ARMSTRONG

Performance Upgrade Services Suite

UPGRADE YOUR SYSTEM

ACTIVE PERFORMANCE MANAGEMENT™

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OPTIMIZED EFFICIENCY
AND PERFORMANCE

ACTIVE PERFORMANCE MANAGEMENT™

LEARNS

PREDICTS

OPTIMIZES

With Active Performance Management at the plant level, you can save up to

40%

annual energy savings

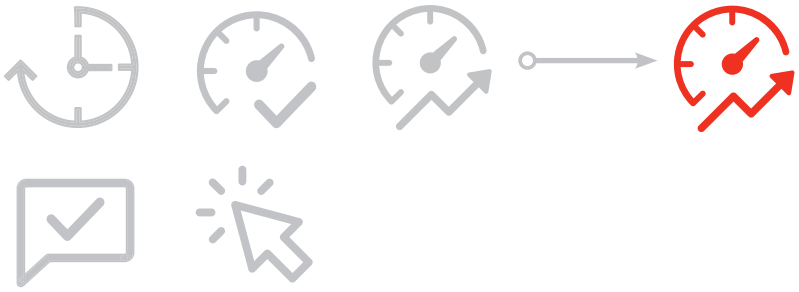
Active Performance Management is a systems management approach that optimizes HVAC systems at any stage of a building's life-cycle by continuously learning from a broad network of installations and responding to changing HVAC requirements. The combination of smart commissioning with real-time alerts and system transparency addresses performance drift and maintains occupant comfort.

PERFORMANCE UPGRADE AND SERVICES FOCUSED ON MANAGING FOR PERFORMANCE

PERFORMANCE UPGRADE SUITE

The Performance Upgrade Suite is one of five service suites that enable Active Performance Management. Solutions included in the Performance Upgrade Suite let you upgrade installed components to take advantage of industry-leading technology and unique Performance Management capabilities.

These upgrade solutions work at the equipment level to provide the best possible mechanical system efficiencies and maximize uptime. Performance Upgrade solutions also include technology for Active Performance Management, delivering actionable insights to help building operators make informed decisions for better results.



Performance Upgrade Suite is one of five service suites that enable Active Performance Management

SEE THE PRESENT KNOW THE FUTURE

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 optimize performance. With accurate flow information, the picture changes entirely. Armstrong can optimize each component and the overall system.

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 $2,295 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
$5,659 CAD	$3,364 CAD
AVERAGE	AVERAGE

ANNUAL COST SAVINGS $2,295 CAD

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

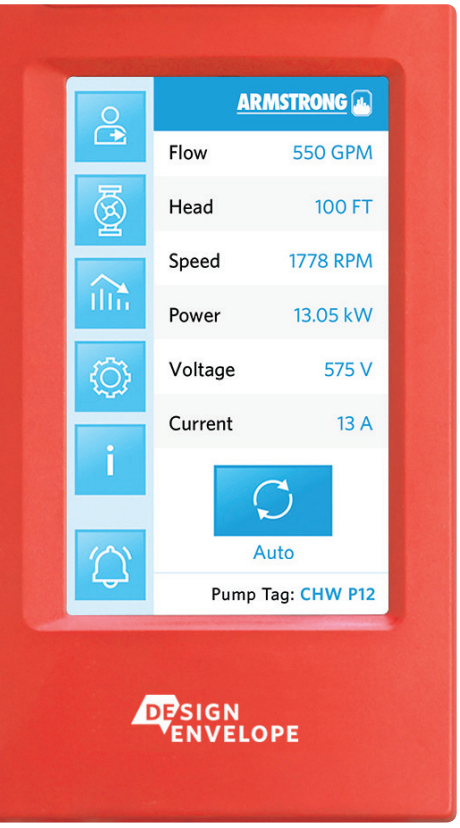
WITH PERFORMANCE UPGRADE SUITE YOU'LL GET:

- Factory tested and validated upgrade solutions designed to minimize disruption and tenant discomfort
- Risk mitigation through upgrade with a clear fallback plan
- Payback in as soon as three to six months
- Ability to perform predictive maintenance on your assets
- Deeper insights into pump and HVAC operations through Active Performance Management to meet your operations and sustainability targets

THE SOLUTIONS

PERFORMANCE UPGRADE FOR DESIGN ENVELOPE PUMPS	>	**LEAP** to an intelligent pump solution
VERTICAL IN-LINE RETROFIT TO DESIGN ENVELOPE	>	**UPGRADE** legacy pump
DESIGN ENVELOPE BOOSTERS	>	**UPGRADE** booster packages
OPTI-VISOR™	>	**OPTIMIZE** chiller plant performance
TOWERMAX	>	**OPTIMIZE** cooling tower

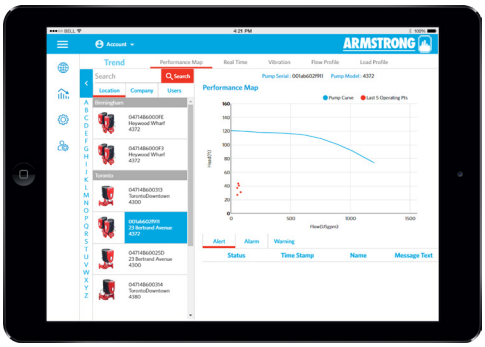
CONTROLLER & CONNECTOR



Performance Upgrade for Design Envelope Pumps retrofits an existing Design Envelope pump seamlessly without having to remove the pump.

- Advanced control capabilities
- Intuitive touchscreen user interface for updates
- Pump Manager, a subscription-based service for alerts, warnings, reports and predictive maintenance

Upgrading existing Armstrong Design Envelope pumps



Powered by:

IBM **Watson**®

Step up to Active Performance Management™

Pump Manager is a secure cloud-based subscription service that enables Active Performance Management™ connecting to existing BAS, CMMS and EMS systems. Pump Manager leverages deep analytics for greater predictive accuracy and even greater efficiencies.

- Real-time operating insights and early diagnostic warnings
- Full transparency in energy savings and carbon footprint reduction
- Reduce pump maintenance cost by up to 50% with predictive maintenance

DROP-IN UPGRADE

The Vertical In-Line (VIL) Retrofit to Design Envelope upgrades an existing Armstrong constant-speed VIL pump to a new Design Envelope pump, but retains the existing casing.

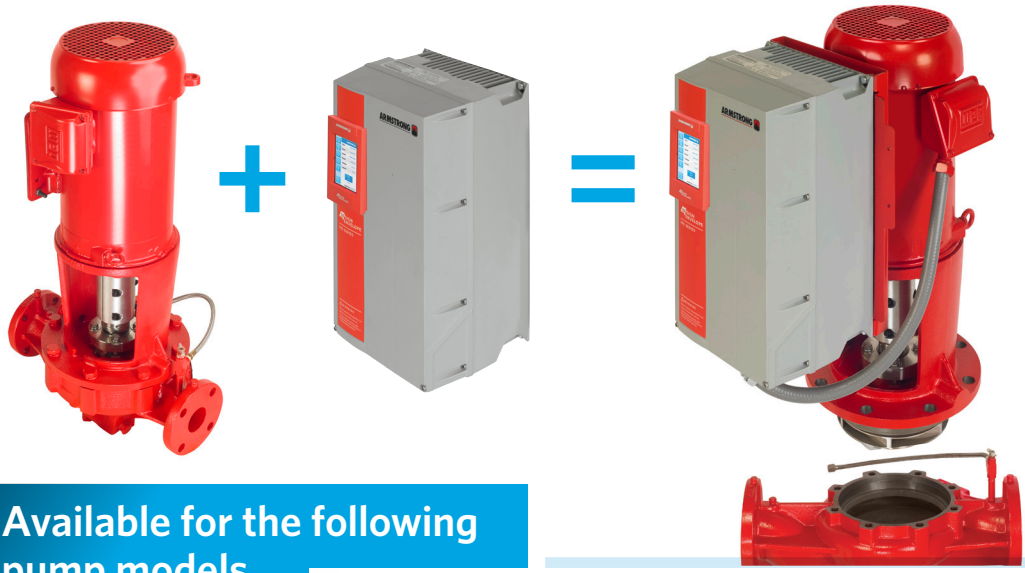
Integrated intelligent controls with connectivity, alerts and reporting

Saves up to 70% in energy over a constant speed pump

Preserves the existing insulation: no need to disconnect or disturb the piping

Qualifies for rebate programs in many jurisdictions

> The Design Envelope Vertical In-Line Retrofit Solution lets you upgrade a constant speed pump to an intelligent, Sensorless, variable speed solution



Available for the following pump models

4300/4380 Vertical In-Line pumps | 132 pump models in 14 casing sizes

4312/4392 Vertical In-Line Twin pumps | 39 pump models in 7 casing sizes

4302/4382 Vertical In-Line dualArm pumps | 59 pump models in 9 casing sizes

All VIL Retrofit units are performance tested using a matching casing.

JUST ENOUGH PRESSURE

Design Envelope 6800 Boosters are fully assembled, programmed, booster systems

Precise, demand-based approach to pressure boosting

Reduces energy use by up to 70%

Compact design and integrated controls minimize installed cost

ALL TOGETHER NOW

OPTI-VISOR™ is a supervisory control solution that interfaces with any BAS to optimize HVAC efficiency

Harmonizes operation of existing HVAC components for up to 30% better efficiency

Full compatibility with existing Building Automation Systems: uses a serial communications link and logic sequences

No other replacements or upgrades are required

SYNCHRONIZED COOLING

TOWERMAX is an optimization service that uses advanced control sequences to reduce energy use and water consumption in HVAC systems

Control sequences and automated staging for cooling towers, pumps, fans and chillers

Optimizes performance of a chiller plant for savings of up to 25%

Available as an upgrade for an Armstrong IPC 9521 plant controller

DESIGN ENVELOPE

HIGHEST
ENERGY EFFICIENCY

LOWEST
INSTALLED COST

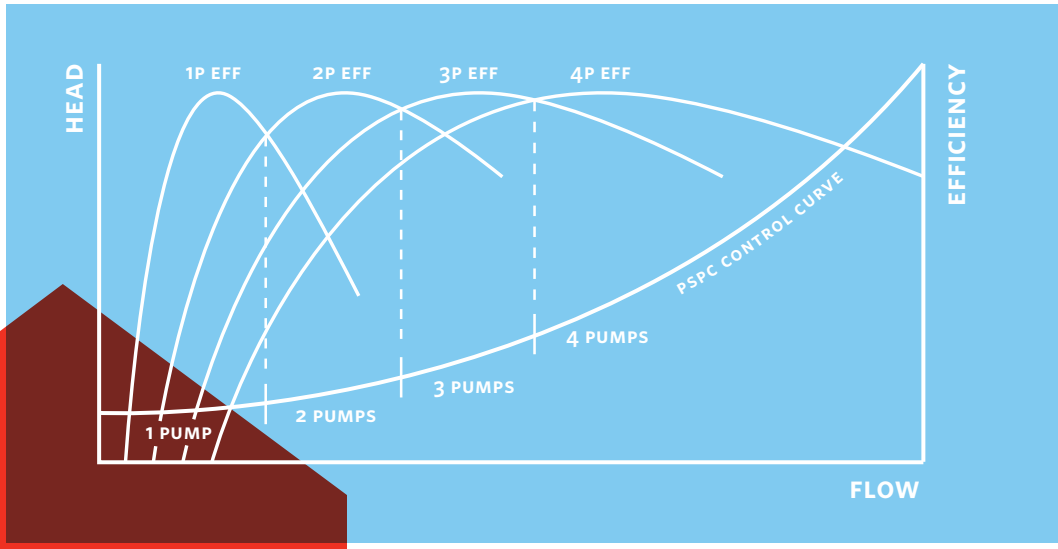
LOWEST
OPERATING COST

LOWEST
ENVIRONMENTAL COST

LOWEST
PROJECT & OPERATING RISK

Design Envelope technology is a demand based intelligent control solution that models equipment and system behavior, monitors actual system conditions and dynamically adjusts equipment operation to match system demand.

Highest Energy Efficiency savings of up to 70% compared to constant speed solutions, plus built-in Parallel Sensorless Pump Control



NEXT LEVEL THINKING

Parallel Sensorless Pump Control

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

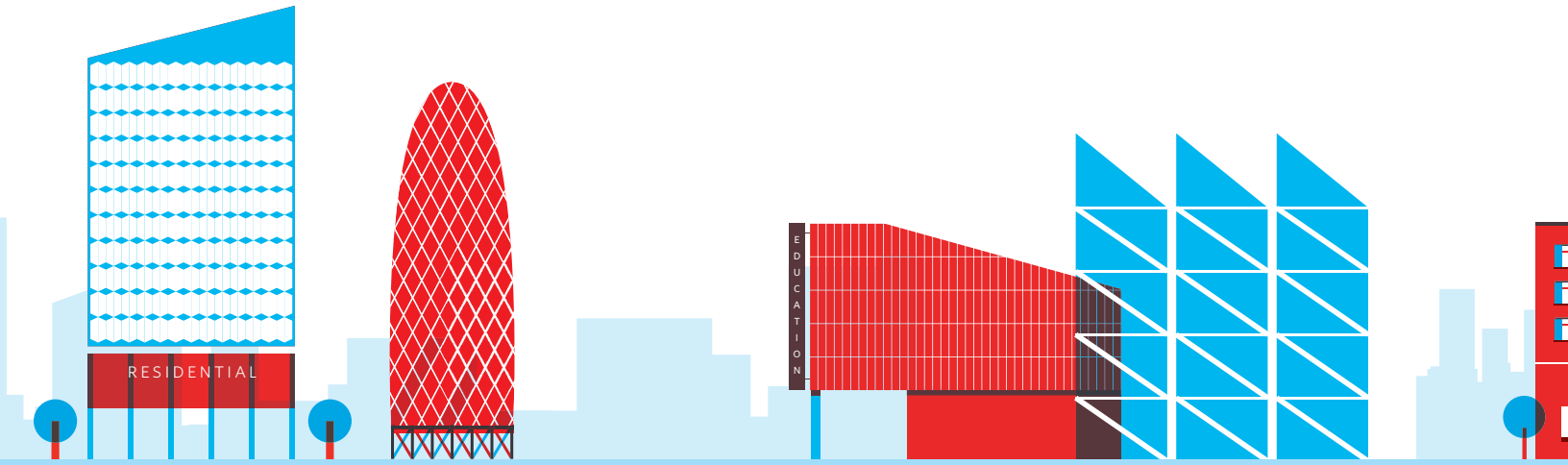
Stages pumps based on efficiency

Reduces the energy use of the entire pump array by up to 30%

Available for all Design Envelope pumps: standard on all Design Envelope Tango units

Ask your Armstrong Representative about the entire family of five service suites that enable Active Performance Management:

MANAGE YOUR SYSTEM	PERFORMANCE MANAGEMENT SUITE	Pump Manager ECO*PULSE
UPGRADE YOUR SYSTEM	PERFORMANCE UPGRADE SUITE	Pump Retrofit Upgrade legacy pumps Upgrade Booster package OPTI-VISOR TOWERMAX
GET IT RIGHT	STARTUP SUITE	Expert planning and design services Managed system startup Smart Commissioning
BOOST YOUR UPTIME	MAINTENANCE, OPERATIONS, REPAIRS SUITE	Replacement parts Emergency services Service agreements
UNDERSTAND THE POSSIBILITIES	CONSULTING SUITE	Pump energy consulting Booster energy consulting Plant energy consulting



OUR SUSTAINABILITY VISION

PLANET PROPOSITION

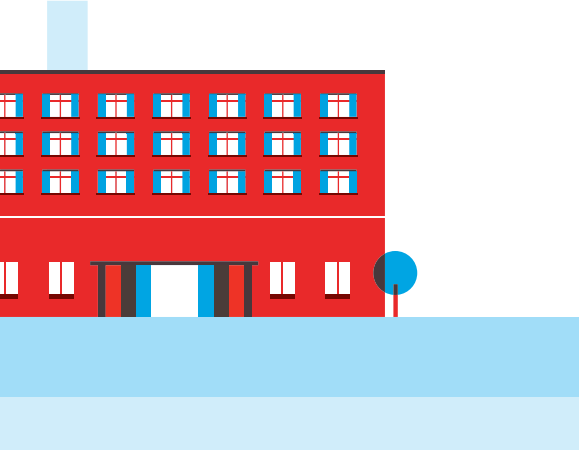
Through our Planet Proposition charter, Armstrong has committed to minimizing our impact on the environment. Around the world, Armstrong's Planet Proposition teams have taken on projects that are helping us meet our targets. Two examples of ongoing projects are:

2 BY 22

Armstrong is committed to helping existing customers reduce GHG emissions of installed equipment by 2 million tons by the year 2022. Under this initiative, Armstrong works with customers to upgrade existing installations and continues to develop new energy-savings solutions.

NET ZERO CARBON BUILDINGS COMMITMENT

The Net Zero Commitment positions energy efficiency as a central component to achieving decarbonization globally. In signing the Net Zero Carbon Buildings Commitment, Armstrong has pledged to ensure our entire portfolio of buildings operates at net zero carbon by the year 2030.



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MAKING ENERGY MAKE SENSE™