

Baelz Online Seminar



Steam Technology

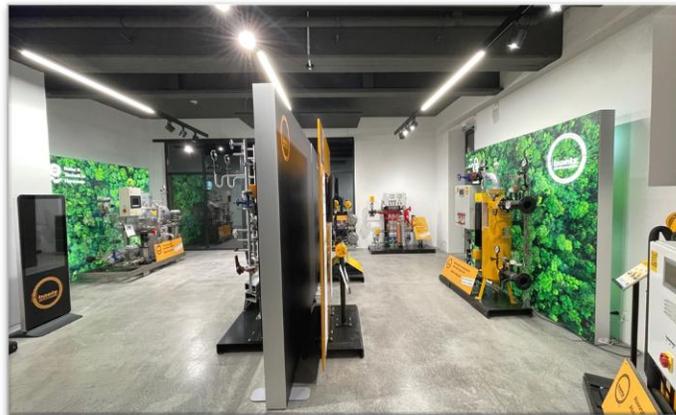


- Founded in 1896
- Family-owned German company in 4th generation
- Managing Directors Andrea and Florian Baelz
- ~ 160 employees
- Manufacturer of components and systems for **heating** and **cooling** applications

Baelz in Germany



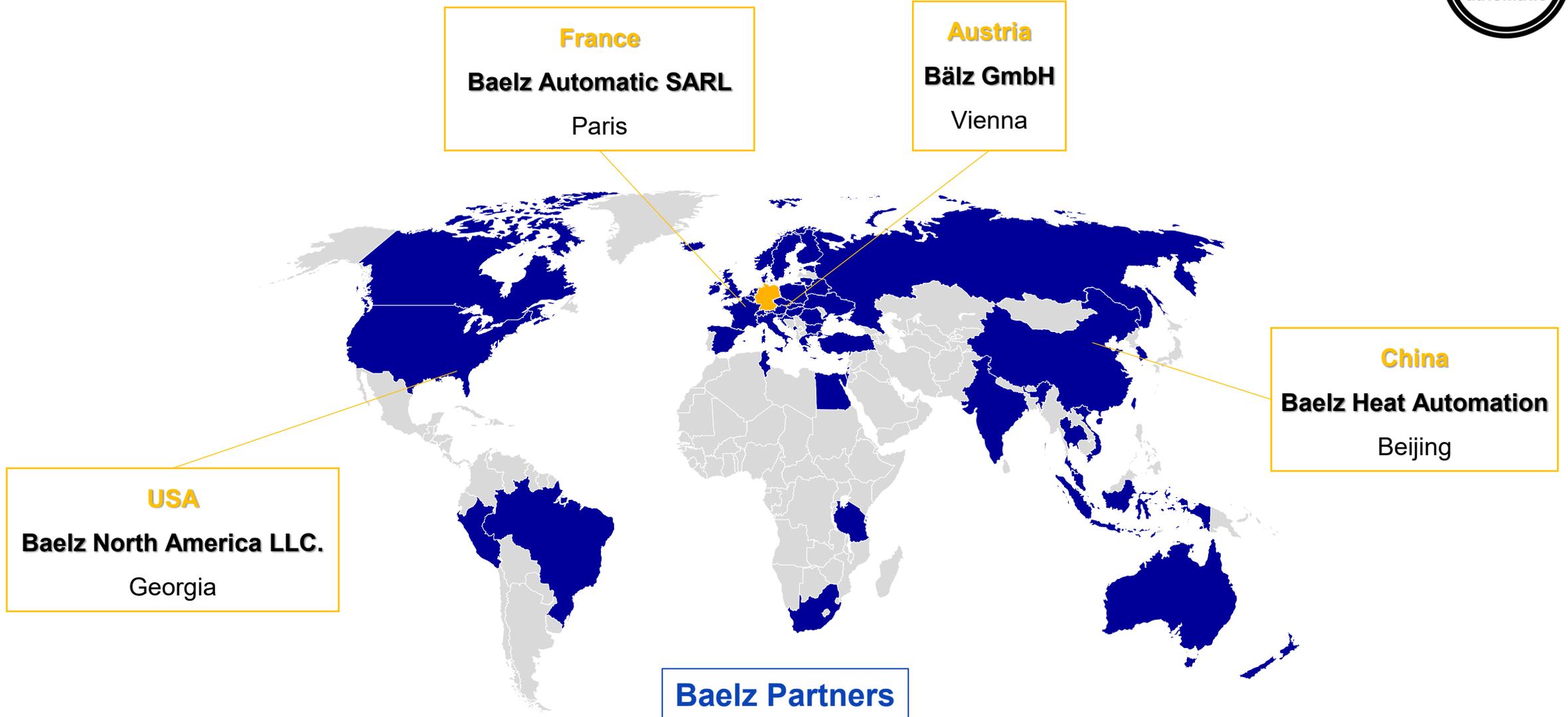
Headquarter
Heilbronn



Production Facility
Siegen



Production Facility
Heilbronn-Biberach

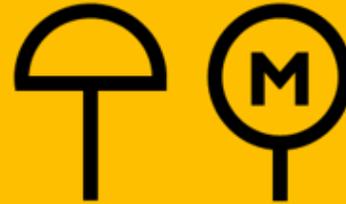




Control Valves



Ejectors



Valve Actuators



System Solutions



Controllers / PLC



Heat Exchangers



Building Control Systems



Absorption Chillers

Baelz in a nutshell



Baelz Control Valves – engineered and produced in Heilbronn



Baelz Control Valves – engineered and produced in Heilbronn



• Valve Series for 2-Way-Applications

- baelz 185
- baelz 192
- baelz 334
- baelz 340
- baelz 344
- baelz 346
- baelz 356
- baelz 358
- baelz 359
- baelz 360

Standard-Valve Series **baelz 340**

- Standard-2-Way-Valve
- Steel Housing
- DN15 – DN300 / PN16 – PN40



Standard-Valve Series **baelz 342**

- Standard-3-Way-Valve
- Steel Housing
- DN15 – DN125 / PN16 – PN40



• Valve Series for 3-Way Applications

- baelz 335
- baelz 342
- baelz 347
- baelz 353
- baelz 354

Standard-Valve Series **baelz 185**

- Standard-Valve for condensate control applications or other minimum-flow applications
- Stainless Steel Housing
- DN15 – DN25 / PN40



[Control valves](#)



Baelz System Solutions – handcrafted for your application



Baelz Showroom Heilbronn: We are happy to welcome you anytime!



Steam Terminal Luxese®



Absorption Chiller Biene®



Heating Distributor Hydropilot®



Steam Generator / Steam Terminal®



Controlled Ejection Valve



Components and System Solutions

WELCOME TO BAE LZ

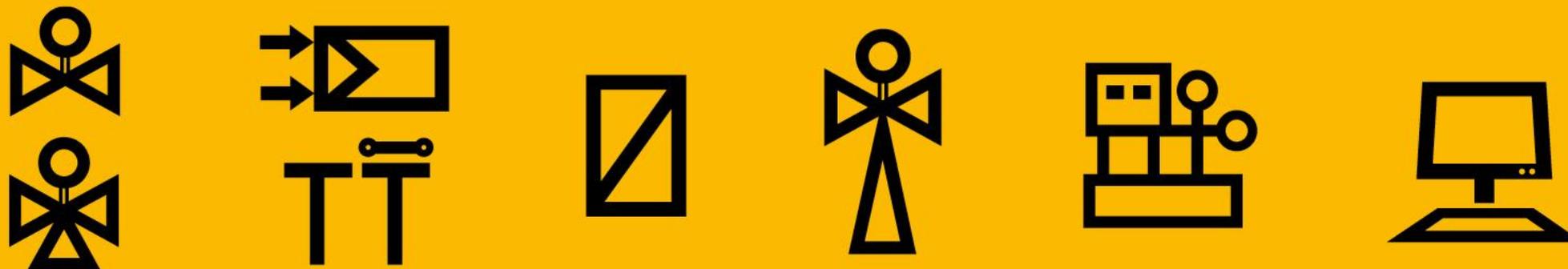


BAELZ
SEIT
189%

**INNOVATIV
NACHHALTIG
FAMILIÄR**

Use the chat to
ask your
questions!

We will answer
them live.



Want to save energy? Baelz offers solutions.

Fundamentals of Steam Technology – Online Seminar

Symbols in Steam Technology



Pneumatic control valve



Sliding support for pipeline assembly



Operating unit and venting



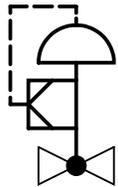
Electric control valve



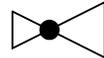
Fixed support for pipeline assembly



Safety valve



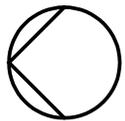
Electro-pneumatic control valve



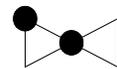
Pressure reducing valve
Reduced pressure on the right



Sight glass



Pump



Check valve



Dirt trap



Heat exchanger primary & secondary separate



Steam trap



Steam dryer

Enthalpy of Water and Steam



To heat 1 kg of water from 0 °C to 100 °C (at atmospheric pressure), 417.5 kJ of energy are required

sensible heat



If further energy is added, the water evaporates. Until it has completely evaporated, the water and steam remain at 100 °C.

The evaporation of water (100 °C) to saturated steam (100 °C) requires 2257.9 kJ of energy

latent heat

The total enthalpy in 1 kg saturated steam (at atmospheric pressure) is 2,675.4 kJ.

For enthalpies, condensation points, steam volumes etc depending on pressure, refer to steam tables

1 bar saturated steam

- If 1 kg of water is heated from 0 °C to 99.6 °C at 1 bar abs (atmosphere), 417.5 kJ enthalpy of water h' is needed.
- If the water is now further heated to 100 °C, an additional 2257.9 kJ of heat of evaporation Δh_v is required.
- This means that a total enthalpy of 2680 kJ for saturated steam generation at 1 bar is necessary.

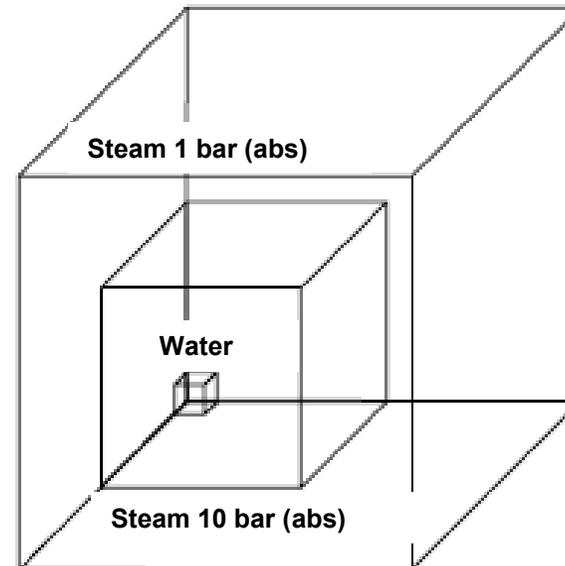
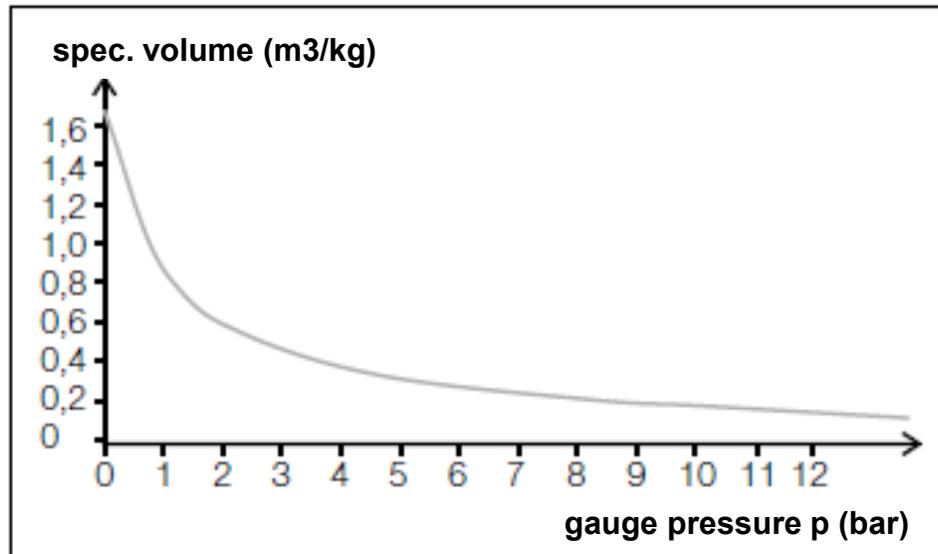
10 bar saturated steam

- If 1 kg of water is heated from 0 °C to 179.9 °C at 10 bar abs (atmosphere), 763.0 kJ enthalpy of water h' is required.
- If the water is now further heated to 180 °C -> another 2013 kJ evaporation heat Δh_v is required.
- This means that we need a total enthalpy of 2776 kJ for saturated steam generation at 10 bar.

Volume Expansion of Water vs. Steam / Pressure Ratios



- In the case of water, water vapor of the same temperature is produced at a boiling temperature of 100 °C and 1 bar pressure.
- At the same time, the volume increases enormously: **1 litre of water becomes 1667 litres of water vapor at normal pressure.**
- Volume of water (1 kg): 1 l
- Volume of saturated steam (1 kg) at 10 bar abs: 240 l
- Volume of saturated steam(1 kg) at 1 bar abs: 1667 l



Different types of steam



There are 3 types of steam:

- **Saturated steam:**

Saturated steam is assumed to be "dry", i.e. it does not contain water droplets.

- **Wet steam:**

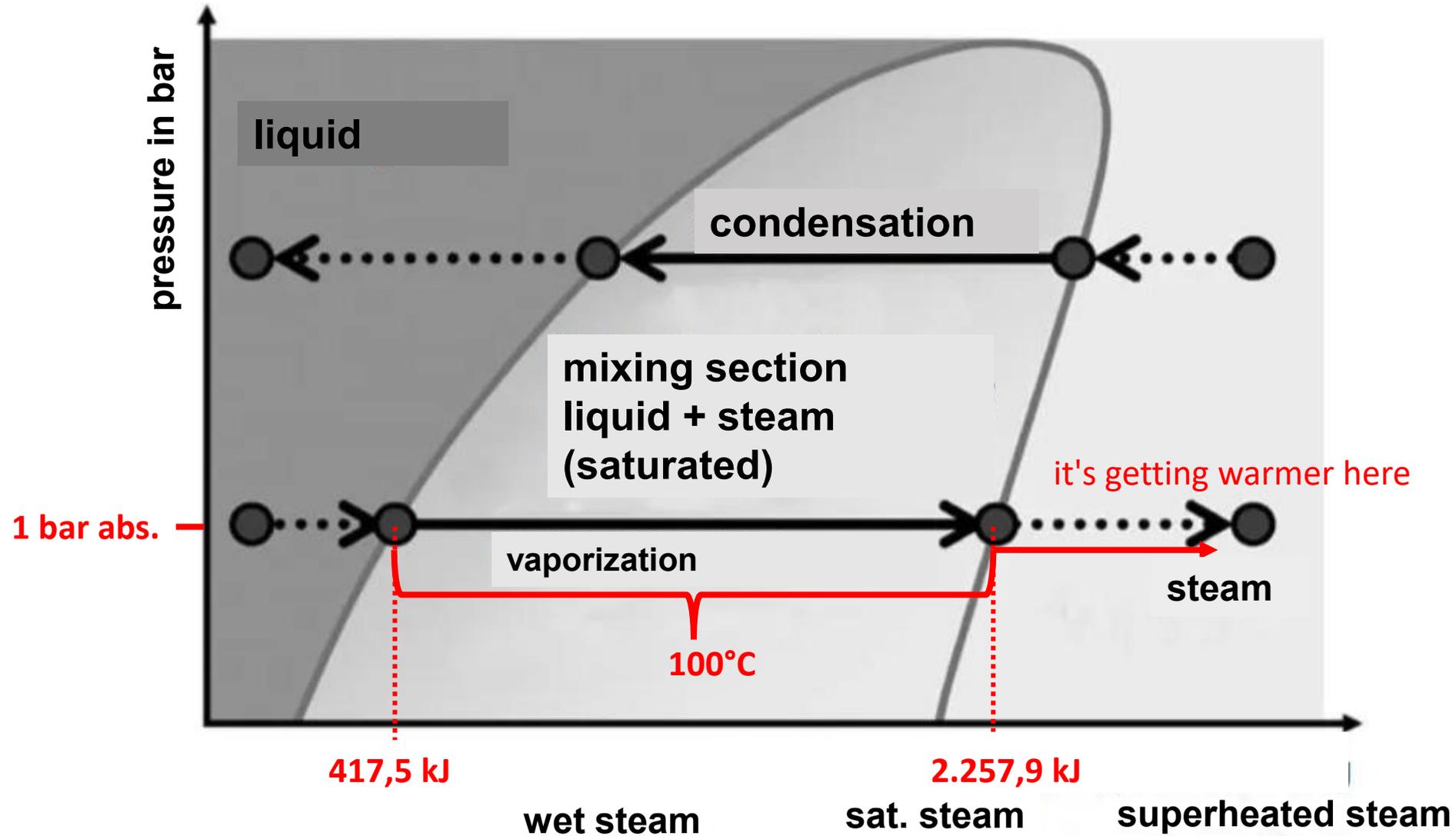
In practice, steam is usually a little "moist", i.e. it contains entrained water particles.

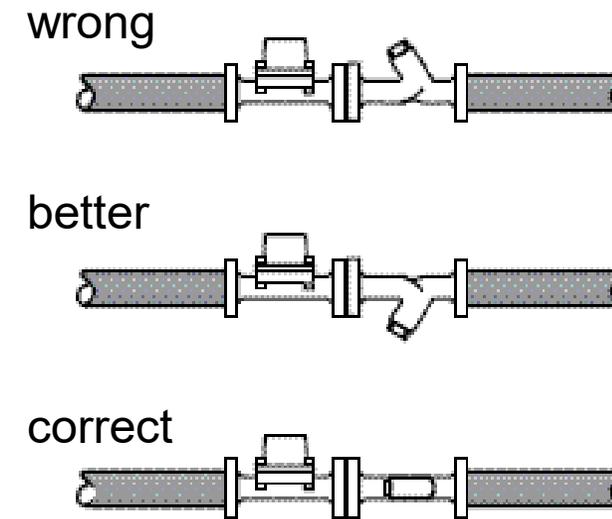
- **Superheated steam:**

If the steam coming out of the boiler is separated from the water and further heat is added to it, the water that is carried along first evaporates: the steam becomes dry.

As soon as all the water has evaporated out of the steam, adding further thermal energy to it leads to an increase in temperature: the steam is "overheated".

Types of Steam





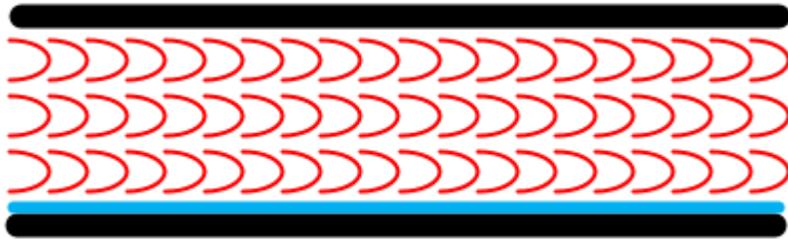
- Ductile iron (cast steel from PN 25) preferred
- Grey cast iron susceptible to steam hammer and other loads
- Schematic installation position of strainers (flow direction from right to left)

All installations must comply with at least the pressure class PS and the maximum temperature TS!

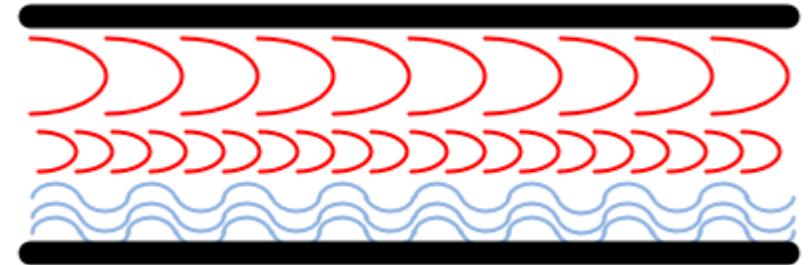
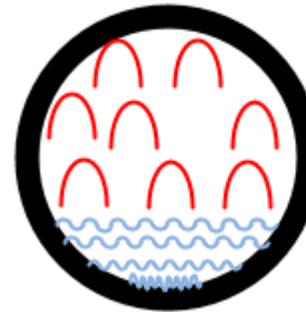
Pipe Dimensioning



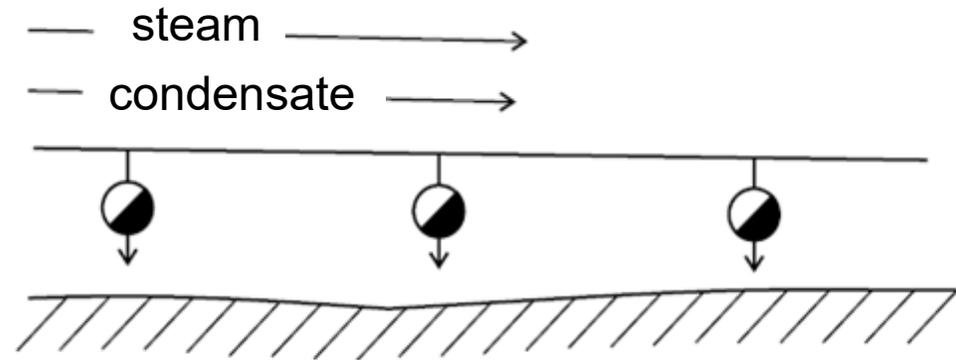
- Steam velocity in saturated steam pipes: $20 \text{ m/s} < v < 30 \text{ m/s}$
- Steam velocity in superheated steam pipes: $v < 45 \text{ m/s}$
- Flow velocity of condensate: $v < 0,5 \text{ m/s}$



- Schematic representation of a steam pipe / cross section
- Minimal condensation from the steam

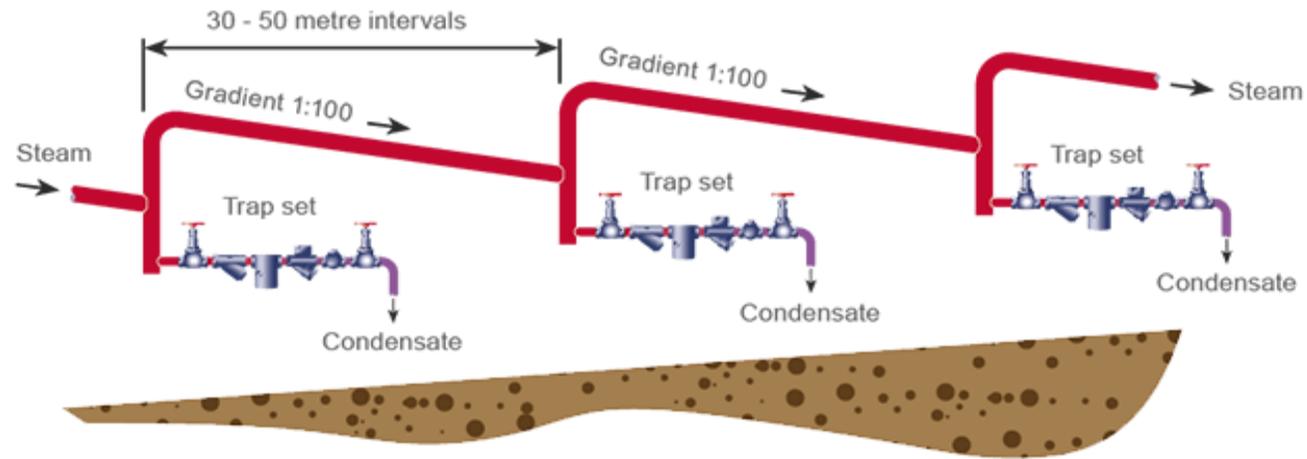


- Schematic representation of a condensate line with secondary evaporation



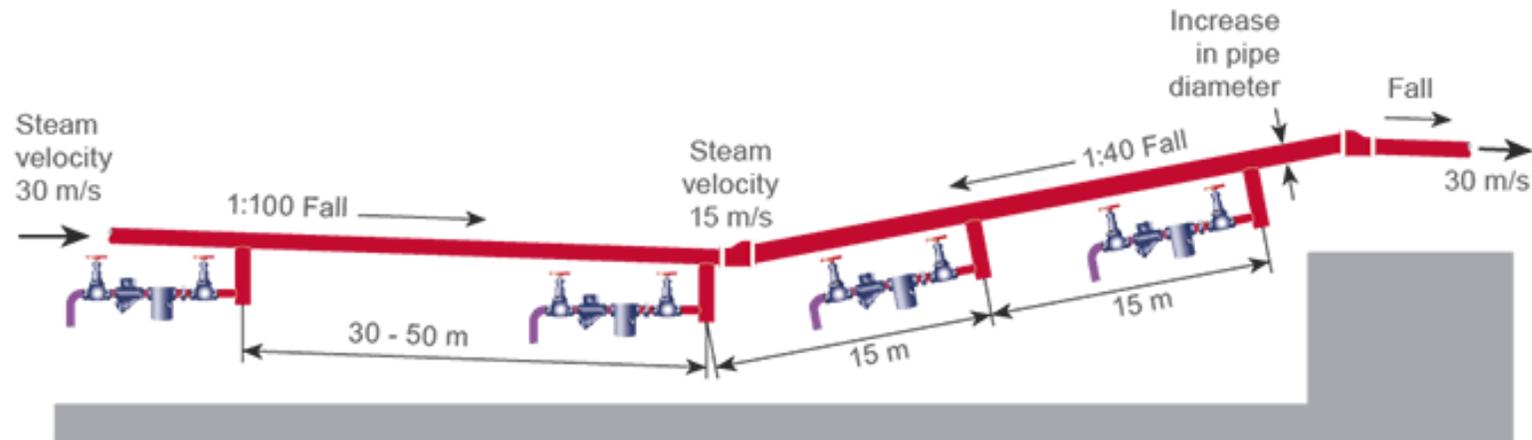
In general, steam pipes should:

- always be laid falling to the lowest/drainage point
- be laid at a defined flow direction falling in 1:200
- if the flow direction is not defined, fall in the direction of flow at a ratio of 1:200 and rise in the counter-current at a ratio of 1:100
- Note the flow velocity! Max.< 20 m/s



In general, steam pipes should:

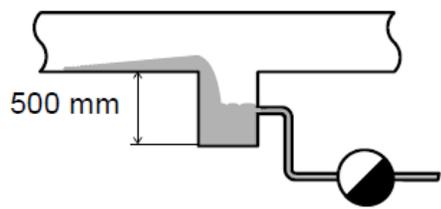
- be laid with a gradient of more than 1:100
- not be laid without a drained low point and, in the case of saturated steam pipes, be laid in steps when gradients are to be overcome.



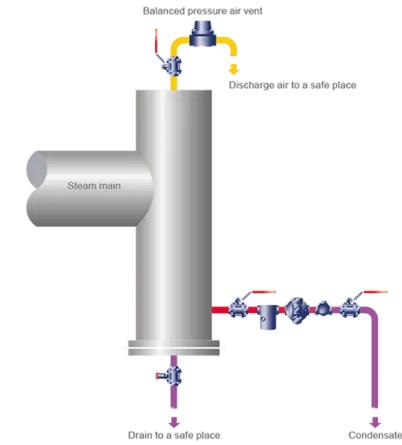
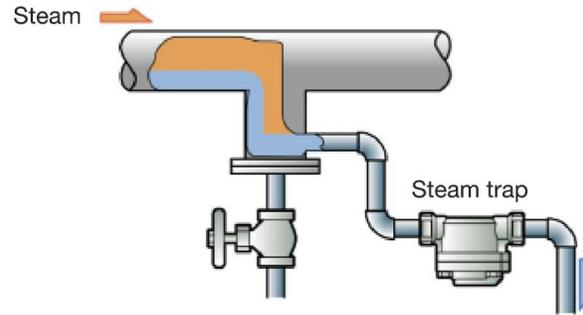
In general, steam pipes should:

- be provided with eccentric line reduction.
- allow condensate produced in the steam pipes to be extracted from the steam pipe from above.

Pipe Routing, Drainage

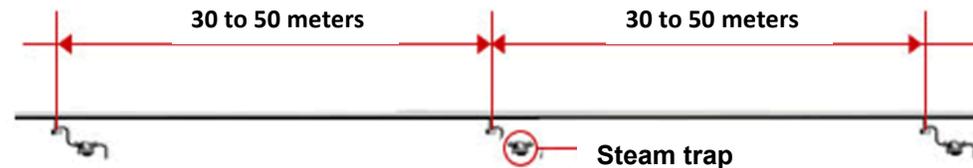


correct



D ₁	DN	50	65	80	100	125	150	200	250	300	350	400	450	500	600
D ₂	DN	50	65	80	80	80	100	150	150	200	200	200	250	250	250
L	mm	≥ 250													

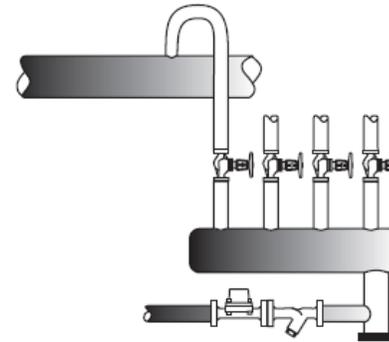
every 30 to 50 meters



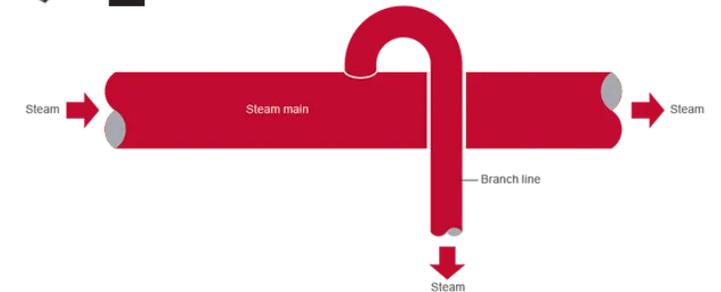
- Equip with eccentric line reduction.



- Steam distributors must always be drained.



- Since condensate always occurs in steam pipes, the tapping point must be planned on the upper side.



Thermal Expansion, Pipe Routing



Thermal Expansion of a Pipeline

- Dependent on material and temperature
- Not dependent on cross-section and wall thickness

Pipe length [m]	Change in length [mm] at temp.		
	100°C	150°C	200°C
5	5	9	13
10	10	18	25
20	20	30	50
30	30	50	70
40	45	60	90
50	55	80	120
60	65	90	150
70	75	110	180
80	90	130	200
90	100	150	210
100	110	170	230

incorrect

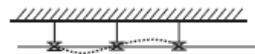


correct



fixed bearing

incorrect

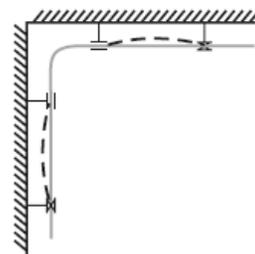


floating bearing

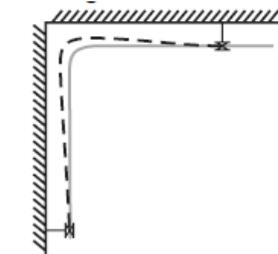
correct



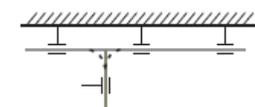
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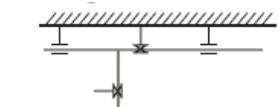
correct



incorrect



correct

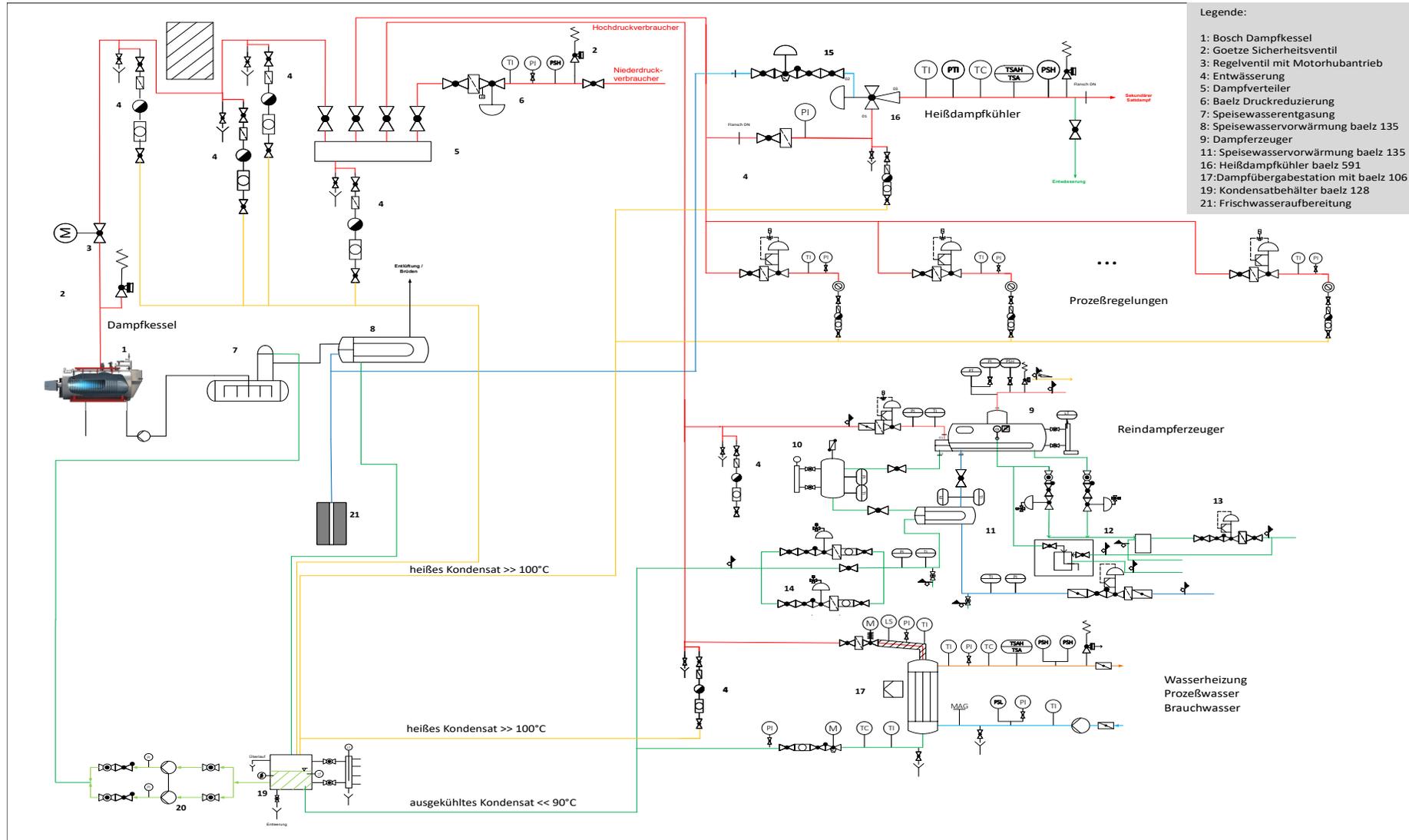


Practical Rule of Thumb

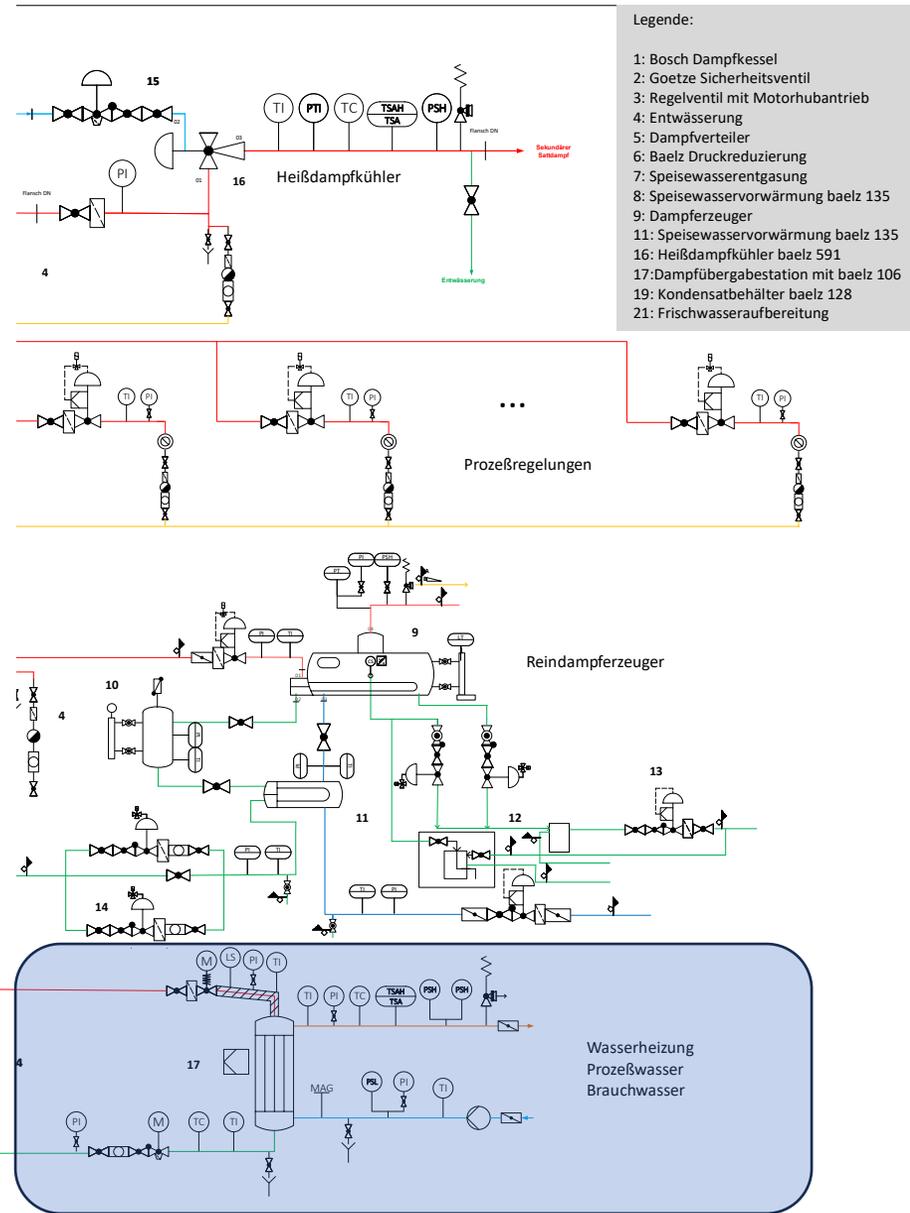


Output	1 kW = 1.5 to 1.8 kg/h steam
	1000 kcal/h = 2 kg/h steam
	10000 kcal : 860 = 11.62KW
	1 W = 1 J/s = 1 kg m ² /s ³
Heating requirements	100 -140 W/m ² (old building)
	50 - 60 W/m ² (new building)
Pressure	Absolute pressure = 1 bar abs (1 barG + 1 bar air pressure)
	Positive pressure = 1 barG or 1 barG (pressure in the pipeline)
Specific heat capacity	of water: 4,2 kJ/kg K
	of steam: approx. 2700 kJ/kg
Pressure regulating valve	1-2 nominal diameters smaller than the steam pipe
Expansion of steel pipes	approx. 10.5 mm for 10 m pipeline at 100 K temperature difference

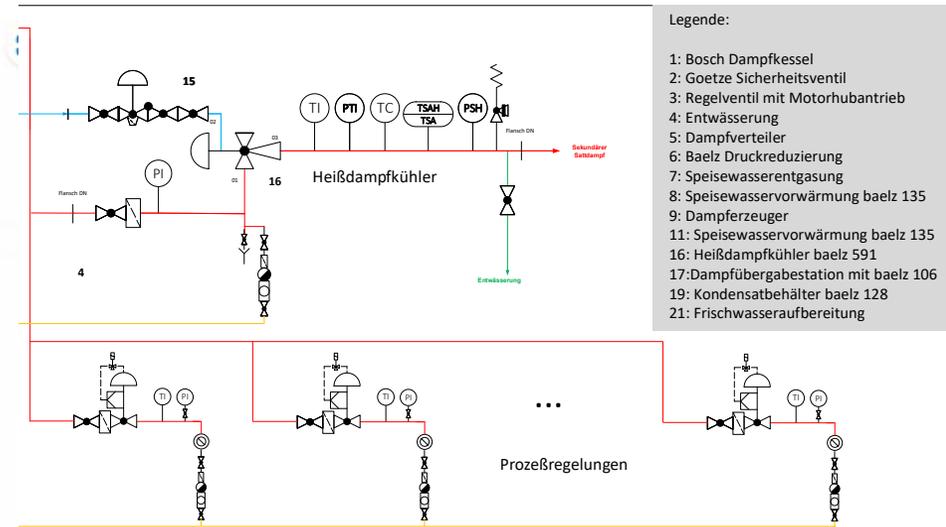
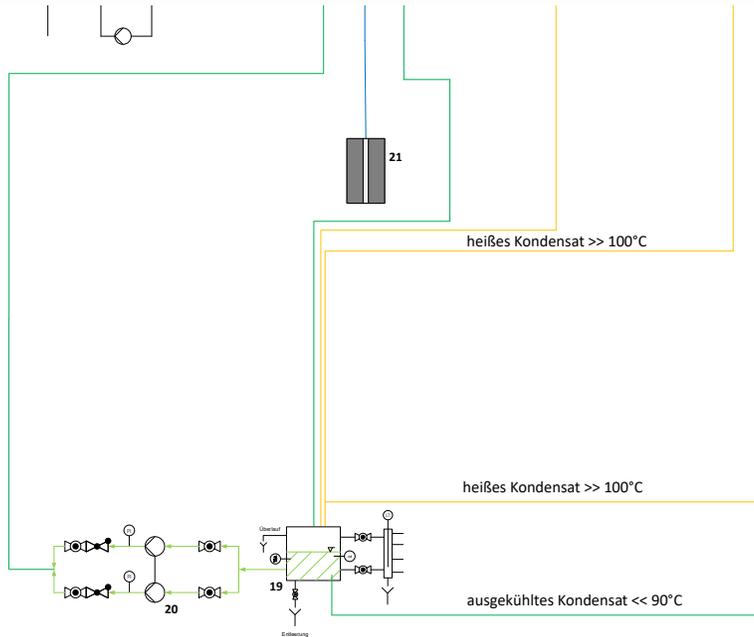
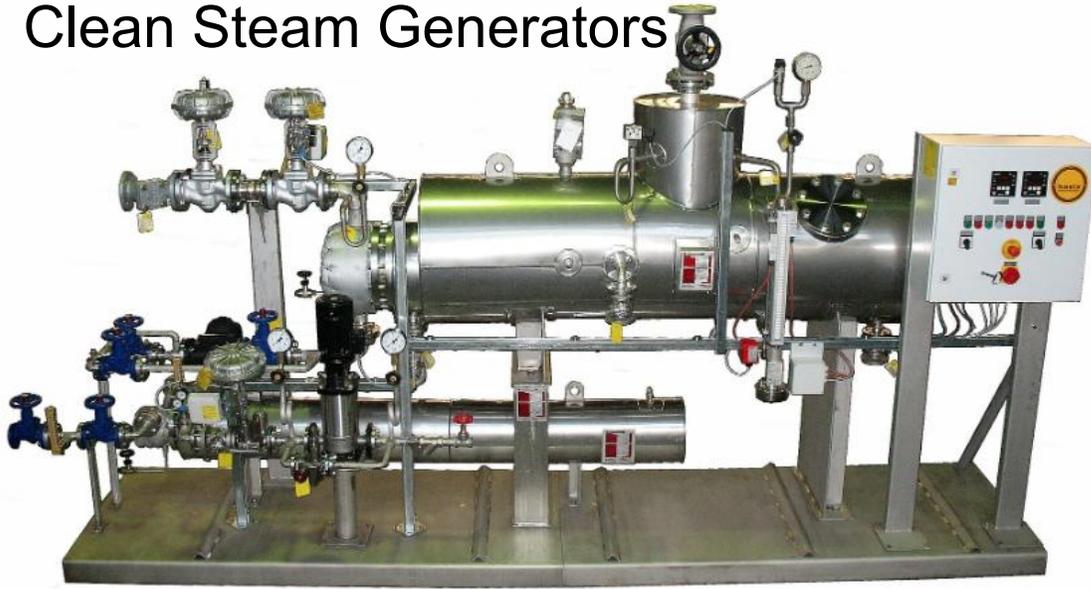
The Closed Steam-Condensate Circuit



Water Heating Process Water Raw Water

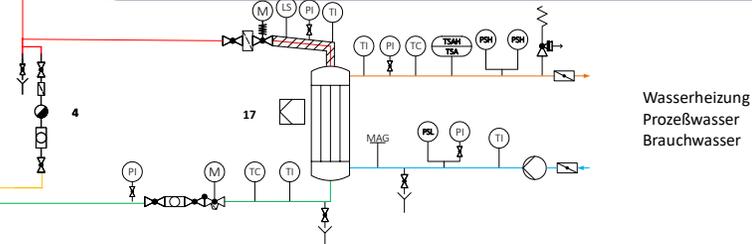
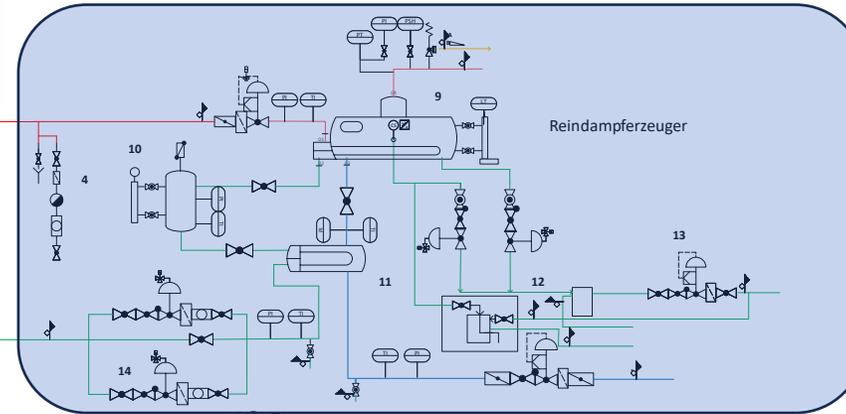


Clean Steam Generators



Legende:

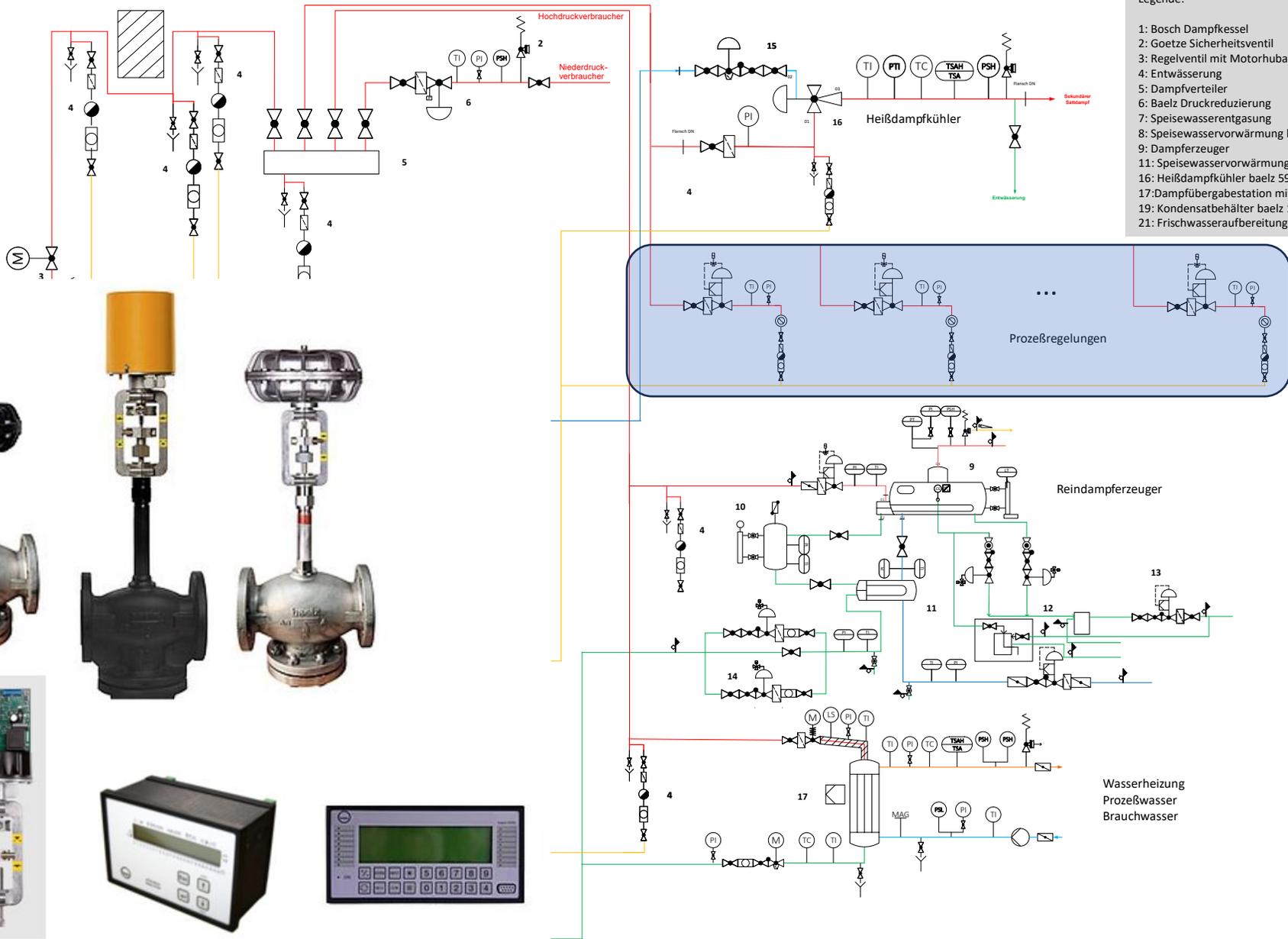
- 1: Bosch Dampfkessel
- 2: Goetze Sicherheitsventil
- 3: Regelventil mit Motorhubantrieb
- 4: Entwässerung
- 5: Dampfverteiler
- 6: Baelz Druckreduzierung
- 7: Speisewasserentgasung
- 8: Speisewasservorwärmung baelz 135
- 9: Dampferzeuger
- 11: Speisewasservorwärmung baelz 135
- 16: Heißdampfkühler baelz 591
- 17: Dampfübergabestation mit baelz 106
- 19: Kondensatbehälter baelz 128
- 21: Frischwasseraufbereitung



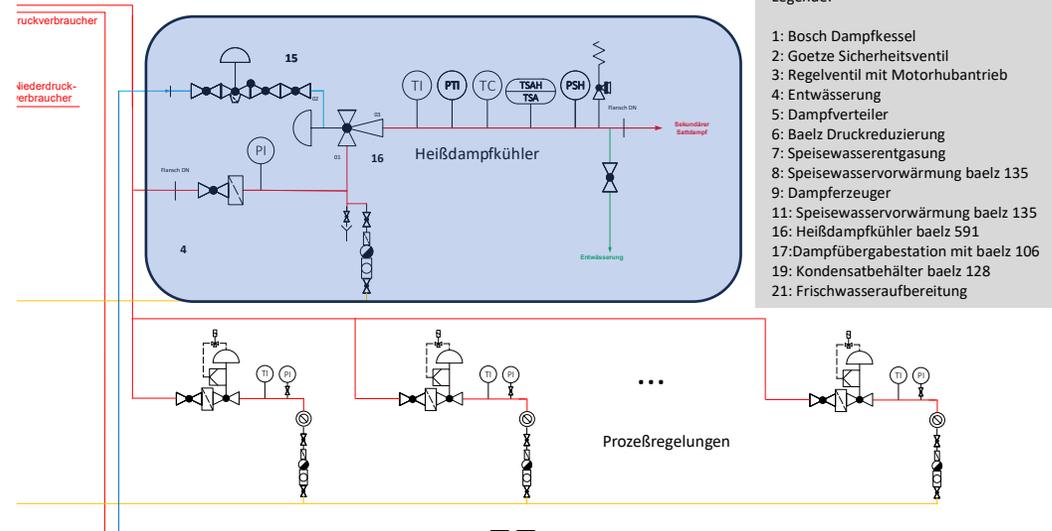
Process Regulation



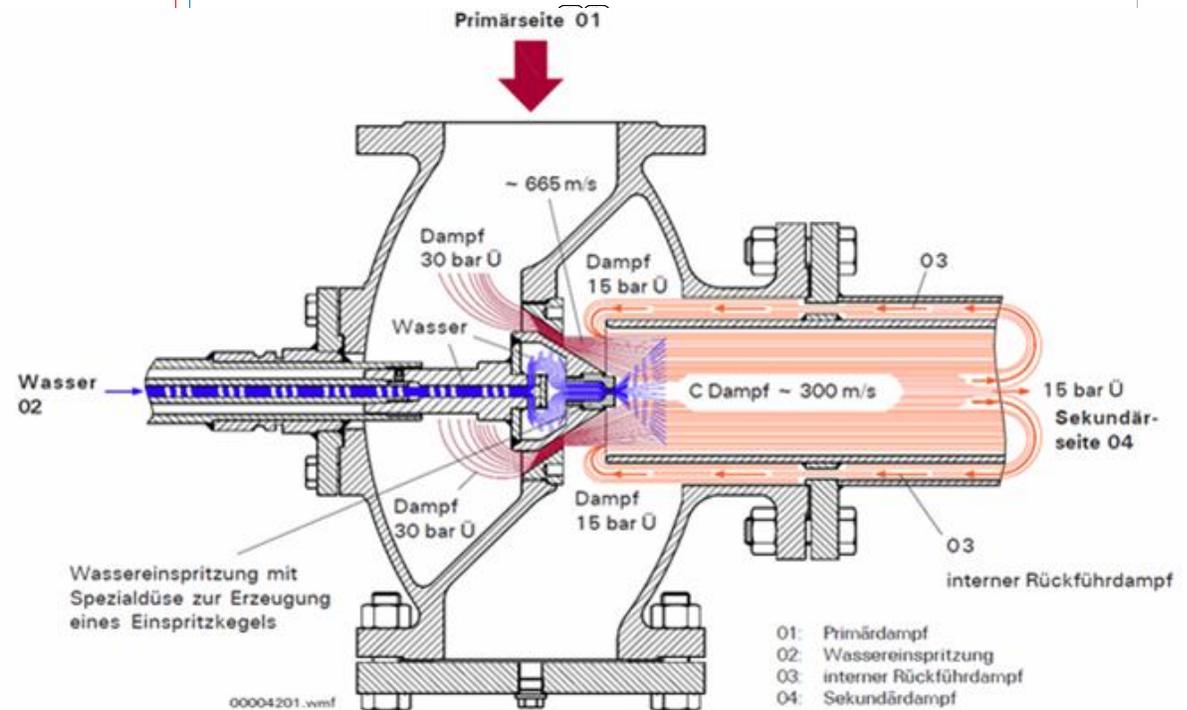
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Steam Conditioning



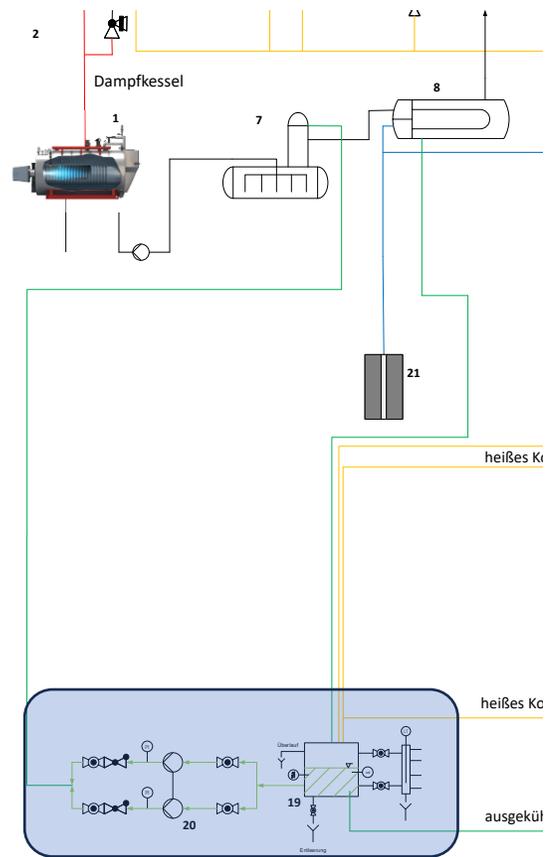
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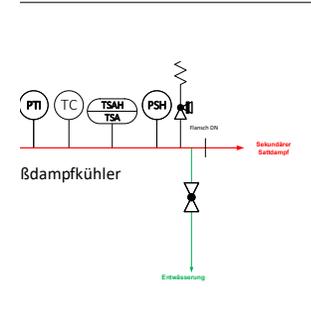


Condensate Handling

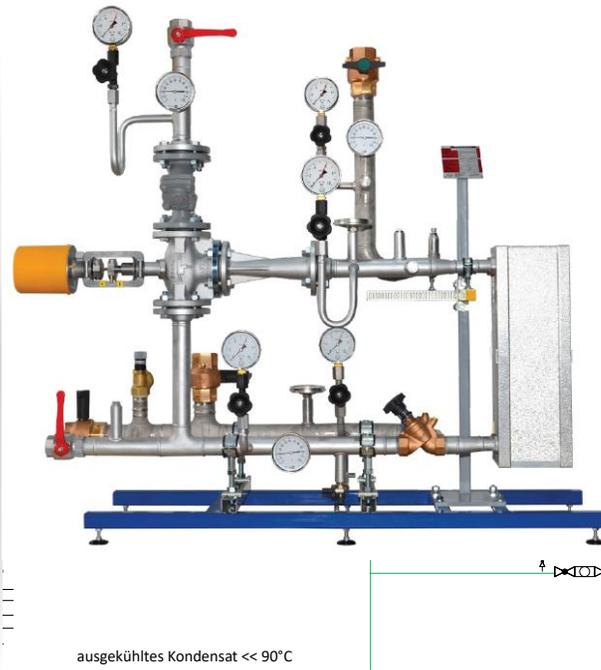
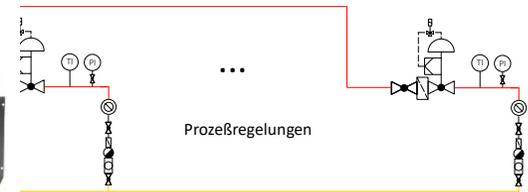


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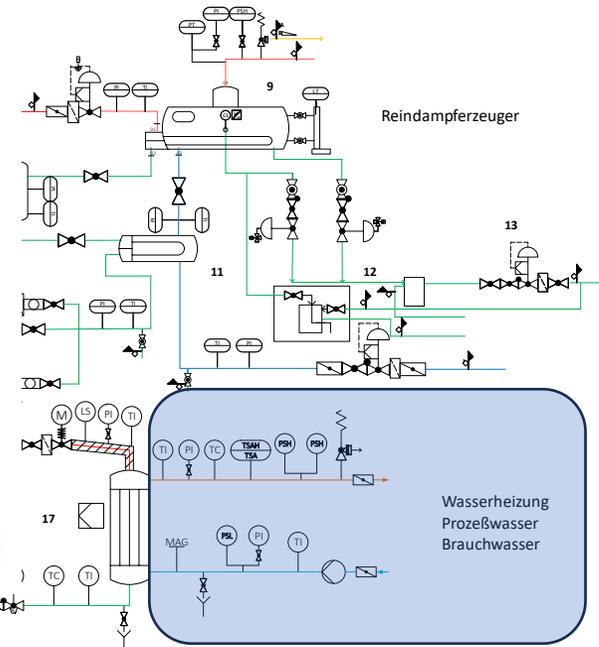




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ausgekühltes Kondensat << 90°C



Water Heating Process Water Raw Water

Steam Transfer Stations: Design Data for Heat Exchangers



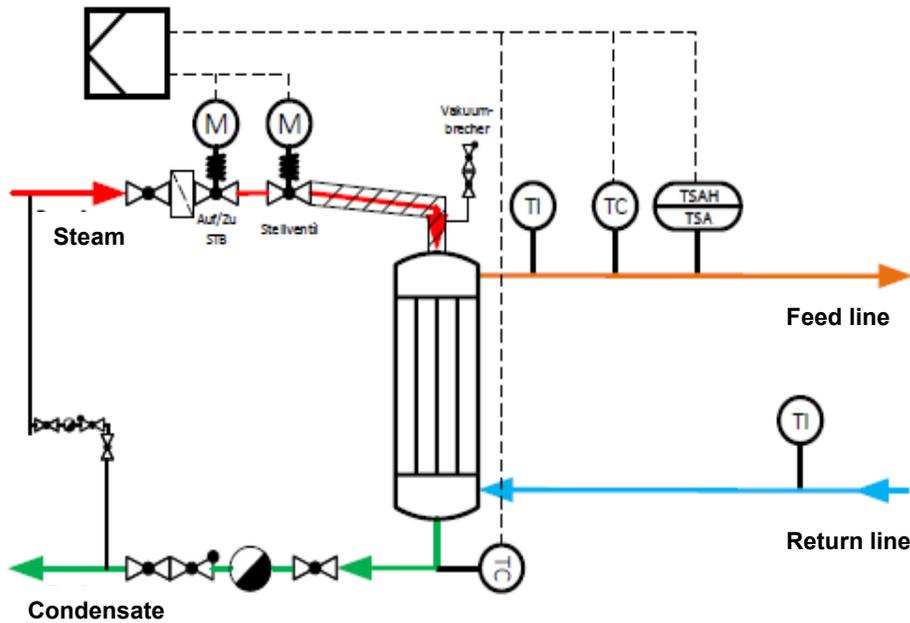
- Use case
- Primary and secondary media
- Design Temperatures and Pressures
- Max. operating temperatures and pressures
- Technical connection conditions
- Type and design of control:
Steam side or condensate side



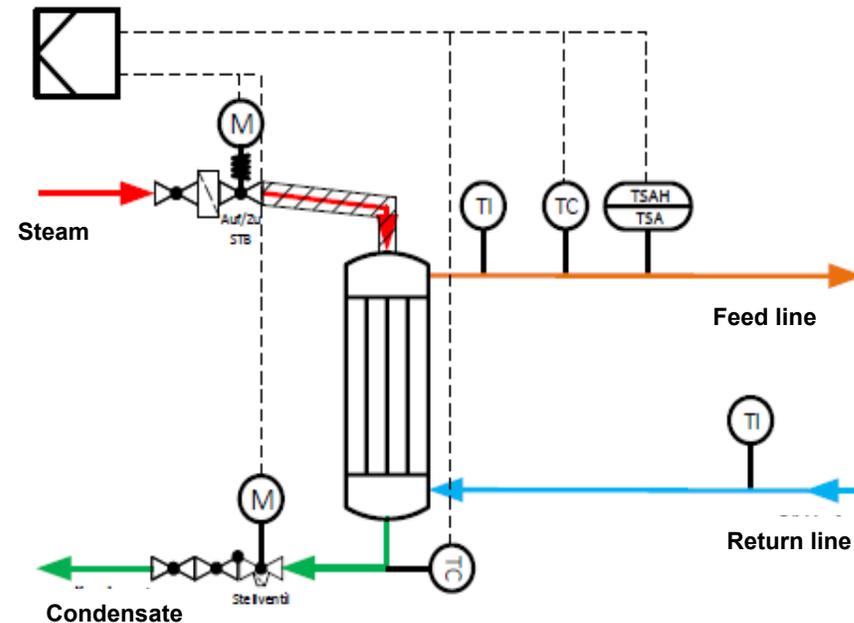
Steam-Side vs. Condensate-Side Control



steam-side control



condensate-side control



Steam-Side Control

Fast response of the control by changing the opening of the control valve.

Free condensate drainage

Possible condensate backlog / in case of back pressure: pump - steam trap recommended

Formation of secondary steam in condensate pipe → larger nominal diameter

Condensate Accumulation Control

Slower response of the control system / low wear on equipment

No condensate backlog due to constant steam pressure

Subcooling of the condensate, therefore usually no secondary steam

Smaller valves, more affordable

System Solutions for Steam: Steam Transfer Station (steam-water)

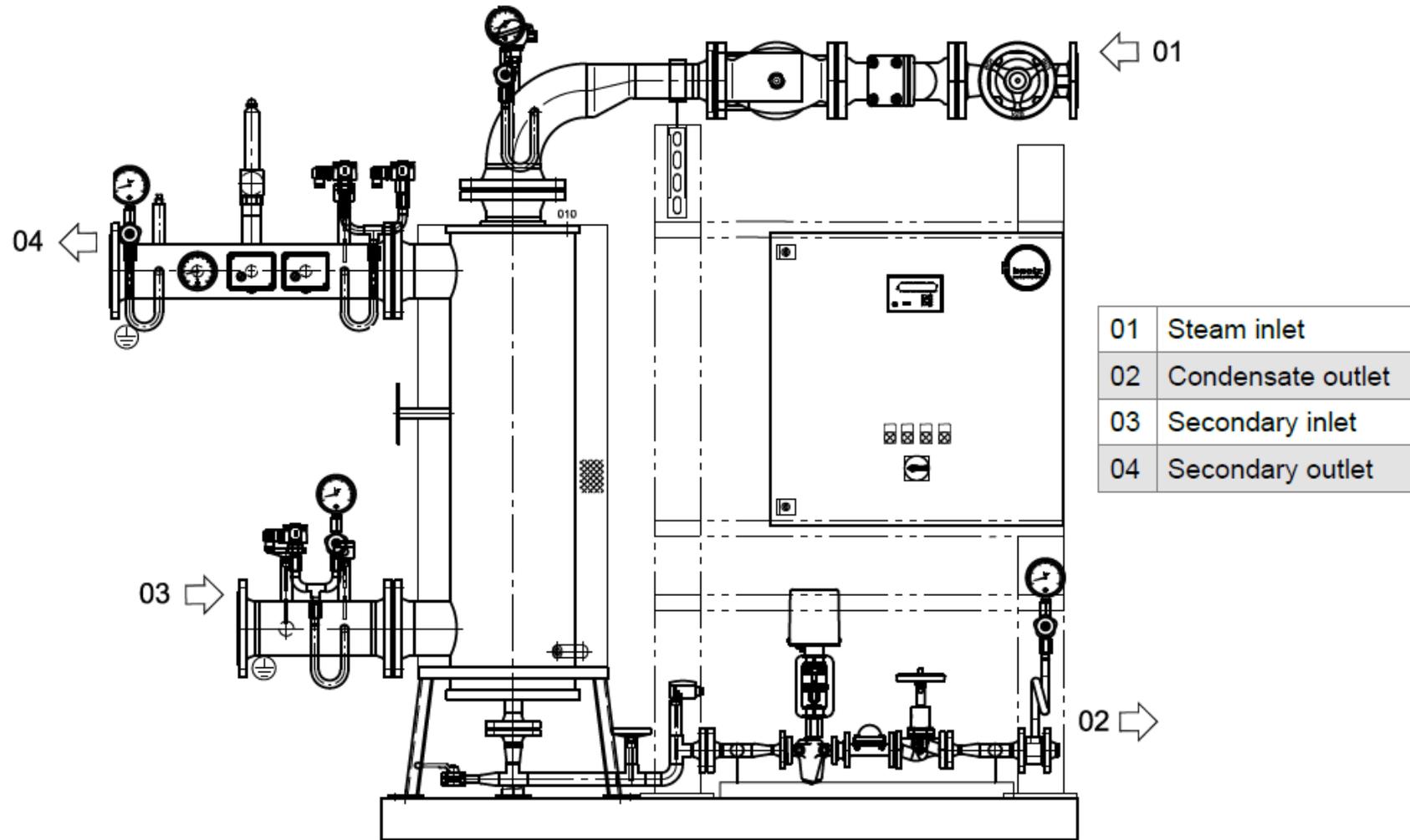


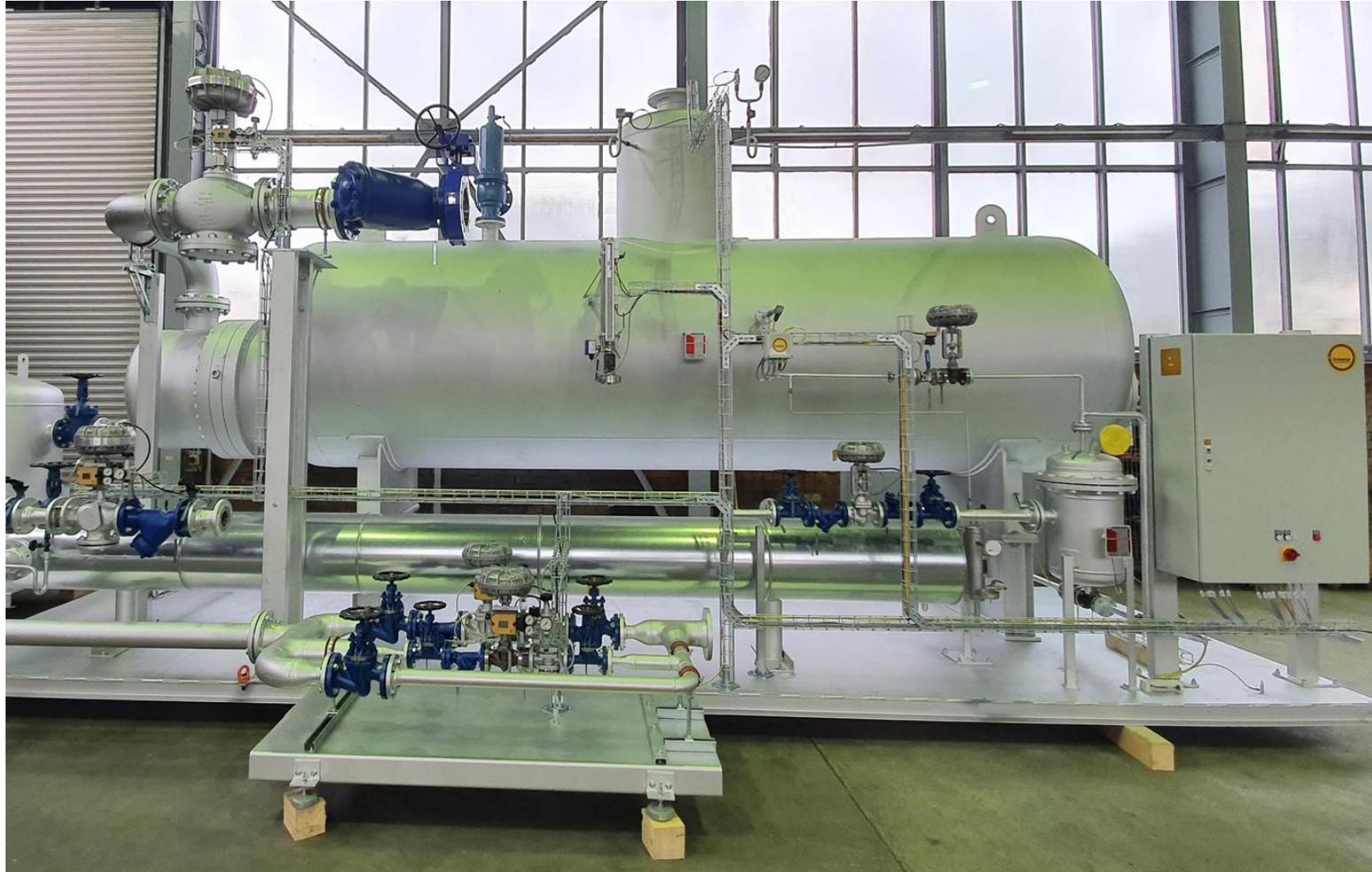
- Steam transfer stations for heating applications and domestic water production
- Clean steam generators
- Steam pressure reduction stations
- Baelz manufactures its own large range of shell-and-tube heat exchangers
- Delivery of ready-to-use stations, fully assembled and wired
- Available power: a few kW up to several MW
- Baelz's own control technology (controllers and control cabinets)
- Durability by use of our own components as a coordinated system
- Save energy with condensate accumulation control with condensate cooling by Baelz



[Resource-Saving Steam Systems \(baelz.de\)](https://www.baelz.de)

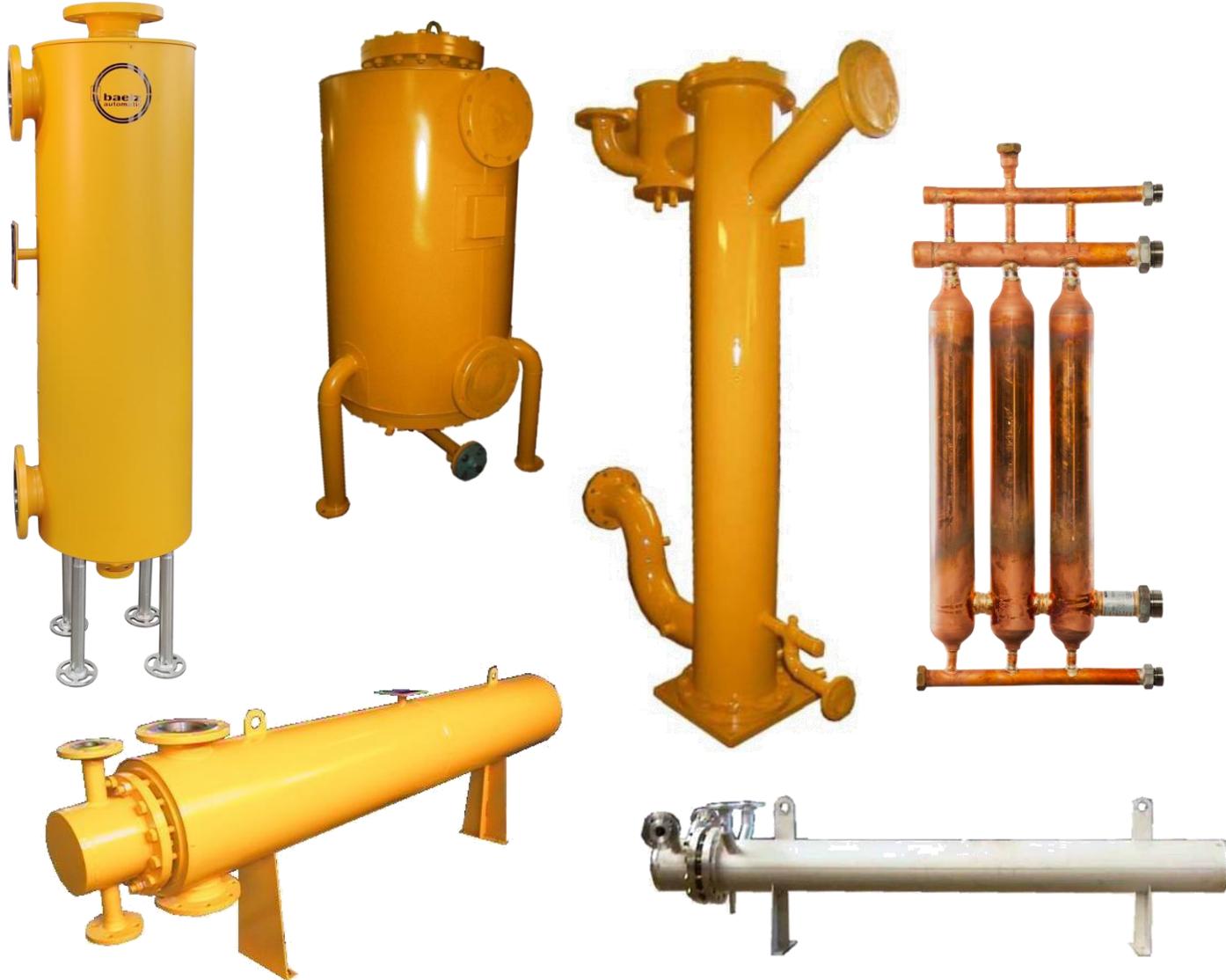
Standard Heat Transfer Station (steam-water)





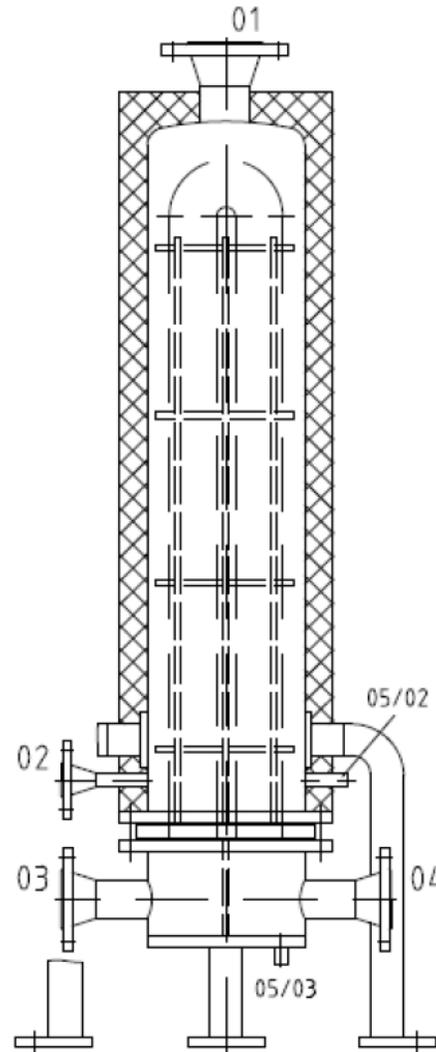
- Heat source: black steam, thermal oil, hot water or electricity (heating bundle)
- Feed water: Treated water / demineralized water
- Result: Pure steam
- Design: horizontal or vertical
- Output: a few KW up to several MW

baelz Heat Exchangers



Design	Applications
U-tube 105	Steam / Liquid
Spiral tube 106	Steam / Liquid
Straight tube 111	Steam / Liquid
U-tube 135	Liquid / Liquid
Spiral finned tubes in modular design 147	Steam / liquid, Liquid / Liquid

Shell-and-Tube Heat Exchanger baelz 105



Range of Applications

- Horizontal for steam-side control
- Vertical for Condensate build-up
- Control (T02 = const.)
- Individual designs possible due to large variety of tube lengths and diameters available

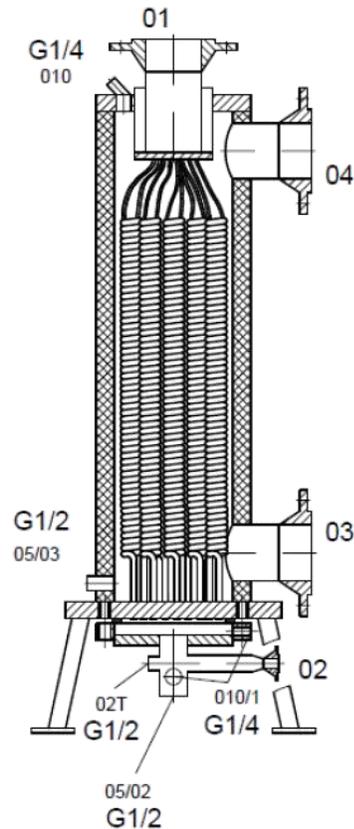
Materials

- Carbon steel shell
- Tubes made of Cu, St35.8I, 1.4571.
- Also in fully stainless steel design

Tube Bundles

- U-tube bundle
- Tubes $\text{Ø } 10, 12, \dots \times 1, 1.5 \text{ mm}$

Shell-and-Tube Heat Exchanger baelz 106



Wärmeübertrager baelz 106

- 01: Dampfeintritt
- 02: Kondensataustritt
- 03: Wassereintritt
- 04: Wasseraustritt

Range of Applications

- Heating of liquids with steam in the small to large output range
- Particularly suitable for condensate control
- Accumulation: 0-100%.
- Heating surfaces from 0.5-140 m²
- Very compact design

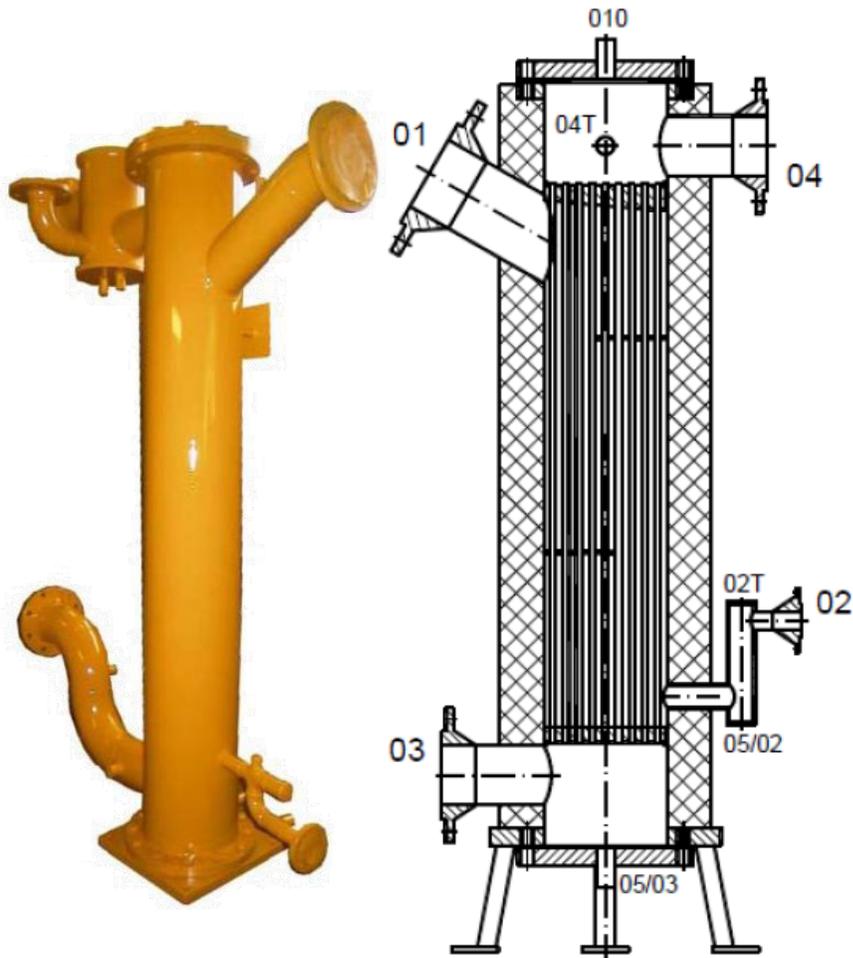
Materials

- Carbon steel shell
- Tubes made of Cu, St35.8l, 1.4571.
- Also in fully stainless steel design

Tube Bundles

- Baelz spiral tube bundle
- Tubes Ø 10 × 1 mm

Shell-and-Tube Heat Exchanger baelz 111



Range of Applications

- Heating, water heating, process heat
- Condensate accumable in upright version $T02 = f[T03]$
- Individual designs possible due to large variety of tube lengths and diameters available

Materials

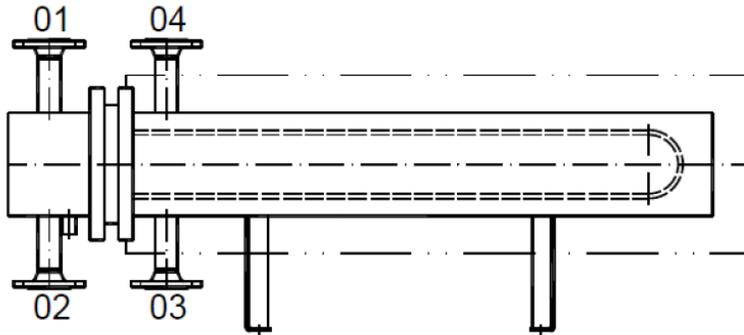
- Carbon steel shell
- Tubes made of Cu, St35.8I, 1.4571.
- Front head/pipe plate stainless steel plated
- coated finish available

Tube Bundles

- Straight tube bundle
- Welded-in tubes $\text{Ø } 10, 12, \dots \times 1 \text{ mm}$



Shell-and-Tube Heat Exchanger baelz 135



Range of Applications

- Horizontal/vertical
- Shell and tube side 2-/4- and 6-way
- With extractable U-tube heating bundle
- Individual designs possible due to large variety of tube lengths and diameters available

Materials

- Carbon steel shell
- Tubes made of Cu, St35.8I, 1.4571
- Also in fully stainless steel design

Tube Bundles

- U-tube bundle
- Tubes $\text{Ø } 10, 12, \dots \times 1, 1.5 \text{ mm}$



Shell-and-Tube Heat Exchanger baelz 147



18 kg empty weight

200 kW at 5 barg



Modular heat exchanger, made entirely of copper

For modular, expandable stations with connecting manifolds

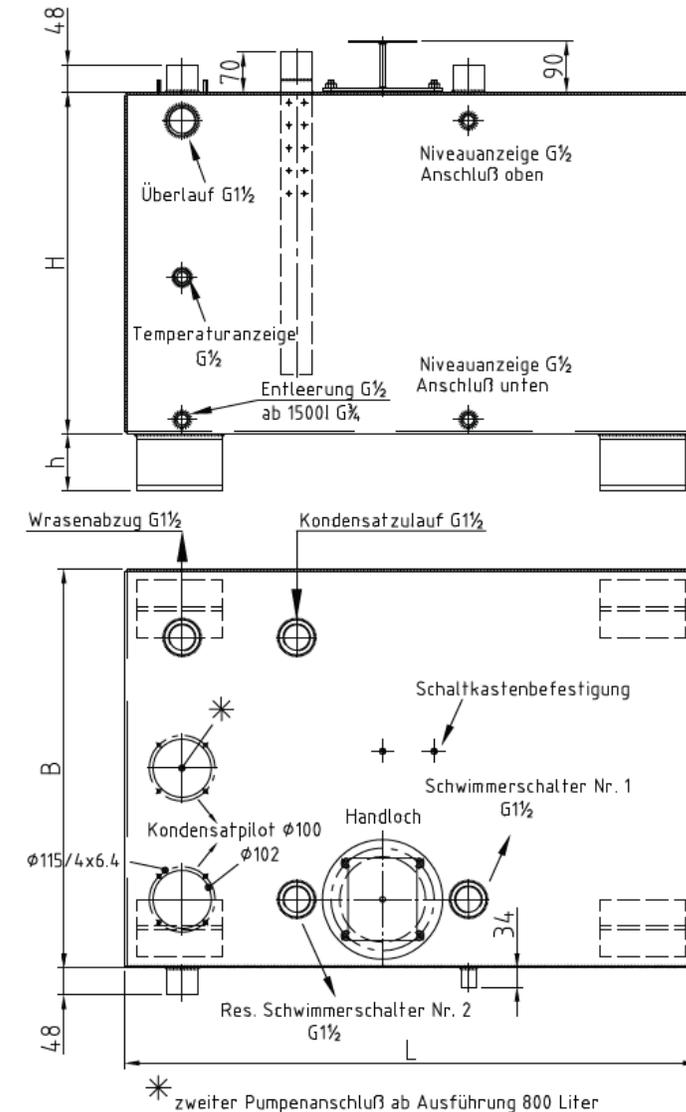
Condensate Handling, e.g. with baelz 128

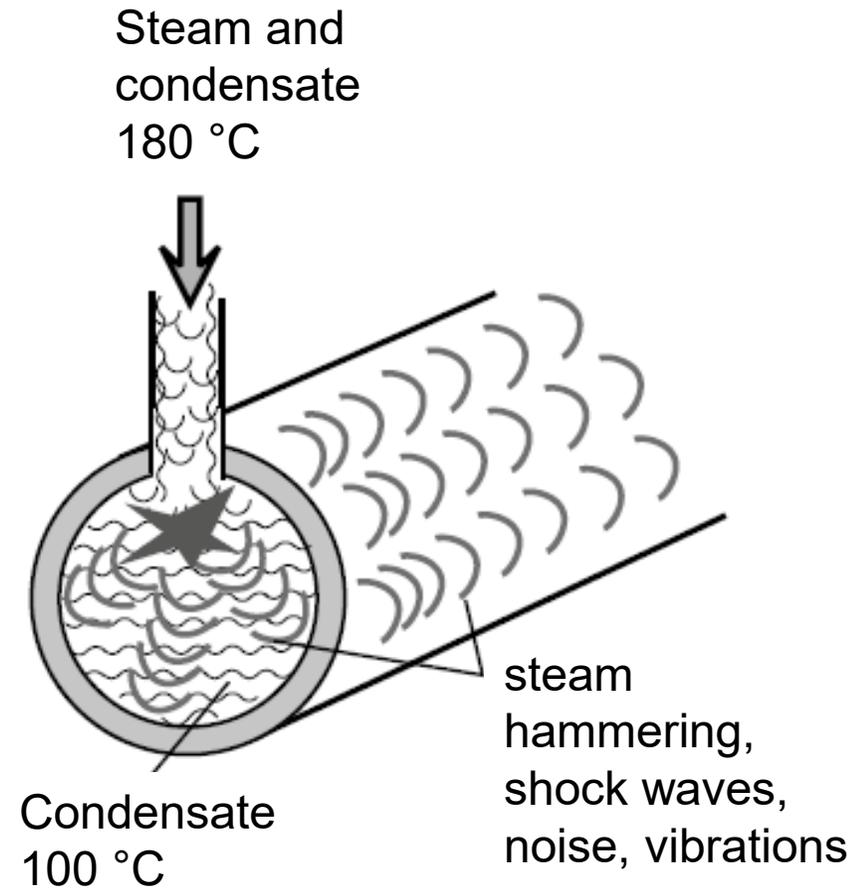


- With internal or external pumps
- Made of steel or stainless steel
- With conductivity measurement and automatic condensate rejection
- A wide range of sizes for different condensate quantities

baelz 128 dimensions and weights

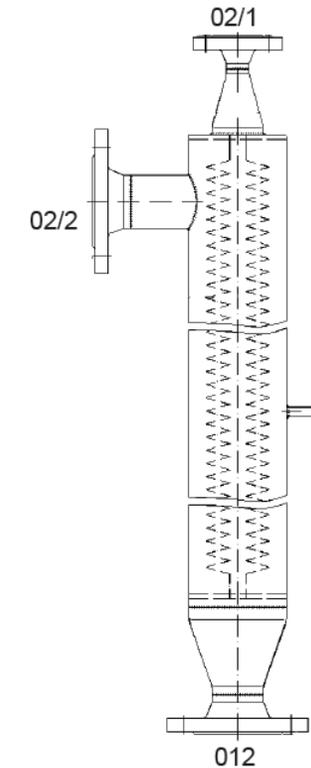
Capacity (l)	100	200	300	400	500	600	700	800	1500	2000
L (mm)	650	700	860	1000	1000	1200	1200	1340	1800	2000
B (mm)	380	500	600	700	850	850	1000	1000	1400	1700
H (mm)	600	600	600	600	600	600	600	600	600	600
h (mm)	90	90	100	100	100	100	100	100	100	100
Weight, approx. (kg)	51	79	102	127	144	162	180	202	336	367





Condensate injection cooler baelz 118

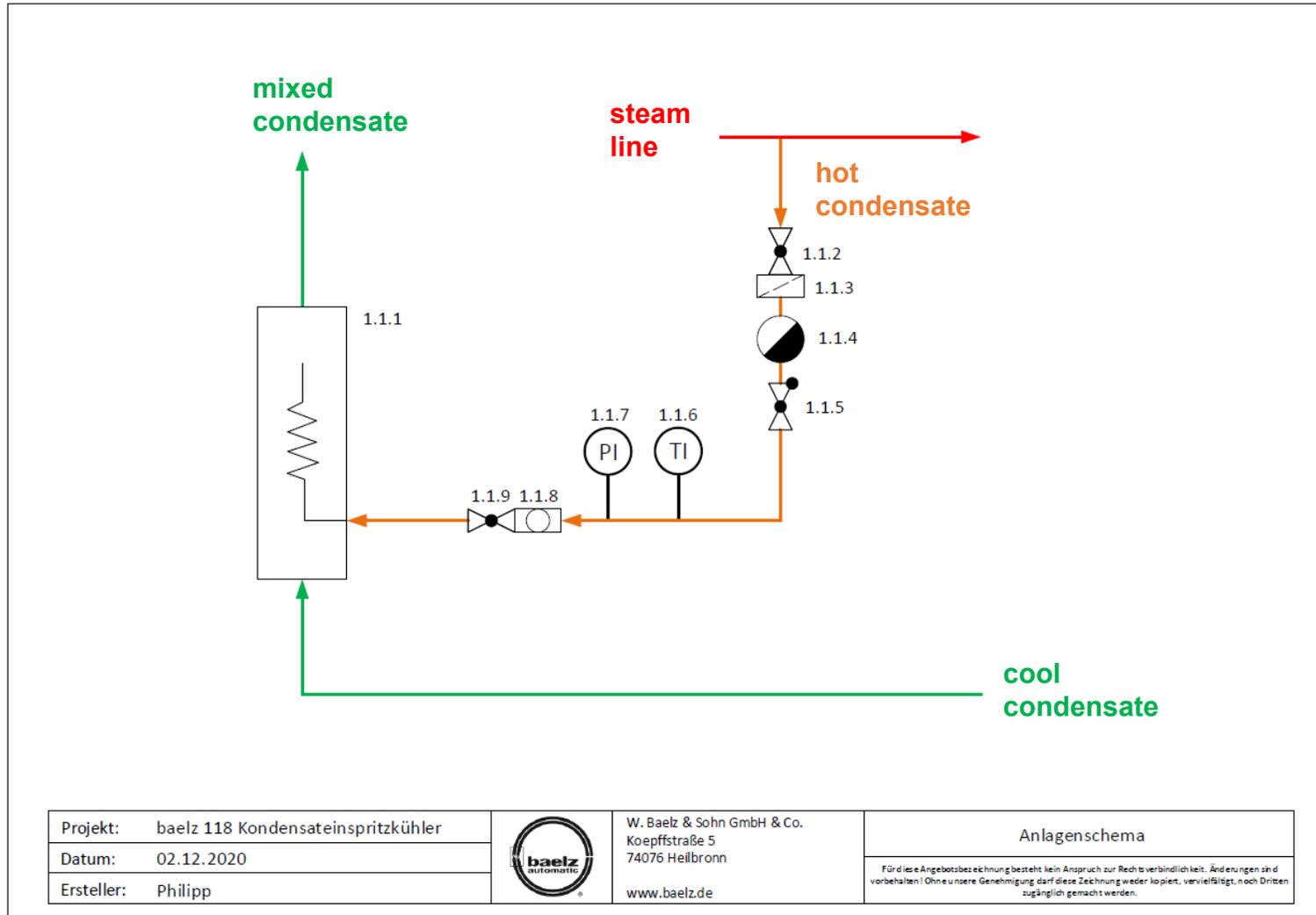
- for cooling high pressure condensate without risk of evaporation
- exchangeable tube bundles optional
- stainless steel 1.4571 tube bundles
- many design options



baelz 118:

02/1 = high-temperature condensate to be cooled inlet
02/2 = cooled condensate inlet
012 = mixture of high-temperature condensate and cooled condensate outlet

Condensate Injection Coolers



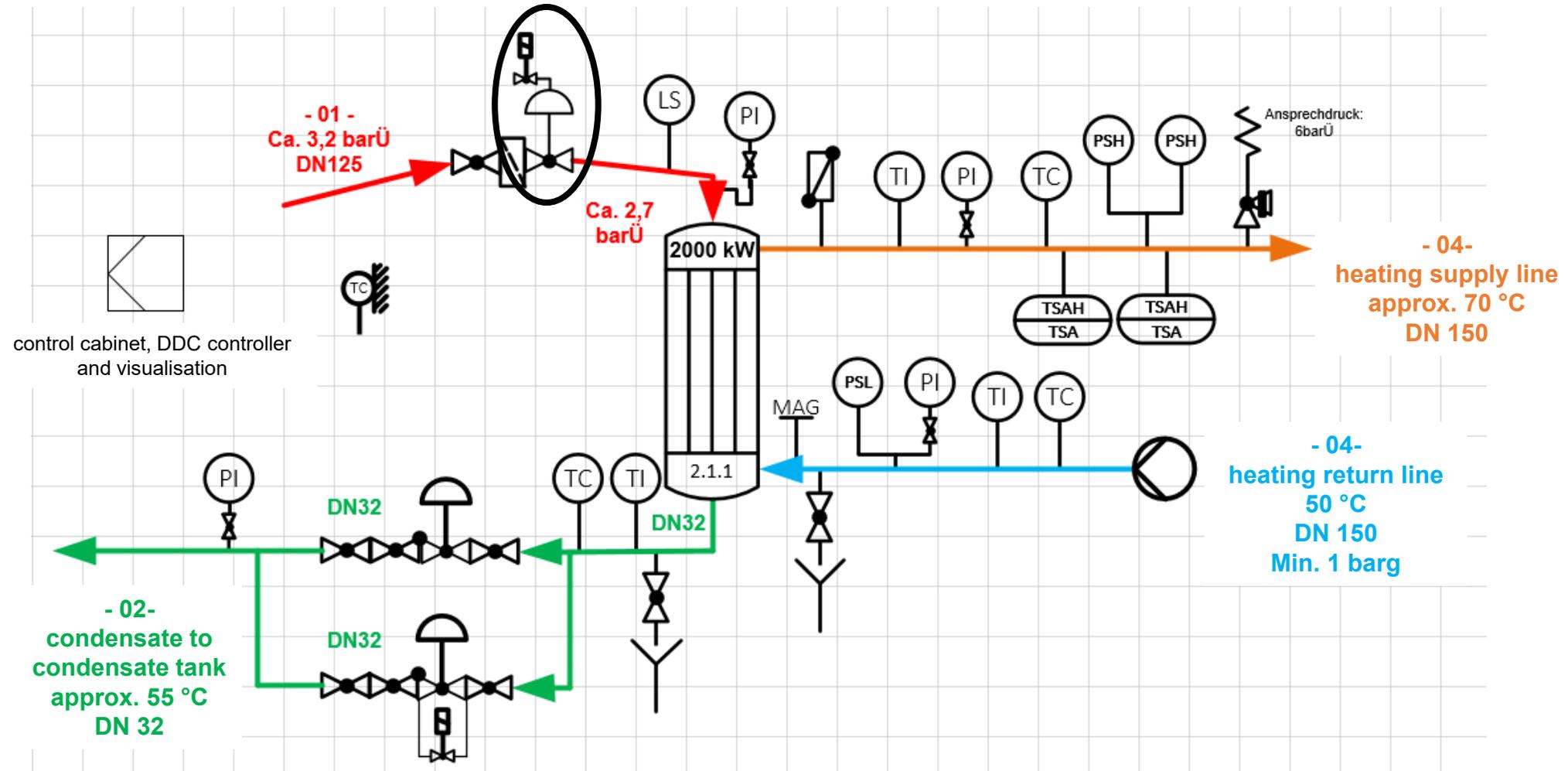
Control Valve Configuration with the Baelz Valve Selector



Fluid: Steam

		Unit	Case 1	Case 2	Case 3	Case 4	Case 5	
PROCESS DATA	Mass / Volume flow (W)	kg/h	2.500,00	1.800,00	500,00			
	Pressure IN (p1)	bar abs	10,00	10,00	12,00			
	Temperature IN (T1)	°C	180,0	180,0	190,0			
	Pressure OUT (p2)	bar abs	8,00	8,00	7,00			
	Velocity IN (v1)	m/s	69	50	12			
	Velocity OUT (v2)	m/s	86	62	20			
	Velocity in pipe OUT (v3)	m/s	34	24	8			
	Kv_{req}			27,49	19,79	3,65		
	Capacity stroke	%		91	65	9		
	Noise level	L[dB(A)]		84	84	93		
Delta p	bar		2,00	2,00	5,00			

Steam Valve for Safety Control Function, e.g. baelz 340



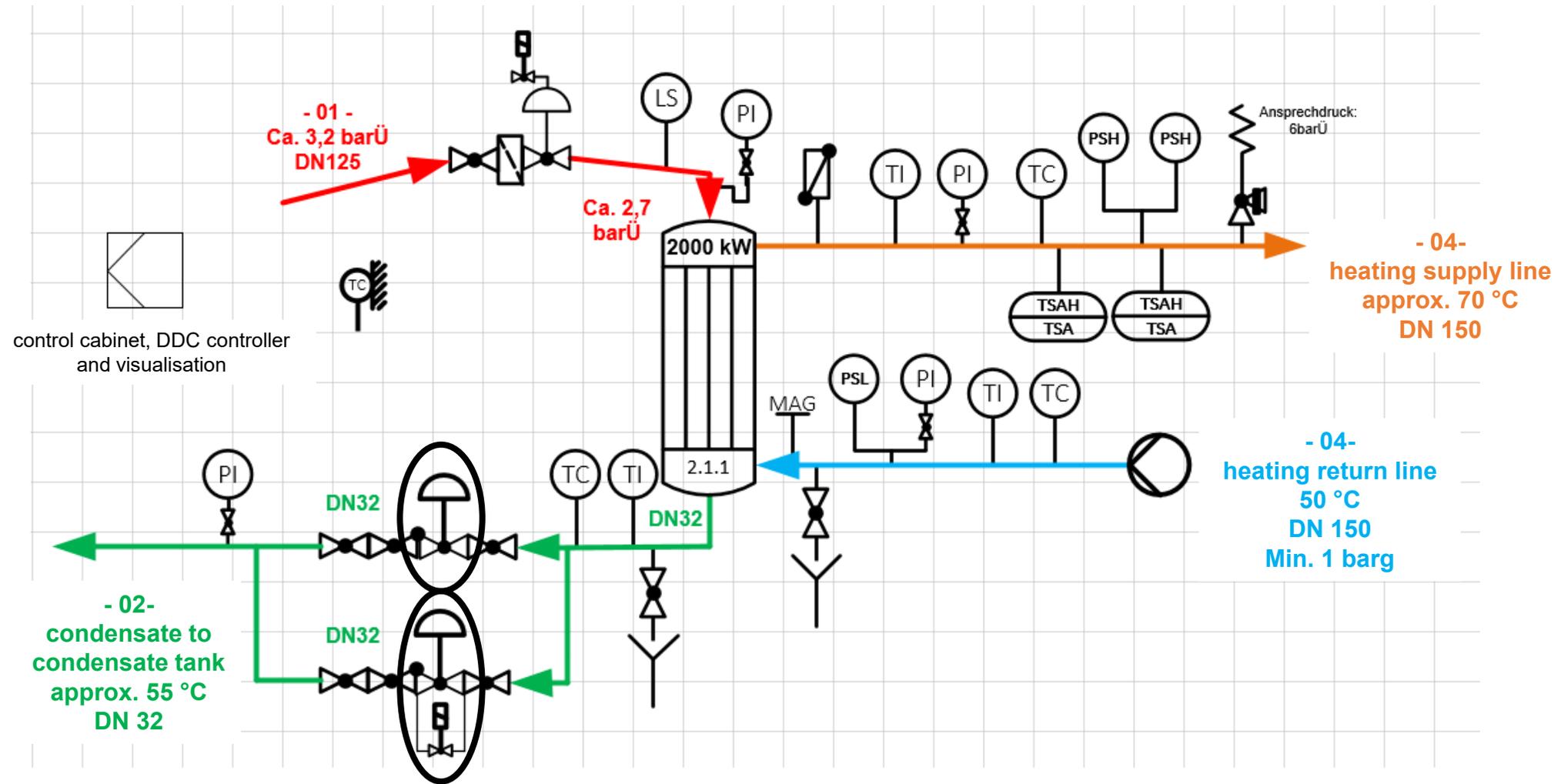
Steam Valve for Safety Control Function, e.g. baelz 340



- Standard 2-way control valve from Baelz
- Threaded valve seat
- Standard yoke fitting for Baelz actuators
- Housing made of ductile iron, cast steel or stainless steel
- DN15 – DN300 / PN16 – PN40
- Standard or custom Kvs values possible
- Parabolic or perforated valve plug design possible
- Balanced versions ("EMF") possible to reduce the actuating force in larger nominal diameters



Condensate Control Valve baelz 185



Condensate Control Valve baelz 185



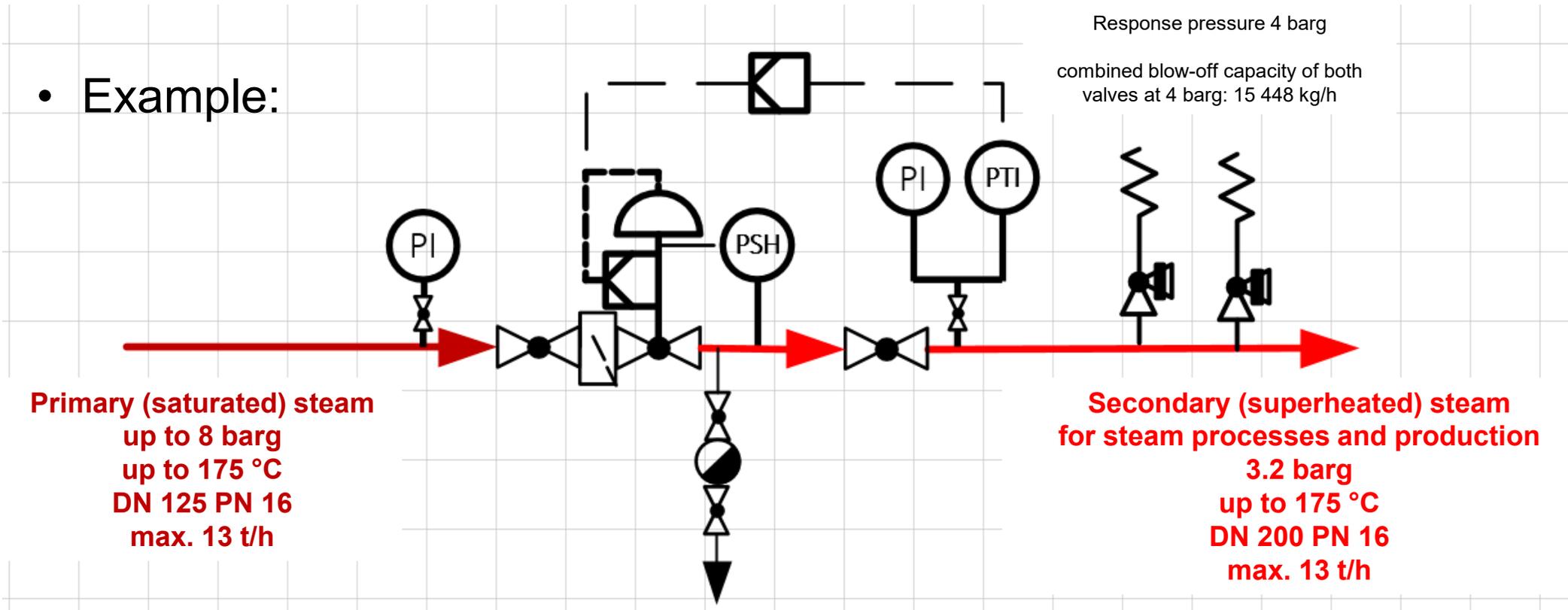
- Compact design
- Small Kvs values for exact capacity control at steam transfer stations
 - Kvs values from 0.025 to 1.4 m³/h
 - Custom valve plugs possible
- Stainless steel body WN 1.4021
 - DN15 PN16/25/40
- Not limited to condensate valve applications!
 - compact design allows for optional shut-off/strainer
 - suitable for use as a microflow valve
 - Pressure measuring and regulating element baelz 185-206r



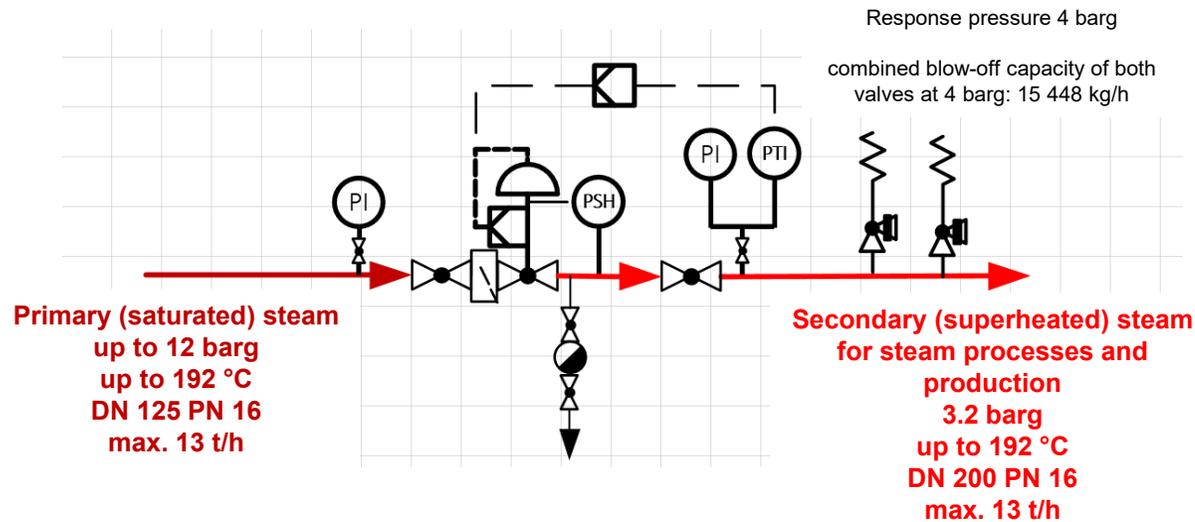
Steam Pressure Reduction, e.g. with baelz 340



- Example:

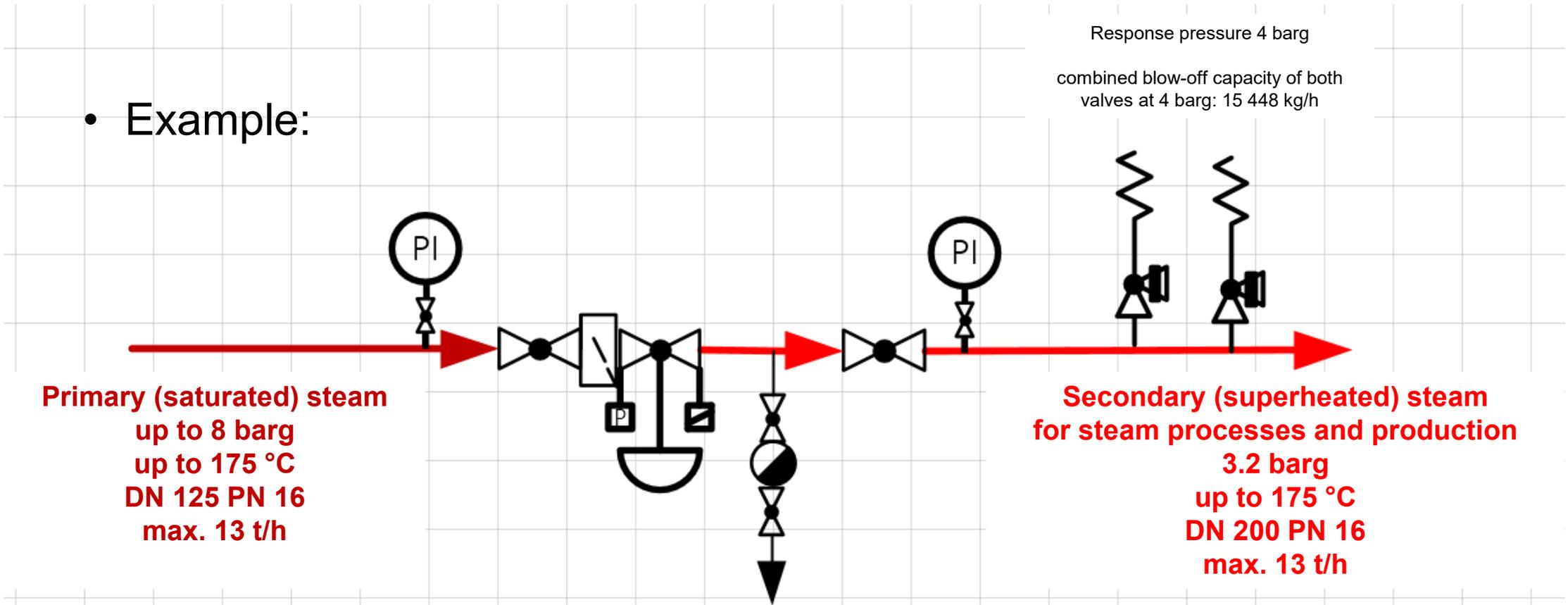


Steam Pressure Reduction, e.g. with baelz 340

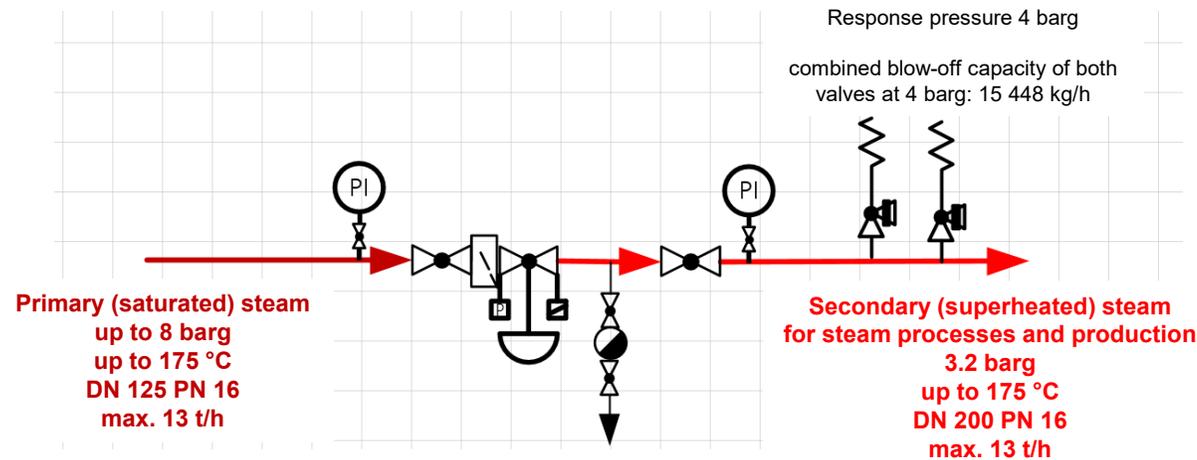


- Reduces steam pressure, setpoint can be set at the controller
- Designed to maintain steam temperature with minimal loss
- A larger pipe diameter after the reducing valve may be necessary
- Design as a pressure reducing station (with components above) suitable for many applications

- Example:

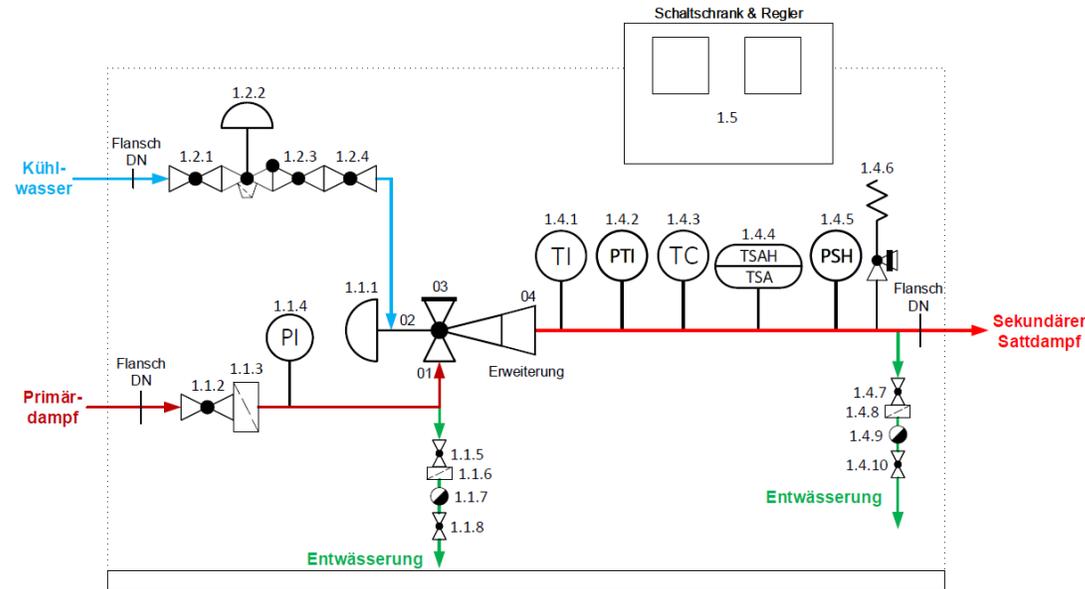


Steam Pressure Reduction, e.g. with baelz 192



- Reduces steam pressure, setpoint using pressure measuring and control element (baelz 206r)
- Designed to maintain steam temperature with minimal loss
- A larger pipe diameter after the reducing valve may be necessary
- Safety function with solenoid valve baelz 265st

Superheated Steam Cooling, e.g. with Desuperheater baelz 591



- Reduces steam pressure and vapor by means of cooling water injection
- Cools superheated steam to almost saturated steam level
- Saturated steam is usually desired due to better thermodynamic properties

Superheated Steam Cooling, e.g. with Desuperheater baelz 591



Internal recirculation enables production of saturated steam without overheating. The Baelz desuperheater is perfectly suited to this purpose.

Advantages at a glance:

- High precision in pressure control
- High precision in temperature control

media	pressure	dimension	housing material	temperature
steam, water/ hot water	16–40	32–300	ductile iron (JS1025)	-50 to 240°C (-cooling tube) -50 to 350°C (+cooling tube)

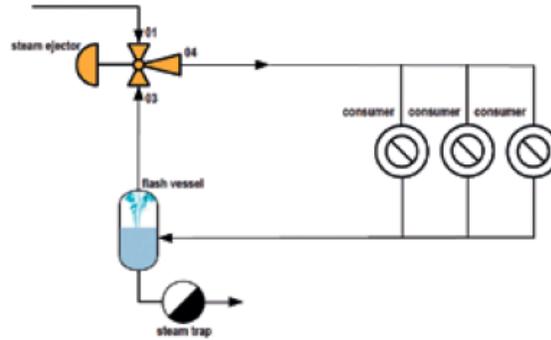


Waste Heat Recovery e.g. with Thermocompressor baelz 590



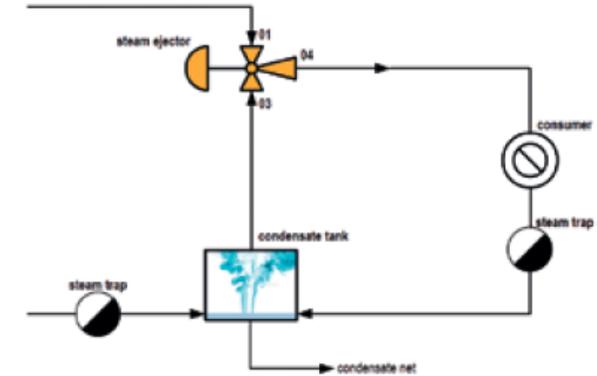
1. Recirculation

This type of system is adopted when there is a need for increased performance and improved production of machines. The performance increase in this type of system can average around 15 %, combined with a steam saving of up to 5 %.



2. Compression

Installations using steam ejectors as thermocompressors are perfect for saving energy, achieving direct steam saving values between 10 and 30 % or more.



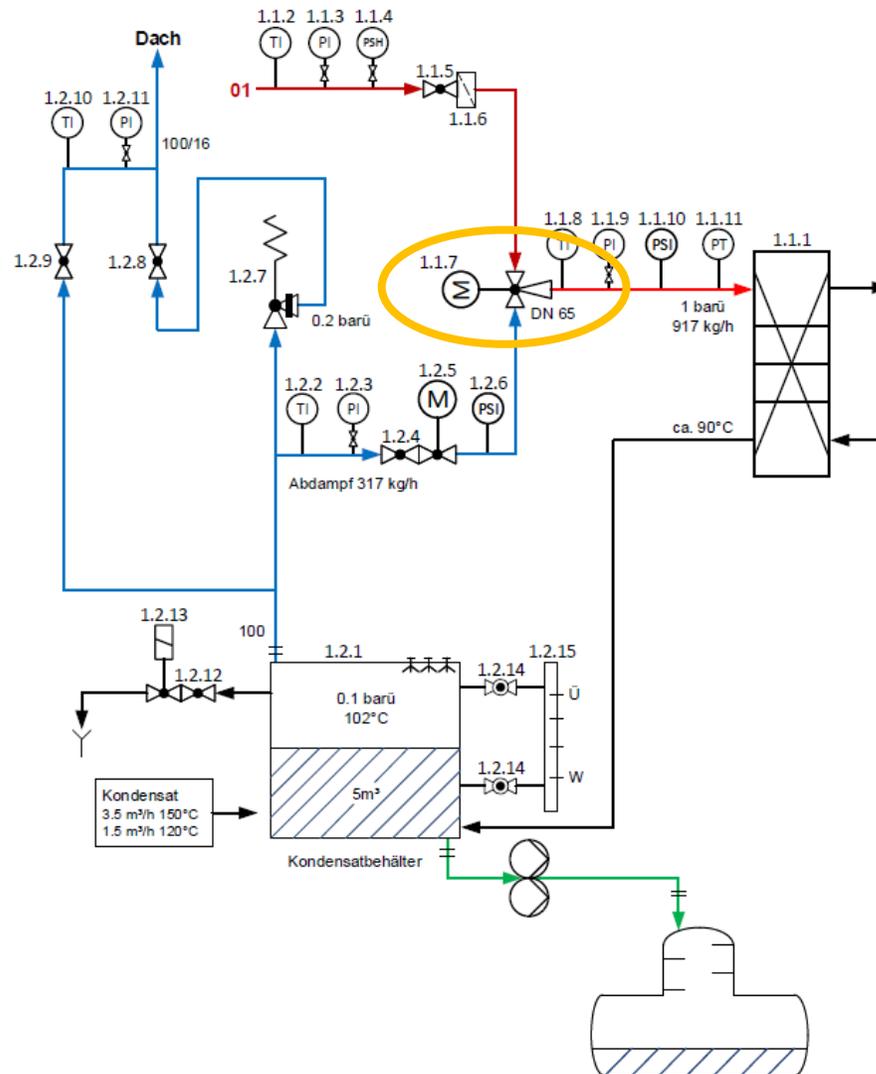
Advantages at a glance:

- Increase of useful heating surface to 100 %
- Reduction of steam losses
- Increased machine performance
- System applicable to all types of steam installations.
- Recirculation and recompression systems make maximum use of available energy
- Can be used with other gases compatible with our products



media	pressure	dimension	housing material	temperature
steam, water / hot water	16–40	15–300	ductile iron (JS1025)	-50 to 240°C (-cooling tube) -50 bis 350°C (+cooling tube)

Waste Heat Recovery e.g. with Thermocompressor baelz 590



Steam-Water Mixer baelz 585



This ejector is particularly suited to processes where a rapid production of hot water with maximum recirculation through direct mixing of steam and water is required. It is available in sizes from DN 15 to DN 125.

Advantages at a glance:

- Optimal use of the motive energy of steam in conveying the water to be heated
- Optimal mixing by condensation of steam in water
- Quiet operation due to specially designed mixing chamber
- Fully integrated in process control together with the actuator, temperature sensor and controller
- Low investment costs
- Can be used with other liquids compatible with our products



media	pressure	dimension	housing material	temperature
steam, water/ hot water	16/25	15 – 125	ductile iron (JS1025)	-50 to 240°C (-cooling tube) -50 to 350°C (+cooling tube)

Steam cooling / steam conversion



Steam cooling / steam conversion: a league of its own in the process and power industry



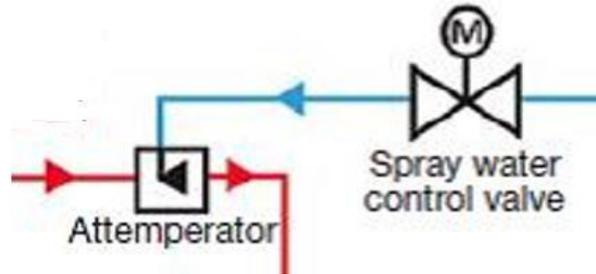
Steam cooling / steam conversion



Steam can be found in many areas

- Power plants
- Paper mills
- Chemical industry
- Breweries
- District heating
- etc.





Superheated steam cooling
(superheated steam cooler)

Pressure and temperature reduction

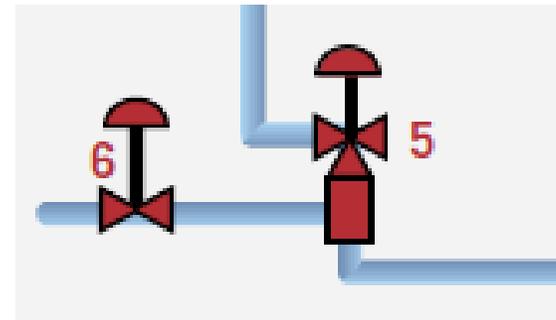
Steam conversion

Implementation:

Steam conversion valve

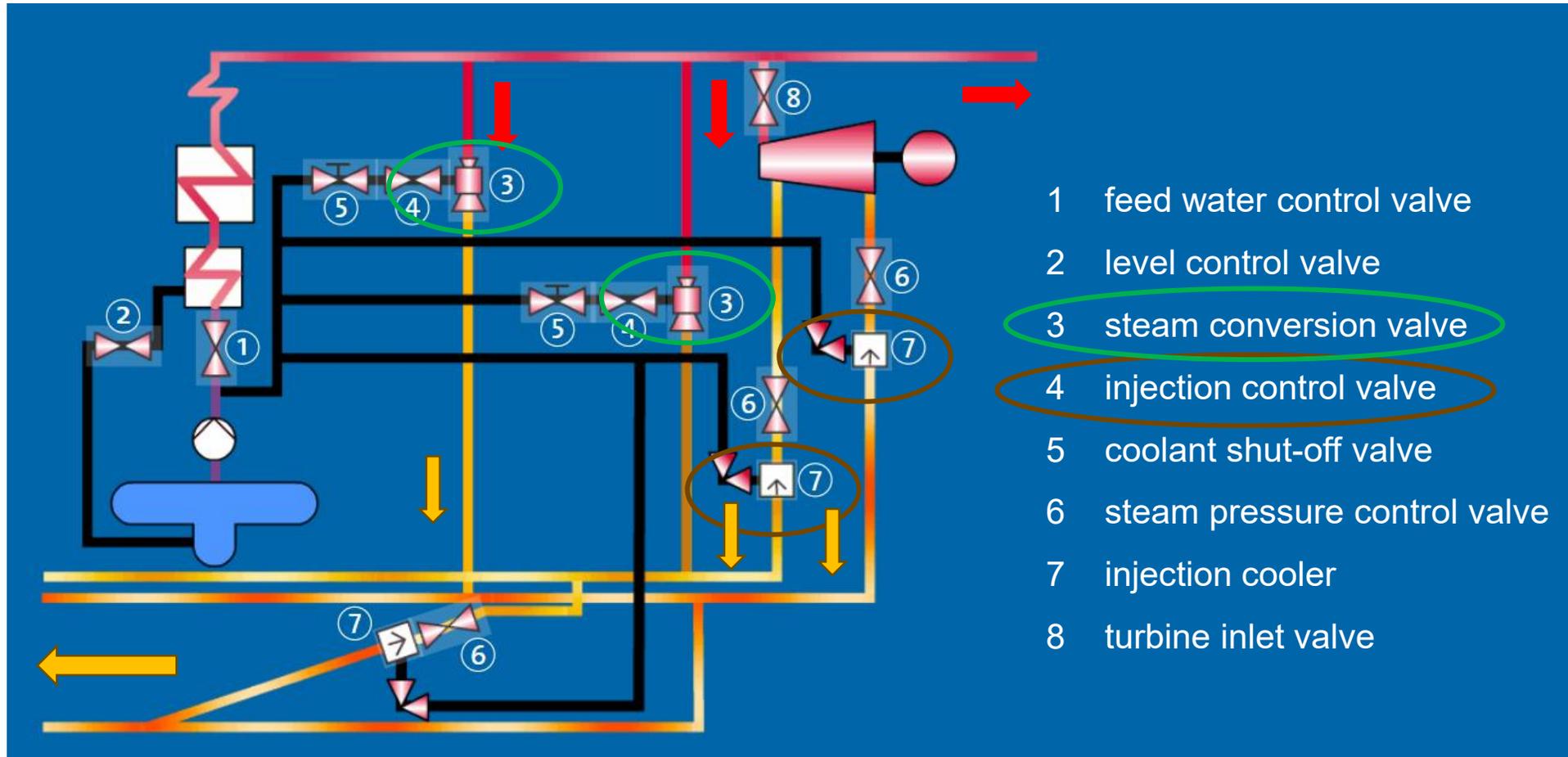
or

Pressure reducing valve with hot steam cooler



Steam cooling / steam conversion

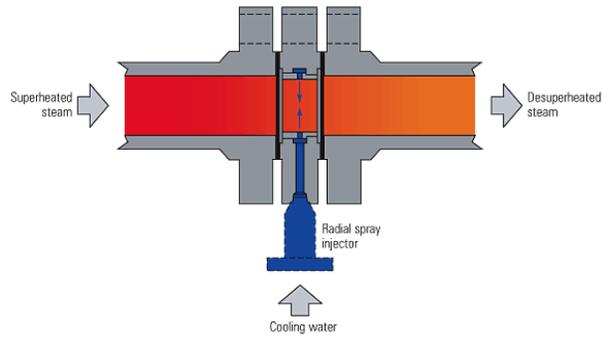
Example of the use of superheated steam coolers and steam conversion valves in power plants



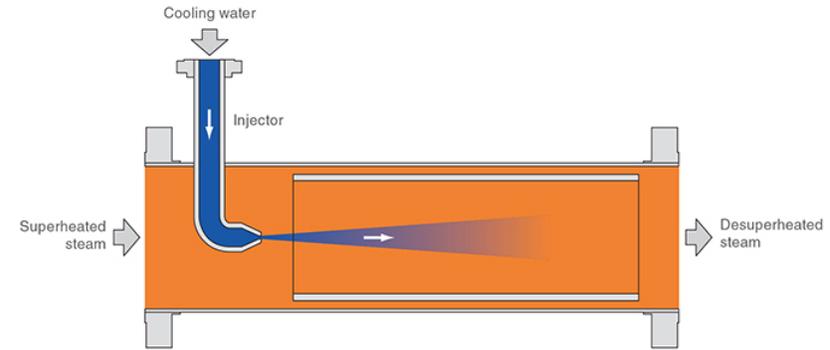
Steam cooling technologies



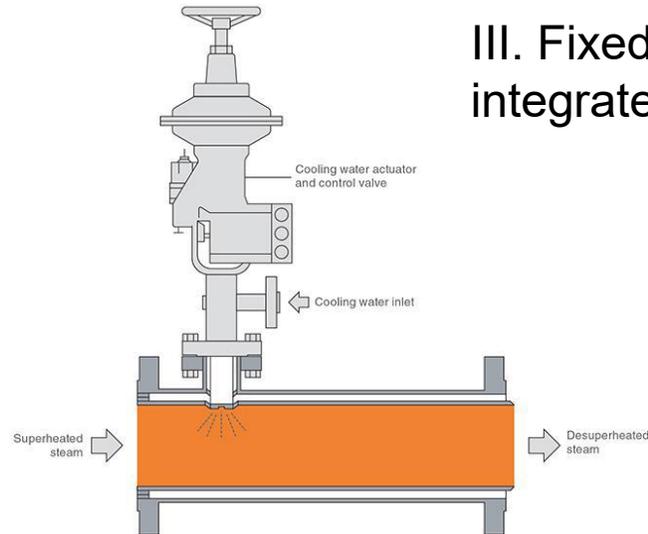
I. Fixed nozzle



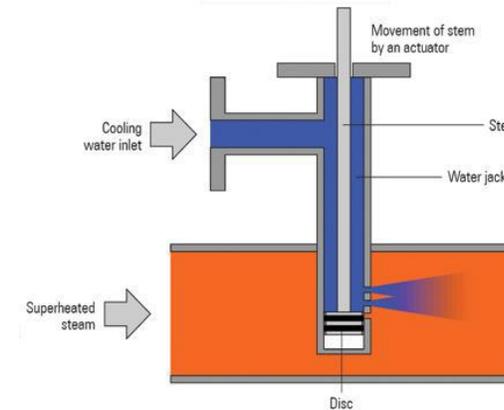
II. Fixed nozzle



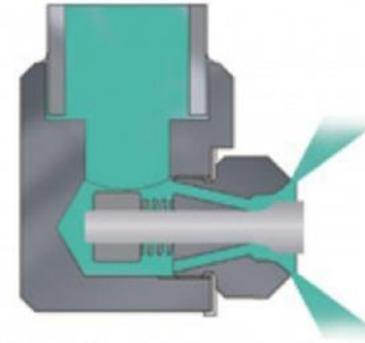
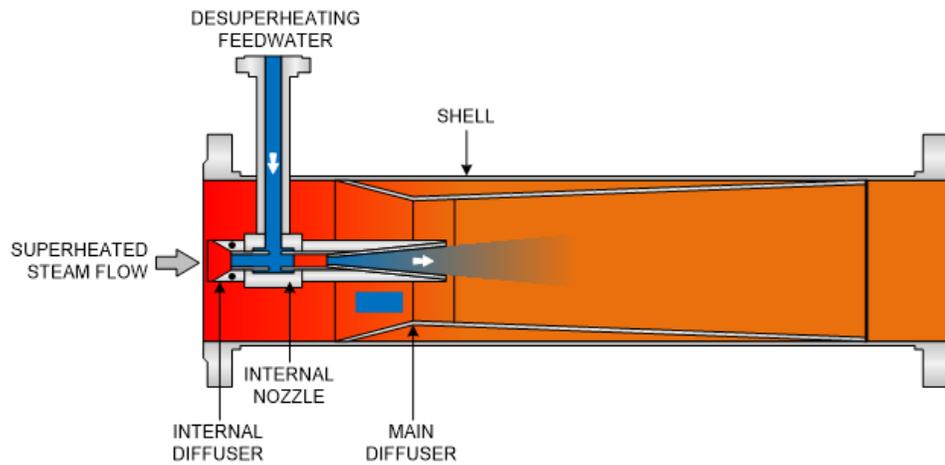
III. Fixed nozzle with integrated control



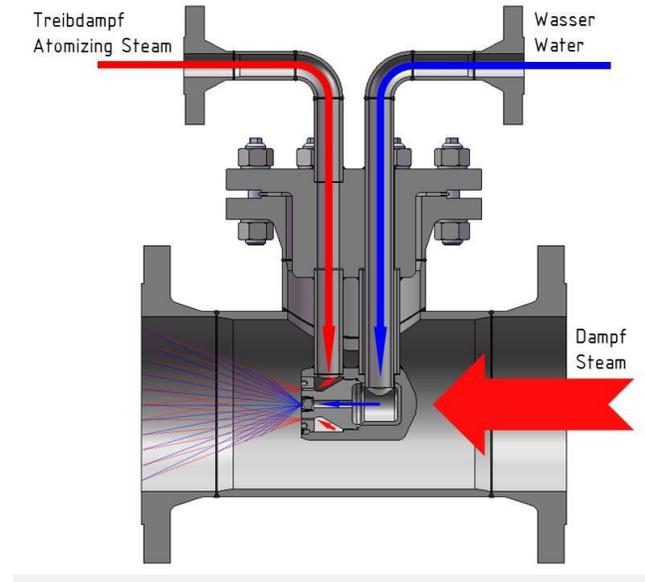
IV. Variable nozzle hot steam cooler



V. Venturi nozzle



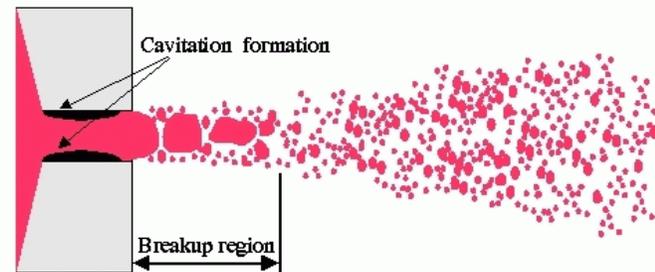
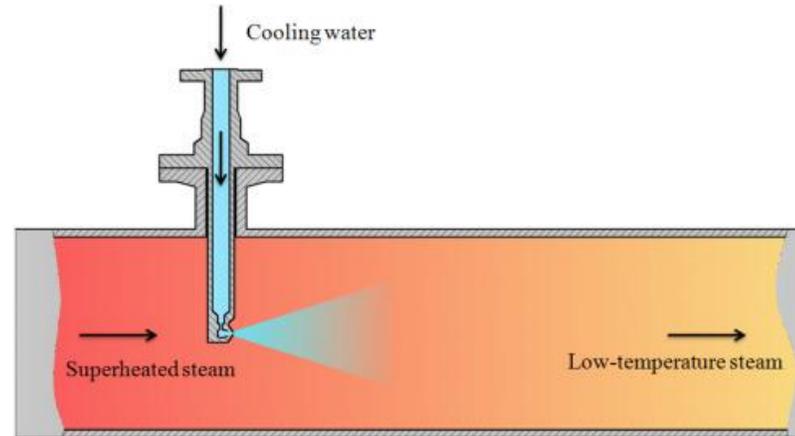
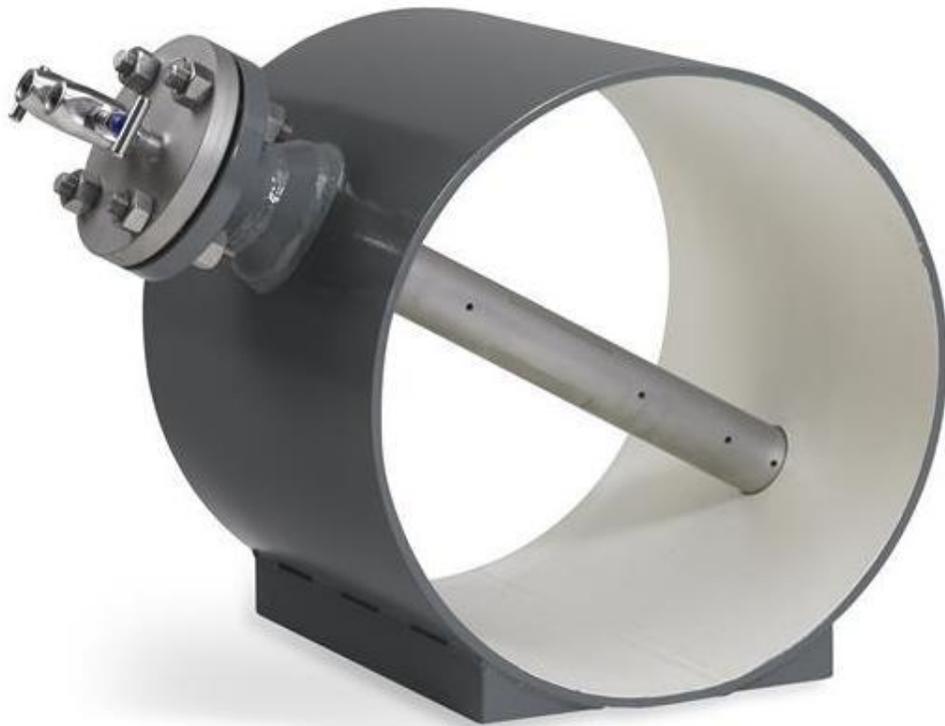
VI. Spring-loaded nozzle



VII. Motive steam cooler

Explanation of steam cooling

I. to III. Fixed nozzle



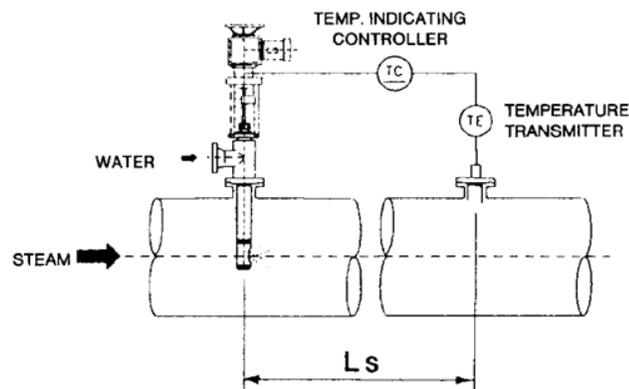
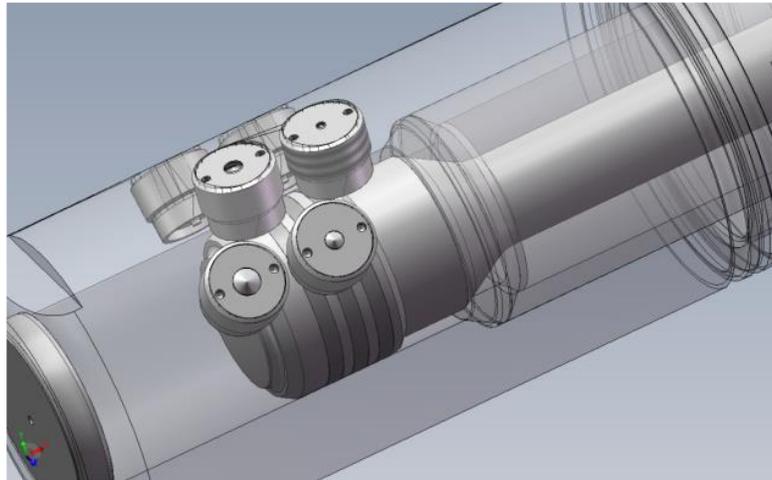
Explanation:

- Regulation by pressure
- Influenced by the speed of the steam

Explanation of steam cooling



IV. Variable nozzle



Explanation:

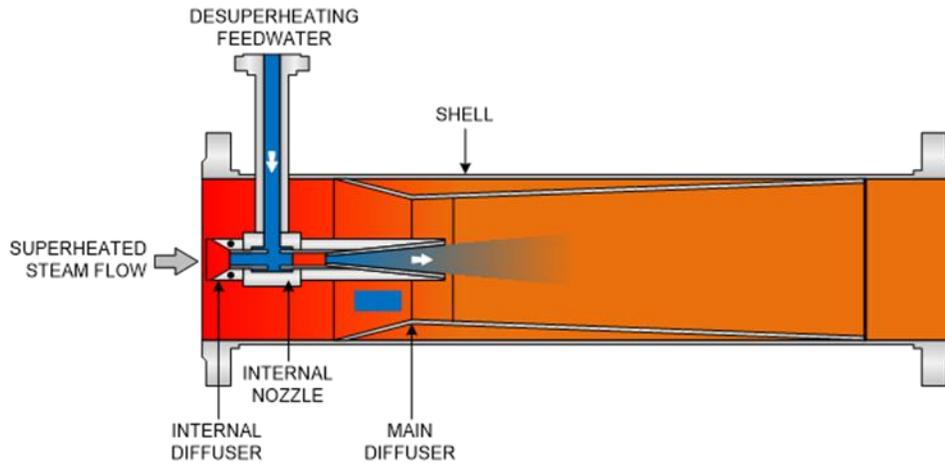
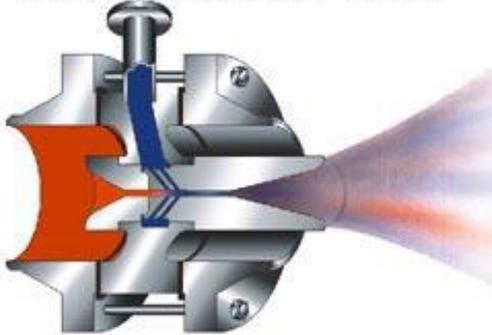
- Regulation by pressure
- Consistent pressure through the release of different nozzles

Explanation of steam cooling



V. Venturi nozzle

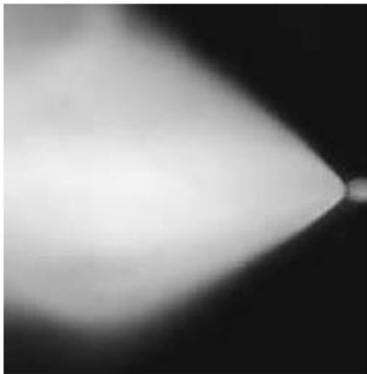
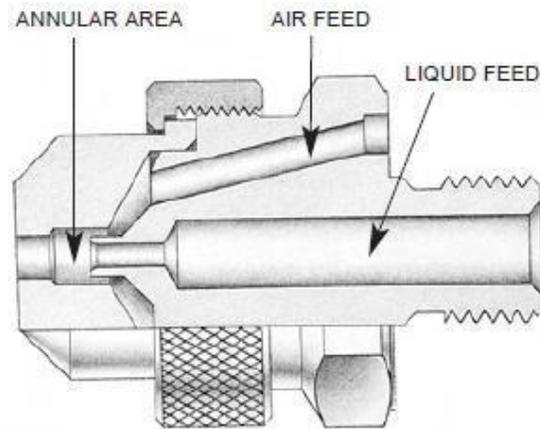
AttemperatorDesuperheater MA 6202



Explanation:

- Regulation by pressure
- Venturi effect increases steam velocity / atomization

VII. Motive steam cooling



Explanation:

- High steam velocity / very fine atomization
- Large rangeability for water

Explanation of steam cooling



Summary:

Fixed nozzle:

Rangeability of 1:5.

Inserted nozzle including thermal protection tube.

If the nozzle is spring-loaded, a larger working area is possible.

Venturi nozzle / superheated steam cooler (variable nozzles):

Rangeability of 1:10.

Suitable for precise temperature control.

The Venturi nozzle creates additional turbulence, resulting in effective steam cooling within the double diffusers. The nozzle is suitable for most general applications.

Motive steam cooler:

Rangeability of 1:50.

Suitable for very precise temperature control.

For applications where the load fluctuates significantly. The motive steam cooler uses a secondary high-pressure steam supply to finely atomize the incoming cooling water.

Comparison of different steam cooling technologies



Summary of the various steam cooling technologies:

Steam cooling only:

- Fixed nozzle
- Variable nozzle
- Spring-loaded nozzle
- Ring injection via spring-loaded nozzle
- Motive steam cooling

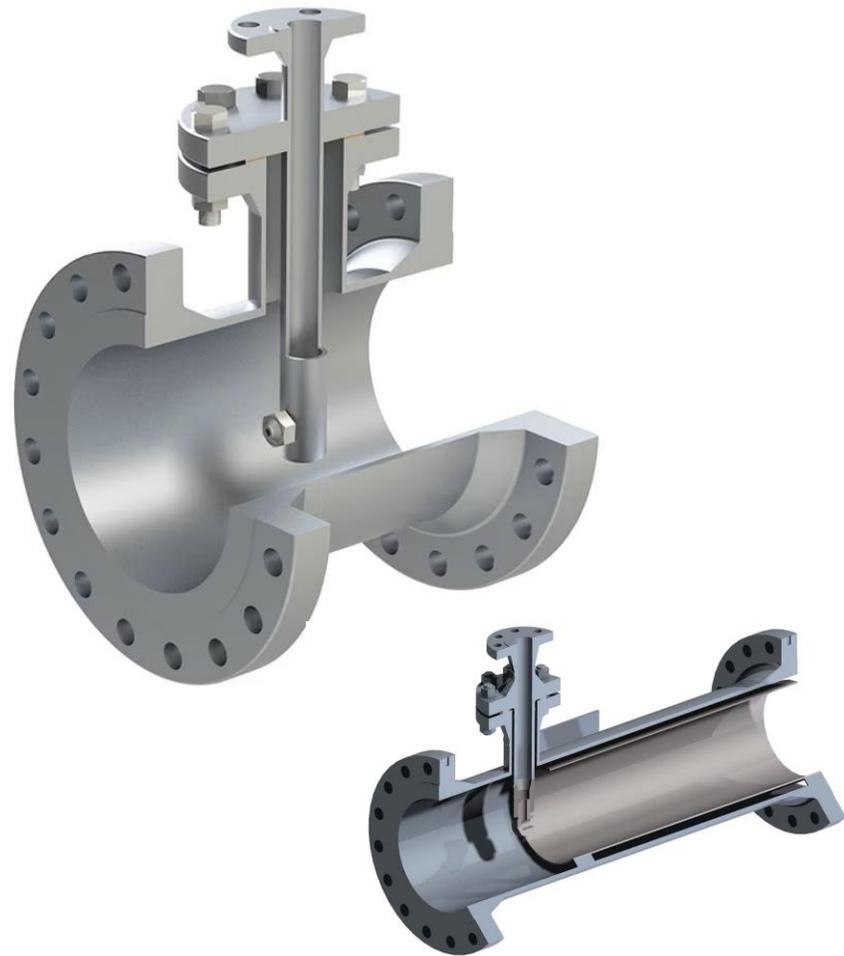
Steam cooling with pressure reduction:

- Pressure control valve followed by one of the nozzle variants
- Steam conversion valve with seat injection
- Steam conversion valve with ring injection
- Steam conversion valve with motive steam

Comparison of different steam cooling technologies



Fixed nozzle:

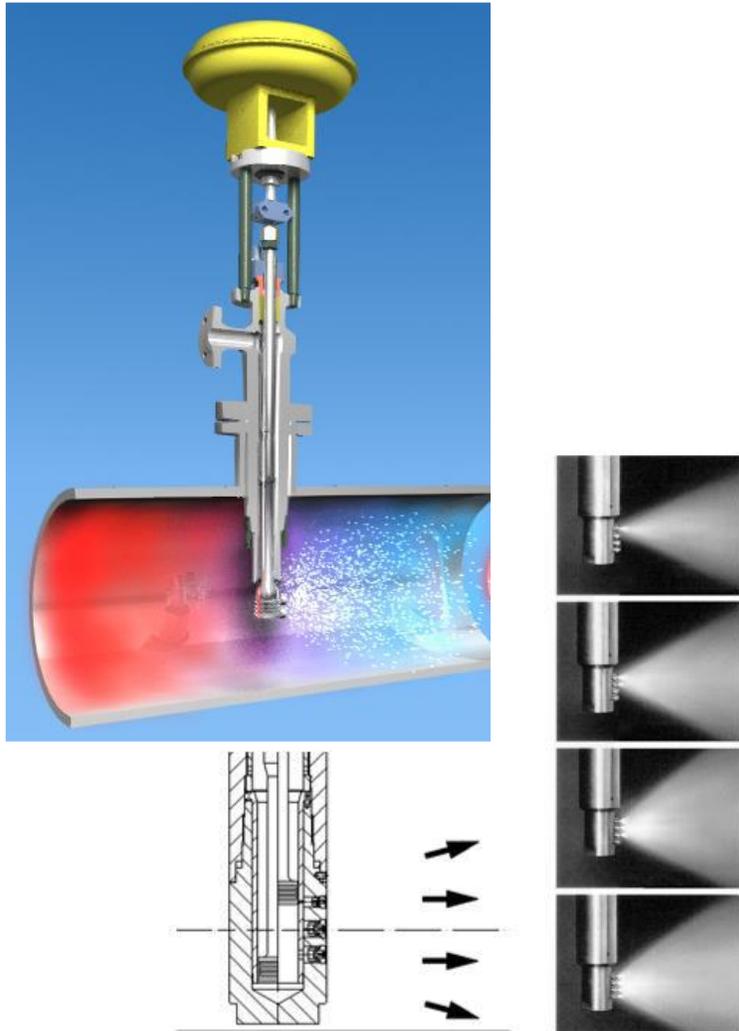


Advantages	Disadvantages
Low price	Low performance (rangeability, ...)
Easy installation and commissioning	Intermediate control accuracy
Can be combined with a pressure control valve	Not applicable for pipe diameters greater than DN 600
	Cooling to a minimum of 15 °C over saturated vapor
	Steam velocity of at least 10 m/s required
	Requires a thermowell in the steam line

Comparison of different steam cooling technologies



Variable nozzle:

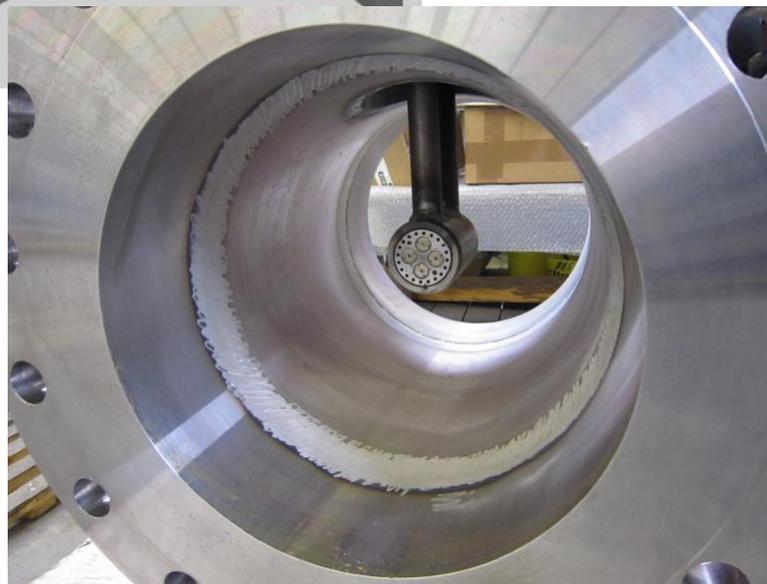
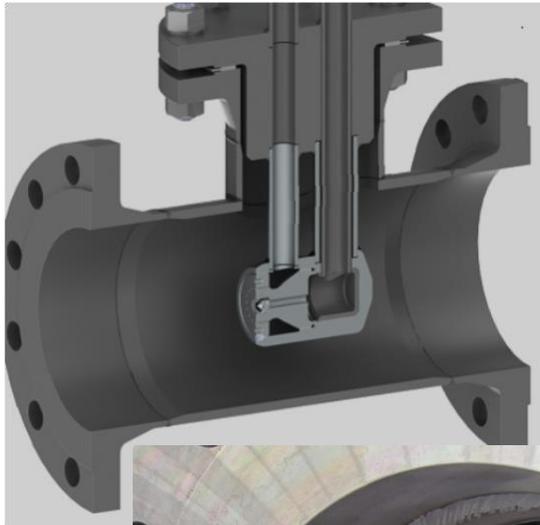


Advantages	Disadvantages
Good rangeability	Maximum 20 % water content
Low investment costs	High water pressure necessary. Min. 10 bar delta P
Control unit included	Not applicable for pipe diameters greater than DN 1200
Can be combined with a pressure control valve	Cooling to minimum 5 °C over saturated vapor
	Minimum steam velocity must be 7 to 10 m/s
	Requires a thermowell in the steam line

Comparison of different steam cooling technologies



Motive steam nozzle:

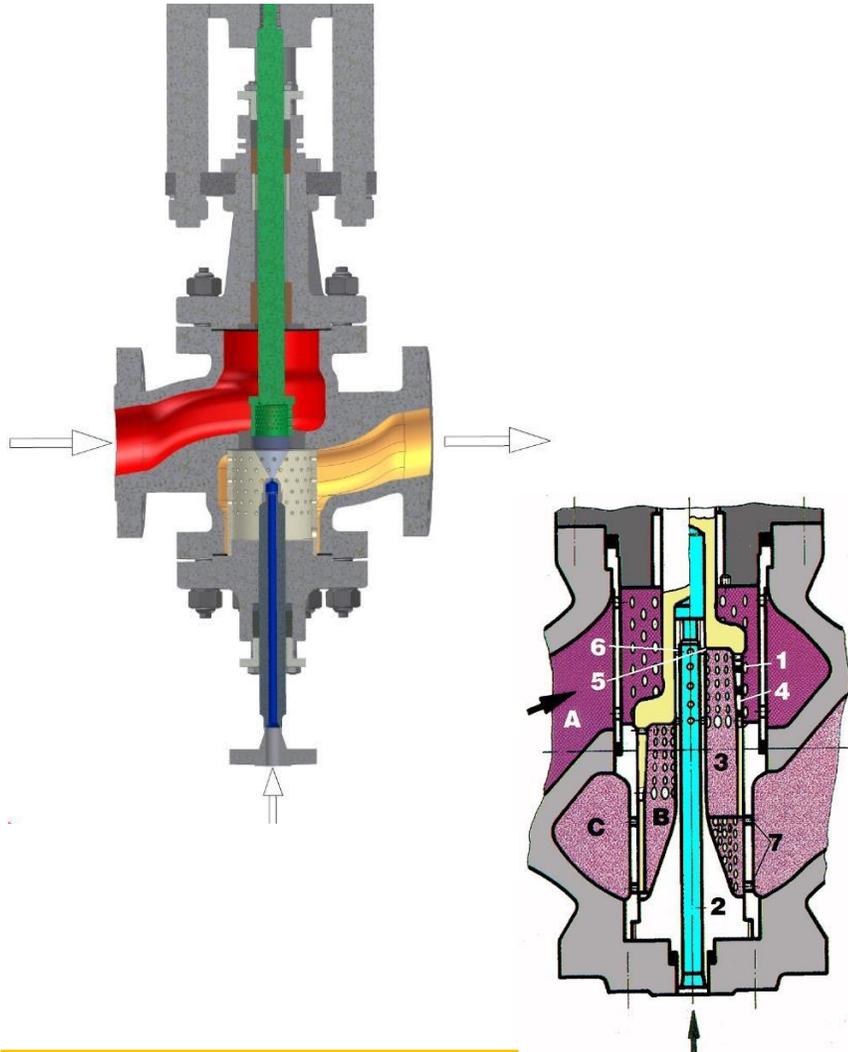


Advantages	Disadvantages
Large rangeability	High outlay – valves required for steam and cooling water
Minimal distance to temperature sensor	Requires motive steam
Cooling to near saturated vapor (+ 3°C)	
Can be combined with a pressure control valve	
Does not require a thermowell in the steam line	

Comparison of different steam converting technologies



Seat injection:



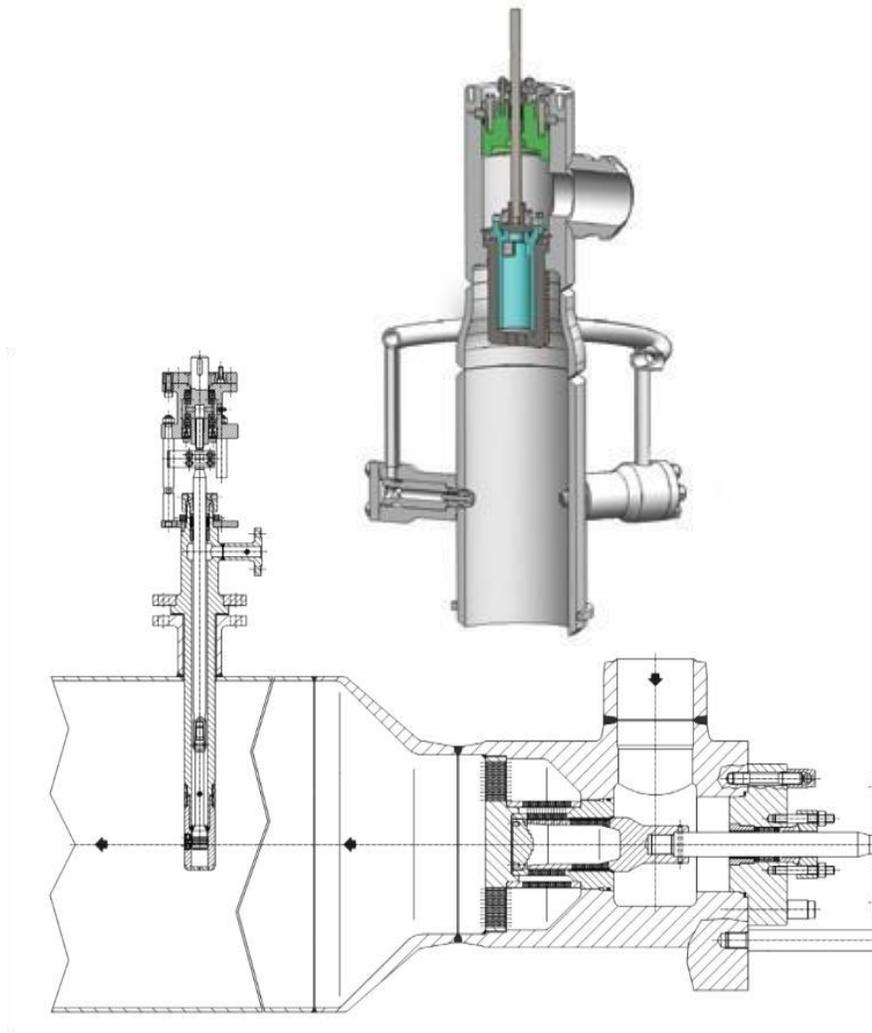
Advantages	Disadvantages
Low cost	Cooling to minimum 5 to 10 °C over saturated vapor
Good control accuracy	Requires high water temperatures
Good rangeability	High risk of thermal shock at high steam temperatures



Comparison of different steam converting technologies



Steam conversion valve with downstream cooling

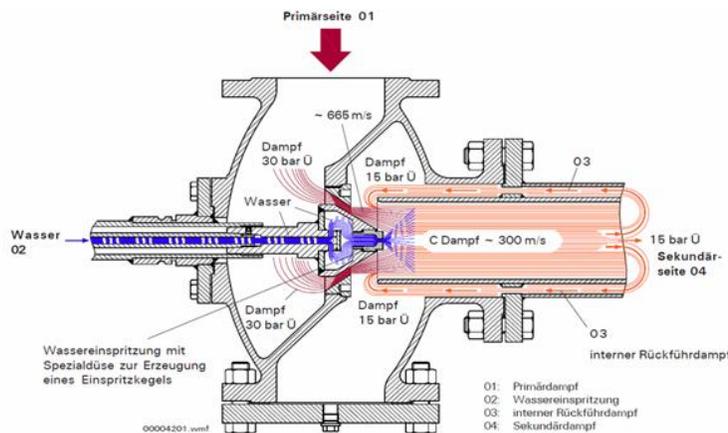


Advantages	Disadvantages
Large quantities of water possible	Cooling to minimum 5 to 10 °C over saturated vapor
Low water pressure possible	Minimum steam velocity must be 7 to 10 m/s
Good controllability with variable or spring-loaded nozzles	Relatively large distance to temperature sensor
	Limited rangeability with standard superheated steam cooler
	Requires a thermowell in the steam line

Comparison of different steam converting technologies



Steam conversion valve with motive steam

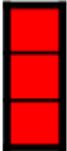


Advantages	Disadvantages
Best temperature control	
Greatest rangeability	
No thermal shock in the seat/plug area	
Very short distance to temperature sensor	
Cooling to near saturated steam (+ 3°C)	
No thermowell required in the steam line	

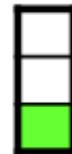
Comparison of different steam converting technologies



Selection table for determining steam cooling based on outlet temperature :

	Fixed nozzle (spraying system)	Venturi nozzle	Variable nozzle controlled Type	Atomizing steam cooler
 $T_2 > T_{\text{Saturation}} + 15^\circ\text{C} / 27^\circ\text{F}$				
 $T_2 > T_{\text{Saturation}} + 7^\circ\text{C} / 13^\circ\text{F}$ to $15^\circ\text{C} / 27^\circ\text{F}$				
 $T_2 < T_{\text{Saturation}} + 7^\circ\text{C} / 13^\circ\text{F}$				

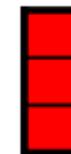
Application Ranking



Simple



Advanced



Severe Service

Comparison of different steam converting technologies



Selection table for determining steam cooling based on water content:

For a load case with only + 10°C / + 18 °F above saturation:

	Fixed nozzle (spraying system)	Venturi nozzle	Variable nozzle controlled Type	Atomizing steam cooler
 % water / steam < 10 %				
 % water / steam < 10-15%				
 % water / steam > 15%, < 20 %				

Application Ranking



Simple



Advanced



Severe Service



Steam converting valve baelz Typ 591

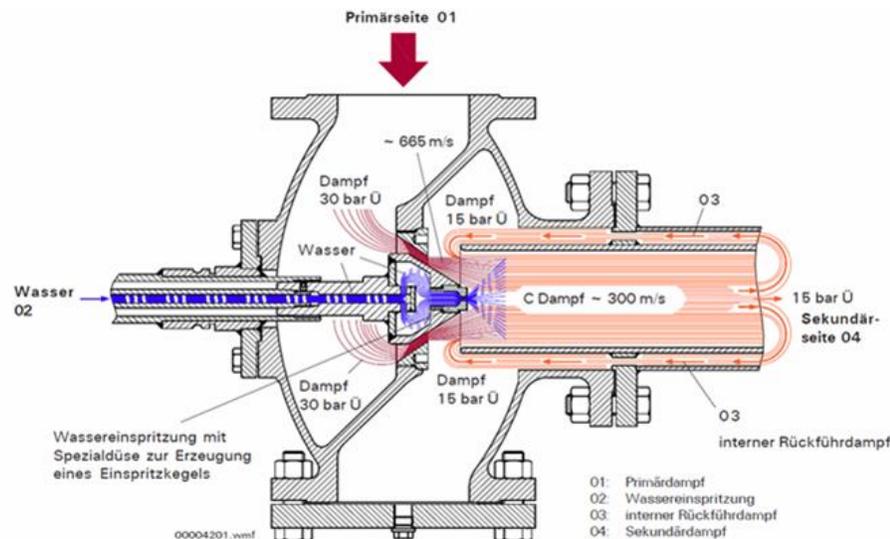
Nominal sizes: DN32 to DN400 (DN250 to DN400 upon request)

Nominal pressure: PN16 to PN160 (PN63 to PN160 upon request)

Body material: 5.3103 / 1.0619 (others upon request)

Standard: DIN (ASME upon request)

Connection: Flanges



Advantages of the 591:

- Motive steam with Venturi effect
- Additional mixing tube for improved evaporation
- High turn down ratio
- Very high steam quality with steam cooling to saturated steam level

Let's get in touch 😊



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