

Oscillating piston flowmeters Series COVOL

Positive displacement flowmeter for liquids

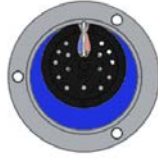
- Suitable for all kind of liquids
- Viscosity up to 120000 mPa·s
- Excellent performance with changing process conditions
- Easily cleaned and sterilized
- Available with materials and connections suitable for hygienic applications
- Bidirectional flow measurement and installation in all flow directions
- Special design for high pressure available
- Flow rate: 25 l/h ... 60 m³/h
- Accuracy: ±0.8% measured value
- Repeatability: ±0.3%
- Connections:
 - EN 1092-1 flange DN10 ... DN100
Other flange standards on request
 - Threaded connections BSP or NPT
 - Sanitary couplings according to ISO 2852, SMS 1145, DIN 11851, TRI-CLAMP®
- Materials:
 - Body: EN 1.4404 (AISI 316L), PVC, PP, PTFE
 - Piston: PTFE+graphite, aluminium, bronze, PVDF
 - Gaskets: NBR / PTFE / EPDM / Viton® / Silicone
- Potential free reed switch output
- Optional:
 - Flow indication, local or remote
 - Volume totalizer, local or remote
 - Electronic transmitter with 4-20 mA analog output.
HART protocol available on request
 - Volume preselection for batching applications
 - Exd version



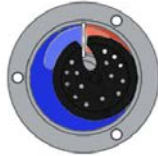
Working principle

By means of oscillating piston and an annular measuring chamber.

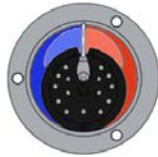
1- The first figure shows the COVOL flowmeter at the beginning of a cycle, when the measuring chamber (in blue) is completely full.



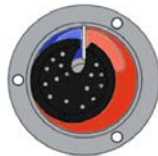
2- The flow of the liquid through the flowmeter makes a force on the oscillating piston, so that it starts turning. From this moment the measuring chamber is divided in two parts: inlet (in red) and outlet (in blue).



3- The liquid fills progressively the inlet measuring chamber (in red), as it is getting emptied on the outlet (in blue). In the middle of the cycle (see figure) the two chambers are the same size.



4- At this stage the outlet measuring chamber has already emptied almost all the liquid corresponding to a cycle, while on the inlet it is almost filled with the liquid corresponding to the next cycle.

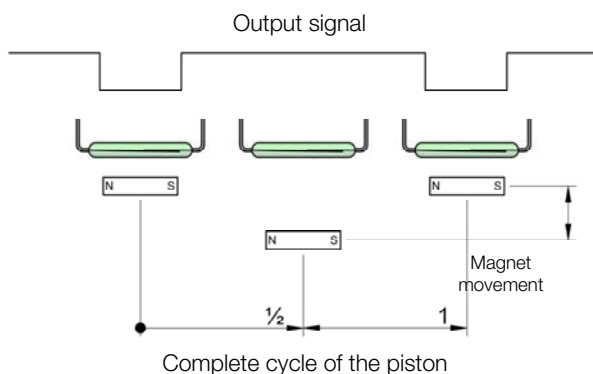


5- At the end of the cycle, the inlet measuring chamber takes all the space. From this moment it can be considered that this is already the outlet chamber, so we are again at the beginning of the cycle.



As one can see, a constant volume of liquid is moved in each cycle.

The piston includes a magnet inside that activates a reed switch each complete turn. The output signal can be treated by means of an electronic converter.



Applications

- Chemical and petrochemical industry
- Tank filling and batching applications
- Measurement of steam condensates in boilers
- Burners, measurement of fuel consumption

Technical data

- **Accuracy:** $\pm 0.8\%$ measured value
- **Repeatability:** $\pm 0.3\%$
- **Scale range:** 30:1
- **Liquid viscosity:** up to 120000 mPa·s
- **Liquid temperature:**
 - AISI 316L: $-40^{\circ}\text{C} \dots +150^{\circ}\text{C}$
 - PTFE: $-20^{\circ}\text{C} \dots +130^{\circ}\text{C}$
 - PP: $-10^{\circ}\text{C} \dots +80^{\circ}\text{C}$
 - PVC: $0^{\circ}\text{C} \dots +45^{\circ}\text{C}$
- **Working pressure:**
 - AISI 316L: PN16 (others on request)
 - PTFE / PP / PVC: PN10
- **Connections:**
 - EN 1092-1 flange DN10 ... DN100
Other flange standards on request
 - Threaded connections BSP or NPT
 - Sanitary couplings according to ISO 2852, SMS 1145, DIN 11851, TRI-CLAMP®
- **Materials suitable for hygienic applications on request**
- **Mounting in horizontal or vertical pipe, bidirectional flow measurement and installation in all flow directions**

Electronic converters and options

- **CP ... CH420:** flow rate indication, volume totalizer and 4-20 mA output, 2-wire system. Compact or remote mounted. HART protocol with model CH420
- **CIP:** volume totalizer. Battery powered. Compact or remote mounted
- **CIP II:** non-resettable volume totalizer, resettable partial volume totalizer. Battery powered. Compact or remote mounted
- **MC01:** flow rate indication, volume totalizer and volume preselector with relay output for batching applications. 4-20 mA analog output as an option, 4-wire system. Panel mounted
- **MT02:** volume totalizer, partial volume totalizer and volume preselector with relay output for batching applications. Panel mounted
- **DFD2:** frequency divider. DIN rail mounted
- **Options:**
 - Heating / cooling chamber
 - Special connector for other displays (please consult)
 - Exd version for hazardous environments

Oscillating piston flowmeters

Series COVOL

Mounting

Both in horizontal and vertical position, bidirectional flow measurement and suitable for all flow directions. Straight pipe run before and after the flowmeter is not required.

In order to assure the good performance of a COVOL flowmeter, the installation of a filter prior to the unit is mandatory, with a mesh size between 0.5 and 1 mm, according to the pipe diameter (smaller sizes involve a smaller mesh size).

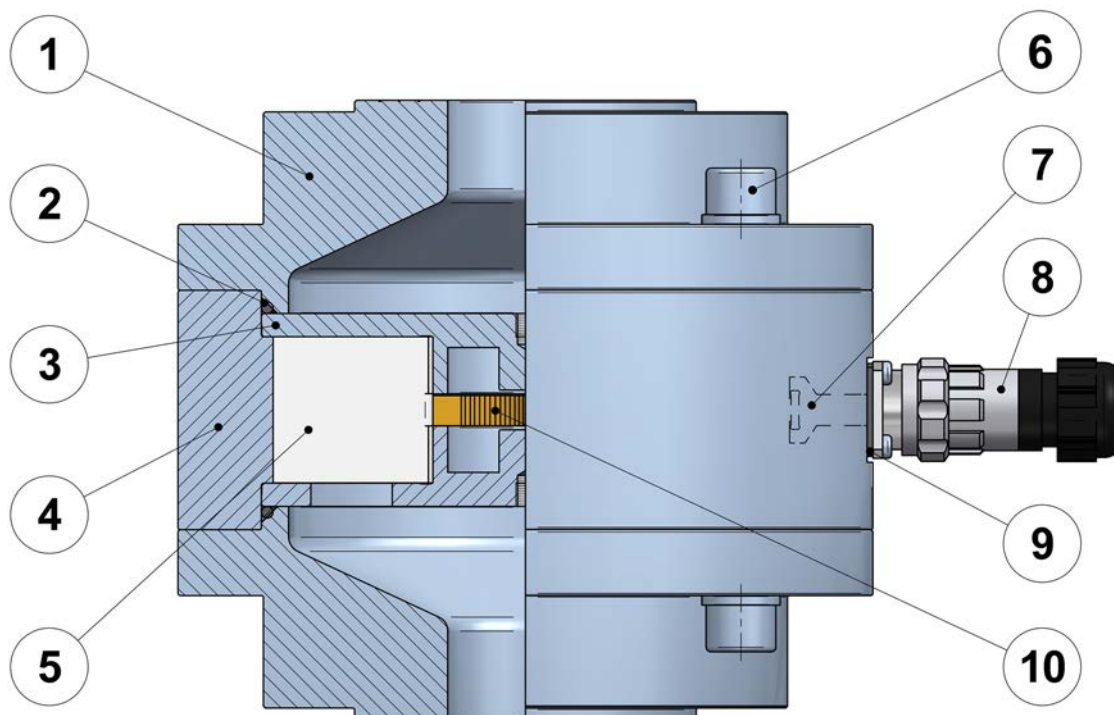
In those processes where air or gases, liquid evaporation, etc. might be present, an air/steam separator must be installed before the flowmeter, in order to obtain a real volume and flow rate measurement.

It is essential to avoid cavitations inside the COVOL flowmeter measuring chamber. In order to do this, the API Std 2534 standard must be taken into account. This standard states that on the outlet of the flowmeter the pressure must be at least twice the pressure drop of the flowmeter, plus 1.25 times the vapour pressure of the liquid or its most volatile components.

The wiring between the COVOL flowmeter and the associated electronic converters must be made so that no mains or power supply cables are placed around the devices, in order to avoid picking up interferences that might affect the reading.

2-wire shielded cable is recommended.

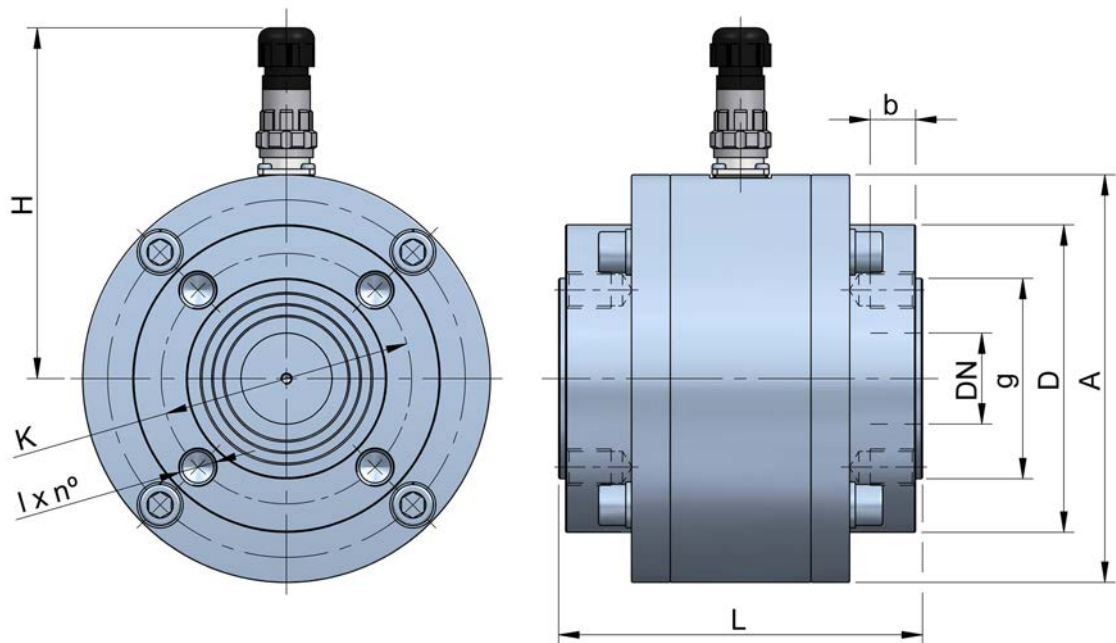
Materials



N°	Description	Materials	
		AISI 316L	PTFE / PVC / PP
1	Inlet / outlet chamber + connection	EN 1.4404 (AISI 316L)	PTFE / PVC / PP
2	O-ring	NBR / PTFE / EPDM / VITON®	
3	Guide disk	EN 1.4404 (AISI 316L)	PTFE / PVC / PP
4	Measuring chamber	EN 1.4404 (AISI 316L)	PTFE / PVC / PP
5	Separator	EN 1.4404 (AISI 316L)	PTFE / PVC / PP
6	Screws	EN 1.4401 (AISI 316)	
7	Reed sensor group	---	
8	Connector	Aluminium alloy + Polyamide	
9	Gasket	NBR	
10	Piston	PTFE + Graphite / Bronze / Aluminium	

On request, materials suitable for hygienic applications: piston in PVDF and silicone seals

Dimensions



All dimensions in mm

Model AISI 316L

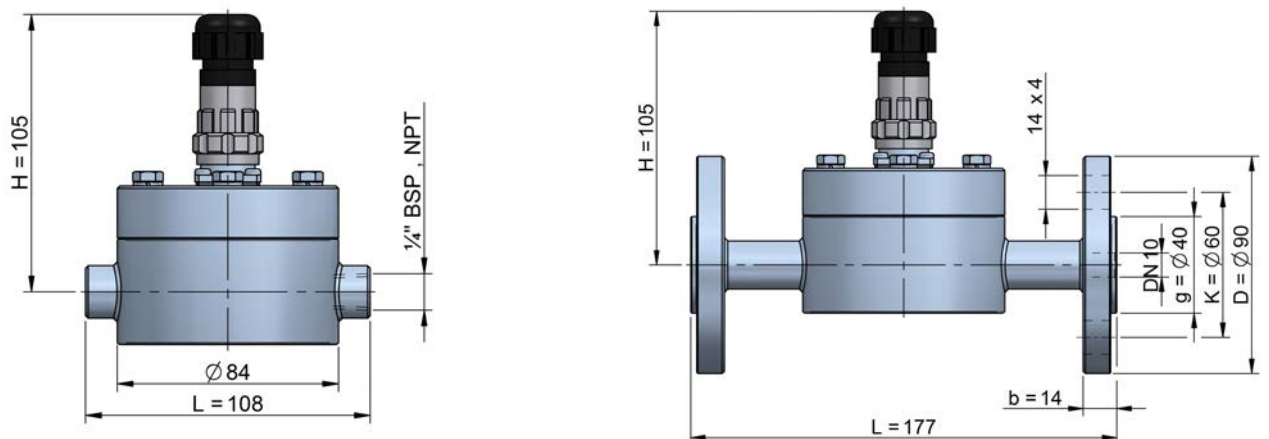
DN	D	g	K	(l x n°) x b	L	A	H
10	77	40	60	(M12 x 4) x 15	90	100	110
15	84	45	65	(M12 x 4) x 15	110	110	115
25	107	68	85	(M12 x 4) x 15	120	140	135
40	135	88	110	(M16 x 4) x 20	150	180	155
50	154	102	125	(M16 x 4) x 20	180	200	165
80	200	138	160	(M16 x 8) x 20	200	250	190

Available for DN100 with special design. Please consult factory

Models PTFE / PVC / PP

DN	D	g	K	(l x n°) x b	L	A	H
10	90	40	60	(M12 x 4) x 18	100	115	120
15	95	45	65	(M12 x 4) x 20	125	125	130
25	115	68	85	(M12 x 4) x 25	140	150	140
40	145	88	110	(M16 x 4) x 25	160	180	155
50	160	102	125	(M16 x 4) x 25	195	200	165
80	200	138	160	(M16 x 8) x 25	235	250	190

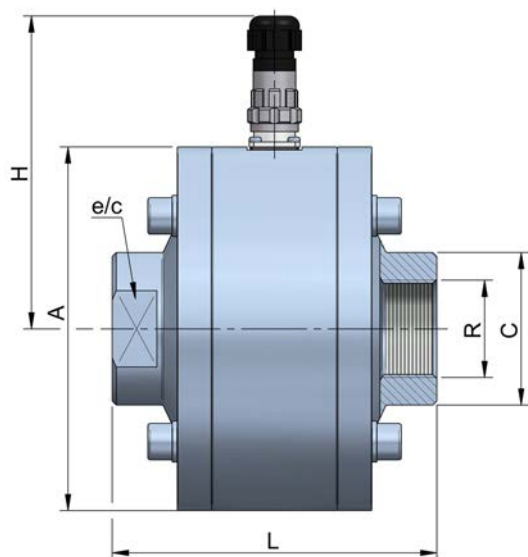
COVOL-H DN10 / 1/4" low flow, horizontal



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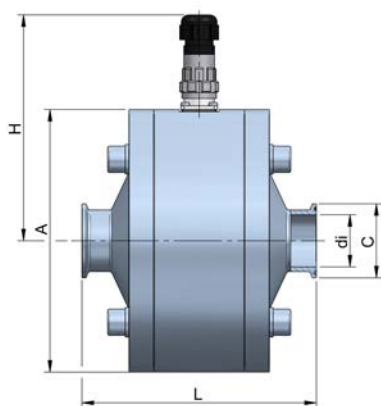
Threaded connection BSP/NPT



DN	R *	C	e/c	L	A	H
10	¼"	36	32	90	100	110
15	½"	42	36	110	110	115
25	1"	60	55	120	140	135
40	1½"	75	65	150	180	155
50	2"	90	80	180	200	165
80	3"	125	115	200	250	190

* Other sizes on request
All dimensions in mm

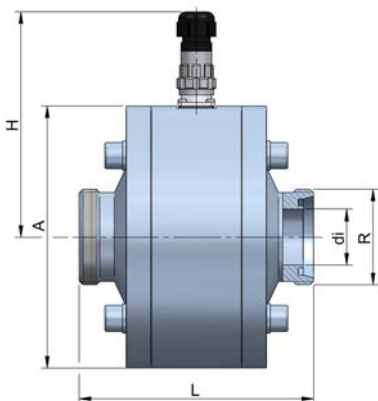
Sanitary couplings



CLAMP ISO 2852 connection

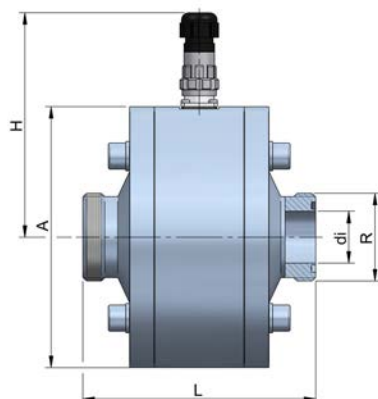
DN	di	C	OD *	L	A	H
10	10.7	34.0	12.7	90	100	110
15	15.2	34.0	17.2	110	110	115
25	35.6	50.5	25.0	120	140	135
40	35.6	50.5	38.6	150	180	155
50	48.6	64.0	51.0	180	200	165
80	72.9	91.0	76.1	200	250	190

* OD: pipe \varnothing_{ext} according to ISO 2037
Other standards on request (DIN 32676, TRI-CLAMP®,...)



DIN 11851 connection

DN	di	R	L	A	H
10	10	Rd 28 x 1/8"	90	100	110
15	16	Rd 34 x 1/8"	110	110	115
25	26	Rd 52 x 1/6"	120	140	135
40	38	Rd 65 x 1/6"	150	180	155
50	50	Rd 78 x 1/6"	180	200	165
80	81	Rd 110 x 1/4"	200	250	190



SMS 1145 connection

DN	di	R	L	A	H
25	22.5	Rd 40 x 1/6"	120	140	135
40	35.5	Rd 60 x 1/6"	150	180	155
50	48.5	Rd 70 x 1/6"	180	200	165
80	72.0	Rd 98 x 1/6"	200	250	190

All dimensions in mm

Flow ranges

DN	Flow scales l/h water	Max. intermittent l/h water	pulses / litre approx.
10 / ¼" (H)	25-250	500	100
10	40-350	800	100
15	150-1500	2700	20
25	500-4500	9000	10
40	800-8500	15500	4
50	1500-16000	28000	2
80	3000-28000	50000	1
100	5000-60000	104000	0.2

The COVOL flowmeters are calibrated with water (density 1 kg/l and viscosity 1 mPa·s). After this calibration the pulse / litre factor is obtained. With this factor, the associated electronic converter can make the calculation of the flow rate and/or the volume values.

As shown in the accuracy curve, the area where the maximum accuracy is obtained is by the mid of the flowmeter flow range.

The measurement errors can be corrected in the different associated electronic converters by means of the adjustment of the pulse / litre factor, obtaining a maximum accuracy.

A change in viscosity can modify the pulse / litre factor.

In general, a change in density affect the COVOL flowmeters, only at the beginning of the scale:

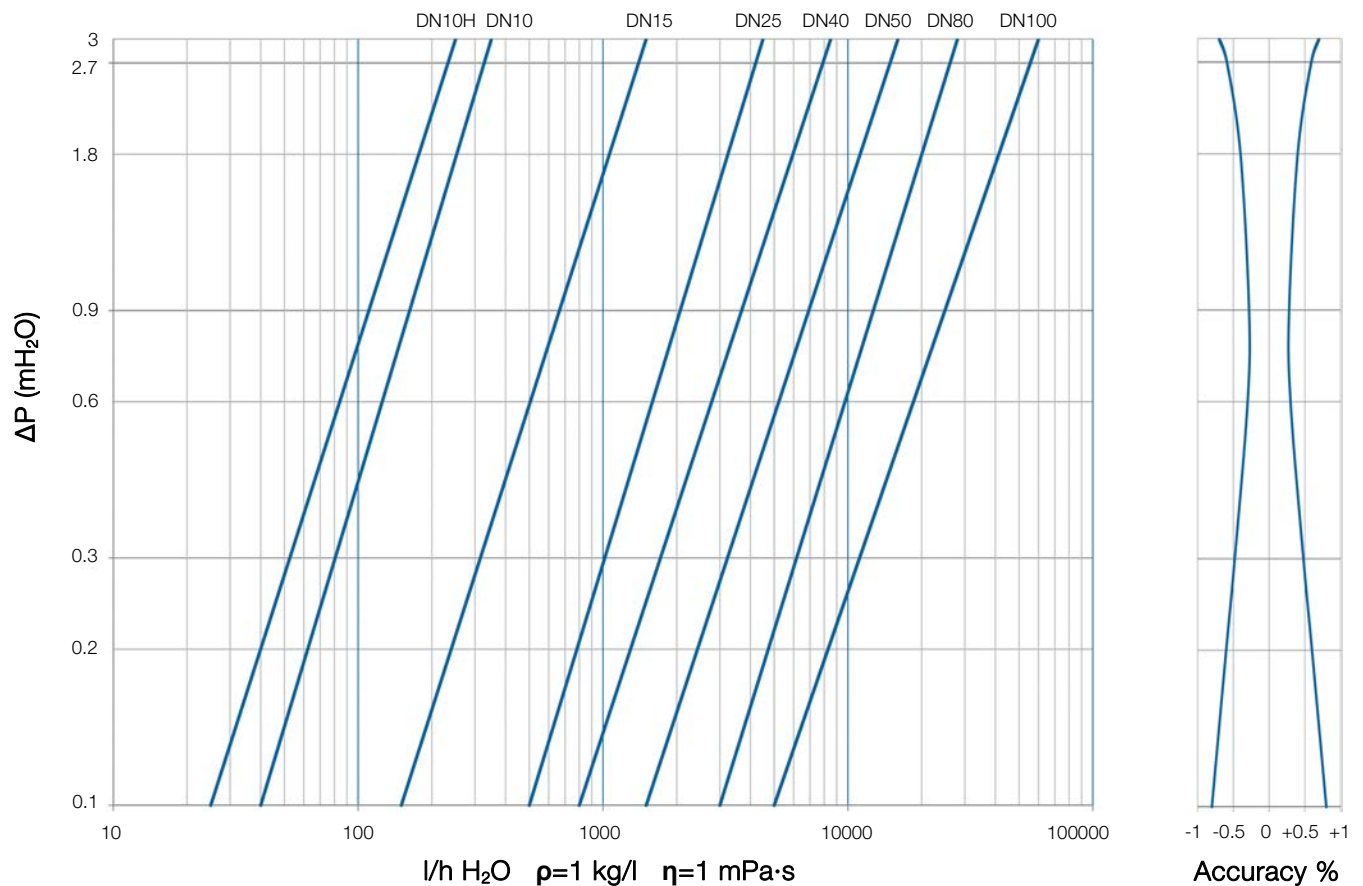
- If the density value is lower than 1 kg/l, the initial flow rate must be higher so that the flowmeter is sensitive to the liquid flow.
- If the value of density is higher than 1 kg/l, the initial flow rate must be lower so that the flowmeter is sensitive to the liquid flow.

In both cases the changes in flow scales are not significant due to the variation of density (not higher than 5% of the measured value with the reference liquid).

With high viscosities (higher than 1000 mPa·s) the scale ranges might change significantly depending on the liquid viscosity.

Flow rate and pressure drop curves

Graph 1

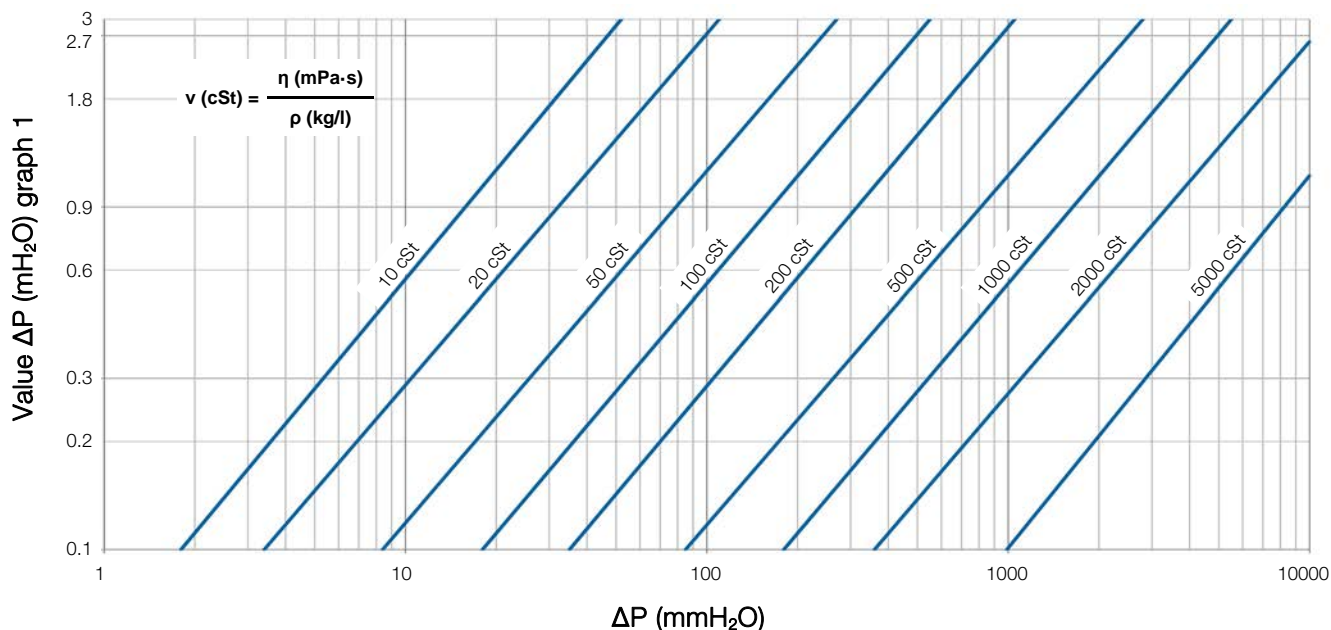


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ΔP increase (mmH₂O) due to the effect of density and viscosity

Graph 2



Electronic converters

Model CP ... CH420

- 4-20 mA transmitter
- System:
 - Compact (CP ... CH420L)
 - Remote in DIN rail (CP ... CH420R)
 - Remote in panel (CP ... CH420P)
- Electronics mounted in a housing with aluminium base and polycarbonate (UV resistant) cover (CP ... CH420L)
- Power supply:
 - 2-wire, loop powered
 - Nominal voltage: 8 ... 36 VDC
 - Power consumption: ≤ 20 mA
- Totalizer:
 - N° of digits: 7
 - Size of digit: 8 mm
 - Reset: by means of keyboard
- Flow rate indication:
 - N° of digits: 5
 - Size of digit: 5 mm
- Programmable beginning and end of scale
- Several selectable flow rate indication and totalizer units
- Programmable pulse / litre factor
- Ingress protection:
 - IP65 for CP ... CH420L
 - IP30 for CP ... CH420R
 - Front IP50 (IP65 on request) and back IP30 for CP ... CH420P
- Ambient temperature: 0°C ... +60°C
- HART protocol available with models CH420L ... R ... P



CP ... CH420L



CP ... CH420P

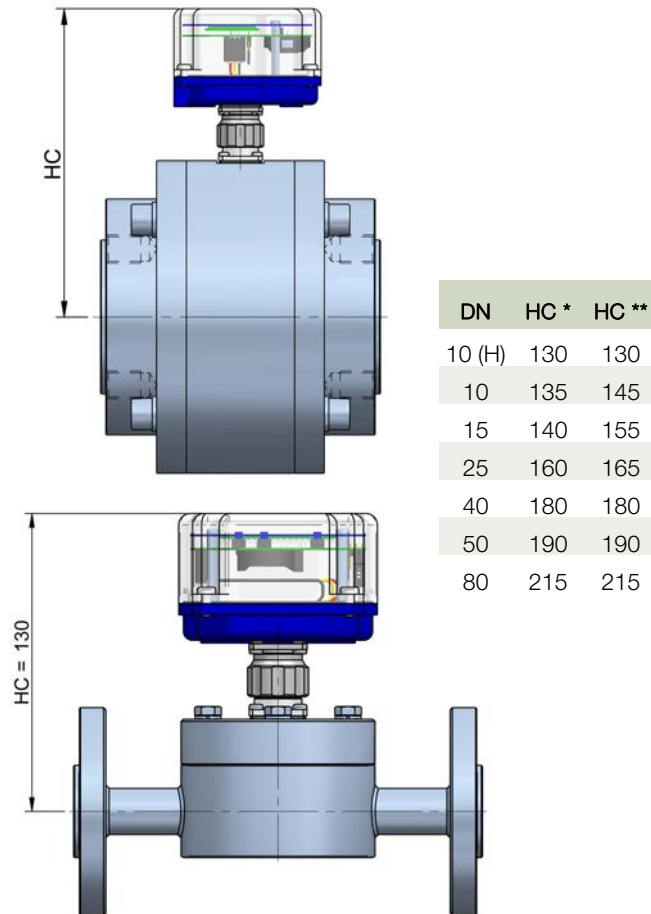


CP ... CH420R

Model CIP ... CIP II

- Volume totalizer:
 - Model CIP: resettable totalizer
 - Model CIP II: non-resettable totalizer and resettable partial totalizer
- Compact or remote system
- Electronics mounted in a housing with aluminium base and polycarbonate (UV resistant) cover
- Battery powered (CR-2450):
 - Nominal voltage: 3 V
 - Load: 560 mAh
 - Power consumption: 8 μ A
- Totalizer:
 - N° of digits: 7
 - Size of digit: 8 mm
 - Reset: by means of key or magnet (non-resettable for CIP II)
- Partial totalizer (only available for CIP II):
 - N° of digits: 5
 - Size of digit: 5 mm
 - Reset: by means of key or magnet
- Battery life: 5 years approx.
- Programmable pulse / litre factor
- Ingress protection: IP65
- Ambient temperature: 0°C ... +50°C

Dimensions COVOL + CIP ... CIP II / CP ... CH420L

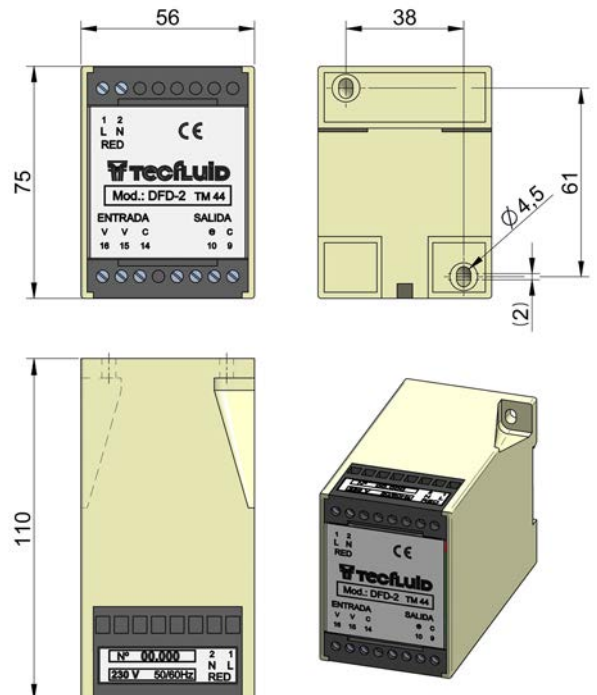


HC * : model AISI 316L ; HC ** : models PVC / PTFE / PP



Model DFD2

- Frequency divider
- Fully programmable by the user
- DIN 46277 rail mounted
- Acts as an interface between the series COVOL flowmeters and systems with frequency limited pulse input, such as some PLCs or mechanical counters.
- Power supply: 24, 110, 220, 240 VAC 50 / 60 Hz, 24 VDC
- Power consumption: 1 VA
- Outputs:
 - TTL (0-5 V)
 - Optoisolated max. 30 V 50 mA
- Special inputs TTL or NAMUR
- Ingress protection: IP40 (terminals IP20)
- Ambient temperature: 0°C ... +50°C



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Model MC01

- Electronic converter for flow rate indication, volume totalizer, partial volume totalizer and preselector with relay output for batching
- Fully programmable by the user
- Panel mounted
- Power supply: 24, 110, 220, 240 VAC 50 / 60 Hz
12, 24 VDC
- 2-line LCD display with 16 characters (5 mm height)
- 7 digits totalizer, partial totalizer and volume preselector
- Relay output for batching
- Flow rate indicator in l/h y m³/h
- Dimensions 96 x 96 mm DIN 43700
- Ingress protection: IP50 front, IP30 back
- Ambient temperature: -10°C ... +50°C

Options

- 0 ... 4-20 mA analog input or output, 4-wire system
- Reset and batching start by means of remote button
- Plastic front protection with key and silicone cover, for IP65 rating



Model MT02

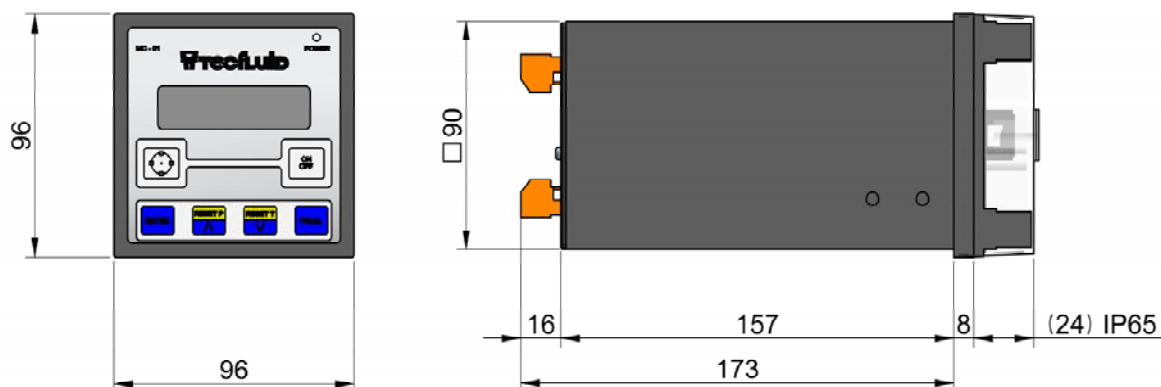
- Electronic converter for volume preselection and totalization
- Fully programmable by the user
- Panel mounted
- Power supply: 24, 110, 220, 240 VAC 50 / 60 Hz
12, 24 VDC
- 7 digits LED display for total and partial volume and preselection + 1 digit for operation mode
- Relay output for batching
- Dimensions 96 x 96 mm DIN 43700
- Ingress protection: IP50 front, IP30 back
- Ambient temperature: -10°C ... +50°C

Options

- Reset and batching start by means of remote button
- Plastic front protection with key and silicone cover, for IP65 rating
- Version with double relay for fast approximation and slow final adjustment for batching processes, model MT02/2



Dimensions converters MC01 / MT02



ATEX version

The COVOL flowmeter is suitable for its installation in ATEX hazardous area, that is, in those zones where a potentially explosive atmosphere can be generated. There are two types of protection available: Exi intrinsically safe or Exd ExProof.

Exia protection

The reed sensor is considered as "simple apparatus" according to EN 60079-11 standard clause 5.7, since it does not contain its own source of ignition.

Reed sensor technical data:

- V_{max} : 30 V ; I_{max} : 20 mA
- Maximum switched power: 0.6 VA
- Max. ambient temperature: 40°C

According to these data, the flowmeter can be installed in hazardous area when an appropriate zener barrier (please consult) is installed between the hazardous and the safe area. The electronic converters, however, must always be installed in safe area.



Exd housing model ADF60V with CIP II display

Exd protection

These devices conform the 94/9/CE directive (Devices and protection systems for use in potentially explosive atmospheres) as indicated in the CE certificate type LOM 14ATEX and its corresponding marking.

The instrument belongs to group II, therefore it is intended for use in places where there is a risk of generation of an explosive atmosphere, except in mining.

Being category 2GD it can be used in an environment where it is probable to generate an explosive atmosphere due to air and gases mixtures, vapours, mist and dust as well.

Three different types of Exd housings are available:

- Model ADF30: blind housing with reduced dimensions
- Model ADF60V: housing with window, can include the CIP ... CIP II or CP ... CH420L converters
- Model ADF60: same as ADF60V but blind housing

Exd version technical data:

- Ambient temperature: -20°C ... +60°C
- Electrical wiring inside the Exd housing
- On request ATEX packing glands for standard or shielded cable
- Associated electronics, for models:
 - CIP ... CIP II: totalizer battery powered
 - CP ... CH420: transmitter 2-wire system with flow rate indication, volume totalizer and 4-20 mA output. HART protocol optional
- ATEX certificate Ex d IIC T6 Gb / Ex tb IIIC T85°C Db



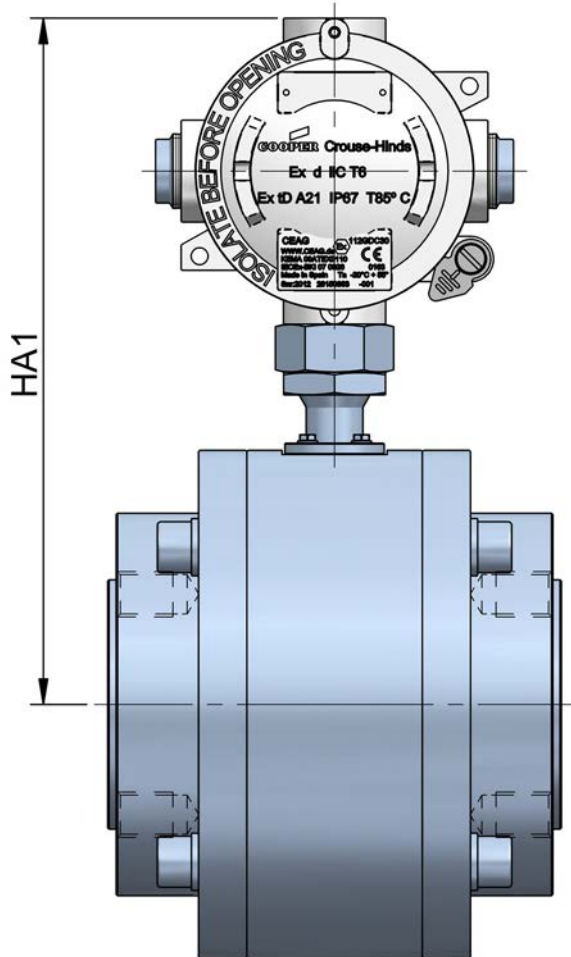
Exd housing model ADF30

Oscillating piston flowmeters

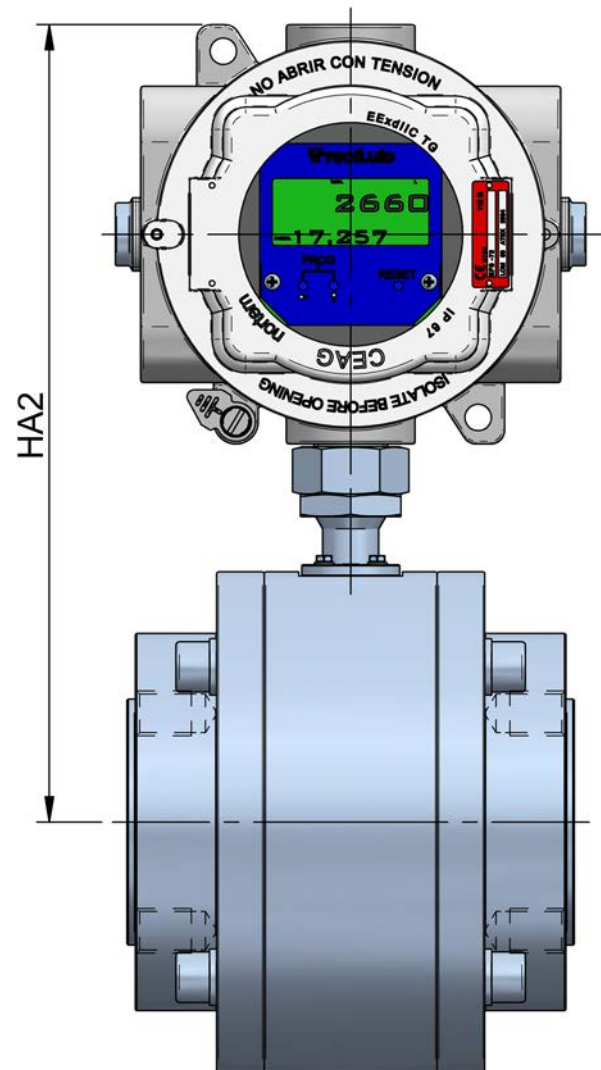
Series COVOL

Dimensions

Exd housing model ADF30



Exd housing model ADF60V



DN	HA1	HA1	HA2	HA2
	AISI 316L	PP/PVC/PTFE	AISI 316L	PP/PVC/PTFE
15	205	220	250	265
25	225	230	270	275
40	245	245	290	290
50	255	255	300	300
80	280	280	325	325

Exd housings are not available for flowmeter sizes DN10 (H) and DN10
DN100 on request


PRESENCE IN MORE THAN 50 COUNTRIES ALL OVER THE WORLD



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