

Sustainability in commercial laundering processes

Module 3

Water and energy saving possibilities in tunnel washers

Chapter 4

By process design and adapted detergent usage

Learning targets

- This chapter will provide a short introduction in the washing process
- This chapter will provide you with typical data of water, energy and chemical consumption of an industrial washing process
- This chapter will show you the possible energy savings by the introduction of a low(er) temperature industrial washing process
- This chapter will present 2 case studies with an economical analysis of replacing a high temperature washing process with low(er) temperature washing process
- The importance of textile wear for an economical implementation of low(er) temperature washing processes will be presented

Content

- Introduction
- Consumption washing process
- High versus low temperature washing process
- Case studies of 2 industrial laundries
- Conclusions

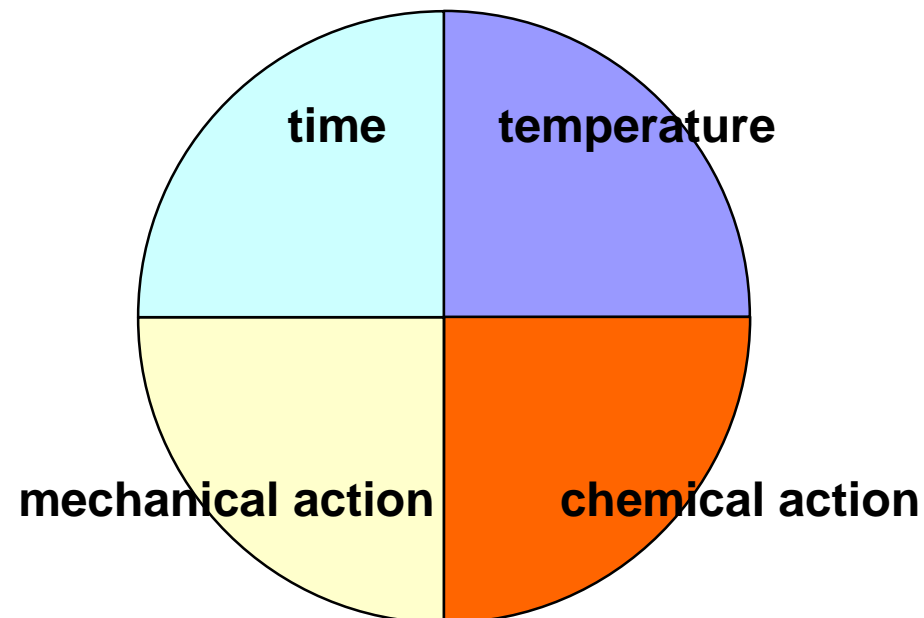
- Total energy consumption industrial laundries in The Netherlands per annum
 - 1998: 1522 TJ
 - 2005: 1408 TJ with 17% more production
 - **thus a total energy reduction of 21% in 7 years**
- The intention between 2005-2008 is a further reduction of energy of 10%

Consumption washing process

- Washing process is estimated to consume 450 TJ per year (1998)
- Energy savings: 20% = 90TJ (assumption)
- Total energy savings = 6%

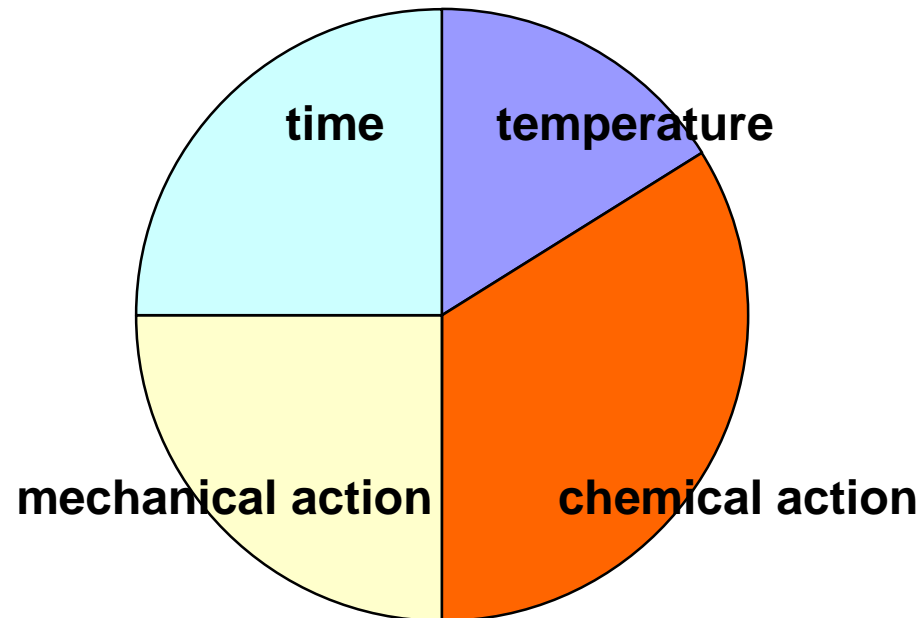
Sinner factors I

- The four Sinner factors for an optimal washing process:
 - temperature
 - chemical action
 - mechanical action
 - time



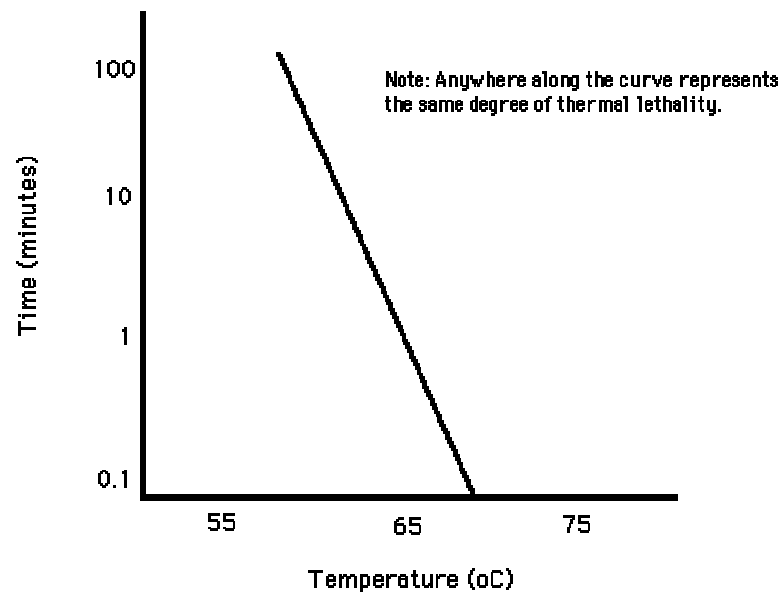
Sinner factors II

- The four Sinner factors for an optimal washing process:
 - temperature
 - chemical action
 - mechanical action
 - time



High vs low temperature washing I

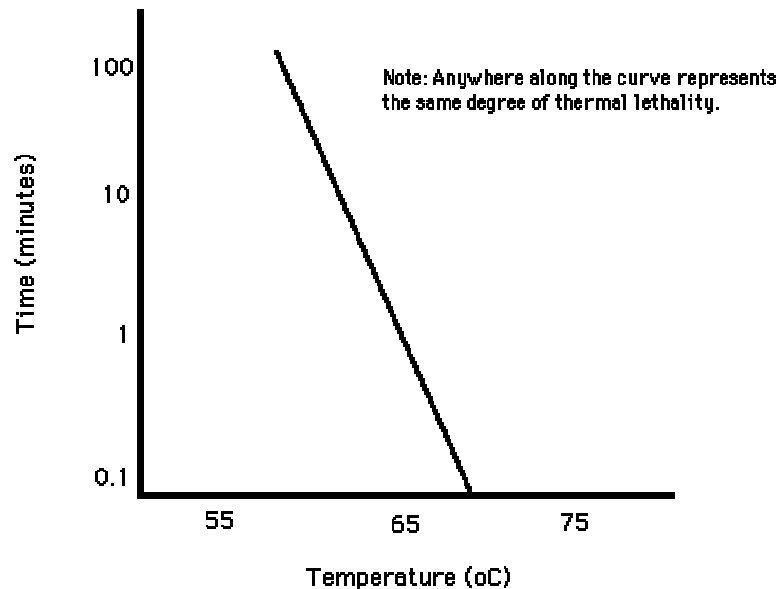
- Low temperature
 - less energy consumption
 - less grease, oil and fat removal
 - insufficient destruction of bacteria (logarithmic relation)



Thermal Death Time Curve for
Clostridium burnetti, $z = 4^{\circ}\text{C}$

High vs low temperature washing II

- Low temperature
 - less energy consumption
 - less grease, oil and fat removal
 - insufficient destruction of bacteria
- } other chemicals



Thermal Death Time Curve for
Coxiella burnetii, z = 40C

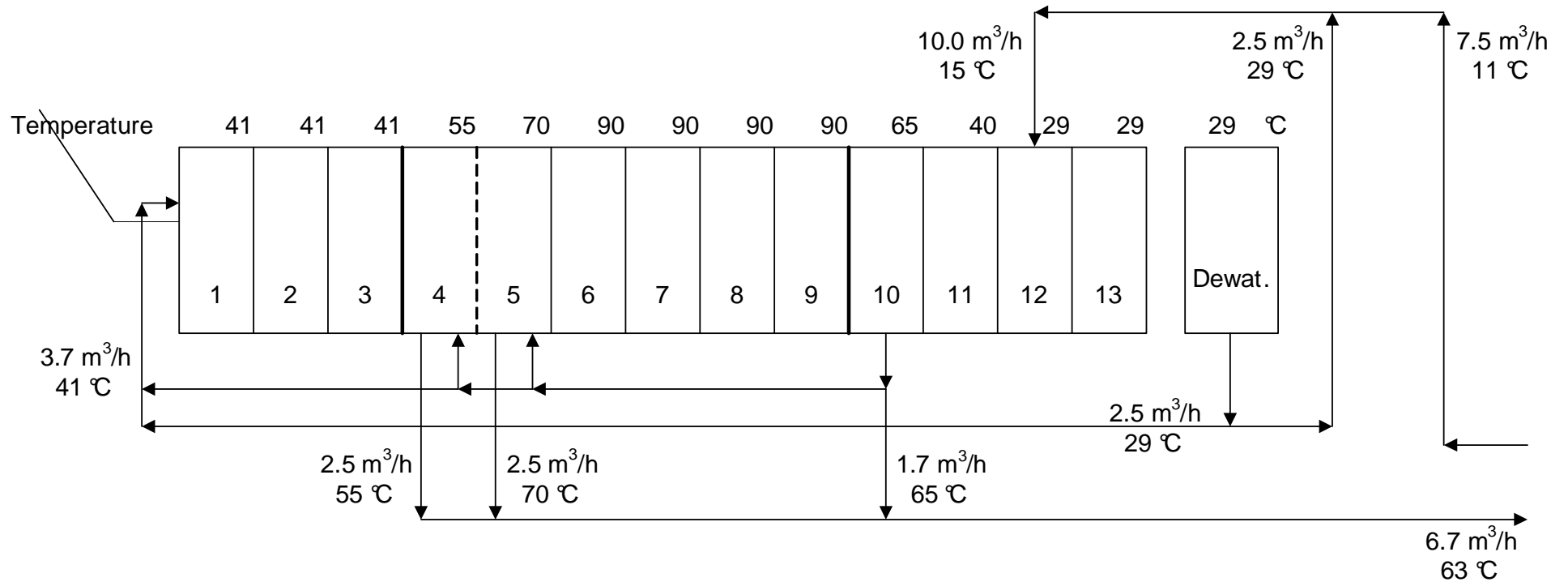
Case studies

- 2 case studies
- High, lower and low temperature washing examined
- Influence on laundering costs determined of:
 - steam: 23.50 €/ton (based on gas price)
 - water: 1.31 €/m³
 - chemicals: 1000 €/ton, 1500 €/ton, 1800 €/ton
 - textile: 7500 €/ton
 - (50% gets lost; 50% is worn out after 100 washing cycles, T = high)
 - (50% gets lost; 50% is worn out after 120 washing cycles, T = lower)
 - (50% gets lost; 50% is worn out after 200 washing cycles, T = low)
 - capacity loss due to changing programs
 - loading (kg/h)

Case 1-High temperature washing process

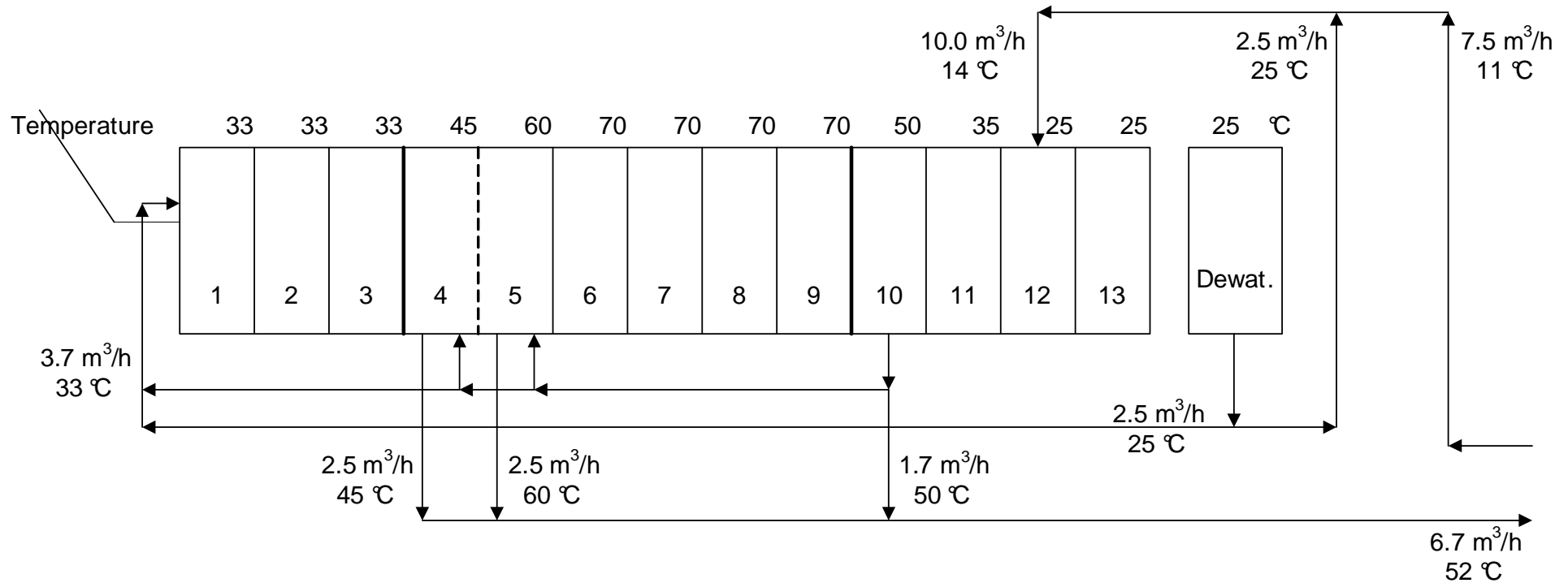
- Tunnel washer: 13 compartments of 50 kg loading
- Charges: 50 kg white cotton, polyester/cotton
- Cycle time per compartment: 145 seconds (25 loads/h)
- Condition Pre / Main wash: 41°C / 90°C

High temperature washing process



- Throughput: 1241 kg/hr

Lower temperature washing process



- Throughput: 1241 kg/hr

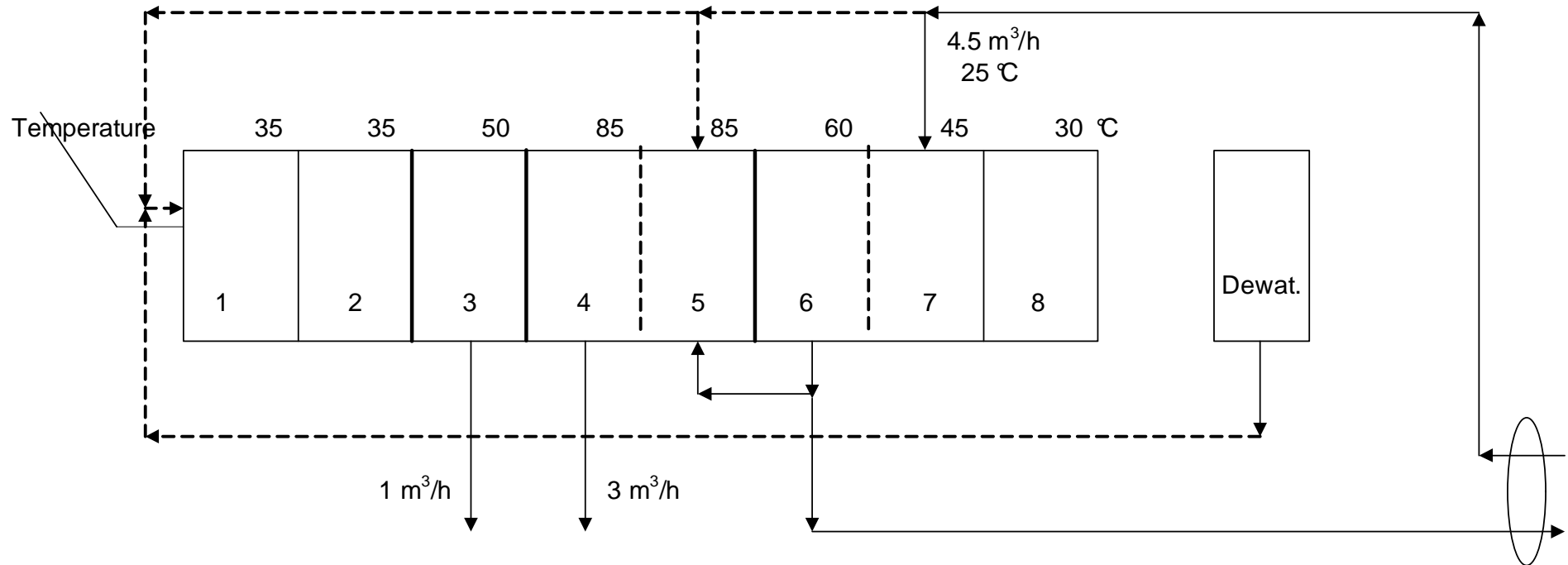
High vs lower temperature washing

Main wash temperature	90	70	°C
Consumption			
Chemicals	12.4	12.4	kg/h
Steam	725	568	kg/h
Water	7.5	7.5	m ³ /h
Textile	6.2	5.0	kg/h
Costs			
Chemicals	10	15	€/ton laundry
Steam	13.7	10.8	€/ton laundry
Water	7.9	7.9	€/ton laundry
Textile	37.5	30	€/ton laundry
Total costs	69.2	63.7	€/ton laundry
Excl. textile	31.6	33.7	€/ton laundry

Case 2-High temperature washing process

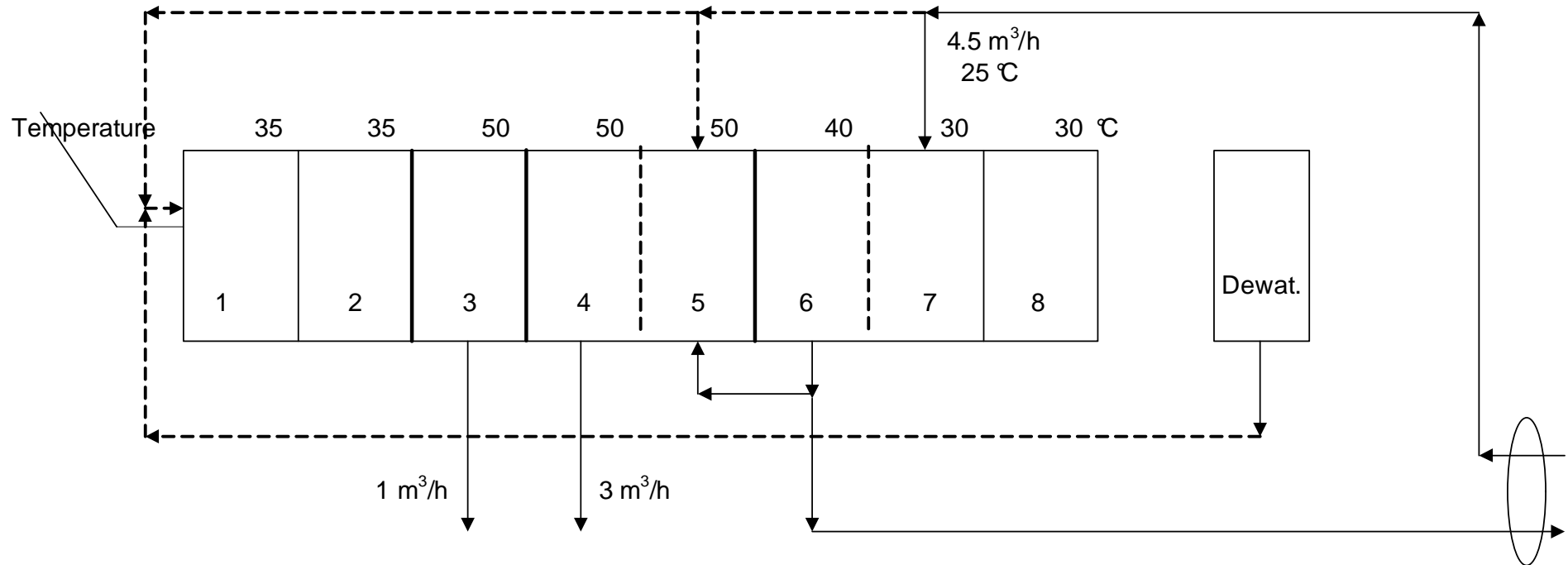
- Tunnel washer: 8 compartments of 50 kg loading
- Charges: 32 kg (average) coloured and white
 - cotton: 50 kg (33%)
 - polyester/cotton 50/50: 30 kg (33%)
 - quilts/blankets: 20 kg (33%)
- Cycle time per compartment: 5 minutes (12 loads/h)
- Capacity loss due to changing programs: 42%
- Condition Pre / Main wash: 35°C / 85°C

High temperature washing process



- Throughput: 222 kg/hr

Low temperature washing process

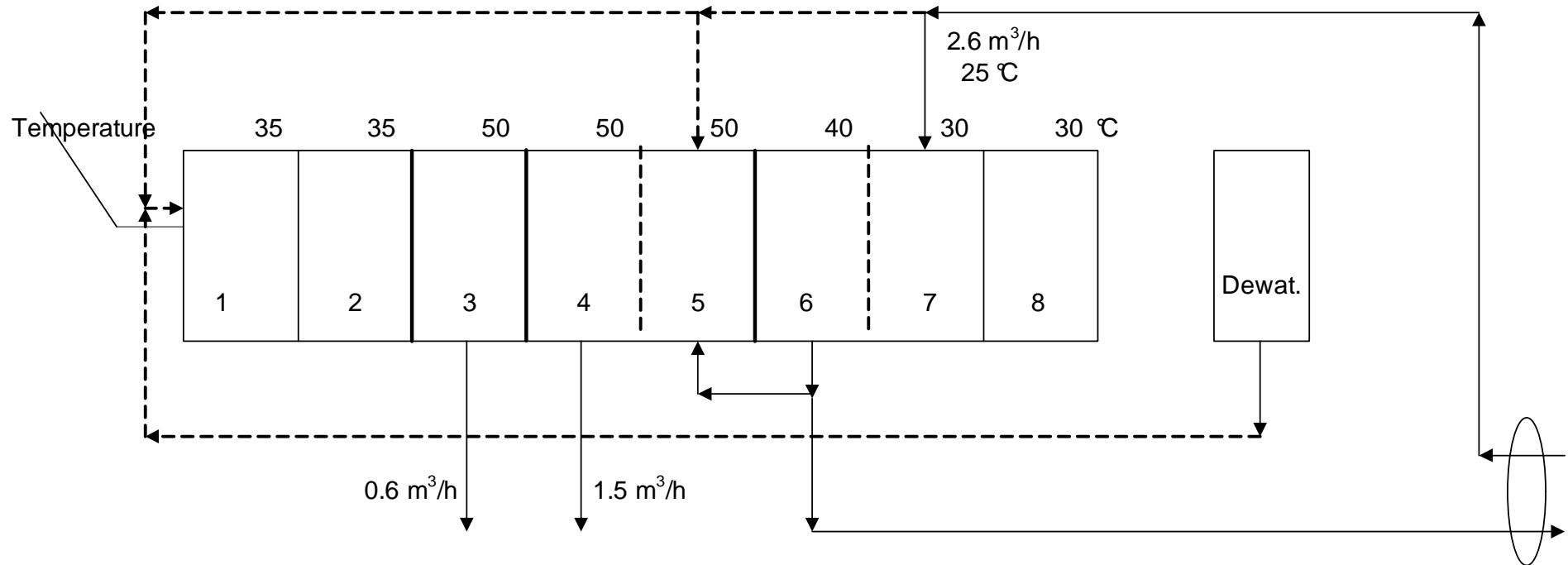


- Throughput: 222 kg/hr

High vs low temperature washing

Main wash temperature	85	50	°C
Consumption			
Chemicals	16.8	16.7	kg/h
Steam	410	200	kg/h
Water	4.5	4.5	m ³ /h
Textile	1.1	0.6	kg/h
Costs			
Chemicals	75.5	135.5	€/ton laundry
Steam	43.3	21.1	€/ton laundry
Water	26.6	26.6	€/ton laundry
Textile	37.5	18.8	€/ton laundry
Total costs	183	202	€/ton laundry

Low temperature washing process



- Throughput: 346 kg/hr; capacity loss: 27%
- Production: 50 kg cotton, 50 kg polyester/cotton 50-50, 20 kg quilts/blanket
- Less water & chemistry (10%) consumption

High vs low temperature washing

Main wash temperature	85	50	50	°C
Throughput	222	222	346	kg/h
Consumption				
Chemicals	16.8	16.7	21.1	kg/h
Steam	410	200	105	kg/h
Water	4.5	4.5	2.6	m ³ /h
Textile	1.1	0.6	0.87	kg/h
Costs				
Chemicals	75.5	135.5	122	€/ton laundry
Steam	43.3	21.1	7.1	€/ton laundry
Water	26.6	26.6	9.9	€/ton laundry
Textile	37.5	18.8	18.8	€/ton laundry
Total costs	183	202	157.7	€/ton laundry

Conclusion

- Higher chemicals price cannot be compensated by energy savings alone.
- Textile savings (very) important
- Washing process at low temperature needs to be evaluated for each laundry