"PEGASUS" BY PSP CSST PLIABLE TUBING SYSTEMS FOR GAS

DESCRIZIONE: CSST pliable corrugated stainless steel tubing system conform to EN 15266 / DVGW G 5616 and EN ISO 10380.

APPLICATION FIELDS:

- plants for the supply of gas in buildings with maximum operative pressure MOP = 0,5 bar;
- connection of fixed gas appliances with maximum operative pressure MOP = 0,5 bar (Note: the "PEGASUS" by PSP S.r.l. pliable corrugated tubes are not suitable for the connection of moving appliances and/or parts in relative motion each other: for these purposes use only suitable flexible hoses by PSP S.r.l.).

The "PEGASUS" tubing system for gas must be installed in accordance with all the existing municipal, regional and national regulations and the instructions by PSP available on www.psp-srl.com

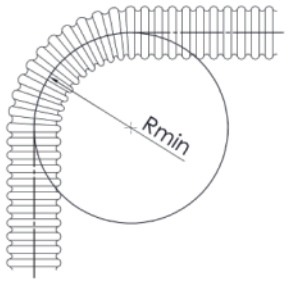
COMPONENTS OF THE TUBING SYSTEM:

- **Tube**: CSST pliable corrugate tube type 3 annular in austenitic stainless steel conform to EN 10028-7 type 1.4404 - X2CrNiMo17-12-2 (AISI 316L) with solution annealing treatment and with yellow external protective coating in plastic material.
- **Fittings**: fittings (nuts and various nipples) in nickel plated brass conform to EN 12164 / EN 12165 type CW614N or CW617N with relative plane gaskets in NBR elastomer conform to EN 549 or in synthetic fibers conform to DIN 3535-6 and DVGW VP 401.
- **Accessories**: supports clamps in galvanized steel with rubber protection, protective self-fusing silicone tape, centering spacers.

The use of fittings other than those specifically supplied by PSP for the "PEGASUS" and "AQUARIUS" tubing could not ensure a durable tightness: contact PSP to verity the suitability of the fittings from other manufacturers.

METHODS OF USE

- Keep the tubes in their original packaging, in a dry place and sheltered from corrosive substances.
- Before their use, verify the integrity of the tubes.
- Do not pull or twist the tubes.
- It is possible to bend by hand the tubes complying with the following minimum bending radii:



Nominal dimension	Minimum bending radius Rmin [mm]
DN 12	25
DN 15	25
DN 20	30
DN 25	45

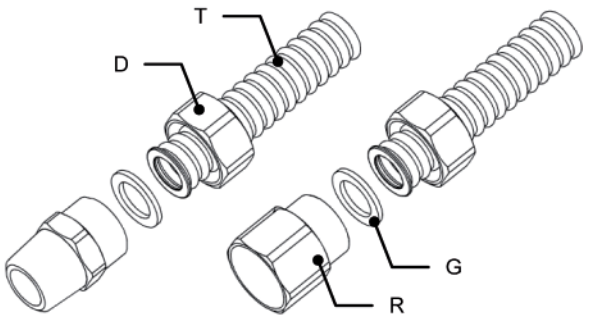
- Do not submit the tubes to repeated bending.
- For the fastening of the tubes, use clamps with rubber protection complying with the following minimum distances:

Nominal dimension	DN 12 DN 15	DN 20 DN 25
At sight tubing (horizontal o vertical)	1,2 m	1,8 m
In channel tubing	3 m	3 m

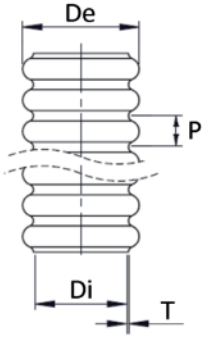
METHODS OF USE

The tightness of the junction is obtained through the compression of the plane gasket between the plane surface of the fitting and the flange of the pliable corrugated tube.

1) Cut to size the CSST pliable corrugated tube (T) adding the two corrugations that will be compressed to obtain the flange.
2) Pay attention not to engrave the tube, remove the external protective coating from seven / eight corrugations.
3) Insert the nut (D) on the tube (T).
4) Flange the tube (T) following the instructions of the flanging tool.
5) Put the plane gasket (G) in the nut (D).
6) Tight the nut (D) on the fitting (R) with plane surface. Do not use fittings without plane surface: it is possible to tight the nut directly on the male threaded of the appliance only if this has a plane surface otherwise the tightness for long time is not secured due to damaging of the gasket:



DIMENSIONS



Nominal dimension	DN 12	DN 15	DN 20	DN 25
Connection thread	1/2"	3/4"	1"	1 1/4"
Thickness T [mm]	0,3	0,3	0,3	0,3
Internal diameter Di [mm]	12,0	15,8	19,7	26,5
External diameter De [mm]	15,8	20,0	25,0	33,0
Pitch P [mm]	5,0	5,5	6,4	7,1
Lineic volume [l/m]	0,15	0,25	0,38	0,70
Thickness of the external coating [mm]	0,5	0,5	0,5	0,5

The gas plant must be dimensioned and tested in accordance with all the existing municipal, regional and national regulations. In the case specific regulations for the dimensioning are not available, the following procedure shall be followed.

DIMENSIONING OF THE GAS PLANT

Gas plants with thermal power up to 35 kW (domestic and similar gas plants)

For the dimensioning of the gas plants with thermal power up to 35 kW (as example domestic and similar gas plants) the size of the tubing shall assure a gas flow rate adequate to cover the maximum request (static pressure measured in dynamic conditions that is when during the operation all the connected appliances work at their maximum nominal power) limiting the pressure drops between the gas meter and each gas appliances to values not exceeding.

- 0,5 mbar for gases of the I family (manufactured gas);
- 1,0 mbar for gases of the II family (natural gas);
- 2,0 mbar for the gases of the III family (LPG).

If there is a pressure regulator upstream the gas meter, the above pressure drops can be the double.
The dimensioning of the gas plant shall be made as follows:

1) determine the maximum flow rate for each stretch of the plant (the flow rate necessary to feed each appliance shall be deducted from the indications given by its manufacturer);
2) determine the virtual lenght of each stretch of tubing measuring the geometrical lenght of the tubes and adding the equivalent lenghts of the special pieces (fittings and valves - table 1) that are in the examined stretch of plant;
3) on the basis of the density of the gas, procede to dimension the plant stretch by stretch using for the virtual lenghts and the flow rates the closest values to excess of the data of the table 2 and from these obtain the diameter to use.

Gas plants with thermal power over 35 kW

The dimensioning of the gas plants with thermal power over 35 kW shall assure the correct operation of the gas appliances complying with the pressures defined for each appliance by its manufacturer. For this reasons the following pressure drops shall be properly determined:

- spread pressure drops: ΔP_d;
- localized pressure drops (due to fittings, section reductions, bends, elbows, and so on): ΔP_l;
- pressure change due to the possible difference in height between the starting point and the gas appliance: ΔP_h [Pa] = $(\gamma_g - \gamma_a) \times h \times g$ where:
  - γ_g [kg/m^3]: density of the gas (15°C, 1013,25 mbar),
  - γ_a [kg/m^3]: density of the air (15°C, 1013,25 mbar),
  - h [m]: difference in height between the base and the final point of the vertical stretch,
  - g = 9,81 m/s^2: gravity acceleration.

Instead of individually calculate the spread pressure drops ΔP_d and the localized pressure drops ΔP_l, it is possible to calculate the virtual lengths (table 2) adding to the lenghts of the tubing stretches the equivalent lenghts of the special pieces that are in the examined stretch of plant (table 1).
The overall pressure drops ΔP_t are the sum of the spread pressure drops ΔP_d, the localized pressure drops ΔP_l and the difference in height ΔP_h: $\Delta P_t = \Sigma(\Delta P_d + \Delta P_l + \Delta P_h)$.
The designer shall also take into consideration any other factor that can influence the correct dimensioning, as for example: delivery pressure of the gas just before the starting point of the plant, contemporaneity of operation of the appliances at their maximum nominal power, effects of the pressure changes on the control devices at the moment of the ignition of the burners.

Table 1: equivalent lenghts of the special pieces

90° bends	0,3 m
Elbows	1,0 m
Tee fittings	0,5 m
Ball valves	0,3 m
Section reductions	0,2 m

Table 2: flow rate in volume in m^3/h for the CSST tubes

	Gas of the II family (natural gas) Pressure drops: 1 mbar				Gas of the III family (LPG) Pressure drops: 2 mbar			
Virtual length [m]	DN 12	DN 15	DN 20	DN 25	DN 12	DN 15	DN 20	DN 25
1	2,8	6,4	11,6	27,7	2,4	5,4	9,9	24,0
2	2,0	4,5	8,2	19,1	1,7	3,8	6,9	16,5
3	1,6	3,7	6,6	15,3	1,4	3,1	5,6	13,3
4	1,4	3,2	5,7	13,1	1,2	2,7	4,9	11,4
5	1,3	2,8	5,1	11,6	1,1	2,4	4,3	10,1
6	1,2	2,6	4,7	10,5	1,0	2,2	4,0	9,1
7	1,1	2,4	4,3	9,7	0,9	2,0	3,7	8,4
8	1,0	2,2	4,0	9,0	0,8	1,9	3,4	7,8
9	0,9	2,1	3,8	8,5	0,8	1,8	3,2	7,3
10	0,9	2,0	3,6	8,0	0,8	1,7	3,0	6,9
11	0,9	1,9	3,4	7,6	0,7	1,6	2,9	6,6
12	0,8	1,8	3,3	7,3	0,7	1,5	2,8	6,3
13	0,8	1,7	3,1	6,9	0,7	1,5	2,7	6,0
14	0,8	1,7	3,0	6,7	0,6	1,4	2,6	5,8
15	0,7	1,6	2,9	6,4	0,6	1,4	2,5	5,6
20	0,6	1,4	2,5	5,5	0,5	1,2	2,1	4,8
21	0,6	1,4	2,5	5,4	0,5	1,2	2,1	4,6
22	0,6	1,3	2,4	5,2	0,5	1,1	2,0	4,5
23	0,6	1,3	2,3	5,1	0,5	1,1	2,0	4,4
24	0,6	1,3	2,3	5,0	0,5	1,1	1,9	4,3
25	0,6	1,3	2,2	4,9	0,5	1,1	1,9	4,2
30	0,5	1,1	2,0	4,4	0,4	1,0	1,7	3,8
35	0,5	1,1	1,9	4,1	0,4	0,9	1,6	3,5
40	0,5	1,0	1,8	3,8	0,4	0,8	1,5	3,3
45	0,4	0,9	1,7	3,6	0,4	0,8	1,4	3,1
50	0,4	0,9	1,6	3,4	0,3	0,8	1,3	2,9
75	0,3	0,7	1,3	2,7	0,3	0,6	1,1	2,3
100	0,3	0,6	1,1	2,3	0,2	0,5	0,9	2,0

TESTING OF THE TIGHTNES OF THE PLANT

The tightness of the gas plant must be verified before its commissioning, connection to the gas meter and before the connection of the gas appliances (for the "PEGASUS" by PSP CSST tubing system, a high pressure test is not necessary):

1) isolate the plant;
2) introduce in the plant air or other inert gas up to a pressure between 100 mbar and 150 mbar;
3) let the pressure stabilize for at least 15 minutes and then measure the pressure using a monometer with an accuracy of at least 0,1 mbar;
4) after 15 minutes measure again the pressure: no difference between the two measures is necessary to assume the gas plant as tight;
5) if there is a difference between the two measures, the leakage shall be found and repaired and then the tightness test must be repeated.