Grundfos Data Center Solutions DiPu

Efficient water solutions
for effective data flow

COPENHAGEN 2025

GRUNDFOS

Possibility in every drop

Agenda

- Who we are
- Sustainability at Grundfos
- Why Grundfos?
- What we offer
- Distributed Pumping
- Case studies

One of the world's leading pump and water solutions companies

20,000+
employees

87.6%
owned by the Poul Due Jensen Foundation

DKK 33.3bn
$5bn
revenue in 2023

5%
of revenue invested

16,000,000
units produced per year

1945
when it all started

Our promise

We promise to respect, protect, and advance the flow of water

Saving energy
through smarter and more efficient pump technology

Saving water
through developing water-efficient and water reuse solutions

Embedding
Circular business
Principles throughout our organisation

Providing
Water access
to people in need

Sustainability is at the heart of everything we do

6 CLEAN WATER AND SANITATION

13 CLIMATE ACTION

We are the first water solutions company with a Science-Based Target approved Net Zero Goal

By 2030

Reduce absolute scope 1 and 2 scopes Greenhouse Gas (GHG) emissions 50%

Reduce absolute scope 3 GHG emissions 25%

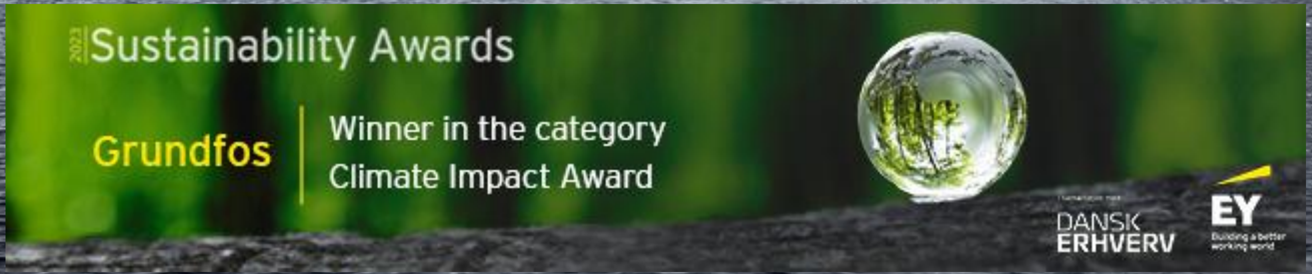
By 2050

Reduce absolute scope 1, scope 2, and scope 3 GHG emissions 90%

SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

Approved science-based net-zero targets




We believe it's
possible to cool
a data center
without warming
the planet

Data Centres

- Estimated to consume 250-350 TWh of electrical energy, comprising 1-1.5% of global electrical demand.
- Energy usage is predicted to rise due to increased adoption of cloud services, AI, and all other electronic interfaces.
- Producing 1 KW of electricity can consume up to 7 litres of water.
- In recent years, the industry has prioritized energy efficiency, leading to a gradual decrease in average PUE.
- Evolving data centre design is driving advancements in cooling technologies.
- Pumps and pump controls are central to cooling systems for facilitating liquid movement.
- Opting for the latest pump systems is crucial for maximising data centre cooling efficiency.

Distributed Pumping

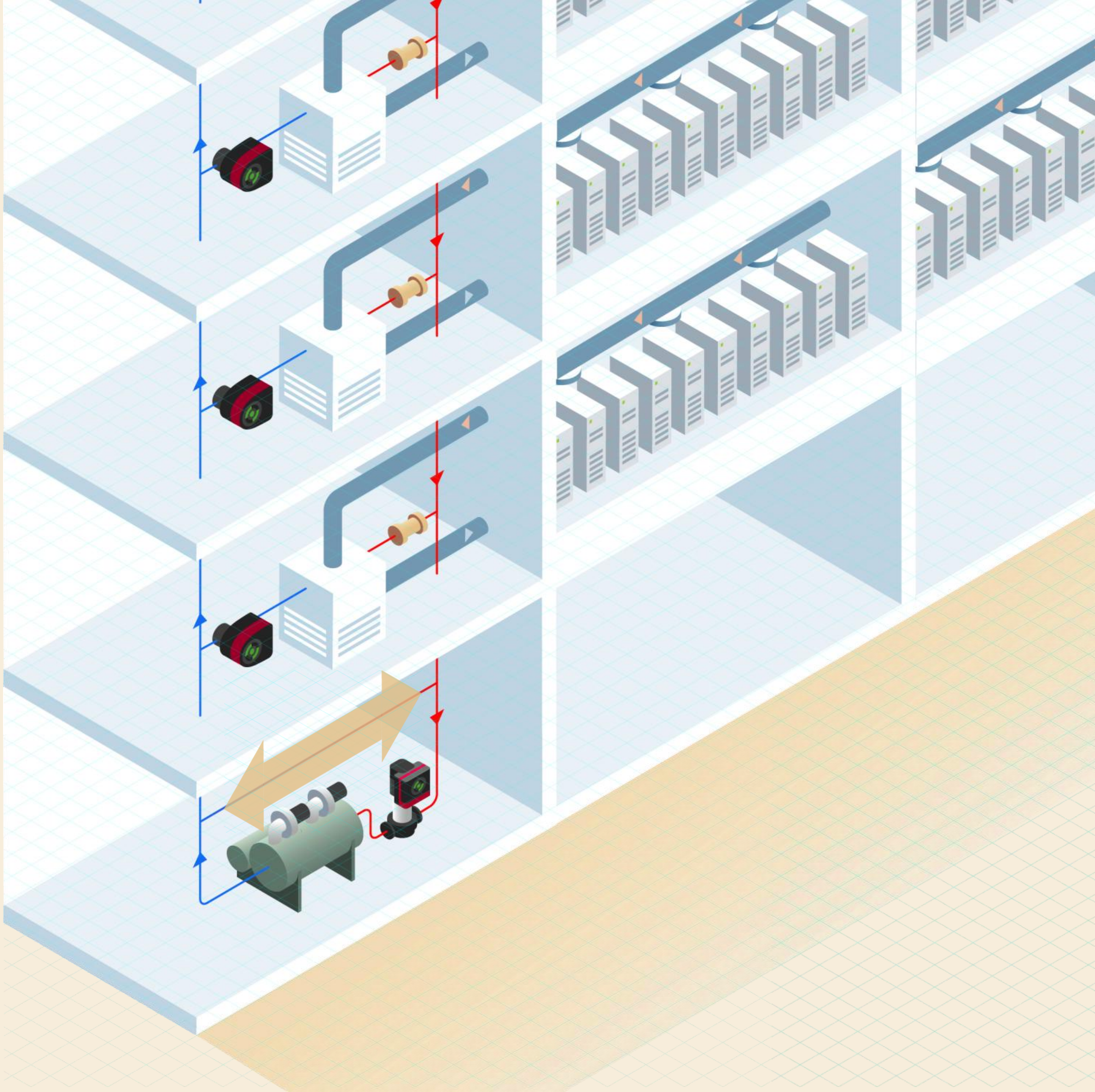
Distributed Pumping represents a paradigm shift towards decentralised pumping, offering an alternative method of distributing chilled water in data centre environments.

It's based on two fundamentals that alter system functionality:

Removing unnecessary modulating valves where feasible.

Balancing flow between the source/primary side and secondary load side to achieve optimal flow control.

This innovative cooling approach can optimise the cooling infrastructure within centres.

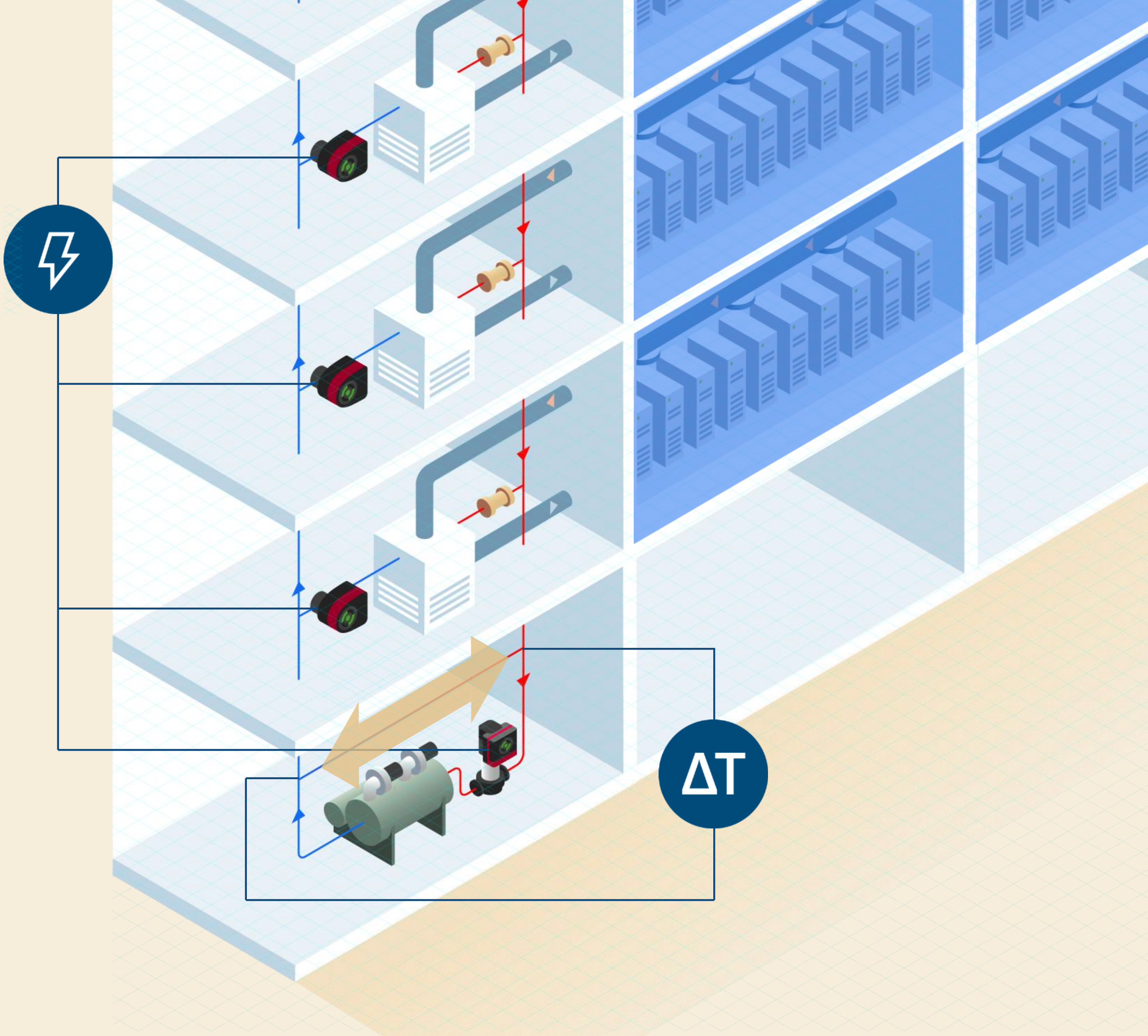


Distributed Pumping

What are the benefits?

- Reduces pumping energy consumption.
- Balances primary and secondary circuits.
- Facilitates modular design.
- Optimises the Delta T.

Using Distributed Pumping results in an automated and more efficient system that has a better balanced and more controlled Delta T.



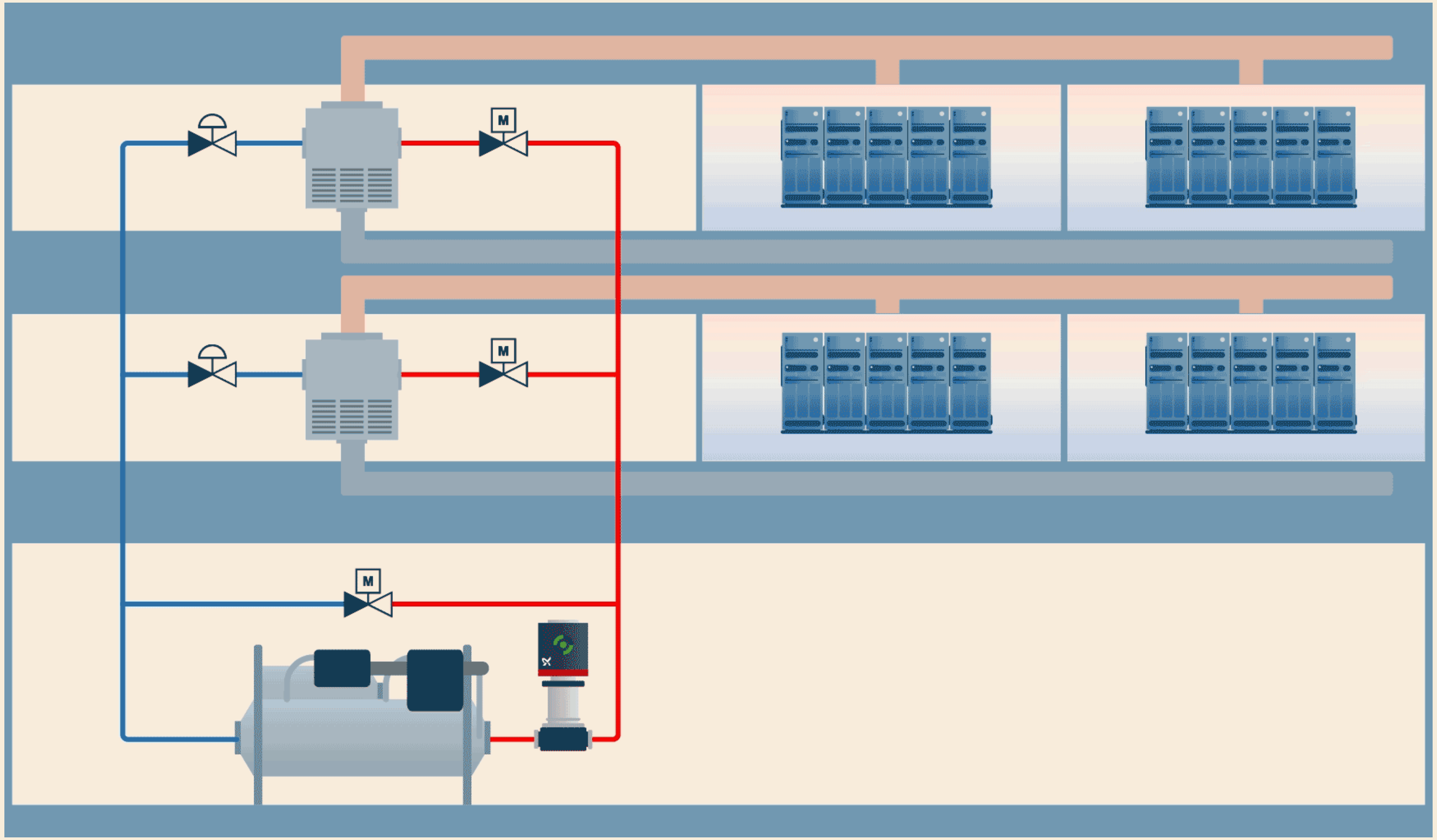
Distributed Pumping

Additional advantages

- Simplified design process.
- Decoupled system, reducing the need to determine the critical index circuit.
- Modular design, allowing for seamless integration of new equipment without impacting existing systems.
- Design performance ensured with Grundfos' recommended control methods.
- Grundfos handles sizing and selection for all coil and primary pumps based on provided piping schematics and equipment information.

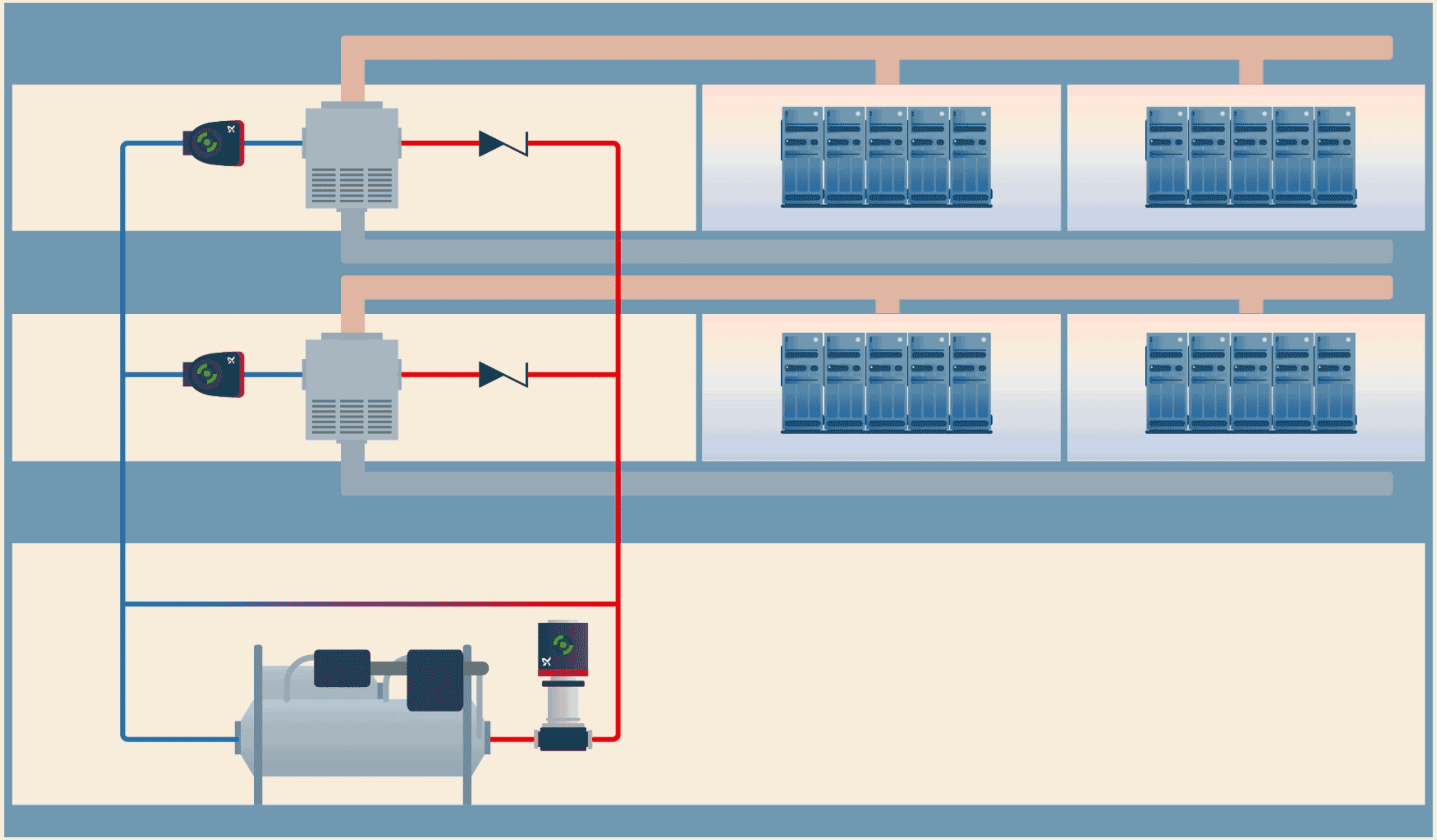
Dynamic flow control in Data Centres without distributed pumping

- Chilled water is produced by chillers or other sources.
- The balancing and modulating valves regulate flow to the CRAH/CDU units.
- Modulating valves regulating chilled water flow create back pressure, consuming energy.



Dynamic flow control in Data Centres with distributed pumping

- The back pressure is eliminated and energy is saved.
- Commissioning is easy as the system is demand-driven.
- Most variable primary or constant primary/variable secondary systems can be converted to a distributed pumping system.



The variable primary circuit

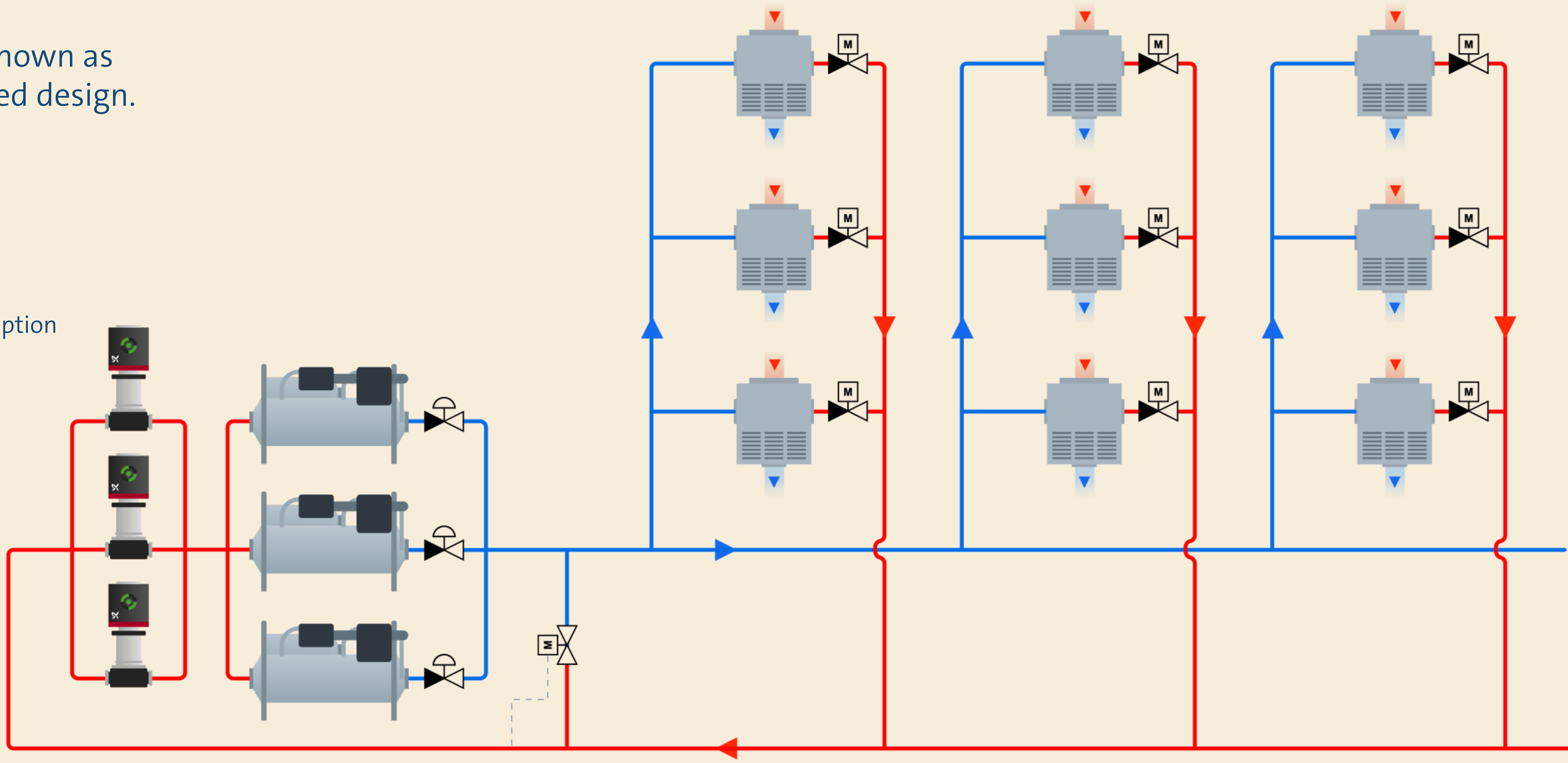
This circuit is also known as the energy-optimised design.

Advantages:

- Lower capital cost
- Saves space
- Reduced power consumption

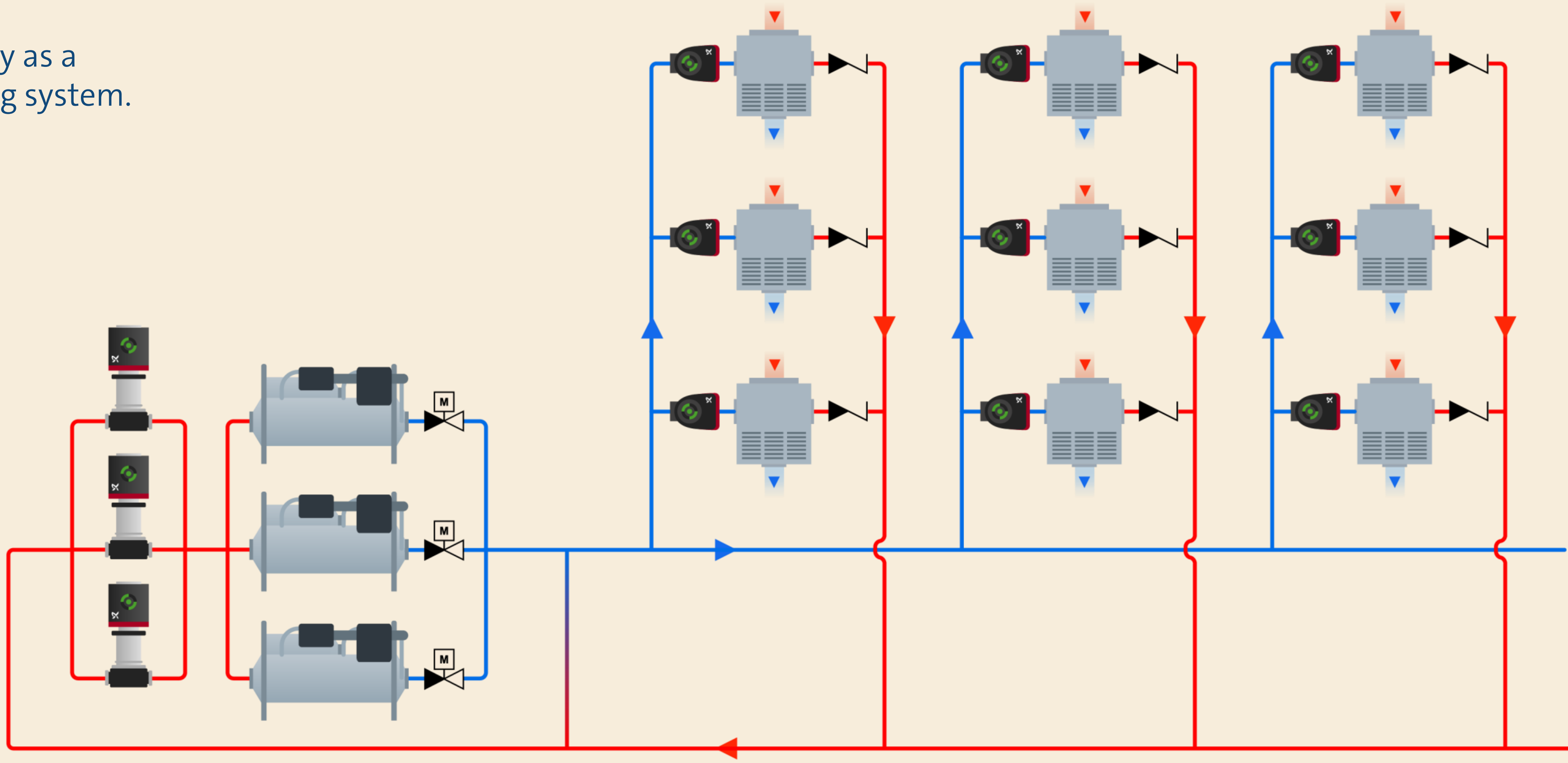
Disadvantages:

- Complex Design
- Risk of bypass malfunction
- Difficult to commission
- Difficult to define index circuit



The variable primary circuit

The variable primary as a distributed pumping system.



The constant primary/ variable secondary circuit

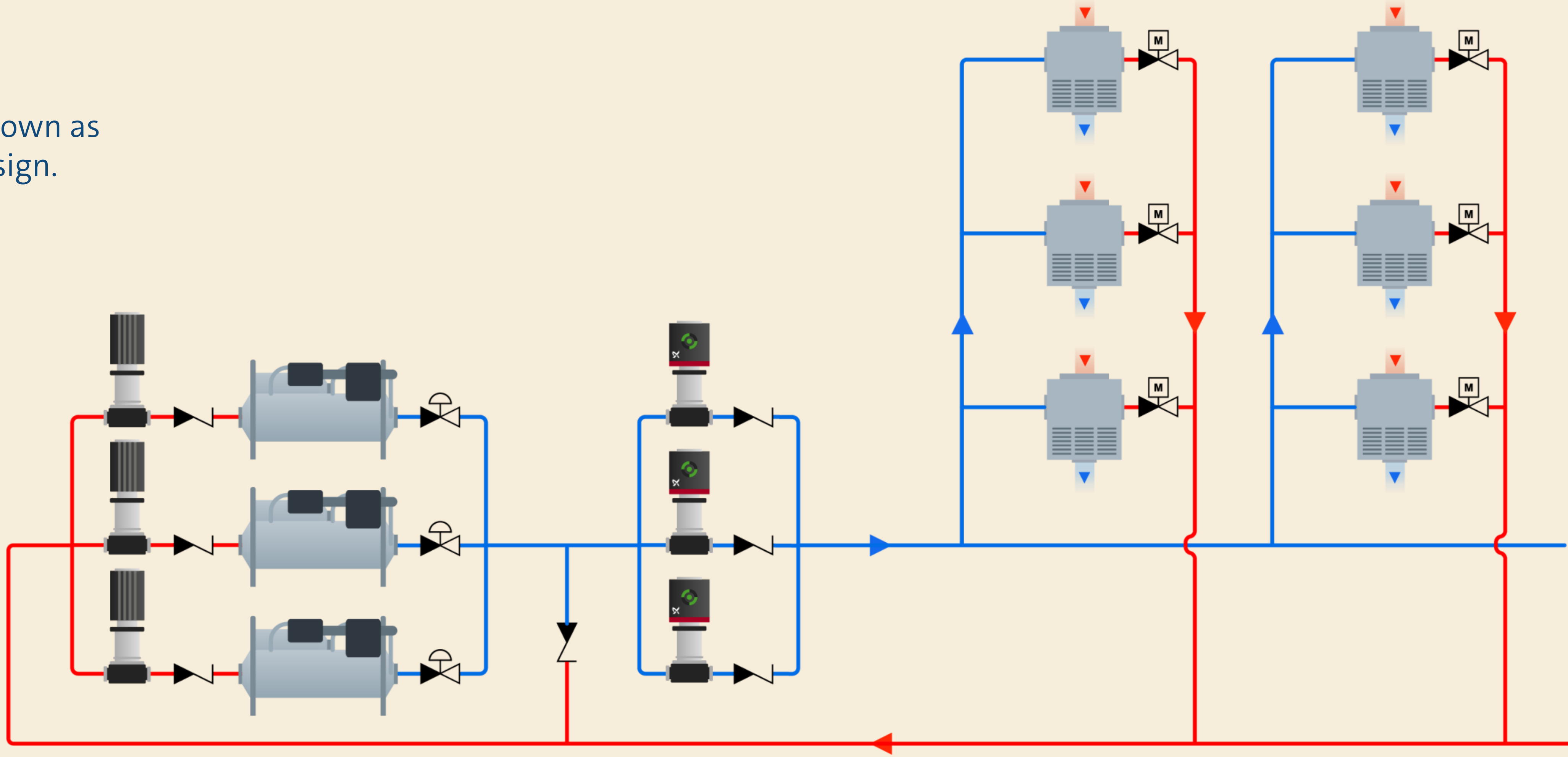
This circuit is also known as the conventional design.

Advantages:

- Easier to design
- Easier to commission
- Easier to balance
- Easier to maintain

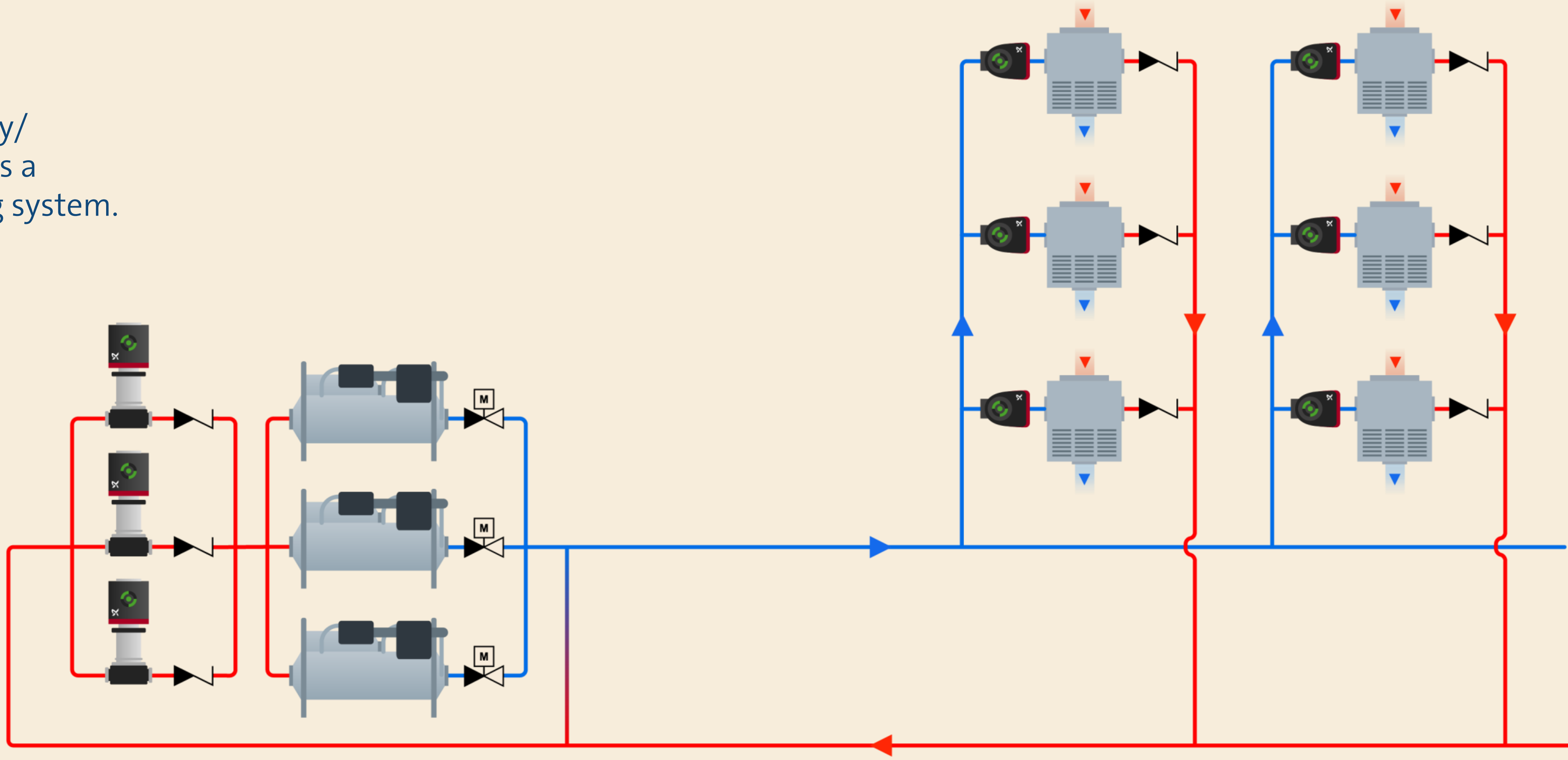
Disadvantages:

- Higher capital cost
- More space required



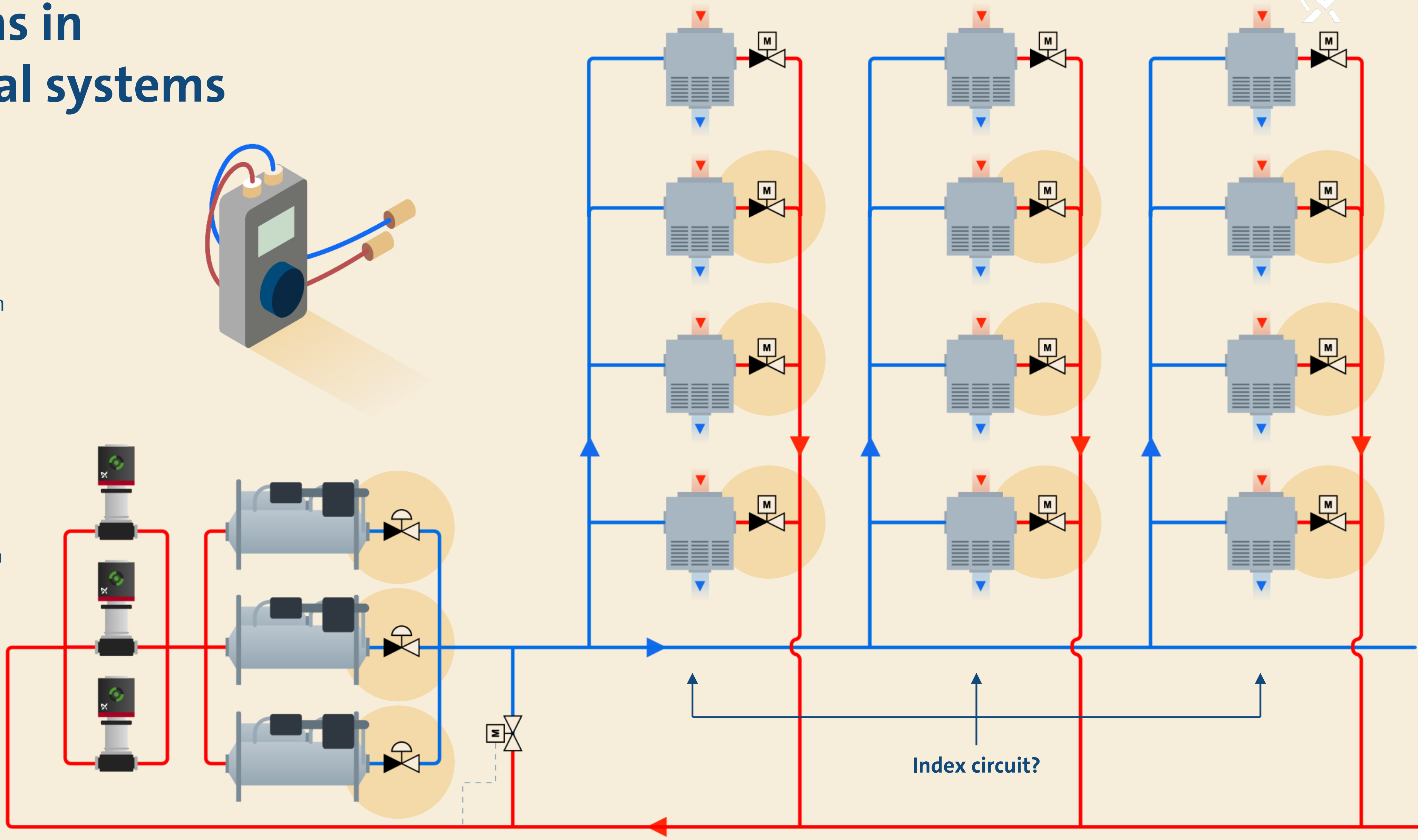
The constant primary/ variable secondary circuit

The constant primary/ variable secondary as a distributed pumping system.



Typical pains in conventional systems

- Difficulty determining the index circuit in complicated designs.
- Proper valve selection with good valve authority is tedious and time consuming.
- Design performance relies on proper commissioning.
- Future extensions or addition of equipment can affect the whole system.

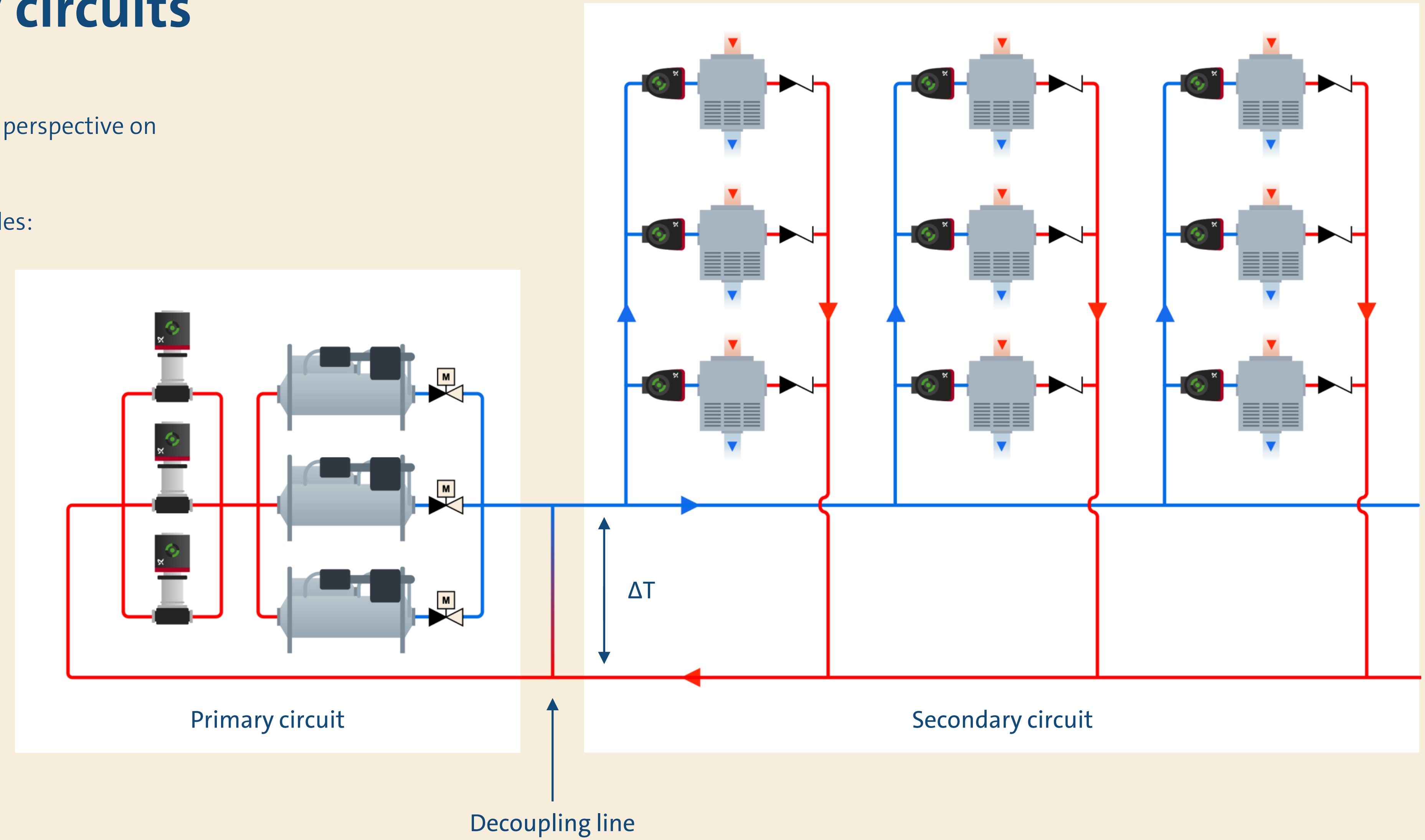


Balancing the primary and secondary circuits

Distributed Pumping offers a fresh perspective on the primary and secondary circuits.

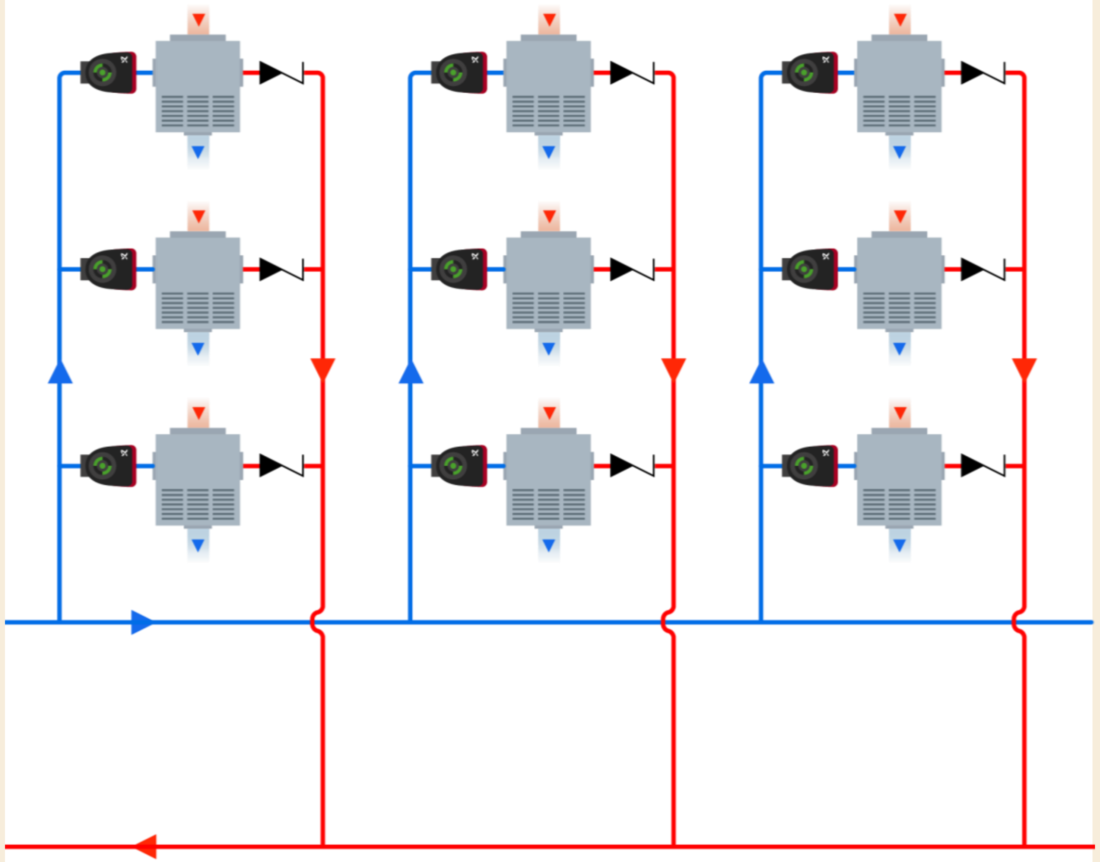
Utilising the decoupling lines enables:

- Control over the primary and secondary circuits.
- Optimisation of the balance of both circuits.
- Control of the system's Delta T.



Balancing the secondary circuit

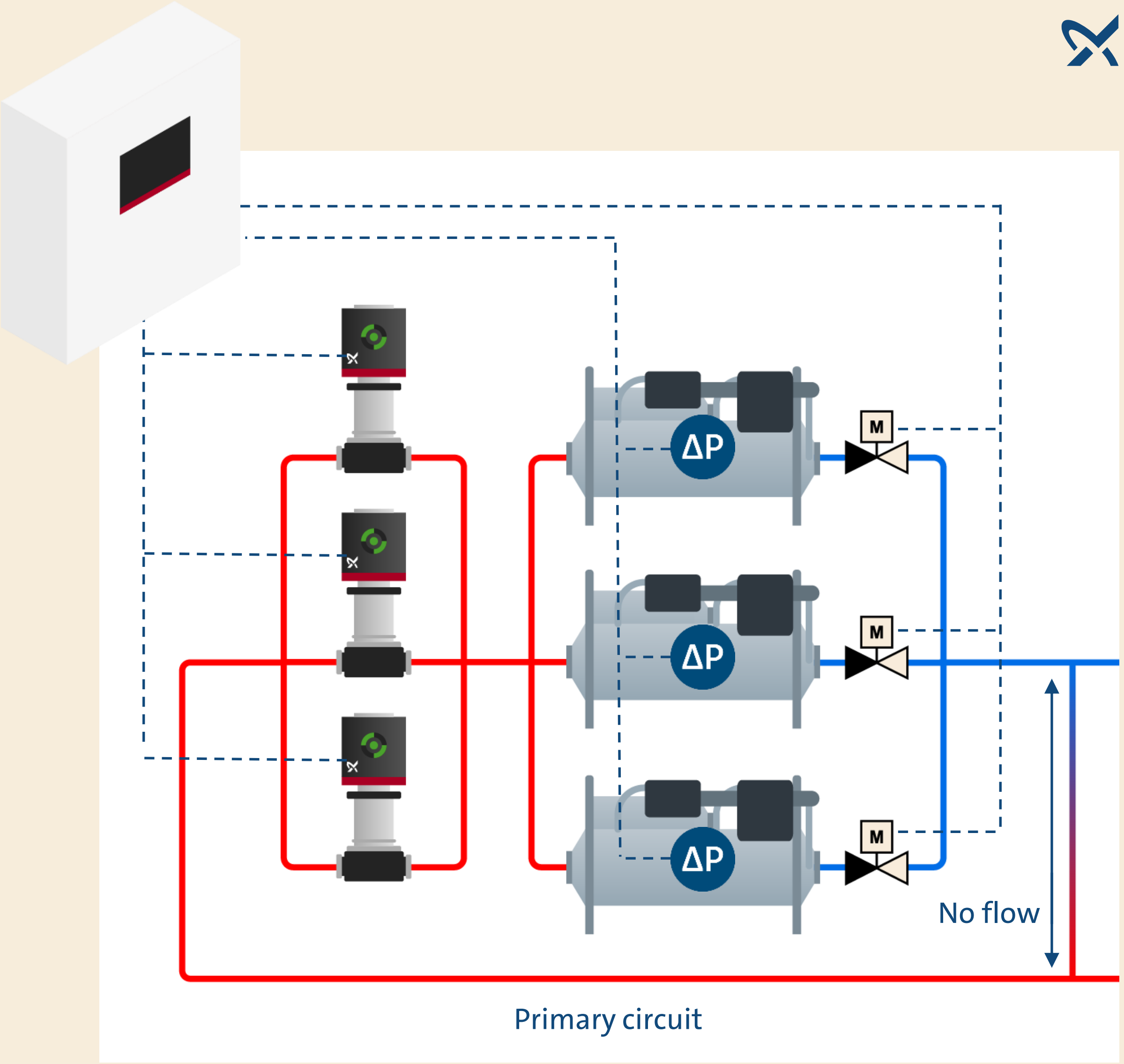
- Distributed pumps on the secondary circuit autonomously manage loads of the CRAH unit they serve.
- Each pump is sized for the load and pipe run serving the CRAH/CDU unit.
- The pumps modulate flow based on circuit sensor feedback.
- The pumps adjust speed to precisely match the chilled water needed for the CRAH/CDU unit.
- Constant communication between pumps and sensors ensures balanced circuits.
- Adding circuits doesn't disrupt system balance as the pumps adjust based on circuit feedback.



Secondary circuit

Balancing the primary circuit

- The primary circuit is controlled differently using the Grundfos MPC Controller.
- Safety of the chiller is a priority, and it is monitored by signals from the chiller control valve.
- Differential pressure sensors across chillers ensure flow rates meet minimum requirements.
- If the minimum flow isn't met, the speed of the primary pumps is increased to meet requirements.
- Once the minimum flow is ensured, the flow between the primary and secondary circuits is balanced.
- The secondary circuit should provide enough chilled water to meet the load on the CRAH/CDU units.
- The primary circuit must provide the chilled water required to meet this demand.
- The ideal situation is for no flow to be in the bypass (decoupling line).



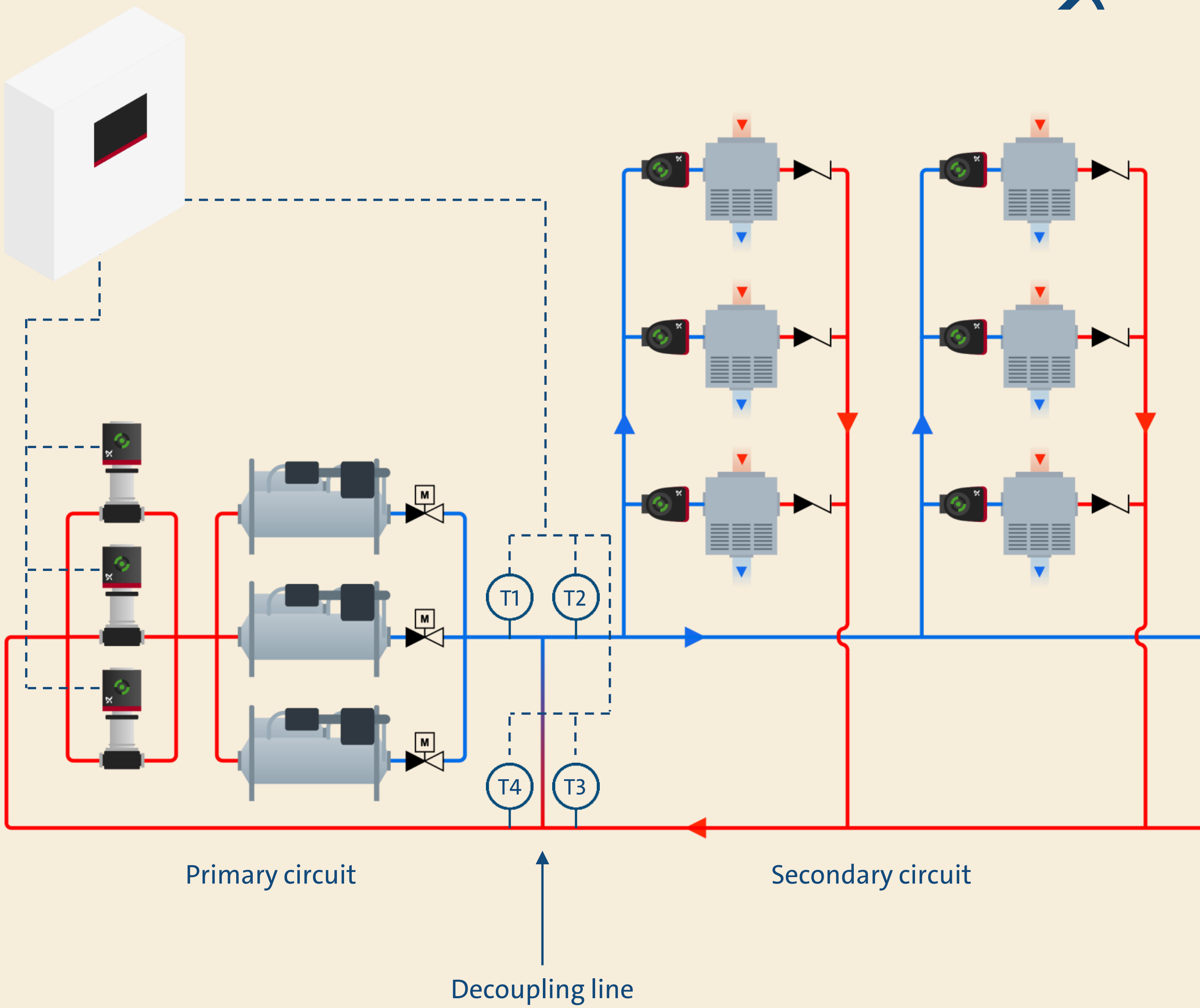
Balancing the primary and secondary circuits

- To balance the flow across the primary and secondary circuits, temperature sensors must be installed on both the primary and secondary loops.
- The differential temperature between T4 and T1 should be compared with the differential temperature between T3 and T2.
- A balanced system can look one of two ways:

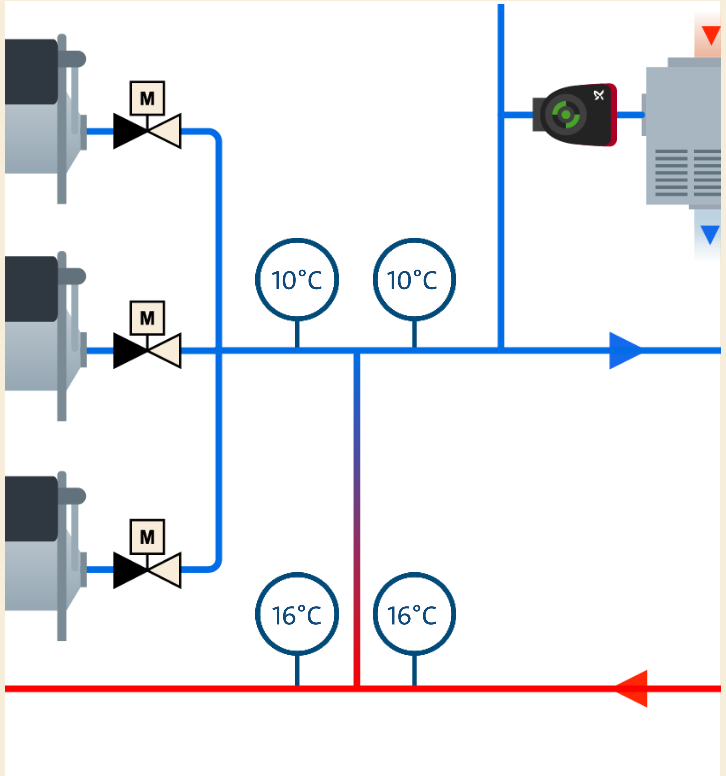
  (T4-T1) = (T3-T2)

  T1=T2 and T3=T4

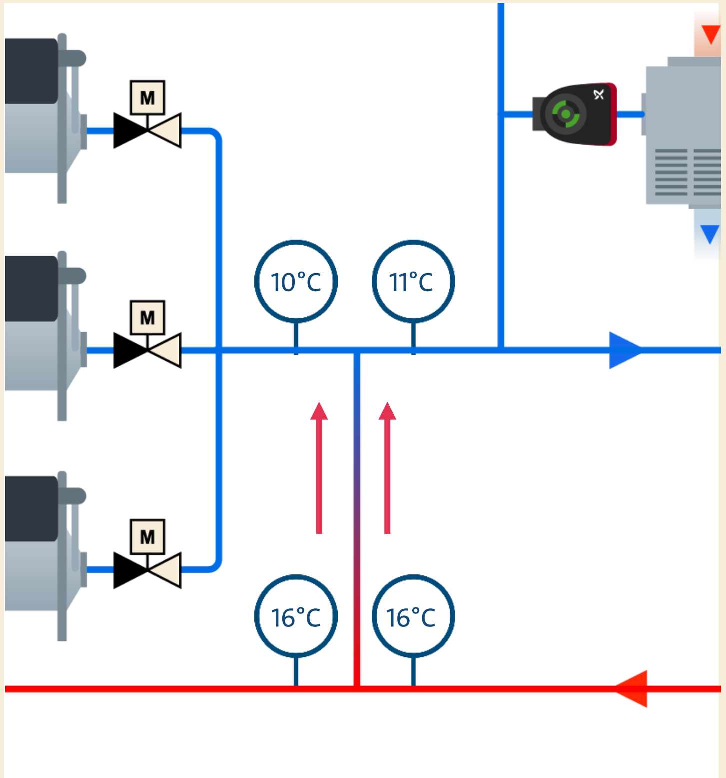
- If they don't match, the system is imbalanced and flow will be in the bypass/decoupling line.
- The MPC Controller adjusts the speed of the primary pumps to balance the flow and deliver the required chilled water.
- When the circuits are balanced, the required amount of chiller water on the secondary side is produced. This optimises energy use and chiller efficiency.



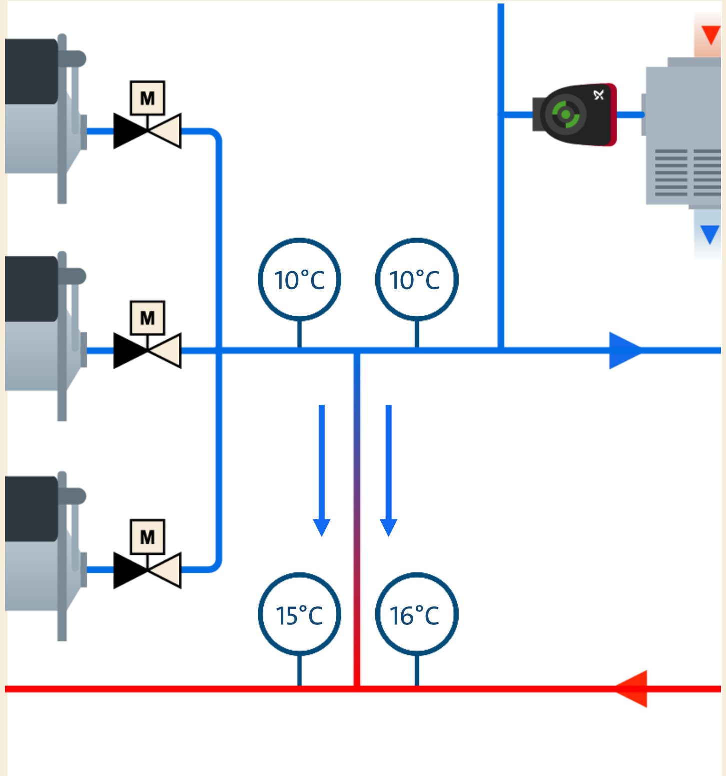
Balancing the primary and secondary circuits



When T1=T2 and T3=T4, the primary and secondary circuits are balanced and there will be no flow in the bypass/decoupling line.

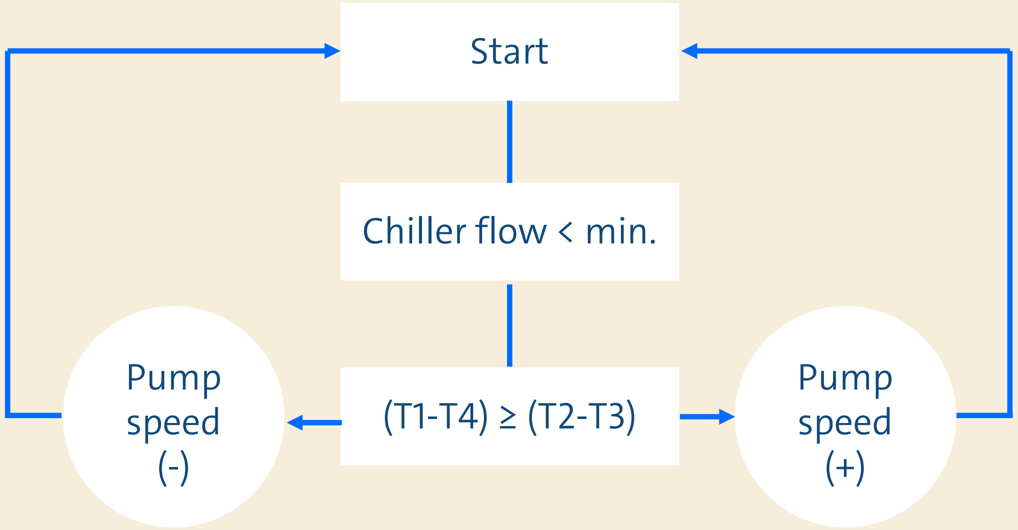


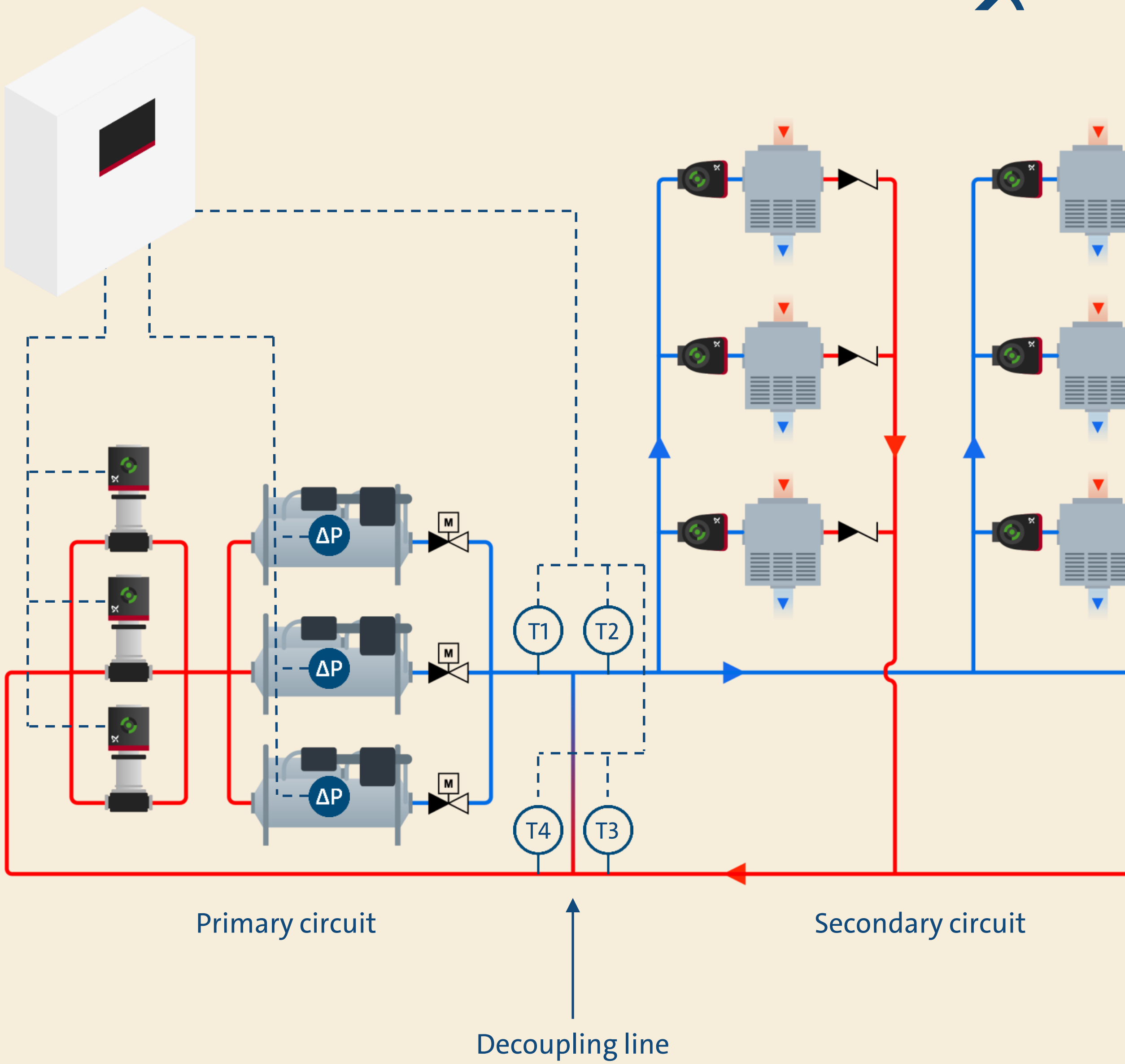
If T2 is greater than T1, there will be flow from the hot water return line through the bypass. This is due to underpumping. When this happens, the speed of the primary pumps is increased.



If T4 is less than T3, there will be flow from the supply line through the bypass. This is due to overpumping. When this happens, the speed of the primary pumps is decreased.

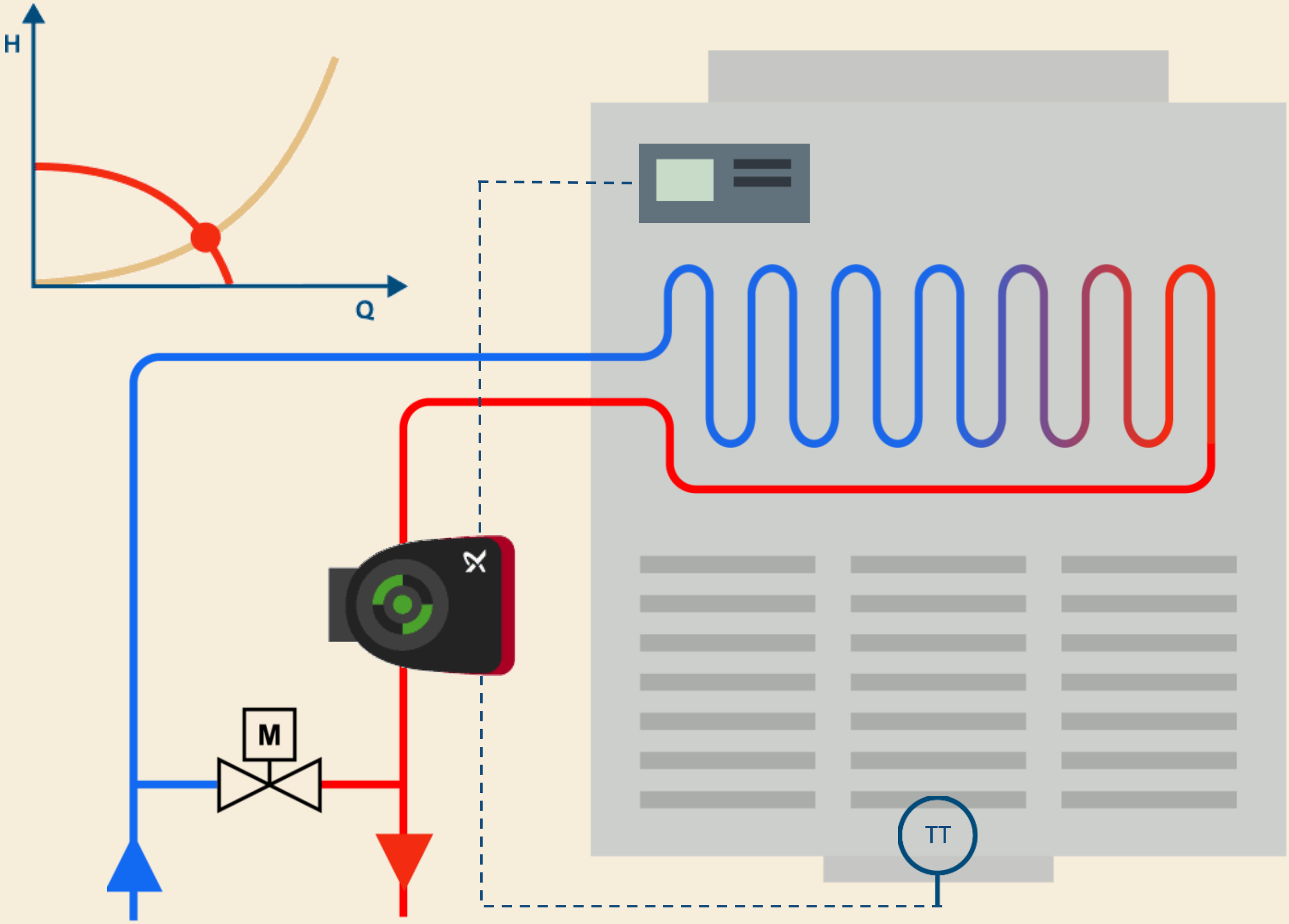
Security and sequencing





Removing unnecessary modulating valves

- The integrated control modes feature a Constant Temperature Control suitable for terminal units.
- An air temperature sensor connects directly to the pump, setting a defined target (TT) for supply air temperature regulation.
- The target (TT) can be adjusted via BMS or pump display, simplifying cooling efficiency optimisation.
- The pump can be controlled by the CRAH/CDU Controller.
- The pump will automatically adjust its speed based on heat load changes (air temperature).



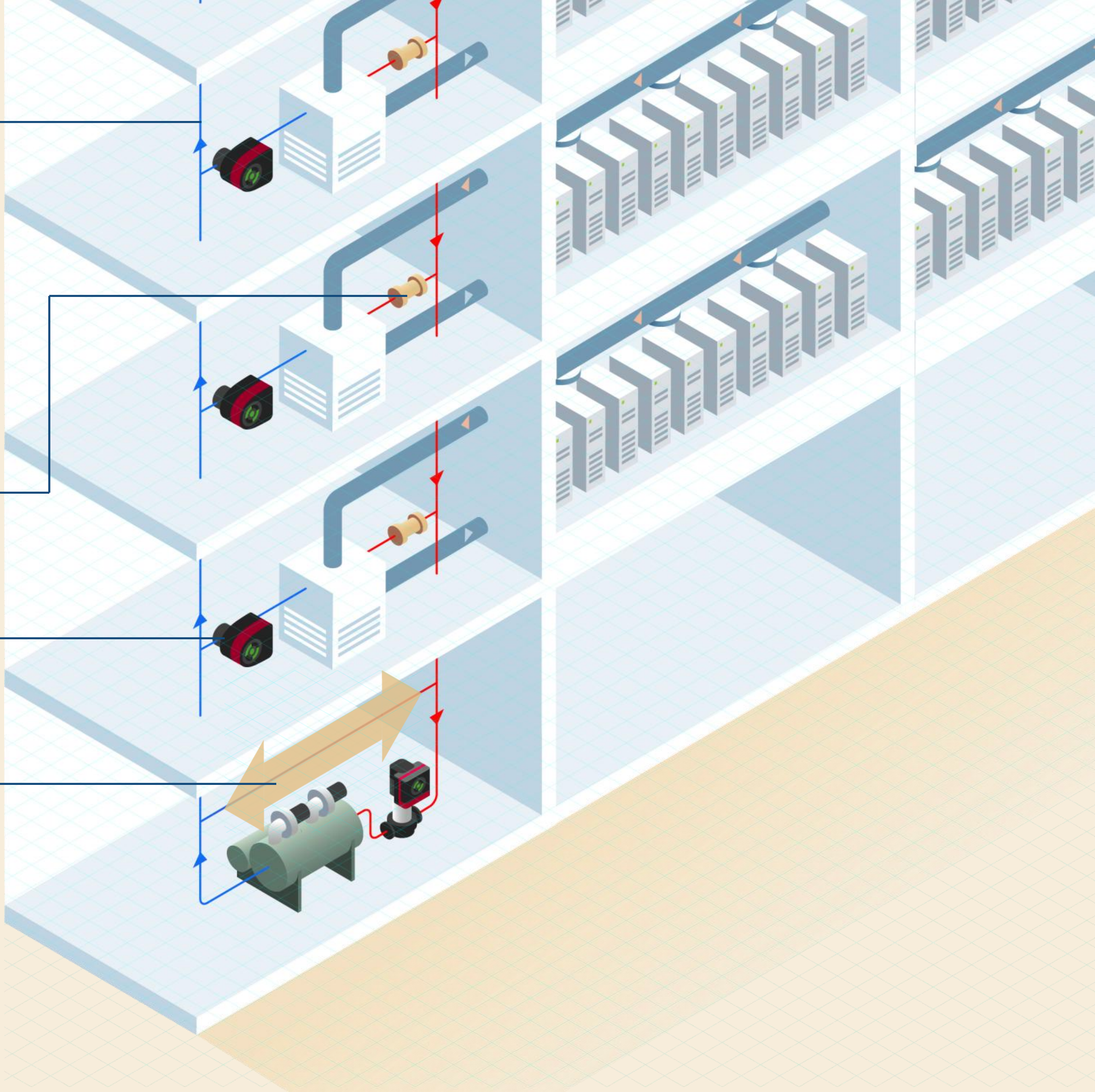
System summary

Energy savings through reduction of supply line pressure.

Remote shutdown at no-load ensures check-valve closure, preventing back-flow.

The pumps provide the required flow for each circuit to match the cooling load.

Automatic balance between the primary and secondary sides eliminates bypass flow.



Workflow

Data centre project

Pipe layout and schematic

Equipment schedule for chillers, pumps, terminal loads

Assessment on feasibility

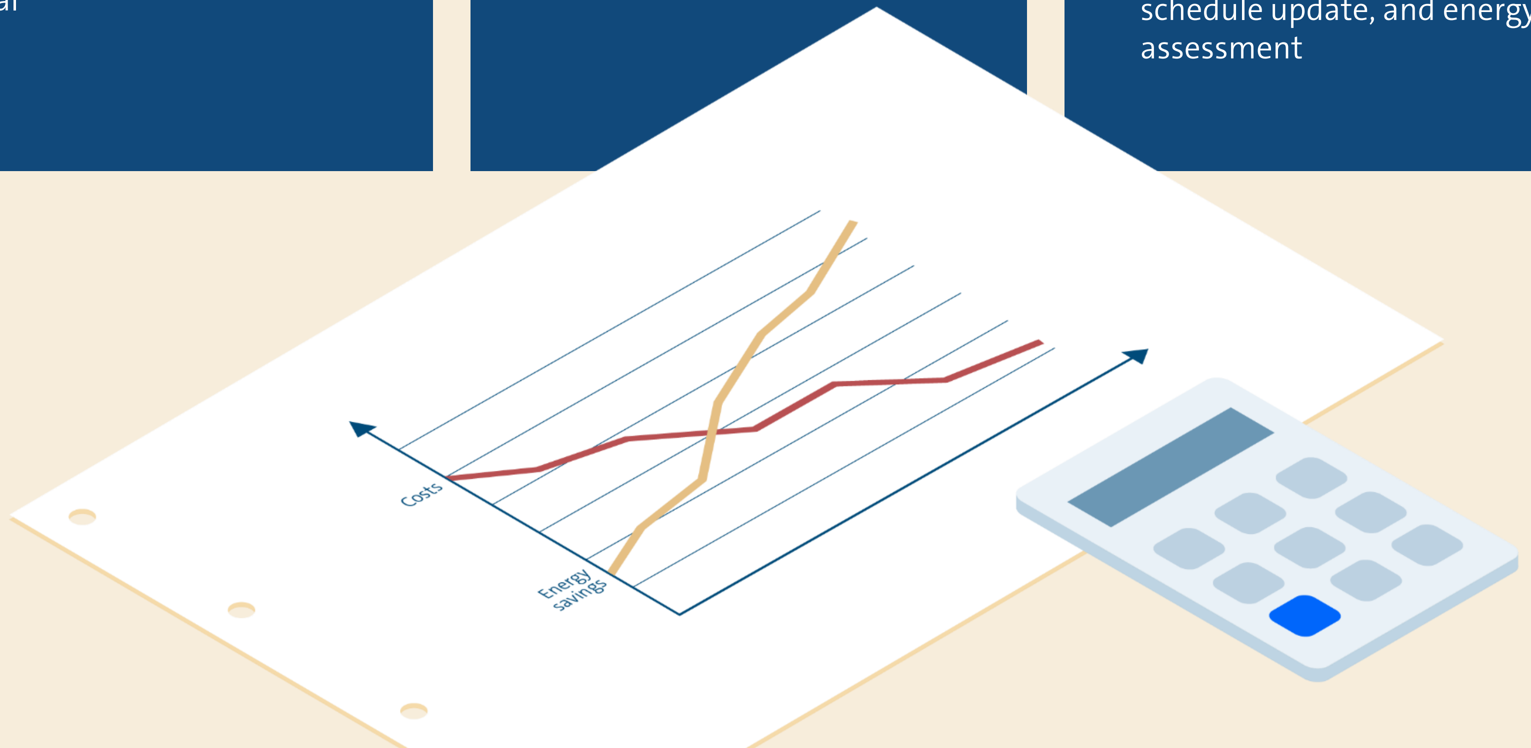
Quick assessment on project scope and fit based on complexity, risk, time and legal

Project sizing and selection

Grundfos engineers size according to requirements and design

Project documentation delivery

Handover of distributed schematic, equipment schedule update, and energy assessment



Deliverables

A design package **will** include:

Hydronic head loss schematic

Pump schedule

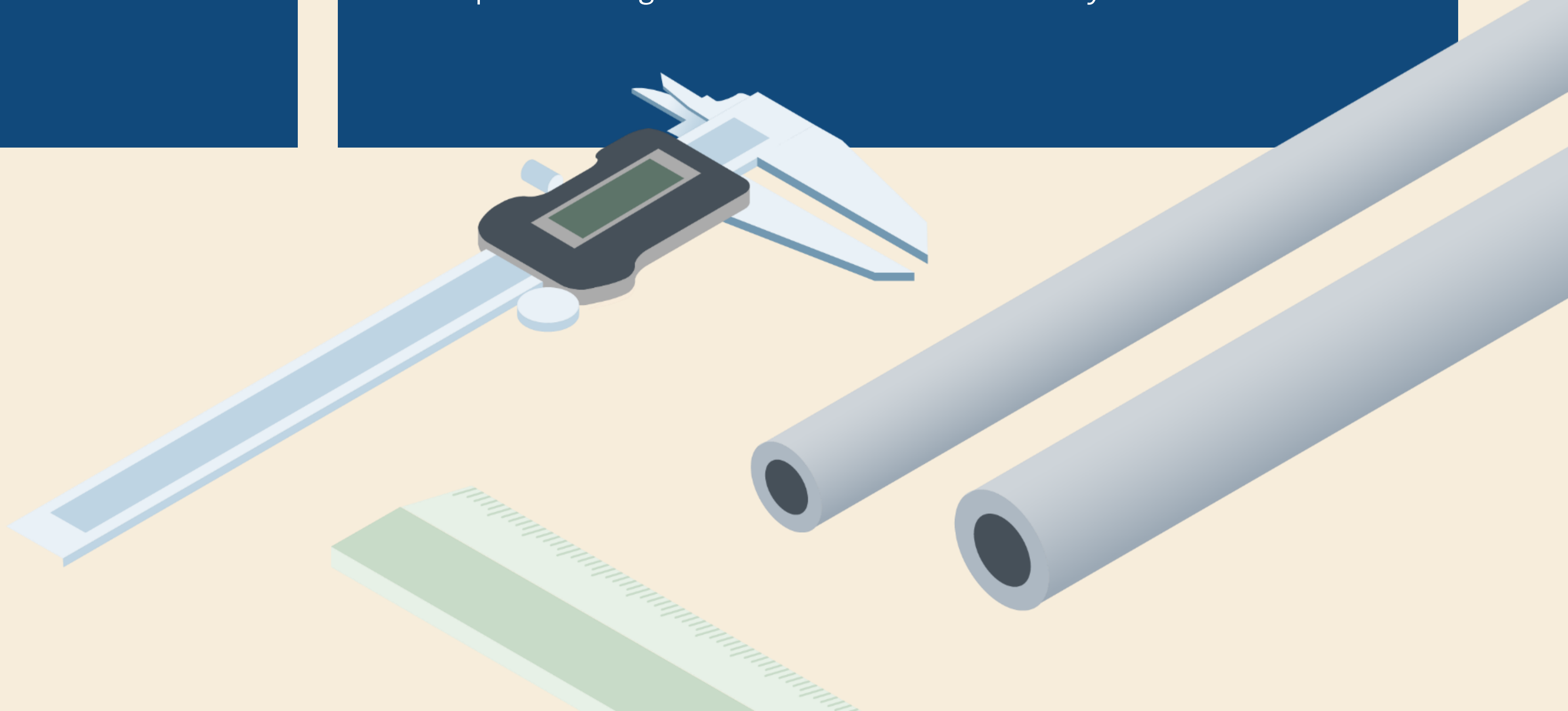
Energy assessment based on conventional design vs. distributed pumping

A design package **can** include:

Flow and head check for pipe sizing

Flow velocity and head loss per meter evaluation

Comparison design for valve-based conventional systems



MAGNA3 and TPE3

HIGH EFFICIENCY

High efficiency motors (IE5) and integrated Variable Frequency Drive ensures high efficiency at any load.

ENERGY-OPTIMISING ALGORITHMS

Algorithms like flow limit and minimum pressure ensure energy efficient distribution.

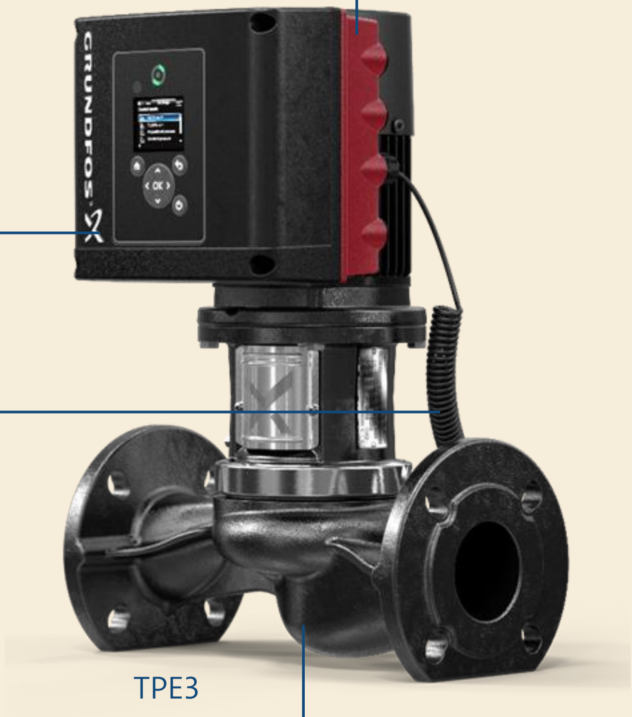
PATENTED SENSOR

Patented Delta P and T sensor minimises energy losses.

OPTIMISED PUMP HYDRAULICS

The pumps' hydraulics have been optimised for optimal flow conditions.

MAGNA3



TPE3

Easy to integrate and control

BACnet

MODbus

More than just pumps

Pump

Pump throttling valve

Flow and heat energy estimation

Commissioning assistant

Case Study

- 3.3 MW facility in IMEA. Chillers, CRAH units, and fan walls needed.
- Original design suggested was a variable primary chilled water system, using:
  10 NK 100-315 – 30 KW Pumps (N+2)
- Estimated energy consumption from the variable primary system:
  672,130 kWh
- Distributed pumping installation suggested:
  10 primary pumps – TPE 125-190/4 – 11 KW (N+2)
  66 TPE pumps 0.55 KW to 4 KW
- Secondary pumps controlled from the CRAH Units.
- Estimated energy consumption from the distributed pumping system:
  392,904 kWh

Total estimated savings:

279,226 kWh

Contact

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