



samatrix

Pumping Systems Engineering

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Pump Performance Analysis - Summary Report

Client:

Site:

Test: Storms Pumps

Date: August 2010

Testing Equipment

- **samatrix Black Box System Converter**
- **Pressure transducer dual digital readout and analogue output**
- **Minisonic clamp on flowmeter**
- **Submersible depth transducer**
- **Laptop with samatrix system analyser software**

Background

The current installation consists of two submersible mounted pumps. There are existing DWF pumps installed within the dry well which did not form part of this test. Both storm pumps draw from a common wet well, which overtops via a concrete weir from the main DWF wet well. The pumps discharge into a common rising main, which terminates at the storm tanks located at the local STW.

Methodology

The following instruments were used during the test and were common to both sets of pumps.

Wet Well Level – 5m Submersible Depth Transducer

Discharge Flow – Clamp on Flowmeter

Delivery Pressure – 0 to 4 Bar Pressure Transducer

The Depth Transducer was lowered in to the common storm wet well and set at base level. For this test, flow was to be measured via a clamp on flowmeter. The first available straight section of common delivery pipework was prepared and the clamp on transducers fitted, in this instance the exposed section of pipe prior to discharge. The delivery pressure transducers were fitted to existing tappings on each associated non-return valves for individual tests and Hs tests. The instruments were then connected to the Black Box System Converter and the results collated and stored on the laptop software.

The pumps were then tested individually and collectively for flow and pressure. The results can be seen in the following report.

The purpose of this test was to ascertain existing system conditions and review current pump performance.

Pump Station Data

Storm Pump	ITT Flygt CP3170	Storm Pump	ITT Flygt CP3170
Pump Serial No.		Pump Serial No.	
Motor Size	17kW	Motor Size	17kW
Impeller Curve	601	Impeller Curve	601

Wet Well	Common wet well	Area	TBA
		Depth	4.185m Approx
Rising Main	50m (Approximation)	Diameter	Ø300 from PS
B.W.L	1.9m (Approximation)	Discharge Level	8.6m (Approximation)

Estimated Rising Main System Losses (From Site Plan)**DWF Pumps**

Flow (l/s)	0.00	50	100	150	200
Static Hd. (m)	6.70	6.70	6.70	6.70	6.70
Headloss (m)	0.00	0.11	0.42	0.93	1.64
Rising Main Fittings Losses (m)	0.00	0.11	0.43	0.97	1.72
Station Losses (m)	0.00	0.09	0.38	0.85	1.52
Total Hd. (m)	6.70	7.01	7.93	9.46	11.59

Manufacturers Data

Storm Pump	
Flygt CP3170 601 17kW	
Flow	Head
7.2	13.01
69.7	10.93
140.6	8.43
191.9	6.59
258.4	4.27

Storm Pump	
Flygt CP3170 601 17kW	
Flow	Head
10.8	13.00
67.8	11.08
125.6	8.85
192.3	6.37
238.8	4.75

Test results for Storm Pump No.1

Test Point	Flow	Pressure (Bar) PTxD	mHD	Z1 (m)	Velocity Correction (m)	Local Losses (m)	Total Head (m)
Static Head	0.00	0.44	4.49	2.375	/	/	6.86
Closed Valve	0.00	1.13	11.56	2.003	/	/	13.56
Mid Point	94.26	0.80	8.18	2.111	0.09	0.17	10.55
Duty Point	125.12	0.63	6.41	2.101	0.16	0.29	8.96

Test results for Storm Pump No.2

Test Point	Flow	Pressure (Bar) PTxD	mHD	Z1 (m)	Velocity Correction (m)	Local Losses (m)	Total Head (m)
Static Head	0.00	0.44	4.49	2.375	/	/	6.86
Closed Valve	0.00	1.22	12.47	1.956	/	/	14.42
Mid Point	53.85	0.92	9.36	1.986	0.03	0.05	11.43
Duty Point	124.89	0.63	6.43	2.066	0.16	0.29	8.95

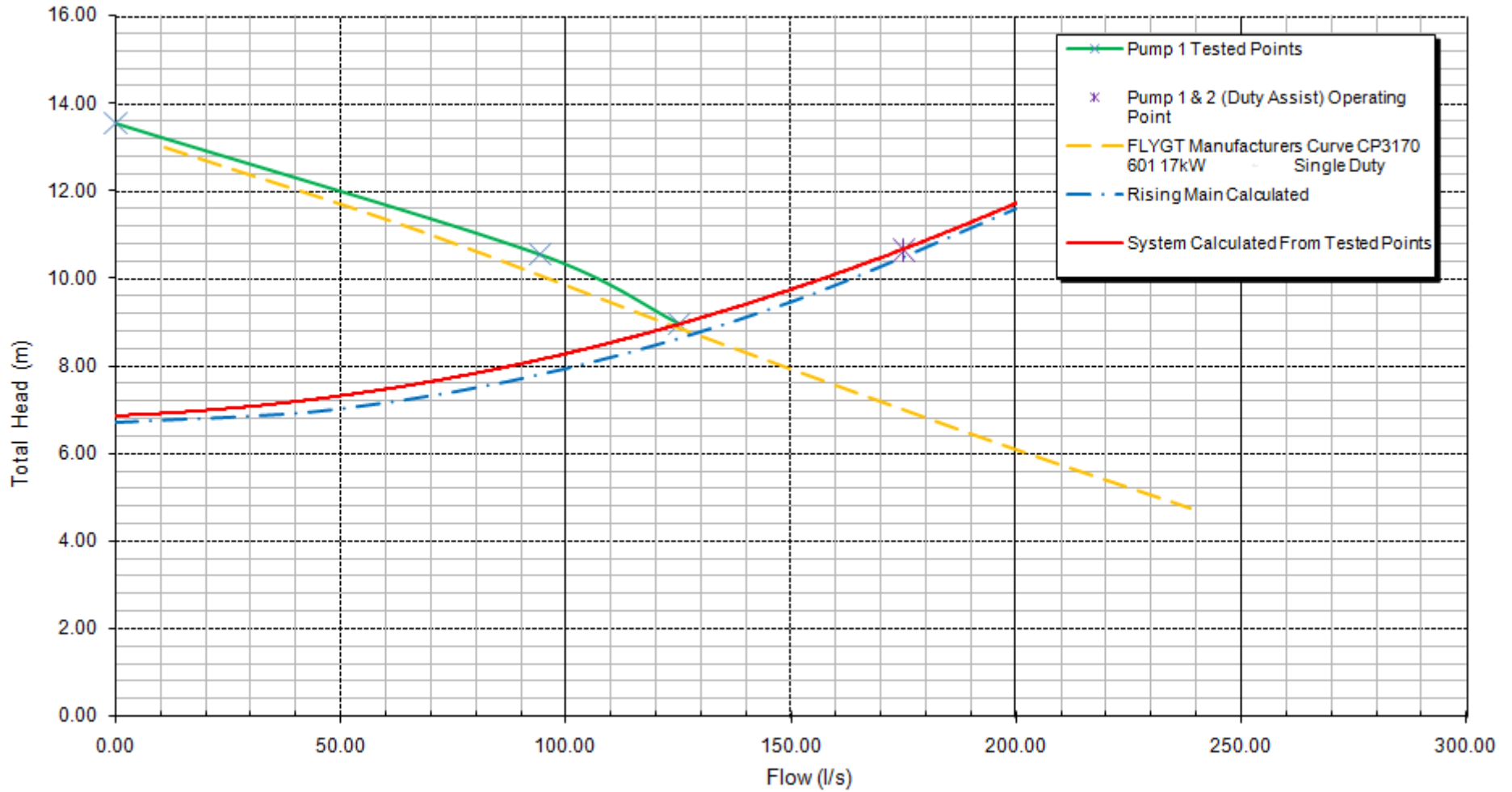
Test results for Combined Duties

Test Point	Flow	Pressure (Bar) PTxD	mHD	Z1 (m)	Velocity Correction (m)	Local Losses (m)	Total Head (m)
Static Head	0.00	0.44	4.49	2.375	/	/	6.86
Duty Point	175.11	0.78	7.98	2.300	0.08	0.29	10.64

Static head taken at approximate Bottom Water Level (BWL)

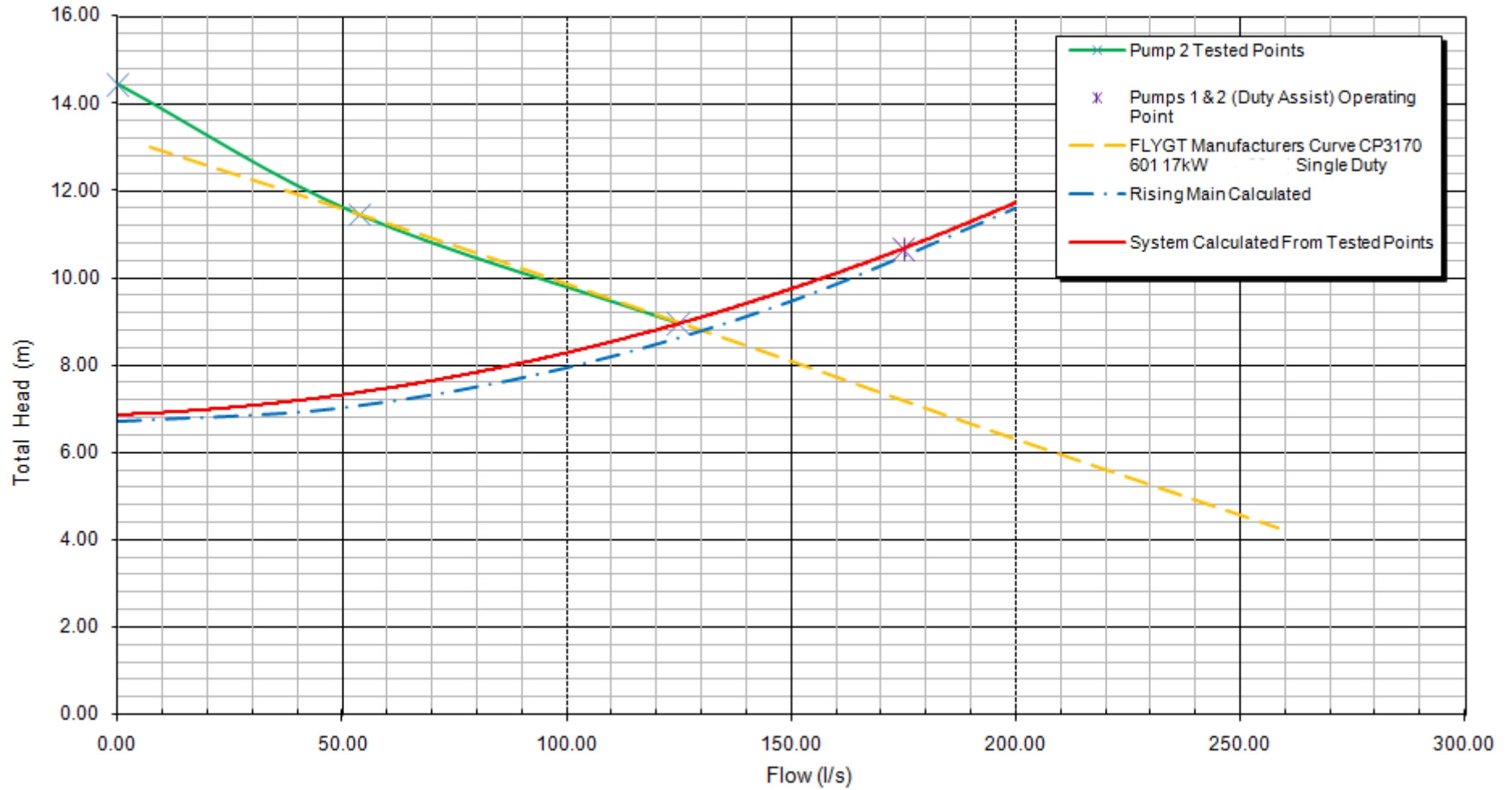
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Fig. 1



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Fig. 2



Notes & Observations

- The test was carried out during wet weather. The inflow and outflow volume changes were monitored throughout the duration of the test. The depth transducer was set at base level of the pumping station wet well. Z1 values have been calculated as the average water level at each point measured and can be seen in the tables above.
- The average system curve in Figs 2&3 is derived from the common static head in the rising main at approximate pump bottom water level (BWL) along with the tested points for both individual and combined pump duties. The calculated system is overlaid and based on information from drawings and existing rising main long section, this system was calculated using the Colebrook-White formula and using a Ks of 0.3mm.
- The pumping station is in a good and safe condition. The pumps operate as required. Delivery gate valves were all operational. The associated reflux valves appeared to operate satisfactorily. The station pipework is also in good condition with no evidence of leaks.
- The pumps installed were identified as:-
 - Storm Pump 1 – Wet well submersible pump Flygt CP3170 with 601 impeller fixed speed drive 17kW.
 - Storm Pump 2 – Wet well submersible pump Flygt CP3170 with 601 impeller fixed speed drive 17kW.
- The pump pressures and flows recorded are a mean value of readings taken over the duration of each pump operating cycle for each test point. For this test we have used a minimum of 15 readings.
- Total dynamic head for each test point includes; Z1 values as given above, local losses to the gauge point and velocity correction.
- Trended data measured at the time of the test can be seen as follows
 - Storm Pump No.1 Duty Point Flow & Pressure Trends - *Fig 3.*
 - Storm Pump No.1 Closed Valve Pressure Trends - *Fig 4.*
 - Storm Pump No.2 Duty Point Flow & Pressure Trends - *Fig 5.*
 - Storm Pump No.2 Closed Valve Pressure Trends - *Fig 6.*
 - Pressure Transients Trend - *Fig 7.*
 - Static Mains Pressure Trend – *Fig 8.*
 - A schematic layout of the pump arrangement and test setup can be seen in *Fig 9.*

Conclusions

- The test results indicate that the existing pumps operate as follows. The comparative Flygt manufacturers data has been obtained from the original manufacturers works test results, carried out in accordance ISO9906/A.
 - Storm Pump No.1 & No.2 – Both pumps are operating very close to their original curves, indicating little wear on the hydraulic components
- The calculated system and sytem generated from the tested points are almost identical signifying no line obstructions or air accumulation. The close proximity of the two curves also demonstrate the rising main has been installed very near to the planned route and levels.
- We have considered NPSHa against the NPSHr of the pumps and conclude this is not an issue on this installation. The approximate NPSHa & associated required for each pump type is given as:
 - Storm Pump NPSHa = 9.92m & NPSHr = 3.1m (at approximate duty point)
 - NPSHr From pump manufacturers software.
- The mains static pressure trend seen in Fig 16 demonstrate that the pump non-return valves and rising main pipework joints provide an adequate seal

We sincerely hope that this report is to your satisfaction and please do not hesitate to contact us if we can assist further. Again, we thank you for your most valued business.

Yours faithfully,

For and on behalf of [samatrix](#) Limited,

Adam Wakefield

Technical Director

Samatrix

Fig 3. – Storm Pump No.1 Duty Point Flow & Pressure Trends

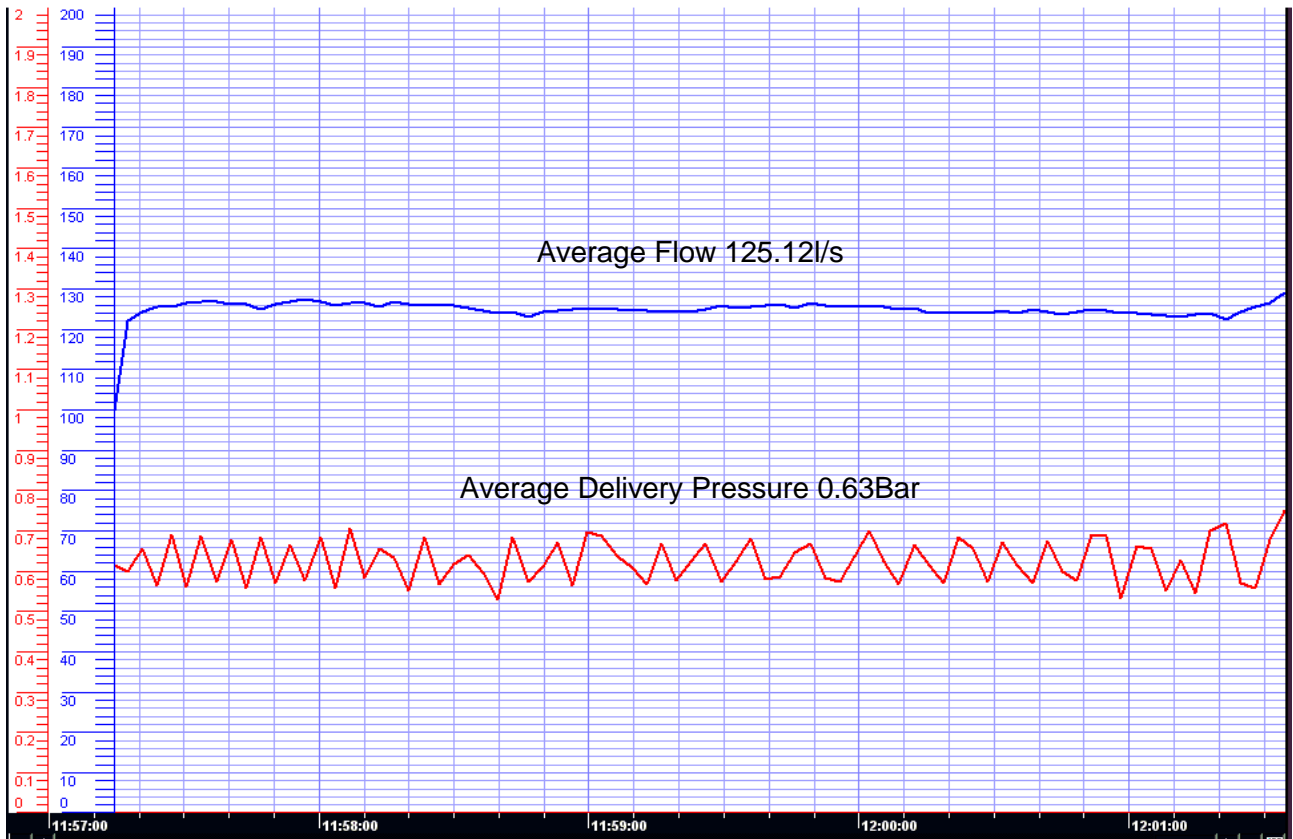


Fig 4. – Storm Pump No.1 Closed Valve Pressure Trends

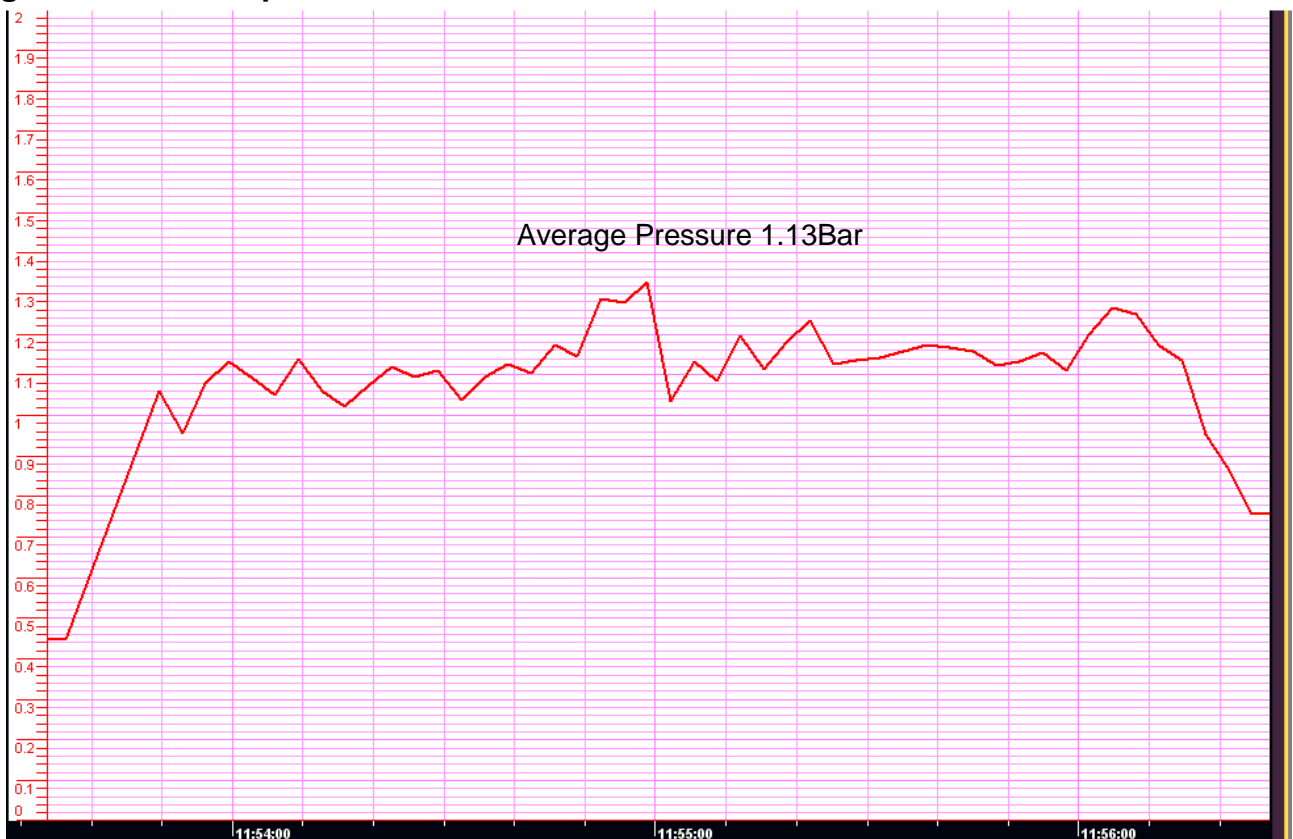


Fig 5. – Storm Pump No.2 Duty Point Flow & Pressure Trends

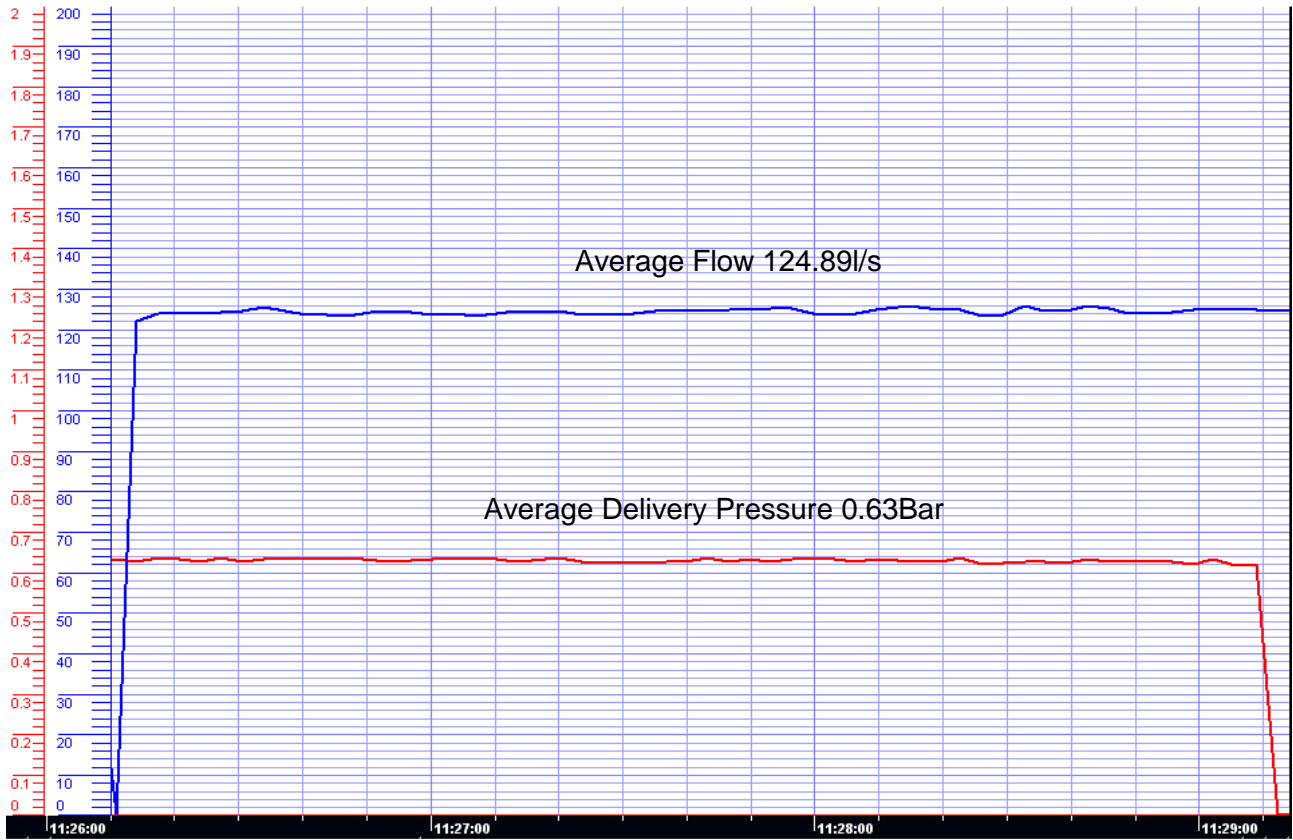


Fig 6. – Storm Pump No.2 Closed Valve Pressure Trends

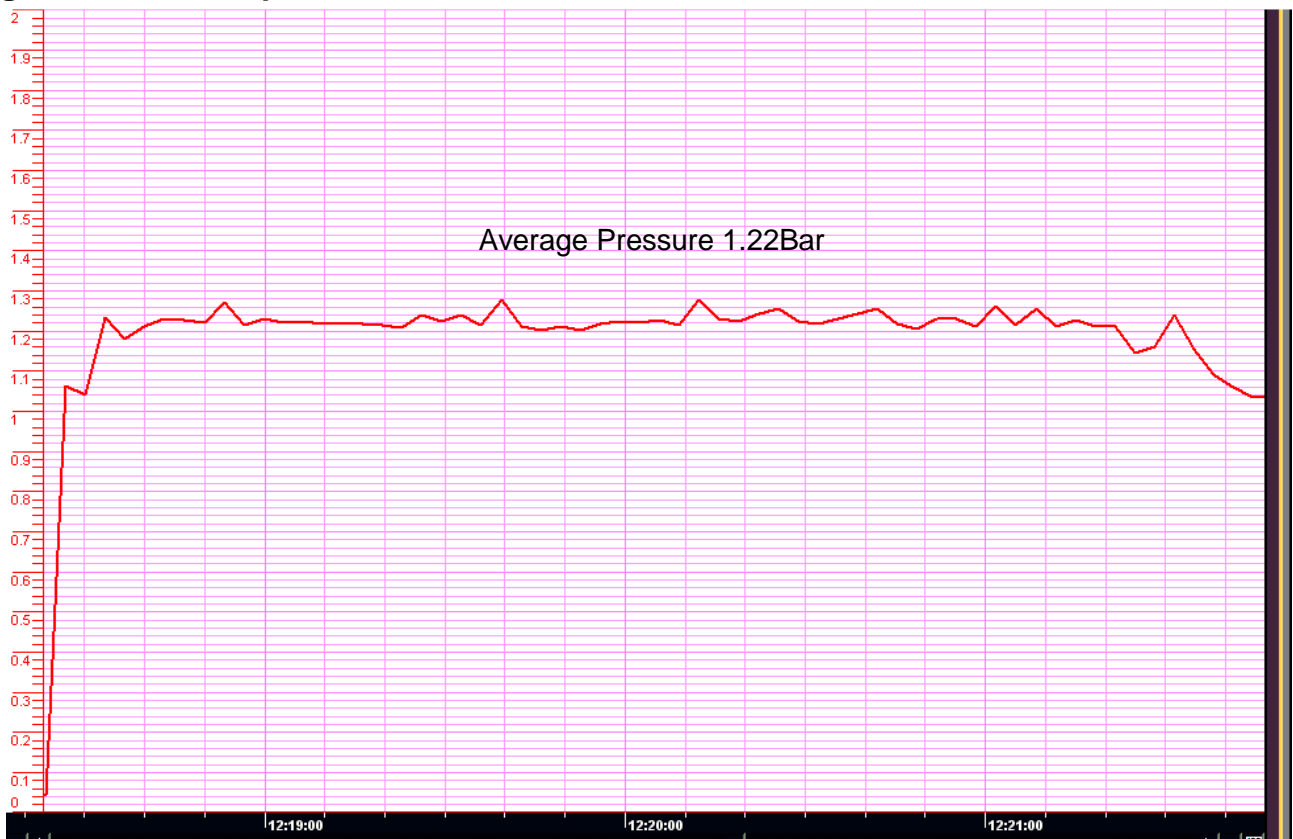


Fig 7. – Pressure Transients Trends

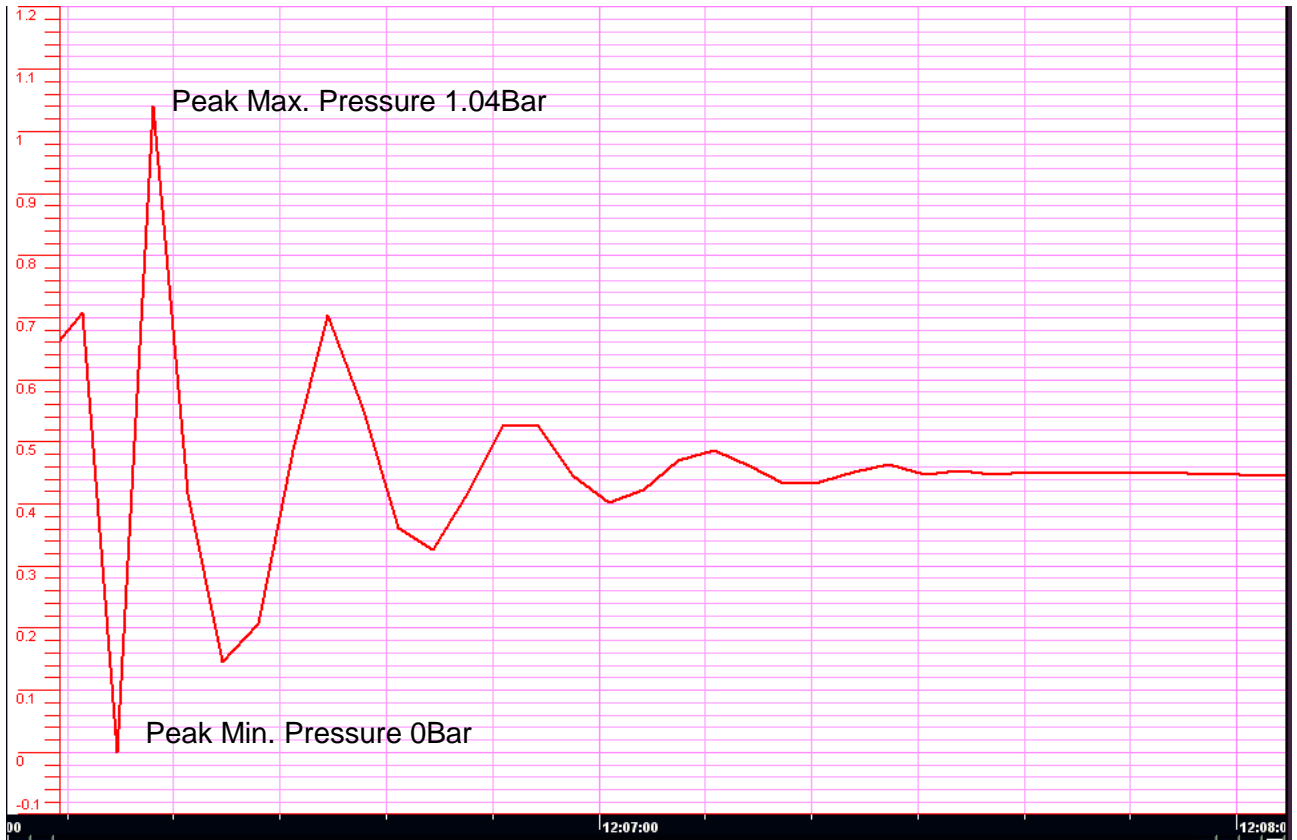


Fig 8. – Static Mains Pressure Trends

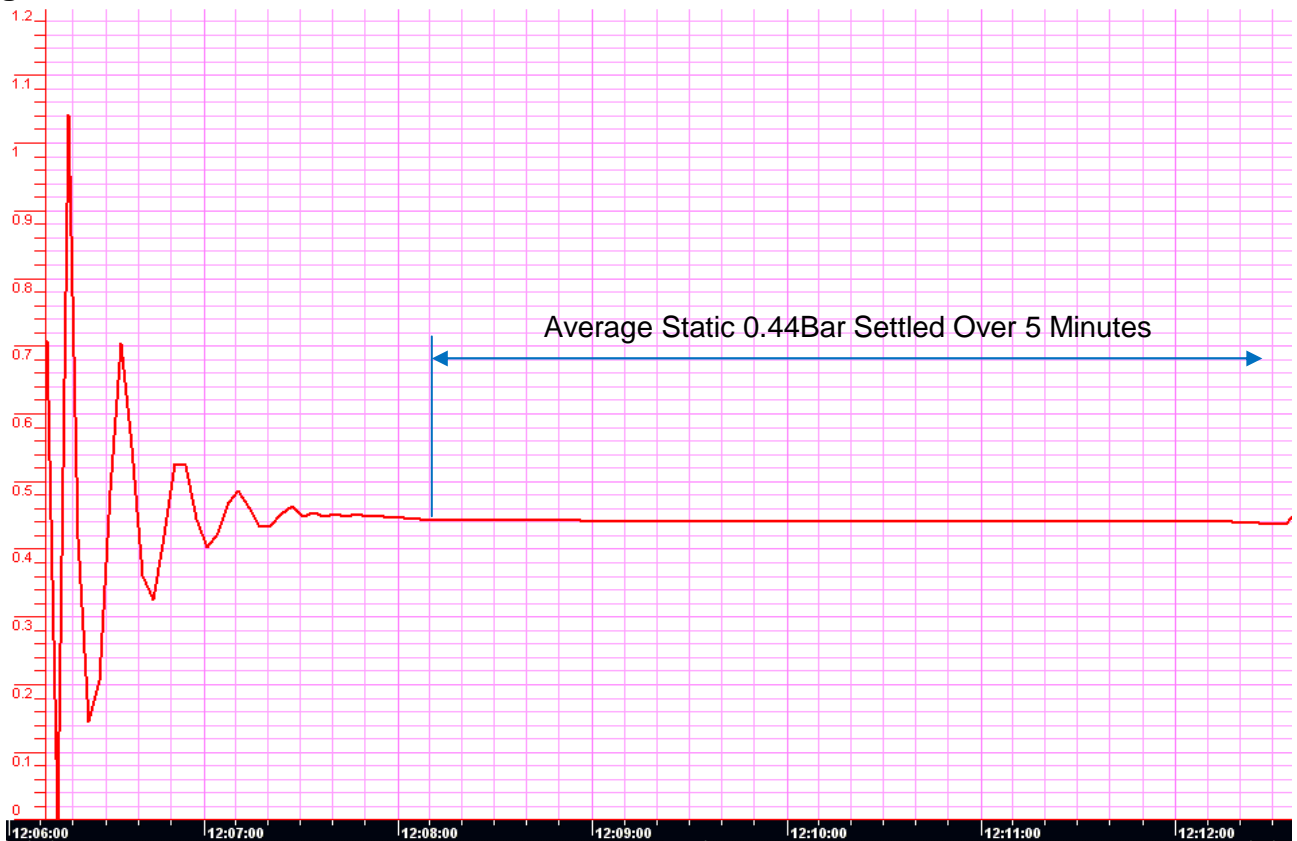


Fig 9. - Schematic Layout

