LAMPIRAN

Lampiran 1
Hasil pengolahan data pada pengujian motor Otto empat langkah.

Hasil pengolahan data tanpa pemasangan *divergent swirling grid* (standar)

No	Putaran (rpm)	T (kg.m)	Ne (PS)	SFCe (kg/PS.jam)	Nbb (PS)	Ni (PS)	Effisiensi (%)	CO (%)
1	1300	7.429	13.484	0.237	48.545	18.897	27.776	0.264
		7.429	13.484	0.238	48.684	17.713	27.696	0.269
		7.429	13.484	0.239	49.007	17.310	27.514	0.405
2	1800	6.176	15.521	0.248	58.527	25.564	26.519	0.289
		6.176	15.521	0.246	57.869	24.916	26.820	0.284
		6.176	15.521	0.247	58.182	23.350	26.676	0.226
3	2300	5.549	17.820	0.257	69.606	34.333	25.601	0.332
		5.549	17.820	0.255	69.078	33.500	25.797	0.389
		5.549	17.820	0.255	68.877	33.302	25.872	0.321
4	2800	4.207	16.445	0.299	74.748	31.787	22.001	0.514
		4.207	16.445	0.300	74.984	34.086	21.932	0.473
		4.207	16.445	0.301	75.127	31.183	21.890	0.429
5	3300	3.043	14.021	0.367	78.100	32.036	17.953	0.637
		3.043	14.021	0.367	78.204	31.378	17.929	0.601
		3.043	14.021	0.366	77.895	31.074	18.000	0.617

Hasil pengolahan data pemasangan *divergent swirling grid* dengan sudut *swirl* 15^0

No	Putaran (rpm)	T (kg.m)	Ne (PS)	SFCe (kg/PS.jam)	Nbb (PS)	Ni (PS)	Effisiensi (%)	CO (%)
1	1300	7.339	13.321	0.238	48.1693	26.029	27.65512	0.756
		7.339	13.321	0.238	48.2085	24.088	27.63262	0.78
		7.339	13.321	0.246	49.6645	25.524	26.82254	0.823
2	1800	6.355	15.971	0.240	58.2105	30.177	27.43584	0.361
		6.355	15.971	0.250	60.5318	31.571	26.38373	0.376
		6.355	15.971	0.251	60.7804	32.576	26.27582	0.471
3	2300	5.818	18.682	0.249	70.5603	39.793	26.47705	0.386
		5.818	18.682	0.244	69.159	39.786	27.01354	0.362
		5.818	18.682	0.254	71.9758	41.655	25.95635	0.436
4	2800	4.744	18.545	0.261	73.4492	35.816	25.24849	0.486
		4.744	18.545	0.276	77.6394	40.06	23.88583	0.474
		4.744	18.545	0.273	76.7835	40.167	24.15209	0.47
5	3300	2.954	13.609	0.376	77.6904	37.94	17.51658	0.687
		2.954	13.609	0.377	77.8948	36.272	17.47061	0.649
		2.954	13.609	0.379	78.2552	36.626	17.39015	0.626

Hasil pengolahan data pemasangan *divergent swirling grid* dengan sudut *swirl* 20^0

No	Putaran	T	Ne	SFCe	Nbb	Ni	Effisiensi	CO
	(rpm)	(kg.m)	(PS)	(kg/PS.jam)	(PS)	(PS)	(%)	(%)
1	1300	7.160	12.996	0.235	46.286	23.996	28.078	1.005
		7.160	12.996	0.236	46.633	22.787	27.870	1.025
		7.160	12.996	0.236	46.504	22.407	27.947	1.038
2	1800	5.997	15.071	0.243	55.561	27.431	27.125	0.488
		5.997	15.071	0.239	54.587	25.705	27.609	0.527
		5.997	15.071	0.237	54.262	25.385	27.774	0.656
3	2300	5.549	17.820	0.224	60.532	30.485	29.439	0.424
		5.549	17.820	0.223	60.408	29.509	29.499	0.478
		5.549	17.820	0.224	60.532	29.030	29.439	0.466
4	2800	4.207	16.445	0.260	64.877	26.577	25.349	0.520
		4.207	16.445	0.257	64.208	27.452	25.613	0.534
		4.207	16.445	0.255	63.725	26.280	25.807	0.541
5	3300	2.685	12.372	0.362	67.929	27.647	18.212	0.711
		2.685	12.372	0.360	67.580	27.145	18.307	0.730
		2.685	12.372	0.362	67.929	26.602	18.212	0.772

Hasil pengolahan data pemasangan *divergent swirling grid* dengan sudut *swirl* 25^0

No	Putaran	T	Ne	SFCe	Nbb	Ni	Effisiensi	CO
	(rpm)	(kg.m)	(PS)	(kg/PS.jam)	(PS)	(PS)	(%)	(%)
1	1300	5.997	10.884	0.276	45.556	24.702	23.892	0.953
		5.997	10.884	0.277	45.732	23.736	23.801	1.055
		5.997	10.884	0.273	45.191	21.936	24.086	0.892
2	1800	5.728	14.396	0.248	54.287	25.67	26.518	0.493
		5.728	14.396	0.248	54.188	25.066	26.567	0.548
		5.728	14.396	0.247	53.990	24.607	26.664	0.588
3	2300	4.923	15.808	0.252	60.377	28.864	26.182	0.549
		4.923	15.808	0.25	59.919	27.558	26.382	0.551
		4.923	15.808	0.25	59.889	27.691	26.396	0.71
4	2800	3.759	14.696	0.285	63.553	27.152	23.124	0.535
		3.759	14.696	0.287	64.069	26.711	22.937	0.535
		3.759	14.696	0.287	64.000	27.592	22.962	0.735
5	3300	2.685	12.372	0.354	66.442	28.742	18.620	0.745
		2.685	12.372	0.363	68.124	26.725	18.160	0.756
		2.685	12.372	0.357	67.044	27.372	18.453	0.742

Lampiran 2

Nilai rata-rata hasil pengolahan data pada pengujian motor Otto empat langkah.

Nilai rata-rata hasil pengolahan data untuk torsi

No	Putaran (rpm)	Standar	*Divergent Swirling Grid* 15^0	*Divergent Swirling Grid* 20^0	*Divergent Swirling Grid* 25^0
1	1300	7.429	7.339	7.160	5.997
2	1800	6.176	6.355	5.997	5.728
3	2300	5.549	5.818	5.549	4.923
4	2800	4.207	4.744	4.207	3.759
5	3300	3.043	2.954	2.685	2.685

Nilai rata-rata hasil pengolahan data untuk daya efektif

No	Putaran (rpm)	Standar	*Divergent Swirling Grid* 15^0	*Divergent Swirling Grid* 20^0	*Divergent Swirling Grid* 25^0
1	1300	13.484	13.321	12.996	10.884
2	1800	15.521	15.971	15.071	14.396
3	2300	17.820	18.682	17.820	15.808
4	2800	16.445	18.545	16.445	14.696
5	3300	14.021	13.609	12.372	12.372

Nilai rata-rata hasil pengolahan data untuk SFCe

No	Putaran (rpm)	Standar	*Divergent Swirling Grid* 15^0	*Divergent Swirling Grid* 20^0	*Divergent Swirling Grid* 25^0
1	1300	0.238	0.241	0.236	0.275
2	1800	0.247	0.247	0.239	0.248
3	2300	0.256	0.249	0.224	0.250
4	2800	0.300	0.270	0.257	0.286
5	3300	0.367	0.377	0.361	0.358

Nilai rata-rata hasil pengolahan data untuk efisiensi

No	Putaran (rpm)	Standar	*Divergent Swirling Grid* 15^0	*Divergent Swirling Grid* 20^0	*Divergent Swirling Grid* 25^0
1	1300	27.662	27.370	27.965	23.926
2	1800	26.672	26.698	27.502	26.583
3	2300	25.757	26.482	29.459	26.320
4	2800	21.941	24.429	25.589	23.008
5	3300	17.961	17.459	18.244	18.411

Nilai rata-rata hasil pengolahan data untuk emisi gas CO

No	Putaran (rpm)	Standar	*Divergent Swirling Grid* 15^0	*Divergent Swirling Grid* 20^0	*Divergent Swirling Grid* 25^0
1	1300	0.240	0.313	0.283	0.359
2	1800	0.403	0.266	0.355	0.543
3	2300	0.395	0.347	0.456	0.562
4	2800	0.477	0.472	0.532	0.622
5	3300	0.654	0.618	0.738	0.748

Lampiran 3

Tabel hubungan $\frac{P_1 - P_2}{P_1} - \varepsilon$, $\theta - P_s$ dan $\theta - \gamma_w$

- Hubungan antara $\frac{P_1 - P_2}{P_1}$ dan ε

$\frac{P_1 - P_2}{P_1}$	0	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
ε	1.000	0.969	0.906	0.873	0.840	0.850	0.769	0.732	0.693	0.653

Sumber: *Manual Book: 10*

- Hubungan $\theta - P_s$, $\theta - \gamma_w$

θ (^oC)	P_S (mmHg)	γ_w ($^{kg}/m^3$)	θ (^oC)	P_S (mmHg)	γ_w ($^{kg}/m^3$)
0.0	4.581	0.00485	20.0	17.53	0.01730
1.0	4.925	0.00520	21.0	18.65	0.01834
2.0	5.292	0.00556	22.0	19.82	0.01943
3.0	5.682	0.00595	23.0	21.07	0.02058
4.0	6.098	0.00636	24.0	22.38	0.02179
5.0	6.540	0.00680	25.0	23.75	0.02306
6.0	7.010	0.00726	26.0	25.21	0.02438
7.0	7.511	0.00775	27.0	26.74	0.02578
8.0	8.042	0.00827	28.0	28.35	0.02725
9.0	8.606	0.00882	29.0	30.04	0.02878
10.0	9.205	0.00940	30.0	31.83	0.03039
11.0	9.840	0.01001	31.0	33.70	0.03207
12.0	10.514	0.01066	32.0	35.67	0.03384
13.0	11.23	0.01135	33.0	37.73	0.03569
14.0	11.98	0.01207	34.0	39.90	0.03762
15.0	12.78	0.01283	35.0	42.18	0.03964
16.0	13.61	0.01364	36.0	44.57	0.04175
17.0	14.53	0.01448	37.0	47.08	0.04396
18.0	15.47	0.01537	38.0	49.70	0.04627
19.0	16.47	0.01631	39.0	52.45	0.04869
			40.0	55.34	0.05120

Sumber: *Manual Book: 22*

Lampiran 4

Tabel F (α ; v_1; v_2) untuk $\alpha = 0.05$

v1 / v2	1	2	3	4	5	6	7	8	9	10	12	15	20	30	40	60	120	-
1	161	200	216	225	230	234	237	239	241	242	244	246	248	250	251	252	253	254
2	18.5	19	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.5	19.5	19.5	19.5	19.5
3	10.2	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.7	8.66	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	9.59	6.39	6.26	6.16	6.09	6.04	6	5.96	5.91	5.86	5.8	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.5	4.46	4.43	4.4	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.1	4.06	4	3.94	3.87	3.81	3.77	3.74	3.7	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.38	3.34	3.3	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.5	3.44	3.39	3.35	3.28	3.22	3.15	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.86	2.83	2.79	2.75	2.71
10	4.96	4.1	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.84	2.77	2.7	2.66	2.62	2.58	2.54
	1	2	3	4	5	6	7	8	9	10	12	15	20	30	40	60	120	-
11	4.84	3.98	3.59	3.36	3.2	3.09	3.01	2.95	2.9	2.85	2.79	2.72	2.65	2.57	2.53	2.49	2.45	2.4
12	4.75	3.89	3.49	3.26	3.11	3	2.91	2.85	2.8	2.75	2.69	2.62	2.54	2.47	2.43	2.38	2.34	2.3
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.6	2.53	2.46	2.38	2.34	2.3	2.25	2.21
14	4.6	3.74	3.34	3.11	2.96	2.85	2.76	2.7	2.65	2.6	2.53	2.46	2.39	2.31	2.27	2.22	2.18	2.13
15	4.45	3.68	3.29	3.06	2.9	2.79	2.71	2.64	2.59	2.54	2.48	2.4	2.33	2.25	2.2	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.2	2.96	2.81	2.7	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.15	2.1	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.9	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.1	2.87	2.71	2.6	2.51	2.45	2.39	2.35	2.28	2.2	2.12	2.04	1.99	1.95	1.9	1.84
	1	2	3	4	5	6	7	8	9	10	12	15	20	30	40	60	120	-
25	4.24	3.39	2.99	2.76	2.6	2.49	2.4	2.34	2.28	2.24	2.16	2.09	2.01	1.92	1.87	1.82	1.77	1.71
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2	1.92	1.84	1.74	1.69	1.64	1.58	1.51
60	4	3.15	2.76	2.53	2.37	2.25	2.17	2.1	2.04	1.99	1.92	1.84	1.75	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.55	1.5	1.43	1.35	1.25
-	3.84	3	2.6	2.37	2.21	2.1	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.46	1.39	1.32	1.22	1