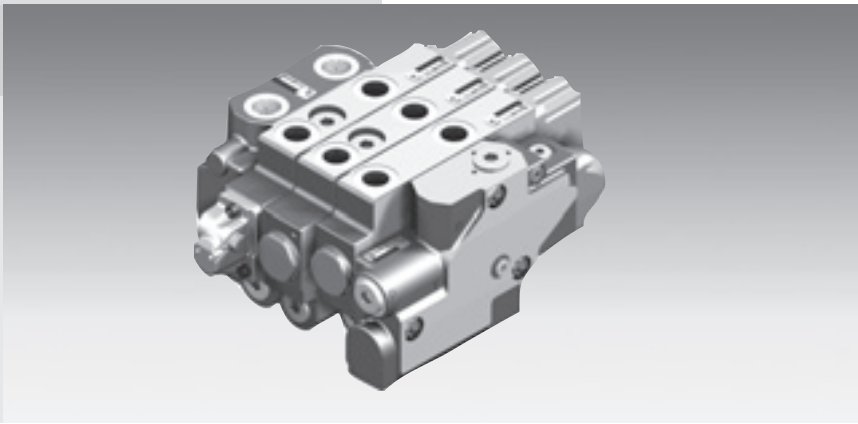
Rexroth
Bosch Group

Control Block SB23-EHS1

RE 66 134/11.11 1/36

SB23-EHS1



with on-board-electronics “OBE”,
pilot-controlled electrohydraulic actuation

Nominal pressure: $p_{nom.}$ = 250 bar
Flow rate: Q_{max} = 100 l/min

Table of contents

Features

System

- Load-independent flow control
- “Load Sensing” system

Design

- Port plate
- Segment design (up to 6 valve segments)
- End plate

Type of actuation

- Pilot-controlled electrohydraulic actuation

Flow rate

- Load-pressure compensated
- High repeat accuracy
- Low hysteresis

Pressure safeguarding

- Optionally included in port plate

Application areas

- Tractor applications

Description

Purely electrically controlled, LS directional valve:

- Double-acting with 4 switch positions
- Mechanically operated check valve in B, optional in A
- 2-way individual pressure compensator in inlet
- Optional flange surface for customer-specific coupling housing
- Check valves in Open center without load pressure opened all the way

Control block SB23-EHS1

Consisting of:
- Port plate
- 1 ...6 valve segments
- 3 tie bolts, 5 tie bolts optional
- End plate

The following combination is shown as an example:

① Port plate

② Control valve, single-action, electrical proportional actuation with 2-way pressure compensator, with secondary pressure relief valve

③ Intermediate plate

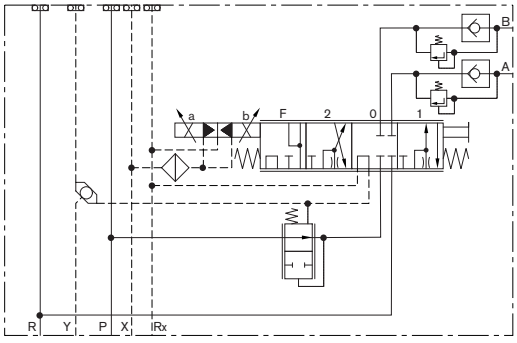
④ – ⑦ Directional valve, double-action, with 2-way pressure compensator, with check valves, hydraulically actuated

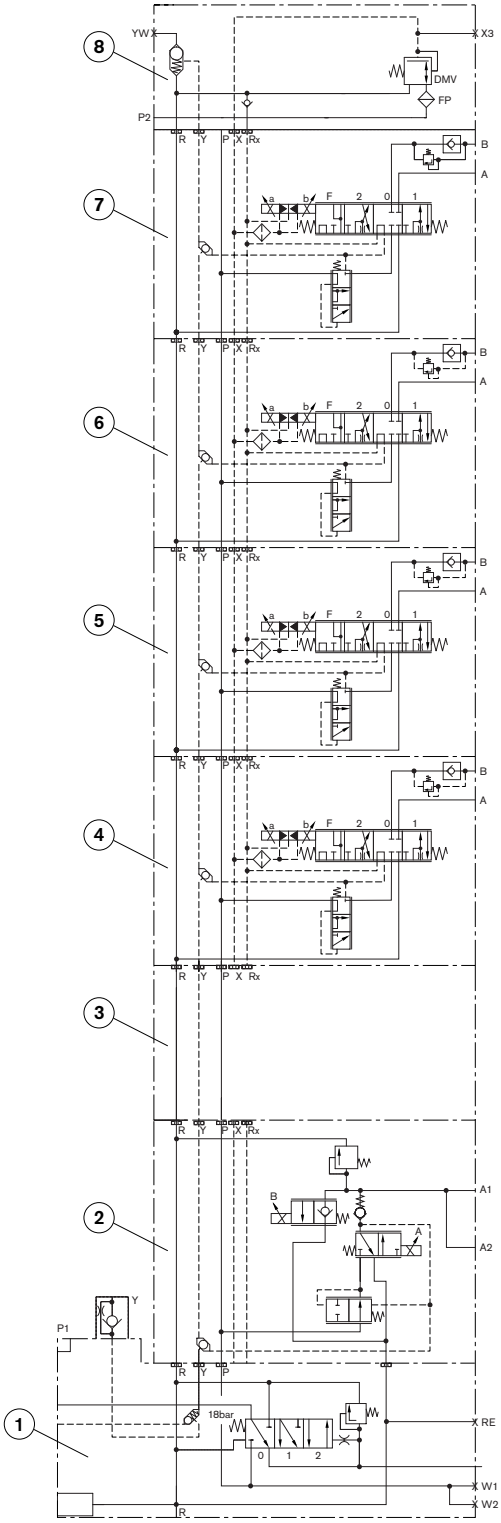
⑧ End plate with coarse and fine filter and pilot oil preparation

Ports

P Pump
A, B Consumers
X Pilot oil supply
Rx Pilot oil return

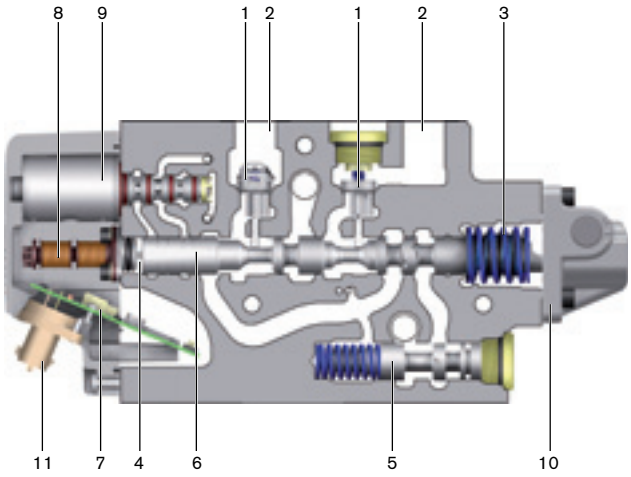
Y (LS)-signal
R Return reservoir

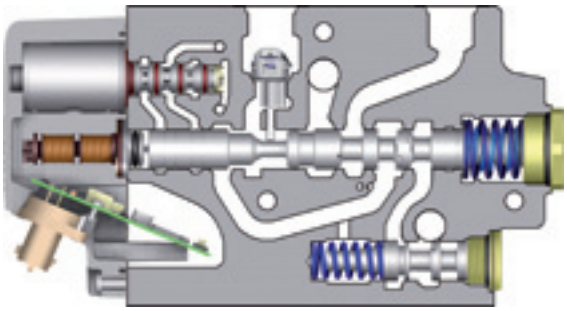




Function, cut

The SB23-EHS1 is a pilot-controlled electrohydraulically actuated directional valve with 4 settings. The main spool is controlled via a 4/3 pilot valve which pressurizes the chambers for moving the main spool. The main spool is guided back by means of a displacement pick-up on the control electronics. Using the current of the pilot valve, the electronics then regulate the position of the main spool as a function of the target value. The mechanically controlled check valves in the two work ports act as non-return valves in the inlet. Load compensation in the inflow occurs via the individual pressure compensators. The electronics are for position control and for communicating with the CAN bus. They are equipped with diagnostic functions.





1 Check valves
2 Work ports
3 Return springs
4 Chamber
5 Individual pressure compensator
6 Main spool
7 Electronics unit
8 Displacement pick-up
9 Pilot valve
10 Cover or cover with manual auxiliary actuation
11 CAN control

Pilot-controlled electrohydraulic actuation SB23-EHS1, EHR23

Technical data (Please contact us if the device is to be used outside of the specified values!)

General	Control blocks consisting of: 1 port plate, 1 end plate 1...6 valve segments 3 tie bolts
Fasteners	Thread in port plate and end plate (standard: M6)
Line ports	Screw-in thread or flange port, see unit dimensions
Installation position	see page 19
Ambient temperature	–35 °C...+110 °C, (storage temperature 3 h, 125 °C)
Hydraulic	
Permissible pressure fluids	• Hydraulic oils on mineral oil base according to DIN 51 524 • HLP according to DIN 51524 • HVLP 32/46/68 hydraulic oils according to DIN 51 524 • HD SAE 10 W 40 • HETG Fuchs Plantohyd 40/Fragol TR46 • HEPG Fuchs Renolin PG • HEES Fuchs Plantosyns Super S40/Fragol Hydraulic HE 15+46 • Engine oils according to API-C • Engine oils according to API-CD • Engine oils according to API-CF • Dye Renolin FST 101 Additional oil types such as multi-functional oils STOU/UTTO are available on request.
Viscosity	7... 500 mm^2/s permissible range 20... 100 mm^2/s recommended range 7...8000 mm^2/s range permissible for start
Fluid temperature in operation	+35 °C...+110 °C permissible range –35 °C range permissible for start
Oil cleanliness	Oil contamination class 20/18/15 according to ISO 4406: 1999 or class 10A/10B/9C according to SAE AS 4059
Operating pressure at port: P A, B R, Rx X	p_{max} = 250 bar (pump side) p_{max} = 250 bar (consumer side) p_{max} = 20 bar (return side) p_{max} = 50 bar
Leakage A, B → R with p = 125 bar, ν = 33 mm^2/s ϑ = 50 °C	$Q_L \leqq$ 2 ml/min with check valves in A, B
Nominal oil flow port P → A, B A, B → R	Q_{nom} = 100 l/min Q_{max} = 120 l/min
Thermo PRV	Optionally as cartridges in work port side Cracking pressure at 150 ml/min, 33 mm^2/s: 242...293 bar Closing pressure: > 215 bar
Neutral recirculation pressure for opening the IDW from the check function from P → R	6.5 bar (1 SPV)
Spring cap with manual auxiliary actuation	Active, bidirectional mechanical actuation of the main spool Actuation torques (see project drawing)

Technical data (continued)

Electrohydraulic		
Relative actuated time	100% ED to +110 °C	
Type of protection	IPX6, IPX9K (with plugged-in CAN connector)	
Plug connection	Compact connector or Jet connector	
Electrical power input	p_{max} = 17 W for 12-V system	
Solenoid voltage	12 V vehicle battery voltage ISO 16750-2: Code C, (24 V on request)	
Response time for 100% deflection	See response time/dynamics	
Pilot pressure	18 bar ±1, referenced to return pressure	
Pilot oil flow	Per valve segment 4.4 l/min short-term at max. actuating speed, in neutral 0.25 l/min, in Lift/Lower control position 0.6 l/min	
Response time/dynamics	Step function: (incl. dead time)	0–100% from position 0 to position 1 or 2: approx. 50 ms 0 to position F: approx. 70 ms 50 °C, 30 mm²/s, VG46, mean value of the valve Response time vs. viscosity, see Z 206 803 930 EHS1 interface description
Hysteresis	with respect to oil flow: typically approx. 1% of Q_{max} (in oil flow range up to 80% of Q_{max})	
Other technical data:	See Z 206 803 930 EHS1 interface description	

This type key describes the desired design variant of a SB23 directional valve and EHR23 control valve.

Type key, e.g. SB23

S B – 2 3 0 0 L 7 0 E H S C C 2 D 2 Q 3

Additional function in the lower axis
– – no pressure compensator
Q 3 2-way individual pressure compensator

Additional function in service line port A optional
D 2 mechanically actuated check valve

Additional function in service line port A B
C 2 mechanically actuated check valve

Target value signal
C CAN signal
P PWM on request

Control type E H S pilot-controlled electrohydraulic actuation

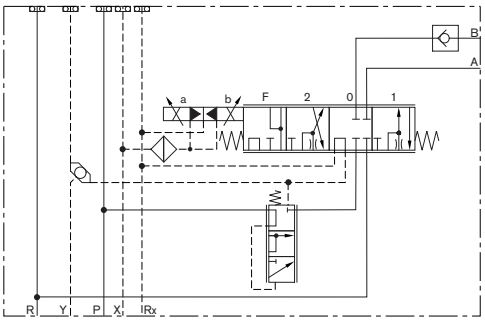
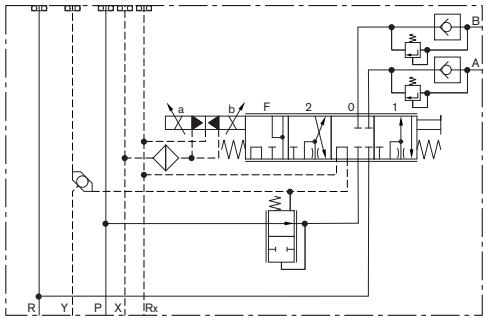
Spool symbol L 7 0 4 positions (Lift – Neutral – Lower – Open center)

Version status
1 EHS1 control unit

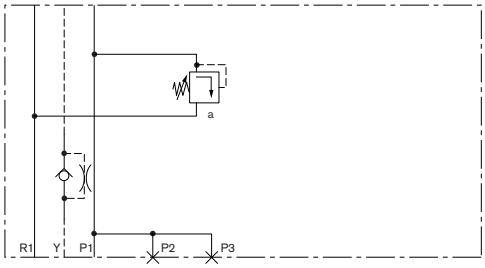
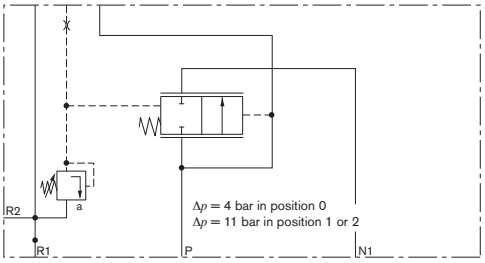
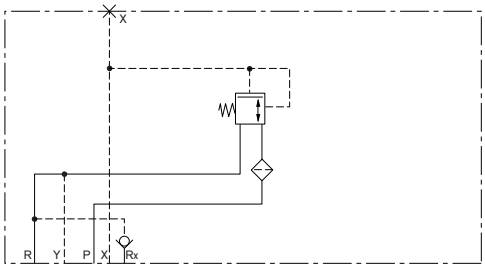
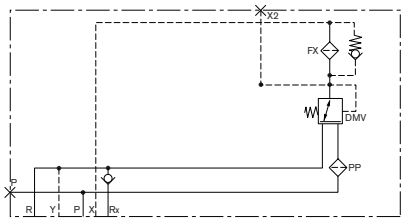
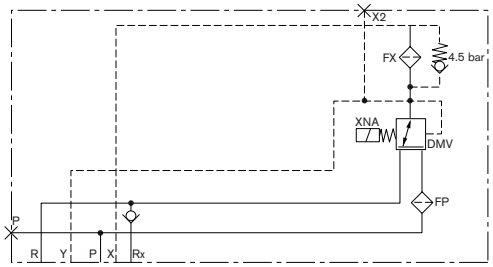
Series status
0 First generation

Valve type - series
S B – 2 3 SB23

Order details

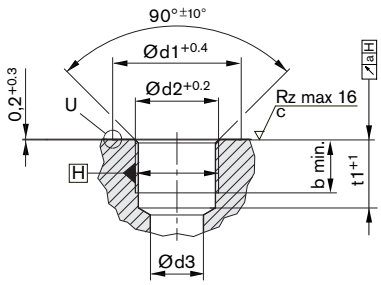
SB23-EHS1	Flow rate Q	Ports/design	Comments	Part number
	100 l/min	A, B = M 22 x 1.5 / I		**R917007116**
	80 l/min	Coupling flange M 6		**R917007117**
	100 l/min	A, B = M 22 x 1.5 / I	Manual auxiliary actuation of the thermo PRV main spool	**R917007219**

Order details (continued)

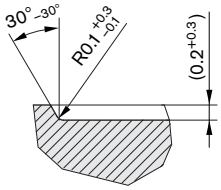
SBx3-EHS1 port plate for variable pump	Ports/ design	Comments	Part number
	**P1 = M27x2/ III** **P2 = M27x2/ III** **P3 = M10x1/ I** **R1 = M33x2/ III** **Y = M12x1.5**	With PRV; P2 port M27x2 plugged; P3 port, M10x1 open; Screw-in thread for tie bolts; securing foot with M8 thread, Dr RV 1527410132 screwed into Y port	**R917007235**
SBx3-EHS1 port plate for fixed pump			
	**P = M22x1.5/ II** **R1 = M27x2/ II** **R2 = M27x2/ II** **N1 = M22x1.5/ II**	With PRV	**R917007203**
SBx3-EHS1 end plate use for variable pump			
	**X: M12x1.5/ III**	Pilot pressure 18 bar (fixed setting) Pilot pressure port: X-port plugged; with sintered metal filter in P line;	**R917007578**
	**X: 9/16-18 UNF; ISO 11926** **P: M12x1.5/ III**	Pilot pressure 18 bar (fixed setting) Pilot pressure port: X-port plugged; with sintered metal filter in P line; fine filter	**R917005923**
SBx3-EHS1 end plate use for fixed pump			
	**X: M10x1/ I** **P: M22x1.5/ III**	Pilot pressure 18 bar, switchable Pilot pressure port: X port plugged; with sintered metal filter in P line; fine filter	**R917007249**
SBx3-EHS1 intermediate plate			
		Disc width: L = 13 mm	**R917005302**
		Disc width: L = 15 mm	**R917006220**
		Disc width: L = 22 mm	**R917007130**
		Disc width: L = 16 mm	**R917007583**

Threaded ports – design

Design I



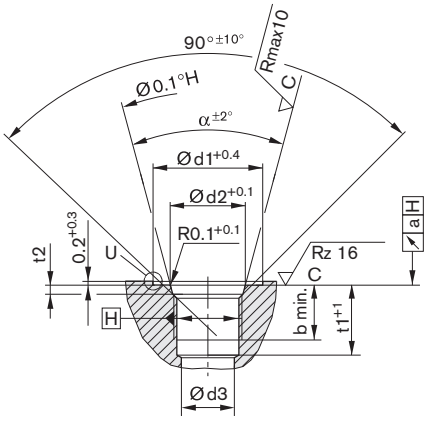
View U



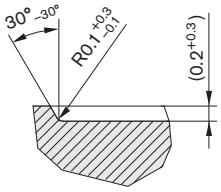
DIN 3852-1									Port
M8x1	M10x1	M12x1.5	M14x1.5	M18x1.5	M22x1.5	M26x1.5	M27x2	M33x2	Thread
I	I	I	I	I	I	I	I	I	Version
17	20	25	25	30	34	42	42	47	Ø d1
8	10	12	14	18	22	26	27	33	Ø d2
$6.5^{\pm0.1}$	$8.5^{\pm0.1}$	$10^{\pm0.1}$	$12^{\pm0.1}$	$16^{\pm0.1}$	$19^{\pm0.15}$	$23.5^{\pm0.15}$	$24^{\pm0.15}$	$30^{\pm0.15}$	Ø d3
–	–	–	–	–	–	–	–	–	Ø d4
–	–	–	–	–	–	–	–	–	Ø d5
0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	a
10	10	15	15	15	17	19	20	22	t1
–	–	–	–	–	–	–	–	–	t2
8	8	12	12	12	14	16	16	18	b
–	–	–	–	–	–	–	–	–	$\measuredangle\,\alpha$

DIN 3852-2				Port
$G^1/_4$	$G^3/_8$	$G^1/_2$	$G^3/_4$	Thread
I	I	I	I	Version
25	28	34	42	Ø d1
13.2	16.7	21	26.5	Ø d2
$10.5^{\pm0.1}$	$14.5^{\pm0.1}$	$18^{\pm0.1}$	$23.5^{\pm0.15}$	Ø d3
–	–	–	–	Ø d4
–	–	–	–	Ø d5
0.1	0.1	0.1	0.2	a
15	15	18	20	t1
–	–	–	–	t2
12	12	14	16	b
–	–	–	–	$\measuredangle\,\alpha$

Design II

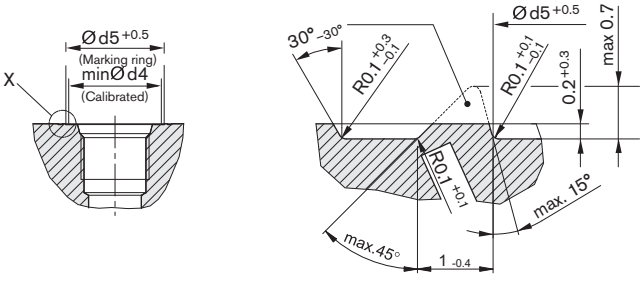


View U



ISO 11926-1						Port
7/16-20 UNF-2B	9/16-18 UNF-2B	3/4-16 UNF-2B	7/8-14 UNF-2B	1 1/16-12 UN-2B	1 5/16-12 UN-2B	Thread
II	II	II	II	II	II	Version
21	25	30	34	41	49	Ø d1
12.4	15.65	20.6	23.95	29.15	35.5	Ø d2
$9^{\pm0.1}$	$12^{\pm0.1}$	$16.5^{\pm0.1}$	$19^{\pm0.15}$	$24^{\pm0.15}$	$30^{\pm0.15}$	Ø d3
–	–	–	–	–	–	Ø d4
–	–	–	–	–	–	Ø d5
0.1	0.1	0.1	0.1	0.1	0.1	a
14	15.5	17.5	20	23	23	t1
$2.4^{\pm0.4}$	$2.5^{\pm0.4}$	$2.5^{\pm0.4}$	$2.5^{\pm0.4}$	$3.3^{\pm0.4}$	$3.3^{\pm0.4}$	t2
11.5	12.7	14.3	16.7	19	19	b
24°	24°	30°	30°	30°	30°	$\measuredangle\,\alpha$

Design III



EN ISO 6149-1										Port
M10x1	M12x1.5	M14x1.5	M16x1.5	M18x1.5	M20x1.5	M22x1.5	M27x2	M30x2	M33x2	Thread
III	III	III	III	III	III	III	III	III	III	Version
20	23	25	28	30	32	34	40	44	49	Ø d1
11.1	13.8	15.8	17.8	19.8	21.8	23.8	29.4	32.4	35.4	Ø d2
$8.5^{\pm0.1}$	$10^{\pm0.1}$	$12^{\pm0.1}$	$14^{\pm0.1}$	$16^{\pm0.1}$	$18^{\pm0.1}$	$19^{\pm0.15}$	$24^{\pm0.15}$	27	$30^{\pm0.15}$	Ø d3
14.5	17.5	19.5	22.5	24.5	25.5	27.5	32.5	36.5	41.5	Ø d4
16	19	21	24	26	27	29	34	38	43	Ø d5
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	a
11.5	14	14	15.5	17	17	18	22	22	22	t1
$1.6^{+0.4}$	$2.4^{+0.4}$	$2.4^{+0.4}$	$2.4^{+0.4}$	$2.4^{+0.4}$	$2.4^{+0.4}$	$2.4^{+0.4}$	$3.1^{+0.4}$	$3.1^{+0.4}$	$3.1^{+0.4}$	t2
10	11.5	11.5	13	14.5	14.5	15.5	19	19	19	b
24°	30°	30°	30°	30°	30°	30°	30°	30°	30°	$\measuredangle\,\alpha$

Unit dimensions

SB23-EHS1

R917007957

Tie bolts

When using port plate(s)		R917007235, R917002924; R917007203	
End plate(s)		R917007578, R917005923	
Valve segments length L [mm]		**Tie bolts ordering no.**	**Tie bolt length [mm]**
from	to		
40	42	1 523 502 096	131
44	44	R 917 000 013	133
80	80	1 523 502 097	171
91	98	R 917 000 538	187
99	106	1 523 502 087	195
107	114	R 917 005 260	203
115	122	1 523 502 098	211
128	133	1 523 502 125	223
140	145	1 523 502 088	235
146	149	R 917 005 261	239
156	161	1 523 502 099	251
162	167	R 917 003 101	257
168	172	R 917 005 949	263
174	178	R 917 004 775	269
180	184	1 523 502 089	275
196	200	1 523 502 100	291
209	212	1 523 502 129	304
215	218	R 917 005 950	310
220	223	1 523 502 090	315
236	239	1 523 502 101	331
249	251	1 523 502 130	344
260	262	1 523 502 091	355
276	278	1 523 502 102	371

Installing the control block in the machine.

The SB23-EHS1 control block, consisting of:

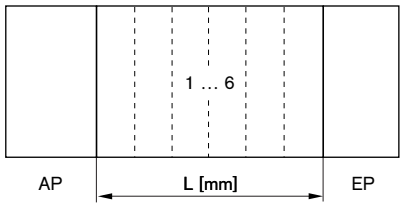
- Port plate
- 1...6 valve segments
- 3 tie bolts, 5 tie bolts optional

End plate

Port plate, valve segments and end plates are secured during control block installation by tie bolts.

The control block is fixed to the port- and/or end plate in the machine.

The number of fasteners and the number of tie bolts depend on the number of valve segments and the expected vibrational load in the machine. At least 3 tie bolts are needed to secure a control block. Depending on loading, 5 tie bolts may be needed.

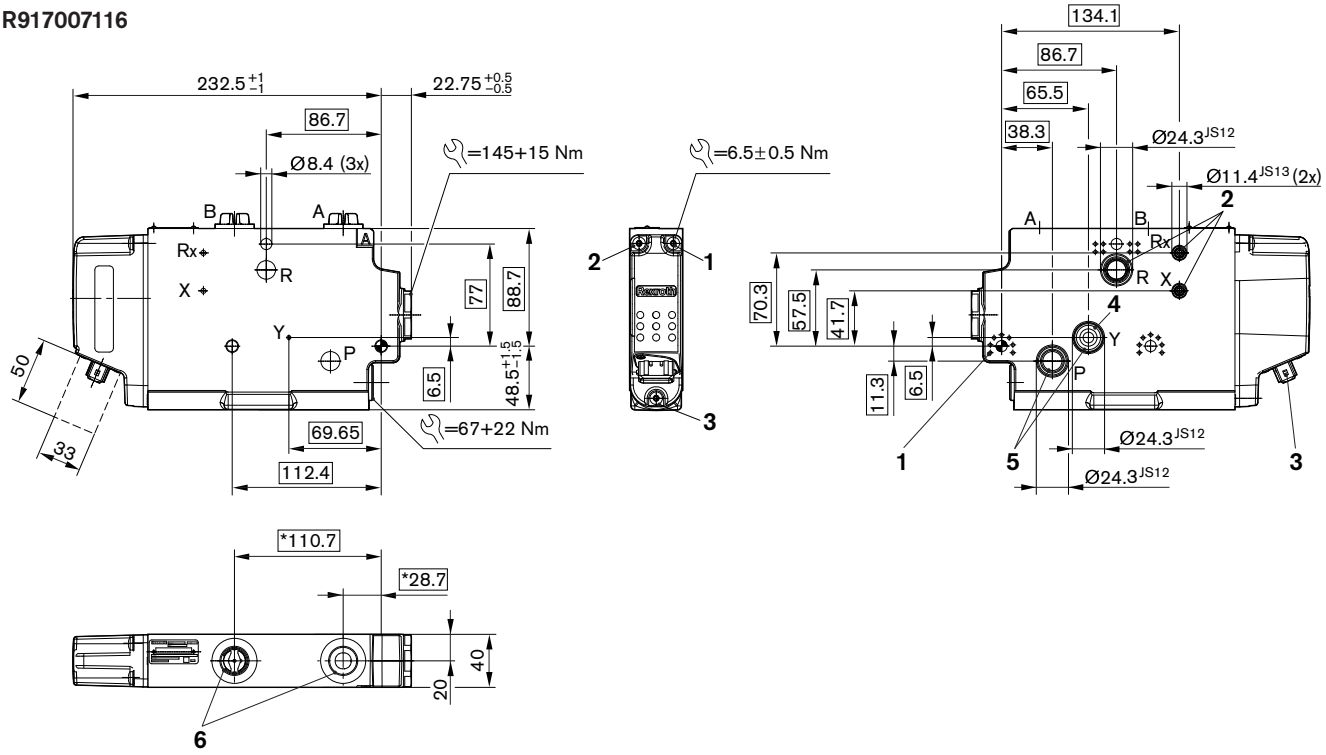


Valve segments

Unit dimensions

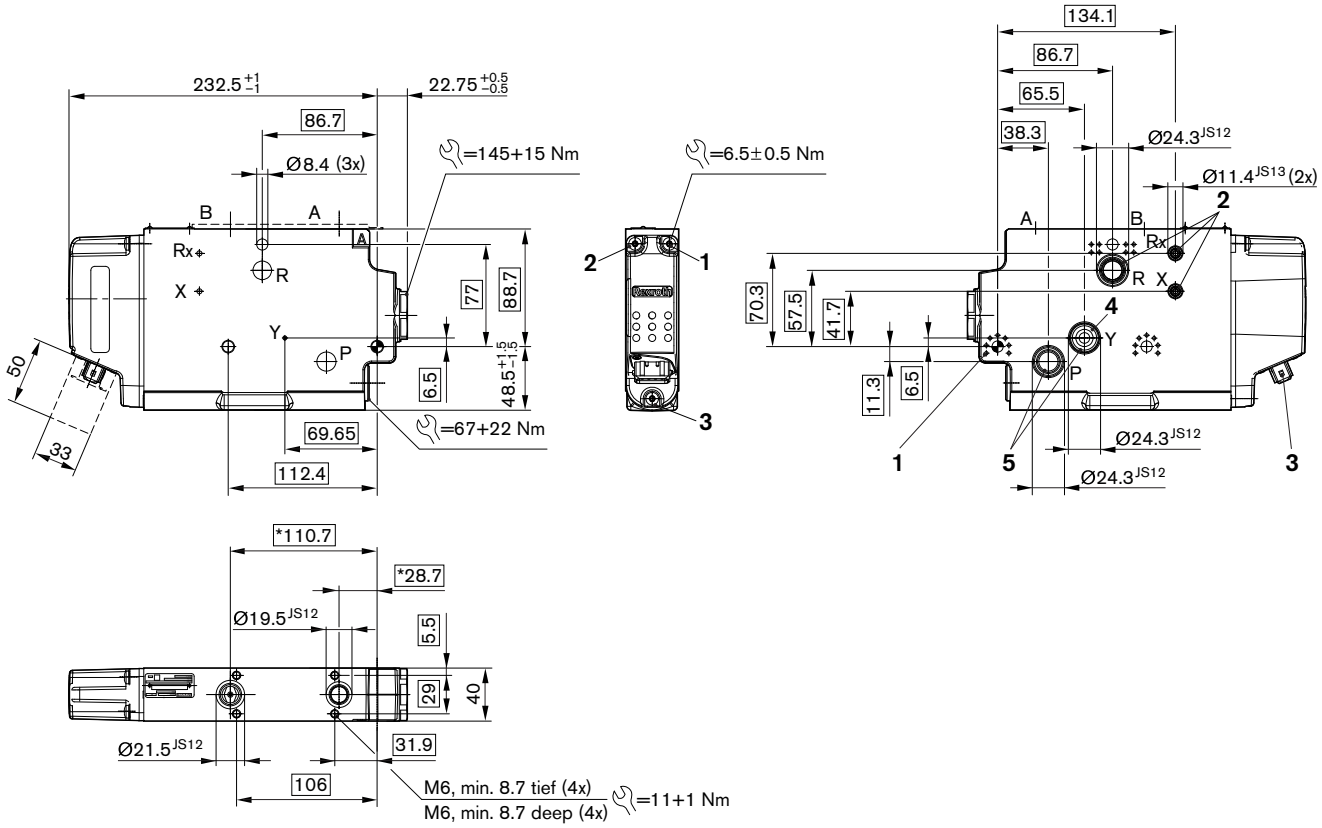
SB23-EHS1

R917007116



SB23-EHS1

R917007117

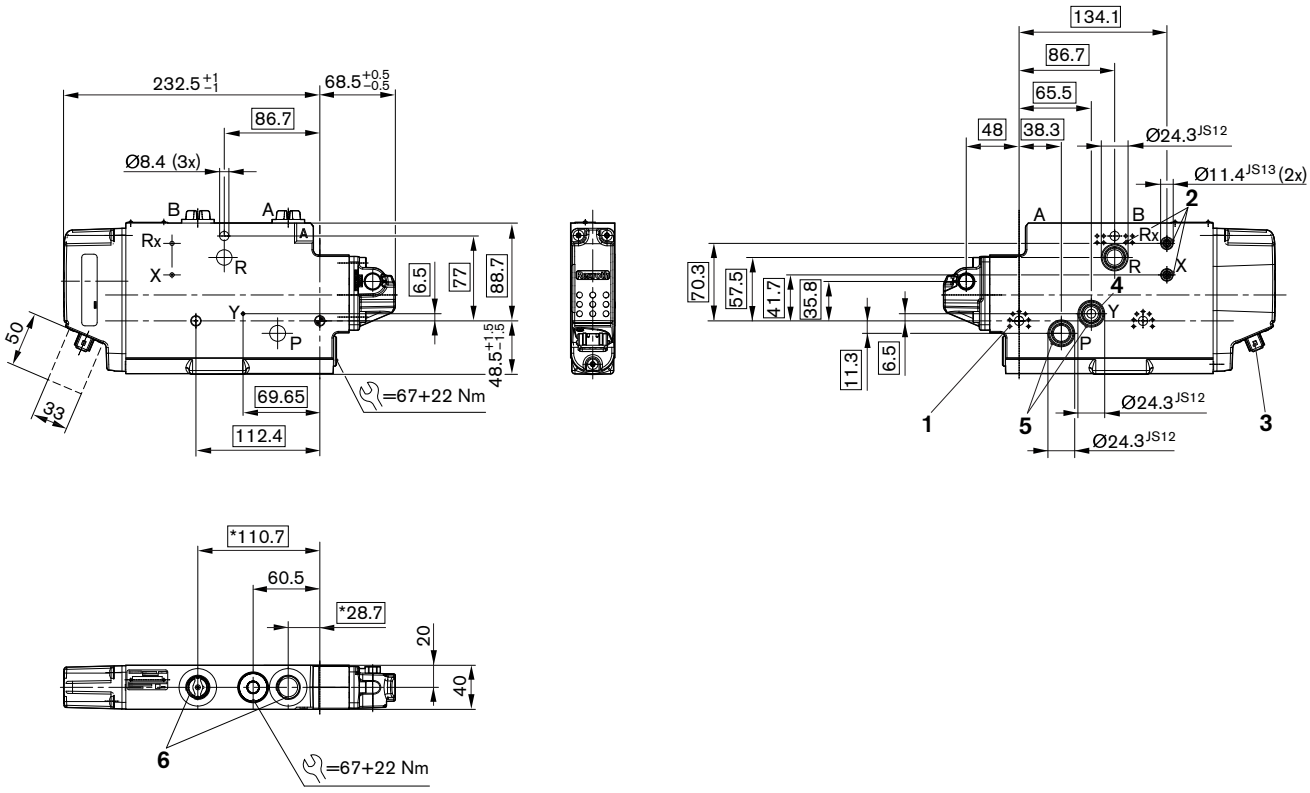


1 Stamped
2 O-ring included in the delivery contents
3 Pull off protective cap before connecting
4 Shuttle valve included in the delivery contents
5 O-ring and back-up ring included in the delivery contents
6 M22x1.5 version 1, see page 9

Unit dimensions

SB23-EHS1

R917007219



1 Stamped

2 O-ring included in the delivery contents

3 Pull off protective cap before connecting

4 Shuttle valve included in the delivery contents

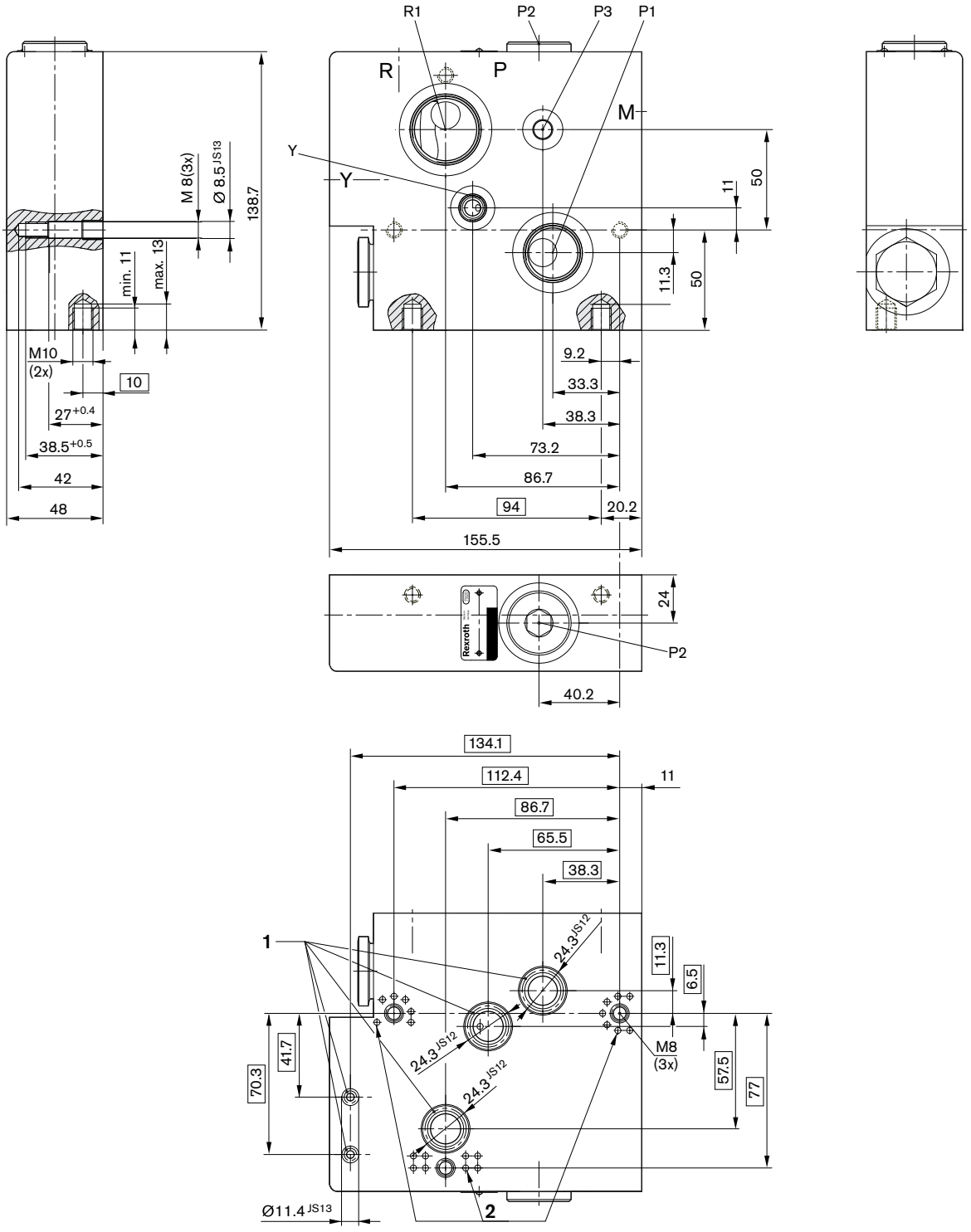
5 O-ring and back-up ring included in the delivery contents

6 M22 x 1.5 version 1

Unit dimensions

Port plate for variable pump

R917007235



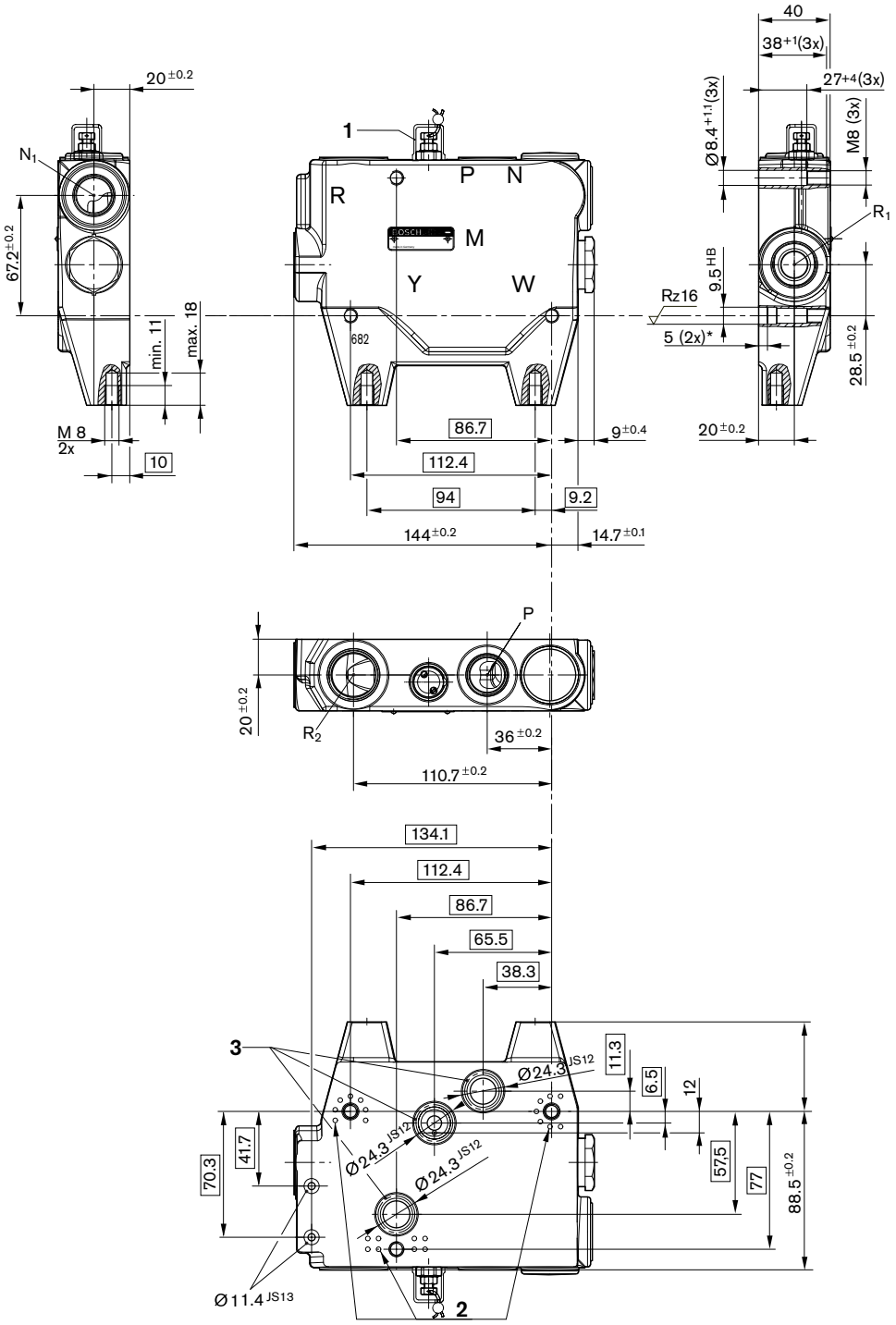
1 Seal rings are included in the delivery contents

2 Stamped

Unit dimensions

Port plate for fixed pump

R917007203



1 Protective cap (sealable)

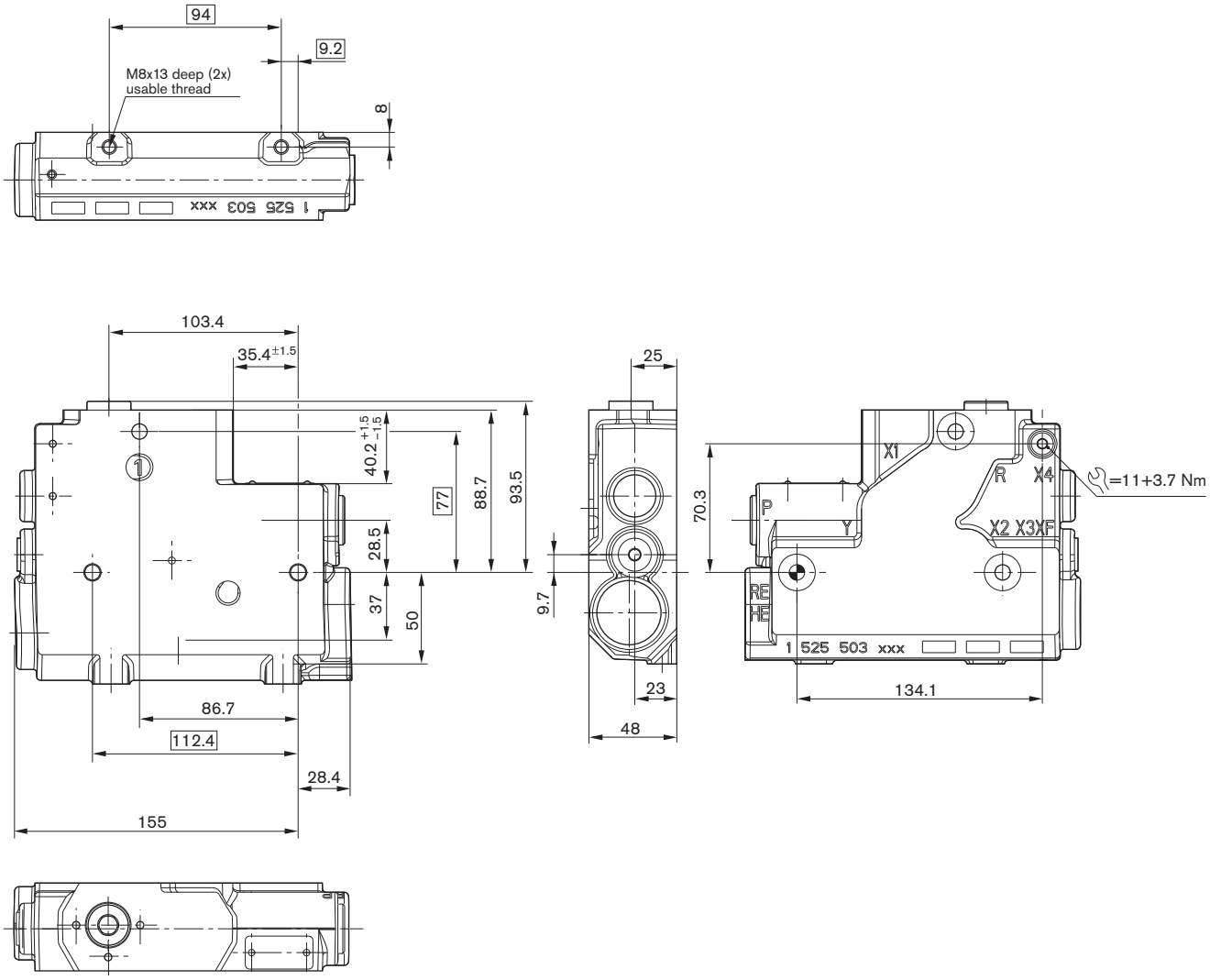
2 Stamped

3 Seal rings are included in the delivery contents

Unit dimensions

End plate for variable pump

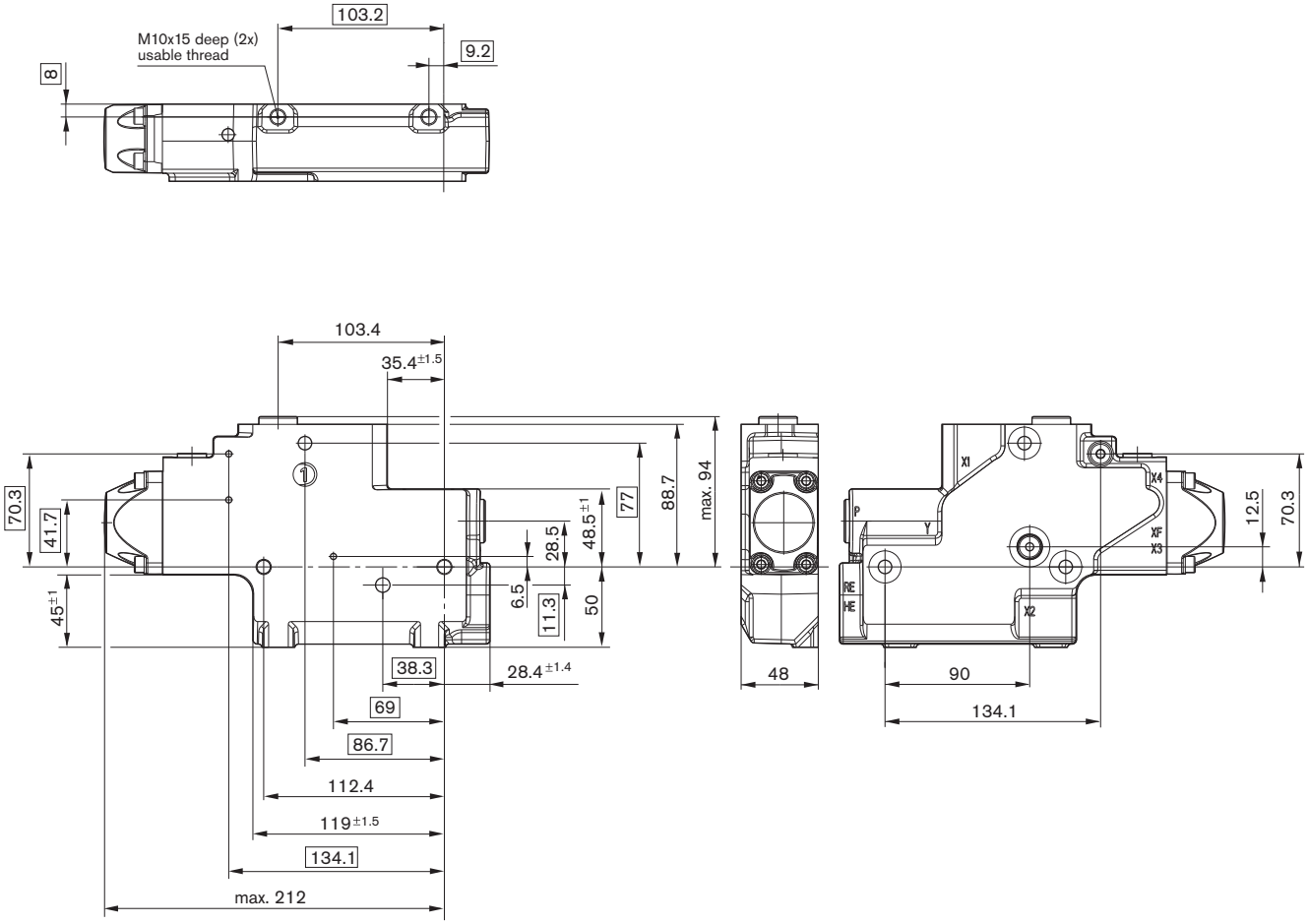
R917007578



Unit dimensions

End plate for variable pump

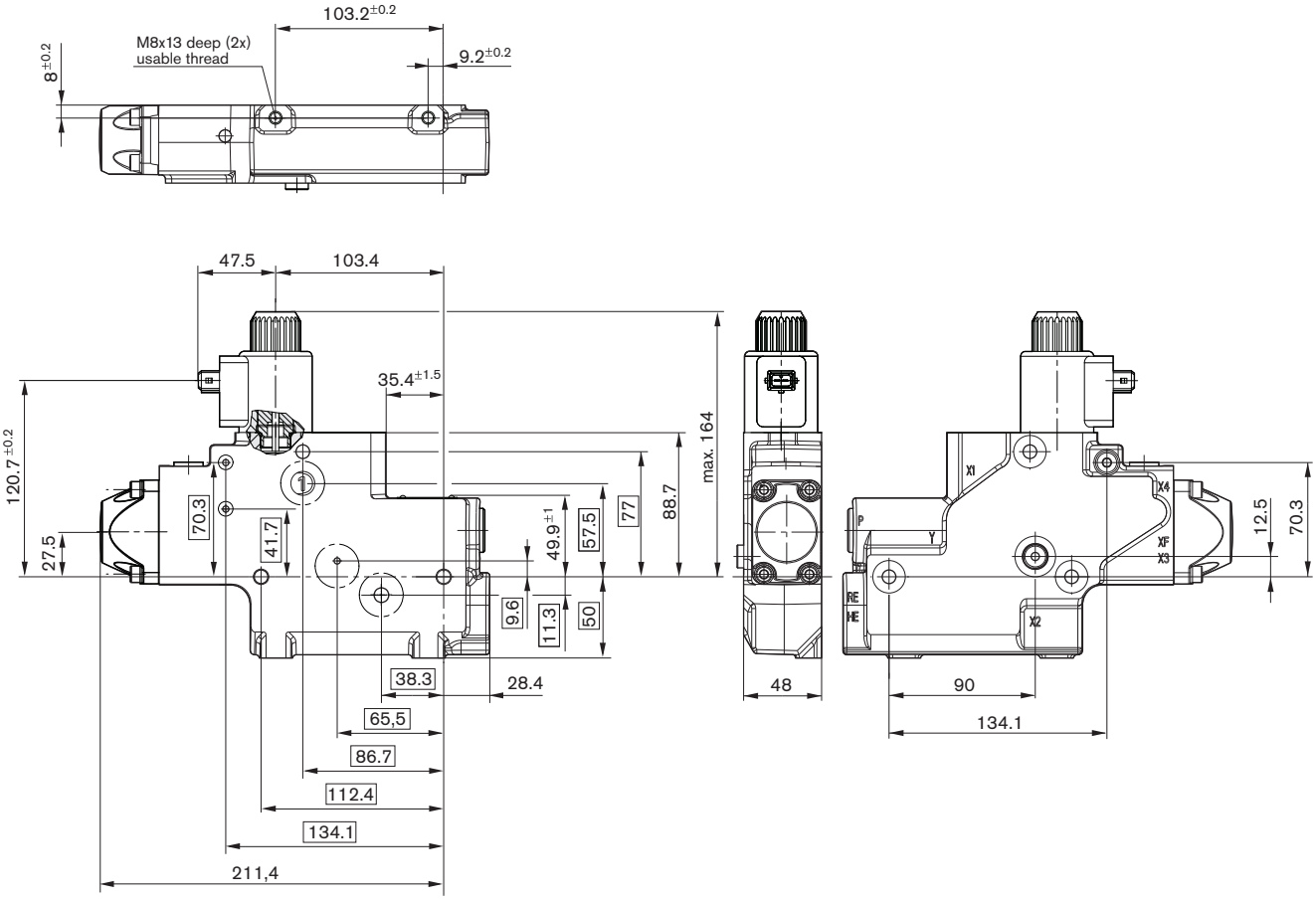
R917005923



Unit dimensions

End plate for fixed pump

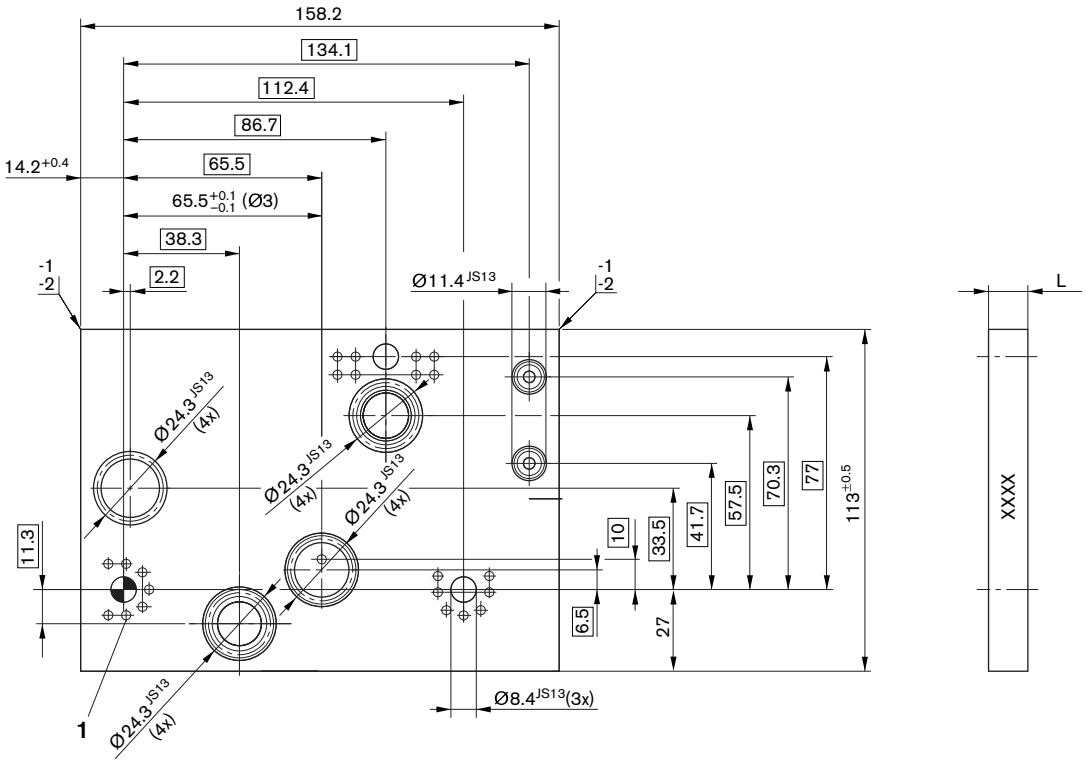
R917007249



Unit dimensions

Intermediate plate

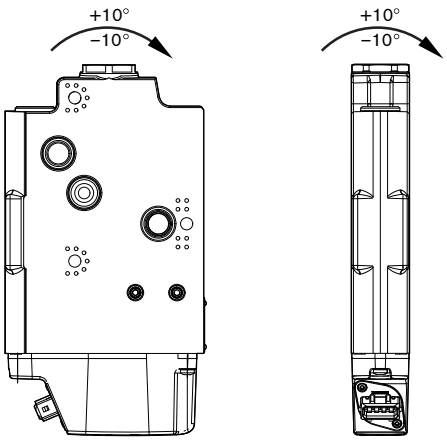
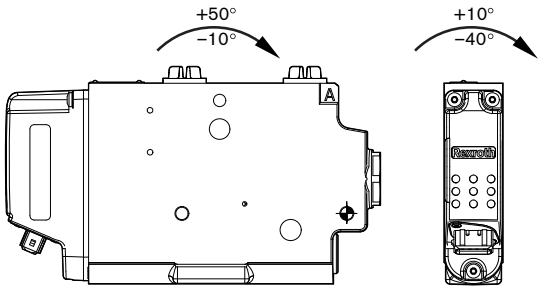
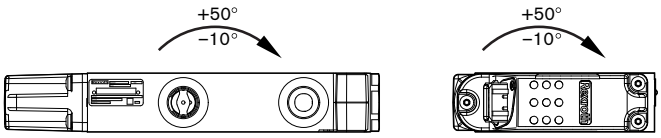
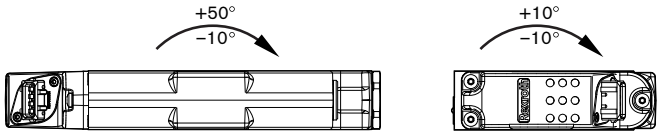
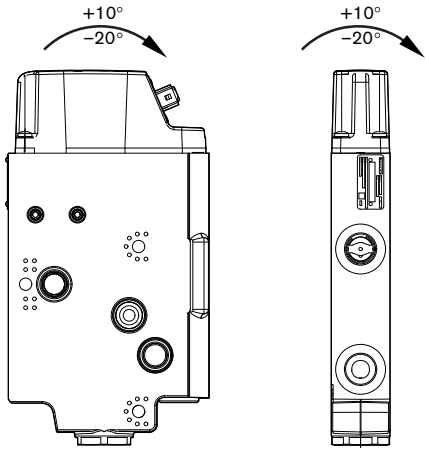
R917005302
R917006220
R917007130
R917007583



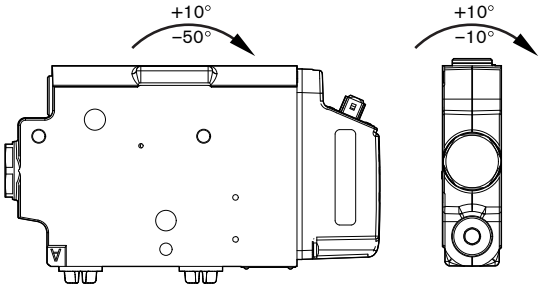
1 Stamped

Installation position

SB23-EHS1 control valve – different installation positions *)

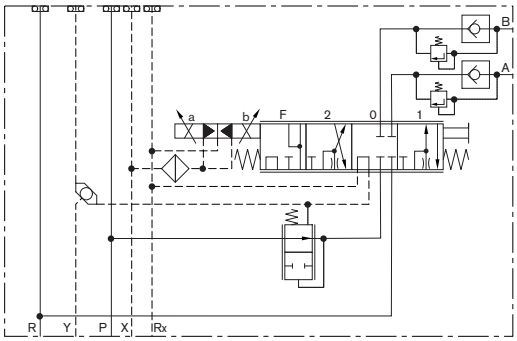
Installation position	Graphical depiction, permissible rotation around axis vertical to image axis
1	
2	
3	
4	
5	

*) The permissible installation positions are can be found in the respective, valid project drawings

Installation position	Graphical depiction, permissible rotation around axis vertical to image axis
6	 *) The permissible installation positions are can be found in the respective, valid project drawings

Hydraulic functions

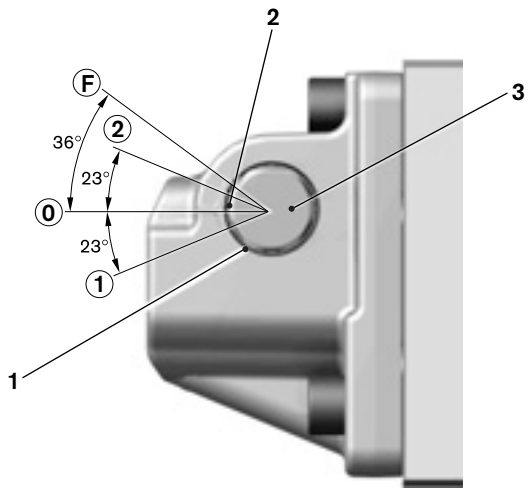
Standard	**Optional**
Check valve for oil flow from B to R	A → R
Work ports / threaded ports: M22x1 .5 / ISO 6149, O-ring seal	M22x1,5 / DIN 3852, flat sealed quick-release couplings: flange surface for coupling housing with M6 fixing thread M6
Spring cap	Manual auxiliary actuation
Main spool with 4 switch positions	Various oil flows
2-way individual pressure compensator	
	Thermo PRV: Integrated in check valve for the ports A and B. It prevents the development of excessive pressure which could otherwise arise due to thermal expansion in a confined space.
Position sensor for position control of the main spool and for diagnostic purposes	



Circuit diagram: SB23-EHS1 with 2 check valves, Thermo PRV and manual auxiliary actuation

Manual auxiliary actuation for SB23-EHS1 directional valve spool (optional)

– Mechanical manual actuation
– Operated with standard tools (WAF 13 hexagon)
– Interlock for directional valve spool not possible
– The configuration of the valves in the tractor must be selected so that dirt cannot accumulate on the positioning shaft that could cause the main spool to seize.



① = Lift
② = Lower
Ⓞ = Neutral
Ⓕ = Float/Open center

1 When painting, cover the gaps on both sides. Alternatively, actuate mechanically several times after painting
2 Position indicator, milled corner of hexagon
3 WAF 13, max. size 6.5 mm, actuation torque max. 10.5 Nm permissible

Pilot oil supply

Not a component of the directional valve (block or system component)

When using manual auxiliary actuation without pilot oil supply and unrestricted pump supply, impermissible pressure increases may occur since without pilot pressure the check valves do not open for lowering.

Remedy: Through appropriate machine design, such pressure increase can be avoided (e.g. through additional auxiliary pilot oil supply or by switching off the LS signal to pump/port plate.

Reason: Without pilot pressure, the check valve A/B to R closes and the pump generates maximum pump pressure in the cylinder. Without such a switch, very high pressures could arise on the load side:
Load pressure + pump pressure x cylinder area ratio.

Required pilot oil flow per SB23 segment:

Values for viscosity 30 mm^2/s:

In Neutral:	typical 250 ml/min, maximum 360 ml/min
In Lift or Lower:	typical 500 ml/min, maximum 820 ml/min
In Open center:	typical 250 ml/min, maximum 400 ml/min
During a jump function (Lift or Lower):	typical 3.5 l/min
During a jump function (Open center):	typical 4.5 l/min

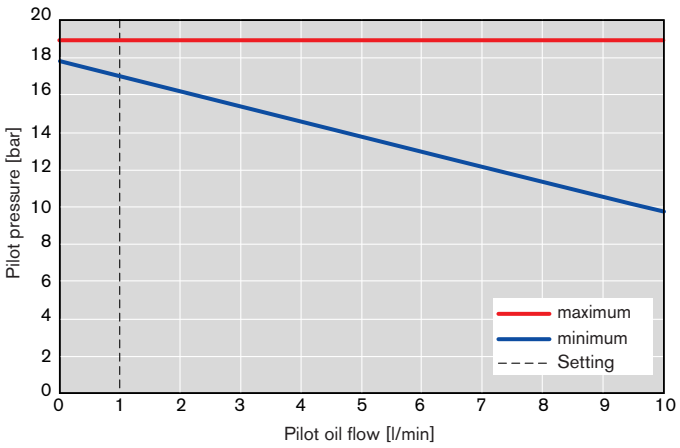
Requirement peaks for pilot oil can be limited by preventing simultaneous activation of several consumers (delay by response time lag + safety margin) or by programming into the time ramp.

Pilot pressure referencing

Make sure that pilot pressure pX is referenced to the highest return pressure of all SB23/EHR33 valves (p_X absolute = $p_X + p_{R\,max}$).
If this referencing is not performed, the coordination of inflow and return oil flow will be disturbed to such an extent that the inflow pressure could rise to PRV pressure. Depending on the loading conditions, this could result in inadmissibly high pressures at the consumer port.

Pilot pressure

$p_x = 18^{\pm 1}$ bar (response point at pilot oil flow 0.8 to 1.2 l/min)



The pilot pressure acc. to the diagram must be available solely to the SB23 valves as full valve performance is not otherwise ensured.

Pilot oil fine filter

Pay close attention to oil cleanliness, particularly with respect to the pilot oil supply; use an additional pilot oil fine filter if necessary.

Oil flow rate

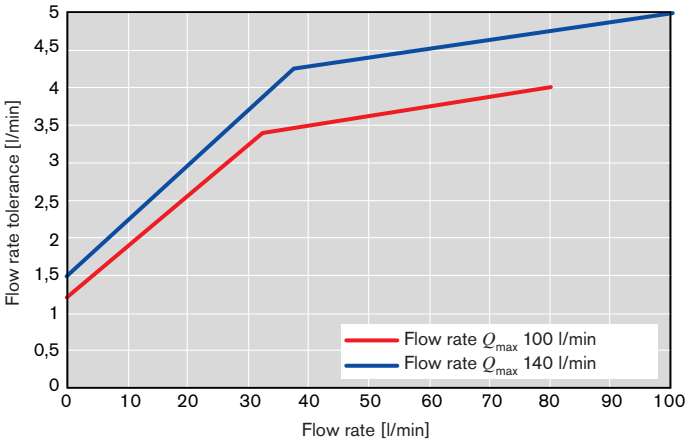
Standard valve oil flow variants:

Oil flow	Nom. oil flow	Tolerance	Max. oil flow
Q_{P-A}	80 l/min	±4 l/min	
Q_{A-R}	100 l/min		$Q_{max, A-R}$ 120 l/min
Q_{P-B}	80 l/min	±4 l/min	
Q_{B-R}	100 l/min		$Q_{max, B-R}$ 120 l/min

Oil flow	Nom. oil flow	Tolerance	Max. oil flow
Q_{P-A}	100 l/min	±5 l/min	
Q_{A-R}	100 l/min		$Q_{max, A-R}$ 120 l/min
Q_{P-B}	100 l/min	±5 l/min	
Q_{B-R}	100 l/min		$Q_{max, B-R}$ 120 l/min

Oil flow tolerance

The tolerance characteristics apply for inflow oil flow for standard variants with inflow calibration. If return flow calibration is used, greater tolerances for the flow rate of the inflow oil will be generated at low flow rates for driving loads. Other tolerances may occur for special versions.



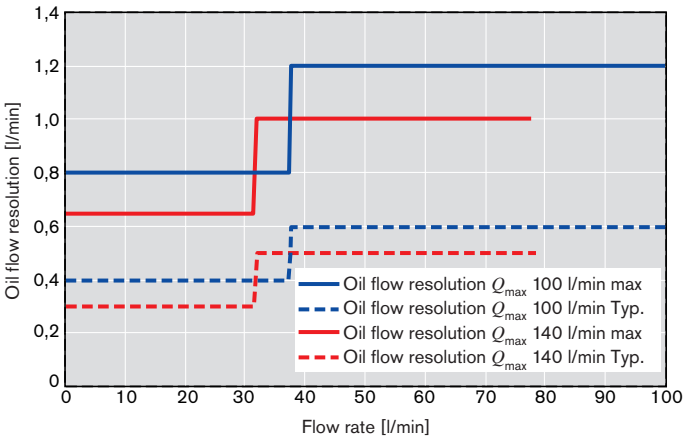
Hysteresis

In respect of flow rate: typical approx. 1 % Q_{max} (for flow rates up to 80 % Q_{max}), maximum 2 % Q_{max}

Oil flow resolution

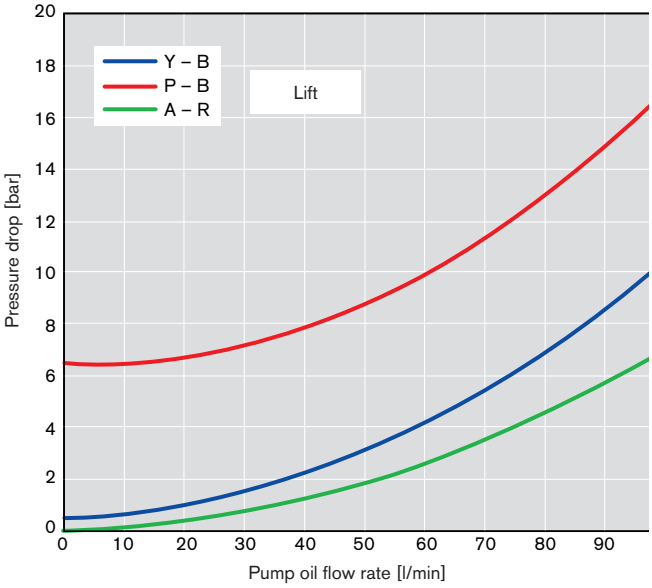
The tolerance characteristics apply for standard variants (inflow calibration). Other tolerances may occur for special versions.

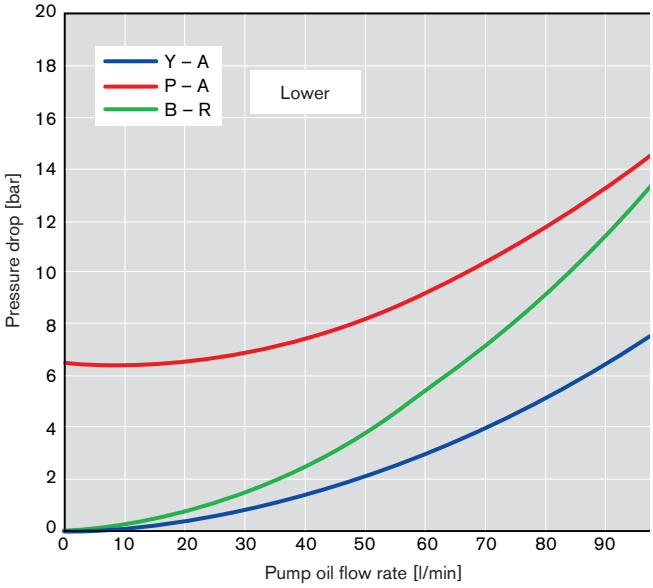
Other tolerances may occur for special slide versions.

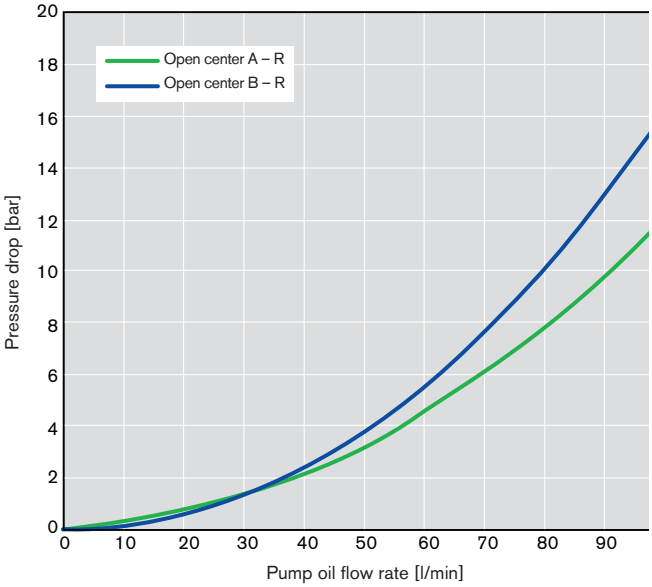


Differential pressure

SB23-EHS1, 1 check valve





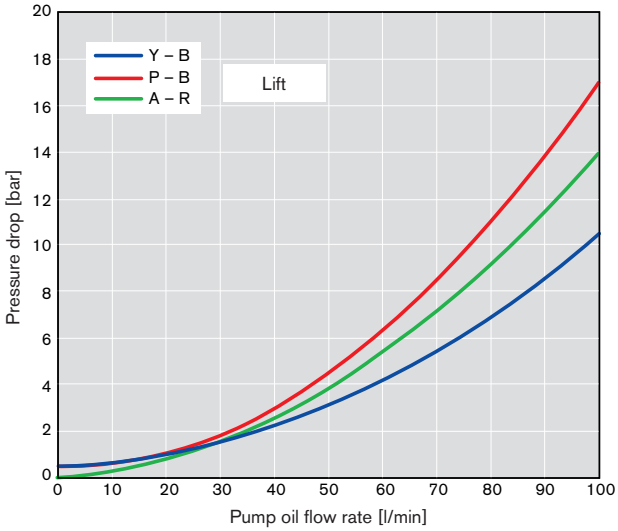


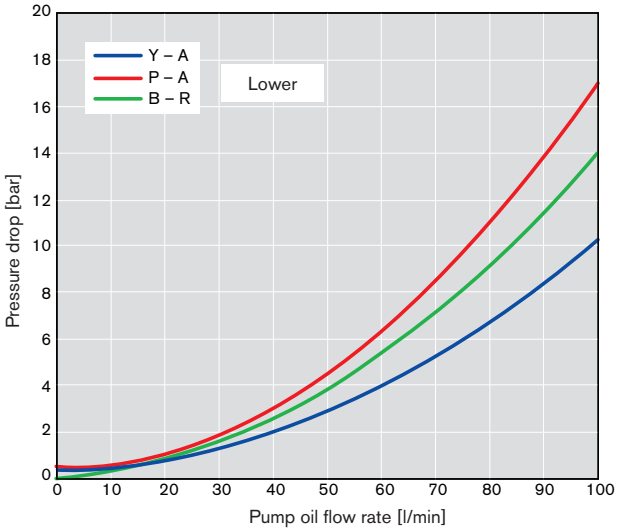
Temperature drift in oil flow
The temperature dependence of the oil flow is electronically compensated.

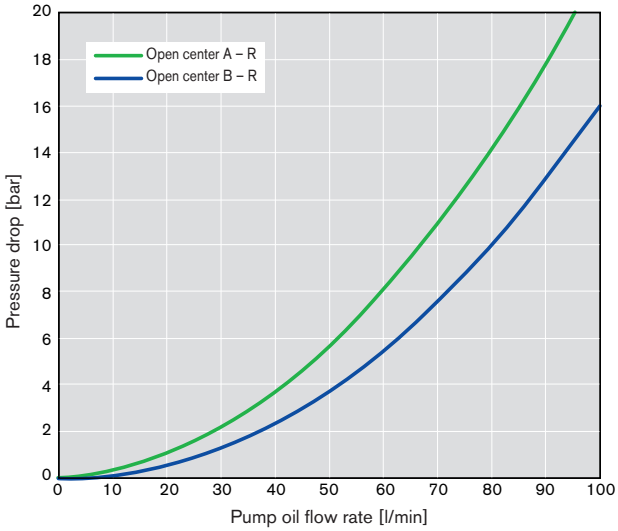
Pressure drift in oil flow
Pressure drift for oil flow (pressure increase through parallel operation) < 10 % change in oil flow with pressure change of 100 bar

Pressure drift for oil flow (pressure increase though change in load pressure in independent operation) < 0.005 l/min / bar for Q < 50 % Q_{max}, < 0.02 % of Q / bar for Q > 50 % Q_{max}

SB23-EHS1, 2 check valves







Leakage

Leakage service line port in the basic version with 1 SPV

B to R in position 0

- 2 ml/min (at p = 125 bar, ν = 30 mm²/s, T = 50 °C, t_W = 15 s, t_M = 60 s)

A to R in position 0

- at p = 125 bar, ν = 30 mm²/s, T = 50 °C
- Standard: 60 ml/min
- Optional: 33 ml/min
- A to R in position 2 (check function)
- Typical: 150 ml/min, Max.: 300 ml/min

Additional leakage values are available on request.

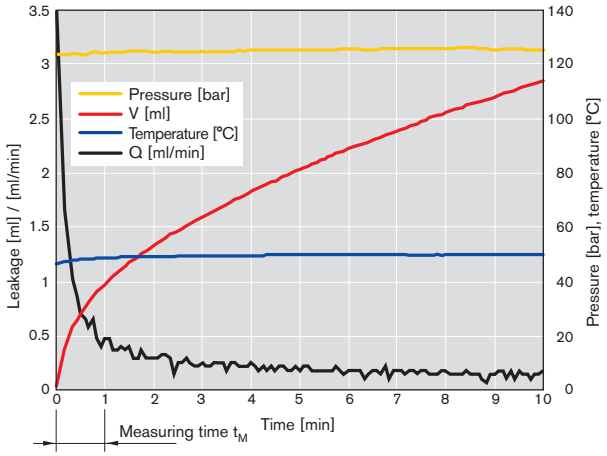
Leakage service line port for variants with optional function SPV at A + B

A, B to R in position 0

- 2 ml/min (at p = 125 bar, ν = 30 mm²/s, T = 50 °C, t_W = 15 s, t_M = 60 s)

Additional leakage values are available on request.

Typical leakage process with check valve:



Leakage P-R in various switch positions

P to R (at p = 200 bar, ν = 30 mm²/s, T = 50 °C)

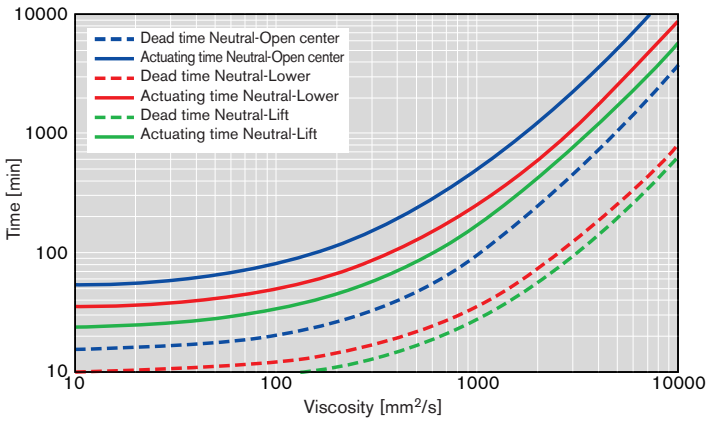
- in position 0: typical: 60 ml/min, maximum: 250 ml/min
- in position 1, 2: typical: 100 ml/min, maximum: 250 ml/min
- in position F: typical: 60 ml/min, maximum: 250 ml/min

Higher values may occur for custom slide variants.

Response time / dynamics

- Jump function Lift / Lower: typical 45 ms, maximum 70 ms
- Jump function (Open center): typical 70 ms, maximum 100 ms
- Cutoff frequency with respect to spool stroke approx. 17 Hz for change in target value from 0 to 100 %

Jump function: see characteristic curve



Electronic functions

Standard	Optional
CAN control	PWM (pulse-width-modulated voltage signal) on request

General electrical details

Supply voltage	Standard on 12-V vehicle battery voltage; on request: 24 V		
Overvoltage resistance	Power supply: 48 V, duration 5 min		
Polarity reversal protection	Test voltage –48 V, duration 5 min		
Protection against short circuit	Protection against short circuit against 36 V, against ground, as well as between the individual inputs and outputs.		
Degree of protection	IP69K (electronics), with mating connector plugged in		
EMI immunity	ISO 11452-2 EMC irradiation measurement 0.2 MHz to 1000 MHz, frequency according to ISO 14982: 1998 Reference limit values: • TEM cell 100 V/m • Stripline 150 V/m		
EMI transmission	ISO 14982: 1998, chapters 6.5 and 6.6		
ESD	ISO 10605: 2008 Unpowered test: relay discharge: ± 8 kV, air discharge ± 15 kV, R_i = 2000 Ω, C = 150 p_F (table C1, category 1) Powered up test: relay discharge: ± 8kV, air discharge ± 15kV, R_i = 2000 Ω, C = 330 p_F (table C2, category 1)		
Line-bound interference	ISO 7637-2:2004, degree of severity 4		
Power input		U_{Bat} = 14V Typ.[W]	Max.[W]
	in neutral position	0.4	0.6
	at max. adjustment speed		12
	in switch or intermediate position	3.6	5.0
	in Open center	6	12
Input signal	CAN, physical layer acc. to ISO 11898 “High Speed”, standard transmission rate 250 kBaud		
Connections	Compact connector Pin 1 = ground Pin 2 = CAN high Pin 3 = CAN low Pin 4 = U_{Bat}	Jet connector Pin 1 = U_{Bat} Pin 2 = CAN low Pin 3 = CAN high Pin 4 = Ground	
Sinusoidal vibration test	DIN EN 60 068-2-6, 10 Hz – 2000 Hz, 57,5 – > 2000 Hz, 6.93 g rms 10 Hz – > 57.5 Hz, 1.5 mm pp		
Broadband noise test	DIN EN 60 068-2-64, 5 Hz – 2000 Hz, a_{eff} 86.9 m/s²		
Shock test	DIN EN 60 068-2-27, a = 500 m/s², 11 ms, 60 cycles DIN EN 60 068-2-29, a = 400 m/s², 6 ms, 300 cycles		

Reading out the error code with the EHS diagnostic tool, error interpretation

The EHS Diagnostics Tool is a software program specially developed for troubleshooting in EHS systems in vehicles or on the test bed. The diagnostic tool is used for identifying and diagnosing individual valves or all valves in the block / tractor. The technical data and error memory of the valves can be read out via RS232 (individual valve only) or CAN (together). For the RS232, the baudrate is set to 9600 baud; for the CAN, the baudrate is automatically calculated

Overview for internal diagnostics

Special measures for protecting against malfunctions resulting from contamination, material defects and similar are not specified. The unit does not effect any safety functions without additional measures on the part of the user.

Fail-safe	In the event of a power failure, short circuit or failure in the oil supply, the actuator will automatically switch the pilot spool to neutral (spool is spring-centered)	
Fault detection	Fault	Reaction to fault:
Internal error:	— Control spool not in neutral position when switching on	– CAN: diagnostic message via CAN bus Caution: uncontrolled load shifts possible, system must be shut down.
	— Spool not deflected far enough	— Valve switched to neutral, optionally only error message
	— Control spool deflected too far or does not return to neutral (e.g. spool held or stuck)	— If countersteering does not help, the actuator will be de-energized . — CAN: diagnostic message via CAN bus Caution: uncontrolled load shifts possible, system must be shut down.
	— Displacement pick-up defective	— Valve is not actuated
	— Current measurement defective	— Valve is not actuated
	— Output stage defective	— Valve is not actuated
	— Checksum error via – Main program – EEPROM customer area	 — Valve is not actuated — Checksum test, optionally only error message or shutdown
	— RAM error	— Test, either for error message or shutdown
	— Computer error	— Error due to interference peaks: A second attempt is only permissible if the target value was first set to neutral. – Other computer errors: – CAN: diagnostic message via CAN bus – Caution: Uncontrolled load shifts possible, system must be shut down.
External errors:	— Supply voltage below permissible range	— Valve is not actuated (with CAN: above Bosch limit, optionally only error message)
	— Supply voltage above permissible range	— Valve is not actuated (with CAN: below Bosch limit, optionally only error message)
	— Target voltage below permissible range	— Valve is not actuated
	— Target voltage above permissible range	— Valve is not actuated
	— No target value message (only with CAN)	— Valve is not actuated
	— Implausible target value message (only with CAN)	— Valve is not actuated
	— No configuration message (only with CAN)	— Valve is not actuated
	— Manual actuation (on manual lever of the valve)	— Valve remains switched off, no counter reaction, no electric control possible
Visual fault display	Diagnostics LED in device plug	Flash code shows type of fault (see flash code)
Fault diagnosis in CAN version	The error is transmitted via CAN with an error code. The transmission message diagnostics is sent up to 5 times directly after the error occurs, then every 100 ms (adjustable). The error code is transmitted (see CAN message description).	

General information on CAN control

The EHS valve can be easily controlled via the serial CAN interface. In this way, the operating modes “Neutral”, “Raise”, “Lower”, “Open center” and the oil flow target value can be set as default by means of a message. A second message can be used for both “Lift” and “Lower” (different for each) to set the characteristic shape, characteristic gradient and ramp times. On the other hand, the valve can communicate any faults to the higher-level control section in detail by means of a fault code.
Finally, the valve can be permanently re-programmed by way of parameter setting messages (CAN baud rate and identifiers, battery voltage limits, valve number, etc.).

General CAN conventions:

	Standard setting
Baud rate	250 kBaud, to ≤ 1 MBaud possible
Sampling	Single sampling
Sampling instant	At 3/4 of the bit length
Synchronisation edges	Only edges from recessive to dominant
Synchronisation increment	SJW = 1 BTL cycles

Caution: The maximum baudrate must always be tested in the vehicle and is dependent on:
- Data traffic on the bus
- Effectiveness of the internal hardware identifier filter, affected e.g. by:
- Allocation of the CAN identifiers which do not affect the valves
  CAN identifier set, see TKU: Z 206 803 930

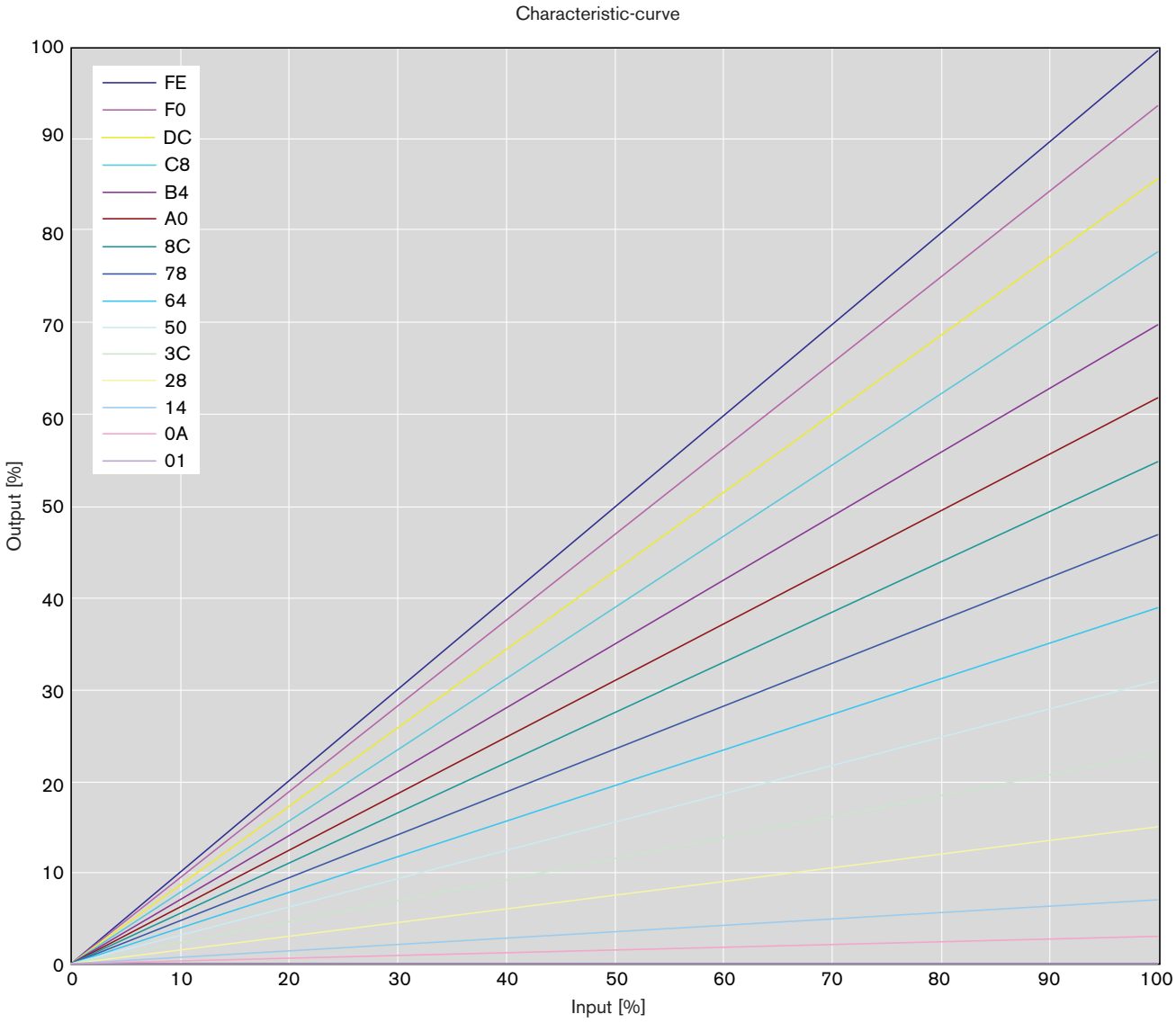
Characteristics for forming target values and time ramps

Characteristic gradient

The characteristic gradient can be used to linearly reduce valve deflection from 100 % to 0 %.

255 steps can be programmed: 00hex, 01hex, 02hex.....FEhex
0 %, 0.39 %, 0.78 %, ...100 %

In CAN mode, the value of the characteristic gradient is transferred in the configuration message; in PWM mode, it is in the valve EEPROM and can be programmed. Standard setting is 100 %. The characteristic gradient should preferably selected with values as shown.



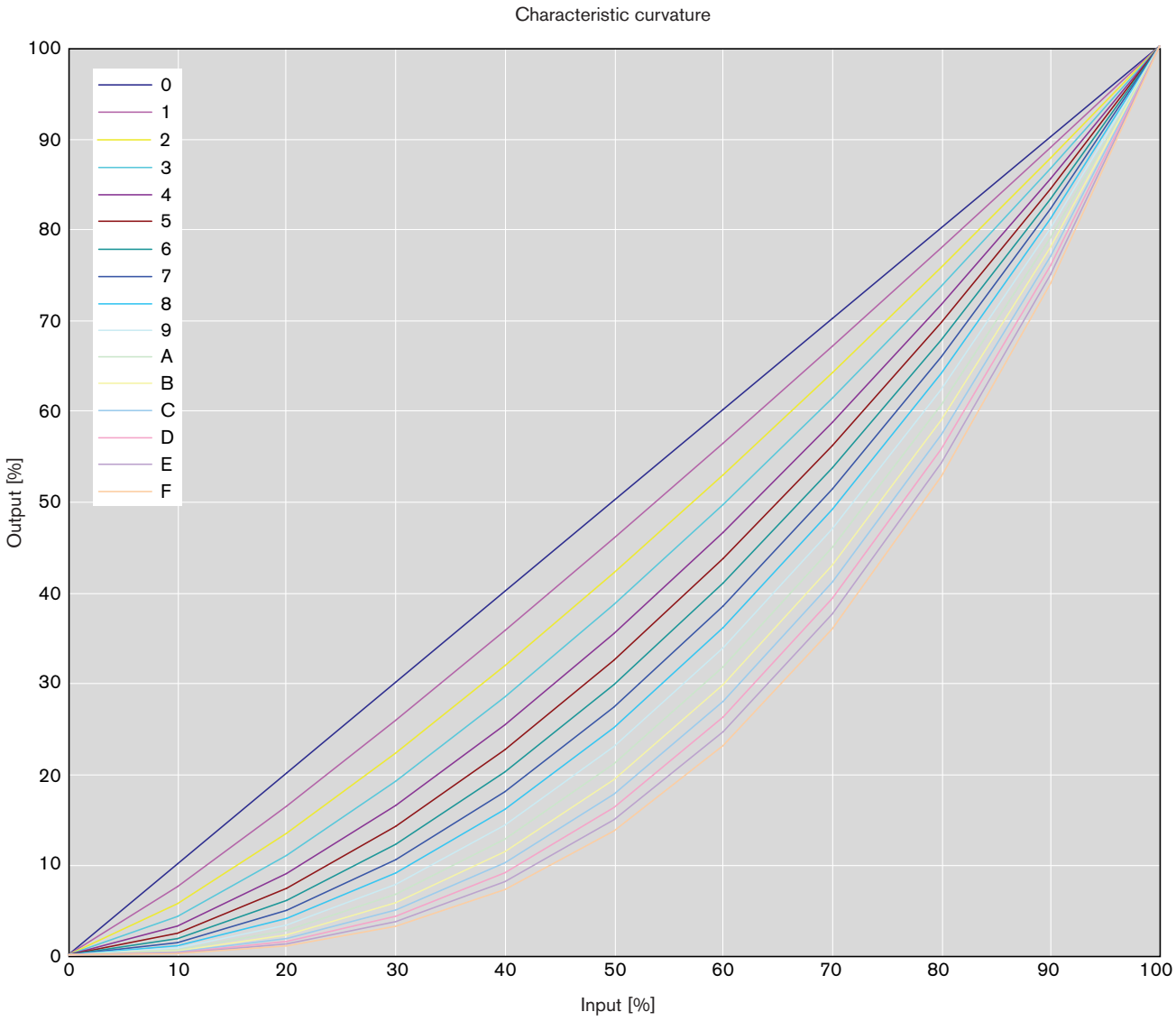
For CAN control, the input corresponds to the oil-flow target value. For PWM control, input = 0...100 % corresponds to a PWM pulse-duty factor of 53...85 % for lowering or 47...15 % for lifting (with standard characteristic vertices). Output corresponds to the oil flow at the directional valve.

Characteristic-curve shape

The characteristic shape can change from linear to heavily progressive. If needed, the valve's fine control characteristic can be changed.

15 steps can be programmed separately for lifting and lowering: 0_{hex}, 1_{hex}, 2_{hex}.....E_{hex}
linear.....progressive

In CAN mode, the value for the characteristic shape is transferred in the configuration message. In PWM mode it is in the valve EEPROM and can be programmed.



For CAN control, the input corresponds to the oil-flow target value. For PWM control, input = 0...100 % corresponds to a signal voltage or a PWM pulse-duty factor of 53...85 % for lowering or 47...15 % for lifting (with standard characteristic curve vertices). Output corresponds to the oil flow at the directional valve.

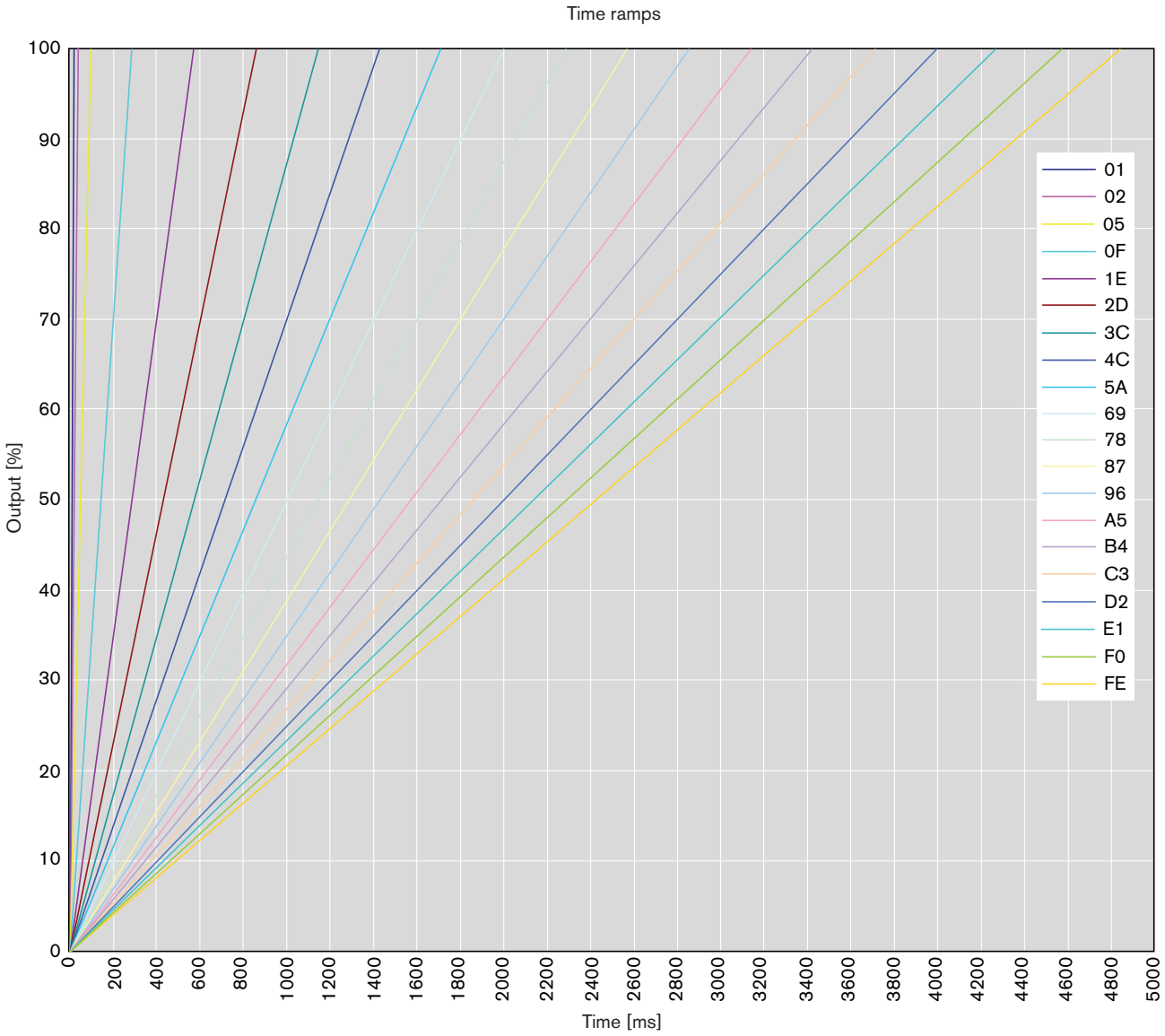
Time ramps

By using time ramps, the dynamics of the valve can be reduced in a well-targeted manner. The ramp time is then the time needed to run through the full stroke (from 0 to 100 % or 100 % to 0 % for lifting or lowering).

255 separate steps can be programmed for lifting and lowering and for switching on and off:

00hex, 01hex, 02hex.....FEhex
0, 16, 32,.....4064ms

In CAN mode, the values for the time ramp are transferred in the configuration message. In PWM mode they are in the valve EEPROM and can be programmed.



Control block segments

The following control block segments are available:

Port plate (AP)

- AP for fixed pump (KP)
  – with pressure compensator
  – optionally with Δp increase
- AP for variable pump (VP)
  – No internal function

EHR23-EM2 control valve

- Optional
- Ideally, the EHR control valve will directly follow the port plate and be located in front of the SB control valve. A maximum of three SB control valves are permissible between the port plate and the EHR control valve.

SB23-EHS1 control valve

Several SB23 control valves can be configured.

End plate (EP)

The end plate caps off the control block.

Installing the control block

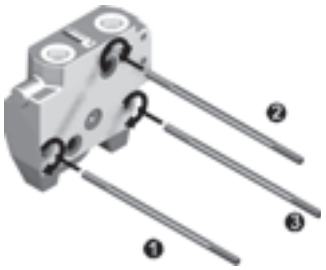
Preparation

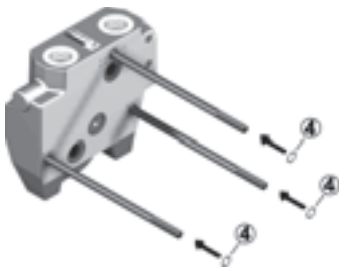
– Install the shuttle valve of the control block segments acc. to chapter 5.5 “Shuttle valve”.
– Install the sealing elements of the control block segments acc. to chapter 5.4 “Repairing flange surface sealing elements”.

If the control block segment flange surface has stamp marks and if they were treated with a whetstone, a spacer disc ④ must be threaded onto tie bolt screws ❶, ❷ and ❸.

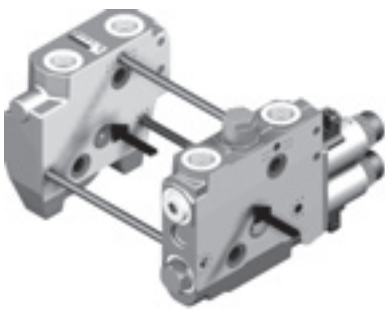
Installation of the port plate

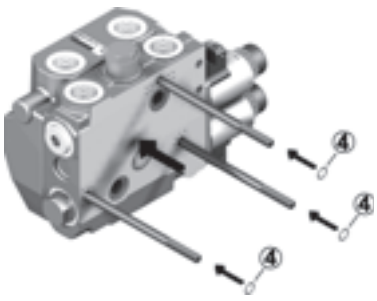
1. Use only original M8 tie bolts from Rexroth (hardness class 10.9).
2. Screw in tie bolt screws ❶ to ❸ clockwise by hand to the ground.





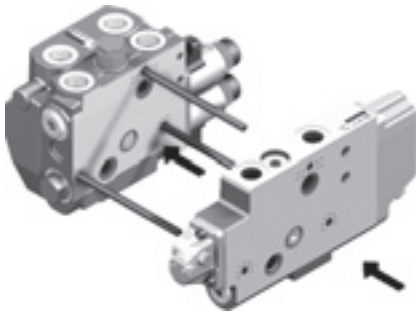
Installation of the EHR23-EM2 control valve

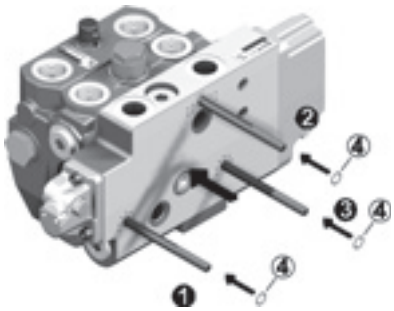


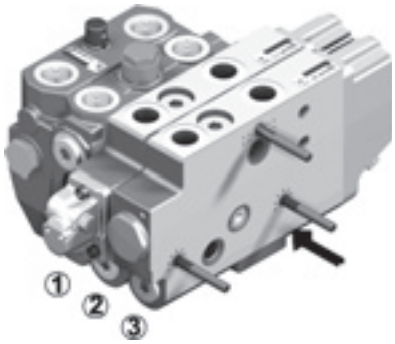


Installation of the control block segments

– Push the control block segments over the tie bolts in the specified order, with the flange on the side opposite the O-ring facing the port plate.





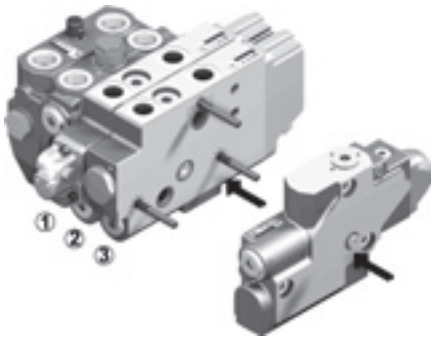


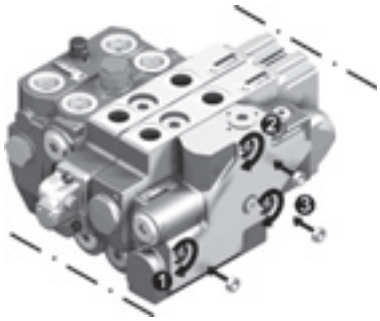
Installation of the end plate

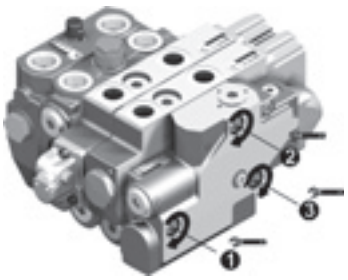
1. Align the end plate with the flange surface to the control block, sliding it over the tie bolts to the stop.
2. Screw the nuts, without washers or retaining discs, onto the tie bolt screws clockwise by hand.
3. Align the control block segments with one another.
4. Pretension nuts with a torque of 5^{+1} Nm.
5. Tighten the nuts clockwise with a torque as given in the table. Tightening sequence ❶ → ❷ → ❸.

Tightening torques for nuts

	Oiled	Dry
❶	$25.5^{+2.5}$ Nm	25^{+8} Nm
❷	$25.5^{+2.5}$ Nm	25^{+8} Nm
❸	$25.5^{+2.5}$ Nm	25^{+8} Nm







Specifications / regulations

The valve itself performs no safety function. It may fail. The tractor manufacturer (customer) must take safety measures as necessary.

Additional notes on operation and commissioning
- For block assembly and installation in the tractor:
- Do not misplace or damage O-rings, back-up rings and shuttle valves.
- Shock-like loads above the specified values may cause invisible concealed damage and must be avoided.
- The installation positions of the valves in the machine must be such that mechanical damage, e.g. due to stones etc., with consequential damage such as housing deformation, jamming, damaged control elements, fractured or damaged cables are avoided.
- Risk in event of drop in pilot pressure, for example if oil from the inlet flows into the system faster than it can flow through the check valves and the main spool, this could cause impermissible pressure spikes. Examine critical operating conditions during commissioning.
- ESD was tested according to ISO 10605: 2008 tables C1 and C2, each in category 1, see “General electrical details”. Adherence to the standard must also be ensured during installation and painting.
- Note: If a hydraulic motor is operated with a directional valve in Open center position, the motor can turn freely. If the hydraulic motor is turned by an external force and is quickly stopped by switching the directional valve to cutoff, the moment of inertia of the hydraulic motor could give rise to very high pressure spikes that could damage the hydraulic system. This could happen, for example, when the machine is switched off or the pilot pressure is cut off. The check valves in the directional valve and the control spool then move to neutral.

For further details, please refer to Bosch Rexroth instruction manual RE-66132-B

Additional documents

	Title	Document number	Document type
🕮	Control block SB23-EHS1, SB33-EHS1, EHR33-EHS1	RE 66132-B	Instruction manual
🕮	Control valve SB23-EHS1	RE 66134-01-R	Repair manual
🕮	Control block SB23-EHS1	RE 66134-10-R	Repair manual
🕮	Control valve SB23-EHS1	RE 66134-20-R	Repair manual
🕮	On Board Electronics SB23-EHS1	RE 66134-40-R	Repair manual
🕮	SB23-EHS1 Interface description	Z 206 803 930	Techn. information
🕮	Air bleeding directional valves	MH 121	Commissioning notes
🕮	Supplied installation drawing / hydraulic plan	Available from your machine or system manufacturer.	Project drawing
🕮	Hydraulic fluids on mineral oil basis	RE 90220	Data sheet
🕮	Hydraulic fluids on mineral oil basis for axial piston units	RE 90220-1	Data sheet

Abbreviations

This documentation uses the following abbreviations:

Abbreviation	Meaning
PP	Port plate
CAN	Controller Area Network
PRV	Pressure relief valve
Th-CV	Throttle check valve
EHR	Electronic and hydraulic hitch control
EHS1	Pilot controlled electro-hydraulic actuator
EP	End plate
IPC	Individual pressure compensator
LS	Load sensing
OBE	On Board Electronics
SB23	Control block, directional valve series 23
SPV	Check valves

Spare parts

Spare parts and material numbers can be found on the Internet at
www.boschrexroth.com/spc

Contacts for accessories and spare parts

Accessories and spare parts are available
- from vehicle manufacturers (specialist dealers),
- from system manufacturers and
- from your Bosch Rexroth dealer.

The Rexroth sales partners can be found on the Internet at
www.boschrexroth.com/addresses

Should you have any questions about spare parts, please contact your responsible Rexroth Service partner or the Service department of the control block manufacturing plant.

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