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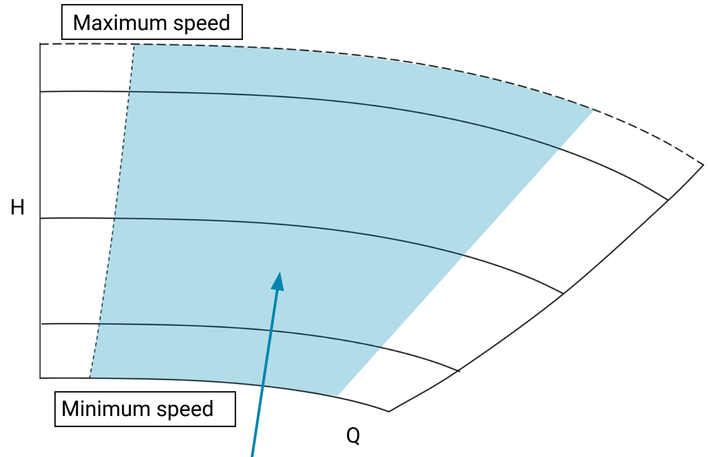
Product Information
BG-HXS-PI-120131 R2

Series e-80SCX/e-80X

with sensorless technology



Sensorless working area: the shaded area on the performance curve indicates the sensorless operating area.

Series e-80SCX and e-80X^ Smart Pumps feature sensorless technology as a standard offering, delivering intelligent performance without the need for external sensors. This advanced capability allows the pump to recognize its operating conditions in real time by using its unique hydraulic map, which is pre-programmed into the drive. The motor-drive recognizes the flow and pressure it is producing relative to power consumption, and the integrated software interprets this data for precise automated control.

Sensorless technology simplifies installation and reduces costs by eliminating the need for additional sensors in proportional and quadratic pressure control modes, making it an ideal solution for smaller systems without sophisticated building management systems (BMS), such as schools, small businesses, and apartment complexes. With hydrovar X and sensorless control, users can easily optimize efficiency by simply plugging in the smart pump system! The system will regulate itself around the duty point set by the user. e-80SCX and e-80X^ Smart Pumps with sensorless technology deliver streamlined setup, reduced hardware requirements, and reliable performance.

Powered by Xylem's hydrovar® X Smart Motor, e-80X (close-coupled) and e-80SCX (split-coupled) Smart Pumps integrate decades of expertise and know-how in pumping solutions to bring the right combination of motors, variable speed drives and hydraulic pumps in one comprehensive, highly efficient package. These pumps reduce electricity consumption, improve overall system performance, and lower life cycle costs. Designed for horizontal and vertical in-line mounting, They are ideal for hydronic heating and cooling systems, light industrial processes and general service applications.

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Sensorless technology at work

Series e-80SCX/e-80X^ sensorless technology is made possible by two simple principles of variable flow systems. The first is the universal application of the affinity laws to centrifugal pumps. This enables the hydrovar X drives to model the pump performance very accurately.

Also essential to sensorless control is the ability of today's variable speed drives to accurately measure and control a motor's speed and torque. By tightly integrating both of these elements, the e-80SCX/e-80X^ supports high-performance variable flow hydronic systems without the hassles of mounting, installing, and wiring a separate VFD on a wall or a wired transducer across the load furthest from the pump.

The right solution for a wide range of applications

Series e-80SCX/e-80X^ pumps ship configured for sensorless operation out of the box. Using the advanced user interface and pre-configured setups, an installer can readily change the mode of operation as needed for the site to:

- Sensorless pressure control
- Wired differential pressure transducer
- Wired flow transducer

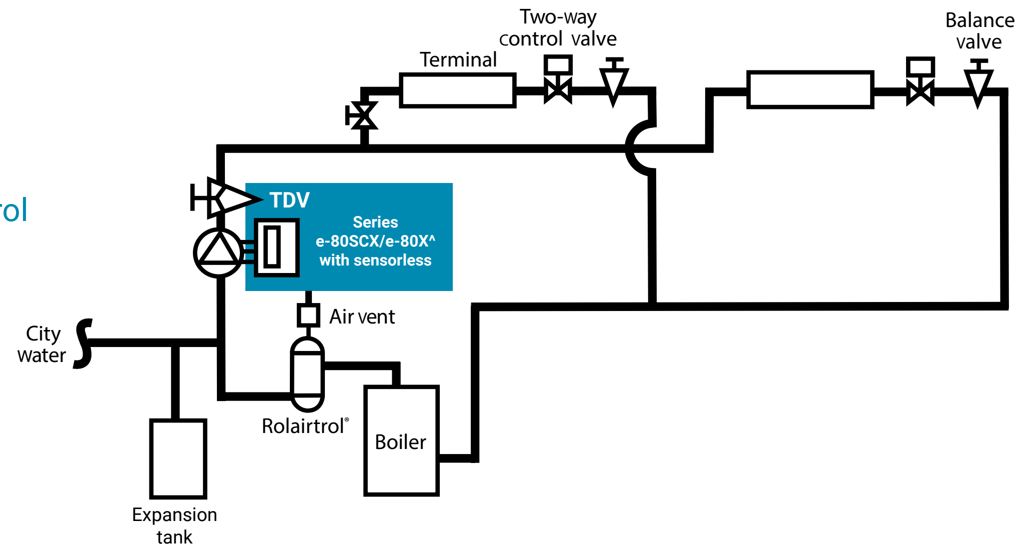
While sensorless technology offers simplicity and efficiency for smaller applications, sensored solutions may be preferable for more complex systems.

^Sensorless is currently only available on e-80SCX pumps. Coming soon to e-80X pumps.

Simple vs. complex applications

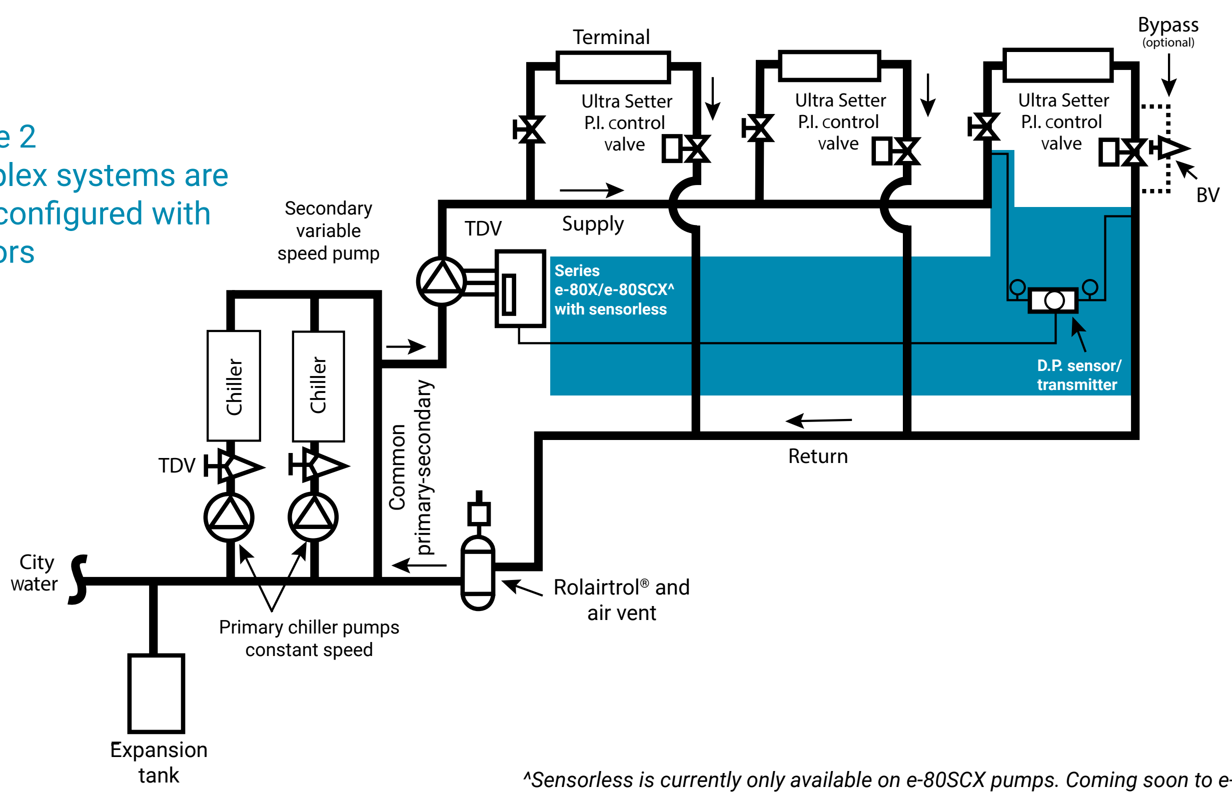
Simple hydronic systems: In less complex hydronic systems (Figure 1) with quadratic friction losses, the e-80SCX/e-80X^ Smart Pump emulates a differential pressure transducer across the load by monitoring the pump's speed and torque characteristics.

Figure 1
Sensorless control ideal for simple systems



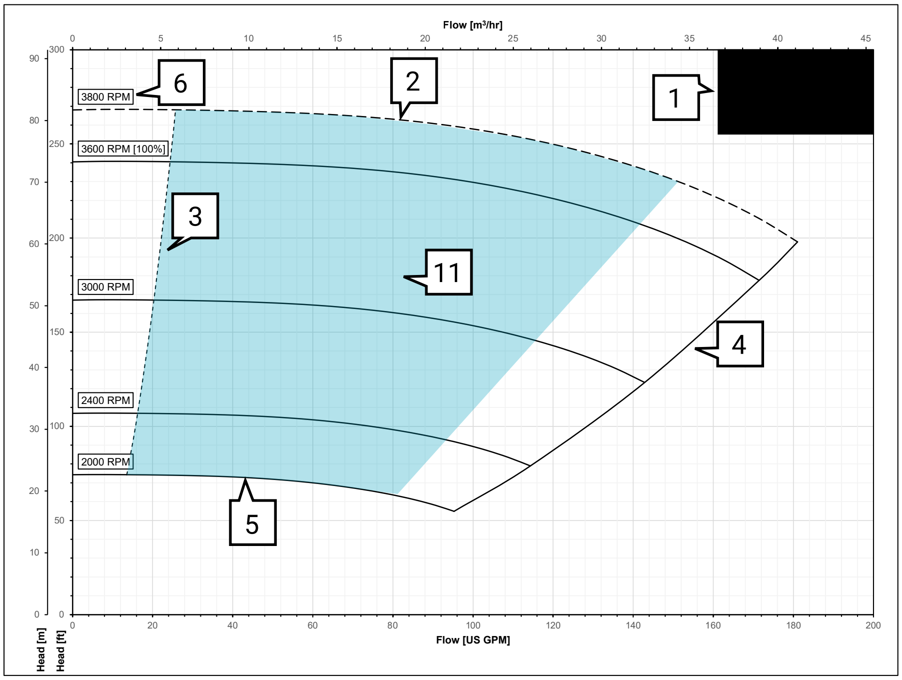
Complex hydronic systems: In more substantial systems (Figure 2) where the differential pressure losses across the loads are more complex, using a differential pressure transducer on the furthest load is the preferred solution. In challenging system designs, the e-80SCX/e-80X^ is also an ideal choice because of its built-in support for wired pressure or flow transducers.

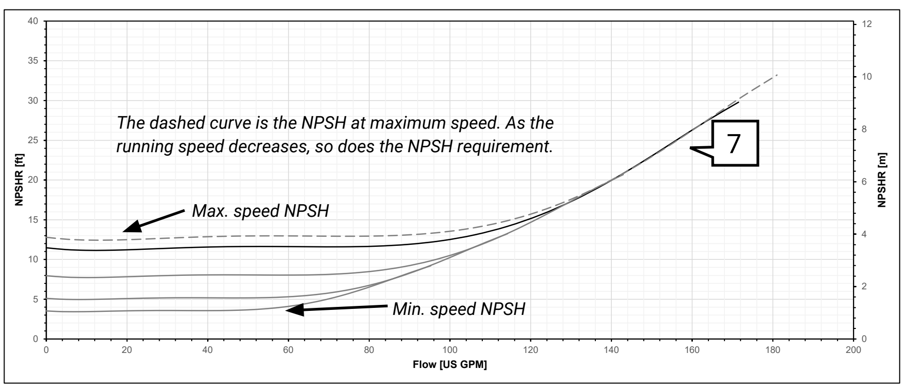
Figure 2
Complex systems are best configured with sensors

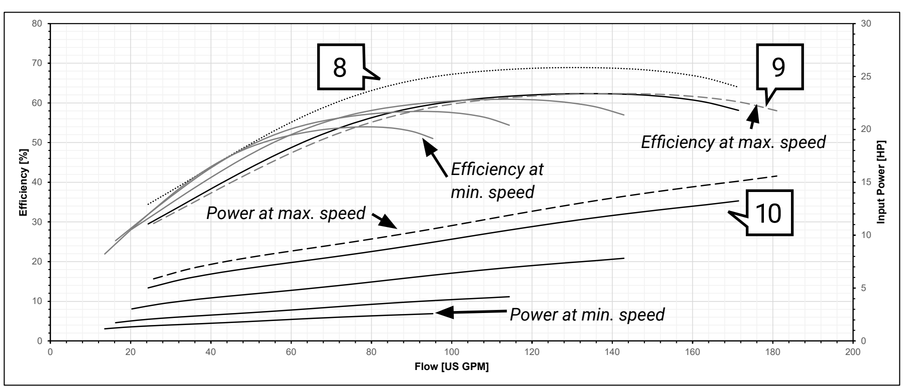


^Sensorless is currently only available on e-80SCX pumps. Coming soon to e-80X pumps.

How to read smart pump series curves





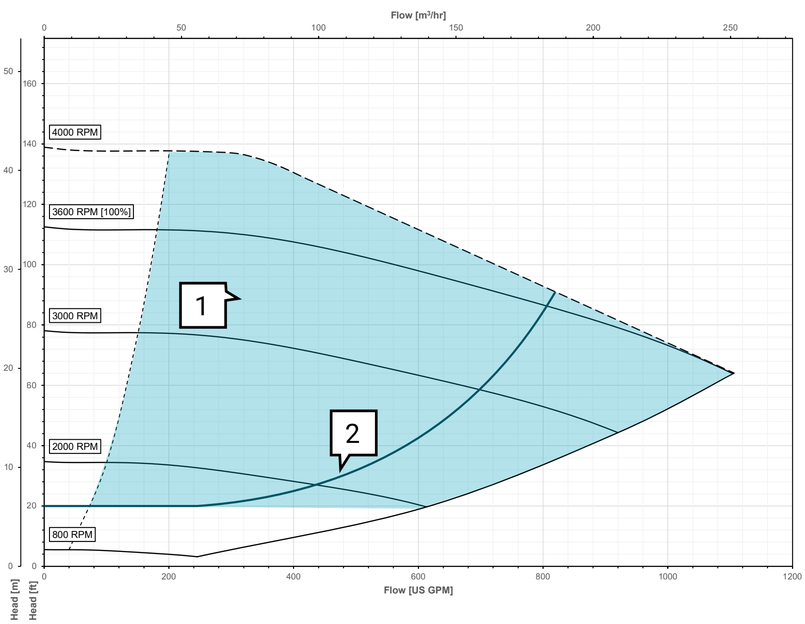


1. **Model information:** pump model and motor information.
2. **Maximum speed curve:** the maximum operating speed of the pump. Any speed above the nominal speed rating (i.e., 1800 RPM or 3600 RPM) is indicated by a dashed line.
3. **Minimum continuous stable flow:** the recommended minimum flow rate of the pump.
4. **Maximum flow curve:** the recommended maximum flow rate of the pump.
5. **Minimum speed curve:** the minimum operating speed of the pump for continuous operation.
6. **Speed tags:** indicate the motor speed of a given performance curve. The [100%] modifier indicates the default maximum speed setting of the motor.
7. **NPSH curve:** the net positive suction head required of the pump.
8. **Pump efficiency curve:** the standalone efficiency of the pump operating at the [100%] speed condition.
9. **Efficiency overall:** the overall efficiency (wire-to-water efficiency) of the pump and motor per speed. **Note:** *efficiency curves for each speed are shown in descending order where lower speeds result in lower efficiency.*
10. **Input power:** the input power required to drive the motor by speed.
11. **Sensorless working area:** the shaded area on the performance curve indicates the sensorless operating area.

Sensorless selection strategy and limitations

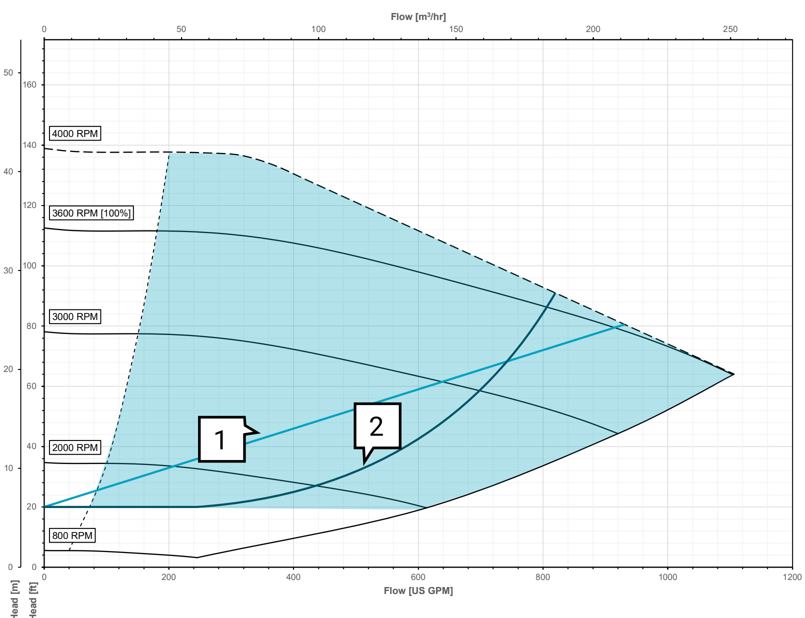
How and where sensorless works

When opting for sensorless operation, it is critical to understand the reliable zone of operation for each specific pump model and how it interacts with the control curve. The reliable zone of operation is the shaded area overlayed on the performance curve. The control curve is the system curve that the drive defines based on the duty point and minimum head input by the user. Note that the control curve is not the true system curve, rather a simple approximation. (See image below.)



1. **Sensorless operating area** (reliable zone of operation)
2. **Control curve**

The control curve may have two possible shapes: linear (proportional pressure control) or quadratic (quadratic pressure control). The type of control that should be used depends on the duty point, expected flow operating range, accuracy needed, and minimum head required. It is up to the user to choose the control strategy that best suits their system while keeping in mind general limitations of sensorless operation. (See image below.)



1. **Linear control curve** (Proportional pressure control mode)
2. **Quadratic control curve** (Quadratic pressure control mode)

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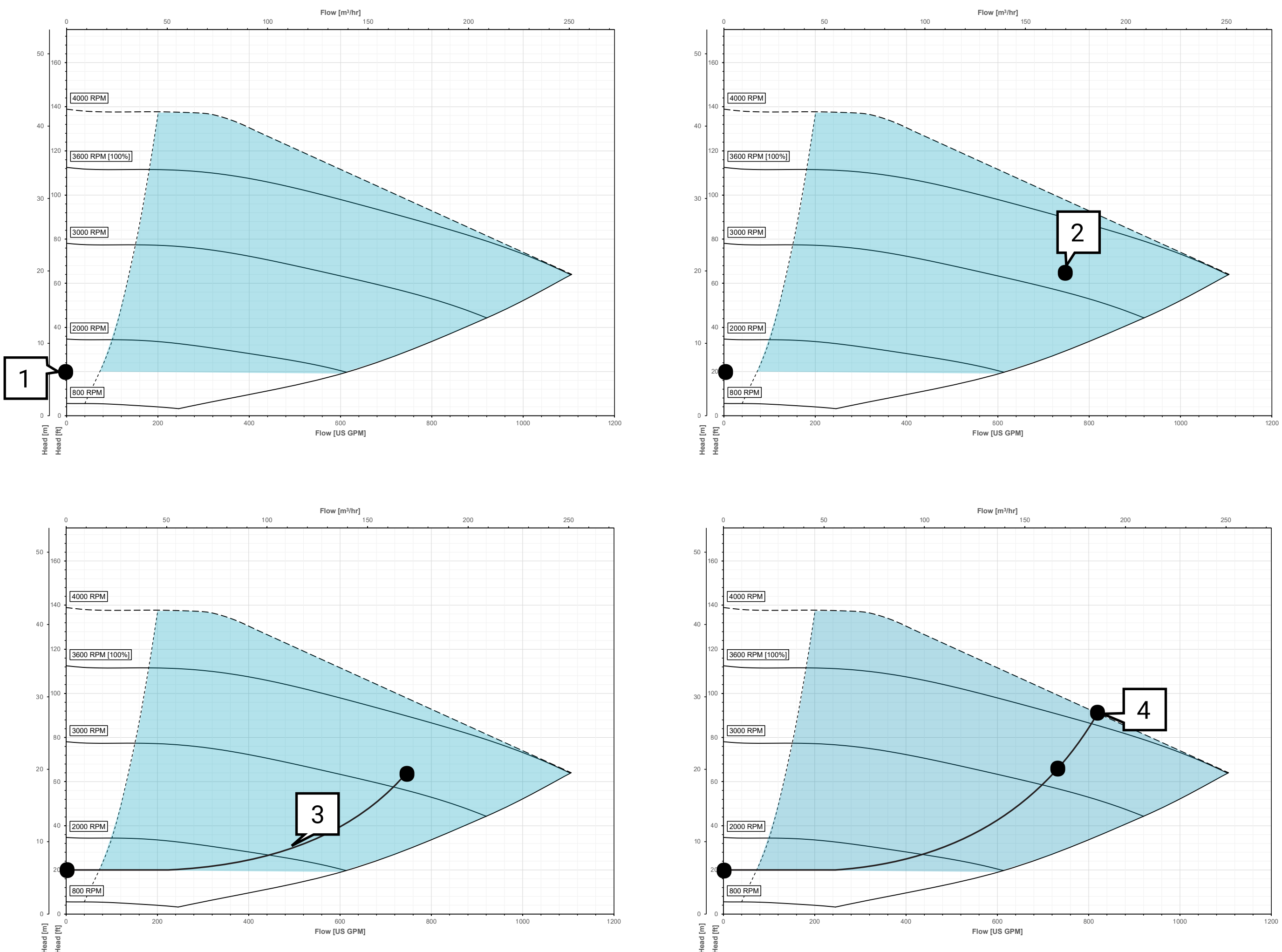
How is the exact shape of the control curve created?

The hydrovar X drive uses the input duty point and minimum head to draw a control curve between both points and then extends the curve towards a maximum speed setpoint. The maximum speed setpoint is located at the intersection of the control curve and the maximum speed curve.
See example below:



1. User sets the zero flow minimum head.
2. User sets the duty point head and flow.
3. The hydrovar X drive will evaluate if the input values are within the sensorless range and draw a curve between both points based on whether the user selected proportional or quadratic control (quadratic control is depicted in the example).
4. The hydrovar X drive will establish the maximum head setpoint at the intersection of the max speed curve and the control curve. This concludes the control curve setup.

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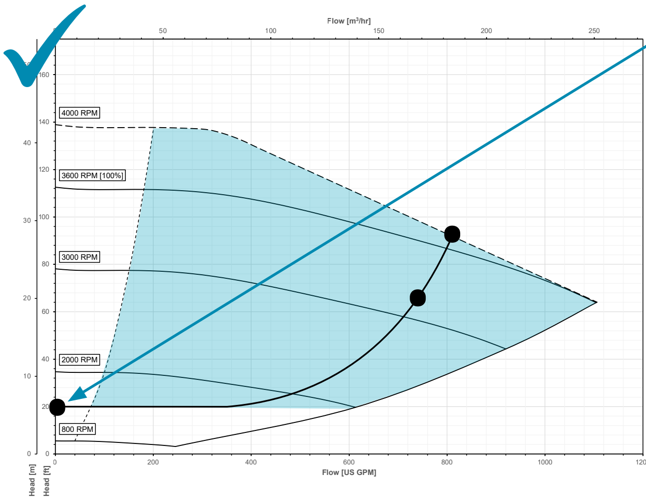
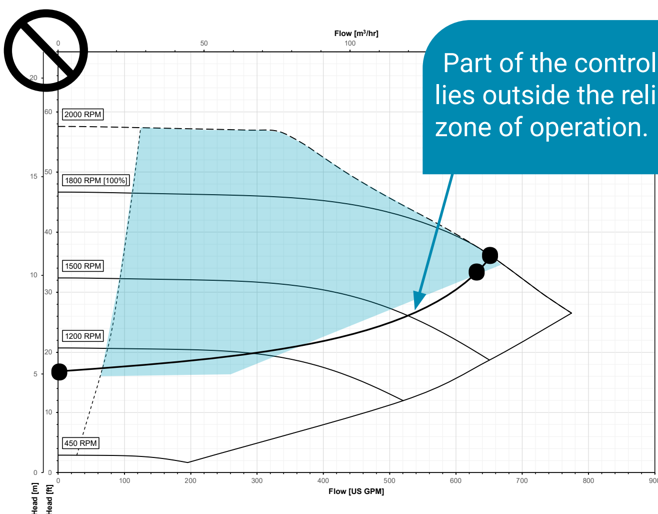
Sensorless selection scenarios and best practices

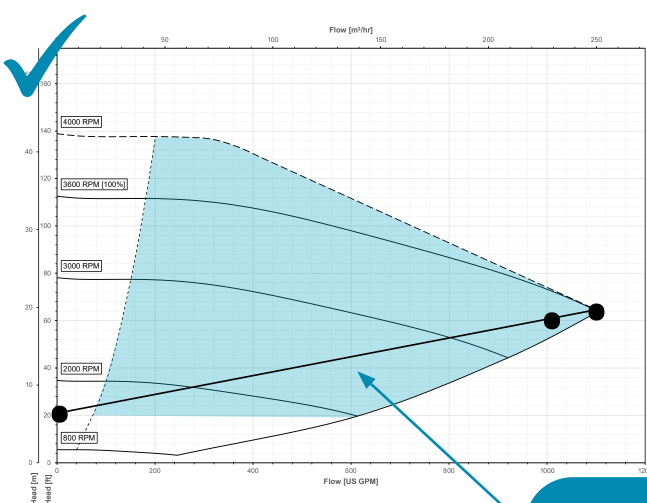
For reliable operation, the entire control curve must fit within the reliable zone of operation. Examples below show various selection scenarios highlighting the limitations of sensorless operation:



1. **Acceptable selection example:** The combination of the zero flow head and duty point values created a control curve that operates within the reliable zone of operation.



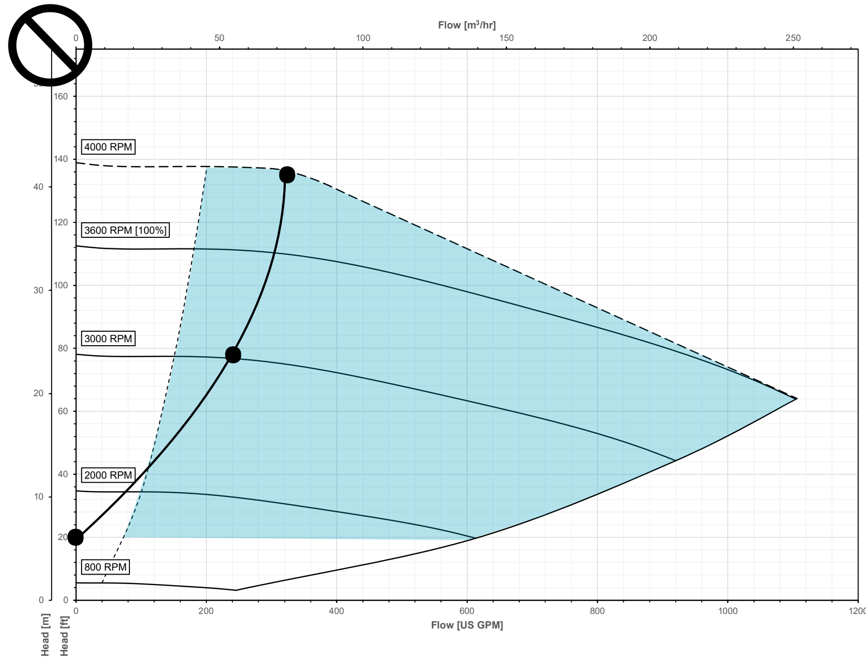
2. **Poor selection:** Placing a duty point near the maximum flow range of the reliable zone of operation and selecting a low head value for zero flow while using quadratic control may create a control curve that lies outside of the shaded region. Such a selection will create control instability along the control curve.



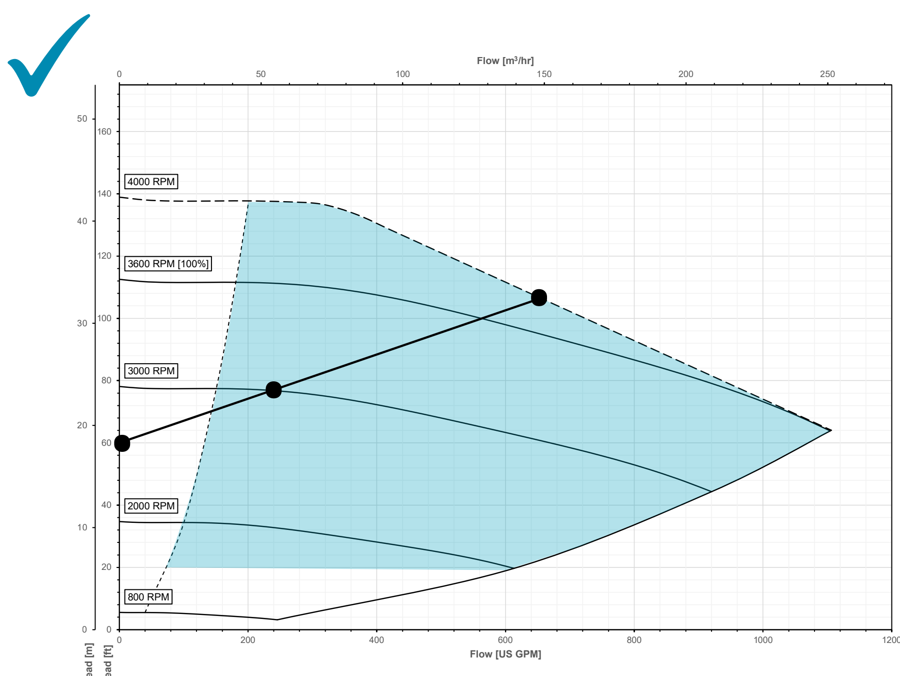
3. **Acceptable:** Placing a duty point near the maximum flow rate of the reliable zone of operation and selecting a low zero-flow head value becomes manageable with linear proportional pressure control.

Sensorless selection scenarios and best practices (cont'd.)

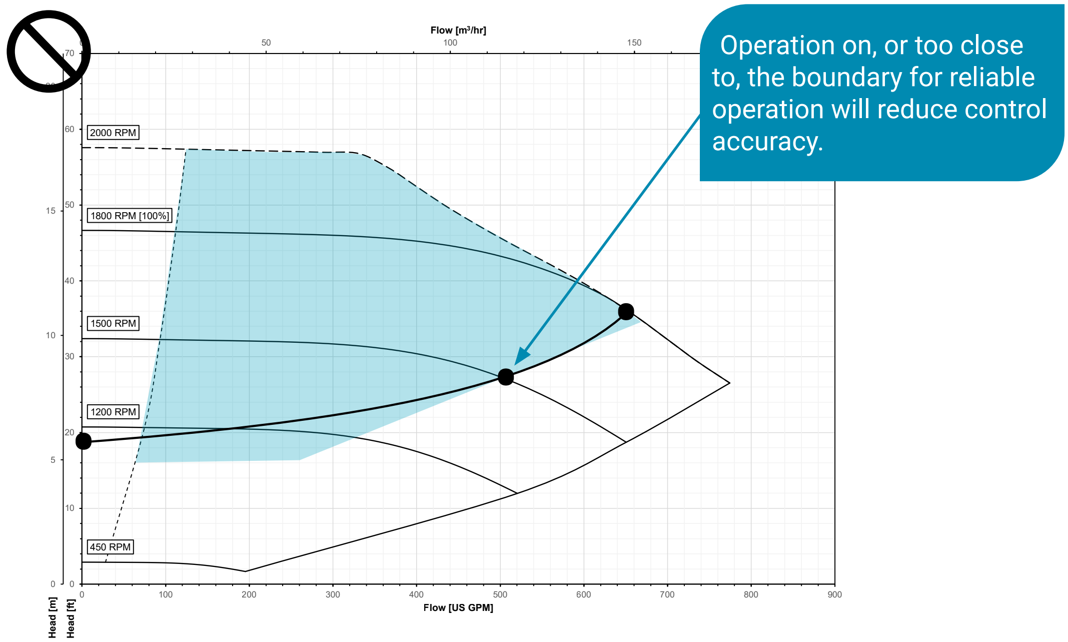
1. **Poor selection example:** Even though the control curve lies within the reliable zone of operation, it is best to avoid unnecessarily steep control curves. Steep curves may cause dramatic changes in pressure over small changes in flow leading to system instability.



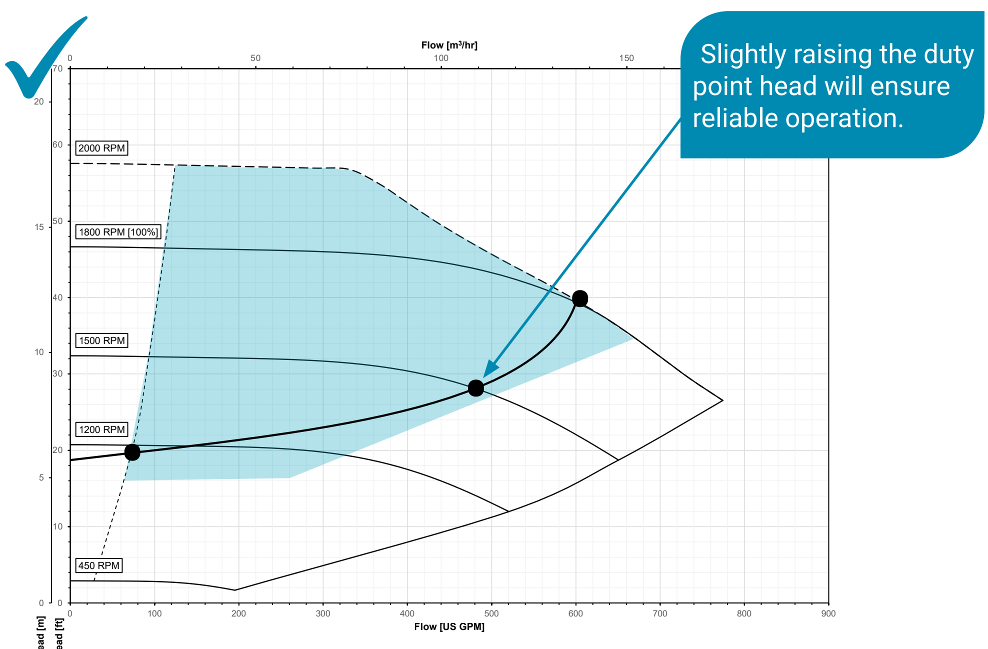
2. For duty points at high head and low flow, it is best to utilize a linear control curve with a raised minimum head value.



3. **Poor selection example:** Even though the control curve lies within the reliable zone of operation, it is best to avoid having the control curve operate near the boundary of sensorless operation. At the boundary, the drive will lose control accuracy which may cause system instability.



4. **Acceptable selection example:** Slightly raising the duty point shifts the control curve upward, moving it well within the reliable zone of operation.



Sensorless minimum and maximum speed regulation behavior

Maximum speed regulation: The smart pump will always ensure continuous operation does not occur above the user-defined maximum speed. If the smart pump reaches maximum speed while under sensorless operation, the control curve will begin to follow the maximum speed limit curve until either the flow demand reduces or the maximum flow rate allowed by the system is met. (See Figure 1 below.) If the flow demand exceeds the maximum flow rate of the reliable zone of operation, sensorless control will lose accuracy and become unstable. It is recommended to implement flow limiting measures that align with the maximum flow rate of the reliable zone of operation. If the user lowers the maximum speed parameter, the control curve will still follow its original path until it reaches the new maximum speed curve. From that point, the control curve will path along the new maximum speed curve. (See Figure 2 below.)

Figure 1

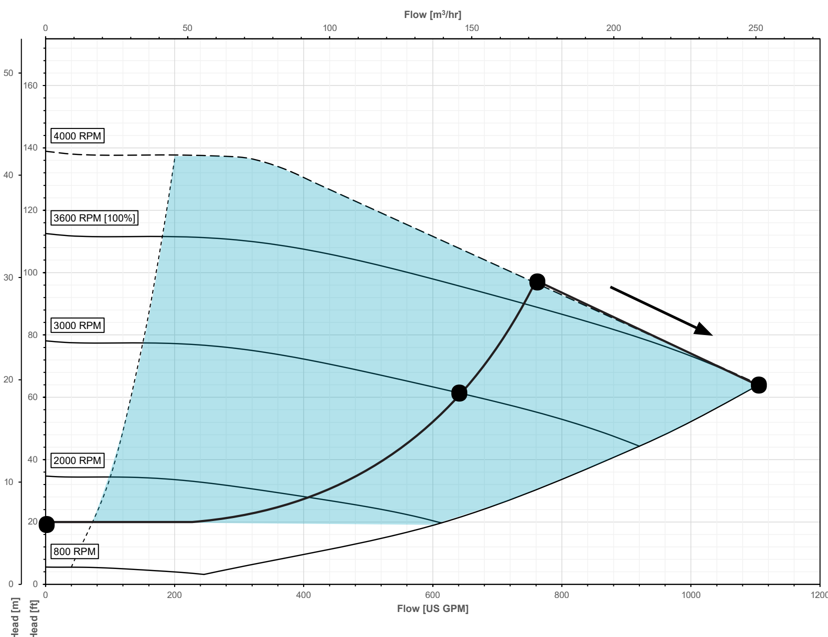
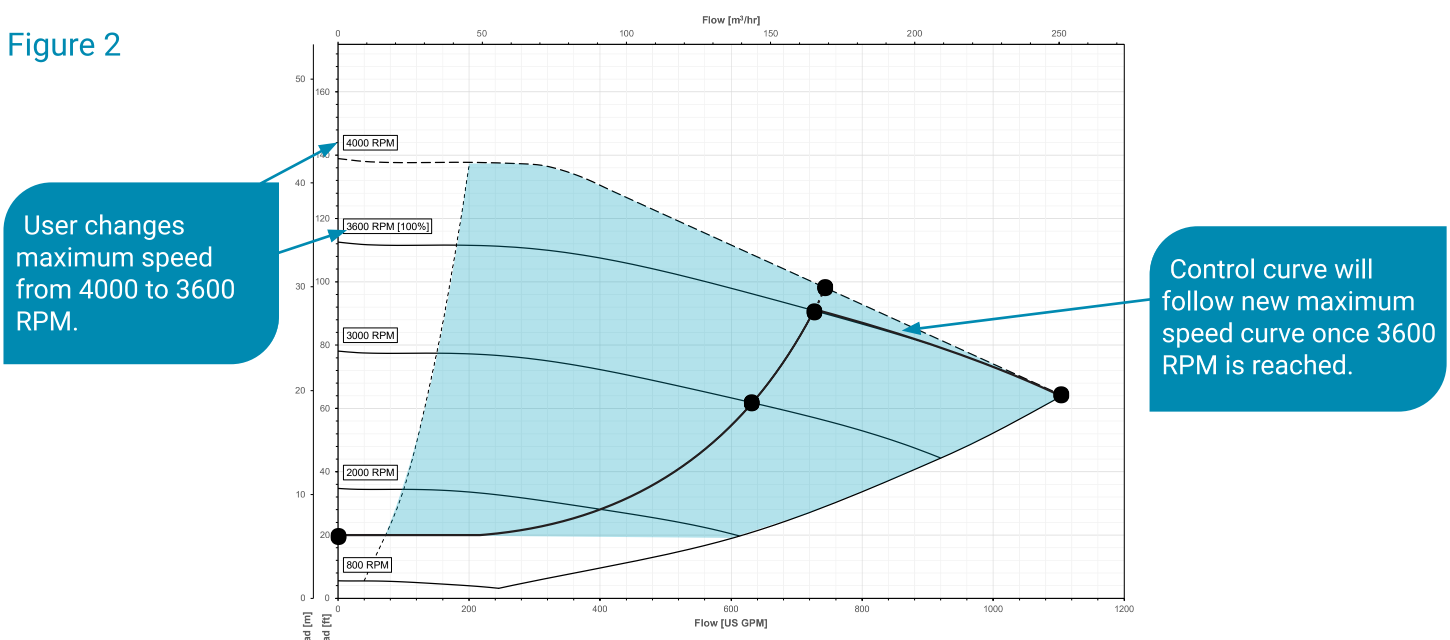


Figure 2



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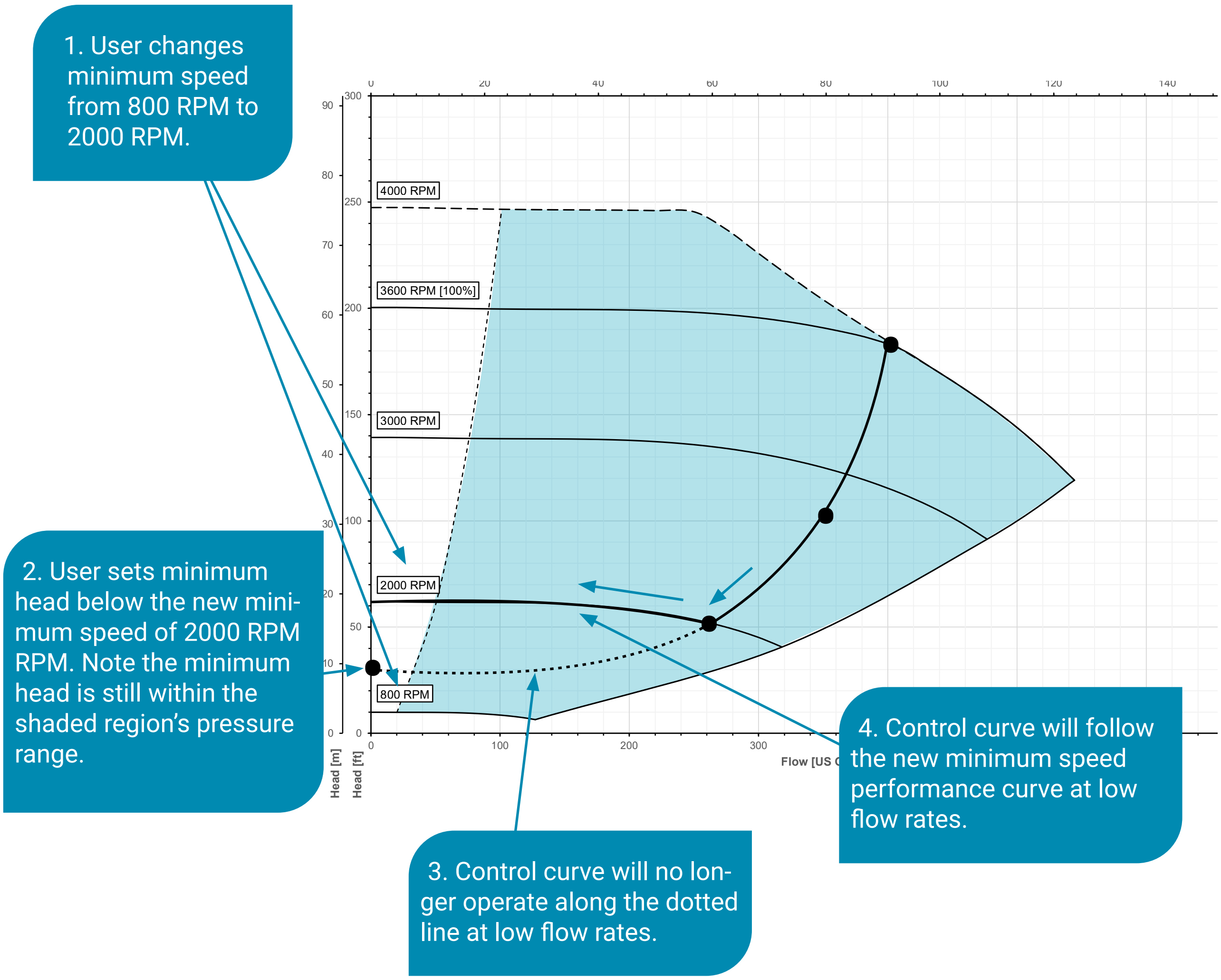
Minimum speed regulation: The smart pump will always ensure continuous operation does not occur below the user-defined minimum speed. In sensorless control, the minimum head may be set below the minimum speed provided that the user-defined minimum head is no less than the minimum head of the reliable zone of operation (shaded area). The control curve is always defined by the user-input minimum head and duty point; however, the control path will follow along the minimum speed curve that is programmed into the drive by the user. (See figure below.)



Warning: Sensorless operation does not include lack of water detection and protection. The smart pump system should be paired with an external stop signal to protect the pump from operating conditions that force the pump to operate below the minimum flow rate.

Notes

Xylem Product Cybersecurity:
Xylem values your system security and the availability of your critical services. For more information on Xylem cybersecurity practices or to contact the cybersecurity team please visit xylem.com/security.

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