Hagglunds Compact CA Radial Piston Hydraulic Motor

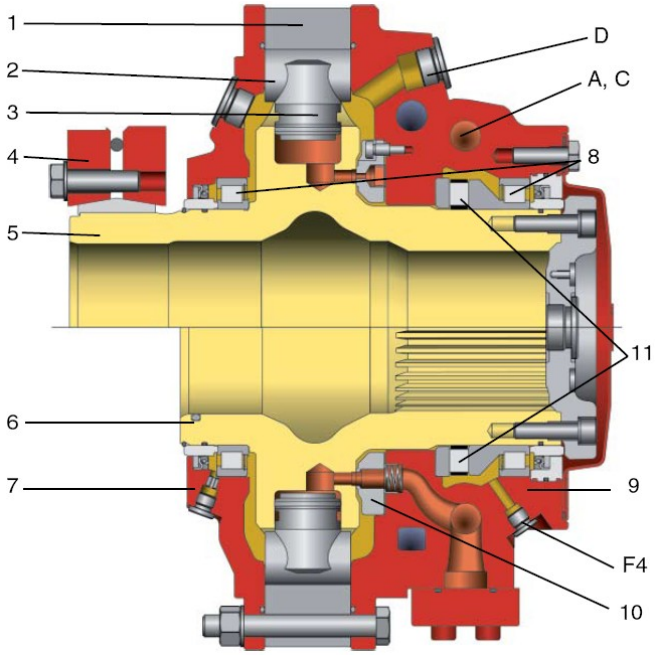
Hagglunds CA50 CA70 CA100 CA140 CA210 motor

Hagglunds compact CA motor was designed for one specific purpose: to power heavy-duty applications with minimum size and weight. Its light and compact design yields a superior ratio of power to weight, Among the popular features of the Compact CA are its ability to handle shock loads and its useful through hole. These, as well as the motor's numerous mounting options, make it a small but flexible powerhouse that provides advantages in many applications.
Compact CA's series hydraulic motor is designed for high-end application. With advantage of hollow rotor, the motor can be mounted with brake, speed encoder, and some special equipment mounted through the center of motor, according to the user's requirements. It shows its striking features of high pressure endurance, stability at low speed, and high output torque in various inferior working conditions.

Main characteristics:

1) Good anti-shock capability and stability;
2) Stable speed switch and brake available;
3) Enable free running working condition;
4) Multi-mounting options; hollow shaft design;
5) Large output torque; wide speed range; directly replace combined devices of high speed motor and gearbox; compact structure;
6) Stable performance in low speed;
7) Higher mechanical and volumetric efficiency;
8) Reversible rotation;
9) Higher power-mass ratio;
10) Higher reliability; easy maintenance.

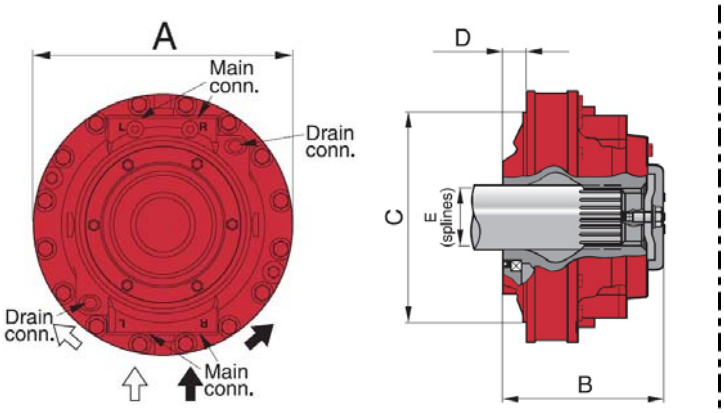
Parts Information of Hagglunds CA Motor：



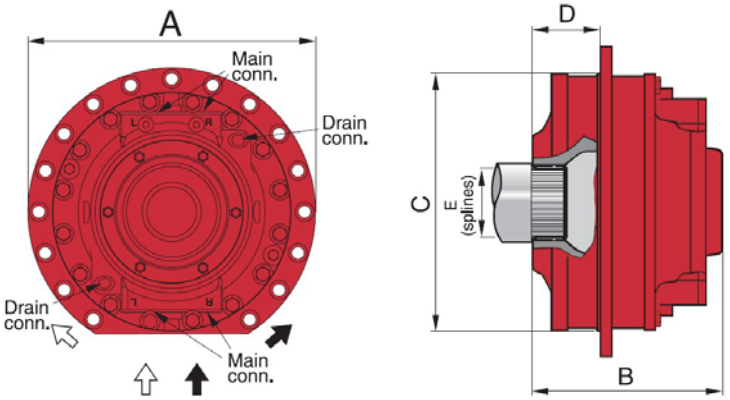
1. Cam ring
2. Cam roller
3. Piston
4. Shaft coupling
5. Cylinder block / hollow shaft
6. Cylinder block / spline
7. Front end cover
8. Cylindrical roller bearing
9. Connection block
10. Valve plate
11. Axial bearing

A = inlet or outlet port »A«
C = inlet or outlet port »C«
D = drain port
F4 = Flushing

Dimensions: with splines for flange mounting



CA50, CA70



CA100, CA140

Model type	A (mm)	B (mm)	C (mm)	D (mm)	E (splines shaft) DIN 5480	Main conn.	Drain conn.	Weight (kg)
CA 50	464	313	390	46	N 120x5x30x22x9H	SAE 1 1/4”	BSP 3/4”	175
CA 70	495	314	435	46	N 120x5x30x22x9H			205
CA 100	560	400	470	135	N 140x5x30x26x9H			265
CA 140	600	401	510	135	N 140x5x30x26x9H			305
CA 210	600	503	510	156	N 150x5x30x28x9H			395

The dimensions are the same for the all related options with smaller displacement.

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

Quantity	Symbol		Metric	US
Pressure loss	$\triangle P$	=	bar	psi
Change pressure	P_c	=	bar	psi
Flow rate required	q	=	l/min	gpm
Total volumetric los s	q_1	=	l/min	gpm
Displacement	V_i	=	cm^3/rev	in^3/rev
Mechanical efficiency	η	=	0.97	

Installation

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 two drain ports must be used.

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.

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

The maximum 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 "Recommended charge pressure".

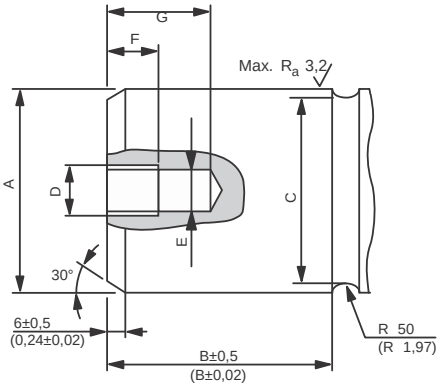
Valid for couplings

Dim	CA50/70	CA100/140	CA210
A mm **in**	120 $^{-0.025}$ 4.7244 $^{-0.00098}$	140 $^{-0.025}$ 5.5118 $^{-0.00098}$	160 $^{-0.025}$ 6.2992 $^{-0.00098}$
B mm **in**	71.5 2.81	84.5 3.33	105 4.13
C mm **in**	116 4.57	133 5.24	153 6.02

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

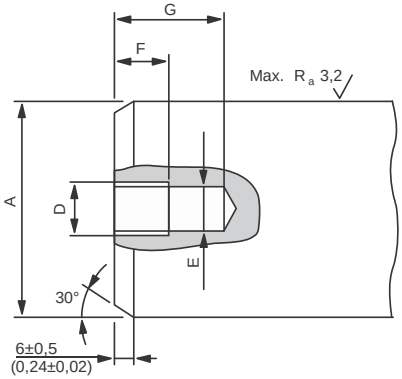
Design of driven shaft end on heavily-loaded shaft

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.



Normally-loaded shaft

In drives with only one direction of rotation where the stresses in the shaft are moderate, the shaft can be plain



Unidirectional drives
Steel with yield strength Rel = 300 N/mm
Bidirectional drives
Steel with yield strength Rel = 450 N/mm

Mounting the coupling onto the motor shaft

Instruction to follow when mounting the COMPACT CA 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 Hagglunds.

- The shaft must have the dimensions as recommended.

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

Molykote 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 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 CA motor hollow shaft. 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 "Mounting the motor onto the driven shaft". (With or without using the mounting tool).

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 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 figure 3.14. 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 maximum 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 head (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.

Now start tightening the screws in sequence shown.

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).

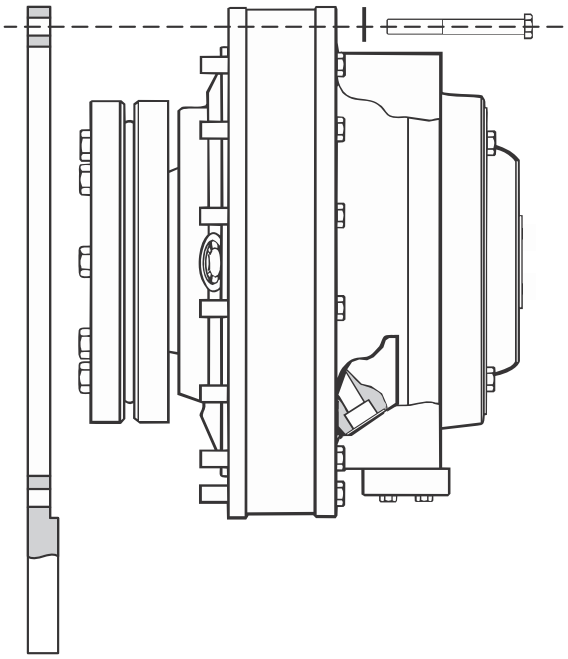
When the specified torque is reached it is important that all screws are tightened with specified torque and that no further movement can be observed.

Fitting the torque arm to the motor

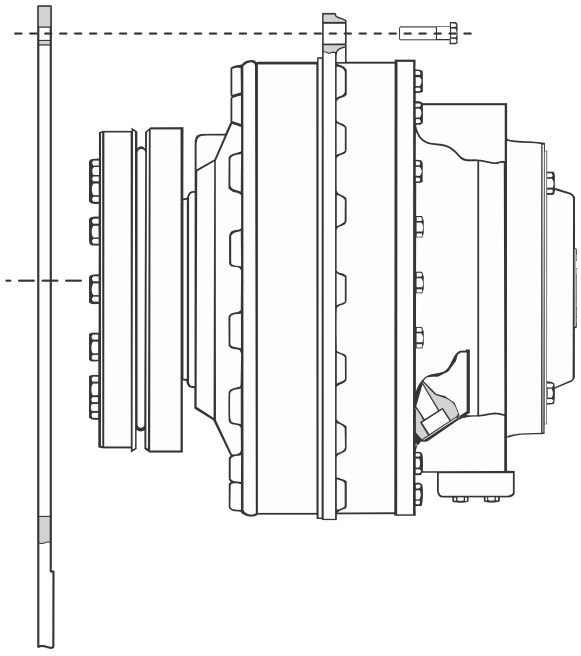
The torque arm is fitted to the motor before the motor is mounted on the driven shaft.

- Open the nuts M16 screws for CA 50-70.
- 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. To achieve the highest possible oil level in the motor housing, the motor must be turned until the drain outlets are positioned.
- Line up the torque arm on the motor by using the screws with washers.
- Tighten the screws to the torque stated in the table below.

Hagglunds CA50 CA70 motor



Hagglunds CA100 CA140 CA210 motor



CAUTION

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

Motor	Screw dimension	Number of screws	Tightening torque	
			Nm	lbf·ft
CA 50	M16 Strength class 10.9	16	280	205
CA 70	M16 Strength class 10.9	20	280	205
CA 100	M20 Strength class 10.9	17	540	400
CA 140/210	M20 Strength class 10.9	21	540	400

Note: Use torque wrench and oiled screws!

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.

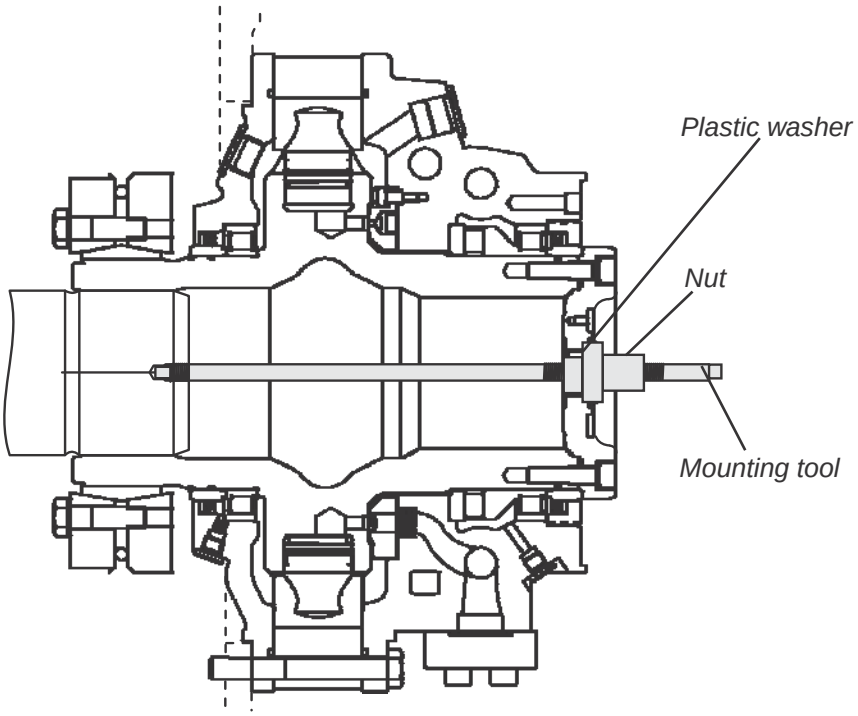
It is important to arrive at the correct clamping length between the driven shaft and the hollow shaft of the motor.

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.

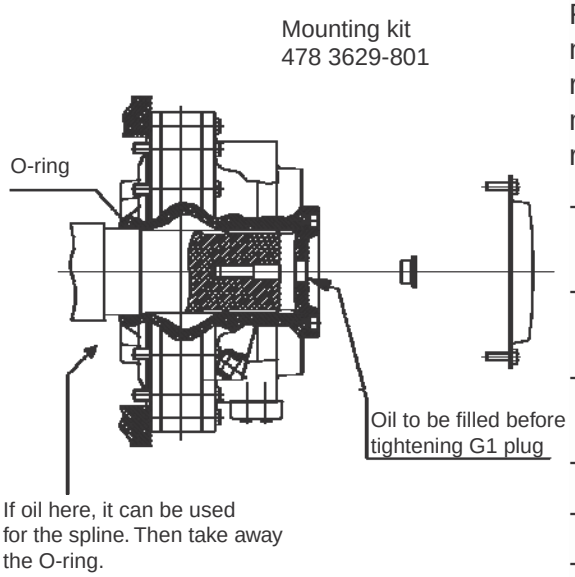
Mounting the motor with a mounting tool

- 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 stated.
- Tightening the shaft coupling
- Remove the mounting tool.
- Refit the plug.
- Refit the end cover and tighten the screws together with washers. Torque 81 Nm (59 lbf·ft).

Mounting the CA 50...210



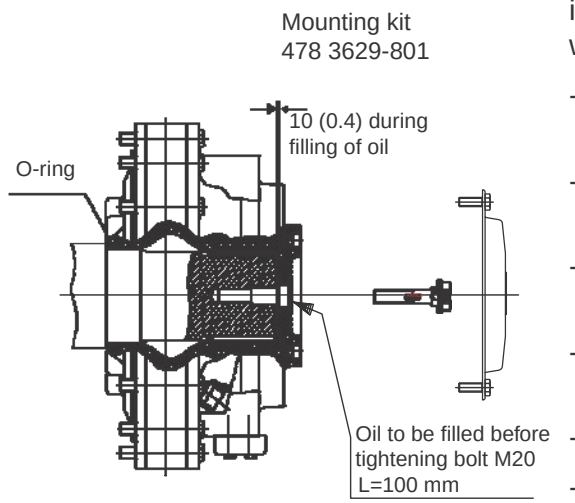
Mounting the motor onto the driven shaft - splines



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 oiled before mounting the motor. If the motor is subject to radial load, the splines shall be filled up with oil.

- 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 on to the shaft.
- Bolt the motor to the flange.
- Fill up hydraulic oil to the G1 plug.
- Torque the G1 plug. M_V=125 Nm/90 lbf·ft.
- Mount the cover. M_V=81 Nm/59 lbf·ft.



Torque arm 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 on to the shaft.
- Fill up hydraulic oil to the G1 plug.
- Mount special designed bolt.
- Torque the bolt. M_V=385 Nm/280 lbf·ft.
- Mount the cover. M_V=81 Nm/59 lbt·ft.

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

Removal by using the mounting tool

- Slacken the shaft coupling screws gradually;

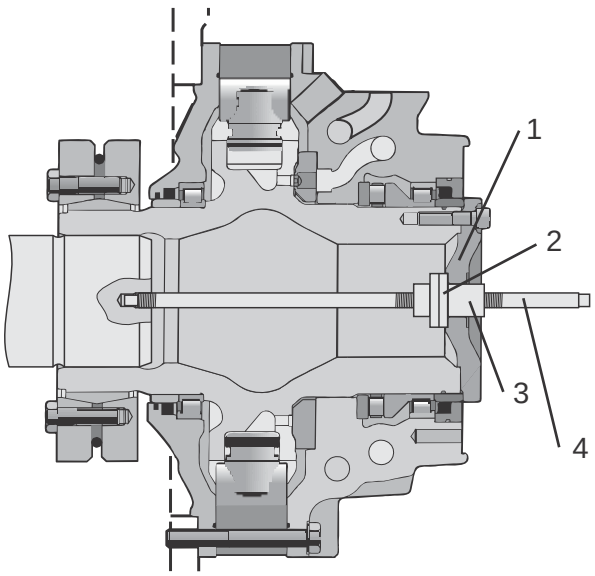
  Each screw should be slackened only about a quarter of a turn each time. Thus tilting and jamming of the collars or thread stretching will be avoided. The screws must be slackened until the coupling ring is fully released.

  - Remove the End cover and Bearing retainer together with screws and washers.

- 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.
- 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 81 Nm (59 lbf·ft) as before.

Removal of Compact CA50...210



1; Bearing retainer

2; Plastic Washer

3; Nut

4; Mounting tool

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.

Place the motor as shown. fill the motor with filtered oil in the following order: D1, A1, B, C1.

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 and D3, the table below states the amount of oil needed to fill the various types of motors.

Before commissioning

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

- Check that the motor is connected to give the correct direction of rotation (see "Oil connections" and "Direction of rotation of motor shaft").
- Select the hydraulic fluid in accordance with the recommendations (see "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).
- Check the drain line to ensure that excessive pressure does not build up in the motor housing; see "Mounting instructions" and "Draining and venting the motor".
- Check that the motor is protected from overloads (see "Motor data").- Check that the charge pressure conforms
- Check that all hydraulic couplings and plugs are properly tightened to prevent leakage.
- Make sure that the torque arm is sufficiently fastened.

Motor	Oil volume approx.	
	Litres	US gallon
CA 50	2.0	0.53
CA 70	2.5	0.66
CA 100	3.7	0.98
CA 140	5.0	1.32
CA 210	6.8	1.80

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 note to check the "filter clogged" indicators.

NOTE:

It is important that the pressure is limited to 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.

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	Braking equipment	Torque arm
After the first 100 hours	Rpl.		Insp.	Insp.
After 3 months or 500 hours	Rpl.		Insp.	
Once every 6 months	Rpl.	Insp.	Insp.	Insp.
Once every 12 months			Ctrl	

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

Ctrl = Control of braking torque

Cleaning and care

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.

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.

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.

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.