

Radial piston motor for frame integrated drives

MCR-A

RE 15195

Edition: 07.2015

Replaces 12.2013



- ▶ Frame size MCR3, MCR5, MCR10, MCR15
- ▶ Displacement 160 cc to 2150 cc
- ▶ Differential pressure up to 450 bar
- ▶ Torque output up to 13687 Nm
- ▶ Speed up to 875 rpm
- ▶ Open and closed circuits

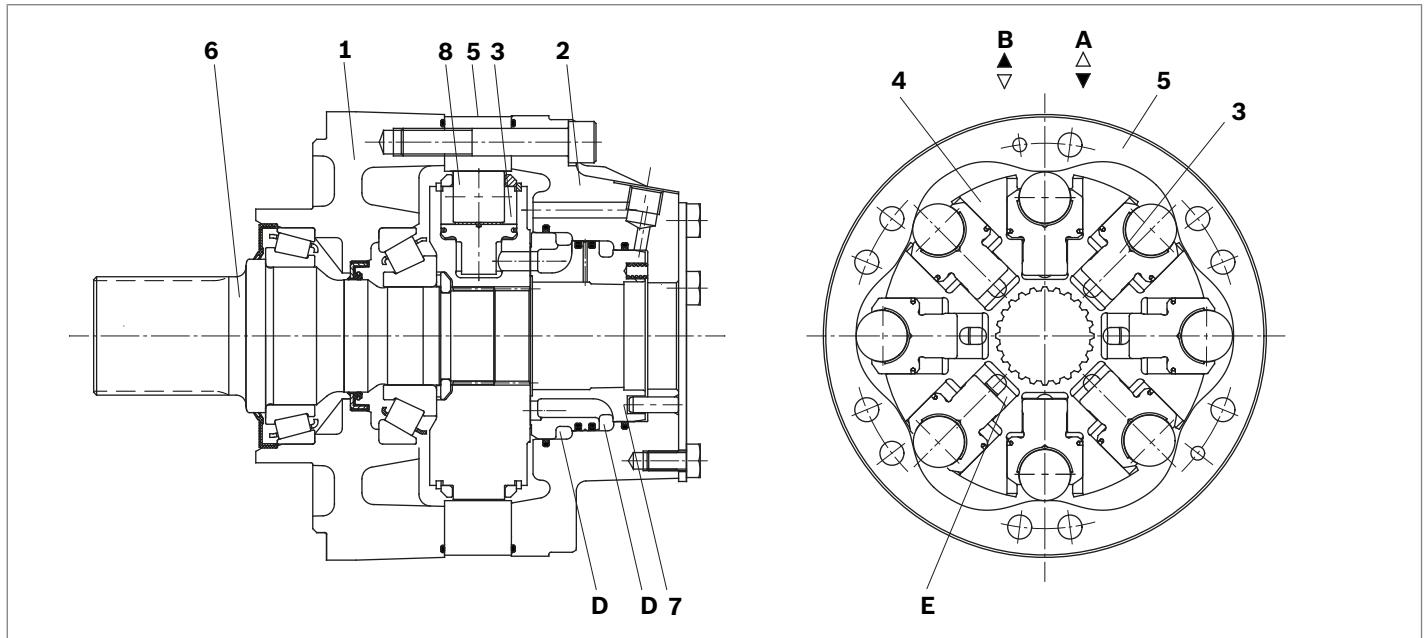
Features

- ▶ Compact robust construction
- ▶ High volumetric and mechanical efficiencies
- ▶ Front case mount
- ▶ Splined drive shaft
- ▶ High reliability
- ▶ Low maintenance
- ▶ Smooth running at very low speeds
- ▶ Low noise
- ▶ Bi-directional
- ▶ Sealed tapered roller bearings
- ▶ Freewheeling possible
- ▶ Available with:
 - Holding brake (multi-disc)
 - Bi-directional two speed
 - Integrated flushing valve
 - Speed sensor

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Functional description



Hydraulic motors of the type MCR-A are radial piston motors with front case mounting and splined drive shaft. The MCR-A motors are intended for open or closed circuit operations as drive motors for the chain drive function primarily on skid steer loaders. A-type motors can be used for a variety of applications depending on the attachment that can be mounted on the spline shaft of the motor (e. g. gear drive, sprocket, chain drive).

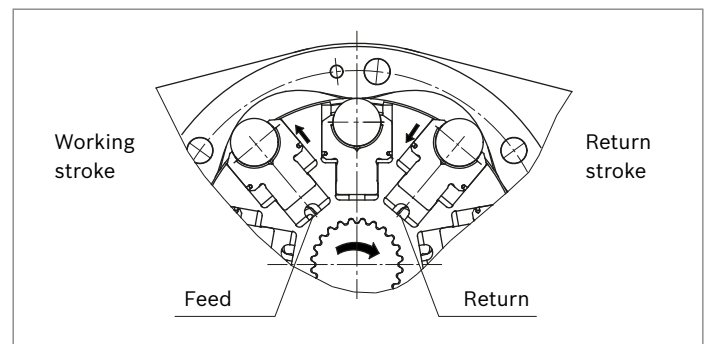
Construction

Two part housing (**1, 2**), rotary group (**3, 4, 8**), cam (**5**), drive shaft (**6**) and flow distributor (**7**)

Transmission

The cylinder block (**4**) is connected to the shaft (**6**) by means of splines. The pistons (**3**) are arranged radially in the cylinder block (**4**) and make contact with the cam (**5**) via rollers (**8**).

Torque generation



The number of working and return strokes corresponds to the number of lobes on the cam multiplied by number of pistons in the cylinder block.

Flow paths

The ports **A** and **B**, which are located in the rear case, carry oil through the distributor to the cylinder chambers (**E**).

Bearings

Tapered roller bearings capable of transmitting high axial and radial forces are fitted as standard.

Freewheeling

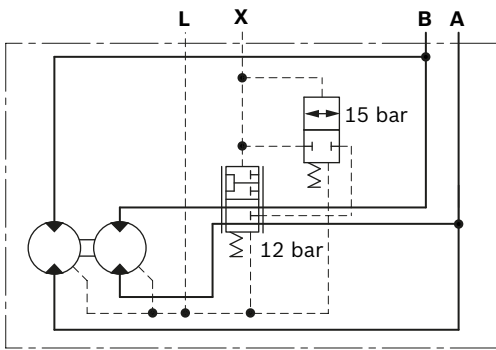
In certain applications there may be a requirement to free-wheel the motor. This may be achieved by connecting ports **A** and **B** to zero pressure and simultaneously applying a pressure of 2 bar to the housing through port **L**. In this condition, the pistons are forced into the cylinder block which forces the rollers to lose contact with the cam thus allowing free rotation of the shaft.

Two speed operation (2W)

In mobile applications where vehicles are required to operate at high speed with low motor loads, the motor can be switched to a low-torque and high-speed mode. This is achieved by operating an integrated valve which directs hydraulic fluid to only one half of the motor while continuously re-circulating the fluid in the other half. This “reduced displacement” mode reduces the flow required for a given speed and gives the potential for cost and efficiency improvements. The motor maximum speed remains unchanged.

Bosch Rexroth has developed a special spool valve to allow smooth switching to reduced displacement whilst on the move. This is known as “soft-shift” and is a standard feature of 2W motors. The spool valve requires either an additional sequence valve or electro-proportional control to operate in “soft-shift” mode.

▼ **Schematic**



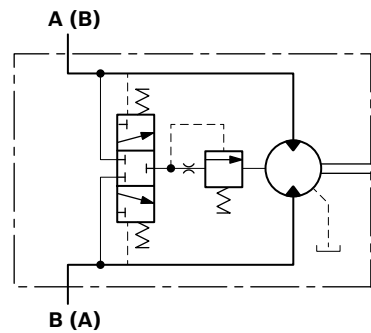
Flushing valve

In a closed circuit, the same hydraulic fluid continuously flows between the pump and the motor. This could therefore lead to overheating of the hydraulic fluid.

The function of the flushing valve option is to replace hydraulic fluid in the closed circuit with that from the reservoir. When the hydraulic motor is operated under load, either in the clockwise or anti-clockwise direction, the flushing valve opens and takes a fixed flow of fluid through an orifice from the low pressure side of the circuit. This flow is then fed to the motor housing and back to the reservoir normally via a cooler. In order to charge the low pressure side of the circuit, cool fluid is drawn from the reservoir by the boost pump and is fed to the pump inlet through the check valve. Thus the flushing valve ensures a continuous renewal and cooling of the hydraulic fluid. The flushing feature incorporates a relief valve which is used to maintain a minimum boost pressure and operates at a standard setting of 14 bar (other options available on request).

Different orifice sizes may be used to select varying flows of flushing fluid. The following table gives flushing rate values based on a boost / charge pressure of 25 bar.

▼ **Schematic**



Flushing flow rates

Flushing code	Orifice size (mm)	Flow (l/min) at 25 bar ¹⁾	
		min	max
F1	Ø1	2.2	2.7
F2	Ø1.5	5.0	6.1
F7	Ø1.7	6.4	7.8
F4	Ø2	8.2	10.7
F6	Ø2.3	8.8	11.4

1) 0.6 mm Shim (Standard), Cracking pressure = 11±3 bar

Holding brake (multi-disc brake)

Mounting

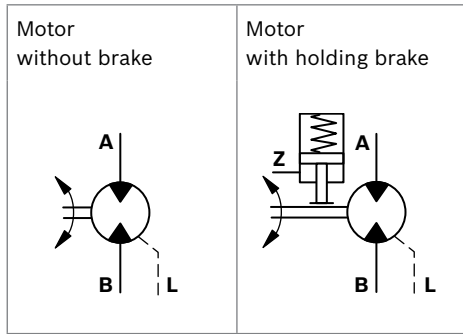
By way of rear housing (2) and brake shaft (14).

Brake application

As a safety requirement in mobile applications a parking brake may be provided to ensure that the motor cannot turn when the machine is not in use. The parking brake provides holding torque by means of discs (11) that are compressed by a disc spring (10). The brake is released when oil pressure is applied to brake port “Z” and the pressure in the annular area (9) compresses the disc spring using brake piston (12) thus allowing the brake discs (11) to turn independently.

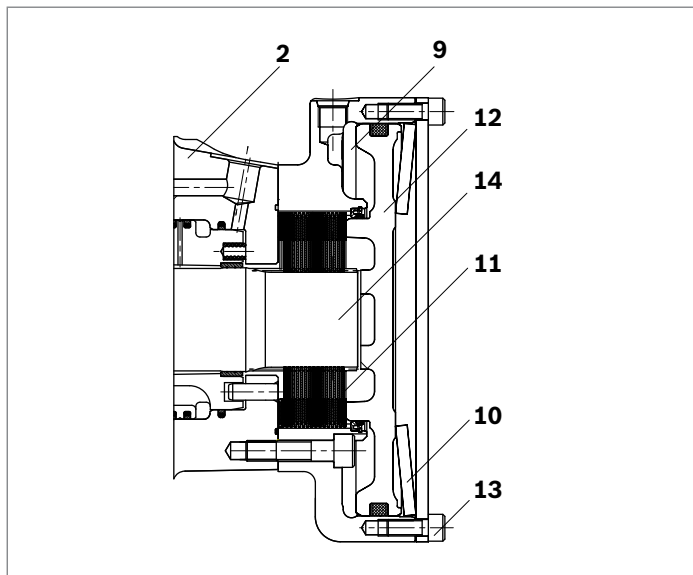
Note
This brake is provided solely for static use - not to be used dynamically.

▼ **Schematic diagrams**



Manual release of holding brake

The brake may also be released manually by loosening screws (13).

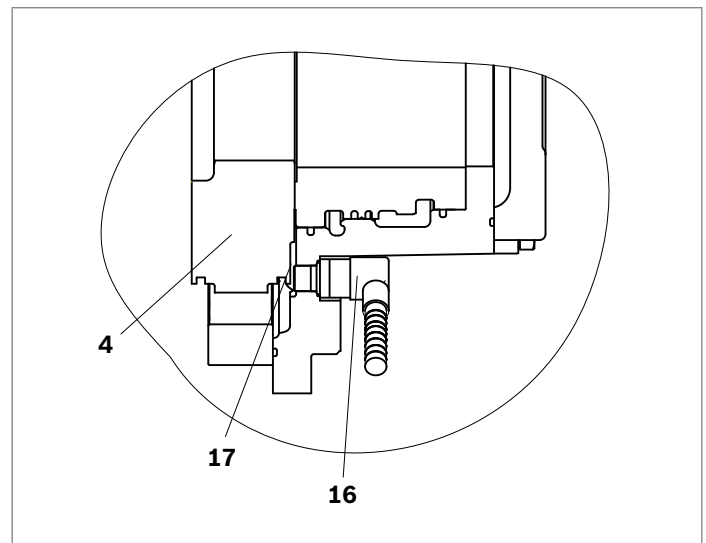


Speed sensor

A Hall-effect speed sensor (16) may be fitted as an option, giving a two-channel output of phase-displaced square waves, and enabling detection of speed and direction. A toothed target disc (17) is fitted to the motor cylinder block (4), and the sensor, fitted to a port in the rear case, produces a pulse on each channel as each tooth passes in front of it. The frequency of the pulses is proportional to the rotational speed.

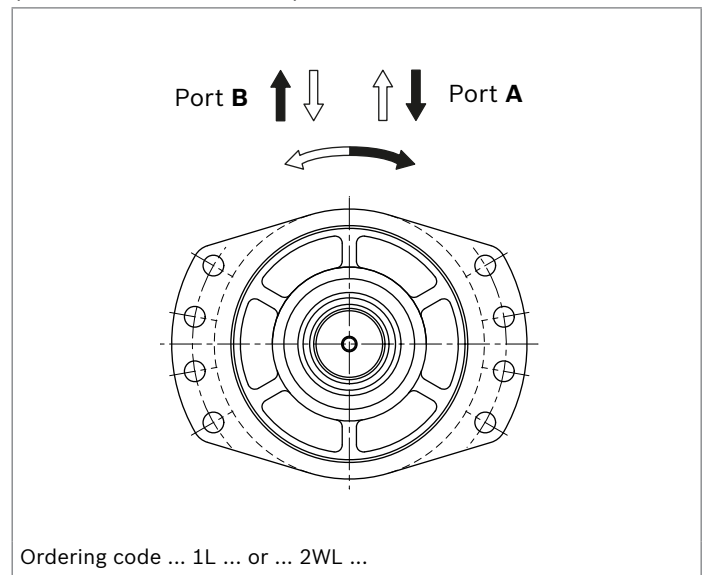
Versions are available for use with regulated supplies 10 V (Code P1) and for direct connection to a 12 V or 24 V unregulated supply (Code P2).

The motor can also be supplied fitted with a target disc and with a speed sensor port machined, but covered and sealed with a blanking plate (Code P0). These “sensor-ready” motors may be fitted with a sensor at a later date.



Direction of shaft rotation with flow

(viewed from drive shaft)



Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
MCR		A			Z	/									

Radial piston motor

01	Radial-piston type, low-speed, high-torque motor	MCR
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Frame size

02	Frame size	3	3
		5	5
		10	10
		15	15

Housing type

03	Front case flanged	A
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Nominal size, displacement V_g in cm^3/rev

04	Frame size 3		160	225	255	280	325	365	400	
	Low displacement: motors use standard cylindrical pistons	LD	●	●	●	●	-	-	-	
	High displacement: motors use stepped pistons	HD	-	-	-	-	●	●	●	
04	Frame size 5		380	470	520	565	620	680	750	820
	Low displacement: motors use standard cylindrical pistons	LD	●	●	●	●	-	-	-	-
	High displacement: motors use stepped pistons	HD	-	-	-	-	●	●	●	●
04	Frame size 10		780	860	940	1120	1250	1340		
	Low displacement: motors use standard cylindrical pistons	LD	●	●	●	-	-	-		
	High displacement: motors use stepped pistons	HD	-	-	-	●	●	●		
04	Frame size 15		1130	1250	1500	1780	2150			
	Low displacement: motors use standard cylindrical pistons	LD	●	●	●	-	-			
	High displacement: motors use stepped pistons	HD	-	-	-	●	●			

Drive shaft

05	Spline shaft ANSI B92.1	MCR3	A45
		MCR5	A60
		MCR10	A75
		MCR15	W80

Rear shaft

06	Without rear shaft	Z
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Series

07	Series 32	32
	Series 33	33

Brake

08	Without brake		MCR3	MCR5	MCR10	MCR15	A0
	Hydraulic release spring applied multi-disc holding brake	2200 Nm	●	●	-	-	B2
		4400 Nm	-	●	-	-	B4
		4400 Nm	-	-	●	-	B5
		7000 Nm	-	-	●	-	B7
		11000 Nm	-	-	-	●	B11

Seals

09	NBR (nitrile rubber)	M
	FKM (fluoroelastomer / Viton)	V

● = Available - = Not available

6 **MCR-A** | Radial piston motor for frame integrated drives
Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
MCR		A			Z	/									

Single/two-speed operation

		MCR3	MCR5	MCR10	MCR15	
10	Single speed, standard direction of rotation	●	●	●	●	1L
	Bi-directional two speed, standard direction of rotation ¹⁾	●	●	-	-	2WL
	Switchable two speed, anti-clockwise direction of rotation	-	●	-	●	2L
	Switchable two speed, clockwise direction of rotation	-	●	-	●	2R

Ports

11	Tapped with UNF thread (SAE J514)	12
	Tapped with UNF thread (SAE J514) (A and B ports SAE split flange metric bolt holes)	42

Studs

12	Without studs (no code)	
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Speed sensor

13	Without sensor (no code)	
	Sensor ready	P0
	Sensor without regulator	P1
	Sensor with regulator	P2

Flushing

14	Without flushing (no code)	
	With flushing (see table on page 3)	F1-F7

Special order

15	Special feature	SOXXX
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Other

16	Mark in text here	*
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1) Not available for MCR10A

Footer from page 7

- 1) Ensure motor case is filled with oil prior to start-up.
- 2) For installation and maintenance details, please see instruction manual 15215-B.
- 3) For use with environmentally acceptable fluids HEES, HEPG, HETG, fluoroelastomer / Viton seals must be specified.
- 4) Extension of the allowable temperature range may be possible depending on specification. Please consult Bosch Rexroth Engineering Department in Glenrothes for further details.
- 5) Maximum values should only be applied for a small portion of the duty cycle. Please consult Bosch Rexroth Engineering Department in Glenrothes for motor life calculations based on particular operating cases.
- 6) When operating motors in series, please consult Bosch Rexroth Engineering Department in Glenrothes.
- 7) For continuous operation at speeds <5 rpm please consult Bosch Rexroth Engineering Department in Glenrothes.
- 8) Based on nominal no-load Δp of 20 bar in full-displacement mode.
- 9) Warning! During the running in period of the motor (min. 20 hrs) it should not be run unloaded at >100 rpm.

Note

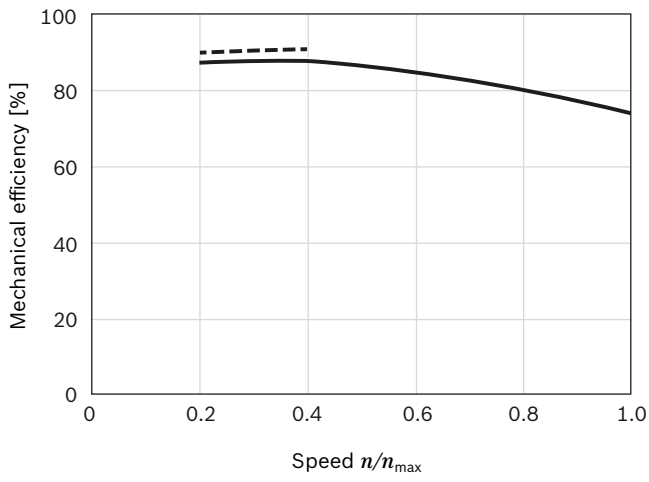
- ▶ Motor performance values are based on theoretical calculations.
 - ▶ Efficiencies are not taken into consideration for theoretical calculations.
 - ▶ Brake torque accounts for tolerances. Values are based when used with standard mineral oil (HLP)
- Please refer the related foot notes for more details.

Technical data

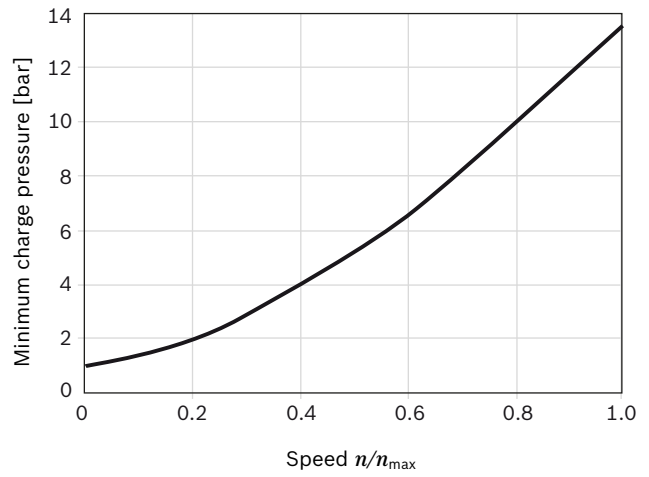
Frame size			MCR3	MCR5	MCR10	MCR15				
Type of mounting			Front case flange mounting							
Pipe connections ¹⁾²⁾			Threaded per SAE J514; Flanged per SAE J518							
Shaft loading			see page 9							
Weight										
Single speed (1L)	<i>m</i>	kg	23	43	70	102				
Two speed (2WL)	<i>m</i>	kg	28	50	–	–				
Two speed (2L/2R)	<i>m</i>	kg		43		102				
Hydraulic fluid ³⁾										
Fluid cleanliness			ISO 4406, Class 20/18/15							
Fluid viscosity range		<i>v</i> _{min/max}	mm ² /s	10 to 2000						
Fluid temperature range ⁴⁾		<i>θ</i> _{min/max}	°C	-20 to +85						
Pressure			Low displacement				High displacement			
Operating pressure		<i>p</i> _{nom}	bar	250	250					
Maximum differential pressure ⁵⁾⁶⁾		<i>Δp</i> _{max}	bar	450	400					
Maximum pressure at port A or B ⁵⁾⁶⁾		<i>p</i> _{max}	bar	470	420					
Maximum case drain pressure		<i>p</i> _{case max}	bar	10	10					
Motor performance MCR3										
Displacement		<i>V</i> _g	cm ³ /rev	160	225	255	280	325	365	400
Specific torque			Nm/bar	3	4	4	4	5	6	6
Maximum torque ⁵⁾		<i>T</i> _{max}	Nm	1146	1611	1826	2005	2069	2324	2546
Minimum speed for smooth running ⁷⁾		<i>n</i> _{min}	rpm	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Maximum speed (1L) ⁸⁾⁹⁾		<i>n</i> _{max}	rpm	670	475	420	385	330	295	270
Maximum speed (2WL) ⁸⁾⁹⁾		<i>n</i> _{max}	rpm	875	620	550	500	430	385	350
Motor performance MCR5										
Displacement		<i>V</i> _g	cm ³ /rev	380	470	520	565	620	680	750 820
Specific torque			Nm/bar	6	7	8	9	10	11	12 13
Maximum torque ⁵⁾		<i>T</i> _{max}	Nm	2722	3366	3724	4047	3947	4329	4775 5220
Minimum speed for smooth running ⁷⁾		<i>n</i> _{min}	rpm	0.5	0.5	0.5	0.5	0.5	0.5	0.5 0.5
Maximum speed (1L) ⁸⁾⁹⁾		<i>n</i> _{max}	rpm	475	385	350	320	290	265	240 220
Maximum speed (2WL) ⁸⁾⁹⁾		<i>n</i> _{max}	rpm	570	465	420	385	350	320	290 265
Motor performance MCR10										
Displacement		<i>V</i> _g	cm ³ /rev	780	860	940		1120	1250	1340
Specific torque			Nm/bar	12	14	15		18	20	21
Maximum torque ⁵⁾		<i>T</i> _{max}	Nm	5586	6159	6732		7130	7958	8531
Minimum speed for smooth running ⁷⁾		<i>n</i> _{min}	rpm	0.5	0.5	0.5		0.5	0.5	0.5
Maximum speed (1L and 2WL) ⁸⁾⁹⁾		<i>n</i> _{max}	rpm	215	195	178		150	134	125
Motor performance MCR15										
Displacement		<i>V</i> _g	cm ³ /rev	1130	1250	1500		1780	2150	
Specific torque			Nm/bar	18	20	24		28	34	
Maximum torque ⁵⁾		<i>T</i> _{max}	Nm	8093	8952	10743		11332	13687	
Minimum speed for smooth running ⁷⁾		<i>n</i> _{min}	rpm	0.5	0.5	0.5		0.5	0.5	
Maximum speed (1L and 2L/2R) ⁸⁾⁹⁾		<i>n</i> _{max}	rpm	145	130	110		90	75	
Brake			MCR3		MCR5		MCR10		MCR15	
Holding brake (disc brake)			B2		B2	B4	B5	B7	B11	
Minimum holding torque		<i>t</i> _{min/max}	Nm	2200	2200	4400	4400	7000	11000	
Release pressure (min)		<i>p</i> _{rel min}	bar	11	11	11	11	11	12	
Release pressure (max)		<i>p</i> _{rel max}	bar	15	15	15	15	15	15	
Maximum pressure at brake port „Z“		<i>p</i> _{max}	bar	40	40	40	40	40	40	
Oil volume to operate brake		<i>V</i> _{rel}	cm ³	23	23	46	17	36	77	

Efficiencies

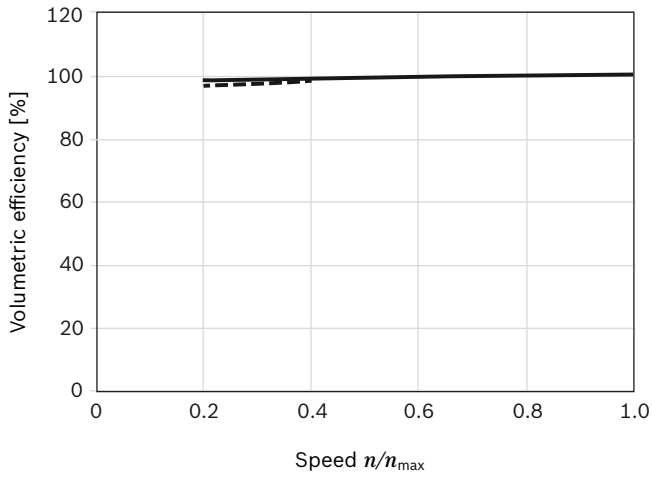
▼ Mechanical efficiency



▼ Charge pressure



▼ Volumetric efficiency



— 100 bar / 1450 psi
- - - 300 bar / 4350 psi

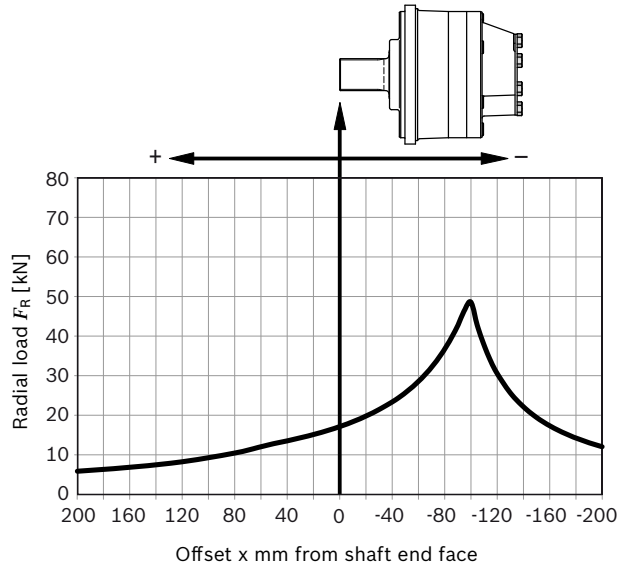
Note:

For specific performance information or operating conditions contact the Engineering Department at Bosch Rexroth, Glenrothes.

Permitted loading on drive shaft

Drive shaft ...3A A45...

Maximum radial load $F_{R \max}$ (with axial load $F_{ax} = 0$)



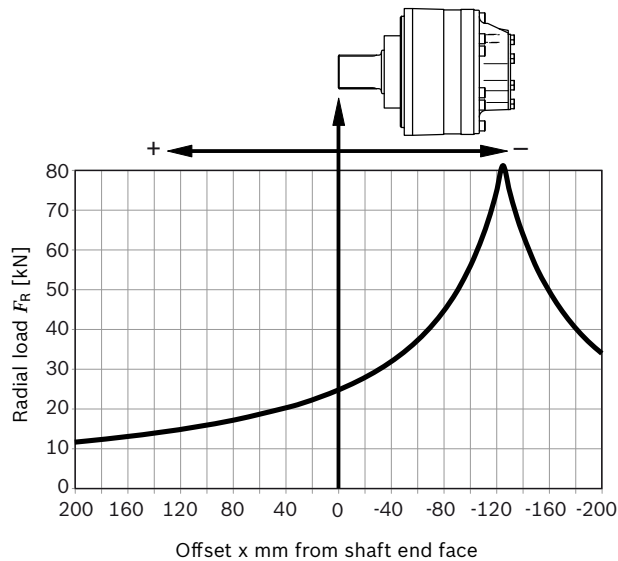
Maximum axial load $F_{ax \max}$ (with radial load $F_R = 0$):

$$F_{ax \max} = 30700 \text{ N} \leftarrow +$$

$$F_{ax \max} = 25200 \text{ N} \rightarrow -$$

Drive shaft ...5A A60...

Maximum radial load $F_{R \max}$ (with axial load $F_{ax} = 0$)



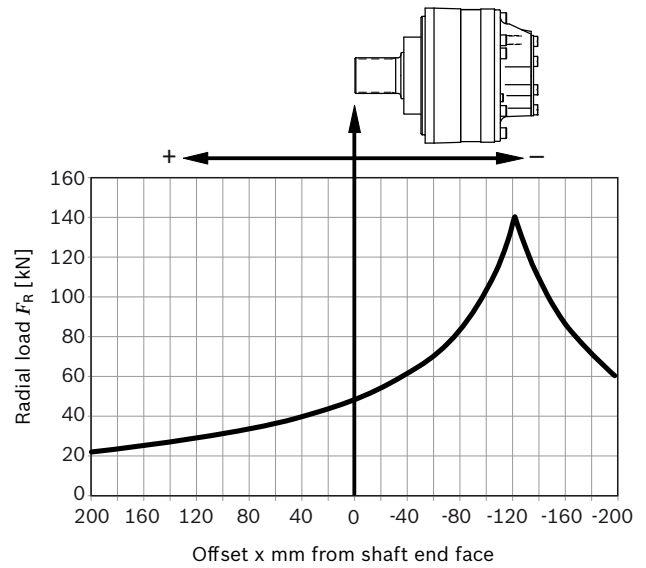
Maximum axial load $F_{ax \max}$ (with radial load $F_R = 0$):

$$F_{ax \max} = 49000 \text{ N} \leftarrow +$$

$$F_{ax \max} = 35400 \text{ N} \rightarrow -$$

Drive shaft ...10A A75...

Maximum radial load $F_{R \max}$ (with axial load $F_{ax} = 0$)



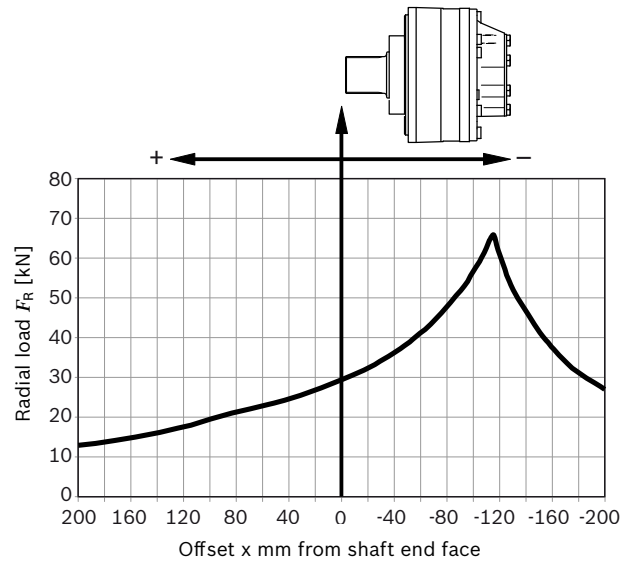
Maximum axial load $F_{ax \max}$ (with radial load $F_R = 0$):

$$F_{ax \max} = 68000 \text{ N} \leftarrow +$$

$$F_{ax \max} = 63400 \text{ N} \rightarrow -$$

Drive shaft ...15A W80...

Maximum radial load $F_{R \max}$ (with axial load $F_{ax} = 0$)



Maximum axial load $F_{ax \max}$ (with radial load $F_R = 0$):

$$F_{ax \max} = 95400 \text{ N} \leftarrow +$$

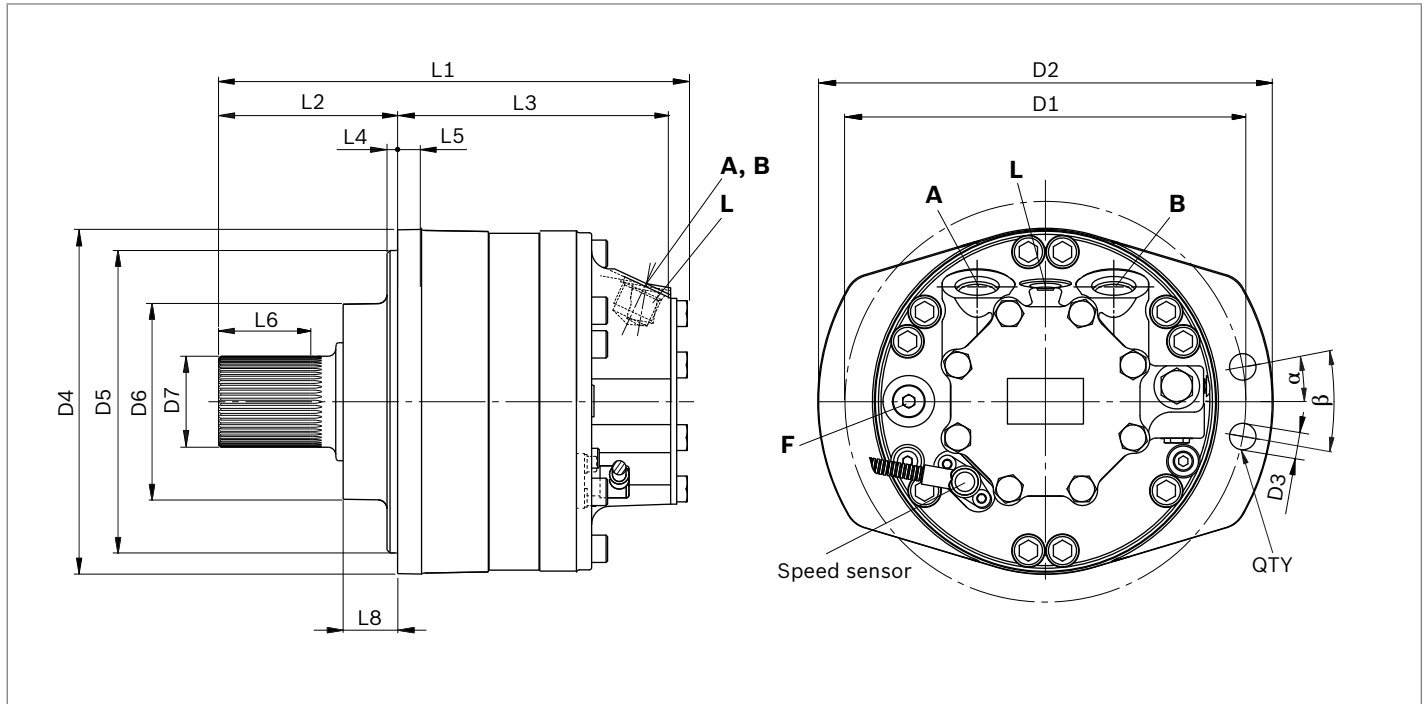
$$F_{ax \max} = 82600 \text{ N} \rightarrow -$$

Note:

- ▶ These values and graphs are for initial guidance only
- ▶ For actual motor life calculations under typical or specified duty cycles, contact Bosch Rexroth Engineering Department in Glenrothes

Dimensions

MCR-A single speed (1L)



Motor	D1	D2	D3	D4	D5	D6	D7
MCR3	∅210	∅237	∅14	∅198	∅180	∅100	∅45
MCR5	∅265	∅300	∅17.5	∅228	∅200	∅131	∅60
MCR10	∅300	∅335	∅17.5	∅262	∅224	∅160	∅75
MCR15	∅335	∅375	∅22.5	∅310	∅280	∅176	∅80

Motor	L1	L2	L3	L4	L5	L6	L8	α	β	QTY
MCR3	260	93	224	6	15	54	22	0°	15°	10
MCR5	308.5	118.5	190	5	15	61	36	10°	20°	8
MCR10	352	110	242	12	25	47	32	0°	15°	10
MCR15	383.5	133	250.5	17	26	57	46	10°	20°	8

Ports

Motor	Designation	Port function	Standard	Size	p_{\max} [bar]	State ²⁾
MCR3	A, B	Inlet, outlet	SAE J514	7/8-14 UNF	470/420 ¹⁾	O
	L	Case drain	SAE J514	9/16-18 UNF	10	O
	F	Filler port	SAE J514	3/4-16 UNF	10	X
MCR5	A, B	Inlet, outlet	SAE J514	1 1/16-12 UNF	470/420 ¹⁾	O
	L	Case drain	SAE J514	3/4-16 UNF	10	O
	F	Filler port	SAE J514	3/4-16 UNF	10	X
MCR10	A, B	Inlet, outlet	SAE J518 ³⁾	3/4 in	470/420 ¹⁾	O
	L	Case drain	SAE J514	3/4-16 UNF	10	O
	F	Filler port	SAE J514	3/4-16 UNF	10	X
MCR15	A, B	Inlet, outlet	SAE J518 ³⁾	3/4 in	470/420 ¹⁾	O
	L	Case drain	SAE J514	3/4-16 UNF	10	O
	F	Filler port	SAE J514	3/4-16 UNF	10	X

1) Depends on nominal size

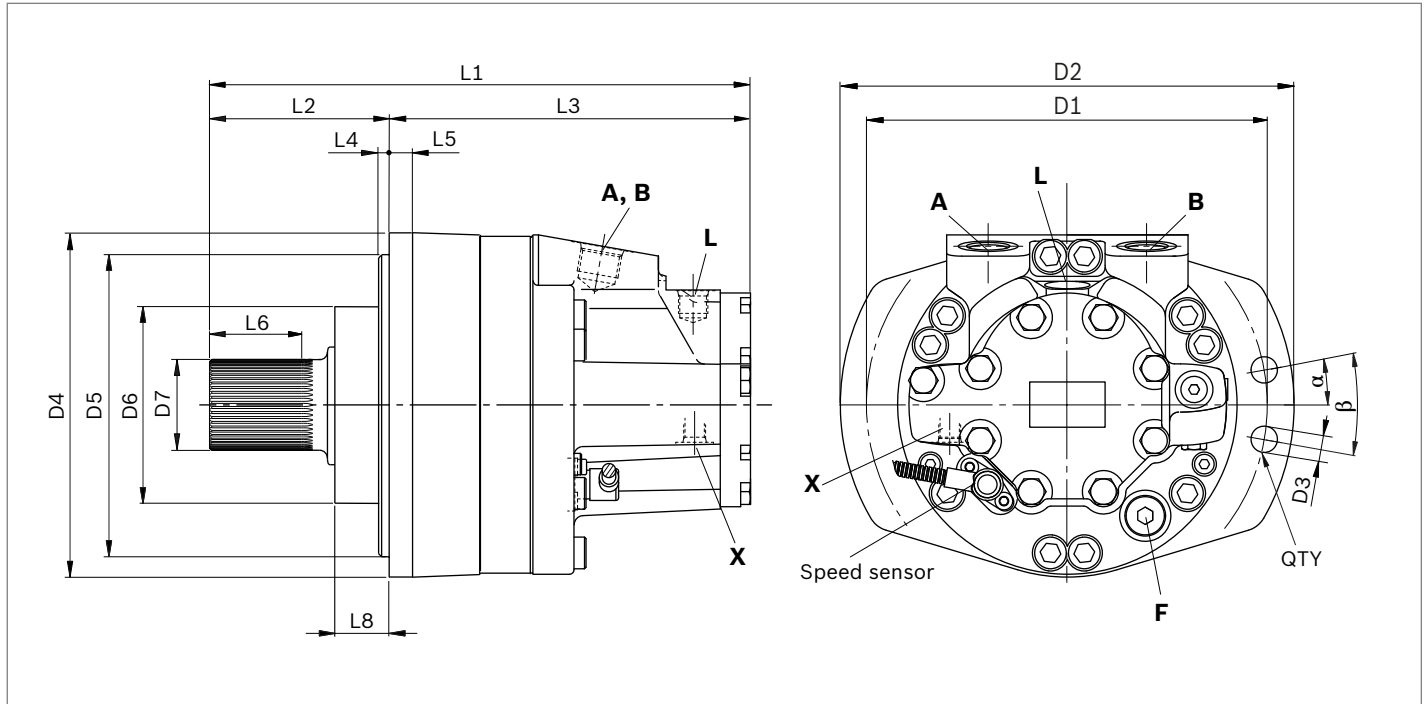
2) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

3) Only dimensions according to SAE J518
(Code 62 - high pressure series)

Before finalizing your design, request a binding installation drawing.

MCR-A two speed (2WL)



Motor	D1	D2	D3	D4	D5	D6	D7
MCR3	ø210	ø237	ø14	ø198	ø180	ø100	ø45.52
MCR5	ø265	ø300	ø17.5	ø228	ø200	ø131	ø60.2

Motor	L1	L2	L3	L4	L5	L6	L8	α	β	QTY
MCR3	219.5	93.1	226.5	6	15	53.5	22.75	0°	15°	10
MCR5	357.5	118.5	239	5	15	61	36	10°	20°	8

Ports

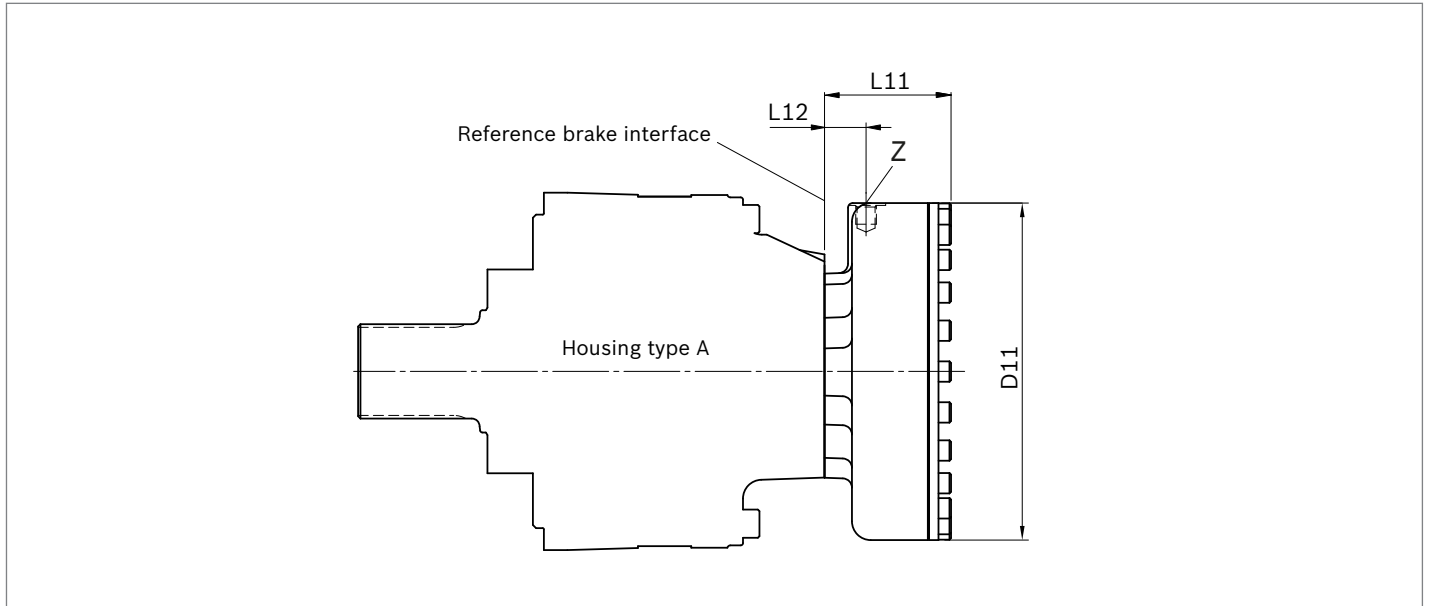
Motor	Designation	Port function	Code	Size	p_{max} [bar]	State ²⁾
MCR3	A, B	Inlet, outlet	SAE J514	7/8-14 UNF	470/420 ¹⁾	O
	L	Case drain	SAE J514	9/16-18 UNF	10	O
	F	Filler port	SAE J514	3/4-16 UNF	10	X
	X	2 speed port	SAE J514	9/16-18 UNF	35	O
MCR5	A, B	Inlet, outlet	SAE J514	1 1/16-12 UNF	470/420 ¹⁾	O
	L	Case drain	SAE J514	3/4-16 UNF	10	O
	F	Filler port	SAE J514	3/4-16 UNF	10	X
	X	2 speed port	SAE J514	9/16-18 UNF	35	O

1) Depends on nominal size

2) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Before finalizing your design, request a binding installation drawing.

Holding brake (multi-disc brake)











Motor	Brake	L11	L12	D11
MCR3	B2	67.3	22	ø174
MCR5	B2	67.3	22	ø174
	B4	80.7	26.5	ø215
MCR10	B5	84.7	26.5	ø215
	B7	97.8	29	ø251
MCR15	B11	102.3	33	ø282

Motor	Designation	Port function	Code	Size	p_{max} [bar]	State ¹⁾
MCR3	Z	Brake port	SAE J515	9/16-18 SAE	30	O
MCR5	Z	Brake port	SAE J515	9/16-18 SAE	30	O
MCR10	Z	Brake port	SAE J515	9/16-18 SAE	30	O
MCR15	Z	Brake port	SAE J515	9/16-18 SAE	30	O

1) O = Must be connected (plugged on delivery)

Before finalizing your design, request a binding installation drawing.

Selection guide

Data sheet	Motor type Application		Frame size					
			3 160..400 cc	5 380..820 cc	6 820..920 cc	10 780..1340 cc	15 1130..2150 cc	20 1750..3000 cc
15198	MCR-F Wheel drives		•	•	-	•	•	-
15200	MCR-W Heavy duty wheel drives		•	•	-	•	-	-
15195	MCR-A Frame integrated drives		•	•	-	•	•	-
15199	MCR-H Integrated drives		•	•	-	•	•	•
15221	MCR-T Track drives		-	•	•	•	-	-
15223	MCR-R Series 41 Hydraulic drive assist		-	-	-	•	-	-
15214	MCR-X Slew drives		•	•	-	-	-	-
15197	MCR-C Compact drives		-	-	-	-	-	•
15196	MCR-D Industrial applications		•	•	-	•	-	-
	MCR-E Industrial applications		-	•	-	-	-	-

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