Panos Konstantin

Power and Energy Systems
Technologies & Economics

Case Study
Cycle Simulation
Extraction-Condensing, No-Reheat

Notes:
1. Cells with black characters include inputs
2. Cells with red characters include formulas
3. Download of FluidEXL required for calculations
4. Read brief instruction for FluidEXL in the **Toolbox** in the book
5. Read introduction and notes in Case Study chapter of the book

The purpose of this Case Study is:
1. Training in calculation of thermodynamic cycles using FluidEXL
2. Calculation of performance parameters for cogeneration such as σ, β, η_{cond}, η_{total}

Last update March. 2016

Panos Konstantin

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.

.

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.

.

The author does not assume any liability to anyone for any loss or damage caused by any error or omission in this work, regardless of wether such error or omission is the result of negligence or any other reason. Any and all such liability is completely disclaimed.

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

Last Update March 2016

The workbook can be used to calculate Performance paramters for cogeneration
(also see examples 6-2 and 6-3and Figure 6-7) in the book)

Example: Calculate "electrical equivalent β" for the steam extraction of 12 bar:
insert a value for steam extraction at 12 bar in the input spreadsheet, e.g. 50 t/h
Insert 0 t/h for the extractions at 6 bar and 3 bar
Power output at condensing mode 175 MW
Power output at cogen mode 164.8 MW
Extracted steam 50 t/h = 35.4 MW_t
Electrical equivalent:
β=(175-164.8)/50=0.20 MWe/t
β=(175-164.8)/35.4 =0.2.88 MW_e/MW_t

Make inputs only here	Unit	Operation mode	
		Cond.	Cogen
Live steam	t/h	561.6	561.6
Pressure	bar	110	110
Temparature	°C	540	540
Saturation temperature	°C	318	318
Process Steam extraction	t/h	0	50
Pressure	bar	12	12
Terminal temperature difference	K	2.0	2.0
Process Steam extraction	t/h	0	0
Pressure	bar	6	6
Terminal temperature difference	K	3.0	3.0
Process Steam extraction	t / h	0	0
Pressure	bar	3	3
Terminal temperature difference	K	5	5
LP bleed	bar	0.8	0.8
Terminal temperature difference	K	5.0	5.0
LP bleed	bar	0.3	0.3
Terminal temperature difference	K	7	7
Condesing steam pressure	bar	0.045	0.045
Boiler efficiency	%	92.0%	92.0%
ST- internal efficiency	%	89.0%	89.0%
Generator efficiency	%	98.0%	98.0%
ST- mechanical efficiency	%	99.5%	99.5%
Condesate return rate	%	0%	100.0%
Condesater temperature	°C	0	90
make-up water	°C	15	15

Altering inputs in yellow cells only

Use goal seek function of Excel to alter power output
Fixed cannot be changed
Fixed cannot be changed

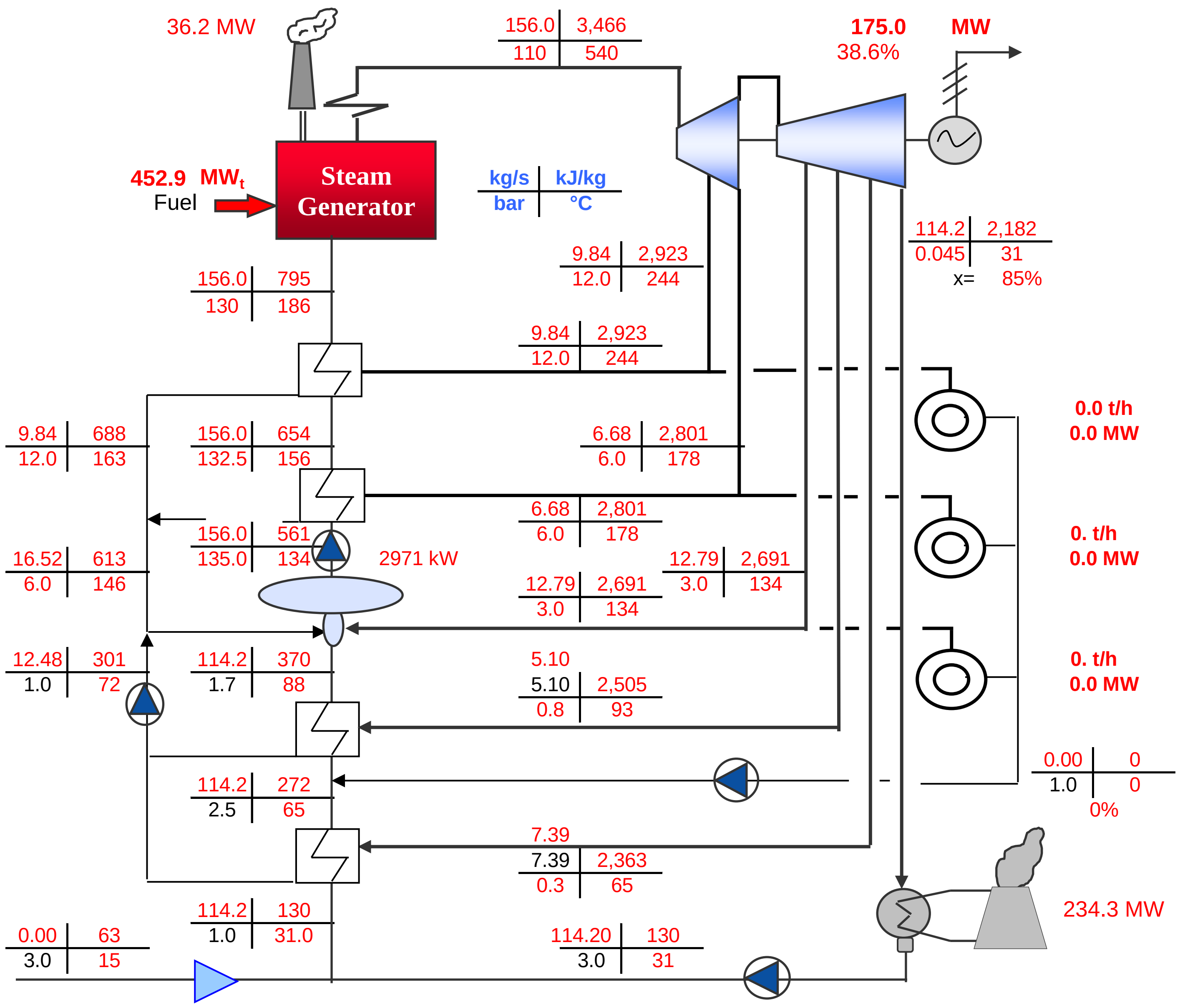
12 ± 2 bar allowed

6 ± 1 bar allowed

3 ± 1 bar allowed

Fixed cannot be changed
Fixed cannot be changed
Fixed cannot be changed
Fixed cannot be changed

TE-CaseStudy-11_Modelling-Simulation-Extraction-Cond-Rankine-Cycle_No-Reheat.xls
Condensing mode _no reheat

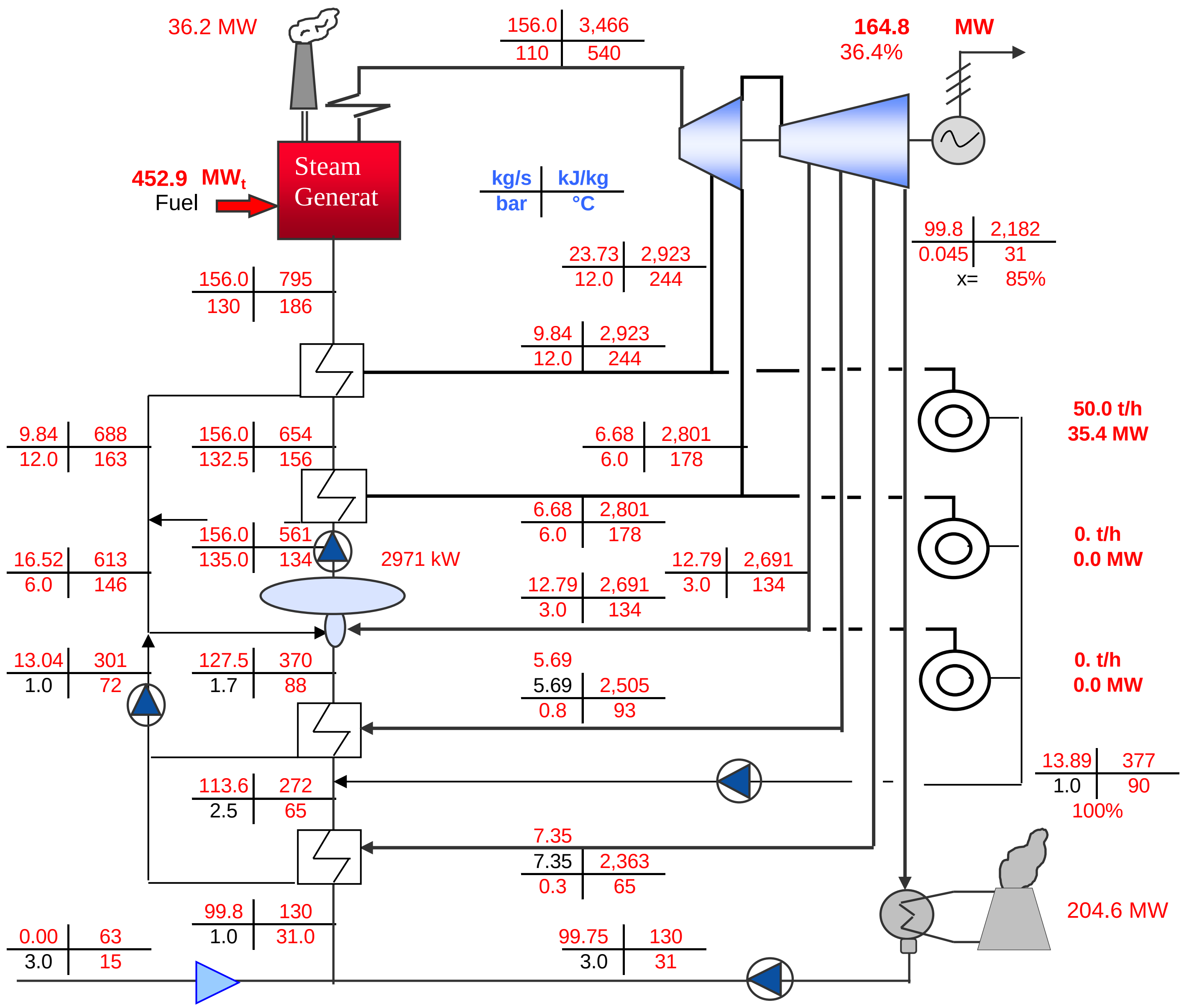


Panos Konstantin
Technologies & Economics

Power output, gross	MW	175.0
Fuel capacity	MW	452.9
Live steam	MW	452.9
Reheat steam	MW	0
Electrical efficiency	%	38.64%
Total efficiency	%	38.64%

2016-07-29

TE-CaseStudy-11_Modelling-Simulation-Extraction-Cond-Rankine-Cycle_No-Reheat.xls
Cogen mode _no reaheat



Panos Konstantin
Technologies & Economics

Generatorleistung, brutto	MW	164.8
Feuerungswärmeleistung:	MW	452.9
Frischdampf	MW	452.9
Zwischenüberhitzung	MW	0
Bruttowirkungsgrad	%	36.38%
Gesamtwirkungsgrad	%	44.19%

2016-07-29