Turkey Point Units 3 and 4

LICENSE AMENDMENT REQUEST FOR EXTENDED POWER UPRATE

ATTACHMENT 8

Cameron/Caldon Ultrasonics Engineering Reports:
ER-748, Revision 1, Meter Factor Calculation and Accuracy Assessment for Turkey Point 3 Nuclear Power Plant, dated June 2010
ER-752, Revision 1, Meter Factor Calculation and Accuracy Assessment for Turkey Point Nuclear Power Plant Unit 4, dated June 2010
ER-783, Revision 2, Bounding Uncertainty Analysis for Thermal Power for Turkey Point Units 3 & 4 Using LEFM CheckPlus™ System, dated June 2010

[Proprietary Reports Withheld Under 10 CFR 2.390]

Alden Research Laboratories Test Reports:
No. 2009-100-C1229, Calibration of Three 14" LEFM CheckPlus Meters, dated May 2009
No. 2009-101-C1229, Calibration of Three 14" LEFM CheckPlus Flow Meters, Rev 1, dated June 25, 2010

This coversheet plus 78 pages

CALIBRATION OF

THREE 14" LEFM CHECKPLUS METERS

CAMERON MEASUREMENT SYSTEMS

PURCHASE ORDER NUMBER 4501956005

MAY 2009 - REPORT NO. 2009-100-C1229

CERTIFIED BY

Philip S. Stacy

ALDEN RESEARCH LABORATORY, INC.

30 SHREWSBURY STREET

HOLDEN, MASSACHUSETTS 01520

All Client supplied information and calibration results are considered proprietary and confidential to the Client. If a third party is a witness during calibrations or if the Client requests transmittal of data to a third party, Alden considers that the Client has waived confidentiality for the Witness.

In the event the Client distributes any report issued by Alden outside its own organization, such report shall be used in its entirety, unless Alden approves a summary or abridgment for distribution.

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INTRODUCTION

Three 14" LEFM CheckPlus Meters, Serial Numbered 29013, 29016, and 29018, were tested and calibrated at Alden Research Laboratory, Inc. for Cameron Measurement Systems under their Purchase Order Number 4501956005 using Alden's standard test procedures, QMSM-01 Rev. 3. Flow meter performance is presented in both tabular and graphical format for configurations simulating field piping and included parametric testing. Results are shown as meter factor versus flow in gpm.

FLOW ELEMENT INSTALLATION

The meters were installed in Test Lines 1 and 2 in the Allen High Reynolds Number Facility shown in plan view on Figure 1. Water was provided by a pair of 300 HP electrically driven centrifugal pumps providing a maximum head of 135 ft and a maximum flow of 20,000 gpm.

The detailed piping arrangements, immediately upstream and downstream of the flow meter, are shown in Figures 2 through 5 and include all significant fittings and pipe lengths with meter location identified. Careful attention was given to aligning the flow element with the test line piping and to assure no gaskets between flanged sections protruded into the flow. Vents were provided at critical locations of the test line to purge the system of air.

TEST PROCEDURE

After checking the installation, water was introduced into the system to equalize line and primary element temperature to water temperature. The downstream control valve was then closed and vent valves in the test line were opened to remove air from the system. With the line flow shut off, the flow meter output was checked for zero flow indication. Prior to the test run, the control valve was set to the desired flow. For the gravimetric measurement method, the flow was diverted away from the weigh tank.

After steady state conditions in the test line and instrument readings had been reached, the weigh tank discharge valve was closed and the weigh tank scale indicator and the electric timer were both zeroed. The flow was then diverted into the weigh tank, which automatically started the timer.

As the weigh tank run was initiated, Cameron personnel noted the time on the flow meters and logged the meter output continuously. At the end of each test run, flow was diverted away from the weigh tank and the timer and the totalizer was stopped to terminate the test run. The weight of water in the tank, elapsed time, and water temperature were recorded on a data sheet. At the end of the weigh tank

run Cameron personnel noted the time again so that the meter output could be averaged over the collection time. Cameron personnel provided Alden the average meter reading at the end of each test series. The control valve was then adjusted to the next flow and the procedure repeated. During the time allowed to stabilize the new flow, the data were entered into the computer to determine the flow and the results were plotted so that each test run was evaluated before the next run began.

FLOW MEASUREMENT METHOD

Flow was measured by the gravimetric method using a tank mounted on calibrated scales having a capacity of 100,000 pounds (resolution 1 lb). Water passing through the flow element was diverted into the tank with a hydraulically operated knife edge passing through a rectangular jet produced by a diverter head box. A Hewlett-Packard 10 MHz Frequency Counter with a resolution 0.001 sec was started upon flow diversion into the tank by an optical switch, which is positioned at the center of the jet. The timer was stopped upon flow diversion back to waste and the elapsed diversion time was recorded. A thermistor thermometer measured water temperature to allow calculation of water density. Volumetric flow was calculated by Equation (1).

$$q_a = \frac{W}{T\rho_w B_c} \qquad (1)$$

where

q_a	=	actual flow, $\frac{ft^3}{sec}$
W	=	mass of water collected, lb_m
T	=	time, sec
ρ_w	=	water density, $\frac{lb_m}{ft^3}$
B_c	=	buoyancy correction, $1 - \frac{\rho_a}{\rho_w}$
ρ_a	=	air density, $\frac{lb_m}{ft^3}$

The buoyancy correction includes air density calculated by perfect gas laws with the standard barometric pressure, a relative humidity of 75%, and measured air temperature. The weigh tank is periodically calibrated to full scale by the step method using 10,000 lb_m of cast iron weights, whose calibration is traceable to NIST. Flow calculations are computerized to assure consistency. Weigh tank calibration data and water density as a function of temperature, are stored on disk file. Data were recorded manually and on disk file for later review and reporting.

TEST RESULTS

Test results are shown both in tabular form and plotted versus flow. The raw data required to calculate flow by the gravimetric method, the meter flow total, and the meter factor are listed in the tables. Meter factor is plotted versus flow for each configuration. A typical test series included equally spaced test flows ranging from the maximum system flow to a minimum flow of about 1,900 gpm with multiple runs at each flow. Tests were conducted with the piping simulating the field installation, parametric tests, including a flow disturbance.

An uncertainty analysis was conducted of the flow measurements in accordance with the methods of NIST Technical Note 1297 Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results and NISTIR 6919 Recommended Guide of Determining and Reporting Uncertainties for Balances and Scales by evaluating each elementary error source for flow measurement. Type A uncertainties were estimated from the precision indices of the test data and Type B uncertainties were estimated from experience. The collection weight was about 95,000 lb for most flow measurements. An example calculation for one test run is shown in the Appendix as a table listing the elementary error sources for each measured component (weight, time, density, and diverter) and combine the error sources by the root sum square (RSS) method. Combining the components results in an expanded uncertainty estimate of about 0.09% at the 95% confidence level. Analyses were conducted for each test flow and the results are plotted versus flow.

Calibrations of the test instrumentation (temperature, time, weight, and length measurements) are traceable to the National Institute of Standards and Technology (formerly the National Bureau of Standards). Alden's Quality Assurance Program is designed to meet ANSI/NCSL Z540-1-1994 "Calibration Laboratories and Test Equipment-General Requirements" (supercedes MIL-STD-45662A).

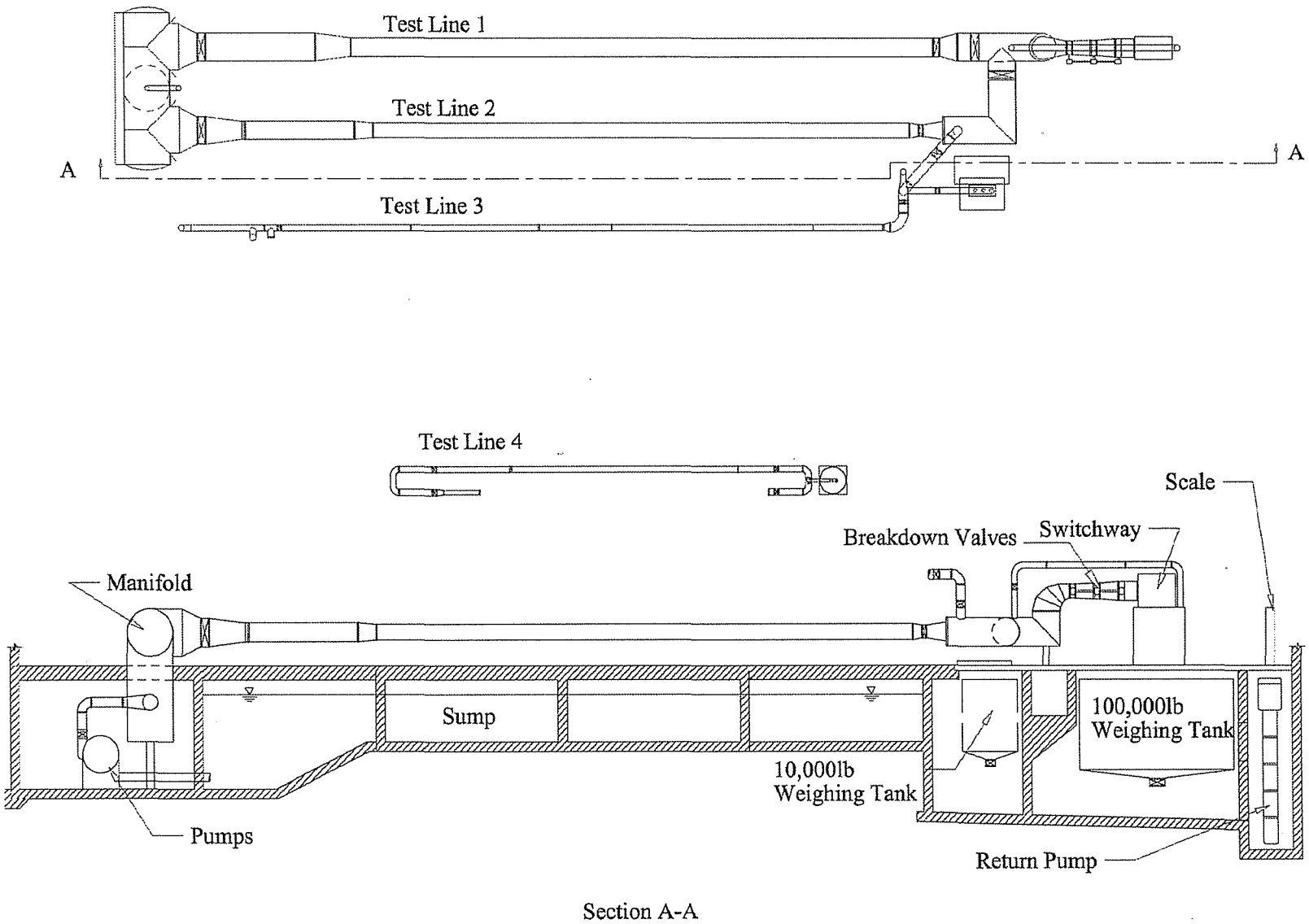
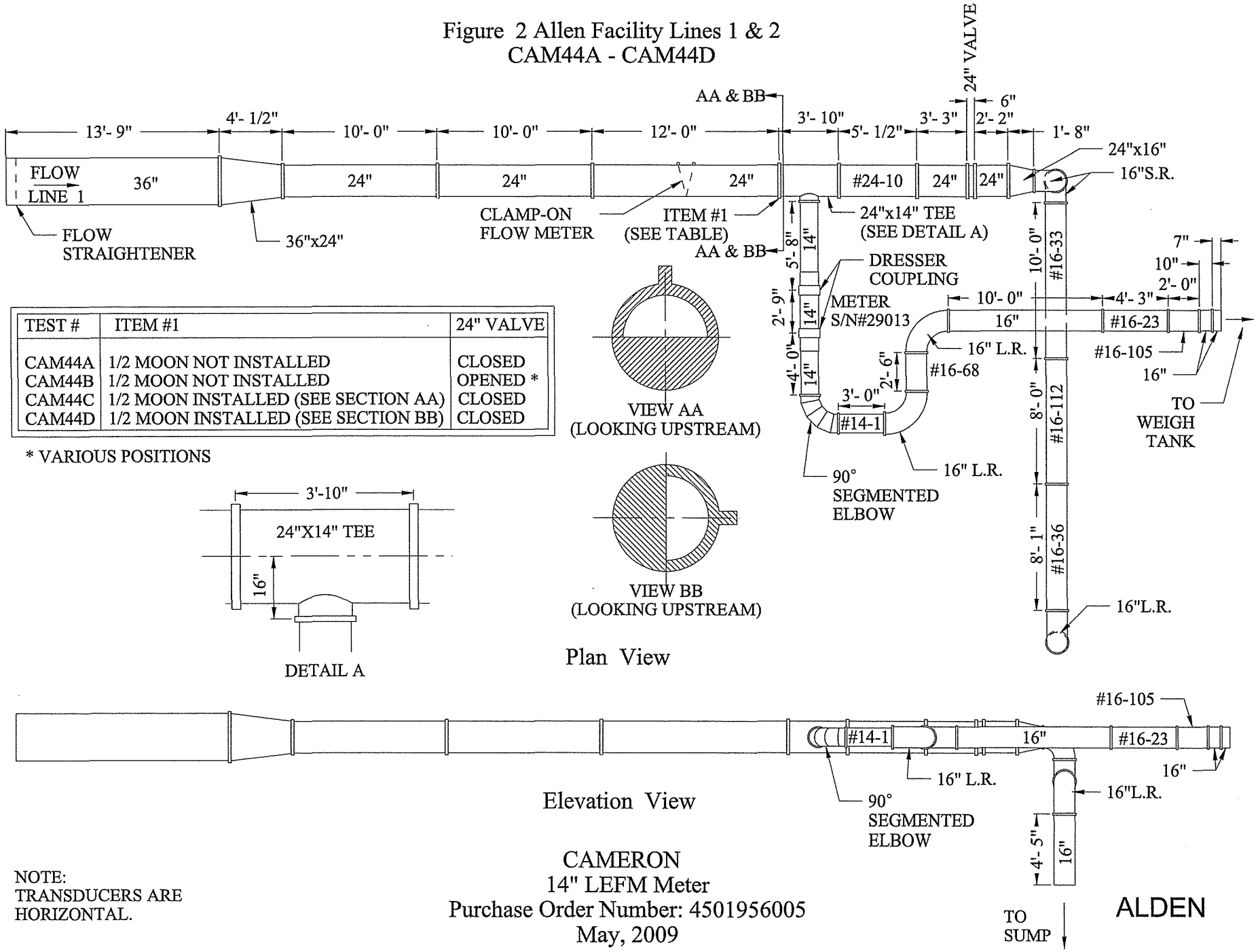


Figure 1
Allen High Reynolds Facility Test Lines 1,2,3 and 4

Figure 2 Allen Facility Lines 1 & 2
CAM44A - CAM44D



TEST #	ITEM #1	24" VALVE
CAM44A	1/2 MOON NOT INSTALLED	CLOSED
CAM44B	1/2 MOON NOT INSTALLED	OPENED *
CAM44C	1/2 MOON INSTALLED (SEE SECTION AA)	CLOSED
CAM44D	1/2 MOON INSTALLED (SEE SECTION BB)	CLOSED

* VARIOUS POSITIONS

NOTE:
TRANSDUCERS ARE
HORIZONTAL.

CAMERON
14" LEFM Meter
Purchase Order Number: 4501956005
May, 2009

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29013
Tag Number: LOOP A

CALIBRATION
DATE: May 18, 2009

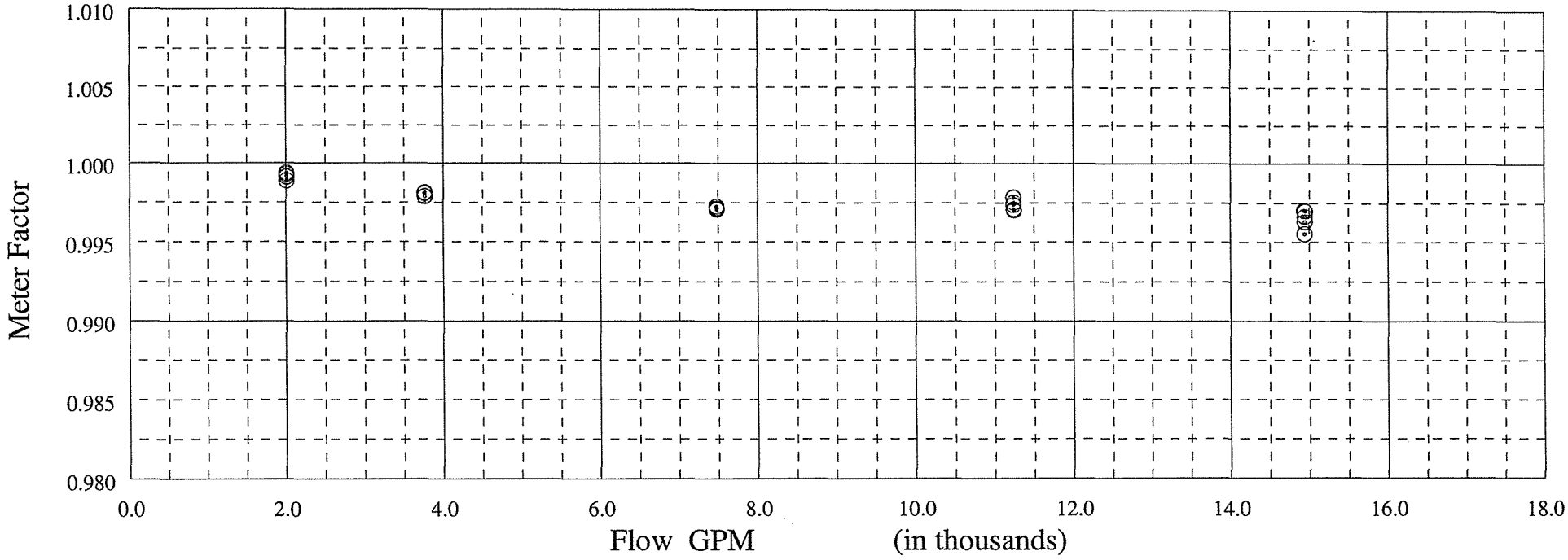
CAM44A-Test A1

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	96	96993	47.015	14940.38	15007.56	0.9955
2	96	96564	46.802	14941.91	14997.40	0.9963
3	96	96794	46.895	14948.16	14993.40	0.9970
4	96	96600	46.819	14942.45	14992.92	0.9966
5	96	96649	46.870	14934.13	14978.50	0.9970
6	96	95037	183.222	3756.63	3764.54	0.9979
7	96	94990	183.144	3756.45	3764.53	0.9979
8	96	95001	183.233	3755.13	3762.26	0.9981
9	96	95093	183.313	3757.20	3764.23	0.9981
10	96	94977	183.147	3756.09	3763.45	0.9980
11	97	96020	61.853	11244.63	11278.37	0.9970
12	97	95923	61.804	11242.31	11270.34	0.9975
13	97	96011	61.881	11238.61	11263.03	0.9978
14	97	95855	61.766	11241.29	11274.17	0.9971
15	97	95956	61.842	11239.27	11268.96	0.9974
16	97	94743	342.709	2002.50	2003.78	0.9994
17	97	94869	343.062	2003.10	2004.58	0.9993
18	97	94792	342.823	2002.83	2004.63	0.9991
19	97	94795	342.786	2003.11	2004.83	0.9991
20	96	94829	342.914	2003.04	2005.29	0.9989
21	96	95343	92.356	7477.26	7497.89	0.9972
22	96	95368	92.339	7480.71	7502.37	0.9971
23	96	95355	92.338	7479.76	7501.06	0.9972
24	96	95292	92.254	7481.62	7503.74	0.9971
25	96	95430	92.398	7480.82	7502.91	0.9971

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY: Carl Stacy



CAM44A-Test A1

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29013
Tag Number: LOOP A
May 18, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29013
Tag Number: LOOP A

CALIBRATION
DATE: May 18, 2009

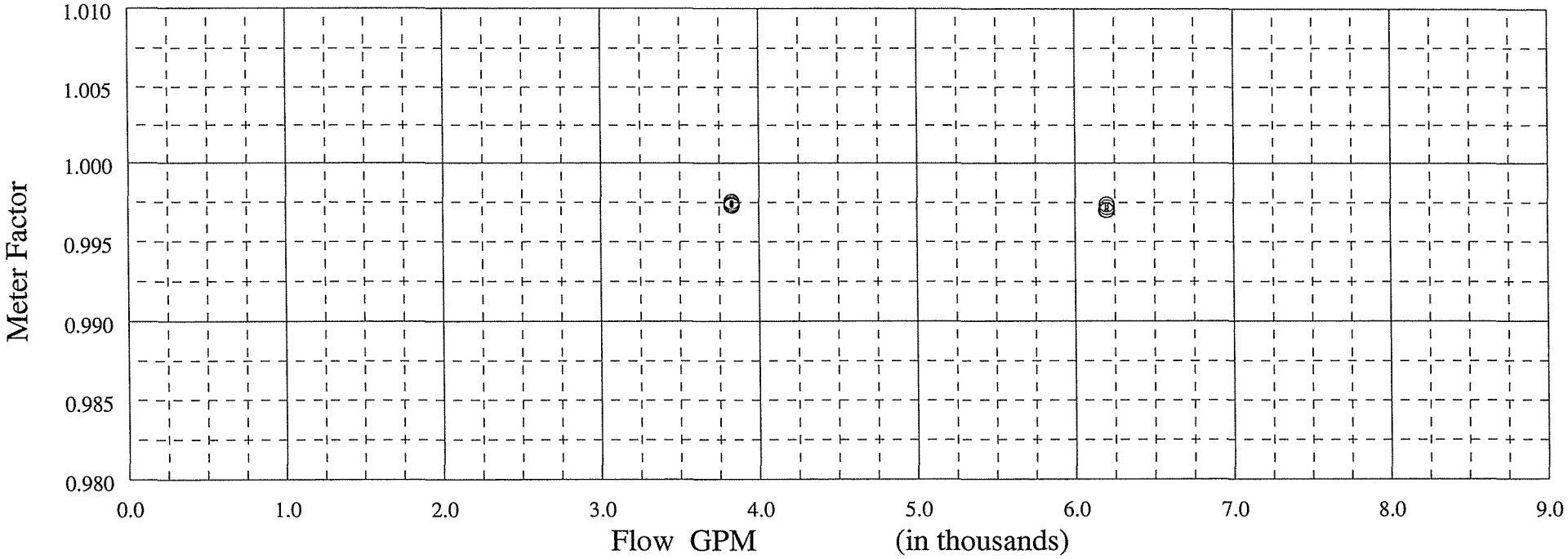
CAM44B-Test A2

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	97	95029	179.739	3829.75	3839.96	0.9973
2	97	95074	179.949	3827.09	3837.60	0.9973
3	97	95074	179.910	3827.85	3837.28	0.9975
4	97	95060	179.928	3826.98	3837.07	0.9974
5	97	95022	179.778	3828.56	3838.36	0.9974
6	97	95086	111.098	6199.65	6216.06	0.9974
7	97	95159	111.140	6202.18	6219.67	0.9972
8	97	95356	111.371	6202.10	6220.86	0.9970
9	97	95139	111.186	6198.31	6216.98	0.9970
10	97	95247	111.357	6195.83	6214.65	0.9970

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY: Carl Stamy



CAM44B-Test A2

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29013
Tag Number: LOOP A
May 18, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29013
Tag Number: LOOP A

CALIBRATION
DATE: May 19, 2009

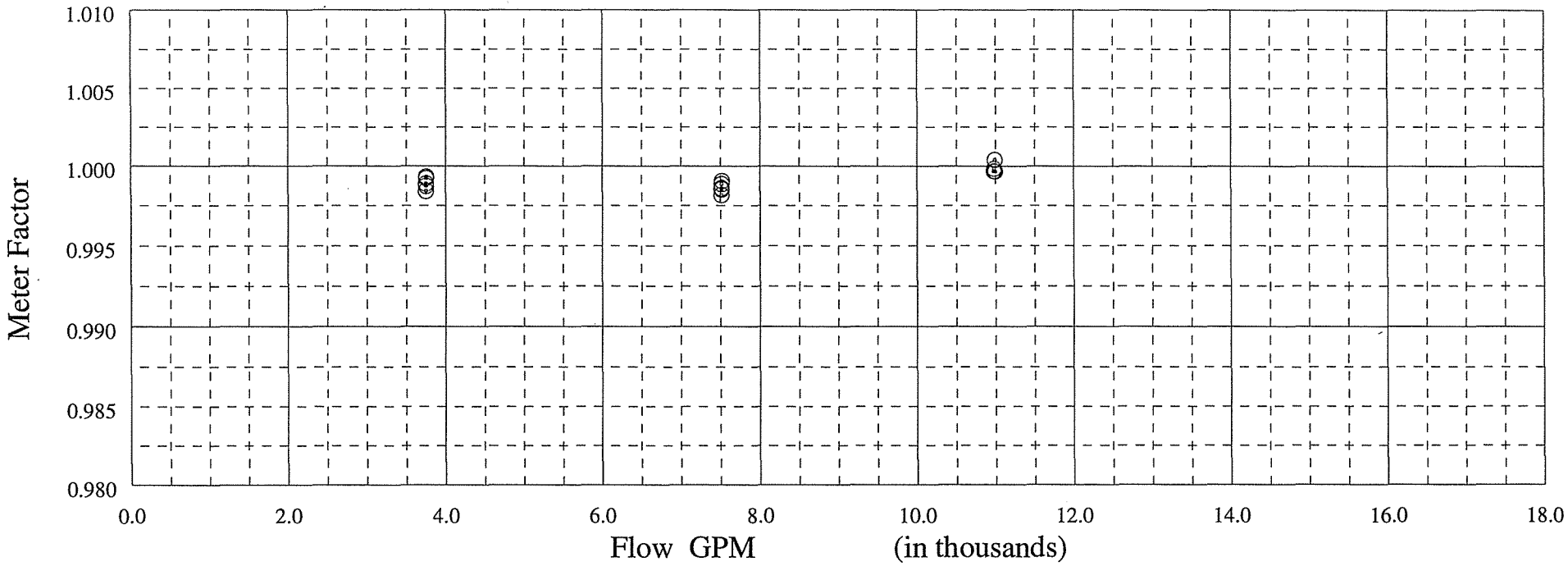
CAM44C-Test A3

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	96	95016	183.266	3755.25	3757.76	0.9993
2	96	94945	183.243	3752.99	3757.15	0.9989
3	97	94955	183.236	3753.60	3756.47	0.9992
4	97	94917	183.211	3752.69	3758.52	0.9984
5	97	94920	183.161	3753.83	3758.52	0.9988
6	97	95985	63.337	10977.69	10980.97	0.9997
7	97	95876	63.236	10983.22	10984.87	0.9998
8	97	95817	63.122	10996.31	10999.97	0.9997
9	97	95828	63.157	10991.70	10987.25	1.0004
10	97	95802	63.168	10987.04	10990.25	0.9997
11	97	95396	91.947	7516.30	7524.78	0.9989
12	98	95395	91.908	7519.49	7526.53	0.9991
13	98	95223	91.794	7515.26	7526.23	0.9985
14	98	95412	91.957	7516.83	7530.38	0.9982
15	98	95360	91.945	7513.77	7524.03	0.9986

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV, THL
Witnessed by a company representative

CERTIFIED BY: Carl Stamy



CAM44C-Test A3

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29013
Tag Number: LOOP A
May 19, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29013
Tag Number: LOOP A

CALIBRATION
DATE: May 19, 2009

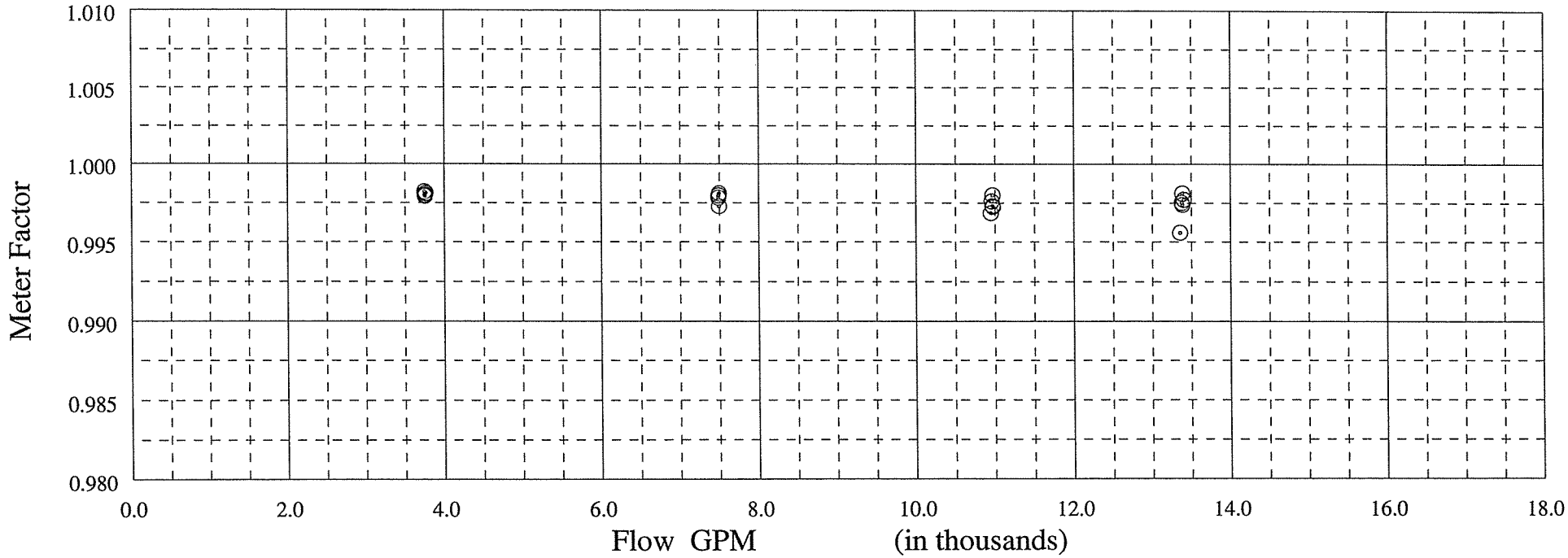
CAM44D-Test A4

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	97	96335	52.259	13354.54	13413.77	0.9956
2	97	96148	51.977	13400.61	13431.26	0.9977
3	97	96330	52.144	13382.99	13408.35	0.9981
4	97	96498	52.231	13384.30	13419.18	0.9974
5	97	96460	52.242	13376.25	13409.60	0.9975
6	97	95013	183.063	3760.02	3767.08	0.9981
7	98	94878	183.262	3750.67	3758.50	0.9979
8	98	94975	183.710	3745.36	3752.89	0.9980
9	97	95046	183.759	3747.07	3754.31	0.9981
10	98	95013	183.848	3744.03	3750.76	0.9982
11	97	95822	63.432	10943.68	10978.40	0.9968
12	98	95974	63.400	10966.81	10988.82	0.9980
13	98	95774	63.326	10956.80	10983.11	0.9976
14	98	95925	63.363	10967.64	10997.18	0.9973
15	98	95975	63.373	10971.64	11002.03	0.9972
16	98	95434	92.283	7491.96	7512.50	0.9973
17	98	95426	92.370	7484.43	7500.71	0.9978
18	98	95348	92.287	7485.04	7500.08	0.9980
19	98	95289	92.249	7483.48	7498.83	0.9980
20	98	95287	92.162	7490.39	7504.66	0.9981

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY:



CAM44D-Test A4

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29013
Tag Number: LOOP A
May 19, 2009

Certified By:

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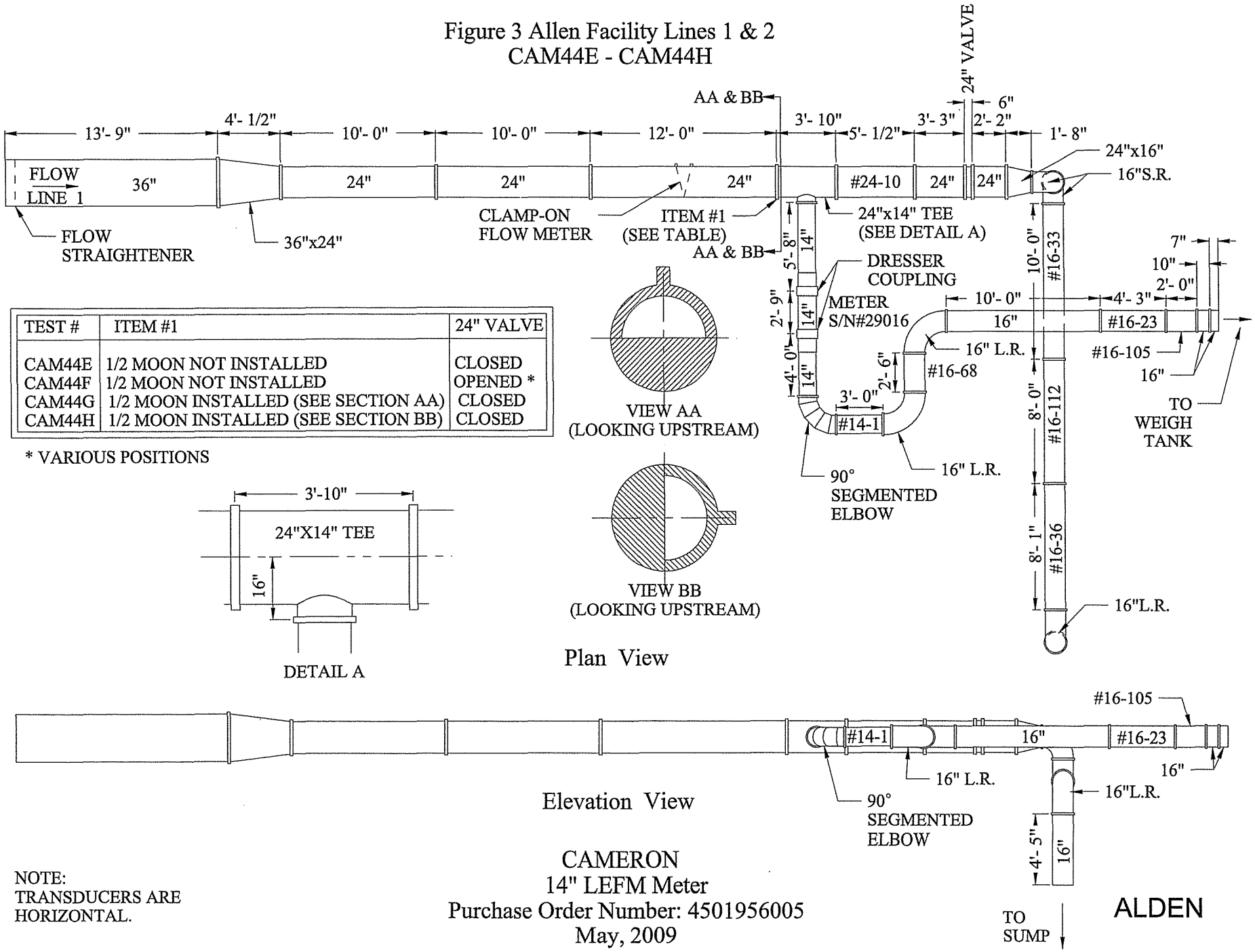
Figure 3 Allen Facility Lines 1 & 2
CAM44E - CAM44H



TEST #	ITEM #1	24" VALVE
CAM44E	1/2 MOON NOT INSTALLED	CLOSED
CAM44F	1/2 MOON NOT INSTALLED	OPENED *
CAM44G	1/2 MOON INSTALLED (SEE SECTION AA)	CLOSED
CAM44H	1/2 MOON INSTALLED (SEE SECTION BB)	CLOSED

* VARIOUS POSITIONS

NOTE:
TRANSDUCERS ARE
HORIZONTAL.

CAMERON
14" LEFM Meter
Purchase Order Number: 4501956005
May, 2009

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29016
Tag Number: LOOP B

CALIBRATION
DATE: May 20, 2009

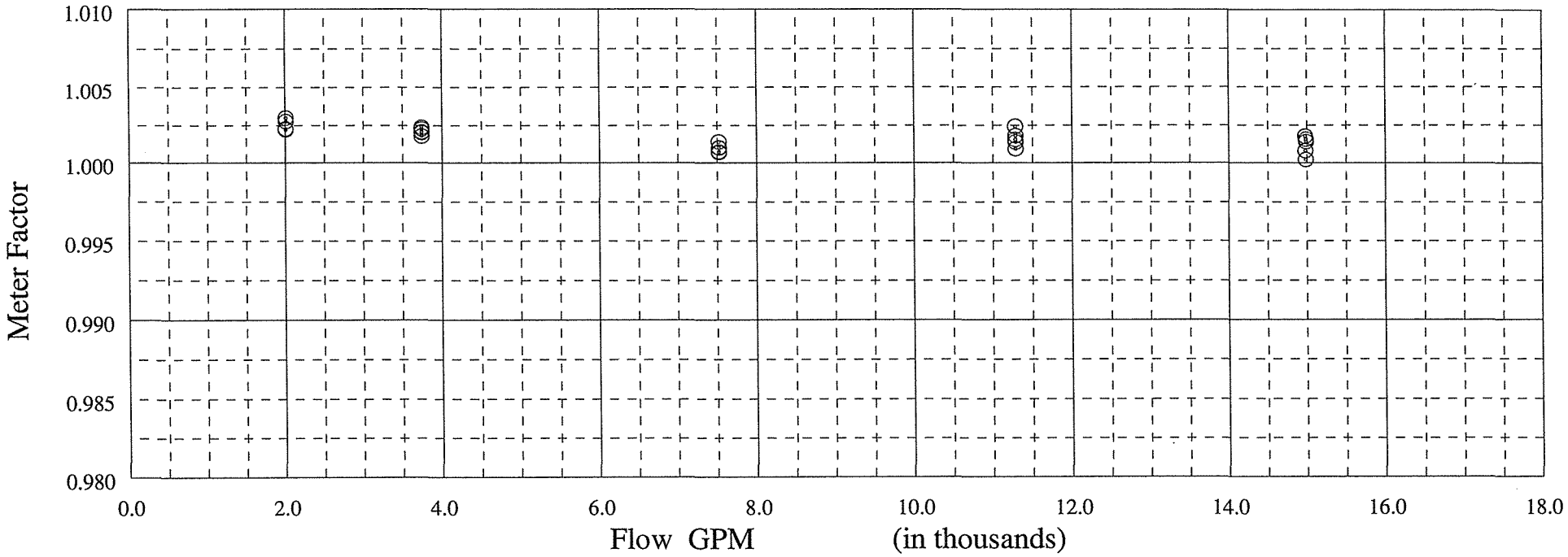
CAM44E-Test B1

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	96	96487	46.625	14986.46	14965.11	1.0014
2	95	96619	46.698	14983.16	14959.61	1.0016
3	95	96648	46.706	14984.78	14981.61	1.0002
4	95	96460	46.644	14975.92	14949.41	1.0018
5	95	96717	46.757	14979.48	14967.41	1.0008
6	96	95080	184.125	3739.64	3730.82	1.0024
7	96	94914	183.817	3739.44	3731.02	1.0023
8	96	95030	184.131	3737.71	3729.95	1.0021
9	96	94966	183.954	3738.86	3731.33	1.0020
10	96	95002	184.099	3737.39	3730.75	1.0018
11	96	95925	61.568	11284.69	11274.10	1.0009
12	96	96010	61.639	11281.87	11264.34	1.0016
13	96	95855	61.530	11283.85	11263.41	1.0018
14	96	95843	61.532	11282.09	11254.87	1.0024
15	96	96058	61.656	11284.69	11268.98	1.0014
16	96	94918	343.130	2003.64	1997.64	1.0030
17	96	94796	342.735	2003.37	1997.83	1.0028
18	96	94927	343.396	2002.28	1997.80	1.0022
19	96	94943	343.433	2002.40	1997.85	1.0023
20	96	94786	342.898	2002.21	1997.80	1.0022
21	96	95438	91.944	7518.17	7513.06	1.0007
22	96	95411	91.906	7519.15	7511.73	1.0010
23	96	95427	91.933	7518.32	7510.67	1.0010
24	96	95391	91.891	7518.92	7513.36	1.0007
25	96	95414	91.932	7517.37	7506.86	1.0014

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV, THL
Witnessed by a company representative

CERTIFIED BY:



CAM44E-Test B1

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29016
Tag Number: LOOP B
May 20, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29016
Tag Number: LOOP B

CALIBRATION
DATE: May 20, 2009

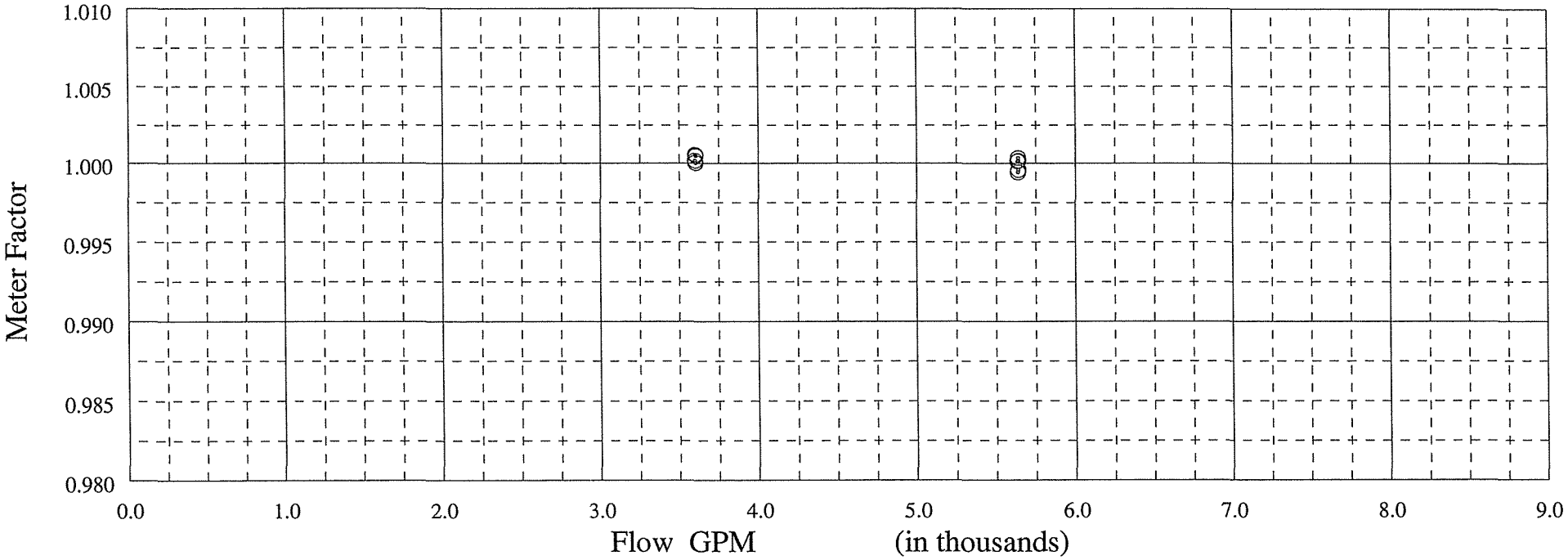
CAM44F-Test B2

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	Total Gallons	Meter Factor
1	97	95032	191.081	3602.64	3600.93	1.0005
2	97	95007	191.157	3600.28	3598.28	1.0006
3	97	94978	191.056	3601.07	3600.99	1.0000
4	97	95001	191.180	3599.61	3599.49	1.0000
5	97	94961	191.125	3599.14	3598.54	1.0002
6	97	95258	122.370	5639.36	5638.36	1.0002
7	97	95223	122.363	5637.62	5635.63	1.0004
8	97	95043	122.153	5636.65	5639.90	0.9994
9	98	95106	122.173	5639.56	5641.98	0.9996
10	98	95229	122.469	5633.20	5632.46	1.0001

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY:



CAM44F-Test B2

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29016
Tag Number: LOOP B
May 20, 2009

Certified By: Carl Stamy

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29016
Tag Number: LOOP B

CALIBRATION
DATE: May 20, 2009

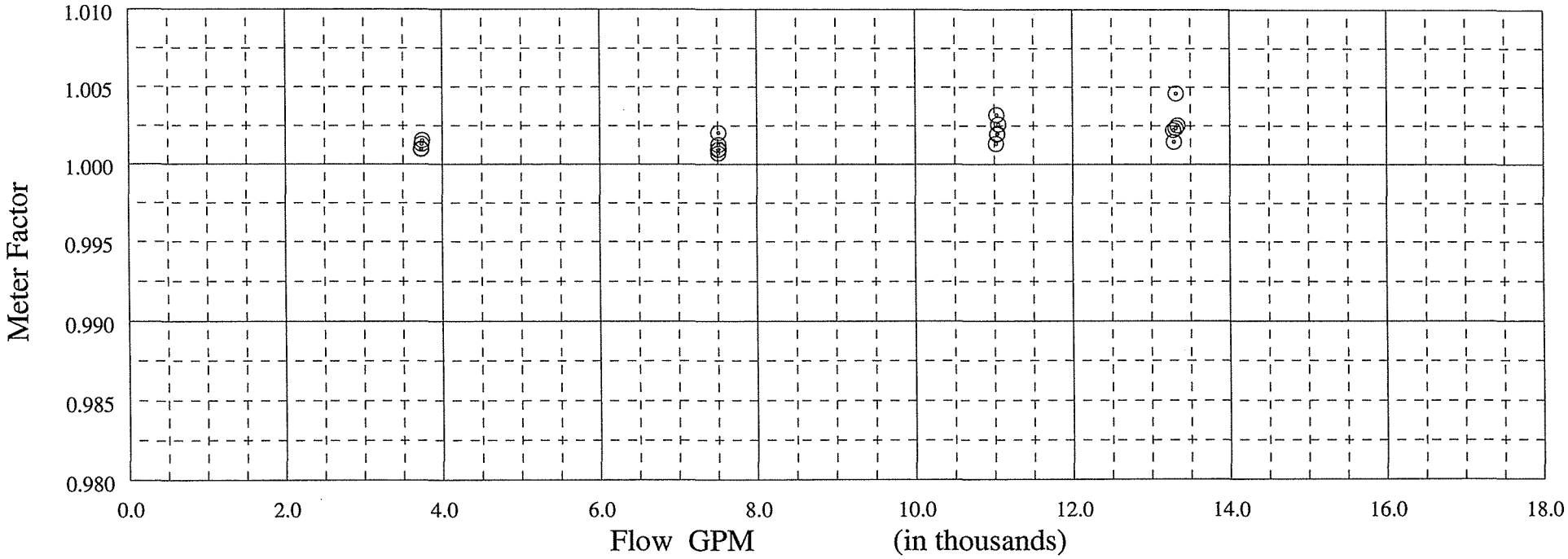
CAM44G-Test B3

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	98	96457	52.502	13309.74	13278.65	1.0023
2	98	96238	52.284	13334.81	13301.23	1.0025
3	98	96272	52.528	13277.72	13248.40	1.0022
4	98	96246	52.371	13313.74	13252.97	1.0046
5	98	96281	52.497	13286.87	13267.63	1.0014
6	98	95096	184.209	3739.99	3734.19	1.0016
7	98	95036	184.438	3733.07	3728.24	1.0013
8	98	95037	184.527	3731.30	3727.71	1.0010
9	98	94945	184.599	3726.24	3722.53	1.0010
10	98	95022	184.908	3723.02	3719.45	1.0010
11	98	95982	63.028	11032.97	11011.62	1.0019
12	98	95897	63.000	11028.12	10992.90	1.0032
13	98	95956	62.979	11038.63	11016.83	1.0020
14	98	95816	62.995	11019.84	11005.21	1.0013
15	98	95836	62.839	11049.56	11020.97	1.0026
16	98	95332	91.979	7509.36	7499.95	1.0013
17	98	95477	92.137	7507.86	7492.65	1.0020
18	98	95355	92.049	7505.66	7500.40	1.0007
19	98	95331	92.062	7502.66	7495.64	1.0009
20	98	95299	91.883	7514.76	7507.53	1.0010

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY:



CAM44G-Test B3

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29016
Tag Number: LOOP B
May 20, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29016
Tag Number: LOOP B

CALIBRATION
DATE: May 21, 2009

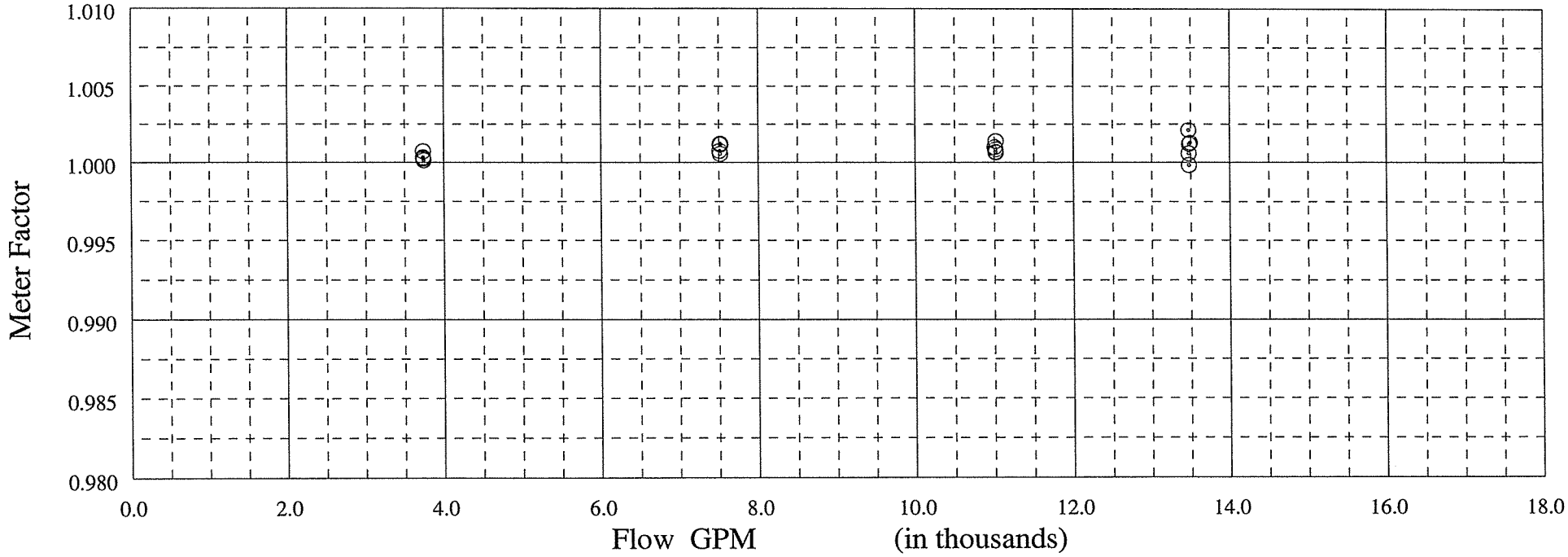
CAM44H-Test B4

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	97	96394	51.818	13475.34	13477.78	0.9998
2	97	96352	51.789	13477.03	13461.16	1.0012
3	97	96450	51.863	13471.45	13443.16	1.0021
4	97	96452	51.859	13473.03	13465.39	1.0006
5	97	96386	51.756	13490.99	13473.94	1.0013
6	97	94926	183.777	3741.89	3741.43	1.0001
7	97	95071	184.426	3734.51	3733.64	1.0002
8	98	95021	184.423	3732.75	3731.74	1.0003
9	98	95035	184.413	3733.57	3732.35	1.0003
10	98	95045	184.456	3733.17	3730.51	1.0007
11	98	95778	62.996	11015.50	11006.25	1.0008
12	98	96130	63.213	11018.05	11010.89	1.0007
13	98	95746	62.984	11013.83	11006.32	1.0007
14	98	95864	63.037	11018.16	11003.04	1.0014
15	98	95845	63.116	11002.17	10991.48	1.0010
16	98	95457	92.060	7512.67	7508.52	1.0006
17	98	95350	91.940	7514.05	7504.92	1.0012
18	98	95321	92.004	7506.58	7501.01	1.0007
19	98	95430	91.945	7519.95	7511.22	1.0012
20	98	95311	91.962	7509.36	7500.69	1.0012

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: THL, DAV
Witnessed by a company representative

CERTIFIED BY:



CAM44H-Test B4

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29016
Tag Number: LOOP B
May 21, 2009

Certified By:

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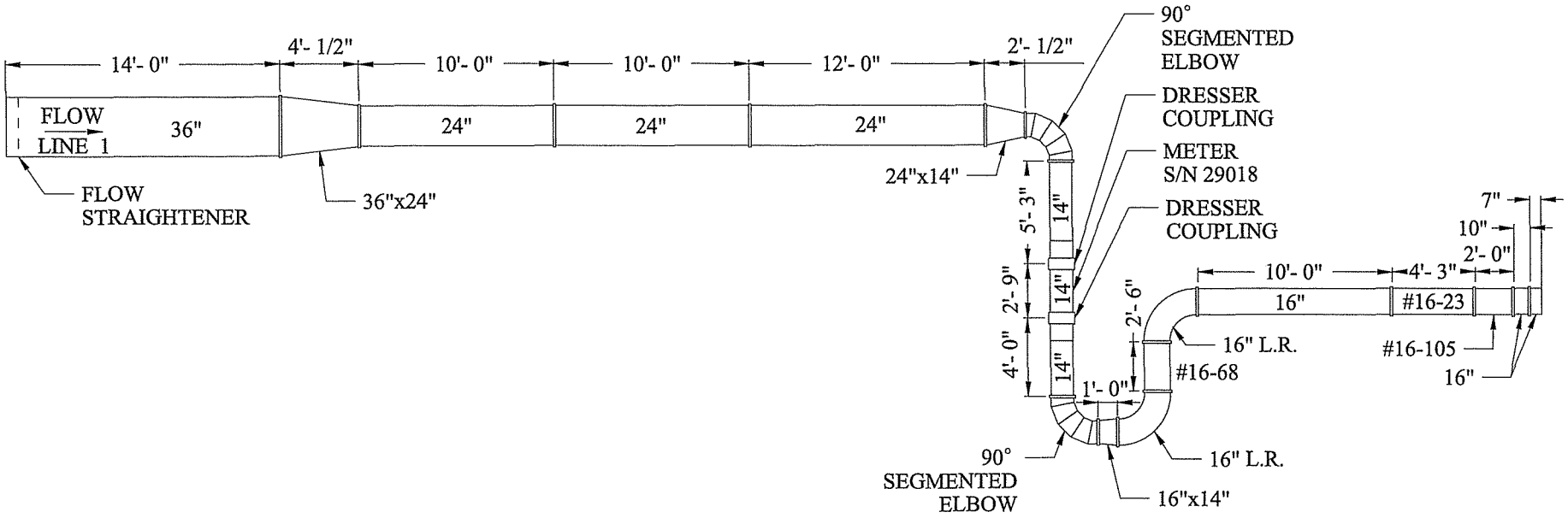
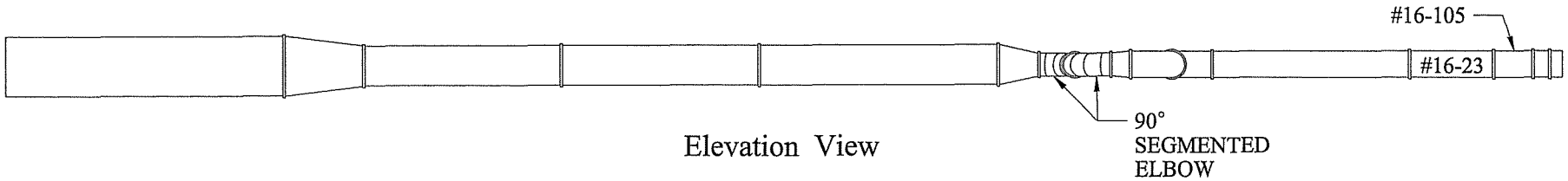
Figure 4 Allen Facility Lines 1 & 2
CAM44I



Plan View



Elevation View

NOTE:
TRANSDUCERS ARE
HORIZONTAL.

CAMERON
14" LEFM Meter
Purchase Order Number: 4501956005
May, 2009

ALDEN

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29018
Tag Number: LOOP C

CALIBRATION
DATE: May 21, 2009

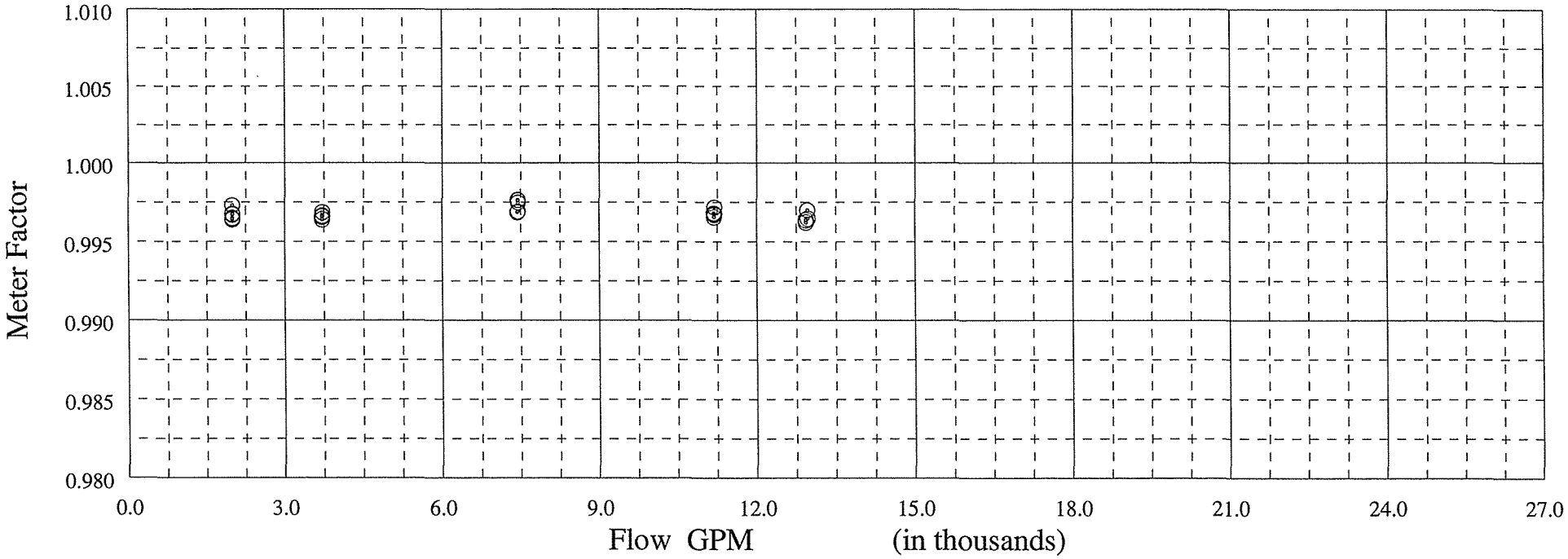
CAM44I-Test C1

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	98	94954	185.126	3715.97	3728.80	0.9966
2	98	95026	185.285	3715.59	3727.41	0.9968
3	98	95016	185.450	3711.97	3725.47	0.9964
4	98	94947	185.386	3710.56	3723.18	0.9966
5	98	95026	185.674	3707.89	3720.78	0.9965
6	98	95840	62.029	11194.24	11226.16	0.9972
7	98	95874	62.096	11186.20	11225.16	0.9965
8	98	95860	62.060	11191.30	11228.73	0.9967
9	98	95889	62.053	11195.92	11232.54	0.9967
10	98	95878	62.114	11183.76	11219.84	0.9968
11	98	94725	344.841	1990.24	1995.67	0.9973
12	98	94877	345.461	1989.86	1996.39	0.9967
13	98	94771	345.156	1989.39	1996.63	0.9964
14	98	94825	345.275	1989.80	1996.44	0.9967
15	98	94739	344.991	1989.63	1996.69	0.9965
16	98	95386	92.840	7443.73	7467.03	0.9969
17	98	95286	92.785	7440.38	7457.93	0.9976
18	98	95437	92.952	7438.93	7456.85	0.9976
19	98	95316	92.735	7446.86	7465.80	0.9975
20	98	95331	92.910	7434.03	7457.73	0.9968
21	98	96200	53.791	12958.15	12997.48	0.9970
22	98	96244	53.910	12935.40	12982.94	0.9963
23	98	96196	53.904	12930.62	12979.92	0.9962
24	98	96051	53.685	12963.95	13010.31	0.9964
25	98	96167	53.899	12928.36	12975.65	0.9964

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY:



CAM44I-Test C1

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29018
Tag Number: LOOP C
May 21, 2009

Certified By:

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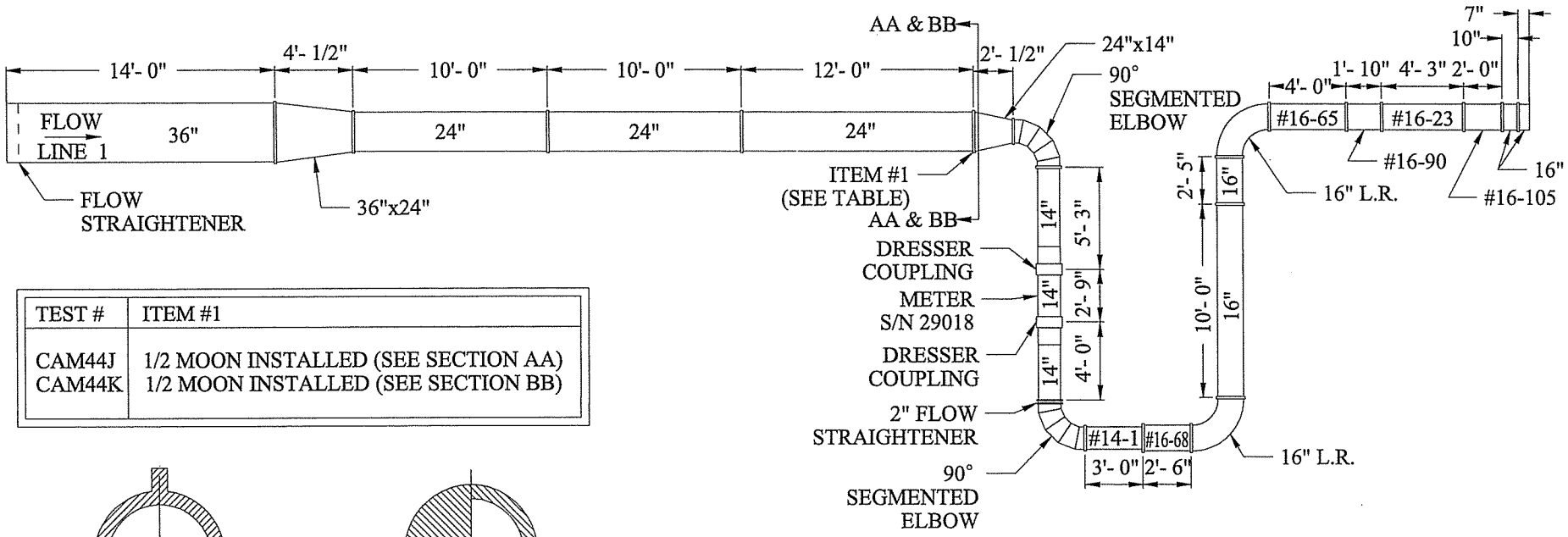
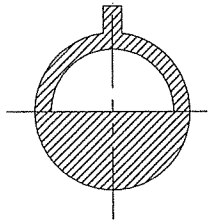
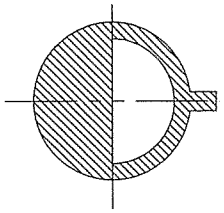
Figure 5 Allen Facility Lines 1 & 2
CAM44J - CAM44K



TEST #	ITEM #1
CAM44J CAM44K	1/2 MOON INSTALLED (SEE SECTION AA) 1/2 MOON INSTALLED (SEE SECTION BB)

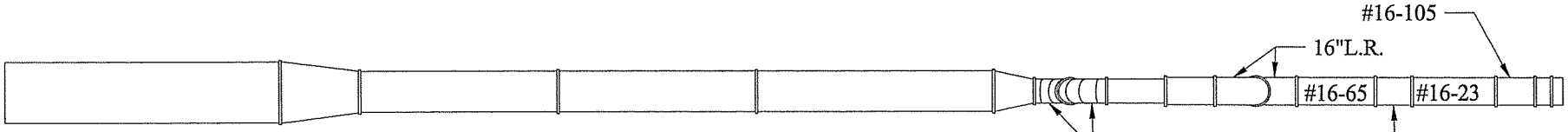


VIEW AA
(LOOKING UPSTREAM)



VIEW BB
(LOOKING UPSTREAM)

Plan View



Elevation View

NOTE:
TRANSDUCERS ARE
HORIZONTAL.

CAMERON
14" LEFM Meter
Purchase Order Number: 4501956005
May, 2009

ALDEN

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29018
Tag Number: LOOP C

CALIBRATION
DATE: May 22, 2009

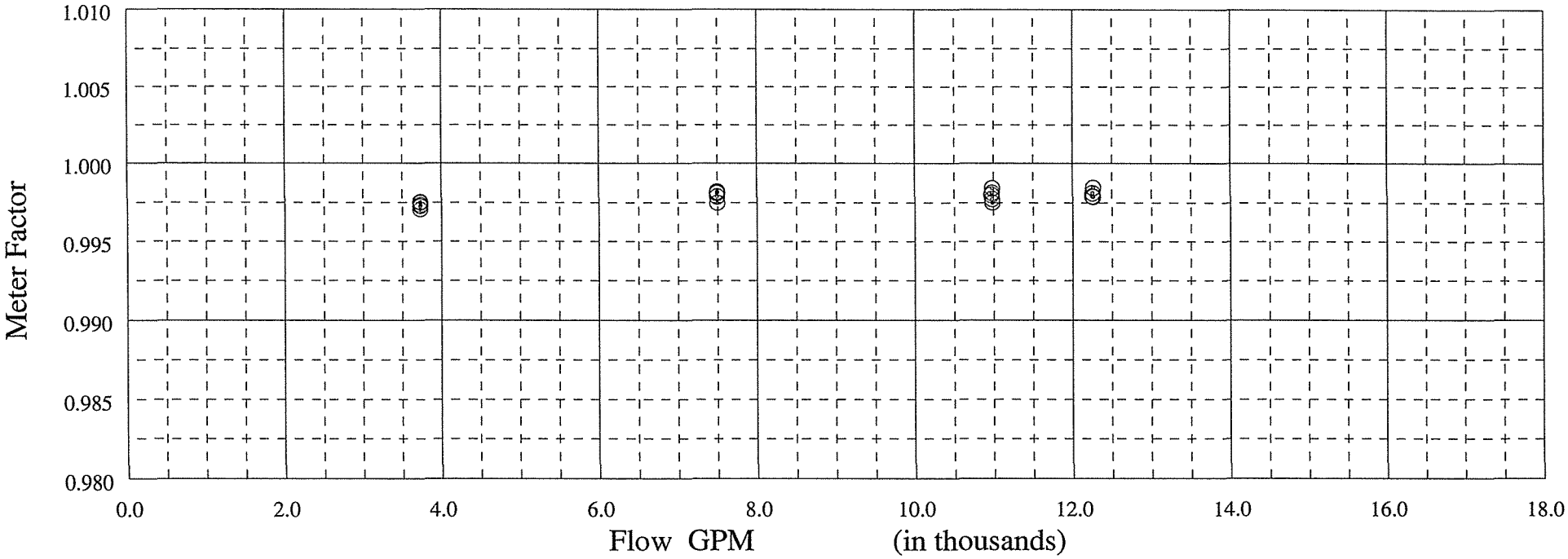
CAM44J-Test C2

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	96	95956	63.268	10983.32	11010.82	0.9975
2	95	95982	63.292	10980.12	10997.68	0.9984
3	94	95891	63.238	10978.60	10999.39	0.9981
4	94	95985	63.345	10970.91	10993.04	0.9980
5	94	95994	63.293	10980.70	11005.68	0.9977
6	94	95145	184.850	3726.56	3736.44	0.9974
7	94	95158	184.935	3725.34	3736.38	0.9970
8	94	95051	184.768	3724.46	3733.89	0.9975
9	94	95071	184.829	3723.93	3734.18	0.9973
10	94	95115	184.927	3723.69	3732.92	0.9975
11	94	95443	92.252	7490.22	7509.18	0.9975
12	94	95429	92.225	7491.12	7505.13	0.9981
13	94	95408	92.246	7487.65	7501.23	0.9982
14	94	95379	92.241	7485.77	7500.08	0.9981
15	94	95457	92.281	7488.51	7504.38	0.9979
16	94	96155	56.786	12258.66	12284.60	0.9979
17	94	96092	56.782	12251.46	12277.18	0.9979
18	94	96039	56.708	12260.55	12286.85	0.9979
19	94	96239	56.863	12252.47	12275.80	0.9981
20	94	96117	56.752	12260.77	12279.95	0.9984

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY: Paul Stamy



CAM44J-Test C2

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29018
Tag Number: LOOP C
May 22, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29018
Tag Number: LOOP C

CALIBRATION
DATE: May 22, 2009

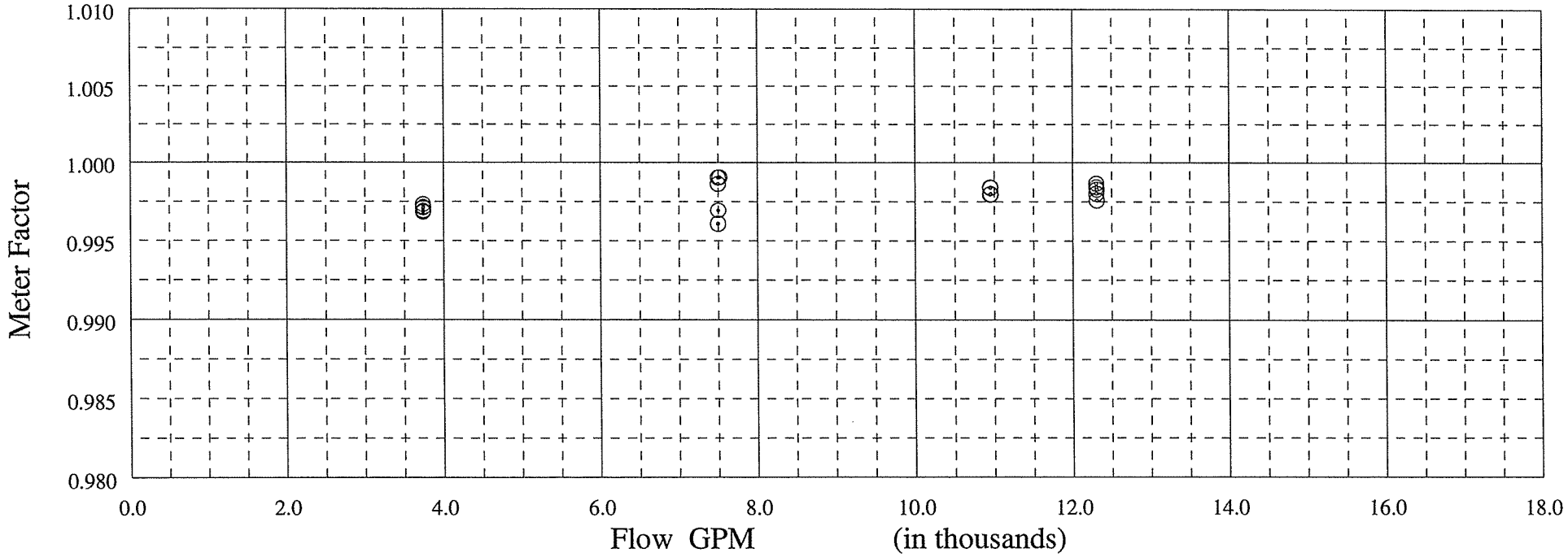
CAM44K-Test C3

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	94	96258	56.625	12305.82	12335.60	0.9976
2	93	96174	56.567	12307.11	12328.51	0.9983
3	93	96046	56.515	12301.75	12318.51	0.9986
4	93	96274	56.651	12301.40	12326.03	0.9980
5	93	96231	56.628	12300.76	12320.35	0.9984
6	93	95128	184.324	3735.80	3745.89	0.9973
7	93	95026	184.102	3736.24	3747.18	0.9971
8	93	95271	184.562	3736.47	3748.41	0.9968
9	93	95153	184.258	3737.92	3749.55	0.9969
10	93	95175	184.335	3737.22	3747.94	0.9971
11	93	96130	63.531	10952.64	10974.87	0.9980
12	93	96025	63.468	10951.44	10969.11	0.9984
13	93	95882	63.382	10949.75	10967.75	0.9984
14	93	96043	63.512	10945.73	10968.18	0.9980
15	93	95968	63.465	10945.03	10962.75	0.9984
16	93	95600	92.332	7494.32	7504.81	0.9986
17	93	95484	92.216	7494.66	7502.02	0.9990
18	93	95303	92.061	7492.98	7522.60	0.9961
19	93	95557	92.056	7513.42	7520.71	0.9990
20	93	95365	92.071	7496.98	7520.13	0.9969

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY:



CAM44K-Test C3

CAMERON
Purchase Order Number: 4501956005
14" LEFM CheckPlus
Serial Number: 29018
Tag Number: LOOP C
May 22, 2009

Certified By:

WATER DENSITY

Temperature Fahrenheit	Density lb_m / ft^3	Temperature Fahrenheit	Density lb_m / ft^3	Temperature Fahrenheit	Density lb_m / ft^3
32	62.4179	62	62.3549	92	62.0903
33	62.4201	63	62.3489	93	62.0788
34	62.4220	64	62.3427	94	62.0671
35	62.4235	65	62.3363	95	62.0552
36	62.4246	66	62.3296	96	62.0432
37	62.4255	67	62.3228	97	62.0311
38	62.4260	68	62.3157	98	62.0188
39	62.4262	69	62.3084	99	62.0063
40	62.4261	70	62.3010	100	61.9937
41	62.4257	71	62.2933	101	61.9810
42	62.4250	72	62.2855	102	61.9681
43	62.4240	73	62.2774	103	61.9551
44	62.4227	74	62.2692	104	61.9419
45	62.4211	75	62.2608	105	61.9286
46	62.4193	76	62.2522	106	61.9151
47	62.4171	77	62.2434	107	61.9015
48	62.4147	78	62.2344	108	61.8878
49	62.4121	79	62.2252	109	61.8739
50	62.4092	80	62.2159	110	61.8599
51	62.4060	81	62.2063	111	61.8458
52	62.4025	82	62.1966	112	61.8315
53	62.3988	83	62.1868	113	61.8172
54	62.3949	84	62.1767	114	61.8027
55	62.3907	85	62.1665	115	61.7880
56	62.3863	86	62.1561	116	61.7733
57	62.3816	87	62.1456	117	61.7584
58	62.3768	88	62.1348	118	61.7434
59	62.3716	89	62.1239	119	61.7284
60	62.3663	90	62.1129	120	61.7132
61	62.3607	91	62.1017	121	61.6978

BLDG 1 TRACEABILITY

ARL NUMBER	DESCRIPTION	Notes	LAST CAL DATE	NEXT CAL DUE	MODEL	SERIAL NUMBER	Location
00105	HEWLETT-PACKARD COUNTER/TIMER	FREQUENCY CHECKED DAILY - BACKUP TIMER ALLEN FACILITY			5301A	1120A00605	BLDG 1
00129	TIME TRANSFER STANDARD	CALIBRATED WEEKLY VERSUS NIST STATION WWV PRIMARY STANDARD	5/18/2009	6/1/2009	ALDEN0001		BLDG 1&2
00167	0 - 1.000" MICROMETER	CALIBRATED BEFORE EACH USE LOCATED IN JBN OFFICE			436-1	949931	BLDG 1&2
00439	STAINLESS STEEL MASS (20LBm) TRANSFER STANDARD	NIST TEST NO. 822/263871-00 ge infrastructure #0508180439 PRIMARY STANDARD	8/23/2005	8/21/2015	NA	NA	BLDG 1&2
00444	STAINLESS STEEL MASS(20LBm & 10LBm) TRANSFER STANDARD	NIST TEST NO. 822/263871-00 GE Infrastructure #0508180444 PRIMARY STANDARD	8/23/2005	8/21/2015	S-1 WEIGHT SET	1969	BLDG 1&2
00471	AMBIENT THERMOMETER W/ AMBIENT PROBE 0471-A	AMBIENT TEMPERATURE ALLEN FACILITY	1/6/2009	7/7/2009	DP-26RTD	34401	BLDG 1

ARL NUMBER	DESCRIPTION	Notes	LAST CAL DATE	NEXT CAL DUE	MODEL	SERIAL NUMBER	Location
00583	LINE TEMPERATURE THERMOMETER W/PROBE 0583A	LINE 1 & 2 TEMPERATURE - ALLEN FACILITY	1/6/2009	7/7/2009	DP41-RTD	5410983	BLDG 1
00600	UNIVERSAL COUNTER - PRIMARY	FREQUENCY CHECKED DAILY ALLEN FACILITY			53131A	MY47000389	BLDG 1
00756	100,000# WEIGH TANK SCALE W/LOAD CELL #1044	100,000# CAPACITY TOLEDO SCALE - ALLEN FACILITY	2/9/2009	8/10/2009	2382	800635	BLDG 1
01035	ULTRASONIC THICKNESS GAUGE	CALIBRATE BEFORE EACH USE			26DL	9041602	BLDG 1&2
01040	0 - 6" DIAL CALIPER	CALIBRATED BEFORE EACH USE			N/A		BLDG 1&2
01046	A/D BOARD - USED W/RESISTOR BOX 00295	16 BIT BOARD - CALIBRATED FOR MILLIAMP - CAL BEFORE USE OR EVERY 6 MONTHS	5/26/2009		DT2805/571	0118473	BLDG 1
10002	CAL3DA ver 3.13 ARL SOFTWARE	COMPUTATIONAL ACCURACY VERIFIED USING HAND CALCS.	5/23/1995		VERIFIED BY	HAND CALCS.	BLDG 1&2

Uncertainty Analysis

Allen 100,000 Lb Scale

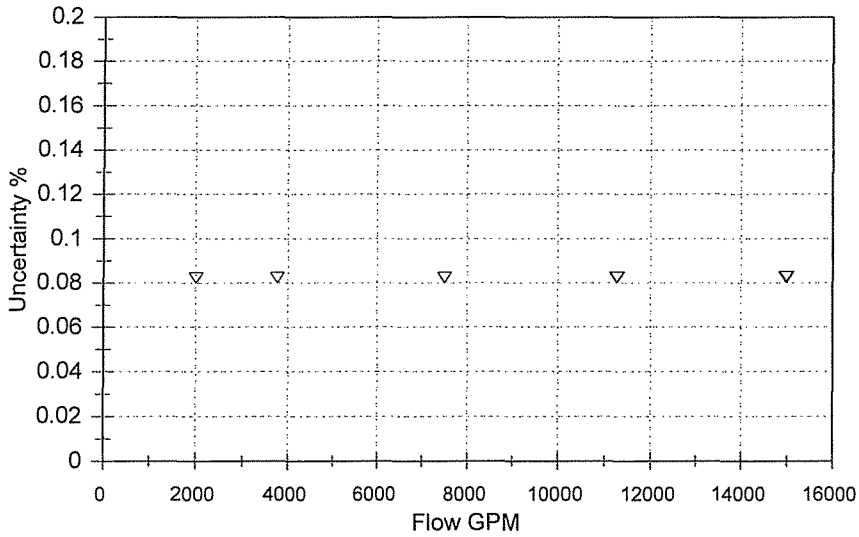
Cameron Purchase Order No: 4501956005

14" LEFM Check Plus: s/n 29013

		Standard Uncertainty Percent
Mass		
96993	Calibration	0.03635
	Buoyancy	0.00520
	Reproducibility	0.01600
	Loss	0.00208
	Resolution	0.00060
	Repeatability	0.00119
Time		
47.0	Standard	0.00030
seconds	Deadband	0.00102
	Resolution	0.00123
	Repeatability	0.00246
Density		
Temperature	Standard	0.00279
96	Impurities	0.01000
	Reproducibility	0.01117
	Resolution	0.00112
Diverter	Inclusive	0.01000
	Flow	
	Standard Uncertainty Percent	0.044
	Expanded Uncertainty Percent	0.088

Cameron Purchase Order No: 4501956005

14" LEFM Check Plus: s/n 29013



CALIBRATION OF

THREE 14" LEFM CHECKPLUS FLOW METERS

CAMERON MEASUREMENT SYSTEMS

PURCHASE ORDER NUMBER 4501956006

JUNE 2009 - REPORT NO. 2009-101-C1229

REVISION 1 – 6/25/10

CERTIFIED BY

Philip S. Stacy

ALDEN RESEARCH LABORATORY, INC.

30 SHREWSBURY STREET

HOLDEN, MASSACHUSETTS 01520

All Client supplied information and calibration results are considered proprietary and confidential to the Client. If a third party is a witness during calibrations or if the Client requests transmittal of data to a third party, Alden considers that the Client has waived confidentiality for the Witness.

In the event the Client distributes any report issued by Alden outside its own organization, such report shall be used in its entirety, unless Alden approves a summary or abridgment for distribution.

No advertising or publicity containing any reference to Alden or any employee, either directly or by implication, shall be made use of by Client without Alden's written approval.

INTRODUCTION

Three 14" LEFM CheckPlus Flow Meters were tested and calibrated at Alden Research Laboratory, Inc. for Cameron Measurement Systems under their Purchase Order Number 4501956006 using Alden's standard test procedures, QMSM-01 Rev. 3. Flow meter performance is presented in both tabular and graphical format for configurations simulating field piping and included parametric testing. Results are shown as meter factor versus flow in gpm. Revision 1 issued to correct a typographic error showing a pipe dimension of 7'-10-1/2" on page 25. The length of the pipe used during testing was confirmed to be 8'-10-1/2" and the Figure was corrected.

FLOW ELEMENT INSTALLATION

The meters were installed in the Allen High Reynolds Number Facility shown in plan view on Figure 1. Water was provided by a pair of 300 HP electrically driven centrifugal pumps providing a maximum head 135 ft and a maximum flow of 20,000 gpm.

The detailed piping arrangements, immediately upstream and downstream of the flow meter, are shown in Figures preceding the test data and include all significant fittings and pipe lengths with meter location identified. Careful attention was given to aligning the flow element with the test line piping and to assure no gaskets between flanged sections protruded into the flow. Vents were provided at critical locations of the test line to purge the system of air.

TEST PROCEDURE

After checking the installation, water was introduced into the system to equalize line and primary element temperature to water temperature. The downstream control valve was then closed and vent valves in the test line were opened to remove air from the system. With the line flow shut off, the flow meter output was checked for zero flow indication. Prior to the test run, the control valve was set to the desired flow. For the gravimetric measurement method, the flow was diverted away from the weigh tank.

After steady state conditions in the test line and instrument readings had been reached, the weigh tank discharge valve was closed and the weigh tank scale indicator and the electric timer were both zeroed. The flow was then diverted into the weigh tank, which automatically started the timer.

As the weigh tank run was initiated, Cameron personnel noted the time on the flow meters and logged the meter output continuously. At the end of each test run, flow was diverted away from the weigh

tank and the timer and the totalizer was stopped to terminate the test run. The weight of water in the tank, elapsed time, and water temperature were recorded on a data sheet. At the end of the weigh tank run Cameron personnel noted the time again so that the meter output could be averaged over the collection time. Cameron personnel provided Alden the average meter reading at the end of each test series. The control valve was then adjusted to the next flow and the procedure repeated. During the time allowed to stabilize the new flow, the data were entered into the computer to determine the flow and the results were plotted so that each test run was evaluated before the next run began.

FLOW MEASUREMENT METHOD

Flow was measured by the gravimetric method using a tank mounted on calibrated scales having a capacity 100,000 pounds (resolution 1 lb). Water passing through the flow element was diverted into the tank with a hydraulically operated knife edge passing through a rectangular jet produced by a diverter head box. A Hewlett-Packard 10 MHz Frequency Counter with a resolution 0.001 sec was started upon flow diversion into the tank by an optical switch, which is positioned at the center of the jet. The timer was stopped upon flow diversion back to waste and the elapsed diversion time was recorded. A thermistor thermometer measured water temperature to allow calculation of water density. Volumetric flow was calculated by Equation (1).

$$q_a = \frac{W}{T\rho_w B_c} \qquad (1)$$

where

q_a	=	actual flow, $\frac{ft^3}{sec}$
W	=	mass of water collected, lb_m
T	=	time, sec
ρ_w	=	water density, $\frac{lb_m}{ft^3}$
B_c	=	buoyancy correction, $1 - \frac{\rho_a}{\rho_w}$
ρ_a	=	air density, $\frac{lb_m}{ft^3}$

The buoyancy correction includes air density calculated by perfect gas laws with the standard barometric pressure, a relative humidity of 75%, and measured air temperature. The weigh tank is periodically calibrated to full scale by the step method using 10,000 lb_m of cast iron weights, whose calibration is traceable to NIST. Flow calculations are computerized to assure consistency. Weigh

tank calibration data and water density as a function of temperature, are stored on disk file. Data were recorded manually and on disk file for later review and reporting.

TEST RESULTS

Test results are shown both in tabular form and plotted versus flow. The raw data required to calculate flow by the gravimetric method, the meter flow total, and the meter factor, are listed in the tables. Meter factor is plotted versus flow for each configuration. A typical test series included equally spaced test flows ranging from the maximum system flow to a minimum flow of about 1,900 gpm with multiple runs at each flow. Tests were conducted with the piping simulating the field installation, parametric tests, including a flow disturbance.

An uncertainty analysis was conducted of the flow measurements in accordance with the methods of NIST Technical Note 1297 Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results and NISTIR 6919 Recommended Guide of Determining and Reporting Uncertainties for Balances and Scales by evaluating each elementary error source for flow measurement. Type A uncertainties were estimated from the precision indices of the test data and Type B uncertainties were estimated from experience. The collection weight was about 95,000 lb for most flow measurements. An example calculation for one test run is shown in the Appendix as a table listing the elementary error sources for each measured component (weight, time, density, and diverter) and combines the error sources by the root sum square (RSS) method. Combining the components results in an expanded uncertainty estimate of about 0.09% at the 95% confidence level. Analyses were conducted for each test flow and the results are plotted versus flow.

Calibrations of the test instrumentation (temperature, time, weight, and length measurements) are traceable to the National Institute of Standards and Technology (formerly the National Bureau of Standards). Alden's Quality Assurance Program is designed to meet ANSI/NCSL Z540-1-1994 "Calibration Laboratories and Test Equipment-General Requirements" (supercedes MIL-STD-45662A).

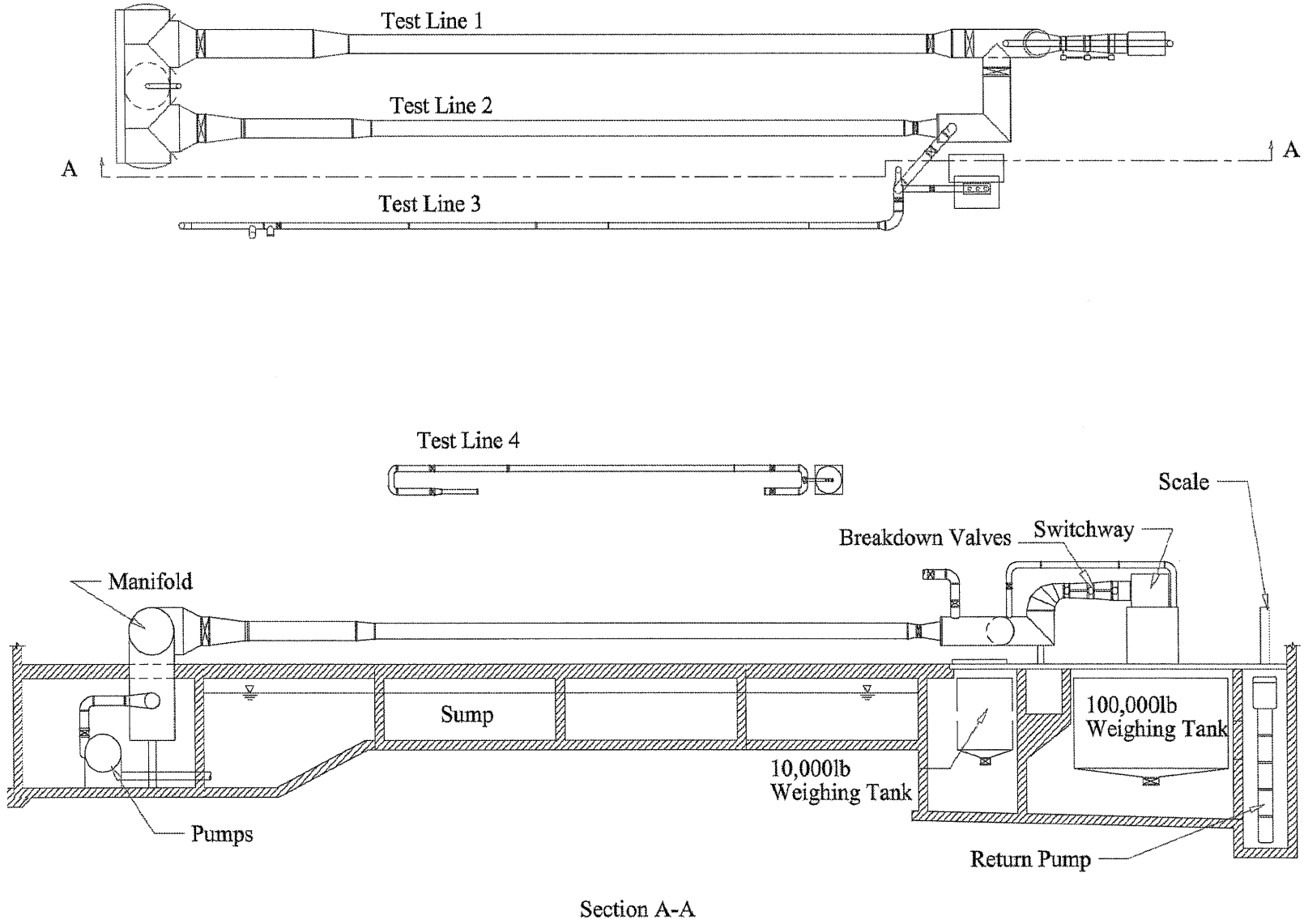
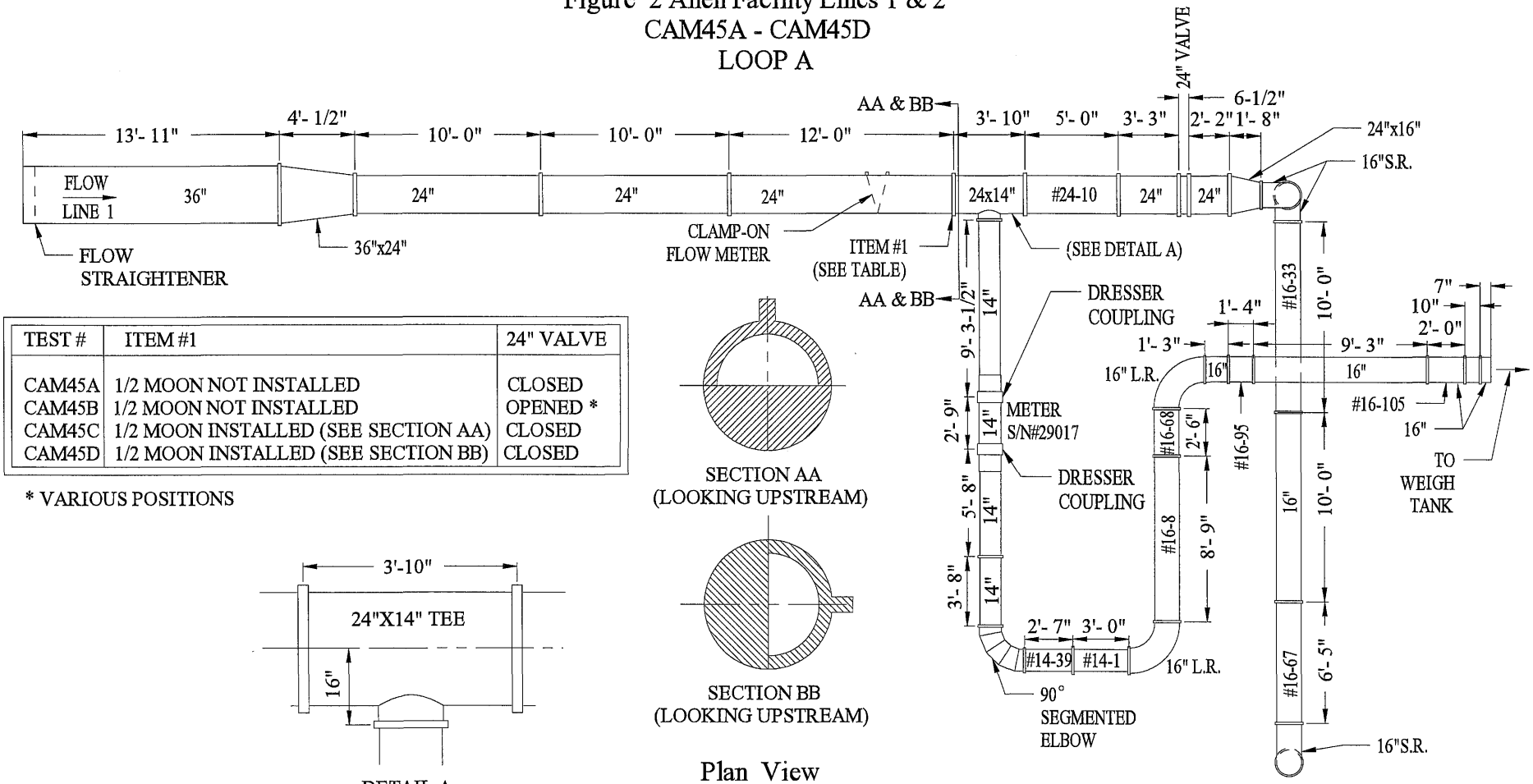


Figure 1

Allen High Reynolds Facility Test Lines 1,2,3 and 4

Figure 2 Allen Facility Lines 1 & 2
CAM45A - CAM45D
LOOP A



TEST #	ITEM #1	24" VALVE
CAM45A	1/2 MOON NOT INSTALLED	CLOSED
CAM45B	1/2 MOON NOT INSTALLED	OPENED *
CAM45C	1/2 MOON INSTALLED (SEE SECTION AA)	CLOSED
CAM45D	1/2 MOON INSTALLED (SEE SECTION BB)	CLOSED

* VARIOUS POSITIONS

NOTE:
TRANSDUCERS ARE
HORIZONTAL.

CAMERON
14" LEFM Meter
Purchase Order Number: 4501956006
June, 2009

ALDEN

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29017
Tag Number: LOOP A

CALIBRATION
DATE: June 8, 2009

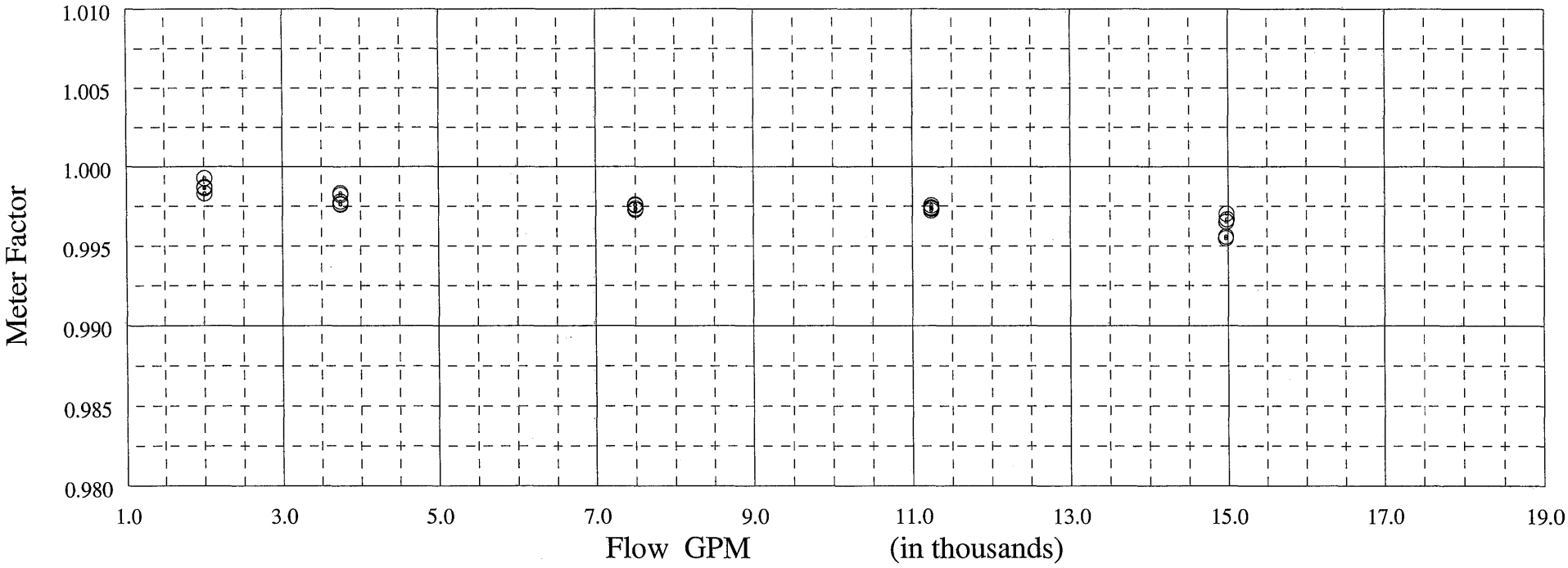
CAM45A-Test A1

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	93	96985	46.891	14970.77	15038.86	0.9955
2	93	96770	46.785	14971.90	15038.27	0.9956
3	93	96858	46.818	14974.80	15027.03	0.9965
4	93	96787	46.758	14983.23	15033.27	0.9967
5	93	96613	46.700	14974.67	15019.54	0.9970
6	93	95160	184.271	3737.98	3746.78	0.9977
7	93	95242	184.310	3740.48	3749.49	0.9976
8	93	95192	184.223	3740.28	3748.52	0.9978
9	93	95088	183.975	3741.23	3747.94	0.9982
10	93	95250	184.329	3740.40	3746.70	0.9983
11	93	96007	61.875	11231.59	11260.93	0.9974
12	93	96018	61.866	11234.63	11262.29	0.9975
13	93	96125	61.961	11229.98	11261.15	0.9972
14	93	96043	61.872	11236.70	11266.86	0.9973
15	93	96017	61.882	11231.72	11260.72	0.9974
16	93	94991	342.951	2005.00	2006.46	0.9993
17	93	95063	343.354	2004.16	2006.74	0.9987
18	93	95009	343.222	2003.80	2006.55	0.9986
19	93	94997	343.054	2004.52	2007.13	0.9987
20	93	94998	343.098	2004.29	2007.69	0.9983
21	93	95455	92.195	7494.54	7515.01	0.9973
22	93	95392	92.133	7494.68	7513.05	0.9976
23	93	95534	92.242	7496.93	7516.68	0.9974
24	93	95427	92.182	7493.59	7511.46	0.9976
25	93	95507	92.270	7492.72	7510.81	0.9976

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV

CERTIFIED BY: Phil Stacy



CAM45A-Test A1

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29017
Tag Number: LOOP A
June 8, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29017
Tag Number: LOOP A

CALIBRATION
DATE: June 9, 2009

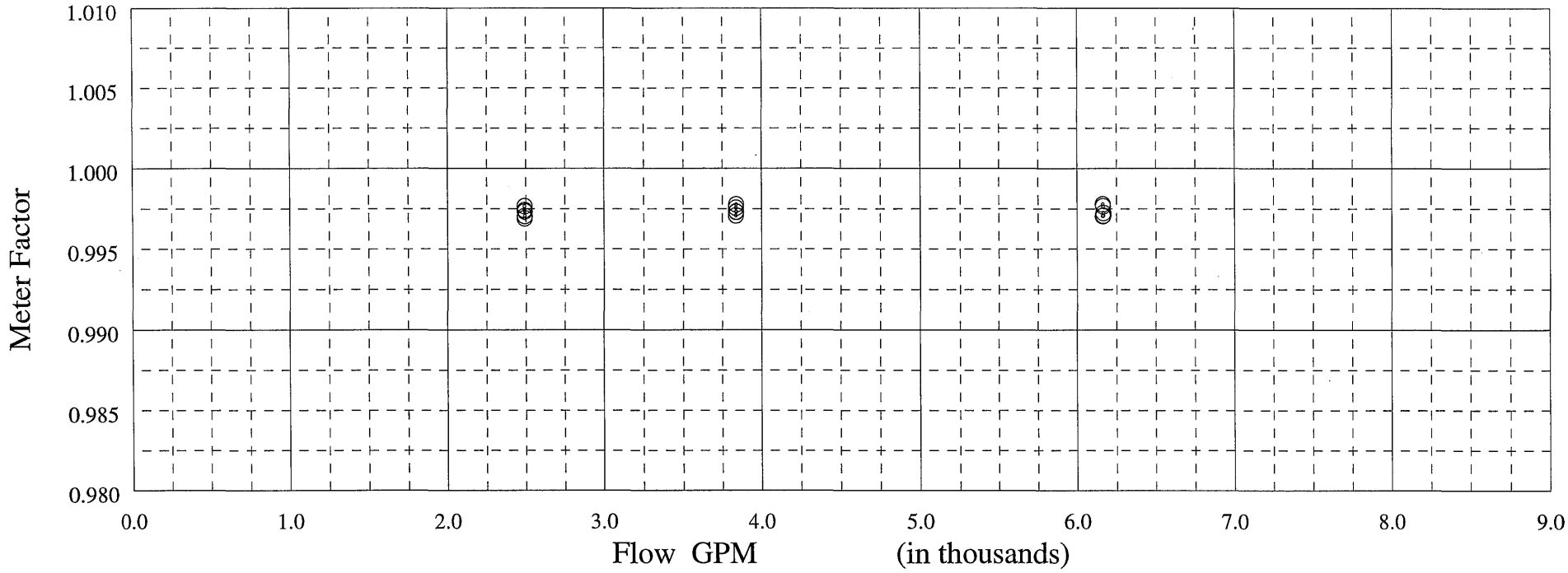
CAM45B-Test A2

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	94	95317	179.829	3837.38	3846.69	0.9976
2	94	95183	179.523	3838.58	3848.82	0.9973
3	94	95124	179.482	3837.15	3848.33	0.9971
4	94	95128	179.419	3838.74	3847.25	0.9978
5	94	95153	179.490	3838.30	3848.66	0.9973
6	95	95388	112.000	6166.76	6183.67	0.9973
7	95	95222	111.834	6165.16	6183.09	0.9971
8	95	95295	111.953	6163.44	6181.55	0.9971
9	95	95341	112.031	6162.11	6175.72	0.9978
10	95	95289	111.929	6164.51	6178.80	0.9977
11	95	95052	276.194	2491.98	2497.81	0.9977
12	95	95010	276.051	2492.16	2498.78	0.9974
13	95	95106	276.379	2491.73	2498.13	0.9974
14	95	95098	276.337	2491.90	2499.60	0.9969
15	95	95069	276.172	2492.63	2499.98	0.9971

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV, THL
Witnessed by a company representative

CERTIFIED BY: Bal Stang



CAM45B-Test A2

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29017
Tag Number: LOOP A
June 9, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29017
Tag Number: LOOP A

CALIBRATION
DATE: June 9, 2009

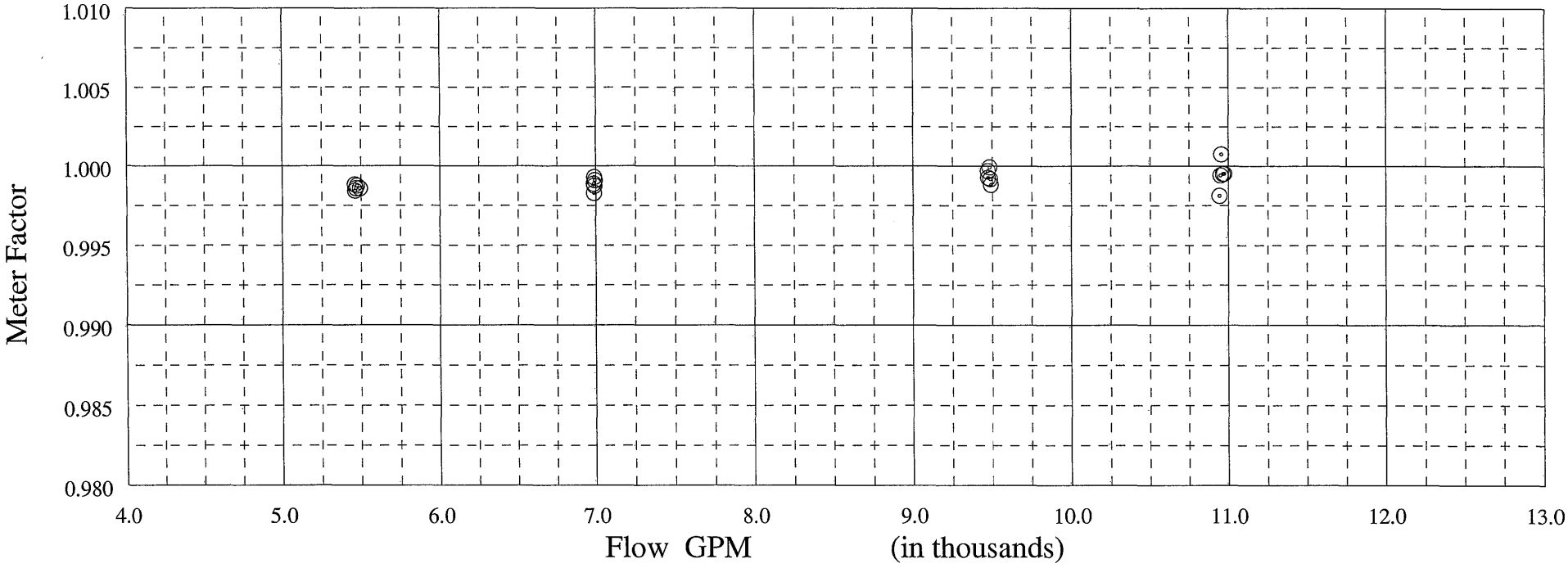
CAM45C-Test A3

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	95	96113	63.559	10949.55	10956.02	0.9994
2	95	96095	63.590	10942.07	10962.66	0.9981
3	95	96095	63.412	10972.89	10978.16	0.9995
4	95	96005	63.460	10954.19	10946.01	1.0007
5	95	96032	63.416	10964.85	10970.45	0.9995
6	95	95542	98.980	6989.46	6998.23	0.9987
7	95	95463	98.955	6985.46	6993.38	0.9989
8	95	95325	98.777	6987.93	6999.90	0.9983
9	95	95212	98.596	6992.42	6998.79	0.9991
10	95	95416	98.858	6988.85	6993.90	0.9993
11	95	95809	73.248	9471.29	9474.22	0.9997
12	95	95774	73.139	9482.03	9482.72	0.9999
13	95	95754	73.202	9471.95	9479.03	0.9993
14	95	95810	73.102	9490.41	9501.65	0.9988
15	95	95688	73.045	9485.94	9493.78	0.9992
16	95	95359	125.748	5491.28	5499.09	0.9986
17	95	95418	126.234	5473.65	5480.57	0.9987
18	95	95238	126.159	5466.53	5474.36	0.9986
19	95	95191	126.226	5460.96	5469.59	0.9984
20	95	95225	126.302	5459.71	5466.25	0.9988

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY:



CAM45C-Test A3

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29017
Tag Number: LOOP A
June 9, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29017
Tag Number: LOOP A

CALIBRATION
DATE: June 9, 2009

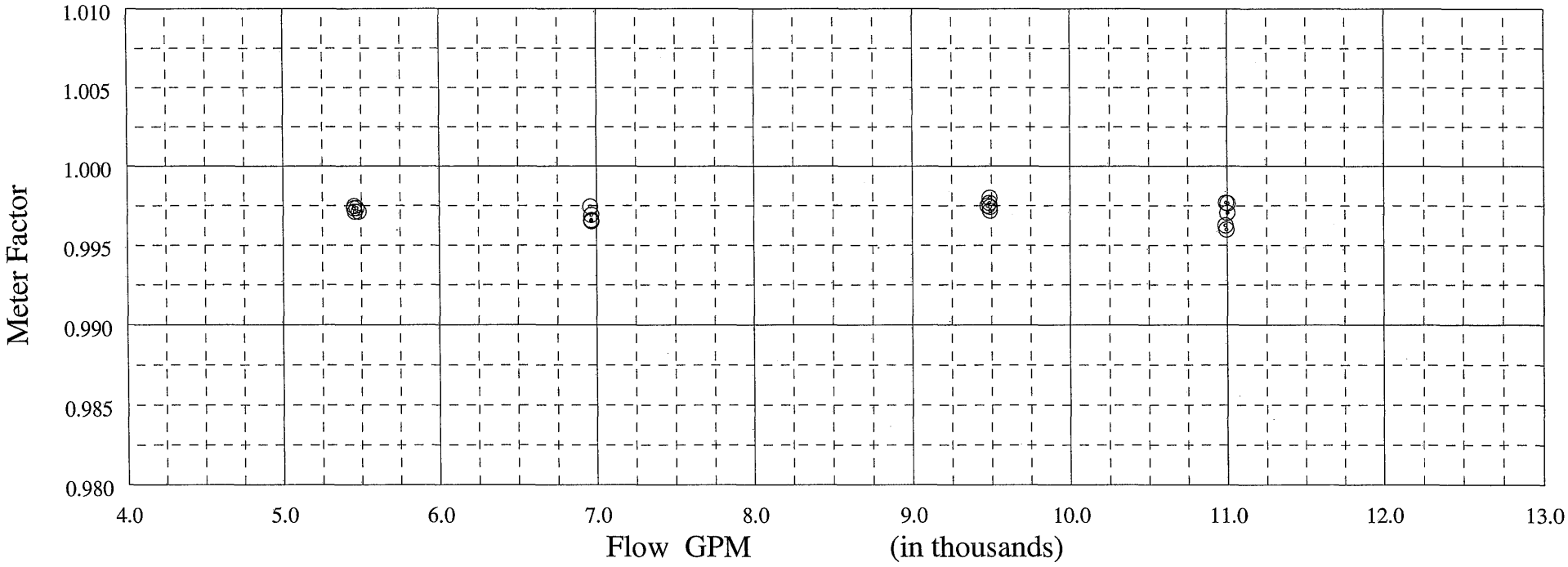
CAM 45D-Test A4

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	95	96054	63.244	10998.35	11030.98	0.9970
2	95	95973	63.232	10991.08	11016.64	0.9977
3	95	95934	63.187	10994.43	11038.71	0.9960
4	95	95883	63.117	11001.08	11027.05	0.9976
5	95	95788	63.122	10989.15	11030.48	0.9963
6	95	95410	99.195	6965.18	6989.34	0.9965
7	95	95383	99.131	6967.87	6992.29	0.9965
8	95	95406	99.175	6966.45	6990.28	0.9966
9	95	95361	99.249	6957.96	6975.82	0.9974
10	95	95482	99.269	6965.38	6987.03	0.9969
11	95	95834	73.137	9489.06	9515.82	0.9972
12	96	95706	73.049	9487.95	9507.05	0.9980
13	96	95772	73.118	9485.49	9507.67	0.9977
14	96	95695	73.028	9489.51	9514.05	0.9974
15	96	95621	73.089	9474.33	9498.17	0.9975
16	96	95252	125.843	5481.39	5497.26	0.9971
17	96	95196	126.079	5468.04	5482.64	0.9973
18	96	95251	126.420	5456.41	5472.22	0.9971
19	96	95204	126.451	5452.41	5466.25	0.9975
20	96	95322	126.636	5451.17	5465.79	0.9973

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV, THL
Witnessed by a company representative

CERTIFIED BY:



CAM45D-Test A4

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29017
Tag Number: LOOP A
June 9, 2009

Certified By:

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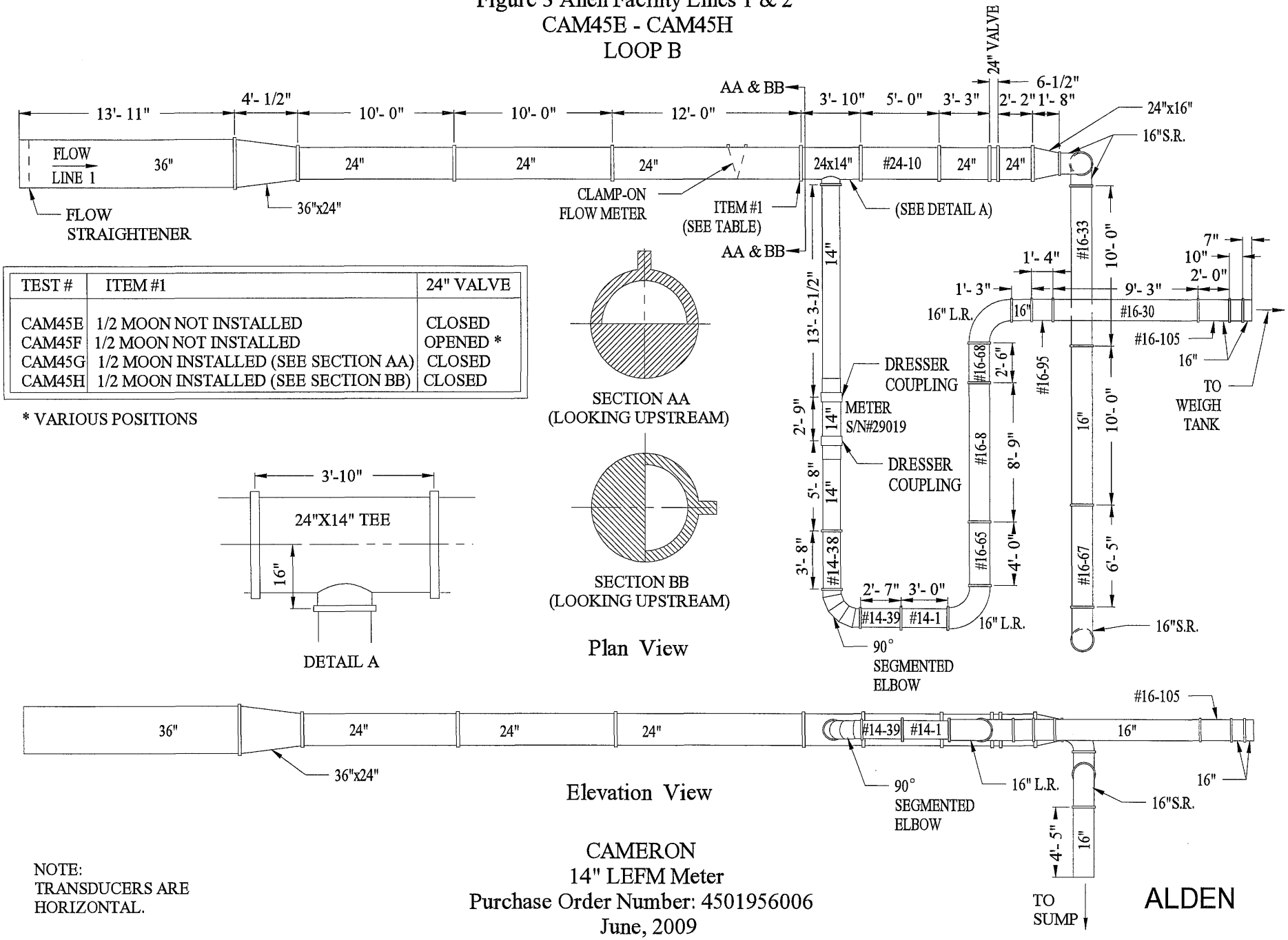
Figure 3 Allen Facility Lines 1 & 2
CAM45E - CAM45H
LOOP B



TEST #	ITEM #1	24" VALVE
CAM45E	1/2 MOON NOT INSTALLED	CLOSED
CAM45F	1/2 MOON NOT INSTALLED	OPENED *
CAM45G	1/2 MOON INSTALLED (SEE SECTION AA)	CLOSED
CAM45H	1/2 MOON INSTALLED (SEE SECTION BB)	CLOSED

* VARIOUS POSITIONS

NOTE:
TRANSDUCERS ARE
HORIZONTAL.

CAMERON
14" LEFM Meter
Purchase Order Number: 4501956006
June, 2009

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29019
Tag Number: LOOP B

CALIBRATION
DATE: June 10, 2009

CAM45E-Test B1

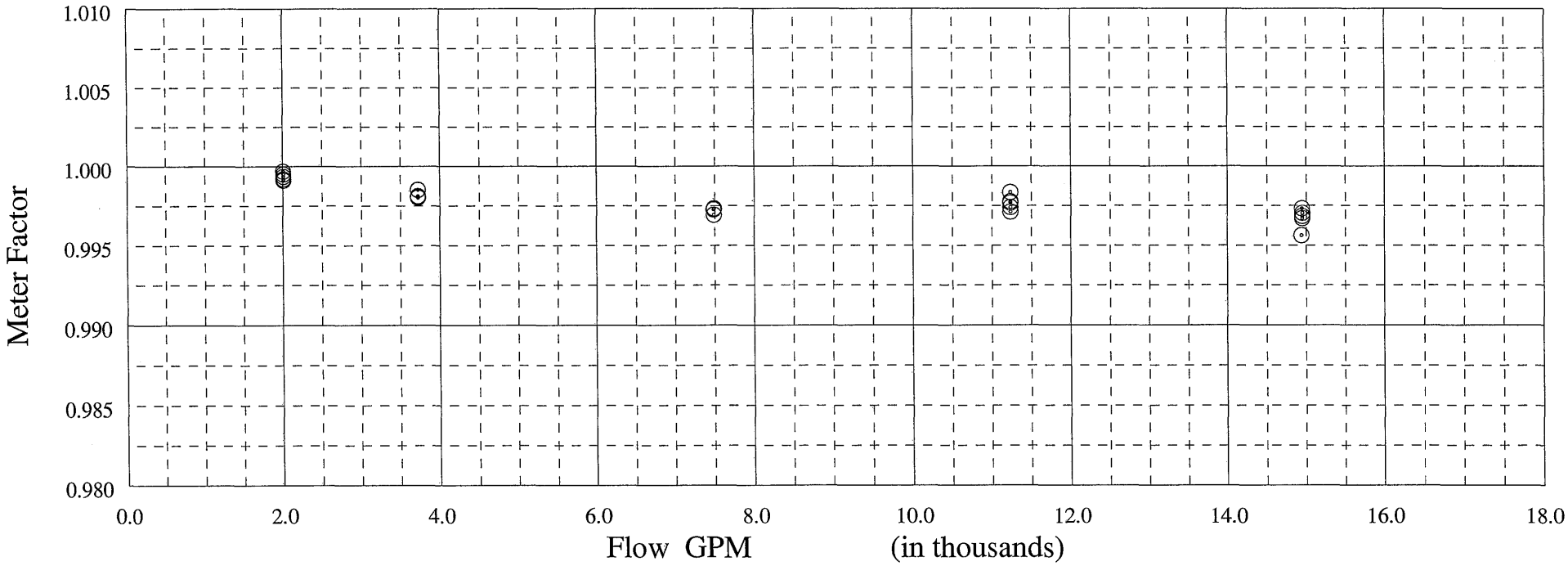
Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	95	96825	46.931	14939.87	15005.63	0.9956
2	95	96542	46.773	14946.94	14991.63	0.9970
3	95	96637	46.828	14944.07	14991.80	0.9968
4	95	96723	46.867	14944.96	14994.72	0.9967
5	95	96779	46.898	14943.89	14984.30	0.9973
6	95	95094	185.073	3720.90	3728.17	0.9980
7	95	95068	185.160	3718.13	3725.51	0.9980
8	96	95167	185.380	3717.66	3723.22	0.9985
9	96	95121	185.292	3717.63	3724.64	0.9981
10	96	95071	185.172	3718.08	3723.60	0.9985
11	96	96242	62.048	11232.90	11262.29	0.9974
12	96	95950	61.856	11233.63	11259.90	0.9977
13	96	96125	61.963	11234.59	11259.90	0.9978
14	96	96016	61.904	11232.85	11251.50	0.9983
15	96	95852	61.793	11233.69	11266.29	0.9971
16	96	94983	343.341	2003.47	2004.46	0.9995
17	96	94952	343.627	2001.15	2001.79	0.9997
18	96	94890	342.944	2003.83	2005.13	0.9993
19	96	95022	343.425	2003.81	2005.42	0.9992
20	96	95017	343.352	2004.13	2005.90	0.9991
21	96	95518	92.415	7485.11	7505.25	0.9973
22	96	95561	92.487	7482.62	7505.70	0.9969
23	96	95531	92.343	7485.55	7505.60	0.9973
24	96	95511	92.401	7479.38	7500.00	0.9973
25	96	95475	92.303	7484.55	7505.01	0.9973

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY: Paul Stary

ARL



CAM45E-Test B1

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29019
Tag Number: LOOP B
June 10, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29019
Tag Number: LOOP B

CALIBRATION
DATE: June 11, 2009

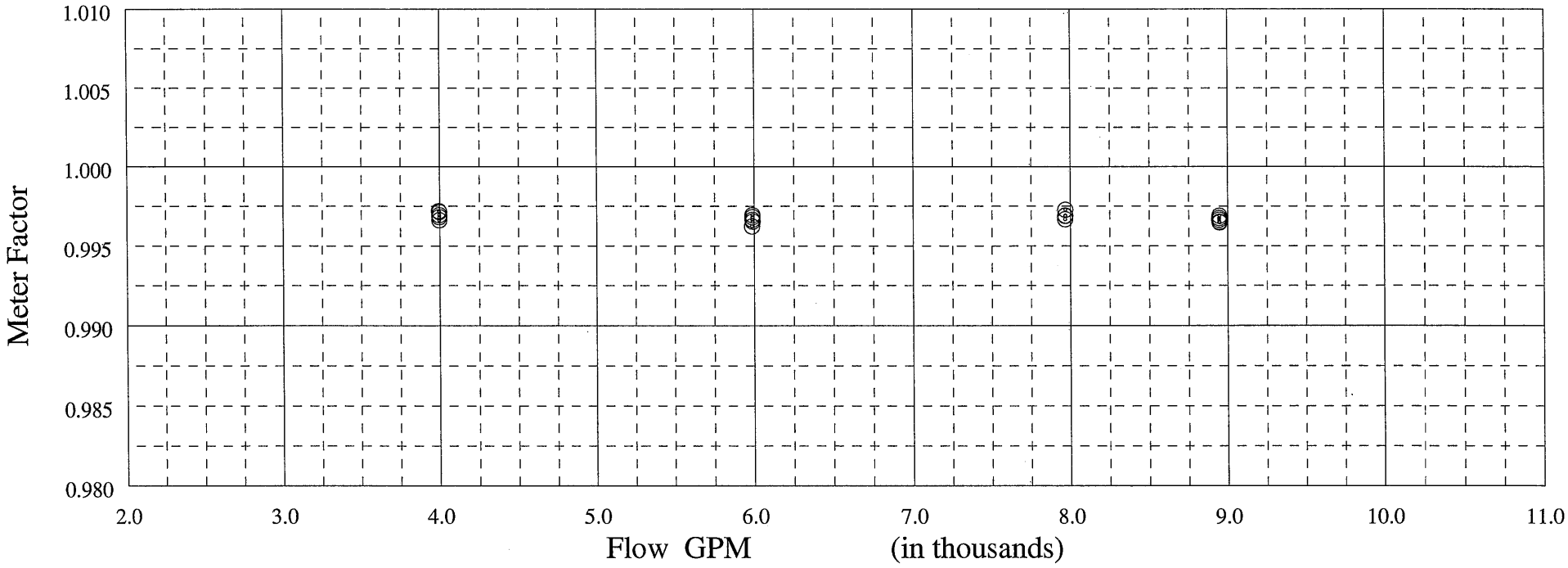
CAM45F-Test B2

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	95	95362	115.387	5984.54	6007.23	0.9962
2	95	95244	115.173	5988.39	6009.23	0.9965
3	95	95293	115.241	5988.15	6008.28	0.9967
4	96	95384	115.366	5987.49	6005.86	0.9969
5	96	95363	115.350	5986.98	6006.11	0.9968
6	96	95594	86.910	7965.85	7990.79	0.9969
7	96	95473	86.793	7966.81	7988.68	0.9973
8	96	95595	86.921	7965.40	7992.01	0.9967
9	96	95613	86.925	7966.70	7991.46	0.9969
10	96	95563	86.894	7965.56	7990.51	0.9969
11	97	95177	172.536	3995.69	4008.48	0.9968
12	97	95149	172.510	3995.20	4006.71	0.9971
13	97	95119	172.451	3995.30	4007.59	0.9969
14	97	95248	172.676	3995.51	4009.10	0.9966
15	97	95155	172.613	3993.06	4004.32	0.9972
16	97	95706	77.476	8948.07	8979.82	0.9965
17	97	95849	77.621	8944.72	8974.95	0.9966
18	97	95367	77.221	8945.77	8973.75	0.9969
19	97	95708	77.501	8945.58	8976.95	0.9965
20	97	95727	77.517	8945.43	8974.66	0.9967

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV, THL
Witnessed by a company representative

CERTIFIED BY:



CAM45F-Test B2

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29019
Tag Number: LOOP B
June 11, 2009

Certified By: Phil Stary

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29019
Tag Number: LOOP B

CALIBRATION
DATE: June 11, 2009

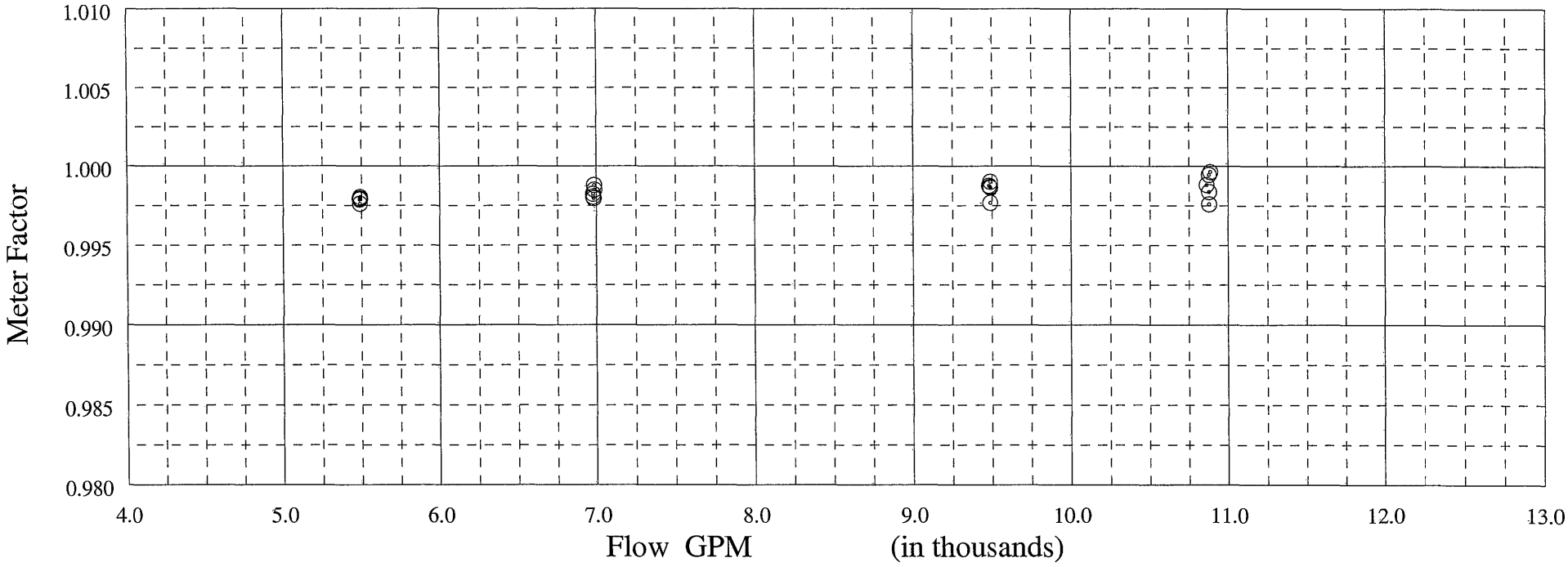
CAM45G-Test B3

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	97	96025	63.897	10886.03	10890.07	0.9996
2	97	95973	63.910	10877.91	10895.71	0.9984
3	97	96107	63.994	10878.81	10905.14	0.9976
4	97	95837	63.908	10862.82	10875.71	0.9988
5	97	96025	63.945	10878.17	10884.21	0.9994
6	97	95262	98.786	6985.57	6996.16	0.9985
7	97	95320	98.904	6981.47	6995.83	0.9979
8	97	95337	98.884	6984.09	6992.64	0.9988
9	97	95280	98.920	6977.36	6991.02	0.9980
10	97	95296	98.943	6976.95	6989.31	0.9982
11	97	95813	73.157	9487.54	9497.00	0.9990
12	97	95659	73.035	9488.11	9510.21	0.9977
13	97	95632	73.082	9479.34	9491.19	0.9988
14	97	95751	73.134	9484.42	9496.87	0.9987
15	97	95721	73.072	9489.44	9502.48	0.9986
16	97	95101	125.492	5489.85	5501.36	0.9979
17	97	95263	125.790	5486.18	5497.49	0.9979
18	97	95327	125.820	5488.69	5499.53	0.9980
19	97	95221	125.745	5485.72	5497.45	0.9979
20	97	95238	125.734	5487.21	5500.37	0.9976

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY:



CAM45G-Test B3

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29019
Tag Number: LOOP B
June 11, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29019
Tag Number: LOOP B

CALIBRATION
DATE: June 11, 2009

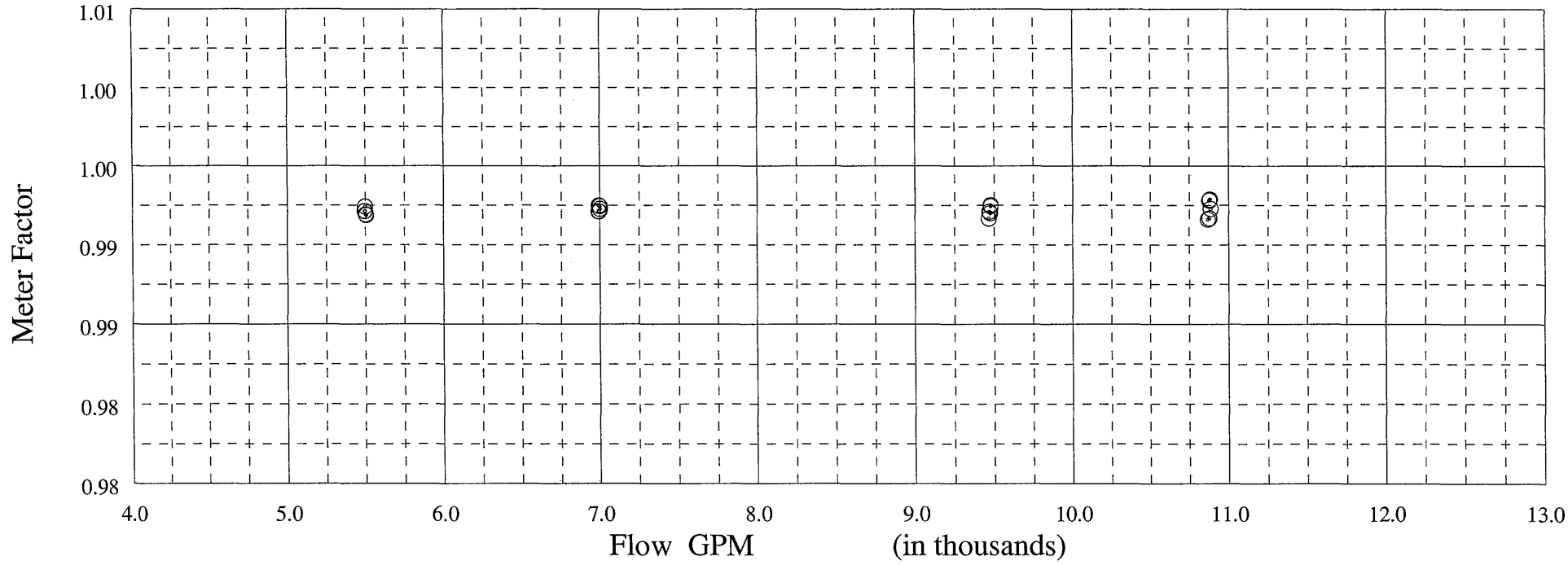
CAM45H-Test B4

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	97	95938	63.893	10877.39	10901.42	0.9978
2	97	95823	63.880	10866.68	10903.71	0.9966
3	97	95904	63.849	10880.98	10904.28	0.9979
4	97	95979	63.928	10876.21	10912.56	0.9967
5	97	95948	63.855	10885.37	10915.15	0.9973
6	97	95485	98.906	6993.82	7014.11	0.9971
7	97	95371	98.842	6989.95	7010.16	0.9971
8	97	95339	98.780	6992.17	7009.87	0.9975
9	97	95402	98.773	6997.27	7015.30	0.9974
10	97	95377	98.736	6998.06	7017.24	0.9973
11	97	95782	73.327	9463.00	9494.73	0.9967
12	98	95754	73.212	9475.32	9499.02	0.9975
13	98	95713	73.185	9474.79	9499.10	0.9974
14	98	95637	73.157	9470.81	9499.42	0.9970
15	98	95667	73.208	9467.20	9494.85	0.9971
16	98	95162	125.282	5502.94	5520.27	0.9969
17	98	95222	125.520	5495.95	5511.81	0.9971
18	98	95127	125.394	5496.09	5510.39	0.9974
19	98	95154	125.336	5500.18	5517.27	0.9969
20	98	95315	125.718	5492.75	5508.65	0.9971

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY: Pat Stump



CAM45H-Test B4

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29019
Tag Number: LOOP B
June 11, 2009

Certified By:

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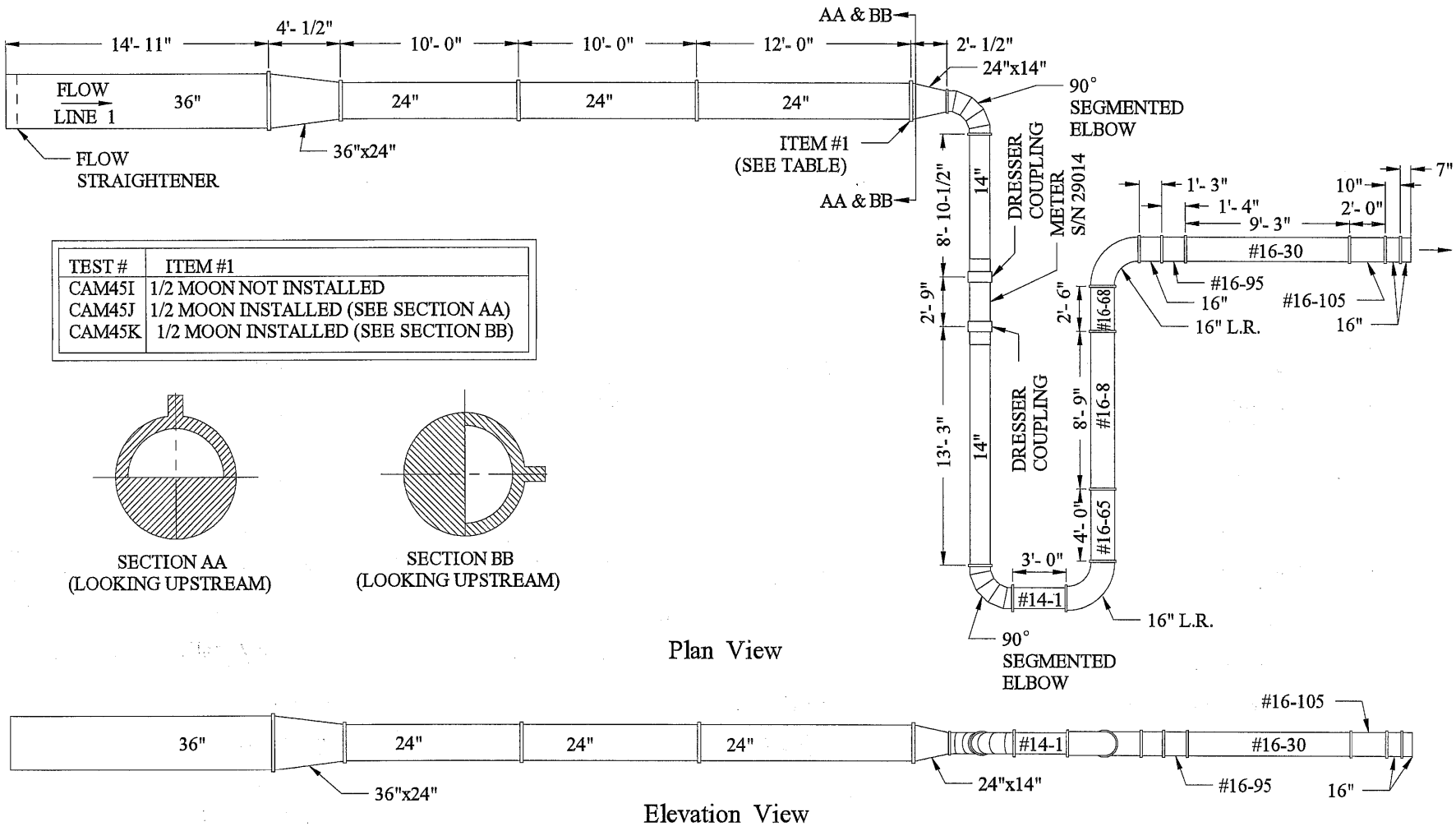
Figure 4 Allen Facility Lines 1 & 2
CAM45I - CAM45K
LOOP C



TEST #	ITEM #1
CAM45I	1/2 MOON NOT INSTALLED
CAM45J	1/2 MOON INSTALLED (SEE SECTION AA)
CAM45K	1/2 MOON INSTALLED (SEE SECTION BB)

SECTION AA (LOOKING UPSTREAM)

SECTION BB (LOOKING UPSTREAM)

NOTE:
TRANSDUCERS ARE HORIZONTAL.

CAMERON
14" LEFM Meter
Purchase Order Number: 4501956006
June, 2009

ALDEN

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29014
Tag Number: LOOP C

CALIBRATION
DATE: June 12, 2009

CAM45I-Test C1

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	96	96714	46.924	14928.57	15013.72	0.9943
2	96	96885	47.009	14927.98	15012.27	0.9944
3	97	96636	46.902	14923.95	15009.82	0.9943
4	97	96736	46.949	14924.52	15006.42	0.9945
5	97	96629	46.912	14919.80	15004.27	0.9944
6	97	95167	184.568	3734.88	3750.54	0.9958
7	97	95120	184.504	3734.32	3747.88	0.9964
8	97	95152	184.631	3733.08	3747.88	0.9961
9	97	95103	184.503	3733.75	3749.54	0.9958
10	97	95127	184.509	3734.57	3749.62	0.9960
11	97	95930	61.967	11213.66	11271.65	0.9949
12	97	96020	62.035	11211.97	11277.72	0.9942
13	97	95956	61.969	11216.54	11278.58	0.9945
14	97	95931	61.981	11211.52	11272.29	0.9946
15	97	96074	62.057	11214.84	11274.87	0.9947
16	97	95052	343.401	2005.16	2010.82	0.9972
17	97	94922	342.525	2007.50	2013.72	0.9969
18	97	94958	342.669	2007.41	2014.24	0.9966
19	97	95009	342.740	2008.08	2014.77	0.9967
20	97	94975	342.667	2007.79	2014.55	0.9966
21	97	95463	92.582	7469.30	7512.62	0.9942
22	97	95372	92.557	7464.22	7504.67	0.9946
23	97	95378	92.489	7470.13	7508.97	0.9948
24	97	95494	92.581	7471.81	7511.14	0.9948
25	97	95322	92.455	7468.63	7509.87	0.9945

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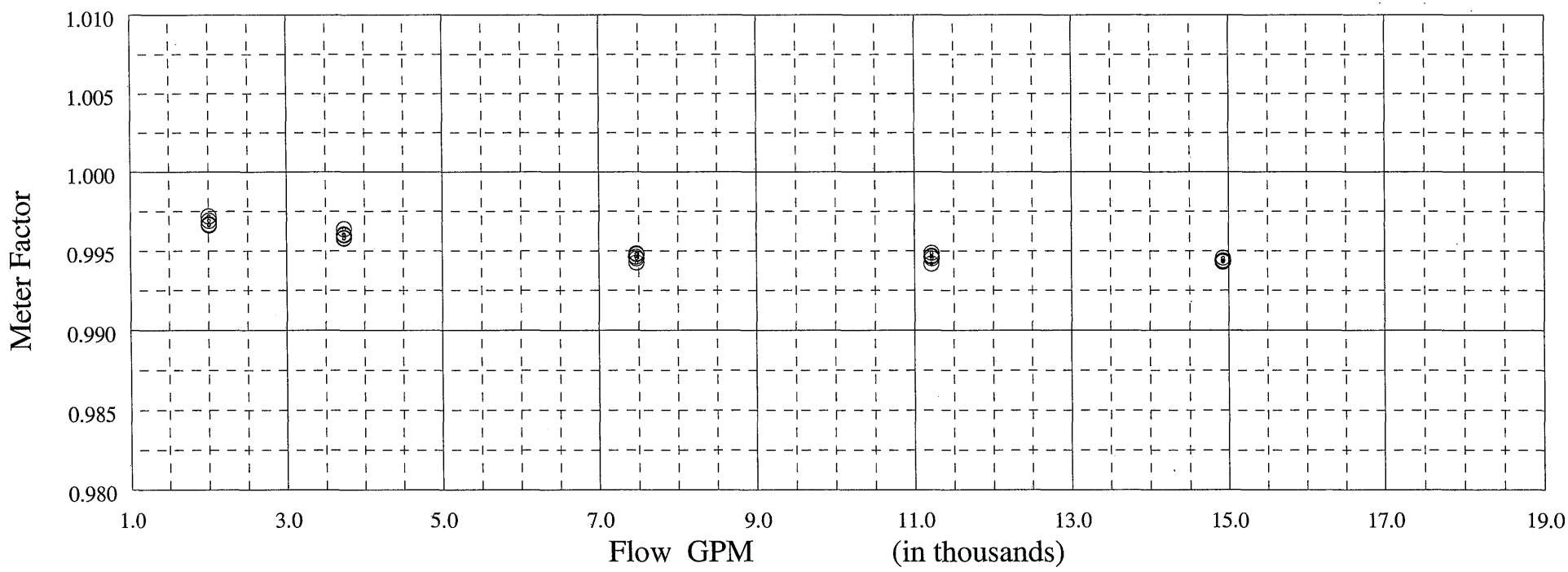
CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY:



CAM45I-Test C1

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29014
Tag Number: LOOP C
June 12, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29014
Tag Number: LOOP C

CALIBRATION
DATE: June 12, 2009

CAM45J-Test C2

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	97	95771	69.180	10028.45	10068.52	0.9960
2	97	95785	69.199	10027.06	10062.42	0.9965
3	97	95768	69.206	10024.30	10063.85	0.9961
4	97	95666	69.115	10026.78	10068.12	0.9959
5	97	95823	69.226	10027.41	10067.39	0.9960
6	97	95176	184.460	3737.78	3751.08	0.9965
7	97	95077	184.286	3737.48	3750.51	0.9965
8	97	95079	184.219	3738.91	3753.48	0.9961
9	97	94973	184.063	3737.91	3751.48	0.9964
10	97	95104	184.351	3737.22	3748.92	0.9969
11	97	95580	92.690	7470.17	7497.48	0.9964
12	97	95469	92.521	7475.28	7503.71	0.9962
13	97	95348	92.426	7473.45	7501.22	0.9963
14	97	95363	92.507	7468.09	7494.75	0.9964
15	97	95498	92.614	7470.06	7499.35	0.9961
16	98	96471	48.231	14490.40	14531.49	0.9972
17	98	96615	48.331	14482.09	14522.40	0.9972
18	98	96697	48.352	14488.25	14535.94	0.9967
19	98	96440	48.228	14487.16	14533.25	0.9968
20	98	96695	48.380	14479.77	14527.13	0.9967

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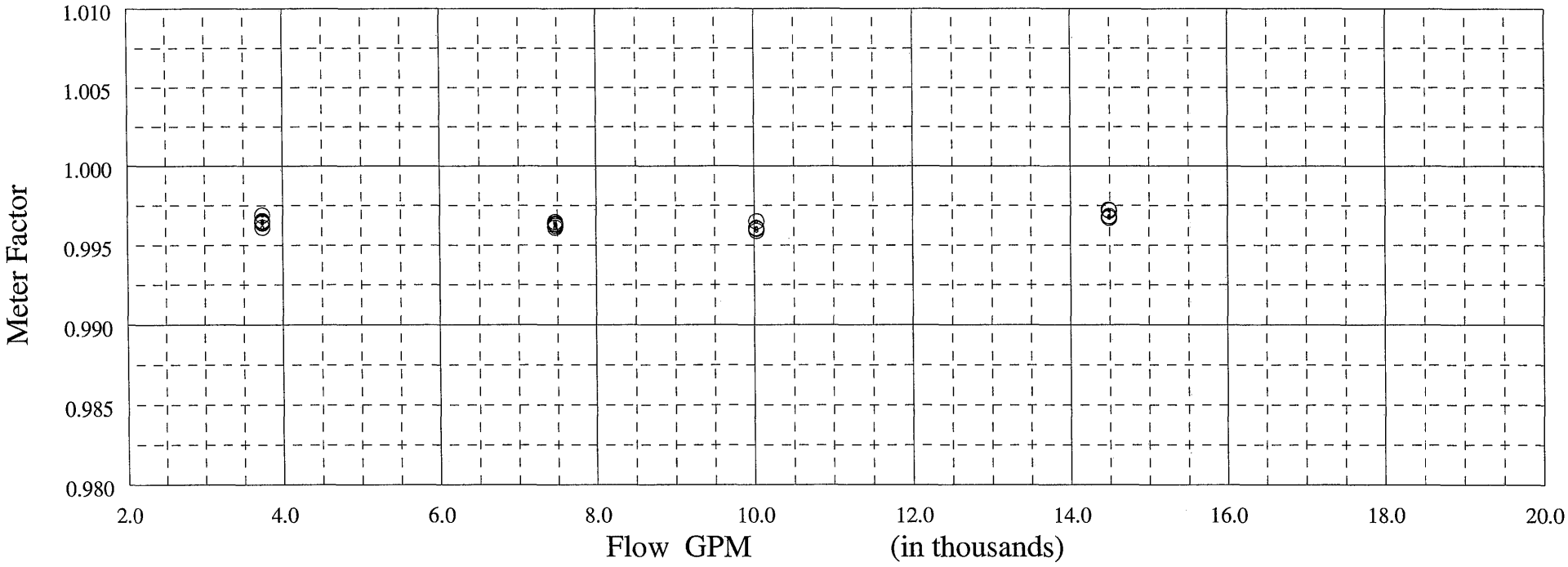
CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY:



CAM45J-Test C2

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29014
Tag Number: LOOP C
June 12, 2009

Certified By:

CAMERON

Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29014
Tag Number: LOOP C

CALIBRATION
DATE: June 12, 2009

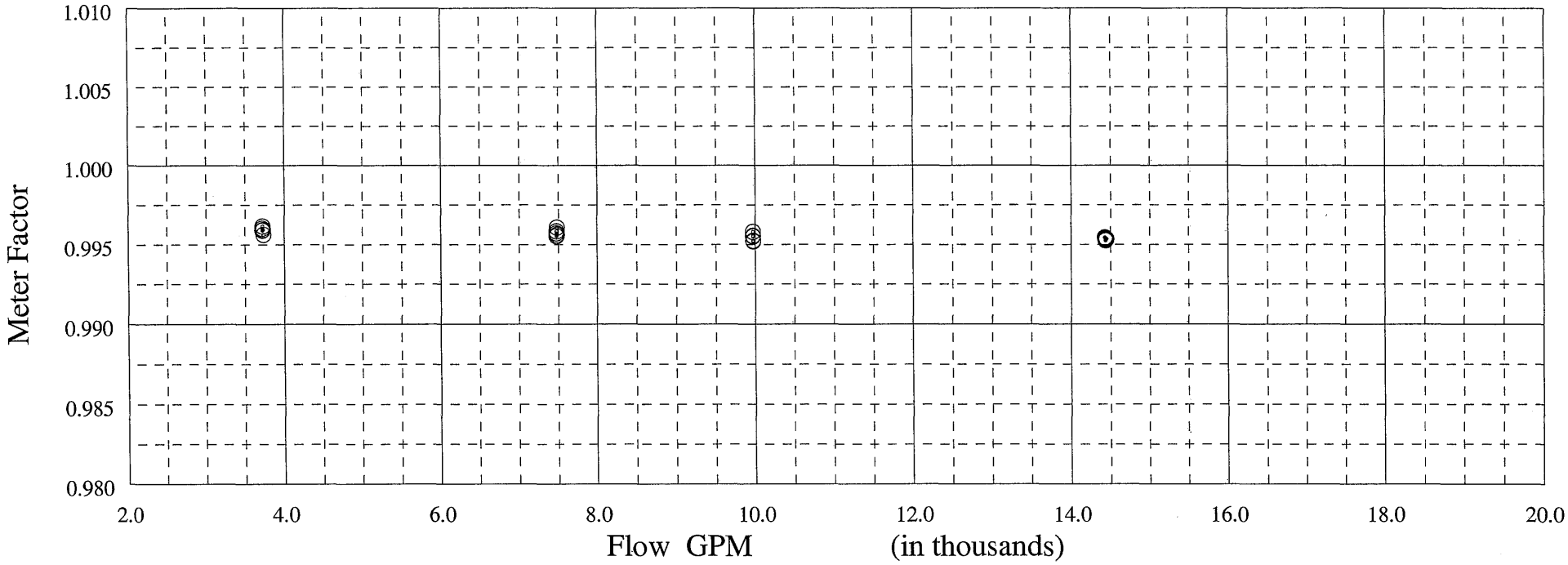
CAM45K-Test C3

Run #	Line Temp Deg F	Net Weight lb.	Run Duration secs.	Flow GPM	LEFM CheckPlus GPM	Meter Factor
1	98	95891	69.660	9972.76	10020.89	0.9952
2	98	95740	69.549	9972.95	10020.63	0.9952
3	98	95813	69.629	9969.08	10013.75	0.9955
4	98	95918	69.699	9970.06	10015.09	0.9955
5	98	95762	69.584	9970.20	10012.25	0.9958
6	98	95205	184.738	3733.58	3749.98	0.9956
7	98	94981	184.648	3726.68	3741.87	0.9959
8	98	94985	184.925	3721.25	3735.61	0.9962
9	98	95037	185.107	3719.63	3734.48	0.9960
10	98	95162	185.373	3719.26	3734.61	0.9959
11	98	95388	92.466	7473.96	7506.14	0.9957
12	98	95487	92.471	7481.31	7514.29	0.9956
13	98	95405	92.460	7475.76	7506.99	0.9958
14	98	95503	92.583	7473.48	7507.04	0.9955
15	98	95387	92.403	7479.01	7508.53	0.9961
16	98	96550	48.451	14437.63	14505.89	0.9953
17	98	96486	48.396	14444.38	14512.05	0.9953
18	98	96594	48.486	14433.75	14502.78	0.9952
19	98	96504	48.444	14433.08	14500.09	0.9954
20	98	96637	48.533	14426.49	14492.61	0.9954

The data reported on herein was obtained by measuring equipment the calibration of which is traceable to NIST , following the installation and test procedures referenced in this report, resulting in a flow measurement uncertainty of +/- 0.25% or less.

CALIBRATED BY: DAV
Witnessed by a company representative

CERTIFIED BY:



CAM45K-Test C3

CAMERON
Purchase Order Number: 4501956006
14" LEFM CheckPlus
Serial Number: 29014
Tag Number: LOOP C
June 12, 2009

Certified By:

WATER DENSITY

Temperature Fahrenheit	Density lb_m / ft^3	Temperature Fahrenheit	Density lb_m / ft^3	Temperature Fahrenheit	Density lb_m / ft^3
32	62.4179	62	62.3549	92	62.0903
33	62.4201	63	62.3489	93	62.0788
34	62.4220	64	62.3427	94	62.0671
35	62.4235	65	62.3363	95	62.0552
36	62.4246	66	62.3296	96	62.0432
37	62.4255	67	62.3228	97	62.0311
38	62.4260	68	62.3157	98	62.0188
39	62.4262	69	62.3084	99	62.0063
40	62.4261	70	62.3010	100	61.9937
41	62.4257	71	62.2933	101	61.9810
42	62.4250	72	62.2855	102	61.9681
43	62.4240	73	62.2774	103	61.9551
44	62.4227	74	62.2692	104	61.9419
45	62.4211	75	62.2608	105	61.9286
46	62.4193	76	62.2522	106	61.9151
47	62.4171	77	62.2434	107	61.9015
48	62.4147	78	62.2344	108	61.8878
49	62.4121	79	62.2252	109	61.8739
50	62.4092	80	62.2159	110	61.8599
51	62.4060	81	62.2063	111	61.8458
52	62.4025	82	62.1966	112	61.8315
53	62.3988	83	62.1868	113	61.8172
54	62.3949	84	62.1767	114	61.8027
55	62.3907	85	62.1665	115	61.7880
56	62.3863	86	62.1561	116	61.7733
57	62.3816	87	62.1456	117	61.7584
58	62.3768	88	62.1348	118	61.7434
59	62.3716	89	62.1239	119	61.7284
60	62.3663	90	62.1129	120	61.7132
61	62.3607	91	62.1017	121	61.6978

Uncertainty Analysis

Allen 100,000 Lb Scale

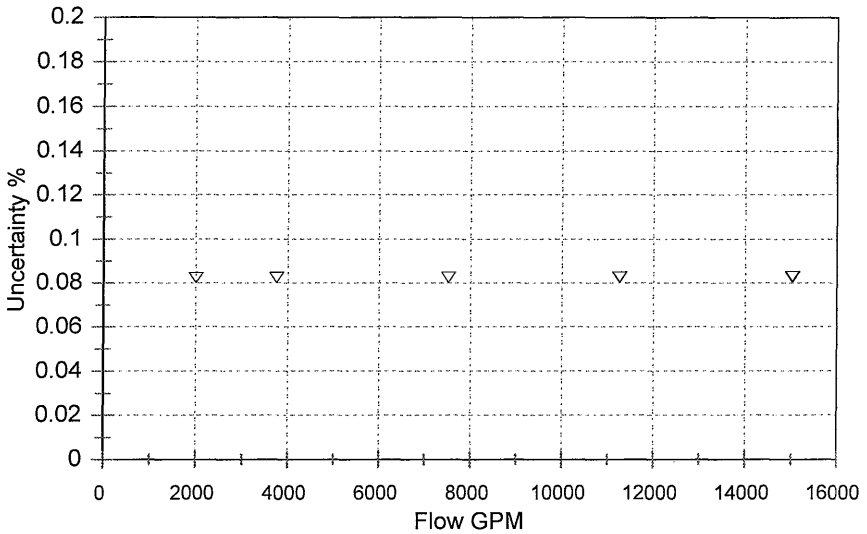
Cameron Purchase Order No: 4501956006

14" LEFM: s/n 29017

		Standard Uncertainty Percent
Mass		
96985	Calibration	0.03635
	Buoyancy	0.00520
	Reproducibility	0.01600
	Loss	0.00208
	Resolution	0.00060
	Repeatability	0.00119
Time		
46.9	Standard	0.00030
seconds	Deadband	0.00103
	Resolution	0.00123
	Repeatability	0.00246
Density		
Temperature	Standard	0.00268
93	Impurities	0.01000
	Reproducibility	0.01073
	Resolution	0.00107
Diverter	Inclusive	0.01000
	Flow	
	Standard Uncertainty Percent	0.044
	Expanded Uncertainty Percent	0.088

Cameron Purchase Order No: 4501956006

14" LEFM: s/n 29017



BLDG 1 TRACEABILITY

ARL NUMBER	DESCRIPTION	Notes	LAST CAL DATE	NEXT CAL DUE	MODEL	SERIAL NUMBER	Location
00105							
	HEWLETT-PACKARD COUNTER/TIMER	FREQUENCY CHECKED DAILY - BACKUP TIMER ALLEN FACILITY			5301A	1120A00605	BLDG 1
00129							
	TIME TRANSFER STANDARD	CALIBRATED WEEKLY VERSUS NIST STATION WWV PRIMARY STANDARD	6/8/2009	6/15/2009	ALDEN0001		BLDG 1&2
00167							
	0 - 1.000" MICROMETER	CALIBRATED BEFORE EACH USE LOCATED IN JBN OFFICE			436-1	949931	BLDG 1&2
00439							
	STAINLESS STEEL MASS (20LBm) TRANSFER STANDARD	NIST TEST NO. 822/263871-00 ge infrastructure #0508180439 PRIMARY STANDARD	8/23/2005	8/21/2015	NA	NA	BLDG 1&2
00444							
	STAINLESS STEEL MASS(20LBm & 10LBm) TRANSFER STANDARD	NIST TEST NO. 822/263871-00 GE Infrastructure #0508180444 PRIMARY STANDARD	8/23/2005	8/21/2015	S-1 WEIGHT SET	1969	BLDG 1&2
00471							
	AMBIENT THERMOMETER W/ AMBIENT PROBE 0471-A	AMBIENT TEMPERATURE ALLEN FACILITY	1/6/2009	7/7/2009	DP-26RTD	34401	BLDG 1

ARL NUMBER	DESCRIPTION	Notes	LAST CAL DATE	NEXT CAL DUE	MODEL	SERIAL NUMBER	Location
00583	LINE TEMPERATURE THERMOMETER W/PROBE 0583A	LINE 1 & 2 TEMPERATURE - ALLEN FACILITY	1/6/2009	7/7/2009	DP41-RTD	5410983	BLDG 1
00600	UNIVERSAL COUNTER - PRIMARY	FREQUENCY CHECKED DAILY ALLEN FACILITY			53131A	MY47000389	BLDG 1
00756	100,000# WEIGH TANK SCALE W/LOAD CELL #1044	100,000# CAPACITY TOLEDO SCALE - ALLEN FACILITY	2/9/2009	8/10/2009	2382	800635	BLDG 1
01035	ULTRASONIC THICKNESS GAUGE	CALIBRATE BEFORE EACH USE			26DL	9041602	BLDG 1&2
01040	0 - 6" DIAL CALIPER	CALIBRATED BEFORE EACH USE			N/A		BLDG 1&2
01046	A/D BOARD - USED W/RESISTOR BOX 00295	16 BIT BOARD - CALIBRATED FOR MILLIAMP - CAL BEFORE USE OR EVERY 6 MONTHS	5/26/2009		DT2805/571	0118473	BLDG 1
10002	CAL3DA ver 3.13 ARL SOFTWARE	COMPUTATIONAL ACCURACY VERIFIED USING HAND CALCS.	5/23/1995		VERIFIED BY	HAND CALCS.	BLDG 1&2