



# FILTERS

for Gas and Liquid Flow Meters / Controllers



# IN-LINE Gas Flow Filters

## › Introduction

Inherent to its construction, a thermal mass flow meter or controller for gases is sensitive to contamination. To increase the MTBF (Mean Time Between Failure) it is important to make sure that the gas entering the instrument is clean. The IN-LINE Filter Assembly, screwed into the inlet of the instrument, provides this service. It contains a 316L sintered metal filter cartridge that is suitable for general purpose filtration and can be cleaned with a suitable solvent. If the gas contains a large particulate content, we advise the use of a pre-filter.

## › Selection

- ◆ Choose a low-flow or medium-flow style filter for instruments with ¼" female thread at the inlet; the high-flow filter is suitable for mounting into instruments with ½" female thread.
- ◆ In principle select finest porosity with low ΔP; preferable ΔP not higher than 250 to 500 mbar, and porosity not bigger than 5 μm.

## › Material of construction

Housing: AISI 316

O-rings: Viton; optional EPDM and FFKM (Kalrez).

## › Pressure drop

The approximate pressure drop across a filter assembly can be calculated as follows:

Stylett	Model no.	Average porosity	Type / area	Connections in / out
Ultra-low-flow	M-410-13/M-420-13	0,5 μm	316L / 2,5 cm <sup>2</sup>	⅛" female / ⅛" male
	M-410-16/M-420-16	2 μm	316L / 2,5 cm <sup>2</sup>	⅛" female / ⅛" male
	M-410-18/M-420-18	7 μm	316L / 2,5 cm <sup>2</sup>	⅛" female / ⅛" male
	M-410-20/M-420-20	15 μm	316L / 2,5 cm <sup>2</sup>	⅛" female / ⅛" male
Low-flow	M-411-13/M-421-13	0,5 μm	316L / 2,5 cm <sup>2</sup>	¼" female / ¼" male
	M-411-16/M-421-16	2 μm	316L / 2,5 cm <sup>2</sup>	¼" female / ¼" male
	M-411-18/M-421-18	7 μm	316L / 2,5 cm <sup>2</sup>	¼" female / ¼" male
Medium-flow	M-411-20/M-421-20	15 μm	316L / 2,5 cm <sup>2</sup>	¼" female / ¼" male
	M-412-16/M-422-16	2 μm	316L / 5 cm <sup>2</sup>	¼" female / ¼" male
	M-412-17/M-422-17	5 μm	316L / 5 cm <sup>2</sup>	¼" female / ¼" male
	M-412-19/M-422-19	10 μm	316L / 5 cm <sup>2</sup>	¼" female / ¼" male
High-flow	M-412-21/M-422-21	20 μm	316L / 5 cm <sup>2</sup>	¼" female / ¼" male
	M-413-16/M-423-16	2 μm	316L / 5 cm <sup>2</sup>	½" female / ½" male
	M-413-17/M-423-17	5 μm	316L / 5 cm <sup>2</sup>	½" female / ½" male
	M-413-19/M-423-19	10 μm	316L / 5 cm <sup>2</sup>	½" female / ½" male
	M-413-21/M-423-21	20 μm	316L / 5 cm <sup>2</sup>	½" female / ½" male
	M-413-22/M-423-22	40 μm	316L / 5 cm <sup>2</sup>	½" female / ½" male

## › Example:

Flow 80 l<sub>v</sub>/min air, pressure 5 bara, filter selected: M-422-17 (5 μm).

At P<sub>1</sub> = 1 bara, ΔP across filter = 389 mbar  
(see second graph on the next page).

At P<sub>1</sub> = 5 bara,  $\Delta P = \frac{389}{5} = 78$  mbar.

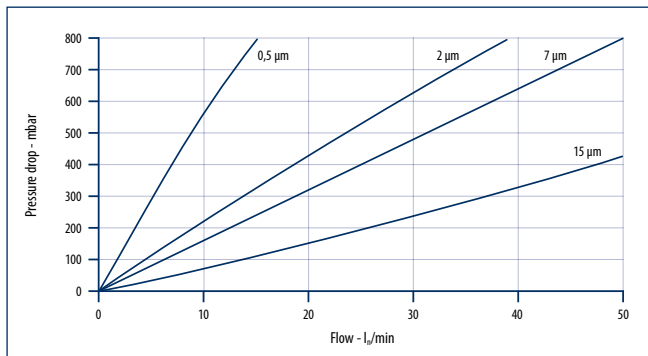
For other gases than air the pressure drop is difficult to calculate, because the total pressure drop is built up from both laminar and turbulent pressure losses; therefore use the Filter Calculations routine on [www.fluidat.com](http://www.fluidat.com) or contact factory regarding exact pressure losses, if so required.



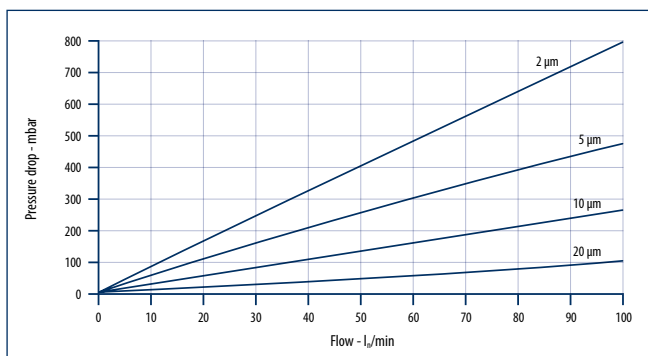
Mass flow controller with IN-LINE gas flow filter

## ➤ Pressure drop

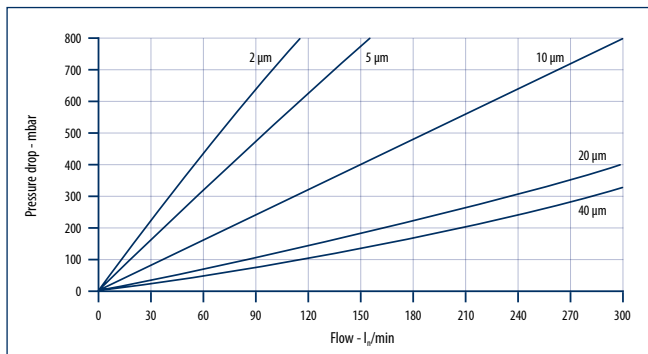
Air at 1 bar, 20 °C, pressure vs. flow



Particle filter M-410/M-411/M-420/M-421



Particle filter M-412/M-422



Particle filter M-413/M-423



IN-LINE gas flow filters

## ➤ Model number identification

<b>M</b>	-	<b>4</b>		<b>N</b>	<b>N</b>	-	<b>NN</b>	-	<b>N</b>	<b>N</b>	-	<b>A</b>
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<b>Pressure rating</b>	
1	100 bar
2	200 bar

<b>Filter housing</b>	
0	Ultra-low-flow
1	Low-flow
2	Medium-flow
3	High-flow

<b>Filter cartridge</b>	
13	0,5 micron sintered metal
16	2 micron sintered metal
17	5 micron sintered metal
18	7 micron sintered metal
19	10 micron sintered metal
20	15 micron sintered metal
21	20 micron sintered metal
22	40 micron sintered metal

<b>Adapter</b>	
0	none
1	1/8" OD compression type
2	1/4" OD compression type
3	6 mm OD compression type
4	12 mm OD compression type
5	1/2" OD compression type
6	20 mm OD compression type
8	1/4" Face seal male
9	other

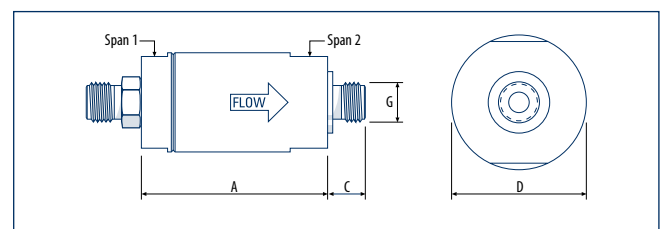
<b>Adapter type</b>	
0	RP/RS
1	ISO 1179

*ISO 1179 only in 100 bar version.*

<b>Seals</b>	
E	EPDM
K	FFKM (Kalrez)
V	Viton (factory standard)

## ➤ Dimensions



RP/RS type	A	C	D	G	Span 1	Span 2
M-410/M-420	53	10	∅ 24	1/8"	20	20
M-411/M-421	53	10	∅ 24	1/4"	20	20
M-412/M-422	70	10	∅ 35	1/4"	30	32
M-413/M-423	80	14	∅ 35	1/2"	30	32

ISO 1179 type	A	C	D	G	Span 1	Span 2
M-410 ISO	52	8	∅ 24	1/8"	20	20
M-411 ISO	52	12	∅ 28	1/4"	20	24
M-412 ISO	71	12	∅ 34,5	1/4"	30	32
M-413 ISO	81	14	∅ 34,5	1/2"	30	32

*Dimensions in mm. Technical specifications and dimensions subject to change without notice.*

# Liquid Flow Filters

## › Introduction

Filters play a relevant role to protect sensitive components in a fluid system. Bronkhorst® COMBI-FLOW filters for liquid flow purposes offer great flexibility, thanks to the modular concept, whereby they can be equipped with different fluid connectors and filter cartridges. M1 Series filters have the advantage, that their cartridge can be replaced without removing the base from the pipe. The configuration of the M2 Series filters features a drain outlet, provided with a drain plug, which can be replaced by a regular fitting to accommodate proper connection to a drainage facility.

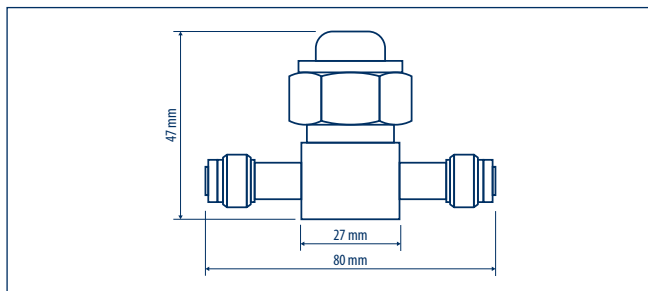
## › M1 Filter

- ◆ SS 316L sintered metal filters, for general purpose filtration
- ◆ Cartridges may be cleaned with suitable solvent
- ◆ In case of severe particle content in gas use pre-filter
- ◆ In principle select finest porosity with low  $\Delta P$ ; preferably  $\Delta P$  not higher than 250 to 500 mbar, and porosity not bigger than 5 mm
- ◆ On request: PVDF fine filters for ultra-clean filtering

## › Available models

Model no.	Average porosity ( $\mu\text{m}$ )	Pressure rating
M1-AB	0.5	100 bar
M1-AC	2	100 bar
M1-AD	7	100 bar
M1-AE	15	100 bar
M2-AF	10	200 bar
M2-AG	40	200 bar
M2-AH	25	200 bar

## › Dimensions M1 Filter



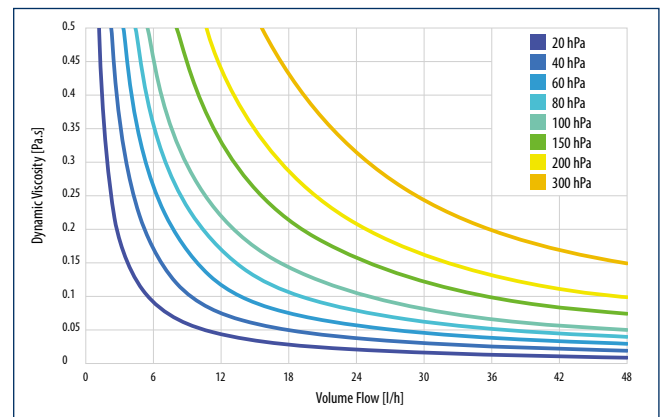
Filter with top mount cartridge, type M1

Filter with drain outlet, type M2

## › M2 Filter - Technical specifications

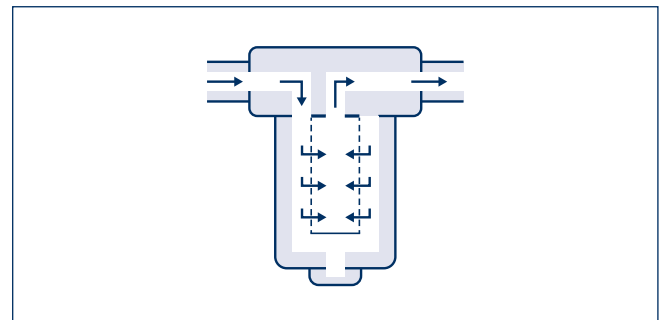
Seals	
Filter fineness (meshed) and area	10 $\mu\text{m}$ , 72 $\text{cm}^2$ 25 $\mu\text{m}$ , 65 $\text{cm}^2$ 40 $\mu\text{m}$ , 60 $\text{cm}^2$
Process connections	See model key
Internal volume	30 ml
Material (housing)	Stainless steel (1.4404)
Material (wetted parts)	Stainless steel (1.4404)
Materials seals (choice)	Viton 70°Sh green 51415 Kalrez 6375 EPDM 559291 USP Viton 514178 USP Kalrez 6230 USP
Fluid temperature range	-10...+100 °C
Ambient temperature range	-20...+70 °C
Fluid pressure (PN)	200 bar (g)
Max. differential pressure	20 bar (d)
Leak integrity, outboard	tested < $2 \times 10^{-9}$ mbar l/s He
Flow range	See flow rate vs pressure drop figure
Drain outlet	Drain connection, blind nut 1/4" RS or tap
Mounting position	Filter housing pointing downwards

## › Flow rate vs pressure drop



Pressure drop of a M2 filter with filter fineness of 10  $\mu\text{m}$  (meshed)

## › Functional principle







[www.bronkhorst.com](http://www.bronkhorst.com)

Bronkhorst High-Tech designs and manufactures innovative instruments and subsystems for low-flow measurement and control for use in laboratories, machinery and industry. Driven by a strong sense of sustainability and with many years of experience, we offer an extensive range of (mass) flow meters and controllers for gases and liquids, based on thermal, Coriolis and ultrasonic measuring principles. Our global sales and service network provides local support in more than 40 countries. Discover Bronkhorst®!

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