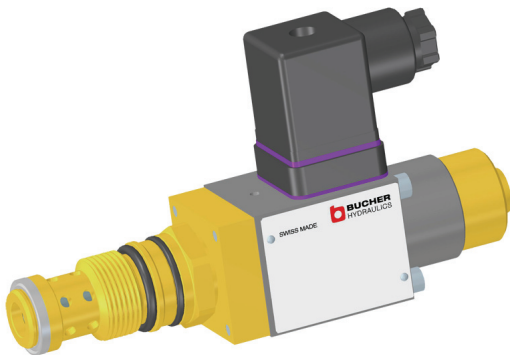


Proportional Throttle Cartridges, Size 10

$Q_{max} = 45 \text{ l/min}$, $p_{max} = 250 \text{ bar}$

Direct acting, de-energised closed, with port for secondary unloading

Series MDRPA-...



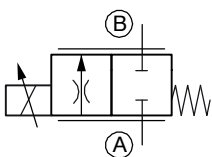
- Sliding-spool design
- Model with port Z for secondary unloading (Load Sensing)
- Compact construction for cavity types DD or DC (with adapter ring C)
- 4 nominal flow ranges
- All external parts zinc plated, chromited (CrVI-free)
- High pressure wet-armature solenoids
- Various plug-connector systems and voltages are available
- Optionally with auxiliary manual adjustment (via rotary knob)
- Can be fitted in a line-mounting body
- Can be fitted in sandwich bodies

1 Description

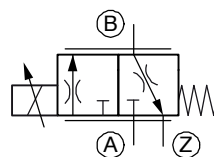
Series MDRPA... direct acting proportional throttle valves are size 10, high performance screw-in cartridges with an M24 x 1.5 mounting thread. They are designed on the proven sliding-spool principle and can be fitted in cavity types DD or DC. The rate of flow changes in proportion to the change in the required value (amplifier output current). In the initial position (solenoid de-energised) the connection A → B is closed. The additional port Z is used for secondary unloading from B → Z in applications where an LS line (load sensing) is required. The proportional throttle cartridges are available in 4 nominal flow ranges. The flow ranges $Q_N = 12$ and 20 l/min can be used with the maximum pressure differential from A → B (Δp 250 bar). Conversely, the flow ranges $Q_N = 30$ and 40 l/min must only be used in combination with

inline or bypass pressure-compensator cartridges (max. permissible Δp from A → B $\leq 14 \text{ bar}$ or $\leq 9 \text{ bar}$ respectively). As an option, the cartridges can be provided with an auxiliary manual adjustment (rotary knob) for setting the required flow rate mechanically if, for example, a proportional solenoid is defective. In both mobile and industrial applications, these proportional throttle cartridges are the ideal choice for responsive and controlled lifting and lowering movements where large pressure differentials exist. All external parts of the cartridge are zinc plated and chromited (CrVI-free) and are thus suitable for use in the harshest operating environments. If you intend to manufacture your own cavities or are designing a line-mounting installation, please refer to the section "Related data sheets".

2 Symbol



MDRPA-...G-10...



MDRPA-DGE-10...

3 Technical data

General characteristics	Description, value, unit
Designation	proportional throttle cartridge
Design	direct acting, sliding-spool design, model with secondary unloading (B → Z) available
Mounting method	screw-in cartridge M24 x 1.5

General characteristics	Description, value, unit
Size	nominal size 10, cavity type DD or cavity type DC (option with adapter ring C)
Weight	1.15 kg
Mounting attitude	unrestricted (preferably vertical, coil down)
Ambient temperature range	-25 °C ... +50 °C

Hydraulic characteristics	Description, value, unit
Maximum operating pressure	250 bar
Maximum flow rate	45 l/min
Nominal flow rate Q_N	- model "120" 12 l/min - model "200" 20 l/min - model "300" 30 l/min ¹⁾ - model "400" 40 l/min ¹⁾
Flow direction	see symbols
Hydraulic fluid	HL and HLP mineral oil to DIN 51 524; for other fluids, please consult BUCHER
Hydraulic fluid temperature range	-25 °C ... +70 °C
Viscosity range	15...380 mm ² /s (cSt), recommended 20...130 mm ² /s (cSt)
Minimum fluid cleanliness Cleanliness class to ISO 4406 : 1999	class 18/16/13



ATTENTION!

1) Must only be used in combination with inline or bypass pressure-compensator cartridges.
 30 l/min = ≤ 14 bar permissible Δp from A → B
 40 l/min = ≤ 9 bar permissible Δp from A → B
 See performance graphs and application examples.

Electrical characteristics	Description, value, unit
Supply voltage	12 V DC, 24 V DC
Control current	12 V = 400...1400 mA, 24 V = 200...700 mA
Coil resistance R	- cold value at 20 °C 12 V = 6.4 Ω / 24 V = 24.5 Ω - max. warm value 12 V = 9.5 Ω / 24 V = 36 Ω
Recommended PWM frequency (dither)	150...200 Hz
Hysteresis with PWM	2...4 % I_N
Reversal error with PWM	2...4 % I_N
Sensitivity with PWM	< 1 % I_N
Reproducibility with PWM	< 2 % p_N
Relative duty cycle	100 %
Protection class to EN 60 529	IP 65 / IP 67, see "Ordering code" (when connector plugs are properly fitted)
Electrical connection	3-pin square plug to ISO 4400 / DIN 43 650 (standard) for other connectors, see "Ordering code"

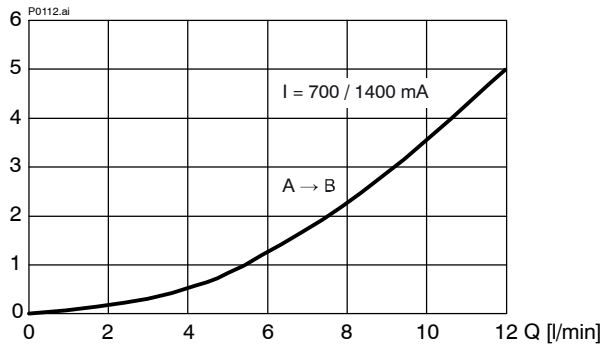
4 Performance graphs

measured with oil viscosity 33 mm²/s (cSt)

Can be used without pressure compensators - nom. flow ranges Q_N 12 and 20 l/min

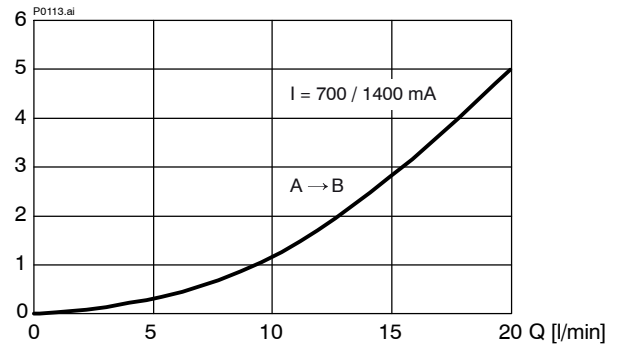
$\Delta p = f(Q)$ Pressure drop - Flow rate characteristic [„120“]

Δp A → B [bar]



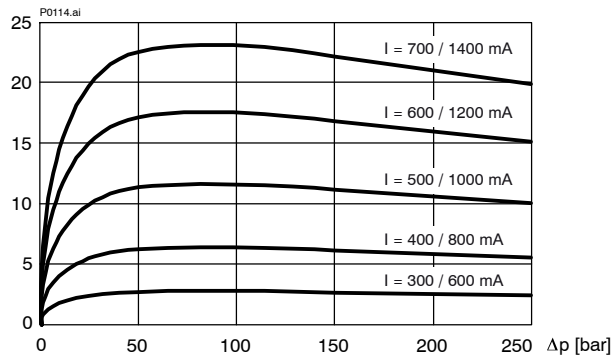
$\Delta p = f(Q)$ Pressure drop - Flow rate characteristic [„200“]

Δp A → B [bar]



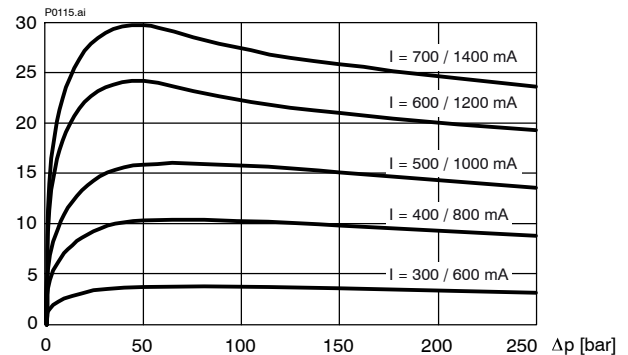
$Q = f(\Delta p; I)$ Flow rate adjustment characteristic [„120“]

Q [l/min]



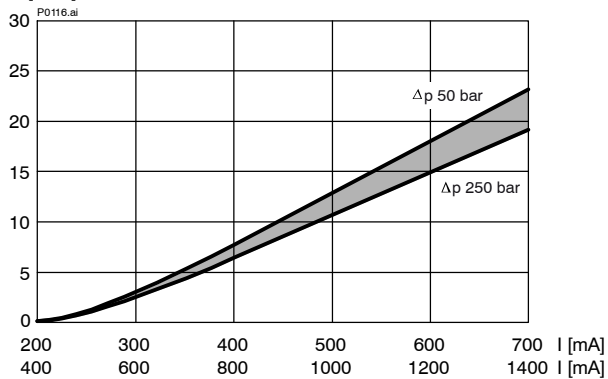
$Q = f(\Delta p; I)$ Flow rate adjustment characteristic [„200“]

Q [l/min]



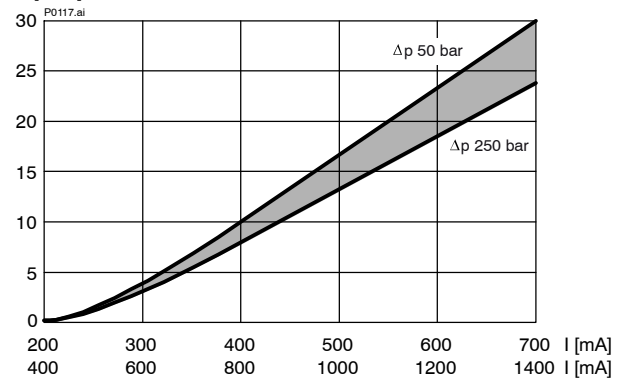
$Q = f(I; \Delta p)$ Flow rate adjustment characteristic [„120“]

Q [l/min]



$Q = f(I; \Delta p)$ Flow rate adjustment characteristic [„200“]

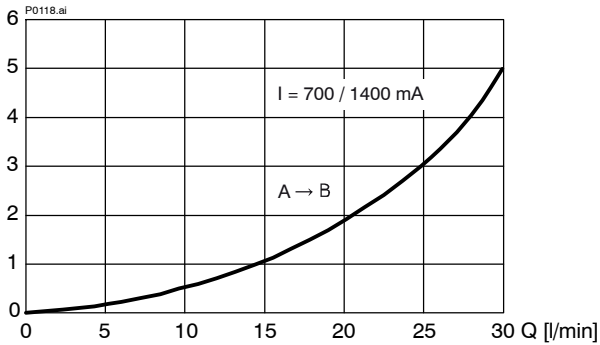
Q [l/min]



Must be used with pressure compensators - Q_N 30 and 40 l/min

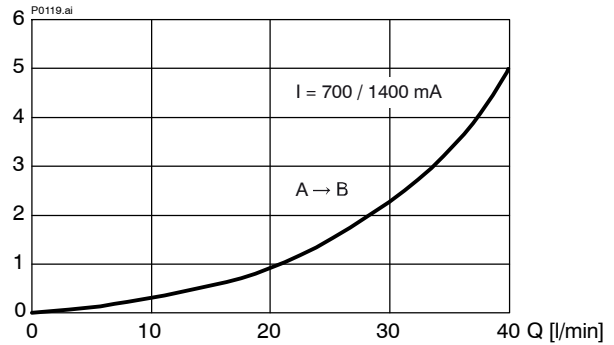
$\Delta p = f(Q)$ Pressure drop - Flow rate characteristic [„300“]

Δp A → B [bar]



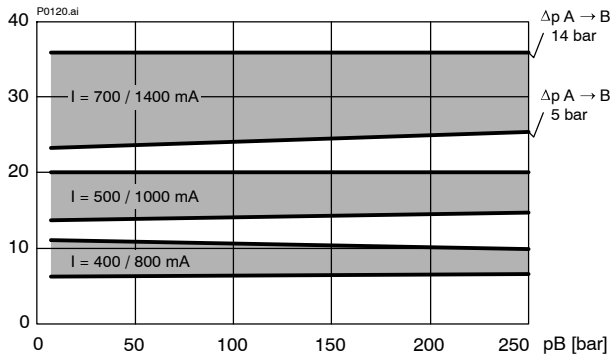
$\Delta p = f(Q)$ Pressure drop - Flow rate characteristic [„400“]

Δp A → B [bar]



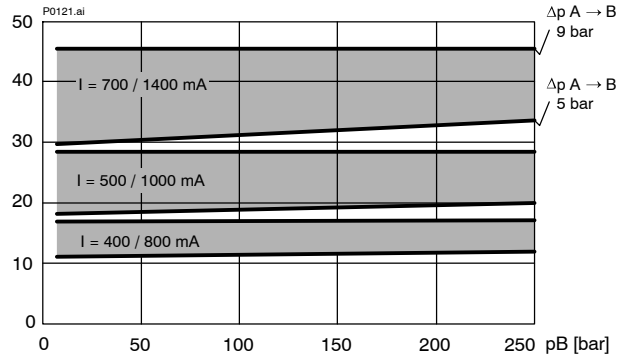
$Q = f(\Delta p; I)$ Flow rate adjustment characteristic [„300“]

Q [l/min]



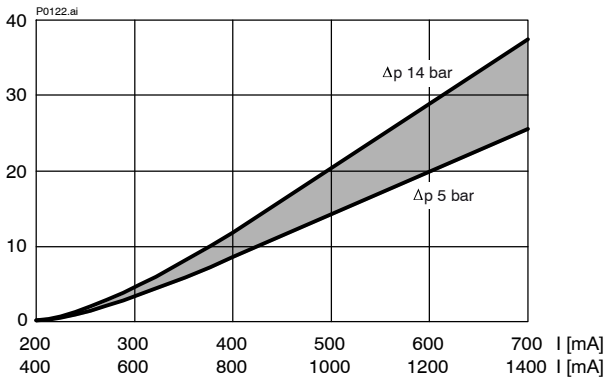
$Q = f(\Delta p; I)$ Flow rate adjustment characteristic [„400“]

Q [l/min]



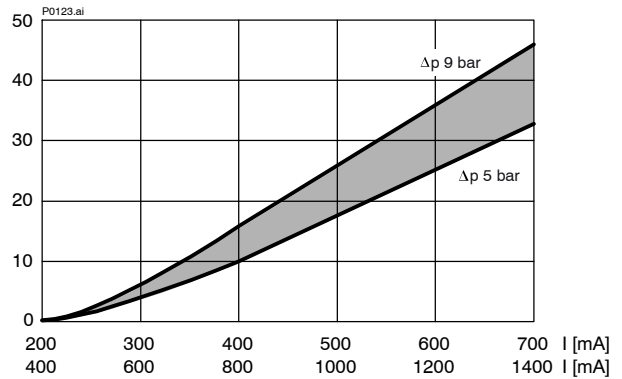
$Q = f(I; \Delta p)$ Flow rate adjustment characteristic [„300“]

Q [l/min]



$Q = f(I; \Delta p)$ Flow rate adjustment characteristic [„400“]

Q [l/min]



ATTENTION!

Must only be used in combination with inline or bypass pressure-compensator cartridges.

30 l/min = ≤ 14 bar permissible Δp from A → B

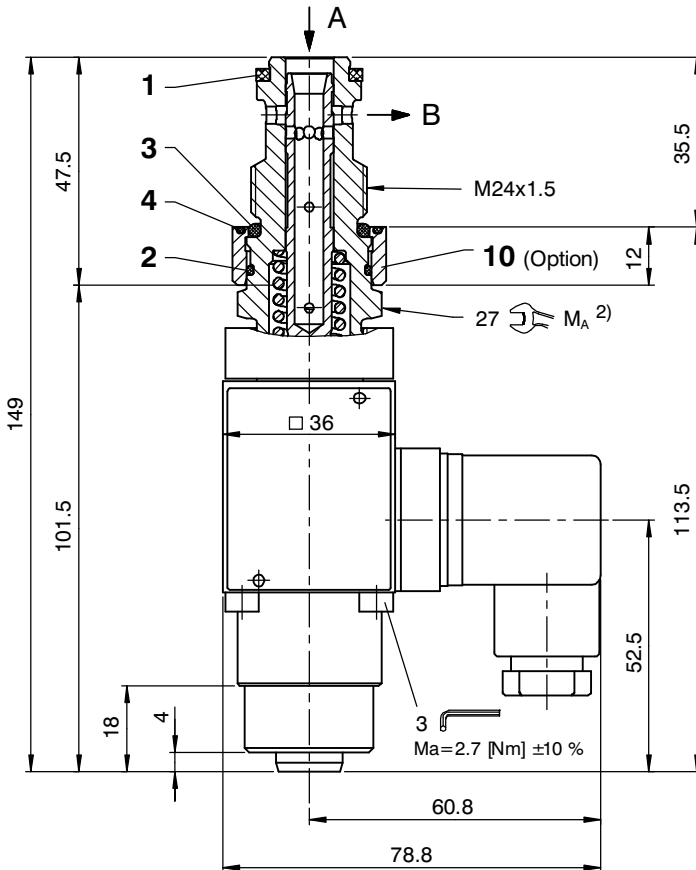
40 l/min = ≤ 9 bar permissible Δp from A → B

See performance graphs and application examples.

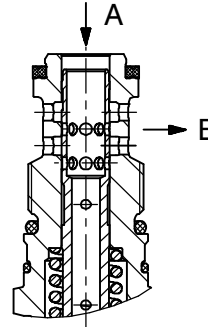
5 Dimensions & sectional view

5.1 Model without secondary unloading

Nominal flow ranges Q_N 12 and 20 l/min



Nominal flow ranges Q_N 30 and 40 l/min



Tightening torque M_A ²⁾ $\pm 10\%$

Cavity type	DD	DC
Can be fitted in steel	65 [Nm]	100 [Nm]
Can be fitted in aluminium	50 [Nm]	100 [Nm]

NBR seal kit no. DS-265-N ³⁾

Item	Qty.	Description
1	1	O-ring $\varnothing 22.10 / 16.50 \times 2.50$
2	1	O-ring no. 020 $\varnothing 21.95 \times 1.78$ N90
3	1	O-ring no. 117 $\varnothing 20.29 \times 2.62$ N90
4	1	O-ring $\varnothing 16.00 \times 1.50$ N90



IMPORTANT!

³⁾ Seal kit with FKM (Viton) seals, no. DS-265-V

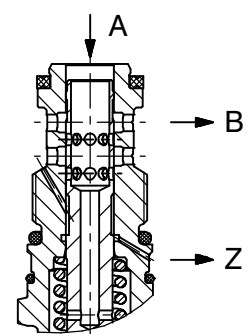
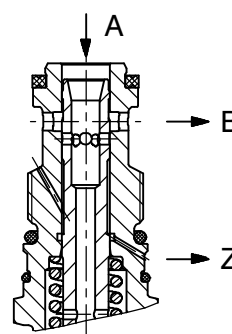
Option with adapter ring C

Item	Qty.	Description
10	1	Adapter ring C $\varnothing 32.00 \times 12.00$

5.2 With secondary unloading (port Z)

Q_N 12 and 20 l/min

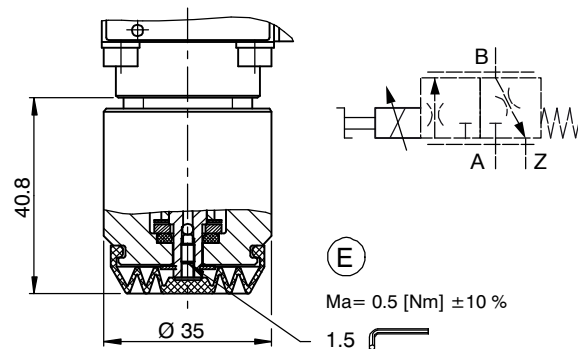
Q_N 30 and 40 l/min



6 Auxiliary manual adjustment

As an option, series MDRPA... proportional throttle cartridges can be provided with an auxiliary manual adjustment, type S508A, for setting the required flow rate mechanically if, for example, a proportional solenoid is defective. The auxiliary manual adjuster also incorporates an air-bleed screw (item E), which allows air to be bled from the cartridges in special applications.

- the flow rate can be set mechanically
- manual override if power supply or solenoid fail
- protected against water splash/spray



7 Installation information



IMPORTANT!

When fitting the cartridges, note the mounting attitude (preferably vertical, with coil down → automatic air bleed) and use the specified tightening torque. No adjustments are necessary, since the cartridges are set in the factory.



ATTENTION!

Only qualified personnel with mechanical skills may carry out any maintenance work. Generally, the only work that should ever be undertaken is to check, and possibly replace, the seals. When changing seals, oil or grease the new seals thoroughly before fitting them.

7.1 Orientation of proportional solenoid



ATTENTION!

There must always be a uniform gap all the way round between the mounting flange and the proportional solenoid.

F Solenoid retaining screws (4 pcs.)

G Proportional solenoid □ 36 mm

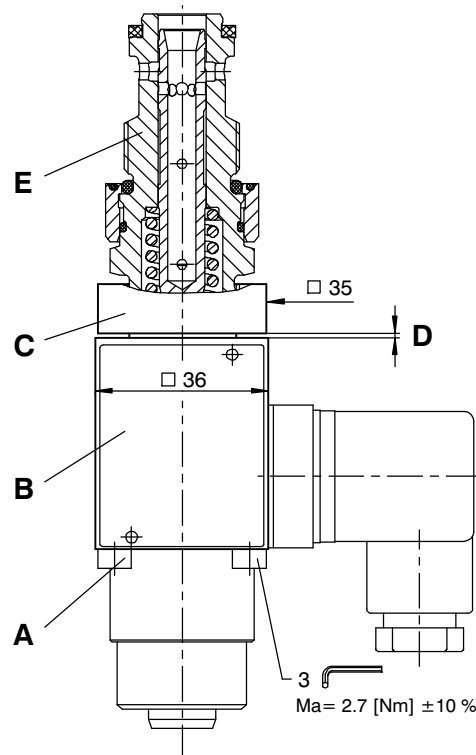
H Mounting flange □ 35 mm

I Existing gap between solenoid and flange

J Cartridge body

After the throttle cartridge has been tightened in its cavity, the proportional solenoid's plug connector might not be facing the required direction. Use the following procedure to realign the solenoid to the required position:

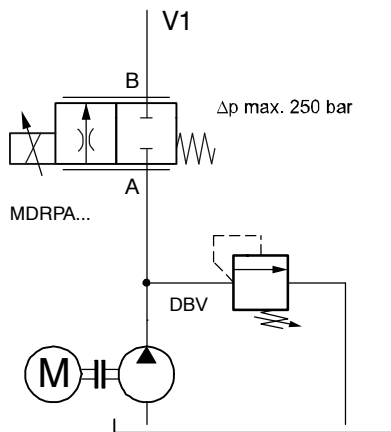
7. Remove the solenoid retaining screws (3 A/F).
8. Withdraw the proportional solenoid from the flange.
9. Turn the □ 35 mm mounting flange clockwise - maximum 90° - towards the required position.
10. Place the solenoid on the mounting flange so that the plug connector is facing the required direction.
11. Tighten the proportional solenoid to the mounting flange with the M4 retaining screws (Ma 2.7 Nm ±10 %).
12. After re-assembly, check that there is a uniform gap all the way round between the mounting flange and the proportional solenoid.



8 Application examples

8.1 Used without pressure compensator

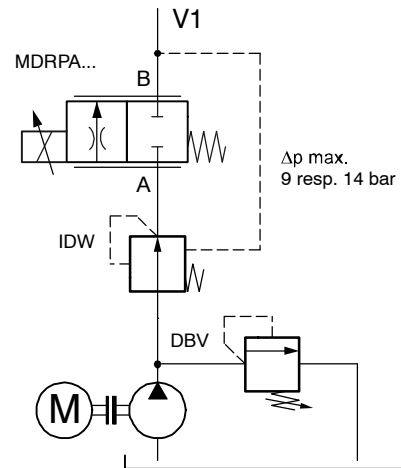
Proportional throttle cartridges with $Q_N = 12$ and 20 l/min can be used in applications in which the maximum Δp from A \rightarrow B (250 bar) may occur.



8.2 Used with secondary unloading

Proportional throttle cartridges with $Q_N = 30$ and 40 l/min must only be used in combination with pressure-compensator cartridges. A bypass compensator can also be used instead of an inline compensator.

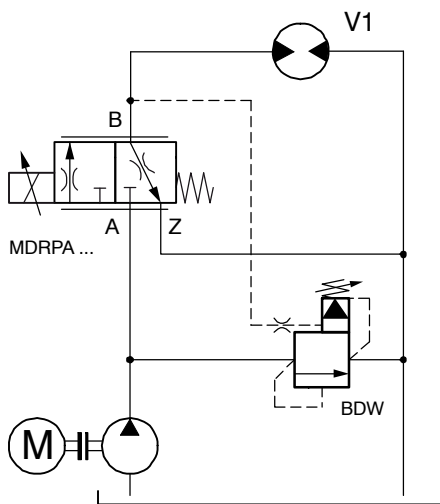
Δp A \rightarrow B: ≤ 14 bar for Q_N 30 l/min
 ≤ 9 bar for Q_N 40 l/min



8.3 Used with pressure compensator

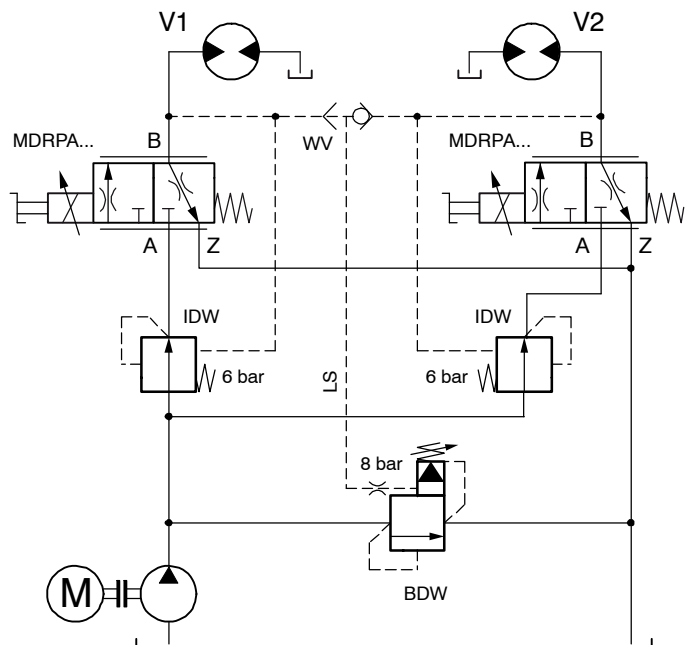
Typical use of a proportional throttle cartridge with additional port Z for secondary unloading. This circuit includes the following functions:

- MDRPA... de-energised = unpressurised flow through bypass compensator (BDW)
- MDRPA... energised = stepless and load-independent speed control at V1
- MDRPA... energised = LS operation with fixed-displacement pump



8.4 Classic combinations

Typical application of proportional throttle cartridges ($Q_N = 30$ and 40 l/min) for parallel operation of two actuators (V1, V2) with different load pressures. To avoid exceeding the maximum permissible Δp from A \rightarrow B, inline pressure-compensator cartridges (IDW) are positioned before the throttles. When an actuator is not being used, its LS line is unloaded through the B \rightarrow Z connection. When both actuators are unloaded, unpressurised flow circulates through the bypass pressure-compensator cartridge (BDW).



9 Ordering code

Ex.

MD	R	P	A	-	D	G	-	10	-	200	-	1	24	D	-	-
----	---	---	---	---	---	---	---	----	---	-----	---	---	----	---	---	---

M D = throttle valve, direct acting

R = proportional-solenoid operated

P = cartridge design

A ... Q = standard model - see relevant data sheets

Z ... R = special features - please consult BUCHER

D = cavity type DD (standard)

C = cavity type DC (option with adapter ring C)

G = de-energised closed

E = with port Z for secondary unloading
(in cavity type "DD" only)

10 = nominal size 10 mm

120 = nominal flow rate 12 l/min

200 = nominal flow rate 20 l/min

300 = nominal flow rate 30 l/min (max. Δp 14 bar)

400 = nominal flow rate 40 l/min (max. Δp 9 bar)

(blank) = NBR (Nitrile) seals (standard)

V = FKM (Viton) seals
(special seals - please consult BUCHER)

1 ... 9 = design stage (omit when ordering new units)

... = voltage e.g. 24 (24 V)

D = current DC

(blank) = ISO 4400 / DIN 43 650 mating plug (standard, IP 65)

M100 = without mating DIN plug

for the following plug-variants, please consult Bucher:

C = Kostal plug connection (IP 65)

JT = Junior Timer radial plug connection (with quenching diode, IP65)

IT = Junior Timer axial plug connection (with quenching diode, IP65)

D = Deutsch plug connection DT04-2P (IP 67)

DT = Deutsch plug connection DT04-2P (with quenching diode, IP 67)

F = flying leads (500 mm)

S508A = as option: auxiliary manual adjustment (via rotary knob) - mechanical air bleed

} mating plug not supplied

10 Related data sheets

Reference	(Old no.)	Description
400-P-040011	(i-32)	The form-tool hire programme
400-P-060121	(i-45.2)	Cavity type DD
400-P-060111	(i-45.1)	Cavity type DC (option with adapter ring C)
400-P-330101	(D-28.12)	Bypass compensator cartridge, size 10, direct acting, type DWDPA-2D...
400-P-330201	(D-28.22)	Bypass compensator cartridge, size 10, two-stage, type DWVPA/Z-2D...
400-P-330501	(D-28.55)	Inline compensator cartridge, size 10, direct acting, type DWDPA-5D...
400-P-511101	(P-3)	Amplifier card, 1-channel for valves with one solenoid, type SAN-535...
400-P-740111	(G-24.21)	Line- and manifold-mounting body, type DD-12 (G 1/2")
400-P-740101	(G-24.20)	Line- and manifold-mounting body, type DC-12 (G 1/2")

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Classification: 430.310.325.305.320.310