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DEPARTMENT OF AGRICULTURE

Nebraska Standards Laboratory
3721 West Cuming St.
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(402) 471-2087

Director of Agriculture
Greg Ibach
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Calibration Date: 8/31/2017

Certificate of Calibration of Volume Transfer

Certificate Number: 2017-020-2

Items Submitted:

Quantity	Nominal Volume	Manufacturer	Type
2	100 gal	Seraphin / Detterman	100 gal prover

Submitted By: FSCP Area 70
17360 SW 14 th st.
Martell, NE 68404

POC: Scott Arner
402-450-1106

Test Results

Nominal Volume	Serial Number	Material	Cubical Coefficient of Expansion (/°F)	As Found Volume Delivered @ 60 °F	As left Volume Delivered @ 60 °F	Uncertainty (U)	(*k*)
100 gal	18969	SS	0.0000265	**99.9849 gal**	**99.9849 gal**	0.0091 gal	2.01
100 gal	8851397	SS	0.0000265	**99.995 gal**	**99.995 gal**	0.0091 gal	2.01

The data in this report only applies to those items specifically listed on this report.

Volume delivered at 60˚F after a 30 second pour and 10 second drain for test measures. For provers and a 30 second drain time would apply.

Conversion Factors:

1 gal = 231 in³
1 gal = 3.785 412 E-03 m³

Traceability Statement:

The artifact(s) described in this report have been compared to the Standards of the State of Nebraska. The Standards of the State of Nebraska are traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and measurement traceability within the level of uncertainty reported by this laboratory. The calibration number for this report is the only unique calibration number to be used in referencing measurement traceability for the artifact(s) described in this report.

Uncertainty Statement:

The combined standard uncertainty includes uncertainties reported for the standard, uncertainties associated with the measurement process, uncertainties for any observed deviations from reference values which are less than surveillance limits and the standard uncertainty for any uncorrected errors. The combined standard uncertainty is multiplied by a coverage factor (*k*), to give the expanded uncertainty, which defines an interval with a 95.45 percent level of confidence. The expanded uncertainty presented in this report is consistent with the Guide to the Expression of Uncertainty in Measurement (2008, revised 2012). Some components of the calibration can be evaluated through a Type A evaluation, or the method of evaluation of uncertainty by the statistical analysis (standard deviation) from the observations taken.

Pertinent Information:

The artifact(s) listed above have been found and/or left within the maximum permissible error for the specification stated above, except as noted. An artifact is considered in-compliance when the correction plus the measurement uncertainty is equal to or less than the maximum permissible error.

Condition of Item(s) Submitted for Calibration:
Minor wear

Treatment of Item(s) before Calibration:
Item(s) were tested as found

Environmental conditions at time of calibration:

Temp ˚C	23.0	Humidity %	55.8
Pressure mmHg	766.31		

Laboratory Reference Standard Used;
100 gal NE 44158

Procedure Used:
NISTIR 7383 (2017), SOP 19

Water temperature at time of calibration:
69.00 °F

Date Submitted: 8/30/2017

Joel P. Lavicky, Metrologist

9/1/2017
Date:

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Calibration Certificate for Volume Transfer of LPG

Calibration Date: August 30, 2017

Certificate Number: 2017-020-1

Submitted by: FSCP Area 70
17360 SW 14 th st
Martell, NE 68404

POC: Scott Arner
Phone: 402-450-1106

Date Received: 08/30/2017

PO Number: N/A
Job Order #: N/A

Artifact(s) Description

Test Item(s): 103 gal LPG Prover
Serial No: A-4-L6998
Manufacture: Unknown
Condition: good

Material: Steel, Pressure Vessel, Low Carbon
Specification: NIST HB 150-4
Cubical Coefficient of Expansion: 0.000016 / ºF

Calibration Information

Reference Standards Used:
NE-44158-100gal
NE-514-1gal

Procedure: NIST SOP 21

Metrologist: JPL

Temperature: 24.3 ºC **Humidity:** 57.6 % RH **Water Temperature:** 21.0 ºC

Calibration Results

Nominal Volume (at zero mark on gauge)	Prover Volume As Found @ 60 ºF and 100 psig (gal)	Prover Volume As Left @ 60 ºF and 100 psig (gal)	Spec. Tol. ± (gal)	Uncertainty ± (gal)	*k* factor	Degrees of Freedom
103 gal	102.916	102.916	0.206	0.021	2.001	4282

Conversion Factors
1 gallon (U.S.) (gal) = 231 in³
1 gallon (U.S.) (gal) = 3.785 412 E-03 m³

Pertinent Information

- The artifact is considered in-tolerance when the error is equal to or less than the specified tolerance minus the measurement uncertainty. RED print indicates an out-of-tolerance reading.
- Enter the Pressure Correction from Table 1 that corresponds with the pressure being tested on your LPG Meter Test form.
- The calibration item was calibrated in a 'wet down' condition using water. The calibration data above applies when the prover bottom zero is obtained during a 30 (± 5) second period after cessation of the main flow.
- The drain time (using the on board pump) to the bottom zero was approximately 5 minute(s) 0 seconds.
- The Top Securty Seal Number is Ne lab and the Bottom Security Seal Number is Ne Lab.

Traceability Statement

The artifact(s) described in this report have been compared to the Standards of the State of Nebraska. The Standards of the State of Nebraska are traceable to the National Institute of Standards and Technology (NIST) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and measurement traceability within the level of uncertainty reported by this laboratory. The International System of Units (SI) for volume is the cubic meter (m³) (see Conversion Factors below). The report number for this report is the only unique report number to be used in referencing measurement traceability for the artifact(s) described in this report.

Uncertainty Statement

The combined standard uncertainty includes uncertainties for the standard(s), for the measurement process, for the material cubical coefficient of expansion, for reading meniscus, for the pressure gauge, for graduated neck errors and for the thermometer(s) used for measuring the water temperature. The combined standard uncertainty is multiplied by a coverage factor, *k* , to give the expanded uncertainty, which defines an interval with a 95.45 % level of confidence. The expanded uncertainty presented in this report is consistent with JCGM 100:2008, *Evaluation of measurement data — Guide to the expression of uncertainty in measurement (GUM 1995 with minor corrections)* . A component for the effects of viscosity was not included in the uncertainty budget.

Signature: Joel P. Lavicky, State Metrologist **Date:** 9/1/2017

The results in this certificate only applies to those items specifically listed in this certificate. The certificate cannot be considered complete unlessit contains **all** pages. The document may not be reproduced except in **full**, without the written consend to the Nebraska Standards Laboratory

Attachme Table 1 and Chart 1 - LPG Prover Pressure Corrections
Table 2 - LPG Prover Temperature Corrections
Table 3 - Volume Corrections for Thermal Expansion or Contraction of Prover
Table 4 - Volume Correction Factors to 60 ºF

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LPG Prover Pressure Corrections

Attachment To Certificate No.: 2017-020-1 **Calibration Date:** August 30, 2017

Tested Item(s): 103 gal LPG Prover Serial Number: A-4-L6998

Table 1 - 103 gal LPG Prover Pressure Corrections @ 60 ºF

psig	Prover Scale Reading (gal)	Pressure Correction (Pcorr) (gal)
20	0.178	-0.106
30	0.161	-0.093
40	0.144	-0.079
50	0.128	-0.066
60	0.111	-0.053
70	0.095	-0.040
80	0.078	-0.026
90	0.062	-0.013
100	0.045	0.000
110	0.031	0.011
120	0.017	0.021
130	0.003	0.032
140	-0.011	0.043
150	-0.025	0.053
160	-0.042	0.067
170	-0.059	0.081
180	-0.076	0.094
190	-0.093	0.108
200	-0.110	0.122

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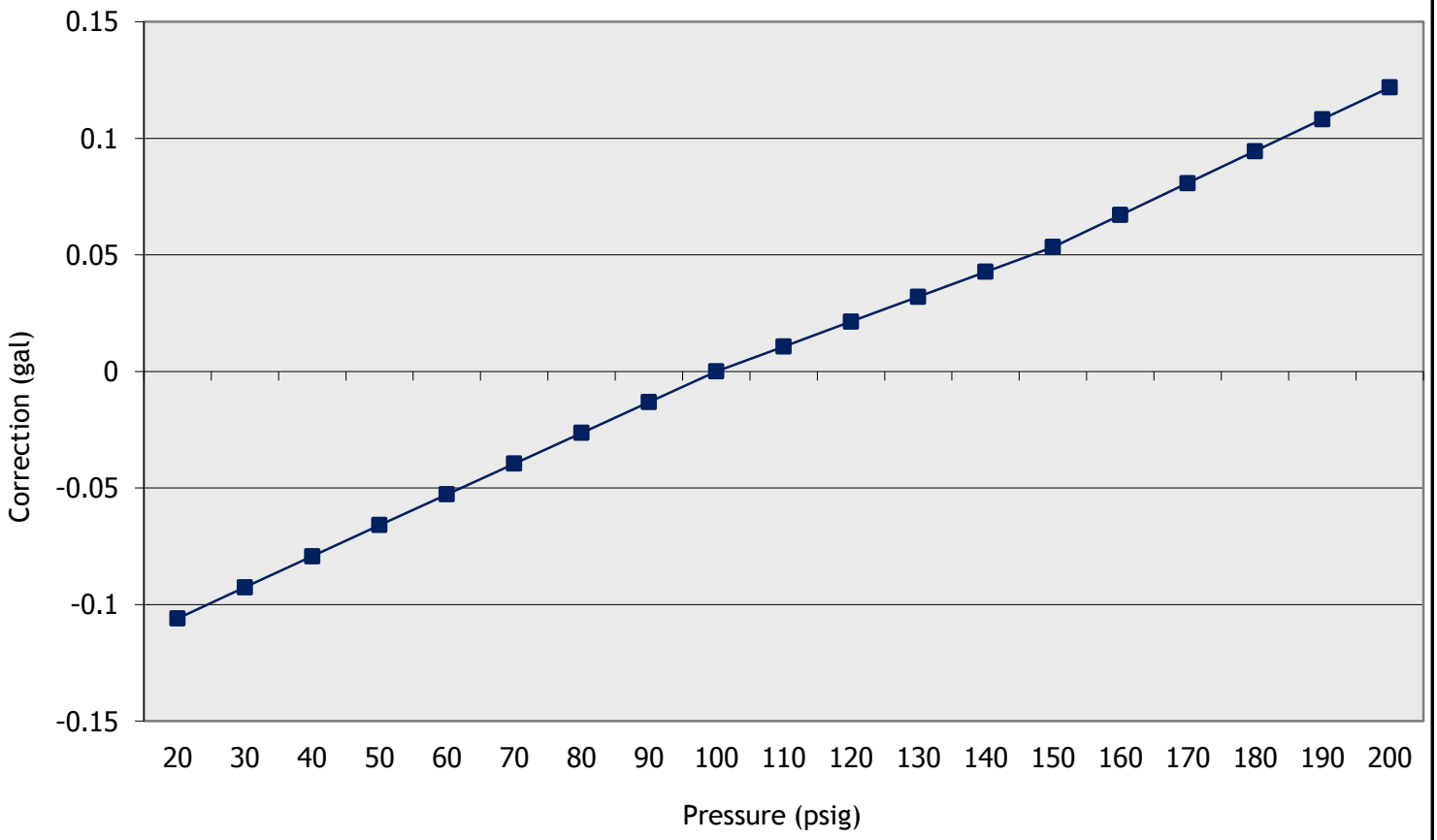
LPG Prover Pressure Corrections

Attachment To Certificate No.: 2017-020-1 **Calibration Date:** August 30, 2017

Tested Item(s): 103 gal LPG Prover Serial Number: A-4-L6998

Chart 1 - LPG Pressure Corrections (gal) @ 60 ºF



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LPG Prover Temperature Corrections

Attachment To Certificate No.: 2017-020-1 **Calibration Date:** August 30, 2017

Tested Item(s): 103 gal LPG Prover Serial Number: A-4-L6998

Table 2 - LPG Temperature Corrections

Correction Per ºF Difference between Meter Temperature and Prover Temperature

Propane Specific Gravity 60/60 ºF 0.505*

Liquid in Prover Temp. ºF	in³ / ºF	gal / ºF	Liquid in Prover Temp. ºF	in³ / ºF	gal / ºF	Liquid in Prover Temp. ºF	in³ / ºF	gal / ºF
0	35.578	0.1540	34	37.260	0.1613	68	39.305	0.1702
1	35.623	0.1542	35	37.314	0.1615	69	39.372	0.1704
2	35.669	0.1544	36	37.369	0.1618	70	39.440	0.1707
3	35.715	0.1546	37	37.424	0.1620	71	39.508	0.1710
4	35.761	0.1548	38	37.479	0.1622	72	39.577	0.1713
5	35.807	0.1550	39	37.535	0.1625	73	39.646	0.1716
6	35.854	0.1552	40	37.590	0.1627	74	39.716	0.1719
7	35.901	0.1554	41	37.646	0.1630	75	39.786	0.1722
8	35.947	0.1556	42	37.703	0.1632	76	39.856	0.1725
9	35.995	0.1558	43	37.760	0.1635	77	39.929	0.1729
10	36.043	0.1560	44	37.817	0.1637	78	40.001	0.1732
11	36.090	0.1562	45	37.875	0.1640	79	40.073	0.1735
12	36.138	0.1564	46	37.933	0.1642	80	40.146	0.1738
13	36.187	0.1567	47	37.991	0.1645	81	40.220	0.1741
14	36.235	0.1569	48	38.049	0.1647	82	40.294	0.1744
15	36.284	0.1571	49	38.108	0.1650	83	40.369	0.1748
16	36.333	0.1573	50	38.168	0.1652	84	40.444	0.1751
17	36.382	0.1575	51	38.228	0.1655	85	40.520	0.1754
18	36.431	0.1577	52	38.288	0.1657	86	40.596	0.1757
19	36.481	0.1579	53	38.348	0.1660	87	40.674	0.1761
20	36.531	0.1581	54	38.409	0.1663	88	40.752	0.1764
21	36.581	0.1584	55	38.470	0.1665	89	40.830	0.1768
22	36.632	0.1586	56	38.532	0.1668	90	40.909	0.1771
23	36.683	0.1588	57	38.594	0.1671	91	40.989	0.1774
24	36.734	0.1590	58	38.657	0.1673	92	41.069	0.1778
25	36.785	0.1592	59	38.719	0.1676	93	41.150	0.1781
26	36.837	0.1595	60	38.783	0.1679	94	41.232	0.1785
27	36.889	0.1597	61	38.846	0.1682	95	41.315	0.1789
28	36.941	0.1599	62	38.911	0.1684	96	41.398	0.1792
29	36.993	0.1601	63	38.975	0.1687	97	41.482	0.1796
30	37.046	0.1604	64	39.040	0.1690	98	41.567	0.1799
31	37.099	0.1606	65	39.106	0.1693	99	41.652	0.1803
32	37.152	0.1608	66	39.172	0.1696	100	41.739	0.1807
33	37.206	0.1611	67	39.238	0.1699			

* Approximate specific gravity for a commercial LPG product.

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Volume Corrections for Thermal Expansion or Contraction of Prover

Attachment To Certificate No.: 2017-020-1 **Calibration Date:** August 30, 2017

Tested Item(s): 103 gal LPG Prover Serial Number: A-4-L6998

Table 3 - Volume Corrections for Thermal Expansion or Contraction of Prover

Coefficient of Cubical Expansion = 0.000016 / ºF

Temp. ºF	Correction (in³)	Correction (gal)	Temp. ºF	Correction (in³)	Correction (gal)	Temp. ºF	Correction (in³)	Correction (gal)
0	-22.8	-0.099	34	-9.9	-0.043	68	3.0	0.013
1	-22.5	-0.097	35	-9.5	-0.041	69	3.4	0.015
2	-22.1	-0.096	36	-9.1	-0.040	70	3.8	0.016
3	-21.7	-0.094	37	-8.8	-0.038	71	4.2	0.018
4	-21.3	-0.092	38	-8.4	-0.036	72	4.6	0.020
5	-20.9	-0.091	39	-8.0	-0.035	73	4.9	0.021
6	-20.6	-0.089	40	-7.6	-0.033	74	5.3	0.023
7	-20.2	-0.087	41	-7.2	-0.031	75	5.7	0.025
8	-19.8	-0.086	42	-6.9	-0.030	76	6.1	0.026
9	-19.4	-0.084	43	-6.5	-0.028	77	6.5	0.028
10	-19.0	-0.082	44	-6.1	-0.026	78	6.9	0.030
11	-18.7	-0.081	45	-5.7	-0.025	79	7.2	0.031
12	-18.3	-0.079	46	-5.3	-0.023	80	7.6	0.033
13	-17.9	-0.077	47	-4.9	-0.021	81	8.0	0.035
14	-17.5	-0.076	48	-4.6	-0.020	82	8.4	0.036
15	-17.1	-0.074	49	-4.2	-0.018	83	8.8	0.038
16	-16.8	-0.073	50	-3.8	-0.016	84	9.1	0.040
17	-16.4	-0.071	51	-3.4	-0.015	85	9.5	0.041
18	-16.0	-0.069	52	-3.0	-0.013	86	9.9	0.043
19	-15.6	-0.068	53	-2.7	-0.012	87	10.3	0.044
20	-15.2	-0.066	54	-2.3	-0.010	88	10.7	0.046
21	-14.8	-0.064	55	-1.9	-0.008	89	11.0	0.048
22	-14.5	-0.063	56	-1.5	-0.007	90	11.4	0.049
23	-14.1	-0.061	57	-1.1	-0.005	91	11.8	0.051
24	-13.7	-0.059	58	-0.8	-0.003	92	12.2	0.053
25	-13.3	-0.058	59	-0.4	-0.002	93	12.6	0.054
26	-12.9	-0.056	60	0.0	0.000	94	12.9	0.056
27	-12.6	-0.054	61	0.4	0.002	95	13.3	0.058
28	-12.2	-0.053	62	0.8	0.003	96	13.7	0.059
29	-11.8	-0.051	63	1.1	0.005	97	14.1	0.061
30	-11.4	-0.049	64	1.5	0.007	98	14.5	0.063
31	-11.0	-0.048	65	1.9	0.008	99	14.8	0.064
32	-10.7	-0.046	66	2.3	0.010	100	15.2	0.066
33	-10.3	-0.044	67	2.7	0.012			

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Volume Correction Factors to 60 ºF

Attachment To Certificate No.: 2017-020-1 **Calibration Date:** August 30, 2017

Tested Item(s): 103 gal LPG Prover Serial Number: A-4-L6998

Table 4 - Volume Correction Factors to 60 ºF

Propane Specific Gravity 60/60 ºF 0.505*

Temp. ºF	Correction Factor	Temp. ºF	Correction Factor	Temp. ºF	Correction Factor	Temp. ºF	Correction Factor
0	1.09008	26	1.05283	52	1.01293	78	0.96955
1	1.08869	27	1.05134	53	1.01133	79	0.96780
2	1.08729	28	1.04986	54	1.00973	80	0.96604
3	1.08590	29	1.04837	55	1.00812	81	0.96427
4	1.08449	30	1.04688	56	1.00651	82	0.96249
5	1.08309	31	1.04538	57	1.00489	83	0.96071
6	1.08168	32	1.04388	58	1.00326	84	0.95892
7	1.08027	33	1.04237	59	1.00163	85	0.95712
8	1.07889	34	1.04086	60	1.00000	86	0.95532
9	1.07744	35	1.03935	61	0.99836	87	0.95351
10	1.07602	36	1.03783	62	0.99671	88	0.95168
11	1.07460	37	1.03631	63	0.99506	89	0.94986
12	1.07317	38	1.03478	64	0.99340	90	0.94802
13	1.07174	39	1.03325	65	0.99174	91	0.94617
14	1.07031	40	1.03172	66	0.99007	92	0.94432
15	1.06887	41	1.03018	67	0.98840	93	0.94246
16	1.06743	42	1.02863	68	0.98671	94	0.94059
17	1.06599	43	1.02708	69	0.98503	95	0.93871
18	1.06454	44	1.02553	70	0.98333	96	0.93682
19	1.06309	45	1.02397	71	0.98163	97	0.93493
20	1.06163	46	1.02241	72	0.97993	98	0.93302
21	1.06017	47	1.02084	73	0.97821	99	0.93110
22	1.05871	48	1.01927	74	0.97649	100	0.92918
23	1.05725	49	1.01769	75	0.97477		
24	1.05578	50	1.01611	76	0.97307		
25	1.05430	51	1.01452	77	0.97130		

* Approximate specific gravity for a commercial LPG product.