WHITE PAPER

MAXIMISING THE ROI ON YOUR PRESSURE BOOSTING INVESTMENT

A Grundfos Expert Insight

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Introduction to Pressure Boosting

With the bulk of a pressure-boosting pump's total life-cycle cost dedicated to energy and maintenance, it is easy to see why choosing the right pump solution has a huge impact on ROI. Read on to discover how you can get the best returns from your pressure-boosting investment.

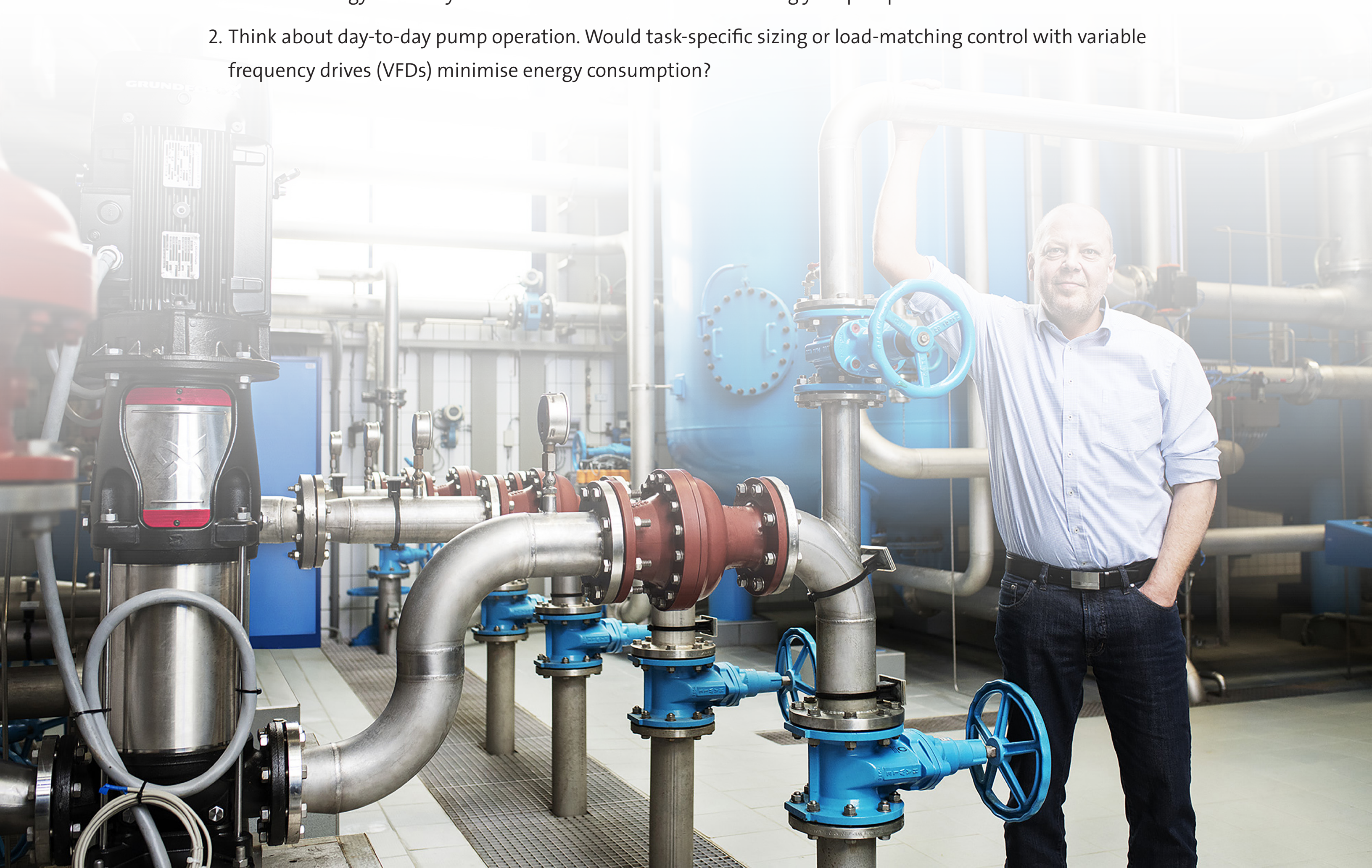
Key Considerations and Life-Cycle Cost Framework

Purchase costs can vary significantly for different types of pumps used in water distribution and industrial pressure-boosting applications. The price of any pump – whether end-suction pumps, split-case pumps, or vertical lineshaft turbines – is a fraction of its life-cycle cost.

Most industry estimates peg energy as the largest single factor in pump life-cycle cost — ranging from 40 to 90 percent. That is why it makes sense to reevaluate traditional pressure-boosting pump selection giving equal consideration to the costs of total life-cycle performance and initial purchasing.

As with so many energy-intensive industry and municipal applications, there are two key ways to reduce total life-cycle costs:

1. Consider energy efficiency and maintenance costs when choosing your pump solution.
2. Think about day-to-day pump operation. Would task-specific sizing or load-matching control with variable frequency drives (VFDs) minimise energy consumption?



Life-Cycle Cost Considerations

Whether you are seeking a more economical replacement for an existing pressure-boosting operation, or choosing an entirely new system, it pays to consider the capital and operational expense (CAPEX and OPEX) of each option. For many applications — such as small municipal utilities, isolated large developments and pressure zones in hilly terrain, and crop irrigation — vertical multistage centrifugal inline pumps are worth considering. Let us look at some of the many benefits they offer – from reduced energy consumption and lower maintenance costs to simple installation, excellent performance, and responsiveness to variable flow and water pressure demands.

Reduced Energy Consumption

A single energy-efficient vertical multistage centrifugal inline pump (Figure 1) can output up to 390 m³/h (1716 gpm) flow in high-head applications ranging from 30m (100 ft) up to 400m (1312 ft). The job-matched efficiency of their pump curves makes these pumps excellent choices for optimising energy efficiency. Each pump design has its own unique curve characteristics. In pressure-boosting applications, a relevant pump curve consideration would be how it adapts to changing flow patterns. Because of the flatness of a split-case pump's curve, it would not be as efficient as a multistage pump in reducing speed when flow demand decreased.

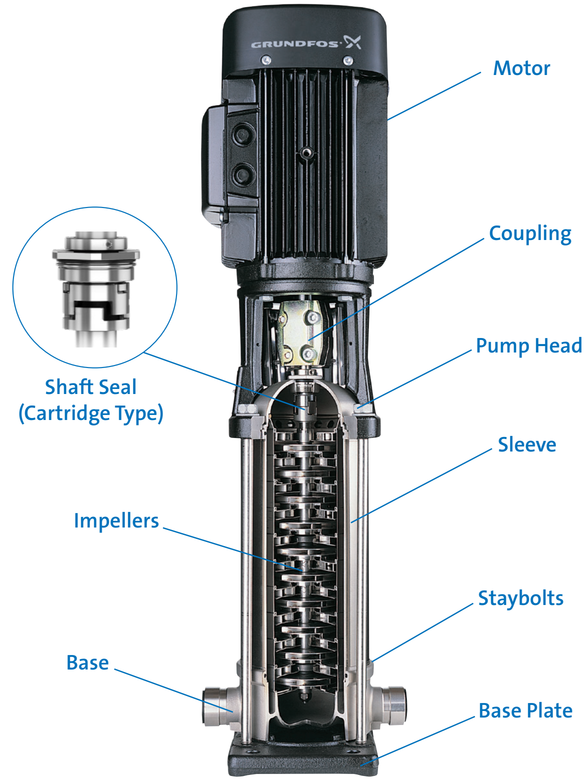
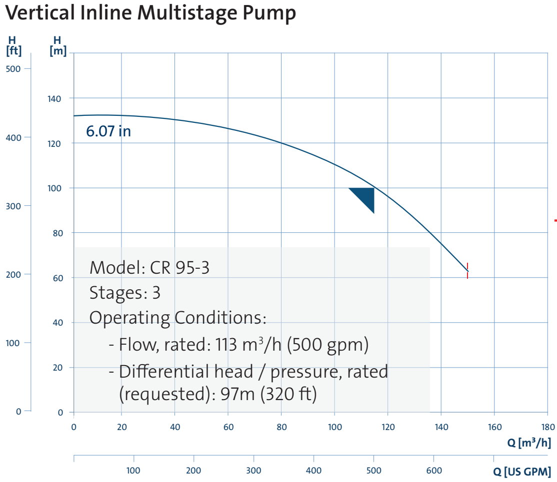


Figure 1: This cross-section of a vertical multistage centrifugal pump shows multiple impellers stacked in a compact housing with a small footprint. Note how the inline positioning of the inlet and outlet ports allows for installation in existing piping with minimal effort. Flanged, union, and clamp-coupling options provide for quick and easy connection and disconnection for service.

Vertical Inline Multistage Pump



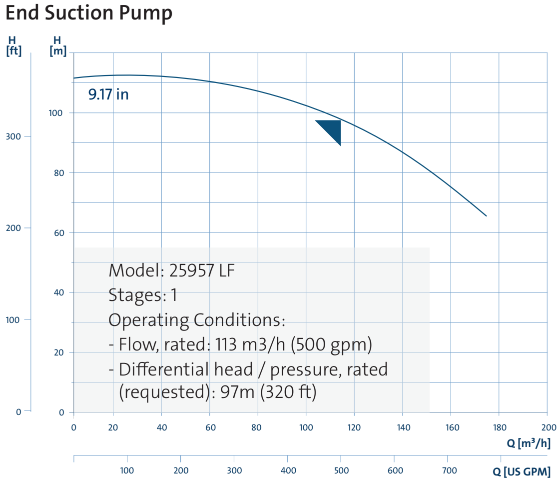
Max Allowable

Shutoff = 131m (430 ft)
Runout = 62m (205 ft)

110% head rise from runout to shutoff

34% head rise from duty point to shutoff

End Suction Pump



Shutoff = 111m (365 ft)
Runout = 65m (215 ft)

70% head rise from runout to shutoff

14% head rise from duty point to shutoff

Streamlined Maintenance

Not all pump styles require the same maintenance. Vertical multistage centrifugal inline pumps offer labour and OPEX advantages over end-suction and split-case pumps.

- **Frequency**
  Vertical multistage centrifugal inline pumps exert very little radial load on bearings, which can be made from materials lubricated by water flowing through the shaft. This means no greasing of ball bearings is required, and the pump does not need dismantling during maintenance - unlike horizontal long-coupled centrifugal or split-case pumps.

- **Convenience**
  You do not need to remove the motor to replace mechanical seals on a vertical multistage pump. This saves money and time, and eliminates alignment issues associated with motor removal. The entire process can be achieved by any technician with minimal training in about 20 minutes (Figure 2) using one-piece shaft seal cartridges (Figure 2). That stands in contrast to older pump styles with more labour-intensive component seals or alignment issues that might require a highly experienced in-house technician or third-party service.

- **Alignment**
  Long-coupled pumps come with a recommended nine-step realignment process every time the motor is removed — ideally including a laser alignment to ensure it is properly positioned and free from vibration. Short-coupled vertical multistage centrifugal inline pumps that do not require motor removal eliminate that excessive realignment labour, saving hours of effort and downtime (Figure 2).

Figure 2: *An easily accessible one-piece mechanical shaft seal cartridge can be replaced in minutes, without removing the motor. This avoids the time and effort typically associated with realigning motors and shaft aftr seal replacement on long-coupled end-suction pumps and split-case pumps.*

Pump Configuration and Installation Efficiencies

The small footprint requirements and simplified mounting configurations of vertical multistage centrifugal inline pumps offer additional cost savings and convenience:

- **Easy Retrofit**
  It is straightforward to upgrade existing applications or configure new installations with limited floorspace using multiple vertical pump units, which take up a fraction of the space compared to horizontally-mounted pumps. The inline mounting format — with flange-to-flange spacing of 46cm (18 in) or less — minimises the amount of piping to fit them into existing infrastructure.

- **Low-Cost Installation**
  Minimal installation costs are associated with small, simple, floor-mounted pedestals and inline piping designs. Unlike end-suction pumps they don't need sweeping vertical piping runs. And unlike vertical turbine pumps, they don't need deep pits for inline piping. High-volume application installations are also streamlined with prepackaged multipump systems (Figure 3).

Figure 3: *Packaged multipump systems that integrate speed control to quickly ramp throughput up or down can satisfy a broader range of demand with greater energy efficiency than typically offered by end-suction or split-case pumps.*

Reduced Vibration

Vibration generated by misalignment issues can significantly shorten pump lifespan in pressure boosting applications, by damaging seals and even bearings. In close-coupled vertical multistage centrifugal inline pumps, you do not need to remove the motor for maintenance – which minimises the risk of shaftmisalignment, and wear-inducing system vibration.

Task-Specific Control

While physical design features — such as hydraulic efficiency, energy-efficient motors and profiled impeller vanes to reduce resistance — contribute toward OPEX-saving potential, the ultimate performance of any pressure-boosting application depends on its ability to respond to changing application demands. Working closely with engineering experts can provide information and insight on the best ways to implement specific projects, whether through identifying a proper pump curve or using variable frequency drives (VFDs).

Depending on the maximum pressure and flow requirement, when working with Grundfos solutions, the VFD can either be a Grundfos MLE motor or a panel-mounted CUE VFD. The MLE motor is available up to 30 hp; a VFD larger than 30 hp will be a panel-mounted CUE VFD. The Grundfos factory-loaded firmware on all VFDs includes the pump curve for the pumping end, to run the system at optimal efficiency. Grundfos VFDs understand Grundfos pumps, so plant maintenance engineers will not need to trim the system for optimised operational efficiency. The VFD allows the pump to provide low-flow demands at system pressures over a wide operating range.

Success Story

Wasserverband Südliches Burgenland (WVSB) is a water treatment plant in the town of Oberwart, Austria, that serves 50,000 residents. Grundfos approached WVSB to test the CR 95 in a water booster supply application, where drinking water would be raised into storage tanks following a sand filtration/backwash process.

Based on the pump design and operation capabilities, Grundfos engineers suggested that the new CR 95 could do the same work as the existing pump with up to 30% reduction in energy consumption.

In testing, the Grundfos CR 95 used 689 W/litre per second, versus 895 W by its predecessor. Further evaluations showed a maximum savings potential of 30%, as the Grundfos engineers had calculated.

“We’ve achieved huge energy savings with this one pump,” said WVSB’s managing director, Christian Portschy. Mr Portschy explained the new CR XL pump supported WVSB’s sustainability ambitions, which include a solar farm on nearby rooftops. With these 200 PV panels and reduced energy demands by its pumping system, WVSB can now run important equipment, even if the farm is hit by a power blackout.

The Grundfos CR XL pump has been so successful that WVSB now plans to acquire three more.

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GRUNDFOS Pumps Ltd
Grovebury Road Leighton Buzzard
Bedfordshire LU7 4TL
Phone: 01525 85 00 00
www.grundfos.co.uk