Grundfos ECADEMY

Pump selection basics

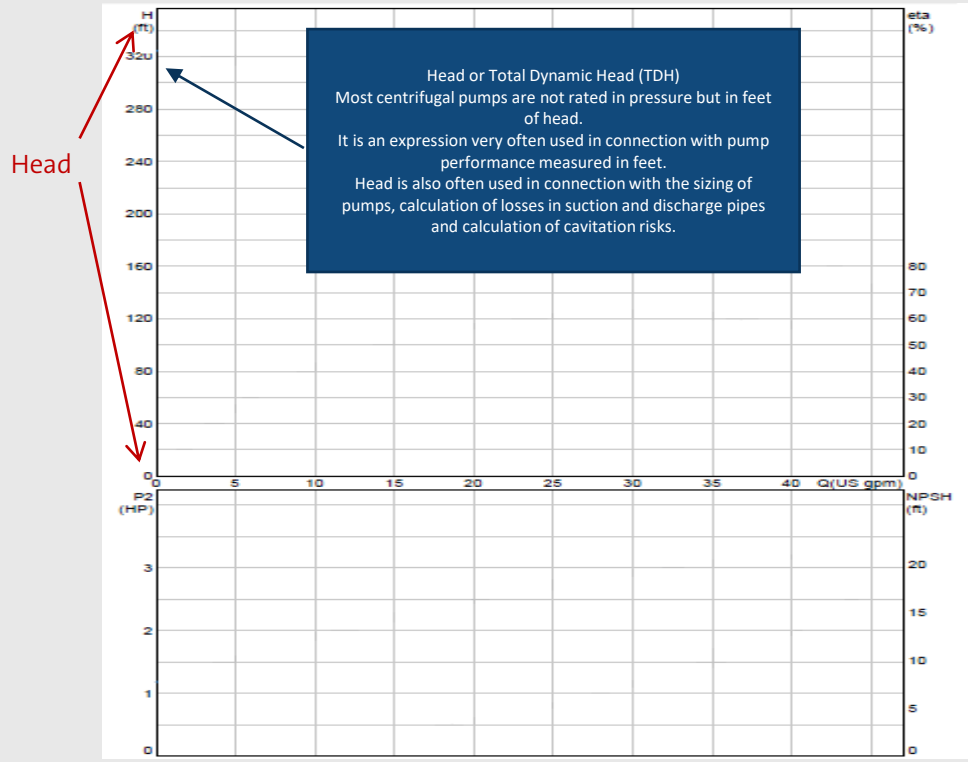
Understanding the Pump Curve

GRUNDFOS

Possibility in every drop

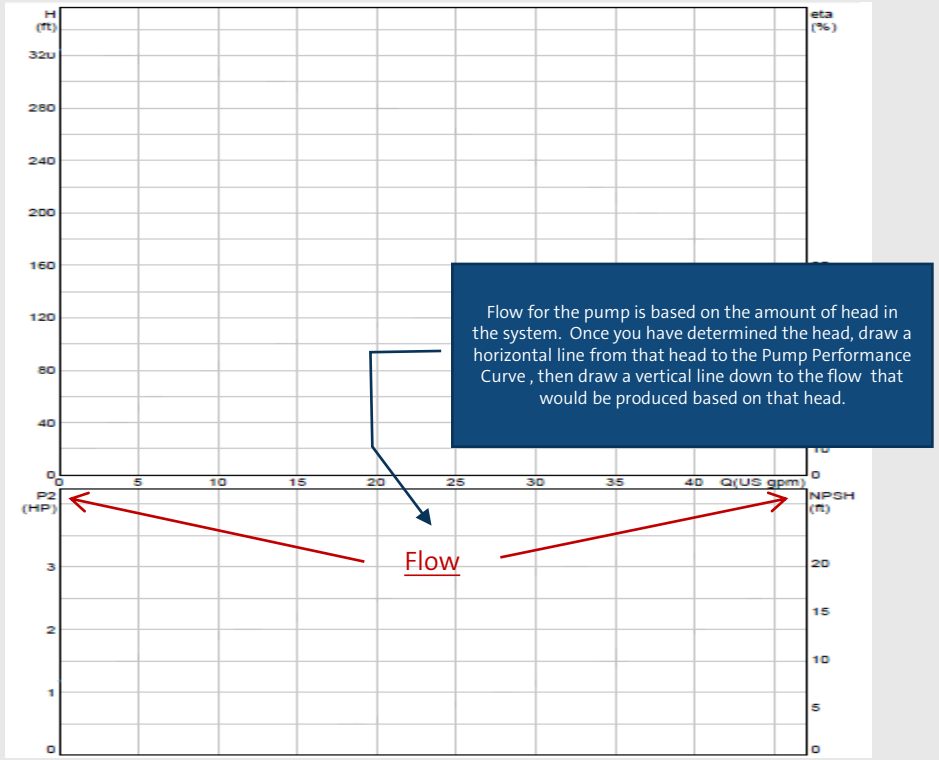
Understanding the pump curve

- The range for this chart goes from 0 Feet of head up to just over 320 feet of head



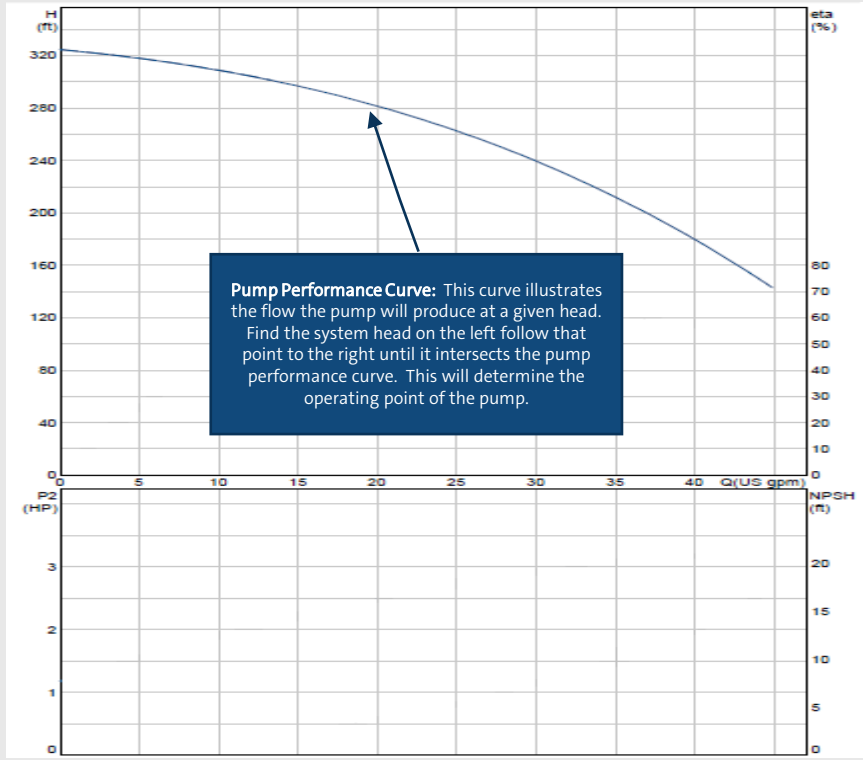
Understanding the pump curve

- The range for this chart goes from 0 gallons per minute up to just over 45 gallons per minute (the 45 would be the line under the Q (US gpm) symbol.



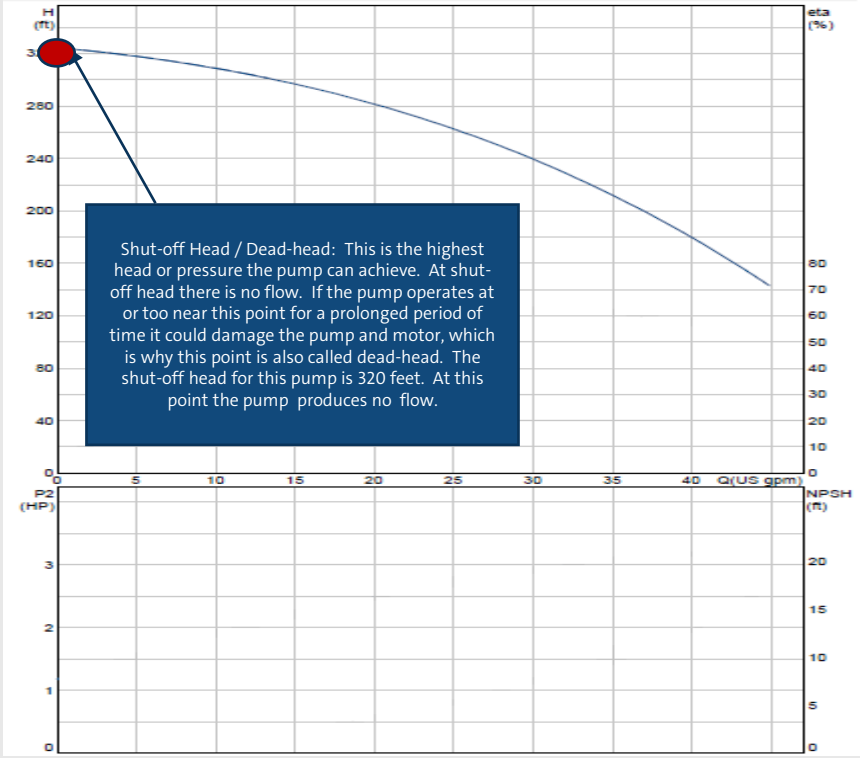
Understanding the pump curve

- For this course we are just going to look at the operation of a single fixed speed pump. To learn about variable speed pump operation go to www.grundfos.us/training.
- We can now see that this pump is capable of operating from just over 320 feet of head producing (0) zero gallons per minute, down to around 140 feet of head will produce 45 gallons per minute.
- A fixed speed pump will always work along its performance curve, and will produce a flow based on the current head in the system.



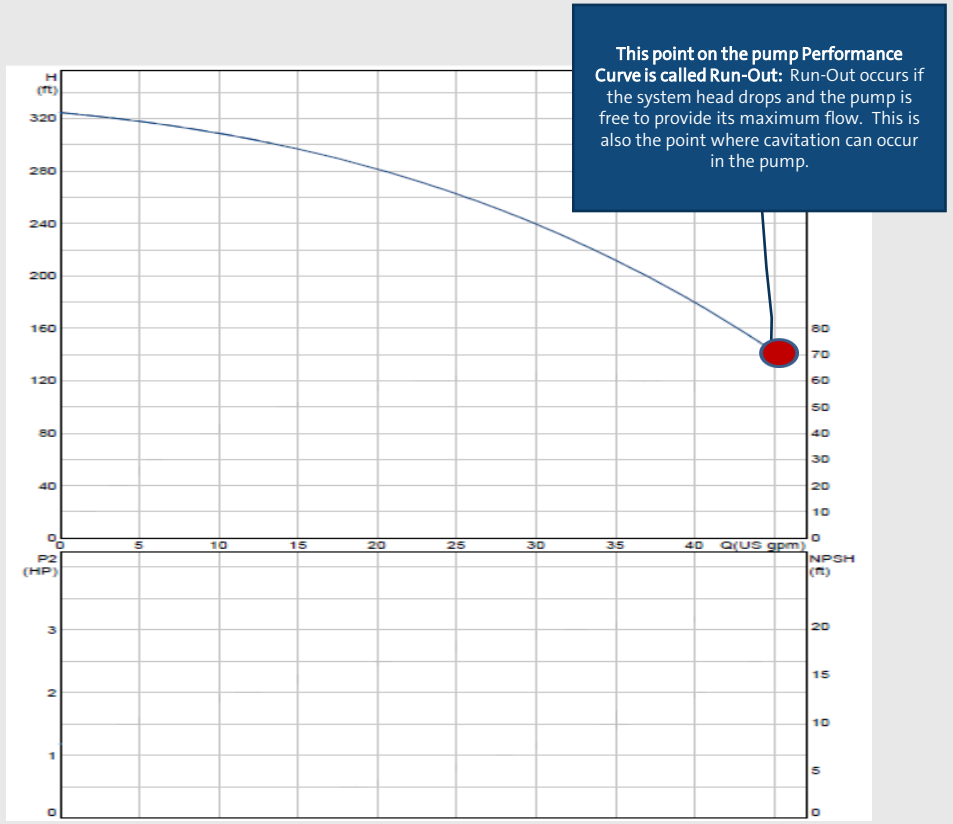
Understanding the pump curve

- Shut-off Head / Dead-head: This is the highest head or pressure the pump can achieve. At shut-off head there is no flow.
- The shut-off head for this pump is 320 feet. At this point the pump produces no flow.



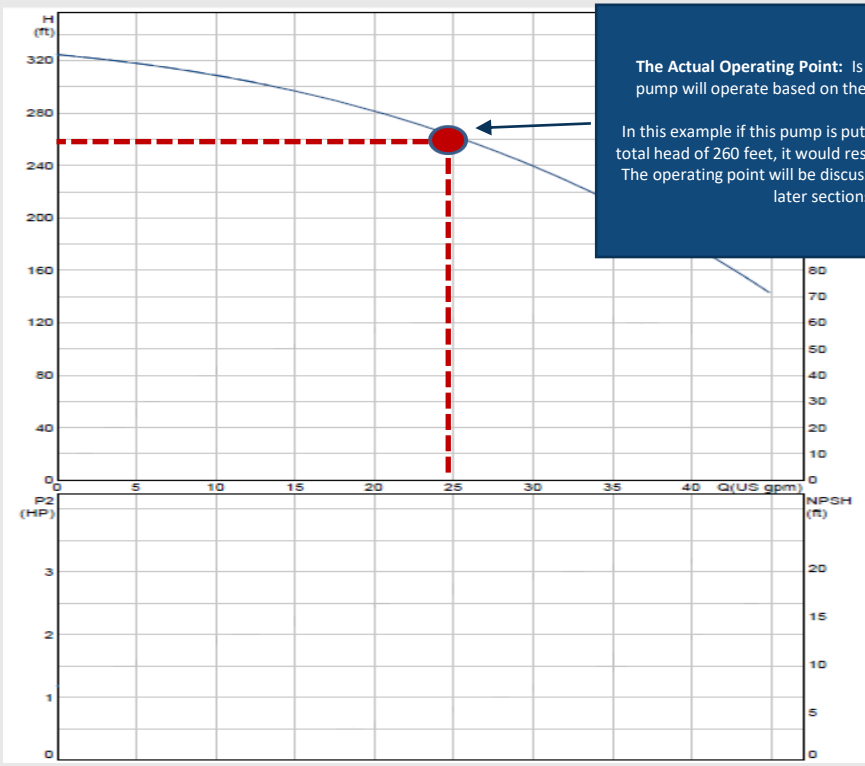
Understanding the pump curve

- Based on the Performance Curve for this pump the highest flow that we could select this pump for is 45 gallons per minute at about 140 feet of head.
- Be aware that running a centrifugal pump at the this point increases the risk of cavitation.



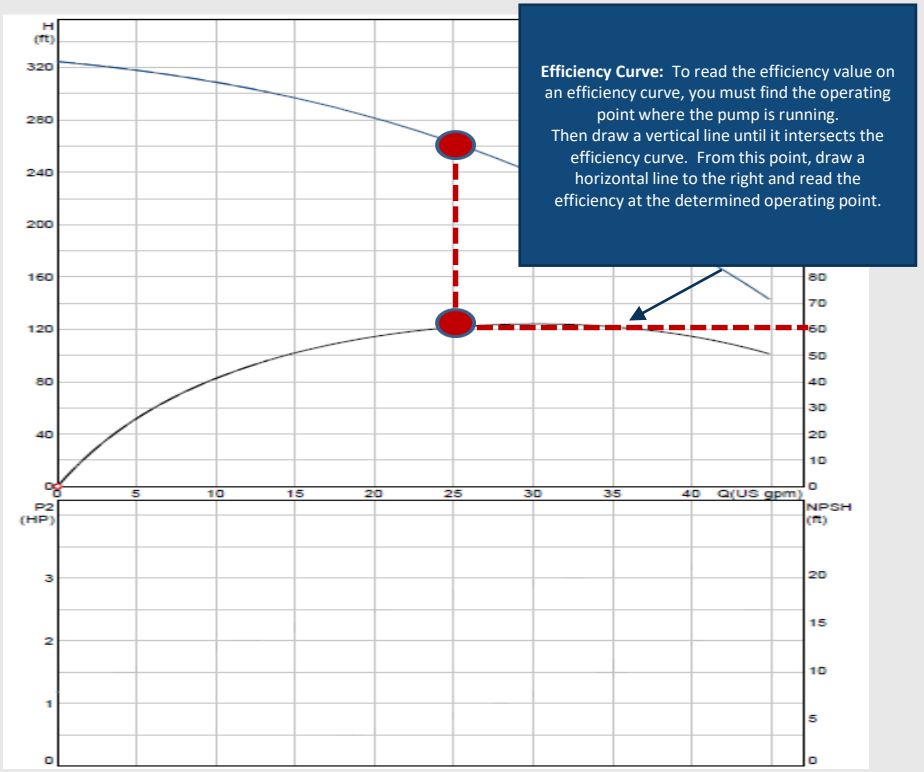
Understanding the pump curve

- The actual operation point



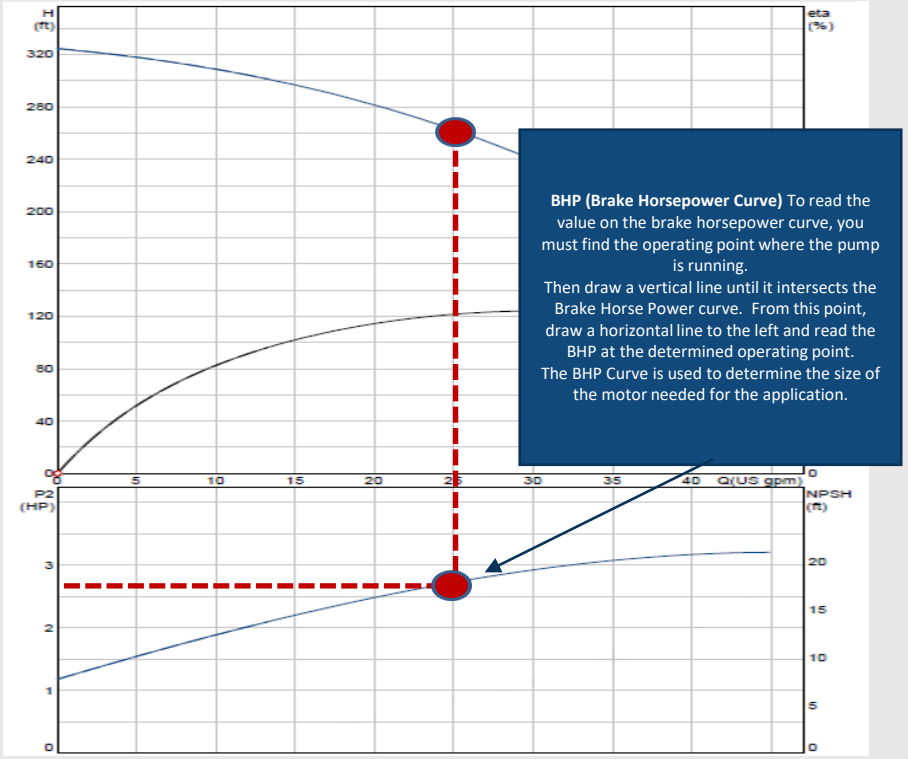
Understanding the pump curve

- In this case if the operating point is 260 feet of head, it would result in a flow of 25 gallons per minute and the pump would be 60% efficient at this point.
- Special note: This efficiency is only the hydraulic efficiency of the pump, and does not account for the over all efficiency of the pump and motor.



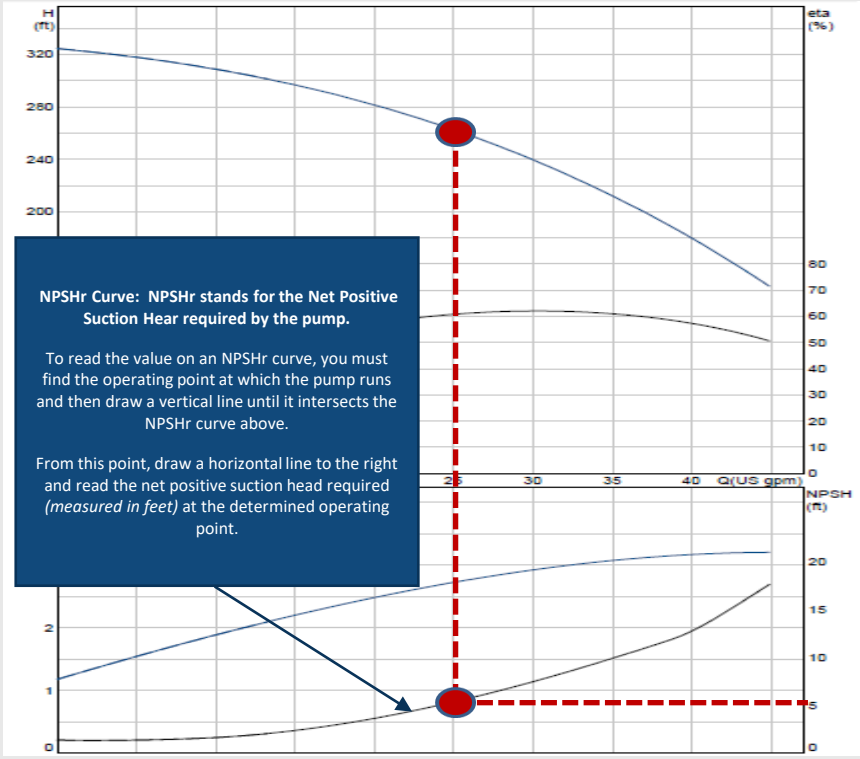
Understanding the pump curve

- Based on this operating point of 260 feet of head, 25 gallons per minute this pump would be need a minimum of 2 ½ brake horsepower.
- It would be suggested for this pump to have at least a 3 horsepower motor in order to cover the full range of the brake horsepower curve for this pump.



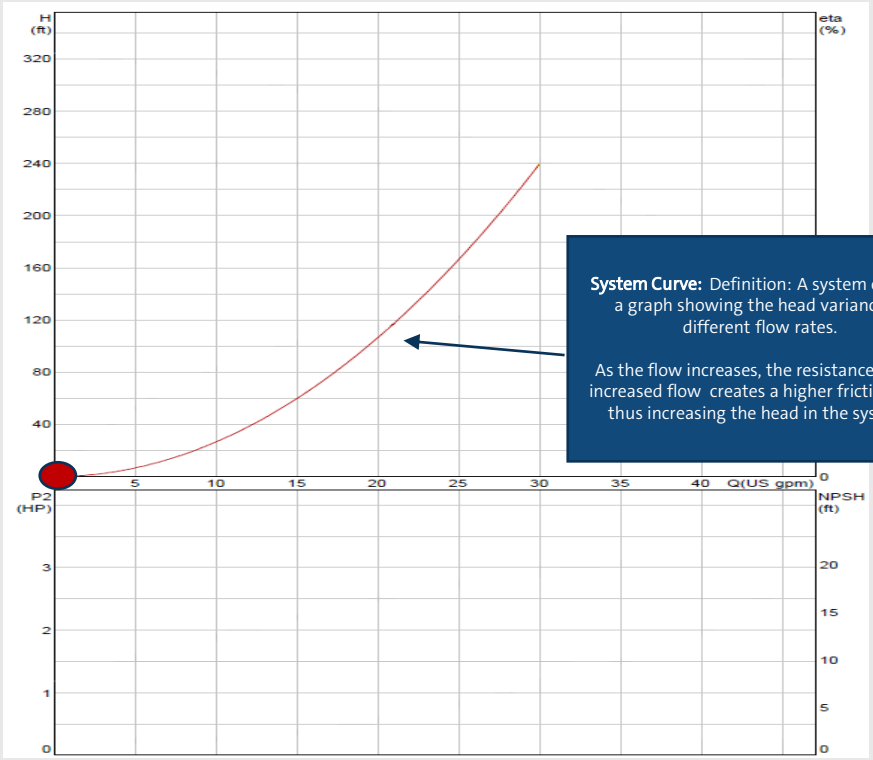
Understanding the pump curve

- This curve is used to determine the amount of head required by the pump at this operating point in order to prevent the risk of cavitation.
- You can learn more about Cavitation and NPSH in other Grundfos Training modules



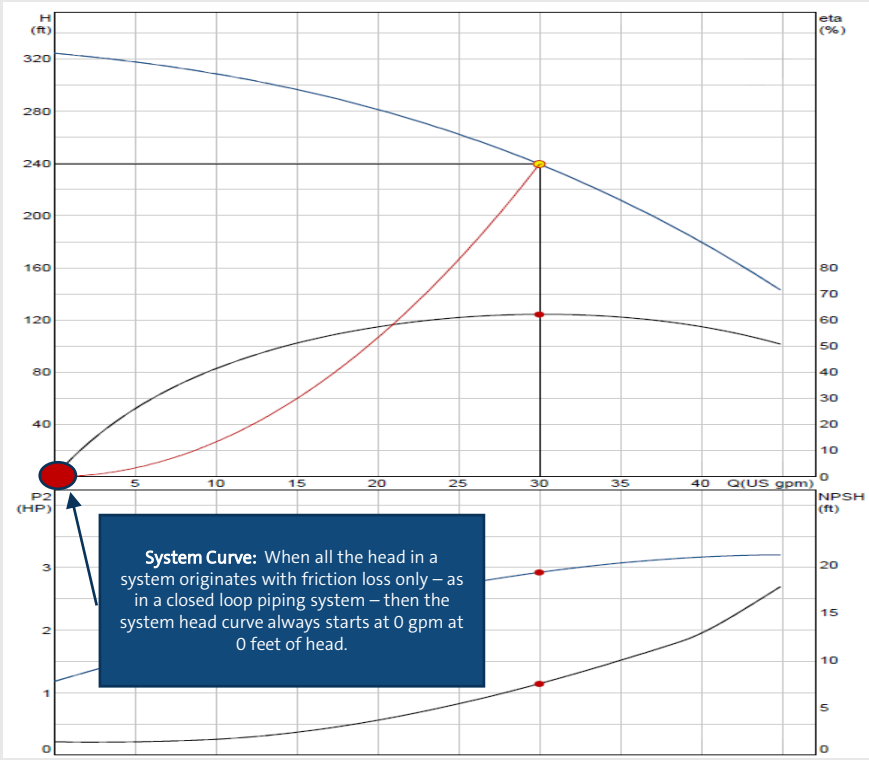
Understanding the pump curve

- The system curve



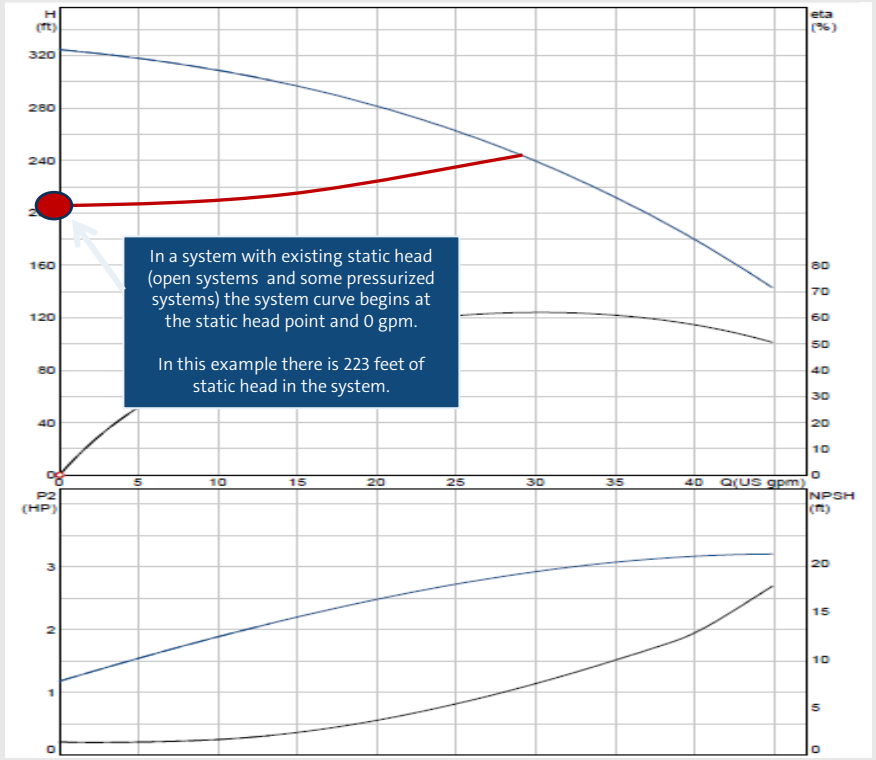
Understanding the pump curve

- The system curve in a system where the head originates from friction loss only.



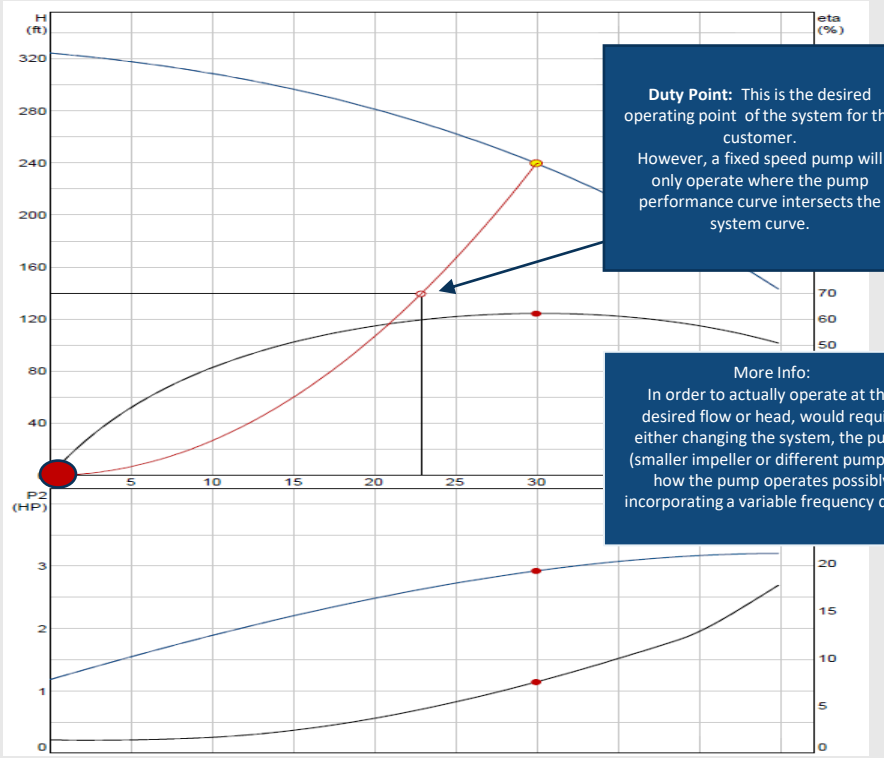
Understanding the pump curve

- The system curve in a system with exsisting static head.



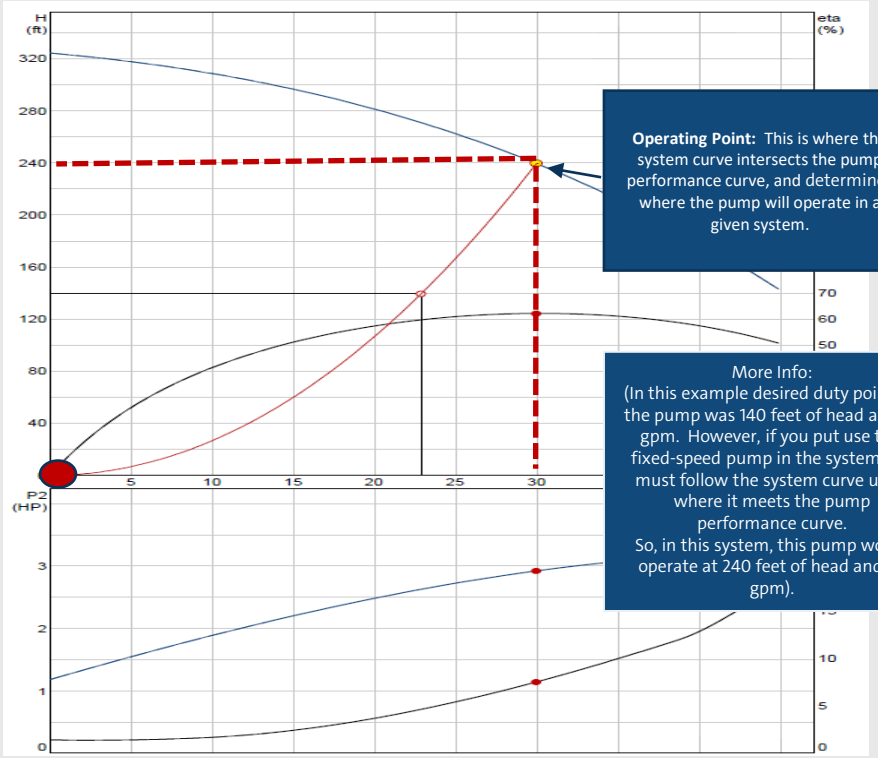
Understanding the pump curve

- The duty point



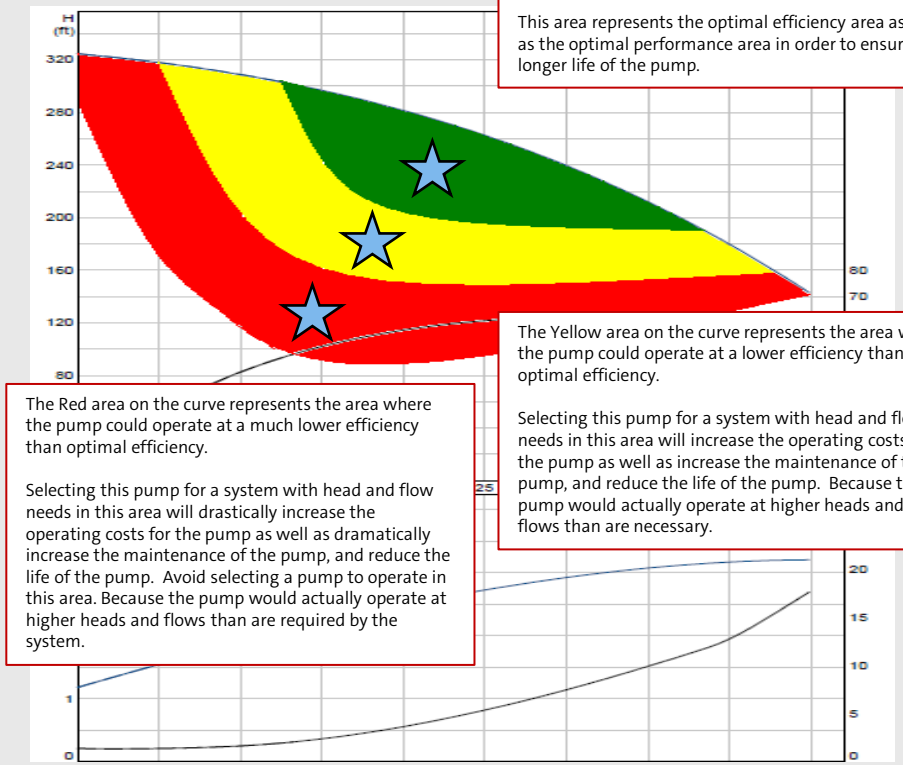
Understanding the pump curve

- The operating point



Understanding the pump curve

- Using this fixed speed pump performance curve we will discuss the results of selecting this pump for the three colored areas.



The Green area on the curve represents the preferred area where the pump should be selected to operate.

This area represents the optimal efficiency area as well as the optimal performance area in order to ensure longer life of the pump.

The Yellow area on the curve represents the area where the pump could operate at a lower efficiency than optimal efficiency.

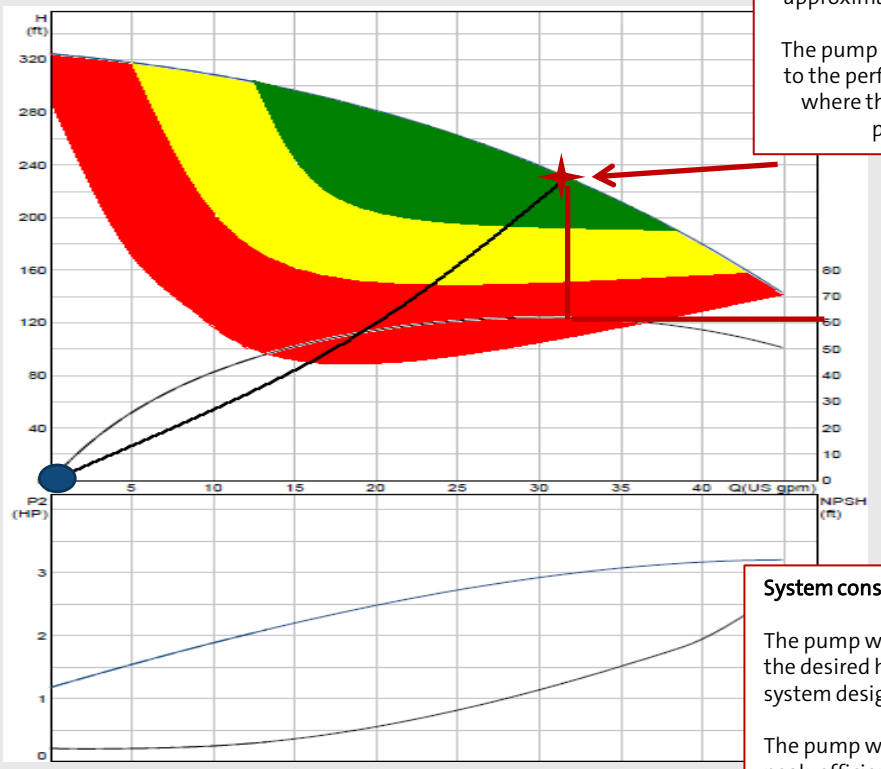
Selecting this pump for a system with head and flow needs in this area will increase the operating costs for the pump as well as increase the maintenance of the pump, and reduce the life of the pump. Because the pump would actually operate at higher heads and flows than are necessary.

The Red area on the curve represents the area where the pump could operate at a much lower efficiency than optimal efficiency.

Selecting this pump for a system with head and flow needs in this area will drastically increase the operating costs for the pump as well as dramatically increase the maintenance of the pump, and reduce the life of the pump. Avoid selecting a pump to operate in this area. Because the pump would actually operate at higher heads and flows than are required by the system.

Understanding the pump curve

- Operating at best efficiency.



What would happen if this pump is selected for this system at this duty point of 230 feet of head and approximately 30 gallons per minute?

The pump will follow the system curve to the performance curve and operate where the system curve meets the performance curve.

System considerations:

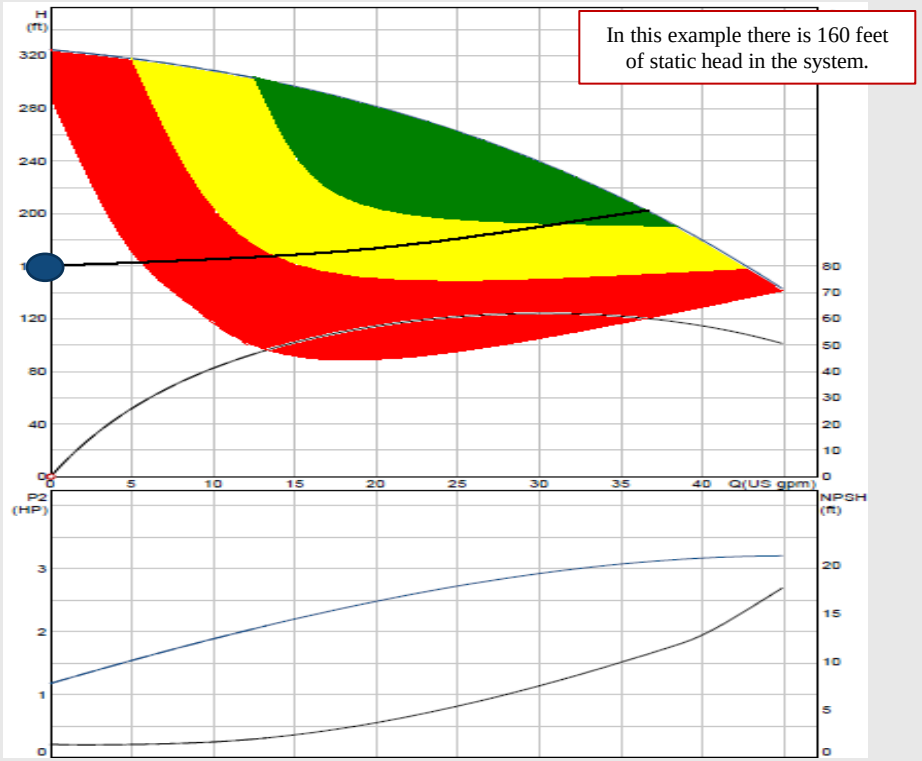
The pump would be operating with the desired head an flow to meet the system design.

The pump would be operating at the peak efficiency point for this pump.

Solution: Teach everyone you know how to do what you have just done.

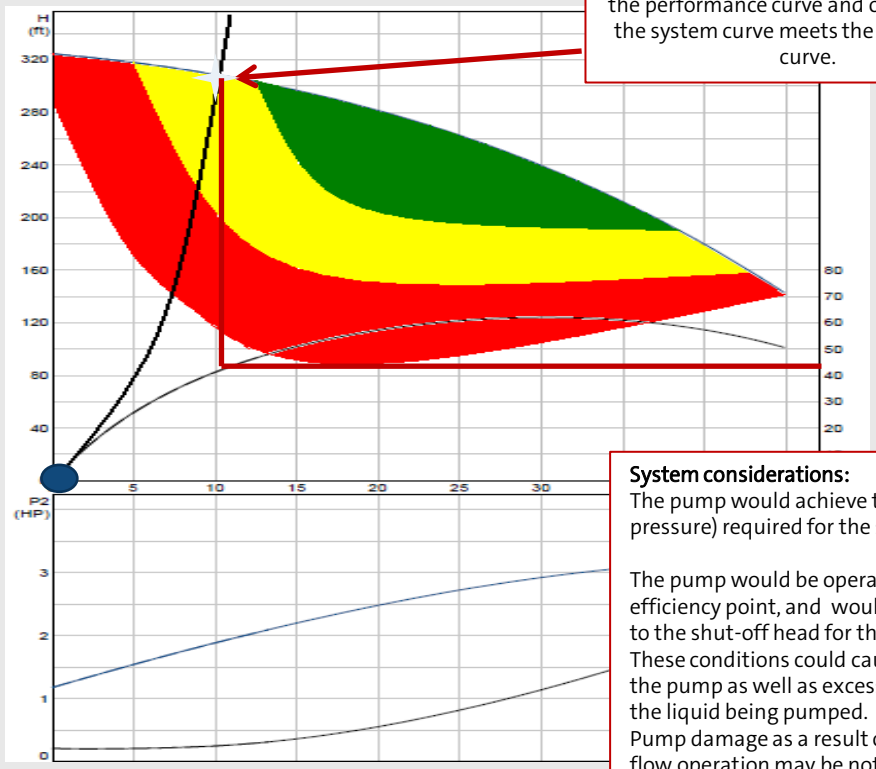
Understanding the pump curve

- Static head in the system.



Understanding the pump curve

- Operating at low efficiency



What would happen if this pump is selected for this system at this duty point, or if the head was increased to this point?

The pump will follow the system curve to the performance curve and operate where the system curve meets the performance curve.

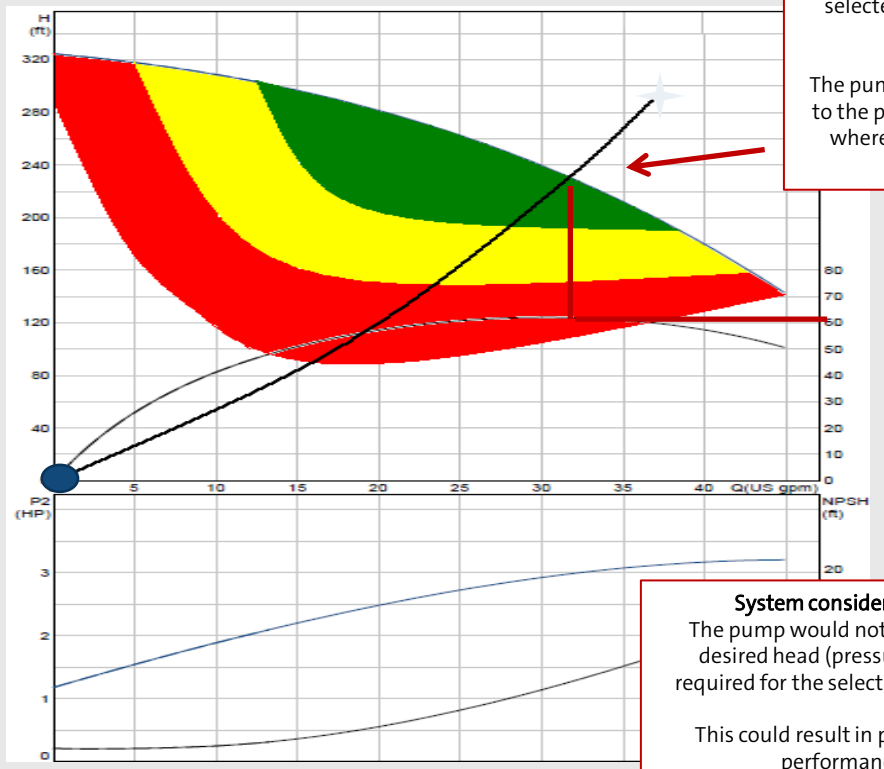
System considerations:
The pump would achieve the desired head (or pressure) required for the selected duty point.

The pump would be operating at a very low efficiency point, and would be operating very close to the shut-off head for the pump.
These conditions could cause minimum flow for the pump as well as excessive temperature rise of the liquid being pumped.
Pump damage as a result of continuous minimum flow operation may be noticeable within one to six months.

Solution: Select a different pump that meets the desired duty point. Installing a variable frequency drive on this pump would reduce energy costs by almost 40%; however, the pump would still be operating below peak efficiency.

Understanding the pump curve

- Not meeting the required needs.



What would happen if this pump is selected for this system at this duty point?

The pump will follow the system curve to the performance curve and operate where the system curve meets the performance curve.

System considerations:
The pump would not achieve the desired head (pressure) or flow required for the selected duty point.

This could result in poor system performance.

The pump would be operating at a very high efficiency point. However, it would not be meeting the required needs.

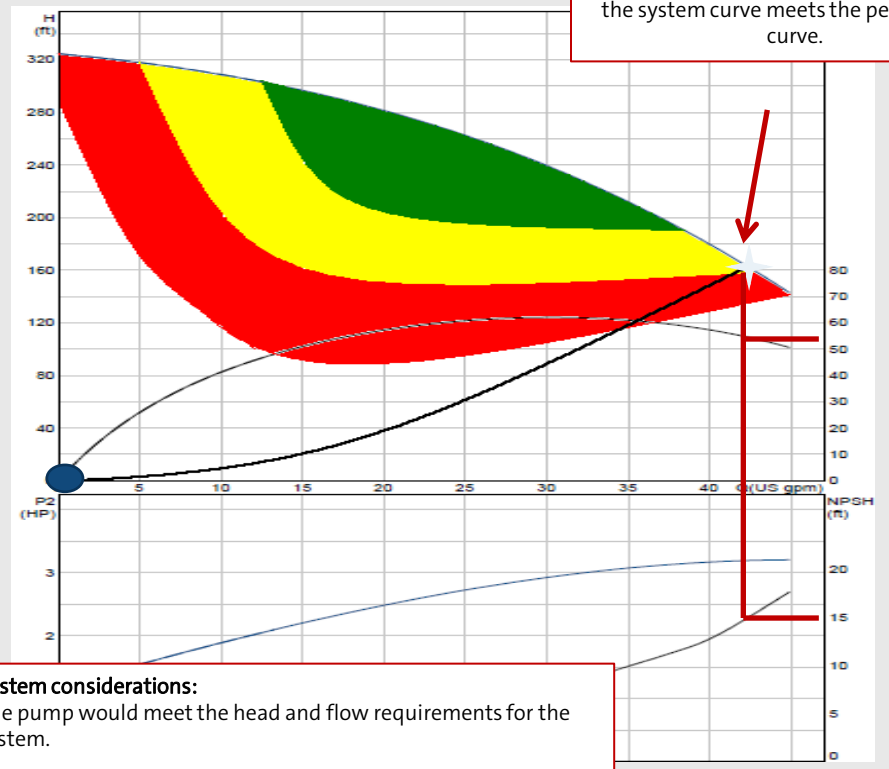
Solution: Select a larger pump that would meet the needed duty point.

Understanding the pump curve

- Risk of cavitation.

What would happen if this pump is selected for this system at this duty point?

The pump will follow the system curve to the performance curve and operate where the system curve meets the performance curve.



System considerations:
The pump would meet the head and flow requirements for the system.

The NPSHr requirement for the pump is very high which increases the risk of **cavitation**.

Solution: Select a different pump with a higher efficiency at this point, and a lower NPSHr requirement in order to reduce the rick of cavitation.