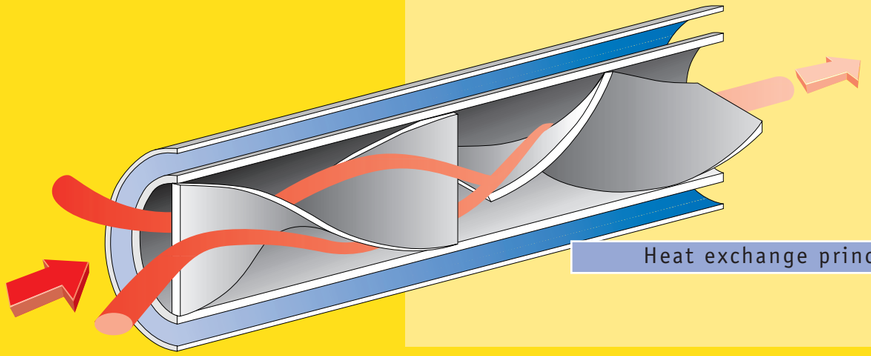
PRIMIX

HEAT EXCHANGERS



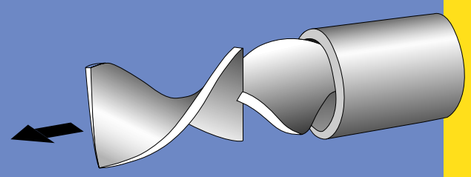
Heat exchange principle

The Primix spiral shaped mixer elements are the basis of the Primix heat exchanger design. Thanks to its advanced construction, this model has its own place in the field of dynamic and static heat exchangers. The Primix heat exchanger is delivered at customer specifications only.

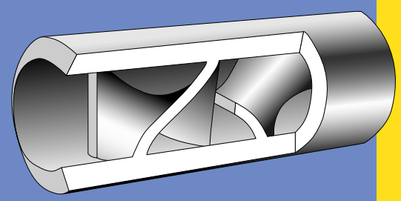
A team of professionally skilled people working in a well-equipped workshop, supported by skilled engineers specialized in process technology and mechanics, will meet your wishes.

AD-Merkblätter, Stoomwezen, ASME and a number of other design codes are day to day practice within the Primix Company.

The Primix heat exchanger, a mixture of assets



Detachable



Advanced connection technology

Quicker refreshment, better mixture
Due to a two times higher radial than linear velocity, caused by the spiral-shaped mixer elements, the refreshment rate of the product at the inner wall of the process tube is increased and as a result the heat exchange has improved considerably. Additionally the increased radial velocity results in a fine mixture of a relatively cold and a relatively warm product:

Option:
- Detachable;
- Sharpened edges;
- Polished.

20 – 100% more transfer of heat
The applied advanced connection technology between process tube and mixer elements results in a heat exchange transfer rate equal to the base material of process tube and mixer element. Due to this property, the surface of each mixer element will act as additional heat transfer area, which results, compared to conventional heat exchangers, in a 20 to 100% better heat transfer.

The PRIMIXER, high operational reliability and wide applicability

Both in the chemical industry and the food industry, heating and cooling of liquids in a continuously operated process is a common unit operation.

The following types of stationary heat exchangers can be distinguished:

- Plate heat exchanger;
- Tube heat exchanger;
- Spiral wound tube heat exchanger;
- Static mixer heat exchanger.

The usability of each type of heat exchanger roughly depends on the applied working pressure, process temperature and the under these conditions ruling viscosity of the process liquid. The desired capacity is reached by choosing a specific construction magnitude or by applying a number of heat exchangers in a parallel set-up.

The above-mentioned types of heat exchangers are put in sequence of increased usability. The heat exchanger with static mixer elements has the widest usability. However, the high reliability of the plate heat exchanger causes other – underlying – types to be less competitive.

In applications dealing with elevated temperature treatment of viscous media and processes where for example starch molecules are opened, systems with an extended applicability are required.

The plate heat exchanger limitation mainly depends on the maximum allowable process pressure, which for this type is 6 bar. In cooling and heating processes however, these working pressures are reached easily.

The ultimate applicability of the tube heat exchanger is generally reached during cooling of viscous process media, where as result of product fouling tunnel effects occur which result in heat isolating layers of product blocking exchange of heat dramatically. Furthermore, the isolating layer of product remainder can have a negative influence on the quality of the end product.

Problems in this application area of the spiral wound heat exchanger are similar to the tube heat exchanger.

Compared to the above described heat exchangers, the static mixer heat exchanger's enormous advantage is the reduction of temperature differences over the cross sectional area of the process tube, resulting in absence of isolating product layers and a broad usability for heat exchange applications with high viscous process media.

Pumping problems can occur as a result of the relatively high total process drop over the heat exchanger.

End product

To solve this problem, Primix has designed a system where a number of process tubes are placed in a parallel formation, resulting in low-pressure drop at equal heat exchange capacity. Special manifolds take care of smooth product flow patterns, without any dead spots.

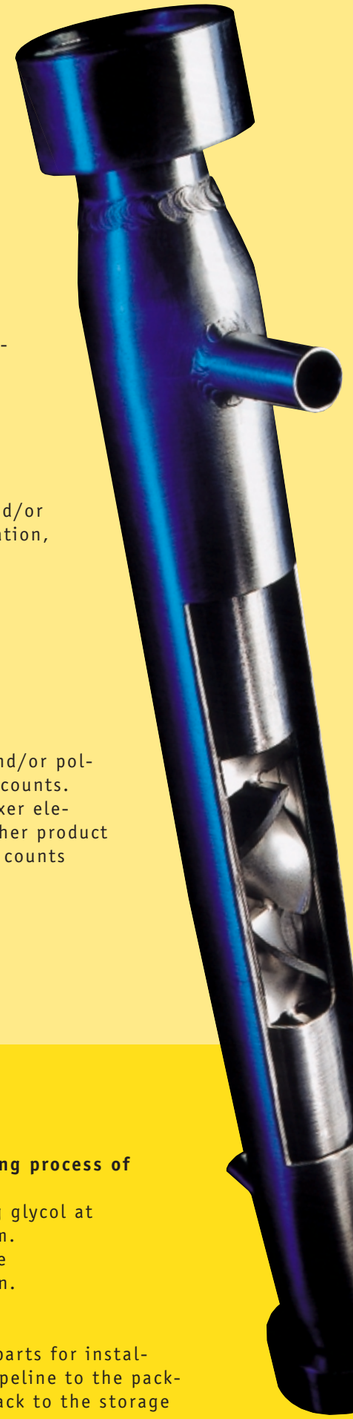
In many cases it is preferable to design the static mixer heat exchanger as a single tube design. However, we have learned from experience that the performance of a parallel system improves with product viscosities more than 400 Pa.s and capacities higher than 1,000 kg/hr.

The static alternative has proved to be a perfect heat exchanger in cases where other types fail. Furthermore, it can be applied as a low cost alternative in areas where in the past only scraped heat exchangers performed relatively well.

The high operational reliability of the Primix static mixers and heat exchangers has proved its use in the past in a number of crucial applications in the chemical, petrochemical, pharmaceutical and food industry. Several explosive and toxic process media are temperature-treated or mixed in this way.

The people of Primix would like to call forth all their skills for solving your mixing, cooling and heating problems.

Besides single components, Primix also offers complete solutions for your mixing and/or heating problems. Complete systems, including charge pumps, control loops, automation, et cetera will be designed, constructed by us and installed at the customer's.



Food articles

A cleaner result
Within the food and pharmaceutical industry, aspects like C.I.P. cleaning, smooth and/or polished surfaces and sanitary connections are of major importance to reach low germ counts. Day to day practice has shown that compared to an empty pipe, the use of static mixer elements leads to considerable better cleaning results. The forced refreshment and higher product velocities at the inner wall of the process tube is causing this positive result. Germ counts after cleaning are irrational.

Chocolate spread

Applications

Cooling of chocolate spread (identical to the cooling process of peanut butter and hazelnut spread)
Product temperature decreases from 50 to 30°C using glycol at approximately 5°C. Effective for culverts up to 80 mm. Laboratory scale tests with a culvert of 15 mm can be scaled easily. 100 l/hr results in a 5 m^3/hr production.

Rework of margarine
All over the Benelux countries, Primix has installed parts for installations to rework margarine. As part of the supply pipeline to the packing installation, a small quantity of product is fed back to the storage tank. In this way, the installation is stand-by in all cases.

Test plant

In case of a sudden drop out of the down stream packing installation, the full flow of margarine (6°C) is fed to the rework installation, heated up to molten phase and fed back to the up stream storage tank. Systems working on hot water or steam operate to full customer satisfaction.

Pasteurization and cooling of sauces
Oil, water and starch, either mixed or separated, are brought at the desired pasteurization temperature using a steam jacket. The temperature hold phase can be brought back to one third of the time required in conventional processes. This is caused by the intensive mixing effects generated by the static mixer elements. Each part of the liquid flow will receive the pasteurization treatment in time. Cooling down to packing temperature takes place using cold water. The system is closed to the atmosphere, easy to sterilize and C.I.P. clean.

Pasteurization of slaughterhouse waste
Strained liquid slaughterhouse waste, a valuable by-product because of its high content of protein, fat and minerals, is temperature treated after separating the larger particles. It is continuously operated and an automatic C.I.P. cleaning step is part of the process. Developments to reach sterilization temperatures during this process are already taking place.

Pasteurization of concentrated fruit
The product is heated-up quickly, using steam of low temperature, descended from a steam cooler developed by Primix. The hold section is relative small as a result of the good mixing efficiency of the static mixer elements. Cooling to room temperature takes place before aseptic product packing.

Polymer chemistry

Within this application area, where high viscosities, process pressures and temperatures are typical, a number of negatively heat transfer influencing aspects are of major importance:

- Thick process pipe walls are required to gain sufficient strength, due to the high process pressures.
- Low heat transfer coefficients of the polymer.
- Laminar flow in all cases as a result of high product viscosities.
- Small acceptable mean temperature differences, as result of the strong dependence of viscosity on temperature.

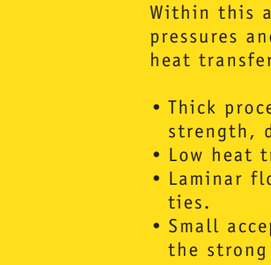
During the development stage of the static mixer heat exchanger, Primix has paid special attention to the practised technology for the connection between process tube and static mixer element. The high vacuum braze connection is not an amorphous layer of material, but forms as a result of the applied braze material together with the mother material one piece of identical material. The heat transfer resistance of the connection material is equal to that of process pipe and mixer element. The mechanical strength is about 70% of the mother material. This connection method's big advantage is that the surface of each mixer element will be acting as additional heat transfer area, which results, as compared to conventional heat exchangers, in a smaller design at equal heat exchange capacity. None high vacuum brazed heat exchangers show about three times higher Nusselt numbers. Brazed elements improve the capabilities by a factor 10.

Besides improved heat transfer, a small spread of residence time is of major importance. During the cooling process, the polymer flow reacts as well and polymer flowing through the system at a longer residence time than foreseen can harm the quality of the end product. To solve this problem, Primix has chosen to design unique manifolds that take care for a perfect spread of product over the parallel process tubes, while dead spots are completely eliminated. The product side's inner walls are finished at a roughness better than 0,5 micron.

Cooling is realized by a counter current flow of thermal oil, flowing around the polymer containing process tubes. Flow reversing partition plates realize an optimal contact between oil and process tube.

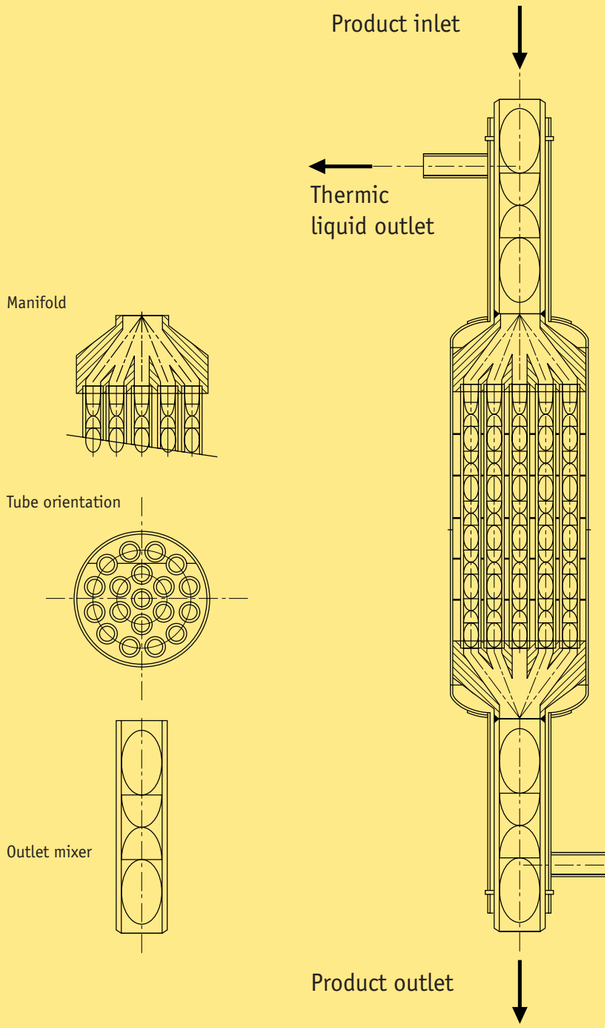
The above-described design has resulted in a heat exchanger that - due to its relative small measurements - can be applied economically for cooling of high viscous products. It has almost ideal plug-flow characteristics. At this moment, the design is recognized as standard in the polymer industry.

Design and construction can take place under all possible design codes, including acceptance by a notified body and final inspection. Common codes are ASME, AD-Merkblätter, Stoomwezen and SQLC P.R.C.; et cetera.



Yarn

Paint



Typical figures of an application:
Cooling polymer at 13,750 kg/hr from 295°C to 288°C using 270°C cooling oil

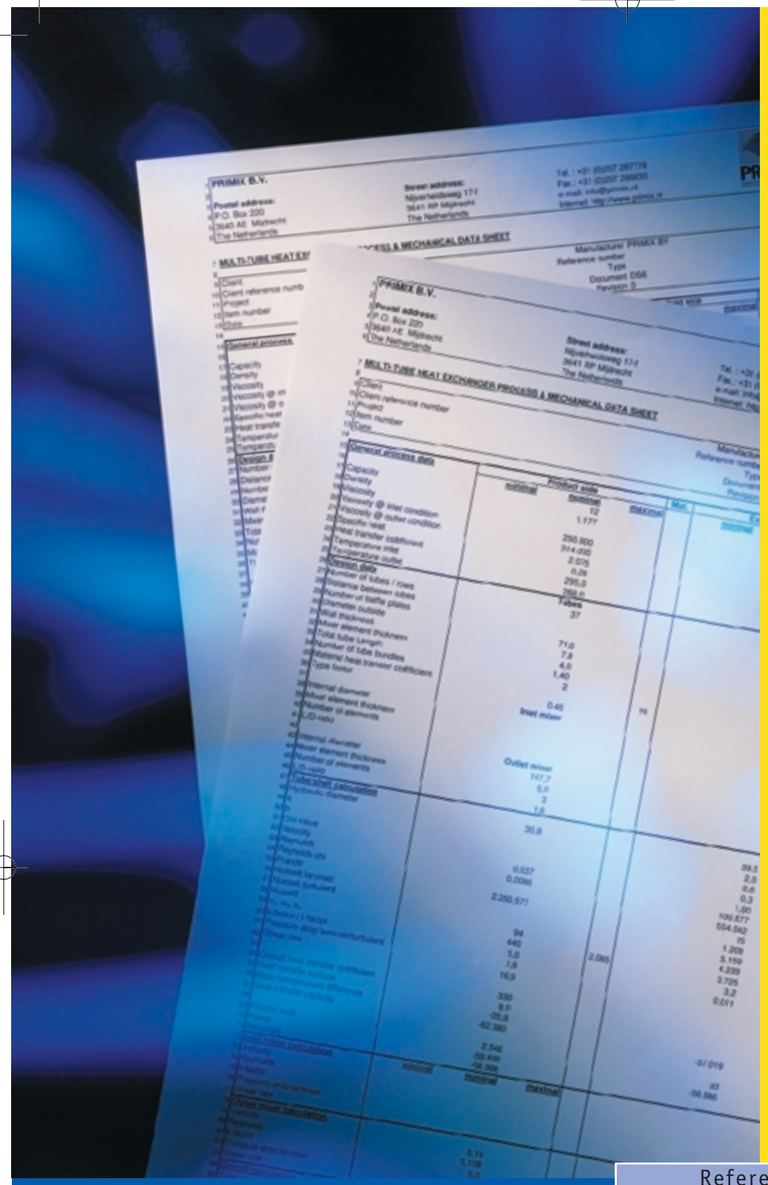
Viscosity	: 315 Pa.s
Pressure drop	: 16.5 bar
Heat exchange surface	: 9 m^2
Residence time	: 61 sec
Capacity	: 57 kW
37 process tubes ∅	: 55 mm
Total weight	: 1,750 kg

Polymer heat exchanger

Chemical industry

Within this application area, figures of major importance are pressure drop, residence time, plug-flow, corrosion and heat transfer. Primix uses a special calculation program, partly based on empirical data, in which all of these parameters are variables. The above mentioned figures can be set independently. Our quotation comes with a set of data sheets in which all data is conveniently arranged. In this way, the customer is optimal informed of all possible options for his new process.

In some cases, our calculation and quotation show in-line heat exchangers of considerable lengths. It can be worthwhile in such case, especially with high alloy metals, to use part of the surrounding process pipe network as part of the heat exchanger.



Address:
Nijverheidsweg 17-f
3641 RP Mijdrecht
The Netherlands

Postal address:
P.O. Box 220
3640 AE Mijdrecht
The Netherlands

Telephone: +31 (0)297 287778
Fax: +31 (0)297 286030
e-mail: info@primix.nl
www.primix.nl

References

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Shell BP Exxon
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