ARMSTRONG

DESIGN ENVELOPE®

TANGO

Intelligent Variable Speed Pumps

with cloud-based Active Performance Management®

SOLUTION OUTLINE

Australian Distributor: MASTERFLOW

DESIGN ENVELOPE

ENGINEERED BEYOND THE OBVIOUS

Design Envelope technology is a demand-based, intelligent control solution that:

Models equipment and system behaviour

Monitors actual system conditions

Dynamically adjusts equipment operation to match system demand

Whether driven by social, environmental or fiscal responsibility, forward-thinking organisations must embrace energy-saving technologies and practices.

Armstrong Design Envelope pumps are a complete solution for heating, cooling and plumbing systems. The integration of a perfectly matched hydraulics, motive power and intelligent variable speed control creates the highest value pumping solution.

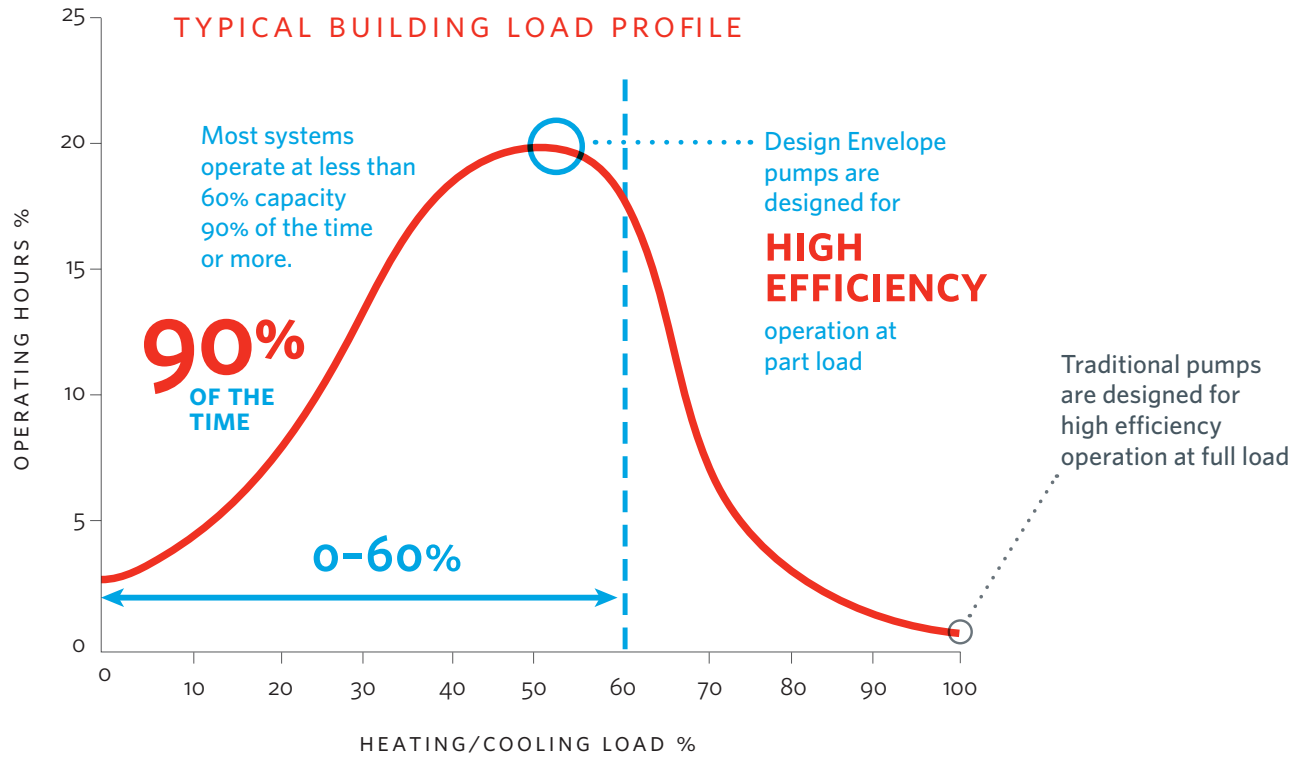
MAXIMUM ENERGY AND COST SAVINGS

UP TO **65%**

INSTALLED COST SAVINGS*

UP TO **90%+**

ENERGY SAVINGS*



Sizing and selecting for efficiency

Design Envelope solutions reduce pumping costs through variable speed, demand-based operation — consuming only the energy required, based on current system demand. Design Envelope pumps use a combination of optimised impeller size and speed control for energy efficient operation within a given performance envelope.

The performance envelopes are selected for the best pump efficiency where variable flow systems operate most often. This ensures a building's pumping system consumes as little energy as possible. It also helps to ensure that the installation meets or exceeds ASHRAE 90.1 guidelines requiring 70% energy savings at 50% of peak load.

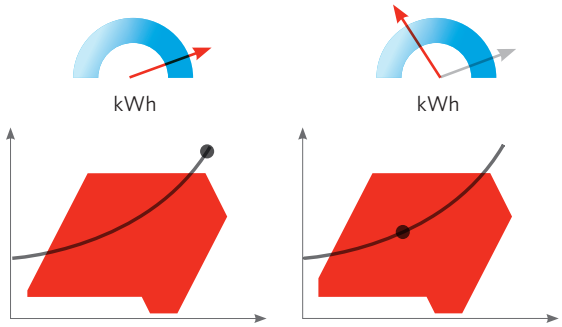
*Compared to a fixed speed system

1 THE TECHNOLOGY

THE EVOLUTION OF PUMPING

Energy Savings

Armstrong Design Envelope variable speed technology fundamentally changes the operation of a pump within the larger HVAC system. The variable speed intelligence embedded in the Armstrong Design Envelope controller adjusts the pump operation to meet the immediate demand. The pump responds instantaneously and draws only the power required to meet that demand.



AT 100% DESIGN FLOW

AT 50% DESIGN FLOW

Eliminate cost trade-offs

Through innovation, Armstrong's Design Envelope offers the lowest installed cost and lowest life cost of any pumping solution on the market.

CONSTANT SPEED PUMP
3-WAY VALVE

VARIABLE SPEED PUMP
WITH CONTROLS DISABLED (PUMP IN HAND)

- > Constant speed operation
- > Base case for pump energy usage
- > Pump runs at design point, controlled by throttling

AVERAGE 15% ENERGY SAVINGS

VARIABLE SPEED PUMP
WALL-MOUNTED CONTROLLER/2-WAY VALVE

- > Constant reduced speed
- > Reduce motor speed in lieu of throttling flow

UP TO 50% ENERGY SAVINGS

VARIABLE SPEED PUMP
WALL-MOUNTED CONTROLLER/2-WAY VALVE

- > Sensor in mechanical room
- > Maintain constant design head
- > No savings if sensor stops working

UP TO 65% ENERGY SAVINGS

VARIABLE SPEED PUMP/
WALL-MOUNTED CONTROLLER/2-WAY VALVE

- > Inefficient induction motor operation
- > Pump selected to design point
- > Sensor located at remote load
- > Maintain pressure at remote zone
- > No savings if sensor stops working

UP TO 70%+ ENERGY SAVINGS

DESIGN ENVELOPE 3.1

- > Pump speed control through Sensorless technology
- > Detailed mapping of performance curve
- > Smaller motor selection on 25% of projects
- > Integrated controller — higher motor efficiency
- > Flow measurement accuracy of ±5%
- > Optimised selection against load profile

PERFORMANCE OF CONSTANT SPEED PUMP
3-WAY VALVE

UP TO
80%+
ENERGY SAVINGS

DESIGN ENVELOPE GENERATION 5

> Advanced digital controls
> Control tuned to specific motor
> DEPM motor: IE5 efficiency rating
> Advanced hydraulics

UP TO
90%+
ENERGY SAVINGS

DESIGN ENVELOPE GENERATION 5

> Multi-pump load sharing
> Best-efficiency staging (Parallel Sensorless)
> Onboard diagnostics and trending
> Real-time performance management

DESIGN ENVELOPE PERMANENT MAGNET (DEPM) MOTOR BENEFITS (UP TO 7.5kW)

> Higher efficiencies at full load and part-loads for lower lifecycle costs
> Higher stable operating speeds for smaller pumps, lower installed costs
> Reduced noise and vibration for quiet and stable operation
> Reduced weight and size for easier, faster installation
> Less heat generated for longer equipment life

NEXT LEVEL THINKING

ACTIVE PERFORMANCE MANAGEMENT SERVICES DELIVER:

- Ongoing tracking, analysis and benchmarking of HVAC performance
- Deeper insights into HVAC operation for informed decision making
- Data-driven optimisation in response to system changes
- Long-term mechanical system efficiency
- Overall savings in HVAC energy and equipment maintenance costs

THE RESULTS

ENERGY SAVINGS UP TO **90%+**

HIGHEST ENERGY EFFICIENCY

1 Armstrong Design Envelope Pumps provide you with highest energy efficiency.

LOWEST INSTALLED COST

2 Design Envelope Pumps provide lowest installed equipment cost, plus savings in infrastructure such as transformers, switch gear, power cables, concrete and cabling.

LOWEST OPERATING COST

3 Design Envelope Pumps provide lowest operating and maintenance cost.

CASE STUDY | National Grid

ANNUAL ENERGY SAVINGS **70%**

Armstrong recently completed a project in the United Kingdom, retrofitting pumps in a commercial office building belonging to National Grid. The retrofit included new pump sets that reduced energy consumption by 70%, saving over $37,065 annually.

FACILITY TYPE
Commerical office

LOCATION
Solihull, Birmingham

SIZE
Three-storey building

ANNUAL ENERGY COST

BEFORE	AFTER
$53, 198 AUD	$16, 136 AUD
AVERAGE	AVERAGE

ANNUAL COST SAVINGS **$37,065** AUD

CO_2 EMISSIONS

BEFORE	AFTER
82,309 kg CO_2	24,967 kg CO_2
AVERAGE	AVERAGE

ANNUAL CO_2 EMISSION REDUCTION **57,342** kg CO_2

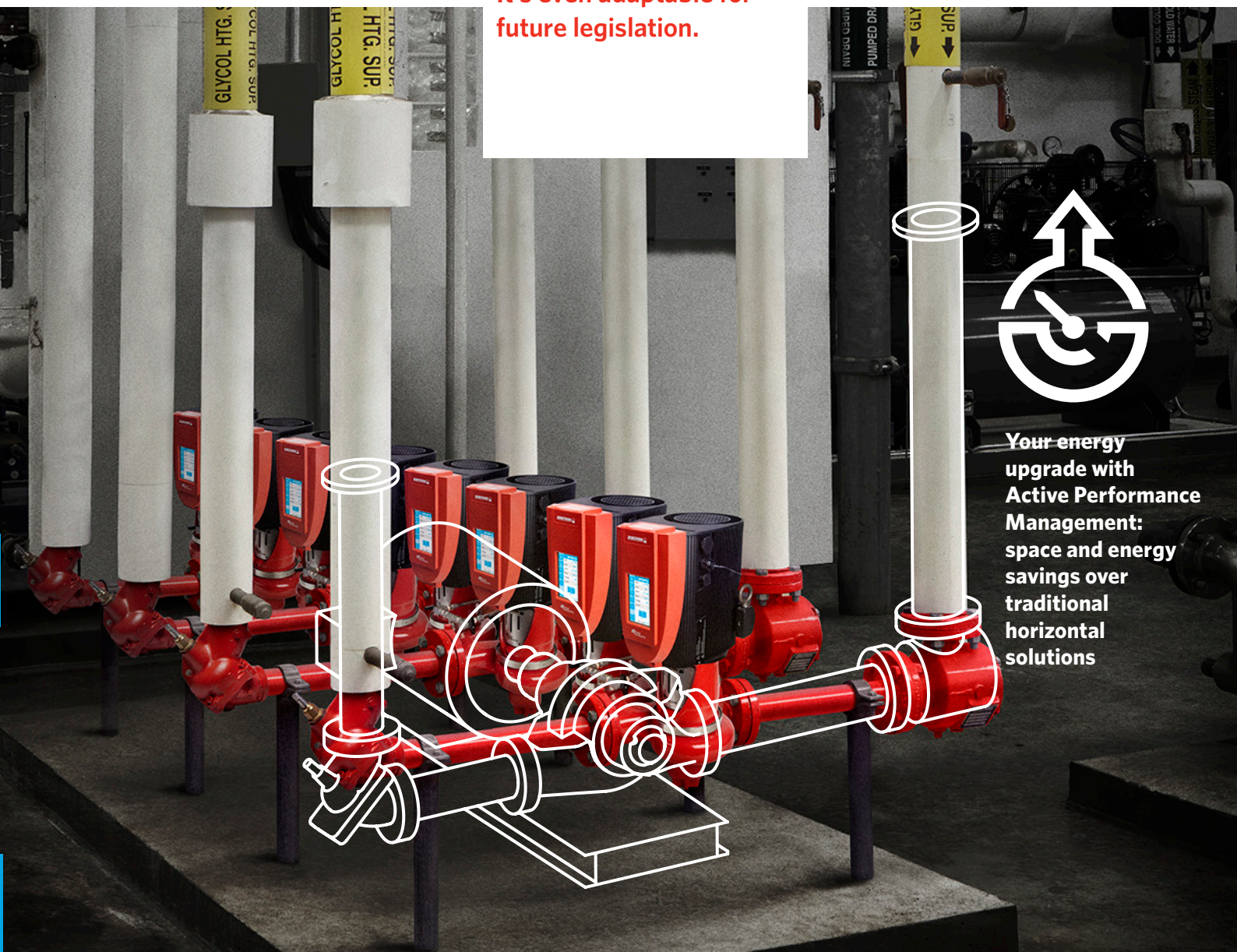
Together, these five key benefits of Design Envelope technology provide customer value far beyond alternative variable-speed or constant-speed solutions.

4

Design Envelope Pumps provide buildings with the lowest carbon footprint.

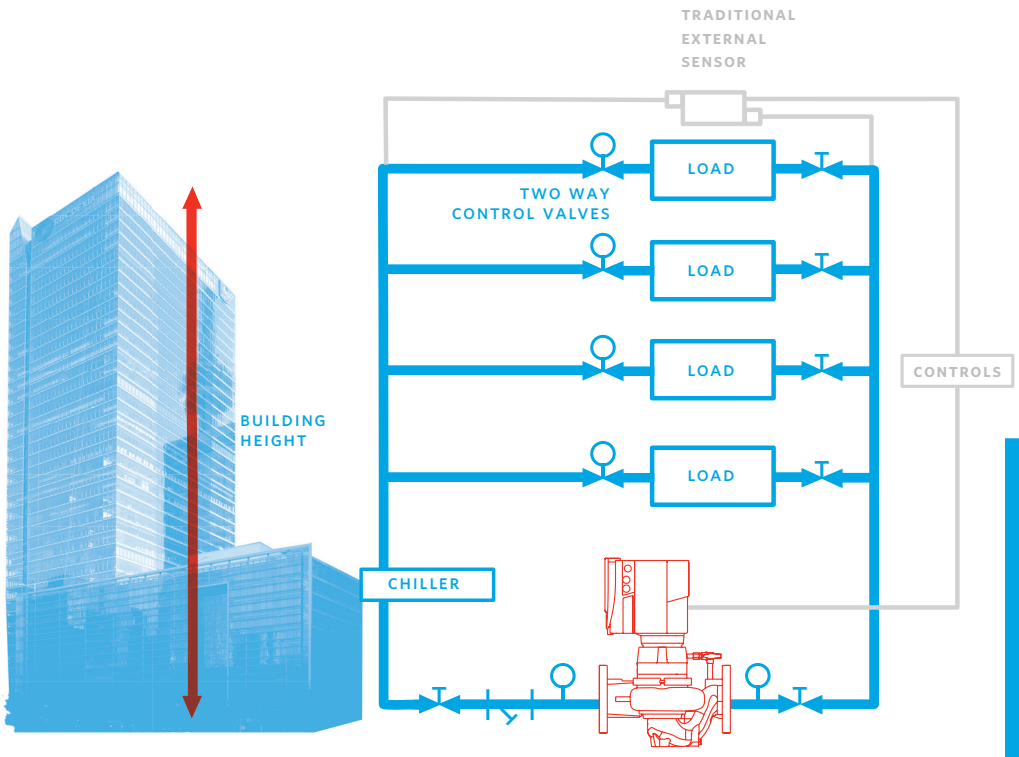
5

Design Envelope Pumps provide lowest project and operating risk, with solutions adaptable to design and building changes. It's even adaptable for future legislation.



Your energy upgrade with Active Performance Management: space and energy savings over traditional horizontal solutions

THE SENSOR WITHIN



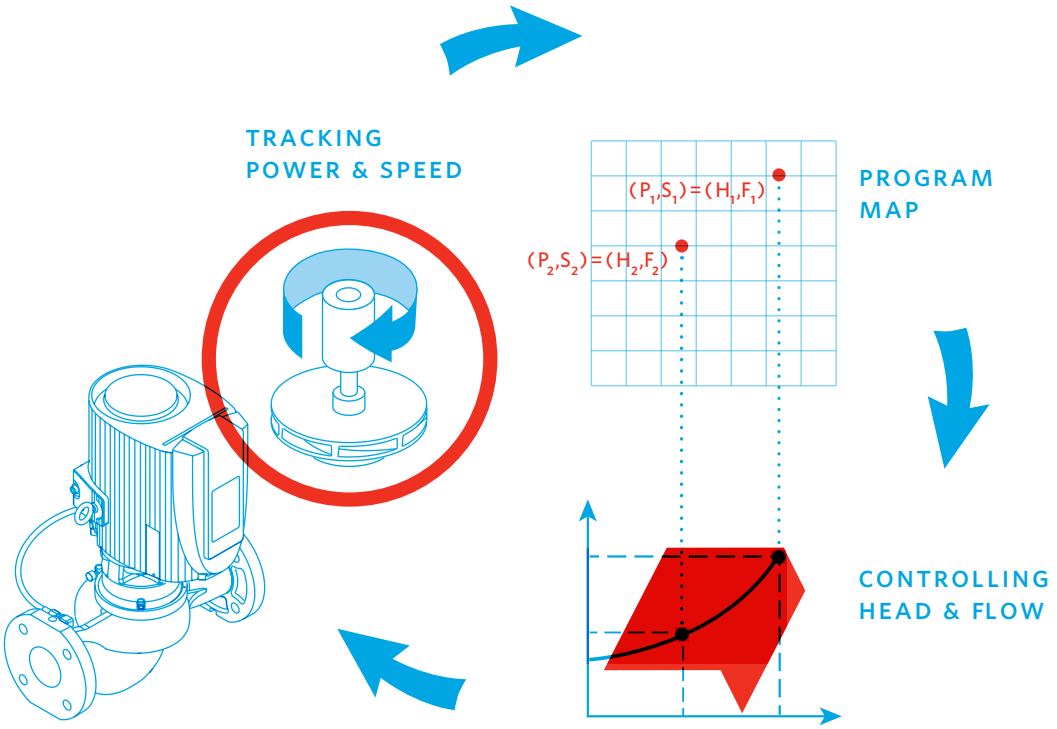
Equipped with Sensorless technology, Design Envelope solutions do not require an external sensor to monitor and control the HVAC load.

Using Sensorless technology, a Design Envelope pump's performance data (power draw and RPM) and operating curve are pre-programmed into the controller. During operation, the controller monitors the power draw and RPM of the pump and establishes the hydraulic performance and position of the pump's head-flow condition relative to the system requirements.

As the building's control valves open or close to regulate flow to the cooling coils and maintain building occupant comfort, the Sensorless controller automatically adjusts the pump speed to match the required system pressure and flow.

MONITOR POWER & SPEED

CONTROL HEAD & FLOW



Equipped with Sensorless technology, Design Envelope solutions do not require an external sensor to monitor and control the HVAC load.

In a chilled water system, a building's temperature controls influence the local flow of control valves that modulate the flow to the cooling coils (load). As the control valves open for more chilled water flow, the differential pressure across the valve decreases.

The controller reacts to this change by increasing the pump speed. If the control valves close to reduce the chilled water flow, the differential pressure across the valve increases and the controller reduces the pump speed.

PARALLEL SENSORLESS

SAVE UP TO 30%

ON OPERATING COSTS

Parallel Sensorless Pump Control (PSPC) is a patented technology that improves the efficiency of a multi-pump installation through optimised load sharing.

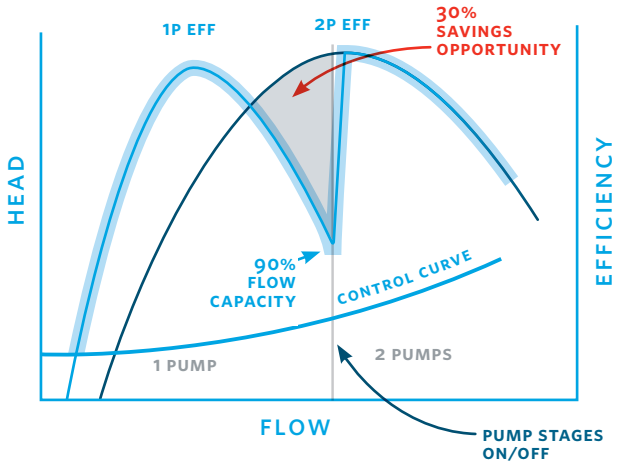
The traditional approach to control in a multi-pump installation involves staging pumps on the basis of motor speed. Parallel Sensorless Pump Control technology stages pumps based on operating efficiency rather than motor speed and improves the efficiency of the full pump array by up to 30% over traditional multi-pump installations.

HVAC loads and flow requirements change throughout the day. In the graphs to the right, the grey dotted line intersecting the pump efficiency curves represents the flow level at which one pump in the array should be staged on or off. The solid grey line, however, indicates where staging often occurs with speed-based control, which forces the pump array to operate at efficiency levels that are less than optimal.

In an installation of (up to four pumps) Parallel Sensorless Pump Control monitors pump speed and stages pumps at the correct flow levels to optimise efficiency, as shown in the bottom-right graph.

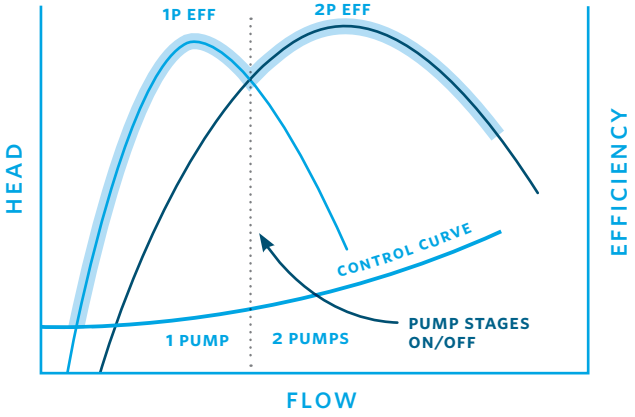
TRADITIONAL

SPEED-BASED STAGING



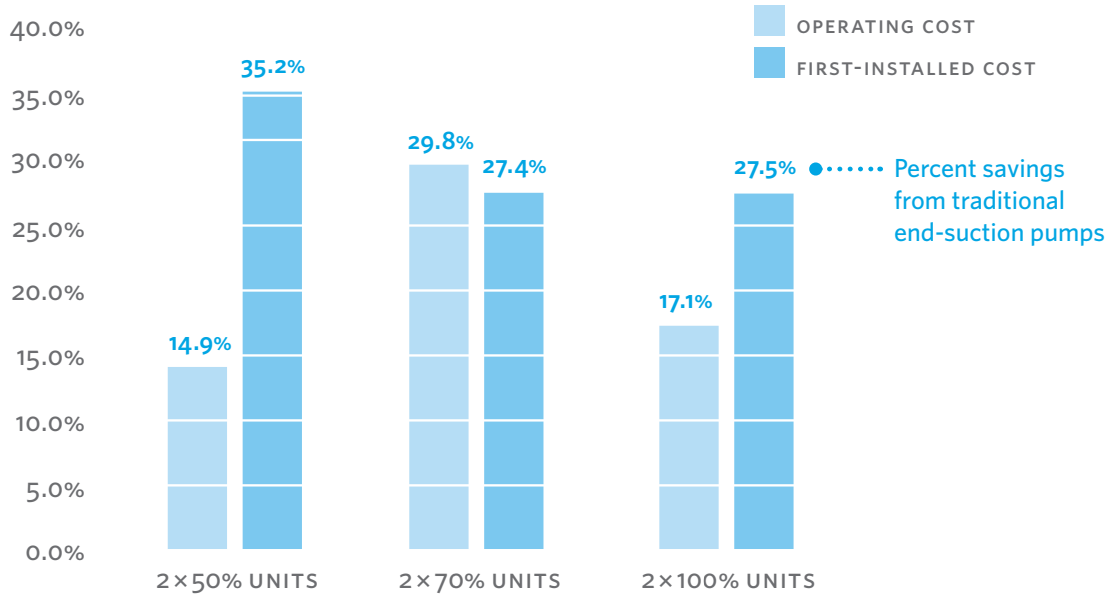
PARALLEL SENSORLESS PUMP CONTROL

BEST-EFFICIENCY STAGING

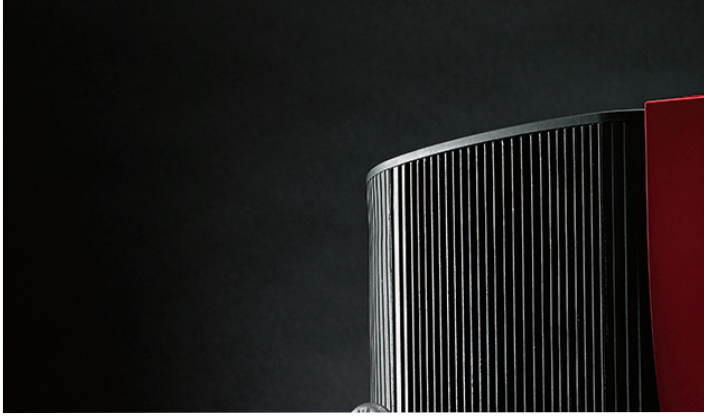


Because HVAC pumping systems mostly operate at part-load, a design using two or more smaller pumps is more efficient than one larger pump. In a two-pump system, if one pump fails, the remaining pump can serve the system requirements with up to 70% flow redundancy. The capacity split can be adjusted based on the building type and duty requirement.

REDUNDANCY AND SAVINGS WITH PARALLEL PUMPING



CAPACITY SPLIT	FLOW REDUNDANCY	DUTY REQUIREMENT	TYPICAL BUILDING EXAMPLES
Two pumps running at **50%**	If one pump fails, the other will operate at **70%**	Generic duty	Schools Apartments
Two pumps running at **70%**	If one pump fails, the other will operate at **85%**	High comfort sensitivity	Hotels Offices Outpatient clinics
Two pumps running at **100%**	If one pump fails, the other will operate at **100%**	Mission critical	Blood banks Hospitals Data centers



FLOW INFORMS

The rate of fluid flow in an HVAC system is crucial to understanding how the different components are operating. Without information on system flow, it's difficult to diagnose and optimise performance. With accurate flow information, the picture changes entirely. Armstrong can optimise each component and the overall system.

Design Envelope Pumps monitor flow so accurately they function as a flow meter. Industry standards recommend balancing system flows to ±5% accuracy. Design Envelope pumps deliver accuracy of ±5%.

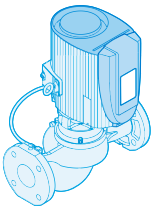
Highly accurate and reliable: no issues with fouling, so no need to service or re-calibrate.

Low installation cost: easy installation for retrofits.

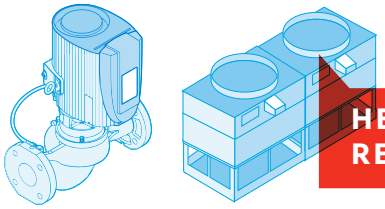
Integral to pump: no additional space or wiring required.

Energy savings: accurate flow data informs optimisation of an entire HVAC system.

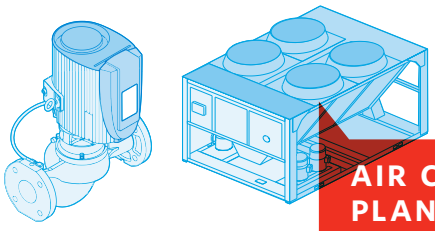
For evaluating an HVAC system, just two flow values and four temperature points provides all the data needed to understand flow rates, heat loads and operating efficiency.



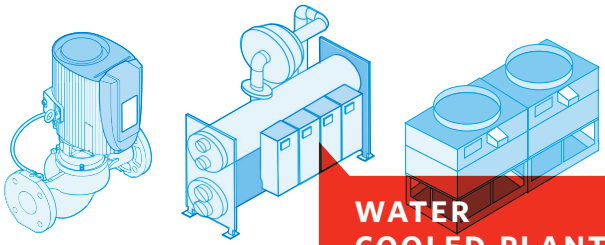
PUMPING SYSTEMS



HEAT REJECTION



AIR COOLED PLANT



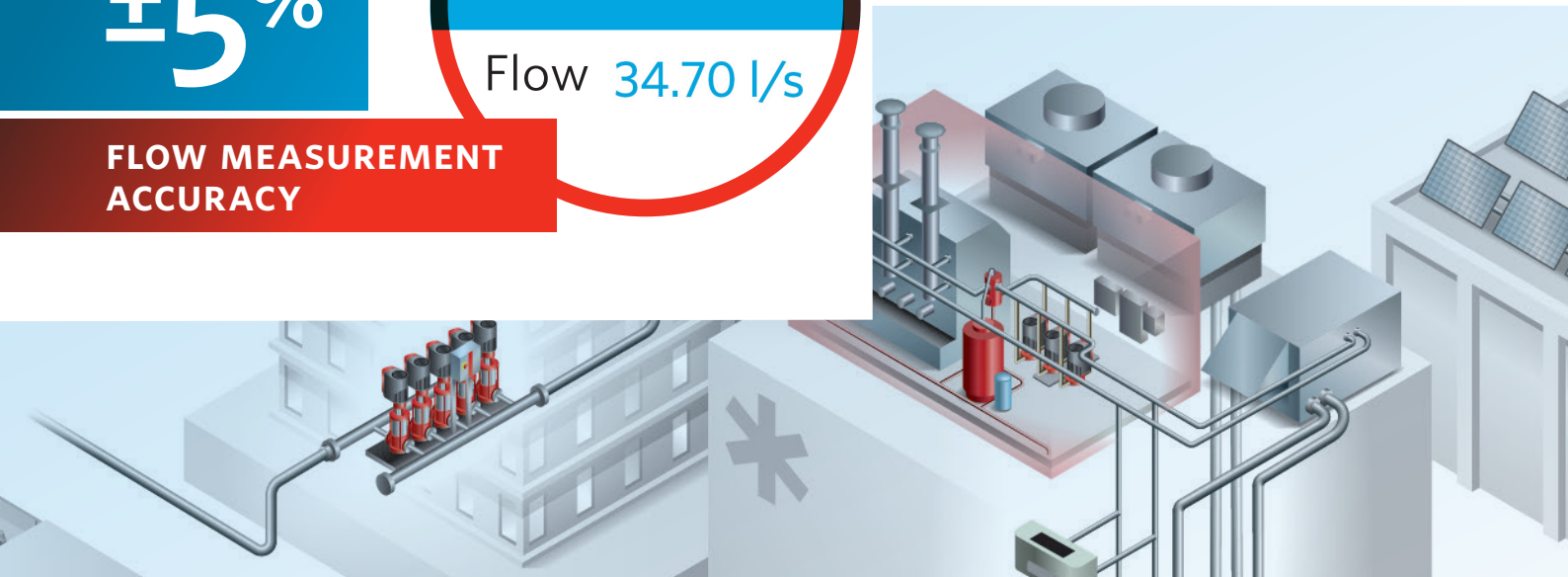
WATER COOLED PLANT

±5%

FLOW MEASUREMENT ACCURACY

ARMSTRONG

Flow 34.70 l/s



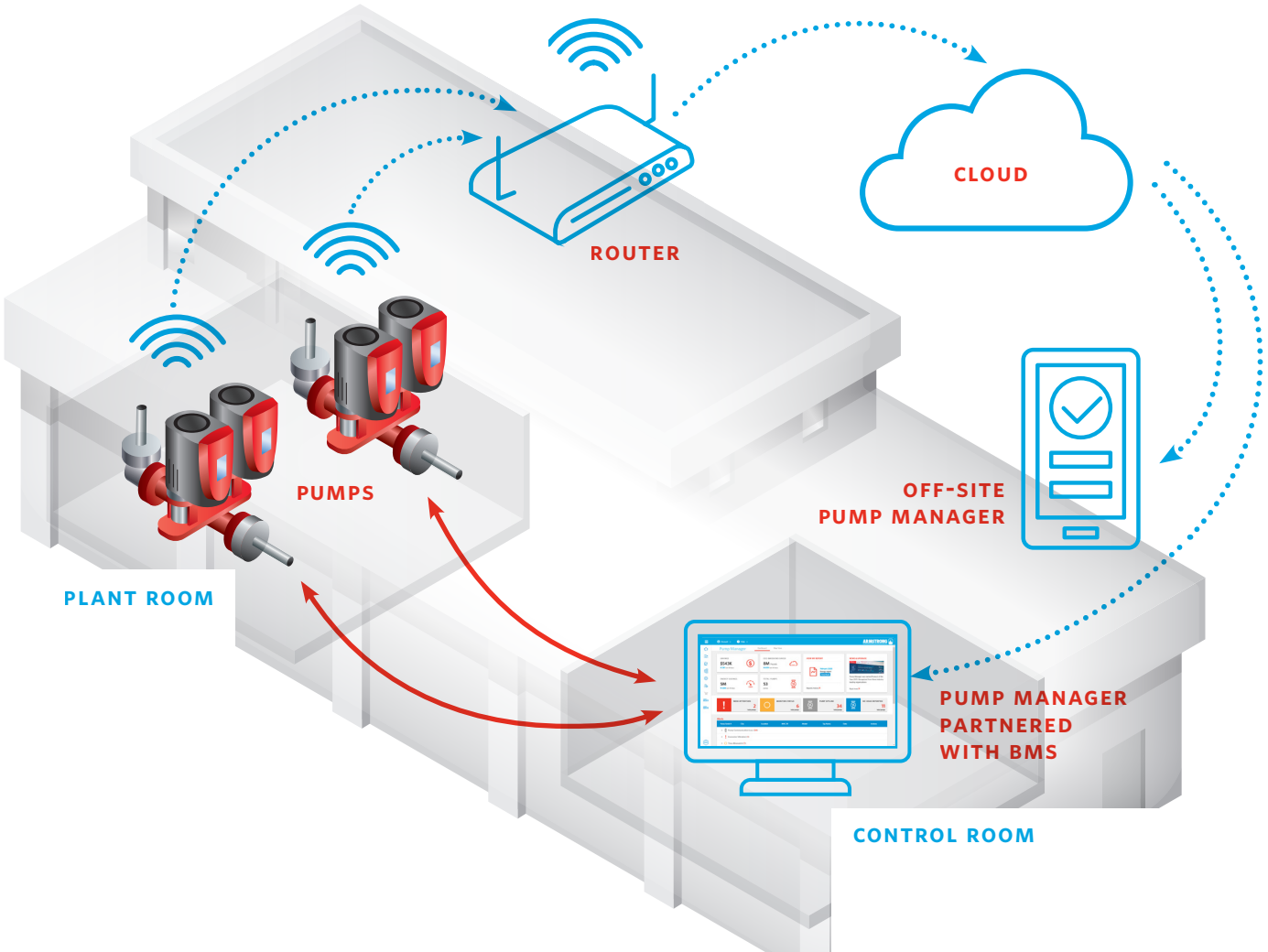
ACTIVE PERFORMANCE MANAGEMENT™

Active Performance Management is a systems management approach that optimises HVAC systems at any stage of a building's life-cycle by continually learning from a broad network of installations and responding to changing HVAC requirements.

The combination of smart commissioning with real-time alerts and system transparency addresses performance drift and maintains occupant comfort.

Bring performance drift under control

With Active Performance Management at the plant level, you can save up to **40%** Annual cost savings



3 THE SOLUTION

TANGO

DESIGN ENVELOPE | TECHNOLOGY

Available for outdoor operation

UNMATCHED ENERGY EFFICIENCY

Advanced hydraulic design supports industry-leading flow efficiency

Built-in Parallel Sensorless pump control saves up to 30% more energy

Armstrong DEPM motor technology delivers an additional 6-20% efficiency, meeting IE5 efficiency standards

Control algorithm constantly reviews operating conditions and adjusts output to meet immediate flow requirements at minimum energy consumption

ALWAYS AVAILABLE

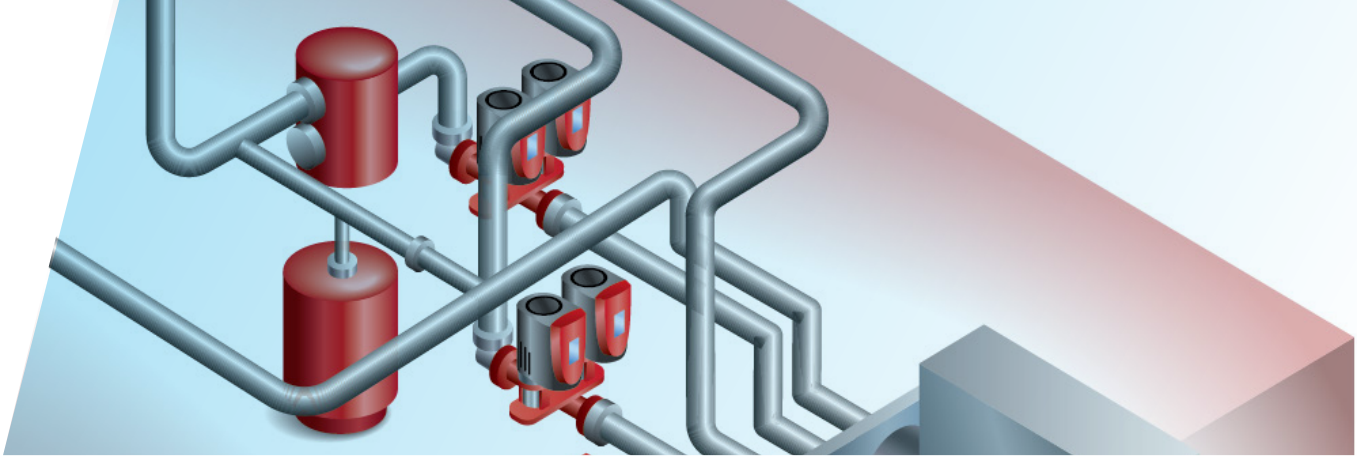
Most building HVAC systems operate at the design point (100% load) less than 1% of the time. Traditional system design applies 100% redundancy and duplication of components to ensure that the design point can always be met. This creates huge over capacity and higher costs.

15 minutes to replace the mechanical seal — no need for realignment.

The traditional duty/standby approach to redundancy in HVAC systems inflates the installed costs for equipment and labour, and adds to the carbon footprint of the building. Tango's dual-pumping configuration modernises the approach to redundancy. Pumps and motors are selected from a range of sizes to achieve a level of redundancy that matches the requirements of the application.

With the proper approach to redundancy, HVAC requirements can be met for all but the most extreme days of the year; and for those few days, variation in temperature will be minimal.

For pumps larger than 7.5kW use dualArm pumps for lowest installed cost, lowest life cyle operating cost achieved with Parallel Sensorless, and increased serviceability with built-in isolation valves.



ENERGY EFFICIENT PRODUCT OF THE YEAR

CIBSE BUILDING PERFORMANCE AWARDS 2019

"Armstrong has made significant commitments to reduce its own carbon emissions in its manufacturing locations. Donating the proceeds from recycling aged pumps, via their sustainability initiative Planet Proposition, to charitable causes also impressed us greatly."

JUDGE'S COMMENTS

CASE STUDY | Delta Hotel

ANNUAL ENERGY SAVINGS

40%

The Delta Hotel commissioned an upgrade of one of their existing pumps to a new Tango. New control algorithms and performance management of the Tango pump proved that the upgrade was the right choice. The total annual energy cost savings amounted to over $2,678 with a total kWh savings of 22,957 kWh: a 40% savings overall.

FACILITY TYPE
Hotel

LOCATION
Toronto, Canada

SIZE
300,000 ft²

ANNUAL ENERGY COST

BEFORE	AFTER
$6,604 AUD	$3,925 AUD
AVERAGE	AVERAGE

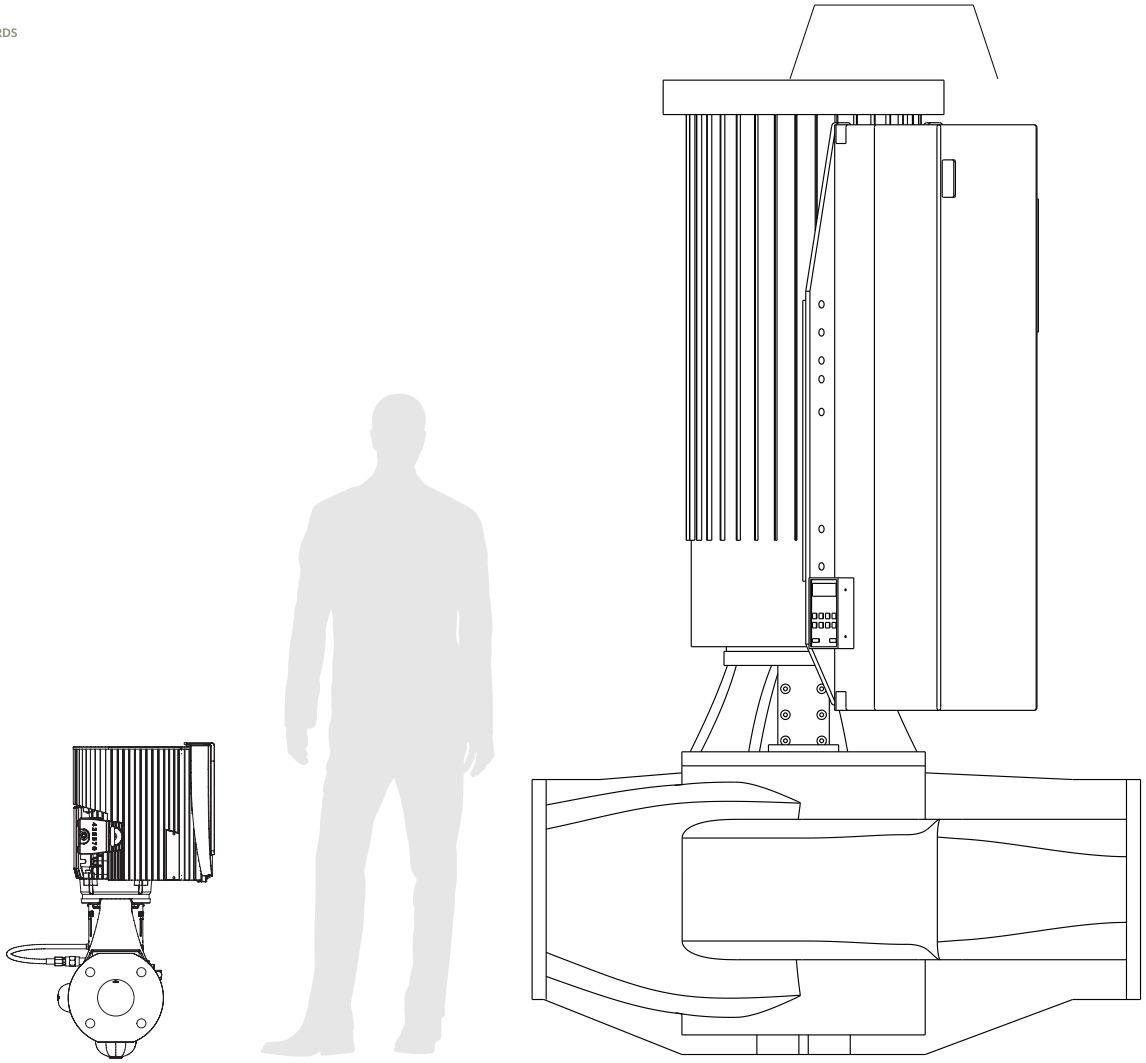
ANNUAL COST SAVINGS **$2,678 AUD**

CO_2 EMISSIONS

BEFORE	AFTER
7,923 kg CO_2	4,709 kg CO_2
AVERAGE	AVERAGE

ANNUAL CO_2 EMISSION REDUCTION **3,214 kg CO_2**

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2021



0.25 kW

Up to 932 kW available

Head Office
New South Wales
184 Newton Road,
Wetherill Park 2164
+61 (2) 9748 2022

Victoria
8-10 Parkhurst Drive
Knoxfield 3180
+61 (3) 9012 9751

Queensland
161 Railway Parade
Thorneside 4158
+61 (7) 3103 7055