Bartels mikrotechnik

Bartels Micropumps

Micropumps transporting the tiniest amounts of gases or liquids can be considered the heart of microfluidics.

In many sectors they have become indispensable. Moving diagnostic samples in the device, dosing lubricants, feeding sensors with sample gas or mixing starch into the steam of flat irons are only a few of the manifold tasks they can fulfill. Many further fields of application for example are located in medical technologies and analytics.

Extremely small in size and low in weight, with good particle tolerance and temperature resistance, Bartels micropumps are well prepared to be used in any of these sectors. As they are almost completely made of plastics, large quantities of these pumps can be produced at low cost and so may well be used as disposables.

The functional principle of the Bartels micropumps is based on a piezoelectric diaphragm in combination with passive check valves. A piezo ceramic mounted on a coated brass membrane is deformed when voltage is applied. By the resulting down stroke, the medium is being displaced out of the pump chamber below. The check valves on both sides of the pump chamber define the flow direction. When the voltage decreases, the corresponding piezo deformation causes an upstroke of the membrane. The medium is sucked in and the chamber is filled again. In every second, the pump can do several hundreds of such pumping cycles. The pumping performance can be influenced by adjustment of the parameters.

Important advantages for all users result from the radically simple pump design: Injection molded parts for housing and pump chamber, piezo actuators and passive valves constitute the key components. Thus any adaptation to specific requirements concerning flow rate or back pressure is easy to realize. This customization of micropumps with the appropriate electronic controllers is part of the services offered by Bartels microComponents. If requested, the pumps can be fully integrated into complex system designs as well.

Once the perfect pump for your application has been found, you may purchase an exclusive production license for this version to include the component into your own production processes. Of course Bartels microComponents can also realize a high quality serial production for you at low cost.

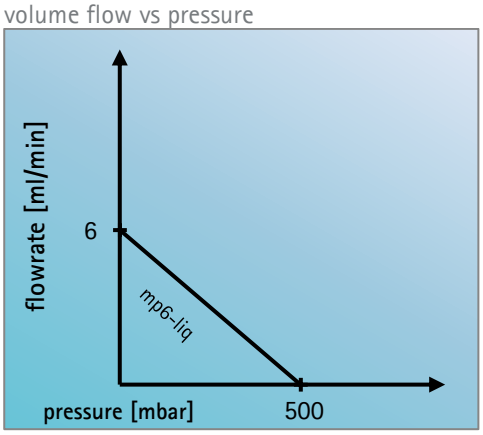
mp6 micropump series (mp6-liq, mp6-gas, mp6-gas+, mp6-pi and mp6-pp)

The Bartels micropump mp6-series combines two piezo actuators inside a single housing. This pump version joins the established functional principle and central advantages of its parent generation mp5 with its own specific innovative features. The small power pack can handle twice the back pressure the mp5 can cope with, has an increased priming capability and is of higher bubble tolerance, so that even gas-liquid-mixtures can be pumped without issues. Its low power consumption is a further advantage. In the entire pump (mp6-liq, mp6-gas) only one material comes into contact with the medium, all parts in medium contact are made of polyphenylsulfone (PPSU). The mp6-pi has its valve foil made of polyimide (PI) and the remaining wetted components made out of polyphenylsulfone (PPSU). The mp6-pp has its valve foil made out of polyimide (PI) and the remaining wetted components made out of polypropylene (PP).

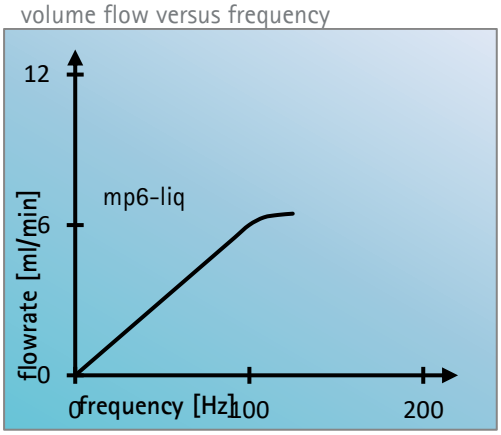
The mp6-liq, mp6-gas and mp6-pi can already be offered at low prices for large quantities due to an automated assembly. The mp6-pp is produced half-automated but can be transferred into automated serial production for large quantities.

Typical characteristics of the Bartels micropumps:

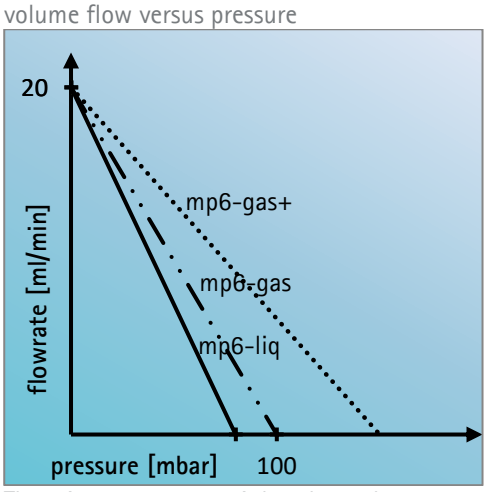
volume flow vs pressure



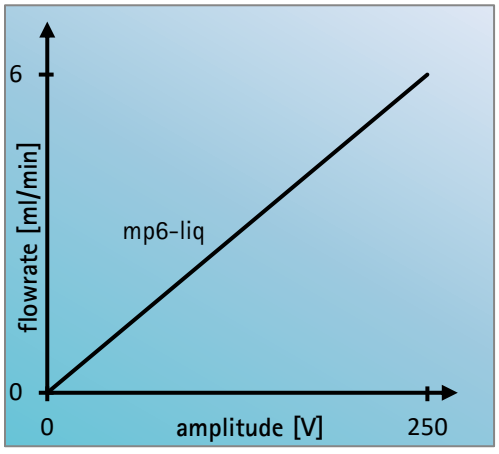
volume flow versus frequency



volume flow versus pressure



volume flow versus amplitude



The micropump mp6-pi does have the same performance behavior as the micropump mp6-liq.

Bartels mikrotechnik

Content

with passion for microfluidics

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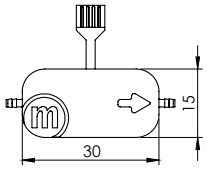
Technical Data of the mp6-liq[1]

mp6-liq	Order code: mp6-liq
Pump type	piezoelectric diaphragm pump
Number of actuators	2
Dimensions without connectors	30 x 15 x 3,8 mm 1.1811 x 0.5906 x 0.1498 in.
Weight	2 g
Fluidic connectors	barbed tube clip, (outer diameter 1.9 mm, length 3.5 mm) [2]
Electric connector	flex connector 1.25 mm pitch
Power consumption	~ 50 mW [6]
Self-priming	yes [3]
Pumping media	Liquids and gases
Operating temperature	0–70°C
Life time	5000 h [6]
IP code	IP33 [7]
Material in contact with media	polyphenylsulfone (PPSU) [8]
Suitable pump driver	mp-labtronix, mp-Multiboard, mp-Highdriver, mp-Lowdriver, mp-Highdriver4
Typical values of flow and back pressure for selected media (values measured with mp-x: 100 Hz, 250 V, SRS):	
Liquids – water	
Controllable flow range[9] Q	8 µl/min – 10000 µl/min
typ. flow rate Q (p=0)	8 ml/min [4]
typ. back pressure p (Q=0)	500 mbar (7,25 psi) [4]
Gases - air	
typ. volume flow Q(p=0)	30 ml/min [5]
typ. back pressure p (Q=0)	80 mbar (1,16 psi) [5]



1 Typical values. Values can vary under application conditions. Content is subject to changes without notice.
2 Recommended tubing: Tygon tubing 1.3 mm inner diameter.
3 Conditions: Suction pressure > 10 mbar, DI water, settings mp-labtronix: 100 Hz, 250 V, SRS, the volume flow will be reached after a few minutes of operation time.
4 Conditions: DI water (25°C), room temperature 23°C, settings mp-labtronix: 100 Hz, 250 V, SRS
5 Conditions: air, room temperature 23°C, mp-labtronix: 300 Hz, 250 V, SRS
6 Conditions: settings mp-labtronix: 100 Hz, 250 V, SRS
7 Can be changed to IP44.
8 For media compatibility details please find more information in the corresponding media compatibility sheets.
9 Controllable with frequency, voltage, signal form and more. Please contact us for more information.

Please find more information concerning the controller and the equipment in the corresponding manuals.

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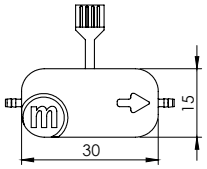
Technical Data of the mp6-pi[1]

mp6-pi	Order code: mp6-pi
Pump type	piezoelectric diaphragm pump
Number of actuators	2
Dimensions without connectors	30 x 15 x 3,8 mm 1.1811 x 0.5906 x 0.1498 in.
Weight	2 g
Fluidic connectors	barbed tube clip, (outer diameter 1.9 mm, length 3.5 mm) [2]
Electric connector	flex connector 1.25 mm pitch
Power consumption	~ 50 mW [5]
Self-priming	yes [3]
Pumping media	Liquids and mixtures
Operating temperature	0–70°C
Life time	5000 h [5]
IP code	IP33 [6]
Material in contact with media	Polyimid foil (PI), polyphenylsulfone (PPSU)[7]
Suitable pump driver	mp-labtronix, mp-Multiboard, mp-Highdriver, mp-Lowdriver, mp-Highdriver4
Typical values of flow and back pressure for selected media (values measured with mp-x: 100 Hz, 250 V, SRS):	
Liquids – water	
Controllable flow range[8] Q	8 µl/min – 8000 µl/min
typ. flow rate Q (p=0)	6 ml/min [4]
typ. back pressure p (Q=0)	500 mbar (7,25 psi) [4]

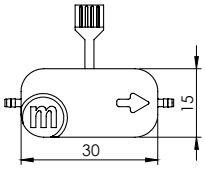


1 Typical values. Values can vary under application conditions. Content is subject to changes without notice.
2 Recommended tubing: Tygon tubing 1.3 mm inner diameter.
3 Conditions: Suction pressure > 10 mbar, DI water, settings mp-labtronix: 100 Hz, 250 V, SRS, the max. volume flow will be reached after a few minutes of operation time.
4 Conditions: DI water (25°C), room temperature 23°C, settings mp-labtronix: 100 Hz, 250 V, SRS
5 Conditions: settings mp-labtronix: 100 Hz, 250 V, SRS
6 Can be changed to IP44.
7 For media compatibility details please find more information in the corresponding media compatibility sheets.
8 Controllable with frequency, voltage, signal form and more. Please contact us for more information.

Please find more information concerning the controller and the equipment in the corresponding manuals.

Technical Data of the mp6-pp[1]

mp6-pp	Order code: mp6-pp
Pump type	piezoelectric diaphragm pump
Number of actuators	2
Dimensions without connectors	30 x 15 x 3,8 mm 1.1811 x 0.5906 x 0.1498 in.
Weight	2 g
Fluidic connectors	barbed tube clip, (outer diameter MIN 1.77 mm - MAX 1.85 mm, length 3.5 mm) [2]
Electric connector	flex connector 1.25 mm pitch
Power consumption	~ 50 mW [4]
Self-priming	yes [3]
Pumping media	Liquids and mixtures
Operating temperature	0 – 70°C
Life time	5000 h [4]
IP code	IP33 [5]
Material in contact with media	polypropylene (PP), Polyimid foil (PI) [7]
Suitable pump driver	mp-labtronix, mp-Multiboard, mp-Highdriver, mp-Lowdriver, mp-Highdriver4
Typical values of flow and back pressure for selected media (values measured with mp-x: 100 Hz, 250 V, SRS):	
Liquids – water	
Controllable flow range[8] Q	8 µl/min – 4000 µl/min
typ. flow rate Q (p=0)	4 ml/min [4]
typ. back pressure p (Q=0)	500 mbar (7,25 psi) [4]

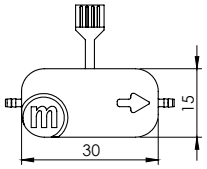


1 Typical values. Values can vary under application conditions. Content is subject to changes without notice.
2 Recommended tubing: Tygon tubing 1.02 mm inner diameter. MIN & MAX values due to injection molding shrink.
3 Conditions: Suction pressure > 10 mbar, DI water, settings mp-x: 100 Hz, 250 V, SRS, the max. volume flow will be reached after a few minutes of operation time.
4 Conditions: Settings mp-labtronix: 100 Hz, 250 V, SRS signal
5 Can be changed to IP44.
6 Conditions: DI water (25°C), room temperature 23°C, settings mp-labtronix: 100 Hz, 250 V, SRS
7 For media compatibility details please find more information in the corresponding media compatibility sheets.
8 Controllable with frequency, voltage, signal form and more. Please contact us for more information.

Please find more information concerning the controller and the equipment in the corresponding manuals.

Technical Data of the mp6-gas[1]

mp6-gas	Order code: mp6-gas
Pump type	piezoelectric diaphragm pump
Number of actuators	2
Dimensions without connectors	30 x 15 x 3,8 mm 1.1811 x 0.5906 x 0.1498 in.
Weight	2 g
Fluidic connectors	barbed tube clip, (outer diameter 1.9 mm, length 3.5 mm) [2]
Electric connector	flex connector 1.25 mm pitch
Power consumption	~ 150 mW [5]
Self-priming	yes [3]
Pumping media	gases
Operating temperature	0–70°C
Life time	5000 h [5]
IP code	IP33 [6]
Material in contact with media	polyphenylene sulphone (PPSU) [7]
Suitable pump driver	mp-labtronix, mp-Multiboard, mp-Highdriver, mp-Lowdriver, mp-Highdriver4
Typical values of flow and back pressure for selected media (values measured with mp-x: 300 Hz, 250 V, SRS):	
Gases - air	
typ. volume flow Q(p=0)	25 ml/min (300 Hz) [5]
typ. back pressure p (Q=0)	100 mbar (300 Hz) (1,45 psi) [5, 8]
Liquid - water	
typ. volume flow Q(p=0)	8 ml/min (300 Hz) [5]
typ. back pressure p (Q=0)	500 mbar (300 Hz) (1,45 psi) [5, 8]



1 Typical values. Values can vary under application conditions. Content is subject to changes without notice.
2 Recommended tubing: Tygon tubing 1.3 mm inner diameter.
3 Conditions: air, room temperature 23°C, settings mp-labtronix: 300 Hz, 250 V, SRS, the max. volume flow will be reached after a few minutes of operation time.
4 Conditions: gases, room temperature 23°C, mp-labtronix: 300 Hz, 250 V, SRS
5 Conditions: settings mp-labtronix: 300 Hz, 250 V, SRS
6 Can be changed to IP44.
7 For media compatibility details please find more information in the corresponding media compatibility sheets.
8 The mp6-gas is available as mp6-gas+ version with 150 mbar (2,18 psi) of back pressure.

Please find more information concerning the controller and the equipment in the corresponding manuals.

Electronic units for Bartels Micropumps

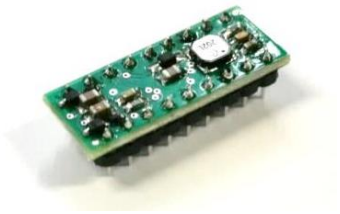
mp-Labtronix controller	Order code: mp-Labtronix
Access to the full range of driving parameters. A system for the professional evaluation of the micropumps.	
Dimensions	7,5 x 16 x 20 cm 2.983 x 6.299 x 7.874 in.
Weight	ca. 800 g
Adjustable parameters	amplitude, frequency, signal form
Amplitude range	0 – 250 V
Frequency range	0 - 300 Hz
Signal form	SRS, rectangular, sine
Power supply	mains adaptor
Current consumption	750 mA at 7,5 V
USB-Port	one
connectable micropumps	all pumps of the mp6-series: 1x with mp6-con

mp-Labrtonix

mp-Mulitboard evaluation board	Order code: mp-Multiboard
The mp-Multiboard is an evaluation board that allows controlling one of our I²C controlled pump-drivers (mp-Lowdriver, mp-Highdriver, mp-Highdriver4) through an Arduino microcontroller. Up to four mp6 micropumps can be directly connected to the board. An external power supply connector is available, but the board can also be powered through the microcontroller USB port. The board has multiple auxiliary connectors for future use with active valves, pressure and flow sensors. The mp-Multiboard comes preprogrammed with an interface software and windows application. Arduino source-code is available on our website. Interface protocol will be available soon.	
Dimensions (not including baseplate)	100 x 50 x 17 mm 3.94 x 1.97 x 0.67 in.
Adjustable parameters	amplitude, frequency, signal shape
Amplitude range	0 – 250 Vpp [2]
Frequency range	8 - 2000 Hz [2]
Signal form	sine, other
Interface	USB
Power supply (optional)	7.5 – 12 V, 500 mA
Typ. current consumption	avg. 240 mA [1]
[1]mp-Highdriver4 connected to four mp6-hyb @ 250 Vpp and 100 Hz	
[2]All 3 drivers are compatible to the mp-Multiboard! Please check the frequency and voltage range for each driver below	

mp-Multiboard

mp-Highdriver controller	Order code: mp-Highdriver
The mp-Highdriver drives the micropump at adjustable performance in a package similar to an integrated circuit. It enables integration into system electronics or on a PCB.	
Dimensions	10,16 x 25,40 x 2.82 mm 0.4 x 1.0 x 0.11 in
Adjustable parameters	amplitude, frequency, wave form
Amplitude range	10 – 250 Vpp [1]
Frequency range	50 – 800 Hz
Signal form	Sine, rectangular, trapezoid
Interface	I^2C
Power supply	2.7 – 5.5 VDC
Current consumption	ca. 30 mA at 5 V
Pin arrangement	DIL 18; horizontal ~2.54 mm, vertical ~7.62 mm
1 amplitude range can go up to 270 Vpp but guaranteed minimum is 250 Vpp	



mp-Highdriver

mp-Lowdriver controller	Order code: mp-Lowdriver
The mp-Lowdriver drives the micropump at adjustable performance in a package similar to an integrated circuit. It enables integration into system electronics or on a PCB.	
Dimensions	10,16 x 25,4 x 2,64 mm 0.4 x 1.0 x 0.10 in
Adjustable parameters	amplitude, frequency, wave-form
Amplitude range	0 – 150 Vpp
Frequency range	8 - 2000 Hz
Signal form	sine, custom
Interface	I^2C
Power supply	3.0 – 5.5 VDC
Current consumption	ca. 30 mA at 5 V
Pin arrangement	DIL 18; horizontal ~2.54 mm, vertical ~7.62 mm

mp-Lowdriver

mp-Highdriver4	Order code: mp-Highdriver4
The mp-Highdriver4 is a pump driver that allows driving up to four mp6 micropumps simultaneously. It comes in a package similar to an integrated circuit that enables integration into system electronics or on a PCB. The driving frequency, amplitude and also the driving signal is adjustable. Sine signal and rectangle are available amongst others. Every pump can be activated and deactivated individually. This driver is configured and controlled through an I²C interface.	
Dimensions	38,1 x 17,78 x 11,6 mm 1.5 x 0.7 x 0.46 in
Adjustable parameters	amplitude, frequency, signal shape
Amplitude range	0 – 250 Vpp
Frequency range	50 - 800 Hz
Signal form	sine, rectangular, other
Interface	I²C
Power supply	2.7 – 5.5 VDC
Current consumption	avg. 220 mA, peak 280 mA[1]
Pin arrangement	DIL28; horizontal 2.54 mm, vertical 15.24 mm
[1] four connected mp6-gas@ 260 V and 800 Hz	

mp-Highdriver4

mp-valvedriver	Order code: mpv-valvedriver
Dimensions	17,78 x 15,24 x 3,2 mm
Power supply	4,5 – 17 VDC (5 V recommended for optimized performance)
Current consumption	ca. 85 mA at 5 V[1]
Compatible valve	Takasago valve: SMV-2R-BN1F
[1] with the use of one SMV valve	

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Accessories for Bartels Micropumps

mp-damper	Order code: mp-damper
This damper is designed to reduce the pulsation of fluids from micropumps to allow sensors (for example calorimetric flow sensors) to measure more reliable	
Materials	PPSU/PP, silicone, Epoxy based adhesive
Dimensions	17 x 19 x 5 mm
No of in-/ outlets	2
In- / outlets inner diameter	1,4 mm
In- /outlets outer diameter	1.6 mm
Material in contact with fluids	PPSU, silicone, PP, epoxy based adhesive
Operating temperature	+5°C up to 45°C

mp-filter	Order code: mp-filter
Protection of fluidic systems from particles.	
Dimensions	21 mm x 5.5 mm 0.82677 in. x 0.2165 in.
Fluidic connectors	barbed tube clip, length : 5.6 mm for tubing with internal diameter: 1.3 mm
Filter porosity	20 – 60 µm

mp6-con connection cable	Order code: mp6-con
Connector for mp6-series to mp-x	
Design and connectors	- Molex FCC 1.25 mm pitch - 85 cm (33.465 in.) cable - Binder 620 connector

mp-cv check valve	Order code: mp-cv
The passive check valve eliminates the back flow of the pumping medium, when the micropump is switched off. It can be connected via tubing.	
Dimensions	21 mm x 5.5 mm (length x wrench size) 0.82677 x 0.2165 in.
Materials in contact with the pumped media	Silicone, stainless steel
Fluidic connectors	barbed tube clip, length : 5.6 mm for tubing with internal diameter: 1.3 mm
Cracking pressure	typical < 35 mbar
Max. back pressure	500 mbar
Typical leak rate	<20 µl/h for DI-water (at 500 mbar)

mp6-mol connector	Order code: mp6-mol
Connector to micropump mp6-series for custom made cabling	
Type	Molex FCC 39532045 1.25 mm pitch
Contacts	4
Entry Angle/Orientation	Vertical
PC Tail Length	3.50 mm
Operating temperature	-20°C – 80°C
Voltage	max. 200V
Current	max. 1.0 A per contact
Termination Interface: Style	Through Hole

mp-t tubing	Order code: mp-t ID 1.3 mm	Order code: mp-t ID 1,02 mm
Inlet/outlet compatible Tygon® tubing.		
Inner diameter	1.3 mm	1,02 mm
Outer diameter	3 mm	2,74 mm
Wall thickness	0.85 mm	
Sterilizable	Yes (autoclave or ethylene oxide)	
Color	transparent	
Suitable micro-pumps	1 m	
Suitable micro-pumps	mp6-liq, mp6-gas, mp6-pi, mp6-gas+	mp6-pp

mp-y tubing connector	Order code: mp-y
Y-connector for tubing, for the parallel use of two micropumps:	
Material	polypropylene (PP)
for tubing inner diameters of	1,3 – 2,6 mm 0.0512 – 0.1024 in.

mp-hc	Order code: mp-hc
Hose clip to prevent leakage in high pressure applications.	
Inner diameter (when closed)	3 mm
Dimensions	In closed state: 4 mm x 5,1 mm Width (in tube direction): 2 mm
Suitable tube	tygon hose 1.3 mm connected with barbed tube clip

Evaluation-Kits

Order code:	Controller	Pumps	Additional components
mp6-lab! kit	mp-labtronix	6x mp6	non
mp-basic kit	mp-Multiboard including all 3 drivers		non
mp-advance kit	mp-Multiboard including all 3 drivers		Flow sensor, active valve, pressure sensor, microfluidic chip
Not the right preselected kit for your application? Please contact us directly			
All kits have tubing, connectors, needed cables and accessories included			

Microfluidic systems

Order code:	Controller	Pumps
mpSmart-Dosing	Specialized for mpSmart-Dosing, Sensirion Sensor SLF3s-1300F	3x mp6
mpSmart-Lowdosing	Specialized for mpSmart-Dosing, Sensirion Sensor SLF3s-0600FF	3x mp6
mpSmart-Flowstop	Specialized for mpSmart-Flowstop; active valve from Takasage SMV	3x mp6

All sets contain the needed accessories to evaluate the mp6 micropumps, like 1 m tubing, 1 pu mp-hc, in addition and needed for particular sets as well electronic connectors like USB-cable, mini-USB-cable, power supply and mp6-con cable, sensors, damper, software.

The offered accessories and sets are meant to assist your evaluation process. After the feasibility of the micropump in the customer specific application has been proven, an adequate miniaturization of the controller and the equipment can be carried out.

The design of customized controllers is part of the services offered by Bartels microEngineering.

Please contact us, so that we can support you in choosing the suitable equipment.

All values are approximate and no guarantee of specific technical properties.

Changes in the course of technical progress are possible without notice.

Bartels mikrotechnik

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