Brian A. Flynn Limited.

Refrigeration

Plate Heat Exchangers

Preventative Maintenance & Service Guidelines

NEWCASTLEWEST, CO. LIMERICK, IRELAND
TEL: +353 69 62044
FAX: +353 69 62452
baflynn@baf.ie
www.baf.ie

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Press Release

Brian A. Flynn and Alfa Laval join forces

In order to improve its service to its Irish refrigeration customers, Alfa Laval Limited has teamed up with Brian A. Flynn Ltd, the leading specialist Industrial Refrigeration and HVAC contracting company in Ireland.

The two companies have recently signed an agreement, under the terms of which Brian A. Flynn Ltd, as an official Alfa Laval Service Partner, will be responsible for the service, maintenance, re-gasketting, re-conditioning and CIP cleaning of Alfa Laval Plate Heat Exchangers installed on refrigeration plants either as stand-alone units or as part of complete skid-mounted assemblies.

Alfa Laval is the world's largest manufacturer of compact heat exchangers and is the supplier of choice to many of the world's leading refrigeration equipment manufacturers. With more than twenty field service engineers, Brian A. Flynn Ltd is, comfortably, Ireland's leading refrigeration service provider in key industrial sectors including food, beverage and the pharmachem industries.

Commenting on the tie-up, Brian Flynn, founder and M.D. of Brian A. Flynn Ltd said "The synergies between our two companies make this a potentially very exciting partnership since we are both dedicated to quality and to providing the best-possible customer service, and we are both leaders in our respective fields. The Alfa Laval Plate Heat Exchanger range also fits in perfectly with our existing product portfolio. In line with our comprehensive training policy, selected service engineers have already completed intensive product training at Alfa Laval's heat exchanger Training Centre in Lund, Sweden.''

Brian A. Flynn Ltd.
PLATE HEAT EXCHANGER
PREVENTIVIVE MAINTENANCE AND SERVICE BINDER

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 an 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. The plate pack is assembled between the pressure retaining frame and pressure plate and compressed by tightening bolts. The pates and the pressure plate are suspended form an upper carrying bar and kept in position by a lower guiding bar, both of which are fixed to the support column.

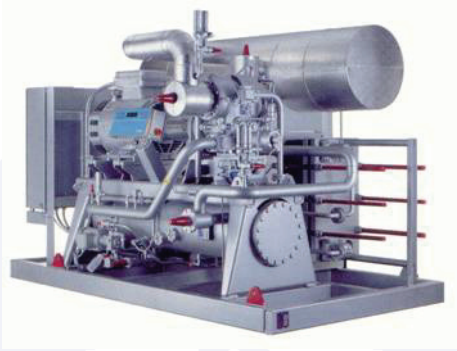


Fig.1 PAC Chiller with Plate Heat exchangers

In ammonia applications the semi-welded construction of plates is used. Two plates are laser welded together forming a cassettes. The cassettes are sealed with field gaskets for coolant flow and ring gaskets for the ammonia flow. The ammonia flows in the welded channels and the ring gaskets control the ammonia flow between the welded channels. Clip-on gaskets are used for easy exchange.

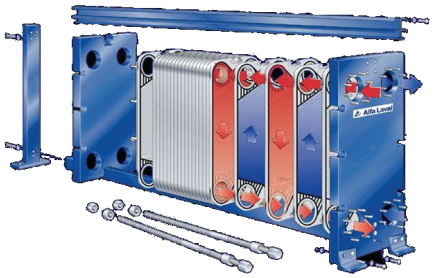


Fig.2 Plate Heat Exchanger Construction

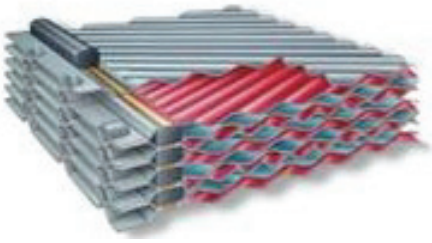


Fig.3 Cross section Semi welded plates

Fig.4 Clip-On Gaskets

SERVCIE GUIDELINES PLATE HEAT EXCHANGERS.
The main service and maintenance on the Plate Heat Exchanger is related to changing the sealing gaskets due to ageing and cleaning of the plates due to fouling.

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

PREVENTIVE MAINTENANCE – GASKET CHANGE.
To avoid disturbance in operation by sudden leakage – Alfa Laval has made recommendations on preventative maintenance schedules for Plate Heat Exchangers used in ammonia refrigeration applications. Preventative maintenance means that you will change the gaskets before you have an increased risk of leakage – thereby you can secure the uptime and the safety on your system. See Recommended Service Interval.

CLEANING OF A PLATE HEAT EXCHANGER.
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. Fouling of a PHE manifests itself as a decrease in thermal performance, an increase in pressure drip across the PHE and/or a reduction in flow.

In ammonia applications the main risk of fouling is on the coolant side, especially if it is in an open system such as cooling tower, river water etc. A closed loop coolant system has less risk of fouling.
There are two general methods of cleaning a PHE.

- Mechanical and/or Chemical cleaning by dismantling the PHE.
- Cleaning-In-Place (CIP) by circulation of CIP agent without dismantling of the PHE.

MECHANICAL CLEANING.
Mechanical and/or chemical cleaning can be performed either on site under guidance of qualified service personnel or off site in an qualified PHE Service Centre. For both procedures the PHE needs to be dismantled, plates are removed from the frame and cleaned remotely from the PHE.

CIP - CLEANING IN PLACE.
CIP is an effective way of cleaning your Plate Heat Exchanger (PHE) without opening it. CIP removes most fouling deposits from the plates by circulating a suitable cleaning agent through the plate heat exchanger without damaging the plates or gaskets. CIP is cost-effective and environmentally friendly. An average size plate heat exchanger can often be cleaned in hours, which causes the minimum of disruption to your operation. CIP requires specific connections to be placed adjacent to the PHE to be able to run a cleaning sequence.

Fig.5 CIP 2200LT

Fig.6 CIP 40

WHY CLEAN THE PHE?
After some years of operation, fouling can occur on the heat transfer surface of the PHE thereby lowering the heat transfer efficiency and increasing the pressure drop.
There are different kinds of fouling, for example: scaling, biological growth, debris etc – and all of them influence the efficiency of the PHE.

ENERGY SAVINGS.
A lower efficiency and higher pressure drop on the PHE will result in higher energy consumption on both compressor and brine pumps. By cleaning a fouled PHE the pressure drop can decrease and the efficiency can be increased.

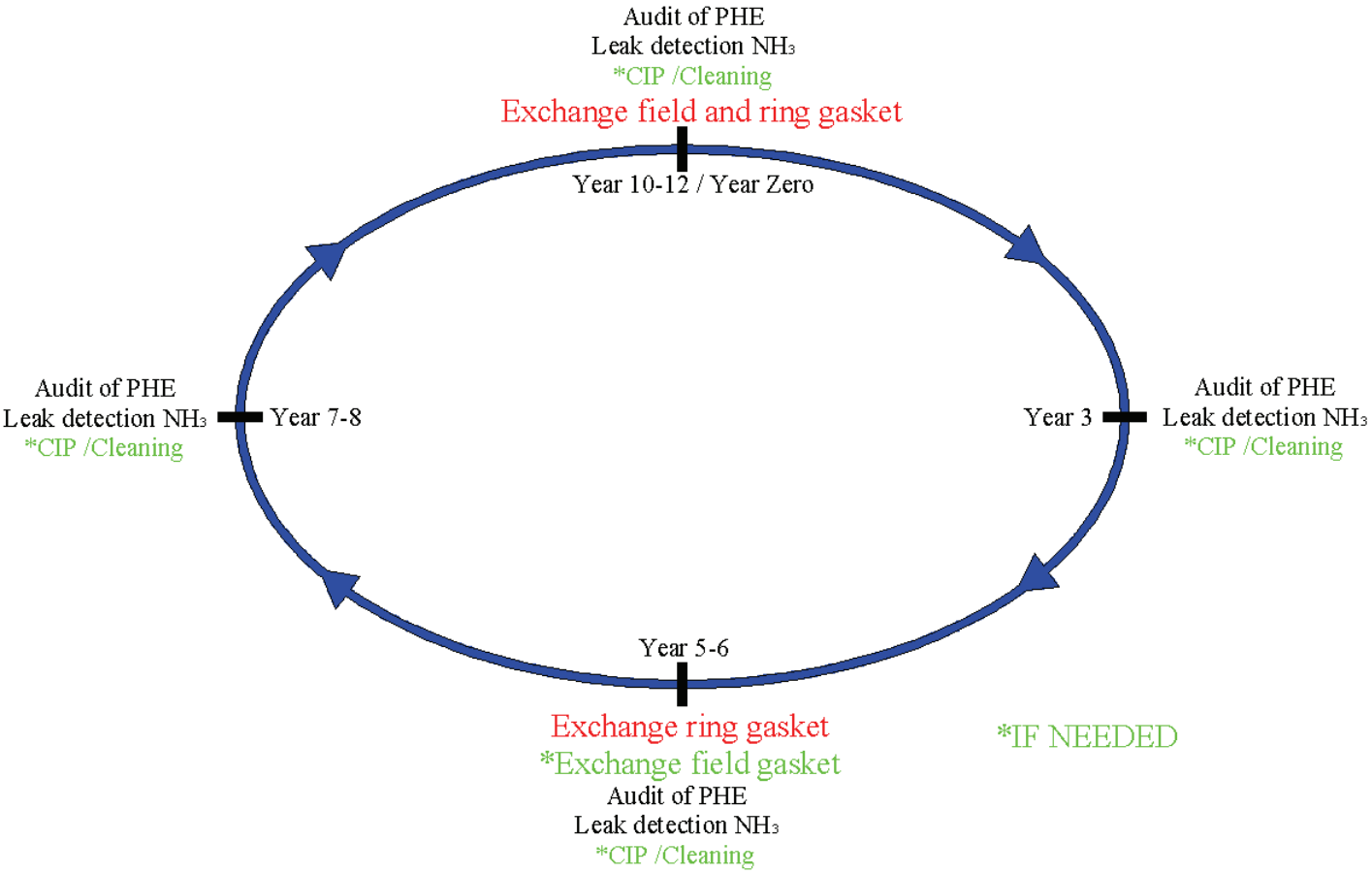
Increased efficiency – can result in higher evaporator or lower condensing temperature. This will reduce the energy consumption on the compressor.
Reduced pressure drop – lower energy consumption for the brine/circulating pumps.

OTHER PHE MAINTENANCE AND SERVICE NEEDS.
A PHE is a static piece of equipment that cannot create pressure surges, temperature changes, plugging of solids or scale. If properly designed for the duty and operated within original design parameters, it will provide many years of trouble free operation. However, if abused and operated outside of the design parameters failures can occur.
If a problem occurs, it is important that the source of the problem is identified and eliminated as quickly as possible. This will minimise the impact of the problem and prevent it from growing into a larger problem.
In additional to the operating procedure outlined above, simple preventive maintenance, such as periodic external visual inspections, gasket change, performance monitoring and an appropriate cleaning program can further extend the operation life of the PHE. Please see "Preventive maintenance schedule".
Except for gasket change and cleaning (see above) a PHE in an ammonia application has a low preventative maintenance requirement, if properly handled by the operator.

FRAME PARTS.
Parts are replaceable, but will in general last the life-time of the PHE (20-40 years).

PLATES.
Plates are replaceable, but will with proper handling and operation within design parameter last the life-time of the PHE (20-40 years).

PREVENTITIVE MAINTENANCE SCHEDULE
Semi Welded Plate Heat Exchanger
Ammonia Refrigeration applications



SAVING ENERGY IN YOUR REFRIGERATION SYSTEM.

FOULING.

Depending on the nature of the transfer fluids and the application, Plate Heat Exchanger performance may decline over a period of time. This deterioration in performance is typically due to the build-up of scale, sediment and/or biological mass on the plates. This is called fouling and occurs with all types of heat exchangers and fluid handling equipment. Fouling will decrease thermal performance and increase the pressure and/or decrease flow-rate.

Fig.7 Fouled PHE

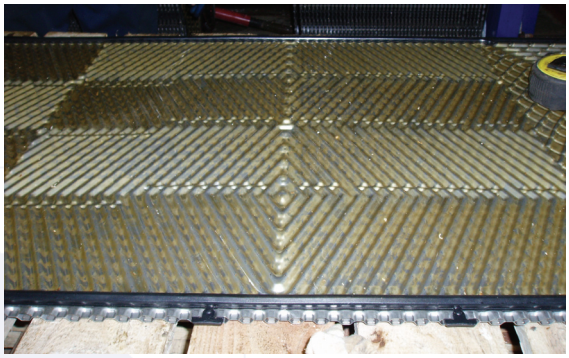


Fig.8 Cleaned Plate

In ammonia applications the main risk for fouling is on the coolant side, if it is in an open system such as cooling tower, river water etc. A closed loop coolant system has less risk of fouling.

REMOVING FOULING – CLEANING.
Two methods are currently available for removing fouling on Plate Heat Exchangers.
For more detailed information, please contact local service partner or Alfa Laval office.

- Removing plates for mechanical and/or chemical cleaning.
- Cleaning in pace without dismantling the Plate Heat Exchanger.

Generally, Cleaning in Place is preferred due to a longer operating life of the gaskets when the Plate Heat Exchanger is not opened frequently. For example opening a semi welded PHE after 2-3 years of operation can require that change of ring gaskets.

ENERGY SAVINGS.
If a Plate Heat Exchanger is fouled, the thermal performance will decline. In a refrigeration system this will affect the evaporation and condensation temperatures. The evaporation temperature will be lower and the condensation temperature will be higher than original design temperatures.

Typically, if the evaporation temperature decreases by 1°C, the energy consumption of the compressor will increase by 3%. The same is applicable for the condenser side, a 1°C change will increase the energy consumption by approximately 3%.

TABLE.
The table below shows typical annual saving in € for different compressor effects and different ΔT changes from the original design temperatures if you revert to the original temperatures by cleaning the PHE.

The calculations are based on:
Annual running hours: 5000 hrs
Energy Savings per ΔT (°C) 3%
Cost per kWh € 0.1

ΔT change (°C) from original design temperatures.

Compressor effect (kW)	0.5 ºC	1.0 ºC	1.5 ºC	2.0 ºC
100 kW	€ 750	€ 1500	€ 2250	€ 3000
150 kW	€ 1125	€ 2250	€ 3375	€ 4500
200 kW	€ 1500	€ 3000	€ 4500	€ 6000
250 kW	€ 1875	€ 3750	€ 5625	€ 7500
300 kW	€ 2250	€ 4500	€ 6750	€ 9000

EXAMPLE:
A system with a 200kW compressor effect, that is running on a 1°C higher ΔT than the original design temperatures will save €3000 annually if you will come back to the original temperatures by cleaning the PHE.

For a specific plant you can make a calculation:

Compressor effect (€) kW Savings % ΔT change Running Hours/Year € / kWh Savings Yearly

_____ X ___3___ X _____X _____ X _____ = _____

Standard ΔT design.
The ΔT, i.e., the difference between evaporation/condensation temperature and the coolant outlet temperature varies for different chiller systems and applications. The exact design ΔT on a chiller should be stated in the instruction manual from the manufacturer. Generally a chiller equipped with a PHE will have a lower ΔT than with other types of heat exchanger.

	Standard ΔT, Chiller with PHE
Evaporation temp	3-4 °C
Coolant outlet temp.	
Condensation temp.	3-4 °C
Coolant outlet temp.	

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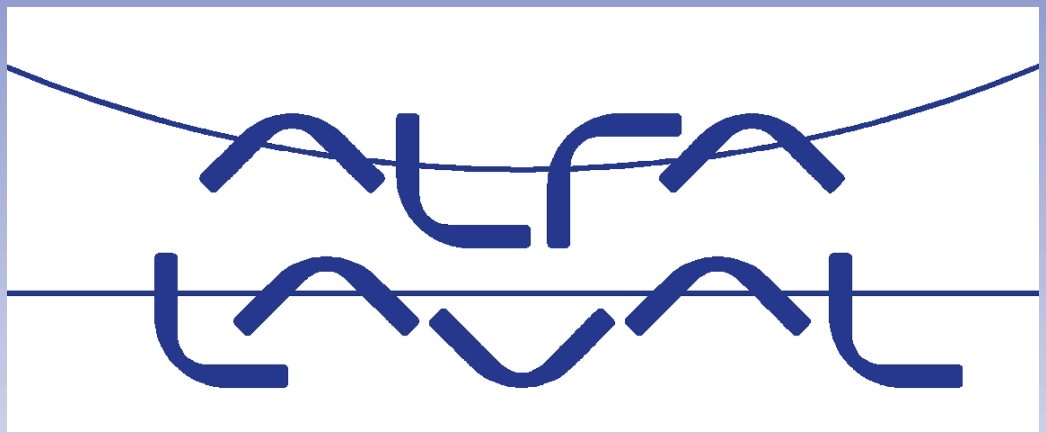

Authorised Service Representative

BRIAN A. FLYNN LTD.
NEWCASTLEWEST, CO. LIMERICK, IRELAND
TEL: +353 69 62044 FAX: +353 69 62452
baflynn@baf.ie www.baf.ie