NEW DESIGN COEFFICIENTS FOR WATER PRESSURE PIPES

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This article contains a suggestions for improving the way in which piping is classified, proposing new values for the design coefficients (C) used in their design that are based upon the contents of a recent publication developed at the Spanish Centre for Hidrographic Studies (CEDEX) related to the design of the pipes used to convey water under pressure; this document was prepared with a view to synthesising the current state of the art in this field.

In Europe, at the present time, the standardised values for the design coefficients (C) for withstanding internal pressure are as shown in Tabla 1. Tabla 2 below, summarises the proposal for the Cs to be applied when designing the different types of piping for withstanding the internal hydraulic pressure.

Tabla 1 Design coefficients (C) currently used for the different pipe typologies

Material		C_{DP}	C_{MDP}	*Variable to which the C is applied*	*Standard*
Ductile iron		3.00	2.50	Minimum tensile strength (R_m)	UNE-EN 545:2002
Steel			2.00	Yield strength ($L_{e,\,min}$)	AWWA M11
PVC-U	DN <110	2.50		Minimum Required Strength (MRS)	UNE EN 1452:2000
	DN >110	2.00			
PE		1.25		Minimum Required Strength (MRS)	UNE EN 12201:2003
PVC-O		1.60		Minimum Required Strength (MRS)	prISO 16422.4:2000
PRFV		1.80		Long-term tensile strength of the structural part of the pipe ($\sigma_{r,\,50}$)	AWWA M 45

? C proposal for the different pipe typologies.

Material	C_{DP}	C_{MDP}	*PMA/PFA*	*Variable to which the C is applied*
Ductile iron	2,00	1,65	1,20	Yiled strength ($L_{e,\,min}$)
Steel	2,00	1,65	1,20	Yiled strength ($L_{e,\,min}$)
PVC-U	2,00	1,40	1,40	Minimum Required Strenght (MRS)
PE	1,60	1,25	1,30	Minimum Required Strenght (MRS)
PVC-O	1,60	1,25	1,30	Minimum Required Strenght (MRS)
PRFV	1,80	1,30	1,40	Long-term tensile strength of the structural part of the pipe ($\sigma_{r,\,50}$)

Complementary to this values for the coefficient of design, in the article has done a proposal for classifying all the pipes typologies by their DN, their thickness and, when necessary, by the strength of the material (i.e., extrapolating the classification system for steel pipes and applying it to ductile iron and thermoplastic pipes).

The classification thus proposed would consist of one table for each pipe typology, in

which would be represented the standardised diameter and thickness combinations, together with the respective PFA and PMA values for each one of those combinations (obtained by applying the C_{DP} and C_{MDP} referred to above). When the pipe classification also required the strength of the material concerned (steel, PE and PVC-O), in addition to the diameter and the thickness, as many tables would have to be prepared as there are standardised strength values.

The enclosed figure shows, by way of guidance, an example of what the classification tables would look like for ductile iron pipes using the DN and the nominal thickness as classification parameters.