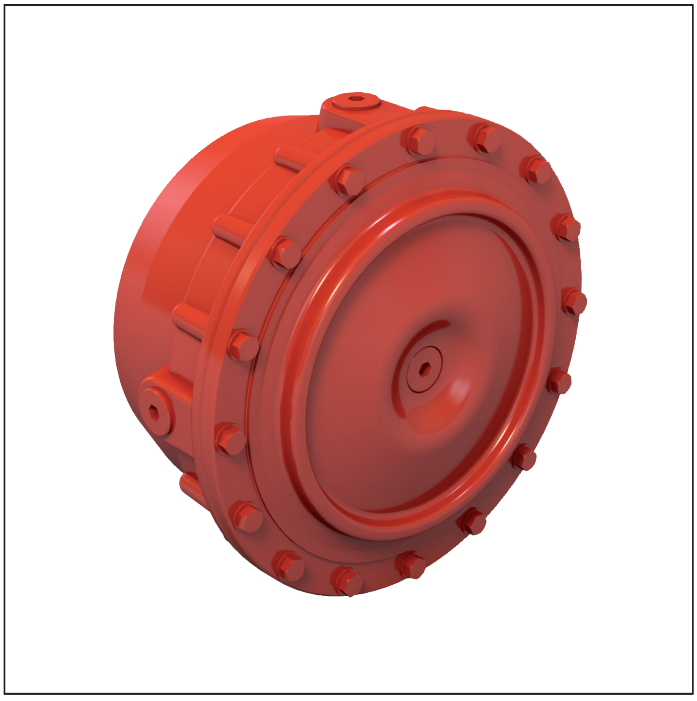
RE 15358/01.2020
Replaces: New

rexroth
A Bosch Company

Multi disc brake Hägglunds MDA



- Hägglunds MDA brake valid for Hägglunds CA motors
- Static brake torque range: 16 to 95 kNm [11801 to 70068 lb-ft]
- Pilot pressure 20 to 25 bar
- Maximum speed 80 to 100 rpm
- Displacement 0.155 to 0.318 l

Features

- Marine brake, specially designed for winches
- DNV type approval
- Torque levels adapted to CA motors
- Quick acting emergency brake for suspended loads
- Possibility for inductive position sensor
- ATEX version available
- Wet brake, oil filled

Contents

1 Ordering code

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

MD	A		05		26		N		1		00
01	02		03				04		05		06

01	**Multidisc brake**	
		MD

02	**Version**	
		A

03	**Brake size**	
	MDA 05 16	**05 16**
	MDA 05 26	**05 26**
	MDA 07 34	**07 34**
	MDA 10 48	**10 48**
	MDA 14 19	**14 19**
	MDA 14 38	**14 38**
	MDA 14 67	**14 67**
	MDA 21 95	**21 95**

04	**Type of seal**	
	NBR (Nitrile)	**N**
	FPM (Viton)	**V**

05	**Modification**	
		1-9

06	**Design**	
	Standard	**00**
	Special index *)	**01-99**

*) See section *7.3*

2 Functional description

2.1 Function

The MDA brake is a multi-disc design with a rotating disc centre (rotors) and a stationary housing (stators). It is a wet brake which means discs are running in oil-bath. The brake is actuated by spring force and released by hydraulic pressure. Brake torque builds up in disc set between rotating disc-centre (brake discs) and stationary housing (steel discs) by a spring force acting on disc set through a piston. The brake is normally activated giving brake torque. When pressurizing brake the piston will move against cover and stop, giving zero brake torque. Intended use is as static parking brake. The brake can also serve as security brake and emergency brake.

2.2 Design

MDA is designed for marine and offshore applications mainly for winches and suspended loads together with Hägglunds CA motors.
DNV type approval according to Standard for Certification No. 2.22 Lifting Appliances

Two types of MDA brakes

MDA 5, MDA 7 and MDA 10: is designed to be mounted directly on the connection side of motors CA 50 to CA 210

MDA 14 and MDA 21 is designed to be mounted separately on the shaft, either flange or torque arm mounted.
MDA 14 can also be tandem mounted directly on the connection side of CA motors, using tandem kit TA 21 2 01

2.3 Design ATEX version

The MDA brake in ATEX version must be ordered separately (ATEX version is not included in ordering code).

Area of application according to ATEX directive 2014/34/EU II 2G Ex h IIC T4 Gb / II 2D Ex h IIC T135°C Db.

Intended use of MDA brake in explosive proof environment is as static parking brake only. Dynamic braking is not allowed i.e use as emergency brake.

ATEX Inducive position sensor is standard for brakes in explosive environment version see *8.1.2*

Note!
Intended use of MDA brake in explosive proof environment is as static parking brake only

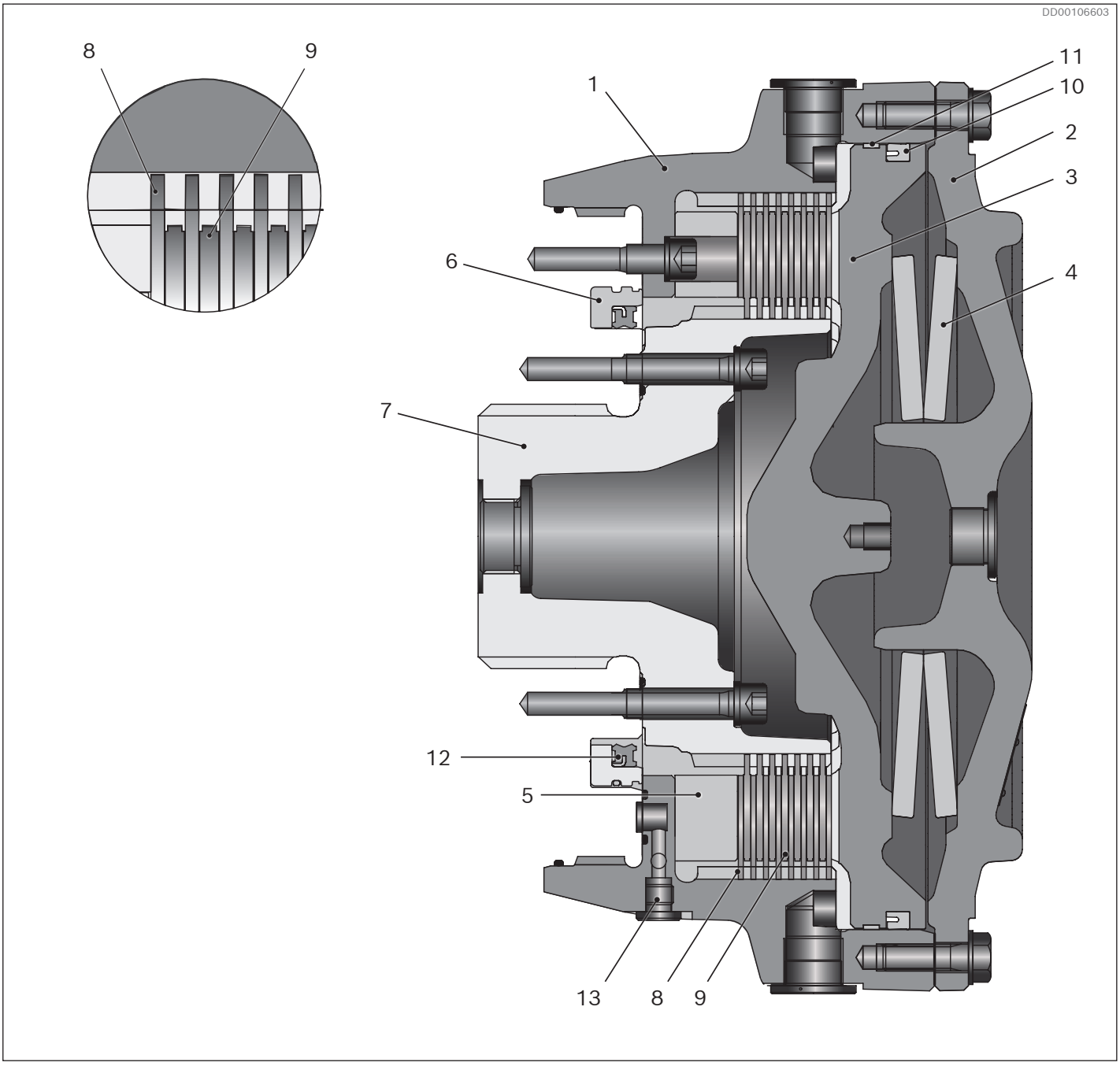


Fig. 1: Section view of Hägglunds MDA 5, MDA 7 and MDA 10

1. Brake housing	**8.** Steel disc, outer disc
2. Brake cover	**9.** Brake disc, inner disc
3. Brake piston	**10.** Piston seal
4. Disc spring	**11.** Guide strings
5. Spacer ring	**12.** Radial sealing (sealed off
6. Seal cover	between motor and brake)
7. Disc center	**13.** Flushing port F3, F4

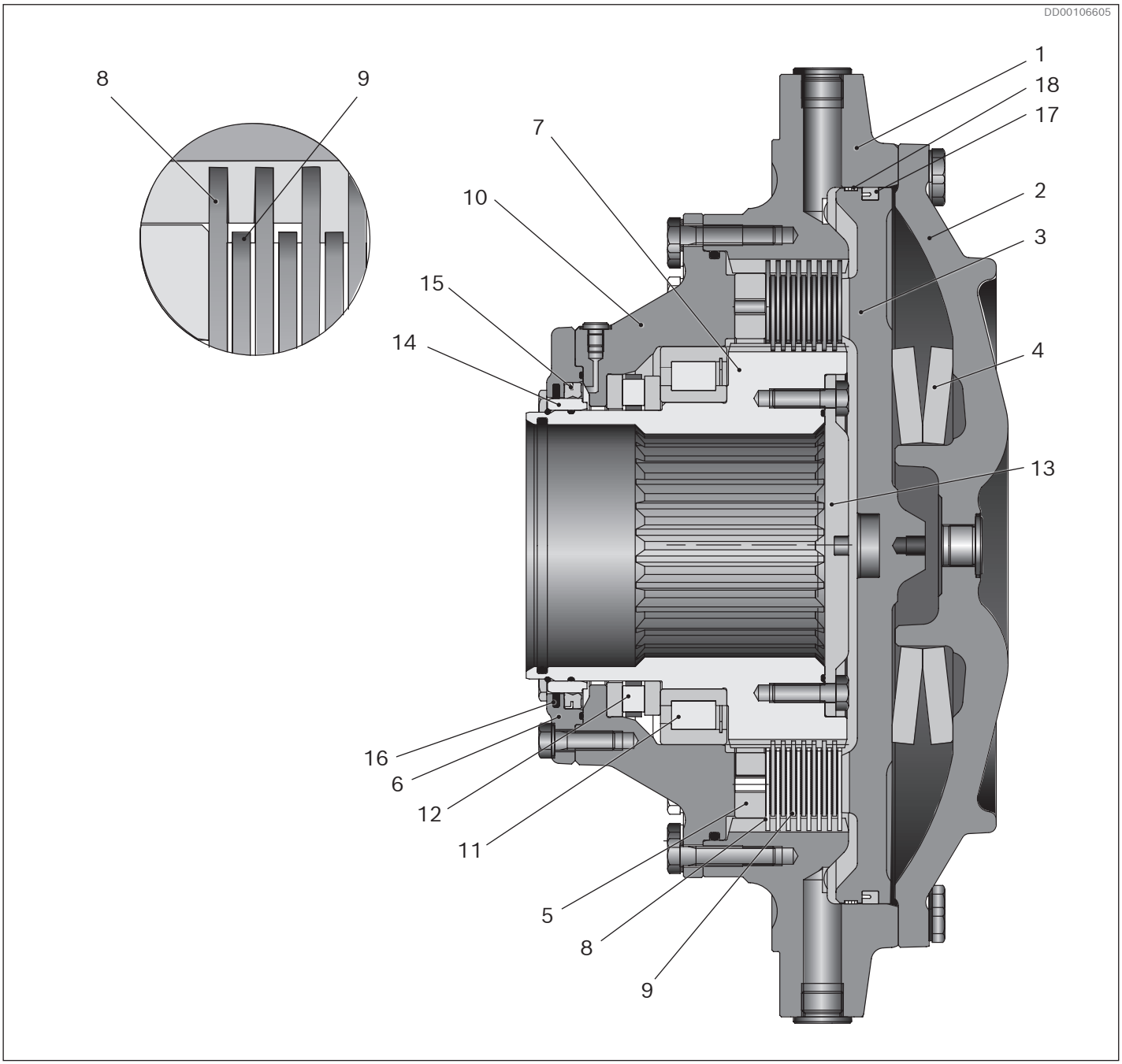


Fig. 2: Section view of Hägglunds MDA 14 and MDA 21

1. Brake housing	**10.** Bearing housing
2. Brake cover	**11.** Cylinder roller bearing
3. Brake piston	**12.** Cylinder roller thrust bearing
4. Disc spring	**13.** Cover
5. Spacer ring	**14.** Wear ring
6. Seal cover	**15.** Radial sealing
7. Disc center	**16.** Dust seal
8. Steel disc, outer disc	**17.** Piston seal
9. Brake disc, inner disc	**18.** Guide string

3 Fluid connections

3.1 Hydraulic symbol

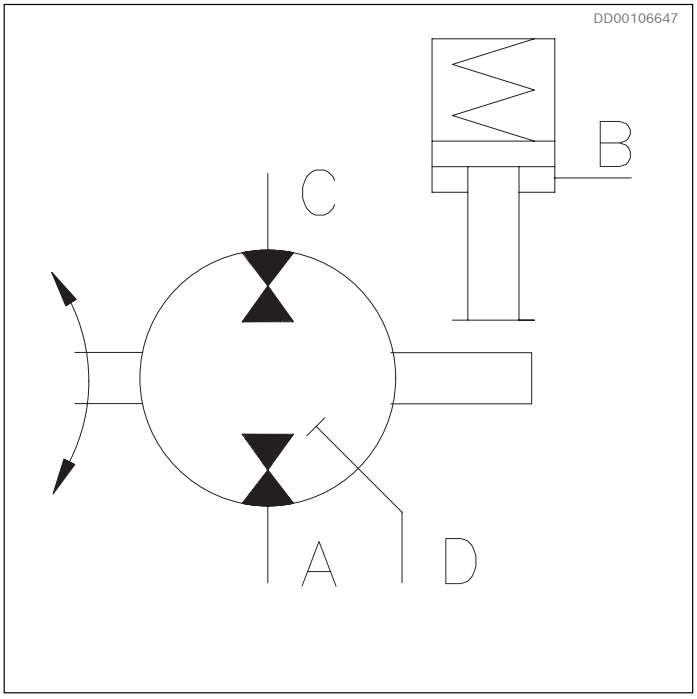


Fig. 3: Hydraulic symbol

Port locations and dimensions, *see Table 1: Port dimensions*

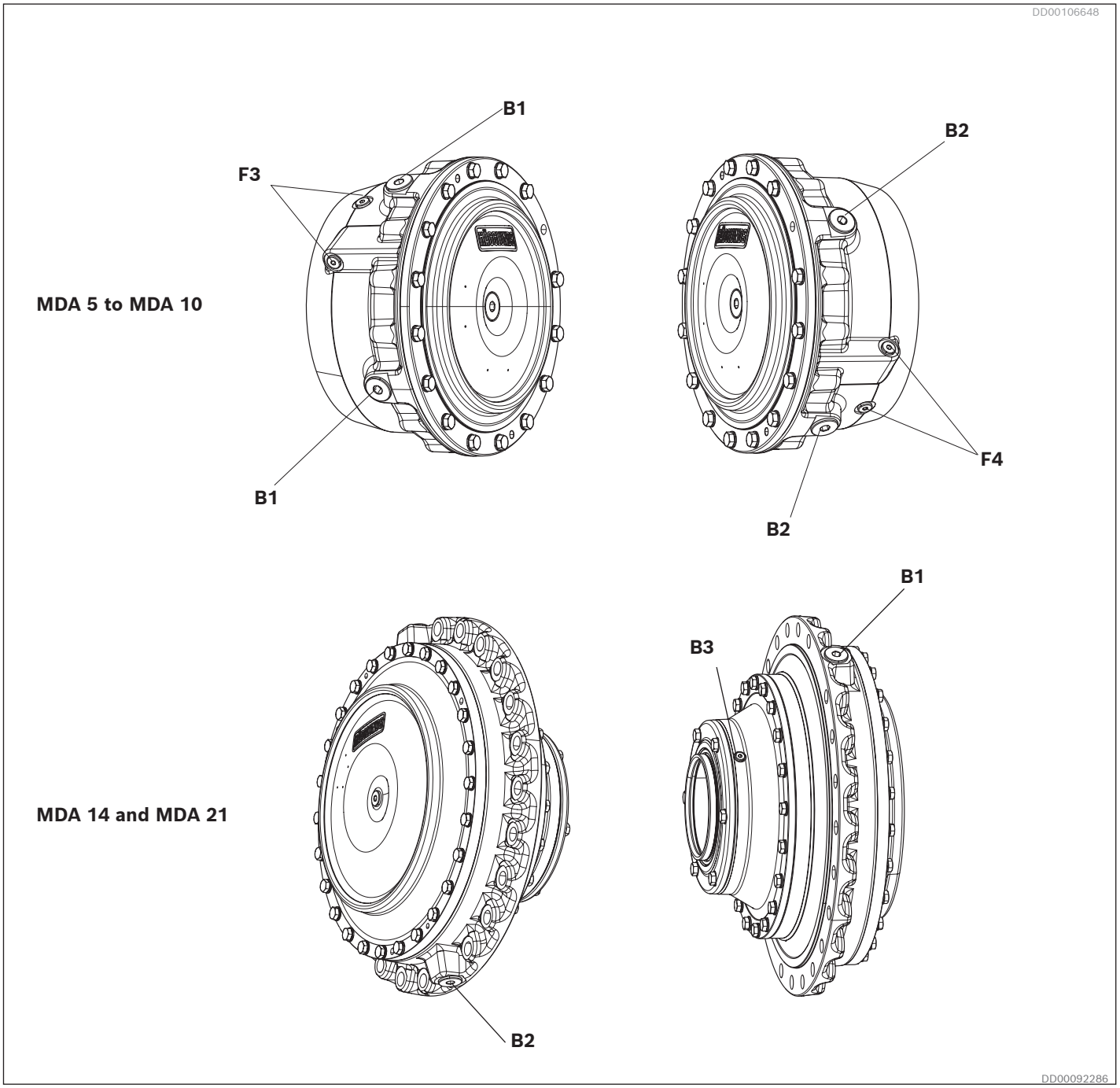


Fig. 4: Port connections Hägglunds MDA

Table 1: Port dimensions

Connection	Description	Dimensions		Remarks
		MDA 5, MDA 7, MDA 10	MDA 14, MDA 21	
B1	Main connection	G 3/4″	G 3/4″	Normally plugged at delivery
B2	Alternative main connection	G 3/4″	G 3/4″	Normally plugged at delivery
B3	Flushing connection		G 1/8″	Normally plugged at delivery
F3, F4	Flushing connections	G 1/4″		Normally plugged at delivery For flushing of axial bearing and housing of motor Also for flushing of motor seal when vertical mounting

4 Technical data

4.1 Brake data

Table 2: Brake data (metric)

			Brake type							
			MDA 5 16	**MDA 5 26**	**MDA 7 34**	**MDA 10 48**	**MDA 14 19**	**MDA 14 38**	**MDA 14 67**	**MDA 21 95**
Torque [1] dynamic		Nm	13600 ± 400	22600 ± 700	30400 ± 900	41500 ± 2000	16300 ± 900	32700 ± 1800	57000 ± 3000	81800 ± 4300
Torque [1] static		Nm	15800 ± 500	26400 ± 800	35500 ± 1100	48400 ± 2300	19000 ± 1000	38200 ± 1800	66800 ± 3500	95000 ± 5000
Corresponding permitted motor torque [2]		Nm	9100	14250	20000	28500	11400	20000	39800	59800
Max energy for emergency braking		kJ	320	540	755	1080	270	540	950	1350
Temperature limits [5]										
NBR	Min	°C	-20	-20	-20	-20	-20	-20	-20	-20
	Max	°C	+70	+70	+70	+70	+70	+70	+70	+70
FPM	Min	°C	-20	-20	-20	-20	-20	-20	-20	-20
	Max	°C	+100	+100	+100	+100	+100	+100	+100	+100
Inertia [3]		kgm^2	0.090	0.110	0.128	0.156	0.270	0.307	0.360	0.417
Displacement		l	0.155	0.155	0.195	0.256	0.318	0.318	0.318	0.318
Pilot pressure		bar	20-25	20-25	20-25	20-25	20-25	20-25	20-25	20-25
Peak pressure [4]		bar	50	50	50	50	50	50	50	50
Weight		kg	100	100	100	100	230	230	230	230
Oil volume		l	1.7	1.7	1.7	1.7	2.0	2.0	2.0	2.0

1) The torques are valid provided that the oil used is a conventional petroleum based hydraulic oil. When other oils are used please contact your Bosch Rexroth representative.

2) Fatigue safe for pulsating torque / unidirectional

3) For rotating parts in brake (disc centre and inner discs).

4) The brakes are designed according to DNV-rules. Test pressure 50 bar.

Peak/transient pressure 50 bar maximum, allowed to occur up to 10000 times.

5) See chapter *5: Type of seal*

Speed

MDA 5-10

Max speed continuously 100 rpm*

Peak up to 220 rpm, t ≤ 2 min

MDA 14-21

Max speed continuously 80 rpm**

Peak up to 220 rpm, t ≤ 2 min

* Flushing in main connection B1-B2 is recommended for speeds above 80 rpm. Flushing with 10 l/min.

** Speeds above 80 rpm needs flushing with 10 l/min in flushnig connection B3.

Note: Flushing of brake can build up back pressure which results in reduced braking torque, please see *Fig. 6 and Fig. 7*

Table 3: Brake data (US)

			Brake type							
			MDA 5-16	**MDA 5-26**	**MDA 7-34**	**MDA 10-48**	**MDA 14-19**	**MDA 14-38**	**MDA 14-67**	**MDA 21-95**
Torque [1] dynamic		lb·ft	10000 ± 295	16700 ± 520	22400 ± 660	30600 ± 1480	12000 ± 660	24100 ± 1330	42000 ± 2200	60300 ± 3170
Torque [1] static		lb·ft	11700 ± 370	19500 ± 590	26200 ± 810	35700 ± 1700	14000 ± 740	28200 ± 1330	49300 ± 2580	70000 ± 3690
Corresponding permitted motor torque [2]		lb·ft	6700	10500	14750	21000	8400	14750	29350	44100
Max energy for emergency braking		Btu	303	511	715	1023	256	511	900	1278
Temperature limits [5]										
NBR	Min	°F	-4	-4	-4	-4	-4	-4	-4	-4
	Max	°F	+158	+158	+158	+158	+158	+158	+158	+158
FPM	Min	°F	-4	-4	-4	-4	-4	-4	-4	-4
	Max	°F	+212	+212	+212	+212	+212	+212	+212	+212
Inertia [3]		lb·ft²	2.3	2.3	3.0	3.7	6.4	7.3	8.5	9.9
Displacement		US gal	0.041	0.041	0.052	0.068	0.084	0.084	0.084	0.084
Pilot pressure		psi	290-360	290-360	290-360	290-360	290-360	290-360	290-360	290-360
Peak pressure [4]		psi	725	725	725	725	725	725	725	725
Weight		lb	220	220	220	220	510	510	510	510
Oil volume		US gal	0.45	0.45	0.45	0.45	0.53	0.53	0.53	0.53

1) The torques are valid provided that the oil used is a conventional petroleum based hydraulic oil. When other oils are used please contact your Bosch Rexroth representative.

2) Fatigue safe for pulsating torque / unidirectional

3) For rotating parts in brake (disc centre and inner discs).

4) The brakes are designed according to DNV-rules. Test pressure 725 psi.

Peak/transient pressure 725 psi maximum, allowed to occur up to10000 times

5) See chapter *5: Type of seal*

Speed

MDA 5-10

Max speed continuously 100 rpm*

Peak up to 220 rpm, t ≤ 2 min

MDA 14-21

Max speed continuously 80 rpm**

Peak up to 220 rpm, t ≤ 2 min

* Flushing in main connection B1-B2 is recommended for speeds above 80 rpm. Flushing with 2.6 gpm.

** Speeds above 80 rpm needs flushing with 2.6 gpm in flushing connection B3.

Note: Flushing of brake can build up back pressure which results in reduced braking torque, please see *Fig. 6 and Fig. 7*

4.2 External load MDA 14 and MDA 21

F_{max} external load 200 kN
Basic load ratings
C_{stat} = 690 kN
C_{dyn}= 410 kN

Calculation of rated bearing life according to following:
$L = (16666/n) \cdot (410/P)^{10/3} \cdot 0.3$ [h]
n = speed in rpm
P = load in kN

Example: n = 70 rpm, P= 100 kN
$L = (16666/70) \cdot (410/100)^{10/3} \cdot 0.3 = 7879$ h

Note!
No axial load permitted for the brake!.

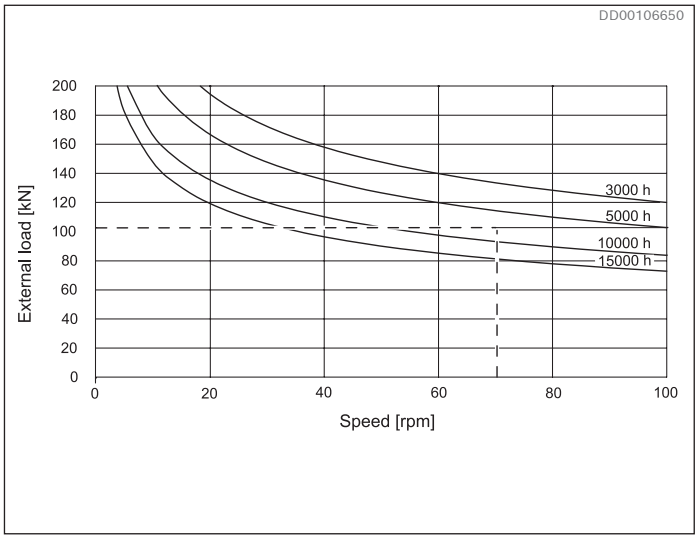


Fig. 5: Lifetime external load MDA 14 and MDA 21

4.3 Reduction of brake torque

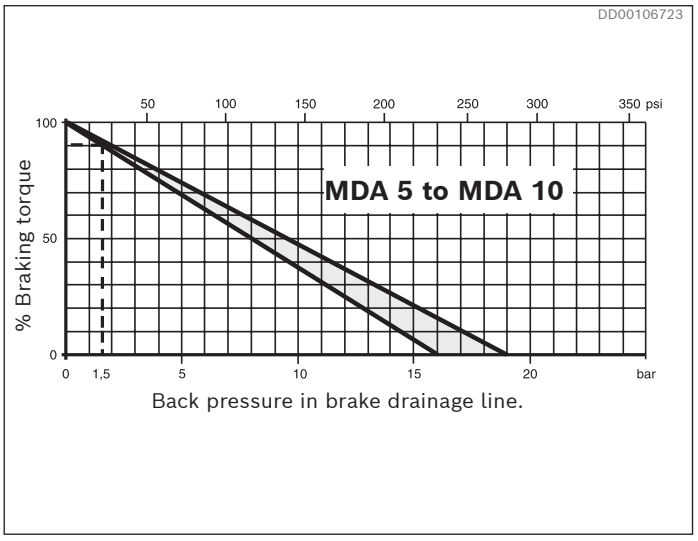


Fig. 6: MDA 5 to MDA 10

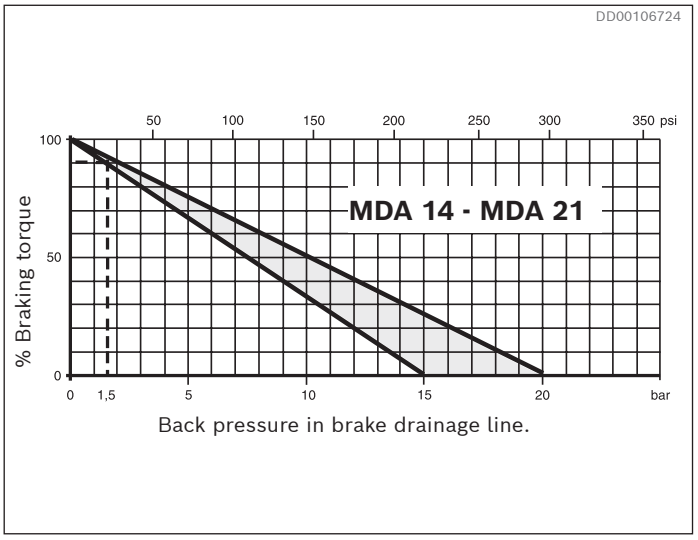


Fig. 7: MDA 14 and MDA 21

The diagrams shows the falling braking torque M_{max} for increasing pressure in the brake drain line.
Example: MDA 10 has a braking torque of 41500 ± 2000 Nm (30600 ± 1780 lbf·ft), when the brake is unpressurized.
Assume that the pressure in brake cylinder drain is 1.5 bar / 21.76 psi. The diagram shows that the actual brake torque (M_{act}) corresponds to only 90% of M_{max}

4.4 Hydraulic fluids

Hägglunds MDA brakes are primarily designed to operate with conventional petroleum based hydraulic fluids.

Before the start of project planning, see data sheet RE 15414, Hydraulic fluid quick reference, for detailed information on hydraulic fluids and specific additional demands.

Filtration of the hydraulic fluid

A contamination level of 18/16/13 or cleaner, according to ISO 4406 is required.

The less contamined the fluid, the longer the service life of the brake, all things equal.

4.5 Painting system

Corrosion protection

The painting system of Hägglunds motors and accessories are avalible in two different corrosivity categories regarding corrosion protection in accordance with SS-EN ISO 12944:

- C3 - Corrosivity category Medium - which is recommended for normal urban and industrial atmosphere.
- C5M - Corrosivity category Very High - which is recommended for marine environment with high salt load or other aggressive atmosphere.

Colour

Standard colour for Hägglunds motors and accessories is orange (RAL 2002)

5 Type of seal

Option N:

NBR (Nitrile) Prefered alternative at low ambient temperatures and moderate oil temperatures.
See section *4.1: Brake data*

Note! All seals are of NBR material except for main radial lip seal which is of FPM material.

Option V:
FPM (Viton)

Note! All seals of significance are made of FPM material.

Fluid type

For some fluids, specific sealing materials are recommended. See data sheet RE 15414.

6 Dimensions / Interface

For dimensional drawings, see *10 Related documents*.

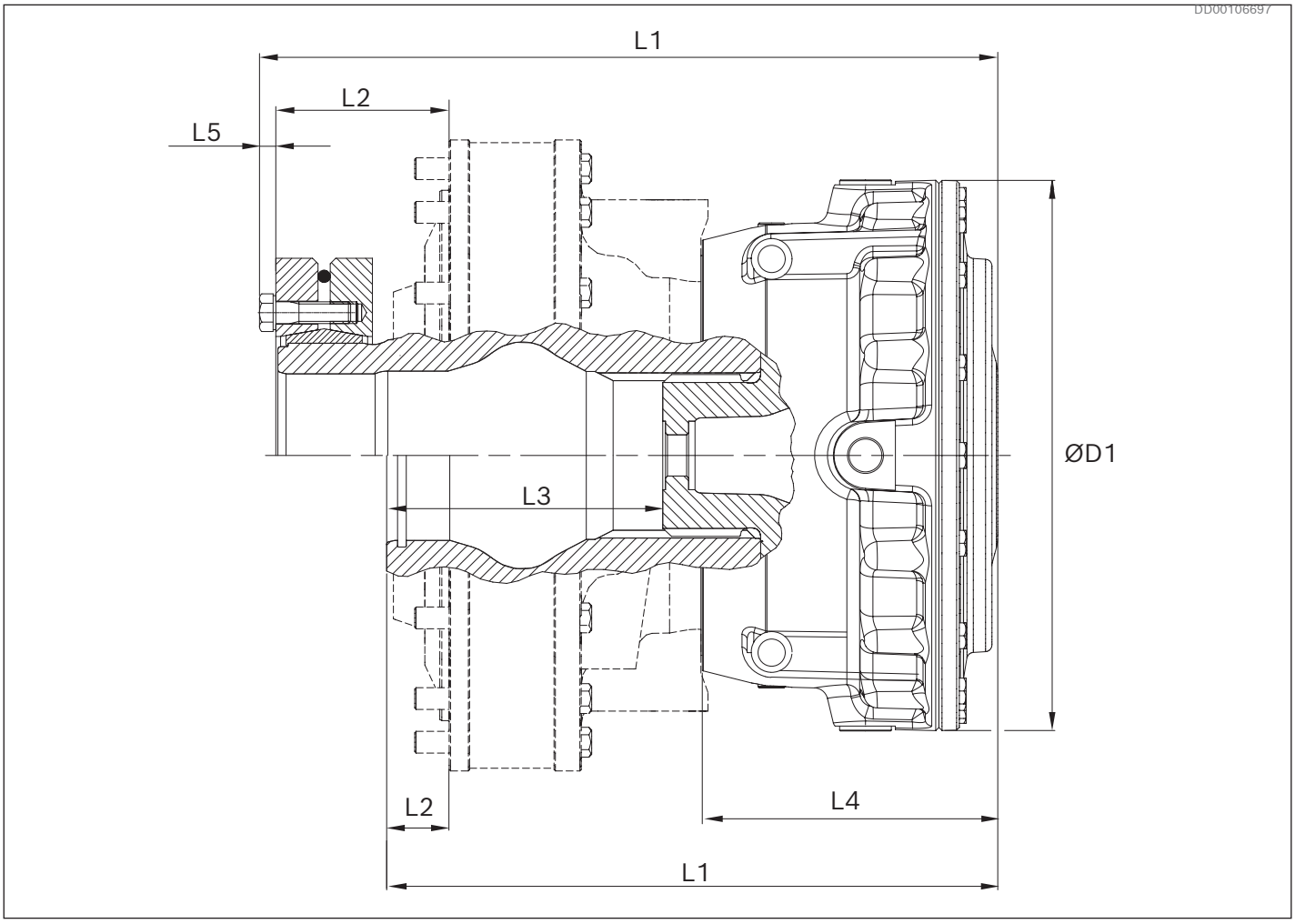


Fig. 8: Dimensions MDA 5 to MDA 10 mounted on motor

			Dimensions					
			Splines			Shrink disc		
			CA 50/CA 70	CA 100/CA140	CA 210	CA 50/CA 70	CA 100/CA140	CA 210
D1	Outer diameter	mm	405			405		
		in	15.94			15.94		
L1	Total length	mm	450	537	638	542	642	781.5
		in	17.72	21.14	25.12	21.34	25.28	30.77
L2	Length to hollow shaft	mm	46.5	135.5	156.5	126	229	288
		in	1.831	5.335	6.161	4.96	9.02	11.34
L3	Length of customer shaft inside motor	mm	203	290	391.5	–	–	–
		in	7.99	11.42	15.41	–	–	–
L4	Length of brake	mm	217			217		
		in	8.54			8.54		
L5	Protruding length of screws	mm	–			12		
		in	–			0.47		

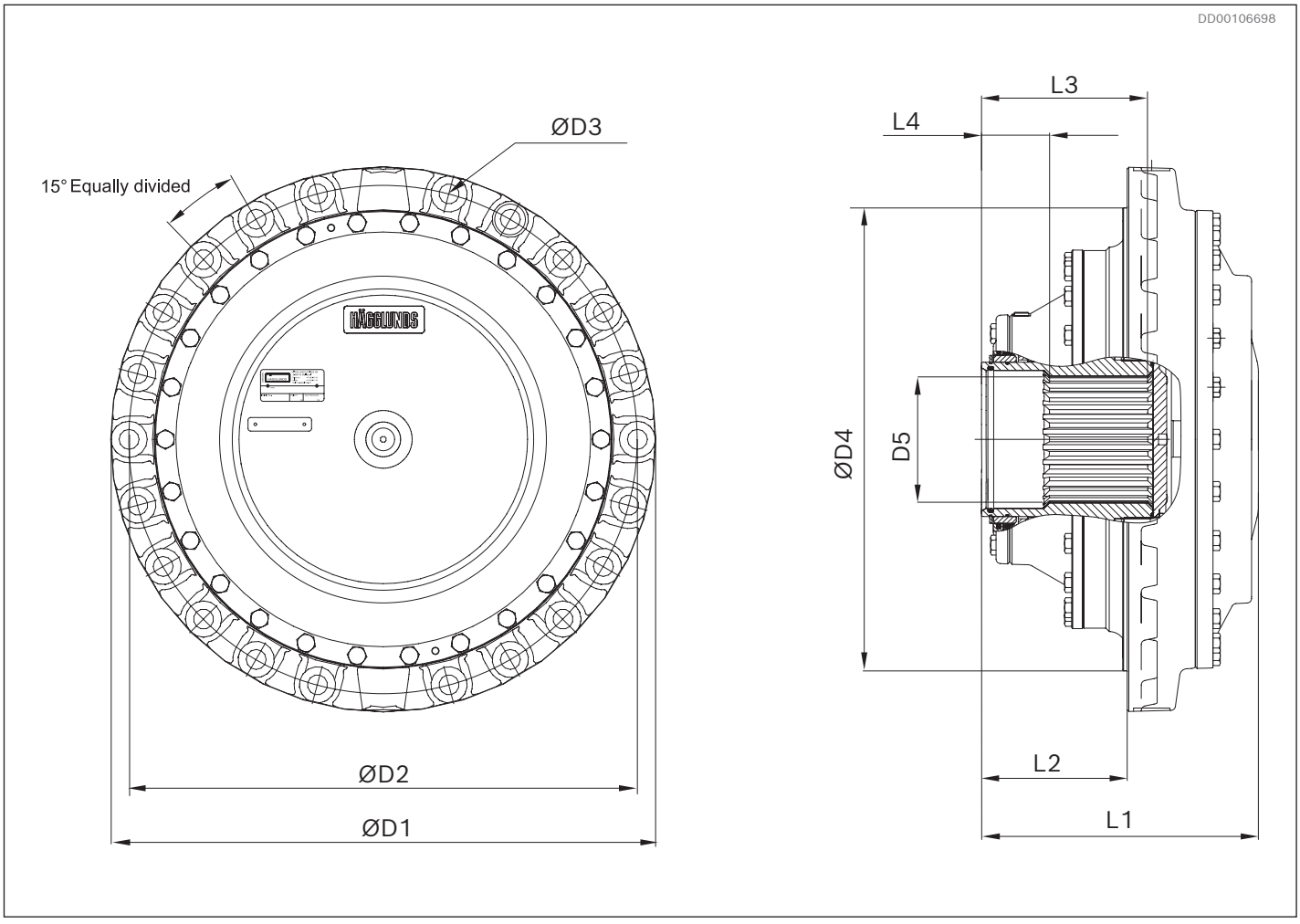


Fig. 9: Dimensions MDA 14 and MDA 21

		Dimensions	
		mm	**in**
D1	Outer diameter	600	23.62
D2	Pitch diameter	560	22.05
D3	Hole diameter	22	0.87
D4	Guide diameter	510	20.08
D5	Spline size DIN 5480	N150 x 5 x 30 x 28 x 9H	
L1	Total length	305	12.01
L2	Length to hollow shaft	160.5	6.32
L3	Length to spline end	184	7.24
L4	Length to start of spline	74	2.91

7 Mounting alternatives

7.1 Hägglunds MDA mounting alternatives

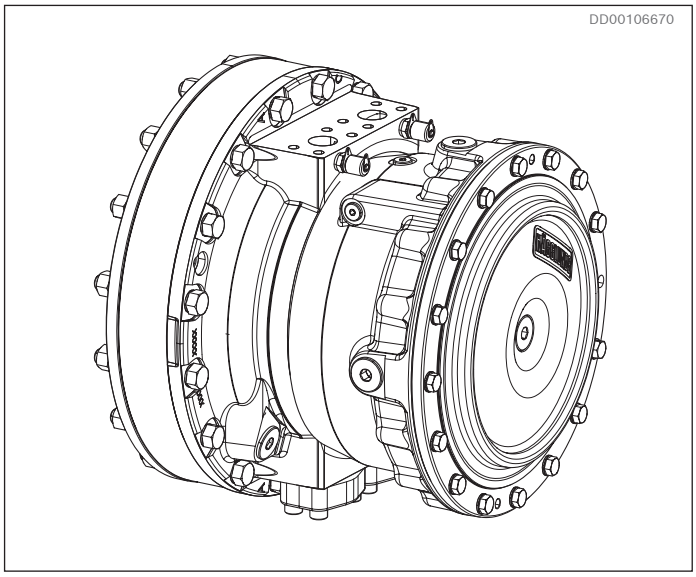


Fig. 10: Example, MDA 5, MDA 7 or MDA 10 mounted on CA 50

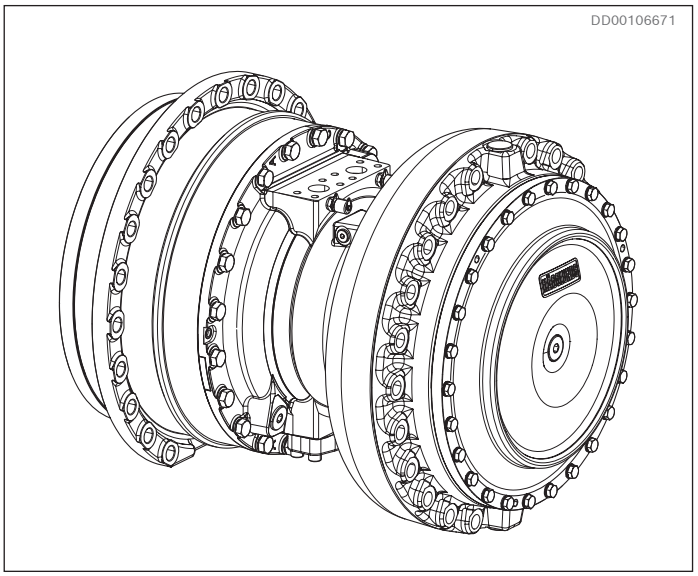


Fig. 11: Example, MDA 14 or MDA 21 tandem mounted on CA 210

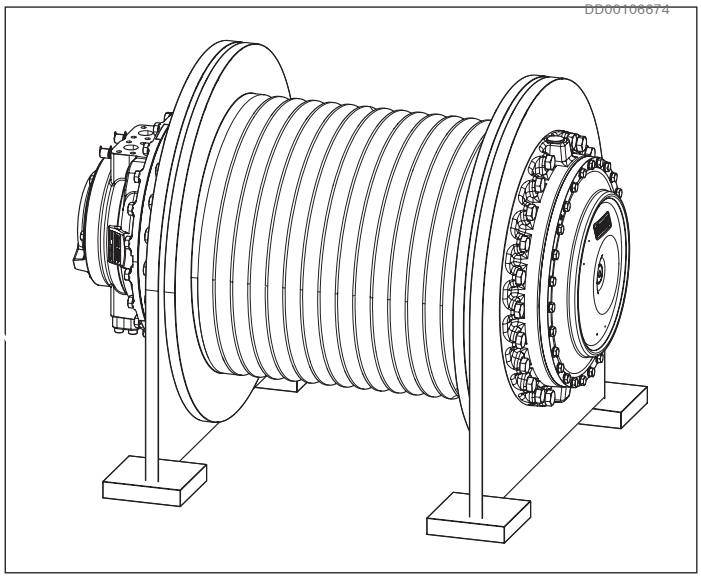


Fig. 12: Example MDA 14 or MDA 21 seperately mounted (flange mounting)

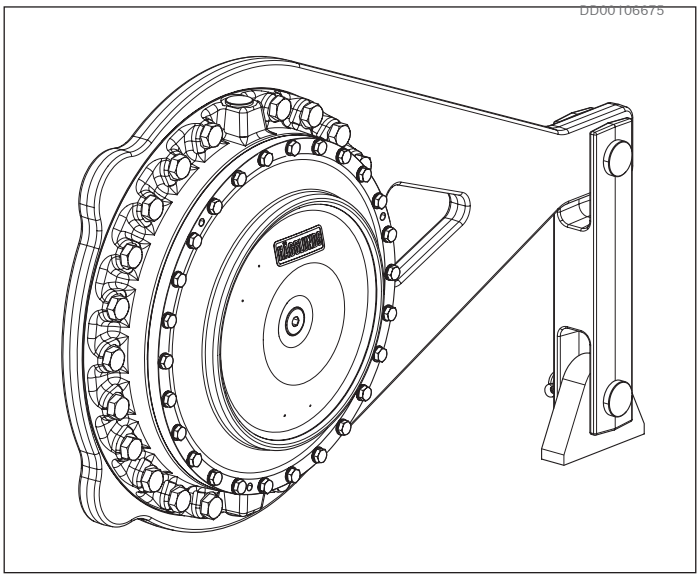


Fig. 13: Example MDA 14 or MDA 21 seperately mounted (torque arm mounting).

Table 4: Possible mounting alternatives

	Mounted on CA motor	Tandem mounting on CA motor	Seperately mounted
MDA 5 16	X		
MDA 5 26	X		
MDA 7 34	X		
MDA 10 48	X		
MDA 14 19		X	X
MDA 14 38		X	X
MDA 14 67		X	X
MDA 21 95			X

7.1.1 General information

Customer shafts

Mounting of MDA is done according to standard shaft recommendations for CA motors.

Assembly tools

Use the same standard assembly tools as for CA motors.

Mounting kits

- Standard mounting kit for CA motors with MDA 5 to MDA 10 brakes. See *Fig. 14*
  Material ID: R939002582
- Mounting kit for torque arm mounted MDA 14 and MDA 21 brakes. See *Fig. 18*
  Material ID: R939058616
- Mounting kit for CA motors with tandem mounted MDA 14. Use Screw MC6S M20x310. See *Fig. 19*
  Material ID: R939054454

7.1.2 Installation of Hägglunds CA with MDA on customer shaft

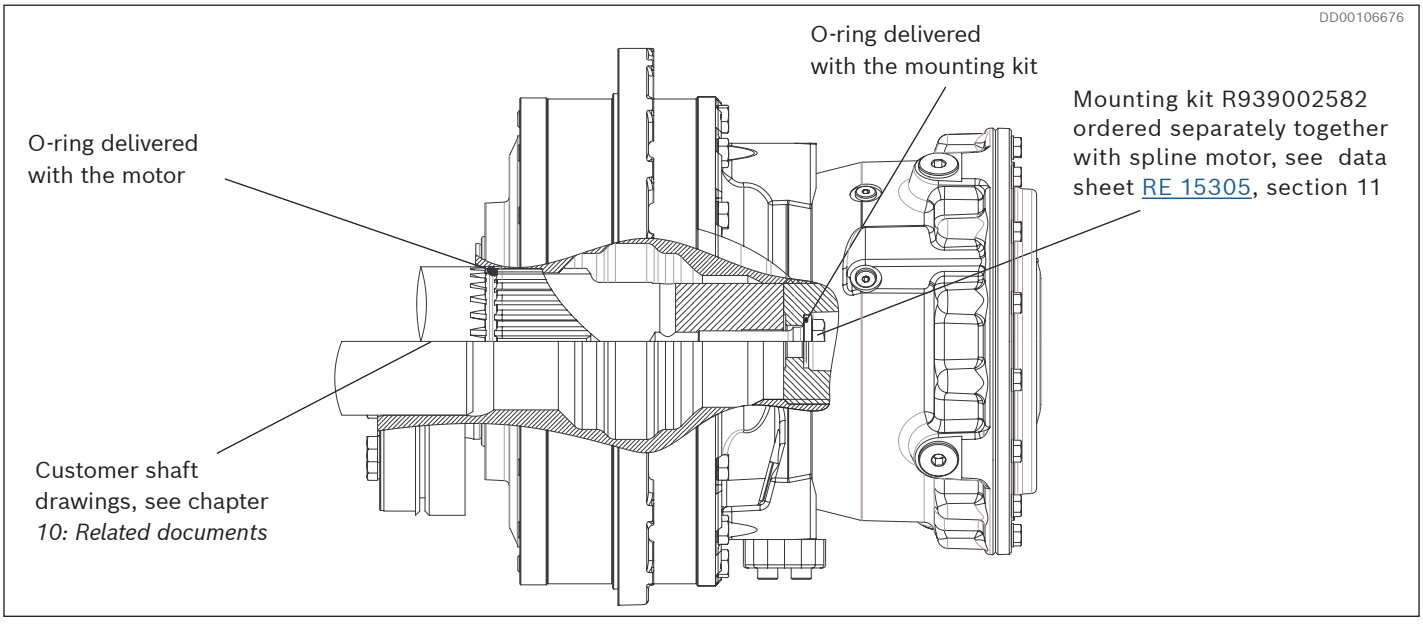


Fig. 14: Example torque arm mounted CA motor with spline or shrink disc coupling and MDA brake on customer shaft

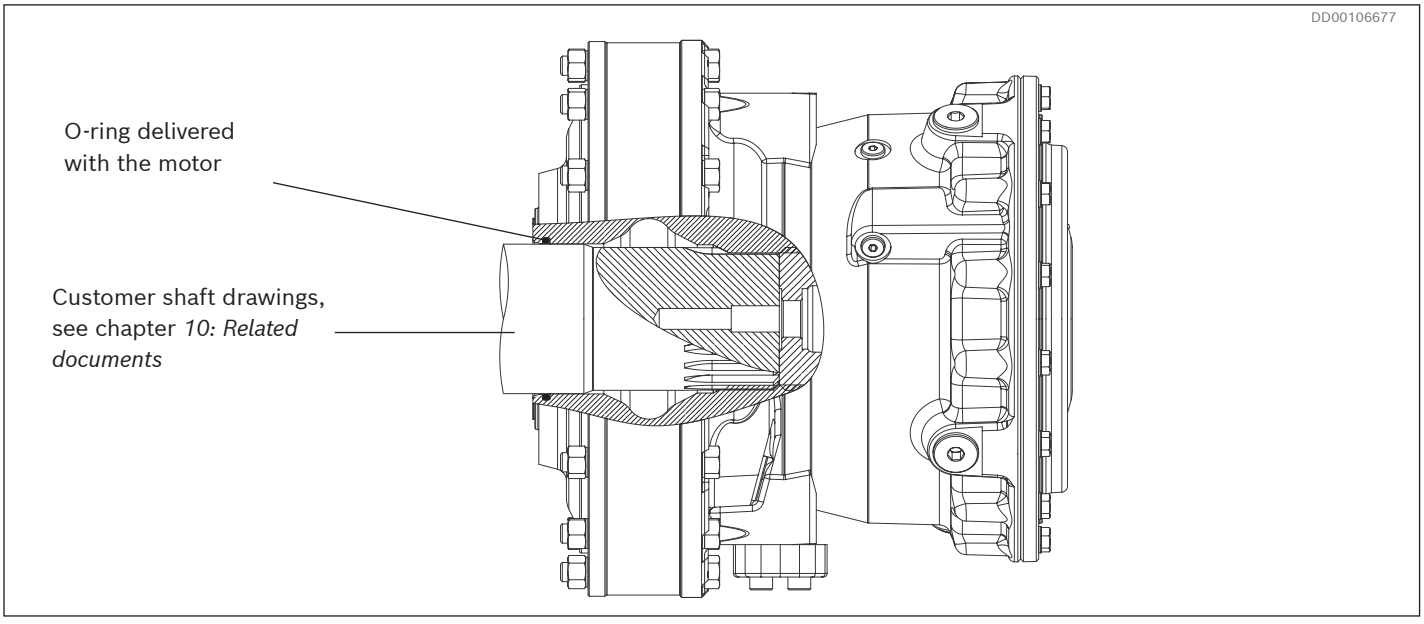


Fig. 15: Example flange mounted CA motor with spline and MDA brake on customer shaft

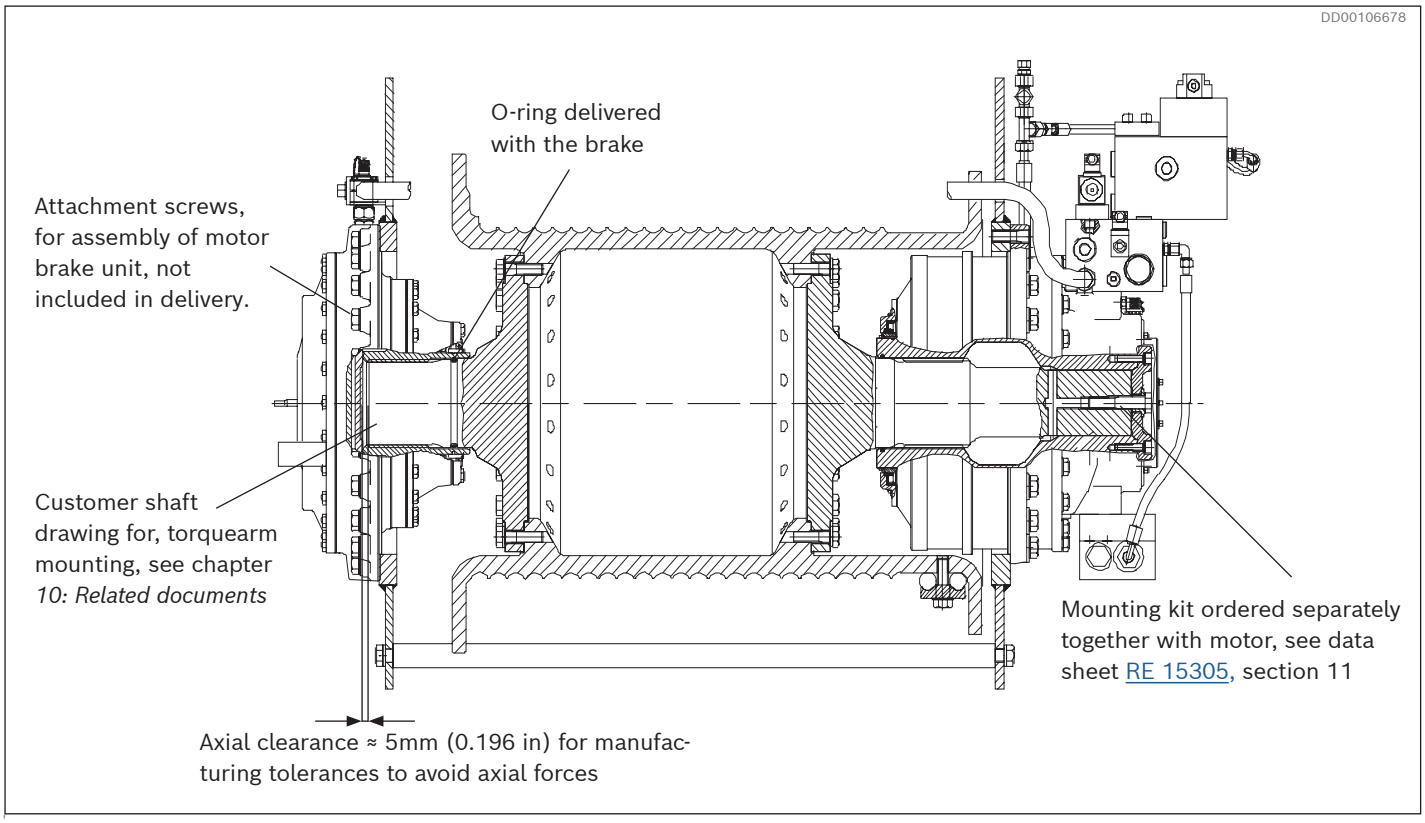


Fig. 16: Example flange mounted CA motor with spline and MDA brake on customer shaft

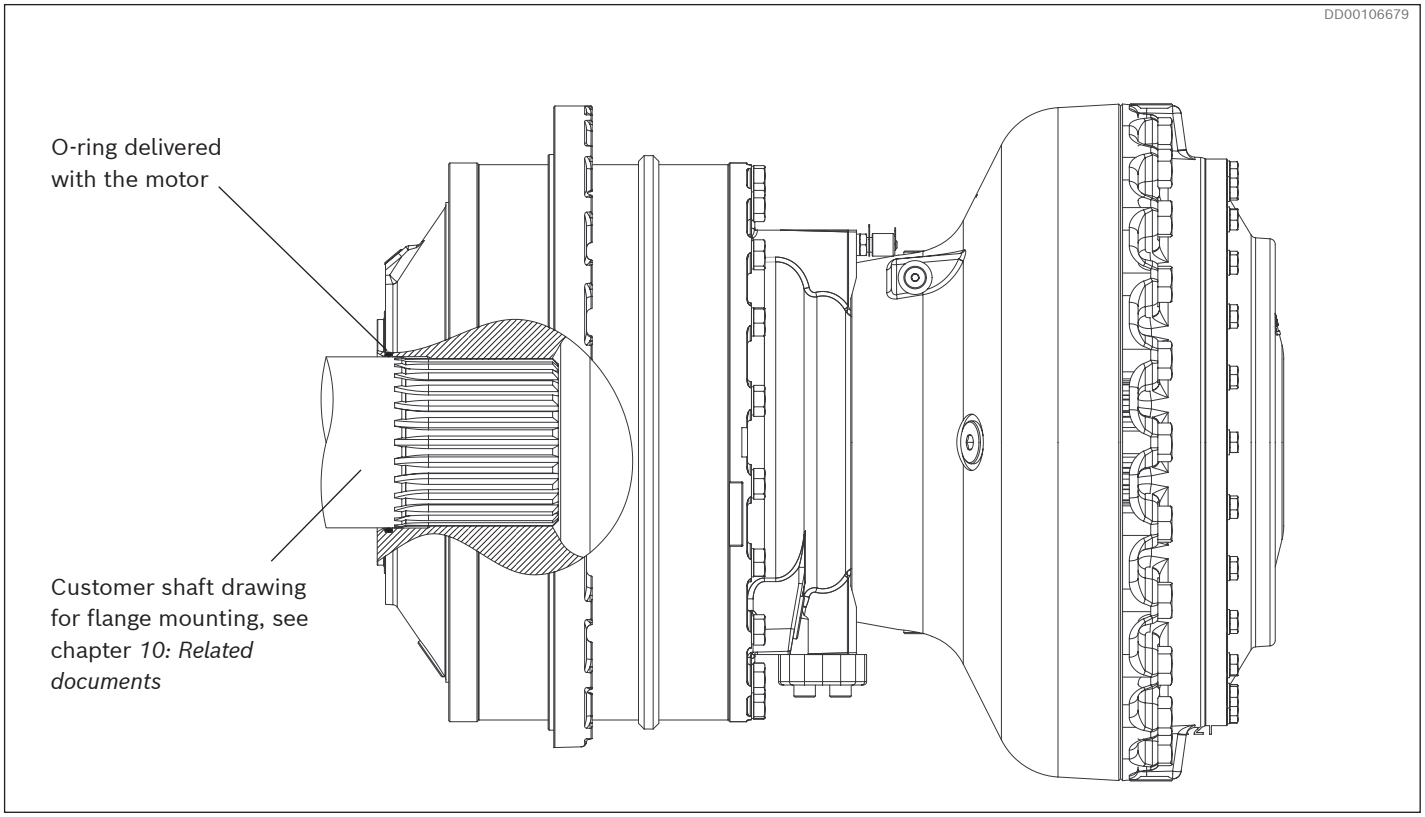


Fig. 17: Example flange mounted CA motor with tandem mounted MDA 14 brake on customer shaft

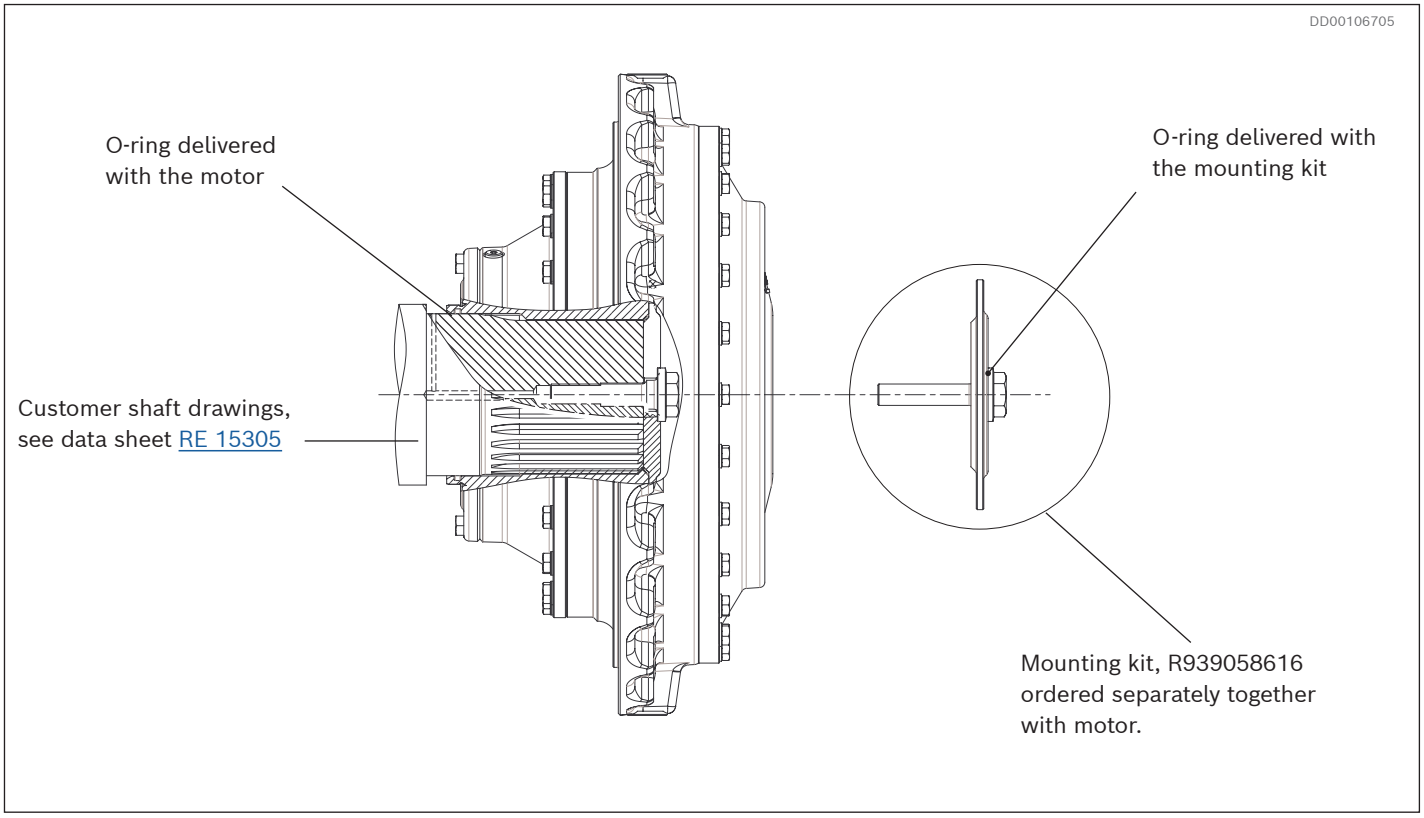


Fig. 18: Example torque arm mounted MDA 14 and MDA 21 on customer shaft

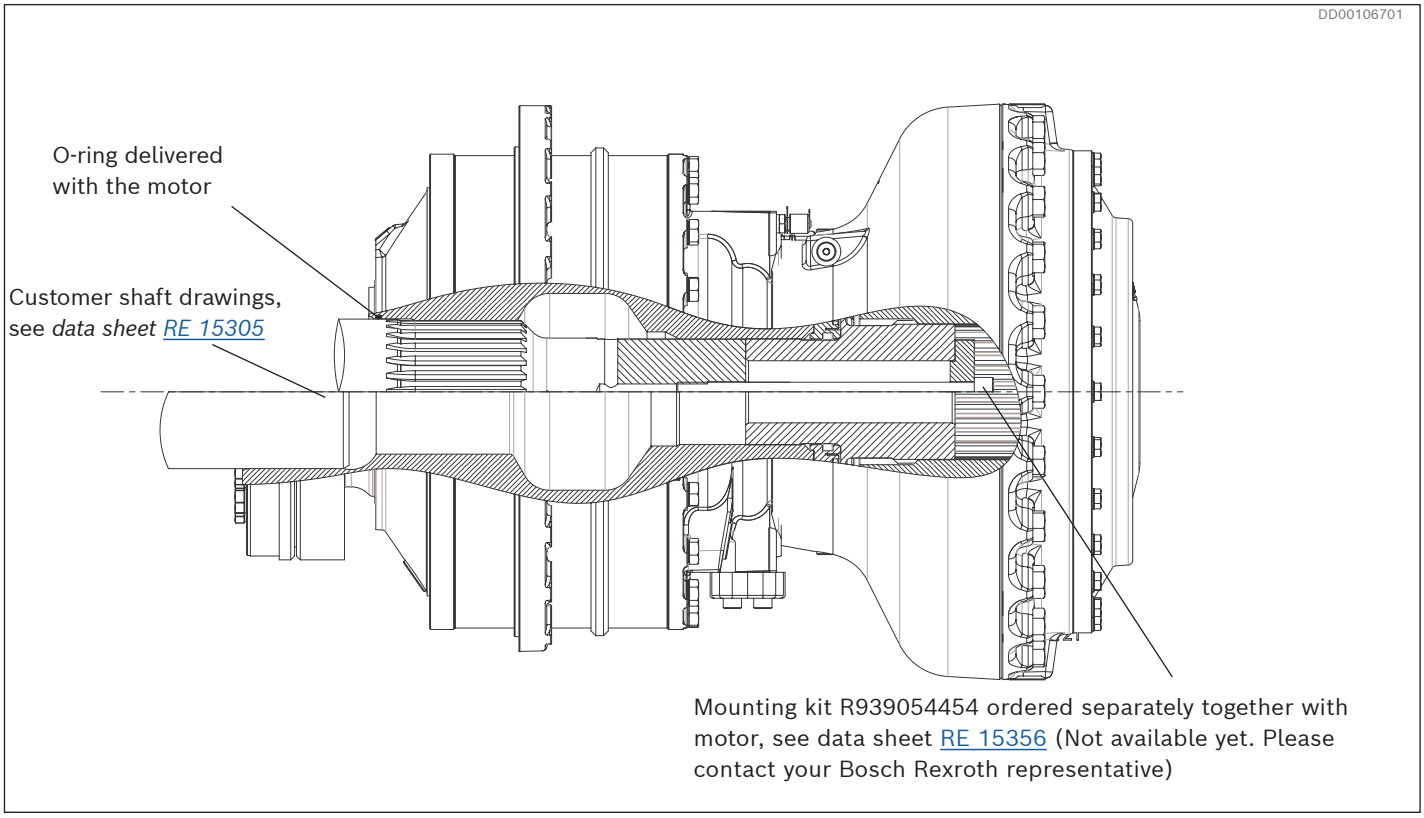


Fig. 19: Example CA motor with spline or shrink disc coupling and tandem mounted MDA 14 brake on customer shaft

7.2 Vertical mounting

Vertical installation with motor shaft or brake shaft pointing upwards not allowed. Risk for build in of air inside brake.

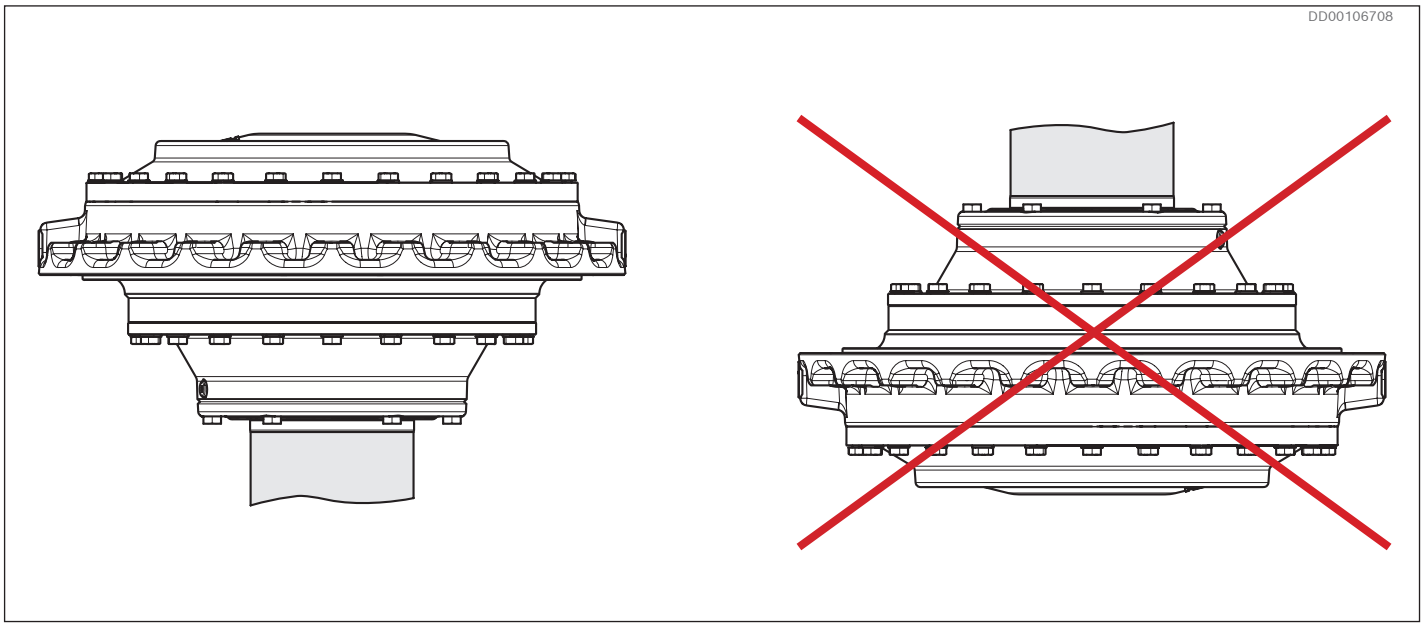


Fig. 20: Example vertical mounting of MDA 14

7.3 Special index 33: Brake for marine environment

- Available for MDA 14 and MDA 21
- Brake equipped with shaft side wear ring of stainless steel

To be ordered separately

- Painting system C5M-Corrosivity category Very High is recommended

8 Accessories

8.1 Inductive position sensor kit

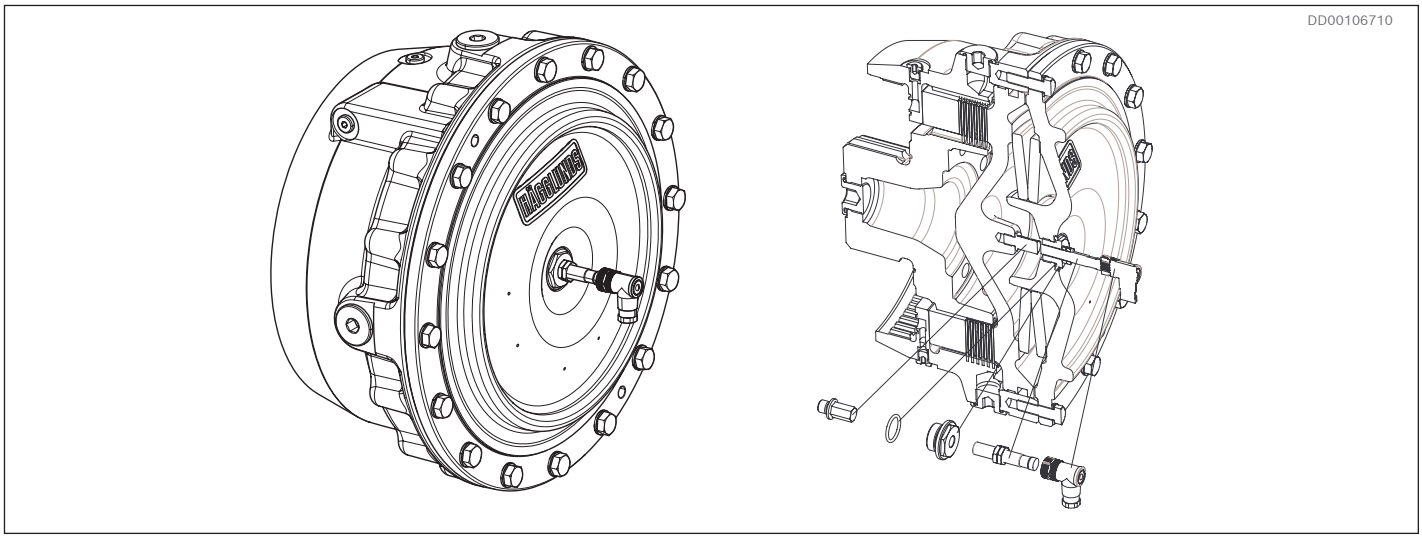


Fig. 21: MDA 5 to MDA 10 with inductive position sensor

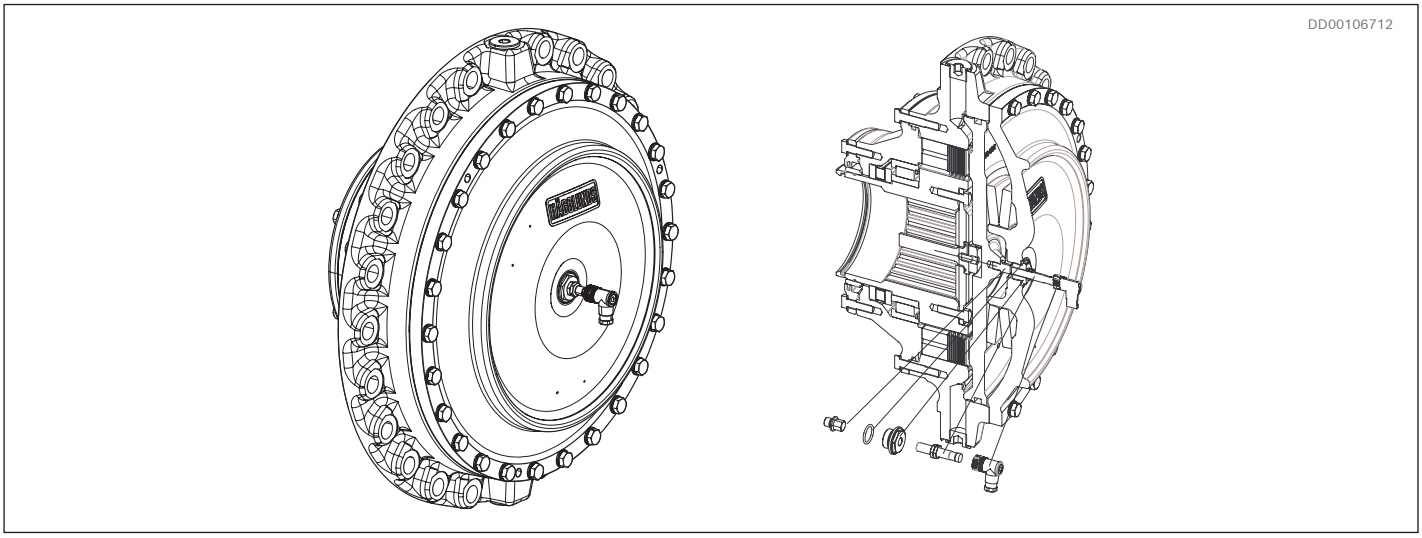


Fig. 22: MDA 14 and MDA 21 brake with inductive position sensor

Features

- Inductive position sensor used as brake indicator
- ATEX Inducive position sensor is standard for brakes in explosive environment version, see *8.1.2*

Description

Indication of deactivated brake protects the drive from running motor against actuated brake.

Inductive position sensor is available for all Hägglunds MDA brakes

- Inductive position sensor kit MDA 5 to MDA 10 **Material ID: R939055730**
- Inductive position sensor kit MDA 14 and MDA 21 **Material ID: R939055547**

8.1.1 Inductive position sensor

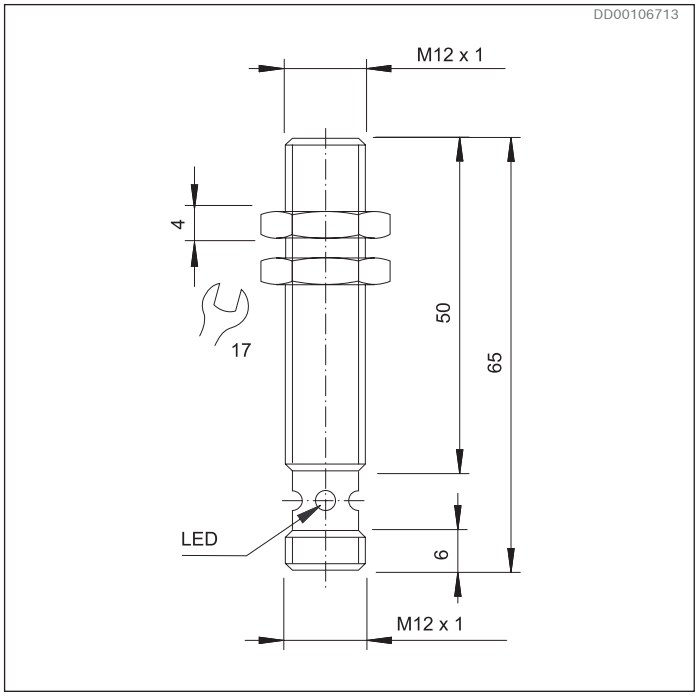


Fig. 23: Dimensions inductive position sensor for MDA 5 to MDA 21

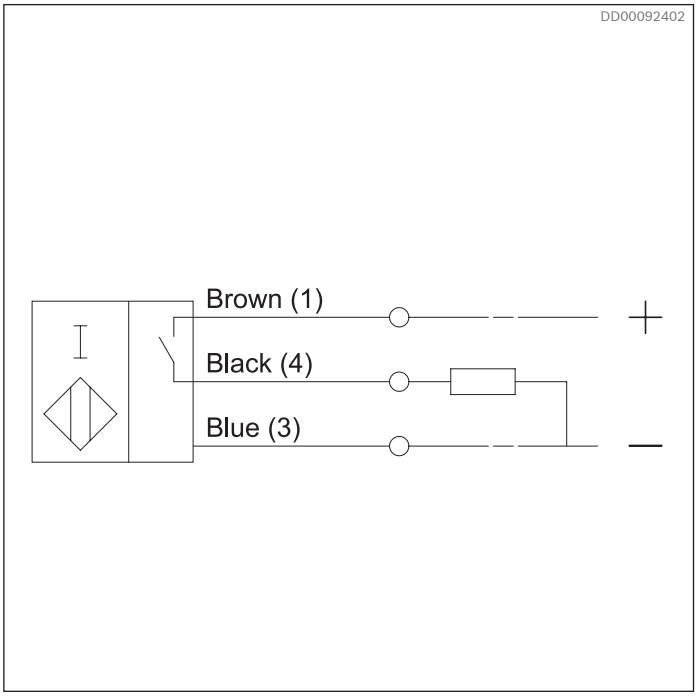


Fig. 24: Wiring diagram inductive position sensor

Table 5: Technical data, inductive position sensor

		MDA 5 to MDA 21
Switching function		PNP (NO)
Operating distance	Sn	Max 2mm
Operating voltage	U_B	10...30 V
Voltage drop	U_B	≤ 3V
Connector		M12x1,4-pin
Operating current	I_L	0...200 mA
Mating contact (included in delivery)		M12 4-socket Female Screw terminals, max 0.75 mm² Cable size 4-6 mm
Connection	Pin 1	L+
	Pin 3	L-
	Pin 4	PNP (NO)
Housing material		Brass, nickel-plated
Degree of protection		IP67
Switching state indicator		LED Yellow

8.1.2 Inductive position sensor ATEX classified version

For MDA brakes in explosive environment (ATEX version) a classified inductive position sensor is standard.

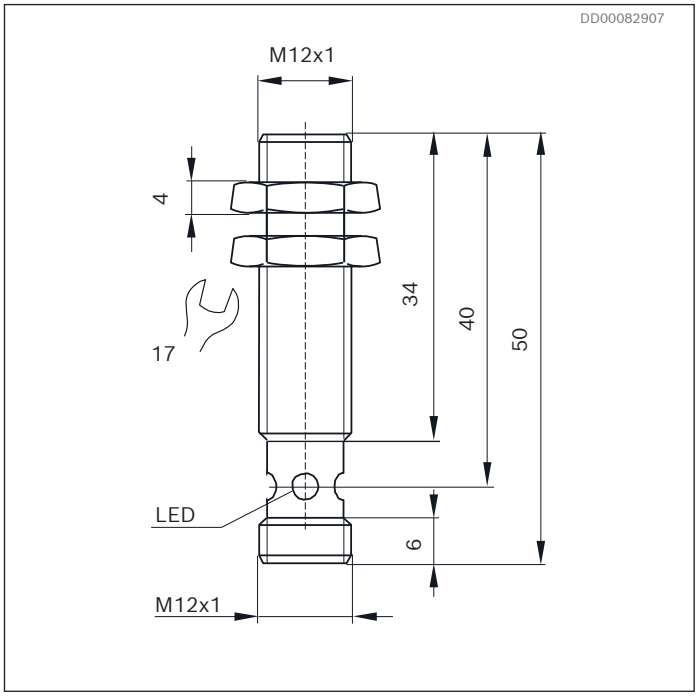


Fig. 25: Dimensions ATEX inductive position sensor for MDA 5 to MDA 21

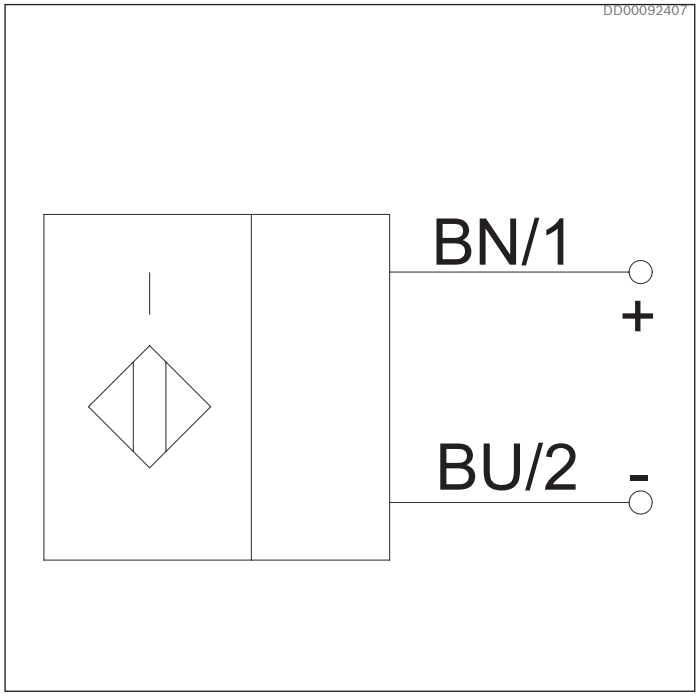


Fig. 26: Wiring diagram ATEX inductive position sensor

Table 6: Technical data, ATEX inductive position sensor

		ATEX MDA 5 to MDA 21
Type		NAMUR
Switching function		Normally closed (NC)
Operating distance	Sn	Max 2mm
Nominal voltage	U_O	8,2 V (Ri approx. 1 kΩ)
Operating voltage	U_B	5...25 V
Connector		M12x1,4-pin
Mating contact (included in delivery)		M12 4-socket Female Screw terminals, max 0.75 mm² Cable size 4-6 mm
Connection	Pin 1	L+
	Pin 2	L-
Housing material		Stainless steel 1.4305
Degree of protection		IP66
Switching state indicator		LED Yellow
Certification	ATEX	II 1G Ex ia IIC T1-T6 Ga
I		I 1D Ex ia IIIC T135°C Da
Effective internal inductivity	C_i	≤90 nF; a cable length of 10 m is considered
Effective internal inductance	L_i	≤100 µH; a cable length of 10 m is considered

8.2 Tandem mounting of CA motor and MDA 14 brake

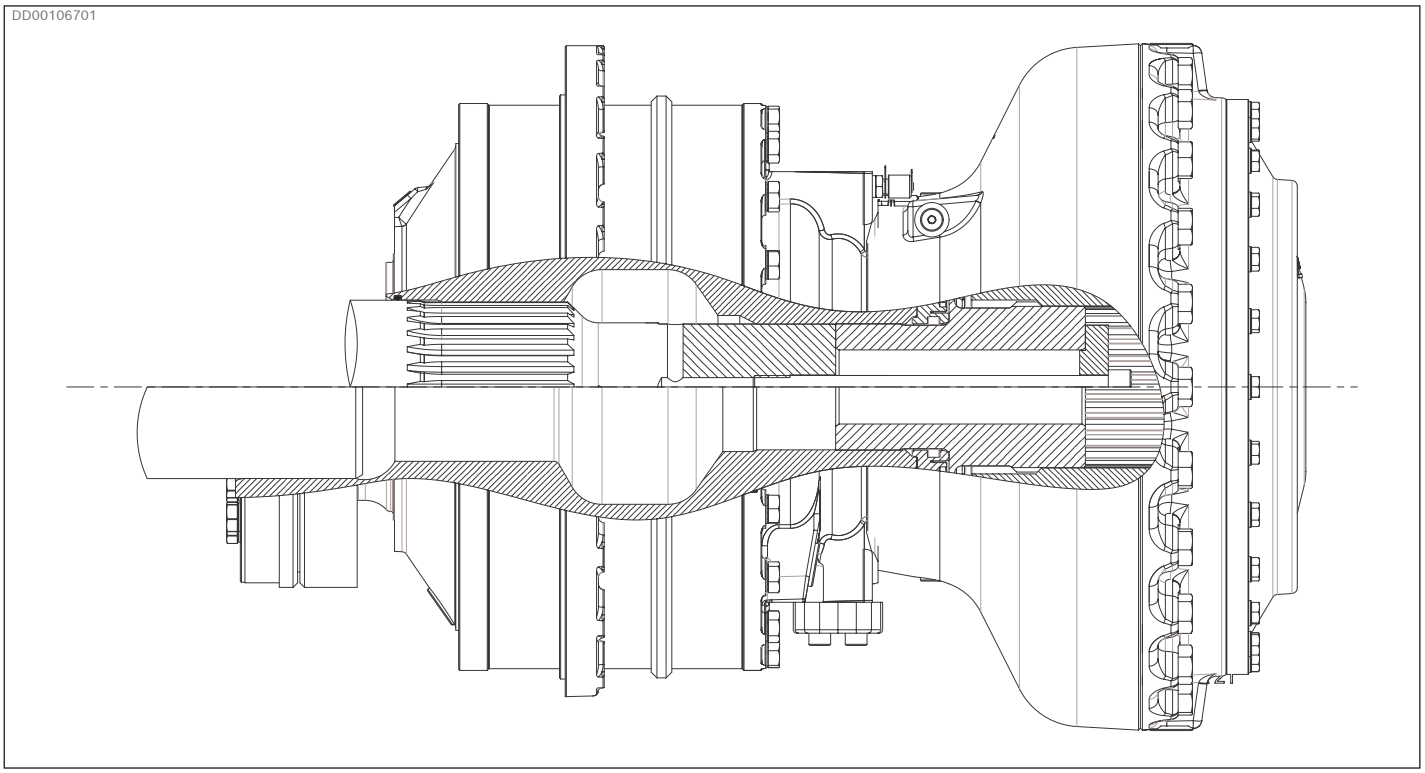


Fig. 27: Tandem mounting of CA motor and MDA 14 brake

CA motor type B and tandem kit TA 21 2 01 must be used

9 Circuit design

Things to consider when designing hydraulic circuit in applications with MDA brakes:

- Be aware of residual back pressure in brake drain line
- Increased level of back pressure on the brake will result in decreased brake torque (inversely related), due to a reduction in brake force
- To avoid pressure peaks, when opening the brake a pressure-limiting valve must be fitted
- Air in the brake results in slow function. Be sure to vent the brake properly before start up of system
- The winch system must be designed so that the winch is rotating at a maximum of 3 rpm when the brake is closed (not valid for emergency braking situation). Valid under normal use.
- Activation time of brake:
  Flushing of brake cylinder lines before start up of system is necessary for a quick brake respons. This is especially important when used as an emergency brake, see example of flushing *Fig. 29*.
  For winch applications, hanging loads and other applications where quick activating times are necessary the sizing of return lines becomes important.

  Higher viscosity, low ambient temperature, long drain lines and smaller tube diameters affects the activation time of brake. This must be taken in to account when designing systems and where multi disc brake MDA will be used. Please see *Fig. 29*
- To provide correct opening pressure:
  Reference the hydraulic schematic shown in *Fig. 28* when using external pressure (system pressure) as control pressure to open and close the brake.
  Use a pressure reducing valve (set at 20 bar) and pressure relief valve (set at 25 bar) in line. See brake opening valve for MDA/BICA,VBO-X. See data sheet:
  RE 15385 (Not available yet. Please contact your Bosch Rexroth representative)

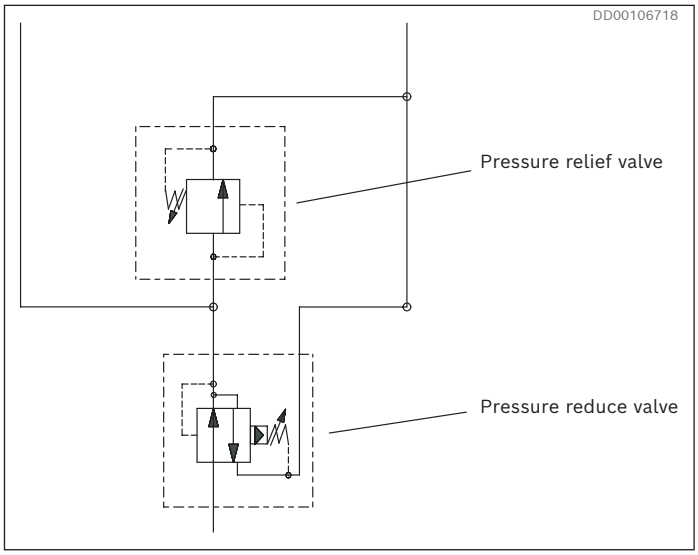


Fig. 28: Example of correct pilot pressure source

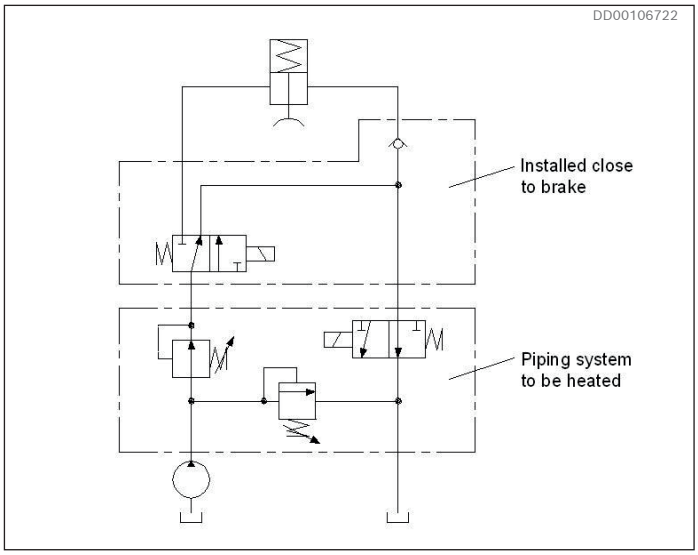


Fig. 29: Example of flushing to reduce activation time

10 Related documents

	Title	Document no	Document type
🕮	Hydraulic fluid quick reference	RE 15414	Data sheet
🕮	Hägglunds CA	RE 15305	Data sheet
🕮	Hägglunds tandem motors	RE 15356	Data sheet
🕮	Brake opening valve Hägglunds VBO	RE 15385	Data sheet
🕮	MDA 5-10	178 1630	Dimension drawing
🕮	MDA 5-10	178 2654	Dimension drawing
🕮	MDA 14 / MDA 21 splines, torque arm mounted	178 2481	Dimension drawing
🕮	MDA 14 / MDA 21 splines, torque arm mounted	178 2571	Dimension drawing
🕮	MDA 14 / MDA 21 splines, torque arm mounted	078 1516	Dimension drawing
🕮	MDA 14 / MDA 21 splines, flange mounted	178 2571	Dimension drawing
🕮	CA 50 and CA 70 splines, Motor with brake MDA 5-10 and torque arm CA 50 and CA 70 splines, torque arm with tandem mounted MDA 14	278 2232	Dimension drawing
🕮	CA 50 and CA 70 splines, Flange mounted with brake MDA 5-10 CA 50 and CA 70 splines, flange mounted with tandem mounted MDA 14 1	278 2233	Dimension drawing
🕮	CA 100 and CA 140 splines, With brake MDA 5 10 and torque arm CA 100 and CA 140 splines, torque arm with tandem mounted MDA 14	278 2236	Dimension drawing
🕮	CA 100 and CA 140 splines, Flange mounted w/o brake MDA 5-10 CA 100 and CA 140 splines, flange mounted with tandem mounted MDA 14	278 2234	Dimension drawing
🕮	CA 210 splines, Motors with brake MDA 5-10 and torque arm CA 210 splines, torque arm with tandem mounted MDA 14	278 2239	Dimension drawing
🕮	CA 210 splines, Flange mounted w/o brake MDA 5-10 CA 210 splines, flange mounted with tandem mounted MDA 14	278 2237	Dimension drawing
🕮	Shaft CA 70 S28 splines, for motor with brake and torque arm MDA 5-10	278 2245	Dimension drawing
🕮	Shaft CA 140 S28 splines, for motor with brake and torque arm MDA 5-10	278 2243	Dimension drawing
🕮	Shaft CA 210 S28 splines, for motor with brake and torque arm MDA 5-10	278 2241	Dimension drawing
🕮	DNV type approval MDA 5 to MDA 10	DD00068362	Certificate
🕮	DNV type approval MDA 14 and MDA 21	DD00068365	Certificate

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rexroth
A Bosch Company

Bosch Rexroth AB
895 80 Mellansel, Sweden
Tel: +46 (0) 660 870 00
Fax: +46 (0) 660 871 60
hagglunds@boschrexroth.com
www.boschrexroth.com

Bosch Rexroth AB, RE 15358/01.2020