



Manufacturer of Flexible Metal Hose and Gas Piping Products

Engineering Project Report - EPR2012-06

DoubleTrac UV Testing / Product Validation

1. INTRODUCTION:

Validate and verify the accelerated UV aging of DoubleTrac Piping.

2. SCOPE:

Complete 16,000 hours of accelerated UV aging and conduct crush tests and burst tests on the primary and secondary, and permeation resistance on the secondary of the DoubleTrac piping which is listed per Underwriters Laboratory UL 971A. As UL 971A does not include any testing for outdoor use, this testing will substantiate the use for outdoor environments.

Up to and including 14k hours will be tested at OmegaFlex for Primary and Secondary burst; remaining (3), 16k hour exposure samples, which represents worst case, will be sent to CSA for 3rd party evaluation of crush, primary and secondary burst, and permeation testing.

3. TESTING PROCEDURES:

3.1. UV Exposure Testing

UV Exposure Testing to be conducted at:

Trace Laboratories, Inc.
5 North Park Drive
Hunt Valley, MD 21030

QUV Exposure:

- Test of thirty (24) pieces of DoubleTrac piping
- Expose to QUV-A340 – Accelerated Weathering Procedure
- Irradiance = 0.85 W/M²/nm
- Dry continuous exposure
- Temperature 55° C
- Duration = 16,000 hours
- Mount samples so one side is exposed to UV continuously – opposite side will not be exposed to UV at all
- Remove three (3) samples every 2,000 hours



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3.2. Visual Inspection – Performed at OmegaFlex

Perform a visual inspection, specifically looking for any irregularities or discontinuities in the outer jacket.

3.3. Primary and secondary pressure testing up to 14k hour samples – Performed at OmegaFlex

Primary:

- Pneumatic test #1 Sample to 125 PSI and hold for 5 minutes (air- under water)
- Hydrostatic test #2 Sample to 650 psi and hold for 5 minutes, increasing the pressure until failure (water/air- out of water)
- Sample # 3 Retain

Secondary:

- Pneumatic test #1 Sample to 50 PSI and hold for 5 minutes (air- under water)
- Hydrostatic test #2 Sample to 250 psi and hold for 5 minutes, increasing the pressure until failure (water/air- out of water)
- Sample #3 Retain

3.4. Crush, Primary and Secondary Burst Testing, Permeation Testing 16k hour sample Performed at CSA

Primary and Secondary Burst, and Crush and Permeation Testing Performed at:

CSA GROUP
8501 East Pleasant Valley Road
Cleveland, Ohio 44131-5575

- Crush samples #1 and #2 OD to 40% of original OD. Leak Check primary and secondary.
- After crush test, burst test primary; sample #1.



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- After crush test, burst test secondary; sample #2.
- Permeation test sample #3.

4. Test results:

2,000 Hours Visual – All samples no discernable change in appearance.

2,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNUEMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNUEMATIC 5 MIN.	1221 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNUEMATIC 5 MIN.	50 PSI PNUEMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	620 PSI	GOOD BURST MIDDLE 90° FROM UV
Sample 3	Retain sample	Retain sample	Retain sample	Retain sample	Retain sample

4,000 Hours Visual Inspection – All samples no discernable change in appearance.

4,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
sample 1	125 PSI PNUEMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNUEMATIC 5 MIN.	1171 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNUEMATIC 5 MIN.	50 PSI PNUEMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	413 PSI	GOOD BURST MIDDLE 90° FROM UV
Sample 3	Retain Sample	Retain Sample	Retain Sample	Retain Sample	Retain Sample



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6,000 Hours Visual Inspection – All samples no discernable change in appearance.

6,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNEUMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN.	1183 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNEUMATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	411 PSI	GOOD BURST MIDDLE 180° FROM UV
Sample 3	Retain Sample	Retain Sample	Retain Sample	Retain Sample	Retain Sample

8,000 Hours Visual Inspection – All samples no discernable change in appearance.

8,000 Hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNEUMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN.	1195 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNEUMATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	485 PSI	GOOD BURST MIDDLE 180° FROM UV
Sample 3	Retain sample	Retain sample	Retain sample	Retain sample	Retain sample

10,000 Hours Visual Inspection – All samples no discernable change in appearance.

10,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNEUMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN.	1171 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNEUMATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	474 PSI	GOOD BURST MIDDLE 180° FROM UV
Sample 3	Retain Sample	Retain Sample	Retain Sample	Retain Sample	Retain Sample



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12,000 Hours Visual Inspection – All samples no discernable change in appearance.

12,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNEUMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN.	1183 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNEUMATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	443 PSI	GOOD BURST MIDDLE 90° FROM UV
Sample 3	Retain Sample	Retain Sample	Retain Sample	Retain Sample	Retain Sample

14,000 Hours Visual Inspection – All samples no discernable change in appearance.

14,000 hours	Primary Pressure Test	secondary Pressure Test	Primary Burst	Secondary Burst	NOTES
Sample 1	125 PSI PNEUMATIC 5 MIN. 625 PSI HYRDOSTATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN.	1181 PSI	N/A	GOOD BURST END Ripped OFF
Sample 2	125 PSI PNEUMATIC 5 MIN.	50 PSI PNEUMATIC 5 MIN. 250 PSI HYRDOSTATIC 5 MIN	N/A	575 PSI	GOOD BURST MIDDLE 90° FROM UV
Sample 3	Retain sample	Retain sample	Retain sample	Retain sample	Retain sample

16,000 Hours Visual Inspection – All samples no discernable change in appearance.

5. CONCLUSION:

The results of the testing to date confirms that the accelerated UV aging has not degraded the exterior of the DoubleTrac piping, nor has it effected the crush, pressure/burst values, and permeation resistance which substantiates the use for above ground and outdoor environments.



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6. CURRENT REVISION – Revision C

Revision Date: 11/2014

Written By: Randy Bayless
Manager of Sales Engineering
Industrial Division
OmegaFlex, Inc.

Approved By: Dean W. Rivest, P.E.
Vice-President & General Manager
Industrial Division
OmegaFlex, Inc.



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APPENDIX "A"

*Created 10-Dec-2012
Revision C – Jul-2013*

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OMEGAFLEX, INC., 451 Creamery Way, Exton, PA 19341-2509
Voice: 800-355-1039 or 610-524-7272 Fax: 610-524-7282 URL: www.omegaflex.com



CSA FINDINGS LETTER

Master Contract - Project Number: 188984-70009285

Date: October 15, 2014

Attention: Mr. Randy Bayless
Omega Flex, Inc.
451 Creamery Way
Exton, PA 19341 USA

Subject: Custom Testing, 1" DoubleTrac Containment Piping for Diesel, Gasoline, Biofuels and DEF.

Dear Mr. Bayless:

We have completed the evaluation of the 1" DoubleTrac Piping that you had submitted for evaluation to the OmegaFlex test plan. The three (3) test samples submitted to CSA group were previously tested for 16,000 hour QUV exposure (advanced aging). Validation is required to determine whether-or-not the exposure compromised or degraded the UV Stabilized Nylon 12 outer jacket.

This Findings Letter provides the results of this evaluation.

REQUIREMENTS

2. TESTING PROCEDURE:

2.1. Crush Resistance Test:

- 2.1.1. #1 & #2 1" DoubleTrac 16,000 hour samples will test in accordance with ASTM D 2412 Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading. The plate shall be 2" long and the width not less than pipe contact width at maximum pipe deflection. The Load is to be applied at the pipe center perpendicular to the axis at ½ inch per minute until conditions per 2.1.2 are met. After unloading the force, the #1 sample will be visually examined before being subjected to primary leakage testing. #2 sample will be visually examined before being subjected to secondary leakage test.
- 2.1.2. The load to obtain a 40 percent reduction of O.D. shall be held for one minute.
- 2.1.3. Leakage Test pressure is twice the pressure rating, and shall be held for 2 minutes and there shall be no leakage or any noncomplying damage while the sample is pressurized.
- 2.1.4. The samples shall not leak or show signs of noncomplying damage after applied force or when subjected to the leakage test.



2.2. Burst Test:

2.2.1. Burst test Primary:

2.2.1.1. Using #1 sample DoubleTrac 16,000 hour (1" DoubleTrac assembly) supplied by OmegaFlex pressurize the primary with air to a MAWP of 125 psig and hold for one minute. Increase pressure to 625 psig and hold for one minute. Increase pressure until primary of 1" DoubleTrac assembly burst.

2.2.2. Burst Test Secondary:

2.2.2.1. Using #2 sample DoubleTrac 16,000 hour (1" DoubleTrac assembly) supplied by OmegaFlex pressurize the secondary with air to a MAWP of 50 psig and hold for one minute. Increase pressure to 125 psig and hold for one minute. Increase pressure until secondary of 1" DoubleTrac assembly burst.

2.3. Permeation Testing:

2.3.1. Permeation values for permeation test samples

2.3.1.1. Motor vehicle fluids/high blend fuels

2.3.1.1.1. Max allowable permeation 4.0 g/m² per day (.079 Oz/ft²)

2.3.2. Using #3 sample DoubleTrac 16,000 hour (1" DoubleTrac assembly) supplied by OmegaFlex weigh the 1" DoubleTrac assembly and record weight.

2.3.3. The DoubleTrac 16,000 hours (1" DoubleTrac assembly) is to be filled to 80% capacities with diesel fuel and store at 80+/-5 F (27+/-3C) for 60days. Measure O.D. (D) & exposed length (L)

2.3.3.1. Fill interstitial space with Diesel fuel and weigh the 1" DoubleTrac assembly and record.

2.3.3.2. Hold filled 1" DoubleTrac assembly for 30 days and re-weigh and record results.

2.3.3.3. Hold filled 1" DoubleTrac assembly for 60 days and re-weigh and record results.

2.3.3.4. The collected time & weight data are to be used to calculate the permeation rate.

2.3.3.4.1. Surface Area = $\text{PI}(D)X(D/2+L)$

2.3.3.4.2. Permeation Rate= Max wt change/surface area /#of days

TEST RESULTS

Sample #1	2.1 Crush Resistance Test	<u>Satisfactory Results Obtained</u>
Sample #1	2.2 Burst Test Primary	<u>Satisfactory Results Obtained</u>
Sample #2	2.1 Crush Resistance Test	<u>Satisfactory Results Obtained</u>
Sample #2	2.2 Burst Test Secondary	<u>Satisfactory Results Obtained</u>
Sample #3	2.3 Permeation Testing	<u>Satisfactory Results Obtained</u>

Please reference the attached report for details pertaining to the test procedures conducted.



ATTENTION: The test results contained within the attached report cannot be utilized and/or promoted as CSA Group Certification to any Standards/Regulations.

If you have any questions, please feel free to contact me. Thank you for your continued business.

Best Regards,

John Kristoff-Kichka

John Kristoff-Kichka
Project Engineer/Certifier
CSA GROUP
8501 East Pleasant Valley Road
Cleveland, Ohio 44131-5575
Tel: (216) 524-4990 ext. 88224
Fax: (216) 642-3081
email: john.kristoff-kichka@csagroup.org



TRACE LABORATORIES, INC
5 North Park Drive
Hunt Valley, MD 21030 USA
Telephone: 410/584-9099 / Fax: 410/584-9117
Website: www.tracelabs.com / Email: info@tracelabs.com

TEST REPORT FOR:

OMEGAFLEX, INCORPORATED
451 Creamery Way
Exton, PA 19341

Attn: Randy Bayless

DATE IN:

July 12, 2011

P/O #:

148240

QUOTE IDENTIFICATION:

OmegaFlex110712a

SUBMISSION IDENTIFICATION:

Twenty-four (24) tube samples were submitted for QUV exposure.

APPROVED:

A handwritten signature in black ink, appearing to read "Keith M. Sellers".

Keith M. Sellers
Managing Scientist



ISO/IEC 17025



S/O 81925

QUV EXPOSURE

METHOD:

The samples were loaded into a QUV chamber set at the following parameters:

- Irradiance of 0.85 W/m²/nm
- Temperature of 55°C
- Exposure type – dry, continuous

The samples were loaded such that one (1) “side” of the tube saw continuous UV exposure. The opposite “side” of the tube saw no UV exposure.

Three (3) samples were removed from the chamber at every 2,000 hour interval and returned to Omegaflex, Inc.

Photographs #1 and #2, below, display representative overviews of the submitted tube samples as-received and within the chamber housing.



Photograph #1: Representative Overview of Submitted Tube Samples, As-received



Photograph #2: Representative Overview of Submitted Tube Samples Within Chamber Housing

RESULTS:

The samples were exposed for a total of 16,000 hours. At every 2,000 hour interval, three (3) samples were removed from the chamber and were returned to Omegaflex, Inc.

The final exposure was completed on July 27, 2013.



TRACE LABORATORIES, INC
5 North Park Drive
Hunt Valley, MD 21030 USA
Telephone: 410/584-9099 / Fax: 410/584-9117
Website: www.tracelabs.com / Email: info@tracelabs.com

Trace Laboratories, Inc. certifies that the test equipment used complies with the calibration test purposes of ISO 10012-1, ANSI/NCSL Z540-1-1994, and MIL-STD-45662A and that the data contained in this report is accurate within the tolerance limitation of this equipment.

All test procedures detailed within this report are complete. The results in this report relate only to those items tested. If any additional information or clarification of this report is required, please contact us. This test report shall not be reproduced except in full, without the written approval of Trace Laboratories, Inc.

Thank you for selecting Trace Laboratories, Inc. for your testing purposes.

PERFORMED BY:

A handwritten signature in blue ink, appearing to read "Daniel D. Phillips", written over a horizontal line.

Daniel D. Phillips
Engineer

ATTACHMENTS: one (1) Equipment Used list

SAMPLE DISPOSITION: samples returned to Omegaflex, Inc.

DATE COMPLETED: July 29, 2013



ISO/IEC 17025



S/O 81925



TRACE LABORATORIES, INC
5 North Park Drive
Hunt Valley, MD 21030 USA
Telephone: 410/584-9099 / Fax: 410/584-9117
Website: www.tracelabs.com / Email: info@tracelabs.com

EQUIPMENT USED

Trace ID	Manufacturer	Equipment Name	Serial/Model Number	Calibration Date	Calibration Due Date
CH-25	Q-Lab	UV Chamber	11-1352-78- SPRAY/ QUV/SPRAY	Every 500 Hours	Every 500 Hours



ISO/IEC 17025



S/O 81925



SPECIFICATION DATA SHEET

DOUBLETRAC PIPING MATERIALS

PRIMARY PIPE: ASTM A240 316 Series Stainless Steel
 OUTER JACKET: Nylon 12; Resistant to hydrocarbons, chemical and water exposure, UV
 Stabilized for above ground and marina use
 SECONDARY BARRIER: EFEP; Permeation resistance

DOUBLETRAC FITTING MATERIAL

MECHANICAL JOINT FITTING: Alloy 360 Brass or Stainless Steel Fitting
 NOTE: Fitting to piping joint shall provide a metal-to-metal seal; no gaskets permitted
 NOTE: All fittings meet Salt Spray Test requirements of ASTM B-117-90;
 NOTE: UL 971A listed file number MH 45578, titled Integral Primary/Secondary for all Fuels

PRESSURE RATINGS

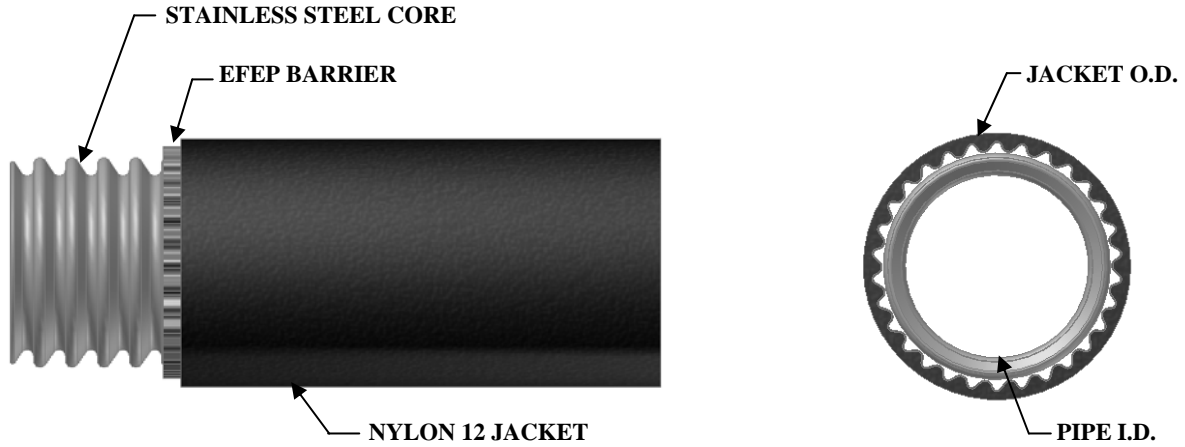
	1"	1-1/2"	2"
PRIMARY MAX OPERATING PRESSURE:	125 PSIG	100 PSIG	75 PSIG
SECONDARY MAX OPERATING PRESSURE:	50 PSIG	50 PSIG	50 PSIG

TEMPERATURE LIMITS

PRIMARY PIPE:	Melting Point:	2400 deg. F
	Maximum Operating Temp: (Less Jacket)	400 deg. F
JACKET:	Melting Point:	350 deg. F
	Maximum Operating Temp:	-20 deg. F to 120 deg. F

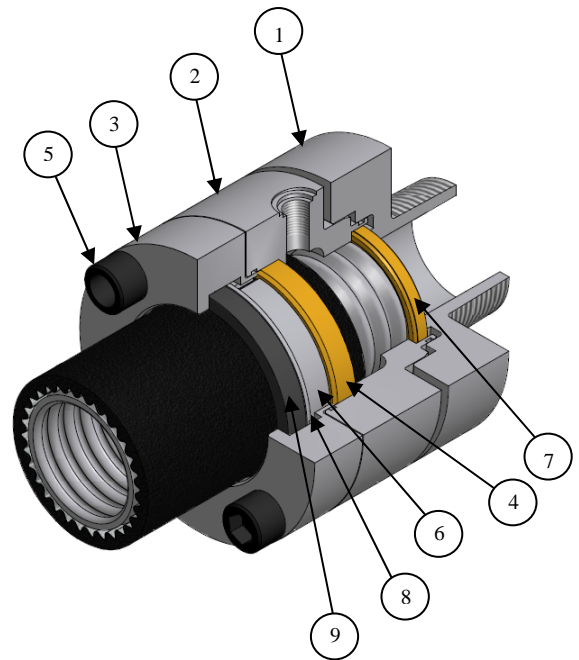
ACCESSORIES

<u>ITEM</u>	<u>DESCRIPTION</u>
BY-PASS TUBING:	FUEL GRADE PVC TUBING
SCHRADER VALVES:	BRASS SCHRADER VALVE
TUBING CUTTERS	(1", 1-1/2", 2"); AND REPLACEMENT WHEELS
LEAK DETECTION	NON- CORROSIVE LEAK TEST SOLUTION



PART #	UGF-FSP-16	UGF-FSP-24	UGF-FSP-32
SIZE (Inch)	1"	1-1/2"	2"
JACKET O.D. (Nom)	1.550"	2.300"	2.925"
INSIDE DIAMETER (Nom)	1.060"	1.525"	2.060"
MINIMUM BEND RADIUS	12"	24"	32"
WEIGHT / FT (lbs)	0.75	1.50	2.00

#	DESCRIPTION
1	NPT ADAPTOR END - BRASS OR SST
2	MAIN BODY - BRASS OR SST
3	REAR BODY - BRASS OR SST
4	JACKET LOCK - BRASS
5	CAP SCREW - HIGH ALLOY STEEL
6	REAR SLEEVE - BRASS OR SST
7	SPLIT RING SET - BRASS OR SST
8	RETAINING RING - SST
9	REAR SEAL - VITON®





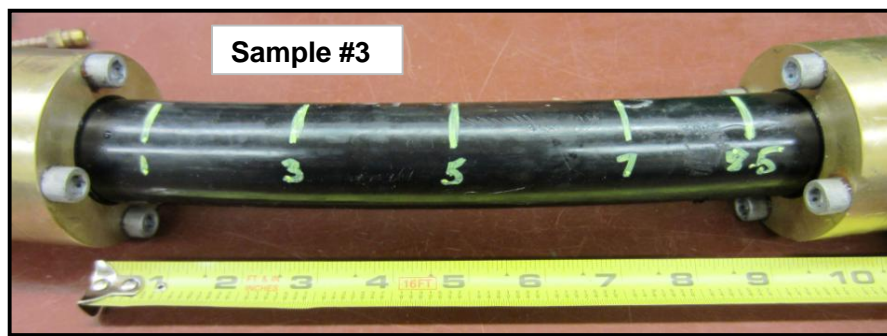
Permeation Testing

Model #UGF-FSP-16

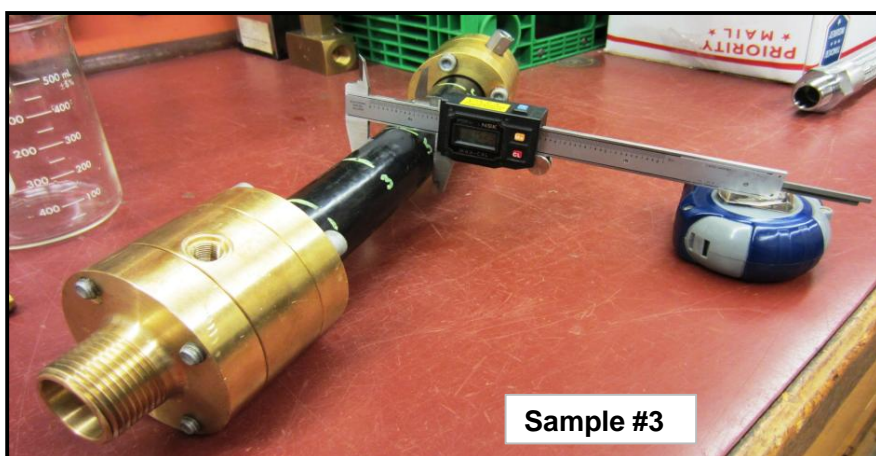
Validate that DoubleTrac 16,000 hour QUV exposure (advanced aging) did not compromise or degrade the UV Stabilized Nylon 12 outer jacket of DoubleTrac.

Length of exposed UV stabilized nylon "black" outer jacket	(inches)	(feet)
	9.5	0.79

Outside Diameter measured at the following locations before adding test fluid to the interstitial space (from left to right):



Location (inches)	Start (inches)	After 30 days (inches)	After 60 days (inches)	Test Temperature Maintained Throughout The Test 80°F (+/- 5°F)
1	1.521	1.525	1.529	
3	1.526	1.530	1.527	
5	1.525	1.535	1.520	
7	1.522	1.527	1.521	
8.5	1.525	1.525	1.526	
Average	1.524	1.528	1.525	
	8/6/2014	9/4/2014	10/3/2014	
Average	0.13	0.13	0.13	feet



EFEP Secondary Barrier Jacket

Interstitial space capacity at 100%	50 mL	tap water & glass beaker used to determine capacity
Interstitial space capacity at 80%	40 mL	calculated

	Start (lbs.)	After 30 days (lbs.)	After 60 days (lbs.)	Test Temperature Maintained Throughout The Test 80°F (+/- 5°F)
Weight empty with fittings attached	8.02			
Weight filled (diesel oil) with fittings attached	8.08	8.08	8.08	
	8/6/2014	9/4/2014	10/3/2014	
Max. Weight Change (lbs.)		0.00	0.00	
Max. Weight Change (grams)		0.00	0.00	
Max. Weight Change (Oz)		0.00	0.00	

Equipment Used:

Item	CSA #	Cal.	Cal. Due
Digital Calipers	D-3	1/22/2014	1/22/2016
Bench Scale	WL-52	11/18/2013	11/18/2014
Glass Beaker	n/a	0 to 140 mL	
Rotella T	SAE 15W-40 Heavy Duty Diesel Engine Oil		
Digital Calipers	D-133	12/18/2013	12/18/2015



Surface Area = $\pi(D)(D/2+L)$ **0.34** ft²

Permeation Rate = $\frac{\text{Maximum Weight Change}}{\text{Surface Area} / \# \text{ of Days}}$ **0.000000** Oz/ft²/day

Max allowable permeation 4.0 g/m² per day (.079 Oz/ft²)

RESULTS: Satisfactory

Signature: John Kristoff-Kichka

Title: Project Engineer



Crush Resistance Test

Model #UGF-FSP-16

Validate that DoubleTrac 16,000 hour QUV exposure (advanced aging) did not compromise or degrade the UV Stabilized Nylon 12 outer jacket of DoubleTrac.

In Accordance With **ASTM D 2412-11** Standard Test Method For Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

1 Scope

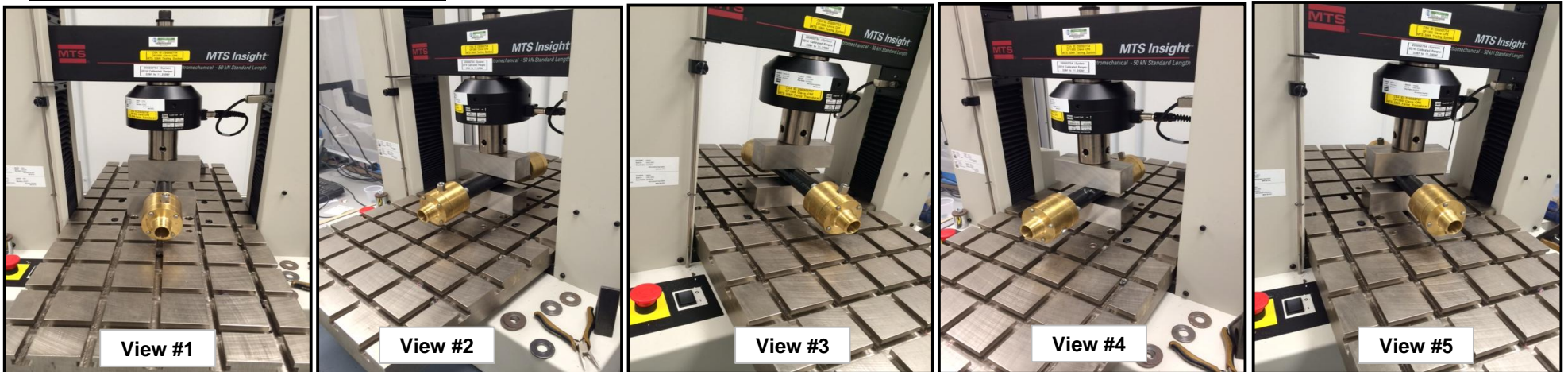
- 1.1 This test method covers the determination of load-deflection characteristics of plastic pipe under parallel-plate loading.
- 1.2 This test method covers thermoplastic resin pipe, reinforced thermosetting resin pipe (RTRP), and reinforced polymer mortar pipe (RPMP).
- 1.3 The characteristics determined by this test method are pipe stiffness, stiffness factor, and load at specific deflections.

4 Summary of Test Method

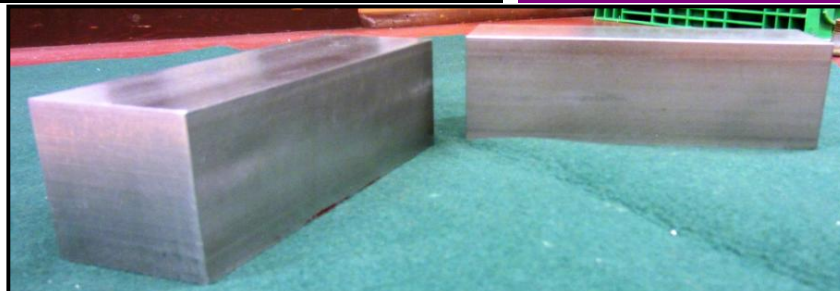
A short length of pipe is loaded between two (2) rigid parallel plates at a controlled rate of approach to one another. Load-deflection (of the pipe diameter) data are obtained. If cracking, crazing, delamination, or rupture occurs, the corresponding load and deflection are recorded.

6 Apparatus

- 6.1 **Testing Machine** - A properly calibrated compression testing machine of the constant-rate-of-crosshead movement type meeting the requirements of Test Method D695 shall be used to make the tests. The rate of head approach shall be 0.50 +/- 0.02 in. (12.5 +/- 0.5 mm)/minute.



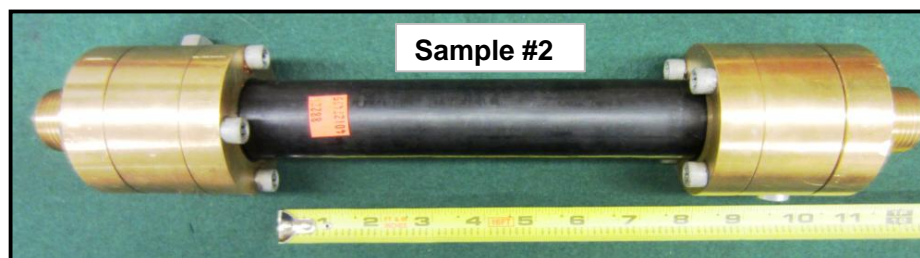
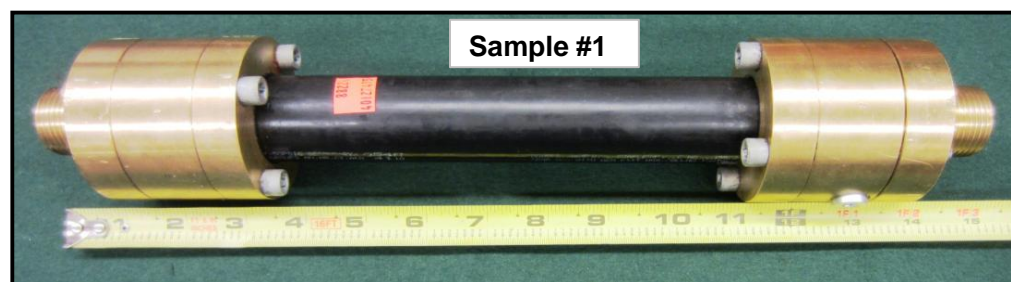
- 6.2 **Loading Plates** - The load shall be applied to the specimen through two (2) parallel steel bearing plates. The plates shall be flat, smooth, and clean. The thickness of the plates shall be sufficient so that no bending or deformation occurs during the test, but it shall not be less than 0.25 in. (6.0 mm). The plate length shall be equal or exceed the specimen length and the plate width shall be not be less than the pipe contact width at maximum pipe deflection plus 6.0 in. (150 mm). *Plates are 2" x 2" x 6", Type 316 S.S.*



- 6.3 **Deformation (Deflection) Indicator** - The change in inside diameter, or deformation parallel to the direction of loading, shall be measured with a suitable instrument meeting the requirements of Test Method D695, except that the instrument shall be accurate to the nearest 0.010 in. (0.25 mm). The instrument shall not support the pipe test specimen or the plate or affect in any way the load deflection measurements. Changes in diameter are measured during loading by continuously recording plate travel or by periodically computing it.

7 Test Specimens

Samples 1 & 2 - 1" DoubleTrac Assemblies with Brass End Fittings.



8 Conditioning

Following 16,000 hour QUV exposure (advanced aging)
 Test samples #1 and #2 maintained at room temperature 72°F (+/- 2°F) and 48% relative humidity.

9 Procedure

Determine:	Size	Tube Length	Wall Thickness	Avg. Inside Dia.	Avg. Outside Dia.	Weight (Lbs.)
Sample #1	1"	8.5"	0.490"	1.060"	1.550"	7.98
Sample #2	1"	7.5"	0.490"	1.060"	1.550"	7.94

No End Fittings Calculated: (Outside Dia. - Inside Dia.)

W/End Fittings



The Load is to be applied at the pipe center perpendicular to the axis at 1/2 inch per minute until a 40% reduction of O.D.

Loading The Force

Determine:	Size	40% Reduction	Test Time	Visual Examination After Unloading The Force
Sample #1	1"	YES	1 minute	Satisfactory Results - Reference Photographs Below!
Sample #2	1"	YES	1 minute	Satisfactory Results - Reference Photographs Below!

Un-Loading The Force

Determine:	Size	Pressure Rating	Twice the Rating	Test Time	Leakage	Non-Complying Damage
Sample #1	1"	125 psig/50 psig	250 psig/100 psig	2 minutes	0 / 0	No Damage to Report
Sample #2	1"	125 psig/50 psig	250 psig/100 psig	2 minutes	0 / 0	No Damage to Report

Nitrogen Gas Used

Photographs After Crush Resistance Test



Test Equipment Used: MTS Electromechanical Test Fixture, CSA#Z00002754, Calibrated On 3/5/2014, Due On 3/5/2015.

Burst Test

Model #UGF-FSP-16

Validate that DoubleTrac 16,000 hour QUV exposure (advanced aging) did not compromise or degrade the UV Stabilized Nylon 12 outer jacket of DoubleTrac.

Tested Using: WATER, OIL

Burst Test Primary:

Determine:	Size	Test Pressure	Test Time	Increase Test Pressure	Test Time
Sample #1	1"	125 psig	1 minute	625 psig	1 minute

RESULTS: Satisfactory - No Damage or Leakage Observed

Determine:	Size	Increase Test Pressure until the primary 1" DoubleTrac assembly bursts.
Sample #1	1"	Test Pressure at Burst:

RESULTS: BURST at 1,403 PSI (Leakage Observed From The Secondary Barrier Fill Fitting).

Burst Test Secondary:

Determine:	Size	Test Pressure	Test Time	Increase Test Pressure	Test Time
Sample #2	1"	50 psig	1 minute	125 psig	1 minute

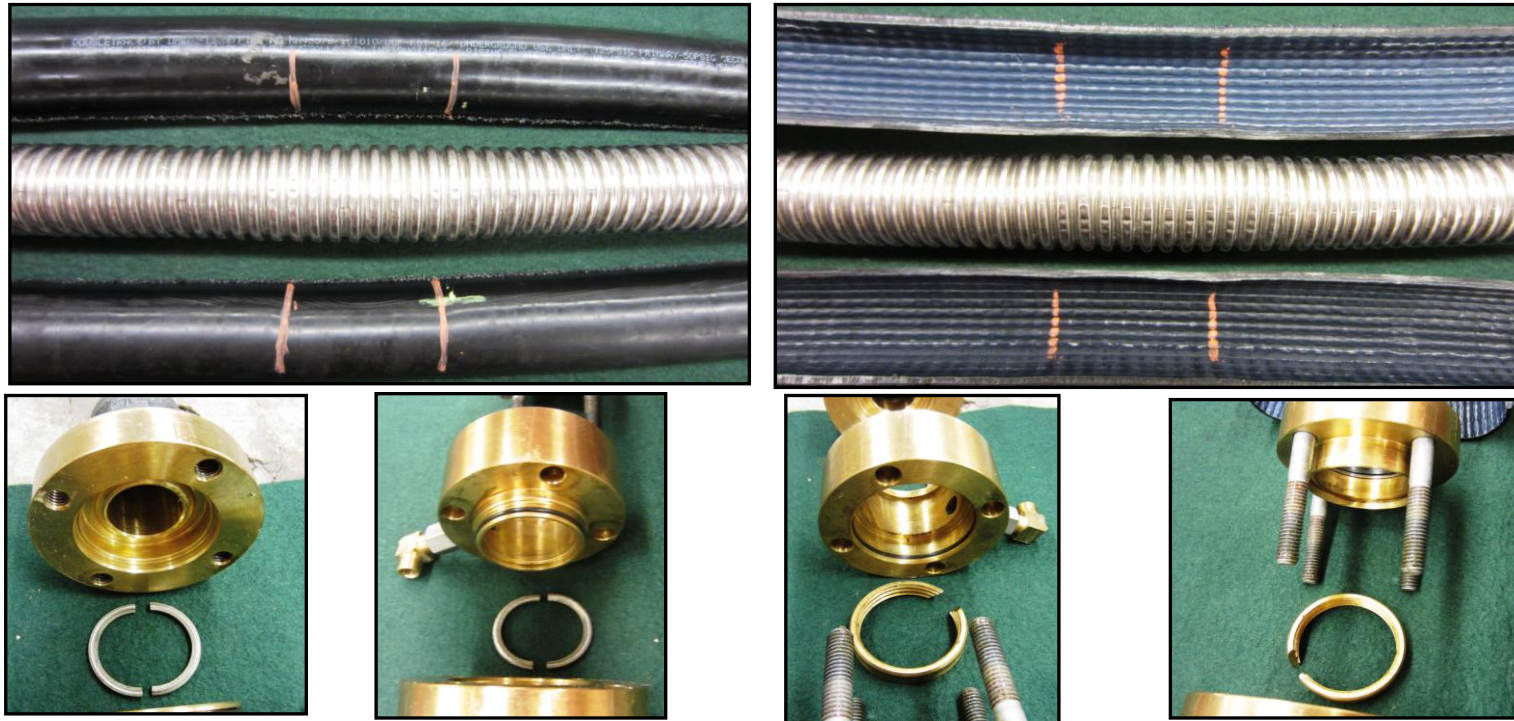
RESULTS: Satisfactory - No Damage or Leakage Observed

Determine:	Size	Increase Test Pressure until the secondary 1" DoubleTrac assembly bursts.
Sample #2	1"	Test Pressure at Burst:

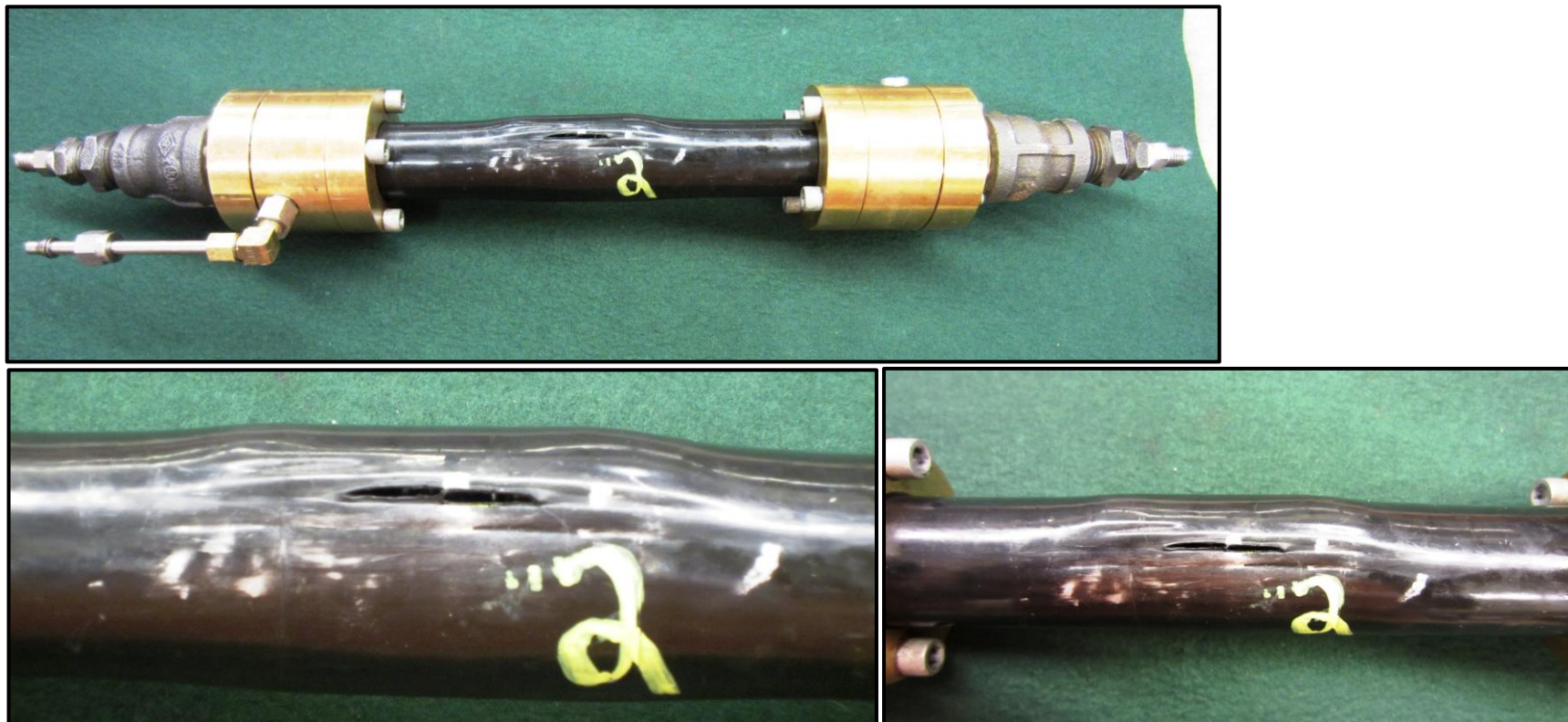
RESULTS: BURST at 494 PSI (Leakage Observed From The Outer Jacket)

Photographs After Burst & Crush Test - Sample #1 (Primary Pipe)





Photographs After Burst & Crush Test - Sample #2 (Secondary Barrier Jacket)



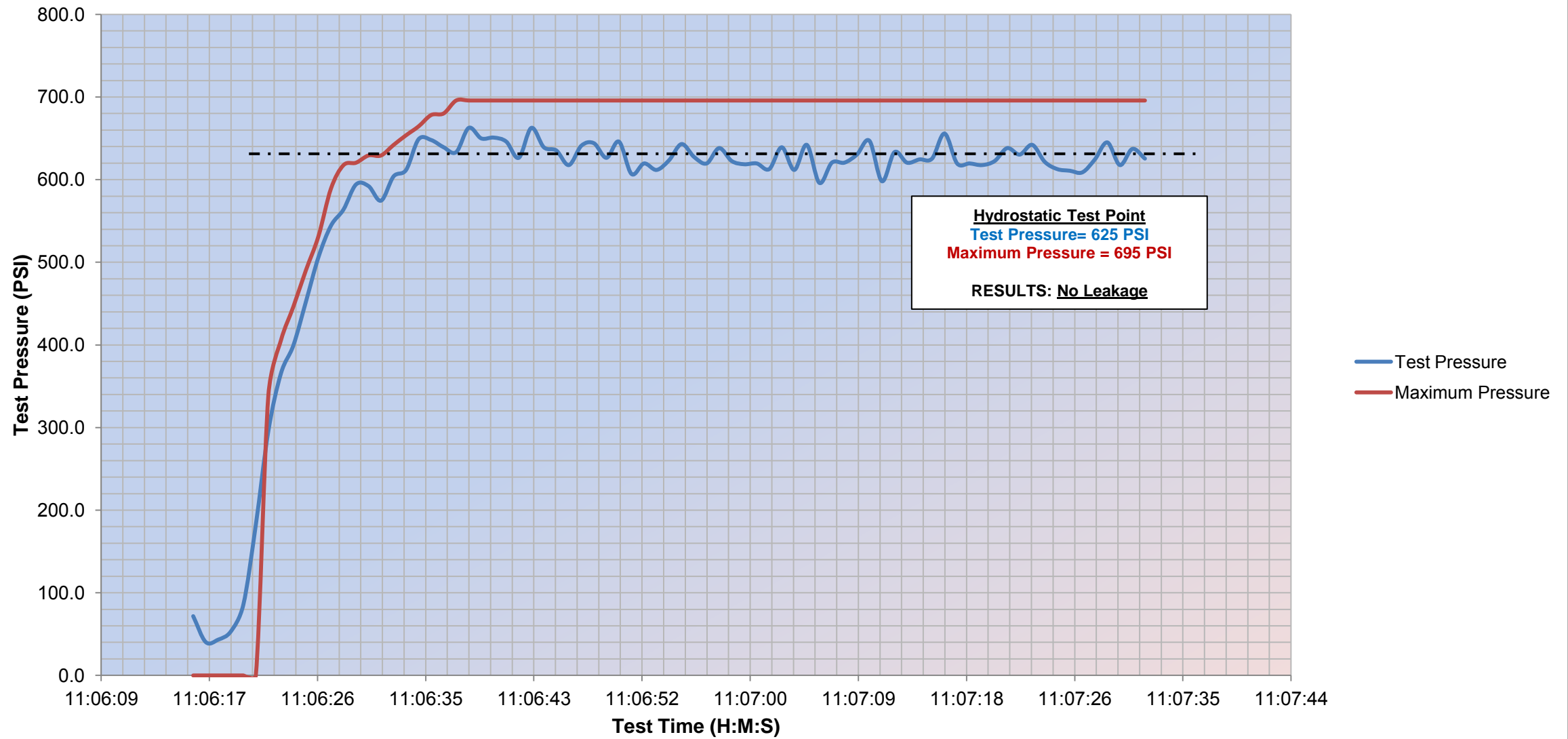
Test Equipment Used: Hydro-Pac Test Fixture, CSA#Z00001141, Calibrated On 2/20/2014, Due On 2/20/2015.
Pressure Test Gauge, CSA#PG-74, Calibrated On 3/26/2014, Due On 3/26/2015

Signature: John Kristoff-Kichka

Title: Project Engineer

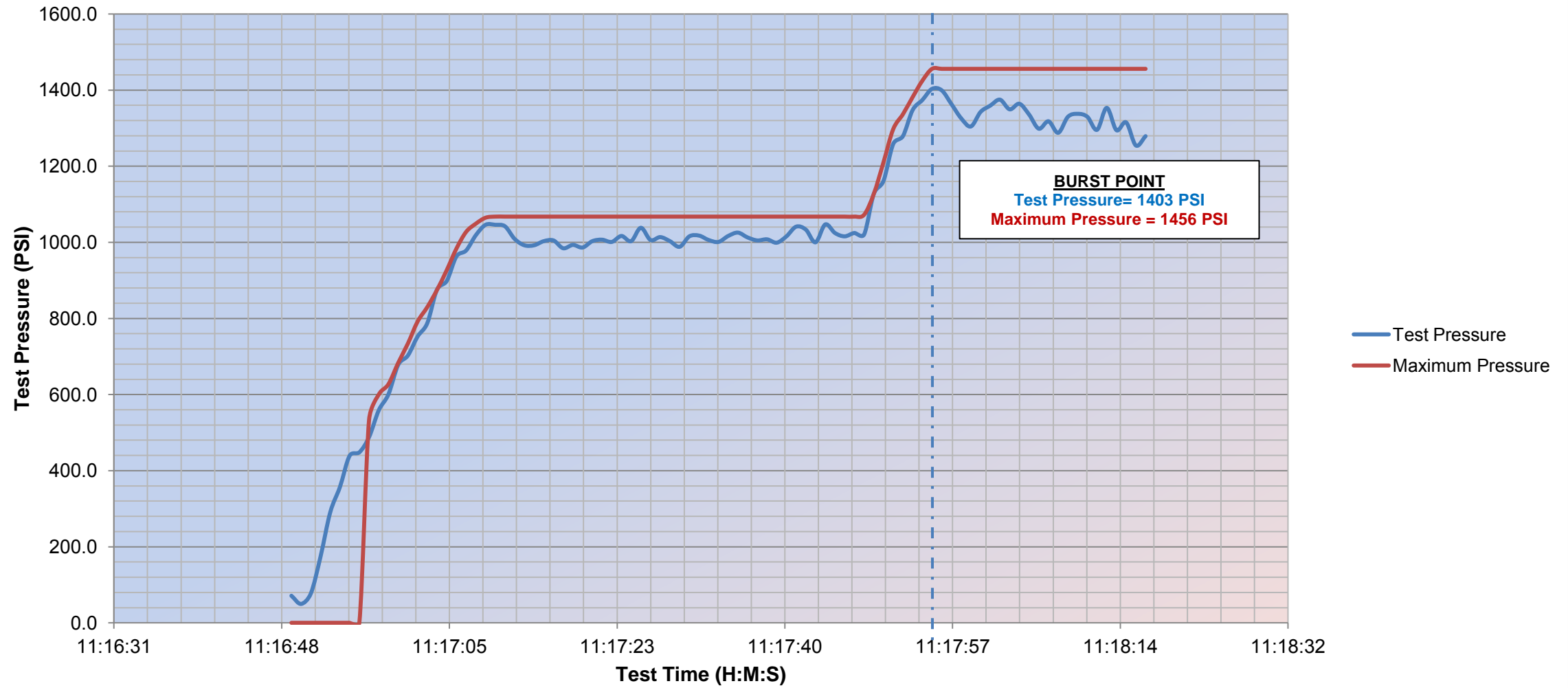


Test Sample #1 - Hydrostatic Test Primary



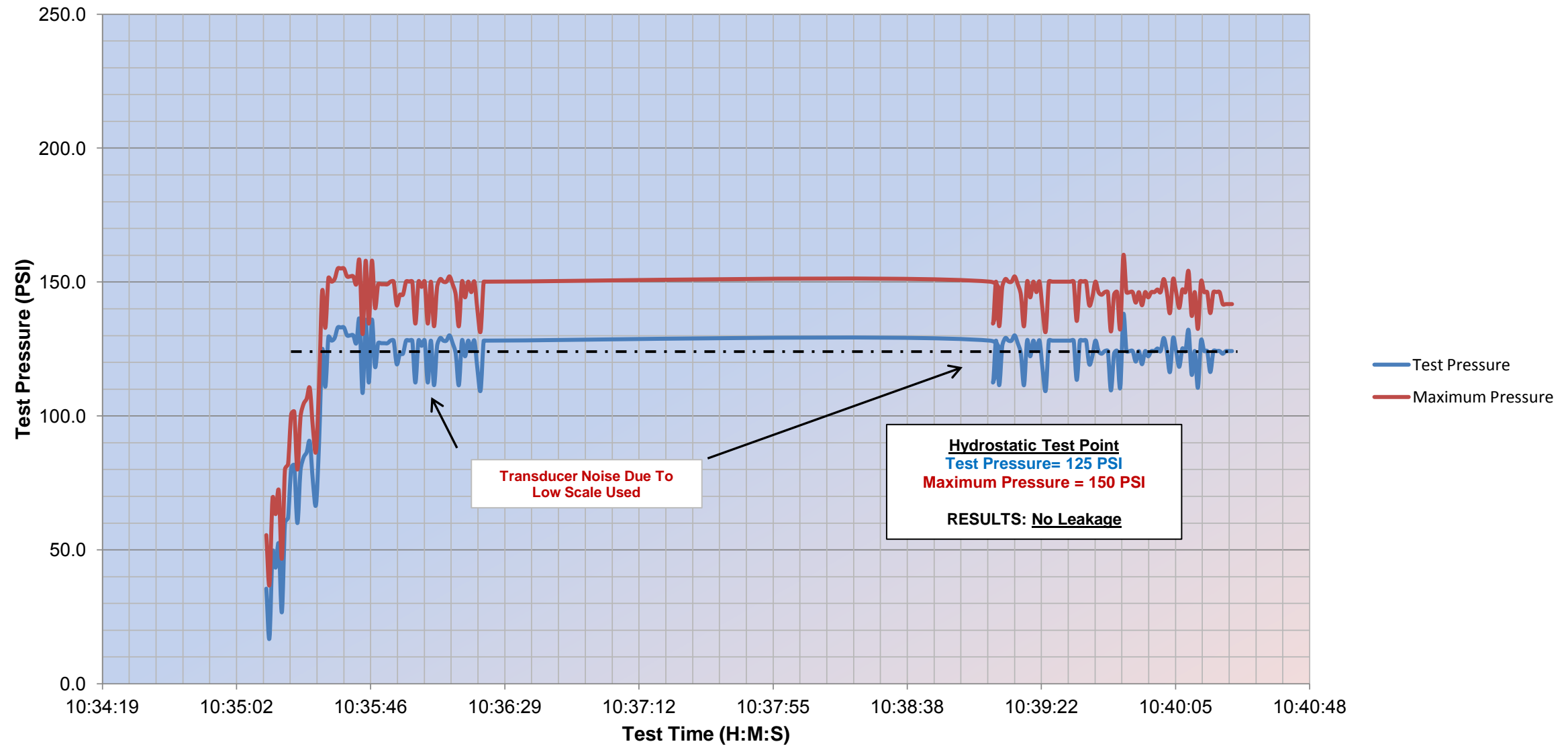


Test Sample #1 - Burst Test Primary





Test Sample #2 - Hydrostatic Test Secondary





Test Sample #2 - Burst Test Secondary

