ENGINEERING
TOMORROW

Technical Information

# THORX Motors
## CLM C

**Revision history**

*Table of revisions*

| Date | Changed | Rev |
|---|---|---|
| July 2025 | First edition | 0101 |

**www.danfoss.com**

## Contents

## Introduction

Our THORX Cam Lobe Motor product line delivers improved performance and higher efficiency to match the evolving customer demands in mobile transmissions. The **CLM C** has been developed in close collaboration with our customers and are based on a well-proven radial piston motor design, also known as a Cam Lobe motor, which is commonly used in closed-circuit medium power propel applications. THORX motors are designed to be combined with other products in systems to transfer and control hydraulic power.

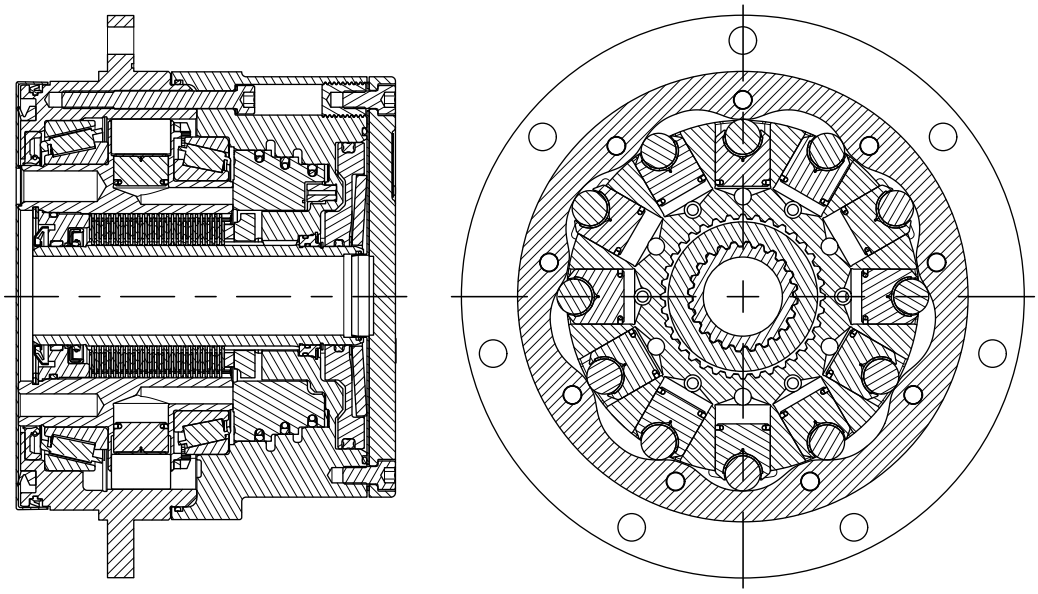
Danfoss has designed the CLM C to fit perfectly for compaction equipment, such as Tandem Rollers. It is optimized for these applications with focus on physical size, longer lifetime, performance, and total installed cost.

The **THORX Motor** family provides a range of products during the next years to cover other applications and new markets. We engineer a better future.

## Customer benefits

Designed for compact drives, our THORX Motors are engineered with our customers in mind. Tapered roller bearings allow for high radial loads, while the novel design of the rotating group provides a market leading high efficiency. Combined with an integrated multi-disc parking brake the CLM C motors delivers a longer lifetime than previously made possible.

## Functional Description



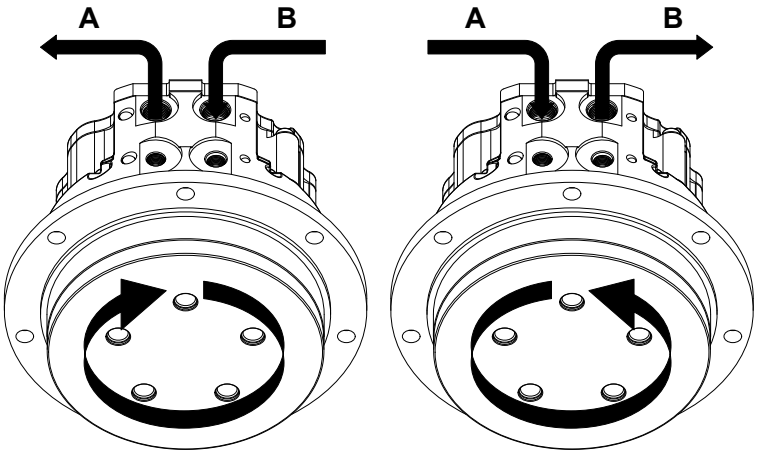
*Sectional drawing of CLM 5 C*

### The Cam Lobe principle

A Cam Lobe Motor is a type of radial piston motor which is a Low Speed High Torque hydraulic motor. It differs from other radial piston motor designs by utilizing a cam ring with multiple lobes and pistons. The pistons move against the cam profile and thereby rotate the motor, either clockwise or counterclockwise. The design of the motors can have either stationary housing and rotating shaft, or a stationary shaft and rotating house. The Cam Lobe motor are in particular known for its high starting efficiency and high efficiency in general.

The Cam Lobe technology is not a new technology, it has been around for more than 60 years, however Danfoss have now refined the technology to design a whole new line of hydraulic motors for mobile off-highway machinery, known as THORX Motors. Cam Lobe motors are typically applied in direct drive solutions because of its ability to provide full torque without the need for a gearbox, opposed to high-speed motors such as axial piston type.

### Bidirectional design



## Functional Description

The THORX motors are based on a bidirectional design which provides the same performance in clockwise rotation as counterclockwise rotation. This provides a clear benefit in drivetrain solutions where the motor needs to reverse and don't go down in performance.

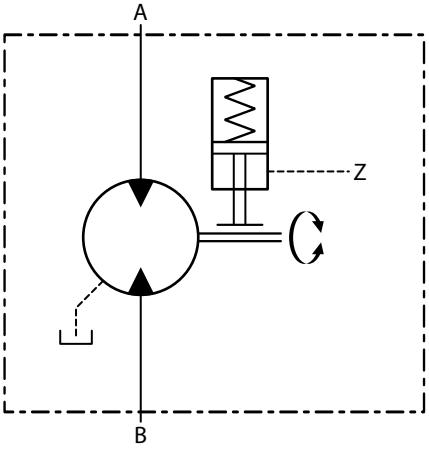
| Rotation direction | Inlet port |
|---|---|
| Clockwise | B port |
| Counter-clockwise | A port |

### Tapered roller bearings

For enhanced durability and load-handling capability, CLM C motors are fitted with dual tapered roller bearings. These bearings are specifically designed to support substantial axial and radial forces, ensuring optimal performance under demanding operating conditions, throughout the motors lifetime.

### Integrated parking brake

The integrated parking brake is a 3,170 Nm [28,325 lbf·in] multi-disc static friction brake. The brake discs are compressed by the disc spring and released by the application of brake pressure. To release the brake is required a release pressure of 17 bar [247 psi] via the Z port. This type of brake is commonly referred to as SAHR, or Spring Applied Hydraulic Release.




*Motor with parking brake*

**Warning**

Never apply more than max. 40 bar pressure to the Z-port.

**Warning**

While the parking brake is designed for 100 emergency dynamic stops during its lifetime, it is intended solely for static use and should not be applied while the motor is in use. Applying the brake while driving can damage the brake.

### Shaft seal

The CLM C features a NBR shaft seal as standard options. This shaft seal is characterized by its ability to handle high temperature operation.

## Functional Description

| **Shaft Seal** | | | **CLM C** |
|---|---|---|---|
| Max. pressure, case drain | bar<br>[psi] | Continuous | 1<br>[15] |
| | | Intermittent[1] | 3<br>[44] |
| | | Peak[2] | 10<br>[145] |

[1] Intermittent operation: the permissible value may occur for less than 1 min per incident and not exceeding 2 % of duty cycle

[2] Peak load: the permissible value may occur for max. 1 % of every minute

## Operating parameters

### System pressure

**System pressure** is the differential pressure between high pressure system ports (A and B ports). It is the dominant operating variable affecting hydraulic unit life. High system pressure, which results from high load, reduces expected life. Hydraulic unit life depends on the speed and normal operating, or weighted average, pressure that can only be determined from a duty cycle analysis.

**Application pressure** is the high pressure relief or pressure limiter setting normally defined within the order code of the pump. This is the applied system pressure at which the driveline generates the maximum calculated pull or torque in the application.

**Maximum working pressure** is the highest recommended application pressure. Maximum working pressure is not intended to be a continuous pressure. Propel systems with application pressures at, or below, this pressure should yield satisfactory unit life given proper component sizing.

**Maximum pressure** is the highest allowable application pressure under any circumstance. Application pressures above Maximum Working Pressure will only be considered with duty cycle analysis and factory approval. Pressure spikes are normal and must be considered when reviewing maximum working pressure.

### Case pressure

Under normal operating conditions, the rated case pressure must not be exceeded. During cold start case pressure must be kept below **maximum intermittent case pressure**. Size drain plumbing accordingly.

**Caution**

**Possible component damage or leakage**

Operation with case pressure in excess of stated limits may damage seals, gaskets, and/or housings, causing external leakage. Performance may also be affected since charge and system pressure are additive to case pressure.

### Temperature

The high temperature limits apply at the hottest point in the motor, which is normally the motor case drain. The **CLM C** motors should generally be run at or below the rated temperature.

The **maximum intermittent temperature** is based on material properties and should never be exceeded.

Cold oil will generally not affect the durability of the transmission components, but it may affect the ability of oil to flow and transmit power. Therefore, temperatures should remain 16°C [30°F] above the pour point of the hydraulic fluid.

The **minimum temperature** relates to the physical properties of component materials. Size heat exchangers to keep the fluid within these limits. Danfoss recommends testing to verify that these temperature limits are not exceeded.

## Operating parameters

### Viscosity

For maximum efficiency and bearing life, ensure the fluid viscosity remains within the recommended range.

The **minimum viscosity** should be encountered only during brief occasions of maximum ambient temperature and severe duty cycle operation.

The **maximum viscosity** should be encountered only at cold starts.

**Attention**

Monitor oil cleanliness at regular intervals.

### Hydraulic fluid specifications

| Features | | Units | CLM C |
|---|---|---|---|
| Viscosity | Intermittent[1] | mm2/sec [SUS] | 5 [42] |
| | Minimum | | 7 [49] |
| | Recommended range | | 12 - 80 [66 - 370] |
| | Maximum (cold start)[2] | | 2,000 [9,375] |
| Temperature range[3] | Minimum (cold start) | °C [°F] | -40 [-40] |
| | Maximum continuous | | 85 [185] |
| | Maximum intermittent | | 115 [240] |
| Cleanliness per ISO 4406 | | | 22/18/13 |
| Hydraulic fluid class | | | ISO VG 46 |

[1] The permissible value may occur for less than 1 min per incident and not exceeding 2 % of duty cycle

[2] Cold start is defined as less than 3 minutes and with pressure not exceeding 50 bar [725 psi]

[3] At the hottest temperature point, normally case drain port

## CLM 5 C motor

On the following pages you will find technical specifications of the CLM 5 C.

## CLM 5 C motor

### Technical Data

**Specifications**

| CLM C | | | Frame size 5 | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Nominal size** | | | **270** | **340** | **410** | **455** | **500** | **545** |
| Geometric displacement | $cm^3$ [$in^3$] | | 272 [16.6] | 340 [20.7] | 408 [24.9] | 456 [27.8] | 502 [30.6] | 545 [33.3] |
| Maximum speed | $min^{-1}$ [rpm] | | 120 | 110 | 100 | 90 | 82 | 75 |
| Maximum torque | Nm [lbf·in] | Continuous | 1,080 [9,575] | 1,350 [11,965] | 1,625 [14,375] | 1,815 [16,055] | 1,995 [17,675] | 2,170 [19,190] |
| | | Peak[1)] | 1,730 [15,325] | 2,165 [19,155] | 2,595 [22,990] | 2,900 [25,695] | 3,195 [28,285] | 3,470 [30,710] |
| Maximum power | kW [hp] | Continuous | 18 [24] | | | | | |
| System pressure | bar [psi] | Nominal pressure[2)] | 250 [3,625] | | | | | |
| | | Max. working pressure (peak[1)]) | 380 [5,510] | | | | | |
| | | Max. pressure (peak[1)]) | 400 [5,800] | | | | | |
| | | Max. pressure in Inlet port (peak[1)]) | 430 [6,235] | | | | | |
| Minimum starting torque | Nm [lbf·in] | at max. press. drop cont. | 810 [7,185] | 1,015 [8,975] | 1,220 [10,780] | 1,360 [12,035] | 1,500 [13,360] | 1,625 [14,390] |
| | | at max. press. drop peak[1)] | 1,385 [12,255] | 1,730 [15,320] | 2,075 [18,390] | 2,320 [20,550] | 2,555 [22,620] | 2,775 [24,560] |
| Weight[3)] | kg [lbs] | | 32 [70.5] | | | | | |

[1)] Peak operation: the permissible values may occur for max. 1% of every minute

[2)] Nominal values are guide values for max. continuous operation

[3)] Depending on product configuration

**Caution**

Do not exceed Δ pressure rating.

**Warning**

The motor should not be run unloaded at above 100 rpm during the running in period.

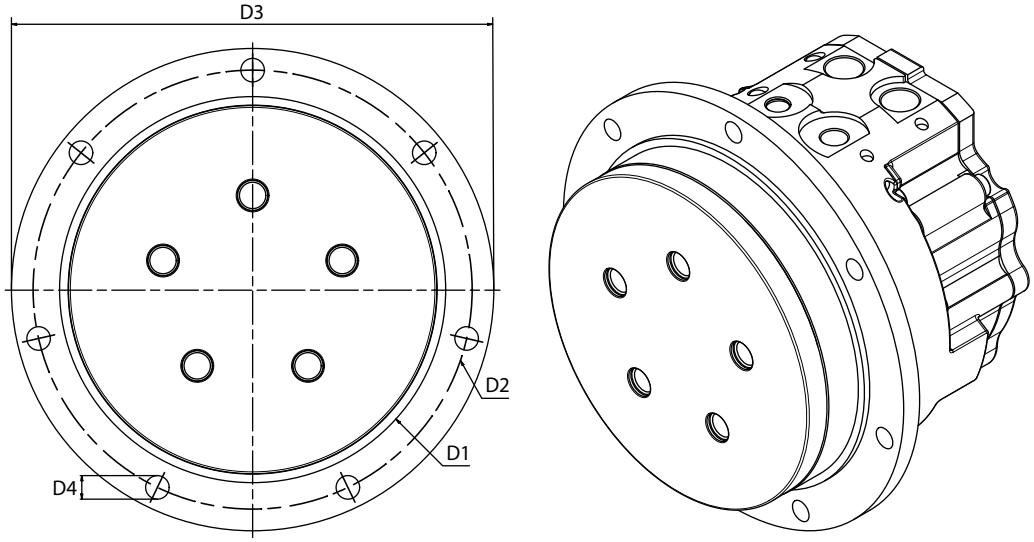
For operation in series with return pressure higher than 40 bar please consult your local sales contact.

For long term operation with speeds under 5 rpm please consult your local sales contact.

## CLM 5 C motor

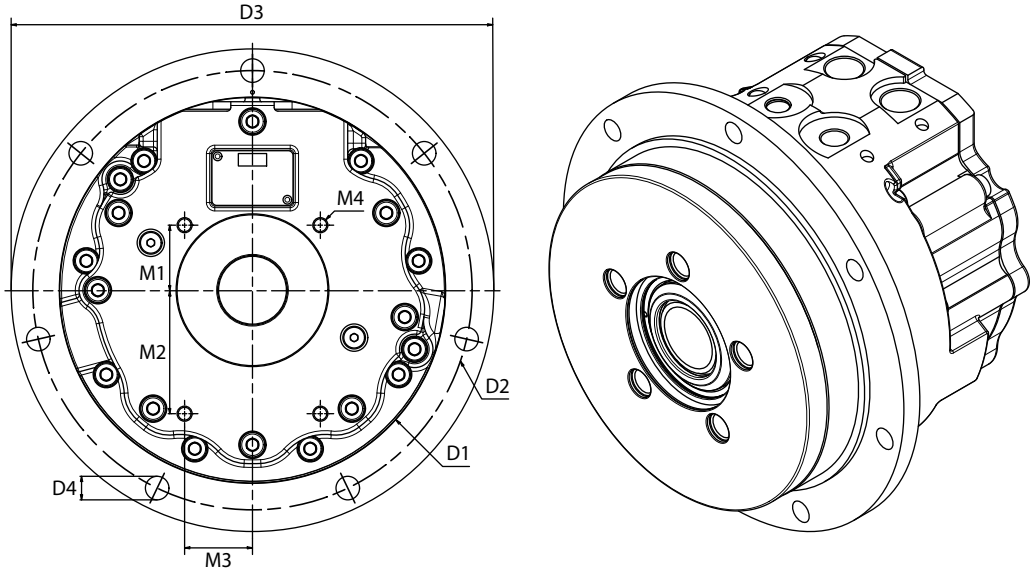
### Housings

***C4A: 7-hole circular mounting flange***




| Motor | | D1 | D2 | D3 | D4 |
|---|---|---|---|---|---|
| CLM 5 C | mm | Ø204.9 | Ø233 | Ø256 | 7 x Ø12.5 |

***C4B: 7-hole circular mounting flange with rear mount***



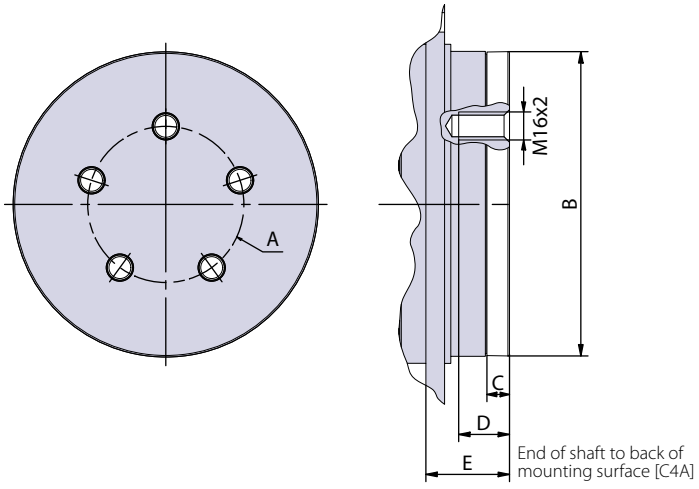

| Motor | | D1 | D2 | D3 | D4 |
|---|---|---|---|---|---|
| CLM 5 C | mm | Ø204.9 | Ø233 | Ø256 | 7 x Ø12.5 |

| Motor | | M1 | M2 | M3 | M4 |
|---|---|---|---|---|---|
| CLM 5 C | mm | 34.5 | 65.5 | 36.0 | 4 x M8x1.25 |

## CLM 5 C motor

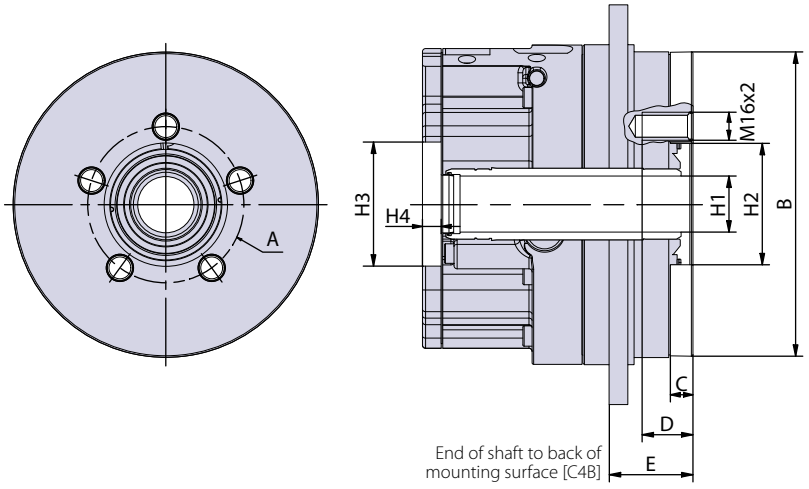
### Shafts

***C01: Ø196 thread hole flange with 5 x M16 – BC100 mm***




| Shaft | | A | B | C | D | E |
|---|---|---|---|---|---|---|
| Ø196 thread hole flange | mm | 100 | 196 | 14.5 | 30.5 | 53.7 |

***CH1: Ø36 Hollow shaft with 5 x M16 – BC100 mm***



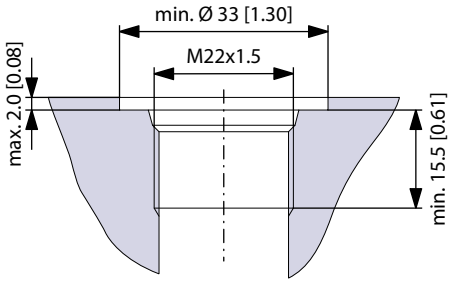

| Shaft | | A | B | C | D | E |
|---|---|---|---|---|---|---|
| Ø36 Hollow shaft | mm | 100 | 196 | 14.5 | 30.5 | 53.7 |

| Shaft | | H1 | H2 | H3 | H4 |
|---|---|---|---|---|---|
| Ø36 Hollow shaft | mm | Ø36 | Ø78 | Ø80 | 12.0 |

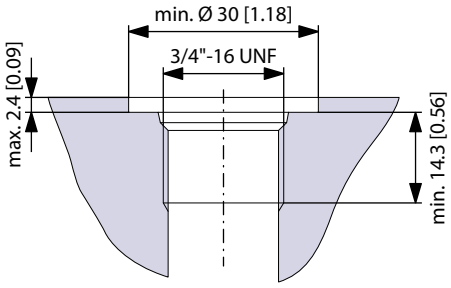
## CLM 5 C motor

### Port thread options

#### Inlet ports

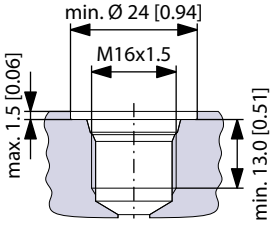



**1B** M22 x 1.5 ISO 9974-1

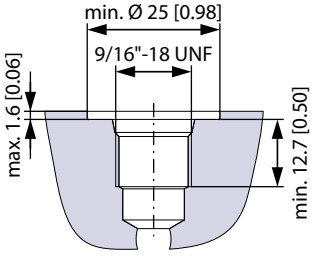



**3A** UNF 3/4" – 16 (ISO 11926-1)

#### Case drain port

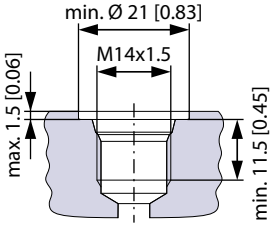



**B** M16 x 1.5 ISO 9974-1

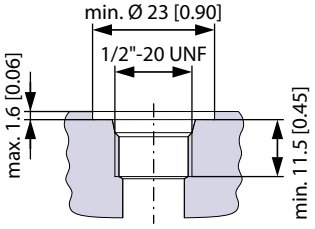



**K** UNF 9/16" – 18 (ISO 11926-1)

#### Brake release port



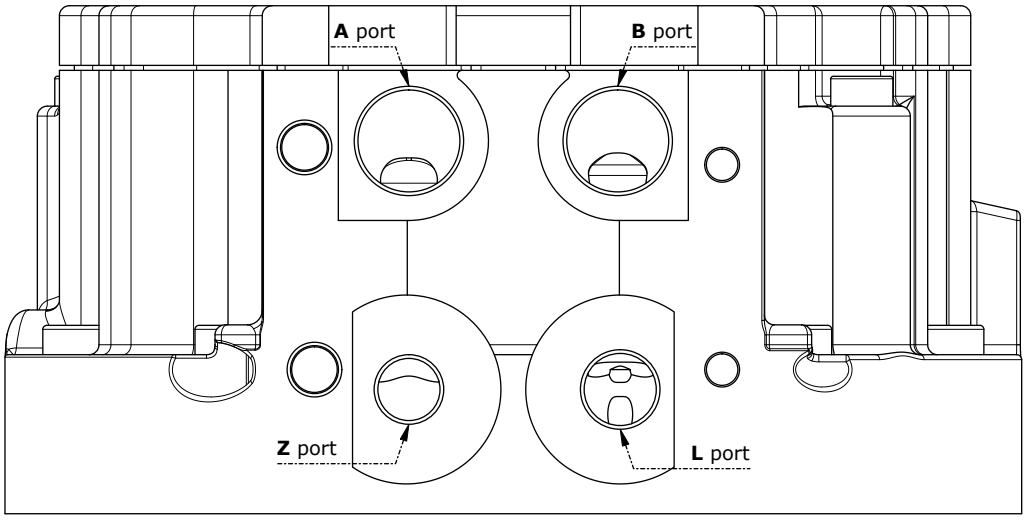

**A** M14 x 1.5 ISO 9974-1




**K** UNF 1/2" – 20 (ISO 11926-1)

## CLM 5 C motor

### Manifold layout

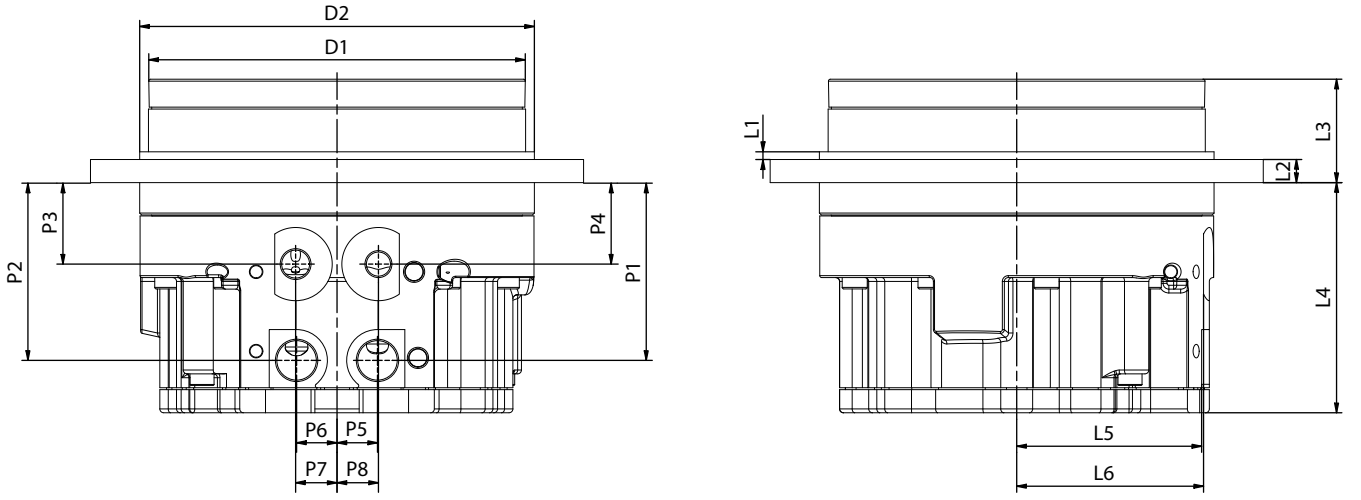



| Thread type | Inlet ports (A+B) | Case drain port (L) | Brake release port (Z) |
|---|---|---|---|
| Metric (ISO 9974-1) | M22 x 1.5 | M16 x 1.5 | M14 x 1.5 |
| UNF (ISO 11926-1) | 3/4 " - 16 UNF | 9/16 " - 18 UNF | 1/2 " - 20 UNF |

## CLM 5 C motor

### Dimensions

***C4x: 7-hole circular mounting flange Ø233***




| Motor | | D1 | D2 |
|---|---|---|---|
| CLM 5 C | mm | Ø196 | Ø204.9 |

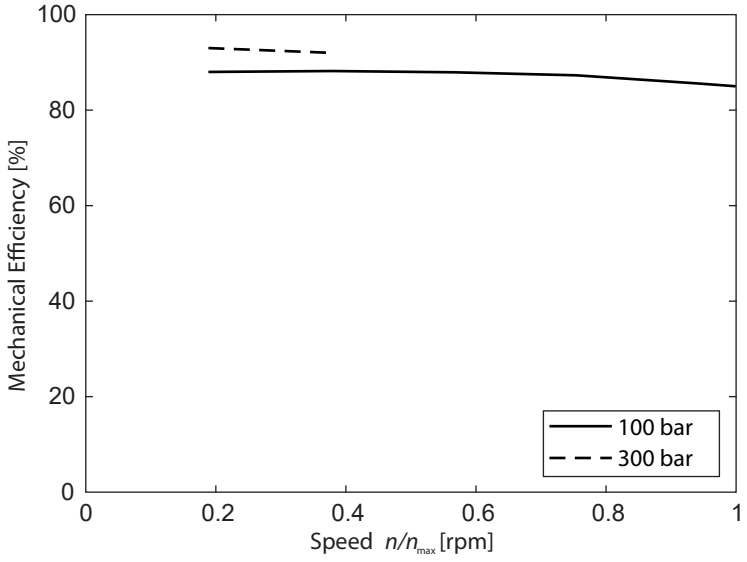
| Motor | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 |
|---|---|---|---|---|---|---|---|---|---|
| CLM 5 C | mm | 92.3 | 92.3 | 42.3 | 42.3 | 21.0 | 21.0 | 21.5 | 21.5 |

| Motor | | L1 | L2 | L3 | L4 | L5 | L6 |
|---|---|---|---|---|---|---|---|
| CLM 5 C | mm | 4.0 | 12.0 | 53.7 | 119.5 | 96.2 | 97.2 |

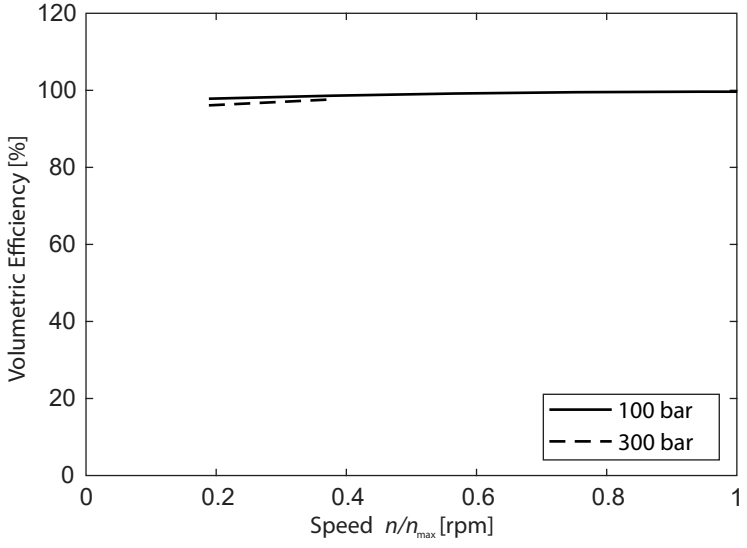
## CLM 5 C motor

### Efficiency curves

**Mechanical efficiency**

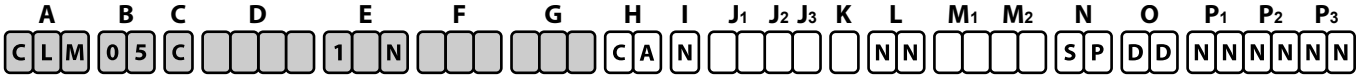



**Volumetric efficiency**



## Ordering Information

### Model Code (A-B-C-D-E-F-G)




*A – Product type*

| Code | Description |
|---|---|
| CLM | THORX motor |

*B – Frame size*

| Code | Description |
|---|---|
| 05 | Frame size |

*C – Housing type*

| Code | Description |
|---|---|
| C | Front case mounting flange |

*D – Nominal size*

| Code | Description |
|---|---|
| 0270 | 272 cc/rev |
| 0340 | 340 cc/rev |
| 0410 | 408 cc/rev |
| 0455 | 456 cc/rev |
| 0500 | 502 cc/rev |
| 0545 | 545 cc/rev |

*E – Single/Two-speed operation*

| Code | Type | Description |
|---|---|---|
| 1AN | Single speed | Clockwise rotation (pressure to port B) |
| 1BN | | Counter-clockwise rotation (pressure to port B) |

*F – Mounting flange*

| Code | Type | Description |
|---|---|---|
| C4A | Circular flange | 7-hole (Ø12.5) circular mounting flange Ø233 |
| C4B | | 7-hole (Ø12.5) circular mounting flange Ø233 + High Speed motor mount on rear (M8x1.25) |

*G – Drive shaft*

| Code | Type | Description |
|---|---|---|
| C01 | Thread hole flange | Ø196 thread hole flange with 5 x M16 – BC100 mm |
| CH1 | Hollow shaft | Ø36 Hollow shaft |

## Ordering Information

### Model Code (H-I-J-K-L)

| A | B | C | D | E | F | G | H | I | $J_1$ | $J_2$ | $J_3$ | K | L | $M_1$ | $M_2$ | N | O | $P_1$ | $P_2$ | $P_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C L M | 0 5 | C | | 1 | N | | C A | N | | | | | N N | | | S P | D D | N N N N N N | | |

*H – Brake options*

| Code | Description |
|---|---|
| CA | 3.170 Nm spring applied hydraulic release multi-disc holding brake (ISO10265) |

*I – Sealing options*

| Code | Description |
|---|---|
| N | NBR – Standard sealing |

*$J_1$ – Porting options – Inlet ports*

| Code | Type | Description |
|---|---|---|
| 1B | Metric threads | ISO Metric 9974-1, M22 x 1.5 |
| 3A | UNF threads | UNF (ISO 11926-1), 3/4 " - 16 UNF |

*$J_2$ – Porting options – Chase drain port*

| Code | Type | Description |
|---|---|---|
| B | Metric threads | ISO Metric 9974-1, M16 x 1.5 |
| K | UNF threads | UNF (ISO 11926-1), 9/16 " - 18 UNF |

*$J_3$ – Porting options – Brake release port*

| Code | Type | Description |
|---|---|---|
| A | Metric threads | ISO Metric 9974-1, M14 x 1.5 |
| K | UNF threads | UNF (ISO 11926-1), 1/2 " - 20 UNF |

*K – Speed sensor*

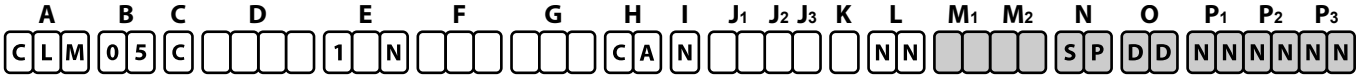
| Code | Description |
|---|---|
| N | Without speed sensor |

*L – Valve options*

| Code | Type | Description |
|---|---|---|
| NN | No flushing | No flushing |

## Ordering Information

### Model Code (M-N-O-P)




***$M_1$ – Paint options – Color***

| Code | Description |
|---|---|
| NN | No paint |
| SB | Standard black primer |

***$M_2$ – Paint options – Masking***

| Code | Type | Description |
|---|---|---|
| NN | No paint | No masking |
| 10 | Painted | Shaft and Mounting flange |
| 1H | Painted | Shaft, Mounting flange and High Speed motor mount |

***N – Packaging***

| Code | Description |
|---|---|
| SP | Single pack |

***O – Name tag***

| Code | Description |
|---|---|
| DD | Danfoss name tag - with data matrix |

***$P_1$ – Special features – Internal***

| Code | Description |
|---|---|
| NN | None |

***$P_2$ – Special features – External***

| Code | Description |
|---|---|
| NN | None |

***$P_3$ – Special features – Other***

| Code | Description |
|---|---|
| NN | None |

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