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Power and Energy Systems
Technologies & Economics

Case Study
Rankine Cycle in T-s Diagram
Calculated with FluidEXL

Notes:

1. Cells with black characters include inputs
2. Cells with red characters include formulas
3. Download of the FluidEXL software tool is required !
4. Read FluidEXL brief instruction in the **Toolbox** of the book !
5. Read introduction in the Case Study chapter of the book !

Last update March 2016

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Disclaimer

The Examples are solely and exlusively indented to provide support and assistance to the readers for practicing and better understanding of the theoretical part of this book.

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The author, Panos Konstantin, believes that all information and guidance provided and all calculations in these examples are correct. Nevertheless anyone using these examples should carry out their own due dilligence and appraisal of the contents.

No warranty is made nor responsibility or liability is taken or accepted by the author for adequacy, completeness or accuracy of the examples or assumptions on which they are based.

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Proposals for improvements of the contents are welcome and will be considered in upcoming updates!

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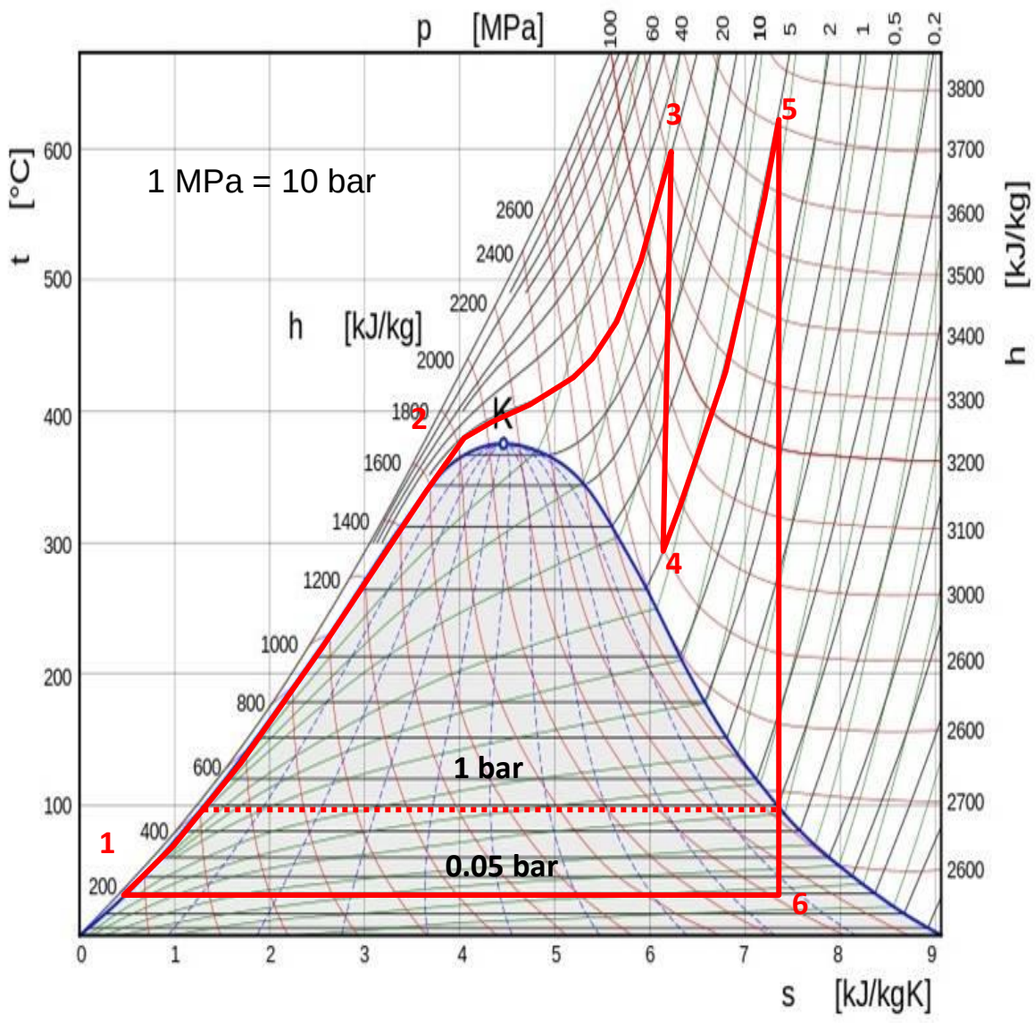
Power Plant 285 bar/600 °C; Reheating to 60 bar/ 620 °C; Expansion to 0.05 bar/33°C

Point	Pressure p	Temperature t	Enthalpy h	Entropy s	Vapor fraction x	
	bar	°C	kJ / kg	KJ / kg K	kg/kg	
1	0.05	32.9	137.8	0.48	0.00	saturated water
3	285	600.0	3461.0	6.27	1.00	superheated steam, isobaric heat input 1 to 3
4	60	336.9	3005.8	6.27	1.00	superheated steam, isentropic expansion 3 to 4
5	60	620.0	3705.8	7.22	1.00	superheated steam, isobaric heat input 4 to 5
6	0.05	32.9	2202.3	7.22	0.85	wet steam, isentropic expansion 5 to 6
1	0.05	32.9	137.8	0.48	0.00	saturated water, condensation 6 to 1

Item	Symbols	Unit	Value	
Mass flow	**m**	kg	1	
Heat input 1 - 3	Q_{in}	kJ/kg	3,323	isobaric heat input
Heat input 4 - 5			700	isobaric reheat input
Condenser 6 - 1	Q_{out}	kJ/kg	2,065	heat rejection in condenser
Mechanical work	**W =** $Q_{out} - Q_{in}$	kJ / kg	1,959	
		kWh / t	544	
Cycle efficiency	$\eta = W / Q_{in}$	%	48.7%	
Steam content of exhaust steam		%	85.2%	

Rankine Cycle 285 bar/600 °C; Reheating to 620 °C; Expansion to 0.05 bar/33°C



Point	Pressure p	Temperature t	Enthalpy h	Entropy s
	bar	°C	kJ / kg	KJ / kg K
1	0.05			
3	285	600.0		
4	60			
5	60	620.0		
6	0.05			
1	0.05			

Item	Symbols	Unit	Value
Mass flow	**m**	**kg**	
Heat input 1 - 3 **Heat input 4 - 5**	Q_{in}	kJ / kg	
Condenser 6 - 1	Q_{out}	kJ / kg	
Mechanical work	**W =** $Q_{out} - Q_{in}$	kJ / kg kWh/t	
Cycle efficiency	$h = W / Q_{in}$	%	
Steam content of exhaust steam		%	

Note: All empty cells shall be calculated

Steam content x
kg /kg
0.00
1.00
1.00
1.00

Rankine Cycle 285 bar/600 °C; Reheating to 620 °C; Expansion to 0.05 bar/33°C