



MachinePoint[®]
Food Technologies

Heat Exchangers

HEATING AND COOLING

Gemina[®]

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Heat Exchangers

HEATING AND COOLING

WHAT IS A HEAT EXCHANGER?

Heat exchangers are devices which allow the heat exchange between two fluids which are at different temperatures while at the same time they avoid the mixing of these fluids.

HOW DOES THE HEAT TRANSFER HAPPEN??

In an exchanger, the heat transfer is normally carried out through convection in each fluid and conduction through the wall which separates them.

Conduction is the energy transfer from the more energetic particles in a substance towards the less energetic, adjacent particles, due to interactions among these particles. Conduction can take place in solids, liquids and gases.

In gases and liquids, conduction is produced by collisions and diffusion of particles as they move randomly.

In solids, it is due to the combination of molecule vibrations and to the energy transportation caused by free electrons.

Convection is the transfer method occurring between a solid surface and the adjacent liquid or gas which is in movement and entails the combined effects of conduction and fluid movement. The faster the fluid movement is, the more heat transfer occurs by convection. In the absence of extensive fluid movement, the heat transfer between a solid surface and the adjacent fluid is by sheer conduction.

Convection can be natural or forced, in the former the thermal energy is transferred by means of natural currents until a temperature balance is achieved. In forced convection, the idea is to favor the mixture of cold and hot parts, providing a turbulent regime to the flow.



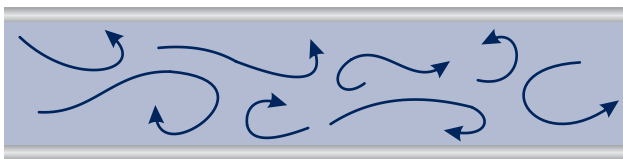
TYPES OF HEAT EXCHANGERS

Different applications of heat transfer demand different types of accessories and configurations on the equipment. The attempt to match the heat transfer accessories to the different needs, respecting specific constraints, has led to the development of various innovative designs of heat exchangers.

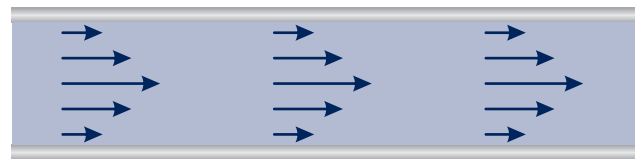
At GÉMINA we design and manufacture heat exchangers adapted to the current needs of the food industry, where the plate exchangers or scraped surface exchangers are not feasible due to the high investment cost that they imply.



Turbulent



Laminar





CORRUGATION

The performance in the heat exchange is highly favored when the heat is transferred by forced convection, that is, in turbulent regime.

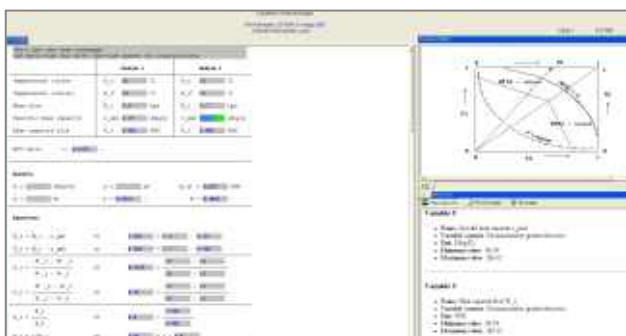
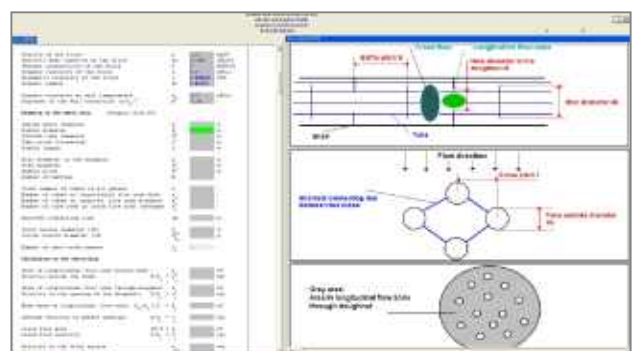
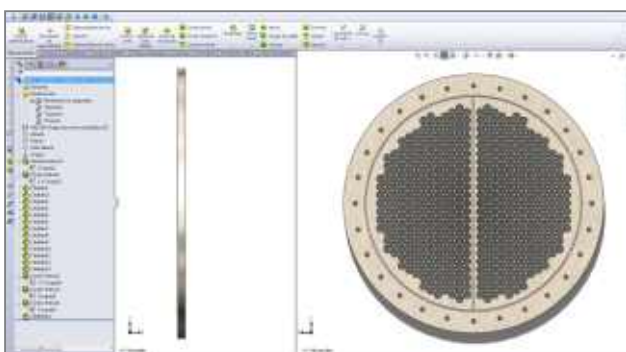
Corrugation in the pipes breaks the laminar flow, causing turbulence in the product and increasing the thermal transfer speed, in contrast to laminar flow.

DESIGN

GÉMINA researches and applies the latest technologies and advances related to heat transfer and mechanics. Our heat exchangers are specially designed for food applications, such as pasteurization, refrigeration and general heating and cooling of beverages, dairies, beers, viscous products, etc.

The engineers at our engineering center study and design each exchanger according to the needs of each application with the help of state-of-the-art software for the calculations and graphic design of our products.

Each application follows a thorough analysis of the particularities demanded by the customer, making all the necessary information available to our customer.



MANUFACTURING PROCESS

At GÉMINA, the manufacturing process is carried out by state of the art equipment for welding, forming, cutting and machining, which guarantee the perfect overlapping between design and manufacturing. Also thanks to the integration of the CAD-CAM system, we assure an excellent quality in our heat exchangers.



The manufacturing process is carried out following the highest standards of quality.

All the exchangers have the **CE marking** and all the used materials are **FDA approved**.

Besides, all the manufacturing processes are governed by various international standards, such as **FBR, EHEDG, 3 A**, etc.

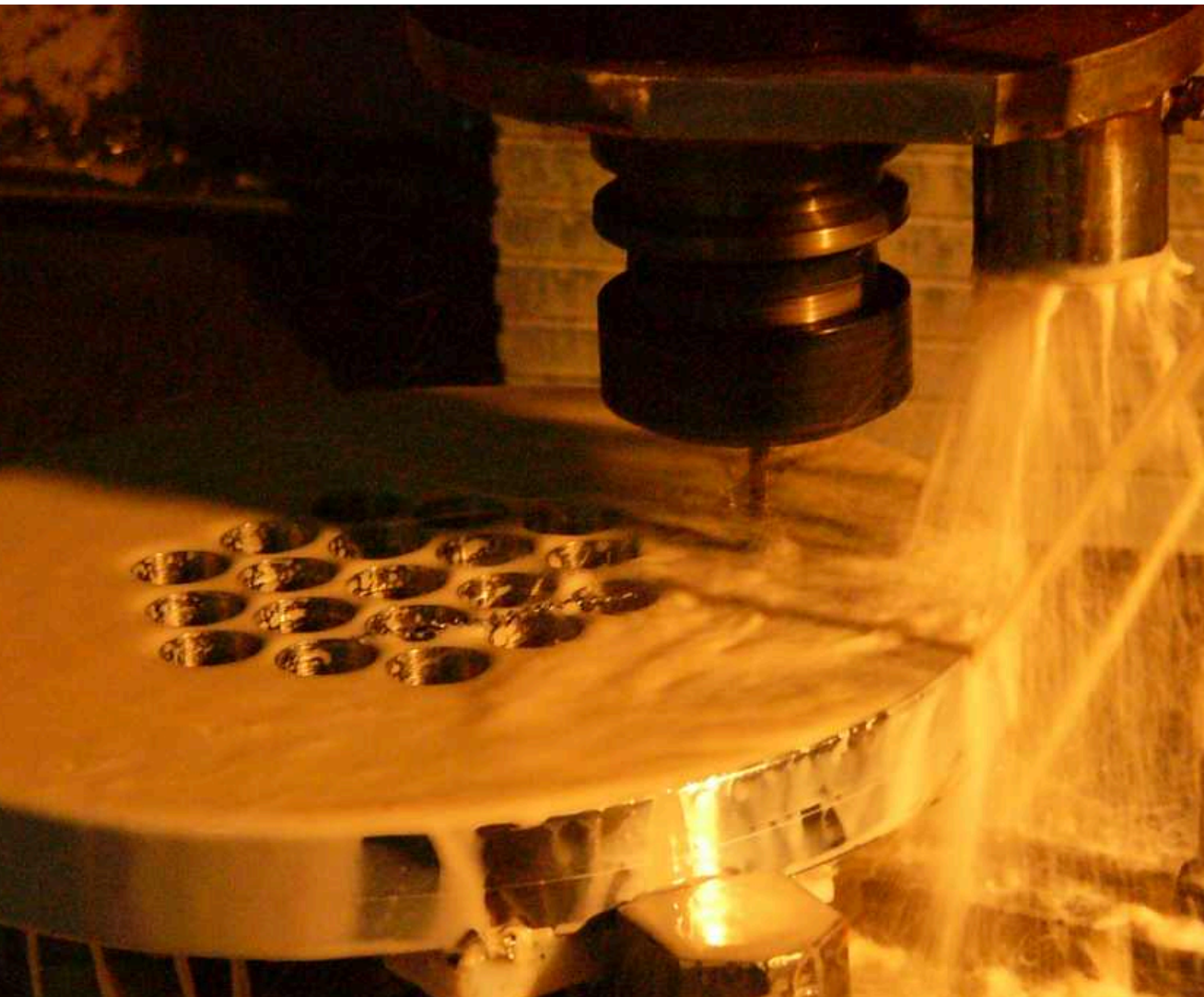
MATERIALS USED

All exchangers are manufactured in **AISI 304** and **AISI 316** steels.

The materials for gaskets are manufactured in **EPDM, VITON, PTFE**, etc.

ACCESSORIES

The accessories can be soldered, threaded or *clamped* (with high or low pressure), flange clamped, aseptic clamps and hygienic models.



Single Tube Heat Exchangers

APPLICATIONS

Ideal for products with big or medium particle sizes, fibers and shreds.

They are mainly used in applications such as:

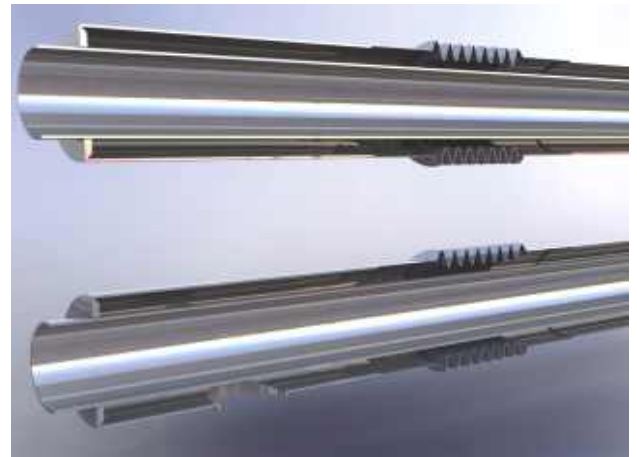
- Pasteurization.
- Heat recovery.
- High pressure or temperature processes or processes with fouling.
- Waste water treatment processes.
- Pilot plants and test plants.
- Thawing and melting treatments.

They are ideal for treatment of products with particles such as sauces, soups, tomato chunks, fruits and minced meat, mashed grapes, frozen pulps and juices, thawing of fruit concentrates and dairies, butter, aseptic processes of fruit pieces for yoghourts, orange pulp cells, pet food, etc.

They can also be used as fruit cookers for enzymatic deactivation processes and in other industries such as chemical, textile, pharmaceutical and cosmetic sectors.

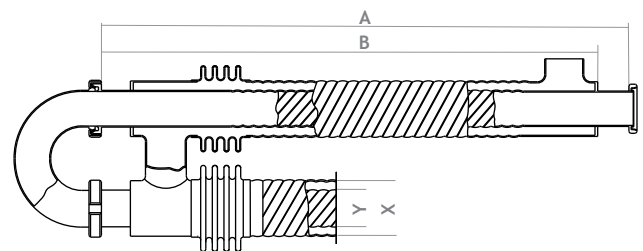
ITS DESIGN

The design of a heat exchanger is very simple: it's based on two concentric tubes.



ADVANTAGES

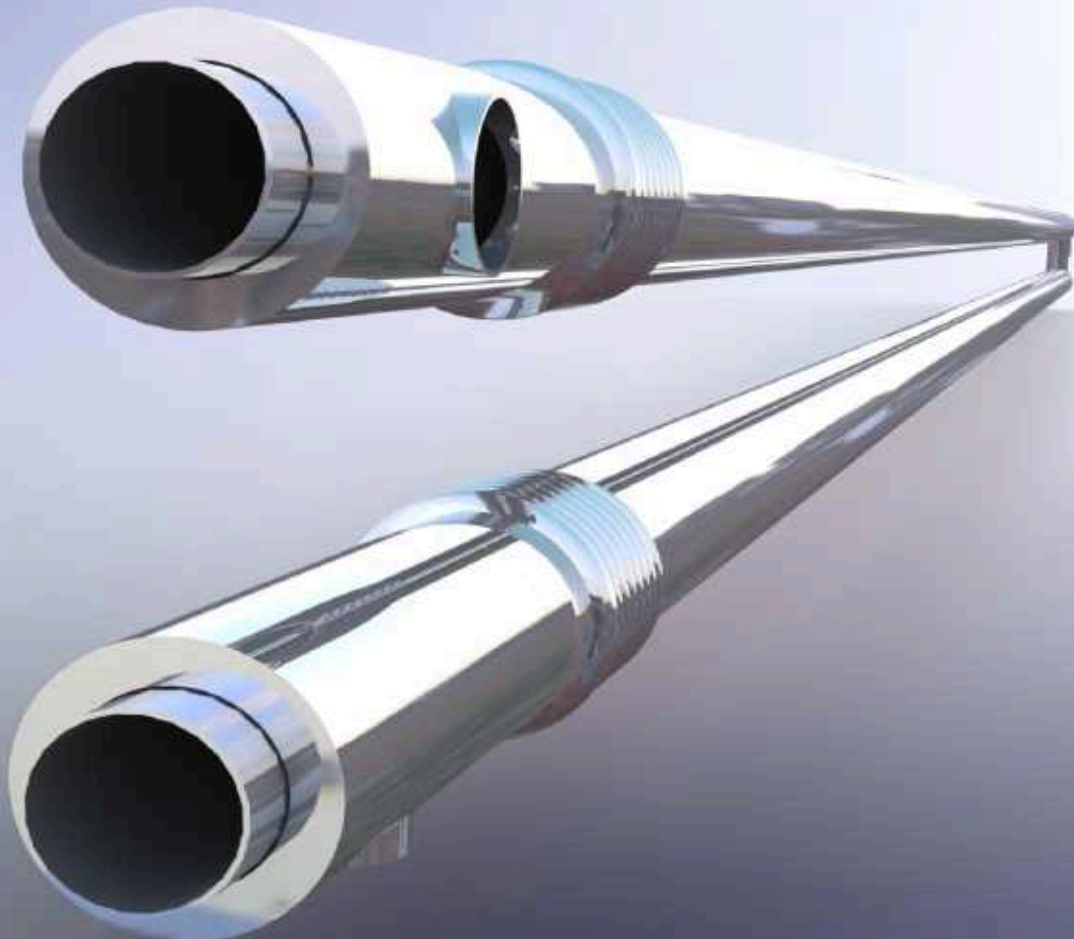
- Short processing times due to corrugation and its high thermal transfer coefficient.
- Homogeneous thermal process.
- Low fouling due to the self-cleaning effect provided by the high turbulence inside a corrugated tube.
- Hygienic design: there are no watertight areas or cavities where microorganisms can stay.
- Low surface roughness $Ra \leq 0.8 \text{ mm}$ or less depending on the finish (plug drawn, bright finish, electropolishing, etc)
- Long working periods between stops without the need for cleaning and great response to the C.I.P. cleaning cycle systems due to the reduction of dead zones which minimize the accumulation of product and allows for a very effective C.I.P.
- Its versatility and profitability, since the exchanger itself can work with an ample range of products.
- Easy to inspect.
- The absence of contact points avoids the burning of the product.
- High working temperatures and pressures thanks to the absence of joints.
- Compact assembly.
- Replacement parts unnecessary.
- Very low maintenance costs.



SINGLE TUBE HEAT EXCHANGERS MODELS

| Model x-y | A [mm] | | B [mm] | | Area [m ²] | | Flow [m ³ /h] (V=1m/s) | |
|--------------|---------|---------|---------|---------|------------------------|---------|-----------------------------------|---------|
| | 3000 mm | 6000 mm | 3000 mm | 6000 mm | 3000 mm | 6000 mm | Services | Product |
| 1,5" - 1" | 2925 | 5925 | 2845 | 5845 | 0,2 | 0,5 | 1,7 | 1,5 |
| 2" - 1" | " | " | " | " | 0,2 | 0,5 | 4,7 | 1,5 |
| 2" - 1,5" | " | " | " | " | 0,4 | 0,7 | 2,4 | 3,5 |
| 2,5" - 1,5" | " | " | " | " | 0,4 | 0,7 | 6,3 | 3,5 |
| 2,5" - 2" | " | " | " | " | 0,5 | 1 | 3,1 | 6,5 |
| 3" - 2" | " | " | " | " | 0,5 | 1 | 7,9 | 6,5 |
| 3" - 2,5" | " | " | " | " | 0,6 | 1,2 | 3,7 | 10,4 |
| 3,5" - 2" | " | " | " | " | 0,5 | 1 | 13,1 | 6,5 |
| 3,5" - 2,5" | " | " | " | " | 0,6 | 1,2 | 9 | 10,4 |
| 3,5" - 3" | " | " | " | " | 0,7 | 1,4 | 4 | 15,1 |
| 4" - 2" | " | " | " | " | 0,5 | 1 | 19,6 | 6,5 |
| 4" - 2,5" | " | " | " | " | 0,6 | 1,2 | 15,5 | 10,4 |
| 4" - 3" | " | " | " | " | 0,7 | 1,4 | 10,5 | 15,1 |
| 4" - 3,5" | " | " | " | " | 0,8 | 1,7 | 4,6 | 20,4 |
| 4,5" - 2" | " | " | " | " | 0,5 | 1 | 27,1 | 6,5 |
| 4,5" - 2,5" | " | " | " | " | 0,6 | 1,2 | 23 | 10,4 |
| 4,5" - 3" | " | " | " | " | 0,7 | 1,4 | 18 | 15,1 |
| 4,5" - 3,5" | " | " | " | " | 0,8 | 1,7 | 12,1 | 20,4 |
| 5" - 2,5" | " | " | " | " | 0,6 | 1,2 | 32,8 | 10,4 |
| 5" - 3" | " | " | " | " | 0,7 | 1,4 | 27,8 | 15,1 |
| 5" - 3,5" | " | " | " | " | 0,8 | 1,7 | 21,8 | 20,4 |
| 5" - 4" | " | " | " | " | 1 | 1,9 | 15 | 26,9 |
| 5,5" - 3" | " | " | " | " | 0,7 | 1,4 | 35,6 | 15,1 |
| 5,5" - 3,5" | " | " | " | " | 0,8 | 1,7 | 29,7 | 20,4 |
| 5,5" - 4" | " | " | " | " | 1 | 1,9 | 22,9 | 26,9 |
| 5,5" - 4,5" | " | " | " | " | 1,1 | 2,2 | 15,1 | 34,4 |
| 6" - 3,5" | " | " | " | " | 0,8 | 1,7 | 41,3 | 20,4 |
| 6" - 4" | " | " | " | " | 1 | 1,9 | 34,4 | 26,9 |
| 6" - 4,5" | " | " | " | " | 1,1 | 2,2 | 26,7 | 34,4 |

Specifications, values and dimensions are subject to change without notification. Can be manufactured with other measures or specifications by request and consultation to the technical department.





Multitubular or Pyrotubular Heat Exchangers

APPLICATIONS

Suitable for products with low or medium viscosity and high or low PH, liquids with small particles destined for various industries: food, chemical, cosmetic, pharmaceutical, etc. They are mainly used in applications like:

- UHT and pasteurization processes.
- Product-product or water-product heat recovery.
- Processes at high pressures and/or temperatures.
- Food transformation.

Suitable for the treatment of products like dairy concentrate, creams, fermented dairy beverages, flavored dairy beverages, dairy products derivatives (cream, yoghurt, etc.), liquid baby food, purees, ice creams, soups, pulps, serums, protein-based beverages, juices, fruit and vegetable purees, juices with or without pulp cells, ketchup, soya products, energy drinks, beers, alcoholic drinks, oils, chocolate, demineralized water, coffee extract, syrups, etc.



ITS DESIGN

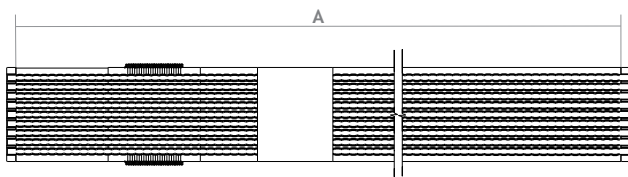
Its design is characterized by the layout of several tubes within an outer tube or shell, with one of various with one or several steps in the product channel.

ADVANTAGES

- Short processing times due to the corrugation, which provides a high thermal transfer coefficient.
- Homogeneous thermal process (without distribution problems as in plate exchangers.)
- Low fouling due to the self-cleaning effect provided by the high turbulence inside a corrugated tube.
- Low surface roughness $Ra \leq 0.8$ mm or less depending on the finish (plug drawn, bright finish, electropolishing, etc.)
- Long working periods between stops without the need for cleaning and great response to the C.I.P. cleaning cycle systems due to the reduction of dead zones which minimize the accumulation of product and allows for a very effective C.I.P.



- High safety in aseptic processes.
- Its versatility and profitability, since the exchanger itself can work with different products
- High quality of thermal treatment, thanks to its high speeds, short heating times, homogeneous distribution and the capacity to withstand high pressures.
- The absence of contact points avoids the burning of the product.
- Modular, its capacity can be increase at any time.
- Easy to inspect and dismantle.
- Low maintenance costs.
- Few replacement parts needed.



PYROTUBULAR HEAT EXCHANGERS MODELS

| Model | A [mm] | | Area [m ²] | | Flow [m ³ /h] (V=1m/s) | | Diameters | | Inner Tubes |
|-------|--------|------|------------------------|-----|-----------------------------------|-------|---------------|------------|-------------|
| | 3 m | 6 m | 3 m | 6 m | Shirt | Tubes | Shirt [inch.] | Tubes [mm] | |
| 3" | 2735 | 5735 | 1,1 | 2,1 | 10,1 | 3,9 | 3 | 16 | 7 |
| | | | 1,2 | 2,4 | 8,7 | 5,1 | 3 | 18 | 7 |
| 3,5" | 2566 | 5566 | 1,1 | 2,1 | 15,3 | 3,9 | 3,5 | 16 | 7 |
| | | | 1,2 | 2,4 | 14 | 5,1 | 3,5 | 18 | 7 |
| | | | 1,3 | 2,6 | 12,5 | 6,4 | 3,5 | 20 | 7 |
| | | | 1,5 | 2,9 | 10,8 | 7,9 | 3,5 | 22 | 7 |
| 4" | 2540 | 5540 | 1,3 | 2,6 | 19 | 6,4 | 4 | 20 | 7 |
| | | | 1,5 | 2,9 | 17,4 | 7,9 | 4 | 22 | 7 |
| | | | 1,6 | 3,3 | 14,6 | 10,5 | 4 | 25 | 7 |
| 4,5" | 2540 | 5540 | 1,6 | 3,3 | 22 | 10,5 | 4,5 | 25 | 7 |
| | | | 1,8 | 3,7 | 18,9 | 12,4 | 4,5 | 28 | 7 |
| | | | 2,9 | 5,7 | 20,6 | 10,5 | 4,5 | 16 | 19 |
| 5" | 2515 | 5515 | 1,8 | 3,7 | 28,7 | 12,4 | 5 | 28 | 7 |
| | | | 2,2 | 4,4 | 22,6 | 17,8 | 5 | 33 | 7 |
| | | | 3,2 | 6,4 | 26,8 | 13,8 | 5 | 18 | 19 |
| | | | 3,6 | 7,2 | 22,7 | 17,4 | 5 | 20 | 19 |
| 5,5" | 2490 | 5490 | 2,2 | 4,4 | 30,5 | 17,8 | 5,5 | 33 | 7 |
| | | | 2,5 | 5 | 23,5 | 24,2 | 5,5 | 38 | 7 |
| | | | 3,2 | 6,4 | 34,7 | 13,8 | 5,5 | 18 | 19 |
| | | | 3,6 | 7,2 | 30,6 | 17,4 | 5,5 | 20 | 19 |
| 6" | 2490 | 5490 | 3,9 | 7,9 | 26,1 | 21,5 | 5,5 | 22 | 19 |
| | | | 2,5 | 5 | 35 | 24,2 | 6 | 38 | 7 |
| | | | 3,6 | 7,2 | 42,1 | 17,4 | 6 | 20 | 19 |
| | | | 3,9 | 7,9 | 37,6 | 21,5 | 6 | 22 | 19 |
| | | | 4,5 | 9 | 30 | 28,4 | 6 | 25 | 19 |

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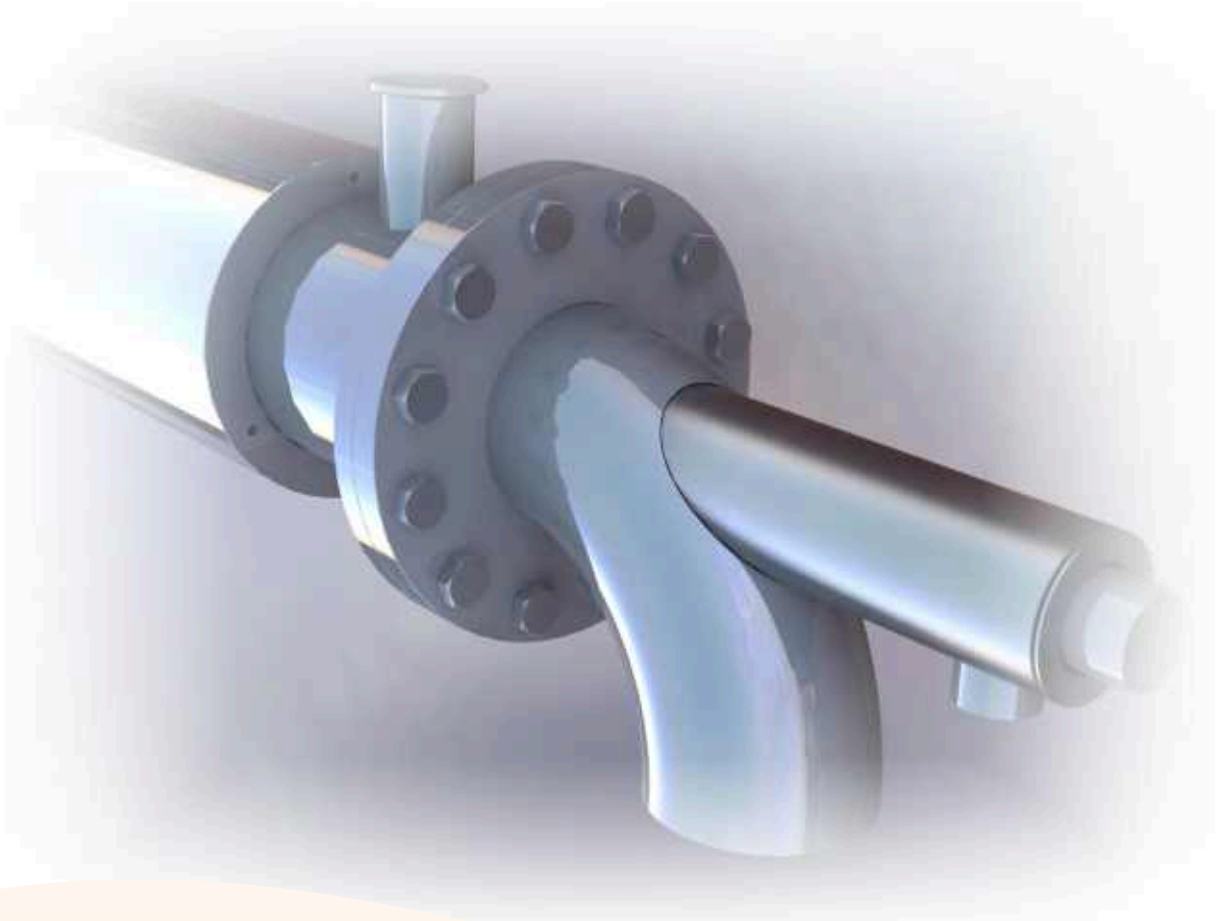
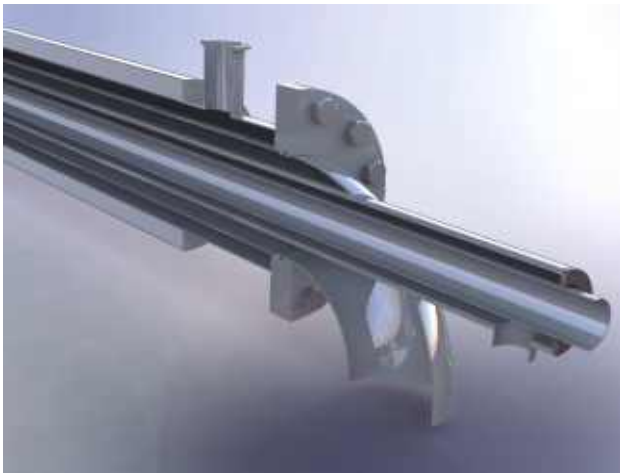
Annular Heat Exchangers

APPLICATIONS

Suitable for products of medium and high viscosity and high or low PH, with tendency to laminar flow which exchange heat by conduction and not by convection, as well as particled and non-Newtonian products, for example:

- Pasteurization.
- Processes at high pressures (300 bar) and/or temperatures.
- Cooling treatments near the solidification point.
- Gelifications.

Suitable for products like fruit pulps, tomato paste, banana paste, purees, honey, yoghurt, chocolate, seasoned and starch-based sauces, butter, cocoa and peanut butter, syrup, pudding, egg-based products, ice cream mixtures, baby food, jams and compotes, lecithins, collagen, gelifications, chemical or pharmaceutical products, textile applications, etc.



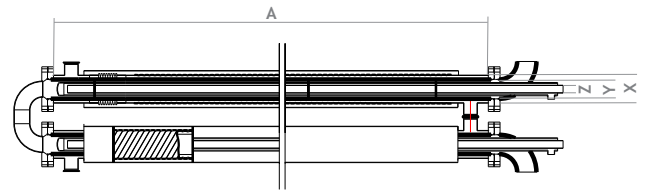
ITS DESIGN

Its design is characterized by three concentric tubes. With this layout, the product is treated by a large surface of thermal exchange, since in this way, heat is exchanged both through the outer and inner parts.

ADVANTAGES

- Short time for thermal treatment thanks to the corrugation and to the increase in the surface for thermal transfer.
- Working pressures up to 300 bars.
- Working temperatures up to 180 °C.
- Different annular spaces to optimize speed at different flow rates.
- High safety in aseptic processes.
- Continuous and double annular flow in the bend.
- The absence of contact points avoids the burning of the product.
- Low surface roughness $Ra \leq 0.8$ mm or less depending on the finish (plug drawn, bright finish, electropolishing, etc.) Homogeneous thermal process due to its mixing capability.
- Easy assembly.
- Its versatility and profitability, since it can work with different products.
- Low fouling due to the self-cleaning effect provided by the high turbulence inside a corrugated tube.

- Long working periods between stops without the need for cleaning and great response to the C.I.P. cleaning cycle systems due to the reduction of dead zones which minimize the accumulation of product and allows for a very effective C.I.P.
- Designed to avoid stops when the product is highly viscous.
- Few replacement parts needed.
- Easily expandable.
- Low maintenance costs.



ANNULAR HEAT EXCHANGERS MODELS

| Model | A [mm] | | Area [m ²] | | Flow [m ³ /h] (V=1m/s) | | Diameters | | |
|----------------|--------|------|------------------------|-----|-----------------------------------|---------|-----------|--------|--------|
| | 3 m | 6 m | 3 m | 6 m | Services | Product | X [mm] | Y [mm] | Z [mm] |
| 2,5"-2"-1,5" | 2934 | 5934 | 0,8 | 1,7 | 6,5 | 2,4 | 63,5 | 50,8 | 38,1 |
| 3"-2,5"-1,5" | 2934 | 5934 | 1 | 1,9 | 7,2 | 6,3 | 76,2 | 63,5 | 38,1 |
| 3"-2,5"-2" | | | 1,1 | 2,2 | 10,2 | 3,1 | | | 50,8 |
| 3,5"-3"-1,5" | 2934 | 5934 | 1,1 | 2,2 | 7,4 | 11,1 | 88,9 | 76,2 | 38,1 |
| 3,5"-3"-2" | | | 1,2 | 2,4 | 10,4 | 7,9 | | | 50,8 |
| 3,5"-3"-2,5" | | | 1,3 | 2,6 | 14,3 | 3,7 | | | 63,5 |
| 4"-3,5"-2" | 2934 | 5934 | 1,3 | 2,6 | 11 | 13,1 | 101,6 | 88,9 | 50,8 |
| 4"-3,5"-2,5" | | | 1,4 | 2,9 | 14,9 | 9 | | | 63,5 |
| 4"-3,5"-3" | | | 1,6 | 3,1 | 8,3 | 4 | | | 76,2 |
| 4,5"-3,5"-2" | | | 1,3 | 2,6 | 18,5 | 13,1 | | | 50,8 |
| 4,5"-3,5"-2,5" | 2934 | 5934 | 1,4 | 2,9 | 22,4 | 9 | 114,3 | 88,9 | 63,5 |
| 4,5"-3,5"-3" | | | 1,6 | 3,1 | 19,9 | 4 | | | 76,2 |
| 5"-4"-2" | 2934 | 5934 | 1,4 | 2,9 | 21,5 | 19,6 | 129 | 101,6 | 50,8 |
| 5"-4"-2,5" | | | 1,6 | 3,1 | 25,3 | 15,5 | | | 63,5 |
| 5"-4"-3" | | | 1,7 | 3,4 | 30,1 | 10,5 | | | 76,2 |
| 5"-4"-3,5" | | | 1,8 | 3,6 | 24 | 4,6 | | | 88,9 |
| 5,5"-4,5"-2,5" | | | 1,7 | 3,4 | 25,5 | 23 | | | 63,5 |
| 5,5"-4,5"-3" | 2934 | 5934 | 1,8 | 3,6 | 30,3 | 18 | 139,7 | 114,3 | 76,2 |
| 5,5"-4,5"-3,5" | | | 1,9 | 3,8 | 24,1 | 12,1 | | | 88,9 |
| 5,5"-4,5"-4" | | | 2 | 4,1 | 25,6 | 5,2 | | | 101,6 |
| 6"-5"-3" | 2934 | 5934 | 1,9 | 3,9 | 31,7 | 27,8 | 154 | 129 | 76,2 |
| 6"-5"-3,5" | | | 2,1 | 4,1 | 25,5 | 21,8 | | | 88,9 |
| 6"-5"-4" | | | 2,2 | 4,3 | 27,1 | 15 | | | 101,6 |
| 6"-5"-4,5" | | | 2,3 | 4,6 | 28,6 | 7,2 | | | 114,3 |

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MachinePoint®

Food Technologies

MACHINEPOINT FOOD TECHNOLOGIES was created as a result of a joint-venture between **MACHINEPOINT GROUP** and **GÉMINA**.

MACHINEPOINT FOOD TECHNOLOGIES designs, manufactures and integrates lines, equipment and processes for the food industry, more specifically for the beverage processors, the dairy industry and processors of fruits and vegetables.

MACHINEPOINT FOOD TECHNOLOGIES belongs to an international group specialized in industrial equipment for plastic, packaging and food industries.

The group is headquartered in Spain (Valladolid) and has sales offices in Turkey, Mexico, France, India and North Africa. The engineering center is also located in Spain (Murcia). It is at the engineering center where we manufacture our equipment and have our R & D + I department.

GEMINA PROCESOS ALIMENTARIOS S.L. is a leading equipment manufacturer that provides innovative solutions for the food industry. It has over 25 years experience in designing, manufacturing, assembling, automating and implementing lines and processes.

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