CLIENT: Fast Fusion, LLC
P.O. Box 55264
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Attention: Dick McKinley

BACKGROUND:

Specifications for polyethylene (PE) pipe are promulgated by many organizations, including ASTM International, the American Water Works Association (AWWA), CSA International, the American Petroleum Institute (API), and others. These specifications typically include requirements for elevated-temperature sustained-pressure testing, which is performed to assure the long-term performance of the extruded pipe. The most stringent (most demanding) requirements for elevated-temperature sustained-pressure testing of PE pipes appear in ASTM D2513, *Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.* Test specimens with butt-fused joints made using the proprietary Fast Fusion process were tested under the conditions specified by D2513-04a, in order to verify that the fusion joints meet the same performance requirement as the pipe itself.

The pipes tested included pipes made with a conventional HDPE (PE3408), a conventional medium-density PE (PE2406), and a PE100 / PE3408 material.

SAMPLES: Nine test specimens were received from the Client, representing three types and sizes of polyethylene (PE) pipe. Each specimen consisted of two lengths of the sample pipe, butt-fused using the Client's proprietary process. PE end-caps were butt fused at each end of the test pipe, using the same process and settings. One end-cap in each specimen also had a PE stub and steel flange adapter fused to the end to create a fill and drain port. The samples and specimens were identified as follows:

Test I PE3408 18-in IPS DR7 with 18 IPS DR7 end cap. The fusion settings as reported by the Client for this sample were: 200 seconds heat, 16 seconds fusion, 360 seconds cooling. The pipe sections were approximately 15 in. long, with the overall specimen length of approximately 42 inches, excluding the flange adapter. The minimum wall thickness for each sample was determined by the Client prior to fusing. These were:

Specimen 1/2: 2.648 in.
Specimen 3/4: 2.664 in.
Specimen 5/6: 2.668 in.

Test II PE2406 12-in IPS SDR 11 with standard butt-fused end-cap. The fusion settings as reported by the Client for this sample were: 100 seconds heat, 16 seconds fusion, 210 seconds cooling. The pipe sections were approximately 10 in. long, with an overall specimen length of approximately 42 inches, excluding the flange adapter.

The minimum wall thickness for each sample was determined by the Client prior to fusing. These were:

Specimen 1/2: 1.187 in.
Specimen 3/4: 1.182 in.
Specimen 5/6: 1.173 in.

Test III PE3408 12-in IPS SDR 11 with standard butt-fused end-cap. This pipe material was also reported to be PE100 per ISO nomenclature. The fusion settings as reported by the Client for this sample were: 100 seconds heat, 16 seconds fusion, 210 second cooling. The pipe sections were approximately 10 in. long, with an overall specimen length of approximately 42 inches, excluding the flange adapter. The minimum wall thickness for each sample was determined by the Client prior to fusing. These were:

Specimen 1/2: 1.175 in.
Specimen 3/4: 1.197 in.
Specimen 5/6: 1.184 in.

TESTS: Sustained pressure testing was performed in accordance with ASTM D1598-02 as specified in ASTM D2513-04a. Table A3.1 was followed for the Test I and Test II samples, while Table X3.3 was followed for Test III samples. Therefore, the test temperature was 80°C, and the test stress, test pressure, and minimum test time for each specimen were in accordance with the following Table 1. Outside Diameter (OD) was measured with a pi-tape in accordance with ASTM D2122-98(2004).

Table 1: ASTM D1598-02 at 80°C

Specimen	OD – inches	Stress – psi	Pressure – psi	Time - hours
I – 1/2	18.250	670	227	170
I – 3/4	18.250	670	229	170
I – 5/6	18.250	670	229	170
II – 1/2	12.733	670	138	170
II – 3/4	12.733	670	137	170
II – 5/6	12.733	670	136	170
III – 1/2	12.750	798	162	165
III – 3/4	12.750	798	166	165
III – 5/6	12.750	798	163	165

RESULTS: All specimens completed the tabulated test times without failure. Specimen Test I – 5/6 has been left on-test at 229 psi and has accumulated 361+ hours test time through the date of this report. A photograph of a representative specimen from each test group is shown as Photo 1.

Photo 1: Representative Specimens After Testing

Photo 1 shows, left to right, one tested specimen from Test III (PE100), Test I (PE3408), and Test II (PE2406) samples.

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