

*Accessories*



**Orifice flow meters with  
measuring ring chambers**

POP-U-S (E5719 rev. 06 - 25/06/2014)

## GENERAL WARNINGS:



■ All installation, maintenance, ignition and setting must be performed by qualified staff, respecting the norms present at the time and place of the installation.

■ To avoid damage to people and things, it is essential to observe all the points indicated in this handbook. The reported indications do not exonerate the Client/User from observing general or specific laws concerning accidents and environmental safeguarding.

■ The operator must wear proper DPI clothing (shoes, helmets...) and respect the general safety, prevention and precaution norms.

■ To avoid the risks of burns or high voltage electrocution, the operator must avoid all contact with the burner and its control devices during the ignition phase and while it is running at high temperatures.

■ All ordinary and extraordinary maintenance must be performed when the system is stopped.

■ To assure correct and safe use of the combustion plant, it is of extreme importance that the contents of this document be brought to the attention of and be meticulously observed by all personnel in charge of controlling and working the devices.

■ The functioning of a combustion plant can be dangerous and cause injuries to persons or damage to equipment. Every burner must be provided with certified combustion safety and supervision devices.

■ The burner must be installed correctly to prevent any type of accidental/undesired heat transmission from the flame to the operator or the equipment.

■ The performances indicated in this technical document regarding the range of products are a result of experimental tests carried out at ESA-PYRONICS. The tests have been performed using ignition systems, flame detectors and supervisors developed by ESA-PYRONICS. The respect of the above mentioned functioning conditions cannot be guaranteed if equipment, which is not present in the ESA-PYRONICS catalogue, is used.

## DISPOSAL:



To dispose of the product, abide by the local legislations regarding it.

## GENERAL NOTES:



■ In accordance to the internal policy of constant quality improvement, ESA-PYRONICS reserves the right to modify the technical characteristics of the present document at any time and without warning.

■ It is possible to download technical sheets which have been updated to the latest revision from the **www.esapyronics.com** website.

■ The products manufactured by ESA-PYRONICS have been created in conformity to the **UNI EN 746-2:2010** Norms: Equipment for industrial thermal process - Part 2: Safety requirements for combustion and the movement and treatment of combustible elements. This norm is in harmony with the Machine Directive **2006/42/CE**. It is certified that the products in question respect all the requirements prescribed by the above mentioned Norms and Directives.

■ Certified in conformity with the **UNI EN ISO 9001** Norm by DNV GL.

## CERTIFICATIONS:



**EN5167-2** Fluid measurement via EN differential pressure devices placed inside full circular pipe sections - Part 2: Diaphragms

**EN331** Ball valves and male cone-shaped valves with closed ends, manually controlled valves, for gas systems in buildings.

The products comply with the requirements of the Eurasian market (Russia, Belarus and Kazakhstan) and are exempt from the EAC certification ref. **Doc. 01-11/437**

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The POP-U-S calibrated flow meters are instruments that measure the fluid flow in piping according to the EN5167-2 Norm. They are available in different materials and sizes according to the type of fluid and flow that needs to be measured.

## APPLICATIONS

- Flow measurements.
- Ratio control coupled with pressure transmitters.
- Control of flow direction coupled with pressure switches.
- Control of combustion chamber pre-purge or burner ignition at minimum power (according to the EN746/2 Regulation).



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## CHARACTERISTICS

### Primary measuring elements:

- UNI PN16 Flanges: P245GH (ASTM A105) / AISI 304
- Ring chambers: Trivalent Galvanisation  
Fe360 - Fe430 - Fe510 / AISI 304
- Disc: AISI 304
- Maximum operating temperature: 500°C
- Maximum operating pressure: 6 bar
- Gaskets AFM-34 / X-PLUS

### Impulse lines (where present):

- Pressure taps: OT58
- Fittings: nichel-plated brass / AISI 321
- Connection pipes (by customer) copper



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## DESCRIPTION

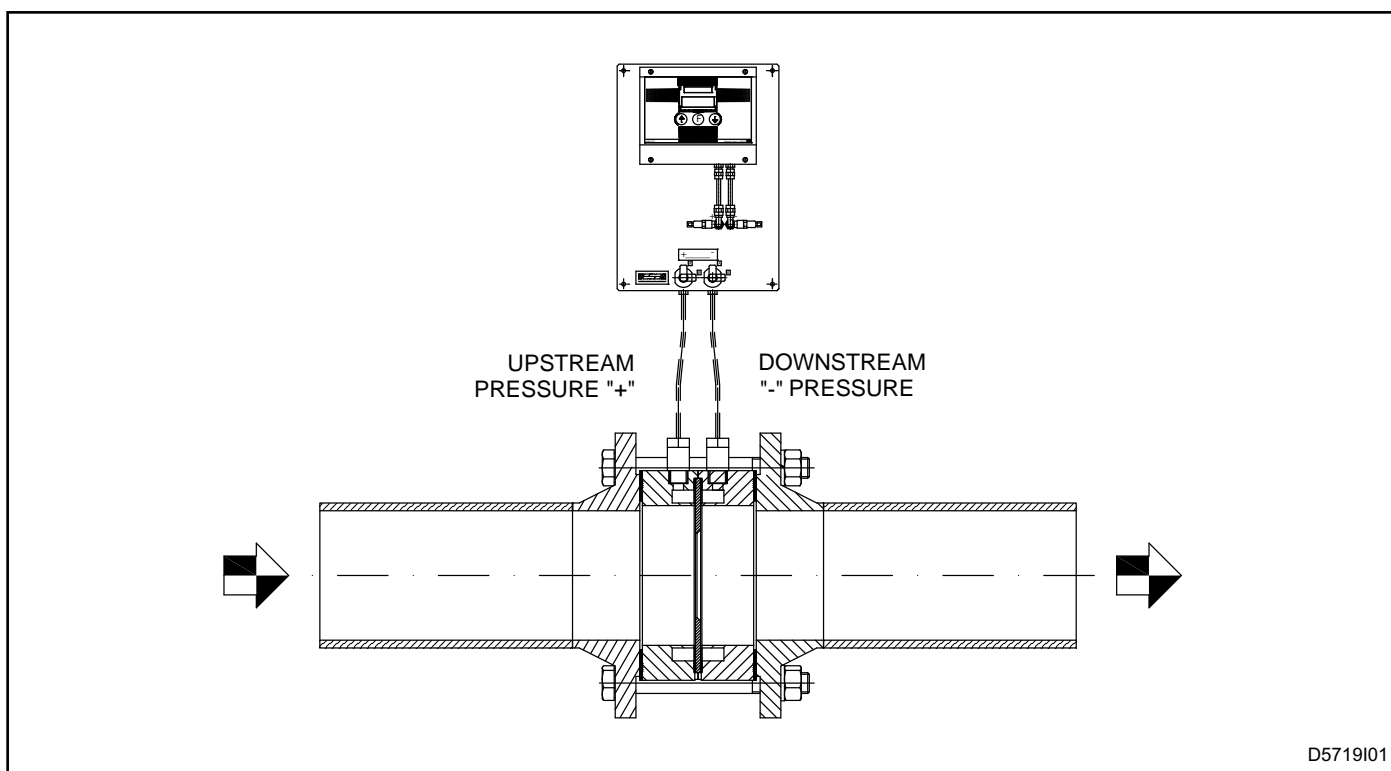
The POP-U-S flanges are instantaneous flow measuring devices characterized by a primary element, made up of a recording device (calibrated diaphragm inserted in two ring chambers), and a secondary element generally made up of a MAG series differential pressure gauge (data sheet E5275) or of an ESA PT-II pressure transmitter (data sheet E7210). The POP-U-S calibrated flanges have welded connections (from DN20 and DN450) directly in the piping and the relative impulse lines are obtained in the flanges with ring chambers. These instruments are characterized by their simple installation, good precision and the possibility of being made in many different types of materials.

The main versions that can be ordered are made to be used with the following fluids:

- Air (room temperature or preheated) or inert fluids

- Fuel gases belonging to classes 1/2/3
- Oxygen

For other types of fluid, appropriate flanges can be supplied. In combustion plants the calibrated flanges represent the ideal instrument for measuring and controlling the flow of air and gas; the AIR/GAS ratio regulation in burners is in fact simpler when the precise volumes of combustion air and fuel gas are known. Together with the calibrated flanges, on request, MAG series differential pressure gauges with relative on-field mounting supports are available. For electronic ratio regulations ESA PT-II pressure transmitters are available. These allow to send (via 0÷20mA or 4÷20mA signal) the flow data detected to the remote equipment: temperature controllers, counters etc.



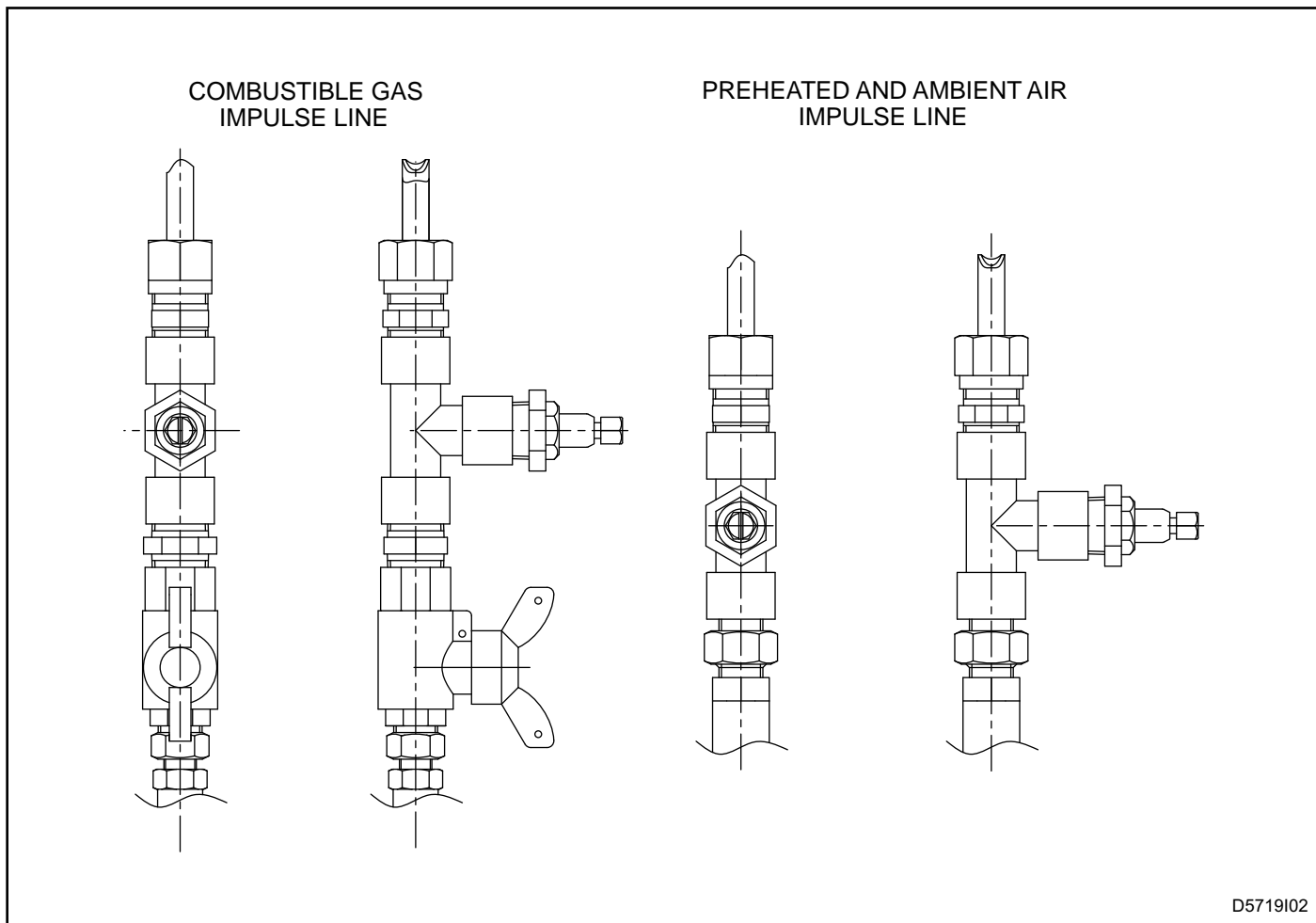
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## INFORMATION FOR SIZING

To be able to correctly size the orifice hole inside the POP-WAC series calibrated flanges, the following project data available must be available:

- Fluid type
- Nominal pipe flow
- Differential pressure on calibrated flange
- Working pressure and temperature
- Nominal diameter of pipe (DN)
- Internal diameter of pipe (if not standard)

## IMPULSE LINE SOCKET KIT



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The calibrated flanges of the POP-U-S series are supplied with special preassembled impulse line socket kits, for which installation with measuring device must be done by the customer. This kit allows to connect the flange to the appropriate pressure transmitters that read the differential pressure between upstream and downstream the

orifice. They give a precise indication of the fluid flow inside the pipe (according to the UNI EN5167-2 Norm). The kits are supplied according to the fluid inside the pipes. For oxygen use, the flanges always have a fitting for copper tube  $\varnothing$  8mm.

**MINIMUM LENGTH OF THE STRAIGHT FITTINGS OF THE PIPING  
UPSTREAM AND DOWNSTREAM OF THE PRIMARY ELEMENT**

Table extracted from the ISO 5167-2: 2003 Standard.

Note: Values expressed as multiples of internal diameter, *D*

Diameter ratio $\beta$	Upstream (inlet) side of orifice plate											Downstream (outlet) side of the orifice plate	
	Single 90° bend Two 90° bends in any plate ( $S > 30D$ ) <sup>a</sup>	Two 90° bends in the same plane: S-configuration ( $30D \geq S > 10D$ ) <sup>a</sup>	Two 90° bends in perpendicular planes ( $30D \geq S \geq 5D$ ) <sup>a</sup>	Two 90° bends in perpendicular planes ( $5D > S$ ) <sup>a,b</sup>	Single 90° tee without an extension Mitre 90° bend	Single 45° bend Two 45° bends in the same plane: S-configuration ( $S \geq 2D$ ) <sup>a</sup>	Concentric reducer 2D to D over a length of 1,5D to 3D	Concentric expander 0,5D to D over a length of D to 2D	Full bore ball valve or gate valve fully open	abrupt symmetrical reduction	Thermometer pocket or well of diameter $\leq 0,03D$ <sup>d</sup>		Fittings (columns 2 to 11) and the densimeter pocket
1	2	3	4	5	6	7	8	9	10	11	12	13	14
-	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>	A <sup>e</sup> B <sup>f</sup>
≤ 0,20	6	3	10	9	10	9	10	9	12	6	30	5	4
0,40	16	3	10	9	10	9	10	9	12	6	30	5	3
0,50	22	9	18	10	22	10	22	10	20	6	30	5	3
0,60	42	13	30	18	42	18	42	18	26	7	30	5	3
0,67	44	20	44	18	44	20	44	18	28	9	30	5	3
0,75	44	20	44	18	44	20	44	18	36	12	30	5	3

NOTE 1: The minimum straight lengths required are the length between various fittings located upstream or downstream of the orifice plate and the orifice plate itself. Straight length shall be measured from the downstream end of the curved portion of the nearest (or only) bend or of the tee or the downstream end of the curved or conical portion of the reducer of the expander.

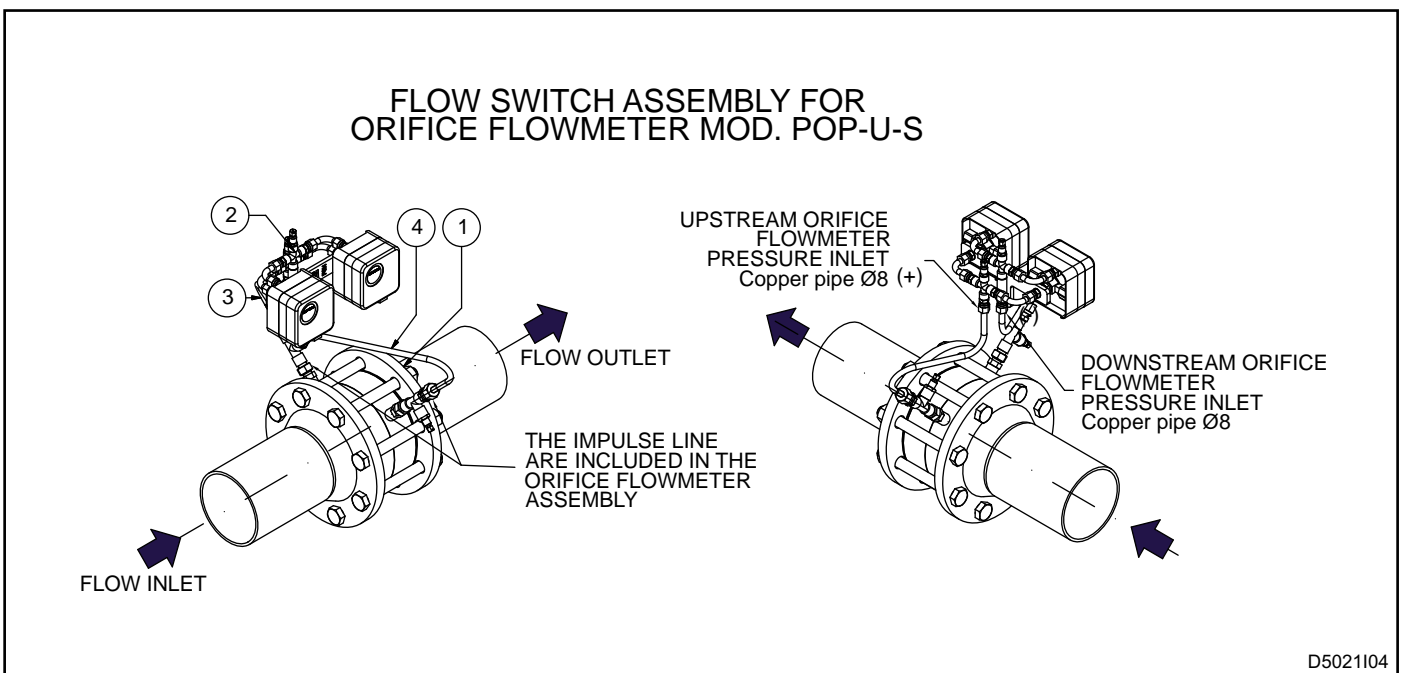
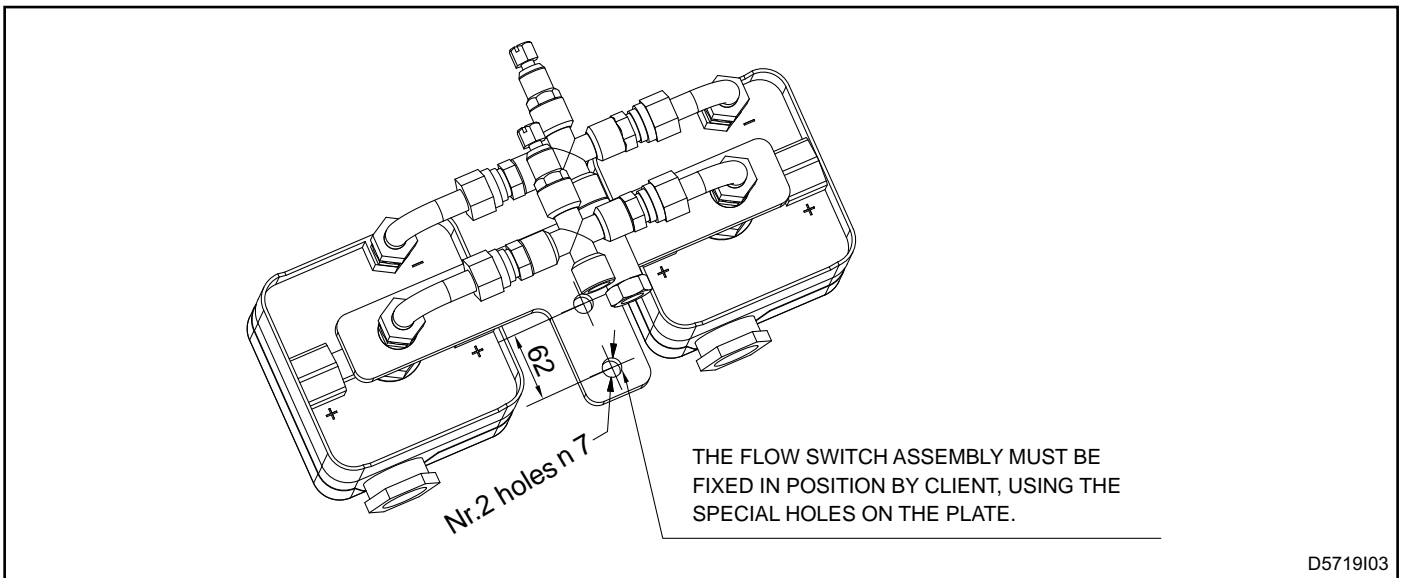
NOTE 2: Most of the bends on which the lengths in this table are based had a radius of curvature equal to 1,5D.

a: S is the separation between the two bends measured from the downstream end of the curved portion of the upstream bend to the upstream end of the curved portion of the downstream bend.  
b: This is not a good upstream installation: a flow conditioner should be used where possible.  
c: The installation of thermometer pockets of wells will not alter the required minimum upstream straight lengths for the other fittings.  
d: A thermometer pocket or well of diameter between 0,03D and 0,13D may be installed provided that the values in Columns A and B are increased to 20 and 10 respectively. Such an installation is not, however, recommended.  
e: Column A for each fitting gives lengths corresponding to "zero additional uncertainty" values (see 6.2.3).  
f: Column B for each fitting gives lengths corresponding to "0,5% additional uncertainty" values (see 6.2.4).  
g: The straight length in Column A gives zero additional uncertainty; data are not available for shorter straight lengths which could be used to give the required straight lengths for Column B.  
h: 95D is required for  $Re_D > 2 \times 10^6$  if  $S < 2D$ .

## FLOW SWITCH

The new 2010 version of the EN746/2 Norm updated the part regarding the inspection to be carried out for the purging of the combustion chamber during furnace start-up and burner ignition with nominal power higher than 120kW, that must necessarily take place below 33% of the power. Following this update, it isn't sufficient to use a low air pressure switch on the pipe that ensures the correct blower ignition, but a differential pressure switch must be used (which in this case, becomes a minimum air flow switch) that can read the Dp of a calibrated flange and that gives permission to activate chamber purge as soon as the measured air flow exceeds 80% of the maximum nominal flow of the plant.

In the same way, it is not possible to switch the burners on at minimum capacity relying on the servo motor limit switches, but a differential pressure switch is used (which in this case becomes a maximum air flow switch) that allows burner ignition below 33% of the nominal power of each. For the above mentioned applications, we suggest the use of a calibrated POP-U-S flange correctly connected to a pair of differential pressure switches according to the scheme in the figure. For this, a special pressure switch mounting kit may be supplied.



## WARNINGS

- Make sure that the fluid working pressure and temperature are below the maximum allowed limits.
- The calibrated POP-U-S flanges are supplied with coupling flanges or gaskets. The flanges and gaskets are fit for the type of fluid and application.
- Check the correct installation of the flange.
- Respect the diameters upstream and downstream according to the pipe sizes.
- Any change or repair done by third parties may compromise the application safety and cause the general warranty conditions to automatically expire.

## INSTALLATION

**Maintenance and installation must be carried out by qualified staff, respecting the laws in force. After installation it is always advisable to carry out a tightness check on the threads or of the flange connections.**

- 1 - For the mounting of the POP-U-S calibrated flange, follow the instructions printed on the actual flange.
- 2 - Check the correct alignment of the attachment pipes and maintain enough distance from the walls allowing air to circulate freely.
- 3 - Respect the upstream and downstream diameters according to the table.
- 4 - Make sure that no foreign bodies enter the valve body

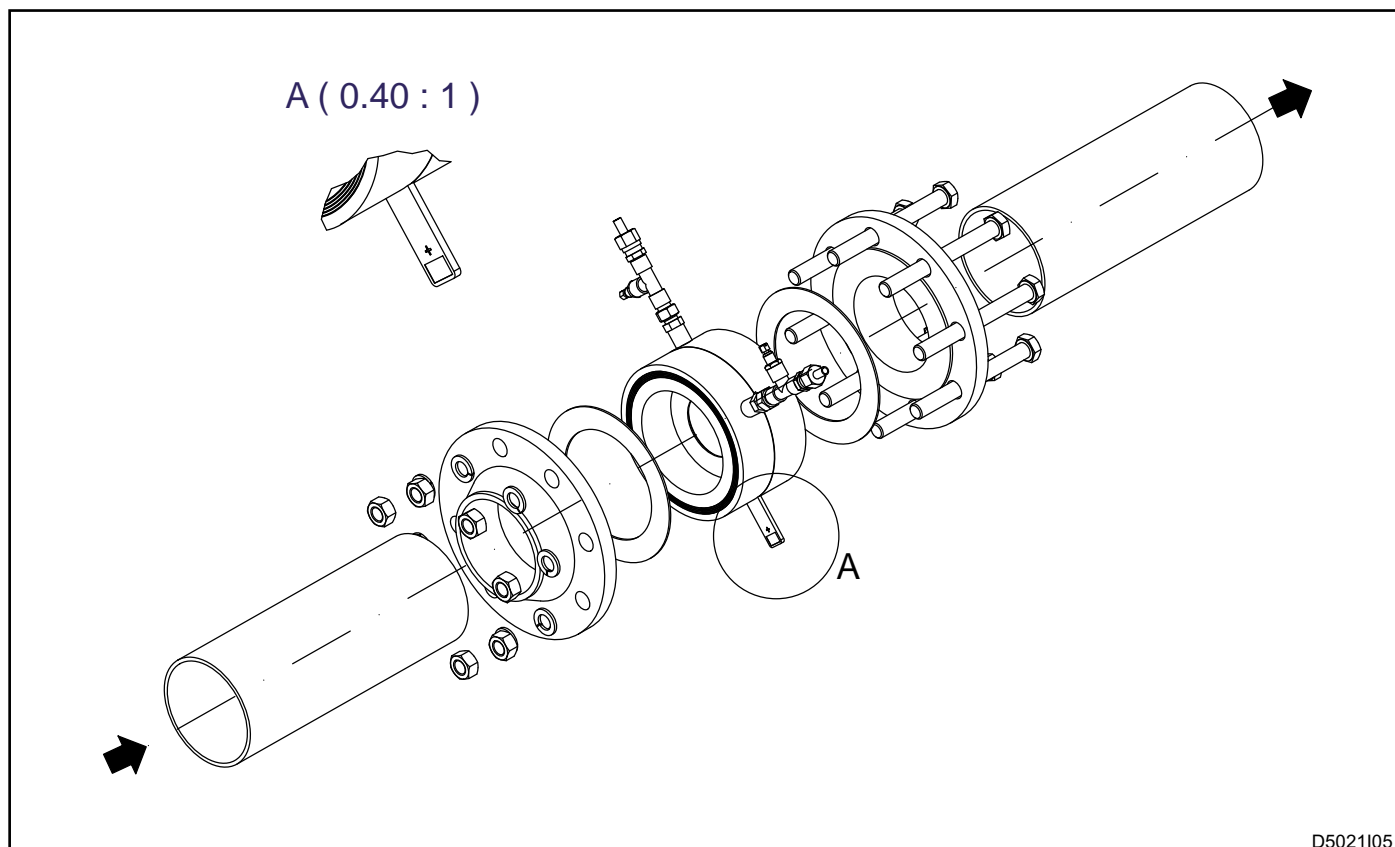
before assembling, if necessary blow with compressed air.

5 - Weld the flanges onto the ends of the pipes, eliminating any welding burrs.

6 - Place the gaskets with calibrated orifice in the correct direction. The printed symbol "+" must be placed upstream on the pipe with the orifice hole's 45° chamfer facing downstream the pipe.

7 - Using appropriate tools, progressively tighten crosswise.

8 - Avoid excessive tightening and mount without voltage. Do not install socket probes facing downwards to avoid possible obstruction of the fittings that could distort the readings.





## GENERAL MAINTENANCE PLAN

Operation	Type	Advised timing	Notes
<b>Gasket integrity</b>	O	annual	Check that there are no leaks on the outside
<b>Impulse socket integrity</b>	O	annual	Check that there are no leaks on the outside

O = Ordinary

## ORDINARY MAINTENANCE

For correct maintenance of the POP-U-S organs, scrupulously follow these instructions. Before carrying out manoeuvres with the plant on, make sure that the process safety and operator safety are not compromised. If necessary, carry out inspection with plant off.

### INTEGRITY CHECK

The integrity of the gaskets and threads can be checked visually. If necessary, use liquid leak detector.

## EXTRAORDINARY MAINTENANCE

For correct maintenance of the POP-U-S orifices, scrupulously follow the instructions below that must be carried out with the plant off.

### GASKET REPLACEMENT

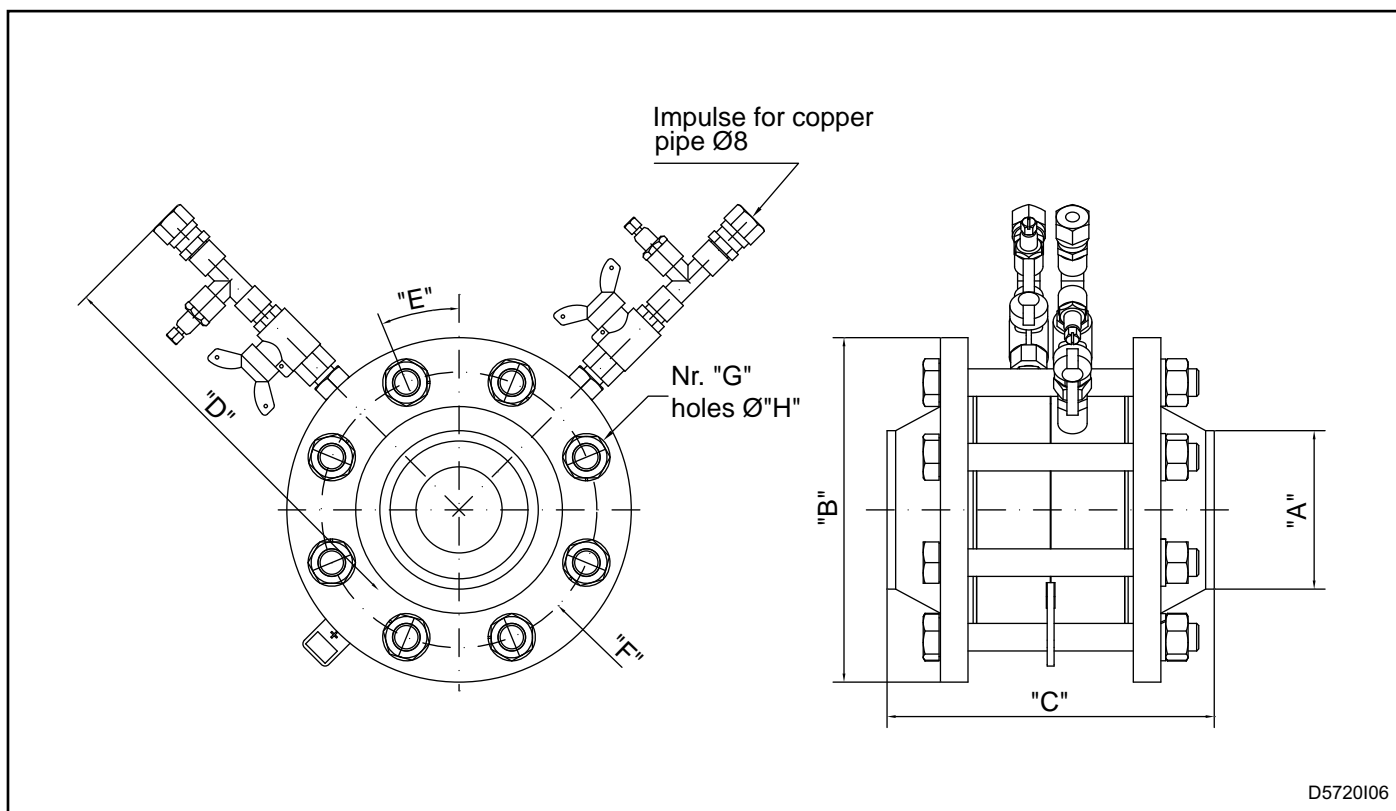
2 - Progressively unscrew the screws that hold the valve crosswise. Extract the orifice and replace the gasket.

### BOLT TIGHTENING

1 - The tightness must be checked with the plant off.

3 - Clean the inside of the orifice with a clean cloth and compressed air. Do not use tools that could damage the internal parts.

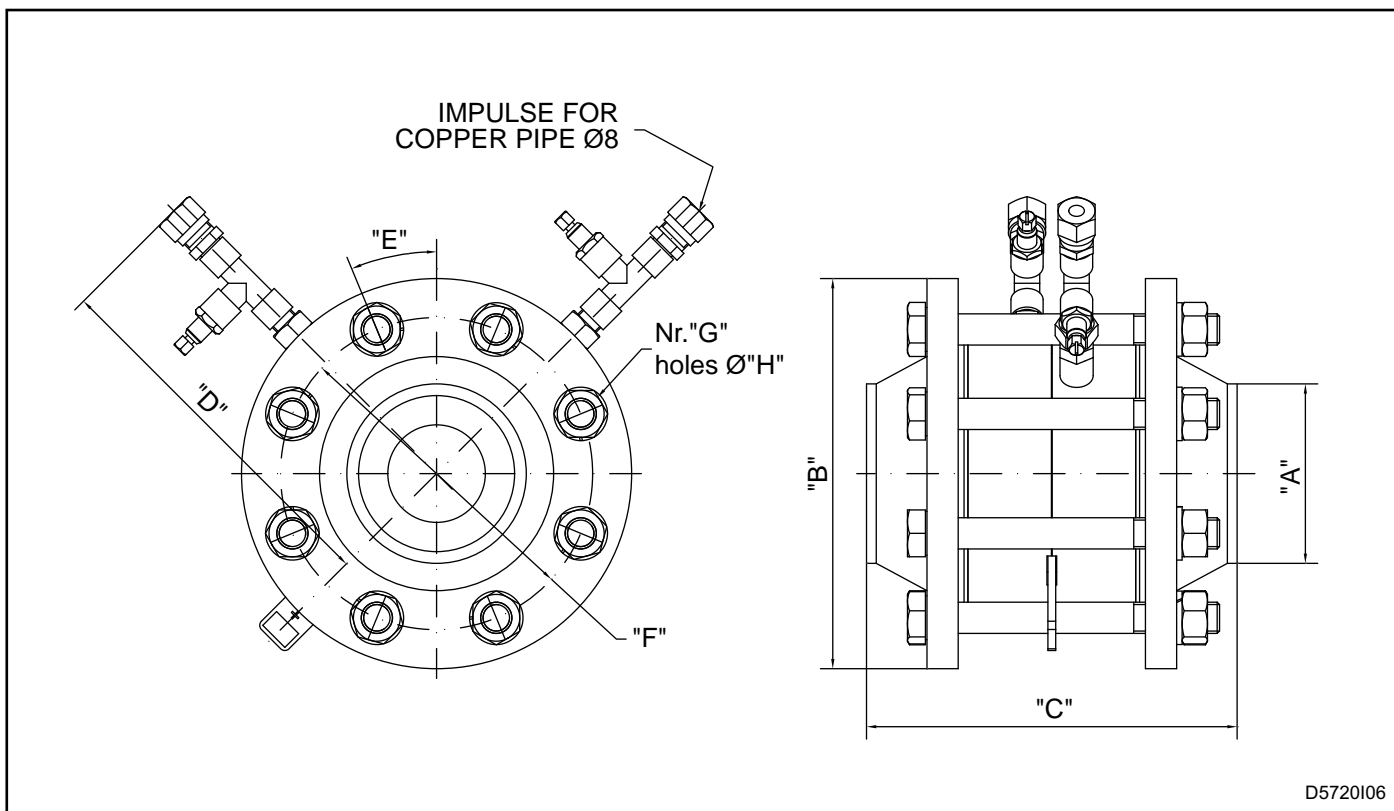
**DIMENSIONS FLANGE POP-U-S-G (GAS)**



Model	"A" DN PN	ø B [mm]	C [mm]	D ±10 [mm]	E	F [mm]	G	ø H [mm]	Screws	Mass [Kg]
6 POP-U-S-G	DN20 PN16	105	116	199	0°	75	4	14	M12X90	3,5
8 POP-U-S-G	DN25 PN16	115	116	205	0°	85	4	14	M12X90	4
10 POP-U-S-G	DN32 PN16	140	124	211	0°	100	4	18	M16X100	6
12 POP-U-S-G	DN40 PN16	150	134	224	0°	110	4	18	M16X110	7,5
16 POP-U-S-G	DN50 PN16	165	154	231	0°	125	4	18	M16X120	9,5
20 POP-U-S-G	DN65 PN16	185	163	234	0°	145	4	18	M16X140	12,5
24 POP-U-S-G	DN80 PN16	200	190	241	22,5°	160	8	18	M16X150	16,5
32 POP-U-S-G	DN100 PN16	220	194	252	22,5°	180	8	18	M16X150	18,5
40 POP-U-S-G	DN125 PN16	250	200	265	22,5°	210	8	18	M16X150	23
48 POP-U-S-G	DN150 PN16	285	200	278	22,5°	240	8	22	M20X180	27,5
64 POP-U-S-G	DN200 PN16	340	234	306	0°	295	12	22	M20X180	42,5
80 POP-U-S-G	DN250 PN16	405	252	334	0°	355	12	26	M24X200	58
96 POP-U-S-G	DN300 PN16	460	288	362	0°	410	12	26	M24X220	77
112 POP-U-S-G	DN350 PN16	520	316	392	11,25°	470	16	26	M24X240	132,5
128 POP-U-S-G	DN400 PN16	580	324	417	11,25°	525	16	30	M27X260	148,5
144 POP-U-S-G	DN450 PN16	640	328	447	0°	585	20	30	M27X270	191

Welding flanges according to UNI2282-67 PN16.

**DIMENSIONS FLANGE POP-U-S-A (AIR)**

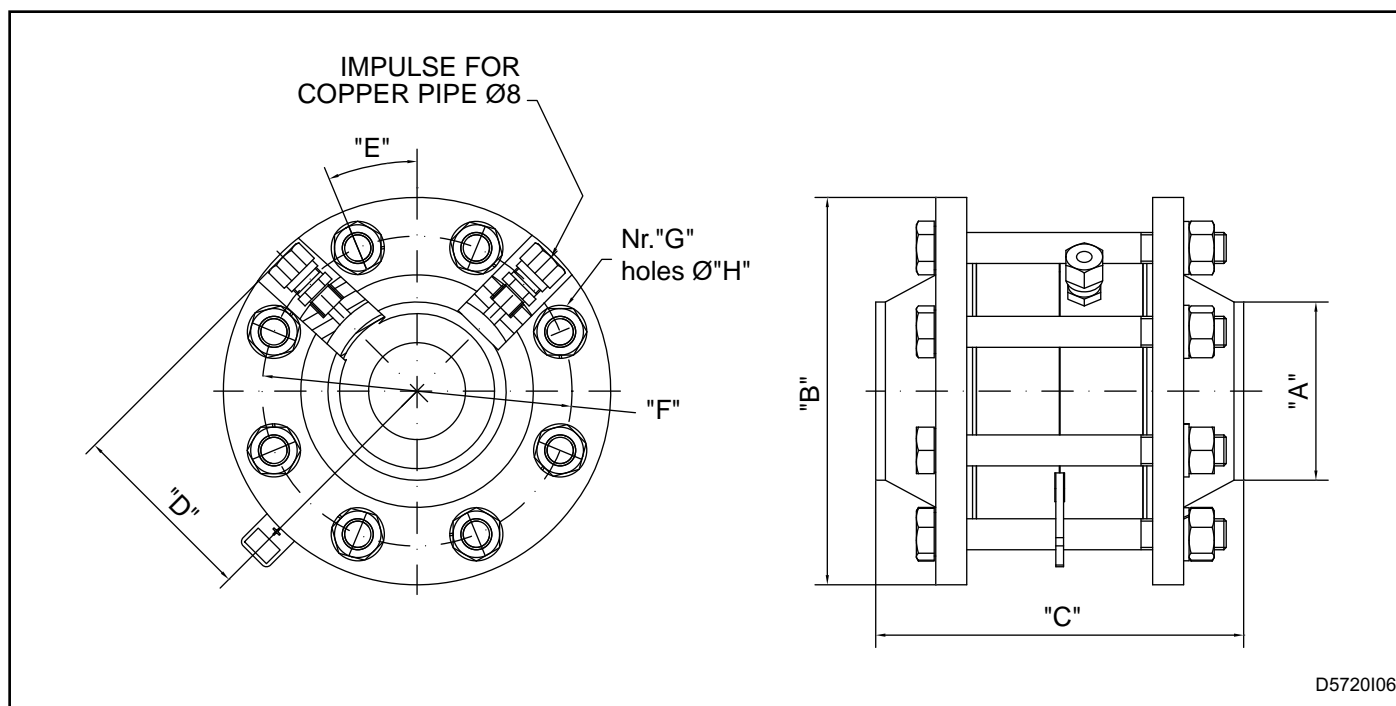


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Model	"A" DN PN	ø B [mm]	C [mm]	D ±10 [mm]	E	F [mm]	G	ø H [mm]	Screws	Mass [Kg]
6 POP-U-S-A	DN20 PN16	105	116	150	0°	75	4	14	M12X90	3
8 POP-U-S-A	DN25 PN16	115	116	154	0°	85	4	14	M12X90	4
10 POP-U-S-A	DN32 PN16	140	124	168	0°	100	4	18	M16X100	5,5
12 POP-U-S-A	DN40 PN16	150	134	173	0°	110	4	18	M16X110	7
16 POP-U-S-A	DN50 PN16	165	154	181	0°	125	4	18	M16X120	9
20 POP-U-S-A	DN65 PN16	185	163	184	0°	145	4	18	M16X140	12
24 POP-U-S-A	DN80 PN16	200	190	191	22,5°	160	8	18	M16X150	16
32 POP-U-S-A	DN100 PN16	220	194	202	22,5°	180	8	18	M16X150	18
40 POP-U-S-A	DN125 PN16	250	200	216	22,5°	210	8	18	M16X150	22,5
48 POP-U-S-A	DN150 PN16	285	200	228	22,5°	240	8	22	M20X180	27
64 POP-U-S-A	DN200 PN16	340	234	256	0°	295	12	22	M20X180	42
80 POP-U-S-A	DN250 PN16	405	252	284	0°	355	12	26	M24X200	57,5
96 POP-U-S-A	DN300 PN16	460	288	311	0°	410	12	26	M24X220	76,5
112 POP-U-S-A	DN350 PN16	520	316	342	11,25°	470	16	26	M24X240	132
128 POP-U-S-A	DN400 PN16	580	324	367	11,25°	525	16	30	M27X260	148
144 POP-U-S-A	DN450 PN16	640	328	397	0°	585	20	30	M27X270	191

Welding flanges according to UNI2282-67 PN16.

**DIMENSIONS FLANGE POP-U-S-O (OXYGEN)**



Model	"A" DN PN	ø B [mm]	C [mm]	D ±10 [mm]	E	F [mm]	G	ø H [mm]	Screws	Mass [Kg]
6 POP-U-S-O	DN20 PN16	105	116	52,5	0°	75	4	14	M12X90	3
8 POP-U-S-O	DN25 PN16	115	116	57,5	0°	85	4	14	M12X90	3,5
10 POP-U-S-O	DN32 PN16	140	124	63	0°	100	4	18	M16X100	5,5
12 POP-U-S-O	DN40 PN16	150	134	68	0°	110	4	18	M16X110	6,5
16 POP-U-S-O	DN50 PN16	165	154	75,5	0°	125	4	18	M16X120	8,5
20 POP-U-S-O	DN65 PN16	185	163	90,5	0°	145	4	18	M16X140	12
24 POP-U-S-O	DN80 PN16	200	190	98	22,5°	160	8	18	M16X150	16
32 POP-U-S-O	DN100 PN16	220	194	108	22,5°	180	8	18	M16X150	18
40 POP-U-S-O	DN125 PN16	250	200	122	22,5°	210	8	18	M16X150	22
48 POP-U-S-O	DN150 PN16	285	200	135	22,5°	240	8	22	M20X180	27
64 POP-U-S-O	DN200 PN16	340	234	162,5	0°	295	12	22	M20X180	42
80 POP-U-S-O	DN250 PN16	405	252	190,5	0°	355	12	26	M24X200	57
96 POP-U-S-O	DN300 PN16	460	288	218	0°	410	12	26	M24X220	76
112 POP-U-S-O	DN350 PN16	520	316	248	11,25°	470	16	26	M24X240	132
128 POP-U-S-O	DN400 PN16	580	324	273,5	11,25°	525	16	30	M27X260	147,5
144 POP-U-S-O	DN450 PN16	640	328	303,5	0°	585	20	30	M27X270	190,5

Welding flanges according to UNI2282-67 PN16.

