

Author Tel.	
Company	To:
Subject LEVIBOOST™ 140 Facility Pressure Fluctuation	

Introduction

The memo is describing the influence of pressure fluctuations on a pressure controlled loop (LEVIBOOST™). In combination with a prepressure regulator very fast and strong pressure fluctuations can be compensated. A prepressure regulator is necessary if the pressure fluctuations are higher than the POU pressure.

Following measures were made for the controlled POU pressure with prepressure regulator and without prepressure regulator:

- Changing prepressure dynamic (1bar/s, 2bar/s, 4bar/s)
- System with only prepressure regulator without pump
- Changing POU flow rate
- Changing prepressure static

Index

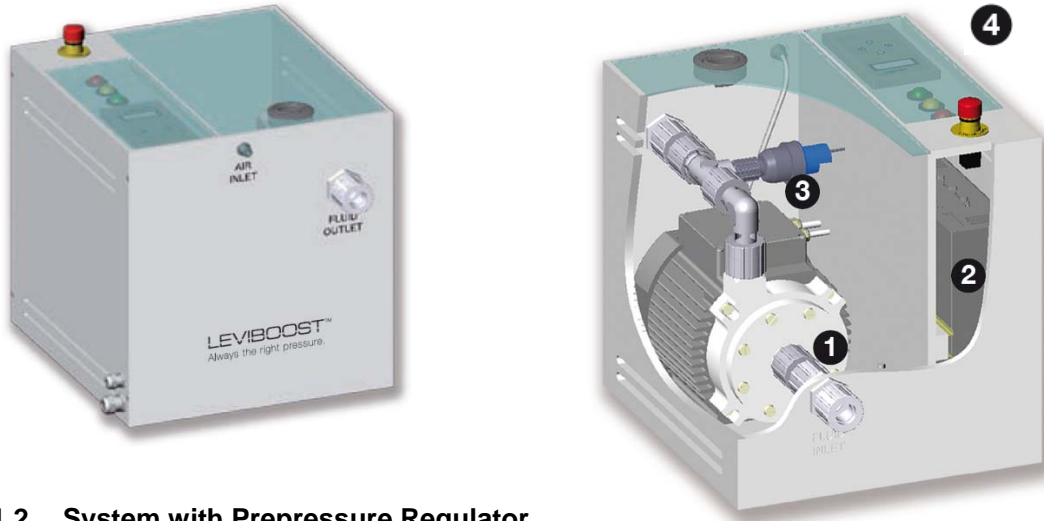
1	System Setup	3
1.1	LEVIBOOST 140	3
1.2	System with Prepressure Regulator	3
1.3	System without Prepressure Regulator	4
2	Dynamic Pressure Fluctuation of Facility with Prepressure regulator	5
2.1	POU = 20lpm, Set Point Pressure = 4bar, Pressure Fluctuation = 3.5 – 4.5bar and 1bar/s	5
2.2	POU = 20lpm, Set Point Pressure = 4bar, Pressure Fluctuation = 3.5 – 4.5bar and 2bar/s	7
2.3	POU = 20lpm, Set Point Pressure = 4bar, Pressure Fluctuation = 3.5 – 4.5bar and 4bar/s	9
3	System with Prepressure regulator without Pressure Controlled Loop	11
3.1	POU = 20lpm, Set Point Pressure = not controlled (POU pump turned off), Pressure Fluctuation = 3.5 – 4.5bar and 2bar/s	11
3.2	POU = 20lpm, Set Point Pressure = not controlled (POU pump speed at 4000rpm), Pressure Fluctuation = 3.5 – 4.5bar and 2bar/s	12
4	Dynamic Flow Rate change of POU with Prepressure Regulator	14
4.1	POU = 20 – 30 lpm, Set Point Pressure = 4bar, Facility Pressure = 2 bar	14
4.2	POU = 20 – 30 lpm, Set Point Pressure = 3bar, Facility Pressure = 2 bar	15
4.3	POU = 20 – 30 lpm, Set Point Pressure = 2bar, Facility Pressure = 2 bar	16
5	Static Pressure Change of Facility with Prepressure Regulator	17
5.1	POU = 20lpm, Set Point Pressure = 4bar, Facility Pressure Change = 1 – 5 bar	17
6	Dynamic Pressure Fluctuation of Facility without Prepressure Regulator	18
6.1	POU = 20lpm, Set Point Pressure = 4bar, Pressure Fluctuation = 3 – 3.5bar	18
7	Dynamic Flow Rate change of POU without Prepressure Regulator	20
7.1	POU = 20 – 30 lpm, Set Point Pressure = 4bar, Facility Pressure = 2 bar	20
7.2	POU = 20 – 30 lpm, Set Point Pressure = 3bar, Facility Pressure = 2 bar	21
8	Conclusion	22

1 SYSTEM SETUP

1.1 LEVIBOOST™ 140

The LEVIBOOST system delivers a maximum flow rate of 140l/min. (more details in LEVIBOOST™ brochure)

1. Levitronix Motor
2. Levitronix Pump Controller
3. Pressure Transducer
4. User Interface



1.2 System with Prepressure Regulator

Pressure fluctuation higher than the set point pressure can be reduced. The BPS – 4 pump is used to generate the prepressure and the pressure fluctuation. The second BPS-4 pump is used for controlling the POU pressure. If there are pressure fluctuations the BPS-4 in the pressure controlled loop is adjusting the pump speed.

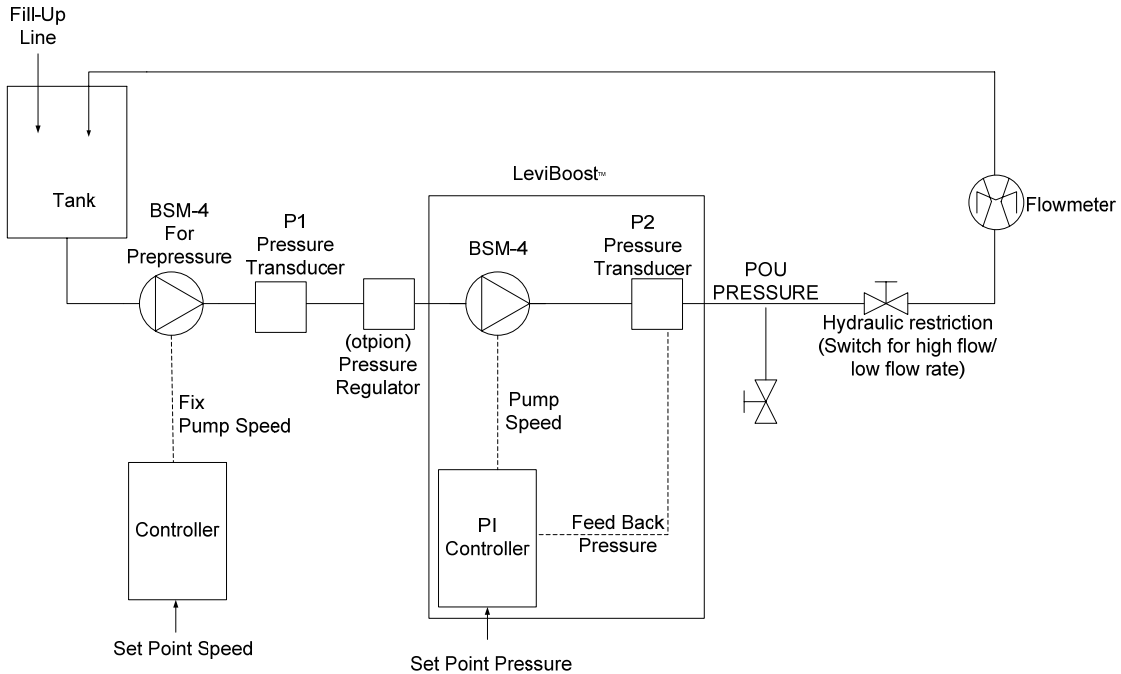


Figure 1

1.3 System without Prepressure Regulator

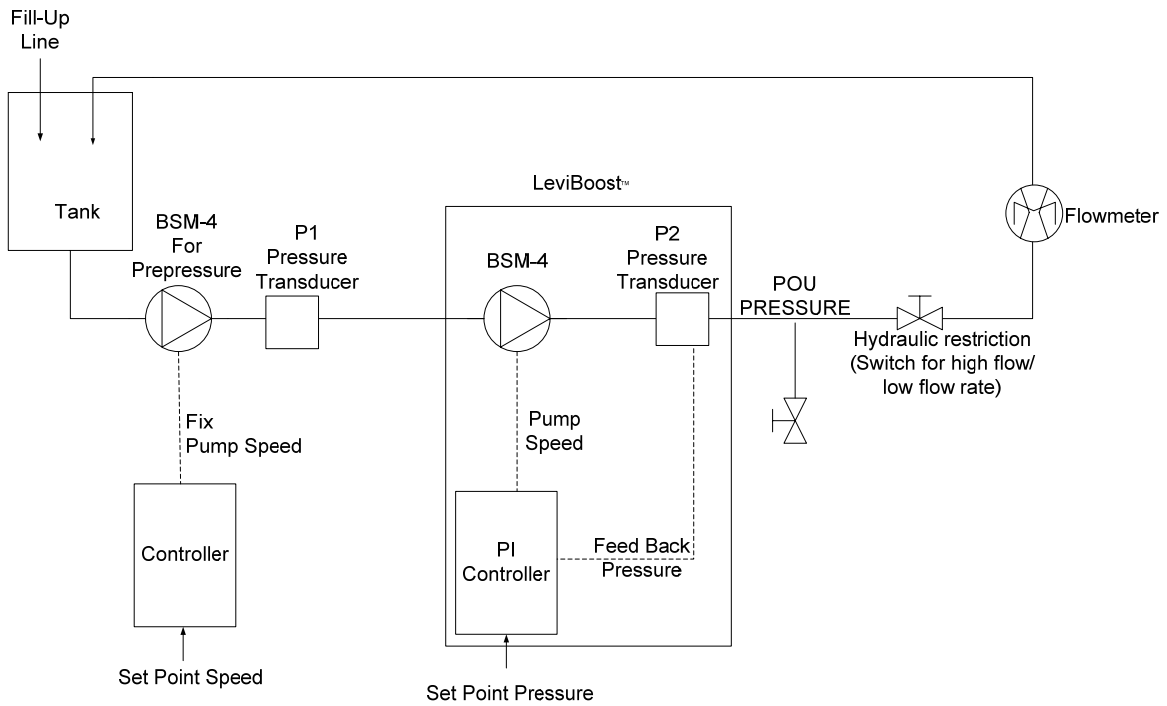


Figure 2

2 DYNAMIC PRESSURE FLUCTUATION OF FACILITY WITH PREPRESSURE REGULATOR

2.1 POU = 20lpm, Set Point Pressure = 4bar, Pressure Fluctuation = 3.5 – 4.5bar and 1bar/s

The prepressure fluctuations are between 3.5 bar and 4.5bar. In the following measurements the pressure fluctuation speed is moderate. The pressure change is 1bar/s.

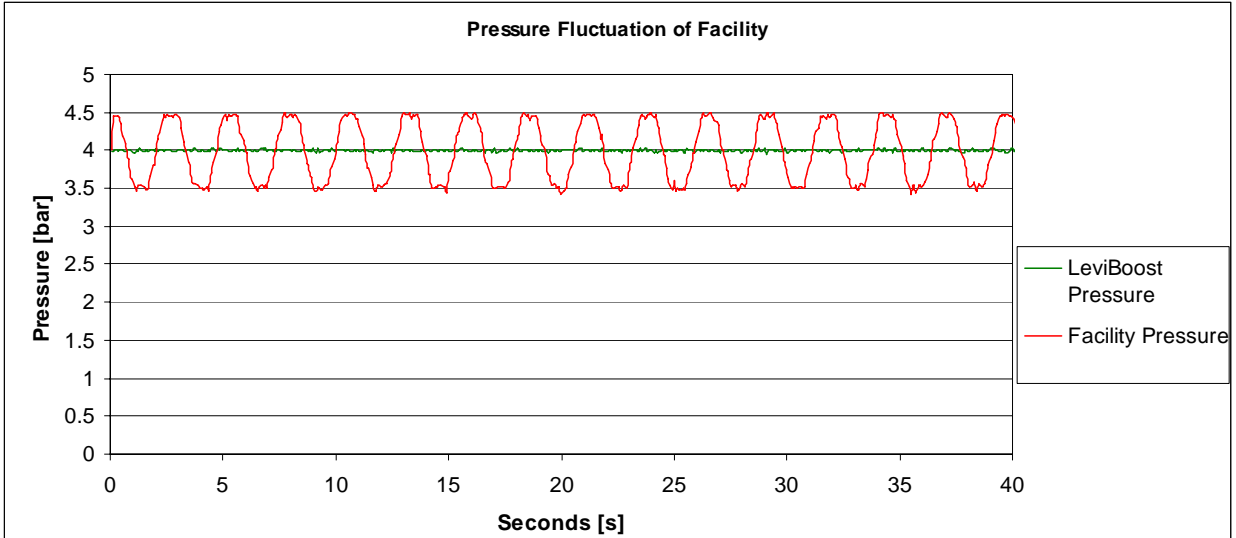


Figure 3

The pump speed changing less.

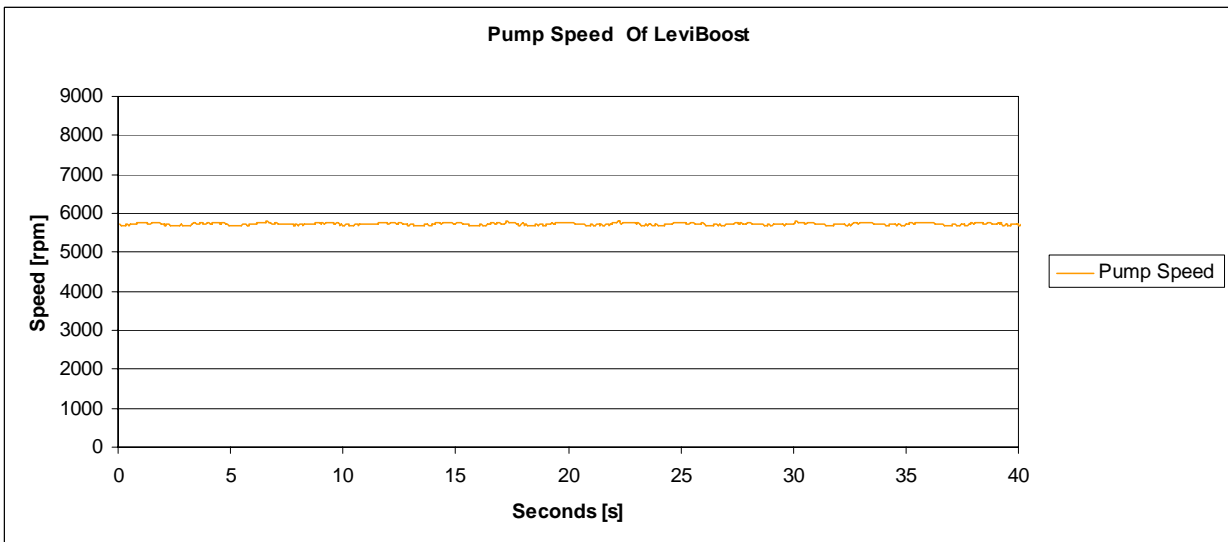


Figure 4

The zoom in figure shows that the POU pressure fluctuations are smaller than 0.1bar but over 0.05bar.

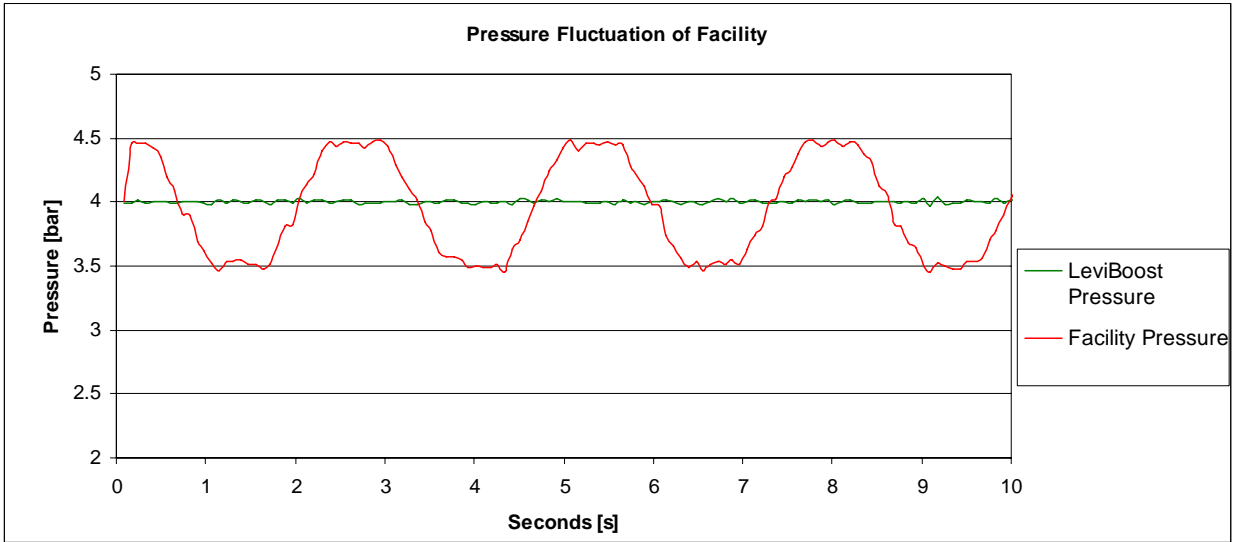


Figure 5

The pump speed is adjusted between 5700rpm and 5800rpm.

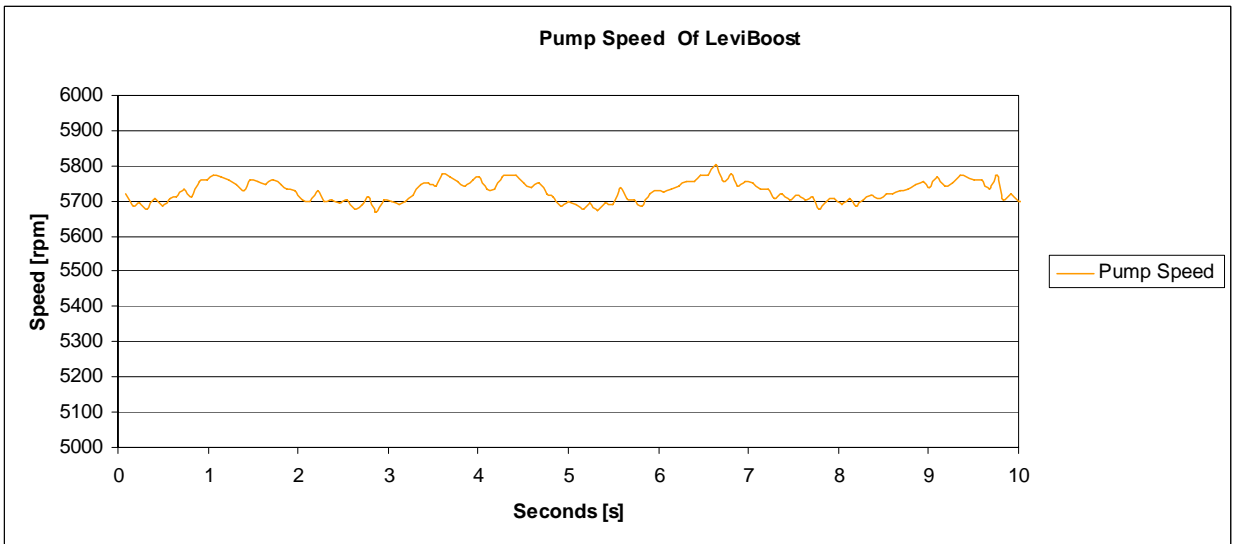


Figure 6

2.2 POU = 20lpm, Set Point Pressure = 4bar, Pressure Fluctuation = 3.5 – 4.5bar and 2bar/s

The prepressure fluctuations are between 3.5 bar and 4.5bar. In the following measurements the pressure fluctuation speed is faster. The pressure change is 2bar/s.

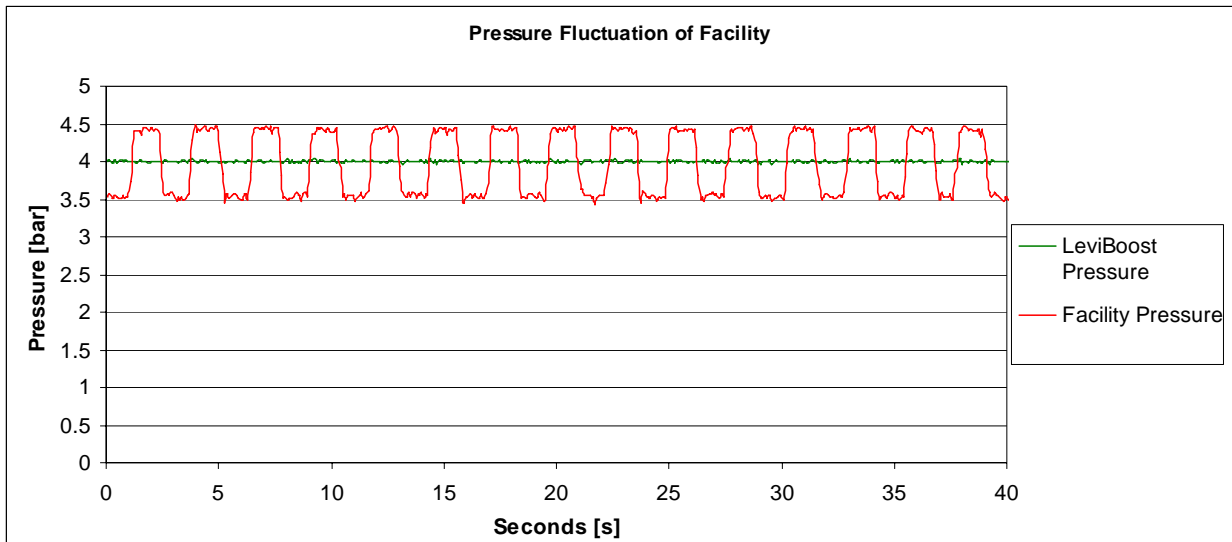


Figure 7

The pump speed changing less.

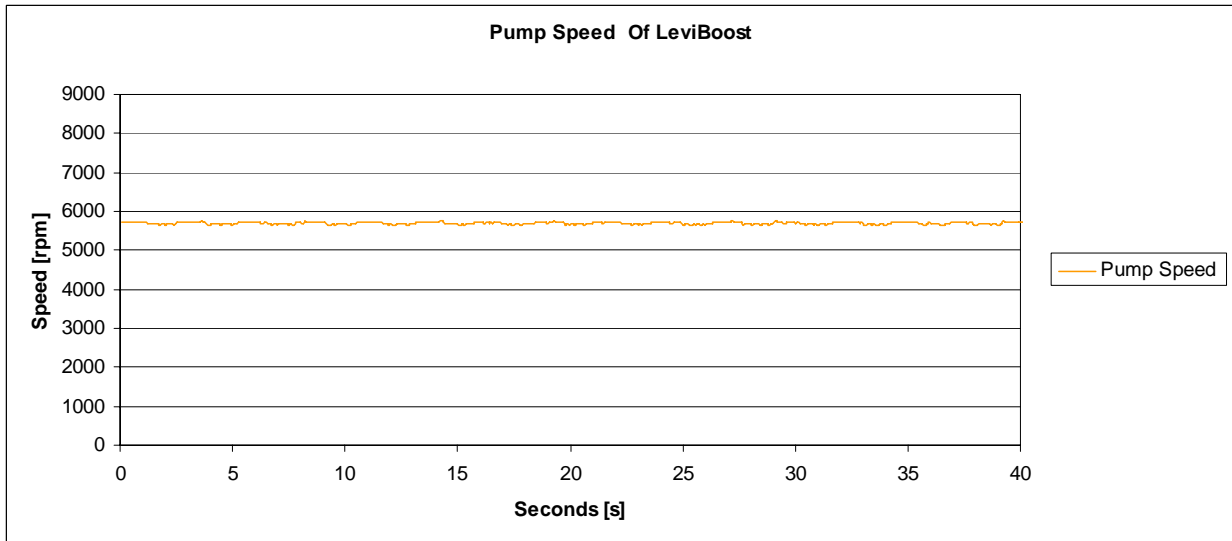


Figure 8

The zoom in figure shows that the POU pressure fluctuations are smaller than 0.1bar but over 0.05bar.

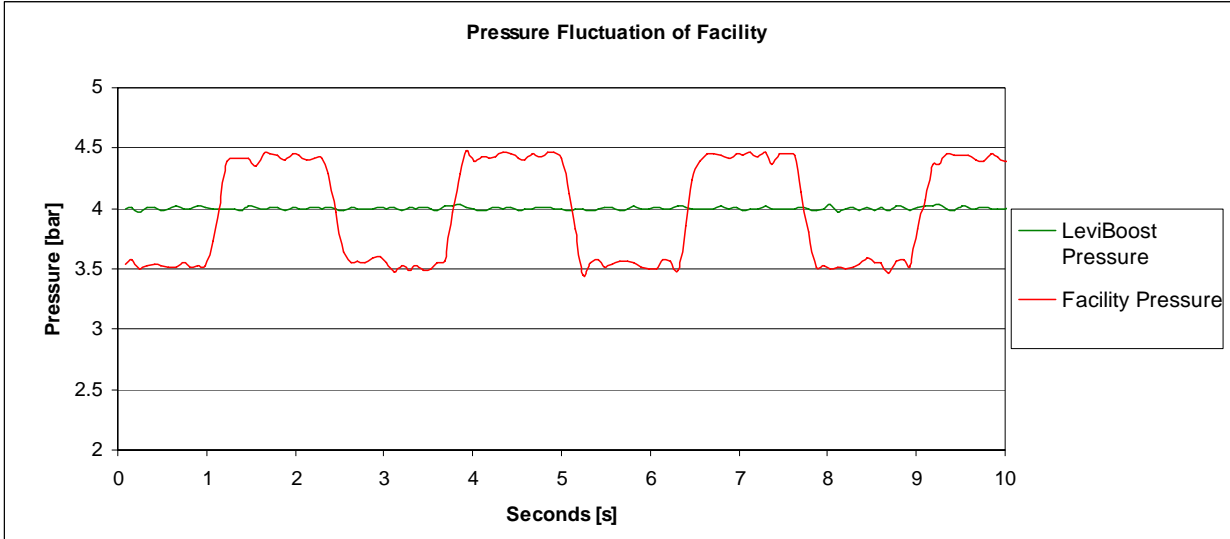


Figure 9

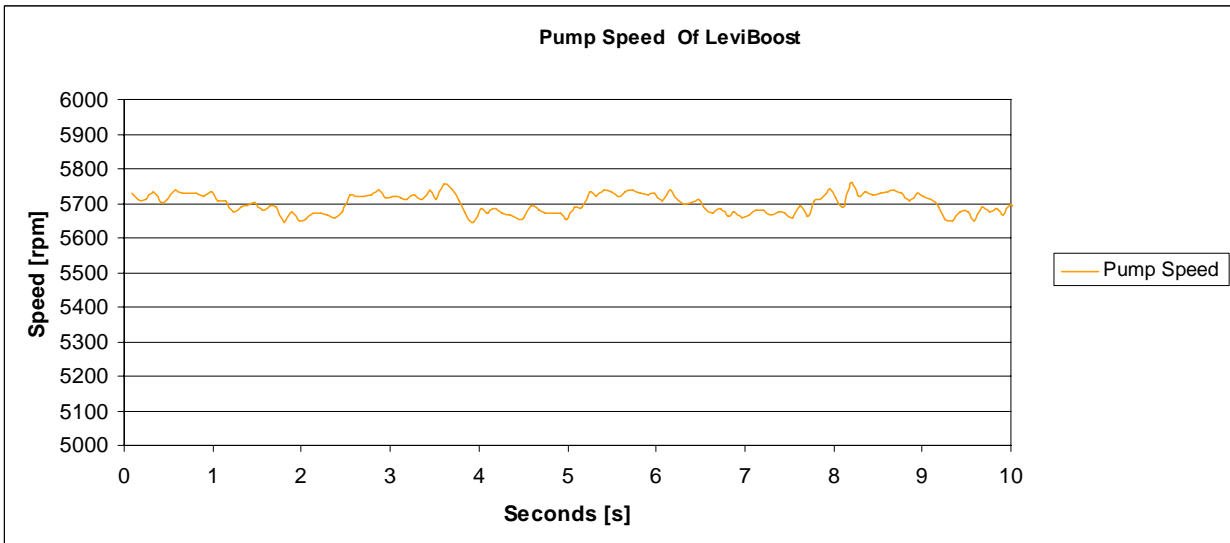


Figure 10

The pump speed is adjusted between 5600rpm and 5800rpm.

2.3 POU = 20lpm, Set Point Pressure = 4bar, Pressure Fluctuation = 3.5 – 4.5bar and 4bar/s

The prepressure fluctuations are between 3.5 bar and 4.5bar. In the following measurements the pressure fluctuation are fast. The pressure change is 4bar/s.

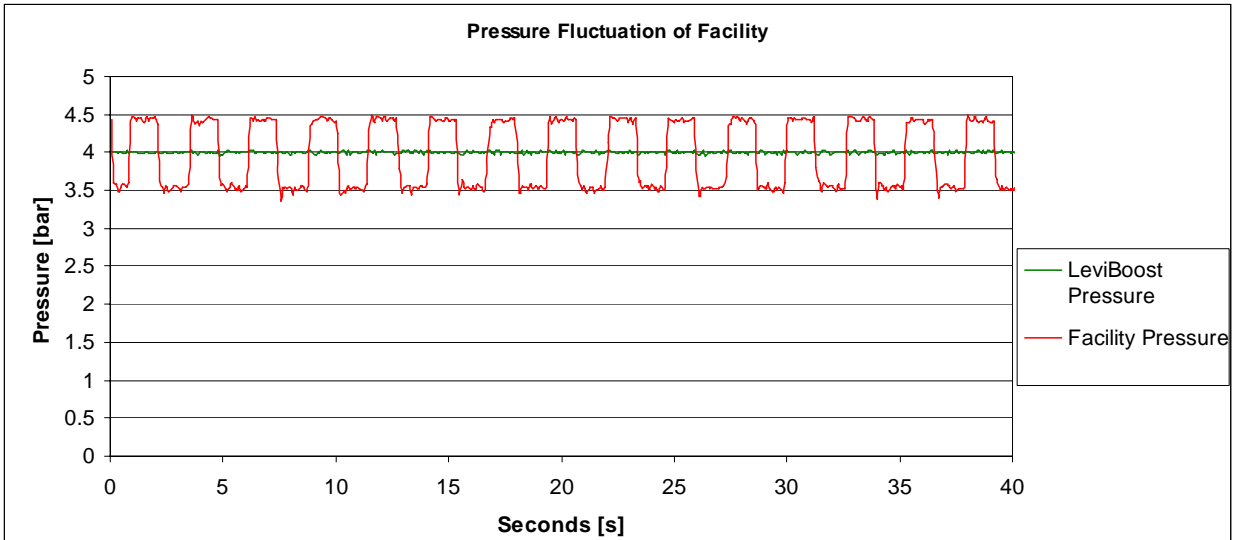


Figure 11

The pump speed is changing less.

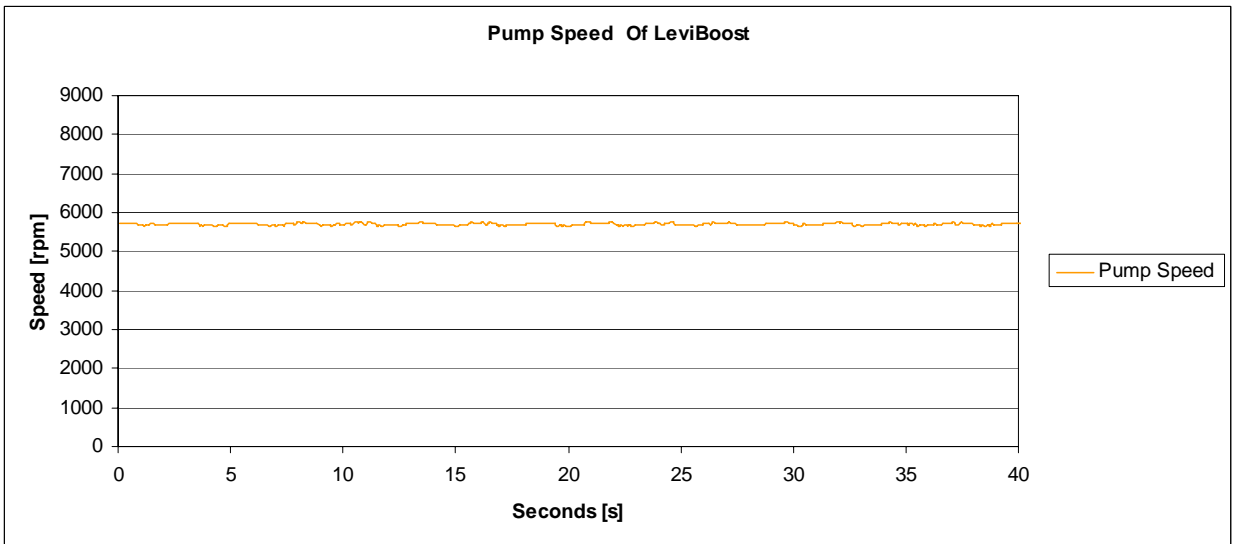


Figure 12

The zoom in figure shows that the POU pressure fluctuations are about 0.1bar.

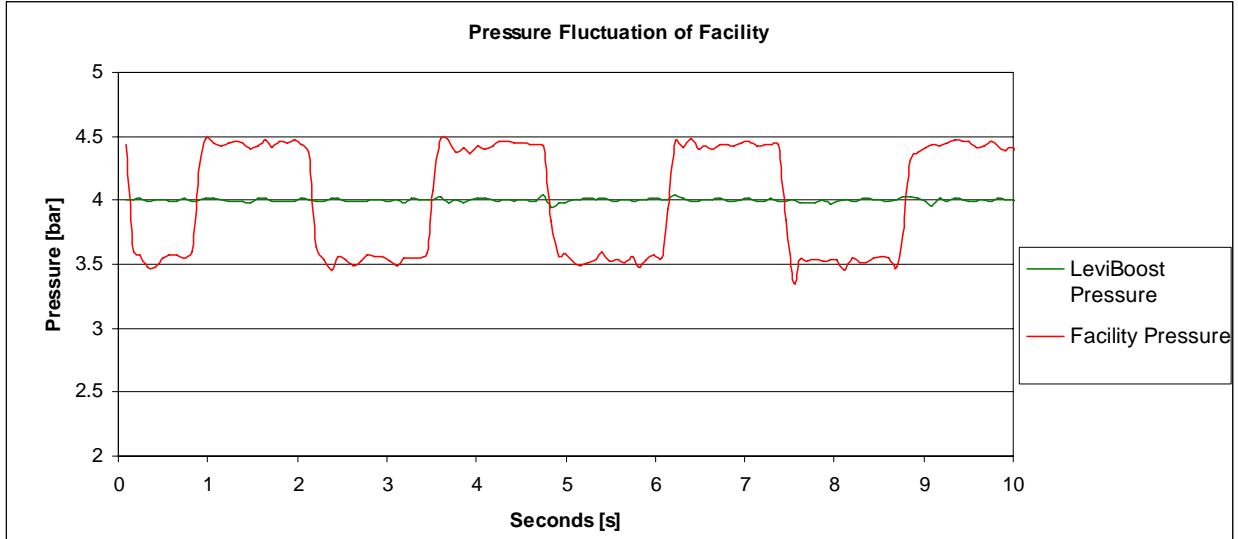


Figure 13

The pump speed is adjusted between 5600rpm and 5800rpm.

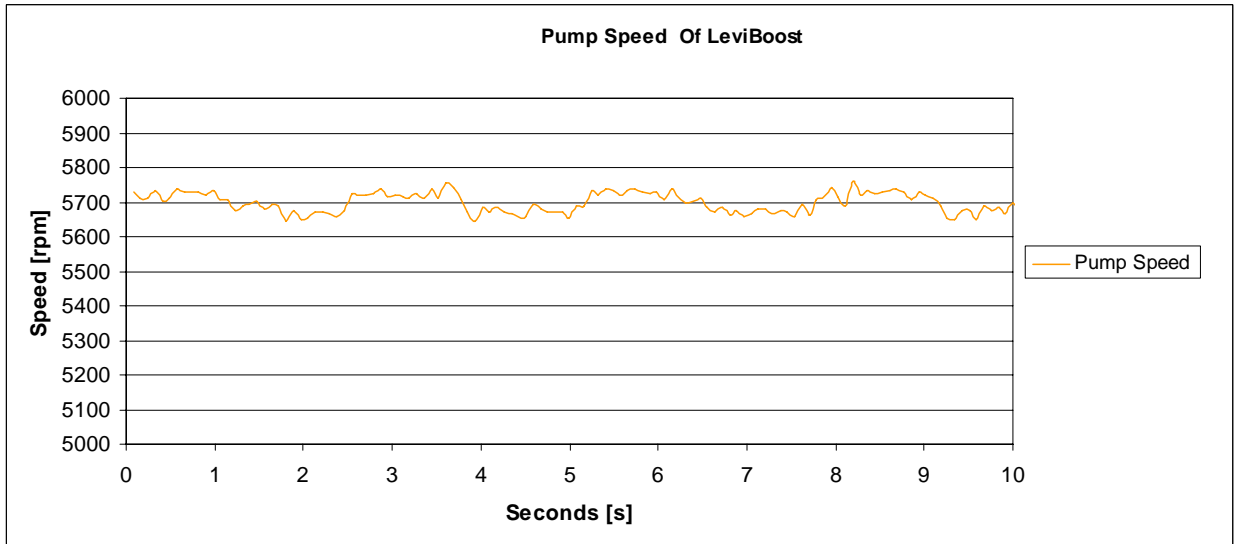


Figure 14

3 SYSTEM WITH PREPRESSURE REGULATOR WITHOUT PRESSURE CONTROLLED LOOP

3.1 POU = 20lpm, Set Point Pressure = not controlled (POU pump turned off), Pressure Fluctuation = 3.5 – 4.5bar and 2bar/s

The following figures show a system with only a prepressure regulator. The pump is turned off and only the prepressure regulator is reducing the pressure fluctuation.

The prepressure fluctuations are between 3.5 bar and 4.5bar. The pressure change is 2bar/s. It is visible that the pressure fluctuation can be reduced but it is still 0.25bar.

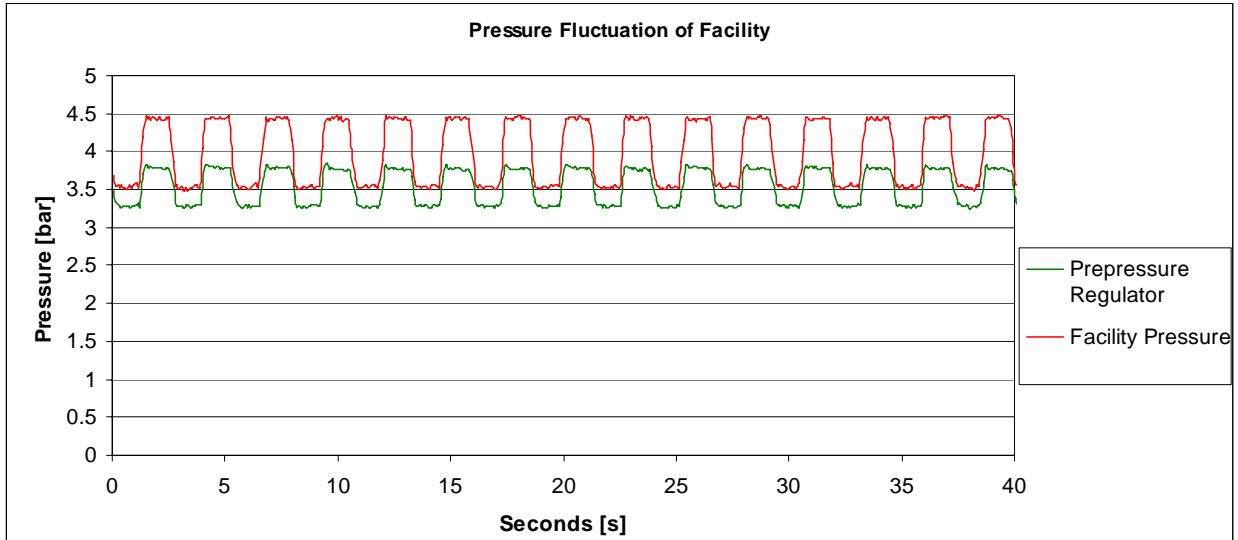


Figure 15

The zoom in figure shows that the POU pressure fluctuations are about 0.25bar.

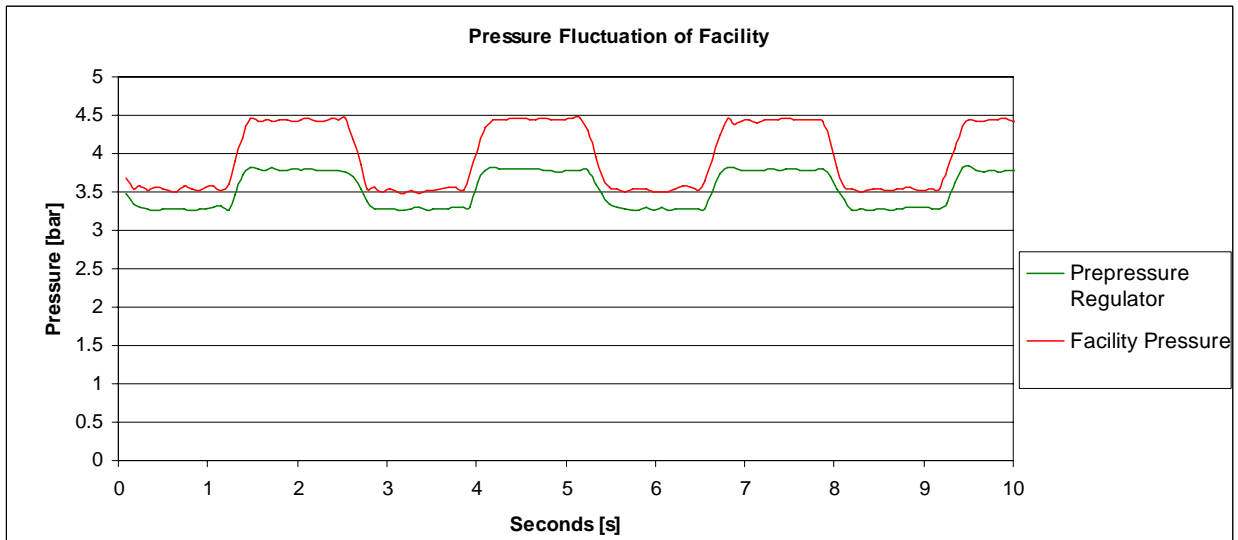


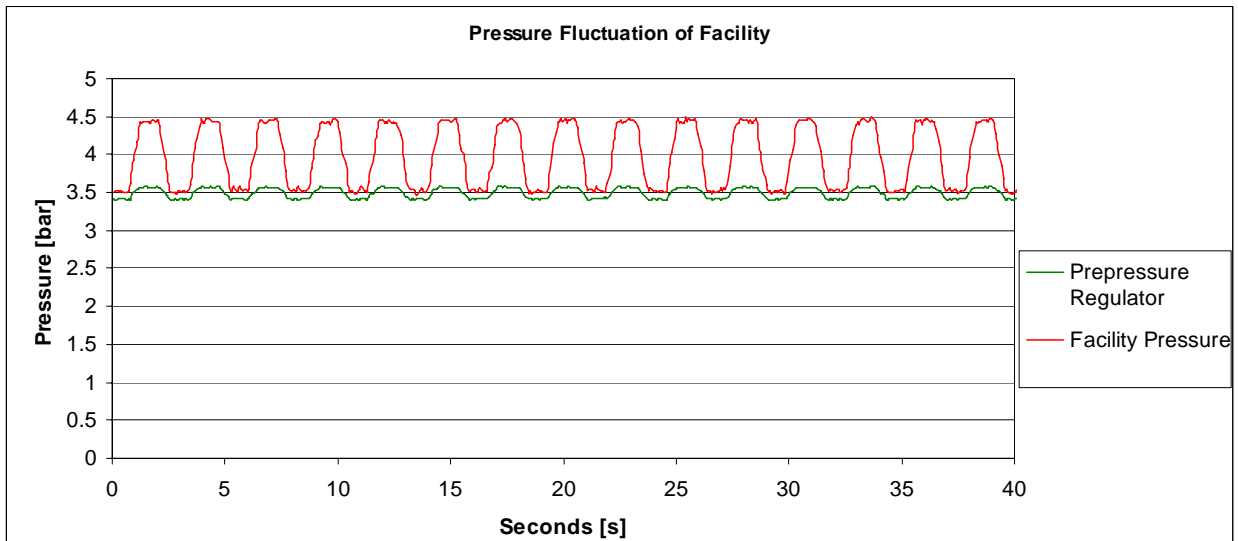
Figure 16

3.2 POU = 20lpm, Set Point Pressure = not controlled (POU pump speed at 4000rpm), Pressure Fluctuation = 3.5 – 4.5bar and 2bar/s

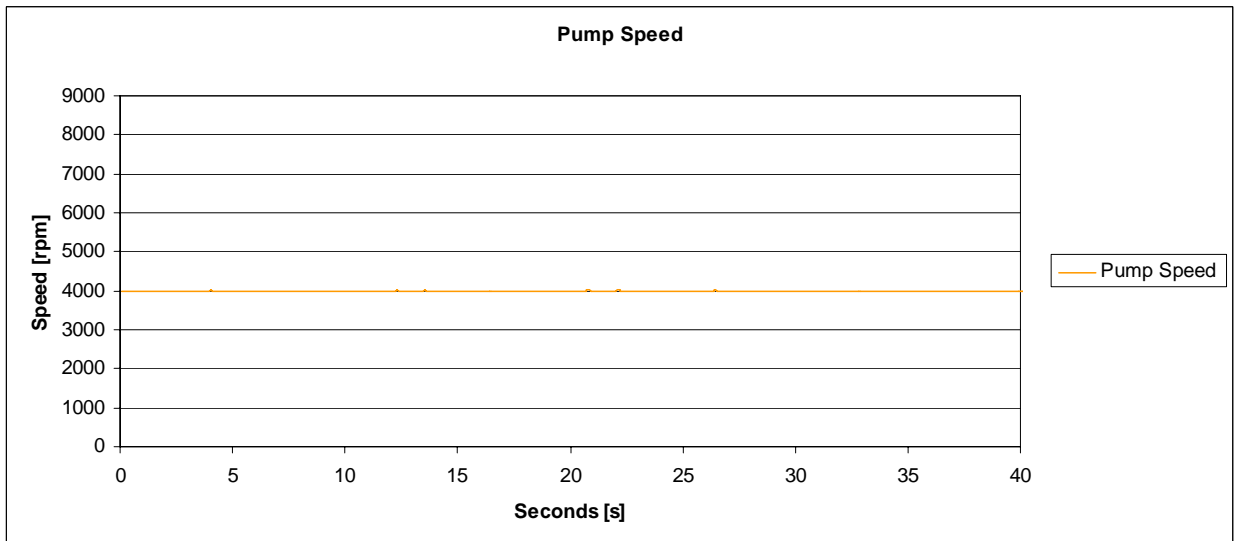
The following figures show a system with a prepressure regulator and a pump which is not pressure controlled. The pump is running with 4000rpm in speed mode and only the prepressure regulator is reducing the pressure fluctuation.

A high pressure difference helps to improve the performance of a prepressure regulator. Because of the working principle of a pressure regulator there is always a difference between setpoint pressure and actual pressure. The prepressure regulator is like a P-controller which is not able to integrate a difference between actual value and setpoint value.

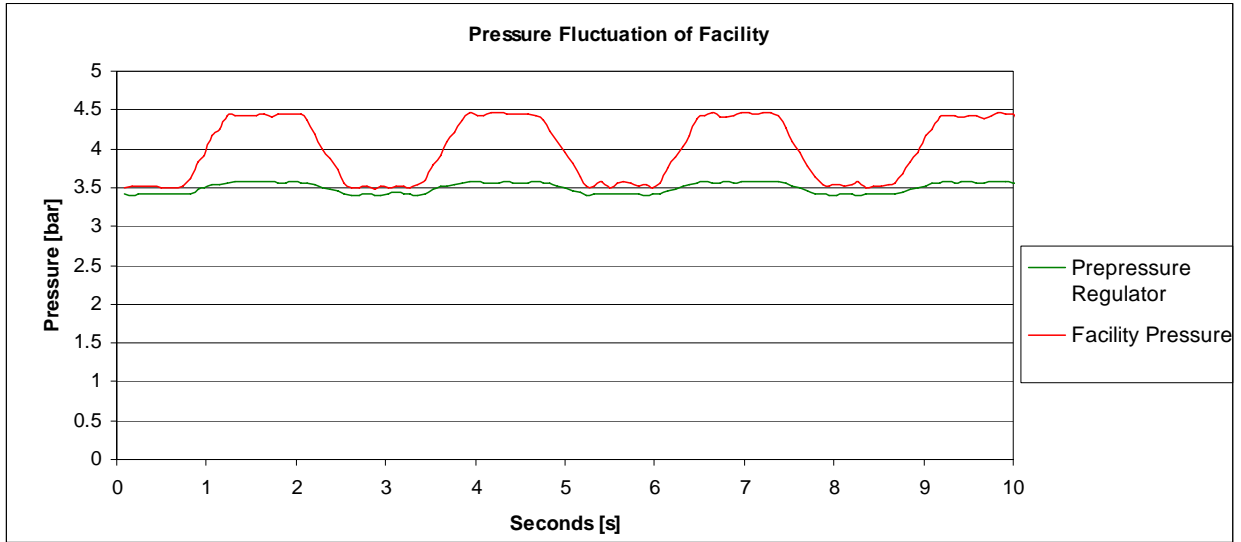
The prepressure fluctuations are between 3.5 bar and 4.5bar. The pressure change is 2bar/s. It is visible that the pressure fluctuation can be reduced, but the fluctuations are about 0.2bar.



The pump speed is fix on 4000rpm.



The zoom in figure show that the pressure fluctuations are at about 0.2bar. It depends on the pressure fluctuation of the facility.



4 DYNAMIC FLOW RATE CHANGE OF POU WITH PREPRESSURE REGULATOR

The following figures are showing changing flow rates. The flow rate is switched between 20 – 30lpm with a valve. The pressure is controlled.

4.1 POU = 20 – 30 lpm, Set Point Pressure = 4bar, Facility Pressure = 2 bar

In the following figure the pump is in the pressure controlled mode. The prepressure is at 2bar and the POU pressure is 4 bar. The flow rate is changing from 20 lpm to 30lpm and back. The pressure is stable because it is in pressure controlled mode. The influence of the flow rate change of 10 lpm can be neglected.

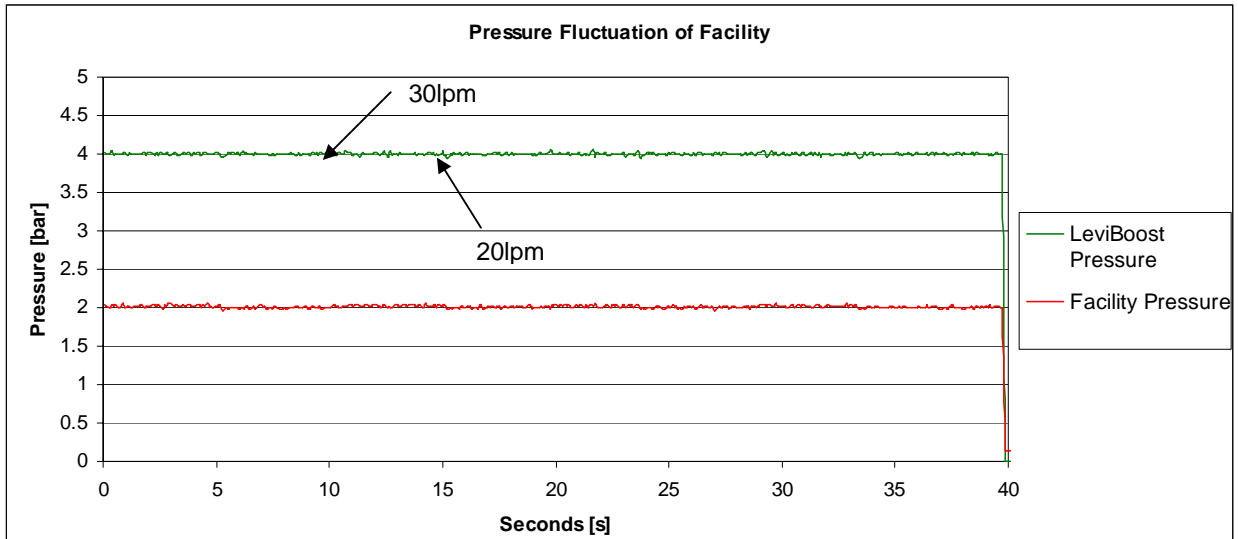


Figure 17

It is visible that the pump speed is changing. If the pump speed is high the flow rate is high.

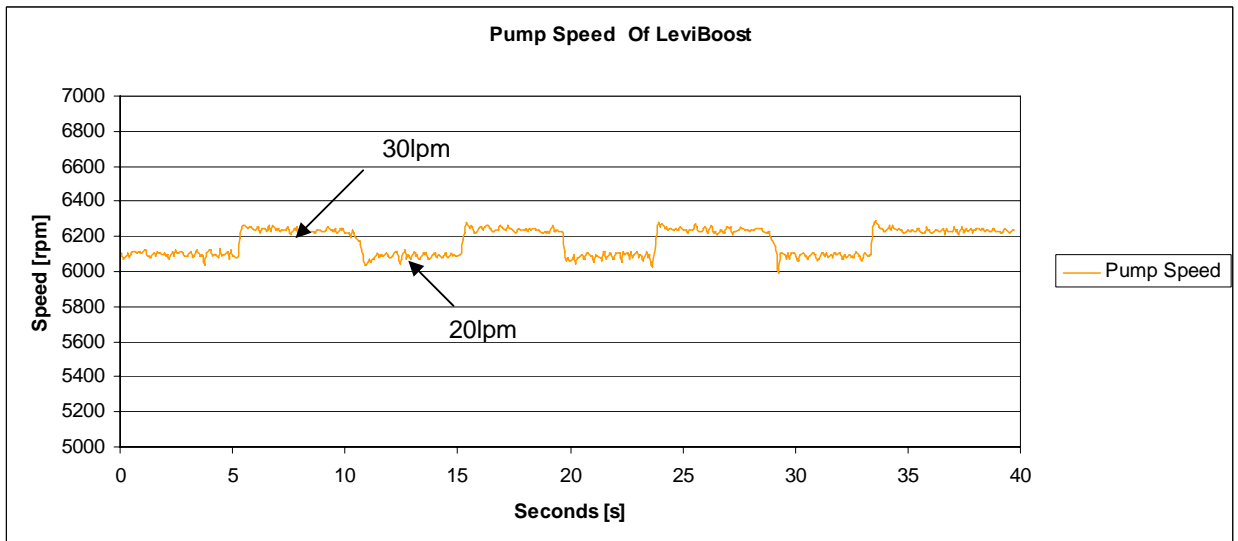


Figure 18

4.2 POU = 20 – 30 lpm, Set Point Pressure = 3bar, Facility Pressure = 2 bar

In the following figure the pump is pressure controlled mode. The prepressure is at 2bar and the POU pressure is 3 bar. The flow rate is changing from 20 lpm to 30lpm and back. The pressure is stable because it is in pressure controlled mode. The influence of the flow rate change of 10 lpm can be neglected.

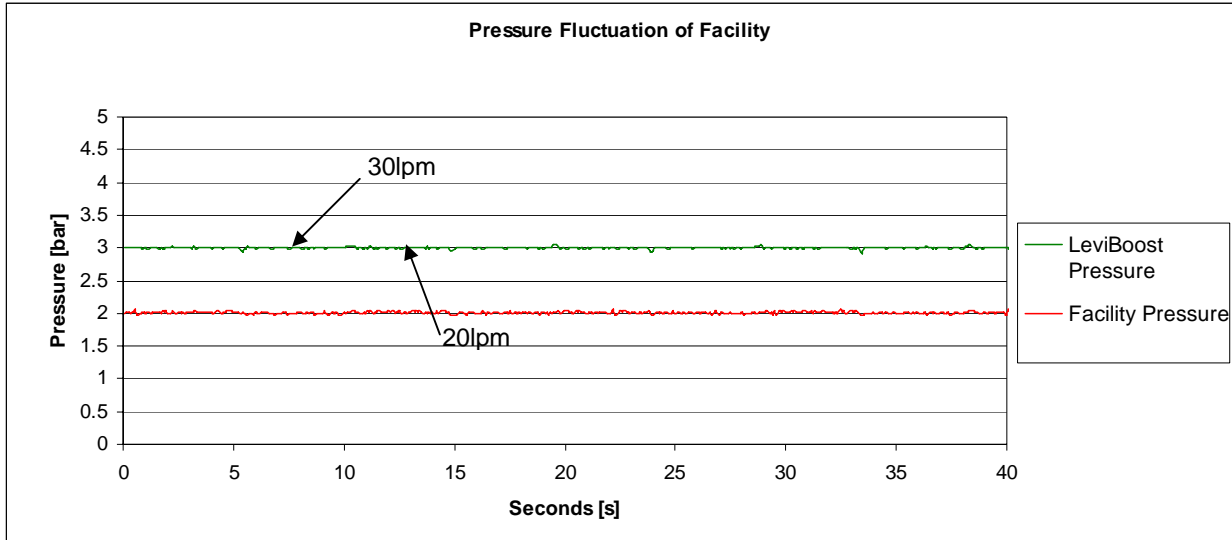


Figure 19

It is visible that the pump speed is changing. If the pump speed is high the flow rate is high.

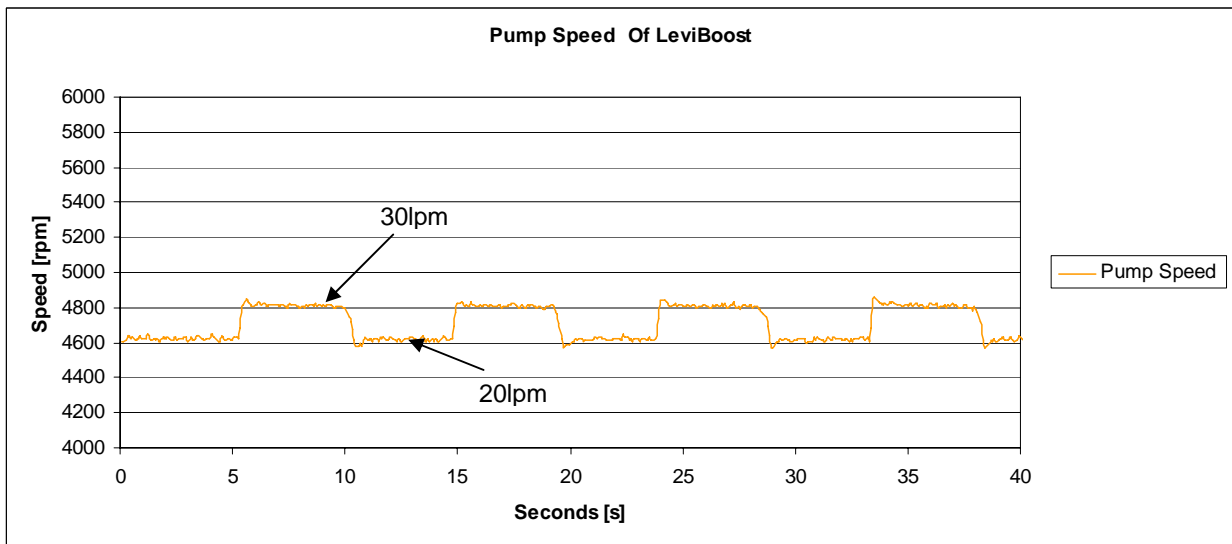


Figure 20

4.3 POU = 20 – 30 lpm, Set Point Pressure = 2bar, Facility Pressure = 2 bar

In the following figure the pump is pressure controlled mode. The prepressure is at 2bar and the POU pressure is 2 bar. The flow rate is changing from 20 lpm to 30lpm and back. The pressure is stable because it is in pressure controlled mode. The influence of the flow rate change of 10 lpm can be neglected.

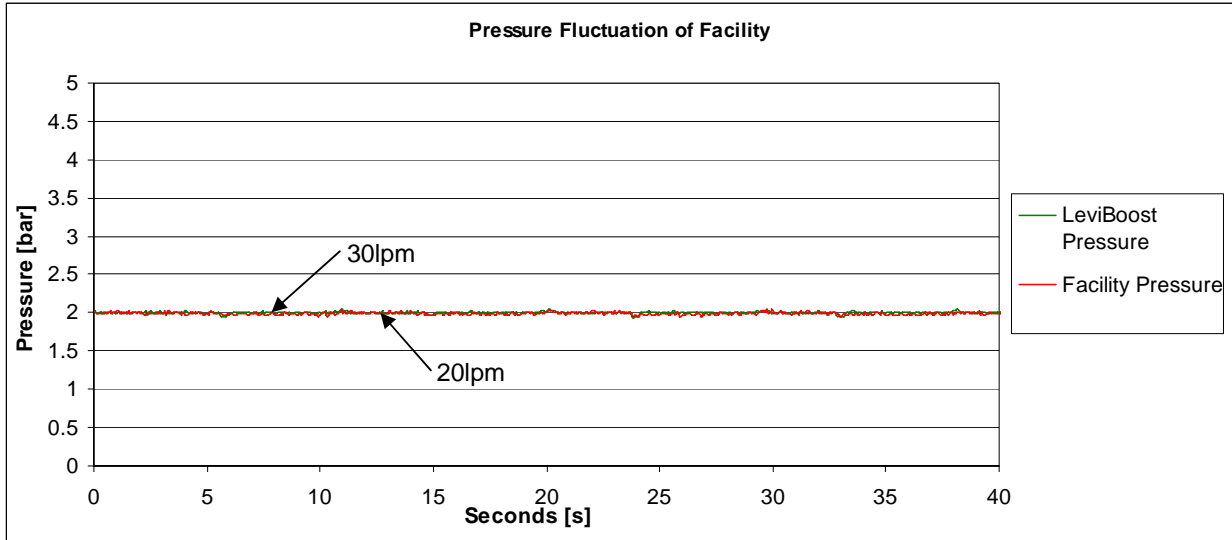


Figure 21

It is visible that the pump speed is changing. If the pump speed is high the flow rate is high.

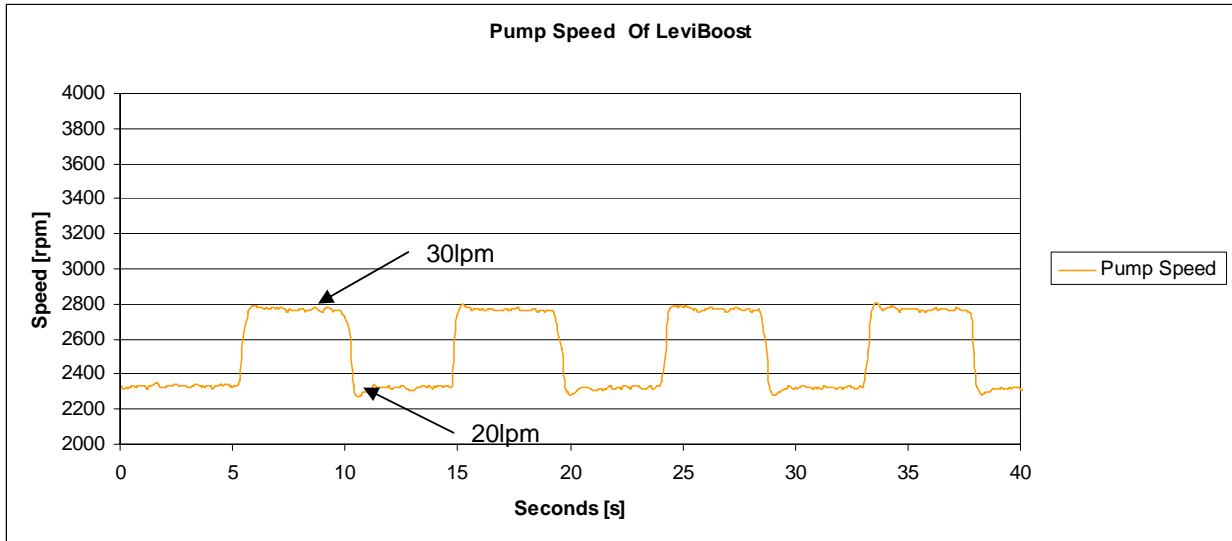


Figure 22

5 STATIC PRESSURE CHANGE OF FACILITY WITH PREPRESSURE REGULATOR

In the following figures shows a changing prepressure. The prepressure is increased in steps from 1 to 5 bar. The POU pressure is actively controlled. Static pressure changes can occur if there is a filter in the loop which is clogging.

5.1 POU = 20lpm, Set Point Pressure = 4bar, Facility Pressure Change = 1 – 5 bar

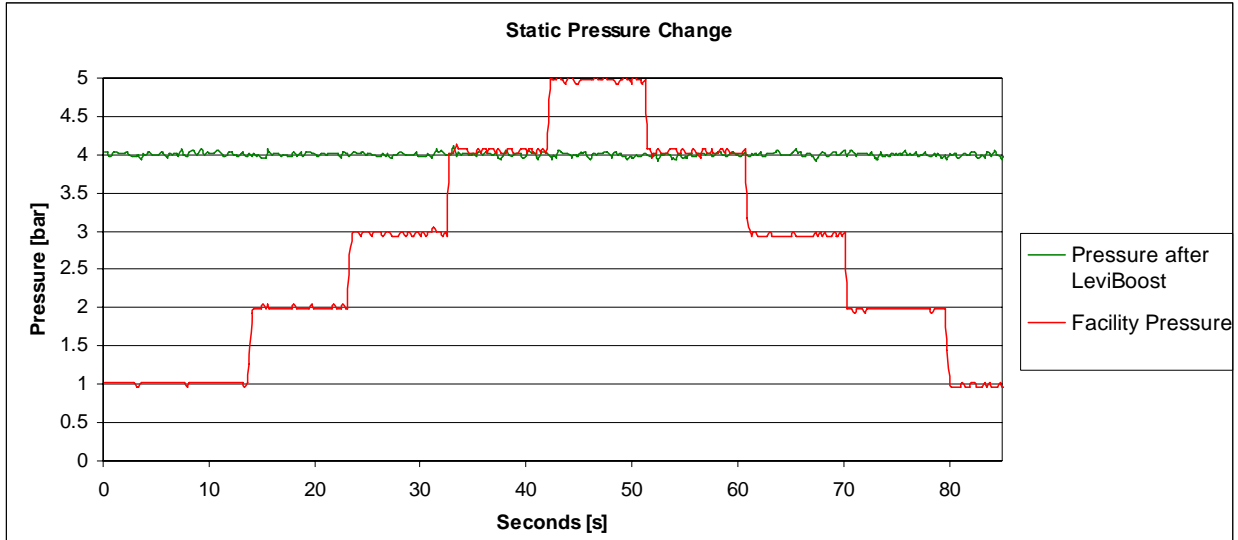


Figure 23

6 DYNAMIC PRESSURE FLUCTUATION OF FACILITY WITHOUT PREPRESSURE REGULATOR

6.1 POU = 20lpm, Set Point Pressure = 4bar, Pressure Fluctuation = 3 – 3.5bar

The prepressure fluctuations are between 3 bar and 3.5 bar. In the following measurements the pressure fluctuation speed is moderate. The pressure change is 2bar/s.

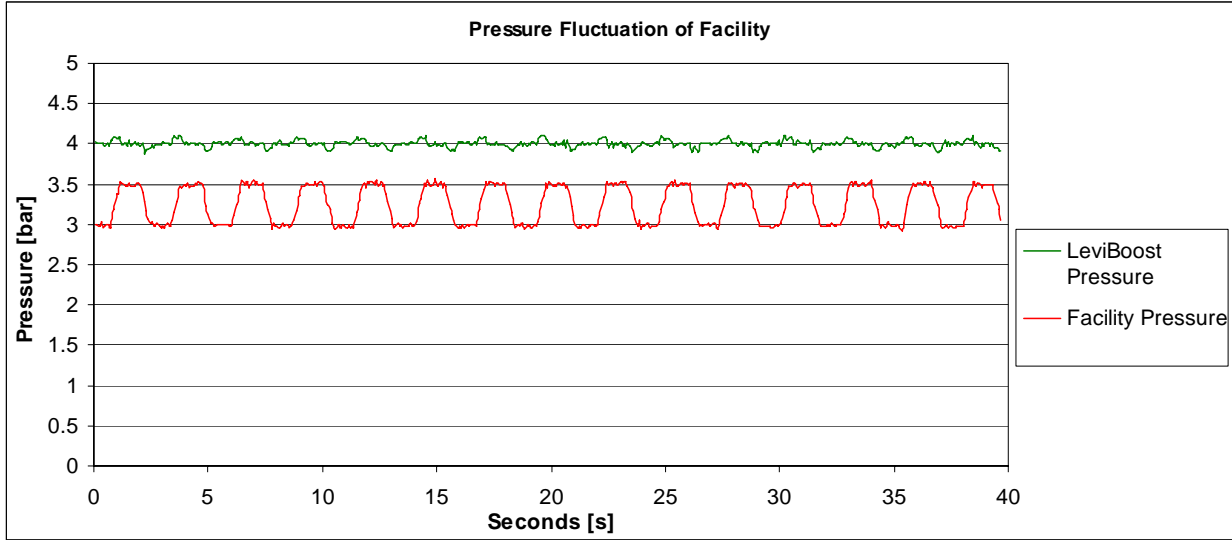


Figure 24

The pump speed is changing.

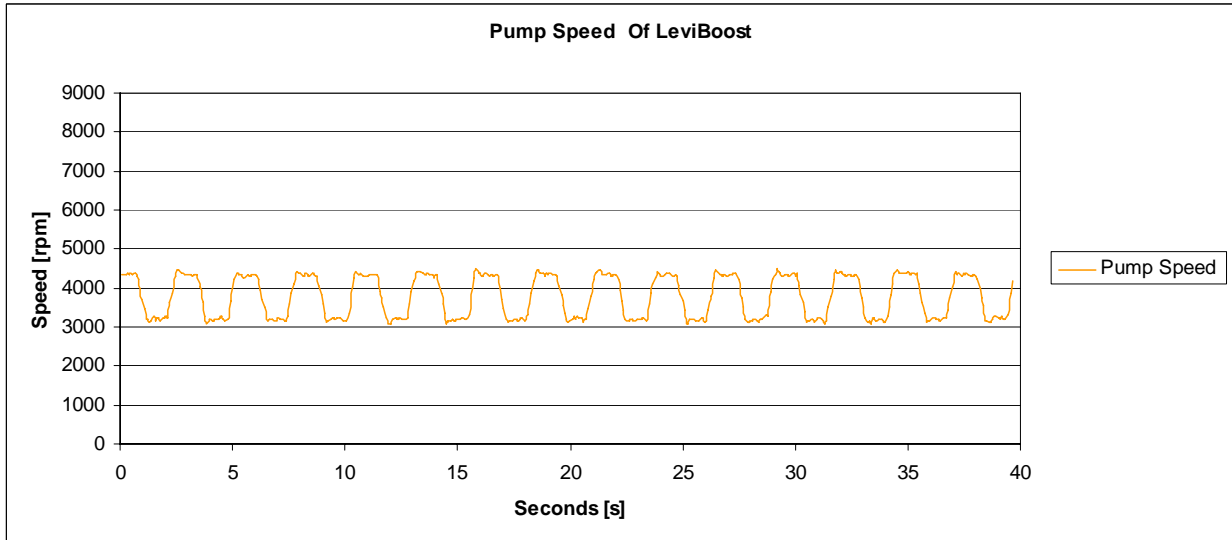


Figure 25

The zoom in figure shows that a pressure fluctuation without prepressure regulator has an impact of 0.1bar on the POU pressure. The pump is reacting on the pressure fluctuation.

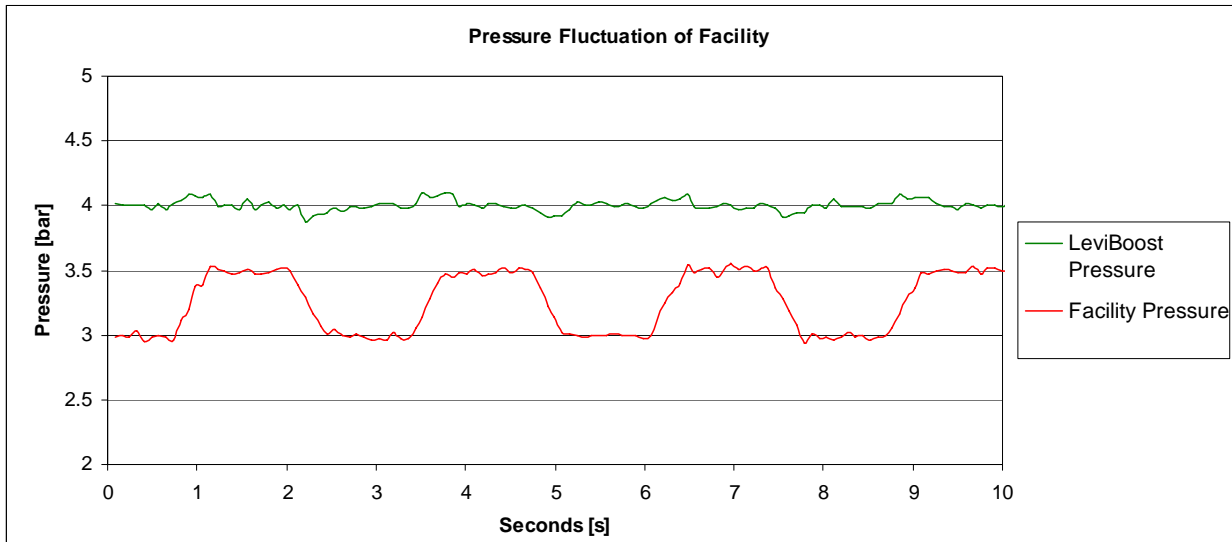


Figure 26

The pump speed is changing between 3000 and 4500rpm.

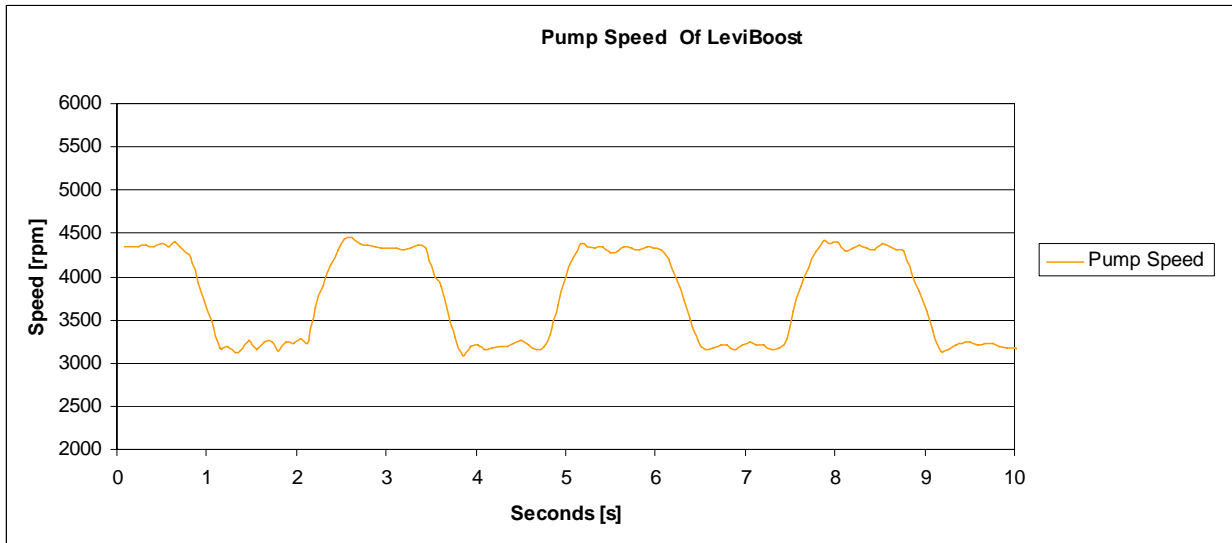


Figure 27

7 DYNAMIC FLOW RATE CHANGE OF POU WITHOUT PREPRESSURE REGULATOR

7.1 POU = 20 – 30 lpm, Set Point Pressure = 4bar, Facility Pressure = 2 bar

In the following figure the pump is pressure controlled mode. The prepressure is at 2bar and the POU pressure is 4 bar. The flow rate is changing from 20 lpm to 30lpm and back. The pressure is stable because it is in pressure controlled mode.

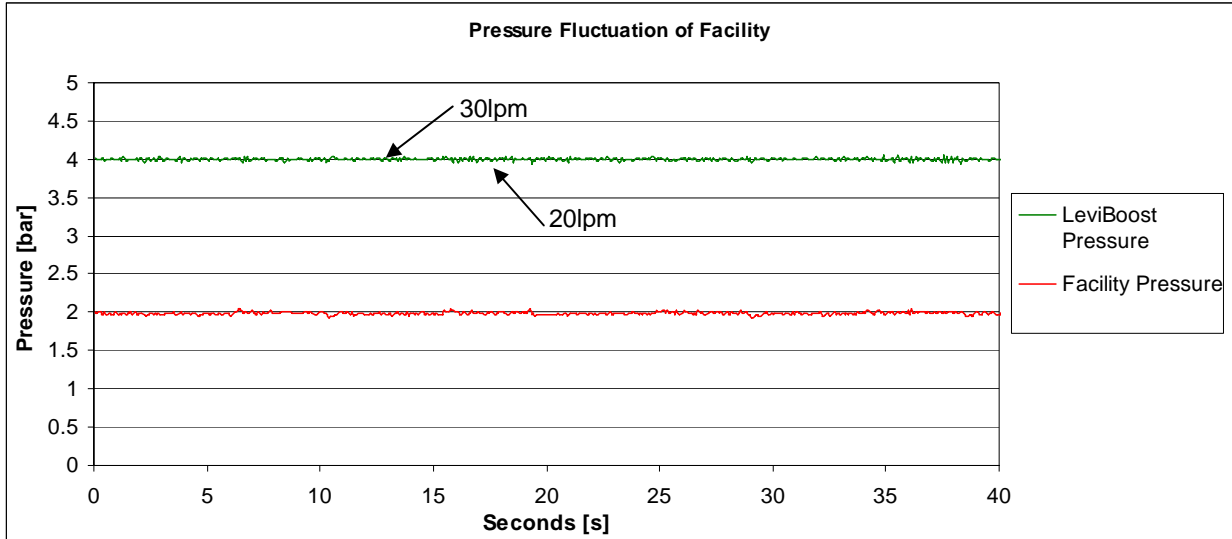


Figure 28

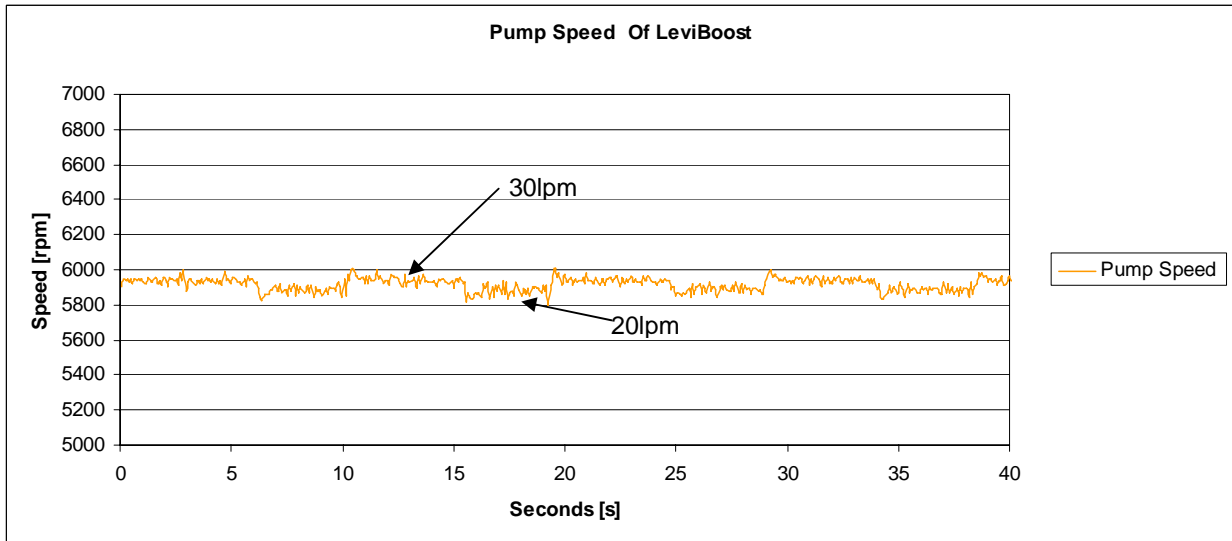


Figure 29

7.2 POU = 20 – 30 lpm, Set Point Pressure = 3bar, Facility Pressure = 2 bar

In the following figure the pump is pressure controlled mode. The prepressure is at 2bar and the POU pressure is 3 bar. The flow rate is changing from 20 lpm to 30lpm and back. The pressure is stable because it is in pressure controlled mode.

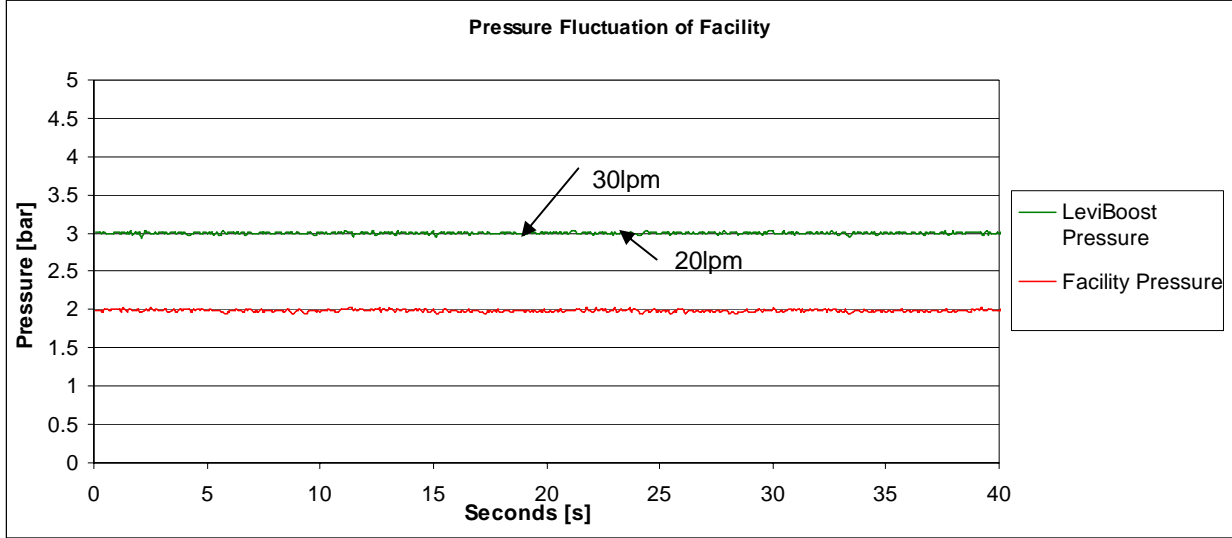


Figure 30

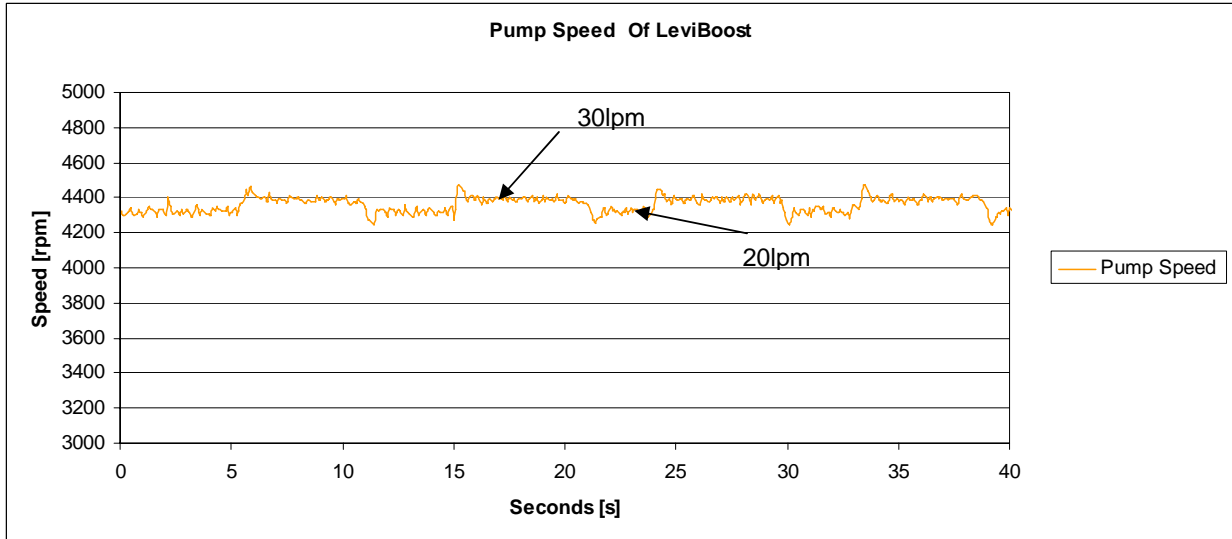


Figure 31

8 CONCLUSION

The measurements show that it is possible to have a constant pressure at 4 bar with a pressure controlled loop. Also pressure peaks higher than the POU pressure can be reduced with a pressure regulator.

It could be shown that a fast prepressure fluctuation 4bar/s (figure 11 and 13) is influencing the controlled POU pressure less than 0.1bar.

Also changing flow rates of 10l/min did not show a visible influence on the controlled POU pressure.

The LEVIBOOST™ system delivers a constant pressure. (option: the prepressure regulator can be also ordered together with the LEVIBOOST™ kit)