# AlfaNova – the first fusion-bonded plate heat exchanger

**A product brochure for AlfaNova within Industrial Refrigeration**

# AlfaNova

**A new concept for plate heat exchangers**

Out of the extreme heat in our furnaces comes AlfaNova, the first 100 percent stainless steel plate heat exchanger. Applications with temperature and pressure fatigue conditions that would destroy a conventional brazed heat exchanger are no match for the rugged AlfaNova.

The secret is AlfaFusion, a unique bonding technology patented by Alfa Laval. Resulting in the world's first fusion bonded plate heat exchanger, AlfaFusion has stunned specialists in the brazing field. Extensive laboratory tests have shown, that AlfaFusion is very close to welding.

The compact, high-performance AlfaNova offers levels of hygiene and corrosion resistance unmatched by any other brazed heat exchanger on the market. It also has the muscle to replace traditional high-capacity heat exchangers in a wide range of applications.

AlfaNova is a new concept for plate heat exchangers, available only from Alfa Laval.

# Simply superior!

**The high-performance AlfaNova is based on a new bonding technology called AlfaFusion, patented by Alfa Laval. The process is so innovative, that it has taken even brazing specialists by surprise. The AlfaNova fusion-bonded plate heat exchanger actually has the mechanical strength of a welded PHE!**

AlfaFusion technology is based on Transient Liquid Phase (TLP) bonding, a method to join components in plate heat exchangers. The principle is, that stainless steel pieces are in contact with each other and – close to the melting point – bond together. The material in the joints therefore consists of material from the original pieces. Therefore, AlfaNova heat exchangers are made out of 100 percent stainless steel.

### Arduous testing

To guarantee safety, reliability and durability, we subjected AlfaNova to arduous testing, both in our own labs and externally.

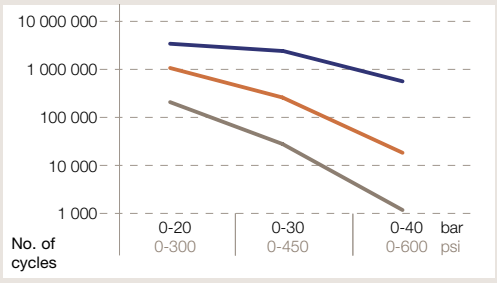
Inspecta has validated the production process. Grain growth in the material following heat treatment was investigated, and a micro-structure analysis was undertaken. A number of certification bodies conducted burst testing, confirming a burst pressure several times higher than the design pressure.

At Alfa Laval we conducted extensive tests in our own laboratories. These included tests for pressure fatigue, thermal fatigue, heat transfer performance, and corrosion resistance.

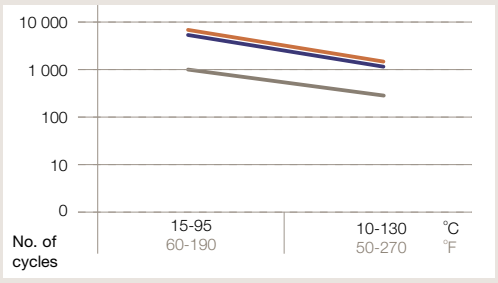
AlfaNova was tested in three different temperature and flow programmes and long-term testing has been carried out in various corrosive environments. We can now confirm that AlfaFusion is the technology of the future for plate heat exchangers. AlfaNova is the first fusion-bonded PHE. Fusion-bonding offers a new concept for plate heat exchangers, available only from Alfa Laval.

AlfaNova is a fruit of innovative technology, brought forth by intense research.

### Pressure fatigue




### Thermal fatigue




Different types of plate heat exchangers were tested to compare pressure fatigue resistance and thermal fatigue resistance.

Legend
- AlfaNova
- Copper brazed
- Nickel brazed

# Ingenious function – superior cost-efficiency

Out of the AlfaFusion technology we have created a new heat exchanger platform – AlfaNova. The AlfaNova heat exchangers are developed mainly for $NH_3$ applications and all the demands connected to them. We have put in all the experience from more than 25 years of heat exchanger deliveries to the Industrial Refrigeration $NH_3$ market. AlfaNova's can be used in all types of applications when $NH_3$ is used as refrigerant or when hygienic demands are crucial.

**Applications**
The AlfaNova offers a gasket-free solution for heat exchangers in refrigeration circuits with both flooded flow and dry expansion systems. As the AlfaNova is made of 100 percent stainless steel, it is highly corrosion resistant. It is hermetic, hygienic and safe. The AlfaFusion technology gives high mechanical strength and a long working life. The well-known Alfa Laval plate pattern means high heat transfer performance in relation to surface.

Typical duties are evaporators, condensers, desuperheaters, oil coolers and economizers. Low need of charging means that AlfaNova is superb for both residential and industrial air conditioning and for $NH_3$ refrigeration plants.

**Advantages**
By using the corrugated plate heat exchanger concept, a high turbulent flow is created with low fouling tendencies. Thus AlfaNova is very efficient regarding heat transfer. AlfaNova has a very compact design as it is without a frame up to a design pressure at 30 bar. The hold-up volume is reduced and it requires very little maintenance.

In comparison with the competing heat exchanger technologies, AlfaNova offers several advantages:

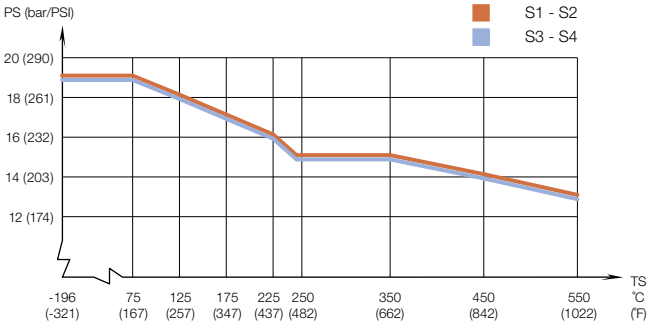
- an extreme compact design cuts the installation costs as less space is needed
- high corrosion resistance
- the heat transfer efficiency gives high COP values
- reduced maintenance
- low refrigerant volume
- absolutely gasket-free
- High temperature resistance

**Plate and connection arrangements**
AlfaNova can be deigned with a several number of plates in single or multi pass. Many types of connection interfaces make it easy to find the right solution for every demand. The connection can be on the S side or on the T side.

**Material**
The AlfaNova's consists of thin corrugated stainless steel plates which are fusion joined together in a vacuum furnace. The material in the plates is AISI 316.

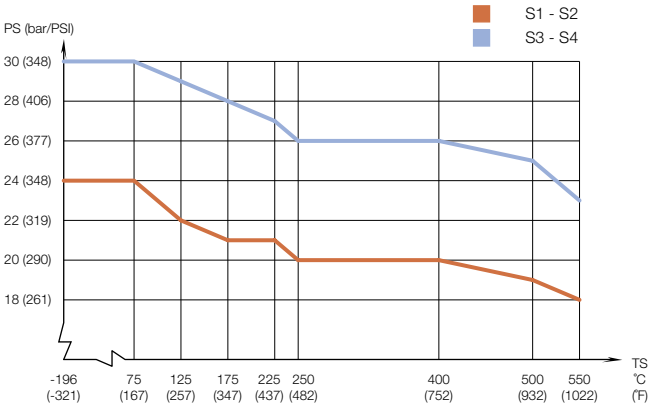
**Characteristics**
The plates have different patterns of corrugation for all kinds of flow and temperature approaches. For AlfaNova 400 you can reach an extremely low approach.

### AlfaNova 400 – PED approval pressure/temperature graph*



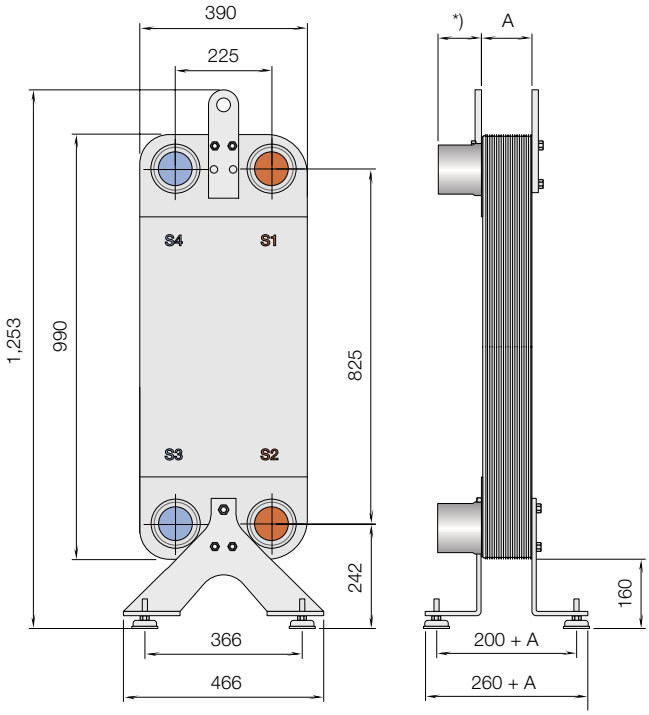

Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

### AlfaNova HP 400 – PED approval pressure/temperature graph*

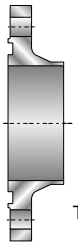



Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

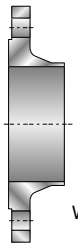
* For exact values please contact your local Alfa Laval representative.




*) Depending on type of connection.



Tounge & Groove flange

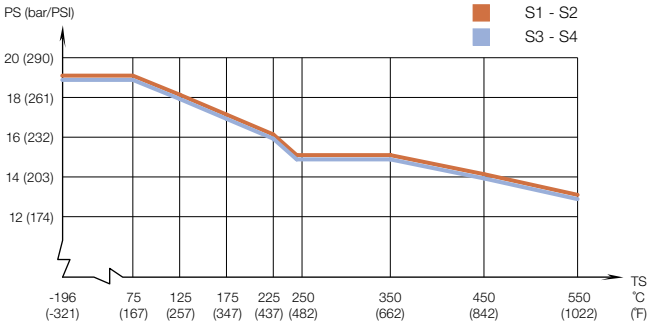


Water flange

Tube for welding

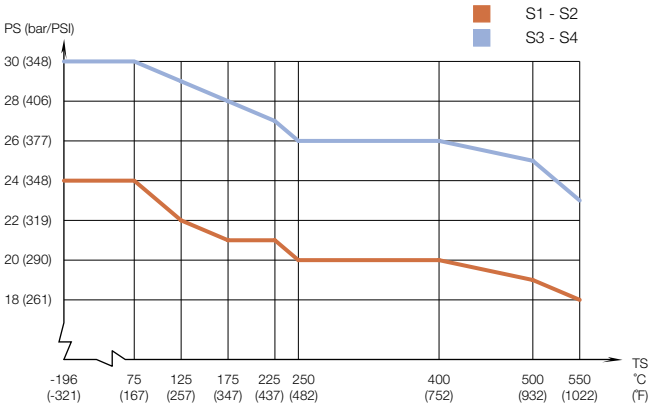
| Number of M plates | | | 30 | 60 | 90 | 150 | 190 | 230 |
|---|---|---|---|---|---|---|---|---|
| **Input data** | Qn | kW | 155 | 320 | 480 | 760 | 900 | 1,060 |
| | m water | kg/h | 26,540 | 54,800 | 82,200 | 130,200 | 154,100 | 181,500 |
| Water<br>Inlet: Ti = 12°C<br>Outlet: To = 7°C | ΔP water | kPa | 71 | 76 | 77 | 74 | 68 | 69 |
| | ΔP Ammonia | kPa | 8 | 8 | 8 | 8 | 8 | 8 |
| Refrigerant = $NH_3$<br>Te = 4°C | LC | mm | 80 | 159 | 238 | 397 | 503 | 609 |
| | $V_{H_2O}$ | $dm^3$ | 11.1 | 22.2 | 33.3 | 55.2 | 70.3 | 85.1 |
| | $V_{NH_3}$ | $dm^3$ | 10.4 | 21.5 | 32.5 | 54.8 | 69.6 | 84.4 |
| | Net weight | kg | 84 | 126 | 168 | 252 | 308 | 364 |
| | Operating weight | kg | 96 | 150 | 203 | 311 | 383 | 454 |
| | Heating surface | $m^2$ | 8.4 | 17.3 | 26.3 | 44.3 | 56.2 | 68.2 |

### AlfaNova 400 – PED approval pressure/temperature graph*



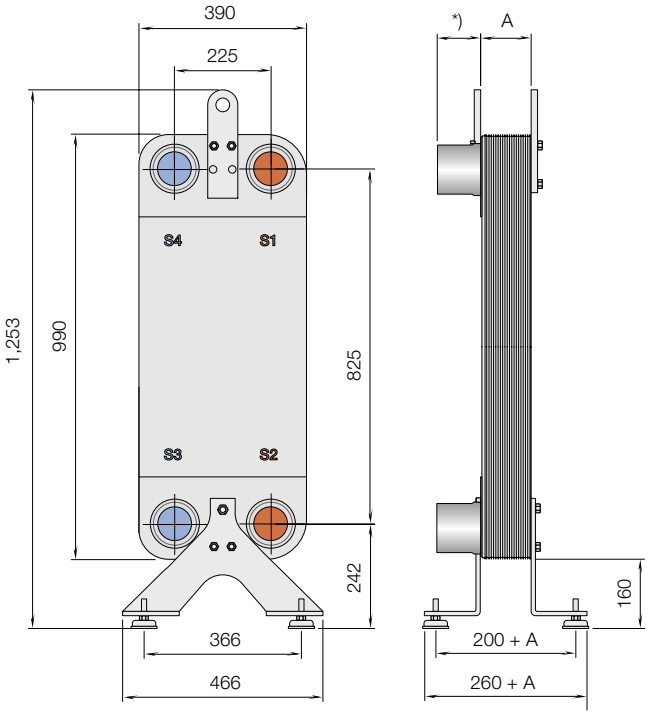

Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

### AlfaNova HP 400 – PED approval pressure/temperature graph*

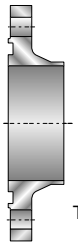



Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

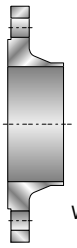
* For exact values please contact your local Alfa Laval representative.




*) Depending on type of connection.



Tounge & Groove flange

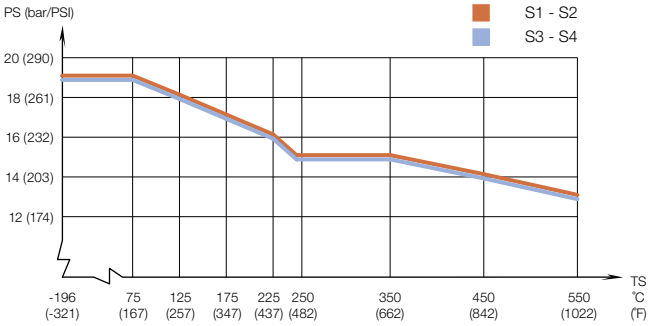


Water flange

Tube for welding

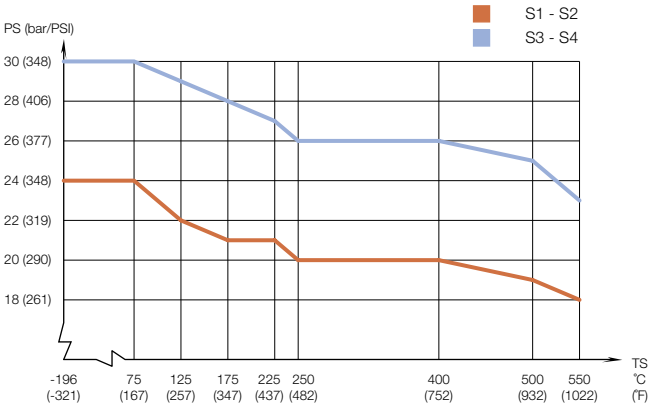
| Number of H plates | | | 30 | 60 | 90 | 150 | 190 | 230 |
|---|---|---|---|---|---|---|---|---|
| **Input data** | Qn | kW | 115 | 240 | 360 | 590 | 740 | 885 |
| Water<br>Inlet: Ti = 12°C<br>Outlet: To = 7°C | m water | kg/h | 19,690 | 41,100 | 61,650 | 101,000 | 126,700 | 151,600 |
| | ΔP water | kPa | 92 | 100 | 100 | 100 | 100 | 100 |
| | ΔP Ammonia | kPa | 11.3 | 11.4 | 11.3 | 11.2 | 11.2 | 11.3 |
| Refrigerant = $NH_3$<br>Te = 3°C<br>Superheat = 8°C<br>Tsubc = 5°C<br>Tcond = 40°C | LC | mm | 80 | 159 | 238 | 397 | 503 | 609 |
| | $V_{H_2O}$ | $dm^3$ | 11.1 | 22.2 | 33.3 | 55.2 | 70.3 | 85.1 |
| | $V_{NH_3}$ | $dm^3$ | 10.4 | 21.5 | 32.5 | 54.8 | 69.6 | 84.4 |
| | Net weight | kg | 84 | 126 | 168 | 252 | 308 | 364 |
| | Operating weight | kg | 95 | 148 | 201 | 308 | | 450 |
| | Heating surface | $m^2$ | 8.4 | 17.3 | 26.3 | 44.3 | 56.2 | 68.2 |

### AlfaNova 400 – PED approval pressure/temperature graph*



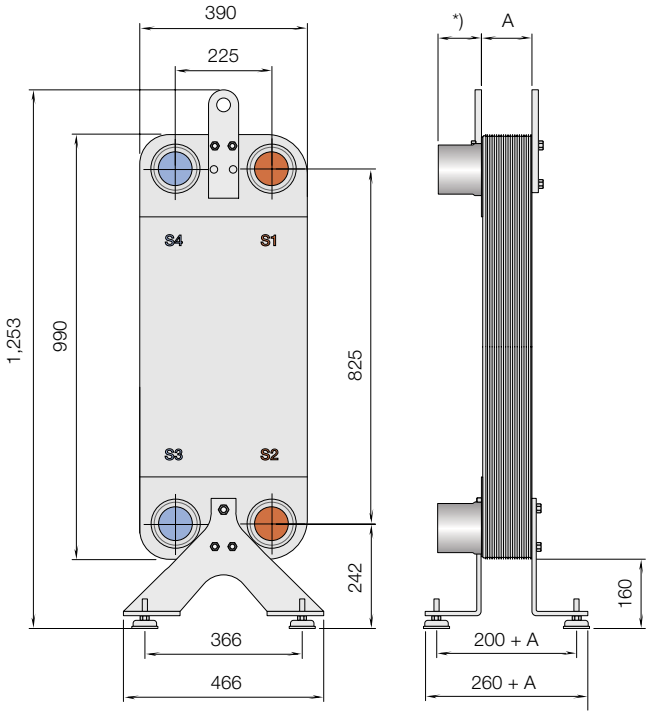

Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

### AlfaNova HP 400 – PED approval pressure/temperature graph*

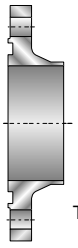



Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

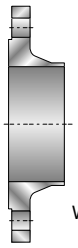
* For exact values please contact your local Alfa Laval representative.




*) Depending on type of connection.



Tounge & Groove flange

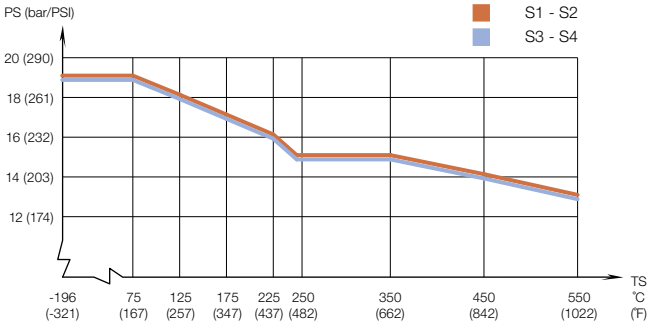


Water flange

Tube for welding

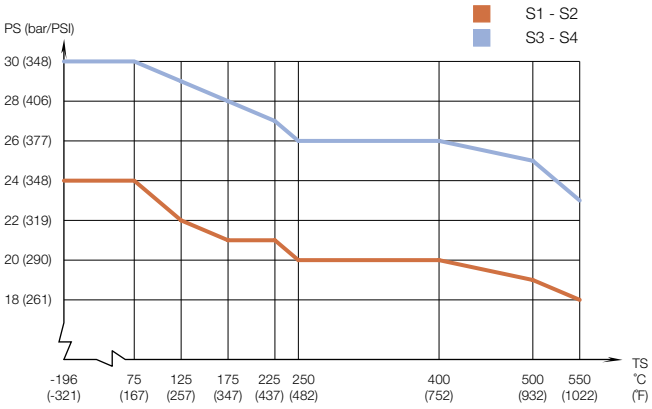
| Number of M plates | | | 30 | 60 | 90 | 150 | 190 | 230 |
|---|---|---|---|---|---|---|---|---|
| **Input data** | Qn | kW | 165 | 340 | 510 | 850 | 1,085 | 1,300 |
| | m water | kg/h | 11,630 | 23,970 | 35,950 | 59,920 | 76,490 | 91,650 |
| Water<br>Inlet: Ti = 25°C<br>Outlet: To = 40°C | ΔP water | kPa | 100 | 100 | 99 | 99 | 100 | 100 |
| | ΔP Ammonia | kPa | 10 | 10.4 | 10.6 | 11.1 | 11.8 | 12.3 |
| | LC | mm | 80 | 159 | 238 | 397 | 503 | 609 |
| Oil ISO VG 68<br>Inlet: Ti = 80°C<br>Outlet: To = 55°C | $V_{H_2O}$ | $dm^3$ | 11.1 | 22.2 | 33.3 | 55.2 | 70.3 | 85.1 |
| | $V_{NH_3}$ | $dm^3$ | 10.4 | 21.5 | 32.5 | 54.8 | 69.6 | 84.4 |
| | Net weight | kg | 84 | 126 | 168 | 252 | 308 | 364 |
| | Operating weight | kg | 104 | 166 | 229 | 353 | 437 | 520 |
| | Heating surface | $m^2$ | 8.4 | 17.3 | 26.3 | 44.3 | 56.2 | 68.2 |

### AlfaNova 400 – PED approval pressure/temperature graph*



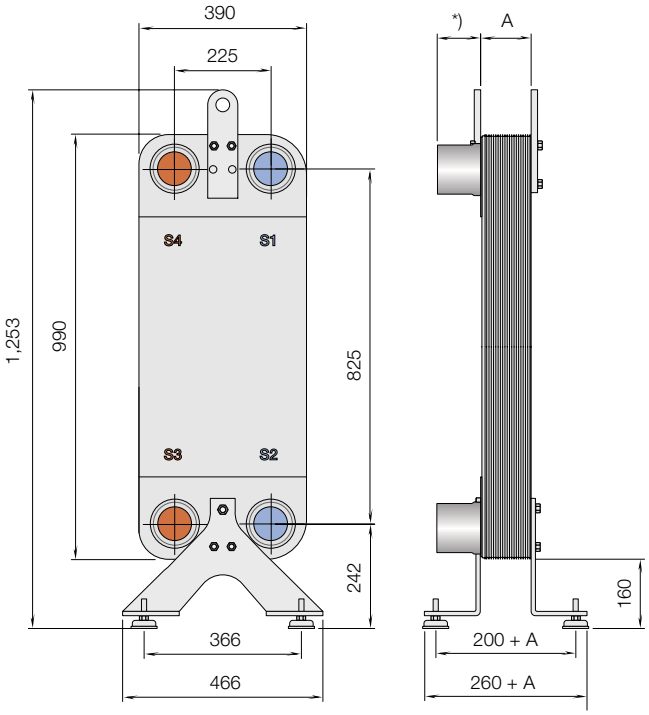

Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

### AlfaNova HP 400 – PED approval pressure/temperature graph*

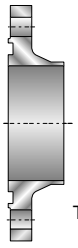



Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

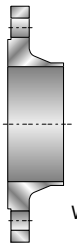
* For exact values please contact your local Alfa Laval representative.




*) Depending on type of connection.



Tounge & Groove flange

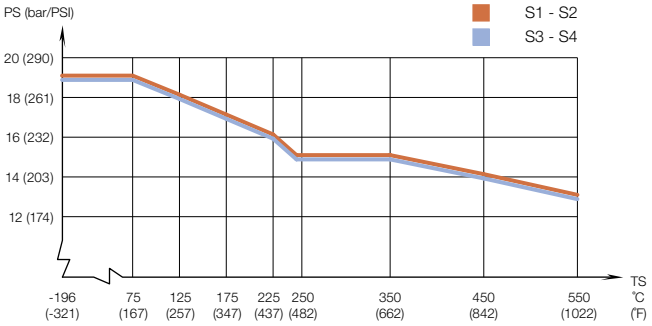


Water flange

Tube for welding

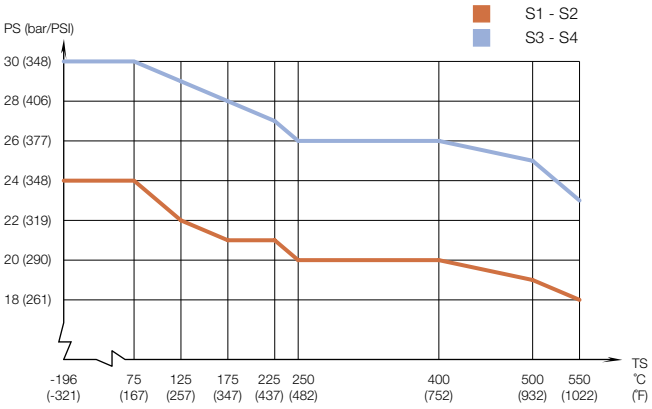
| Number of M plates | | | 30 | 60 | 90 | 150 | 190 | 230 |
|---|---|---|---|---|---|---|---|---|
| **Input data** | Qn | kW | 175 | 370 | 565 | 940 | 1,200 | 1,450 |
| | m water | kg/h | 18,840 | 39,840 | 60,840 | 101,200 | 129,200 | 156,100 |
| Water<br>Inlet: Ti = 31°C<br>Outlet: To = 39°C | ΔP water | kPa | 39 | 41 | 42 | 44 | 47 | 49 |
| | LC | mm | 80 | 159 | 238 | 397 | 503 | 609 |
| Superheat = 41°C<br>Tc = 75°C | $V_{H_2O}$ | $dm^3$ | 11.1 | 22.2 | 33.3 | 55.2 | 70.3 | 85.1 |
| | $V_{NH_3}$ | $dm^3$ | 10.4 | 21.5 | 32.5 | 54.8 | 69.6 | 84.4 |
| | Net weight | kg | 84 | 126 | 168 | 252 | 308 | 364 |
| | Operating weight | kg | 95 | 149 | 203 | 310 | | 454 |
| | Heating surface | $m^2$ | 8.4 | 17.3 | 26.3 | 44.3 | 56.2 | 68.2 |

### AlfaNova 400 – PED approval pressure/temperature graph*



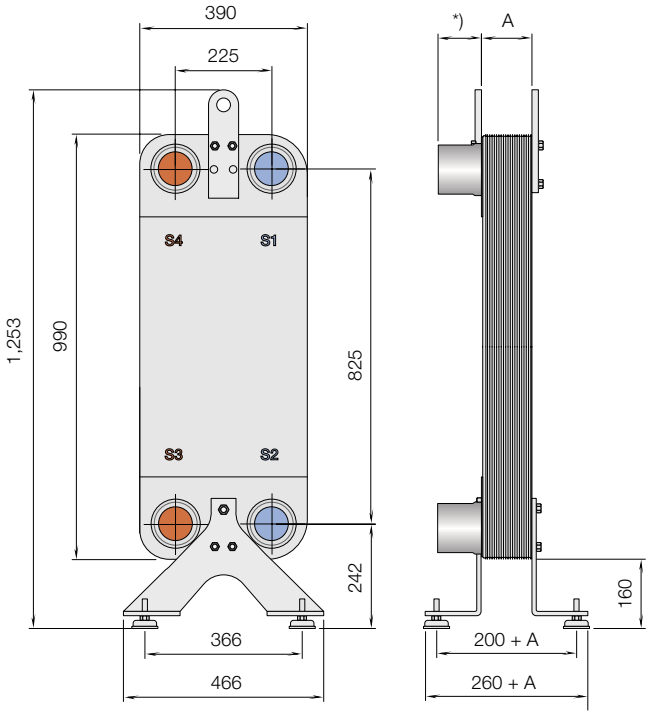

Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

### AlfaNova HP 400 – PED approval pressure/temperature graph*

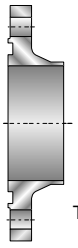



Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

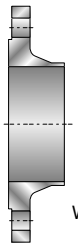
* For exact values please contact your local Alfa Laval representative.




*) Depending on type of connection.



Tounge & Groove flange

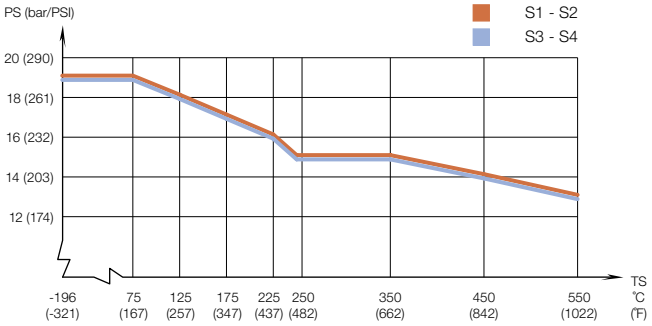


Water flange

Tube for welding

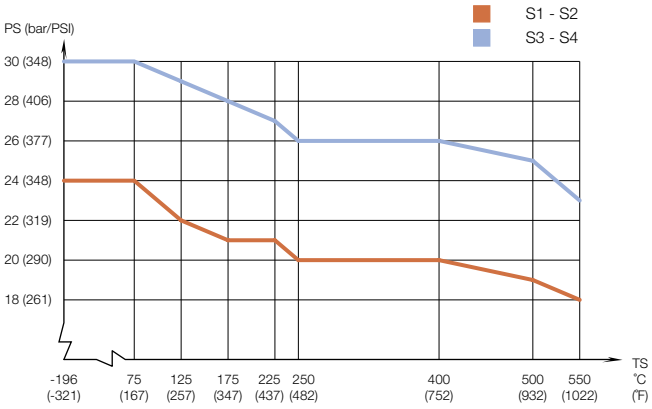
| Number of M plates | | | 30 | 60 | 90 | 150 | 190 | 230 |
|---|---|---|---|---|---|---|---|---|
| **Input data** | Qn | kW | 170 | 360 | 565 | 940 | 1,200 | 1,450 |
| | m water | kg/h | 18,290 | 38,730 | 60,780 | 101,100 | 129,100 | 156,000 |
| Water<br>Inlet: Ti = 25°C<br>Outlet: To = 33°C | ΔP water | kPa | 38 | 40 | 43 | 44 | 47 | 50 |
| | LC | mm | 80 | 159 | 238 | 397 | 503 | 609 |
| Refrigerant = $NH_3$<br>Tc = 35°C<br>Gas inlet = 75°C | $V_{H_2O}$ | $dm^3$ | 11.1 | 22.2 | 33.3 | 55.2 | 70.3 | 85.1 |
| | $V_{NH_3}$ | $dm^3$ | 10.4 | 21.5 | 32.5 | 54.8 | 69.6 | 84.4 |
| | Net weight | kg | 84 | 126 | 168 | 252 | 308 | 364 |
| | Operating weight | kg | 95 | 191 | 203 | 310 | | 454 |
| | Heating surface | $m^2$ | 8.4 | 17.3 | 26.3 | 44.3 | 56.2 | 68.2 |

### AlfaNova 400 – PED approval pressure/temperature graph*



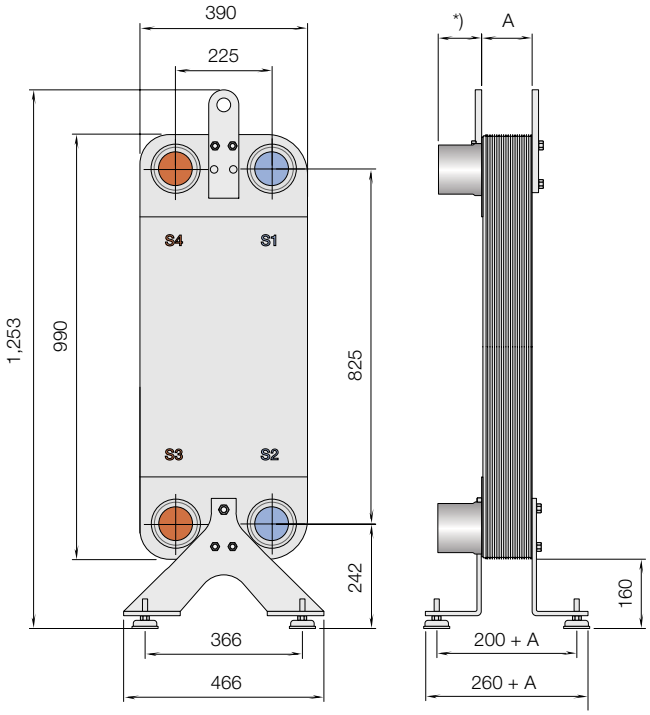

Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

### AlfaNova HP 400 – PED approval pressure/temperature graph*

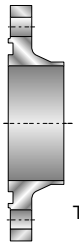



Min temperature -50 °C (-58 °F) with connection tubes made of carbon steel.

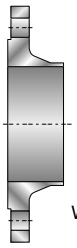
* For exact values please contact your local Alfa Laval representative.




*) Depending on type of connection.



Tounge & Groove flange

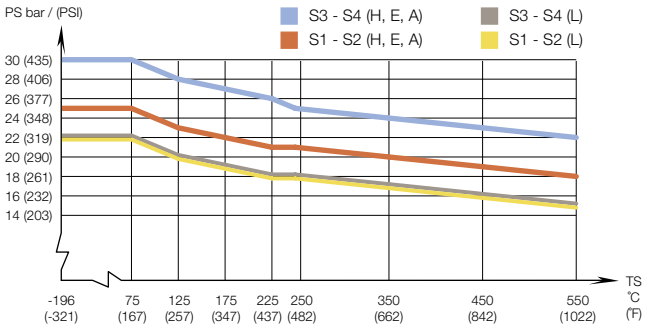


Water flange

Tube for welding

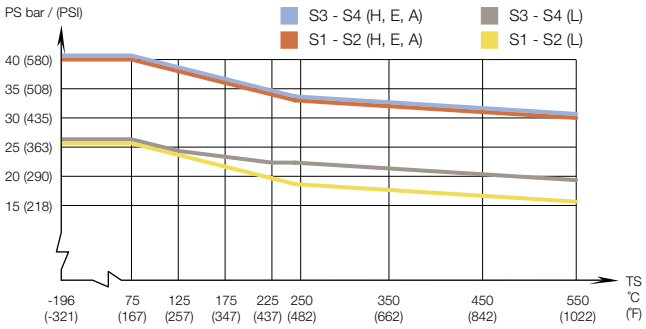
| Number of M plates | | | 30 | 60 | 90 | 150 | 190 | 230 |
|---|---|---|---|---|---|---|---|---|
| **Input data** | Qn | kW | 100 | 210 | 320 | 530 | 655 | 760 |
| Hot side, Condenser Refrigerant $NH_3$ Tc = -8°C Gas inlet: = 50°C | dP ammonia flooded | kPa | 6.6 | 6.7 | 6.9 | 7.1 | 7.3 | 7.4 |
| | LC | mm | 80 | 159 | 238 | 397 | 503 | 609 |
| | $V_{NH_3}$ CONDENSER | $dm^3$ | 11.1 | 22.2 | 33.3 | 55.2 | 70.3 | 85.1 |
| Cold side, Evaporation Refrigerant $NH_3$ Flooded Te = -12°C | $V_{NH_3}$ FLOODED | $dm^3$ | 10.4 | 21.5 | 32.5 | 54.8 | 69.6 | 84.4 |
| | Net weight | kg | 84 | 126 | 168 | 252 | 308 | 364 |
| | Operating weight | kg | 88 | 134 | 180 | 273 | | 396 |
| | Heating surface | $m^2$ | 8.4 | 17.3 | 26.3 | 44.3 | 56.2 | 68.2 |

### AlfaNova 76 – PED approval pressure/temperature graph*



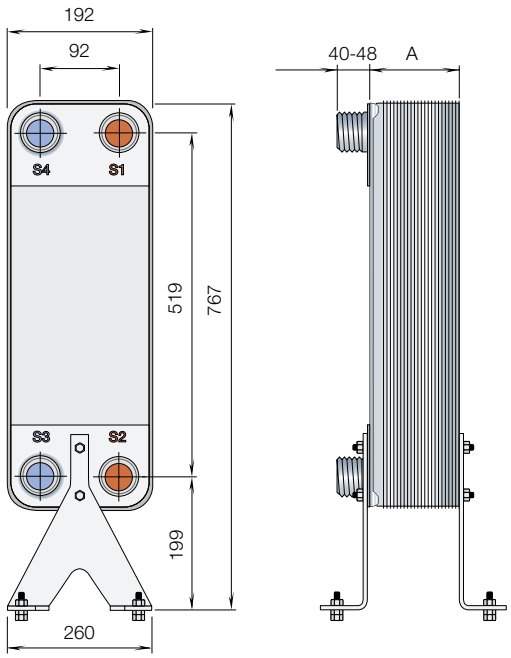

Min temperature -10 °C (14 °F) with connection tube made of carbon steel.

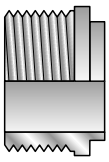
### AlfaNova HP 76 – PED approval pressure/temperature graph*



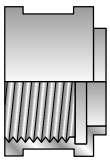

Min temperature -10 °C (14 °F) with connection tube made of carbon steel.

* For exact values please contact your local Alfa Laval representative.

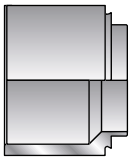


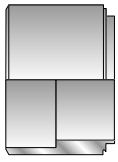
Outside threaded



Inside threaded



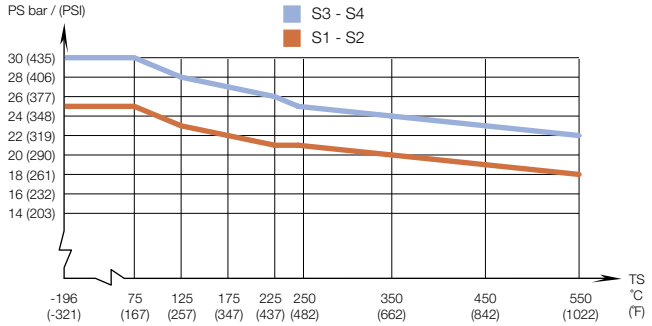
Soldering



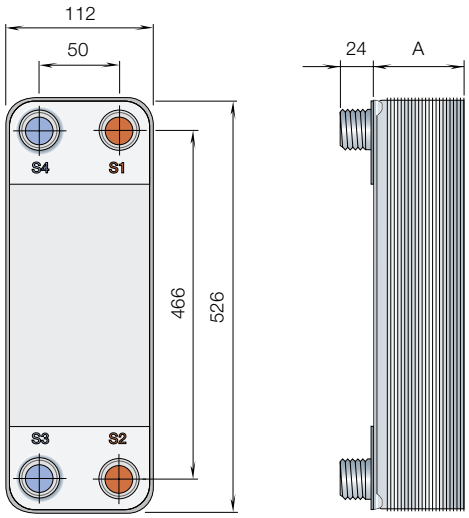
Welding

| Number of H plates | | | 30 | 50 | 64 | 80 | 100 |
|---|---|---|---|---|---|---|---|
| **Input data** | Qn | kW | 90 | 155 | 200 | 265 | 330 |
| Water<br>Inlet: Ti = 25°C<br>Outlet: To = 40°C | m water | kg/h | 5,167 | 8,898 | 11,480 | 15,210 | 18,940 |
| | ΔP water | kPa | 14.5 | 16 | 18.8 | 19.8 | 21.3 |
| | ΔP Oil | kPa | 66.9 | 68.4 | 75.3 | 75.9 | 77.7 |
| Oil ISO VG 68<br>Inlet: Ti = 80°C<br>Outlet: To = 55°C | LC | mm | 96.6 | 153.6 | 193.5 | 239.1 | 296.1 |
| | $V_{H_2O}$ | $dm^3$ | 3.7 | 6.2 | 8 | 10 | 12.5 |
| | V Oil | $dm^3$ | 3.5 | 6.0 | 7.8 | 9.8 | 12.3 |
| | Net weight | kg | 33.2 | 46.6 | 53.3 | 66.7 | 80.1 |
| | Operating weight | kg | 39.9 | 57.9 | 66.9 | 84.8 | 103 |
| | Heating surface | $m^2$ | 3 | 5 | 6.4 | 8 | 10 |

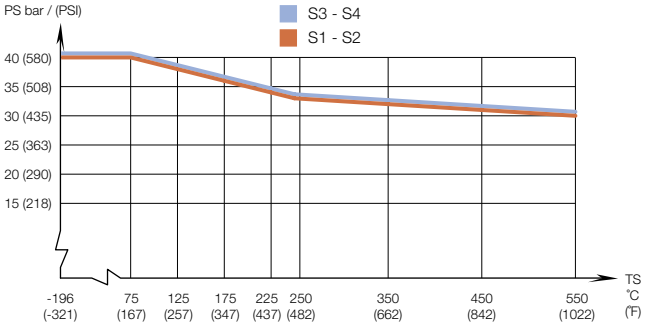
### AlfaNova 52 – PED approval pressure/temperature graph*




Min temperature -10 °C (14 °F) with connection tube made of carbon steel.

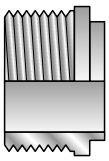



### AlfaNova HP 52 – PED approval pressure/temperature graph*

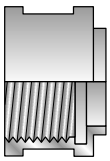



Min temperature -10 °C (14 °F) with connection tube made of carbon steel.

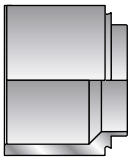
* For exact values please contact your local Alfa Laval representative.



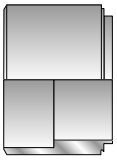
Outside threaded



Inside threaded



Soldering



Welding

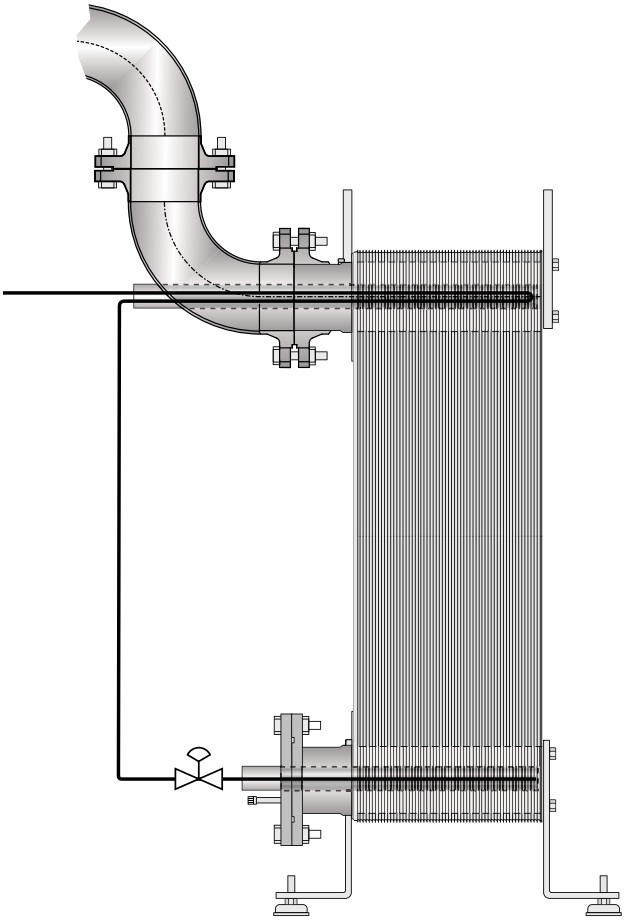
| Number of H plates | | | 30 | 50 | 64 | 80 | 100 |
|---|---|---|---|---|---|---|---|
| **Input data** | Qn | kW | 55 | 98 | 125 | 155 | 180 |
| Water<br>Inlet: Ti = 25°C<br>Outlet: To = 40°C | m water | kg/h | 3,877 | 5,626 | 7,176 | 8,898 | 10,330 |
| | ΔP water | kPa | 24 | 30 | 32 | 35 | 36 |
| | ΔP Oil | kPa | 90 | 98 | 98 | 98 | 90 |
| Oil ISO VG 68<br>Inlet: Ti = 80°C<br>Outlet: To = 55°C | LC | mm | 84 | 132 | 165 | 204 | 252 |
| | $V_{H_2O}$ | $dm^3$ | 1.42 | 2.38 | 3.04 | 3.8 | 4.75 |
| | V Oil | $dm^3$ | 1.3 | 2.3 | 3.0 | 3.7 | 4.7 |
| | Net weight | kg | 9.1 | 13.7 | 16.9 | 20.6 | 25.2 |
| | Heating surface | $m^2$ | 1.53 | 2.55 | 3.26 | 4.08 | 5.1 |

# Suction-X ammonia DX boosting system

Suction-X™ is an integrated system to boost the COP in an Ammonia-DX plant. The high latent heat of Ammonia and its low sensible heat require a relatively high super-heat to secure a stable signal for an even control of the expansion valve. The arrangement provides the required superheat in a simple way.

Hot condensate is let into the exit port area through a surface enhanced tube. The evaporator operates with wet evaporation throughout. Droplets hitting the hot tube will break into smaller droplets, evaporate and superheat together with the main gas flow. The heat transfer area will now be smaller or the evaporation temperature higher.

Together with the 2-phase flow distributor the Integrated Suction Gas heater boosts the performance over a wider range of loads.



# AlfaNova CIP

A problem frequently encountered in almost all applications where heat exchangers are used, is the build-up of deposits on heat transfer surfaces. This gives a reduction in thermal performance and as well a potential risk of under-deposit corrosion. Another effect is increased pressure drop over the heat exchanger. If it then is connected with pumps or compressors in the same loop, these will get a higher workload and due to that increased energy consumption as well as increased wear and tear.

Alfa Laval supplies a wide range of cleaning agents suitable for removing most of these troublesome deposits and restoring performance to optimal levels.

When having a high value equipment as an AlfaNova the means of preventing a decrease of performance is to clean it by using an Alfa Laval Cleaning-in-Place (CIP) unit. When cleaning a unit one must seal off the heat exchanger from the surrounding and drain it, as described in the attached figure. If one has two heat exchangers in parallel, one does not need to loose any performance totally, just clean one unit at a time.

Alfa Laval CIP units are available in a wide range of standard sizes, with optional extras that include reversible flow and explosion-proof capabilities.

Alfa Laval CIP units can be used for all types of heat exchangers, including spiral heat exchangers, shell-and-tube heat exchangers and gasketed, welded and brazed plate heat exchangers.

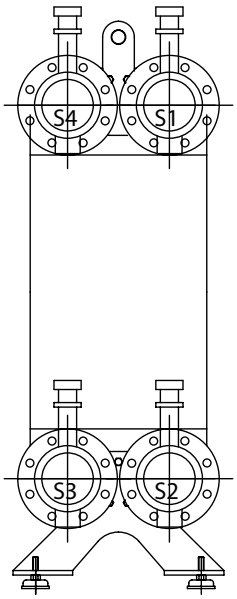
**Concept**
Alfa Laval CIP units are simplicity itself:

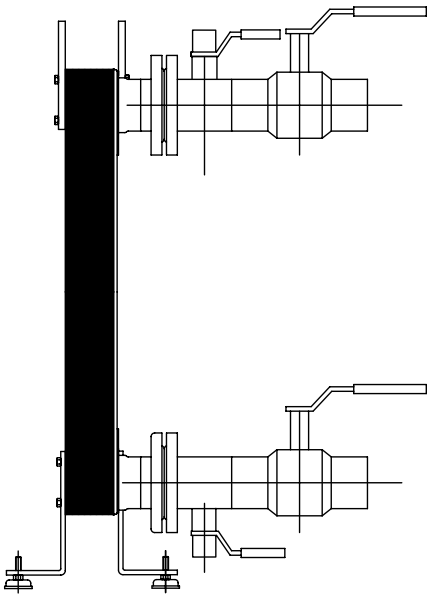
- Connect the Alfa Laval CIP unit to the heat exchanger
- Mix the cleaning agent with water in the tank
- Circulate the cleaning solution a couple of hours
- Drain and rinse
- Disconnect the CIP unit
- The heat exchanger is back to full performance capacity*

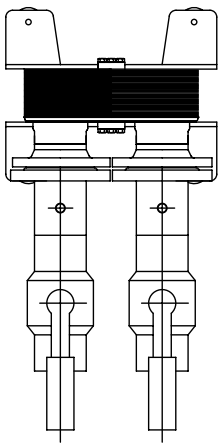
Alfa Laval CIP units are a cost-effective way to achieve better performance and the cleaning agents used are, of course, environmentally friendly.

In addition to boosting the performance of all kinds of heat exchangers, Alfa Laval cleaning agents extend the operating time between cleaning cycles and prolong the overall lifetime of the heat exchangers without damaging the plates.

* Only if the cleaning takes place with regular intervals, circulation in the channels is possible in order for the cleaning agents to remove the deposits.





## Alfa Laval in brief

Alfa Laval is a leading global provider of specialized products and engineered solutions.

Our equipment, systems and services are dedicated to helping customers to optimize the performance of their processes. Time and time again.

We help our customers to heat, cool, separate and transport products such as oil, water, chemicals, beverages, foodstuffs, starch and pharmaceuticals.

Our worldwide organization works closely with customers in almost 100 countries to help them stay ahead.

## How to contact Alfa Laval

Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com

© 2006 Alfa Laval

ERC00047EN 0808

AlfaNova et AlfaFusion sont des marques de Alfa Laval Corporate AB. ALFA LAVAL est une marque déposée de Alfa Laval Corporate AB.