Measuring orifice VMO

Technical Information · GB
3 Edition 12.18

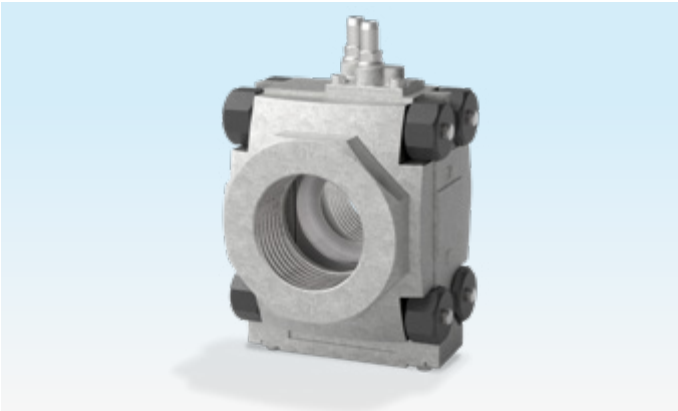
- For use as a measuring or restricting orifice
- Can be combined with valVario valves and regulators
- Air and gas flow rate diagrams to facilitate configuration
- Easy installation thanks to flanges with internal thread
- Replaceable aluminium washers for optimal adjustment to local operating conditions

Table of contents

Measuring orifice VMO 1
Table of contents 2
1 Application 3
1.1 Examples of application 4
1.1.1 Self recuperative burner for direct heating systems ..4
1.1.2 Continuous control with pneumatic ratio control system 4
1.1.3 Continuous or staged flow rate control 5
2 Certification 6
3 Function 7
4 Flow rate 8
4.1 VMO 110, VMO 115, VMO 120 8
4.2 VMO 125, VMO 232 9
4.3 VMO 240, VMO 250 10
4.4 VMO 340, VMO 350 11
4.5 VMO 365 12
4.6 k_V value 13
5 Selection 15
5.1 Type code 15
6 Project planning information 16
6.1 Installation 16
6.2 Gas line connection 16
7 Accessories 17
7.1 Seal set VMO/VMV 17
7.2 Washer 17
8 Technical data 18
8.1 Dimensions 19
8.1.1 VMO..R 19
8.1.2 VMO..N 19
8.1.3 VMO 240F 20
9 Maintenance 21
Feedback 22
Contact 22

= To be continued

1 Application



The valVario measuring orifice VMO is installed in gas control and safety systems, as well as in air systems used in industrial and commercial gas heat generation. It can serve as a restricting orifice when used in conjunction with valVario gas solenoid valves and gas control valves.

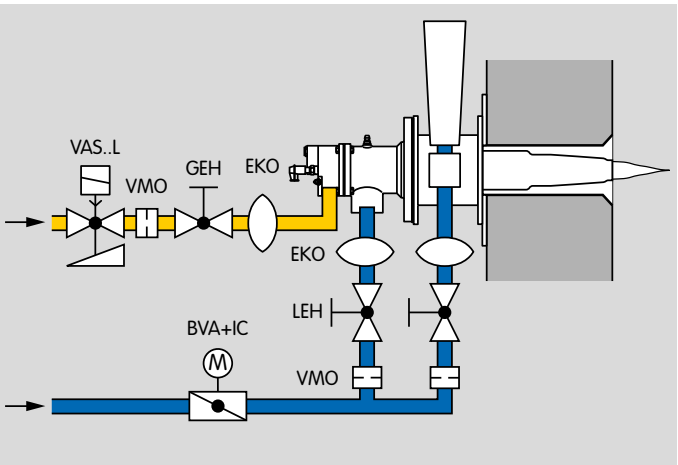
The test points are located in the measuring orifice housing. The measuring orifice VMO is a good-value alternative in areas where no standardized measuring orifice is required. The replaceable washers with different hole sizes allow the orifice to be adjusted perfectly to the local operating conditions.

Shaft melting furnace

Incineration installation for thermal regenerative flue air purification

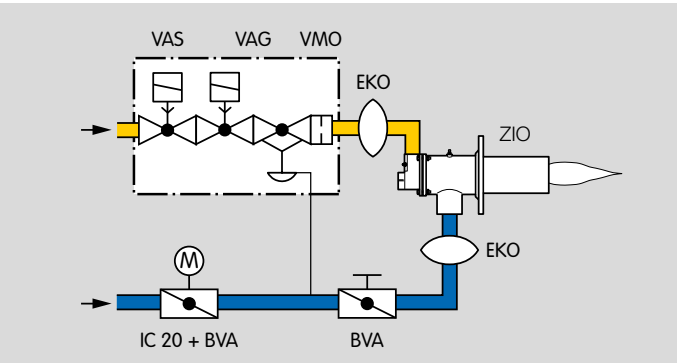
1.1 Examples of application

1.1.1 Self recuperative burner for direct heating systems



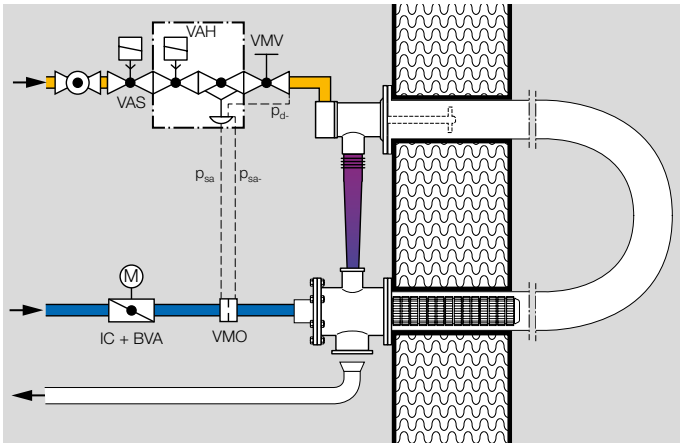
Self recuperative burner in a direct heating system with an inductor for evacuating the flue gases from the furnace. The inductor generates a vacuum with a centrally positioned nozzle and thus draws the flue gases out of the furnace chamber through the burner's heat exchanger. The measuring orifices VMO are designed to record the gas and air flow rates.

1.1.2 Continuous control with pneumatic ratio control system



With this type of control, the mixture setting can be maintained over a wide control range while at the same time preventing air deficiency. This type of control is used in melting furnaces in the aluminium industry or in regenerative incineration installations in the environment industry, for example. Here, the measuring orifice VMO is designed to record the gas flow rate.

1.1.3 Continuous or staged flow rate control



This application shows flow rate control for a tube firing burner system with plug-in recuperator for air preheating.

There are temperature-dependent air pressure losses in the recuperator. The ratio of gas pressure to air pressure does not remain constant. The fluctuating air flow rate is measured at the measuring orifice VMO and the VAH controls the gas flow rate proportionally.

The air index (lambda) can be set using the fine-adjusting valve VMV.

2 Certification

EU certified pursuant to

CE

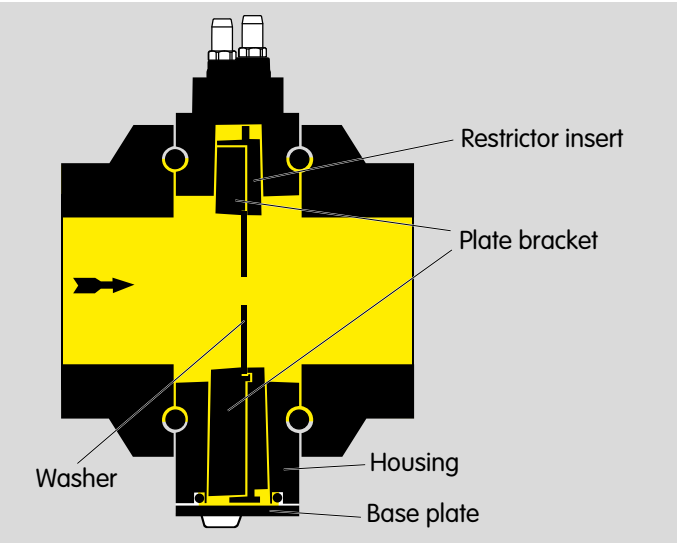
Meets the requirements of the

– Low Voltage Directive (2014/35/EU),
– EMC Directive (2014/30/EU).

Regulation:

– Gas Appliances Regulation (EU) 2016/426

3 Function



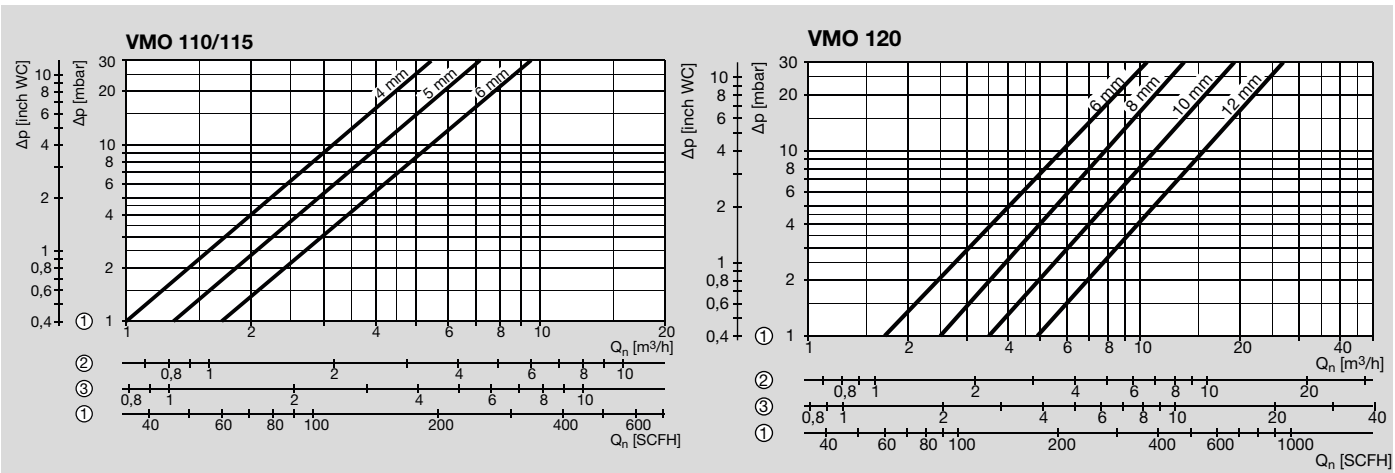
A plate bracket with a washer is placed in the VMO housing. There is a hole in the washer through which gas can flow. A circumferential seal on the restrictor insert reduces the leakage flow. For replacing the washer, the base plate of the housing can be removed in order to pull the plate bracket and washer together out of the housing.

4 Flow rate

The characteristic curves are measured at the test points at 15°C (59°F) for the individual washers with an inlet and outlet section of 5 x D, see also Project planning information.

For calculating the nominal size, see www.adlatus.org

4.1 VMO 110, VMO 115, VMO 120



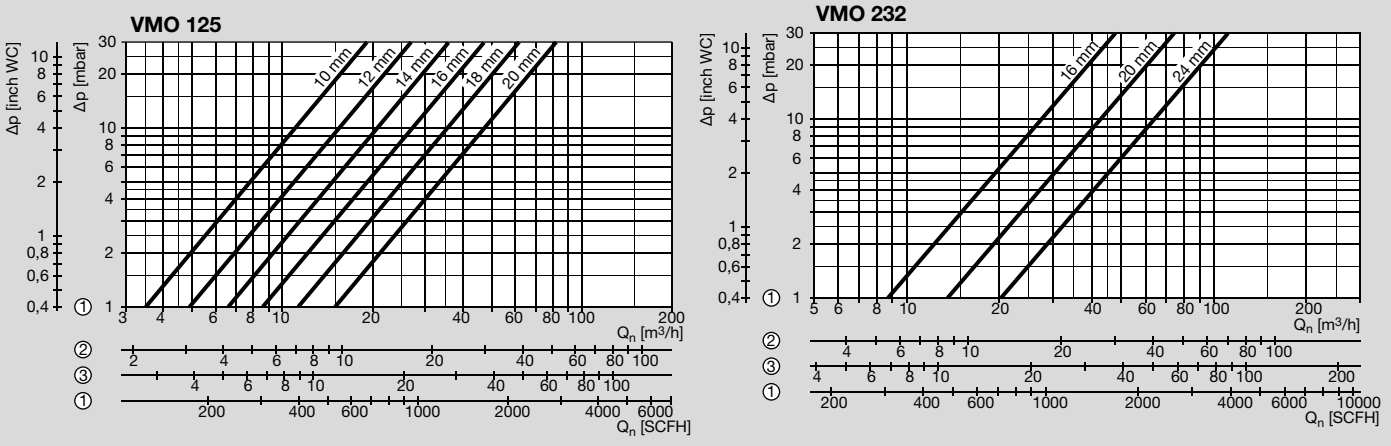
Legend

① = natural gas (ρ = 0.80 kg/m³)

② = propane (ρ = 2.01 kg/m³)

③ = air (ρ = 1.29 kg/m³)

4.2 VMO 125, VMO 232



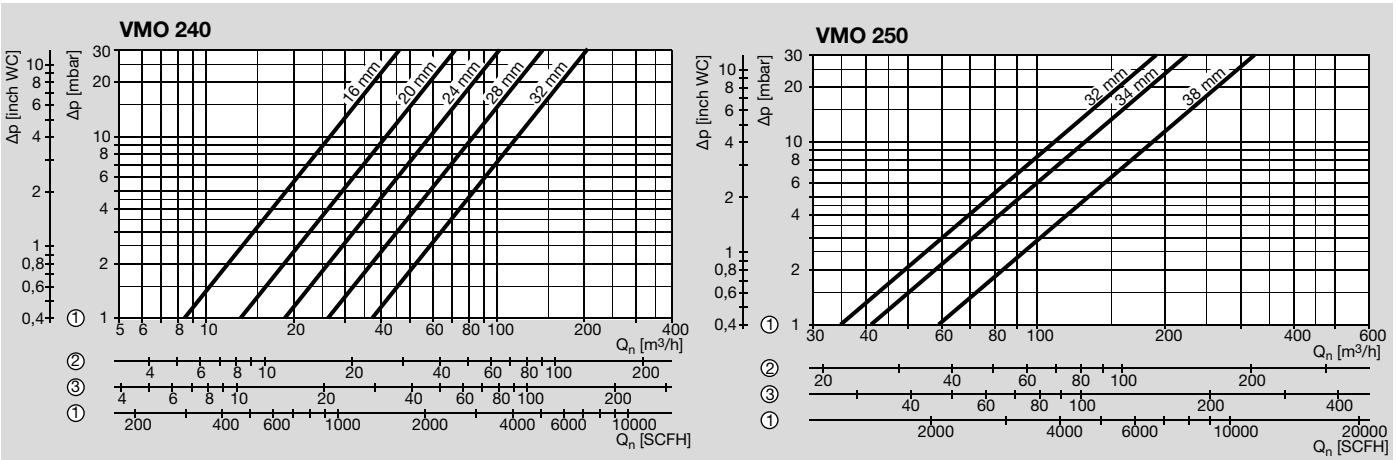
Legend

① = natural gas (ρ = 0.80 kg/m³)

② = propane (ρ = 2.01 kg/m³)

③ = air (ρ = 1.29 kg/m³)

4.3 VMO 240, VMO 250



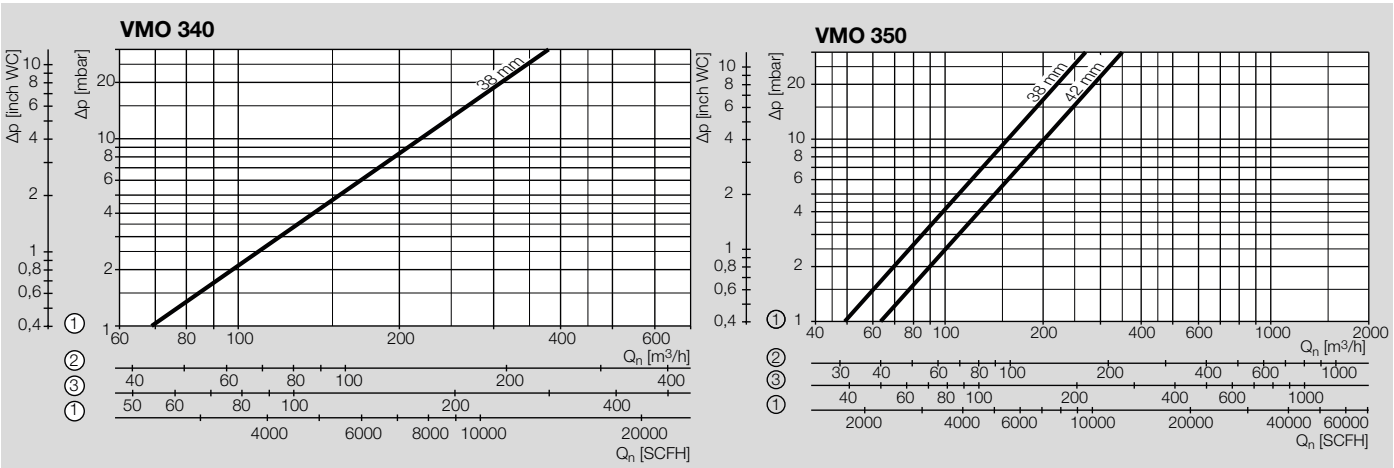
Legend

① = natural gas (ρ = 0.80 kg/m³)

② = propane (ρ = 2.01 kg/m³)

③ = air (ρ = 1.29 kg/m³)

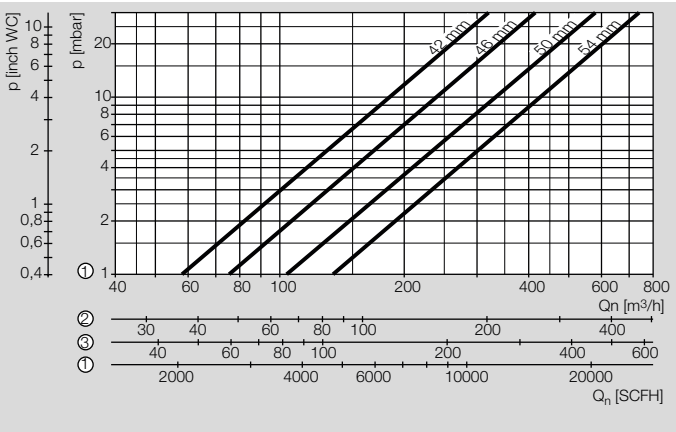
4.4 VMO 340, VMO 350



Legend

① = natural gas (ρ = 0.80 kg/m³)
② = propane (ρ = 2.01 kg/m³)
③ = air (ρ = 1.29 kg/m³)

4.5 VMO 365



Legend

① = natural gas (ρ = 0.80 kg/m³)

② = propane (ρ = 2.01 kg/m³)

③ = air (ρ = 1.29 kg/m³)

4.6 k_V value

The measuring orifice is determined using the flow rate diagram or by calculation using the k_v value. The kV values are mean values calculated from the measured flow rate diagrams.

Measuring orifice	Nominal flange size	Hole diameter Washer [mm]	k_V [m^3/h]
VMO 110	DN 10	4	0.95
		5	1.2
		6	1.6
VMO 115	DN 15	4	0.9
		5	1.2
		6	1.6
VMO 120	DN 20	6	1.55
		8	2.25
		10	3.2
		12	4.5
VMO 125	DN 25	10	3.2
		12	4.5
		14	6.0
		16	7.9
		18	10.3
		20	13.7
VMO 232	DN 32	16	8.0
		20	12.4
		24	18.6
VMO 240	DN 40	16	7.7
		20	12.0
		24	17.0
		28	24.0
		32	34.0
VMO 250	DN 50	32	31.8
		34	37.5
		38	54.0
VMO 340	DN 40	38	67.0
VMO 350	DN 50	38	50.0
		42	64.0
VMO 365	DN 65	42	66.0
		46	61.0
		50	80.0
		54	97.0

$Q_{(n)}$ = Flow rate (standard state) [m^3/h]

k_V = Valve coefficient (see table)

Δp = Pressure loss [bar]

p_a = Outlet pressure (absolute) [bar]

ρ_n = Density [kg/m^3] (air 1.29/natural gas 0.80/propane 2.01/butane 2.71)

T = Medium temperature (absolute) [K]

$$k_v = \frac{Q_{(n)}}{514} \cdot \sqrt{\frac{\rho_n \cdot T}{\Delta p \cdot p_d}} \qquad Q_{(n)} = 514 \cdot k_v \cdot \sqrt{\frac{\Delta p \cdot p_d}{\rho_n \cdot T}}$$

$$\Delta p = \left(\frac{Q_{(n)}}{514\ k_v}\right)^2 \cdot \frac{\rho_n \cdot T}{p_d}$$

Example

We want to find the hole diameter for the washer and the nominal flange diameter for a measuring orifice VMO.

We have the maximum flow rate $Q_{(n)\,max}$, the outlet pressure p_a and the temperature T for the medium of natural gas.

$Q_{(n)\,max.} = 37\ m^3/h$

$p_a = 30\ mbar = 0.03\ bar \Rightarrow$

$p_{a\,absolute} = 0.03\ bar + 1\ bar = 1.03\ bar$

$\Delta p_{max.} = 0.01\ bar$ (desired)

$T = 20°C \Rightarrow$

$T_{absolute} = 20 + 273\ K = 293\ K$

$$k_v = \frac{37}{514} \cdot \sqrt{\frac{0.83 \cdot 293}{0.01 \cdot 1.03}} = 11.1\ m^3/h$$

The measuring orifice with the next higher k_v value is to be selected (see table): e.g. VMO 125 with a washer hole diameter of 20 mm.

5 Selection

Typ	R	N	F	05	M	04	05	06	08	10	12	14	16	18	20	24	28	32	34	38	42	46	50	54
VMO 110	●	○		●	●	●	●	●																
VMO 115	●	○		●	●	●	●	●																
VMO 120	●	○		●	●			●	●	●	●													
VMO 125	●	○		●	●					●	●	●	●	●	●									
VMO 232	●	○		●	●								●		●	●								
VMO 240	●	○	○	●	●								●		●	●	●	●						
VMO 250	●	○		●	●													●	●	●				
VMO 340	●	○		●	●															●				
VMO 350	●	○	○	●	●															●	●			
VMO 365	●	○		●	●																●	●	●	●

● = *standard*, ○ = *available*

Order example

VMO 115R05M05

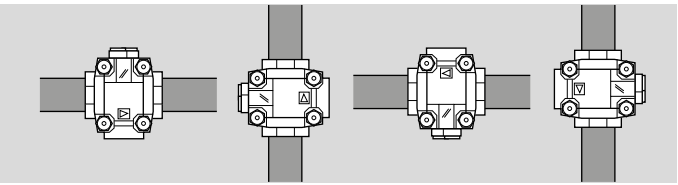
5.1 Type code

Code	Description
VMO	Measuring orifice
1–3	Size
– 10–65	Without inlet and outlet flange Nominal inlet and outlet diameter in DN
R N F	Rp internal thread NPT internal thread Flange to ISO 7005
05	$p_{u\,max}$ 500 mbar
M	With pressure test points
04 – 58	Orifice diameter* in mm

** Delivery of washers with individual orifice diameter on request.*

6 Project planning information

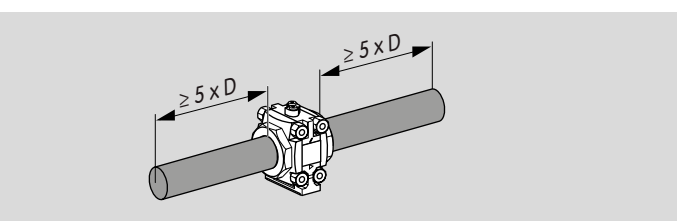
6.1 Installation



Installation position: VMO can be installed as required.

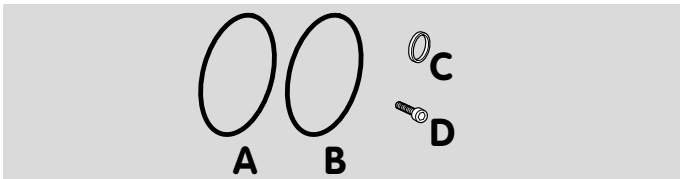
6.2 Gas line connection

In order to take accurate measurements of the pressure differential on the measuring orifice VMO, it must be ensured that there is an undisturbed flow of gas at the inlet and outlet for a distance of ≥ 5 × DN.



7 Accessories

7.1 Seal set VMO/VMV



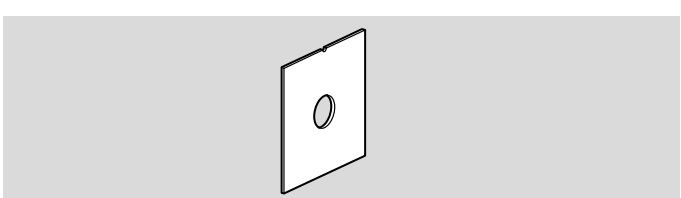
Seal set VMO/VMV 1 /B: 74924936
Seal set VMO/VMV 2 /B: 74924937
Seal set VMO/VMV 3 /B: 74926024

Scope of delivery:

A 1 x O-ring (base plate),
B 1 x O-ring (restrictor insert),
C 2 x profiled sealing ring,
D 2 x or 4 x set screws.

7.2 Washer

For installing in the plate bracket of measuring orifice VMO. The hole diameter is engraved on the washer. Supply including the new seal for the base plate.



Orifice	Hole dia. [mm]	Order No.
VMO1 D4 /B	4	74923803
VMO1 D5 /B	5	74923804
VMO1 D6 /B	6	74923805
VMO1 D8 /B	8	74923806
VMO1 D10 /B	10	74923807
VMO1 D12 /B	12	74923808
VMO1 D14 /B	14	74923809
VMO1 D16 /B	16	74923810
VMO1 D18 /B	18	74923811
VMO1 D20 /B	20	74923812
VMO1 Dx /B*	xx*	74923813
VMO2 D16 /B	16	74923814
VMO2 D20 /B	20	74923815
VMO2 D24 /B	24	74923816
VMO2 D28 /B	28	74923817
VMO2 D32 /B	32	74923818
VMO2 D34 /B	34	74923819
VMO2 D38 /B	38	74923820
VMO2 Dx /B	xx*	74923821
VMO 3 D38 /B	38	74926017
VMO 3 D42 /B	42	74926018
VMO 3 D46 /B	46	74926019
VMO 3 D50 /B	50	74926020
VMO 3 D54 /B	54	74926021
VMO 3 Dx /B	xx*	74926022

** Hole diameter on request.*

8 Technical data

Gas types: natural gas, LPG (gaseous), biologically produced methane (max. 0.1 %-by-vol. H_2S) or air; other gases on request.

The gas must be dry in all conditions and must not contain condensate.

Max. inlet pressure p_e: max. 500 mbar (7.25 psig).

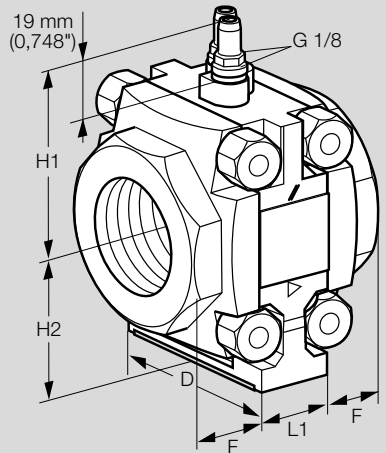
Medium and ambient temperatures:
-10 to +60°C (14 to 140°F),
no condensation permitted.

Storage temperature: 0 to +40°C (-4 to +104°F).

Housing: aluminium.

Connection flanges with internal thread: Rp to ISO 7-1, NPT to ANSI/ASME. : DN 40 and DN 50 to ISO 7005.

8.1 Dimensions



VMO..R, VMO..N

8.1.1 VMO..R

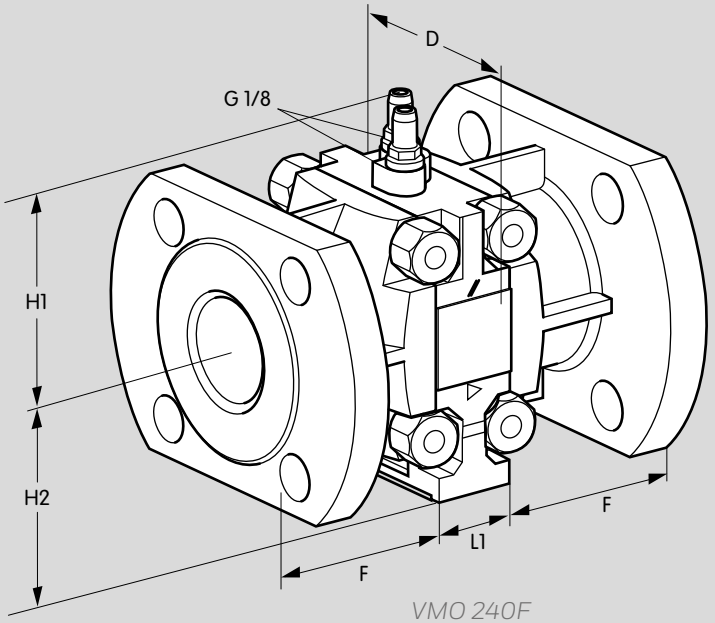
Type	Connection		Dimensions					Weight*
			L1	F	D	H1	H2	
	Rp	DN	mm	mm	mm	mm	mm	kg
VMO 110	3/8	10	30	15	62.7	69.1	44.2	0.245
VMO 115	1/2	15	30	15	62.7	69.1	44.2	0.245
VMO 120	3/4	20	30	23	62.7	69.1	44.2	0.245
VMO 125	1	25	30	23	62.7	69.1	44.2	0.245
VMO 225	1	25	34	29	88	82.8	64.6	0.505
VMO 232	1¼	32	34	29	88	82.8	64.6	0.505
VMO 240	1½	40	34	29	88	82.8	64.6	0.505
VMO 250	2	50	34	29	88	82.8	64.6	0.505
VMO 340	1½	40	36	36	106	94.6	77.5	1.3
VMO 350	2	50	36	36	106	94.6	77.5	1.3
VMO 365	2½	65	36	36	106	94.6	77.5	1.3

** Without flanges and connection parts.*

8.1.2 VMO..N

Type	Connection		Dimensions					Weight*
			L1	F	D	H1	H2	
	NPT	DN	inch	inch	inch	inch	inch	lbs
VMO 110	3/8	10	1.18	0.59	2.47	2.72	1.74	0.54
VMO 115	1/2	15	1.18	0.59	2.47	2.72	1.74	0.54
VMO 120	3/4	20	1.18	0.91	2.47	2.72	1.74	0.54
VMO 125	1	25	1.18	0.91	2.47	2.72	1.74	0.54
VMO 225	1	25	1.34	1.14	3.46	3.26	2.54	1.11
VMO 232	1¼	32	1.34	1.14	3.46	3.26	2.54	1.11
VMO 240	1½	40	1.34	1.14	3.46	3.26	2.54	1.11
VMO 250	2	50	1.34	1.14	3.46	3.26	2.54	1.11
VMO 340	1½	40	1.42	1.42	4.17	3.72	3.05	2.86
VMO 350	2	50	1.42	1.42	4.17	3.72	3.05	2.86
VMO 365	2½	65	1.42	1.42	4.17	3.72	3.05	2.86

** Without flanges and connection parts.*



VMO 240F

8.1.3 VMO 240F

Type	Connection	Dimensions					Weight*
		L1	F	D	H1	H2	
	DN	mm	mm	mm	mm	mm	kg
VMO 240	40	34	66	88	81	65,2	0.505
VMO 350	50	36	73.8	106	94.6	76	1.3

** Without flanges and connection parts.*

9 Maintenance

Check for external tightness at least once per annum, at least twice per annum for operation with biologically produced methane.

Feedback

Finally, we are offering you the opportunity to assess this “Technical Information (TI)” and to give us your opinion, so that we can improve our documents further and suit them to your needs.

Clarity

- ○ Found information quickly
- ○ Searched for a long time
- ○ Didn’t find information

  What is missing?
- ○ No answer

Comprehension

- ○ Coherent
- ○ Too complicated
- ○ No answer

Scope

- ○ Too little
- ○ Sufficient
- ○ Too wide
- ○ No answer

Use

- ☐ To get to know the product
- ☐ To choose a product
- ☐ Planning
- ☐ To look for information

Navigation

- ○ I can find my way around
- ○ I got “lost”
- ○ No answer

My scope of functions

- ○ Technical department
- ○ Sales
- ○ No answer

Remarks

Contact

Elster GmbH
Postfach 2809 · 49018 Osnabrück
Strotheweg 1 · 49504 Lotte (Büren)
Germany
Tel +49 541 1214-0
Fax +49 541 1214-370
hts.lotte@honeywell.com
www.kromschroeder.com

The current addresses of our international agents are available on the Internet:
www.kromschroeder.de/Weltweit.20.0.html?&L=1

We reserve the right to make technical modifications in the interests of progress.

VMO · Edition 12.18

03250928