LAMPIRAN

Lampiran A. Tabel *Water Properties* dalam SI

Temp, °C	Unit gravity force γ, N/m³	Density ρ, kg/m³	Viscosity μ, Pa·s	Kinematic viscosity ν, m²/s $10^6\ \nu =$	Surface tension σ, N/m $100\ \sigma =$	Vapor-pressure p_v kPa	Bulk modulus of elasticity K, GPa
0	9805	999.9	1.792	1.792	7.62	0.6	2.04
5	9806	1000.0	1.519	1.519	7.54	0.9	2.06
10	9803	999.7	1.308	1.308	7.48	1.2	2.11
15	9798	999.1	1.140	1.141	7.41	1.7	2.14
20	9789	998.2	1.005	1.007	7.36	2.5	2.20
25	9779	997.1	0.894	0.897	7.26	3.2	2.22
30	9767	995.7	0.801	0.804	7.18	4.3	2.23
35	9752	994.1	0.723	0.727	7.10	5.7	2.24
40	9737	992.2	0.656	0.661	7.01	7.5	2.27
45	9720	990.2	0.599	0.605	6.92	9.6	2.29
50	9697	988.1	0.549	0.556	6.82	12.4	2.30
55	9679	985.7	0.506	0.513	6.74	15.8	2.31
60	9658	983.2	0.469	0.477	6.68	19.9	2.28
65	9635	980.6	0.436	0.444	6.58	25.1	2.26
70	9600	977.8	0.406	0.415	6.50	31.4	2.25
75	9589	974.9	0.380	0.390	6.40	38.8	2.23
80	9557	971.8	0.357	0.367	6.30	47.7	2.21
85	9529	968.6	0.336	0.347	6.20	58.1	2.17
90	9499	965.3	0.317	0.328	6.12	70.4	2.16
95	9469	961.9	0.299	0.311	6.02	84.5	2.11
100	9438	958.4	0.284	0.296	5.94	101.3	2.07

Sumber: Tabel A.1.1. *Variation of Some Properties of Water with Temperature* (Douglas, 704)

Lampiran C. Data Hasil Pengujian

1. **Data Hasil Pengujian Peletakan *Vortab Flow Conditioner* Pada Jarak 2D**

No.	Bukaan Gate Valve (%)	Debit (Liter/jam)	Debit (m3/s)	V (m/s)	Bil. *Reynolds* (Re)
1	30	1023,251	0,000284236	0,140180203	7567,645
2	40	1137,890	0,000316081	0,155885165	8415,480
3	50	1276,287	0,000354524	0,174844853	9439,021
4	60	1290,543	0,000358484	0,176797853	9544,454
5	70	1403,692	0,000389914	0,192298693	10381,268
6	80	1703,921	0,000473311	0,233428545	12601,669
7	90	1978,897	0,000549694	0,271098864	14635,305

Pengujian 1			Pengujian 2			Pengujian 3			ΔHrata2 (mH2O)	ΔP	ζ
H1	H2	ΔH1	H1	H2	ΔH1	H1	H2	ΔH1			
3647,2877	3591,6379	55,6498	3642,8553	3603,8723	38,983	3651,9843	3611,3498	40,6345	0,045	441,174	0,01738
3647,2856	3587,9473	59,3383	3651,9887	3601,2654	50,7233	3654,8721	3609,5438	45,3283	0,052	506,804	0,02470
3667,1765	3585,3897	81,7868	3663,6186	3592,8761	70,7425	3672,7612	3595,8701	76,8911	0,076	748,254	0,04587
3678,9102	3585,1456	93,7646	3671,1824	3581,6453	89,5371	3677,3561	3581,2782	96,0779	0,093	911,196	0,05711
3684,7638	3574,3827	110,3811	3675,1965	3574,5563	100,6402	3680,8564	3575,4567	105,3997	0,105	1032,006	0,07652
3689,7461	3560,5932	129,1529	3682,4896	3560,8372	121,6524	3685,3957	3560,3764	125,0193	0,125	1225,751	0,13393
3691,0935	3551,3546	139,7389	3684,2895	3548,0587	136,2308	3684,1758	3551,4972	132,6786	0,136	1332,806	0,19642

2. Data Hasil Pengujian Peletakan *Vortab Flow Conditioner* Pada Jarak 3D

No.	Bukaan Gate Valve (%)	Debit (Liter/jam)	Debit (m3/s)	V (m/s)	Bil. *Reynolds* (Re)
1	30	1023,251	0,000284236	0,140180203	7567,645
2	40	1137,890	0,000316081	0,155885165	8415,480
3	50	1276,287	0,000354524	0,174844853	9439,021
4	60	1290,543	0,000358484	0,176797853	9544,454
5	70	1403,692	0,000389914	0,192298693	10381,268
6	80	1703,921	0,000473311	0,233428545	12601,669
7	90	1978,897	0,000549694	0,271098864	14635,305

Pengujian 1			Pengujian 2			Pengujian 3			ΔHrata2 (mH2O)	ΔP	ζ
H1	H2	ΔH1	H1	H2	ΔH1	H1	H2	ΔH1			
3636,0621	3574,2889	61,7732	3642,7117	3574,9322	67,7795	3653,8632	3583,1999	70,6633	0,067	653,004	0,02573
3648,4608	3562,3013	86,1595	3654,6469	3564,497	90,1499	3666,8508	3571,2123	95,6385	0,091	886,958	0,04322
3659,8595	3555,3137	104,5458	3665,5821	3555,0618	110,5203	3676,8384	3565,2247	111,6137	0,109	1065,466	0,06531
3671,2582	3548,3261	122,9321	3676,5173	3545,6266	130,8907	3686,826	3554,2371	132,5889	0,129	1260,281	0,07899
3678,6569	3541,3385	137,3184	3687,4525	3536,1914	151,2611	3700,8136	3543,2495	157,5641	0,149	1455,096	0,10790
3686,0556	3534,3509	151,7047	3698,3877	3532,7562	165,6315	3714,8012	3532,2619	182,5393	0,167	1630,343	0,17813
3697,4543	3527,3633	170,091	3710,8746	3532,3425	178,5321	3720,2354	3531,6543	188,5811	0,179	1752,090	0,25821

3. Data Hasil Pengujian Peletakan *Vortab Flow Conditioner* Pada Jarak 4D

No.	Bukaan Gate Valve (%)	Debit (Liter/jam)	Debit (m3/s)	V (m/s)	Bil. *Reynolds* (Re)
1	30	1023,251	0,000284236	0,140180203	7567,645
2	40	1137,890	0,000316081	0,155885165	8415,480
3	50	1276,287	0,000354524	0,174844853	9439,021
4	60	1290,543	0,000358484	0,176797853	9544,454
5	70	1403,692	0,000389914	0,192298693	10381,268
6	80	1703,921	0,000473311	0,233428545	12601,669
7	90	1978,897	0,000549694	0,271098864	14635,305

Pengujian 1			Pengujian 2			Pengujian 3			ΔHrata2 (mH2O)	ΔP	ζ
H1	H2	ΔH1	H1	H2	ΔH1	H1	H2	ΔH1			
3640,9871	3559,4826	81,5045	3634,0502	3564,2983	69,7519	3644,042	3560,45	83,592	0,078	765,958	0,03018
3650,7525	3549,6061	101,1464	3645,3927	3554,0248	91,3679	3655,3707	3549,1249	106,2458	0,100	974,405	0,04748
3659,5179	3544,7296	114,7883	3656,7352	3543,7513	112,9839	3666,6994	3537,7998	128,8996	0,119	1163,284	0,07131
3671,2833	3539,8531	131,4302	3667,0777	3533,4778	133,5999	3679,0281	3536,4747	142,5534	0,136	1329,333	0,08332
3684,0487	3534,9766	149,0721	3677,4202	3531,2043	146,2159	3691,3568	3531,1496	160,2072	0,152	1485,597	0,11016
3696,8141	3530,1001	166,714	3687,7627	3528,9308	158,8319	3710,2354	3525,8245	184,4109	0,170	1663,223	0,18173
3709,5795	3521,6543	187,9252	3699,1835	3526,6573	172,5262	3711,2342	3520,4994	190,7348	0,184	1797,693	0,26493

4. Data Hasil Pengujian Peletakan *Vortab Flow Conditioner* Pada Jarak 5D

No.	Bukaan Gate Valve (%)	Debit (Liter/jam)	Debit (m3/s)	V (m/s)	Bil. *Reynolds* (Re)
1	30	1023,251	0,000284236	0,140180203	7567,645
2	40	1137,890	0,000316081	0,155885165	8415,480
3	50	1276,287	0,000354524	0,174844853	9439,021
4	60	1290,543	0,000358484	0,176797853	9544,454
5	70	1403,692	0,000389914	0,192298693	10381,268
6	80	1703,921	0,000473311	0,233428545	12601,669
7	90	1978,897	0,000549694	0,271098864	14635,305

Pengujian 1			Pengujian 2			Pengujian 3			ΔHrata2 (mH2O)	ΔP	ζ
H1	H2	ΔH1	H1	H2	ΔH1	H1	H2	ΔH1			
3616,7709	3556,5951	60,1758	3627,3208	3538,5411	88,7797	3634,6328	3534,9228	99,71	0,083	811,022	0,03196
3629,4282	3547,0104	82,4178	3639,6084	3530,1959	109,4125	3648,6204	3525,7574	122,863	0,105	1026,372	0,05001
3642,0855	3537,4257	104,6598	3654,896	3521,8507	133,0453	3666,608	3516,592	150,016	0,129	1264,552	0,07752
3654,7428	3527,841	126,9018	3670,1836	3513,5055	156,6781	3684,5956	3504,4266	180,169	0,155	1512,516	0,09480
3680,4001	3518,2563	162,1438	3688,4712	3508,1603	180,3109	3712,5832	3487,2612	225,322	0,189	1851,803	0,13731
3706,0574	3512,6716	193,3858	3709,7588	3502,8151	206,9437	3718,5708	3470,0958	248,475	0,216	2116,075	0,23121
3731,7147	3502,0869	229,6278	3728,0464	3491,7463	236,3001	3729,2312	3471,2673	257,9639	0,241	2360,972	0,34794

5. **Data Hasil Pengujian Tanpa Peletakan *Vortab Flow Conditioner***

No.	Bukaan Gate Valve (%)	Debit (Liter/jam)	Debit (m3/s)	V (m/s)	Bil. *Reynolds* (Re)
1	30	1023,251	0,000284236	0,140180203	7567,645
2	40	1137,890	0,000316081	0,155885165	8415,480
3	50	1276,287	0,000354524	0,174844853	9439,021
4	60	1290,543	0,000358484	0,176797853	9544,454
5	70	1403,692	0,000389914	0,192298693	10381,268
6	80	1703,921	0,000473311	0,233428545	12601,669
7	90	1978,897	0,000549694	0,271098864	14635,305

pengujian 1			pengujian 2			pengujian 3			ΔHrata2 (mH2O)	ΔP	ζ
H1	H2	ΔH1	H1	H2	ΔH1	H1	H2	ΔH1			
3617,7807	3544,9118	72,8689	3628,8282	3522,1944	106,6338	3624,3436	3541,2293	83,1143	0,088	856,525	0,03375
3630,2343	3534,6804	95,5539	3644,066	3512,1954	131,8706	3640,5781	3529,9757	110,6024	0,113	1102,474	0,05372
3649,6879	3519,449	130,2389	3659,3038	3501,1964	158,1074	3656,8126	3518,7221	138,0905	0,142	1390,823	0,08526
3669,1415	3504,2176	164,9239	3679,5416	3490,1974	189,3442	3682,0471	3498,4685	183,5786	0,179	1754,186	0,10995
3694,5951	3483,9862	210,6089	3699,7794	3474,1984	225,581	3697,2816	3478,2149	219,0667	0,218	2137,118	0,15847
3720,0487	3463,7548	256,2939	3720,0172	3458,1994	261,8178	3712,5161	3457,9613	254,5548	0,258	2520,050	0,27535
3742,5162	3451,6435	290,8727	3731,6354	3451,3425	280,2929	3729,1425	3441,2536	287,8889	0,286	2801,805	0,41291

Lampiran B. F Tabel Alpha 5%

Table of F-statistics α = 0.05

df2\df1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	24	26	28	30	35	40	45	50	60	70	80	100	200	500	1000
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.76	8.74	8.73	8.71	8.70	8.69	8.68	8.67	8.67	8.66	8.65	8.64	8.63	8.62	8.62	8.60	8.59	8.59	8.58	8.57	8.57	8.56	8.55	8.54	8.53	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.94	5.91	5.89	5.87	5.86	5.84	5.83	5.82	5.81	5.80	5.79	5.77	5.76	5.75	5.75	5.73	5.72	5.71	5.70	5.69	5.68	5.67	5.66	5.65	5.64	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.70	4.68	4.66	4.64	4.62	4.60	4.59	4.58	4.57	4.56	4.54	4.53	4.52	4.50	4.50	4.48	4.46	4.45	4.44	4.43	4.42	4.42	4.41	4.39	4.37	4.37
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.03	4.00	3.98	3.96	3.94	3.92	3.91	3.90	3.88	3.87	3.86	3.84	3.83	3.82	3.81	3.79	3.77	3.76	3.75	3.74	3.73	3.72	3.71	3.69	3.68	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.60	3.57	3.55	3.53	3.51	3.49	3.48	3.47	3.46	3.44	3.43	3.41	3.40	3.39	3.38	3.36	3.34	3.33	3.32	3.30	3.29	3.29	3.27	3.25	3.24	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.31	3.28	3.26	3.24	3.22	3.20	3.19	3.17	3.16	3.15	3.13	3.12	3.10	3.09	3.08	3.06	3.04	3.03	3.02	3.01	2.99	2.99	2.97	2.95	2.94	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.10	3.07	3.05	3.03	3.01	2.99	2.97	2.96	2.95	2.94	2.92	2.90	2.89	2.87	2.86	2.84	2.83	2.81	2.80	2.79	2.78	2.77	2.76	2.73	2.72	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.94	2.91	2.89	2.86	2.85	2.83	2.81	2.80	2.79	2.77	2.75	2.74	2.72	2.71	2.70	2.68	2.66	2.65	2.64	2.62	2.61	2.60	2.59	2.56	2.55	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.82	2.79	2.76	2.74	2.72	2.70	2.69	2.67	2.66	2.65	2.63	2.61	2.59	2.58	2.57	2.55	2.53	2.52	2.51	2.49	2.48	2.47	2.46	2.43	2.42	2.41
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.72	2.69	2.66	2.64	2.62	2.60	2.58	2.57	2.56	2.54	2.52	2.51	2.49	2.48	2.47	2.44	2.43	2.41	2.40	2.38	2.37	2.36	2.35	2.32	2.31	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.63	2.60	2.58	2.55	2.53	2.51	2.50	2.48	2.47	2.46	2.44	2.42	2.41	2.39	2.38	2.36	2.34	2.33	2.31	2.30	2.28	2.27	2.26	2.23	2.22	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.57	2.53	2.51	2.48	2.46	2.44	2.43	2.41	2.40	2.39	2.37	2.35	2.33	2.32	2.31	2.28	2.27	2.25	2.24	2.22	2.21	2.20	2.19	2.16	2.14	2.14
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.51	2.48	2.45	2.42	2.40	2.38	2.37	2.35	2.34	2.33	2.31	2.29	2.27	2.26	2.25	2.22	2.20	2.19	2.18	2.16	2.15	2.14	2.12	2.10	2.08	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.46	2.42	2.40	2.37	2.35	2.33	2.32	2.30	2.29	2.28	2.25	2.24	2.22	2.21	2.19	2.17	2.15	2.14	2.12	2.11	2.09	2.08	2.07	2.04	2.02	2.02
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.41	2.38	2.35	2.33	2.31	2.29	2.27	2.26	2.24	2.23	2.21	2.19	2.17	2.16	2.15	2.12	2.10	2.09	2.08	2.06	2.05	2.03	2.02	1.99	1.97	1.97
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.37	2.34	2.31	2.29	2.27	2.25	2.23	2.22	2.20	2.19	2.17	2.15	2.13	2.12	2.11	2.08	2.06	2.05	2.04	2.02	2.00	1.99	1.98	1.95	1.93	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.34	2.31	2.28	2.26	2.23	2.21	2.20	2.18	2.17	2.16	2.13	2.11	2.10	2.08	2.07	2.05	2.03	2.01	2.00	1.98	1.97	1.96	1.94	1.91	1.89	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.31	2.28	2.25	2.23	2.20	2.18	2.17	2.15	2.14	2.12	2.10	2.08	2.07	2.05	2.04	2.01	1.99	1.98	1.97	1.95	1.93	1.92	1.91	1.88	1.86	1.85
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.26	2.23	2.20	2.17	2.15	2.13	2.11	2.10	2.08	2.07	2.05	2.03	2.01	2.00	1.98	1.96	1.94	1.92	1.91	1.89	1.88	1.86	1.85	1.82	1.80	1.79
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.22	2.18	2.15	2.13	2.11	2.09	2.07	2.05	2.04	2.03	2.00	1.98	1.97	1.95	1.94	1.91	1.89	1.88	1.86	1.84	1.83	1.82	1.80	1.77	1.75	1.74
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.18	2.15	2.12	2.09	2.07	2.05	2.03	2.02	2.00	1.99	1.97	1.95	1.93	1.91	1.90	1.87	1.85	1.84	1.82	1.80	1.79	1.78	1.76	1.73	1.71	1.70
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.15	2.12	2.09	2.06	2.04	2.02	2.00	1.99	1.97	1.96	1.93	1.91	1.90	1.88	1.87	1.84	1.82	1.80	1.79	1.77	1.75	1.74	1.73	1.69	1.67	1.66
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.13	2.09	2.06	2.04	2.01	1.99	1.98	1.96	1.95	1.93	1.91	1.89	1.87	1.85	1.84	1.81	1.79	1.77	1.76	1.74	1.72	1.71	1.70	1.66	1.64	1.63
35	4.12	3.27	2.87	2.64	2.49	2.37	2.29	2.22	2.16	2.11	2.08	2.04	2.01	1.99	1.96	1.94	1.92	1.91	1.89	1.88	1.85	1.83	1.82	1.80	1.79	1.76	1.74	1.72	1.70	1.68	1.66	1.65	1.63	1.60	1.57	1.57
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.04	2.00	1.97	1.95	1.92	1.90	1.89	1.87	1.85	1.84	1.81	1.79	1.77	1.76	1.74	1.72	1.69	1.67	1.66	1.64	1.62	1.61	1.59	1.55	1.53	1.52
45	4.06	3.20	2.81	2.58	2.42	2.31	2.22	2.15	2.10	2.05	2.01	1.97	1.94	1.92	1.89	1.87	1.86	1.84	1.82	1.81	1.78	1.76	1.74	1.73	1.71	1.68	1.66	1.64	1.63	1.60	1.59	1.57	1.55	1.51	1.49	1.48
50	4.03	3.18	2.79	2.56	2.40	2.29	2.20	2.13	2.07	2.03	1.99	1.95	1.92	1.89	1.87	1.85	1.83	1.81	1.80	1.78	1.76	1.74	1.72	1.70	1.69	1.66	1.63	1.61	1.60	1.58	1.56	1.54	1.52	1.48	1.46	1.45
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.95	1.92	1.89	1.86	1.84	1.82	1.80	1.78	1.76	1.75	1.72	1.70	1.68	1.66	1.65	1.62	1.59	1.57	1.56	1.53	1.52	1.50	1.48	1.44	1.41	1.40
70	3.98	3.13	2.74	2.50	2.35	2.23	2.14	2.07	2.02	1.97	1.93	1.89	1.86	1.84	1.81	1.79	1.77	1.75	1.74	1.72	1.70	1.67	1.65	1.64	1.62	1.59	1.57	1.55	1.53	1.50	1.49	1.47	1.45	1.40	1.37	1.36
80	3.96	3.11	2.72	2.49	2.33	2.21	2.13	2.06	2.00	1.95	1.91	1.88	1.84	1.82	1.79	1.77	1.75	1.73	1.72	1.70	1.68	1.65	1.63	1.62	1.60	1.57	1.54	1.52	1.51	1.48	1.46	1.45	1.43	1.38	1.35	1.34
100	3.94	3.09	2.70	2.46	2.31	2.19	2.10	2.03	1.97	1.93	1.89	1.85	1.82	1.79	1.77	1.75	1.73	1.71	1.69	1.68	1.65	1.63	1.61	1.59	1.57	1.54	1.52	1.49	1.48	1.45	1.43	1.41	1.39	1.34	1.31	1.30
200	3.89	3.04	2.65	2.42	2.26	2.14	2.06	1.98	1.93	1.88	1.84	1.80	1.77	1.74	1.72	1.69	1.67	1.66	1.64	1.62	1.60	1.57	1.55	1.53	1.52	1.48	1.46	1.43	1.41	1.39	1.36	1.35	1.32	1.26	1.22	1.21
500	3.86	3.01	2.62	2.39	2.23	2.12	2.03	1.96	1.90	1.85	1.81	1.77	1.74	1.71	1.69	1.66	1.64	1.62	1.61	1.59	1.56	1.54	1.52	1.50	1.48	1.45	1.42	1.40	1.38	1.35	1.32	1.30	1.28	1.21	1.16	1.14
1000	3.85	3.00	2.61	2.38	2.22	2.11	2.02	1.95	1.89	1.84	1.80	1.76	1.73	1.70	1.68	1.65	1.63	1.61	1.60	1.58	1.55	1.53	1.51	1.49	1.47	1.43	1.41	1.38	1.36	1.33	1.31	1.29	1.26	1.19	1.13	1.11