Hagglunds CB motor

Hydraulic Hagglunds CB motor CB280 CB400 CB560

Features of Compact Hagglunds CB motor

- High output torque and power to weight ratio
- Full torque from zero to maximum speed
- Small outer diameter
- Many sizes to choose from to optimize the drive
- Flexible mounting by using shaft coupling or splines, suitable for torque arm or flange mounting
- High efficiency and low maintenance cost
- Resistant against shock loads
- Through hole

Hagglunds Drives is one of the world's leading manufacturers of large hydraulic Drive Systems. A leading position, made possible by unbeatable service spirit and of continuing development of both products and markets all over the world. Our drives are to be found in most industrial and marine segments, where there are extremely high demands for efficiency and reliability. Our main office and production plant is in Mellansel, Sweden and we have our own sales- and representation offices in some 40 different countries.

Our high quality Drive Systems, are based upon our unique hydraulic piston motors, developed through a wealth of experience accumulated over 30 years in marine and industrial areas. Today this ongoing development work has resulted in the powerful COMPACT CB industrial motor. New, as well as established technical solutions, contribute to the creation of this product. The most desirable features and operating reliability have been designed in this hydraulic motor.

This manual provides necessary information for installation and maintenance of the motor. In order to find particular information, just search for the wanted section as listed in the table of contents. However, 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.

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 Hagglunds 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.

DANGER is used to indicate the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.

WARNING is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored.

CAUTION is used to indicate the presence of a hazard which will or can cause minor personal injury or property damage if the warning is ignored.

Application area

All new and rebuild applications, should always be approved and supervised by Hagglunds 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

Motor type **Metric**	Displace-ment V_i cm^3/rev	Specific torque T_S Nm/bar	Rated* speed 1) *n* rpm	Max speed *n* rpm	Max.** pressure *p* bar	Max. torque 2) kNm	Max. power 3) intermittently kW
CB 280-240	15 100	240	53	68	350	79	530
CB 280	**17 600**	**280**	**44**	**58**	**350**	**92**	**530**
CB 400-240	15 100	240	94	125	350	79	970
CB 400-280	17 600	280	73	105	350	92	950
CB 400-320	20 100	320	71	94	350	110	970
CB 400-360	22 600	360	59	82	350	120	960
CB 400-440	27 600	440	49	65	320	131	820
CB 400-480	30 200	480	48	62	290	129	660
CB 400-520	32 700	520	41	57	270	130	670
CB 400-560	35 200	560	40	53	250	129	630
CB 400	**25 100**	**400**	**58**	**75**	**350**	**130**	**970**
CB 560-440	27 600	440	49	65	350	140	930
CB 560-480	30 200	480	48	62	350	160	970
CB 560-520	32 700	520	41	57	350	170	960
CB 560	**35 200**	**560**	**40**	**53**	**350**	**180**	**970**
CB 840-600	37 700	600	30	45	350	200	880
CB 840-640	40 200	640	28	41	350	210	850
CB 840-680	42 700	680	27	40	350	220	890
CB 840-720	45 200	720	25	37	350	240	870
CB 840-760	47 800	760	23	34	350	250	840
CB 840-800	50 300	800	23	34	350	260	890
CB 840	**52 800**	**840**	**21**	**32**	**350**	**280**	**870**
CB1120-880	55 300	880	25	34	350	290	970
CB1120-920	57 800	920	24	33	350	300	980
CB1120-960	60 300	960	24	32	350	315	990
CB1120-1000	62 800	1000	22	31	350	330	1000
CB1120-1040	65 300	1040	21	29	350	340	980
CB1120-1080	67 900	1080	20	28	350	355	980
CB1120	70 400	1120	20	27	350	370	980

*) Related to a required pressure of 12 bar for motors in braking mode. (Special considerations regarding charge pressure, cooling and choice of hydraulic system for speeds above rated, 4 ports must be used for higher speed).
**) The motors are designed according to DNV-rules. Test pressure 420 bar. Peak/transient pressure 420 bar maximum, allowed to occur 10000 times.
[1]) Special considerations regarding charge pressure, cooling and choice of hydraulic system for speed above rated.
[2]) Calculated as: Metric= Ts·(350-15)·0,98.
[3]) Valid for minimum permissible oil viscosity 20 cSt in the motor case.

Motor type	Displace-ment	Specific torque	Rated* speed 1)	Max speed	Max.** pressure	Max. torque 2)	Max. power 3) intermittently
US	V_i in^3/rev	T_S lbf·ft/1000 psi	*n* rpm	*n* rpm	*p* psi	lbf·ft	hp
CB 280-240	920	12 200	53	68	5000	57 000	710
CB 280	**1070**	**14 200**	**44**	**58**	**5000**	**67 000**	**710**
CB 400-240	920	12 200	94	125	5000	57 000	1300
CB 400-280	1070	14 200	73	105	5000	67 000	1300
CB 400-320	1230	16 300	71	94	5000	76 000	1300
CB 400-360	1380	18 300	59	82	5000	86 000	1300
CB 400-440	1690	22 400	49	65	4600	97 000	1100
CB 400-480	1840	24 400	48	62	4200	95 000	890
CB 400-520	1990	26 400	41	57	3900	96 000	900
CB 400-560	2150	28 500	40	53	3600	95 000	840
CB 400	**1530**	**20 300**	**58**	**75**	**5000**	**95 000**	**1300**
CB 560-440	1690	22 400	49	65	5000	100 000	1300
CB 560-480	1840	24 400	48	62	5000	110 000	1300
CB 560-520	1990	26 400	41	57	5000	120 000	1300
CB 560	**2150**	**28 500**	**40**	**53**	**5000**	**130 000**	**1300**
CB 840-600	2300	30 500	30	45	5000	140 000	1200
CB 840-640	2450	32 500	28	41	5000	150 000	1100
CB 840-680	2610	34 600	27	40	5000	160 000	1200
CB 840-720	2760	36 600	25	37	5000	170 000	1200
CB 840-760	2910	38 700	23	34	5000	180 000	1100
CB 840-800	3070	40 700	23	34	5000	190 000	1200
CB 840	**3220**	**42 700**	**21**	**32**	**5000**	**200 000**	**1200**
CB1120-880	3370	44 700	25	34	5000	210 000	1300
CB1120-920	3520	46 700	24	33	5000	220 000	1300
CB1120-960	3680	48 800	24	32	5000	230 000	1300
CB1120-1000	3830	50 800	22	31	5000	240 000	1300
CB1120-1040	3980	52 800	21	29	5000	250 000	1300
CB1120-1080	4140	54 900	20	28	5000	260 000	1300
CB1120	4290	56 900	20	27	5000	270 000	1300

*) Related to a required pressure of 175 psi for motors in braking mode. (Special considerations regarding charge pressure, cooling and choice of hydraulic system for speeds above rated, 4 ports must be used for higher speed).
**) The motors are designed according to DNV-rules. Test pressure 6000 psi. Peak/transient pressure 6000 psi maximum, allowed to occur 10000 times.
[1]) Special considerations regarding charge pressure, cooling and choice of hydraulic system for speed above rated.
[2]) Calculated as: US= Ts·(5000-218)·0,98.
[3]) Valid for minimum permissible oil viscosity 20 cSt in the motor case.

1.3 Functional description

Hagglunds hydraulic industrial motor COMPACT **CB** is of the radial-piston type with a rotating cylinder block/hollow shaft and a stationary housing. The cylinder block is mounted in fixed roller bearings in the housing. 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 housing, thereby producing a torque. The cam rollers transfer the reaction force to the piston which are guided in the rotating cylinder block. Rotation therefore occurs, and the torque available is proportional to the pressure in the system.

Oil main lines are connected to ports A and C in the connection block and drain lines to ports D1, D2, D3 or D4 in the motor 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.

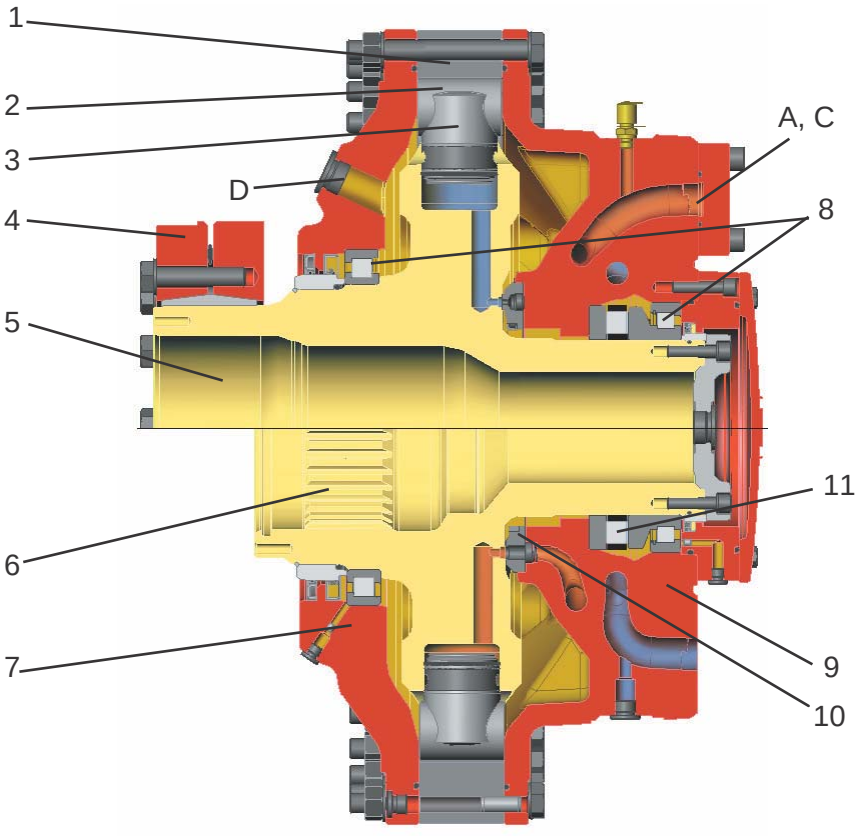
Valid patents

US 4522110, US 005979295A, SE 910 1950-5, EP 0102915, JP 83162704, GB 1524437, EP DE 69211238.3.

Quality

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

*COMPACT **CB** motor*



1. Cam ring
2. Cam roller
3. Piston
4. Shaft coupling
5. Cylinder block / hollow shaft
6. Cylinder block / spline
7. Front end cover
8. Cylindrical roller bearing
9. Connection block
10. Valve plate
11. Axial bearing

A = inlet or outlet port »A«

C = inlet or outlet port »C«

D = drain port

2.3 Choice of hydraulic fluid

The Hagglunds 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%.

Viscosity index = 100 is recommended. Viscosity index = 150 can be used for operation with large temperature difference, however many hydraulic fluids are subject to temporary and permanent reductions of the viscosity. Hagglunds 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.

RECOMMENDED VISCOSITY IN MOTOR CASE AT OPERATING TEMPERATURE 40-150 cSt/187-720 SSU.

FOR SPEEDS BELOW 3 RPM, COATED PISTON OR HIGH VISCOSITY SHALL BE USED.

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

Minimum viscosity limits at operating temperature in motor case	
Standard motors with uncoated piston and uncoated cam rollers	20 cSt/98 SSU *
Motors type C (coated pistons and coated cam rollers) for speed below 3 rpm or when charge pressure exceeds 50 bar (725 psi) at speed above 50 rpm	10 cSt/59 SSU

* Low viscosity gives reduced service life for the motors
Maximum permitted viscosity is 10 000 cSt/48 000 SSU.

Fire resistant fluids

OPERATING WITH FIRE RESISTANT FLUIDS

The following fluids are tested for Hagglunds 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 the order.

IMPORTANT!
Down rating of pressure data and service life must be considered when using fire resistant fluid. The Hagglunds 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 fluids give the same service life for the drive, as mineral oil.

*** The fluid shall have max. 10 g/100 g 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 4406:1999 18/16/13 (NAS 1638, class 7).

2. When filling the tank and motor case, we recommend the use of a filter with the grade of filtration β**10=75**.

Explanation of "GRADEOF 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%).

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 adversely affect the service life of the motor.

Normally the motor must be completely filled with oil. When the motor is installed with the shaft in the horizontal plane, the drain ports must be positioned vertically. The higher of the four ports must be used: see fig. 3.25.

When the motor is mounted with the shaft in the vertical plane, see 3.2.2 "Draining and venting the motor".

The drain line must be dimensioned so that max. 3 bar (43.5 psi) motor housing pressure is not exceeded.

The max housing pressure is 3 bar (43.5 psi). Brief peaks during operation up to 8 bar (116 psi) are permissible. The permitted housing 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".

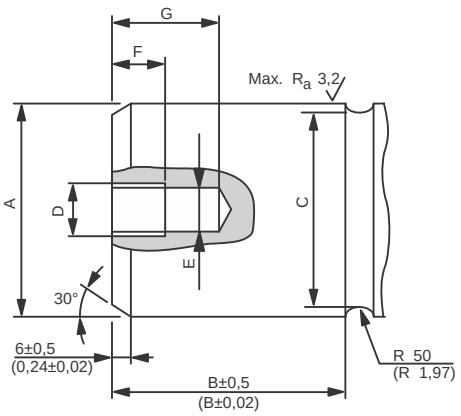
Valid for couplings

Dim	CB 280	CB 400	CB 560/840
A			
mm	$180^{-0,014}_{-0,054}$	$200^{-0,015}_{-0,061}$	$260^{-0,017}_{-0,069}$
in	$7,0866^{-0,00055}_{-0,00213}$	$7,8740^{-0,00059}_{-0,00240}$	$10,2362^{-0,00067}_{-0,00272}$
B			
mm	106	117	153
in	4,17	4,61	6,02
C			
mm	174	194	254
in	6,85	7,64	10

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

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 3.4.



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. 3.2 and tables 3.1 and 3.5

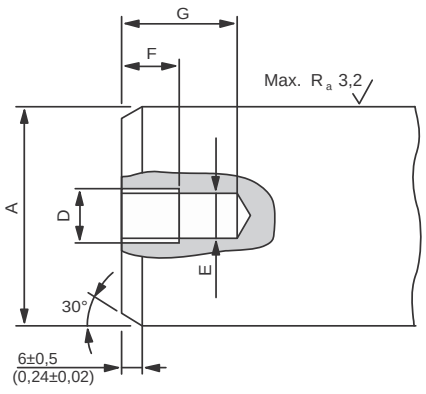


Table 3.2a

Unidirectional drives
Steel with yield strength Rel_{min} = 300 N/mm²
Bidirectional drives
Steel with yield strength Rel_{min} = 450 N/mm²

Spline

The splines shall be lubricated, with hydraulic oil or filled with transmission oil from the connected gearbox. To avoid wear in the splines, the installation must be within the specified tolerances in figure below. If there is no radial or axial force on the shaft, the shaft can be oiled only.

For production of the shaft, see 278 5023, 278 5024, 278 5025 and 278 5026. For control of spline see table below.

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

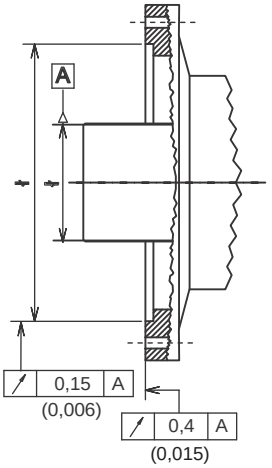
Motor	**CB 280/400**	**CB 560/840/1120**
Tooth profile and bottom form	DIN 5480	DIN 5480
Tolerance	8f	8f
Guide	Flank centring (Back)	Flank centring (Back)
Pressure angle	30°	30°
Module	5	5
Number of teeth	38	50
Pitch diameter	Ø 190	Ø 250
Minor diameter	Ø 188 $^{0}_{-1,201}$	Ø 248 $^{0}_{-1,201}$
Major diameter	Ø 199 $^{0}_{-0,290}$	Ø259 $^{0}_{-0,320}$
Measure over measuring pins	210,158 $^{-0,088}_{-0,157}$	270,307 $^{-0,103}_{-0,181}$
Diameter of measuring pins	Ø 10	Ø 10
Addendum modification X M	+2,25	+2,25

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 3.5) 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 alternatives given in table below.

CB 280 - 840		
D	M20	UNC 5/8"
E	>17 (0,67)	>13,5 (0,53)
F	25 (0,98)	22 (0,87)
G	50 (1,97)	30 (1,18)



3.1.2 Mounting the coupling onto the motor shaft

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

- You should note that the couplings are from the factory lubricated with MoS_2 (Molykote) on the conical surfaces and the bolts, see fig. 3.11. This lubricants shall remain on those surfaces but:

Molykote must under no circumstances be trans-fered to the surfaces between the driven shaft and the motor.

It is therefore important that you clean your hands free from Molykote. If those conditions are fulfilled you may start the mounting.

- Clean the driven shaft and the out- and inside of the Compact motor hollow shaft.

- 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. Use a screwdriver to open the coupling ring for easier mounting.

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

- Mount the motor onto the driven shaft by following the instruction in the section 3.1.4. (With or without using the mounting tool).

Remember:

-The conical surface between the coupling ring and the clamping rings + the bolts shall be coated with MoS_2 (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 reassembled 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-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).

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

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".

Alt. 1:

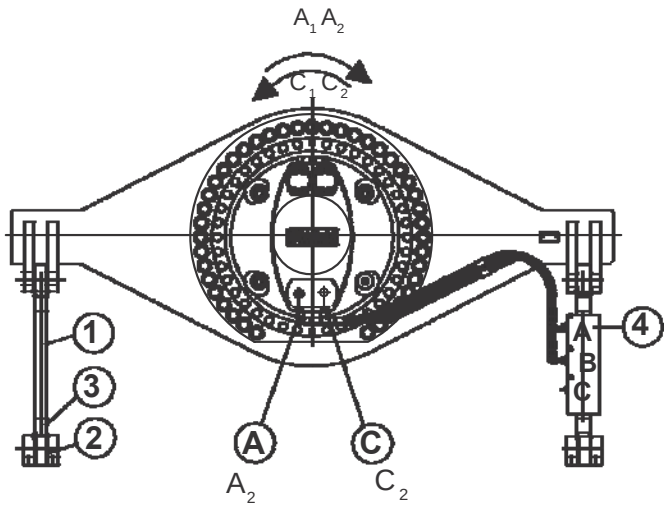
Check and adjust the rod end (pos 1) according to the drawing. Mount the rod to the torque arm, use the shaft (pos 2) and lock them with circlips. Tighten the 4 pcs of screw (pos 3) on the rod end with torque according to table 3.10b.

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 (A_1 , A_2) has to be mounted to the hydraulic cylinders connection A, and the hose from (C_1, C_2) has to be mounted to the cylinders connection B.

This is valid with the cylinder on the right side hand-side of the the motor, and a single speed motor.

Remark!
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
63/45 63/50 70/45 80/50 80/56 80/63	M10 x 30	49	36



3.1.4a Mounting the motor onto the driven shaft - shaft coupling

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 makes the work easier.

It is important to arrive at the correct clamping length between the driven shaft and the hollow shaft of the shaft adapter.

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. 3.11, 3.11a and the table 3.9.

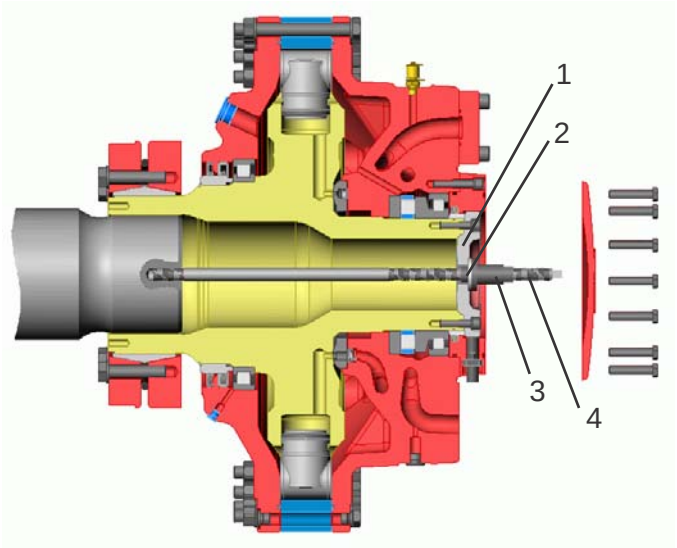
Mounting the motor with a mounting tool

- Remove the end cover together with screws and washers.
- Align the motor with the driven shaft.
- Locate the existing plastic washer between the nut on the mounting tool and the bearing retainer.
- Pass the mounting tool through the centre of the motor, and screw it into the driven shaft to stated depth by using the key handle in the end of the tool.
- Pull the motor onto the shaft by turning the nut on the mounting tool until the length B is obtained; see fig. 3.13, 3.13a and table 3.10. Push and pull the end of the torque arm for easier mounting.
- Tightening the shaft coupling see table 3.10.
- Remove the mounting tool.
- Refit the plug.
- Refit the end cover and tighten the screws together with washers. Torque 80 Nm (59 lbf·ft).

CAUTION

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

Mounting the CB 280...840



1; Bearing retainer

2; Plastic washer

3; Nut

4; Mounting tool

Tightening of shaft coupling

However for the tightening of the coupling screws the following must be observed:

Keep tension in your lifting wires to avoid a skew setting of the motor on the shaft during the tightening of the screws. Wobbling caused by a 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. 3.14a. The difference between the measured gaps must never vary more than 1 mm (0,04") during any stage of the tightening process.

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 3.10.

Now start tightening the screws in sequence shown in fig. 3.14.

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.

Table 3.10

Motor type	No of screws	Screw dim	Strength class	Tightening torque		Type of head
				Nm	lbf·ft	
CB 280	12	M20 x 80	10.9	490	362	Hexagon
CB 400	15	M20 x 90				
CB 560	20	M20 x 100				
CB 840	20	M20 x 100				
CB 1120	32	M20 x 130				

Note 1 Uncoated screws greased with Molykote, MoS_2.
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.
Note 4 CB 1120 with shaft coupling set

3.1.5 Removing the motor from the driven shaft

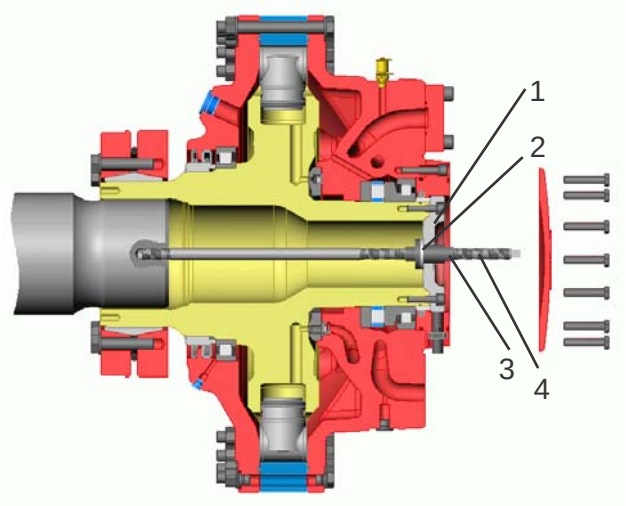
Before dismounting the motor from the driven shaft the oil in the motor housing must be drained through the lower draining hole.

The motor can be removed from the shaft with or without the mounting tool. The operation is easier if the tool is used.

Never stay below the motor during disassembly

Always make sure that the lifting equipment is strong enough to handle the weight of the motor

Fig. 3.15 Removal of Compact CB 280...840



1; Bearing retainer
2; Plastic Washer
3; Nut
4; Mounting tool

Removal by using the mounting tool

- Slacken the shaft coupling screws gradually; see fig. 3.14 and 3.14a. **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 and bearing retainer together with screws and washers; see fig. 3.16
- 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 bearing retainer can be refitted, torque 136 Nm (100 lbf·ft)
- Remove the motor from the driven shaft by unscrewing the nut of the mounting tool.
- Remove the bearing retainer and mounting tool. Finally, refit the removed bearing retainer, torque 136 Nm (100 lbf·ft) and end cover, torque 80 Nm (59 lbf·ft) as before.

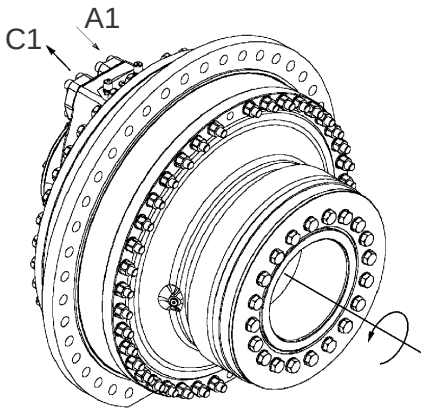
Removing the motor without using the mounting tool

- Slacken the screws of the shaft coupling, see above "Removal of motors by using the mounting tool".
- Remove end cover and plug to allow air to enter the space in the hollow shaft of the motor; see “Mounting the motor without a mounting tool“. 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.

3.2.1 Direction of rotation of motor shaft

With the inlet pressure supply connected to A port, the motor shaft rotates in the direction shown by the arrow, anti-clockwise viewed from the motor shaft side.

With the inlet pressure supply connected to C port, the motor shaft rotates clockwise viewed from the motor shaft side.



3.2.2 Draining and venting the motor

Horizontal mounting

When the motor is installed with the shaft in the horizontal plane, the highest of the four drain outlets D1, D2, D3 or D4 must always be used; see fig. 3.28.

Drain line must be connected direct to the tank with a minimum of restrictions, to ensure that the maximum housing pressure is not exceeded.

Vertical mounting

When the motor is mounted vertically, the highest of the four drain outlets D1, D2, D3 or D4 must be used. Flushing of radial seal from low pressure is necessary.

Motor shaft pointing downwards

The motor must be connected to one of the drain connections in the connection block; see figure 3.29. The flushing connection F2 shall be connected to low pressure connection. Orifice must be installed.

Motor shaft pointing upwards

The motor must be connected to the drain line connection on the shaft end housing; see figure 3.30.

The flushing connection F1 on the shaft end housing should be connected to the low pressure connection. With 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.

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.

Note: the antirust protection must be touched-up after transport and handling.

If the motor is stored for more than 3 months in uncontrolled environment or more than 12 months in controlled environment, it must be filled with oil and positioned as shown in fig. 3.7.

Place the motor as shown in fig 4.1, fill the motor with filtered oil in the following order: D1, A1, C1. See 2.3, "Filtration" and table 4.1.

Take extreme care to ensure that no contamination enters the motor.

Seal connections A and C with the cover plate fitted to the connection surface at delivery. Check that the O-rings or rubber seals are in position in the cover plate.

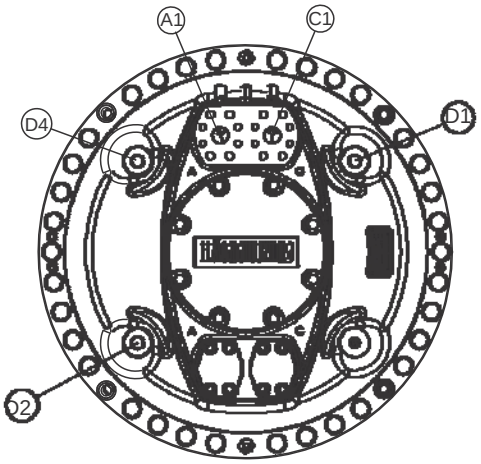
Fit the plug to D1, D2, D3 and D4, the table below states the amount of oil needed to fill the various types of motors.

4.2 Before commissioning

Check the following points before commissioning the motor, i.e. before starting the first time:

Make sure that all fluids been removed from the motor to prevent accidental mixing with the hydraulic fluid used in the system.

- 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 housing with hydraulic fluid via a filter into the drain outlets D1, D2 or the vent hole (depending on how the motor is mounted), see table 4.1.
- Check the drain line to ensure that excessive pressure does not build up in the motor housing; see 3.1 "Mounting instructions" and 3.2.2. "Draining and venting the motor".
- Check that the motor is protected from overloads (see 1.2 "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 and 3.1.6.



Motor	Oil volume approx.	
	Litres	US gal.
CB 280	15	4,0
CB 400	21	5,6
CB 560	19	5,0
CB 840	25	6,6
CB 1120	32	8,5

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 seals.
- 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. see 4.4 note to check the "filter clogged" indicators.

NOTE:

It is important that the pressure is limited to 250 bar (3626 psi) when starting up the motor.

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.

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".
- 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 be 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	Torque arm
After the first 100 hours	Rpl.		Insp.
After 3 months or 500 hours	Rpl.		
Once every 6 months	Rpl.	Insp.	Insp.
Once every 12 months			

Rpl = Replacement ***Insp*** = Inspection

4.4.3 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 4000 working hours.

4.4.4 Oil (Se 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.

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.

All hydraulic fluids are affected differently. Obtain the advice of your oil supplier or by nearest Hagglunds 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. 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 great 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 driven unit.
Noise in the motor.	The motor is being operated with too low charge pressure.	Adjust the charge pressure to the correct level. See 2.1 "Recommended charge pressures".
	Internal faults in the motor.	Investigate the drain oil, if necessary. Put a magnetic plug in the oil flow and check the material that sticks to the magnet. Steel particles indicate damage. Note that fine material 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.