

## DESIGN ENVELOPE

Intelligent Variable  
Speed pumps

### SOLUTION OUTLINE

FILE NO: 100.11UK  
DATE: FEBRUARY 2019

SUPERSEDES: 100.11UK  
DATE: OCTOBER 2017

# DESIGN ENVELOPE

OPTIMUM  
PERFORMANCE  
ANY GIVEN TIME

A

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

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

Through design advances,

Armstrong has eliminated the cost trade-offs that are frequently attached to sustainable choices. Design Envelope offers the lowest installed cost and the lowest life cost of any pumping solution today.

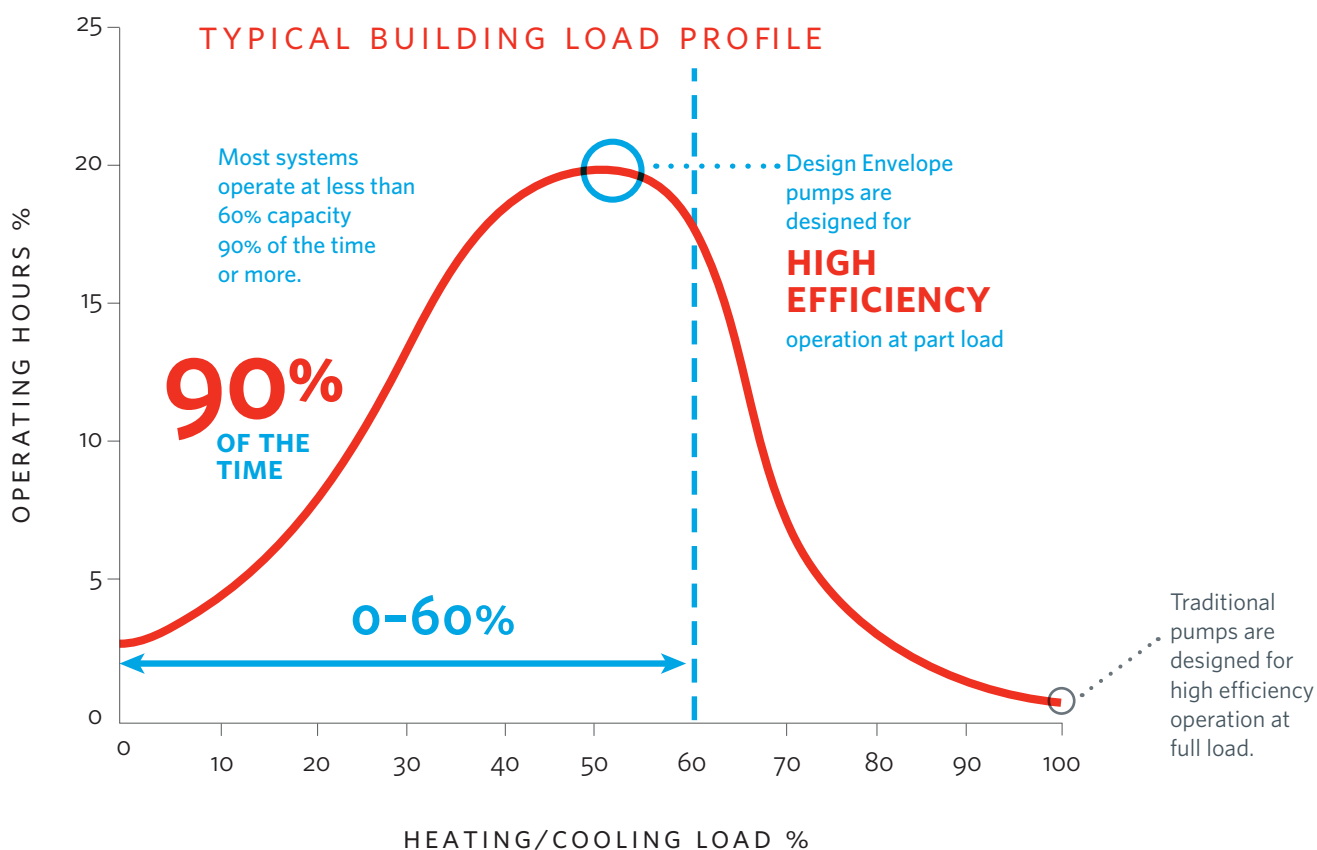




UP TO  
**65%**  
INSTALLED  
COST  
SAVINGS



UP TO  
**80%**  
ENERGY  
SAVINGS



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 mapped for the best pump efficiency, where variable flow systems operate most often. This ensures a building's hydronic pumping system consumes as little energy as possible. Design Envelope pumps up to 7.5 kW exceed this legislation and are IE5 certified.

# EVOLUTION OF PUMPING

## & INSTALLED COSTS

### DESIGN ENVELOPE TANGO/DUALARM

- > Managed redundancy and parallel operation replaces duty/standby
- > Reporting and proactive management
- > Smaller units are easier to handle
- > Two rotating devices sharing one casing
- > Optimised lifetime performance

### DESIGN ENVELOPE VERTICAL IN-LINE

- > Integrated, sensorless variable speed controller
- > Eliminates wiring from Variable Frequency drive panel (VFD) to pump
- > Supports smaller motor selections
- > No feedback sensor or wiring required
- > Internal harmonic filter
- > No requirement for wall space
- > One-touch auto-flow balancing
- > Onboard Web services and connectivity

Saves an additional  
£1541 on average

### VERTICAL IN-LINE WITH VARIABLE SPEED CONTROL

- > Wall/rack mounted VFD
- > System feedback sensor
- > Partially reduces energy costs

### VERTICAL IN-LINE SPLIT-COUPLING

- > **Eliminates the need for:** housekeeping pads, inertia base, flex connections, grouting and alignment
- > Reduced installation labour costs
- > Smaller mechanical room footprint (50-75%)

15 minute seal change: saves up to £539

Saves over £3852 for a 203.0 mm pump

### BASE-MOUNTED END SUCTION

- > Legacy design
- > Base case for comparison
- > Time intensive seal change

AVERAGE  
**15%**  
ENERGY  
SAVINGS

#### CONSTANT SPEED PUMP 3-WAY VALVE

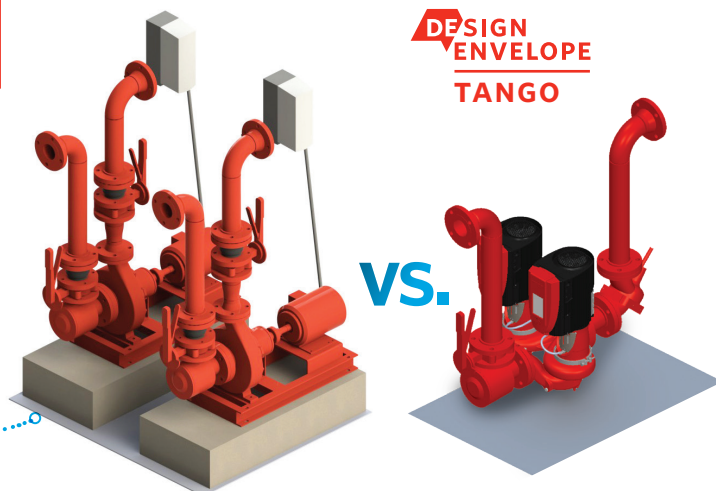
#### VARIABLE SPEED PUMP WITH CONTROLS DISABLED (PUMP IN HAND)

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

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

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

#### DESIGN ENVELOPE TANGO





# SUPERIOR PERFORMANCE

& ENERGY SAVINGS

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%<sup>+</sup>**  
ENERGY  
SAVINGS

**DESIGN ENVELOPE  
GENERATION 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  $\pm 5\%$
- > Optimised selection against load profile



UP TO  
**80%<sup>+</sup>**  
ENERGY  
SAVINGS

**DESIGN ENVELOPE  
GENERATION 5**

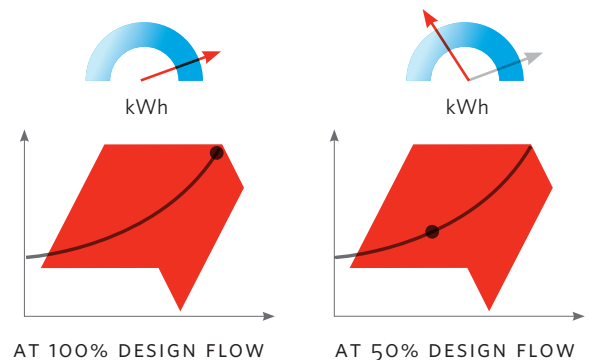
- > Advanced digital controls
- > Control tuned to specific motor
- > iECM motor: IE5 efficiency rating
- > Advanced hydraulics

**NEXT  
LEVEL  
THINKING**

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

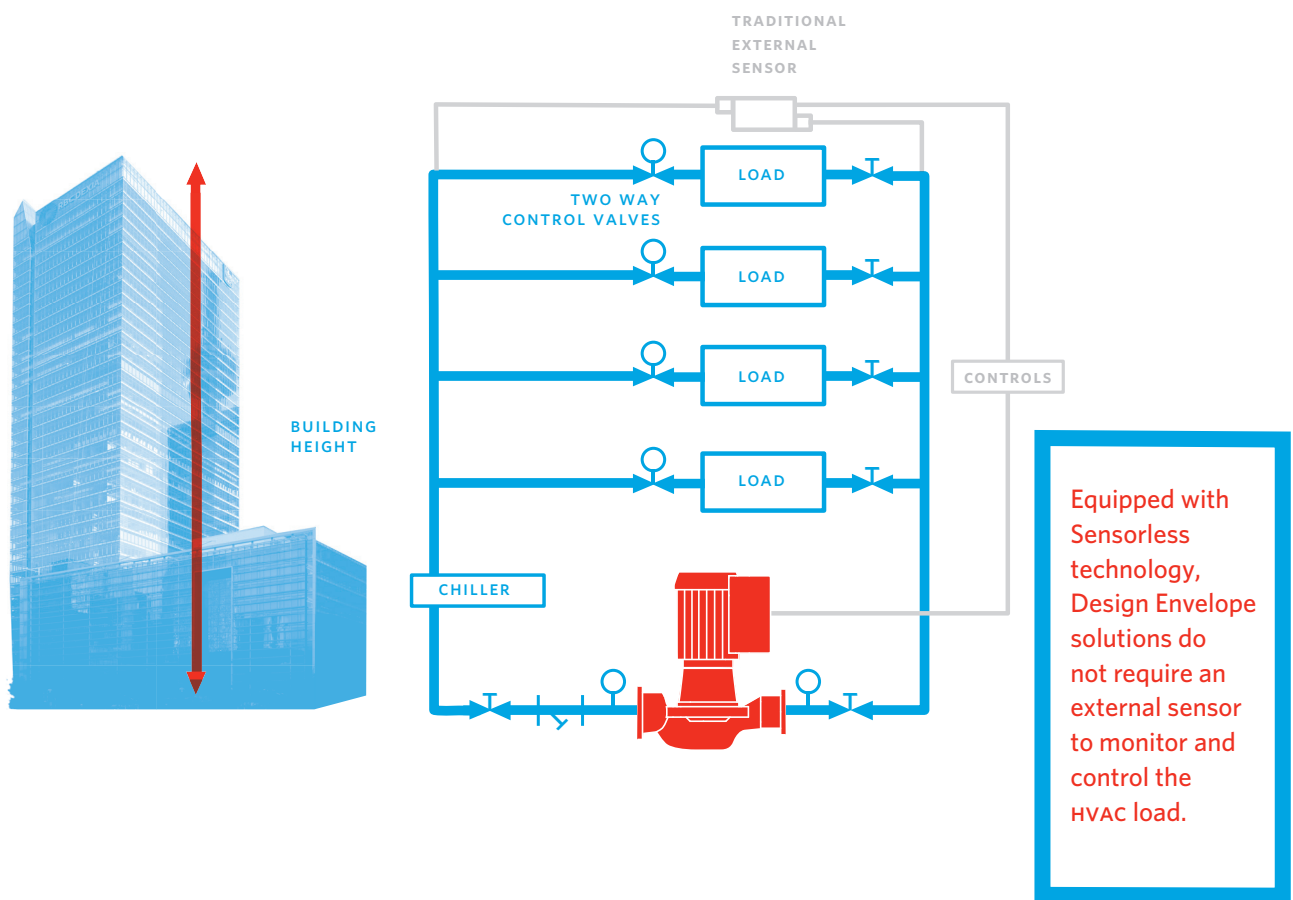
## ENERGY SAVINGS

**A**rmstrong 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.



# HOW IT

## THE SENSOR WITHIN



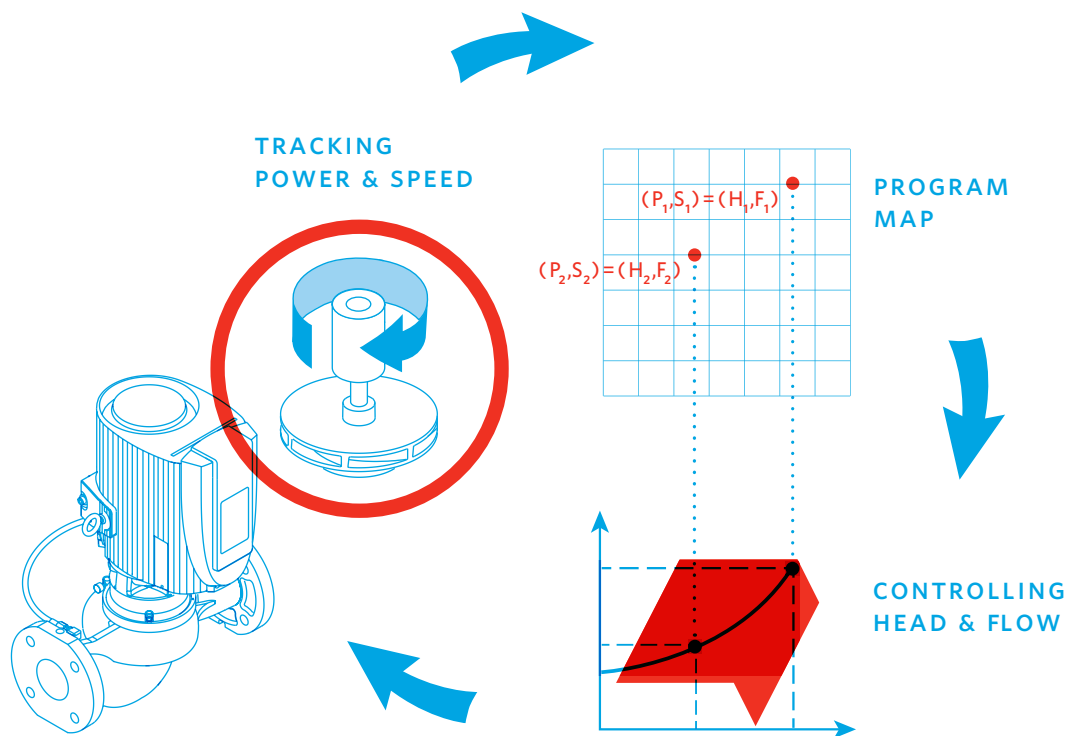
**I**n a chilled water system, a building's temperature controls influence the local flow of control valves that modulate the flow to the cooling coils (load). As the control valves open for more chilled water flow, the differential pressure across the valve decreases.

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.

# WORKS

## MONITOR POWER & SPEED

## CONTROL HEAD & FLOW



**E**quipped with Sensorless technology, a Design Envelope pump's performance characteristic curve (power draw and RPM) and operating curve are pre-programmed into the controller. During operation, the controller monitors the power and speed 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.

# LIVING

## LOWEST OPERATING COST

UP TO 80% SAVINGS COMPARED TO  
INDUSTRY STANDARD SOLUTIONS

Lowest maintenance costs of any pumping configuration  
Extended high-efficiency performance

## LOWEST INSTALLED COST

UP TO 65% SAVINGS COMPARED TO  
INDUSTRY STANDARD SOLUTIONS

Smaller footprint  
Reduced overall weight  
Fewer connecting components  
Reduced labour cost  
Auto commissioning for immediate  
maximum efficiency

## LOWEST RISK

Maximum reliability  
Maximum flexibility  
Managed redundancy without duty/standby

## EXTENDED PERFORMANCE

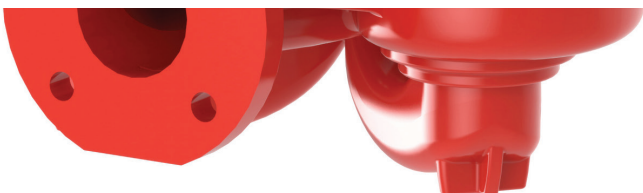
**Pump Manager is a performance management service to help operators maintain optimised long-term efficiency.**

- > Early detection of changes in pump condition
- > Notification of changes in equipment settings
- > Insight into pump status, performance and efficiency
- > Extended lifespan and optimum performance with Tango and dualArm configurations

**Parallel Sensorless Pump Control (PSPC) is a technology that minimises the energy costs of multi-pump installations using best efficiency staging.**

**M**ost multi-pump control systems stage pumps on the basis of capacity. The PSPC control logic draws on detailed mapping of pump efficiency curves to determine the best possible combination of pumps and operating speeds for any flow requirement.

When the PSPC calculates that a pump array would operate more efficiently with one more pump added to the current set of operating pumps, the control logic turns on one more pump and coordinates the operating speeds of all the operating pumps to share the load.





# PERFORMANCE

Armstrong has re-invented and redesigned pumping solutions to include connectivity and performance management services. Design Envelope pumps deliver optimal lifetime efficiency through:

Flow meter functionality delivers accuracy of +/- 5%, optimising the performance of the entire HVAC system for improved efficiency and reduced operating costs

Expanded performance range and options

One-touch auto-flow balancing

Pump speed modulation based on an adjustable quadratic control curve for best part-load efficiency

On-board data and diagnostics to provide performance information and notifications

## PERFORMANCE PACKAGES

## FUNCTIONS INCLUDED



**Sensorless Bundle**  
(standard)

- Sensorless control
- Flow meter
- Constant flow
- Constant pressure



**Parallel Sensorless**  
(standard on Tango and dualArm)

- Parallel Sensorless control



**Energy Performance Bundle**

- Auto-flow balancing
- Maximum flow control



**Protection Bundle**

- Minimum flow control
- Bypass valve control



**Zone optimisation**

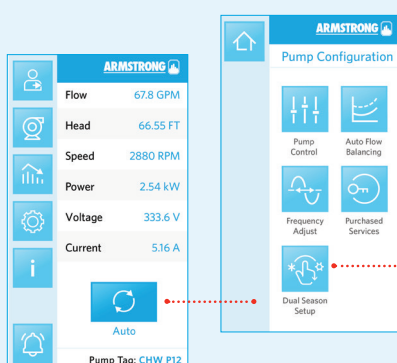
- Accept up to two dp sensor control signals



**Dual-season setup**

- Pre-set heating and cooling parameters for two-pipe systems

## PUMP MANAGER



## CONNECTIVITY

Built-in Wi-Fi capability supports remote control, real-time monitoring and management for lowest operating costs

Local and remote access from any smart device

Adaptive browser-compatible software and intuitive user interface

# INDUSTRY-LEADING

## DESIGN ENVELOPE

Design Envelope technology offers advanced HVAC performance management, the simplest and fastest commissioning and optimised lifetime performance through real-time insight and action.



**HIGHEST**  
ENERGY EFFICIENCY



**LOWEST**  
INSTALLED  
COST



**LOWEST**  
OPERATING COST



**LOWEST**  
ENVIRONMENTAL COST



**LOWEST**  
PROJECT  
& OPERATING RISK

## CAPABILITIES

**Extended intelligence:** integrated controller provides on-board diagnostics, trending, alerts, automatic flow-balancing and optional Parallel Sensorless pump control

**Advanced controls:** colour touchpad with intuitive HMI and access to real-time performance and pump conditions

**Real-time connectivity:** options include BACnet, BACnet IP, and MODBUS IP and MODBUS RTU. Built-in Wi-Fi and wired connectivity supports web-based control or local control from a handheld unit

**Armstrong intelligent motors:** with integrated controls deliver IE5 levels of energy efficiency (on select models) and lowest energy consumption

## VALUE

### BUILDING OWNERS

- Lowest operating costs over the life of the pumps
- Additional capacity provides future proofing against changing building loads
- Unmatched space savings, efficiency and redundancy with Tango and dualArm multi-pump configurations

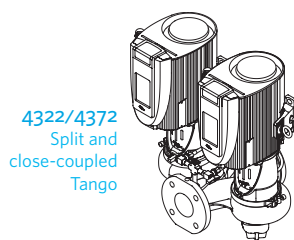
### DESIGN ENGINEERS

- Broad range of performance leads to reduced iterations of pump selection and reduced performance risk
- UL STD 778 and CSA STD C22.2 no.108 certified, CE certification

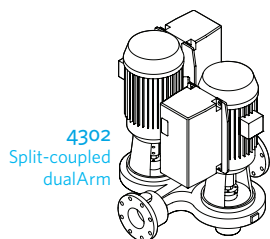
### CONTRACTORS

- Easy installation and commissioning
- Express models available for quick delivery
- Single source accountability for all aspects of an integrated pumping solution

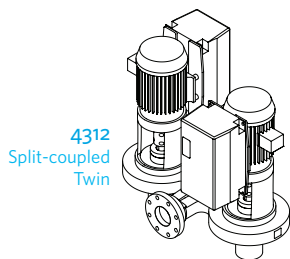
## DESIGN ENVELOPE PUMP RANGE\*



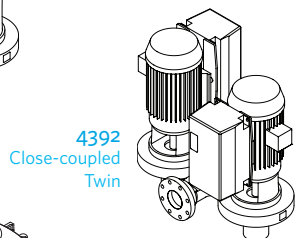
4322/4372  
Split and  
close-coupled  
Tango



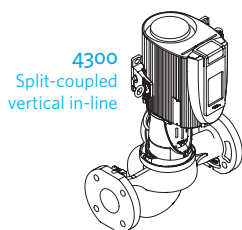
4302  
Split-coupled  
dualArm



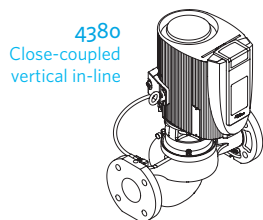
4312  
Split-coupled  
Twin



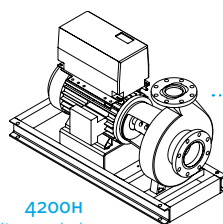
4392  
Close-coupled  
Twin



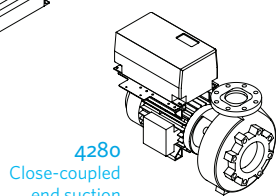
4300  
Split-coupled  
vertical in-line








4380  
Close-coupled  
vertical in-line



4200H  
Split-coupled  
end suction



4280  
Close-coupled  
end suction

INDOOR	OUTDOOR
0.25-7.5 kW	0.75-7.5 kW
Express models available 	
INDOOR	OUTDOOR
0.55-37 kW	0.55-37 kW
INDOOR	OUTDOOR
0.55-22 kW	0.55-22 kW
INDOOR	OUTDOOR
0.55-7.5 kW	0.55-7.5 kW
INDOOR	OUTDOOR
0.25-250 kW	0.55-90 kW
Standalone 315 kW-1000 kW	
Express models available 	
INDOOR	OUTDOOR
0.25-7.5 kW	0.75-7.5 kW
Express models available 	
INDOOR	OUTDOOR
0.55-90 kW	N/A
Express models available 	
INDOOR	OUTDOOR
0.55-5.5 kW	N/A
Express models available 	

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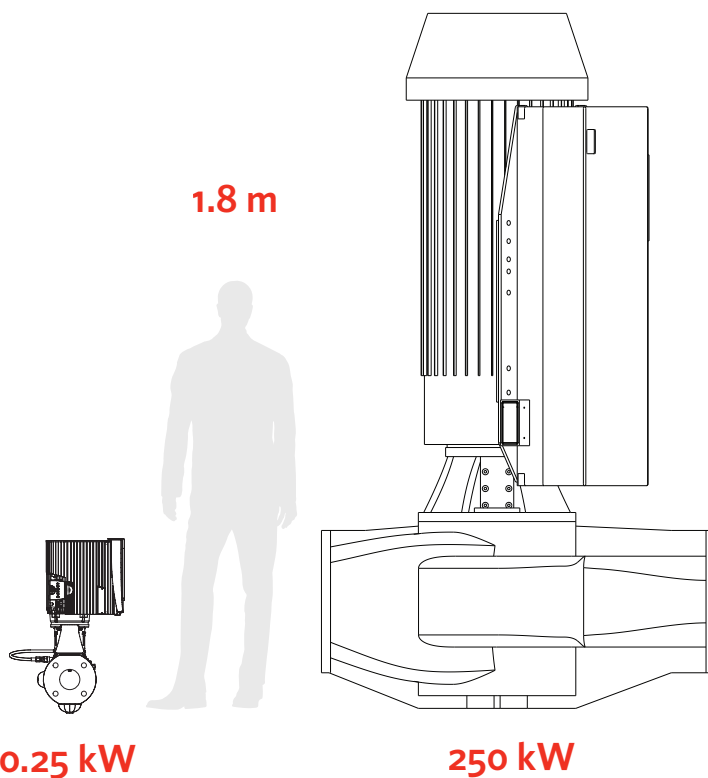
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