



ELECTRIC MOTOR POWER CONSUMPTION COMPARISON TESTING

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Test Protocol
Customer-Supplied

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Program Description

To conduct comparative testing on the energy consumption of electric motors powering a spa-pump in a closed loop, steady state operating condition. Using the same pump mechanical hardware, the original motor powered by 240VAC will be compared to a Switch Reluctance Motor (SRM) – Digitally Controlled (prototype) motor powered by both a 30VDC power supply and 48VDC power pack. The test will consist of 10-minute runs measuring the discharge pressure, flow rate and power consumption for each configuration.

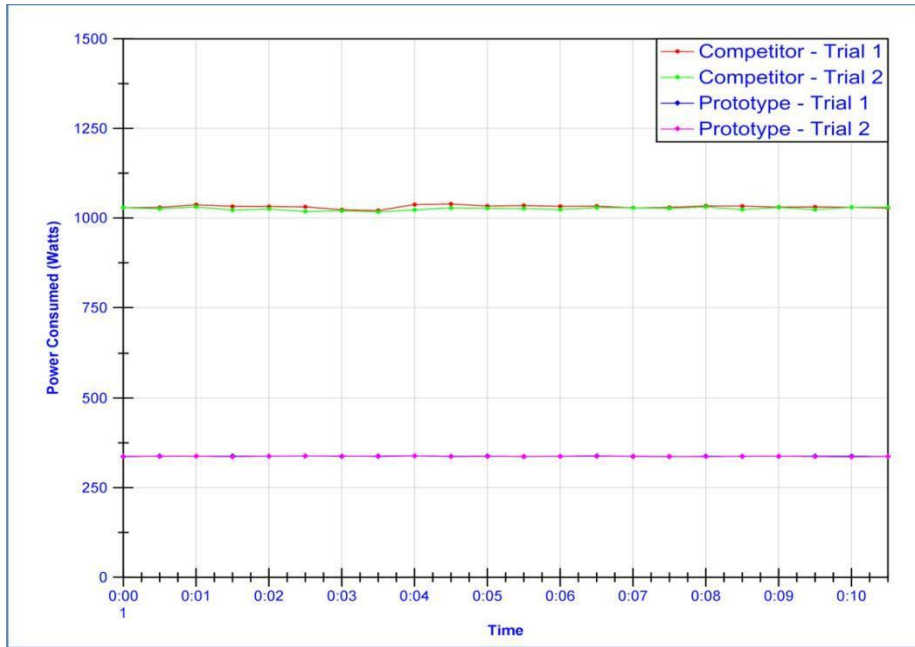
Executive Summary

The customer provided the OEM manufacturer’s pump and motor as well as the Switch Reluctance Motor (SRM) – Digitally Controlled (prototype), power supply and power pack. A closed loop system was installed in one of the pump room’s square water totes featuring a gravity feed to the pump’s supply inlet, an ASTM B11.7-compliant discharge pressure measurement section, an in-line flow meter and a manual ball valve to control initial back pressure.

A series of 10-minute runs was taken using all three motor configurations, all conducted without removing the pump itself from the system and using the manual valve to set an initial backpressure of approximately 6 PSI.

Motor Type	Run ID	Water Flow (GPM)	Discharge Pressure (PSI)	Supply Voltage (Volts)	Current (Amps)	Power Consumption (Watts)
OEM Motor	Run 1 (Average)	55.8	6.14	239.5	4.31	1032.2
	Run 2 (Average)	55.7	6.13	239.2	4.3	1028.6
	OEM Motor (Average)	55.8	6.14	239.4	4.3	1030.4
Prototype Motor	Run 1 (Average)	53.9	6.05	30.1	11.21	337.4
	Run 2 (Average)	53.8	5.97	30.1	11.23	338.0
	Prototype Motor (Average)	53.9	6.01	30.1	11.2	337.7
Percent Change OEM to Prototype						-67.2%

Performance Plot



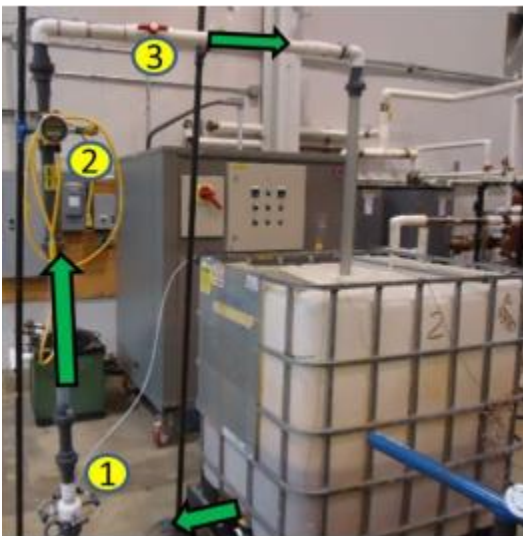
Raw Data (Competitor)

Competitor Motor - Run 1						Competitor Motor - Run 2					
Elapsed Time	Flow	Discharge Pressure	AC Voltage	Current	Power	Elapsed Time	Flow	Discharge Pressure	AC Voltage	Current	Power
Seconds	GPM	PSI	Volts	Amps	Watts	Seconds	GPM	PSI	Volts	Amps	Watts
29.8	55.41	6.14	239.25	4.3	1028.8	29.8	55.43	6.12	239.29	4.3	1028.9
59.79	55.73	6.15	239.43	4.3	1029.5	59.8	55.72	6.13	239.08	4.29	1025.7
89.79	56.2	6.15	240.03	4.32	1036.9	89.8	55.41	6.14	239.76	4.3	1031.0
119.79	55.57	6.12	239.54	4.31	1032.4	119.8	55.64	6.13	238.84	4.28	1022.2
149.79	55.61	6.13	239.44	4.31	1032.0	149.8	55.49	6.12	238.98	4.29	1025.2
179.79	56.33	6.14	239.2	4.31	1031.0	179.8	56.12	6.13	238.48	4.27	1018.3
209.79	56.15	6.13	238.41	4.29	1022.8	209.8	55.97	6.12	238.3	4.28	1019.9
239.79	55.54	6.12	238.52	4.28	1020.9	239.8	55.2	6.12	238.18	4.27	1017.0
269.79	55.97	6.14	240.17	4.32	1037.5	269.8	55.37	6.14	238.93	4.28	1022.6
299.79	55.4	6.14	240.54	4.32	1039.1	299.8	55.82	6.13	239.73	4.29	1028.4
329.79	55.75	6.12	239.75	4.31	1033.3	329.8	56.13	6.1	239.49	4.29	1027.4
359.79	56.04	6.17	240.08	4.31	1034.7	359.8	55.47	6.12	239.29	4.29	1026.6
389.8	55.82	6.14	239.58	4.31	1032.6	389.8	55.9	6.12	239.13	4.28	1023.5
419.8	55.98	6.12	239.67	4.31	1033.0	419.8	55.54	6.14	239.85	4.29	1029.0
449.8	56.05	6.13	239.18	4.3	1028.5	449.8	56.45	6.15	239.69	4.29	1028.3
479.81	55.94	6.14	239.42	4.3	1029.5	479.8	55.47	6.1	239.37	4.29	1026.9
509.81	56.12	6.15	239.82	4.31	1033.6	509.8	55.48	6.12	239.77	4.3	1031.0
539.81	55.69	6.12	239.67	4.31	1033.0	539.8	56.28	6.12	239.18	4.28	1023.7
569.82	56.15	6.12	239.61	4.3	1030.3	569.8	55.8	6.14	239.45	4.3	1029.6
599.82	55.82	6.14	239.69	4.3	1030.7	599.8	55.52	6.14	239.13	4.28	1023.5
629.82	55.56	6.14	239.54	4.3	1030.0	629.79	55.7	6.12	239.53	4.3	1030.0
659.82	55.7	6.15	239	4.3	1027.7	659.79	56.01	6.13	239.49	4.3	1029.8
Averages	55.8	6.14	239.52	4.31	1031.3	689.79	55.8	6.13	239.28	4.29	1026.5
Std Dev	0.3	0.01	0.48	0.01	4.1	Averages	55.7	6.13	239.2	4.3	1025.9
						Std Dev	0.31	0.01	0.45	0.01	3.88

Raw Data (Prototype – 30V)

Prototype Motor - Run 1					
Elapsed Time	Flow	Discharge Pressure	AC Voltage	Current	Power
Seconds	GPM	PSI	Volts	Amps	Watts
29.91	53.67	6.06	30.08	11.19	336.6
59.91	53.56	6.06	30.07	11.24	338.0
89.91	53.89	6.02	30.07	11.23	337.7
119.91	53.53	6.03	30.07	11.24	338.0
149.91	53.86	6.01	30.07	11.23	337.7
179.91	53.2	6.07	30.07	11.25	338.3
209.91	53.89	6.04	30.07	11.22	337.4
239.91	54	6.08	30.07	11.24	338.0
269.91	54.32	6.07	30.07	11.26	338.6
299.91	53.96	6.06	30.07	11.22	337.4
329.91	54.08	6.06	30.07	11.24	338.0
359.91	54.22	6.04	30.07	11.2	336.8
389.91	53.89	6.06	30.07	11.22	337.4
419.91	53.56	6.05	30.07	11.26	338.6
449.91	54.2	6.05	30.08	11.21	337.2
479.91	53.87	6.05	30.07	11.19	336.5
509.91	54.25	6.03	30.07	11.23	337.7
539.91	54.12	6.03	30.07	11.21	337.1
569.91	54.16	6	30.07	11.22	337.4
599.91	54.12	6.04	30.07	11.24	338.0
629.91	53.9	6.05	30.07	11.23	337.7
659.91	53.9	6.05	30.08	11.21	337.2
689.91	54.4	6.06	30.08	11.24	338.1
Averages	53.9	6.05	30.1	11.23	337.6
Std Dev	0.28	0.02	0	0.02	0.56

Prototype Motor - Run 2					
Elapsed Time	Flow	Discharge Pressure	AC Voltage	Current	Power
Seconds	GPM	PSI	Volts	Amps	Watts
30	53.62	6.05	30.07	11.22	337.4
60	53.28	6.01	30.08	11.21	337.2
90	53.84	6.04	30.07	11.23	337.7
120	53.24	6.02	30.08	11.18	336.3
150	53.91	5.99	30.07	11.22	337.4
180	53.64	6.02	30.08	11.25	338.4
210	54	6.03	30.07	11.25	338.3
240	54.39	6.05	30.08	11.2	336.9
270	54.08	6.05	30.08	11.25	338.4
300	54.22	6.07	30.08	11.2	336.9
330	53.86	6.04	30.07	11.21	337.1
360	53.68	6.04	30.08	11.21	337.2
390	53.51	6.06	30.07	11.21	337.1
420	53.85	5.9	30.07	11.22	337.4
449.99	54.29	5.9	30.07	11.23	337.7
479.99	53.82	5.92	30.07	11.21	337.1
509.99	53.84	5.92	30.08	11.19	336.6
539.99	53.71	5.9	30.07	11.23	337.7
569.99	53.69	5.92	30.07	11.23	337.7
599.99	53.72	5.89	30.07	11.2	336.8
629.99	53.83	5.91	30.07	11.17	335.9
659.99	53.52	5.9	30.08	11.21	337.2
689.99	53.21	5.9	30.08	11.21	337.2
719.99	53.74	5.94	30.07	11.2	336.8
Averages	53.8	5.97	30.1	11.21	337.3
Std Dev	0.3	0.07	0	0.02	0.61

Setup Hardware and Equipment


Description	Barcode	Instrument Range	ID #
Yokogawa	73009078	Multiple	Not Shown
Signet 2551 Flow Meter	Z00001547	0-200 GPM	2
Omegadyne Pressure Transducer	Z00001491	0-50 PSI	1
Flow Meter "T" Fitting	Z00001549	1-1/2" Schedule 80 PVC	2