LAMPIRAN 1

Tabel iterasi % air dan % uap dari air yang dicerat pada tekanan air masuk 1 Kg/cm^2 dan kevakuman 755 mmHg

Temp.Air yang dicekik	Entalpi air yg dicekik	hg air cekik - hf vakum 755 mmHg abs	Entalpi vapour vakum 755	Entalpi liquid vakum 755				20.06 l/h = 5.6 g/s		
T (ºC)	hg (kj/kg)	(kj/kg)	hf (kj/kg)	hf (kj/kg)	hf 755 - hg 755 (kj/kg)	% fasa uap air	% fasa air	m air yang dicekik (g/s)	m fasa uap air (g/s)	m fasa air (g/s)
36	150.86	145.84	2502.7	5.022	2497.678	5.83894321	94.16105679	5.6	0.32698082	5.27301918
37	155.04	150.02	2502.7	5.022	2497.678	6.00629865	93.99370135	5.6	0.336352724	5.263647276
38	159.02	154.00	2502.7	5.022	2497.678	6.165646653	93.83435335	5.6	0.345276213	5.254723787
39	163.40	158.38	2502.7	5.022	2497.678	6.34100953	93.65899047	5.6	0.355096534	5.244903466
40	167.57	162.55	2502.7	5.022	2497.678	6.507964598	93.4920354	5.6	0.364446017	5.235553983
41	171.75	166.73	2502.7	5.022	2497.678	6.675320037	93.32467996	5.6	0.373817922	5.226182078
42	175.93	170.91	2502.7	5.022	2497.678	6.842622094	93.15737791	5.6	0.383186837	5.216813163
43	180.11	175.08	2502.7	5.022	2497.678	7.00988602	92.99011398	5.6	0.392553617	5.207446383
44	184.28	179.26	2502.7	5.022	2497.678	7.177149946	92.82285005	5.6	0.401920397	5.198079603
45	188.46	183.44	2502.7	5.022	2497.678	7.344413873	92.65558613	5.6	0.411287177	5.188712823
46	192.64	187.62	2502.7	5.022	2497.678	7.511677799	92.4883222	5.6	0.420653957	5.179346043
47	196.82	191.80	2502.7	5.022	2497.678	7.678941725	92.32105828	5.6	0.430020737	5.169979263
48	200.99	195.97	2502.7	5.022	2497.678	7.846205651	92.15379435	5.6	0.439387516	5.160612484
49	205.17	200.15	2502.7	5.022	2497.678	8.013469577	91.98653042	5.6	0.448754296	5.151245704
50	209.36	204.34	2502.7	5.022	2497.678	8.181118623	91.81888138	5.6	0.458142643	5.141857357
51	213.53	208.51	2502.7	5.022	2497.678	8.348073691	91.65192631	5.6	0.467492127	5.132507873
52	217.71	212.69	2502.7	5.022	2497.678	8.515429131	91.48457087	5.6	0.476864031	5.123135969
53	221.89	216.87	2502.7	5.022	2497.678	8.68278457	91.31721543	5.6	0.486235936	5.113764064
54	226.07	221.05	2502.7	5.022	2497.678	8.85014001	91.14985999	5.6	0.495607841	5.104392159
55	230.25	225.23	2502.7	5.022	2497.678	9.01749545	90.98250455	5.6	0.504979745	5.095020255
56	234.43	229.41	2502.7	5.022	2497.678	9.18485089	90.81514911	5.6	0.51435165	5.08564835
57	238.61	233.59	2502.7	5.022	2497.678	9.352206329	90.64779367	5.6	0.523723554	5.076276446
58	242.79	237.77	2502.7	5.022	2497.678	9.519561769	90.48043823	5.6	0.533095459	5.066904541
59	246.97	241.95	2502.7	5.022	2497.678	9.686917209	90.31308279	5.6	0.542467364	5.057532636
60	251.15	246.13	2502.7	5.022	2497.678	9.854272648	90.14572735	5.6	0.551839268	5.048160732
61	255.33	250.31	2502.7	5.022	2497.678	10.02162809	89.97837191	5.6	0.561211173	5.038788827
62	259.51	254.49	2502.7	5.022	2497.678	10.18898353	89.81101647	5.6	0.570583078	5.029416922
63	263.69	258.67	2502.7	5.022	2497.678	10.35633897	89.64366103	5.6	0.579954982	5.020045018
64	267.88	262.86	2502.7	5.022	2497.678	10.52409478	89.47590522	5.6	0.589349308	5.010650692
65	272.06	267.04	2502.7	5.022	2497.678	10.69145022	89.30854978	5.6	0.598721212	5.001278788
66	276.24	271.22	2502.7	5.022	2497.678	10.85880566	89.14119434	5.6	0.608093117	4.991906883
67	280.42	275.39	2502.7	5.022	2497.678	11.02597546	88.97402454	5.6	0.617454626	4.982545374

68	284.61	279.59	2502.7	5.022	2497.678	11.19391691	88.80608309	5.6	0.626859347	4.973140653
69	288.76	283.74	2502.7	5.022	2497.678	11.36007123	88.63992877	5.6	0.636163989	4.963836011
70	292.98	287.96	2502.7	5.022	2497.678	11.52902816	88.47097184	5.6	0.645625577	4.954374423
71	297.17	292.15	2502.7	5.022	2497.678	11.69678397	88.30321603	5.6	0.655019902	4.944980098
72	301.35	296.33	2502.7	5.022	2497.678	11.86413941	88.13586059	5.6	0.664391807	4.935608193
73	305.54	300.52	2502.7	5.022	2497.678	12.03189522	87.96810478	5.6	0.673786133	4.926213867
74	309.73	304.71	2502.7	5.022	2497.678	12.19965104	87.80034896	5.6	0.683180458	4.916819542
75	313.92	308.90	2502.7	5.022	2497.678	12.36740685	87.63259315	5.6	0.692574783	4.907425217
76	318.11	313.09	2502.7	5.022	2497.678	12.53516266	87.46483734	5.6	0.701969109	4.898030891
77	322.30	317.28	2502.7	5.022	2497.678	12.70291847	87.29708153	5.6	0.711363434	4.888636566
78	326.49	321.47	2502.7	5.022	2497.678	12.87067428	87.12932572	5.6	0.72075776	4.87924224
79	330.68	325.66	2502.7	5.022	2497.678	13.03843009	86.96156991	5.6	0.730152085	4.869847915
80	334.88	329.86	2502.7	5.022	2497.678	13.20658628	86.79341372	5.6	0.739568832	4.860431168
81	339.07	334.05	2502.7	5.022	2497.678	13.37426201	86.62573799	5.6	0.748958673	4.851041327
82	343.26	338.24	2502.7	5.022	2497.678	13.5420979	86.4579021	5.6	0.758357482	4.841642518
83	347.45	342.43	2502.7	5.022	2497.678	13.70993379	86.29006621	5.6	0.767756292	4.832243708
84	351.66	346.64	2502.7	5.022	2497.678	13.87841027	86.12158973	5.6	0.777190975	4.822809025
85	355.86	350.84	2502.7	5.022	2497.678	14.04645969	85.95354031	5.6	0.786601742	4.813398258
86	360.06	355.04	2502.7	5.022	2497.678	14.21461587	85.78538413	5.6	0.796018489	4.803981511
87	364.26	359.24	2502.7	5.022	2497.678	14.38277205	85.61722795	5.6	0.805435235	4.794564765
88	368.46	363.44	2502.7	5.022	2497.678	14.55092824	85.44907176	5.6	0.814851981	4.785148019
89	372.66	367.64	2502.7	5.022	2497.678	14.71908442	85.28091558	5.6	0.824268727	4.775731273
90	376.86	371.84	2502.7	5.022	2497.678	14.8872406	85.1127594	5.6	0.833685474	4.766314526
91	381.06	376.04	2502.7	5.022	2497.678	15.05539679	84.94460321	5.6	0.84310222	4.75689778
92	385.26	380.24	2502.7	5.022	2497.678	15.22355297	84.77644703	5.6	0.852518966	4.747481034
93	389.46	384.44	2502.7	5.022	2497.678	15.39170915	84.60829085	5.6	0.861935713	4.738064287
94	393.68	388.66	2502.7	5.022	2497.678	15.56077285	84.43922715	5.6	0.871403279	4.728596721
95	397.89	392.87	2502.7	5.022	2497.678	15.7293294	84.2706706	5.6	0.880842446	4.719157554
96	402.10	397.08	2502.7	5.022	2497.678	15.89788596	84.10211404	5.6	0.890281614	4.709718386
97	406.31	401.29	2502.7	5.022	2497.678	16.06644251	83.93355749	5.6	0.899720781	4.700279219
98	410.52	405.50	2502.7	5.022	2497.678	16.23499907	83.76500093	5.6	0.909159948	4.690840052
99	414.73	409.71	2502.7	5.022	2497.678	16.40355562	83.59644438	5.6	0.918599115	4.681400885
100	418.94	413.92	2502.7	5.022	2497.678	16.57211218	83.42788782	5.6	0.928038282	4.671961718

LAMPIRAN 2

Tabel iterasi daya AC yang digunakan pada tekanan air masuk 1 Kg/cm^2 dan kevakuman 755 mmHg

T (ºC)	Beban pendinginan uap (watt)	daya AC (watt)
36	816.6928	233.3408
37	840.1008	240.0288
38	862.3888	246.3968
39	886.9168	253.4048
40	910.2688	260.0768
41	933.6768	266.7648
42	957.0773333	273.4506667
43	980.4725333	280.1350095
44	1003.867733	286.8193524
45	1027.262933	293.5036952
46	1050.658133	300.1880381
47	1074.053333	306.872381
48	1097.448533	313.5567238
49	1120.843733	320.2410667
50	1144.2928	326.9408
51	1167.6448	333.6128
52	1191.0528	340.3008
53	1214.4608	346.9888
54	1237.8688	353.6768
55	1261.2768	360.3648
56	1284.6848	367.0528
57	1308.0928	373.7408
58	1331.5008	380.4288
59	1354.9088	387.1168
60	1378.3168	393.8048
61	1401.7248	400.4928
62	1425.1328	407.1808
63	1448.5408	413.8688
64	1472.0048	420.5728
65	1495.4128	427.2608
66	1518.8208	433.9488
67	1542.202835	440.6293815
68	1565.6928	447.3408
69	1588.9328	453.9808
70	1612.5648	460.7328
71	1636.0288	467.4368
72	1659.4368	474.1248

73	1682.9008	480.8288
74	1706.3648	487.5328
75	1729.8288	494.2368
76	1753.2928	500.9408
77	1776.7568	507.6448
78	1800.2208	514.3488
79	1823.6848	521.0528
80	1847.2048	527.7728
81	1870.6576	534.4736
82	1894.1328	541.1808
83	1917.608	547.888
84	1941.1728	554.6208
85	1964.677867	561.3365333
86	1988.197867	568.0565333
87	2011.717867	574.7765333
88	2035.237867	581.4965333
89	2058.757867	588.2165333
90	2082.277867	594.9365333
91	2105.797867	601.6565333
92	2129.317867	608.3765333
93	2152.837867	615.0965333
94	2176.4848	621.8528
95	2200.0608	628.5888
96	2223.6368	635.3248
97	2247.2128	642.0608
98	2270.7888	648.7968
99	2294.3648	655.5328
100	2317.9408	662.2688

LAMPIRAN 3

Tabel iterasi daya water heater yang digunakan pada tekanan air masuk 1 Kg/cm^2 dan kevakuman 755 mmHg

Temp.Air yang dicekik	Water Heater		
T (°C)	ΔT (To = 25 °C)(°C)	Cp (J/Kg °C)	Q (watt)
36	11	4200	258.72
37	12	4200	282.24
38	13	4200	305.76
39	14	4200	329.28
40	15	4200	352.8
41	16	4200	376.32
42	17	4200	399.84
43	18	4200	423.36
44	19	4200	446.88
45	20	4200	470.4
46	21	4200	493.92
47	22	4200	517.44
48	23	4200	540.96
49	24	4200	564.48
50	25	4200	588
51	26	4200	611.52
52	27	4200	635.04
53	28	4200	658.56
54	29	4200	682.08
55	30	4200	705.6
56	31	4200	729.12
57	32	4200	752.64
58	33	4200	776.16
59	34	4200	799.68
60	35	4200	823.2
61	36	4200	846.72
62	37	4200	870.24
63	38	4200	893.76
64	39	4200	917.28
65	40	4200	940.8
66	41	4200	964.32
67	42	4200	987.84
68	43	4200	1011.36
69	44	4200	1034.88

70	45	4200	1058.4
71	46	4200	1081.92
72	47	4200	1105.44
73	48	4200	1128.96
74	49	4200	1152.48
75	50	4200	1176
76	51	4200	1199.52
77	52	4200	1223.04
78	53	4200	1246.56
79	54	4200	1270.08
80	55	4200	1293.6
81	56	4200	1317.12
82	57	4200	1340.64
83	58	4200	1364.16
84	59	4200	1387.68
85	60	4200	1411.2
86	61	4200	1434.72
87	62	4200	1458.24
88	63	4200	1481.76
89	64	4200	1505.28
90	65	4200	1528.8
91	66	4200	1552.32
92	67	4200	1575.84
93	68	4200	1599.36
94	69	4200	1622.88
95	70	4200	1646.4
96	71	4200	1669.92
97	72	4200	1693.44
98	73	4200	1716.96
99	74	4200	1740.48
100	75	4200	1764

LAMPIRAN 4

Tabel iterasi daya pompa 1 yang digunakan pada tekanan air masuk 1 Kg/cm^2 dan kevakuman 755 mmHg

Temp.Air yang dicekik T (°C)	m fasa air (g/s)	Pompa 1		
		H (m)	γ (N/m3)	P (watt)
36	222.72	10.26	9810	0.530732544
37	245.24	10.26	9810	0.529789256
38	267.76	10.26	9810	0.528891102
39	290.28	10.26	9810	0.527902681
40	312.8	10.26	9810	0.52696165
41	335.32	10.26	9810	0.526018362
42	357.84	10.26	9810	0.525075375
43	380.36	10.26	9810	0.524132603
44	402.88	10.26	9810	0.523189831
45	425.4	10.26	9810	0.522247059
46	447.92	10.26	9810	0.521304287
47	470.44	10.26	9810	0.520361515
48	492.96	10.26	9810	0.519418743
49	515.48	10.26	9810	0.518475971
50	538	10.26	9810	0.517531028
51	560.52	10.26	9810	0.516589997
52	583.04	10.26	9810	0.515646709
53	605.56	10.26	9810	0.514703421
54	628.08	10.26	9810	0.513760133
55	650.6	10.26	9810	0.512816846
56	673.12	10.26	9810	0.511873558
57	695.64	10.26	9810	0.51093027
58	718.16	10.26	9810	0.509986982
59	740.68	10.26	9810	0.509043694
60	763.2	10.26	9810	0.508100407
61	785.72	10.26	9810	0.507157119
62	808.24	10.26	9810	0.506213831
63	830.76	10.26	9810	0.505270543
64	853.28	10.26	9810	0.504324999
65	875.8	10.26	9810	0.503381711
66	898.32	10.26	9810	0.502438423
67	920.84	10.26	9810	0.501496181
68	943.36	10.26	9810	0.500549591
69	965.88	10.26	9810	0.499613073
70	988.4	10.26	9810	0.498660758

71	1010.92	10.26	9810	0.497715214
72	1033.44	10.26	9810	0.496771926
73	1055.96	10.26	9810	0.495826381
74	1078.48	10.26	9810	0.494880837
75	1101	10.26	9810	0.493935292
76	1123.52	10.26	9810	0.492989748
77	1146.04	10.26	9810	0.492044204
78	1168.56	10.26	9810	0.491098659
79	1191.08	10.26	9810	0.490153115
80	1213.6	10.26	9810	0.489205313
81	1236.12	10.26	9810	0.48826022
82	1258.64	10.26	9810	0.487314224
83	1281.16	10.26	9810	0.486368229
84	1303.68	10.26	9810	0.485418622
85	1326.2	10.26	9810	0.484471423
86	1348.72	10.26	9810	0.483523622
87	1371.24	10.26	9810	0.48257582
88	1393.76	10.26	9810	0.481628019
89	1416.28	10.26	9810	0.480680218
90	1438.8	10.26	9810	0.479732417
91	1461.32	10.26	9810	0.478784616
92	1483.84	10.26	9810	0.477836815
93	1506.36	10.26	9810	0.476889013
94	1528.88	10.26	9810	0.475936097
95	1551.4	10.26	9810	0.474986039
96	1573.92	10.26	9810	0.474035981
97	1596.44	10.26	9810	0.473085924
98	1618.96	10.26	9810	0.472135866
99	1641.48	10.26	9810	0.471185808
100	1664	10.26	9810	0.47023575

LAMPIRAN 5

Tabel data kalibrasi flow meter sekaligus data flow katup ekspansi

No.	Tekanan Air	Bukaan Katup (put.)							
		1/8		1/4		3/8		1/2	
		Tmb.	FM	Tmb.	FM	Tmb.	FM	Tmb.	FM
1.	0.5 Kg/cm^2	22.08	26.67	36.75	40.00	50.99	53.33	62.44	66.67
2.		21.97	20.00	36.68	33.33	51.49	53.33	61.39	66.67
3.		22.02	20.00	36.7	40.00	51.32	53.33	62.21	66.67
4.		22.07	20.00	36.34	40.00	51.71	60.00	62.15	66.67
5.		22.44	20.00	35.71	46.67	51.88	53.33	62.5	66.67
$\bar{x}$		22.12	21.33	36.44	40.00	51.48	54.67	62.14	66.67
1.	0.75 Kg/cm^2	24.33	26.67	41.77	46.67	62.85	66.67	78.27	86.67
2.		24.86	20.00	42.08	46.67	62.35	66.67	76.79	80.00
3.		25.06	26.67	42.07	40.00	62.96	66.67	76.39	80.00
4.		24.93	26.67	41.48	46.67	62.44	66.67	77.43	86.67
5.		24.9	26.67	41.94	40.00	62.97	66.67	78.77	80.00
$\bar{x}$		24.82	25.33	41.87	44.00	62.71	66.67	77.53	82.67
1.	1.0 Kg/cm^2	31.12	33.33	49.8	53.33	73.35	80.00	89.78	100.00
2.		30.55	33.33	49.48	53.33	72.74	73.33	87.36	86.67
3.		30.44	26.67	50.14	53.33	72.15	80.00	89.94	100.00
4.		31.08	33.33	49.45	46.67	73.46	73.33	91.26	93.33
5.		30.58	33.33	49.93	53.33	73.55	73.33	89.27	86.67
$\bar{x}$		30.75	32.00	49.76	52.00	73.05	76.00	89.52	93.33

No.	$\bar{x}$ Tmb. (gr/s)	$\bar{x}$ FM (gr/s)	Penyimpangan (gr/s)
1	22.12	21.33	-0.79
2	36.44	40.00	3.56
3	51.48	54.67	3.19
4	62.14	66.67	4.53
5	24.82	25.33	0.51
6	41.87	44.00	2.13
7	62.71	66.67	3.96
8	77.53	82.67	5.14
9	30.75	32.00	1.25
10	49.76	52.00	2.24
11	73.05	76.00	2.95
12	89.52	93.33	3.81
			$\bar{x}$ = 2.71

LAMPIRAN 6

Tabel data kalibrasi pressure indikator

No.	Tekanan Pada Kolom Air Raksa (Kg/cm^2)	Tekanan Pada Pressure Indikator (Kg/cm^2)	Penyimpangan (Kg/cm^2)
1	0.00	0.02	0.02
2	0.10	0.11	0.01
3	0.20	0.21	0.01
4	0.30	0.31	0.01
5	0.40	0.42	0.02
6	0.50	0.52	0.02
7	0.60	0.61	0.01
8	0.70	0.72	0.02
9	0.80	0.81	0.01
10	0.90	0.91	0.01
11	1.00	> 1.00	
			$\bar{x}$ = 0.01

LAMPIRAN 7

Tabel data kalibrasi vacuum gauge

No.	Vakum Pada Kolom Air Raksa (mmHg)	Vakum Pada Vacuum Gauge (mmHg)	Penyimpangan (mmHg)
1	0	0	0
2	100	75	25
3	200	170	30
4	300	270	30
5	400	370	30
6	500	470	30
7	600	570	30
8	700	670	30
9	750	720	30
			$\bar{x} = 30$

LAMPIRAN 8

Tabel data simulasi perhitungan efisiensi termal PLTU konvensional dan PLTU yang ditambahkan dengan alat throttling process

Vakum Tabung (mmHg)	Vakum kondensor (mmHg)	h2	h1	h3	h4	Beban Pend. AC	Daya AC	η_{th} (%)	Air Destilat (ton/h)
		(kj/kg)							
-755	748.48	1917	3411.8	56.375	64.649	25.77	4.10	**44.29**	**117.3**
-750	738.34	1981	3411.8	98.437	106.73	25.57	4.07	**42.92**	**114.77**
-745	729.02	2019	3411.8	123.77	132.05	25.3	4.03	**42.09**	**114.4**
-740	719.74	2048	3411.8	143.09	151.33	25.21	4.01	**41.45**	**114.4**
-735	710.64	2071	3411.8	158.6	166.78	25.12	3.99	**40.94**	**114.4**
-730	701.68	2090	3411.8	171.68	179.75	25.05	3.98	**40.52**	**114.2**
~	696.6	2100	3411.8	178.23	183.89	~	~	**40.46**	~

LAMPIRAN 9

Tabel data pengujian alat throttling process

No. Pengujian	1	2	3
durasi (s)	600	1800	1200
Bukaan katup (put)	1/8	1/8	1/2
Tek.air masuk (kg/cm^2)	0.5	0.5	0.5
Temp.air masuk (^oC)	70	70	70
Vakum awal (mmHg)	650	650	650
Vakum akhir (mmHg)	610	560	590
Flow meter awal (m^3)	0.14221	0.14237	0.1431
Flow meter akhir (m^3)	0.14235	0.143	0.14318
Volume Air Tbg.1 (cc)	3800	14650	8000
Volume Air Tbg.2 (gr)	2.74	1.25	0.85
Temp. air tbg 1 (^oC)	43.6	60.9	51.4
Temp. air tbg 2 (^oC)	29	29	30
durasi tarik vakum 0 s/d 650 mmHg (menit)	27	22	21
Olah Data			
Aliran massa air oleh flow meter (gr/s)	0.23	0.35	0.07
Aliran massa air oleh gelas ukur (gr/s)	6.33	8.14	6.67
gelas ukur tbg.2 (gr/s)	0.0046	0.0007	0.0007
aliran massa uap teoritis tbg 2.(gr/s)	0.19	0.24	0.2
gelas ukur tbg.1 + gelas ukur tbg.2 (gr/s)	6.34	8.14	6.67
Keterangan			

No. Pengujian	4	5	6
durasi (s)	1800	600	600
Bukaan katup (put)	3 1/2 (full)	1/4	1/4
Tek.air masuk (kg/cm^2)	1	0.5	0.5
Temp.air masuk (^oC)	70	70	80
Vakum awal (mmHg)	650	650	650
Vakum akhir (mmHg)	630	580	570
Flow meter awal (m^3)	0.14318	0.14366	0.15885
Flow meter akhir (m^3)	0.14355	0.1588	0.15926
Volume Air Tbg.1 (cc)	6300	19300	7500
Volume Air Tbg.2 (gr)	1.9	0.72	1.1
Temp. air tbg 1 (^oC)	46.1	57.3	59.2
Temp. air tbg 2 (^oC)	28.5	28.5	30
durasi tarik vakum 0 s/d 650 mmHg (menit)	24	23	23
Olah Data			
Aliran massa air oleh flow meter (gr/s)	0.21	25.23333333	0.683333333
Aliran massa air oleh gelas ukur (gr/s)	3.5	32.16666667	12.5
gelas ukur tbg.2 (gr/s)	0.0011	0.0012	0.001833333
aliran massa uap teoritis tbg 2.(gr/s)	0.105	0.964105469	0.374652384
gelas ukur tbg.1 + gelas ukur tbg.2 (gr/s)	3.5011	32.16786667	12.50183333
Keterangan	aliran mampat	temperatur air masuk turun s/d 62 oC	aliran mampat dan temperatur air masuk turun s/d 74 oC

No. Pengujian	7	8	9
durasi (s)	600	1200	1560
Bukaan katup (put)	1/4	1/8	1/8
Tek.air masuk (kg/cm^2)	0.5	0.5	0.5
Temp.air masuk (^oC)	80	80	80
Vakum awal (mmHg)	650	650	650
Vakum akhir (mmHg)	610	560	570
Flow meter awal (m^3)	0.15984	0.16317	0.16325
Flow meter akhir (m^3)	0.16314	0.16322	0.16335
Volume Air Tbg.1 (cc)	26600	21600	24000
Volume Air Tbg.2 (gr)	2.47	144.9	132.08
Temp. air tbg 1 (^oC)	55.5	66.8	63.6
Temp. air tbg 2 (^oC)	31	32	31.5
durasi tarik vakum 0 s/d 650 mmHg (menit)	21	24	23
Olah Data			
Aliran massa air oleh flow meter (gr/s)	5.5	0.041666667	0.064102564
Aliran massa air oleh gelas ukur (gr/s)	44.33333333	18	15.38461538
gelas ukur tbg.2 (gr/s)	0.004116667	0.12075	0.084666667
aliran massa uap teoritis tbg 2.(gr/s)	1.328767123	0.539499434	0.461110627
gelas ukur tbg.1 + gelas ukur tbg.2 (gr/s)	44.33745	18.12075	15.46928205
Keterangan	temperatur air masuk turun s/d 46 oC	temperatur air masuk turun s/d 74 oC	temperatur air masuk turun s/d 74 oC)

LAMPIRAN 10

Tabel sifat termodinamik air dan uap air

TABEL A-4a Sifat uap jenuh, tabel temperatur (satuan SI)

Temperatur, °C	Tekanan, bar	Volume spesifik, m³/kg			Energi spesifik, kJ/kg			Entropi spesifik, kJ/(kg·K)		
		v_f	v_g	u_f	u_{fg}	u_g	s_f	s_{fg}	s_g
0,01	0,00611	0,0010002	206,1	0,00	2501	2501	0,0000	9,1544	9,1544
1	0,00657	0,0010002	192,6	4,22	2498	2502	0,0154	9,1327	9,1482
2	0,00706	0,0010001	179,9	8,42	2496	2504	0,0306	9,1011	9,1318
3	0,00758	0,0010001	168,2	12,63	2493	2506	0,0455	9,0700	9,0753
4	0,00813	0,0010001	157,5	16,84	2491	2508	0,0610	9,0395	9,0494
5	0,00872	0,0010001	147,2	21,05	2489	2510	0,0762	9,0094	9,0231
6	0,00935	0,0010001	137,8	25,25	2487	2512	0,0913	8,9798	8,9978
7	0,01001	0,0010001	129,1	29,45	2485	2514	0,1063	8,9507	8,9726
8	0,01073	0,0010001	121,0	33,65	2483	2516	0,1211	8,9221	8,9483
9	0,01147	0,0010001	113,4	37,85	2481	2519	0,1361	8,8937	8,9238
10	0,01228	0,0010004	106,42	42,04	2477	2519	0,1510	8,8658	8,8994
11	0,01312	0,0010003	99,91	46,22	2475	2521	0,1658	8,8384	8,8752
12	0,01402	0,0010005	93,84	50,41	2473	2523	0,1805	8,8115	8,8513
13	0,01497	0,0010007	88,18	54,60	2470	2525	0,1952	8,7850	8,8276
14	0,01597	0,0010008	82,90	58,78	2468	2527	0,2098	8,7588	8,8060
15	0,01704	0,0010010	77,97	62,97	2466	2528	0,2244	8,7330	8,7866
16	0,01817	0,0010011	73,37	67,16	2463	2530	0,2389	8,7075	8,7734
17	0,01937	0,0010013	69,05	71,34	2461	2532	0,2534	8,6824	8,7344
18	0,02062	0,0010015	65,02	75,53	2458	2534	0,2678	8,6578	8,7116
19	0,02196	0,0010016	61,26	79,72	2456	2536	0,2821	8,6334	8,6890
20	0,02337	0,0010018	57,84	83,90	2454	2537	0,2964	8,6093	8,6665
21	0,02486	0,0010021	54,66	88,08	2452	2539	0,3107	8,5855	8,6462
22	0,02643	0,0010022	51,70	92,27	2449	2541	0,3249	8,5621	8,6270
23	0,02809	0,0010025	48,93	96,46	2447	2543	0,3391	8,5388	8,6081
24	0,02983	0,0010028	46,33	100,65	2444	2545	0,3532	8,5159	8,5785
25	0,03166	0,0010030	43,90	104,81	2442	2547	0,3672	8,4928	8,5700
26	0,03360	0,0010033	41,64	109,00	2440	2548	0,3812	8,4700	8,5138
27	0,03564	0,0010035	39,52	113,17	2437	2550	0,3951	8,4476	8,5147

TABEL A-4a Sifat uap jenuh, tabel temperatur (satuan SI) (Lanjutan)

Temperatur, °C	Tekanan, bar	Tekanan, psia	Volume spesifik, m³/kg		Entalpi spesifik, kJ/kg			Entropi spesifik, kJ/(kg)(K)		
			v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
160	6.181	89.648	0.0011022	0.3068	675.47	2081.5	2756.7	1.9425	4.8050	6.7475
165	7.008	101.64	0.0011092	0.2736	697.28	2064.8	2762.0	1.9925	4.7138	6.7048
170	7.920	114.87	0.0011163	0.2428	719.17	2047.8	2767.1	2.0416	4.6234	6.6650
175	8.924	129.43	0.0011209	0.2161	741.07	2030.7	2771.8	2.0906	4.5314	6.6221
180	10.027	145.43	0.0011275	0.19380	763.12	2013.2	2776.3	2.1393	4.4476	6.5869
185	11.233	162.92	0.0011344	0.17388	785.26	1995.2	2780.4	2.1876	4.3648	6.5424
190	12.551	182.04	0.0011415	0.15632	807.52	1976.7	2784.3	2.2356	4.2869	6.5056
195	13.987	202.86	0.0011489	0.14084	829.88	1957.6	2787.8	2.2833	4.1821	6.4654
200	15.549	225.52	0.0011565	0.12716	852.37	1938.0	2790.3	2.3307	4.0979	6.4278
210	19.077	276.81	0.0011728	0.10434	897.73	1898.5	2796.2	2.4247	3.9393	6.3639
220	23.198	336.45	0.0011900	0.08604	943.67	1858.5	2799.9	2.5178	3.7839	6.3017
230	27.976	405.82	0.0012087	0.07145	990.27	1817.9	2800.9	2.6099	3.6306	6.2405
240	33.478	485.59	0.0012291	0.05963	1037.60	1776.6	2800.3	2.7010	3.4788	6.1798
250	39.776	576.86	0.0012513	0.05004	1085.78	1734.7	2800.4	2.7935	3.3273	6.0208
260	46.94	680.81	0.0012755	0.04217	1134.94	1692.3	2799.4	2.8848	3.1761	6.0610
270	55.05	798.58	0.0013020	0.03559	1185.25	1649.4	2799.9	2.9763	3.0241	5.9004
280	64.20	931.14	0.0013324	0.03013	1236.84	1605.8	2799.4	3.0683	2.8703	5.8386
290	74.46	1079.95	0.0013659	0.02554	1290.01	1477.6	2767.6	3.1611	2.6207	5.7848
300	85.93	1246.31	0.0014048	0.021669	1345.05	1406.9	2751.9	3.2552	2.4529	5.7081
310	98.70	1431.52	0.0014489	0.018374	1402.39	1327.6	2730.0	3.3512	2.2766	5.6278
320	112.89	1637.35	0.0014993	0.015440	1462.60	1241.1	2703.7	3.4500	2.0893	5.5423
330	128.63	1865.62	0.0015615	0.012935	1526.52	1148.6	2670.2	3.5528	1.8903	5.4490
340	146.05	2118.28	0.0016387	0.010780	1595.47	1050.7	2626.2	3.6616	1.6811	5.3427
350	165.38	2398.20	0.0017411	0.008799	1671.96	891.7	2567.7	3.7800	1.4276	5.2077
360	186.75	2708.56	0.0018939	0.006940	1764.97	721.3	2485.6	3.9210	1.1390	5.0600
370	210.54	3053.62	0.0022136	0.004973	1890.31	452.6	2342.8	4.1106	0.7038	4.8144
374.15	220.70	3198.23	0.00317	0.0031	2107.37	0.0	2107.4	4.4429	0.0	4.4429

TABEL A-4b Uap jenuh: tabel tekanan (satuan SI)

Tekanan, bar	Tekanan, psia	Temperatur, °C	Volume spesifik, m³/kg		Entalpi spesifik, kJ/kg			Entropi spesifik, kJ/(kg)(K)		
			v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
0.010	0.1450	6.98	0.0010001	129.20	29.30	2484.9	2514.2	0.1034	8.8714	8.9748
0.015	0.2176	13.04	0.0010007	87.98	54.71	2470.6	2525.3	0.1958	8.6312	8.8270
0.020	0.2901	17.51	0.0010014	67.00	73.48	2460.0	2533.5	0.2569	8.4659	8.7228
0.025	0.3626	21.08	0.0010021	54.24	88.49	2451.6	2540.0	0.3083	8.3340	8.6423
0.030	0.4351	24.10	0.0010028	45.66	101.05	2444.5	2545.5	0.3510	8.2258	8.5768
0.040	0.5802	28.98	0.0010041	34.81	121.46	2432.9	2554.4	0.4197	8.0541	8.4738
0.050	0.7252	32.90	0.0010053	28.19	137.82	2423.7	2561.5	0.4740	7.9203	8.3943
0.060	0.8702	36.16	0.0010064	23.74	151.50	2415.0	2566.9	0.5191	7.8105	8.3296
0.070	1.0153	39.03	0.0010075	20.53	163.43	2409	2572.4	0.5591	7.7149	8.2740
0.080	1.1603	41.54	0.0010085	18.10	173.9	2402.6	2576.5	0.5915	7.6364	8.2279
0.090	1.3053	43.79	0.0010094	16.20	183.3	2396.7	2580.0	0.6225	7.5635	8.1860
0.10	1.4504	45.84	0.0010103	14.68	191.9	2392.3	2584.2	0.6488	7.5006	8.1494
0.11	1.5954	47.72	0.0010111	13.40	199.7	2388.3	2588.0	0.6740	7.4420	8.1160
0.12	1.7405	49.45	0.001012	12.36	207.1	2383.5	2590.6	0.6964	7.3891	8.0855
0.14	2.0305	52.58	0.001013	10.69	220.3	2375.8	2596.1	0.7371	7.2964	8.0317
0.16	2.3206	55.34	0.001015	9.433	231.9	2369.1	2601.0	0.7728	7.2124	7.9852
0.18	2.6107	57.82	0.001016	8.445	242.4	2362.9	2605.3	0.8045	7.1397	7.9442
0.20	2.9008	60.09	0.001017	7.649	251.9	2357.4	2609.3	0.8332	7.0745	7.9077
0.25	3.6259	64.99	0.001020	6.204	272.6	2345.1	2617.7	0.8947	6.9359	7.8306
0.30	4.3511	69.12	0.001022	5.229	289.9	2334.9	2624.8	0.9458	6.8220	7.7678
0.40	5.8015	75.88	0.001026	3.993	318.3	2318.0	2636.3	1.0279	6.6413	7.6692
0.50	7.2519	81.35	0.001030	3.240	341.3	2304.1	2645.4	1.0930	6.5001	7.5931
0.60	8.7023	85.95	0.001033	2.732	360.6	2292.4	2653.0	1.1471	6.3841	7.5312
0.80	11.6030	93.52	0.001038	2.087	392.3	2273.0	2665.3	1.2344	6.1994	7.4338
1.0	14.5038	99.64	0.001043	1.694	418.0	2257.0	2675.0	1.3038	6.0548	7.3580
1.013	14.696	100	0.001043	1.673	419.5	2256.1	2675.6	1.3079	6.0462	7.354
1.2	17.4045	104.81	0.001047	1.428	439.7	2243.4	2683.1	1.3617	5.9356	7.2973
1.4	20.305	109.3	0.001051	1.237	458.6	2231.4	2690.0	1.4115	5.8341	7.2456
1.6	23.206	113.3	0.001054	1.091	475.5	2220.5	2696.0	1.4553	5.7456	7.2009
1.8	26.107	116.9	0.001058	.9775	490.8	2210.6	2701.4	1.4945	5.6670	7.1615

(bersambung)

TABEL A-4b Uap jenuh: tabel tekanan (satuan SI) (Lanjutan)

Tekanan, bar	Tekanan, psia	Temperatur, °C	Volume spesifik, m^3/kg		Entalpi spesifik, kJ/kg			Entropi spesifik, kJ/(kg)(K)		
			v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
2.0	29.008	120.2	0.001061	.8857	504.7	2201.5	2706.2	1.5300	5.5963	7.1263
2.5	36.259	127.4	0.001067	.7187	535.2	2181.3	2716.5	1.6068	5.4451	7.0519
3.0	43.511	133.6	0.001073	.6058	561.2	2163.7	2724.9	1.6710	5.3201	6.9911
4.0	58.015	143.6	0.001084	.4625	604.3	2133.8	2738.1	1.7755	5.1196	6.8951
5.0	72.519	151.9	0.001093	.3749	639.8	2108.4	2748.2	1.8594	4.9611	6.8205
6.0	87.023	158.9	0.001101	.3157	670.1	2086.3	2756.4	1.9299	4.8293	6.7592
8.0	116.03	170.4	0.001115	.2404	720.7	2048.0	2768.7	2.0451	4.6169	6.6620
10.	145.04	179.9	0.001127	.1944	762.5	2015.1	2777.6	2.1378	4.4479	6.5857
12	174.05	188.0	0.001139	.1633	798.5	1985.9	2784.4	2.2160	4.3065	6.5225
14	203.05	195.1	0.001149	.1408	830.2	1959.4	2789.6	2.2838	4.1847	6.4685
16	232.06	201.4	0.001159	.1238	858.8	1934.8	2793.6	2.3440	4.0770	6.4210
18	261.07	207.1	0.001168	.1104	884.9	1911.8	2796.7	2.3981	3.9805	6.3786
20	290.08	212.4	0.001176	.0996	908.9	1890.2	2799.1	2.4474	3.8927	6.3401
25	362.59	224.0	0.001197	.0800	962.4	1840.2	2802.6	2.5549	3.7018	6.2567
30	435.11	233.9	0.001216	.0667	1008.7	1795.0	2803.7	2.6461	3.5400	6.1861
40	580.15	250.4	0.001252	.0498	1087.6	1713.4	2801.0	2.7968	3.2725	6.0693
50	725.19	264.0	0.001286	.0394	1154.5	1639.4	2793.9	2.9206	3.0520	5.9726
60	870.23	275.6	0.001319	.0324	1213.7	1570.2	2783.9	3.0271	2.8613	5.8884
70	1015.3	285.9	0.001352	.0274	1267.4	1504.3	2771.7	3.1216	2.6909	5.8125
80	1160.3	295.1	0.001385	.0235	1317.0	1440.5	2757.5	3.2073	2.5351	5.7424
90	1305.3	303.3	0.001417	.0205	1363.7	1379.3	2743.0	3.2870	2.3910	5.6780
100	1450.4	311.1	0.001453	.0180	1407.9	1316.4	2724.3	3.3600	2.2533	5.6133
110	1595.4	318.2	0.001489	.0160	1450.2	1255.0	2705.2	3.4296	2.1224	5.5520
120	1740.5	324.8	0.001527	.0143	1491.2	1193.2	2684.4	3.4960	1.9956	5.4916
130	1885.5	330.9	0.001567	.0128	1531.1	1130.7	2661.8	3.5599	1.8717	5.4316
140	2030.5	336.8	0.001610	.0115	1570.4	1066.8	2637.2	3.6220	1.7490	5.3710
160	2320.6	347.4	0.001710	.0093	1648.9	931.3	2580.2	3.7441	1.5007	5.2448
180	2610.7	357.1	0.001840	.0075	1731.4	777.4	2508.8	3.8703	1.2336	5.1039
200	2900 8	365.8	0.002041	.00584	1828.5	581.0	2409.5	4.0172	0.9093	4.9265
220.89	3203.7	374.1	0.003155	.003155	2098.8	0	2098.8	4.4289	0	4.4289

TABEL A-5 Sifat uap panas lanjut (satuan SI)

Tekanan bar (temperatur jenuh, °C)		Temperatur, °C									
		100	150	200	250	300	400	500	600	700	800
0.1 (45.81)	v	17.196	19.51	21.825	24.136	26.445	31.063	35.679	40.295	44.911	49.526
	h	2867.5	2783.0	2879.5	2977.3	3076.5	3279.6	3489.1	3705.4	3928.7	4159.0
	s	8.4479	8.6882	8.9038	9.1002	9.2813	9.6077	9.8978	10.1608	10.4028	10.6281
0.5 (81.33)	v	3.418	3.889	4.356	4.820	5.284	6.209	7.134	8.057	8.981	9.904
	h	2682.5	2780.1	2877.7	2976.0	3075.5	3278.9	3488.7	3705.1	3928.5	4158.9
	s	7.6947	7.9401	8.1580	8.3556	8.5373	8.8642	9.1546	9.4178	9.6599	9.8852
1.0 (99.63)	v	1.6958	1.9364	2.172	2.406	2.639	3.103	3.565	4.028	4.490	4.952
	h	2676.2	2776.4	2875.3	2974.3	3074.3	3278.2	3488.1	3704.7	3928.2	4.158.6
	s	7.3614	7.6134	7.8343	8.0333	8.2158	8.5435	8.8342	9.0976	9.3398	9.5652
2.0 (120.23)	v		0.9596	1.0803	1.1988	1 3162	1.5493	1.7814	2.013	2.244	2.475
	h		2768.8	2870.5	2971.0	3071.8	3276.6	3487.1	3704.0	3927.6	4.158.2
	s		7.2795	7.5066	7.7086	7.8926	8.2218	8.5133	8.7770	9.0194	9.2449
3.0 (135.55)	v		0.6339	0.7163	0.7964	0.8753	1.0315	1.1867	1.3414	1.4957	1.6499
	h		2761.0	2865.6	2967.6	3069.3	3275.0	3486.0	3703.2	3927.1	4.157.8
	s		7.0778	7.3115	7.5166	7.7022	8 0330	8.3251	8.5892	8.8319	9.0576
4.0 (143.63)	v		0.4708	0.5342	0.5951	0.6548	0.7726	0.8893	1.0552	1.1215	1.2372
	h		2752.8	2860.5	2964.2	3066.8	3273.4	3484.9	3702.4	3926.5	4.157.3
	s		6.9299	7.1706	7.5662	7.5662	7.8985	8.1913	8.4558	8.6987	8.9244
5 (151.86)	v			0.4249	0.4744	0.5226	0.6173	0.7109	0.8041	0.8969	0.9896
	h			2855.4	2960.7	3064.2	3271.9	3483.9	3701.7	3925.9	4156.9
	s			7.0592	7.2709	7.4599	7.7938	8.0873	7.3522	8.5952	8.8211

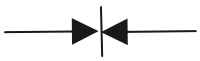
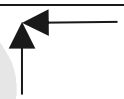
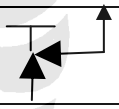
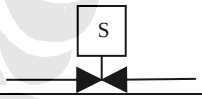
(bersambung)

TABEL A-5 Sifat uap panas lanjut (steam superheated)

Tekanan bar (temperatur jenuh, °C)		Temperatur, °C									
		100	150	200	250	300	400	500	600	700	800
6 (158.84)	v			0.3520	0.3938	0.4344	0.5137	0.5920	0.6697	0.7472	0.8245
	h			2850.1	2957.2	3061.6	3270.3	3482.8	3700.9	3925.3	4156.5
	s			6.9963	7.1816	7.3724	7.7079	8.0021	8.2634	8.5107	8.7367
10 (179.91)	v			0.2060	0.2327	0.2579	0.3066	0.3541	0.4011	0.4478	0.4943
	h			2813.9	2942.6	3051.3	3263.9	3478.5	3697.9	3923.1	4154.7
	s			6.6040	6.9247	7.1229	7.4651	7.7622	8.0290	8.2731	8.4996
20 (212.42)	v				0.1114	0.1255	0.1512	0.1757	0.1996	0.2232	0.2467
	h				2902.5	3023.5	3247.6	3467.6	3690.1	3917.4	4150.5
	s				6.5452	6.7664	7.1271	7.4319	7.7024	7.9487	8.1760
30 (233.9)	v				0.0758	0.08114	0.0994	0.1162	0.1324	0.1484	0.1641
	h				2855.8	2993.5	3228.9	3456.5	3683.3	3911.7	4145.9
	s				6.3272	6.5390	6.9012	7.2128	7.5005	7.7571	7.9852
40 (250.4)	v					0.0568	0.07734	0.0864	0.09885	0.11095	0.12285
	h					2960.7	3213.6	3445.3	3674.4	3905.9	4141.5
	s					6.3615	6.7690	7.0901	7.3668	7.6198	7.8502
50 (263.99)	v					0.0457	0.0598	0.06857	0.07869	0.08849	0.0981
	h					2924.5	3185.1	3433.8	3666.5	3900.1	4137.1
	s					6.2081	6.6459	6.9759	7.2589	7.5122	7.7440
60 (275.64)	v					0.0362	0.0474	0.0567	0.0653	0.0735	0.0816
	h					2884.2	3157.2	3422.2	3658.4	3894.3	4132.7
	s					6.0674	6.5408	6.8803	7.1677	7.4234	7.6566
70 (285.88)	v					0.0195	0.0402	0.0481	0.0557	0.0628	0.0698
	h					2838.4	3128.1	3410.5	3650.3	3888.3	4128.2
	s					5.9505	6.4470	6.8075	7.0894	7.3474	7.5832

LAMPIRAN 11

Simbol untuk beberapa jenis katup

N0	Jenis valve	simbol
1	Globe valve	
2	Gate valve	
3	Check valve	
4	Angle valve	
5	Needle valve	
6	Diaphragm	
7	Safety valve	
8	Solenoid valve	
9	Pneumatic diaphragm valve