

INTERNAL and EXTERNAL PRESSURE and VACUUM TESTING

**Georg Fischer Harvel LLC
Fuseal and SeaDrain White**

Final Report – Revision 0

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Test Profiles Included:

24hr @ 87psi (~6bar) Pressure Test
Ramp to Failure Test
External Pressure Test (ASTM D2924-12)
24hr/72hr Fast-Lock Vacuum Test

Test Profile 1

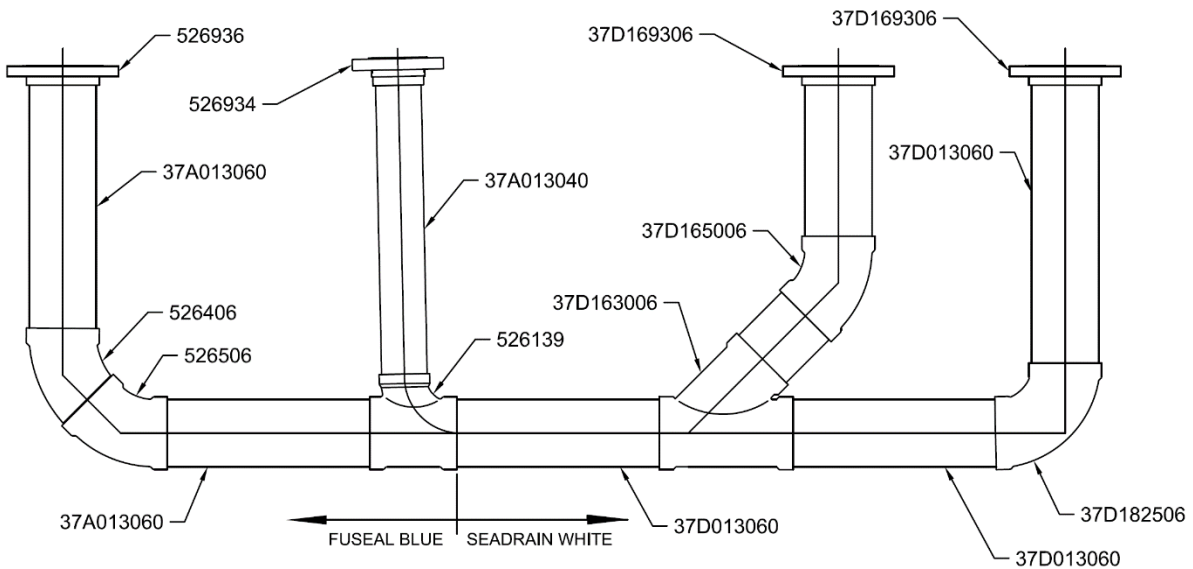
24hr @ 87psi (~6bar) PRESSURE TEST

Overview:

Georg Fischer Harvel performed a 24hr pressure test of a combined weldment of Fuseal and SeaDrain White utilizing electrofusion jointing technology. The pressure test set point was 87psi. For safety, the test weldment was not ramped to failure.

Design:

The weldment was manufactured per the following (actual picture below).



Pictured: 6" and 4" Test Weldment



Test Parameters:

Product Tested: 4" and 6" Fuseal and SeaDrain White
Test Description: 24hr Pressure Hold Test

Average Pressure: 89.98 psi (6.20 bar)
Min Pressure: 80.98 psi (5.58 bar)
Max Pressure: 98.99 psi (6.83 bar)
Ramp Time 71.00 sec

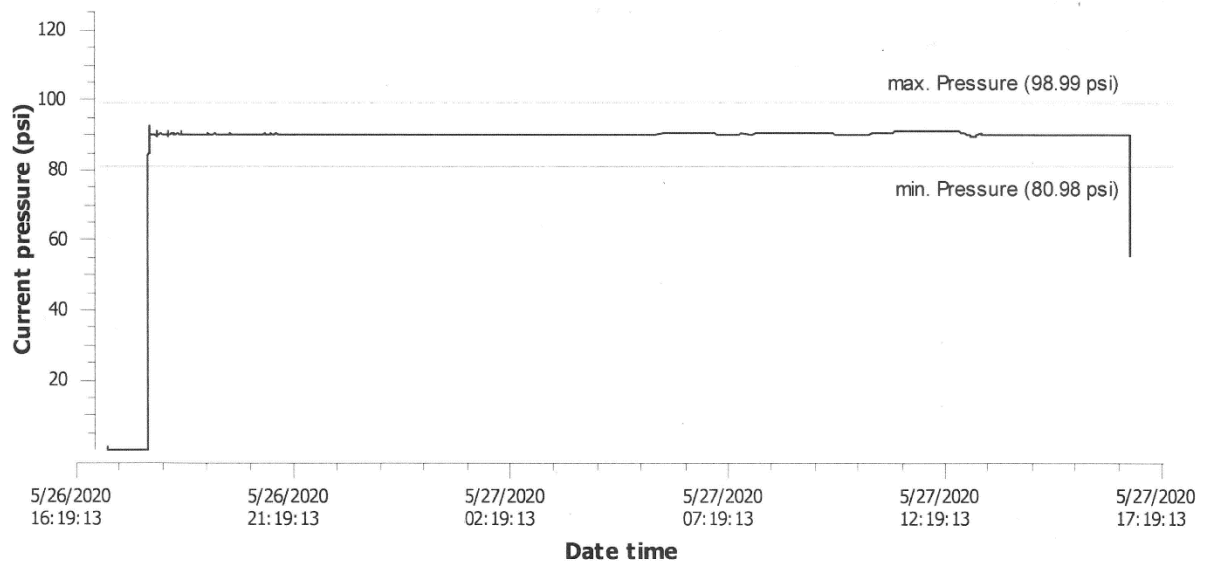
Test Temperature: 78.1°F (25.6°C)
Conditioning Time 1.00 hr.

Start Date: 5/26/2020 (16:19 central time) - includes 1hr Conditioning
End Date: 5/27/2020 (17:19 central time)

Success Criteria: 24hr Pressure Hold without Leak Failure

Graph Record of Data:

Record:



Result: Pass

Test Profile 2

RAMP TO FAILURE TEST

Overview:

Georg Fischer Harvel performed a ramp to failure test of all sizes 1½" (DN40), 2" (DN50), 2½" (DN65), 3" (DN80), 4" (DN100) and 6" (DN150) comparing the maximum performance of Fuseal electrofusion jointing to SeaDrain White electrofusion jointing.

Design:

Each weldment was constructed with 2 sections of pipe cut 12" (304.8mm) long and electrofused to either side of a coupling.

Test Parameters:

Test Temperature: 72.0°F (22.2°C)

Conditioning Time 1.00 hr.

Record of Data:

Size: in [bar]	Fuseal: psi [bar]	Failure Method:	SeaDrain White: psi [bar]	Failure Method:
1½" (DN40)	990 [68.3]	Pipe Failure	853 [58.8]	Coupling Failure
2" (DN50)	811 [55.9]	Coupling Failure	740 [51.0]	Coupling Failure
2½" (DN65)	N/A	N/A	850 [58.6]	Coupling Failure
3" (DN80)	617 [42.5]	Coupling Failure	712 [49.1]	Coupling Failure
4" (DN100)	325 [22.4]	Coupling Failure	433 [29.9]	Coupling Failure
6" (DN150)	246 [17.0]	Coupling Failure	252 [17.4]	Coupling Failure

Result: In some cases either product outperformed the other with a maximum of 30% variance in the largest sizes.

Test Profile 3

External Pressure Test (ASTM D2924-12)

Test Performed by Southwest Research Institute

(SwRI Project No. 18.18288.01.001)

Overview:

Georg Fischer Harvel contracted with SwRI to perform testing in accordance to ASTM D2924-12 (Reapproved 2017) on SeaDrain White sizes 1½" (DN40), 4" (DN100) and 6" (DN150).

Design:

The specimens were composed of pipes cut to a specific length (10 times the OD of the pipe) as dictated by the ASTM D2924... standard.

Test Parameters:

Product Tested: 1½" (DN40), 4" (DN100) and 6" (DN150) SeaDrain White Pipe
Test Description: ASTM D2924-12 (2017) External Pressure Resistance Test

Test Temperature: Ambient +/- 2°C
Conditioning Time 2.00 hr.

Record of Data:

Size: in [bar]	Average Collapse pressure: psi [bar]	Average Pipe OD: in [mm]	Min. Wall Thickness in [mm]	Compressive Failure Scaling Constant (C)
1½" (DN40)	418 [28.8]	1.90	0.15	2529
4" (DN100)	134 [9.2]	4.50	0.24	1218
6" (DN150)	77 [5.3]	6.63	0.28	885

3.0 times Safety Factor

Size: in [bar]	Average Collapse pressure: psi [bar]
1½" (DN40)	68.3 [9.6]
4" (DN100)	22.4 [3.1]
6" (DN150)	17 [1.8]

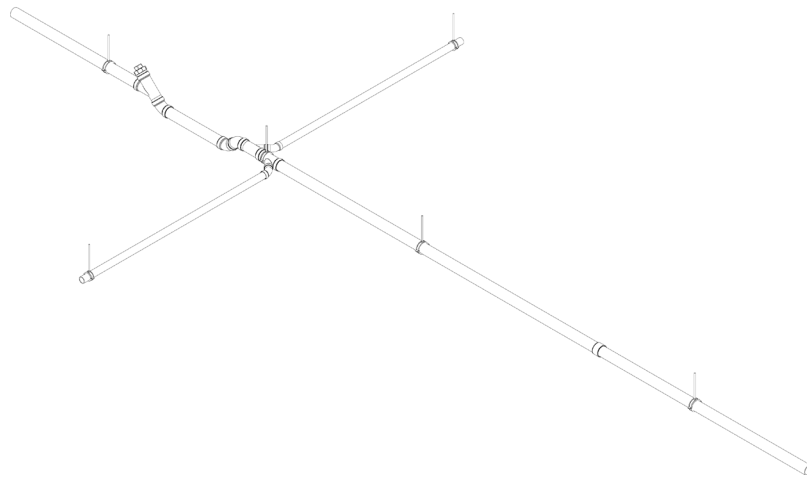
Test Profile 4

Fast-Lock Vacuum Test

Overview:

Georg Fischer Harvel performed a two stage vacuum leak test utilizing the fast-lock jointing technology. The first stage was a -10.44 psi (-0.72 bar / 21.3 "Hg) vacuum that was held for 24hrs. The second stage was a -14.5 psi (-1.0 bar / 29.5 "Hg) vacuum that was held for 72hrs.

Design:



The test spool was configured (as above) with a 2½" main that included (14) 2½" Fast-Lock joints and 1½" branches that included (6) 1½" Fast-Lock joints.

Test Parameters:

Product Tested: 2½" and 1½" Fast-Lock only (No Electrofusion) for full (29.5"Hg) and ship board (21.26"Hg) vacuum service.

Record of Data:

Test#	Date	Fast-Lock Torque	Vacuum Pressure	Time Held	Total Losses
1	Dec. 26, 2019	Visual (Nibs Touch)	-10.44 psi (-0.72 bar / 21.3"Hg)	24 hrs	None
2	Dec. 27, 2019	Visual (Nibs Touch)	-14.50 psi (-1.00 bar / 29.5"Hg)	72 hrs	+0.02 bar

Pass/Fail Limit:

Leak is limited to +0.2 psi/hr (+0.014 bar/hr)