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Let's Solve Water

WHITE PAPER
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White Paper Series: Part 1 – How to read a pump performance curve

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Understanding how to read a pump curve is critical in selecting the right pump for an HVAC or water system in a commercial building. Selecting the right centrifugal pump for the facility will, in turn, maximize pump and system efficiency, and contribute to overall longer operational life.

There are different performance curves for every pump design, speed (RPM) and impeller diameter. By understanding all of the information provided by a performance curve, one can make intelligent decisions about the pump type, size, RPM, horsepower and efficiencies that will be required for the system.

Pump curves are established by the manufacturer under carefully controlled test conditions specified by international standards. The pump curve in **Figure 1** illustrates the relationship between how much flow (Q) a pump can deliver against the corresponding head (H).

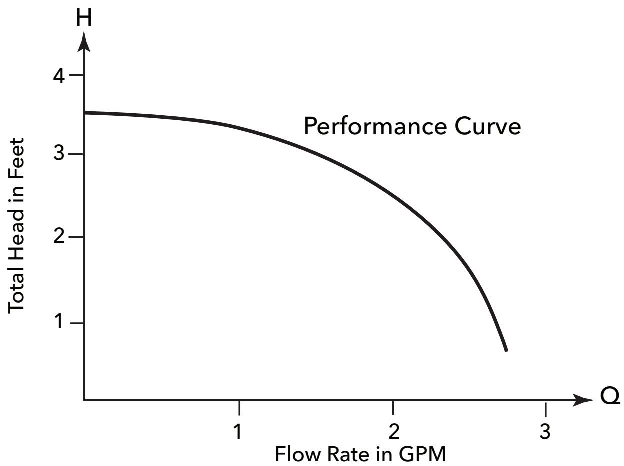

Figure 1

Flow rates (horizontal axis) are typically measured in liters per second, gallons per minute (GPM), and cubic meters per hour. The amount of work or energy a pump can apply to a specific flow is measured in meters or feet of head (vertical axis).

Pump curves are almost always illustrated as total head in meters or feet versus liters per second, or GPM because this gives a general description of pump operation completely unaffected by water temperature or density. The GPM versus foot head capacity curve is general because of the physical characteristics of the centrifugal pump. The centrifugal pump produces energy in the form of foot pounds per pound of water pumped (head), and is dependent on the volume flow rate passing through the impeller. In a manner of speaking, the pump raises each pound of water passing through it to an energy level at its discharge, which is higher than that at the suction by the difference in foot head.

Energy as foot pound per pound is shortened to foot head by mathematical term cancellation. Since foot head is a simple energy statement, a pump curve defined by this term is not affected by water temperature change. This is because energy is not affected by temperature change. Likewise, water density has no effect on the pump curve, though density does affect pump power requirements.

The curved line in **Figure 2** illustrates the flow/head relationship of a specific pump at a known speed and impeller diameter. It is important to note that changing the speed or impeller diameter will produce a new flow/head relationship for this pump and alter the curved line.

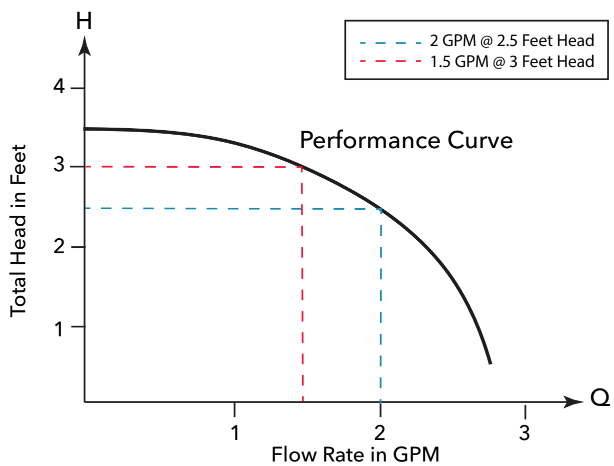

Figure 2

To read the curve, find a point on the horizontal axis, which represents GPM. In this example the chosen point is the 2 GPM mark. Then draw a vertical line from the 2 GPM mark until it hits the pump curve. At the intersection of the 2 GPM line and the pump curve, draw a horizontal line toward the left axis to identify the corresponding head. From this, one can determine the pump will deliver 2 GPM at 2.5 feet of head.

Similar readings can be taken from the vertical axis. If one needs to know the flow rate at 3 feet of head, a line can be drawn from the 3-foot mark on the vertical axis until it intersects with the pump curve. Then, draw a second line straight down to hit the horizontal axis at 1.5 GPM. Therefore, in this example, at 3 feet of head, the pump will deliver 1.5 GPM.

The first step towards proper pump selection is to ensure that the required system flow and head fall on or marginally below the pump performance curve. The remaining steps involve comparing additional information, such as horsepower, efficiency, etc., included on performance curves to help eliminate poor performing pumps.