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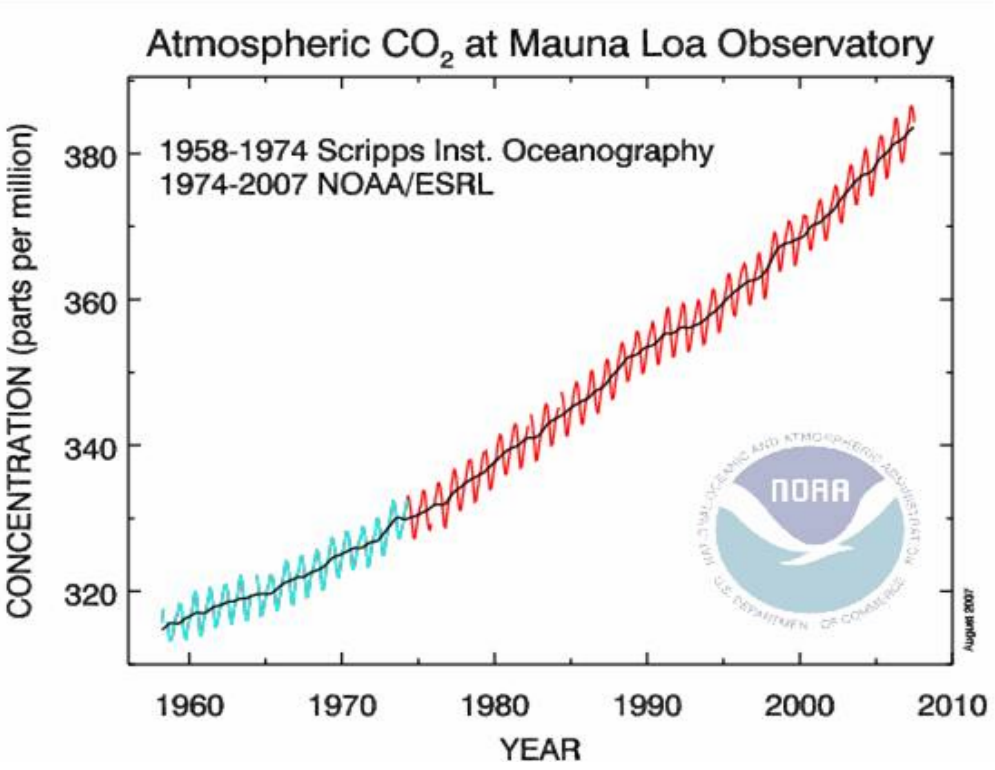
How to reduce 50% of the energy consumption in hospitals ?

Legionella safe tap water
Heat solution without using energy

Trond Thorgeir Harsem
trond.thorgeir.harsem@norconsult.com

Why Low Energy Hospitals?

The historical perspective (Future requirement including hospitals)



Zero emission buildings from 2019

NULLENERGIBYGG I EU FRA 2019

Ifølge et nylig fattet vedtak i Europaparlamentet må alle bygg, oppført etter 31. desember 2018, produsere like mye energi som de forbruker. Vedtaket er en endring av direktivet om bygningers energibruk fra 2002. EUs medlemsland skal sette nasjonale, etappevise mål for hvor stor andel av de eksisterende bygningene som skal være nullenergibygg innen 2015 og 2020. (ILMN)

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Hospital energy consumption in focus

- Hospitals represent 10% af the total heated area of commercial buildings in Norway
- Large university hospital buildings use double energy compared to other commercial buildings
- 20 % of total energy consumption for commercial buildings is related to hospitals in Norway

Aim of the study and targets

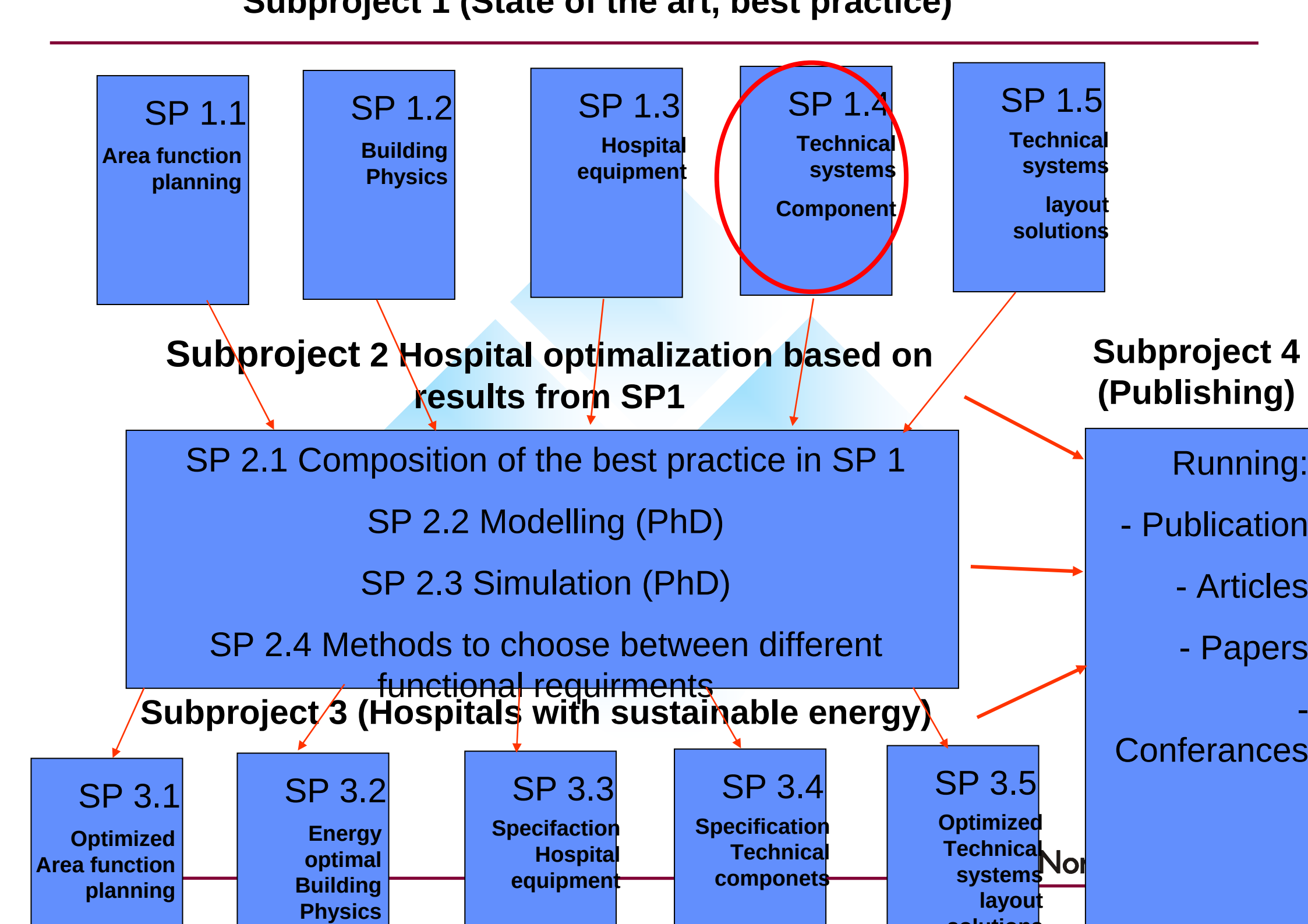
50% reduction of energy consumption in relation to new hospitals (400-500 kWh/m^2)

Targets:

- 20 % - Reduce energy consumption to a minimum
  Insulation, infiltration, klimate system / lightning, heat recovering, integration of technical system, DCV
- 10 % - Medical equipment, Diagnostic imaging equipment
- 10 % - Moving energy – using surpluss heat from cooling
- 10 % - Environmentally friendly energy production

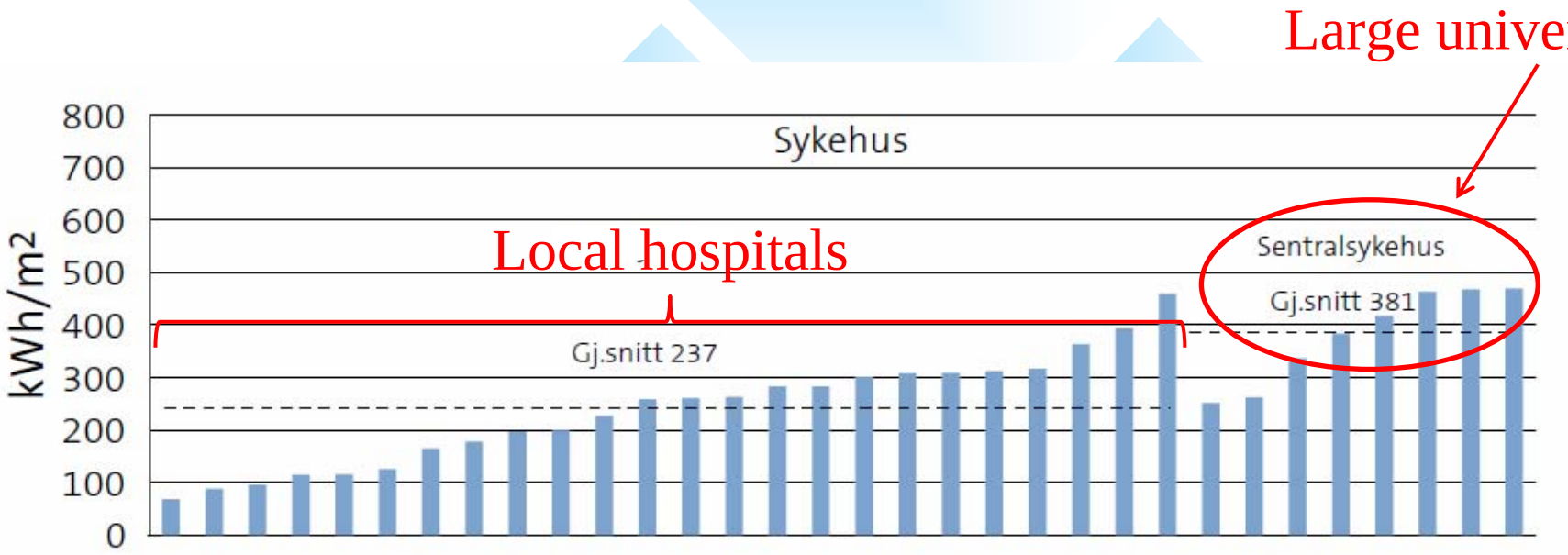
- 1 PhD to develop simulation models

Project participants


Subproject 1 (State of the art, best practice)
SP 1.1
Area function planning
SP 1.2
Building Physics
SP 1.3
Hospital equipment
SP 1.4
Technical systems
Component
SP 1.5
Technical systems
layout solutions
Subproject 2 Hospital optimalization based on results from SP1
Subproject 4 (Publishing)
SP 2.1 Composition of the best practice in SP 1
SP 2.2 Modelling (PhD)
SP 2.3 Simulation (PhD)
SP 2.4 Methods to choose between different functional requirments
Running:
- Publication
- Articles
- Papers
- Conferances
Subproject 3 (Hospitals with sustainable energy)
SP 3.1
Optimized Area function planning
SP 3.2
Energy optimal Building Physics
SP 3.3
Specifaction Hospital equipment
SP 3.4
Specification Technical componets
SP 3.5
Optimized Technical systems layout

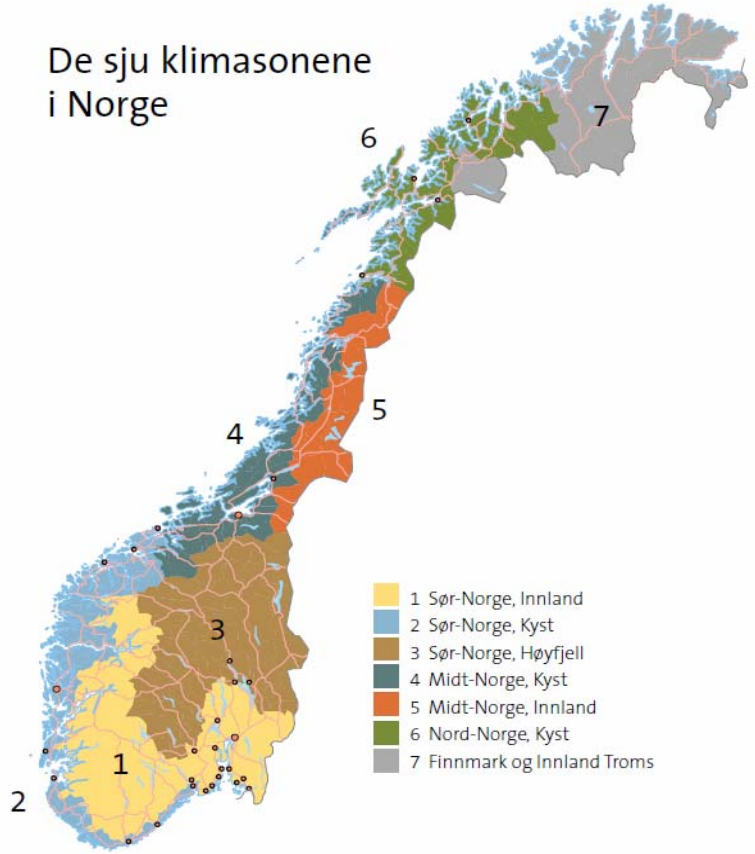
Hospital energy consumption in focus

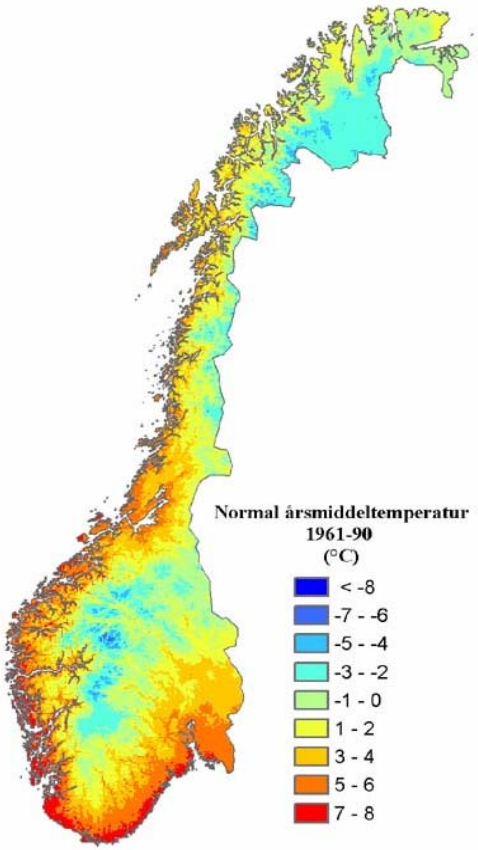
- Specific energy consumption for hospitals



Climate zones in Norway

Normal annual mean temperature





	< - 8
	-7 - -6
	-5 - -4
	-3 - -2
	-1 - -0
	1 - 2
	3 - 4
	5 - 6
	7 - 8

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Requirement of technical regulations and energy label

Building Category	Total net energy - maximum values (kWh/m2 heated BRA per year)					
	TEK-10	TEK-07	Diff Tek10-Tek07	Energy label A	Energy label B	Energy label C
Smal Houses, holyday homes of 150 m	120+1600m2 oppv.BRA	125+1600m2 oppv.BRA	-5	79	118	158
Apartment building	115	120	-5	67	100	134
Children's garden	140	150	-10	90	135	180
Office building	150	165	-15	84	126	168
school building	120	135	-15	79	118	158
University / College	160	180	-20	95	143	191
Hospital	**300(335)**	**325**	**-25**	**179**	**268**	**358**
Nursing homes	215(250)	235	-20	136	203	271
Hotels	220	240	-20	135	202	269
Sports building	170	185	-15	109	164	218
Business Buildings	210	235	-25	129	194	258
Culture Building	165	180	-15	105	158	210
Light industrial / garage	175(190)	185	-10	106	159	212
						tilsv. TEK07?

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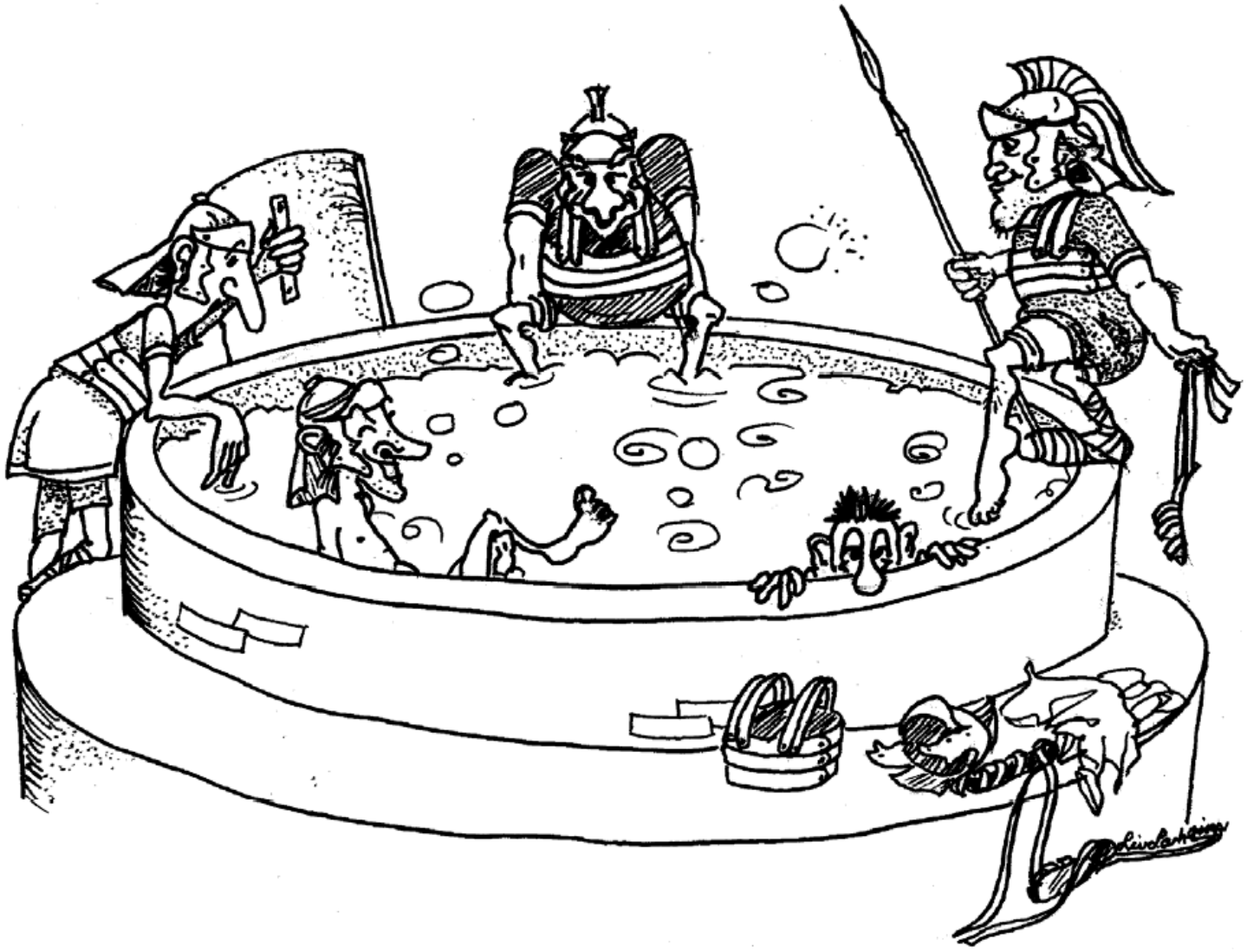
Healthcare equipment - energy consumption

- Hospital building category with the largest spesific energy consumption
- The energy consumption is spread on the following categories

		kWh/year	kWh/m2	%
Electrical power	Ventilation Fans	632 667	40	9,6 %
	Light	1 470 095	92	22,3 %
	Equipment	1 483 725	93	22,5 %
Thermal cooling	Ventilation cooling	167 453	10	2,5 %
	Room cooling	566 822	35	8,6 %
Thermal heating	Ventilation heating	1 828 830	114	27,7 %
	Room heating	443 297	28	6,7 %
	Sum	**6 592 889**	**412**	**100,0 %**



Pre history

- The legionary desease got it's name in 1976 when the the American Legion had a conference at a hotel in Philadelphia
  - 182 (221) persons staying at the same hotel, developed pneumonia simultaniously
  - 34 of them died
- Between 8 000 and 18 000 persons in USA are hospitalized due to legionary desease every year

Pre history

- The legionary bacteria was first isolated in 1943
- The first outbreak of the desease was registered in 1947
- The first outbreak of the Pontiac-fever was in 1968

About the desease

- The bacteria
- Growth conditions
- Contamination
- Rules / Procedures

About the desease

- Clinical picture
- Internal tapwater net
- Cooling system
- Responsibility relations
- HVAC regulations

About the desease

- Clinical picture
- Internal tapwater net
- Cooling system
- Responsibility relations
- HVAC regulations

How the Legionella bacteria is spread?

- Through aerosols (small water particles)
- Particles less than 5 micrometer penetrates the alveoles in the lungs

Which persons are most in danger?

- Old people with reduced immune defence
- Men have higher risk compared to women
- Smokers have a higher risk
- KOLS and other cronical lung deseases
- Alcohol abuse

Contaminations ways

- Not contagious between people
- Laboratory contamination not reported

How is Legionella bacteria spread?

- Cooling tower
- Air scrubbers
- Air humidiators
- Tap water systems (20-50 ºC)
- Jacuzzi
- Indoor fountains
- etc

What protects against the desease?

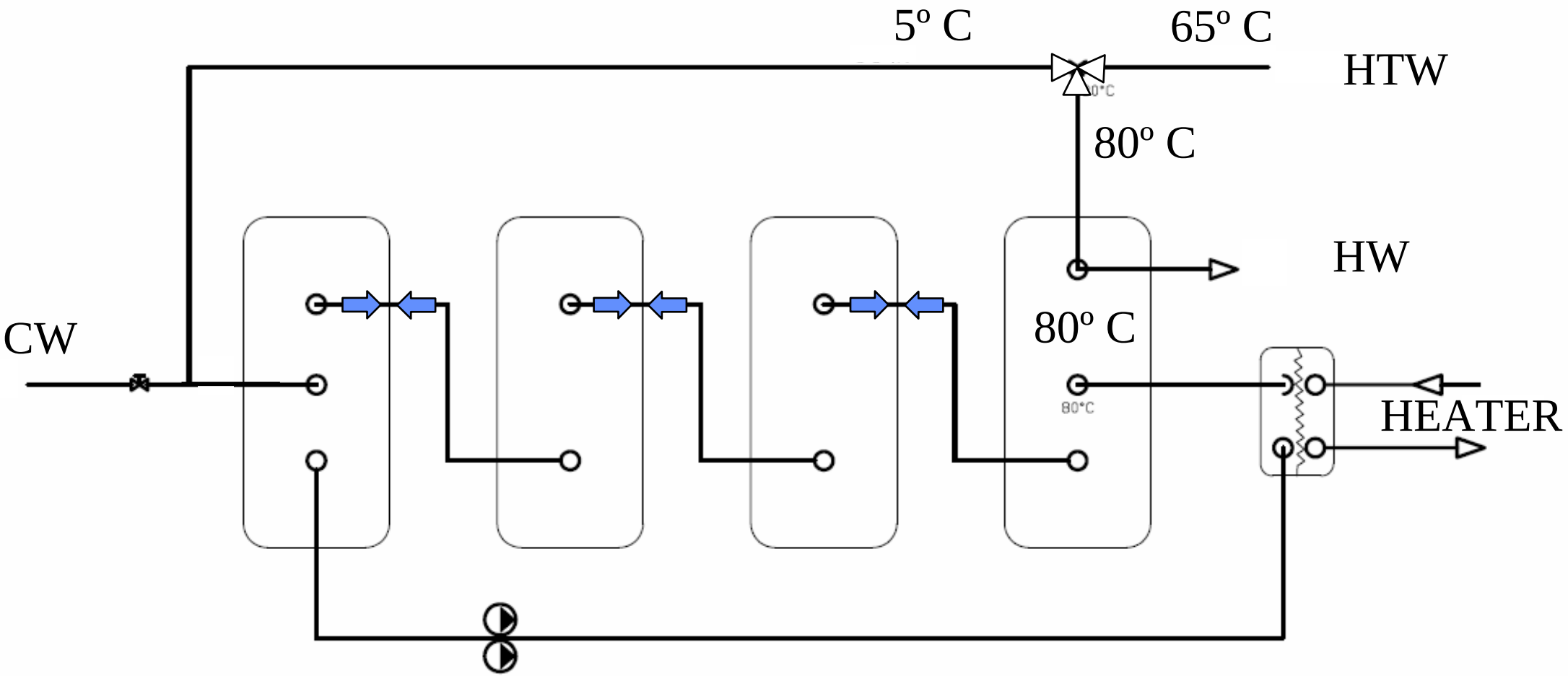
- Clean tap water system
- High and low temperature tap water
- Tap water system without blind zones
- System with different dosing
  - chlorine
  - chloramine
  - chlorine dioxide
  - silver and copper ions

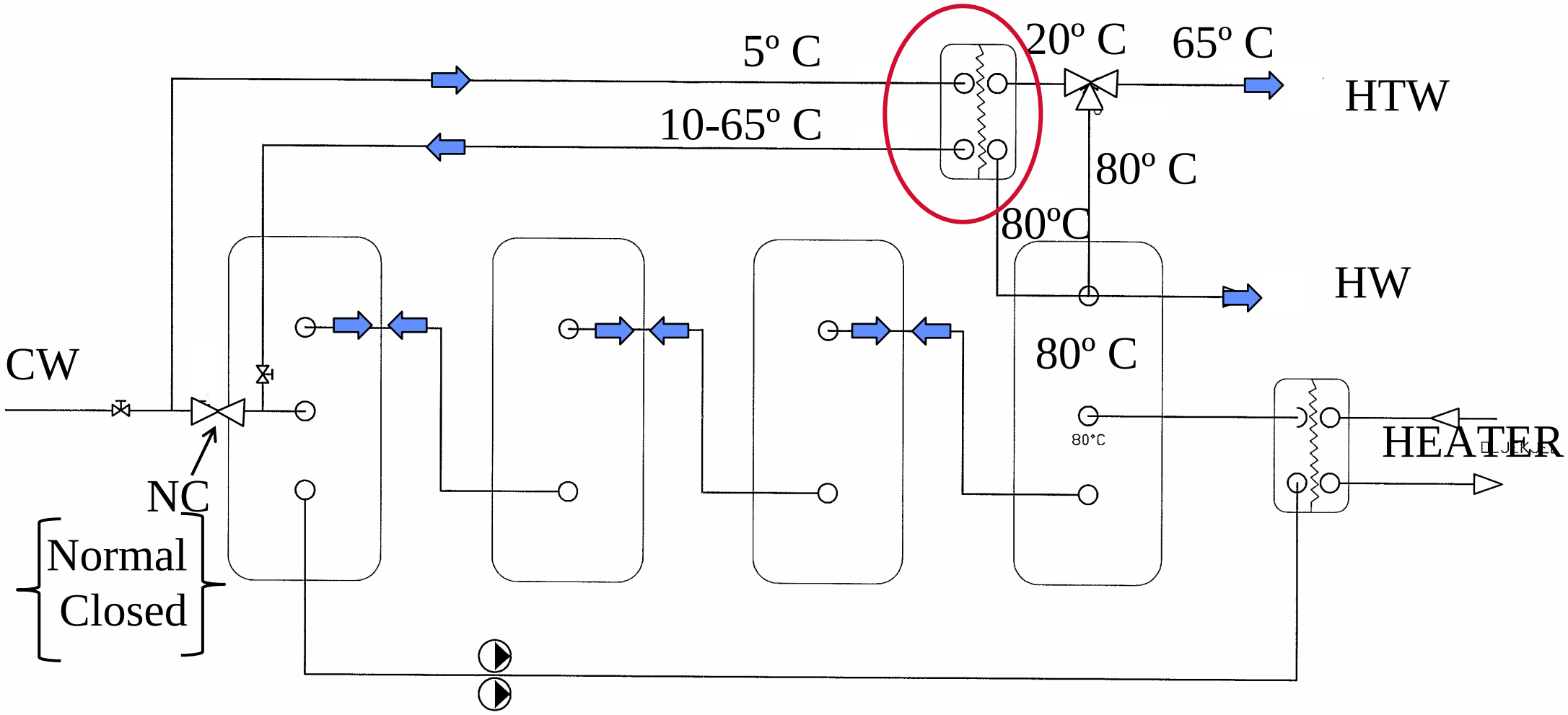
Legionella-safe tap water

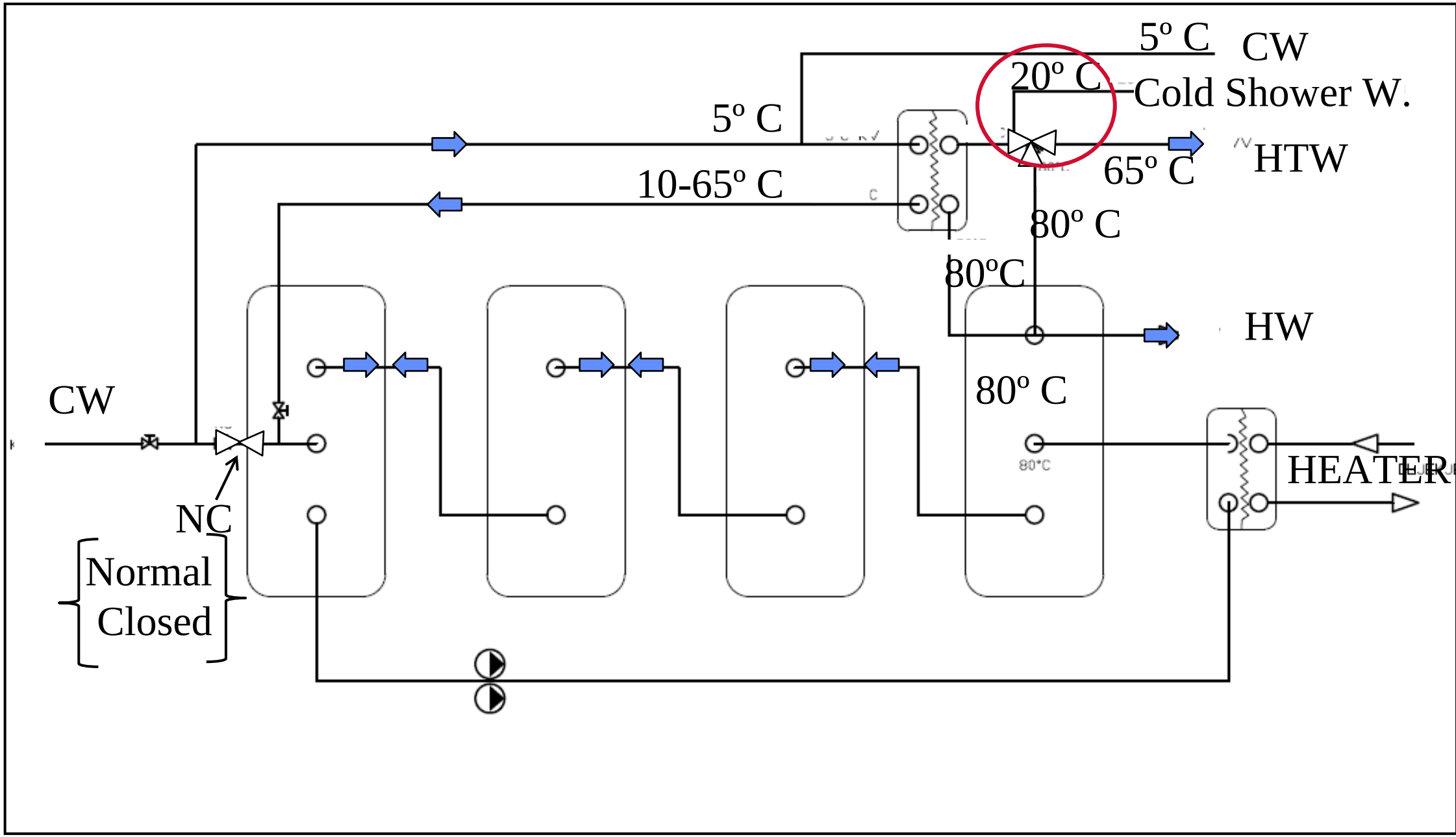
Heat solution without using energy

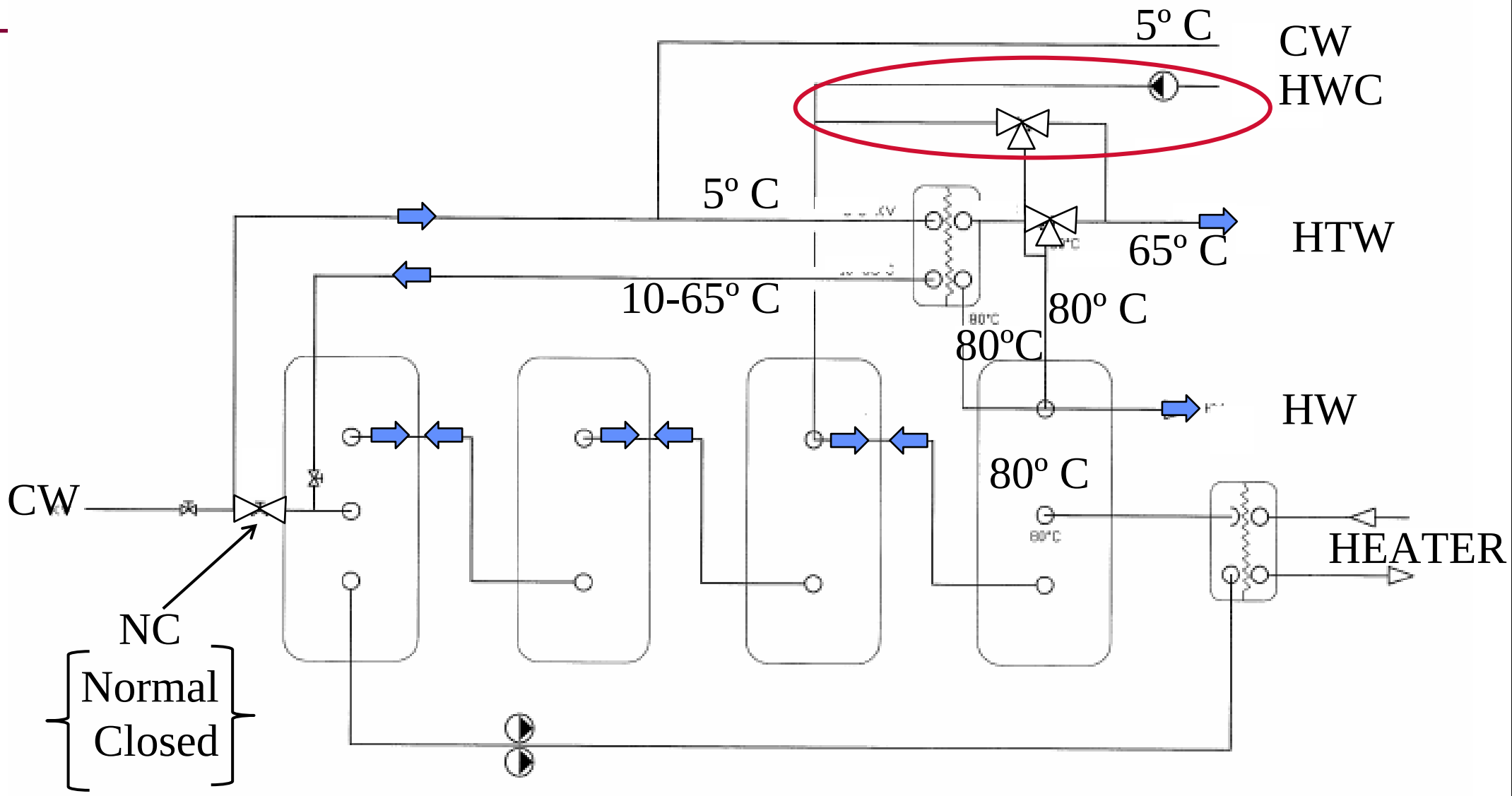
Connections between temperature and time

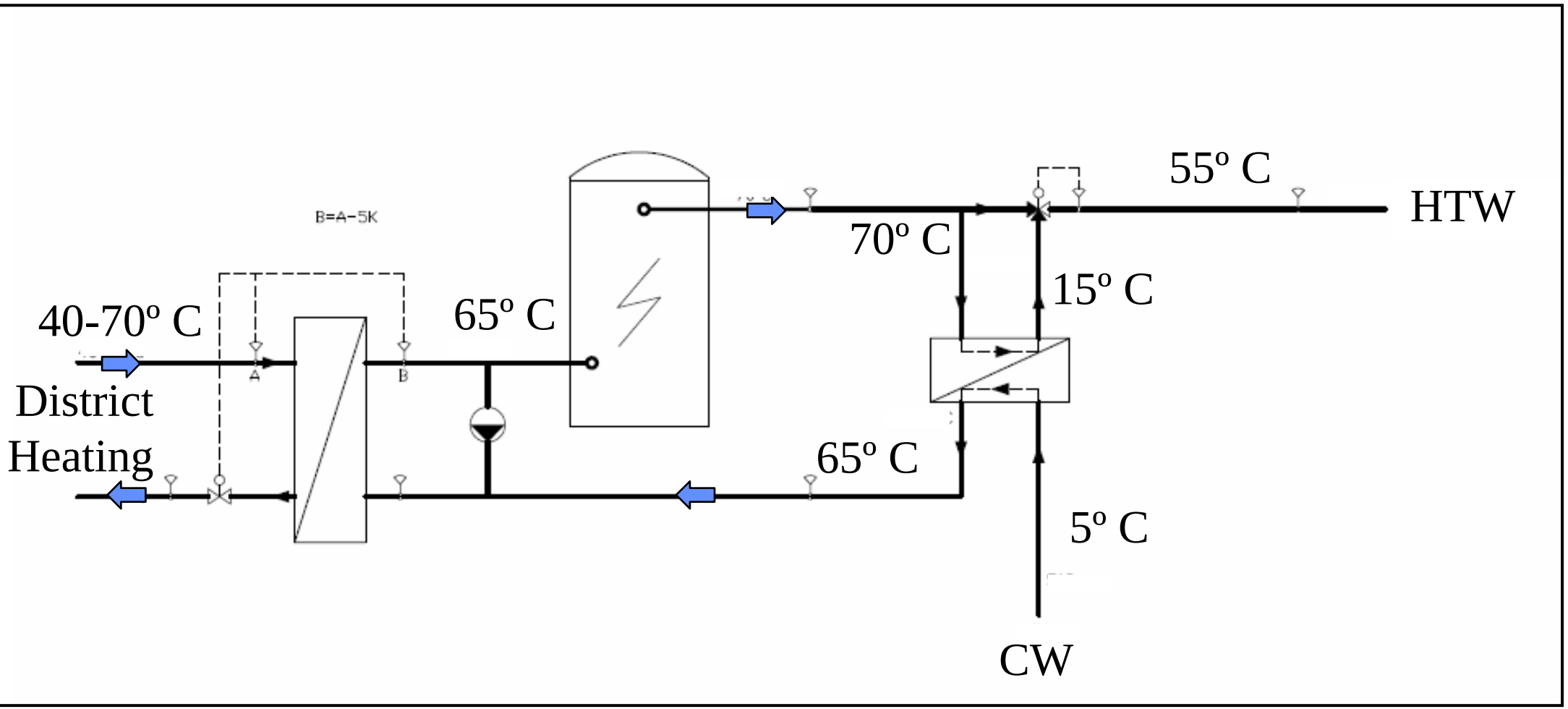
Temperature °C	Temperature °F	Consequence for the Legionella bacteria
70-80	158-176	Disinfection range
66	151	Death of bacteria: 2 minutes
60	140	Death of bacteria: 32 minutes
55	131	Death of bacteria: 5 to 6 hours
Above 50	122	Bacteria can survive but do not multiply
35-46	95-115	Ideal growth range for the bacteria
20-50	68-122	Growth range for the bacteria
Below 20	68	Bacteria can survive but are dorman

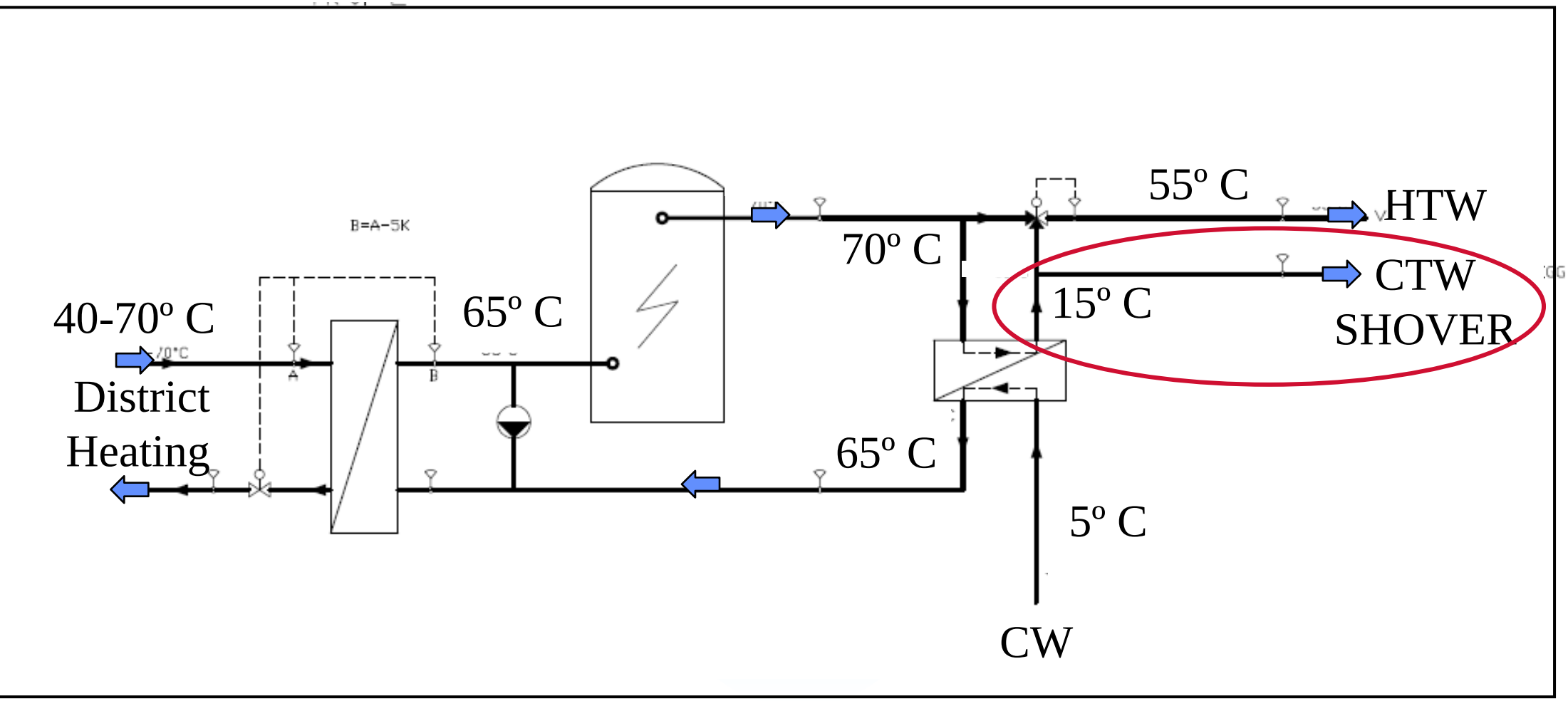

5º C
65º C
HTW
80º C
HW
CW
80º C
HEATER

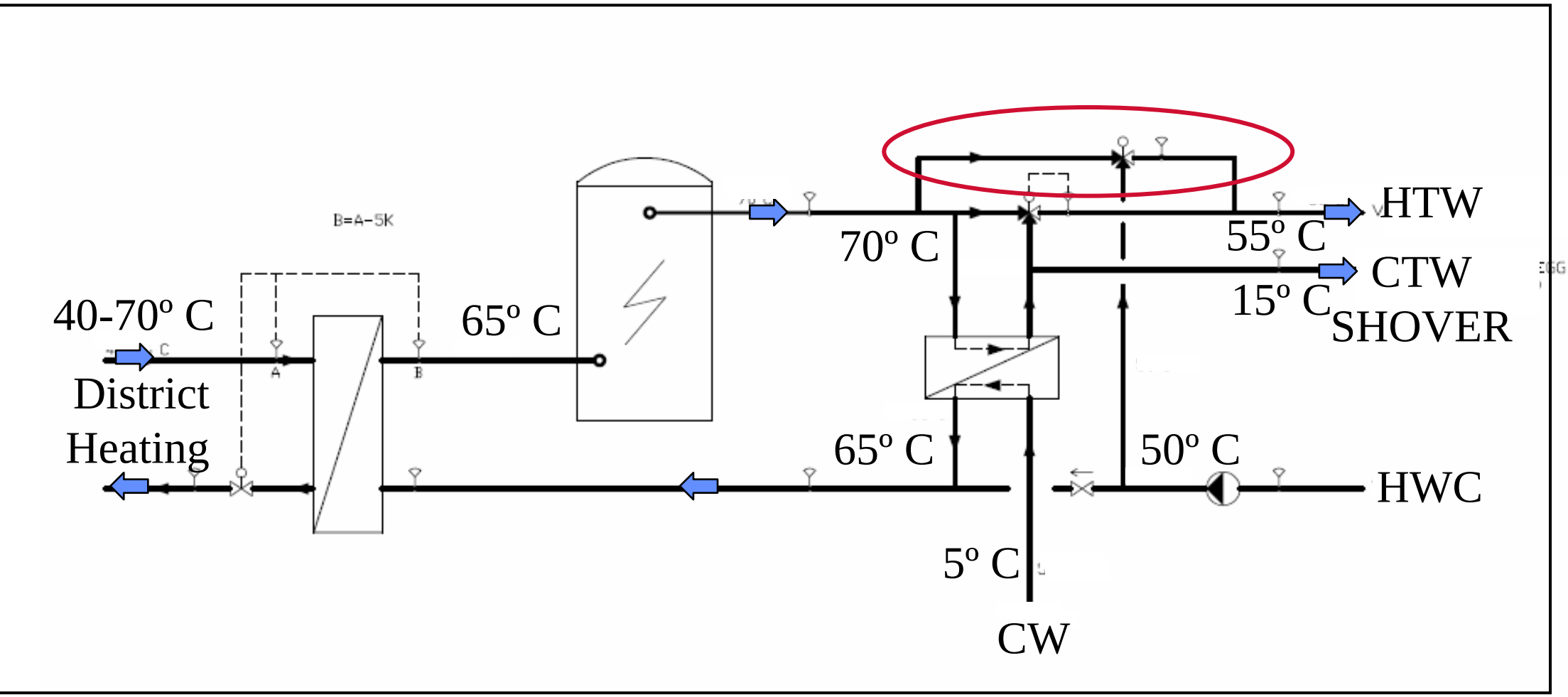

5º C
20º C
65º C
HTW
10-65º C
80º C
80ºC
HW
CW
80º C
80°C
HEATER
NC
Normal
Closed


5º C
CW
20º C
Cold Shower W.
5º C
HTW
65º C
10-65º C
80º C
80ºC
HW
80º C
CW
HEATER
NC
Normal
Closed


5º C
CW
HWC
5º C
HTW
65º C
10-65º C
80º C
80ºC
HW
80º C
CW
HEATER
NC
Normal
Closed


B=A-5K
40-70° C
District
Heating
A
B
65° C
70° C
55° C
HTW
15° C
65° C
5° C
CW


B=A-5K
40-70º C
District
Heating
65º C
70º C
55º C
HTW
CTW
SHOVER
15º C
65º C
5º C
CW


B=A-5K
40-70º C
District
Heating
65º C
70º C
55º C
HTW
CTW
15º C
SHOVER
65º C
50º C
HWC
5º C
CW

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Thank you for your attention

Trond Thorgeir Harsem

trond.thorgeir.harsem@norconsult.com