

HUGO PETERSEN
Verfahrenstechnischer Anlagenbau

PETERSEN-WATER/ACID MIXING-SYSTEMS
When Water meets Acid

www.hugo-petersen.de

The company

HUGO PETERSEN GmbH located in Wiesbaden, origins from the renowned engineering company Hugo Petersen, founded in 1906, in Berlin. HUGO PETERSEN is part of the Chemieanlagenbau Chemnitz (CAC) group and as such, can provide full support and security for the development and implementation of small to large scale installations.

Initially, using the expertise gained in the classical production of sulphuric acid, from off-gases generated in the refining of metallurgical ores, the company HUGO PETERSEN specialized in the field of manufacture of sulphuric acid, hydrochloric acid and gas cleaning.



Figure 1:
Hugo Petersen 1906

HUGO PETERSEN has more than 110 years of experience in the design and operation of sulphuric acid plants and their equipment. Today, HUGO PETERSEN offers a vast range of technology to this industry. The design, whilst incorporating HUGO PETERSEN's extensive experience, has been developed and optimised through a comprehensive research program, conducted using HUGO PETERSEN'S own pilot plant facilities. This, together with its 50 years know-how in the design and operation of gas cleaning equipment and plants processes, offers further advantages through the experience from both worlds.

The initial sulphuric acid tower technology invented by Mr. Hugo Petersen required since these days systems for irrigation of acids in the towers. Thus, from the very beginning the company was designing its own irrigation distributors.

About 50 well trained process technologists and engineers contribute their knowledge and expertise in the fields of mechanical and electronic engineering, as well as material science, to their design work.

Accurate Planning - the basis for our work

The scope of the tender, for a custom designed plant, is solely defined by the task, operating requirements and the requirements of our customer.

The thorough evaluation of the ecological and economic factors ensures the best plant specific solution. Proven technology, combined with HUGO PETERSEN's site specific developments, leads to the construction of a plant suitable for the respective application.

HUGO PETERSEN has installed more than 400 turnkey plants and plant components for the manufacture of sulphuric acid, oleum and SO_2/SO_3 .

Every plant is unique and all plant components have to be finely adjusted. Hence, it is of great advantage when a single company designs all components.

Water/Acid-Mixing-Systems by HUGO PETERSEN

Precision required

In the absorption of SO_3 into concentrated sulphuric acid the requirement for concentration is very important, as the intensive absorption ability of the sulphuric acid will lead to fast concentration increase even into Oleum if the acid would permanently diluted. Therefore water mixed into acid is a task that needs special consideration.

In Chemistry every student learns **‘Always do things as you oughta, add the acid to the water!’** By good reason!. In manufacturing of sulphuric acid the acid is already there and we cannot follow the advice of our teachers. Therefore it needs intelligent solutions to have the mixture of water into acid to the utmost control.

Hazardous methods were chosen to deal with the water into acid mixing water injection lances were positioned in the middle of pump tanks or absorber sumps. Hoping that sufficient turbulence in the towers or the pump-tanks would mix the water into the acid.

Everyone who had put water on to acid has learned that the heat formation at contact area between acid and water will immediately form a steam phase and hindering the water to mix with the acid.

This method is used till today and creates heavy corrosion in the piping as the concentration with indefinite mixing could vary between 80 and 98 wt.-%. It is well known that especially metallic material have problems to resist such conditions.

Already in the 1970's HUGO PETERSEN approached the mixing by taking a bypass stream of controlled volume and injected in this stream the water using the own, patented Tube-Injection-Mixers (TIM) and achieved an optimal mixing.



Figure 2. HP-TI-Mixer

The disadvantage of this method was only that the pump-capacity had to be increased. But the long-living equipment paid for it.

Since 2012 HUGO PETERSEN installed mixers in the recirculation lines, but the optimal solution was introduced with the patented Circular Inline Mixer (CIM)^P in 2017. The experience from optimal mixing and the installation in the recirculation stream assures very low risk of concentration excursion and the optimal pump capacity.

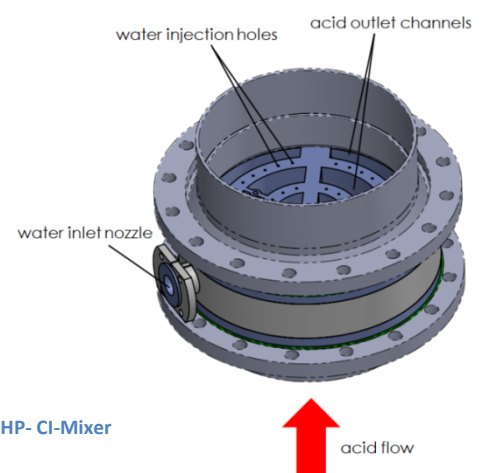


Figure 3: Example of the patented HP- CI-Mixer

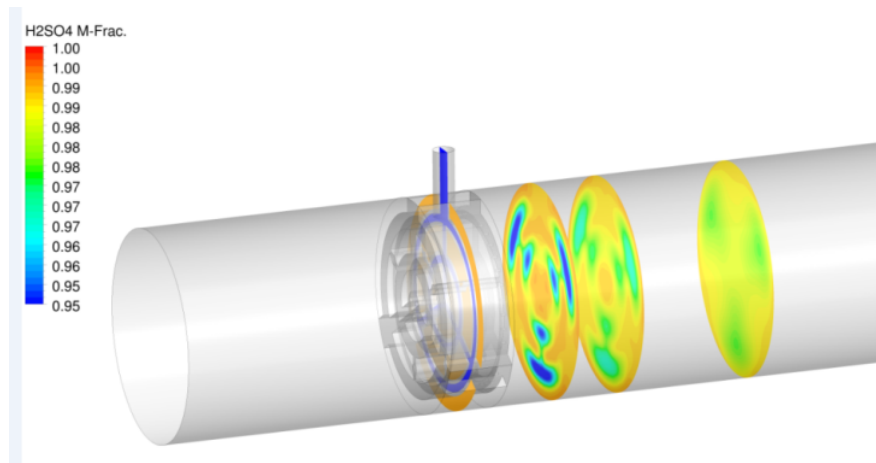


Figure 4: Example of a CFD Simulation of an Acid-Water Mixer
(Dilution of approx. 1,000 m³/h acid from 99.3 to 98.5%)

The mixer demonstrated already its superior performance. in large installations. CFD studies for an installation in a 1,500 tpd production showed fast and homogeneous mixing after 500 mm. downstream the water injection

The most advanced technique to get water into acid.

Long lifetime and homogeneous Mixing are characterising this unit.
The large free flowing area assures extremely low pressure drop (< 0.1 bar)

Best for retrofitting into existing plants.

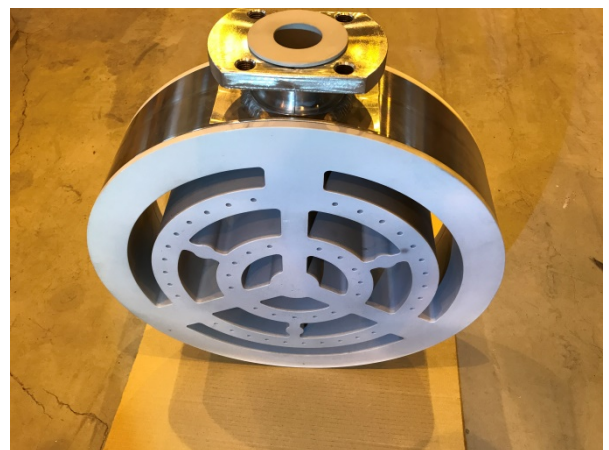


Figure 5: CI-Mixer ready for Installation

Features	Remarks	Results
Mixing Quality	CFD Simulation proved homogenous mixing within 500 mm after injection	✓
Pump Capacity	no impact	✓
Corrosion	negligible as material as PTFE or similar are used	✓
Pressure Drop	< 0,5 mbar	✓
Backflow	Pressure of water is always higher than acid	✓

Table 1: Advantages of HP-CI-Mixer

Finally the CI-Mixer combines the advantages of optimal mixing and lowest impact to the pump → Best choice for retrofit

A comparison of the before mentioned systems are shown in the following table:

Type of System	Mixing Quality	Impact to pump	Risk of Corrosion	Risk of backflow	Mixer Lifetime	Ranking
CI-Mixer	++	++	++	++	++	1
Bypass Mixer	++	+	++	++	++	2
Lance-Injector	-	++	—	++	-	3

Table 2: Comparison of Mixers

The before mentioned facts demonstrate again the first class design of HUGO PETERSEN's Technology.

The Detail makes the Difference!

Selected References:



Figure 6: 1,800 tpd Mh Sulphur Burning Plant



Figure 7: 200 tpd Mh Sulphur Burning Plant



Figure 8: 200 tpd Mh FeSO₄-Roasting



Figure 9: 1,500 tpd Mh Sulphur Burning Plant

Figure 10: 2,200 tpd Mh Sulphur-Burning Plant



Figure 11: 600 tpd Mh Sulphur-Burning Plant



Figure 12: 400 tpd Mh Roasting Plant



HUGO PETERSEN

Verfahrenstechnischer Anlagenbau

HUGO PETERSEN GmbH
Rheingastr. 190-196, Geb. K330
65203 Wiesbaden
Deutschland

Tel.: +49-611-9627820 Fax: +49-611-962 9099
E-Mail: contact@hugo-petersen.de Web: www.hugo-petersen.de

ENGINEERING IS OUR PASSION