



PPI PENT Test Investigation TN-21/2013

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Foreword

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The purpose of this technical note is to provide general information on use of the PENT test (ASTM F1473) when conducted on samples molded from PE pellets and also when conducted on extruded solid wall pipe with the samples cut in the axial direction.

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The Plastics Pipe Institute, Inc.
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PENT Test Investigation

1. Scope

The purpose of this project was to evaluate applicability of the PENT test (ASTM F 1473 “Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins”) for slow crack growth determination of polyethylene (PE) resins and extruded solid wall pipe. The PENT method was also evaluated as a quality control (QC) indicator for extruded pipe. PENT has been identified as a potential test protocol to supplement 80°C hydrostatic testing of PE pipe resins.

The evaluation included the compression molded plaques under slow cooled condition that were further prepared by machining and band sawing, and longitudinal samples cut directly from the wall of extruded pipe along the pipe direction. Testing included numerous laboratories and several commercially available medium density gas pipe resins. The resins chosen were 1st generation resins with significant long-term field experience.

A number of extrusion conditions were also evaluated to determine if the PENT test has applicability as an extrusion quality monitor.

2. Results

As shown in Attachment #1, molded plaque specimens that were further prepared by machining produced the most consistent and reproducible results. Molded plaques prepared by band sawing yielded similar average test times but produced significant data scatter and a standard deviation of results about twice that for machined samples.

Attachment #2 summarizes testing of samples cut longitudinally (axial direction) from the wall of pipe, which yielded widely scattered and non-reproducible results. Sample preparation and direction of sample loading for pipe samples, compared to polymer orientation, appears to handicap PENT applicability to pipe.

PPI also conducted PENT and 80°C sustained pressure testing (ASTM D1598) on pipe samples prepared with several changes in extrusion variables (see attachment #4). These tests showed there is no apparent correlation between the PENT results (cut from axial direction) and those of traditional 80°C hydrostatic testing of pipe (see attachment #3).