



# QVF® SUPRA SHELL AND TUBE HEAT EXCHANGERS

- Medium side corrosion resistant - service side up to 6 barg -
- Both sides corrosion resistant up to 3 barg -
- Suitable for pharmaceutical production -

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PROCESS SYSTEMS





The large heat transfer surfaces and high heat transfer coefficients of shell & tube heat exchangers permit the transfer of larger amounts of heat than is possible with coil type heat exchangers

## HIGHLIGHTS

- Both sides resp. tubes and shell resistant to corrosion
- Pressure-proof (medium or service side) up to +6 barg
- Suitable for pharmaceutical products

The QVF SUPRA shell and tube heat exchangers are available with

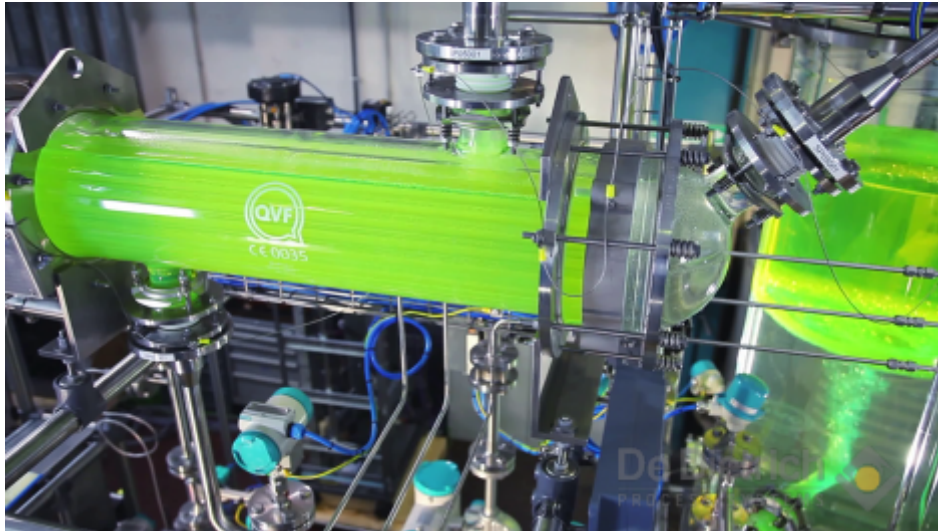
- nominal diameters of DN80 to DN300
- heat exchange surfaces of 0.3m<sup>2</sup> to 27m<sup>2</sup>
- tubes made of borosilicate glass 3.3 or SiC
- shells made of borosilicate glass 3.3, glass-lined steel or stainless steel
- headers made of borosilicate glass 3.3, glass-lined steel or stainless steel

The standard models of the QVF SUPRA shell and tube heat exchanger are designed for the condensation and tempering of highly corrosive substances between

- -20 and 150°C
- -1 bis +6 barg

For other process parameters, we offer custom-engineered solutions. Please contact us for details.

QVF type 1 universal shell and tube heat exchanger for liquid/liquid heat transfer in an extraction plant.



## CONCEPT

- Corrosion and diffusion resistant materials
- For pressures up to +6 barg
- Modular design catering for a wide range of heat transfer processes
- One tube diameter for all versions
- One tube fitting for all versions
- One PTFE tube plate for all versions of same nominal diameter
- FDA material certificates for all components that are in direct contact with the product
- Prevention of cross-contamination by means of optional intermediate chamber that can be drained separately

## YOUR BENEFITS

- Inert materials suitable for highly corrosive processes and ultra-pure products
- Diffusion resistant materials for extended operation time
- Smooth inert surfaces allowing for extended service intervals
- Minimized spare parts stocking thanks to modular design
- Excellent design and construction for reliable operation and easy servicing
- Compliance with European and other international safety standards
- Optimized apparatus design based on extensive experience in plant manufacture

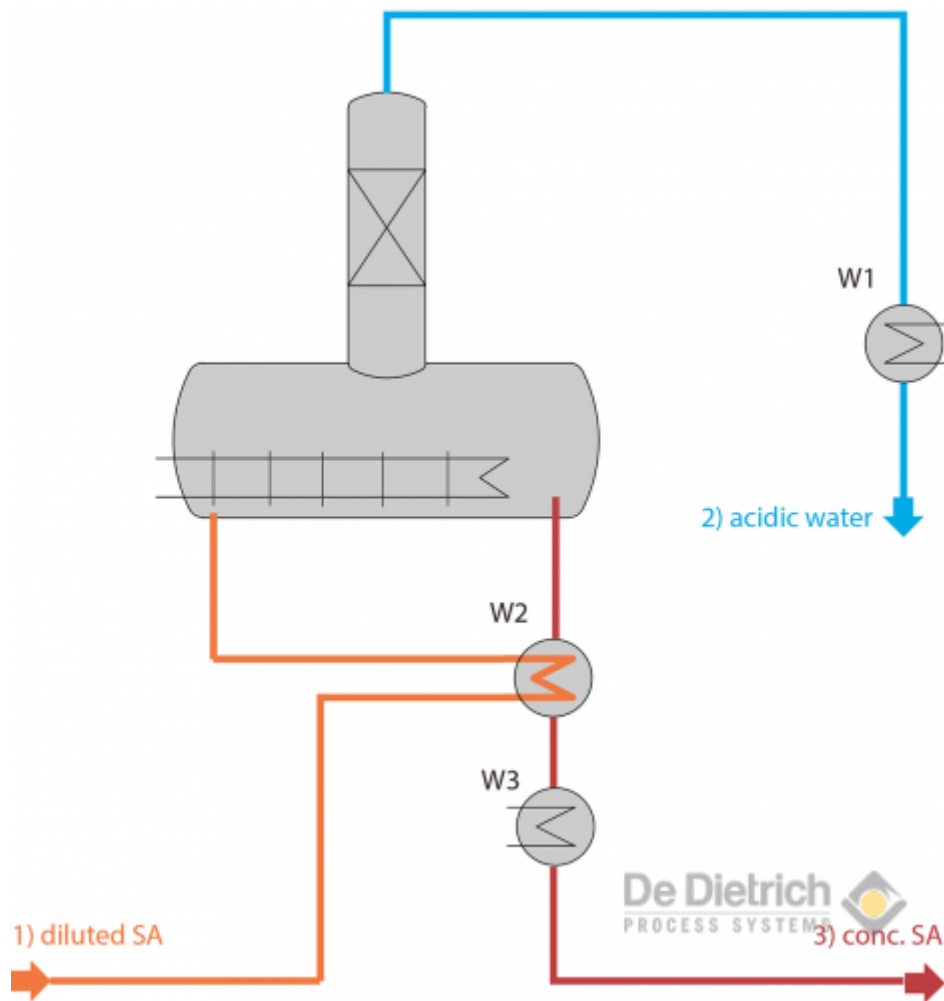
## APPLICATION

- W1: Condensation - one side corrosion resistant
- W2: Heat transfer - both sides corrosion resistant
- W3: Cooling - one side corrosion resistant

QVF SUPRA shell and tube heat exchangers with borosilicate glass 3.3 or SiC tubes are corrosion resistant and can thus be used for a wide range of processing steps. The example below shows a simplified sulfuric acid concentration plant to illustrate this:

Flow chart of a QVF sulfuric acid concentration plant with QVF shell and tube heat exchangers

- W1: Condensation - one side corrosion resistant
- W2: Heat transfer - both sides corrosion resistant
- W3: Cooling - one side corrosion resistant

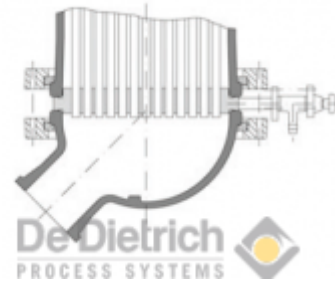
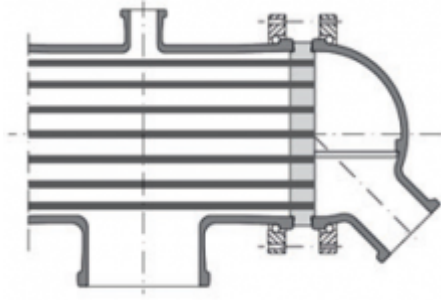


## UNIVERSAL SHELL AND TUBE HEAT EXCHANGER - TYPE 1

Tube and shell resistant to corrosion - tube side resistant to +3 barg

The universal shell and tube heat exchanger type 1 is resistant to corrosion at both sides. At the tubes and headers, the maximum permissible pressure is +3 barg, irrespective of the size of the glass header. At the shell, the maximum permissible pressure depends on the rated diameter of the glass shell and is limited to max. +2 barg. This PED heat exchanger can be used for the applications below - condensation in shell, heat recovery and cooling in shell and/or tubes. With the appropriate headers, it can also be operated as a falling-film absorber and evaporator. The shell and tube heat exchanger is suitable for horizontal or vertical installation. For servicing, it can be completely emptied.

Universal shell and tube heat exchanger - Type 1



## HEAT TRANSFER TUBE

### Corrosion and diffusion resistant materials

The heat is transferred through the walls of the tubes. SiC has a significantly higher thermal conductivity than borosilicate glass 3.3. In practical applications, and depending on the actual process conditions, SiC shell and tube heat exchangers therefore achieve heat transfer coefficients that are 2 to 4 times higher than those of shell and tube heat exchangers made in borosilicate 3.3 glass. For the dimensioning of the plant, the choice of the tube material (SiC or borosilicate 3.3 glass) is therefore a key factor. SiC shell and tube heat exchangers tend to be of a more compact design than those made in borosilicate 3.3 glass, but costs are significantly higher. The SiC and borosilicate 3.3 glass tubes used in all heat exchangers have the same diameter. The glass tubes can withstand 6 barg, while the SiC tubes are designed for pressures up to 180 barg.

Application / Anwendung	Fluid / Medium	k-value / k-Wert W/m <sup>2</sup> K	
		Glass / Glas	SiC
Liquid/Liquid / Flüssig/Flüssig	Water - Wasser / Wasser - Wasser	330-560	650 - 1800
	Water - Organics / Wasser - Lösemittel	300 - 500	500 - 1400
	Water - Heat transfer oil / Wasser - Wärmeträgeröl	220 - 400	400 - 800
Liquid/Gas / Flüssig/ Gas	Water - Air / Wasser - Luft	15 - 90	15 - 90
Liquid/Vapour / Flüssig/ Dampf	Water - Water / Wasser - Wasser	520 - 640	1400 - 3100
	Water - Organics / Wasser - Lösemittel	400 - 580	900 - 2100

Typical heat transfer coefficients for various applications

## TUBE PLATE

Standardized PTFE tube plate for all QVF SUPRA shell and tube heat exchangers of the same nominal diameter

The tube plates that seal the heat transfer tubes are made from pure PTFE with FDA material certificate. The seals between the tube plates and the shell as well as the header consist of exchangeable FEP-coated silicone rings placed in a recess in the tube plate. In vertically installed heat exchangers, the shell can be emptied through the PTFE tube plate. The PTFE tube plate is equipped with a steel ring and can withstand differential pressures of up to 4 bar at temperatures far in excess of 150°C. As there is only one tube plate type per nominal diameter that fits all heat exchangers, spare parts stocking is streamlined.

## TUBE FITTING

### Single-piece fitting for easy installation

The tube fitting made in pure PTFE with FDA material certificate fits all QVF SUPRA shell and tube heat exchangers, irrespective of the tube material or size. Consisting of a single part and protruding from the tube plate, it can be easily re-tightened and replaced. Operators can thus exchange individual tubes without having to open the seals of adjacent tubes.

Single-piece PTFE tube fitting



## HEADER

### Corrosion resistant glass header for up to 3 barg

The glass headers are made in borosilicate glass 3.3 to ensure that the tube side of the heat exchanger is completely resistant to corrosion. The glass headers of all sizes meet the PED requirements and are dimensioned for 3 barg. Optional PTFE segments in the headers allow for 3-channel flow of the service medium through the tubes.

## SHELL

### Corrosion resistant glass shell

The shell of the heat exchanger is made in borosilicate 3.3 glass. The permissible maximum

pressure according to PED is max. +2 barg, depending on the nominal diameter. The shell branches are dimensioned and positioned according to the actual application requirements.

## **GMP UNIVERSAL SHELL AND TUBE HEAT EXCHANGER - TYPE 5**

Tube and shell resistant to corrosion - tube side resistant to 3 barg

The type 5 GMP universal shell and tube heat exchanger is based on the type 1 heat exchanger, whereby each tube plate is equipped with an intermediate chamber made in borosilicate 3.3 glass and a second tube plate. The intermediate chamber is designed to collect any liquid that might escape through leakage to prevent it from contaminating the other medium. It thus eliminates any risk of cross-contamination between the two media. For applications and operating conditions, see type 1.

GMP universal shell and tube heat exchanger - Type 5



## **VERSIONS WITH STAINLESS STEEL COMPONENTS**

One side corrosion resistant

The QVF SUPRA shell and tube heat exchanger is available in various versions that are optimised for specific applications. The tubes, PTFE tube plates, tube fittings, glass shells and glass headers are the same as in type 1. If there is no risk of corrosion at the service side, it is possible to use stainless steel components.

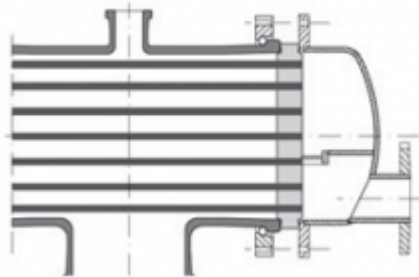
## **CONDENSER - TYPE 2**

Shell side corrosion resistant - service side with

# stainless steel header and DIN or ANSI connection

Type 2 heat exchangers with corrosion resistant medium side are of the same design as type 1 universal shell and tube heat exchangers, but feature stainless steel headers with DIN/ANSI connection flanges instead of a glass headers. The flanges allow for more compact connections to the service medium lines, while the operating conditions remain the same. The service medium is fed through the headers and flows through the tubes. As the shell side of the heat exchanger is corrosion resistant, this version is generally used for the condensation and tempering of corrosive liquids.

Heat exchanger corrosion resistant on shell side - Type 2



## VERSION WITH REINFORCING PLATE

Stainless steel plate allows for higher service side pressures

If corrosion is not an issue at the service side, reinforcing plates made in stainless steel can be installed so that the service medium pressure can be increased from +3 to +6 barg. The reinforcing plate is secured with PTFE-jacketed bolts to the header or the shell side of the standard PTFE tube plate. Depending on the nominal diameter, the bolts replace 1, 2 or 3 heat transfer tubes.

PTFE tube plate with stainless steel reinforcing plate at header / tube / service side





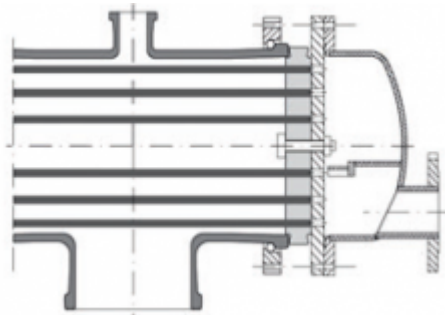
## REINFORCED CONDENSER - TYPE 3

Shell side corrosion resistant – service side pressure resistant up to 6 barg

Diagram of type 3 heat exchanger with pressure resistant service side

The type 3 heat exchanger with pressure resistant service side is based on the type 2 condenser, with an added reinforcing plate at the header side, which allows for service side pressures up to +6 barg.

Heat exchanger with increased pressure resistance on service / tube side - Type 3

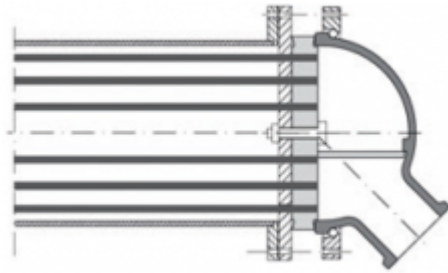


## REINFORCED EVAPORATOR - TYPE 4

Tube side corrosion resistant – service side pressure resistant up to 6 barg

The type 4 heat exchanger with pressure resistant shell at the service side is a variation of the type 1 heat exchanger, whereby the glass shell is replaced with a stainless steel shell and a reinforcing plate also made in stainless steel is screwed to the tube plate at the shell side. The service medium lines are connected to the shell, which can withstand pressures of up to 6 barg. The standard type is particularly suitable for applications where a corrosive medium at a low temperature needs to be cooled rapidly. With modified headers, it can also be used for tube condensation, as a falling-film apparatus or as an evaporator.

Heat exchanger with increased pressure resistant on shell / service side - Type 4

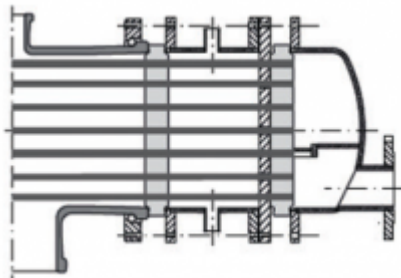


## REINFORCED GMP CONDENSER - TYPE 6

Shell side corrosion resistant – service side pressure resistant up to 6 barg

The type 6 pressure resistant GMP shell and tube heat exchanger features an intermediate chamber and a tube plate with a reinforcing plate, which allows for service side pressure in the tubes of up to 6 barg. As the PTFE tube plate is pressed against the reinforcing plate in the intermediate chamber, there is no need for PTFE-jacketed bolts to secure the reinforcing plate. This means that all bores in the PTFE tube plate can be used for heat transfer tubes.

Service side pressure resistant GMP shell and tube heat exchanger - Type 6



## REINFORCED UNIVERSAL SHELL AND TUBE HEAT EXCHANGER - TYPE 7

One side corrosion resistant – service and medium side pressure resistant up to 6 barg

The medium side of the type 7 heat exchanger is corrosion resistant and designed for pressure of up to 6 barg at the both the medium and service side. This type is available with enamel components replacing the glass header or the glass shell (as required). The PTFE tube plate is equipped with a reinforcing plate at the service side.

Heat exchanger being both sides pressure resistant up to 6 barg and the shown version is corrosion resistant on the shell side - Type 7.



## TYPE OVERVIEW

The table below provides an overview of the various versions of the Standard QVF shell and tube heat exchanger.

Component	Material	Pressure + barg	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7
Shell	Glass	1 (2)	X	X	X		X	X	
	Steel	6				X			X
	Enamel	6							X
Header	Glass	3	X			X	X		
	Steel	6		X	X			X	X
	Enamel	6							X
Plate	PTFE	3	X	X			X		
	PTFE = Plate, header side	6			X			X	X
	PTFE = Plate, shell side	6				X			X
Tube	Glass	6	X	X	X	X	X	X	X
	SiC	10	X	X	X	X	X	X	X
Inter-mediate chamber	Glass	-					X		
	Steel	-							

Overview of the various versions of the Standard QVF® shell and tube heat exchanger.

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## SAMPLE APPLICATIONS

W1:

CW tube side, shell side corrosion resistant =>

P(KW) <+3 barg without S-Platte: Typ 1, 2 (glass shell)

P(KW) >+3 barg with S-Platte: Typ 3 (glass shell)

W2:

both sides corrosion resistant =>

P < 3 barg without S-Platte: Typ1

W3:

CW tube side, shell side corrosion resistant=>

P(KW) < +3 barg without S-Platte: Typ1 (glass shell)

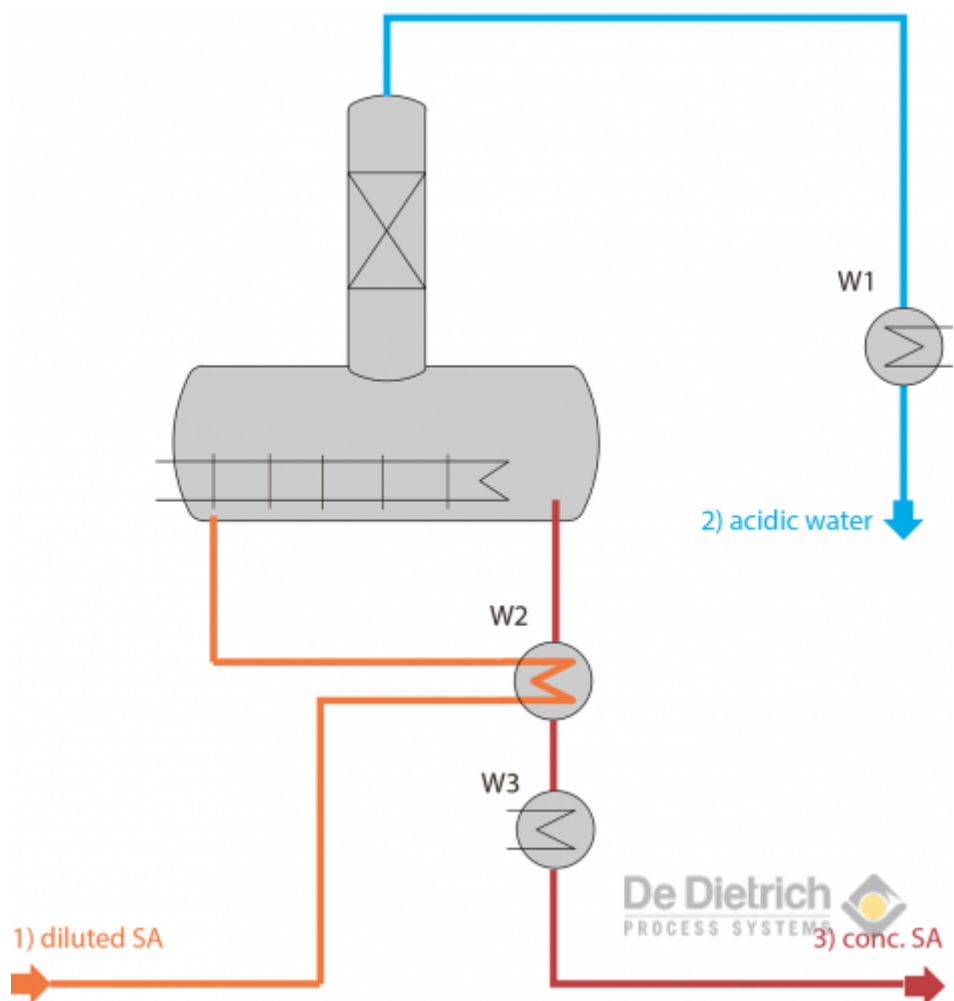
P(KW) > +3 barg with S-Platte: Typ 7 (email shell)

CW tube side, shell side corrosion resistant =>

P(KW) < +1/2 barg without S-Platte: Typ 1 (glass header)

P(KW) > +1/2 barg with S-Platte: Typ 4 (glass header)

Suitable heat exchanger types for use in the previously introduced sulfuric acid concentration plant are shown below. We would be delighted to design optimized heat exchangers that meet the requirements of your process.

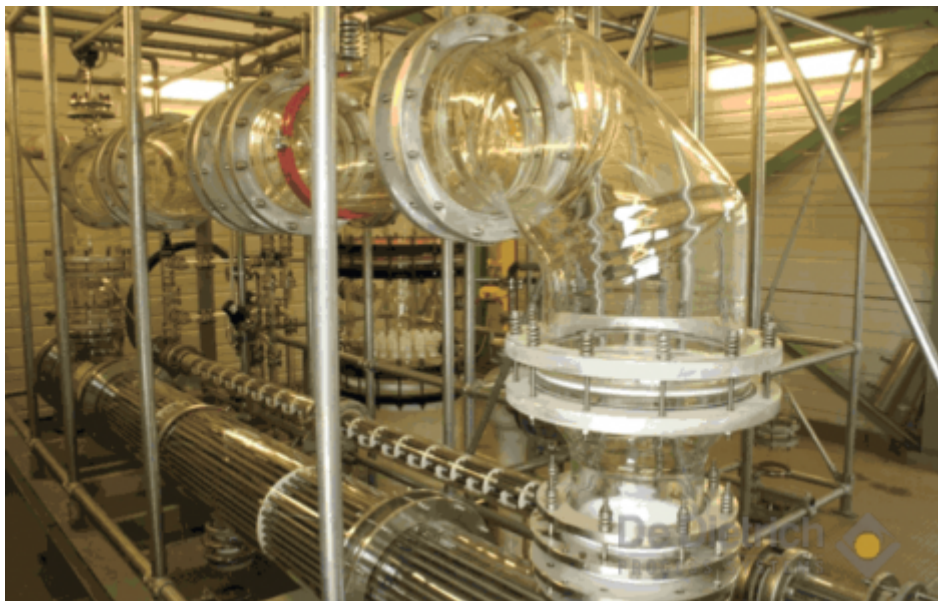


## EXAMPLES

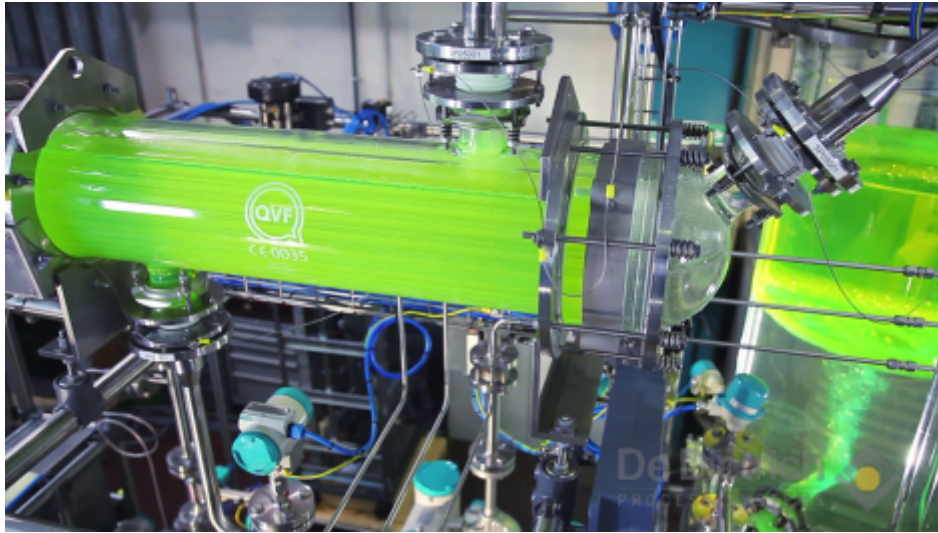
Plant for the dealcoholization of wine with 2 falling-film evaporators based on type 1.



QVF type 2 shell and tube heat exchanger with SiC tubes for the condensation of distillates containing chloric or sulfuric acid.



QVF type 1 universal shell and tube heat exchanger for liquid/liquid heat transfer in an extraction plant.



QVF type 4 shell and tube heat exchanger acting as falling-film absorber in a plant used for the production of concentrated hydrochloric acid.



## Questions? We are here to help.

If you'd like to talk with a sales representative about purchasing De Dietrich Process Systems's products and services, you can reach us here.



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