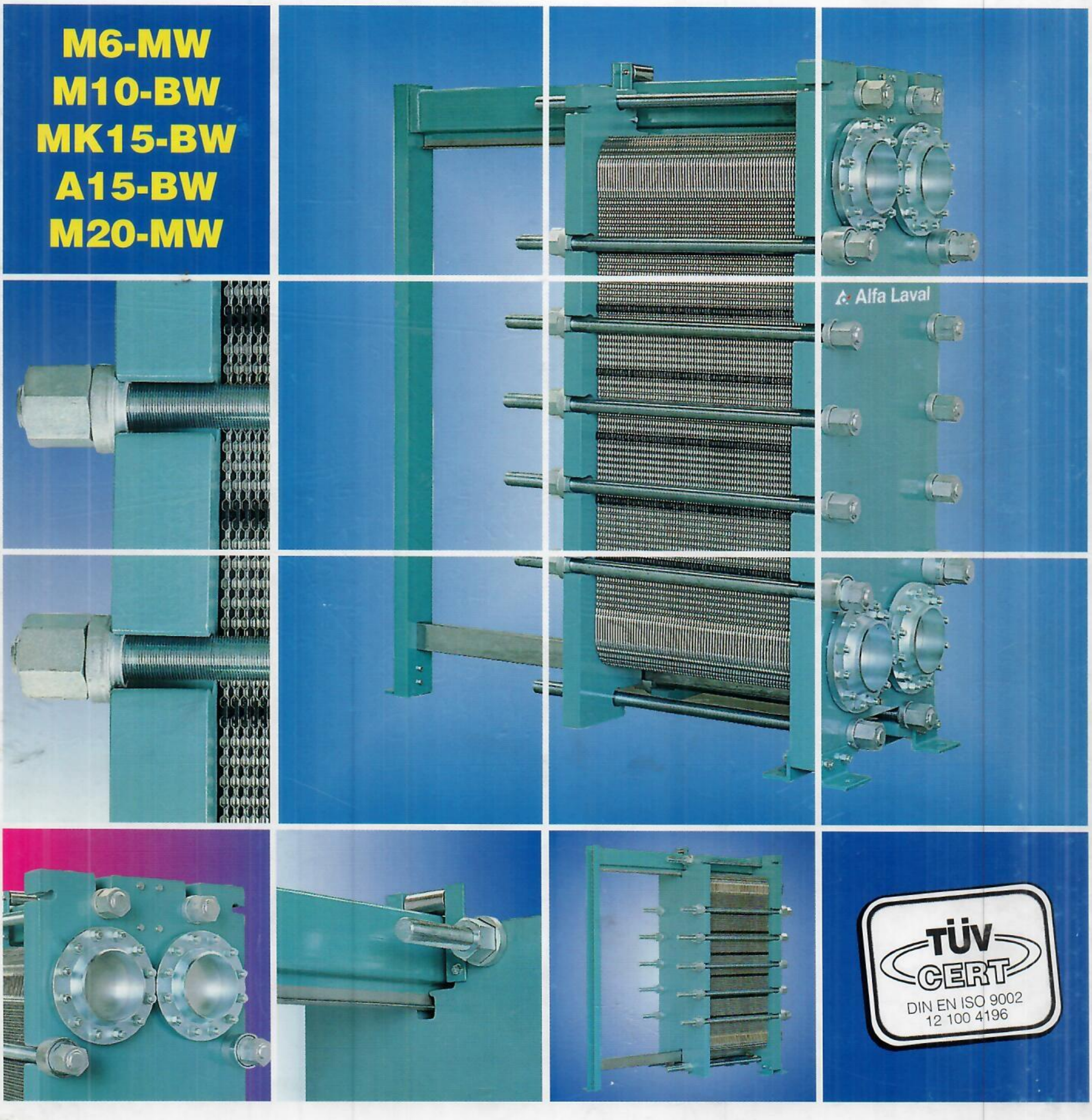
Semi Welded Plate Heat Exchanger

Product Manual for Refrigeration



Alfa Laval

Semi Welded Plate Heat Exchanger

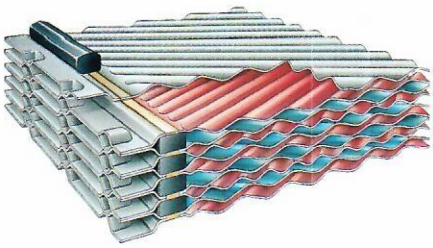


Fig. 1 *The channels for the refrigerant and the brine are sealed by laser welds and gaskets.*

The Alfa Laval Semi Welded Heat Exchanger (SWPHE) alternates welded channels and traditional gasketed channels.
The refrigerant flows in welded channels and the only gaskets in contact with the refrigerant are two circular porthole gaskets between the welded plate pairs. These gaskets are made from highly resistant materials, attached for easy replacement by a glue-free construction.
The secondary medium flows in channels sealed by traditional elastomer gaskets. Double sealing and corrosion resistant plate materials prevent intermixture of media, the absence of pressure-retaining seal welds and a flexible, yet vibration-resistant design.

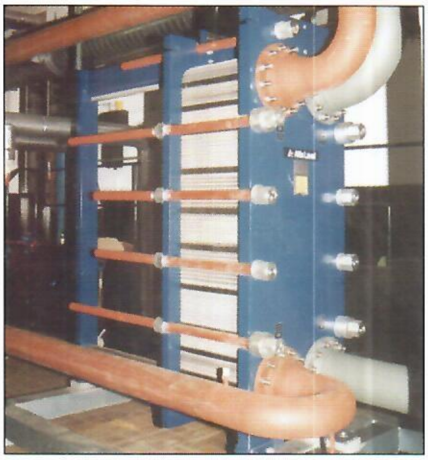


Fig. 2 *SWPHE as an evaporator in a brewery installation.*

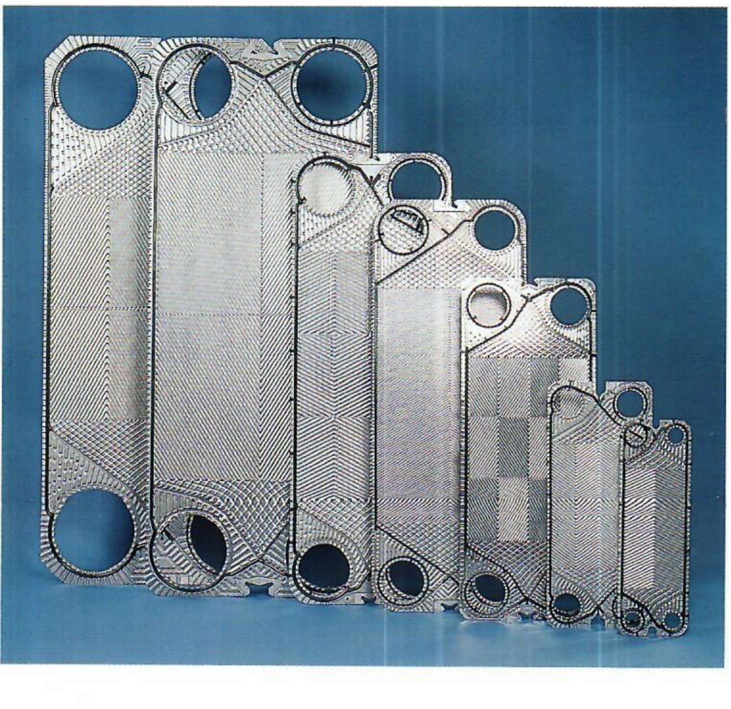
Applications

The Alfa Laval Semi Welded Heat Exchangers are used as evaporators and condensers for refrigeration systems in a whole series of applications, eg:

- Dairy, brewery and vineyard production
- Marine
- Fishing vessels and fish processing
- Slaughterhouses
- Chemical and pharmaceutical industries
- Ice manufacturing, ice-skating rinks
- Cold and frozen storage
- Food retail outlet

When the gasketed side is food approved it could be used in direct cooling of food liquids, eg. NH_3/beer, juice or water.
Other application like Heat Pumps, Organic Rankine Cycles and Absorption Systems could also request SWPHE for different duties.

Fig. 3 *The complete range of Alfa Laval plates for SWPHE.*



Features

The SWPHE is very flexible and variable and can be arranged in Twin or two-units-in-one design, e.g. Desuperheater/Condenser, Oilcooler/Evaporator. These features give us the possibility to manufacture two duties in one frame at a lower cost, smaller volume and shorter footprint.

Disassembling and Assembling Possibilities

The plate heat exchanger concept allows the SWPHE to be opened and reclosed several times.
This makes assembly on site piece by piece possible, which is an advantage when transportation space is limited. It also allows opening the SWPHE for service. Since all connections are normally located at one end, no pipework removal for service is necessary. The heat transfer surface could also be augmented if the capacity is increased or if the temperature program is changed.

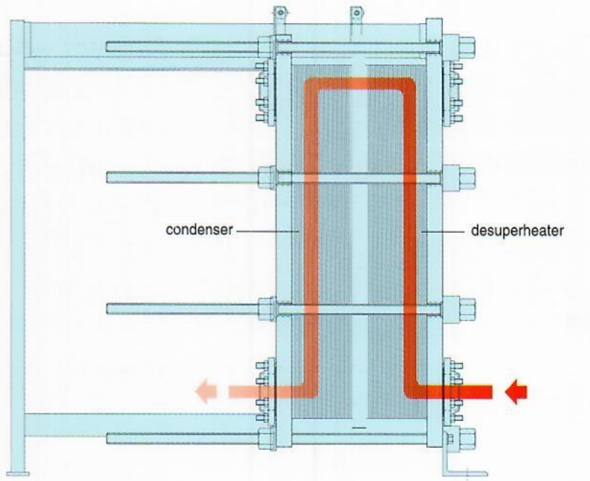


Fig. 1 Condenser and desuperheater arranged in the same frame.

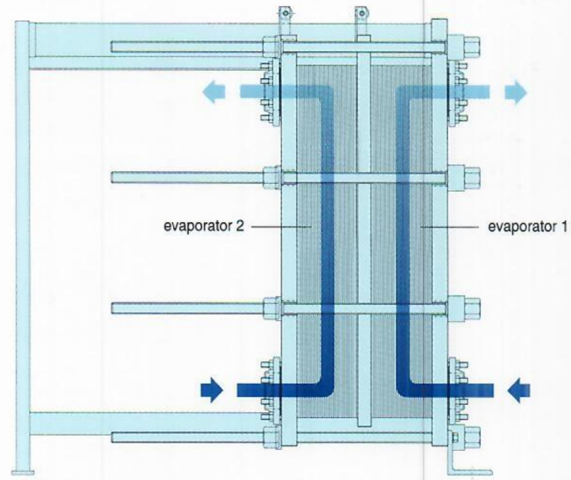


Fig. 2 Two evaporators or condensers, also in different size, arranged in the same frame.

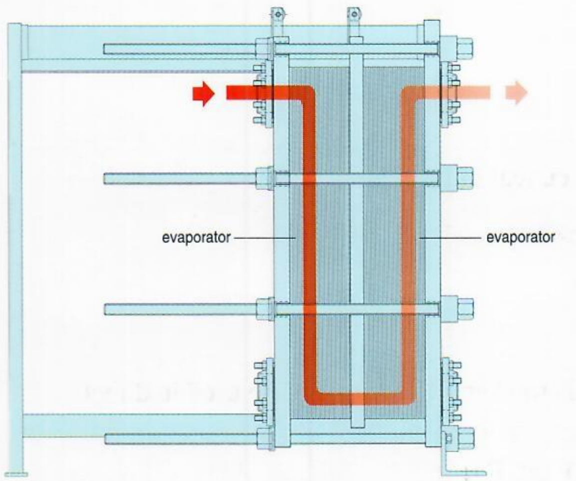


Fig. 3 Multipass evaporator for cooling of media in two stages.

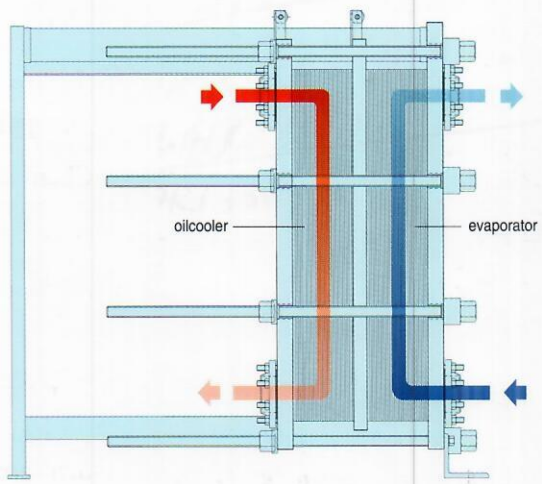


Fig. 4 Oilcooler and evaporator arranged in the same frame.

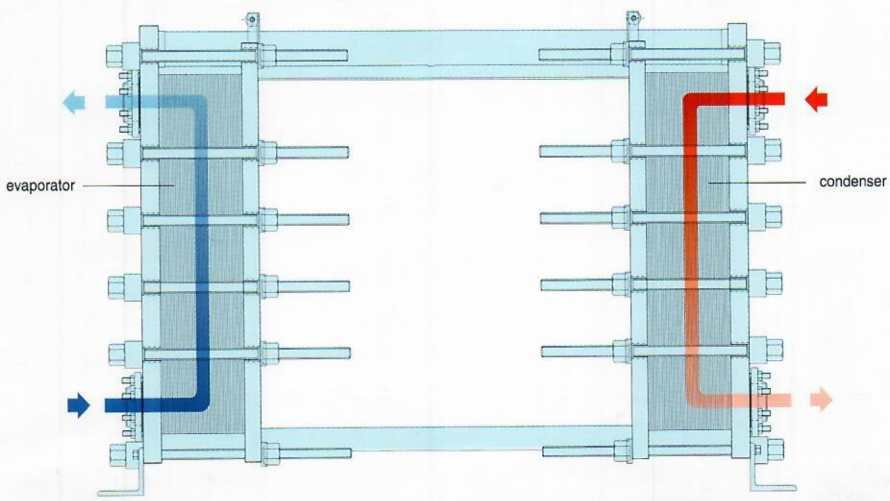


Fig. 5 Evaporator and condenser arranged in a Twin frame.

Advantages

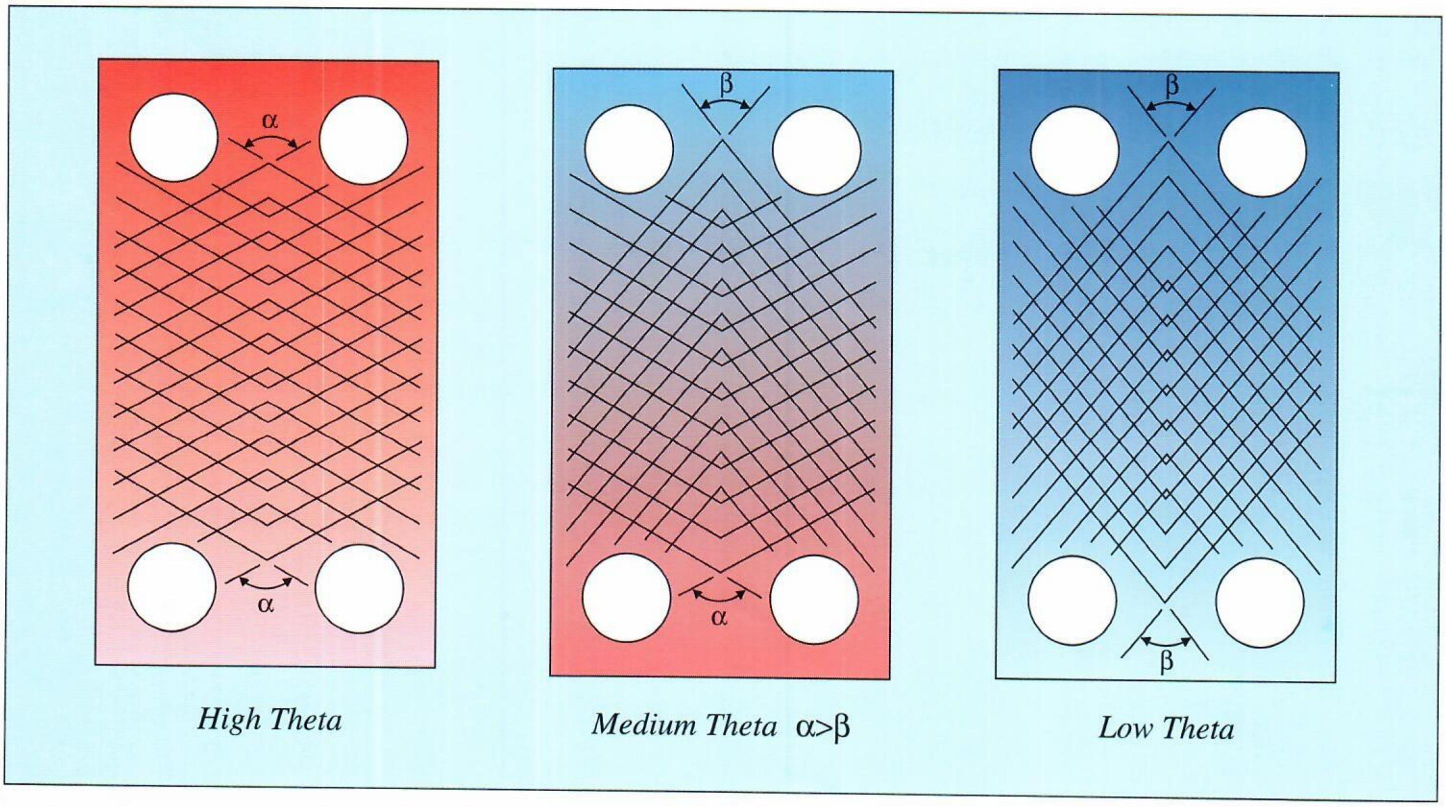
The plate heat exchanger concept, with flow-through channels formed by corrugated plates and the heat transfer taking place through the thin plates, is an extremely efficient heat exchange technique.
The turbulent flow, coupled with low fouling factors and high heat transfer coefficients, means that it is possible to operate with a small temperature difference in evaporating and chilled water temperatures. This in turn provides a good operational economy with high C.O.P. values.
It also means that a Semi Welded Plate Heat Exchanger becomes much more compact than a Shell & Tube Heat Exchanger for the same duty. The practical advantages are:

- lower weight
- smaller space requirements
- lower refrigerant filling.

Fig. 4 *SWPHE becomes more compact and request a lower filling of refrigerant for the same duty.*

Characteristics of cassettes

The cassettes are designed in three different angles of corrugation:
Low Theta = for higher flow and high temperature approach
Medium Theta = for medium flow and medium temperature approach
High Theta = for lower flow and low temperature approach



The Medium Theta cassette is a mixture of High and Low Theta plates.
New plate cassettes in alternative material can be inserted when more corrosive cooling water is introduced.
The following plate materials are standard:

- AISI 304
- AISI 316
- Titanium

Mechanical Aspects and Freezing

The SWPHE is not sensitive to temperature shocks, and there is no vibration due to the small distance between the support points.
There is no pressure retaining welds in the SWPHE. Due to the turbulent flow, freezing risks are small, but the flexible design will accommodate expansion, and no damage will be caused should freezing occur.

Fig. 5 *Due to flexible design, no damage will occur when freezing.*

Leak Detection

Intermixing of media is not possible with the double sealing. The diagonal gaskets form the weakest components, and any leak will occur through a gasket, which is externally detectable for both media sides.
The Alfa Laval SWPHE is designed with no internal welds, and hence there will be no internal leaks.

Guarantee and Maintenance

The guarantee for the SWPHE is 12 months from the delivery date. The guarantee is not valid if the unit is operated under conditions other than those specified. It is very important that the unit is installed and set up according to the instructions.
Gasket replacement of SWPHE will be recommended for evaporator/condenser at an interval of 5/4 years for ring gaskets and 10/8 years for field gaskets.
In case of fouling growth, the SWPHE can be cleaned by CIP on site. A mobile CIP could be docked to the unit and then circulate CIP liquid.
For more thorough service the cassettes can be sent in for total reconditioning, where the gaskets will be removed, the cassette cleaned and new gaskets provided.

Approvals and Pressure Vessel Codes

Local countries limitations, requirements and additionals based on NH3 services.

Country of destination	Pressure vessel authority	Approval required	Preapproval available	Accepted design code	Inspection by	Design pressure		Design temperature		Test pressure DP x coeff.
						LP bar minimum	HP bar minimum	LT °C minimum	HT °C maximum	
Sweden	SAQ	Yes	Yes	SA	SA	13	23	-45	120	1,3
Norway	KK		No	SA	SA			-45	120	1,3
Finland	INSPECTA	Yes	Yes	SA/TÜV	SA	20,8	20	-45	120	1,3
Denmark	AT	Yes	Yes	SA	SA	24	24	-45	120	1,3
Germany	TÜV	Yes	Yes	TÜV	SA/Self	13	23	-45	120	1,3
Greece			No	SA	SA O.R.			-45	120	1,3
Turkey			No	SA/TÜV	SA O.R.			-45	120	1,3
Netherlands	Stoomweezen	Yes	No	SA	SA	15	23,5	-45	120	1,4
Belgium	AIB-Vincotte		No	SA	SA O.R.			-45	120	1,3
France	Service de Min	PV/ch>80bl	No	SA	SA O.R.			-45	120	1,3
Spain			No	SA	SA O.R.			-45	120	
U.K.	BS		No	ASME/SA		10,5	17,5	-45	120	1,35
Austria	TÜV/ÖTÜV	Yes	ÖTÜV partly	TÜV/ÖTÜV	SA	17,3	22	-45	120	1,5
South Africa			No	SA/TÜV	SA O.R.			-45	120	1,3
Italy	ISPESL	Yes, Vtot>25 l	Yes	ISPESL	SA/ISPESL	15	22	-45	120	1,2
Russia	GOOSP	Yes	Yes	SA	SA			-45	120	1,3
Czech Rep.			No	SA	SA O.R.			-45	120	1,3
Slovakia			No	SA	SA O.R.			-45	120	1,3
Hungary			No	SA	SA O.R.			-45	120	1,3
Romania	ISCIR	Yes	Partly	SA	SA			-45	120	1,3
Poland	UDT	Yes	Partly	SA	SA			-45	120	1,3
USA	ASME	Yes	Not appl.	ASME VIII	ASME			-45	120	1,5
Canada	CZA	Yes	Not appl.	ASME VIII	ASME			-45	120	1,5
Brazil			No	SA/ASME	SA O.R.			-45	120	1,3
India			No	SA/TÜV	SA O.R.			-45	120	1,3
Japan	KHK	Yes	Yes	KHK	KHK	13		-45	120	1,3

O.R. = on request / LP = low pressure / HP = high pressure / LT = low temperature / HT = high temperature / DP = design pressure

The low and high temperatures are gasket limited temperatures.

Marine approvals are on request.

Frame and plate guide

Models		M6-MW	M10-BW	MK15-BW	A15-BW	M20-MW
FGR						
Max design press. / Test press.	bar	16/21	16/21	16/21	16/21	16/21
Standard temperature	°C	-10/120	-10/120	-10/120	-10/120	-10/120
Low temperature	°C	-45/50	-45/50	-45/50	-45/50	-45/50
FDR						
Max design press. / Test press.	bar	25/33	25/33	25/33	25/33	25/33
Standard temperature	°C	-10/120	-10/120	-10/120	-10/120	-10/120
Low temperature	°C	-45/50	-45/50	-45/50	-45/50	-45/50
AISI 304 - 0,6 mm						
Max design press. / Test press. gasket side	bar	on request	27/36	25/33	on request	on request
Max design press. / Test press. welded side	bar	on request	31/41,5	31,8/42	on request	on request
Cassette weight	kg	on request	3,00	5,64	on request	on request
AISI 316 - 0,6 mm						
Max design press. / Test press. gasket side	bar	23/31	27/36	25/33	on request	20/26
Max design press. / Test press. welded side	bar	31/41,5	31/41,5	31,8/42	on request	24/31
Cassette weight	kg	1,80	3,00	5,64	on request	10,1
AISI 316 - 0,7 mm						
Max design press. / Test press. gasket side	bar	on request	on request	on request	20/26	24/31
Max design press. / Test press. welded side	bar	on request	on request	on request	25/33	27/36
Cassette weight	kg	on request	on request	on request	9,20	11,6
Titanium - 0,6 mm						
Max design press. / Test press. gasket side	bar	20/26	20/26	16/21	12/16	16/21
Max design press. / Test press. welded side	bar	24,5/32	25/32	24/32	16/21	16/21
Cassette weight	kg	1,10	1,75	3,28	4,80	6,10
Titanium - 0,7 mm						
Max design press. / Test press. gasket side	bar	on request	on request	21/28	on request	20/26
Max design press. / Test press. welded side	bar	on request	on request	28/36	on request	24/31
Cassette weight	kg	on request	on request	3,79	on request	6,90
Titanium - 0,8 mm						
Max design press. / Test press. gasket side	bar	on request	on request	on request	20/26	24/31
Max design press. / Test press. welded side	bar	on request	on request	on request	25/33	27/36
Cassette weight	kg	on request	on request	on request	6,30	7,90
Area / Plate	m^2	0,124	0,24	0,46	0,75	0,85
Volume / Channel	l	0,40	0,63	1,27	1,70	3,67
Free channel	mm	2,80	2,40	2,50	2,30	4,00

The low and high temperatures are gasket limited temperatures.

The design pressure of the unit is limited to the frame.

Gasket selection guide

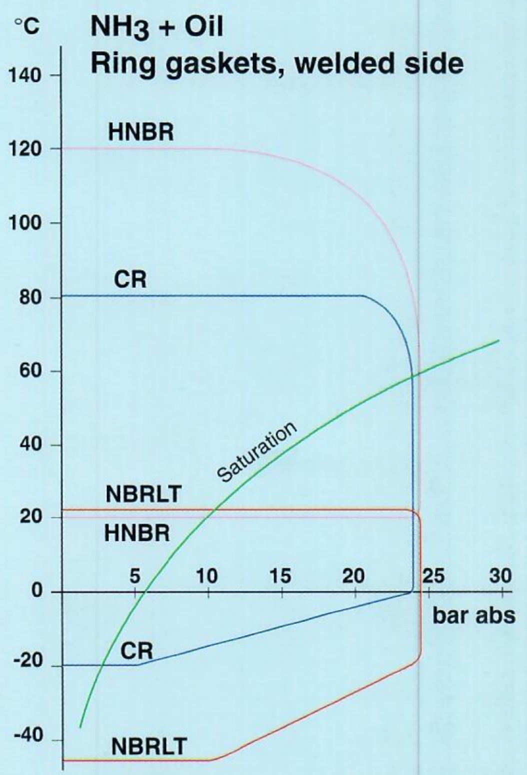
Refrigerant on welded side

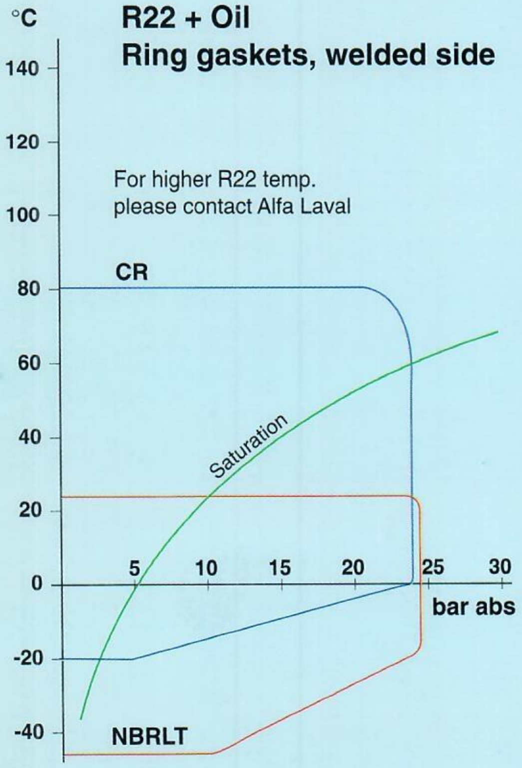
Refrigerant mixed with normal compressor oil – type mineral oil with low aromatic contents (synthetic oils have to be checked).

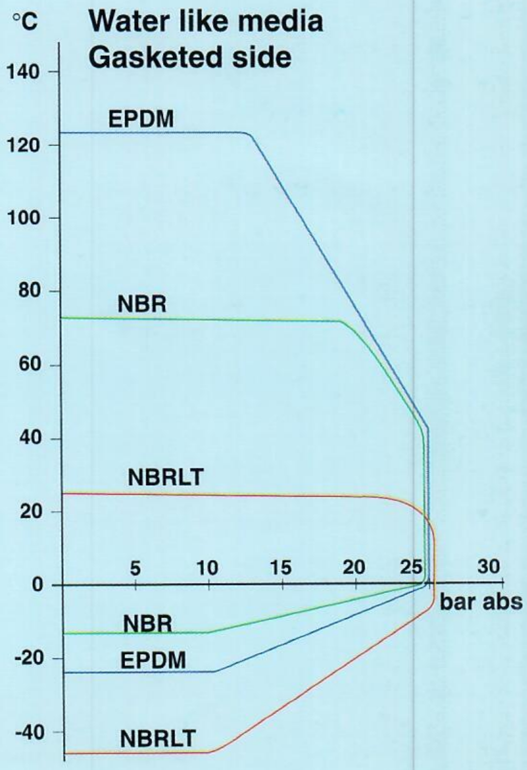
For special operation cases like:

- temporary high temperature changes
- cleaning by CIP at high temperature
- other media than R22, NH3 or water like brines.

Please contact Alfa Laval technical support.

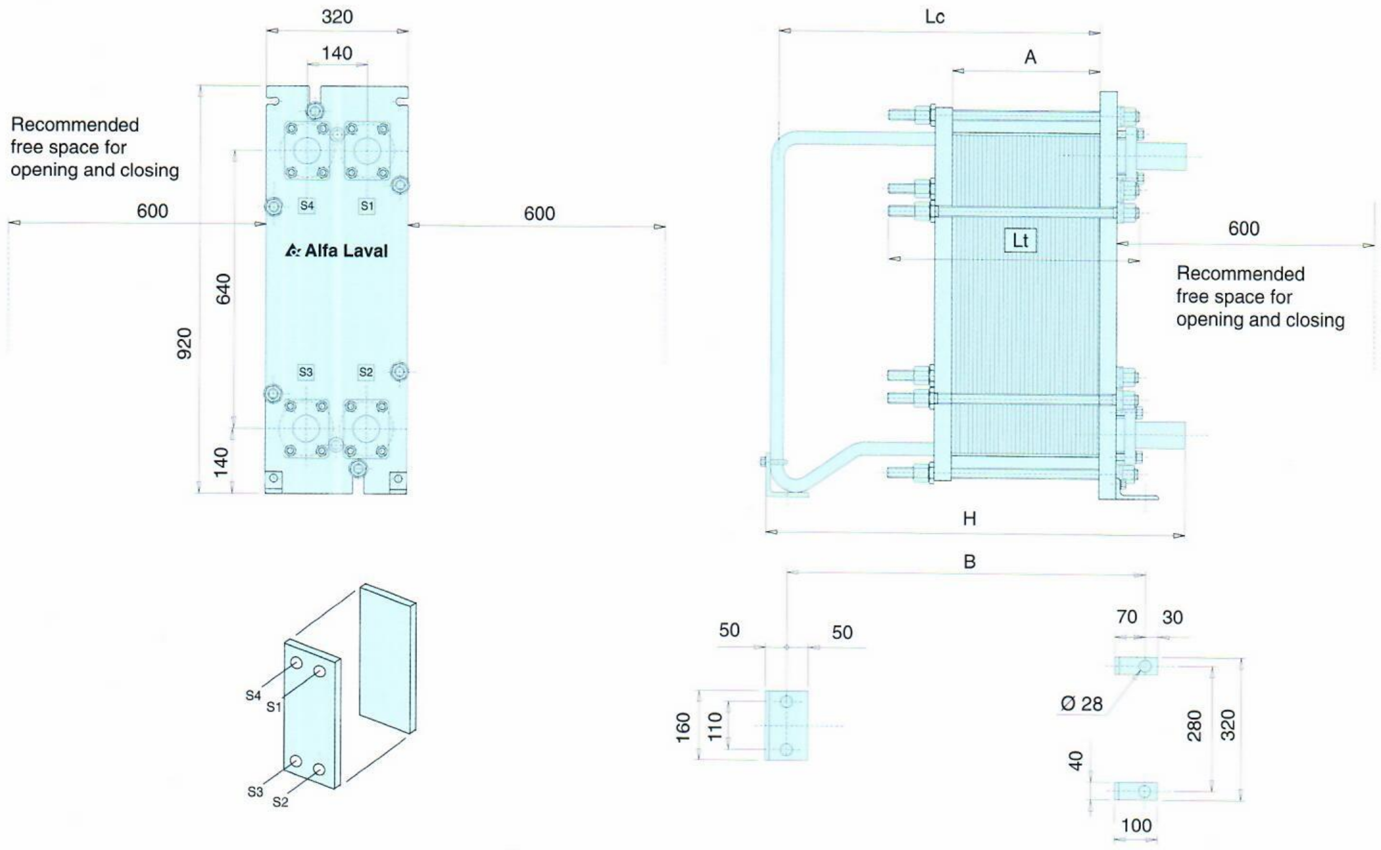






EVAPORATOR M6 - MW FGR

N° of cassets			15	25	35	45	55
Nominal data	Qn	kW	60	100	135	155	170
Ethylene Glycol = 30% Ti = -2°C To = -6°C	Wn	m^3/h	14,7	24,5	33,1	37,9	41,6
Refrigerant = NH_3 Te = -10°C	Δp glycol	bar	0,62	0,62	0,61	0,53	0,48
	Δp NH_3	kPa	6,6	6,8	6,9	6,6	6,3



N° of cassets			< 11	< 28	< 45	< 67	< 90	< 125
DIMENSIONS	A	mm	75	150	305	455	612	880
	Lc	mm	350	550	550	750	950	1400
	Lt	mm	200	350	500	700	900	1300
	H	mm	550	750	750	950	1150	1600
	B	mm	545	745	745	945	1145	1595
	Connection	mm	OD 62	OD 62	OD 62	OD 62	OD 62	OD 62
DATA	V_{H_2O}	dm^3	3,6	9,6	15,6	21,6	27,6	40,8
	V_{NH_3}	dm^3	4	10	16	22	28	42
	W	Kg	186	216	247	286	328	392

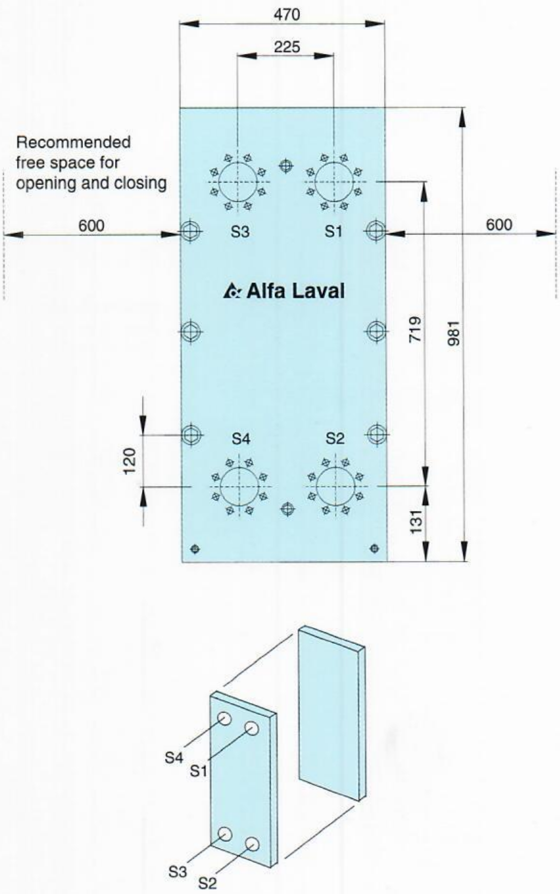
S_1 Outlet water
S_2 Inlet water
S_3 Inlet refrigerant
S_4 Outlet refrigerant

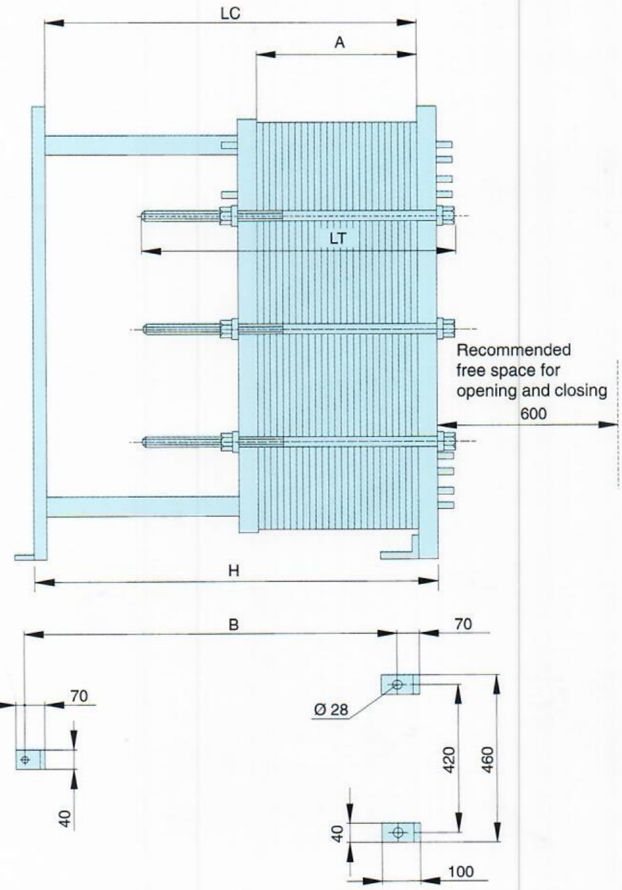
Ti Glycol inlet temperature
Tu Glycol outlet temperature
Te Evaporation temperature
Qn Nominal capacity

Wn Glycol nominal flow
Δ_p glycol Glycol pressure drop
Δ_p NH_3 Ammonia pressure drop
Wo Operating weight

V H_2O Water volume
V NH_3 Ammonia volume

N° of cassets			20	30	40	50	60	70
Nominal data	Qn	kW	115	180	240	300	360	415
Ethylene Glycol = 30% Ti = -2°C To = -6°C	Wn	m^3/h	28,2	44,1	58,8	73,4	88,4	101,6
Refrigerant = NH_3	Δp glycol	bar	0,72	0,76	0,76	0,77	0,78	0,78
Te = -10°C	Δp NH_3	kPa	5,4	5,7	5,8	5,9	6,1	6,2





N° of cassets			< 16	< 29	< 64	< 102	< 152	< 219
DIMENSIONS	A	mm	96	180	408	636	864	1314
	Lc	mm	500	650	900	1250	1600	2100
	Lt	mm	450	450	750	1050	1650	1950
	H	mm	580	730	980	1330	1680	2150
	B	mm	505	655	905	1255	1605	2105
	Connection	mm	DN 100	DN 100	DN 100	DN 100	DN 100	DN 100
DATA	V_{H_2O}	dm^3	10,0	18,3	40,5	61,9	84,2	124,5
	V_{NH_3}	dm^3	10,6	18,9	41,1	62,8	84,5	125,1
	W	Kg	381	427	571	696	844	1125

S_1 Outlet water
S_2 Inlet water
S_3 Inlet refrigerant
S_4 Outlet refrigerant

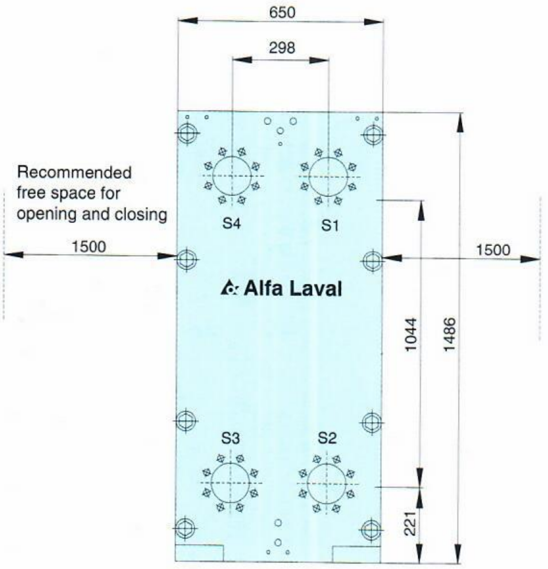
Ti Glycol inlet temperature
Tu Glycol outlet temperature
Te Evaporation temperature
Qn Nominal capacity

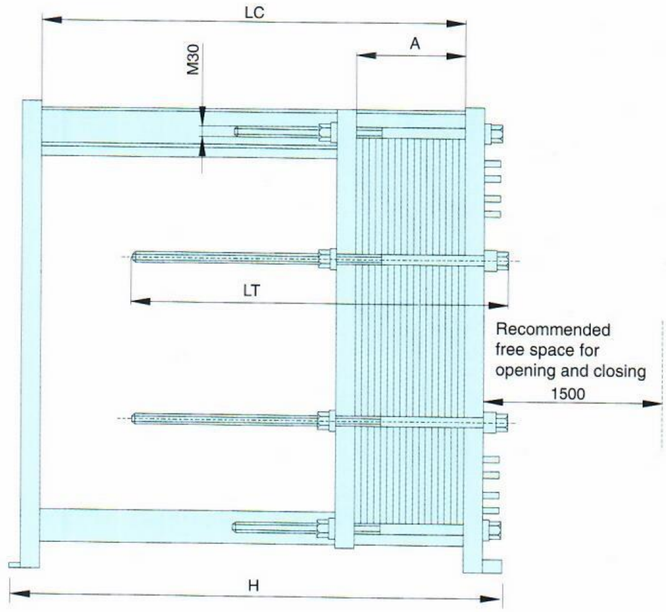
Wn Glycol nominal flow
Δ_p glycol Glycol pressure drop
Δ_p NH_3 Ammonia pressure drop
Wo Operating weight

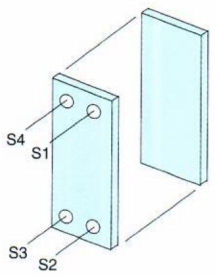
V H_20 Water volume
V NH_3 Ammonia volume

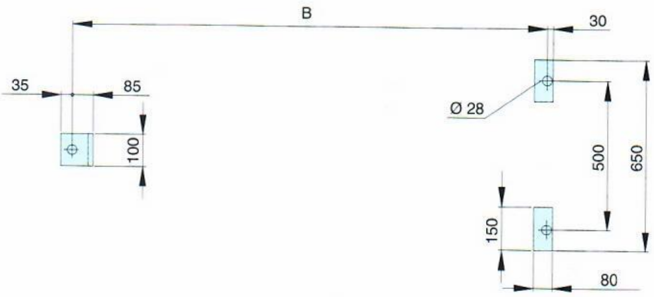
EVAPORATOR MK15-BWFGR

N° of cassets			30	40	50	60	70	80
Nominal data	Qn	kW	340	460	580	690	800	900
Ethylene Glycol = 30% Ti = -2°C To = -6°C	Wn	m^3/h	83,2	112,6	142,0	168,9	195,8	220,3
Refrigerant = NH_3	Δp glycol	bar	9,0	9,2	9,4	9,6	9,6	9,7
Te = -10°C	Δp NH_3	kPa	6,8	7,0	7,2	7,3	7,4	7,5









N° of cassets			< 37	< 66	< 94	< 121	< 179	< 215
DIMENSIONS	A	mm	229	409	583	750	1100	1333
	Lc	mm	900	1200	1500	1800	2400	2800
	Lt	mm	750	1050	1350	1650	2250	2850
	H	mm	1200	1500	1800	2100	2700	3100
	B	mm	1095	1395	1695	1995	2595	2995
	Connection	mm	DN 150	DN 150	DN 150	DN 150	DN 150	DN 150
DATA	V_{H_2O}	dm^3	45,8	81,5	115,2	147,9	193,6	284,3
	V_{NH_3}	dm^3	47,3	82,8	116,5	149,2	195,9	235,6
	W	Kg	1298	1546	1874	2025	2521	2724

S_1 Outlet water
S_2 Inlet water
S_3 Inlet refrigerant
S_4 Outlet refrigerant

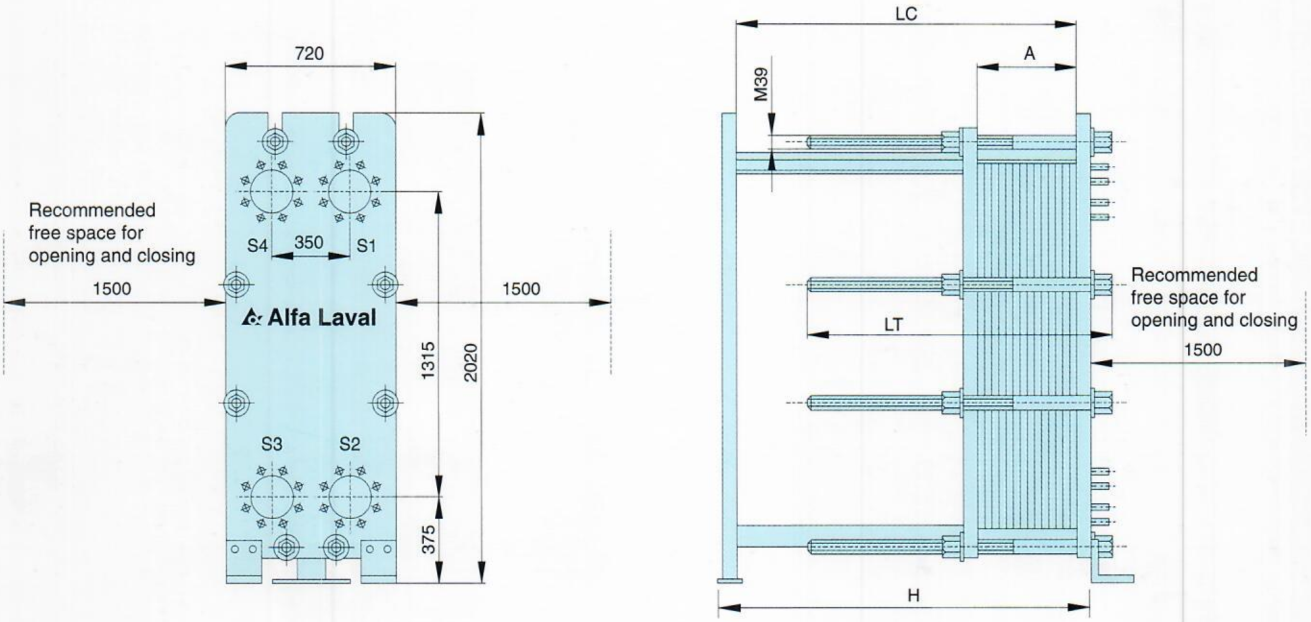
Ti Glycol inlet temperature
Tu Glycol outlet temperature
Te Evaporation temperature
Qn Nominal capacity

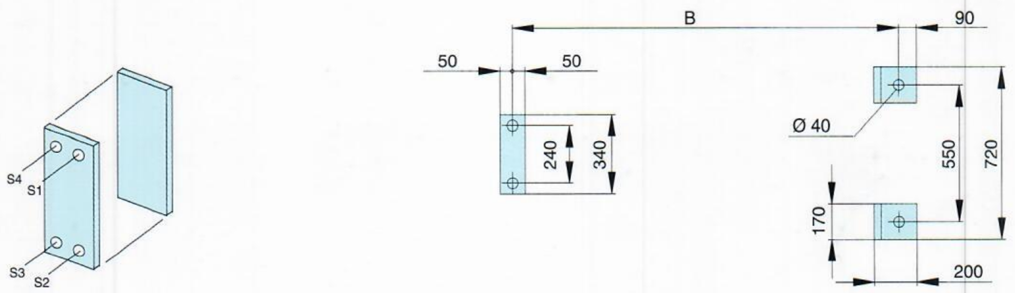
Wn Glycol nominal flow
Δ_p glycol Glycol pressure drop
Δ_p NH_3 Ammonia pressure drop
Wo Operating weight

V H_20 Water volume
V NH_3 Ammonia volume

EVAPORATOR A15-BWFGR

N° of cassets			20	30	40	50	60	70
Nominal data	Qn	kW	280	430	560	700	840	950
Ethylene Glycol = 30% Ti = -2°C To = -6°C	Wn	m³/h	68,5	105,3	137,1	171,4	205,6	232,6
Refrigerant = NH_3	Δp glycol	bar	0,64	0,65	0,63	0,64	0,65	0,63
Te = -10°C	Δp NH_3	kPa	4,8	4,9	4,9	5,1	5,2	5,2





N° of cassets			< 38	< 65	< 118	< 171	< 224	< 250
DIMENSIONS	A	mm	228	390	708	1026	1644	1500
	Lc	mm	900	1200	1800	2400	3000	3300
	Lt	mm	750	1050	1650	2250	2850	3150
	H	mm	1035	1335	1935	2535	3135	3435
	B	mm	1095	1395	1995	2595	3195	3495
	Connection	mm	DN 150	DN 150	DN 150	DN 150	DN 150	DN 150
DATA	V_{H_2O}	dm³	32	108	202	248	338	370
	V_{NH_3}	dm³	34	110	206	252	342	376
	W	Kg	1829	2363	3112	3862	4299	4594

S_1 Outlet water
S_2 Inlet water
S_3 Inlet refrigerant
S_4 Outlet refrigerant

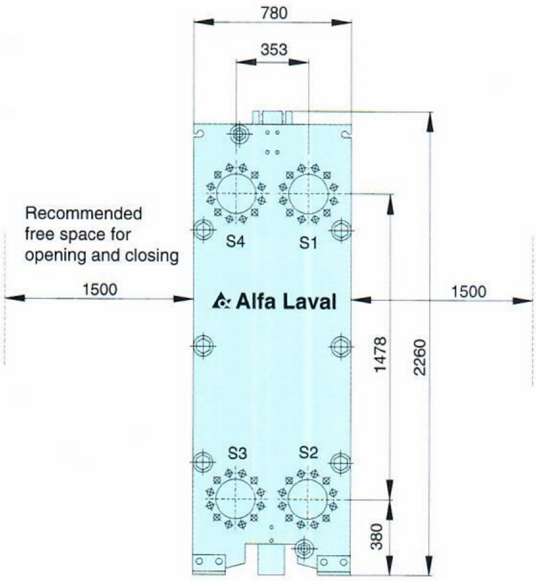
Ti Glycol inlet temperature
Tu Glycol outlet temperature
Te Evaporation temperature
Qn Nominal capacity

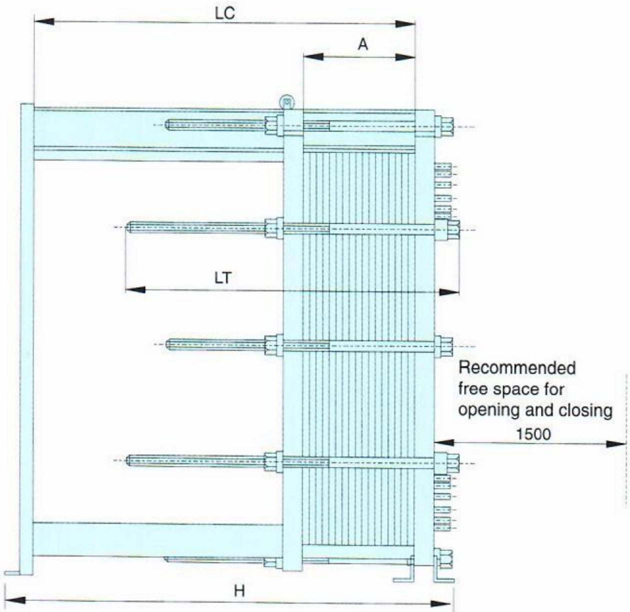
Wn Glycol nominal flow
Δ_p glycol Glycol pressure drop
Δ_p NH_3 Ammonia pressure drop
Wo Operating weight

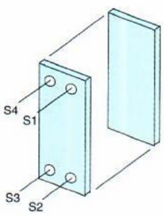
V H_2O Water volume
V NH_3 Ammonia volume

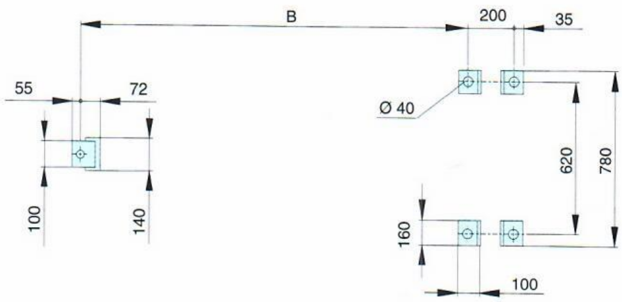
EVAPORATOR M20-MW FGR

N° of cassets			30	40	50	60	70	80
Nominal data	Qn	kW	590	790	1000	1180	1350	1500
Ethylene Glycol = 30% Ti = -2°C To = -6°C	Wn	m^3/h	144,4	193,4	244,8	288,9	330,5	367,5
Refrigerant = NH_3 Te = -10°C	Δp glycol	bar	0,48	0,48	0,50	0,49	0,49	0,47
	Δp NH_3	kPa	4,7	4,8	4,9	4,9	5,0	5,0









N° of cassets			< 27	< 52	< 101	< 150	< 199	< 248
DIMENSIONS	A	mm	248	478	929	1380	1831	2282
	Lc	mm	900	1200	1800	2400	3000	3600
	Lt	mm	750	1050	1650	2250	2850	3450
	H	mm	1200	1500	2100	2700	3300	3900
	B	mm	905	1205	1805	2405	3005	3605
	Connection	mm	DN 200	DN 200	DN 200	DN 200	DN 200	DN 200
DATA	V_{H_2O}	dm^3	97	184	368	552	736	920
	V_{NH_3}	dm^3	101	188	376	568	752	944
	W	Kg	2086	2627	3415	4304	5294	6207

S_1 Outlet water
S_2 Inlet water
S_3 Inlet refrigerant
S_4 Outlet refrigerant

Ti Glycol inlet temperature
Tu Glycol outlet temperature
Te Evaporation temperature
Qn Nominal capacity

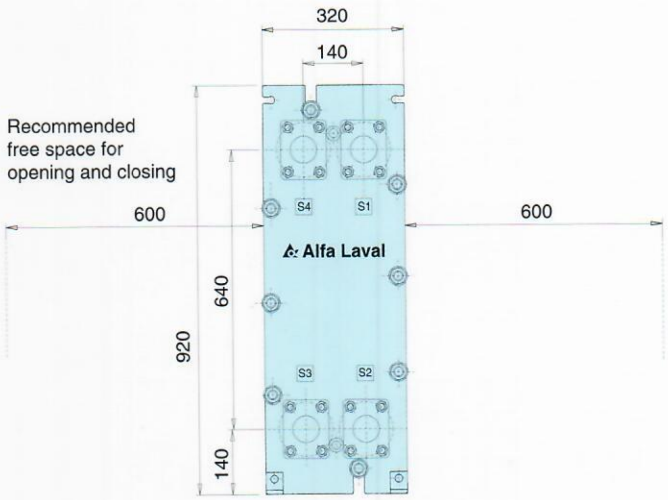
Wn Glycol nominal flow
Δ_p glycol Glycol pressure drop
Δ_p NH_3 Ammonia pressure drop
Wo Operating weight

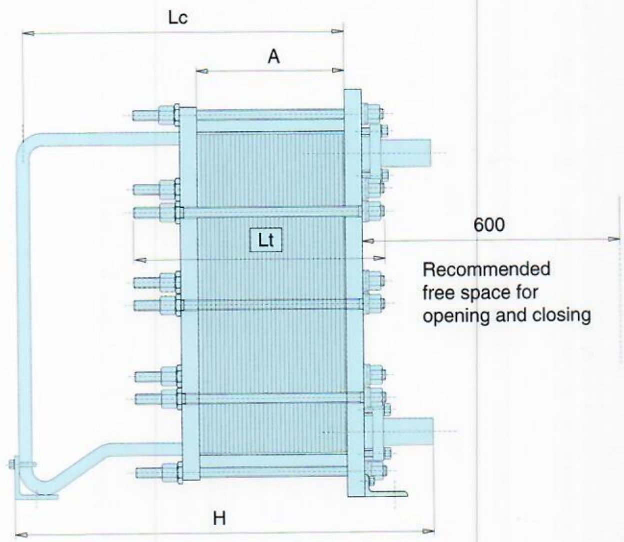
V H_20 Water volume
V NH_3 Ammonia volume

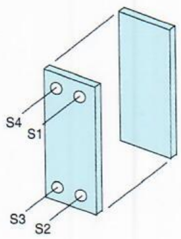
CONDENSER M6 - MW FDR

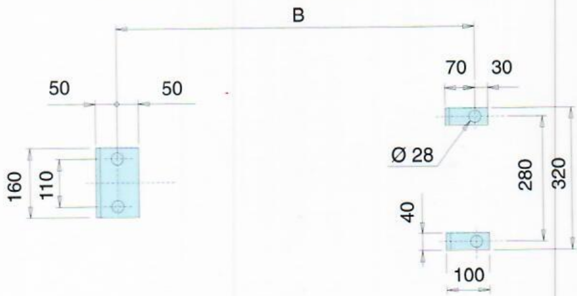
N° of cassets			20	30	40	50	60
Cooling tower	Qn	kW	110	170	230	270	290
Ti = 29,5°C	Wn	m³/h	17,2	26,6	36,0	40,1	40,9
Tc = 38,5°C	$\Delta p\ H_2O$	bar	0,43	0,47	0,53	0,47	0,39

City water	Qn	kW	105	160	210	270	300
Ti = 15°C	Wn	m³/h	13,9	21,1	27,7	35,7	39,6
Tc = 25°C	$\Delta p\ H_2O$	bar	0,29	0,31	0,32	0,38	0,37









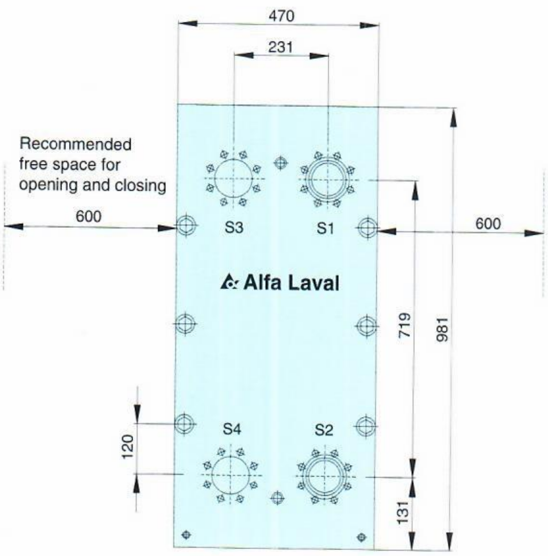
N° of cassets			< 18	< 26	< 54	< 70	< 92	< 125
DIMENSIONS	A	mm	122	177	367	476	626	850
	Lc	mm	350	550	750	750	950	1400
	Lt	mm	260	335	585	725	935	1300
	H	mm	610	810	1010	1010	1210	1775
	B	mm	455	655	855	855	1055	1595
	Connection	mm	OD 62	OD 62	OD 62	OD 62	OD 62	OD 62
DATA	V_{H_2O}	dm³	6,6	9,6	21,6	27,6	36,8	40,8
	V_{NH_3}	dm³	7	10	22	29	39	42
	W	Kg	200	214	265	293	333	392

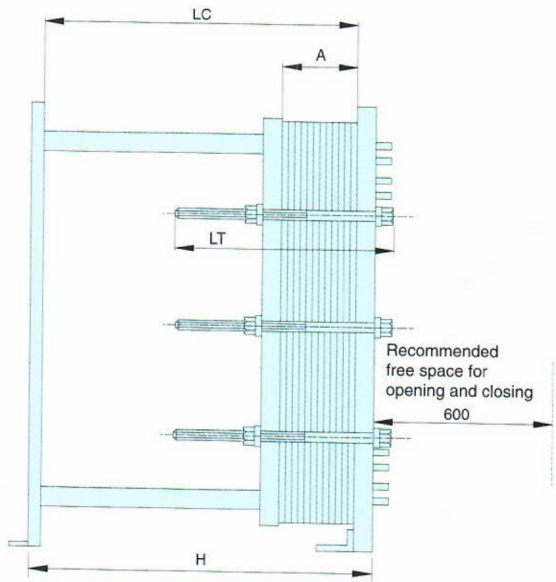
- **S_1** Outlet water
- **S_2** Inlet water
- **S_3** Outlet refrigerant
- **S_4** Inlet refrigerant
- **Ti** Water inlet temperature
- **Tc** Condensing temperature
- **Qn** Nominal capacity
- **Wn** Water nominal flow
- **$\Delta_p\ H_2O$** Water pressure drop
- **W** Weight
- **$V\ H_2O$** Water volume
- **$V\ NH_3$** Ammonia volume

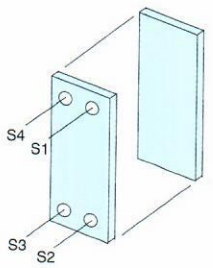
CONDENSER M10-BW FDR

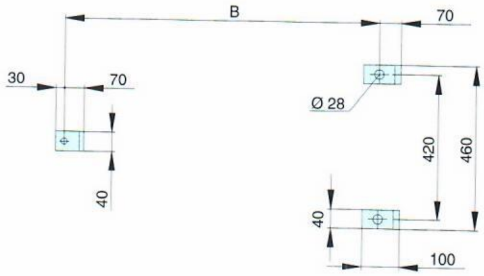
N° of cassets			20	30	40	50	60	70	80	90
Cooling tower	Qn	kW	215	330	440	560	680	780	890	1010
Ti = 29,5°C	Wn	m³/h	33,7	51,7	68,9	87,7	106,5	122,1	139,3	158,1
Tc = 38,5°C	Δp H_2O	bar	0,80	0,83	0,83	0,86	0,91	0,91	0,93	0,99

City water	Qn	kW	220	340	460	570	690	810	920	1040
Ti = 15°C	Wn	m³/h	29,1	44,9	60,8	75,3	91,1	107,0	121,5	137,4
Tc = 25°C	Δp H_2O	bar	0,60	0,63	0,65	0,65	0,67	0,70	0,72	0,75









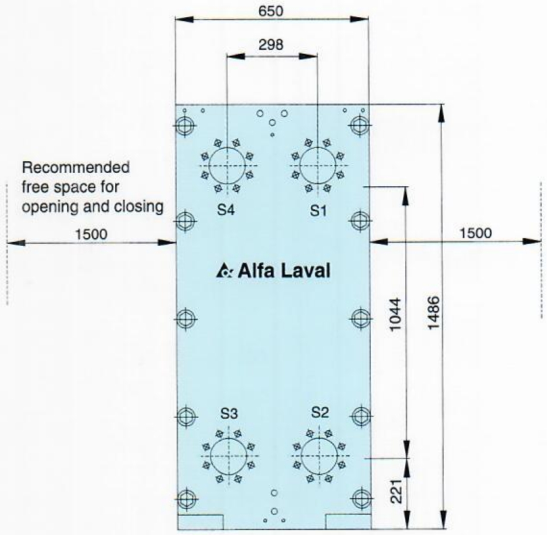
N° of cassets			< 16	< 29	< 64	< 102	< 152	< 219
DIMENSIONS	A	mm	96	174	384	612	912	1314
	Lc	mm	500	650	900	1250	1600	2100
	Lt	mm	450	450	750	1050	1650	1950
	H	mm	590	740	990	1340	1690	2190
	B	mm	505	655	905	1255	1605	2105
	Connection	mm	DN 100	DN 100	DN 100	DN 100	DN 100	DN 100
DATA	V_{H_2O}	dm³	9,0	18,3	42,5	63,9	88,1	126,5
	V_{NH_3}	dm³	9,6	18,9	43,1	64,8	88,6	127,1
	W	Kg	388	430	574	699	847	1126

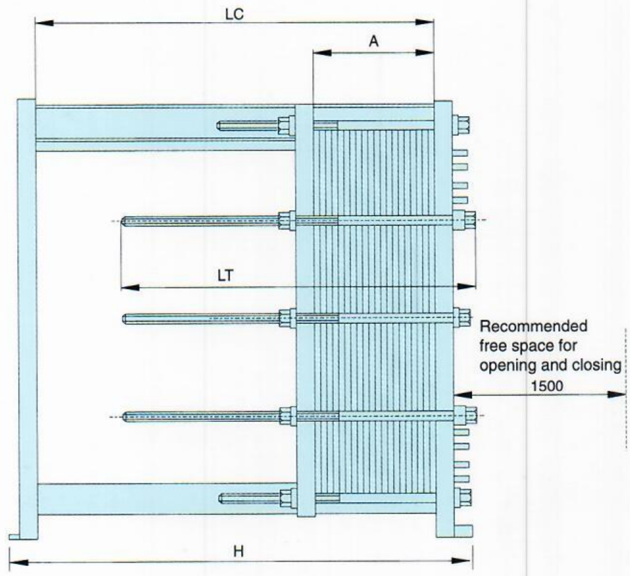
S_1 Outlet water
S_2 Inlet water
S_3 Outlet refrigerant
S_4 Inlet refrigerant
Ti Water inlet temperature
Tc Condensing temperature
Qn Nominal capacity
Wn Water nominal flow
$\Delta_p H_2O$ Water pressure drop
W Weight
V H_2O Water volume
V NH_3 Ammonia volume

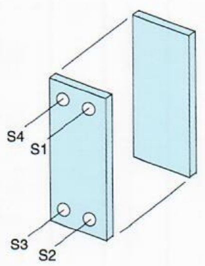
CONDENSER MK15-BW FDR

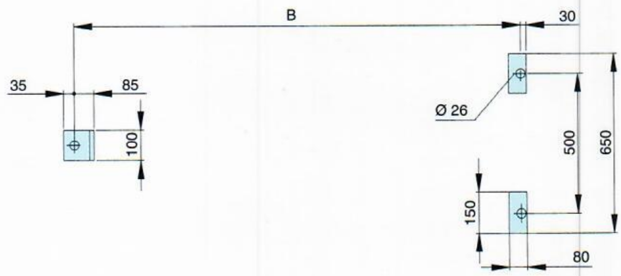
N° of cassets			20	30	40	50	60	70	80	90
Cooling tower	Qn	kW	390	600	810	1020	1230	1440	1650	1850
Ti = 29,5°C	Wn	m^3/h	56,0	86,1	116,3	146,4	176,5	206,7	236,8	265,5
Tc = 38,5°C	$\Delta p\ H_2O$	bar	0,78	0,80	0,82	0,84	0,86	0,89	0,92	0,94

City water	Qn	kW	400	620	830	1050	1260	1480	1690	1910
Ti = 15°C	Wn	m^3/h	49,1	76,1	101,8	128,8	154,5	181,5	207,3	234,3
Tc = 25°C	$\Delta p\ H_2O$	bar	0,62	0,65	0,65	0,67	0,68	0,71	0,72	0,75









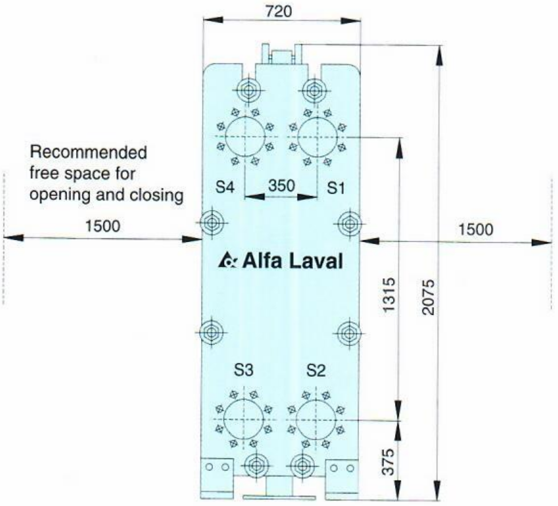
N° of cassets			< 37	< 66	< 94	< 121	< 179	< 215
DIMENSIONS	A	mm	229	409	583	750	1100	1333
	Lc	mm	900	1200	1500	1800	2400	2800
	Lt	mm	750	1050	1350	1650	2250	2850
	H	mm	1200	1500	1800	2100	2700	3100
	B	mm	1095	1395	1695	1995	2595	2995
	Connection	mm	DN 150	DN 150	DN 150	DN 150	DN 150	DN 150
DATA	V_{H_2O}	dm^3	45,1	86,5	116,1	161,2	247,2	277,1
	V_{NH_3}	dm^3	46,2	87,7	116,3	163,5	250,1	280,2
	W	Kg	1521	1809	2017	2248	2744	2998

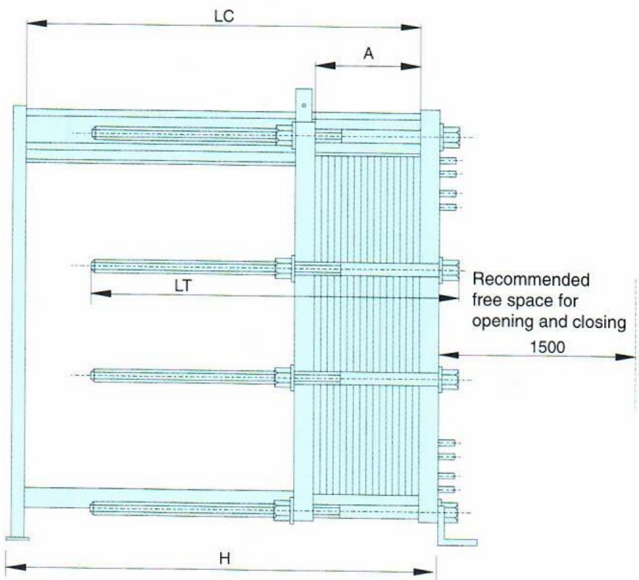
S_1 Outlet water
S_2 Inlet water
S_3 Outlet refrigerant
S_4 Inlet refrigerant
Ti Water inlet temperature
Tc Condensing temperature
Qn Nominal capacity
Wn Water nominal flow
$\Delta_p\ H_2O$ Water pressure drop
W Weight
$V\ H_2O$ Water volume
$V\ NH_3$ Ammonia volume

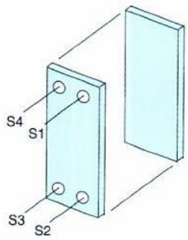
CONDENSER A15-BWFDR

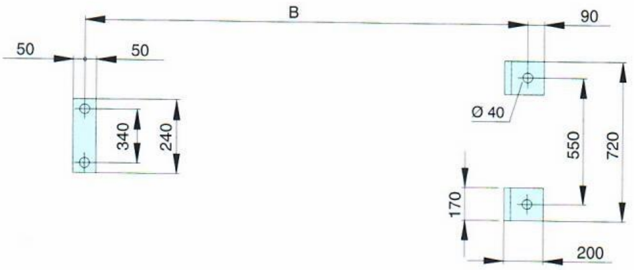
N° of cassets			20	30	40	50	60	70	80	90
Cooling tower	Qn	kW	560	850	1150	1450	1750	2050	2250	2400
Ti = 29,5°C	Wn	m³/h	87,7	133,1	180,1	227,0	274,0	321,0	339,9	344,5
Tc = 38,5°C	$\Delta p\ H_2O$	bar	0,68	0,69	0,71	0,74	0,77	0,81	0,74	0,64

City water	Qn	kW	570	860	1170	1470	1770	2080	2350	2500
Ti = 15°C	Wn	m³/h	75,3	113,6	154,5	194,2	233,8	274,4	310,4	330,2
Tc = 25°C	$\Delta p\ H_2O$	bar	0,53	0,53	0,55	0,57	0,59	0,62	0,64	0,61









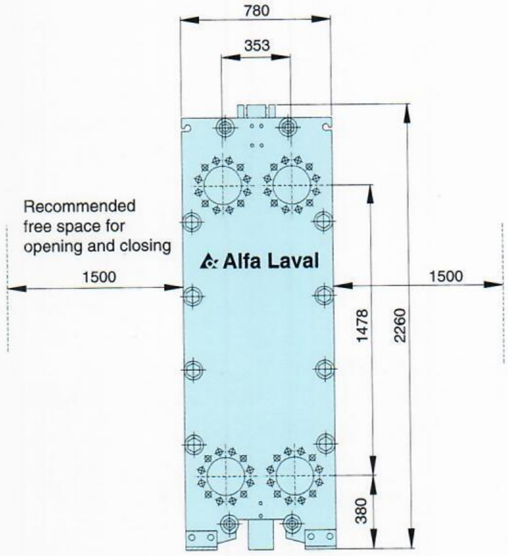
N° of cassets			< 38	< 65	< 118	< 171	< 224	< 250
DIMENSIONS	A	mm	228	390	708	1026	1644	1500
	Lc	mm	900	1200	1800	2400	3000	3300
	Lt	mm	750	1050	1650	2250	2850	3150
	H	mm	1035	1335	1935	2535	3135	3435
	B	mm	1095	1395	1995	2595	3195	3495
	Connection	mm	DN 150	DN 150	DN 150	DN 150	DN 150	DN 150
DATA	V_{H_2O}	dm³	34	110	206	252	342	374
	V_{NH_3}	dm³	38	114	210	258	346	380
	W	Kg	2009	2560	3230	4080	4480	4810

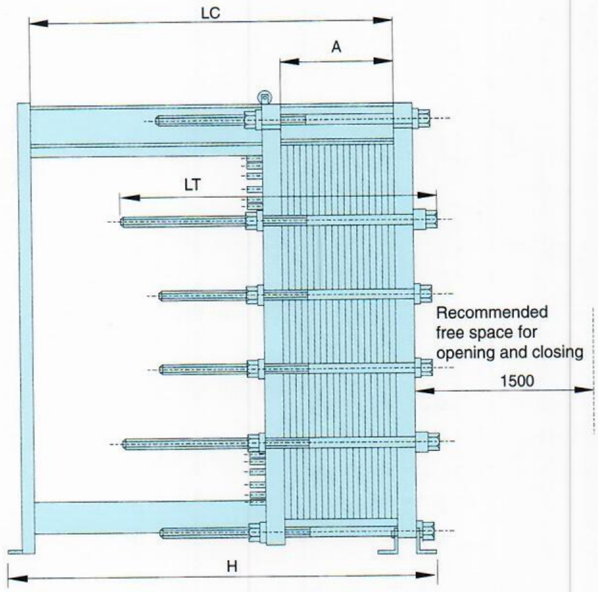
S_1 Outlet water
S_2 Inlet water
S_3 Outlet refrigerant
S_4 *Inlet refrigerant*
Ti Water inlet temperature
Tc Condensing temperature
Qn Nominal capacity
Wn Water nominal flow
$\Delta_p\ H_20$ Water pressure drop
W Weight
$V\ H_20$ Water volume
$V\ NH_3$ Ammonia volume

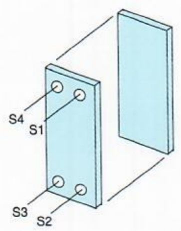
CONDENSER M20-MW FDR

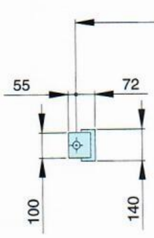
N° of cassets			20	30	40	50	60	70	80	90
Cooling tower	Qn	kW	840	1230	1620	2010	2400	2790	3180	3570
Ti = 29,5°C	Wn	m³/h	114,8	235,4	310,0	384,6	459,2	533,9	608,5	683,1
Tc = 38,5°C	Δp H_2O	bar	0,74	0,78	0,77	0,79	0,79	0,80	0,79	0,78

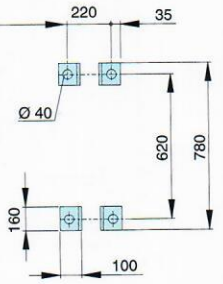
City water	Qn	kW	850	1240	1640	2030	2420	2820	3210	3600
Ti = 15°C	Wn	m³/h	121,6	177,4	234,6	290,4	346,2	403,5	459,3	515,1
Tc = 25°C	Δp H_2O	bar	0,40	0,42	0,45	0,47	0,48	0,51	0,55	0,57











N° of cassets			< 27	< 52	< 101	< 150	< 199	< 248
DIMENSIONS	A	mm	254	489	949	1410	1871	2331
	Lc	mm	900	1200	1800	2400	3000	3600
	Lt	mm	750	1050	1650	2250	2850	3450
	H	mm	1200	1500	2100	2700	3300	3900
	B	mm	905	1205	1805	2405	3005	3605
	Connection	mm	DN 200	DN 200	DN 200	DN 200	DN 200	DN 200
DATA	V_{H_2O}	dm³	97	184	368	552	736	920
	V_{NH_3}	dm³	101	188	378	568	752	944
	W	Kg	2667	3072	4086	5093	6100	7232

S_1 Outlet water
S_2 Inlet water
S_3 Outlet refrigerant
S_4 Inlet refrigerant
Ti Water inlet temperature
Tc Condensing temperature
Qn Nominal capacity
Wn Water nominal flow
$\Delta_p H_2O$ Water pressure drop
W Weight
V H_2O Water volume
V NH_3 Ammonia volume

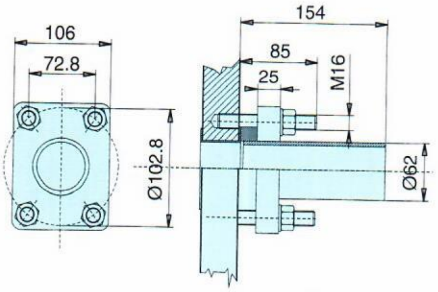


Fig. 1 Connections S1, S2, S3 and S4 for M6-MW. Design pressure 16/25 bar

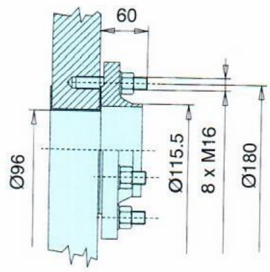


Fig. 2 Connections S1, S2, S3 and S4 for M10-MW. Design pressure 16 bar

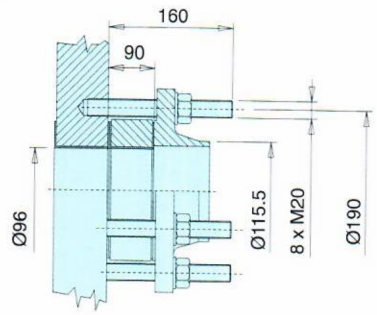


Fig. 3 Connections S1, S2 for M10-BW. Design pressure 25 bar

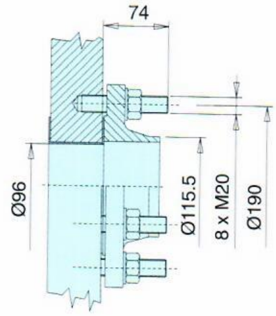


Fig. 4 Connections S3 and S4 for M10-BW. Design pressure 25 bar

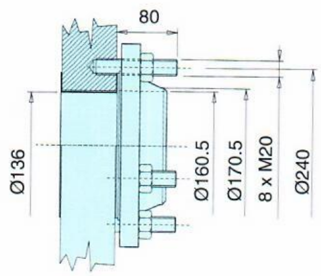


Fig. 5 Connections S1, S2, S3 and S4 for MK15-BW and A15-BW. Design pressure 16 bar

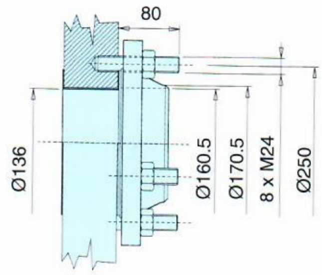


Fig. 6 Connections S1, S2, S3 and S4 for MK15-BW and A15-BW. Design pressure 25 bar

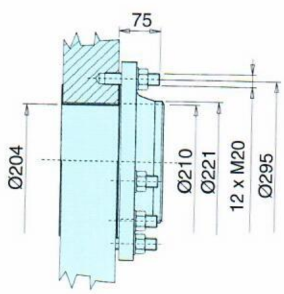


Fig. 7 Connections S1, S2, S3 and S4 for M20-MW. Design pressure 16 bar

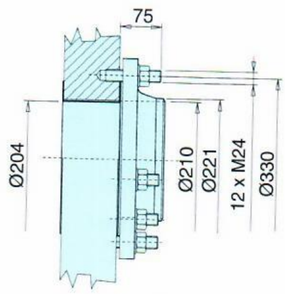


Fig. 8 Connections S1, S2, S3 and S4 for M20-MW. Design pressure 25 bar

Alfa Laval SWPHE will be delivered with counter flanges on all connections.