PVC PIPE MATERIALS: CELL-CLASS EXPLAINED

The material used to produce PVC pipe is known as "PVC compound." The primary ingredient, PVC resin, is blended with smaller amounts of other materials to produce the compound. These minor ingredients are used to enhance the pipe's properties or to facilitate the manufacturing process.

PVC COMPOUND MUST MEET CELL-CLASS REQUIREMENTS

Almost all product standards for PVC water and sewer pipes require the PVC compound to meet cell-class requirements defined in ASTM D1784. The cell class consists of five cells that designate different aspects of the material. The 1st, 2nd, and 5th cells are the same for almost all PVC compounds used for municipal pipes and are summarized below:

- First cell – material = 1 for PVC pipe
- Second cell – test: IZOD impact = 2 for most PVC municipal pipe
- Fifth cell – test: deflection temperature under load = 4 for most PVC municipal pipe

THIRD & FOURTH CELLS ADDRESS TENSILE STRENGTH & TENSILE MODULUS

Tensile strength of the compound is found in the 3rd cell. Tensile strength is the design-limiting property for pressure pipe to resist hoop stress caused by internal pressure. This is less important for gravity pipe, because hoop stress is not design-limiting.

Tensile modulus of elasticity (4th cell) is the design-limiting property for non-pressure pipe to resist deflection (ovalization) caused by external loads. This is less important for pressure pipe, where external loads rarely govern wall-thickness design.

Below is part of an ASTM D1784 table that gives the values of the 3rd and 4th cells for compounds used for most municipal PVC pipes:

Cell Number	Property (Units)	Cell Limits			
		3	4	5	6
3	Tensile Strength, min. (psi)	**6,000**	**7,000**		
4	Tensile Modulus of Elasticity, min. (psi)			**400,000**	**440,000**

PRESSURE PIPE: CELL CLASS 12454

While some pressure-pipe product standards permit other cell classes, almost all PVC municipal pressure pipe is made from PVC compound meeting cell class 12454. The compound's tensile strength required is 7,000 psi minimum and tensile modulus is 400,000 psi minimum. ***(See blue highlight in table above.)***

SOLID-WALL GRAVITY PIPE: CELL CLASS 12364 OR 12454

While some gravity-pipe standards also include other cell classes, almost all PVC solid-wall gravity sewer pipe is produced from compound meeting either 12364 or 12454 cell class. For the 12364 cell class, tensile strength requirement is 6,000 psi minimum and tensile modulus is 440,000 psi minimum. ***(See green highlight in table above.)*** The 12364 cell class first appeared in ASTM PVC sewer pipe standards about 35 years ago.

"LETTER" AT THE END OF THE CELL-CLASS

Occasionally, a project specification is submitted that still contains a letter at the end of the cell-class. However, the letter should be removed from specifications, since ASTM eliminated the letter designation in a revision of the standard published in 1997. For example, the "12364-B" cell class is obsolete and should be changed to "12364."

References: ASTM D1784; *Handbook of PVC Pipe,* Uni-Bell

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