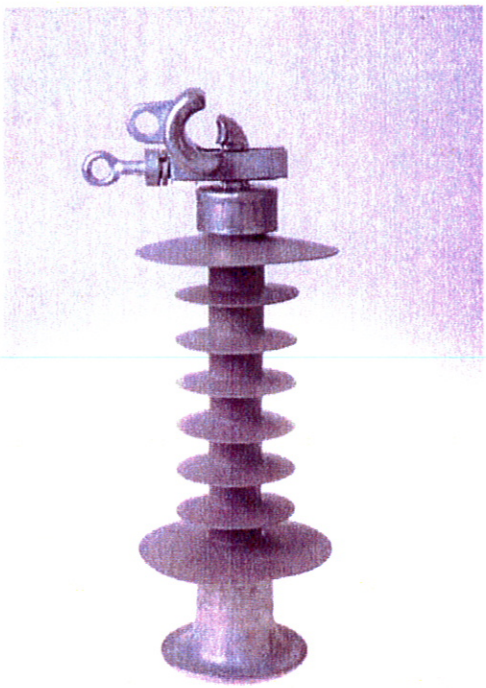
HUBBELL POWER SYSTEMS, INC.

OHIO BRASS

Design Test Report EU1572
Supplement to Reports No. EU1535, EU1531, EU1532
Universal Clamp
46-72 kV Veri*Lite Line Post



Test	Standard	Test Request # (Date)	Location	Judgment
Tensile Load Test	LWIWG -02 Clause 5.8	M09-07-01 (07-17-2009)	HPS Wadsworth	Pass
Cantilever Strength	ANSI C29.1 - 5.1.3	M09-04-01 (4-15-2009)	HPS Wadsworth	Pass
Working Cantilever Load Test	LWIWG -02 Clause 5.7	M08-11-10 (11-25-2008)	HPS Wadsworth	Pass

Universal Clamp Design Test Summary

Tested By: Kiran Pusthay
Staff Engineer

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7/31/09

Reviewed By: Jeff Thomas, PE

7/31/09

ENGINEERING REPORT

SUBJECT:	TENSILE LOAD TEST, LWIWG-02 Clause 5.8			
DATE:	07-17-2009		Location	Wadsworth
PAGE 1	Test Requests:	M09-07-01	Report Number:	M09-07-01

Tensile Load Test
Catalog Number 80S046-0U09

Introduction:

The tensile load test was performed on three samples of VLLP posts, catalog number 80S046-0U09. The post utilized a stud base and the universal clamp assembly, catalog number PSPIVPCLP013001.The test was performed in accordance with LWIWG-02, clause 5.8. All three samples were tested on the horizontal (orange) load frame (equipment number 185). Figure 1 shows the sales drawing of the assembly.

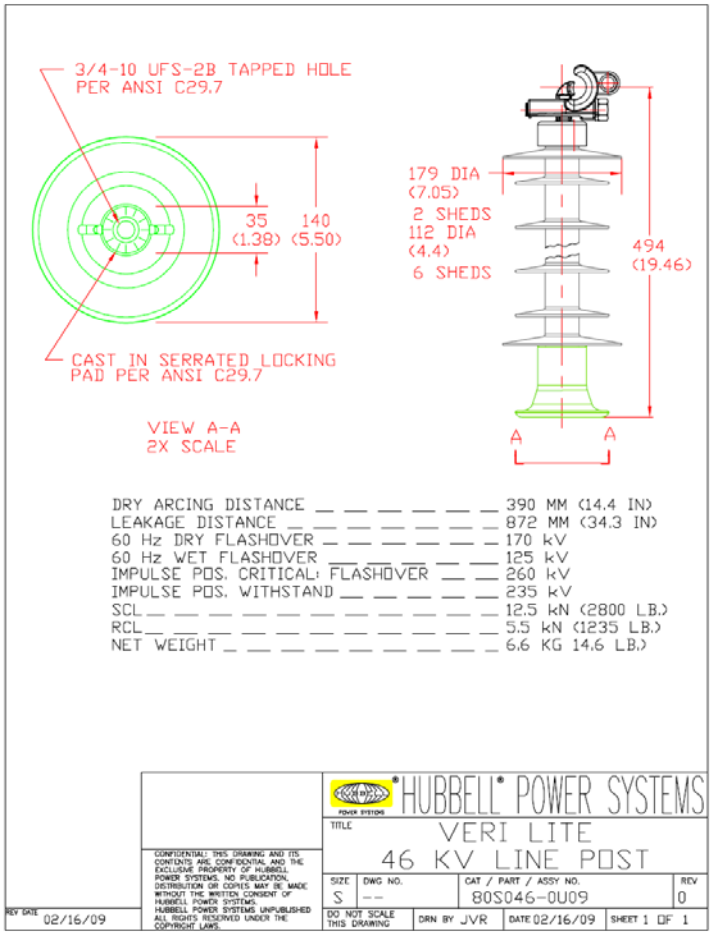

Figure 1: Sales drawing of catalog number 80S046-0U09

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Test Protocol:

The test protocol is listed below.

5.8 Tensile load test

- ***Test specimens***
  - *Three insulators shall be tested.*
- ***Test procedures***
  - *Test each insulator in accordance with Clauses 5.1.1 and 5.1.4.3 of ANSI Standard C29.1 for a tensile load of 12 KN*
  - *Increases the load until the insulator fails and record the failure load.*
- ***Test evaluation***
  - *The test is regarded as passed if all three insulators have no failure at and below the tensile load of 12 KN*

Test Results:

The results of the test are contained in table 1.

Sample Number	Catalog Number	Ultimate Load, lbf (KN)	Mode of Failure
1	80S046-0U09	6,937 (30.85)	Keeper broke
2	80S046-0U09	6,937 (30.85)	Keeper broke
3	80S046-0U09	6,552 (29.14)	Keeper broke

Table 1: Results showing the cantilever loading

Analysis:

A 1.31 “diameter conductor was clamped onto the universal clamp assembly with approximately 25 ft-lbs torque. Each insulator was loaded in tension until failure; the test set up and condition of the insulators after test completion are shown below.

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Test setup

Test set up

Sample#1

Sample#1

Sample#2

Sample#2

Sample#3

Sample#3

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Conclusions:

The VLLP posts, catalog number 80S046-0U09, assembled with the universal clamp assembly, catalog number PSPIVPCLP013001, passed the tensile load test as specified in LWIWG-02 clause 5.8. The specification requires that the samples must withstand at least 12 KN in tensile loading. The average tensile load sustained by the samples tested was 6,808 lbs or 30.26 KN.

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Catalog Number 80S069-0U00/9
ANSI C29.1 – Clause 5.1.3
Cantilever-Strength Test
M09-04-01

Introduction:

A cantilever-strength test was performed on three VLLP post samples. The catalog numbers of samples tested were 80S069-0H09 (sample#1), 80S069-0U00 (sample #2) and 80S069-0H00 (sample #3) insulators. The samples evaluated were assembled using universal clamp sub assembly. This test evaluates the strength of the material as well as the design.

Test Protocol:

The test was performed in accordance with ANSI C29.1, Clause 5.1.3. The test protocol follows:

> ***5.1.3 Cantilever-Strength Test.*** *"Mechanical load shall be applied in line with the side groove of the test specimen and normal to the axis of the pinhole. The load at the tie-wire groove may be applied by means of a loop of flexible standard cable or equivalent. The mounting pin, connecting hardware and linkages between the test specimen and the testing machine shall be such that no appreciable deflection takes place at values up to the failure point of the test specimen. Insulators whose design incorporates self contained metal caps, mounting bases, pins, or conductor clamps, shall be tested with this hardware, using a suitable rigid support".*

Test Results:

Three samples were tested and the results are listed in table 1. All tests were performed with a 10,000 lb load cell (Calibrated 12-17-2008). A 1.31" conductor with eye bolts was used for this test. Using a link from the two eye bolts at either ends of the conductor a cantilever load was applied to the assembly.

Sample Number	Ultimate Strength, lb	Mode of Failure
1	2759	Fiberglass rod broke
2	2780	Fiberglass rod broke
3	2744	Fiberglass rod broke

Table 1

Conclusions:

> All three samples assembled with the universal clamp, C/N PSPIVPCLP013001 met the cantilever design criteria. The components of the universal clamp (keeper, clamp and bolt) did not exhibit any damage as a result of the test. The graphics are contained in the appendix.

Appendix:

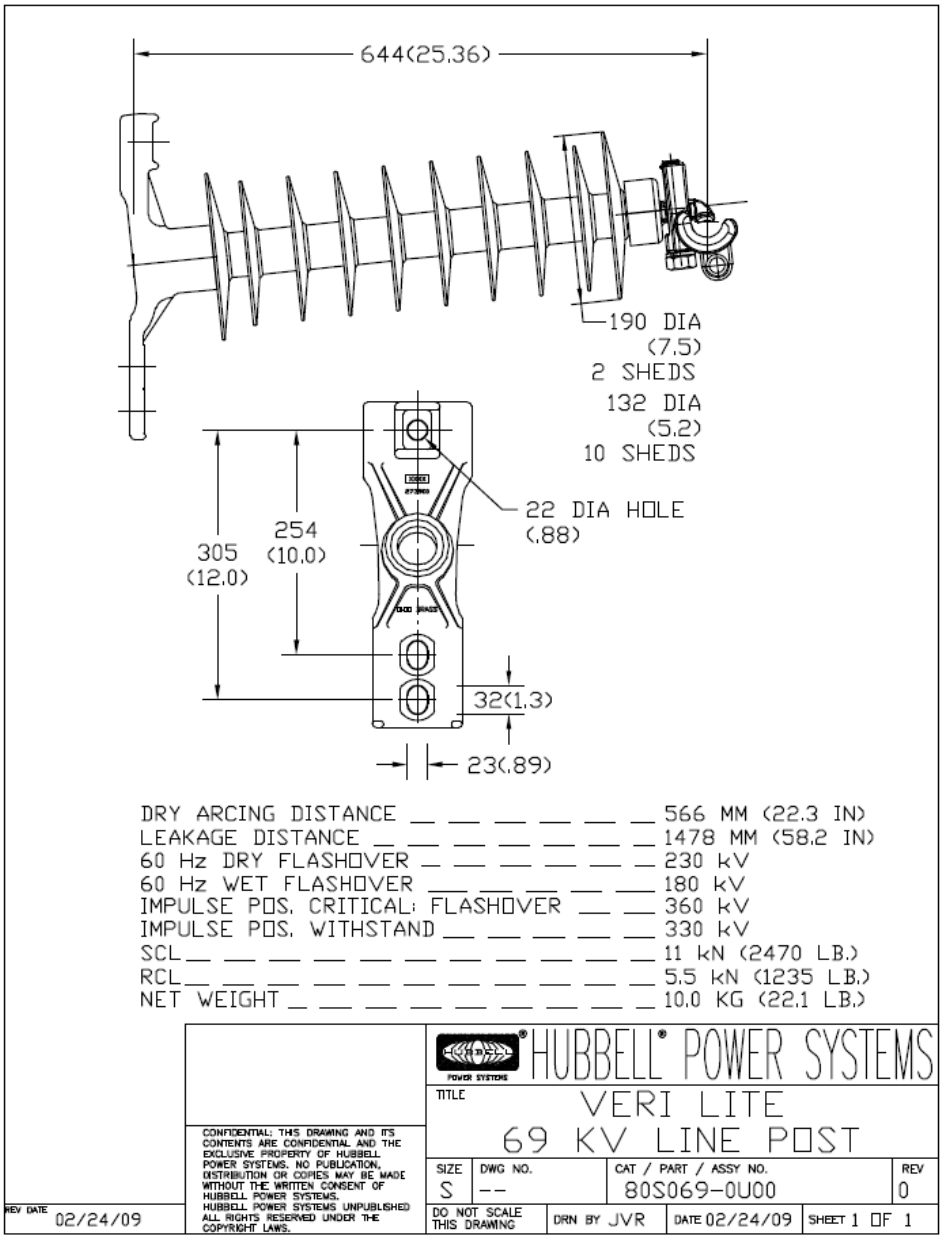

Figure 1: Sales Drawing of Sample #2

Figure 2: Test setup

Figure 3: Test setup

Figure 4: Sample #1 after test

Figure 5: Sample #1 after test

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Figure 6: Sample #2 after test

Figure 7: Sample #2 after test

Figure 8: Sample #3 after test

Figure 9: Sample #2 after test

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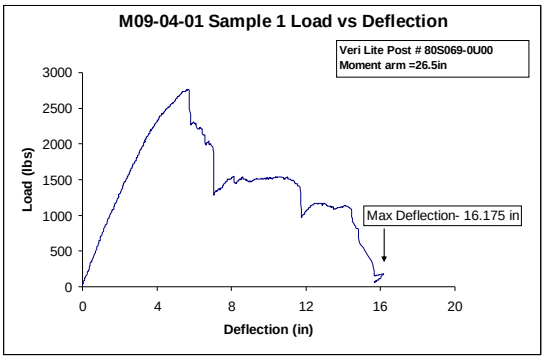

Figure 10 Load vs. Deflection for sample #1

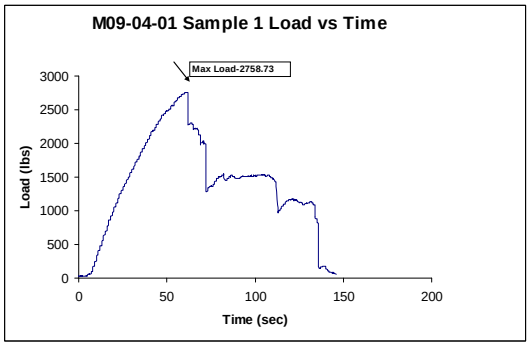

Figure 11 Load vs. Time for sample #1

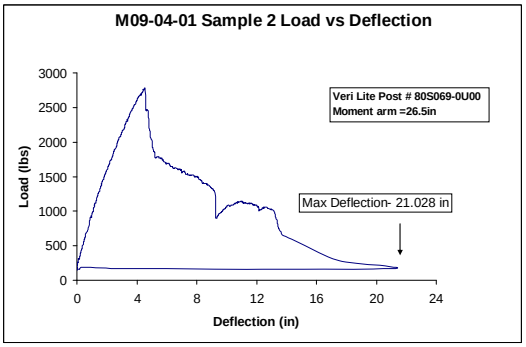

Figure 12 Load vs. Deflection for sample #2

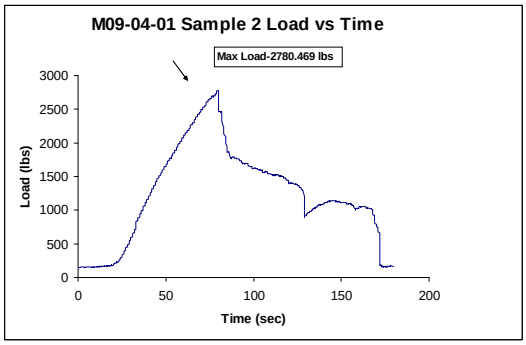

Figure 13 Load vs. Time for sample #2

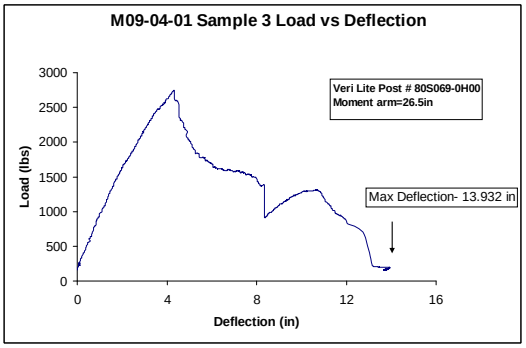

Figure 14 Load vs. Deflection for sample #3

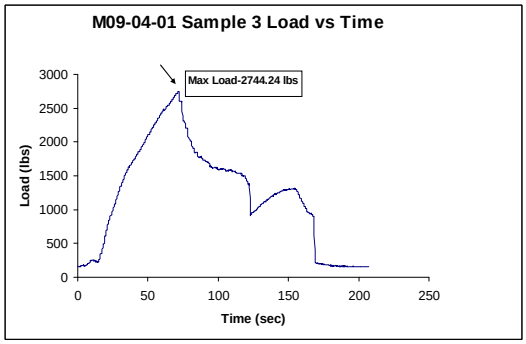

Figure 15 Load vs. Time for sample #3

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Working Cantilever Load

Catalog Number: 80S069-0U09

Introduction:

A working cantilever load test was performed on two VLLP posts, catalog number 80S046-0U09. The post utilized a stud base and universal clamp assembly, catalog number PSPIVPCLP013001. The test was performed in accordance with LWIWG-02, clause 5.7.

Test Protocol:

The test protocol is listed below.

5.7 Working cantilever load test

- ***Test specimens***
  - *Three insulators shall be tested.*

- ***Test procedures***
  - *Gradually load the insulator to 1.1 times its working cantilever load rating at a temperature of 20°C ±10K and hold for 96 hours. The load shall be applied to the insulator as described in the definition of the cantilever load.*

- ***After removal of the load:***
  - *Cut each insulator 90° to the axis of the core and about 50mm from the base end fitting;*
  - *Cut the base end fitting longitudinally into two halves in the plane of the previously applied cantilever load;*

- ***Test evaluation***
  - *The test is regarded as passed if all the threads of the base are reusable and each fiber glass rod has*
    - *No delamination, and*
    - *Cracks.*

Test Results:

The results of the test are contained in table 1.

Sample Number	Catalog Number	Applied Load (lbs)	Result
1	80S069-0U09	1370	Passed
2	80S069-0U09	1370	Passed

Table 1

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Analysis:

A load of 1370 lbs was applied to the insulators for 96 hours. Both samples withstood the load for 96 hours without any failure. The threads in the stud bases were checked and it was determined they were reusable. The dissection of the rod did not show any delamination or cracks.

Conclusions:

Both samples met the requirements for working cantilever load. Graphics are contained in the appendix.

Appendix:

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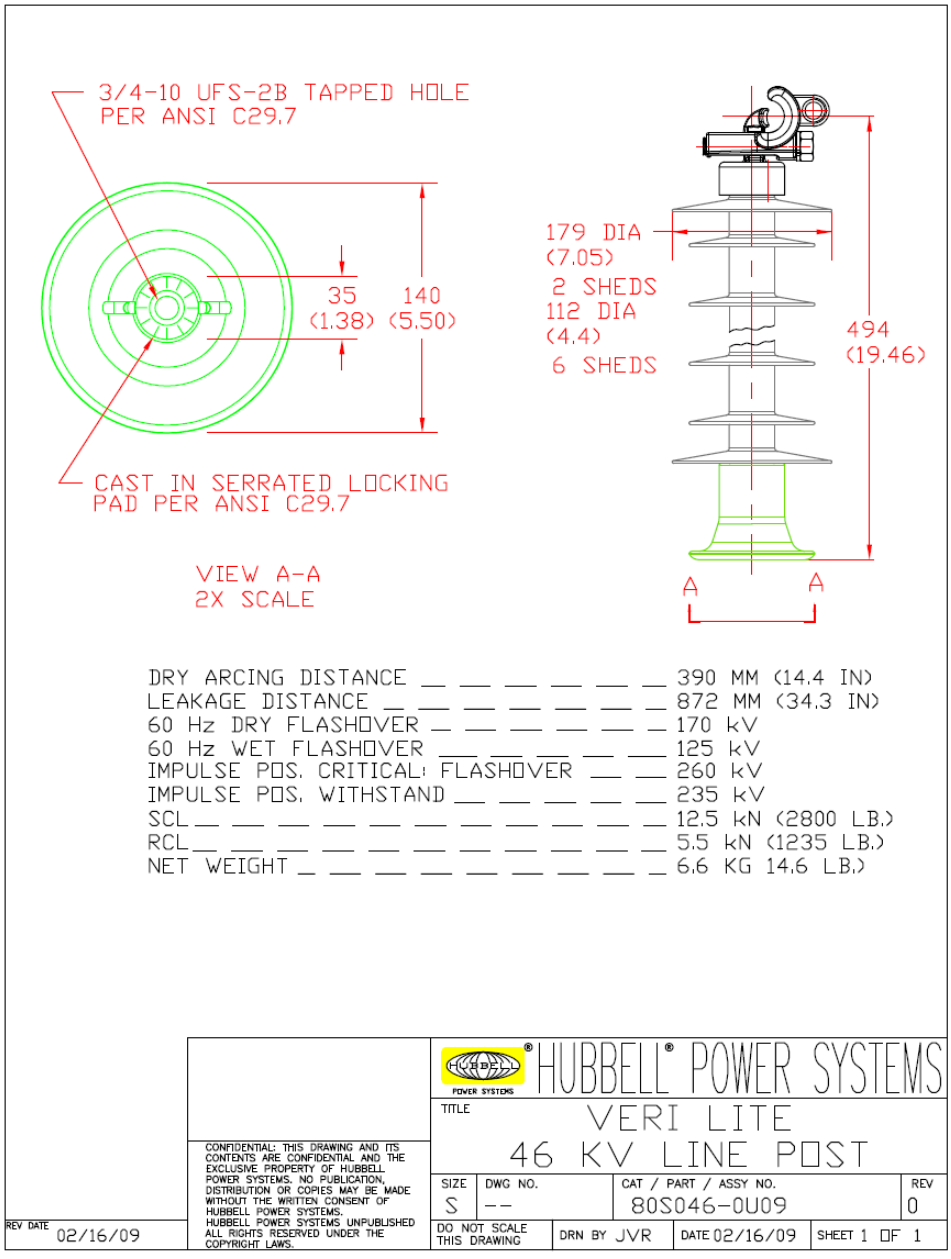

Figure 1: Sales Drawing of the Catalog Number 80S046-0U09

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Figure 2: Test Set up

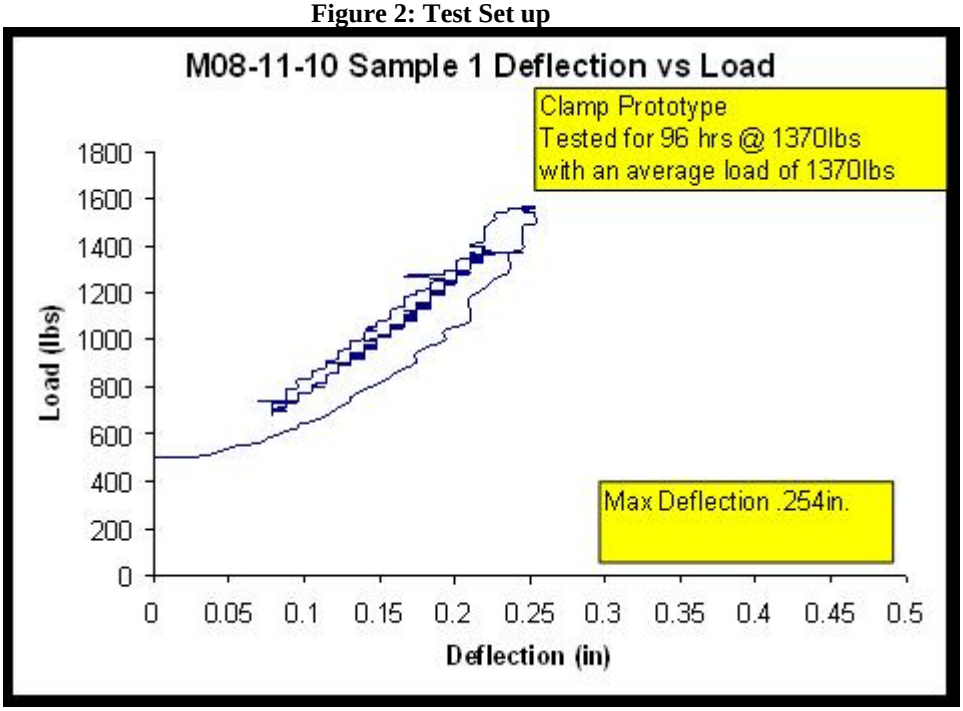

Figure 3: Load vs. Deflection Curve

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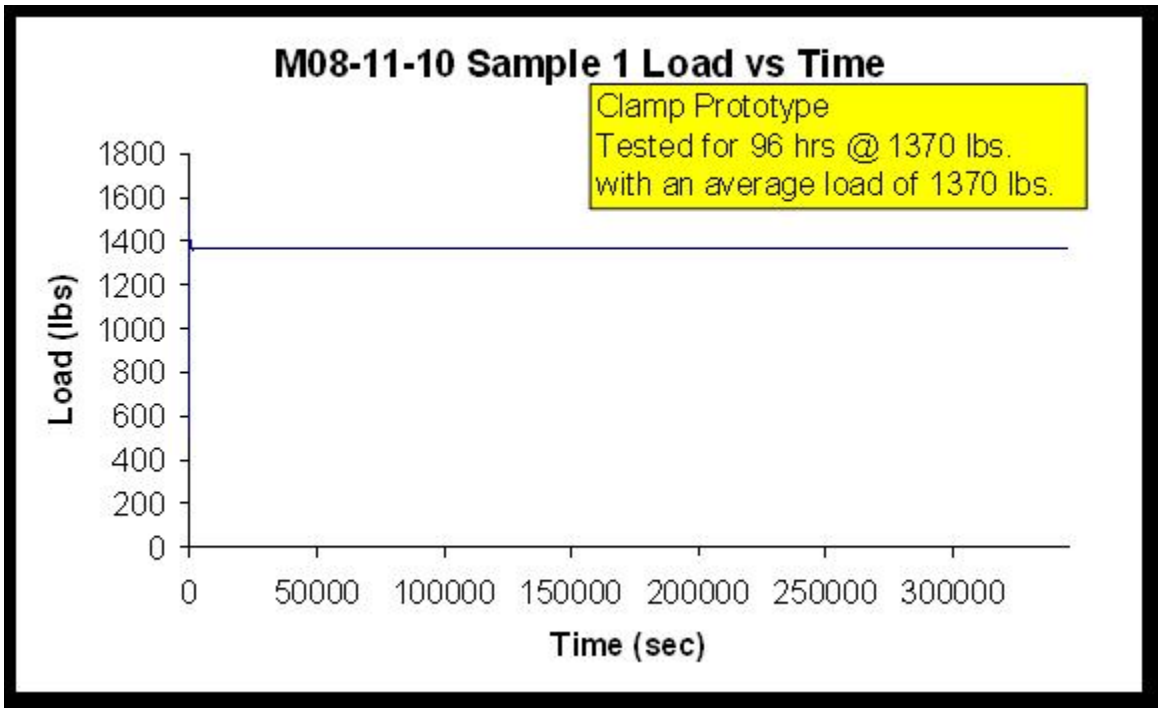

Figure 4: Load vs. Time Curve

Figure 5: Dissected Sample #1

Figure 6: Dissected Sample #1

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Figure 7: Dissected Sample #2

Figure 8: Dissected Sample #2