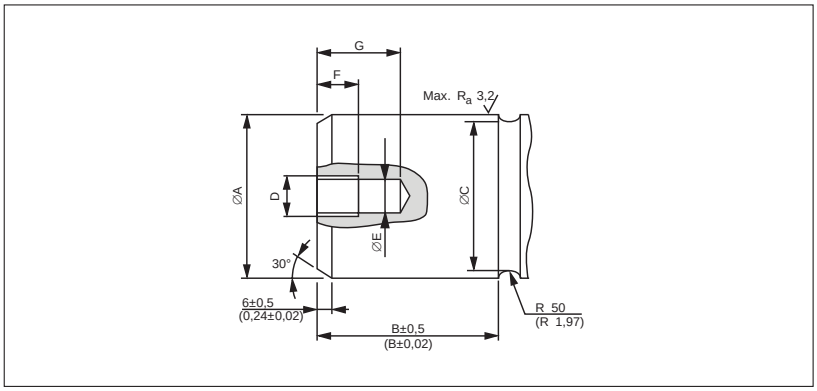


Fig. 3.1

Normally-loaded shaft

In drives with only one direction of rotation where the stresses in the shaft are moderate, the shaft can be plain, see Fig. 3.1a and tables 3.1 and 3.2.

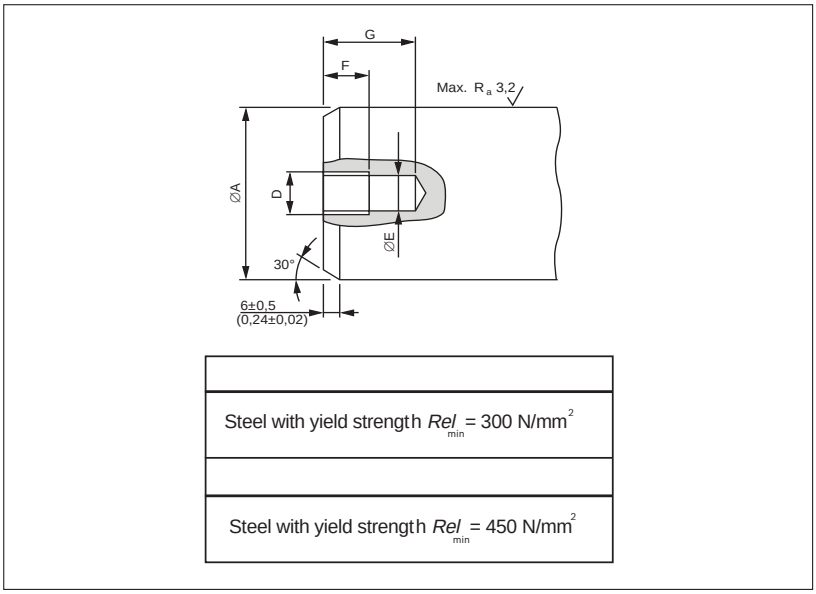


Fig. 3.1a

Table 3.1: Valid for couplings with slitted inner ring

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	0 -0.025 140	0 -0.025 155	-0.014 -0.054 180	-0.015 -0.061 200	-0.017 -0.069 260	-0.018 -0.075 340	-0.018 -0.075 360	-0.020 -0.083 460
in	0 -0.00098 5.5118	0 -0.00098 6.1024	-0.00055 -0.00213 7.0866	-0.00059 -0.00240 7.8740	-0.00067 -0.00272 10.2362	-0.00068 -0.00292 13.3858	-0.00068 -0.00292 14.1732	-0.00075 -0.00323 18.1102
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)								

Thread for mounting tool

To make it easier to mount the motor on the driven shaft end or to remove the motor from the shaft it is recommended that a hole (table 3.2) should be drilled and tapped in the centre of the shaft for a mounting tool; see 3.1.4 “Mounting the motor onto the driven shaft”, and 3.1.5 “Removing the motor from the driven shaft”.

The tool has both a UNC thread and a metric thread, so that the hole can be drilled and tapped to conform to one of the two alter-natives given in table 3.2.

Table 3.2: Alternative thread (Fig. 3.1 and 3.1a)

	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 Hägglunds Drives representative.				

Spline

The splines shall be lubricated with hydraulic oil, or filled with transmission oil from the connected gearbox. Motors that carry radial load, must have the splines filled with oil. To avoid wear in the splines, the installation must be within the specified tolerances in fig. 3.2. For control of spline see table 3.3. If there is no radial or axial force on the shaft, the shaft can be oiled only.

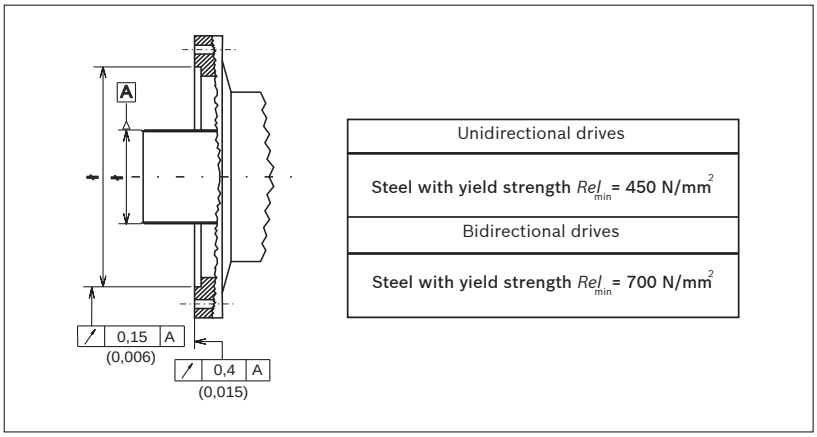


Fig. 3.2

Table 3.3

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 angle	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	$^{0}_{-1.178}$ ø 128	$^{0}_{-1.178}$ ø 138	$^{0}_{-1.178}$ ø 168	$^{0}_{-1.178}$ ø 188	$^{0}_{-1.801}$ ø 280.8	$^{0}_{-1.201}$ ø 248	$^{0}_{-1.801}$ ø 340.8	$^{0}_{-1.825}$ ø 420.8
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	$^{-0.085}_{-0.150}$ 149.908	$^{-0.085}_{-0.151}$ 159.961	$^{-0.087}_{-0.155}$ 190.091	$^{-0.088}_{-0.157}$ 210.158	$^{-0.102}_{-0.180}$ 316.665	$^{-0.103}_{-0.181}$ 270.307	$^{-0.107}_{-0.188}$ 377.099	$^{-0.121}_{-0.212}$ 457.155
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

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3.1.1 Lifting methods

One of the lifting methods shown here must be used when handling the motor and torque arm; see Figures 3.3–3.8.

⚠ DANGER

Before lifting, check that the lifting eyes are screwed fully home. Make sure that the lifting tools can handle the weight (see table 3.4).

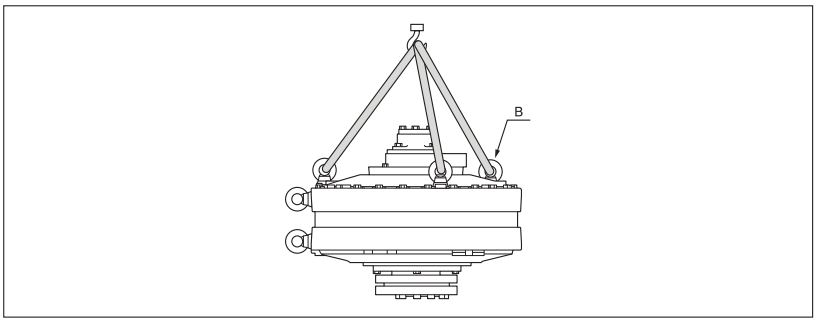

Fig. 3.3

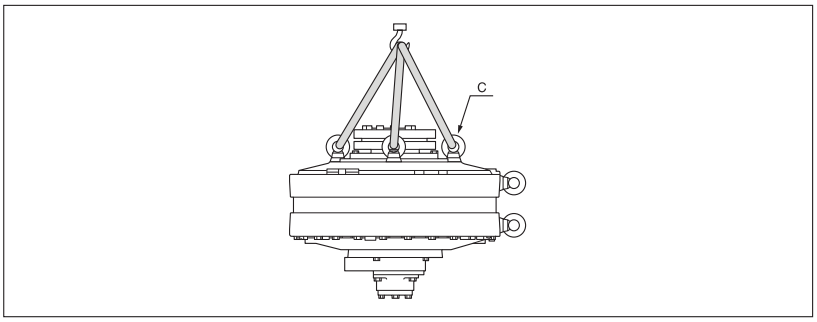

Fig. 3.4

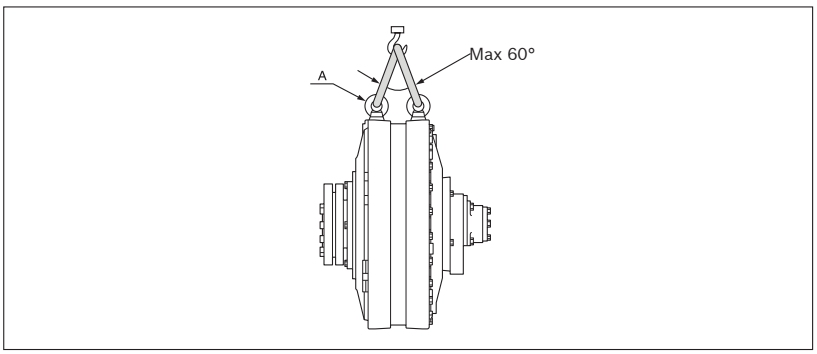

Fig. 3.5: MA141–MB 800

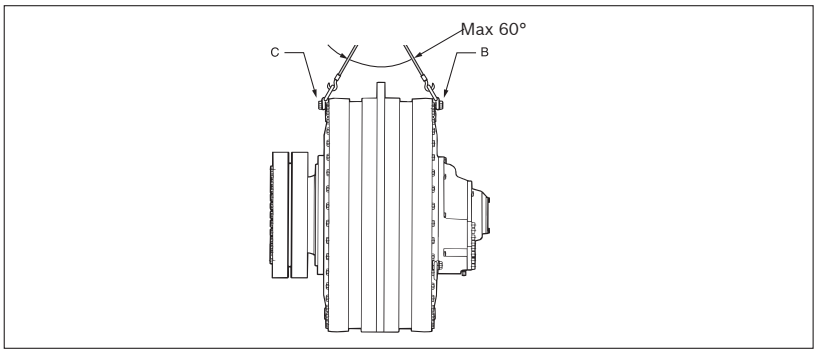

Fig. 3.6.a: MB 1150/1600

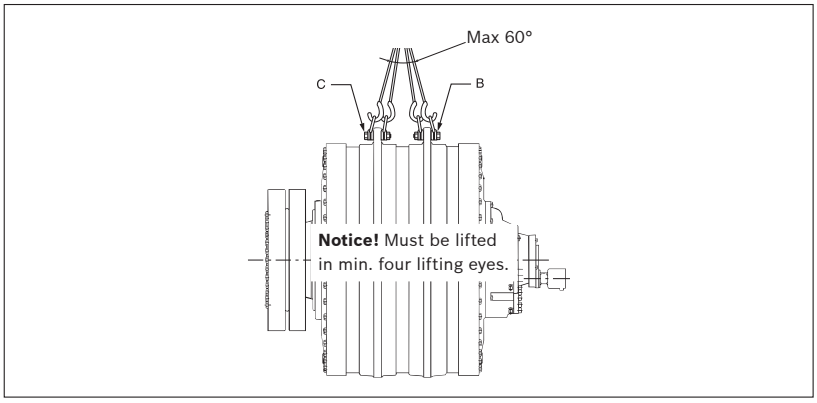

Fig. 3.6.b: MB 2400/3200/4000

Lifting the torque arm

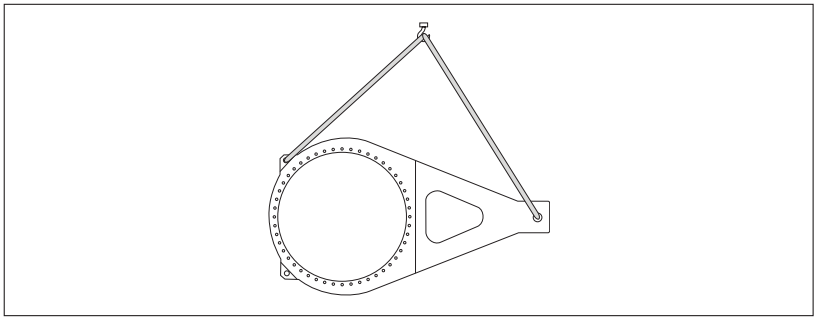

Fig. 3.7

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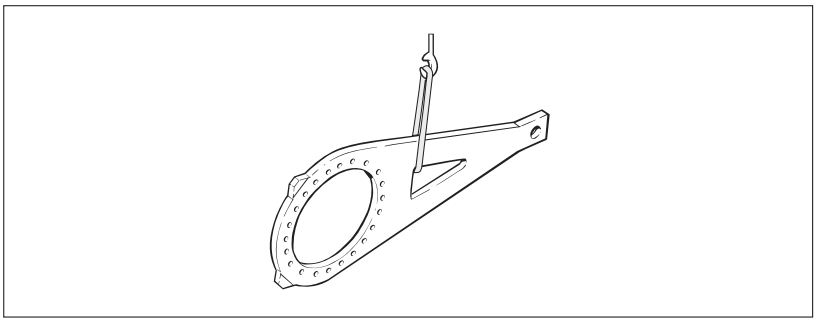

Fig. 3.8

⚠ DANGER

Always make sure where the centre of gravity is before any lifting, never stand below a hanging motor or torque arm.

Table 3.4

Motor	Weight		Lifting eye dimensions		
	kg	lb	A	B	C
MA 141	990	2 183	1" UNC	1" UNC	3/4" UNC
MA 200	1 130	2 490			
MB 283	1 395	3 075			1" UNC
MB 400	1 625	3 594			
MB 566	2 108	4 647	1 1/4" UNC	1 1/4" UNC	
MB 800	2 580	5 688			
MB 1150	4 600	10 140	–	M24	M24
MB 1600	4 600	10 140			
MB 2400	6 460	14 222			
MB 3200	8 930	19 730		M30	M30
MB 4000	10 750	23 700			

Table 3.5

Torque arm	Weight	
	kg	lb
TMA 20	75	165
TMA 40	133	283
TMA 60	207	456
TMA 80	420	930
TMA100/120/140	762	1 679

Standing the motor on a flat surface

When the motor is placed on a flat surface such as a floor, it must stand either on its outer diameter or on the suitably protected end face of the hollow shaft (see Fig. 3.9 and 3.10).

NOTICE

The motor must not be placed on the end face of the hollow shaft when the coupling is fitted, since this may cause damage to the coupling.
When in storage, the motors MA141–MB800 must always be placed on the end face to the hollow shaft. It is also advisable to provide supports at the mounting surface of the motor; see Fig. 3.10.

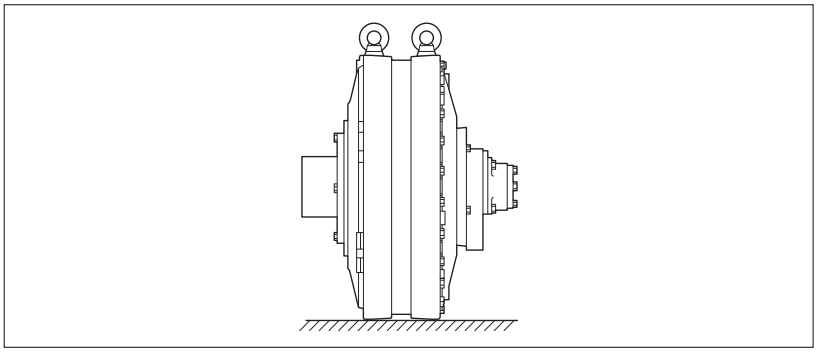

Fig. 3.9: MA 141–MB 4000

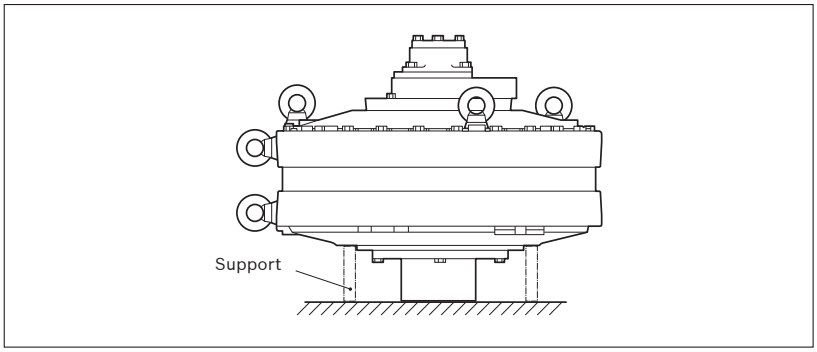

Fig. 3.10: MA 141–MB 800

3.1.1 Mounting the coupling onto the motor shaft onto the motor shaft

The motor is delivered with anti-rust treatment on the hollow shaft and coupling.

Instruction to follow when mounting the Marathon motor on a driven shaft

Before the motor is mounted there are some preconditions which must be fulfilled:

- The shaft material for the driven shaft must be of a quality which meets the minimum requirements specified by Hägglunds Drives (see recommendations, page 14).
- The shaft must have the dimensions as recommended in the section 3.1.

You should note that the couplings are from the factory lubricated with MoS2 (Molykote) on the conical surfaces and the bolts. This lubricants shall remain on those surfaces but:

⚠ CAUTION

Molycote must under no circumstances be transferred to the surfaces between the driven shaft and the motor.

It is therefore important that you clean your hands if you got Molykote on them.
If those conditions are fulfilled you may start the mounting.

- Clean the driven shaft and the out- and inside of the Marathon motor hollow shaft, see Fig. 3.12. Use acetone or similar.
- Remove the spacers between the two clamping rings of the coupling.
- Mount the coupling on the hollow shaft of the motor. The coupling must be pushed right up to the stop of the shaft.
- Mount the motor onto the driven shaft by following the instruction in the section 3.1.4 page 22, 23 and 24 (With or without using the mounting tool).

⚠ CAUTION

Never tighten the coupling screws until the motor has been mounted onto the driven shaft.

However for the tightening of the coupling screws the following must be observed: Keep tension in your lifting wires to avoid skew setting of the motor on the shaft during the tightening of the screws. Wobbling caused by skew setting of the motor gives extra forces on the main bearings.

In order to avoid the misalignment of the two clamping rings during the screw tightening, the gap between the rings must be measured in several places during the process, see Fig. 3.13.a, page 19. The difference between the measured gaps must never vary more than 1 mm (0.04”) during any stage of the tightening process. For motors MB 1150 and larger this dimension may be max. 2 mm (0.08”).

Pre-set the coupling screws in opposite pairs (12-6-3-9 o´clock) until you reach max. 50% of the torque specified for the screws. It is very important that when you reach this stage the misalignment is controlled as described above.

Mark the screw heads at 12 o´clock with a pen or paint so that you can follow the turning sequence of the screws.
Set the torque wrench for the specified maximum torque. Tightening torque of the coupling screws; see the sign on the coupling, or table 3.6, page 19.
Now start tightening the screws in sequence shown in Fig. 3.13.b, page 19.
Keep on doing this until you have reached the stated torque. Several passes are required before the screws are tightened to specified torque. Keep checking the alignment of the coupling (15–20 passes may be necessary).

When the specified torque is reached it is important that all screws are tightened with specified torque and that no further movement can be observed.

Remember:
The following factors are important for successful mounting:

- Right material and dimension on the driven shaft.
- The conical surface between the coupling ring and the clamping rings + the bolts shall be coated with MoS2 (Molykote), see Fig. 3.11. This is done from the factory at delivery! When a motor has been in for overhaul or service and shall be re assembled it may be necessary to relubricate those surfaces with Molykote again but remember only the specified surfaces!
- Absolutely No Molykote on the surfaces between shaft and motor. Clean the driven shaft and the inside of the motor hollow shaft.
- Alignment of the motor on the shaft (dimensional check).
- Minimum variation in the gap between the clamping rings (dimensional check).
- Right torque on the bolts (use torque wrench).

⚠ CAUTION

Before starting the motor, check that the rotating coupling can not cause damage.

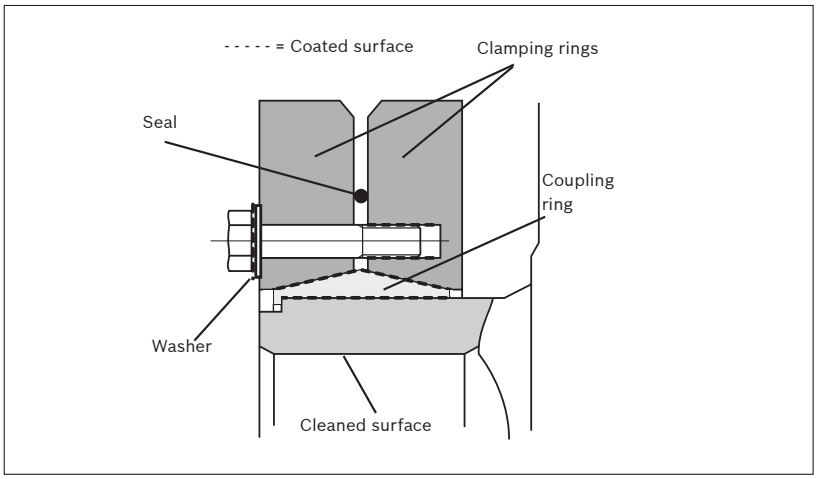

Fig. 3.11

⚠ CAUTION

Clean the driven shaft and the inside of the motor hollow shaft.

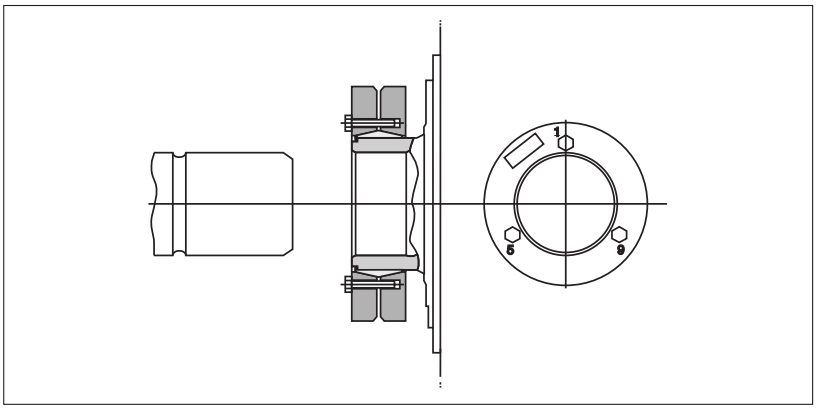

Fig. 3.12

Table 3.6

Motor type	No. of screws	Screw dim	Tightening torque Nm	Tightening torque lbf·ft	Strenght class	Type of head
MA 141	12	M16x65	250	185	10.9	Hexagon
MA 200	14					
MB 283	12	M20x80	490	362		
MB 400	15	M20x90				
MB 566	20	M20x100				
MB 800	20					
MB 1150	32	M20x130				
MB 1600	32					
MB 2400	36	M20x160	570	420	12.9	
MB 3200	48	M20x180				
MB 4000	48					

Note 1 Uncoated screws greased with MoS2.

Note 2 There is a metallic sign on every coupling with a tightening torque stamped on it. This torque is always to be used.

Note 3 Tightening torque value is critical. Use calibrated torque wrench.

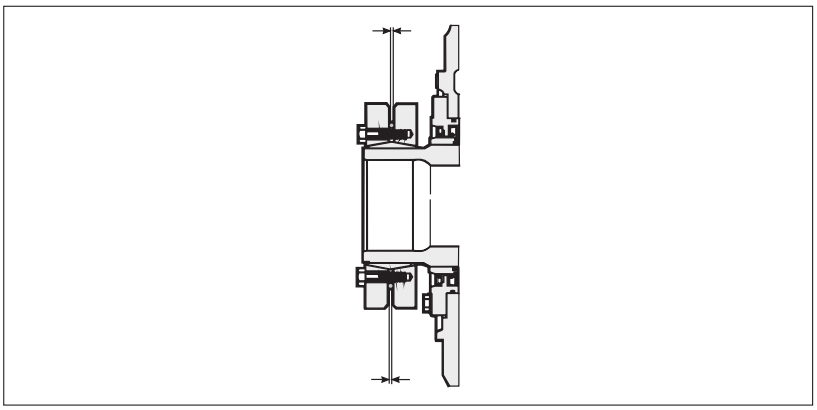

Fig. 3.13.a

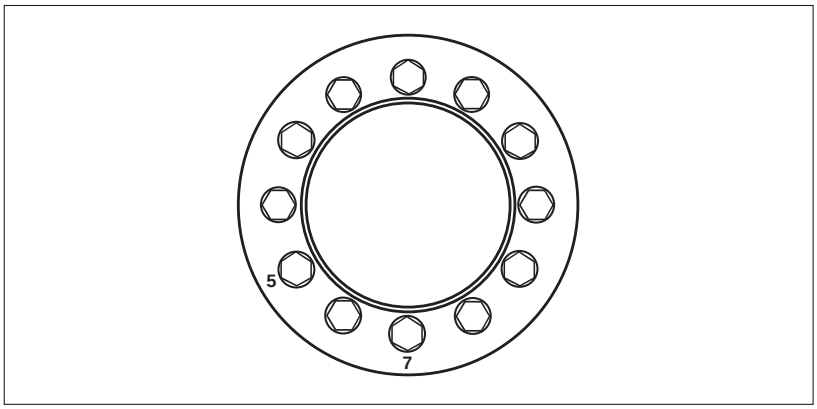

Fig. 3.13.b

3.1.1 a Fitting the torque arm to the motor

The torque arm is fitted to the motor before the motor is mounted on the driven shaft.

- Clean the spigot surface on the torque arm and motor.
- Oil the screws.
- Make sure that the torque arm will be pointing in the right direction when the motor is mounted in place on the machine.
- Line up the torque arm on the motor by using the screws.
- Tighten the screws to the torque stated in the table below.

Table 3.7

Motor	Screw dimensions	Number of screws	Tightening torque Nm	Tightening torque lbf·ft
MA 141	3/4" UNC Strength class 8.8	24	340	250
MA 200				
MB 283	1" UNC Strength class 8.8	24	810	597
MB 400				
MB 566		36		
MB 800				
MB 1150	M24 Strength class 8.8	43	650	480
MB 1600				
MB 2400	M24 Strength class 10.9	43	900	660
MB 3200				
MB 4000				
Note: Use torque wrench and oiled screws!				

⚠ CAUTION

Do not weld, drill, grind or carry out any similar work on the torque arm without Hägglunds Drives approval.

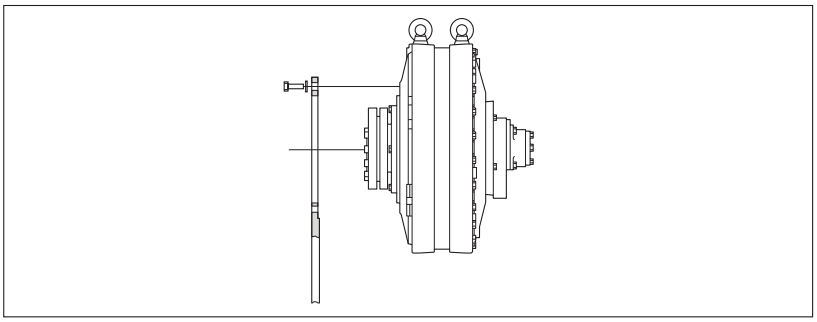

Fig. 3.14.a: MA 141–MB 800

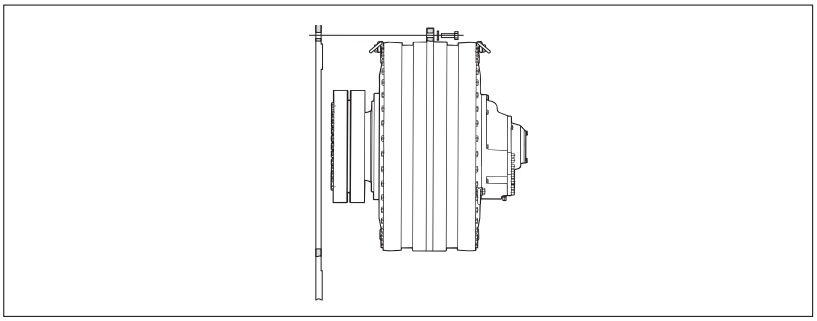

Fig. 3.14.b: MB 1150/1600

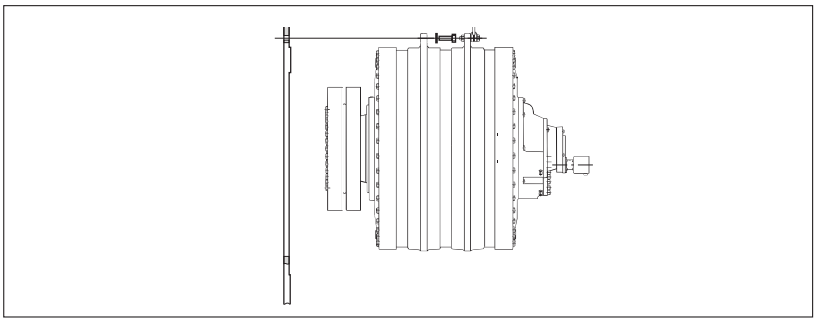

Fig. 3.14.c: MB 2400

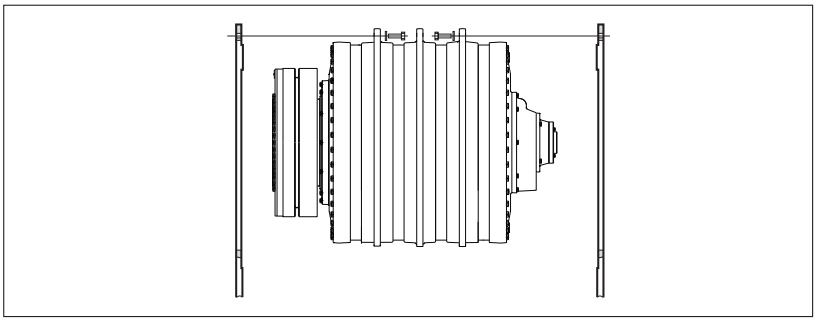

Fig. 3.14.d: MB 3200/4000

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3.1.3b Fitting the double ended torque arm

The torque arm is fitted to the motor before the motor is mounted on to the driven shaft. See 3.1.3a “Fitting the torque arm to the motor”.

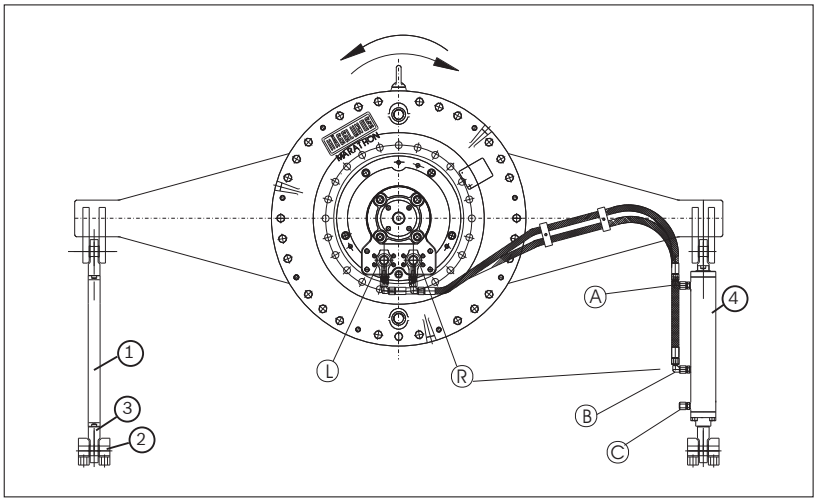
Check and adjust the rod end (pos 1) according to the drawing. Mount the rod to the torque arm, use the shaft (pos 2) and lock them with circlips. Tighten the 4 pcs of screw (pos 3) on the rod end, torque according to table 3.7b.

Mount the hydraulic cylinder. The piston rod has to be mounted upwards, and on the right hand viewed from the motors main connection side.

Cylinders oil connection A, B and C must point in the direction to the motor. Mount the hoses. The hose mounted to connection (R) has to be mounted to the hydraulic cylinders connection B, and the hose from connection (L) has to be mounted to the cylinders connection A.

Notice!

Start the system and run it for some minutes. Vent the cylinder from air. Use the vent screws on the cylinder (pos 4).



Cylinder	Screw dimension	Tightening torque	
		Nm	lbf·ft
50/36	M8x25	25	15
80/56	M10x30	49	36
100/70	M12x40	86	63
125/90	M16x30	210	155

3.1.1 a Mounting the motor onto the driven shaft

The motor can be mounted onto the driven shaft with or without a mounting tool, but the use of a mounting tool is recommended since it make the work easier.
If the motor is to be mounted with the shaft pointing upwards, a venting nipple and hose must be connected to the shaft end housing of the motor; see section 3.2.2 “Draining and venting the motor”, Fig. 3.28. It is recommended that the nipple and hose should be fitted to the motor before the coupling and torque arm are fitted. Then fit the torque arm to the motor; see section 3.1.3.
It is important to arrive at the correct clamping length between the driven shaft and the hollow shaft of the motor.
Ensure that the full clamping length is used by, for example, measuring and marking the driven shaft. This is of particular importance if the duty is so severe that a stress relieving groove has been made on the driven shaft. See Fig. 3.20 and the table 3.8 on page 24.

Mounting the motors MA 14–MB 800 with a mounting tool

- Remove the plug, the end cover together with screws and washers, and the plug in the centre shaft; see Fig. 3.18.a.
- Mount the end cover without plug.
- Align the motor with the driven shaft.
- Locate the existing plastic washer inside the nut on the mounting tool. Pass the mounting tool through the end cover and the centre shaft of the motor, and screw it into the driven shaft to stated depth byusing the key handle in the end of the tool.
- Pull the motor onto the shaft by turning the nut on the mounting tool; see Fig.3.18.b, until the length stated in the table 3.8 on page 24 is obtained; see Fig. 3.20.
- Remove the mounting tool and also the end cover.
- Refit the plug in the centre shaft by tightening to the given torque. Finally fit the end cover and plug. Tighten the screws properly together with washers.

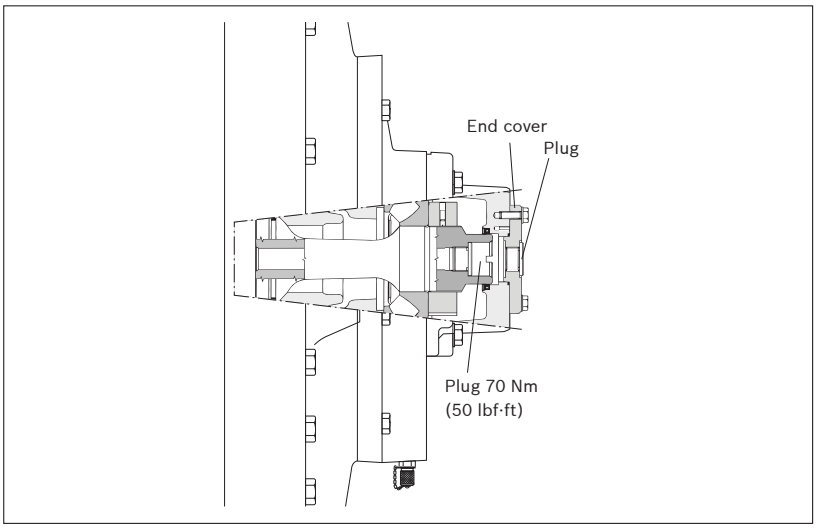


Fig. 3.18.a: Mounting the MA 141–200 and MB 283–800

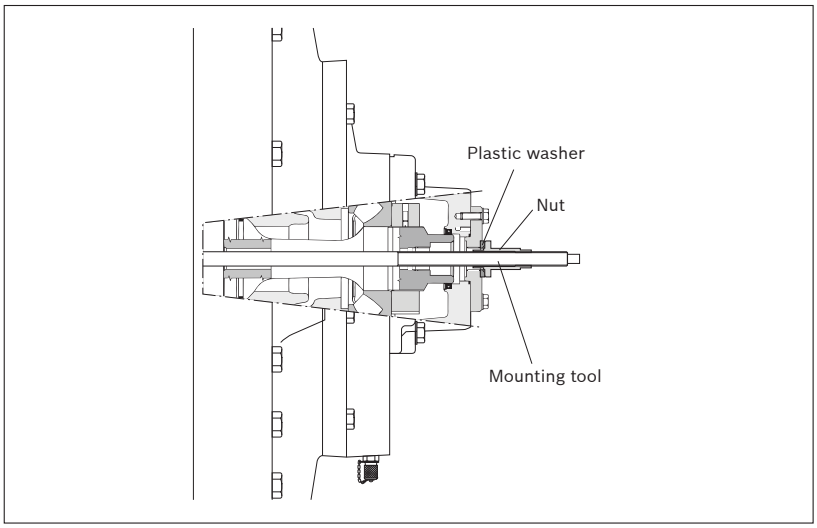


Fig. 3.18.b

Mounting the motors MB 1150–MB 4000 with a mounting tool

- Remove the end cover with screws and washers; see Fig. 3.19.a.
- Remove the lock ring.
- Align the motor with the driven shaft.
- Pass the mounting tool through the centre shaft of the motor, and screw it into the driven shaft by using the key handle in the end of the tool. Make sure that the tool is screwed into the shaft end to specified length.
- Pull the motor onto the shaft by turning the nut on the mounting tool; see Fig. 3.19.b, until the length stated in the table 3.8 on page 24 is obtained; see Fig. 3.20.
- Remove the mounting tool.
- Refit the lock ring.
- Finally fit the end cover, tighten the screws properly together with washers.

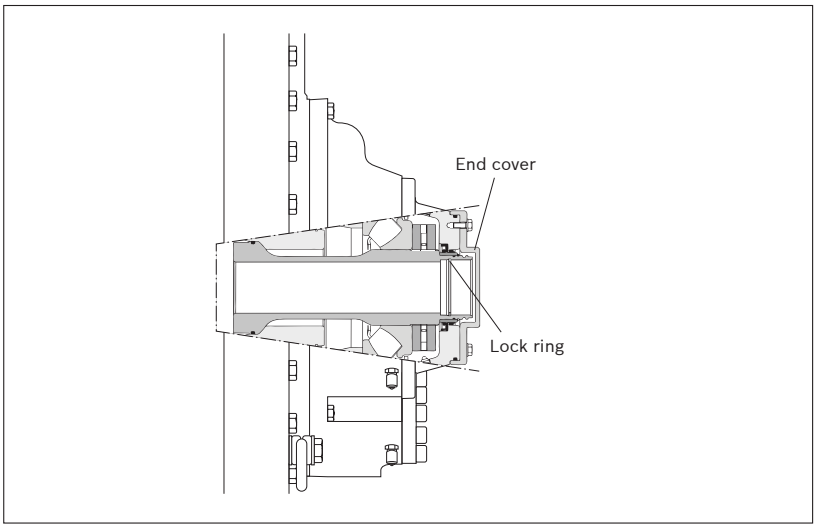


Fig. 3.19.a: Mounting the MB 1150–4000

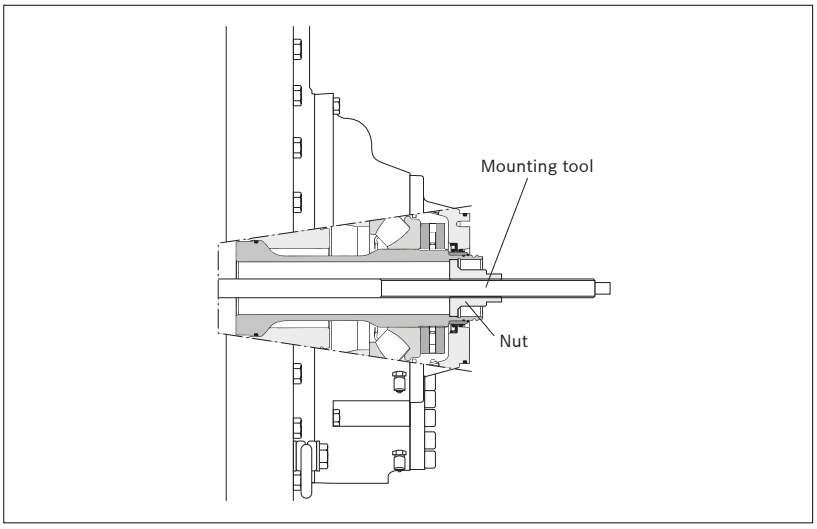


Fig. 3.19.b

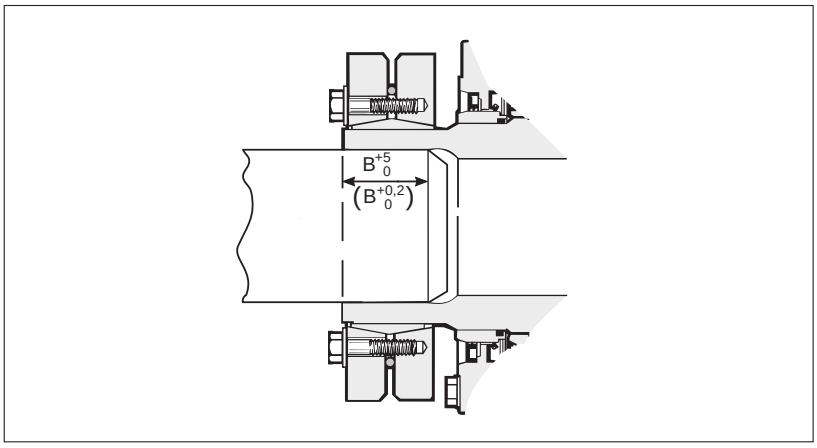


Fig. 3.20.a: Without stress relieving groove

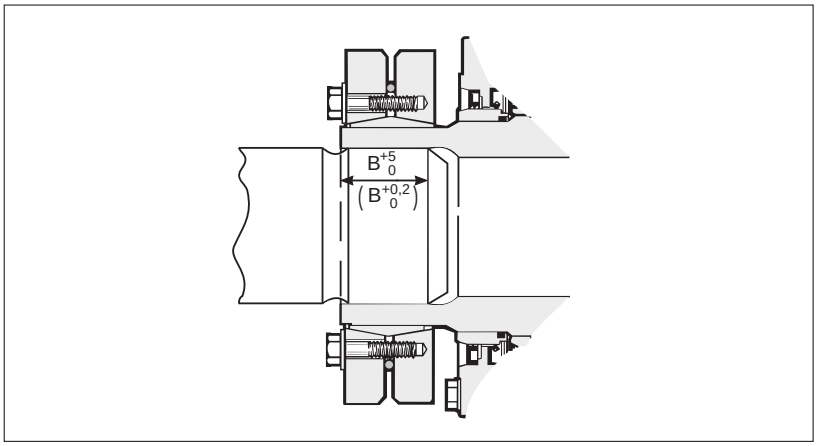


Fig. 3.20.b: With stress relieving groove

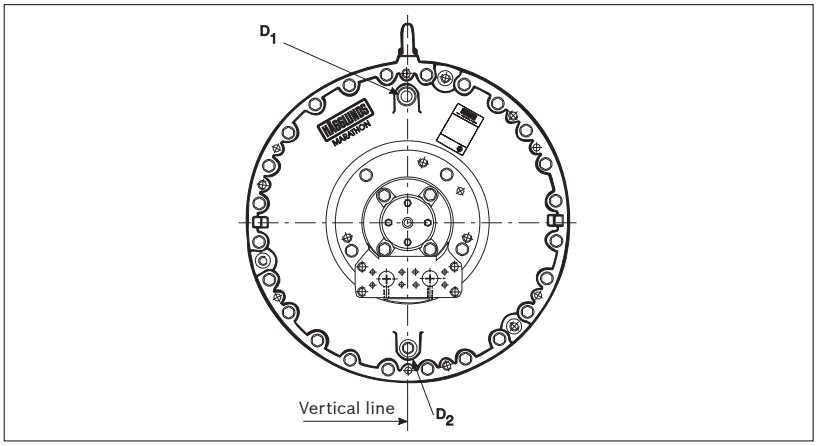


Fig. 3.21

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Table 3.8

Motor	B mm	Lenght B in
MA 141	84	3.31
MA 200		
MB 283	106	4.17
MB 400	117	4.61
MB 566	153	6.02
MB 800		
MB 1150	215	8.46
MB 1600		
MB 2400	257	10.12
MB 3200	300	11.81
MB 4000		

Mounting the motor without a mounting tool

The motor can be mounted onto the driven shaft without using a mounting tool, though this is more difficult and takes longer time. However, it is easier to mount the motor if during mounting the compressed air trapped within the hollow shaft is evacuated. To do this, perform in the following manner:

Motors MA 141–MB 800

Remove the end cover together with plug, as well as the plug in the centre shaft; see Fig. 3.18.a. After mounting, refit the removed components.Tighten the end cover screws properly, as also the plug in the centre shaft to given torque.

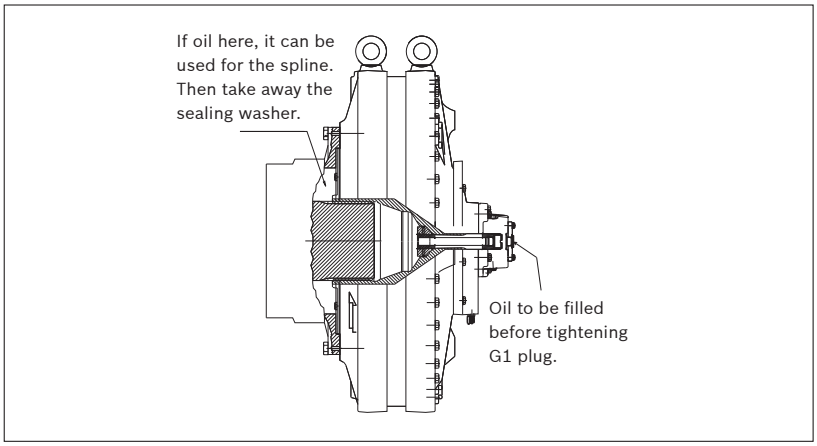
Motors MB 1150–MB 4000

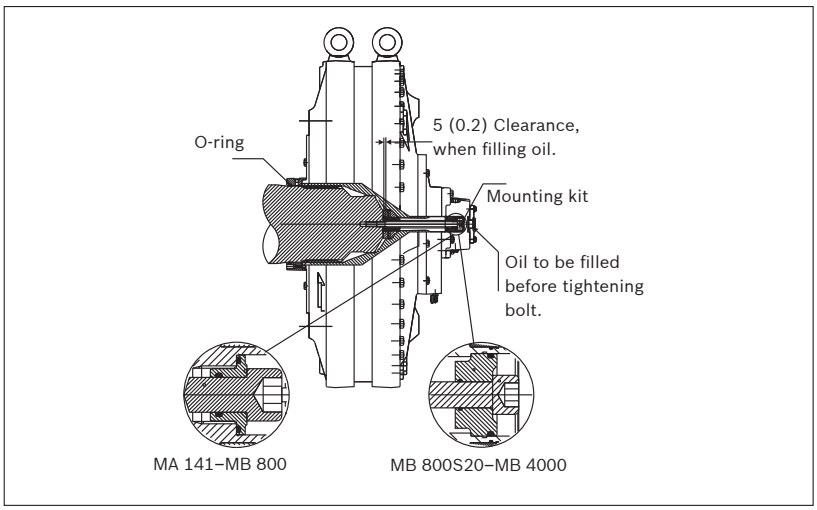
Remove the end cover during mounting; see Fig. 3.19.a. After mounting, refit the end cover. Tighten the screws properly. Align the motor with the driven shaft using an overhead crane or lifting truck and press it carefully onto the shaft so that the length stated in the table beside is obtained, see Fig. 3.20.

Maximum allowed axial force on motors
MB 1150–MB 4000: Fa = 150kN (32 000 lbf)

To achieve the highest possible oil level in the motor case, the motor must be turned until the drain outlets are positioned vertically one above the other, see fig 3.21.

3.1.4b Mounting the motor onto the driven shaft – splines





Flange mounted motors

For flange mounted motors, the spline shall normally not be subject to radial load. With no radial load, the spline shaft can be greased before mounting the motor. If the motor is subject to radial load, the splines shall be filled up with oil.

- Mount the motor on to the shaft.
- Bolt the motor to the flange.
- Fill up hydraulic oil to the G1 plug.
- Torque the G1 plug. MV=125 Nm/90 lbf.ft.

Torquearm mounted motors

Motors that carry radial load, must have the splines oiled. The motor can be used for horizontal mounting and mounting with motor shaft pointing downwards.

- Mount torque arm to motor with bolts supplied. Align with oil connection ports as required.
- Lubricate and install o-ring at leading edge of motor bore.
- Check shaft/splines for burrs and lubricate shaft/splines.
- Mark spline tooth location on outside of motor bore to assist alignment during installation
- Mount the motor using the installation tool.
- Fill up hydraulic oil to the G1 plug.
- Mount washer and bolt.
- Torque the bolt. MV=200 Nm/144 lbf.ft for MA 141- 800. MV=700 Nm/504 lbf.ft for MB 1150–4000.

Mounting kit

478 3631–801=MA 200, 478 3629–802=MB 283-800,
478 3629–803=MB 800S20–2400

3.1.1 Removing the motor from the driven shaft

Before dismounting the motor from the driven shaft the oil in the motor case must be drained through the lower draining hole. The motor can be removed from the shaft with or without the mounting tool. The operation is easier if the tool is used.

Removal of motors MA 141–MB 800 by using the mounting tool

- Slacken the shaft coupling screws gradually; see Fig. 3.13.a and 3.13.b on page 19. Each screw should be slackened only about a quarter of a turn each time. Thus tilting and jamming of the collars or thread stretching will be avoided. The screws must be slackened until the coupling ring is fully released.
- Remove the plug, the end cover together with screws and washers, and the plug in the centre shaft; see Fig. 3.18.a.
- Locate the existing plastic washer outside the mounting tool nut. Then pass the tool through the centre shaft, and screw it into the driven shaft to stated depth.
- Screw in the nut of the tool until the end cover can be refitted; see Fig. 3.22.
- Remove the motor from the driven shaft by unscrewing the nut of the mounting tool.
- Remove the end cover and mounting tool. Finally, refit the removed plugs and end cover as before.

Removal of motors MB 1150–MB 4000 by using the mounting tool

- Slacken the shaft coupling screws gradually; see Fig. 3.13.a and 3.13.b on page 19. Each screw should be slackened only about a quarter of a turn each time. Thus tilting and jamming of the collars or thread stretching will be avoided. The screws must be slackened until the coupling ring is fully released.
- Remove the end cover with screws and washers; see Fig. 3.19.a. Remove the lock ring.
- Pass the mounting tool through the centre shaft, and screw it into the driven shaft to stated depth.

- Screw in the nut of the tool until the lock ring can be fitted outside the nut; see Fig. 3.23.
- Remove the motor from the driven shaft by unscrewing the nut on the mounting tool.
  *If the motor is hard to remove from the shaft, put a tube over the mounting tool to avoid bending of it. Inner diameter=35 (1,4), MB1150/1600 L=700 (27,5), MB2400 L=1000 (39), MB3200 L=1200 (47), MB4000 L=1500 (59).
- Remove the lock ring and mounting tool. Finally, refit the lock ring in place, as also the end cover.

Removing the motor without using the mounting tool

- Slacken the screws of the shaft coupling, see above “Removal of motors by using the mounting tool”.
- Remove some components to allow air to enter the space in the hollow shaft of the motor; see “Mounting the motor without a mounting tool“, page 24. After removal of the motor, refit the removed components as before.
- Carefully pull the motor off the driven shaft supported by an overhead crane or a lifting truck.

⚠ DANGER

Always make sure that the lifting equipment is strong enough, and never stand below the motor during disassembly.

⚠ WARNING

Each screw should be slackened only about a quarter of a turn each time.

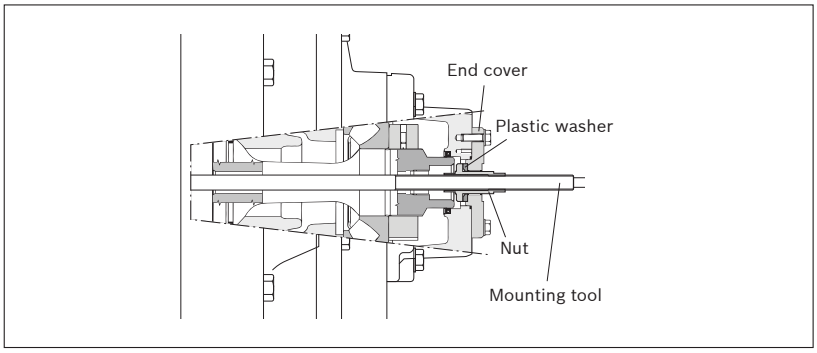


Fig. 3.22: Removal of MA 141–200 and MB 283–800

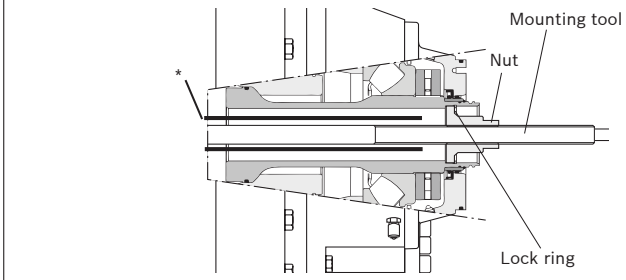


Fig. 3.23: Removal of MB 1150–2400

3.1.1 Mounting the reaction point

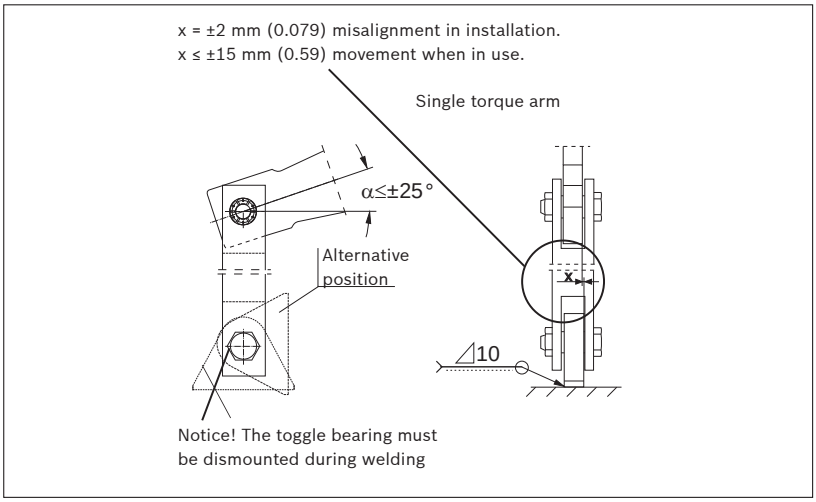


Fig. 3.15: Mounting of pivoted attachment

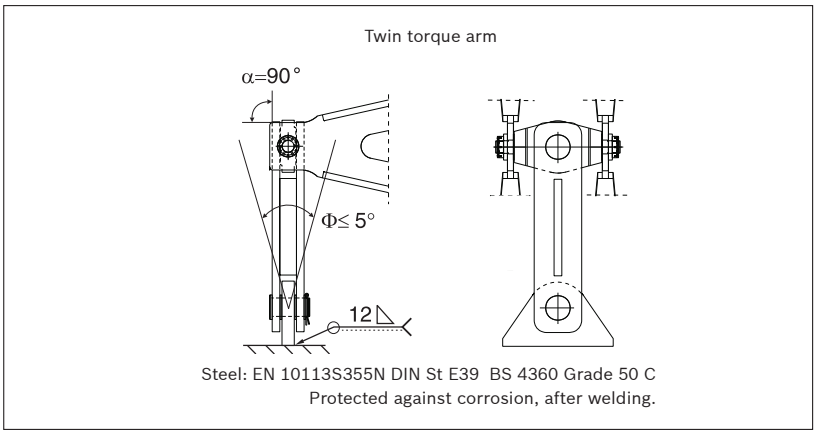


Fig. 3.15: Mounting of pivoted attachment

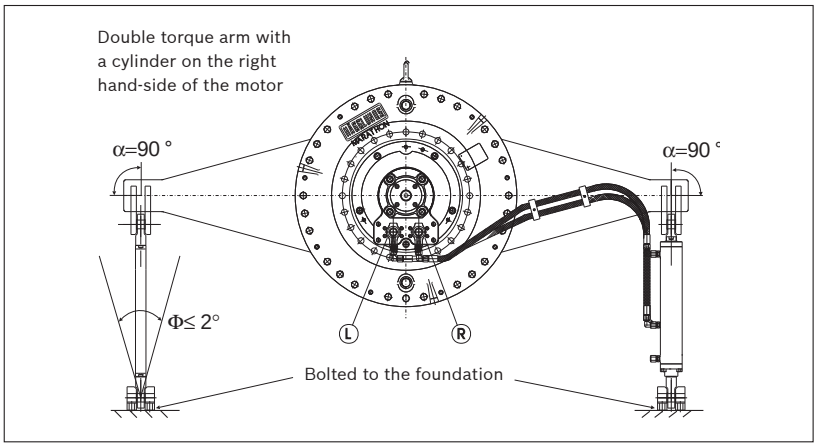


Fig. 3.15: Mounting of pivoted attachment

⚠ DANGER

Make sure that the foundation can withstand the forces from the torque arm.

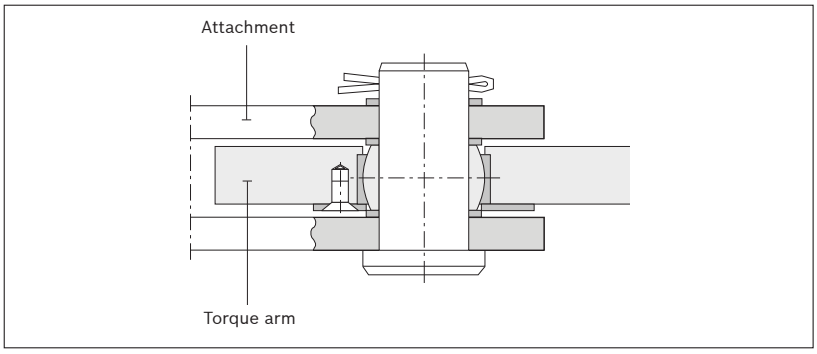


Fig. 3.16: Mounting of torque arm on pivoted attachment TMA 20, 40, 60, 80, 100.

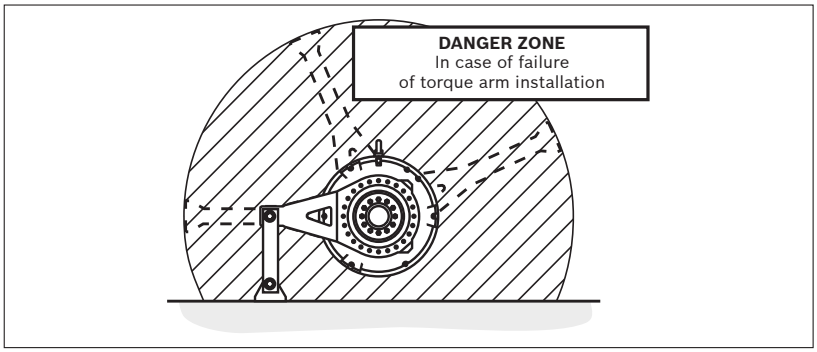


Fig. 3.17: Torque arm installation

Bosch Rexroth Mellansel AB, Installation and maintenance manual, Hägglunds MB, EN320-23BR/2011

3.2 Oil connections

MB 2400, MB 3200 and MB 4000 are partly filled with oil at delivery (Shell Tellus Korrhydraul S68). Please check if it could be mixed with the systems oil or have to be exchanged. See table beside for filled in volume.

Motor	Oil volume, litre (US gal.)
MB 2400	60 (15.8)
MB 3200	90 (23.8)
MB 4000	120 (31.7)

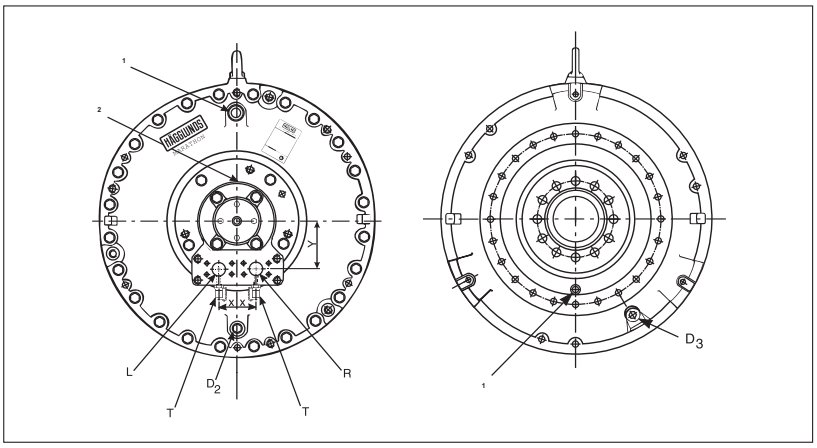


Fig. 3.24 (See Fig. 4.4.1 for MB 1150–MB 4000)

Connection	Description	Remarks
R	Main connection	If R is used as the inlet, the motor shaft rotates clockwise, viewed from the motor shaft side.
L	Main connection	If L is used as the inlet, the motor shaft rotates anticlockwise, viewed from the shaft side.
D_1	Drain outlet	Normally plugged at delivery.
D_2, D_3	Alternative drain outlet	Normally plugged at delivery.
F1, F2	Flushing connection	For flushing a radial lip seal. Normally plugged.
T	Test connections	Used to measure pressure and temperature at the main connection. Normally plugged.

Motor	R*	L*	D_1, D_2	D_3	D_4	F	T	y mm	y in	x mm	x in
MA 141	1 1/2"	1 1/2"	BSP 1 1/4"	BSP 1"	–	BSP 1/4"	BSP 1/4" x M16	159	6.26	60	2.36
MA 200											
MB 283								172	6.77		
MB 400											
MB 566	2"	2"						201	7.91	91	3.58
MB 800											
MB 1150***	2" **	2" **		BSP 1 1/4"	BSP 1 1/4"			238	9.37		
MB 1600***											
MB 2400***											
MB 3200***											
MB 4000***											

* SAE coupling J 518 C, code 62, 414 bar (6000 psi).
** One „R"-connection and one „L"-connection is blocked at delivery (se Fig. 4.4.1).
*** See Fig. 4.4.1 for oil connections.

When using (heavy wall) piping and in frequent reversal drives, it is recommended to fit flexible hoses between the motor and piping to avoid damage due to vibration and to simplify installation of the motor. The length of the hoses has to be as short as possible.

Table 3.9: Main connection R, L

Motor	A mm (in)	B	C mm (In)
MA 141	38 (1.5)	5/8" UNC	35 (1.38)
MA 200			
MB 283			
MB 400			
MB 566	48 (1.89)	3/4" UNC	36 (1.42)
MB 800			
MB 1150			
MB 1600			
MB 2400			
MB 3200			
MB 4000			

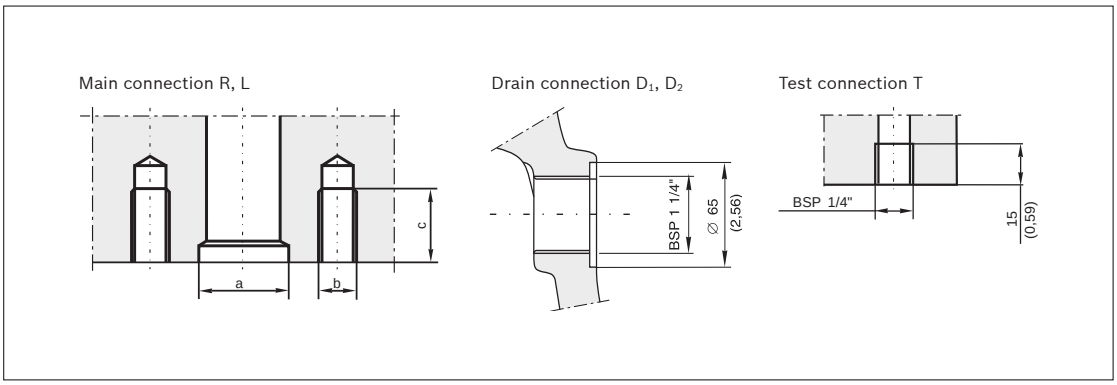


Fig. 3.25

3.2.1 Direction of rotation of motor shaft

With the high pressure supply connected to R port, the motor shaft rotates in the direction shown by the arrow, i.e. clockwise viewed from the motor shaft side. With the high pressure supply connected to L port, the motor shaft rotates anti-clockwise viewed from the motor shaft side.

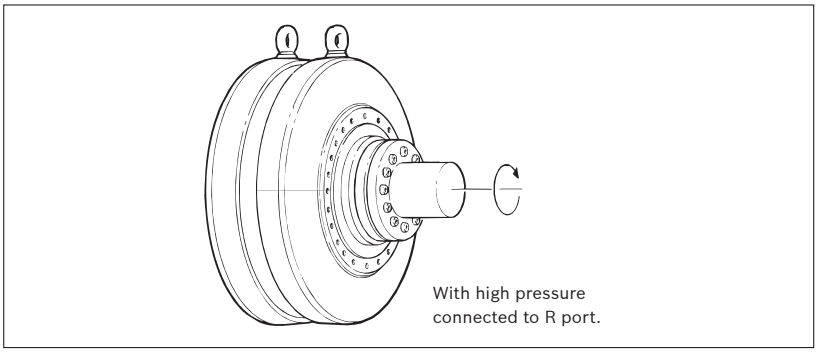


Fig. 3.26

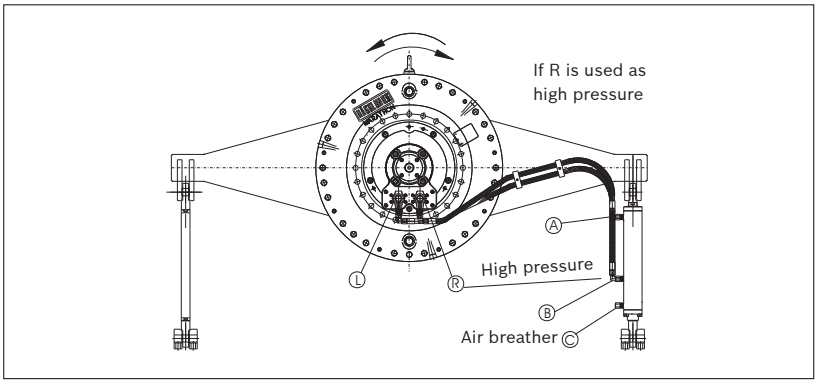


Fig. 3.26.a: Example of a motor with a double torque arm, with cylinder mounted on the right hand side of the motor, viewed from the connection side.

⚠ CAUTION

Check direction of rotation.

3.2.1 Draining and venting the motor

General for all mounting positions

The motor´s drain lines must be connected direct to the oil tank with minimum of restrictions to ensure that maximum case pressure is not exceeded. To ensure that proper venting takes place and that the motor is completely full of oil, the drain connection on the motor´s highest level must be used.

Notice! If the oil tank is placed in lower level than the motor, a preloaded check valve must be connected in the drain line. The check valve must be preset to 0.3–0.7 bar (4–10 psi). Case pressure below 0 is not allowed during operation and stand still.

Horizontal mounting

When the motor is installed with the shaft in the horizontal plane, the higher of the two drain outlets D1 or D2 must always be used; see Fig. 3.24 and 3.27. D1 D2 must be connected direct to the oil-tank.

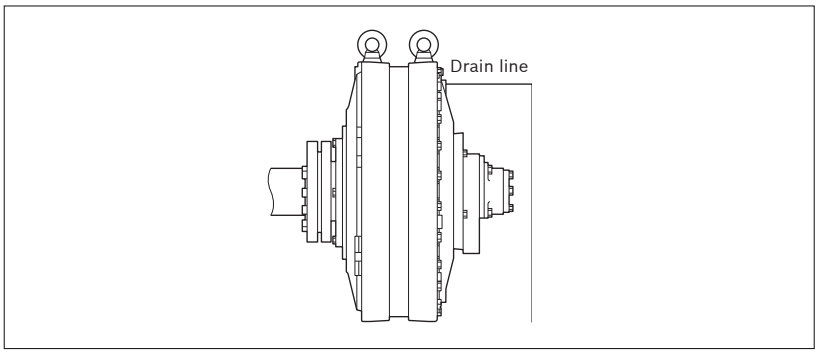


Fig. 3.27

Vertical mounting

When the motor is mounted vertically, one or the other of the vent holes must be connected to the drain line. Which of the two holes that is to be used depends on whether the motor shaft is pointing upwards or downwards.

Motor shaft pointing upwards

The venting hole on the shaft end housing should be connected to the low pressure connection. At bidirectional drives, use the connection with lowest average pressure (connection to high pressure will increase the motor drain flow). This gives flushing of the radial lip seal. It is advisable to fit the nipple and the hose to the motor before fitting the torque arm, see Fig 3.28.

Motor shaft pointing downwards

The drain line has to be connected to the drain connection as shown on Fig. 3.29 and Fig. 3.30.The flushing connection F2 shall be connected to low pressure connection. Orifice must be installed. Use flushing kit 441 0152-801.

⚠ CAUTION

If a check valve is used in the drain line, make sure that it is connected in the right direction.

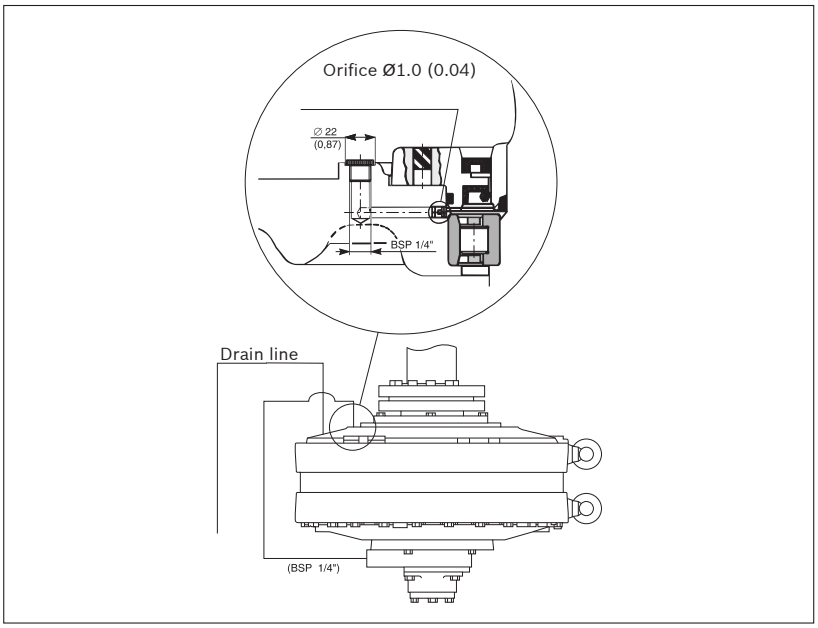


Fig. 3.28

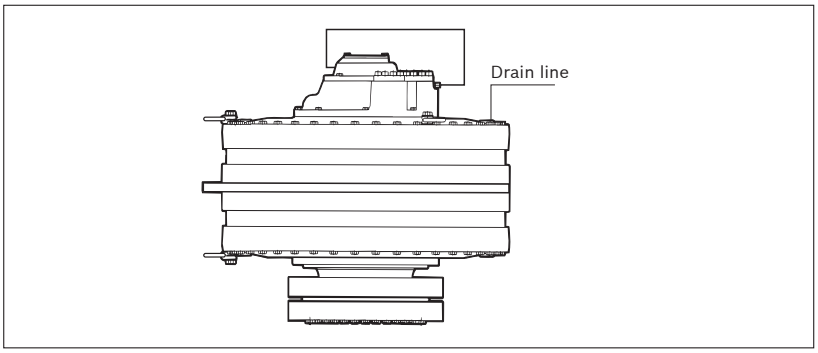


Fig. 3.29

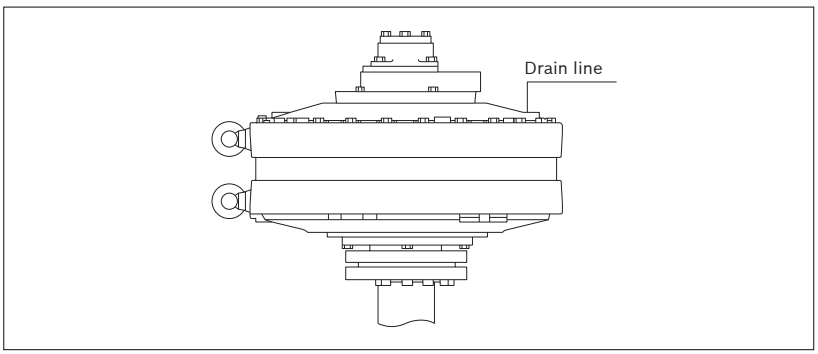


Fig. 3.30

3.2.1 Flushing

Flushing of motor case

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 service 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 beside:

Max power without flushing	
MA 141–MB 283	120 kW (160 hp)
MB 400/566/800	170 kW (227 hp)
MB 1150/1600/2400	250 kW (335 hp)
MB 3200/4000	250 kW (335 hp)

For calculation of required flushing, please contact your Hägglunds Drives representative. The flushing oil shall be drained in the normal drain line. See 3.2.2. Connect the input line for flushing in the lowest drain port.

4 Operating instructions

4.1 Storage

The motor is delivered with internal protection in the form of an oil film and external protection in the form of an anti-rust film. This provides sufficient protection for indoor storage in normal temperatures for about 12 months.

NOTICE
The anti-rust protection must be touched-up after transport and handling.

If the motor is stored for more than 3 months in unheated premises or more than 12 months in heated premises, it must be filled with oil* and positioned as shown in Fig. 3.9 and Fig. 3.10, page 17.

Fill the motor with filtered oil in the following order: D1, R, L. See 2.3, “Filtration”. Take extreme care to ensure that no contamination enters the motor with the oil. Seal connections R and L with the cover plate fitted to the connection surface at delivery. Check that the O-rings or rubber seals are in postion in the cover plate. Fit the plugs to D1, D2. The table below states the amount of oil needed to fill the various types of motors.

*See page 32 “Motor”.

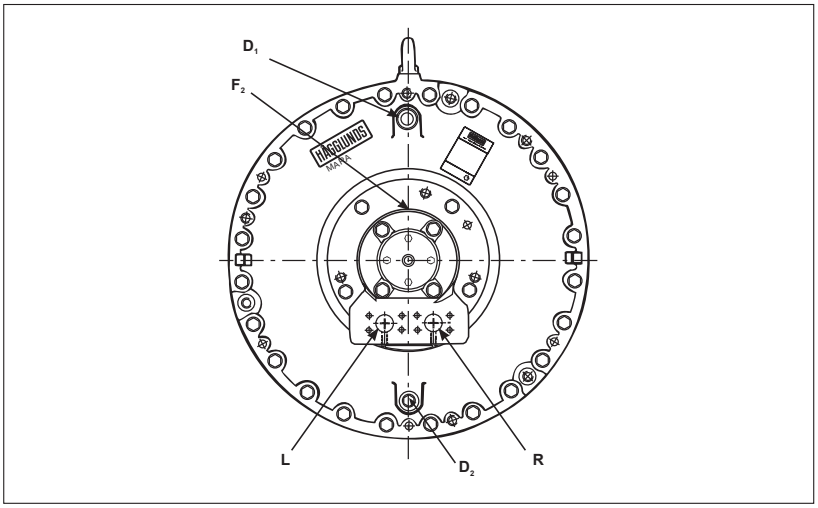


Fig. 4.1

Table 4.1

Motor	Oil volume approx.	
	Liters	US gal.
MA 141	55	14.6
MA 200	60	15.9
MB 283	70	18.5
MB 400	80	21.1
MB 566	100	26.4
MB 800	135	35.7
MB 1150	230	60.7
MB 1600	230	60.7
MB 2400	270	71.2
MB 3200	335	88.4
MB 4000	410	108.2

4.2 Before commissioning

Check the following points before commissio-ning the motor, i.e. before starting the first time:

- Check that the motor is connected to give the correct direction of rotation (see 3.2 “Oil connections” and 3.2.1 “Direction of rotation of motor shaft”).
- Select the hydraulic fluid in accordance with the recommendations (see 2.3 “Choice of hydraulic fluid”).
- Fill the motor case with hydraulic fluid via a filter into the drain outlets D1, D2 or the vent hole (depending on how the motor is mounted).
- Check the drain line to ensure that excessive pressure does not build up in the motor housing; see 3.1 “Mounting instruc-tions” and 3.2.2. “Draining and venting the motor”.
- Check that the motor is protected from overloads (see 1.1 “Motor data”).
- Check that the charge pressure conforms to the charge pressure curve (see 2.1 “Recommended charge pressure”).

- Check that all hydraulic couplings and plugs are properly tightened to prevent leakage.
- Make sure that the torque arm is sufficiently fastened, see 3.1.3.

4.3 Commissioning

- During initial starting and the period immediately after it, any hydraulic installation must be regularly and carefully checked at frequent intervals.
- The working pressure and charge pressure must be checked to ensure that they correspond to the contracted values.
- The pressure in the drain line measured at the motor must be less than 3 bar (43,5 psi). This pressure limit is important for the life of the motor.
- If leakage occurs, correct the fault and carry out new measurements.
- Check all lines, connections, screws, etc. and correct if necessary.
- Check other possible leakage points and replace faulty parts.
- During the start up period, dirt particles in the system are removed by the filters. The filter cartridges have to be changed after the first 100 working hours and after that according to the maintenance chart. Note to check the “filter clogged” indicators.
- When starting up the motor it is important that the motor output power is limited to 75% of max power according to technical data, see Fig. 4.3. A not run-in motor in combination with dirt particles in the oil can badly affect the sliding surfaces in the motor. This is valid during the first 100 working hours.

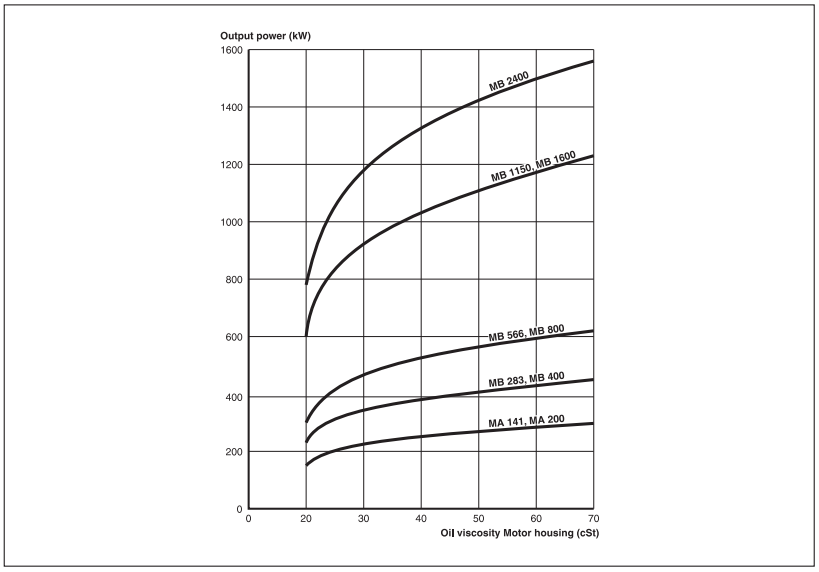


Fig. 4.3

4.4 Periodic maintenance

When a hydraulic system has been in service for some time, it must undergo periodic maintenance and servicing at intervals which depend on the equipment and the type of duty. This periodic maintenance must include the following operations:

- Check the hydraulic system for leakage. Tighten the screws, replace faulty seals and keep the drive clean.
- Inspect and clean all air, oil and magnetic filters; replace all filter cartridges for which a filter clogged indication has been given; inspect tank, pump, filters etc. and clean if necessary.
- Check the pressure and temperature of the hydraulic fluid and carry out routine operations. Adjust valves etc. if necessary.
- Check the hydraulic fluid; see the Section headed “Oil”, page 34.
- Check that no dirt or other contaminations enter the system during inspection. Check that the outside of the hydraulic motor in an installation is kept free of dirt; thus leakage and faults will be detected earlier.
- We recommend that a running log is kept and that planned inspections are carried out at set intervals.
- Maintenance checks and operations are as follows:

Maintenance chart

In operation	Oil filters	Oil	Oil for axial ***) thrust bearing	Torque arm
After the first 100 hours	Repl.		Insp.	Insp.
After 3 months or 500 hours	Repl.			
Once every 6 months	Repl.	Insp.	*)	Insp.
Once every 12 months			Insp. (fill up) **)	

Repl. = Replacement
Insp. = Inspection

* Inspection (fill up) every 6 months, when the motor shaft is pointing downwards
** Not needed when shaft is pointing upwards.
*** MB 1150–4000 Modification Q3 (Produced after 2008 03), have hydraulic oil for axial trust bearing. Inspection is not needed.

Axial thrust bearing

Motors which have separate oil for axial thrust bearing. Oil must be changed every five years. Fill up to the top of the connection BSP 3/8”. Mobil SHC 634, Mobil SHC 639, Shell Paolina 460, Shell Paolina 680 or equivalent must be used.

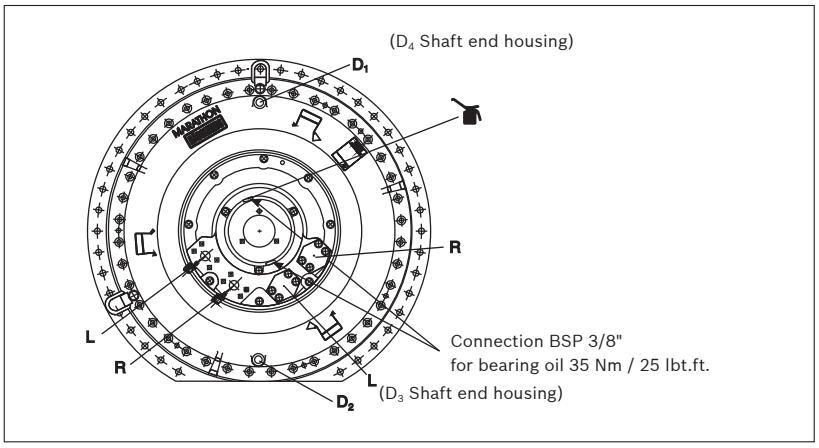


Fig. 4.4.1

Motor Size	Volume needed litre (US. gal.)
MA 141/200	0.9 (0.24)
MB 283/400	1.8 (0.48)
MB 566/800	2.1 (0.56)
MB 1150/1600/2400/3200/4000	4.7 (1.24)

4.4.1 Cleaning and care

⚠ CAUTION

Damage to the surface caused by solvents and aggressive detergents!

Aggressive detergents may damage the seals on the hydraulic motor and cause them to age faster.

- Never use solvents or aggressive detergents.
- If in doubt, check the compatibility of the detergent with the seal type (Nitrile or Viton) specified in the hydraulic motor.

⚠ CAUTION

Damage to the hydraulic system and the seals!

Using a high-pressure cleaner could damage the speed encoder and the seals of the hydraulic motor.

- Do not point the high-pressure cleaner at sensitive components, e. g. shaft seal, seals in general, electrical connections and speed encoder.
- For cleaning and care of the hydraulic motor, observe the following:
- Plug all openings with suitable protective caps/devices.
- Check whether all plugs and plug seals are securely seated to ensure that no moisture can penetrate into the hydraulic motor during cleaning.

- Use only water and, if necessary, a mild detergent to clean the hydraulic motor.
- Remove coarse dirt from the outside of the machine and keep sensitive and important components, such as sensors and valve blocks clean.

4.4.1 Motor

If the motor is to be stored stationary for a longer period than about 1 month, it must be protected from internal rust. This can be done as follows:

1. Mix anti-rust additive with the hydraulic fluid of the system. Use 5% of Rust Veto Concentrate (manufactured by E F Houghton & Co, Philadelphia, USA). This additive gives rust protection for up to about 1 year, after which time the motor must be turned a few revolutions.
2. If no additives are used, the motor must be regularly turned a few revolutions.
3. If it is not possible to turn the motor, plug all connections, open drain outlet D1 or D2 on the port end housing (or if the motor is mounted vertically, vent hole F1 on the shaft end housing) and fill the motor with hydraulic fluid (see Fig. 4.4.2).

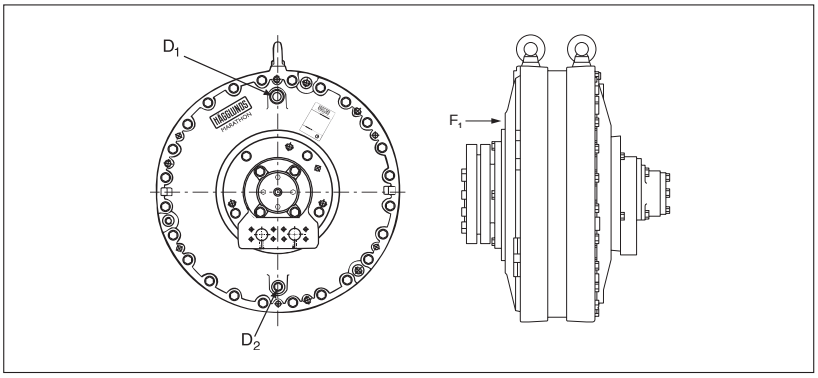


Fig. 4.4.2

4.4.1 Filters

Filters must be changed after the first 100 working hours and the second change is to be carried out after 3 months or 500 working hours whichever is earlier. They must then be changed at regular intervals of 6 months or 4 000 working hours.

4.4.1 Oil (See also 2.3)

Analysis

It is recommended that the oil should be analysed every 6 months. The analysis should cover viscosity, oxidation, water content, additives and contamination. Most oil suppliers are equipped to analyse the state of the oil and to recommend appropriate action. The oil must be replaced immediately if the analysis shows that it is exhausted.

Viscosity

Many hydraulic oils become thinner with increasing use, and this means poorer lubrication. The viscosity of the oil in service must never fall below the minimum recommended viscosity.

Hägglunds MB, EN320-23BR/2011, Installation and maintenance manual, Bosch Rexroth Mellansel AB

Oxidation

Hydraulic oil oxidizes with time of use and temperature. This is indicated by changes in colour and smell, increased acidity or the formation of sludge in the tank. The rate of oxidation increases rapidly at surface temperatures above 60° C (140° F), and the oil should then be checked more often.

The oxidation process increases the acidity of the fluid; the acidity is stated in terms of the “neutralisation number”. Typical oxidation is slow initially and increases rapidly later.

A sharp increase (by a factor of 2 and 3) in the neutralisation number between inspections is a signal that the oil has oxidized too much and should be replaced immediately.

Water content

Contamination of the oil by water can be detected by sampling from the bottom of the tank. Most hydraulic oils repel the water, which then collects at the bottom of the tank. This water must be drained off at regular intervals. Certain types of transmission oils and engine oils emulsify the water; this can be detected by coatings on filter cartridges or a change in the colour of the oil. Obtain the advice of your oil supplier in such cases.

Degree of contamination

Heavy contamination of the oil causes increased wear of the hydraulic system components. The cause of the contamination must be immediately investigated and remedied.

⚠ CAUTION

All hydraulic fluids are affected differently. Obtain the advice of your oil supplier or your nearest Hägglunds Drives representative.

4.5 Oil inspection

Purpose

The purpose to take an oil sample is to check the condition of the oil.

With scheduled oil analysis, wear products can be identified and corrective action can be taken before failure occurs. Oil analysis can indicate when an oil change is required, point out shortcomings in maintenance and keep repair cost to a minimum. Using oil analysis can create a “window of opportunity”, allowing the user to schedule re-fittings or overhauls, maintenance or repairs, thus saving money on equipment repairs and downtime.

The most used method is to take samples in a special bottle and send it to a fluid laboratory for an analysis and from the laboratory you get a report, which follow a specific international standard.

You have to select what analysis the laboratory should take, but the most used analysis are particle count, water content, oxidation and viscosity.

Another method is to install an inline particle counter direct in your hydraulic system which give you the contamination level according to the international rules, the disadvantage with this method is that you only get the contamination level in the oil.

General

The intention is to verify the condition of the oil during operation. The motors should be running at normal operation while the sample is taken.
The cleanliness is extremely important during sampling.
Always use bottles adapted to oil samples, they can be ordered from any fluid analysis laboratory.
Never try to clean your own bottle if you want a true value of the result.
The sample should be taken by using a mini-mess hose connected to a mini-mess coupling.
Always clean the connections carefully before you connect the mini-mess hose to the coupling.
Be careful when connecting the mini-mess hose because the oil beam can be dangerous and should never point against any person or other sensible object.
Check and be aware of the pressure you may have on the connection before you connect.

How to do

Bottle samples

The sample shall be taken at the mini-mess coupling on the charge pressure side of the motor in the closed loop system. Never out of the tank using the ball valves.
Clean the coupling and the hose carefully.
Connect the mini-mess hose to the coupling but be careful and be aware of the direction of the oil beam.
Let minimum 2 litres (0.6 gallon US) of oil flush into a bucket before you fill the bottle.
Remove the cap of the bottle as late as possible and don’t let any contamination be in touch with the cap, bottle or the mini-mess hose when the sample is taken.

In dirty air area, use a soft plastic foil (normal as protection in laboratory bottles between bottle and cap).
Do not remove the foil, prick the end of your mini-mess hose through the foil into the bottle and fill.
To get a reliable result the system must run without moving any valves and the mini-mess hose should not touch the bottle.
Only ¾ of the bottle shall be filled because the laboratory has to shake the sample to get a mixed fluid when they analyse it. Minimum 200 ml are needed for a good analysis.
When the bottled is filled close the cap as soon as possible to prevent contamination from the air that might enter the bottle and give you a wrong result.

Inline measure

The sample shall be taken at the mini-mess coupling on the charge pressure side of the motor in of the closed loop system. Clean the coupling and the hose carefully.
Connect the hoses according to the particle counters manual.
To get a true value the contamination readings have to be stable about 10 min before you stop to measure.

5 Disposing

When the system or a single component is worn out, it should be handled in an environmentally friendly way. In general waste should at first hand be reused or recycled followed by safe disposal.
Careless disposal of the system, its components and the oil can lead to pollution of the environment.
Therefore, please observe the following points:

- Dispose the product/components in accordance with the national regulations in your country and/or your company-internal specifications.
- Dispose the oil according to the current applicable material safety data sheet.

6 Fault finding

Hydraulic motor

Fault	Probable cause	Action
The motor does not run.	Mechanical stop in the drive.	Check system pressure. If the pressure has risen to the relief valve setting, remove the load from the drive.
	The motor does not deliver enough torque because the pressure difference across the motor is not enough for the load.	Investigate the pressure level in the system and correct the setting of the pressure limiting valve if necessary.
	Insufficient or no oil being supplied to motor.	Check the hydraulic system. Check the external leakage of the motor (The D-connection).
Motor rotates in wrong direction.	Oil supply connections to motor incorrectly connected	Connect the oil supply correctly.
Motor runs jerkily.	Pressure or flow fluctuations in the hydraulic system.	Find the cause in the system or in the mechanical power transmissions.
Noise in the motor.	The motor is being operated with the charge pressure to low.	Adjust the charge pressure to the correct level. See 2.1 “Recommended charge pressure”.
	Internal faults in the motor.	Investigate the drain oil, if necessary. Put a magnetic plug in the drain flow and check the materials that stick to the magnet. Steel Particles indicates damage. Note that fine materials from the castings may be deposited and does not mean internal damage in the motor.
External oil leakage on the motor.	The radial lip seal is worn.	Replace the radial lip seal.

7 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

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.