TECFLUID s.a.

Instrumentation for fluids

Oscillating piston flowmeter series COVOL

Instructions manual

HART COMMUNICATION PROTOCOL

R-MI-COVOL Rev.: 4 English version

PREFACE

Thank you for choosing the oscillating piston flowmeter series COVOL from Tecfluid S.A.

This instruction manual allows the installation and operation of the oscillating piston flowmeter series COVOL. It is recommended to read it before using the equipment.

WARNINGS

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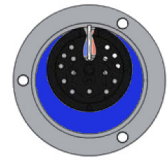
- Make sure this manual goes to the end user.
- Keep this manual in a place where you can find it when you need it.
- In case of loss, ask for a new manual or download it directly from our website www.tecfluid.com Downloads section.
- Any deviation from the procedures described in this instruction manual, may cause user safety risks, damage of the unit or cause errors in the equipment performance.
- Do not modify the equipment without permission. Tecfluid S.A. is not responsible for any problems caused by a change not allowed. If you need to modify the equipment for any reason, please contact us in advance.

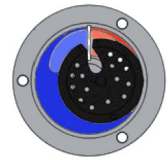
TABLE OF CONTENTS

1 WORKING PRINCIPLE

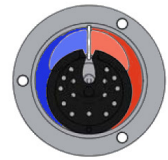
By means of oscillating piston and an annular measuring chamber.



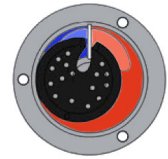
1– The first figure shows the COVOL flowmeter at the beginning of a cycle, when the measuring chamber (in blue) is completely full.



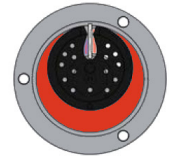
2– The flow of the liquid through the flowmeter makes a force on the oscillating piston, so that it starts turning. From this moment the measuring chamber is divided in two parts: inlet (in red) and outlet (in blue).



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.



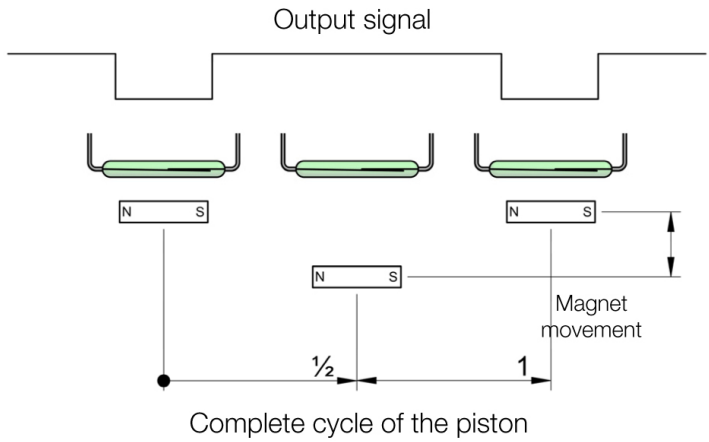
4– At this stage the outlet measuring chamber has already emptied almost all the liquid corresponding to a cycle, while on the inlet it is almost filled with the liquid corresponding to the next cycle.



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.



2 RECEPTION

COVOL oscillating piston flowmeters are supplied individually packaged for protection during transport and storage, including their corresponding instructions manual, for their installation and use.

All the flowmeters have been verified in our flow rigs, obtaining the K factor for each device.

3 INSTALLATION

The installation must be made in a point that ensures that the pipe is completely full of liquid.

Highest points in the installation as well as downwards pipes must be avoided, since air pockets or vacuums might occur.

In installations where air can be present, a degasser must be installed before the flowmeter.

Partially full pipe can involve important measurement errors.

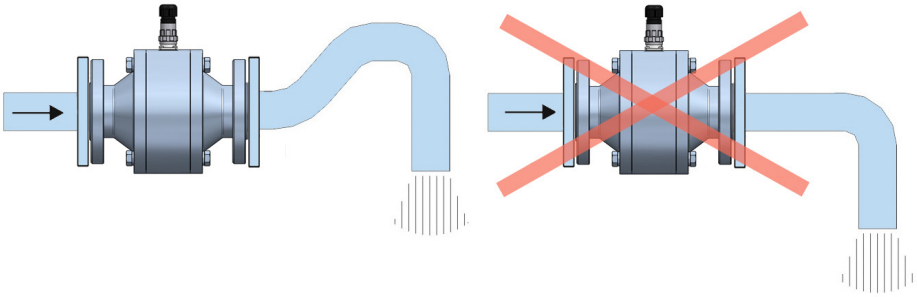
3.1 Filter

The installation of a filter before the COVOL oscillating piston is mandatory. This way a correct performance is guaranteed and severe damage is avoided.

The mesh size must be between 0.1 and 0.2 mm², in order to avoid that bigger particles can block or get embedded in the oscillating piston, stopping or slowing it and providing false readings.

3.2 Open discharge

When the flow measurement is to be made before an open discharge, it is necessary to install the flowmeter in a section of pipe with a trap which avoids the presence of air inside the meter.



3.3 Position

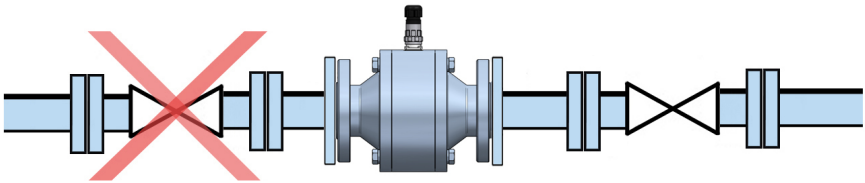
The installation and position of the flowmeter can be either vertical, horizontal or inclined. The flow direction does not affect the flowmeter accuracy.

3.4 Straight pipe sections

Straight pipe run is not required, the flowmeter can be installed just before or after disturbing elements.

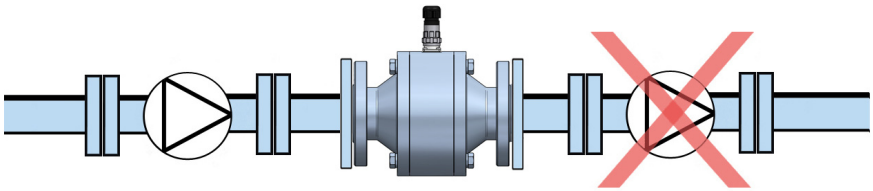
3.5 Valves

Regulating or shut-off valves must always be installed after the flowmeter, in order to assure that pipe is full of liquid.



3.6 Pumps

Pumps must always be installed before the flowmeter in order to avoid cavitations.



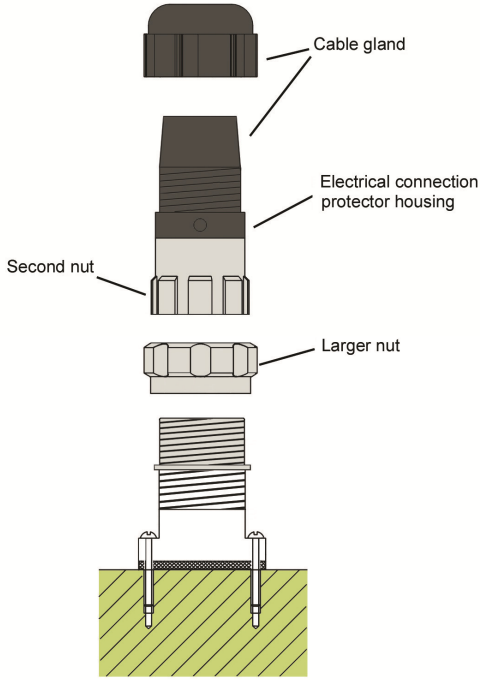
This way the presence of air pockets in the flowmeter is avoided, which could cause false readings. In particular, the associated electronics would show a volume higher than real.

Note: In order to avoid cavitations, 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 (in case of COVOL, this pressure drop is 3 mH2O or 0.3 bar, for fluids with viscosity 1 mPa·s at maximum flow rate), plus 1.25 times the vapour pressure of the liquid or its most volatile components.

3.7 Electrical connection

It is important to keep the connecting cable between the flowmeter and the associated electronics away from mains or power supply cables, in order to avoid interferences. In any case, those should be separated at least 5 cm.

The COVOL oscillating piston flowmeter has a connector fastened to the counter by means of 4 screws. The connector consists of 3 parts joined by threaded nuts. (See figure).



Loosening the larger nut in the middle of the connector allows us to withdraw the half where the cable will be later soldered.

The other half of the connector is fixed to the counter and should not be removed, except when servicing the detector (See point 4.3 of the MAINTENANCE section).

The removable part of the connector consists of the cable gland at the top and the electrical connection protector housing.

Before starting the installation, check that the cable gland is the right size for the cable to be used. This will guarantee the instrument will stay watertight. The cable gland used is for cables with outside diameters between 6 mm and 10 mm.

The electrical connection protector housing is dismounted by loosening the second nut.

When this is removed, the three connector terminals are visible.

The terminals are numbered 1 to 3 and the connection is as follows:

N. 1 & 2: Electrical switch connection.

N. 3: This terminal has a shortcircuit with terminal N.1. Don't connect anything to this terminal.

Before soldering the connections, unscrew the cable gland and feed it, together with the electrical connection protector housing, over the cable.

The joint between the cable and the connector should always be soldered, and should be tidy and without short circuits between terminals.

Peel the outside insulation to free the inner cables. It is recommended to tin the ends of the wires to avoid loose ends.

Once the connections have been made, the housing should be mounted screwing it on and then the cable gland should be tightened to avoid entry of any liquid or humidity.

Once assembled the half of the connector, the mounting in the base has only one position defined by the keyway between the two parts.

Check that the rubber seal is in its position inside the connector base. If this is the case, introduce the connector half in the base, positioning by the keyway, and screw on the nut until the end of the thread is reached.

4 MAINTENANCE

In normal working conditions the COVOL flowmeter has a long life. Normally it will not be necessary to change any parts.

The life of the parts depends mainly on the abrasive characteristics of the product to be measured and the flow rate.

The combination of these two factors, together with the construction material of the flowmeter, makes it difficult to estimate the life of the device in good working conditions

If the maximum flow rate for each DN shown in the chart below is exceeded the life of the pieces can be considerably reduced.

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

4.1 Disassembly

The list of the different elements is shown in the chart and figure in “Part List” on page 11.

The device consists of the following elements:

- Flowmeter body (chamber and connections)
- Oscillating piston
- Inlet / outlet separator
- Chamber guide disks (2 off)

Flowmeter body

The disassembly of the body should be started at the side marked with the number 2, and this is done by loosening the hexagonal bolts (8) situated on the periphery of the cups (1) and central ring of the counter (4).

Once loosened and removed (it only has to be done on the number 2 side of the counter), we can detach the cup (1). The o-ring (2) and the smooth exterior part of the metering chamber's disk (3), marked with number 1, can now be seen.

The disk (3) has a threaded hole that takes a screw to allow us to withdraw the disk smoothly.

The disk should be withdrawn perpendicularly, uncovering the metering chamber (4) with the rotary piston (10) and inlet/outlet separator (5).

The piston (12) is easily removed and it has a drop form opening to fit the inlet/outlet separator (5) which acts as a guide for the rotation of the piston.

The inlet/outlet separator (5) joins the metering chamber ring to the central circular guide of the guide disk (3). It can be removed by pulling it out perpendicularly.

In this way the metering chamber (4) is completely dismounted for inspection and thorough cleaning if necessary.

If the metering chamber (4) is damaged due to the effect of abrasive products or non-filtered hard particles that scratched its inner wall, said chamber must be machined at Tecfluid S.A. facilities and proceed with the re-adjustment with a new rotary piston as well.

In case it was necessary to clean the chamber (7) marked with number 1, the external screws (13) must be loosen. Once removed the inlet chamber, the gasket and the external smooth side of the inlet guide disk (6) can be seen.

Then the cleaning of all components can be carried out.

Rotary piston

This is the only mobile piece of the COVOL oscillating piston flowmeter.

It has a long life due to the Teflon and graphite composition, that makes it very wear resistant and gives it a low friction coefficient.

Premature wear can only be due to abrasive products and flow rate higher than those indicated in the table of page 8, which can cause excessive knocks at the inflection point of the oscillating turning of the piston, producing breakage at very high speeds. Other materials for the piston can be used depending on the application without affecting significantly its working life. Non-filtered particles can also damage the piston.

4.2 Mounting

If the flowmeter body has been completely disassembled, reassembly should start by placing the guide disk (6) in the metering chamber (4), matching the positioning hole with the metering chamber (4) pin. Then place the o-ring and the inlet chamber (7), which is marked with number 1.

Mount the inlet chamber (7) together with the metering chamber (4) by tightening the screws (13) and washers until a rigid assembly is obtained (the final tightening will be done later).

The inlet/outlet separator is fitted with the bevelled part in the groove of the guide disk (6) rings and the part with sharp edges in the groove of metering chamber (4).

The piston (12) is mounted taking care that the drop form opening fits over the inlet/outlet separator (5) and that the piston shaft fits into the circular groove formed by the two rings of the guide disk (6). Check that the piston rotates smoothly without rubbing in its complete path.

With the help of the extractor screw that we have mounted during disassembly, mount the guide disk (3) with the flat side outwards, coupling the inlet/outlet separator (5) in its position.

Note that the guide disk (3) has its mounting position defined by the groove for the inlet/ outlet separator.

If this is not done as indicated, the guide disk (3) could be damaged also avoiding a hermetic sealing of the flowmeter.

Check the perfect fitting of the guide disk (3), place the O-ring (2) on the guide disk and adjust it around the edge of the metering chamber (4).

Mount the cup or coupling piece (1), checking the position of the O-ring (2). Assemble the fixing screws and tighten them until the two pieces are firmly against each other.

Tighten the screws of the other cup (13).

The flowmeter is ready for installation and operation.

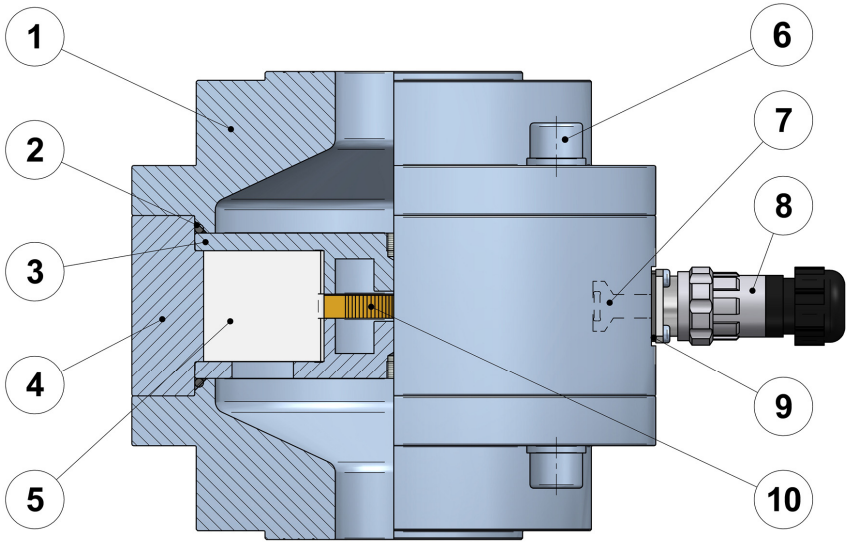
4.3 Replacing the reed group

The female connector (10), as already indicated in the Installation section, is removed from the base by the larger nut. The connector base is mounted together with the reed switch group (9).

Unscrew the female connector (10) to separate the cable and then loosen the 4 screws of the reed switch group (9).

In order to replace the reed switch group please follow the opposite procedure taking care that the gasket (11) is correctly positioned.

5 PART LIST



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®	
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	

6 TECHNICAL DATA

Accuracy

± 0.8% measured value

Repeatability

± 0.3% measured value

Measuring range: 30:1.

Installation: Horizontal or vertical.

Connections

EN 1092-1 PN16 flanges. Others on request.

Materials

Body: AISI 316L, PVC, PTFE, PP

Piston: PTFE-Graphite, PVDF, Aluminium, Bronze, others on request.

Working pressure

AISI 316L:	PN 16
PVC / PTFE / PP:	PN 10

Others on request

Working temperature

AISI 316L:	-40ºC ... +150ºC
PVC:	0ºC ... +40ºC
PTFE:	-20ºC ... +130ºC
PP:	-10ºC ... +80ºC

Electrical connection

By means of IP65 connector.

Recommended cable

Shielded bifilar up to 50 m length.

Reed switch characteristics

V max: 30 VDC. I max: 20 mA.

Conforms with the Pressure Equipment Directive 97/23/EC. CE

This equipment is considered as being a pressure accessory and **NOT** a safety accessory as defined in the 97/23/CE directive, Article 1, paragraph 2.1.3.

Associated electronics

CIP / CIP II: Battery powered volumetric counter.

CP ... CH420: 2-wire analog transmitter with flow rate and volume indication.
HART protocol optional.

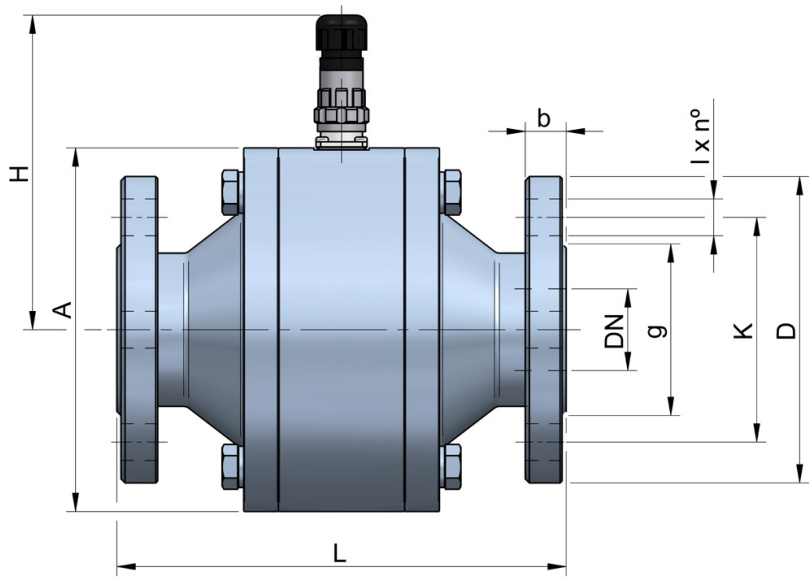
MC01: Flow rate and volume indicator with relay output for batching.

MT02: Volume counter with relay output for batching.

DFD2: Frequency divider.

CI420: Analog transmitter.

7 DIMENSIONS

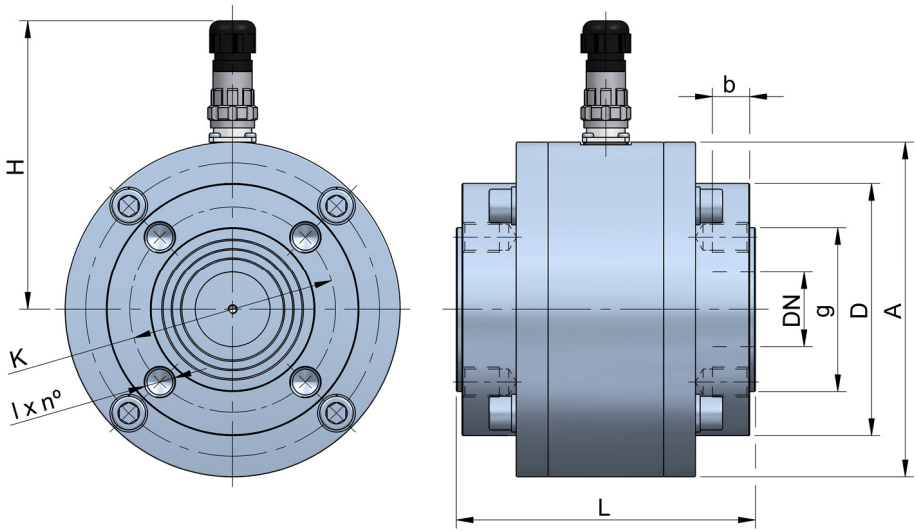


INOX

DN	PN (flanges)	D	K	g	l x nº	L	b	A	H (max)
10	16	90	60	40	14 x 4	180	14	80	105
15	16	95	65	45	14 x 4	180	14	105	115
25	16	115	85	68	14 x 4	200	16	140	135
40	16	150	110	88	18 x 4	220	16	180	155
50	16	165	125	102	18 x 4	240	18	200	165
80	16	200	160	138	18 x 8	260	20	250	190
100	16	220	180	158	18 x 8	340	20	360	245

PVC, PTFE, PP

DN	PN (flanges)	D	K	g	l x nº	L	b	A	H (max)
10	10	95	60	40	M10 x 4	150	20	90	110
15	10	100	65	44	M12 x 4	210	30	145	140
25	10	120	85	64	M12 x 4	230	30	170	150
40	10	150	110	84	M16 x 4	250	30	200	165
50	10	175	125	98	M16 x 4	270	30	225	180
80	10	230	160	138	M16 x 8	305	45	300	215
100	10	250	180	158	M16 x 8	450	55	420	275



Model AISI 316L

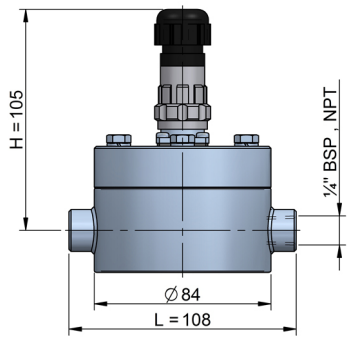
DN	D	g	K	(l x nº) x b	L	A	H
10	77	40	60	(M12 x 4) x 15	90	100	110
15	84	45	65	(M12 x 4) x 15	110	110	115
25	107	68	85	(M12 x 4) x 15	120	140	135
40	135	88	110	(M16 x 4) x 20	150	180	155
50	154	102	125	(M16 x 4) x 20	180	200	165
80	200	138	160	(M16 x 8) x 20	200	250	190

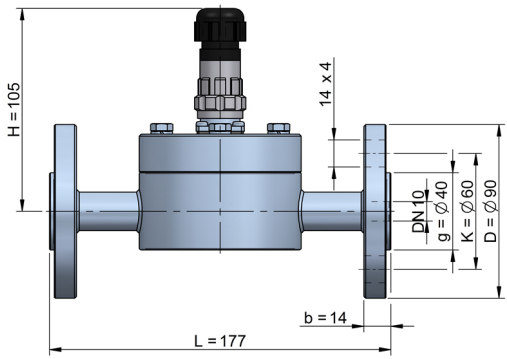
Available for DN100 with special design. Please consult factory

Models PTFE / PVC / PP

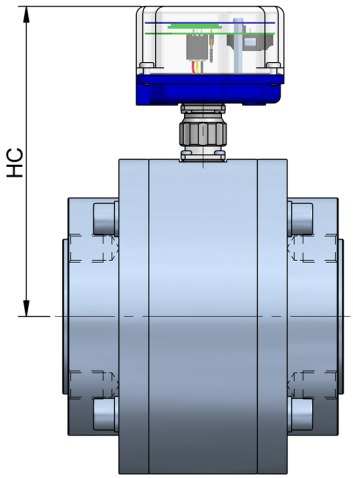
DN	D	g	K	(l x nº) x b	L	A	H
10	90	40	60	(M12 x 4) x 18	100	115	120
15	95	45	65	(M12 x 4) x 20	125	125	130
25	115	68	85	(M12 x 4) x 25	140	150	140
40	145	88	110	(M16 x 4) x 25	160	180	155
50	160	102	125	(M16 x 4) x 25	195	200	165
80	200	138	160	(M16 x 8) x 25	235	250	190

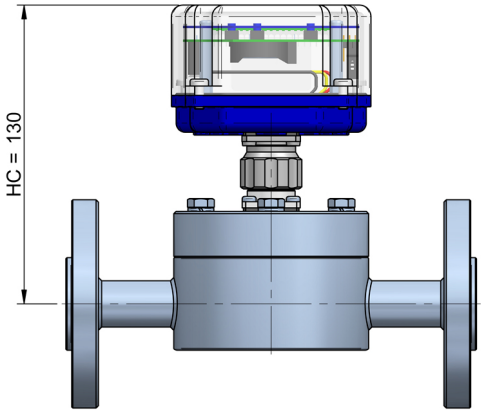
COVOL-H DN10 / ¼” low flow, horizontal





COVOL + CIP … CIP II / CP … 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

8 K FACTOR (PULSES / LITRE)

DN	Pulses / litre ± 12%	cm^3 / pulse ± 10%
10 / 1/4" (H)	100	10
10	100	10
15	20	50
25	10	100
40	4	250
50	2	500
80	1	1000
100	0,2	5000

Measured values for water at 20 ºC

9 ADDITIONAL INSTRUCTIONS FOR THE ATEX VERSION

This chapter only applies to equipment intended for use in explosive atmospheres.

9.1 Intrinsic safety

The flowmeters of series COVOL, when include just the reed sensor and the connector, can be considered simple apparatus as defined in the EN 60079-11 standard. In these cases it can be installed in hazardous areas provided that they are connected to a zener barrier or to an intrinsic safety isolator. Please consult factory for the recommended models.

9.2 Flameproof enclosure

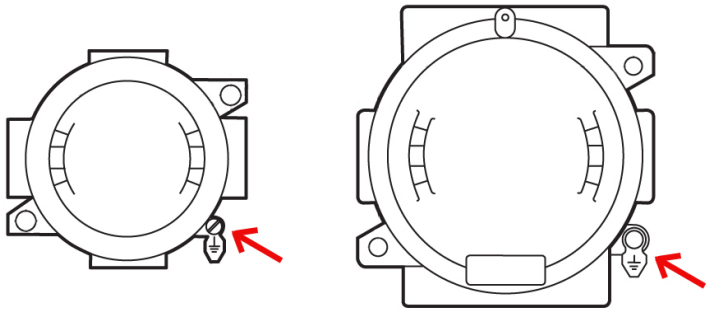
These equipment conform with the directive 94/9/CE (Equipment and protective systems intended for use in potentially explosive atmospheres) as indicated in the EC-type examination certificate LOM 14ATEX2006 X and its marking.

Given that this instrument belong to group II, it is intended for use in places likely to become endangered by explosive atmospheres, but not in mines.

The category is 2GD, that is, it is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours, mists or air/dust mixtures are likely to occur.

9.2.1 Earth connection

When the instrument is not grounded securely through the connection process, it should be grounded through the housing screw, as shown in the figure.



9.2.2 Maintenance

NOTE: When the flameproof enclosure contains an electronics model CIP or CIP II, **it should never be opened in presence of explosive atmosphere**.

For the rest of models, before any maintenance that involves opening the flameproof enclosure, **make sure there is no voltage in any of internal components**.

The is no special maintenance for the ATEX version.

9.2.3 Technical data for the ATEX version

Temperature

Ambient temperature: -20 ... +60 ºC

Electrical connection

Inside the flameproof enclosure.

Recommended cable

The standard thread supplied for the cable gland connection is 3/4” NPT.

ATEX cable glands for non-armoured or armoured cables can be placed .

The outer diameter of the cables that fits the 3/4” NPT cable glands is between 6 and 21 mm.

Associated electronics

CIP / CIP II: Battery powered volumetric counter.

CP ... CH420: 2-wire analog transmitter with flow rate and volume indication.
HART protocol optional.

Conforms to 94/9/EC Directive (equipment and protective systems intended for use in potentially explosive atmospheres).

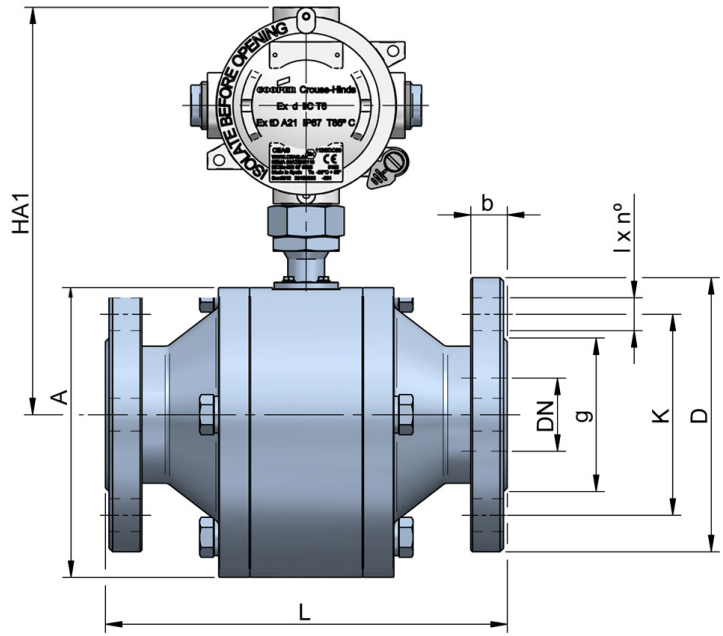
The rest of characteristics are the same as in the point 6.

9.2.4 Marking

The marking of the equipment shows the following characteristics:

- Manufacturer
- Model
- Serial number (year of construction and number)
- CE marking
- ATEX marking
- Certification number
- Address of the manufacturer

9.2.5 Dimensions

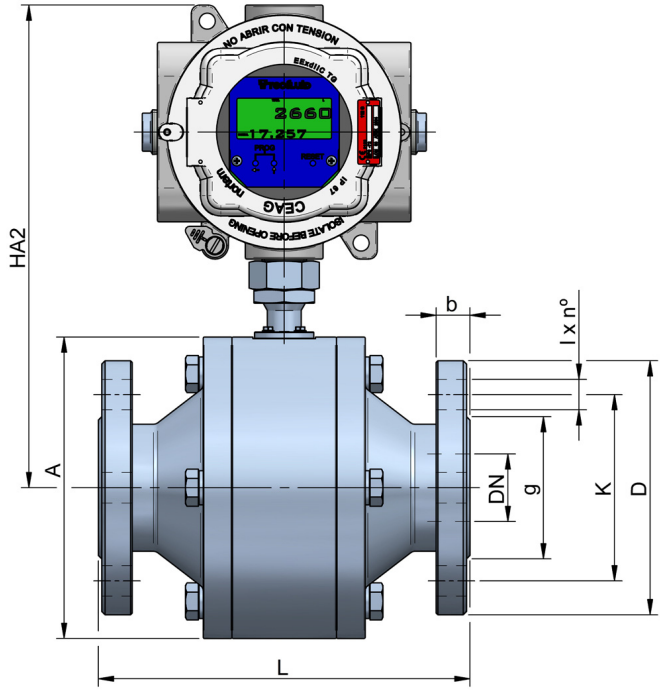


INOX

DN	PN (flanges)	D	K	g	l x n°	L	b	A	HA1 (max)
15	16	95	65	45	14 x 4	180	14	105	205
25	16	115	85	68	14 x 4	200	16	140	225
40	16	150	110	88	18 x 4	220	16	180	245
50	16	165	125	102	18 x 4	240	18	200	255
80	16	200	160	138	18 x 8	260	20	250	280
100	16	220	180	158	18 x 8	340	20	360	335

PVC, PTFE, PP

DN	PN (flanges)	D	K	g	l x n°	L	b	A	HA1 (max)
15	10	100	65	44	M12 x 4	210	30	145	230
25	10	120	85	64	M12 x 4	230	30	170	240
40	10	150	110	84	M16 x 4	250	30	200	255
50	10	175	125	98	M16 x 4	270	30	225	270
80	10	230	160	138	M16 x 8	305	45	300	305
100	10	250	180	158	M16 x 8	450	55	420	365



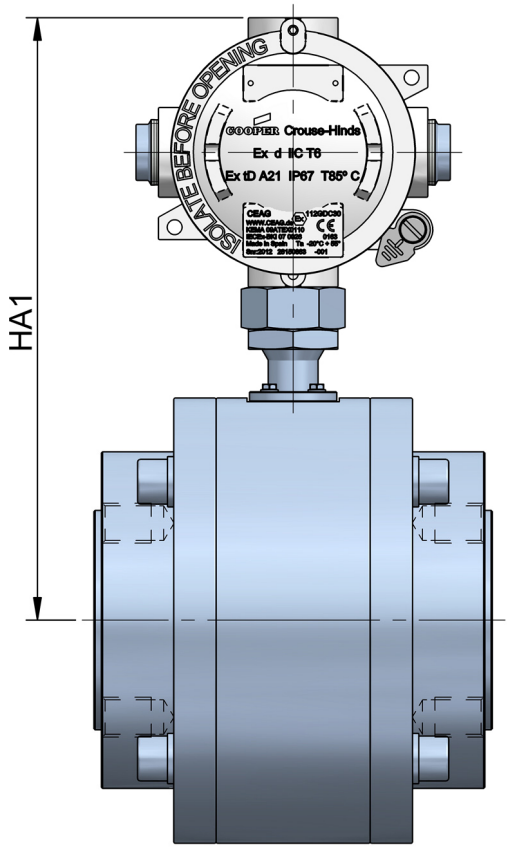
INOX

DN	PN (flanges)	D	K	g	l x nº	L	b	A	HA2 (max)
15	16	95	65	45	14 x 4	180	14	105	250
25	16	115	85	68	14 x 4	200	16	140	270
40	16	150	110	88	18 x 4	220	16	180	290
50	16	165	125	102	18 x 4	240	18	200	300
80	16	200	160	138	18 x 8	260	20	250	325
100	16	220	180	158	18 x 8	340	20	360	380

PVC, PTFE, PP

DN	PN (flanges)	D	K	g	l x nº	L	b	A	HA2 (max)
15	10	100	65	44	M12 x 4	210	30	145	275
25	10	120	85	64	M12 x 4	230	30	170	285
40	10	150	110	84	M16 x 4	250	30	200	300
50	10	175	125	98	M16 x 4	270	30	225	315
80	10	230	160	138	M16 x 8	305	45	300	350
100	10	250	180	158	M16 x 8	450	55	420	410

Model Exd ADF30

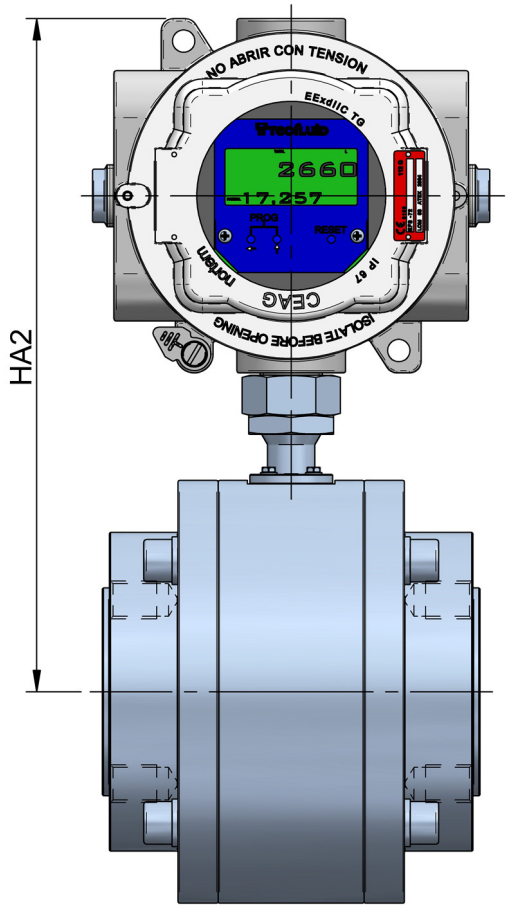


DN	HA1 AISI 316L	HA1 PP/PVC/PTFE
15	205	220
25	225	230
40	245	245
50	255	255
80	280	280

Exd models are not available for flowmeter sizes DN10 (H) and DN10

DN100 on request

Exd housing model ADF60V



DN	HA2 AISI 316L	HA2 PP/PVC/PTFE
15	250	265
25	270	275
40	290	290
50	300	300
80	325	325

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

DN100 on request

10 TROUBLESHOOTING

Problem	Possible cause	Solution
The associated electronics does not totalize	Blockage or friction of the piston by particles	Install a filter according to specification (maximum mesh size between 0.1 y 0.2 mm²).
	Damaged reed group	Change the reed group
	Disconnected cables between the COVOL and the associated electronics	Check the cable connection
The associated electronics totalize less than the actual volume	Operating liquid with properties very different from water at 20ºC (calibration liquid)	Correct the i/l factor
	Blockage or friction of the piston by particles	Install a filter according to specification (maximum mesh size between 0.1 y 0.2 mm²).
The associated electronics totalizes more than the actual volume	Operating liquid with properties very different from water at 20ºC (calibration liquid)	Correct the i/l factor
	Presence of air pockets	Control the minimum tank level. Provide an air degasser upstream of the counter if air intakes can be expected.
	Excessive emptying of storage tanks	
The flow rate indicated by the associated equipment is unstable	The pipe is not completely full	Make sure that the pipe is completely full, for example, installing the counter in a vertical pipe with upwards flow

WARRANTY

Tecfluid S.A. guarantees all the products for a period of 24 months from their sale, against all faulty materials, manufacturing or performance. This warranty does not cover failures which might be imputed to misuse, use in an application different to that specified in the order, the result of service or modification carried out by personnel not authorized by Tecfluid S.A., wrong handling or accident.

This warranty is limited to cover the replacement or repair of the defective parts which have not damaged due to misuse, being excluded all responsibility due to any other damage or the effects of wear caused by the normal use of the devices.

Any consignment of devices for repair must observe a procedure which can be consulted in the website www.tecfluid.com, “After-Sales” section.

All materials sent to our factory must be correctly packaged, clean and completely exempt of any liquid, grease or toxic substances.

The devices sent for repair must enclose the corresponding form, which can be filled in via website from the same “After-Sales” section.

Warranty for repaired or replaced components applies 6 months from repair or replacement date. Anyway, the warranty period will last at least until the initial supply warranty period is over.

TRANSPORTATION

All consignments from the Buyer to the Seller´s installations for their credit, repair or replacement must always be done at freight cost paid unless previous agreement.

The Seller will not accept any responsibility for possible damages caused on the devices during transportation.

Tecfluid
The art of measuring

Tecfluid S.A.
Narcís Monturiol 33
08960 Sant Just Desvern
Barcelona
Tel: +34 93 372 45 11
Fax: +34 93 473 44 49
tecfluid@tecfluid.com
www.tecfluid.com

Quality Management System ISO 9001 certified by Applus

Pressure Equipment Directive 97/23/CE certified by Lloyd's Register

ATEX European Directive 94/9/CE certified by LOM

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