GRUNDFOS DISTRIBUTED PUMPING

A modern approach to HVAC system design

BETTER **SYSTEM DESIGN**

IMPROVED **INDOOR CLIMATE**

UP TO **54%** ENERGY SAVINGS

GRUNDFOS iSOLUTIONS | A SMART SOLUTION FOR YOU

be
think
innovate

GRUNDFOS

AN EFFICIENT EVOLUTION OF HVAC SYSTEMS

DISTRIBUTED PUMPING ENABLES HIGH-PERFORMANCE BUILDINGS

Accurately controlled cooling systems are crucial to maintaining an efficient, comfortable building. But this accuracy can be difficult to achieve with standard valve-based chilled water systems. These systems face challenges with balancing and poor dynamic flow regulation, which leads to severe energy loss, inadequate climate control and uncomfortable occupants.

Distributed Pumping from Grundfos means a more:

Balanced Solution

So why are building owners and operators turning to more intelligent ways to balance their HVAC systems.

- Improved system design
- Improved indoor climate
- Up to 54% energy savings

Distributed Pumping Solutions replaces centralized pumps, balancing valves and control valves with smaller more intelligent pumps throughout the building.

This means the system is equipped with the components that generate pressure only when and where it's needed, automatically balancing the system and reducing your energy consumption.

Sustainable HVAC System

Your HVAC system is made up of many components, all working together to provide building comfort. Traditionally, pumps role in this was to circulate water — all of it, at a set rate, without any understanding of what was happening in the system.

Now, by placing pumps out in the system you can deliver the precise amount of fluid needed to achieve ideal indoor climates without wasted energy.

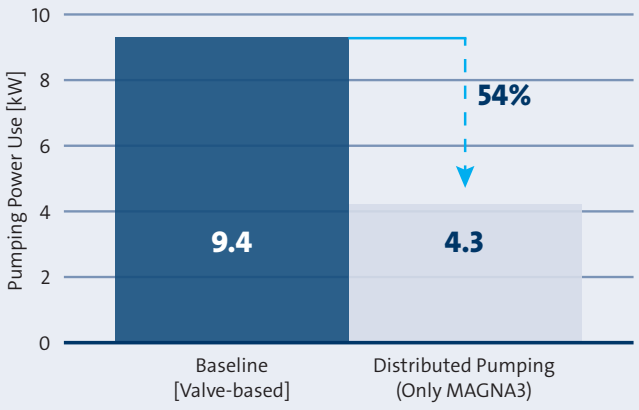
That's why Distributed Pumping Solutions are the most efficient solution for your new or existing building — **IT'S YOUR INSURANCE AGAINST BUILDING DRIFT.**

SUBSTANTIAL ENERGY SAVINGS ACHIEVED WITH DISTRIBUTED PUMPING

These figures are based on a mixed-use building in Singapore. (See case study on page 6.)

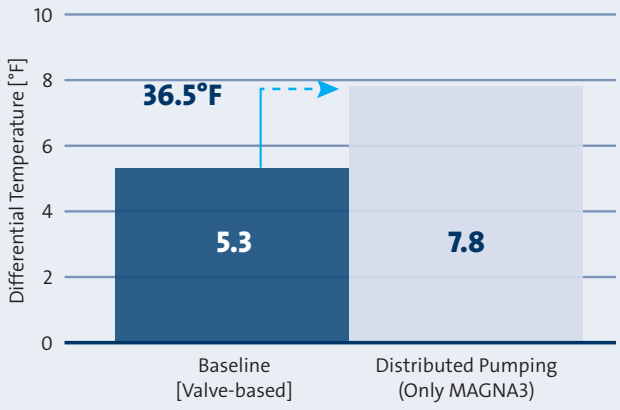
Average Pumping Energy Savings (3-weeks)

Replacing the balancing and control valves with distributed pumps reduced the total pump energy consumption for chilled water loop by 54%.



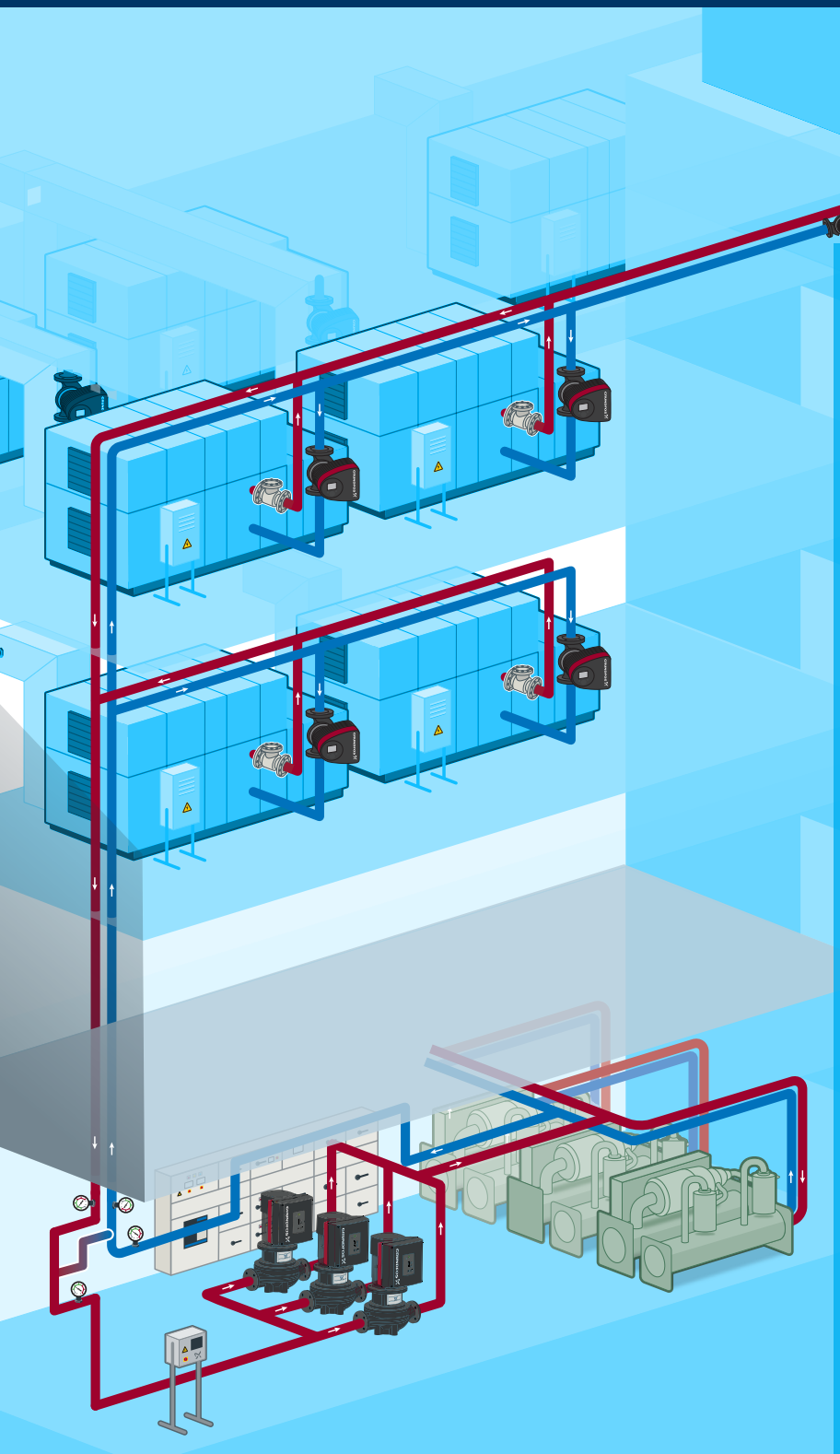
Average Differential Temperature (3-weeks)

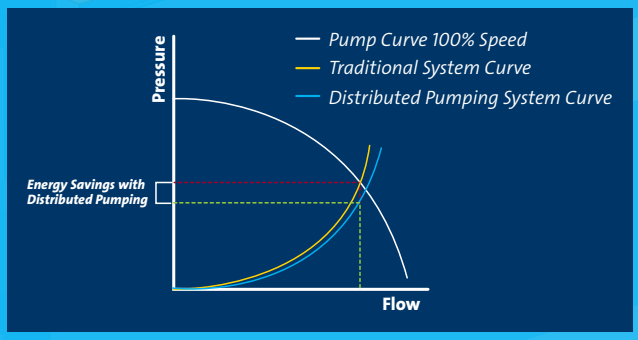
The design Delta T is 10°F. Before the distributed pumping concept, its Delta T was 5.3°F, which increased to 7.8°F after introducing the concept.



OPTIMIZE HVAC SYSTEM PERFORMANCE WITH DEMAND-DRIVEN DISTRIBUTION

Replacing control valves throughout the building with smaller pumps, will allow you to reduce the size of your building's primary pumps and save energy by reducing overall horsepower and providing chillers with targeted flow to meet the exact demands of the building.





EASY COMMISSIONING

Reduce your commissioning time by replacing traditional balancing and control valves with intelligent pumps that generate flow and pressure only when and where it's needed.

Pump programming is easy during installation, and fine-tuning can be done later via the building management system (BMS).

SEAMLESS INTEGRATION

Distributed Pumping easily integrates with your BMS. Many flexible control options are available to ensure seamless integration based on your operation sequence.

Grundfos and their team of knowledgeable partners are available to consult and advise during the design process.

AUTOMATIC BALANCING

During operation, the pump serving each zone, continuously measures the air duct temperature and automatically adjusts the pump speed to achieve the desired set-point — each zone achieves set-point without over pumping, and wasting energy.

IMPROVED DELTA T

An unbalanced water loop can lead to a low Delta T, causing the chillers to work outside the best efficiency point (BEP) and over pumping the loop. Distributed Pumping improves Delta T, which ultimately reduces energy consumption. See how in the case study on page 6.

A TALE OF

1 TRADITIONAL
VALVE-BASED CHILLED WATER SYSTEM

Today, HVAC systems consist of a chiller, air handling unit (AHU) and a pump at the core. To control the system, restrictive devices — or balancing valves — are installed at each AHU to provide the required flow and knock down the excess pressure created by the centralized pumping system.

The balancing process is very time consuming and costly, but it is needed to ensure correct flow in the loops and control the temperature in the coils of the AHUs, according to the design set-point.

During the balancing process, the balancing valves are adjusted to compensate for the various pressure losses in each loop. This helps to create a balanced distribution of the chilled water into the various terminal units located at each loop. In order to have a functional and reliable system, the system components need to be correctly sized to meet the building's cooling load.

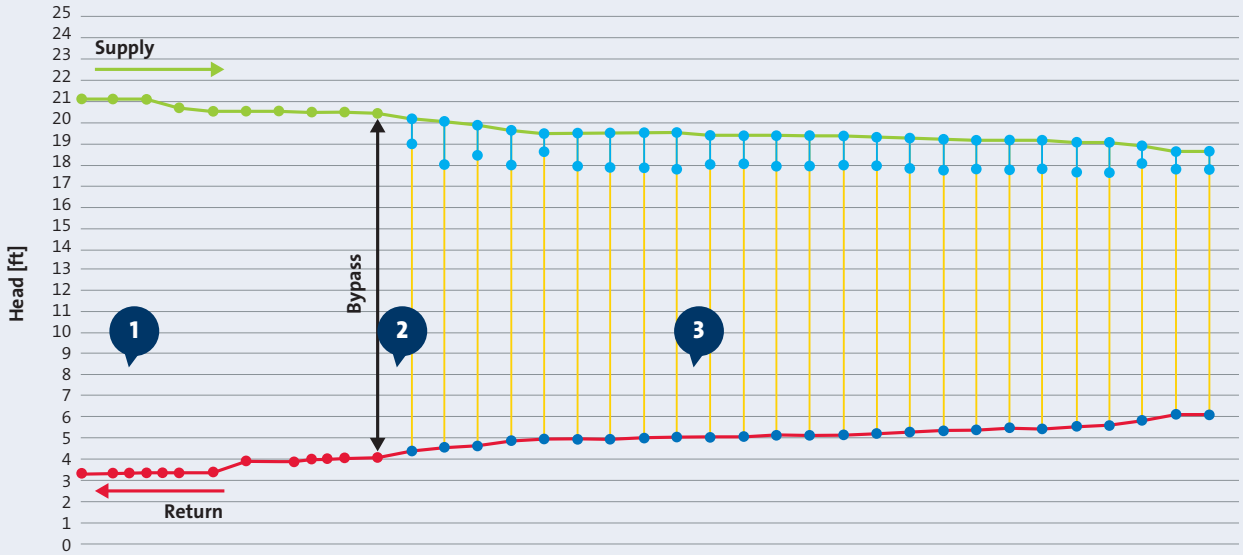
The valve-based pressure gradient
In the figure below we can see the simulation of a pressure gradient for a conventional (Variable Primary Only) HVAC system. The graph illustrates the transfer of pump energy in a hydronic system. It shows that the overall pressure required to overcome the friction losses for the critical loop is very high (the difference between the red and blue lines.) This creates a demand for higher pump power. Also, the non-critical loops require less pressure and will throttle the excess pressure in valves (yellow line), which results in excess energy consumption.

Energy savings at part-load

Simulation of 25-floor riser at part-load

Total Pumping Power = 54.6 kW

Pressure:
- Air Handling Units (AHUs)
- Control & Balancing Valve



1. Big primary pumps
2. High system pressure
3. Huge pressure loss by valves and time consuming balancing process

TWO SYSTEMS

2 GRUNDFOS DISTRIBUTED PUMPING SYSTEM

Replacing traditional balancing and control valves with distributed pumps reduces the time spent on balancing the system. After selecting the right-sized pumps, they will start to provide the precise amount of hydronic energy needed for that specific terminal unit at that given time, there are no valves needed to balance the system — the pumps become your automatic control device for balancing. Additionally, the main pumps can be downsized as each distributed pump generates only the needed pressure for its loop and terminal unit(s). This demand-driven distribution of energy reduces main pump energy, distribution pump energy and provides automatic balance to the entire system, thus delivering desired return temperatures to the chiller.

Dedicated distributed pumps are installed with a check valve at each AHU. The check valve prevents backflow in case the AHU is not calling. The distributed pumps measure the air temperature using the AHU air duct sensor and will automatically regulate the speed of the pump, to provide chilled water and achieve the desired temperature.

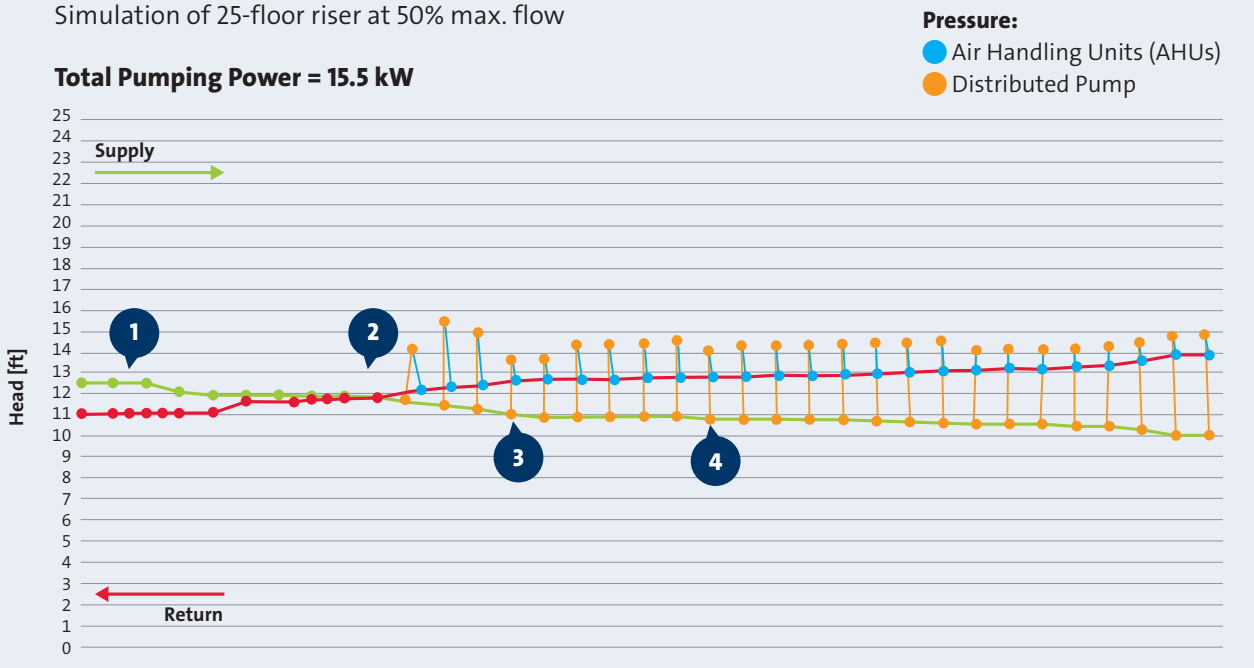
Distributed Pumping System Pressure Gradient

Distributed Pumping offers a completely different picture on the pressure diagram for the same system. The overall pressure required is significantly lowered, as the main pumps' responsibility is reduced and each distributed pump generates only the amount of pressure needed for its loop (the difference between the red and blue lines.) The valves have been removed completely from the system leaving only the AHU coils as the main source of pressure drop. This design results in much lower energy usage and lower total expenditures.

Energy savings at part-load

Simulation of 25-floor riser at 50% max. flow

Total Pumping Power = 15.5 kW



1. Small primary pumps
2. Primary/secondary bypass/decoupler line
3. Low system and differential pressure
4. Each pump adjust to heat load

CASE STUDY | NGEE ANN POLYTECHNIC

Located in Singapore, Ngee Ann Polytechnic Block 22 is a mixed-use, Green Mark Platinum building; certified by The Singapore Building Construction Authority.

Consisting of 10 AHUs and five FCUs, the building's air conditioning system is served by three chillers with a total cooling capacity of 570 RT (2005 kW). The system is configured with two working and one standby chiller. Four chilled water pumps were originally installed to distribute the chilled water in the facility in a Variable Primary Only System.

To uphold the building's Green Mark credentials and push the limits of energy conservation, Grundfos retrofitted Block 22 with a Distributed Pumping system.

This delivered significant time savings compared to using traditional balancing valves, control valves or pressure independent control valves (PICVs).

Installation was easy, with the initial pump configuration done using the Grundfos GO Remote app, and the adjustments to the flow limits were done directly in the BMS for each pump.

During operation, the distributed pumps continuously measure the air duct temperature and automatically adjust the pump speed to achieve the desired temperature — the system is auto-balancing any load, providing optimal comfort for tenants. Reducing the pressure-consuming devices and replacing the balance and control valves with distributed pumps reduced the total pump energy consumption for the chilled water loop by 54%.

EXPLORE OUR
DISTRIBUTED PUMPING PRODUCTS

Grundfos Distributed Pumping Systems consist of five key components: distributed pumps, primary pumps, primary pump controls, check valves and sensors. By combining easy to use system design tools and the latest in smart pumping technology Grundfos Distributed Pumping Systems are not only the easiest hydronic systems to design, install and commission; they will automatically and continuously optimize your system providing maximum comfort, using the least amount of energy.

DISTRIBUTED PUMPS:
MAGNA3, TPE3

The distributed pumps ensure optimum flow and pressure for each terminal unit while continuously keeping the system in balance.

- Most advanced permanent magnet motor (PMM) and industry leading hydraulics make these pumps the most efficient in their class
- Grundfos ePumps come with all necessary control modes for advanced system operation and easy set up
- FLOW*LIMIT* allows you to easily set and maintain max flow for AHU's and FCU's without any additional equipment
- The MAGNA3 is a wet-rotor pump that does not utilize a mechanical seal and is maintenance-free
- Onboard BMS communication modules simplify installation and commissioning, while providing advanced monitoring and logging features

SENSORS & VALVES:
SENSORS

- A variety of sensing elements can be used for operation of the controller
- Air temperature measurement ensures that the distributed pumps are constantly adjusting to the variable load demand

CHECK VALVES

The check valves ensure that there is no backflow in the loops where the terminal units are off.

PRIMARY PUMPS:
HYDRO MPC HVAC, NBSE, VLSE

The primary pumps provide supply pressure for the primary side only.

- The Grundfos Hydro MPC HVAC is an integrated packaged pumping system, designed with advanced controls for optimized pumping, simplified installation and unrivaled efficiency
- Additional capabilities provide for active management of system bypass and chiller low-flow protection
- Reducing primary pump size and continuously optimizing for efficiency makes achieving Delta T design requirements easy

PRIMARY PUMP CONTROLLER:
CU 352

The Controller minimizes the flow in the bypass line, prevents the primary pumps from over pumping and ensures that the minimum flow for the chillers is always met.

WE ARE IN THE WATER BUSINESS WITH YOU

As a pioneer and global leader in water pump technology, Grundfos creates intelligent, sustainable solutions to help solve the world's water and climate challenges. Through our heritage, we have the experience and innovative capabilities to help our partners, customers and communities move water in an increasingly energy and water efficient manner. We see this as not only a great business opportunity, but as an obligation to ensure the world heads toward a more sustainable tomorrow. Our complete portfolio of pumps and solutions are designed for commercial, residential, groundwater, municipal and industrial applications with emphasis in trendsetting, energy efficient technologies such as permanent magnet motors and advanced pump controls and monitoring. Because water matters, and so does your business.

To learn more, visit **grundfos.us** or follow us on Facebook and LinkedIn.

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Visit grundfos.us/pei to learn more about Department of Energy (DOE) pump energy index (PEI) requirements and PEI ratings on specific Grundfos models.

Grundfos Americas
Brookshire, TX 77423

www.grundfos.us
www.grundfos.ca
www.grundfos.mx

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