AlfaNova – the first fusion-bonded plate heat exchanger

A product brochure for AlfaNova within Industrial Refrigeration

AlfaNova

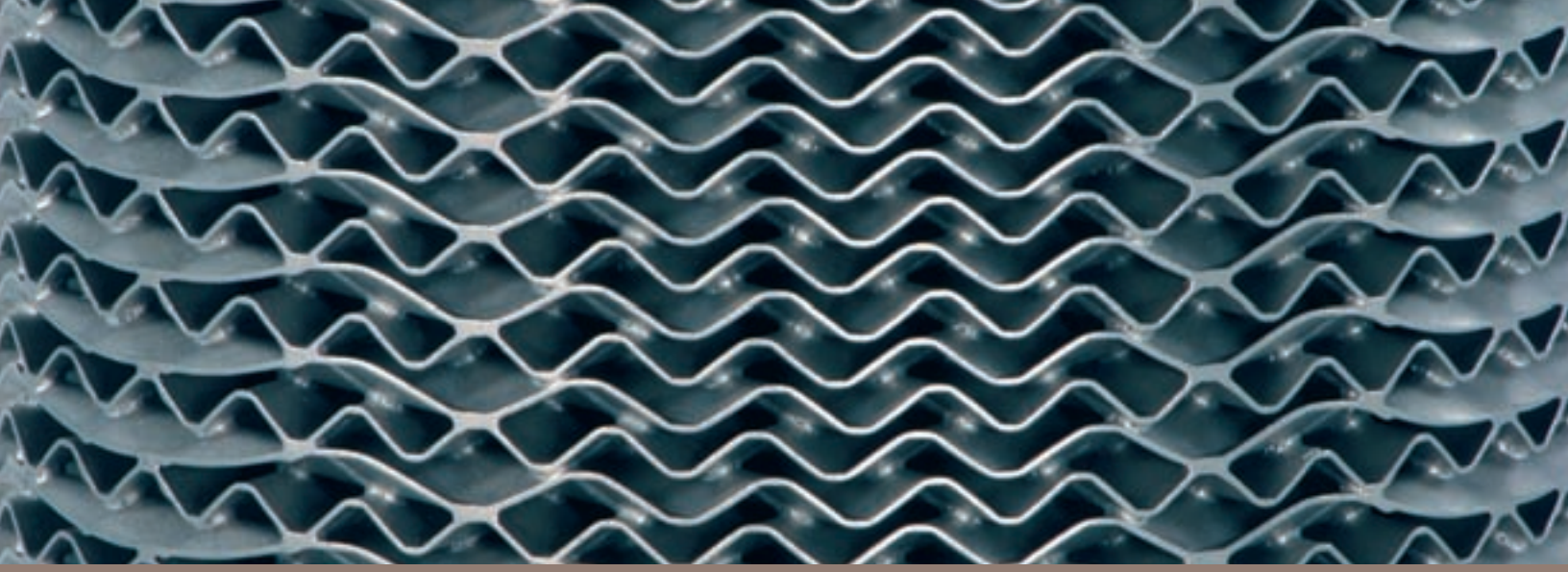
A new concept for plate heat exchangers

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.

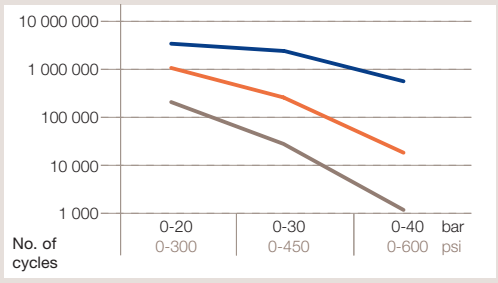
Det Norske Veritas (DNV) has validated the production process. Grain growth in the material following heat treatment was investigated, and a micro-structure analysis was undertaken. A number of certification bodies conducted burst testing, confirming a burst pressure several times higher than the design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

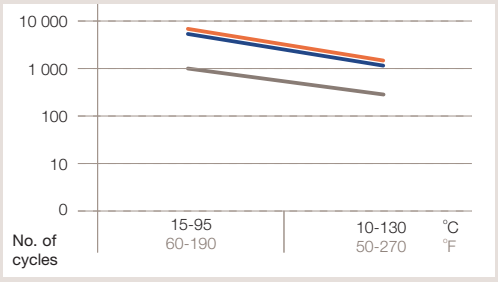
AlfaNova was tested in three different temperature and flow programmes and long-term testing has been carried out in various corrosive environments. We can now confirm that AlfaFusion is the technology of the future for plate heat exchangers. AlfaNova is the first fusion-bonded PHE. Fusion-bonding offers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

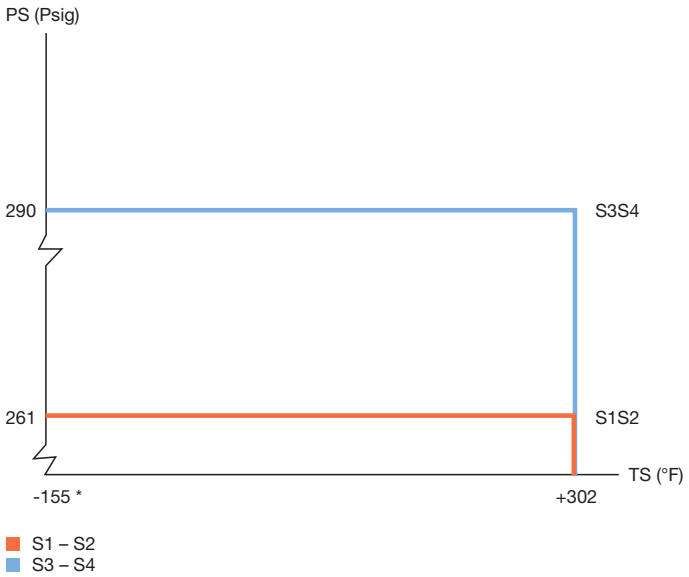
- an extreme compact design cuts the installation costs as less space is needed
- high corrosion resistance
- the heat transfer efficiency gives high COP values
- reduced maintenance
- low refrigerant volume
- absolutely gasket-free
- High temperature resistance

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.

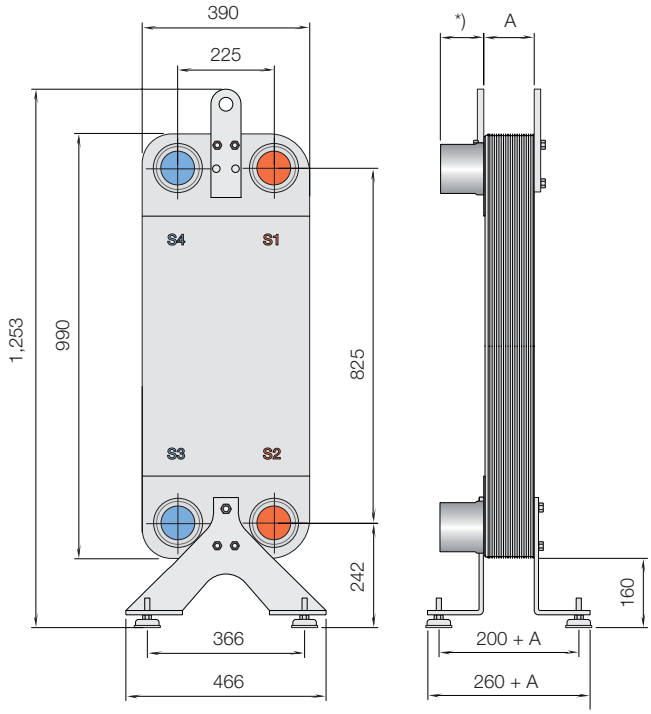
Material
The AlfaNova's consists of thin corrugated stainless steel plates which are fusion joined together in a vacuum furnace. The material in the plates is AISI 316.

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.

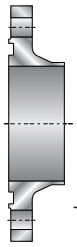
AlfaNova 400 – ASME approval pressure/temperature graph



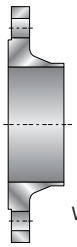
*) MDMT at MAWP -49°F with Connection tubes of carbon steel



*) Depending on type of connection.



Tongue and groove flange

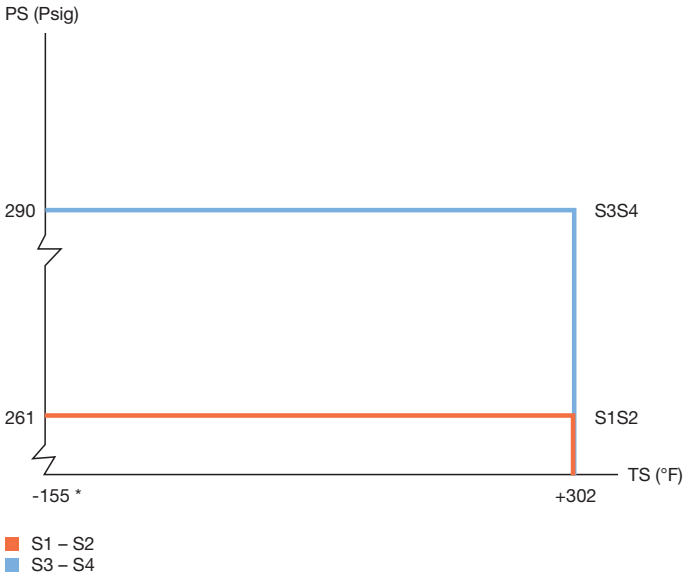


Water flange

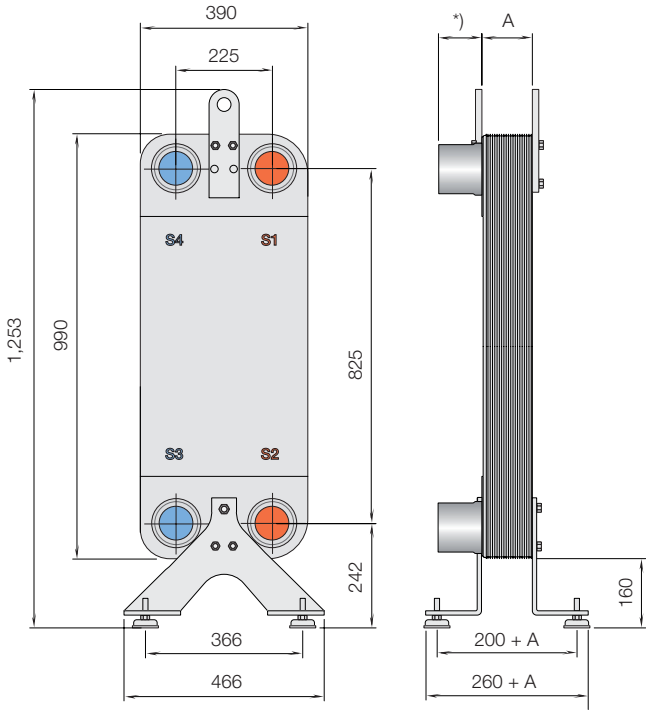
Tube for welding

Number of M plates			30	60	90	150	190	230
Input Data	Qn	kBTU/h	529.2	1092.6	1638.9	2594.9	3073.0	3619.3
	m water	lb/hr	58,388	120,560	180,840	286,440	339,020	399,300
Water	P water	psi	10.3	11.0	11.2	10.7	9.9	10.0
Inlet: T_{in} = 53.6 °F	ΔP ammonia	psi	1.2	1.2	1.2	1.2	1.2	1.2
Outlet: T_{out} = 44.6 °F	LC	in	3.1	6.3	9.4	15.6	19.8	24.0
	V H2O	ft³	0.39	0.78	1.18	1.95	2.48	3.01
Refrigerant = NH_3	V NH3	ft³	0.37	0.76	1.15	1.94	2.46	2.98
T_{evap} = 39.2 °F	Net Weight	lb	185	277	370	554	678	801
	Operating Weight	lb	211	330	447	684	843	999
	Heating Surface	ft²	90.4	186.1	283.0	476.7	604.7	733.8

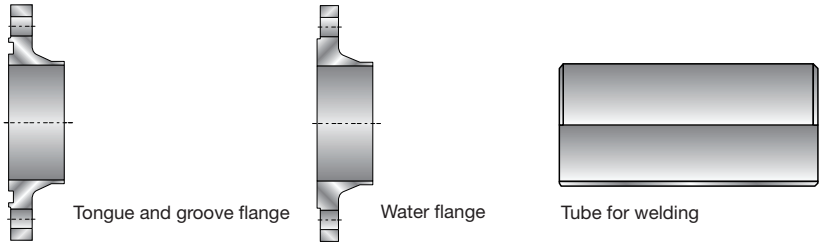
AlfaNova 400 – ASME approval pressure/temperature graph



*) MDMT at MAWP -49°F with Connection tubes of carbon steel

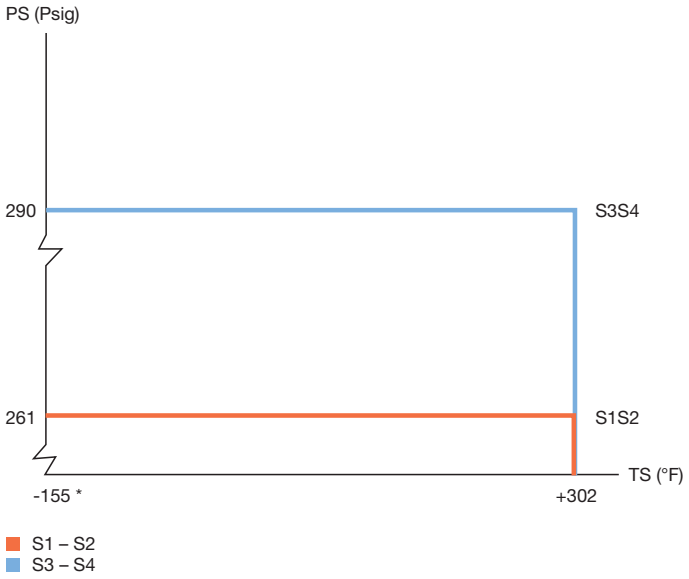


*) Depending on type of connection.

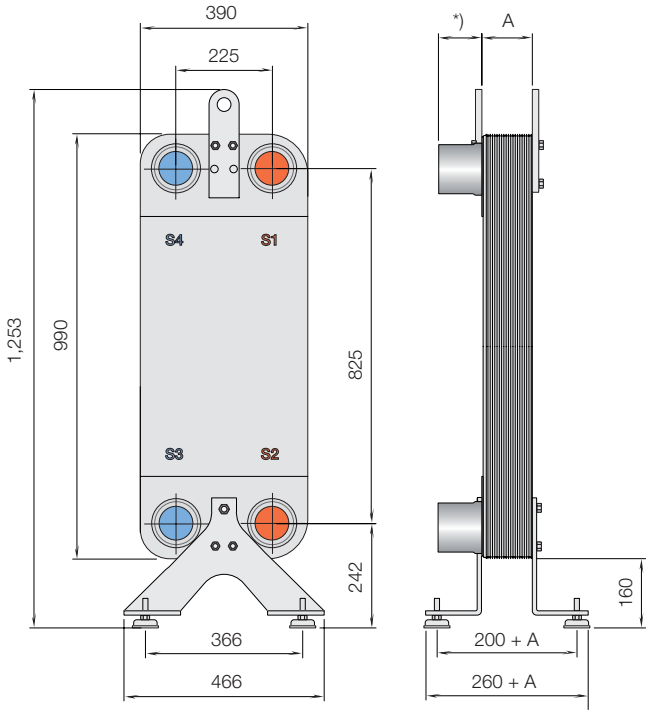


Number of M plates			30	60	90	150	190	230
Input Data	Qn	kBTU/h	392.7	819.5	1229.2	2014.5	2526.7	3021.7
Water	m water	lb/hr	43,318	90,420	135,630	222,200	278,740	333,520
Inlet: T_{in} = 53.6 °F	ΔP water	psi	13.3	14.5	14.5	14.5	14.5	14.5
Outlet: T_{out} = 44.6 °F	ΔP ammonia	psi	1.6	1.7	1.6	1.6	1.6	1.6
Refrigerant = NH_3	LC	in	3.1	6.3	9.4	15.6	19.8	24.0
T_{evap} = 37.4 °F	V H2O	ft^3	0.39	0.78	1.18	1.95	2.48	3.01
Superheat = 46.4 °F	V NH3	ft^3	0.37	0.76	1.15	1.94	2.46	2.98
T_{subc} = 41 °F	Net Weight	lb	185	277	370	554	678	801
T_{cond} = 104 °F	Operating Weight	lb	209	326	442	678	0	990
	Heating Surface	ft^2	90.4	186.1	283.0	476.7	604.7	733.8

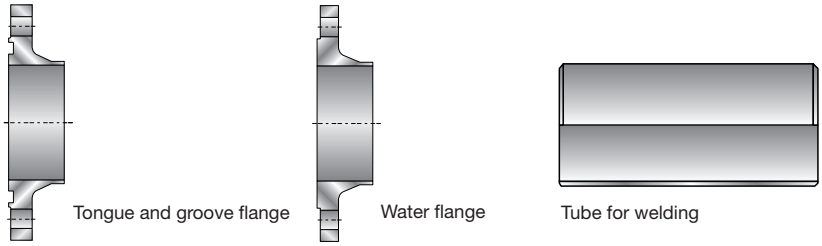
AlfaNova 400 – ASME approval pressure/temperature graph



*) MDMT at MAWP -49ºF with Connection tubes of carbon steel

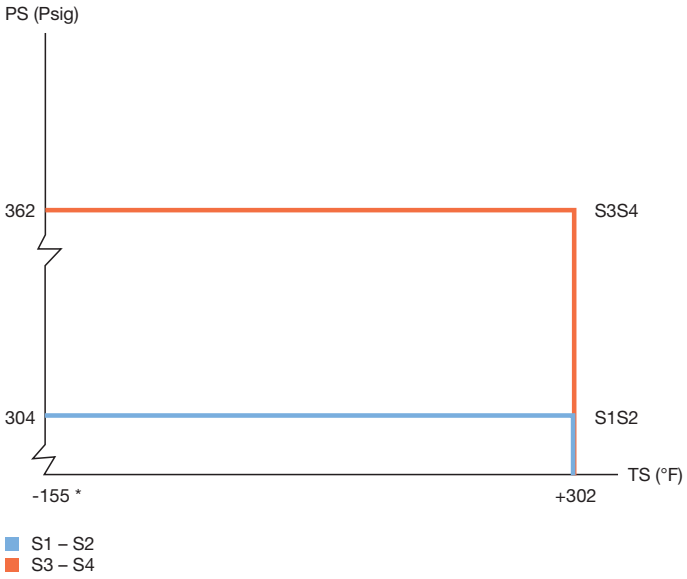


*) Depending on type of connection.

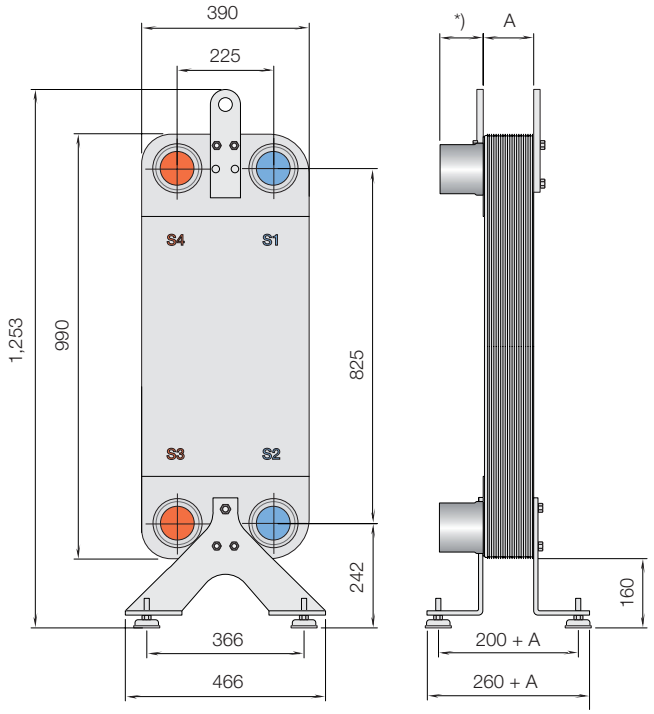


Number of M plates			30	60	90	150	190	230
Input Date	Qn	kBTU/h	563.4	1160.9	1741.3	2902.2	3704.6	4438.7
	m water	lb/hr	25,586	52,734	79,090	131,824	168,278	201,630
Water	ΔP water	psi	14.5	14.5	14.4	14.4	14.5	14.5
Inlet: T_{in} = 77 °F	ΔP ammonia	psi	1.5	1.5	1.5	1.6	1.7	1.8
Outlet: T_{out} = 104 °F	LC	in	3.1	6.3	9.4	15.6	19.8	24.0
	V $_{H2O}$	ft³	0.39	0.78	1.18	1.95	2.48	3.01
Oil ISO VG 68	V $_{NH3}$	ft³	0.37	0.76	1.15	1.94	2.46	2.98
Inlet: T_{in} = 176 °F	Net Weight	lb	185	277	370	554	678	801
Outlet: T_{out} = 131 °F	Operating Weight	lb	229	365	504	777	961	1144
	Heating Surface	ft²	90.4	186.1	283.0	476.7	604.7	733.8

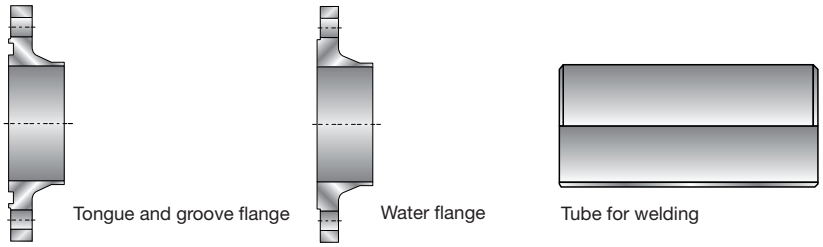
AlfaNova HP 400 – ASME approval pressure/temperature graph



*) MDMT at MAWP -49ºF with Connection tubes of carbon steel

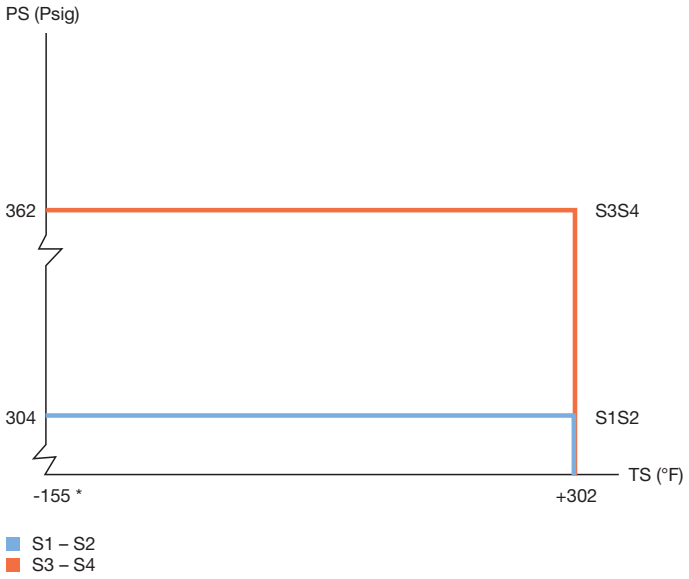


*) Depending on type of connection.

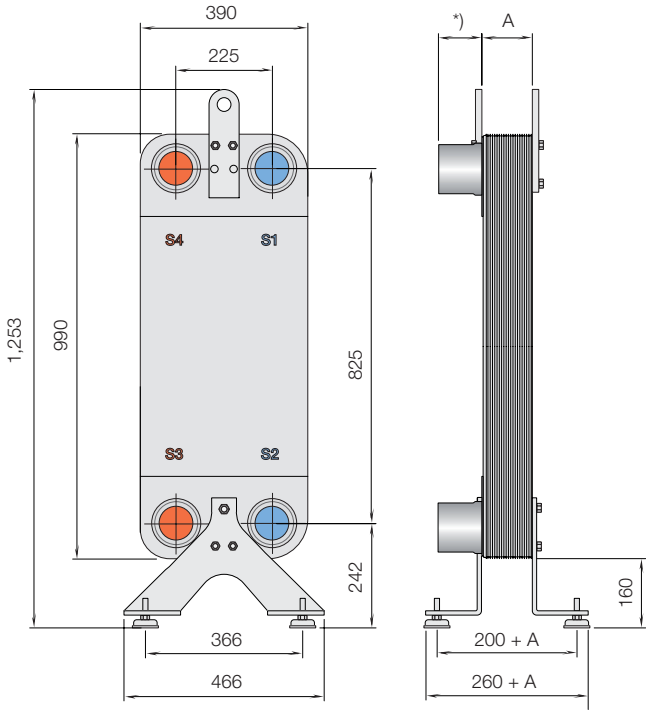


Number of M plates			30	60	90	150	190	230
Input Data	Qn	kBTU/h	597.5	1263.3	1929.1	3209.5	4097.3	4950.9
Water	m water	lb/hr	41,448	87,648	133,848	222,640	284,240	343,420
Inlet: T_{in} = 87.8 °F	ΔP water	psi	5.7	5.9	6.1	6.4	6.8	7.1
Outlet: T_{out} = 102.2 °F	LC	in	3.1	6.3	9.4	15.6	19.8	24.0
	V $_{H2O}$	ft³	0.39	0.78	1.18	1.95	2.48	3.01
Superheat = 105.8 °F	V $_{NH3}$	ft³	0.37	0.76	1.15	1.94	2.46	2.98
T_{cond} = 167 °F	Net Weight	lb	185	277	370	554	678	801
	Operating Weight	lb	209	328	447	682	0	999
	Heating Surface	ft²	90.4	186.1	283.0	476.7	604.7	733.8

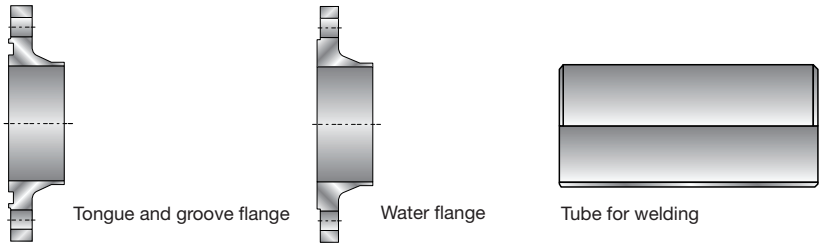
AlfaNova HP 400 – ASME approval pressure/temperature graph



*) MDMT at MAWP -49ºF with Connection tubes of carbon steel

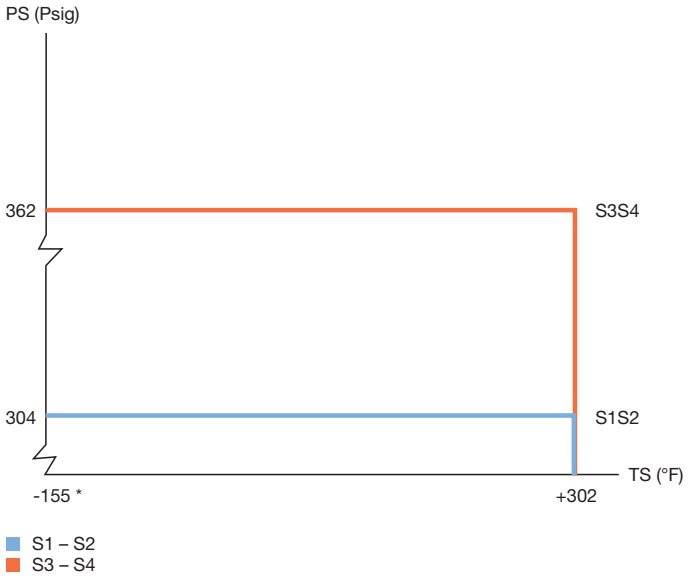


*) Depending on type of connection.

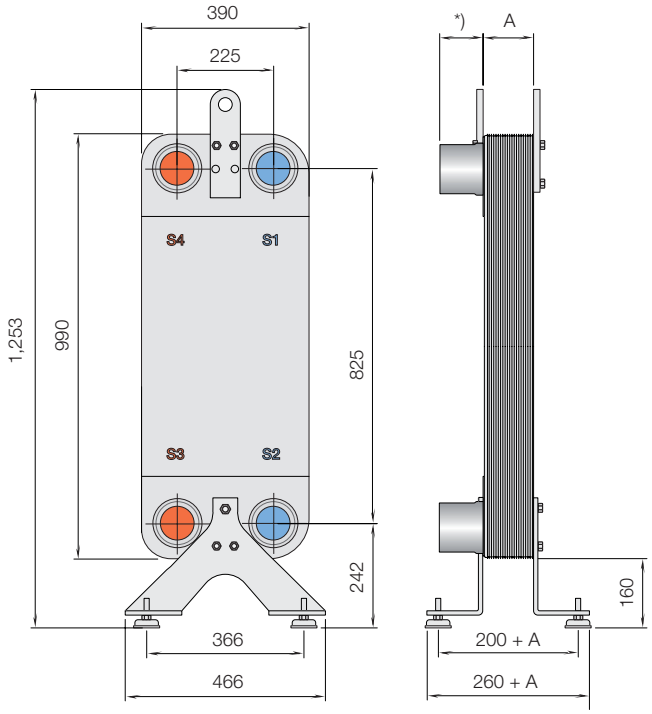


Number of M plates			30	60	90	150	190	230
Input Data	Qn	kBTU/h	580.4	1229.2	1929.1	3209.5	4097.3	4950.9
Water	m water	lb/hr	40,238	85,206	133,716	222,420	284,020	343,200
Inlet: T_{in} = 77 °F	ΔP water	psi	5.5	5.8	6.2	6.4	6.8	7.3
Outlet: T_{out} = 91.4 °F	LC	in	3.1	6.3	9.4	15.6	19.8	24.0
	V H2O	ft³	0.39	0.78	1.18	1.95	2.48	3.01
Refrigerant = NH_3	V NH3	ft³	0.37	0.76	1.15	1.94	2.46	2.98
T_{cond} = 95 °F	Net Weight	lb	185	277	370	554	678	801
Gas Inlet = 167 °F	Operating Weight	lb	209	420	447	682	0	999
	Heating Surface	ft²	90.4	186.1	283.0	476.7	604.7	733.8

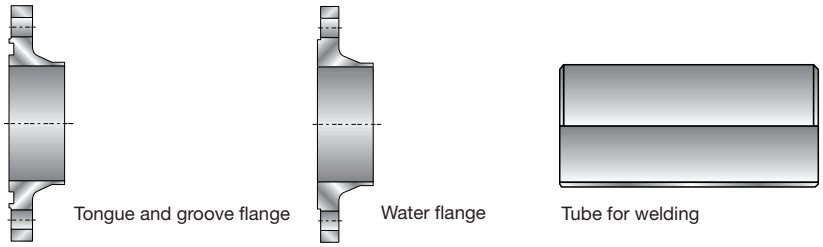
AlfaNova HP 400 – ASME approval pressure/temperature graph



*) MDMT at MAWP -49ºF with Connection tubes of carbon steel

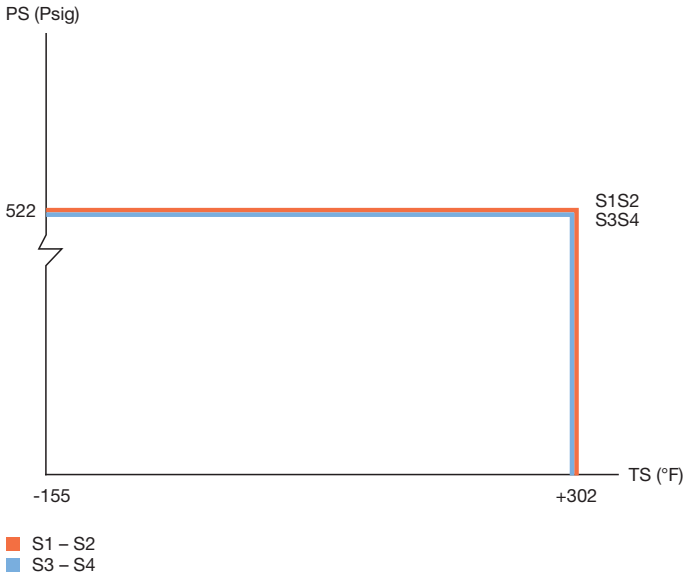


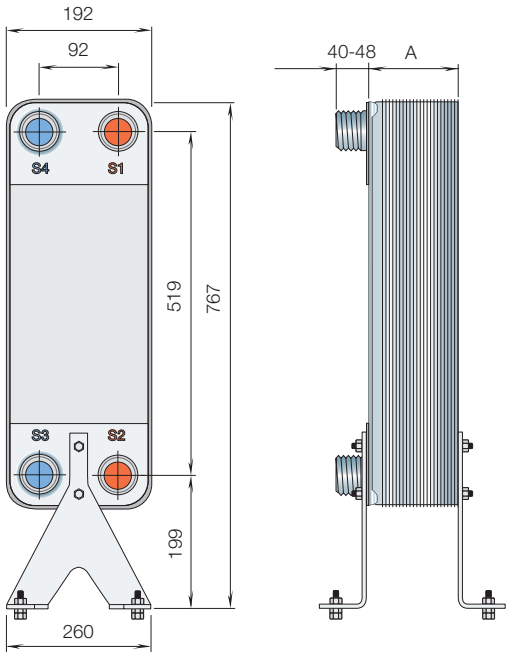
*) Depending on type of connection.

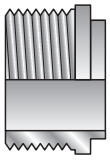


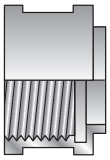
Number of M plates			30	60	90	150	190	230
Input data Hot side: Condenser Refrigerant NH_3 T_{cond} = 17.6 Gas Inlet = 122 °F Cold side: Evaportion Refrigerant NH_3 Flooded T_{evap} = 10.4 °F	Qn	kBTU/h	341.4	717.0	1092.6	1809.6	2236.4	2594.9
	ΔP water	psi	1.0	1.0	1.0	1.0	1.1	1.1
	LC	in	3.1	6.3	9.4	15.6	19.8	24.0
	V H2O	ft³	0.39	0.78	1.18	1.95	2.48	3.01
	V NH3	ft³	0.37	0.76	1.15	1.94	2.46	2.98
	Net Weight	lb	185	277	370	554	678	801
	Operating Weight	lb	194	295	396	601	0	871
	Heating Surface	ft²	90.4	186.1	283.0	476.7	604.7	733.8

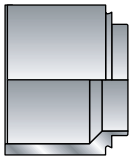
AlfaNova HP 76 – ASME approval pressure/temperature graph

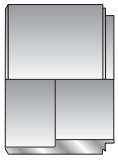





Outside threaded

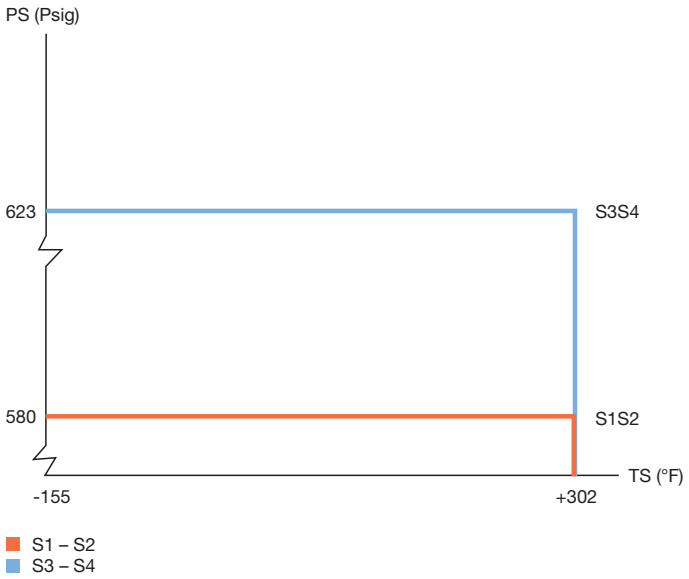

Inside threaded

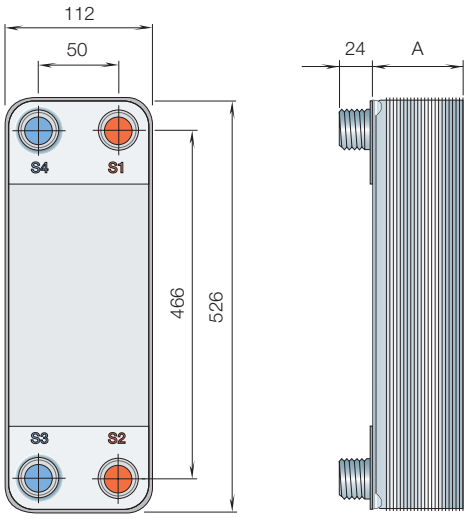

Soldering


Welding

Number of M plates			30	60	90	150	190
Input Data	Qn	kBTU/h	307.3	529.2	682.9	904.8	1126.8
	m water	lb/hr	11,367	19,576	25,256	33,462	41,668
Water	ΔP water	psi	2.1	2.3	2.7	2.9	3.1
Inlet: T_{in} = 77 °F	ΔP oil	psi	9.7	9.9	10.9	11.0	11.3
Outlet: T_{out} = 104 °F	LC	in	3.8	6.0	7.6	9.4	11.7
	V $_{H2O}$	ft³	0.13	0.22	0.28	0.35	0.44
Oil ISO VG 68	V $_{Oil}$	ft³	0.12	0.21	0.28	0.35	0.43
Inlet: T_{in} = 176 °F	Net Weight	lb	73	103	117	147	176
Outlet: T_{out} = 131 °F	Operating Weight	lb	88	127	147	187	227
	Heating Surface	ft²	32.3	53.8	68.9	86.1	107.6

AlfaNova HP 52 – ASME approval pressure/temperature graph





Outside threaded | Inside threaded | Soldering | Welding

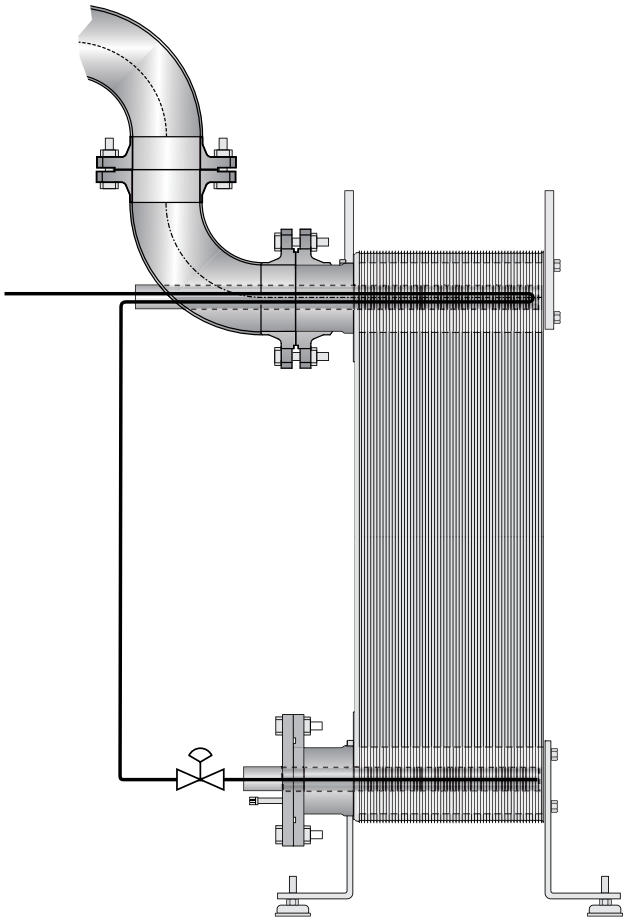
Number of M plates			30	60	90	150	190
Input Data	Qn	kBTU/h	187.8	334.6	426.8	529.2	614.6
Water	m water	lb/hr	8,529	12,377	15,787	19,576	22,726
Inlet: T_{in} = 77 °F	ΔP water	psi	3.5	4.4	4.6	5.1	5.2
Outlet: T_{out} = 104 °F	ΔP oil	psi	13.1	14.2	14.2	14.2	13.1
	LC	in	3.3	5.2	6.5	8.0	9.9
Oil ISO VG 68	V $_{H2O}$	ft³	0.05	0.08	0.11	0.13	0.17
Inlet: T_{in} = 176 °F	V $_{Oil}$	ft³	0.05	0.08	0.11	0.13	0.17
Outlet: T_{out} = 131 °F	Net Weight	lb	20	30	37	45	55
	Heating Surface	ft²	16.5	27.4	35.1	43.9	54.9

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 super-heat 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.

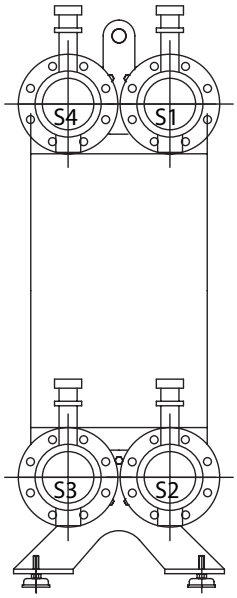
Concept
Alfa Laval CIP units are simplicity itself:

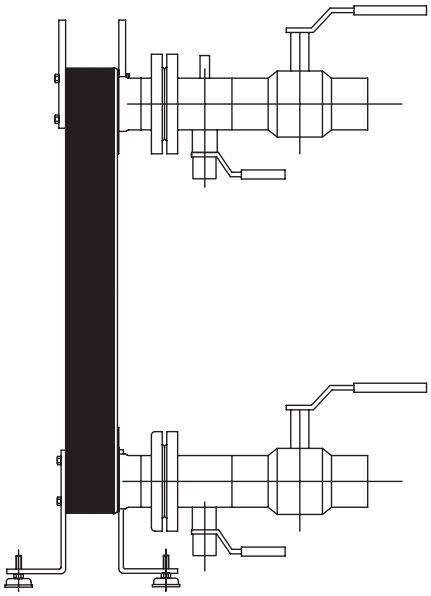
- Connect the Alfa Laval CIP unit to the heat exchanger
- Mix the cleaning agent with water in the tank
- Circulate the cleaning solution a couple of hours
- Drain and rinse
- Disconnect the CIP unit
- The heat exchanger is back to full performance capacity*

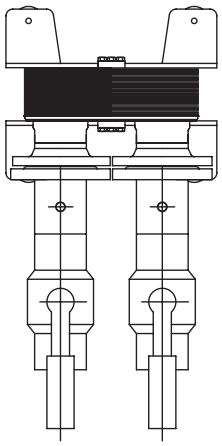
Alfa Laval CIP units are a cost-effective way to achieve better performance and the cleaning agents used are, of course, environmentally friendly.

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

ERC00047US 0612