PVC PIPE ASSOCIATION
TECHNICAL BRIEF

DESIGN FACTOR AND SAFETY FACTOR EXPLAINED

Recent changes to AWWA standards have introduced confusion to the concepts of design factor (DF) and safety factor (SF). This document will clarify the relationship between the two terms by:

- Referencing AWWA standards
- Providing a table of examples

DESIGN FACTOR DEFINED

The AWWA C900, C905, and C909 standards define "design factor" as follows:

> "Design Factor (DF): The inverse of the safety factor. It is used to reduce the hydrostatic design basis (HDB) to arrive at the Hydrostatic Design Stress (HDS) from which the Pressure Class is calculated."

Putting this definition into simpler terms:

> Design Factor (DF): The inverse of the safety factor. DF is used to reduce the material's breaking stress to provide a safe design stress.

In equation form:

$$\text{Design stress} = \text{Breaking stress} \times DF$$

or

$$HDS = HDB \times DF$$

RELATIONSHIP BETWEEN DESIGN FACTOR AND SAFETY FACTOR

The AWWA definition is very clear: the design factor is the inverse of the safety factor.

Again in equation form:

$$DF = 1/SF$$

or

$$SF = 1/DF$$

TABLE OF DFS AND SFS IN AWWA PLASTIC TRANSMISSION/DISTRIBUTION PIPE STANDARDS

Material	Standard	Breaking Stress HDB (psi)	Design Stress HDS (psi)	Design Factor	Safety Factor
PVC	AWWA C900-07	4000	2000	0.50	2.0
PVC	AWWA C905-10	4000	2000	0.50	2.0
PE3406	AWWA C906-07	1200	600	0.50	2.0
PE3608	AWWA C906-07	1600	800	0.50	2.0
PVCO	AWWA C909-09	7100	3550	0.50	2.0

CONSISTENT SAFETY FACTOR OF 2.0

From the last two columns in the table, it is clear that AWWA has consistently maintained a maximum design factor of 0.50 (equivalent to a minimum safety factor of 2.0).

Uni-Bell recommends that engineers maintain the practice of using 2.0 as the minimum safety factor for design.

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