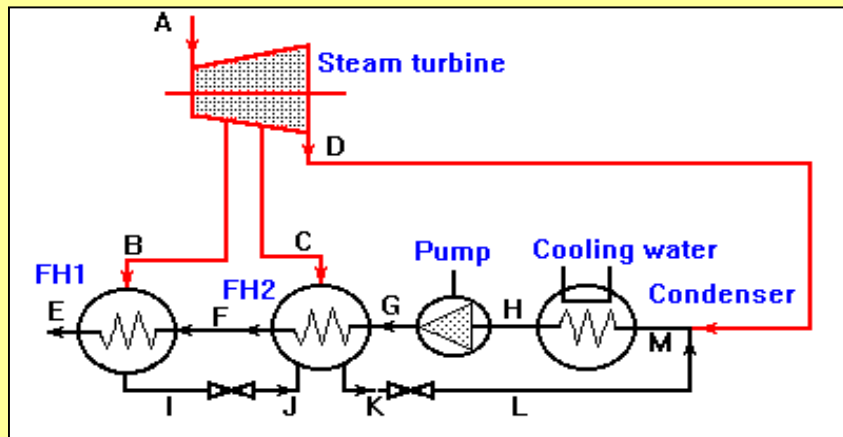


Regenerative steam cycle

This document shows how Thermo Utilities, MS Excel Add-ins can be used for calculation of regenerative steam cycle.

A regenerative steam cycle uses two closed-feed heaters. Determine the amount of steam bled at each stage, the work output of the plant and cycle efficiency. It is known that: $p_A=40$ bar, $t_A=500$ C, $p_B=10$ bar, $p_C=1.0$ bar, $p_D=0.035$ bar. Isentropic efficiency of the steam turbine and pump are 0.85 and 0.90 respectively. Boiler supplies 10 kg/s steam to the turbine.



Inputs		Units	Error ?
Pressure at A	40.00	bar	
temperature at A	500.00	C	
Pressure at B	10.00	bar	
Pressure at C	1.00	bar	
Pressure at D	0.035	bar	
Pressure at G	40.00	bar	
Mass flow through the system	10.00	kg/s	
Turbine isentropic eff.	0.85		
Pump isentropic eff.	0.90		
Outputs			
Spec. enthalpy at A	3444.99	kJ/kg	
Spec. entropy at A	7.09	kJ/(kg.K)	
Isentropic enthalpy at B	3032.71	kJ/kg	
Spec. enthalpy at B	3094.55	kJ/kg	
Power generated at stage 1, POW1	3504.33	kW	
Spec. entropy at B	7.20	kJ/(kg.K)	
Isentropic enthalpy at C	2615.07	kJ/kg	
Spec. enthalpy at C	2686.99	kJ/kg	
Power generated at stage 2, POW2	3472.49	kW	
Spec. entropy at C	7.39	kJ/(kg.K)	
Isentropic enthalpy at D	2210.69	kJ/kg	
Spec. enthalpy at D	2282.14	kJ/kg	
Power generated at stage 3, POW3	3003.49	kW	
Spec. enthalpy at H	111.85	kJ/kg	
Spec. entropy at H	0.39	kJ/(kg.K)	
Isentropic enthalpy at G	116.00	kJ/kg	
Spec. enthalpy at G	116.47	kJ/kg	
Power req. for pump	46.21	kW	
For the throttling process, I-J			

Regenerative steam cycle

hE = hI = hJ	762.61	kJ/kg		
For the throttling process, K-L				
hF = hK = hL	417.51	kJ/kg		
Energy balance on FH1 gives, mB	1.48	kg/s		
Energy balance on FH2 gives, mC	1.10	kg/s		
Net power generated	9934.10	kW		
Cycle efficiency	0.370			
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