



Fast track by Alfa Laval

- Delivered in days.
- Delivers for decades.

Gasketed Plate Heat Exchangers

T-Series



The background of the document is a photograph of industrial machinery, specifically large-scale heat exchangers. These units are composed of numerous metal plates held together by blue vertical supports. The scene is set in a factory or industrial plant, with various pipes and mechanical components visible. The lighting is somewhat dim, highlighting the metallic surfaces of the equipment.

Fast Track by Alfa Laval

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Fast Track by Alfa Laval

Fast Track by Alfa Laval

- Delivered in Days
- Delivers for Decades

Delivered in days, delivering for decades

Fast track is the first standardized line of plate heat exchangers to guarantee fast, energy-efficient results without compromising on quality or lifecycles. Starting with fast and easy selection, Fast track eliminates the time spent waiting for calculations and making orders. Then, once you have made a decision in your own time, we promise to have your order packed and on its way within a matter of days.

How to contact Alfa Laval

Contact details for all countries are continually up- dated on our web site. Please visit www.alfalaval.com to access the information.

The world's most modern gasketed plate heat exchangers

Gasketed plate-and-frame heat exchangers are so well established that few could imagine major leaps in their development. At Alfa Laval, however, we don't believe in settling for status quo. That's why we introduced our line of next-generation gasketed plate heat exchangers for industrial applications – to meet your needs today, tomorrow and beyond.

New standards

In redeveloping our gasketed plate heat exchangers, we questioned every aspect and rethought every detail. The results are bold new standards in efficiency, reliability and serviceability. Continuously upgraded with new models, innovative features and new technical concepts, this is the world's most modern gasketed plate heat exchanger range with options for virtually any industry and application.

Boosting efficiency and sustainability – whatever the application

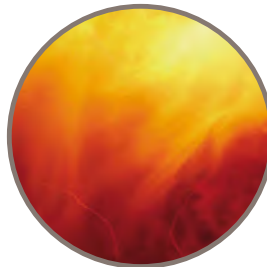
Our objective has been clear from the start: to solve existing customer challenges in a more sustainable and cost-efficient way. Development has therefore focused on improving thermal efficiency and operational performance, with an eye toward **reducing our customers' total cost of ownership**. Regardless of your industry, the application or the position of your heat exchanger, we want to help you save energy and minimize the environmental impact of your processes.

Manufacturing applications



Machining

Cutting/Forming/Pressing
Coolant oils



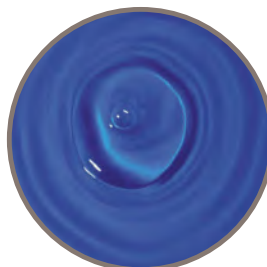
Heat treatment

Quenching/Annealing
Quench oils, Process water



Degreasing

Washing/Degreasing
Water Solvent



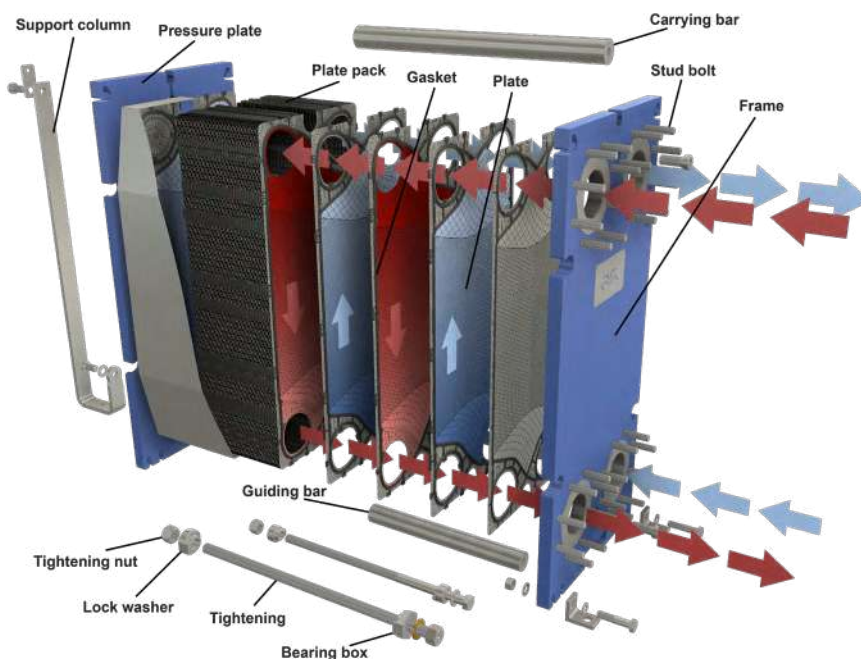
Surface treatment

Phosphating/Plating/
Anodizing/Painting
Acids, Paint



Automotive

Oil, Water, Air



How gasketed plate heat exchangers work

GPHEs are the most common type of compact heat exchanger. They are often used for food and drink processing, chemical production, and heating and cooling purposes.

Metallic plates are pressed into packs to facilitate heat transfer between two fluids. These plates can be made from a range of different metals, including stainless steel and titanium, but selection will ultimately depend on the type of fluid that is being processed. Note 'fluid' does not necessarily mean liquid; gases can also be processed in a GPHE.

Plate packs are suspended from a carrying bar and set by a lower guiding bar before being sandwiched and compressed between a frame plate and a pressure plate. They are then tightened with bolts that run across the length of the GPHE.

In a gasketed plate heat exchanger (GPHE), the metal plates are fitted with elastomeric gaskets which seal and direct each fluid into alternate channels. Hot channels will be placed against cool channels with each fluid flowing counter or co-currently to facilitate thermal transfer. GPHEs are prized for their high efficiency rate afforded by a large surface area.⁴ They are much easier to deconstruct and clean than brazed or welded designs, making them favourable in hygiene-critical environments as well as in high fouling applications.

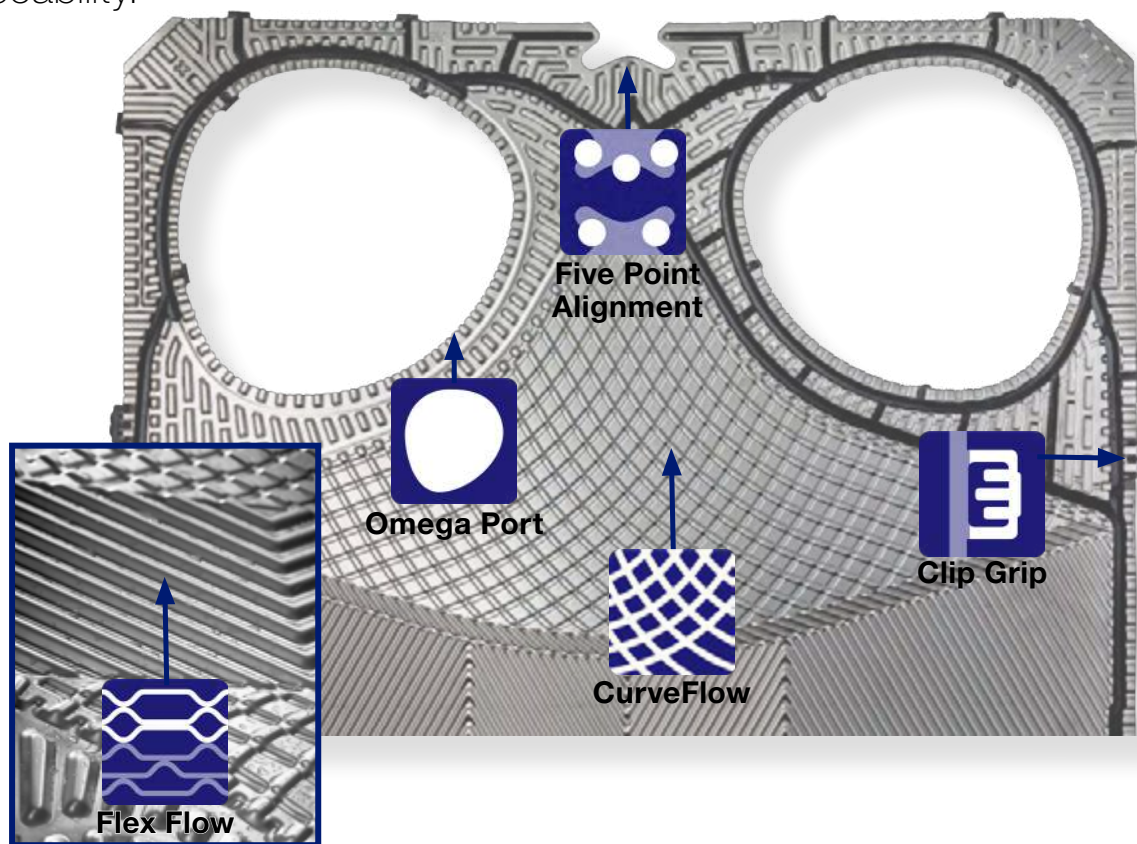
GPHEs are used in many HVAC applications to indirectly connect chillers, boilers and cooling towers to central plant systems. They are also used to effectively remove excess heat produced by chillers while they are in operation. It is then redistributed to another part of the process where heating is required.⁵

4. <https://www.sciencedirect.com/topics/engineering/plate-heat-exchangers>

5. <https://theengineeringmindset.com/plate-heat-exchanger-applications/#:~:text=You'll%20find%20gasket%20plate,cooling%20load%20on%20the%20chillers.>

Features that help you achieve a new standard

Alfa Laval's next-generation gasketed plate heat exchangers contain unique features to help your business achieve new levels of efficiency, reliability and serviceability.



Efficiency



CurveFlow™ distributor area Improves media flow and minimizes the risk of fouling



OmegaPort™ non circular port holes Ensures media flow and thermal efficiency



Offset Gasket Groove Ensures plate utilization for maximum heat transfer efficiency



FlexFlow™ plate design Improves thermal efficiency and optimizes pressure drop utilization

Reliability



Five-point alignment Ensures reliable plate positioning and easy service of large units



Steerlock™ plate alignment Ensures reliable plate positioning and easy service



PowerArc™ plate pattern divider Improves plate rigidity for longer lifetime



RefTight™ sealing system High-performance gasket sealing for high-pressure duties

Serviceability



ClipGrip™ gasket attachment Ensures perfect seal and trouble-free maintenance



Bearing boxes Guarantees an easy-to-open unit for smoother, more efficient maintenance



T-bar roller Provides a lower unit that is easy to service



Compact frame Facilitates maintenance and minimizes service area requirement

Alfa Laval Industrial Line

Our wide range of industrial gasketed plate heat exchangers includes models that are suitable for all types of industries. We can support applications ranging from heating, cooling and heat recovery to condensation and evaporation, and we are constantly looking to expand and upgrade with new performance criteria and greater flexibility.



Alfa Laval's next-generation of gasketed plate heat exchangers feature a range of unique innovations that break new barriers in industrial heating and cooling applications.

Scope of Alfa Laval Industrial line*

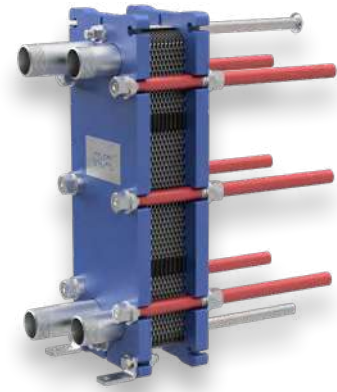
Dimensions	From	To
Port size mm (in)	20 (0.79)	500 (19.7)
Height mm (in)	380 (15)	4095 (161)
Width mm (in)	180 (5.5)	1550 (61)
Design limitations		Up to
Maximum flow capacity (m ³ /hour)	-	4946
Max design pressure barg (psig)	-	35 (507)
Max temperature °C (°F)	-	180 (356)

The table contains values with the intention of providing a general overview. Actual values vary depending on the frame, plates and gasket materials used in the final configuration. Contact your local sales representative for more specific details.

	Hydraulic Oil ISO VG 46/Water	General Cooling Water/Water	General Heating Water/Water
TempIn Hot(°F)	140	100	176
TempOut Hot(°F)	100	80	140
TempIn Cold (°F)	75	65	130
TempOut Cold (°F)	90	85	165
Max PSIG Hot/Cold	10	10	10

Temperature In
Temperature Out chart.

Model M-3

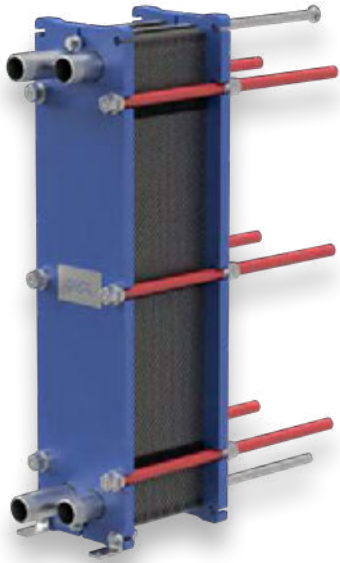


Height	18.9"
Width	7.09"
Min Length	16.5"
Max Length	24.4"
Type of Connection	Stainless Steel Pipe
Connection Size	1-1/4" NPT
Plate Material	316 Stainless Steel
Plate Thickness	0.50mm

Model	Plates	Part #	Oil Cooling		General Cooling		General Heating	
			Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)
M3	15	8240170849	3	1	75	7	50	3
M3	20	8240171381	7	1	100	10	65	4
M3	25	8240171385	10	1	125	13	80	5
M3	30	8240171386	10	1	150	15	100	6
M3	35	8240171388	14	2	175	18	125	7
M3	40	8240171391	17	2	200	20	150	9
M3	45	8240171392	17	2	225	22	165	10

See Temperature In / Temperature Out table on page 7.

Model TL-3



Height	31.1"
Width	7.5"
Min Length	16.5"
Max Length	53.9"
Type of Connection	Stainless Steel Pipe
Connection Size	1-1/4" NPT
Plate Material	316 Stainless Steel
Plate Thickness	0.50mm

Model		Plates	Part #	Oil Cooling		General Cooling		General Heating	
				Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)
Small Pressing Depth	TL3B	10	8240171407	20	3	100	10	75	4
	TL3B	15	8240171409	34	6	150	15	125	7
	TL3B	20	8240171411	51	8	200	20	200	11
	TL3B	25	8240171412	61	10	250	25	250	14
	TL3B	30	8240171414	68	11	300	30	300	17
	TL3B	35	8240171415	85	14	350	35	350	20
	TL3B	40	8240171418	102	17	400	40	400	23
	TL3B	45	8240171419	119	20	450	45	475	27
	TL3B	50	8240171421	136	23	500	50	550	31
Medium Pressing Depth	TL3P	10	8240171425	10	1	90	9	40	2
	TL3P	15	8240171427	27	5	120	12	100	5
	TL3P	20	8240171428	34	6	170	17	150	8
	TL3P	25	8240171430	51	8	220	22	175	10
	TL3P	30	8240171431	61	10	270	27	200	11
	TL3P	35	8240171432	68	11	330	33	250	14
	TL3P	40	8240171434	75	12	370	37	325	18
	TL3P	45	8240171436	85	14	420	42	350	20
	TL3P	50	8240171437	102	17	480	48	400	23

See Temperature In / Temperature Out table on page 7.

Model T-5

Height	29"
Width	9.7"
Min Length	5.9"
Max Length	13.8"
Type of Connection	Stainless Steel Pipe
Connection Size	2" NPT
Plate Material	316 Stainless Steel
Plate Thickness	0.50mm



Model		Plates	Part #	Oil Cooling		General Cooling		General Heating	
				Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)
Small Pressing Depth	T5B	15	8240152917	68	10	200	20	100	6
	T5B	20	8240152918	89	12	300	30	150	9
	T5B	25	8240152920	119	17	400	40	200	11
	T5B	30	8240152921	136	19	500	50	250	14
	T5B	35	8240152922	167	23	500	50	300	17
	T5B	40	8240152923	188	26	600	60	350	20
	T5B	45	8240152924	218	31	700	70	400	23
	T5B	50	8240152926	235	33	800	80	450	25
	T5B	60	8240152927	287	40	1000	100	575	33
	T5B	70	8240152928	334	47	1200	120	675	38
Large Pressing Depth	T5M	15	8240152929	17	2	250	25	175	10
	T5M	20	8240152930	27	4	275	27	250	14
	T5M	25	8240152931	34	5	350	35	300	17
	T5M	30	8240152932	44	6	425	40	400	23
	T5M	35	8240152933	51	7	550	55	450	25
	T5M	40	8240152934	61	9	700	70	550	31
	T5M	50	8240152935	78	11	850	85	700	40

See Temperature In / Temperature Out table on page 7.

Model T-6



Height	35"
Width	12.6"
Min Length	18.7"
Max Length	54.2"
Type of Connection	Stainless Steel Lined
Connection Size	2" Studded Port
Pressure Rating	150#
Plate Material	316 Stainless Steel
Plate Thickness	0.50mm

Model		Plates	Part #	Oil Cooling		General Cooling		General Heating	
				Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)
Small Pressing Depth	T6B	15	8240152969	102	14	350	35	250	14
	T6B	20	8240152971	130	18	450	45	350	20
	T6B	25	8240152972	171	24	650	65	500	28
	T6B	30	8240152974	205	29	750	75	600	34
	T6B	35	8240152975	246	34	950	95	700	40
	T6B	40	8240152976	273	38	1150	115	850	48
	T6B	45	8240152977	314	44	1250	125	1000	57
	T6B	50	8240152978	348	49	1350	135	1100	63
	T6B	55	8240152979	416	58	1450	145	1200	68
	T6B	60	8240152980	485	68	1550	155	1300	75
Medium Pressing Depth	T6B	70	8240152981	560	78	1650	165	1600	91
	T6P	15	8240152960	68	11	300	30	200	11
	T6P	20	8240152959	85	14	500	50	300	17
	T6P	25	8240152961	102	17	700	70	400	22
	T6P	30	8240152962	136	23	800	80	500	28
	T6P	35	8240152963	157	26	900	90	600	34
	T6P	40	8240152964	191	32	1000	100	700	40
	T6P	45	8240152965	205	34	1200	120	800	45
	T6P	50	8240152966	239	39	1400	140	850	48
	T6P	60	8240152967	293	48	1500	150	1100	62
T6P	70	8240152968	341	56	1600	160	1300	74	

See Temperature In / Temperature Out table on page 7.

Model TL-6



Height	49.8"
Width	12.6"
Min Length	24.6"
Max Length	66.5"
Type of Connection	Stainless Steel Lined
Connection Size	2" Studed Port
Pressure Rating	150#
Plate Material	316 Stainless Steel
Plate Thickness	0.50mm

Model	Plates	Part #	Oil Cooling		General Cooling		General Heating	
			Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)
TL6B	20	8240152994	78	11	550	55	600	35
TL6B	30	8240152995	78	11	800	80	1000	57
TL6B	40	8240152996	123	17	1100	110	1500	85
TL6B	50	8240152997	171	24	1350	135	1750	105
TL6B	60	8240152998	198	28	1600	160	2150	123
TL6B	70	8240152999	212	30	1800	180	2500	145
TL6B	80	8240153000	259	36	2100	210	2900	165
TL6B	90	8240153001	290	41	2300	230	3200	185
TL6B	100	8240153002	341	52	2500	250	3500	200

See Temperature In / Temperature Out table on page 7.

Model T-8



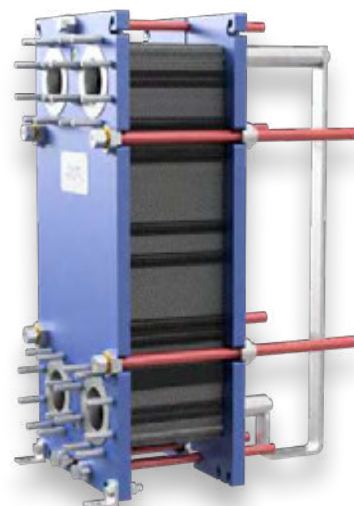
Height	35"
Width	15.78"
Min Length	18.86"
Max Length	66.38"
Type of Connection	Stainless Steel Lined
Connection Size	3" Studded Port
Pressure Rating	150#
Plate Material	316 Stainless Steel
Plate Thickness	0.50mm

	Model	Plates	Part #	Oil Cooling		General Cooling		General Heating	
				Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)
Small Pressing Depth	T8B	20	8240152989	102	14	600	60	400	23
	T8B	30	8240152990	157	14	900	90	600	34
	T8B	40	8240152991	218	22	1300	130	900	51
	T8B	50	8240152992	280	31	1600	160	1100	62
	T8B	60	8240152993	334	39	2000	200	1350	77
Large Pressing Depth	T8M	20	8240152982	27	4	450	45	350	20
	T8M	25	8240152983	34	5	550	55	450	25
	T8M	30	8240152984	48	5	650	65	550	31
	T8M	35	8240152985	55	7	950	95	650	37
	T8M	40	8240152986	61	8	1000	100	750	43
	T8M	45	8240152987	68	9	1100	110	850	49
	T8M	50	8240152988	82	10	1200	120	950	55

See Temperature In / Temperature Out table on page 7.

Model T-10

Height	41.5"
Width	18.5"
Min Length	16.14"
Max Length	76"
Type of Connection	Stainless Steel Lined
Connection Size	4" Studded Port
Pressure Rating	150#
Plate Material	316 Stainless Steel
Plate Thickness	0.50mm



Model		Plates	Part #	Oil Cooling		General Cooling		General Heating	
				Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)	Capacity (kbtu/h)	Flow Rate (GPM)
Small Pressing Depth	T10B	20	8240153010	198	28	950	95	400	23
	T10B	30	8240153011	307	43	1200	120	700	40
	T10B	40	8240153012	427	60	1700	170	950	54
	T10B	50	8240153013	546	77	2200	220	1300	75
	T10B	60	8240153014	665	93	2700	270	1550	88
	T10B	70	8240153015	785	110	3200	320	1800	103
	T10B	80	8240153016	904	127	3700	370	2000	114
	T10B	90	8240153018	1024	143	4200	420	2300	131
	T10B	100	8240153019	1143	160	4700	470	3500	200
	T10B	110	8240153020	1228	172	5200	520	3800	217
Large Pressing Depth	T10M	20	8240153003	51	7	500	50	450	25
	T10M	30	8240153004	78	11	800	80	650	37
	T10M	40	8240153005	109	15	1100	110	900	51
	T10M	50	8240153006	136	19	1400	140	1250	71
	T10M	60	8240153007	164	23	1700	170	1750	97
	T10M	70	8240153008	198	28	2000	200	1900	108

See Temperature In / Temperature Out table on page 7.



Choosing the right gasket material

Creating the right rubber compound for each type of installation can involve selecting five to 15 different substances from around 1,700 polymer grades, vulcanising chemicals and processing materials. While it might appear a straightforward process, gasketing a GPHE requires a high level of technical expertise and solid understanding of how chemicals interact.

Rubber type	Applications	Maximum temperature
Nitrile butadiene rubber (NBRP)	Compatible with oil and fats. Low chemical resistance to acids and bases	140°C (284°F)
Hydrogenated nitrile butadiene rubber (HNBR)	Better chemical resistance compared to NBR. Compatible with hydrocarbons, oils and fats	160°C (320°F)
EPDM	Better chemical resistance to acids and bases	180°C (356°F)
FKMG	Strong chemical resistance and compatibility with oils	150°C (302°F)
FKMT	Performance grade, especially for high temperatures. Slightly lower chemical resistance than FKMG	180°C (356°F)
FEPM	Suitable for gas sweetening applications	160°C (320°F)
Q (Silicone performance grade)	Medical grade, for applications with ultra-pure water	100°C (212°F)
Chloroprene/paraprene	Ammonia applications	110°C (230°F)

Nomenclature

Generation name

The first letter in the name designates what generation the heat exchanger is.

T - is the latest generation of plate heat exchangers.

M - is the previous generation.

Connection size

Designates connection size in centimeters.

Frame type

Last two letters designate the frame type and pressure capacities.

Examples:

FM	1001	PSIG
FG	1501	PSIG
FD	3001	PSIG
FS	4001	PSIG

T L 10 - P FG

Frame height

The second letter in the name designates the height of the frame.

L - is long

X - is also long

S - is short

K - is short

Plate pressing

This letter designates the type of pressing on the plate

B - Small pressing depth, i.e. narrow channel (-2mm)

P - Medium pressing depth (-3mm)

M - Large pressing depth (-4mm)

Plate Type

After pressing information there can be an additional letter designating a specialty unit type.

No extra letter - Regular gasketed plates

D - Double wall unit

W - Semi-welded unit.

S - Widegap unit

SM - Wide gap unit

X - Widegap unit



02

Features & Benefits

Alfa Laval Industrial line is a wide product range that is used in virtually all types of industry.

Designed for high throughput, this model delivers excellent thermal performance. A large selection of plate and gasket types is available.

Applications:

- HVAC heating and cooling
- Refrigeration
- Oil cooling
- Industrial heating and cooling

Key benefits of the demand new standards features

- up to 15% higher efficiency
- 24% higher flow capacity
- up to 40% improved self-cleaning capability

Alfa Laval's advantage

Towards new standards in efficiency, reliability and serviceability

- High energy efficiency
- Flexible - configureable for broad range of applications
- Ensures optimal performance in specific applications based on specific needs
- Easy to install
- High serviceability

Our industrial plate heat exchangers are energy efficient, compact, simple to maintain, easy to adjust for capacity changes and represent a relatively low capital investment. The vast range of options when it comes to size, plate and gasket material and add-ons means they can be specifically designed and configured for your application, from the simplest of duties to the most demanding where requirements on both performance and documentation are high.

03

Conclusion

Key to efficient heat transfer

High performance is better than more surface area.

- ✓ Distribution of the fluids across the plate, and the plate pack.
- ✓ The use of all of the available pressure drop on the heat transfer surfaces.
- ✓ Getting the maximum value of your heat transfer surface, not the amount of heat transfer surface you have.



This is Alfa Laval

Alfa Laval is active in the areas of Energy, Marine, and Food & Water, offering its expertise, products, and service to a wide range of industries in some 100 countries. The company is committed to optimizing processes, creating responsible growth, and driving progress – always going the extra mile to support customers in achieving their business goals and sustainability targets.

Alfa Laval's innovative technologies are dedicated to purifying, refining, and reusing materials, promoting more responsible use of natural resources. They contribute to improved energy efficiency and heat recovery, better water treatment, and reduced emissions. Thereby, Alfa Laval is not only accelerating success for its customers, but also for people and the planet. Making the world better, every day. It's all about Advancing better™.

in @Alfa Laval

 @Alfa_Laval

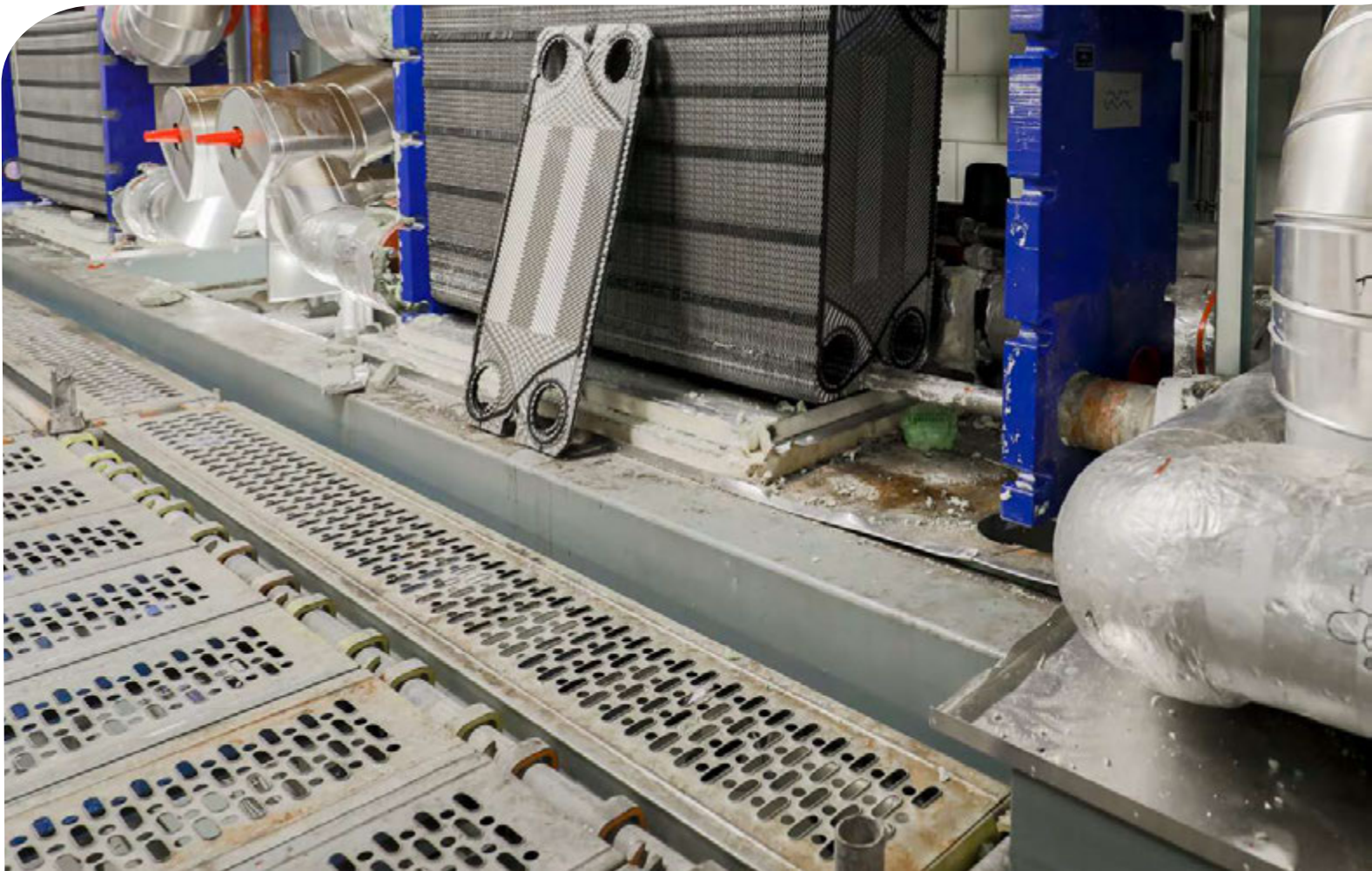
 @AlfaLavalAB

How to contact Alfa Laval

Contact details for all countries are continually up- dated on our web site. Please visit www.alfalaval.com to access the information.

For more information, or to book a call with an engineer, please visit: alfalaval.us

Literature Code



Alfa Laval Tubes and Fittings

Introduction

Alfa Laval is your complete source for specialized fittings and tubing required in food, dairy, beverage, personal care, biotechnology and pharmaceutical process applications. Smooth, crevice-free interiors and secure, self-aligning joints are characteristic for Alfa Laval Fittings. Each offers superior corrosion-resistance and unmatched service life. Alfa Laval fittings are designed and manufactured to ensure dimensional accuracy and structural integrity, making them easy to install. Tubing is manufactured to Alfa Laval's stringent specifications, making it a perfect match for the weld fittings. Choose from a wide range of tube sizes, surface finishes and connect options. All products are labelled with a bar code, product information and manufacturing date. This provides the optimum identification and ensures that the product arrives to the job site in a clean orbital weld condition. The Alfa Laval tubes and fittings are divided into two product ranges, Hygienic and UltraPure. The Hygienic range is suitable for most standard duties and the UltraPure range is suitable for duties with extra high demands on hygiene and cleanability.

Hygienic range tubes and fittings

The Hygienic product range offers a wide range of tubes and fittings with an internal surface finish from $Ra < 1.6 \mu m$. The Hygienic range has tubes and fittings according to EN10357-A (DIN 11850), ISO 2037 and BS 4825. Tri-Clover Tri-Clamp® and Tri-Weld® Fittings are part of Alfa Laval's product line produced according to ASME BPE dimension standards. Tubing is manufactured to Alfa Laval's stringent specifications, making it a perfect match for the Weld Fittings. Choose from a complete range of tube sizes and connection options. The internal surface finish is $Ra < 0.8 \mu m$. All product wetted stainless steel items in the Hygienic range are delivered with 3.1. certificate in accordance with EN 10204.

UltraPure range tubes and fittings

Alfa Laval is proud to present the line of Fittings designed for use in the Pharmaceutical and Bio-Technologies Industries. This line consists of Tri-Clover® parts with either Tri-Weld® ends suitable for use with Orbital Welding Equipment or self-aligning Tri-Clamp® end connections. Alfa Laval offers a full line of UltraPure Fittings that are manufactured in compliance with the current ASME BPE Standard. All BPE items are individually capped and bagged. All products are labelled with a bar code, product information and manufacturing date. This provides the optimum identification and ensures that the



product arrives to the job site in a clean orbital weld condition. The UltraPure product range offers an internal surface finish from $Ra < 0.8 \mu m$, either electro polished or mechanically polished. All product wetted stainless steel items in the UltraPure range are delivered with MTR (Mill Test Report) or with 3.1. certificate in accordance with EN 10204. The UltraPure range is manufactured under extra strict and thorough quality control methods. Wall thickness integrity is maintained by fabrication grade minimum wall tubing for all cold-formed tubular products. After cold forming, our tube product is resized to ensure that the ovality falls within the prescribed tolerances. End facing is provided with a machined square-cut method. This allows for the most accurate and consistent orbital weld result. All fittings are put through 100% visual inspection and ovality and squareness tolerances are inspected with calibrated equipment. Surface finish is inspected with a calibrated profilometer to ensure the Roughness average (Ra) maximum is not exceeded.

TECHNICAL DATA

Alfa Laval offers a range of Mechanical Polish as well as Electropolish finishes. Mechanical polishing is achieved by using a progressive series of abrasives, from low to high grit. This allows a consistent internal finish and both optimal and economical cleaning. Electropolishing is a further process that promotes a chromium-enriched surface layer that maximizes corrosion resistance as well as minimizing bacterial build up on surface cavities. Metallurgy - Incoming raw material goes through a stringent inspection process to ensure its chemistry will be ideal for both weldability and electropolishing Quality Control Methods - Our manufacturing facilities operate under an approved ISO 9001 quality standard. Wall thickness integrity is maintained with fabrication grade minimum wall tubing for all cold-formed tubular products. Our BPE fittings are designed for use with all current orbital welding equipment. After cold forming, our tube product is resized to ensure that the ovality falls within the prescribed BPE tolerances. End facing is provided with a machined square-cut method. This allows for the most accurate and consistent orbital weld result. All fittings are put through 100% visual inspection and ovality and squareness tolerances are inspected with calibrated equipment. Surface finish is inspected with a calibrated profilometer to ensure the Roughness average (Ra) maximum is not exceeded. Hygienic fittings identified with this symbol on the following pages are accepted as meeting the 3A Hygienic standards by the appropriate committees of the International Association of Milk, Food and Environmental Sanitarians, U.S. Public Health Service, and Dairy Industry Committee.

Surface specification for Alfa Laval Hygienic range

Hygienic tubes

Alfa Laval designation	Surface texture (Ra µm)			Standard designation	According to	Treatment	Dimension ranges			
	Internal Surface	Welded area	External				EN 10357-A	ISO 2037	BS 4825	Tri-Clover® Hygienic
BC	< 0.8	< 1.6	pickled	BC	EN 10357-A	Annealed	X	X	X	
BD	< 0.8	< 1.6	< 1.0	BD	EN 10357-A	Annealed	X	X	X	
CC	< 0.8	< 1.6	pickled	CC	EN 10357-A	Not annealed	X			
CD	< 0.8	< 1.6	< 1.0	CD	EN 10357-A	Not annealed	X			
Tri-Clover® Hygienic	< 0.8	< 0.8	< 0.8	No. 4 ¹	3A	Annealed				X

¹ According to 3A 33-01 section D1

Hygienic Fittings

Product	Surface designation		Dimension ranges			
	Internal	External	DIN	ISO	BS	Tri-Clover® Hygienic
Unions	Mat	Mat	X			
	Semi bright	Semi bright	X	X	X	
	Mirror	Mirror				
	3A	3A				X
Bends	Mat	Mat	X			
	Raw	Raw			X	
	Raw	Semi bright	X			
	Raw	Polished	X	X		
	Semi bright	Semi bright		X		
	Polished	Polished			X	
	Mirror	Mirror				
	3A	3A				X
Tees	Mat	Mat	X			
	Raw	Raw			X	
	Polished	Polished	X	X	X	
	Mirror	Mirror				
Reducers	3A	3A				X
	Mat	Mat	X			
	Raw	Semi bright	X			
	Raw	Polished		X	X	
	Semi bright	Semi bright		X		

Explanation of surface designation for fittings

Alfa Laval designation	Surface texture (Ra µm)		Method
	Internal	Bended area	
Mat	< 1.6	Not spec.	Shot Blasted
Raw	< 0.8 ¹	Not spec.	As fabricated or tumbled
Semi bright	< 0.8	Not spec.	As fabricated or tumbled

¹ Not guaranteed in welds

Alfa Laval designation	Surface texture (Ra µm)		Method
	Internal	Bended area	
Polished	< 0.8	Not spec.	Mechanically polished
Mirror	< 0.8	Not spec.	Mechanically polished and buffed for a shiny surface
3A	< 0.8	< 0.8	Mechanically polished or as fabricated

¹ Not guaranteed in welds

Surface specification for Alfa Laval Tri-Clover® UltraPure range

UltraPure tubes and fittings

Alfa Laval designation	Surface texture (Ra µm)			Standard designation		According to	Treatment	Tri-Clover® UltraPure ASME-BPE
	Internal	Welded / Bended area	External	Tubular	Machined			
PL	< 0.5	< 0.5	< 0.8	SF1	SF1	ASME BPE	Annealed	X
PM	< 0.38 EP ¹	< 0.38 EP ¹	< 0.8	SF4	SF4	ASME BPE	Annealed	X

¹ Electro polished

Conversion table - Surface finish

Correlation between Grit and Ra values

Ra (µm)	Ra (µ inch)	US Grit	UK Grit
3	125		120
2	85		180
1.65	70	80	
1.5	50		240
0.75	30		320
0.62	25	180	
0.45	18	240	
0.40	15		500
0.25	10	320	

Material specification for Alfa Laval Hygienic range

Wetted steel parts

Material	Dimension ranges			
	EN 10357-A	ISO 2037	BS 4825	Tri-Clover® Hygienic
1.4301 ¹ (304)	X	X		
1.4307 ¹ (304L)	X	X	X	
1.4401 ¹ (316)			2	
1.4404 ¹ (316L)	X	X	X	
304 ³				X
316L ³				X

¹ According to DIN EN 10088-1

² Reducing tees are only available in 1.4401 (316)

³ According to ASTM A 269 and A 270

Seal ring material for clamp fittings

Material	Dimension ranges			
	EN 10357-A	ISO 2037	BS 4825	Tri-Clover® Hygienic
NBR	X	X	X	
Nitrile (Buna-N)				X
White Nitrile (White Buna-N)				X
EPDM	X	X	X	X
FPM	X	X	X	
Viton®				X
PTFE	X	X	X	X
Silicone (Q)	X	X		X

Material specification for Alfa Laval Tri-Clover® UltraPure range

Wetted steel parts

Material	Dimension ranges
	Tri-Clover® UltraPure ASME-BPE
316L ¹	X

¹ According to ASTM A 269 and A 270 S2. All Tri-Clover® UltraPure ASME BPE weld ends are also according to ASME BPE sulphur content 0.005-0.017%

Gasket material in fittings

Material	Dimension ranges
	Tri-Clover® UltraPure ASME-BPE
Nitrile (Buna-N)	X
White Nitrile (White Buna-N)	X
EPDM	X ¹
FPM	
Viton®	X ¹
White Viton®	X
PTFE	X
Silicone (Q)	X ¹

¹ EPDM, Viton and Silicone available with USP Class 6 certificate - please request by order

Chemical composition table

Material Grade		Chemical composition in % by mass								
Material Number	Standard	C	Si	Mn	P	S	N	Cr	Ni	Mo
1.4404	DIN-EN 10088-1	≤ 0.030	≤ 1.000	≤ 2.00	0.045	≤ 0.015	≤ 0.11	16.50 - 18.50	10.00 - 13.00	2.00 - 2.50
316L	ASTM A 269	≤ 0.035	≤ 0.750	≤ 2.00	0.040	≤ 0.030		16.00 - 18.00	10.00 - 15.00	2.00 - 3.00
316L ¹	ASTM BPE / ASTM A 270 S-2	≤ 0.035	≤ 0.075	≤ 2.00	0.040	0.005 - 0.017		16.00 - 18.00	10.00 - 10.00	2.00 - 3.00

¹ According to ASTM A 269 and A 270 S2. All Tri-Clover® UltraPure ASME BPE weld ends are also according to ASME BPE sulphur content 0.005-0.017%

Pressure ratings (bar) for Alfa Laval Hygienic range

Material	Dimension ranges			
	DIN	SMS / ISO 2037	BS 4825	Tri-Clover® Hygienic
Tubes (20 °C)	39/355	39/355	56-467 ¹	56-351 ¹
Bends, Tees, Reducers (80 / 200 °C)	40/16	40/16	25/15	25/15
Nut unions (80 / 200 °C)	40/16	40/16	25/15	
Flange unions (80 / 200 °C)	25/16	25/16	25/15	

¹ Tube pressure ratings depending on size (larger diameter smaller pressure rating)

Pressure ratings (bar) of Tri-Clamp® Connections

Service rating ¹ (bar) of Tri-Clamp® Connections							
Size Tube OD	1/2 & 3/4 inch	1 & 1 1/2 inch	2 inch	2 1/2 inch	3 inch	4 inch	6 inch
13MHMM	(Wing nut tightened to 2.8 Nm of torque)						
at 20 °C	--	34.5	31.0	27.6	24.1	20.7	10.3
at 120 °C	--	20.7	20.7	13.8	13.4	10.3	5.2
13MHHS	(Wing nut tightened to 2.8 Nm of torque)						
at 20 °C	151.7	41.4	37.9	31.0	24.1	20.7	--
at 120 °C	82.7	20.7	19.0	15.5	12.1	10.3	--
A13MHP	Bolts tightened to 27 Nm of torque						
at 20 °C	--	103	68.9	68.9	68.9	55.1	20.7
at 120 °C	--	82.7	55.2	55.2	55.2	41.4	13.8
A13MHM	(Wing nut tightened to 2.8 Nm of torque)						
at 20 °C	--	34.5	31	27.6	24.1	20.7	10.3
at 120 °C	--	20.7	17.2	13.8	12.1	10.3	5.2

¹ Service ratings are based on hydrostatic tests using standard-molded Buna-N material gaskets, with proper installation of ferrules, assembly of joints and absence of shock pressure. All ratings shown are dependent upon related components within the systems and proper installation. For temperatures above at 120 °C, we recommend using only 13MHP clamps.

Service Rating of Tri-Clamp® Connections

Service rating ¹ (PSI) of Tri-Clamp® Connections							
Size Tube OD	½ & ¾ inch	1 & 1½ inch	2 inch	2½ inch	3 inch	4 inch	6 inch
13MHMM	(Wing nut tightened to 25 in. lb. of torque)						
at 70 °F	--	500	450	400	350	300	150
at 250 °F	--	300	300	200	195	150	75
13MHHS	(Wing nut tightened to 25 in. lb. of torque)						
at 70 °F	2200	600	550	450	350	300	--
at 250 °F	1200	300	275	225	175	150	--
A13MHP	(Bolts tightened to 24 in. lb. of torque)						
at 70 °F	--	1500	1000	1000	1000	800	300
at 250 °F	--	1200	800	800	800	600	200
A13MHM	(Bolts tightened to 20 ft. lb. of torque)						
at 70 °F	--	500	450	400	350	300	150
at 250 °F	--	300	250	200	175	150	75

¹ Service ratings are based on hydrostatic tests using standard-molded Buna-N material gaskets, with proper installation of ferrules, assembly of joints and absence of shock pressure. Contact Tri-Clover® for ratings at higher temperatures. All ratings shown are dependent upon related components within the systems and proper installation. For temperatures above 250 ° F, we recommend using only 13MHP clamps. This information is only valid if Tri-Clover® clamps, ferrules, and gaskets are used.

Tri-Clamp® Gasket Materials

	Characteristic	Buna-N (U)	EPDM (E)	Fluoro- elastomer (SFY)	Silicone (X)	PTFE (G)
Original Physical Properties	Hardness, Shore A	70	70	70	70	---
	Tensile Strength, PSI	1875	1650	1212	1340	---
	Elongation, %	340	317	272	260	---
Temperature Range		-65 to 200 °F	-60 to 300 °F	-20 to 350 °F	-40 to 400 °F	-40 to 200 °F ¹
Resistance	Acid Resistance	Good	Good to Excel	Good to Excel	Poor to Good	Good to Excel
	Alkali Resistance	Fair to Good	Good to Excel	Poor to Good	Poor to Fair	Excellent
	Resistance to Fats/Oils	Good to Excel	Poor	Good to Excel	Poor to Good	Excellent
	Abrasion Resistance	Excellent	Good	Good to Excel	Poor	Fair
	Compression Set Resistance	Good	Fair	Good to Excel	Good to Excel	Cold Flows

¹ Note: PTFE materials tendency to "cold flow" and incompressibility, limit its max. temperature to 200 °F due to possible leaking problems.

Basic Dimensions of Tri-Clamp®

Connection for Hygienic OD-Tubing			
OD Outer Diameter (inch)	ID Inner Diameter (inch)	Wall Thickness (inch/gauge)	A Ferrule Face (inch)
½	0.37	0.065 / 16 ga.	0.984
¾	0.62	0.065 / 16 ga.	0.984
1	0.87	0.065 / 16 ga.	1.984
1½	1.37	0.065 / 16 ga.	1.984
2	1.87	0.065 / 16 ga.	2.516
2½	2.37	0.065 / 16 ga.	3.047
3	2.87	0.065 / 16 ga.	3.579
4	3.87	0.083 / 14 ga.	4.682

Hygienic Tube Information

Tube OD	Tube ID	Wall Thickness	Volume	Weight Dry	Weight with Water	Flow (GPM) at a Mean Velocity		
inch	inch	inch	Gal/100 ft	lbs/100 ft	lbs/100 ft	5 fps	7 fps	10 fps
½	0.37	0.065	0.56	30.6	35.3	1.7	2.3	3.4
¾	0.62	0.065	1.57	48.2	61.3	4.7	6.6	9.4
1	0.87	0.065	3.09	65.8	91.5	9.3	13	19
1½	1.37	0.065	7.66	100.9	164.8	23	32	46
2	1.87	0.065	14.27	136.1	255.1	43	60	86
2½	2.37	0.065	22.92	171.2	362.4	69	96	138
3	2.87	0.065	33.6	206.4	486.7	101	141	202
4	3.834	0.083	59.97	351.8	851.9	180	252	360
6	5.782	0.109	136.39	694.7	1832.2	409	573	818
8	7.782	0.109	247.07	930.6	2991.1	741	1038	1482

Technical Information

Pipe Schedule and Chemical Composition

Schedule 5 Pipe

Size	OD inch	ID inch	Wall Thickness
1/8	0.405	0.335	0.035
1/4	0.540	0.442	0.049
3/8	0.675	0.577	0.049
1/2	0.840	0.710	0.065
3/4	1.500	0.920	0.065
1	1.315	1.185	0.065
1 1/4	1.660	1.530	0.065
1 1/2	1.900	1.770	0.065
2	2.375	2.245	0.065
2 1/2	2.875	2.790	0.083
3	3.500	3.334	0.083
3 1/2	4.000	3.834	0.083
4	4.500	4.334	0.083
5	5.563	5.345	0.109
6	6.625	6.407	0.109
8	8.625	8.407	0.109

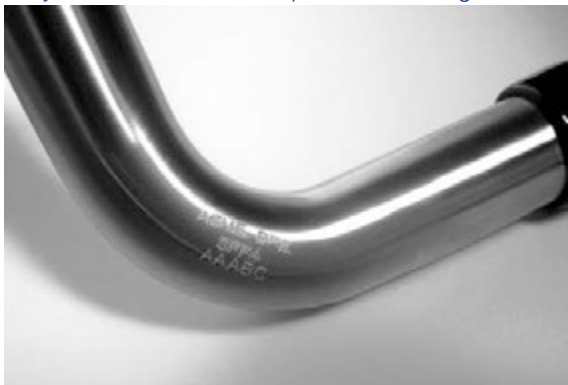
Chemical Composition %

	304	316L
C	0.080	0.030
MN	2.000	2.000
P	0.045	0.045
S	0.030	0.030 ¹
Si	1.000	1.000
Cr	18.0-20.0	16.0-18.0
Ni	8.0-13.0	10.0-14.0
Mo	-	2.0-3.0

¹ The sulfur content for 316L ASME BPE fittings is 0.005-0.017% for all weld ends

Material Test Reports (MTRs)

Easy Online Access to Comprehensive Fittings Information



A 5-alpha character serial ID is marked on to each new 316SS fitting


As one of the most comprehensive and technologically advanced reports in the market, our new Material Test Reports (MTRs) provide detailed information that takes traceability and validation to a new level. Alfa Laval has established a new standard as all MTRs are available 24 hours a day, 7 days a week online at www.alfalaval.us.

Simply type a 5-alpha character code (e.g. AAABC) called the serial ID, which you can find stenciled on each new 316SS fitting, to access the following information:

- All heat certification numbers used to manufacture the fitting
- Date the fitting was manufactured
- The fitting's part number and description
- View and print any MTR and the above information

Connection Types

Clamp Fittings

 Authorized to carry the 3A symbol

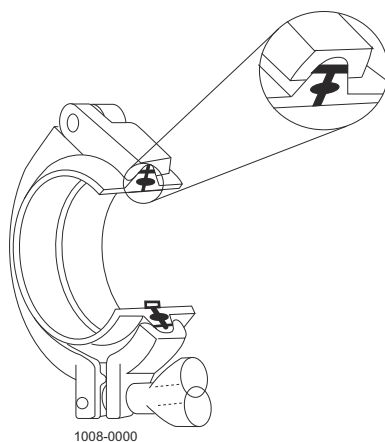



Figure 1. Tri-Clamp

 Authorized to carry the 3A symbol

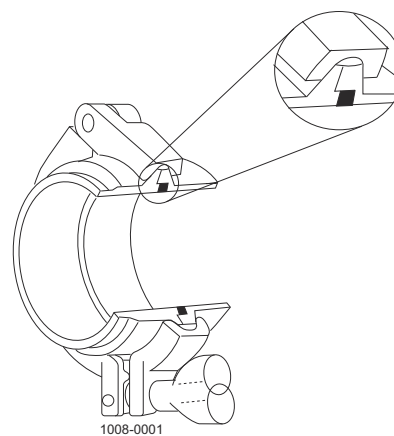


Figure 2. H-Line

A connection is made up of a plain ferrule, a clamp, and a gasket. Tees, elbows and reducers are available with Tri-Clamp connections. All three styles are in compliance with 3A standards for C.I.P. (clean in place). The three types of clamp fittings are designed for use in Food, Dairy, Pharmaceutical and Chemical Industries.

- Tri-Clamp connections are the industry standard, having nueter-style ferrules to simplify design and installation.
- H-Line male/female ferrules self-align during tightening so joints are quick and easy to assemble or take apart.

Loss of head pressure due to friction. Loss is shown in feet of head. Loss through tubing is for 1 ft of tube

Capacity	O.D.	1"	O.D.	1½"	O.D.	2"	O.D.	2½"	O.D.	3"	O.D.	4"
in U.S.	I.D.	0.902"	I.D.	1.402"	I.D.	1.870"	I.D.	2.370"	I.D.	2.870"	I.D.	3.834"
G.P.M.	Tubing	Elbow	Tee	Tubing	Elbow	Tee	Tubing	Elbow	Tee	Tubing	Elbow	Tee
2	0.01	0.01	0.1									
4	0.025	0.02	0.2									
5	0.035	0.025	0.25									
10	0.12	0.06	0.4	0.02	0.01	0.15	0.005	0.015	0.1			
15	0.25	0.1	0.8	0.04	0.02	0.25	0.013	0.02	0.15			
20	0.43	0.22	1.5	0.06	0.03	0.3	0.02	0.025	0.2	0.005	0.02	0.1
25	0.66	0.4	2.3	0.08	0.04	0.4	0.025	0.03	0.25	0.006	0.03	0.15
30	0.93	0.7	3.3	0.105	0.06	0.55	0.035	0.05	0.3	0.008	0.05	0.2
35	1.22	1.25	5.2	0.135	0.09	0.8	0.04	0.06	0.4	0.011	0.06	0.25
40				0.17	0.11	1.0	0.05	0.08	0.5	0.015	0.07	0.3
45				0.21	0.16	1.3	0.063	0.1	0.6	0.02	0.09	0.35
50				0.25	0.2	1.6	0.073	0.12	0.7	0.022	0.1	0.4
60				0.34	0.35	2.2	0.1	0.18	0.9	0.03	0.12	0.45
80				0.57	0.76	3.7	0.16	0.3	1.5	0.05	0.15	0.55
100				0.85	1.35	5.8	0.23	0.44	2.3	0.075	0.18	0.6
120				1.18	2.05	9.1	0.32	0.64	3.3	0.105	0.21	1.0
140							0.42	0.85	4.5	0.14	0.23	1.25
160							0.54	1.13	5.8	0.17	0.28	1.6
180							0.67	1.45	7.4	0.205	0.31	2.0
200							0.81	1.82	9.0	0.245	0.35	2.5
220							0.95	2.22	11.0	0.29	0.41	3.0
240							1.10	2.63	13.5	0.34	0.48	3.7
260										0.39	0.53	4.5
280										0.45	0.61	5.3
300										0.515	0.7	6.2
350										0.68	1.05	8.5
400										0.86	1.55	11.0
450										1.05	2.25	13.5
500										0.54	1.4	8.0
550										0.64	1.7	9.5
600										0.75	2.05	10.2
650										0.87	2.41	13.0

Capacity	O.D.	1"	O.D.	1½"	O.D.	2"	O.D.	2½"	O.D.	3"	O.D.	4"
in U.S.	I.D.	0.902"	I.D.	1.402"	I.D.	1.870"	I.D.	2.370"	I.D.	2.870"	I.D.	3.834"
G.P.M.	Tubing	Elbow	Tee	Tubing	Elbow	Tee	Tubing	Elbow	Tee	Tubing	Elbow	Tee
700										1.0	2.8	15.0
750												0.23
800												0.26
850												0.3
900												0.33
950												0.37
1000												0.41
1050												0.45
1100												0.53

NOTES:

- 1. For elbows - R/D=1.5
- 2. Test medium - water at 70 °F
- 3. Flow thru tees
Flow A to B
Port C capped off

Prepared by members of the Hygienic pump subgroup of the natl. assn. of dairy equipment manufacturers.

Pressure drop and flow velocity curves

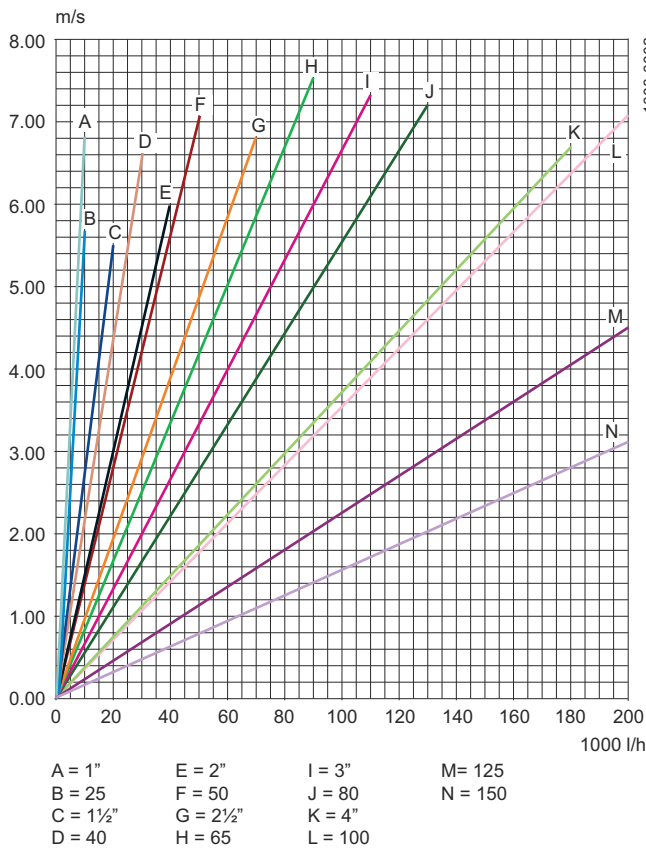


Figure 3. Flow velocity in ISO 2037 and EN 10357-A tubes

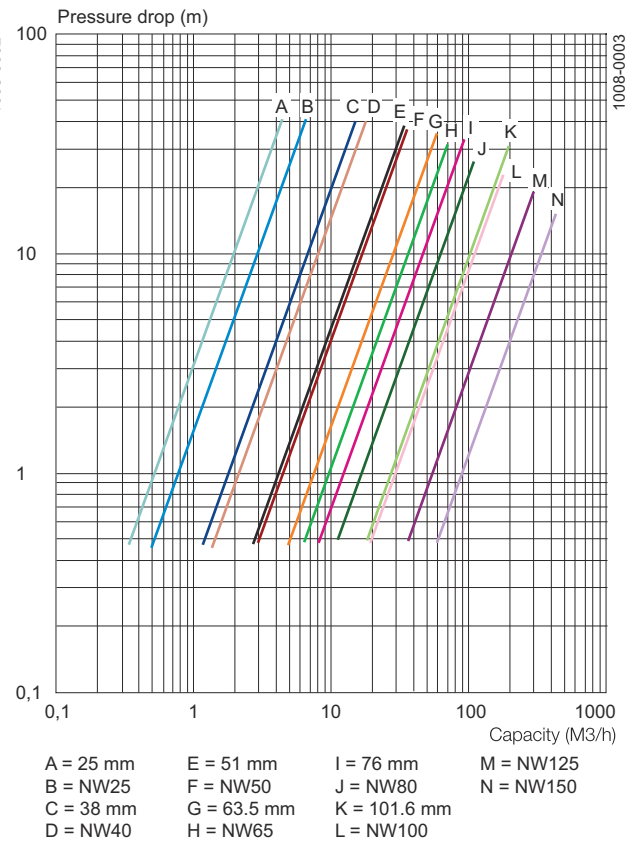


Figure 4. Pressure drop in 100 m ISO 2037 and EN 10357-A tubes

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



Alfa Laval plate heat exchangers

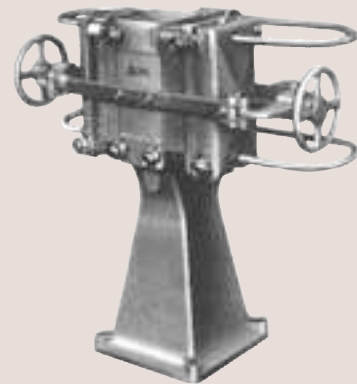
A product catalogue for HVAC



Inside view

- 3 Six sound reasons to buy your PHEs from the market leader
- 4 Alfa Laval gasketed heat exchangers
- 6 Heating applications
- 7 Cooling applications
- 8 Product specifications
- 10 Accessories

Six sound reasons to buy your PHEs from the market leader



Alfa Laval supplied the first plate heat exchangers to the dairy industry in 1931. Plates were 5-10 mm thick with a milled pattern, compared with 0.4 mm today. In developing our range of plate heat exchangers, we have focused on cost-efficiency.

1. Technology that saves you money

The result of decades of development and testing, Alfa Laval plate heat exchangers utilise well-proven materials and advanced designs that optimize performance. Most important of all, they reduce your operating costs and save you money.

2. Service-friendly designs

Service-friendly designs ensure that even the largest Alfa Laval PHE can be serviced rapidly and easily by one person using standard tools. This reduces downtime, enhances safety and ensures a longer equipment life-time.

3. A wide range of solutions

Let us advise you on the correct solutions for your specific needs. Alfa Laval PHEs come in a wide range of sizes and capacities. Different plate patterns are available for various duties and performance specifications. A range of pressing depths from 1.5 mm to 11 mm ensures an optimal plate design for any duty. Two-pass plate packs can give double capacity in the same floor space.

4. Full compliance with PED

All Alfa Laval PHEs comply with the European Pressure Vessel Safety Directive, PED, in terms of mechanical and materials specifications. They can also be delivered according to other relevant standards, such as ASME. Various national codes are also available.

5. A partner you can trust

Genuine application know-how and long experience make Alfa Laval the ideal business partner for heating and cooling. Rely on us to supply the most cost-effective solution for your specific needs – we won't let you down.

6. Fast deliveries and service worldwide

Alfa Laval is a truly global company. Our regional distribution centres serve Alfa Laval facilities and distributors worldwide, ensuring fast delivery to customers. We also have more than 30 Alfa Laval PHE Service Centres throughout the world. Wherever you are, talk to us, we're only a phone call away.

Choosing Alfa Laval makes sound financial sense



Alfa Laval gasketed heat exchangers

Alfa Laval plate heat exchangers (PHEs) are the most cost-efficient solution available for your comfort heating and cooling needs. The result of decades of development and testing, our PHEs utilise well-proven materials and advanced designs that optimise performance and reduce your operating costs. We are the market leader. Our cost-efficient products and unmatched global distribution and service capabilities make us the ideal business partner.

- Single-step pressing of plates down to 0.4 mm
- Unique plate patterns for optimal heat exchange
- Clip-on or glued gaskets

Reliability in a single step

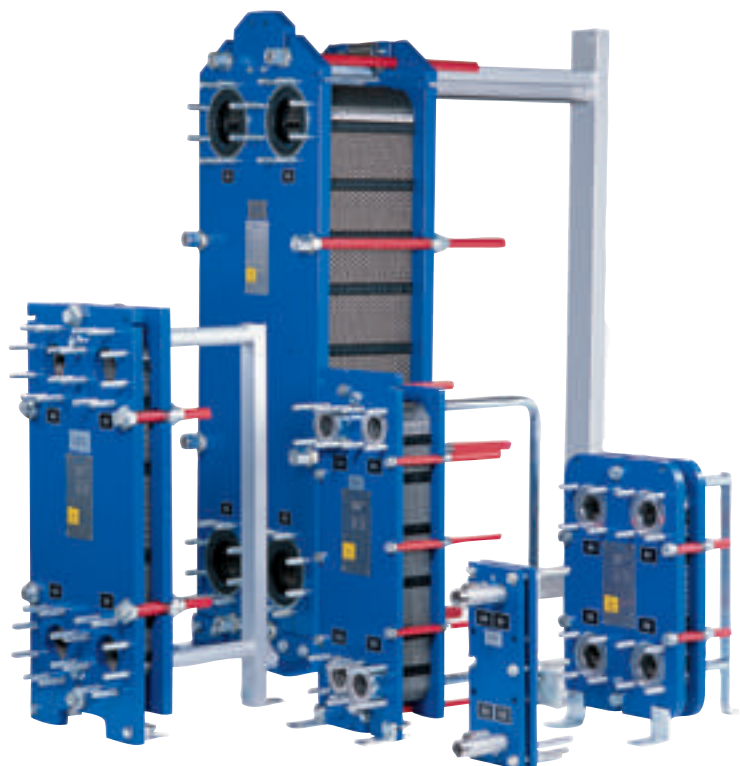
The heat transfer efficiency and degree of process control offered by a PHE depend partly on the thickness of the plates. In today's advanced Alfa Laval units, plates as thin as 0.4 mm, normally in stainless steel, offer highly efficient heat transfer and impressive strength.

Each plate is pressed in a single step in a hydraulic press exerting a pressure of up to 40,000 tons. Thus all plates are identical, minimising the risk of distortion and leakage when hundreds are stacked together in a PHE. When assembled with gaskets, the metal-to-metal contact points on the plates create a flexible, yet mechanically stable construction that can withstand enormous stress.

The pattern of performance

The corrugated pattern on the plates gives parallel flow and strength. The "chocolate" pattern of the distribution area ensures even distribution of the fluid over the plate surface, while the herringbone pattern in the main heat transfer area creates maximum turbulence. Together, these features ensure high heat transfer efficiency and eliminate dead spots that can lead to scaling and corrosion.

With parallel flow, only one plate type and one gasket type are required in the heat exchanger. This means fewer spare parts and simpler installation and maintenance. As the plate corrugations are fully supported diagonally across the entire surface, a higher design pressure can be achieved, or plates can be made thinner.





- Wide range of products for every need
- Extremely reliable
- Highly service-friendly

The seal of approval

Our ongoing development and testing of gasket materials for specific duties, ensure that Alfa Laval gaskets last longer. Made from nitrile (NBR) or EPDM, they are moulded in one piece, guaranteeing exact gasket geometry. Our "roof-top" gasket profile produces a highly efficient seal, minimising the risk of leakage.

The groove on the plate and the gasket are a perfect match, ensuring full support for the gasket and eliminating the risk of a gasket blow-out. The gasket groove design ensures minimum contact between the media and the gasket, another factor that makes our gaskets last longer.

Bonded for life

Alfa Laval gasket fastening solutions guarantee a perfect result. The Alfa Laval glue-free clip-on gasket makes re-gasketing fast and simple.

Where the PHE is opened frequently, glued gaskets are an excellent solution. Alfa Laval uses two-component, oven-cured epoxy glue to bond the gasket to the plate. This more than doubles gasket life-time compared to using standard rubber glues.

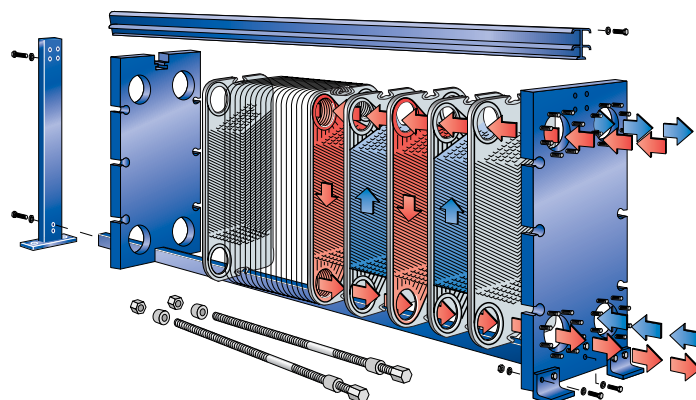


Designed with service in mind

Alfa Laval gasketed PHEs of all sizes can be opened quickly and easily for inspection and gasket replacement by one man using standard tools. They are reassembled just as easily.

Our large units feature Alfa Laval's 5-point alignment system. Precise positioning of the plates horizontally and vertically ensures efficient sealing throughout the plate pack. A roller on the pressure plate, and bearing boxes on the four tightening bolts, make opening and closing an easy task.

Simpler in design, our smaller PHEs are equally service-friendly, while keeping costs to a minimum. During reassembly, alignment of the plate pack is achieved using the round carrying and guide bar. Corner guides lock the plates in position and ensure perfect final alignment.



Heating applications

PHEs in heating systems

Plate heat exchangers are commonly used in all types of heating applications with demands on comfort, reliability and safety. In addition to transferring heat from one circuit to another, the heat exchanger also efficiently handles the pressure differences that normally exist between the primary and secondary sides. The Alfa Laval range of gasketed plate heat exchanger models covers all comfort heating duties like tap water heating and swimming pool heating, from small to large capacities. Thanks to a flexible design, the PHE can be tailor-made to fit your specific needs exactly.

Tap water heating

The advantages of using a plate heat exchanger to produce hot tap water compared to traditional coil in tank systems are numerous. The PHE instantly heats the tap water to the required temperature when it passes through the heat exchanger. This means that hot water is available immediately and at any time. Another benefit with using plate heat exchangers for hot tap water production is that the system requires much less space than a traditional tank and coil system. If solar energy is used to produce hot tap water, a PHE makes it possible to separate the treated water in the solar panels from the tap water circuit. Also, scaling problems and corrosion risks in the solar panels are reduced when separating the circuits with a PHE.



Swimming pool heating

During the summer season when the building's heating system is not used to full capacity, excess heat from the existing heat source can be used for heating outdoor pools. A heat exchanger installed between the swimming pool's circulation system and the building's ordinary heating system separates the circuits and provides pool heating. It's important to remember that addition of chlorine should take place after the water has passed the heat exchanger in order to avoid a high concentration of chlorine flowing through the heat exchanger. It is recommended to use titanium plates when the chloride concentration is high.



Cooling applications

PHEs in cooling systems

The requirement for thermal efficiency - close temperatures - is very high particularly in cooling applications e.g. thermal storage and free cooling. Thanks to Alfa Laval's superior competence in plate pressing, temperature approaches of down to 0.5°C (0.9°F) between the two circuits can be achieved. In addition, this can be accomplished in a single pass connection with all four connections on the front plate, making installation and maintenance very easy.

Central cooling

The main component of the central comfort cooling system is the cold source, commonly a chiller. While cold water or glycol solution is produced on the evaporator side, heat is generated and rejected on the condenser side of the chiller. There are several benefits using a plate heat exchanger in either the hot condenser circuit or the cold evaporator circuit.

The condenser can for example be cooled by an open cooling source like sea or river water. However, the often aggressive media in the open circuits can affect sensitive AC equipment such as the chiller. A plate heat exchanger, installed as a divider between the two systems, eliminates these problems. On the cold evaporator side the plate heat exchanger is used to separate two clean cold circuits, and to protect other equipment from high pressures.

District cooling

District cooling is environment-friendly with better utilisation of cooling capacities and an environment-friendly cooling source. It gives the user convenience and comfort and a better level of equipment redundancy, less need for maintenance and space savings. It also gives the user economical benefits with lower investment costs and flexibility of operation. Using plate heat exchangers in indirect district cooling distribution creates a number of advantages, for example pressure interception between the different circuits. The wide range of Alfa Laval PHE models with different characteristics assures that optimum solutions can be found for virtually all comfort cooling duties.



Small



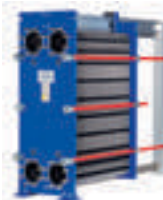
Model	T2	M3	TL3	T5	M6		TL6		
Plate types	T2B	M3/M3D	TL3B/TL3P/TL3BD	T5M/T5B	M6, M6M, M6MD		TL6B		
Frame type	FG	FG	FG	FG	FG	FD	FM	FG	
Height, H [mm]	380	480	790	737	920	940	1264	1299	
Width, W [mm]	140	180	190	245	320	330	320	320	
Min standard length, L [mm]	165	400	420	190	500	500	615	620	
Max standard length, L [mm]	275	650	1370	365	1500	1500	1665	1670	
Vertical port distance, VC [mm]	298	357	668	553	640	640	1036	1036	
Horizontal port distance, HC [mm]	50	60	60	100	140	140	140	140	
Max temperature [°C]	180	180	180	180	180	180	180	180	
Max pressure [barg]	16	16	16	16	16	25	10	16	
PV codes and directives	ALS	ALS, PED, ASME	ALS, PED, ASME	ALS, PED, ASME	ALS, PED, ASME	PED, ASME	ALS, PED	ALS, PED, ASME	ALS
Flange size	–	–	–	–	DN50/2"	DN50/2"	DN50/DN65/2"/2,5"		
Pipe size	3/4"	1 1/4"	1 1/4"	2"	2"		2"		
Max. flow rate [kg/s]	2	4	4	14	16		20		

Medium




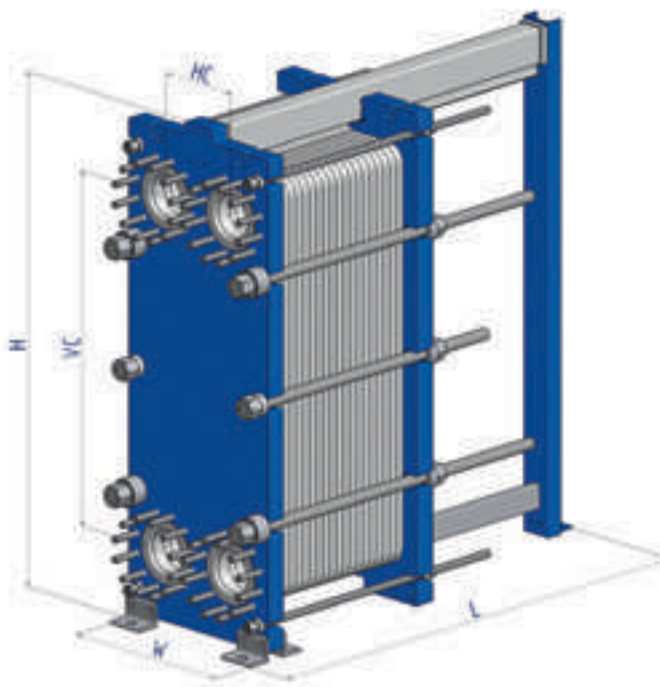
Model	M10				TL10			
Plate types	M10M, M10B, M10BD				TL10B			
Frame type	FL	FM	FG	FD	FM	FG	FD	FS
Height, H [mm]	1084	1084	1084	1084	1885	1923	1923	1923
Width, W [mm]	470	470	470	470	480	480	480	480
Min standard length, L [mm]	800	700	700	800	850	850	850	850
Max standard length, L [mm]	1100	2300	2300	2400	2350	3250	3250	3250
Vertical port distance, VC [mm]	719	719	719	719	1338	1338	1338	1338
Horizontal port distance, HC [mm]	225	225	225	225	225	225	225	225
Max temperature [°C]	130	180	180	180	160	160	160	160
Max pressure [barg]	6	10	16	25	10	16	25	27.6
PV codes and directives	ALS	ALS, PED, ASME	ALS, PED, ASME	ALS, PED, ASME	ALS	ALS, PED, ASME	PED	ASME
Flange size	DN100/4"				DN100/4"	DN100/4"	DN100/4"	4"
Max. flow rate [kg/s]	50				50			

Large



Model	TS20			T20				
Plate types	TS20M			T20M, T20B, T20P				
Frame types	FM	FG	FS	FM	FG	FS	FMS	FGS
Height, H [mm]	1405	1405	1435	2150	2150	2180	2595	2595
Width, W [mm]	740	800	800	750	780	780	920	920
Min standard length, L [mm]	900	900	950	1250	1250	1300	1550	1600
Max standard length, L [mm]	2700	2700	2750	3350	3950	4000	3350	3400
Vertical port distance, VC [mm]	698	698	698	1478	1478	1478	1939	1939
Horizontal port distance, HC [mm]	363	363	363	353	353	363	439	439
Max temperature [°C]	180	180	180	180	180	180	180	180
Max pressure [barg]	10	16	30	10	16	30	10	16
PV codes and directives	ALS, PED	ALS, PED, ASME	PED, ASME	ALS	ALS, PED, ASME	PED, ASME	ALS, PED	ALS, PED, ASME
Flange size	DN200/8"	DN200/8"	DN200/8"	DN200/8"	DN200/8"	DN200/8"	DN200/DN250/8"/10"	DN200/8"
Max. flow rate [kg/s]	190			225				

		
TS6		
TS6M		
FD	FG	FD
1308	704	704
320	400	410
625	530	540
1675	1430	1440
1036	380	380
140	203	203
180	180	180
25	16	20.6
ALS, PED, ASME	ALS, PED, ASME	ASME
	DN65/2"	2.5"
20		





					
M15			TL15**		
M15E,M15B,M15M,M15BD			TL15B		
FM	FG	FD	FM	FG	FS
1885	1885	1980	2672	2752	2752
610	650	650	610	637	646
1150	1110	1140	928	928	928
2050	3210	3240	4368	4368	4368
1294	1294	1294	2035	2035	2035
298	298	321	288	288	288
180	180	180	180	18	180
10	16	25	10	16	30
ALS, PED	ALS, PED, ASME	ALS, PED, ASME	ALS	ALS, PED, ASME	ALS, PED, ASME
DN150/6"			DIN150/6"		
120			120		

Plate and gasket materials

Plates can be obtained in all pressable materials. The most common materials are: stainless steel Alloy 254 SMO, Alloy 304, Alloy 316 and titanium. Gaskets are available in a wide range of elastomers: The most common are: nitrile and EPDM.

									
MX25			M30			TL35B			
MX25M, MX25B			M30/M30D			TL35B			
FG	FD	FS	FM	FG	FD	FM	FG	FD	FS
2895	2895	2895	2882	2882	2920	3210	3210	3218	3218
920	940	940	1150	1170	1190	1506	1506	1529	1526
1600	1600	1600	1600	1600	1650	2195	2210	2235	2245
5200	5200	5200	5200	5200	5250	4595	4610	3435	3345
1939	1939	1939	1842	1842	1842	2177	2177	2177	2177
439	439	439	596	596	596	578	578	578	578
180	180	180	180	180	180	180	180	180	180
16	25	27.6	10	16	25	10	16	25	30
ALS, PED, ASME	PED, ASME	ASME	ALS, PED, ASME			ALS, PED, ASME			
DN200/DN250/8"/10"	DN200/DN250/8"/10"	8"/10"	DN300/DN350/12"/14"			DIN300/DIN350/12"/14"			
250			497			550			

Insulation

Insulation, designed for HVAC applications, is available for most PHE models. There are two different types of insulation – heating and cooling insulation.

The reason for having two different types is that the mineral wool will be wet from condensing water if used when the heat exchanger temperature is lower than the surrounding temperature. Polyurethane is more expensive than mineral wool, but technically the cooling insulation can be used for heating duties as well.

Heating insulation

Heating insulation consists of 65 mm of mineral wool, clad with a 1 mm aluminium sheet on the outside and aluminium foil on the inside. It covers all sides of the PHE including the frame and pressure plate, except downwards. The different parts are held together with snap catches.



Cooling insulation

Cooling insulation consists of 60 mm of polyurethane, clad with a 1 mm aluminium sheet on the outside and aluminium foil on the inside. It covers all sides of the PHE including the frame- and pressure plate, except down-wards, where there is a galvanized drip tray. The different parts are held together with snap catches.



Drip tray

The Alfa Laval drip tray insulates the heat exchanger from the floor, and it also collects any condensate formed on the outside of the heat exchanger. The drip tray also collects any remaining water (after drainage) in the PHE when the unit is opened for inspection or maintenance. The drip tray consists of 0.75 mm hot galvanized steel plates, 50 mm polyurethane foam, supports of waterproof wood, and a draining valve.



Protection sheet

A protection sheet is a device covering all sides of the plate pack except downwards. It is used to prevent persons from getting injured if a sudden leak of hot, corrosive or toxic media should occur. The Alfa Laval protection sheet consists of one or more aluminium or stainless steel (AISI 304) sheet(s) formed to fit the PHE. On most frames the sheet is fitted between the plate pack and the tightening bolts.





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



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Alfa Laval reserves the right to change specifications without prior notification.

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Our mission

We optimize the
performance of our
customers' processes.

Time and time again.



Pure Performance

Alfa Laval focuses closely on offering its customers solutions that pay off.

This is clearly reflected in our mission:

To optimize the performance of our customers' processes. Time and time again.

This is a never-ending commitment. Every improvement we achieve creates a new platform for the next step on the improvement ladder.

Our aim is to stay in pole position at all times.



High-tech performance

The Alfa Laval brand stands for technical expertise, reliable products, efficient service and the finest possible process-engineering skills.

Our reputation is based on our unique knowledge and experience in three key technologies:

- Separation
- Heat transfer
- Fluid handling

These are technologies that play major roles in most sectors of industry.



Our company



A global brand

Our equipment, systems and service are hard at work in more than 100 countries.

In 2011 Alfa Laval had 37 major production units and 99 service centres all over the world. The proximity to the market is vital to the company's success, for it is only by working closely with our customers that we can respond to their needs.



129 years young

The origin of the company dates back to 1883, when Gustaf de Laval founded Alfa Laval to exploit his pioneering invention of the centrifugal separator.

Gustav de Laval was a great technical genius who registered 92 patents in his lifetime. His innovative spirit has always been the guiding star for Alfa Laval and remains so to this day.



3.2 billion euros in sales

During 2011, Alfa Laval posted sales of 3.2 billion euros.

Europe is the biggest geographical market in terms of sales volume – roughly twice the size of both Asia and the American continent.



Ten customer segments

To create a clear focus on different types of customer, Alfa Laval's business is divided into ten segments.

Each segment is dedicated to working closely with specific customer groups. This gives us insight into their special needs and the power to develop the best possible solutions to fulfil them.



14,700 employees

Alfa Laval has nearly 14,700 highly qualified employees worldwide. Their basic mission is to assist industries of almost every kind to refine and improve their products and to optimise the performance of their processes. Thereby we help create better living conditions and a cleaner, safer environment for all mankind.

Technical leadership

Alfa Laval holds world-leading market positions in its fields of technical expertise.

Its success is based on an average investment of 2.5% of annual turnover in Research & Development.

The work of our almost 300 dedicated R&D specialists results in 35-40 new product releases every year.



Our key areas

Separation

Alfa Laval has led the development of separation technology since the company was formed in 1883. Today Alfa Laval is the world's largest supplier of separation technologies.

Heat transfer

Alfa Laval is the world leader in plate and spiral heat exchangers.

It also offers the market's most extensive range of refrigeration equipment.

Fluid handling

Alfa Laval produces flow equipment for industries requiring high standards of hygiene and reliable, continuous process flows.

Heat transfer



Plate heat exchangers

Alfa Laval has the most comprehensive range in the market for industrial, sanitary and heating applications.



Air heat exchangers, evaporators and condensers
Designed for refrigeration.

Shell-and-tube heat exchangers

An extensive range of heat exchangers dedicated to pharmaceutical, food and refrigeration applications.



Spiral heat exchangers

Tailored for viscous and particulate products that can cause severe fouling or corrosion.



Finned tube heat exchangers

Alfa Laval's range covers most types of refrigerants and most cooling applications.



Separation



High-speed separators

Primarily used for separating fluids and sludges containing up to 30% of solid particles.



Membrane filtration

Alfa Laval's wide range of filters covers reverse osmosis, nanofiltration, ultra-filtration and microfiltration.



Decanter centrifuges

For separating solids from liquids: a key function in countless industrial, food and treatment processes.

Fluid handling



Valves

Sanitary mixproof valves. Intelligent control equipment. For example: Butterfly valves. Seat valves. Aseptic diaphragm valves.

Pumps

We cover every need for gentle, precision pumping of all kinds of fluids of all viscosities in sanitary applications.



Tank equipment

We offer the widest range of sanitary applications for the marine/offshore business – supplying everything except the tank itself.



Installation material

Our promise: You can always find the right installation material, in the right quantity, for the right application.



Focus on customer segments



Vegetable oils industry
Our equipment and systems produce tons of extra virgin olive oil every day.



Marine industry
More than half of the world's ships are equipped with Alfa Laval products and solutions.



Beverage industry
We manage the vital balance between flavour, food safety and manufacturing efficiency. Our equipment handles millions of litres of wine and beer every year.



Wastewater
Alfa Laval has unique knowledge in the increasingly critical areas of effluent treatment and recycling.



Energy
Alfa Laval is involved throughout the long process from the extraction of raw materials to the production and use of energy.



Starch industry
More than half of the 60 million tons of starch produced in the world every year comes from our products and processes.



Pharmaceutical and biotech industry
We offer a wide range of products to satisfy the industry's exceptional demands for precision, safety and cleanliness.



Comfort/HVAC and refrigeration
Alfa Laval is a leader in climate control, providing an optimized balance of heating and cooling.



Food industry
Our equipment helps the food industry to turn quality raw materials into equally high-quality products.

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Heating and cooling solutions from Alfa Laval

The Alfa Laval Business Unit Comfort/HVAC applies heat-transfer technology to heating and cooling systems, helping you to be more efficient in obtaining the ideal temperature in any area.

Customers in more than 60 countries have made Alfa Laval the world market leader in heat exchangers and thermal solutions. Over 60 years of dedicated research and development in the field of heat-exchanger solutions, together with field experience from some 500,000 heating installations around the world, are your assurance that we have the solutions you are looking for.

There are many different ways to achieve comfortable, economic climate control. That's why a thorough understanding of each individual situation, the available resources and the real needs is the first step towards success.



Global experience always near you

In a world of constant change, it can be comforting to know that some essentials will remain the same. One such essential is the local presence of Alfa Laval through our local sales companies and network of authorized distributors, who can meet all your needs and help you optimize your systems' performance.

Many of our customers are engaged in building a modern infrastructure based on proven, effective and sophisticated technology.

This calls for customized design to meet specifications that address local conditions and specific needs.

Others are expanding current plants or designing next generation systems. This means analyzing the application benefits that new technology has to offer, locating opportunities for even faster return on investment, ensuring lower than ever total cost of ownership, and reducing environmental impact. Globalization is an obligation – the obligation to adapt global experience to meet local needs.

Alfa Laval is fully equipped to meet any project requirements from day one with fast answers and timely suggestions for improvements. These are the success factors that lead to a rewarding, long-term customer supplier relationship.

Time is money: that's why it's easy to do business with us

Speed and simplicity are essential for us, because a company's leadership derives not just from the quality of its products, but also from its organization and the services it offers. This is why we provide our customers with all the tools they need to do business with us easily and efficiently. Contact our local representative to learn more about the latest available tools.

We know because we have been there

Alfa Laval customers always benefit from our first-hand experience in hundreds of projects in different countries and climates all over the world. You can access our experience through our global team of Alfa Laval experts and partners. Your Alfa Laval agent is just a phone call away, while contact details for all countries are continually updated on our website at www.alfalaval.com

Fast, timely delivery

Experienced planning means superior logistics. At Alfa Laval, we believe that deliveries should not merely be in time. They should be just in time in order to save money and storage space for our customers. This is one of our major strengths together with supplying and supporting the resources needed at each different stage of a project.

From a single product to the complexity of a power plant

Close collaboration with the customer and every one of his partners and advisors is essential. We contribute actively and constructively from the very first enquiry in order to assure you the best possible solution – whether you need a single product or a full-scale project.



Advanced design

Alfa Laval's extensive product development work has led to technologically advanced plates for heat exchangers that make it possible to adopt our "close approach" to energy efficiency. The optimized plate corrugation pattern not only increases heat transfer, but also reduces the risk of fouling thanks to highly turbulent flow. Plates are available in different materials and configurations to suit the customer's needs.

Alfa Laval's innovative heating and cooling systems are certified according to ISO 9001 and we have the possibility to control every component. As the interaction between all components is thoroughly tested, you can be sure to receive a reliable and cost-efficient system, ensuring lowest cost of ownership.

Leveraging local energy sources

The availability of local energy is an important cost parameter in designing a system. By using heat exchangers from Alfa Laval, you can choose one or several of a wide variety of energy sources in order to maximize economic benefits and minimize environmental impact.

Global expertise for local projects

District-heating system projects typically span a period of several years. These projects are complex processes

that are often split up into several stages. Each of these starts with a pilot project, and is minutely documented as a basis for improvements and refining specifications for coming stages.

This meticulous process is even more critical when external financing and approvals need to be obtained. At first it may seem daunting, but it is part of our global experience and everyday work.

Full documentation

We provide documentation and specifications for local authorities, consultants and contractors. We can customize throughout the project – down to the smallest details of three-dimensional drawings.

Innovative solutions

Alfa Laval pursues an active research and development policy at laboratories around the world. All Alfa Laval development projects are based on an analysis of the benefits of applying new technologies and the opportunities for even faster return on investment, reducing both the total operating cost and environmental impact.

We're closer than you think

Alfa Laval is represented in most countries by local sales companies, and a network of regional authorized distributors are responsible for serving our customers at all times. All of our

authorized distributors and sales companies are able to perform dimensioning of heat exchangers based on application, heat load and available space, and to provide installation guidelines together with full pricing details.

We understand and meet your needs

There are many different ways to achieve comfortable, economic climate control. A thorough understanding of each individual situation, the available resources and the real needs is always the first step towards success.

Power and performance

Alfa Laval has a full range of products catering for every need, however large or small. We offer versatile, compact and easy-to-install products that ensure high efficiency and low maintenance costs. Alfa Laval is your assurance of reliable operation, unsurpassed operating life span, fast return on investment and low cost of ownership.

Chapter 3

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Applications

In this chapter, we will illustrate a number of common applications of heat exchangers and heat-exchanger systems in HVAC installations.

The diagrams and other information provided are intended only to clarify the operating principle. Actual systems must thus be completed with the components and accessories envisaged by current regulations.

For a more tailor-made design, contact your local Alfa Laval representative, who will be happy to provide you with professional assistance in selecting the best heat exchanger or heat-exchanger system for the job (see contact details at www.alfalaval.com).

At www.alfalaval.com/HVAC you can check out our reference library and read about installations we have completed within all applications in different places all over the world.



District heating/Community heating

Space heating

Heating, in most cases, is a matter of providing a comfortable indoor environment, whether at home, at work or in a public facility. Heating can also involve tapwater heating, swimming pools, greenhouses etc.

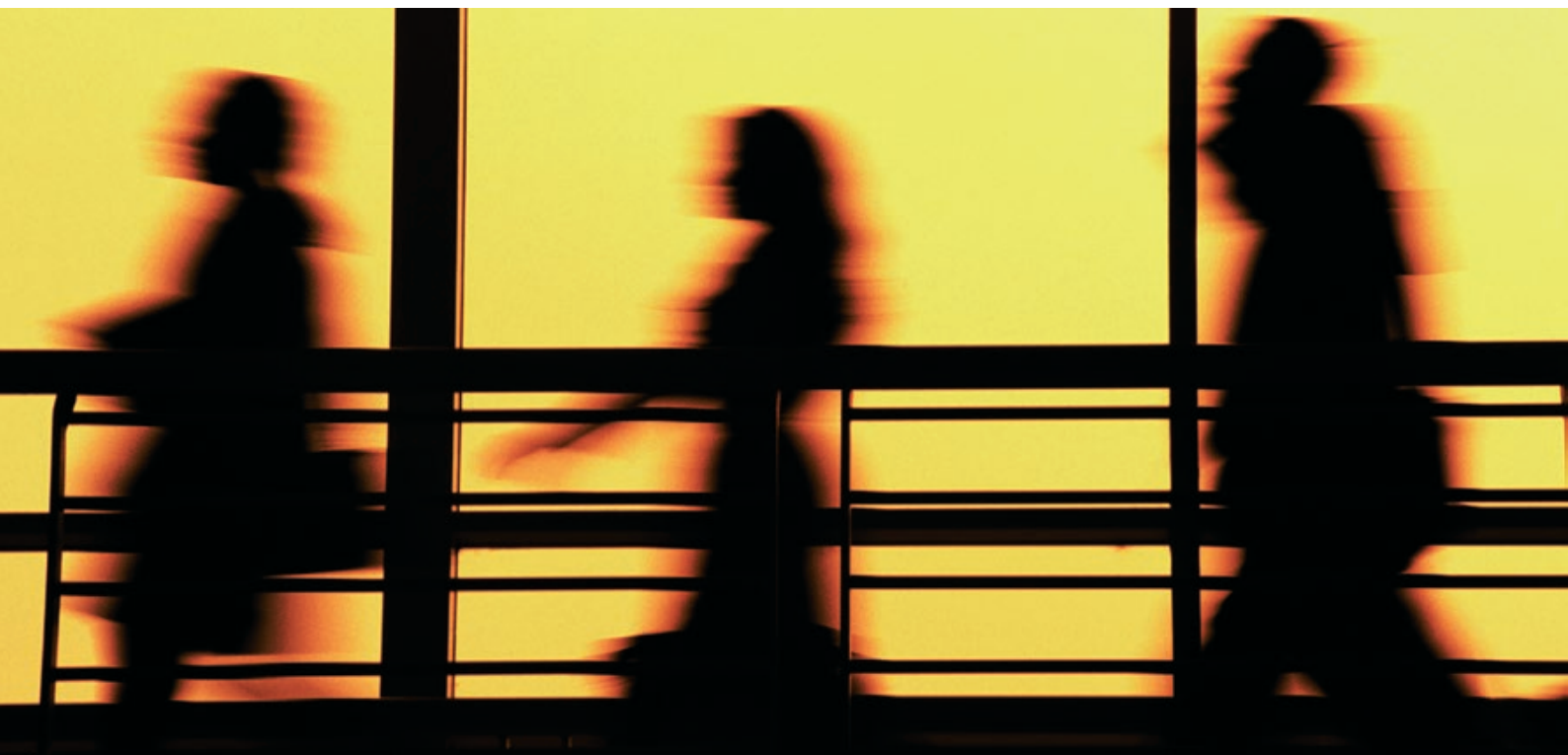
Space heating

The use of hot water for space heating is very common. The methods used to transfer energy from the water to a comfortable indoor environment vary. Using radiators is one common method.

An alternative to radiators is under-floor heating, where heat circuits are placed under the floor. The floor-heating circuit can be connected to the radiator circuit.

An air heater, blowing hot air into a room, is more commonly used in public buildings. Very often a combination is used, with for example radiators and floor heating, or radiators and air heaters via a separate mixing loop.

The objective of space heating is usually to achieve a comfortable indoor temperature. The heat can be transferred using radiators, floor heating or air heaters.





What is district and community heating?

District heating and community heating are environmentally friendly and energy-efficient methods of delivering hot tapwater and radiator heating. Heat generated in a central boiler plant is transferred to several buildings through pipes. A very wide range of energy sources, including combustion of oil, natural gas, biofuel or renewable energy, can provide the heat. A successful energy company will have 6-8 heating sources that they can combine and utilize according to their priorities – fuel cost, emissions, etc. The possibilities of using waste heat from industry, surplus heat from waste incineration, industrial processes and sewage, purpose-built heating plants or co-generation plants in district heating make it a flexible and energy-efficient choice. You can optimise costs as prices change, and maximize environmental protection.

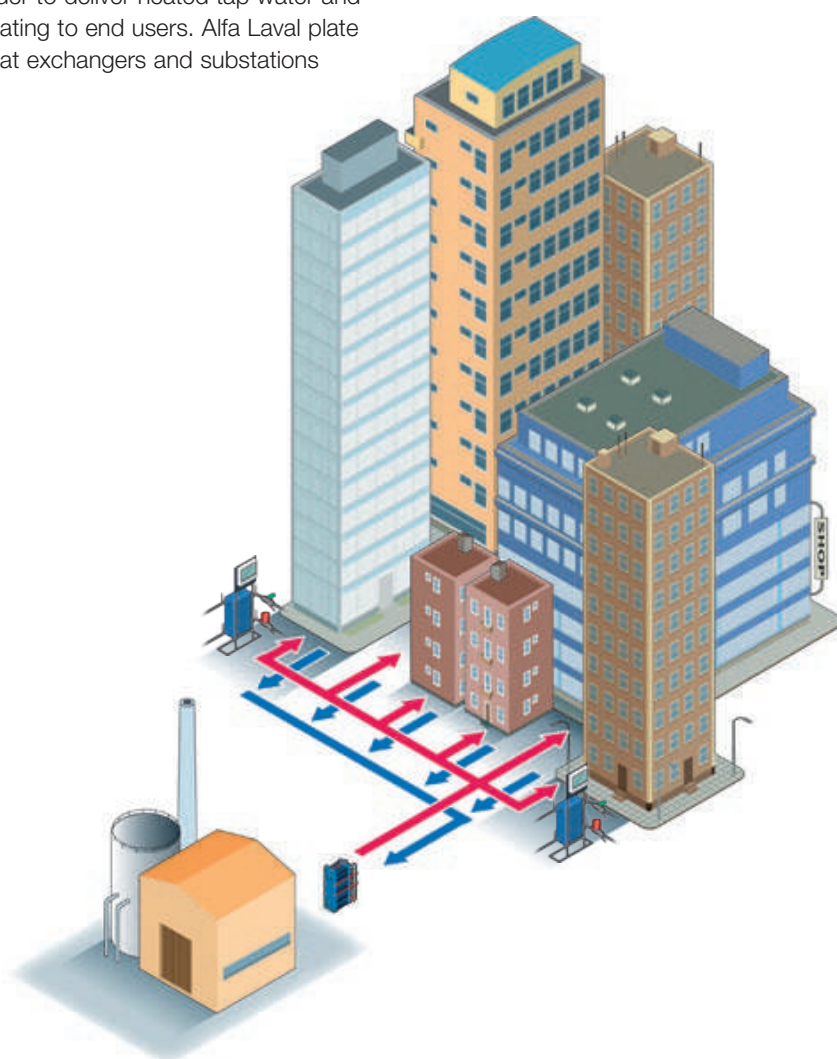
For the consumer, district or community heating means a trouble-free way of receiving energy. The heating sources of a district or community heating system are more convenient and more efficient than small individual

space-heating systems. Combustion techniques and exhaust cleaning will decrease the negative impact on the environment.

Plate heat exchangers and heat-exchanger systems, substations, play a major role in enabling efficient heat transfer between the two systems in order to deliver heated tap water and heating to end users. Alfa Laval plate heat exchangers and substations

deliver the preferred solution in district- or community-heating systems throughout the world today.

Alfa Laval currently offers different types of plate heat exchangers and substations in district- and community-heating applications.





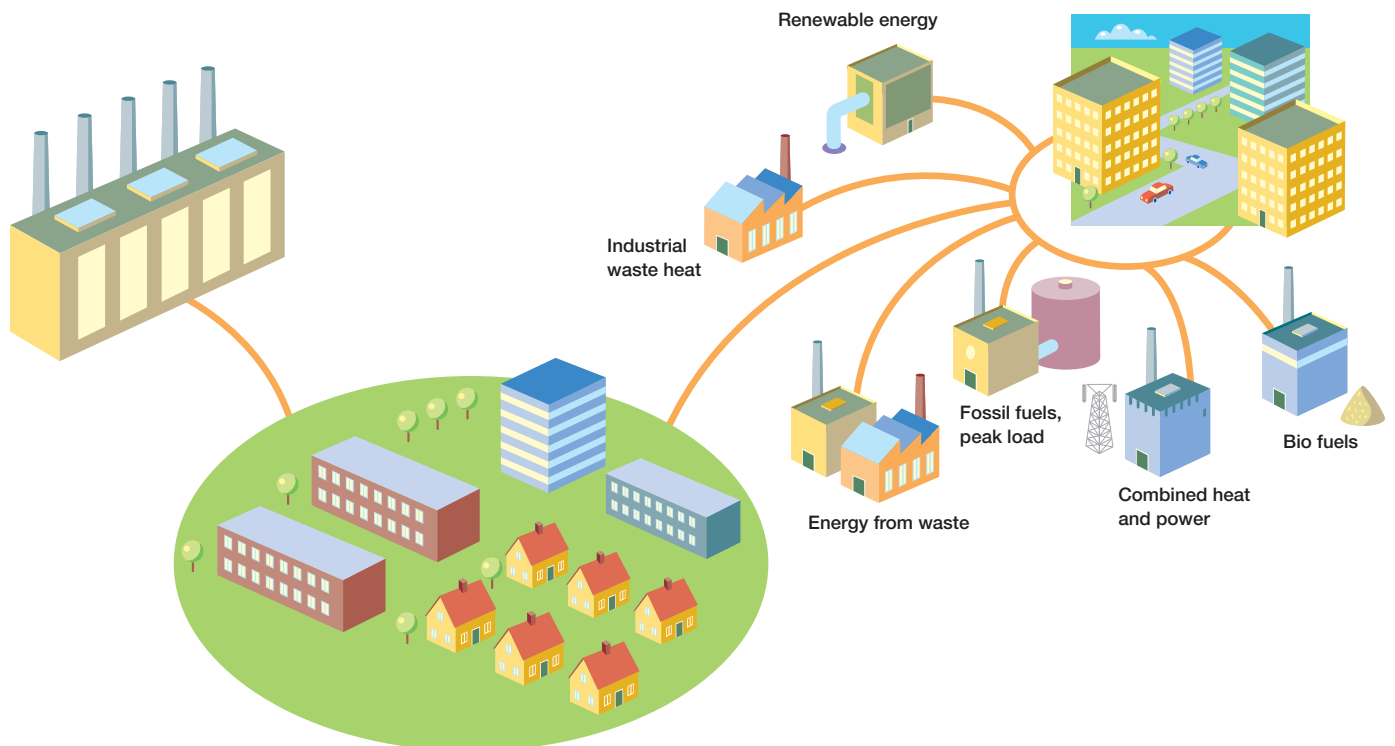
Community heating

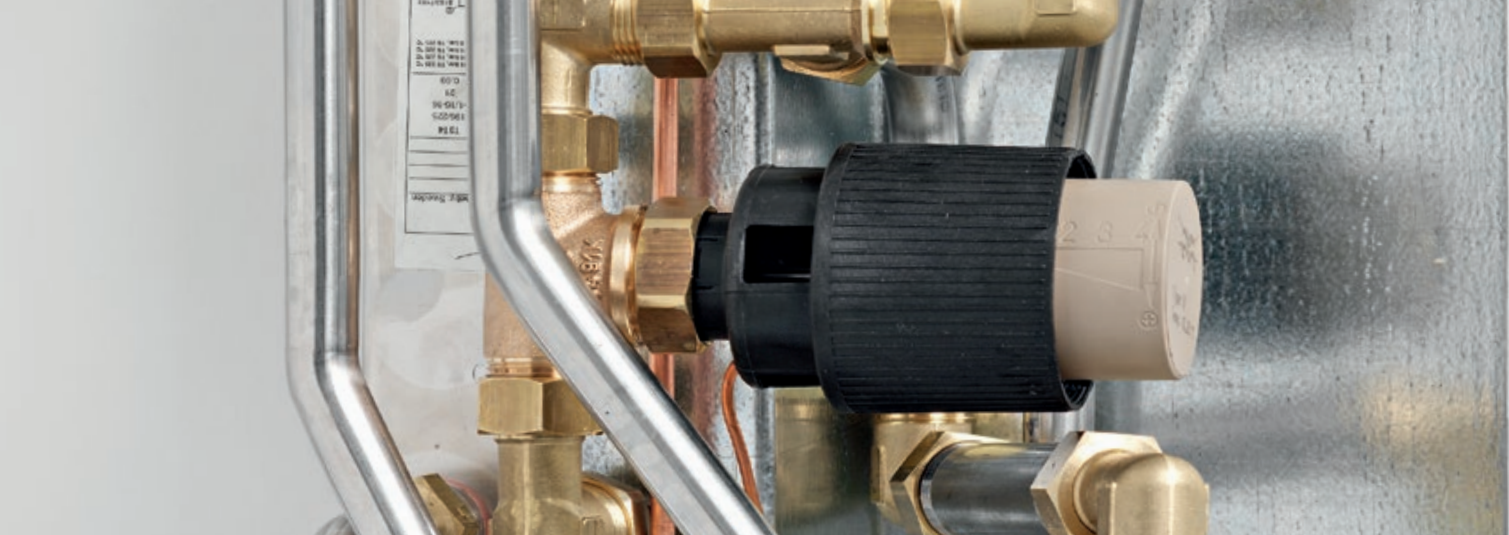
Community heating is based on the same technology as a “standard” district-heating network but on a smaller scale. Even in networks consisting of a relatively small number of houses or apartments, the technology developed for district heating offers some obvious benefits. One central boiler will replace several of small boilers. Fuel from different local sources – e.g. industrial waste energy, garbage or solar – can be used.

In many cases, small-scale community heating networks can be integrated into more comprehensive district-heating networks, thus creating economies of scale while some of the initial investments in equipment are already taken.

Substations are the brain of the community-heating concept. The challenge is to achieve the ideal temperature while simultaneously

reducing energy consumption and paying attention to environmental issues. During the last few years, compact and very efficient units have been developed specifically for small-scale applications. As metering can be set individually, residents are offered an incentive to save energy, while sensors adjust the indoor temperature in relation to temperature fluctuations outdoors.



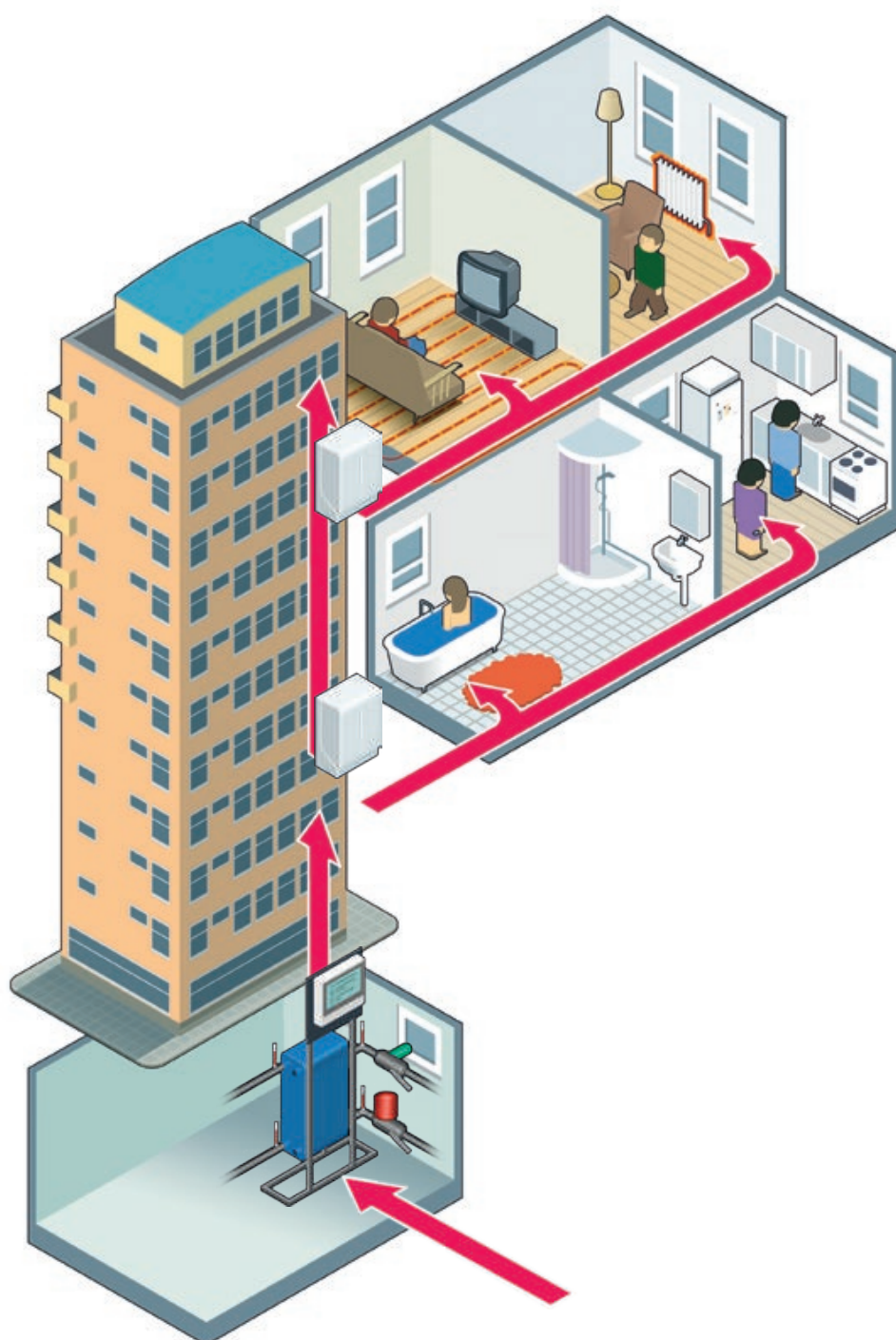


Energy savings in district/community heating

Today, the district- and community heating application is moving from “production-driven” towards “demand-driven”. In a production-driven system the production plant regulates the volumes of heat delivered to residents. The residents have no technical means of regulating the heat reaching their apartments, as the system temperature can only be set at the heat source.

In a demand-driven system, each building is furnished with an individual substation equipped with a weather sensor. The sensor and control equipment adjust the supply temperature automatically, taking into account the specific heating needs of the building. Therefore, the substation will capture only the heat needed from the network. A refined regulation of the ambient temperature also means that the temperature gap between the supply and return temperatures can be expanded. As a result, pipe dimensions can be kept relatively small, thus cutting investment costs and pumping costs.

One substation in every building (even every apartment) has proven to provide the best result, enabling individual control and superior economy.





District and community heating must be viewed as a total system, and as all systems, it requires a holistic approach – optimising and working with the total system and not only focusing on parts. For district and community heating it is crucial to have products and components in the system that work together as well as separately in an optimal way.

Strategy

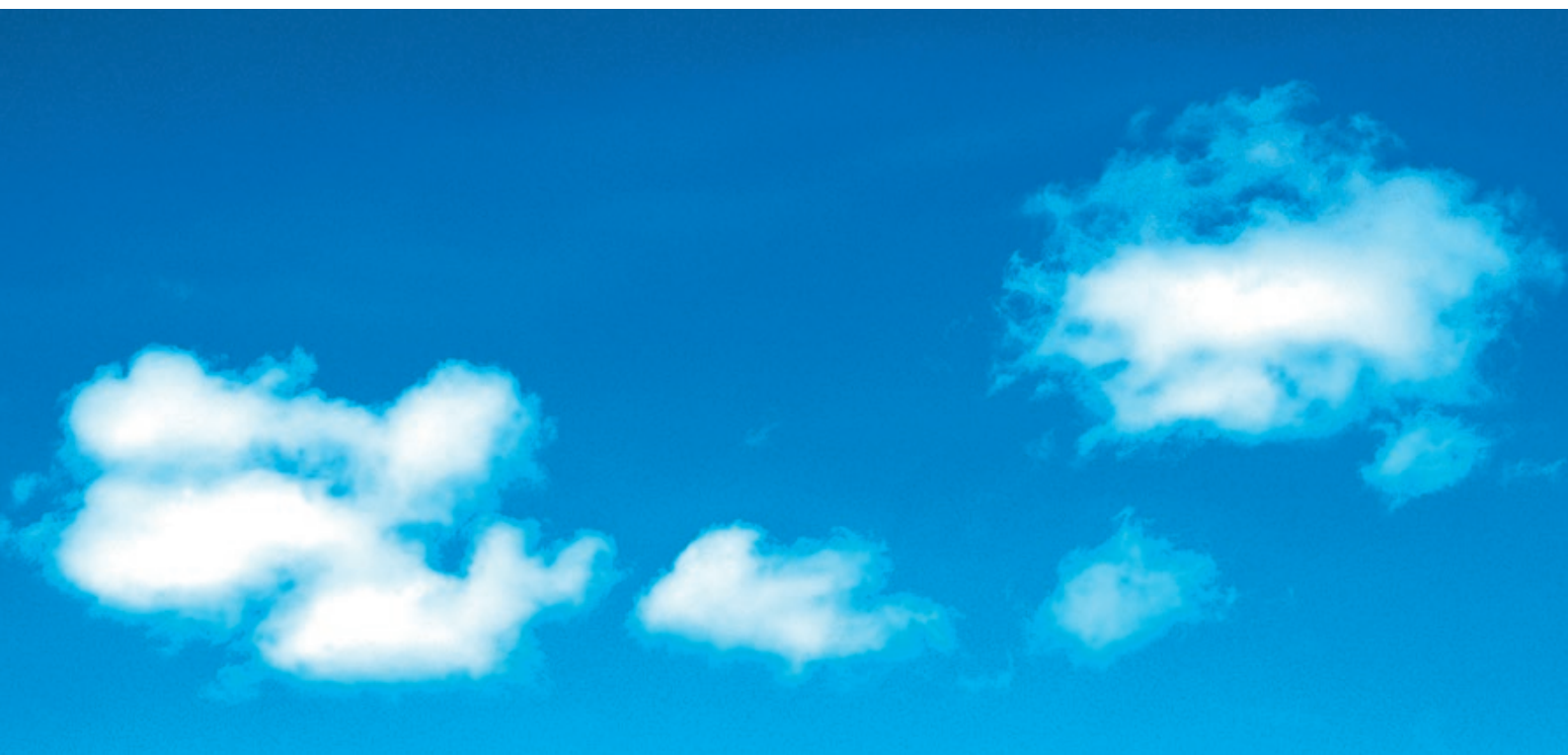
- Two pipe systems
- Eliminating leaking pipes and waste of water
- A substation in every building
- All buildings need its own metering
- Individual measuring of use of energy for every apartment
- Connecting small district- and community-heating networks to the main city networks
- Analysis of optional energy supply
- Individual building efficiency

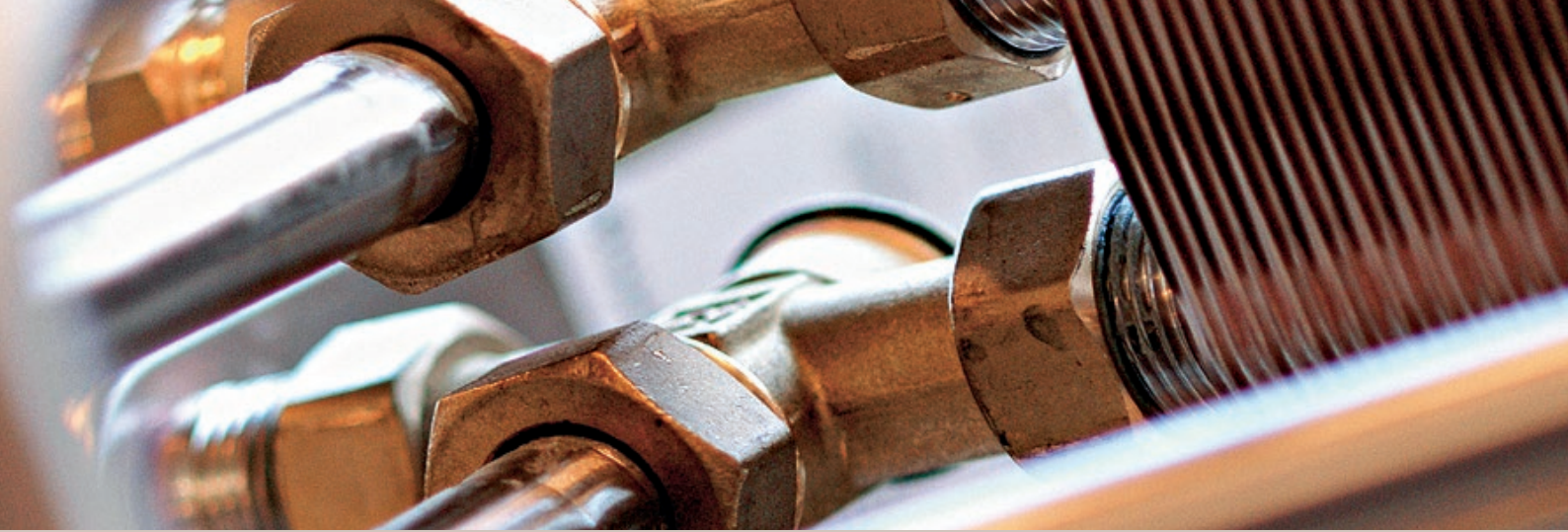
Keeping waste heat from going to waste

In many companies and industries there are untapped sources of waste heat or surplus heat. Such heat can be found in many forms, whether it is steam going out into the air or hot water going out

into the ocean. By utilizing the waste heat in district heating, the same fuel achieves twice the work, thereby doubling fuel efficiency.

Huge heat losses appear in power plants, oil refineries and industrial processes. Much of this heat could be retrieved and distributed by district heating systems to heat urban buildings. District-heating systems provide the necessary heat load for high-efficiency combined heat and power plants while at the same time, allowing the use of renewable energy.



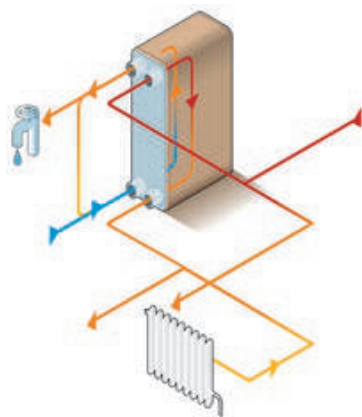


Connection principles

There are many different ways to connect district heating/community heating to buildings. The most common principles are:

1. Direct connection
2. Indirect parallel connection
3. Indirect two-step connection

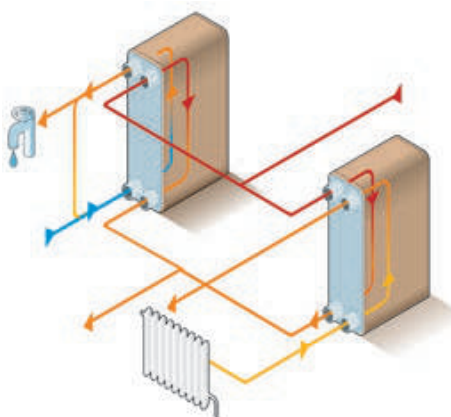
The direct-connection system includes a heat exchanger for the domestic tap water circuit but there is no heat exchanger between the heating network and the customer heating circuit. The same heating water is inside the secondary network (radiators, under-floor heating etc.).



Direct connection

A direct connection system needs a differential pressure controller in order to decrease pressure on the secondary side and is recommended for low-pressure systems.

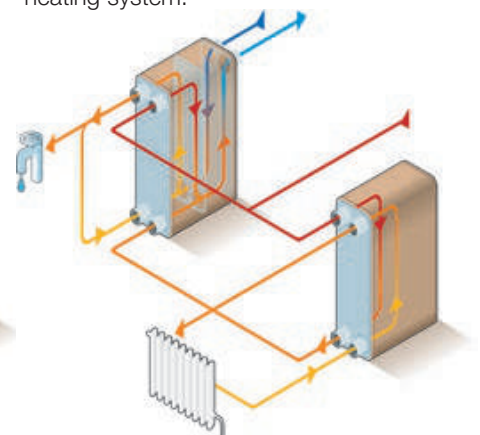
The indirect parallel-connection system includes a heat exchanger for the domestic hot water circuit and a heat exchanger separating the district- or community-heating network from the customer heating circuit.



Indirect parallel system

In the indirect parallel connection system, a differential pressure controller can be used in some cases.

The indirect two-step connection includes a two-step heat exchanger for the domestic hot water circuit and a heat exchanger separating the district- or community-heating network from the customer heating circuit. The heating flow from space heating flows through the pre-heater of the domestic tap water exchanger and improves the total cooling of the district- or community-heating system.



Indirect two-step system

The indirect two-step connection means maximum utilization of heat and a low return temperature during tap water consumption.



Environmental aspects

Combined Heat & Power (CHP) is a key technology for district and community heating. It will almost double fuel efficiency and at the same time reduce the need for additional heating sources. This reduces the impact on the climate and environment and increases the energy efficiency.

Wherever district or community heating is established, the surrounding environment benefits. One large plant has better combustion and cleaner emissions than many smaller plants. District and community heating enables the utilization of waste heat from industries and garbage from both households and industries; energy that would otherwise be lost.

Large or small-scale district and community heating open up for using local fuels and switching between different heat sources, thus making renewable energy sources an attractive alternative.



Tap water heating

Hot tap water is a convenience and comfort that most people take for granted in modern society. For cleaning, washing and personal hygiene, we're used to turning a tap and getting as much hot water as we need – quickly and reliably. And we do use lots of it!

Close to 40% of all energy consumed by households in Europe goes to heating tap water. Hot tap water can

be produced in a variety of ways, depending on the type of energy employed (electricity, gas, solar or other fuels) and the users needs. Essentially, tap water heating systems can be either instantaneous, without a storage tank, or semi-instantaneous, using a tank storage.

Which method is best for any particular application is determined by weighing

the advantages and disadvantages of each solution. The main factors involved are:

- available capacity (kW) on site
- temperatures needed on the primary and secondary sides
- available energy on site
- available place in the boiler room
- local preferences and/or habits



Instantaneous



Semi-instantaneous

&

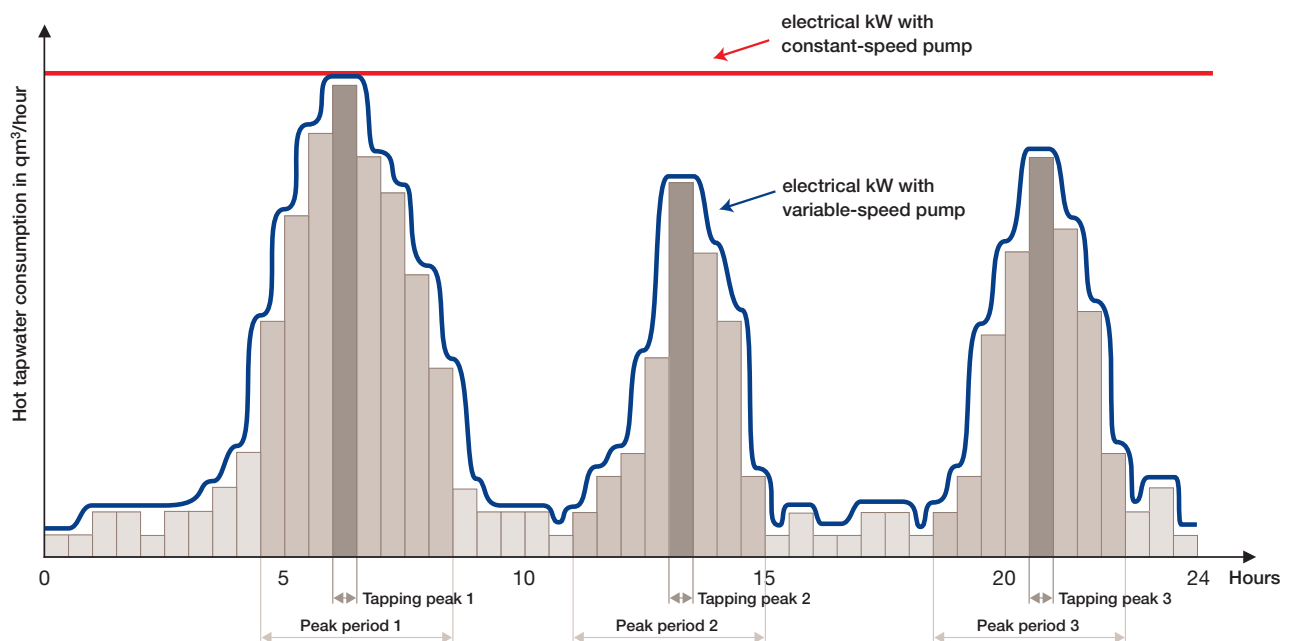




Some of the key requirements that are considered in selecting a system are as follows:

Indicator	Benefits
Cost efficiency	Low up-front investment, operating and maintenance cost
Energy efficiency	Low energy consumption
Space efficiency	Using minimal floor and room space
Installation efficiency	Simple and quick to install, test and start up
Service efficiency	Easy to clean and maintain; long maintenance intervals with short service shut-downs
Comfort	No waiting for hot water; and appropriate temperature levels, no risk of scalding at the tap
Dependability	Hot water available at the right moment
Health	No build-up bacteria cultures
Sufficiency	Enough hot water even during peak-consumption hours

Tap water demand



Modern buildings are designed to consume less and less energy. If building losses can thus be brought down to very low levels, the same cannot be said of domestic hot water

production: it is not possible to reduce the heat needed to produce hot water significantly, as it depends on quantity and distribution characteristics.

In order to keep energy consumption low, it is thus essential to optimise the hot water production system, where tap-water systems from Alfa Laval play a fundamental role.



A tap-water system is much more than a heat exchanger; it combines the Alfa Laval know-how of heat exchangers with a perfect knowledge of quality material and professional skills in order to offer a complete ready-to-use hot-water system to the customer.

Alfa Laval offers:

- Instantaneous systems
- Semi-instantaneous systems
- Anti-legionella systems
- Multi functional electronic controlbox
- Choice of gasketed, brazed and fusion-bonded heat exchangers
- Choice of 2-port, 3-port and 4-port valves on the primary side

These systems are the best solution for anywhere where hot water is needed in large volumes in a short time:

- For any collective application:

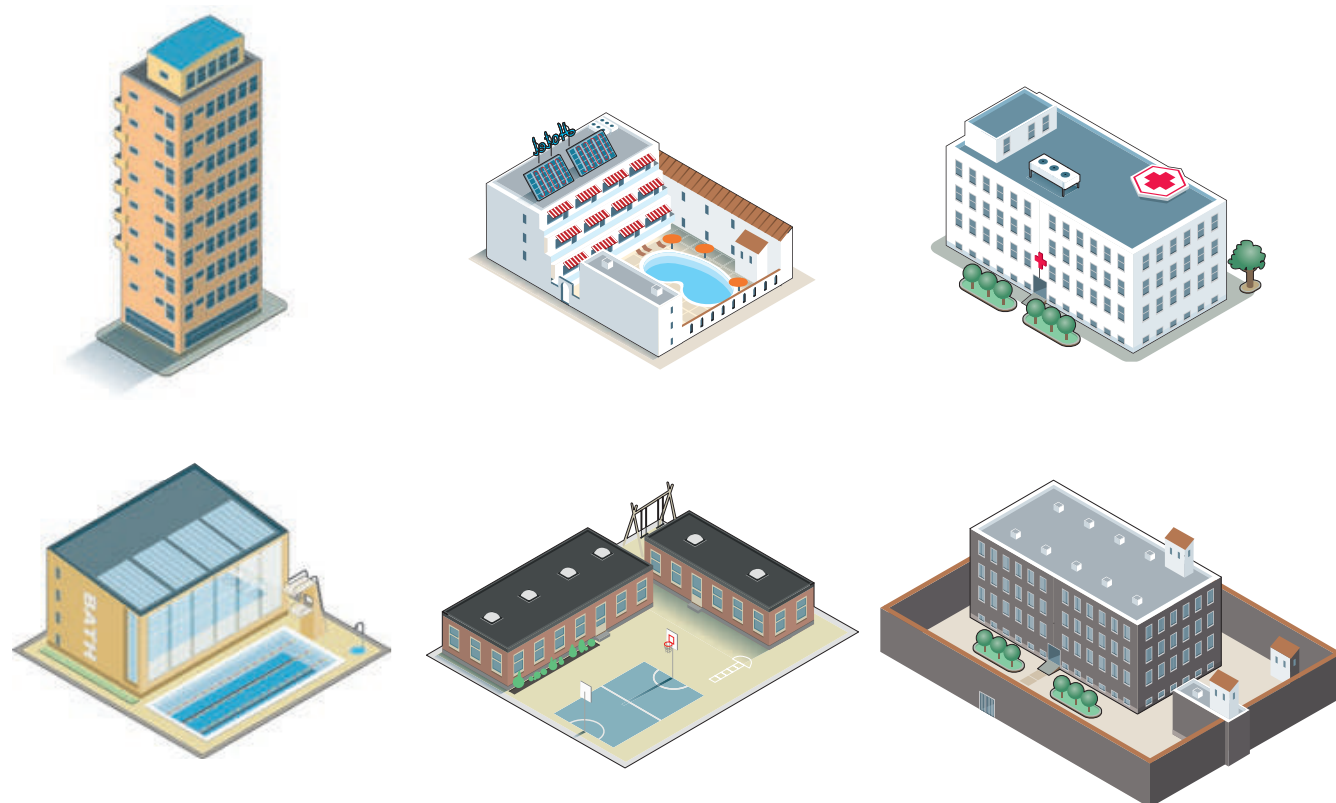
- Apartment blocks
- Hotels
- Hospitals
- Sports facilities
- Retirement homes
- Schools & universities
- Prisons

- For any heating source:

- Local boiler
- District heating
- Community heating
- Renewable energies

- For any functionality:

- Simple product range
- Standard product range
- Smart product range





Instantaneous hot water production

An instantaneous tap water system heats the water at the moment it is needed by the user.

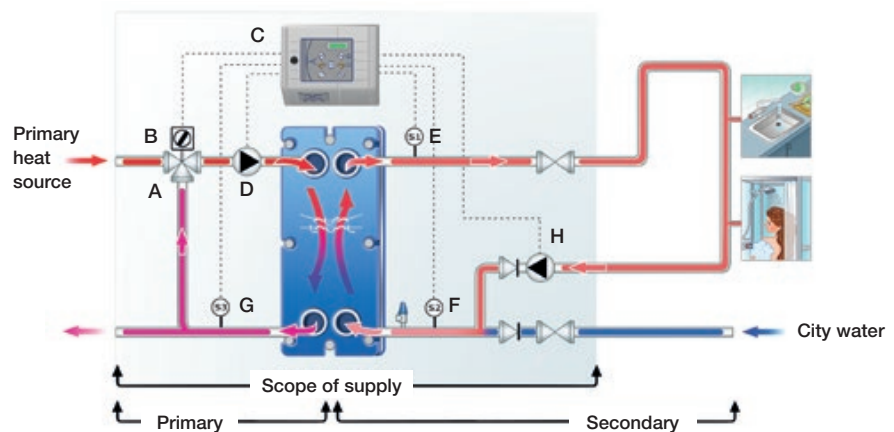
The working principle is very simple: connected to the hot water distribution pipe works, the heat exchanger provides controllable domestic hot water directly to the consumption taps in large volumes and at very fast pace. The primary side can be fed by different heating sources such as:

- A local boiler
- A district-heating system
- A community-heating system
- A system using renewable energy: solar, heat pumps etc.

The system operates with a 2-, 3- or 4-port *control valve* on the primary side (A). The valve is connected to an *actuator* (B) and the *control box* (C).

The *temperature sensor* S1(E), located at the secondary outlet, checks the temperature and adjusts the control

Working principle instantaneous, 3-port valve



valve accordingly, via the control box, in order to supply domestic hot water at the right temperature.

The *primary pump* (D) maintains a constant flow rate whereas the temperature entering the heat exchanger is continuously adapted to the demand detected at sensor S1(E).

This eliminates thermal shock in the plate heat exchanger and reduces the build-up of lime scale on the tap-water side.

Sensor S2 (F) indicates if circulating water has reached 70°C minimum for thermal treatment.

Sensor S3 (G) indicates a decrease of the heat-exchanger efficiency due to scaling.

The *circulation pump* (H) maintains a minimum flow rate through the entire network.

An instantaneous tap water system must be sized to cope with peak consumption which means that both the plate heat exchanger and the boiler capacity (or heating network) must be larger than for a semi-instantaneous system (see next section).

Advantages of an instantaneous tap water system:

- It is simple, reliable and easy to install (plug & play)
- It provides domestic hot water in large quantities, up to 1220kW, in a very short time
- It comfortably keeps up with peak consumption without having a tank on site; cost and space saving
- With no stagnant water, there is no less risk of legionella
- Limited lime scaling thanks to the mixing valve on the primary side and turbulent flow through the plate heat exchanger
- Extremely compact
- One instantaneous tap water system has the muscle to replace several storage tanks



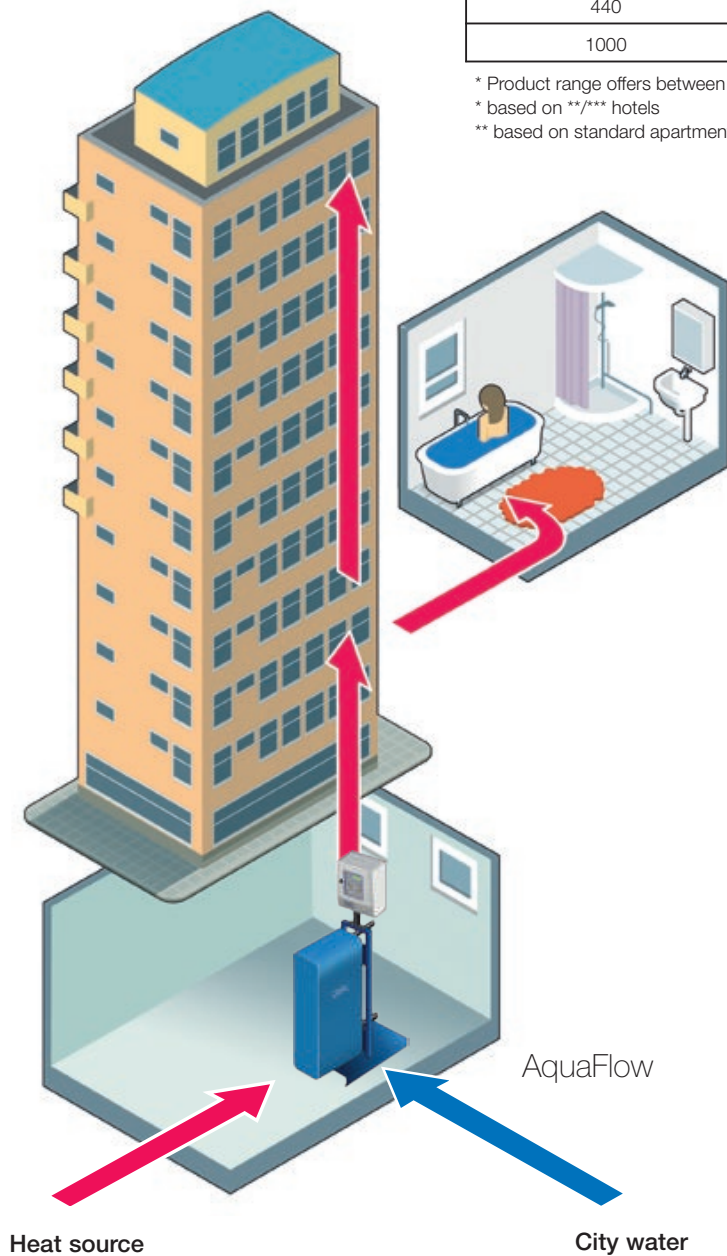
Application examples for one single instantaneous tap water system:

Nominal capacity of the system (kW)*	number of hotel rooms**	number of apartments***
70	8	5
150	25	20
440	100	130
1000	320	500

* Product range offers between 50 and 1220kW

* based on **/*** hotels

** based on standard apartments of 3/4 rooms





Semi-instantaneous hot water production

In a semi-instantaneous tap-water system, the heated domestic hot water is stored in a buffer tank on the secondary side. The stored hot water is only used for peak periods when the domestic hot water demand is higher than the energy supply.

Contrary to instantaneous systems these systems can operate with a smaller boiler (or heating network).

The primary side can be fed by different heating sources:

- A local boiler
- A district-heating system
- A community-heating system
- A system using renewable energy: solar, heat pumps etc.

The system operates with a 2-, 3- or 4-port *control valve* on the primary side (A). The valve is connected to an *actuator* (B) and the *control box* (C).

The *temperature sensor* S1(E), located at the secondary outlet, checks the temperature and adjusts the control valve accordingly, via the control box, in order to supply domestic hot water at the right temperature.

The *primary pump* (D) maintains a constant flow rate whereas the temperature entering the heat exchanger is continuously adapted to the demand detected at sensor S1. This eliminates thermal shock in the plate heat exchanger and reduces the build-up of limescale on the tap-water side.

Sensor S2 (F) indicates if circulating water has reached 70°C minimum for thermal treatment.

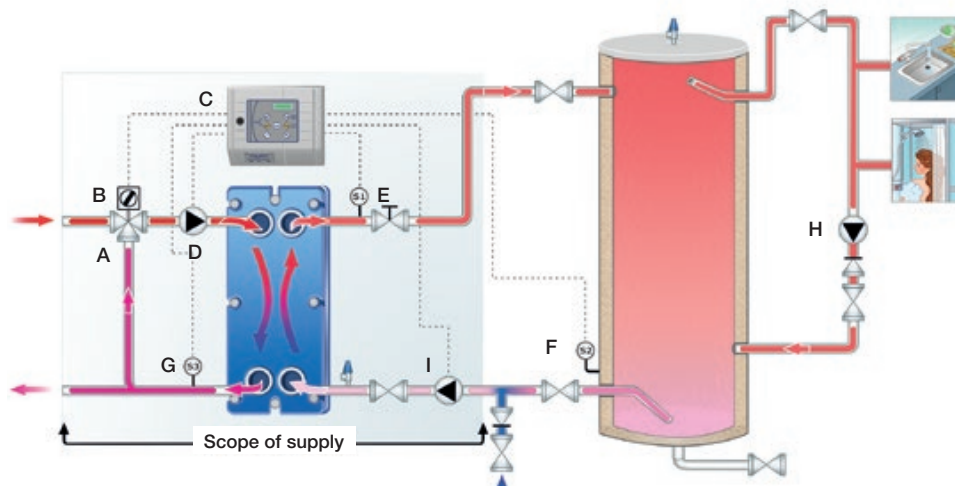
Sensor S3 (G) indicates a decrease of the plate heat-exchanger efficiency due to scaling.

The *circulation pump* (H) maintains a minimum flow rate through the entire network.

The *charging pump* (I) on the secondary side is used to store hot water in the storage tank. When there is no or limited tapping of domestic hot water, the storage vessel is gradually heated up to the set point temperature. When tapping occurs, hot water is being drawn from the top of the storage tank.

The only feature difference between an instantaneous and a semi-instantaneous tap water system is the charging pump (I) on the secondary side.

Working principle semi-instantaneous, 3-port valve





Advantages of a semi-instantaneous tap-water system:

- It is simple, reliable and easy to install (plug & play)
- Even where hot water demand is not constant, it comfortably keeps up with sudden peak consumption thanks to the buffer tank
- No need for a large boiler capacity on site
- No need for a very large heat exchanger
- Any combination of power output (50-1220kW) and tank size (150 to 4000L) is possible, thus providing large quantities of hot water
- To avoid legionella proliferation the semi-instantaneous systems are equipped with a thermal treatment function which raises the temperature to 70°C in order to kill the bacteria
- Limited lime scaling thanks to the mixing valve on the primary side and turbulent flow through the plate heat exchanger

Applications

Application examples for one single semi-instantaneous tap water system combined with one 300L storage tank:

Nominal capacity of the system (kW)*	number of hotel rooms**	number of apartments***
70	25	20
150	50	45
440	130	200
1000	350	620

* Product range offers between 50 and 1220kW

** based on **/** hotels

*** based on standard apartments of 3/4 rooms

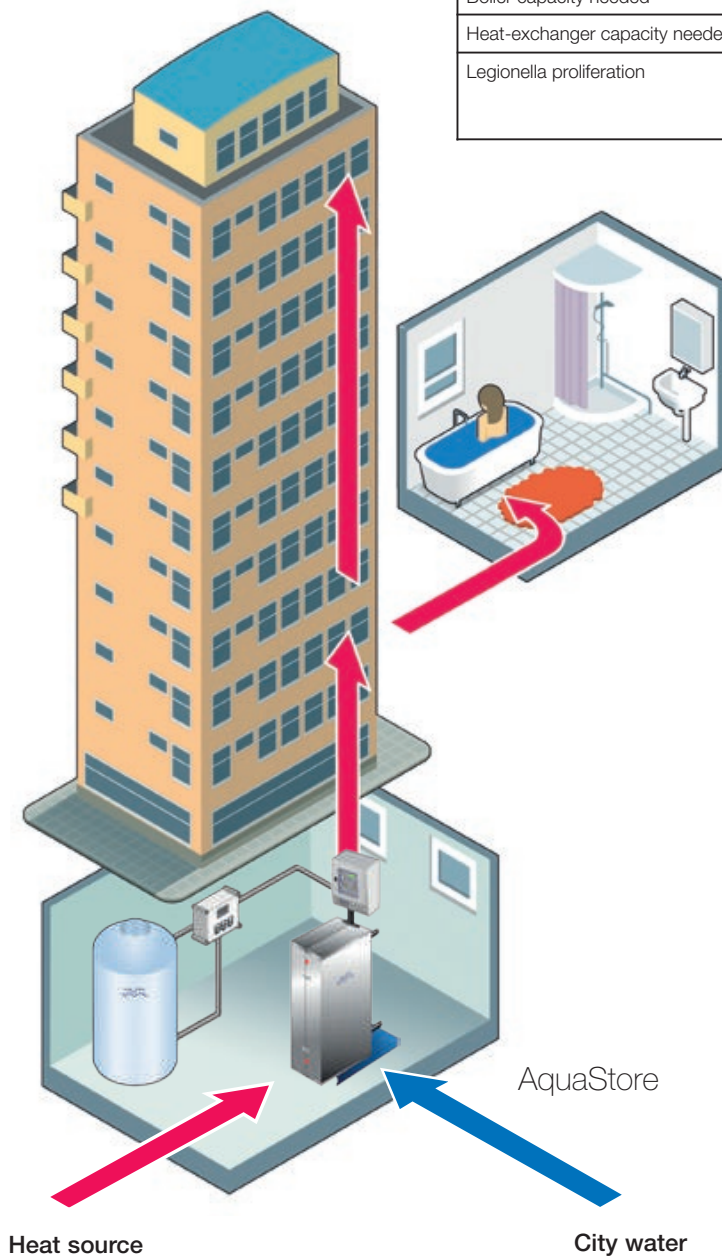
Application examples for one single semi-instantaneous tap water system combined with one 2000L storage tank:

Nominal capacity of the system (kW)*	number of hotel rooms**	number of apartments***
150	100	120
440	320	430
1000	580	950



Comparison Instantaneous versus Semi-instantaneous

	Instantaneous	Semi-instantaneous
Features	No charging pump	One or two charging pumps
Tank needed	No	Yes
Boiler capacity needed	High	Mid to Low
Heat-exchanger capacity needed	High	Mid to Low
Legionella proliferation	No stagnant water, reduced risk, possibility for thermal treatment function	Stagnant water in tank but possibility for thermal treatment function

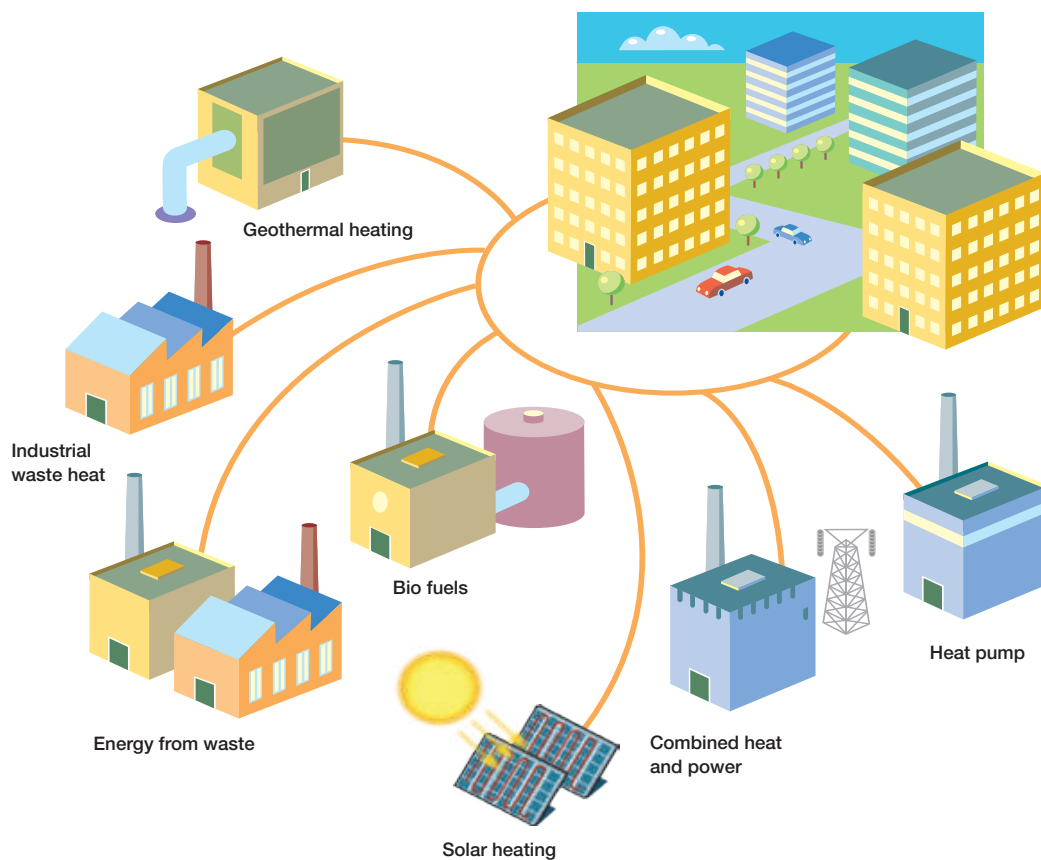


Renewable energies

The fact that reserves of fossil fuels (e.g. coal, petroleum and natural gas) are depleted much faster than they develop, and that CO₂ emissions need to be reduced, poses a giant challenge within multiple fields of technological evolution. Renewable energies represent a “technology of the future”, and Alfa Laval has developed solutions for heating systems based on alternative energies as heating sources.

A major characteristic of a modern district- and community-heating system is flexibility – also when it comes to fuels. Switching from one fuel to another can be done without adjustment or change of equipment in the houses or apartments of the subscribers. The preparedness for future changes of energy source is built into the system.

A district- or community-heating network can be integrated with local recycling energy sources, such as industrial waste, garbage and biomass. There is also a possibility to use geothermal or solar energy as an energy source.





Solar heating

Transferring heat from solar collector panels is an ideal way of using the sun's energy. The sun's heat is absorbed on a flat surface, and then transferred to a fluid. The hot fluid can be used for heating domestic tap water and for radiator heating.

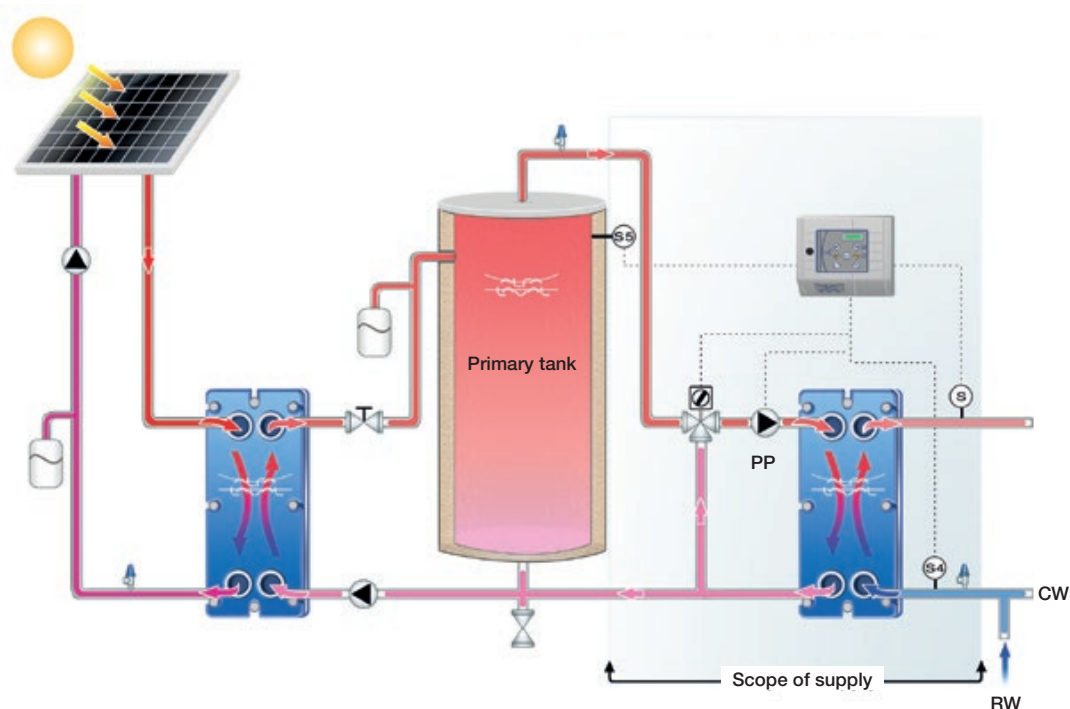
Solar heating is a renewable energy that works well as an alternative or supplement to other energy sources in a district-heating plant. During peak loads, or during seasons when the number of sunshine hours are not sufficient, other energy sources can be used as a complement.

It is advisable to separate the primary and secondary circuits with a plate heat exchanger and a heat exchanger system. For heating of domestic tap water, a storage tank can be used to cover the peak load demand. Alfa Laval offers suitable products for solar heating of both domestic tap water and radiators.





Working principle SolarFlow



Working principle

On the primary side, SolarFlow is connected to a primary tank that is heated by renewable energy.

A temperature sensor (S4) located at the secondary inlet checks the temperature of the water entering into SolarFlow.

The water can come from the water main (CW) or from the circulation loop (RC). This temperature is compared to the temperature checked by a sensor (S5) located on top of the primary tank.

Renewable energy vs. fossil

If water heated by renewable energy is available in the primary tank ($S5 > S4$), then SolarFlow regulation is engaged.

A temperature sensor (S), located at the secondary side outlet, checks the temperature and adjusts the control valve (VA) accordingly in order to always maintain domestic hot water as close as possible to the set-point temperature.

If water heated by renewable energy is not available in the primary tank ($S5 < S4$), SolarFlow goes to stand-by mode. The valve is closed, the pump (PP) is switched off and the energy consumption of SolarFlow equals zero.

In that case, the tap water will have to be heated using different source of energy.

Economy mode

To generate further energy savings, SolarFlow can switch to an economy mode that will limit the electricity consumption of the pump when the network temperature is stable.

SolarFlow offers electronic control equipment that provides several user-definable functions to customize the system and ensure precise temperature control in order to reduce the build-up of limescale.



Geothermal heating

Geothermic is the science that studies the earth's heat. The earth's heat content (enthalpy) is 10^{31} Joule and the energy the earth sends out in the atmosphere is double that what we consume. Today we only use a small fraction (0,07%) of the available geothermal energy available. A great untapped resource is at our disposal.

By using heat from geothermal water we have a cheap and environmentally friendly method for heat generation.

The ground is an inexhaustible source of heat and the seasonal variations in the soil temperature is reduced as depth increases.

At depths of 15 to 18 meters, the ground's temperature will remain absolutely constant year round at 9-12 °C. As we go deeper, the temperature will not only remain constant, but will increase by an average of 3 °C every 100 meters.

Geothermal heat is used in two major areas of application:

- Direct use of geothermal energy, involving geological anomalies or volcanic activity that provide a source of steam (which can be used to produce electricity) or hot water for heating buildings and tap water
- Low enthalpy geothermal energy, where the subsoil or ground water is used as a thermal reservoir in combination with heat pumps.

Especially in the low enthalpy geothermal energy, growth has been spurred by the availability of increasingly efficient heat pumps. With current technologies, using heat pumps is very safe and requires no additional energy from other sources (e.g. natural gas boilers) to cover consumption peaks or situations where performance is reduced.

Since the geothermal water often contains chemicals and solid particles aggressive to the plate it is important to select suitable plate materials for the main heat exchanger. Titanium or SMO are often used because of high content of calcium. Gasketed plate heat exchangers are often the preferred solution due to good serviceability, maximum heat transfer, high capacities and possibilities to increase or decrease the capacity.

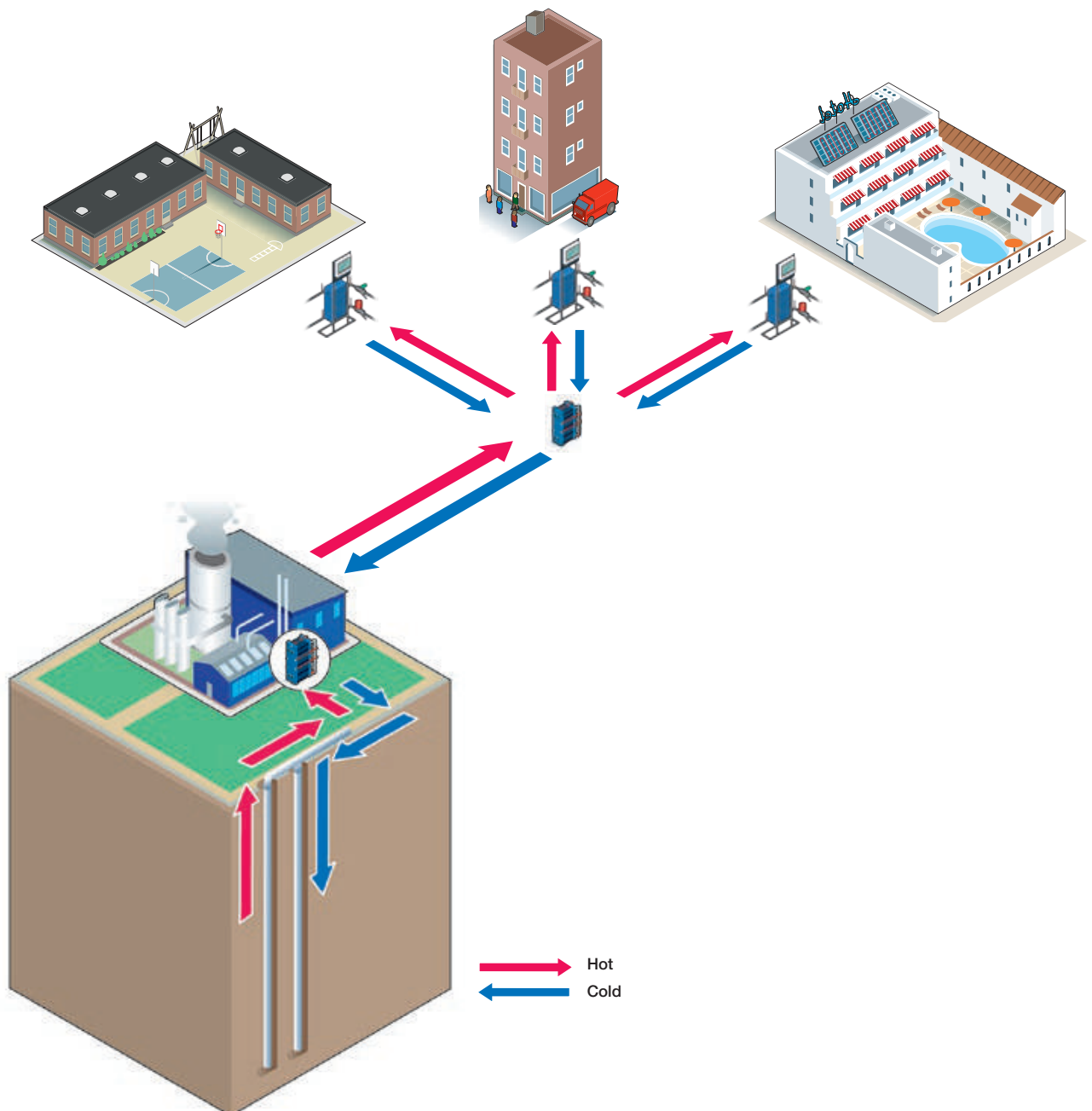




The supply of geothermal heat is the same as district and community heating; it is only the heat source that differs.

Typical end users of geothermal heat are single and multi-family houses often using a heat exchanger system.

Other common applications using geothermal heat are fish farms, green houses, thermal spas and industrial applications.



Other heating applications

Steam heating

Steam has been used as a carrier of heat since the Industrial Revolution and continues to be a modern, flexible and versatile tool wherever heating is needed. It is produced by the evaporation of water; a relatively inexpensive and plentiful commodity that is environmentally friendly. Its temperature can be adjusted very accurately by the control

of its pressure and it carries a large amount of energy in a small mass.

Steam is commonly used in HVAC applications as the primary heat source, heating water in the secondary circuit:

- Heat generation: Boiler plants, Combined heat and power plants
- Heat usage: Tap water heating, space heating and maintaining temperature in tanks/pools.

Some industries use a lot of steam in their processes. Surplus steam may be used for space heating and tap water heating locally, or sold for use in district- and community-heating systems.

Alfa Laval can offer different types of equipment for steam duties:



Gasketed plate heat exchangers

It is usually the temperature performance of the gaskets that sets the limits of its use. Their elastic mechanical design makes them resistant to pressure pulsation and thermal fatigue. Alfa Laval has developed a range of steam plate heat exchangers, the TS-M Series, for heating water with industrial steam

All-welded plate heat exchangers

In the all-welded heat exchanger, the gaskets have been replaced by laser-welds. This raises the performance limits considerably and makes it a very good choice for large capacities, high pressures and high temperatures.

Tubular heat exchanger

The tubular heat exchanger, Cetecoil, is well suited in steam systems due to flexibility in connections and low pressure drops on the shell side, as well as high temperature performance.



Swimming-pool heating

Using plate heat exchangers to heat swimming pools has become common practice because of its unquestioned thermodynamic advantages and low cost compared to conventional shell-and-tube heat exchangers.

At heat transfer level, the problem is maintaining temperatures steady. Accordingly, it is important that the heat exchanger be dimensioned as suggested in our selection tables.

It's important to remember that additions of chlorine should take place after the water has passed the heat exchanger to avoid a high concentration of chlorine flowing through the exchanger from coming into contact with the plates and causing cracking.

Alfa Laval offers a compact system for reheating and maintaining the temperature of water in swimming pools of any dimension – the AquaPool.

The AquaPool can be connected to any primary heat source, such as a local boiler, a solar installation, a heat pump etc.

The AquaPool system consists of a gasketed plate heat exchanger, with plates in either stainless steel or titanium, an electronic control panel, a primary pump and various valves.

The AquaPool is extremely simple to use, robust, compact and highly reliable.

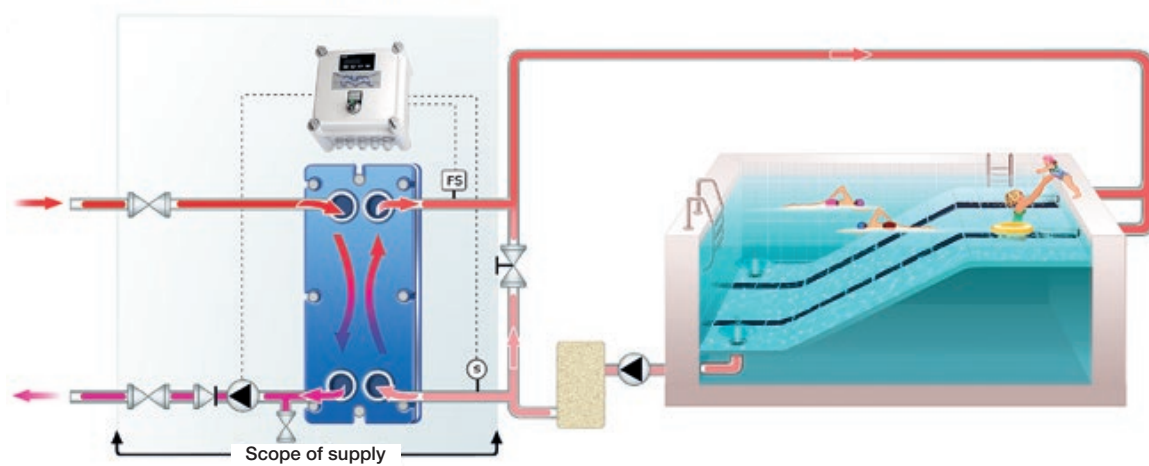


3 key parameters for the right AquaPool selection:

1. Volume of the swimming pool
2. Temperature rises necessary
3. Time required to heat up the pool



Working principle AquaPool



AquaPool selection tables

Model	90°C					80°C					70°C					55 °C				
	kW	Primary		Swim. pool		kW	Primary		Swim. pool		kW	Primary		Swim. pool		kW	Primary		Swim. pool	
		m³/h	kPa	m³/h	kPa		m³/h	kPa	m³/h	kPa		m³/h	kPa	m³/h	kPa		m³/h	kPa	m³/h	kPa
AquaPool-7	30	0,5	44	1,3	41	30	0,9	24	1,3	41	30	1,2	6	1,3	41	17	1,2	6	0,7	18
AquaPool-11	52	0,9	41	2,2	43	51	1,4	25	2,2	41	50	1,8	5	2,2	41	30	1,8	5	1,3	19
AquaPool-17	82	1,3	36	3,5	43	79	1,9	19	3,4	40	76	2,5	6	3,3	38	46	2,5	6	2	18
AquaPool-23	111	1,7	30	4,8	43	104	2,3	18	4,5	38	96	2,9	6	4,1	33	58	2,9	6	2,5	16
AquaPool-29	140	2,2	26	6,0	43	125	2,7	18	5,4	34	111	3,2	6	4,8	28	69	3,2	6	3	14
AquaPool-35	166	2,6	22	7,1	42	144	3,0	15	6,2	32	123	3,5	5	5,3	27	78	3,5	5	3,4	12
AquaPool-41	194	3,1	16	8,3	42	164	3,4	11	7,1	30	134	3,6	6	5,8	21	84	3,6	6	3,6	11
AquaPool-49	222	3,5	11	9,5	41	184	3,6	11	7,9	28	146	3,8	5	6,3	19	96	3,8	5	4,1	9
AquaPool-55	246	3,8	5	10,6	41	199	3,8	5	8,6	27	151	3,8	5	6,5	16					

Note: Secondary conditions: 27/47°C (if primary at 70°C, 80°C or 90°C)
20/40°C (if primary at 55°C)



Waste heat recovery

For many energy companies and municipalities there are untapped opportunities for using waste heat or surplus heat. Such heat can be found in many forms, whether it is steam going out into the air or hot water going out into the ocean.

A lot of heat is lost in power plants, oil refineries and industrial processes. Many of these losses could be retrieved and distributed by district-heating systems to heat buildings. The same fuel achieves twice the work, thereby doubling fuel efficiency.

District-heating systems provide the necessary heat load for high-efficiency combined heat and power plants, while at the same time enabling the use of renewable energy. It demonstrates fantastic opportunities for other communities from a financial as well as an environmental point of view.



A residential building in Belgium, heated by surplus energy from a waste incineration facility.

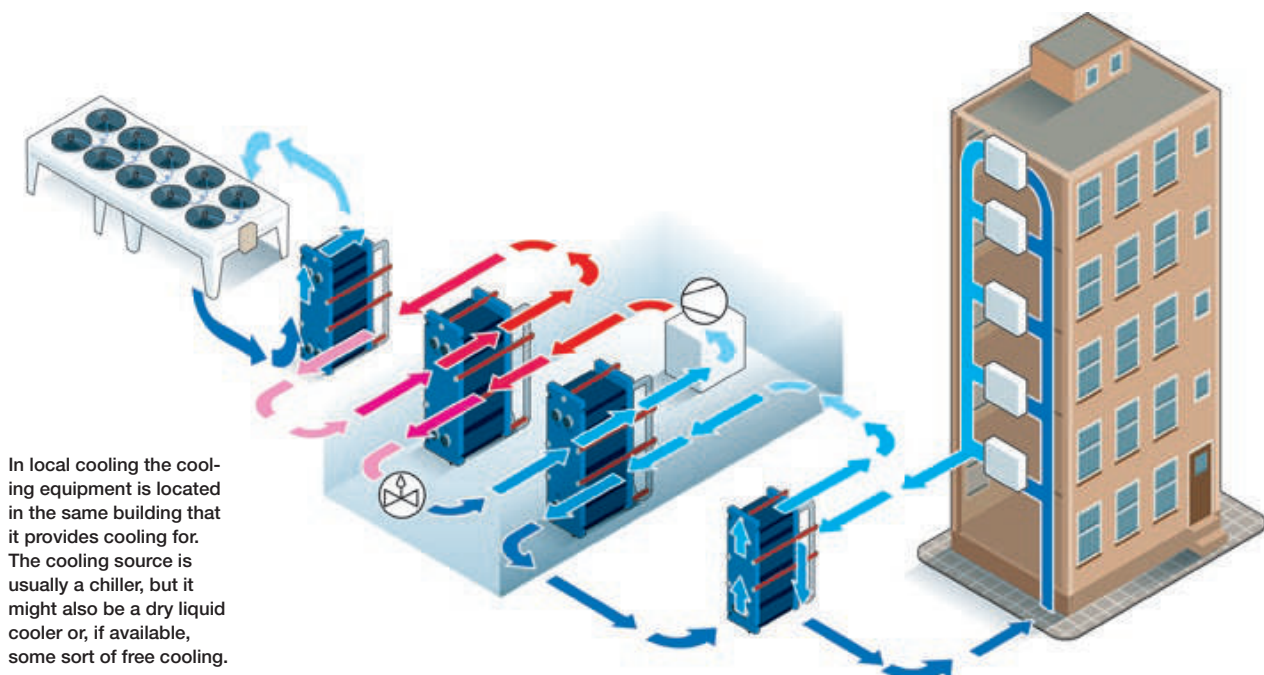
Local and district cooling

Local cooling

Local cooling is the most common cooling system globally. The local cooling system provides cooling for a single building, for example a hotel, conference center, sports center, hospital, or an office block. The chiller plant and the storage facility are located inside each building, the cooling source usually being a chiller. Depending on availability some sort of free cooling might be used, alone or in combination with the chiller. The cold from the source water is transferred to the building's internal cooling system through a plate heat exchanger.

OLA (Optimization Liquid Air), Alfa Laval's new special software, will let you calculate an optimized combination of two heat exchangers, for example a dry liquid cooler and a plate heat exchanger. This optimized package will make your system work at just the right capacity. A fine-tuned system will run smoother and minimize maintenance. It will also enable you to choose the most economical cooling source solution for each season, for example free cooling in the wintertime.

Another application is installing plate heat exchangers at different stories in tall buildings to solve the cooling system's pressure problems. These heat exchangers act as pressure interceptors, transferring the cold between the separate zones, and also protecting the air handling units and other equipment from excessive pressure.



In local cooling the cooling equipment is located in the same building that it provides cooling for. The cooling source is usually a chiller, but it might also be a dry liquid cooler or, if available, some sort of free cooling.



District cooling

The concept of district cooling is becoming more and more widespread all over the world. The idea, as for district heating, is to use one central source instead of local systems for each building. This will create both economic and environmental benefits.

The district-cooling system offers operating flexibility, since each building can use as much or as little cooling as needed, without worrying about chiller size or capacity. The installation will be very comfortable and convenient for the customer, with the possibility of using the same supplier for electricity, heating and cooling. The installation of a district cooling system is greatly facilitated if combined with an existing district-heating system, or one built at the same time, since the costs can be shared between the two systems.

One of the benefits for the customer is the saving of space at the location as there is no chiller. The investment cost will also be less than when having to invest in a chiller. There will be no need to re-place chiller, cooling towers or pumps due to wear or CFC/HCFC phase-out, as the CFC/HCFC handling problem will be taken care of. With centrally produced comfort cooling there will be no noise or vibrations. Maintenance and running costs will be lower, and a better level of equipment redundancy and round-the-clock expert management, which individual buildings cannot match, will be achieved.

Direct and indirect cooling systems

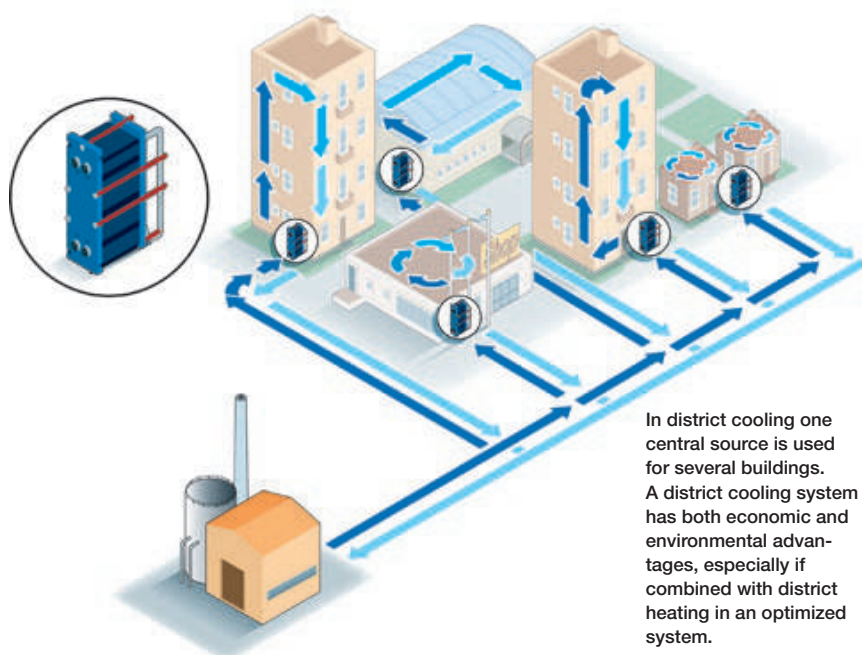
In cooling systems the distribution can be either direct or indirect. If direct, the cooling water goes directly into the internal piping system of a building. In an indirect system, a heat exchanger separates the internal from the external system. Today this is the most common system, and the indirect system provides several benefits.

Leakage will be easier to detect, and if it does occur, will create minimum damage. There is no risk of one system contaminating another. In a district cooling system the responsibility line will be clearer, and the regulation and sales are easier to monitor with clear borders. With separate circuits the customers may experience fewer fluctuations and disturbances, should

the central system expand or need maintenance.

In an indirect system the heat exchanger will also decrease the static pressure, thus working as a pressure interceptor. Noise from valves can be eliminated when the pressure in the pipes is decreased. In the indirect system solution the dimensions of the consumer's in-home system will be smaller, and thus cheaper.

Installing Alfa Laval plate heat exchangers in an indirect cooling system ensures minimal energy loss throughout the system. Alfa Laval's "close approach" enables temperature exchange approaches of no more than $0.5^{\circ}\text{C}/<0.9^{\circ}\text{F}$.





Pressure interceptor

In skyscrapers, the static head creates a pressure that may exceed what the chiller condenser or room air conditioners can handle. A plate heat exchanger will then split the circuit in order to keep the pressure at an acceptable level. It is possible to put plate heat exchangers on different levels throughout the building, thus limiting the pressure and the corresponding requirements on, for example, pumps, piping and valves.

Depending on the size of a skyscraper there might be many plate heat exchangers acting as pressure interceptors. It is very important that cold is not wasted in the cooling system. Alfa Laval's "close approach" when it comes to energy efficiency means that the heat exchangers will transfer practically all cold to the top of the building with minimum loss.

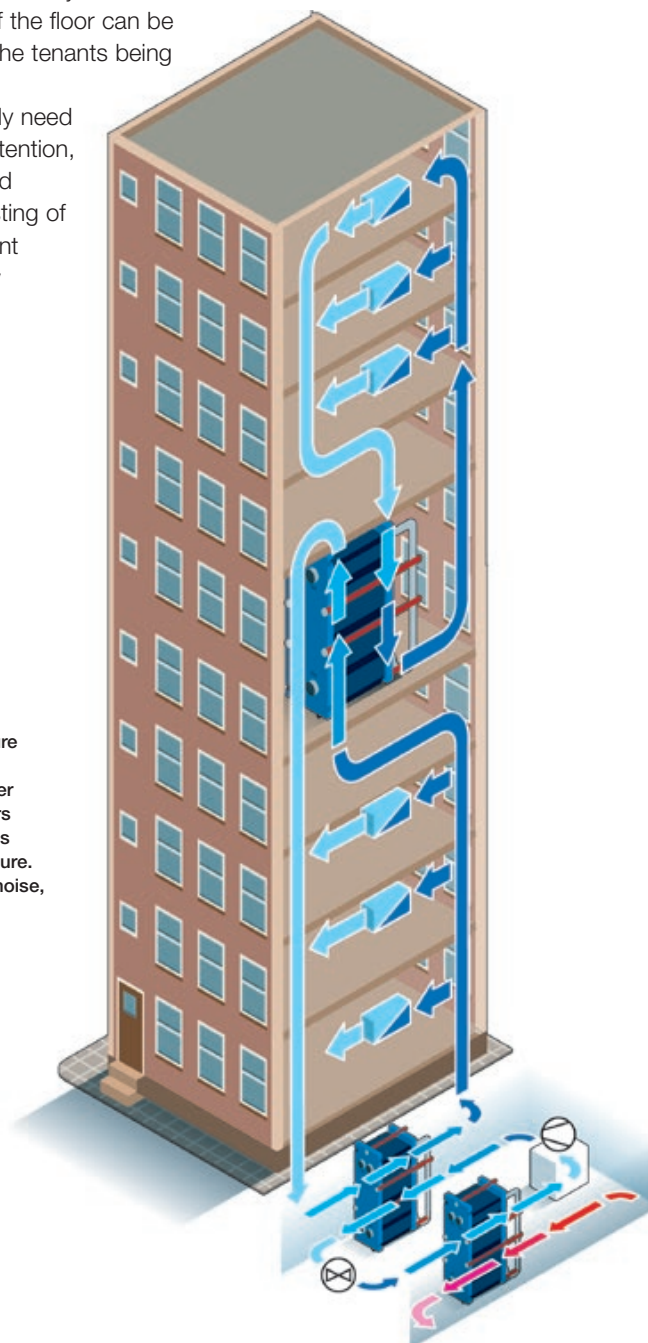
Advantages of plate heat exchangers as pressure interceptors

The entire chilled water system will be designed for low pressure, for example 10 bar (150 psig). This means cost savings in the chiller as well as in the selection of air handling units and other system equipment. Instead of having many chillers in a building, plate heat exchangers can be placed on several floors as pressure interceptors. This has a positive effect on building design:

- They are very compact and only require normal room height, i.e. <3 m/10 ft, and only a third of the floor space of a chiller with identical capacity. This makes them easy to install, even in buildings with limited space.

- They do not cause any vibrations or noise. This will save money for the owner as the rest of the floor can be rented out without the tenants being disturbed.
- They do not normally need any maintenance attention, apart from a planned maintenance consisting of a gasket replacement approximately every 10-12 years.

PHEs used as pressure interceptors in tall buildings protect other equipment like chillers and air condition units from excessive pressure. It is a compact, low-noise, no-worries solution.





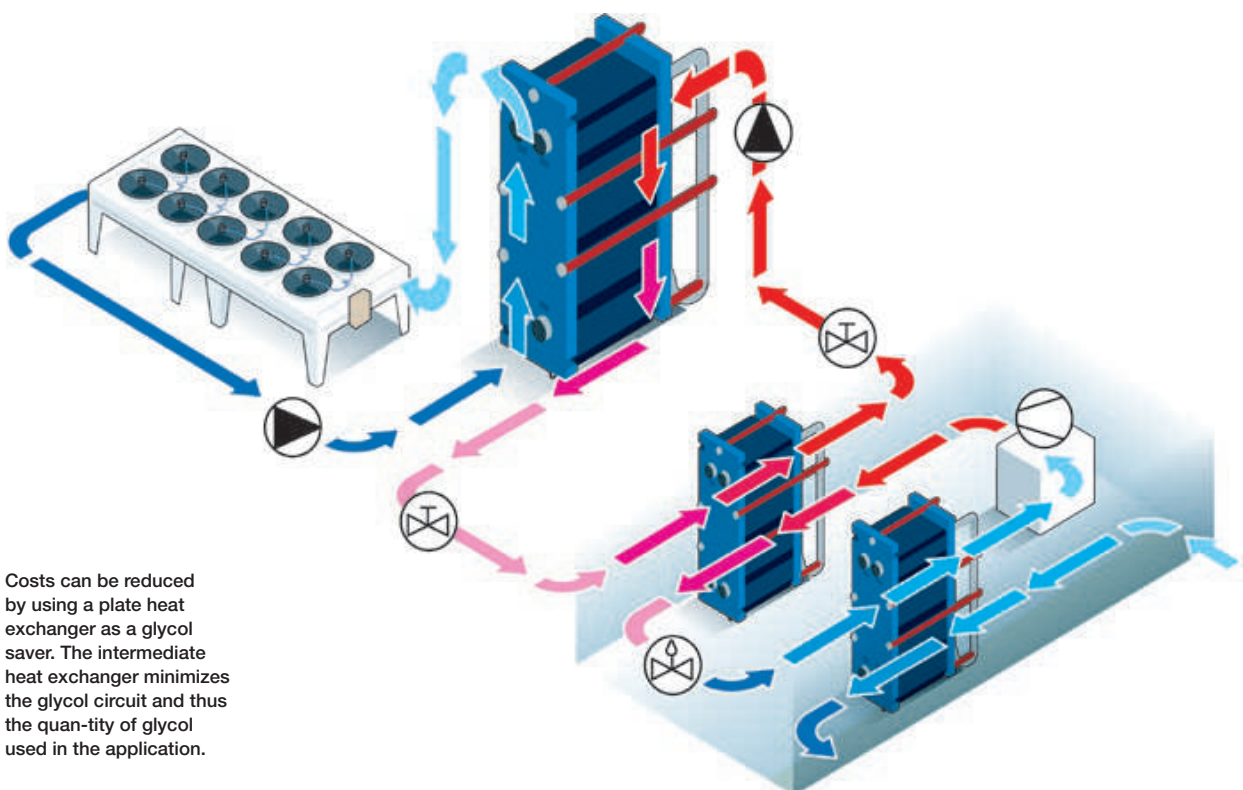
Glycol saving

Glycol is used in systems with outside piping when there is a risk of the ambient temperature dropping below 0°C/32°F. Another cooling application for plate heat exchangers is to use them as glycol savers.

The sketch above shows an example where a dry liquid cooler is used instead of a cooling tower.

In order to avoid the risk of bacteria in the cooling tower water, this is increasingly required by law in many countries.

In cases where the dry liquid cooled condenser is situated far away from the chiller and glycol is used, the amount of glycol that has to be added to the system is high and so is the cost. An intermediate plate heat exchanger will minimize the glycol circuit, thus acting as a glycol saver and cutting expenses.



Costs can be reduced by using a plate heat exchanger as a glycol saver. The intermediate heat exchanger minimizes the glycol circuit and thus the quantity of glycol used in the application.

Cooling sources

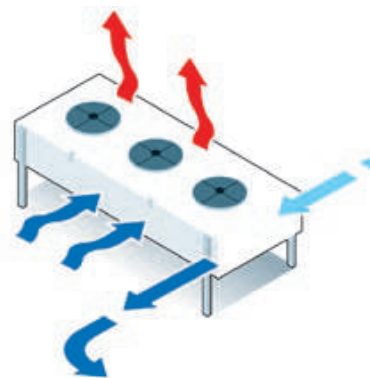
Cooling tower

Today water qualities are deteriorating because of different kinds of pollution. This increases the risk of chiller shut-downs due to operation problems of the condenser. The condenser is subject to attacks from either chlorides that will cause corrosion or impurities or biological activities in the water that will cause fouling. As the expectations of trouble-free cooling operations have increased, it has become more and more interesting to look at alternative solutions where these problems can be avoided.

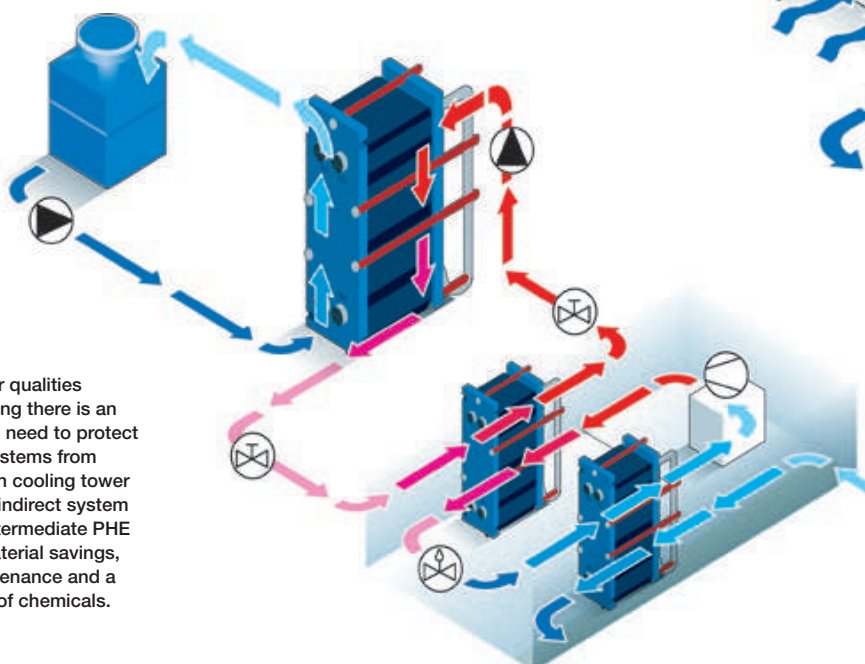
One solution is an indirect system using a heat exchanger in combination with an open cooling tower. The advantages of this are:

- Low system cost: Cost calculations show that the payback period of the heat exchanger is very short.
- Material savings in the condenser: Less expensive materials can be used.
- With an intermediate heat exchanger, chillers as well as cooling towers can be run at an optimal temperature.
- An intermediate heat exchanger means that the use of water treatment chemicals, for example chromates used for the cooling tower water, can be minimized.
- Less maintenance of the condenser.

For smaller or medium-sized cooling applications a dry liquid cooler is an energy-saving option that might be a source of free cooling when the temperature drops. Alfa Laval offers a wide range of high-quality dry liquid coolers.



With water qualities deteriorating there is an increasing need to protect cooling systems from pollution in cooling tower water. An indirect system with an intermediate PHE means material savings, less maintenance and a minimum of chemicals.





Free cooling

Free cooling combines an environment-friendly alternative for producing cold with economical benefits. Cooling applications relying on free cooling have been installed with good results in many countries around the world.

When utilizing free cooling as a cooling source in an application, the use of ecologically harmful refrigerants can be reduced. Free cooling is also a way to cut down on electricity costs – in some cases the reduction might exceed 75 percent, resulting in great savings. Reduction in electricity consumption also has positive environmental effects, as electricity production often involves air pollution.

Free cooling is used mainly for air conditioning and process cooling. It can cover the cooling requirements during the period when the free cooling source has lower temperature than the cold water, for example during winter. In spring and autumn a combination of free cooling and chiller-produced cold is used. In the summertime the chiller

supplies the total cooling requirement. Suitable free cooling sources are water from for example rivers, lakes, (deep) oceans or ground water, ice and snow storage, or air.

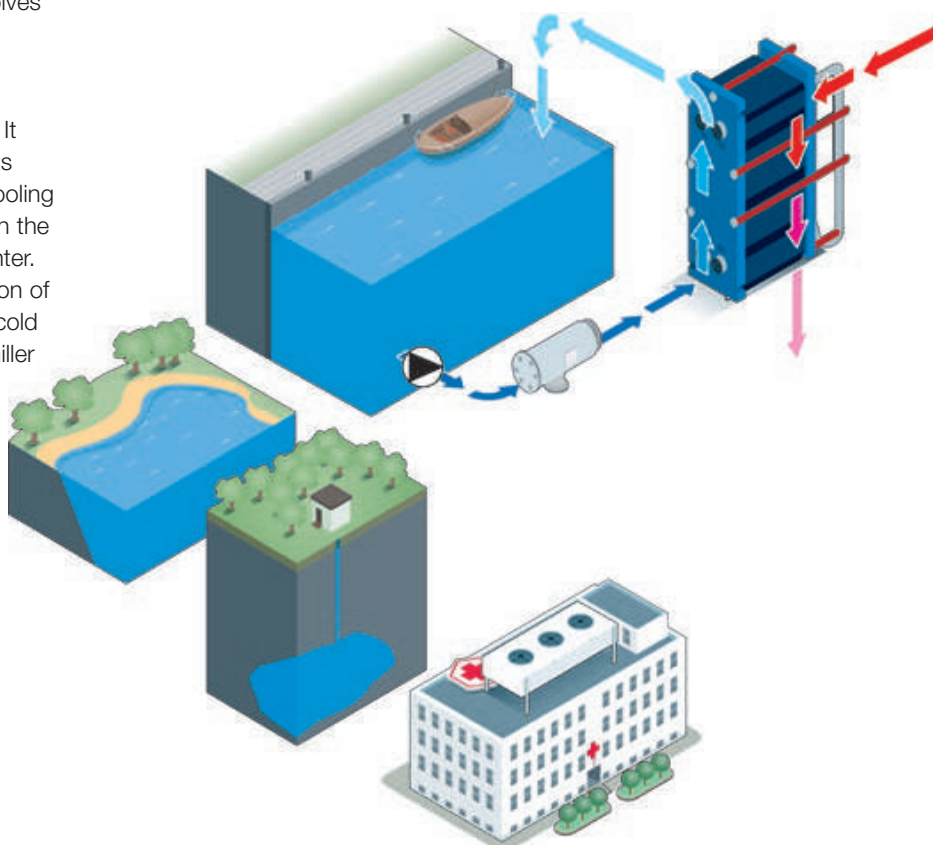
Products for free cooling

Alfa Laval's continuous research and development strategy means we are able to supply products for any cooling application, regardless of cooling media and cooling source. This makes it possible to utilize aggressive cooling media such as sea-water, brackish water, or water from rivers and wells.

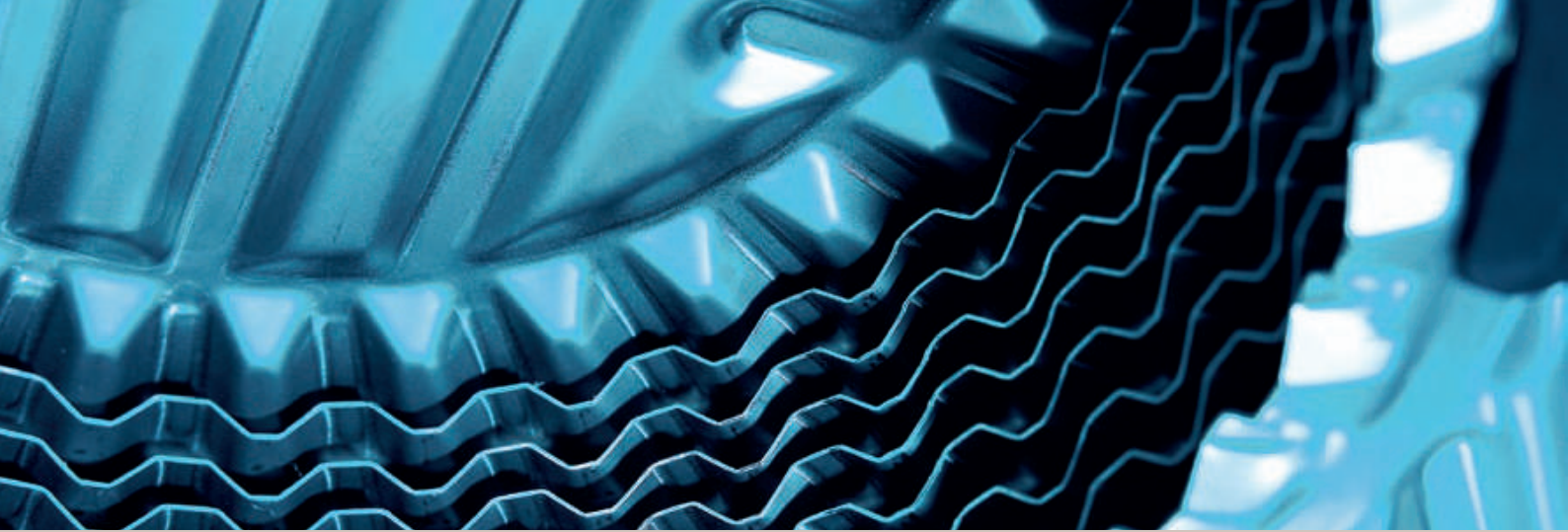
By installing a plate heat exchanger, the chilled water loop can be totally isolated from sensitive equipment like air conditioners, thereby eliminating corrosion, scaling and constant maintenance. In seawater and fresh-water applications, installation of a filter for protecting the heat exchanger is recommended.

A cooling system using free cooling in combination with a plate heat exchanger will also require less space, creating an extremely compact solution.

But Alfa Laval is more than outstanding products and optimized systems. Based on our vast experience we are always able to provide quality solutions.



Free cooling has many economical and environmental advantages. Alfa Laval's knowledge about for example corrosive media has resulted in products that can handle aggressive cooling media like seawater and brackish water.



Chiller bypass

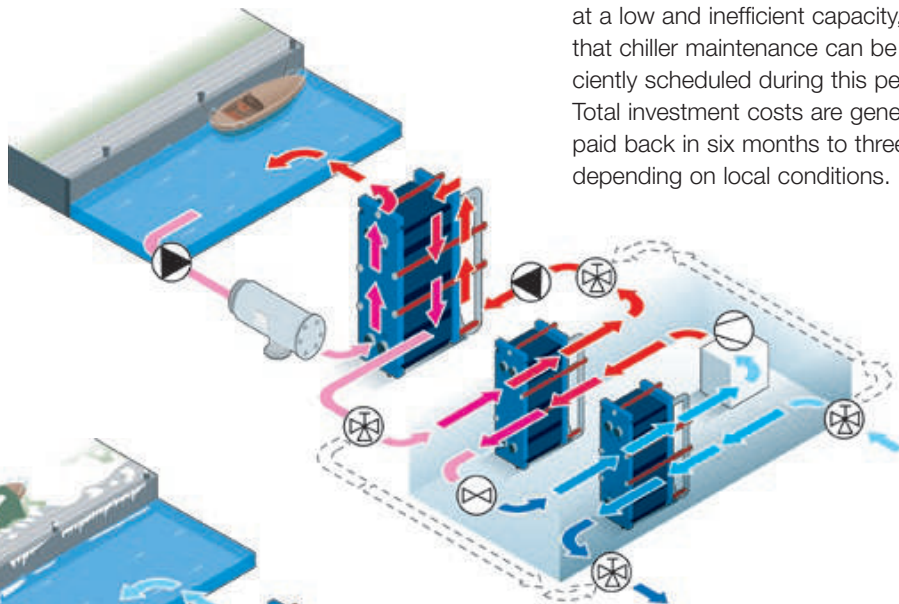
Traditionally the chiller in an air conditioning system runs continuously during the entire cooling season, even when full capacity is not required. Previously, the only alternative to constant chiller operation has been a chiller bypass system using a strainer. This strainer removes impurities, but at the same time it requires costly maintenance, chlorination and other chemical treatment.

By installing a plate heat exchanger – and sometimes a filter to protect it – in the chiller bypass system, corrosion, scaling and constant maintenance can be virtually eliminated. Another advantage is that this system can use any type of cooling, such as a cooling tower or free cooling with river or well water, even seawater or brackish water,

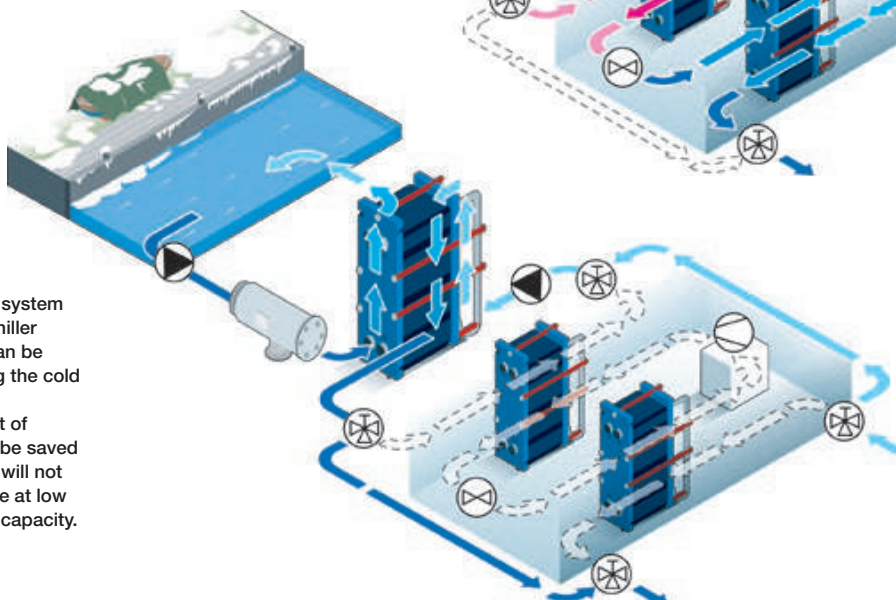
without ruining sensitive equipment like air conditioners.

As soon as the bulb drops below the required condenser temperature (min. 1°C/1.8°F), the heat exchanger makes it possible to reduce the chiller temperature. This means that a large amount of electricity can be saved during the cold season. It also means that the chiller will not have to operate at a low and inefficient capacity, and that chiller maintenance can be efficiently scheduled during this period. Total investment costs are generally paid back in six months to three years, depending on local conditions.

Chiller bypass system (summer). The chilled water is isolated from the other cooling equipment. This minimizes costly maintenance and the system can use aggressive cooling media.



Chiller bypass system (winter). The chiller temperature can be reduced during the cold season. A large amount of electricity can be saved and the chiller will not have to operate at low and inefficient capacity.





Ice accumulator/storage

An ice accumulator/storage is a tank where ice can be accumulated during one period, stored and then thawed and used during another. There are two main reasons for using an ice accumulator/storage:

- Where the cooling requirements vary during the day a smaller chiller can be used. As a result the initial cost of cooling equipment can be reduced considerably.
- Cooling energy can be purchased during the night or off-peak hours. In many countries this means that it can be obtained at a lower price.

Since it has been shown that payback periods for ice accumulators will be as low as two years, it is an increasingly worthwhile investment. There are two main applications for ice accumulators: air conditioning and industry. Especially in industry, the cooling demand is often variable, for example in a dairy where the milk will be brought in in the morning.

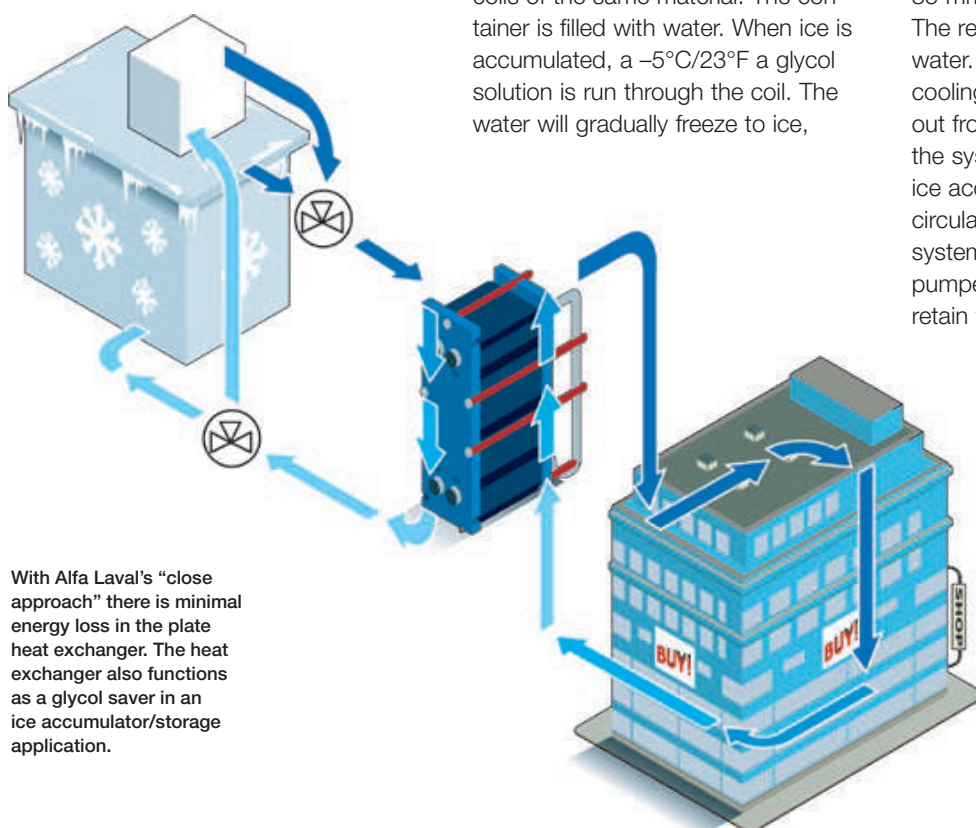
Types of ice accumulators

There are two main types of ice accumulator systems:

- Systems with internal melting consist of a polyethylene tank containing coils of the same material. The container is filled with water. When ice is accumulated, a $-5^{\circ}\text{C}/23^{\circ}\text{F}$ glycol solution is run through the coil. The water will gradually freeze to ice,

first around the coils and then further and further out in the tank. When the extra cooling capacity is required, the glycol solution in the coils will be led through the system and returned to the tank at a higher temperature. The ice accumulated in the tank will then melt, and the glycol solution will be re-cooled until all the ice is consumed.

- In systems with external melting the tank is made of steel or concrete. Here too are coils with glycol or a CFC/HCFC coolant, and ice is accumulated to a thickness of 35 mm/1.4 inches around each coil. The rest of the tank will be filled with water. When there is a need for cooling energy, ice water is pumped out from the bottom of the tank to the system. When it returns to the ice accumulator it will be forced to circulate around the ice. In this system, the ice water that is pumped into the system will always retain the same temperature.



With Alfa Laval's "close approach" there is minimal energy loss in the plate heat exchanger. The heat exchanger also functions as a glycol saver in an ice accumulator/storage application.

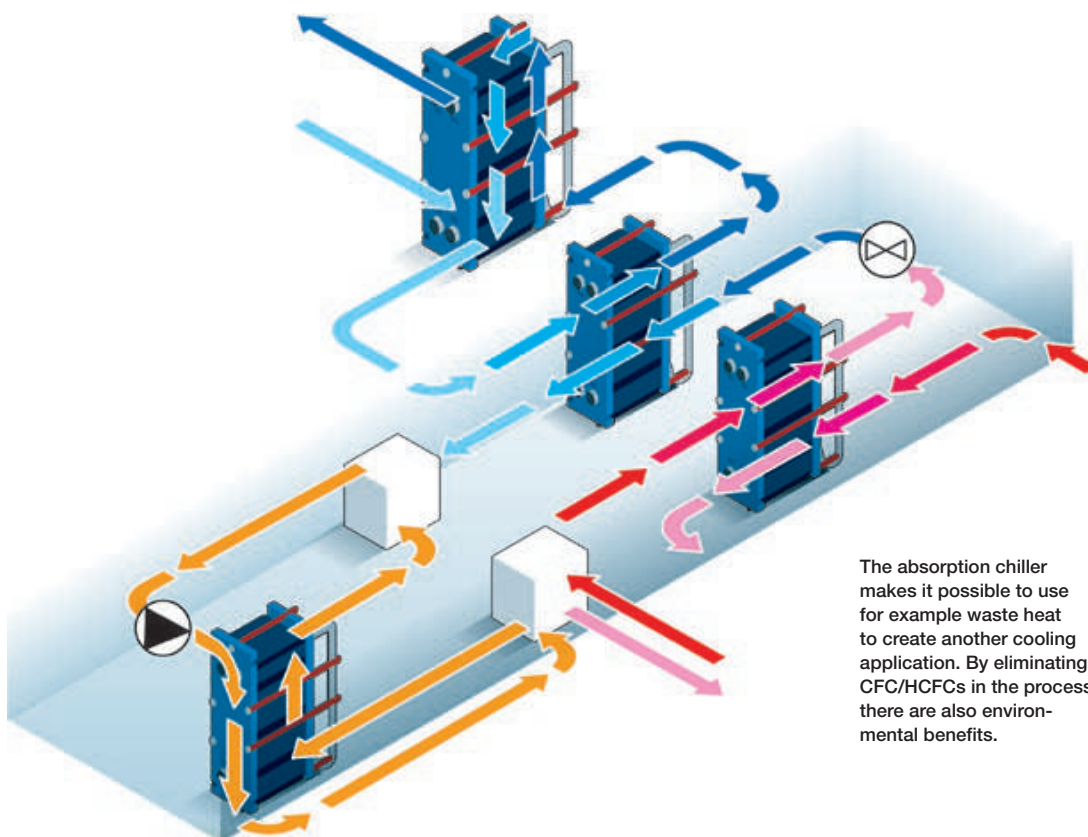
Other cooling applications

Absorption chiller

If district heat or waste heat is available, for example from waste disposal, there is another possibility for comfort cooling with an absorption chiller. This is an example of the kind of system optimization that Alfa Laval excels in. We have the knowledge and just the right equipment for providing solutions with both economical and environmental benefits.

In this application the CFC/HCFCs influencing the ozone are replaced with for example water and lithium bromide, both environment-friendly. In the evaporator the refrigerant (water) takes up heat/energy from the connected system, thus cooling the air conditioning circuit in a heat exchanger. The refrigerant enters the absorber as low-pressure vapor, where the liquid solvent (lithium bromide) absorbs it. The pump increases the pressure and the mixture

continues to the interchanger where it is preheated in for example a plate heat exchanger. Using the district heat, the refrigerant is boiled off from the solvent in the regenerator. The high-pressure vapor is sent to the condenser, where heat is emitted during the refrigerant's condensation.



The absorption chiller makes it possible to use for example waste heat to create another cooling application. By eliminating CFC/HCFCs in the process, there are also environmental benefits.



Heat recovery

In an optimized HVAC system, cooling and heating are integrated and waste heat and cold will be re-utilized in the system. Heat recovery is one often-neglected area where plate heat exchangers can be profitably used.

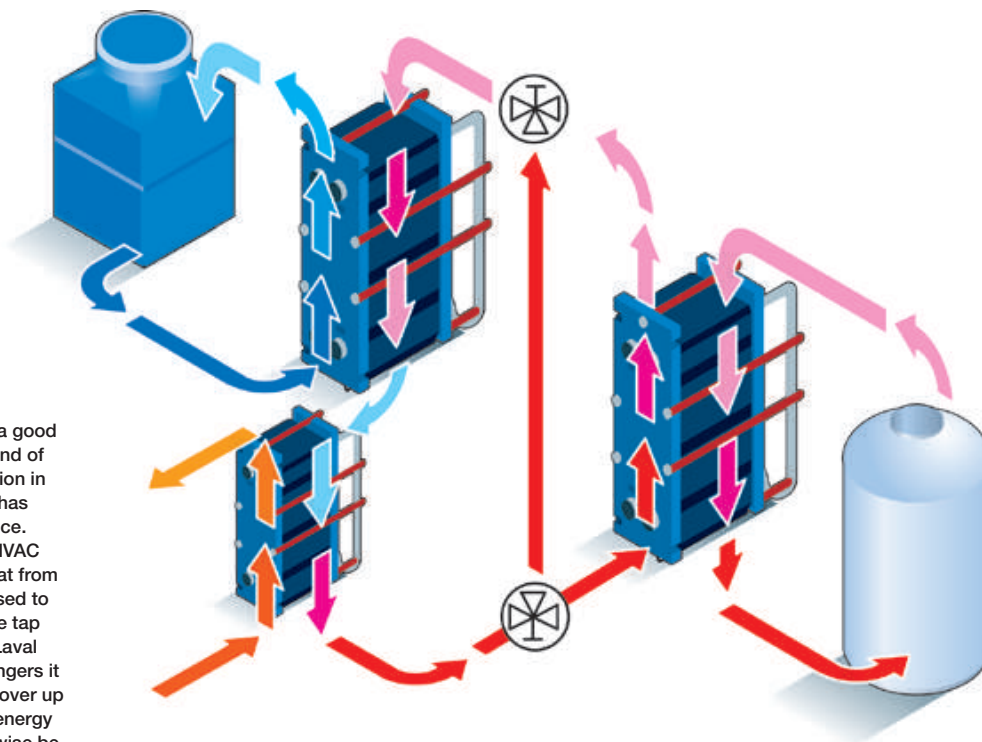
There are large potential savings as soon as there is a demand for hot tap water or other types of heating at the same time as the cooling system is running. Some types of buildings where this may be the case are hospitals and hotels, or different production facilities, for example in the chemical, pharmaceutical and beverage industries.

Alfa Laval has many years' experience from both cooling and heating applications and from customizing this kind of optimized system.

The heat-recovery plate heat exchanger will be installed between the condenser and the cooling tower, recouping part of the energy that would otherwise be let out in the air. While recovering heat for pre-heating tap water, for example, the cooling need decreases on the condenser side. Thus the savings will not only be the energy recovered in the heating system, but also the energy not wasted in the cooling system. Due to the extreme efficiency of the plate

heat exchanger it is possible to recover up to 95 percent of the energy that would otherwise be wasted. This is often more than enough to offset the capital and operating costs of the plate heat exchanger. In this case the heat exchanger should be of the double-wall type, with double walls between the condenser circuit and the tap water, to give extra protection against contamination.

Heat recovery is a good example of the kind of system optimization in which Alfa Laval has years of experience. In an optimized HVAC system waste heat from cooling can be used to warm for example tap water. With Alfa Laval plate heat exchangers it is possible to recover up to 95 percent of energy that would otherwise be wasted.





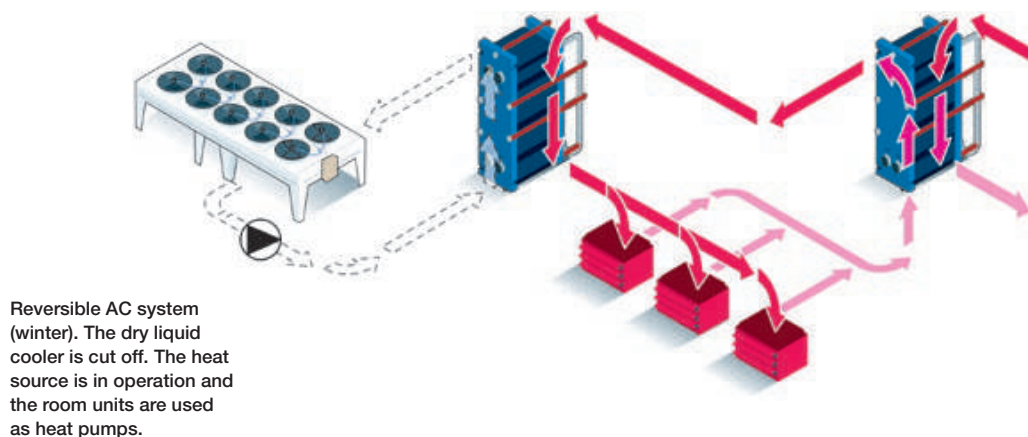
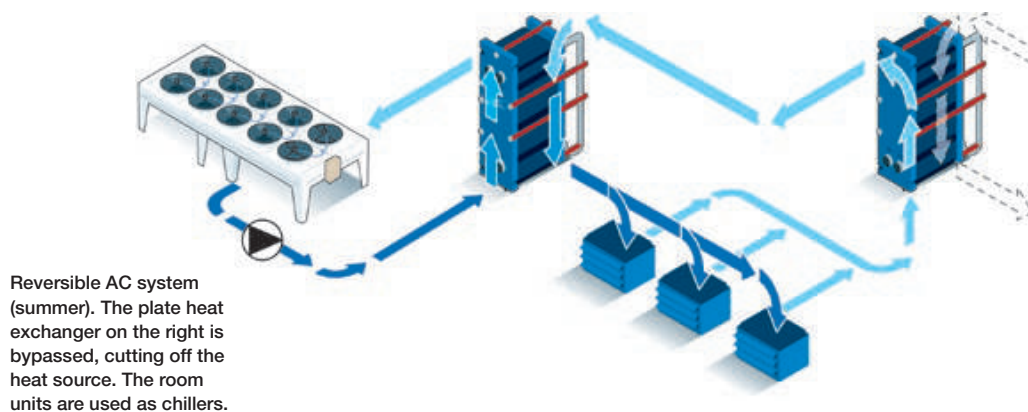
Reversible air conditioning system

Another system where heating and cooling is integrated is the reversible air conditioning system. In this particular type of condenser cooling system there are separate small cooling units in each room of, for example, an office building. These chillers can be used as either chillers or heat pumps, depending on the season and the climate. They are all connected to a main pipe that carries water through the system. This pipe is connected both to the cooling

source and to the heat source of the building.

During summer, the heat source is cut off and the water will flow directly through the plate heat exchanger on the heat-source side. The water of the main pipe will cool the condensers of the room units and transport the excess energy to the cooling source via the heat exchanger on the cooling-source side.

During winter, the cooling source is cut off and the water will flow through the plate heat exchanger on the cooling-source side with no change of temperature. Instead the heat source will now be in operation, and the water will be heated when passing the plate heat exchanger on the heat-source side. The room units will now be reversed, so that the hot water will go into the evaporators and transfer the heat to the rooms. The room units are now heat pumps.





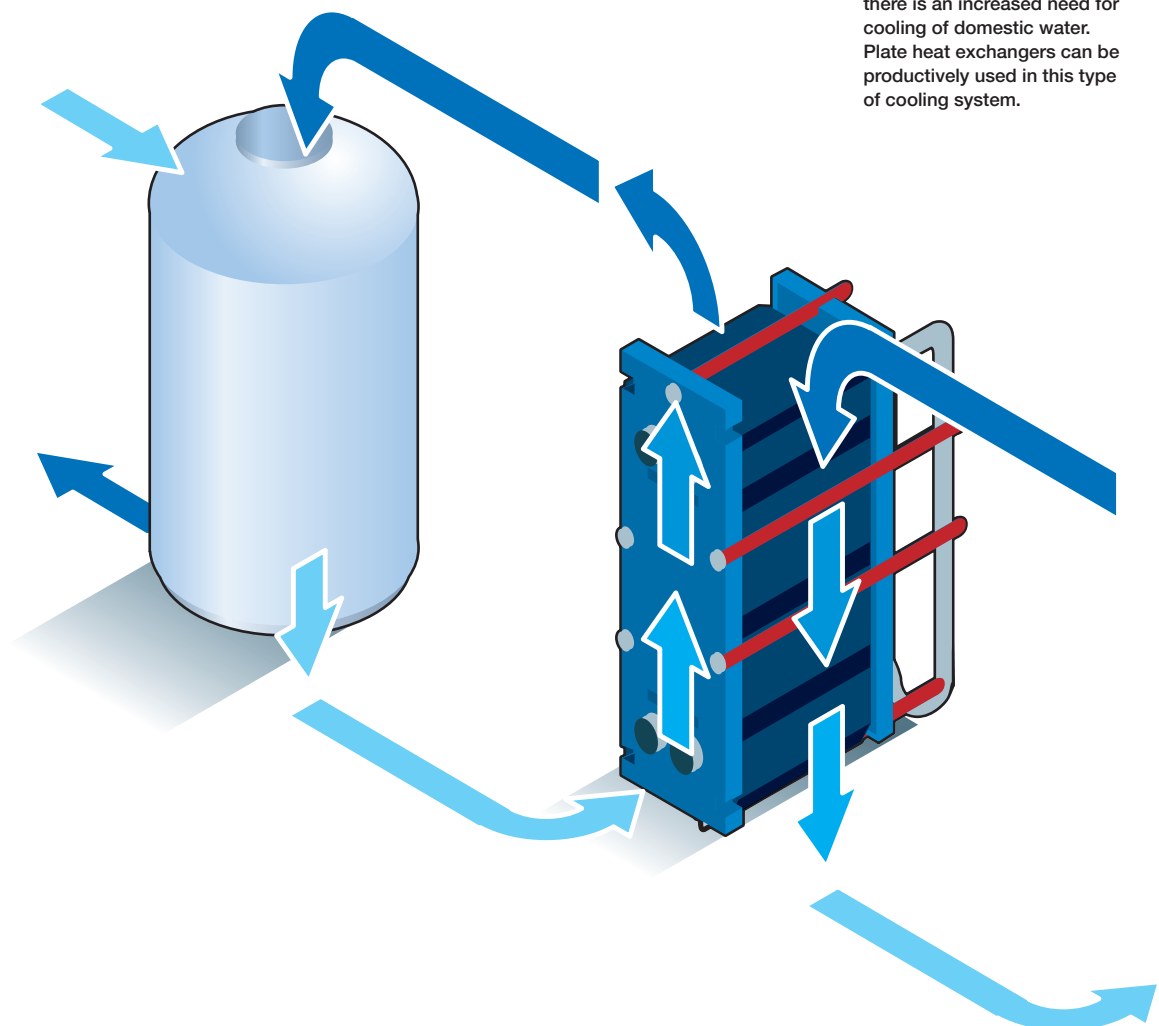
Tap water cooling

In hot geographical regions, where the atmospheric temperatures are in the range of 40–45°C/104–113°F, cooling plays a vital role in an individual's daily life. With such an atmospheric temperature one can easily imagine the water supply temperature to be in the range of 35°C/95°F.

This gives rise to the need for domestic water cooling.

This is achieved by having domestic water flowing through one side of the heat exchanger. The other medium flowing through the heat exchanger is chilled water.

In regions with extremely hot atmospheric temperatures there is an increased need for cooling of domestic water. Plate heat exchangers can be productively used in this type of cooling system.





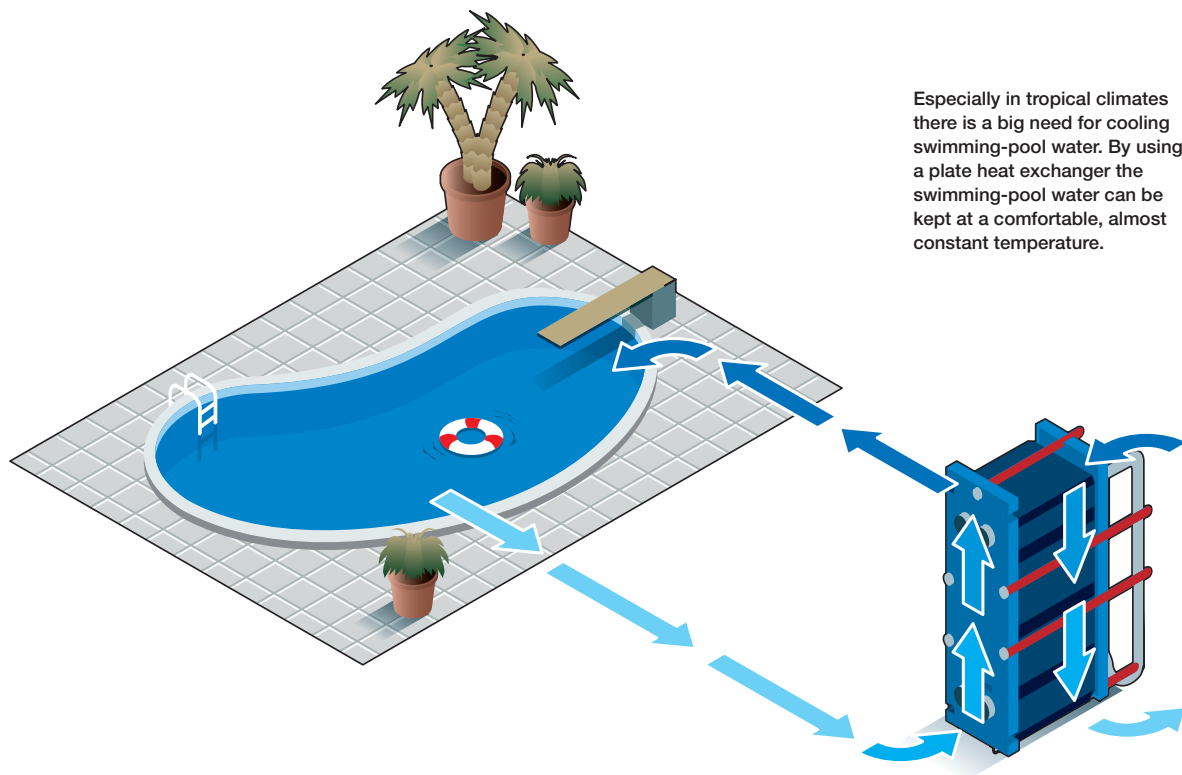
Swimming pool cooling

Plate heat exchangers can be used to maintain a nearly constant temperature in swimming pools all year round.

In hot geographical regions where the atmospheric temperatures are in the range of 40–45°C/104–113°F, there is a need to cool the incoming water

temperature (~40°C/104°F) to more suitable pool temperatures (~26°C/79°F).

The swimming pool water is one of the media that flows through the heat exchanger. Chilled water is used as the other medium.



Especially in tropical climates there is a big need for cooling swimming-pool water. By using a plate heat exchanger the swimming-pool water can be kept at a comfortable, almost constant temperature.

Data-center cooling

The data-center industry is a big industry in full expansion. Their needed cooling capacities grow fast, especially driven by the latest trend in cloud computing.

Typically, data-center owners and operators are looking for reliable, cost-

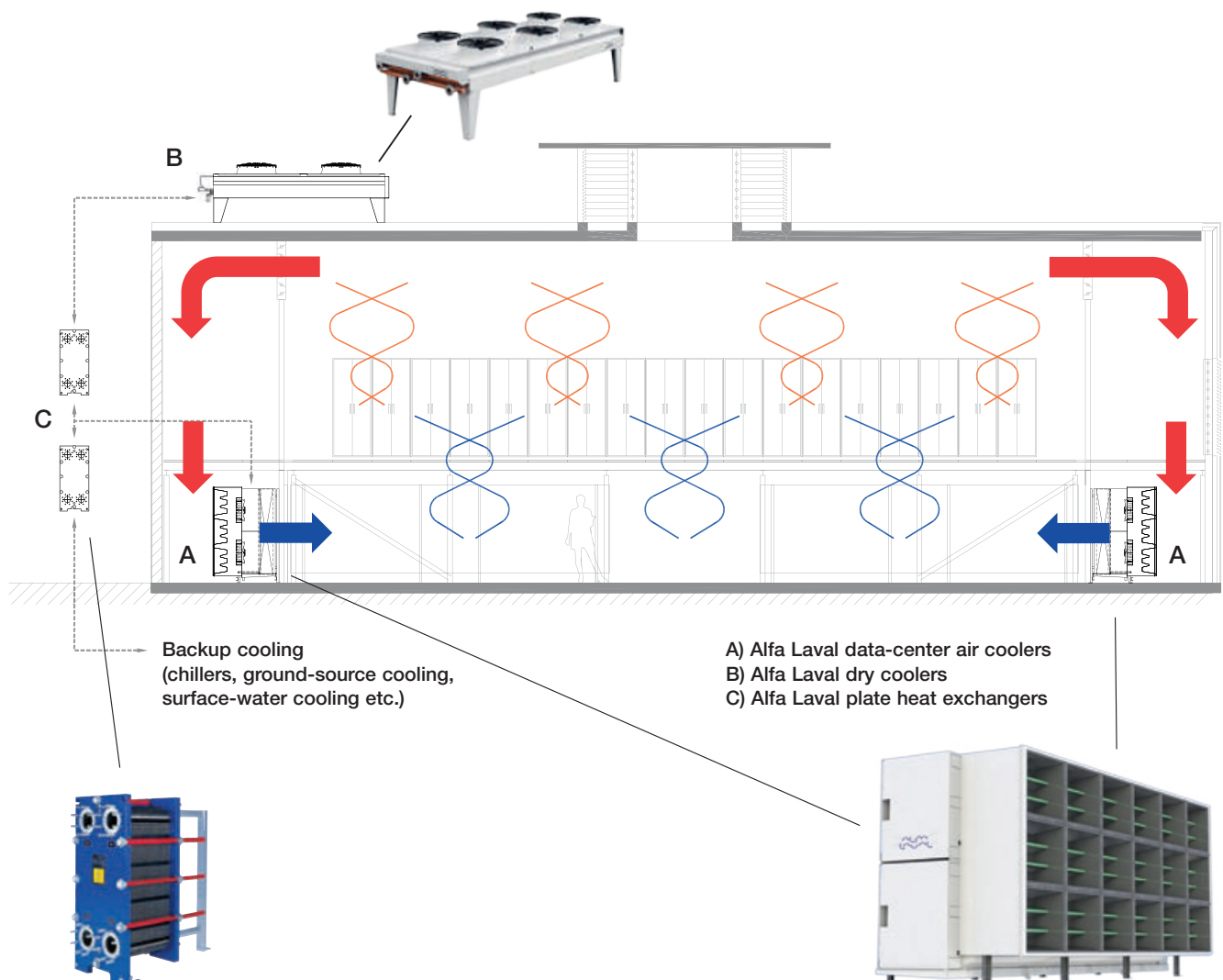
efficient equipment with long lifetime, energy savings, elimination of hot spots in their servers and minimum maintenance.

The Low Speed Ventilation concept for data centers is a completely integrated



building ventilation/recirculation system. It dissipates heat from the servers by means of low-speed controlled-air recirculation. As a result, hot spots are avoided at the lowest energy consumption possible (-30%).

Example of data-center design





Additional benefits of the Low Speed Ventilation Datacenter™ concept are:

- Lower investment compared with traditional Computer Room Air Conditioning units (CRAC): CAPEX -15%
- Very low maintenance cost (OPEX)
- Maintenance happens outside the whitespace, avoiding unauthorized people entering this sensitive area
- Suitable for both cold and hot containment
- Optimal temperature and humidity conditions at any server position
- Possibility to re-use dissipated heat
- No dust accumulation

Alfa Laval products used in the Low Speed Ventilation Datacenter™ concept

• **Alfa Laval THOR LSV Air Cooler**

THOR LSV air coolers are heavy duty industrial air coolers specifically designed for cooling servers in data centers that have been built according to “Low Speed Ventilation”. LSV air coolers operate with low fan speed, low air velocities and minimal pressure differences along the route of the air flow. This is achieved by the building itself being part of the system. For this reason all THOR-LSV air coolers have been designed with a nominal of 12 Pa air-sided pressure drop and a sensible heat factor of 1.0. In case direct fresh air is used in the computer room the THOR LSV air cooler contains an F7 or F9 filter, with a pressure drop of just 25 Pa.

• **Alfa Laval plate heat exchangers**

Plate heat exchangers are used for general heating and cooling duties.

• **Alfa Laval dry coolers**

Alfa Laval dry coolers are mainly used for free cooling duties.



Alfa Laval THOR LSV Air Cooler



Alfa Laval plate heat exchangers



Alfa Laval dry coolers

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The theory behind heat transfer

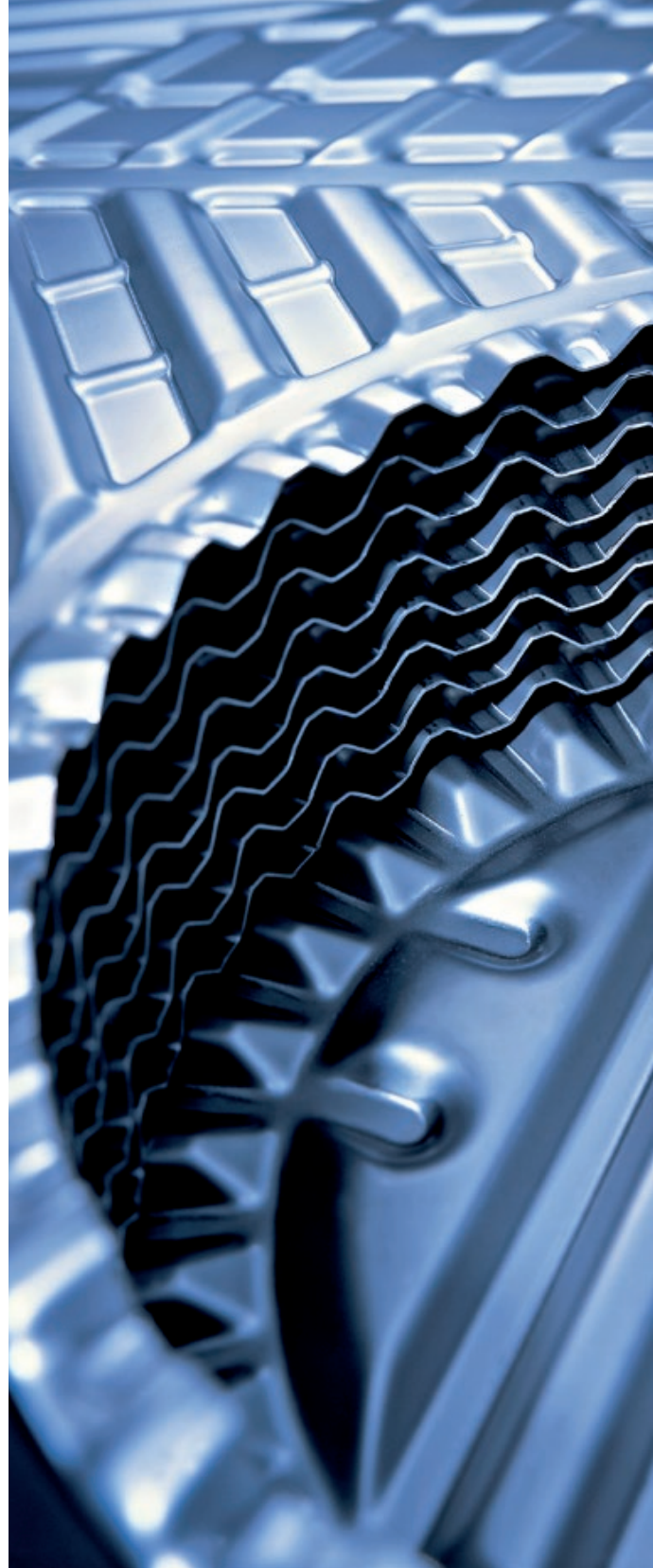
The following pages will help you gain a better understanding of how heat exchangers work.

The basic principles of heat transfer will be clearly and simply illustrated.

The natural laws of physics always allow the driving energy in a system to flow until equilibrium is reached. Heat leaves the warmer body or the hottest fluid, as long as there is a temperature difference, and will be transferred to the cold medium.

A heat exchanger follows this principle in its endeavour to reach equalization. With a plate type heat exchanger, the heat penetrates the surface, which separates the hot medium from the cold one very easily. It is therefore possible to heat or cool fluids or gases which have minimal energy levels.

The difference in temperature is the heat exchanger's "driving energy".



Heat transfer theory

The theory of heat transfer from one media to another, or from one fluid to another, is determined by several basic rules.

- Heat will always be transferred from a hot medium to a cold medium.
- There must always be a temperature difference between the media.
- The heat lost by the hot medium is equal to the amount of heat gained by the cold medium, except for losses to the surroundings.

Heat exchangers

A heat exchanger is a piece of equipment that continually transfers heat from one medium to another.

There are two main types of heat exchangers.

- Direct heat exchanger, where both media are in direct contact with each other. It is taken for granted that the media are not mixed together.

An example of this type of heat exchanger is a cooling tower, where water is cooled through direct contact with air.

- Indirect heat exchanger, where the two media are separated by a wall through which heat is transferred.

Heat transfer theory

Heat can be transferred by three methods.

- **Radiation** – Energy is transferred by electromagnetic radiation. One example is the heating of the earth by the sun.
- **Conduction** – Energy is transferred between solids or stationary fluids by the movement of atoms or molecules.
- **Convection** – Energy is transferred by mixing part of a medium with another part.

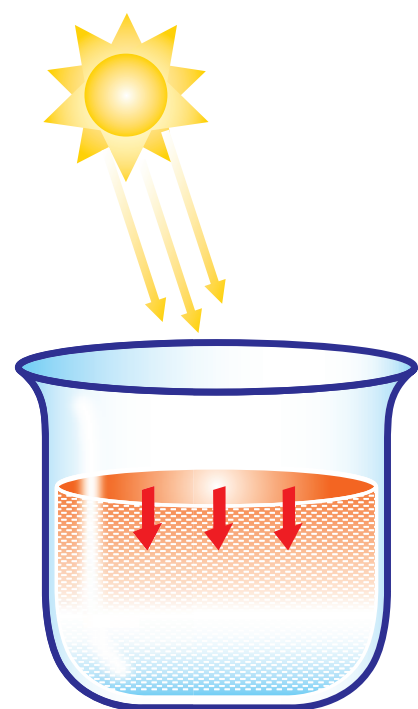
a) Natural convection, where the movement of the media depends entirely upon density difference, and temperature differences are evened out.

b) Forced convection, where the movement of the media depends entirely or partly upon the results of an outside influence. One example of this is a pump causing movement in a fluid.

Heat exchanger types

In this context only indirect heat exchangers are discussed, i.e. those where the media are not mixed, but where the heat is transferred through heat-transfer surfaces.

Temperature losses through radiation can be disregarded when considering heat exchangers in this context. Indirect heat exchangers are available in several main types (plate, shell-and-tube, spiral etc.) In most cases the



Radiation

plate type is the most efficient heat exchanger. Generally it offers the best solution to thermal problems, giving the widest pressure and temperature limits within the constraint of current equipment. The most notable advantages of a plate heat exchanger are:

- Takes up much less space than a traditional shell-and-tube heat exchanger.
- Thin material for the heat transfer surface – this gives optimum heat transfer, since the heat only has to penetrate thin material.
- High turbulence in the medium – this gives a higher convection, which results in efficient heat transfer between the media. The consequence

of this higher heat transfer coefficient per unit area is not only a smaller surface area requirement but also a more efficient operation.

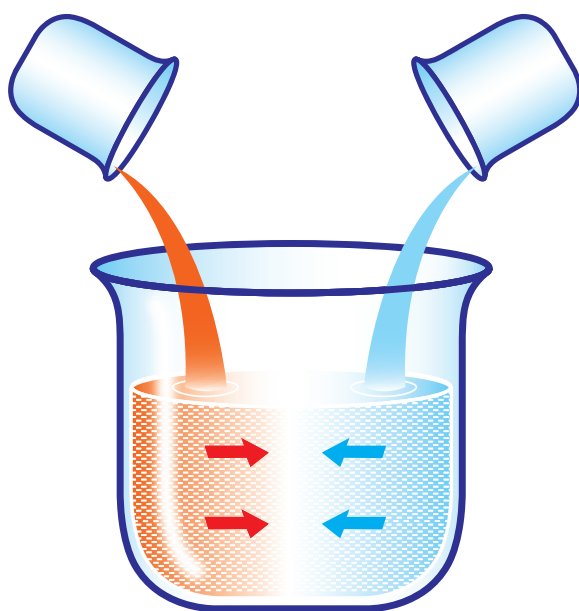
The high turbulence also gives a self-cleaning effect. Therefore, when compared to the traditional shell-and-tube heat exchanger, the fouling of the heat transfer surfaces is considerably reduced. This means that the plate heat exchanger can remain in service far longer between cleaning intervals.

- Flexibility – the plate heat exchanger consists of a framework containing several heat transfer plates. It can easily be extended to increase capacity. Furthermore, it is easy to open for the purpose of cleaning. (This only applies to gasketed heat exchangers, and not to brazed or fusion-bonded units.)

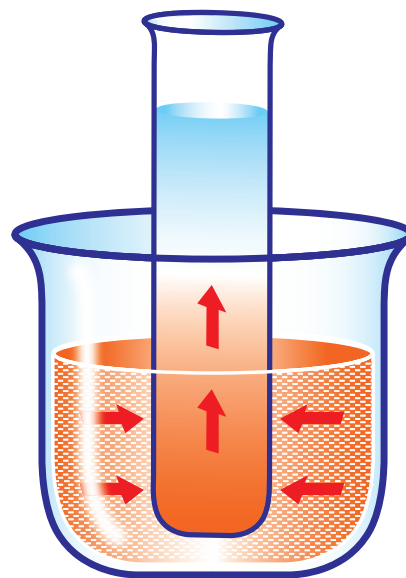
- Variable thermal length – most of the plate heat exchangers manufactured by Alfa Laval are available with two different pressing patterns. When the plate has a narrow pattern, the pressure drop is higher and the heat exchanger is more effective. This type of heat exchanger has a long thermal channel.

When the plate has a wide pattern, the pressure drop is smaller and the heat transfer coefficient is accordingly somewhat smaller. This type of heat exchanger has a short thermal channel.

When two plates of different pressing patterns are placed next to each other, the result is a compromise between long and short channels as well as between pressure drop and effectiveness.



Convection



Conduction

Calculation method



To solve a thermal problem, we must know several parameters. Further data can then be determined. The six most important parameters are the following:

- The amount of heat to be transferred (heat load).
- The inlet and outlet temperatures on the primary and secondary sides.
- The maximum allowable pressure drop on the primary and secondary sides.
- The maximum operating temperature.
- The maximum operating pressure.
- The flow rate on the primary and secondary sides.

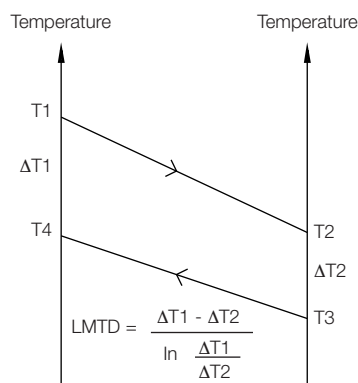
If the flow rate, specific heat and temperature difference on one side are known, the heat load can be calculated. See also page 4:6.

Temperature program

This means the inlet and outlet temperatures of both media in the heat exchanger.

- T1 = Inlet temperature – hot side
- T2 = Outlet temperature – hot side
- T3 = Inlet temperature – cold side
- T4 = Outlet temperature – cold side

The temperature program is shown in the diagram below.



Heat load

Disregarding heat losses to the atmosphere, which are negligible, the heat lost (heat load) by one side of a plate heat exchanger is equal to the heat gained by the other. The heat load (P) is expressed in kW or kcal/h.

Logarithmic mean temperature difference

Logarithmic mean temperature difference (LMTD) is the effective driving force in the heat exchanger. See diagram to the left.

Thermal length

Thermal length (Θ) is the relationship between temperature difference δt on one side and LMTD.

$$\Theta = \frac{\delta t}{\text{LMTD}}$$

Thermal length describes how difficult a duty is from a thermal perspective.

Density

Density (ρ) is the mass per unit volume and is expressed in kg/m³ or kg/dm³.

$$P = m \times c_p \times \delta t$$

Where;

P = Heat load (kW)

m = Mass flow (kg/s)

c_p = Specific heat (KJ/kg °C)

δt = Difference between inlet and outlet temperatures on one side (°C)

Cooling

For some duties, cooling applications for example, the temperature program is very tight with close approaches on the different temperatures. This gives what we refer to as high theta duties and requires high theta units. High theta duties are duties that have $\Theta > 1$ and are characterized by:

- Long plate, longer time for the fluid to be cooled
- Low pressing depth that gives less fluid per plate to be cooled

Plate heat exchangers are superior compared to shell-and-tube heat exchangers when it comes to theta values. Shell-and-tube heat exchangers can go up to a maximum value of theta ~1 while plate heat exchangers reach theta values of 10 and more. For a shell-and-tube to climb over theta value of 1 or more, several units need to be installed in a series.

Flow rate

This can be expressed in two different terms, either by weight or by volume. The units of flow by weight are in kg/s or kg/h, the units of flow by volume in m³/h or l/min. To convert units of volume into units of weight, it is necessary to multiply the volume flow by the density.

The maximum flow rate usually determines which type of heat exchanger is the appropriate one for a specific purpose. Alfa Laval plate heat exchangers can be used for flow rates from 0.05 kg/s to 1,400 kg/s. In terms of volume, this equates 0.18 m³/h to 5,000 m³/h in a water application. If the flow rate is in excess of this, please consult your local Alfa Laval representative.

Pressure drop

Pressure drop (Δp) is in direct relationship to the size of the plate heat exchanger. If it is possible to increase the allowable pressure drop, and incidentally accept higher pumping costs, then the heat exchanger will be smaller and less expensive. As a guide, allowable pressure drops between 20 and

100 kPa are accepted as normal for water/water duties.

Specific heat

Specific heat (c_p) is the amount of energy required to raise 1 kg of a substance by one degree centigrade. The specific heat of water at 20°C is 4.182 kJ/kg °C or 1.0 kcal/kg °C.

Viscosity

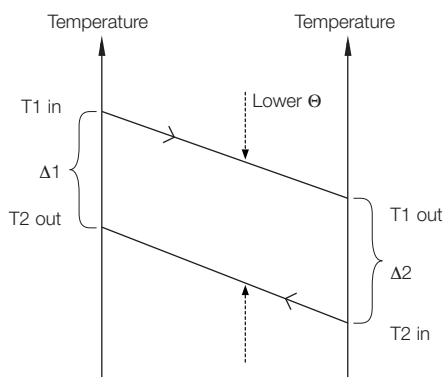
Viscosity is a measure of the ease of flow of a liquid. The lower the viscosity, the more easily it flows.

Viscosity is expressed in centiPoise (cP) or centiStoke (cSt).

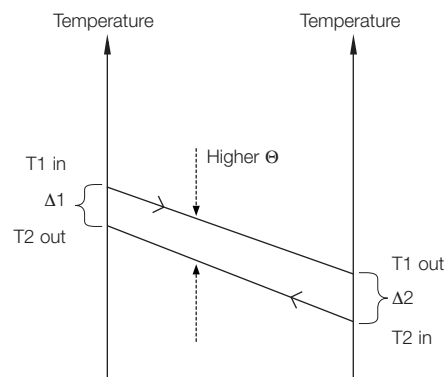
Overall heat transfer coefficient

Overall heat transfer coefficient (k) is a measure of the resistance to heat flow, made up of the resistances caused by the plate material, amount of fouling, nature of the fluids and type of exchanger used.

Overall heat transfer coefficient is expressed as W/m² °C or kcal/h, m² °C.



The diagram shows that large temperature differences result in low theta.



The diagram shows that small temperature differences result in high theta.

Calculation method

The heat load of a heat exchanger can be derived from the following two formulas:

1. Heat load, Theta and LMTD calculation

$$P = m \cdot c_p \cdot \delta t \quad (m = \frac{P}{c_p \cdot \delta t}; \delta t = \frac{P}{m \cdot c_p})$$

$$P = k \cdot A \cdot \text{LMTD}$$

Where:

P = heat load (kW)

m = mass flow rate (kg/s)

c_p = specific heat (kJ/kg °C)

δt = temperature difference between inlet and outlet on one side (°C)

k = heat transfer coefficient (W/m² °C)

A = heat transfer area (m²)

LMTD = log mean temperature difference

$$\Theta = \text{Theta-value} = \frac{\delta t}{\text{LMTD}} = \frac{k \cdot A}{m \cdot c_p}$$

T1 = Temperature inlet – hot side

T2 = Temperature outlet – hot side

T3 = Temperature inlet – cold side

T4 = Temperature outlet – cold side

LMTD can be calculated by using the following formula, where $\Delta T1 = T1 - T4$ and $\Delta T2 = T2 - T3$

$$\text{LMTD} = \frac{\Delta T1 - \Delta T2}{\ln \frac{\Delta T1}{\Delta T2}}$$

2. Heat transfer coefficient and design margin

The total overall heat transfer coefficient k is defined as:

$$\text{Where: } \frac{1}{k} = \frac{1}{\alpha_1} + \frac{1}{\alpha_2} + \frac{\delta}{\lambda} + R_f = \frac{1}{k_c} + R_f$$

$$\text{The design margin (M) is calculated as: } M = \frac{k_c - k}{k}$$

α_1 = The heat transfer coefficient between the warm medium and the heat transfer surface (W/m² °C)

α_2 = The heat transfer coefficient between the heat transfer surface and the cold medium (W/m² °C)

δ = The thickness of the heat transfer surface (m)

R_f = The fouling factor (m² °C/W)

λ = The thermal conductivity of the material separating the medias (W/m °C)

k_c = Clean heat transfer coefficient ($R_f=0$) (W/m² °C)

k = Design heat transfer coefficient (W/m² °C)

M = Design Margin (%)

Combination of these two formulas gives: $M = k_c \cdot R_f$

i.e the higher k_c value, the lower R_f -value to achieve the same design margin.

$$LMTD = \frac{\Delta T_1 - \Delta T_2}{\ln \frac{\Delta T_1}{\Delta T_2}}$$

$$\frac{1}{k} = \frac{1}{\alpha_1} + \frac{1}{\alpha_2} + \frac{\delta}{\lambda} + R_f = \frac{1}{k_c} + R_f$$

Every parameter in the equation above can influence the choice of heat exchanger. The choice of materials does not normally influence the efficiency, only the strength and corrosion properties of the unit.

In a plate heat exchanger, we have the advantages of small temperature differences and plate thicknesses of between 0.3 and 0.6 mm. The alpha values are products of the very high turbulence, and the fouling factor is usually very small. This gives a k-value which under favourable circumstances can be in the order of 8,000 W/m² °C.

With traditional shell-and-tube heat exchangers, the k-value will be below 2,500 W/m² °C.

Important factors to minimize the heat exchanger cost:

1. Pressure drop

The larger allowed pressure drop, the smaller the heat exchanger.

2. LMTD

The larger the temperature difference between the media, the smaller the heat exchanger.

Manufacturing materials

High-quality AISI 316 stainless steel plates are used in most Alfa Laval heat exchangers for water/water applications. When the chloride content does not require AISI 316, the less expensive stainless steel material AISI 304 may sometimes be used. Several other plate materials are also available for various applications. For Alfa Laval brazed and fusion bonded plate heat exchangers AISI 316 is always used. For salt and brackish water only titanium should be used.

Pressure and temperature limitations

The maximum allowed temperature and pressure influence the cost of the heat exchanger. As a general rule, the lower the maximum temperature and maximum pressure are, the lower the cost of the heat exchanger will be.

Fouling and fouling factors

Fouling allowance can be expressed either as a design margin (M), i.e. an additional percentage of heat transfer area, or as a fouling factor (R_f) expressed in the units m² °C/W or m²h °C/kcal. R_f should be much lower for a plate heat exchanger than for a shell-and-tube exchanger. There are two main reasons for this.

Higher k-values means lower fouling factors

The design of plate heat exchangers gives much higher turbulence, and thereby thermal efficiency, than a shell-and-tube exchanger. A typical k-value (water/water) for a plate heat exchanger is 6,000-7,500 W/m² °C while a typical shell-and-tube exchanger only gives 2,000-2,500 W/m² °C. A typical R_f-value used for shell-and-tube exchangers is 1 x 10⁻⁴ m² °C/W. With k-values 2,000-2,500 W/m² °C this give a Margin of 20-25%. (M = k_c x R_f). To achieve M = 20-25% in the plate heat exchanger with 6,000-7,500 W/m² °C the R_f-value should only be 0.33 x 10⁻⁴ m² °C/W.

Difference in how margin is added

In a shell-and-tube heat exchanger margin is often added by increasing the tube length, keeping the same flow through each tube. In a plate heat exchanger however, margin is added by adding parallel channels, i.e. lowering the flow per channel. This results in lower turbulence/efficiency, increasing the risk for fouling. A too high fouling factor can result in increased fouling!

For a plate heat exchanger in a water/water duty a Margin of 0-15% depending on water quality is normally enough.

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Product range

Alfa Laval has a full range of heat exchangers, heat exchanger systems and accessories catering to every need, however large or small.









Alfa Laval is your assurance of quality in terms of compactness, ease of installation, low maintenance costs, high energy efficiency, confidence and flexibility.

In other words, reliable operation, unsurpassed operating life span and fast return on investment.





Alfa Laval product range

Gasketed Plate Heat Exchangers Read all about it in chapter 6 	Brazed Plate Heat Exchangers Read all about it in chapter 7 	Fusion-bonded plate heat exchangers, AlfaNova Read all about it in chapter 8 
Air Heat Exchangers Read all about it in chapter 9 	Heating and Cooling systems Read all about it in chapter 10 	Tap Water Systems Read all about it in chapter 11 
Tubular Heat Exchangers Read all about it in chapter 12 	All Welded Heat Exchangers Read all about it in chapter 13 	Filters Read all about it in chapter 14 



Pumps for hygienic use

The complete line





Alfa Laval is one of the world's largest pump suppliers, offering a flexible portfolio of centrifugal pumps, liquid ring pumps and positive pumps.

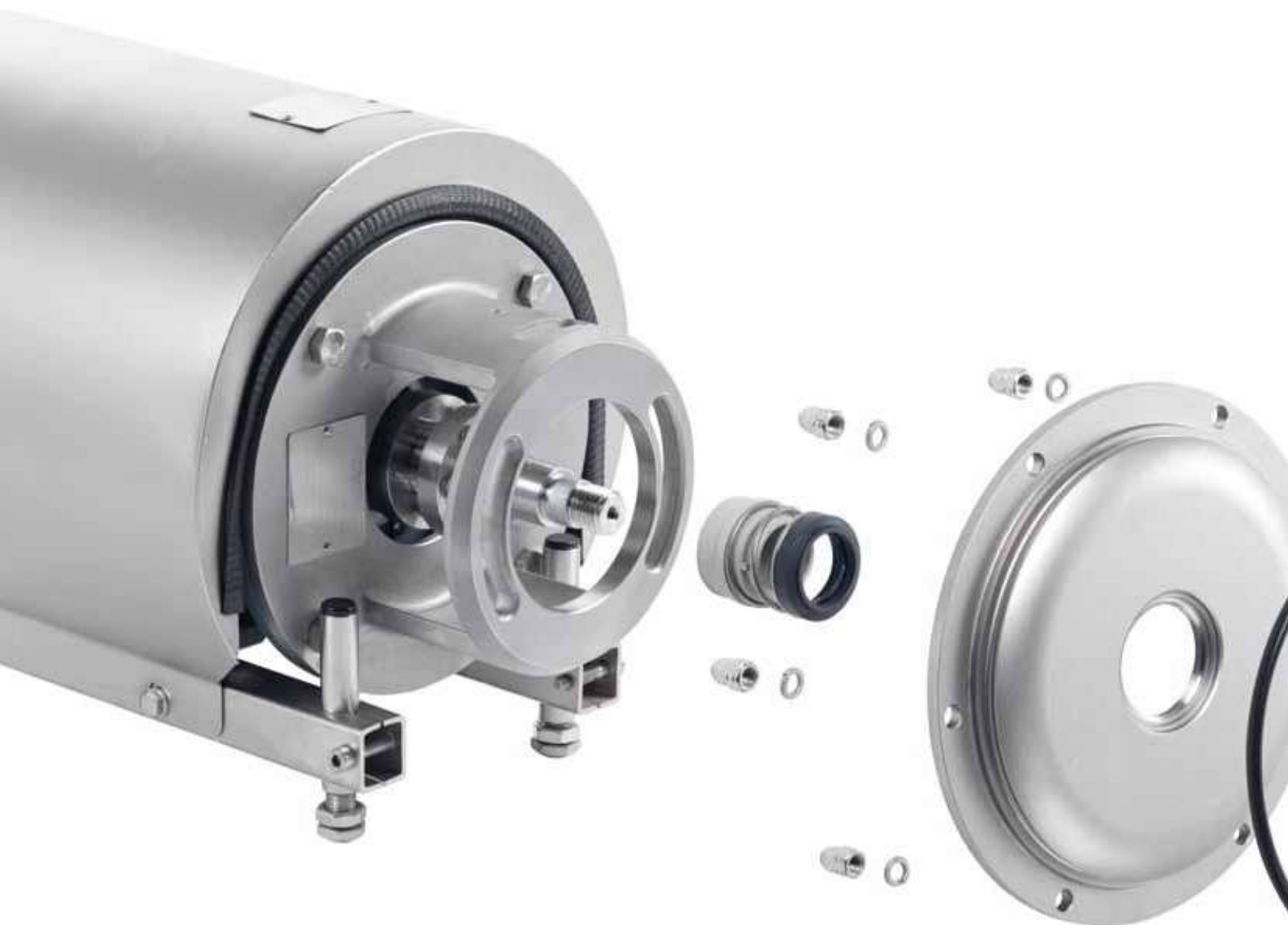
Our portfolio is the result of a combination of comprehensive pump knowledge and the highest standards of hygiene, trouble-free operation and a truly low cost of ownership.

Performance in good hands

Working with hygienic applications is a question of care, attention to detail and dedication to outstanding performance. Alfa Laval has a proven track record in delivering innovative solutions for hygienic applications based on our core technologies of separation, heat transfer and fluid handling.

Superior safety, gentle efficiency and uncompromising cleanliness are the hallmarks of our hygienic pumps, heat exchangers, valves and automation, tubes and fittings, and separation, filtration and tank equipment. Which is why so many customers in the food, biopharm and other demanding industries put process performance and hygiene in the capable hands of our experts, sales companies and partners worldwide.

Here you will find an overview of Alfa Laval pumps for hygienic applications. For complete technical details and product specification, contact your local Alfa Laval supplier or visit us at **www.alfalaval.com**

**Gentle product treatment**

Our centrifugal pumps are renowned for their ability to move products gently and efficiently. The integrity of your product is assured, regardless whether you choose a premium or standard-duty model.

Advanced hygienic design

With emphasis on features such as optimized internal geometry and profiled o-rings, our centrifugal pumps are suitable for CIP (cleaning-in-place) and offer exceptional levels of hygiene. All have been tested in accordance with EHEDG requirements and many are authorized to carry the 3-A symbol.

Advanced seal design

Many of our pumps share the same mechanical shaft seal, which simplifies maintenance and spare parts inventory. Combined with the quick and easy front-loading design, this reduces maintenance costs, increases uptime and reduces the cost of ownership.

Easy seal conversion

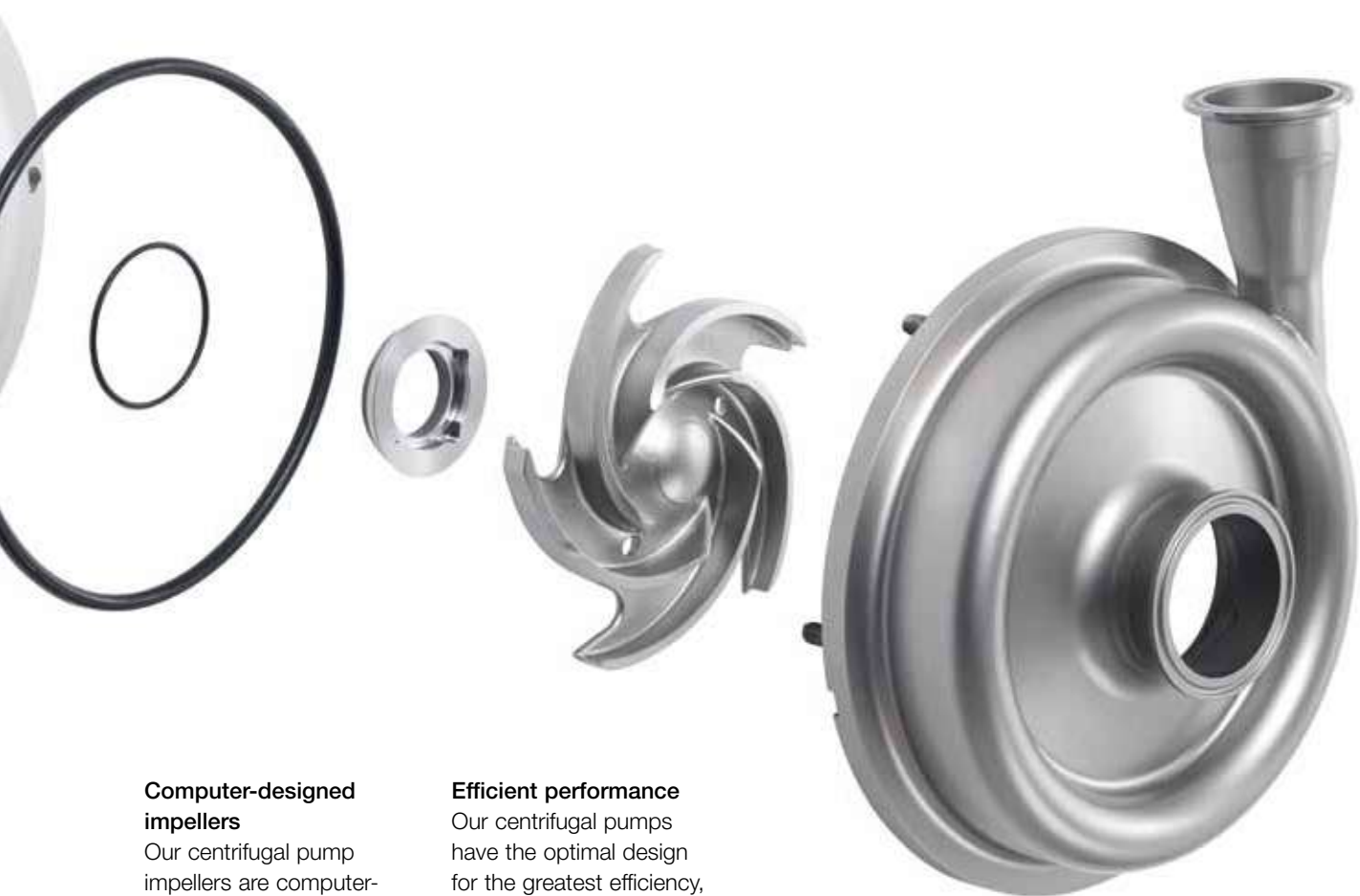
The external design of our centrifugal pumps, as well as the seal's construction, is designed to make seal conversion as fast and as simple as possible. Our premium LKH pumps can be converted from single to flushed or double-mechanical seals, while our standard-duty SolidC pumps can be converted from single to flushed shaft seals.

Centrifugal pumps

Alfa Laval's centrifugal pumps are built to perform in all areas – from process quality to overall energy efficiency. In addition to gentle product handling and a wide range of hygienic features, they provide a long and trouble-free service life that ensures low cost of ownership.

Our centrifugal pump series can be divided into two categories, premium and standard-duty.

The first category comprises our various cost-effective LKH pumps, which handle specialized needs such as evaporation, high-pressure, self-priming and high-purity applications. The second focuses on initial cost, which includes our optimized SolidC pump series.



Computer-designed impellers

Our centrifugal pump impellers are computer-designed and hydraulically balanced for optimum performance. Both the impellers and their retaining screws (optional) are smooth, which keeps them from accumulating product and makes cleaning more effective.

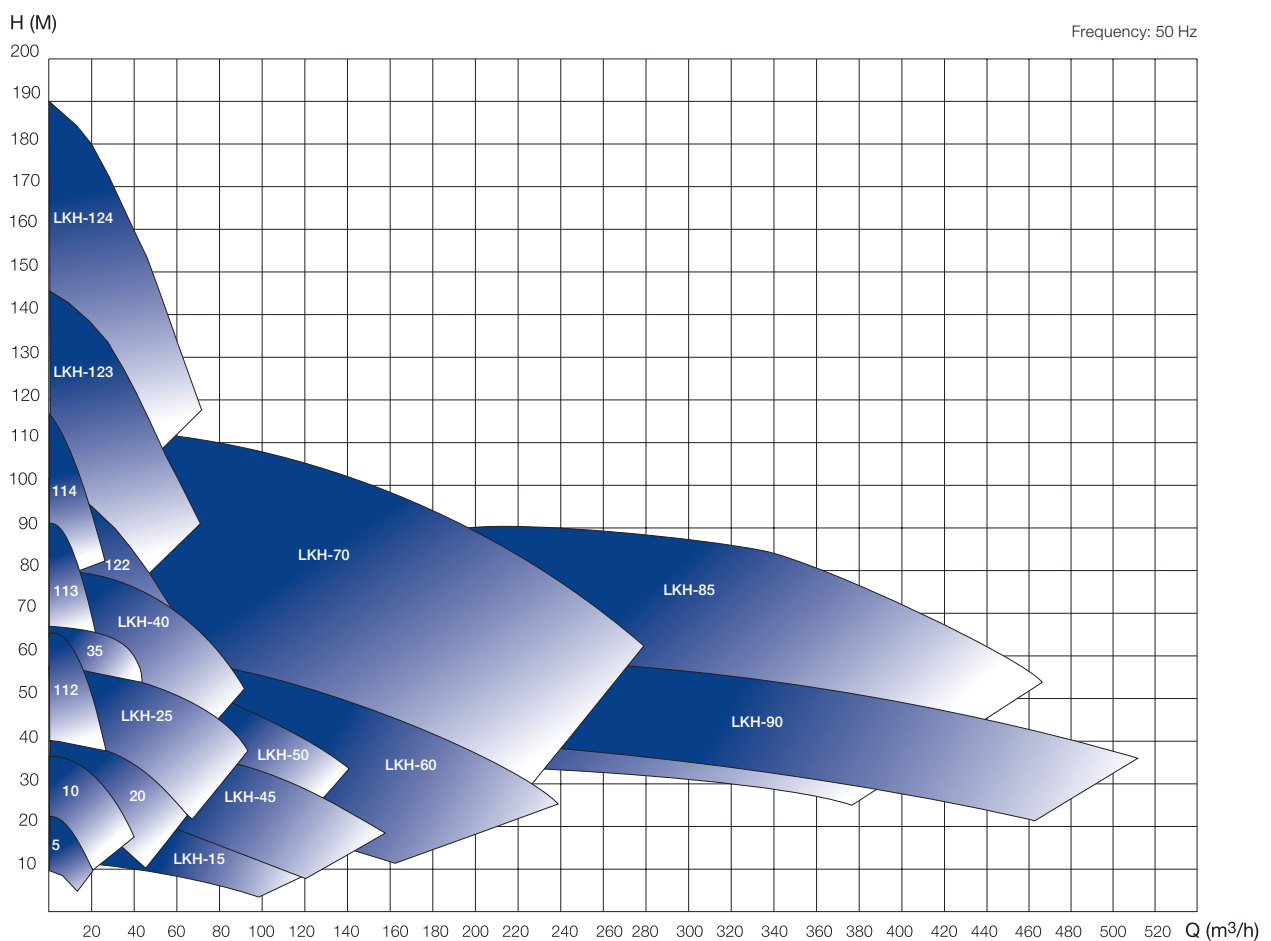
Efficient performance

Our centrifugal pumps have the optimal design for the greatest efficiency, lowest NPSH requirement and low noise levels. This reduces energy cost, lowers the risk of cavitation and provides a safe working environment, which enables efficient capitalization of the process.

Premium pumps

Quiet but rugged, Alfa Laval's LKH series of centrifugal pumps are the ultimate solution for gentle and efficient product handling. Through a combination of enlarged inlets and advanced impeller design, they offer an unobstructed product flow, very low NPSH requirements and superior hydraulic efficiency.

Designed for CIP (cleaning-in-place), LKH pumps are available in capacities of up to 500 m³/h and pressures of up to 190 m (19 bar), with different versions available for specific applications.



LKH performance: LKH pumps are available for capacities up to 500 m³/h and pressures up to 190 m (19 bar).

LKH

The LKH is a highly efficient and economical centrifugal pump range, which meets the requirements of sanitary processes for gentle product treatment, hygiene and chemical resistance. Its front-loaded design makes quick, effective maintenance possible, thereby contributing to more production time and low cost of ownership. Available in 13 sizes, the LKH features efficient drives which make it possible to optimize performance for the selected duty as well as comply with 3-A, CE and EHEDG requirements.



LKH UltraPure

LKH UltraPure pumps are high-purity pumps that meet specifications for water-for-injection (WFI) and other demanding applications. Authorized to carry the 3-A symbol, they are suitable for both CIP (cleaning-in-place), SIP (sterilization-in-place) and manual cleaning. LKH UltraPure pumps are also available with a 0.5 µm (150 grit) finish, flushed seal kit and a comprehensive Q-doc documentation package to smooth the qualification and validation process.

LKHex

Highly efficient and economical, the LKHex centrifugal pump meets the requirements of the ATEX directive 94/9 IEC group II, categories 2G and 3G with temperature classes T1~T4.



LKHI

An extension of the LKH range, the LKHI has an internal seal for use in applications that require higher inlet pressures of up to 16 bar. The simple, effective design is well suited, although not limited to, filtration-type applications and combines reliable and efficient operation with ease of maintenance.



LKH Multistage

Designed to 3-A standards and available in two-, three- or four-stage models, LKH Multistage pumps save space and energy by replacing up to three booster pumps in a line. Used primarily in high-pressure applications with low capacity, they withstand system pressures up to 40 bar and deliver boost pressures up to 19 bar. This makes them suitable for, but not limited to, many types of filtration applications.



LKHPF High Pressure

Pumps in the LKHPF High Pressure series feature a reinforced pump casing and backplate, as well as high pressure internal seals and multiple heavy-duty studs. This enables them to handle inlet pressures as high as 40 bar, making them ideal for nanofiltration and reverse osmosis filtration. Their seals can be removed in a matter of seconds, without removal of the back plate.





LKHSP

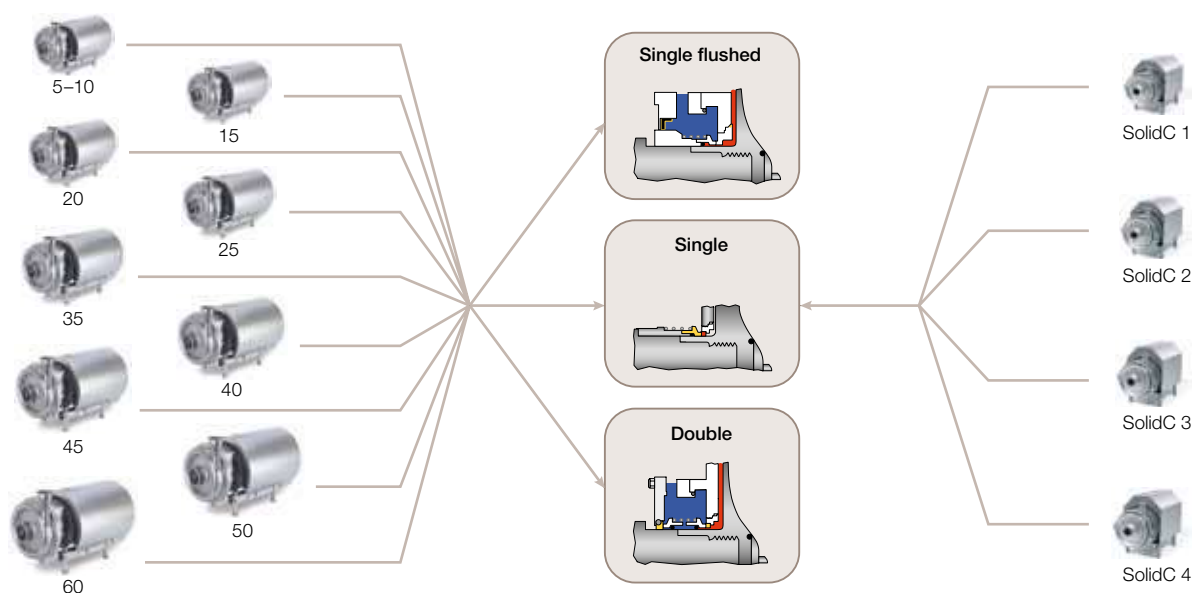
Pumps in the LKHSP series are self-priming, which means they can be used to pump products containing air or gas. This makes them ideal as return pumps in CIP (cleaning-in-place) systems, as well as for emptying tanks. LKHSP pumps feature a tank, a non-return valve (normally closed) on the inlet side, a tee and a non-return valve (normally open) on the bypass line.

LKH Evap

LKH Evap are sanitary pumps with high efficiency and the lowest NPSH requirements, making them ideal for use in evaporation applications, such as liquid concentration and powder processing solutions, as well as in dewatering plants. Using the optional clear flow impeller design, process optimization can be achieved in applications where there is a risk of hard layer deposits.



Maximum shaft seal interchangeability for pump ranges. Front-loaded design.



Identical shaft seal for easy maintenance and flexibility. Only one size of shaft seal is required for all LKH standard models (LKH 5–60) and SolidC (SolidC 1–4), which makes keeping the right parts in inventory simple and inexpensive. Plus, a single mechanical seal can easily be changed to a flushed or double mechanical seal in minutes with just a few extra components.

Standard-duty pumps

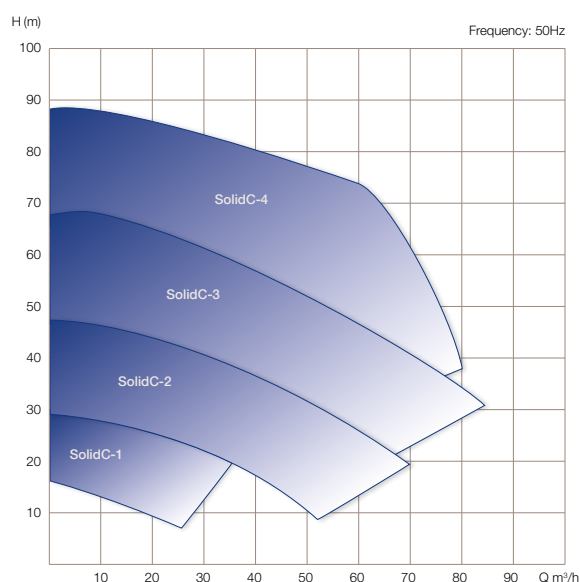
Alfa Laval's standard-duty centrifugal pumps are designed to offer high value for money. In addition to gentle product handling and efficient operation, they offer high reliability and possibilities for swift and easy maintenance.

The highlight of our standard-duty pumps is the SolidC series, which combines a practical, cost-effective design with certain characteristics of our premium LKH centrifugal pumps.



SolidC

The SolidC pump series is a reliable and cost-effective solution for simple transport duties up to 85 m³/h. It utilizes the same mechanical shaft seal found in our LKH series, which is front-loaded and easily replaced without removing the backplate. SolidC pumps are available in four sizes and comply with 3-A, CE and EHEDG requirements.



SolidC performance: SolidC is a reliable, cost-effective centrifugal pump for standard duties up to 85 m³/h.

SolidC UltraPure

This reliable and economical centrifugal pump meets the requirements of the biopharm industries. It has a 0.5 µm (150 grit) finish, 3.1 material certification, gentle product treatment and chemically resistant material suitable for a wide range of duties. Our comprehensive Q-doc documentation package supports a smooth qualification and validation process, which provides solid value for money.



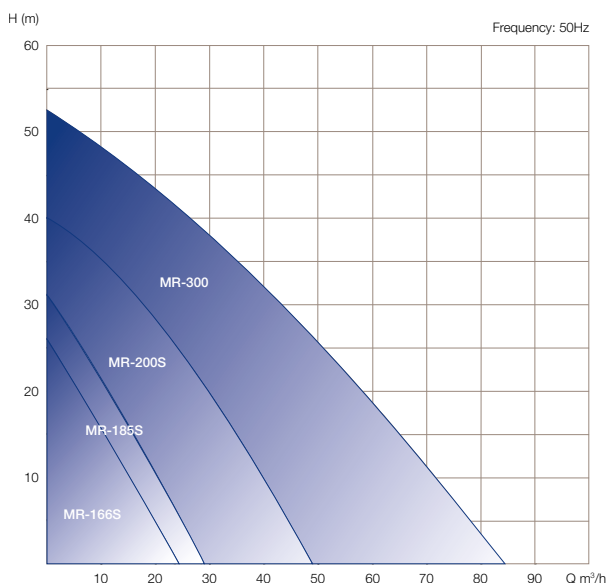
FM-OS and GM centrifugal pumps

The FM-OS and GM centrifugal pumps series are economical alternatives for industries in which acid-resistant steel is required. Specifically designed to handle specific applications at low capacities, these centrifugal pumps are solid, cost-effective solutions for handling acidic products.



Liquid ring pumps

Liquid ring pumps are an ideal solution when gases are contained in the process medium. Because the pumps are self-priming when the casing is half filled with fluid, they are capable of pumping from a suction line that is partly filled with air or other gases.



MR liquid ring pumps are reliable and cost-effective for standard duties up to 84 m³/h.

MR liquid ring

Through the simplicity of its design and service reliability, the MR liquid ring pump series is a cost-effective solution for products containing air or gas. These pumps are specifically developed for use in food, chemical and pharmaceutical industries, where they are often used as return pumps in CIP (cleaning-in-place) systems. MR liquid ring pumps are available in four sizes with duties up to 84 m³/hr to fully optimize your process requirements.

Positive pumps

Designed for low, medium and high-viscosity media, Alfa Laval positive pumps offer gentle pumping action and reliable performance which results from more than 50 years of continuous development at advanced production and R&D facilities.

Our positive pump portfolio includes four ranges: SX, SRU, OptiLobe and SCPP.

With its robust construction, each pump is developed for a different type of demand and meets high standards of quality and reliability. Collectively, they provide operating economy and high flexibility of use.



Gentle, hygienic design

With their high-precision rotors and low-shear operation, our positive pumps ensure the gentle movement of delicate products. Designed for maximum cleanability, our pumps comply with the world's leading hygienic standards.

Modular pump design

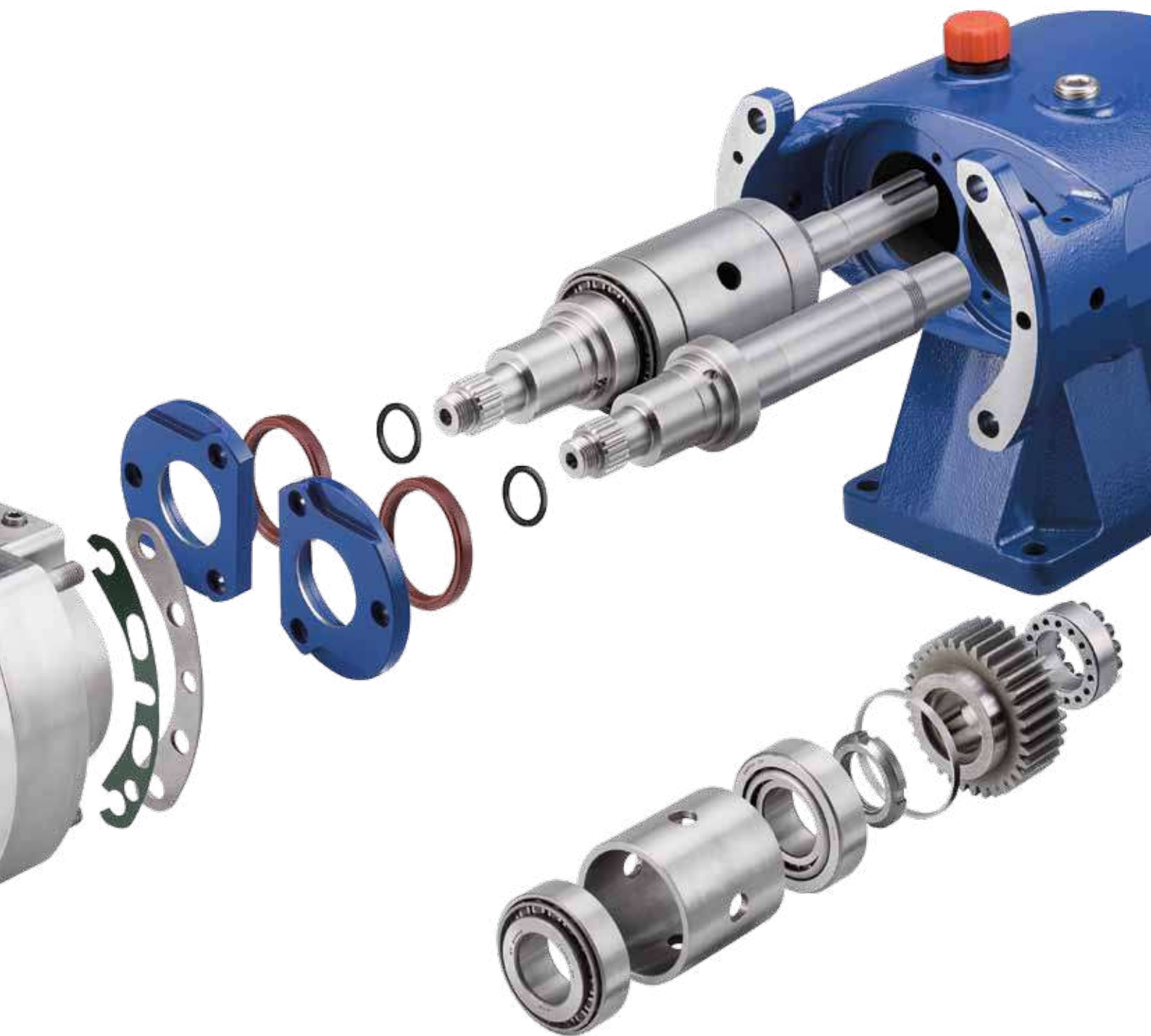
Modular design increases flexibility and component interchangeability, reducing maintenance time and spare parts inventory. The wide range of sizes available enables selection of the most cost-effective solution for your process requirements.

Universal mounting

To provide high flexibility when fitting the pump into a production line, all of our positive pumps can be mounted in either a vertical or horizontal port position.

Improved drainability

All of our positive pumps can be drained easily when mounted in vertical port position. In the case of our OptiLobe and SX pumps, cusps are retained in vertical configurations for greater efficiency.



Easy seal retrofit

The seals of our positive pumps are designed for quick and simple up-grading. Our broad range of seals includes many seal types and configurations, which can be tailored to your need and application.

Heavy-duty gearbox construction

These pumps have a cast iron gearbox with heavy-duty taper roller bearings and torque locking assemblies for easy maintenance and high reliability.

CIP and SIP

Our positive pumps are ideal for both CIP (cleaning-in-place) and SIP (sterilization-in-place) applications.

Standards and approvals

All of our positive pumps are compliant with CE directives and the EHEDG, 3-A and FDA hygienic standards. In addition, our SX and SRU pumps can meet ATEX requirements for use in explosive environments.



SX

The SX is Alfa Laval's premium positive pump, is designed for use in sensitive and ultra-clean applications. With optimized pump head geometry and multi-lobe rotors, SX pumps ensure low-shear operation with minimum pulsation. This makes them the best choice for maintaining the integrity of delicate products.

SX pumps feature front-loading mechanical seals, and low-profile rotor nut for the highest level of hygienic sealing and enhancing cleanability. Options available for mechanical and/or electropolishing to achieve higher surface finishes up to 0.5 Ra as well as 3.1 material traceability.

SRU

The SRU is Alfa Laval's core positive pump with extensive options, materials and ability to handle a wide range of temperatures and pressures. This makes it the ideal solution for the most demanding of applications.

Among the many options are saddles and jackets for heating and cooling of the pump head, rectangular inlet for pumping high viscosity fluids and a wide selection of standard seals, including proprietary seals to suit most applications. In addition, you can choose from tri-lobe or bi-lobe rotors depending on the application.



OptiLobe

The OptiLobe is Alfa Laval's standard positive pump intended for general applications. Available in an optimized range with fewer options, OptiLobe pumps combine cost-effective simplicity with Alfa Laval quality and reliability.

OptiLobe pumps feature a paint-free design with front-loading seals and tri-lobe rotors. They are the latest example of Alfa Laval's leadership in innovative design and advanced manufacturing processes.

SCPP

The SCPP is a circumferential piston pump designed for transporting very low viscosity products in applications that require medium to high discharge pressures. The piston design offers low shear with low pulsation and minimizes damage to product and bruising of solids.

Two SCPP ranges are available: the SCPP1 specifically designed for quick and easy strip-clean type processes and the SCPP2 where CIP (cleaning-in-place) may be utilized.



This complete portfolio of positive pumps enables Alfa Laval to offer the most effective solution, whatever the application.

Motorization



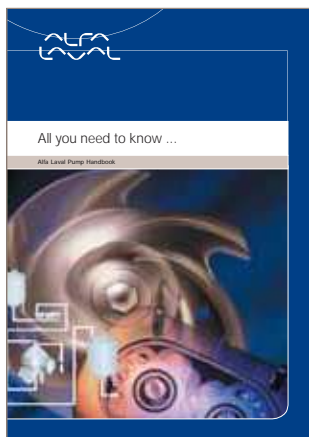
Pumps can be supplied as bareshaft for mounting locally in the process line or within a skid. Alternatively, Alfa Laval offers the units fully motorized using robust, reliable and efficient geared drives, which can be designed for direct drive or for speed control.

The rigid base plate ensures accurate alignment of the pump and drive and is available in stainless steel for hygienic environments or painted carbon steel for industrial applications.

Other options include ball feet for raising the unit above the floor level to provide access for cleaning and stainless steel shrouds to protect the drive against dirt entrapment and enable easy wash down.

Everything you need

To tailor pump solutions to individual customer requirements, Alfa Laval has a comprehensive package of effective tools and software programs that help our partners size and configure the right pumps for any given installation – quickly and efficiently.



The Alfa Laval pump handbook.



Computer-Aided Selection (CAS) software.



Maintenance videos.

All you need to know

The Alfa Laval pump handbook is a comprehensive reference guide to support pump users at all levels. It includes all the necessary information for the correct selection and successful application of the Alfa Laval range of pumps.

Computer-Aided Selection software

Alfa Laval Computer-Aided Selection (CAS) software helps quickly and easily size hygienic pump installations and identify the pump configuration optimized to your specific process requirements. CAS also includes article numbers and spare parts lists, which makes it easy to compile order lists and streamline maintenance and service procedures. This unique Alfa Laval tool can also help to estimate service costs to assist in budget planning.

Rheology laboratory

Our laboratory provides us with a thorough understanding of individual fluid behaviour, which contributes to the correct sizing of pumps, seal specification as well as optimizing system design. This ensures the selection of the right pump the first time, which potentially reduces both capital investment and life cycle costs.

CAD portal

The Alfa Laval CAD portal offers access to 2D and 3D CAD drawings in a variety of formats, providing ease of design and installation.

Animations and maintenance videos

Effective short animations provide a general overview of the products and a greater understanding of its characteristics and capabilities. In addition, Alfa Laval maintenance videos detail the procedures of timely and effective maintenance to keep processes running efficiently and achieve low life cycle costs.

Comprehensive documentation

We provide you and your suppliers with full documentation and comprehensive installation and maintenance instructions in multiple languages. This makes it easier to keep to installation and maintenance schedules, helps cut operating and maintenance costs and increases plant running time.

Q-doc

All Alfa Laval UltraPure products can be supplied with Q-doc, a comprehensive documentation package based on GDP (Good Documentation Practices). Q-doc comprises equipment manuals, quality and manufacturing procedures, relevant material certificates and necessary parts and service information for standard components. The Q-doc documentation package supports a smooth qualification and validation process.

Certification and compliance

Alfa Laval pumps generally comply with the latest international standards and legislation to ensure total process safety and the highest quality product. This includes, but is not limited to, the highest standards and requirements in the industry such as the CE machinery directive, 3-A, EHEDG, FDA and ATEX as well as EU Regulation 1935/2004, Article 17 (traceability).

Close at Hand

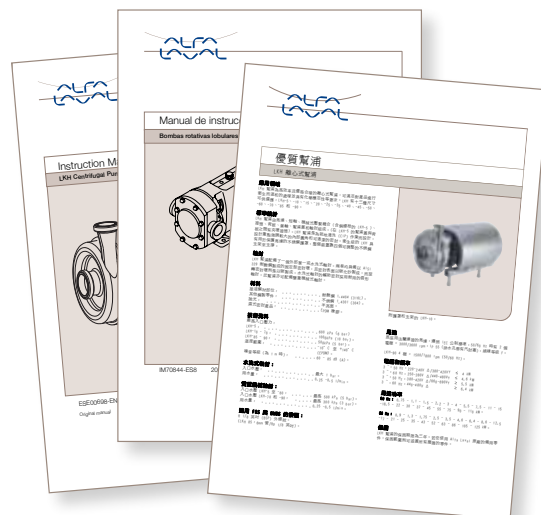
To make selection of Alfa Laval products easy, there is a comprehensive over 1400-page catalogue entitled “Close at Hand”, which includes detailed information on the world’s broadest portfolio of hygienic components and provides convenient one-stop shopping.

For more info and access to tools and software

www.alfalaval.com/biopharm

www.alfalaval.com/food

www.alfalaval.com/high



Comprehensive documentation in multiple languages.



Q-doc.



Close at Hand catalogue.

Handling your hygienic processing needs

Optimizing the performance of hygienic processes is a challenge best met with expertise. Alfa Laval expertise is the result of years of accumulated knowledge and a comprehensive research and development programme.

With this foundation, we work closely with our channel partners to help companies extract the most value from raw materials, minimize waste and emissions, and deliver safe and hygienic products. Ultimately, our ambition is to help companies supply quality products to consumers at competitive prices.

Alfa Laval has served as the standard bearer for the production of hygienic products since Gustaf de Laval invented the centrifugal separator to separate cream from milk more than a century ago. That same ingenuity is applied to all our hygienic components and solutions that safeguard the flavour, texture and appearance of food, dairy products, beer and other beverages.

For the pharmaceutical, biopharm and personal care industries, our contributions not only entail hygienic design and superior performance but comprehensive documentation and solutions that are easy to validate. Which in turn raise the quality, cleanliness and uniformity of the final products.

Safeguarding hygienic applications requires entrusting your processes to the safe, competent care of a reliable partner. With Alfa Laval you are in good hands.



Working locally on a global scale

Alfa Laval brings you the advantages of a worldwide organization supported by a strong network of 1,500 partners around the globe. This gives you a one-stop shop for everything, including quality parts and unmatched service expertise.

Trustworthy service

Guaranteed performance, reliability and hygiene come standard with every Alfa Laval pump. Each pump is backed by the service and support from our global organization and local network of distributors, system builders and contractors. This gives you easy access to advanced resources and specialist knowledge about hygienic components and processes.

Investing in quality parts

There are no short cuts to quality, especially when the integrity of hygienic processes is at stake. That is why investing in Alfa Laval hygienic components and solutions ultimately pays off.

Alfa Laval parts are precision-made to ensure optimal performance. Rigorous testing in our materials laboratory under actual operating conditions ensures that each part will uphold safety, efficiency and hygiene of your processes for the long term.

Unsurpassed reliability

It goes without saying that an investment in quality is an investment in reliability. Alfa Laval hygienic components and solutions are designed and sized right from the start. When reinforced by maintenance programmes and Alfa Laval parts, you are able to achieve a strong total cost of ownership and true peace of mind.



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, foodstuff, 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

www.fotoskrift.se

ALFA LAVAL is a trademark registered and owned by Alfa Laval Corporate AB.





Valves and automation for hygienic use

The complete line





Valve matrix –



customized flow solutions

Alfa Laval valve matrix solutions

We are specialists in providing pre-built valve matrices customized to meet individual requirements.

Our expertise helps ensure you the most efficient flow management, using as few components as possible and dealing effectively with key issues that include thermal cycling, cleanability, drainability and flow control.

Alfa Laval valve matrix solutions can be supplied pre-assembled and pre-tested as well as fully wired and with all the necessary pneumatic tubing, junction boxes and control panels pre-connected.

This means you can bring even complex installations online as quickly as possible, saving time and avoiding lost revenue associated with onsite troubleshooting and downtime.



Performance in good hands

Working with hygienic applications is a question of care, attention to detail and dedication to outstanding performance. Alfa Laval has a proven track record in delivering innovative solutions for hygienic applications based on our core technologies of separation, heat transfer and fluid handling.

Superior safety, gentle efficiency and uncompromising cleanliness are the hallmarks of our hygienic valves and automation, pumps, heat exchangers, tubes and fittings, and separation, filtration and tank equipment. Which is why customers in the food, biopharm and other demanding industries put process performance and hygiene in the capable hands of our experts, sales companies and partners worldwide.

Here you will find an overview of Alfa Laval valves and automation for hygienic applications. For complete technical details and product specification, contact your local Alfa Laval supplier or visit us at **www.alfalaval.com**

Mixproof valves

Mixproof valves provide maximum flexibility and safety in hygienic flow processing by making it possible to handle two different fluids at the same time, with no risk of cross-contamination. Using two independent plugs and seals means a single mixproof valve can often replace two or more valves of other types.

Alfa Laval supplies several different designs of mixproof valves, all with leakage detection, that help boost reliability and safety levels. They enable you to design versatile set-ups that are both cost-effective and easy to maintain, as well as providing you with important new processing opportunities.

These include the Unique mixproof valve concept and the SMP range.



Low cost of ownership

Alfa Laval mixproof valves are designed to provide the lowest possible operating costs throughout their exceptional service life. This key advantage comes from a combination of low maintenance costs, using fewer utilities, easy repair and reduced spare parts inventory. It also comes from minimizing downtime and any resultant loss of earnings.

More uptime

Alfa Laval mixproof valves are in operation more of the time, helping you avoid costly unscheduled interruptions in your processing operations. The double-seat design, with the advanced seat lift and SpiralClean, means you can continue using one flow path while cleaning the other.



Cut-away views of the plug and seat design in Unique mixproof valves.



Greater flexibility

The modular concept behind Unique mixproof valves means you only pay for the exact features and capabilities you need. This gives you rapid payback and maximum return on investment. The concept also enables easy upgrades with additional features and functionalities, if your needs change. This ensures exceptional flexibility in designing your processing installation.

Reliable operation

The unique design of these mixproof valves, featuring a guided and protected radial seal, provides long-lasting operation. The double-acting lip seal also minimizes risk of product contamination. Alfa Laval mixproof valves can be fitted with monitoring systems for cost-effective process control.

Optimized maintenance

These valves are designed for quick, easy maintenance. Cost-saving advantages include the top-loaded, easy-to-dismantle design, no adjustable parts and a maintenance-free actuator that ensures safe repair, due to the caged spring.

Easy to clean

Alfa Laval mixproof valves feature built-in leak detection for maximum safety. Unique mixproof valves can be fitted with the proven SpiralClean system for the plugs and leakage chamber. This provides fast, more effective cleaning even under difficult conditions, using less cleaning fluid, utilities and time. A controlled seat lift ensures individual cleaning of the plug seals, with no risk of cleaning liquids mixing with the product.









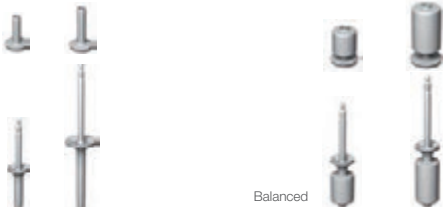



Unique mixproof valves

The Alfa Laval Mixproof Valve concept is the ideal solution for any process application where high process safety and flexibility as well as the lowest total cost of ownership are required.

The Alfa Laval Unique Mixproof Valve concept provides modular solutions that you can easily tailor to your specific requirements. This also means you only pay for the exact features and capabilities you really need.

Alfa Laval Unique
UltraClean Mixproof Valve



UNIQUE MIXPROOF TANK OUTLET		UNIQUE MIXPROOF	
READING / CONFIGURATION DIRECTION ↓	CONNECTION		CONTROL
	VALVE BODY		
	PLUG		ACTIVATION
	CLEANING OPTION		
	ACTIVATION		PLUG
	CONTROL		
		UNIQUE MIXPROOF	
			CONTROL
			
			CLEANING OPTION
			
			VALVE BODY
			
			CLEANING OPTION
			

The selection guide illustrates the many combinations of features and equipment available with the Unique mixproof valve concept. In addition, there are different sizes and standards to comply with the full spectrum of worldwide installation standards. As a result, you can always find a configuration to meet any specific requirement. For configuration of your exact requirement, please use CAS or the electronic configurator in Alfa Laval Anytime, our eBusiness.

To assist you in the selection, these standard configurations are available. You can choose to use these directly or add additional features to ensure the valve suits your specific needs.



Alfa Laval Unique Basic has the basic components that provide significant safety and leakage detection. It features an actuator without seat lift and unbalanced plugs.



Alfa Laval Unique SeatClean is the choice for standard installations that handle products with solids. Seat lift during normal cleaning procedures cleans the plugs and seats. A balanced lower plug eliminates the risk of mixing products by pressure shock or when the pressure in the pipe is high.



Alfa Laval Unique HighClean meets your processing needs when dealing with sticky products. SpiralClean ensures thorough cleaning of the spindles, upper and lower plugs and in the leakage chamber. With balanced upper and lower plugs, the configuration of this valve protects against the effects of high pressure and water hammer.



Alfa Laval Unique UltraClean meets the highest demands for hygienic processing of sticky products, products with high content of solids, or applications that require close-to-aseptic conditions. It features an actuator with integrated seat lift, balanced upper and lower plugs and SpiralClean.



Alfa Laval Unique Tank Outlet is the choice for standard installations. Seat lift during normal cleaning procedures cleans the plugs and seats. A balanced plug protects against water hammer when closing in the direction of product flow.



Alfa Laval Unique Tank Outlet with external cleaning meets the highest hygienic demands for applications with sticky products, products with high content of solids or applications that require close-to-aseptic conditions. It features SpiralClean and plugs that lift independently to ensure thorough cleaning of the plugs, seats and corresponding pipe.

**Alfa Laval Unique Mixproof
Large Particle Valve**

For applications with very large particles or highly viscous fluids, the Alfa Laval Unique Mixproof Large Particle Valve (LP) offers the same basic advantages as Unique mixproof valves but are specially designed with large openings up to 45 mm in diameter.



SMP mixproof range

The Alfa Laval SMP Mixproof Valve is a cost-effective alternative to Unique mixproof valves yet still provides the advantages of mixproof design. The range is available in both on-off and changeover versions. The SMP mixproof valves are double-seat, self-draining units with no seat lift. They provide maximum safety with a minimum of moving parts, and are top-loaded to give easy access for dismantling and service.



Alfa Laval SMP-BC

Keeps liquids separate by using two seals on the same plug, with a leakage chamber in between. Often used as part of CIP (cleaning-in-place) set-ups, with leakage detection for greater safety. In such installations, seat lift is not necessary.



Alfa Laval SMP-BCA

As SMP-BC, but fitted with a PTFE/rubber diaphragm, designed for use under aseptic conditions, and sterilization involving high temperatures.

Unique mixproof tank outlet valves

Same basic advantages as the unique mixproof valves but specially designed for vertical and horizontal mounting directly on the tank wall at the inlets and outlets.

Alfa Laval Unique Mixproof Tank Outlet Valve

For tank inlet and outlet applications, the Unique mixproof tank outlet (TO) valve offers full drainability and provides cleanability all the way up to the tank without any risk of cross-contamination.



Alfa Laval Unique Mixproof Horizontal Tank valve

Offers the same basic advantages as unique mixproof valves but is specially designed for horizontal mounting directly on the tank wall. It improves cleanliness of the horizontal tank connections and ensures that no area of the tank inlet or tank outlet is left uncleaned.



Single seat valves

Single seat valves feature one single contact surface between the plug and the seat. They are one of the fundamental building blocks in virtually every kind of process installation. This means they have to be supremely reliable and versatile in order to maintain uninterrupted production with a high hygiene standard.

The Alfa Laval range of single seat valves bears the designations Alfa Laval Unique SSV and Alfa Laval Unique SSSV, and consists of large numbers of purpose-designed valve units that are particularly robust and flexible.



The most for your money

You benefit from a relatively simple, straightforward design with a minimum of components and few moving parts, reducing service requirements and keeping inventory costs down. You get the best possible return on investment as a result of enhanced service life and exceptional reliability, combined with reduced product loss, greater product safety and improved hygiene.

Lower engineering costs

Alfa Laval Unique SSV valves provide full traceability in compliance with the EU Food Regulation 1935/2004. They also have EHEDG certification and can be delivered with 3-A labelling. The modularity of the design, with the many combination possibilities this provides, significantly reduces the engineering costs of setting up processing plants around the world.



Exceptional hygiene

The valve body is made from a single disc of stainless steel with a $Ra < 0.8 \mu m$ final internal surface finish. The weld-free, ball-shaped body eliminates bacterial traps, and the design of the plug and seal support more effective cleaning and exceptional hygiene. The double-acting lip seal minimizes any risk of product contamination by air or dirt.

Low cost of ownership

The design of these valves makes them easy to clean and keep clean, with a minimum of maintainable parts. This saves you time, resources, manpower and inventory. The costs of ownership are reduced still further by exceptional durability, reduced product loss and more processing uptime. The actuator design also provides more accurate valve performance.

Greater durability

The unique design used in Alfa Laval Unique SSV valves, featuring defined compression of the O-rings and metal-to-metal contact between plug and seat, not only provides better sealing but also extends the service life of Alfa Laval Unique SSV valves.

Saving on resources

The reliability of Alfa Laval Unique SSV valves means you have less product wastage to deal with. And because they are designed with effective CIP (cleaning-in-place) procedures in mind, you use fewer expensive cleaning fluids, less water and fewer utilities in general, resulting in a reduced environmental impact.

Unique SSV single seat valves

The modular basic design of Alfa Laval Unique SSV single seat valves centres round a body deep-drawn from one single stainless steel disc, an efficient double-acting lip seal design that minimizes any risk of cross-contamination, and a valve plug with enhanced CIP (cleaning-in-place) capabilities.

You can also combine different configurations with different types of actuator. This cost-effective modular design approach gives you the opportunity to build either shut-off or changeover valves, in either normally open/normally closed or reverse-acting configurations, to meet virtually any requirement.



The selection guide illustrates the many combinations of features and types available with the Unique SSV valve range. In addition, there are different sizes and standards to comply with the full spectrum of worldwide installation standards. As a result, you can always find a configuration to meet any specific requirement. For configuration of your exact requirement, please use CAS.

Alfa Laval Unique SSV Valve (standard configuration)

As the world's most widely used single seat valves, the Alfa Laval shut-off and changeover configurations are employed for a broad spectrum of different processing duties.



Alfa Laval Unique SSV Aseptic Valve

A one-piece diaphragm provides hermetic sealing against intrusion from the atmosphere, ensuring full protection against the effects of micro-organisms during processing.

The special diaphragm can also be used with other Alfa Laval Unique SSV units – including standard, tangential, two-step and tank outlet valve configurations – where aseptic processing is crucial.

Alfa Laval Unique SSV Y-body Valve

Normally used in installations that involve flows featuring large particles and/or high viscosity, and where the focus is on particularly gentle treatment of products and flows.



Alfa Laval Unique SSV Tank Outlet Valve

Consists of a valve body with or without a tank flange. Available in two different versions for installations that either open into the tank (reverse-acting) or close up against the tank (standard version).



Alfa Laval Unique SSV Long-Stroke Valve

Specially suitable for use with media or products that contain particles and/or suspended solids, and also with high-viscosity flows. In such cases, larger openings are needed to provide gentler, more effective flow control.

Alfa Laval Unique SSV Tangential Valve

Features an off-centre body so that the port connection can still be drained when the valve is positioned horizontally.

Particularly suitable for use in tank openings, horizontally mounted drains and a wide range of installations where space restrictions make it difficult to install valves at other angles.



Alfa Laval Unique SSV Two-step Valve

Lifting height can be adjusted as required to match specific volumes and quantities. This makes it especially suitable for dosing, and for two-stage filling where the focus is on ensuring an exact volume. Can also be used for draining two pipes at the same time.



Alfa Laval Unique SSV Reverse-acting Valve

Provides multiple solutions, for instance, to prevent pressure shocks when the pipe work does not permit closing against product flow with the use of standard single seat valves. May be used as an overflow valve after a positive displacement pump or as a multi-port flow diversion valve. Can also be configured as a shut-off valve with two or four ports, or as a changeover valve with three to six ports.

Alfa Laval Unique SSSV Small Single Seat Valve

Features a particularly simple design and few moving parts.

Widely used in processing food, beverages and dairy products, as well as pharmaceuticals and personal care products. Ideal for use in sampling, CIP (cleaning-in-place) and other contexts where only small flow rates are involved.



Alfa Laval Unique SSV Manually Operated Valve

Small, relatively simple valves that are available with many different options and features, including lockable flights, for either regulating or dosing purposes.

Butterfly valves

Alfa Laval LKB butterfly valves are relatively straightforward on/off routing valves with a substantial opening area and low flow resistance. This makes them the workhorse solution in modern processing technology, ideal for use with low and medium-viscosity liquids. In addition the patented Alfa Laval Clamp Butterfly Valve is optimized for easy maintenance making it possible to retract the seal while the valve is still placed in the pipeline.



Seal technology

The unparalleled technical resources of Alfa Laval enable us to provide you with a comprehensive range of elastomer seals to meet all requirements. Different materials and specifications can provide greater thermal stability, better chemical resistance and improved tensile strength – adding up to longer, more reliable service.

Disc benefits

Alfa Laval butterfly valves feature a highly polished stainless steel disc with surface smoothness down to $Ra < 0.8 \mu m$. The disc design has been thoroughly tested. The bearing bushes are clipped onto the disc stems, avoiding any metal-to-metal abrasion and ensuring smoother disc movement.

**Strength under pressure**

Different models are available for working at pressures from full vacuum up to 10 bar. This is one reason why Alfa Laval LKB butterfly valves feature a 12 mm stem diameter – larger and more solid than the industry norm. This additional strength helps withstand pressure shocks better, resulting in better operating safety and greater reliability.

Wide-spectrum compatibility

These valves are manufactured for full compatibility with both metric and imperial tubing and virtually all dimension standards, including ISO, DIN, JIS, ASME, etc. Compatibility with multiple standards also provides significant logistics advantages as well as opportunities for participation in advantageous Alfa Laval purchasing plans.

Exceptional hygiene

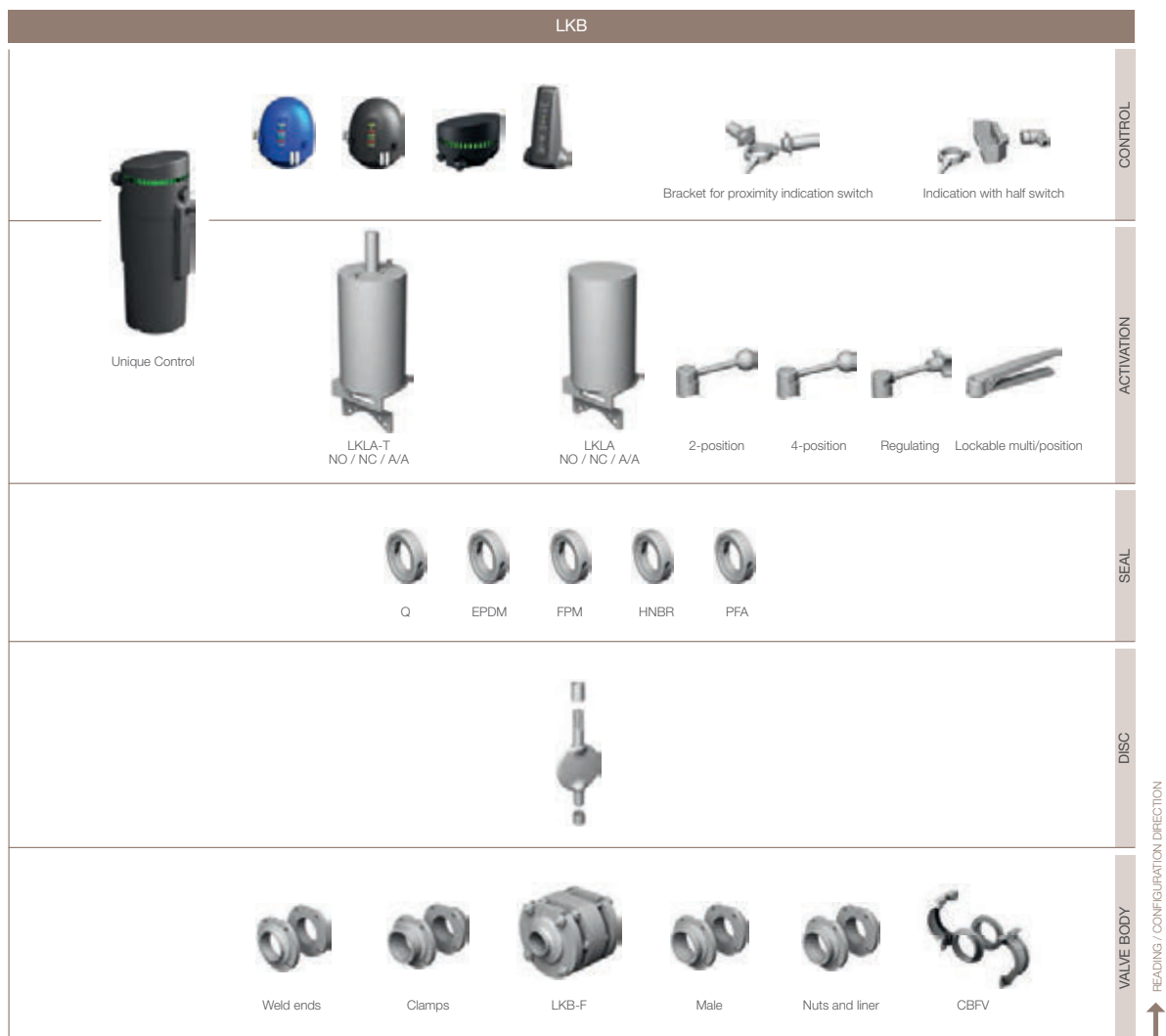
These highly reliable valves conform with FDA requirements. Alfa Laval inspection certificates and 3.1 traceability certification are also available, on request. The benefits of Alfa Laval seal technology also play a major role in preventing any kind of contamination.

Matrix advantage

Alfa Laval LKB butterfly valves can easily be mounted in even complex matrix set-ups, side-by-side with valves of other types. Using Alfa Laval control and monitoring technologies, they can also be integrated into a broad spectrum of electronic control systems, for maximum efficiency.

LKB butterfly valves

The Alfa Laval LKB range of butterfly valves consists of modular units designed to meet the full spectrum of requirements for effective, reliable butterfly valves at working pressures from full vacuum to 10 bar.



The selection guide illustrates the many combinations of features and equipment available with LKB butterfly valves. In addition, there are different versions to comply with the full spectrum of worldwide installation standards. As a result, you can always find a configuration to meet any specific requirement.

Alfa Laval LKB with standard handle

Available with standard handle for straightforward manual operation, with a pulling/turning movement. The standard handle has a spring-locking action.



Alfa Laval LKB-F for flange connections

Special version that makes it easy to remove the valve without needing to dismantle piping set-ups. This in turn makes it easy to undertake repair, service and replacement with a bare minimum of disruption.

Alfa Laval LKB with actuator

A selection of different actuators is available. The special actuator design, featuring double springs, makes sure that maximum torque is applied to the valve disc at breakaway and seal positions. This results in efficient, reliable opening and closing. Alfa Laval actuators are renowned for their exceptional reliability, regardless of operating conditions.



Alfa Laval Clamp Butterfly Valve

The practical design of this in-line valve helps reduce the total installation cost. With a handle that can be mounted step-less (360°) in any direction, it is a very flexible solution and, thanks to its easy assembly and disassembly, the valve is ideal for applications that require fast and frequent maintenance.

Unique Control

With its integrated automation, Unique Control consistently ensures an optimal interface between the actuator and the automaton.

Reliable simplicity

Unique Control is an innovative actuator that is controlled by an air spring instead of a conventional mechanical spring. Combined with the intelligent capabilities of the sensing and control unit, it delivers significant benefits both in terms of durability and reliability, thereby ensuring more system uptime. Tested to over a million strokes without service, it is the most durable actuator available today. The hygienically designed casing withstands harsh environments without weakening, corroding or discolouring.

One size fits all

The Alfa Laval Unique Control LKB fits all valve sizes from 1" to 4" (DN 50 to DN 100). With the option to switch from normally open (NO) to normally closed (NC) onsite, a single actuator covers the majority of all possible valve solutions. Existing installations are easy to upgrade to Unique Control; all that is required is a new bracket. Existing actuators may gradually be upgraded as they become due for renewal and enhanced with valve sensing and control for intelligent automation.

Intelligent performance

By simply pressing one button, Alfa Laval Unique Control LKB detects the valve positions and monitors the air pressure in the system to support self-configuration to the best possible mode of operation. It is not sensitive to pressure shocks or temperature variations, thereby eliminating false alarms that can shut down the process. The all-in-one design also makes it more hygienic.



Alfa Laval Unique Control LKB provides a 360-degree view of the valve operation mode.



Ball valves

Ball valves are constructed around a full-bore design. This makes sure the product passes through the valve with no restrictions on the flow, and that there is only minimal pressure drop. This basic design allows cleaning and product recovery using pigging systems, and also makes this kind of valve ideal for use with viscous liquids and liquids containing solid or semi-solid particles. Alfa Laval ball valves for hygienic use bear the SBV and Tri-Clover® designations.

Alfa Laval SBV Sanitary Ball Valve

Alfa Laval SBV units are designed for use as a product valve, and are available with pneumatic actuators or manually-operated handles. Ideal for applications that involve high operating pressure and temperatures as well as where the use of pigging systems is required.



Alfa Laval Tri-Clover Ball Valve

Ideal for applications that require a full-flow body design to minimize line turbulence and pressure drop. An encapsulated seat option is available for applications where it is important to reduce potential product entrapment as much as possible.

Regulating valves

Regulating valves are the right choice when flow volumes and flow directions must be adjusted or monitored. Specially designed for use in a broad range of metering, blending, weighing and filling system applications, they are the ideal solutions for precision control of flow rate or pressure.



Alfa Laval CPM-2 Valve

Designed to maintain a constant pressure at the valve inlet or outlet, using different plug sizes and different Kv values. These react effectively to any changes in product pressure by shifting position against a constant air pressure. Often used upstream of filling and bottling machines, etc.

Alfa Laval LKC-2 Non-return Valve

Non-return valve that opens when the pressure below the valve plug exceeds the combination of the pressure above the plug and the spring compression force. The valve closes when pressure equalization is reached. Any higher pressure above the valve plug forces it to close against the seat, preventing any reverse flow.



Alfa Laval SPC-2 Valve

Electro-pneumatic modulating valve that features an IP converter as an integrated part of the actuator. Available with a range of plug designs with different Kv values, providing different capacities. This type is widely used for the accurate control of pressure, flow, temperature and the level of liquids in tanks.

Alfa Laval Unique RV-ST Regulating Valve

Push-and-play regulating valve with integrated IP converter built on the Unique SSV platform. Offers plug designs with different Kv values, which provide different capacities. This enables effective control of product flow by combining different pressure drops and stroke lengths. Widely used as a regulating valve in metering, blending, weighing and filling duties.



Special valves

Alfa Laval provides a comprehensive selection of valves that are designed for particular purposes and to meet special requirements.

Alfa Laval LKAP Air-operated Valve

A straightforward, remotely controlled, air-operated shut-off valve widely used for small flows, and for dosing applications in the food and chemical industries.



Alfa Laval Unique Sampling Valve

Special valves designed to help ensure effective sterilization before and after taking each sample. Different versions are available for high-viscosity and low-viscosity products, and for taking samples using a hypodermic needle.



Alfa Laval LKUV-2 Air-relief Valve

Double-seat automatic air-relief valve with a freely moving ball that closes against the upper or lower seat, depending on pressure conditions. Designed for use when it is important to remove any air present. Examples include vertical mounting on top of a pipe run or container, or upstream from a pump inlet.



Alfa Laval LKBV Air-blow Valve

Solenoid-operated valve for emptying liquids from pipe runs or for agitating the contents of tanks by blowing in air.

Alfa Laval MH Shutter Valve

Self-draining valves that can allow product to flow in different directions. An internal shutter closes the valve ports progressively to help minimize pressure shock and stress on both the valve and the liquids passing through. Available in manually and single or double-acting pneumatically operated versions, and normally used in systems where it is important to contend with pressure shocks.



UltraPure valves

Tailored for the challenges of the biopharm industry and other demanding hygienic applications, the Alfa Laval UltraPure valve range is designed to meet cGMP (current Good Manufacturing Practices). It is supported by the Alfa Laval Q-doc documentation package, which facilitates the validation process.

Well-documented performance

Alfa Laval Q-doc is a state-of-the-art documentation package for all UltraPure products and is based on GDP (Good Documentation Practices). Q-doc documents every aspect of manufacturing from raw material to delivered equipment. With full transparency of sourcing, production and supply chains, it is easy to trace the slightest change in material or manufacturing procedures, even when it comes to spare parts. All product contact parts, such as steel and gaskets, are fully traceable to ensure correct design performance and validation right from the start.

Q-doc comprises equipment manuals, quality and manufacturing procedures, relevant material certificates and necessary parts and service information for standard components.

Reliable, high performance products ensure in-batch and batch-to-batch consistency, safeguarding product characteristics and quality.

Learn more at www.alfalaval.com/biopharm



Alfa Laval
Ball Valve
UltraPure



Alfa Laval LKB
UltraPure



Alfa Laval LKC
UltraPure



Alfa Laval Unique
DV-ST UltraPure



Alfa Laval Unique
Diaphragm Valve-
Premium
UltraPure



Alfa Laval Radial
Diaphragm Valve
UltraPure

Aseptic diaphragm valves

Aseptic diaphragm valves are most commonly used in the pharmaceutical industry. However, they are also ideal for use in other processing installations where it is crucial to prevent any increase in micro-organism concentrations.



Alfa Laval Unique Diaphragm Valve-Premium UltraPure

The Alfa Laval Unique Diaphragm-Valve Premium UltraPure gives double flow rate compared to conventional designs, with significantly reduced pressure drop. It also has a more linear flow characteristic, which results in a more precise flow regulation.

Alfa laval Unique DV-ST UltraPure Diaphragm Valve

Features a light, compact actuator with easy conversion of control function (NC-Air/Air/NO). Has an extensive range of well-proven diaphragms and high quality valve bodies with low delta ferrite and specified sulphur content.



UNIQUE DIAPHRAGM											
								CONTROL			
									ACTIVATION		
Stainless steel Composite/ Stainless steel Composite			Stainless steel Composite/ Stainless steel Composite			Composite Composite					
										DIAPHRAGMS	
Threaded Button Bayonet								Threaded			
										VALVE BODY	
2-way valve T-valve T-block valve Multiport valve Tandem valve Block tank outlet valve 2-way valve											

The selection guide illustrates the many combinations of features and equipment available with the aseptic diaphragm valve concept. In addition, there are different sizes and standards to comply with the full spectrum of worldwide installation standards. As a result, you can always find a configuration to meet any specific requirement.

Valve control and monitoring

One of the most effective ways to reap full benefit from high-quality hygienic valves is to control and monitor their action as accurately, reliably and economically as possible. Alfa Laval provides a full range of easy-to-install, easy-to-use valve-top control and monitoring indicator units for use with hygienic valves.

More reliable, cost-effective control

Traditional indicators are rarely capable of maintaining pre-set parameters for valve operation. Alfa Laval units solve this by using a state-of-the-art, no-touch sensor system, pre-configured with a tolerance band. This does away with adjustments during the unit's service life, providing you with a time-saving, set-and-forget solution that also keeps production downtime to a minimum.

Cost-effective combinations of our ThinkTop® top-mounted automated control head for pneumatic valves and IndiTop valve position indicators give you full control over fluid handling processes – with the exact degree of automation you require.

Easy to install

These units fit onto all Alfa Laval hygienic valves fitted with actuator valve-tops in an easy, straightforward procedure that requires no special expertise or costly adaptors. This makes them ideal for retrofitting and updating your existing processing plant and for increasing flexibility. Once fitted, the initial set-up is done manually using a fast and foolproof “five-push setup”.

Alfa Laval valve-top control and indicator units benefit your operations by ensuring:

- Better control and monitoring of processing operations
- Full insight and documentation about actual events
- Greater safety and reliability
- Low cost of ownership due to savings on time and manpower and elimination of downtime and errors
- Easy upgrading, expansion and reconfiguration of existing installations, with no adaptors required.





Alfa Laval
Unique Control
LKB



Alfa Laval LKB
Butterfly Valve
with Alfa Laval
ThinkTop D30



Alfa Laval
Unique SSV
Single Seat Valve
with Alfa Laval
ThinkTop Basic



Alfa Laval Unique
Mixproof Valve
with Alfa Laval
ThinkTop

Built to last

Alfa Laval control and indicator units are built for maximum durability, providing long-term service both indoors and outdoors. They comply with the stringent IP66 and IP67 standards for protecting electronic equipment against penetration by dust particles or liquids.

ThinkTop automated control heads for pneumatic valves are completely watertight and suitable for use in any known operating environment. They are also fitted with GORE™ protective venting technology that gets rid of any accumulated moisture.

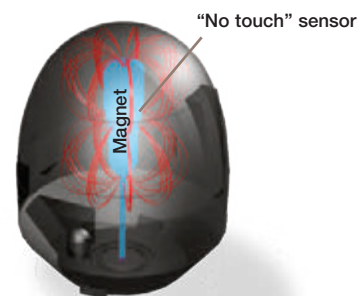
All the materials used help protect against the effects of physical impact, UV radiation and working environments in which grease, oil and chemicals may be present.

Data about the settings for each valve is automatically stored in the unit's own memory. This important information is therefore fully protected against the effects of any power failure.

Safe and rugged

Alfa Laval control and indicator units have well-proven features designed to ensure maximum safety during production by making sure that each valve is doing exactly what it is supposed to – regardless of conditions.

The “no touch” sensor system is less sensitive to the effects of temperature and vibration because they are moulded directly into the valve-top units.



The sensor detects valve stem movement with extremely high accuracy. This means these units can be set up with individual tolerance bands for detecting any deviation in the opening/closing of the valve plug. This helps prevent any operating errors that may result in wasted production.

Low cost of ownership

Alfa Laval control and indicator units give you a remarkably low cost of ownership via savings on time, manpower and installation costs, as well as by boosting production uptime throughout the service life of the unit.

Alfa Laval ThinkTop and Alfa Laval IndiTop units feature modular, fully encapsulated (potted) designs that are extremely robust and have only a small number of components. This saves on spare parts inventory and maintenance costs throughout their service life.

Alfa Laval ThinkTop

This premium top-mounted automated control head for pneumatic valves gives you access to the full range of electronic interfaces available for operating solenoid valves, transmitting feedback signals and ensuring the operator full benefit of Alfa Laval hygienic valves.

ThinkTop units make it possible to fulfil all the requirements for automated valve monitoring and control - minimizing waste and maximizing the traceability during production.



Alfa Laval ThinkTop Basic. Intrinsically safe for ATEX environments

Alfa Laval ThinkTop Basic

This standard top-mounted automated control head for pneumatic valves fulfils requirements for the automated sensing and control of hygienic valves, with a reduced number of digital inputs and outputs.

Installing the Alfa Laval ThinkTop Basic units is both quick and easy, and helps provide a cost-effective degree of flexibility in controlling an automated production.

Alfa Laval ThinkTop D30

This basic top-mounted automated control head for pneumatic valves provides basic automated sensing and control of hygienic valves, designed with inputs and outputs, and as an alternative solution to external solenoid valve and for use on non-critical valve actuators.

The plug 'n' play setup makes it quick and easy to install, which eliminates fault handling during commissioning and production. It is designed and meet the market challenges for even more usability and hassle-free control of automated valves.



Alfa Laval ThinkTop D30



Alfa Laval IndiTop

The Alfa Laval IndiTop top-mounted indicator units are designed to transmit feedback about the current position of any hygienic valve. No solenoids are used, eliminating the need for feedback adjustment over time and, making this a true set-and-forget system.



Side indicator brackets

Certain Alfa Laval valve types are available with special side indicators and brackets for mounting a range of different sensors.

Getting the message across

Alfa Laval control and indicator units are designed to provide you and your staff with accurate, reliable information about the exact operating status of your hygienic-standard valves at any given time.

This important information is always presented visually, with colour-coded LEDs to make sure operators can see the current valve position and whether the power is on or off.

Broad interface compatibility

Alfa Laval control and indicator units can also provide digital electronic feedback by relaying sensor data about the exact valve position to a programmable logic controller (PLC) via a range of different industry-standard configurations. These include traditional digital interfaces, the relatively simple AS-Interface system and the more advanced DeviceNet™ fieldbus interface.

By combining bus systems and digital technologies, Alfa Laval equipment is compatible with all major PLC digital input/output cards and gateways for communication via other fieldbus systems. This makes it easy to combine different types of control and indication units and data communication interfaces to meet your particular valve control needs at any given time.

Flexibility for changing requirements

Alfa Laval valve automation technology enables you to combine different valves, different control equipment and different communication protocols as you see fit, to deal with your changing requirements.

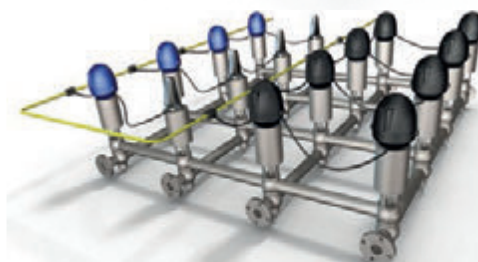
Alfa Laval solutions also let you streamline interface and wiring configurations by connecting feedback signals from multiple control or indicator units into one. This greatly reduces the investment required to implement efficient, future-compatible valve control and monitoring set-ups.



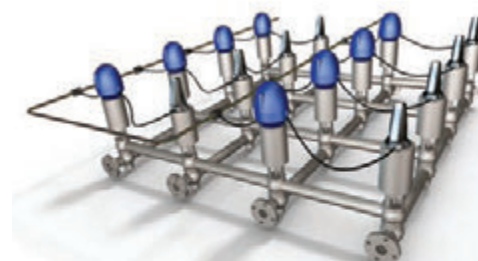
Digital interface



AS-Interface



Combination of different communication protocols



DeviceNet

Flow management solutions

Alfa Laval supplies a vast selection of different types of hygienic valves, in many different configurations and sizes. This is backed by the know-how and experience essential for configuring any installation in the most cost-effective way, no matter how complex.

Full spectrum

Alfa Laval can provide you with a comprehensive range of hygienic valve equipment, designed to meet virtually all your requirements.

- DN4–150 (3/8 to 6 inches) in size.
- Virtually all dimension standards, including ISO, DIN, ASME, etc.
- 1.4435 (316L) and 1.4404 (316L) standards for stainless steel.
- Seals made of EPDM, PTFE, HNBR, FPM, Q silicone and PFA.
- Surface finishes with roughness values of Ra 6.3–0.25 µm, including electro-polished options.
- Internationally recognized hygiene ratings, including options for aseptic operation.
- Compliance with a wide range of key international standards, including FDA approval, 3-A conformity certificate, EHEDG compliance, ATEX, etc.



Full details about all Alfa Laval hygienic valves are available in the “Close at hand” catalogue at www.alfalaval.com/high

Overview of Alfa Laval hygienic valves

Valve categories	Duty							
	On-off valves	Regulating valves	Sampling valves	Tank outlet valves	Divert valves	ATEX valves	P/M*	Aseptic valves
Unique mixproof	●			●		(●)***	P	
SMP	●				●	●	P	●
Unique SSV	●			●	●	●	P/M	●
Unique SSSV	●				●		P/M	
CPM-2		●				●	P	●
LKC-2		●				●	P	
SPC-2 & RV-ST		●					P	●
Unique sampling valve			●				P/M	
MH shutter valve	●					●	P/M	
LKB & Clamp butterfly valve	●			●		●	P/M	
Ball valve	●					●	P/M	
Unique diaphragm valve	●	●		●	●	●	P/M	●
Radial diaphragm valve	●			●			P/M	●

Everything you need

Alfa Laval combines the offering and advantages of a global brand with the individual attention of local sales and channel partners, creating a one-stop shop with the world's largest accumulation of process expertise. In addition, we provide effective, time-saving software tools that help you easily configure, size and receive supporting dimensional drawings for hygienic valve installations.

Computer-Aided Selection software (CAS)

Alfa Laval's CAS software helps you quickly and easily identify the valve configuration best suited for your particular process. It also provides you with a clear visual overview while you are configuring each valve. CAS includes drawings, article numbers and spare parts lists, quickly and easily compiling ordering lists and streamlining your maintenance and service procedures.

Computer-Aided Design (CAD)

Our CAD portal offers dimensional drawings of all Alfa Laval mixproof valves, single seat valves and butterfly valves. Any user can download 2D and 3D CAD drawings in both neutral and native formats.

Extending equipment performance by 360° service

Through Alfa Laval's broad range of spare parts, equipment, and services you get the support you need when you need it, performed by skilled and knowledgeable staff.

With Alfa Laval service you maximize the reliability and uptime of your equipment. The result is superior performance throughout the equipment life cycle – performance that puts you ahead of competition.



For more information visit
www.alfalaval.com/high

		Control and monitoring								
UltraPure	Piggable	Unique Control	ThinkTop	ThinkTop Basic intrinsically safe	ThinkTop Basic	ThinkTop D30	IndiTop	Side indicator	Bracket system	Other
	•		•	•	•		(•)**	•	•	
	•		•	•	•		•	•	•	
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* Pneumatic and/or manually operated.

** Can be fitted and used on this type of valves, although this is not standard practice.

*** In order to use Unique mixproof in ATEX environment, the blue plastic cover must be removed.

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, foodstuff, 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

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