

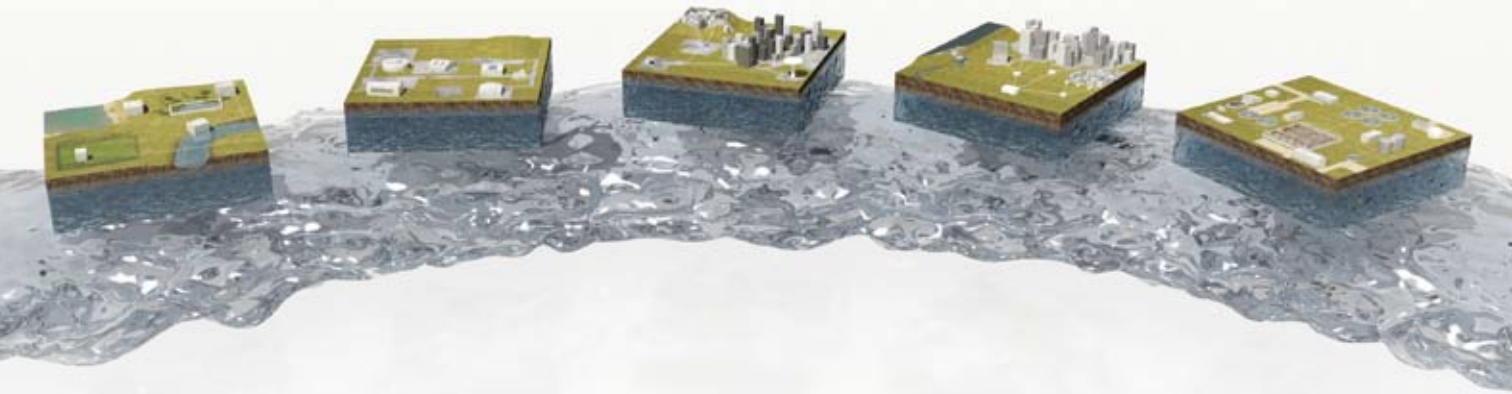


**RELIABLE AND
COST-EFFECTIVE
WATER
DISTRIBUTION**

– Save on leakage losses and energy costs



BUILDING ON A PROVEN TRACK-RECORD



Reliable and cost-effective water distribution

Grundfos offers support in the planning, designing and commissioning of pumping systems, and we deliver the technology that can meet our customers' objectives.

With our high-efficiency pumps, IE3 motors and plug'n'play controls, we can go further than most to bring water to life in a financially and environmentally sustainable way. Our insight can be applied to addressing the key issues of safeguarding water resources, meeting consumer needs and ensuring cost-effective infrastructure.

Over the years Grundfos has pioneered numerous innovations that have become or are becoming industry standards. Grundfos will continue to be at the forefront in promoting and facilitating energy efficiency and sustainable technology. It is these innovations that will enable water distribution infrastructure to meet future challenges and regulations.

Our commitment is to play a strong part in the bigger picture, to ensure the reliable and efficient supply of clean, safe water that households and businesses depend on.



Thousands of Grundfos Hydro MPC boosters are already providing consumers with constant water pressure. Each booster is a fully integrated turnkey unit based on the extremely reliable, high-efficiency CR pump and the Control MPC multi-pump controller. The system ensures complete and instant control and unbeatable efficiency, while keeping leakage loss down.

DRIVE DOWN WATER LOSS

The key issue of reducing and controlling non-revenue water (NRW) in distribution networks is many faceted with no single cure. Central to a typical strategy is to minimise losses through existing leaks and reduce the risk of new leaks.

Pressure management is now well recognised as being essential to effective leakage management. In addition to pressure management, the International Water Association (IWA) also recommends active leak control, speed and quality of repairs, and infrastructure management.

Grundfos' contributions lie within pressure management and infrastructure management, as presented on the following pages. We have developed systems to support pressure management systems, and these are integrated in our pumping solutions.

Cut water loss by 20%

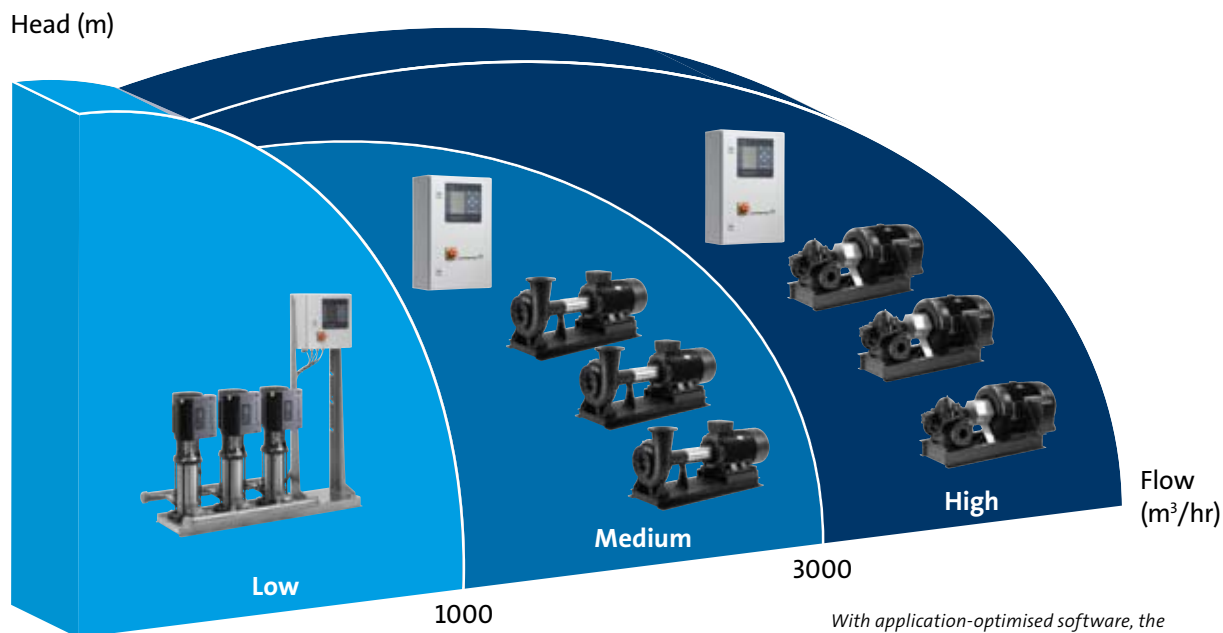
With unique proportional pressure control, the Grundfos Control MPC multi-pump controller automatically reduces surplus pressure in the water mains. Both leakage losses and energy costs are reduced significantly as a result.

Start with the pump first

When you start replacing pipes, you also reduce water loss and friction loss, resulting in increased pressure in other parts of the network. It is therefore important to be able to manage pressure from the pump. So before you start digging up the streets to repair leaks, make sure you have the right pumps and controllers first. If you have variable flow, an analysis of consumption patterns will reveal the potential benefits of optimising your pump systems.

Grundfos Control MPC

- Proportional pressure control
- Gradual ramp-up/ramp-down
- Cascade operation of up to six pumps
- Monitoring and control with clear text messages



With application-optimised software, the Control MPC offers complete monitoring and control of up to six multistage, split-case or end-suction pumps from Grundfos.



PROPORTIONAL PRESSURE CONTROL – A UNIQUE WAY TO SAVE MONEY

Lower leakage losses

Proportional pressure control ensures constant tap pressure at the consumer as opposed to a constant pump discharge pressure. Automatic setpoint reduction typically reduces leakage by 5-20% – sometimes by as much as 50%.

In high flow periods, friction loss in the mains is relatively high. The loss is correspondingly low when flow drops in off-peak periods of the day. If the pump discharge pressure remains constant regardless of flow, the difference in friction loss will result in excess pressure in the system. This increases leakage losses during off-peak periods.

Proportional pressure control compensates for excessive system pressure by automatically adapting the setpoint to the actual flow. This is unique to Grundfos' multi-pump controller, Control MPC, and is made possible because the controller has been designed and programmed specifically for Grundfos pumps.

Example of the savings

If the pressure loss in the pipe system is 2 bar during high flow periods, the pump discharge pressure must be set

to 6 bar in order to deliver a tap pressure of 4 bar.

However, in a low-flow situation, the pressure loss in the pipe system may only be 1 bar. If the setpoint remains fixed at 6 bar, this would increase tap pressure to 5 bar. The surplus 1 bar in the system increases leakage loss and represents excess energy consumption, hitting your cost level in two ways.

To compensate for this excess system pressure, the proportional pressure function in the Control MPC automatically reduces pump discharge pressure to 5 bar so tap pressure at the consumer remains a constant at 4 bar.

In this example an average reduction in pressure of 15% can be obtained by constantly adapting the pressure to the actual demand. This would reduce water losses by 10%.

PRESSURE MANAGEMENT PAYS WELL

Reduce surplus pressure

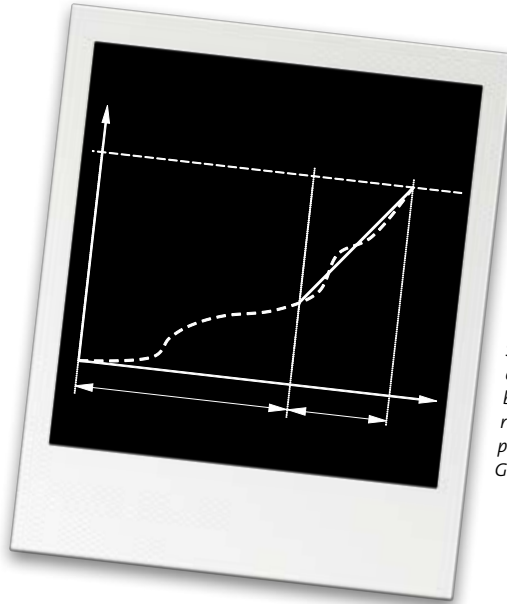
When you reduce pump pressure by 50%, you reduce leakage loss by at least 30%.

The surplus system pressure that arises in low flow situations is a major cause of water loss through existing leaks. The proportional pressure functionality built into the Grundfos Control MPC is a unique tool for reducing this surplus. The Control MPC monitors system conditions, detects the increase in system pressure and reduces the set-point accordingly. For the consumer there is no change in tap pressure. But for operator, leakage is reduced significantly, and a considerable cost saving is achieved.

Beat water hammer

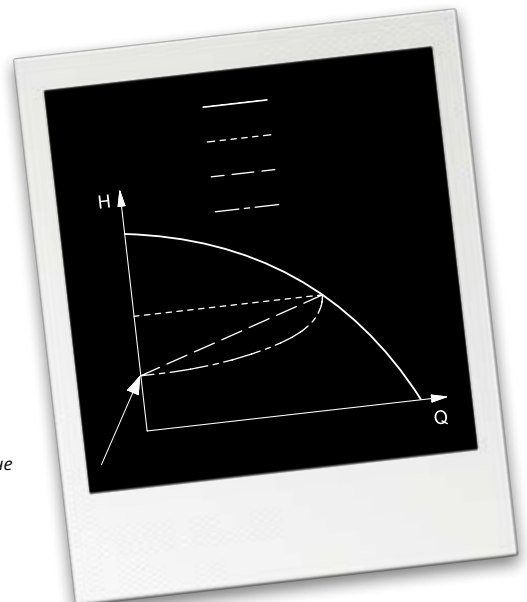
An important contributing factor behind new leaks is water hammer. Caused by sudden momentum changes in a pipe system, this phenomenon can be reduced or eliminated by lowering fluid velocities, reducing pump size or by gradual ramp-up/ramp-down.

To combat water hammer, Grundfos can assess the options for each distribution network by analysing system conditions and consumption patterns. Our recommendations are held up against the economic level of leakage and the resources available to maintain a viable pressure management strategy.



Sudden momentum changes that cause water hammer can be avoided by a gradual ramp-up, likewise with ramping down. This is a standard pre-programmed function in the Grundfos Control MPC.

A big pump has a big water hammer effect; this is a factor of the pump's inertia. Smaller pumps reduce the risk of water hammer. The purchase price and operating costs are also lower.



Proportional pressure control automatically regulates the set-point to minimise water loss and energy consumption. This is unique to Grundfos Control MPC.

NEW COST-EFFECTIVE DESIGN PRINCIPLES

Lower capital investment

Compared to traditional set-ups, the design principle described here reduces initial capital investment. When converting existing systems, payback time is typically within 1-3 years.

The highly variable flow rates that characterise water distribution networks are an important factor affecting cost-efficiency and water loss. To be sure that consumer needs are met at any given time, a tendency in system design has been to size pumps based on maximum demand. Pump-

ing stations are then typically equipped with one duty and one standby pump, each of them able to meet 100% demand.

However, far more time is spent pumping at low flows. Regardless of whether flow is regulated by a valve or Variable Frequency Drive, the efficiency of such a single pump solution will fall quickly as flow decreases.

Instead of two "100% pumps," the optimal solution is to install three or more smaller pumps in parallel controlled by the Control MPC. Grundfos systems can be expected to deliver a hydraulic efficiency of more than 80%. Instead of two "100% pumps", the optimal solution is to install three or more

smaller pumps in parallel. The multi-pump controller automatically maintains the best efficiency point by cascade operation and speed control. Our experience shows that installing such a system results in a lower initial capital investment, lower energy consumption and lower leakage losses. The lower inertia in the smaller pumps also reduces the risk of water hammer

To design systems based on this principle, Grundfos uses load profiles based on 24-hour consumption patterns. The load profile gives an overview of how much a pumping system operates at a specific flow rate on a daily basis, and the system can be designed or redesigned accordingly.

Example of demand-driven distribution system:

Estimate of savings

Initial investment:
20%

Operating costs:
30%

Leakage loss:
5-20%
(as much as 50% in some instances)

Assumptions

Duty point:
900 m³/h at 40 m

Existing pumps:
1 x 100% duty + 1 x 100% standby
(2 x 160 kW)

Replacement pumps:
3 x 50% in cascade
(3 x 75 kW, variable speed
+ proportional pressure control)



IT'S NEVER TOO LATE TO OPTIMISE

When discussing energy-efficiency, the long-standing experience that Grundfos brings to the table is a unique asset. We can illustrate how optimising energy consumption also has a positive impact on the reliability, overall performance and life-cycle costs of a distribution network.

By analysing pumping needs in relation to consumption patterns and periodical variations, we can determine the

our offering and freely available in our online sizing tool WebCAPS.

The Grundfos Pump Audit is a relatively simple process of measuring flow and energy consumption. There is no need to dismantle or modify the installation in any way. Data is recorded over a period of time, and the subsequent analysis shows the pump efficiencies and energy consumption of the existing system. Grundfos then

Cut energy consumption by 50%

Many system designers claim that as much as 50% of the pump energy consumption can be saved. This claim is substantiated by the many pump audits Grundfos has performed around the world.

A Grundfos Pump Audit is an exceptional and well-proven tool that enables the water supplier to prioritise investments in energy reduction.

optimal pump configuration to meet the utility's objectives for cost-efficiency. Our recommendations cover the size and number of pumps, the viability of frequency control, suitable motor protection, pipe materials, etc. The desired outcome is financially and environmentally sustainable energy consumption, trouble-free duty and low service costs with a minimal need for specialised knowledge. Lifecycle cost calculations are a natural part of

recommends design improvements, quantifying the energy saving, CO₂ reduction and the payback time.

The step-by-step process is well-documented, and the subsequent report gives clear economic and ecological implications of investments in energy optimisation. It is most common for a pump audit to identify improvements with payback times of only 6-24 months.



A pump audit is a step-by-step process to identify potential energy-saving investments. Payback times are most commonly 6-24 months.

INTEGRATION IS THE KEY TO EFFICIENCY

Clean, safe water to the door

A dedicated project engineering team specialises in designing and implementing turnkey water disinfection projects internationally.

- Complete disinfection and dosing systems
- Complete measurement and control systems

Disinfection systems for the network

Although the objective is the same – to provide safe, clean water – the methods used to do so are numerous both at central treatment plants and in secondary treatment throughout the mains network. Chlorine-based water disinfection methods are the most common, but no single method can meet all needs. Local regulations are probably the one factor that has most bearing on which system we recommend. The availability of raw materials and the costs of energy and chemicals also have a decisive influence.

Chlorine gas – proven and effective

Gas chlorination systems under full vacuum, such as Grundfos' Vaccuperm, are the proven ways of meeting the challenges of storing and handling chlorine while ensuring effective disinfection.

Chlorine dioxide

– no change in taste or smell

Grundfos' Oxiperme Pro ClO₂ generators are well suited for secondary disinfection in the network. Chlorine dioxide does not change the taste or smell of the water. It is less corrosive than hypochlorite in the water pipeline, and is effective against biofilm and microorganisms exhibiting chlorine resistance.

Electrolytic chlorine generation – safe and simple

The hypochlorite generated electrolytically with Grundfos Selcoperm is not subject to the same rate of degradation as commercial hypochlorite. This gives greater dosing precision. Given the simple precursors (water and salt), the onsite generation process is also considered safer for operators to use.





Hydraulics, motors, drives, controls, data communication, dosing and disinfection systems. Grundfos can integrate the many parts to work as a whole.

Made for each other

The hydraulics, motors and electronics on Grundfos systems are specifically developed for pump operation. Motors are optimised to the pump's duty range, typical pump functionalities are built into pump controllers, and communication interfaces are pre-programmed for data exchange to and from central SCADA systems.

Control and monitoring systems

In recent years, control and monitoring systems have increased the potential for improving both efficiency and reliability. However, integrating the many isolated components involved has at times proven complex and costly.

Grundfos has addressed this problem by engineering integrated drives and monitoring and control units that are dedicated specifically to pumping systems. The external variable speed drive (Grundfos CUE), multi-pump control (Grundfos Control MPC) and internet-based supervision (Grundfos Remote Management) are recent examples. The key has been to integrate components to offer complete systems that are pre-engineered to work together. Interface issues that require expensive programming are replaced

by simple commissioning procedures that offer step-by-step guidance that anyone can follow. Specialised functionalities have been developed and optimised for pumping systems.

To enable communication with a central SCADA system or supervisory controller, Grundfos monitoring and control systems include plug-and-play communication interfaces for Profibus, ModBus, GENibus, LON, GSM and other systems.

Monitoring and control specialists from Grundfos can contribute to finding the right solution based on your objectives for a given set-up.

FULL REFURBISHMENT AND CONVERSION TO DIRECT PUMPING

Time to put an end to leakage losses

The deteriorating state of an elevated suction tank had pushed the issue of non-revenue water to the top of the agenda for a water authority in Malaysia.

Space limitations around a big-city pumping station made it impracticable to simply replace an old tank that was the cause of extensive leakage losses. Alternative solutions were called for, and Grundfos tended a proposal for direct pumping to consumers.

As shown on the schematic diagram, the solution was based on split-case (Grundfos HS) and in-line (Grundfos CR) boosters, all with variable speed control.

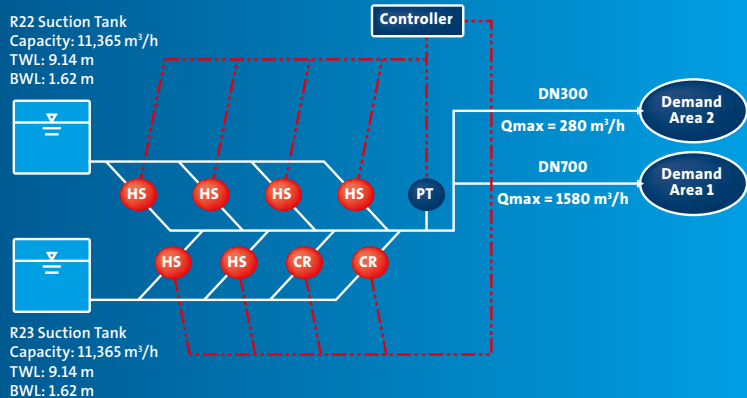
The solution was accepted, but there were conditions attached to ensure minimal disruption to water consumers. As required by the authority, Grundfos completed the refurbishment including the monitoring systems within two days.

The facts of the case

- Total water demand – 30m l/day
- Total pumping time – 24 hours/day
- System pressure – 4 bar
- Total pump capacity – 1860 m³/h with 50% safety factor
- Budget: MYR 4 million

Schematic diagram

Schematic diagram of the new booster pumping system



BENEFIT FROM A LONG-TERM PARTNERSHIP



Commissioning, service and spare parts

Our offering extends from the initial planning of water distribution projects to the end of a long service life. After installing and commissioning, we can actively ensure that our systems continue to live up to expectations.

Incorrect installation will cause pump parts to wear out prematurely and energy consumption to soar. Under the terms of a Grundfos Commissioning Agreement, we offer to install our systems and offer an extended warranty. We ensure correct alignment and wiring, and as documentation, we provide a full report, including operational data.

Customised service

Our service capability is based on a close-knit infrastructure of local service staff and 500 authorised service partners worldwide. These are well-trained people with a thorough knowledge of

our technology. As well as being able to commission Grundfos systems, we also offer service agreements, pump audits and an assurance of readily available spare parts.

A service agreement is customised to cover the individual service needs for each pump in each given application. It would typically provide technical advice, training to operations staff and customised service solutions.

Our spare parts service is also customised to reflect each situation and is based on efficient global distribution. We have a variety of offerings, such as online spare parts ordering and support, specially designed service kits, and recommended spare parts list. Authorised local service partners have their own stock of commonly needed Grundfos parts immediately on hand.

A service agreement means

- Rapid response time
- 24-hour hotline support from Grundfos Service Centres
- Warranties on all maintenance and repair work
- Reports after every service visit
- Discounts on spare parts – or on pump replacements

Unmatched online service

All technical documentation and service information is available – always updated – via our online tool WebCAPS:

- Service instructions
- Step-by-step service videos
- Interactive exploded views
- Sectional drawings



SEE THE BIGGER PICTURE

Grundfos is a global leader within water-handling technology and is dedicated to developing pumping and treatment systems for water utility infrastructure. We offer expertise and industry insight that increase reliability, reduce lifecycle costs and handle water resources responsibly.

Our products are the result of decades of engineering expertise and are supported by a worldwide service network. Visit www.grundfos.com/water-utility for more.

Our expertise with pumping systems is supported by a full line of products and systems for:

- Water Intake
- Water Treatment
- Water Distribution
- Wastewater Transport
- Wastewater Treatment

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