"PEGASUS" BY PSP CSST PLIABLE CORRUGATED TUBING SYSTEM

DESCRIPTION

"PEGASUS" CSST pliable corrugated stainless steel tubing system conform to EN 15266 / DVGW G 5616 for combustible gases.

APPLICATION FIELDS

- Plants for the supply of gas of the I (town gas), II (natural gas - methane) and III (GPL) family in buildings with maximum operative pressure MOP = 0,5 bar;

The "PEGASUS" CSST tubing system must be installed in accordance with all the existing municipal, regional and national regulations and the instructions by PSP.

Note: details of installation are given in the national standards / codes of practice. The European standard EN 1775 "Gas supply - Gas pipework for buildings - Maximum operating pressure less than or equal to 5 bar - Functional recommendations" specifies general recommendations for the design, construction, testing, commissioning, operation and maintenance of installation pipework between the delivery point of the gas and the inlet connection of the gas appliance.

- Connection of fixed gas appliances with maximum operative pressure MOP = 0,5 bar.

The CSST pliable corrugated tubes are not suitable for the connection of moving appliances: for these purposes use only suitable flexible hoses.

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 synthetic fibers conform to DIN 3535-6 and DVGW VP 401 or in NBR rubber conform to EN 549.

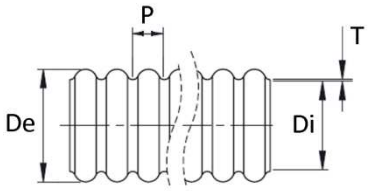
The use of fittings other than those specifically supplied by PSP for the "PEGASUS" tubing could not ensure a durable tightness: contact PSP to verity the suitability of the fittings from other manufacturers.

- **Accessories**: supports clamps in galvanized steel with rubber protection, protective self-fusing silicone tape, centering spacers, pipe-cutter with smooth rollers, flanging toll and templates.

CERTIFICATIONS

- The quality management system of PSP S.r.l. is certified as conform to EN ISO 9001 : 2015 (Bureau Veritas certificate nr. IT308879).
- The "PEGASUS" CSST tubing system by PSP is certified as conform to EN 15266 : 2007 (Bureau Veritas certificate nr. 900/002).

DIMENSIONS OF THE TUBES

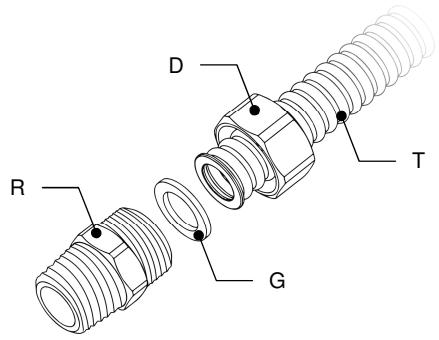


Nominal dimension	DN 12	DN 15	DN 20	DN 25
Connection thread	1/2"	3/4"	1"	1 1/4"
Thickness T [mm]	0,3	0,3	0,3	0,3
Internal diameter Di [mm]	12,0	15,8	19,7	26,5
External diameter De [mm]	15,8	20,0	25,0	33,0
Pitch P [mm]	5,0	5,5	6,4	7,1
Lineic volume [l/m]	0,15	0,25	0,38	0,70
Thickness of the external coating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

JOINTING METHODS

Fittings of the flanging system:

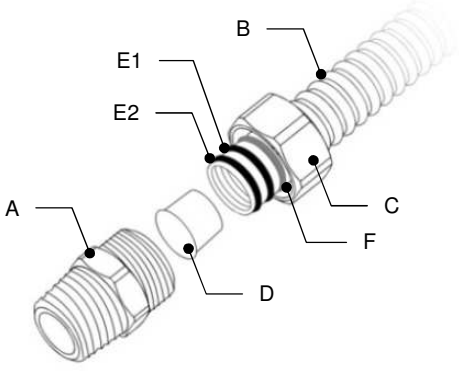
1) Cut to size the CSST pliable corrugated tube (T) adding the two corrugations that will be compressed to obtain the flange.
2) Pay attention not to engrave the tube, remove any external coating from seven / eight corrugations.
3) Insert the nut (D) on the tube (T).
4) Flange the tube (T) following 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).



Fittings of the flanging system:

Always use the protective cap in order to avoid to damage the O-rings during their insertion on the CSST corrugated tube.

1) Screw the fitting (A) onto the terminal to be connected using a suitable sealant.
2) Insert the nut (C) into the CSST tube (B).
3) Insert the protective cap (D) into the CSST tube (B).
4) Insert two O-rings (E1 and E2) in the first two grooves of the CSST tube (B).
5) Remove the protective cap (D).
6) Insert the open brass ring (F) into the third groove of the CSST tube (B) and tighten it with pliers without deforming the CSST tube (B).
7) Insert the CSST tube (B) up to the stop in the fitting (A).
8) Screw the nut (C) onto the fitting (A).



GAS PLANTS WITH THE "PEGASUS" CSST TUBING SYSTEM BY PSP

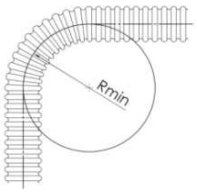
INSTALLATION MODALITIES

The "PEGASUS" CSST tubing system must be installed in accordance with all the existing municipal, regional and national regulations and the instructions by PSP.

Details of installation of the gas plants are given in the national standards / codes of practice.
The European standard EN 1775 "Gas supply - Gas pipework for buildings - Maximum operating pressure less than or equal to 5 bar - Functional recommendations" specifies general recommendations for the design, construction, testing, commissioning, operation and maintenance of installation pipework; pipework between the delivery point of the gas and the inlet connection to the gas appliance and specifies common basic principles for gas installation pipework.
Users of EN 1775 European standard need to be aware that more detailed national standards and/or codes of practice may exist in their Countries: this standard is intended to be applied in association with these national standards and/or codes of practice setting out the above mentioned basic principles.

GENERAL LAYING CRITERIA

- The materials used for the construction of gas systems must:
  - refer to technical product standards;
  - be declared suitable by the manufacturer;
  - comply with the provisions of current legislation;
  - be suitable for the type and place of installation;
  - be free of visible damage caused by transport, storage or special events.
- Before their installation, all components must be left in their original packaging and stored in a dry place and protected from contact with corrosive substances.
- Before their installation, the CSST tubes must not be left outdoors and their end sections must be closed with the supplied plugs or other methods (for example adhesive tape).
- To avoid deformations, when the CSST tube is unwound from the coil, excessive force must not be applied and it is also necessary to be very careful not to tangle the CSST tubes or catch it with other elements present on the installation site.
- Before installation, the installer must always check the integrity of the coating of the CSST tube and choose the most suitable routes so that the coating is protected against accidental impacts, thermal stresses and corrosive action.
- The pipes must be intact: they must not show any deformation or crushing that could hinder the regular flow of the gas.
- The CSST tube must be replaced if the following situations occur:
  - damage to the CSST tube with crushing, drilling or abrasion of any kind;
  - bending the CSST tube beyond its minimum bending radius.
- The configuration of the internal plant must be planned in such a way as to avoid the formation of bags due to leakage or accidental gas leaks.
- The laying of the pipelines must be done following appropriate paths set up for this purpose.
- The number of joints must be kept to the minimum required.
- At least one general shut-off valve must be installed and as many taps as the gas appliances installed.
- The pipelines must preferably be laid outside the building (courtyards, perimeter walls, boundary walls, etc.) limiting as much as possible the path inside the premises and guaranteeing accessibility for possible inspections and / or maintenance.
- In compliance with the technical standards for buildings, crossings must not compromise the stability of the structures.
- CSST tubes must not be stretched or twisted.
- To avoid any corrosion or mechanical damage, the sections of the tube were junction fittings are present or that present damages to the coating must be covered with yellow protective supplied or declared suitable by PSP that must be applied by wrapping it under tension so to adhere to the tube and the fitting.
- It is possible to bend the tubes by hand, avoiding repeated bending, respecting the following minimum bending radii:



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

- To fasten the tubes use the collars with rubber coating supplied by PSP respecting the following minimum distances:

Nominal dimension	DN 12 / 15	DN 20 / 25
At sight tubes (horizontal or vertical)	1,2 m	1,8 m
Tubes in channel or hollow	3 m	3 m

- When exposed at heights of less than two meters from walkways, the tubes must be protected against accidental collisions that could damage their coating.
- Exposed tubes and tubes inserted in ducts or technical housings must be anchored to the wall or to other suitable structures to avoid shaking and vibrations.
- The ducts and the special housings must be made in order to allow easy maintenance and cleaning and, if installed in buildings subject to fire prevention, they must be equipped with a fire protection net on each floor and must in any case be constructed in compliance with the applicable fire regulations: the metal ducts must be earthed in compliance with the regulation in force.
- Before being used, the gas plant must be tested.
- The gas system must be periodically checked.

GENERAL PROHIBITIONS

- The underpass of the buildings, the passage of the gas pipelines under the base surface and / or inside crawl spaces and / or in the inaccessible cavities are not allowed.
- Laying the pipelines in the expansion joints and in the seismic joints of the buildings is not permitted.
- Contact with binders, mortars or other materials that are corrosive to the pipeline is not permitted (to avoid the contact it is possible to use sheathed or coated pipes).
- Laying the pipes in contact with the supporting poles of the television antennas is not allowed.
- It is not allowed the contact of the gas pipelines with the water pipelines and for the parallelisms and crossings the gas pipeline, if in the positions below, must be protected with a waterproof sheath made of polymeric material.
- It is not allowed to place pipelines in chimneys and flues, in exhalation chimneys, in the technical slots used for the ducting, in the ducts for the discharge of the combustion products, in the wells for garbage, in the lift shafts, in ventilation ducts.
- It is not allowed to place the pipelines inside structures designed to contain electrical and telephone services if not in compliance with what is established for installation in technical housing.
- It is not permitted to place threaded and mechanical joints inside unventilated or non-aerable places if not drowned in cement mortar in accordance with the provisions for installation concealed in the wall.
- It is not allowed to install gas pipelines with a relative density higher than 0.8 (LPG) in rooms with floors below the ground level.
- The use of gas pipes such as ground dissipators, conductors or connectors for the protection of electrical systems and equipment, including telephone systems, is not permitted.
- It is not allowed to use components removed from other plants, which are not intact or different from those declared suitable by the manufacturer of any system.
- Crossing of walls / floors / interspaces with flexible hoses for connecting gas appliances is not permitted.

INSTALLATION METHODOLOGIES FOR THE DOMESTIC AND SIMILAR GAS PLANTS

The "PEGASUS" tubing system for domestic and similar gas plants (Qn ≤ 35 kW) must be installed in accordance with all the existing municipal, regional and national regulations and the instructions by PSP.

When a municipal, regional or national installation specification is not available, the following tables summarize the types of installation allowed in the domestic and similar gas plants by the Italian standard UNI 7129-1 for the CSST pliable corrugated tubing systems (see also EN 1775 European standard):

- YES = installation possible with the methods specified in detail in the paragraphs indicated of the UNI 7129-1 standard;
- NO = installation not possible.

General installation modes: (# 4.3, 4.4, 4.5, 4.6, 4.7, 4.8)		In the dwelling of single-family or multi-family / condominium buildings		In the common areas of multi-family / condominium buildings	
		inside (# 4.7.1)	outside (# 4.7.2, 4.8.5)	inside (# 4.8.1, 4.8.2)	outside (# 4.8.3, 4.8.4)
At sight (# 4.5.1)		NO	YES	NO	YES
In technical housings (# 4.5.2)	in duct (# 4.5.2.2, 4.5.2.3)	YES	YES	YES	YES
	in service sleeve (# 4.5.2.4)	YES	YES	YES	YES
	in underground technical cunicular (# 4.5.2.5)	YES	NO	YES	NO
	in sheath (# 4.5.2.6)	YES	YES	YES	NO
	in special housing (*) (# 4.5.2.7)	NO	YES	NO	NO
Buried (# 4.5.3)		YES	NO	YES	NO
In horizontal artefacts at open sky (# 4.5.4)		YES	NO	YES	NO
Concealed (# 4.5.5)		NO	YES	NO	NO

(*):with fire protection function, meeting the requirements set by the technical rules of fire prevention.

Special installation modes:

Crossing of spaces or rooms classified with fire hazard (# 4.6.3)	YES
Crossing of walls (# 4.6.3.4)	YES
Crossing of floors (# 4.6.3.5)	YES

INSTALLATION METHODOLOGIES FOR THE NON-DOMESTIC CIVIL GAS PLANTS

The "PEGASUS" tubing system for non-domestic civil gas plants (Qn > 35 kW)must be installed in accordance with all the existing municipal, regional and national regulations and the instructions by PSP.

When a municipal, regional or national installation specification is not available, the following tables summarize the types of installation allowed in the non-domestic civil gas plants by the Italian standard UNI 11528 for the CSST pliable corrugated tubing systems (see also EN 1775 European standard):

- YES = installation possible with the methods specified in detail in the paragraphs indicated of the UNI 11528 standard;
- NO = installation not possible.

Installation modes: (# 5.3, # 5.4.2, # 5.4.3)	Outside the building (# 5.4.3.3)	Inside the building (# 5.4.3.4)
At sight (# 5.3.3.5, # 5.4.3.3.2)	NO	NO
In duct (# 5.4.3.3.3)	YES	YES
Concealed (# 5.4.3.4.4)	NO	YES
Buried (# 5.3.3.5, 5.4.3.3.1)	YES	NO
In technical housing (# 5.4.3.3.4)	YES	NO
In anti-fire housing (# 5.4.3.4.2)	NO	YES
In sheath (counter-tube) (# 5.4.3.4.3)	NO	YES

INSTALLATION METHODOLOGIES FOR THE GAS PLANTS FOR PROFESSIONAL HOSPITALITY, COMMUNITY AND SIMILAR AREAS

The "PEGASUS" tubing system for gas plants for professional cooking appliances and similar must be installed in accordance with all the existing municipal, regional and national regulations and the instructions by PSP.

When a municipal, regional or national installation specification is not available, the types of installation allowed in the gas plants for professional cooking appliances and similar using the CSST pliable corrugated tubing systems are described by the Italian standard UNI 8723 (see also EN 1775 European standard) that specifies that the installation of the gas plant must be carried out in compliance with the provisions of the relevant installation standards:

- UNI 7129-1 (natural gas: methane) or UNI 7131 (LPG) for gas plants in which the installed appliances all have a single thermal capacity of not more than 35 kW;
- UNI 11528 for gas plants with at least one appliance having a maximum nominal thermal capacity greater than 35 kW or with appliances installed in a battery with a total thermal capacity greater than 35 kW.

For the CSST pliable corrugated tubes it is not permitted to use the "drop" laying.

DIMENSIONING OF THE GAS PLANT

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.

Gas plants with thermal power up to 35 kW

For the dimensioning of the gas plants with thermal power up to 35 kW 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 VL 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:

$$\Delta P_h\ [Pa] = (\gamma_g - \gamma_a) \times h \times g$$

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

Special piece	Equivalent lenght [m]
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			
VL [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 in accordance with all the existing municipal, regional and national regulations.
In the case specific municipal, regional and national regulations for the dimensioning are not available, use the following procedure (for the "PEGASUS" 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.

INSTALLATION AND TESTING DOCUMENTATION

After the installation, the installer shall release the documentation required by the applicable municipal, regional and national regulations.