



February 3, 2014

Public Service Commission  
600 East Boulevard Avenue, Dept. 408  
Bismarck, ND 58505-0480

Re: Permanent Variance Permit Request for Bidirectional Prover  
Owner/Operator: NuStar Pipeline Operating Partnership L.P.  
Location: Jamestown North Terminal, 3598 74th Avenue S.E., Jamestown, ND 58401  
Prover: Precision Measurement Inc., serial # 869-015-86-4, capacity 12.94903

Dear Public Service Commission,

In accordance with NDAC Chapter 69-10-01-04.1, NuStar Pipeline Operating Partnership L.P. (NuStar) requests the grant of a permanent variance permit for the bidirectional prover located at the above referenced facility. NDAC Chapter 69-10-03-02 requires standards used to certify commercial weighing and measuring devices to be certified by a NIST-recognized metrology lab. The specialized functionality of the bidirectional prover is to produce a meter factor for the volume of product coming through the "in-line" meter at the terminal. The meter factor is used in configuring an invoice from volume of product passing through the meter into storage tanks at the terminal. The prover is used approximately 7-8 times a week, providing a meter factor for each product moved through the meter. The prover is built into the pipeline system and is not a separate device that can be removed and transported (please see attached photos for reference).

Since the prover cannot be removed and transported, the only other solution would be to have an employee from a NIST-certified lab oversee the calibration onsite. However, this is not an option since North Dakota does not have a NIST-certified laboratory.

The process for calibrating this type of prover is not typical, and meeting the annual compliance requirement in NDAC Chapter 69-10-03-02 will be challenging. A considerable amount of time and manpower is needed to prepare, as it involves many steps beginning up to one month prior to the actual calibration. Therefore, NuStar would like to request a permanent variance permit with a three year compliance period.

Please do not hesitate to contact me if you need any additional information or if you have any questions or comments. I can be reached at (210) 918-4942, and my email address is [jerry.stauffer@nustarenergy.com](mailto:jerry.stauffer@nustarenergy.com).

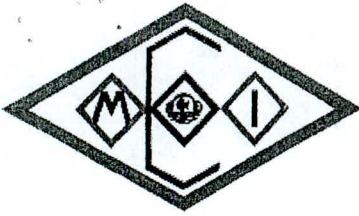
Sincerely,

Gerald A. Stauffer  
Executive Director HSE

1 WM-14-155 Filed 02/10/2014 Pages: 30  
Request for variance permit  
NuStar Pipeline Operating Partnership, L.P.  
Gerald Stauffer







|             |                    |
|-------------|--------------------|
| Customer    | Nustar             |
| Location    | Jamestown, ND      |
| Designation | Jamestown Terminal |
| Serial      | 869-015-86-4       |
| Prover Type | Bidirectional      |

## Certificate of Calibration

Jul 25, 2012

This is to certify that Meter Engineers, Inc. calibrated subject Bidirectional meter prover and established the volume at 60 degrees fahrenheit and atmospheric pressure for a round trip of the displacer to be:

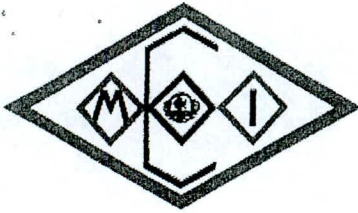
**Average Round Trip Volume: 12.9549 bbl**

The calibrating medium used was water and the calibration was performed in accordance with the latest edition of the API Standards Chapters 4, 11, & 12 by Gary Clark and certified by the undersigned. Test performed using trailer unit number 134.

Certified Test Measures Used:

| Measure # | Gal | NIST # |
|-----------|-----|--------|
| 1         | 100 | 6996   |
| 2         | 100 | 6997   |
| 3         | 50  | 6998   |
| 6         | 5   | 7002   |
| 9         | 15  | 7000   |

Signed



|             |                    |
|-------------|--------------------|
| Customer    | Nustar             |
| Location    | Jamestown, ND      |
| Designation | Jamestown Terminal |
| Serial      | 869-015-86-4       |
| Prover Type | Bidirectional      |

## BiDirectional Run Comparisons

### Left to Right Volumes

### Right to Left Volumes

Run 1 = 62,858.0423

Run 2 = 62,828.8658

0.0082 %

0.0193 %

Run 3 = 62,852.8612

0.0143 %

Run 4 = 62,840.9634

0.0101 %

0.0061 %

0.0092 %

Run 5 = 62,849.0333

Run 6 = 62,835.1932

Round Trip Volume First = 125,686.9081

0.0055 %

Round Trip Volume Second = 125,693.8246

0.0021 %

Round Trip Volume Third = 125,684.2265

0.0076 %

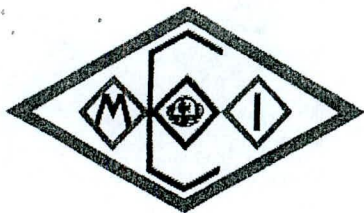
Previous Volume was 12.953006 barrels

Previous Volume was 125670.064212 inches

This WaterDraw 12.9549 barrels

.0145 % Diff from Previous Volume

This WaterDraw 125,688.3197 inches



|             |                    |
|-------------|--------------------|
| Customer    | Nustar             |
| Location    | Jamestown, ND      |
| Designation | Jamestown Terminal |
| Serial      | 869-015-86-4       |
| Prover Type | Bidirectional      |

## Prover Information

|                                    |                       |
|------------------------------------|-----------------------|
| Prover Type                        | Bidirectional         |
| Designation                        | Jamestown             |
| Serial                             | 869-015-86-4          |
| Pipe I.D.                          | 12                    |
| ANSI                               | 150                   |
| Ball Percent Oversize              | 3 %                   |
| Ball Composition                   | Polyurethane (Yellow) |
| Pipe Wall Thickness                | .375                  |
| Mfg of Prover                      | Precision Measurement |
| Mfg of 4- Way                      | General               |
| Mfg of SwitchBase                  | Kidd Pipeline Spec.   |
| Mfg of Switches                    | Magtek                |
| First Detector Switch Seal Number  |                       |
| Second Detector Switch Seal Number |                       |
| Coated?                            | Yes                   |
| Insulated?                         | No                    |
| Metallic Composition               | Carbon Steel          |
| Coefficient of Cubical Expansion   | .0000186              |
| Modulus of Elasticity              | 30000000              |
| Unit Number                        | 134                   |
| Above or Below Ground              | Above                 |
| Notes                              |                       |

### Methodology

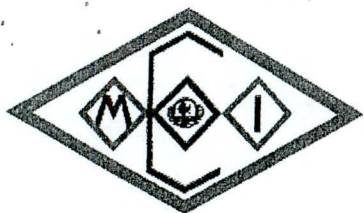
CTL Temperature Correction Factor is based on API Petroleum Measurement manual Chapter 11.2.3

CTS Metal Correction Factor =  $(1 + ((\text{Can Temp in F} - 60) \text{ times the Can Coefficient of Expansion}))$   
 divided by  $(1 + ((\text{Prover Temp in F} - 60) \text{ times the Prover Coefficient of Expansion}))$

CPS =  $1 + (\text{Pressure times the Pipe ID divided by the Modulus of Elasticity times the Prover Pipewall Thickness})$

CPL =  $1 \text{ divided by } \{1 - (\text{Compressibility Constant of Water times Prover Pressure})\}$

File Source: Waterdraws



Customer | Nustar  
 Location | Jamestown, ND  
 Designation | Jamestown Terminal  
 Serial | 869-015-86-4  
 Prover Type | Bidirectional

# Run Calculation Summary

Gary Clark

Run # 1 (L-R) Elapsed Time 4 : 39 min GPM 58.53 Pressure 36

| Measure         | Certified Volume | Scale Reading | Actual Volume | Prover Temp | Can Temp | CTL Temp Correction | CTS Metal Correction | Adjusted Volume |
|-----------------|------------------|---------------|---------------|-------------|----------|---------------------|----------------------|-----------------|
| Can # 1 100gal  | 23,090.34        | 240           | 23,330.34     | 68          | 67.8     | 1.000023            | 1.000058             | 23,332.2298     |
| Can # 2 100gal  | 23,091.12        | 240           | 23,331.12     | 68          | 67.8     | 1.000023            | 1.000058             | 23,333.0099     |
| Can # 3 50gal   | 11,549.47        | 37            | 11,586.47     | 68          | 67.9     | 1.000011            | 1.000060             | 11,587.2926     |
| Can # 9 15gal   | 3,461.53         | .5            | 3,462.03      | 68          | 68.1     | 0.999988            | 1.000066             | 3,462.2169      |
| Can # 6 5gal    | 1,153.39         | -5            | 1,152.89      | 68          | 68.5     | 0.999942            | 1.000076             | 1,152.9107      |
| Volume This Run |                  |               |               |             |          |                     |                      | 62,867.6599     |
| Divided by CPS  |                  |               |               |             |          |                     |                      | 1.000038        |
| Divided by CPL  |                  |               |               |             |          |                     |                      | 1.000115        |

Pressure & Temperature Adjusted Volume This Run **62,858.0423**

Run # 2 (R-L) Elapsed Time 4 : 15 min GPM 64.01 Pressure 35

| Measure        | Certified Volume | Scale Reading | Actual Volume | Prover Temp | Can Temp | CTL Temp Correction | CTS Metal Correction | Adjusted Volume |
|----------------|------------------|---------------|---------------|-------------|----------|---------------------|----------------------|-----------------|
| Can # 1 100gal | 23,090.34        | 241           | 23,331.34     | 68.8        | 68.4     | 1.000047            | 1.000059             | 23,333.8132     |
| Can # 2 100gal | 23,091.12        | 240           | 23,331.12     | 68.8        | 68.4     | 1.000047            | 1.000059             | 23,333.5932     |
| Can # 3 50gal  | 11,549.47        | 5             | 11,554.47     | 68.8        | 68.5     | 1.000035            | 1.000061             | 11,555.5793     |
| Can # 9 15gal  | 3,461.53         | 0             | 3,461.53      | 68.8        | 68.7     | 1.000012            | 1.000067             | 3,461.8035      |
| Can # 6 5gal   | 1,153.39         | 0             | 1,153.39      | 68.8        | 69.1     | 0.999965            | 1.000077             | 1,153.4384      |

## Run Calculation Summary (cont)

|                 |             |
|-----------------|-------------|
| Volume This Run | 62,838.2276 |
| Divided by CPS  | 1.000037    |
| Divided by CPL  | 1.000112    |

Pressure & Temperature Adjusted Volume This Run      **62,828.8658**

Run # 3 (L-R)      Elapsed Time 6 : 24 min      GPM 42.52      Pressure 36

| Measure           | Certified Volume | Scale Reading | Actual Volume | Prover Temp | Can Temp | CTL Temp Correction | CTS Metal Correction | Adjusted Volume |
|-------------------|------------------|---------------|---------------|-------------|----------|---------------------|----------------------|-----------------|
| Can # 1    100gal | 23,090.34        | 240           | 23,330.34     | 69          | 68.9     | 1.000012            | 1.000069             | 23,332.2298     |
| Can # 2    100gal | 23,091.12        | 240           | 23,331.12     | 69          | 68.9     | 1.000012            | 1.000069             | 23,333.0098     |
| Can # 3    50gal  | 11,549.47        | 32            | 11,581.47     | 69          | 69.1     | 0.999989            | 1.000074             | 11,582.1996     |
| Can # 9    15gal  | 3,461.53         | 0             | 3,461.53      | 69          | 69.4     | 0.999953            | 1.000082             | 3,461.6511      |
| Can # 6    5gal   | 1,153.39         | 0             | 1,153.39      | 69          | 69.8     | 0.999905            | 1.000093             | 1,153.3877      |
| Volume This Run   |                  |               |               |             |          |                     |                      | 62,862.4780     |
| Divided by CPS    |                  |               |               |             |          |                     |                      | 1.000038        |
| Divided by CPL    |                  |               |               |             |          |                     |                      | 1.000115        |

Pressure & Temperature Adjusted Volume This Run      **62,852.8612**

Run # 4 (R-L)      Elapsed Time 6 : 21 min      GPM 42.85      Pressure 33

| Measure           | Certified Volume | Scale Reading | Actual Volume | Prover Temp | Can Temp | CTL Temp Correction | CTS Metal Correction | Adjusted Volume |
|-------------------|------------------|---------------|---------------|-------------|----------|---------------------|----------------------|-----------------|
| Can # 1    100gal | 23,090.34        | 240           | 23,330.34     | 70          | 69.8     | 1.000024            | 1.000074             | 23,332.6264     |
| Can # 2    100gal | 23,091.12        | 240           | 23,331.12     | 70          | 69.8     | 1.000024            | 1.000074             | 23,333.4065     |
| Can # 3    50gal  | 11,549.47        | 18            | 11,567.47     | 70          | 69.8     | 1.000024            | 1.000074             | 11,568.6036     |
| Can # 9    15gal  | 3,461.53         | 0             | 3,461.53      | 70          | 70.1     | 0.999988            | 1.000082             | 3,461.7723      |
| Can # 6    5gal   | 1,153.39         | 0             | 1,153.39      | 70          | 70.6     | 0.999927            | 1.000095             | 1,153.4154      |
| Volume This Run   |                  |               |               |             |          |                     |                      | 62,849.8242     |
| Divided by CPS    |                  |               |               |             |          |                     |                      | 1.000035        |
| Divided by CPL    |                  |               |               |             |          |                     |                      | 1.000106        |

Pressure & Temperature Adjusted Volume This Run      **62,840.9634**

## Run Calculation Summary (cont)

Run # 5 (L-R)      Elapsed Time 4 : 12 min      GPM 64.79      Pressure 36

| Measure           | Certified Volume | Scale Reading | Actual Volume | Prover Temp | Can Temp | CTL Temp Correction | CTS Metal Correction | Adjusted Volume |
|-------------------|------------------|---------------|---------------|-------------|----------|---------------------|----------------------|-----------------|
| Can # 1    100gal | 23,090.34        | 240           | 23,330.34     | 70.4        | 70.4     | 1.000000            | 1.000083             | 23,332.2764     |
| Can # 2    100gal | 23,091.12        | 240           | 23,331.12     | 70.4        | 70.4     | 1.000000            | 1.000083             | 23,333.0565     |
| Can # 3    50gal  | 11,549.47        | 28            | 11,577.47     | 70.4        | 70.4     | 1.000000            | 1.000083             | 11,578.4309     |
| Can # 9    15gal  | 3,461.53         | 0             | 3,461.53      | 70.4        | 70.7     | 0.999963            | 1.000091             | 3,461.7169      |
| Can # 6    5gal   | 1,153.39         | -25           | 1,153.14      | 70.4        | 71       | 0.999926            | 1.000099             | 1,153.1688      |
| Volume This Run   |                  |               |               |             |          |                     |                      | 62,858.6495     |
| Divided by CPS    |                  |               |               |             |          |                     |                      | 1.000038        |
| Divided by CPL    |                  |               |               |             |          |                     |                      | 1.000115        |

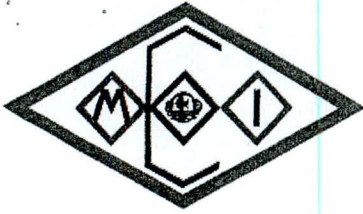
Pressure & Temperature Adjusted Volume This Run      **62,849.0333**

Run # 6 (R-L)      Elapsed Time 4 : 22 min      GPM 62.3      Pressure 34

| Measure           | Certified Volume | Scale Reading | Actual Volume | Prover Temp | Can Temp | CTL Temp Correction | CTS Metal Correction | Adjusted Volume |
|-------------------|------------------|---------------|---------------|-------------|----------|---------------------|----------------------|-----------------|
| Can # 1    100gal | 23,090.34        | 240           | 23,330.34     | 71.2        | 71.1     | 1.000013            | 1.000086             | 23,332.6497     |
| Can # 2    100gal | 23,091.12        | 239           | 23,330.12     | 71.2        | 71       | 1.000025            | 1.000084             | 23,332.6630     |
| Can # 3    50gal  | 11,549.47        | 13            | 11,562.47     | 71.2        | 71       | 1.000025            | 1.000084             | 11,563.7303     |
| Can # 9    15gal  | 3,461.53         | 0             | 3,461.53      | 71.2        | 71.3     | 0.999988            | 1.000091             | 3,461.8035      |
| Can # 6    5gal   | 1,153.39         | 0             | 1,153.39      | 71.2        | 71.5     | 0.999962            | 1.000097             | 1,153.4580      |
| Volume This Run   |                  |               |               |             |          |                     |                      | 62,844.3045     |
| Divided by CPS    |                  |               |               |             |          |                     |                      | 1.000036        |
| Divided by CPL    |                  |               |               |             |          |                     |                      | 1.000109        |

Pressure & Temperature Adjusted Volume This Run      **62,835.1932**

Meter Engineers, Inc.



# WaterDraw Calibration Worksheet

|             |                    |
|-------------|--------------------|
| Customer    | Nustar             |
| Location    | Jamestown, ND      |
| Designation | Jamestown Terminal |
| Serial      | 869-015-86-4       |
| Prover Type | Bidirectional      |

Technician: Gary Clark  
 Scale Reading: 489.2 cubic inches  
 Tolerance: 12.6 cubic inches

*SLOW*

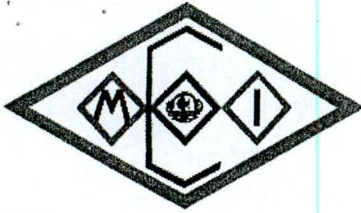
Date: 7-25-12    1 68.0 36 4:39    2 68.8 35 4:15    3 69.0 36 6:24  
 Run Prv Temp Pres Time    Run Prv Temp Pres Time    Run Prv Temp Pres Time  
 Direction: L-R    Direction: R-L    Direction: L-R

| Measure            | Scale Reading    | Temp        | Scale Reading    | Temp        | Scale Reading    | Temp        |
|--------------------|------------------|-------------|------------------|-------------|------------------|-------------|
| Can # 1    100 gal | 1 <u>240</u>     | <u>67.8</u> | 1 <u>241</u>     | <u>68.4</u> | 1 <u>240</u>     | <u>68.9</u> |
| Can # 2    100 gal | 2 <u>240</u>     | <u>67.8</u> | 2 <u>240</u>     | <u>68.4</u> | 2 <u>240</u>     | <u>68.9</u> |
| Can # 3    50 gal  | 3 <u>37</u>      | <u>67.9</u> | 3 <u>5</u>       | <u>68.5</u> | 3 <u>32</u>      | <u>69.1</u> |
| Can # 9    15 gal  | 9 <u>7.5</u>     | <u>68.1</u> | 9 <u>0</u>       | <u>68.7</u> | 9 <u>0</u>       | <u>69.4</u> |
| Can # 6    5 gal   | 6 <u>-.5</u>     | <u>68.5</u> | 6 <u>0</u>       | <u>69.1</u> | 6 <u>0</u>       | <u>69.8</u> |
|                    | <u>517</u> Total |             | <u>486</u> Total |             | <u>512</u> Total |             |

Thermometer Numbers: 469719    406450    487983

|                       |               |            |           |
|-----------------------|---------------|------------|-----------|
| Witnesses:            | (Company)     | Witnesses: | (Company) |
| <u>[Signature]</u>    | <u>MEI</u>    | _____      | _____     |
| <u>Wilbur J Latun</u> | <u>NUSTAR</u> | _____      | _____     |
| <u>[Signature]</u>    | <u>NUSTAR</u> | _____      | _____     |

Meter Engineers, Inc.



# WaterDraw Calibration Worksheet

|             |                    |
|-------------|--------------------|
| Customer    | Nustar             |
| Location    | Jamestown, ND      |
| Designation | Jamestown Terminal |
| Serial      | 869-015-86-4       |
| Prover Type | Bidirectional      |

Technician: Gary Clark  
 Scale Reading: 489.2 cubic inches  
 Tolerance: 12.6 cubic inches

*SLOW*

Date: 7-25-12      4 70 33 6:21      5 70.4 36 4:12      6 71.2 34 4:22

Run Prv Temp Pres Time      Run Prv Temp Pres Time      Run Prv Temp Pres Time

Direction: R-L      Direction: L-R      Direction: R-L

| Measure            | Scale Reading    | Temp        | Scale Reading       | Temp        | Scale Reading    | Temp        |
|--------------------|------------------|-------------|---------------------|-------------|------------------|-------------|
| Can # 1    100 gal | 1 <u>240</u>     | <u>69.8</u> | 1 <u>240</u>        | <u>70.4</u> | 1 <u>240</u>     | <u>70.1</u> |
| Can # 2    100 gal | 2 <u>240</u>     | <u>69.8</u> | 2 <u>240</u>        | <u>70.4</u> | 2 <u>239</u>     | <u>70.0</u> |
| Can # 3    50 gal  | 3 <u>18</u>      | <u>69.8</u> | 3 <u>28</u>         | <u>70.4</u> | 3 <u>13</u>      | <u>70.0</u> |
| Can # 9    15 gal  | 9 <u>0</u>       | <u>70.1</u> | 9 <u>0</u>          | <u>70.7</u> | 9 <u>0</u>       | <u>71.3</u> |
| Can # 6    5 gal   | 6 <u>0</u>       | <u>70.6</u> | 6 <u>-0.25</u>      | <u>71.0</u> | 6 <u>0</u>       | <u>71.5</u> |
|                    | <u>498</u> Total |             | <u>507.75</u> Total |             | <u>492</u> Total |             |

Thermometer Numbers: 469719    486450    487983

|                    |               |            |           |
|--------------------|---------------|------------|-----------|
| Witnesses:         | (Company)     | Witnesses: | (Company) |
| <u>[Signature]</u> | <u>MEI</u>    | _____      | _____     |
| <u>[Signature]</u> | <u>NUSTAR</u> | _____      | _____     |
| <u>[Signature]</u> | <u>NUSTAR</u> | _____      | _____     |



National Institute of Standards and Technology  
Technology Administration, U.S. Department of Commerce

# REPORT OF CALIBRATION

FOR

**A ONE-HUNDRED (100) GALLON VOLUME PROVER  
(Graduated Neck Type)**

**March 31, 2009**

Manufacturer: Seraphin  
Rancocas, NJ

NIST Seal Number: 6996  
Material: Stainless Steel  
Serial Number: 2470-A

submitted by

Meter Engineers, Inc.  
7718 W. 53<sup>rd</sup> St. N.  
Mazie, KS 67101

(Reference: Purchase Order Number 003680, dated January 15, 2009)

The internal volume of the prover described above has been determined by the gravimetric method [1]. The gravimetric method requires weighing the vessel dry and empty and re-weighing it when filled with a fluid of known density. The internal or contained volume was determined in this way and the value is given in Table 1 using the requested units. The fluid used was distilled water and the prover was leveled before determining the volume.

To determine the delivered volume, the contained volume is poured from the prover by opening the valve at the bottom of the vessel. When this flow finishes, the valve is held open for 30 seconds to complete the drain procedure. Subsequent re-weighing completes the gravimetric procedure and enables calculation of the delivered volume, also given in Table 1. Both the contained and delivered volumes are given for the scale reading of zero (0) and have been corrected for the reference temperature of 15.56 °C (60 °F), assuming a volumetric coefficient of expansion of 0.0000477 per °C (0.0000265 per °F).

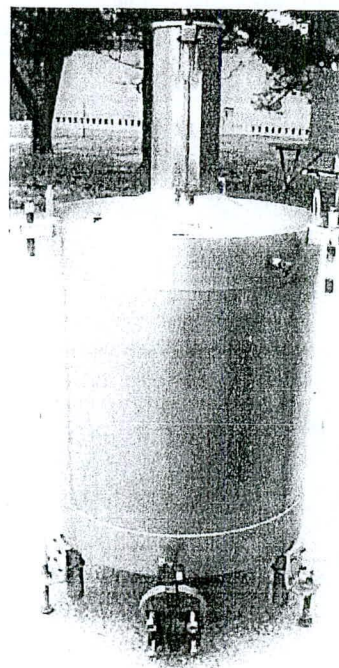
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[1] Bean, V. E., Espina, P. I., Wright, J. D., Houser, J. F., Sheckels, S. D., and Johnson, A. N., "NIST Calibration Services for Liquid Volume," NIST Special Publication 250-72, National Institute of Standards and Technology, March 24, 2006.

**Table 1.** Contained and delivered volumes for the tested vessel for a scale reading\* of zero.

|                          | Volume Contained | Volume Delivered |
|--------------------------|------------------|------------------|
| gal at 60 °F             | 99.9755          | <b>99.9582</b>   |
| in <sup>3</sup> at 60 °F | 23094.35         | <b>23090.34</b>  |

The volume measurement procedure was repeated 5 times with the neck scale filled approximately to zero each time. The repeatability of the 5 measurements was 22 parts in 10<sup>6</sup> and the expanded uncertainty in the measured volume is ±0.007 %. It was calculated according to References [1] and [2] with a 95 % confidence level† and is traceable to NIST mass, temperature, pressure, and humidity standards, and a NIST distilled water density determination.



**Figure 1.** Photographs of the volume prover.

The input data used for calculation of the prover volume are given in the spreadsheet attached to this report.

\* The scale reading is determined by the intersection of the horizontal plane, tangent to the bottom of the meniscus reading on the gauge tube. For this vessel, the scale range was from -175 and +200 and each division is equivalent to 5 in<sup>3</sup>.

[2] Taylor, B. N. and Kuyatt, C. E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, National Institute of Standards and Technology (January 1993).

† Coverage factor of 2.09 for 20 effective degrees of freedom.

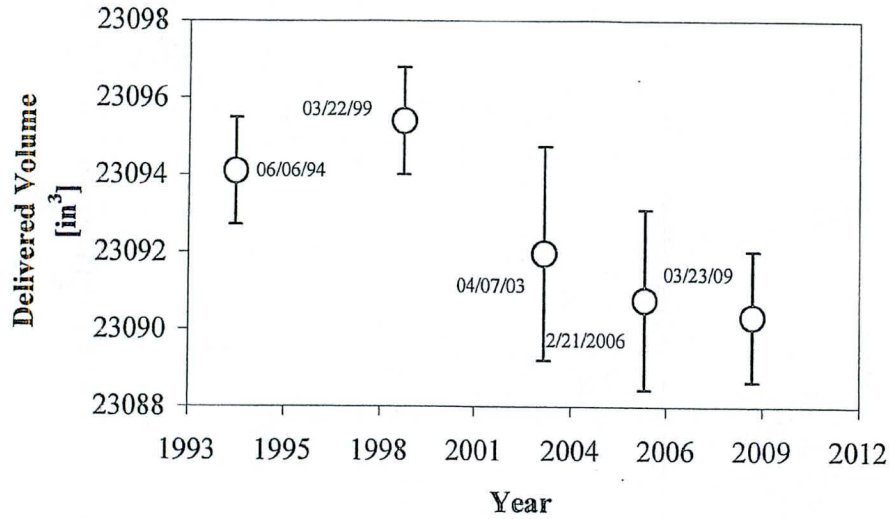


Figure 2. Calibration control chart for 100 gallon graduated neck test measure SN 2470-A.

Table 2. Results of prior calibrations for the delivered volume.

| Date     | Delivered Volume [in <sup>3</sup> ] | Difference from Prior [in <sup>3</sup> ] | Degree of Equivalence [-] |
|----------|-------------------------------------|--|---------------------------|
| 03/23/09 | 23090.34                            | -0.43                                    | -0.07                     |
| 02/21/06 | 23090.77                            | -1.20                                    | -0.20                     |
| 04/07/03 | 23091.97                            | -3.43                                    | -0.58                     |
| 03/22/99 | 23095.40                            | 1.30                                     | 0.22                      |
| 06/06/94 | 23094.10                            | -  | -                         |

For the Director,  
National Institute of Standards and Technology

Dr. John D. Wright  
Project Leader, Fluid Metrology Group  
Process Measurements Division  
Chemical Science and Technology Laboratory  
National Institute of Standards and Technology

Sherry Sheckels  
Calibration Technician, Fluid Metrology Group  
Process Measurements Division  
Chemical Science and Technology Laboratory  
National Institute of Standards and Technology



National Institute of Standards and Technology  
Technology Administration, U.S. Department of Commerce

# REPORT OF CALIBRATION

FOR

**A ONE-HUNDRED (100) GALLON VOLUME PROVER  
(Graduated Neck Type)**

**March 31, 2009**

Manufacturer: Seraphin  
Rancocas, NJ

NIST Seal Number: 6997  
Material: Stainless Steel  
Serial Number: 2470-B

submitted by

Meter Engineers, Inc.  
7718 W. 53<sup>rd</sup> St. N.  
Mazie, KS 67101

(Reference: Purchase Order Number 003680, dated January 15, 2009)

The internal volume of the prover described above has been determined by the gravimetric method [1]. The gravimetric method requires weighing the vessel dry and empty and re-weighing it when filled with a fluid of known density. The internal or contained volume was determined in this way and the value is given in Table 1 using the requested units. The fluid used was distilled water and the prover was leveled before determining the volume.

To determine the delivered volume, the contained volume is poured from the prover by opening the valve at the bottom of the vessel. When this flow finishes, the valve is held open for 30 seconds to complete the drain procedure. Subsequent re-weighing completes the gravimetric procedure and enables calculation of the delivered volume, also given in Table 1. Both the contained and delivered volumes are given for the scale reading of zero (0) and have been corrected for the reference temperature of 15.56 °C (60 °F), assuming a volumetric coefficient of expansion of 0.0000477 per °C (0.0000265 per °F).

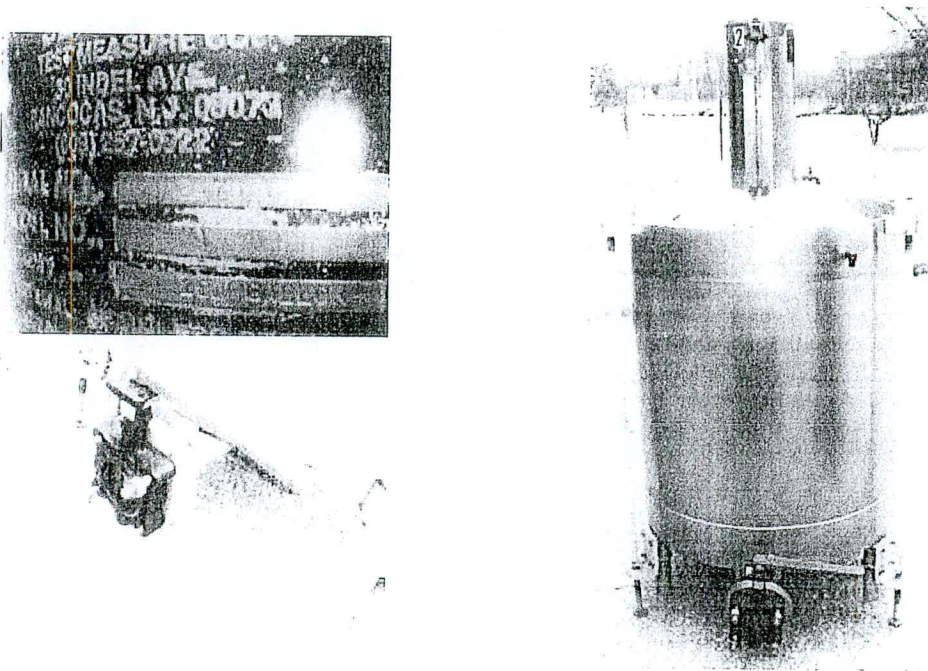
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[1] Bean, V. E., Espina, P. I., Wright, J. D., Houser, J. F., Sheckels, S. D., and Johnson, A. N., "NIST Calibration Services for Liquid Volume," NIST Special Publication 250-72, National Institute of Standards and Technology, March 24, 2006.

**Table 1.** Contained and delivered volumes for the tested vessel for a scale reading\* of zero.

|                          | Volume Contained | Volume Delivered |
|--------------------------|------------------|------------------|
| gal at 60 °F             | 99.9812          | <b>99.9615</b>   |
| in <sup>3</sup> at 60 °F | 23095.67         | <b>23091.12</b>  |

The volume measurement procedure was repeated 5 times with the neck scale filled approximately to zero each time. The repeatability of the 5 measurements was 28 parts in 10<sup>6</sup> and the expanded uncertainty in the measured volume is  $\pm 0.008\%$ . It was calculated according to References [1] and [2] with a 95 % confidence level<sup>†</sup> and is traceable to NIST mass, temperature, pressure, and humidity standards, and a NIST distilled water density determination.



**Figure 1.** Photographs of the volume prover.

The input data used for calculation of the prover volume are given in the spreadsheet attached to this report.

\* The scale reading is determined by the intersection of the horizontal plane, tangent to the bottom of the meniscus reading on the gauge tube. For this vessel, the scale range was from -200 and +200 and each division is equivalent to 5 in<sup>3</sup>.

[2] Taylor, B. N. and Kuyatt, C. E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, National Institute of Standards and Technology (January 1993).

<sup>†</sup> Coverage factor of 2.14 for 15 effective degrees of freedom.

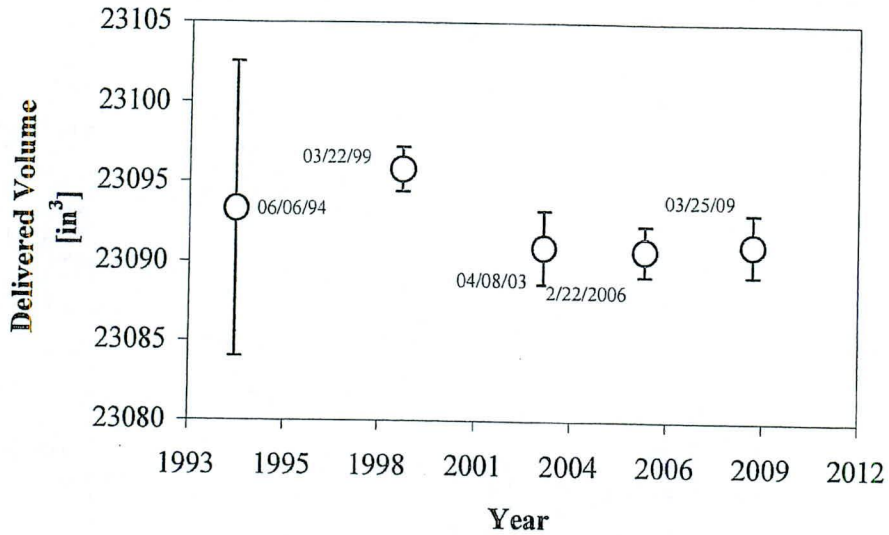


Figure 2. Calibration control chart for 100 gallon graduated neck test measure SN 2470-B.

Table 2. Results of prior calibrations for the delivered volume.

| Date     | Delivered Volume [in <sup>3</sup> ] | Difference from Prior [in <sup>3</sup> ] | Degree of Equivalence [-] |
|----------|-------------------------------------|--|---------------------------|
| 03/25/09 | 23091.12                            | 0.39                                     | 0.07                      |
| 02/22/06 | 23090.74                            | -0.19                                    | -0.03                     |
| 04/08/03 | 23090.93                            | -4.87                                    | -0.83                     |
| 03/22/99 | 23095.80                            | 2.50                                     | 0.42                      |
| 06/06/94 | 23093.30                            | -  | -                         |

For the Director,  
National Institute of Standards and Technology

Dr. John D. Wright  
Project Leader, Fluid Metrology Group  
Process Measurements Division  
Chemical Science and Technology Laboratory  
National Institute of Standards and Technology

Sherry Sheckels  
Calibration Technician, Fluid Metrology Group  
Process Measurements Division  
Chemical Science and Technology Laboratory  
National Institute of Standards and Technology



National Institute of Standards and Technology  
Technology Administration, U.S. Department of Commerce

# REPORT OF CALIBRATION

FOR

**A FIFTY (50) GALLON VOLUME PROVER  
(Graduated Neck Type)**

**March 31, 2009**

Manufacturer: Seraphin  
Rancocas, NJ

NIST Seal Number: 6998

Material: Stainless Steel

Serial Number: 7293-C

submitted by

Meter Engineers, Inc.  
7718 W. 53<sup>rd</sup> St. N.  
Mazie, KS 67101

(Reference: Purchase Order Number 003680, dated January 15, 2009)

The internal volume of the prover described above has been determined by the gravimetric method [1]. The gravimetric method requires weighing the vessel dry and empty and re-weighing it when filled with a fluid of known density. The internal or contained volume was determined in this way and the value is given in Table 1 using the requested units. The fluid used was distilled water and the prover was leveled before determining the volume.

To determine the delivered volume, the contained volume is poured from the prover by opening the valve at the bottom of the vessel. When this flow finishes, the valve is held open for 30 seconds to complete the drain procedure. Subsequent re-weighing completes the gravimetric procedure and enables calculation of the delivered volume, also given in Table 1. Both the contained and delivered volumes are given for the scale reading of zero (0) and have been corrected for the reference temperature of 15.56 °C (60 °F), assuming a volumetric coefficient of expansion of 0.0000477 per °C (0.0000265 per °F).

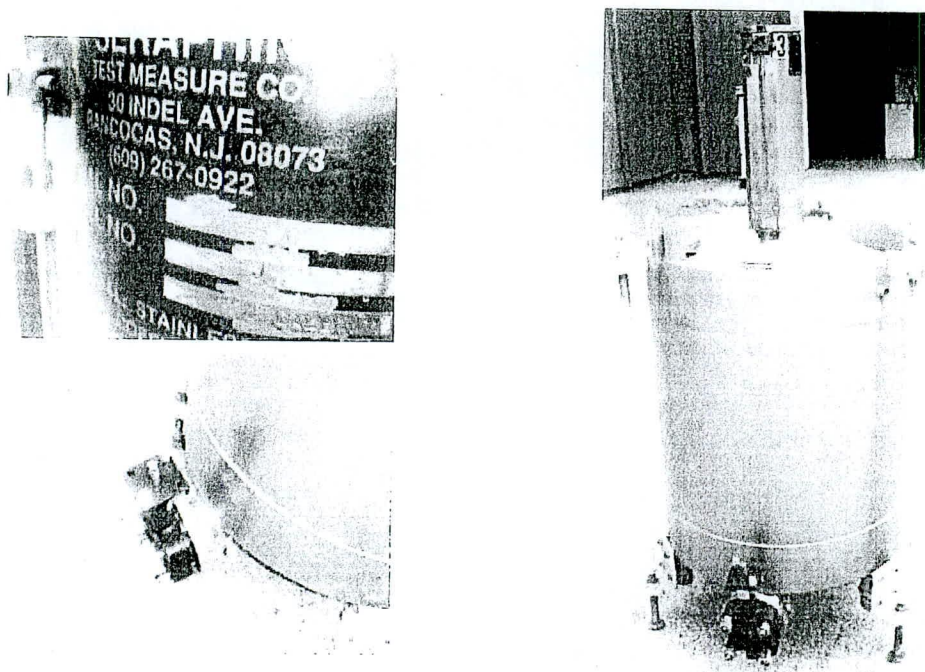
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[1] Bean, V. E., Espina, P. I., Wright, J. D., Houser, J. F., Sheckels, S. D., and Johnson, A. N., "NIST Calibration Services for Liquid Volume," NIST Special Publication 250-72, National Institute of Standards and Technology, March 24, 2006.

**Table 1.** Contained and delivered volumes for the tested vessel for a scale reading\* of zero.

|                          | Volume Contained | Volume Delivered |
|--------------------------|------------------|------------------|
| gal at 60 °F             | 50.0078          | 49.9977          |
| in <sup>3</sup> at 60 °F | 11551.80         | 11549.47         |

The volume measurement procedure was repeated 5 times with the neck scale filled approximately to zero each time. The repeatability of the 5 measurements was 8 parts in 10<sup>6</sup> and the expanded uncertainty in the measured volume is ±0.009 %. It was calculated according to References [1] and [2] with a 95 % confidence level† and is traceable to NIST mass, temperature, pressure, and humidity standards, and a NIST distilled water density determination.



**Figure 1.** Photographs of the volume prover.

The input data used for calculation of the prover volume are given in the spreadsheet attached to this report.

\* The scale reading is determined by the intersection of the horizontal plane, tangent to the bottom of the meniscus reading on the gauge tube. For this vessel, the scale range was from -110 and +100 and each division is equivalent to 2 in<sup>3</sup>.

[2] Taylor, B. N., and Kuyatt, C. E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, National Institute of Standards and Technology (January 1993).

† Coverage factor of 1.96 for 5227 effective degrees of freedom.

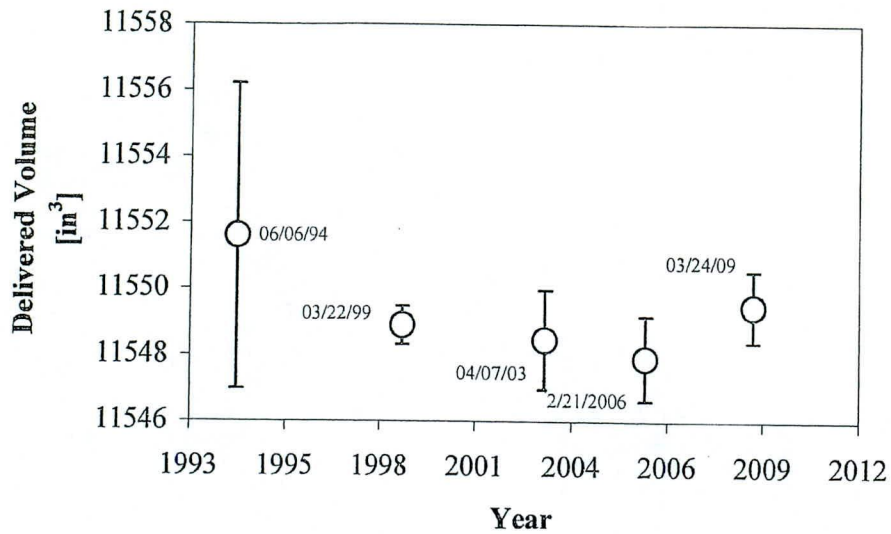


Figure 2. Calibration control chart for 50 gallon graduated neck test measure SN 7293-C.

Table 2. Results of prior calibrations for the delivered volume.

| Date     | Delivered Volume [in <sup>3</sup> ] | Difference from Prior [in <sup>3</sup> ] | Degree of Equivalence [-] |
|----------|-------------------------------------|--|---------------------------|
| 03/24/09 | 11549.47                            | 1.57                                     | 0.46                      |
| 02/21/06 | 11547.90                            | -0.56                                    | -0.16                     |
| 04/07/03 | 11548.46                            | -0.44                                    | -0.13                     |
| 03/22/99 | 11548.90                            | -2.70                                    | -0.78                     |
| 06/06/94 | 11551.60                            | -  | -                         |

For the Director,  
National Institute of Standards and Technology

Dr. John D. Wright  
Project Leader, Fluid Metrology Group  
Process Measurements Division  
Chemical Science and Technology Laboratory  
National Institute of Standards and Technology

Sherry Sheckels  
Calibration Technician, Fluid Metrology Group  
Process Measurements Division  
Chemical Science and Technology Laboratory  
National Institute of Standards and Technology



National Institute of Standards and Technology  
Technology Administration, U.S. Department of Commerce

# REPORT OF CALIBRATION

FOR

**A FIVE (5) GALLON VOLUME PROVER  
(Graduated Neck Type)**

**March 31, 2009**

Manufacturer: Seraphin  
Rancocas, NJ

NIST Seal Number: 7002  
Material: Stainless Steel  
Serial Number: 7293F

submitted by

Meter Engineers, Inc.  
7718 W. 53<sup>rd</sup> St. N.  
Mazie, KS 67101

(Reference: Purchase Order Number 003680, dated January 15, 2009)

The internal volume of the prover described above has been determined by the gravimetric method [1]. The gravimetric method requires weighing the vessel dry and empty and re-weighing it when filled with a fluid of known density. The internal or contained volume was determined in this way and the value is given in Table 1 using the requested units. The fluid used was distilled water and the prover was leveled before determining the volume.

To determine the delivered volume, the contained volume is poured from the vessel by tilting it through a continuously increasing angle so that the poured flow is smooth and not oscillating. When this flow finishes, the vessel is held for 10 seconds at an angle of 70° with the horizontal to complete the drain procedure. Subsequent re-weighing completes the gravimetric procedure and enables calculation of the delivered volume, also given in Table 1. Both the contained and delivered volumes are given for the scale reading of zero (0) and have been corrected for the reference temperature of 15.56 °C (60 °F), assuming a volumetric coefficient of expansion of 0.0000477 per °C (0.0000265 per °F).

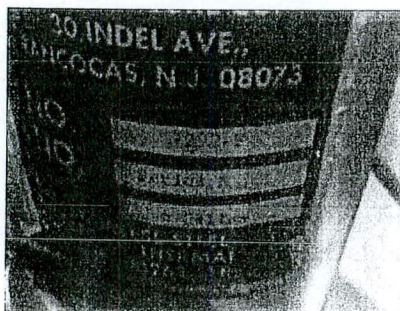
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[1] Bean, V. E., Espina, P. I., Wright, J. D., Houser, J. F., Sheckels, S. D., and Johnson, A. N., "NIST Calibration Services for Liquid Volume," NIST Special Publication 250-72, National Institute of Standards and Technology, March 24, 2006.

**Table 1.** Contained and delivered volumes for the tested vessel for a scale reading\* of zero.

|                          | Volume Contained | Volume Delivered |
|--------------------------|------------------|------------------|
| gal at 60 °F             | 4.9965           | <b>4.9930</b>    |
| in <sup>3</sup> at 60 °F | 1154.20          | <b>1153.39</b>   |

The volume measurement procedure was repeated 5 times with the neck scale filled approximately to zero each time. The repeatability of the 5 measurements was 272 parts in 10<sup>6</sup> and the expanded uncertainty in the measured volume is  $\pm 0.075\%$ . It was calculated according to References [1] and [2] with a 95 % confidence level<sup>†</sup> and is traceable to NIST mass, temperature, pressure, and humidity standards, and a NIST distilled water density determination.



**Figure 1.** Photographs of the volume prover.

The input data used for calculation of the prover volume are given in the spreadsheet attached to this report.

\* The scale reading is determined by the intersection of the horizontal plane, tangent to the bottom of the meniscus reading on the gauge tube. For this vessel, the scale range was from -20 and +20 and each division is equivalent to 1 in<sup>3</sup>.

[2] Taylor, B. N. and Kuyatt, C. E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, National Institute of Standards and Technology (January 1993).

† Coverage factor of 2.45 for 6 effective degrees of freedom.

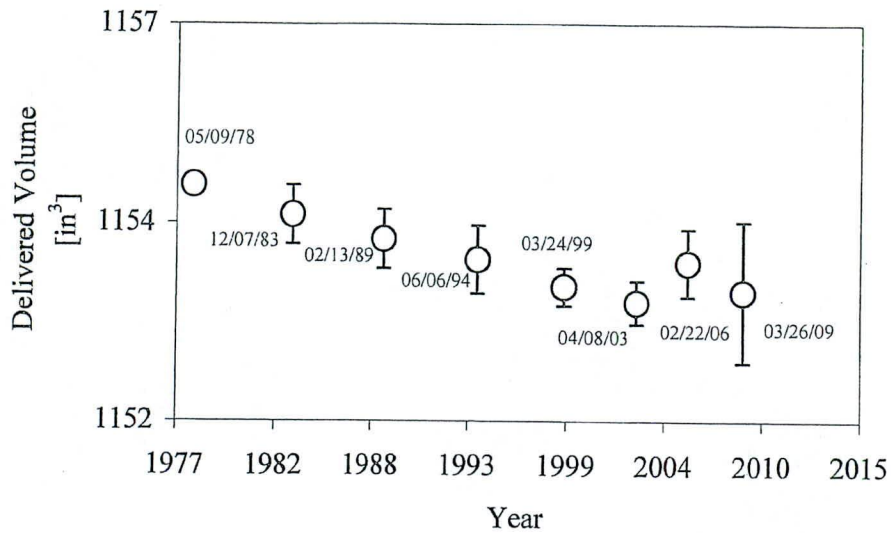


Figure 2. Calibration control chart for 5 gallon graduated neck test measure SN 7293F.

Table 2. Results of prior calibrations for the delivered volume.

| Date     | Delivered Volume [in <sup>3</sup> ] | Difference from Prior [in <sup>3</sup> ] | Degree of Equivalence [-] |
|----------|-------------------------------------|--|---------------------------|
| 03/26/09 | 1153.3879                           | -0.36                                    | -0.29                     |
| 02/22/06 | 1153.7442                           | 0.48                                     | 0.39                      |
| 04/08/03 | 1153.2600                           | -0.19                                    | -0.15                     |
| 03/24/99 | 1153.4500                           | -0.33                                    | -0.27                     |
| 06/06/94 | 1153.7800                           | -0.25                                    | -0.20                     |
| 02/13/89 | 1154.0300                           | -0.30                                    | -0.24                     |
| 12/07/83 | 1154.3300                           | -0.36                                    | -0.29                     |
| 05/09/78 | 1154.6900                           | -  | -                         |

For the Director,  
National Institute of Standards and Technology

Dr. John D. Wright  
Project Leader, Fluid Metrology Group  
Process Measurements Division  
Chemical Science and Technology Laboratory  
National Institute of Standards and Technology

Sherry Sheckels  
Calibration Technician, Fluid Metrology Group  
Process Measurements Division  
Chemical Science and Technology Laboratory  
National Institute of Standards and Technology



National Institute of Standards and Technology  
Technology Administration, U.S. Department of Commerce

# REPORT OF CALIBRATION

FOR

**A FIFTEEN (15) GALLON VOLUME PROVER  
(Graduated Neck Type)**

**March 31, 2009**

Manufacturer: Seraphin  
Rancocas, NJ

NIST Seal Number: 7000  
Material: Stainless Steel  
Serial Number: 13064

submitted by

Meter Engineers, Inc.  
7718 W. 53<sup>rd</sup> St. N.  
Mazie, KS 67101

(Reference: Purchase Order Number 003680, dated January 15, 2009)

The internal volume of the prover described above has been determined by the gravimetric method [1]. The gravimetric method requires weighing the vessel dry and empty and re-weighing it when filled with a fluid of known density. The internal or contained volume was determined in this way and the value is given in Table 1 using the requested units. The fluid used was distilled water and the prover was leveled before determining the volume.

To determine the delivered volume, the contained volume is poured from the prover by opening the valve at the bottom of the vessel. When this flow finishes, the valve is held open for 30 seconds to complete the drain procedure. Subsequent re-weighing completes the gravimetric procedure and enables calculation of the delivered volume, also given in Table 1. Both the contained and delivered volumes are given for the scale reading of zero (0) and have been corrected for the reference temperature of 15.56 °C (60 °F), assuming a volumetric coefficient of expansion of 0.0000477 per °C (0.0000265 per °F).

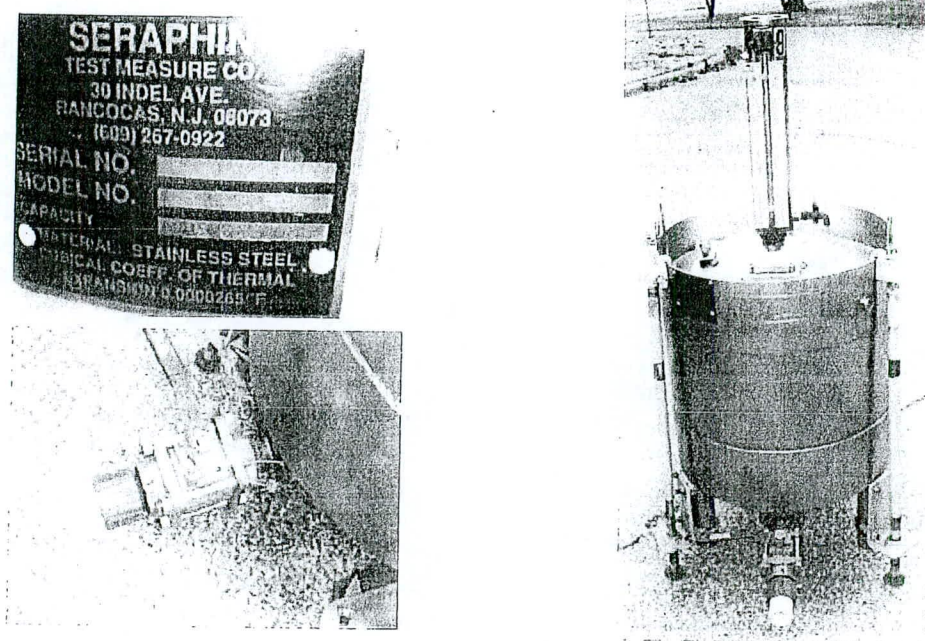
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[1] Bean, V. E., Espina, P. J., Wright, J. D., Houser, J. F., Sheckels, S. D., and Johnson, A. N., "NIST Calibration Services for Liquid Volume," NIST Special Publication 250-72, National Institute of Standards and Technology, March 24, 2006.

**Table 1.** Contained and delivered volumes for the tested vessel for a scale reading\* of zero.

|                          | Volume Contained | Volume Delivered |
|--------------------------|------------------|------------------|
| gal at 60 °F             | 14.9935          | <b>14.9850</b>   |
| in <sup>3</sup> at 60 °F | 3463.49          | <b>3461.53</b>   |

The volume measurement procedure was repeated 5 times with the neck scale filled approximately to zero each time. The repeatability of the 5 measurements was 11 parts in 10<sup>6</sup> and the expanded uncertainty in the measured volume is  $\pm 0.029\%$ . It was calculated according to References [1] and [2] with a 95 % confidence level† and is traceable to NIST mass, temperature, pressure, and humidity standards, and a NIST distilled water density determination.



**Figure 1.** Photographs of the volume prover.

The input data used for calculation of the prover volume are given in the spreadsheet attached to this report.

\* The scale reading is determined by the intersection of the horizontal plane, tangent to the bottom of the meniscus reading on the gauge tube. For this vessel, the scale range was from -25 and +34 and each division is equivalent to 0.5 in<sup>3</sup>.

[2] Taylor, B. N. and Kuyatt, C. E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note 1297, National Institute of Standards and Technology (January 1993).

† Coverage factor of 1.96 for 2865 effective degrees of freedom.

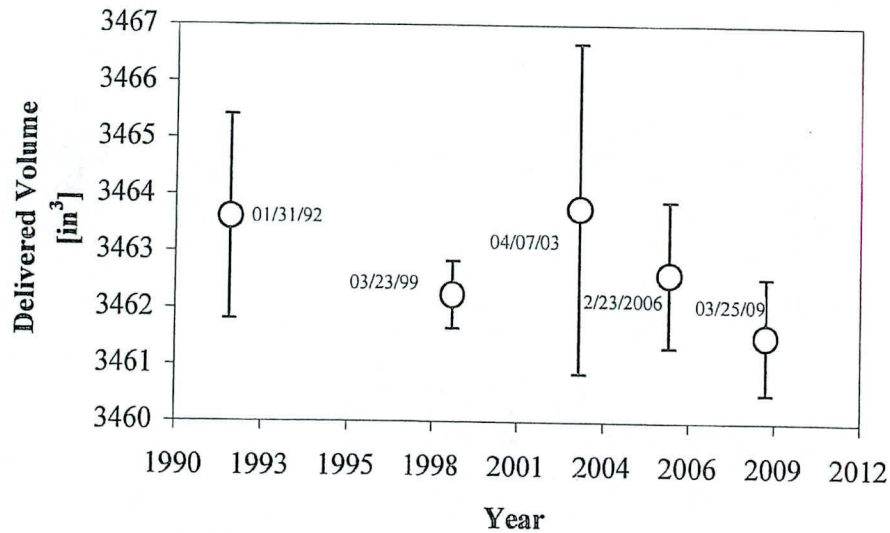


Figure 2. Calibration control chart for 15 gallon graduated neck test measure SN 13064.

Table 2. Results of prior calibrations for the delivered volume.

| Date     | Delivered Volume [in <sup>3</sup> ] | Difference from Prior [in <sup>3</sup> ] | Degree of Equivalence [-] |
|----------|-------------------------------------|--|---------------------------|
| 03/25/09 | 3461.53                             | -1.08                                    | -0.63                     |
| 02/23/06 | 3462.61                             | -1.15                                    | -0.67                     |
| 04/07/03 | 3463.76                             | 1.52                                     | 0.88                      |
| 03/23/99 | 3462.24                             | -1.37                                    | -0.79                     |
| 01/31/92 | 3463.61                             | -  | -                         |

For the Director,  
National Institute of Standards and Technology

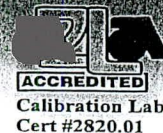
Dr. John D. Wright  
Project Leader, Fluid Metrology Group  
Process Measurements Division  
Chemical Science and Technology Laboratory  
National Institute of Standards and Technology

Sherry Sheckels  
Calibration Technician, Fluid Metrology Group  
Process Measurements Division  
Chemical Science and Technology Laboratory  
National Institute of Standards and Technology



# Johnson Gage and Inspection, Inc.

5920 W 21st St. N., Wichita, KS 67205  
Phone 316.943.7532; Fax 316.944.6256



## Certificate of Calibration

Report Number: 108128HH  
Customer: METER ENGINEERS, INC.

Page 1 of 1

Form 2511  
REV C 12-01-11

7718 W. 53rd ST. NORTH  
MAIZE KS 67101

Item: MERCURY THERMOMETER  
Unit Number: 4G9719  
Model Number: MILLER & WEBER T-3426  
Serial Number: 4G9719  
Location: PRODUCTION

Inspector: EJ  
Date Calibrated: Jan 23, 2012  
Recalibration Date: Jan 23, 2013  
Temperature: 70.7 °F  
Relative Humidity: 29 %

\*\*\*\*\*  
Item Range: 30°F/124°F Resolution: 0.05°F  
Tolerance: ±0.2°F Class: N/A  
Controlling Specification(s): ISO 10012, ANSI/NC SL Z540-1  
Calibration/Inspection Procedure(s): WP4001 Tolerance Source: R See Below  
\*\*\*\*\*

| Standard Value | Test Result | Deviation | Uncertainty @k=2 |
|----------------|-------------|-----------|------------------|
|                |             |           |                  |
| 32.00°F        | 32.00°F     | NONE      | 0.14°F           |
|                |             |           |                  |
| 76.00°F        | 76.05°F     | +0.05°F   | 0.14°F           |
|                |             |           |                  |
| 120.00°F       | 120.10°F    | +0.10°F   | 0.14°F           |
|                |             |           |                  |
|                |             |           |                  |

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%. This estimate was performed in accordance with guidelines set forth in ANSI/NC SL Z540-2. The acceptance or rejection of the item(s) is based on the actual test values shown, without adjustment for measurement uncertainty. All testing performed using standards traceable to NIST or to intrinsic standards. This document shall not be reproduced except in full, without the written permission of Johnson Gage and Inspection. Tolerance source key: C = Customer; S = Specification; M = Manufacturer; R = JGI Recommended.

\*\*\*\*\*  
Comments: FOUND IN TOLERANCE. NO ADJUSTMENT REQUIRED.  
ADDITIONAL STANDARD: HP34420A SN:US36001770 CERTIFIED:12-14-11 DUE:12-14-12 TN:55429AT  
\*\*\*\*\*

Condition: USED  
RESULTS: ACCEPTED

\*\*\*\*\*  
CALIBRATION STANDARD  
Manufacturer/type: BURNS ENGINEERING PRT Model Number: 3925  
Date Certified: Jul 27, 2011 Serial Number: 496142  
Date Due: Jul 27, 2013 TRACEABILITY NUMBER: U187370  
\*\*\*\*\*

Approved by: *[Signature]* 1.25.12



# Johnson Gage and Inspection, Inc.

5920 W 21st St. N., Wichita, KS 67205

Phone 316.943.7532; Fax 316.944.6256



## Certificate of Calibration

Report Number: 108380  
Customer: METER ENGINEERS, INC.

Page 4 of 6

Form 2511  
REV C 12-01-1

7718 W. 53rd ST. NORTH  
MAIZE KS 67101

Item: MERCURY THERMOMETER  
Unit Number: 4D6450  
Model Number: Miller & Webber T-3426  
Serial Number: 4D6450  
Location: PRODUCTION

Inspector: JV  
Date Calibrated: Jan 12, 2012  
Recalibration Date: Jan 12, 2013  
Temperature: 68.8 °F  
Relative Humidity: 27 %

Item Range: 30°F/124°F Resolution: 0.05°F  
Tolerance: ±0.2°F Class: N/A

Controlling Specification(s): ISO 10012, ANSI/NC SL Z540-1

Calibration/Inspection Procedure(s): WP4001

Tolerance Source: R See Below

\*\*\*\*\*

| Standard Value | Test Result | Deviation | Uncertainty @k=2 |
|----------------|-------------|-----------|------------------|
|----------------|-------------|-----------|------------------|

|          |          |         |        |
|----------|----------|---------|--------|
|          |          |         |        |
| 32.00°F  | 32.10°F  | +0.10°F | 0.12°F |
| 76.00°F  | 76.10°F  | +0.10°F | 0.12°F |
| 120.00°F | 119.95°F | -0.05°F | 0.12°F |
|          |          |         |        |

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%. This estimate was performed in accordance with guidelines set forth in ANSI/NC SL Z540-2. The acceptance or rejection of the item(s) is based on the actual test values shown, without adjustment for measurement uncertainty. All testing performed using standards traceable to NIST or to intrinsic standards. This document shall not be reproduced except in full, without the written permission of Johnson Gage and Inspection. Tolerance source key: C = Customer; S = Specification; M = Manufacturer; R = JGI Recommended.

\*\*\*\*\*

Comments: FOUND IN TOLERANCE. NO ADJUSTMENT REQUIRED. ADDITIONAL STANDARD: HP34420A SN:US36001770  
CERTIFIED:12-14-11 DUE:12-14-12 TN:55429AT

Condition: USED

RESULTS: ACCEPTED

\*\*\*\*\*

### CALIBRATION STANDARD

Manufacturer/type: BURNS ENGINEERING PRT  
Date Certified: Jul 27, 2011  
Date Due: Jul 27, 2013

Model Number: 3925  
Serial Number: 496142

TRACEABILITY NUMBER: U187370

Approved by: *JV* dm 1.12.12



# Johnson Gage and Inspection, Inc.

5920 W 21st St. N., Wichita, KS 67205  
Phone 316.943.7532; Fax 316.944.6256



## Certificate of Calibration

Report Number: 108380  
Customer: METER ENGINEERS, INC.

Page 6 of 6

Form 2511  
REV C 12-01-1

7718 W. 53rd ST. NORTH  
MAIZE KS 67101

Item: MERCURY THERMOMETER  
Unit Number: 4B7983  
Model Number: Miller & Webber T-3426  
Serial Number: 4B7983  
Location: PRODUCTION

Inspector: JV  
Date Calibrated: Jan 12, 2012  
Recalibration Date: Jan 12, 2013  
Temperature: 68.8 °F  
Relative Humidity: 27 %

\*\*\*\*\*  
Item Range: 30°F/124°F Resolution: 0.05°F  
Tolerance: ±0.2°F Class: N/A  
Controlling Specification(s): ISO 10012, ANSI/NC SL Z540-1  
Calibration/Inspection Procedure(s): WP4001 Tolerance Source: R See Below  
\*\*\*\*\*

| Standard Value | Test Result | Deviation | Uncertainty @k=2 |
|----------------|-------------|-----------|------------------|
| 32.00°F        | 32.05°F     | +0.05°F   | 0.12°F           |
| 76.00°F        | 76.00°F     | NONE      | 0.12°F           |
| 120.00°F       | 120.00°F    | NONE      | 0.12°F           |

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%. This estimate was performed in accordance with guidelines set forth in ANSI/NC SL Z540-2. The acceptance or rejection of the item(s) is based on the actual test values shown, without adjustment for measurement uncertainty. All testing performed using standards traceable to NIST or to intrinsic standards. This document shall not be reproduced except in full, without the written permission of Johnson Gage and Inspection. Tolerance source key: C = Customer; S = Specification; M = Manufacturer; R = JGI Recommended.

\*\*\*\*\*  
Comments: FOUND IN TOLERANCE. NO ADJUSTMENT REQUIRED. ADDITIONAL STANDARD: HP34420A SN:US36001770  
CERTIFIED:12-14-11 DUE:12-14-12 TN:55429AT  
\*\*\*\*\*

Condition: USED  
RESULTS: ACCEPTED

\*\*\*\*\*  
CALIBRATION STANDARD  
\*\*\*\*\*

Manufacturer/type: BURNS ENGINEERING PRT Model Number: 3925  
Date Certified: Jul 27, 2011 Serial Number: 496142  
Date Due: Jul 27, 2013 TRACEABILITY NUMBER: U187370

Approved by: *[Signature]* 1-12-12

# ARROW LABORATORY, INC.

PO BOX 248  
WICHITA KS 67201-0248  
Phone: (316) 267-2893

Metallurgical Analysis and Testing

1333 N MAIN ST  
WICHITA KS 67203  
Fax: (316) 267-0171

Attn: DEBBIE  
METER ENGINEERS  
7718 W 53rd St North  
WICHITA KS 67101

01-10-12  
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LABORATORY REPORT #d90ma233

## PRESSURE GAGE CALIBRATION

One 4.5 inch WIKA XSEL liquid filled pressure gage, S/N 586, 0-60 psi capacity with 0.5 psi subdivisions, was received in usable condition and calibrated as shown below. The gage was checked with our Ashcroft dead weight gage tester. Testing was performed in accordance with ASME B40.100-2005 and ANSI/NCSL Z540.3-2006.  
Calibration Data:

| LOAD psi | Average<br>GAGE READING as Left |
|----------|---------------------------------|
| 5        | 4.8 psi                         |
| 15       | 14.7                            |
| 25       | 24.6                            |
| 35       | 34.5                            |
| 45       | 44.5                            |
| 55       | 54.6                            |

Maximum Error center 1/2 of scale: 0.9% of span  
Max Error upper and lower 1/4 of scale: 0.9% of span  
Maximum Friction: 0.3% of span  
Repeatability: +/- 0.3% of span  
Accuracy: +/- 0.9% of span  
Adjustments: none Limitations of use: none  
Calibrated: 1-10-12 Temperature: 71°F  
Client Provided Confirmation Interval: Annual

These results meet ASME B40.100 grade 1A accuracy requirements.

Ashcroft Gage Tester: S/N DWT 11436, Uncertainty: +/- 0.07%  
Weights: Tester weights were compared with weights calibrated on NIST.  
Test #'s 822/262551-0 and 822/268214-03. Cal Due: 5-31-12

Piston Assembly:

The piston diameter and cylinder bore were measured by Dresser Industries Test# IR700547 and certified to +/- 0.05% using masters traceable to NIST. Cal Due: 2-28-13

Project Supervisor

  
Dale E. Roark

DER/dr  
Rec'd 01-09-12

The sample or instrument was received in suitable condition for the tests performed except as noted above.  
Chemical Analysis of Carbon & Sulfur: Combustion/IR, Silicon: grav., Others: ICP/AA.  
Tensile per ASTM E 8-09, B 557-10, or A 370-11. Hardness per ASTM E 10-10, E 18-08b, E 384-11.  
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