Pipe sizing errors

The data used by engineers to design correctly sized systems is available in ISO 10239:2017, PD 54823:2016 and training manuals. 93% of gas engineers interviewed for this research use training manuals to calculate piping size. However, the training manuals contain an error relating to piping size, where a table header is mislabelled for *outside* diameter, yet the data actually relates to *inside* diameter. Table 1 below shows the correct table from ISO 10239:2017, and table 2 shows the table with the error from training manuals.

Note: the tables include correct data for hoses, referring to inside diameter in both cases

TABLE 1

Annex A
(informative)

Design guidelines for pressure drop due to pipe resistance

Table A.1 — Design guidelines for pressure drop due to pipe resistance

Inside diameter of hose/pipe mm	Pressure drop per metre of pipe length kPa										
	Connected appliance input										
	1 kW	2 kW	3 kW	4 kW	6 kW	8 kW	10 kW	12 kW	15 kW	20 kW	25 kW
4	0,004	0,015	0,03	0,05	0,15	0,23	—	—	—	—	—
6	0,001	0,004	0,007	0,012	0,03	0,04	0,07	0,10	0,14	0.26	—
8	< 0,001	0,001	0,002	0,003	0,01	0,015	0,02	0,025	0,04	0.07	0.11
10	—	< 0,001	< 0,001	0,001	0,003	0,004	0,006	0,009	0,013	0.022	0.032
15	—	—	—	< 0,001	0,001	0,001	0,002	0,002	0,004	0.006	0.01
22	—	—	—	—	< 0.001	< 0.001	< 0.001	0.001	0.001	0.001	0.001

Pipe size chart from BS EN ISO 10239:2017

TABLE 2

Table 13.1 Pipe sizing table

Pipe * (mm)	Pressure Loss in kPa/m Run of Pipe								
	Connected Appliance Input (kW)								
	1	2	3	4	6	8	10	12	15
4	0.004	0.015	0.03	0.05	0.15	0.23			
6	0.001	0.004	0.007	0.012	0.03	0.04	0.07	0.1	0.14
8	<0.001	0.001	0.002	0.003	0.01	0.015	0.02	0.025	0.04
10		<0.001	<0.001	0.001	0.003	0.004	0.006	0.009	0.013
15				<0.001	0.001	0.001	0.002	0.002	0.004

* Inside diameter of hose or outside diameter of copper pipe

Note 1: This table is for use with Propane at 3 kPa (30 mbar), 3.7 kPa (37 mbar), 5 kPa (50 mbar).

Note 2: Equivalent pipe lengths per fitting are: tee/elbow 0.5 m, straight connector/hose or pipe bend 0.3 m
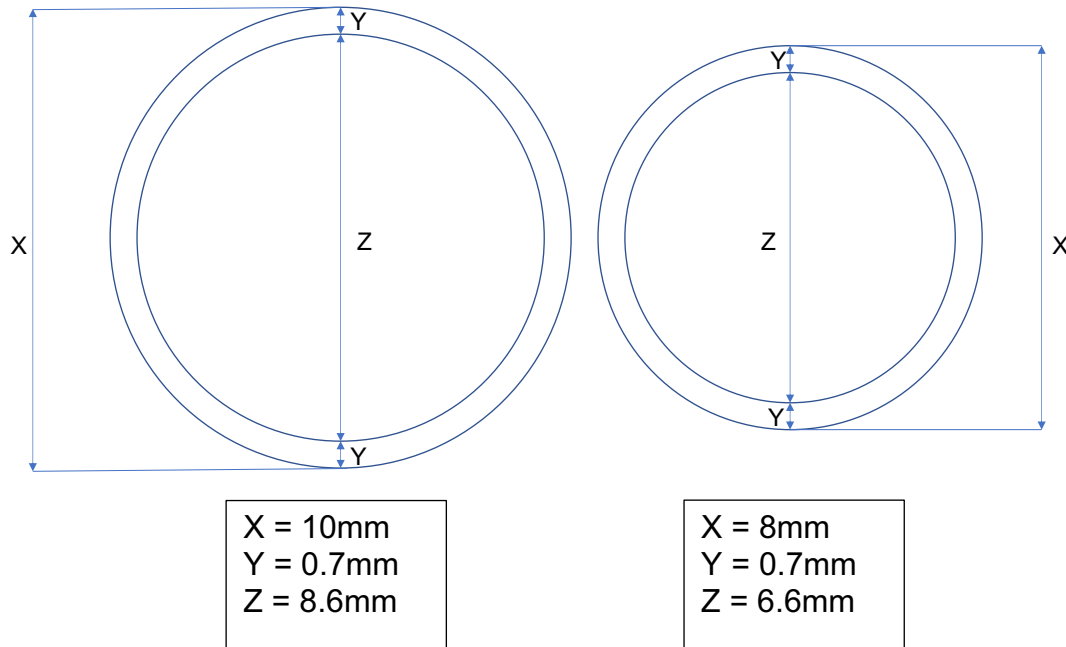
Pipe size chart from NICEIC 2021 (ISBN 978-1-83868-006-5)

Piping dimensions can be explained through the following cross section drawing:

X = Outside diameter of pipe
Y = Wall thickness of pipe
Z = Inside diameter of pipe

X = 10mm
Y = 0.7mm
Z = 8.6mm

X = 8mm
Y = 0.7mm
Z = 6.6mm

The mislabelled table header causes the designer to specify a pipe size too small, as the following example shows:

Example:

ID = Internal Diameter   OD = Outside Diameter

A boat gas system has a 18m total piping length and a 12kw cooker. The installer requires a maximum design pressure drop over the system of **< 2mbar.**

In the 12kw column, selecting 10mm piping the pressure drop calculation is

*18 (metres) x 0.009 (kpa/m) = 0.162 kpa or (**1.62mbar**)*

Using Table 1:   The data guides the installer to select piping with ID of 10mm, so with wall thickness added (2 x 0.7mm) the correct choice is 12mm OD piping which will be less than or equal to **1.62 mbar**

Using Table 2:   The mislabelled data guides the installer to select piping with of OD of 10mm which would really give the following pressure drop

*18 x 0.025 = 0.45 kpa or (**4.5mbar**)*