



GEORG FISCHER CENTRAL PLASTICS

ENGINEERING TEST REPORT

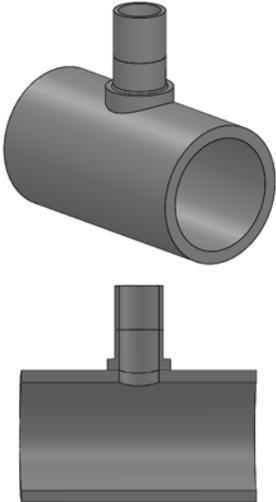
Subject:	12 IPS Butt Fusion Branch Saddle Reducing Tee Qualification
Prepared by:	JWright
Date:	7 September 2016
Requested By :	ENGINEERING

I. Introduction

12x8 IPS SDR, 12x6 IPS, 12x4 IPS, and 12x2 IPS Reducing tees were tested to ASTM D2513 requirements for fittings. These fitting designs incorporate branch saddles with reinforced cross-sectional areas where they are subject to stress intensifications due to geometry and point loads. The tees were subjected to long-term sustained pressure, short-term rupture test requirements, and impact tests to verify performance that meets or exceeds design requirements using unit stresses for high density polyethylene in including design factors of .32 and .4 for gas service.

II. Background

Sustained pressure and short-term rupture testing to the requirements of ASTM D2513-09a and ASTM D3261-12e1 was performed on the above fittings. The testing is required by CFR 49 Part 192 for qualification of the fitting design for distribution of natural gas. The fitting design incorporates a branch saddle outlet that is saddle fused to the 12 IPS main. The polyethylene has a cell classification of 445574C in accordance with ASTM D3350 and is listed in PPI TR-4 as PE4710. Pipe pups are butt fused to the outboard ends for operator use as well as testing. The testing is required by CFR 49 Part 192.191 for qualification of the fitting design for gas and pressure service.



Qualification of the fusion procedure to the requirements of CFR 49 Part 192.283 and the fusion operator to the requirements of CFR 49 Part 192.285 was completed through tests performed on these fittings.

III. Procedure

The pressure test assemblies were capped on the 12 IPS pipe ends and outlet pipes ends. Pressure and air purge ports were provided on the end caps to allow for pressurization and air escape.

As described under ASTM D2513 and D3261 the parts must be subjected to the following performance tests and methods:

ASTM D1598-15a - Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.

- Test assemblies were filled with water and conditioned in air to 73F. The assemblies were subjected to internal pressure test conditions as described in ASTM D2513. The test temperature was maintained at 73F (±3F) at an internal hoop stress of 1600 psi (320

psig) for the duration of the test. The minimum required time on test without failure is 1000 hours.

ASTM D1599-14e1 – Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings – Procedure B

- Test assemblies were filled with water and conditioned at 73F. The assemblies were subjected to uniformly increased pressure to achieve >580 psig internal pressure before 70 seconds elapsed. The minimum burst pressure required to pass the test was 580 psig. The maximum pressure achieved was recorded for each test assembly.

ASTM F905-04-2011 - Standard Practice for Qualification of Polyethylene Saddle-Fused Joints

- Pipe pups lengths equal to 5 times the outlet diameter were fused to the branch outlets.
- Test assemblies were positioned so that a falling weight impacted the center of the nipple length from axial and radial directions.
- An impact force of 500 ft. lbs. was used.

IV. Results

All fittings tested exceeded the minimum requirements without failure.

Test result: **PASS**

Report Approved:

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Appendices – Test Data, pages 3-6

**12 IPS SDR 11 x 8 IPS SDR 11
PE4710
Branch Saddle Reducing Tee**

**Sustained Pressure Test (ASTM D1598)
1600 psi Hoop Stress @ 73°F / 1000 Hours Minimum**

Quantity	SPECIMEN PRESSURE	TOTAL HOURS ON TEST	RESULT
3	320 PSIG	1,000*	PASS

*Test terminated without failure.

**Short Term Hydraulic Pressure Test (ASTM D1599)
2900 psi Hoop Stress Minimum Burst (464 psig)**

Quantity	SPECIMEN FAILURE	SPECIMEN PRESSURE	RESULT
5	12 IPS Pipe Section	589 psig at 70 seconds	PASS / 883 psig peak

Specimen consisted of 5 each reducing tees fused together in series with 60" long section of 12 IPS SDR 11 PE4710 pipe.

**Saddle Fusion Impact Test (ASTM F905)
≥500 ft. lb. Impact Force
8 IPS OUTLET CP201640**

SPECIMEN FAILURE	AXIAL IMPACT	RADIAL IMPACT	RESULT
None	500 ft. lb.	500 ft lb.	PASS

Test result: **PASS**

12 IPS SDR 11 x 6 IPS SDR 11

**PE4710
Branch Saddle Reducing Tee**

**Sustained Pressure Test (ASTM D1598)
1600 psi Hoop Stress @ 73°F / 1000 Hours Minimum**

Quantity	SPECIMEN PRESSURE	TOTAL HOURS ON TEST	RESULT
3	320 PSIG	1,000*	PASS

*Test terminated without failure.

**Short Term Hydraulic Pressure Test (ASTM D1599)
2900 psi Hoop Stress Minimum Burst (464 psig)**

Quantity	SPECIMEN FAILURE	SPECIMEN PRESSURE	RESULT
5	12 IPS Pipe Section	586 psig at 70 seconds	PASS / 877 psig peak

Specimen consisted of 5 each reducing tees fused together in series with 60" long section of 12 IPS SDR 11 PE4710 pipe.

**Saddle Fusion Impact Test (ASTM F905)
≥500 ft. lb. Impact Force
6 IPS OUTLET CP201641**

SPECIMEN FAILURE	AXIAL IMPACT	RADIAL IMPACT	RESULT
None	500 ft. lb.	500 ft lb.	PASS

Test result: **PASS**

12 IPS SDR 11 x 4 IPS SDR 11

**PE4710
Branch Saddle Reducing Tee**

**Sustained Pressure Test (ASTM D1598)
1600 psi Hoop Stress @ 73°F / 1000 Hours Minimum**

Quantity	SPECIMEN PRESSURE	TOTAL HOURS ON TEST	RESULT
3	320 PSIG	1,000*	PASS

*Test terminated without failure.

**Short Term Hydraulic Pressure Test (ASTM D1599)
2900 psi Hoop Stress Minimum Burst (464 psig)**

Quantity	SPECIMEN FAILURE	SPECIMEN PRESSURE	RESULT
5	12 IPS Pipe Section	590 psig at 70 seconds	PASS / 870 psig peak

Specimen consisted of 5 each reducing tees fused together in series with 60" long section of 12 IPS SDR 11 PE4710 pipe.

**Saddle Fusion Impact Test (ASTM F905)
≥500 ft. lb. Impact Force
4 IPS OUTLET CP201642**

SPECIMEN FAILURE	AXIAL IMPACT	RADIAL IMPACT	RESULT
Distortion of 4 IPS pipe*	500 ft. lb.	500 ft lb.	PASS

*No failure in fusion joint.

Test result: **PASS**

**12 IPS SDR 11 x 4 IPS SDR 11
PE4710
Branch Saddle Reducing Tee**

**Sustained Pressure Test (ASTM D1598)
1600 psi Hoop Stress @ 73°F / 1000 Hours Minimum**

Quantity	SPECIMEN PRESSURE	TOTAL HOURS ON TEST	RESULT
3	320 PSIG	1,000*	PASS

*Test terminated without failure.

**Short Term Hydraulic Pressure Test (ASTM D1599)
2900 psi Hoop Stress Minimum Burst (464 psig)**

Quantity	SPECIMEN FAILURE	SPECIMEN PRESSURE	RESULT
5	12 IPS Pipe Section	595 psig at 70 seconds	PASS / 855 psig peak

Specimen consisted of 5 each reducing tees fused together in series with 60" long section of 12 IPS SDR 11 PE4710 pipe.

**Saddle Fusion Impact Test (ASTM F905)
≥500 ft. lb. Impact Force
2 IPS OUTLET CP201642**

SPECIMEN FAILURE	AXIAL IMPACT	RADIAL IMPACT	RESULT
2 IPS outlet torn away*	500 ft. lb.	500 ft lb.	PASS

*No failure in fusion joint.

Test result: **PASS**