Single Stage vs. Two Stage Pumps

The saga continues - the controversy goes on - which type of pump, single-stage or two stage, is better.

Some of the single-stage versus two-stage controversy comes from the proponents of each point of view who may well believe that one type is superior to the other. It is also possible that some proponents of either type may also have some self-serving reasons in attempting to convince others of the benefits of one type over the other. This could potentially lead to the acquisition of an inappropriate type of equipment chosen for all the wrong reasons.

Both the single-stage and two-stage type pumps play important roles in the fire service and the choice of single-stage or two-stage should be a result of an informed decision based on the choice of pumps meeting your specific pumping requirements. Selecting the proper type pump to meet your specific needs is simply choosing the right “tool” for the job just like a carpenter or plumber selecting the right tools for his trade.

Both type of pumps meet all NFPA1901 and NFPA1911 standards. Therefore, why the controversy. Truth is both types of pump meet all NFPA standards because they are designed to do so; however, beyond the “Class A” NFPA standards are subtle, yet important design differences. These differences are found when pumping procedures go beyond the stated NFPA standards for volume and pressure and once known, could be a determining factor in making the right choice of pump type.

Fundamentally, the differences between the single-stage and two stage pumps are relatively simple. A single-stage pump, of current design, has one dual suction impeller designed to take water in both sides of the impeller, providing discharge flows to all discharge gates. The operator has full range pump performance with the operation of the engine throttle. A single-stage pump can reach approximately 350 Psi maximum pressure.

A two-stage pump has two impellers operating side by side on a common shaft by design, which gives the operator a choice of selecting a “volume or pressure” option from the pump, depending on the demands of the fire scene. Incorporated into this design is a transfer valve (changeover) which the operator selects a “volume or pressure position” at his discretion. A two-stage pump, by design, can attain higher pressures than a single-stage pump and in many cases can attain as high as 600 PSI. (Hale’s rating for the pump casing is 600 PSI.)

Essentially, the choice of pump types leads us to the simplicity of operation of a single-stage pump with a maximum pressure of 350 PSI or a two-stage that can achieve higher pump pressures, but adds a device (transfer/changeover valve) that the operator must choose the appropriate volume or pressure position.

The theme of this essay cannot be emphasized strongly enough; that is, if a choice is to be made it should be based on facts and that the ultimate choice of pump type meets your pumping requirements. This decision should not be made through the influence of others that may be promoting one type over the other to further their interests, which may not be in your best interests.
In discussing the single-stage/two stage issue, I believe it worthwhile to return to that point in pump history when centrifugal pumps first appeared. The first centrifugal pump was a single-stage pump, with a single impeller capable of taking suction from only one side of the impeller. It was quickly determined that the maximum attainable pump pressure was ultimately determined by the size and speed of the engine. Since engines at that time were relatively small in size an improved pump design was required to utilize the available engine performance to attain higher pump pressures - and the two-stage pump was born. This was over fifty years ago and the two stage pump technology remains fundamentally the same today as when it began. However, the single-stage pump technology has been revolutionized over twenty-five years ago, which fuels the current controversy. Unquestionably, the development of two-stage concept was overwhelmingly superior to the single-stage pump fifty years ago. However, the evolution of the current single-stage pump technology is often overlooked in the current discussions on this topic.

Current single-stage pump technology incorporates a superior impeller design with suction entry on both sides of a single impeller providing axial balance of the impeller, combined with dual cutwater design of the Hale pump, also provides radial balance an smoother vibration-free performance. This impeller design fitted with a Hale unique one-piece pump body design eliminates the inefficiencies caused by multi-piece pump bodies, and vastly improves the pump’s performance. Coupled with the increased, almost unlimited power, of today’s current engine technology it provides a strong single-stage pump combination worthy of consideration that could meet or exceed your pumping requirements.

We believe the single-stage preference at 75% is essentially due to the “simplicity of operation.” Issues of training pump operators as the correct position, volume or pressure are eliminated and a single control, the engine throttle, provides you full pumping capabilities.

The efficiencies of each type pump, single-stage or two stage, often become part of the controversy and it should not, because each type of pump is designed for a different purpose and therefore has different design points. The two-stage pump is designed for higher pressures and therefore in a “pressure” mode is more efficient at this point. Conversely the single-stage (double suction impeller) pump designed for higher, more efficient volume. Comparing the two types of pump without consideration for the differences in design is not a fair comparison. More importantly should the efficiencies of each type pump be a significant factor in choosing one type over the other - probably not. As noted earlier, the right tool for the job, and if your choice meets all of your pumping requirements it will be the right choice and the issue of pump efficiency will not be a factor.

The single-stage/two stage pump controversy continues, and perhaps although it may not be required, we will other one more position on this subject.

Some of the controversy over the single-stage versus two-stage issue comes from the fact that some proponents of either side wants you to believe that one type is better than the other. I believe that both types of pumps, single-stage or two-stage play important roles in the fire service and the only decision should be to choose the rig type to fit your particular needs. Select the right tool for the job.

The Hale Fire Pump Company manufactures both single-stage ant two stage pumps for the “Class A” fire pump market in the U.S./Canada and around the world. Currently we are producing 75% single-stage, 25% two stage and we believe this ratio 75/25 has been determined by a preference of the fire service.