

Compact CA

PRODUCT MANUAL



HÄGGLUNDS

Product Manual

COMPACT

EN396-10h 2011

One partner all over the world

Häggglunds Drives

is the worlds leading manufacturer of heavy duty hydraulic drive systems. If what you need is low speed and high torque, then Häggglunds Drives should be your partner.

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



Original EN396-9h, 2009

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

Features

High power capacity

The new Compact has a wider speed range than any motor we have built before. It can work at high speed and high pressure, check out the efficiency curves on page 15.

High power/weight ratio

The new Compact with its small outer diameter and low weight will give you a high power to weight ratio that is extraordinary. This means great performance but also lower energy consumption.

Insensitive to shock loads

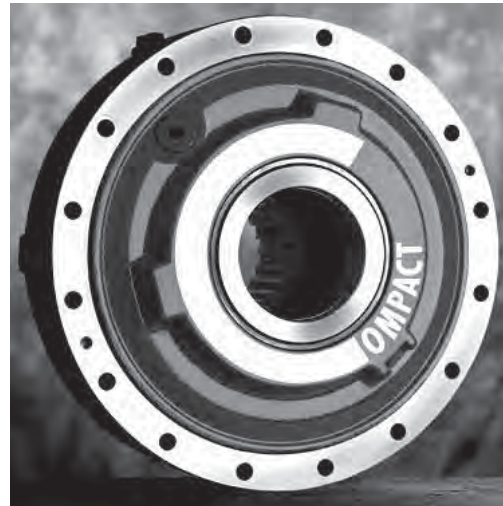
The new Compact is small and light but at the same time tough and insensitive to shock loads. The new Compact has everything you have come to expect from a Hägglunds motor - high torque, wide speed range, shock resistant, easy to install, easy to maintain, and as tough as they come. - Only smaller!

Hole through motor centre

The hole through the motor centre is extremely useful in some applications. For example with through shaft for driving from both ends - or to gain access to the machine to feed water or other medium through the shaft.

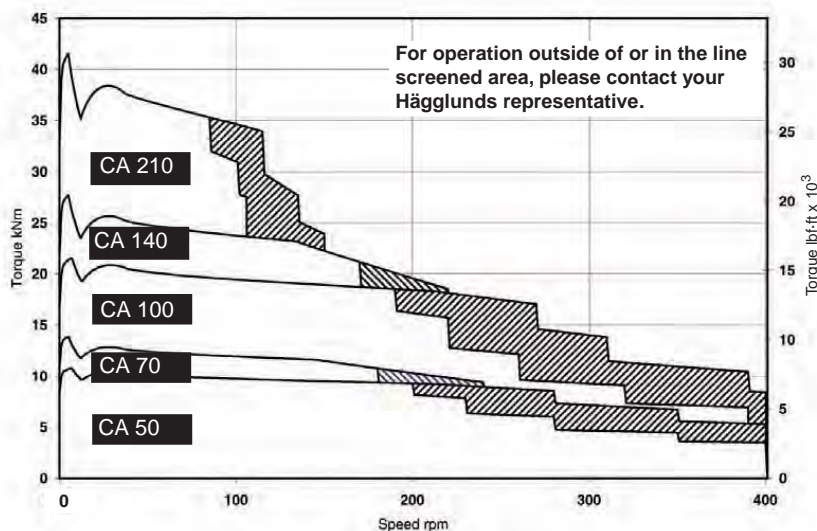
Adaptable mounting

Even though we believe in standard solutions. We also believe in adapting our products to our customers needs. The new Compact can be mounted in just about any way you want it.



Quick selection diagram for Compact motors

The diagram below represents the torque and speed, corresponding to a basic rating life $L_{10\text{aah}} = 20\,000$ h. Oil viscosity in the motor case 40 cSt (187 SSU). When operating below 5 rpm, coated pistons or oil with higher viscosity shall be used. Contact your Hägglunds representative.



Functional description

Hägglunds hydraulic industrial and marine motor COMPACT 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 pistons which are guided in the 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 or D3 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 shrink disc, or alternatively by splines.

The symmetrical design of the motor has made it possible to design it as a two displacement motor. This means that two different displacements and speeds can be obtained for a given flow. To get the 2-speed function, a motor prepared for two speeds has to be ordered together with a 2-speed valve.

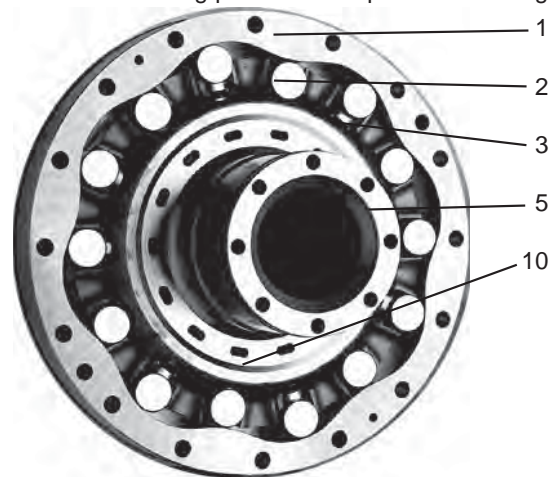
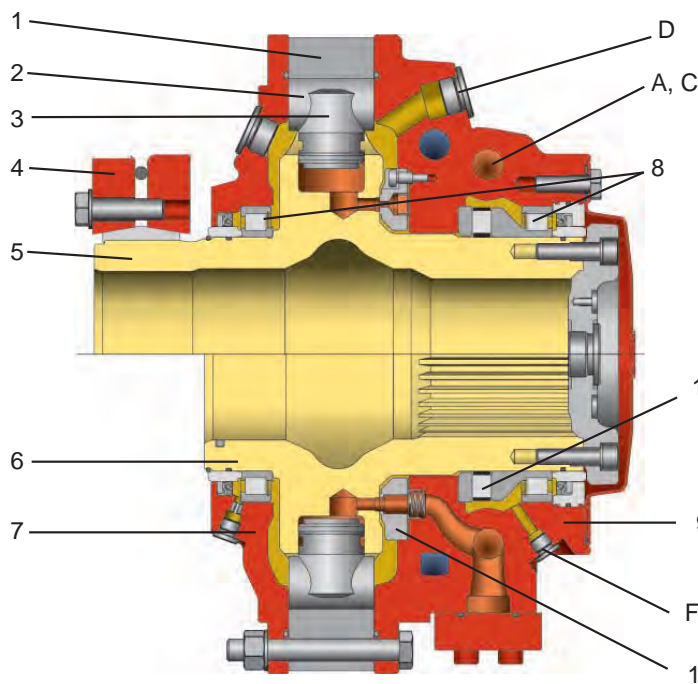


Fig. 1 Compact motor



Valid patents

US 4522110, US 005979295A, SE 456517, EP 0102915, JP 83162704, GB 1385693, EP 0524437.

Quality

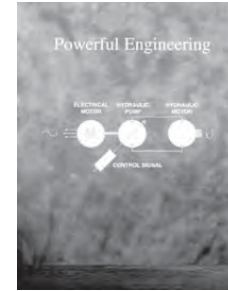
To assure our quality we maintain a Quality Assurance System, certified to standard ISO 9001, EN 29001 and BS 5750; Part 1.

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

A = Inlet or outlet port »A« (2 each)
C = Inlet or outlet port »C«
D = Drain port (3 each)
F4 = Flushing

Calculation fundamentals

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



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

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

Quantity	Symbol	Metric	US
Pressure loss	Δp_i	= bar	psi
Charge pressure	p_c	= bar	psi
Flow rate required	q	= l/min	gpm
Total volumetric loss	q_l	= l/min	gpm
Displacement	V_i	= cm ³ /rev	in ³ /rev
Mechanical efficiency η_m		= 0.97 (Not valid for starting efficiency)	

Definitions

Rated speed¹⁾

Rated speed is the highest allowed speed for a charge pressure of 12 bar (175 psi) above case pressure. When a closed loop system is used, a minimum of 15% of oil is to be exchanged in the main loop.

Max speed

Maximum speed is the maximum allowed speed. Special considerations are necessary regarding charge pressure, cooling and choice of hydraulic system for speeds rated above.

Accepted conditions for standard type of motor:

- Oil viscosity 20 - 40 - 10000 cSt (98 - 187 - 4650 SSU). See page 24.
- Temperature -35°C to +70°C (-31°F to +158°F).
- Running case pressure 0-3 bar (0-45 psi)
Max case pressure 8 bar (116 psi)
- Charge pressure (see diagram).
- Volumetric losses (see diagram).

¹⁾Operating above rated conditions requires Hägglunds approval.

Data

Motor type	FULL DISPLACEMENT						Max. ** pressure	DISPLACEMENT SHIFT				
	Displacement	Specific torque	Rated speed	Max. *** speed	Max. *** speed	p		Displacement	Specific torque	Rated speed	Max. speed	Ratio
CA 50 20	1256	20	400	400	350							
CA 50 25	1570	25	350	400	350							
CA 50 32	2010	32	280	400	350							
CA 50 40	2512	40	230	350	350							
CA 50	3140	50	200	280	350		1570	25	200	280	1:2	
CA 70 40	2512	40	270	400	350							
CA 70 50	3140	50	225	320	350		1570	25	225	320	1:2	
CA 70 60	3771	60	195	275	350		1886	30	195	275	1:2	
CA 70	4400	70	180	240	350		2200	35	180	240	1:2	
CA 100 40	2512	40	390	400	350							
CA 100 50	3140	50	320	400	350							
CA 100 64	4020	64	260	390	350							
CA 100 80	5024	80	220	310	350		2512	40	220	310	1:2	
CA 100	6280	100	190	270	350		3140	50	190	270	1:2	
CA 140 80	5024	80	245	340	350							
CA 140 100	6280	100	205	275	350		3140	50	205	275	1:2	
CA 140 120	7543	120	180	245	350		3771	60	180	245	1:2	
CA 140	8800	140	170	220	350		4400	70	170	220	1:2	
CA 210 160	10051	160	105	150	350		5026	80	105	150	1:2	
CA 210 180	11314	180	100	135	350		5857	90	100	135	1:2	
CA 210	13200	210	85	115	350		6600	105	85	115	1:2	

Motor type	FULL DISPLACEMENT						Max. ** pressure	DISPLACEMENT SHIFT				
	Displacement	Specific torque	Rated speed	Max. *** speed	Max. *** speed	p		Displacement	Specific torque	Rated speed	Max. speed	Ratio
CA 50 20	76.6	1017	400	400	5000							
CA 50 25	95.8	1271	350	400	5000							
CA 50 32	122.6	1627	280	400	5000							
CA 50 40	153.3	2034	230	350	5000							
CA 50	191.6	2543	200	280	5000		95.8	1271	200	280	1:2	
CA 70 40	153.3	2034	270	400	5000							
CA 70 50	191.6	2543	225	320	5000		95.8	1271	225	320	1:2	
CA 70 60	230.1	3051	195	275	5000		115.1	1526	195	275	1:2	
CA 70	268.5	3560	180	240	5000		134.3	1780	180	240	1:2	
CA 100 40	153.3	2034	390	400	5000							
CA 100 50	191.6	2543	320	400	5000							
CA 100 64	245.3	3254	260	390	5000							
CA 100 80	306.6	4068	220	310	5000		153.3	2034	220	310	1:2	
CA 100	383.2	5085	190	270	5000		191.6	2543	190	270	1:2	
CA 140 80	306.6	4068	245	340	5000							
CA 140 100	383.2	5085	205	275	5000		191.6	2543	205	275	1:2	
CA 140 120	460.3	6102	180	245	5000		230.1	3050	180	245	1:2	
CA 140	537	7119	170	220	5000		268.5	3560	170	220	1:2	
CA 210 160	613.2	8136	105	150	5000		306.7	4068	105	150	1:2	
CA 210 180	690.4	9154	100	135	5000		345.2	4577	100	135	1:2	
CA210	805.5	10678	85	115	5000		402.8	5339	85	115	1:2	

*Related to a required charge 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, 4 ports must be used for higher speed).

**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.

***Speed above 280 rpm requires viton seals. Max permitted continuous case pressure is 2 bar.

Ordering codes

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

Compact motors

Example: CA 50 SA 0 V 0 C 00 00

Motor series CA

Generation 50

Motor size CA 50
CA 70
CA 100
CA 140
CA 210

Specific torque (Nm/bar) SA

Mounting alternatives, shaft
Shrink disc coupling C
Splines S
Other 0

Multi disc brake or Tandem kit
Motor without brake or TA kit A
Motor prepared for brake or TA 1) B

Displacement shift
Single speed motor 0
Two speed motor, rotation clockwise (As viewed from shaft end and inlet to A port) R
Two speed motor, rotation counter clockwise (As viewed from shaft end and inlet to A port) L

Type of seal
Nitrile N
Viton V

Through hole kit
No 0
Yes H

Coated pistons and coated cam rollers
No 0
Yes C

Modification 00-99

Design
Standard 00
Special index 01-99

To be filled in by Hägglunds

1) Brake and TA kit must be ordered separately

Painting
Orange Standard
Other Option

Multi Disc Brake (MDA)

Example: MDA 05 N 1 00

Multidisc brake MDA

Generation 05

Brake size MDA 5
MDA 7
MDA 10
MDA 14*
MDA 21*

Type of seal
Nitrile N
Viton V

Modification 1-9

Design
Standard 00
Special index 01-99

To be filled in by Hägglunds

Brake must be ordered separately

Painting
Orange Standard
Other Option

*MDA 14 and MDA 21, designed for separate mounting on the driven shaft. MDA 14 can be mounted directly to the motor via Tandem kit 21, this is not possible with MDA 21.

Torque arm

Example: TCA 5-0-0-00

Torque arm TCA

Generation 5

Torque arm size TCA 5 (for CA 50)
TCA 7 (for CA 70)
TCA 10 (for CA 100)
TCA 14* (for CA 140/210)

Attachment
Pivoted 2
Other 9

Modification 0-9

Design
Standard 00
Special index 01-99

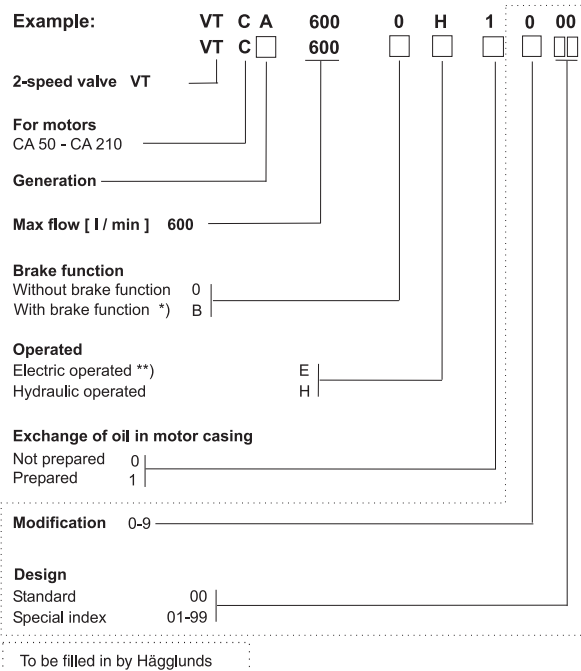
To be filled in by Hägglunds

*Also for CA 210
Note: Torque arm incl. Pivot attachment.
TCA 5/7 - bolts supplied with motor.
TCA 10/14 - bolts & washers supplied with torque arm.

Ordering codes

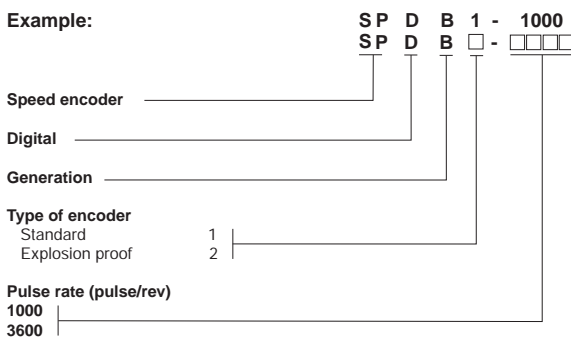
In order to identify Hägglunds equipment exactly, the following ordering code is used. These ordering codes should be stated in full in all correspondence e.g. when ordering spare parts.

2-Speed valve

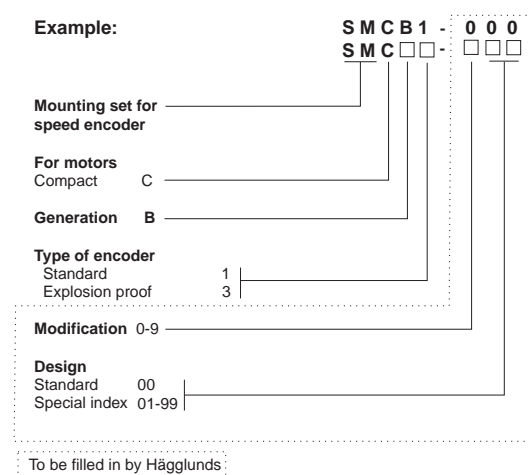


*) Only in combination with electric operated valve
**) Other than 24 VDC, must be ordered separately

Speed encoder



Mounting set for speed encoder



Dimensions With splines for flange mounting.

Fig. 2

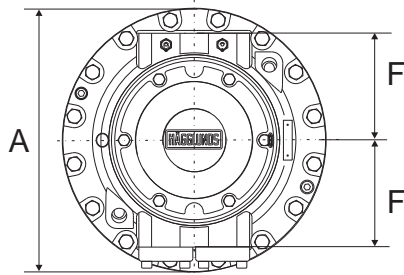


Fig. 3

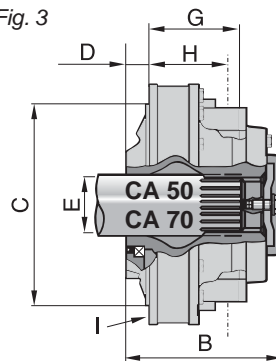


Fig. 3a

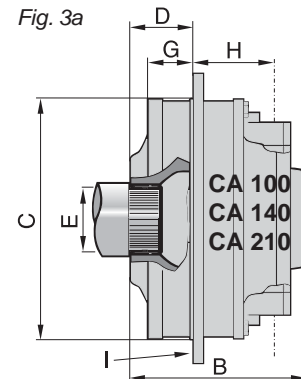


Table 1 Dimensions for the motor

Motor	A mm (in)	B mm (in)	C mm (in)	D mm (in)	E	F mm (in)	G mm (in)	H mm (in)	I Hole Ø	Weight kg (lb)	Main. conn.	Drain conn.	
CA 50	464 (18.26)	318.5 (12.54)	390 (15.35)	46.5 (1.83)	N120x5x30x22x9H	188 (7.40)	217.5 (8.56)	160 (6.30)	16xM16 PCD 430 (15.93)	175 (437)	SAE 1 1/4"	BSP 3/4"	
CA 70	500 (19.68)		435 (17.12)						20xM16 PCD 470 (18.50)	205 (450)			
CA 100	560 (22.05)	406 (15.98)	470 (18.50)	135.5 (5.33)			N140x5x30x26x9H	95 (3.74)	158 (6.22)	17xØ22 PCD 520 (20.47)			265 (584)
CA 140	600 (22.62)	510 (20.07)	21xØ22 PCD 560 (22.00)							305 (672)			
CA 210		507.5 (19.98)	156 (6.16)	N150x5x30x28x9H			238 (9.37)						395 (870)

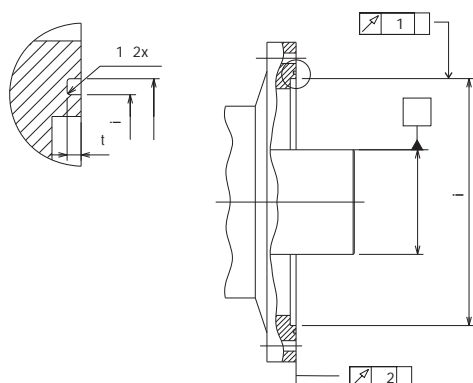
When the motor is used flange mounted it is normal to use spline. To avoid wear in the splines, the installation must be within the specified tolerances in fig. 4. If it's possible, let the spline connection be filled with oil. If the spline is not lubricated, there is a risk for wear and corrosion. If there is radial and axial force on the shaft, the spline area in the motor shall be filled with oil. 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 table 2. If there is no radial or axial force on the shaft, the shaft can be oiled only.

For production of the shaft, see 278 2230, 278 2231, 278 2232, 278 2233, 278 2234, 278 2235, 278 2236, 278 2238 or 278 2239. For control of spline see table 2.

Table 2 Dimensions for splines

Motor	CA50/70	CA100/140	CA210
Tooth profile and bottom form	DIN 5480	DIN 5480	DIN 5480
Tolerance	8f	8f	8f
Guide	Back	Back	Back
Pressure angle	30°	30°	30°
Module	5	5	5
Number of teeth	22	26	28
Pitch diameter	Ø 110	Ø 130	Ø 140
Minor diameter	Ø 109 ⁰ -1.62	Ø 129 ⁰ -1.62	Ø 139 ⁰ -1.62
Major diameter	Ø 119 ⁰ -0.220	Ø 139 ⁰ -0.250	Ø 149 ⁰ -0.250
Measure over measuring pins	-0.083 129.781 -0.147	-0.085 149.908 -0.150	-0.085 159.961 -0.150
Diameter of measuring pins	Ø 10	Ø 10	Ø 10
Addendum modification X M	+2.25	+2.25	+2.25

Fig. 4



Dimensions

With hollow shaft, shrink disc coupling.

Fig. 5

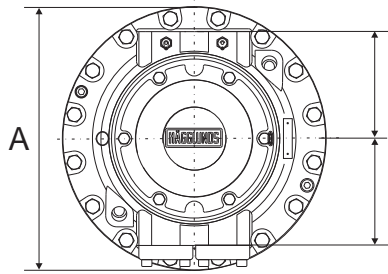


Fig. 6

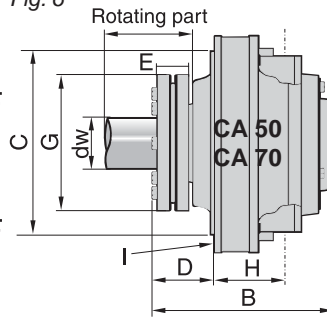


Fig. 6a

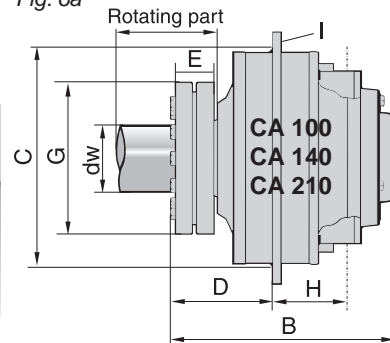


Table 3 Dimensions for the motor

Motor	A mm (in)	B mm (in)	C mm (in)	D mm (in)	E mm (in)	F mm (in)	G mm (in)	H mm (in)	I Hole Ø	dw mm (in)	Weight kg (lb)	Main. conn.	Drain conn.
CA 50	464 (18.26)	408 (16.08)	390 (15.35)	136 (5.35)	71.5 (2.81)	188 (7.40)	290 (11.42)	160 (6.30)	16xM16 PCD 430 (15.93)	120 (4.72)	205 (447)	SAE 1 1/4"	BSP 3/4"
CA 70	500 (19.68)		435 (17.12)						20xM16 PCD 470 (18.50)		232 (512)		
CA 100	560 (22.05)	509 (20.04)	470 (18.50)	239 (9.41)	84.5 (3.33)		330 (12.99)	158 (6.22)	17xØ22 PCD 520 (20.47)	140 (5.51)	310 (683)		
CA 140	600 (22.62)		510 (20.07)				21xØ22 PCD 560 (22.00)	347 (765)					
CA 210		649 (25.55)		298 (11.72)	105 (4.13)		350 (13.78)	238 (9.37)		160 (6.29)	456 (1005)		

Design of driven shaft end on heavily loaded shaft.

Where the driven shaft is heavily loaded and is subject to high stresses, for example for changes in the direction of rotation and/or load, it is recommended that the driven shaft should have a stress relieving groove; see fig. 7 and tables 4 and 6.

Table 4 Alternative thread (fig. 2 & 3)

CA 50-210		
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)

Normally loaded shaft

In drives with only one direction of rotation and/or load where the stresses in the shaft are moderate, the shaft can be plain, see Fig. 8 and tables 4 and 6.

Table 6 Dimensions for the driven shaft

Dim	CA50/70	CA100/140	CA210
A mm	120 ⁰ _{-0.025}	140 ⁰ _{-0.025}	160 ⁰ _{-0.025}
in	4.7244 ⁰ _{-0.00098}	5.5118 ⁰ _{-0.00098}	6.2992 ⁰ _{-0.00098}
B mm	71.5	84.5	105
in	2.81	3.33	4.13
C mm	116	133	153
in	4.57	5.24	6.02

Note! The dimensions are valid for +20°C (86°F)

Fig. 7

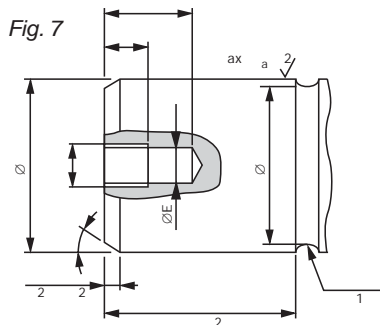
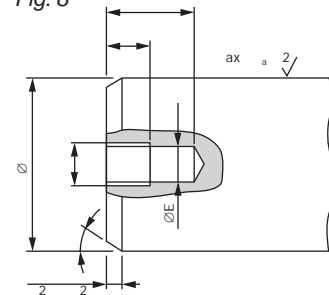


Table 5

Recommended material in the shaft

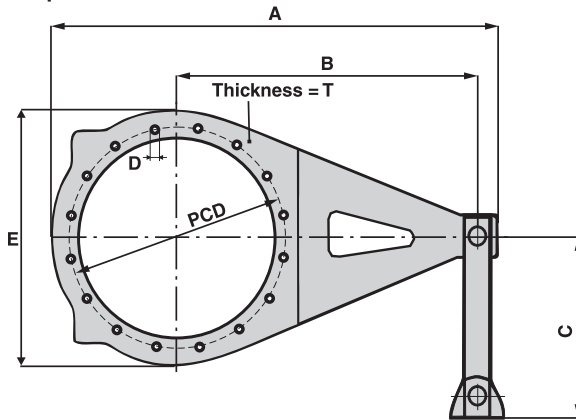
Unidirectional drives
Steel with yield strength $Re_{min} = 300 \text{ N/mm}^2$
Bidirectional drives
Steel with yield strength $Re_{min} = 450 \text{ N/mm}^2$

Fig. 8



Dimensions Torque arm

Fig. 9 Torque arm

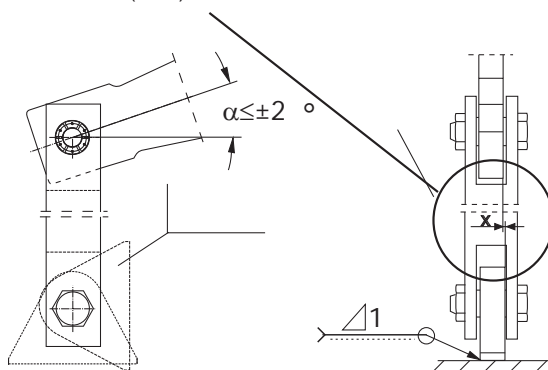


Torque arm	A mm (in)	B mm (in)	C mm (in)	D Ø	E mm (in)	T mm (in)	Weight kg (lb)
TCA 5 for CA50	890 (35.03)	600 (23.62)	340 (13.38)	M16	500 (19.68)	25 (0.98)	28 (61.5)
TCA 7 for CA70	915 (36.02)				550 (21.65)		31 (68.4)
TCA 10 for CA100	1175 (46.26)	800 (31.50)	435 (17.12)	M20	665 (26.18)	39 (1.54)	91 (200)
TCA 14 for CA140 and CA210							81 (178)

Torque arm	Max torque (Nm) For alternating or pulsating torque	Max torque (Nm) At static torque
TCA 5 for CA50	17500	21000
TCA 7 for CA70	24500	29400
TCA 10 for CA100	35000	42000
TCA 14 for CA140 and CA210	70000	84000
Torque arm	Max torque (Nm) For alternating or pulsating torque	Max torque (Nm) At static torque
TCA 5 for CA50	12900	15500
TCA 7 for CA70	18100	21700
TCA 10 for CA100	25800	31000
TCA 14 for CA140 and CA210	51600	62000

Fig. 9a Mounting of pivoted attachment

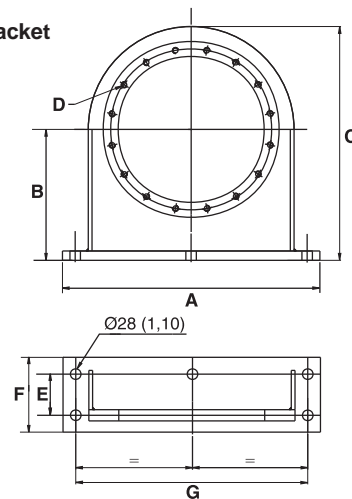
$x = \pm 2 \text{ mm (0.079)}$ misalignment in installation.
 $x \leq \pm 15 \text{ mm (0.59)}$ movement when in use.



Note: Ideal angle = 0°

Bracket

Fig. 10 Bracket



Bracket	A mm (in)	B mm (in)	C mm (in)	D Ø	E mm (in)	F mm (in)	G mm (in)	Weight kg (lb)
CAB 5 CAB 7	690 (27.16)	350 (13.78)	625 (24.60)	16xM16	110 (4.33)	200 (7.87)	620 (24.41)	85 (187)
CAB 10 CAB 14	750 (29.53)	480 (18.90)	805 (31.69)	20xM20	110 (4.33)	200 (7.87)	700 (27.55)	108 (238)

Accessories

Data Compact brake MDA

The brake is fatigue safe for pulsating torque	Oil volume
MDA 5 14250 Nm (10500 lbf-ft)	1.7 l (0.45 US.gal.)
MDA 7 20000 Nm (14750 lbf-ft)	1.7 l (0.45 US.gal.)
MDA 10 28500 Nm (21000 lbf-ft)	1.7 l (0.45 US.gal.)
MDA 14 39800 Nm (29350 lbf-ft)	2.0 l (0.53 US.gal.)
MDA 21 59800 Nm (44100 lbf-ft)	2.0 l (0.53 US.gal.)

Pilot pressure: min 20 bar (280 psi) max 50 bar (725 psi)
Recommended opening pressure: 20-25 bar (290-360 psi)
Fatigue resistant for 25 bar (360 psi)
Displacement: MDA 5-10 0.2 lit. (0.06 US.gal.)
MDA 14 & 21 Min. 0.2 lit (0.06 US.gal.)
MDA 14 & 21 Max. 0.3 lit (0.08 US.gal.)
Max speed 100 rpm, peaks up to 220 rpm.

Braking torque, dynamic with friction coefficient 0.12		
MDA 5	22600 ± 700 Nm	(16650 ± 515 lbf-ft)
MDA 7	30400 ± 900 Nm	(22400 ± 660 lbf-ft)
MDA 10	41500 ± 2000 Nm	(30600 ± 1475 lbf-ft)
MDA 14	57000 ± 3000 Nm	(42000 ± 2210 lbf-ft)
MDA 21	81800 ± 4300 Nm	(60300 ± 3170 lbf-ft)
Braking torque, static with friction coefficient 0.14		
MDA 5	26400 ± 800 Nm	(19450 ± 590 lbf-ft)
MDA 7	35500 ± 1100 Nm	(26200 ± 810 lbf-ft)
MDA 10	48400 ± 2300 Nm	(35700 ± 1695 lbf-ft)
MDA 14	66800 ± 3500 Nm	(49200 ± 2580 lbf-ft)
MDA 21	95000 ± 5000 Nm	(70000 ± 3685 lbf-ft)

Inertia	
MDA 5	0.110 kgm ² (2.3 lbf-ft ²)
MDA 7	0.128 kgm ² (3.0 lbf-ft ²)
MDA 10	0.156 kgm ² (3.7 lbf-ft ²)
MDA 14	0.360 kgm ² (8.5 lbf-ft ²)
MDA 21	0.417 kgm ² (9.9 lbf-ft ²)

There dynamic conditions may occur please contact your Häggglunds representative.

For emergency braking the brake can take these energies:		
MDA 5	540 kJ	(511 Btu)
MDA 7	755 kJ	(715 Btu)
MDA 10	1080 kJ	(1023 Btu)
MDA 14	950 kJ	(900 Btu)
MDA 21	1350 kJ	(1278 Btu)

Fig. 11 MDA 5 - MDA 10 mounted on motor

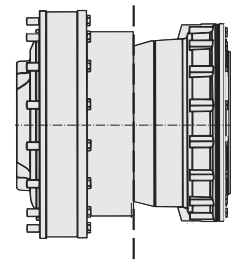


Diagram 1 MDA 5 - MDA 10

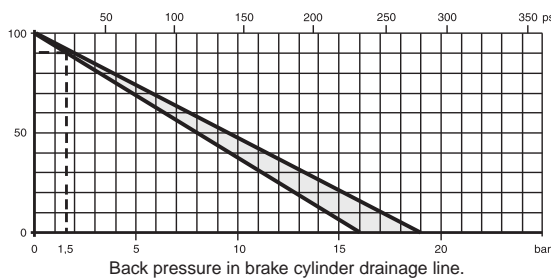


Diagram 1a MDA 14 - MDA 21

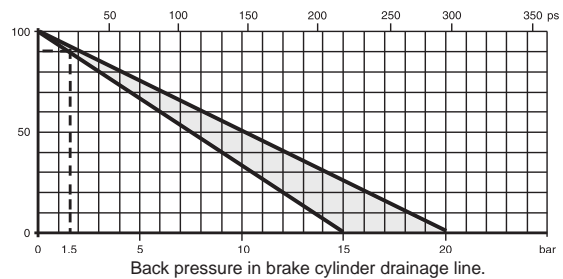


Fig 12a MDA 14 and MDA 21 for separate mounting

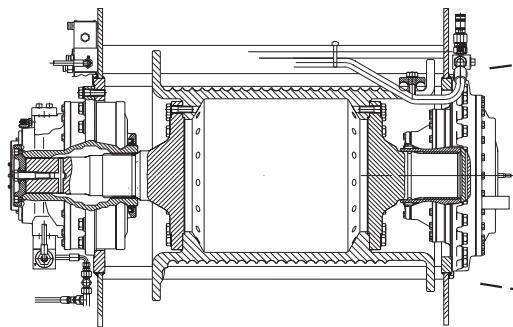
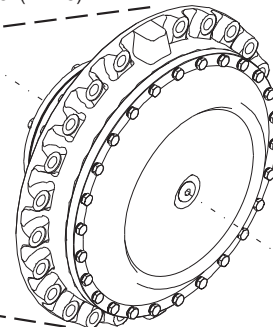


Fig 12 MDA 14 and MDA 21

Max external radial load: 200 kN (44800 lbf)
External load: 110 kN (24600 lbf) according to FEM M5: (L2:T5)



Accessories

Speed encoder with mounting set SMCB

Speed encoder with mounting set SMCB. The Speed encoder could be ordered in 18 different models, full scale output from 2 to 300 rpm.

Fig. 13 Speed encoder

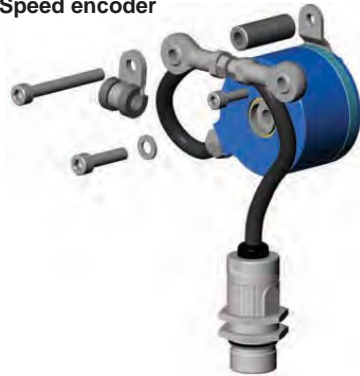


Fig. 14 Speed encoder mounting set



2-Speed valve for Compact, type VTCA 600

The 2-speed valve is designed for use with Compact motors CA 50-CA 210. The valve has displacement shifting function and is mounted directly on the motor. When ordering motor prepared for 2-speed function the main rotation, clockwise (R) or counter clockwise (L), has to be specified.

Displacement shift when motor is running is allowed for speed up to 30 rpm and max high pressure 150 bar (2175 psi).

The valve is available in three main designs:

VTCA 600 0 H: Hydraulic operated displacement shift.

VTCA 600 0 E: Electric operated displacement shift, 24 VDC.

VTCA 600 B E: Electric operated displacement shift with brake control function, 24 VDC.

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.

Fig. 15 Standard motor

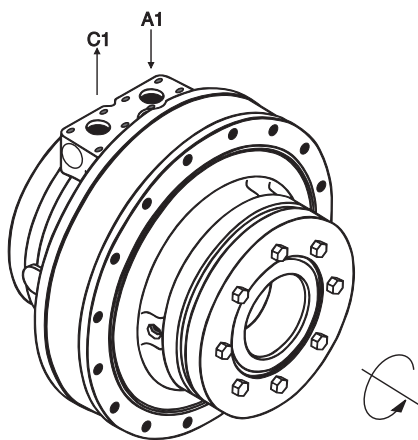
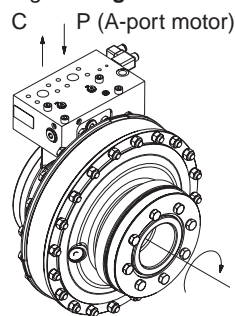
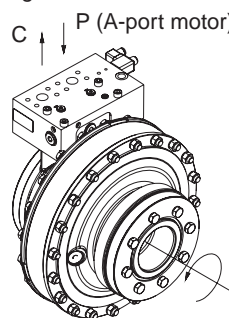


Fig. 16 Right hand motor



If the motor sign is marked "R" the motor rotation direction is clockwise, see fig. 16.

Fig. 17 Left hand motor



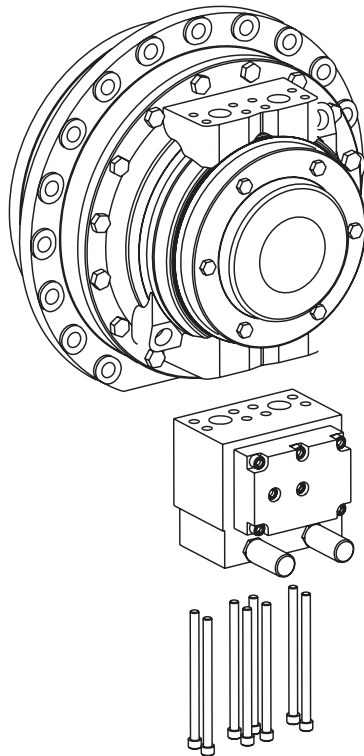
With a two-speed valve mounted on the motor and the oil supply connected to P give a counter clockwise rotation direction on a motor sign marked "L", see fig. 17.

Accessories

Cross-over valve, COCB 1000

The valve is designed for use with Compact motors CA 50 - CA 210. The valve is bolted directly on the motor, and the valve protects the motor and system from too high pressure, if the motor is suddenly stopped. The relief valves have a standard pressure settings of 350 bar (5075 psi), but are fully adjustable between 50 bar (500 psi) to 350 bar (5075 psi). Screws and O-rings are included in delivery.

Fig. 19 COCB



Emergency stop manifold, VECA

The VECA manifold can be mounted directly on the Compact motor. The VECA manifold can be converted for either clockwise or counter clockwise motor shaft rotation. The VECA manifold gives a very quick stop and can be integrated in most common control systems. Screws and O-rings are included in delivery.

Fig. 20 VECA

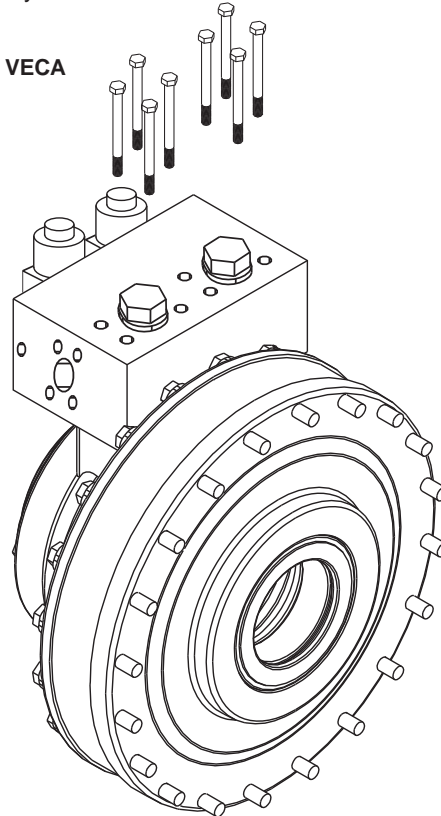
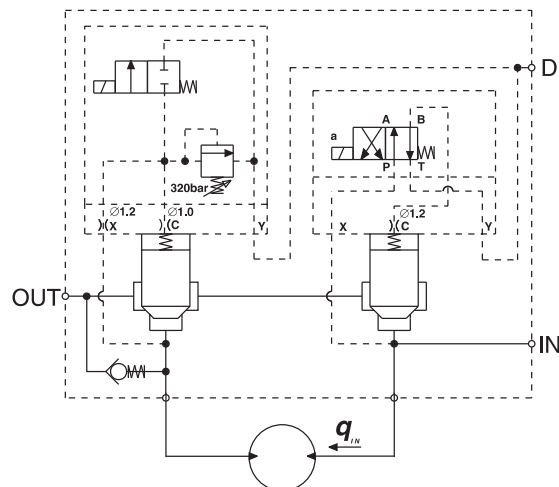
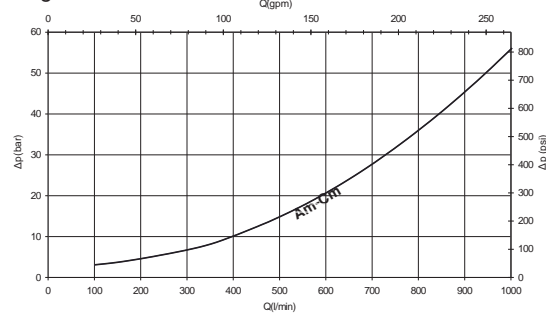


Diagram 3 Schematic diagram, VECA

Diagram 2 Pressure loss, COCB



Diagrams for Compact

Compact motors

Diagram 4 Charge pressure - Compact motors 2 port connection

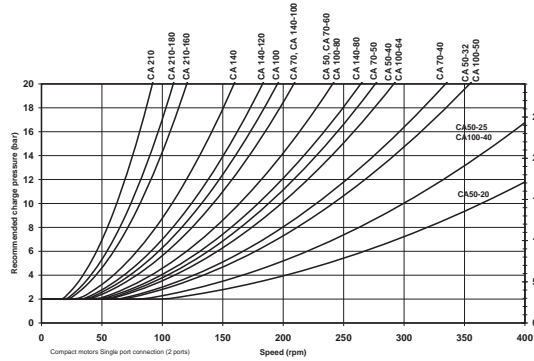
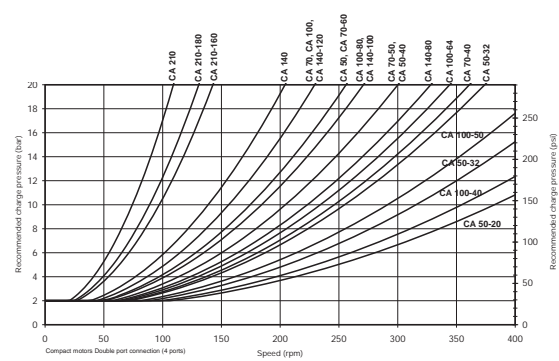


Diagram 5 Charge pressure - Compact motors 4 port connection



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

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

Case 3: The motor is used with 2-speed valve. Required charge pressure at inlet port for valve is according to diagram below.

2-speed valve

Diagram 6 Charge pressure - Compact motors half displacement (motor & valve)

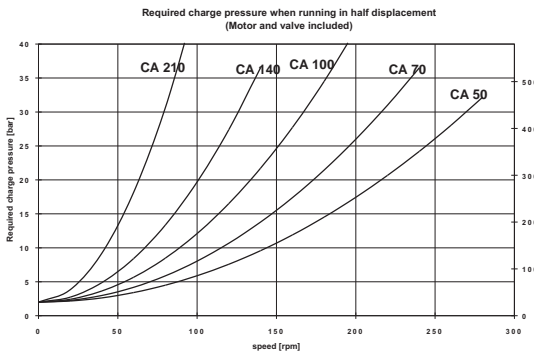


Diagram 7 Exchange of oil in motor case vs pressure in C-line with restriction (D = 2 mm, 40 cSt/187 SSU)

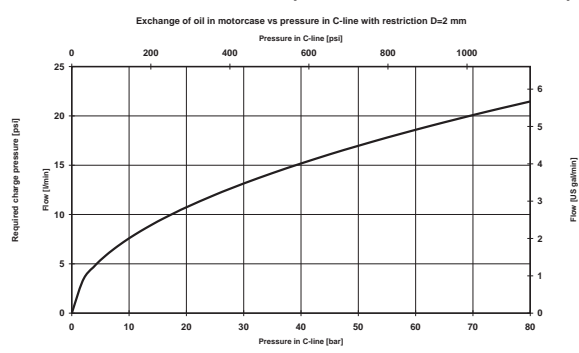


Diagram 8 Pressure loss main circuit P-C full displacement (motor & valve, 40 cSt/187 SSU)

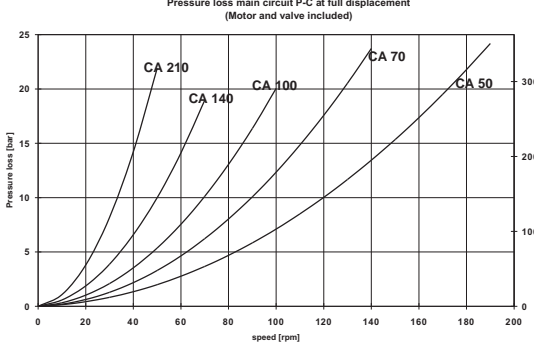
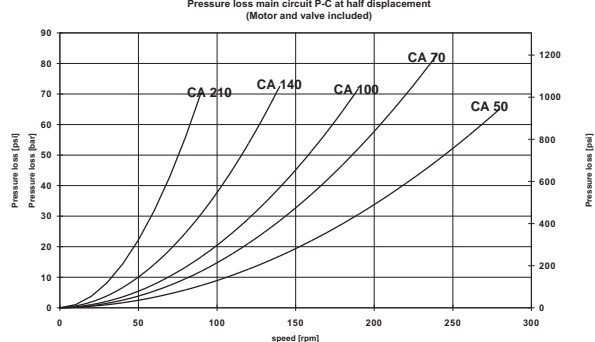


Diagram 9 Pressure loss main circuit P-C half displacement (motor & valve, 40 cSt/187 SSU)



Diagrams for Compact

Overall efficiency, oil viscosity 40 cSt/187 SSU, $P_c = 15 \text{ bar (217 psi)}$

Diagram 10 CA 50, 2 ports

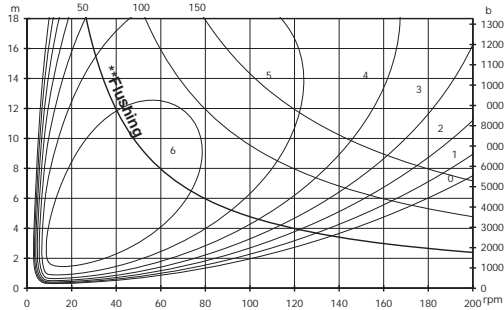


Diagram 11 CA 50, 4 ports

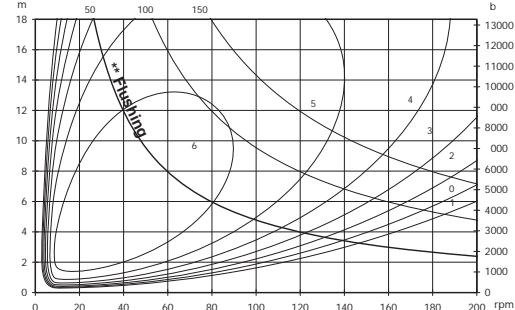


Diagram 12 CA 70, 2 ports

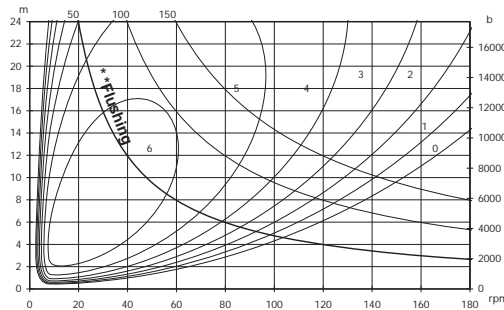


Diagram 13 CA 70, 4 ports

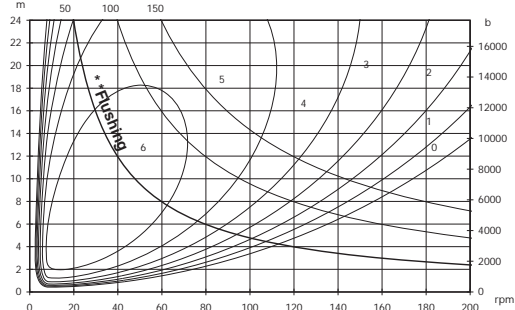


Diagram 14 CA 100, 2 ports

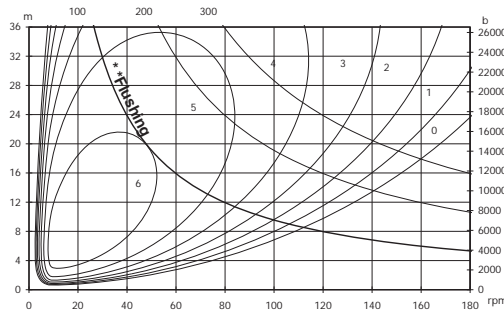


Diagram 15 CA 100, 4 ports

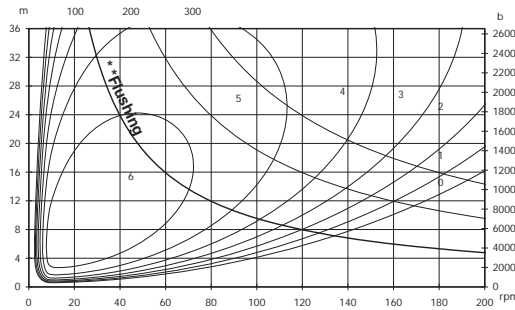


Diagram 16 CA 140, 2 ports

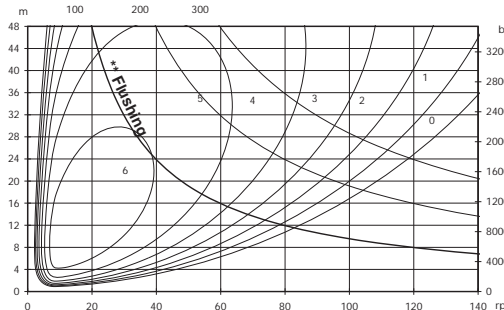
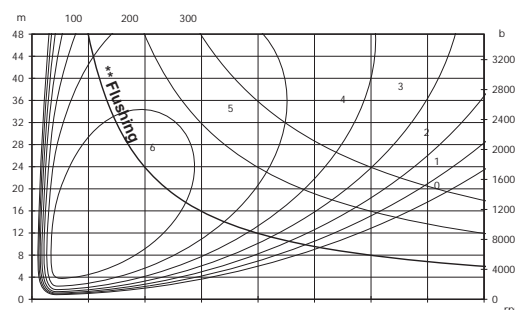


Diagram 17 CA 140, 4 ports



** See AC-4.5 Flushing of motor case.

Diagrams for Compact

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

Diagram 18 CA 210, 2 ports

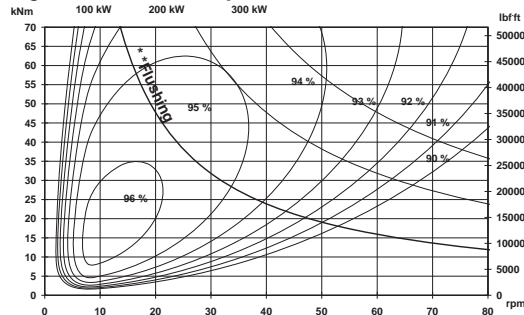
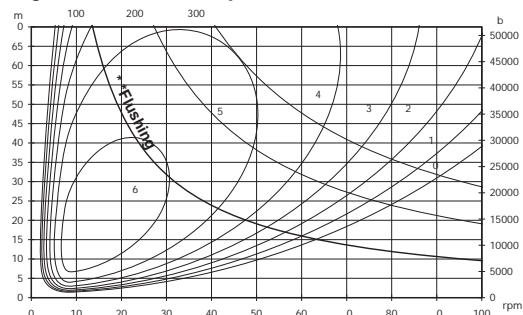


Diagram 19 CA 210, 4 ports



** See AC-4.5 Flushing of motor case.

Flushing of motor case

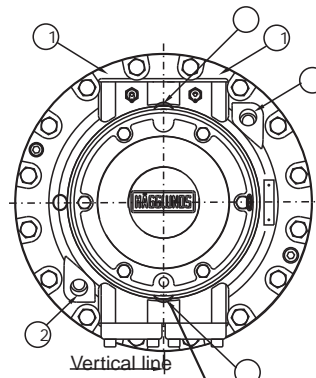
The Compact motors have very high total efficiency, and they are now frequently used in applications with high power. To avoid high temperature in the motor case the heat must be cooled away, because high temperature gives lower viscosity and that gives reduction in basic rating life. Low viscosity also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

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

Max power without flushing

CA 50/70	60 kW (80 hp)
CA 100/140/210	120 kW (160 hp)

Fig. 21 Flushing connection F



Flushing inlet. Connection G1/4".
Max allowed flushing 20 litres/
min (5.5 gal./min).

Diagrams for Compact

Pressure loss, oil viscosity 40 cSt/187 SSU

Diagram 20 CA 50 pressure loss 2 ports

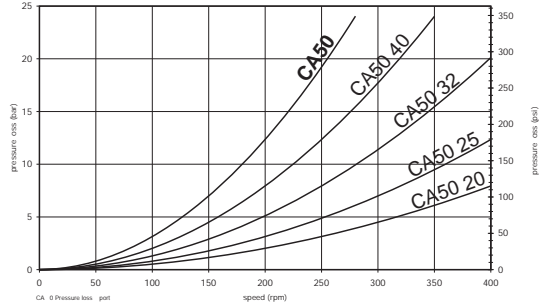


Diagram 21 CA 50 pressure loss 4 ports

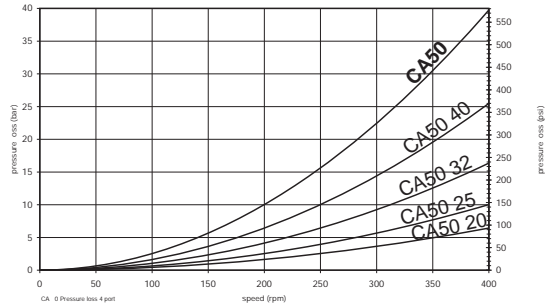


Diagram 22 CA 70 pressure loss 2 ports

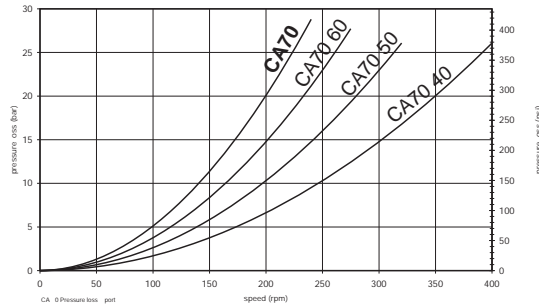


Diagram 23 CA 70 pressure loss 4 ports

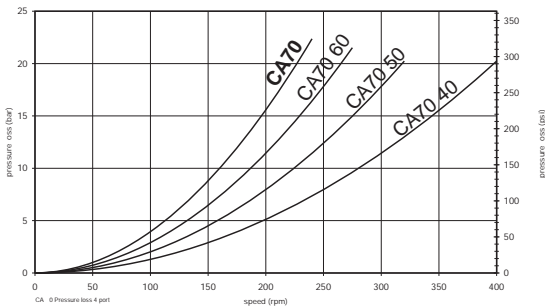


Diagram 24 CA 100 pressure loss 2 ports

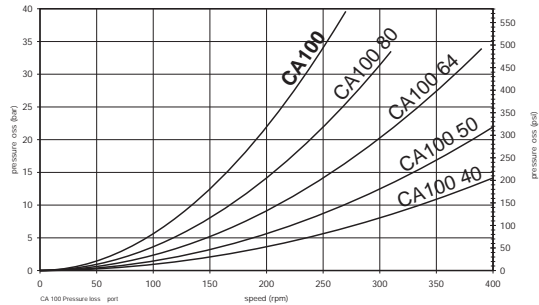


Diagram 25 CA 100 pressure loss 4 ports

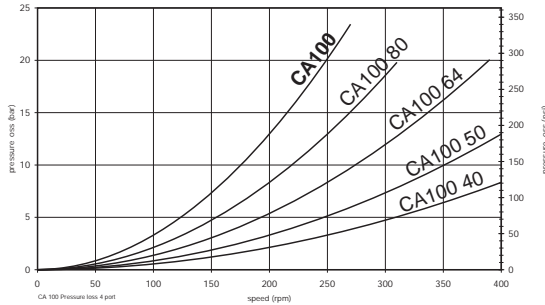


Diagram 26 CA 140 pressure loss 2 ports

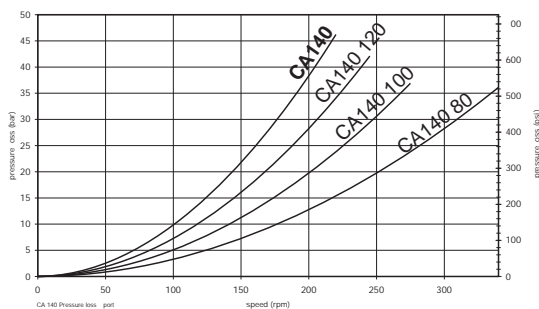
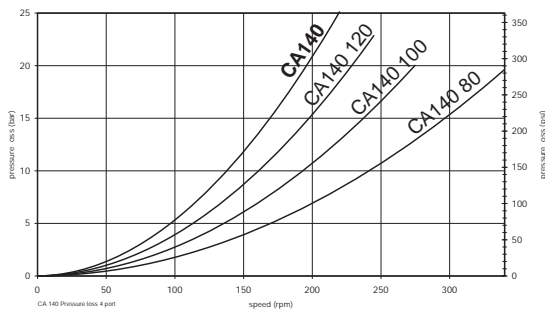


Diagram 27 CA 140 pressure loss 4 ports



Diagrams for Compact

Pressure loss, oil viscosity 40 cSt/187 SSU

Diagram 28 CA 210 pressure loss 2 ports

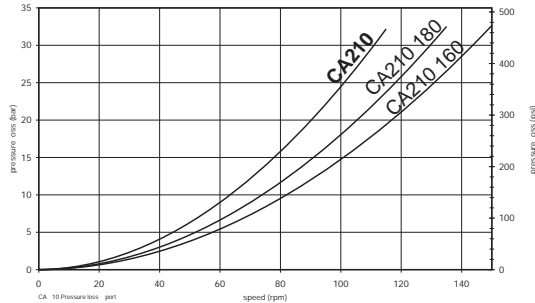
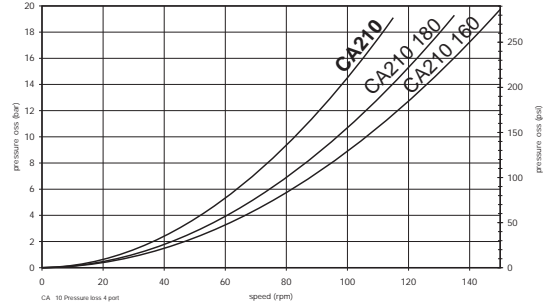


Diagram 29 CA 210 pressure loss 4 ports



Volumetric losses

Valid for an oil viscosity of 40 cSt/187 SSU, the diagram 30 shows the average values. When calculating volumetric losses using other viscosities, multiply the value given in the diagram by the factor K in diagram 31.

Diagram 30

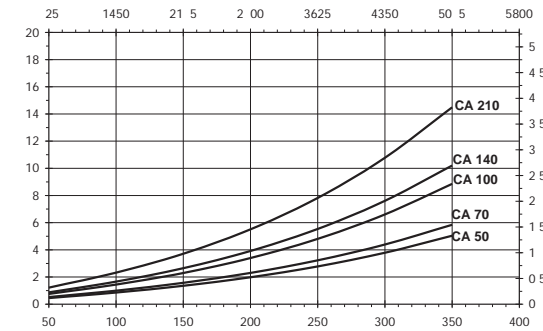
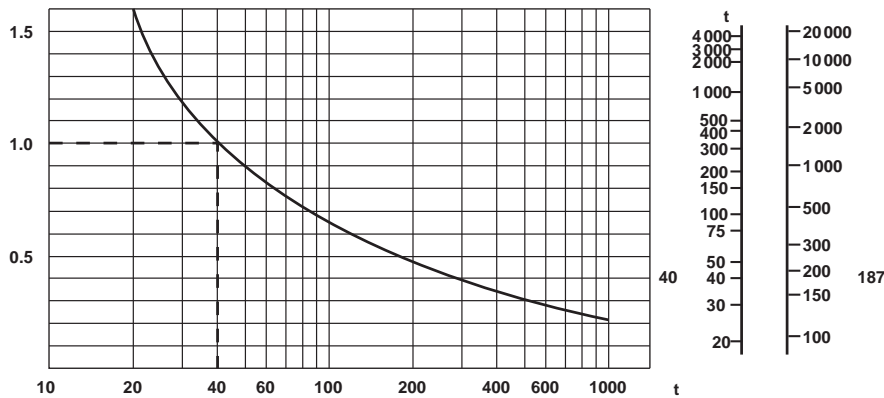


Diagram 31 Factor K - Variation in volumetric losses



Examples of installations

Fig. 22 Torque arm mounted motor with splines.

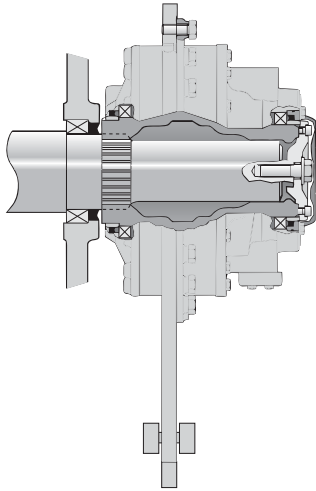


Fig. 23 Flange mounted motor with splines

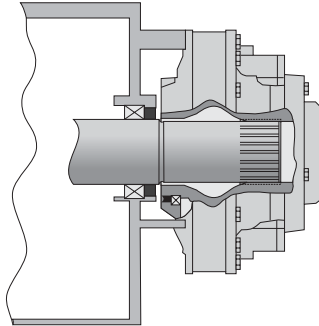


Fig. 24 Motor with through hole for cooling of driven machine.

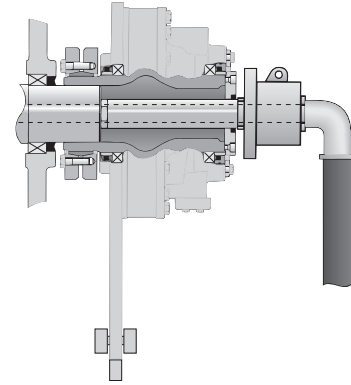


Fig. 25 Flange mounted motor with through shaft for high radial load.

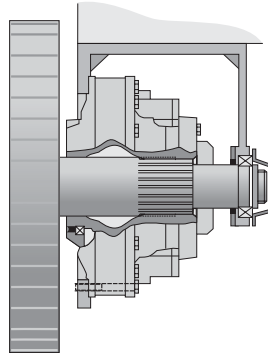


Fig. 26 Bracket mounted capstan drive.

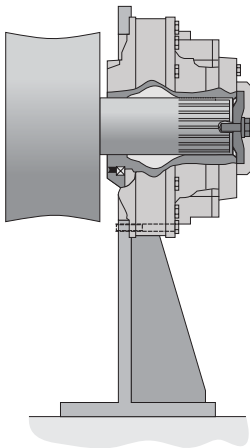


Fig. 27 Bracket mounted motor with stub shaft.

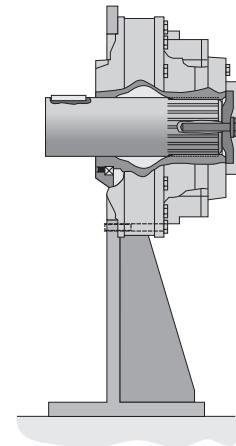


Fig. 28 Direct mounted winch drum drive with brake.

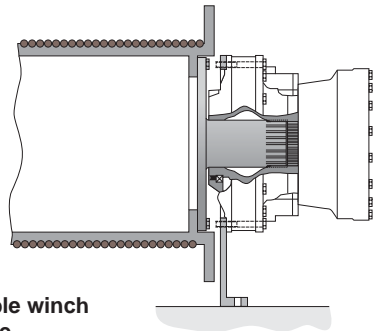
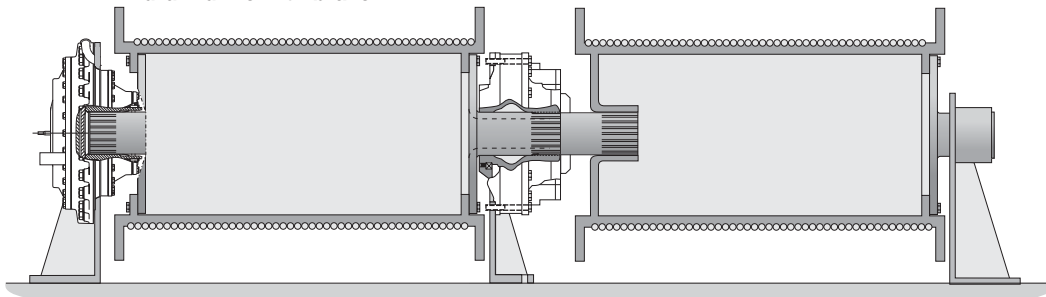


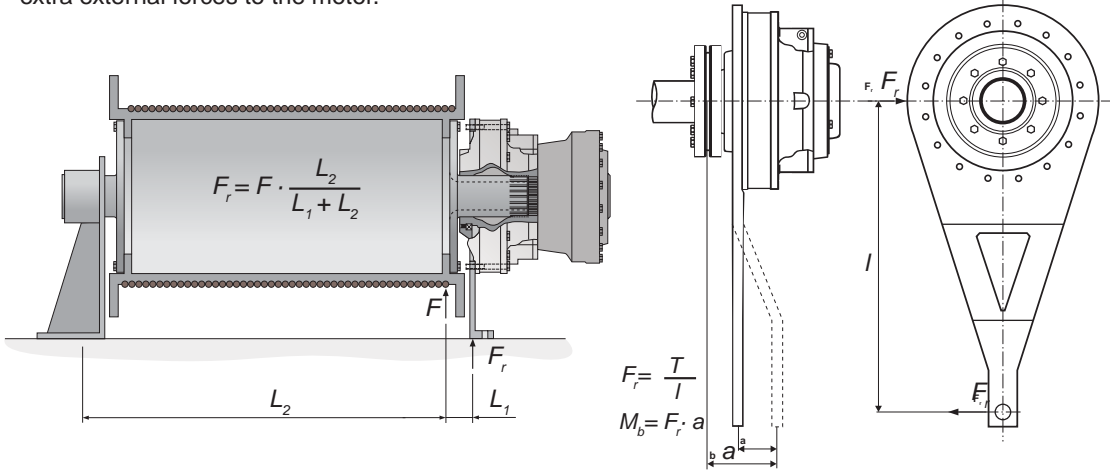
Fig. 28a Direct mounted double winch drum drive with brake.



Recommended external loads for Compact

Motor mounted in winch - reaction forces.
- The bracket must be designed so it does not give extra external forces to the motor.

If not standard torque arms TCA are used, forces must be checked for main bearings and coupling.



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

Permissible external loads

Fixed shaft - torque arm mounted motor, viscosity 40/250 cSt, speed 100 rpm.

Torque arm is mounted at $a = 0$ mm on the motor.

Note: When Bracket mounted motor or higher external load, please contact Hågglunds representative.

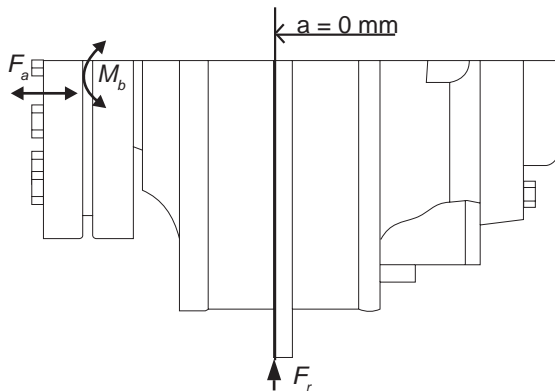


Diagram 32 Motor type CA 50 and CA 70

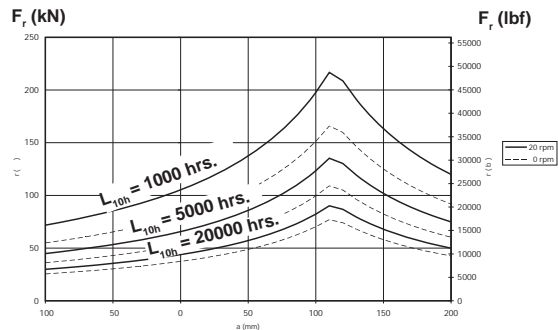


Diagram 33 Motor type CA 100 and CA 140

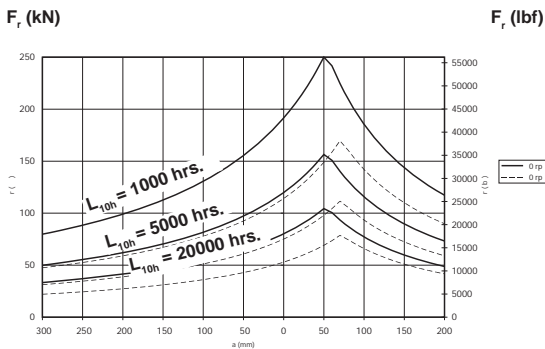
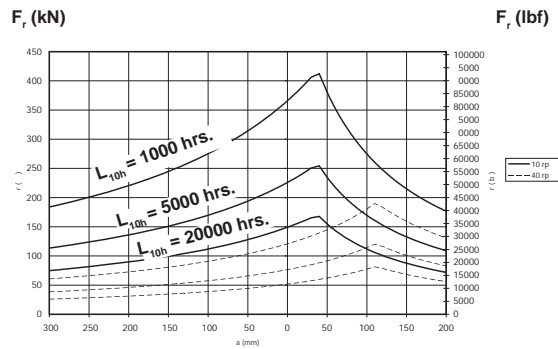


Diagram 34 Motor type CA 210



Max permitted external static load for Compact

Torque arm is mounted at $a = 0$ mm on the motor.

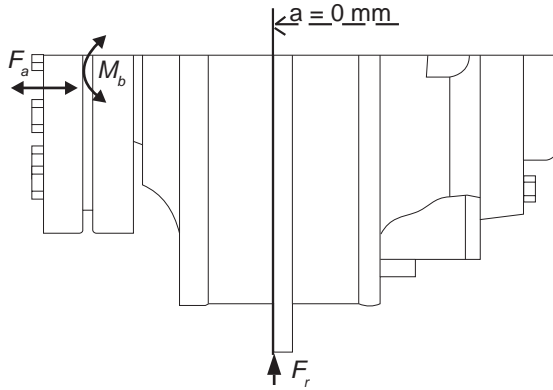


Diagram 35 Motor type CA 50

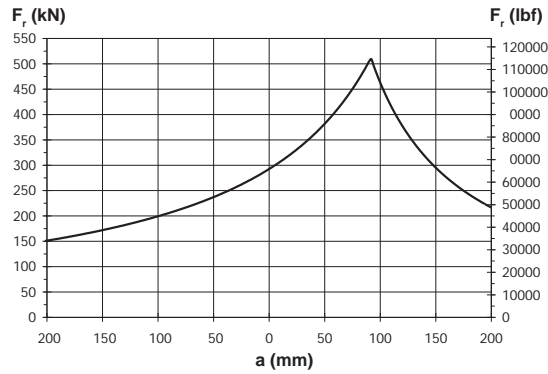


Diagram 36 Motor type CA 70

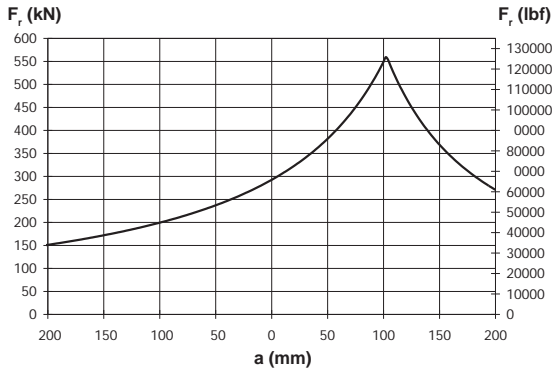


Diagram 37 Motor type CA 100

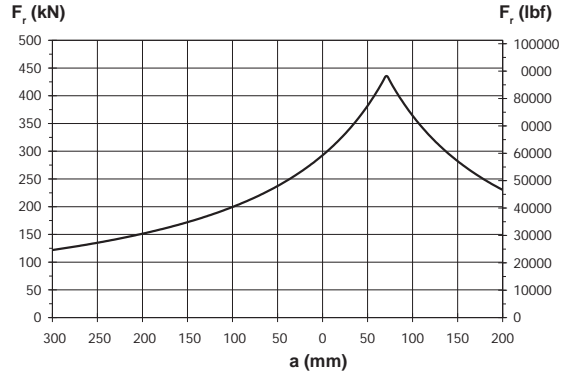


Diagram 38 Motor type CA 140

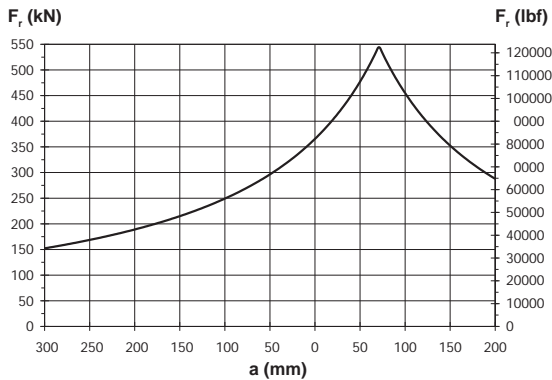
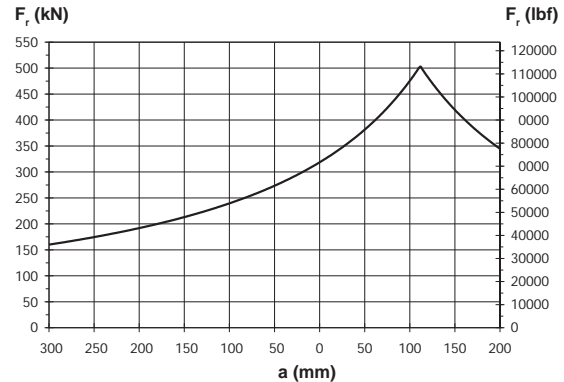


Diagram 39 Motor type CA 210



Choice of hydraulic fluid

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

General

The oil shall have FZG (90) fail stage minimum 11 described in IP 334 (DIN 51354). The oil must also contain inhibitors to prevent oxidation, corrosion and foaming. The viscosity of mineral oil is highly dependent of the temperature. The final choice of oil must depend on the operating temperature that can be expected or that has been established in the system and not in the hydraulic tank. High temperatures in the system greatly reduce the service life of oil and rubber seals, as well as resulting in low viscosity, which in turn provides poor lubrication. Content of water shall be less than 0.1%. In Industrial applications with high demands for service life, the content of water shall be less than 0.05%.

**Recommended viscosity in motor case at operating temperature
40-150 cSt/187-720 SSU.
For speed below 5 rpm, coated
pistons shall be used, please contact
your Hägglunds representative.**

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

Minimum viscosity limits at operating temperature in motor case	
Standard motors with uncoated pistons and uncoated cam rollers	20 cSt/98 SSU*
Motors type C (coated pistons and coated cam rollers) for speed below 5 rpm or when charge pressure exceeds 50 bar (725 psi) at speed above 100 rpm	10 cSt/59 SSU*

* Low viscosity gives reduced service life for the motors.
Max permitted viscosity is 10000 cSt/48000 SSU

Fire resistant fluid

The following fluids are tested for Hägglunds 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.

**The motor must have synthetic oil for the axial bearing.

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 service life for the drive, as mineral oil.

Choice of hydraulic fluid

Down rating of pressure data and basic rating life

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

HFA-fluid	not fit for use
HFB-fluid	0.7 x maximum pressure for motor
HFC-fluid	0.7 x maximum pressure for motor
HFD-fluid	0.9 x maximum pressure for motor

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

HFA-fluid	not fit for use
HFB-fluid	0.26 x expected life with mineral oil
HFC-fluid	0.24 x expected life with mineral oil
HFD-fluid	0.80 x expected life with mineral oil

Filtration

The oil in a hydraulic system must always be filtered and also new oil from your supplier has to be filtered when adding it to the system. The grade of filtration in a hydraulic system is a question of service life v.s. money spent on filtration.

In order to obtain stated service life it is important to follow our recommendations concerning contamination level.

When choosing the filter it is important to consider the amount of dirt particles that the filter can absorb and still operate satisfactory. For that reason we recommend a filter with an indicator that gives a signal when it is time to change the filter cartridge.

Filtering recommendations

Before start-up, check that the system is thoroughly cleaned.

1. In general the contamination level 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 $\beta_{10}=75$.

Explanation of "Grade of Filtration"

Grade of filtration $\beta_{10}=75$ indicates the following:

β_{10} means the size of particle $\geq 10\mu\text{m}$ 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.

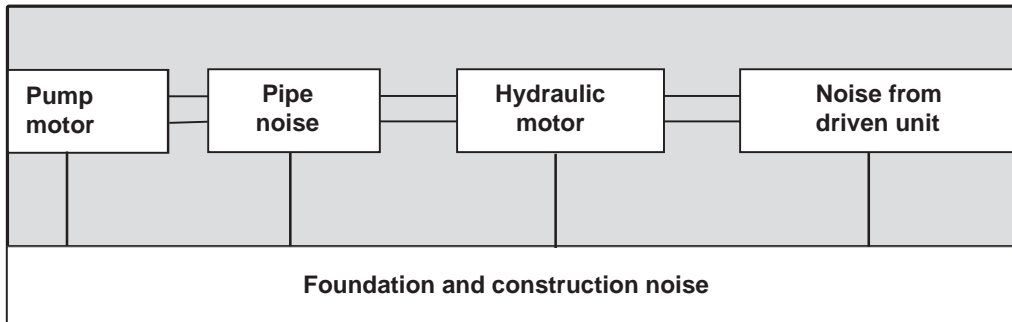
Ex. Grade of filtration is $\beta_{10}=75$.

Before the filtration the oil contains N number of particles $\geq 10\mu\text{m}$ and after passing the filter once the oil contains $\frac{N}{75}$ number of particles $\geq 10\mu\text{m}$.

This means that $N - \frac{N}{75} = \frac{74 \cdot N}{75}$ number of particles have been filtered (=98.6%).

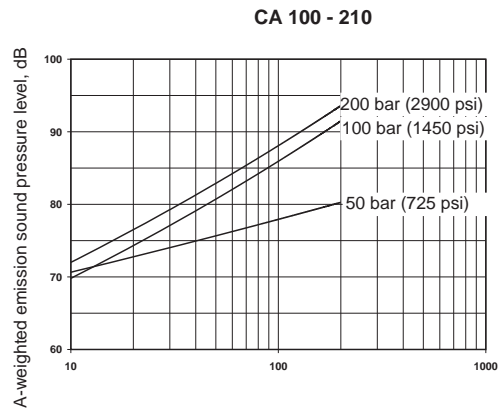
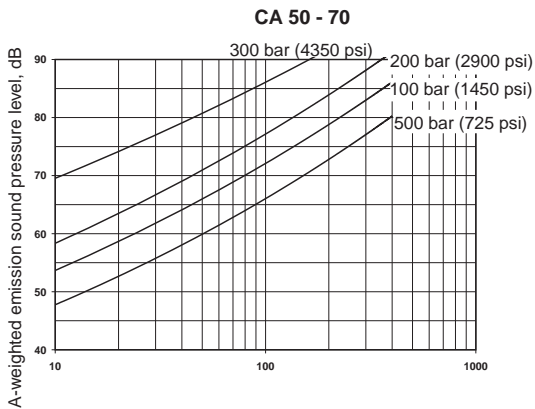
Noise from a complete installation

Background noise



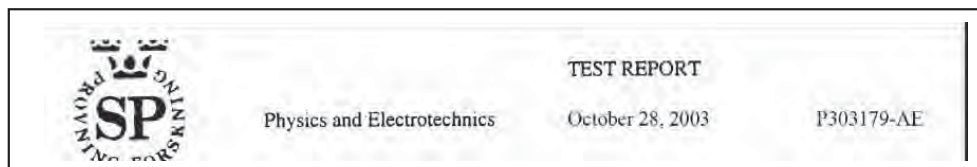
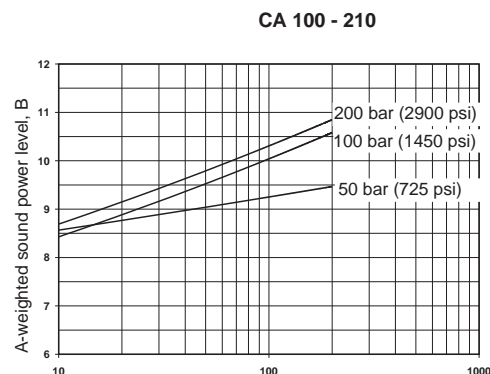
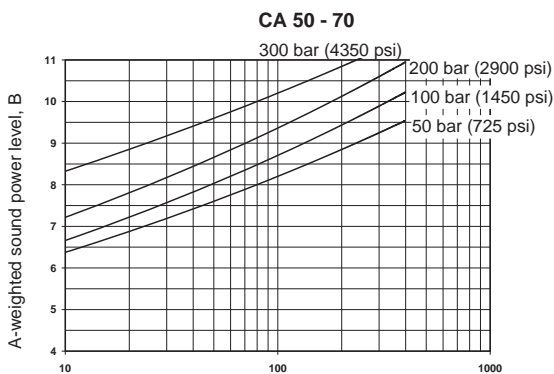
A-weighted emission sound pressure level of Compact CA

The emission sound pressure level have been calculated according to ISO/DIS 11203 for unattended machines. All values refer to a position of the test object > 1 m (3.28 ft).




A-weighted sound power level of Compact CA

The sound power level have been calculated according to ISO/DIS 11203 for unattended machines. All values refer to a position of the test object > 1 m (3.28 ft).



Declaration of Incorporation

Example of the Incorporation of Conformity given by Hägglunds Drives AB



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: Compact CA
Function: Hydraulic motor
Model: Compact
Type: CA
Trade name: Compact CA

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		

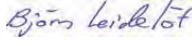
The requirements are fulfilled provided that the data in the product documentation (fitting instructions, operating instructions, project management and configuration documents) are implemented by the product user. The requirements of Appendix I to Machinery Directive 2006/42/EC not mentioned here are 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 982
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

 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.