July 27, 2017

Welcome to Xylem CBS Seminar



5th Generation HYDROVAR - HVL







Index

- What is a Variable Speed Drive (VSD)
- What are the benefits of using a VSD with a pump
- HVL - Hydrovar 5th Generation
  - Key features – Mechanical and Software
- Retrofit
- Applications
- Wall-mounted VFD
- Eco Directives

(*) The complete software description is on a separate presentation

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What is a Variable Speed Drive

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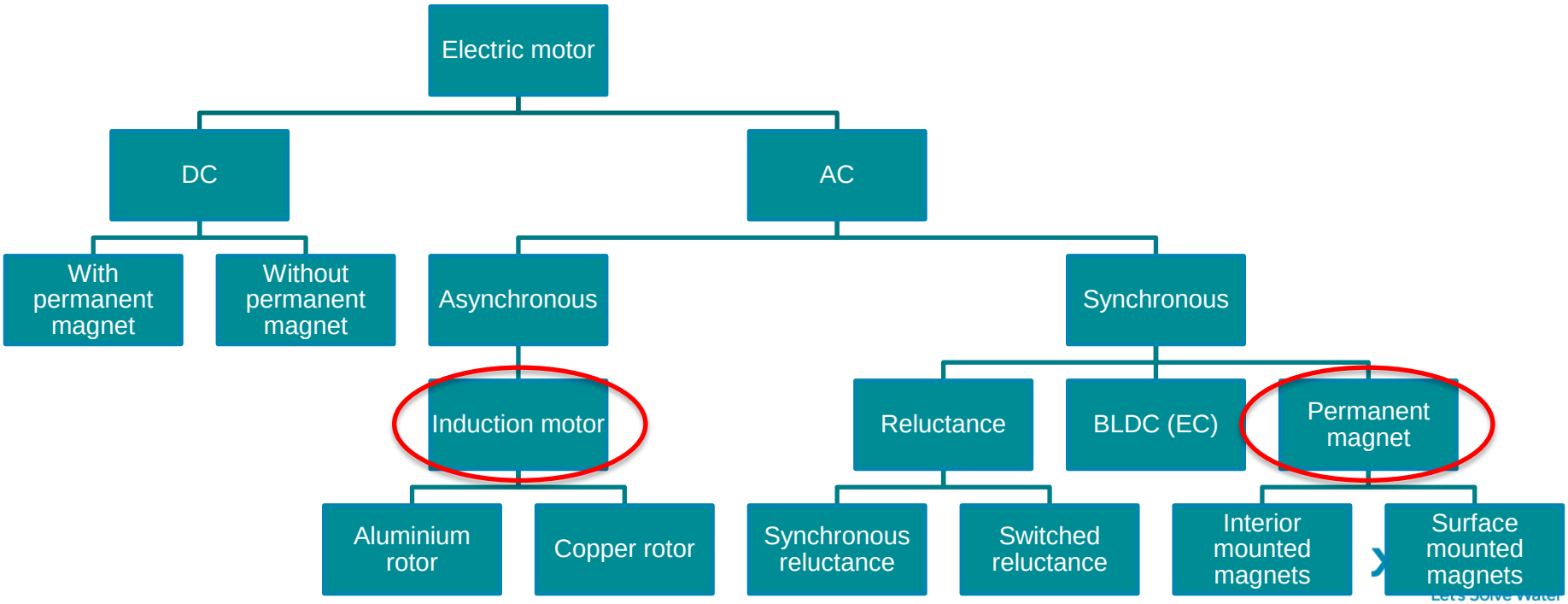
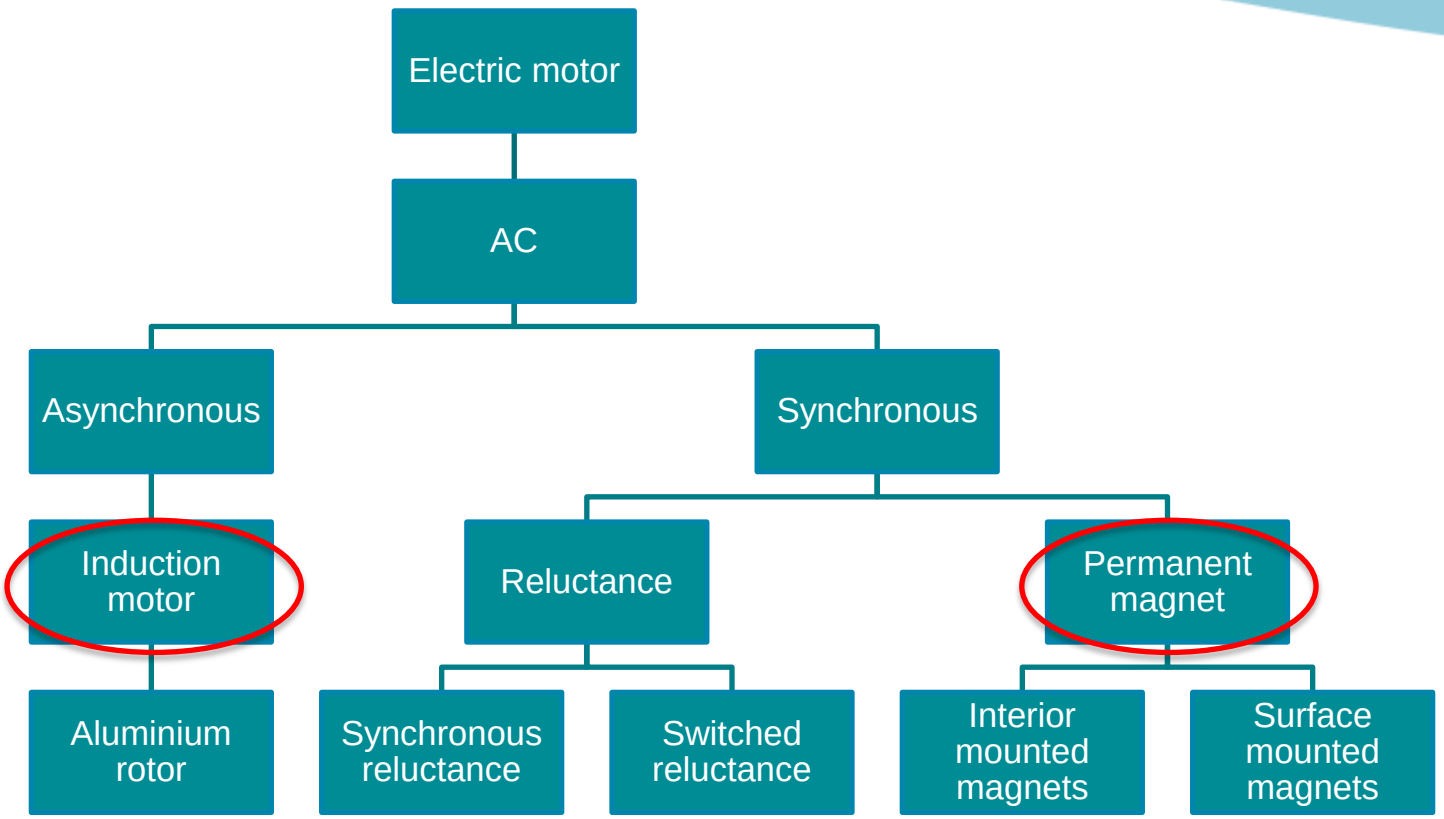
Motors

An electric motor is an electromechanical device that converts electrical energy into mechanical energy. The reverse process of producing electrical energy from mechanical energy is performed by a generator.

The operating demands of the electric motor, especially in industry, have been enormous. Robustness, reliability, size, energy efficiency, and price are only some of these criteria. The differing needs have resulted in the development of different types of electric motors



Motors in the pumps









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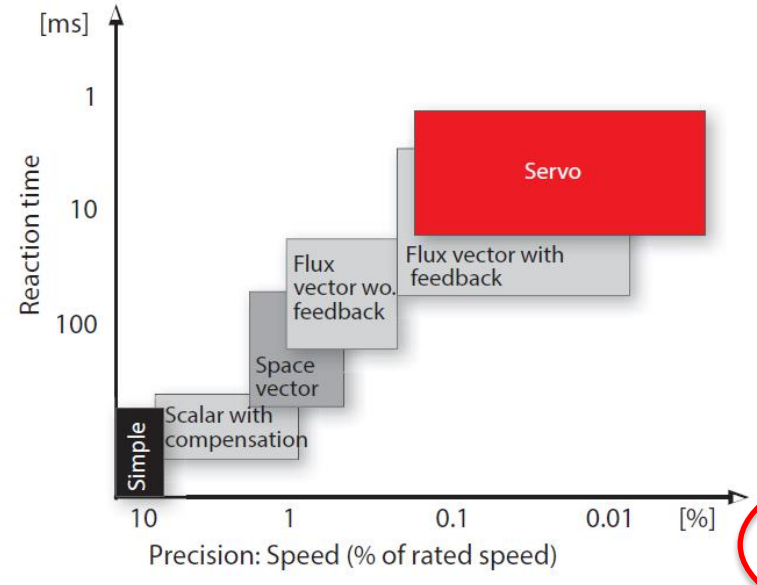
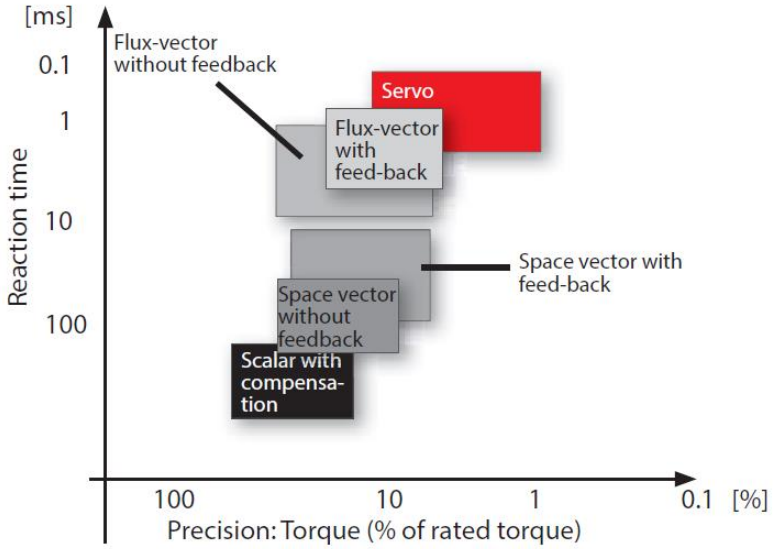
Control circuit and methods





Six different types can be identified:

- Simple (scalar) without compensation control
- Scalar with compensation control
- Space vector control
- Open loop flux (field-oriented) control
- Closed loop flux (field-oriented) control
- Servo-controlled systems

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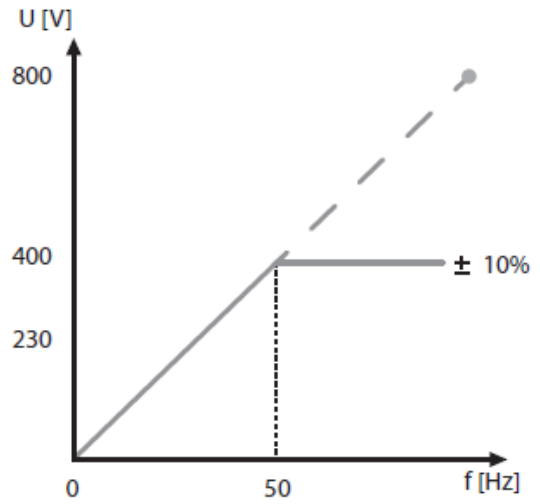
Scalar control with compensation

- The most common control used in the VSD for pumps
- Voltage/frequency [U/f] control with load and slip compensation (most important manufacturer)
- Control of voltage amplitude and frequency

Typical shaft output:

- Speed setting range 1:25
- Speed accuracy —1% of rated frequency
- Acceleration torque 40-90% of rated torque
- Speed change response time 200-500 ms
- Torque control response time Not available



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Space vector control

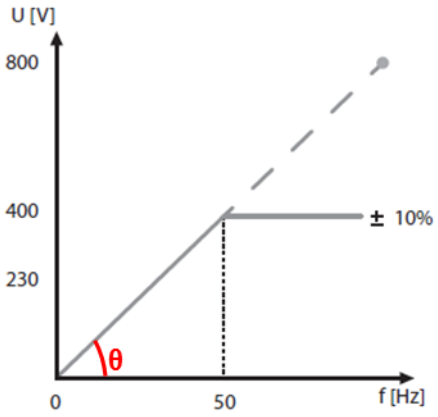
The space vector control method is available with (“closed loop”) or without (“open loop”) an external motor speed feedback

The voltage angle (θ) is regulated in addition to the voltage (U) and frequency (f).



Typical shaft output:

- Speed setting range 1:100
- Speed accuracy (steady state) — 0.5% of rated frequency
- Acceleration torque 80-130% of rated torque
- Speed change response time 50-300 ms
- Torque change response time 20-50 ms



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Space vector control - benefits

Typical features:

- Voltage vector control in relation to steady-state characteristic values (static)
- Improved dynamic performance compared with scalar control
- Very good at withstanding sudden changes in load (compared with scalar plus compensation)
- Operation at the current limit
- Possibility of active resonance dampening
- Possibility of open-loop/closed-loop torque control
- High starting and holding torque
- Problems during rapid reversing compared with flux vector
- No “rapid” current control



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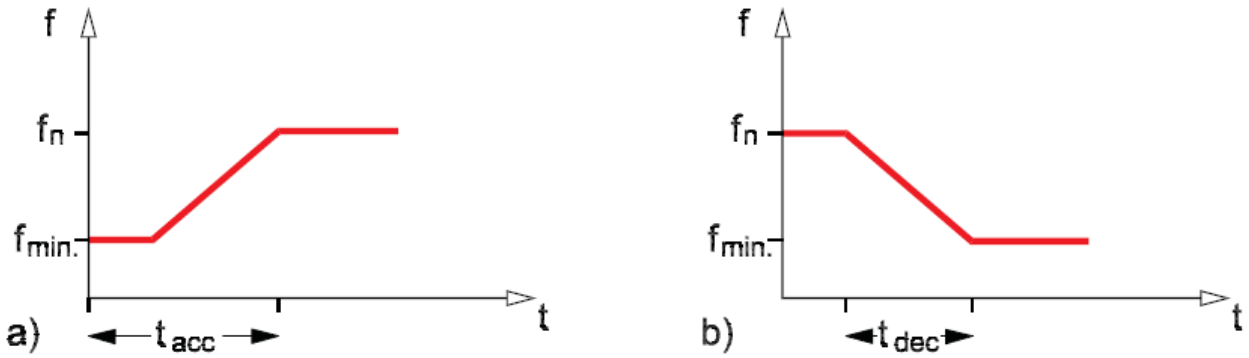
Frequency converters and motors

For many applications there are various reasons why the speed must not change too quickly but instead must be changed slowly or with smooth transitions. All modern FC's have ramp functions to facilitate this. These ramps are adjustable



If the inertia of the motor shaft and the referred inertia of the load are known, the optimum acceleration and deceleration times can be calculated

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What are the benefits of using a VSD with a pump?

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What is the LCC?

Pumping systems account for nearly **20%** of the world's electrical energy demand and range from **25-50%** of the energy usage in certain industrial plant operations.

The energy and materials used by a system depend on the design of the pump, the design of the installation, and the way the system is operated. **These factors are interdependent.**

Energy Savings Method	Savings
Replace throttling valves with speed controls	10-60%
Reduce speed for fixed load	5-40%
Install parallel system for highly variable loads	10-30%
Replace motor with a more efficient model	1-3%
Replace pump with a more efficient model	1-2%

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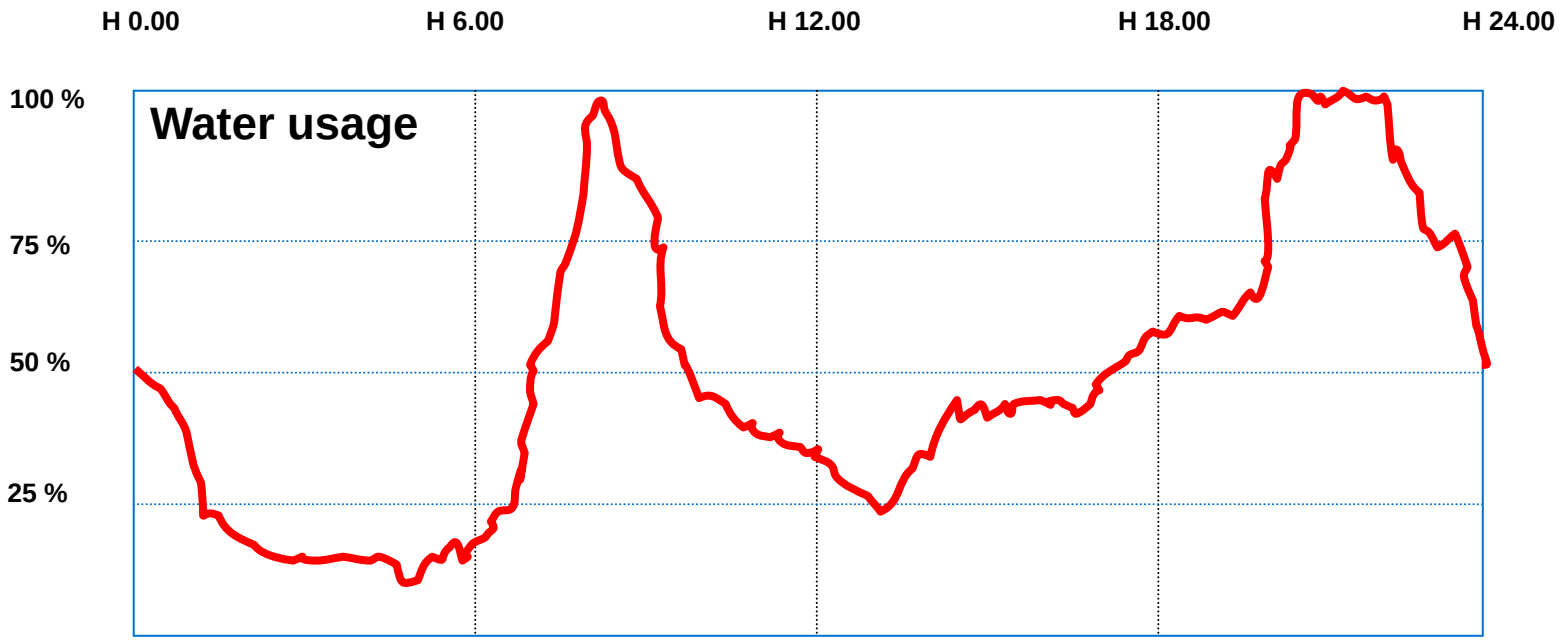
Reduction of energy cost



Water consumption in a building is not uniform during the day.

The pumping system should be able to match the real needs of the users.

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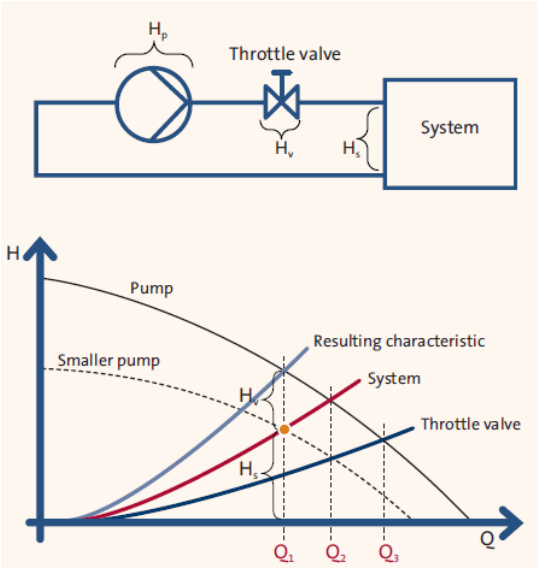
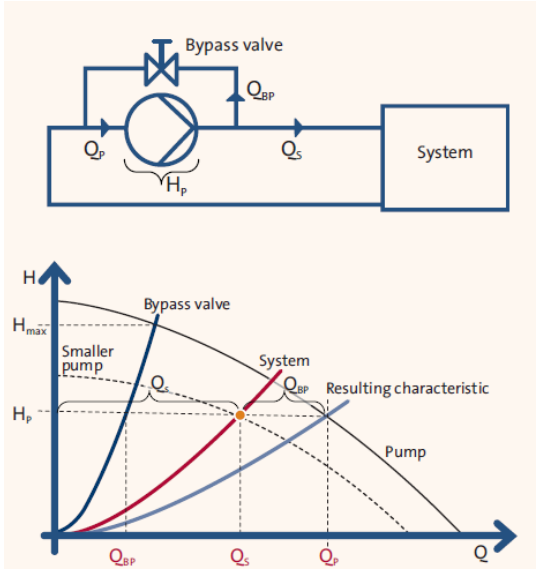
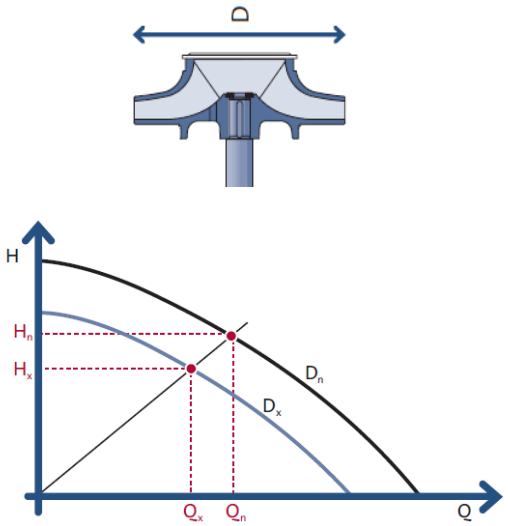
Reduction of energy cost



throttle valve



bypass valve



impeller trimming

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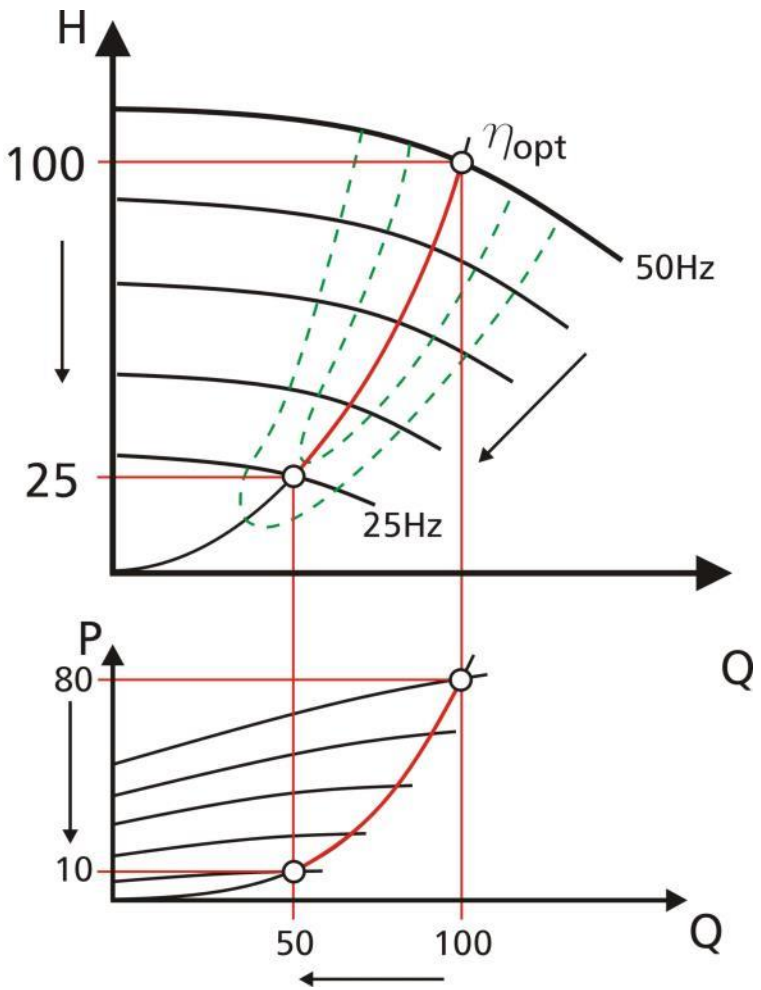
Reduction of energy cost



$$Q \propto n \qquad \left(\frac{Q_1}{Q_2}\right)=\left(\frac{n_1}{n_2}\right)$$

$$h \propto n^2 \qquad \left(\frac{h_1}{h_2}\right)=\left(\frac{n_1}{n_2}\right)^2$$

$$P \propto n^3 \qquad \left(\frac{P_1}{P_2}\right)=\left(\frac{n_1}{n_2}\right)^3$$

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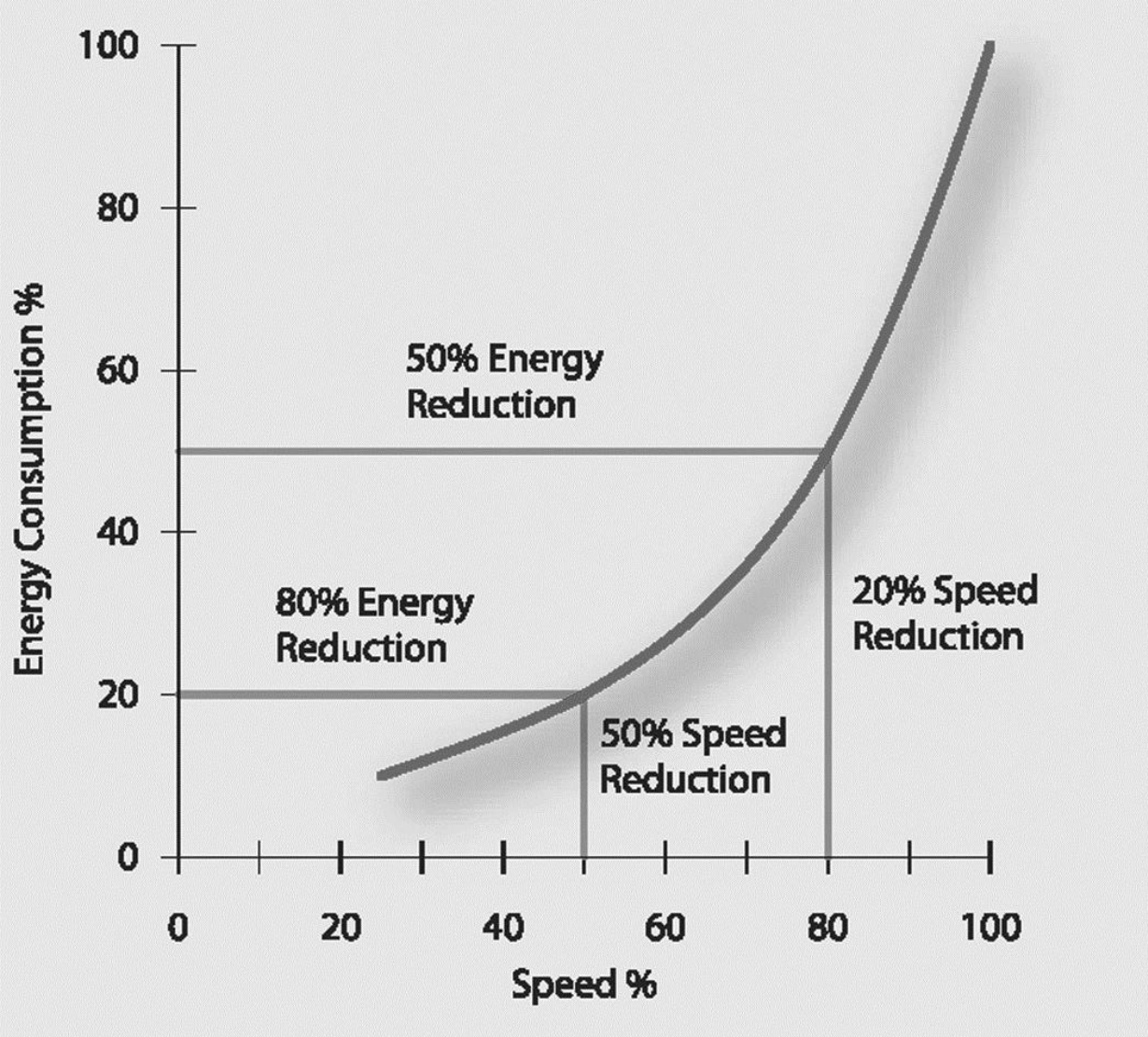
Energy Consumption at Varying Speed



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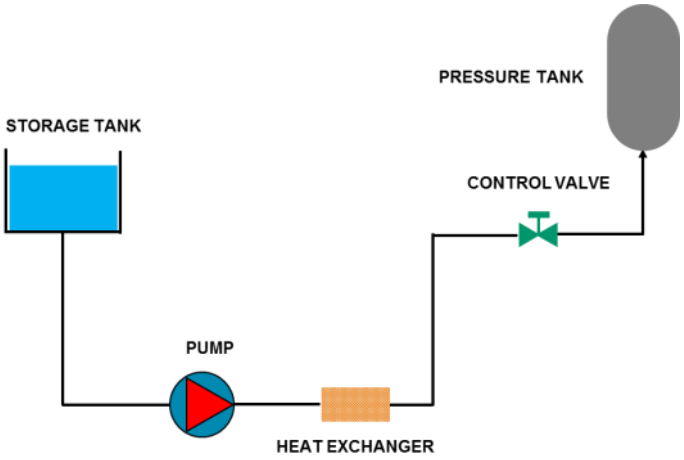
Example 1



Analysis for the piping system direceted at a control valve

Single pump circuit, flow: 80 m^3/h

Problem with the Fluid Control Valve: fails every 12 months due to cavitation. Cost for repair: S$8000

Analysis of the LCC on 4 possible solutions

1. A new control valve can be installed to accommodate the high pressure differential.
2. The pump impeller can be trimmed so that the pump does not develop as much head, resulting in a lower pressure drop across the current valve.
3. A variable frequency drive (VFD) can be installed, and the flow control valve removed. The VFD can vary the pump speed and thus achieve the desired process flow.
4. The system can be left as it is, with a yearly repair of the flow control valve to be expected.

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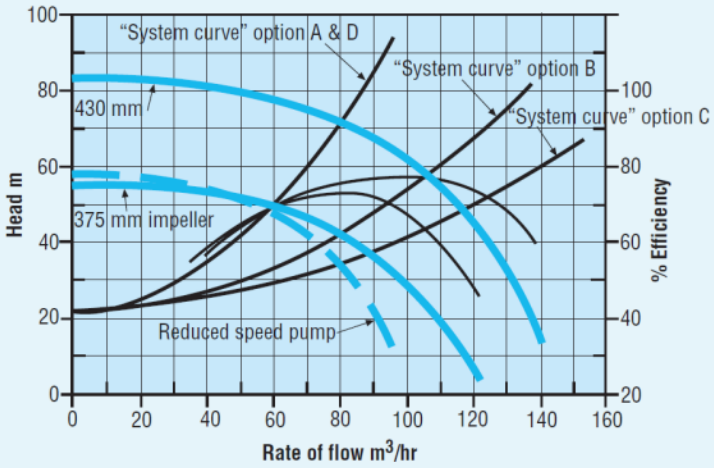
Example 1 cont.



COST	CHANGE CONTROL VALVE	TRIM IMPELLER	VFD	REPAIR CONTROL VALVE
Impeller diameter	430 mm	375 mm	430 mm	430 mm
Pump head	71,7 m	42,0 m	34,5 m	71,7 m
Pump efficiency	75,1%	72,1%	77%	75,1%
Rate of flow	80 m^3/h	80 m^3/h	80 m^3/h	80 m^3/h
Power consumed	23,1 kW	14,0 kW	11,6 kW	23,1 kW
Energy cost/Year	S$28,717.92	S$17,404.80	S$ 14,421.12	S$25,717.92
New valve	$10,000	0	0	0
Modify impeller	0	S$4,500	0	0
VFD	0	0	S$10,000	0
Installation of VFD	0	0	S$3,000	0
Valve repair/Year	0	0	0	S$8,000

Assumption for the LCC:

1. Energy price: S$ 0.2072/kWh
2. The process is operated for 6.000 hours/year
3. Routine maintenance cost $1000; with repair costs S$5000
4. No decomissioning costs or environmental disposal cost
5. 8-year life
6. The interest rate for new capital projects is 8% and inflation rate of 4%

20.72 cents/kWh

ELECTRICITY TARIFF

(wef 1 Jul 17 - 30 Sep 17)

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	CHANGE CONTROL VALVE	TRIM IMPELLER	VFD	REPAIR CONTROL VALVE
Input				
Initial investment cost	S$10,000	S$4500	S$13000	0
Energy price per kWh	0.2072	0.2072	0.2072	0.2072
Weighted average power of eqipment in kW	23,1	14,0	11,6	23,1
Average operating hours/year	6000	6000	6000	6000
Energy cost/year	28,700	17,400	14,400	25,700
Maintenance cost	1000	1000	2000	1000
Repair every 2° year	5000	5000	5000	5000
Other yearly cost	0	0	0	8000
Down time cost/year	0	0	0	0
Environmental cost	0	0	0	0
Decommisioning cost	0	0	0	0
Life time in years	10	10	10	10
Interest rate (%)	8%	8%	8%	8%
Inflation rate (%)	4%	4%	4%	4%
Output				
	€ 317,000	**€ 198,500**	**S$177,000**	**S$357,000**

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Example 1 cont.

	CHANGE CONTROL VALVE	TRIM IMPELLER	VFD	REPAIR CONTROL VALVE
Input				
Initial investment cost	S$10,000	S$4500	S$13000	0
Energy price per kWh	0.2072	0.2072	0.2072	0.2072
Weighted average power of eqipment in kW	23,1	14,0	11,6	23,1
Average operating hours/year	6000	6000	6000	6000
Energy cost/year	28,700	17,400	14,400	25,700
Maintenance cost	1000	1000	2000	1000
Repair every 2° year	5000	5000	5000	5000
Other yearly cost	0	0	0	8000
Down time cost/year	0	0	0	0
Environmental cost	0	0	0	0
Decommisioning cost	0	0	0	0
Life time in years	10	10	10	10
Interest rate (%)	8%	8%	8%	8%
Inflation rate (%)	4%	4%	4%	4%
Output				
	€ 317,000	**€ 198,500**	**S$177,000**	**S$357,000**

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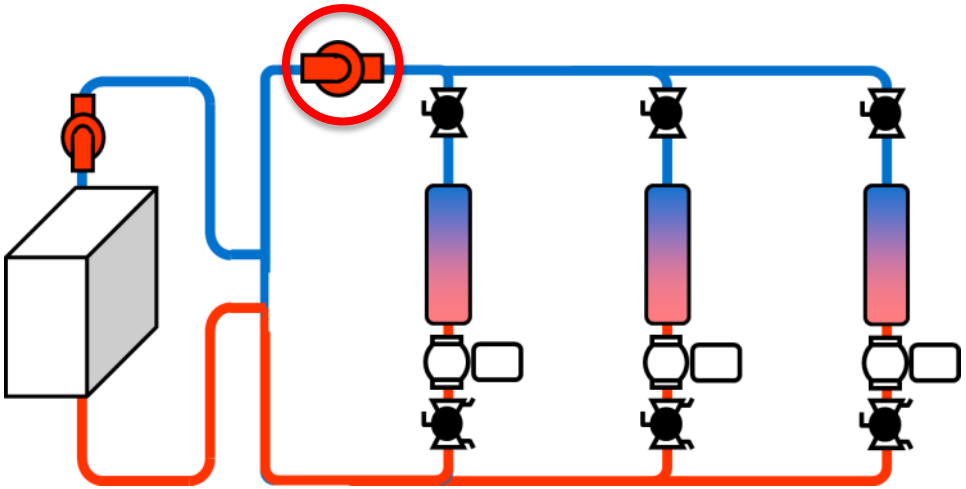
Example 2



EXAMPLE

Circulation pump in secondary circuit, with a nominal power of 11 kW used for heating and cooling

Q in %	Runtime in % of the whole year	POWER CONSUMPTION		Energy saving in kW	Energy saving within one year
		Pump at constant speed	Pump with VFD		
25%	55%	5,8 kW	1,8 kW	4,0	19.272 kWh
50%	25%	7,6 kW	3,2 kW	4,4	9.636 kWh
75%	10%	9,2 kW	5,7 kW	3,5	3.066 kWh
100%	10%	11,0 kW	11,0 kW	0	0
			Energy savings within 1 year (=8.760 hours)		**31.974 kWh**

CONSIDERING A COST OF ENERGY OF 0,15 €/kW → € 4.796,10 SAVED IN ONE YEAR

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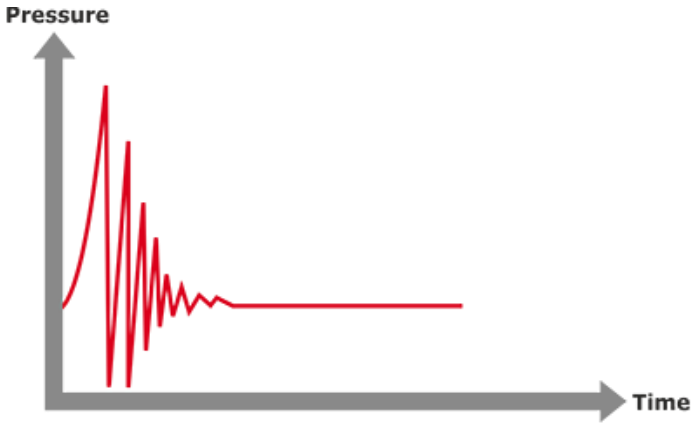
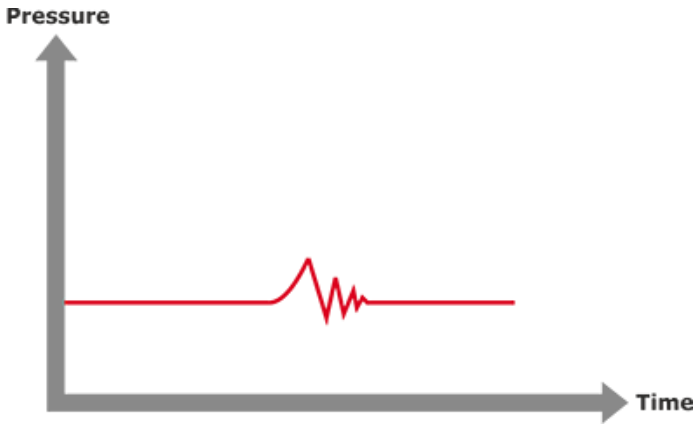
Reduction of maintenance costs

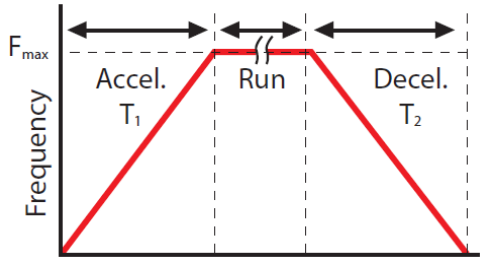
To avoid water hammer which occur during stopping of a full speed pump



Without a VSD: due to sudden stop of the pump a pressure surge is generated inside the pipe



With a VSD



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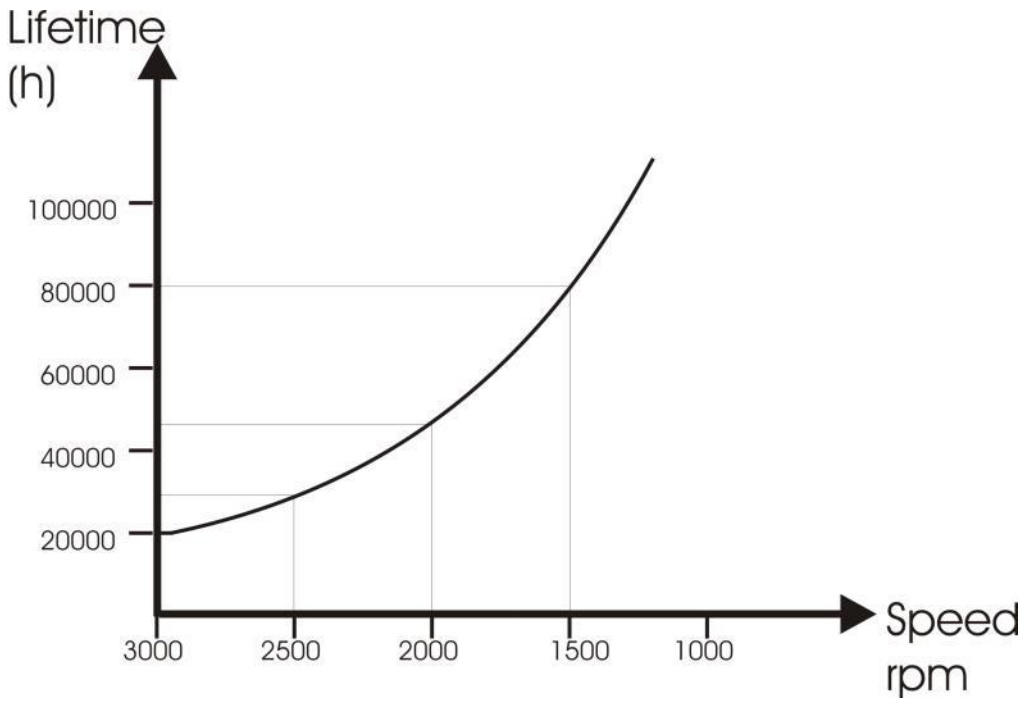
Reduction of maintenance costs:

Increase of motor bearing life



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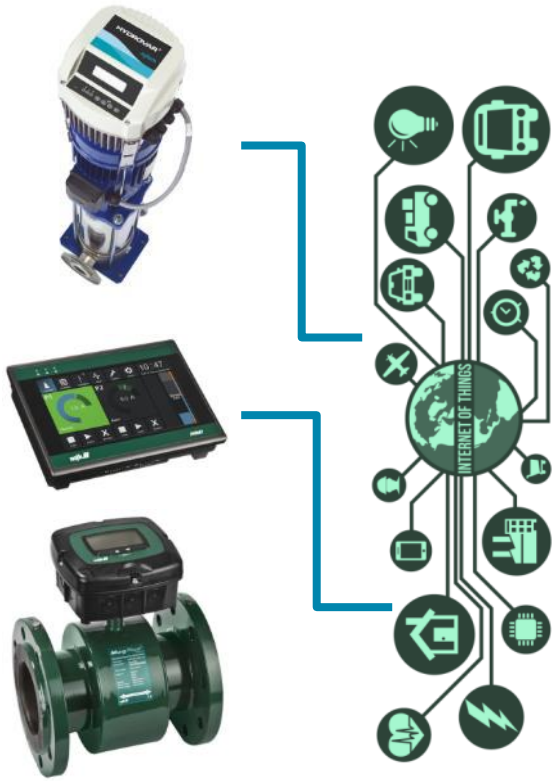
Reduction of maintenance costs:

Monitoring systems through sensors and BMS



- Sensor control
- BMS communication
- Preventive maintenance
- Active protection system

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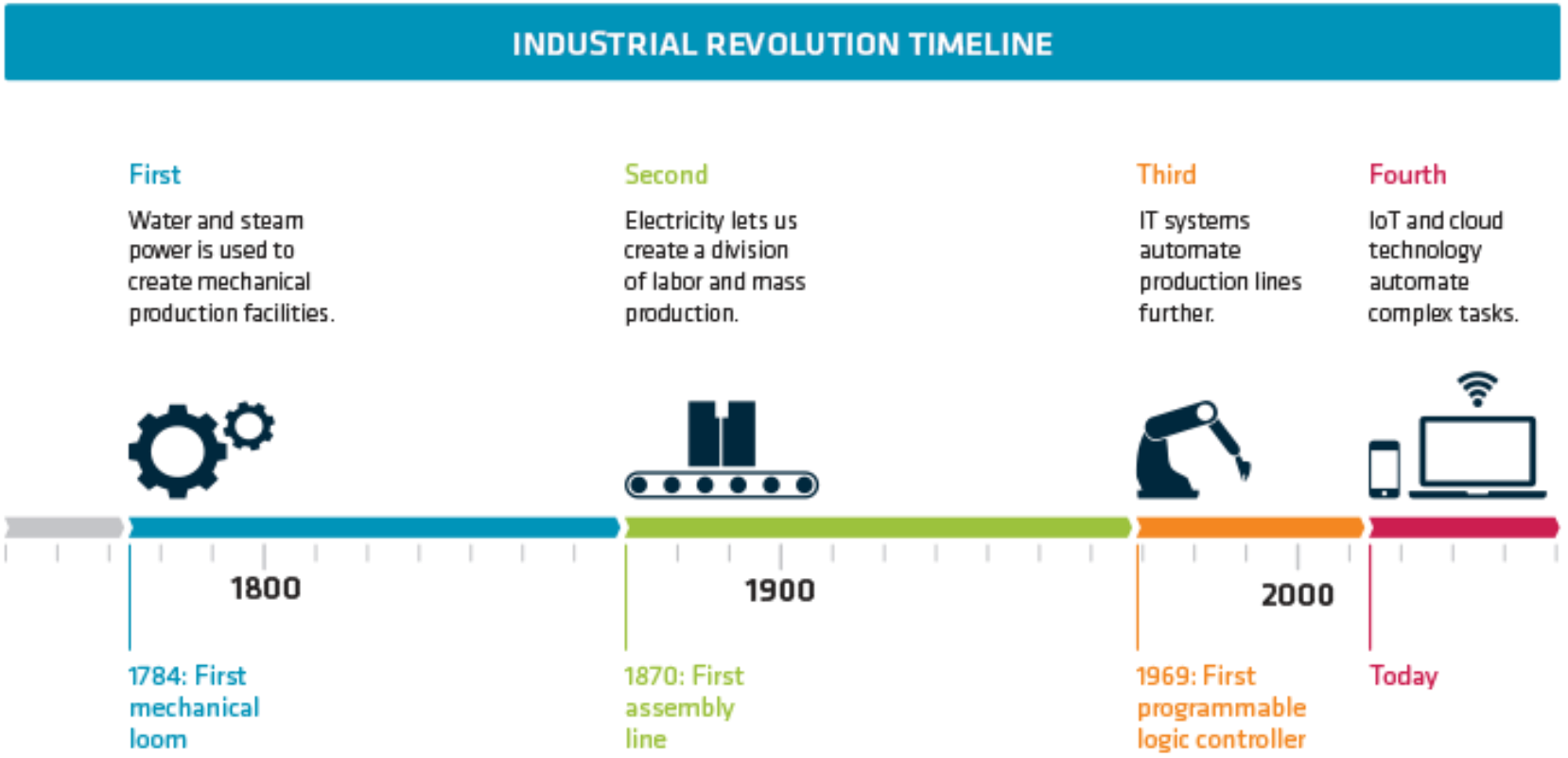
The 4° industrial revolution



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The 4° industrial revolution in pumps













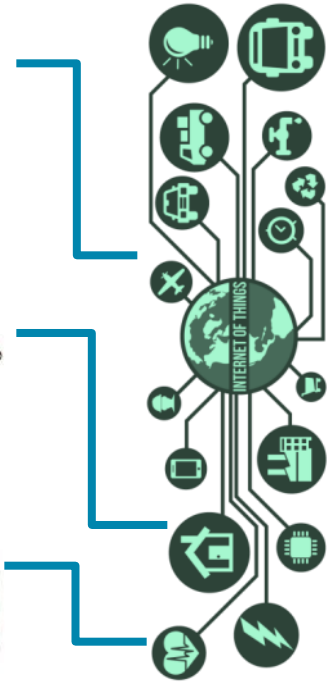

Evolution of pumping systems

Smart City

1° 2° 3° 4°

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HVL - Hydrovar 5th Generation

Key Features

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Hydrovar Gen 5



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VSD – evolution of Hydrovar











1994 2002 2008 2011 2016



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Introducing HYDROVAR

A micro-processor controller with integrated VFD functionality







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Integrated drive: all components – one unit

Centrifugal pump







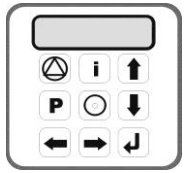


Sensors for actual value



VFD totally enclosed IP55





Control by microprocessor designed for pump applications

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General Hydrovar value proposition

Motor or Wall Mountable

- Simple mounting
- Small footprint of the package with the HV mounted on the motor
- Mountable in any standard AC motor

Pump Specific Application software

- Easy to commission
- Easy to program and operate
- Enables virtually any configuration of pumps
- Pump specific functions / language operation / application software
- Safe stop of the pump



Multipump capability up to 8 pumps

- Great redundancy for failsafe systems.
- No external control panel is needed

Integrated functions to protect pumps and motors

- Specific pump protections
  (e.g. Dry run protection, shout off of the system in case of pipe burst, etc…)
- Specific motor protections
  (e.g. over temperature, overcurrent, under voltage etc…)
- Log Error with date and time stamp

Easy to integrate in BMS Systems

- Modbus as standard
- Complete set of Analog & Digital I/O
- Direct motor control function (Actuator)

Robust and Quality Design

- IP55 as standard
- Quality components
- Aluminum pod

Retrofitting

- Suitable for any AC Motor in the Market
- Easy and cost effective installation with the motor mounted version
- Longer lifetime of the pumps

Energy saving up to 70%

- Variable speed pump vs fix speed pump

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5th Generation HYDROVAR - HVL value prop.

Easy and Safe Accessibility for Wiring Harness.

- Separated wiring chamber with a dedicated cover.
- Electronic components protected

Easier to Commission and to Operate

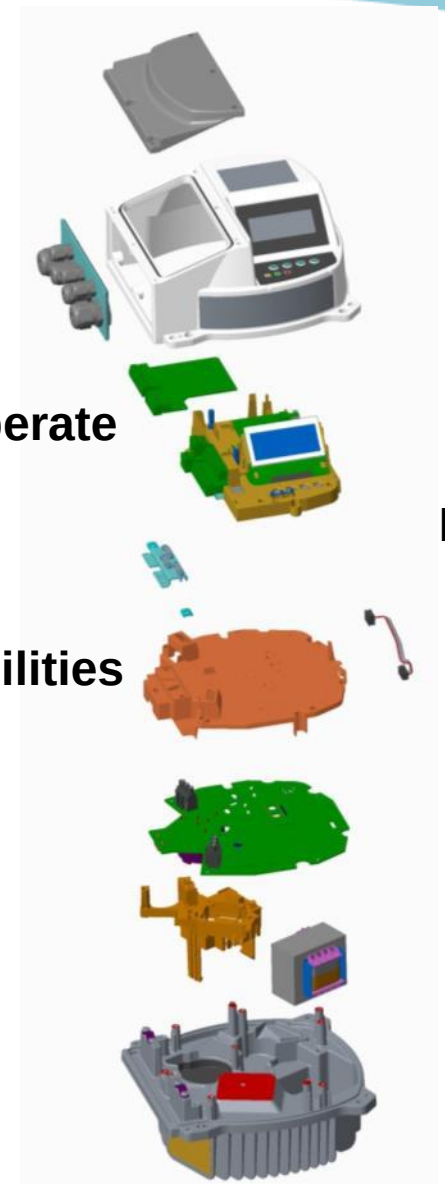
- Start-up Menu
- Wider LCD with additional parameters shown in the same page
- Extended set of Language
- Pre-programmed parameter for Standard Motors

Extended Communication Capabilities

- BACnet as standard
- Wi-Fi card as option

Advanced Motor Control :

- Reduced heating of the motor
- Extended lifetime of the motor
- Thermal protection of the motor via software (no more PTC)
- Minimizing the drive losses



Two Tiers Offering

- Multipump capability as standard
- Premium Card Hydrovar as option for extended I/O
- Easy product selection
- Optimized supply chain

Range Extension

- Introduction of 1,5 kW 3ph 380-460V.
- Introduction of 1,5kW 2,2kW 3ph 208-240V

THDi Filter embedded

- Better quality of the Grid
- Reduced heating of the cables
- Extended lifetime of equipment
- No line reactor filters

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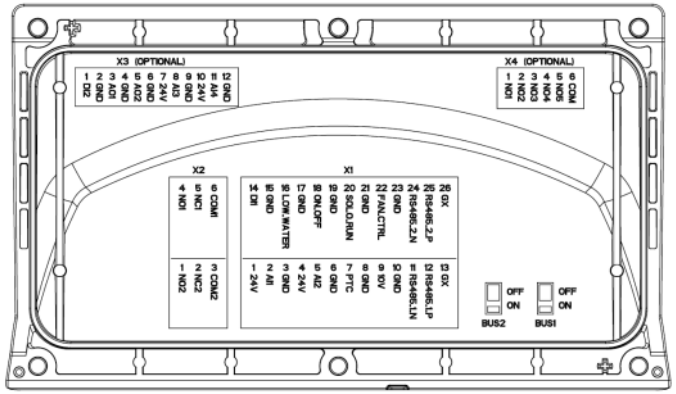
HVL - Easy and Safe Accessibility for Wiring Harness.

1. Separated wiring chamber with a dedicated cover.
2. Terminal descriptions on the top cover







3. through holes for motor clamps



Not necessary to remove the whole top aluminum cover for wirings and assembling to the motors





Safer and Easier Assembling

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HYDROVAR retrofit

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Tim Brown
8 June

Introducing the 5th Generation HVL Hydrovar to the Australian market.
This is the first system installed and commissioned including 6 pumps in total - 5 x 22kW and 1 x 11kW Jockey pump providing 120l/s @ 70mt at the Gold Coast Water Coombabah WWTP. The system will be pumping treated effluent to be used by golf courses and truck filling.

Application: Pressure Booster - Golf Course / Water Reuse



Application: HVAC
Replace / Retrofit existing solutions











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Realised Retrofit-projects: Vogel 2-pump booster

Original:







Afterwards:



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Realised Retrofit-projects: Water supply

Before



Afterwards



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Realised Retrofit-projects: Hot water circulation

Original:



Afterwards:



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Realised Retrofit-projects: Hot water circulation

Final project:



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Realised Retrofit-projects: Boosters

Do you know the original?



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HYDROVAR Applications

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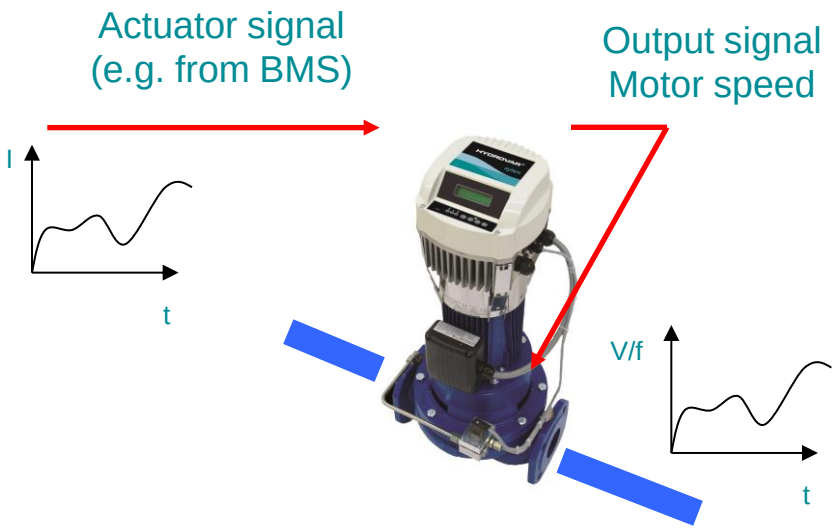
HYDROVAR controller

Open loop
(setpoint of speed signal [Hz])

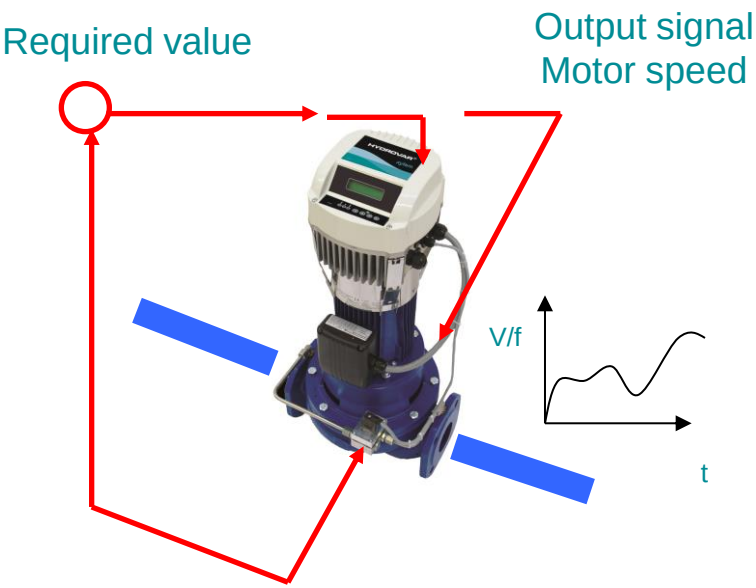
HYDROVAR in ACTUATOR mode



Without any reference signal
from the system

Closed loop
(e.g. setpoint of a system pressure [bar])

HYDROVAR in CONTROLLER mode



Reference signal from
actual value sensor

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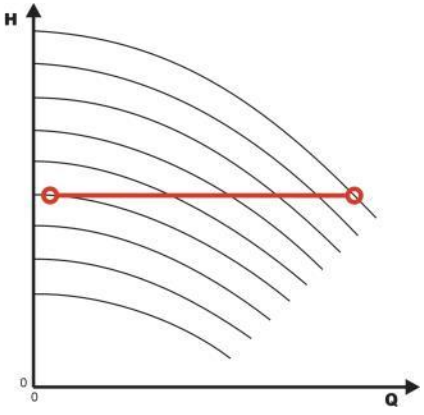
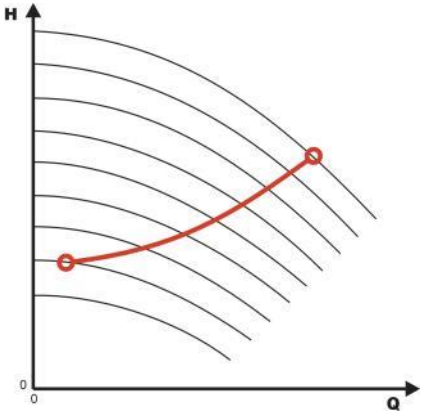
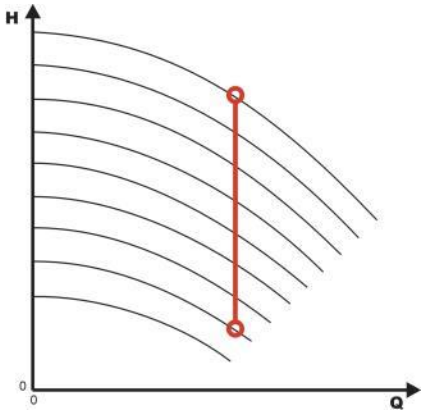
System applications



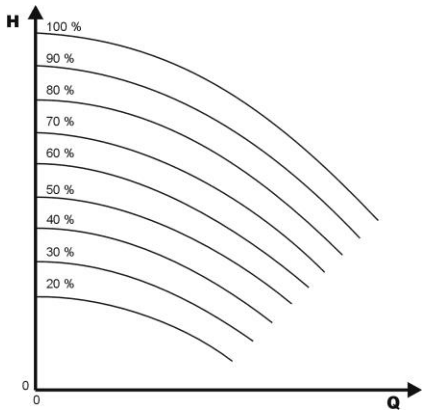
control on constant pressure



control acc. to system curve



control on constant flow at variable pressure



speed adjustment 0 - 100% without control function (actuator)

+ others, like constant level, constant temperature,…

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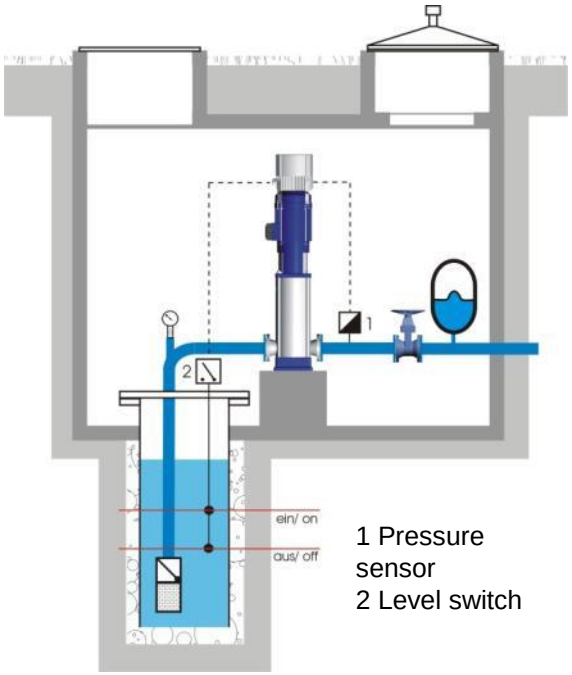
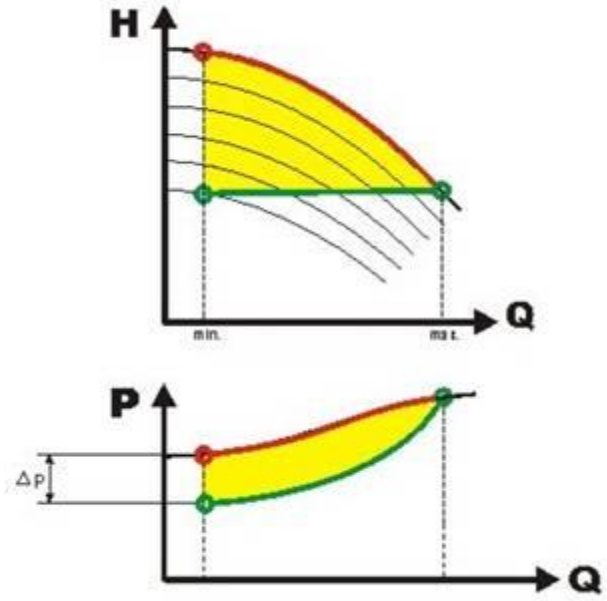
Constant pressure systems



1 Pressure sensor
2 Level switch





Application:
Drinking water and irrigation installations, where constant system pressure is required at highly fluctuating consumption.

Advantages:
Constant system pressure at variable flow rates with energy savings compared with full speed applications.

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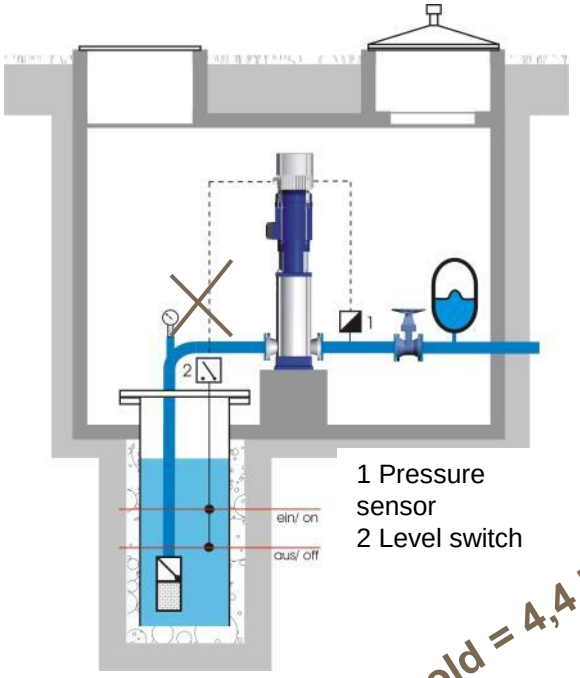
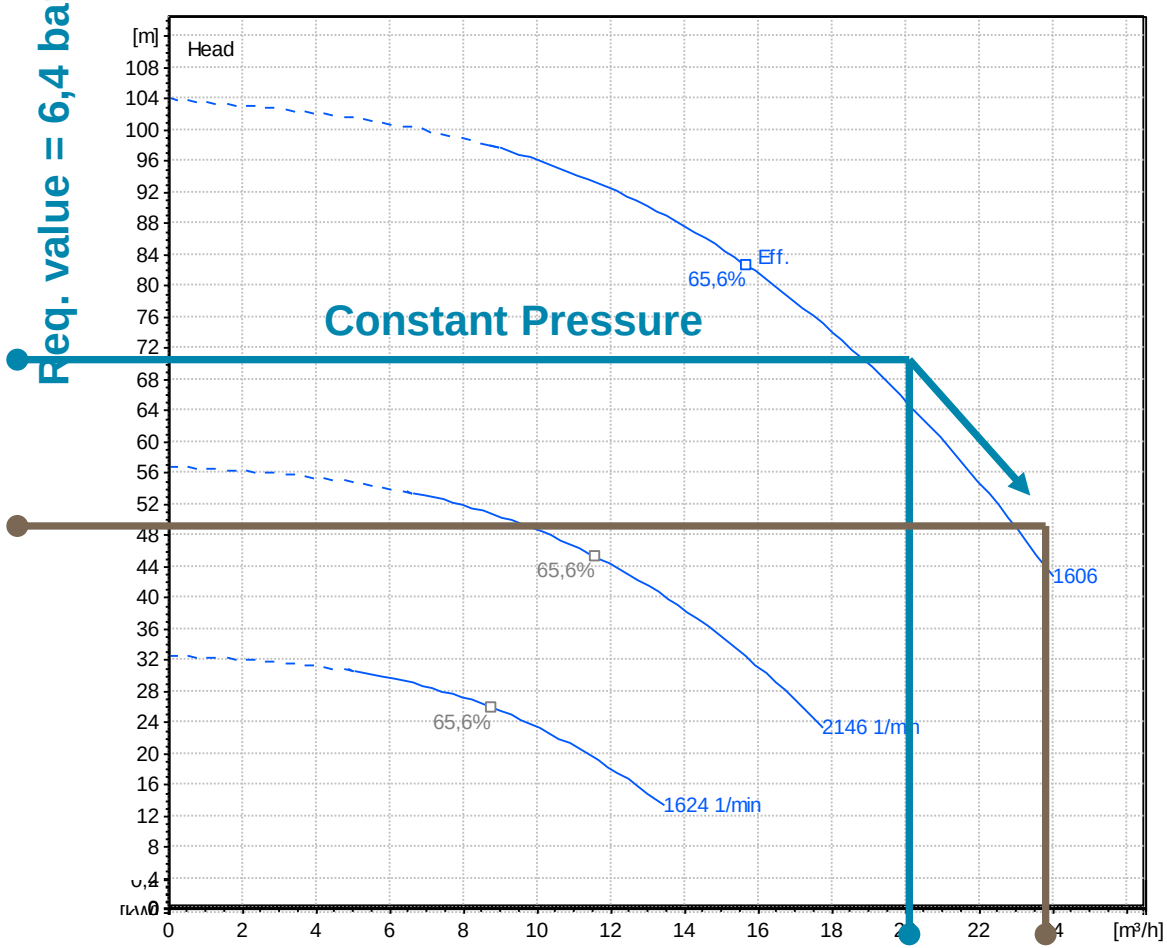
Integrated dry-run protection



1 Pressure sensor
2 Level switch

minThreshold = 4,4 bar

Req. value = 6,4 bar



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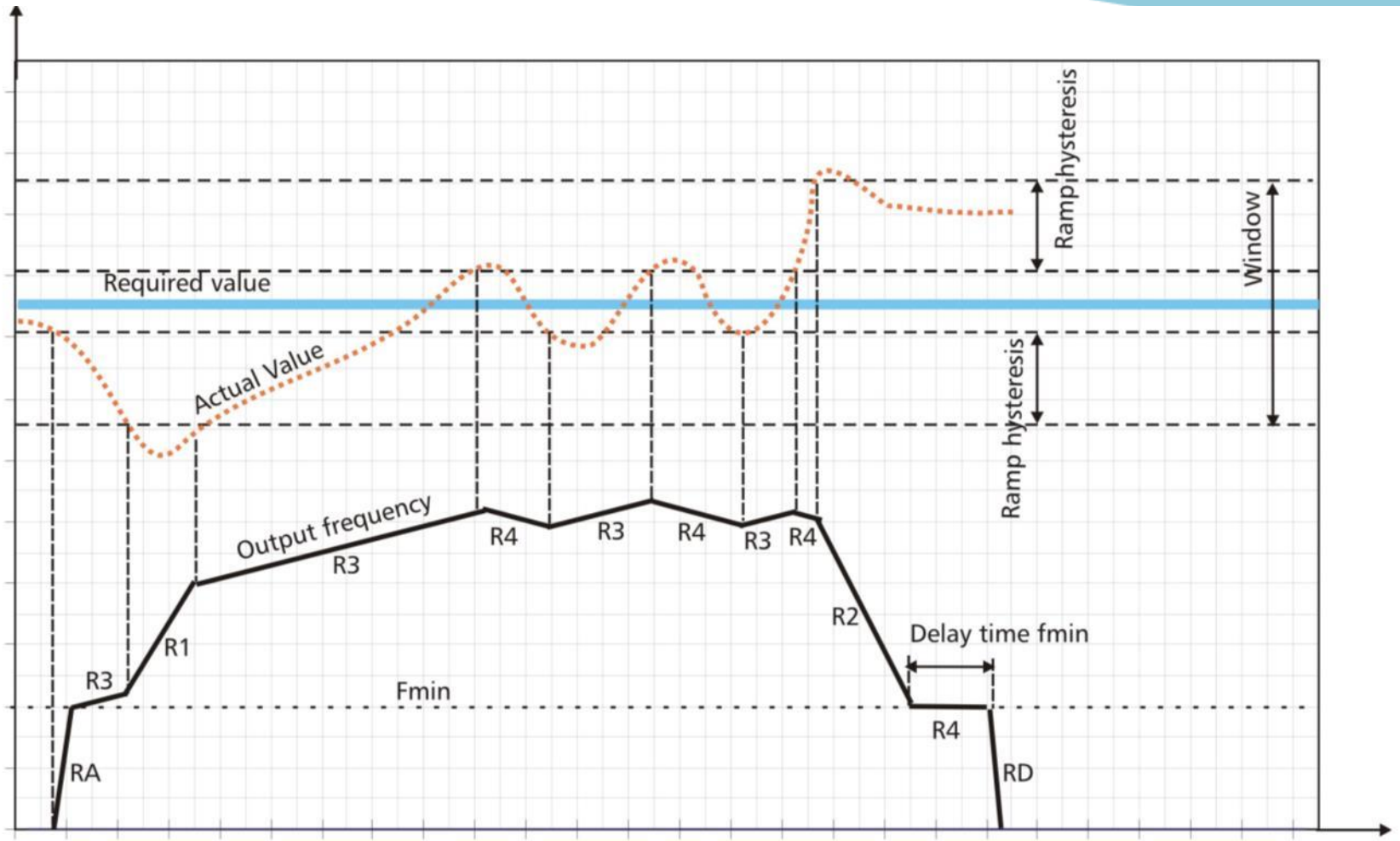
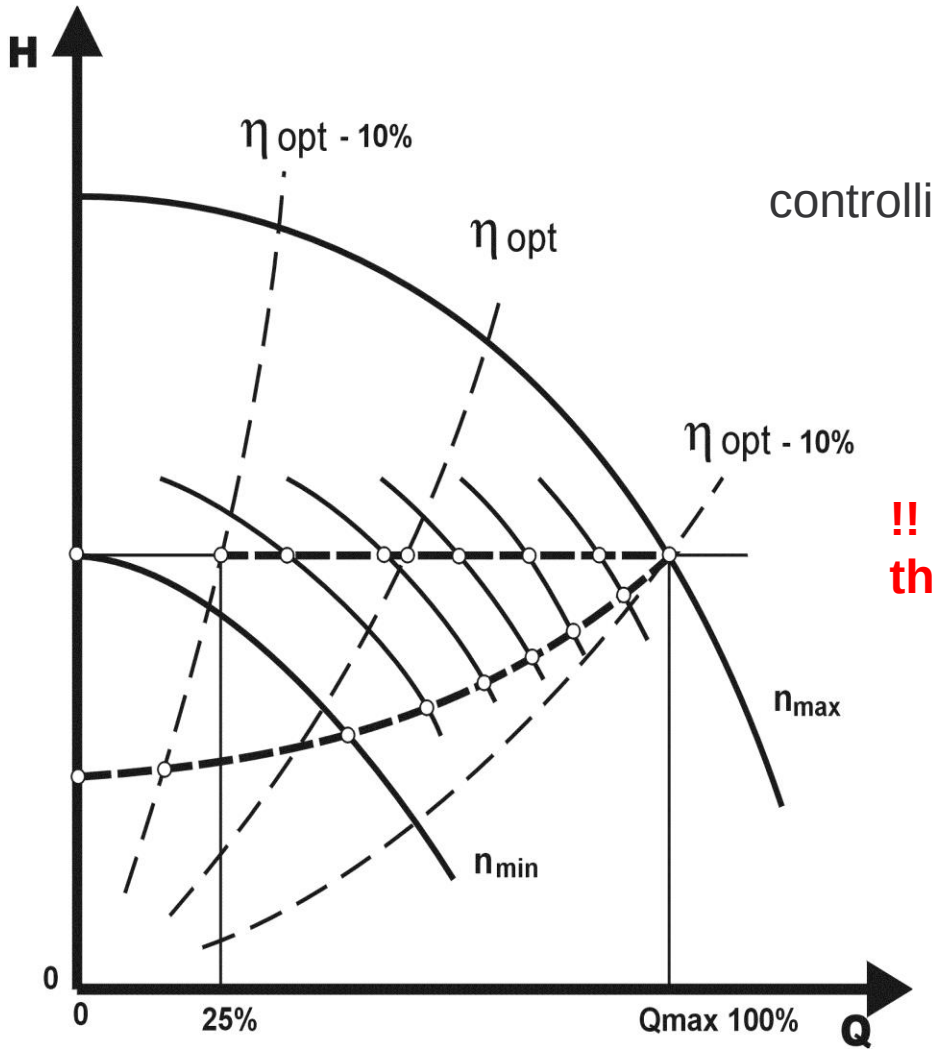
Software Parameter – Settings
Example – constant pressure application



Selection of speed controlled pumps



controlling on constant pressure or along a system curve

!! Max. duty point shall be right of the best efficiency of the pump !!

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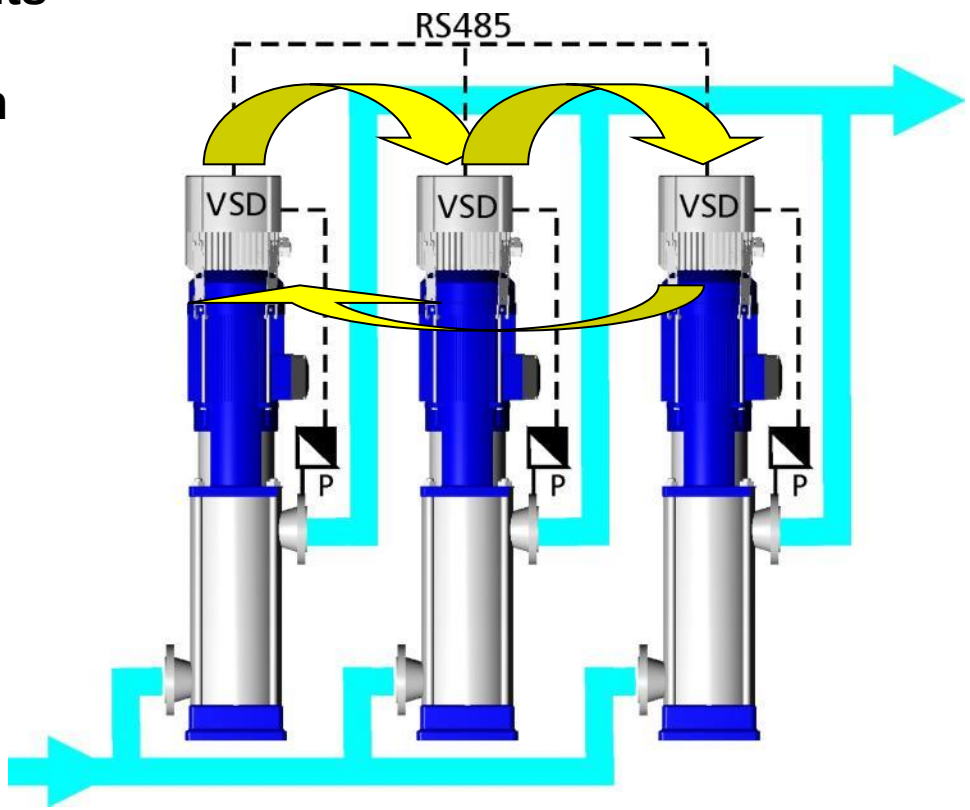
Multipump system without any external controller

Simple design of multiple pump units (max. 8 pumps) by incorporated processor and interface connection (RS 485) which allows:

- full redundancy within the system
- cyclic change of lead and lag pumps
- automatic start and stop of lag pumps following the actual demand
- synchronous mode option to run the pumps with better efficiency
- automatic switch over because of pumps being out of order
- integration into BMS systems possible



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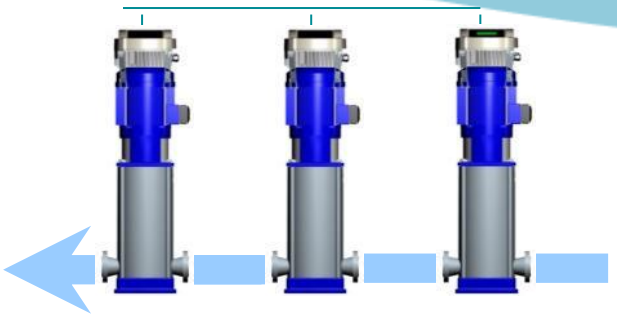
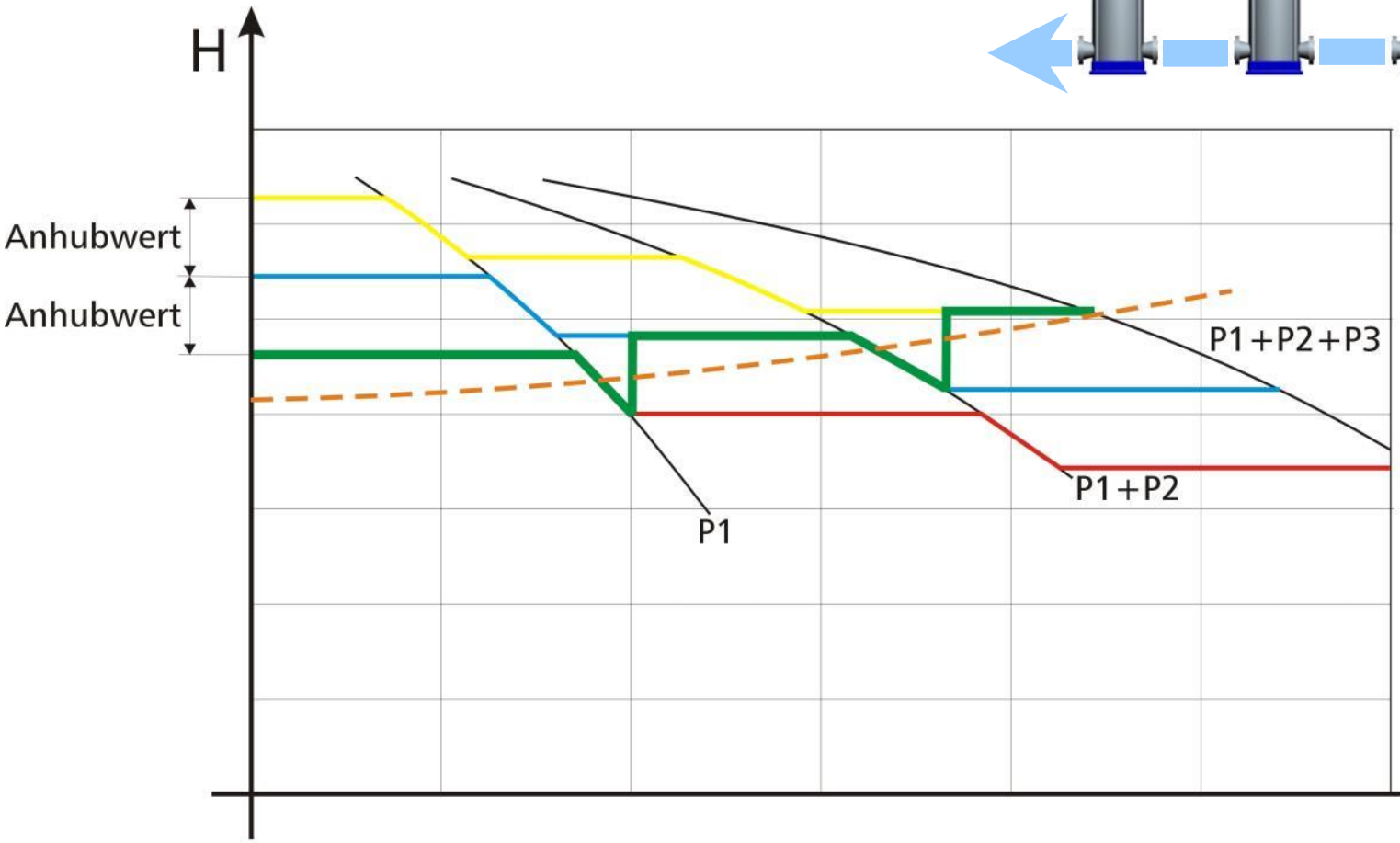
Water supply / Booster units
Operating curve





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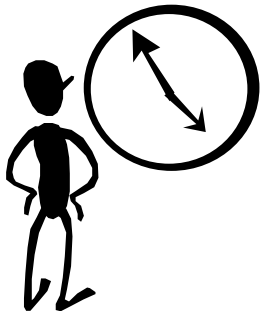
Automatic Test run for each pump separately

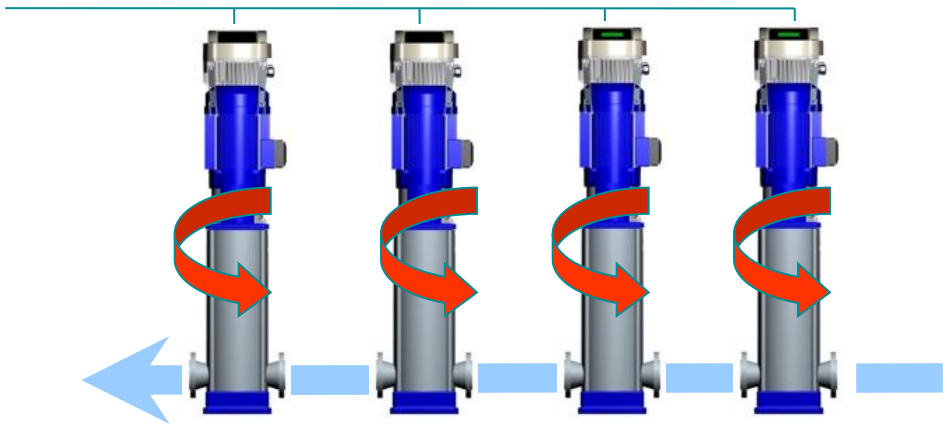
To avoid a blocking of the pumps due to a too long stand still period, an automatic test run can be programmed.

The delay time for the test run can be set for each pump separately and starts automatically after the last stop of the appropriate pump.

Then the pump will start up to 30Hz for 20 seconds and then stops, by using the ramps 1 and 2.

Settings between 10 and 100 hours are possible and calculated from the OPERATING HOURS (supply OK to the HYDROVAR)!





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Applications: water supply systems



WVA Loicht



WVA Klosterneuburg



Hotel Hilton Vienna

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Applications: irrigation systems





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Water supply system – HYDROVAR booster set



Booster set / water supply Hunter‘s Lodge UK

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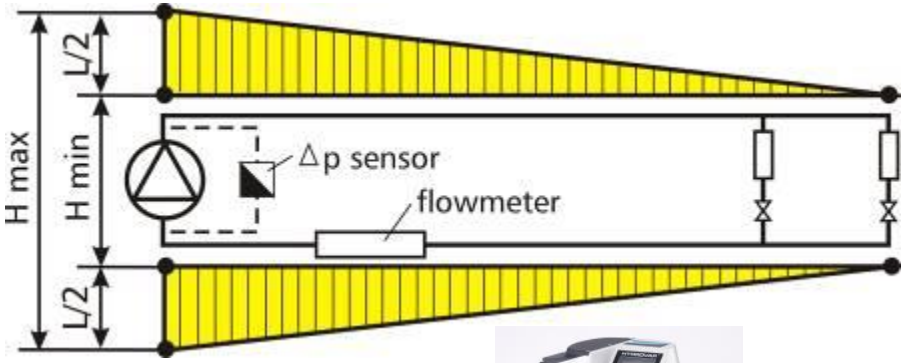
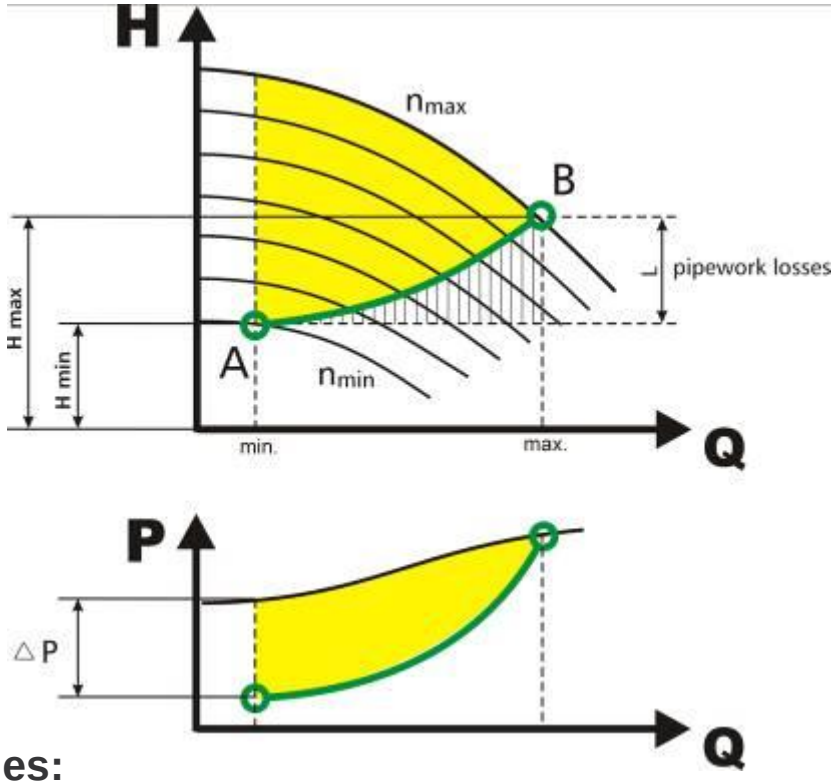
Applications:
HVAC system – control along system curve







Application:
Circulation systems in the HVAC market

Advantages:
Energy saving compared with throttle controls or bypass regulator in part load operation up to 70%.

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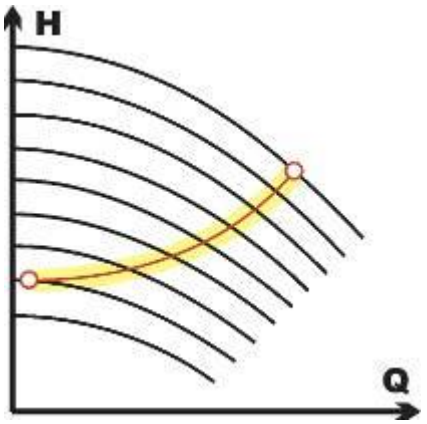
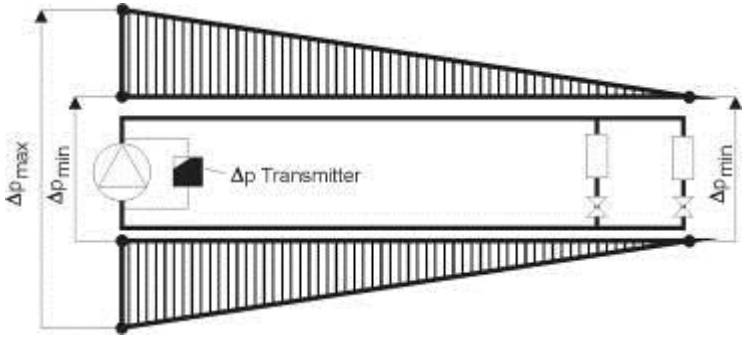
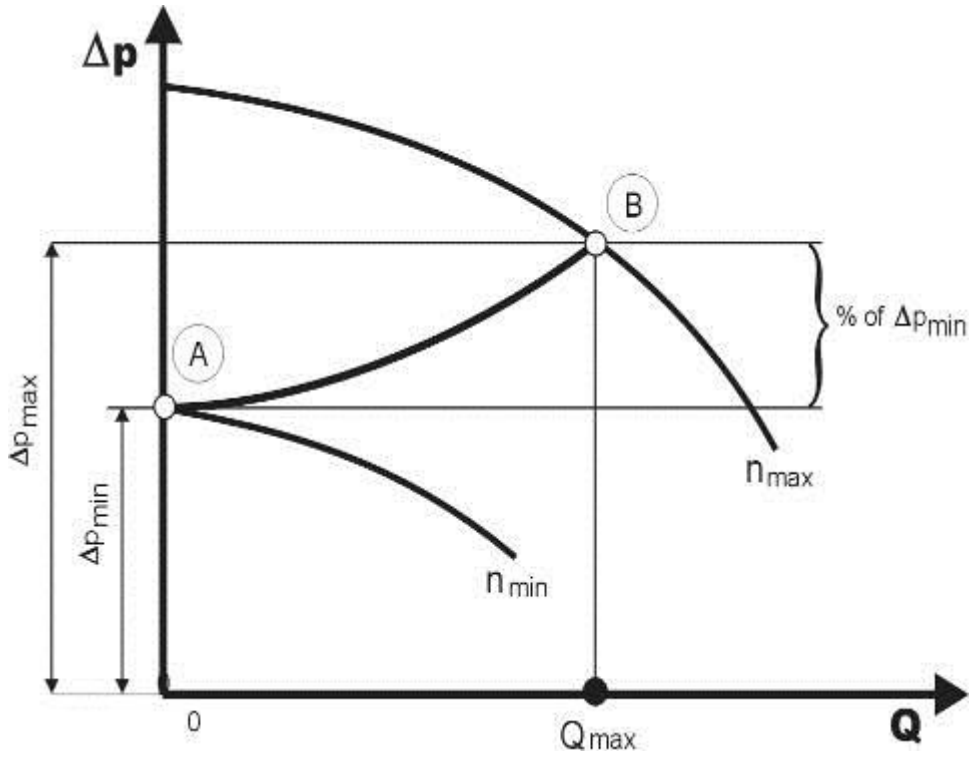
Applications:
HVAC system – control along system curve







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Applications: HVAC system – heating/cooling





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Applications: HVAC system – heating (central district heating Vienna)



More than 400 circulating pumps with HYROVAR® control units from Vogel Pumpen are responsible for an efficient heat distribution of the district heating network of Vienna.



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Applications: HVAC system – heating (Gasometer buildings Vienna - air condition)



The air conditioning system for the Gasometer complex is designed for 6.000.000 kWh per year. There are a total of 8 x 18.5 kW Hydrovar-equipped and non-Hydrovar Vogel pumps used in the air conditioning.



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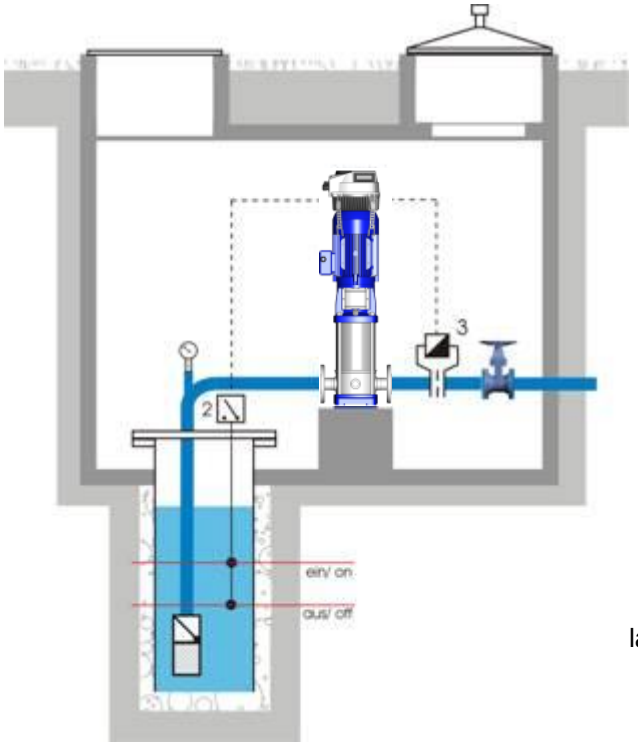
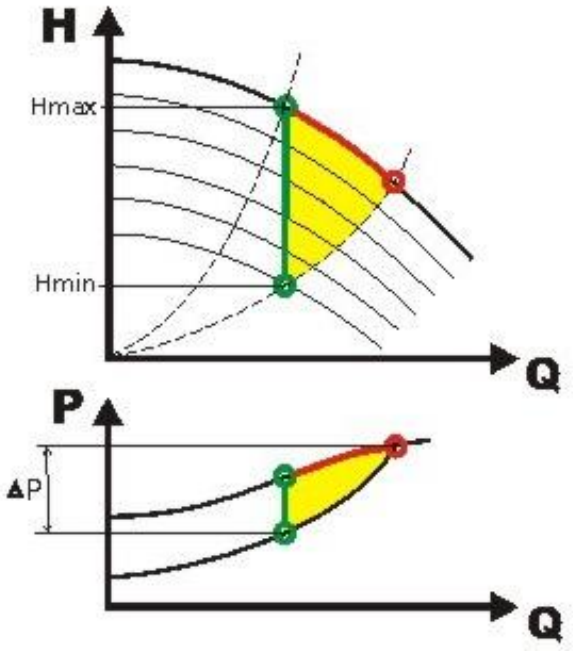
Constant flow systems



late or IDM)



Application:

All filter system versions for constant filter loads, regardless to different pressure and contamination levels..

Advantages:

Prevention of excess flow rates and cavitation and energy savings compared with throttle controls up to 50%.

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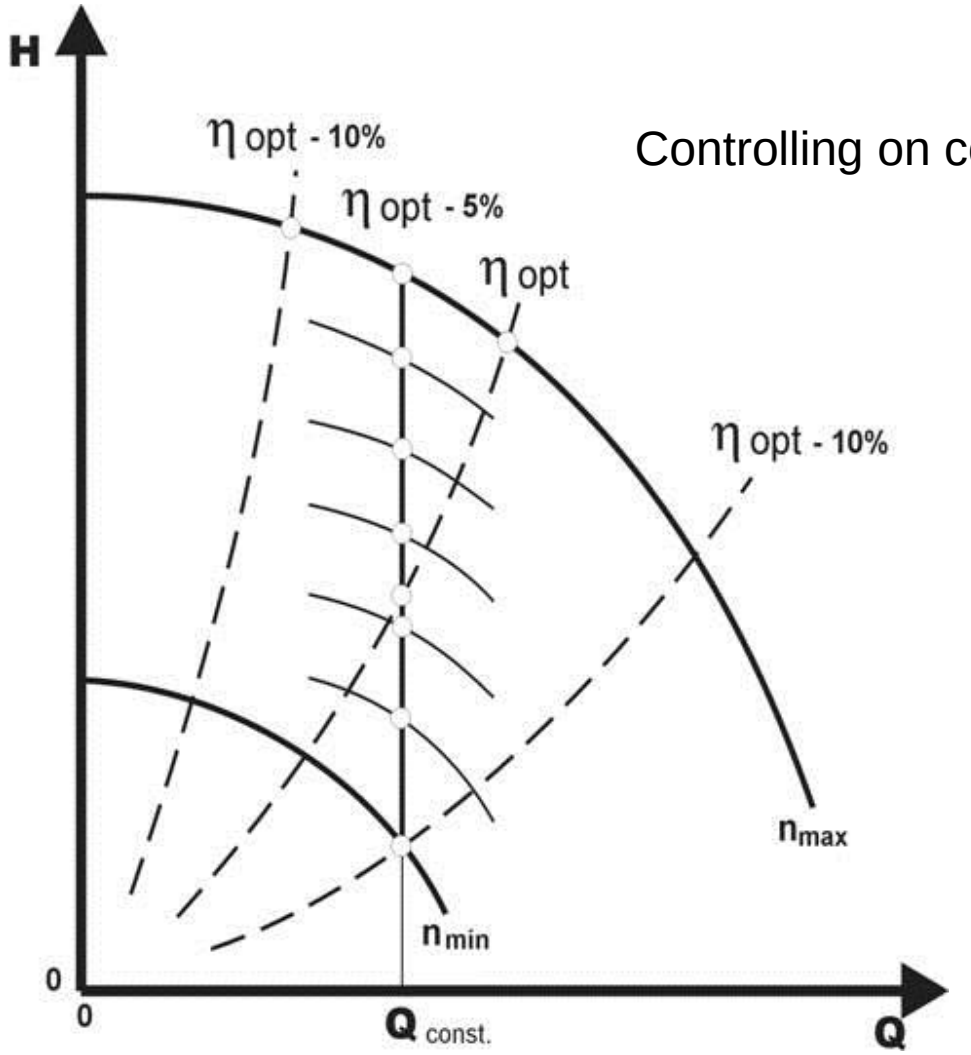
Selection of speed controlled pumps



Controlling on constant flow

!! Max. duty point shall be left of the best efficiency of the pump !!

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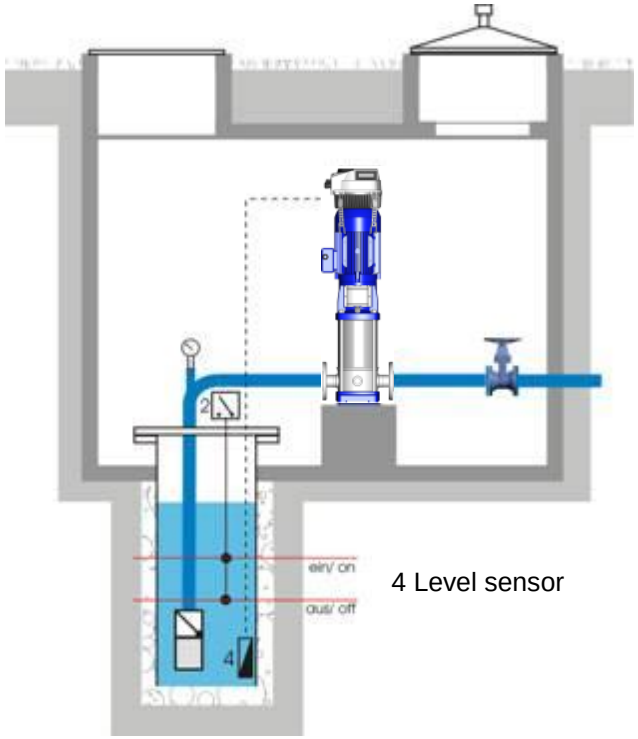
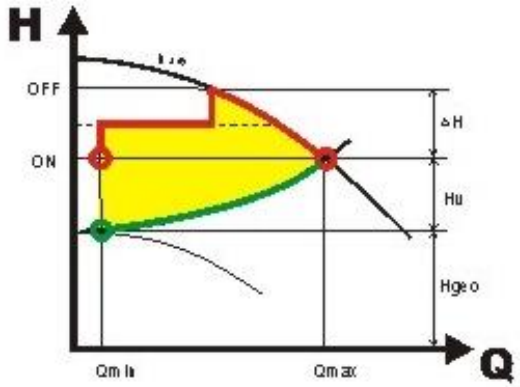
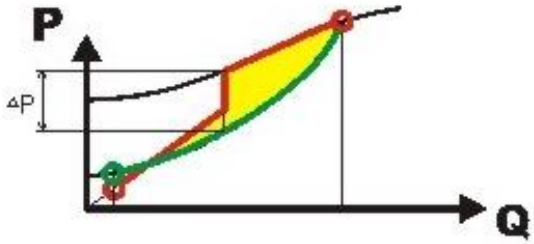
Constant level control



4 Level sensor





Application:

Adapting of the flow to an actual productiveness of the well.

Advantages:

Continuous operation with energy saving up to 50%.

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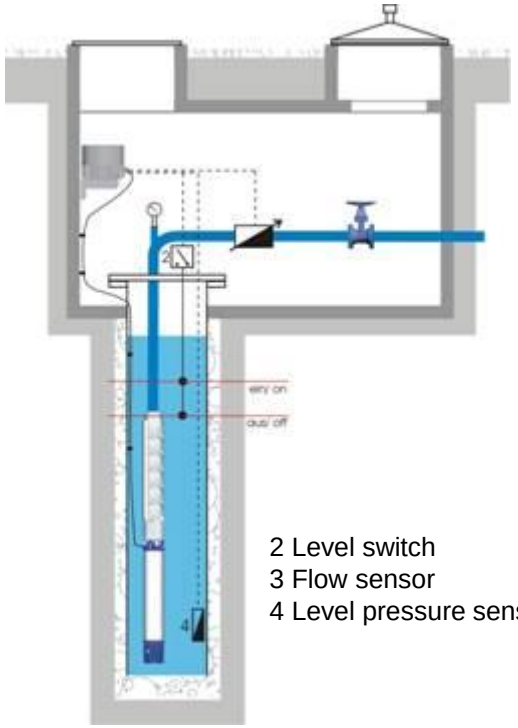
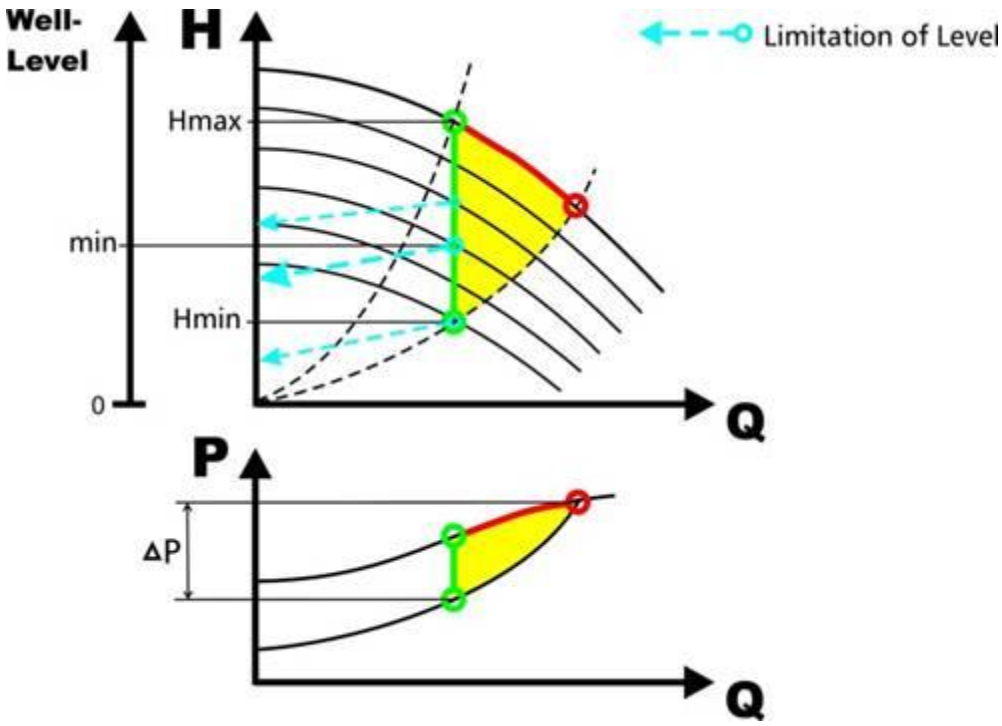
Special applications:
Constant flow system with minimum level control



2 Level switch
3 Flow sensor
4 Level pressure sensor



Application:

Systems with highly fluctuating pump delivery rates (e.g. filter systems and tank charging), where a minimum level in the extraction tank should not be undercut.

Advantages:

Continuous pump operation, at varying productiveness of the well.

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HYDROVAR Installations



Key project references – Domestic Systems

- **Vivo City Shopping Mall**
  - 6 sets of Hydrovar VSD Systems
    (18 pumps with individual VSD controllers for direct booster systems)
  - Pump audit on replacement system
  - Energy savings up to 30%
  - Payback in less than 2 years
- **Seng Kang Hospital**
  - 26 sets of Hydrovar VSD Systems
    (59 pumps with individual VSD controllers for booster and transfer systems)
- **Singapore General Hospital**
- **Hillion Mixed Development**
- **Connexion Hospital**
- **Venture (Office)**
- **Thomson Grand Condo**
- **EuHabitat Condo**
- **Echelon Condo**



Replacement of pumps with Hydrovar at Vivo City, 2015

Applications: water supply systems



WVA Loicht



WVA Klosterneuburg



Hotel Hilton Vienna

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Water supply system – HYDROVAR booster set



Booster set / water supply Hunter‘s Lodge UK

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Applications: irrigation systems





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Applications: HVAC system – heating/cooling





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Applications: HVAC system – heating
(central district heating Vienna)



More than 400 circulating pumps with HYROVAR® control units from Xylem Pumps are responsible for an efficient heat distribution of the district heating network of Vienna.



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Applications: HVAC system – heating
(Gasometer buildings Vienna - air condition)



The air conditioning system for the Gasometer complex is designed for 6.000.000 kWh per year. There are a total of 8 x 18.5 kW Hydrovar-equipped and non-Hydrovar pumps used in the air conditioning.



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Applications: HVAC system – Cooling Tower



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ErP directives

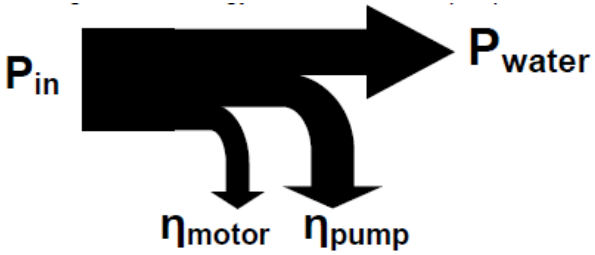
ROTATING ELECTRICAL MACHINES AND POWER DRIVE SYSTEMS LEGISLATION



What is the Ecodesign Directive?



The Ecodesign Directive is a framework of requirements established by the European Parliament, that aims to reduce the energy consumption and negative environmental impacts of energy-related products.



This regulation mainly addresses manufacturers of water pumps placing these products on the European market.

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Ecodesign directives

According with the ErP directive, the directives related to the pump business are 3:

1. **640/2009 & 4/2014**: Ecodesign requirements for electric motors
   - IE, efficiency level (*)

2. **641/2009 & 622/2012**: Ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products
   - EEI, Energy Efficiency Endex (*)

3. **547/2012**: Ecodesign requirements for water pumps
   - MEI, Minimum Efficiency Index (*)

(*)For more detailed information please look Annex 1

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640/2009 & 4/2014

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640/2009 & 4/2014

This Regulation establishes ecodesign requirements for the placing on the market and the putting into service of motors, including those integrated in other products.

‘Motor’ means an electric single speed, three-phase 50 Hz or 50/60 Hz, squirrel cage induction motor that:

- has 2 to 6 poles,
- has a rated voltage of U N up to 1 000 V,
- has a rated output P N between 0,75 kW and 375 kW,
- is rated on the basis of continuous duty operation.

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640/2009 & 4/2014

This Regulation shall not apply to:

a) motors specified to operate wholly immersed in a liquid;

b) motors completely integrated into a product (for example gear, pump, fan or compressor) of which the energy performance cannot be tested independently from the product;

c) motors specified to operate exclusively:
   i. at altitudes exceeding 4 000 metres above sea-level;
   ii. where ambient air temperatures exceed 60 °C;
   iii. in maximum operating temperature above 400 °C;
   iv. where ambient air temperatures are less than – 30 °C for any motor or less than 0 °C for a motor with water cooling;
   v. where the water coolant temperature at the inlet to a product is less than 0 °C or exceeding 32 °C; or
   vi. in potentially explosive atmospheres as defined in Directive 94/9/EC of the European Parliament and of the Council (*);

d) brake motors

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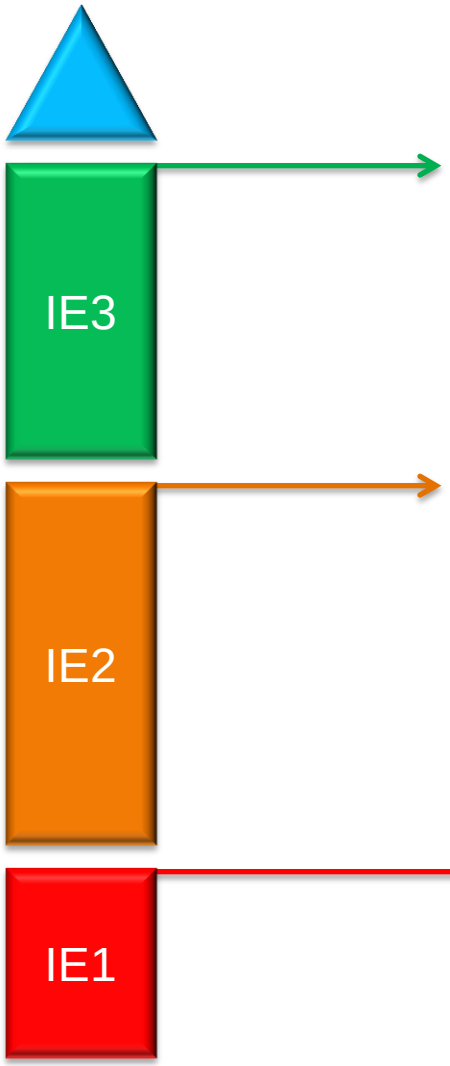
640/2009 & 4/2014



from 1 January 2017: all motors with a rated output of 0,75-375 kW shall not be less efficient than the IE3 efficiency level, or meet the IE2 efficiency level and be equipped with a variable speed drive.

from 1 January 2015, motors with a rated output of 7,5-375 kW shall not be less efficient than the IE3 efficiency level, or meet the IE2 efficiency level and be equipped with a variable speed drive.

from 16 June 2011, motors shall not be less efficient than the IE2 efficiency level, as defined in Annex I, point 1;

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641/2009 & 622/2012

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ErP Directive EC 641/2009

Now it's a law, defining a time line and new rules for calculating the efficiency

1. The new efficiency: EEI, Energy Efficiency Index

The EEI (Energy Efficiency Index) is the index used to classify Circulators with respect to Energy Consumption

It is defined as:

$$EEI = \frac{P_{L,avg}}{P_{ref}}$$

where:

$P_{L,avg}$ is a *real*, weighted average power consumption

P_{ref} is a *reference* power consumption, taking into account the dependency between circulator efficiency and size

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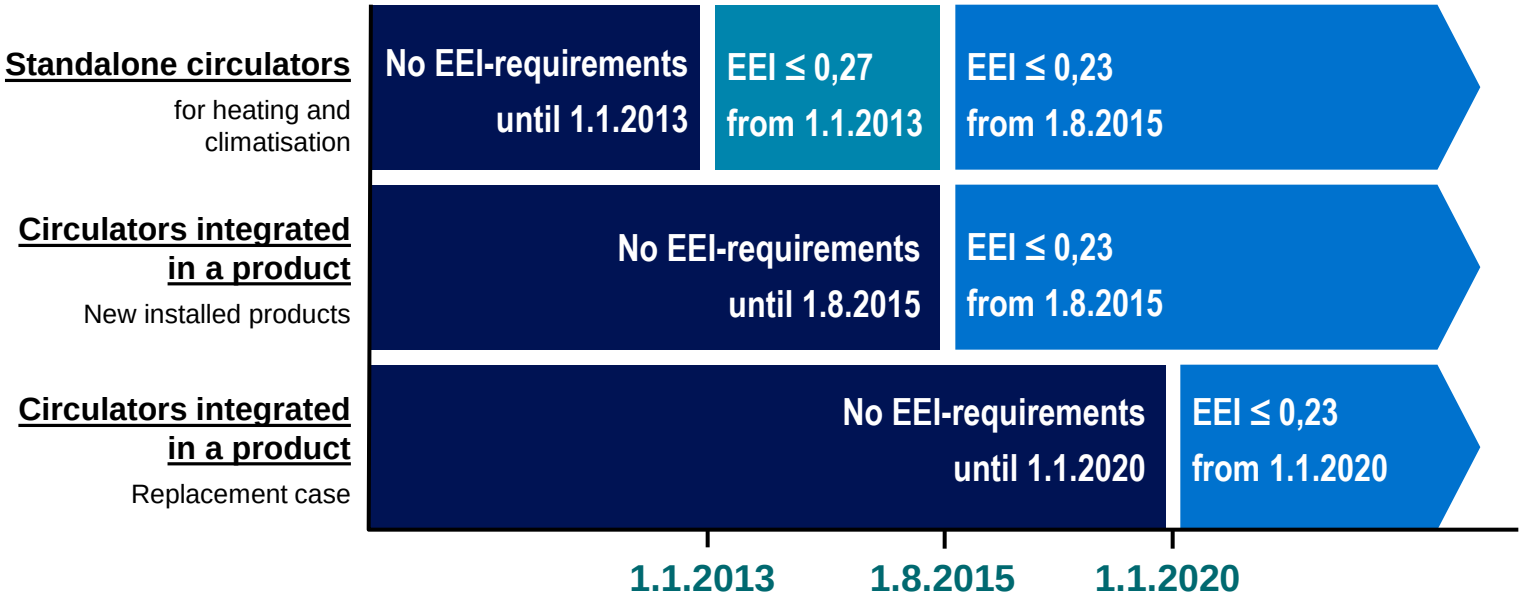
ErP Directive EC 641/2009

2. Timing



From 1st of January 2013, **glandless standalone circulators**, with the exception of those specifically designed for primary circuits of thermal solar systems and of heat pumps, shall have an energy efficiency index (EEI) of not more than 0,27…[1]

From 1st of August 2015, **glandless standalone circulators and glandless circulators integrated** in products shall have an energy efficiency index (EEI) of not more than 0,23 …[1]

[1] COMMISSION REGULATION (EC) No 641/2009, 191/38

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547/2012

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547/2012

'*water pump*' is the hydraulic part of a device that moves clean water by physical or mechanical action and is of one of the following designs:

- **End suction own bearing (ESOB),** is an end suction water pump with own bearings
- **End suction close coupled (ESCC),** is an end suction water pump of which the motor shaft is extended to become also the pump shaft
- **End suction close coupled inline (ESCCi),** means a water pump of which the water inlet of the pump is on the same axis as the water outlet of the pump
- **Vertical multistage (MS-V),** means a glanded multi stage (i > 1) rotodynamic water pump in which the impellers are assembled on a vertical rotating shaft, which is designed for pressures up to 25 bar, with a nominal speed of 2900 rpm and a maximum flow of 100 m^3/h
- **Submersible multistage (MSS);** means a multi stage (i > 1) rotodynamic water pump with a nominal outer diameter of 4″ or 6″ designed to be operated in a borehole at nominal speed of 2900 rpm, at operating temperatures within a range of 0 °C and 90 °C

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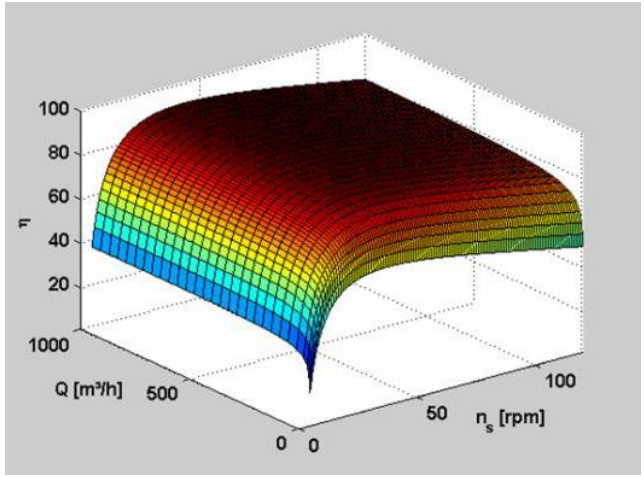
Ecodesign for Rotodynamic Pumps: MEI Index



Guideline on the application of COMMISSION REGULATION (EU) N° 547/2012 implementing Directive 2009/125/EC of the European Parliament and of the Council

- The MEI Index, multiplied by 100, is a value that corresponds to the percentage of the existing pumps in the market with a minimum hydraulic efficiency under a specific set point.
- MEI 0.1, for example, corresponds to the bottom 10% of the pumps in the market with the lowest efficiency values.

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Ecodesign for Rotodynamic Pumps: Timing



- From the **1st January 2013**, water pumps in the scope shall have a minimum hydraulic efficiency measured and calculated according to the **MEI 0.1 index.**

- From the **1st January 2015**, water pumps in the scope shall have a minimum hydraulic efficiency measured and calculated according to the **MEI 0.4 index.**

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Ecodesign - timing

640/2009 4/2014



16/06/2011 — IE1

IE2

01/01/2015 — IE3 IE2+VFD

01/01/2017 — IE4 IE3+VFD

641/2009 622/2012

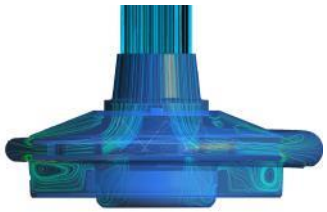


01/01/2013 — NO EEI

EEI≤0.27

01/08/2015 — EEI≤0.23

547/2012



01/01/2013 — NO MEI

MEI 0.1

01/01/2015 — MEI 0.4

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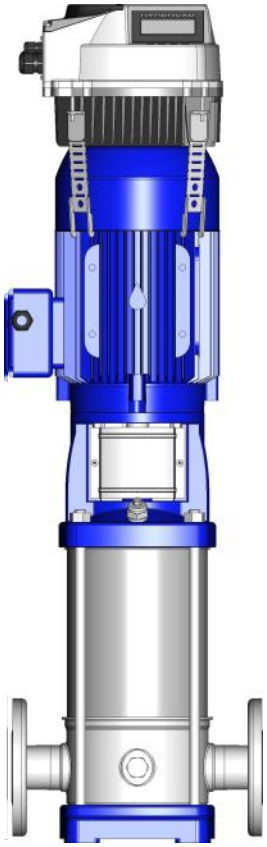
The current situation – EU directives



ErP
640/2009

EcoDesign
ErP Ready IE3 Motors

Electric motors efficiency

ErP
547/2012

EcoDesign
Water Pumps MEI 0.4

Hydraulic efficiency



ErP
641/2009

EcoDesign
ErP Circulators ≤0.23

ONLY FOR CIRCULATORS

Circulators efficiency

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Standards

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Standard definition

A **harmonized standard** is a European standard elaborated to develop a European standard that provides solutions for compliance with a legal provision. Manufacturers, other economic operators or conformity assessment bodies can use harmonized standards to demonstrate that products, services or processes comply with relevant EU legislation.

The Standards used to demonstrate that an electropump is compliant to the Ecodesign directive are the following:

- **ISO 9906:2012**, *Rotodynamic pumps - Hydraulic performance acceptance tests*
- **IEC/EN 60034-30-1**, *Efficiency classes of line operated AC motors (IE code)*
- **IEC/TS 60034-30-2**, *Efficiency classes of variable speed AC motors (IE code)*
- **EN 50598**, *Ecodesign for power drive systems, motor starters power electronics & their driven applications (part 1 and part 2)*

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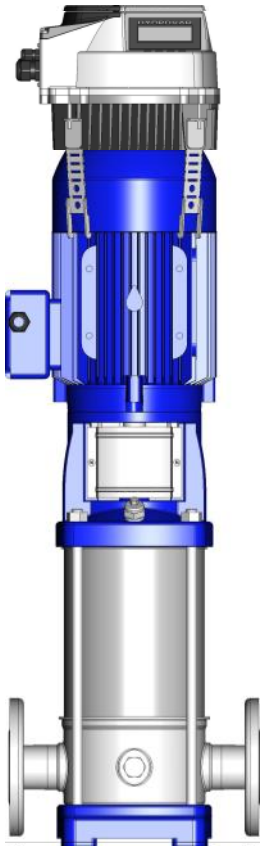
The current situation – Harmonized Standards



ISO 9906

Rotodynamic pumps

IEC/EN 60034-30-1
IEC/EN 60034-30-2

IE code of line operated AC motors
IE code of variable speed AC motors

EN 50598-2

Ecodesign for power drive systems, motor starters power electronics

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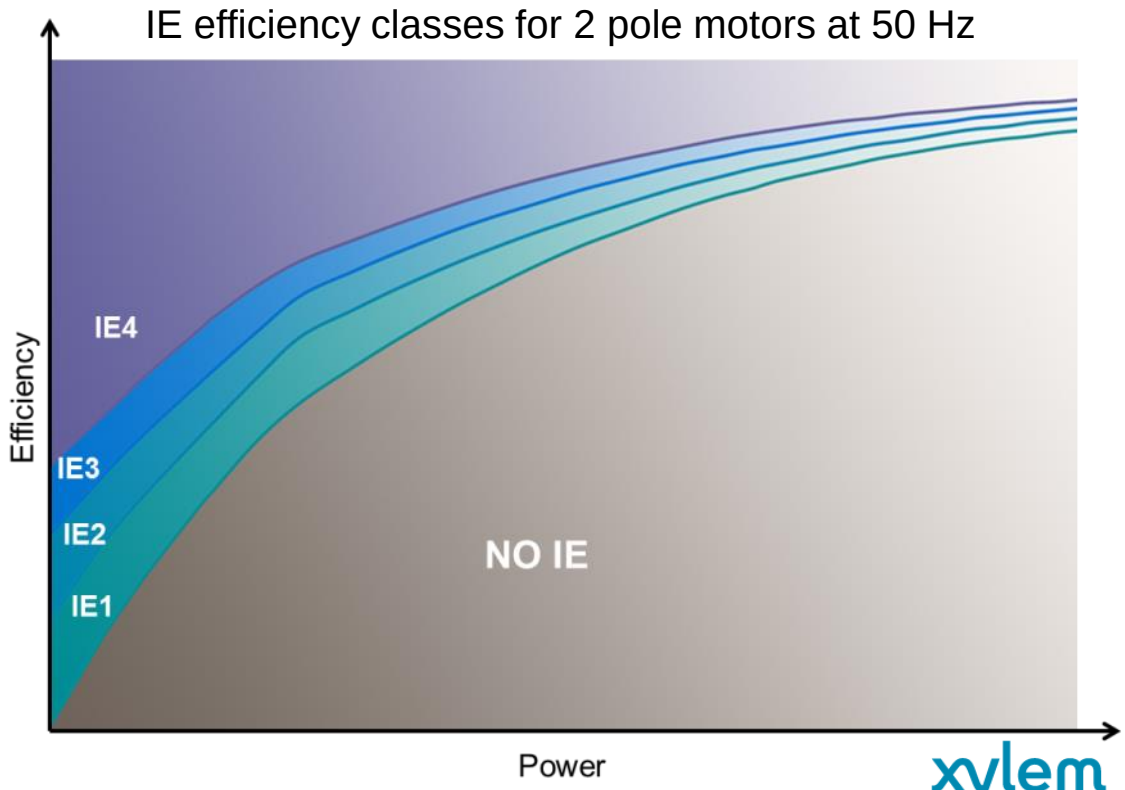
IEC/EN 60034-30-1

Standard **IEC/EN 60034-30-1** on efficiency classes of **line operated AC motors** is concerned with the global harmonization of energy efficiency classes for electric motors. All technical constructions of motors are covered as long as they are **rated for direct on-line operation**.

Super-premium efficiency	IE4
Premium efficiency	IE3
High efficiency	IE2
Standard efficiency	IE1



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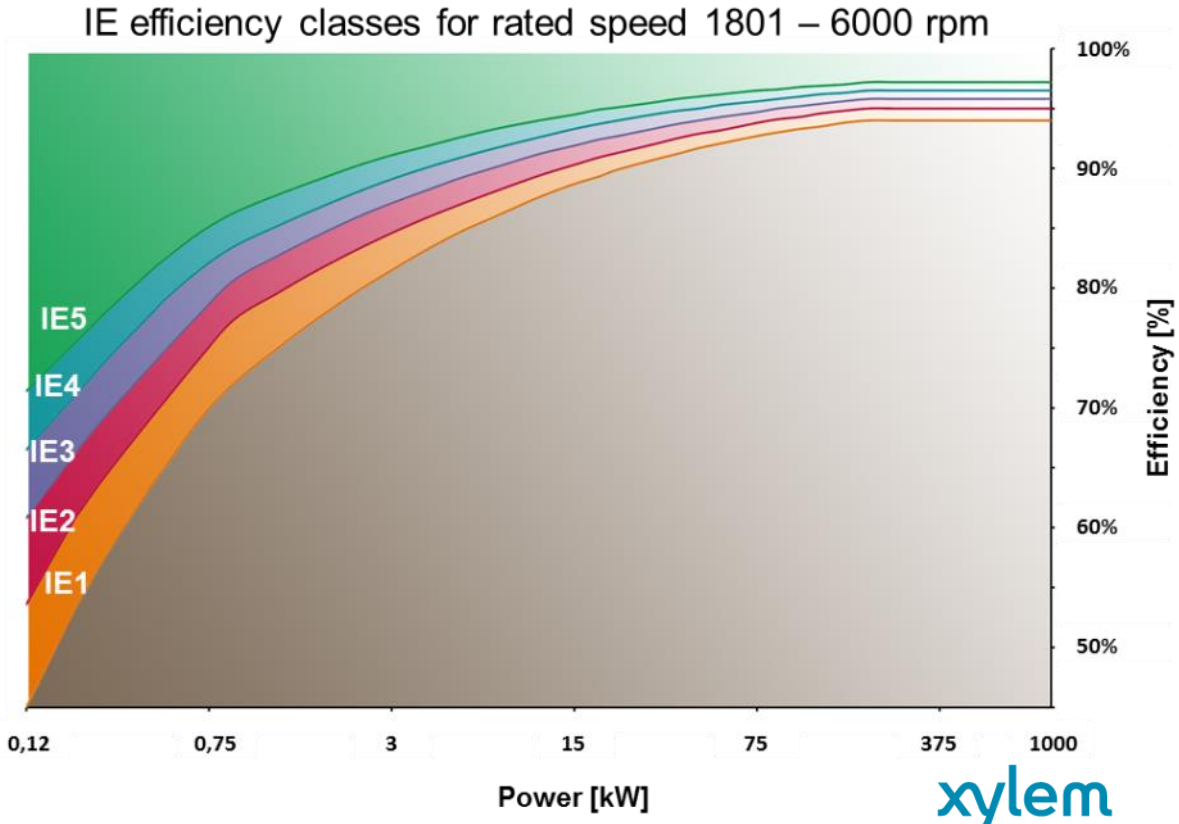
IEC/TS 60034-30-2

This clause deals with motors **exclusively rated for variable frequency and voltage operation**. The specification **introduces IE5 efficiency performance class for variable speed electric motors**. It only covers machines **not designed to be operated direct on-line** (grid).

Ultra-premium efficiency	**IE5**
Super-premium efficiency	IE4
Premium efficiency	IE3
High efficiency	IE2
Standard efficiency	IE1



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EN 50598 Regulation

Standard **EN 50598**, *Ecodesign for power drive systems, motor starters power electronics & their driven applications*, consists of the following parts:

- *Part 1: General requirements for setting energy efficiency standards for power driven equipment using the **extended product approach** (EPA), and semi analytical model (SAM);*

- *Part 2: Energy efficiency indicators for power drive systems and motors starters;* Similar to the IE classification of motors, EN50598-2 introduces :

  - **IE** classes for frequency converters and 

  - **IES** classes for the frequency converters **plus motor** systems 

    (known as the power drive system : PDS)

- *Part 3: Quantitative ecodesign approach through life cycle assessment including product category rules and the content of environmental declarations.*

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EN 50598-1 – The extended product approach (EPA)

Defined in **EN50598-1**

Extended Product

Motor System

Power Drive System (PDS)

Motor Starter (Contactor, Softstarter,…)

Complete Drive Module (CDM),

Often named as VSD (Variable Speed Drive)

Motor

Driven Equipment

Transmission + Load- Machine

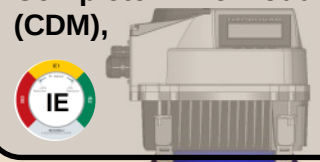
(E.g. Pump)

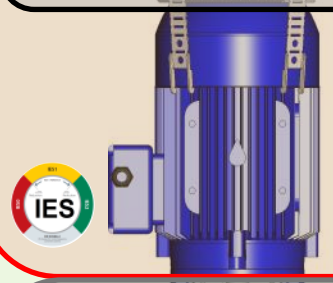
Scope of EN50598-2 **Power Drive System (PDS)**

Extended Product

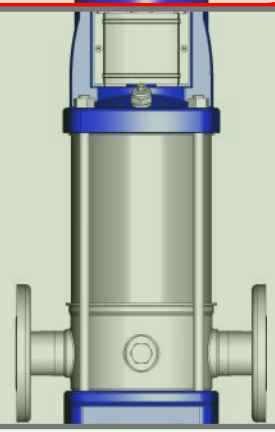
Power Drive System (PDS)

Complete Drive Module (CDM),





Driven Equipment



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SUM UP

EN 60034-30-1



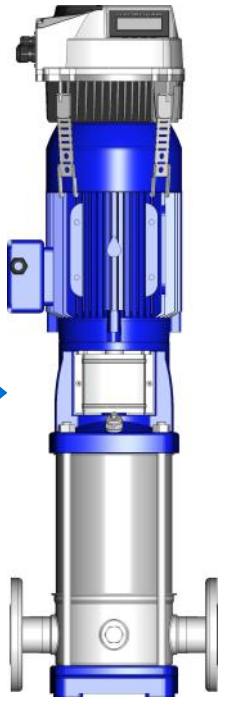
EN/TS 60034-30-2



EN50598-2



2009 **2020**



EPA







LOWARA a xylem brand
EcoDesign
ErP Ready IE3 Motors

LOWARA a xylem brand
EcoDesign
ErP Circulators ≤0.23

LOWARA a xylem brand
EcoDesign
Water Pumps MEI 0.4

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Conclusion

- The European Commission is changing is approach to the ErP products
- The new standards will be referred to the products placed in the market
- Each manufacturer will have to be compliant to a specific Regulation
- For pumps the regulation will be according to the EPA and LCC approach like the circulators



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