

# GEA Air-cooled Heat Exchangers

Heat Transfer is our Passion.





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[Background]

## GEA Group

GEA Group Aktiengesellschaft is one of the largest system providers for food and energy processes.

As an internationally operating technology group, the company focuses on process technology and components for demanding production processes in various end markets. The group generates about 70 percent of its revenue from the long-term growing food and energy industries. The GEA Group Aktiengesellschaft is currently present in more than 50 countries worldwide, and is active in all growth regions.

The GEA Group provides GEA Batignolles Technologies Thermiques (GEA BTT) with a solid foundation and, through partnership with other Group members, allows a greater scope of supply. These close relationships with organisations that are themselves leaders in their fields provide GEA BTT with inspiration to stimulate its own development and maintain its market leading technology.

The benefits of GEA:

- The innovative strength of a strong group
- Synergies within all GEA segments
- Different technologies and products to serve different markets

GEA Batignolles Technologies Thermiques is part of the GEA Heat Exchangers segment of the GEA Group and specialises in heat exchangers for the global heat exchange market.





A worldwide presence since 1958 in the oil, gas, energy and petrochemical sectors

[History]

## GEA Batignolles Technologies Thermiques at a glance

1958

The design and manufacturing of the first API Air-cooler in France begins under the name of 'Creusot Loire'.

1985

Batignolles Technologies Thermiques is acquired by GEA Group Aktiengesellschaft. Under the new ownership, GEA BTT is developed to become a world leader in the market for API 661 Air-cooled heat exchangers.

2010

GEA BTT is a worldwide market leader for process air-cooled heat exchangers and part of the GEA Heat Exchangers segment.



[Worldwide]

## Large facilities to serve a growing world demand

The world markets are going through rapid change globally.

New processing capacity has been built in the Middle East and Asia to follow the increasing demand. At the same time existing plants in Europe and North America need upgraded extensions. With its global manufacturing network GEA BTT is able to fulfil customers' global needs locally.

### The benefits of GEA

- Local service from global manufacturing network.
- Extensive engineering know how in heat transfer since 1920.
- The ability to handle huge, complex projects by networking between manufacturing sites.

## France

### Manufacturing capacity in France

- 75 header boxes per week
- 55 km/week of extruded finned tubes
- 50 km/week L and G finned tubes
- 1200 tube bundles per year



## China

### Manufacturing capacity in China

- 30 headers per week
- 30 km/month of extruded finned tubes
- 25 km/month of L and G finned tubes
- 700 tube bundles per year



## Qatar

### Manufacturing capacity in Qatar

- 30 km/month of extruded finned tubes
- 25 km/month L and G finned tubes
- 500 tube bundles per year

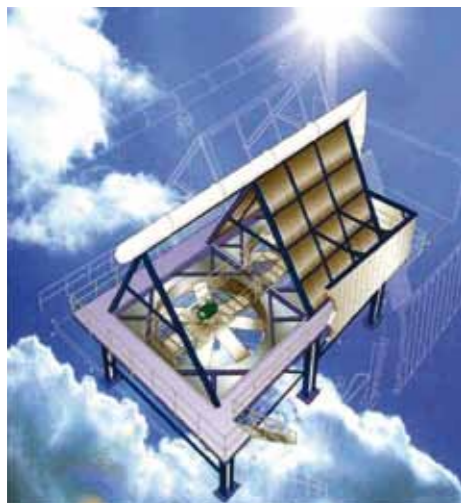




## GEA Batignolles Technologies Thermiques Products

### Air Fin Coolers (AFC)

Process air-cooled heat exchangers are designed to condense and cool fluids in a lot of industries. Air Fin Coolers are used in petrochemical industries, geothermal and solar plant or in carbon capture and storage applications. The heat exchange surface is made of round finned tubes fed by inlet and outlet header boxes. Finned tube bundles are installed flat on a structure and sometimes sloped in an A-frame structure as well and are blown by fans.



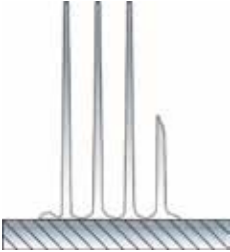

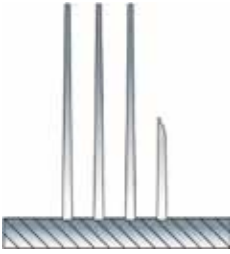
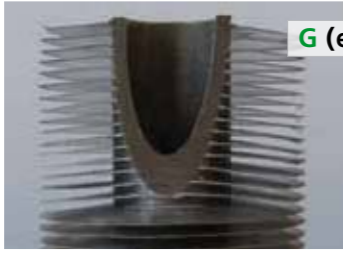
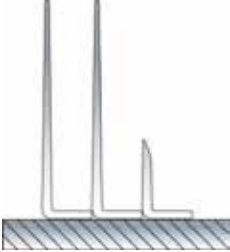

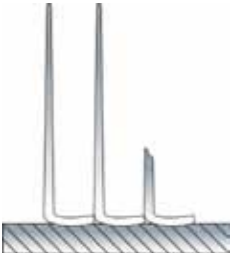
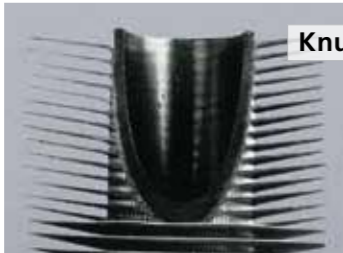
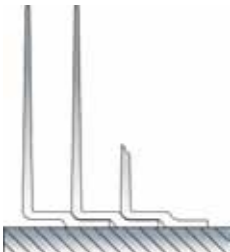

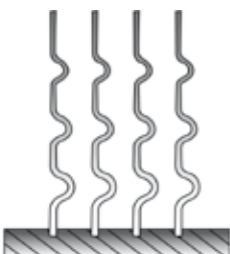

### Air Cooled Condensers (ACC)

Air Cooled Vacuum Steam Condensers (ACC) are designed to condense exhaust steam from turbines. The heat exchange surface is an assembly of finned tubes, fed by an inlet steam duct and manifold. Condensates are drained down into bonnet header boxes. The finned tube bundles are sloped in an 'A' frame structure and blown by fans and drivers. GEA BTT is experienced to handle and deliver complete packages including vacuum units, condensate tanks, pumps, control devices.



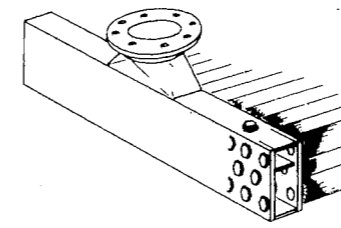
## Finned tubes

The cost efficiency of air-cooled heat exchangers depends among others on the heat transfer capabilities of the finned tubes used. Important factors to increase the heat transfer are: the quality of the finning, the quality of the contact between the fin and the innertube, the fin profile.

		<b>Bimetallic extruded</b>				
		Maximum working temperature	Atmospheric corrosion resistance	Mechanical strenght	Thermal performance	
		300 °C 560 °F	Excellent	Excellent	Very good	
		<b>G (embedded)</b>				
		Maximum working temperature	Atmospheric corrosion resistance	Mechanical strenght	Thermal performance	
		400 °C 750 °F	Low	Very good	Very good	
		<b>L (wrap-on)</b>				
		Maximum working temperature	Atmospheric corrosion resistance	Mechanical strenght	Thermal performance	
		120 °C 250 °F	Average	Low	Average	
		<b>Knurled L</b>				
		Maximum working temperature	Atmospheric corrosion resistance	Mechanical strenght	Thermal performance	
		250 °C 480 °F	Good	Acceptable	Average	
		<b>Double LL</b>				
		Maximum working temperature	Atmospheric corrosion resistance	Mechanical strenght	Thermal performance	
		120 °C 250 °F	Good	Low	Average	
		<b>GROOVY®</b>				
		Maximum working temperature	Atmospheric corrosion resistance	Mechanical strenght	Thermal performance	
		400 °C 750 °F	Low	Excellent	Excellent	

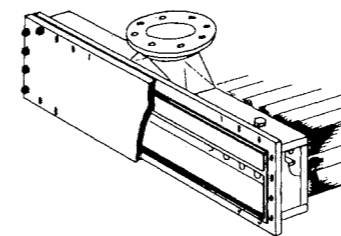
## Headers

A range of header designs have been developed for different applications and requirements. Standard header configurations are listed below.



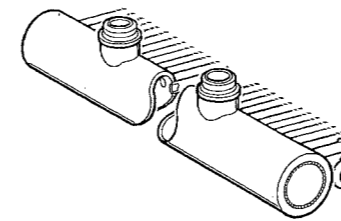
**Plug header**

The plug header is the most commonly used for working pressures up to 250 bar.



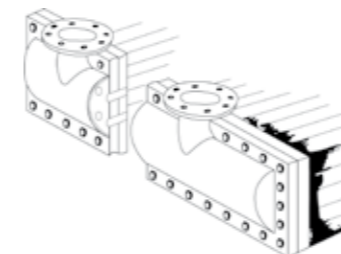
**Cover plate header**

The cover plate header is used for fluids with high fouling factors, when frequent mechanical cleaning is necessary, at pressures up to 30 bar.



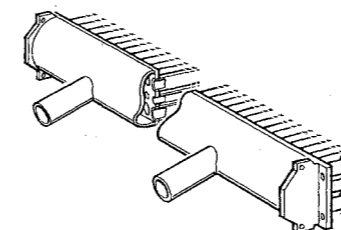
**Pipe header**

The pipe header is used for working pressures over 250 bar when no inner access is necessary.



**D type header**

This large manifold ensures an equal distribution of fluid flow in the tubes. This type is used for vacuum steam condensers and refrigeration units.



**Welded bonnet header**

The welded bonnet header is used for ammonia condensers and air-cooled steam condensers. It benefits from a full-welded construction that is suitable for vacuum applications.



Finned tube test

## GEA BTT - your partner for designing your projects

### Thermal Design

A dedicated team deals with customers' technical requirements:

- Heat duty
- Maximum tubeside pressure drop
- Maximum noise level
- Plot plan restriction
- Electrical power consumption
- Extreme environmental conditions
- Any specific request

Systems are designed with cost and efficiency in mind to provide the most appropriate plant for each customer's requirements, at the right price.

### Tools

- In-house thermal rating and costing software
- Internationally-recognised thermal software (Xace® from HTRI)
- Fan suppliers' sizing softwares
- Computational Fluid Dynamics software

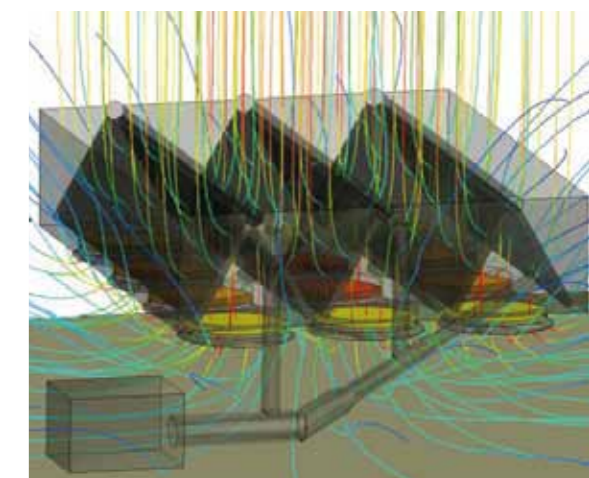
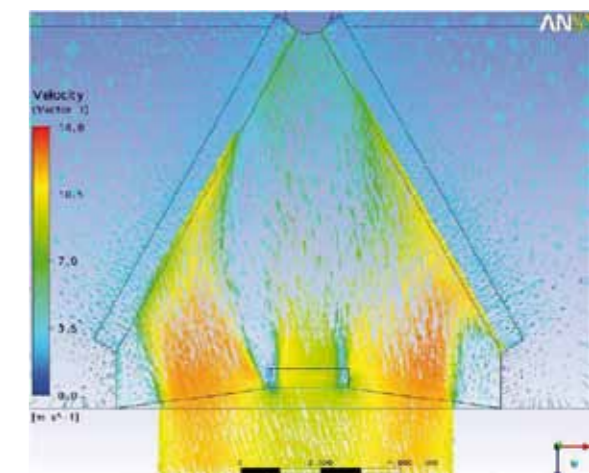
### Research and Development

High qualified team for developing, improving and optimizing the products through continuous research and development activities

- Long and short term research
- Collaboration with research institutes
- Development of testing facilities
- Development of new innovative products
- Patents (3 new patents every year)
- Use of Computational Fluid Dynamics, experiments, prototyping for validation of new ideas

Some of our current projects:

- Newly designed and patented finned tube
- Reduction of noise level by innovative design
- Environmental friendly system for regasification plant

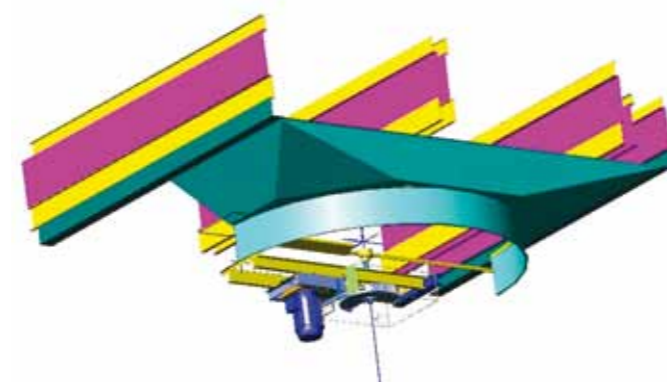




## Total support from FEED stage with TOTING

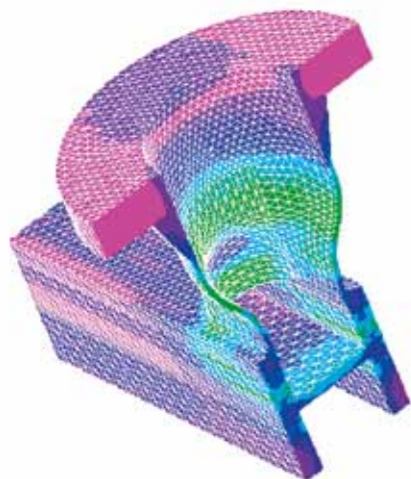
TOTING is a software developed in-house which can generate from the thermal design preliminary engineering drawings at an early stage of the project.

- Arrangement drawings and loading data can be submitted to the customer during the pre-engineering phase to optimise the plant cost.
- Bill of materials allows cost calculations to be optimised.
- The detail engineering phase can be launched immediately after order placement.



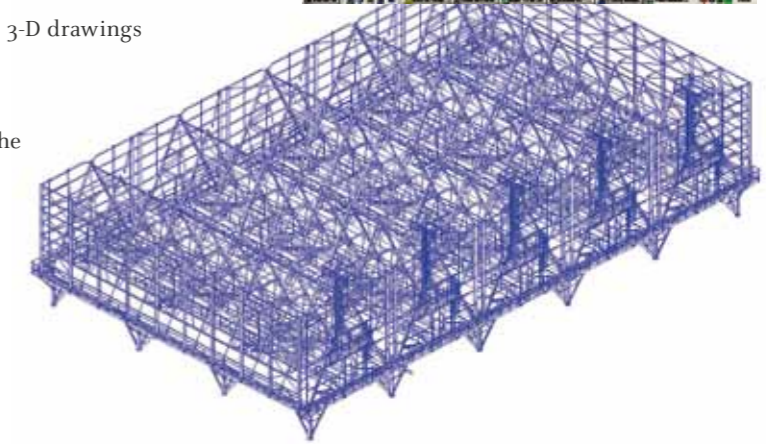
## Design of Headers

- Finite element calculation methods, developed in-house and certified by ASME authorised inspection agencies, are used for header design as per ASME VIII div.1 App. 13.
- Finite element specific software and models are used for nozzle stress analysis under piping loads.



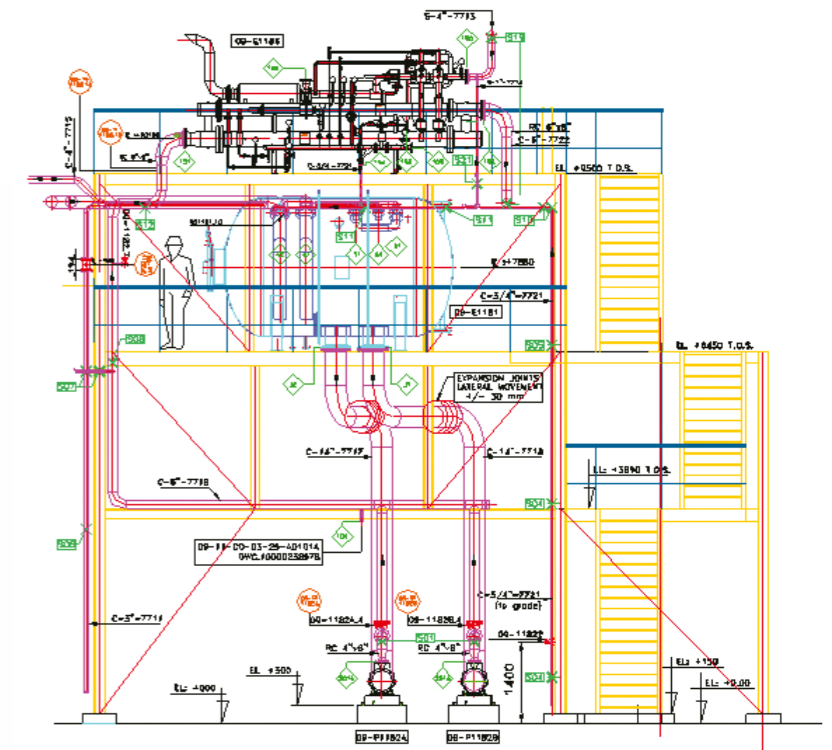
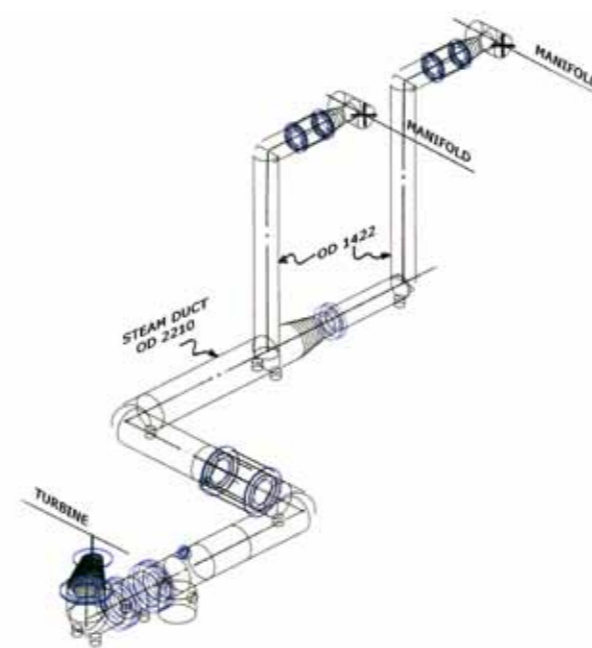
## Design of steel structure for AFC and ACC

- From the GAD produced by TOTING GEA BTT will generate a 3-D model to perform the calculation of the structural steel using STAAD pro® software. This model is then exported to X-steel® software to produce 3-D drawings and shop drawings.
- This integrated design process ensures the manufacturing of the steel structure and allows the production of calculation data when required.



## Design of the auxiliaries for ACC

- GEA BTT carries out basic and detailed engineering for auxiliary equipment using the latest design technology.



# GEA BTT – your partner for manufacturing your projects

## Manufacturing facilities

All GEA BTT's facilities have the necessary equipment and expertise to ensure the manufacture of complete bundles on time and to the approved quality standard.

The manufacturing of headers has been substantially improved over the years with the use of modern manufacturing techniques, CNC equipment and bar coding systems.

GEA BTT is highly experienced in special design using exotic materials (such as Titanium, Monel, Incolloy, etc.) for special/stringent services (very toxic, lethal, etc.) and using the most modern welding technology such as electron beam welding.

Tube manufacturing is performed with machinery developed in-house by GEA BTT for extruded fins and the latest available technology for wrap-on fins.

### The benefits of GEA

- Modern manufacturing facilities
- Experience with different kinds of materials and alloys
- Production machinery has been adapted by GEA for the special needs of the heat exchanger industry

## Quality Control

Products go through extensive testing before delivery to the customer.

### Pressure parts

X-Ray, Ultrasonic, Liquid Penetrant



**Complete bundle**  
Hydrotest, PMI examination



**AFC and ACC testing**  
Shop run-in tests may include vibration, air flow, power consumption and noise level measurement.

## Certifications

Design and manufacturing activities at GEA BTT comply with the latest certifications, European directives and with some specific national regulations.

### ISO 9001

ISO 9001 for the quality of the whole process (design, manufacture, tests, installation) with regular audit from the authorised agencies.



### ASME (American)

S, U, U2 for pressure vessels and pressure boiler.



### ASME (American) NB and R



### AD 2000 Code HP 0





### Packing

A large storage area is available in GEA BTT's workshops for the preparation of shipments where packing lists, packing, marking and customer requirements are controlled. A specific packing area has been developed for ocean freight.

### Transport

GEA-BTT is committed to on-time delivery.

Ocean freight



Air freight

Road transport



### Module assembly

GEA BTT uses either local yard facilities for storage and modular erection or erection facilities in the different workshop location.





## Field Activities

### Erection, commissioning and services

Once equipment is delivered, GEA BTT is on site for:

- the erection of Air Fin Coolers or Air-cooled Condensers with a 'supervision only' or 'full turnkey' service
- Commissioning
- Performance tests



## Spares and After-Sales-Service

GEA BTT provides a full range of After-Sales-Services including spare parts and services for all air-cooled heat exchangers, including 3rd party design.

GEA BTT recommends identical or interchangeable spare parts, designed and manufactured in compliance with the most recent standards and international codes. Fast-track delivery (under 72 hours) is available on request for all stock components.



## GEA BTT Spare Parts & Components Dept

### Bundles

- Spare bundles certified interchangeable with original supply (header boxes / fintubes / frame), designed and delivered.

### Fans

- Spare parts for fans from stock: blades, hubs, bushings

### Components

- Bearings, pulleys, belts, gear reducers, shafts, plugs, gaskets and bolting

Email: [bttspares@geagroup.com](mailto:bttspares@geagroup.com)

## GEA Airflow Services

GEA BTT has created a subsidiary company, GEA Airflow Services, fully dedicated to after-sales field services such as:

- Air-cooled heat exchangers assessments
- Performance improvement by up grading fans and drivers
- De-bottlenecking analysis
- Maintenance programs
- Cleaning verification and consultancy
- Cleaning hardware

Website: <http://www.airflow-services.com>

Email: [airflow@geagroup.com](mailto:airflow@geagroup.com)



## Products and markets: A specific offer for each customer

A range of aircoolers for different applications in different markets.

### Oil / Refineries



Air Fin Coolers (induced draft)  
Leuna 2000, Germany

### Oil fields



Humidified Aircooler  
Khursaniyah, K.S.A.

### Petrochemical



Air Fin Coolers and Air Cooled Condensers  
Nanjing, China

### Gas / Liquid Natural Gas (LNG)



Air Fin Coolers (induced draft)  
Bonny Island, Nigeria

### Gas / FPSO



Air Fin Coolers (Forced draft)  
Sanha LPG, Angola

### Gas / Offshore platforms



Air Fin Coolers  
Tunu, Indonesia

### Energy / Steam Condensers



Vacuum Steam Condenser for  
Combined Cycle; Kulim, Malaysia

### Energy / Steam Condensers



A-frame Air Cooled Condenser  
Bintulu SMDS, Malaysia

### Energy / Turbine Cooling-Fuel Gas Heater (TCA/FGH)



Air Fin Coolers  
Power Plant, Taiwan



### ... and other fields

Air Fin Coolers (induced draft)  
Chillers for Eurotunnel, England/France



GEA Heat Exchangers

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