The art of measuring

Oscillating piston flowmeters

Series COVOL

Positive displacement flowmeter for liquids

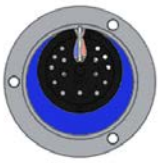
- Suitable for all kind of liquids
- Viscosity up to 120000 mPa·s
- Excellent performance with changing process conditions
- Easily cleaned and sterilized
- Available with materials and connections suitable for hygienic applications
- Bidirectional flow measurement and installation in all flow directions
- Special design for high pressure available
- Flow rate: 25 l/h ... 60 m³/h
- Accuracy: ±0.8% measured value
- Repeatability: ±0.3%
- Connections:
  - Compatible with 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 and MODBUS protocols available on request
  - Volume preselection for batching applications
  - Repeater, amplifier and pulse divider
  - Relay outputs configurable as alarms
  - ATEX version. Exd protection

HART COMMUNICATION PROTOCOL

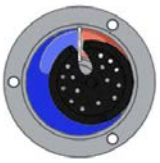
Modbus

Working principle

By means of an oscillating piston and an annular measuring chamber.

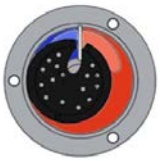


1– The first figure shows the COVOL flowmeter at the beginning of a cycle, when the measuring chamber (in blue) is completely full.



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 the inlet measuring chamber progressively (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.

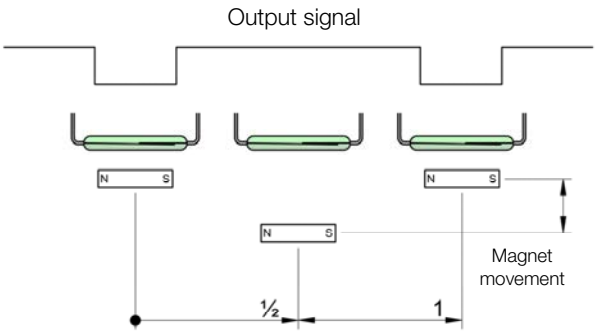


4– At this stage, the outlet measuring chamber has already emptied almost all the liquid corresponding to a cycle, while on the inlet it is almost filled with the liquid corresponding to the next cycle.

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.



Complete cycle of the piston

Applications

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

Technical data

- **Accuracy:** ±0.8% measured value
- **Repeatability:** ±0.3%
- **Scale range:** please check flow ranges chart
- **Liquid viscosity:** up to 120000 mPa·s
- **Liquid temperature:**
  - EN 1.4404 (AISI 316L):
    - NBR gaskets: -30ºC ... +105ºC
    - EPDM gaskets: -40ºC ... +135ºC
    - VITON® gaskets: -15ºC ... +150ºC
    - Silicone / PTFE gaskets: -40ºC ... +150ºC
  - PTFE:
    - NBR gaskets: -20ºC ... +105ºC
    - EPDM gaskets: -20ºC ... +130ºC
    - VITON® gaskets: -15ºC ... +130ºC
    - Silicone / PTFE gaskets: -20ºC ... +130ºC
  - PP: -10ºC ... +80ºC
  - PVC: 0ºC ... +40ºC
- **Working pressure:**
  - EN 1.4404 (AISI 316L): PN16 (others on request)
  - PTFE / PP / PVC: PN10
- **Connections:**
  - Compatible with 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 a horizontal or vertical pipe, bidirectional flow measurement and installation in all flow directions**

Electronic converters and options

- **CP420 ... CH420:** flow rate indication, volume totalizer and 4-20 mA output, 2-wire system. Compact or remote mounted. HART protocol with model CH420
- **CIP II:** non-resettable volume totalizer, resettable partial volume totalizer. Battery powered. Compact or remote mounted
- **MT03F:** flow rate indication, volume totalizer and 2 relay outputs programmable as volume preselector for batching applications and/or alarm outputs. Pulse repeater. 4-20 mA analog output, 4-wire system. Panel mounted. Programmable via USB cable by means of Tecfluid S.A. Winsmeter MT03 software or by means of keyboard
- **DFD420:** pulse amplifier and frequency divider. 4-20 mA analog output, 2-wire system. Compact mounted in aluminium housing or DIN rail remote mounted. Programmable via USB cable by means of Tecfluid S.A. Winsmeter DFD software or by means of keyboard
- **Options:**
  - Heating / cooling chamber
  - Special connector for other displays (please consult)
  - Exd version for hazardous environments

Installation

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).

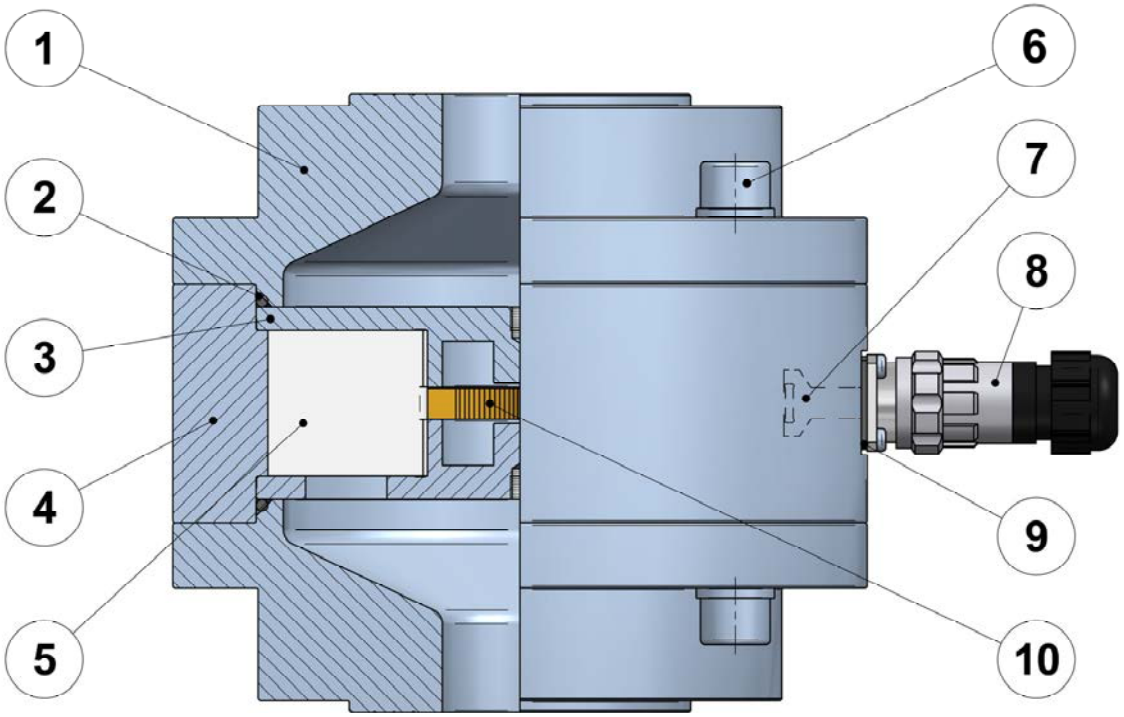
In those processes where air or gases, liquid evaporation, etc. might be present, an air/steam separator must be installed before the flowmeter, in order to obtain an accurate volume and flow rate measurement.

It is essential to avoid cavitation 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.

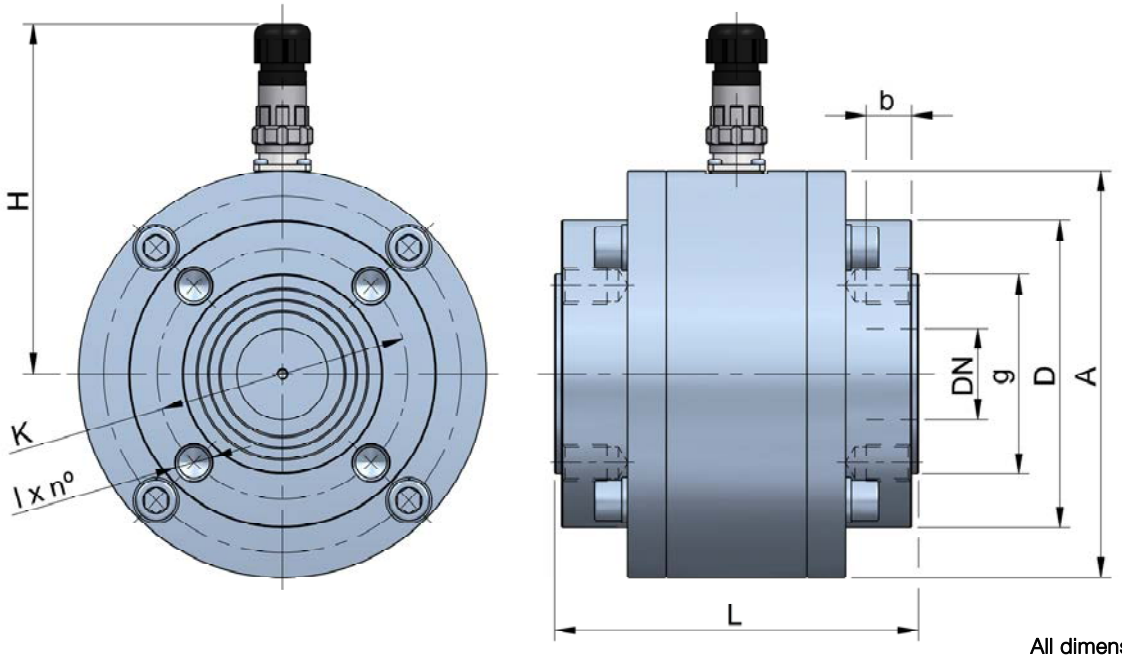
Materials



Nº	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® / Silicone *	
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 1.4301 (AISI 304)	
7	Reed sensor group	— — —	
8	Connector	Aluminium alloy + Polyamide	
9	Gasket	NBR	
10	Piston	PTFE + Graphite / Bronze / Aluminium / PVDF *	

*** Materials suitable for hygienic applications**

Dimensions



All dimensions in mm

Model EN 1.4404 (AISI 316L)

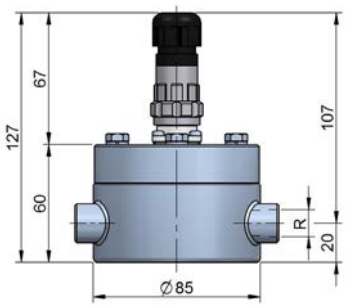
DN	D	g	K	(l x nº) x b	L	A	H
10	77	40	60	(M12 x 4) x 15	90	100	110
15	84	45	65	(M12 x 4) x 15	110	110	115
25	107	68	85	(M12 x 4) x 15	120	140	135
40	135	88	110	(M16 x 4) x 20	150	180	155
50	154	102	125	(M16 x 4) x 20	180	200	165
80	200	138	160	(M16 x 8) x 20	200	250	190

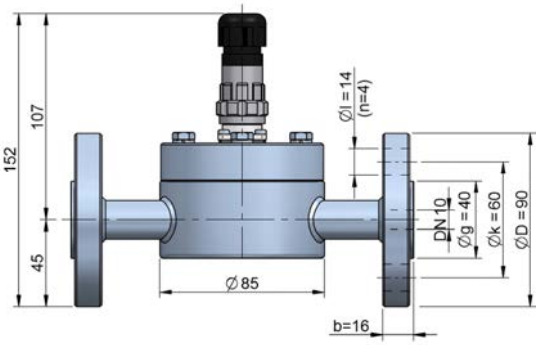
Available for DN100 with special design. Please consult factory

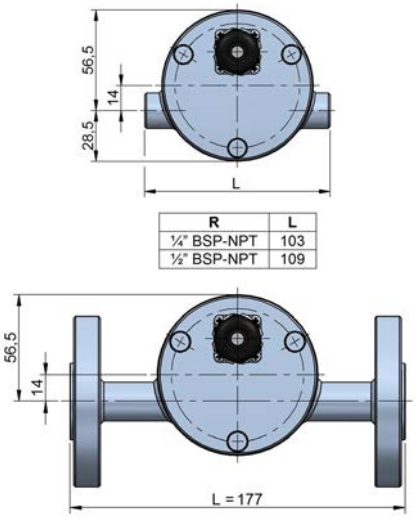
Models PTFE / PVC / PP

DN	D	g	K	(l x nº) 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

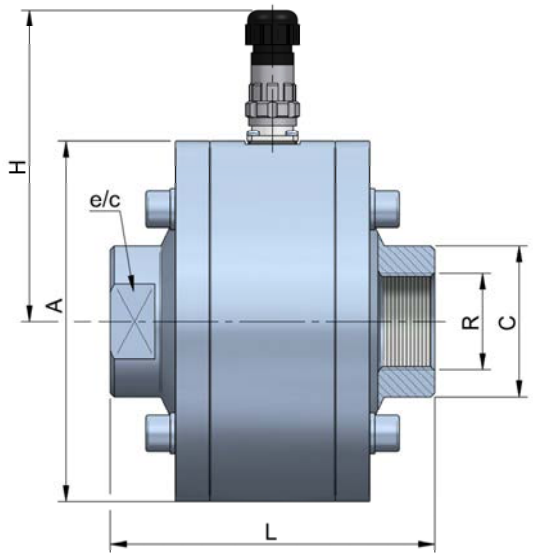
COVOL-H DN10 / ¼" low flow







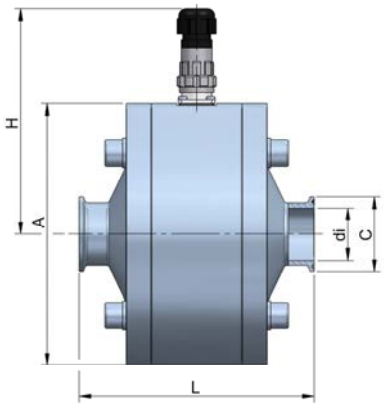
Threaded connection BSP/NPT



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

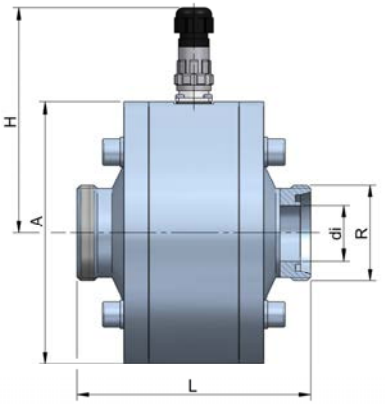
Sanitary couplings



CLAMP ISO 2852 connection

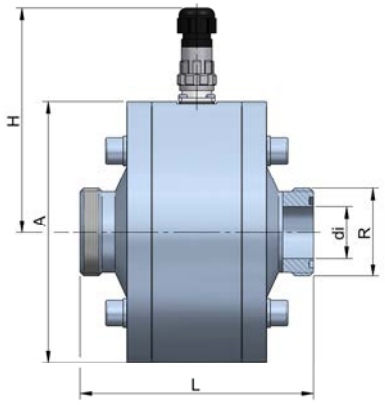
DN	di	C	OD *	L	A	H
10	10.7	34.0	12.7	90	100	110
15	15.2	34.0	17.2	110	110	115
25	35.6	50.5	25.0	120	140	135
40	35.6	50.5	38.0	150	180	155
50	48.6	64.0	51.0	180	200	165
80	72.9	91.0	76.1	200	250	190

* OD: pipe $Ø_{ext}$ 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 ranges 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 K factor (pulse / litre) is obtained. With this factor, the associated electronic converter can calculate 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.

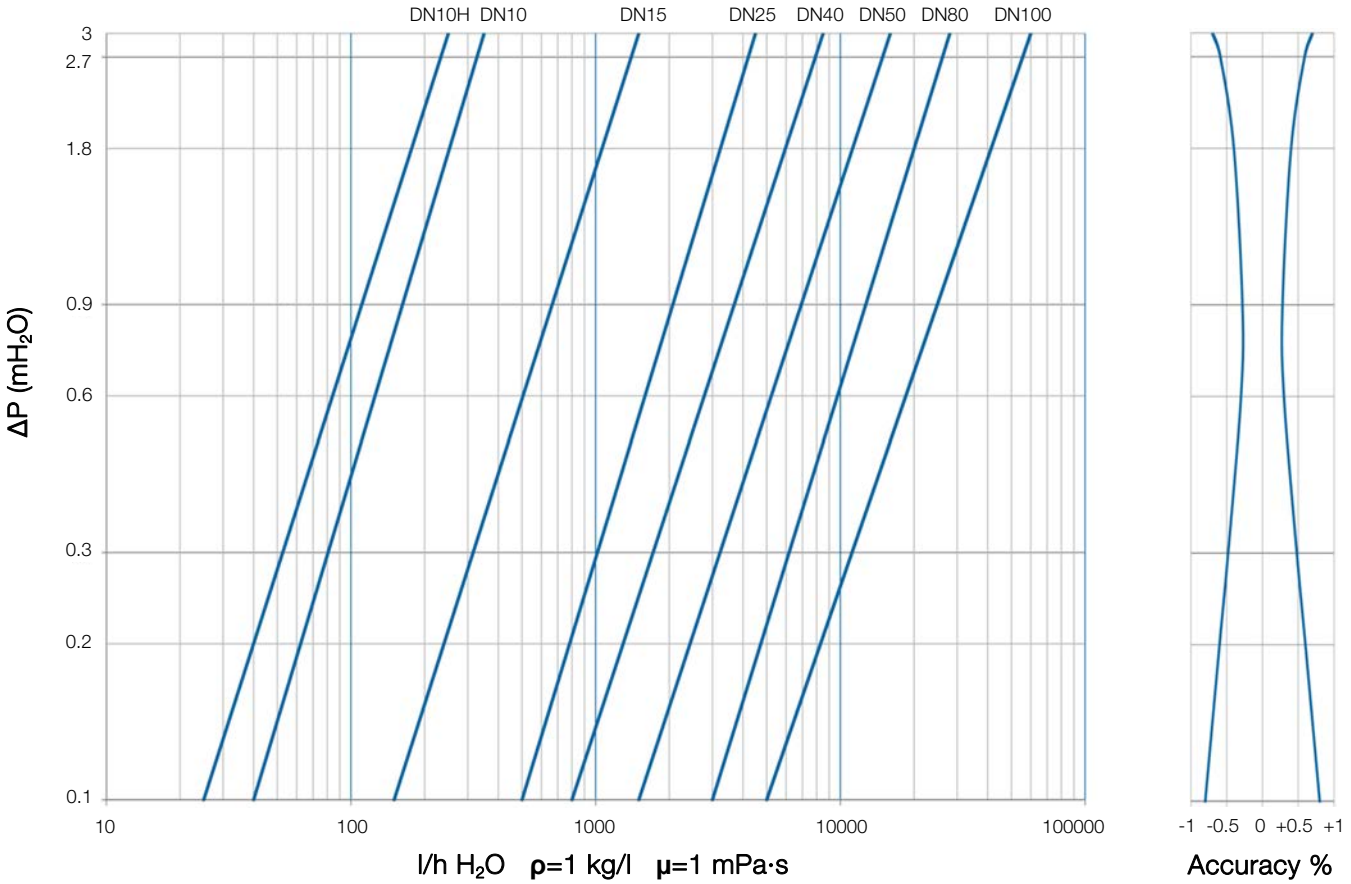
The measurement errors can be corrected in the different associated electronic converters by means of the adjustment of the pulse / litre factor, obtaining a maximum accuracy.

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

With high viscosities (higher than 800 mPa·s) the flow ranges might change significantly depending on the liquid viscosity.

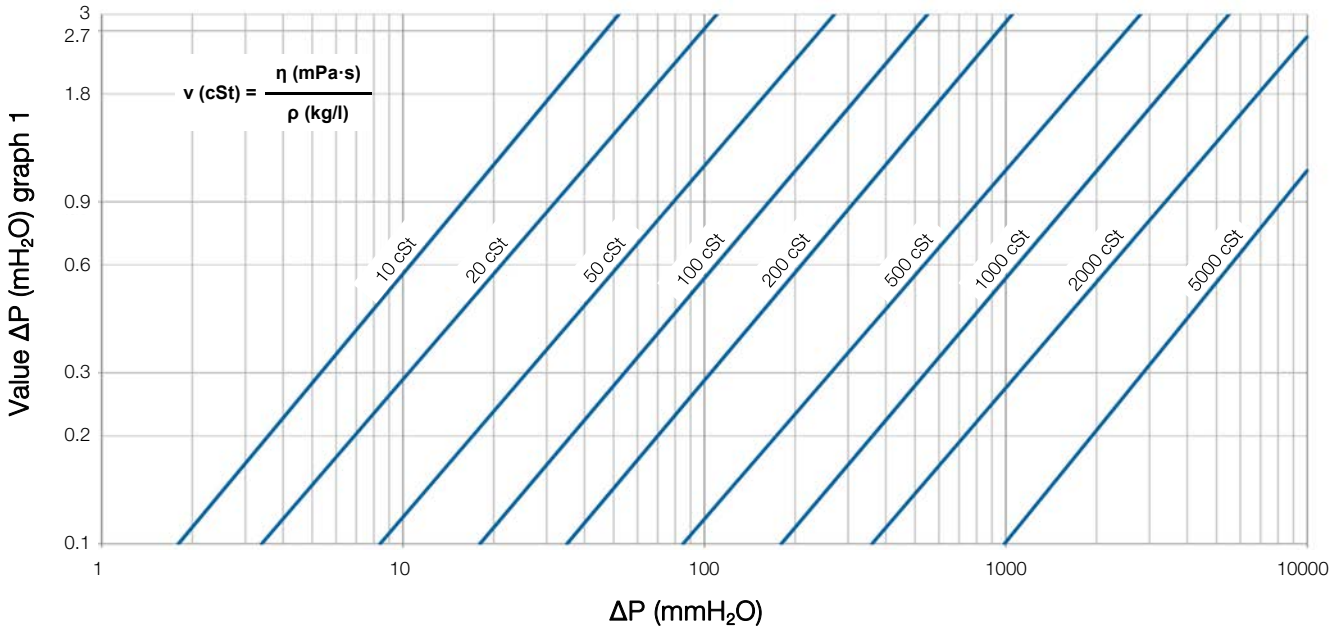
Flow rate and pressure drop curves

Graph 1



ΔP increase (mmH_2O) due to the effect of density and viscosity

Graph 2



Electronic converters

Model CP420 ... CH420

- 4-20 mA transmitter
- System:
  - Compact (CP420L ... CH420L)
  - Remote in DIN rail (CP420R ... CH420R)
- Electronics mounted in a housing with aluminium base and polycarbonate (UV resistant) cover (CP420L … CH420L)
- Power supply:
  - 2-wire, loop powered
  - Nominal voltage: 8 ... 36 VDC
  - Power consumption: ≤20 mA
- Totalizer:
  - Nº of digits: 7
  - Size of digit: 8 mm
  - Reset: by means of keyboard
- Flow rate indication:
  - Nº 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 CP420L ... CH420L
  - IP30 for CP420R ... CH420R
- Ambient temperature: -10ºC ... +60ºC
- HART protocol available with models CH420L ... R
- Optional Exd certificate (model ADF60 or ADF60V)

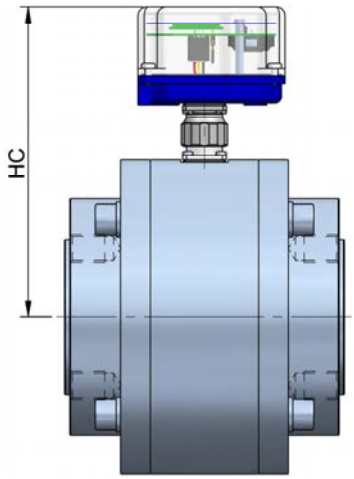
CP420L ... CH420L

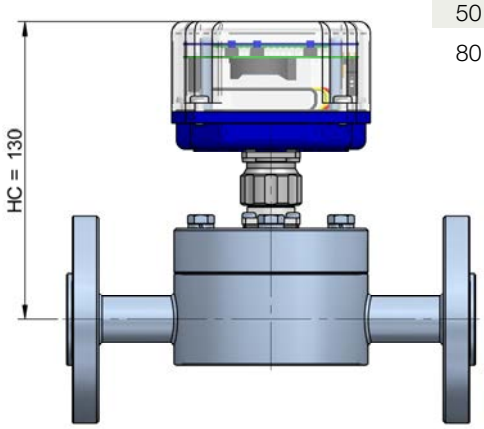
CP420R ... CH420R

Model CIP II

- Non-resettable totalizer and resettable partial
- Compact or remote system
- Electronics mounted in a housing with aluminium base and polycarbonate (UV resistant) cover (compact system)
- Battery powered (CR-2450):
  - Nominal voltage: 3 V
  - Load: 560 mAh
  - Power consumption: 8 µA
  - Battery life: 5 years approx.
- Totalizer:
  - Nº of digits: 7
  - Size of digit: 8 mm
- Partial totalizer:
  - Nº of digits: 5
  - Size of digit: 5 mm
  - Reset: by means of key or magnet
- Programmable pulse / litre factor
- Ingress protection: IP65
- Ambient temperature: -10ºC ... +60ºC
- Optional Exd certificate (model ADF60 or ADF60V)

Dimensions COVOL + CIP II / CP420L ... CH420L





DN	HC *	HC **
10 (H)	130	130
10	135	145
15	140	155
25	160	165
40	180	180
50	190	190
80	215	215

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

Model DFD420

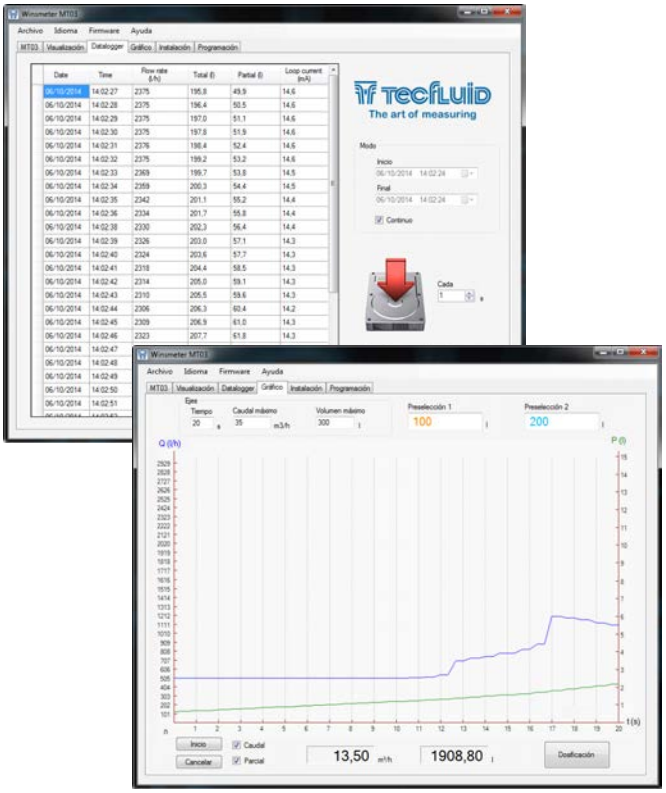
- Frequency divider and pulse amplifier
- 4-20 mA transmitter
- Pulse and pick-up coil inputs
- Fully programmable via USB cable by means of Tecfluid S.A. Winsmeter DFD software
- Compact mounted in an IP68 aluminium housing or DIN 46277 rail remote mounted
- Acts as an interface between the series COVOL flowmeters and systems with 4-20 mA or frequency limited pulse inputs, such as some PLCs or mechanical counters.
- Power supply: 12 ... 36 VDC, 2-wire system
- Power consumption: 0.8 W max.
- Outputs:
  - 4-20 mA analog output
  - Optoisolated pulse output max. 30 VDC
- Ingress protection: IP68 (when supplied in aluminium housing)
- Ambient temperature: -20ºC ... +85ºC
- Optional Exd certificate (model ADF40)

COVOL with IP68 aluminium housing and DFD420 compact converter

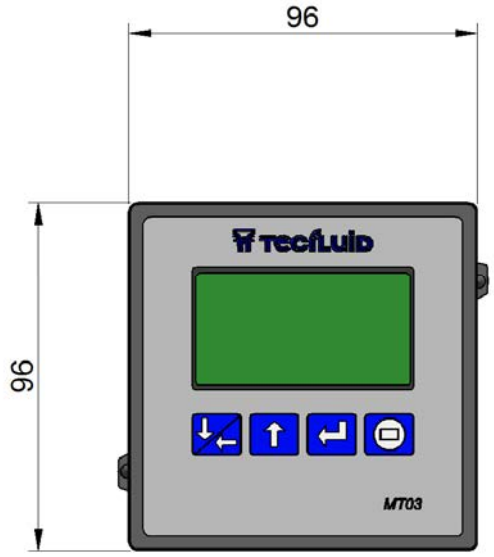
DFD420 converter

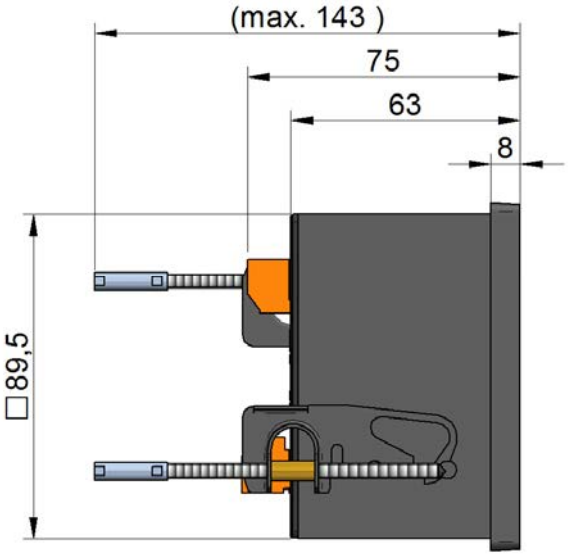
Model MT03F

- Electronic converter
- Pulse and pick-up coil inputs
- Programmable via USB cable by means of Tecfluid S.A. Winsmeter MT03 software or by means of keyboard and graphic display with intuitive menus
- Panel mounting with dimensions 96 x 96 mm DIN 43700
- Power supply: 100 … 240 VAC 50 / 60 Hz
  18 … 36 VDC
- Full diagnosis. User selectable password protection
- Possibility of 10-point linearization flow rate-frequency
- Preselection and relay outputs for batching applications
- 5 digits local flow rate indication and 8 digits totalizer and partial totalizer. Possibility of remote reset
- Pulse output (input signal repeater)
- Programmable 4-20 mA analog output
- 2 x relay outputs programmable as flow rate alarms
- Mass flow rate can be measured programming the product density
- Ingress protection: IP50 front, IP30 back
  (Optional IP65 front with silicone cover)
- Ambient temperature: -20ºC ... +60ºC
- MODBUS RTU RS485 protocol on request
- Optional Exd certificate



Dimensions MT03F converter





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: 40ºC

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 Tecfluid electronic converters must always be installed in safe area, except Exd versions. Other Exia converters for compact mounting are available on request.

Exd housing model ADF30

Exd protection

These devices conform the 2014/34/UE directive (Devices and protection systems for use in potentially explosive atmospheres) as indicated in the CE certificate type LOM 14ATEX2008 X 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.

Four different types of Exd housings are available:

- Model ADF40: IP68 blind housing with reduced dimensions for DFD420 converter
- Model ADF30: IP67 blind housing with reduced dimensions
- Model ADF60V: IP67 housing with window, can include the CIP II or CP420L ... CH420L converters
- Model ADF60: IP67 blind housing, can include the CIP II or CP420L ... CH420L converters

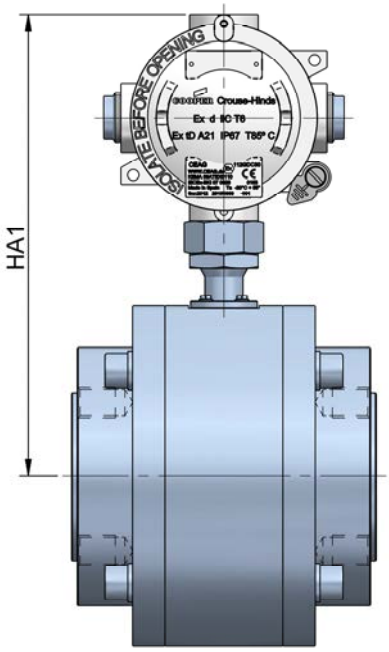
Exd version technical data:

- Ambient temperature: -20ºC ... +60ºC
- Electrical wiring inside the Exd housing
- Standard cable entries ¾” NPT. On request ATEX packing glands for standard or shielded cable
- Associated electronics:
  - DFD420: frequency divider, pulse amplifier and 4-20 mA transmitter
  - CIP II: totalizer battery powered
  - CP420 … CH420: transmitter 2-wire system with flow rate indication, volume totalizer and 4-20 mA output. HART protocol optional for model CH420
- ATEX certificate Ex d IIC T6 Gb / Ex tb IIIC T85ºC Db

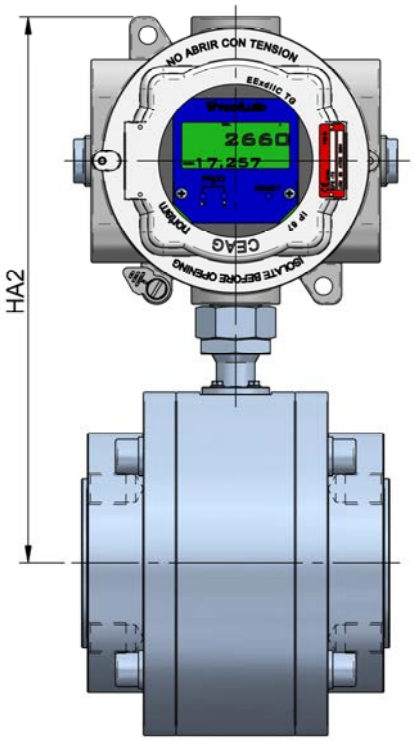
Exd housing model ADF60V con CIP II converter

Dimensions

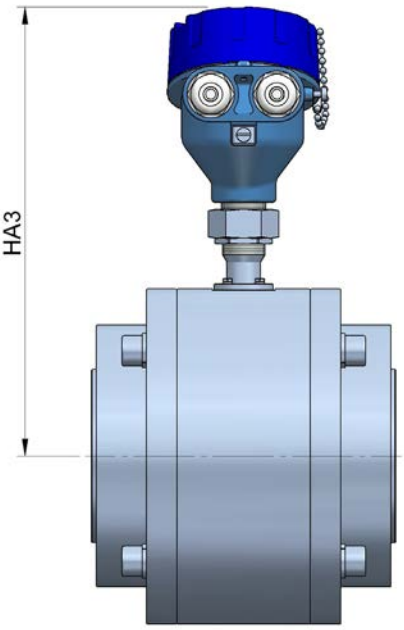
Exd housing model ADF30



Exd housing model ADF60V



Exd housing model ADF40



DN	HA1 EN 1.4404 (AISI 316L)	HA1 PP/PVC/PTFE	HA2 EN 1.4404 (AISI 316L)	HA2 PP/PVC/PTFE	HA3 EN 1.4404 (AISI 316L)	HA3 PP/PVC/PTFE
15	205	220	250	265	229	237
25	225	230	270	275	237	244
40	245	245	290	290	257	257
50	255	255	300	300	267	267
80	280	280	325	325	292	292

All dimensions in mm (±1,5 mm)
Exd housings not available for sizes DN10 (H) and DN10
DN100 on request

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