

INSTRUCTIONS

Few brief information about the webinar

- **Webinar will start at 11.00 am.**
- **Your microphone will be not active as well as webcam.**
- **You can send us messages by using box on the right side of the screen.**
- **There is no sound on right now. It will be activated after 11.00.**
- **Feel free to make questions during webinar. Answers will come at the end.**

Hydronic kit in modern HVAC installation

Webinar

Wednesday the 29th April 2020

Speaker: Giulio Abati, export sales dep.

Moderator: Fabrizio Girolami , export sales dep.; Riccardo Lombardi, marketing dep.

Abstract:

Chillers play an important role in cooling large buildings and industrial processes. F-GAS regulation is now pushing chillers manufacturer to develop new unit with natural refrigerant gases.

Wherever there is a chiller there will be a Hydronic kit to handle the working fluid.

In this session you will get a basic overview of the different types of hydraulic variants in combination with chillers and heat pump installation.

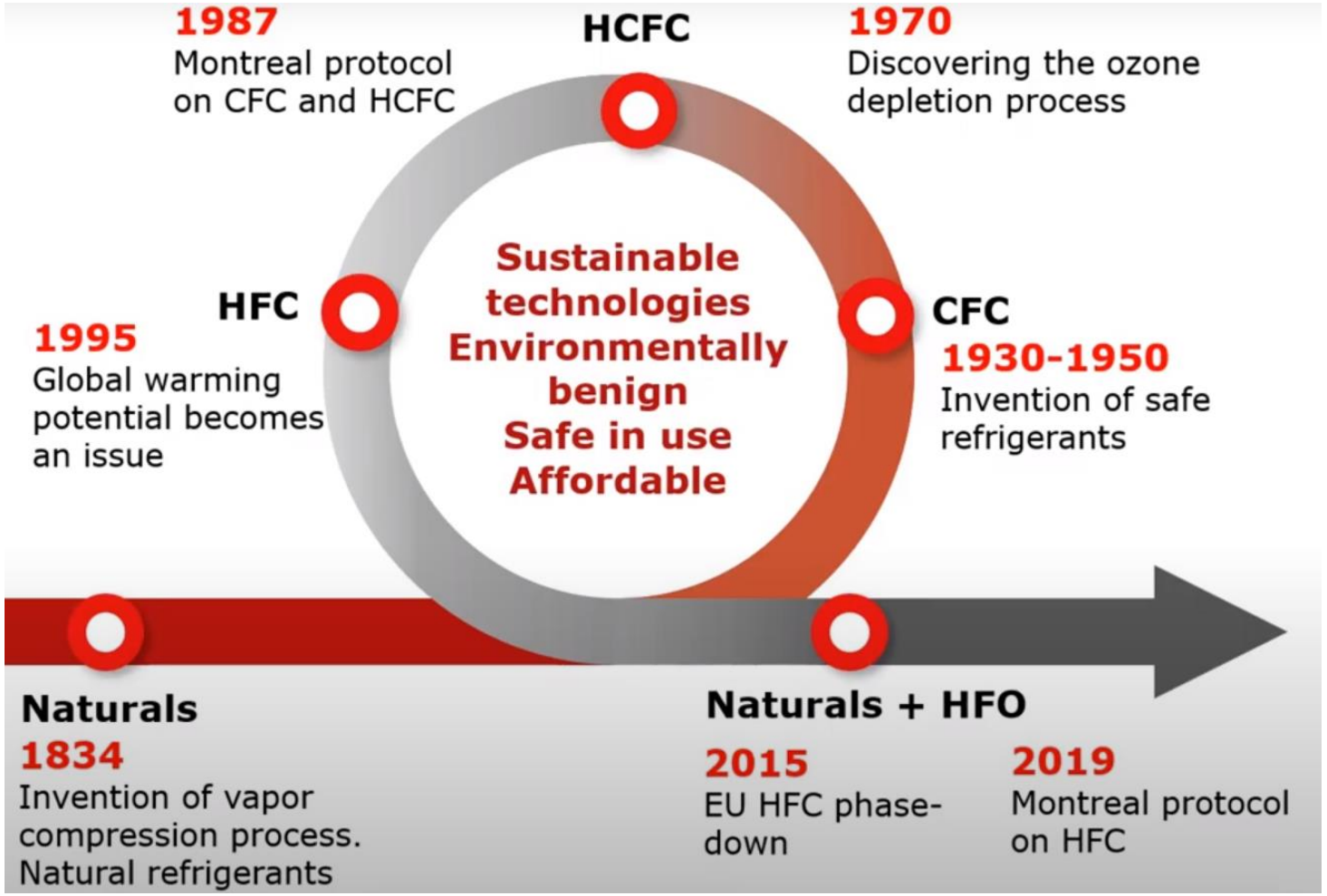
The session also includes an overview of the most modern applications with EC pump motor and benefit given by them.

Hydronic kit in modern HVAC installation

INDEX

1. Overview of F-Gas Regulation (EU) 517/2014.
2. Impact of F-Gas Regulation (EU) 517/2014 in different cooling system (VRV, VRF, Chillers)
3. Defining an Hydronic kit.
4. Design:
   a) how to size buffer tank and other main components;
   b) positioning of water tank into the system: on return of the system, on outlet of chiller, in between as balance tank;
   c) focus on double ring installation (layout 2 and 3);
   d) main accessories,
   e) selection tool.
5. Focus on High-efficiency pumps with EC motor
6. Examples of bespoken execution.
7. Questions and remarks.

Overview of F-Gas Regulation (EU) 517/2014



After almost 200 years of history circle will be almost closed once again

Natural refrigerant

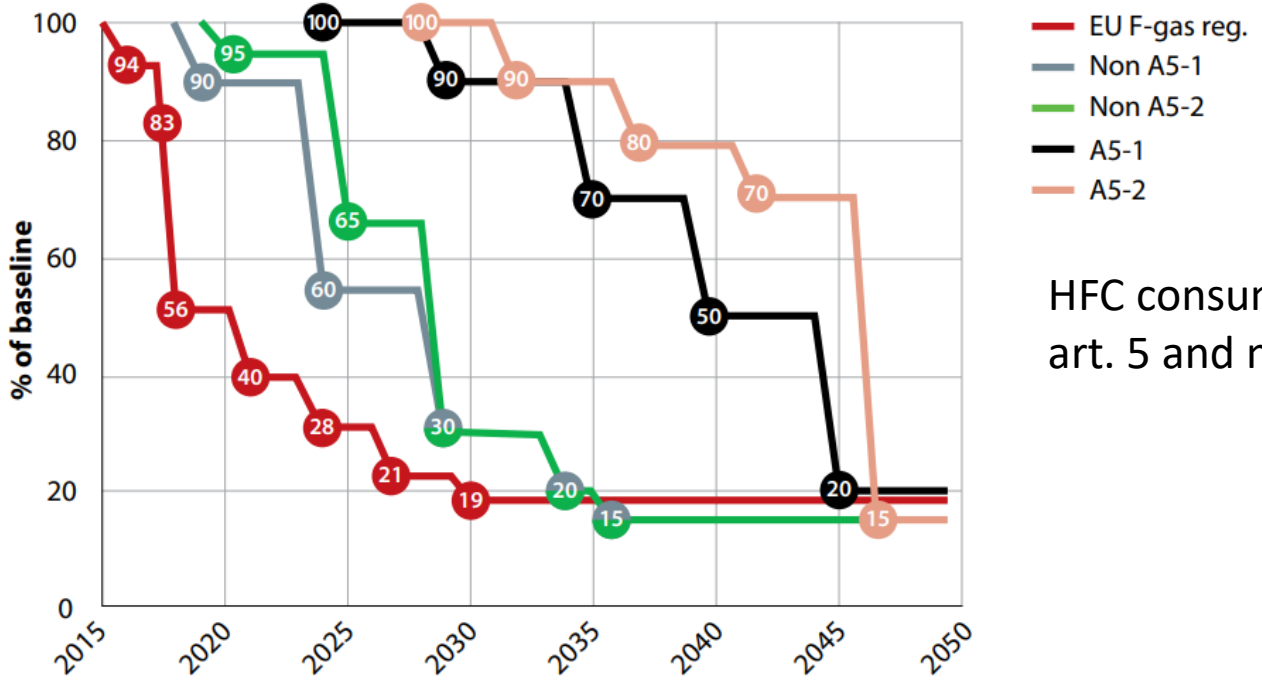
Plus

Synthesis refrigerant: HFO

Overview of F-Gas Regulation (EU) 517/2014

2015

- Impose a severe reduction in emission of greenhouse gases, 79% by 2030 (taking as reference the average emission during 2009-2012).
- Big emission reduction of F-Gas (HFC), measured in equivalent tons of CO2, and emitted on European territory, as pictured in the graph.



HFC consumption phase-down for art. 5 and non-art. 5 countries

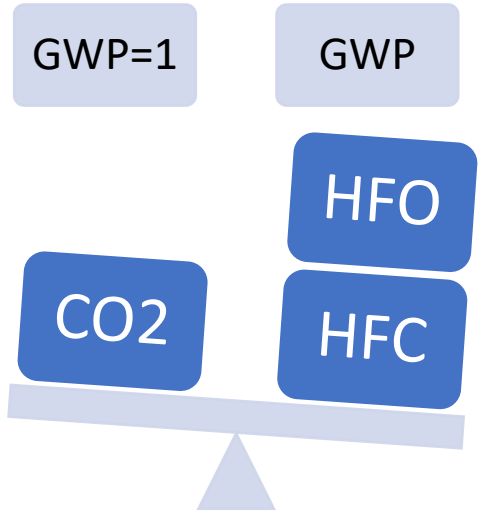
Overview of F-Gas Regulation (EU) 517/2014

GWP: global warming Potential

Greenhouse gases (GHGs) warm the Earth by absorbing energy and slowing the rate at which the energy escapes to space; they act like a blanket insulating the Earth.

GWP is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO2).

GWPs provide a common unit of measure, which allows analysts to add up emissions estimates of different gases (e.g., to compile a national GHG inventory), and allows policymakers to compare emissions reduction opportunities across sectors and gases.



The time period used for GWPs is 100 years

Overview of F-Gas Regulation (EU) 517/2014

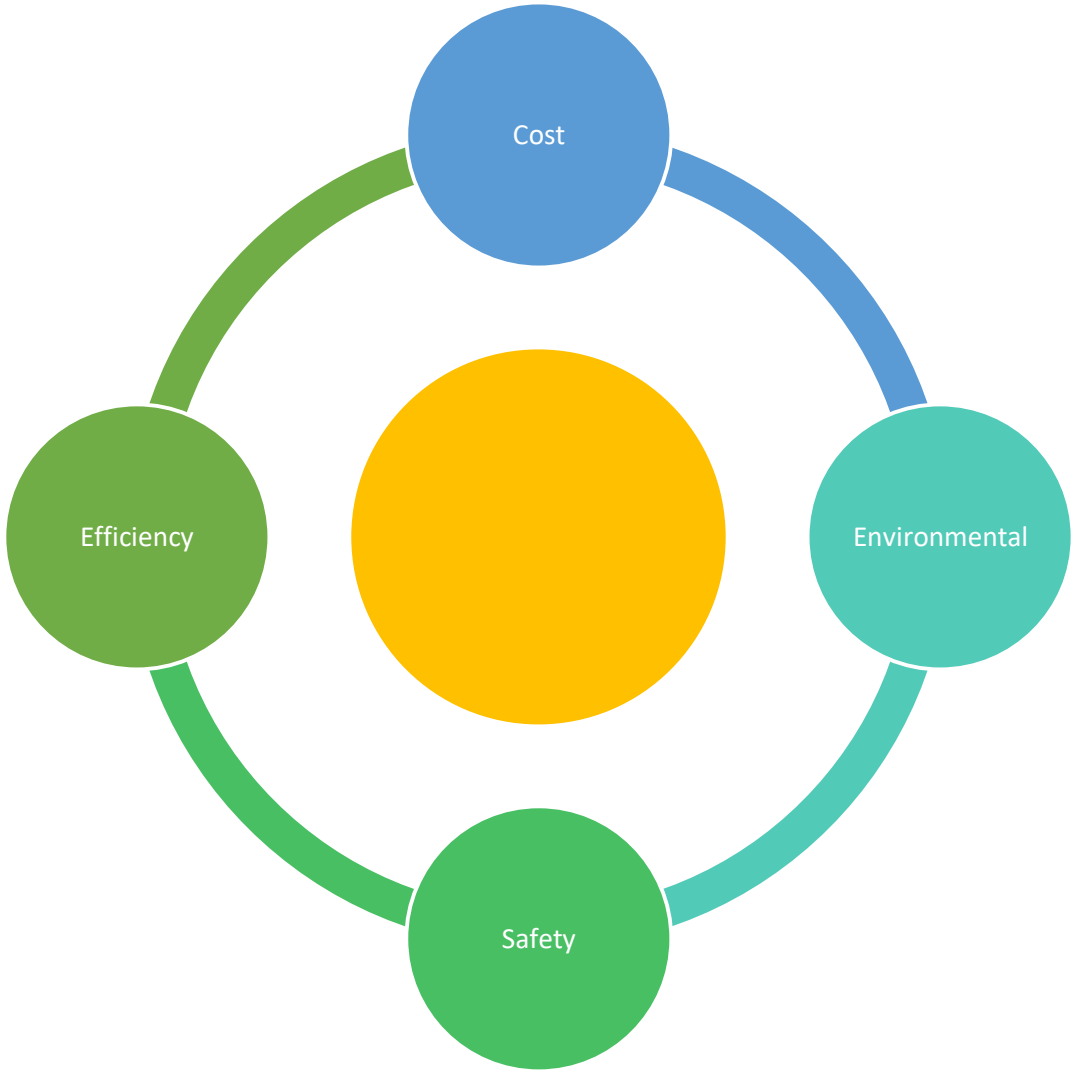
Future scenario

HFO - **THE 4TH GENERATION REFRIGERANT GASES**	**NATURAL REFRIGERANT**
New fluorinated greenhouse gases, with limited GWP. -Low greenhouse effect but not zero -Safety: sometimes it is an issue	Ammonia, C02, Prophane, ect. -Safety issue

Combination of both technology

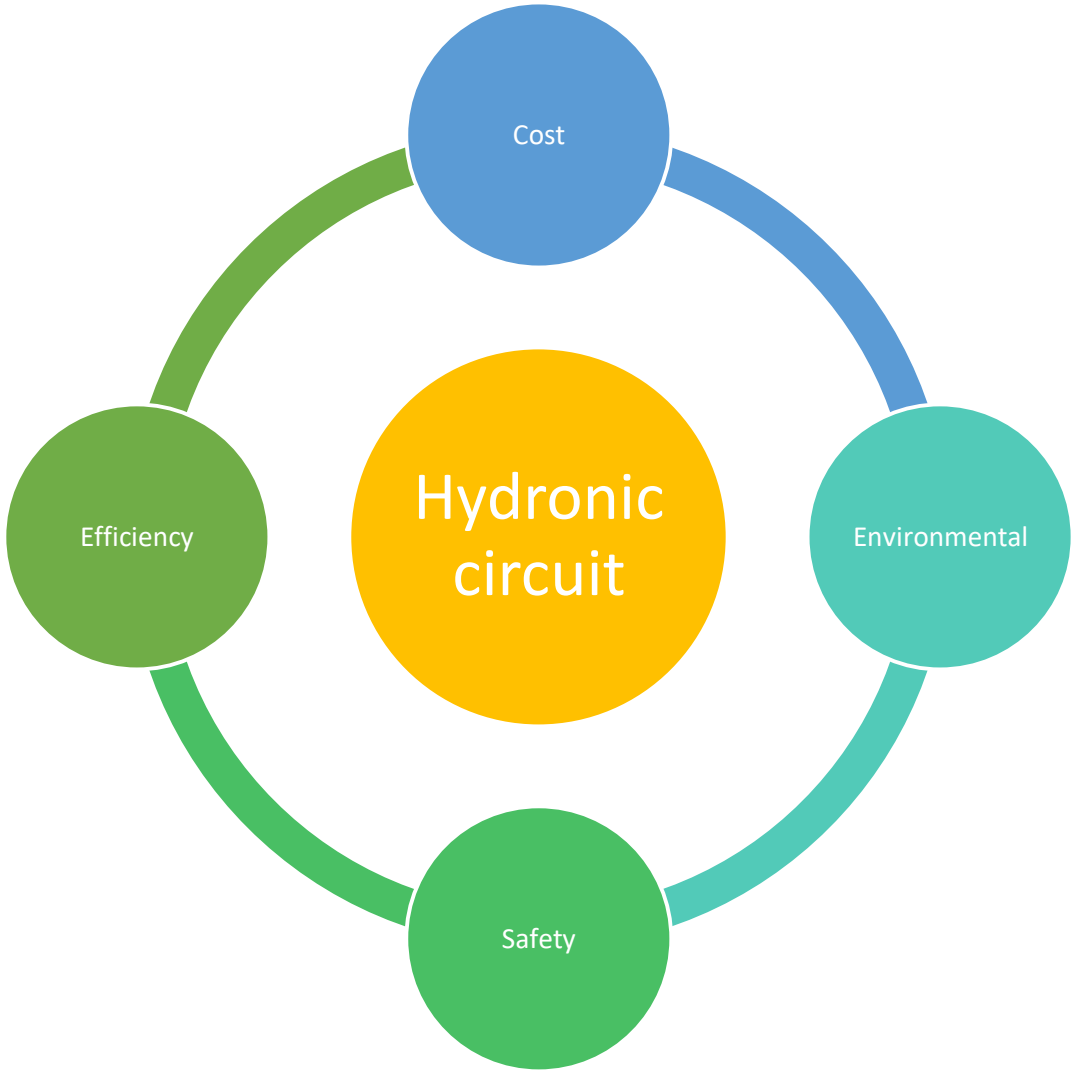
Impact of F-Gas Regulation (EU) 517/2014 in different cooling system

How do we, in Fiorini, respond to refrigerant changes?



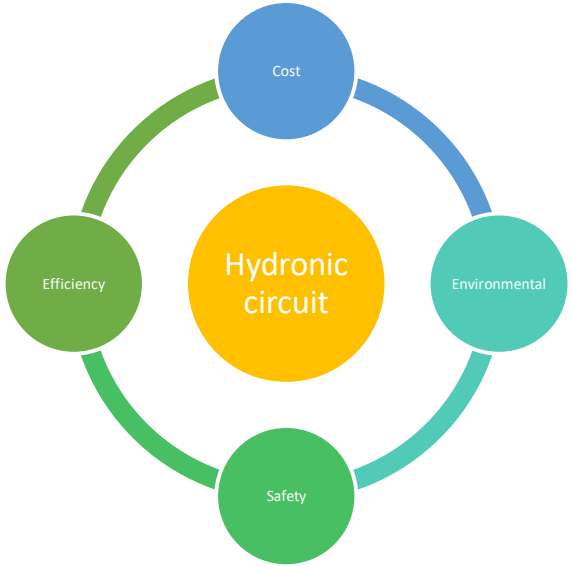
Impact of F-Gas Regulation (EU) 517/2014 in different cooling system

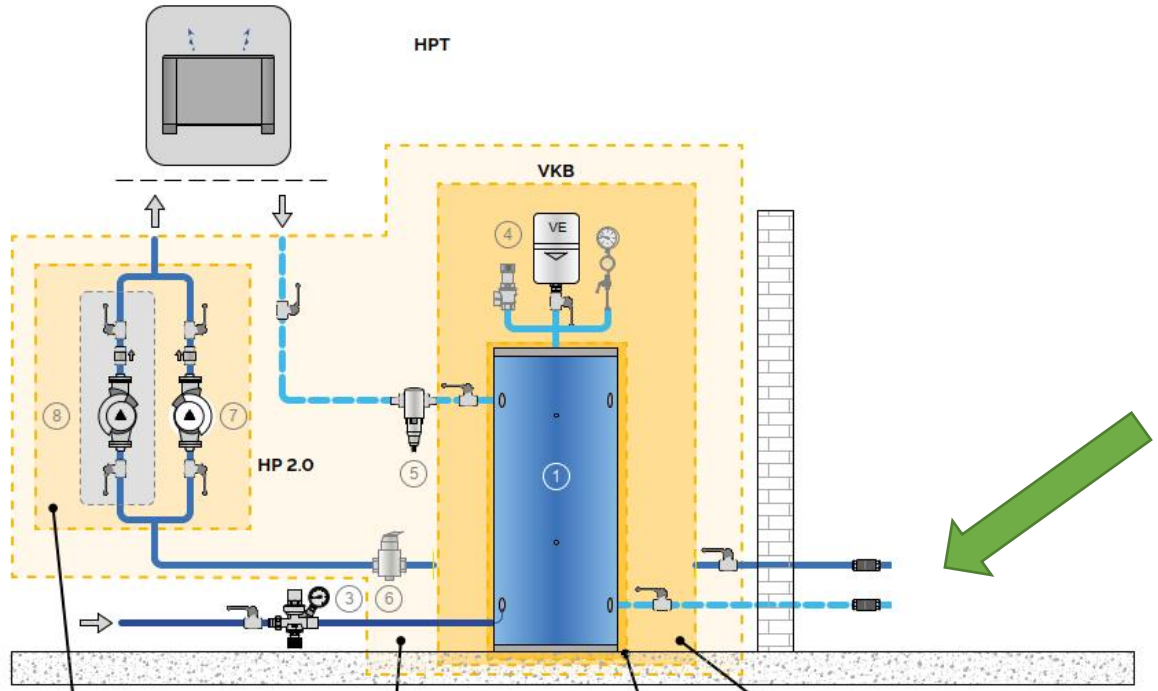
How do we, in Fiorini, respond to refrigerant changes?



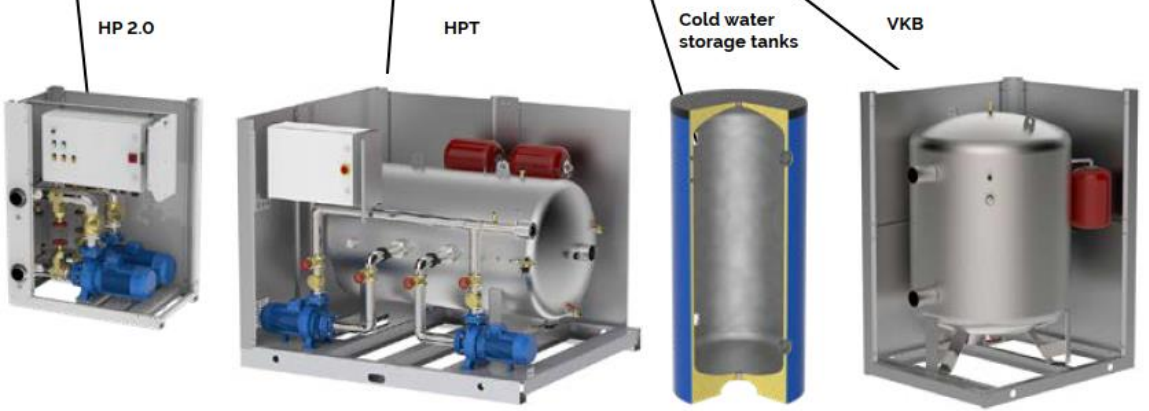
Impact of F-Gas Regulation (EU) 517/2014 in different cooling system

How do we, in Fiorini, respond to refrigerant changes?





- Ammonia
- CO2
- Propane
- HFO



Impact of F-Gas Regulation (EU) 517/2014 in different cooling system

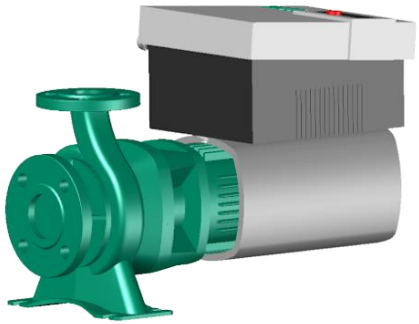
Chiller + Hydronic circuit

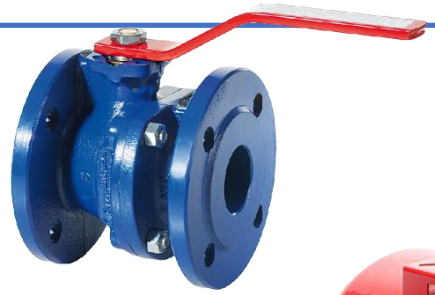
- Enormous installation possibility
- Easy transformation (upgrading, enlargement, ect)
- Gas reduced to min q.ty.
- Gas located only in a specific area
- Circuit assembled with higher quality standard
- Free-cooling integration

DX, VRV, VRF

- Big risk of gas leakages
- Large quantity of gas
- Gas inside building
- Long pipeline
- Extreme impact in GWP

Defining an Hydronic kit









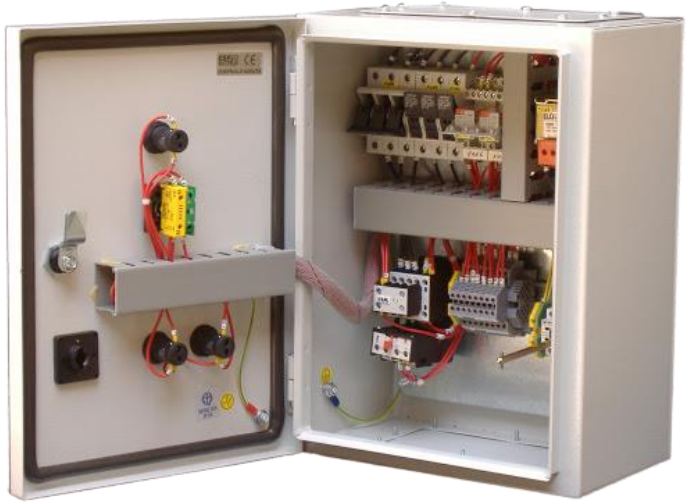










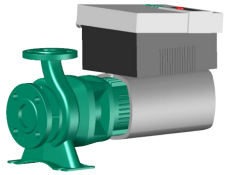


Defining an Hydronic kit

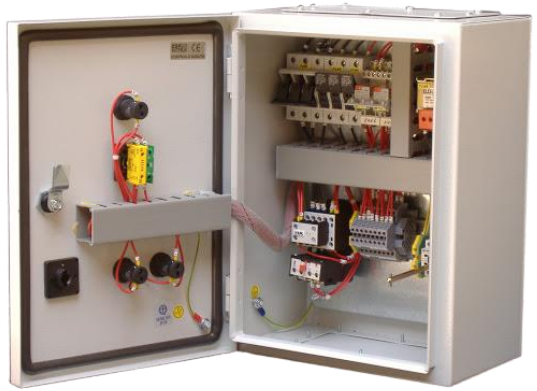


















Defining an Hydronic kit





Defining an Hydronic kit

Standard range of FIORINI hydronic kit



HPT
Unit with tank, pump
and accessories



VKB 2.0
Unit with tank
and accessories



HP 2.0
Unit with pump
and accessories

DESIGN - How to size buffer tank

Main functions of buffer tank

- Reducing short cycle of compressor (frequent on/off)
- Stabilizing temperature in the system



DESIGN - How to size buffer tank

There are some specific formulas to calculate the minimum quantity of water necessary to the chiller to work properly.
They depend on:

- Capacity of the unit
- ΔT: differential set point
- Number of compressor or number of regulation steps
- Anti recycle time

$$V = \frac{P\tau}{60C\Delta T}$$



V: Volume of the system*
P: Power in kW at nominal condition
τ: minimum running time in minute. As per beside table
C: Specific heat capacity J/(kg*K)
ΔT: differential set point.
I.e difference of inlet temperature in the evaporator between those two condition:

1. full compressor/s load (for example 10 °C chiller works at full load)
2. switching off of all comp (for example 6 °C chiller turn of)

τ	Minimum	Optimized
• Chiller • Heat pump	• 2 • 3,5	• 5 • 10

DESIGN - How to size buffer tank

Normally chiller manufacturer make volume selection very easy.
They provide you the number of litres per KW (l/kW) according to the model of chiller.

For instance common value for scroll type chiller is 4 l/kW min and recommend 7 l/kW

$$V = \frac{P\tau}{60C\Delta T}$$

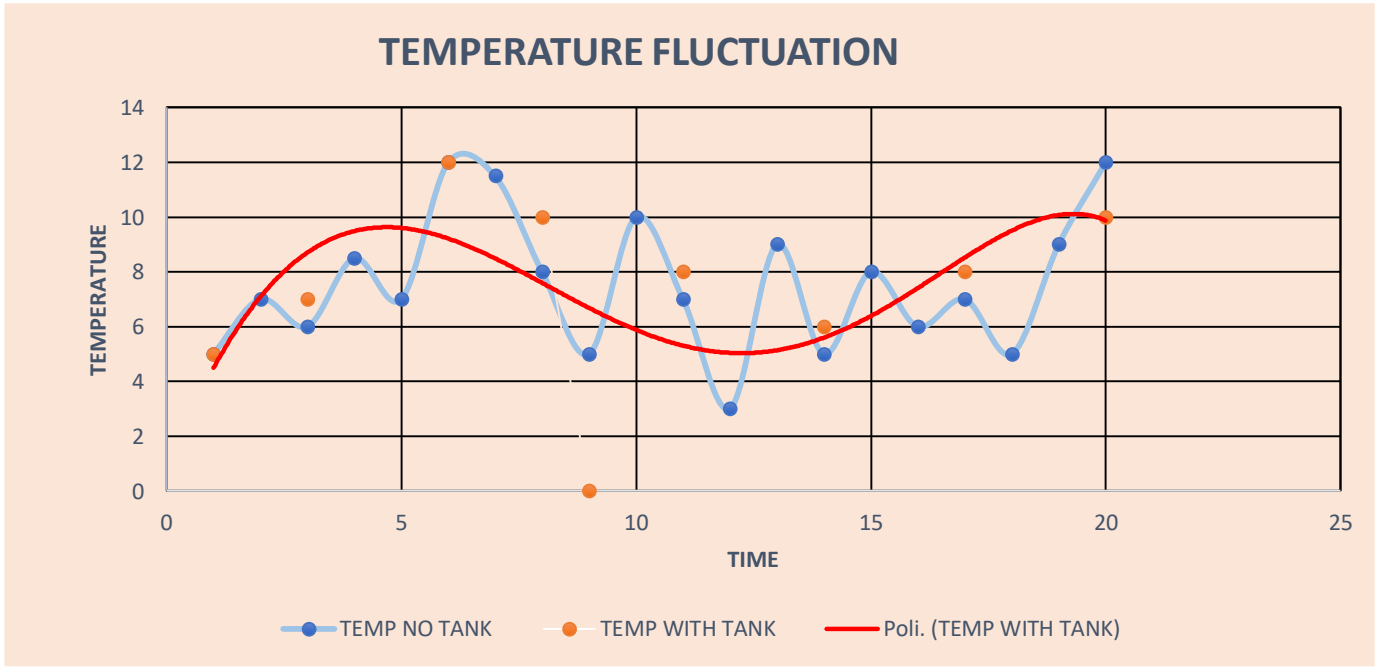
$$\frac{l}{kW}$$

According to chiller manufacturer



DESIGN - Positioning of water tank into system

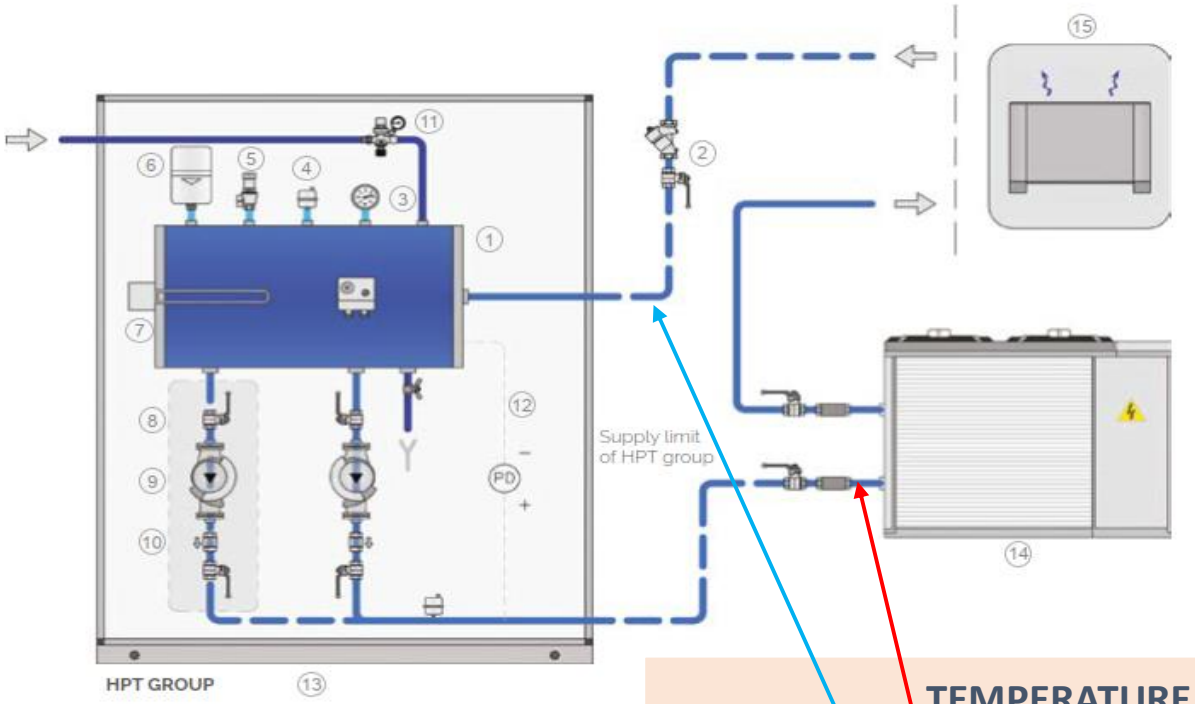
Temperature stabilization in the system

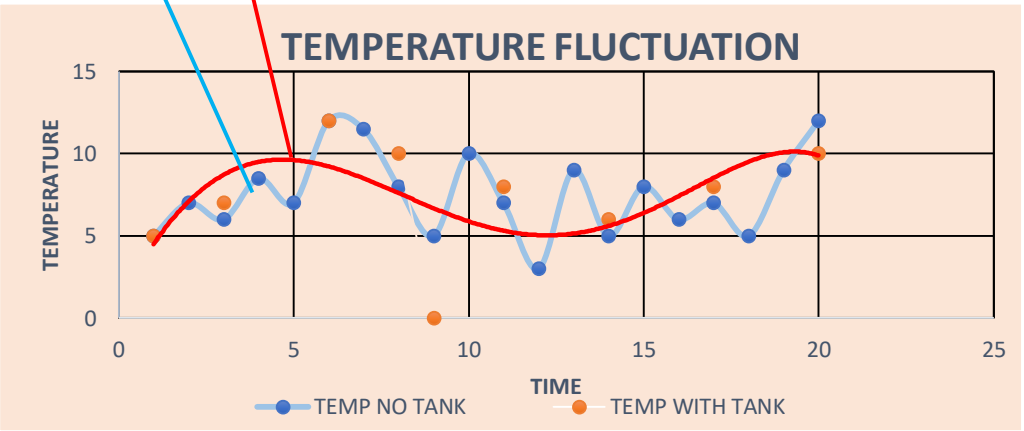




DESIGN - Positioning of water tank into system

On return leg





Stabilized temperature

- Return temperature to the chiller

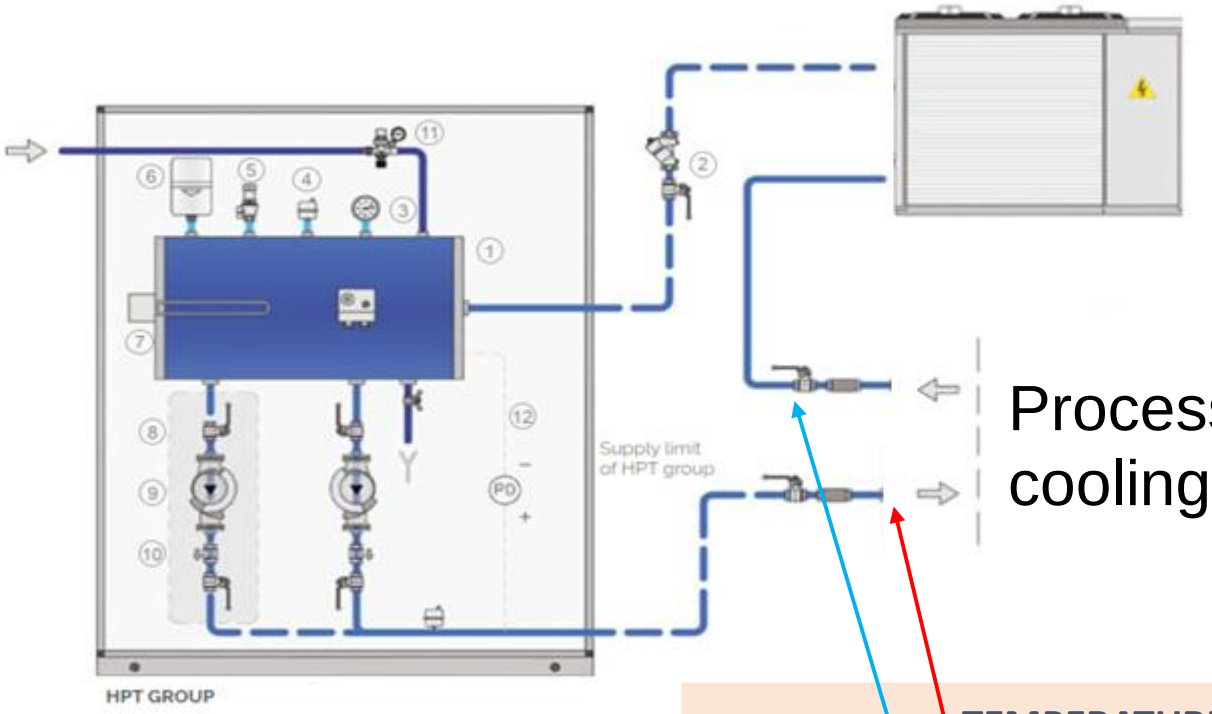
Priority

- Increase efficiency
- Simplify chiller regulation
- Increasing the estimated time life of chiller

HVAC

DESIGN - Positioning of water tank into system

On the outlet



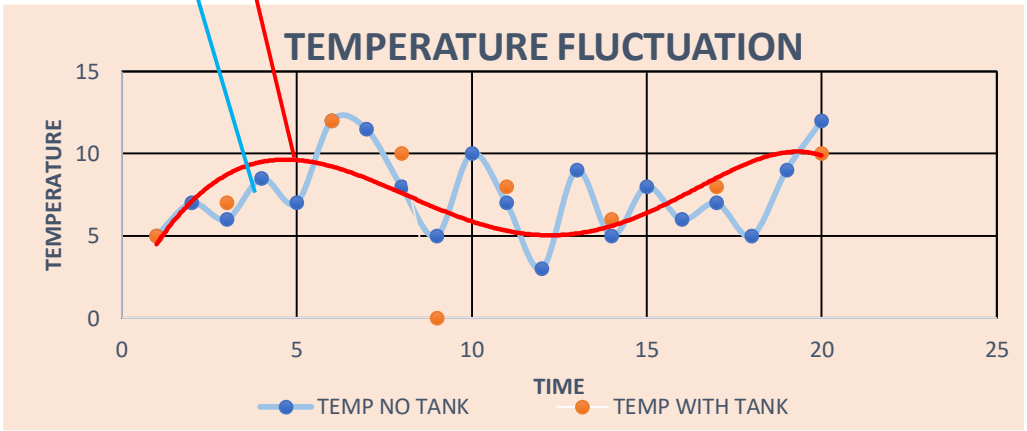
Process cooling plant

Stabilized temperature

- Outlet to the system

Priority

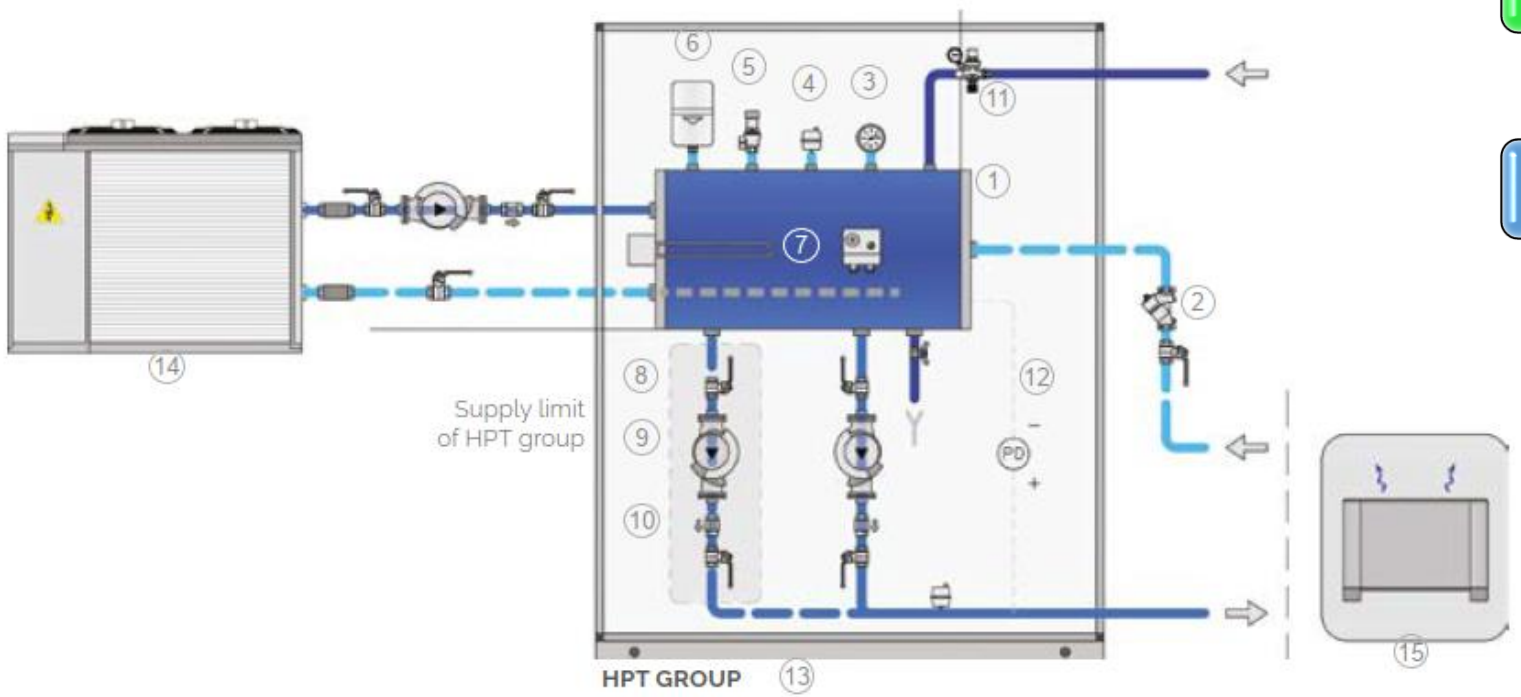
- Stable temperature to the plant



Process cooling

DESIGN - Positioning of water tank into system

In between as balance tank



Stabilized temperature

- Return temperature to the chiller
- Outlet to the system

Priority

- Increasing the estimated time life of chiller
- Stable temperature to the plant

Unique characteristics

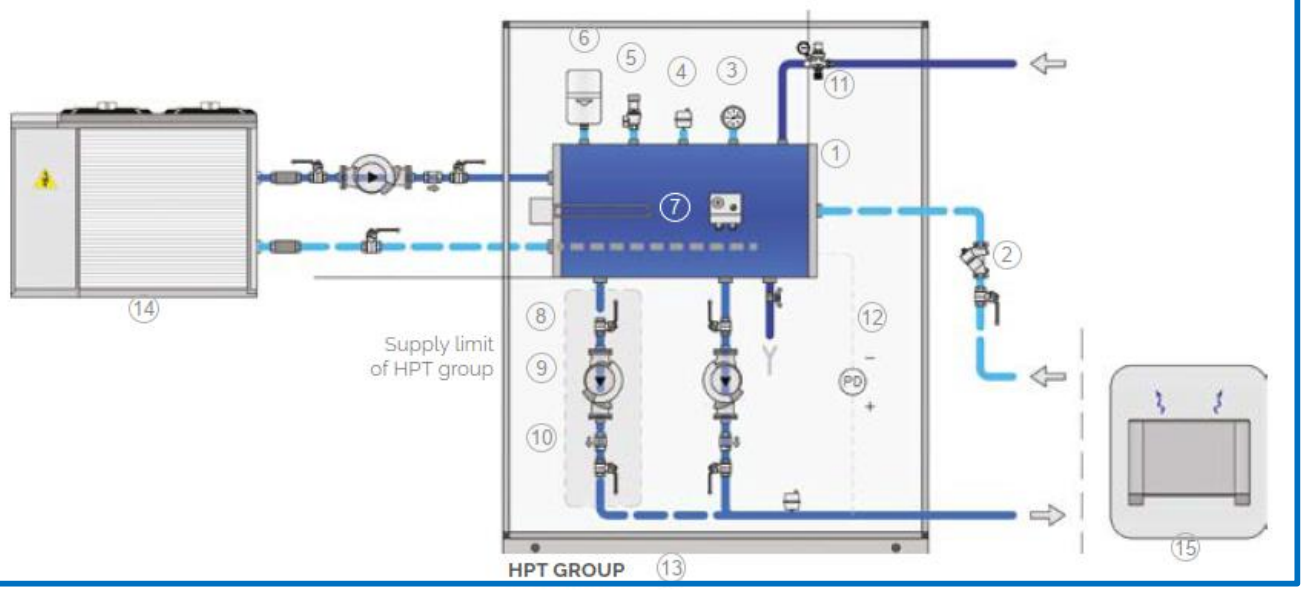
- Generate two independents circuits: primary and secondary loop
- Primary loop: typical fix speed pump
- Secondary loop: typical speed regulation pump regulated on pressure

Process cooling

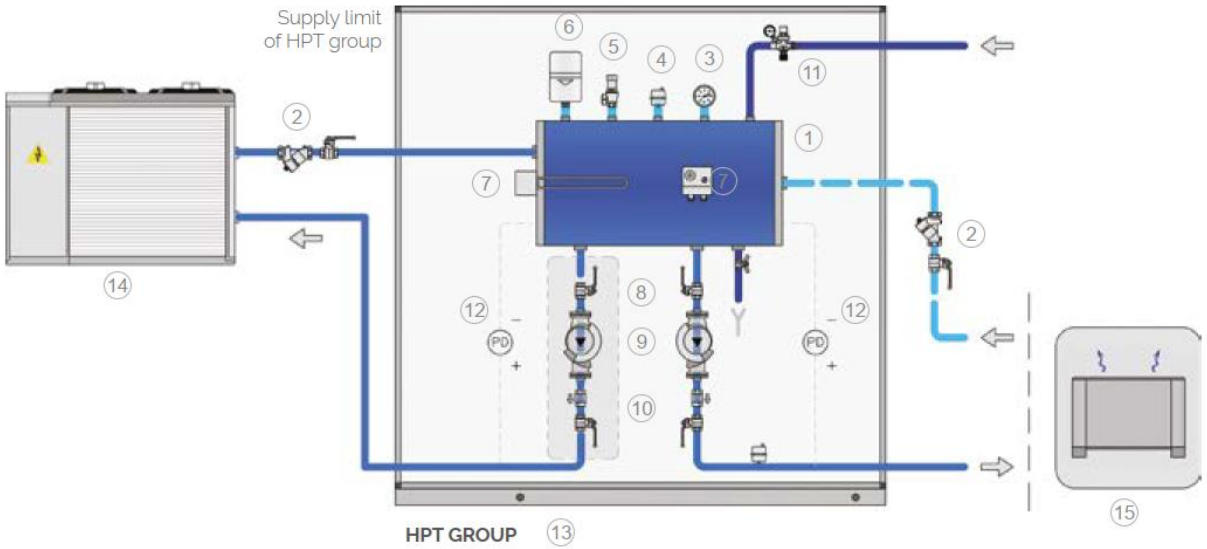
HVAC

DESIGN - Focus on double ring installation (layout 2 and 3)

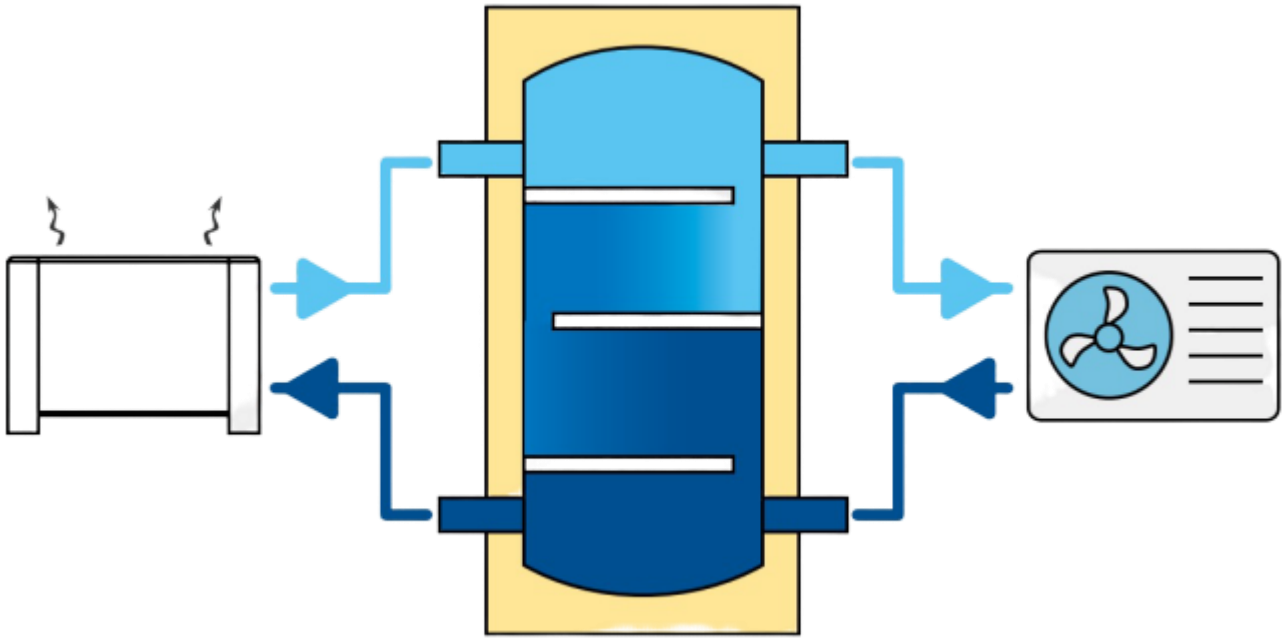
LAYOUT 2



LAYOUT 3



DESIGN - Focus on double ring installation (layout 2 and 3)



Connections

- Correct size properly designed
- Right position to avoid short cut
- Correct fluid path inside tank

Insulation

- Reduce heat loss and increase efficiency of entire system
- Avoid humidity condensation due to contact with cold surface

Materials

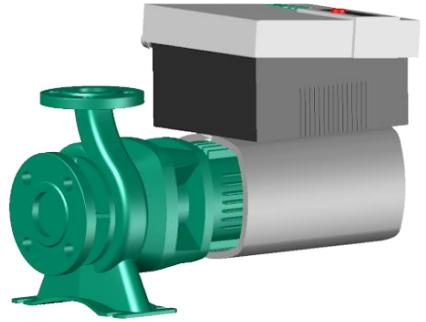
- Raw material coming from European community
- Using only certified raw materials

100 % tested

DESIGN – pump selection

What is necessary to consider in pump selection?

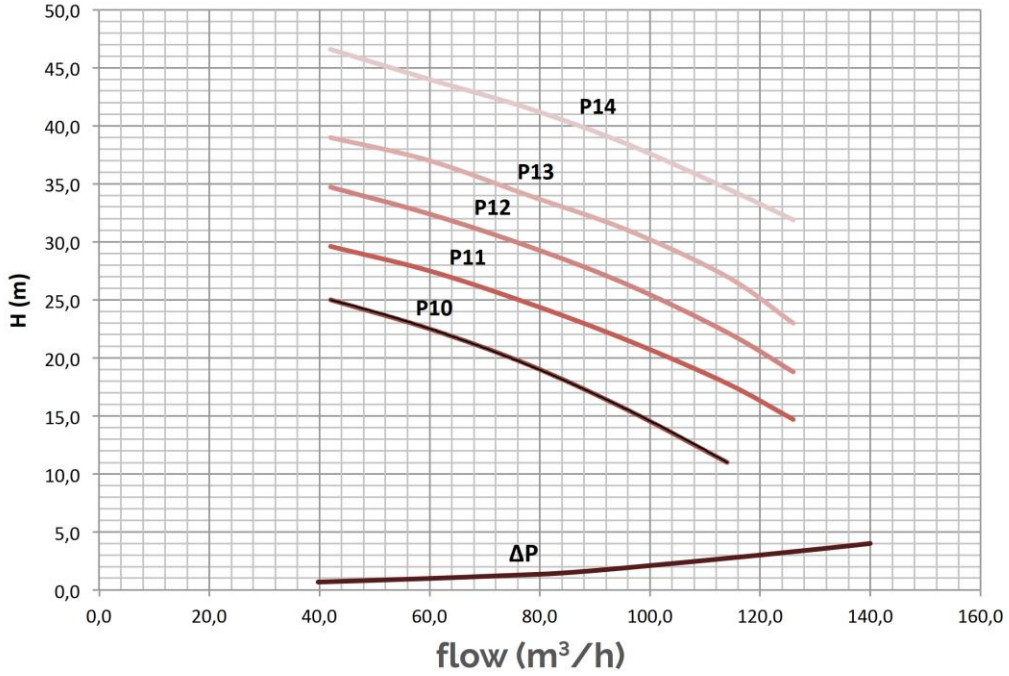
- **Fluid**
  In influence: seal, impeller and pump housing, motor
- **Layout**
  Vertical (inline), horizontal, twin
- **Temperature**
- **Duty point**
  Flow and pressure







DESIGN – pump selection

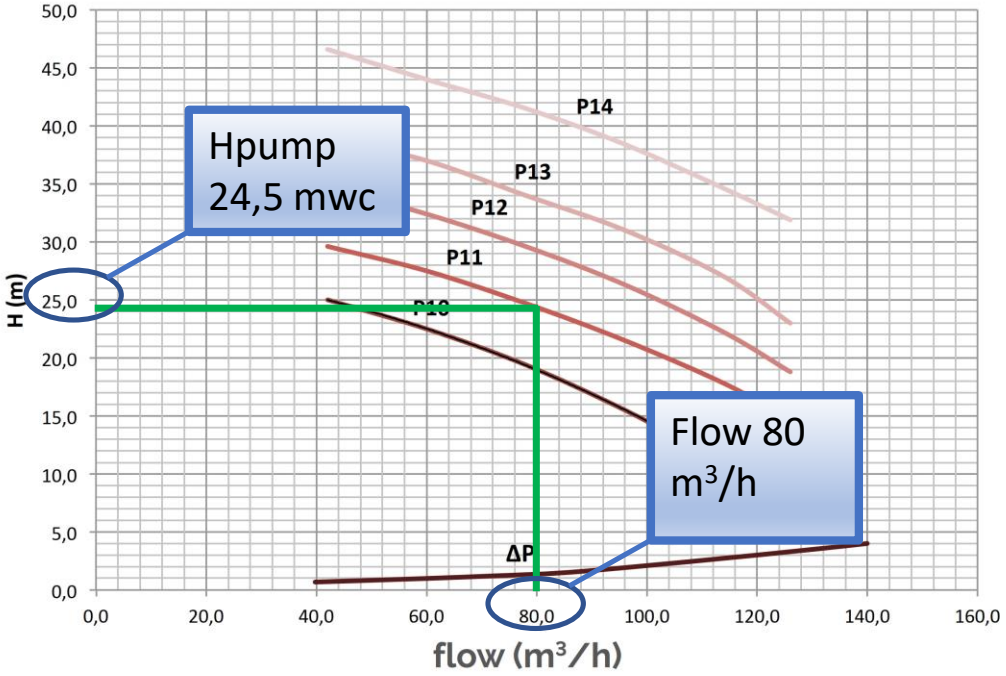


Medium: water or ethylene glycol and water mixtures up to a maximum of 30%. For operations with percentages of higher glycols or with different fluids, you must consult our technical service.

Medium temperature: -10°C/+60°C
Special executions for operations with lower or higher temperature fluids are available on request.

Air temperature: -20°C + 40°C.
Special versions are available for operations outside the standard range.

DESIGN – pump selection



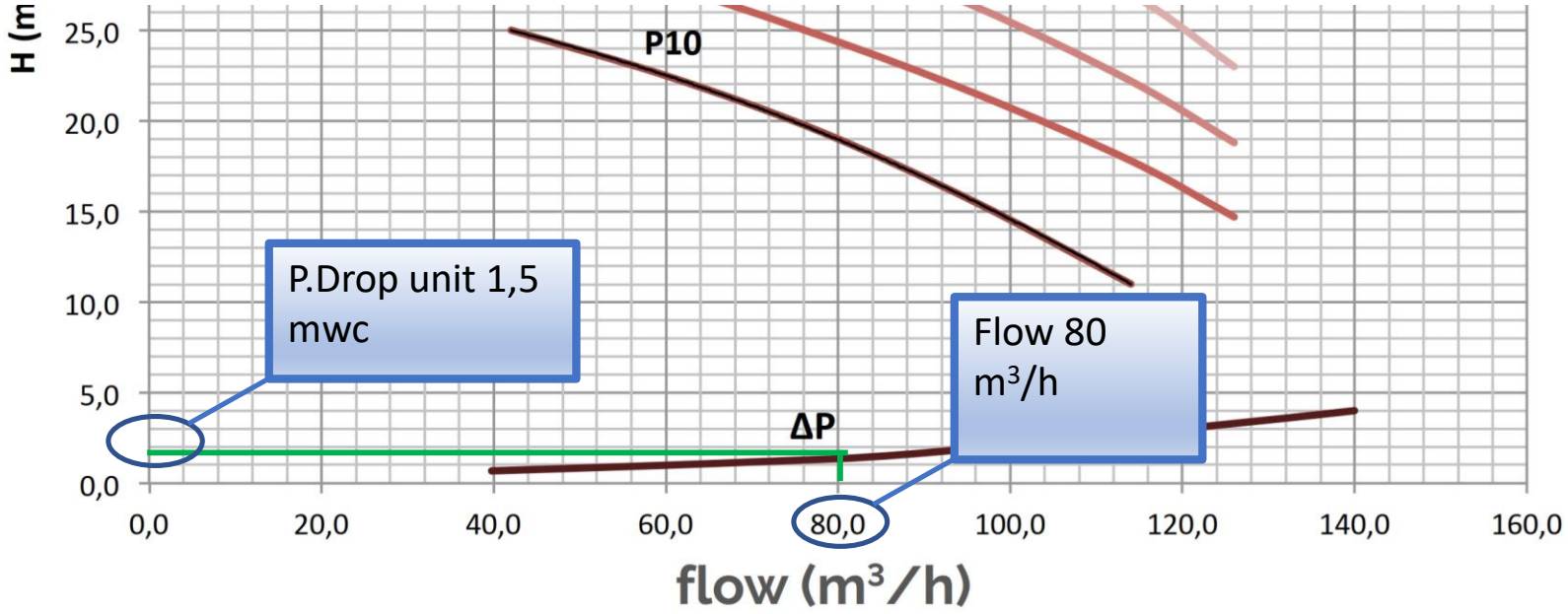
Pump P11 can provide 24,5 mwc head at a flow of 80 m^3/h

Medium: water or ethylene glycol and water mixtures up to a maximum of 30%. For operations with percentages of higher glycols or with different fluids, you must consult our technical service.

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DESIGN – pump selection



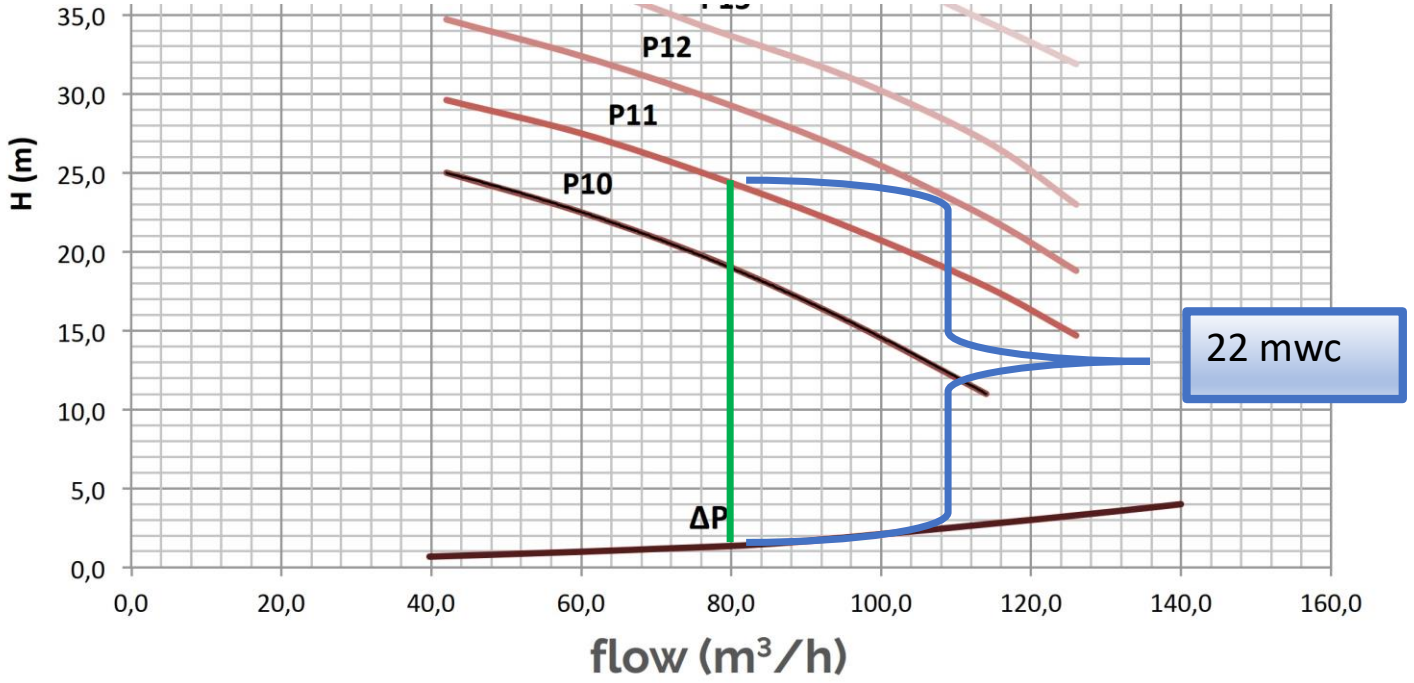
Unit introduce 1,5 mwc pressure drop at a flow of 80 m^3/h

Medium: water or ethylene glycol and water mixtures up to a maximum of 30%. For operations with percentages of higher glycols or with different fluids, you must consult our technical service.

Medium temperature: -10°C/+60°C
Special executions for operations with lower or higher temperature fluids are available on request.

Air temperature: -20°C + 40°C.
Special versions are available for operations outside the standard range.

DESIGN – pump selection



Kydronic kit gives
(24,5 – 1,5) = 22 mwc
Of head @ 80 m³/h

Medium: water or ethylene glycol and water mixtures up to a maximum of 30%. For operation with percentages of higher glycols or with different fluids, you must consult our technical service.

Medium temperature: -10°C/+60°C
Special executions for operation with lower or higher temperature fluids are available on request.

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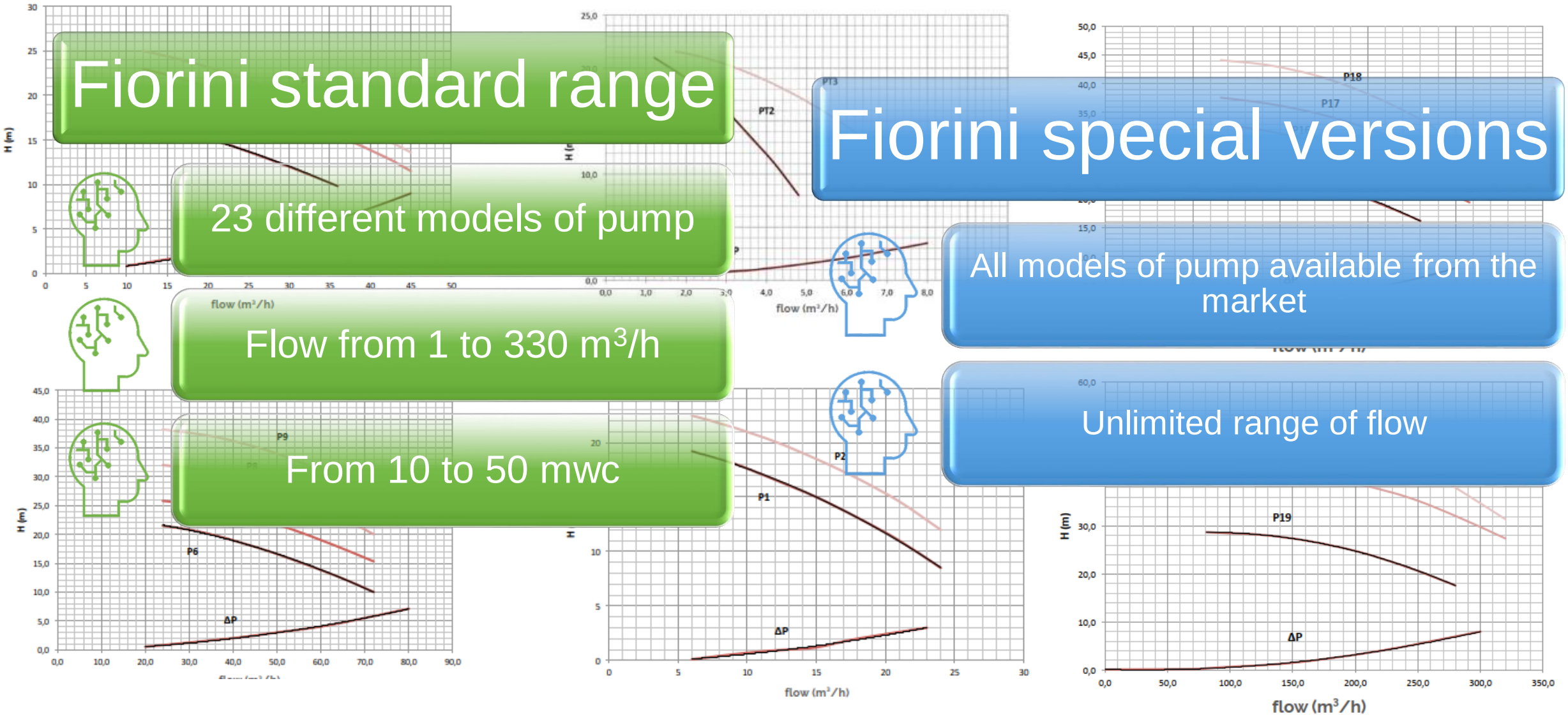
DESIGN – pump selection

Fiorini standard range

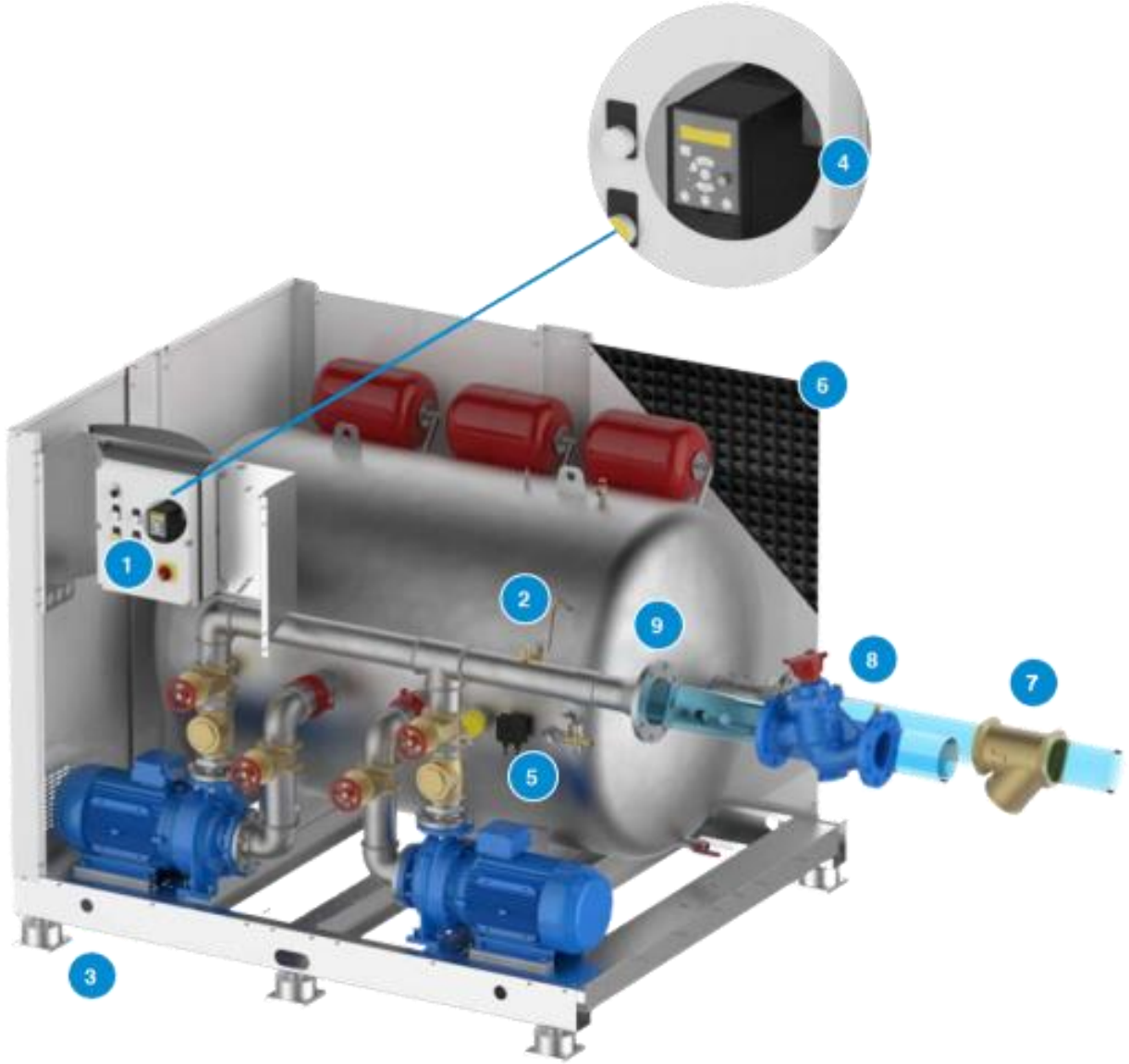
- 23 different models of pump
- Flow from 1 to 330 m³/h
- From 10 to 50 mwc

Fiorini special versions

- All models of pump available from the market
- Unlimited range of flow



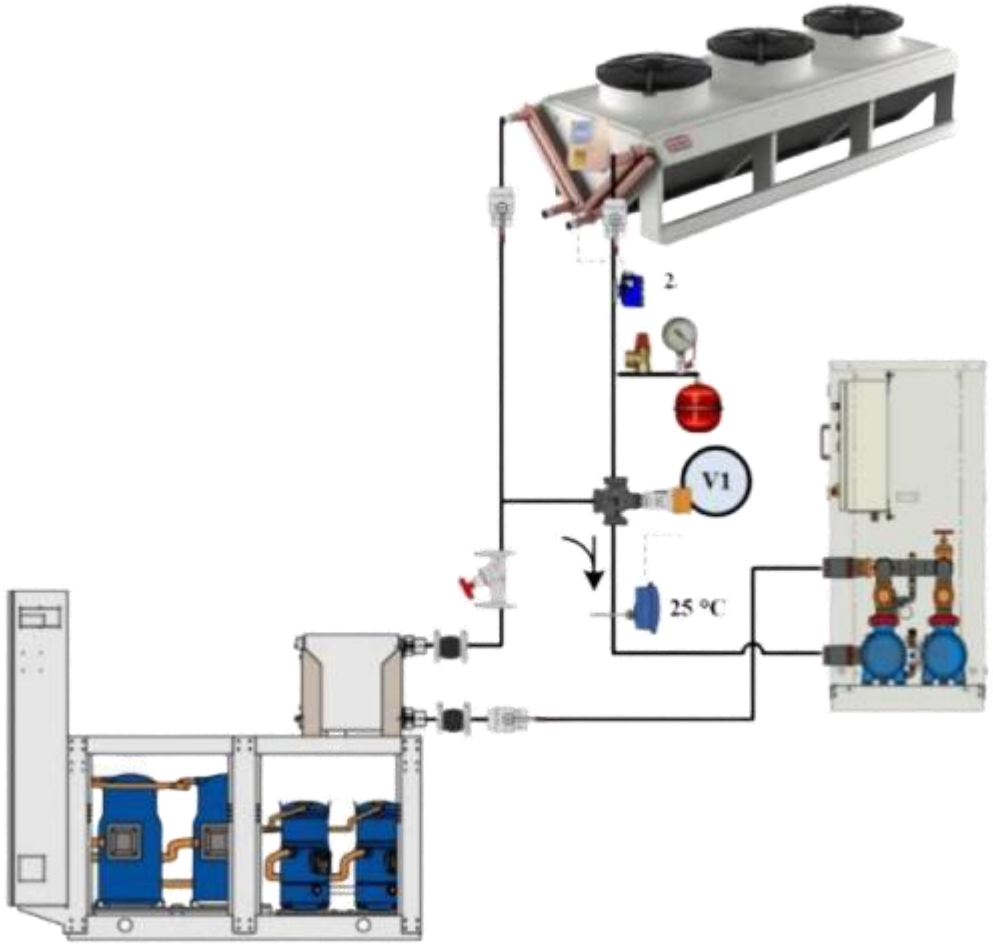
DESIGN - accessories



1. • Programmable timer for alternating pumps
2. • Differential pressure switch
3. • Anti-vibrating feet
4. • Inverter
5. • Antifreeze electric resistance kit
6. • Soundproof insulation
7. • Mesh filter
8. • Balancing valves
9. • Tailored connections

DESIGN - accessories

3 way mixing valve



Application

- Hydronic kit can be installed on the source side of a water cooled chiller in order to pump water from drycooler.

Purpose

- Regulate water inlet temperature in the chiller in order to avoid problem of regulation in it.

Advantage

- All in one solution complete with pump, 3 way mixing valve, motor, temperature regulator and all component necessary to complete a perfect istallation

100 % tested

DESIGN - Selection tool

Input data

PRODUCT:	HPT	
Fluids:	Glycol max 30%	
Volume:	1500	lt
Flow:	50	m^3/h
Head:	20	m.w.c.
No. Pumps:	2	num
Difference:	10%	

	Accessories:
	Anti Freeze Electric Heater
	Differential pressostat
X	Timer for automating working pump changing
	Anti vibration feet
	Mesh Filter
X	Inverter
	Double ring execution

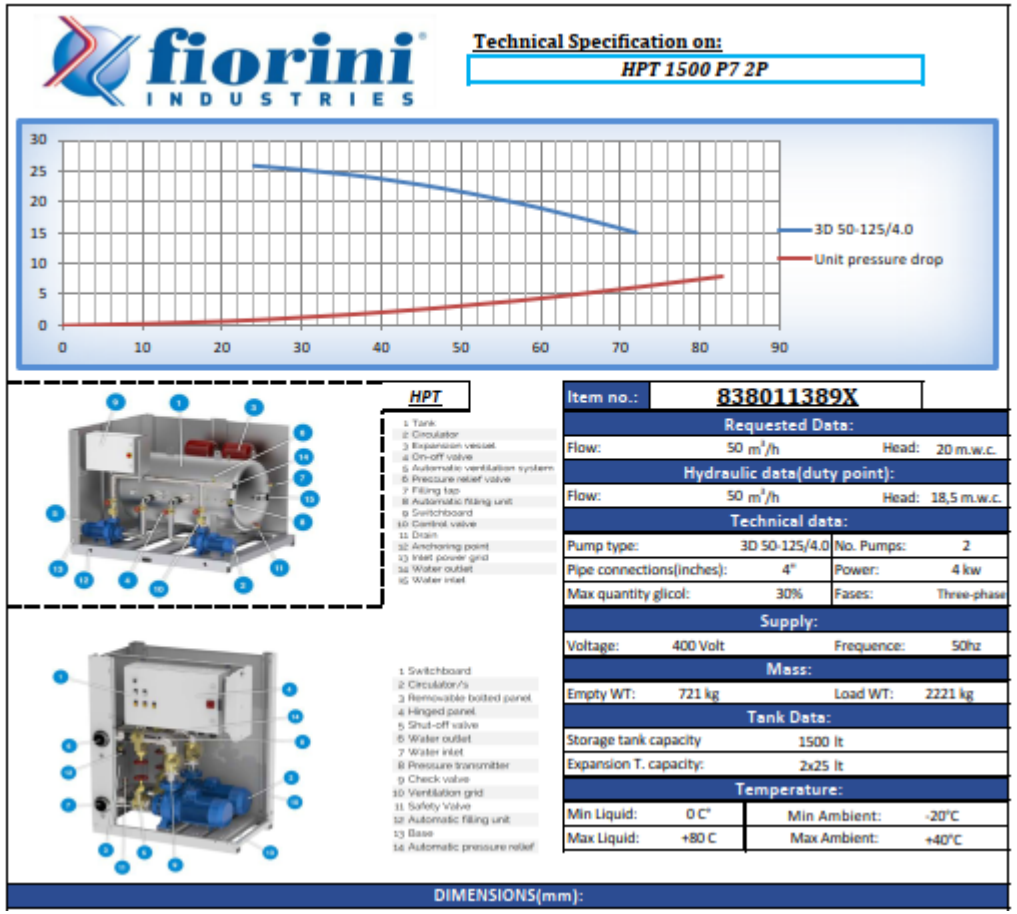
NOTE: If you want to add an accessory please put the x in the first column

Language:	ENG

Min Flow for this case	24
Max Flow for thi case	236

DESIGN - Selection tool

Complete data sheet – page 1



fiorini INDUSTRIES

Technical Specification on:

HPT 1500 P7 2P

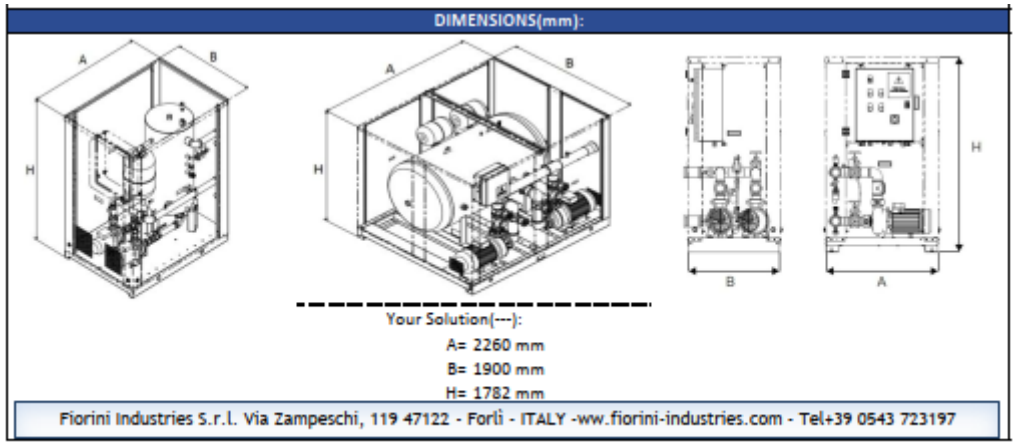
HPT

1 Tank
2 Circulator
3 Expansion vessel
4 On-off valve
5 Automatic ventilation system
6 Pressure relief valve
7 Filling tap
8 Automatic filling unit
9 Switchboard
10 Control valve
11 Drain
12 Anchoring point
13 Inlet power grid
14 Water outlet
15 Water inlet

1 Switchboard
2 Circulator/s
3 Removable bolted panel
4 Hinged panel
5 Shut-off valve
6 Water outlet
7 Water inlet
8 Pressure transmitter
9 Check valve
10 Ventilation grid
11 Safety Valve
12 Automatic filling unit
13 Base
14 Automatic pressure relief

Item no.:	838011389X		
Requested Data:			
Flow:	50 m³/h	Head:	20 m.w.c.
Hydraulic data(duty point):			
Flow:	50 m³/h	Head:	18,5 m.w.c.
Technical data:			
Pump type:	3D 50-125/4.0	No. Pumps:	2
Pipe connections(inches):	4"	Power:	4 kw
Max quantity glicol:	30%	Fases:	Three-phase
Supply:			
Voltage:	400 Volt	Frequence:	50hz
Mass:			
Empty WT:	721 kg	Load WT:	2221 kg
Tank Data:			
Storage tank capacity	1500 lt		
Expansion T. capacity:	2x25 lt		
Temperature:			
Min Liquid:	0 C°	Min Ambient:	-20°C
Max Liquid:	+80 C	Max Ambient:	+40°C

DIMENSIONS(mm):



DESIGN - Selection tool

Complete data sheet
page 2



Technical Specification on:

HPT 1500 P7 2P

PRODUCT DESCRIPIONTS:

Item no.: **838011389X**

Technical Description:

HPT units are hydraulic stations intended for installation in air conditioning and cooling plants, developed to cut down on installation times and be combined wuth any water chillers.

Factory fitted unit consisting of:

- Double centrifugal pumps with ball valves MODEL ------- 3D 50-125/4.0
- Control panel providing alternated pump switch at every start, auxiliary pump activation in the event of a pump failure, thermal protection, operating pump alarm, protection level IP56
- Safety valve
- Air bleeder
- Pressure gauge
- Inlet/outlet valve
- Galvanized steel base with paint finish
- Self-supporting frame suitable for open-air installations.
- Expansion vessel

Accessories Descriptions:

Timer for automating working pump changing: (available only for double pump version), HPT and HP double pump automatically change the working pump at every start. In case of unit working continuously 24 h a day and 7 day per week, it is necessary a timer to switch the working pump.

---Inverter: installed on the electric box, wired to the pump and to pressure sensor installed on the discharge of the pump. Pressure sensor are assembled and wired on factory. Inverter will be programmed in order to have constant pressure on the discharge side of the pump.

Focus on High-efficiency pumps with EC motor

Directive 2009/125/EC

- Starting from 2011 big changings in pump motors were required by the regulation
- Starting from 1st January 2017 practically all pumps used in HVAC system needs to be equipped by motor with efficiency index IE≥3
- Once again environmental regulation represents boost to research and development of new product



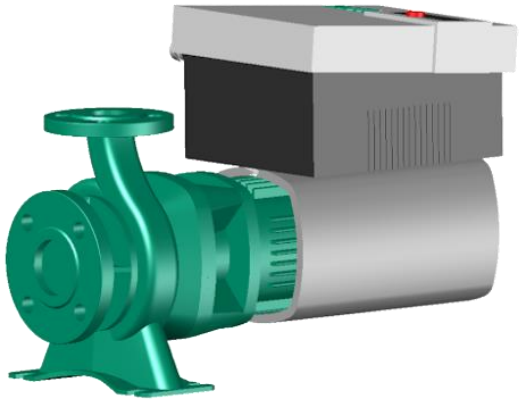
Focus on High-efficiency pumps with EC motor



Asynchronous motor

AC electric motor

Traditional electric motor where rotation is induced by rotation of magnetic fields. Brushes are necessary to generate rotation of magnetic fields



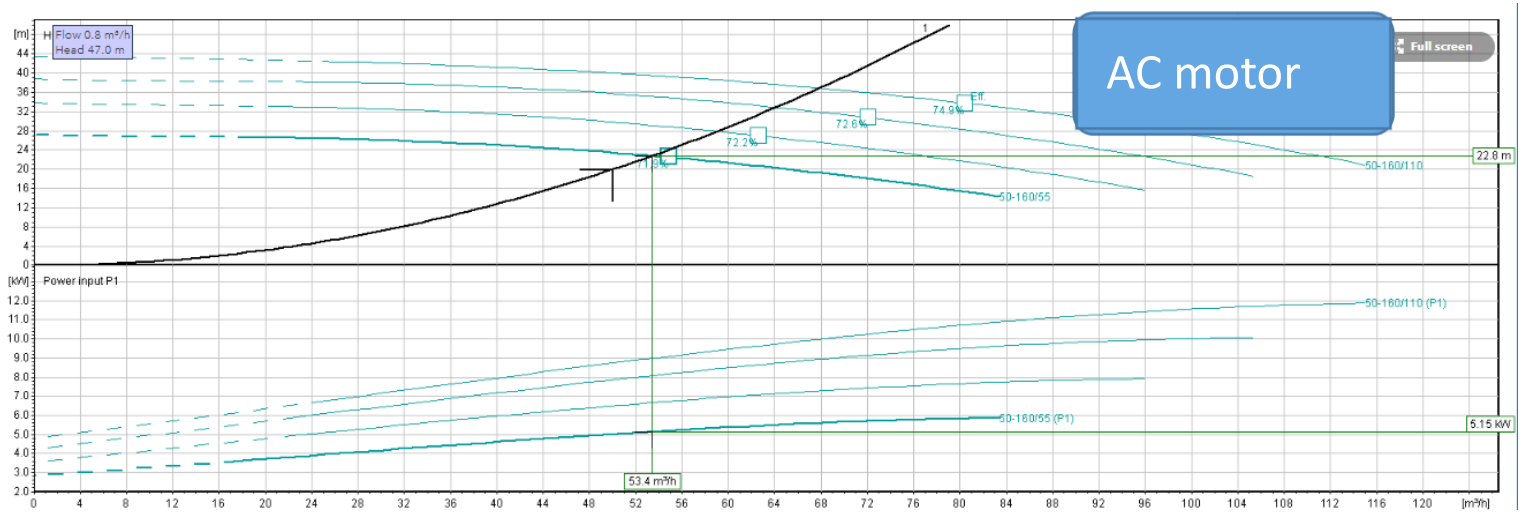
EC motor (electronically communicated)

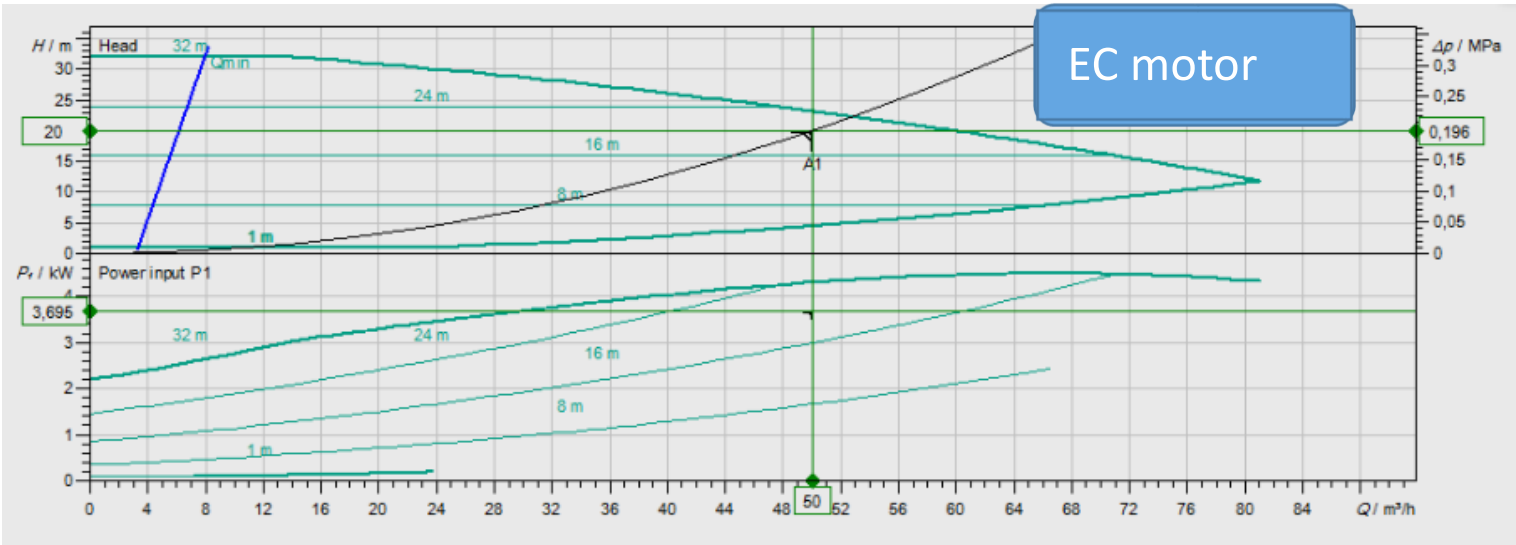
The rotor contains permanent magnets

Stator has a set of fixed windings

Electronic board switches the phases in the fixed windings to keep the motor turning

Focus on High-efficiency pumps with EC motor



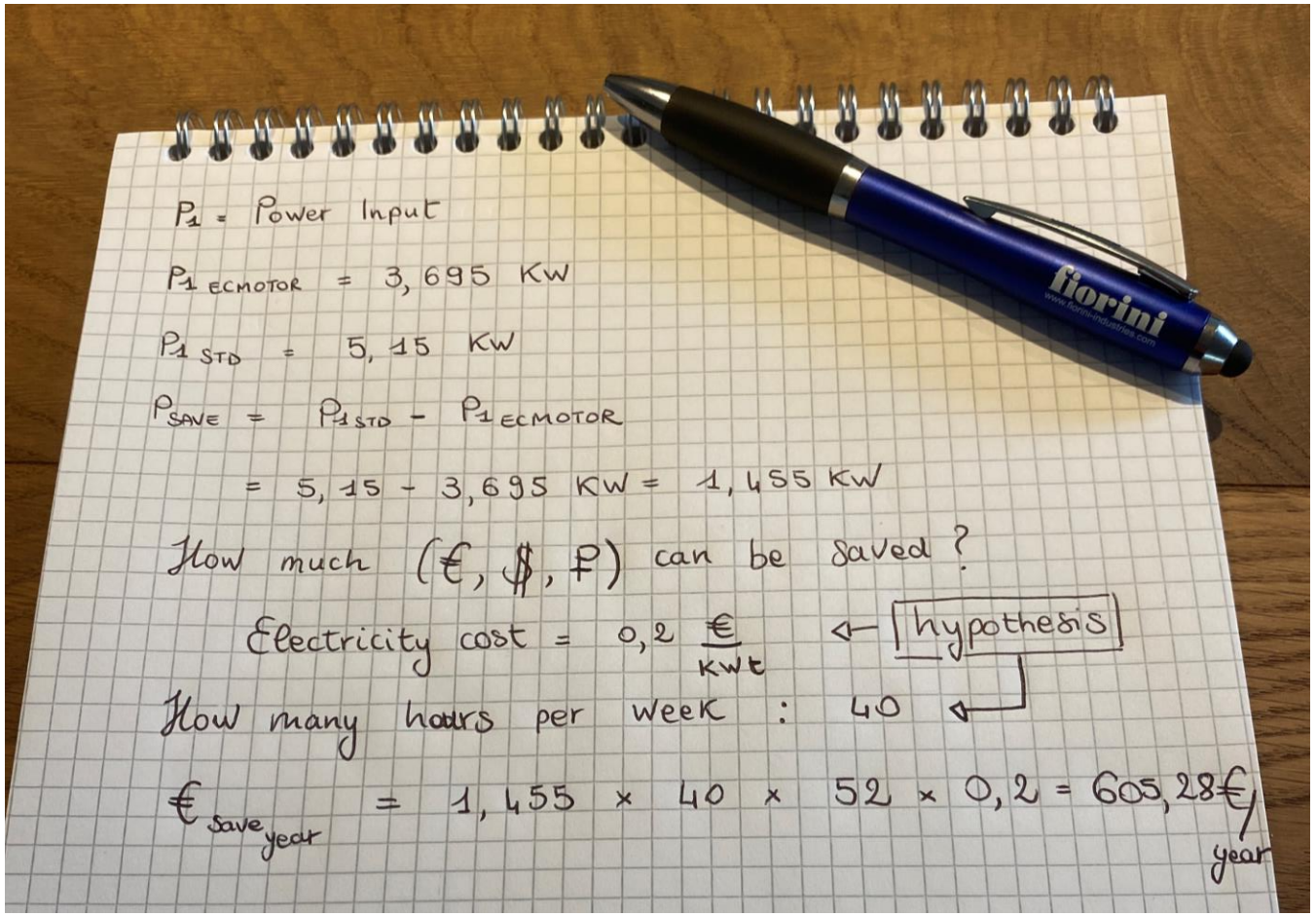


Example of selection: 200 kPa@50 m^3/h

AC traditional pump: P1=5,15 kW

EC pump P=3,695 kW

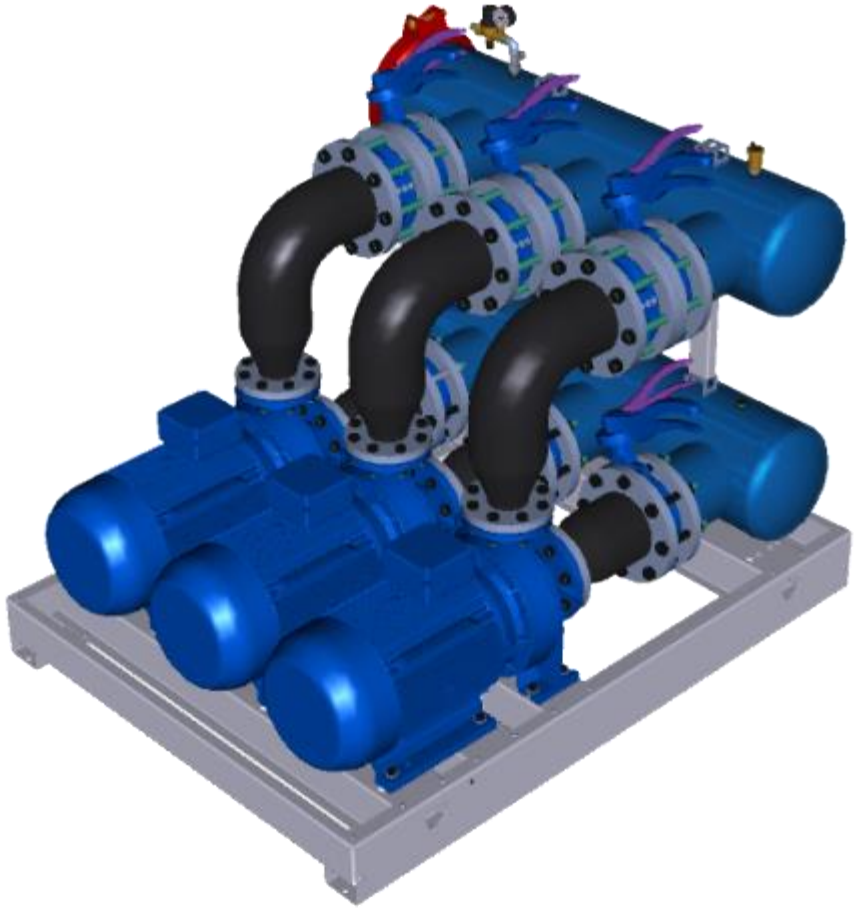
Focus on High-efficiency pumps with EC motor

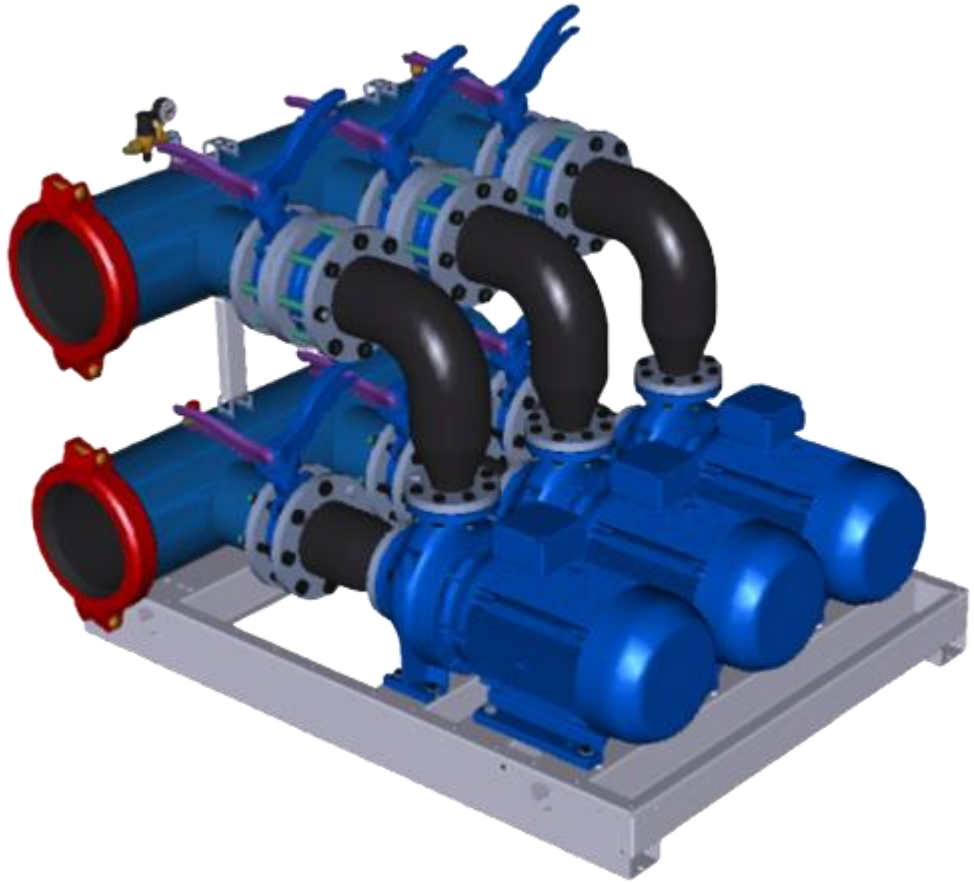


What does energy efficiency mean?

Examples of bespoken execution

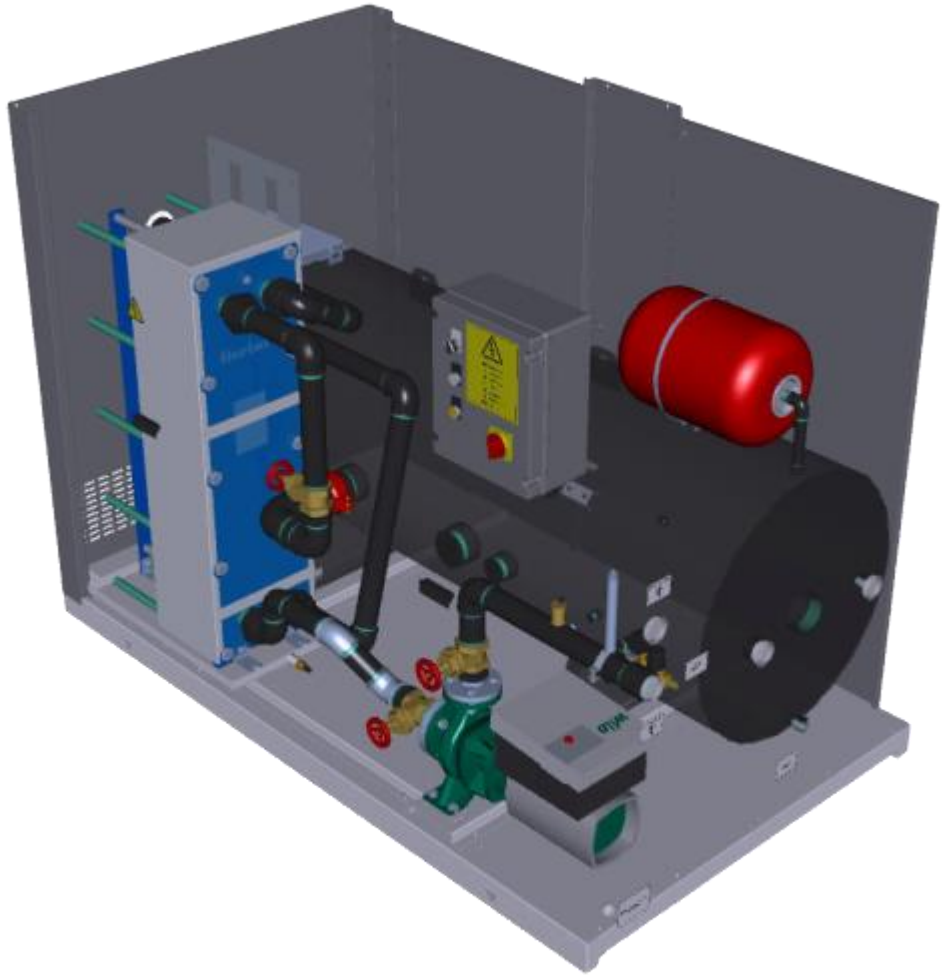
Multi-pumps module

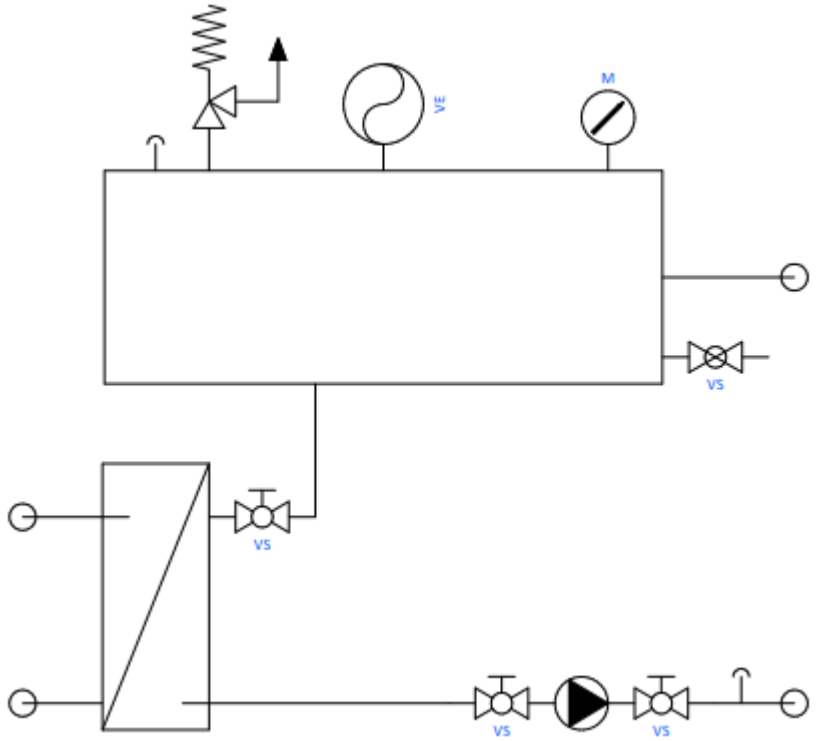




Examples of bespoken execution

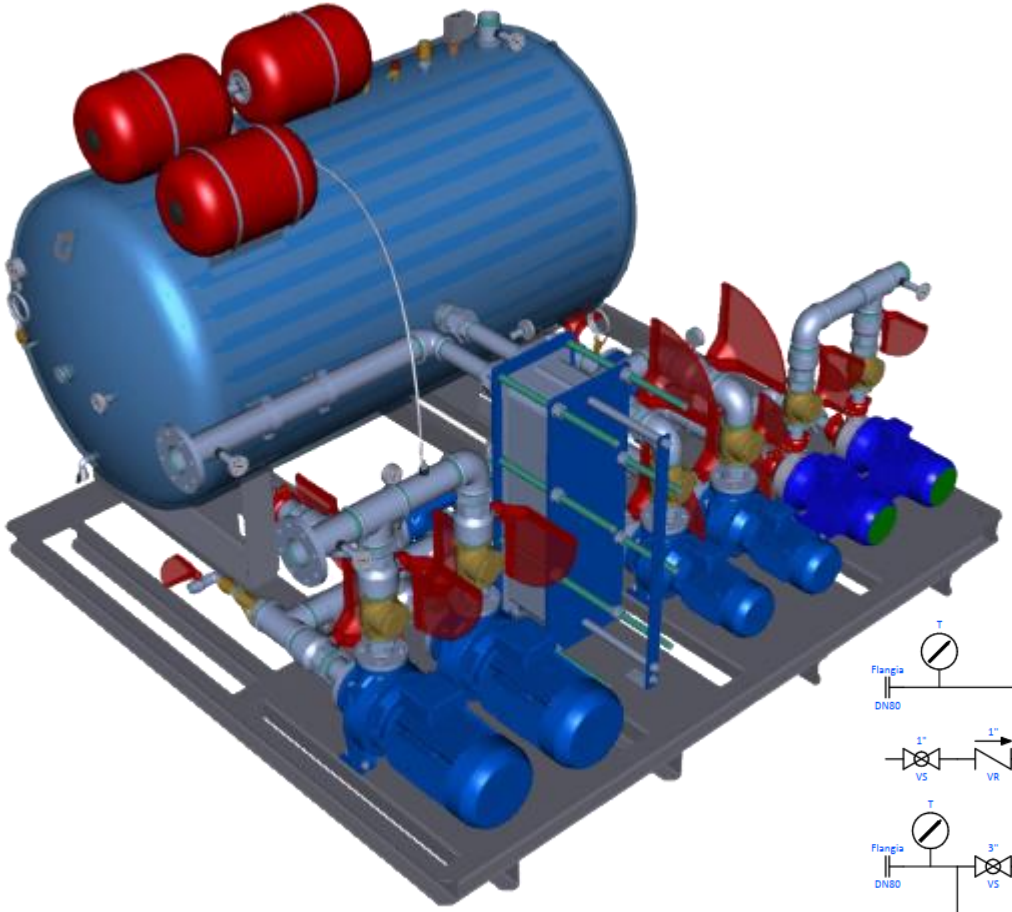
Free cooling station with heat exchanger, pump and tank

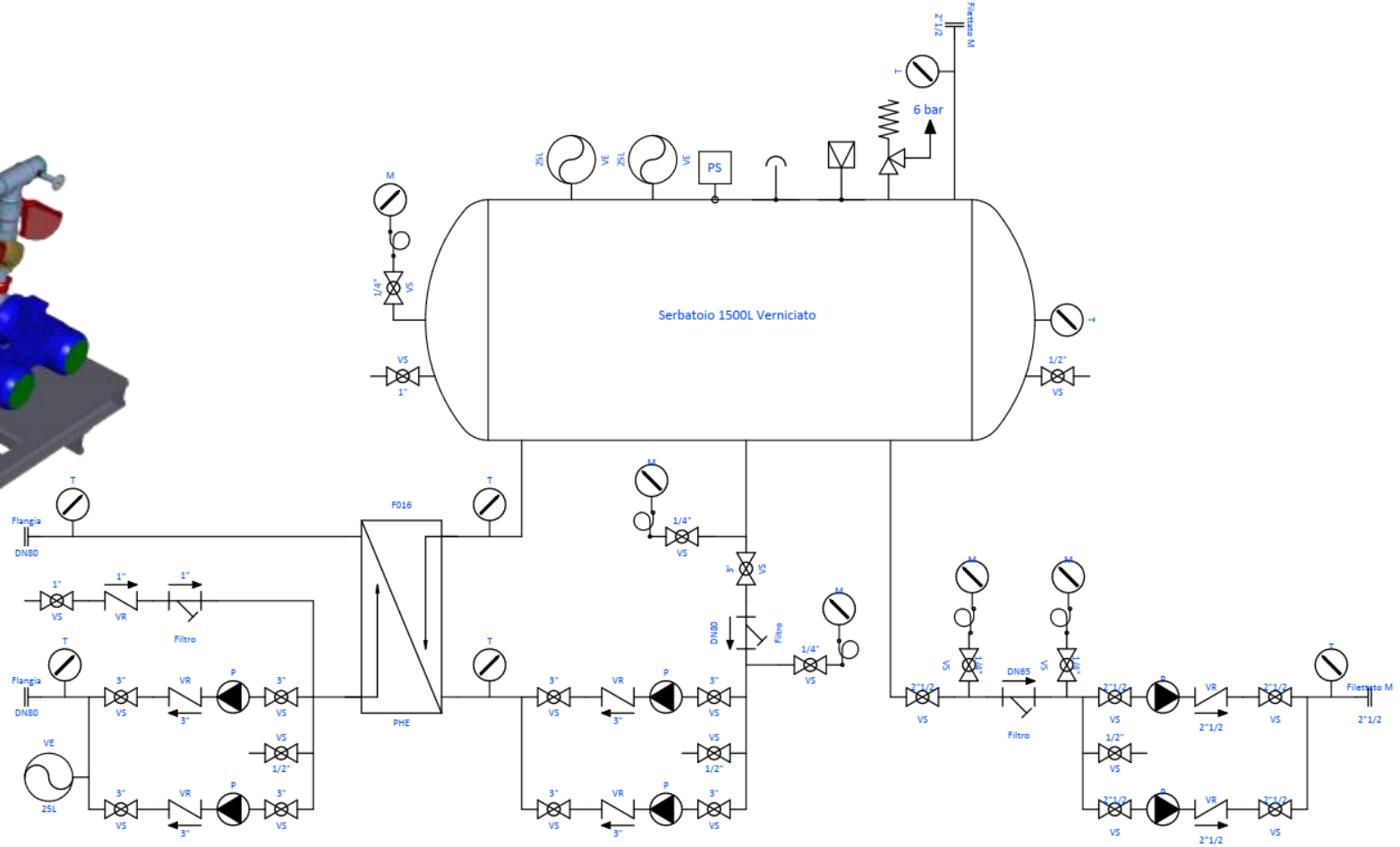




Examples of bespoken execution

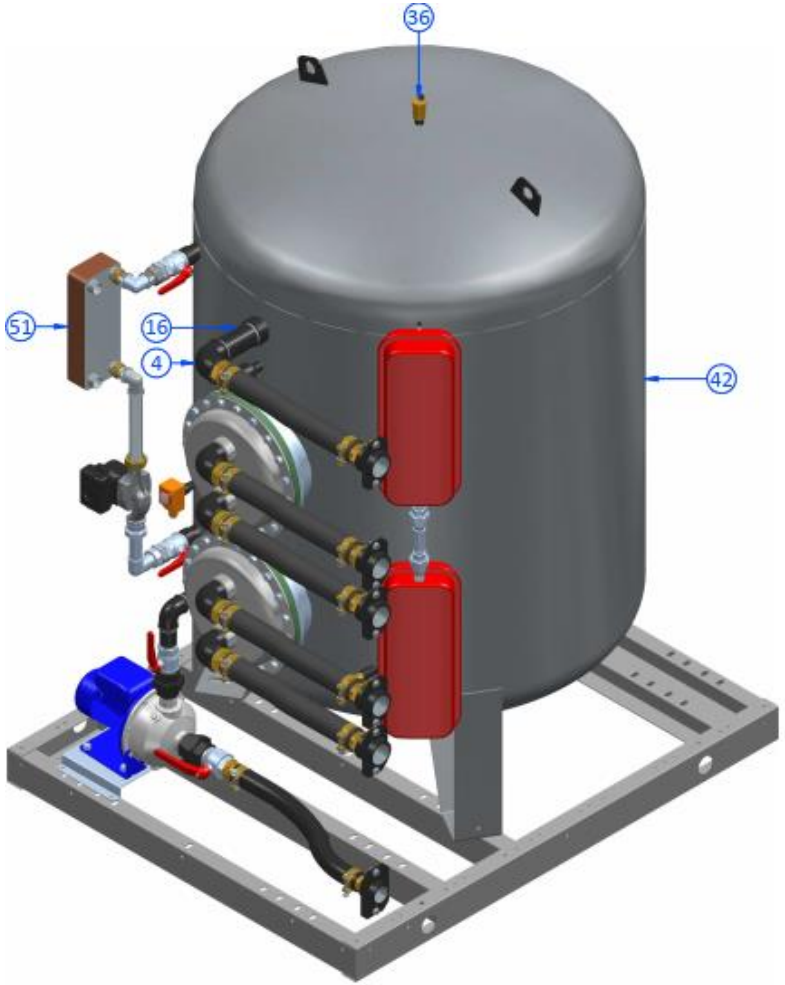
Multi-pumps, tanks, heat exchanger module

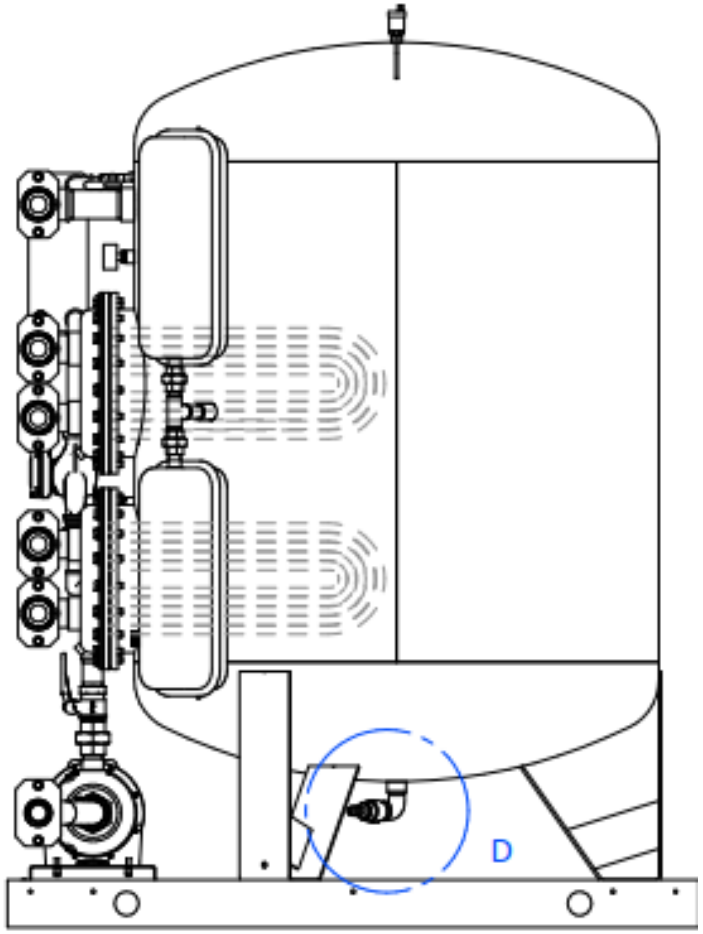




Examples of bespoken execution

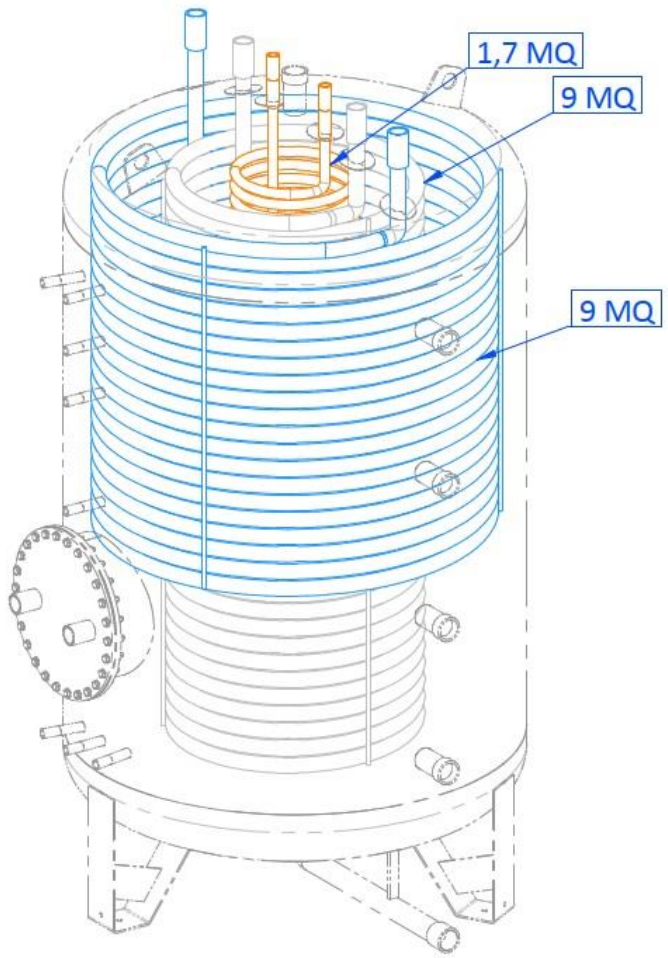
Heat recovery

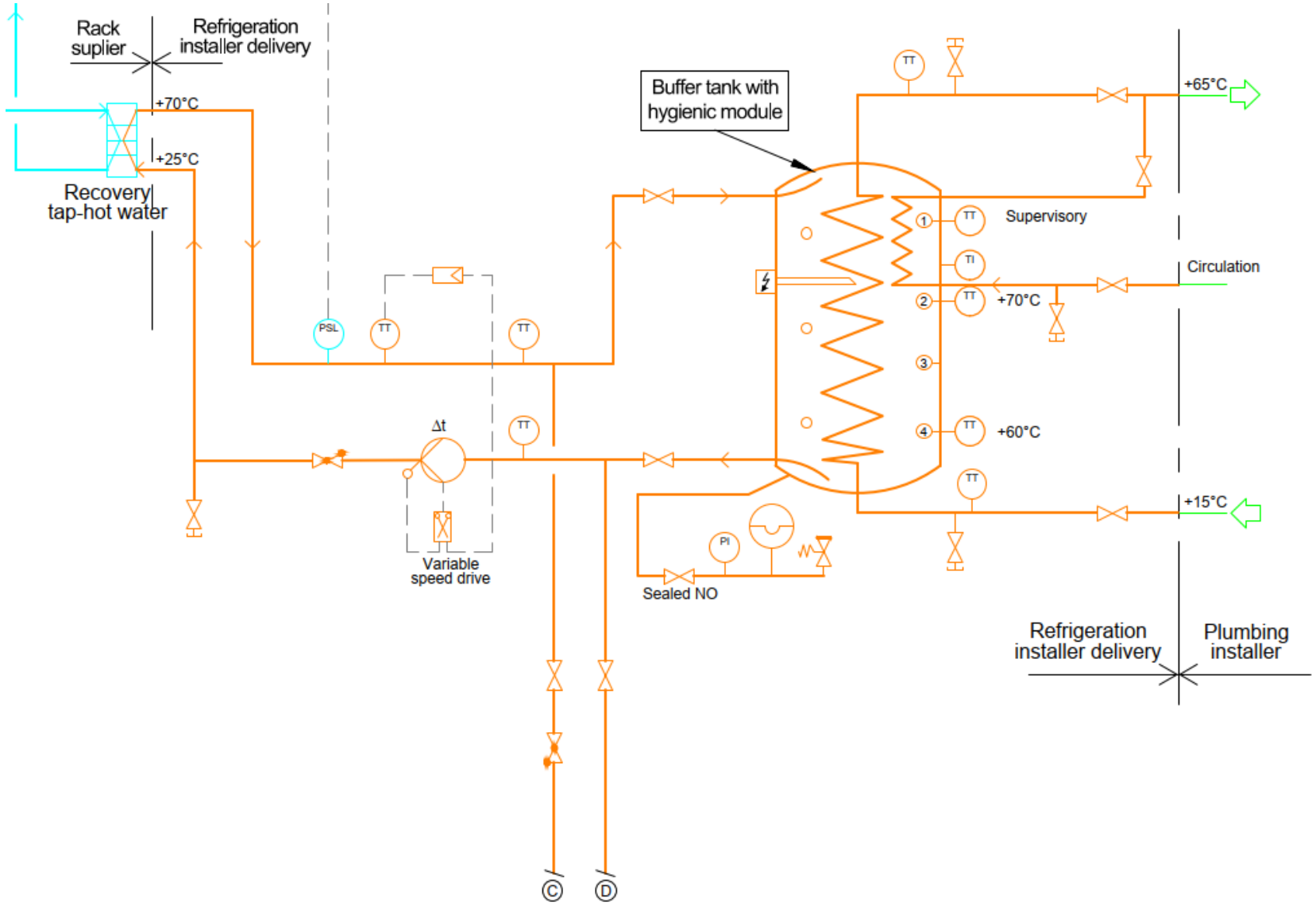




Examples of bespoken execution

Heat recovery





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Thursday the 7th May 2020

Ing. Massimiliano Marrughi
Technical Manager

Reading in Italian language