



LAMPIRAN A  
SIFAT-SIFAT AIR

## SIFAT FISIKA AIR (SI)

Tabel A.1 Sifat-sifat Fisika Air dalam satuan SI

Temperature °C	Pressure Pa	Saturation vapor pressure Pa	Density kg/m <sup>3</sup>	Specific enthalpy of liquid water		Specific heat		Volume heat capacity kJ/m <sup>3</sup>	Dynamic viscosity kg/m.s
				kJ/kg	kcal/kg	kJ/kg	kcal/kg		
0	101325	611	999.82	0.06	0.01	4.217	1.007	4216.1	0.001792
1	101325	657	999.89	4.28	1.02	4.213	1.006	4213.03	0.001731
2	101325	705	999.94	8.49	2.03	4.21	1.006	4210.12	0.001674
3	101325	757	999.98	12.7	3.03	4.207	1.005	4207.36	0.00162
4	101325	813	1000	16.9	4.04	4.205	1.004	4204.74	0.001569
5	101325	872	1000	21.11	5.04	4.202	1.004	4202.26	0.00152
6	101325	935	999.99	25.31	6.04	4.2	1.003	4199.89	0.001473
7	101325	1001	999.96	29.51	7.05	4.198	1.003	4197.63	0.001429
8	101325	1072	999.91	33.7	8.05	4.196	1.002	4195.47	0.001386
9	101325	1147	999.85	37.9	9.05	4.194	1.002	4193.4	0.001346
10	101325	1227	999.77	42.09	10.05	4.192	1.001	4191.42	0.001308
11	101325	1312	999.68	46.28	11.05	4.191	1.001	4189.51	0.001271
12	101325	1402	999.58	50.47	12.06	4.189	1.001	4187.67	0.001236
13	101325	1497	999.46	54.66	13.06	4.188	1	4185.89	0.001202
14	101325	1597	999.33	58.85	14.06	4.187	1	4184.16	0.00117
15	101325	1704	999.19	63.04	15.06	4.186	1	4182.49	0.001139
16	101325	1817	999.03	67.22	16.06	4.185	1	4180.86	0.001109
17	101325	1936	998.86	71.41	17.06	4.184	0.999	4179.27	0.001081
18	101325	2063	998.68	75.59	18.05	4.183	0.999	4177.72	0.001054
19	101325	2196	998.49	79.77	19.05	4.182	0.999	4176.2	0.001028
20	101325	2337	998.29	83.95	20.05	4.182	0.999	4174.7	0.001003
21	101325	2486	998.08	88.14	21.05	4.181	0.999	4173.23	0.000979
22	101325	2642	997.86	92.32	22.05	4.181	0.999	4171.78	0.000955
23	101325	2808	997.62	96.5	23.05	4.18	0.998	4170.34	0.000933
24	101325	2982	997.38	100.68	24.05	4.18	0.998	4168.92	0.000911
25	101325	3166	997.13	104.86	25.04	4.18	0.998	4167.51	0.000891
26	101325	3360	996.86	109.04	26.04	4.179	0.998	4166.11	0.000871
27	101325	3564	996.59	113.22	27.04	4.179	0.998	4164.71	0.000852
28	101325	3779	996.31	117.39	28.04	4.179	0.998	4163.31	0.000833
29	101325	4004	996.02	121.57	29.04	4.179	0.998	4161.92	0.000815
30	101325	4242	995.71	125.75	30.04	4.178	0.998	4160.53	0.000798

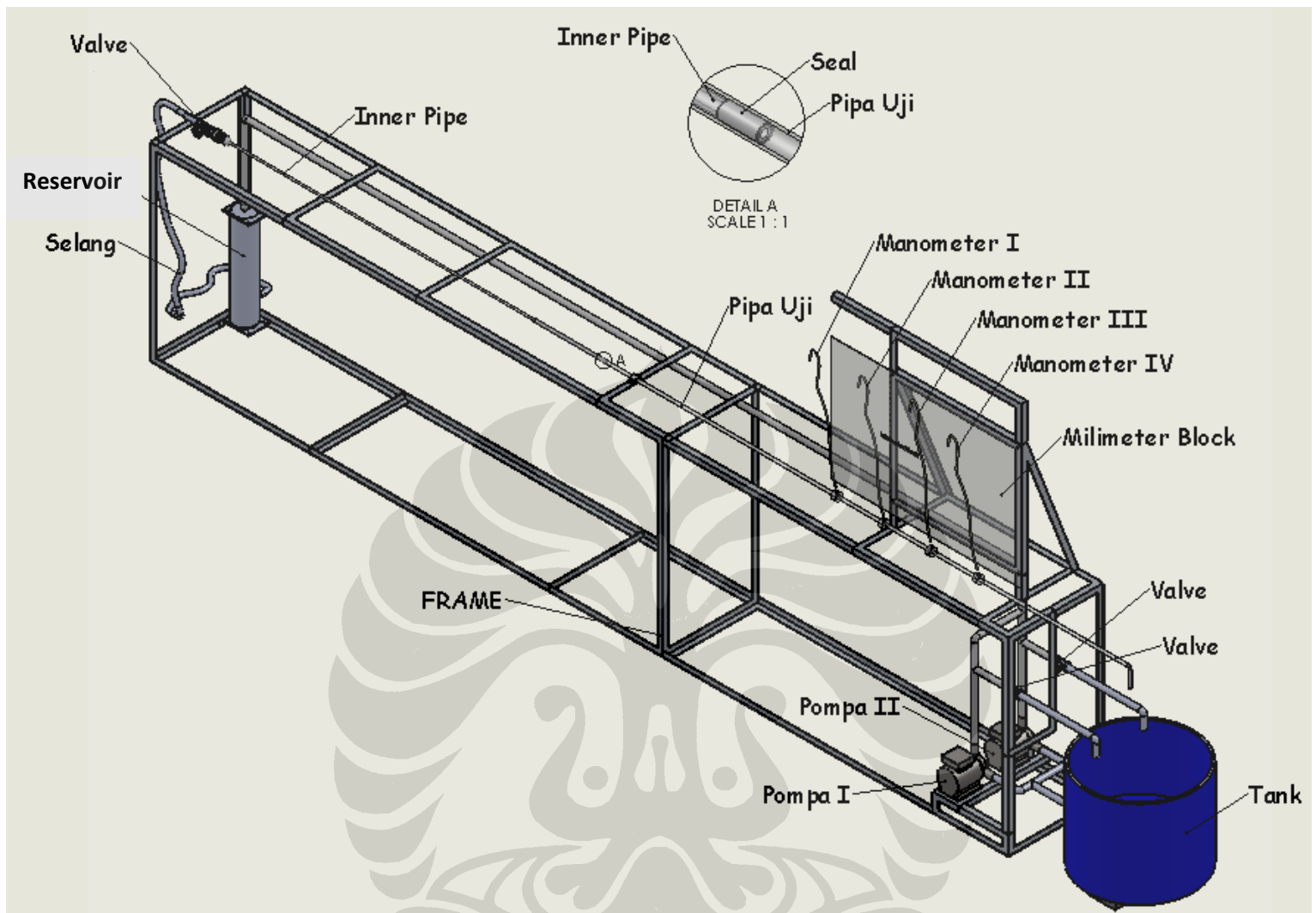
27	101325	3564	996.59	113.22	27.04	4.179	0.998	4164.71	0.000852
27.5			$\rho$						$\mu$
28	101325	3779	996.31	117.39	28.04	4.179	0.998	4163.31	0.000833

$\rho = 996.45$	$v = 8.46 \text{ E-}07$
$\mu = 0.0008425$	

(Sumber: [www.thermexcel.com](http://www.thermexcel.com))



LAMPIRAN B  
GAMBAR 3-D ALAT DAN FOTO PERALATAN YANG  
DIGUNAKAN



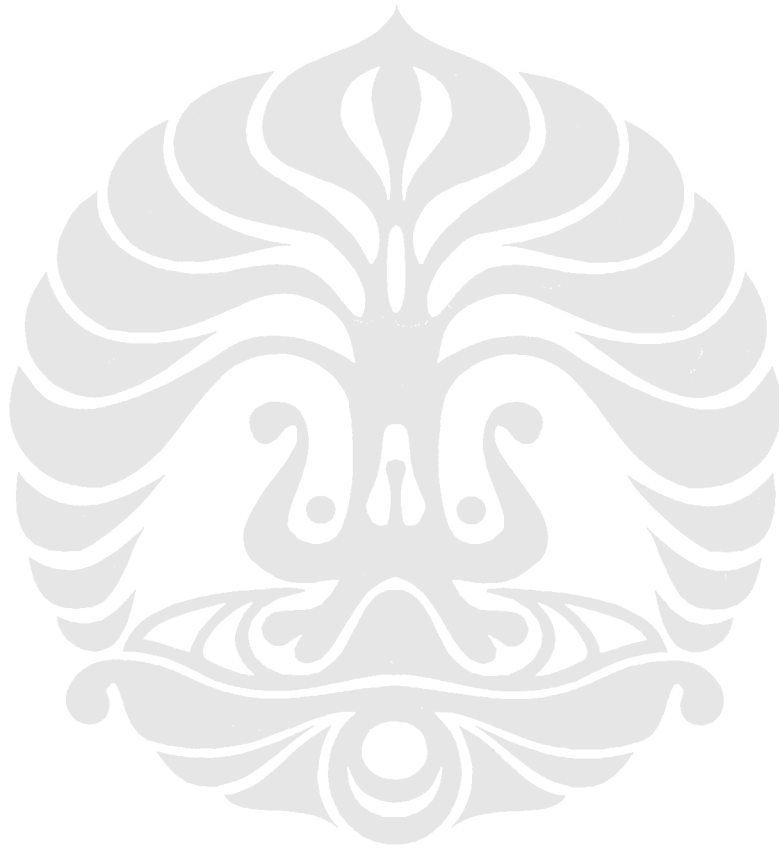
Gambar B.1 Gambar 3-D Alat Uji



Gambar B-2 Foto Alat Uii

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LAMPIRAN C  
DATA PENGUKURAN PENGUJIAN I



Tabel C.1 Data pengukuran aliran air pada pipa masuk (*inlet*) Acrylic berdiameter 4 mm pada saat di posisi  $50D$

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.02	10.23	0.5
2	0.03	10.94	0.6
3	0.05	10.39	0.9
4	0.06	10.39	1.1
5	0.07	10.03	1.4
6	0.09	10.34	1.5
7	0.12	10.95	2.1
8	0.14	10.89	2.9
9	0.16	10.74	3.5
10	0.18	10.84	4.7
11	0.20	10.48	5.5
12	0.25	10.94	7.3
13	0.27	10.46	8.4
14	0.29	10.32	9.2
15	0.38	10.84	13.5
16	0.41	10.43	15.6
17	0.45	10.32	18.8
18	0.52	10.43	25.1
19	0.61	10.43	29.7
20	0.68	10.54	31.3
21	0.84	10.50	47.7
22	1.08	10.32	75.6
23	1.23	10.43	88.2
24	1.51	10.42	131.2
25	1.79	10.54	166.7
26	2.15	10.90	223.1
27	2.44	10.96	269.3
28	2.49	10.49	311.1
29	3.15	10.96	425.5
30	3.19	10.42	448.9

Tabel C.2 Data pengukuran aliran air pada pipa masuk (inlet) Acrylic berdiameter 4 mm pada saat di posisi 70D

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.01	10.08	0.2
2	0.02	10.06	0.3
3	0.03	10.11	0.4
4	0.03	10.21	0.5
5	0.04	10.32	0.7
6	0.05	10.43	0.8
7	0.07	10.14	1.2
8	0.08	10.33	1.3
9	0.10	10.21	1.5
10	0.11	10.25	1.7
11	0.14	10.12	2.7
12	0.17	10.13	3.6
13	0.19	10.21	4.7
14	0.23	10.33	5.9
15	0.24	10.54	6.3
16	0.28	10.37	8.2
17	0.32	10.32	9.9
18	0.51	10.20	21.7
19	0.65	10.35	27.8
20	0.76	10.36	38.6
21	1.09	10.37	68.2
22	1.37	10.38	98.1
23	1.59	10.53	118.4
24	1.69	10.51	133.6
25	2.05	10.20	211.2
26	2.41	10.22	276.9
27	2.73	10.21	329.3
28	2.89	10.32	399.7
29	3.45	10.46	480.2
30	3.71	10.47	531.7



Tabel C.3 Data pengukuran aliran air pada pipa masuk (inlet) Acrylic berdiameter 4 mm pada saat di posisi  $100D$

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.02	10.95	0.2
2	0.02	10.04	0.2
3	0.03	10.32	0.3
4	0.03	10.43	0.4
5	0.04	10.56	0.5
6	0.05	10.43	0.6
7	0.06	10.40	0.7
8	0.07	10.54	0.7
9	0.07	10.45	0.7
10	0.09	10.62	0.9
11	0.10	10.32	1.2
12	0.12	10.63	1.3
13	0.14	10.72	1.9
14	0.14	10.39	2.0
15	0.17	10.94	2.6
16	0.19	10.84	3.8
17	0.24	10.43	5.0
18	0.27	10.20	6.8
19	0.40	10.46	12.0
20	0.48	10.54	17.0
21	0.60	10.59	25.5
22	0.76	10.40	38.0
23	1.00	10.94	55.0
24	1.20	10.39	75.0
25	1.50	10.03	116.0
26	1.85	10.49	165.0
27	2.30	10.82	227.0
28	2.80	10.93	325.0
29	2.90	10.32	377.0
30	3.30	10.40	450.0

Tabel C.4 Data pengukuran aliran air pada pipa masuk (inlet) Acrylic berdiameter 4 mm pada saat di posisi 130D

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.02	10.90	0.1
2	0.02	10.39	0.2
3	0.03	10.99	0.2
4	0.04	10.39	0.3
5	0.04	10.98	0.4
6	0.05	10.75	0.4
7	0.06	10.92	0.5
8	0.07	10.45	0.6
9	0.07	10.29	0.6
10	0.08	10.20	0.7
11	0.10	10.62	0.8
12	0.11	10.53	1.0
13	0.12	10.93	1.0
14	0.13	10.62	1.2
15	0.14	10.39	1.6
16	0.15	10.32	1.5
17	0.15	10.39	2.2
18	0.22	10.20	4.0
19	0.40	10.33	10.5
20	0.48	10.31	15.5
21	0.60	10.28	23.0
22	0.75	10.26	35.0
23	0.94	10.23	51.0
24	1.15	10.21	68.0
25	1.50	10.18	108.0
26	1.75	10.16	150.0
27	2.14	10.13	210.0
28	2.60	10.11	307.8
29	2.85	10.08	350.0
30	3.20	10.06	420.0

Tabel C.5 Data pengukuran aliran air pada pipa masuk (inlet) Alluminium berdiameter 4 mm pada saat di posisi 50D

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.02	10.02	0.6
2	0.03	10.92	0.7
3	0.03	10.32	0.8
4	0.04	10.43	1.0
5	0.06	10.33	1.6
6	0.08	10.42	2.2
7	0.09	10.83	2.6
8	0.10	10.30	3.3
9	0.11	10.21	4.0
10	0.15	10.43	5.5
11	0.18	10.54	7.5
12	0.20	10.32	9.0
13	0.22	10.50	9.2
14	0.26	10.21	12.5
15	0.30	10.43	13.5
16	0.34	10.32	15.0
17	0.38	10.40	18.0
18	0.44	10.00	20.0
19	0.55	10.38	26.0
20	0.60	10.20	35.0
21	0.84	10.92	50.0
22	0.93	10.32	64.0
23	1.20	10.52	85.0
24	1.30	10.21	112.0
25	1.50	10.32	140.0
26	1.65	10.21	165.0
27	1.85	10.56	195.0
28	2.00	10.54	230.0
29	2.30	10.22	290.0
30	2.70	10.67	330.0

Tabel C.6 Data pengukuran aliran air pada pipa masuk (inlet) Alluminium berdiameter 4 mm pada saat di posisi 70D

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.01	10.09	0.3
2	0.02	10.03	0.4
3	0.03	10.32	0.5
4	0.04	10.93	0.8
5	0.05	10.39	0.9
6	0.06	10.03	1.2
7	0.07	10.32	1.4
8	0.08	10.49	1.6
9	0.10	10.39	1.8
10	0.11	10.03	2.0
11	0.14	10.21	2.6
12	0.16	10.43	4.4
13	0.18	10.40	5.5
14	0.20	10.02	7.0
15	0.22	10.02	7.5
16	0.24	10.32	8.0
17	0.29	10.39	10.2
18	0.34	10.21	12.0
19	0.36	10.46	14.0
20	0.40	10.03	17.0
21	0.55	10.10	23.0
22	0.68	10.32	36.0
23	0.90	10.54	53.0
24	1.11	10.94	70.0
25	1.25	10.43	98.0
26	1.50	10.43	130.0
27	1.80	10.56	175.0
28	2.00	10.54	215.0
29	2.20	10.32	245.0
30	2.40	10.44	285.0

Tabel C.7 Data pengukuran aliran air pada pipa masuk (inlet) Alluminium berdiameter 4 mm pada saat di posisi 100D

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.02	10.90	0.3
2	0.02	10.80	0.3
3	0.03	10.43	0.4
4	0.04	10.45	0.5
5	0.04	10.41	0.6
6	0.05	10.04	0.7
7	0.06	10.67	0.8
8	0.07	10.54	1.0
9	0.08	10.97	1.0
10	0.09	10.32	1.1
11	0.10	10.98	1.2
12	0.11	10.59	1.3
13	0.12	10.29	1.7
14	0.14	10.03	2.4
15	0.16	10.34	3.4
16	0.19	10.98	4.5
17	0.24	10.67	5.0
18	0.28	10.04	8.0
19	0.35	10.47	9.6
20	0.40	10.48	12.5
21	0.50	10.56	17.5
22	0.70	10.43	32.5
23	0.85	10.54	45.0
24	1.00	10.94	60.0
25	1.28	10.43	90.0
26	1.40	10.43	110.0
27	1.60	10.56	129.2
28	1.82	10.54	175.0
29	2.00	10.32	210.5
30			

Tabel C.8 Data pengukuran aliran air pada pipa masuk (inlet) Alluminium berdiameter 4 mm pada saat di posisi 130 *D*

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.02	10.65	0.2
2	0.02	10.21	0.2
3	0.03	10.19	0.3
4	0.03	10.19	0.3
5	0.04	10.12	0.4
6	0.05	10.30	0.4
7	0.05	10.17	0.5
8	0.06	10.12	0.6
9	0.07	10.32	0.7
10	0.08	10.22	0.7
11	0.10	10.20	1.0
12	0.11	10.21	1.0
13	0.12	10.11	1.1
14	0.13	10.21	1.1
15	0.13	10.09	1.2
16	0.14	10.10	1.7
17	0.15	10.11	2.3
18	0.19	10.22	3.0
19	0.25	10.23	5.0
20	0.30	10.19	8.0
21	0.45	10.15	13.5
22	0.53	10.13	21.0
23	0.65	10.21	28.0
24	0.80	10.11	41.5
25	1.05	10.11	70.0
26	1.46	10.74	105.0
27	1.60	10.56	125.0
28	1.84	10.75	155.0
29	2.20	10.88	205.0
30	2.50	11.01	254.0

Tabel C.9 Data pengukuran aliran air pada pipa masuk (inlet) Acrylic berdiameter 6 mm pada saat di posisi 50 *D*

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.02	10.76	0.3
2	0.03	10.92	0.4
3	0.04	10.29	0.6
4	0.06	10.92	0.8
5	0.08	10.82	1.2
6	0.08	10.29	1.4
7	0.10	10.93	1.8
8	0.11	10.39	2.4
9	0.13	10.92	2.8
10	0.15	10.82	3.1
11	0.17	10.82	4.1
12	0.19	10.29	5.5
13	0.24	10.86	7.8
14	0.27	10.62	8.7
15	0.31	10.28	11.8
16	0.36	10.81	14.0
17	0.39	10.82	16.0
18	0.42	10.63	17.5
19	0.50	10.92	22.5
20	0.61	10.82	32.0
21	0.76	10.98	44.0
22	0.87	10.92	54.0
23	0.99	10.88	70.0
24	1.16	10.80	88.0
25	1.26	10.30	108.0
26	1.42	10.20	130.0
27	2.20	10.29	255.0
28	2.72	10.92	340.0
29	2.93	10.30	430.0
30	3.55	10.32	570.0

Tabel C.10 Data pengukuran aliran air pada pipa masuk (inlet) Acrylic berdiameter 6 mm pada saat di posisi 70D

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.02	10.30	0.2
2	0.02	10.32	0.3
3	0.03	10.32	0.3
4	0.03	10.49	0.4
5	0.04	10.32	0.5
6	0.05	10.49	0.6
7	0.06	10.92	0.9
8	0.08	10.31	1.0
9	0.10	10.90	1.4
10	0.11	10.34	1.8
11	0.13	10.33	2.2
12	0.16	10.93	3.0
13	0.19	10.30	4.2
14	0.20	10.32	5.0
15	0.21	10.40	5.8
16	0.23	10.30	6.0
17	0.26	10.20	8.0
18	0.32	10.32	11.0
19	0.35	10.30	12.0
20	0.45	10.70	16.0
21	0.55	10.21	25.0
22	0.98	10.39	72.0
23	1.20	10.20	90.0
24	1.40	10.23	128.0
25	1.70	10.82	150.0
26	2.20	10.82	230.0
27	2.52	10.92	300.0
28	2.80	10.76	365.0
29	3.20	10.36	480.0
30	4.20	10.93	670.0



Tabel C.11 Data pengukuran aliran air pada pipa masuk (inlet) Acrylic berdiameter 6 mm pada saat di posisi 100D

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.02	10.87	0.2
2	0.02	10.32	0.2
3	0.03	10.93	0.3
4	0.03	10.39	0.3
5	0.04	10.29	0.4
6	0.06	10.32	0.5
7	0.06	10.39	0.5
8	0.07	10.32	0.6
9	0.08	10.39	0.8
10	0.09	10.32	0.9
11	0.11	10.49	1.2
12	0.12	10.22	1.5
13	0.14	10.30	1.9
14	0.15	10.32	2.6
15	0.18	10.40	2.9
16	0.21	10.30	3.8
17	0.25	10.20	4.5
18	0.32	10.32	7.6
19	0.42	10.39	12.1
20	0.55	10.98	19.4
21	0.68	10.59	28.7
22	0.75	10.40	36.3
23	0.99	10.51	52.9
24	1.44	10.52	103.5
25	1.66	10.54	135.6
26	2.21	10.55	207.2
27	2.38	10.56	239.7
28	3.09	10.58	395.5
29	3.82	10.59	522.9
30	4.24	10.60	664.6

Tabel C.12 Data pengukuran aliran air pada pipa masuk (inlet) Acrylic berdiameter 6 mm pada saat di posisi 130D

No	W ( kg )	Time ( s )	$\Delta H$ ( mm )
1	0.02	10.63	0.1
2	0.02	10.77	0.2
3	0.03	10.92	0.2
4	0.03	10.02	0.3
5	0.04	10.72	0.4
6	0.05	10.03	0.4
7	0.05	10.29	0.5
8	0.07	10.92	0.6
9	0.07	10.01	0.7
10	0.08	10.27	0.7
11	0.10	10.21	1.0
12	0.13	10.82	1.1
13	0.14	10.92	1.2
14	0.14	10.92	1.5
15	0.14	10.02	1.6
16	0.15	10.32	2.0
17	0.15	10.82	2.5
18	0.18	10.02	3.1
19	0.24	10.09	5.2
20	0.32	10.23	8.0
21	0.44	10.19	15.0
22	0.52	10.21	19.0
23	0.65	10.33	29.0
24	0.80	10.29	42.0
25	1.20	10.74	62.0
26	1.35	10.02	105.0
27	1.60	10.32	124.0
28	1.80	10.39	150.0
29	2.00	10.12	202.0
30	2.45	10.29	240.0



LAMPIRAN D  
TABEL PENGOLAHAN DATA PENGUJIAN I

Tabel D.1 Tabel pengolahan data aliran air pada pipa masuk (inlet) Acrilic berdiameter 4 mm pada saat di posisi 50D

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U (m/s)	Re	Friction ( $\lambda$ )
1	27.5	0.02	10.23	0.5	996.45	8.455E-07	0.023108	273.31	0.734856
2	27.5	0.03	10.94	0.6	996.45	8.455E-07	0.035041	414.44	0.383502
3	27.5	0.05	10.39	0.9	996.45	8.455E-07	0.061492	727.29	0.186792
4	27.5	0.06	10.39	1.1	996.45	8.455E-07	0.073791	872.75	0.158542
5	27.5	0.07	10.03	1.4	996.45	8.455E-07	0.089179	1054.75	0.138152
6	27.5	0.09	10.34	1.5	996.45	8.455E-07	0.111222	1315.45	0.095164
7	27.5	0.12	10.95	2.1	996.45	8.455E-07	0.140034	1656.23	0.084044
8	27.5	0.14	10.89	2.9	996.45	8.455E-07	0.164274	1942.91	0.084338
9	27.5	0.16	10.74	3.5	996.45	8.455E-07	0.190363	2251.48	0.075799
10	27.5	0.18	10.84	4.7	996.45	8.455E-07	0.212183	2509.55	0.081929
11	27.5	0.20	10.48	5.5	996.45	8.455E-07	0.243858	2884.18	0.072585
12	27.5	0.25	10.94	7.3	996.45	8.455E-07	0.292005	3453.63	0.06719
13	27.5	0.27	10.46	8.4	996.45	8.455E-07	0.329837	3901.08	0.060595
14	27.5	0.29	10.32	9.2	996.45	8.455E-07	0.359075	4246.89	0.055998
15	27.5	0.38	10.84	13.5	996.45	8.455E-07	0.447942	5297.94	0.052802
16	27.5	0.41	10.43	15.6	996.45	8.455E-07	0.502304	5940.90	0.048523
17	27.5	0.45	10.32	18.8	996.45	8.455E-07	0.557186	6590.01	0.047524
18	27.5	0.52	10.43	25.1	996.45	8.455E-07	0.637069	7534.81	0.048536
19	27.5	0.61	10.43	29.7	996.45	8.455E-07	0.747331	8838.91	0.041734
20	27.5	0.68	10.54	31.3	996.45	8.455E-07	0.824396	9750.38	0.036144
21	27.5	0.84	10.50	47.7	996.45	8.455E-07	1.022251	12090.47	0.035823
22	27.5	1.08	10.32	75.6	996.45	8.455E-07	1.337247	15816.02	0.033179
23	27.5	1.23	10.43	88.2	996.45	8.455E-07	1.506913	17822.71	0.030483
24	27.5	1.51	10.42	131.2	996.45	8.455E-07	1.851726	21900.91	0.030029
25	27.5	1.79	10.54	166.7	996.45	8.455E-07	2.1701	25666.43	0.02778
26	27.5	2.15	10.90	223.1	996.45	8.455E-07	2.520457	29810.21	0.027561
27	27.5	2.44	10.96	269.3	996.45	8.455E-07	2.844767	33645.91	0.026116
28	27.5	2.49	10.49	311.1	996.45	8.455E-07	3.033132	35873.76	0.026539
29	27.5	3.15	10.96	425.5	996.45	8.455E-07	3.672547	43436.32	0.024758
30	27.5	3.19	10.42	448.9	996.45	8.455E-07	3.911924	46267.49	0.023021
31	27.5	0.02	10.23	0.5	996.45	8.455E-07	0.023108	273.31	0.734856

Tabel D.2 Tabel pengolahan data aliran air pada pipa masuk (inlet) Acrilic berdiameter 4 mm pada saat di posisi 70D

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U	Re	Friction ( $\lambda$ )
1	27.5	0.01	10.08	0.2	996.45	8.46E-07	0.0183812	217.40	0.541129093
2	27.5	0.02	10.06	0.3	996.45	8.46E-07	0.0243877	288.44	0.413722679
3	27.5	0.03	10.11	0.4	996.45	8.46E-07	0.0315978	373.72	0.305307953
4	27.5	0.03	10.21	0.5	996.45	8.46E-07	0.0375459	444.07	0.278357638
5	27.5	0.04	10.32	0.7	996.45	8.46E-07	0.0495276	585.78	0.223955439
6	27.5	0.05	10.43	0.8	996.45	8.46E-07	0.0612566	724.50	0.167318036
7	27.5	0.07	10.14	1.2	996.45	8.46E-07	0.0937567	1108.89	0.107136005
8	27.5	0.08	10.33	1.3	996.45	8.46E-07	0.1009386	1193.83	0.100135447
9	27.5	0.10	10.21	1.5	996.45	8.46E-07	0.1251531	1480.22	0.075156562
10	27.5	0.11	10.25	1.7	996.45	8.46E-07	0.1390012	1644.01	0.069051176
11	27.5	0.14	10.12	2.7	996.45	8.46E-07	0.1767726	2090.74	0.067809865
12	27.5	0.17	10.13	3.6	996.45	8.46E-07	0.2144405	2536.25	0.061439505
13	27.5	0.19	10.21	4.7	996.45	8.46E-07	0.2409198	2849.43	0.063549485
14	27.5	0.23	10.33	5.9	996.45	8.46E-07	0.2845083	3364.96	0.057203308
15	27.5	0.24	10.54	6.3	996.45	8.46E-07	0.2909632	3441.31	0.058401426
16	27.5	0.28	10.37	8.2	996.45	8.46E-07	0.3450219	4080.68	0.054060426
17	27.5	0.32	10.32	9.9	996.45	8.46E-07	0.3962212	4686.23	0.049490153
18	27.5	0.51	10.20	21.7	996.45	8.46E-07	0.6389067	7556.54	0.04171996
19	27.5	0.65	10.35	27.8	996.45	8.46E-07	0.8025928	9492.51	0.033869847
20	27.5	0.76	10.36	38.6	996.45	8.46E-07	0.937401	11086.92	0.034474298
21	27.5	1.09	10.37	68.2	996.45	8.46E-07	1.3429776	15883.80	0.029676032
22	27.5	1.37	10.38	98.1	996.45	8.46E-07	1.6861406	19942.49	0.027079488
23	27.5	1.59	10.53	118.4	996.45	8.46E-07	1.9294713	22820.44	0.024959395
24	27.5	1.69	10.51	133.6	996.45	8.46E-07	2.0543386	24297.28	0.024843994
25	27.5	2.05	10.20	211.2	996.45	8.46E-07	2.5681543	30374.33	0.025131054
26	27.5	2.41	10.22	276.9	996.45	8.46E-07	3.0132389	35638.48	0.023933975
27	27.5	2.73	10.21	329.3	996.45	8.46E-07	3.4166801	40410.10	0.022138189
28	27.5	2.89	10.32	399.7	996.45	8.46E-07	3.5783726	42322.49	0.024497514
29	27.5	3.45	10.46	480.2	996.45	8.46E-07	4.214276	49843.51	0.021219502
30	27.5	3.71	10.47	531.7	996.45	8.46E-07	4.5270235	53542.46	0.020361049

Tabel D.3 Tabel pengolahan data aliran air pada pipa masuk (inlet) Acrilic berdiameter 4 mm pada saat di posisi 100D

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U	Re	Friction ( $\lambda$ )
1	27.5	0.02	10.95	0.2	996.45	8.46E-07	0.01914	226.35	0.391973
2	27.5	0.02	10.04	0.2	996.45	8.46E-07	0.02673	316.11	0.255944
3	27.5	0.03	10.32	0.3	996.45	8.46E-07	0.03355	396.86	0.201158
4	27.5	0.03	10.43	0.4	996.45	8.46E-07	0.04276	505.70	0.190561
5	27.5	0.04	10.56	0.5	996.45	8.46E-07	0.04985	589.64	0.15788
6	27.5	0.05	10.43	0.6	996.45	8.46E-07	0.06126	724.50	0.115277
7	27.5	0.06	10.40	0.7	996.45	8.46E-07	0.07212	853.02	0.102307
8	27.5	0.07	10.54	0.7	996.45	8.46E-07	0.08486	1003.72	0.073723
9	27.5	0.07	10.45	0.7	996.45	8.46E-07	0.09159	1083.22	0.065673
10	27.5	0.09	10.62	0.9	996.45	8.46E-07	0.10829	1280.77	0.057264
11	27.5	0.10	10.32	1.2	996.45	8.46E-07	0.12184	1441.01	0.063442
12	27.5	0.12	10.63	1.3	996.45	8.46E-07	0.14257	1686.18	0.049205
13	27.5	0.14	10.72	1.9	996.45	8.46E-07	0.16628	1966.67	0.054245
14	27.5	0.14	10.39	2.0	996.45	8.46E-07	0.17292	2045.14	0.052495
15	27.5	0.17	10.94	2.6	996.45	8.46E-07	0.19412	2295.97	0.054186
16	27.5	0.19	10.84	3.8	996.45	8.46E-07	0.22397	2648.97	0.059933
17	27.5	0.24	10.43	5.0	996.45	8.46E-07	0.29403	3477.60	0.045388
18	27.5	0.27	10.20	6.8	996.45	8.46E-07	0.34426	4071.64	0.044904
19	27.5	0.40	10.46	12.0	996.45	8.46E-07	0.48865	5779.38	0.039441
20	27.5	0.48	10.54	17.0	996.45	8.46E-07	0.58738	6947.14	0.038566
21	27.5	0.60	10.59	25.5	996.45	8.46E-07	0.72397	8562.65	0.038182
22	27.5	0.76	10.40	38.0	996.45	8.46E-07	0.93747	11087.77	0.033933
23	27.5	1.00	10.94	55.0	996.45	8.46E-07	1.17211	13862.87	0.031419
24	27.5	1.20	10.39	75.0	996.45	8.46E-07	1.47582	17454.95	0.027024
25	27.5	1.50	10.03	116.0	996.45	8.46E-07	1.91099	22601.82	0.024929
26	27.5	1.85	10.49	165.0	996.45	8.46E-07	2.25353	26653.19	0.025499
27	27.5	2.30	10.82	227.0	996.45	8.46E-07	2.71624	32125.77	0.024146
28	27.5	2.80	10.93	325.0	996.45	8.46E-07	3.27345	38716.04	0.023803
29	27.5	2.90	10.32	377.0	996.45	8.46E-07	3.59075	42468.93	0.022945
30	27.5	3.30	10.40	450.0	996.45	8.46E-07	4.05460	47954.97	0.021482

Tabel D.4 Tabel pengolahan data aliran air pada pipa masuk (inlet) Acrilic berdiameter 4 mm pada saat di posisi 130D

No	T (°C)	W (kg)	t (s)	ΔH (mm)	BJ	Viskos	U	Re	Friction (λ)
1	27.5	0.02	10.90	0.1	996.45	8.46E-07	0.019226	227.39	0.296675118
2	27.5	0.02	10.39	0.2	996.45	8.46E-07	0.024228	286.55	0.236817868
3	27.5	0.03	10.99	0.2	996.45	8.46E-07	0.033602	397.42	0.157150412
4	27.5	0.04	10.39	0.3	996.45	8.46E-07	0.049194	581.83	0.102382785
5	27.5	0.04	10.98	0.4	996.45	8.46E-07	0.049925	590.48	0.125943063
6	27.5	0.05	10.75	0.4	996.45	8.46E-07	0.059433	702.93	0.097497335
7	27.5	0.06	10.92	0.5	996.45	8.46E-07	0.067752	801.33	0.085483504
8	27.5	0.07	10.45	0.6	996.45	8.46E-07	0.083516	987.77	0.068156456
9	27.5	0.07	10.29	0.6	996.45	8.46E-07	0.091645	1083.91	0.055825658
10	27.5	0.08	10.20	0.7	996.45	8.46E-07	0.104731	1238.68	0.050085267
11	27.5	0.10	10.62	0.8	996.45	8.46E-07	0.120321	1423.08	0.044500497
12	27.5	0.11	10.53	1.0	996.45	8.46E-07	0.128267	1517.05	0.046112917
13	27.5	0.12	10.93	1.0	996.45	8.46E-07	0.140291	1659.26	0.040456998
14	27.5	0.13	10.62	1.2	996.45	8.46E-07	0.156418	1850.00	0.037194451
15	27.5	0.14	10.39	1.6	996.45	8.46E-07	0.171318	2026.23	0.042310162
16	27.5	0.15	10.32	1.5	996.45	8.46E-07	0.185729	2196.67	0.0342221
17	27.5	0.15	10.39	2.2	996.45	8.46E-07	0.190504	2253.14	0.047574595
18	27.5	0.22	10.20	4.0	996.45	8.46E-07	0.275607	3259.68	0.041064903
19	27.5	0.40	10.33	10.5	996.45	8.46E-07	0.494628	5850.11	0.033681455
20	27.5	0.48	10.31	15.5	996.45	8.46E-07	0.594987	7037.09	0.034361803
21	27.5	0.60	10.28	23.0	996.45	8.46E-07	0.751498	8888.19	0.032003314
22	27.5	0.75	10.26	35.0	996.45	8.46E-07	0.937417	11087.11	0.031258024
23	27.5	0.94	10.23	51.0	996.45	8.46E-07	1.172061	13862.32	0.029135896
24	27.5	1.15	10.21	68.0	996.45	8.46E-07	1.439392	17024.12	0.025757865
25	27.5	1.50	10.18	108.0	996.45	8.46E-07	1.882056	22259.64	0.023928611
26	27.5	1.75	10.16	150.0	996.45	8.46E-07	2.201112	26033.21	0.024297739
27	27.5	2.14	10.13	210.0	996.45	8.46E-07	2.703679	31977.22	0.022545929
28	27.5	2.60	10.11	307.8	996.45	8.46E-07	3.286328	38868.38	0.022368089
29	27.5	2.85	10.08	350.0	996.45	8.46E-07	3.605384	42641.96	0.021131193
30	27.5	3.20	10.06	420.0	996.45	8.46E-07	4.064728	48074.75	0.019950115

Tabel D.5 Tabel pengolahan data aliran air pada pipa masuk (inlet) *Acrylic* berdiameter 6 mm pada saat di posisi 50D

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U	Re	Friction ( $\lambda$ )
1	27.5	0.02	10.76	0.3	996.45	8.46E-07	0.019951	235.97	0.683708788
2	27.5	0.03	10.92	0.4	996.45	8.46E-07	0.0343522	406.29	0.258310262
3	27.5	0.04	10.29	0.6	996.45	8.46E-07	0.0503448	595.44	0.201234878
4	27.5	0.06	10.92	0.8	996.45	8.46E-07	0.0696554	823.83	0.131565391
5	27.5	0.08	10.82	1.2	996.45	8.46E-07	0.0889108	1051.57	0.120403071
6	27.5	0.08	10.29	1.4	996.45	8.46E-07	0.1011473	1196.30	0.110269618
7	27.5	0.10	10.93	1.8	996.45	8.46E-07	0.1193863	1412.02	0.099943061
8	27.5	0.11	10.39	2.4	996.45	8.46E-07	0.1373898	1624.95	0.100606664
9	27.5	0.13	10.92	2.8	996.45	8.46E-07	0.1577446	1865.69	0.088309623
10	27.5	0.15	10.82	3.1	996.45	8.46E-07	0.1745639	2064.62	0.079458737
11	27.5	0.17	10.82	4.1	996.45	8.46E-07	0.2022807	2392.43	0.078368523
12	27.5	0.19	10.29	5.5	996.45	8.46E-07	0.2404111	2843.41	0.074681441
13	27.5	0.24	10.86	7.8	996.45	8.46E-07	0.285072	3371.63	0.075325947
14	27.5	0.27	10.62	8.7	996.45	8.46E-07	0.3303349	3906.97	0.062570446
15	27.5	0.31	10.28	11.8	996.45	8.46E-07	0.385438	4558.69	0.062335006
16	27.5	0.36	10.81	14.0	996.45	8.46E-07	0.4255538	5033.15	0.060670564
17	27.5	0.39	10.82	16.0	996.45	8.46E-07	0.4655373	5506.05	0.057938865
18	27.5	0.42	10.63	17.5	996.45	8.46E-07	0.4999821	5913.44	0.054939923
19	27.5	0.50	10.92	22.5	996.45	8.46E-07	0.5901392	6979.75	0.050715611
20	27.5	0.61	10.82	32.0	996.45	8.46E-07	0.7260299	8586.97	0.047643096
21	27.5	0.76	10.98	44.0	996.45	8.46E-07	0.8850229	10467.43	0.044086201
22	27.5	0.87	10.92	54.0	996.45	8.46E-07	1.0208325	12073.69	0.040667152
23	27.5	0.99	10.88	70.0	996.45	8.46E-07	1.1666874	13798.76	0.04035971
24	27.5	1.16	10.80	88.0	996.45	8.46E-07	1.3770652	16286.96	0.036403376
25	27.5	1.26	10.30	108.0	996.45	8.46E-07	1.5665869	18528.49	0.034536137
26	27.5	1.42	10.20	130.0	996.45	8.46E-07	1.7780931	21030.04	0.032269583
27	27.5	2.20	10.29	255.0	996.45	8.46E-07	2.7349822	32347.45	0.02675409
28	27.5	2.72	10.92	340.0	996.45	8.46E-07	3.1838639	37656.51	0.026322608
29	27.5	2.93	10.30	430.0	996.45	8.46E-07	3.6387691	43036.81	0.025486984
30	27.5	3.55	10.32	570.0	996.45	8.46E-07	4.3949557	51980.46	0.023159269



Tabel D.6 Tabel pengolahan data aliran air pada pipa masuk (inlet) *Acrylic* berdiameter 6 mm pada saat di posisi *70D*

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U	Re	Friction ( $\lambda$ )
1	27.5	0.02	10.30	0.2	996.45	8.46E-07	0.0248119	293.46	0.241952594
2	27.5	0.02	10.32	0.3	996.45	8.46E-07	0.0268687	317.78	0.273247219
3	27.5	0.03	10.32	0.3	996.45	8.46E-07	0.0315739	373.43	0.226149097
4	27.5	0.03	10.49	0.4	996.45	8.46E-07	0.0392236	463.91	0.178630271
5	27.5	0.04	10.32	0.5	996.45	8.46E-07	0.0495276	585.78	0.146337367
6	27.5	0.05	10.49	0.6	996.45	8.46E-07	0.0663878	785.19	0.107367736
7	27.5	0.06	10.92	0.9	996.45	8.46E-07	0.0702095	830.39	0.142645672
8	27.5	0.08	10.31	1.0	996.45	8.46E-07	0.1008865	1193.22	0.074710965
9	27.5	0.10	10.90	1.4	996.45	8.46E-07	0.1201613	1421.18	0.076095235
10	27.5	0.11	10.34	1.8	996.45	8.46E-07	0.1359376	1607.77	0.076445579
11	27.5	0.13	10.33	2.2	996.45	8.46E-07	0.160809	1901.94	0.066766834
12	27.5	0.16	10.93	3.0	996.45	8.46E-07	0.1870541	2212.34	0.067289264
13	27.5	0.19	10.30	4.2	996.45	8.46E-07	0.2357131	2787.85	0.059325403
14	27.5	0.20	10.32	5.0	996.45	8.46E-07	0.2476382	2928.89	0.064182293
15	27.5	0.21	10.40	5.8	996.45	8.46E-07	0.25802	3051.68	0.068372309
16	27.5	0.23	10.30	6.0	996.45	8.46E-07	0.285337	3374.77	0.05783546
17	27.5	0.26	10.20	8.0	996.45	8.46E-07	0.3257171	3852.35	0.059179024
18	27.5	0.32	10.32	11.0	996.45	8.46E-07	0.3962212	4686.23	0.054989059
19	27.5	0.35	10.30	12.0	996.45	8.46E-07	0.4364415	5161.92	0.049441107
20	27.5	0.45	10.70	16.0	996.45	8.46E-07	0.5373981	6355.97	0.043479713
21	27.5	0.55	10.21	25.0	996.45	8.46E-07	0.6854636	8107.18	0.041694793
22	27.5	0.98	10.39	72.0	996.45	8.46E-07	1.2052522	14254.88	0.038898746
23	27.5	1.20	10.20	90.0	996.45	8.46E-07	1.5033098	17780.10	0.031253922
24	27.5	1.40	10.23	128.0	996.45	8.46E-07	1.7488891	20684.64	0.032843121
25	27.5	1.70	10.82	150.0	996.45	8.46E-07	2.007655	23745.14	0.029206001
26	27.5	2.20	10.82	230.0	996.45	8.46E-07	2.5981417	30729.00	0.026739985
27	27.5	2.52	10.92	300.0	996.45	8.46E-07	2.9441194	34820.98	0.02716248
28	27.5	2.80	10.76	365.0	996.45	8.46E-07	3.3251648	39327.72	0.0259075
29	27.5	3.20	10.36	480.0	996.45	8.46E-07	3.9469138	46681.33	0.024181596
30	27.5	4.20	10.93	670.0	996.45	8.46E-07	4.9101702	58074.05	0.021809249

Tabel D.7 Tabel pengolahan data aliran air pada pipa masuk (inlet) *Acrylic* berdiameter 6 mm pada saat di posisi 100D

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U	Re	Friction ( $\lambda$ )
1	27.5	0.02	10.87	0.2	996.45	8.46E-07	0.0191613	226.63	0.3453025
2	27.5	0.02	10.32	0.2	996.45	8.46E-07	0.0242685	287.03	0.2636107
3	27.5	0.03	10.93	0.3	996.45	8.46E-07	0.0335528	396.84	0.1851793
4	27.5	0.03	10.39	0.3	996.45	8.46E-07	0.0427988	506.19	0.1429514
5	27.5	0.04	10.29	0.4	996.45	8.46E-07	0.0499204	590.42	0.1359861
6	27.5	0.06	10.32	0.5	996.45	8.46E-07	0.0742915	878.67	0.0667072
7	27.5	0.06	10.39	0.5	996.45	8.46E-07	0.073791	872.75	0.0720647
8	27.5	0.07	10.32	0.6	996.45	8.46E-07	0.0866734	1025.11	0.0615572
9	27.5	0.08	10.39	0.8	996.45	8.46E-07	0.0983879	1163.66	0.0648583
10	27.5	0.09	10.32	0.9	996.45	8.46E-07	0.1053701	1246.24	0.0636161
11	27.5	0.11	10.49	1.2	996.45	8.46E-07	0.1309485	1548.77	0.0549211
12	27.5	0.12	10.22	1.5	996.45	8.46E-07	0.1500368	1774.53	0.0522943
13	27.5	0.14	10.30	1.9	996.45	8.46E-07	0.1736834	2054.21	0.0494306
14	27.5	0.15	10.32	2.6	996.45	8.46E-07	0.1888242	2233.28	0.0572291
15	27.5	0.18	10.40	2.9	996.45	8.46E-07	0.22116	2615.73	0.0465312
16	27.5	0.21	10.30	3.8	996.45	8.46E-07	0.260525	3081.31	0.0439383
17	27.5	0.25	10.20	4.5	996.45	8.46E-07	0.3131895	3704.19	0.0360045
18	27.5	0.32	10.32	7.6	996.45	8.46E-07	0.3962212	4686.23	0.0379924
19	27.5	0.42	10.39	12.1	996.45	8.46E-07	0.5165367	6109.23	0.0355912
20	27.5	0.55	10.98	19.4	996.45	8.46E-07	0.6400704	7570.30	0.0371625
21	27.5	0.68	10.59	28.7	996.45	8.46E-07	0.8205034	9704.34	0.0334565
22	27.5	0.75	10.40	36.3	996.45	8.46E-07	0.9215	10898.86	0.0335486
23	27.5	0.99	10.51	52.9	996.45	8.46E-07	1.2036407	14235.82	0.0286564
24	27.5	1.44	10.52	103.5	996.45	8.46E-07	1.7485522	20680.65	0.026567
25	27.5	1.66	10.54	135.6	996.45	8.46E-07	2.0131648	23810.30	0.0262579
26	27.5	2.21	10.55	207.2	996.45	8.46E-07	2.676821	31659.56	0.0226939
27	27.5	2.38	10.56	239.7	996.45	8.46E-07	2.879125	34052.27	0.0226937
28	27.5	3.09	10.58	395.5	996.45	8.46E-07	3.7333544	44155.50	0.0222693
29	27.5	3.82	10.59	522.9	996.45	8.46E-07	4.6095864	54518.96	0.0193132
30	27.5	4.24	10.60	664.6	996.45	8.46E-07	5.1100245	60437.79	0.0199744

Tabel D.7 Tabel pengolahan data aliran air pada pipa masuk (inlet) *Acrylic* berdiameter 6 mm pada saat di posisi 130D

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U	Re	Friction ( $\lambda$ )
1	27.5	0.02	10.63	0.1	996.45	8.46E-07	0.0192333	227.48	0.285721148
2	27.5	0.02	10.77	0.2	996.45	8.46E-07	0.0251741	297.74	0.201902483
3	27.5	0.03	10.92	0.2	996.45	8.46E-07	0.0335702	397.05	0.152104359
4	27.5	0.03	10.02	0.3	996.45	8.46E-07	0.0427518	505.64	0.125066691
5	27.5	0.04	10.72	0.4	996.45	8.46E-07	0.0498832	589.98	0.114852819
6	27.5	0.05	10.03	0.4	996.45	8.46E-07	0.0590139	697.98	0.086924392
7	27.5	0.05	10.29	0.5	996.45	8.46E-07	0.0677571	801.38	0.086326008
8	27.5	0.07	10.92	0.6	996.45	8.46E-07	0.0760603	899.59	0.081394297
9	27.5	0.07	10.01	0.7	996.45	8.46E-07	0.0916124	1083.53	0.061679616
10	27.5	0.08	10.27	0.7	996.45	8.46E-07	0.1047019	1238.34	0.047330562
11	27.5	0.10	10.21	1.0	996.45	8.46E-07	0.1282196	1516.49	0.047330562
12	27.5	0.13	10.82	1.1	996.45	8.46E-07	0.148578	1757.28	0.040751318
13	27.5	0.14	10.92	1.2	996.45	8.46E-07	0.1603077	1896.01	0.036646394
14	27.5	0.14	10.92	1.5	996.45	8.46E-07	0.1636645	1935.71	0.043766484
15	27.5	0.14	10.02	1.6	996.45	8.46E-07	0.1769924	2093.34	0.041033793
16	27.5	0.15	10.32	2.0	996.45	8.46E-07	0.1815325	2147.04	0.047988996
17	27.5	0.15	10.82	2.5	996.45	8.46E-07	0.1827909	2161.92	0.058720536
18	27.5	0.18	10.02	3.1	996.45	8.46E-07	0.2280103	2696.75	0.047330562
19	27.5	0.24	10.09	5.2	996.45	8.46E-07	0.3082865	3646.20	0.043165985
20	27.5	0.32	10.23	8.0	996.45	8.46E-07	0.3935088	4654.15	0.04054525
21	27.5	0.44	10.19	15.0	996.45	8.46E-07	0.5457007	6454.17	0.039531315
22	27.5	0.52	10.21	19.0	996.45	8.46E-07	0.6455866	7635.55	0.035776974
23	27.5	0.65	10.33	29.0	996.45	8.46E-07	0.8034419	9502.55	0.035257214
24	27.5	0.80	10.29	42.0	996.45	8.46E-07	0.9934409	11749.72	0.03339829
25	27.5	1.20	10.74	62.0	996.45	8.46E-07	1.4277244	16886.12	0.023870522
26	27.5	1.35	10.02	105.0	996.45	8.46E-07	1.7216048	20361.94	0.027802341
27	27.5	1.60	10.32	124.0	996.45	8.46E-07	1.9811059	23431.13	0.024795066
28	27.5	1.80	10.39	150.0	996.45	8.46E-07	2.2137286	26182.43	0.024021577
29	27.5	2.00	10.12	202.0	996.45	8.46E-07	2.5253228	29867.75	0.024855177
30	27.5	2.45	10.29	240.0	996.45	8.46E-07	3.0424127	35983.53	0.020348574

Tabel D.8 Tabel pengolahan data aliran air pada pipa masuk (inlet) Aluminium berdiameter 4 mm pada saat di posisi 50D

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U	Re	Friction ( $\lambda$ )
1	27.5	0.02	10.02	0.6	996.45	8.45502E-07	0.02308226	273.00	0.915153863
2	27.5	0.03	10.92	0.7	996.45	8.45502E-07	0.03030711	358.45	0.626558423
3	27.5	0.03	10.32	0.8	996.45	8.45502E-07	0.03491699	412.97	0.503473946
4	27.5	0.04	10.43	1.0	996.45	8.45502E-07	0.04545242	537.58	0.383651253
5	27.5	0.06	10.33	1.6	996.45	8.45502E-07	0.07421955	877.82	0.230682137
6	27.5	0.08	10.42	2.2	996.45	8.45502E-07	0.09810467	1160.31	0.179391684
7	27.5	0.09	10.83	2.6	996.45	8.45502E-07	0.10205988	1207.09	0.195894485
8	27.5	0.10	10.30	3.3	996.45	8.45502E-07	0.12592044	1489.30	0.165522939
9	27.5	0.11	10.21	4.0	996.45	8.45502E-07	0.13766843	1628.25	0.165634297
10	27.5	0.15	10.43	5.5	996.45	8.45502E-07	0.18315733	2166.26	0.128668751
11	27.5	0.18	10.54	7.5	996.45	8.45502E-07	0.2193135	2593.89	0.122374101
12	27.5	0.20	10.32	9.0	996.45	8.45502E-07	0.24763824	2928.89	0.115177083
13	27.5	0.22	10.50	9.2	996.45	8.45502E-07	0.2648116	3132.01	0.103318154
14	27.5	0.26	10.21	12.5	996.45	8.45502E-07	0.32539811	3848.58	0.092648622
15	27.5	0.30	10.43	13.5	996.45	8.45502E-07	0.36753979	4347.00	0.078603508
16	27.5	0.34	10.32	15.0	996.45	8.45502E-07	0.42556632	5033.30	0.065000359
17	27.5	0.38	10.40	18.0	996.45	8.45502E-07	0.46689333	5522.09	0.064803155
18	27.5	0.44	10.00	20.0	996.45	8.45502E-07	0.56223787	6649.76	0.049653379
19	27.5	0.55	10.38	26.0	996.45	8.45502E-07	0.67706872	8007.89	0.044510947
20	27.5	0.60	10.20	35.0	996.45	8.45502E-07	0.7516549	8890.05	0.048617212
21	27.5	0.84	10.92	50.0	996.45	8.45502E-07	0.97942286	11583.93	0.040906143
22	27.5	0.93	10.32	64.0	996.45	8.45502E-07	1.14805089	13578.34	0.038117848
23	27.5	1.20	10.52	85.0	996.45	8.45502E-07	1.45758175	17239.26	0.03139873
24	27.5	1.30	10.21	112.0	996.45	8.45502E-07	1.62699053	19242.90	0.033205266
25	27.5	1.50	10.32	140.0	996.45	8.45502E-07	1.85765828	21971.08	0.031838703
26	27.5	1.65	10.21	165.0	996.45	8.45502E-07	2.0651516	24425.17	0.030362607
27	27.5	1.85	10.56	195.0	996.45	8.45502E-07	2.23859344	26476.52	0.03053818
28	27.5	2.00	10.54	230.0	996.45	8.45502E-07	2.42469323	28677.57	0.030702464
29	27.5	2.30	10.22	290.0	996.45	8.45502E-07	2.87570516	34011.83	0.027521258
30	27.5	2.70	10.67	330.0	996.45	8.45502E-07	3.23345455	38243.04	0.024770765

Tabel D.8 Tabel pengolahan data aliran air pada pipa masuk (inlet) Alluminium berdiameter 4 mm pada saat di posisi 70D

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U	Re	Friction ( $\lambda$ )
1	27.5	0.01	10.09	0.3	996.45	8.46E-07	0.018363	217.19	0.751903578
2	27.5	0.02	10.03	0.4	996.45	8.46E-07	0.0243332	287.80	0.578963194
3	27.5	0.03	10.32	0.5	996.45	8.46E-07	0.0315739	373.43	0.409632926
4	27.5	0.04	10.93	0.8	996.45	8.46E-07	0.0467635	553.09	0.287100858
5	27.5	0.05	10.39	0.9	996.45	8.46E-07	0.0581719	688.02	0.206835289
6	27.5	0.06	10.03	1.2	996.45	8.46E-07	0.0747833	884.48	0.173556741
7	27.5	0.07	10.32	1.4	996.45	8.46E-07	0.0879116	1039.76	0.139945366
8	27.5	0.08	10.49	1.6	996.45	8.46E-07	0.09745	1152.57	0.134736985
9	27.5	0.10	10.39	1.8	996.45	8.46E-07	0.1229849	1454.58	0.09339589
10	27.5	0.11	10.03	2.0	996.45	8.46E-07	0.1361897	1610.76	0.082558592
11	27.5	0.14	10.21	2.6	996.45	8.46E-07	0.1752144	2072.31	0.066464987
12	27.5	0.16	10.43	4.4	996.45	8.46E-07	0.1967563	2327.10	0.088347316
13	27.5	0.18	10.40	5.5	996.45	8.46E-07	0.2259518	2672.40	0.084545417
14	27.5	0.20	10.02	7.0	996.45	8.46E-07	0.2510992	2969.83	0.087129699
15	27.5	0.22	10.02	7.5	996.45	8.46E-07	0.2805578	3318.24	0.074778286
16	27.5	0.24	10.32	8.0	996.45	8.46E-07	0.293699	3473.67	0.072819191
17	27.5	0.29	10.39	10.2	996.45	8.46E-07	0.3530897	4176.10	0.064014821
18	27.5	0.34	10.21	12.0	996.45	8.46E-07	0.4255206	5032.76	0.052011462
19	27.5	0.36	10.46	14.0	996.45	8.46E-07	0.4445471	5257.79	0.055597013
20	27.5	0.40	10.03	17.0	996.45	8.46E-07	0.5095965	6027.15	0.051375371
21	27.5	0.55	10.10	23.0	996.45	8.46E-07	0.6958389	8229.90	0.037279439
22	27.5	0.68	10.32	36.0	996.45	8.46E-07	0.8413509	9950.91	0.039912335
23	27.5	0.90	10.54	53.0	996.45	8.46E-07	1.091112	12904.91	0.034937855
24	27.5	1.11	10.94	70.0	996.45	8.46E-07	1.2970857	15341.02	0.032652747
25	27.5	1.25	10.43	98.0	996.45	8.46E-07	1.5309257	18106.72	0.032815333
26	27.5	1.50	10.43	130.0	996.45	8.46E-07	1.8376989	21735.02	0.030210201
27	27.5	1.80	10.56	175.0	996.45	8.46E-07	2.1780909	25760.93	0.028949765
28	27.5	2.00	10.54	215.0	996.45	8.46E-07	2.4246932	28677.57	0.028700129
29	27.5	2.20	10.32	245.0	996.45	8.46E-07	2.7240207	32217.81	0.0259122
30	27.5	2.40	10.44	285.0	996.45	8.46E-07	2.9375019	34742.72	0.025920748

Tabel D.8 Tabel pengolahan data aliran air pada pipa masuk (inlet) Aluminium berdiameter 4 mm pada saat di posisi 100D

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U	Re	Friction ( $\lambda$ )
1	27.5	0.02	10.90	0.3	996.450	8.46E-07	0.01876	221.84	0.557670
2	27.5	0.02	10.80	0.3	996.450	8.46E-07	0.02485	293.87	0.381377
3	27.5	0.03	10.43	0.4	996.450	8.46E-07	0.03308	391.23	0.286896
4	27.5	0.04	10.45	0.5	996.450	8.46E-07	0.04280	506.18	0.235659
5	27.5	0.04	10.41	0.6	996.450	8.46E-07	0.05033	595.23	0.185913
6	27.5	0.05	10.04	0.7	996.450	8.46E-07	0.05855	692.43	0.167147
7	27.5	0.06	10.67	0.8	996.450	8.46E-07	0.07185	849.85	0.124642
8	27.5	0.07	10.54	1.0	996.450	8.46E-07	0.08486	1003.72	0.112240
9	27.5	0.08	10.97	1.0	996.450	8.46E-07	0.09552	1129.69	0.086022
10	27.5	0.09	10.32	1.1	996.450	8.46E-07	0.10525	1244.78	0.080062
11	27.5	0.10	10.98	1.2	996.450	8.46E-07	0.11987	1417.71	0.065544
12	27.5	0.11	10.59	1.3	996.450	8.46E-07	0.12911	1527.01	0.063089
13	27.5	0.12	10.29	1.7	996.450	8.46E-07	0.15026	1777.15	0.057702
14	27.5	0.14	10.03	2.4	996.450	8.46E-07	0.17454	2064.30	0.061830
15	27.5	0.16	10.34	3.4	996.450	8.46E-07	0.20020	2367.81	0.066575
16	27.5	0.19	10.98	4.5	996.450	8.46E-07	0.22112	2615.20	0.072233
17	27.5	0.24	10.67	5.0	996.450	8.46E-07	0.28742	3399.38	0.047501
18	27.5	0.28	10.04	8.0	996.450	8.46E-07	0.35636	4214.80	0.049439
19	27.5	0.35	10.47	9.6	996.450	8.46E-07	0.42716	5052.13	0.041463
20	27.5	0.40	10.48	12.5	996.450	8.46E-07	0.48772	5768.35	0.041242
21	27.5	0.50	10.56	17.5	996.450	8.46E-07	0.60503	7155.81	0.037455
22	27.5	0.70	10.43	32.5	996.450	8.46E-07	0.85759	10143.01	0.034712
23	27.5	0.85	10.54	45.0	996.450	8.46E-07	1.02565	12130.61	0.033572
24	27.5	1.00	10.94	60.0	996.450	8.46E-07	1.17152	13855.96	0.034309
25	27.5	1.28	10.43	90.0	996.450	8.46E-07	1.56817	18547.21	0.028722
26	27.5	1.40	10.43	110.0	996.450	8.46E-07	1.71029	20228.06	0.029505
27	27.5	1.60	10.56	129.2	996.450	8.46E-07	1.93608	22898.61	0.027053
28	27.5	1.82	10.54	175.0	996.450	8.46E-07	2.20283	26053.58	0.028303
29	27.5	2.00	10.32	210.5	996.450	8.46E-07	2.47762	29303.56	0.026914

Tabel D.8 Tabel pengolahan data aliran air pada pipa masuk (inlet) Aluminium berdiameter 4 mm pada saat di posisi 130D

No	T (°C)	W (kg)	t (s)	$\Delta H$ (mm)	BJ	Viskos	U	Re	Friction ( $\lambda$ )
1	27.5	0.02	10.65	0.2	996.450	8.46E-07	0.019197	227.05	0.32551805
2	27.5	0.02	10.21	0.2	996.450	8.46E-07	0.024264	286.97	0.246684386
3	27.5	0.03	10.19	0.3	996.450	8.46E-07	0.033570	397.05	0.208915784
4	27.5	0.03	10.19	0.3	996.450	8.46E-07	0.042752	505.64	0.125066691
5	27.5	0.04	10.12	0.4	996.450	8.46E-07	0.049883	589.98	0.114852819
6	27.5	0.05	10.30	0.4	996.450	8.46E-07	0.059014	697.98	0.086924392
7	27.5	0.05	10.17	0.5	996.450	8.46E-07	0.067757	801.38	0.086326008
8	27.5	0.06	10.12	0.6	996.450	8.46E-07	0.075760	896.03	0.082041565
9	27.5	0.07	10.32	0.7	996.450	8.46E-07	0.091612	1083.53	0.061679616
10	27.5	0.08	10.22	0.7	996.450	8.46E-07	0.104702	1238.34	0.047330562
11	27.5	0.10	10.20	1.0	996.450	8.46E-07	0.128220	1516.49	0.047330562
12	27.5	0.11	10.21	1.0	996.450	8.46E-07	0.135505	1602.66	0.040751318
13	27.5	0.12	10.11	1.1	996.450	8.46E-07	0.151340	1789.95	0.038560412
14	27.5	0.13	10.21	1.1	996.450	8.46E-07	0.160308	1896.01	0.032444543
15	27.5	0.13	10.09	1.2	996.450	8.46E-07	0.170590	2017.62	0.031343079
16	27.5	0.14	10.10	1.7	996.450	8.46E-07	0.176992	2093.34	0.042589145
17	27.5	0.15	10.11	2.3	996.450	8.46E-07	0.187912	2222.49	0.051118469
18	27.5	0.19	10.22	3.0	996.450	8.46E-07	0.237558	2809.67	0.041719588
19	27.5	0.25	10.23	5.0	996.450	8.46E-07	0.308286	3646.20	0.041287635
20	27.5	0.30	10.19	8.0	996.450	8.46E-07	0.376196	4449.39	0.044362908
21	27.5	0.45	10.15	13.5	996.450	8.46E-07	0.566518	6700.38	0.033084371
22	27.5	0.53	10.13	21.0	996.450	8.46E-07	0.671359	7940.36	0.036565313
23	27.5	0.65	10.21	28.0	996.450	8.46E-07	0.813495	9621.45	0.033205266
24	27.5	0.80	10.11	41.5	996.450	8.46E-07	1.011128	11958.92	0.031874117
25	27.5	1.05	10.11	70.0	996.450	8.46E-07	1.333382	15770.31	0.030899257
26	27.5	1.46	10.74	105.0	996.450	8.46E-07	1.737065	20544.78	0.027309661
27	27.5	1.60	10.56	125.0	996.450	8.46E-07	1.936219	22900.24	0.026167366
28	27.5	1.84	10.75	155.0	996.450	8.46E-07	2.188159	25880.01	0.025405811
29	27.5	2.20	10.88	205.0	996.450	8.46E-07	2.587942	30608.36	0.024021707
30	27.5	2.50	11.01	254.0	996.450	8.46E-07	2.903718	34343.15	0.023641973



TABEL PENGOLAHAN DATA PENGUJIAN II



Tabel D.11 Tabel data pengujian untuk mencari kondisi aliran laminar berkembang penuh

No	Re 751.2		Re 1216		Re 1624		Re 1982	
	$\Delta h$	L/D	$\Delta h$	L/D	$\Delta h$	L/D	$\Delta h$	L/D
1	11.69	6.1	15.86	7.4	21.94	14.9	27.45	23.4
2	11.18	8.9	14.87	11	20.86	19.56	26.54	29.6
3	10.46	14.4	13.79	16	20.23	22.54	25.64	33.5
4	10.29	16.7	13.62	17.4	20.02	24.53	24.6	36.5
5	9.78	20.19	13	21.3	19.24	28.76	24	40.3
6	9.4	23.48	12	26	18	36	23	46
7	9	25	11.5	33	17	41	21.4	56
8	8.3	32	11	37	15.6	51	19.5	66
9	7.92	36	10.6	42	14.8	61	18.5	76
10	7.9	38	10.5	53	14	81	17.9	86
11	7.9	45	10.4	60	14	91	17	99
12	7.9	55	10.4	70	14	88.5	17	111.2
13	7.9	75	10.4	88	14	95.6	17	116.2
14	7.9	81.7	10.4	90	14	97.9	17	119.2
15	7.9	93.2	10.4	95.7	14	108.4	17	129.6
16	7.9	86.4	10.4	101.4	14	104.3	17	133.4
17	7.9	97.6	10.4	106.2	14	111.4	17	139.9
18	7.9	116.6	10.4	114.3	14	115.7	17	140.3

Tabel D.12 Tabel data pengujian untuk mencari kondisi aliran turbulen berkembang penuh

No	Re 20924.56		Re 20412.42		Re 15246.57		Re 13022.98	
	$\Delta H$	L/D	$\Delta H$	L/D	$\Delta H$	L/D	$\Delta H$	L/D
1	1550.0	19.8	1480.0	17.0	940.0	16.0	670.0	14.2
2	1540.0	20.5	1455.0	17.8	910.0	18.0	665.0	15.0
3	1520.0	21.3	1440.0	18.3	890.0	19.0	650.0	16.0
4	1490.0	22.2	1420.0	19.8	830.0	20.5	640.0	18.0
5	1460.0	23.1	1390.0	21.5	770.0	22.4	635.0	19.0
6	1460.0	24.2	1350.0	23.0	770.0	23.6	575.0	21.5
7	1460.0	27.1	1350.0	26.0	770.0	26.0	575.0	23.5
8	1460.0	31.2	1350.0	29.5	770.0	29.6	575.0	26.5
9	1460.0	35.6	1350.0	36.0	770.0	34.5	575.0	29.0
10	1460.0	38.5	1350.0	39.6	770.0	38.0	575.0	34.0
11	1460.0	42.0	1350.0	44.0	770.0	42.0	575.0	39.0
12	1460.0	48.0	1350.0	46.0	770.0	45.0	575.0	44.0

