A*d*SORPTION CHILLER
N*A*K

Chilling Capacity from *50* to *430* kW
Usage of Surplus Heat from *50° C*

TECHNICAL DESCRIPTION

ADSORPTION CHILLER NAK

1 INTRODUCTION

The growing interest in the recovery of thermal energie in the lower temperature range (<100°) is leading to an increased search for possibilities to technically convert these demands. A common energy source in this respect is the waste heat from engines an production processes. It usually ranges between 60°C and 100°C and in most cases can only be utilized for heating purposes.

The **adsorption chiller** described in the following, now offers a new possibility to **economically** utilize this energy on a large scale. The main application of this adsorption chiller is the production of cold water.

The demand for the production of cold water for air conditioning or process cooling is apparent in many areas of domestic power suppliers or the industry.

The following areas offer interesting applications:

- Administration offices, Hospitals, Hotels
- Printing factories
- Food Industry
- Chemical Industry
- Computer Centres
- Breweries
- Agriculture
- **District Heating**

Especially in the district heating area there is an intense search for possibilities to economically utilize this energy, particularly in the summer months.

The adsorption chiller is the ideal partner in the district heating network.

- Heating with feeding temperatures in the summer months results in the desired high cooling capacity in the summer.
- Heating with return temperature in the winter results in a reduced cooling capacity.

Another interesting energy source for the utilization of the adsorption chiller is the solar energy collector. **Solar airconditioning** is possible with adsorption chiller technology. Naturally, the highest chilling capacity required for air conditioning exists in the hot summer months. The combination of the adsorption chiller with solar collectors offers a technically simple and energy saving solution.

The adsorption chiller offers an important alternative for the preparation of cold water in all mentioned areas. The ever increasing demands for energy saving and utilization of low temperature waste heat potentials are herewith equally satisfied.

2 THE PRINCIPLE OF ADSORPTION

The adsorption chiller uses **water as it's cooling agent.**
Water evaporates in a vacuum at room temperature and thereby extracts heat from it's surroundings (evaporation-energy). Through this process, a cooling takes place in the circuit.

Compared to open systems, the evaporated water is not released as steam into the surroundings, but recondensed within the machine.

The adsorption chiller is a **closed system.**

For thermodynamical reasons, a direct condensation of the evaporated water is energetically not feasible.

Therefore, the water is first adsorbed by a solid carrier material. This material consists of silica-gel, a material related to quartz or sand.

In refrigeration engineering the principle of adsorption - the collection of water vapour in the air by a hydroscopic material (silica-gel, zeolithe) - is commonly used to dehumidify the air. Utilizing the warm waste air in such systems, the material used is constantly regenerated (disc wheels).

The same process takes place in the packaged chiller.

With the use of hot water, the adsorbed water on the carrier material (silica-gel) is again evaporated and thereby the carrier material is regenerated.

Condensation of the secondary evaporated water (off the carrier material) is, opposed to the primary evaporated water (out of the cooling circuit), now easy.
The following factors are essential for the process:

Silica-gel can easily take up water (adsorb), without causing a structural change or volume expansion.

Silica-gel can easily release the stored water through a temperature increase.
This process is reversible and unlimitedly repeatable.

The evaporation process is **temperature and pressure dependent**.
Under normal atmospheric pressure (760 mm Hg), water evaporates at 100°C. If the surrounding pressure

drops, the evaporating temperature of the water also decreases.

With the achievement of a high enough vacuum, the water evaporates at a lower temperature.

For the purpose used in the adsorption chiller, a vacuum in the area of 10-20 mm Hg, is sufficient.

If water is sprayed or injected into a vessel under vacuum, it evaporates spontaneously and extracts energy from it's surroundings.

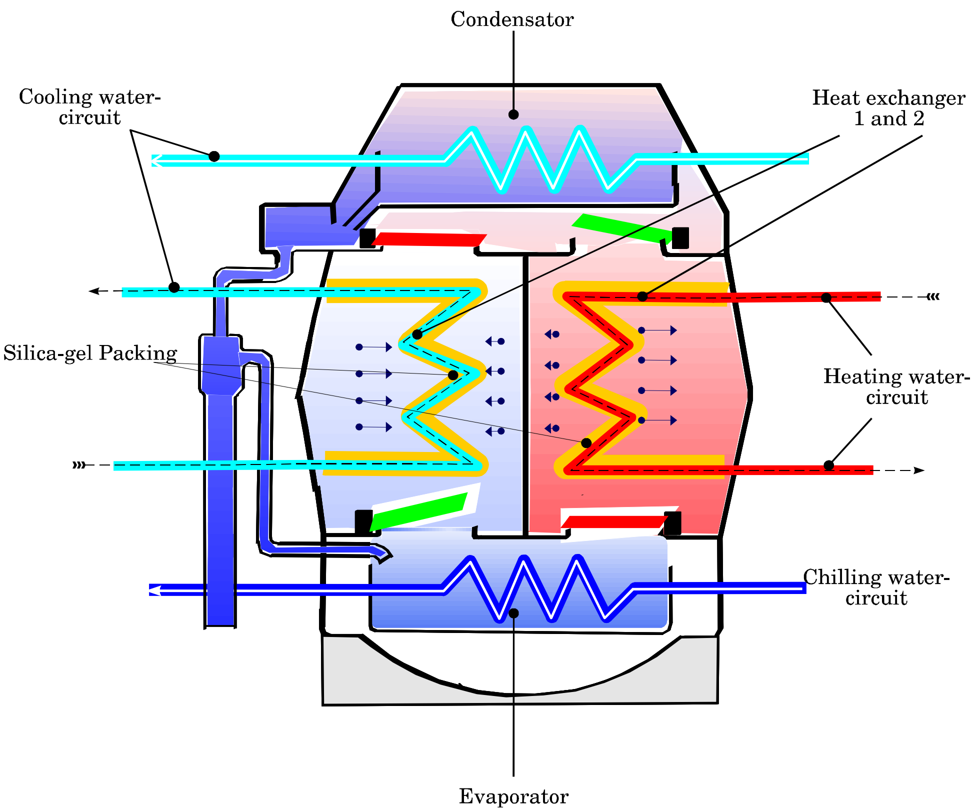
The adsorption chiller utilizes the following properties:

a) the reversible adsorption and de-sorption process of water on sil-ica-gel

b) the spontaneous evaporation of water on silica-gel

c) the easy condensation of water on a high energy level.

Scheme of the NAK
Low Temperature Adsorption Chiller



Picture 1 Scheme of the NAK Adsorption Chiller

3 THE FUNCTION OF THE ADSORPTION CHILLER

The adsorption chiller has in principle the following structure (See Picture 1):

The machine essentially consists of a pressure vessel (St 33), devided into four chambers.

1st chamber (lower):
Evaporator

2nd/3rd chamber (middle):
Generator/Receiver

4th chamber (upper):
Condenser

The generators/receivers are each connected to the above lying condenser and the below lying evaporator by flap valves.
A heat exchanger manufactured with seamless drawn copper tube (>>DIN 2.0090 SF-CU) is installed in each chamber.
The tube sheets and tubes of the heat exchangers placed in the generator/receiver are additionally packed with silica-gel granulated material.
Operating Cycle:

During the **initial start-up** of the machine, the entire pressure vessel is evacuated with the help of a small evacuation-pump, that is permanently installed for this purpose.
The machine operates fully automatically with an operation cycle of about 5 to 7 minutes, that consists of mainly four steps:

Step 1:
Water is brought into the evaporator and **evaporates.** Through this, the cooling circuit cooles down.

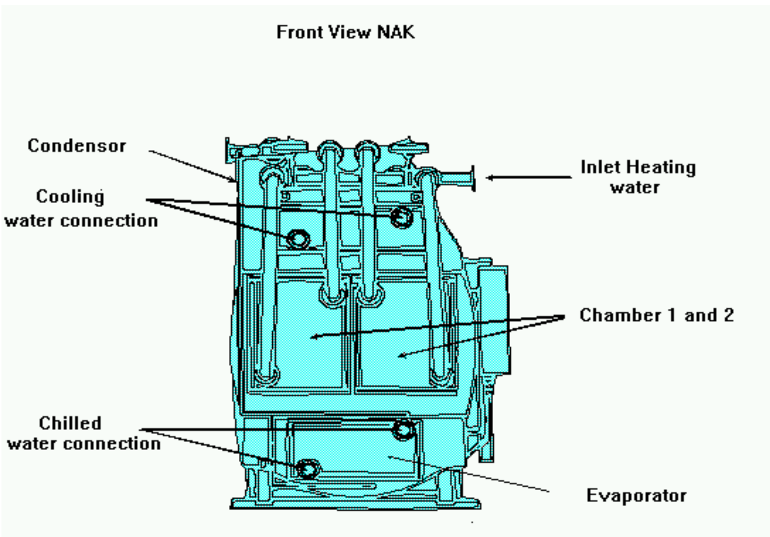
Step 2:
The water evaporated in step one is **adsorbed** on the receiver.

Step 3:
The adsorbed water is **de-adsorbed** with the supply of thermal energy. The receiver turns into the generator.

Step 4:
The de-adsorbed water is **condensed** in the condenser (cooling cycle).

The cycle is completed with the return of the in step 4 condensed water into the evaporator (step one).
Note:
Receiver and Generator are alternately heated and cooled.
During the heating of the one side, the receiver is partially cooled by the cold water flow of the condenser, to draw off the heat created through the adsorption. After the cycle-time expiration the machine switches over by means of pneumatically actuated valves.

The different chambers are connected with automated brackets. the operating method of the brackets is determined by the pressure differences in the chambers during the operation-cycle. The machine does not contain any costly or maintenance requiring parts inside the evacuated chamber!
The refrigerant reaches the upper part of the evaporation chamber either through weightlessness or with the help of a small pump. During the evaporation process there, it wanders down through cascades.

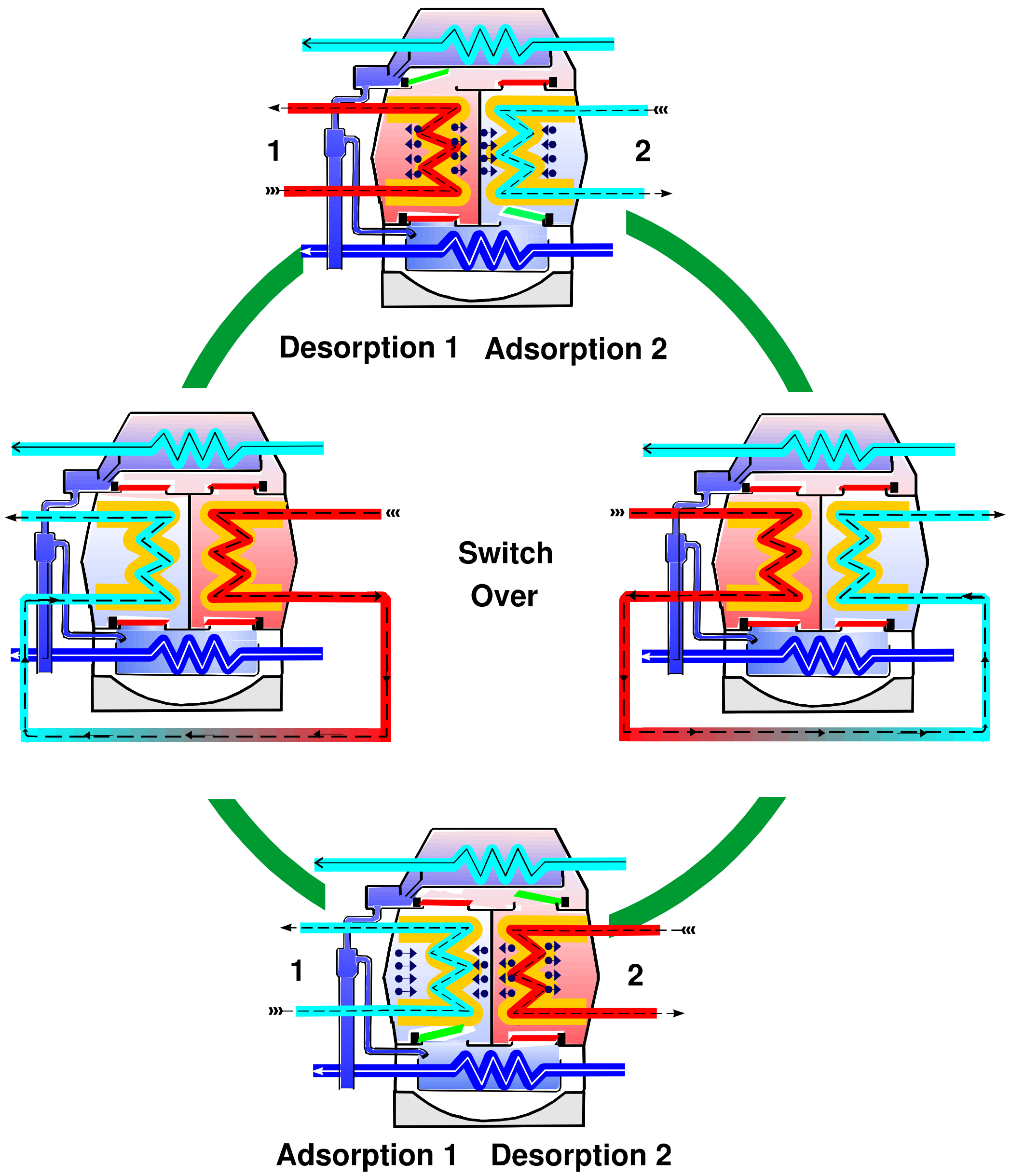


Picture 2 Front View NAK Adsorption Chiller

Controls:
The machine is controlled by the the chilled water entry-temperature at the evaporator.
As the temperature exceeds, the machine switches over, the cooling capacity increases.

The machine does not switch over at the end of a cycle if the temperature drops below a preset limit, but instead continues to heat the generator currently in operation. The cooling capacity drops with the decreasing water vapour production in the evaporator. The cold water temperature has to increase again in the return line.
The vacuum pump installed in the machine is only required for the initial startup, and during later operation only used periodically.

NAK Chilling Process



4 ADVANTAGES - OPERATING CONDITIONS - APPLICATIONS

Under closer examination, the adsoption chiller, NAK, shows several operational advantages.

- Simple design without many moving parts;
- low operation cost compared to a conventional system (approx. 1/10);
- necessary inspections can be carried out by maintenance personnel without special training;
- in the event of unscheduled shutdowns - i.e. central power failure - there is no danger of damage inside the machine; restarting presents no problems;
- start-up time for reaching the desired cold water temperature is only 1-2 minutes;
- high efficiency even at low hot water entry temperatures;
- no lower limit to the cooling water temperature in the recooling system, as there is no danger of crystallisation. A spiral tube on the bottom of the evaporation chamber is activated at approx. 4°C and the hot water flows through it.
- where possibilities exist for utilizing the heat from the cooling water, the recooling outlet temperature of the machine can be increased to approx. 45°C (i.e. for low temperature heating systems, like wall- or floorheating). The cold water production decreases through this, but the overall efficiency of the machine increases to factor 2;
- the hot water mass flow can be reduced to half the rated value to achieve a greater temperature scale. The cold water capacity still remains 93% of the standard rated flow;
- the hot water inlet temperature can reach up to 100°C;
- the temperature difference on the hot water side can be as much as 13°C, depending on the volumetric flow of the hot water;
- cold water outlet temperatures as low as 5°C can be achieved;
- the combination of silica-gel (as the adsorbent) and water (as refrigerant or adsorbate) is absolutely environmentally safe, as they are both natural substances;
- Silica-gel does not age, and can be regenerated in the process without loss of adsorption capacity.

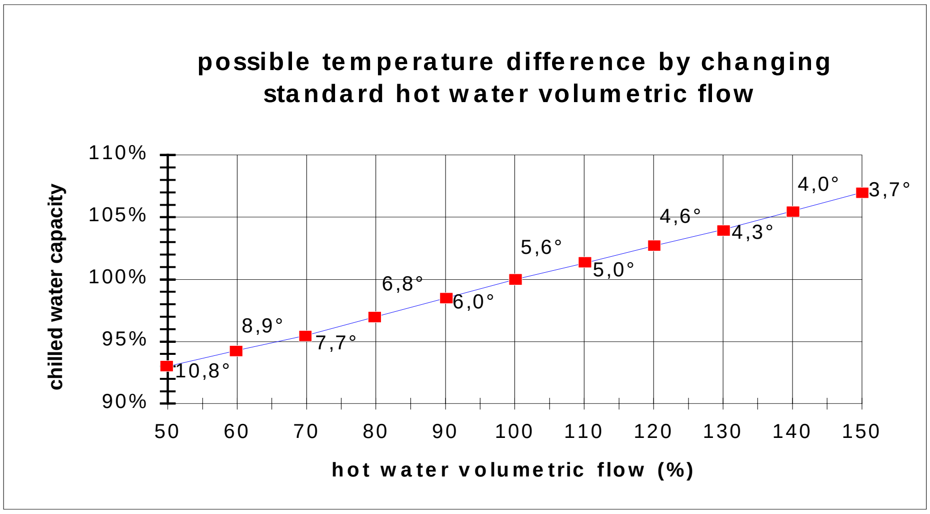
A cooling tower is necessary for operation of the machine. To prevent contamination of the hot- and cold water-circuits, a closed cooling tower must be used. Alternatively, an open cooling tower in conjunction with a separate heat exchanger can be used. An adsorption chiller can be incorporated into an existing supply network and replace conventional systems wherever chilled water of down to 5°C is required for cooling. For newly proposed systems, the adsorption chiller offers a genuine alternative to the standard refrigeration compressor with its high electric power consumption. When planning a power supply with a block heating system, a chilled water supply system can be set up with low cost *without using a high temperature-cooled engine.*

5 TECHNICAL DATA

The following performance data refers to a chilled water temperature level of 14/9°C at standard volumetric flow (see also section 5.1.).
A reduction of the hot water flow rate results in a larger temperature difference (see also the diagram below).
The chilling capacity then drops to 93% of the maximum capacity.

On request, an individual calculation of the chilling capacity can be carried out if the following characteristic data is supplied.

- required chilling capacity
- hot water entry temperature
- volumetric flow (or existing thermal capacity).
- target temperature difference of the hot water
- desired chilled water temperature
- desired cooling water temperature



5.1 Standard Volumetric Flows (m³/h)

TYPE	HOT WATER	COOLING WATER	CHILLED WATER
NAK 020/70	18 (9 - 27)	42 (21 - 63)	12 (6 - 18)
NAK 050/170	45 (22,5 - 67)	105 (52,5 - 157)	30 (15 - 45)
NAK 100/350	90 (45 - 135)	210 (105 - 315)	60 (30 - 90)
NAK 300/1050	270 (135 - 405)	630 (315 - 945)	181 (90 - 271)

The volumetric flow can be freely varied within the given ranges (see above). Through the use of variable-speed pumps (in conjunction with a programmable logic control) makes it possible, for example, to achieve a demand-controlled operation of the chiller without having to switch off the individual systems or the machine temporarily (hot water, cold water, cooling water).

5.2 Capacity at Different Temperatures

	CHILLED WATER 12/6 °C HOT WATER 65 °C COOLING WATER 28/33 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	37,1	80,7	0,46	34,5	75
50/170	93,3	202,8	0,46	86,8	188,6
100/350	186,6	405,6	0,46	173,5	377,2
300/1050	559,7	1216,7	0,46	520,5	1131,5

	CHILLED WATER 12/6 °C HOT WATER 70 °C COOLING WATER 28/33 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	49,7	95,6	0,52	46,2	88,9
50/170	125	240,3	0,52	116,2	223,5
100/350	249,9	480,6	0,52	232,4	447,0
300/1050	749,8	1441,8	0,52	697,3	1340,9

	CHILLED WATER 12/6 °C HOT WATER 75 °C COOLING WATER 28/33 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	59,5	106,3	0,56	55,3	98,8
50/170	149,6	267,1	0,56	139,1	248,4
100/35	299,2	534,3	0,56	278,3	496,9
300/1050	897,6	1602,9	0,56	834,8	1490,7

	CHILLED WATER 12/6 °C HOT WATER 80 °C COOLING WATER 28/33 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	67,2	113,9	0,59	62,5	105,9
50/170	169,0	286,4	0,59	157,1	266,3
100/350	337,9	572,7	0,59	314,3	532,7
300/1050	1013,8	1718,2	0,59	942,8	1598,0

	CHILLED WATER 12/6 °C HOT WATER 85 °C COOLING WATER 28/33 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	73,5	120,5	0,61	68,4	112,1
50/170	184,8	303,0	0,61	171,9	281,7
100/350	369,6	605,9	0,61	343,7	563,5
300/1050	1108,8	1817,7	0,61	1031,2	1690,5

	CHILLED WATER 12/6 °C HOT WATER 90 °C COOLING WATER 28/33 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	79,1	125,6	0,63	73,6	116,8
50/170	198,9	315,7	0,63	185,0	293,6
100/350	397,8	631,4	0,63	369,9	587,2
300/1050	1193,3	1894,1	0,63	1109,8	1761,5

	CHILLED WATER 12/6 °C HOT WATER 95 °C COOLING WATER 28/33 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	82,6	129,1	0,64	76,8	120,0
50/170	207,7	324,5	0,64	193,1	301,8
100/350	415,4	649,0	0,64	386,3	603,6
300/1050	1246,1	1947,0	0,64	1158,9	1810,7

	CHILLED WATER 12/6 °C HOT WATER 100 °C COOLING WATER 28/33 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	86,1	132,5	0,65	80,1	123,2
50/170	216,5	333,0	0,65	201,3	309,7
100/350	433,0	666,0	0,65	402,7	619,5
300/1050	1298,9	1998,3	0,65	1208,0	1858,4

	CHILLED WATER 12/6 °C HOT WATER 70 °C COOLING WATER 30/35 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	35,7	79,3	0,45	33,2	73,8
50/170	89,8	199,5	0,45	83,5	185,5
100/350	179,5	398,9	0,45	167,0	371,0
300/1050	538,6	1196,8	0,45	500,9	1113,0

	CHILLED WATER 12/6 °C HOT WATER 75 °C COOLING WATER 30/35 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	46,2	92,4	0,5	43,0	85,9
50/170	116,2	232,3	0,5	108,0	216,1
100/350	232,3	464,6	0,5	216,1	432,1
300/1050	697,0	1393,9	0,5	648,2	1296,3

	CHILLED WATER 12/6 °C HOT WATER 80 °C COOLING WATER 30/35 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	54,6	99,3	0,55	50,8	92,3
50/170	137,3	249,6	0,55	127,7	232,1
100/350	274,6	499,2	0,55	255,3	464,3
300/1050	823,7	1497,6	0,55	766,0	1392,8

	CHILLED WATER 12/6 °C HOT WATER 85 °C COOLING WATER 30/35 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	62,3	107,4	0,58	57,9	100,0
50/170	156,6	270,1	0,58	145,7	251,2
100/350	313,3	540,1	0,58	291,4	502,3
300/1050	939,8	1620,4	0,58	874,1	1507,0

	CHILLED WATER 12/6 °C HOT WATER 90 °C COOLING WATER 30/35 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	68,6	114,3	0,6	63,8	106,3
50/170	172.5	287,5	0,6	160,4	267,3
100/350	345,0	574,9	0,6	320,8	534,7
300/1050	1034,9	1724,8	0,6	962,4	1604,1

	CHILLED WATER 12/6 °C HOT WATER 95 °C COOLING WATER 30/35 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	74,2	119,7	0,62	69,0	111,3
50/170	186,6	300,9	0,62	173,5	279,8
100/350	373,1	601,8	0,62	347,0	559,7
300/1050	1119,4	1805,4	0,62	1041,0	1679,0

	CHILLED WATER 12/6 °C HOT WATER 100 °C COOLING WATER 30/35 °C				
NAK	HOT WATER Δ-t = 5,6 °C			HOT WATER Δ-t = 10,8 °C	
TYP	KW CHILLED	KW THERMAL	COP	KW CHILLED	KW THERMAL
20/70	79,1	125,6	0,63	73,6	116,8
50/170	198,9	315,7	0,63	185,0	293,6
100/350	397,8	631,4	0,63	369,9	587,2
300/1050	1193,3	1894,1	0,63	1109,8	1761,5

5.3 Technical Data Adsorption-packaged-chiller, Type NAK

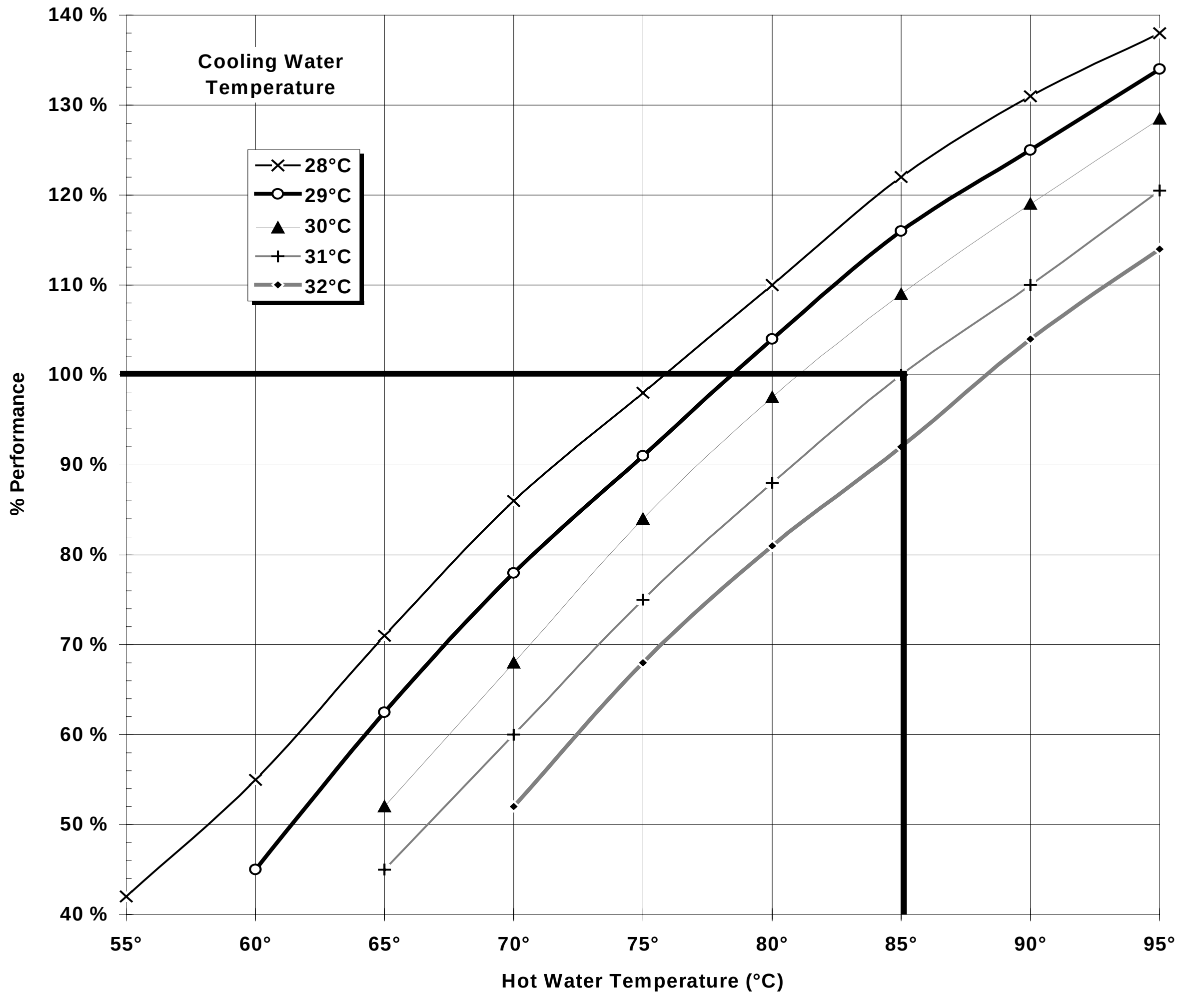
TECHNICAL SPECIFICATION (Standard-Configuration)						
ADSORPTION CHILLER TYP NAK						
		20/70	**50/170**	**100/350**	**300/1050**	
	INLET TEMPERATURE	85	85	85	85	°C
HOT WATER CIRCLE	OUTLET TEMPERATURE	79,4	79,4	79,4	79,4	°C
	DIFFERENTIAL TEMPERATURE	5,6	5,6	5,6	5,6	°C
	VOLUMETRIC FLOW	18	45	90	270	m3/h
	PRESSURE DROP	4,5	5,6	3,0	5,0	mH2O
HOT WATER HEATING CAPACITY Qzu		**118**	**295**	**589**	**1768**	**KW**
C.O.P. (HEATING EFFICIENCY Qo : Qzu)		**0,6**	**0,6**	**0,6**	**0,6**	
CHILLING CAPACITY Qo		**71**	**177**	**354**	**1061**	**KW**
CHILLED WATER CIRCLE	INLET TEMPERATURE	14	14	14	14	°C
	OUTLET TEMPERATURE	9	9	9	9	°C
	DIFFERENTIAL TEMPERATURE	5	5	5	5	°C
	VOLUMETRIC FLOW	12	30	60	181	m3/h
	PRESSURE DROP	5,5	11,4	7,7	8,0	mH2O
REQUIRED CHILLING CAPACITY		**189**	**472**	**943**	**2829**	**KW**
COOLING WATER CIRCLE	INLET TEMPERATURE	31	31	31	31	°C
	OUTLET TEMPERATURE	34,8	34,8	34,8	34,8	°C
	DIFFERENTIAL TEMPERATURE	3,8	3,8	3,8	3,8	°C
	VOLUMETRIC FLOW	42	106	212	637	m3/h
	PRESSURE DROP (Heat Exchanger)	8,0	8,6	4,5	6,0	mH2O
	PRESSURE DROP (Condenser)	6,0	7,5	5,9	5,5	mH2O
SUPPLY CONNECTION DATA						
	COMPRESSED AIR CONNECTION	500	500	500	500	kPa
	COMPRESSED AIR CONSUMPTION	64	117	232	432	l/h
	ELECTRICAL CONNECTION (220 V/ 50	0,4	0,4	0,4	0,4	kVA
	REFRIGERANT PUMP	0,4	0,4	0,4	0,7	KW
MESSURMENTS AND WEIGHTS						
	LENGTH	3.700	4.000	5.300	6.900	mm
	WIDTH	1.600	1.900	2.120	3.040	mm
	HEIGHT	2.400	3.000	3.270	5.200	mm
	RUNNING WEIGHT	5.000	8.000	14.000	39.000	kg
	TRANSPORTATION WEIGHT	4.000	6.500	12.500	35.500	kg

5.4 Degree of Effectiveness (C.O.P.) in Cooling down from 14°C to 9°C (Standard-Selection)

Hot Water Efficiency

Chilling Temperature 14°C to 9°C

Coefficient of Performance (C.O.P.) - Standard Configuration

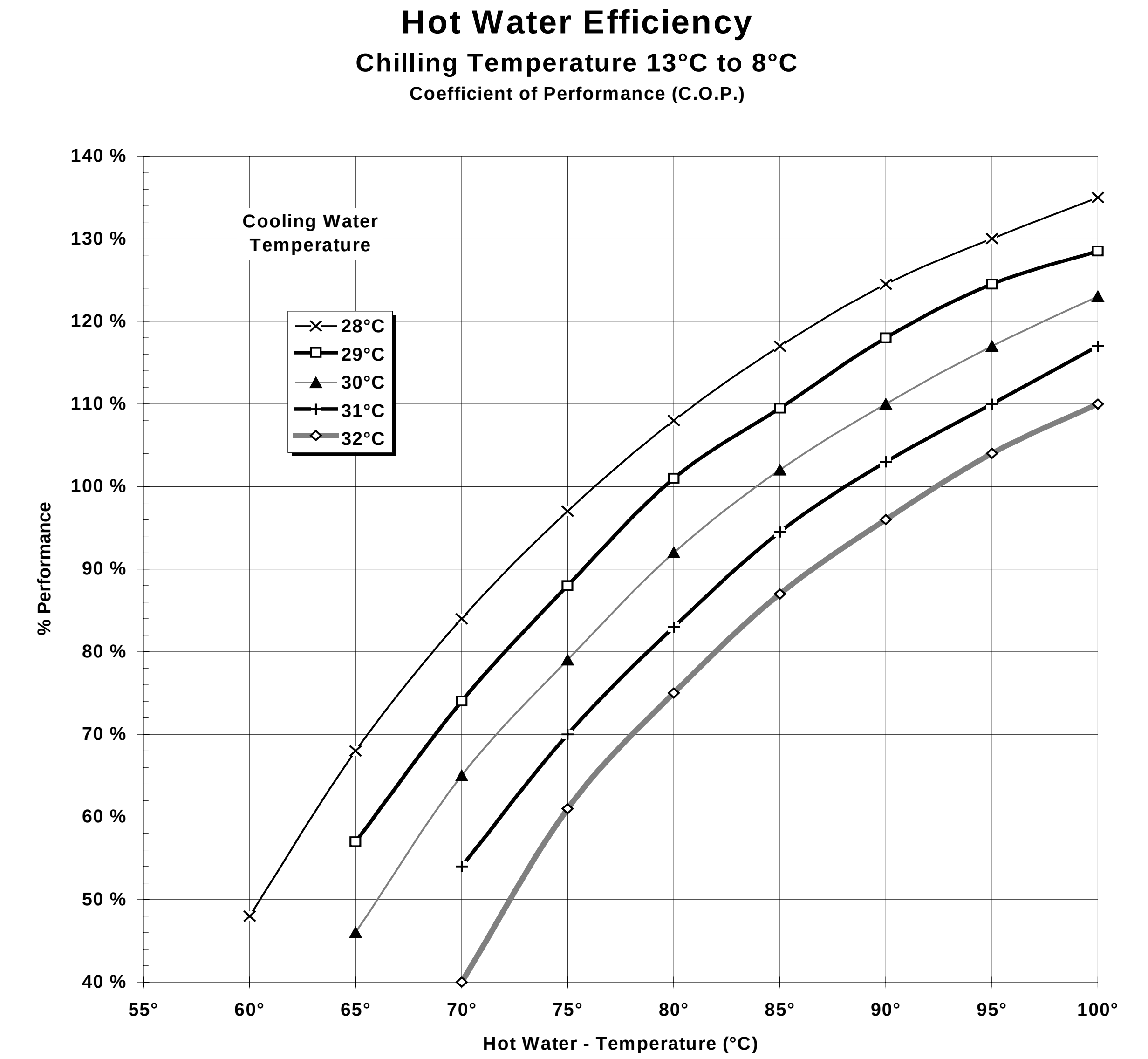


All data valid for standard values for hot and cooling water

C.O.P. - values under different operating conditions :

Cooling Water Temperature	Hot Water - Temperature								
	55°C	**60°C**	**65°C**	**70°C**	**75°C**	**80°C**	**85°C**	**90°C**	**95°C**
28°C	0,52	0,56	0,58	0,61	0,62	0,64	0,65	0,66	0,66
29°C			0,56	0,58	0,6	0,61	0,62	0,63	0,64
30°C			0,52	0,56	0,57	0,59	0,61	0,62	0,63
31°C				0,52	0,55	0,57	0,6	0,61	0,62
32°C				0,49	0,53	0,56	0,57	0,58	0,59

5.5 Degree of Effectiveness (C.O.P.) in Cooling down from 13°C to 8°C

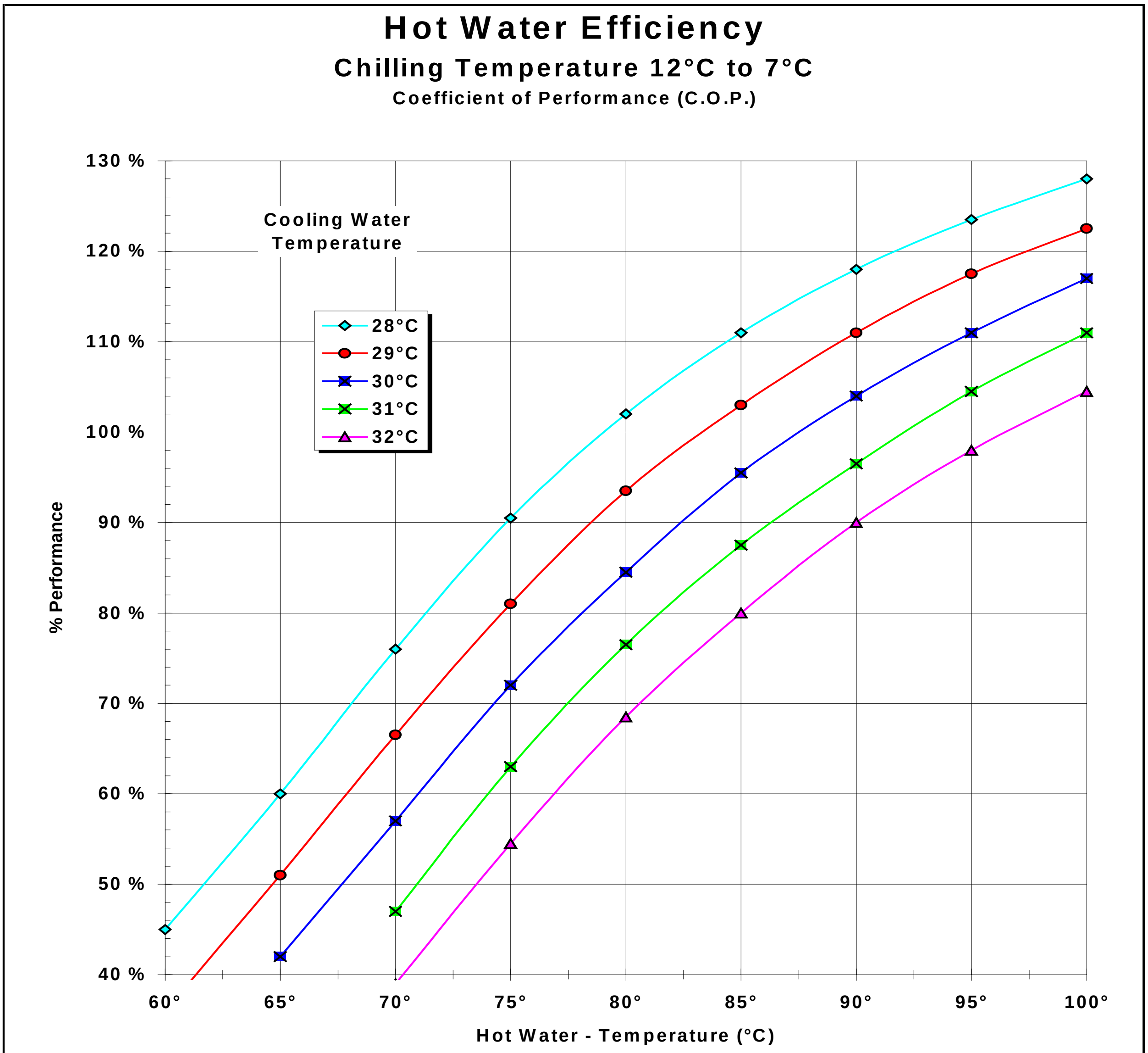


All data valid for standard values for hot and cooling water

C.O.P. - values under different operating conditions :

Cooling Water Temperature	Hot Water - Temperature								
	60°C	**65°C**	**70°C**	**75°C**	**80°C**	**85°C**	**90°C**	**95°C**	**100°C**
28°C	0,43	0,51	0,56	0,6	0,62	0,64	0,65	0,66	0,67
29°C		0,47	0,53	0,57	0,6	0,62	0,64	0,65	0,66
30°C			0,5	0,55	0,58	0,61	0,63	0,64	0,65
31°C			0,46	0,52	0,56	0,59	0,61	0,63	0,64
32°C				0,49	0,53	0,57	0,59	0,61	0,63

5.6 Degree of Effectiveness (C.O.P.) in Cooling down from 12°C to 7°C

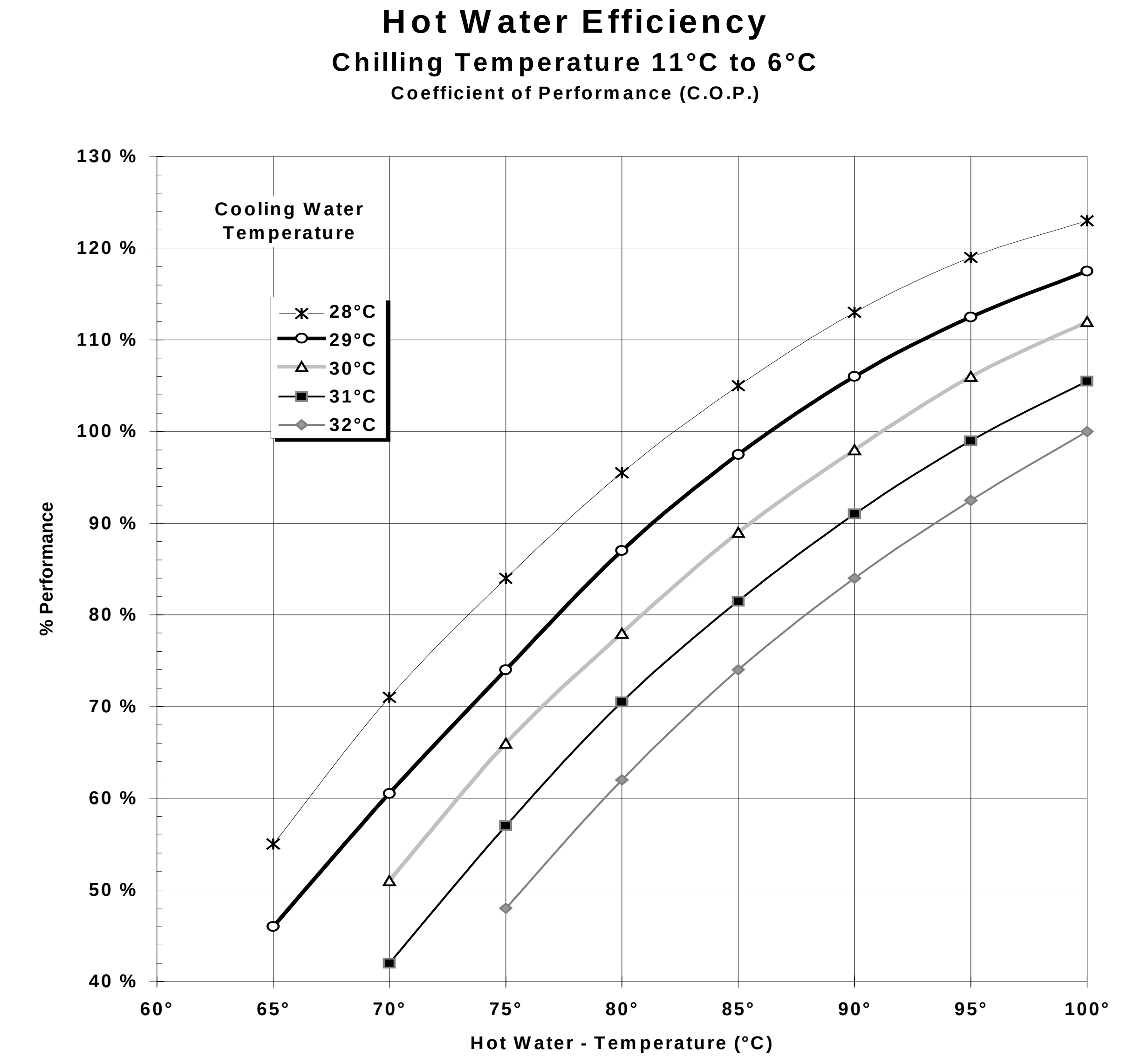


All data valid for standard values for hot and cooling water

C.O.P. - values under different operating conditions :

Cooling Water Temperature	Hot Water - Temperature							
	65°C	70°C	75°C	80°C	85°C	90°C	95°C	100°C
28°C	0,56	0,57	0,58	0,61	0,63	0,64	0,65	0,66
29°C	0,44	0,51	0,55	0,59	0,61	0,63	0,64	0,65
30°C		0,47	0,53	0,56	0,59	0,61	0,63	0,64
31°C		0,44	0,50	0,54	0,57	0,60	0,61	0,63
32°C			0,46	0,51	0,55	0,58	0,60	0,61

5.7 Degree of Effectiveness (C.O.P.) in Cooling down from 11°C to 6°C



All data valid for standard values for hot and cooling water

C.O.P. - values under different operating conditions :

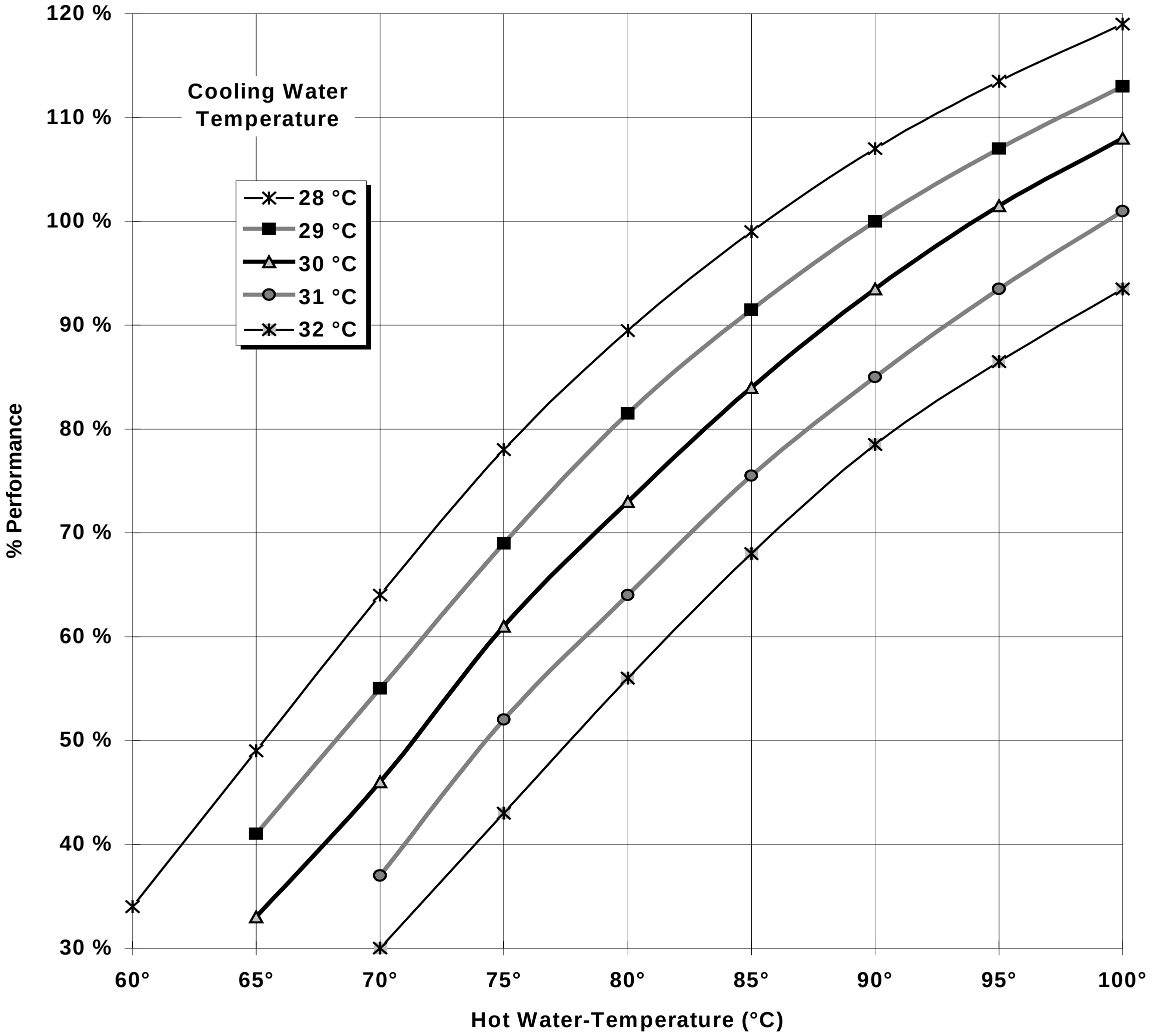
Cooling Water Temperature	Hot Water - Temperature							
	65°C	70°C	75°C	80°C	85°C	90°C	95°C	100°C
28°C	0,46	0,52	0,56	0,59	0,61	0,63	0,64	0,65
29°C		0,48	0,53	0,57	0,60	0,62	0,63	0,64
30°C		0,45	0,50	0,55	0,58	0,60	0,62	0,63
31°C			0,47	0,52	0,55	0,58	0,60	0,62
32°C			0,44	0,49	0,53	0,56	0,58	0,60

5.8 Degree of Effectiveness (C.O.P.) in Cooling down from 10°C to 5°C

Hot Water Efficiency

Chilling Temperature 10°C to 5°C

Coefficient of Performance (C.O.P.)

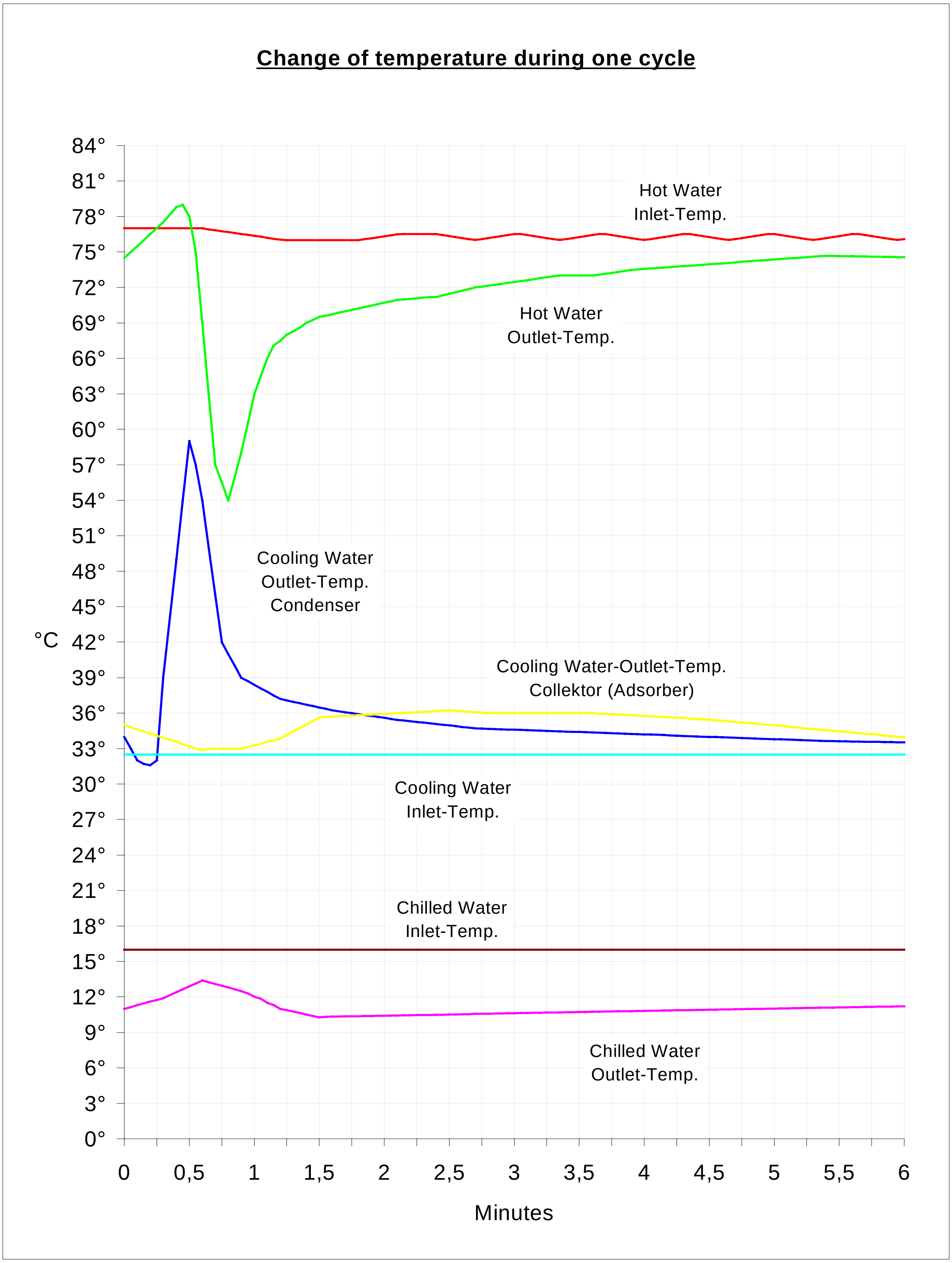


All data valid for standard values for hot and cooling water

C.O.P. - values under different operating conditions :

Cooling Water Temperature	Hot Water - Temperature							
	65°C	70°C	75°C	80°C	85°C	90°C	95°C	100°C
28°C	0,43	0,50	0,54	0,58	0,60	0,62	0,63	0,64
29°C		0,46	0,51	0,55	0,58	0,60	0,62	0,63
30°C			0,48	0,53	0,56	0,58	0,60	0,62
31°C			0,45	0,50	0,54	0,57	0,59	0,60
32°C				0,47	0,51	0,54	0,57	0,59

5.9 Temperature Course during a Working-Cycle



GBU mbH
Wiesenstraße 5
D-64625 Bensheim
GERMANY

Phone: 0049-6251-801-0
Fax 0049-6251-801-180
email: info@gbunet.de

http://www.adsorption.de