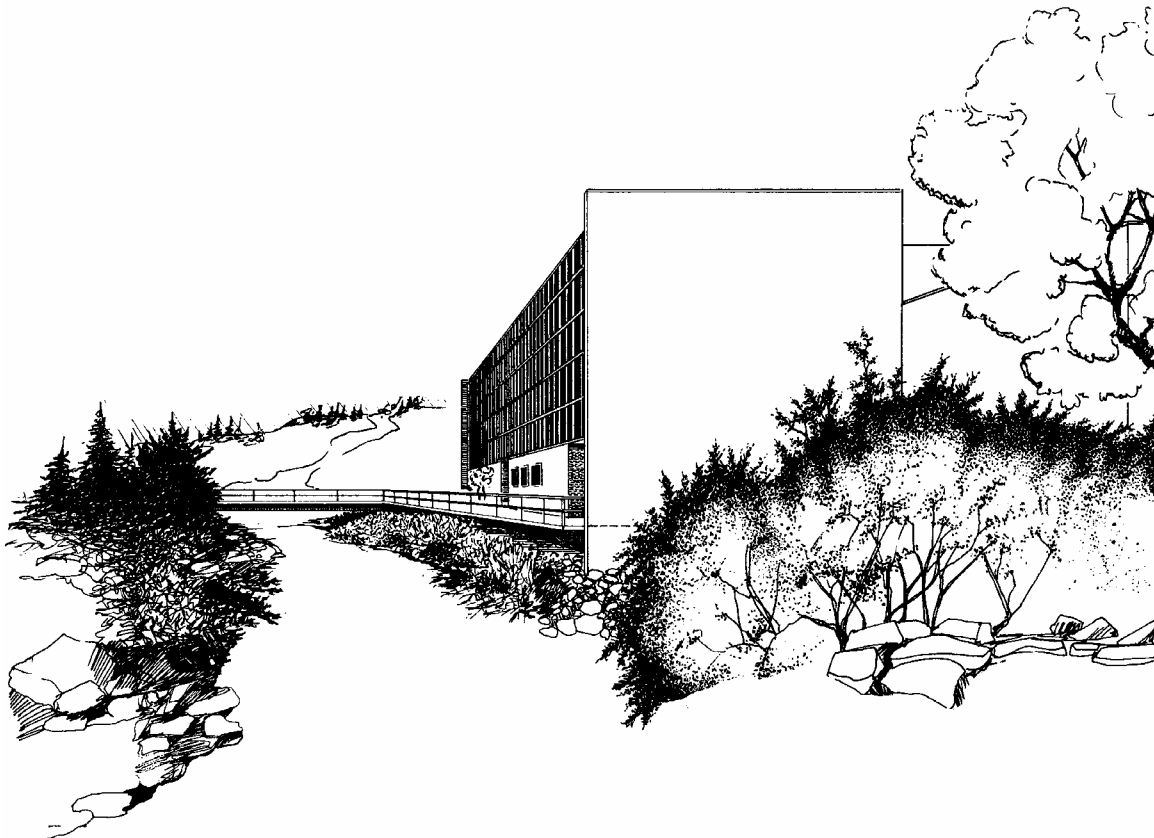


5/8-Inch Dialog 3G-DS Flow Meter Endurance Testing

Prepared for

Master Meter

July 2006



UTAH WATER RESEARCH LABORATORY

**Utah State University
Logan, Utah**

Report No. 1690

5/8-inch Dialog 3G-DS Flow Meter Endurance Testing

Submitted to:

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INTRODUCTION

Utah State University was contracted by Master Meter to perform flow calibrations at the Utah Water Research Laboratory (UWRL) in Logan, Utah on 5/8-inch Dialog 3G-DS positive displacement flow meters. The testing required that the new meters in each size be base line tested in cold water (water less than 80 degrees Fahrenheit) and then operated at a set flow rate of 10 gallons per minute until incremental volumes of 500,000 gallons, 1,500,000 gallons, 2,500,000 gallons, and 4,000,000 gallons had passed through each meter. Upon reaching the volumes indicated, the meters were then accuracy tested to identify any shifts in performance associated with throughput.

TEST SETUP

Each 5/8-inch meter was installed in series with approximately 7 inches of straight pipe between each meter. Potable water from the City of Logan was used for the testing with it being continually refreshed to maintain temperatures less than 80 degrees. Upstream from the meters were filters (500 micron) to prevent any debris from getting into the meters. The water was pumped using a 2 horsepower pump connected to a small reservoir and the flow rate was regulated using throttling valves downstream from the meters. Figure 1 shows the endurance test loop.



Figure 1. Endurance loop setup.

ACCURACY TESTING

Upon receipt of the flow meters from Master Meter, the meters were baseline tested. Table 1 shows the conditions under which each of the meter sizes were tested. The typical draft size for each meter at each flow rate is shown in Table 2.

Table 1. Flow conditions tested.

Meter Size	Min Flow (gpm)	Low Flow (gpm)	Intermediate flow (gpm)	High Flow (gpm)
5/8-inch	0.25	2	12	20

Table 2. Draft sizes collected at indicated flow rate.

Meter Size	Min Flow (gallons)	Low Flow (gallons)	Intermediate flow (gallons)	High Flow (gallons)
5/8-inch	20	20	80	120

Rather than make adjustments to each meter at the baseline to represent the best possible accuracy over the range, it was determined by personnel from Master Meter and the Utah Water Research laboratory to simply let the as new condition represent the baseline. This was done because the endurance test is to identify changes in accuracy resulting from extended use. Therefore, changes in accuracy will be reported relative to the conditions established prior to endurance testing the meters.

The meters were tested using a gravimetric bench that was certified using NIST traceable weights. The weight of each draft and the temperature were measured for each run.

RESULTS

Tables 3 through 5 show the results of the testing. Note that the lower portion of the tables (titled “Average Shift in Registry from Initial”) shows the shift from the initial testing in percent.

Tables 6 through 10 show the raw data for each benchmark. The data collected for this study show that the meters perform well within the accuracy specified by AWWA Manual M6 “Water Meters – Selection, Installation, Testing and Maintenance.”

Table 3. Results from testing for meter 4853524.

Meter Serial Number 4853524					
Test Cond.	INITIAL	500,000	1,500,000	2,500,000	4,000,000
Flow (gpm)	Percent Registered	Percent Registered	Percent Registered	Percent Registered	Percent Registered
20	100.28%	99.85%	99.78%	99.81%	99.63%
20	100.09%	99.97%	99.97%	99.81%	99.60%
12	100.41%	99.95%	100.04%	99.94%	99.71%
12	100.35%	100.02%	99.90%	99.79%	99.66%
2	101.26%	100.63%	100.89%	100.39%	100.31%
2	101.20%	100.57%	100.67%	99.98%	100.26%
0.25	100.91%	96.05%	96.99%	97.18%	97.07%
0.25	97.30%	96.92%	97.16%	96.52%	96.27%
0.25	97.42%	96.48%	97.48%	94.11%	-

Averages and Standard Deviations					
Test Cond.	INITIAL	500,000	1,500,000	2,500,000	4,000,000
Avg 20	100.18%	99.91%	99.87%	99.81%	99.61%
Std 20	0.130%	0.079%	0.136%	0.004%	0.026%
Avg 12	100.38%	99.98%	99.97%	99.87%	99.69%
Std 12	0.036%	0.049%	0.098%	0.102%	0.039%
Avg 2	101.23%	100.60%	100.78%	100.19%	100.29%
Std 2	0.043%	0.045%	0.155%	0.290%	0.030%
Avg 0.25	98.54%	96.49%	97.21%	95.94%	96.67%
Std 0.25	2.051%	0.434%	0.253%	1.612%	0.567%

Average Shift in Registry from Initial					
Test Cond.	INITIAL	500,000	1,500,000	2,500,000	4,000,000
20	-	-0.27%	-0.31%	-0.38%	-0.57%
12	-	-0.40%	-0.41%	-0.51%	-0.69%
2	-	-0.63%	-0.45%	-1.04%	-0.94%
0.25	-	-2.06%	-1.33%	-2.61%	-1.87%

Table 4. Results from testing for meter 4853525.

Meter Serial Number 4853525					
Test Cond.	INITIAL	500,000	1,500,000	2,500,000	4,000,000
Flow (gpm)	Percent Registered	Percent Registered	Percent Registered	Percent Registered	Percent Registered
20	99.91%	99.65%	99.54%	99.61%	99.43%
20	99.89%	99.73%	99.65%	99.57%	99.45%
12	100.10%	99.83%	99.92%	99.73%	99.54%
12	100.11%	99.84%	99.54%	99.58%	99.52%
2	101.01%	100.38%	100.89%	100.18%	100.76%
2	101.20%	100.57%	100.67%	100.24%	100.52%
0.25	95.95%	97.89%	97.23%	97.80%	94.01%
0.25	97.88%	98.54%	97.16%	97.07%	94.76%
0.25	98.39%	97.87%	97.48%	97.65%	-

Averages and Standard Deviations					
Test Cond.	INITIAL	500,000	1,500,000	2,500,000	4,000,000
Avg 20	99.90%	99.69%	99.59%	99.59%	99.44%
Std 20	0.013%	0.055%	0.082%	0.022%	0.010%
Avg 12	100.10%	99.83%	99.73%	99.66%	99.53%
Std 12	0.007%	0.008%	0.264%	0.102%	0.013%
Avg 2	101.11%	100.47%	100.78%	100.21%	100.64%
Std 2	0.132%	0.129%	0.155%	0.045%	0.174%
Avg 0.25	97.41%	98.10%	97.29%	97.51%	94.39%
Std 0.25	1.287%	0.378%	0.172%	0.382%	0.533%

Average Shift in Registry from Initial					
Test Cond.	INITIAL	500,000	1,500,000	2,500,000	4,000,000
20	-	-0.21%	-0.31%	-0.31%	-0.46%
12	-	-0.27%	-0.37%	-0.45%	-0.57%
2	-	-0.63%	-0.33%	-0.90%	-0.46%
0.25	-	0.69%	-0.11%	0.10%	-3.02%

Table 5. Results from testing for meter 4853527.

Meter Serial Number 4853527					
Test Cond.	INITIAL	500,000	1,500,000	2,500,000	4,000,000
Flow (gpm)	Percent Registered	Percent Registered	Percent Registered	Percent Registered	Percent Registered
20	100.11%	99.81%	99.66%	99.65%	99.47%
20	100.05%	99.85%	99.77%	99.65%	99.43%
12	100.41%	99.95%	99.92%	99.82%	99.61%
12	100.35%	100.02%	99.72%	99.62%	99.50%
2	101.26%	100.63%	100.61%	100.39%	100.51%
2	101.20%	100.57%	100.93%	100.29%	100.32%
0.25	98.11%	98.35%	98.45%	98.27%	98.65%
0.25	99.43%	98.77%	98.38%	97.54%	98.71%
0.25	99.60%	98.34%	98.70%	97.65%	-

Averages and Standard Deviations					
Test Cond.	INITIAL	500,000	1,500,000	2,500,000	4,000,000
Avg 20	100.08%	99.83%	99.71%	99.65%	99.45%
Std 20	0.043%	0.024%	0.081%	0.006%	0.025%
Avg 12	100.38%	99.98%	99.82%	99.72%	99.56%
Std 12	0.036%	0.049%	0.139%	0.143%	0.082%
Avg 2	101.23%	100.60%	100.77%	100.34%	100.41%
Std 2	0.043%	0.045%	0.230%	0.074%	0.138%
Avg 0.25	99.05%	98.49%	98.51%	97.82%	98.68%
Std 0.25	0.818%	0.244%	0.168%	0.395%	0.040%

Average Shift in Registry from Initial					
Test Cond.	INITIAL	500,000	1,500,000	2,500,000	4,000,000
20	-	-0.25%	-0.37%	-0.43%	-0.63%
12	-	-0.40%	-0.56%	-0.66%	-0.82%
2	-	-0.63%	-0.46%	-0.89%	-0.82%
0.25	-	-0.56%	-0.54%	-1.23%	-0.36%

Table 6. Test results for new meters.

20 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	196.25	320.00	123.75	0.00	1028.00	1028.00	57.35	8.3300	123.41	100.28%	
4853525	235.15	358.45	123.30	0.00	1028.00	1028.00	57.35	8.3300	123.41	99.91%	
4853527	242.00	365.55	123.55	0.00	1028.00	1028.00	57.35	8.3300	123.41	100.11%	

20 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	320.00	445.80	125.80	0.00	1047.00	1047.00	56.62	8.3304	125.68	100.09%	
4853525	358.45	484.00	125.55	0.00	1047.00	1047.00	56.62	8.3304	125.68	99.89%	
4853527	365.55	491.30	125.75	0.00	1047.00	1047.00	56.62	8.3304	125.68	100.05%	

12 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	445.85	526.85	81.00	0.00	672.00	672.00	57.33	8.3300	80.67	100.41%	
4853525	484.05	564.80	80.75	0.00	672.00	672.00	57.33	8.3300	80.67	100.10%	
4853527	491.35	572.35	81.00	0.00	672.00	672.00	57.33	8.3300	80.67	100.41%	

12 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	526.85	607.45	80.60	0.00	669.00	669.00	57.80	8.3297	80.32	100.35%	
4853525	564.80	645.20	80.40	0.00	669.00	669.00	57.80	8.3297	80.32	100.11%	
4853527	572.35	652.95	80.60	0.00	669.00	669.00	57.80	8.3297	80.32	100.35%	

2 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	607.45	627.85	20.40	0.00	167.80	167.80	58.55	8.3292	20.15	101.26%	
4853525	645.20	665.55	20.35	0.00	167.80	167.80	58.55	8.3292	20.15	101.01%	
4853527	652.95	673.35	20.40	0.00	167.80	167.80	58.55	8.3292	20.15	101.26%	

2 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	627.85	648.50	20.65	0.00	169.95	169.95	59.22	8.3288	20.41	101.20%	
4853525	665.55	686.20	20.65	0.00	169.95	169.95	59.22	8.3288	20.41	101.20%	
4853527	673.35	694.00	20.65	0.00	169.95	169.95	59.22	8.3288	20.41	101.20%	

0.25 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	649.65	669.40	19.75	0.00	173.60	163.00	59.90	8.3283	19.57	100.91%	
4853525	687.25	707.25	20.00	0.00	173.60	173.60	59.90	8.3283	20.84	95.95%	
4853527	695.10	715.55	20.45	0.00	173.60	173.60	59.90	8.3283	20.84	98.11%	

0.25 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	669.40	694.55	25.15	0.00	215.30	215.30	57.97	8.3296	25.85	97.30%	
4853525	707.25	732.55	25.30	0.00	215.30	215.30	57.97	8.3296	25.85	97.88%	
4853527	715.55	741.25	25.70	0.00	215.30	215.30	57.97	8.3296	25.85	99.43%	

0.25 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	694.55	714.60	20.05	0.00	171.45	171.45	57.09	8.3302	20.58	97.42%	
4853525	732.55	752.80	20.25	0.00	171.45	171.45	57.09	8.3302	20.58	98.39%	
4853527	741.25	761.75	20.50	0.00	171.45	171.45	57.09	8.3302	20.58	99.60%	

Table 7. Test results at 500,000 gallon benchmark.

20 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	499072.65	499195.00	122.35	0.00	1020.00	1020.00	64.69	8.3245	122.53	99.85%	
4853525	498241.10	498363.20	122.10	0.00	1020.00	1020.00	64.69	8.3245	122.53	99.65%	
4853527	499072.70	499195.00	122.30	0.00	1020.00	1020.00	64.69	8.3245	122.53	99.81%	

20 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	499195.00	499320.75	125.75	0.00	1047.00	1047.00	66.21	8.3232	125.79	99.97%	
4853525	498363.20	498488.65	125.45	0.00	1047.00	1047.00	66.21	8.3232	125.79	99.73%	
4853527	499195.00	499320.60	125.60	0.00	1047.00	1047.00	66.21	8.3232	125.79	99.85%	

12 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	499320.75	499404.80	84.05	0.00	700.00	700.00	65.39	8.3239	84.09	99.95%	
4853525	498488.65	498572.60	83.95	0.00	700.00	700.00	65.39	8.3239	84.09	99.83%	
4853527	499320.60	499404.65	84.05	0.00	700.00	700.00	65.39	8.3239	84.09	99.95%	

12 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	499404.80	499489.05	84.25	0.00	701.00	701.00	67.72	8.3219	84.24	100.02%	
4853525	498572.60	498656.70	84.10	0.00	701.00	701.00	67.72	8.3219	84.24	99.84%	
4853527	499404.65	499488.90	84.25	0.00	701.00	701.00	67.72	8.3219	84.24	100.02%	

2 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	499489.05	499509.50	20.45	0.00	169.10	169.10	68.60	8.3210	20.32	100.63%	
4853525	498656.70	498677.10	20.40	0.00	169.10	169.10	68.60	8.3210	20.32	100.38%	
4853527	499488.90	499509.35	20.45	0.00	169.10	169.10	68.60	8.3210	20.32	100.63%	

2 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	499509.50	499530.00	20.50	0.00	169.60	169.60	69.69	8.3200	20.38	100.57%	
4853525	498677.10	498697.60	20.50	0.00	169.60	169.60	69.69	8.3200	20.38	100.57%	
4853527	499509.35	499529.85	20.50	0.00	169.60	169.60	69.69	8.3200	20.38	100.57%	

0.25 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	499530.00	499550.90	20.90	0.00	181.05	181.05	68.88	8.3207	21.76	96.05%	
4853525	498697.60	498718.90	21.30	0.00	181.05	181.05	68.88	8.3207	21.76	97.89%	
4853527	499529.85	499551.25	21.40	0.00	181.05	181.05	68.88	8.3207	21.76	98.35%	

0.25 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	499550.90	499571.90	21.00	0.00	180.35	180.35	65.64	8.3237	21.67	96.92%	
4853525	498718.90	498740.25	21.35	0.00	180.35	180.35	65.64	8.3237	21.67	98.54%	
4853527	499551.25	499572.65	21.40	0.00	180.35	180.35	65.64	8.3237	21.67	98.77%	

0.25 gpm Tests											
Meter S/N (#)	Initial Reading (gallons)	Final Reading (gallons)	Ind. Net Volume (gallons)	Initial Weight (lbs)	Final Weight (lbs)	Net Weight (lbs)	Water Temp. (deg F)	H2O Unit Weight (lb/gal)	Act. Net Volume (gallons)	Percent Registry (%)	
4853524	499571.90	499592.70	20.80	0.00	179.45	179.45	65.41	8.3239	21.56	96.48%	
4853525	498740.25	498761.35	21.10	0.00	179.45	179.45	65.41	8.3239	21.56	97.87%	
4853527	499572.65	499593.85	21.20	0.00	179.45	179.45	65.41	8.3239	21.56	98.34%	

Table 8. Test results at 1,500,000 gallon benchmark.

20 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	1518481.35	1518604.60	123.25	0.00	1028.00	1028.00	67.27	8.3222	123.52	99.78%	
4853525	1516224.60	1516347.55	122.95	0.00	1028.00	1028.00	67.27	8.3222	123.52	99.54%	
4853527	1518069.25	1518192.35	123.10	0.00	1028.00	1028.00	67.27	8.3222	123.52	99.66%	

20 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	1518604.60	1518729.55	124.95	0.00	1040.00	1040.00	68.71	8.3209	124.99	99.97%	
4853525	1516347.55	1516472.10	124.55	0.00	1040.00	1040.00	68.71	8.3209	124.99	99.65%	
4853527	1518192.35	1518317.05	124.70	0.00	1040.00	1040.00	68.71	8.3209	124.99	99.77%	

12 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	1518729.55	1518814.30	84.75	0.00	705.00	705.00	68.08	8.3215	84.72	100.04%	
4853525	1516472.10	1516556.75	84.65	0.00	705.00	705.00	68.08	8.3215	84.72	99.92%	
4853527	1518317.05	1518401.70	84.65	0.00	705.00	705.00	68.08	8.3215	84.72	99.92%	

12 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	1518814.30	1518899.30	85.00	0.00	708.00	708.00	68.80	8.3208	85.09	99.90%	
4853525	1516556.75	1516641.45	84.70	0.00	708.00	708.00	68.80	8.3208	85.09	99.54%	
4853527	1518401.70	1518486.55	84.85	0.00	708.00	708.00	68.80	8.3208	85.09	99.72%	

2 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	1518900.40	1518918.55	18.15	0.00	149.60	149.60	73.98	8.3155	17.99	100.89%	
4853525	1516642.60	1516660.75	18.15	0.00	149.60	149.60	73.98	8.3155	17.99	100.89%	
4853527	1518487.70	1518505.80	18.10	0.00	149.60	149.60	73.98	8.3155	17.99	100.61%	

2 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	1518918.55	1518937.40	18.85	0.00	155.70	155.70	74.38	8.3151	18.72	100.67%	
4853525	1516660.75	1516679.60	18.85	0.00	155.70	155.70	74.38	8.3151	18.72	100.67%	
4853527	1518505.80	1518524.70	18.90	0.00	155.70	155.70	74.38	8.3151	18.72	100.93%	

0.25 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	1518947.75	1518967.70	19.95	0.00	171.05	171.05	73.88	8.3156	20.57	96.99%	
4853525	1516689.90	1516709.90	20.00	0.00	171.05	171.05	73.88	8.3156	20.57	97.23%	
4853527	1518535.05	1518555.30	20.25	0.00	171.05	171.05	73.88	8.3156	20.57	98.45%	

0.25 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	1518967.70	1518987.50	19.80	0.00	169.45	169.45	74.67	8.3148	20.38	97.16%	
4853525	1516709.90	1516729.70	19.80	0.00	169.45	169.45	74.67	8.3148	20.38	97.16%	
4853527	1518555.30	1518575.35	20.05	0.00	169.45	169.45	74.67	8.3148	20.38	98.38%	

0.25 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4684550	1518987.50	1519007.55	20.05	0.00	171.00	171.00	75.22	8.3142	20.57	97.48%	
4684551	1516729.70	1516749.75	20.05	0.00	171.00	171.00	75.22	8.3142	20.57	97.48%	
4684554	1518575.35	1518595.65	20.30	0.00	171.00	171.00	75.22	8.3142	20.57	98.70%	

Table 9. Test results at 2,500,000 gallon benchmark.

20 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	2516707.20	2516831.80	124.60	0.00	1039.00	1039.00	67.05	8.3224	124.84	99.81%	
4853525	2512821.80	2512946.15	124.35	0.00	1039.00	1039.00	67.05	8.3224	124.84	99.61%	
4853527	2514936.55	2515060.95	124.40	0.00	1039.00	1039.00	67.05	8.3224	124.84	99.65%	

20 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	2516831.80	2516958.10	126.30	0.00	1053.00	1053.00	68.06	8.3215	126.54	99.81%	
4853525	2512946.15	2513072.15	126.00	0.00	1053.00	1053.00	68.06	8.3215	126.54	99.57%	
4853527	2515060.95	2515187.05	126.10	0.00	1053.00	1053.00	68.06	8.3215	126.54	99.65%	

12 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	2516958.10	2517043.75	85.65	0.00	713.00	713.00	70.26	8.3194	85.70	99.94%	
4853525	2513072.15	2513157.62	85.47	0.00	713.00	713.00	70.26	8.3194	85.70	99.73%	
4853527	2515187.05	2515272.60	85.55	0.00	713.00	713.00	70.26	8.3194	85.70	99.82%	

12 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	2517043.75	2517129.30	85.55	0.00	713.00	713.00	72.52	8.3171	85.73	99.79%	
4853525	2513157.62	2513242.99	85.37	0.00	713.00	713.00	72.52	8.3171	85.73	99.58%	
4853527	2515272.60	2515358.00	85.40	0.00	713.00	713.00	72.52	8.3171	85.73	99.62%	

2 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	2517129.30	2517147.65	18.35	0.00	152.00	152.00	73.49	8.3161	18.28	100.39%	
4853525	2513242.99	2513261.30	18.31	0.00	152.00	152.00	73.49	8.3161	18.28	100.18%	
4853527	2515358.00	2515376.35	18.35	0.00	152.00	152.00	73.49	8.3161	18.28	100.39%	

2 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	2517147.65	2517167.25	19.60	0.00	163.00	163.00	74.49	8.3150	19.60	99.98%	
4853525	2513261.30	2513280.95	19.65	0.00	163.00	163.00	74.49	8.3150	19.60	100.24%	
4853527	2515376.35	2515396.01	19.66	0.00	163.00	163.00	74.49	8.3150	19.60	100.29%	

0.25 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	2517202.30	2517222.72	20.42	0.00	175.00	175.00	60.24	8.3281	21.01	97.18%	
4853525	2513316.30	2513336.85	20.55	0.00	175.00	175.00	60.24	8.3281	21.01	97.80%	
4853527	2515431.45	2515452.10	20.65	0.00	175.00	175.00	60.24	8.3281	21.01	98.27%	

0.25 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4853524	2517222.72	2517243.50	20.78	0.00	179.25	179.25	63.47	8.3256	21.53	96.52%	
4853525	2513336.85	2513357.75	20.90	0.00	179.25	179.25	63.47	8.3256	21.53	97.07%	
4853527	2515452.10	2515473.10	21.00	0.00	179.25	179.25	63.47	8.3256	21.53	97.54%	

0.25 gpm Tests											
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry	
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)	
4684550	2517282.45	2517302.40	19.95	0.00	176.50	176.50	62.44	8.3264	21.20	94.11%	
4684551	2513396.60	2513417.30	20.70	0.00	176.50	176.50	62.44	8.3264	21.20	97.65%	
4684554	2515511.95	2515532.65	20.70	0.00	176.50	176.50	62.44	8.3264	21.20	97.65%	

Table 10. Test results at 4,000,000 gallon benchmark.

20 gpm Tests										
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)
4853524	4003726.69	4003848.00	121.31	0.00	1013.00	1013.00	69.87	8.3198	121.76	99.63%
4853525	3998917.15	3999038.22	121.07	0.00	1013.00	1013.00	69.87	8.3198	121.76	99.43%
4853527	4000976.29	4001097.40	121.11	0.00	1013.00	1013.00	69.87	8.3198	121.76	99.47%

20 gpm Tests										
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)
4853524	4003848.00	4003970.05	122.05	0.00	1019.50	1019.50	70.31	8.3194	122.55	99.60%
4853525	3999160.09	3999160.09	121.87	0.00	1019.50	1019.50	70.31	8.3194	122.55	99.45%
4853527	4001097.40	4001219.25	121.85	0.00	1019.50	1019.50	70.31	8.3194	122.55	99.43%

12 gpm Tests										
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)
4853524	4003970.05	4004050.78	80.73	0.00	673.50	673.50	70.94	8.3187	80.96	99.71%
4853525	3999160.09	3999240.68	80.59	0.00	673.50	673.50	70.94	8.3187	80.96	99.54%
4853527	4001219.25	4001299.90	80.65	0.00	673.50	673.50	70.94	8.3187	80.96	99.61%

12 gpm Tests										
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)
4853524	4004050.78	4004132.01	81.23	0.00	678.00	678.00	71.57	8.3181	81.51	99.66%
4853525	3999240.68	3999321.80	81.12	0.00	678.00	678.00	71.57	8.3181	81.51	99.52%
4853527	4001299.90	4001381.00	81.10	0.00	678.00	678.00	71.57	8.3181	81.51	99.50%

2 gpm Tests										
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)
4853524	4004136.05	4004155.75	19.70	0.00	163.35	163.35	72.33	8.3173	19.64	100.31%
4853525	3999326.01	3999345.80	19.79	0.00	163.35	163.35	72.33	8.3173	19.64	100.76%
4853527	4001385.05	4001404.79	19.74	0.00	163.35	163.35	72.33	8.3173	19.64	100.51%

2 gpm Tests										
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)
4853524	4004155.75	4004175.45	19.70	0.00	163.40	163.40	73.24	8.3163	19.65	100.26%
4853525	3999345.80	3999365.55	19.75	0.00	163.40	163.40	73.24	8.3163	19.65	100.52%
4853527	4001404.79	4001424.50	19.71	0.00	163.40	163.40	73.24	8.3163	19.65	100.32%

0.25 gpm Tests										
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)
4853524	4004193.92	4004212.95	19.03	0.00	163.00	163.00	74.82	8.3146	19.60	97.07%
4853525	3999383.26	3999401.69	18.43	0.00	163.00	163.00	74.82	8.3146	19.60	94.01%
4853527	4001443.40	4001462.74	19.34	0.00	163.00	163.00	74.82	8.3146	19.60	98.65%

0.25 gpm Tests										
Meter S/N	Initial Reading	Final Reading	Ind. Net Volume	Initial Weight	Final Weight	Net Weight	Water Temp.	H2O Unit Weight	Act. Net Volume	Percent Registry
(#)	(gallons)	(gallons)	(gallons)	(lbs)	(lbs)	(lbs)	(deg F)	(lb/gal)	(gallons)	(%)
4853524	4004212.95	4004231.50	18.55	0.00	160.20	160.20	75.38	8.3140	19.27	96.27%
4853525	3999401.69	3999419.95	18.26	0.00	160.20	160.20	75.38	8.3140	19.27	94.76%
4853527	4001462.74	4001481.76	19.02	0.00	160.20	160.20	75.38	8.3140	19.27	98.71%