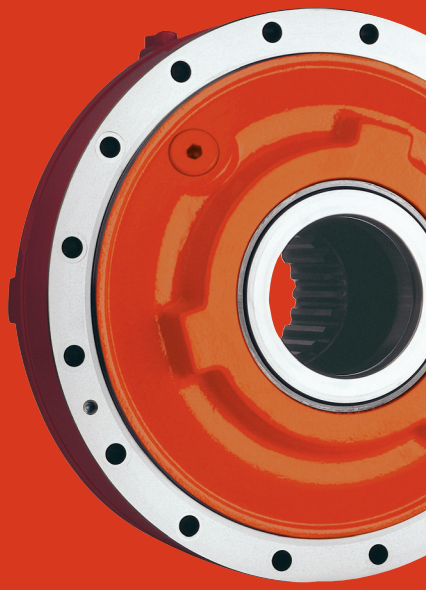
# Compact CA

PRODUCT MANUAL



HÄGGLUNDS

# Product Manual

# COMPACT

## EN396-10h 2011

# One partner all over the world

## Hägglunds Drives


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

Original EN396-9h, 2009

# 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 it´s 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.

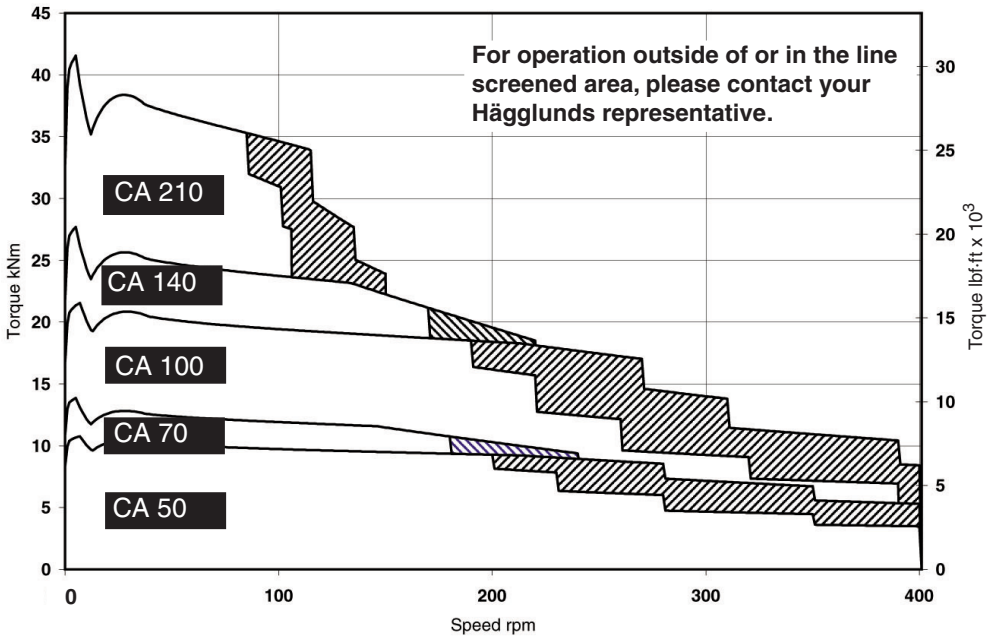
### Insensitive to shock loads
The new Compact is small and light but at the same time tough and insensitive to shock loads. The new Compact has everything you have come to expect from a Hägglunds motor - high torque, wide speed range, shock resistant, easy to install, easy to maintain, and as tough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

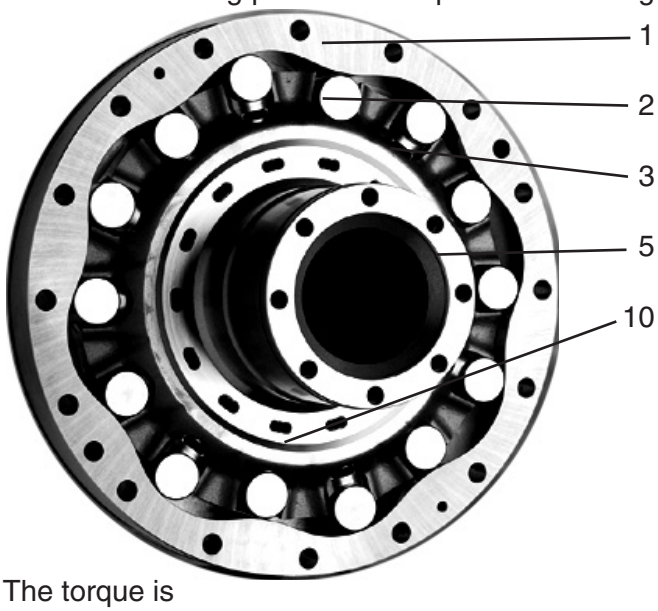

# Quick selection diagram for Compact motors

The diagram below represents the torque and speed, corresponding to a basic rating life $L_{10aah}$ = 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.

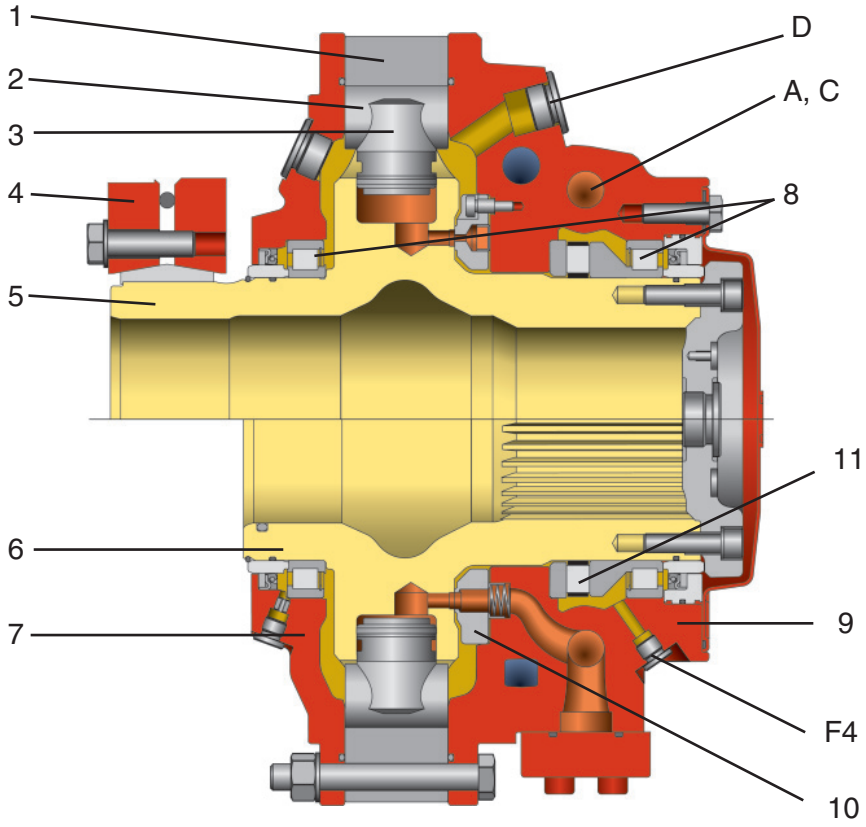



When the hydraulic pressure is acting on the pistons, the cam rollers are pushed against the slope on the cam ring that is rigidly connected to the housing, thereby producing a torque. The cam rollers transfer the reaction force to the pistons which are guided in the cylinder block. Rotation therefore 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%) | $T = T_s \cdot (p - \Delta p_l - p_c) \cdot \eta_m$ (Nm) | $T = \frac{T_s \cdot (p - \Delta p_l - p_c) \cdot \eta_m}{1000}$ (lbf·ft) |
| Pressure required ($\eta_m$=98%) | $p = \frac{T}{T_s \cdot \eta_m} + \Delta p_l + p_c$ (bar) | $p = \frac{T \cdot 1000}{T_s \cdot \eta_m} + \Delta p_l + p_c$ (psi) |
| Flow rate required | $q = \frac{n \cdot V_i}{1000} + q_l$ (l/min) | $q = \frac{n \cdot V_i}{231} + q_l$ (gpm) |
| Output speed | $n = \frac{q - q_l}{V_i} \cdot 1000$ (rpm) | $n = \frac{q - q_l}{V_i} \cdot 231$ (rpm) |
| Inlet power | $P_{in} = \frac{q \cdot (p - p_c)}{600}$ (kW) | $P_{in} = \frac{q \cdot (p - p_c)}{1714}$ (hp) |

| 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 | $\Delta p_l$ | = | bar | psi |
| Charge pressure | $p_c$ | = | bar | psi |
| Flow rate required | $q$ | = | l/min | gpm |
| Total volumetric loss | $q_l$ | = | l/min | gpm |
| Displacement | $V_i$ | = | cm³/rev | in³/rev |
| Mechanical efficiency | $\eta_m$ | = | 0.97 (Not valid for starting efficiency) | |

# Definitions

### Rated speed[1)]

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.

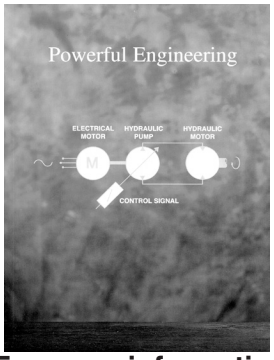
### Max speed

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:

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

[1)]Operating above rated conditions requires Hägglunds approval.




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

# Data

| Motor type **Metric** | FULL DISPLACEMENT | | | | Max. ** pressure | DISPLACEMENT SHIFT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Displacement | Specific torque | Rated* speed | Max.*** speed | | Displacement | Specific torque | Rated speed | Max. speed | Ratio |
| | $V_i$ cm³/rev | $T_s$ Nm/bar | $n$ rev/min | $n$ rev/min | $p$ bar | $V_i$ cm³/rev | $T_s$ Nm/bar | $n$ rev/min | $n$ rev/min | |
| CA 50 20 | 1256 | 20 | 400 | 400 | 350 | Not recommended to be used in reduced displacement | | | | |
| 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 | 5657 | 90 | 100 | 135 | 1:2 |
| CA 210 | 13200 | 210 | 85 | 115 | 350 | 6600 | 105 | 85 | 115 | 1:2 |

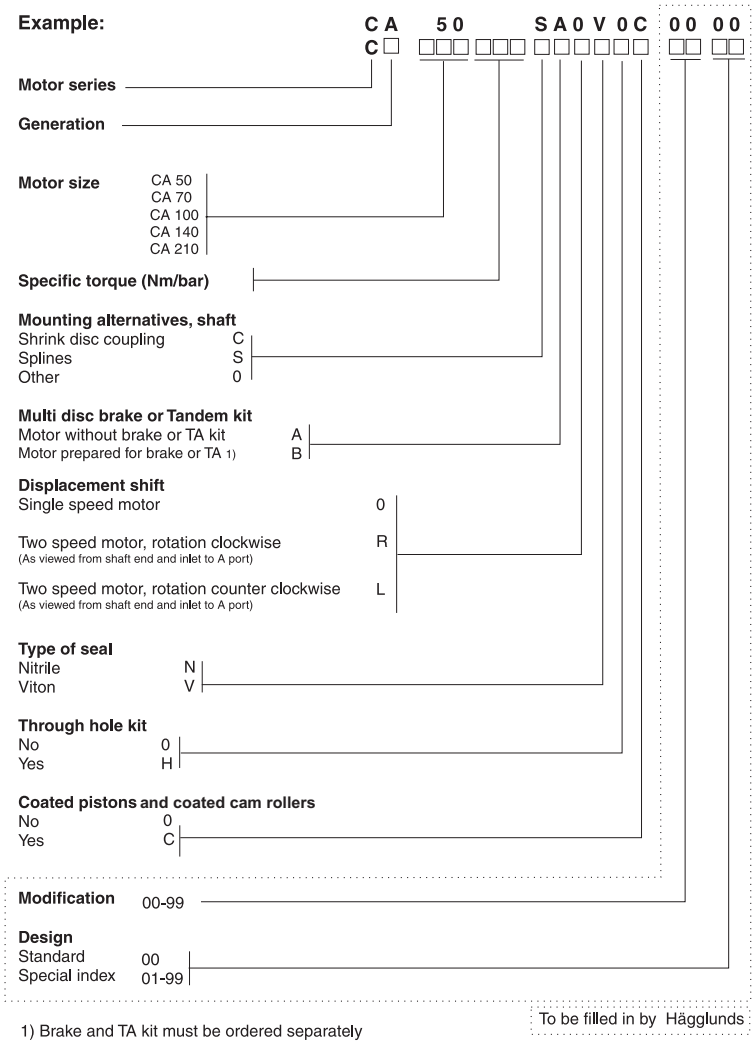
| Motor type **US** | FULL DISPLACEMENT | | | | Max. ** pressure | DISPLACEMENT SHIFT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Displacement | Specific torque | Rated* speed | Max. *** speed | | Displacement | Specific torque | Rated speed | Max. speed | Ratio |
| | $V_i$ in³/rev | $T_{s_{1000\ psi}}$ lbf·ft | $n$ rev/min | $n$ rev/min | $p$ psi | $V_i$ in³/rev | $T_{s_{1000\ psi}}$ lbf·ft | $n$ rev/min | $n$ rev/min | |
| CA 50 20 | 76.6 | 1017 | 400 | 400 | 5000 | Not recommended to be used in reduced displacement | | | | |
| 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 continues 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.

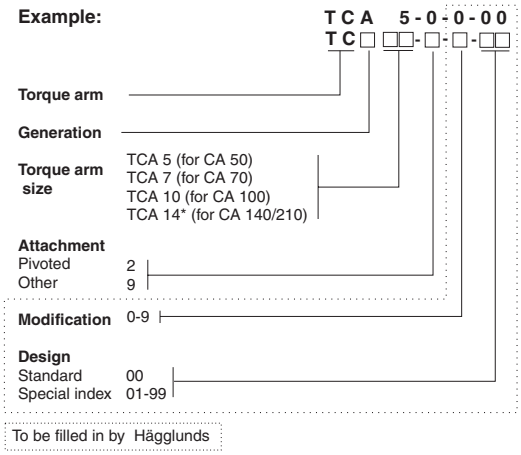
## Compact motors




1) Brake and TA kit must be ordered separately

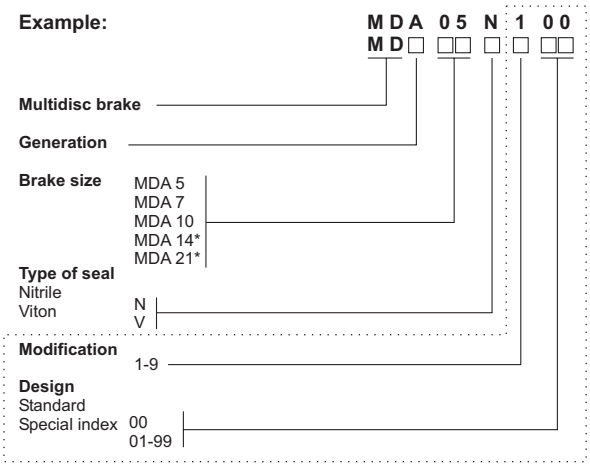
**Painting**
Orange Standard
Other Option

## Torque arm




***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.**

## Multi Disc Brake (MDA)




Brake must be ordered separately

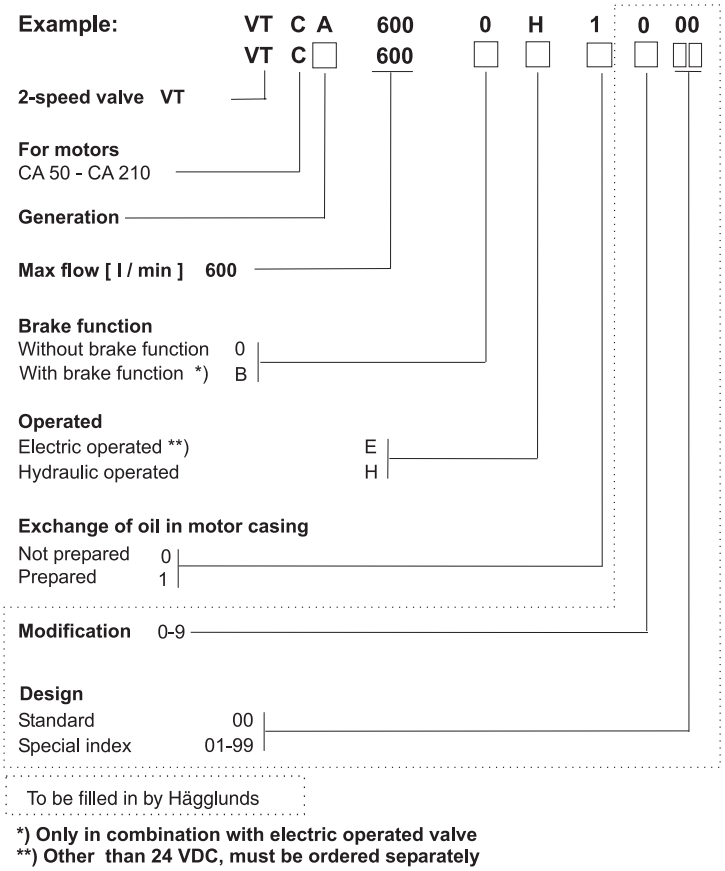
**Painting**
Orange Standard
Other Option

***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.**

# Ordering codes

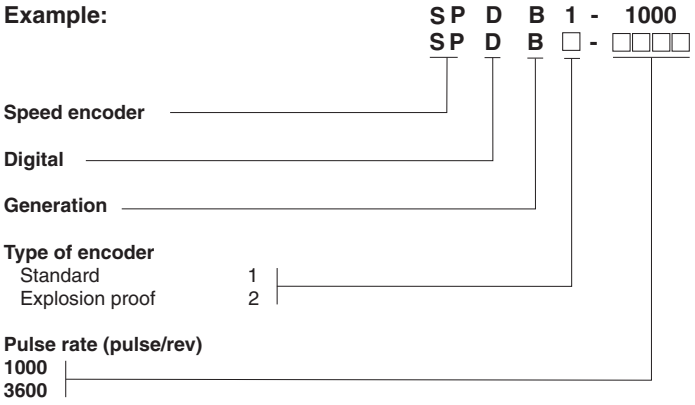
In order to identify Hägglunds equipment exactly, the following ordering code is used. These ordering codes should be stated in full in all correspondence e.g. when ordering spare parts.

## 2-Speed valve

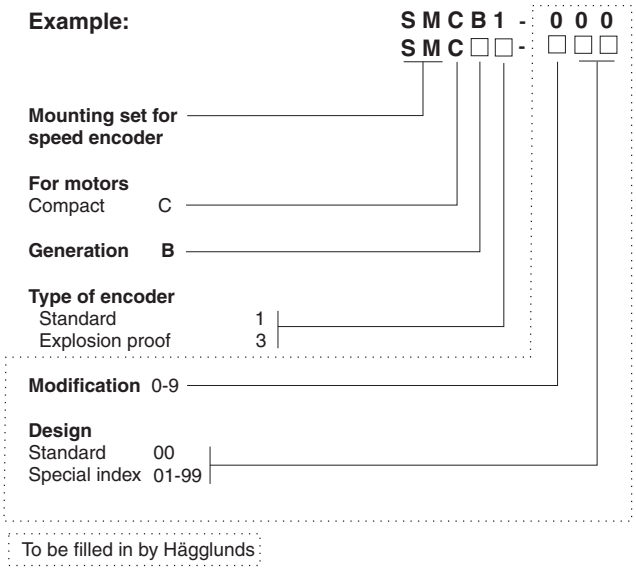



***) Only in combination with electric operated valve**
****) Other than 24 VDC, must be ordered separately**

## Speed encoder




## Mounting set for speed encoder



# Dimensions

## With splines for flange mounting.

*Fig. 2*

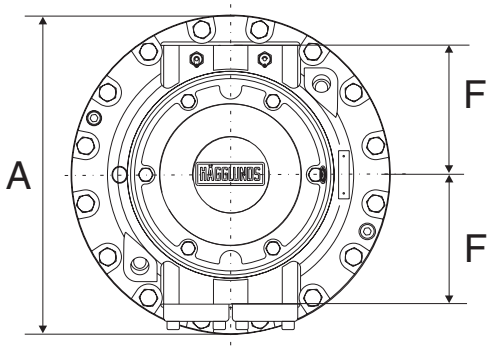



*Fig. 3*

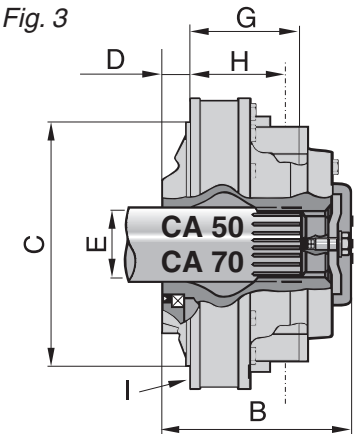



*Fig. 3a*

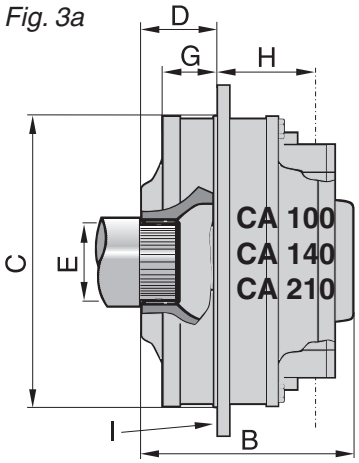



*Table 1* **Dimensions for the motor**

| 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.

*Fig. 4*

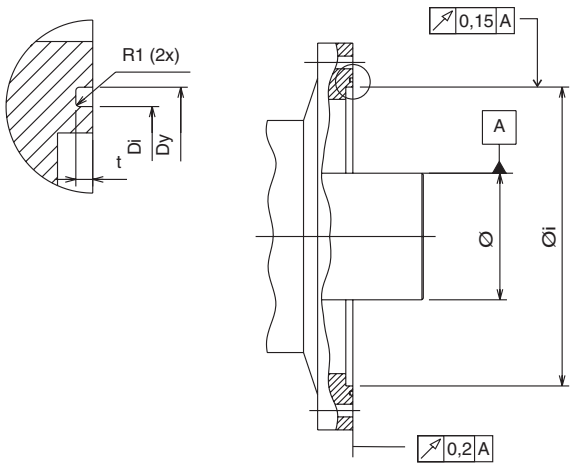



*Table 2* **Dimensions for splines**

| Motor | CA50/70 | CA100/140 | CA210 |
|---|---|---|---|
| Toth 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 $^{0}_{-0.220}$ | Ø139 $^{0}_{-0.250}$ | Ø 149 $^{0}_{-0.250}$ |
| Measure over measuring pins | 129.781 $^{-0.083}_{-0.147}$ | 149.908 $^{-0.085}_{-0.150}$ | 159.961 $^{-0.085}_{-0.150}$ |
| Diameter of measuring pins | Ø 10 | Ø 10 | Ø 10 |
| Addendum modification X M | +2.25 | +2.25 | +2.25 |

# Dimensions

## With hollow shaft, shrink disc coupling.

*Fig. 5*

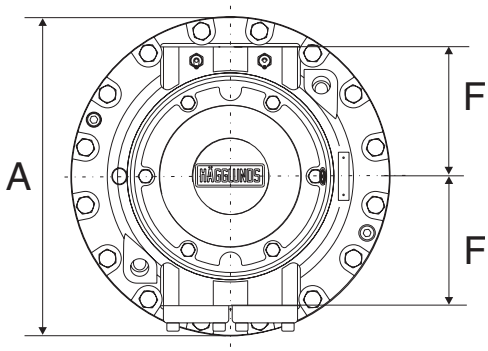



*Fig. 6*

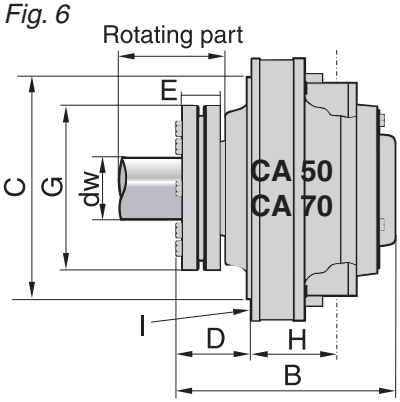



*Fig. 6a*

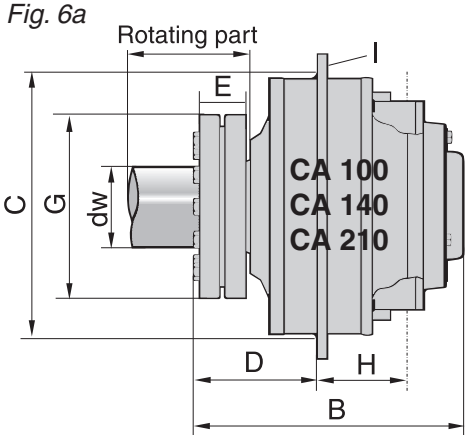



*Table 3* **Dimensions for the motor**

| 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*

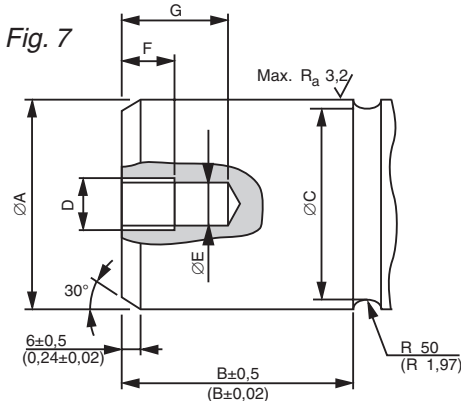
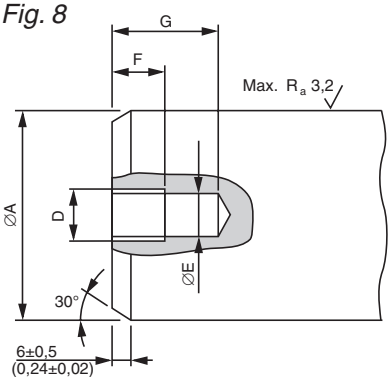



*Table 5*

**Recommended material in the shaft**

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

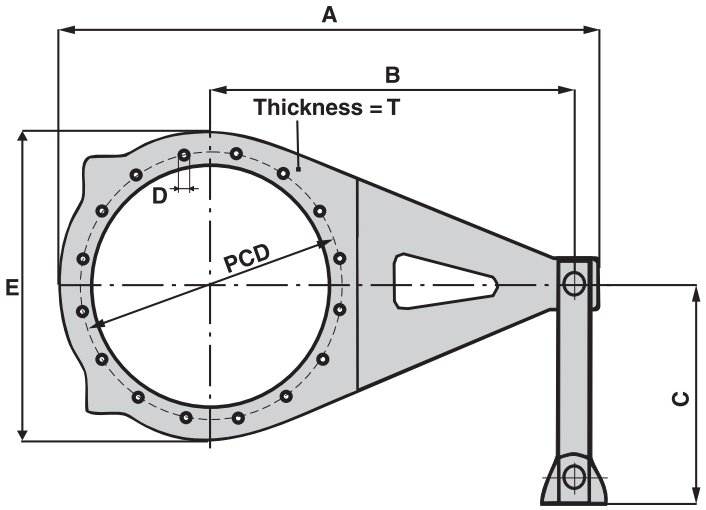
*Fig. 8*



# Dimensions

## Torque arm

*Fig. 9* **Torque arm**



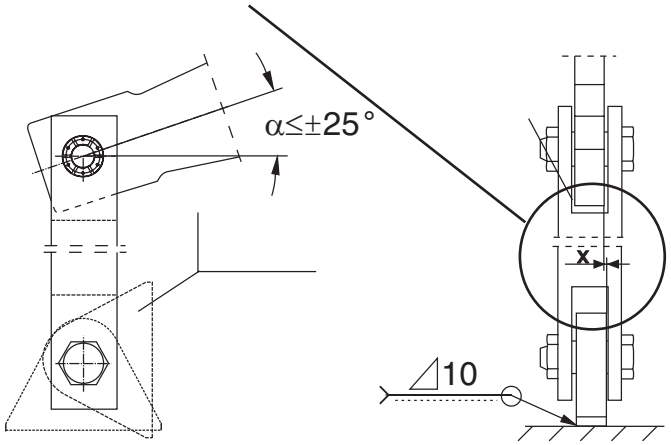

| Torque arm | A mm (in) | B mm (in) | C mm (in) | D Ø | E mm (in) | T mm (in) | Weight kg (lb) |
|---|---|---|---|---|---|---|---|
| TCA 5 for CA50 | 890 (35.03) | 600 (23.62) | 340 (13.38) | M16 | 500 (19.68) | 25 (0.98) | 28 (61.5) |
| TCA 7 for CA70 | 915 (36.02) | | | | 550 (21.65) | | 31 (68.4) |
| 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**

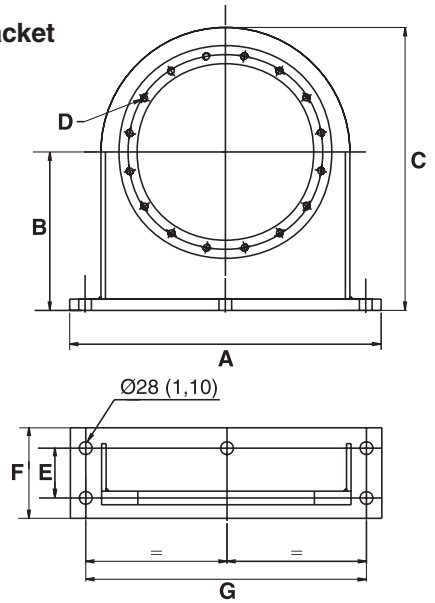
x = ±2 mm (0.079) misalignment in installation.
x ≤ ±15 mm (0.59) movement when in use.




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 presssure: 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 Hägglunds 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**

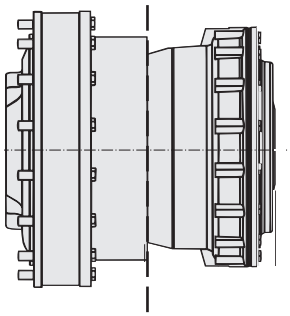
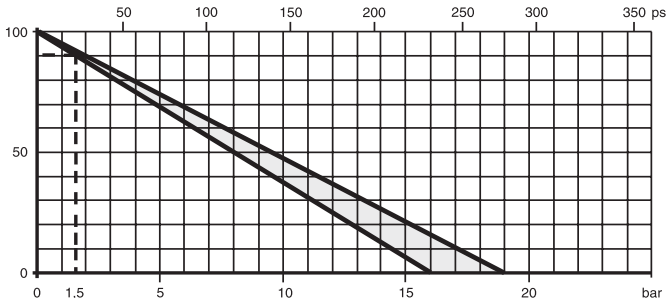
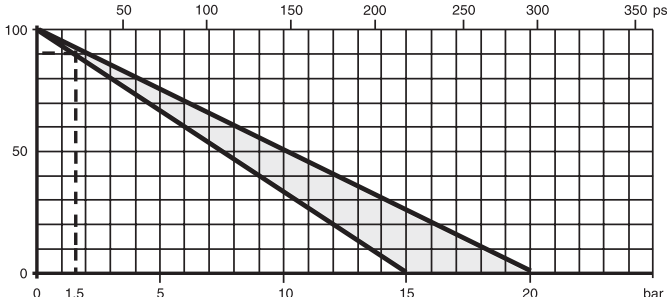


*Diagram 1* **MDA 5 - MDA 10**




Back pressure in brake cylinder drainage line.

*Diagram 1a* **MDA 14 - MDA 21**




Back pressure in brake cylinder drainage line.

*Fig 12a* **MDA 14 and MDA 21 for separate mounting**

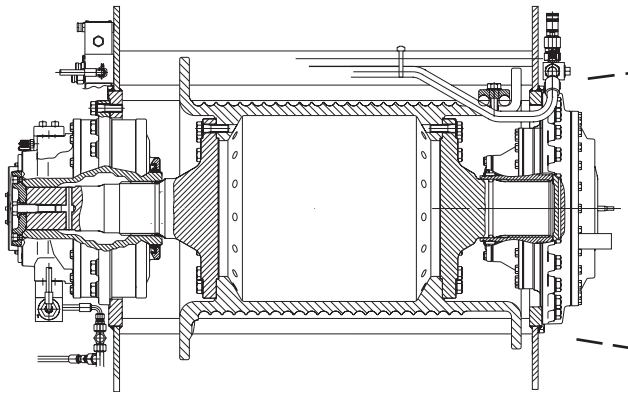
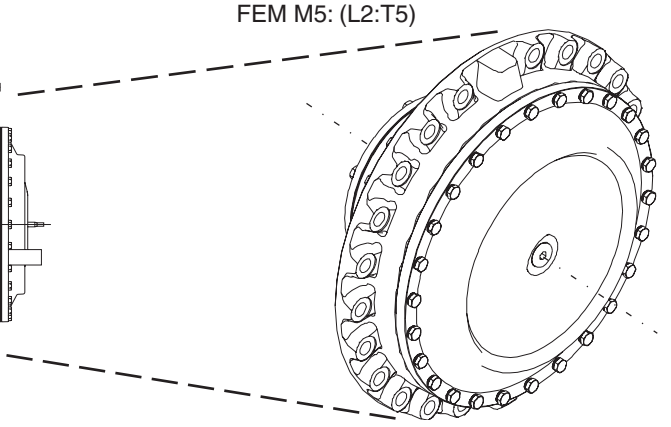


*Fig 12* **MDA 14 and MDA 21**
Max external radial load: 200 kN (44800 lbf)
External load: 110 kN (24600 lbf) according to FEM M5: (L2:T5)



# 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**

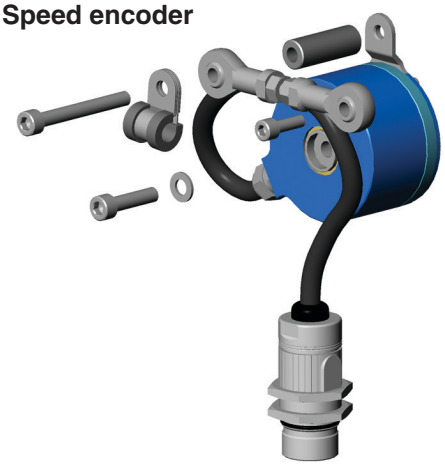


*Fig. 14* **Speed encoder mounting set**


## 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**

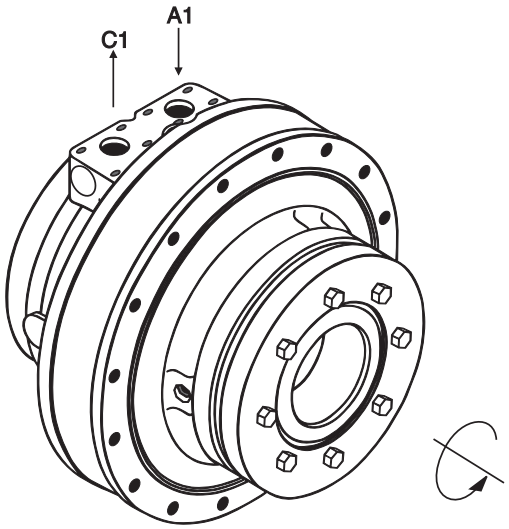
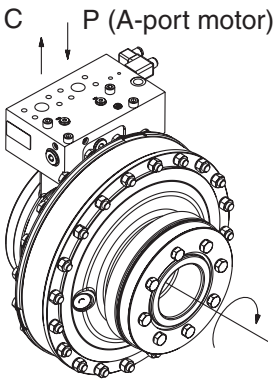
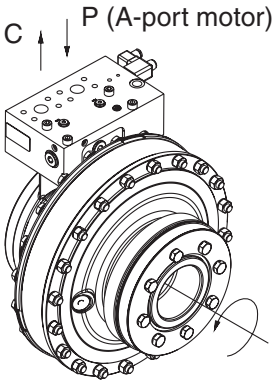



*Fig. 16* **Right hand motor**




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**

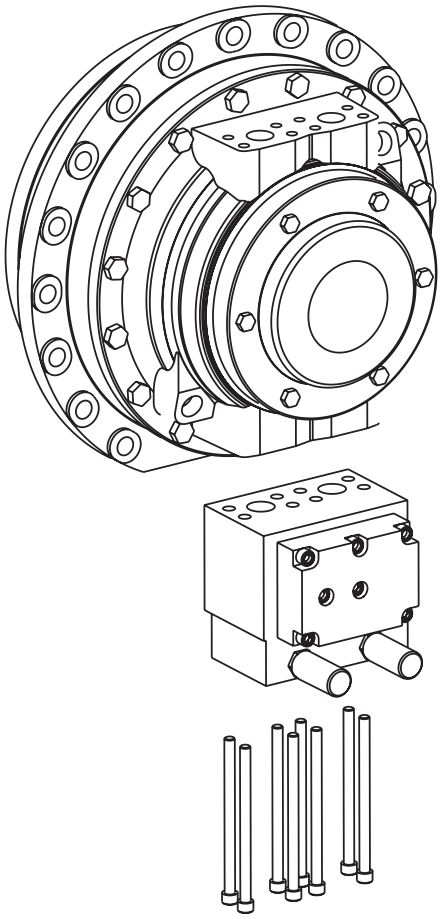
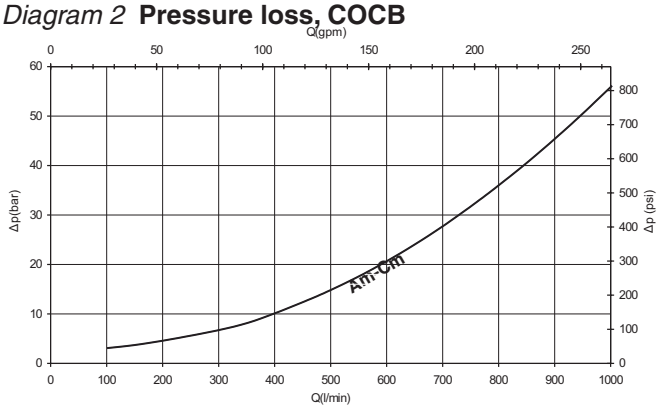


*Diagram 2* **Pressure loss, COCB**




## 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**

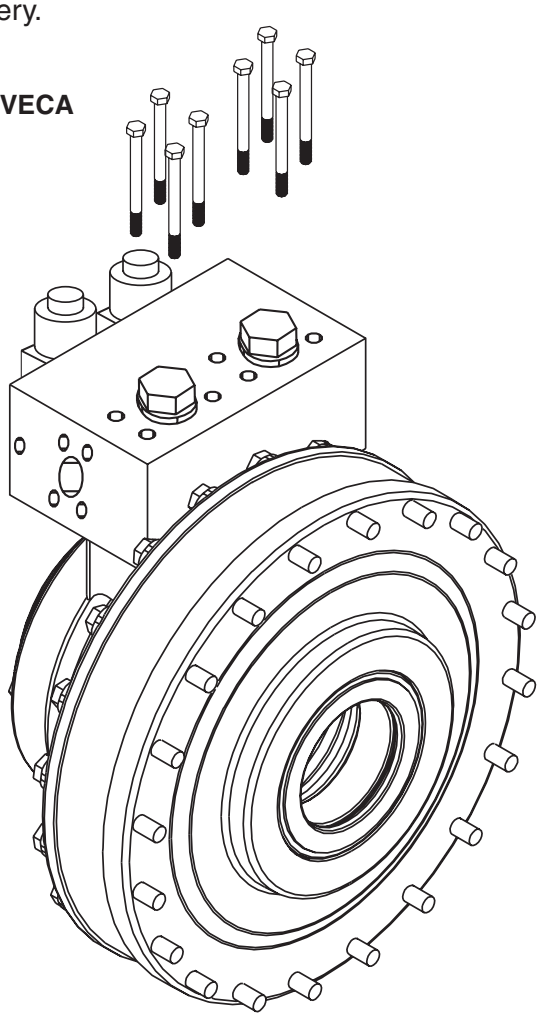
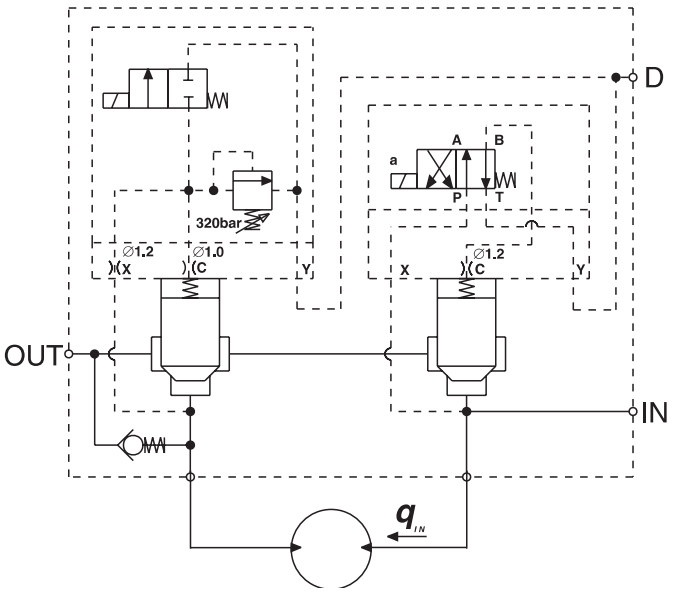


*Diagram 3* **Schematic diagram, VECA**



# Diagrams for Compact

## Compact motors

*Diagram 4* **Charge pressure - Compact motors 2 port connection**

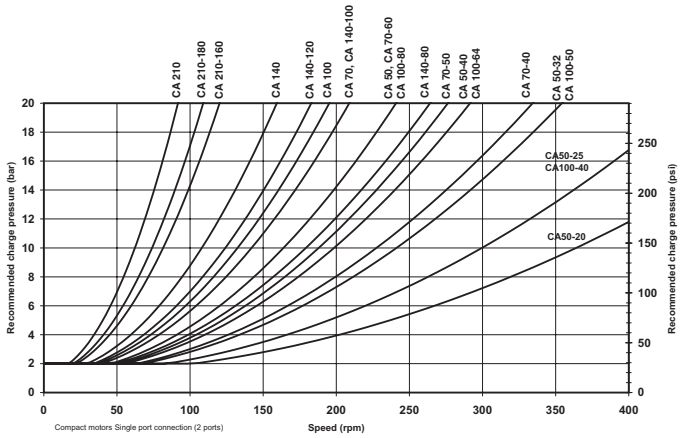
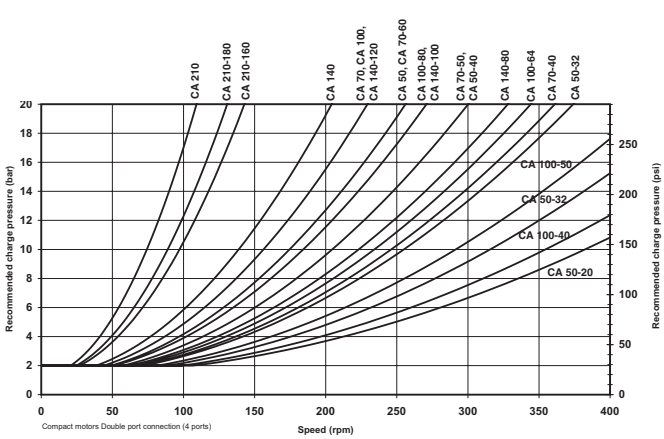



*Diagram 5* **Charge pressure - Compact motors 4 port connection**




**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)**

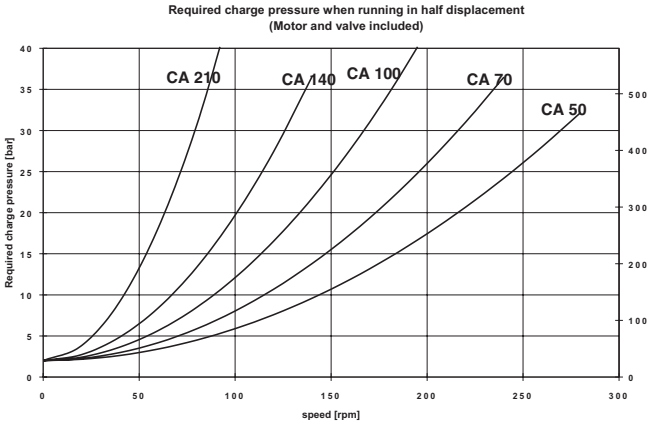



*Diagram 7* **Exchange of oil in motor case vs pressure in C-line with restriction (D = 2 mm, 40 cSt/187 SSU)**

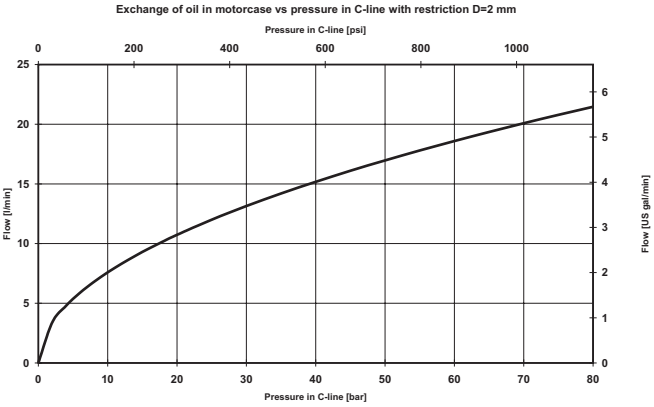



*Diagram 8* **Pressure loss main circuit P-C full displacement (motor & valve, 40 cSt/187 SSU)**

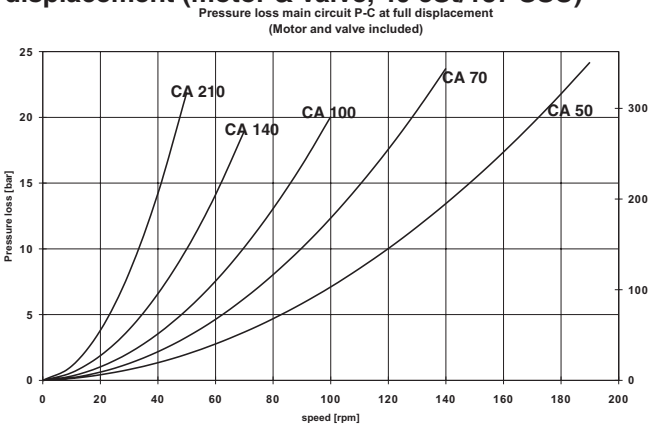
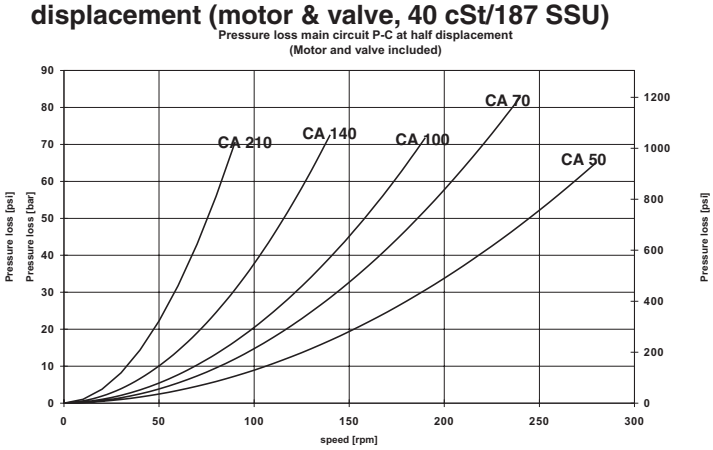



*Diagram 9* **Pressure loss main circuit P-C half displacement (motor & valve, 40 cSt/187 SSU)**



# Diagrams for Compact

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

*Diagram 10* **CA 50, 2 ports**

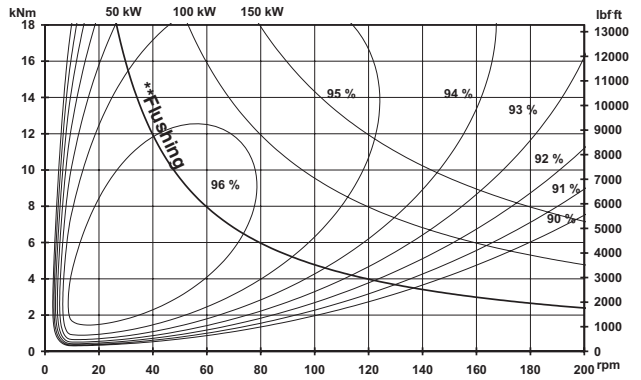



*Diagram 11* **CA 50, 4 ports**

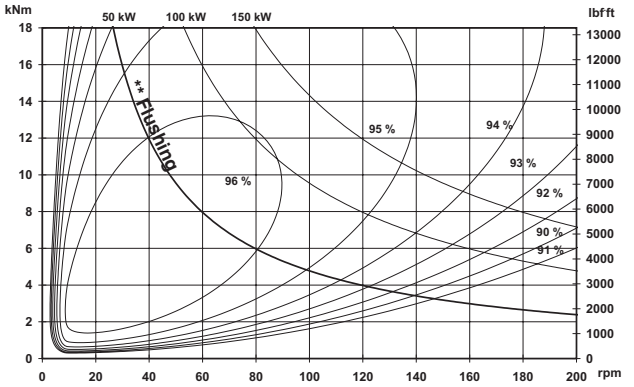



*Diagram 12* **CA 70, 2 ports**

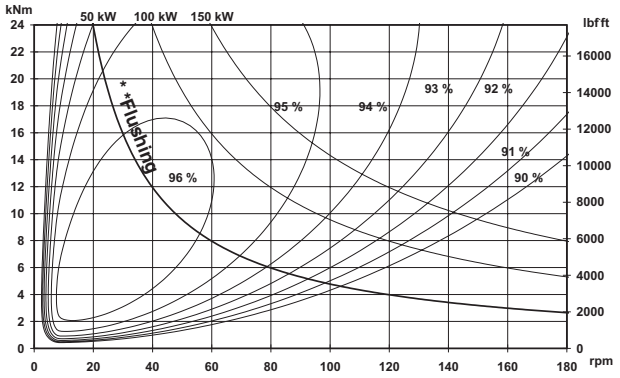



*Diagram 13* **CA 70, 4 ports**

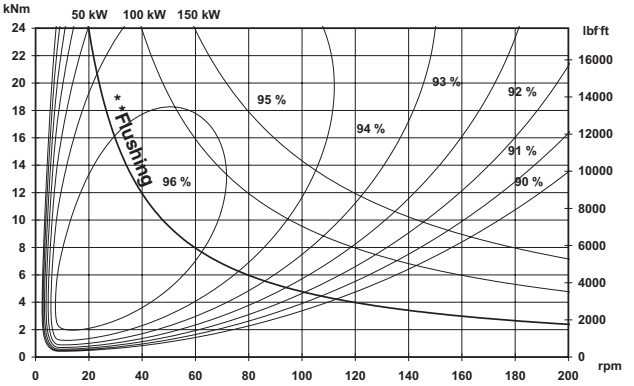



*Diagram 14* **CA 100, 2 ports**

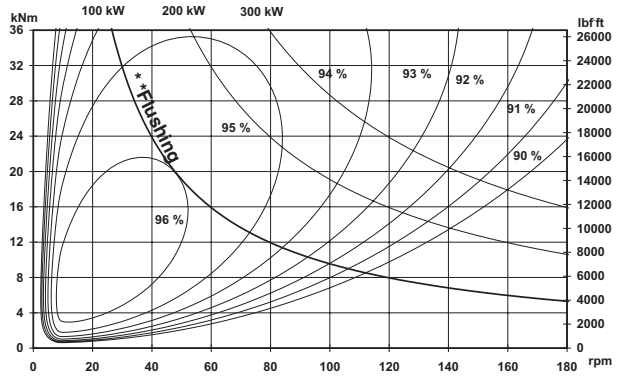



*Diagram 15* **CA 100, 4 ports**

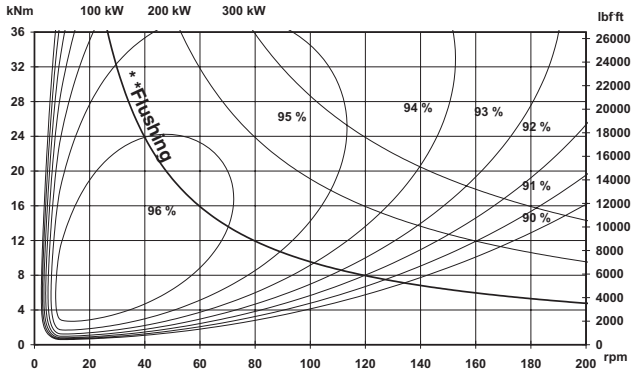



*Diagram 16* **CA 140, 2 ports**

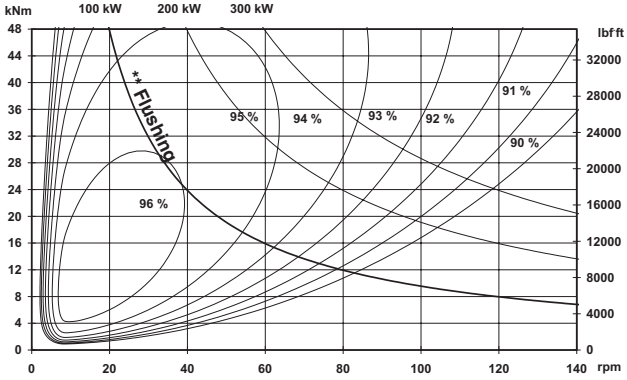
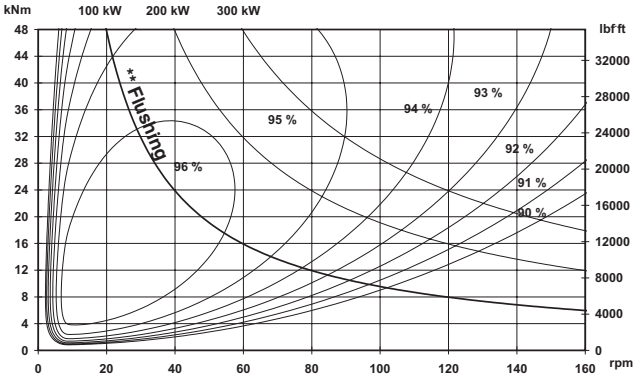



*Diagram 17* **CA 140, 4 ports**




** See AC-4.5 Flushing of motor case.

# Diagrams for Compact

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

*Diagram 18* **CA 210, 2 ports**

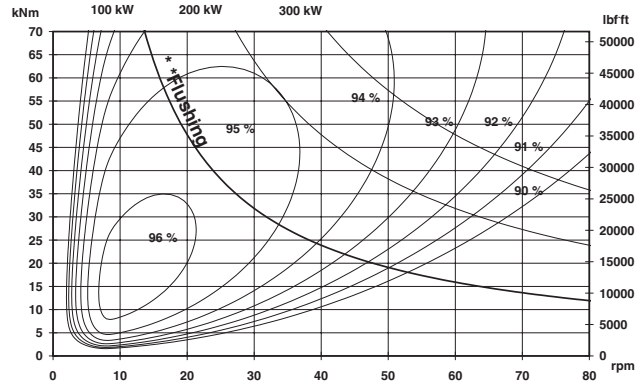
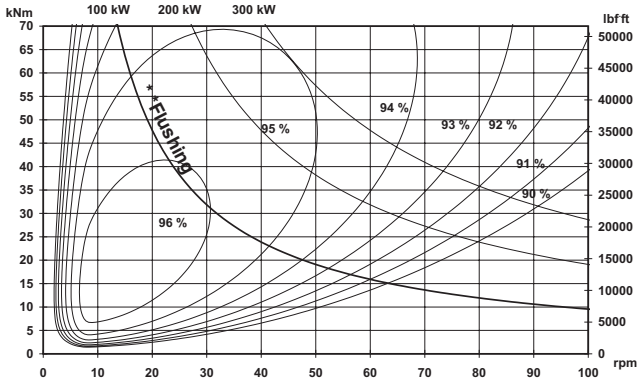



*Diagram 19* **CA 210, 4 ports**




** See AC-4.5 Flushing of motor case.

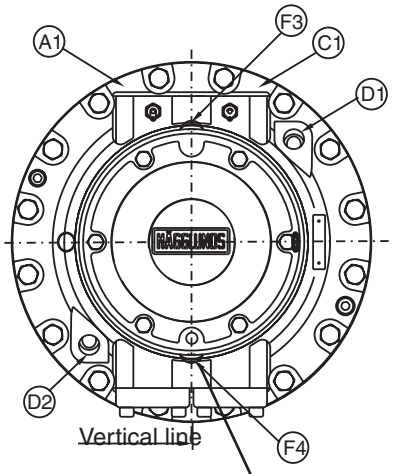
# Flushing of motor case

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°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**

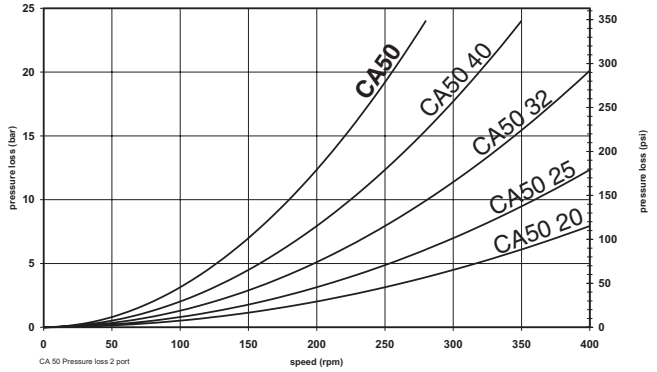



*Diagram 21* **CA 50 pressure loss 4 ports**

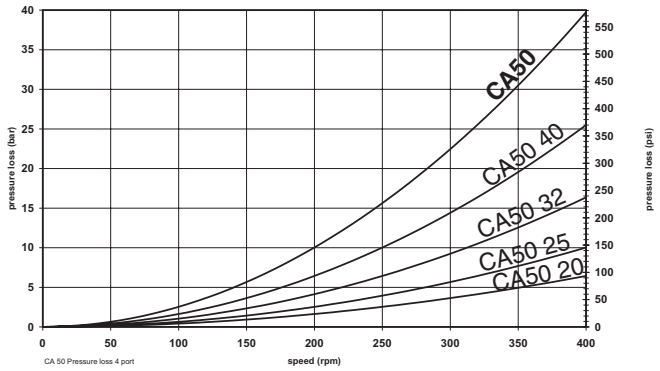



*Diagram 22* **CA 70 pressure loss 2 ports**

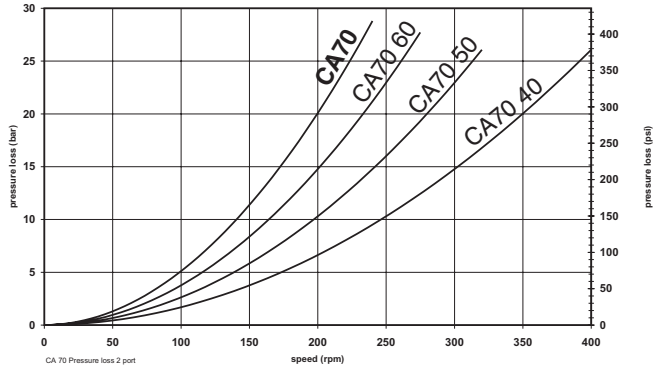



*Diagram 23* **CA 70 pressure loss 4 ports**

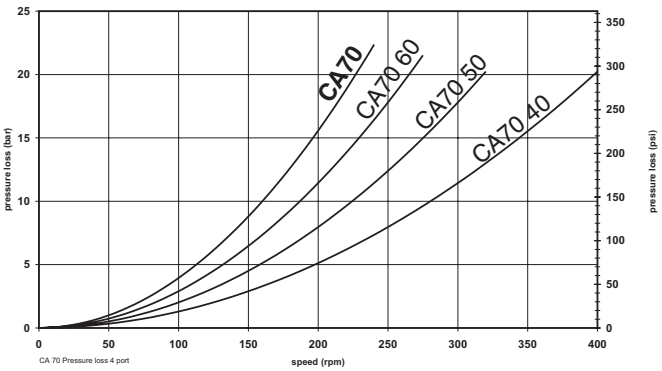



*Diagram 24* **CA 100 pressure loss 2 ports**

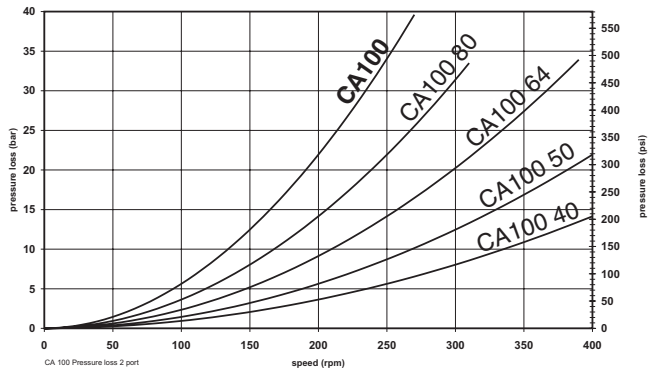



*Diagram 25* **CA 100 pressure loss 4 ports**

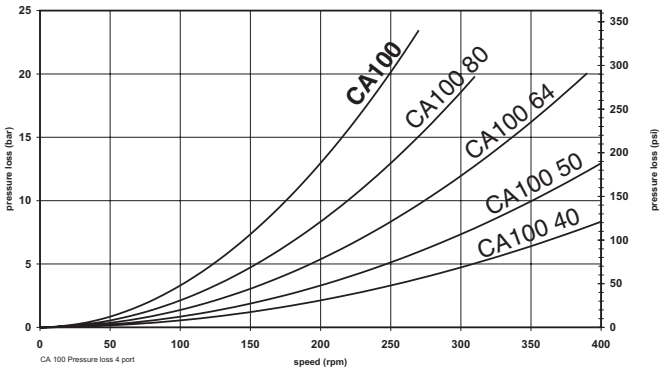



*Diagram 26* **CA 140 pressure loss 2 ports**

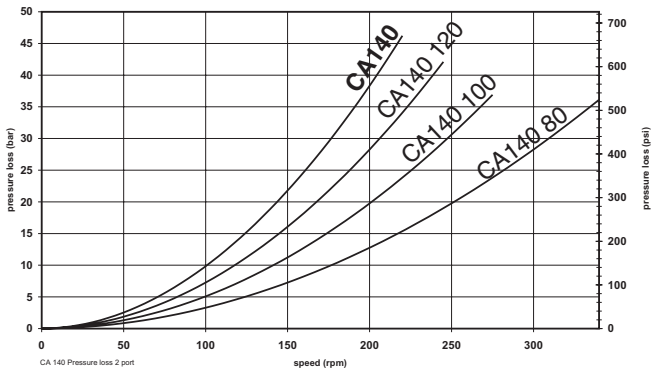
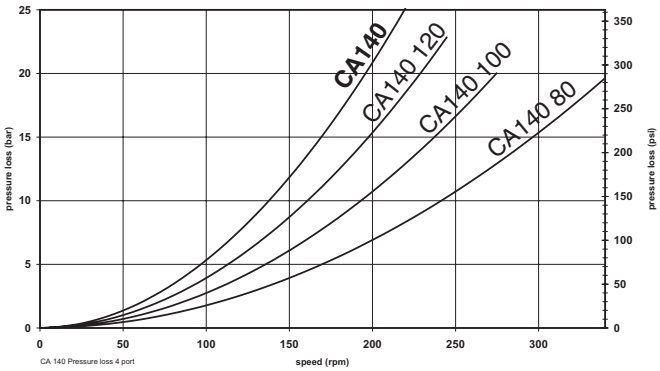



*Diagram 27* **CA 140 pressusre loss 4 ports**



# Diagrams for Compact

## **Pressure loss,** oil viscosity 40 cSt/187 SSU

*Diagram 28* **CA 210 pressure loss 2 ports**

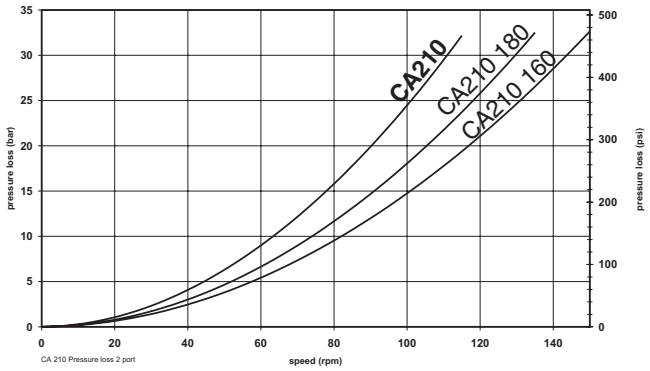
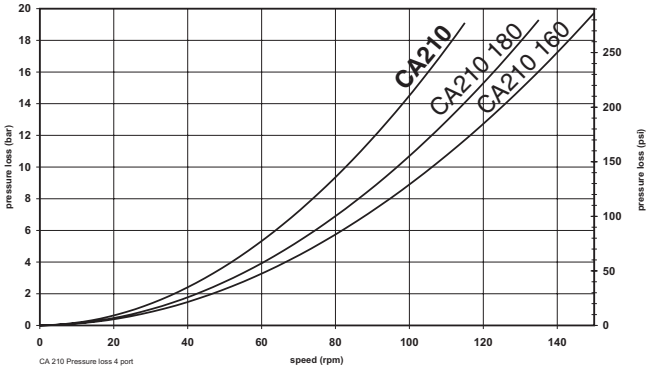



*Diagram 29* **CA 210 pressure loss 4 ports**




## 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*

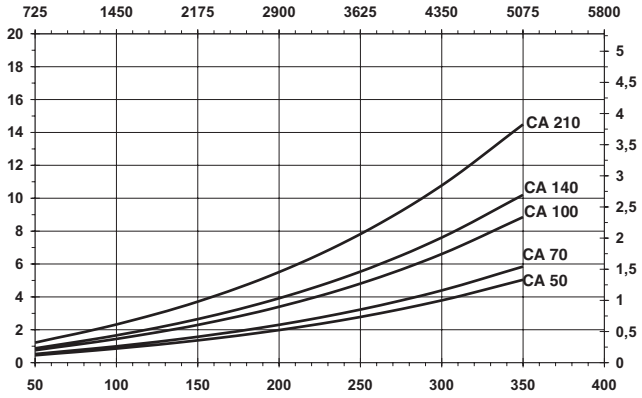
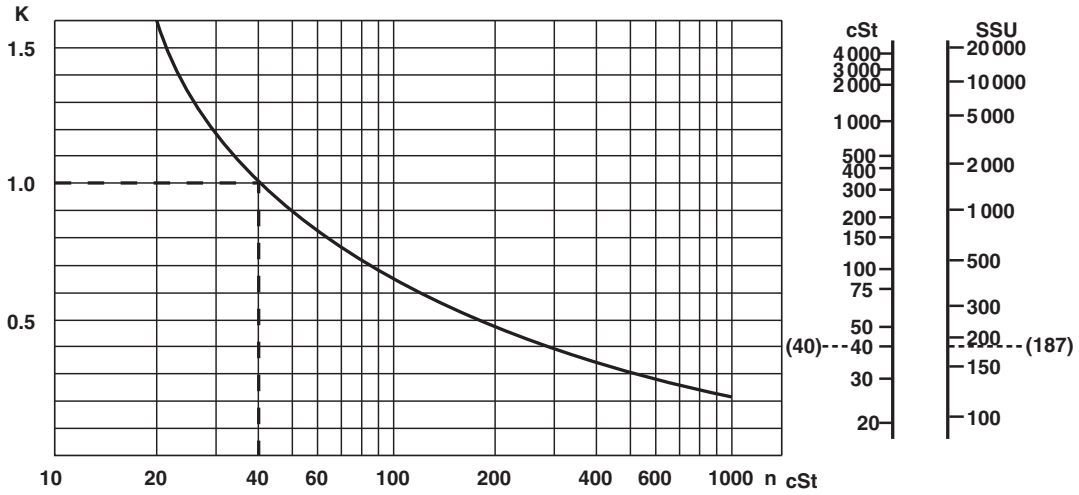



*Diagram 31* **Factor K - Variation in volumetric losses**



# Examples of installations

*Fig. 22* **Torque arm mounted motor with splines.**

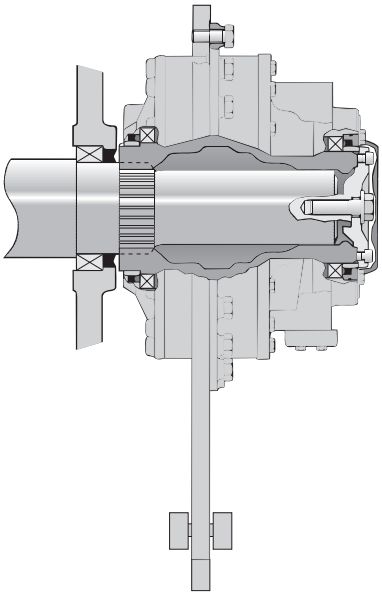


*Fig. 23* **Flange mounted motor with splines**

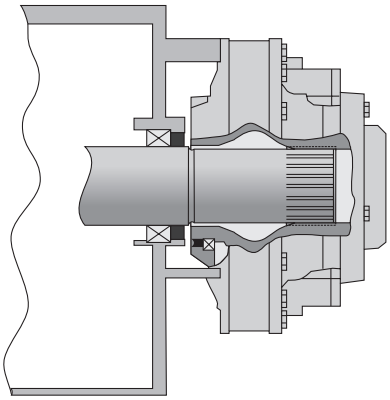


*Fig. 24* **Motor with through hole for cooling of driven machine.**

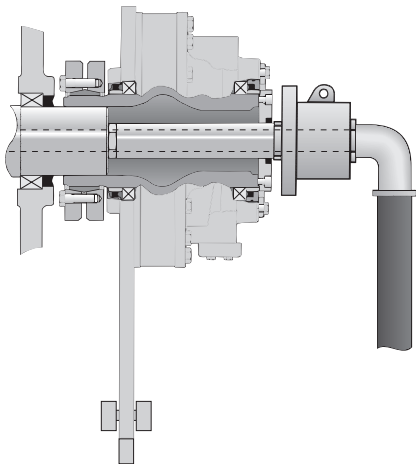


*Fig. 25* **Flange mounted motor with through shaft for high radial load.**

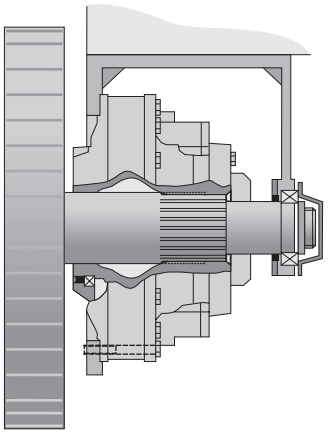


*Fig. 26* **Bracket mounted capstan drive.**

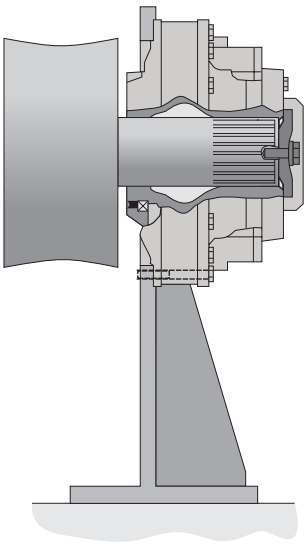


*Fig. 27* **Bracket mounted motor with stub shaft.**

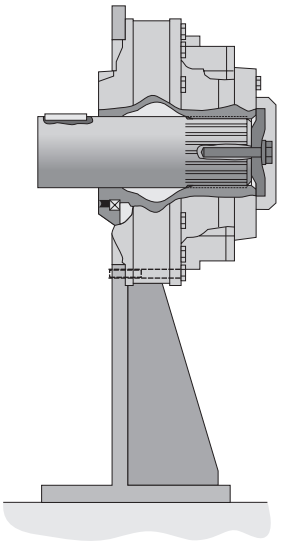


*Fig. 28* **Direct mounted winch drum drive with brake.**

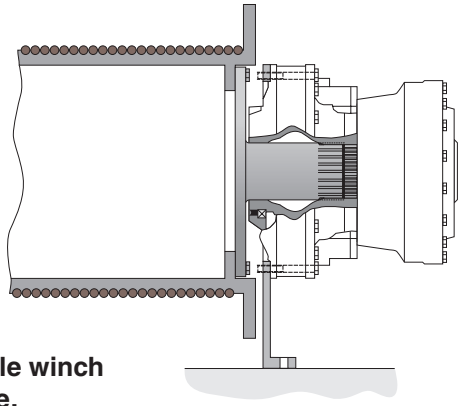
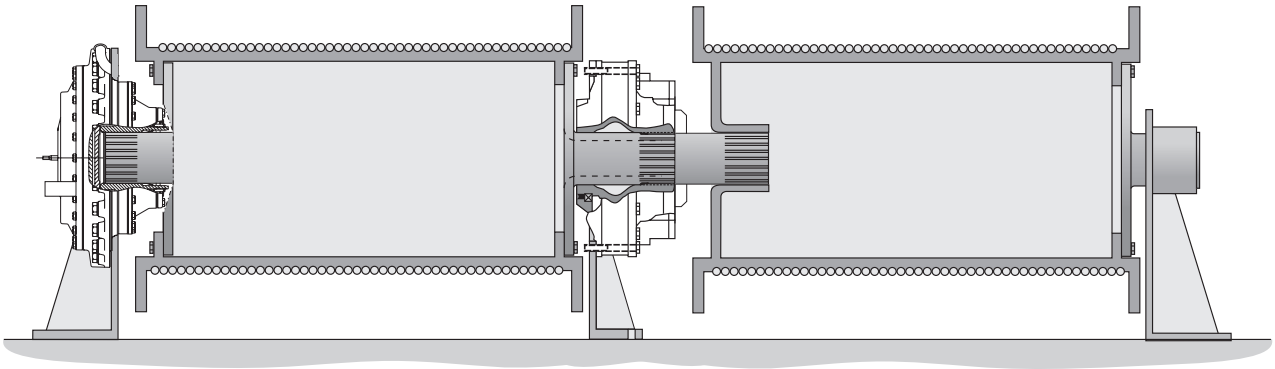


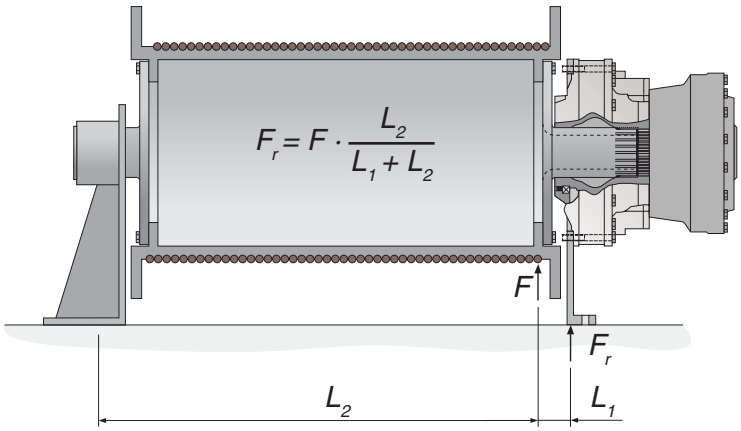
*Fig. 28a* **Direct mounted double winch drum drive with brake.**

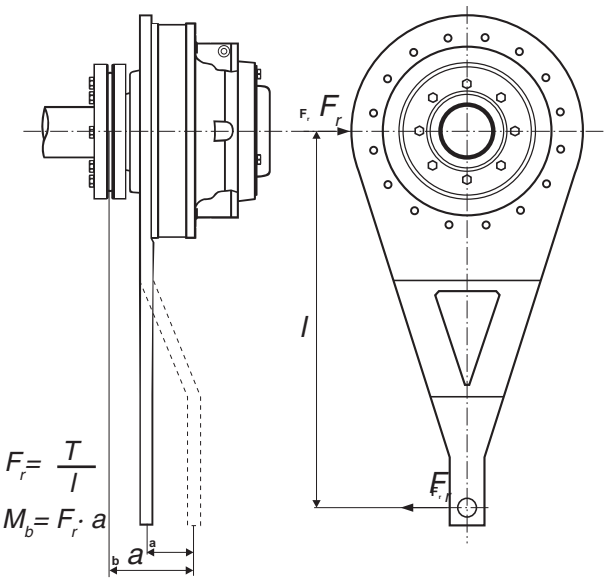


# Recommended external loads for Compact

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
$F_a$ = Axial force acting on motor centerline
$T$ = Output torque for motor
$M_b$ = 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 Hägglunds representative.

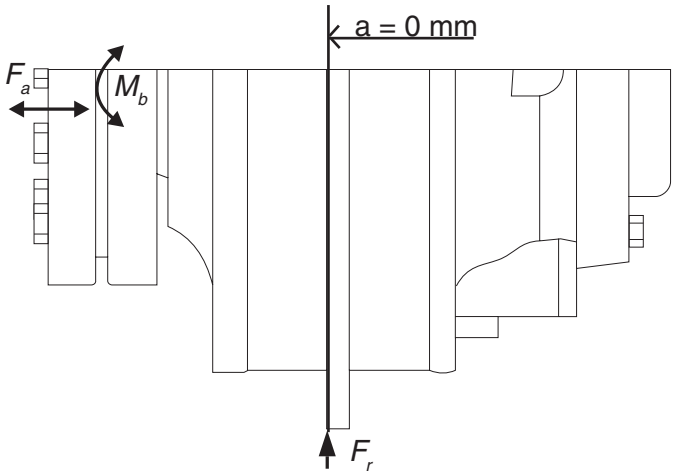



*Diagram 32* **Motor type CA 50 and CA 70**

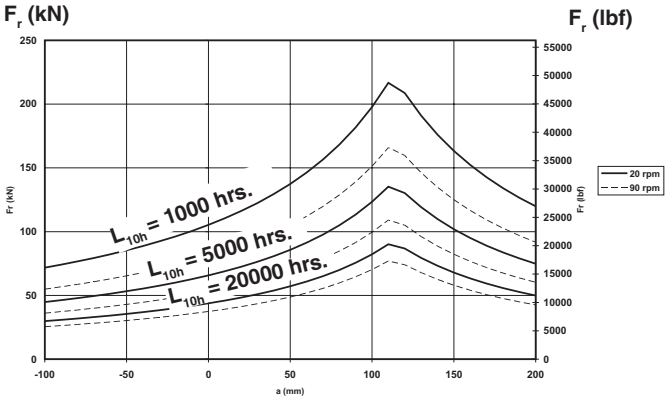



*Diagram 33* **Motor type CA 100 and CA 140**

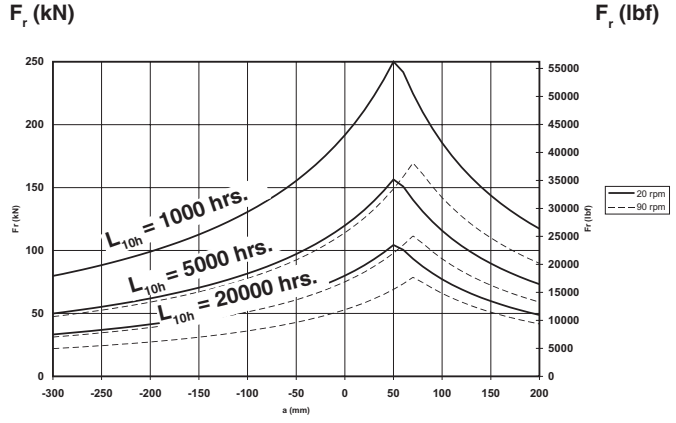
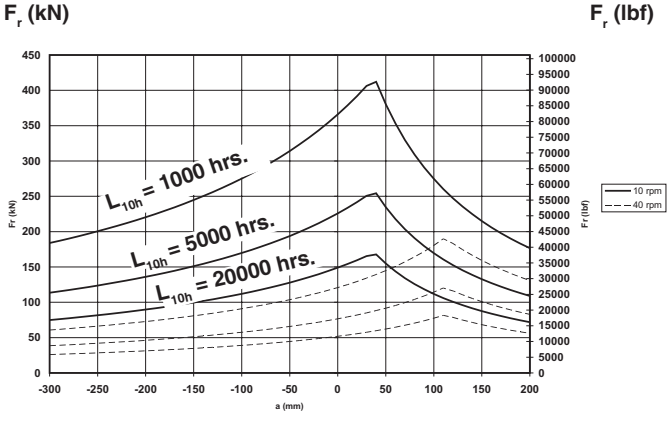



*Diagram 34* **Motor type CA 210**



# Max permitted external static load for Compact

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

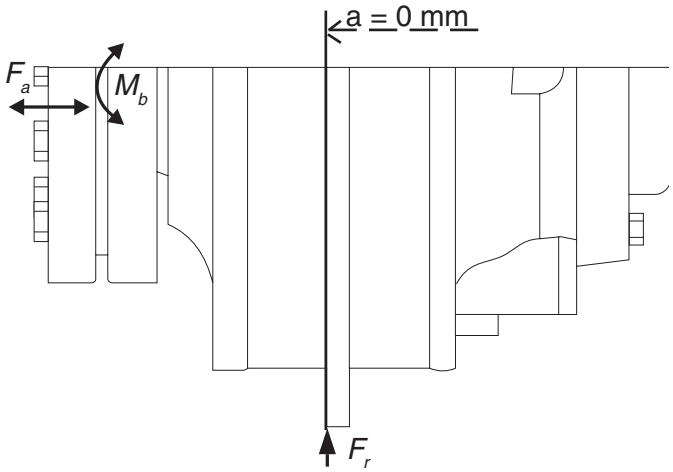



*Diagram 35* **Motor type CA 50**

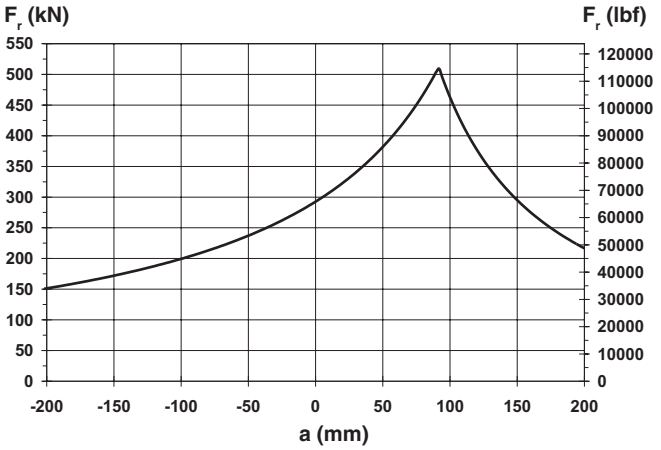



*Diagram 36* **Motor type CA 70**

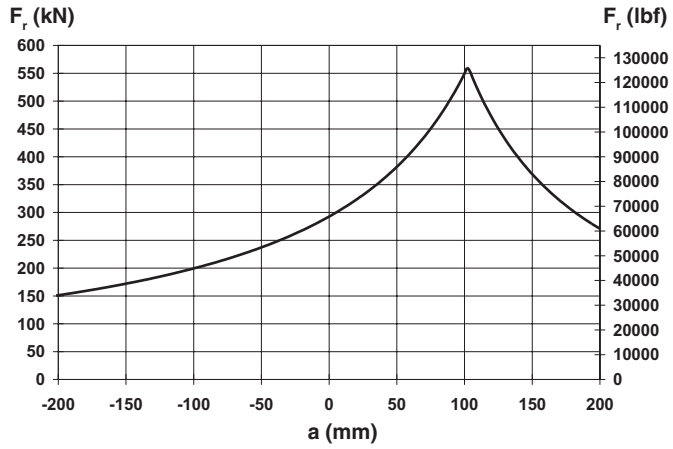



*Diagram 37* **Motor type CA 100**

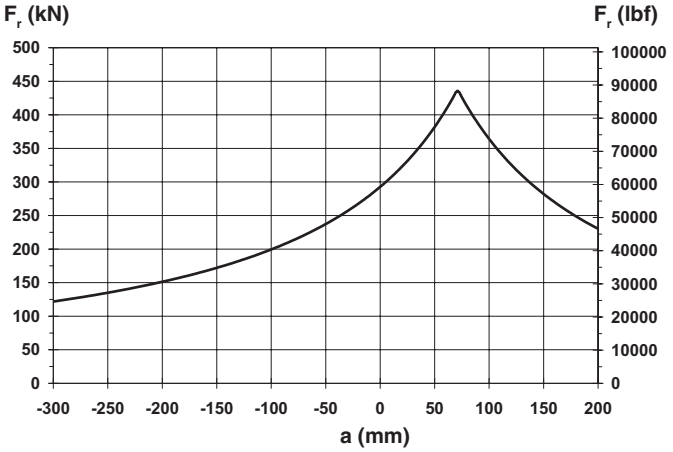



*Diagram 38* **Motor type CA 140**

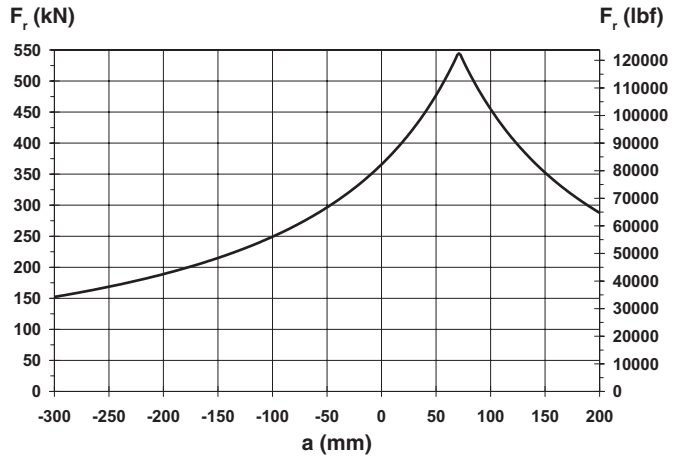
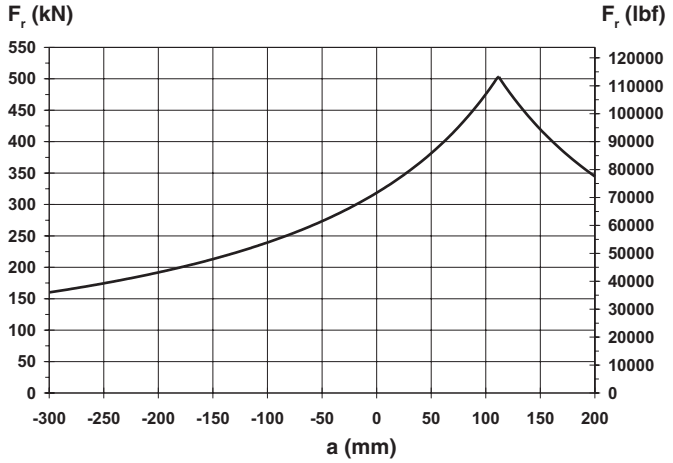



*Diagram 39* **Motor type CA 210**



# 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)<br>Viton seals | -35°C to +70°C<br>-20°C to +100°C |
| Nitrile seals (std motor)<br>Vition seals | -31°F to +158°F<br>-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

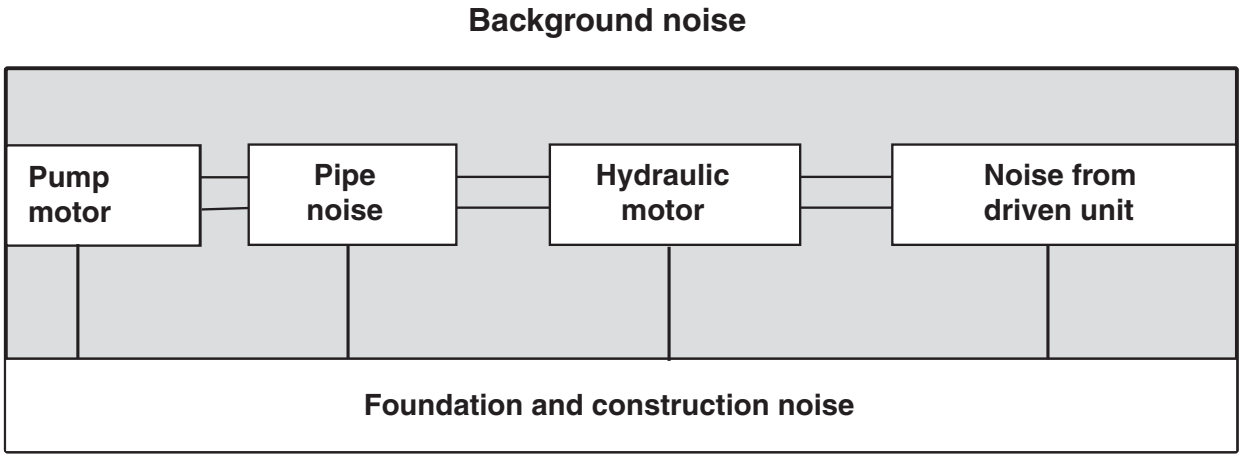
Before start-up, check that the system is thoroughly cleaned.
1. In general the contamination level should not exceed ISO 4406:1999 18/16/13 (NAS 1638, class 7).
2. When filling the tank and motor case, we recommend the use of a filter with the grade of filtration ß10=75.

## Explanation of "Grade of Filtration"

Grade of filtration $\beta$**10=75** indicates the following:
$\beta$**10** means the size of particle $\geq$10$\mu$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.

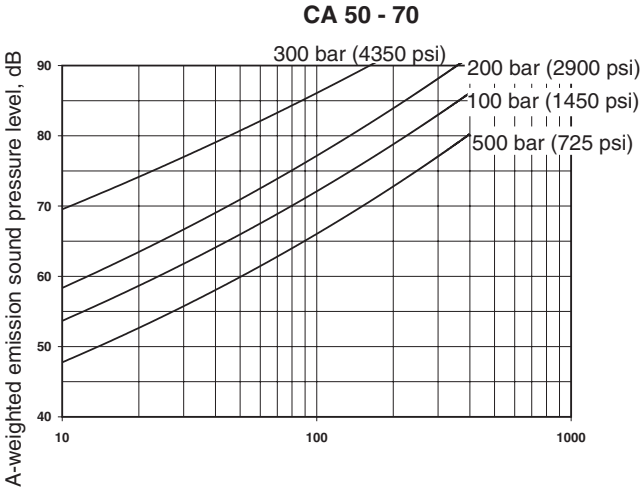
Ex. Grade of filtration is $\beta$**10=75**.
Before the filtration the oil contains *N* number of particles $\geq$10$\mu$m and after passing the filter once the oil contains $\frac{N}{\mathbf{75}}$ number of particles $\geq$10$\mu$m.
This means that $N - \frac{N}{\mathbf{75}} = \frac{74 \cdot N}{\mathbf{75}}$ number of particles have been filtered (=98.6%).

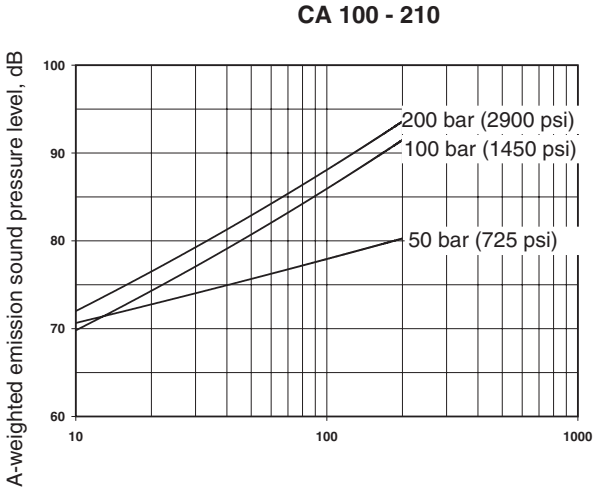
# Noise from a complete installation




## A-weighted emission sound pressure level of Compact CA

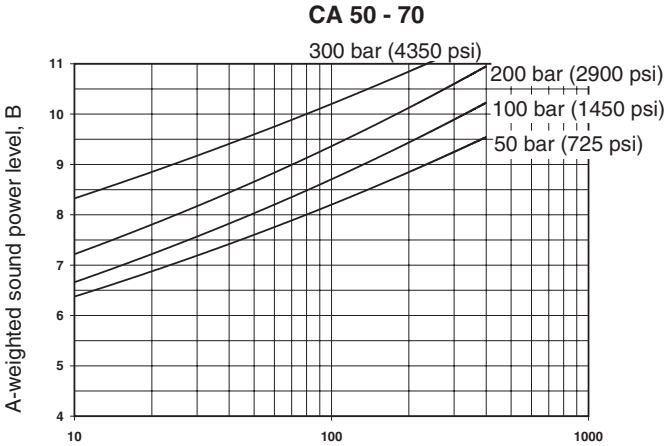
The emission sound pressure level have been calculated according to ISO/DIS 11203 for unattended machines. All values refer to a position of the test object > 1 m (3.28 ft).

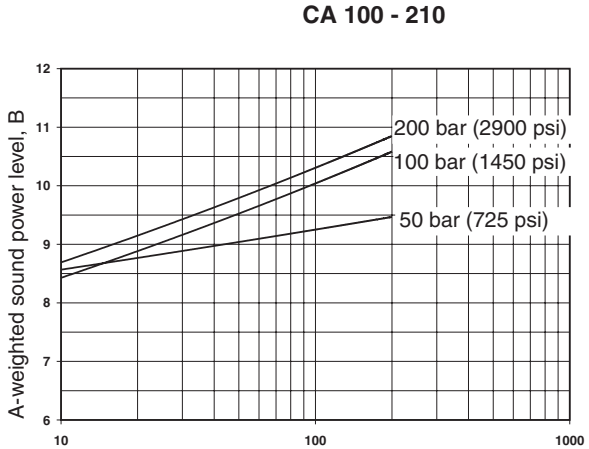



## A-weighted sound power level of Compact CA

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).




SP PROVNING FORSKNING

TEST REPORT

Physics and Electrotechnics October 28, 2003 P303179-AE

# Declaration of Incorporation

## Example of the Incorporation of Conformity given by Hägglunds Drives AB

HÄGGLUNDS

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

The manufacturer

Hägglunds Drives AB

hereby declares that the partly completed machinery

Name: 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

Björn Leidelöf Mellansel, 2009-12-29

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

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

www.hagglunds.com

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E-mail: info@se.hagglunds.com
**www.hagglunds.com**

Our drive is your performance.

HÄGGLUNDS

EN 396-10H. Repro: Öviks Repro. Printer: Ågrens Tryckeri 2011.