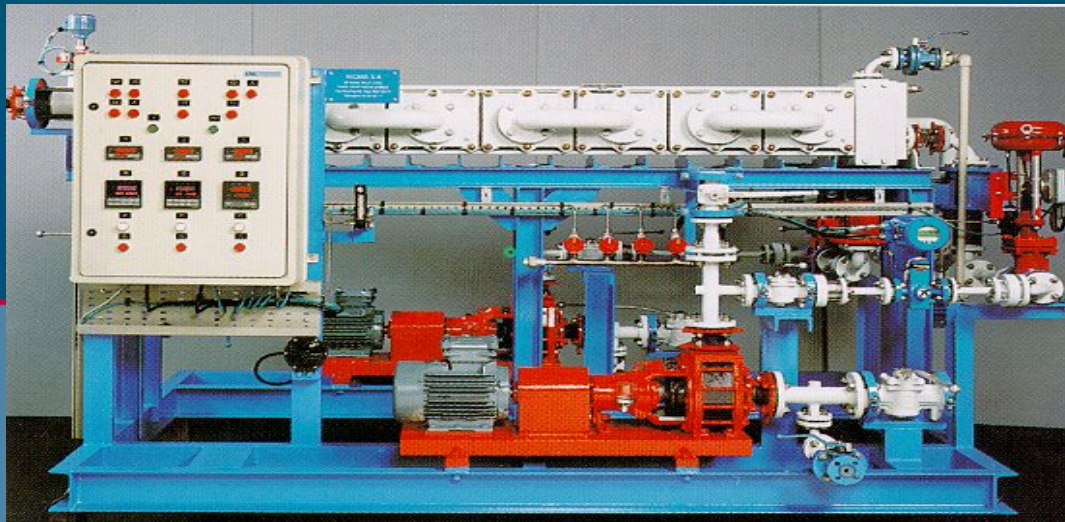




SGL GROUP
THE CARBON COMPANY

Sulfuric acid dilution units



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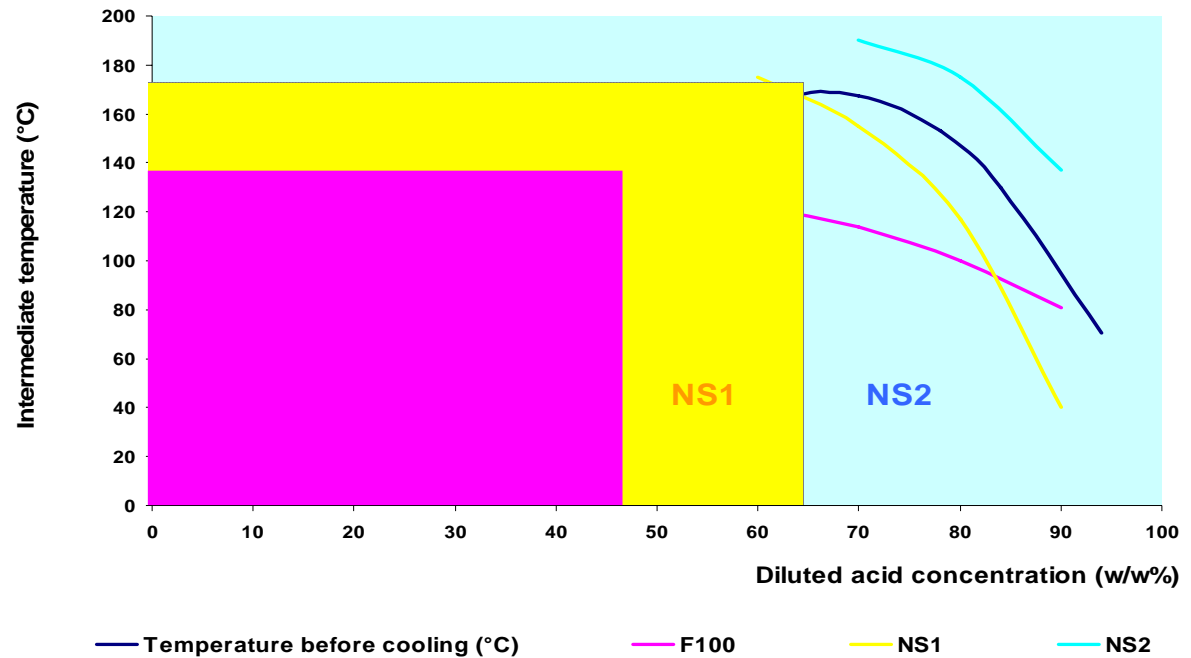
Sulfuric acid : H₂SO₄

- **Applications and market**

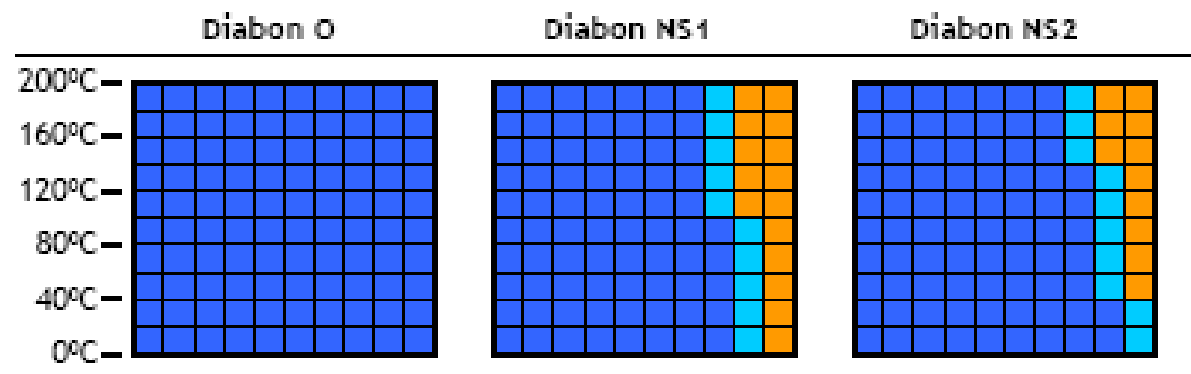
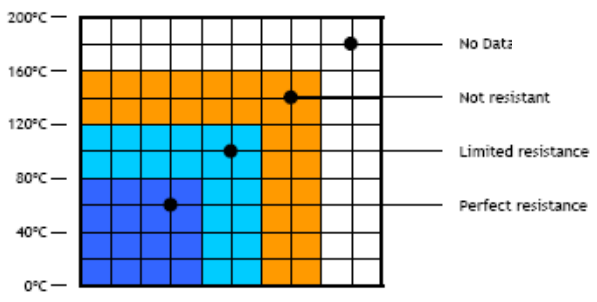
- Pigment producers (Titanium white, Barium white)
- Fertilizer Plants / phosphate rock attack
- Iron & Steel / pickling baths
- Automotive industry / car batteries
- Batteries in General
- Chemicals retailer
- Sulfuric Acid production plants
- Leather industry

DIABON Graphite is ideal material for dilution system

Corrosion table for DIABON®



Diabon® type
 0% 20% 40% 60% 80% 100%



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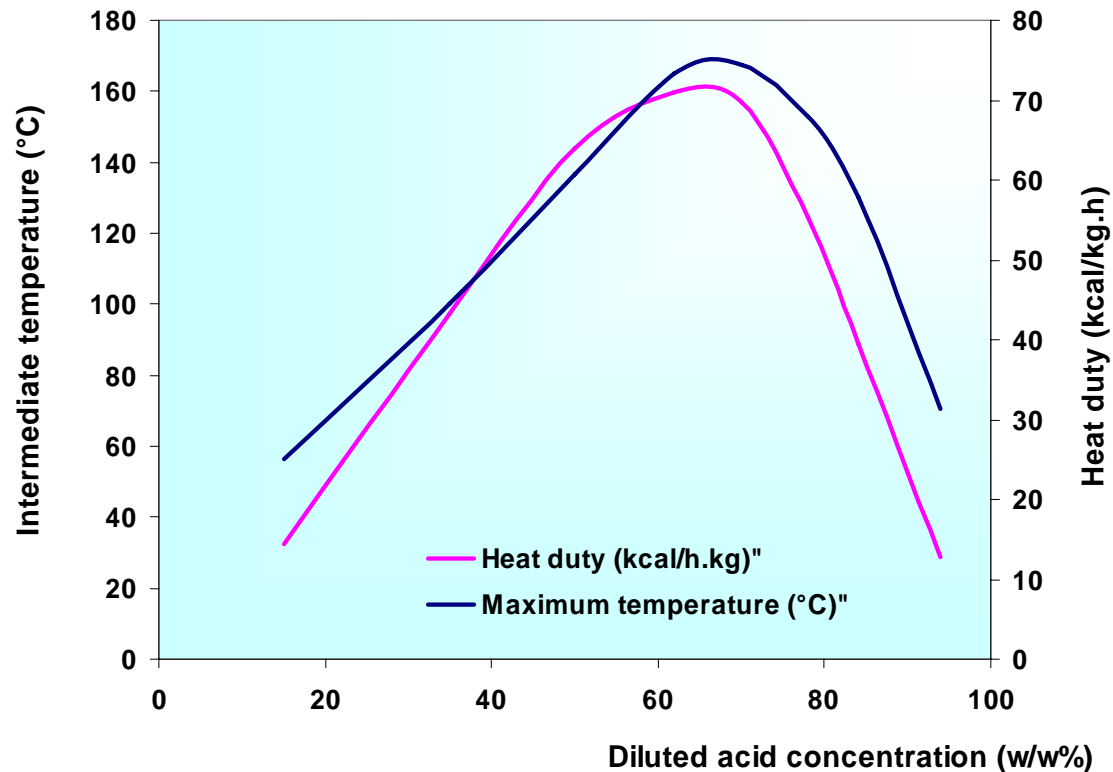
Dilution process: fluids, features and items

- **Concentrated sulfuric acid**
 - Colorless or slightly yellow liquid when pure, Very hygroscopic (used as a drying agent) and very viscous
 - Usually between 98 and 99 %, produced by sulfur burning
 - Not corrosive with high concentration with piping in C-steel or SS
- **Dilution water**
 - Should / shall be de-mineralized to avoid sulfate deposit
 - Water / Acid flow rate ratio has to be controlled to ensure the appropriate concentration
- **Sulfuric dilution process is very exothermic**
 - Dilution enthalpy is very high and after dilution, the temperature can rise up to 180 C
 - Dilution is carried out in a mixing device in PTFE lined C-steel and/or graphite PTFE
 - Static mixer or multi-pass heat exchanger are recommended to avoid corrosion in heat exchanger,. (S&T, plate or monoblock heat exchanger)
 - Pressure must be controlled and maintained to avoid boiling of diluted acid before cooling.

Dilution process: fluids, features and items

Heat exchanger

- To remove energy generated by the dilution, cooling down diluted acid from 180 C to storage temperature
- Depending on flow rate and clearness of fluids HX can be plate, block or shell and tubes
- Depending on intermediate temperature and/or H₂SO₄ concentration, DIABON NS2 must be chosen.



FEEDS at 25°C

Concentrated acid = 98%

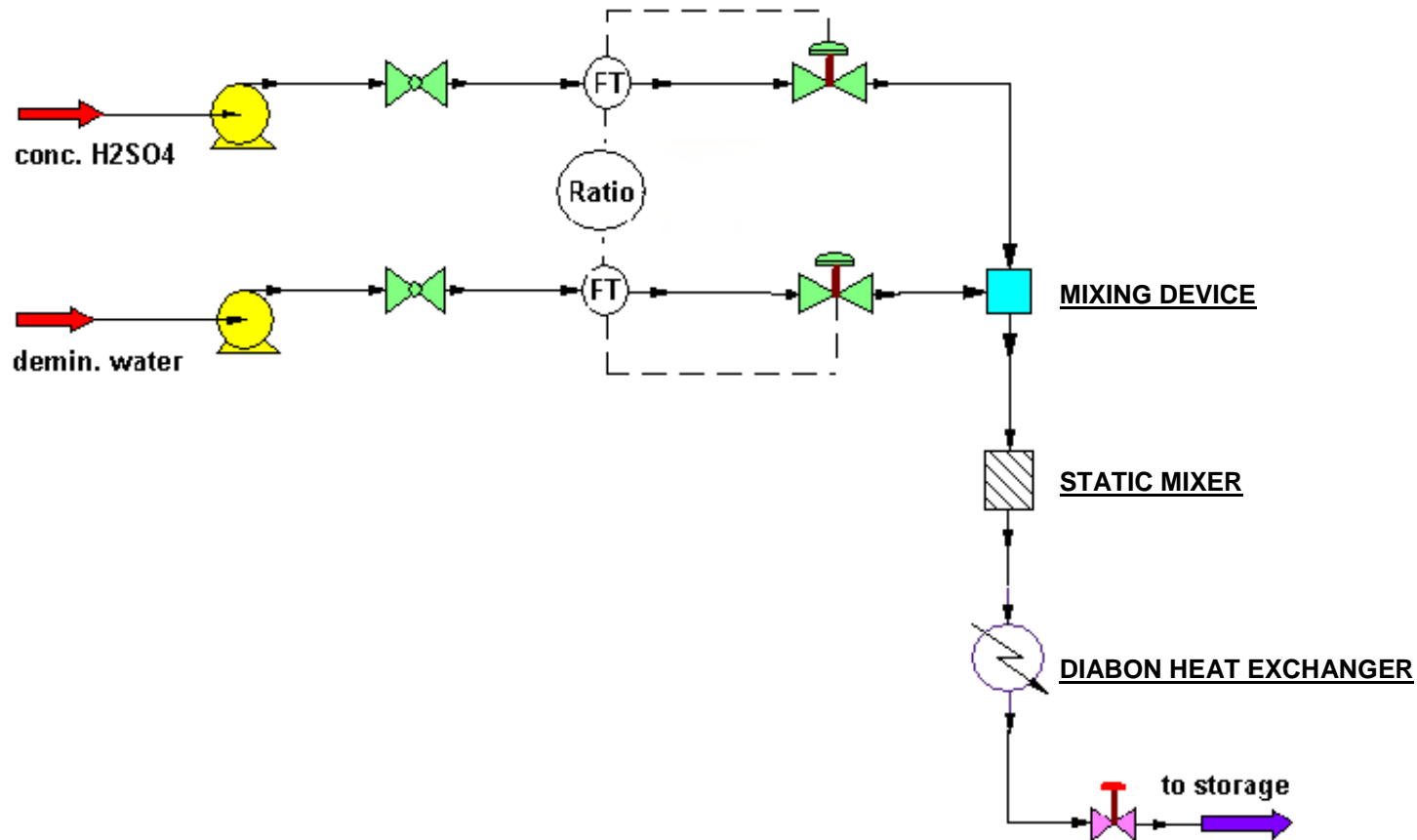
Dilution water

PRODUCT :

For storage at 40°C

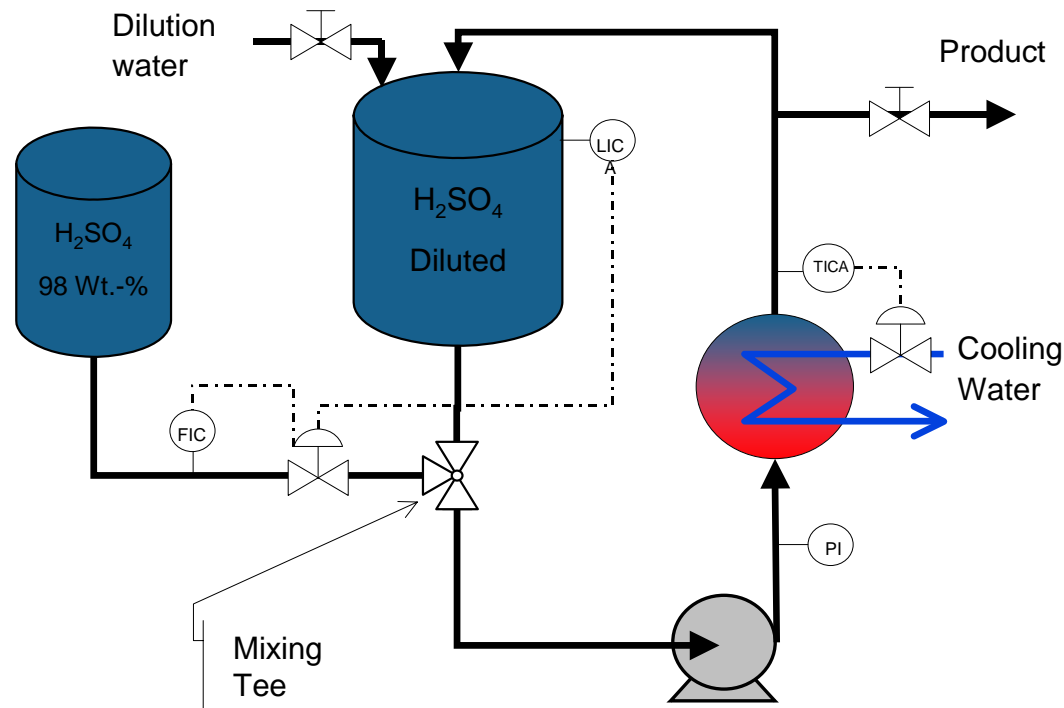
Dilution process: type of flow schemes

Continuous operations



Dilution process: type of flow schemes

Batch operations



1. The diluted acid tank is filled up with the calculated water quantity.
2. Cooling water ON
3. Pump ON
4. Control Valve ON
5. The flow meter on the concentrated acid line controls the flow rate.
6. **Level Indicator Controller Alarm (LICA)** shuts the control valve OFF
7. Manual opening of the ON/OFF valve on the product tank.
8. Either another batch can be produced, either the pump is stopped.

DIABON Dilution Systems: turn key units

- **SGL PT produces turn key units which include**
 - Anti-corrosive pumps,
 - Non return valves
 - Mixing device
 - Heat exchanger
 - All valves and control valves
 - PTFE lined piping, C-steel piping
 - Instrumentation, control and regulation including:
 - Plastic storage tanks (in option)
 - Steel structure (skid mounted units, in option)
 - Cooling tower (in option)
- **Commissioning and start-up can be carried out by SGL GROUP engineers**

Control & instrumentation

- **To control the concentrations**
 - FIC on both lines with a ratio control
 - High temperature safety level on the diluted acid at the outlet of the cooler
 - Concentration analyzer with low and high alarm on the diluted acid outlet
 - pH-meter on service side to detect acid leakages
 - Control panel including
 - PLC or other controlling device
 - Start up / shut down sequences, fully automated
 - safety interlock
 - Easy-to-use and safe mode
 - Option for manual mode in case of control system failure
 - Many concentration values may be achieved and managed by control panel, with precise and accurate regulation.

Inquiry sheet: data needed for quote

GENERAL INFORMATION				
Type of production required	Continuous	<input type="checkbox"/>	Batch	<input type="checkbox"/>
Future location of the plant (country)				
Location of the unit in the plant	Inside	<input type="checkbox"/>	Outside	<input type="checkbox"/>

PRODUCT : Diluted acid	Unit *	
Concentration <i>If the unit must be flexible to produce a range of concentrations, please precise the range.</i>		Weight %
Temperature		°C
Pressure		Bar
Diluted acid flow rate <i>(in case of continuous production)</i>		Kg/h
Production rate <i>(in case of batch production)</i> For example : 5000 kg to be produced in 4 hours		

FEED : Concentrated acid	Unit *	
Concentration available <i>(for ex. 98%)</i>		Weight %
Pressure		bar
Temperature		°C
Nature of impurities if any and quantity <i>The purity of the feed will define the purity of the product</i>		

FEED : Dilution water	Unit *	
Pressure		Bar
Temperature		°C
Nature of impurities if any and quantity <i>The purity of the feed will define the purity of the product</i>		

COOLING WATER	Unit *	
Inlet temperature		°C
Max outlet temperature		°C

COOLING WATER	Unit *	
Inlet temperature		°C
Max outlet temperature		°C
Pressure		Bar

* please advise if other

SCOPE OF SUPPLY	please mark required items
Main equipment	
Concentrated acid pumps	<input type="checkbox"/>
Dilution water pumps	<input type="checkbox"/>
Mixing device	<input type="checkbox"/>
Heat exchanger	<input type="checkbox"/>
Diluted acid intermediate storage tank	<input type="checkbox"/>
Diluted acid expedition pumps	<input type="checkbox"/>
Piping and steel structure	<input type="checkbox"/>
Skid mounted unit Including on-line instrumentation and process control system.	<input type="checkbox"/>
with Local control panel	<input type="checkbox"/>
or Control from control room(cablings up to battery limit)	<input type="checkbox"/>
Other <i>(precise)</i>	

PRICING	please mark required item
budget price +/- 15%	<input type="checkbox"/>
fixed price offer	<input type="checkbox"/>

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Example of calculations

- **Data given by the customer**
 - Concentration required = 40%
 - Flow rate = 5 m³/h
 - Outlet temperature = 40°C max.
- Cooling water temperature = 25°C
 - Concentrated acid available : 98% at 30°C
 - Dilution media available : water at 30°C

- **Calculation results**

Dilution water

Flow rate needed = 2628 kg/h

Concentrated acid

Flow rate needed = 3812 kg/h

Diluted acid before cooling

Flow rate = 6440 kg/h

Intermediate temperature = 117°C (>boiling point at 1 bar)

⇒ Heat must be evacuated to cool down to 40°C

⇒ Pressure must be maintained to avoid boiling of H₂SO₄

⇒ Flow rates must be maintained proportionally to ensure the final concentration

References

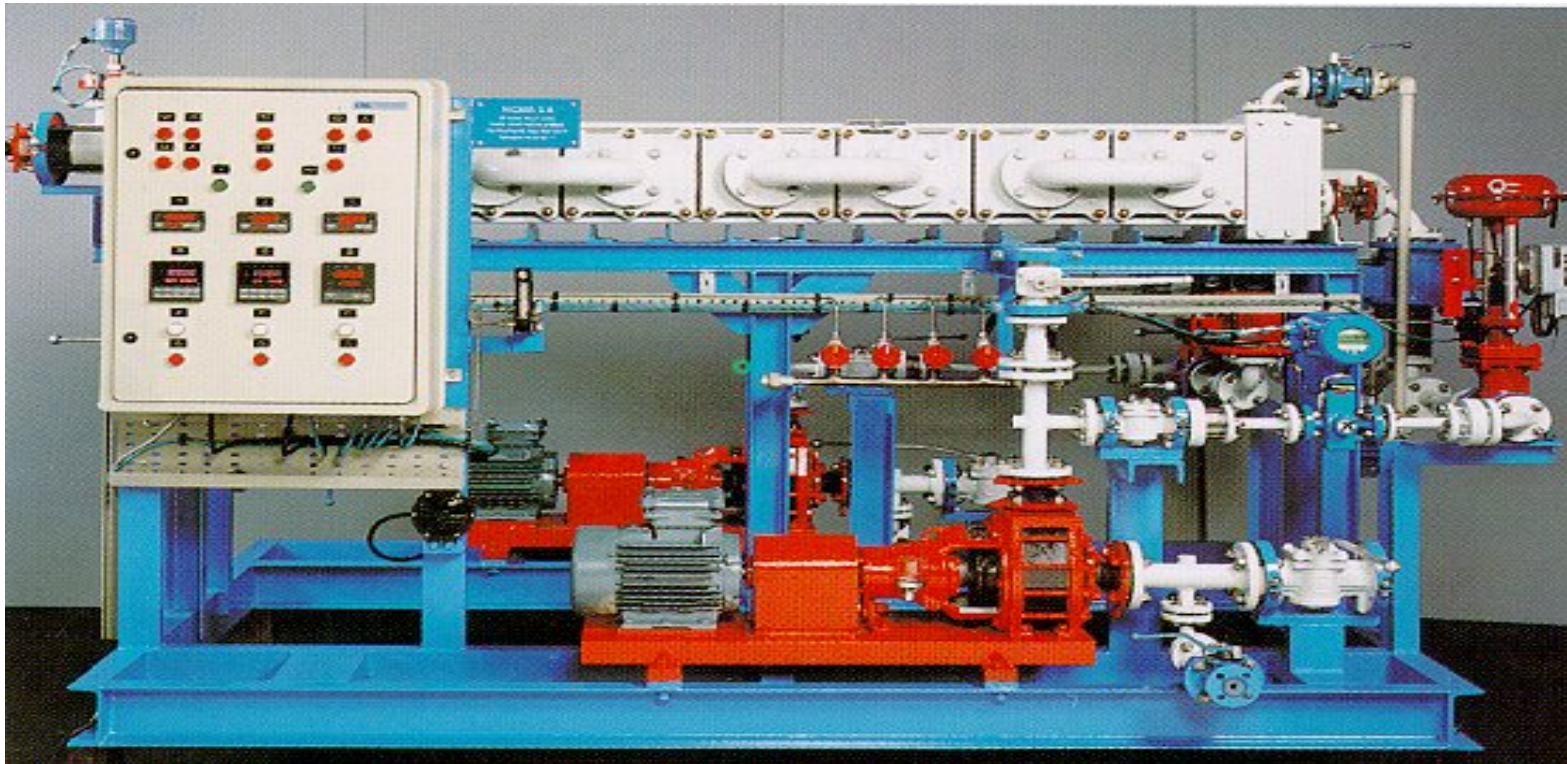
More than 200 references over the world since 1970

- **Simon Carves for Saudi Arabia : 1 unit delivered on a skid in 2003, different concentrations possible**
- **Koffolk in Israel in 2002 : 2.6 t/h of 15% sulfuric acid**
- **Tartaros in Spain : unit on a skid delivered in 2001, 2 t/h of 50% sulfuric acid**
- **SFIE in Egypt : 2 unit skid mounted, 45 tons/h**
- **CEAC in France : 1 unit delivered on a skid in 1999, 5.7 t/h of 50% sulfuric acid**
- **SORIS in Italy, 2006, skid mounted 14 tons/h**
- **SCFP in Egypt, 1 skid mounted, 2004, 30tons/h**

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Examples of H₂SO₄ dilution units.

- Example of one skid mounted dilution unit, ready for start-up. It is made of one NEC type cooler, two graphite pumps and of one mixing device in PTFE.



Examples of H₂SO₄ dilution units.



- Skid mounted dilution units with one shell and tube cooler.



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Examples of H₂SO₄ dilution units.

- **Very compact skid mounted dilution unit with a mono-block graphite heat exchanger. (KU type)**



Q&A

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