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PE100 vs. PE3408: Can Someone Please Explain These?

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ABSTRACT:

This is the second in a series of papers prepared at the request of the AGA-PMC to educate the US gas distribution industry on the history and benefits of PE100 polyethylene resins for gas piping applications. (I) In this paper, we will explore the fundamental differences between a PE100 and a PE3408 polyethylene resin for gas distribution pipe production. Inherent in this discussion will be a brief overview of the standards and protocol by which both materials are defined and how these relate to the usage of each material in gas distribution applications. The discussion shall conclude with a direct comparison of typical PE3408 to PE100 on the basis of the physical properties of the two and the performance guidelines and limitations of both. From this paper the reader should develop a clear understanding of the differences and similarities of these two materials and how they are utilized in the gas distribution industry.

INTRODUCTION:

The continuing expansion of applications for HDPE pipe has led to extensive research and development of higher performance

polymers. Recognizing the performance needs of specific end uses such as natural gas distribution, resin companies in collaboration with pipe manufacturers continue to develop materials which offer a higher level of performance as designed under internationally recognized standards. In the United States, this evolution has culminated in a category of HDPE piping that is referred to as PE3408. Since its introduction in the late 1970's, this classification of HDPE pipe products has been recognized for its higher level of pressure capability as defined under the regulations and standards endemic to the United States such as ASTM. On a more global scale, PE100 has rapidly become a mainstay within the international gas distribution community owing to the enhanced performance capabilities it affords. These qualities are more readily apparent under the ISO and CEN standards systems. While the two designations, PE3408 and PE 100, sound very similar; the breadth of qualities that they each represent are (1) The other two papers in this series are: a) "What is PE100? ", presented at the AGA-PMC Winter Workshop, 1999 in New Orleans, LA, and b) "PE100: Performance Plus ", to be presented at the 1999 International Plastic Fuel Gas Pipe Symposium in New Orleans, LA.

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considerably different. This paper is offered to provide a basic understanding of the two designations, the performance attributes they represent and the relationship of the two terms to each other.

WHAT IS PE3408?

The term PE3408 is widely recognized within the North American gas distribution industry. Since its inception, the term has become synonymous with a higher level of performance in the demanding gas distribution applications. But, what does the term PE3408 actually mean?

The PE3408 terminology has its roots in ASTM D2513, section 3.6. (1) This standard requires that any plastic pipe that is to be used in gas distribution must have a "standard thermoplastic designated code". The standard thermoplastic code shall consist of an abbreviation for the type of plastic followed by Arabic numerals, which describe the short-term properties for that material in accordance with applicable ASTM standards. The final two numerals in the term refer to the hydrostatic design stress for that material in units of 100 psi with any decimal figures dropped.

P	PE designation refers to
E	polyethylene
3	Density cell class 3 per D3350
4	SCG cell class 4 per D3350
0	800 psi hydrostatic design stress
8	for water at 73.4 F

Figure I: The Definition of PE3408

As shown in Figure I, the term PE3408 clearly identifies the piping compound as a polyethylene grade P34 with a density cell

class of 3 in accordance with D3350, a slow crack growth cell class of 4 also in accordance with D3350, and an 800 psi maximum hydrostatic design stress at 73.4 ° F as recommended by the Plastics Pipe Institute. (2)

Of particular importance is the determination of the hydrostatic design stress in accordance with ASTM D2837. (3) This standard is utilized within North America to determine the long-term pressure capability of plastics for piping applications. The categorization established in ASTM D2837 is based on a regression analysis to 100,000 hours and is presented in Table I.

**Table I
Hydrostatic Design Categories from
ASTM D2837**

Range of LTHS, Psi	Hydrostatic Design Basis, psi
380 to 470	400
480 to 590	500
600 to 750	630
760 to 950	800
960 to 1190	1000
1200 to 1520	1250
1530 to 1910	1600
1920 to 2390	2000
2400 to 3010	2500

The combination of these specific properties provides the gas distribution utility the assurance of the material's ability to sustain higher operating pressures than its PE3406 predecessor when utilized in accordance with the guidelines established by the US Department of Transportation (USDOT) Code of Federal Regulations, 49 CFR Part 192.121.(4) This regulation establishes a service factor for gas distribution of 0.32. When this service factor is taken into consideration the pressure capability of PE3408 versus a PE3406 can be readily demonstrated as shown in Figure II.

