



Static Testing of 0.5-in EZ-Place Rail High Impact Insert

Static Testing of Post-Tensioned Products, Inc. Barrier Cable Insert

9140 CR 229 N

Sanderson, Florida 32087



FINAL REPORT

August 2, 2024

WJE No. 2021.3293

PREPARED FOR:

Post-Tensioned Products, Inc.

9140 CR 229 N

Sanderson, Florida 32087

PREPARED BY:

Wiss, Janney, Elstner Associates, Inc.

330 Pfingsten Road

Northbrook, Illinois 60062

847.272.7400 tel



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A handwritten signature in black ink that reads 'John Pearson'.

John Pearson SE (IL), PE (FL)
Project Manager

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INTRODUCTION

At the request of Post-Tensioned Products, Inc. (PTP), the firm of Wiss, Janney, Elstner Associates, Inc. (WJE) conducted tension testing services to determine the tensile capacity and failure location of an insert used for the PTP EZ-Place Cable Rail system.

Scope of Work

The scope of work consisted of performing a tension test by WJE in general accordance ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*. Tension testing was performed to determine the ultimate tensile capacity of the insert used as part of the PTP EZ-Place Cable Rail barrier cable system.

BASIC PRODUCT INFORMATION

Product Description

The insert is a hollow cylinder measuring 8-in long by 1 3/32-in in diameter (Figure 1). An increased diameter section at one end measures 1/4-in long by 1 1/4-in diameter. The insert has an internal threaded section of 3/4-in-10 and 3-in long. The remaining hollow portion of the insert has a 2-in long by 1/2-in diameter section and a 3-in long by 11/32-in diameter section. The drawing states the insert is fabricated using 108 1018 steel.

Product Sampling

The insert tested was shipped to WJE by PTP. WJE arbitrarily selected the insert for testing from those provided.

TEST METHODS AND REQUIREMENTS

All testing of the strand and anchorages were conducted by WJE personnel at our structural laboratory in Northbrook, Illinois. Test machine calibration records are included in Appendix A. All testing protocols followed WJE's Quality Manual.

Tension Test

The tension test was conducted using a Satec universal test machine (s/n 1240). The test machine utilizes wedge grips for holding a test sample during loading. In order to uniformly grip the inserts, the section of the insert with 1 1/4-in diameter (Figure 2) had to be turned down to 1 3/32-in diameter to match the diameter of the remaining length.

The test configuration consisted of two inserts connected with a 3/4-in diameter threaded rod (Figure 3). The threaded rod was threaded the full length of the insert threads. Testing was conducted using the Satec universal test machine with a closed-loop computer-controlled hydraulic system. The controller was programmed to operate the test machine crosshead separation in displacement control at a rate of approximately 0.003 in/s. Load was applied until the sample fractured. The applied load and test machine crosshead movement were measured and continuously recorded.

TEST RESULT

The sample was loaded by the test machine in displacement control until the sample fractured. A maximum load of 46,660 lbf was achieved. The fracture occurred at the end of the internally threaded section. A photograph of the failure mode is shown in Figure 4. A load-displacement plot for the test sample is shown in Figure 5.



Static Testing of 0.5-in EZ-Place Rail High Impact Insert

Static Testing of Post-Tensioned Products, Inc. Barrier Cable Insert

FIGURES

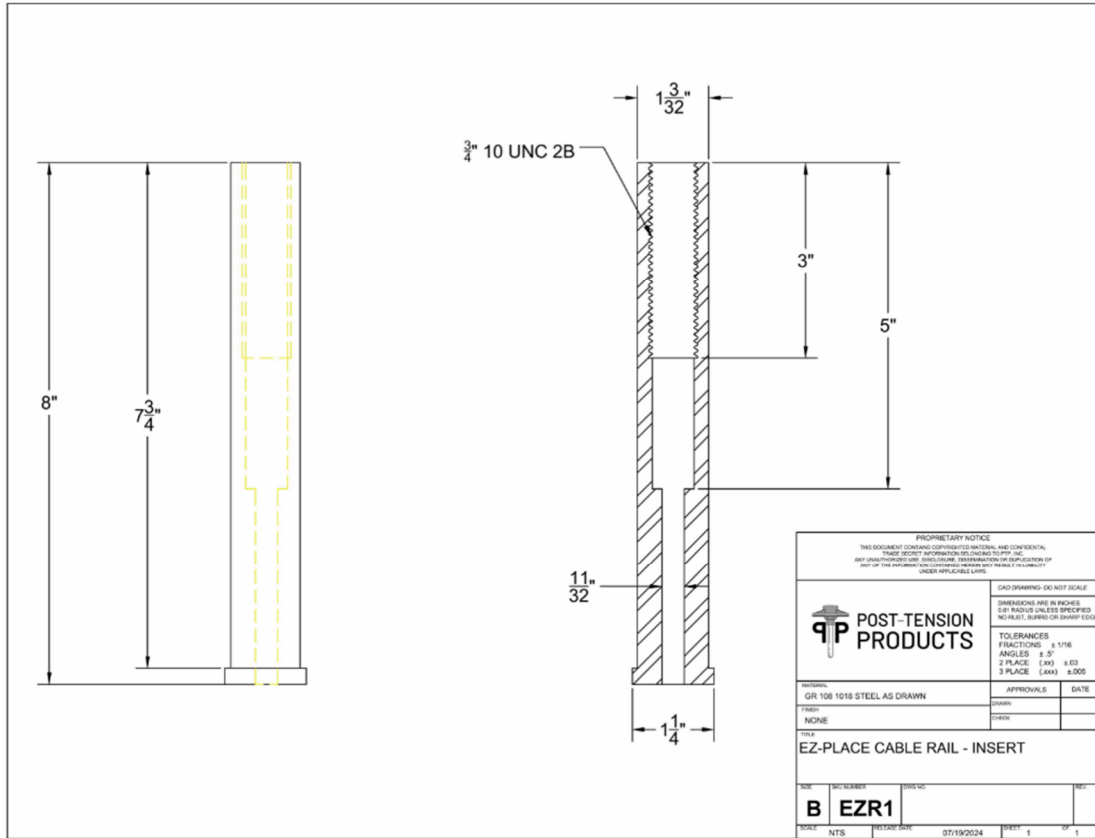


Figure 1. Drawing of EZ-Place Cable Rail insert



Figure 2. Insert showing section before being turned down to match the diameter of the remaining length of insert.

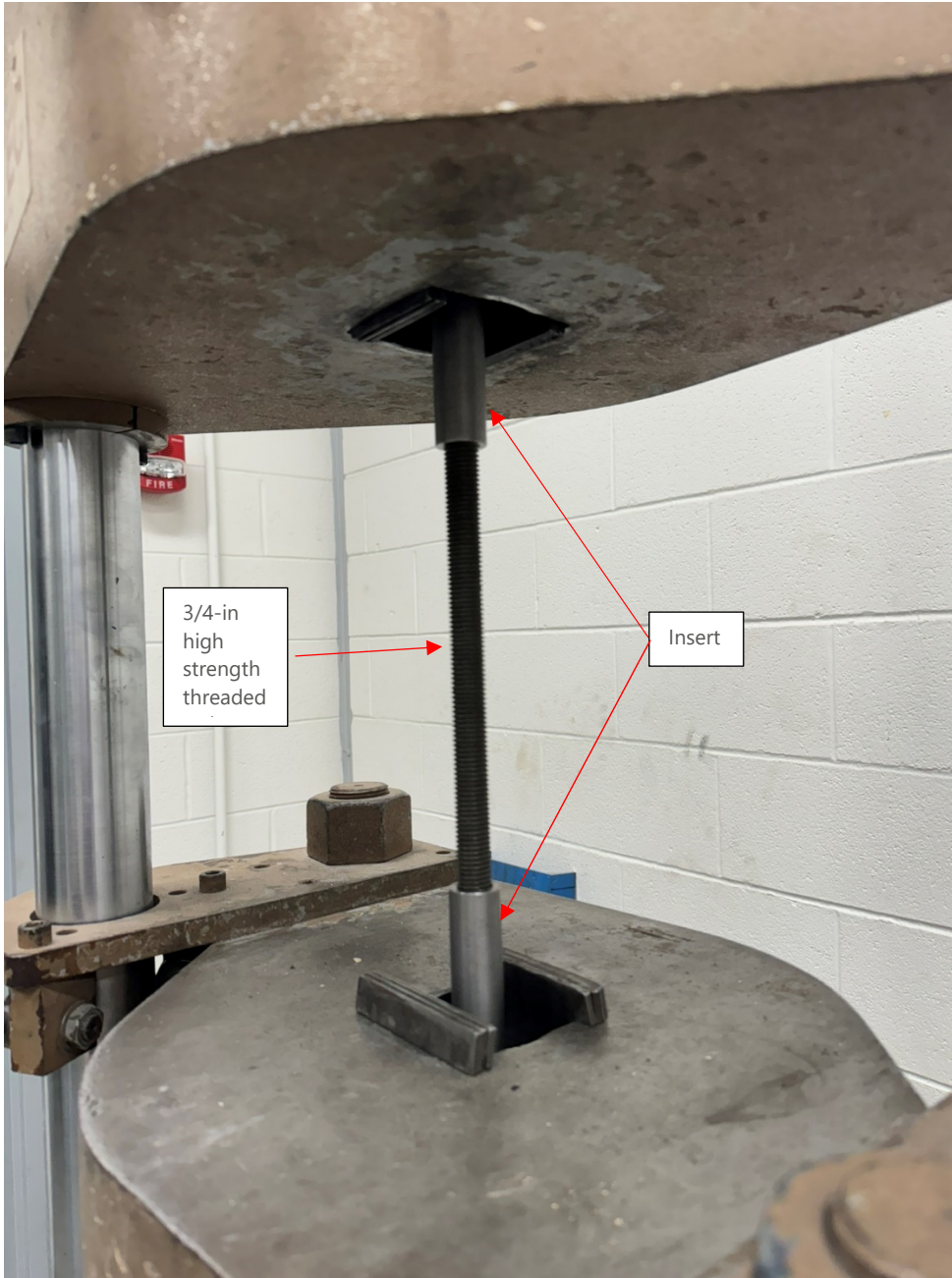


Figure 3. Test sample with insert on either end connected with a 3/4-in diameter high strength threaded rod.

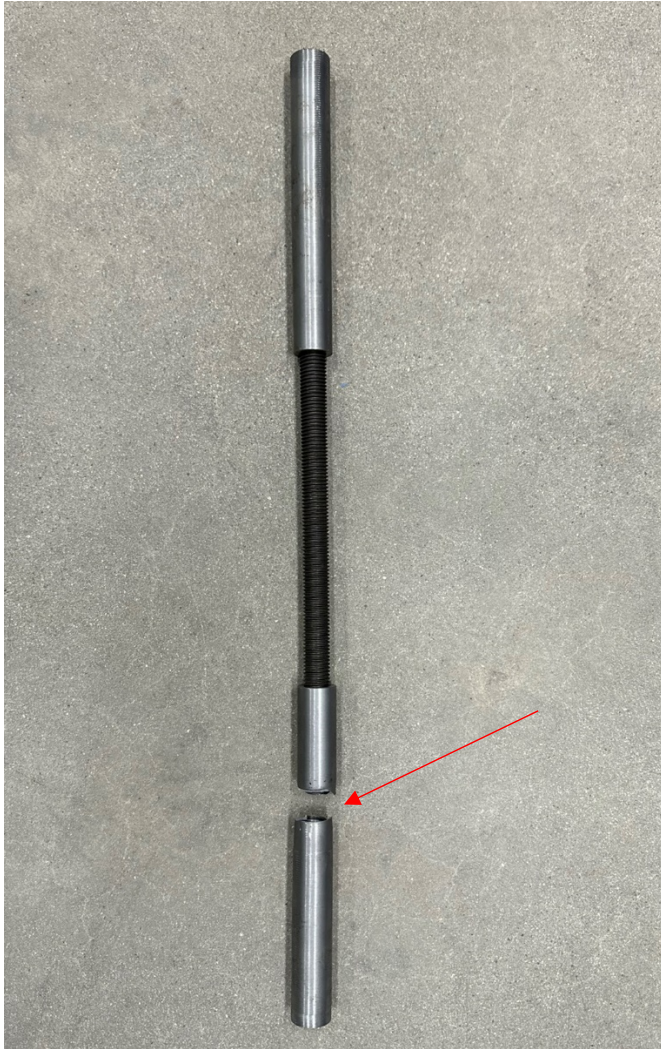


Figure 4. Test sample fracture

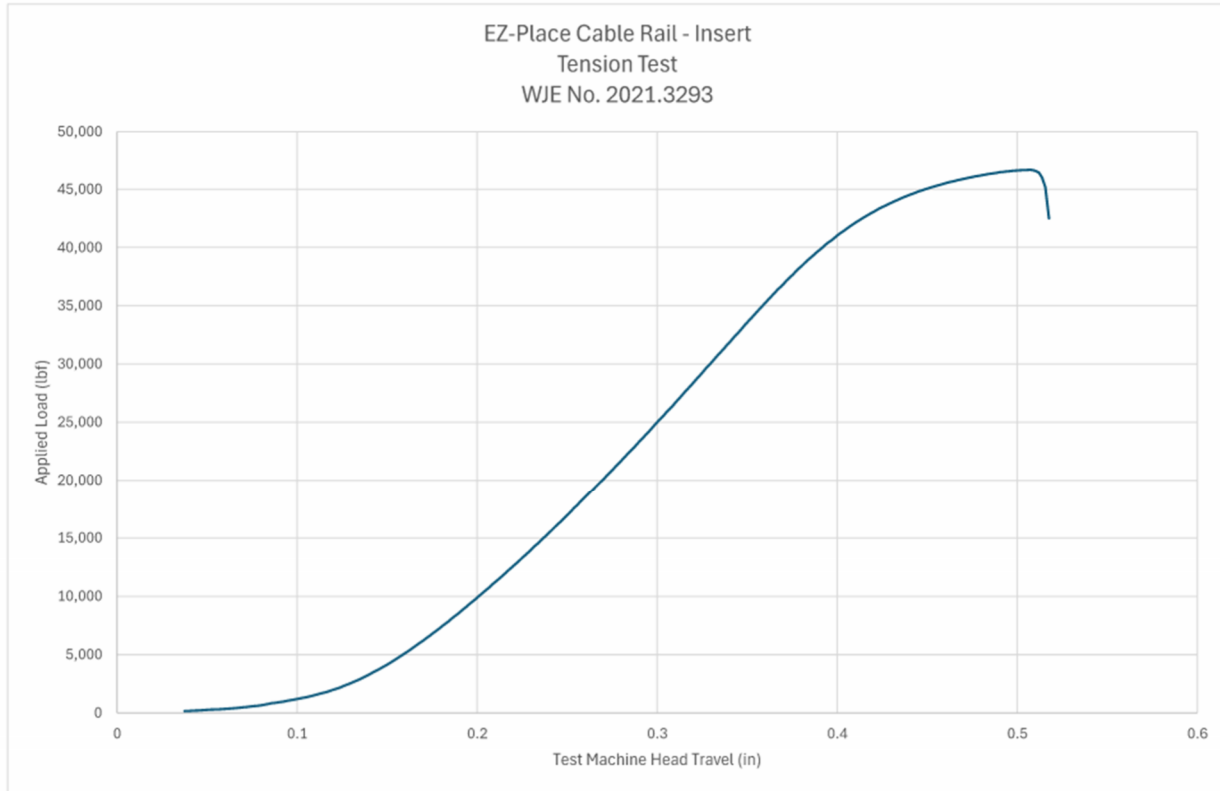


Figure 5. Load-displacement (crosshead separation) plot



Static Testing of 0.5-in EZ-Place Rail High Impact Insert

Static Testing of Post-Tensioned Products, Inc. Barrier Cable Insert

TEST MACHINE CALIBRATION



Cal-Rite Corporation

1665 QUINCY AVENUE, UNIT 103, NAPERVILLE, IL 60540
P 630.355.1522 F 630.355.1544 WWW.CAL-RITE.COM

Certificate Of Calibration

Equipment Calibration was performed at the address below for

WISS, JANNEY, ELSTNER ASSOC.

330 PFINGSTEN ROAD
NORTHBROOK ,IL 60062



Certificate # 866.01
Calibration

Date of Calibration
Monday, March 18, 2024

Issue Date:
04/04/2024

Manufacturer: SATEC

Capacity: 120000

Model: 120HVL

Next Calibration: 18-Mar-2025

Serial #: 1240

Customer #: 692

Specification: ASTM E 4-21 / ISO 7500-1:2018

QMS Revision: 3.01

Reading (%FS)	Nominal	Resolution	ISO Relative Resolution Error(%)	ISO Relative Indication Error	ISO Relative Indication Error(%)	ISO Relative Repeatability Error (%)	ISO Class	ASTM Accuracy Tolerance (% of rdg)	ASTM Repeatability Tolerance (% of rdg)	Uncertainty (%)
0.00%	0	1	0.000	0.000	0.00	0.00	0.00	1.0 %	1.0 %	0.29
1.00%	1200	1	0.083	0.000	0.00	0.25	1.00	1.0 %	1.0 %	0.29
2.00%	2400	1	0.042	-2.333	-0.10	0.17	1.00	1.0 %	1.0 %	0.29
4.00%	4800	1	0.021	-4.000	-0.08	0.10	1.00	1.0 %	1.0 %	0.29
7.00%	8400	1	0.012	-2.667	-0.03	0.05	1.00	1.0 %	1.0 %	0.29
10.00%	12000	1	0.008	6.000	0.05	0.08	1.00	1.0 %	1.0 %	0.29
20.00%	24000	1	0.004	-22.333	-0.09	0.11	1.00	1.0 %	1.0 %	0.29
40.00%	48000	1	0.002	-54.667	-0.11	0.12	1.00	1.0 %	1.0 %	0.29
60.00%	72000	1	0.001	-39.333	-0.05	0.06	1.00	1.0 %	1.0 %	0.29
80.00%	96000	1	0.001	-54.333	-0.06	0.06	1.00	1.0 %	1.0 %	0.29
100.00%	120000	1	0.001	-30.667	-0.03	0.03	1.00	1.0 %	1.0 %	0.29

- Cal-Rite has calibrated the testing equipment described above in accordance with the latest applicable specifications (ISO/IEC 17025, ANSI Z-540-1 and 10-CFR-21). All calibration measurements are traceable to the International System of Units (SI) through NIST.
- When a decision rule is stated in the governing specification, the prescribed decision rule was used in the pass/fail determination unless otherwise noted. In all other cases where a statement of conformance is made, the determination of conformance is made solely on the measurements falling in or out of the applied tolerance. Measurement uncertainty is stated, but not used to determine pass/fail status.
 - The uncertainty of the calibration process was estimated approximately at the 95% confidence level (k=2).
 - These results relate only to the item calibrated
- All force verification devices have been calibrated in accordance with ISO 376 practices and used within the certified Class 1 or better range
 - All force verification devices have been calibrated in accordance with ASTM E74 practices and used within the certified Class A range.
 - Computed forces have been temperature corrected as necessary

Service Comments: Verified proper operation of machine. Calibrated force in compression in accordance with ASTM and ISO standards. All readings found and left within tolerance and repeatable. Made adjustments to reduce error. The machine is in good condition and functioning properly at this time.

As Found Condition: In Tolerance

Calibration Procedure: CR100 Rev 16

Calibration Method: Follow the Force

Service Order #: 20256 - 17

GIL GUTIERREZ

SERVICE ENGINEER

As a mutual protection to the purchaser, the public, and ourselves, all Cal-Rite calibration reports are submitted as the confidential property of the purchaser, and any authorization for publication of statements, conclusions, or extractions from or regarding our reports is reserved pending our prior written approval.



Manufacture: SATEC	Indicator: DIGITAL	Calibration Date: 18-Mar-2024
Model: 120HVL	Capacity: 120000	Next Calibration: 18-Mar-2025
Serial #: 1240	Shunt #: 14231	Customer Id: 692
Software Version: MTQ 5.07.07	Test Direction: COMPRESSION	
Specification's: ISO 7500-1:2018	External Cell: 35253	
Temp/Humidity: 69.8 F/27 %	Temp Variance: 0.6	

ISO REPORT

Run-1 2Å Piston Position: .5

Reading (%FS)	UUT Indication	Resolution	Resolution Error(%)	Reading-1	Reading-1 Error	Reading-1 Error%	Class
0.00%	0	1	0.000	0	0.000	0.00	0
1.00%	1,200	1	0.083	1,209	-9.000	-0.74	1
2.00%	2,400	1	0.042	2,419	-19.000	-0.79	1
4.00%	4,800	1	0.021	4,834	-34.000	-0.70	1
7.00%	8,400	1	0.012	8,452	-52.000	-0.62	1
10.00%	12,000	1	0.008	12,076	-76.000	-0.63	1
20.00%	24,000	1	0.004	24,117	-117.000	-0.49	1
40.00%	48,000	1	0.002	48,289	-289.000	-0.60	1
60.00%	72,000	1	0.001	72,373	-373.000	-0.52	1
80.00%	96,000	1	0.001	96,537	-537.000	-0.56	1
100.00%	120,000	1	0.001	120,816	-816.000	-0.68	1

Run-1 Return to Zero: 8
 Max Force Applied: 120000
 Relative Zero Error: 0.01%
Calibration Load Cell Agreement
 Test Force: 24000
 Load Cell A Reading: 24027
 Load Cell B Reading: 24023
 Relative Error (A): 0.112
 Relative Error (B): 0.096
 Difference: 0.017
 Class: 0.5

Run-2 342Å Piston Position: 1

Reading (%FS)	UUT Indication	Resolution	Resolution Error(%)	Reading-2	Reading-2 Error	Reading-2 Error%	Class
0.00%	0	1	0.000	0	0.000	0.00	0
1.00%	1,200	1	0.083	1,198	2.000	0.17	1
2.00%	2,400	1	0.042	2,401	-1.000	-0.04	1
4.00%	4,800	1	0.021	4,804	-4.000	-0.08	1
7.00%	8,400	1	0.012	8,401	-1.000	-0.01	1
10.00%	12,000	1	0.008	11,988	12.000	0.10	1
20.00%	24,000	1	0.004	24,027	-27.000	-0.11	1
40.00%	48,000	1	0.002	48,057	-57.000	-0.12	1
60.00%	72,000	1	0.001	72,041	-41.000	-0.06	1
80.00%	96,000	1	0.001	96,053	-53.000	-0.06	1
100.00%	120,000	1	0.001	120,041	-41.000	-0.03	1

Run-2 Return to Zero: 8
 Max Force Applied: 120000
 Run to Zero Error: 0.01%
Calibration Load Cell Agreement
 Test Force: 48000
 Load Cell A Reading: 48057
 Load Cell B Reading: 48049
 Relative Error (A): 0.119
 Relative Error (B): 0.102
 Difference: 0.017
 Class: 0.5

Run-3 462Å Piston Position: 1.5

Reading (%FS)	UUT Indication	Resolution	Resolution Error(%)	Reading-3	Reading-3 Error	Reading-3 Error%	Class
0.00%	0	1	0.000	0	0.000	0.00	0
1.00%	1,200	1	0.083	1,201	-1.000	-0.08	1
2.00%	2,400	1	0.042	2,402	-2.000	-0.08	1
4.00%	4,800	1	0.021	4,805	-5.000	-0.10	1
7.00%	8,400	1	0.012	8,404	-4.000	-0.05	1
10.00%	12,000	1	0.008	11,996	4.000	0.03	1
20.00%	24,000	1	0.004	24,023	-23.000	-0.10	1
40.00%	48,000	1	0.002	48,058	-58.000	-0.12	1
60.00%	72,000	1	0.001	72,044	-44.000	-0.06	1
80.00%	96,000	1	0.001	96,061	-61.000	-0.06	1
100.00%	120,000	1	0.001	120,029	-29.000	-0.02	1

Run-3 Return to Zero: 10
 Max Force Applied: 120000
 Run to Zero Error: 0.01%
Calibration Load Cell Agreement
 Test Force: 55000
 Load Cell A Reading: 55044
 Load Cell B Reading: 55053
 Relative Error (A): 0.080
 Relative Error (B): 0.096
 Difference: -0.016
 Class: 0.5

Service Order #: 20256 - 17

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Manufacture:	SATEC	Indicator:	DIGITAL	Calibration Date:	18-Mar-2024
Model:	120HVL	Capacity:	120000	Next Calibration:	18-Mar-2025
Serial #:	1240	Shunt #:	14231	Customer Id:	692
Software Version:	MTQ 5.07.07	Test Direction:	COMPRESSION		
Specification's:	ISO 7500-1:2018	External Cell:	35253		
Temp/Humidity:	69.8 F/27 %	Temp Variance:	0.6		

ISO REPORT

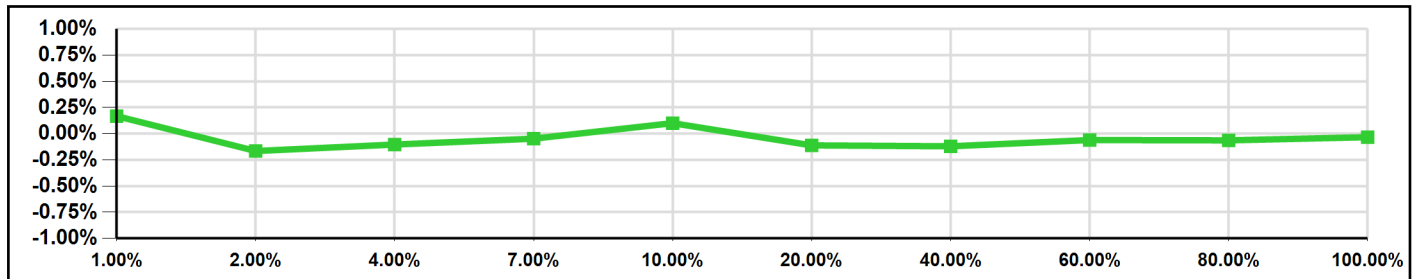
Run-4 (If Required)

Piston Position: 2

Run-4 Return to Zero:	9
Max Force Applied:	120000
Run to Zero Error:	0.01%
<i>Calibration Load Cell Agreement</i>	
Test Force:	0
Load Cell A Reading:	0
Load Cell B Reading:	0
Relative Error (A):	0.000
Relative Error (B):	0.000
Difference:	0.000
Class:	0.5

Reading (%FS)	UUT Indication	Resolution	Resolution Error(%)	Reading-4	Reading-4 Error	Reading-4 Error%	Class
0.00%	0	1	0.000	0	0.000	0.00	0
1.00%	1,200	1	0.083	1,201	-1.000	-0.08	1
2.00%	2,400	1	0.042	2,404	-4.000	-0.17	1
4.00%	4,800	1	0.021	4,803	-3.000	-0.06	1
7.00%	8,400	1	0.012	8,403	-3.000	-0.04	1
10.00%	12,000	1	0.008	11,998	2.000	0.02	1
20.00%	24,000	1	0.004	24,017	-17.000	-0.07	1
40.00%	48,000	1	0.002	48,049	-49.000	-0.10	1
60.00%	72,000	1	0.001	72,033	-33.000	-0.05	1
80.00%	96,000	1	0.001	96,049	-49.000	-0.05	1
100.00%	120,000	1	0.001	120,022	-22.000	-0.02	1

Linearity Profile (Percent Full Scale)



Calibrating Apparatus Used

Manufacture	Type	Serial Number	Cls	Capacity	Class A	Cert. #	Cal. Date	Cal. Due	Cal By
TOVEY	CS22-60K	119937A	1	60,000	1200	19971-1	10/16/2023	10/16/2025	CAL-RITE
STRAINSENSE	SSTMM604C	101208	1	600,000	17520	19718-1	9/1/2023	9/1/2025	TOVEY
MANTRACOURT	S181	17062459	1	4	0	20272-5	3/15/2024	7/15/2024	CAL-RITE

Service Order #: 20256 - 17

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Cal-Rite Corporation

1665 QUINCY AVENUE, UNIT 103, NAPERVILLE, IL 60540
P 630.355.1522 F 630.355.1544 WWW.CAL-RITE.COM



Certificate # 866.01
Calibration

Manufacture:	SATEC	Indicator:	DIGITAL	Calibration Date:	18-Mar-2024
Model:	120HVL	Capacity:	120000	Next Calibration:	18-Mar-2025
Serial #:	1240	Shunt #:	14231	Customer Id:	692
Software Version:	MTQ 5.07.07	Test Direction:	COMPRESSION		
Specification's:	ASTM E 4-21	External Cell:	35253		
Temp/Humidity:	69.8 F/27 %	Temp Variance:	0.6		

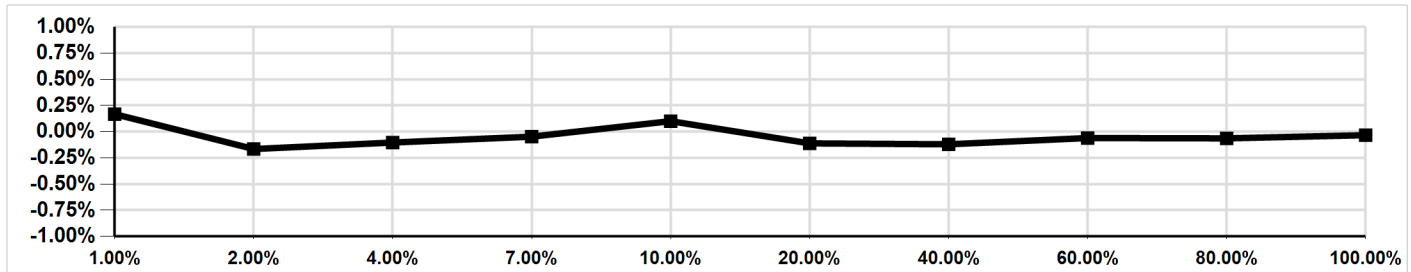
ASTM

Range: 120,000 LBF Resolution 1 LBF Accuracy: +/-: 1.0 % Uncertainty: 0.29%

Readout UUT	As Found	As Adjusted	As Left	Repeat %	Max Error	Error %
0	0	0	0	0.0000	0.0000	0.0000
1,200	1,209	1,198	1,201	-0.250	-1.000	0.167
2,400	2,419	2,401	2,402	-0.042	-2.000	-0.166
4,800	4,834	4,804	4,805	-0.021	-5.000	-0.104
8,400	8,452	8,401	8,404	-0.036	-4.000	-0.048
12,000	12,076	11,988	11,996	-0.067	4.000	0.100
24,000	24,117	24,027	24,023	0.017	-23.000	-0.112
48,000	48,289	48,057	48,058	-0.002	-58.000	-0.121
72,000	72,373	72,041	72,044	-0.004	-44.000	-0.061
96,000	96,537	96,053	96,061	-0.008	-61.000	-0.064
120,000	120,816	120,041	120,029	0.010	-29.000	-0.034

Zero Return: 0.010% 0.010% 0.010%

Linearity Profile (Percent Full Scale)



Calibrating Apparatus Used

Manufacture	Serial Number	Capacity	Class A	Cal Date	Cal Due	Calibrated By
TOVEY	119937A	60,000	1200	10/16/2023	10/16/2025	CAL-RITE
STRAINSENSE	101208	600,000	17520	9/1/2023	9/1/2025	TOVEY
MANTRACOURT	17062459	4	0	3/15/2024	7/15/2024	CAL-RITE

Service Order #: 20256 - 17

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