



## ASTM E985 TEST REPORT

### GR2457 HCB-10 Base Shoe and PG2475 Pad and Isolator

Rendered to:  
R&B Wagner, Inc.  
10600 W Brown Deer Rd  
Milwaukee, WI 53224

Report Number: R15-06-210.2  
Set-up Date: 07/23/2015  
Test Date: 07/23/2015  
Report Date: 07/28/2015

**Project Identification:** GR2457HCB-10 base shoe with PG2475 pad and isolator ASTM E985 Testing

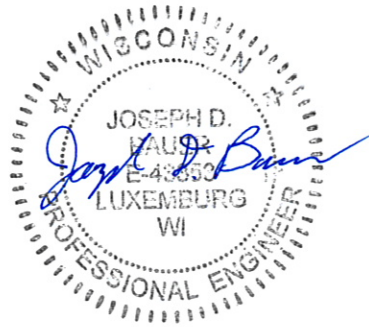
**Project Scope:** Rice Engineering was contacted by R&B Wagner, Inc. to witness testing of their GR2457 base shoe guardrail system, specifically the amount of deflection that would occur in 13/16" thick tempered PVB laminated glass (3/8" / 0.060" PVB / 3/8"), 5/8" thick tempered PVB laminated glass (1/4" / 0.060" PVB / 3/8"), and 5/8" thick tempered SGP laminated glass (1/4" / 0.060" SGP / 3/8") when pulled to design loads as described in ASTM E985 "Standard Specification for Permanent Metal Railing Systems and Rails for Buildings". On July 23rd, 2015, Joseph Bauer of Rice Engineering witnessed testing for the three different configurations. The testing was performed on-site at the R&B Wagner facility and was conducted by Justin Wesser.

**Conclusions:** The 13/16" PVB laminated glass lite was tested to a maximum deflection of 1.938" at ultimate test load (365 lbf). The allowable deflection was 2.25". The residual deflection (measured at 90 lbf) was 0.155". The allowable residual deflection was 0.45". There were no signs of deformation on the base shoe or any problems with the pad and isolators, therefore 13/16" PVB laminated glass passed the ASTM E985 test.

The 5/8" PVB laminated glass lite was tested to a maximum deflection of 2.653" at ultimate test load (365 lbf). The allowable deflection was 2.25". The residual deflection (measured at 90 lbf) was 0.171". The allowable residual deflection was 0.45". There were no signs of deformation on the base shoe or any problems with the pad and isolators, therefore 5/8" PVB laminated glass passed the ASTM E985 test for residual deflection, but did not pass for maximum deflection.

The 5/8" SGP laminated glass lite was tested to a maximum deflection of 1.394" at ultimate test load (365 lbf). The allowable deflection was 2.25". The residual deflection (measured at 90 lbf) was 0.067". The allowable residual deflection was 0.45". There were no signs of deformation on the base shoe or any problems with the pad and isolators, therefore the 5/8" SGP laminated glass passed the ASTM E985 test.

Prepared & Witnessed By:



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Joseph D. Bauer, Wisconsin P.E.

**MASTER TABLE**

**ZERO POINT FOR CALCULATIONS**

Height of Rail (h)	42
Length of Rail (l)	48
Max Deflection [(h/24)+(l/96)]	2.25
Max Residual Deflection (20% of Max)	0.45

**Front**

<b>All inputs should be unadjusted read outs from test</b>	Actual lbsf	Mid	Actual lbsf	Left (If Applicable)	Actual lbsf	Left 2 (If Applicable)
Deflection Reading @ 0 lbs	0	3.866	0	4.196	0	4.057
Deflection Reading @ Pre-Load (180 lbsf)	178	3.084	179	3.130	180	2.878
<b>Deflection Reading @ Released Test Load (1/2 Pre-load)</b>	<b>90</b>	<b>3.350</b>	<b>91</b>	<b>3.476</b>	<b>91</b>	<b>3.317</b>
Deflection Reading @ 150 lbsf	150	3.173	150	3.214	152	3.022
Deflection Reading @ 200 lbsf	202	3.016	201	3.005	203	2.777
Deflection Reading @ 250 lbsf	249	2.854	254	2.763	252	2.527
Deflection Reading @ 300 lbsf	299	2.674	304	2.513	303	2.257
Deflection Reading @ Ultimate Test Load (365 lbsf)	365	2.423	367	2.194	364	1.923
Deflection Reading @ Released Test Load (1/2 Pre-load)	94	3.306	89	3.409	89	3.287

**Back**

<b>All inputs should be unadjusted read outs from test</b>	Actual lbsf	Mid	Actual lbsf	Left (If Applicable)	Actual lbsf	Left 2 (If Applicable)
Deflection Reading @ 0 lbs	0	4.308	0	4.424	0	4.354
Deflection Reading @ Pre-Load (180 lbsf)	184	3.391	181	3.280	180	3.221
<b>Deflection Reading @ Released Test Load (1/2 Pre-load)</b>	<b>88</b>	<b>3.698</b>	<b>92</b>	<b>3.653</b>	<b>89</b>	<b>3.620</b>
Deflection Reading @ 150 lbsf	150	3.494	151	3.398	156	3.228
Deflection Reading @ 200 lbsf	202	3.326	203	3.170	199	3.023
Deflection Reading @ 250 lbsf	249	3.147	250	2.927	250	2.708
Deflection Reading @ 300 lbsf	301	2.947	303	2.656	301	2.411
Deflection Reading @ Ultimate Test Load (365 lbsf)	368	2.668	366	2.305	366	2.001
Deflection Reading @ Released Test Load (1/2 Pre-load)	91	3.647	93	3.593	87	3.520

## *Railing System Load/Deflection Testing*

Test Type:	Horizontal Load to 365 lbs per ASTM E985 per section 7.1.5	Submitted By:	KES	Submitted On:	07/23/15
Test Focus (Part #s):	48" Long GR2457HCB-10, 5/8" Laminated with SGP Interlayer (0.060"), PG2475, PGISO17				
Railing Type:	Shoe molding, 4 panel grips, with glass and unsupported sides				
Railing Specifications:	42" (TOR) No caprail. 12" C-C hole locations				
Test Method:	365 lbf load per ASTM standards				

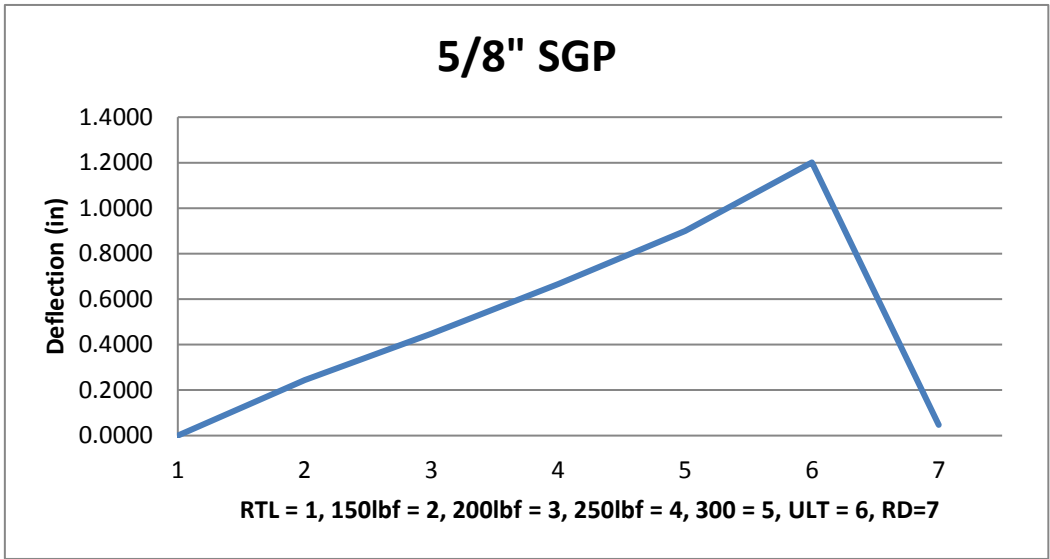
Test Specifications per ASTM E985		Results				
System Calculations		Load (lbf)	Displacement (in.)			Test Avg
Pre Load	180 (lbf)		Midrail	Left	Left 2	
Released Test Load	90 (lbf)	Preload	0.266	0.346	0.439	0.3503
Ultimate Test Load	365 (lbf)	RTL	0	0	0	0.0000
		150	0.177	0.262	0.295	0.24466667
Deflection Specifications Per ASTM E985		200	0.334	0	0.54	0.4483
		250	0.496	0.713	0.79	0.6663
Max Deflection	(h/24)+(l/96) = 2.25 in	300	0.676	0.963	1.06	0.8997
		UTL	0.927	1.282	1.394	1.2010
Residual Deflection (At RTL)	20% of MD = 0.45 in	RD	0.044	0.067	0.03	0.047

### Notes

Midrail at 0 lbf = 3.866  
 Potentiometer cannot be zeroed, so calculations are done manually  
 Shoe mounted to steel

### Conclusions

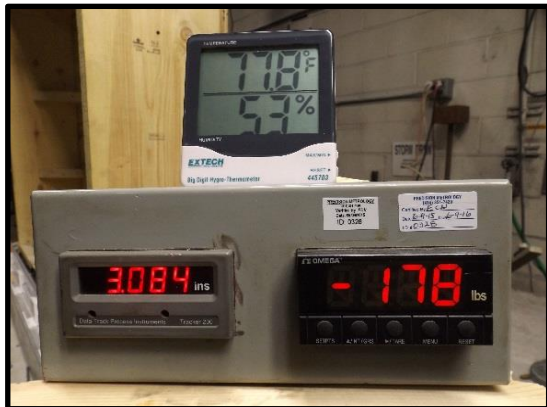
Rail meets ASTM Standard for Max Deflection  
 Rail meets ASTM Standard for Residual Deflection



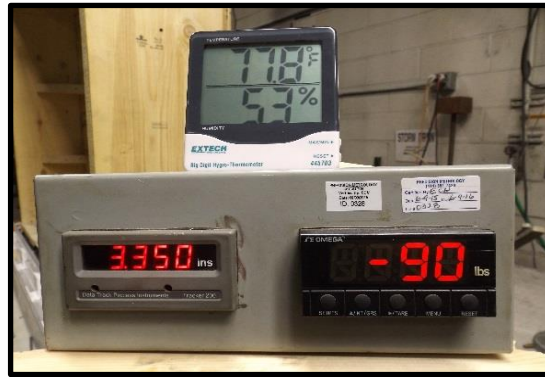
Initial Setup  
(Mid)



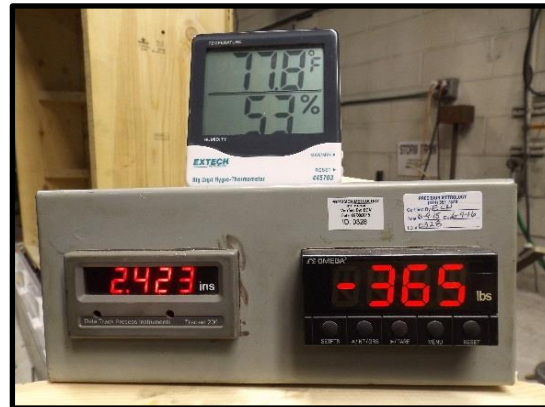
Preload of 180 lbf  
Actual Deflection of  
0.266 in



Release Test Load of 90 lbf



Ultimate Test Load of 365 lbf  
Actual Deflection of  
0.927 in

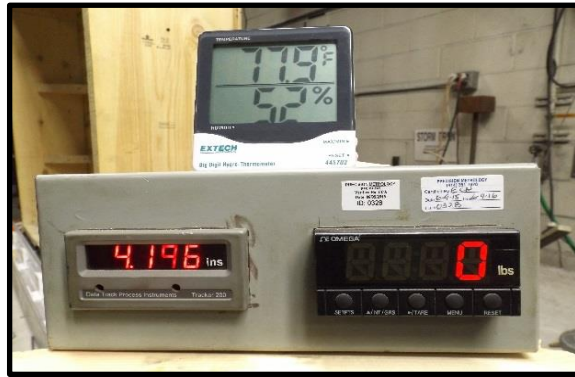


Residual Deflection at 90 lbf  
Actual Deflection of 0.044 in



Initial Setup  
(Left)





Preload of 180 lbf  
Actual Deflection of 0.346 in  
Deflection number will  
automatically update



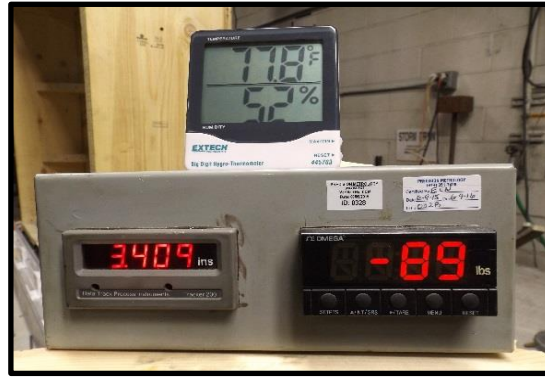
Release Test Load of 90 lbf



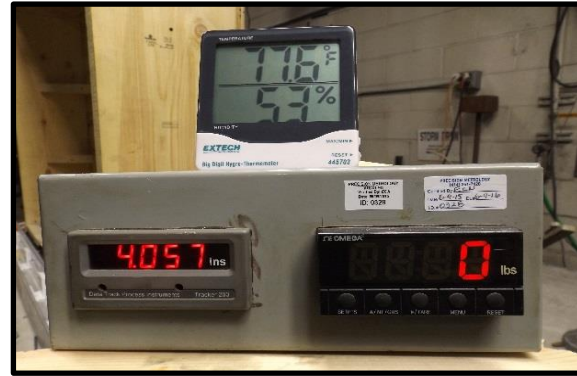
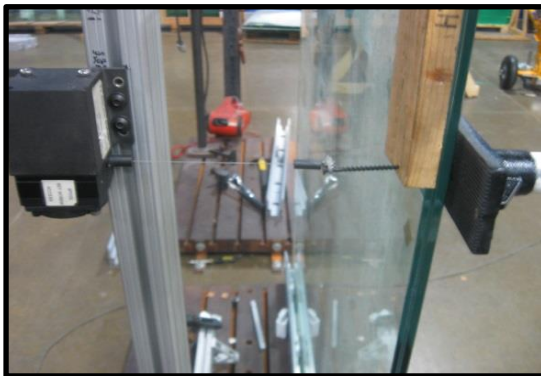
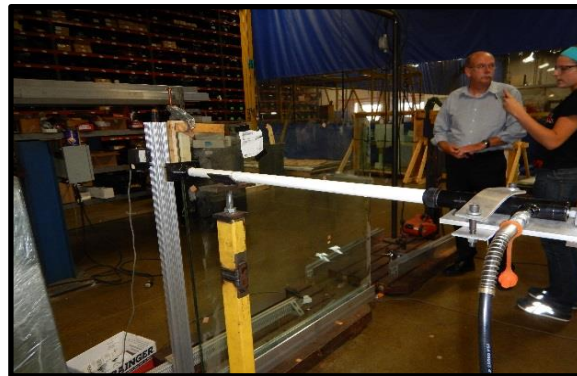
Ultimate Test Load of 365 lbf  
Actual Deflection of 1.282 in  
Deflection number will  
automatically update



Residual Deflection at 90 lbf  
Actual Deflection of 0.067 in  
Deflection number will automatically update



Initial Setup  
(Left 2)

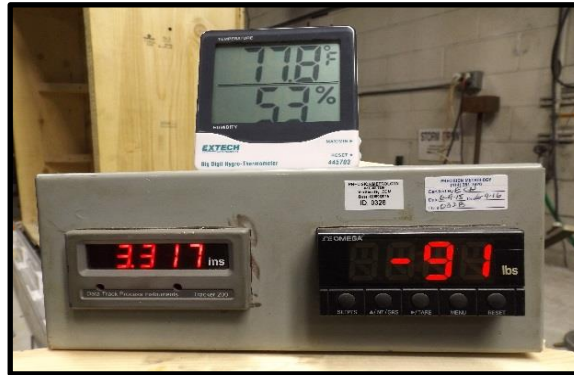


Preload of 180 lbf  
Actual Deflection of 0.439 in  
Deflection number will automatically update





Release Test Load of 90 lbf



Ultimate Test Load of 365 lbf  
Actual Deflection of 1.394 in



Residual Deflection at 90 lbf  
Actual Deflection of 0.03 in  
Deflection number will  
automatically update



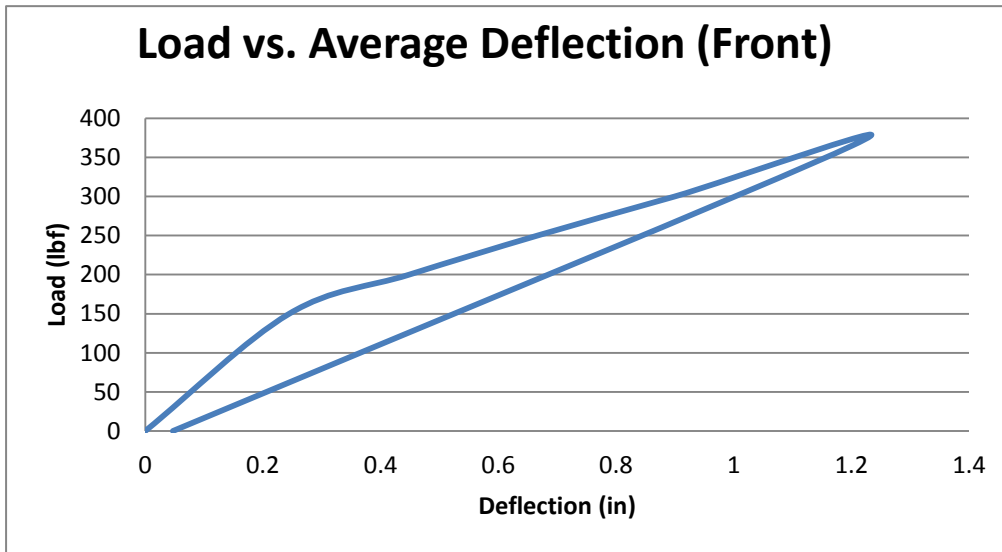




**R & B WAGNER, INC.**

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Load	Average Deflection
0	0
150	0.244666667
200	0.448333333
250	0.666333333
300	0.899666667
365	1.201
0	0.047





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## Railing System Load/Deflection Testing

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Railing Specifications:	42" (TOR) No caprail. 12" C-C hole locations				
Test Method:	365 lbf load per ASTM standards				

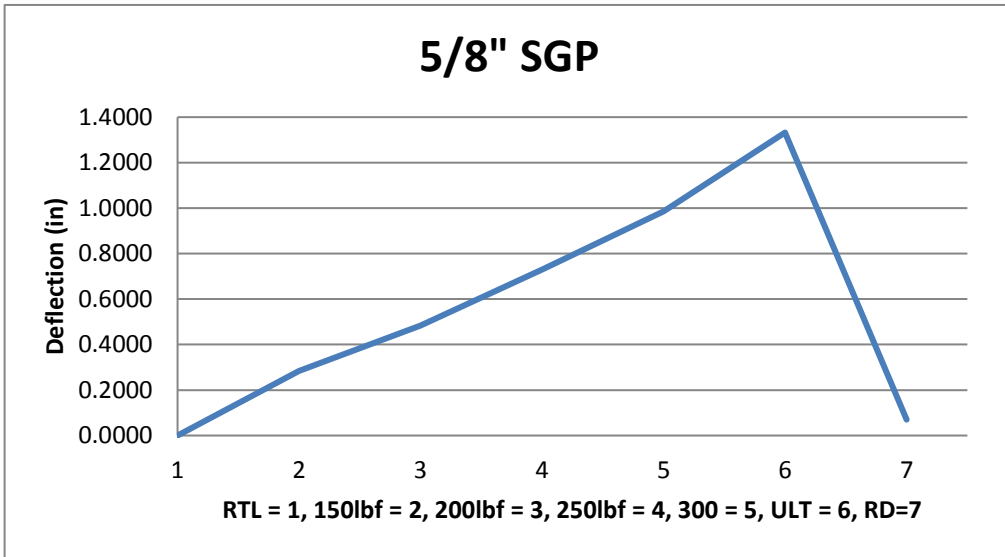
Test Specifications per ASTM E985		Results				
	System Calculations	Load (lbf)	Displacement (in.)			Test AVG
			Midrail	Left	Left 2	
<b>Pre Load</b>	<b>180 (lbf)</b>	Preload	0.307	0.373	0.399	0.3597
<b>Released Test Load</b>	<b>90 (lbf)</b>	RTL	0	0	0	0.0000
<b>Ultimate Test Load</b>	<b>365 (lbf)</b>	150	0.204	0.255	0.392	0.28366667
		200	0.372	0	0.597	0.4840
<b>Deflection Specifications Per ASTM E985</b>		250	0.551	0.726	0.912	0.7297
		300	0.751	0.997	1.209	0.9857
<b>Max Deflection</b>	<b>(h/24)+(l/96) = 2.25 in</b>	UTL	1.03	1.348	1.619	1.3323
		RD	0.051	0.06	0.1	0.0703
<b>Residual Deflection (At RTL)</b>	<b>20% of MD = 0.45 in</b>					

### Notes

Midrail at 0 lbf = 4.308 in  
 Potentiometer cannot be zeroed, so calculations are done manually  
 Shoe mounted to Steel

### Conclusions

Rail meets ASTM Standard for Max. Allowed Deflection  
 Rail meets ASTM Standard for Residual Deflection



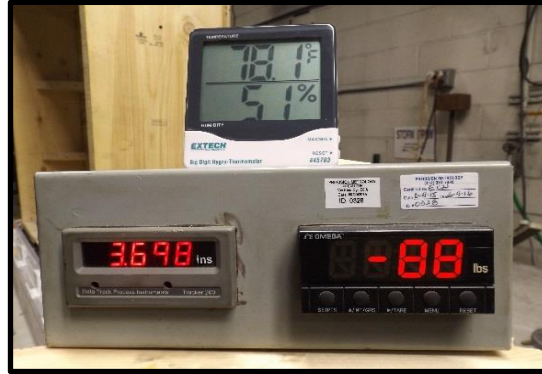
Initial Setup  
(Middle)



Preload of 180 lbf  
Actual Deflection of  
0.307 in



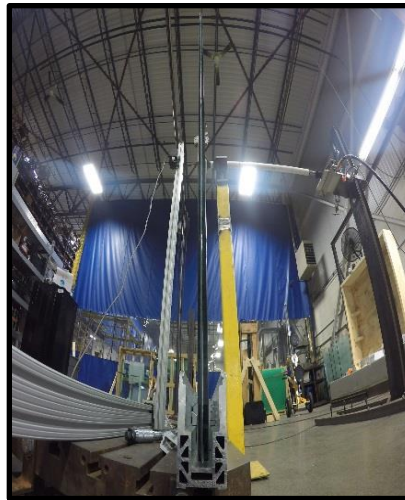
Release Test Load of 90 lbf



Ultimate Test Load of 365 lbf  
Actual Deflection of 1.03 in



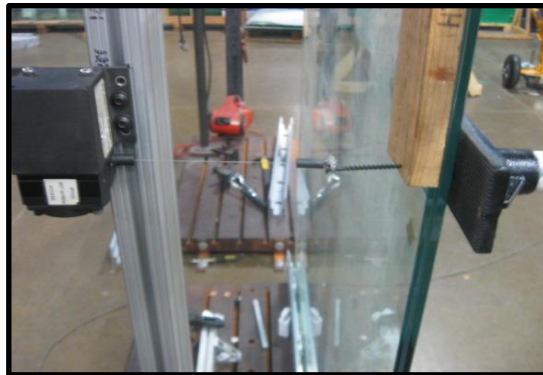
Deflection at ULT



Residual Deflection at 90 lbf  
Actual Deflection of 0.051 in



Initial Setup  
(Left)



Preload of 180 lbf  
Actual Deflection of 0.373 in  
Deflection number will  
automatically update



Release Test Load of 90 lbf



Ultimate Test Load of 365 lbf  
Actual Deflection of 1.348 in  
Deflection number will automatically update



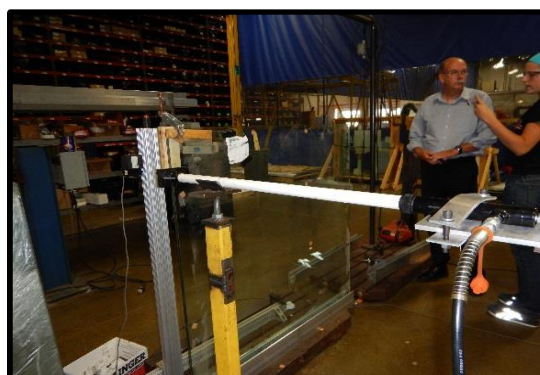
Deflection at ULT



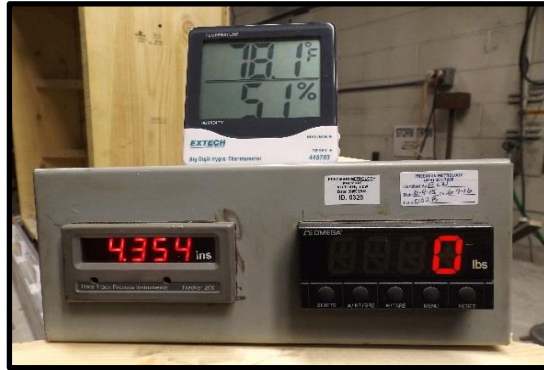
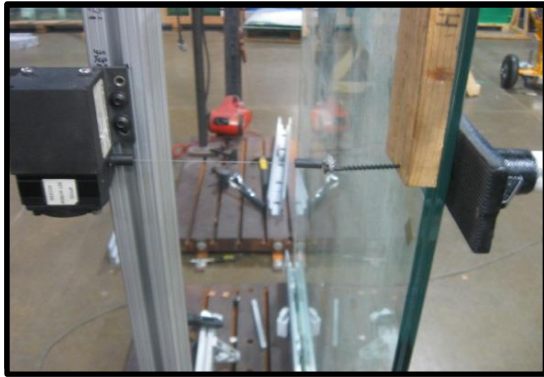
Residual Deflection at 90 lbf  
Actual Deflection of 0.06 in  
Deflection number will automatically update



Initial Setup  
(Left 2)



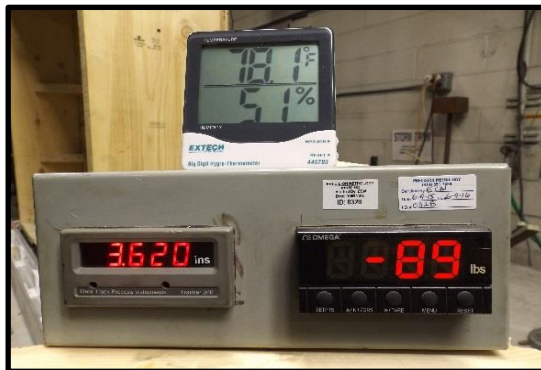




Preload of 180 lbf  
Actual Deflection of 0.399 in  
Deflection number will  
automatically update



Release Test Load of 90 lbf



Ultimate Test Load of 365 lbf  
Actual Deflection of 1.619 in  
Deflection number will  
automatically update



Deflection at ULT



Residual Deflection at 90 lbf  
Actual Deflection of 0.1 in  
Deflection number will  
automatically update







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Load	Average Deflection
0	0
150	0.283666667
200	0.484
250	0.729666667
300	0.985666667
365	1.332333333
0	0.070333333

