



# Instant Coffee

**GEA Niro process technologies for the  
instant coffee industry**

# Complete lines for exceptional results



## Green Bean Treatment

*Solutions for cleaning, blending and storage using technology from selected partners*



## Roasting

*Batch mode or continuous operation using technology from selected partners*



## Roast Bean Treatment

*Solutions for storage, grinding and conditioning of the roasted product using technology from selected partners*



## Extraction

*Batch mode or continuous operation*



## Extract Treatment

*Clarification, storage and aroma recovery from the coffee extract*



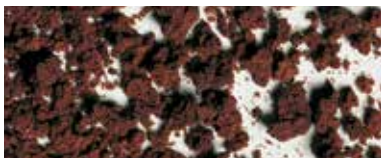
## Concentration

*Freeze and thermal concentration, membrane filtration*



## Freeze Drying/Spray Drying

*The full range of solutions – only from GEA Process Engineering*



## Agglomeration

*For dustless powder and customized granules*



## Packing

*Powder: Packed in bulk or retail quantities*

*Liquid: Supplied in cans or drums*



## CIP System

*Fast and flexible Cleaning-In-Place features*

## Process Control

*Plant supervision and monitoring, recipe control, and logging functionality*

# Convenient perfection for every taste

MODERN TECHNOLOGY HAS MADE THE FULL-BODIED, AROMATIC, PERFECT CUP OF COFFEE CONVENIENT. AND GEA PROCESS ENGINEERING MAKES IT POSSIBLE – EVERY DAY, ALL OVER THE WORLD.

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## Setting the standards

Coffee is pleasure. Its taste, flavour, aroma, and refreshing effect make it unique. It is also a product that attracts great attention in the food and beverage industry. And in the technology used to manufacture canned liquid coffee as well as regular and agglomerated instant coffee, GEA Process Engineering sets the standards for others to follow.

## Helping you to the best solution

A successful delivery is more than supplying the best plant available. Consumer requirements vary from market to market, and the coffee that commands a premium price in one market may fail completely in another. From a wide range of processing possibilities, we select the best GEA Niro plant type, layout, and operation to meet the customer's specifications of the desired product properties.

## CONVENIENT COFFEE FACTS

THERE ARE TWO MAIN SORTS OF COFFEE: ARABICA AND ROBUSTA. THE MOST POPULAR IS ARABICA, WHICH COMPRISES 60% OF THE GLOBAL COFFEE PRODUCTION.

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## The proven ability

We have maintained our leading position by repeatedly proving our ability to provide reliable and innovative technical GEA Niro solutions for the entire process from product testing to plant installation and after sales support. Our constant dedication to providing cutting-edge quality to our customers is the main reason why we have installed more than 200 GEA Niro plants for the coffee industry worldwide.

## A complete range

We supply solutions for all aspects of successful coffee production, making us the obvious supplier of individual GEA Niro plants as well as complete lines. Our solutions include our own unique GEA Niro technologies as well as equipment from trusted partners in coffee bean handling, roasting, and packing of the finished product.

No matter the plant or process line, our customer will experience not only an increase in product quality, but also significant cost reductions due to efficient waste treatment and recycle systems.

Our commitment extends beyond the actual plants. A strong international network of companies gives our customers the comfort of local service combined with the quality that comes from global presence.



## Quality solutions at a glance

### Great coffee comes from great plants

Coffee beans are seeds from coffee fruits. After removal of the pulp, the green coffee beans are dried, cleaned and packed – typically in 60 kg bags – and stored until they can be roasted and, if required, decaffeinated.

Roasting is a delicate process, part art and part science, where the roast master must decide exactly how long and hard the beans are to be roasted to get the desired result. It is during roasting that the beans acquire the flavour and colour of the finished coffee. The beans are now ready for sale to consumers.

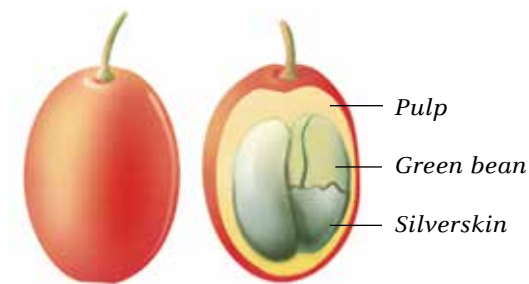
Or they can be ground and processed into convenient coffee. And no matter the process, GEA Process Engineering knows how.

### Great powders also come from great plants

No one knows more about creating coffee powders with highly specific properties and strong natural flavours than GEA Process Engineering. With data gathered from over 80 years of experience and a reference list of some 10,000 GEA Niro plants, we're perfectly equipped to engineer the exact product you want from your coffee - and the processes needed to produce them.

Our coffee powder engineering specialists will help you design the perfect system for your needs - including dedicated process control - that can meet precise specifications. Furthermore, using our advanced "gentle processing" GEA Niro technology, the coffee's natural essence is retained 100%, guaranteeing outstanding quality and flavour for your final product.

#### COFFEE FRUIT



#### CONVENIENT COFFEE FACTS

COFFEE BEANS ARE SEEDS FROM THE FRUIT OF THE COFFEE BUSH. WHEN ROASTED, THE BEANS LOSE 15-20% OF THEIR WEIGHT, BUT INCREASE UP TO 25% IN SIZE.

## Quality engineering



### A partnership of success

GEA Process Engineering is a resource in every stage of the project. We have the experience and know-how to ensure that all aspects are completed as smoothly

as possible, including:

- Product testing at our test station in Denmark
- Process evaluation and optimisation
- Design and engineering
- Project management
- Plant delivery, installation and commissioning
- Training of plant operators
- Technical service and supply of spare parts
- Project financing

Ultimately, our goal is to help you maximise competitiveness through superior product quality and high-yield processes. The coffee industry is dynamic, with market demands changing over time. With a proven ability of controlling powder properties to a unique degree, GEA Niro spray dryers can adjust production to meet market trends.

Whether you need a new investment, process modification or optimisation, it's all part of the GEA Niro solution.

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FROM ADVANCED GEA NIRO EQUIPMENT TO COMPLETE PLANT DESIGN, FROM FEED FORMULATION TO COMPETITIVE POWDERS, FROM SANITATION TO SAFETY – GEA PROCESS ENGINEERING HAS THE ANSWERS.



# The best results begin with the best extraction

## Extraction

GEA Process Engineering's unique Fast Instant Coffee (FIC™) extractor is a continuous system that features automated multi-extraction percolators. Fully integrated with a PC/PLC (Programmable Logic Controller) system, the GEA Niro FIC™ yields a uniform extract quality.

## Short extraction time

### – superior aroma profile

The GEA Niro FIC™ extractor reduces the extraction time by 50%. Water is directed through the ground coffee in two stages. The process results in two separate extract fractions, aroma and hydrolysis. The GEA Niro FIC™ extractor gives a superior aroma profile, which is ideal for high quality convenient coffee production.

After the process is completed, aroma recovery takes place and the extract is filtered and centrifuged.

The GEA Niro FIC™ is available with 3 modes of extraction

**Dual/Split**

**Dual/Dual**

**Single/Split**



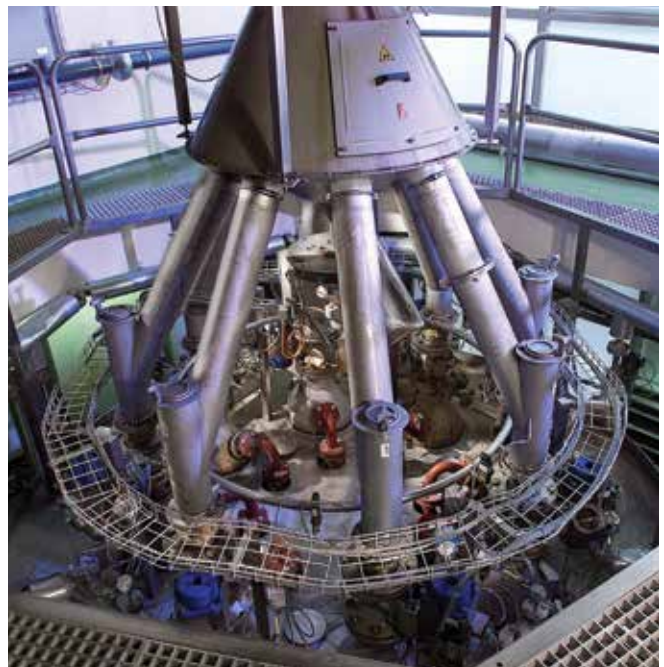
The layout of the percolator columns gives a compact design and reduces space requirements compared to standard battery extraction units.

The conventional batch extractor has a well-known design with the percolator columns in a straight line. With its proven efficiency, it is used in instant coffee plants around the world.

The continuous horizontal helice extractor, the GEA Niro CONTEX™, is specially designed for operation at atmospheric pressure and at low temperature, thus only extracting the aroma rich fraction of the coffee.

## High yield

GEA Process Engineering's extractors are designed to process a variety of coffee types as efficiently as possible. This gives the customer unparalleled flexibility and the highest obtainable yield.



*The GEA Niro  
FIC™ Extractor  
– top view*

*Conventional  
batch percolator  
– top view*



*The GEA Niro  
CONTEX™*



*Conventional  
batch percolator  
- bottom view*



**CONVENIENT COFFEE FACTS**

A TYPICAL ARABICA COFFEE BUSH BEARS ABOUT 5 KG OF FRUIT PER YEAR. THIS CORRESPONDS TO ABOUT 300-400 GRAMS OF INSTANT COFFEE. FOR ROBUSTA BUSHES, THE YIELD IS SLIGHTLY HIGHER.

# Gentle liquid processing: Extract treatment

## **Aroma recovery**

To prevent the desired, and volatile, aroma components in the aroma extract from being lost during thermal concentration, the extract fractions are stripped of their volatiles in an aroma recovery unit. After being stripped from the extract in a flash evaporator, the aroma components are recovered in a two-stage condenser system.

## **Clarification**

In order to achieve international standards for convenient coffee, clarification is an essential part of the process. A system consisting of filters and centrifuges is used to separate insoluble parts from the extract.

## **Concentration**

Concentration serves the dual purpose of increasing the solids content in the extract prior to freeze or spray drying, and making the process as economical as possible.

The aroma being quite volatile, lenient processing conditions throughout the concentration process are essential. GEA Process Engineering has developed a number of processes that maximize efficiency while being as lenient to the extract as possible.



*Freeze concentrator*

*Aroma recovery*





### **Thermal concentration**

Our multistage non-recirculating evaporators operate under vacuum in a plug flow mode. They concentrate the coffee extract gently, quickly, and efficiently. In combination with the aroma recovery system, the evaporator preserves the aroma and taste components and produces an excellent concentrate for the production of convenient coffee.

### **Freeze concentration**

With GEA Process Engineering's freeze concentration process, aroma loss due to thermal degradation is eliminated. By cooling the extract to subzero temperatures, excess water is removed as ice crystals. And this process requires no waste-water treatment, as the melted ice crystals are pure water.

### **Membrane filtration**

The aroma fraction of the extract can be pre-concentrated using reverse osmosis in a membrane filtration system. This slightly changes the taste profile, which is an advantage for some coffees and in some markets. Membrane filtration is in its beginning stage.



*Evaporator  
– bottom view*



*Membrane  
filtration*



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### **CONVENIENT COFFEE FACTS**

IN 2012, THE GLOBAL COFFEE PRODUCTION REACHED ALMOST 8.7 MILLION TONNES OF GREEN BEANS. THIS CORRESPONDS TO MORE THAN 880 BILLION CUPS OF COFFEE.

# The premium product: Freeze drying

1

*Foaming and  
prefreezing*

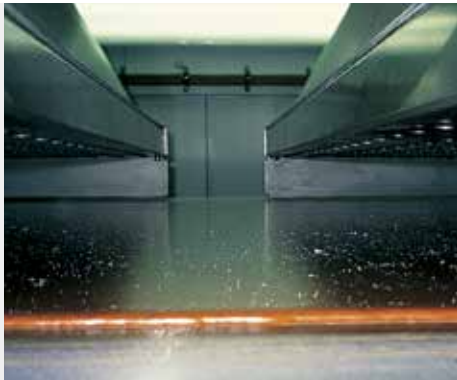


Freeze drying preserves all the desirable aspects of the concentrated coffee extract. The finished product commands a premium price across the world by meeting market demands for quality parameters such as colour, density, and solubility.

The Atlas freeze drying process from GEA Process Engineering enables a unique degree of control over all of these crucial quality parameters.

2

*CAB freezing*



By using the proven Structure Control System (SCS), product colour and solubility as well as bulk density can be controlled during the pre-freezing process to meet any requirements.

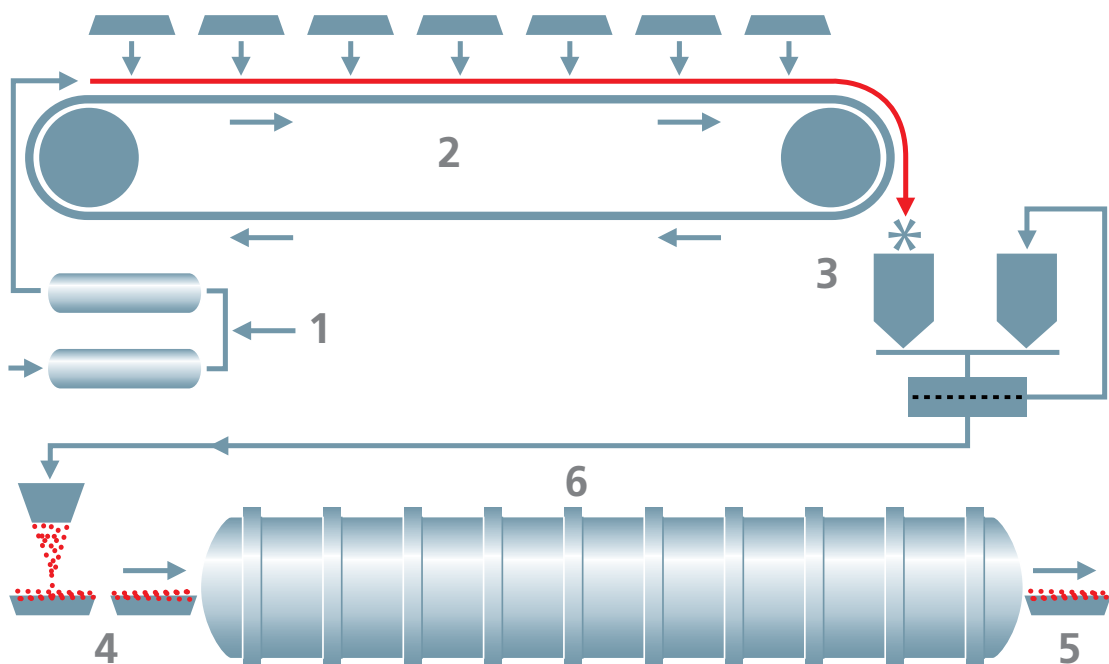
Actual freezing can take place on a Continuous Air Blast (CAB) belt freezer or for smaller capacities on a Rota Drum freezer.

3

*The frozen  
coffee is  
prebroken*

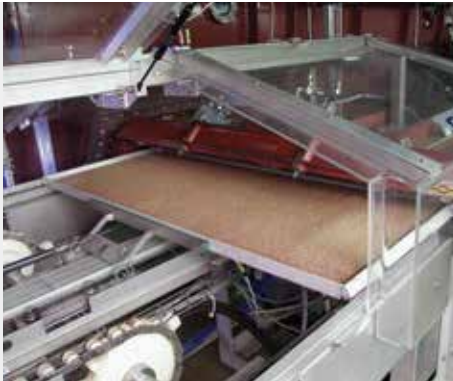


Granulation of the frozen coffee slabs in a carefully designed system ensures the right granule size and size distribution and completes the process prior to freeze drying.



4

Freeze drying:  
Tray going  
into the Atlas  
CONRAD™  
freeze dryer



The unique Atlas CONRAD™ freeze dryer protects all the qualities obtained in the concentrate during the full-automatic, continuous operation, and a first-class soluble coffee is produced thanks to the integrated control system for the entire process.

Our Atlas RAY™ batch freeze dryers are used for smaller capacity requirements or as add-on units to existing coffee processing plants.

5

Freeze drying:  
Tray with the  
finished pro-  
duct



Freeze drying

6

Atlas  
CONRAD™  
freeze dryer



Atlas RAY™ batch freeze dryer

#### CONVENIENT COFFEE FACTS

COFFEE IS GROWN IN A WIDE BELT AROUND THE EQUATOR. ROBUSTA COFFEE CAN GROW FROM SEA LEVEL TO 700 METRES ALTITUDE, WHEREAS ARABICA COFFEE MUST BE GROWN AT AN ALTITUDE BETWEEN 1,000 AND 2,000 METRES.



# The proven quality: Spray drying

GEA Niro  
Spray dryer  
- top view



GEA Niro  
Spray dryer  
- side view



GEA Niro  
Spray dryer  
- bottom view



## Spray Drying

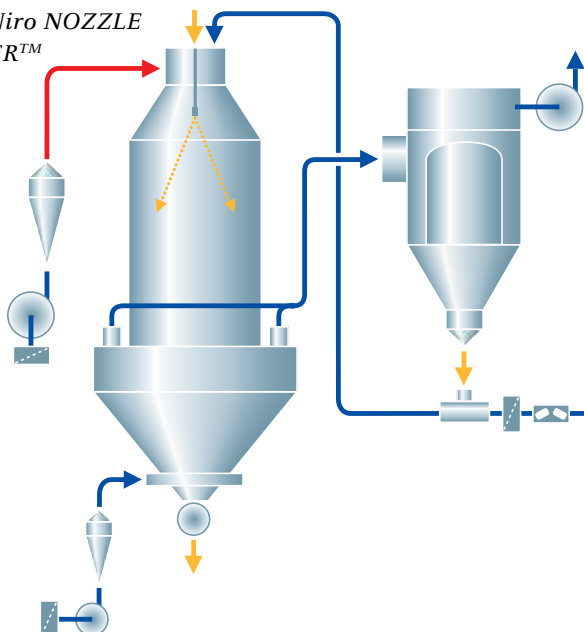
The most economic method for producing soluble coffee is spray drying, which results in free-flowing and agglomerated/granulated powders. Thanks to an extremely high level of control, our customers can manufacture products meeting the demands of their individual markets.

The design of the spray dryer depends upon the specified powder properties, e.g. moisture content, particle size, and bulk density. GEA Process Engineering offers three designs for the manufacture of soluble coffee:

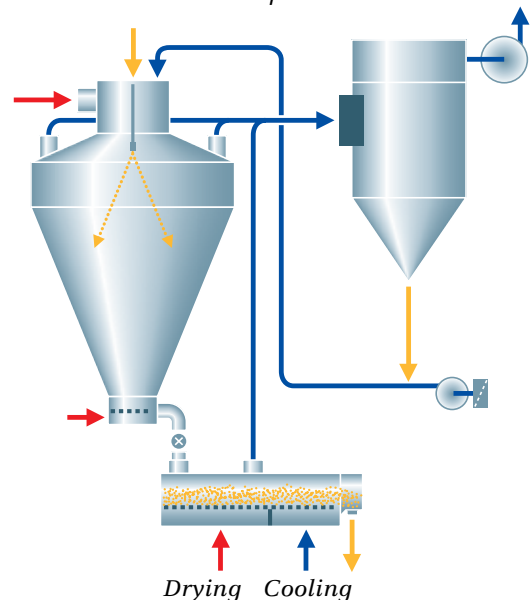
*GEA Niro NOZZLE TOWER™ (NT)* spray dryers are used for producing free-flowing powders comprising individual round, soluble beads with average particle sizes ranging from 100 to 250 microns. The tower-like chamber design results in a long residence time for the product to be dried.

The most common type of spray dryers used today is the Fluidized Spray Dryer - *GEA Niro FSD™*.

GEA Niro NOZZLE  
TOWER™



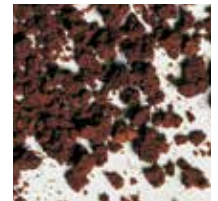
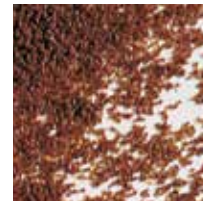
The GEA Niro FSD™ process



*Fluidized spray dryer (GEA Niro FSD™) with integrated fluid bed.*



The Fluidized Spray Dryers - GEA Niro FSD™, equipped with an integrated fluid bed, are extremely compact. In order to achieve the required moisture content and temperature of the instant coffee, post-drying and cooling are carried out in an external GEA Niro VIBRO-FLUIDIZER™. The GEA Niro FSD™s produce a free-flowing agglomerated/granulated coffee powder with average particle sizes between 100 and 300 microns. The lower temperatures during drying give improved aroma properties.



*GEA Niro VIBRO-FLUIDIZER™*



*Powder produced on a GEA Niro NOZZLE TOWER™*

*Powder produced on a GEA Niro FSD™*

*Powder produced on a GEA Niro REWET AGGLOMERATOR™*

### **Agglomeration**

Different markets require different types of convenient soluble coffee. To meet the demand for granulated, dust-free products, the powder is processed in a GEA Niro REWET AGGLOMERATOR™ (RWA). Material handling during the agglomeration process itself is specially controlled according to the desired properties of the end product. Average particle size is above 1000 microns.

### **CONVENIENT COFFEE FACTS**

SOLUBLE COFFEE CONSUMPTION ACCOUNTS FOR OVER 20% OF GLOBAL COFFEE CONSUMPTION, A FIGURE THAT HAS BEEN STABLE FOR THE LAST DECADE.



*GEA Niro REWET AGGLOMERATOR™ (RWA)*

# Meeting every requirement with the best in CIP and process control



*Process control room*

## **Process control**

Controlling and monitoring a process line is of the essence for any operator. GEA Process Engineering's proven process control system meets all requirements for safety, flexibility, and ease of use.

Using standard hardware components, the process system enables you to:

- Supervise and monitor automatic plant start up, shut down, and cleaning procedures
- Work with several product recipes in one system
- Log every process activity for real-time and historical trending

Instrument and system specifications are selected in cooperation with our customer to ensure the best hardware service during the lifetime of the plant.

## **CIP system**

Cleaning, while necessary, can be an expensive and time-consuming part of the process. Drawing on over 80 years of experience in working with sanitary processes, GEA Process Engineering has developed a series of Cleaning-In-Place (CIP) systems.

With features such as retractable nozzles in the main drying chamber as well as highly efficient process water recovery, the GEA Niro CIP system makes a significant contribution to the profitability of the entire process line.



*GEA Niro SANICIP™ bag filter - top view*

## More than just a plant...

### CONVENIENT COFFEE FACTS

CONSUMPTION OF FRESH VS. INSTANT COFFEE VARIES: IN NORTH AMERICA, THE RATIO IS LESS THAN 10% INSTANT COFFEE TO OVER 90% FRESH. IN EASTERN EUROPE, IT IS UP TO 90% INSTANT TO 10% FRESH, AND IN AUSTRALASIA, THE SHARE OF INSTANT IN TOTAL COFFEE CONSUMPTION VARIES BETWEEN 30%-90%.



### Plant sizes

General operational data for GEA Niro Instant Coffee (IC) plants are given in the table. Available Sizes refer to the amount of kg that is produced each hour, i.e. an IC-250 plant will produce 250 kg of instant coffee each hour.

Typical Sizes	IC-125	IC-250	IC-330	IC-500	IC-550	IC-750	IC-1000	IC-1500
Green coffee input (kg/h) 10% H <sub>2</sub> O	275-375	550-750	750-1000	1100-1500	1200-1650	1636-2250	2200-3000	3300-4500
Roasted, ground coffee (hg/h) 6% H <sub>2</sub> O	240-330	480-650	635-860	960-1300	1055-1430	1440-1950	1920-2600	2880-3900
*Yield %	47-53	47-53	47-53	47-53	47-53	47-53	47-53	47-53
Instant coffee (kg/h) 3% H <sub>2</sub> O	125	250	330	500	550	750	1000	1500
Annual production (t/year) Based on: 7500 (h/year)	940	1875	2475	3750	4125	5625	7500	11250

*\*Yield is a result of the type and mix of beans. Robusta will typically give a higher yield than Arabica.*



*We live our values.*

Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 Index.

## **GEA Process Engineering**

GEA Process Engineering A/S

Gladsaxevej 305 · DK-2860 Soeborg · Denmark

Tel +45 39 54 54 54 Fax +45 39 54 58 00

E-mail: [gea-niro.food@gea.com](mailto:gea-niro.food@gea.com) Website: [www.gea.com](http://www.gea.com)