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ISO 9080 and the US Natural Gas Distribution Industry

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ABSTRACT:

This is a follow-up paper to 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 PE 100 polyethylene resins for gas piping applications.

In this paper, we briefly explain the nature of ISO 9080, the preeminent ISO standard by which these new HDPE materials are stress rated and how they compare to the ASTM methodology currently utilized throughout the US natural gas distribution industry. Finally, an assessment is made of the benefits to be realized by the US gas distribution industry through the incorporation of the ISO protocol into the prevailing ASTM HDPE and PE gas pipe standards

INTRODUCTION:

The continuing expansion of applications for HDPE pipe has led to extensive research and development of higher performance polymers. Recognizing the needs of specific end uses such as natural gas distribution, resin companies in collaboration with pipe producers continue to develop materials which offer higher levels of performance as defined under internationally recognized standards.

An integral part of this development cycle is the evolution of product and performance standards and specifications which provide for the characterization of product improvements in accordance with industry recognized design .. criteria. In the United States, we define the long term hydrostatic strength of HDPE pipe resins in accordance with ASTM D2837.(1) These materials are then converted into pipe which must meet the requirements for PE gas pipe established in ASTM D2513.(2)

On a more global scale, ISO 9080 is used to determine the long term hydrostatic strength of PE materials.(3) These materials are then utilized to manufacture gas pipe produced in accordance with ISO 4437.(4)

Clearly, a fundamental understanding of these two standards systems is important as the gas distribution and HDPE pipe industries continue to globalize. In the paragraphs that follow, we shall take a closer look at the ISO 9080 protocol and investigate just how it relates to the ASTM D2837 methodology. Comparative examples of HDPE pipe resin hydrostatic data using both the ISO and ASTM protocol shall then be presented. This paper will conclude with a brief discussion on the impact of incorporating the ISO method

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into the relevant ASTM standards and the benefits to be realized by the US gas distribution industry.

SO, WHAT IS ISO 9080?

ISO 9080 is one of the most widely recognized standard methodologies for regression analysis of piping materials in the world. In essence it is the ISO equivalent of the ASTM D2837 protocol.

The method is similar to that proposed by ASTM D2837 in that PE pipe specimens are placed on hydrostatic test in a controlled environment under specific conditions of stress and temperature. The specimens are monitored and data is gathered as specimens fail over time. The data is then analyzed using the protocol set forth in ISO 9080.

A typical set of ISO 9080 curves is shown in Figure I. The reader will note the similarities to the ASTM D2837 regression curves and the metric nomenclature.

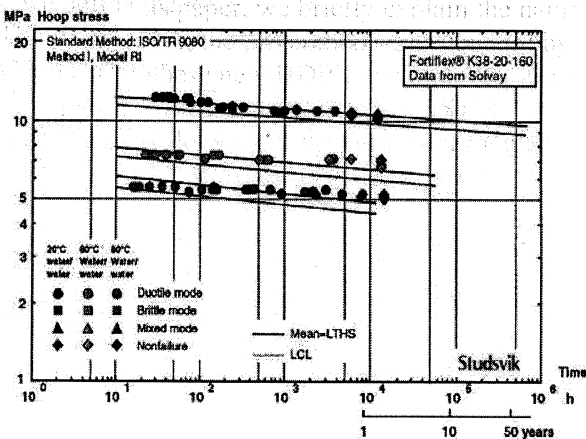


Figure I: Typical ISO TR9080 Regression Curves for a PE2406

Within ISO 9080, the stress regression curves are analyzed to determine the 50-year strength of the material. The lower confidence limit (LCL) of the 50-year intercept generated using this technique is then categorized into one of a series

of minimum recommended strength (MRS) categories in megaPascals, or MPa as defined within ISO 12162.(5)

A table of these LCL intercept values, their respective MRS classifications and subsequent PE designations is shown in Table I.

**Table I
MRS Classifications and PE Designations**

LCL Range (MPa)	MRS Classification (Mpa)	PE Material Designation
3.15 – 3.99	3.15	PE31.5
4.00 – 4.99	4.0	PE40
5.00 – 6.29	5.0	PE50
6.30 – 7.99	6.3	PE63
8.00 – 9.99	8.0	PE80
10.00 – 11.19	10.0	PE100
11.20 – 12.49	11.2	
12.50 – 13.99	12.5	
14.00 – 15.99	14.0	

The PE designations presented in Table I are then referenced in ISO 4437, the internationally recognized standard for HDPE gas distribution pipe. These designations are utilized in combination with other performance criteria to establish the pressure capability of a PE pipe for gas distribution applications under the ISO system of standards much like ASTM D2513 references the HDB established in ASTM 2837.

COMPARING ISO 9080 AND ASTM D2837:

The fundamental technique by which materials are analyzed in ISO 9080 is quite different from the procedure used in ASTM D2837 despite similarities in the methodology. Table II presents a summary of the fundamental differences between the two methodologies.

The two methods differ specifically in their treatment of the pipe failure data. Both methods utilize basic regression equations to project the service life of the material being analyzed. The

