

PROJECT 09-3795
FINAL REPORT

**Determination of the
Long-Term Hydrostatic
Strength of a 4" PVC Pipe
Sample**



February 22, 2010

Executive Summary

The purpose of this project was to determine the Long-Term Hydrostatic Strength (LTHS) of a 4" PVC pipe sample at 73°F.

Testing was performed on the following samples:

Jana Sample ID	Description	Print Line
09-579	4" x 30" long blue pipe	JM MANUFACTURING 4" IPS PVC1120 200PSI 2/1SF NSF-pw ASTM D2241 JM90 2006 JUNE 4 01 WH
09-697		

A summary of the test results is provided in Table 1.

Table 1: Summary of Test Results

Test Description	Test Hours	LTHS (psi)	Target Minimum LTHS (psi)	LCL Ratio (%)	HDB (psi)	Target HDB (psi)	Exp. Data Level
E-2 at 73°F	2,012	4,410	3,830	87	4,000	4,000	E-2

LTHS: Long-Term Hydrostatic Strength; LCL: Lower Confidence Limit; HDB: Hydrostatic Design Basis; Exp.: Experimental

Based on the testing performed in this project, the following conclusion is made:

- The 4" PVC pipe sample meets the target 73°F HDB category of 4,000 psi at the E-2 level.

Report No.: Project 09-3795 – Final Report

Client: JM Eagle
5200 West Century Blvd
Los Angeles, CA 90045
U.S.A.

Date of Issue: February 22, 2010

1.0 Purpose of Test

The purpose of this project was to determine the Long-Term Hydrostatic Strength (LTHS) of a 4" PVC pipe sample at 73°F.

2.0 Test Item Identification and Description

The following samples, as shown in Table 2, were provided by the Client. No further detail of the samples was provided. The samples were received under two different Sample IDs as they were received on different dates. The samples are used interchangeably.

Table 2: Sample Description

Jana Sample ID	Description	Print Line
09-579	4" x 30" long blue pipe	JM MANUFACTURING 4" IPS PVC1120 200PSI 2/1SF NSF-pw ASTM D2241 JM90 2006 JUNE 4 01 WH
09-697		

3.0 Test Methods

The Long-Term Hydrostatic Strength test at 73°F was performed in accordance with ASTM D2837-08, using the method described in ASTM D1598-02(2009). Definitions of Experimental Grade Levels (E-levels) are per PPI TR-3(2008).

This test is covered by Jana's ISO 17025 scope of accreditation (I.A.S. TL-256).

4.0 Test Results

A summary of the test results is provided in Table 3. Detailed test results are provided in Appendix A.

Table 3: Summary of Test Results

Test Description	Test Hours	LTHS (psi)	Target Minimum LTHS (psi)	LCL Ratio (%)	HDB (psi)	Target HDB (psi)	Exp. Data Level
E-2 at 73°F	2,012	4,410	3,830	87	4,000	4,000	E-2

LTHS: Long-Term Hydrostatic Strength; LCL: Lower Confidence Limit; HDB: Hydrostatic Design Basis; Exp.: Experimental

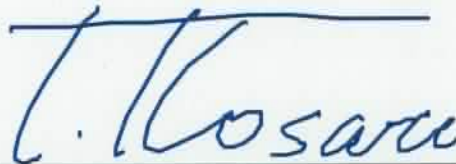
5.0 Conclusion

Based on the testing performed in this project, the following conclusion is made:

- The 4" PVC pipe sample meets the target 73°F HDB category of 4,000 psi at the E-2 level.

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Issued by



Tony Kosari, M.Sc.
Project Team Leader

Reviewed by



Sarah Chung, M.A.Sc., P.Eng.
Senior Project Leader



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Appendix A

Test Details

ASTM D1598 / ASTM D2837

E-2 Test at 73°F

1. Sample ID: 09-579 & 09-697
2. Nominal Size: 4"
3. Temperature of Test: $73 \pm 3.6^{\circ}\text{F}$ ($23 \pm 2^{\circ}\text{C}$)
4. Regression Parameters:
 - 100,000-hour **LTHS**: 4,410 psi
 - **50-year** strength value: 4,310 psi
 - The log-log regression **equation**:
Log Failure Time (h) = $245.123 + (-65.885) \times \text{Log Stress (psi)}$
 - **95% LCL** of $f(100,000)$: 3,840 psi
 - **LCL Ratio**: 87%
5. Estimated **HDB** Category: 4,000 psi
6. Conditioning time at the test temperature: A minimum of 1 hour
7. Type of end caps: Free end
8. Sample length between end caps: A minimum of 12"
9. The test environment inside/outside the specimen: Water/Water
10. Additional Information:
 - Number of Lots: 1
 - Number of Extrusions: 1
 - Creep is not the controlling factor

11. Test Supervisor: Tony Kosari

12. Time-to-Failure/Stress Data:

Specimen ID	Test Pressure (psig)	OD _{Avg} (inch)	t _{Avg} (inch)	t _{Min} (inch)	Start YY.MM.DD	End YY.MM.DD	Stress (psi)	Total Hours	Status of Specimen
09-697-16	379	4.498	0.189	0.175	09-11-25	10-02-17	4,693	2,012.00	Non-Failure
09-697-17	366	4.500	0.186	0.171	09-11-25	10-02-14	4,643	1,932.25	Ductile
09-579-03	394	4.497	0.191	0.177	09-12-08	10-01-16	4,794	927.35	Ductile
09-697-12	382	4.499	0.184	0.170	09-11-17	09-12-18	4,875	743.07	Ductile
09-697-13	397	4.499	0.190	0.176	09-11-17	09-12-18	4,877	742.57	Ductile
09-579-10	395	4.499	0.189	0.176	09-12-08	09-12-23	4,865	367.02	Ductile
09-579-01	388	4.499	0.182	0.175	09-12-08	09-12-18	4,793	229.92	Ductile
09-697-06	401	4.500	0.188	0.181	09-10-15	09-10-22	4,788	169.32	Ductile
09-697-07	405	4.500	0.187	0.180	09-10-15	09-10-22	4,866	86.12	Ductile
09-579-02	416	4.499	0.188	0.184	09-12-08	09-12-10	4,866	56.20	Shatter
09-697-05	406	4.499	0.187	0.175	09-10-15	09-10-19	5,014	5.50	Ductile

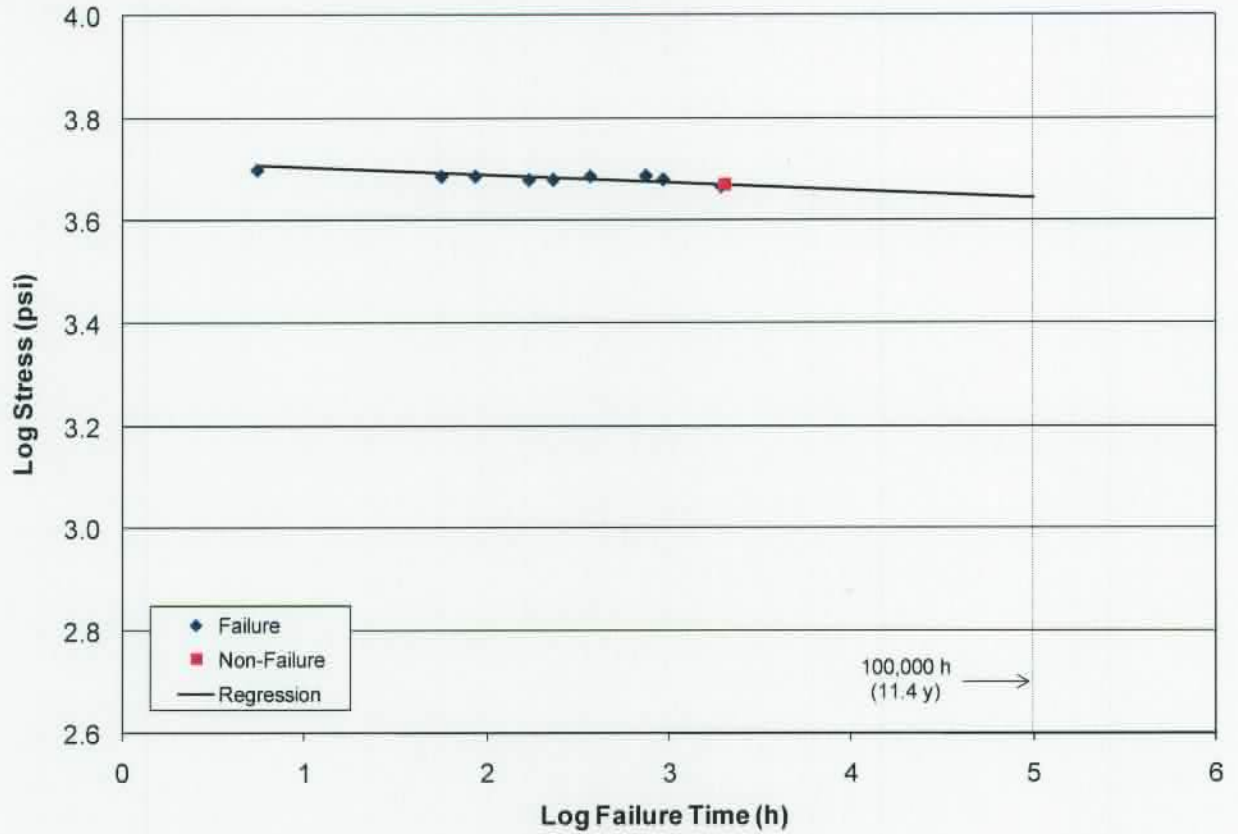
13. Additional specimens not used in regression:

Specimen ID	Test Pressure (psig)	OD _{Avg} (inch)	t _{Avg} (inch)	t _{Min} (inch)	Start YY.MM.DD	End YY.MM.DD	Stress (psi)	Total Hours	Status of Specimen
09-697-03	365	4.496	0.192	0.177	09-10-15	10-02-17	4,450	2,997.00	Terminated
09-697-02	368	4.497	0.195	0.176	09-10-15	10-02-17	4,515	2,997.00	Terminated
09-697-04	378	4.498	0.190	0.178	09-10-15	10-02-17	4,596	2,995.77	Terminated
09-697-08	349	4.498	0.186	0.173	09-10-15	10-02-17	4,369	2,995.48	Terminated
09-697-10	351	4.498	0.191	0.171	09-10-19	10-02-17	4,434	2,898.00	Terminated
09-697-11	351	4.499	0.184	0.171	09-10-22	10-02-17	4,432	2,829.00	Terminated
09-697-15	371	4.498	0.185	0.173	09-11-25	10-02-17	4,635	2,012.00	Terminated
09-697-14	364	4.500	0.183	0.170	09-11-25	10-02-17	4,644	2,012.00	Terminated

Legend: OD_{Avg} = Average Outside Diameter; t_{Avg} = Average Wall Thickness; t_{Min} = Minimum Wall Thickness

14. See Figure A1 for plot of test data and regression line.

Figure A1: Log Failure Time versus Log Stress – E-2 at 73°F



PROJECT 09-3795
FINAL REPORT

**Determination of the
Long-Term Hydrostatic
Strength of a PVC Pipe
Sample**



January 14, 2010

Executive Summary

The purpose of this project was to determine the Long-Term Hydrostatic Strength (LTHS) of a PVC pipe sample at 73°F.

Testing was performed on the following sample:

Jana Sample ID	Description	Print Line
09-578	2" x 24" long blue pipe	JM EAGLE 2" IPS PVC1120 200PSI 2/1 SF ASTM D2241 NSF-pw U.P.CODE JM90 WI 2009/AUG/21

A summary of the test results is provided in Table 1.

Table 1: Summary of Test Results

Jana Sample ID	Data Set No.	Test Description	Test Hours	LTHS (psi)	Target Minimum LTHS (psi)	LCL Ratio (%)	HDB (psi)	Target HDB (psi)	Exp. Data Level
09-578	1	E-2 at 73°F	2,109	3,930	3,830	95	4,000	4,000	E-2

LTHS: Long Term Hydrostatic Strength; LCL: Lower Confidence Limit; HDB: Hydrostatic Design Basis; Exp.: Experimental

Based on the testing performed in this project, the following conclusion is made:

- Sample 09-578 meets the target 73°F HDB category of 4,000 psi at the E-2 level.

Report No.: Project 09-3795 – Final Report
Client: JM Eagle
9 Peach Tree Hill Road
Livingston, NJ 07039
U.S.A.
Date of Issue: January 14, 2010

1.0 Purpose of Test

The purpose of this project was to determine the Long-Term Hydrostatic Strength (LTHS) of a PVC pipe sample at 73°F.

2.0 Test Item Identification and Description

The following sample, as shown in Table 2, was provided by the Client. No further detail of the sample was provided.

Table 2: Sample Description

Jana Sample ID	Description	Print Line
09-578	2" x 24" long blue pipe	JM EAGLE 2" IPS PVC1120 200PSI 2/1 SF ASTM D2241 NSF-pw U.P.CODE JM90 WI 2009/AUG/21

3.0 Test Methods

The Long-Term Hydrostatic Strength test at 73°F was performed in accordance with ASTM D2837-08, using the method described in ASTM D1598-02(2009). Definitions of Experimental Grade Levels (E-levels) are per PPI TR-3(2008).

This test is covered by Jana's ISO 17025 scope of accreditation (I.A.S. TL-256).

4.0 Test Results

A summary of the test results is provided in Table 3. Detailed test results are provided in Appendix A.

Table 3: Summary of Test Results

Jana Sample ID	Data Set No.	Test Description	Test Hours	LTHS (psi)	Target Minimum LTHS (psi)	LCL Ratio (%)	HDB (psi)	Target HDB (psi)	Exp. Data Level
09-578	1	E-2 at 73°F	2,109	3,930	3,830	95	4,000	4,000	E-2

LTHS: Long Term Hydrostatic Strength; LCL: Lower Confidence Limit; HDB: Hydrostatic Design Basis; Exp.: Experimental

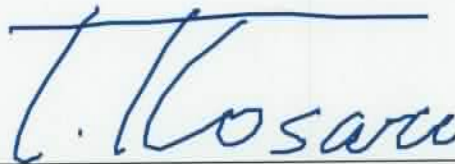
5.0 Conclusion

Based on the testing performed in this project, the following conclusion is made:

- Sample 09-578 meets the target 73°F HDB category of 4,000 psi at the E-2 level.

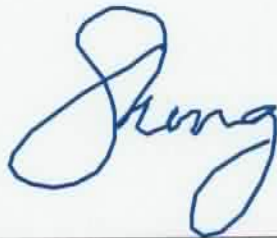
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Issued by



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Appendix A

Test Details

ASTM D1598 / ASTM D2837

Data Set No. 01: E-2 Test at 73°F

1. Sample ID: 09-578
2. Nominal Size: 2"
3. Temperature of Test: $73 \pm 3.6^{\circ}\text{F}$ ($23 \pm 2^{\circ}\text{C}$)
4. Regression Parameters:
 - 100,000-hour **LTHS**: 3,930 psi
 - **50-year** strength value: 3,760 psi
 - The log-log regression **equation**:
Log Failure Time (h) = $130.152 + (-34.822) \times \text{Log Stress (psi)}$
 - **95% LCL** of $f(100,000)$: 3,720 psi
 - **LCL Ratio**: 95%
5. Estimated **HDB** Category: 4,000 psi
6. Conditioning time at the test temperature: A minimum of 1 hour
7. Type of end caps: Free end
8. Sample length between end caps: A minimum of 12"
9. The test environment inside/outside the specimen: Water/Water
10. Additional Information:
 - Number of Lots: 1
 - Number of Extrusions: 1
 - Creep is not the controlling factor

11. Test Supervisor: Tony Kosari

12. Time-to-Failure/Stress Data:

Specimen ID	Test Pressure (psig)	OD _{Avg} (inch)	t _{Avg} (inch)	t _{Min} (inch)	Start YY.MM.DD	End YY.MM.DD	Stress (psi)	Total Hours	Status of Specimen
09-578-14	452	2.378	0.117	0.114	09-10-08	10-01-04	4,474	2,109.00	Non-Failure
09-578-13	446	2.378	0.117	0.114	09-10-08	09-11-30	4,428	1,261.25	Ductile
09-578-06	470	2.378	0.119	0.115	09-09-14	09-10-30	4,615	1,087.50	Ductile
09-578-10	450	2.378	0.119	0.115	09-10-08	09-11-16	4,443	934.00	Ductile
09-578-11	460	2.378	0.118	0.115	09-10-08	09-11-11	4,519	817.00	Ductile
09-578-02	481	2.379	0.118	0.114	09-09-14	09-10-18	4,778	809.00	Shatter
09-578-19	451	2.378	0.119	0.116	09-11-20	09-12-21	4,392	733.50	Ductile
09-578-12	453	2.378	0.120	0.117	09-10-08	09-11-05	4,395	661.00	Ductile
09-578-04	470	2.379	0.117	0.114	09-09-14	09-09-28	4,688	319.75	Ductile
09-578-09	465	2.379	0.117	0.112	09-09-14	09-09-27	4,699	298.17	Ductile
09-578-08	486	2.378	0.121	0.117	09-09-14	09-09-22	4,678	188.50	Shatter
09-578-03	500	2.379	0.118	0.116	09-09-14	09-09-15	4,872	28.60	Ductile
09-578-05	518	2.379	0.119	0.115	09-09-14	09-09-14	5,091	7.40	Shatter
09-578-01	518	2.380	0.116	0.113	09-09-14	09-09-14	5,181	4.15	Ductile
09-578-07	538	2.378	0.116	0.114	09-09-14	09-09-14	5,352	1.45	Shatter

13. Additional specimens not used in regression:

Specimen ID	Test Pressure (psig)	OD _{Avg} (inch)	t _{Avg} (inch)	t _{Min} (inch)	Start YY.MM.DD	End YY.MM.DD	Stress (psi)	Total Hours	Status of Specimen
09-578-20	441	2.378	0.116	0.113	09-11-20	10-01-04	4,416	1,077.25	Terminated
09-578-18	443	2.378	0.118	0.114	09-11-20	10-01-04	4,385	1,077.25	Terminated

Legend: OD_{Avg} = Average Outside Diameter; t_{Avg} = Average Wall Thickness; t_{Min} = Minimum Wall Thickness

14. See Figure A1 for plot of test data and regression line.

Figure A1: Log Failure Time versus Log Stress – E-2 at 73°F

