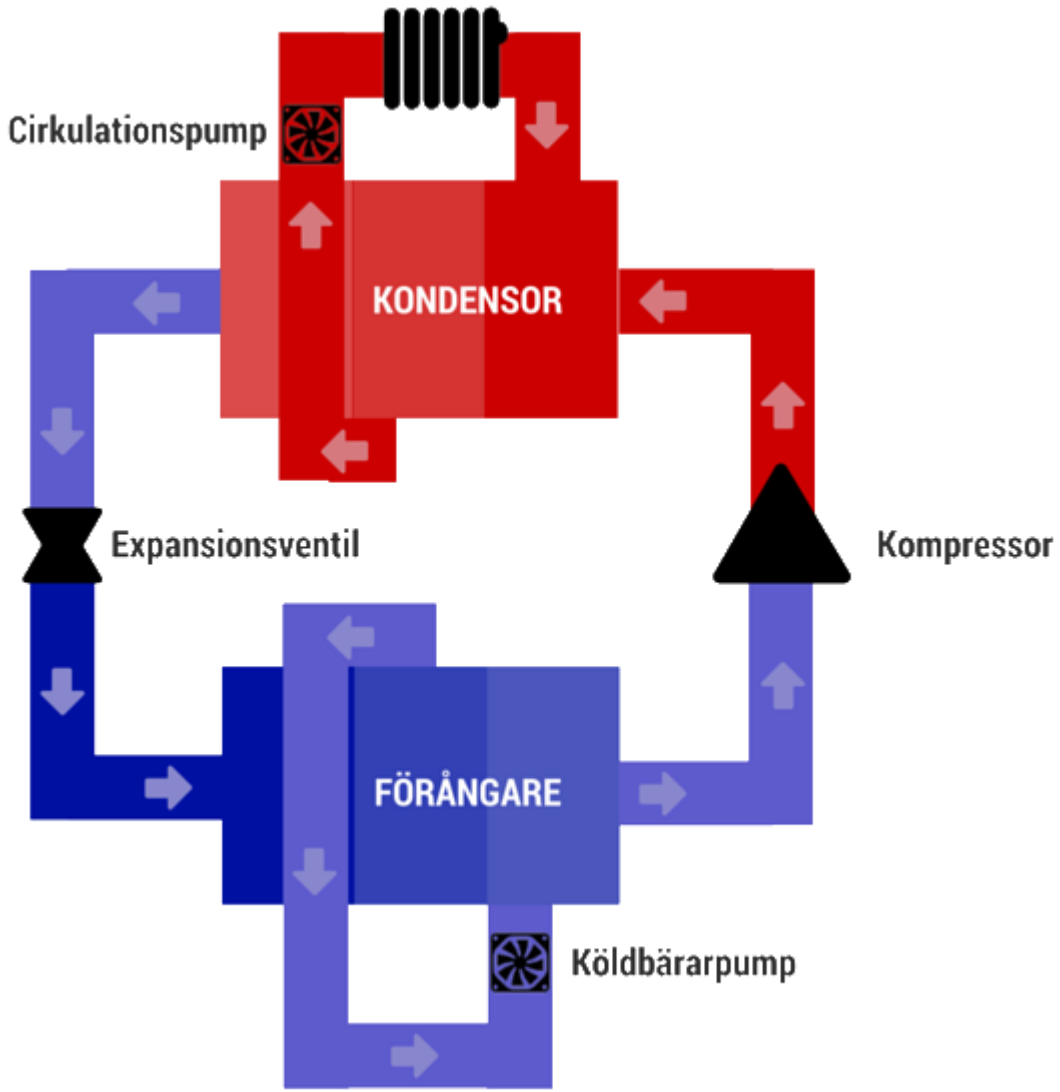
NFKK

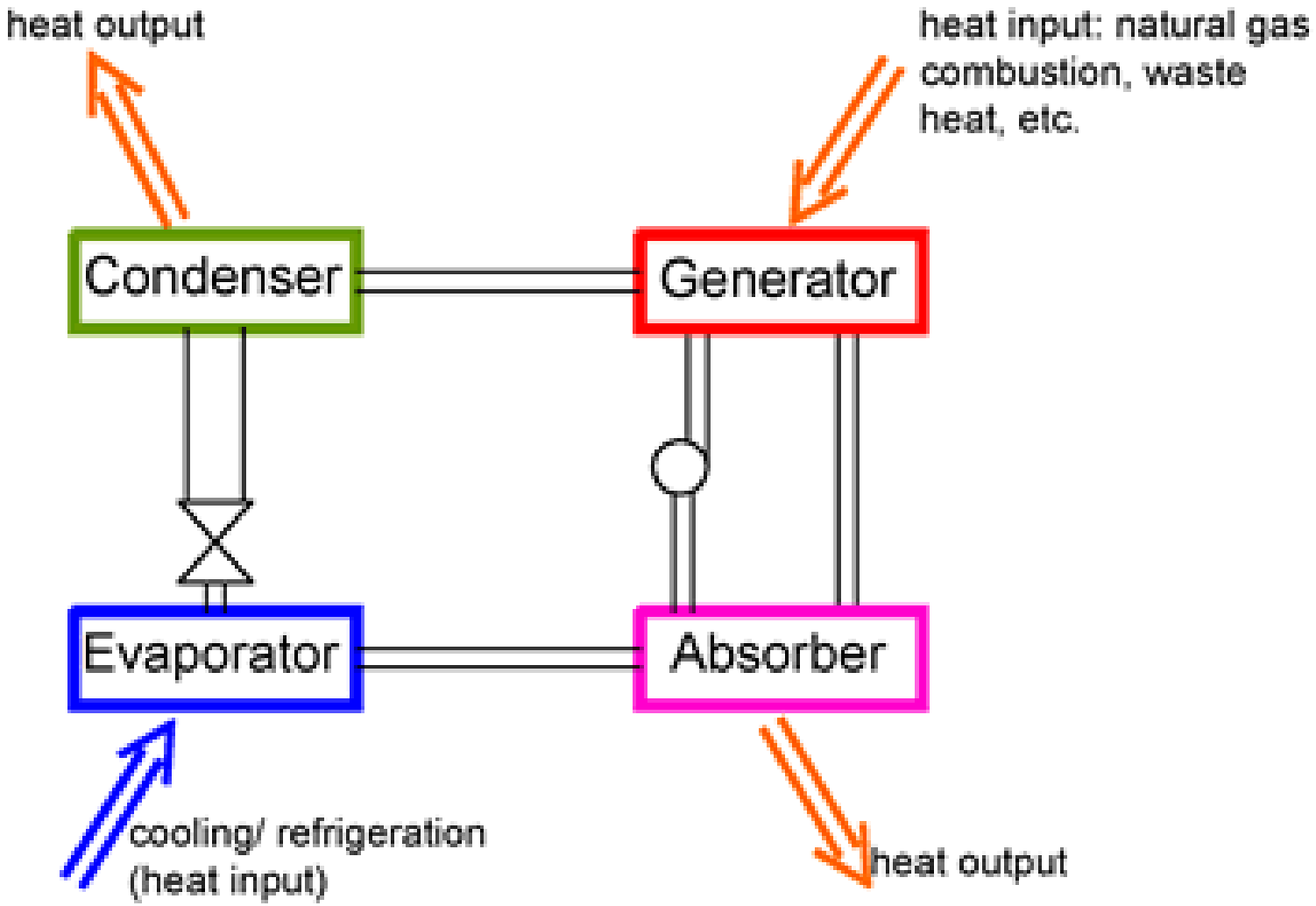
Energiseminarium, STOCKHOLM den 8-9 november 2018

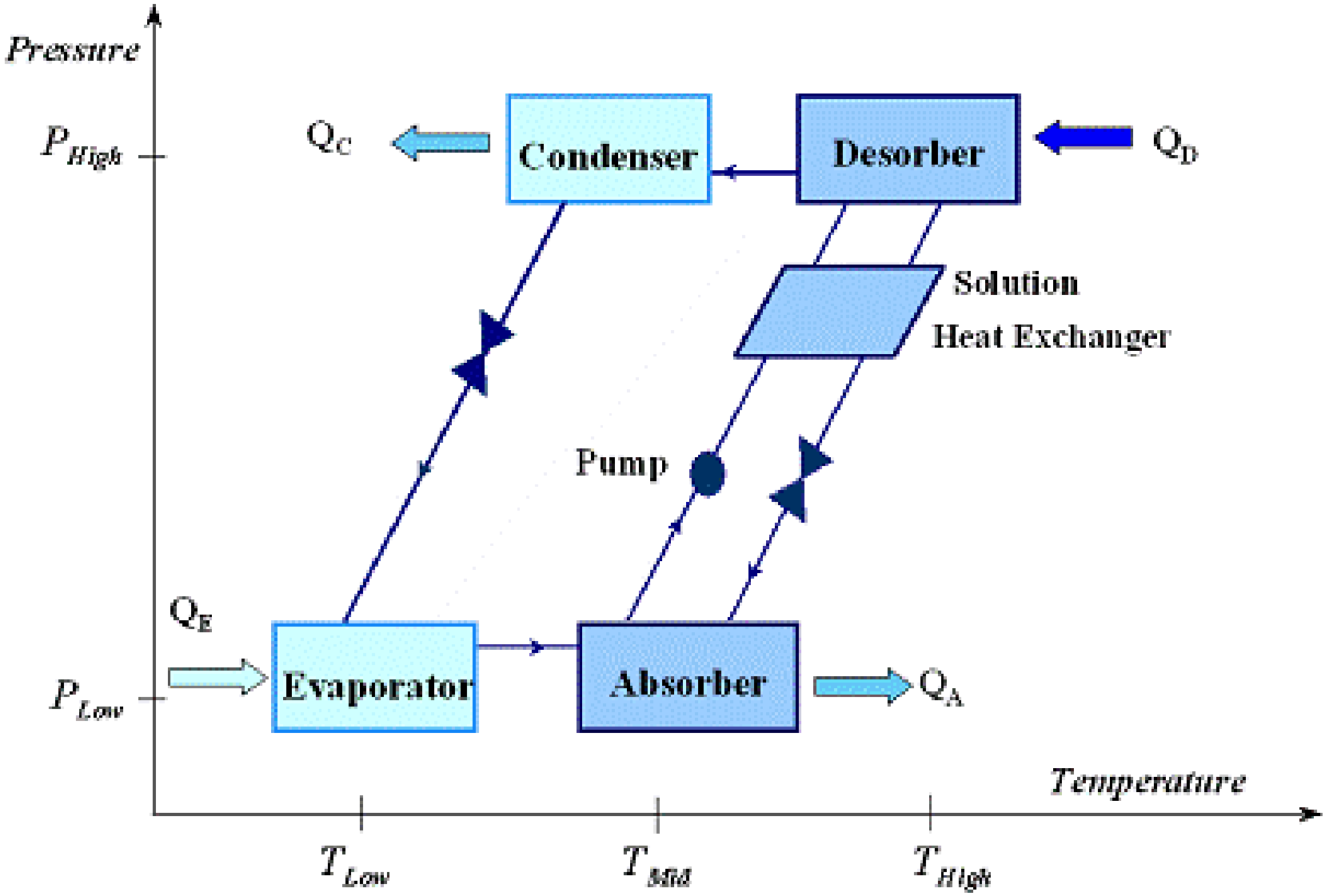
VÄRMEDRIVNA KYLMASKINER, ABSORPTIONSMASKINER

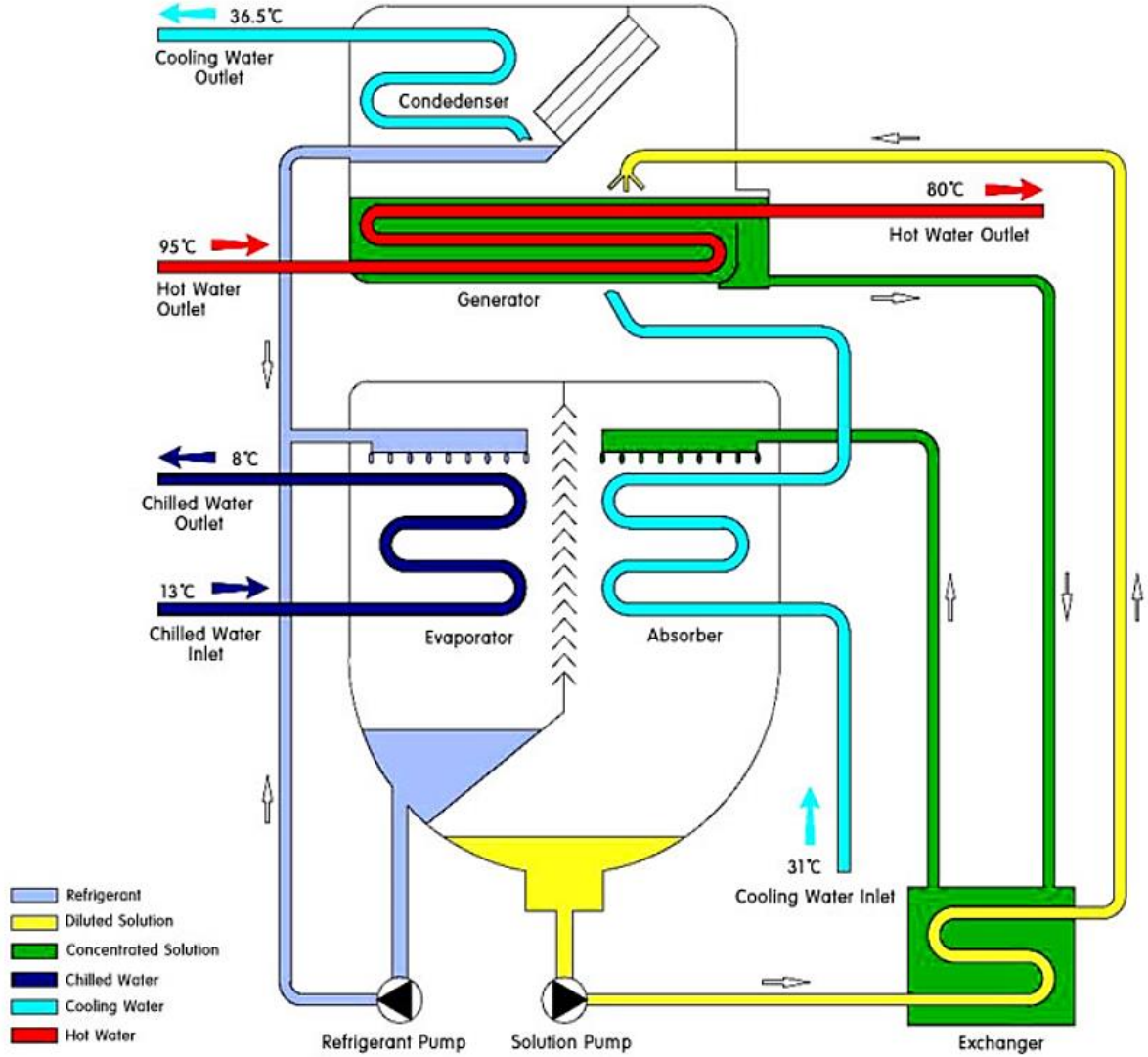
Bo Edberg

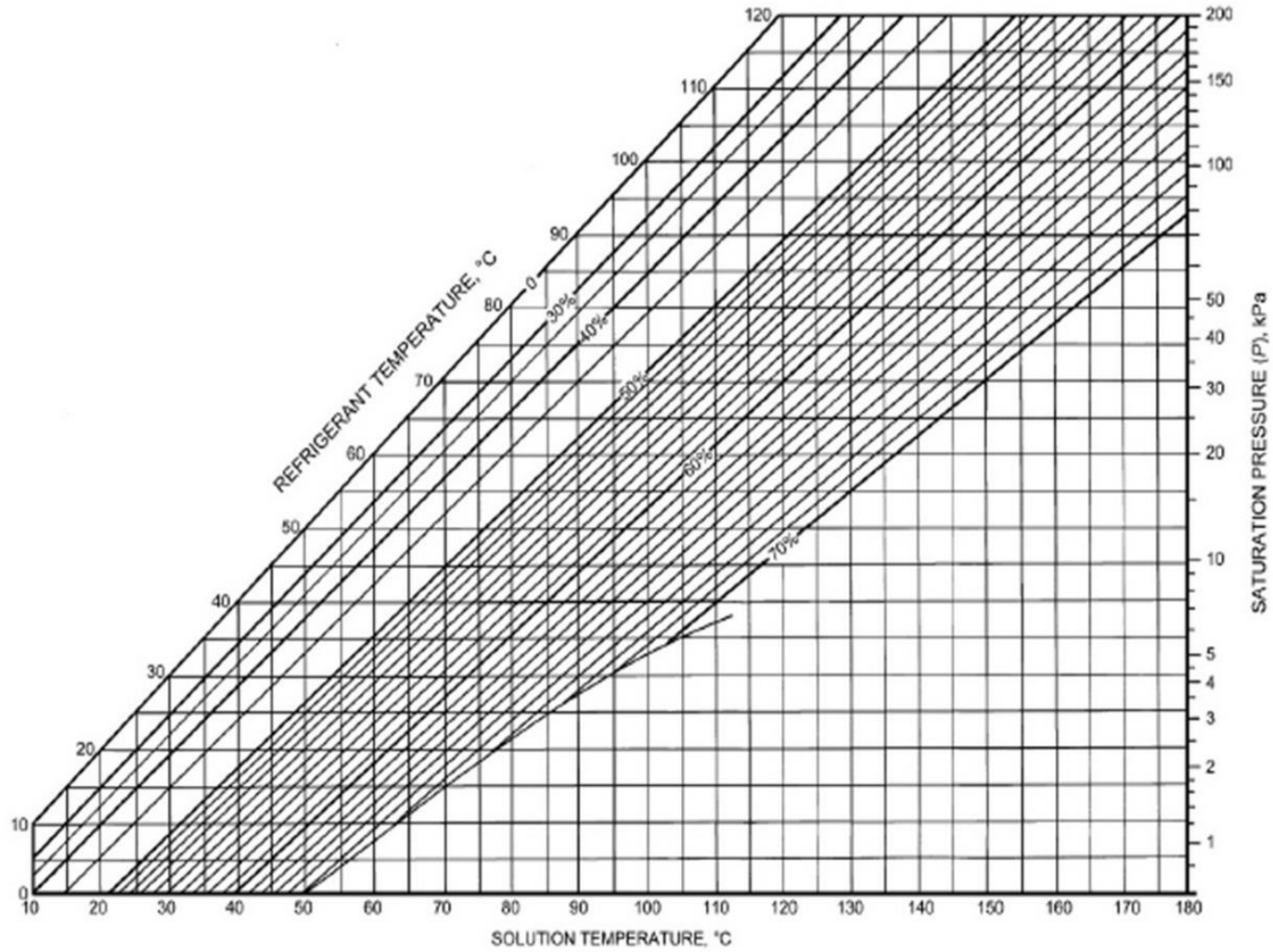
ENERGIPROJEKT AB

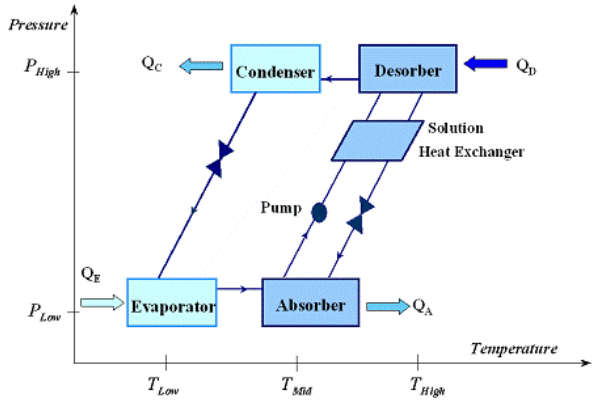

Cirkulationspump
KONDENSOR
Expansionsventil
Kompressor
FÖRÅNGARE
Köldbärarpump


heat output
heat input: natural gas combustion, waste heat, etc.
Condenser
Generator
Evaporator
Absorber
cooling/ refrigeration (heat input)
heat output


Pressure
P_{High}
Q_C
Condenser
Desorber
Q_D
Solution
Heat Exchanger
Pump
Q_E
P_{Low}
Evaporator
Absorber
Q_A
Temperature
T_{Low}
T_{Mid}
T_{High}


36.5℃
Cooling Water Outlet
Condedenser
80℃
Hot Water Outlet
95℃
Hot Water Outlet
Generator
8℃
Chilled Water Outlet
13℃
Chilled Water Inlet
Evaporator
Absorber
31℃
Cooling Water Inlet
Refrigerant
Diluted Solution
Concentrated Solution
Chilled Water
Cooling Water
Hot Water
Refrigerant Pump
Solution Pump
Exchanger


REFRIGERANT TEMPERATURE, °C
SOLUTION TEMPERATURE, °C
SATURATION PRESSURE (P), kPa
30%
40%
50%
60%
70%


Pressure
P_{High}
P_{Low}
Q_C
Condenser
Desorber
Q_D
Solution
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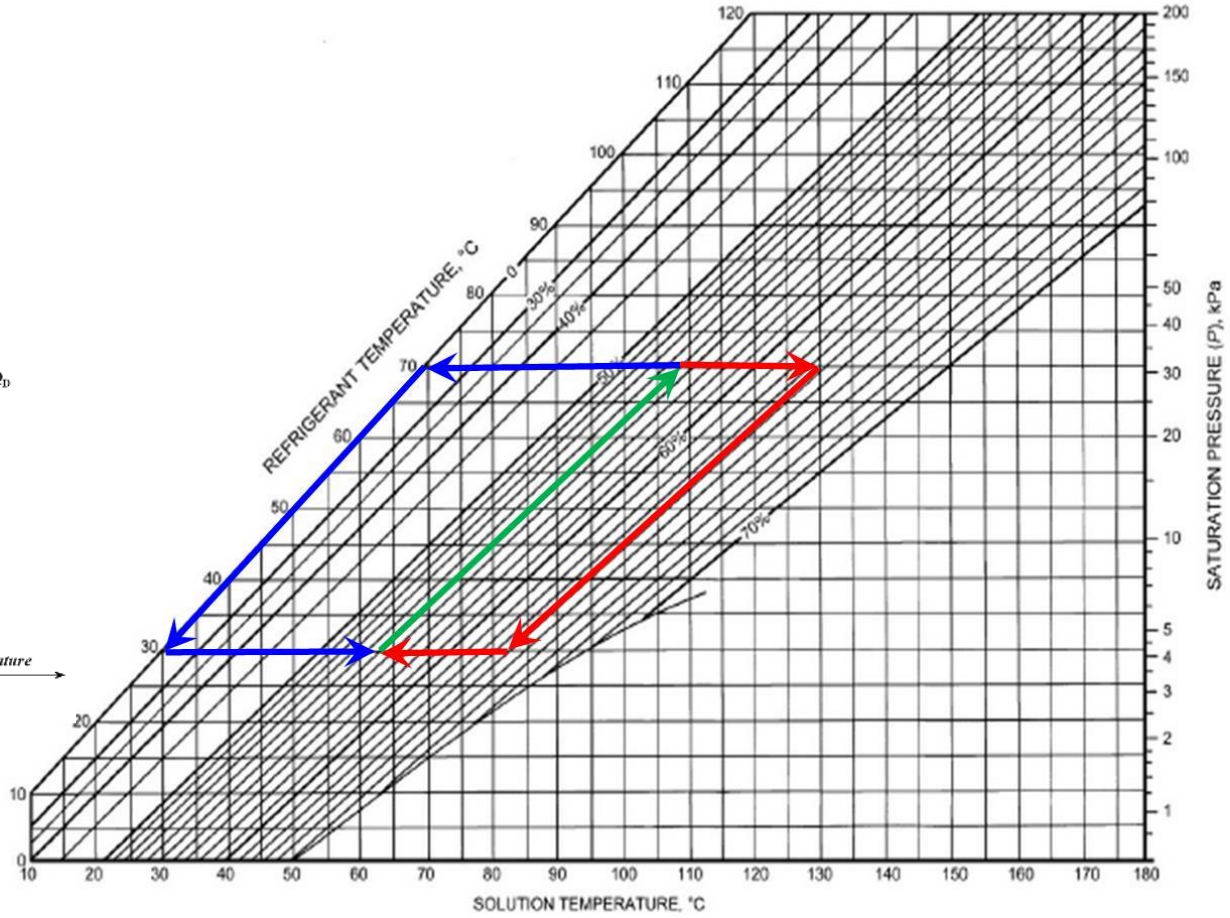
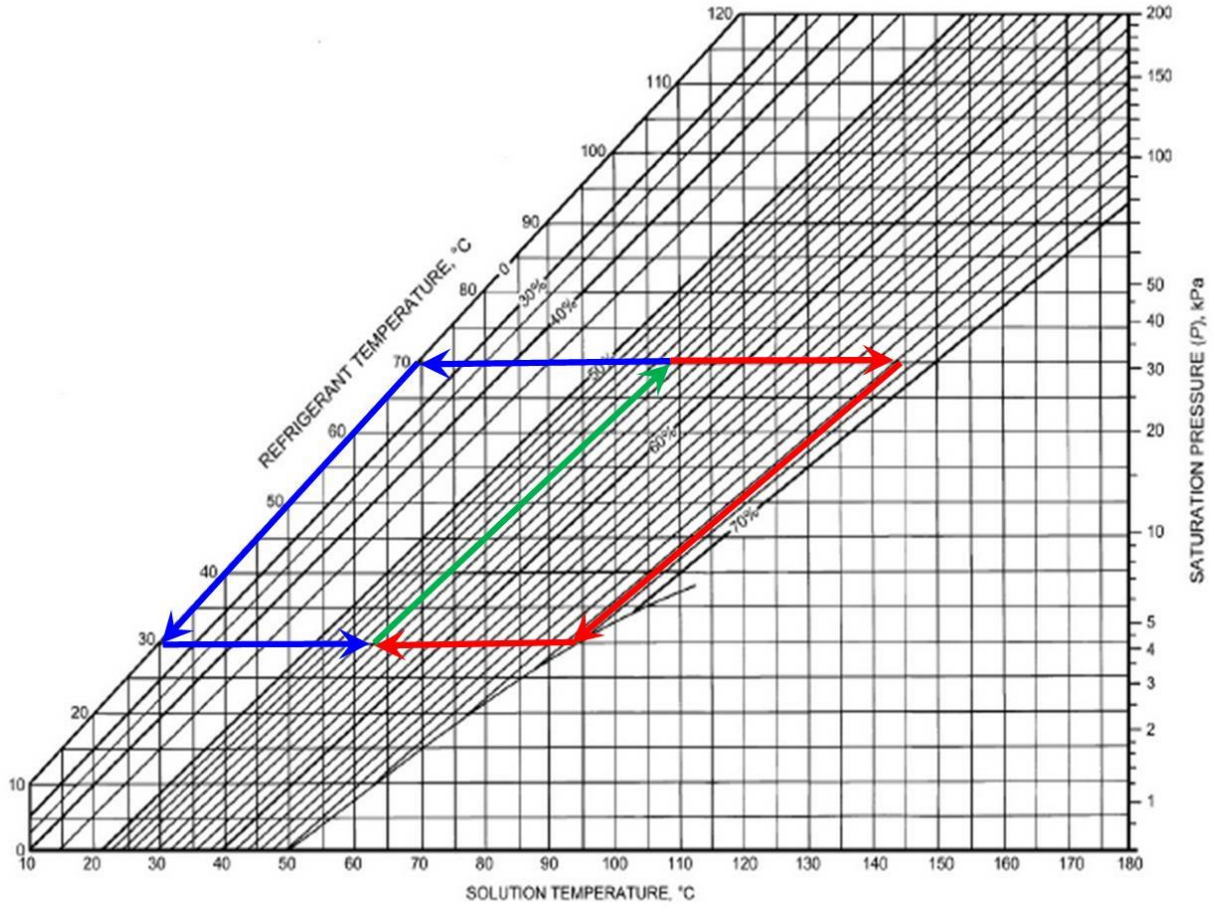
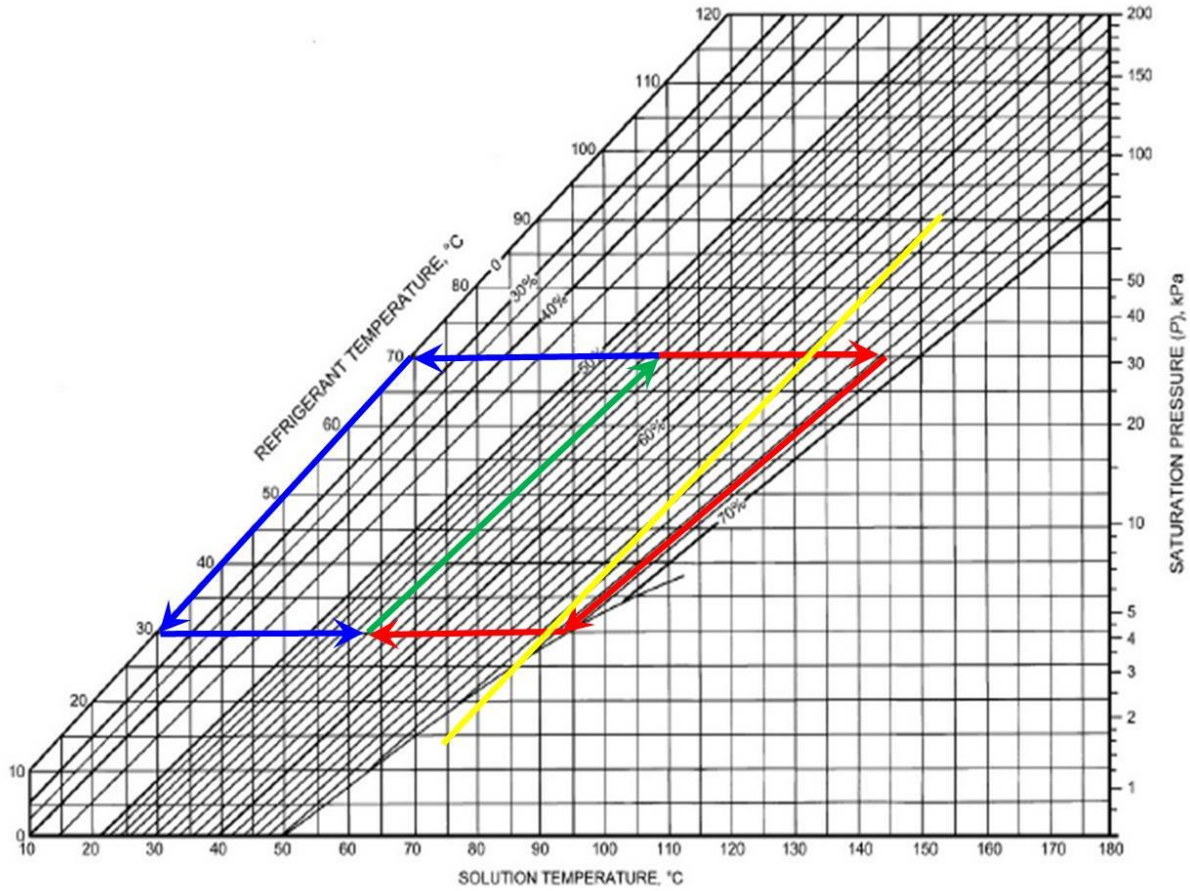
Evaporator
Absorber
Q_A
Temperature
T_{Low}
T_{Mid}
T_{High}


REFRIGERANT TEMPERATURE, °C
SOLUTION TEMPERATURE, °C
SATURATION PRESSURE (P), kPa
0%
30%
40%
50%
60%
70%


REFRIGERANT TEMPERATURE, °C
SATURATION PRESSURE (P), kPa
SOLUTION TEMPERATURE, °C
0
30%
40%
50%
60%
70%

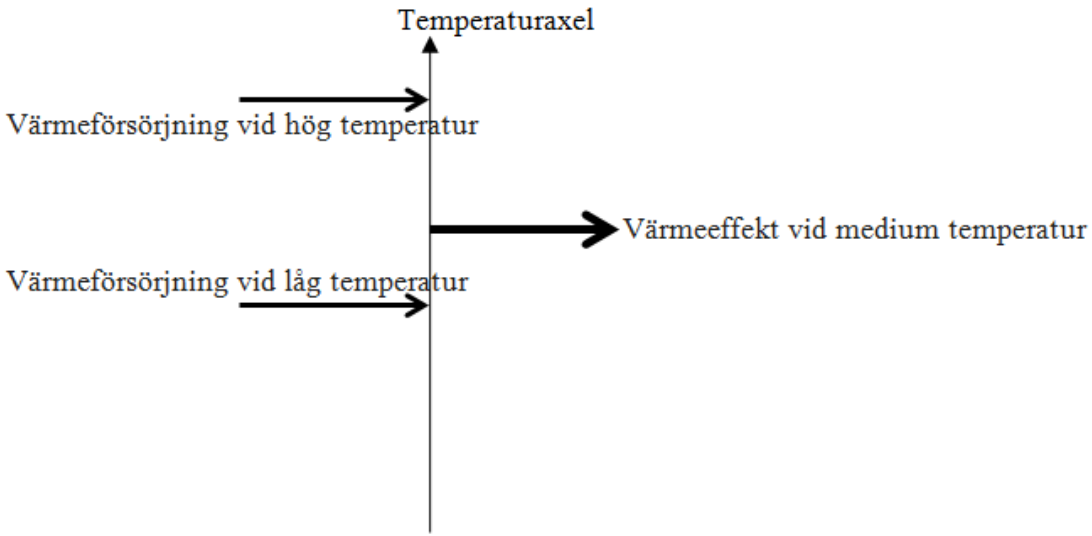

REFRIGERANT TEMPERATURE, °C
SOLUTION TEMPERATURE, °C
SATURATION PRESSURE (P), kPa
0%
30%
40%
50%
60%
70%

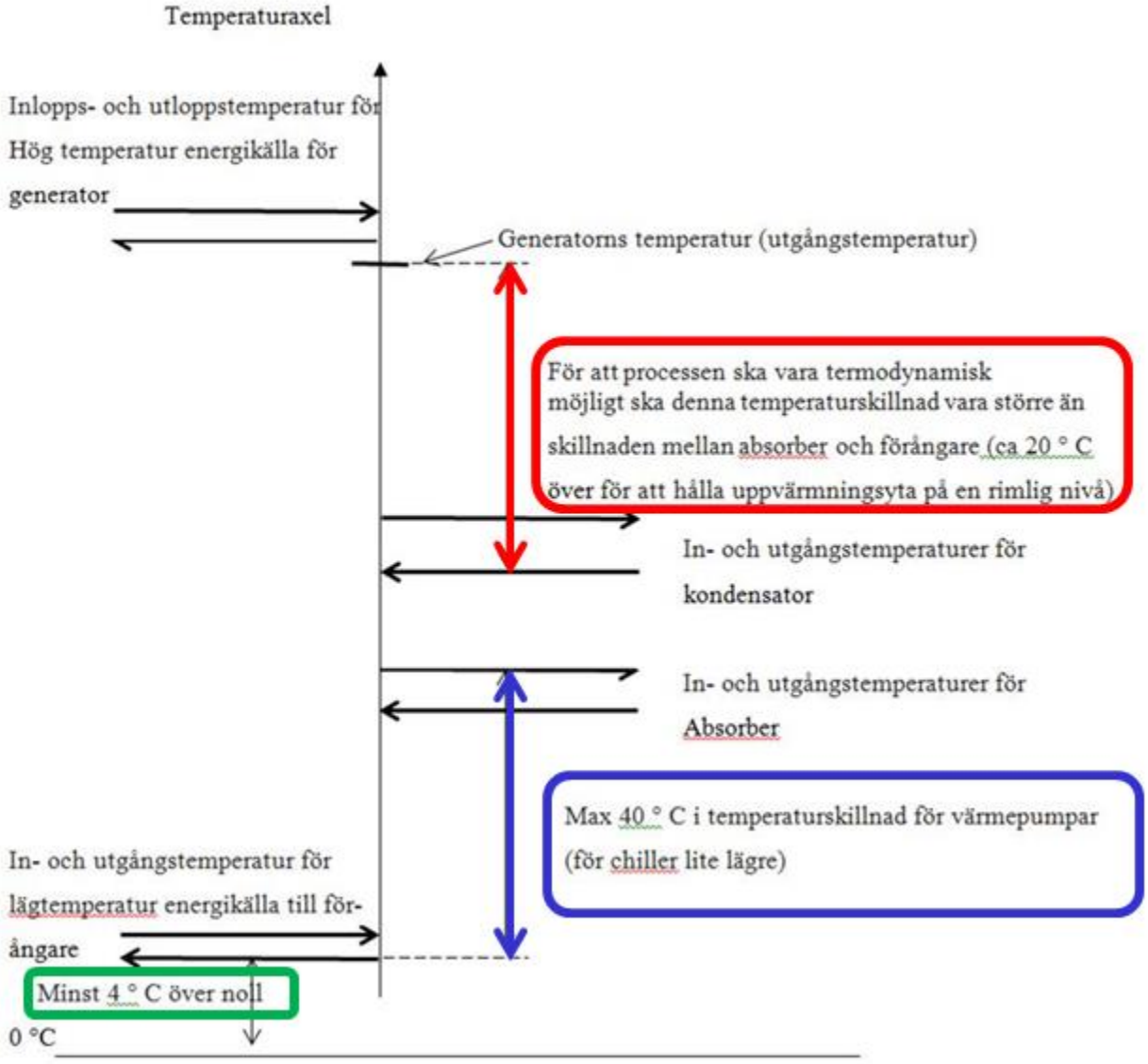
1. Beskrivning av driftsprincipen

1. Möjliga användningar av absorptionskylning

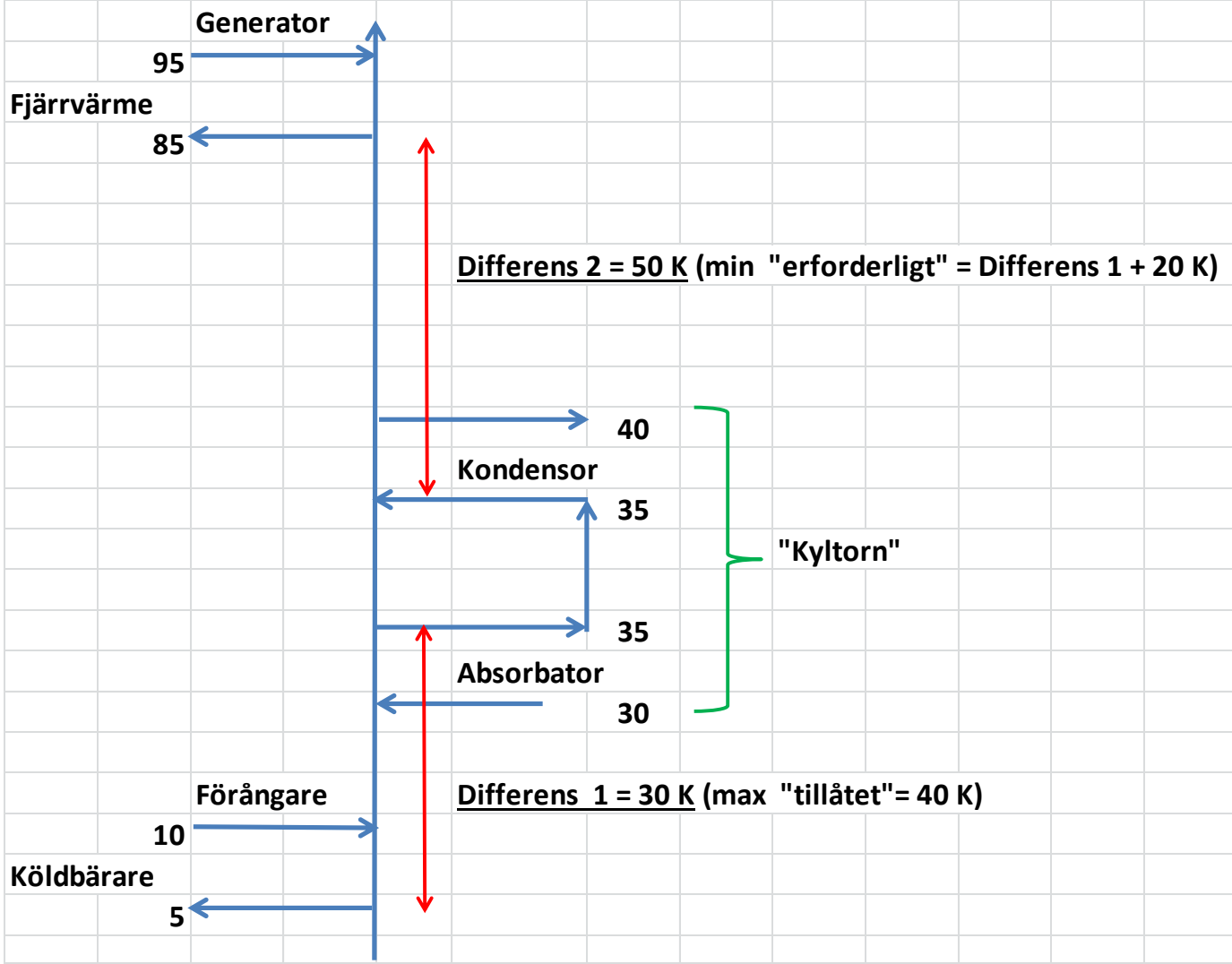
Absorptionskylskapacitet tar i grunden värme från två temperaturnivåer (en lågtemperaturenergikälla och en högtemperaturenergikälla) och levererar hela värmeledningen vid en mellanliggande temperatur. För att processen ska vara möjlig måste denna mellanliggande temperatur vara närmast lågtemperaturenergikällan

Grafiskt presenterad kan det se ut som följer:

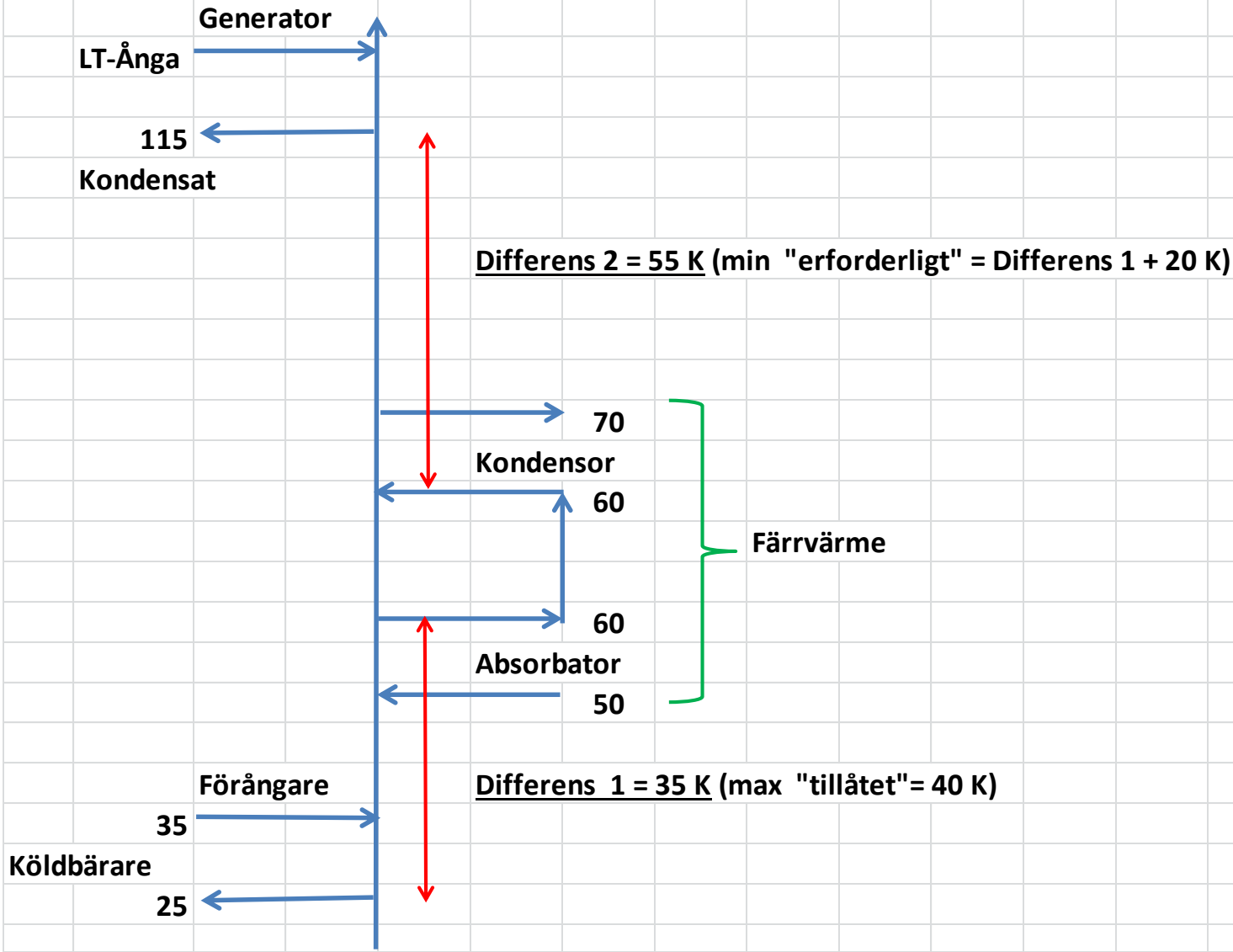



Temperaturaxel
Inlopps- och utloppstemperatur för
Hög temperatur energikälla för
generator
Generatorns temperatur (utgångstemperatur)
För att processen ska vara termodynamisk möjligt ska denna temperaturskillnad vara större än skillnaden mellan absorber och förångare (ca 20 ° C över för att hålla uppvärmningsyta på en rimlig nivå)
In- och utgångstemperaturer för
kondensator
In- och utgångstemperaturer för
Absorber
Max 40 ° C i temperaturskillnad för värmepumpar (för chiller lite lägre)
In- och utgångstemperatur för
lägtemperatur energikälla till för-
ångare
Minst 4 ° C över noll
0 °C

Exempel: färrvärmedriven maskin för komfortkyla



Exempel: Ångdriven maskin för rökgaskondensering



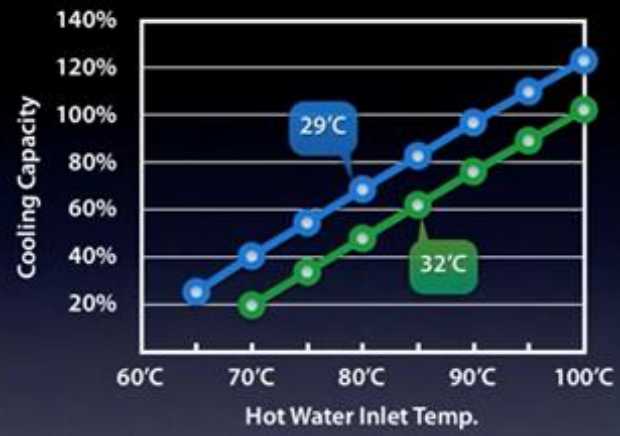
World Energy Absorption Chiller

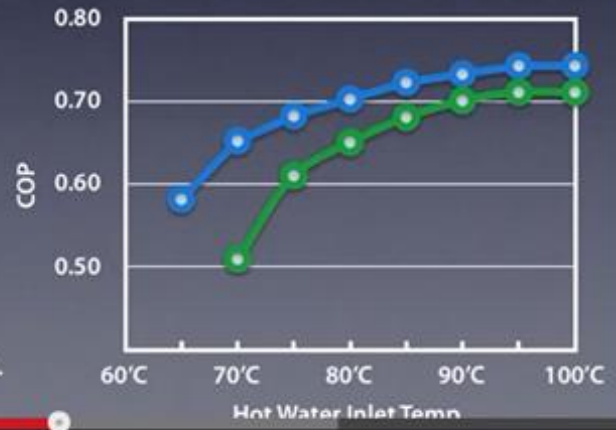
HWAR-L Series Performance

Hot Water Inlet Temp. vs. Cooling Capacity & COP

Cooling Water Outlet Temp.		29'C		32'C	
Hot W. Inlet Temp. ('C)	Hot W. Outlet Temp. ('C)	Cooling Capacity (%)	COP	Cooling Capacity (%)	COP
100	83.2	122%	0.73	102%	0.71
95	80.0	109%	0.73	89%	0.71
90	77.0	96%	0.72	76%	0.70
85	73.9	82%	0.72	62%	0.68
80	70.8	68%	0.70	48%	0.65
75	67.7	54%	0.68	34%	0.61
70	64.6	40%	0.65	20%	0.51
65	61.5	25%	0.58		

Condition
1. Chilled water outlet temp. is constant at 7'C.
2. Flow rate of chilled water, cooling water and hot water is constant.
3. ARI560.





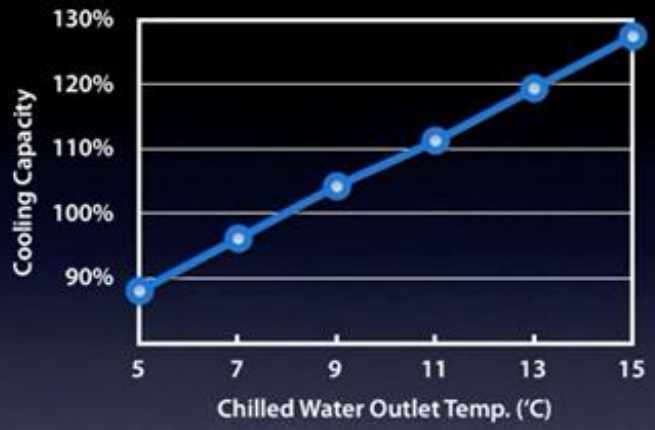
3:20 / 5:45

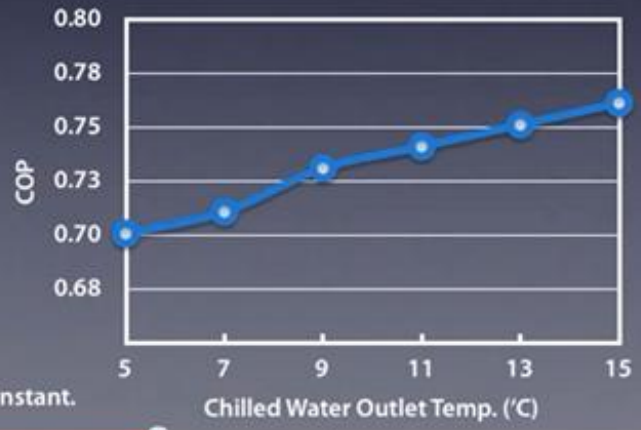
World Energy Absorption Chiller

HWAR-L Series Performance

Chilled Water Outlet Temp. vs. Cooling Capacity & COP

Chilled W. Outlet Temp. (°C)	Cooling Capacity (%)	COP
15	127%	0.76
14	123%	0.75
13	119%	0.75
12	115%	0.74
11	111%	0.74
10	108%	0.73
9	104%	0.73
8	100%	0.72
7	96%	0.71
6	92%	0.71
5	88%	0.70





Condition
1. Hot water Inlet temp. is constant at 95°C.
2. Cooling water inlet temp. is constant at 31°C.
3. Flow rate of chilled water, cooling water and hot water is constant.

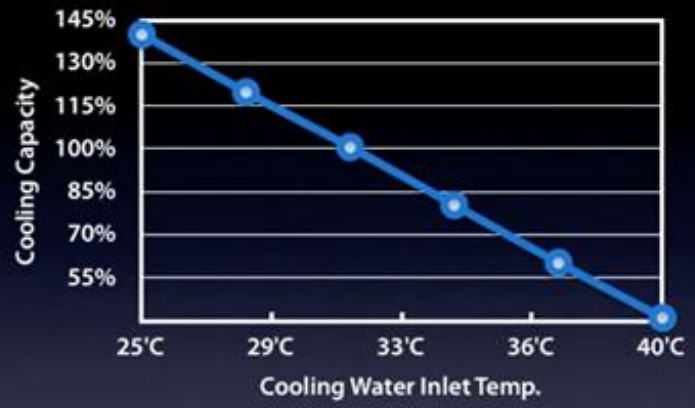
3:25 / 5:45

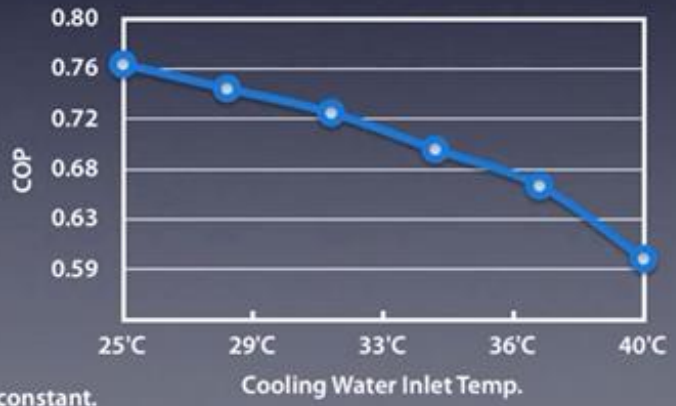
World Energy Absorption Chiller

HWAR-L Series Performance

Cooling Capacity vs. Cooling Water Inlet Temp.

Cooling W. Inlet Temp. (°C)	Cooling Capacity (%)	COP
40	41%	0.60
37	60%	0.66
34	80%	0.69
31	100%	0.72
28	119%	0.74
25	139%	0.76



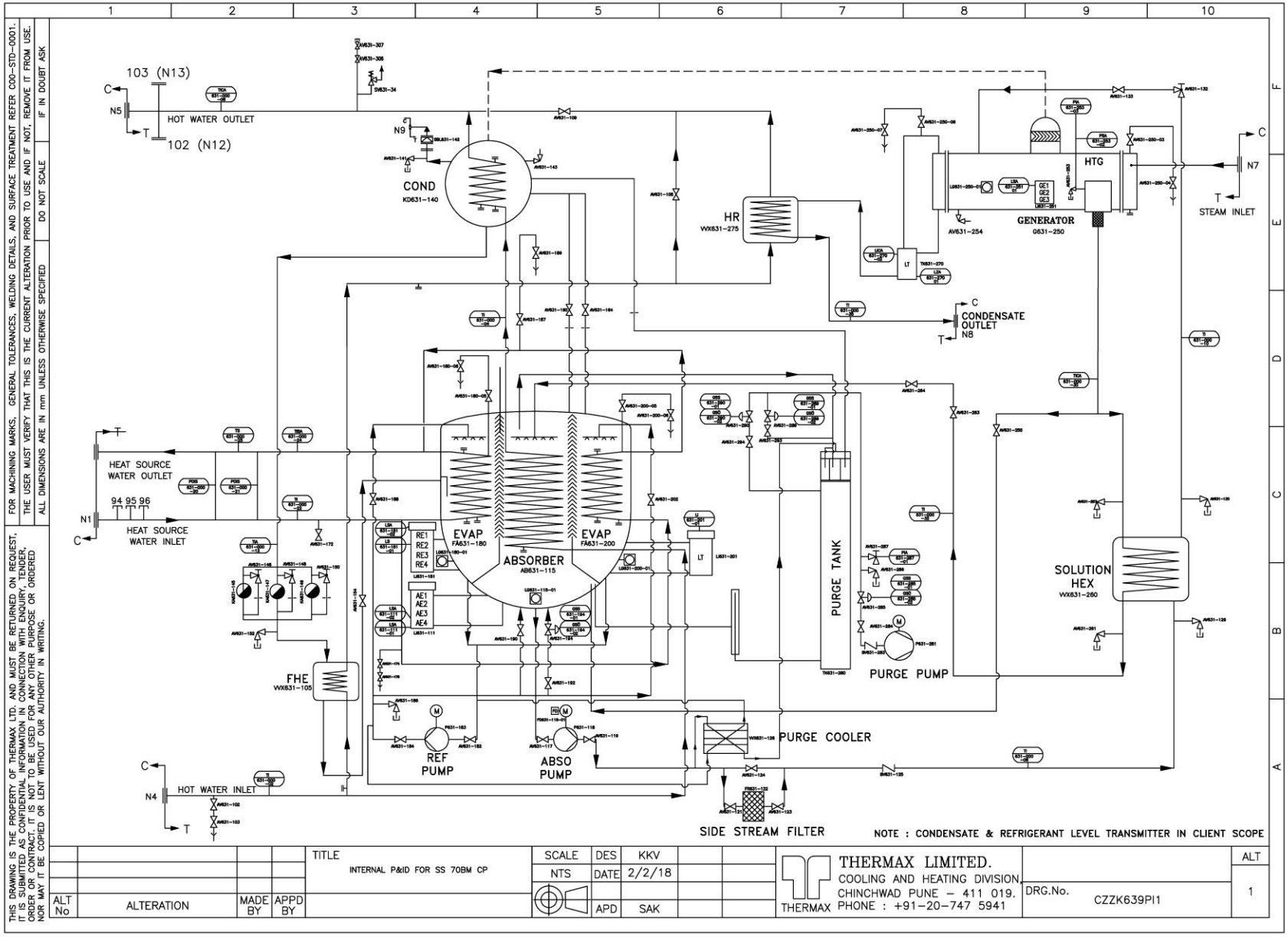


Condition

1. Hot water Inlet temp. is constant at 95°C.
2. Chilled water Outlet temp. is constant at 8°C.
3. Flow rate of chilled water, cooling water and hot water is constant.

3:30 / 5:45

ENERGIPROJEKT AB



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