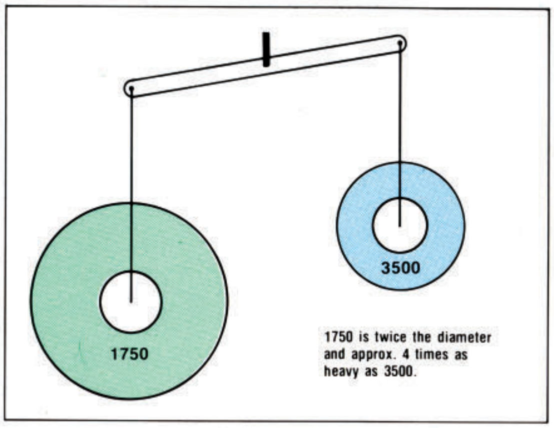
SHIPCO® PUMPS

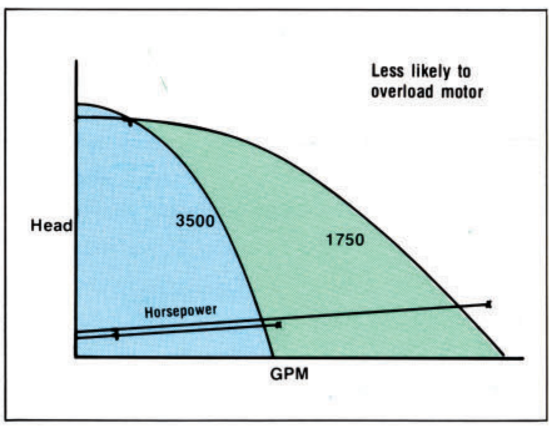
SHIPPENSBURG PUMP CO., INC.
P.O. BOX 279, SHIPPENSBURG, PA 17257
WWW.SHIPCOPUMPS.COM

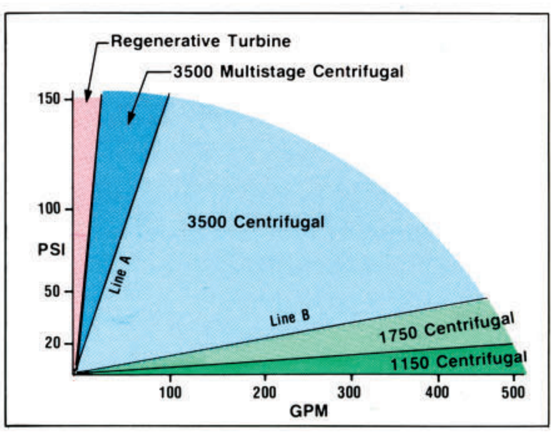
PHONE 717-532-7321
FAX 717-532-7704

WHY 3500 RPM CENTRIFUGAL PUMPS ARE SUPERIOR

(For the Usual Condensate and Boiler Feed Applications)







USUAL TYPES OF PUMPS FOR DIFFERENT HEADS AND CAPACITIES.

IN THE AREA OF LINE A — Multistage are more efficient but much more expensive.
IN THE AREA OF LINE B — It is a cost, efficiency, and NPSH trade-off. In these areas individual selections of both pump types should be looked at.

3500 RPM ADVANTAGES

1. **Impeller is half the diameter and one fourth the weight** of a 1750 impeller producing the same head and capacity.
2. **Moment of Inertia approx. one sixteenth** of a 1750 impeller, making starting easier and frequent cycling more practical.
3. **More efficient** than 1750 RPM for most condensate and boiler feed applications.
4. **Four times the pressure** is possible with a 3500 RPM impeller of the same diameter as a 1750 RPM pump, making it a must for higher pressures.
5. **Just as durable as 1750 RPM** centrifugal pumps for the same head and capacity. Centrifugal pumps are not subject to the wear problems of Regenerative turbine pumps which are frequently chosen to run at 1750 RPM because of this inherent limitation.
6. **Less likely to overload Motor** than 1750 RPM pumps because of much steeper head - capacity, characteristic especially for small capacities. If actual head on the pump is lower than the design head, the pump will operate at higher capacities with accompanying higher power. The 3500 RPM pump maximum load is lower.
7. **Just as quiet as 1750 RPM** centrifugal pumps. Condensate and Boiler Feed pumps are piped to boilers so pipe-borne noise to convectors cannot occur as it can with hydronic circulating pumps.
8. **NPSH requirements are low** for the lower capacities and can be further reduced by use of the "P" modification for higher capacities where the NPSH available is unusually low. (More on NPSH on other side.)
9. **Initial Cost is appreciably lower** because the pump is smaller and lighter than a 1750 RPM pump.
10. **Operating and repair costs are lower** because pumps are more efficient and the motors and parts are less expensive.

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NPSH — NET POSITIVE SUCTION HEAD

There are two parts to NPSH: The NPSH required by the pump inherent in its design and the NPSH available to the pump from its source of water. A centrifugal pump forces water out the discharge by centrifugal action, but water entering must be pushed in by atmospheric pressure or a positive pressure on the suction. Factors that provide NPSH are atmospheric pressure (14.7 PSIA or 34 ft. of water at sea level), additional head of water above the pump suction or positive pressure in the tank supplying the water. Factors that subtract from NPSH are the vapor pressure of the water for its temperature, a suction lift, a vacuum in the tank supplying the water and pipe friction in the suction passage. For example, a pump pumping 160° F water from a 10″ vacuum with 1′ height of water level above the pump centerline would have an available NPSH of 14.7 atmosphere (sea level), minus a vapor pressure of 4.74 PSI (for 160° F water), minus 10″ Hg. or 4.91 PSI vacuum. If the friction loss is 1′ at the rated capacity it would cancel the 1′ static head leaving 14.7 PSI — 4.74 PSI — 4.91 PSI or 5.05 PSI = 11.7′ As long as the pump requirement is less than 11.7′ throughout its anticipated range of capacities it will pump without cavitation. A rise in temperature to 170° F however would reduce the NPSH by .66 PSI or 1.5′.

In general the NPSH demands of a pump can be kept low by large suction cross sectional areas and low velocities. This includes generous areas in the impeller eye itself and low vane loadings. This means that slower shaft speeds result in lower NPSH requirements as flow rates go up. However, the 3500 RPM pump can compete quite well on NPSH requirements at low flow rates with proper design, and NPSH requirements can be reduced further by adding in the suction a well designed axial flow impeller, whose own NPSH requirements are low, and can provide a small pressure increase to satisfy the centrifugal impellers' requirements at somewhat higher flow rates.

REGENERATIVE TURBINE PUMPS

There is a special type of centrifugal pump which has the advantages of high head for low capacity with relatively low horsepower. It consists of a disc of metal with short slots machined on both sides of the periphery of the disc. The vanes left standing between the slots sling the water out into a circular passage where it travels in twin helical paths around the passage which ends just short of the beginning. Each time the water enters the vanes it builds up a little pressure so that the total pressure from inlet to discharge in just under one revolution is quite high for the diameter compared to centrifugal pumps. It is practical only up to 10 or 15 GPM and does better than centrifugal pumps only at higher pressures — 50 PSI and up. Its big disadvantage is close machined clearances and loss of performance as they wear. It is reasonable in cost, but has a short life. They are used mainly for small high pressure boilers. A typical pump would be 4 GPM at 100 PSI.

TWO-STAGE AND MULTI-STAGE PUMPS

The efficiency can be increased for a high pressure low capacity pumping requirement by using two 3500 RPM centrifugal pumps in series. For example, a requirement for 25 GPM at 100 PSI could be handled more efficiently and with less total power with two 50 PSI 3500 RPM centrifugal pumps in series. This can be done with two impellers and volutes in one somewhat more complicated pump or by piping two single-stage pumps in series. The second pump casing and mechanical seal would have to be suitable for the higher pressure, however.

Dividing the 100 PSI into three 33 PSI pumps or into four 25 PSI pumps would tend to improve the efficiency further, but the improvement becomes less with more stages, and the cost goes up. More than 3 individual pumps in series would not be as practical as a multi-stage pump. The main drawback of multi-stage pumps is their high cost, which is usually hard to justify for small quantities of water.

FORM CPS *Revised 4/00*

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