PARALLEL PUMPING WITH BPS SERIES PUMP SYSTEMS

Introduction

The BPS series pump systems can be put in parallel to increase the flow rate. The possibility to control system flow and pressure with the variable speed of the BPS pump systems still exists in the parallel configuration. A further aspect of parallel pumping is a partly or even 100% redundancy that can be achieved.

Parallel Pumping for Higher Flow

If the flow that can be achieved with one pump is not high enough, it can be raised by putting additional pumps in parallel. Each pump carries a portion of the overall flow. If the pumps are identical, the flow is ideally uniformly distributed among all pumps. The pressure over each parallel branch of such a configuration is the same and thus can't be higher than the maximum pressure of a single pump.

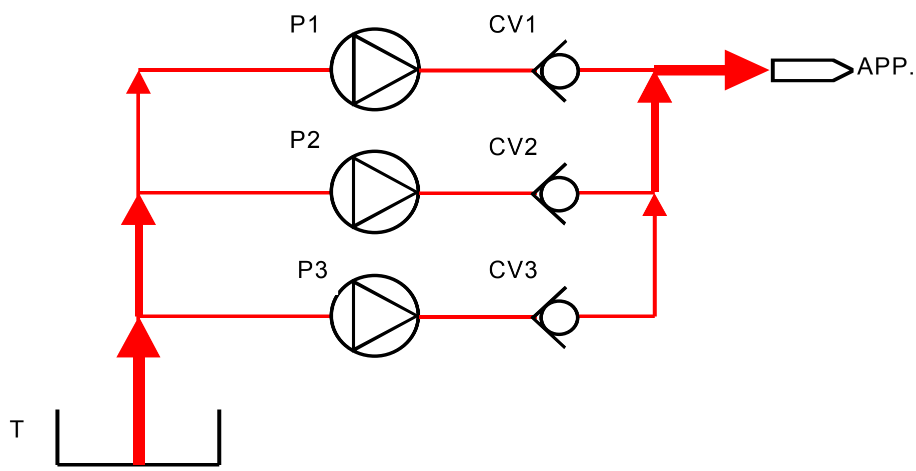

Figure 1: Three Pumps in Parallel

T: Tank
P1-P3: Levitronix pump (BPS Series)
CV1-CV3: Check valve

Installation

Check Valve

A check valve has to be placed in line to every pump of the parallel arrangement (Figure 1). The check valve helps to get uniformly distributed flow among the pumps and prevents the whole parallel system from a breakdown in case of a significant pressure drop of one pump. Such a pressure drop could occur if air gets into one pump, if the speed of the pumps are different (for example during the startup phase), or if one pump breaks down. Without a check valve the affected pump would see a high backflow driven by the higher pressure of the correctly running pumps of the parallel system. Consequently the flow through the remaining pumps would go up dramatically, which would result in a loss of pressure over the parallel configuration (Figure 2 left). The check valve prevents a backflow in the branch of the parallel configuration and the non defective pumps are still able to feed the application (Figure 2 right).

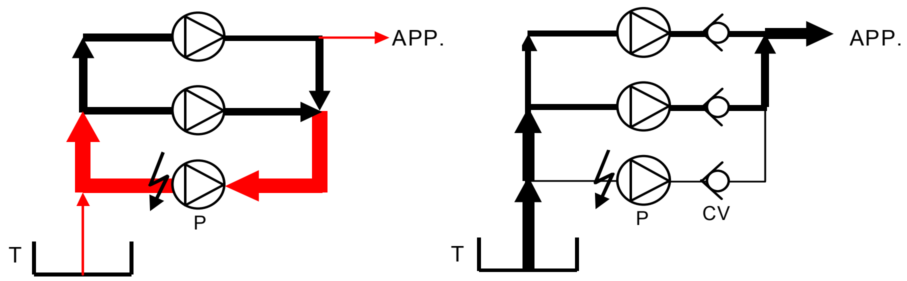

***Figure 2: Pump failure without check valve (left)
pump failure with check valve (right)***

T: Tank
P: Levitronix pump (BPS Series)
CV: Check Valve

Due to the flat pump characteristic of the BPS series pumps the flow dependent friction losses over the check valve and the lines improve the uniformity of the flow distribution among the pumps. This flow dependent pressure drop brings down the characteristic curve of a parallel branch.

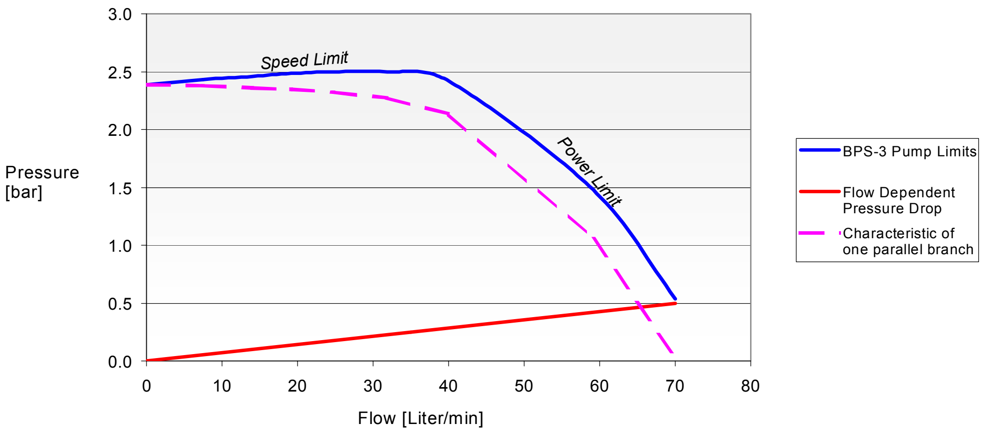

Figure 3: Influence of flow dependent pressure drop

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Calculate the Resulting Flow

Operating two pumps in parallel the assumption is made that the flow will double. This however is not the case. In order to calculate the additional flow realized by running pumps in parallel the system head curve has to be considered. Two pumps in parallel are just able to deliver double flow at the same pressure. However for higher flow normally also higher pressure is needed to compensate the higher friction losses in the hydraulic load. If the relationship between pressure requirement and flow of a system is known, the resulting flow of a parallel pumping setup can be calculated.
Figure 4 shows the characteristic curves of one, two and three BPS-3 systems in parallel and a system head curve of a high flow application. It can be seen that the maximum flow of three pumps in parallel (point C) is not three times higher than the maximum flow of a single pump (point A).

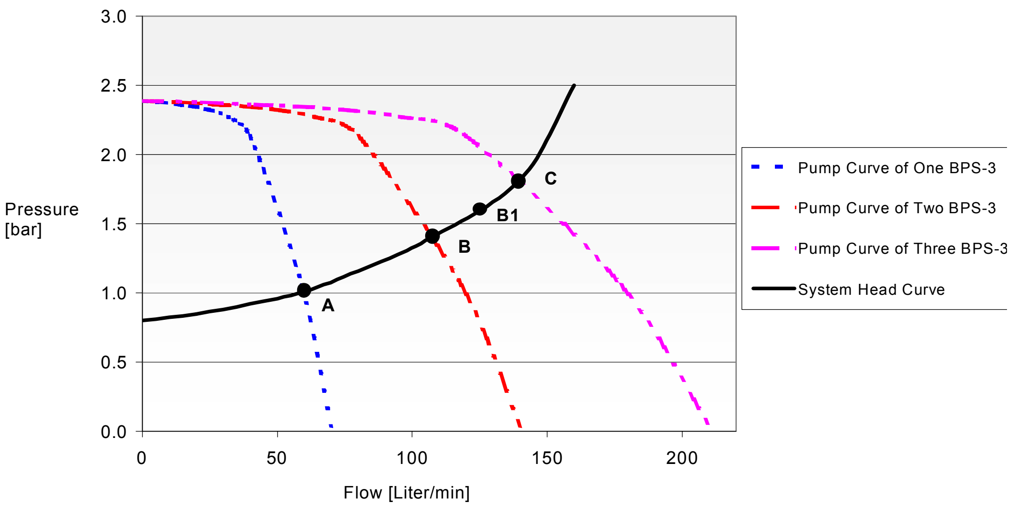

Figure 4: Influence of the system head curve on the resulting flow

Control Methods

The preferable method to control a system with BPS pumps in parallel is controlling the speed, which is the same for each pump. Compared to control methods with different pump speeds this method provides the following advantages:

- **Best possible flow distribution among the pumps.**
- **Best possible pump performance without additional cooling (no overheating of a pump, while the other pumps are still cold).**
- **The system can be controlled from zero to maximum pump power.**
- **The same speed reference can be used for each pump.**

Redundancy of Parallel Pumping

Partly Redundant Systems

An important aspect of parallel pumping is redundancy. In case of a pump failure the remaining functional pumps automatically take over a part of the flow of the defective pump (if check valves are installed). If for example in a system of three BPS-3 systems running at point B1 (Figure 4) one pump breaks down, the flow can still be kept at point B. The flow will not drop to 66% of the value before the failure because of two reasons. The first reason is the increase of the pump power of each remaining pump and the second reason is the system head curve that has a positive effect on the loss of flow (because also the need for pressure goes down).

100% Redundant Systems

If 100% redundancy is required one additional pump has to be added to the system. An example for complete redundancy would be an application with the need for point B (Figure 4) that is equipped with three pumps in parallel.
If more than one pump is required to meet the specifications of the application, a solution with one additional pump might even be the most economic solution. Instead of using the next bigger pump to meet the flow requirement of an application and adding a second one for redundancy, it is often cheaper to install three smaller pumps in parallel. The same smaller pump could also be used for other applications, which would have a positive effect on the costs for purchasing, spare parts keeping or technical training.

Technical Support

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