STAMICARBON

Nitrogen technology licensor of MAIRE Group

NITRIC ACID TECHNOLOGY

Maximum energy recovery with mono or dual pressure

STAMI **NITRIC ACID**

WHAT ARE THE CHALLENGES

for nitric acid plants?

When setting up a nitric acid plant, your aim is to **maximize energy recovery while minimizing your cost of investment.** That makes the single-train design process a real challenge.

We have what it takes to deliver **the nitric acid plant that covers all your needs.** Because we draw on experience going back many decades and always use components that have proven their reliability in industrial settings.

Since the 1930s we have licensed a range of **safe, reliable and sustainable nitrate technologies** and built over 40 nitric acid plants worldwide. Depending on your preferences, we offer best-in-class, **mono and dual pressure nitric acid technologies.**

See the difference we make for you.

We have what it takes to deliver the nitric acid plant that covers all your needs.


40
20
60
0
80
-30
100

SMART PROCESS DESIGN

with mono or dual pressure technology

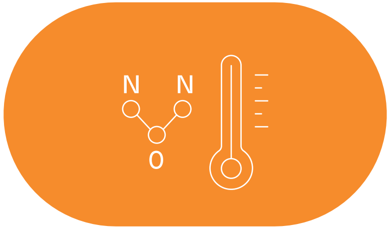
Our mono and dual pressure plant designs are ideal for large-scale nitric acid production, as found in the fertilizer industry. They are well suited to a mono pressure plant capacity of up to 600MTPD, increasing to 2000MTPD for dual pressure plants.

Both these processes are characterized by **maximum energy recovery, reliable operation** and **minimal greenhouse gas emissions** at **high tail gas temperatures** of up to 480°C.

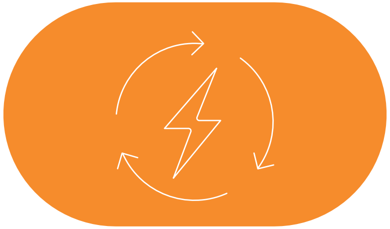
And the condensation/re-evaporation effect that causes corrosion is minimized by the smart heat exchanger layout. Our proven nitric acid technology works in conjunction with the most commonly used building materials, **driving down heat exchanger manufacturing costs substantially.**

Drive down manufacturing costs

Sustainable benefits



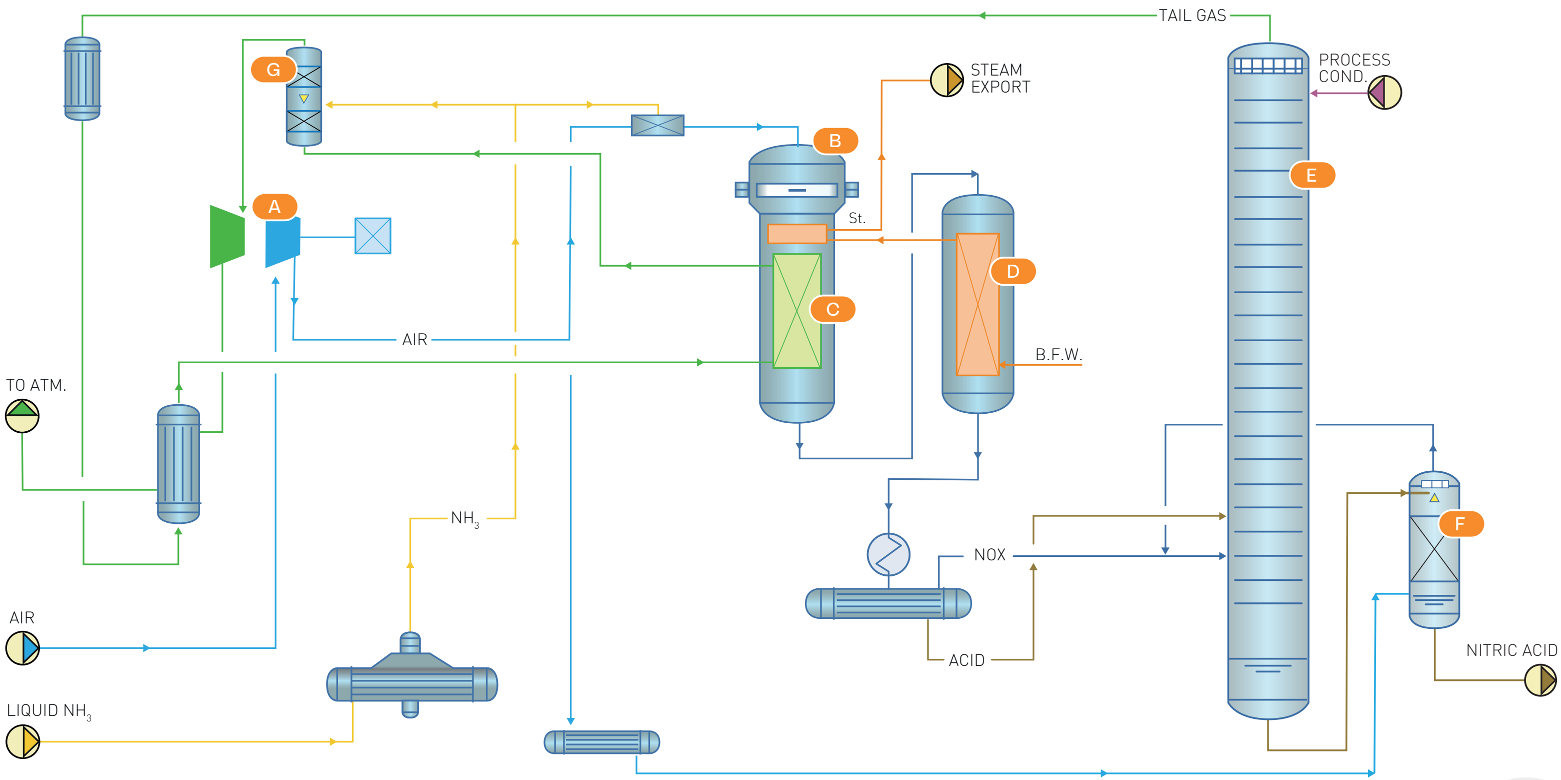
High tail gas temperature boosts N2O decomposition without adding external agents like natural gas.



Extra power generation in the expansion turbine and additional heat recovery minimize energy loss through tail gas emissions.

Corrosion prevention by design promotes process safety and reliability.

MONO PRESSURE TECHNOLOGY FOR THE NITRIC ACID PRODUCTION PROCESS



A Compressor train

B Burner

C Tail gas heater

D Waste heat boiler

E Absorption column

F Bleaching column

G N_2O/NOx abatement reactor

- The process operating pressure is 8 bar (a).

- A mixture of compressed air and NH_3 is fed into the ammonia burner, where NH_3 is oxidized to NO on Pt/Rh gauzes. Small amounts of N_2 and N_2O are formed as side products. Optimum gauze temperature is ensured.

- The NO is oxidized to NO_2 in the gas phase downstream, leading to the formation of HNO_3. The heat released by the oxidation reaction is used to generate high-pressure steam and heat the tail gas.

- Downstream of the waste heat boiler, the nitrous gas is cooled down further in a boiler feed water preheater. This is then fed into the cooler condenser, where a weak acid solution is condensed and transmitted to the oxidation/absorption column. The remaining gas enters the bottom of the oxidation/absorption column, which consists of a series of sieve trays.

- The acid from the sieve trays is fed into the upper bleaching trays, which are situated at the bottom of the absorption column. Here, the acid undergoes air stripping to remove traces of NOx, leaving a colorless nitric acid solution of approx. 58-63 wt%.

- Traces of NOx and N_2O remain in the overhead vapor from the absorption/oxidation column. To get this down to an acceptable level, this tail gas is heated to approx. 480°C and fed through a tertiary abatement system. Here, N_2O and NOx are converted into water and nitrogen by means of two catalyst beds.

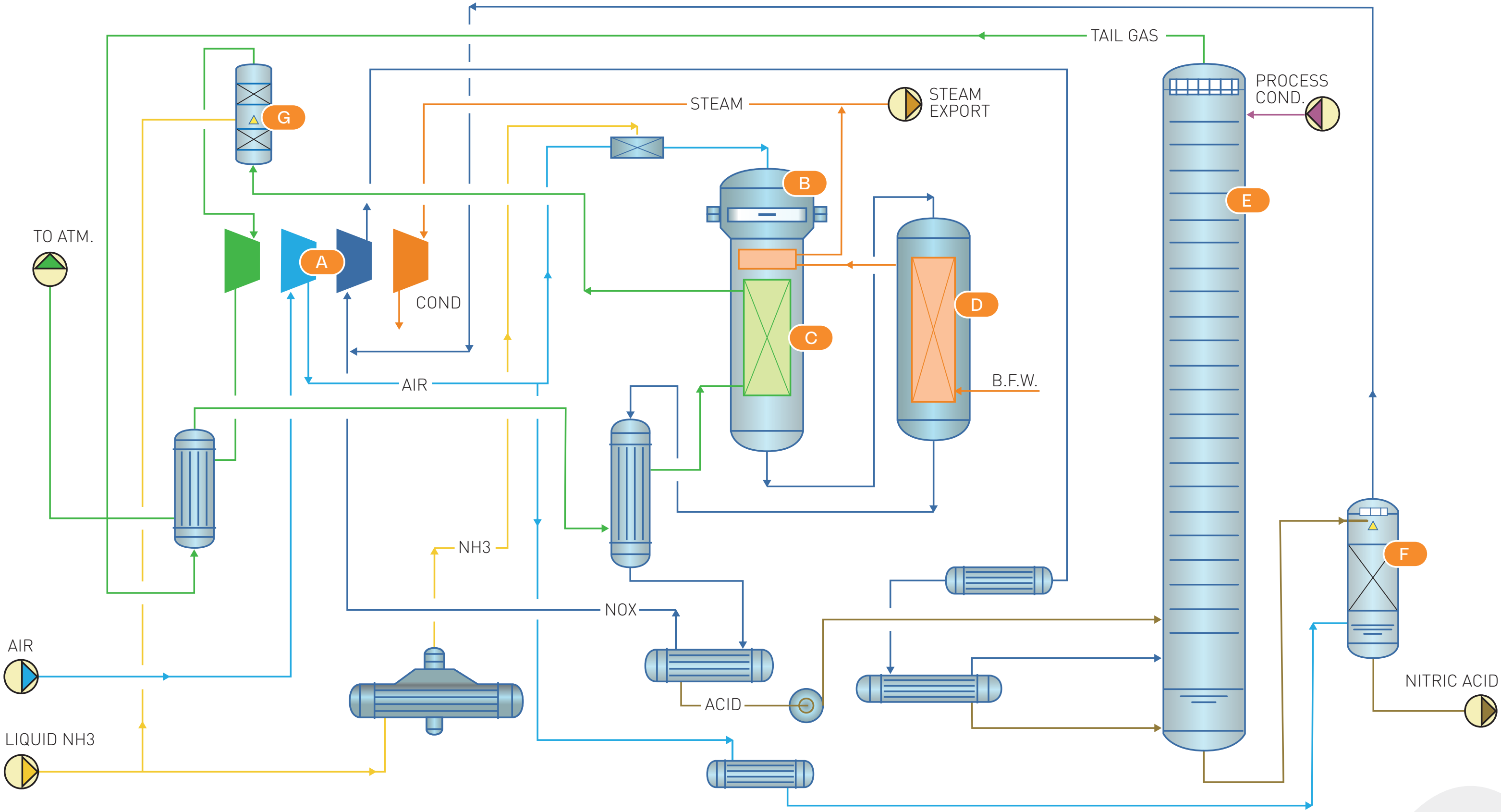
- In the expansion turbine, the tail gas is expanded. The in-line compressor train configuration enables the energy this releases to drive the air compressor. Additional power is generated by a steam turbine or electromotor.

- After expansion, the tail gas stream is still hot enough for another heat exchanging step, which lowers the temperature of the tail gas released to the atmosphere.

Consumption

Operating range	%	70 - 110
NH_3 consumption	kg/ton 100% HNO_3	282
Pt losses (incl. recovery)	g/ton 100% HNO_3	0.035
HP steam export, 45 bar, 450°C	kg/ton 100% HNO_3	> 600
NO_3	ppm vol	< 20
N_2O	ppm vol	< 20
Cooling water	ton/ton 100% HNO_3	110
Process water	ton/ton 100% HNO_3	0.3

DUAL PRESSURE TECHNOLOGY FOR THE NITRIC ACID PRODUCTION PROCESS



A Compressor train
B Burner
C Tail gas heater
D Waste heat boiler
E Absorption column
F Bleaching column
G N_2O/NOx abatement reactor

- Air is filtered and compressed to approx. 5 bar(a) and mixed with evaporated ammonia.

- The ammonia/air mixture is fed into the ammonia burner. NH_3 is oxidized to NO on Pt/Rh gauzes and small amounts of N_2 and N_2O are formed as side products.

- The NO is oxidized to NO_2 in the gas phase downstream, leading to the formation of HNO_3. The heat released by the oxidation reaction is used to generate high-pressure steam and heat the tail gas.

- Downstream of the waste heat boiler, the nitrous gas is cooled down further to below its dew point. This is then fed into the low-pressure cooler condenser, where a weak acid solution is condensed and transmitted to the oxidation/absorption column.
  The remaining nitrous gas is compressed to 11 bar (a) by the NOx compressor and re-cooled to below its dew point to form a more concentrated acid solution in the high-pressure cooler condenser.

- The remaining gas enters the bottom of the oxidation/absorption column, which consists of a series of sieve trays.

- The acid exits the bottom of the absorption column and is fed into the bleacher where last traces of dissolved NOx are eliminated by air stripping, producing a colorless nitric acid solution of approx. 58-63 wt%.

- Traces of NOx and N2O remain in the overhead vapor from the absorption/oxidation column. To get this down to an acceptable level, this tail gas is heated to approx. 480°C and fed through a tertiary abatement system. Here, N2O and NOx are converted into water and nitrogen by means of two catalyst beds.

- In the expansion turbine, the tail gas is expanded. The in-line compressor train configuration enables the energy this releases to drive the air and NOX compressors. Additional power is generated by a steam turbine.

Consumption

Operating range	%	70 - 110
NH_3 consumption	kg/ton 100% HNO_3	282
Pt losses (incl. recovery)	g/ton 100% HNO_3	0.03
HP steam export, 45 bar, 450°C	kg/ton 100% HNO_3	> 800
NO_3	ppm vol	< 20
N_2O	ppm vol	< 20
Cooling water	ton/ton 100% HNO_3	100
Process water	ton/ton 100% HNO_3	0.3

References

We are proud to present some of our nitric acid plants around the world.

Total capacity (mt/d)	Customers	Site	Country	Technology	Contractor
1400	DSM Agro Division	Geleen	Netherlands	Dual pressure design	Didier Engineering, Germany
670	UKF	IJmuiden	Netherlands	Dual pressure design	Didier Engineering, Germany
1100	Akdeniz Gubre Sanayi	Mersin	Turkey	Mono pressure design	Kellogg Continental, Netherlands
652	Fertilizantes Mexicanos	Pajaritos	Mexico	Mono pressure design	Krebs, France
600	UKF Fertilizers	Ince	UK	Mono pressure design	Sim. Chem., UK
570	Agrico Chemical Corporation	Oklahoma, Tulsa	USA	Mono pressure design	Pullman Kellogg, USA
800	Sonatrach	Annaba	Algeria	Mono pressure design	Krebs, France
570	Agrico Chemical Corporation	Oklahoma, Tulsa	USA	Mono pressure design	Kellogg Continental, Netherlands
700	Duslo	Šaľa	Slovakia	Mono pressure design	Société Krebs & Cie, France
225	Monomeros Colombo-Venezolanos	Barranquilla	Colombia	Mono pressure design	McKee, USA
255	Scottish Agricultural Industries	Edinburgh	UK	Mono pressure design	Humphreys & Glasgow, UK
675	Cuba Industrial	Cienfuegos	Cuba	Mono pressure design	Simon Carves, UK
820	Societe Rhodannienne d'Engrais	Chasse	France	Mono pressure design	Kuhlmann, France
725	Masinimport	Targu Mures	Romania	Mono pressure design	Didier-Werke, Germany
190	Haifa Chemicals	Ashdod	Israel	Mono pressure design	Staff
275	Kwinana Nitrogen	Kwinana	Australia	Mono pressure design	Humphreys & Glasgow, UK
185	Associated Chemical Companies	Harrogate	UK	Mono pressure design	Humphreys & Glasgow, UK
420	DSM	Geleen	Netherlands	Mono pressure design	DSM, Netherlands
530	Imperial Chemicals Industries	Severnside	UK	Mono pressure design	Humphreys & Glasgow, UK
810	Societé Egyptienne d'Engrais et d'Industrie, Chimique	Suez	Egypt	Mono pressure design	Uhde, Germany
330	Jwestling	Nebraska	USA	Mono pressure design	KT- Kinetics Technology, Italy

Total capacity (mt/d)	Customers	Site	Country	Technology	Contractor
2700	Pulway Azot	Puławy	Poland	Mono pressure design	Didier-Werke, Germany
530	Imperial Chemicals Industries	Severnside	UK	Mono pressure design	Humphreys & Glasgow, UK
295	Al Nasar Co.	Helwan	Egypt	Mono pressure design	Continental Engineering, Netherlands
255	SASOL	Sasolburg	South Africa	Mono pressure design	Simon Carves, UK
125	Sefanitro	Bilbao	Spain	Mono pressure design	Uhde, Germany
425	Columbia Nitrogen Corp.	Georgia, Augusta	USA	Mono pressure design	Braun, USA
160	Imperial Chemical Industries	Severnside	UK	Mono pressure design	ICI
160	Imperial Chemical Industries	Heysham	UK	Mono pressure design	ICI
260	Ruhrchemie	Oberhausen	Germany	Mono pressure design	Uhde, Germany
195	Kemira Oy	Oulu	Finland	Mono pressure design	Tippi Oy
320	Farbwerke 'Hoechst' (extension)	Höchst	Germany	Mono pressure design	Uhde, Germany
810	Fertilizer Corporation of India	Rourkela	India	Mono pressure design	Fertilizer Corporation of India
345	Hibernia	Wanne-Eickel	Germany	Mono pressure design	Uhde, Germany
225	Ministry of Coordination	Athens	Greece	Mono pressure design	Uhde, Germany
205	Nitratos de Portugal	Lisbon	Portugal	Mono pressure design	Werkspoor, Netherlands
200	KIMA (extension)	Assuan	Egypt	Mono pressure design	Uhde, Germany
150	Société Egyptienne d'Engrais et d'Industrie, Chimique	Cairo	Egypt	Mono pressure design	Uhde, Germany
320	Farbwerke 'Hoechst'	Höchst	Germany	Mono pressure design	Uhde, Germany
160	Imperial Chemical Industries	Ardeer	UK	Mono pressure design	ICI
90	African Explosives & Chemical Industries	Modderfontein	South Africa	Mono pressure design	Werkspoor, Netherlands
610	KIMA	Assuan	Egypt	Mono pressure design	Uhde, Germany
790	DSM	Geleen	Netherlands	Mono pressure design	DSM, Netherlands

WE ARE STAMICARBON

Stamicarbon is the innovation and license company of the Maire Group.
We are a trailblazing specialist in the fertilizer industry, with the vision needed to help feed the world and improve everyone's quality of life. As a global leader in fertilizer technologies, we have licensed more than 260 urea plants and completed more than 110 revamping and optimization projects.

Our leading position is based on more than 75 years' licensing experience and maintained by continuous innovation in terms of technologies, products and materials.
Headquartered in Sittard, the Netherlands, Stamicarbon has a sales office in the USA and representative offices in Russia and China.
For more information, see **www.stamicarbon.com.**

WHAT CAN WE DO FOR YOU?

Questions about our nitric acid technology? Like to know how our expertise, knowledge and experience creating, optimizing and upgrading nitric plants can help you make the switch to sustainable, futureproof production? We are here≈for you. Contact our experts at **www.stamicarbon.com.**

Stamicarbon
Mercator 3 - 6135 KW Sittard - Netherlands | P.O. Box 53 - 6160 AB Geleen - Netherlands
Tel. +31 46 4237000 - communication@stamicarbon.com - www.stamicarbon.com

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