



Preventive Maintenance Guidelines

Plate Heat Exchangers in Ammonia Refrigeration Systems



Plan your maintenance budget and your downtime

Plate Heat Exchanger – PHE

The Plate Heat Exchanger transfers heat (energy) between two medias without intermixing. The medias can either be in liquid or gaseous form. The main applications in ammonia refrigeration system are evaporators and condensers. The Plate Heat Exchanger consists of a pack of thin corrugated metal plates with portholes for the passage of the two fluids between which the heat transfer takes place. The plates are fitted with a rubber gasket, which seals the channel and directs the fluids into alternate channels.

Gaskets

The gaskets are sealing off and controlling the flow direction of the medias in the PHE. Gaskets are made of rubber material such as Nitrile (NBR), EPDM and Chloroprene (CR). All rubber materials have a natural ageing process. How long the lifetime of a gasket is depends on different factors – material of gasket, media exposure, temperature, pressure, on/off operation, opening frequency – to mention some. At some point the gasket will not be able to seal off the media due to low sealing force – and an external leakage will occur.

Gasket change – preventive maintenance

A sudden leakage of ammonia will disturb the operation and can be a personnel safety risk. Alfa Laval has made recommendations on preventive maintenance schedules for PHE used in ammonia refrigeration applications. Preventive maintenance means that you will change the gaskets before you have an increased risk of leakage – thereby you can secure the uptime and a safe operation of your system.

	Evaporators	Condensers
Ring Gasket Quality – NH₃ side		
CR before year 2000	5	5
New CR from year 2001	6	6 at 80°C / 5 at 100°C
LTNBR	5	n.a
HNBR	n.a	5
EPDM	6	6
Field Gasket Quality – Coolant side		
EPDM, NBR, LTNBR	10-12	10-12

Advised Service Interval (Years).

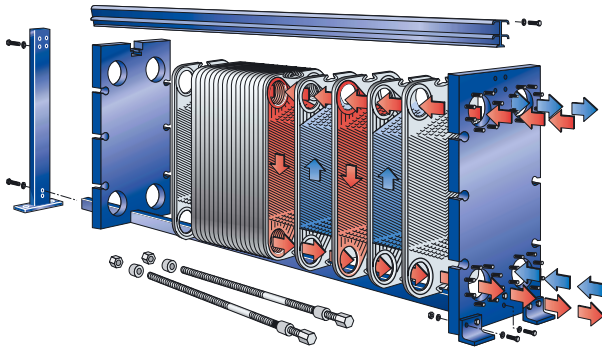


Plate Heat Exchanger construction.



Clip-On Glue Free Gaskets.



CIP Unit.

Fouling and Cleaning

Depending on the nature of the transfer fluids and the application, the Plate Heat Exchanger performance may decline over a period of time due to fouling.

This deterioration in performance is typically due to the build-up of scale, sediment and/or biological debris on the plates. In ammonia applications the main risk for fouling is on the coolant side, especially if it has open systems like cooling towers, river water etc. Closed loop coolant system has less risk of fouling.

There are two general methods to removing fouling:

- Mechanical and/or chemical cleaning by dismantling the PHE
- Cleaning in Place (CIP) by circulation of CIP fluid without dismantling the PHE

Fouling will deteriorate the thermal performance of the PHE. The evaporation temperature will decrease and the condensation temperature will increase from start up conditions.

1°C in higher temperature difference (ΔT) between evaporation/condensation and coolant will increase the required energy input to the compressor by approximately 3%.

Example: By cleaning a fouled PHE and reducing the ΔT by 1°C, the energy savings will be 45,000 kWh/year with a 300 kW compressor motor running 5.000 hours/year. With a cost per kWh of 0.1 Euro the annual savings will be 4.500 Euro.

Preventive maintenance schedule

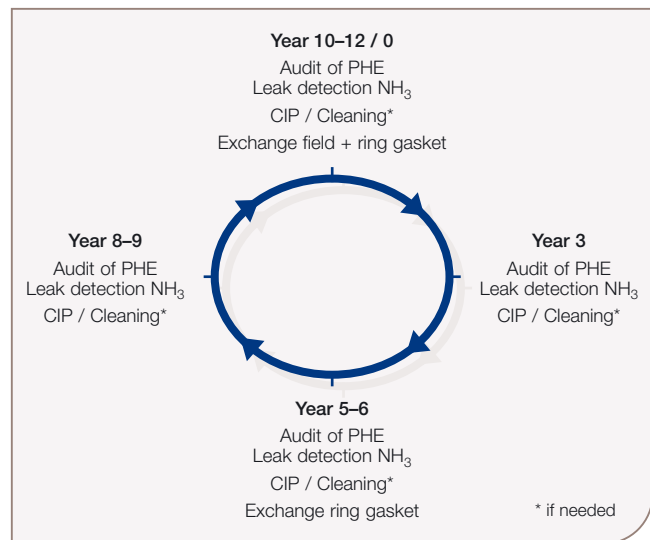
On a yearly basis a check-up on performance, leakage, ammonia permeation etc. can be done on the PHE's. A 10–12 year rolling service schedule is shown below to secure maximum uptime and availability on your refrigeration system.

Year 3; Audit of PHE, Cleaning if needed.

Year 5–6; Audit of PHE, Cleaning if needed, Exchange Ring Gasket.

Year 8–9; Audit of PHE, Cleaning if needed.

Year 10–12; Audit of PHE, Cleaning if needed, Exchange Ring Gasket + Field Gasket.



How to contact Alfa Laval

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