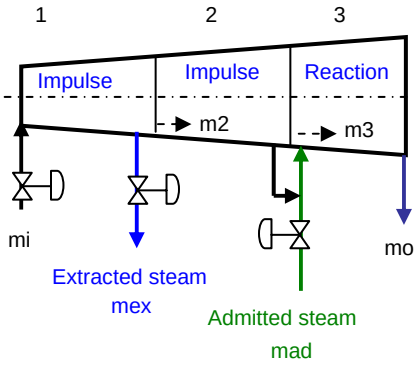
Logo

STEAM TURBINE CALCULATION SHEET

STEAM CONSUMPTION

No.	Designation		Quantity		Note and additional information
1			EXTRACTION AND ADMISSION		
2	Turbine type		IMPULSE+IMPULSE+REACTION		
3					
4			CONDENSING TURBINE		
5	REQUIRED CONDITION				
6			Normal	Rated	
7	Steam flow available, m	ton/hr	40		
8	N	RPM	7000		
9	pi	bar A	100		
10	ti	C	550		
11	Extracted pressure	bar A	40		
12	Extracted steam mass flow, mex	ton/hr	5		
13	Admitted pressure	bar A	5		
14	Admitted temperature	C	300		m2 = mi - mex, m3 = m2 + mad = mo
15	Admitted steam mass flow, mad	ton/hr	5		
16	po	bar A	0.12		
17	STEAM DATA				
18					
19	hi	kJ/kg	3490		See steam Mollier diagram, point A.
20	hos	kJ/kg	2155		See steam Mollier diagram, point C
21	Δhs	kJ/kg	1335		= hi - hos
22	Governor valve factor		0.97		Multi valve 0.97, single valve 0.93
23	Δhs'	kJ/kg	1295.0		= Gov. vlv. Factor x Δhs (equation 11)
24	hos'	kJ/kg	2195.1		See diagram, point B1
25	pi'	bar A	80		
26	ti'	C	540		
27	vi'	m^3/kg	0.0444		See steam table at pi' and ti'
28	CALCULATION				
29			*1'st Section*	*2'nd Section*	*3'rd Section*
30	Steam inlet flow	ton/hr	40	35	40
31	hi		3490	3323.8	2919.4
32	po	bar A	40	5	0.12
33	hos'	kJ/kg	3260	2780	2300
34	Head, Δhs'	kJ/kg	230	543.8	619.4
35	vi		0.0444	0.080	0.460
36	Selected dia., D	mm	600	600	700
37	Base diameter for reaction	mm	-	-	630
38	Peripheral velocity, U	m/s	220.3	220.3	257.0
39	Calculated Number of stage		2.02	4.78	9.80
40	Selected Number of stage, z		2	5	10
41	Head coefficient, μ_s and Vrat		2.4	2.2	0.73
42	Efficiency, η_{05} for impulse		0.81	0.82	-
43	Entrance area factor, A		34	34	34
44	l x ε	mm	2.255	3.656	70
45	Average nozzle height, l		25	25	70
46	Selected ε		0.090	0.146	1.0
47					



Mix steam for section 3

Decide in integer number

Equation 15 for impulse

Select l so that ε within the range

Average ε impulse may < 0.45

No.	Designation		Quantity		Note and additional information	
1						
2	D/l		-	-	10	
3	S/l		-	-	0.4	
4	Efficiency factor Fl		0.97	0.97	1.00	Figure 13
5	Efficiency factor Fe		0.915	0.933	1.000	Equation in figure 13
6	Efficiency, η		0.723	0.744	0.860	= η_{05} x F_l x Fε for impulse
7	Δhe	kJ/kg	166.2	404.4	532.7	= ηx Δhs'
8	he	kJ/kg	3323.8	2919.4	2386.7	
9	Exh. temperature or fraction, to,X	C	450	225	0.925	
10	Exhaust specific volume, vo	m^3/kg	0.08	0.451	12.28	Steam diagram
11	P_{LOSS}	kW	103.21	17.31	0.17	
12	Wet enthalpy	kJ/kg	-	-	2700	
13	Wet eficiency, η_{WET}		-	-	0.978	
14	Reaction efficiency		-	-	0.841	
15	Output power	kW	1743	3914	4978	
16	Total output power	kW	10635			
17	Mech. Eff., η_m		0.995			
18	BHP	kW	10582			
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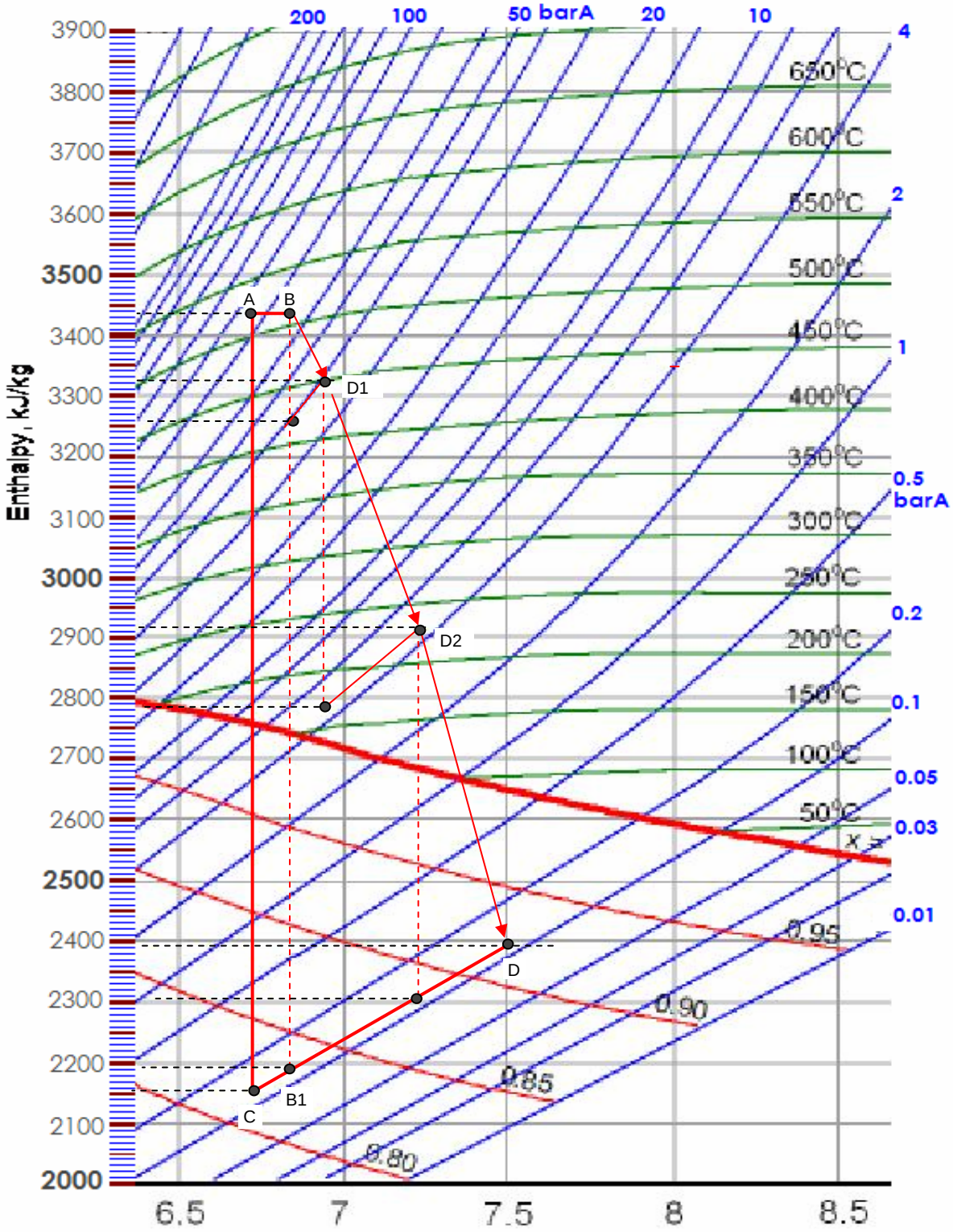
200
100
50 barA
20
10
4
2
1
0.5 barA
0.2
0.1
0.05
0.03
0.01
650°C
600°C
550°C
500°C
450°C
400°C
350°C
300°C
250°C
200°C
150°C
100°C
50°C
x =
0.95
0.90
0.85
0.80
Enthalpy, kJ/kg
3900
3800
3700
3600
3500
3400
3300
3200
3100
3000
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
6.5
7
7.5
8
8.5
A
B
D1
D2
D
B1
C