

Radial piston motor for integrated drives

MCR-H

RE 15199

Edition: 03.2017

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- ▶ Frame size MCR3, MCR5, MCR10, MCR15, MCR20
- ▶ Displacement 160 cc to 3000 cc
- ▶ Differential pressure up to 450 bar
- ▶ Torque output up to 19099 Nm
- ▶ Speed up to 875 rpm
- ▶ Open and closed circuits

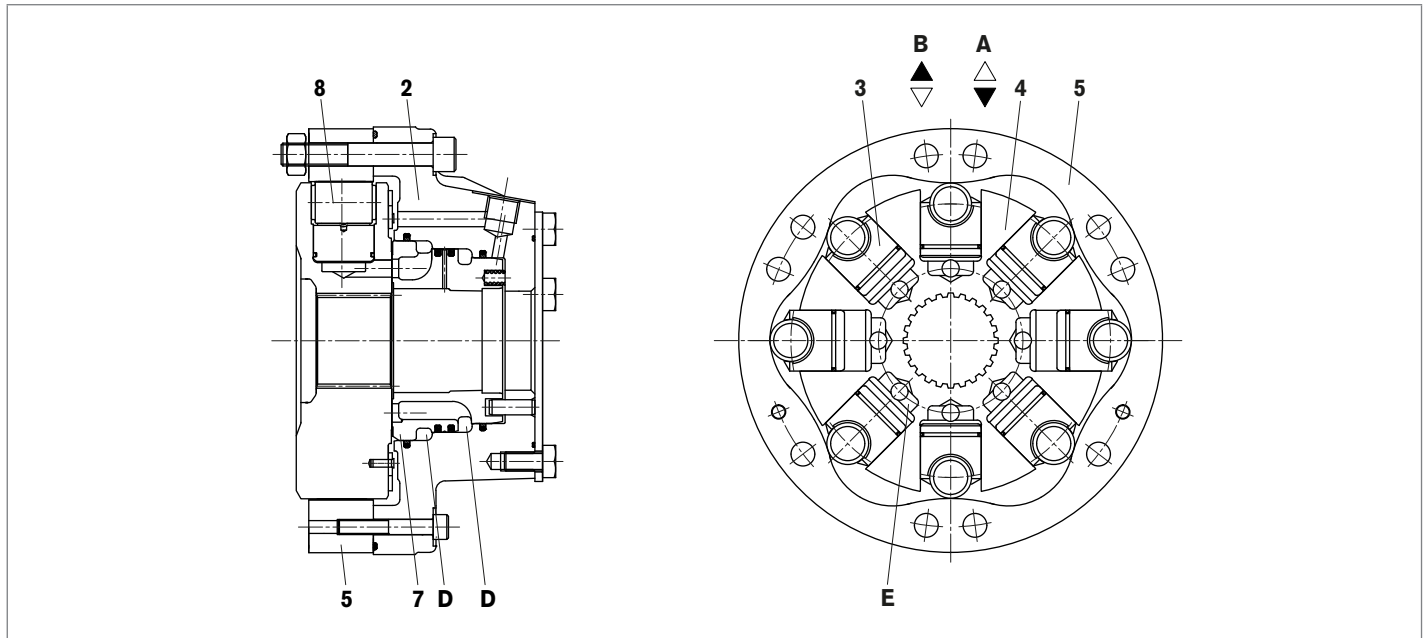
Features

- ▶ Hydrobase motor
- ▶ Optimised design for integration
- ▶ Compact installation in customer structure
- ▶ High volumetric and mechanical efficiencies
- ▶ High reliability
- ▶ Low maintenance
- ▶ Smooth running at very low speeds
- ▶ Low noise
- ▶ Bi-directional
- ▶ 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-H are radial piston motors with a hydraulic rotary group as the base (Hydro-base) and a rear case sub assembly. These motors are intended for various integrated drive applications in open or closed circuits where the front case, shaft and bearing arrangement of the motor are provided by the customer structure. Some of the applications in which these motors are used are construction machinery, fork lift trucks, forestry machines and industrial applications. The compact design allows installation to very confined spaces and contributes in weight savings.

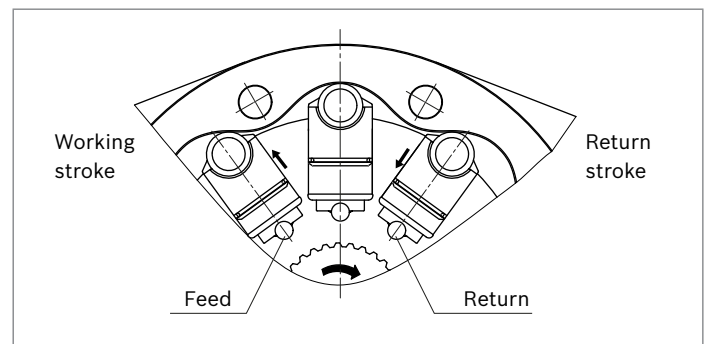
Construction

Rear case (2), rotary group (3, 4, 8), cam (5) and flow distributor (7)

Transmission

The cylinder block (4) is connected to the shaft located in the customer structure to which the motor is mounted 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).

Freewheeling

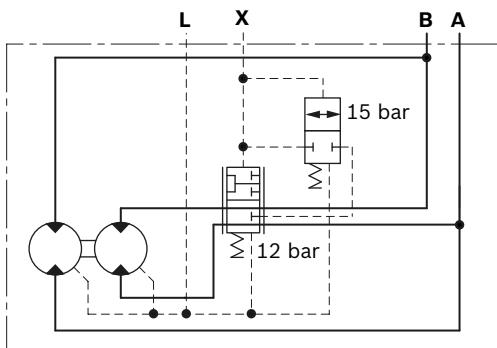
In certain applications there may be a requirement to free-wheel the motor. This may be achieved by connecting ports A and B to zero pressure and simultaneously applying a pressure of 2 bar to the housing through port L. In this condition, the pistons are forced into the cylinder block which forces the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

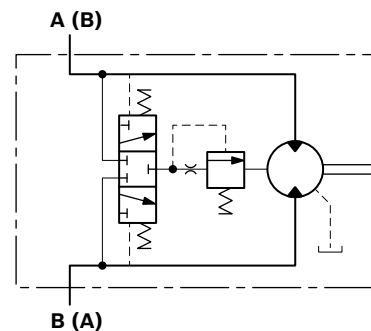
▼ Schematic



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

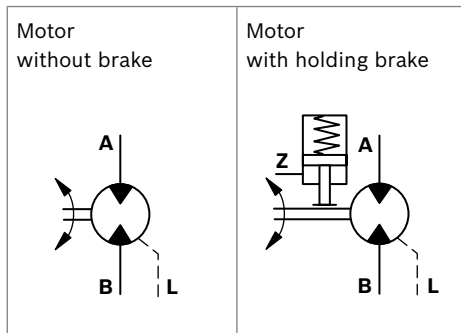
By way of rear housing (2) and brake shaft (14).

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.

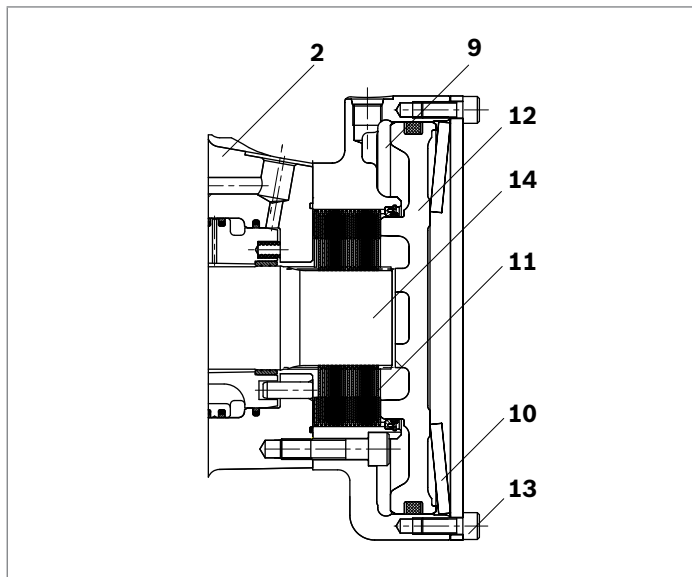
Notice
Brakes not for dynamic use!

▼ **Schematic diagrams**



Manual release of holding brake

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

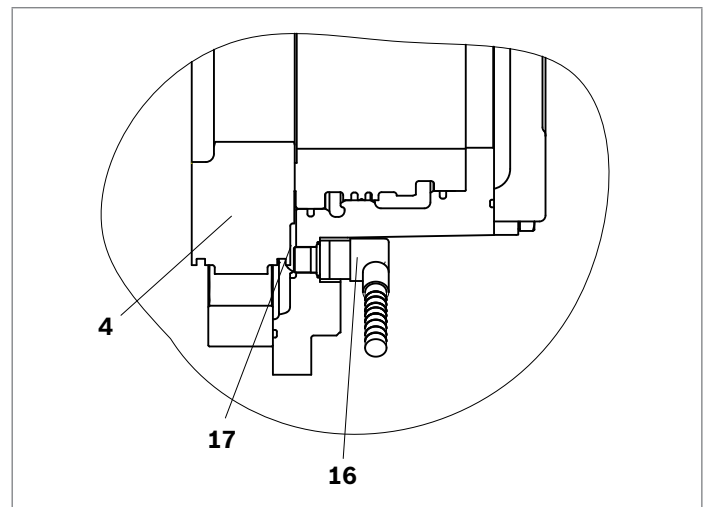


Speed sensor

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.

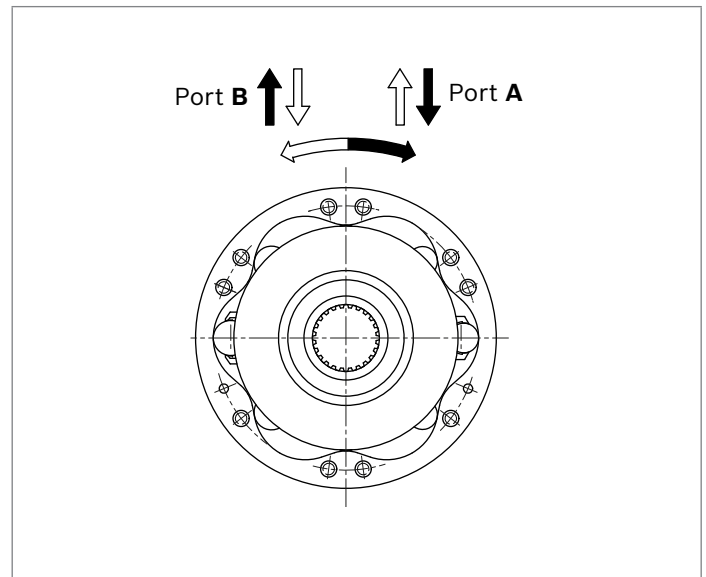
Versions are available for use with regulated supplies 10 V (Code P1) and for direct connection to a 12 V or 24 V unregulated supply (Code P2).

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 rotation with flow

(viewed from cylinder block)



Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
MCR		H			Z	/	33				S				

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
		20	20

Housing type

03	Hydrobase motor	H
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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	-	-	-	-	●	●	●	
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	-	-	-	-	●	●	●	●
Frame size 10			780	860	940	1120	1250	1340		
	Low displacement: motors use standard cylindrical pistons	LD	●	●	●	-	-	-		
	High displacement: motors use stepped pistons	HD	-	-	-	●	●	●		
Frame size 15			1130	1250	1500	1780	2150			
	Low displacement: motors use standard cylindrical pistons	LD	●	●	●	-	-			
	High displacement: motors use stepped pistons	HD	-	-	-	●	●			
Frame size 20			1750	2100	2500	3000				
	Low displacement: motors use standard cylindrical pistons	LD	●	●	-	-				
	High displacement: motors use stepped pistons	HD	-	-	●	●				

Drive shaft

05	Without drive shaft	Z
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Rear shaft

06	Without rear shaft	Z
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Series

07	Series 33	33¹⁾
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Brake

		MCR3	MCR5	MCR10	MCR15	MCR20		
08	Without brake	●	●	●	●	●	A0	
	Hydraulic release spring applied multi-disc holding brake	2200 Nm	●	●	-	-	-	B2
		4400 Nm	-	●	-	-	-	B4
		4400 Nm	-	-	●	-	-	B5
		7000 Nm	-	-	●	-	-	B7
		11000 Nm	-	-	-	●	-	B11
		19000 Nm	-	-	-	-	●	B19

● = Available - = Not available

¹⁾ This data sheet also applies series 32.

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

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
MCR		H			Z	/	33				S				

Seals

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

Single/two-speed operation

		MCR3	MCR5	MCR10	MCR15	MCR20	
10	Single speed, standard direction of rotation	●	●	●	●	●	1L
	Bi-directional two speed, standard direction of rotation	●	●	●	-	●	2WL

Ports

		MCR3	MCR5	MCR10	MCR15	MCR20	
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
	BSP threaded ports (A and B ports SAE split flange metric bolt holes)	-	-	-	-	●	11

Studs

12	With wheel studs and nuts	S
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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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● = Available - = Not available

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 any other fluid type contact the Engineering Department at Bosch Rexroth, Glenrothes. For more information on hydraulic fluids, see datasheets 90220 and 90223.
- 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.

Technical data

Frame size			MCR3	MCR5	MCR10	MCR15	MCR20				
Type of mounting			Face mounting								
Pipe connections ¹⁾²⁾			Threaded per SAE J514; Flanged per SAE J518								
Weight											
Single speed (1L)		<i>m</i>	kg	12	23	36	54	76			
Two speed (2WL)		<i>m</i>	kg	18	30	40	54	76			
Hydraulic fluid ³⁾			Mineral oil type HLP/HLVP to DIN 51524								
Fluid cleanliness			ISO 4406, Class 20/18/15								
Fluid viscosity range		$v_{\min/\max}$	mm ² /s	10 to 2000							
Fluid temperature range ⁴⁾		$\theta_{\min/\max}$	°C	-20 to +85							
Pressure			Low displacement				High displacement				
Maximum differential pressure ⁵⁾⁶⁾		Δp_{\max}	bar	450				400			
Maximum pressure at port A or B ⁵⁾⁶⁾		p_{\max}	bar	470				420			
Maximum case drain pressure		$p_{\text{case max}}$	bar	10				10			
Motor performance MCR3											
Displacement		V_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⁾		T_{\max}	Nm	1146	1611	1826	2005	2069	2324	2546	
Minimum speed for smooth running ⁷⁾		n_{\min}	rpm	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Maximum speed (1L) ⁸⁾⁹⁾		n_{\max}	rpm	670	475	420	385	330	295	270	
Maximum speed (2WL) ⁸⁾⁹⁾		n_{\max}	rpm	875	620	550	500	430	385	350	
Motor performance MCR5											
Displacement		V_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⁾		T_{\max}	Nm	2722	3366	3724	4047	3947	4329	4775 5220	
Minimum speed for smooth running ⁷⁾		n_{\min}	rpm	0.5	0.5	0.5	0.5	0.5	0.5	0.5 0.5	
Maximum speed (1L) ⁸⁾⁹⁾		n_{\max}	rpm	475	385	350	320	290	265	240 220	
Maximum speed (2WL) ⁸⁾⁹⁾		n_{\max}	rpm	570	465	420	385	350	320	290 265	
Motor performance MCR10											
Displacement		V_g	cm ³ /rev	780	860	940		1120	1250	1340	
Specific torque			Nm/bar	12	14	15		18	20	21	
Maximum torque ⁵⁾		T_{\max}	Nm	5586	6159	6732		7130	7958	8531	
Minimum speed for smooth running ⁷⁾		n_{\min}	rpm	0.5	0.5	0.5		0.5	0.5	0.5	
Maximum speed (1L and 2WL) ⁸⁾⁹⁾		n_{\max}	rpm	215	195	180		150	135	125	
Motor performance MCR15											
Displacement		V_g	cm ³ /rev	1130	1250	1500		1780	2150		
Specific torque			Nm/bar	18	20	24		28	34		
Maximum torque ⁵⁾		T_{\max}	Nm	8093	8952	10743		11332	13687		
Minimum speed for smooth running ⁷⁾		n_{\min}	rpm	0.5	0.5	0.5		0.5	0.5		
Maximum speed (1L and 2WL) ⁸⁾⁹⁾		n_{\max}	rpm	150	150	150		125	125		
Motor performance MCR20			Low displacement				High displacement				
Displacement		V_g	cm ³ /rev	1750	2100			2500	3000		
Specific torque			Nm/bar	28	33			40	44		
Maximum torque ⁵⁾		T_{\max}	Nm	12533	15040			15915	19099		
Minimum speed for smooth running ⁷⁾		n_{\min}	rpm	0.5	0.5			0.5	0.5		
Maximum speed (1L and 2WL) ⁸⁾⁹⁾		n_{\max}	rpm	125	125			115	115		

			MCR3	MCR5		MCR10		MCR15	MCR20
Holding brake (disc brake)			B2	B2	B4	B5	B7	B11	B19
Minimum holding torque	$t_{\min/\max}$	Nm	2200	2200	4400	4400	7000	11000	19000
Release pressure (min)	$p_{\text{rel min}}$	bar	11	11	11	11	11	12	15
Release pressure (max)	$p_{\text{rel max}}$	bar	15	15	15	15	15	15	30
Maximum pressure at brake port „Z“	p_{max}	bar	40	40	40	30	30	30	30
Oil volume to operate brake	V_{rel}	cm ³	23	23	46	17	36	77	99

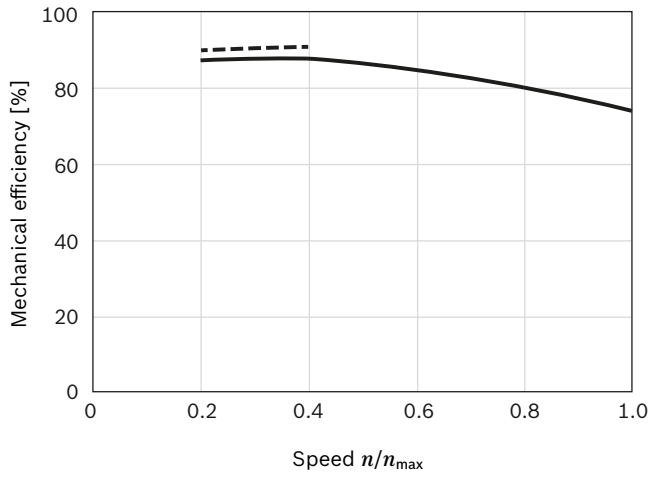
Notice

- ▶ 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).
- ▶ Significant thrust load from cylinder block which must be supported by a suitable bearing. Consult installation drawing for details.

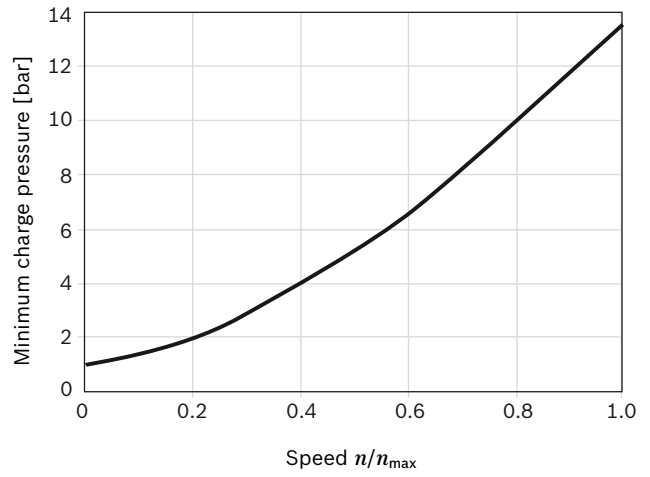
Please refer the related foot notes for more details.

Efficiencies

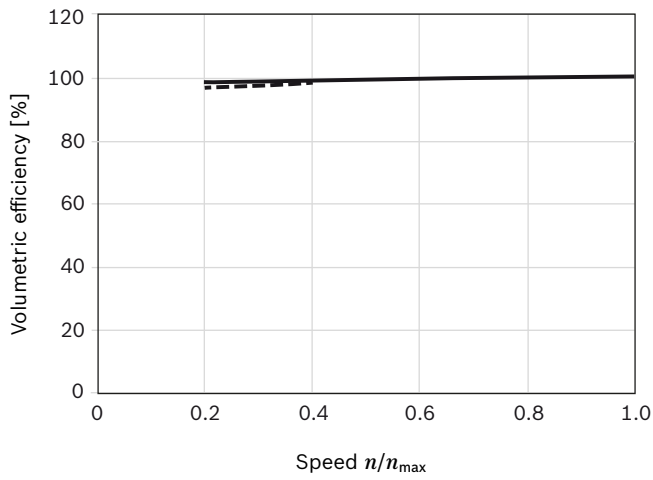
▼ Mechanical efficiency



▼ Charge pressure



▼ Volumetric efficiency



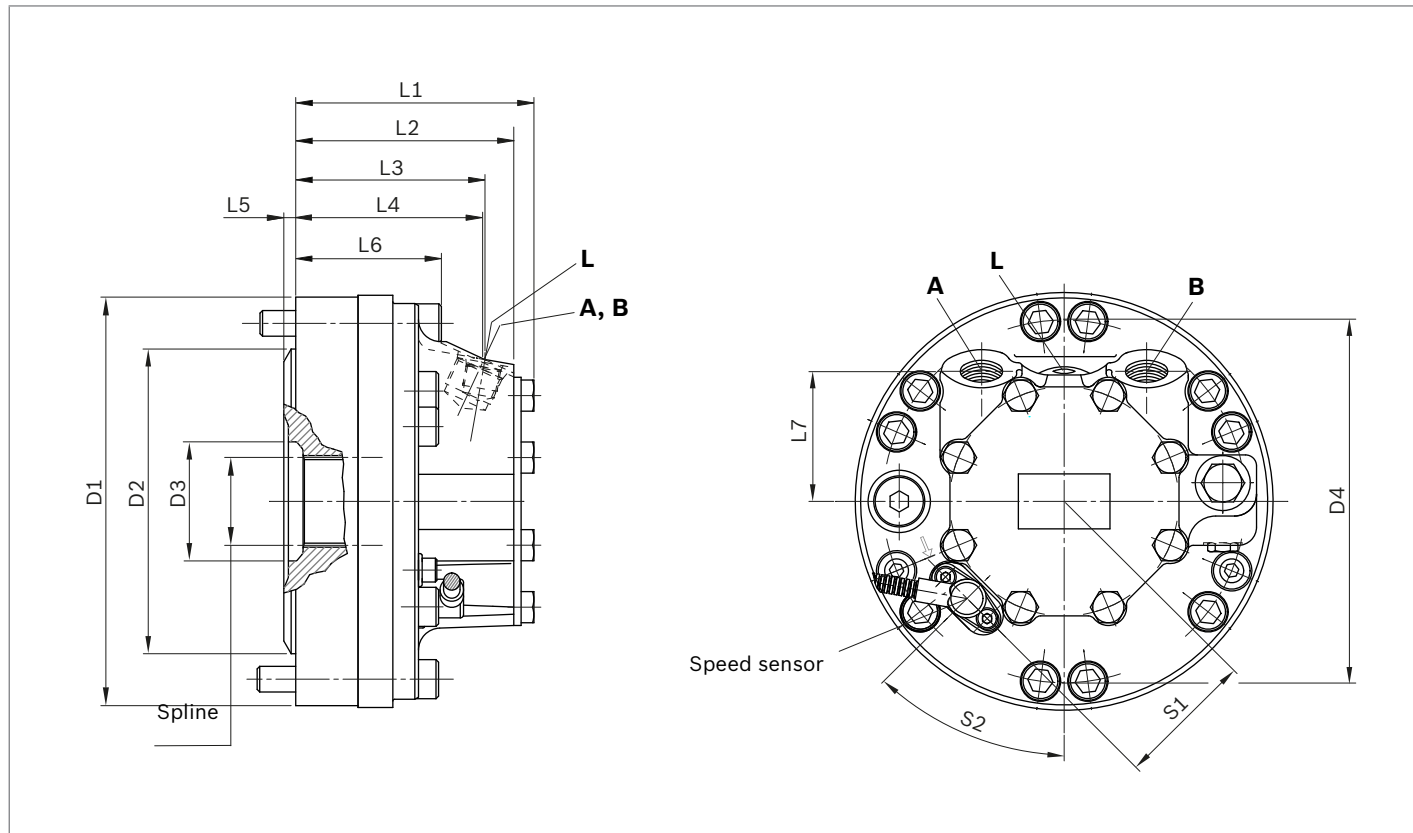
— 100 bar / 1450 psi
- - - 300 bar / 4350 psi

Notice

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

Dimensions

MCR-H single speed (1L)



Motor	D1	D2	D3	D4	L1	L2	L3	L4	L5	L6	L7
MCR3	ø180	ø131	ø50	ø156	105	95	83	71	9	48	66.5
MCR5	ø223	ø166.3	ø65.25	ø196	130	119	103	103	6.5	68	76
MCR10	ø264	ø192	ø81.13	ø223	167	141.5	125	105.5	9.4	63.5	102
MCR15	ø304	ø229	ø96.5	ø304	173.4	156.7	141	116	10	84.5	115
MCR20	ø345	ø260	ø108.25	ø310	217.7	173.8	129	129	15.5	81	120

Motor	S1	S2	Spline
MCR3	63.5	90°	BS3550 class 1 fillet root side fit, pitch 24/48, PCD 38.1 mm, No of spaces 36
MCR5	75	45°	N50 x 2 x 24 x 9H DIN 5480
MCR10	89	45°	N65 x 2 x 31 x 9H DIN 5480
MCR15	103	45°	N75 x 2 x 36 x 9H DIN 5480
MCR20	125	45°	N90 x 2 x 44 x 9H DIN 5480

Before finalizing your design, request a binding installation drawing.

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
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
MCR20	A, B	Inlet, outlet	SAE J518 ³⁾	1 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

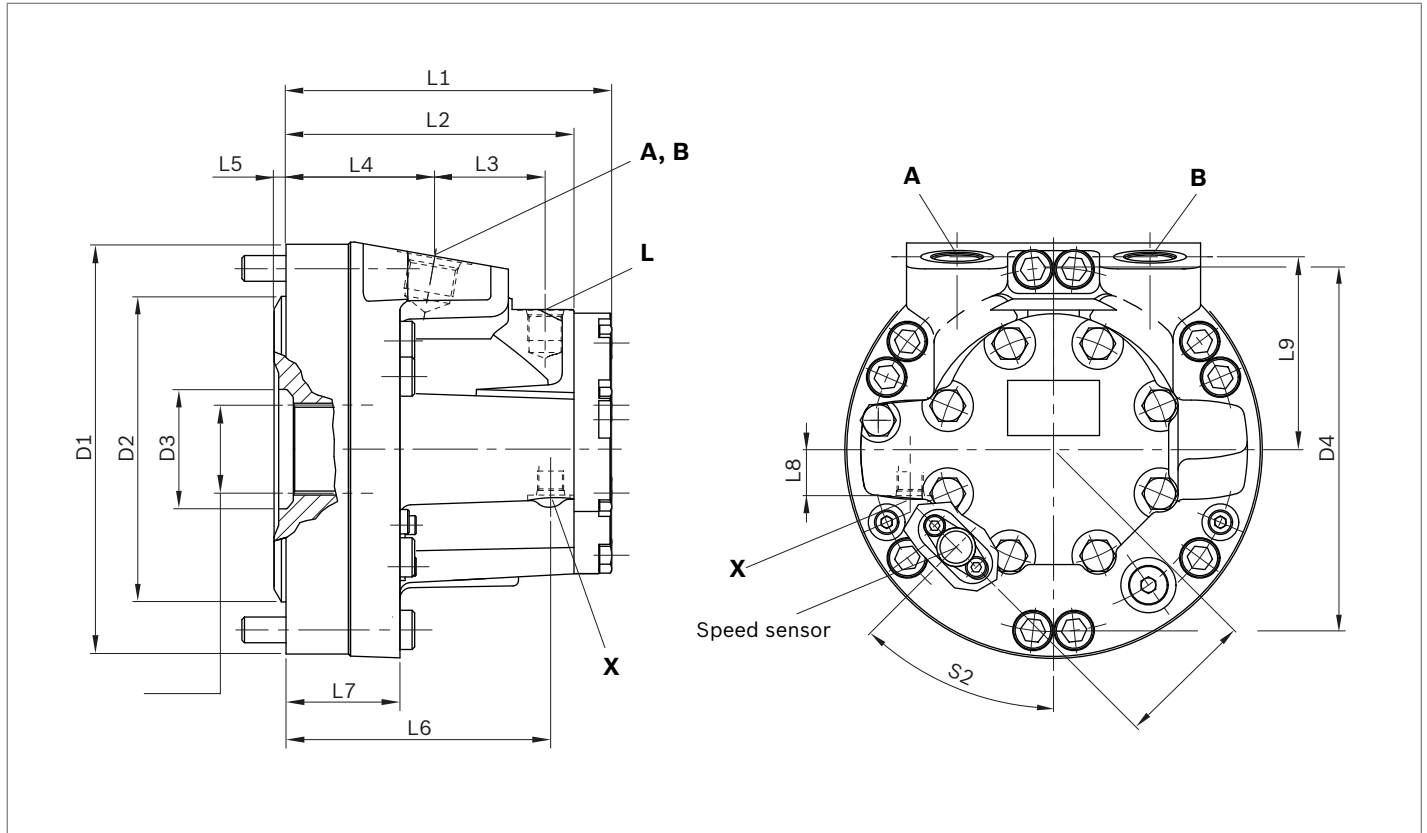
1) Depends on nominal size

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

X = Plugged (in normal operation)

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

MCR-H two speed (2WL)



Motor	D1	D2	D3	D4	L1	L2	L3	L4	L5	L6	L7
MCR3	ø180	ø131	ø50	ø156	129	114	101	83	9	48	97
MCR5	ø223	ø166.3	ø65.25	ø196	179.1	159.1	144	81	6.5	62	144
MCR10	ø264	ø192	ø81.13	ø223	192	166.5	150	105.5	10.15	63.5	151
MCR15	ø304	ø229	ø96.5	ø304	173.4	156.7	141	116	10	84.5	140.5
MCR20	ø345	ø260	ø108.25	ø310	217.7	173.8	129	129	15.5	81	118.5

Motor	L8	L9	S1	S2	Spline
MCR3	26	67.5	63.5	300°	BS3550 class 1 fillet root side fit, pitch 24/48, PCD 38.1 mm, No of spaces 36
MCR5	25	105	75	45°	N50 x 2 x 24 x 9H DIN 5480
MCR10	25	88	89	45°	N65 x 2 x 31 x 9H DIN 5480
MCR15	28.5	105	103	45°	N75 x 2 x 36 x 9H DIN 5480
MCR20	38	120	125	45°	N90 x 2 x 44 x 9H DIN 5480

Before finalizing your design, request a binding installation drawing.

Ports

Motor	Designation	Port function	Code	Size	p_{\max} [bar]	State ²⁾
MCR3	A, B	Inlet, outlet	SAE J514	1 1/16-12 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
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
	X	2 speed port	SAE J514	9/16-18 UNF	35	O
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
	X	2 speed port	SAE J514	9/16-18 UNF	35	O
MCR20	A, B	Inlet, outlet	SAE J518 ³⁾	1 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
	X	2 speed port	SAE J514	9/16-18 UNF	35	O

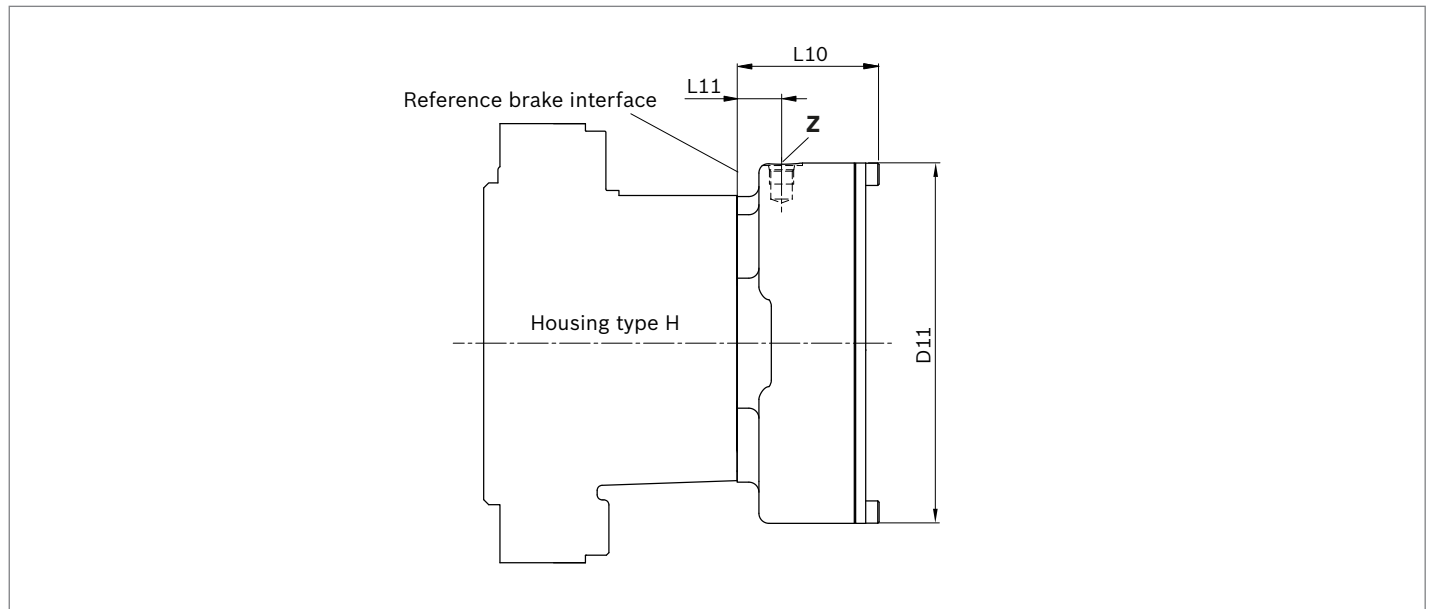
1) Depends on nominal size

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

X = Plugged (in normal operation)

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

Holding brake (multi-disc brake)



Motor	Brake	L10	L11	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
MCR20	B19	116.3	32	ø328











Ports

Motor	Designation	Port function	Code	Size	p_{max} [bar]	State
MCR3	Z	Brake Port	SAE J515	9/16-18 SAE	40	O
MCR5	Z	Brake Port	SAE J515	9/16-18 SAE	40	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
MCR20	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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