Why parallel pumping of pumps?

Normally, pumps are operated in parallel to meet variable capacity requirements and for emergency back up (installed spare). Pumps in parallel delivers larger volume flow than one pump can handle alone.

Parallel pumping is very common in many industries, including the Municipal Water and Wastewater markets. Parallel pumping typically involves using number of pumps. The suction to the pumps is via either individual pipeline or from a manifold via individual pipeline and the discharge of pumps into a common header.

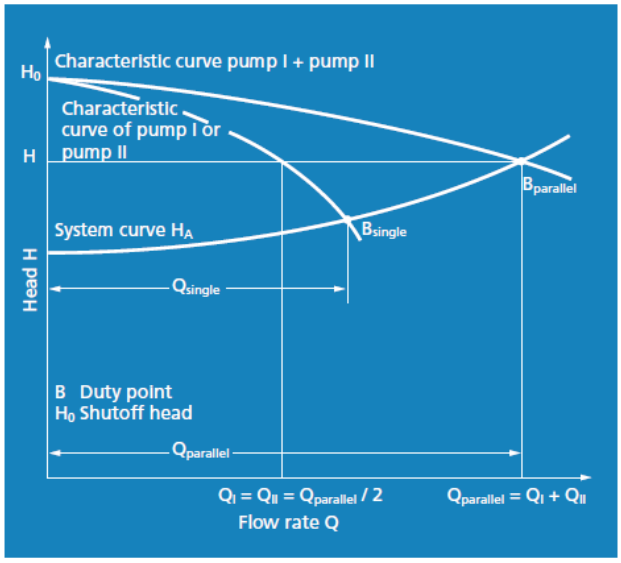
Buying and running two small pumps is economical than buying and maintaining a single large pump.

Principle of Parallel Pumping of Pumps :

A centrifugal pump will pump the fluid at the point where the system curve intersects the pump curve. When the pumps run in parallel, they operate against same discharge head.

Two pumps in parallel will deliver less than twice the flow rate of a single pump (Q single) in the system because of the increased friction in the piping, same is for number of pumps more than two. As more pumps are placed in operation, the incremental increase in pumping capacity becomes smaller.

The shape of the system head curve will determines actual increase in capacity with multiple pumps.



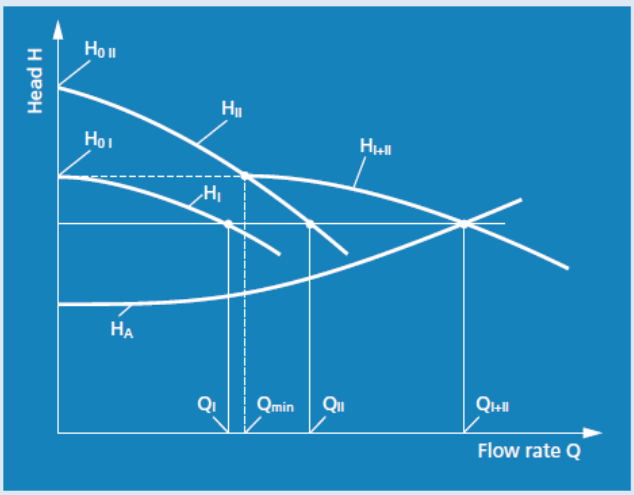


Fig. 8: Parallel operation of two dissimilar pumps

Important Points While Designing Parallel Pumping :

If the pumps are not properly selected for parallel operation, or if these are not operated in the most optimum combinations, pump reliability and overall system energy efficiency can be affected.

Operating the wrongly selected pumps or dissimilar pump models in parallel can cause one of the pumps to operate at shut off and damaging the pumps. In case of dissimilar pump models having different shut off heads, pump can run satisfactory only if shut off head of the smaller pump is not exceeded.

Similarly, pumps with unstable characteristics may give trouble, unless running of the pumps only in steep portion of the curve is assured.

In general, parallel pumps provide good operating flexibility in static head-dominated systems (with less frictional variable head), but are not nearly as effective in friction-dominated systems.

Duty Point Selection of Individual Pump in Parallel Pumping :

Duty point for individual pump is selected based on mode of operation, considering efficiency of each pump the pump system and NPSH of the pumps.

If all the pumps in parallel pumping are planned to run continuously, then the pump duty point near to BEP should be selected for individual pump. However, in that case it must be ensured that if a single pump is run, the individual pump may run at the right side of BEP, is within safe operating limits and motor should be selected with sufficient power margin. If the individual pump operates at too much right of BEP, outside safe zone, pump may cavitate, vibrate and also may give shaft deflection damaging pump parts.

On the other hand if parallel pumping is very occasional to meet peak demand, then pump should be selected such that single pump operation is near BEP (which is for most of the time). During parallel running of all the pumps, the duty point of the individual pump shifts towards left of the BEP.

Variable Speed Control in Parallel Pumping :

There are three basic ways that a VFD can be used to control two identical pumps operating in parallel.

1) Running Of All The Pumps With Single VFD:

The first method uses a single drive sized to operate both identical pumps simultaneously. Both the pumps run at identical speeds and changes in system conditions result in identical speed changes.
This configuration is more often seen in industrial applications and can be the result of application growth and the addition of a second identical pump. This control scheme is best suited for applications where minimum flow always exceeds the capacity of a single pump. Both pumps can also take advantage of soft start and stop via the shared drive.

2) Running And Adjusting The Primary Pumps With VFD:

The second option utilizes a single drive that is sized to control the primary pump. If flow reaches some preset maximum or pressure falls to some preset minimum, the secondary pump is started across the line and runs at full speed. The VFD reduces the speed of the primary pump and then attempts to maintain the required conditions. Although this control scheme has a lower initial cost, the savings may not be worth some of the negatives that can arise. For example, in some constant pressure systems, a control valve (PRV) will be required to prevent over pressure by the secondary pump. There is also a good probability that the primary pump will operate well to the left of BEP during parallel operation. And, only the primary pump can take advantage of soft start and stop.

3) Running All The Pumps With Individual VFD :

The third option uses an individual drive to control each pump and results in a more complex control scheme that allows communication between the two drives. In a typical scenario, the primary pump is controlled by drive 1. If conditions exceed its capacity, drive 2 starts the secondary pump and attempts to meet the system requirements. Over a period of several seconds, the pumps are coordinated and run at the same speed (similar to our first example). As flow decreases, one pump is slowly brought off line and a single pump remains on line. Advantages of this control method include alternation of the primary pump, a wider range of variable speed flow, and soft start & stop of both pumps.

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