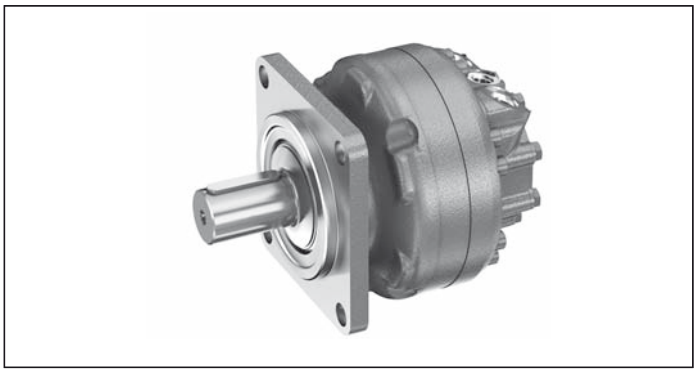
The Drive & Control Company

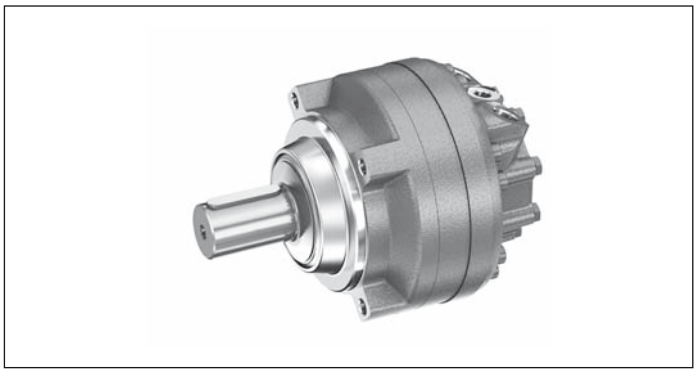
Rexroth
Bosch Group

Radial piston motors for industrial applications
MCR-D
MCR-E

RE 15196
Edition: 12.2013



MCR-D
- Frame size MCR3, MCR5, MCR10
- Displacement 160 cc to 1340 cc
- Differential pressure up to 450 bar
- Torque output up to 8530 Nm
- Speed up to 875 rpm
- Open and closed circuits

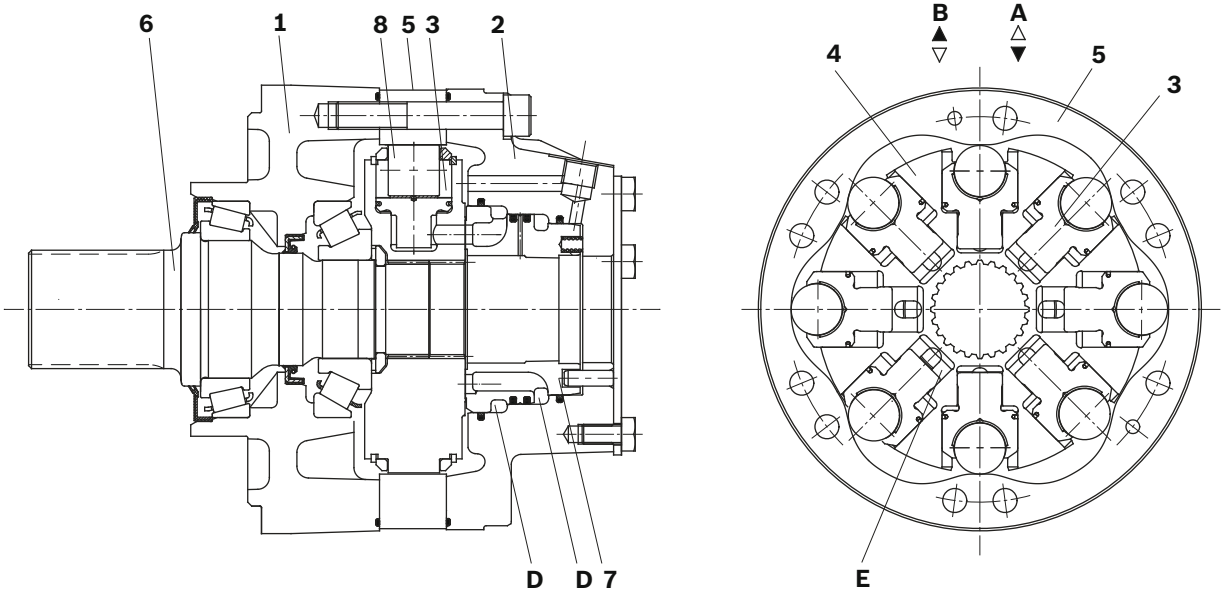


MCR-E
- Frame size MCR5
- Displacement 380 cc to 820 cc
- Differential pressure up to 450 bar
- Torque output up to 5220 Nm
- Speed up to 570 rpm
- Open and closed circuits

Features
- Compact robust construction
- High volumetric and mechanical efficiencies
- Front case mount
- Parallel shaft with key
- 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

Contents

Functional description

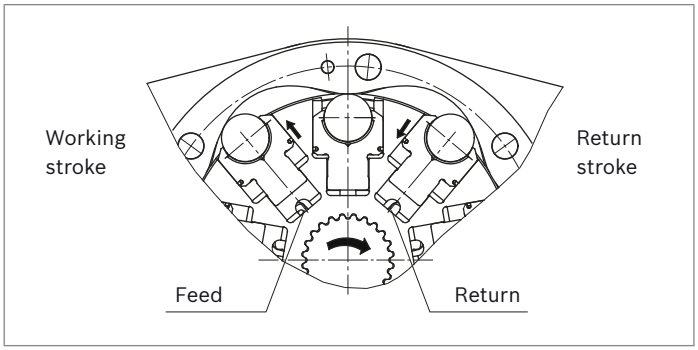


Hydraulic motors of the type MCR-D, MCR-E are radial piston motors with front case mounting and parallel shaft with key. MCR-D and MCR-E have the same type of rotary group and rear case assembly but differ in the front case mounting. These motors are intended for open or closed circuit operations as drive motors for various industrial applications.

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.

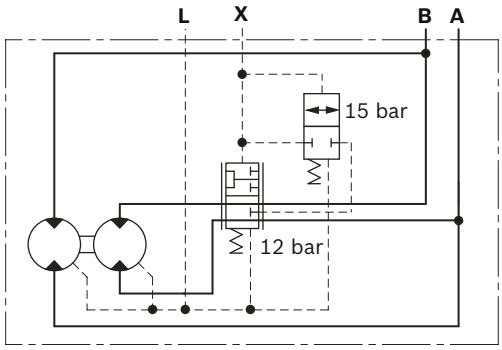
Freewheeling
In certain applications there may be a requirement to free-wheel the motor. This may be achieved by connecting ports **A** and **B** to zero pressure and simultaneously applying a pressure of 2 bar to the housing through port **L**. In this condition, the pistons are forced into the cylinder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



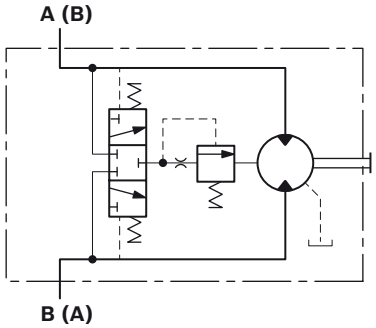
Flushing valve

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

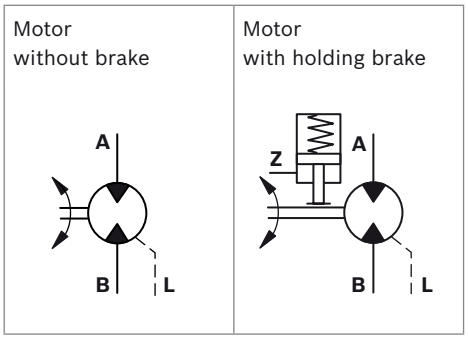
By way of rear housing (**2**) and brake shaft (**14**).

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.

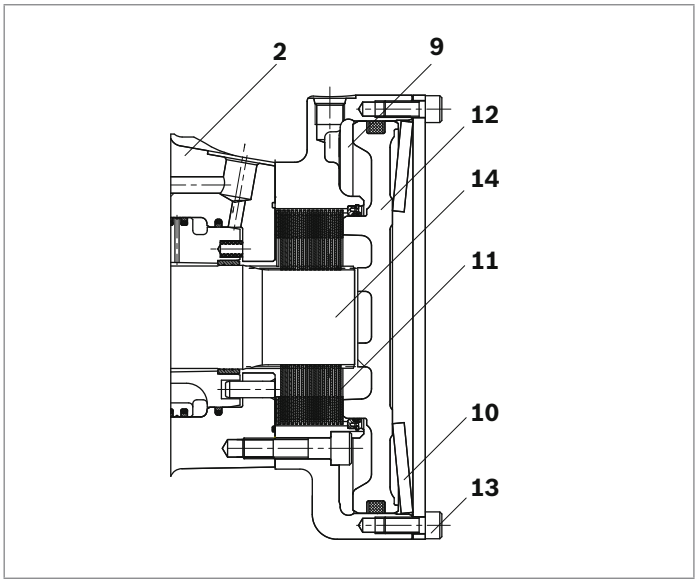
Note
This brake is provided solely for static use - not to be used dynamically.

▼ **Schematic diagrams**



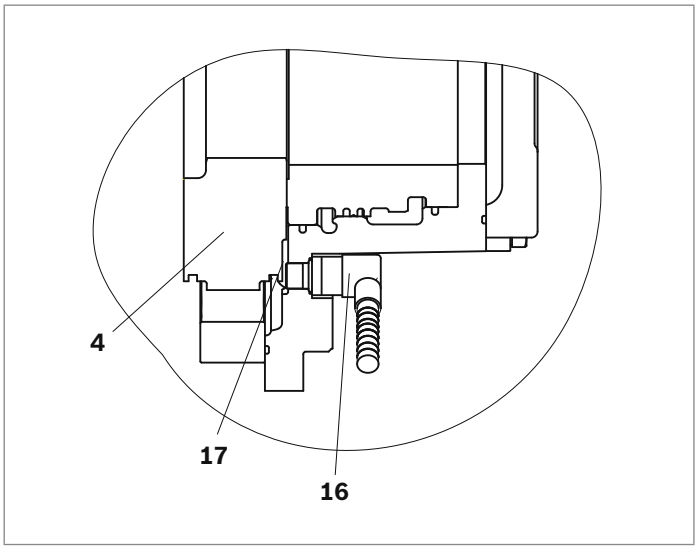
Manual release of holding brake

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



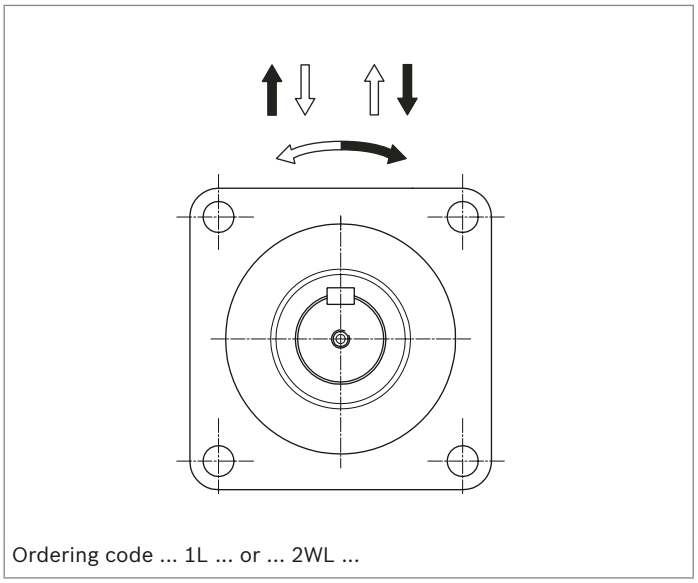
Speed sensor

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 ... 1L ... or ... 2WL ...

Ordering code

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

Radial piston motor

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

Frame size

			MCR-D	MCR-E	
02	Frame size	3	●	–	**3**
		5	●	●	**5**
		10	●	–	**10**

Housing type

03	Front case square mounting flange - SAE 4 off holes	**D**
	Front case mounting - 4 off M16 tapped holes	**E**

Nominal size, displacement V_g in cm^3/rev

04	Frame size 3 (only for MCR-D)		**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 (only for MCR-D)		**780**	**860**	**940**	**1120**	**1250**	**1340**		
	Low displacement: motors use standard cylindrical pistons	LD	●	●	●	–	–	–		
	High displacement: motors use stepped pistons	HD	–	–	–	●	●	●		

Drive shaft

05	Parallel keyed shaft	ø40 mm only for MCR3D	**L40**
		ø50 mm available for MCR5D and MCR5E	**L50**
		ø60 mm only for MCR10D	**L60**

Through shaft

06	Without through shaft	**Z**

Series

07	Series 33	**33**

Brake

			MCR3	MCR5	MCR10	
08	Without brake		●	●	●	**A0**
	Hydraulic release spring applied multi-disc holding brake	2200 Nm	●	–	–	**B2**
		4400 Nm	–	●	–	**B4**
		7000 Nm	–	–	●	**B7**

Seals

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

Single/two-speed operation

10	Single speed, standard direction of rotation	**1L**
	Bi-directional two speed, standard direction of rotation	**2WL**

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**

● = Available – = Not available

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

Studs

12	Without studs (no code)	

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-F8**

Special order

15	Special feature	**SOXXX**

Other

16	Mark in text here	*

Footer from page 7

1) Not available for E-Type
2) Ensure motor case is filled with oil prior to start-up. See instruction manual 15215-B.
3) For installation and maintenance details, please see instruction manual 15215-B.
4) For use with environmentally acceptable fluids HEES, HEPG, HETG, fluoroelastomer / Viton seals must be specified.
5) Extension of the allowable temperature range may be possible depending on specification. Please consult Bosch Rexroth Engineering Department in Glenrothes for further details.
6) 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.
7) When operating motors in series, please consult Bosch Rexroth Engineering Department in Glenrothes.
8) For continuous operation at speeds <5 rpm please consult Bosch Rexroth Engineering Department in Glenrothes.
9) Based on nominal no-load Δp of 20 bar in full-displacement mode.
10) Warning! During the running in period of the motor (min. 20 hrs) it should not be run unloaded at >100 rpm.
11) Guide values for up to 5000 hours of motor operation (ISO VG46 at 50 °C).
12) Maximum pressure is restricted according to maximum torque

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.

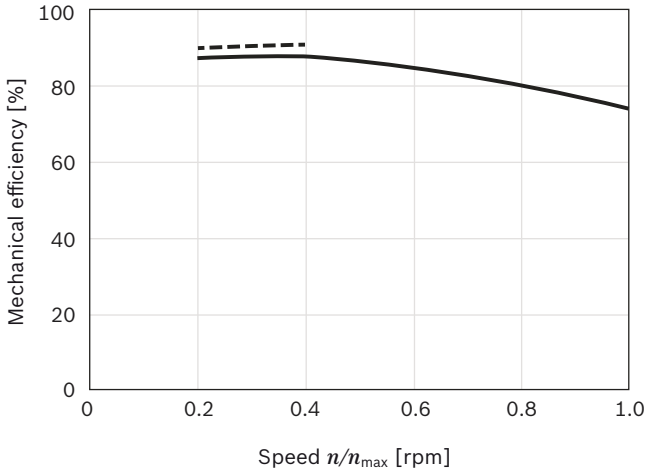
Technical data

Frame size			**MCR3**[1)]	**MCR5**	**MCR10**[1)]				
Type of mounting			Flange mounting, face mounting						
Pipe connections[2)3)]			Threaded per SAE J514; Flanged per SAE J518						
Shaft loading			see page 9						
Weight			**MCR3D**	**MCR5D**	**MCR5E**	**MCR10D**			
Single speed (1L)	m	kg	21	39	36	62			
Two speed (2WL)	m	kg	27	47	44	67			
Hydraulic fluid[4)]									
Fluid cleaniness			ISO 4406, Class 20/18/15						
Fluid viscosity range	$v_{min/max}$	mm²/s	10 to 2000						
Fluid temperature range[5)]	$\theta_{min/max}$	°C	-20 to +85						
Pressure			Low displacement				High displacement		
Operating pressure	p_{nom}	bar	250				250		
Maximum differential pressure[6)7)]	Δp_{max}	bar	450				400		
Maximum pressure at port **A** or **B**[6)7)]	p_{max}	bar	470				420		
Maximum case drain pressure	$p_{case\ max}$	bar	10				10		
Motor performance MCR3									
Displacement	V_g	cm³/rev	**160**	**225**	**255**	**280**	**325**	**365**	**400**
Specific torque		Nm/bar	3	4	4	4	5	6	6
Maximum torque[6)12)]	T_{max}	Nm	1146	1500	1500	1500	1500	1500	1500
Minimum speed for smooth running[8)]	n_{min}	rpm	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
Maximum speed (1L)[9)10)]	n_{max}	rpm	**670**	**475**	**420**	**385**	**330**	**295**	**270**
Maximum speed (2WL)[9)10)]	n_{max}	rpm	**875**	**620**	**550**	**500**	**430**	**385**	**350**
Continuous operating power[10)]	P	kW	11.64	15.34	15.17	17.48	11.61	11.38	14.99
Motor performance MCR5									
Displacement	V_g	cm³/rev	380	470	520	565	620	680	750	820
Specific torque		Nm/bar	6	7	8	9	10	11	12	13
Maximum torque[6)12)]	T_{max}	Nm	2722	3000	3000	3000	3000	3000	3000	3000
Minimum speed for smooth running[8)]	n_{min}	rpm	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Maximum speed (1L)[9)10)]	n_{max}	rpm	475	385	350	320	290	265	240	220
Maximum speed (2WL)[9)10)]	n_{max}	rpm	570	465	420	385	350	320	290	265
Continuous operating power[10)]	P	kW	38.01	38.14	37.86	42.42	26.52	25.85	24.42	31.98
Motor performance MCR10									
Displacement	V_g	cm³/rev	780	860	940		1120	1250	1340	
Specific torque		Nm/bar	12	14	15		18	20	21	
Maximum torque[6)12)]	T_{max}	Nm	4800	4800	4800		4800	4800	4800	
Minimum speed for smooth running[8)]	n_{min}	rpm	0.5	0.5	0.5		0.5	0.5	0.5	
Maximum speed (1L and 2WL)[9)10)]	n_{max}	rpm	215	195	180		150	135	125	
Continuous operating power[10)]	P	kW	50.21	55.67	52.82		38	42.34	38.81	
Brake			**MCR3D**		**MCR5D, MCR5E**		**MCR5D, MCR5E**		**MCR10D**
Holding brake (disc brake)			**B2**		**B2**		**B4**		**B7**
Minimum holding torque	$t_{min/max}$	Nm	2200		2200		4400		7000
Release pressure (min)	$p_{rel\ min}$	bar	11		11		11		11
Release pressure (max)	$p_{rel\ max}$	bar	15		15		15		15
Maximum pressure at brake port „Z“	p_{max}	bar	40		40		40		40
Oil volume to operate brake	V_{rel}	cm³	23		23		46		36

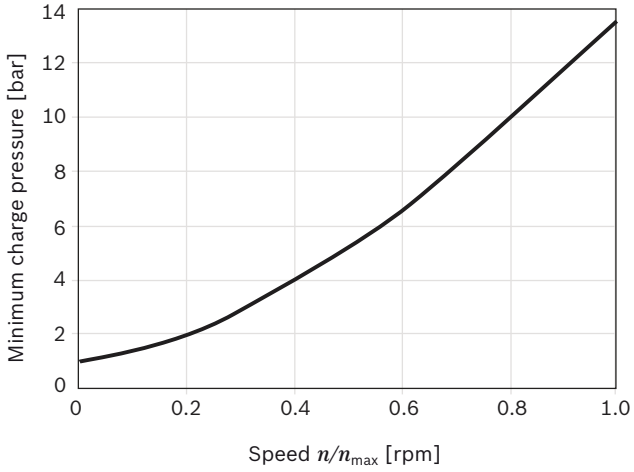
Footer on page 6

Efficiencies

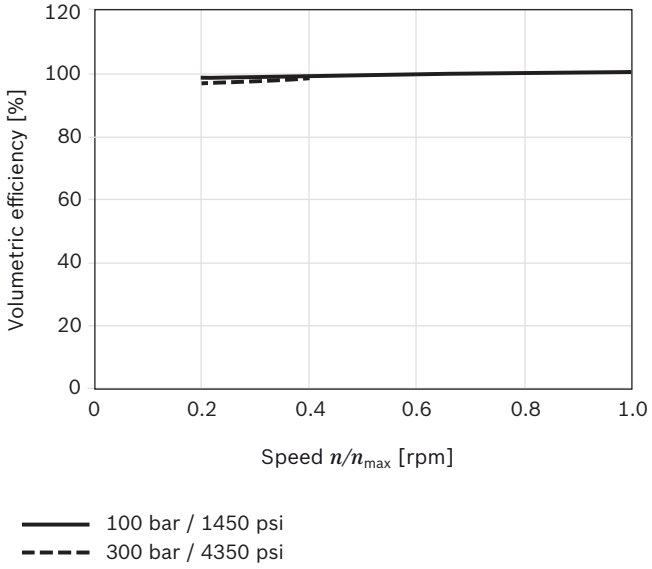
▼ **Mechanical efficiency**



▼ **Charge pressure**



▼ **Volumetric efficiency**



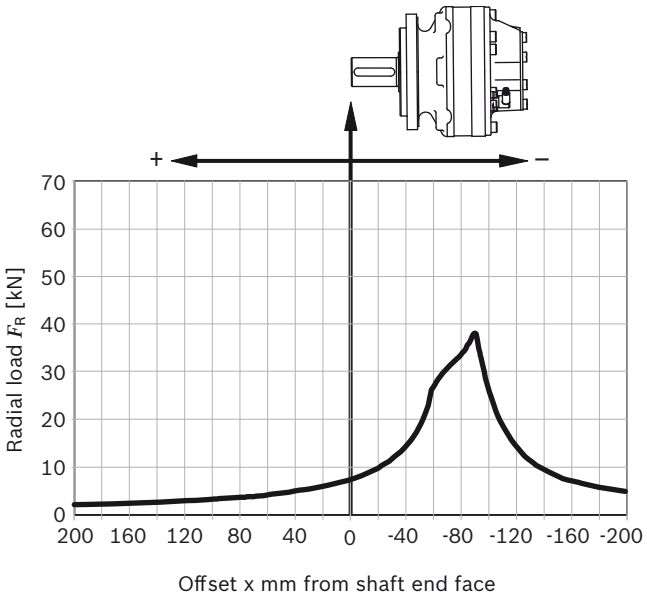
Note:

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

Permitted loading on drive shaft

Drive shaft ...3D L40...

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



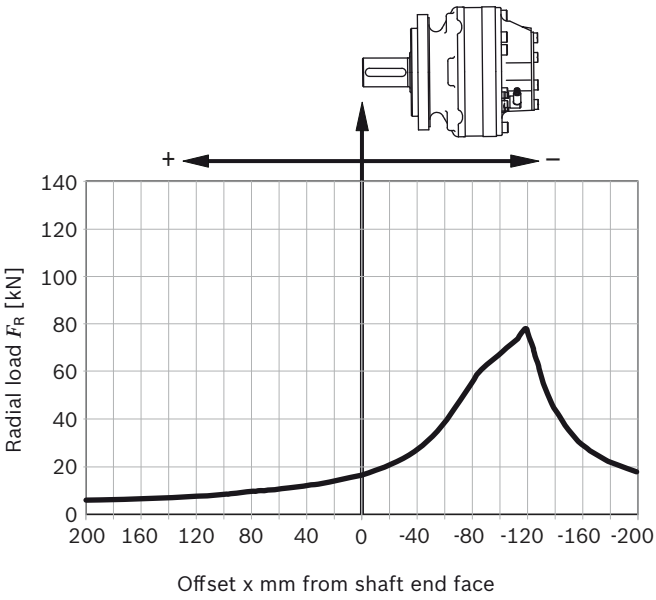
Maximum axial load $F_{ax\,max}$ (with radial load F_R = 0):

$F_{ax\,max}$ = 30200 N ← +

$F_{ax\,max}$ = 27000 N → –

Drive shaft ...10D L60...

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



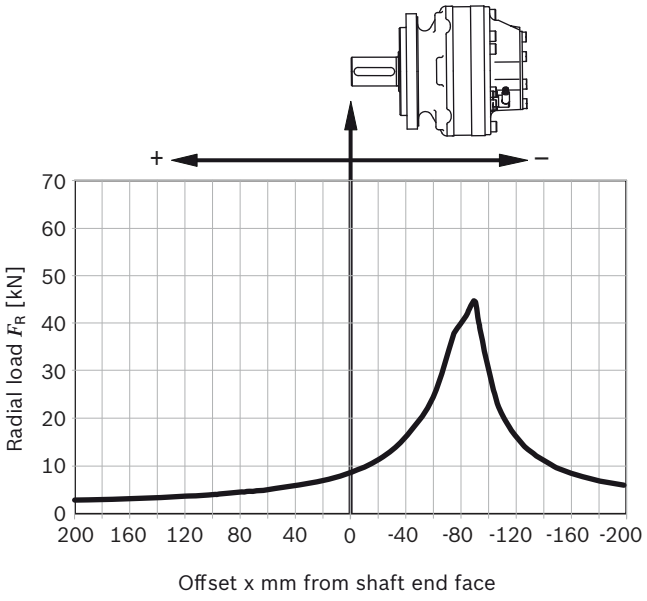
Maximum axial load $F_{ax\,max}$ (with radial load F_R = 0):

$F_{ax\,max}$ = 78700 N ← +

$F_{ax\,max}$ = 63400 N → –

Drive shaft ...5D L50...5E L50...

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



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

$F_{ax\,max}$ = 50000 N ← +

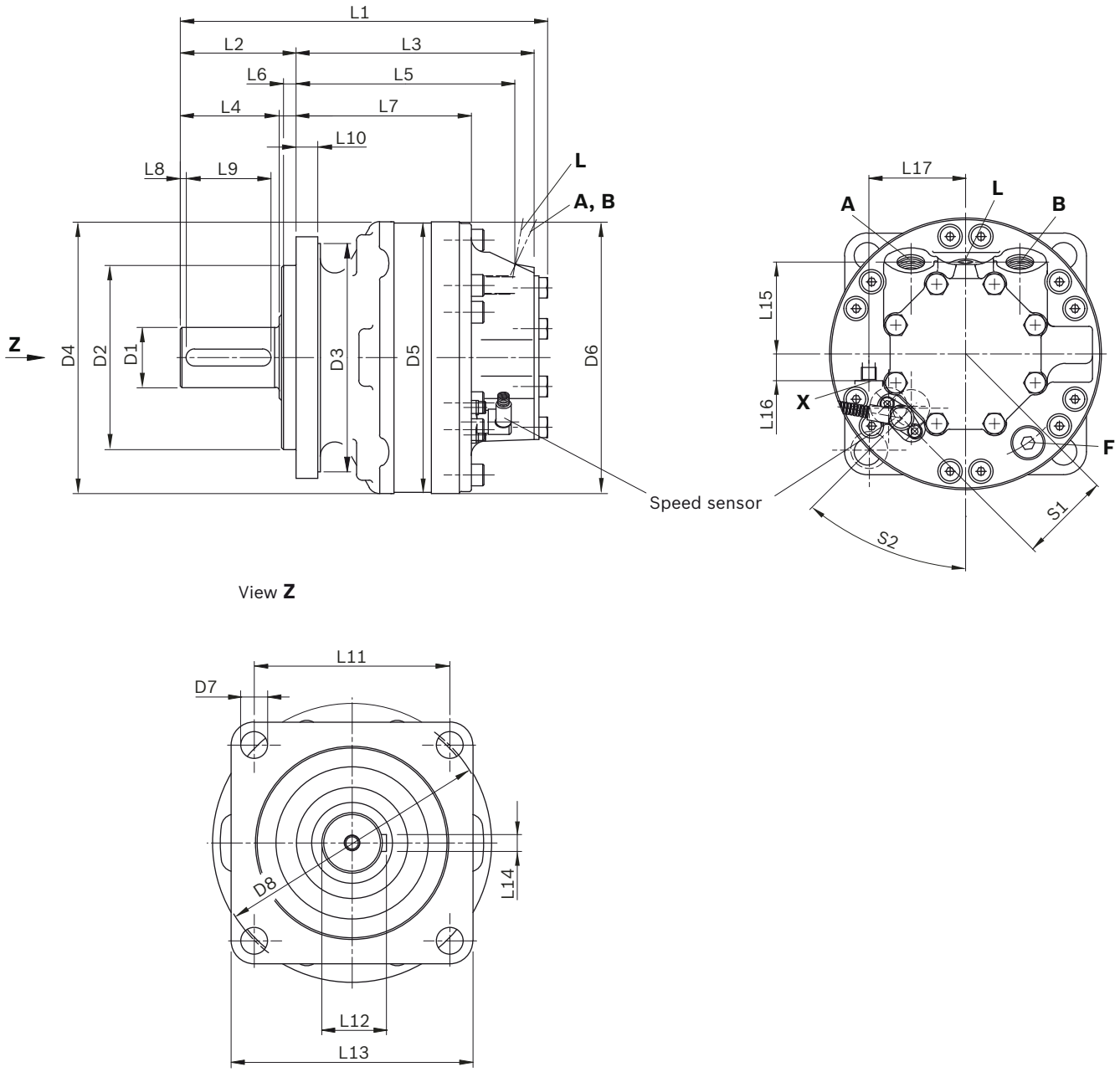
$F_{ax\,max}$ = 32000 N → –

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-D



Before finalizing your design, request a binding installation drawing.
Dimensions in mm.

Single speed (1L)

Motor	D1	D2	D3	D4	D5	D6	D7	D8	L1	L2	L3	L4	L5	L6
MCR3	ø40	ø125	ø134	–	ø180	–	ø14	ø160	281.3	114.4	167	84.5	133	9
MCR5	ø50	ø152.4	ø189	ø225	ø223	ø225	ø22	ø229	304	96	197	82	181	10.5
MCR10	ø60	ø152.4	ø189	ø264	ø262	ø262	ø20.5	ø229	407	123	259	105	223	10.5

Motor	L7	L8	L9	L10	L11	L12	L13	L14	L15	S1	S2
MCR3	112	5	70	14	113	43	140	12	66.5	63.5	90°
MCR5	145	5	70	18	162	53.5	200	14	76	75	45°
MCR10	182	6	80	19	162	64	200	18	98	89	45°

Two speed (2WL)

Motor	D1	D2	D3	D4	D5	D6	D7	D8	L1	L2	L3	L4	L5	L6
MCR3	ø40	–	ø134	–	ø180	–	ø14	ø160	341	114.4	226.7	84.5	105.7	9
MCR5	ø50	ø152.4	ø189	ø225	ø223	ø225	ø22	ø229	343	96	237	82	159	10.5
MCR10	ø60	ø152.4	ø189	ø264	ø262	ø262	ø20.5	ø229	432	123	283.5	105	247.5	10.5

Motor	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	S1	S2
MCR3	112	5	70	14	113	43	140	12	67.5	26	65	63.5	30°
MCR5	–	5	70	18	162	53.5	200	14	105	23.5	78	75	45°
MCR10	180.5	5	80	19	162	64	200	18	88	25	107	89	45°

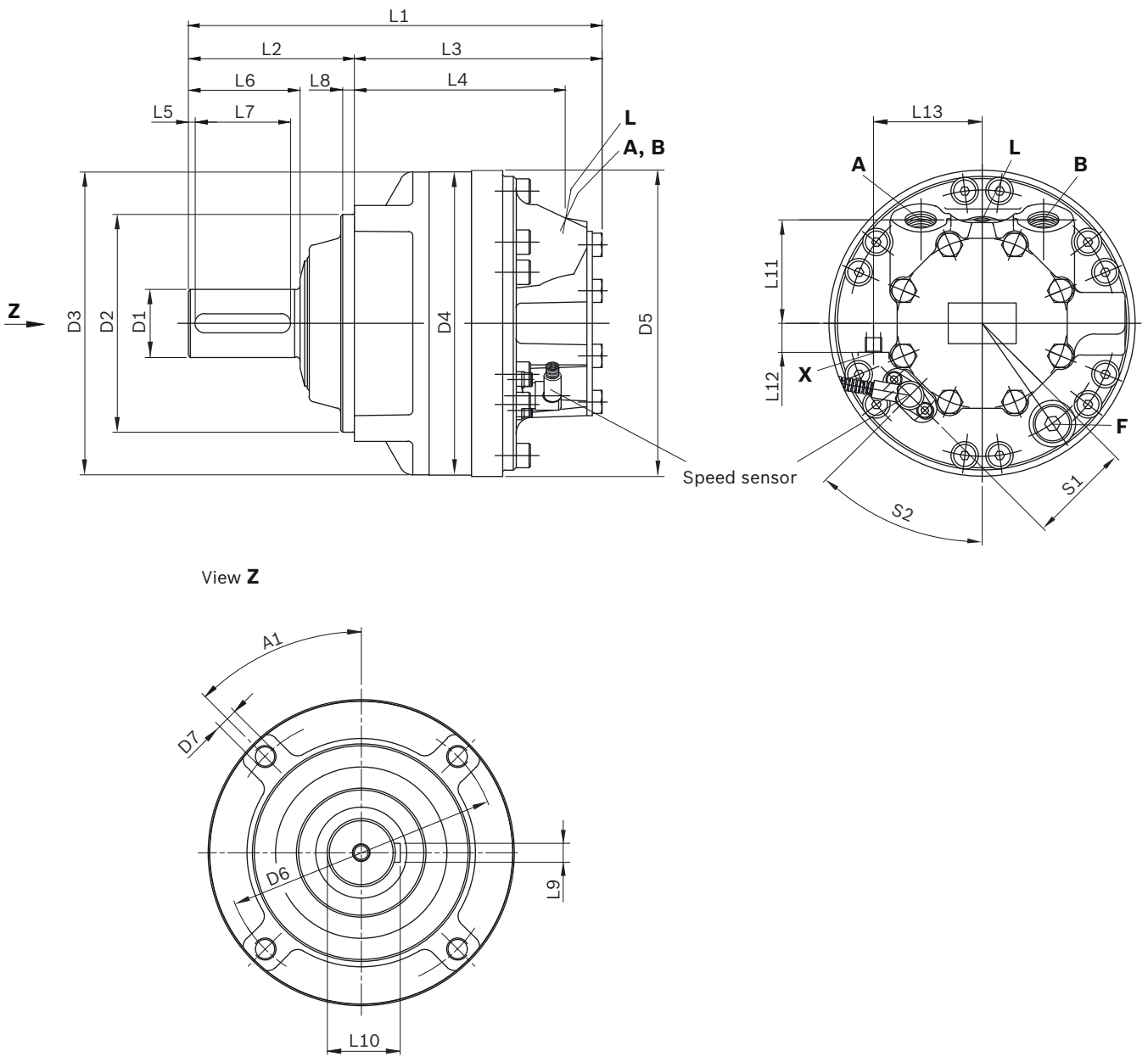
Ports

Motor	Designation	Port function	Code	Size	p_{max} [bar]	State[2)]
MCR3	**A, B**	Inlet, outlet	SAE J514	7/8-4 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

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)

Dimensions

MCR-E



Before finalizing your design, request a binding installation drawing.
Dimensions in mm.

Single speed (1L)

Motor	D1	D2	D3	D4	D5	D6	D7	L1	L2	L3	L4	L5
MCR5	ø50	ø160	ø222.5	ø223	ø225	ø200	M16	304	122	182	155	5

Motor	L6	L7	L8	L9	L10	L11	A1	S1	S2
MCR5	82	70	8.5	14	53.45	76	45°	75	45°

Two speed (2WL)

Motor	D1	D2	D3	D4	D5	D6	D7	L1	L2	L3	L4	L5
MCR5	ø50	ø160	ø222.5	ø223	ø225	ø200	M16	343	122	221	134.4	5

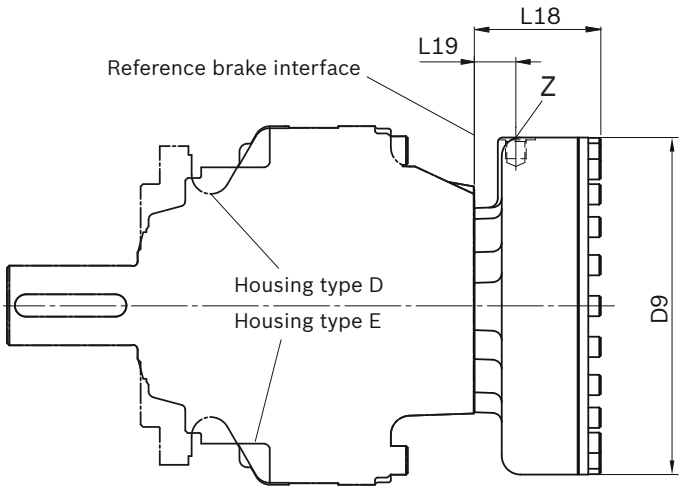
Motor	L6	L7	L8	L9	L10	L11	L12	L13	A1	S1	S2
MCR5	82	70	8.5	14	53.45	76	23.5	78	45°	75	45°

Ports

Motor	Designation	Port function	Code	Size	p_{max} [bar]	State[2)]
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)
3) Only dimensions according to SAE J518
(Code 62 - high pressure series)

Holding brake (multi-disc brake)



Motor	Brake	L18	L19	D9
MCR3	**B2**	67.3	22	ø174
MCR5	**B2**	67.3	22	ø174
	B4	80.7	26.5	ø215
MCR10	**B7**	97.8	29	ø251

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

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

Before finalizing your design, request a binding installation drawing.
Dimensions in mm.

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 40** 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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