

LAMPIRAN

Tabel 1.1 Jadwal Penelitian

NO	Jenis Kegiatan	Bulan ke-					
		I	II	III	IV	V	VI
1	Studi Pustaka	■					
2	Seminar poposal	■					
3	Pembuatan alat turbin angin savonius tipe L 2 sudu		■				
4	Pengambilan data			■			
5	Pengolahan data			■	■		
6	Pembahasan				■	■	
7	Kesimpulan dan saran					■	
8	Seminar hasil						■
9	Ujian						■

LAMPIRAN JURNAL RUJUKAN

NO	AUTHOR/ TAHUN	PUBLISHER	JUDUL	TUJUAN	METODE	HASIL
1	(Riyadi, 2023).	<i>SIMETRIS</i> , 17(1), 6-8.	Pengaruh sudut sudu terhadap putaran turbin angin Savonius tipe-L.	Tujuan penelitian untuk mengetahui adakah pengaruh sudut sudu terhadap putaran.	Penelitian dilakukan secara eksperiment laboratorium, kecepatan angin divariasikan pada 3, 4, 5, dan 6 m/s.	Hasilnya menunjukkan bahwa semakin tinggi sudut dari sudu turbin mengakibatkan semakin besar putaran yang dihasilkan, semakin tinggi kecepatan angin mengakibatkan semakin tinggi pula putaran yang dihasilkan.
2	(Jamal, J & Lewi,L, 2019)	<i>INTEK: Jurnal Penelitian</i> , 6(1), 64.	Pengaruh Jumlah Sudu Terhadap Kinerja Turbin Savonius. <i>INTEK: Jurnal Penelitian</i> , 6(1), 64.	Penelitian bertujuan untuk meningkatkan kinerja turbin angin Savonius dengan variasi jumlah sudu turbin serta variasi kecepatan aliran udara.	Metode penelitian adalah eksperimental dimana dilakukan pengujian turbin angin Savonius dengan variasi jumlah sudu turbin yaitu 2, 3 dan 4 sudu, variasi lain yang dilakukan adalah kecepatan angin yaitu	Penelitian hasil bahwa turbin 2 sudu menghasilkan putaran yang lebih besar, tetapi momen torsi yang rendah dibandingkan turbin 3 dan 4 sudu, hal ini terlihat pada rendahnya efisiensi turbin 2 sudu pada

					3,5; 4,5; 5,5 dan 6,5 m/s.	kecepatan angin rendah dengan pembebanan tinggi. Pada kecepatan angin 3,5 m/s turbin 2 sudu memiliki efisiensi yang cenderung sama dengan turbin 3 dan 4 sudu hingga beban 0,5 N tetapi pada beban 0,6 – 1,2 N turbin 2 sudu memiliki efisiensi yang lebih rendah, sedangkan pada kecepatan angin 4,5 – 6,5 m/s turbin 2 sudu memiliki efisiensi yang lebih besar dari turbin 3 dan 4 sudu hingga beban 1,2 N tetapi jika beban ditambah maka efisiensi turbin 2 sudu dapat lebih kecil dari efisiensi 3 dan 4 sudu.
--	--	--	--	--	----------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

3	(Jamal, J & Lewi,L, 2019).	<i>INTEK J. Penelit, 6(2), 139</i>	Pengaruh Kelengkungan Sudu Terhadap Kinerja Turbin Angin Savonius.	Penelitian bertujuan untuk meningkatkan kinerja turbin angin Savonius dengan variasi kelengkungan sudu turbin serta variasi kecepatan angin. turbin 1,5R; pada kecepatan angin yang rendah (4 m/s) turbin 1,5R memiliki efisiensi yang lebih baik dari turbin 1R sebaliknya pada	Metode penelitian adalah uji laboratorium pada alat uji fan test, variasi uji adalah kelengkungan sudu yaitu 1R; 1,5R dan 2R, variasi lain adalah kecepatan angin yaitu 4,0; 5,5; 7,0 dan 8,5 m/s.	Diperoleh hasil penelitian yaitu semakin besar kecepatan angin maka daya input, laju aliran massa udara, daya output, dan efisiensi akan semakin besar; semakin besar beban gaya pada poros turbin maka torsi pada poros turbin juga akan semakin besar; hubungan beban gaya dengan daya output dan efisiensi turbin adalah membentuk kurva parabolik; untuk kecepatan angin yang sama maka turbin 2R memiliki putaran, daya output dan efisiensi yang terendah
---	----------------------------	------------------------------------	--------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

						dibandingkan turbin 1R dan 1,5R; pada kecepatan angin yang sama turbin 1R menghasilkan putaran yang lebih tinggi tetapi cenderung memiliki torsi yang lebih rendah dibandingkan
4	PRIBADI, M. A., & SIREGAR, I. H. (2019).	<i>Jurnal Teknik Mesin, 7(2).</i>	Pengaruh Rasio Luas Blade Utama Dengan Blade Pengganggu Terhadap Kinerja Turbin Angin Savonius. <i>Jurnal Teknik Mesin, 7(2).</i>	Penelitian ini menggunakan metode eksperimen. Teknik analisa data dalam penelitian ini menggunakan analisis data deskriptif yaitu menggambarkan hasil penelitian secara grafis dalam tabel, histogram, dan grafik.	Penelitian ini dilakukan untuk mengetahui pengaruh variasi rasio luas blade utama dengan blade pengganggu.	Hasil penelitian tentang variasi rasio luas antara blade utama dengan blade pengganggu pada turbin angin savonius menunjukkan daya maksimal yang diperoleh pada kecepatan 6 m/s dengan beban 4750 gram sebesar 2,88 watt dan efisiensi maksimal turbin angin sebesar 26,4 % dengan

						menggunakan variasi rasio luas blade pengganggu dengan blade utama 2 : 6
5	Rasyid, K. S. (2018)	Doctoral dissertation, Universitas Muhammadiyah Ponorogo.	Pengaruh variasi jumlah stage terhadap kinerja turbin angin sumbu vertikal savonius tipe- 1	Tujuan penelitian ini adalah untuk mendapatkan unjuk kerja model turbin angin Savonius tipe L dengan 3 variasi.	Ketiga variasi turbin angin tersebut dibuat dalam tiga staga, dengan ukuran yang sama yakni 0,35 m x 0,60 m.. Setiap model turbin angin diuji untuk mengetahui torsi, putaran poros, daya kincir, dan koefisien daya.	Hasil penelitian menunjukkan bahwa model turbin Savonius dengan jumlah 2 stage memberikan koefisien daya (C_p) maksimal (21,86 % pada kecepatan angin 8,57 m/s) tertinggi di antara ketiga model turbin yang diteliti.
6	Andreas Augustinus Manurung dan Tri Yogi Yuwono (2021)	Departemen Teknik Mesin, Institut Teknologi Sepuluh Nopember (ITS)	Studi Eksperimen Kinerja Turbin Angin Savonius yang Terintegrasi dengan Gedung pada Jarak $G/D = 1,82$ dari Dinding	Penelitian ini dimaksudkan bahwa dengan mengintegrasikan turbin angin Savonius pada gedung tinggi dapat menjadi solusi dalam pemanfaatan	digunakan turbin angin Savonius dua sudu dengan diameter sudu (D) 165,2 mm, tinggi turbin (H) 303,4 mm, diameter poros (b) 19 mm, dan diameter endplate (D_o) 321 mm. Turbin diletakkan di samping model	Hasil penelitian yang diperoleh adalah kecepatan angin 8 m/s merupakan kecepatan optimum untuk meningkatkan performa turbin angin Savonius, dibuktikan oleh peningkatan nilai Coefficient of

				energi baru terbarukan sebagai penghasil energi listrik.	bangunan pada sisi advancing-nya dengan rasio jarak pusat turbin ke dinding terhadap diameter sudu turbin (G/D) sebesar 1,82. Variasi kecepatan angin yang digunakan adalah 4 hingga 9 m/s.	Power (CoPmax) sebesar 14,7% dan peningkatan Coefficient of Moment (CoMmax) sebesar 15,9%. Pemasangan dinding disebelah di sudu advancing juga dapat meningkatkan kemampuan self-starting turbin angin Savonius pada seluruh variasi kecepatan angin, dengan peningkatan tertinggi yaitu pada kecepatan 9 m/s sebesar 79,9%.
7	Afiyah Shuhufam .M (2020)	Departemen Teknik Mesin, Fakultas Teknologi Industri Dan Rekayasa Sistem, Institut Teknologi	STUDI EKSPERIMEN PENINGKATAN KINERJA TURBIN ANGIN SAVONIUS DENGAN PENEMPATAN SILINDER	Tujuan dari Eksperimen ini adalah meningkatkan performa turbin Savonius dengan meletakkan silinder pengganggu	Penelitian ini menggunakan rasio diameter pengganggu terhadap diameter sudu turbin d/D sebesar 0,5 dengan variasi jarak dari titik pusat turbin sampai titik pusat	hasil yang didapatkan dari penelitian ini adalah, bahwa turbin angin Savonius dengan silinder pengganggu berukuran d/D=0,5 di depan returning

		Sepuluh Nopember	SIRKULAR DIDEPAN RETURNING BLADE TURBIN	di depan returning blade.	silinder pengganggu terhadap diameter turbin $S/D = 2,6$ dan variasi kecepatan angin = 3,8; 4,4; 5; 6; 7; 8; dan 9 m/s .	blade pada posisi $S/D = 2,6$ pada bilangan Reynolds $9,6 \times 10^4$ yang paling efektif meningkatkan performa turbin.
8	Muhammad Firman, Rendi (2024)	Teknik Mesin, Universitas Islam Kalimantan	Peningkatan Kinerja Turbin Angin Savonius Tipe L dengan Variasi Jarak Overlap	Penelitian ini bertujuan untuk meningkatkan kinerja turbin angin Savonius tipe L dengan memvariasikan jarak overlap pada sudu turbin. Turbin Savonius tipe L dengan sudu dua digunakan sebagai model, dengan tinggi turbin 800 mm dan diameter rotor 350 mm.	Pengujian langsung di lapangan, dengan mengukur kecepatan rotasi turbin dan beban yang dihasilkan.	Hasil penelitian menunjukkan bahwa jarak overlap memiliki pengaruh signifikan terhadap kinerja turbin. Nilai koefisien power (CoP), koefisien torsi (C_m), dan koefisien torsi statis (CTs) mencapai titik tertinggi pada jarak overlap 30 mm. Namun, ketika jarak overlap melebihi titik optimumnya, nilai-nilai ini cenderung menurun. Titik optimum tercapai pada sudut

						rotor turbin 90 derajat.
9	Cahya Irani, Bayu Rudiyanto, Risse Entikaria Rahmanita (2023)	Jurusan Teknik, Politeknik Negeri Jember	Uji performa turbin angin savonius tipe u berdasarkan variasi sudut guide vane	Tujuan penelitian ini adalah untuk mengetahui pengaruh penambahan guide vane atau deflector terhadap perfoma turbin angin Savonius Tipe U sebagai upaya peningkatan kinerja turbin angin Savonius Tipe U.	Penelitian ini adalah jenis penelitian eksperimen, meliputi penambahan guide vane atau pengarah angin terdiri dari 3 variasi sudut pitch pada guide vane antara lain 30°, 60° dan 80° dengan variasi kecepatan angin menggunakan variasi jarak 150 cm, 180 cm dan 200 cm dari sumber angin berupa blower menuju turbin angin Savonius Tipe U dengan pengujian menggunakan generator dan tanpa generator dan dilakukan perbandingan dengan data tanpa menggunakan guide vane pada turbin	Hasil penelitian eksperimen yang dilakukan mendapat hasil data yang maksimal terhadap turbin angin Savonius Tipe U pada variasi penambahan guide vane sudut pitch 40° dengan jarak 150 cm rata – rata kecepatan angin 7,6 m/s sampai 7,9 m/s dengan putaran turbin sebesar 218,1 rpm daya yang dihasilkan sebesar 61,70 Watt dengan Cp sebesar 0,88%, Torsi sebesar 3,46 Nm menggunakan beban lampu LED 12 Watt.

					angin Savonius Tipe U. Faktor – faktor yang diobservasi dan diukur yaitu kecepatan angin, daya, rpm (rotation per minute), torsi dan Cp (Coefficient of power)	
10	Sampelawang, P. (2013).	<i>AgroSainT</i> , 4(1), 527-527.	Study Eksperimen Savonius dengan Tiga Pelat Lengkung.	Penelitian ini dimaksudkan untuk mengetahui karakteristik kincir angin tipe savonius dengan tiga sudu lengkung.	Model uji berupa kincir angin proros vertikal (Savonius) dengan tiga sudu lengkung terbuat dari material pipa paralon diameter 9 cm dengan panjang 15 cm dibelah dan direkatkan pada pipa paralon diameter 1 inci yang berfungsi sebagai poros kincir angin. Prototipe tersebut diuji pada suatu wind Tunnel sederhana yang terbuat dariseng plat dengan panjang 120 cm dan diameter 28 cm. Untuk memperoleh	Daya maksimum yang dihasilkan sesuai urutan peningkatan kecepatan tersebut adalah 0.04173 watt, 0.12519 watt dan 0.31296 watt. Sedangkan Torsi maksimum untuk masing-masing urutan peningkatan kecepatan angin adalah 0.00498 Nm, 0.00997 Nm, dan 0.01993 Nm. Efisiensi yaitu perbandingan output yaitu daya kincir (P) dengan input Kincir

					<p>aliran udara, digunakan fan yang dipasang pada bagian belakang wind tunnel dan kecepatannya dapat divariasikan sebanyak 3 variasi masing-masing 1,2 m/s, 1,4 m/s dan 1,8 m/s. Kincir angin dipasang tepat pada wind Tunnel bagian depan selanjutnya dipasang alat ukur Anemometer dan Tachometer. Pada penelitian ini, dilakukan pengambilan data berupa berat pembebanan yang digunakan, pengukuran putaran poros kincir angin, pengukuran kecepatan angin, pengukuran temperature udara</p>	<p>angin yaitu daya ideal angin (W) untuk savonius dengan tiga sudu pelat lengkung sesuai prototype dapat menghasilkan efisiensi sebesar 22,34% hingga 44,10%.</p>
--	--	--	--	--	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------

					sekeling.	
11	Pasae, N., Suririk, M., Nitha, N., & Rante, M. (2025).	Unjuk kerja turbin angin savonius tiga sudu model twist dengan variasi sudut puntir sudu.	<i>Innovative: Journal Of Social Science Research</i> , 5(1), 5493–5503.	Penelitian ini bertujuan untuk mengetahui pengaruh sudut puntir sudu terhadap torsi, daya, dan efisiensi turbin angin Savonius tiga sudu tipe twist.	Metode yang digunakan dalam penelitian ini adalah metode eksperimen dengan melakukan pengujian terhadap turbin angin Savonius tiga sudu tipe twist dengan variasi sudut puntir sudu dengan dimensi diameter 250 mm dan tinggi 350 mm. Pada penelitian ini dilakukan variasi sudut puntir sudu yaitu 120°, 150°, dan 180°. Torsi maksimum yang dihasilkan sudut puntir 180° sebesar 2,94 Nm dengan beban 15 kg dan putaran 0 rpm.	Daya maksimum yang dihasilkan sudut puntir 180° sebesar 8,16Watt dengan beban 7 kg dan putaran 57,00 rpm. Efisiensi maksimum yang dihasilkan sudut puntir 180° sebesar 15,38 % dengan putaran 57,00 rpm dan beban 7 kg.

Tabel L.2 sifat-sifat zat

PROPERTY TABLES AND CHARTS							
TABLE A-9							
Properties of air at 1 atm pressure							
Temp. T, °C	Density ρ , kg/m ³	Specific Heat c_p , kJ/kg·K	Thermal Conductivity k , W/m·K	Thermal Diffusivity α , m ² /s	Dynamic Viscosity μ , kg/m·s	Kinematic Viscosity ν , m ² /s	Prandtl Number Pr
-150	2.866	963	0.01171	4.158×10^{-6}	8.636×10^{-6}	3.013×10^{-6}	0.7246
-100	2.038	966	0.01582	8.036×10^{-6}	1.189×10^{-5}	5.837×10^{-6}	0.7263
-50	1.882	999	0.01979	1.252×10^{-5}	1.474×10^{-5}	9.319×10^{-6}	0.7440
-40	1.814	1002	0.02067	1.356×10^{-5}	1.527×10^{-5}	1.008×10^{-5}	0.7436
-30	1.481	1004	0.02134	1.465×10^{-5}	1.579×10^{-5}	1.087×10^{-5}	0.7426
-20	1.394	1005	0.02211	1.578×10^{-5}	1.630×10^{-5}	1.169×10^{-5}	0.7408
-10	1.341	1006	0.02288	1.696×10^{-5}	1.680×10^{-5}	1.252×10^{-5}	0.7387
0	1.292	1006	0.02364	1.818×10^{-5}	1.729×10^{-5}	1.338×10^{-5}	0.7362
5	1.269	1006	0.02401	1.880×10^{-5}	1.754×10^{-5}	1.382×10^{-5}	0.7350
10	1.246	1006	0.02439	1.944×10^{-5}	1.778×10^{-5}	1.426×10^{-5}	0.7336
15	1.226	1007	0.02476	2.009×10^{-5}	1.802×10^{-5}	1.470×10^{-5}	0.7323
20	1.204	1007	0.02514	2.074×10^{-5}	1.825×10^{-5}	1.516×10^{-5}	0.7309
25	1.184	1007	0.02551	2.141×10^{-5}	1.849×10^{-5}	1.562×10^{-5}	0.7296
30	1.164	1007	0.02588	2.208×10^{-5}	1.872×10^{-5}	1.608×10^{-5}	0.7282
35	1.145	1007	0.02625	2.277×10^{-5}	1.895×10^{-5}	1.655×10^{-5}	0.7268
40	1.127	1007	0.02662	2.346×10^{-5}	1.918×10^{-5}	1.702×10^{-5}	0.7255
45	1.109	1007	0.02699	2.416×10^{-5}	1.941×10^{-5}	1.750×10^{-5}	0.7241
50	1.092	1007	0.02735	2.487×10^{-5}	1.963×10^{-5}	1.798×10^{-5}	0.7228
60	1.059	1007	0.02808	2.632×10^{-5}	2.008×10^{-5}	1.896×10^{-5}	0.7202
70	1.028	1007	0.02881	2.780×10^{-5}	2.052×10^{-5}	1.995×10^{-5}	0.7177
80	0.9994	1008	0.02953	2.931×10^{-5}	2.096×10^{-5}	2.097×10^{-5}	0.7154
90	0.9718	1008	0.03024	3.086×10^{-5}	2.139×10^{-5}	2.201×10^{-5}	0.7132
100	0.9458	1009	0.03095	3.243×10^{-5}	2.181×10^{-5}	2.306×10^{-5}	0.7111
120	0.8977	1011	0.03235	3.565×10^{-5}	2.264×10^{-5}	2.522×10^{-5}	0.7073
140	0.8542	1013	0.03374	3.898×10^{-5}	2.345×10^{-5}	2.745×10^{-5}	0.7041
160	0.8148	1016	0.03511	4.241×10^{-5}	2.420×10^{-5}	2.975×10^{-5}	0.7014
180	0.7788	1019	0.03646	4.593×10^{-5}	2.504×10^{-5}	3.212×10^{-5}	0.6992
200	0.7459	1023	0.03779	4.954×10^{-5}	2.577×10^{-5}	3.455×10^{-5}	0.6974
250	0.6746	1033	0.04104	5.890×10^{-5}	2.760×10^{-5}	4.091×10^{-5}	0.6946
300	0.6158	1044	0.04418	6.871×10^{-5}	2.934×10^{-5}	4.766×10^{-5}	0.6935
350	0.5664	1056	0.04721	7.892×10^{-5}	3.101×10^{-5}	5.475×10^{-5}	0.6937
400	0.5243	1069	0.05015	8.951×10^{-5}	3.261×10^{-5}	6.219×10^{-5}	0.6948
450	0.4880	1081	0.05298	1.004×10^{-4}	3.415×10^{-5}	6.997×10^{-5}	0.6965
500	0.4565	1093	0.05572	1.117×10^{-4}	3.563×10^{-5}	7.806×10^{-5}	0.6986
600	0.4042	1115	0.06093	1.352×10^{-4}	3.846×10^{-5}	9.515×10^{-5}	0.7037
700	0.3627	1135	0.06581	1.598×10^{-4}	4.111×10^{-5}	1.133×10^{-4}	0.7092
800	0.3289	1153	0.07037	1.855×10^{-4}	4.362×10^{-5}	1.326×10^{-4}	0.7149
900	0.3008	1169	0.07465	2.122×10^{-4}	4.600×10^{-5}	1.529×10^{-4}	0.7206
1000	0.2772	1184	0.07868	2.398×10^{-4}	4.826×10^{-5}	1.741×10^{-4}	0.7260
1500	0.1990	1234	0.09599	3.938×10^{-4}	5.817×10^{-5}	2.922×10^{-4}	0.7476
2000	0.1653	1264	0.11113	5.664×10^{-4}	6.630×10^{-5}	4.270×10^{-4}	0.7539

Note: For ideal gases, the properties c_p , k , μ , and Pr are independent of pressure. The properties λ , ν , and α at a pressure P (in atm) other than 1 atm are determined by multiplying the values of ρ at the given temperature by P and by dividing λ and α by P .

Source: Data generated from the EES software developed by S. A. Klein and F. L. Alvarado. Original sources: Keenan, Chao, Keyes, Gas Tables, Wiley, 1983, and Thermophysical Properties of Matter, Vol. 3: Thermal Conductivity, Y. S. Touloukian, P. E. Liley, S. C. Saxena, Vol. 11: Viscosity, Y. S. Touloukian, S. C. Saxena, and P. Hestermann, Plenum, NY, 1970, ISBN 0-306067022-8.

Tabel L.4 Hasil pengujian sudut busur 120°

Tanpa beban			0.5 kg		1 kg		1.5 kg		2 kg		2.5 kg		3 kg	
No.	Putaran	Tanggal/Waktu												
1	443,30	2025-07-31 13:55:41.329	406,30	2025-07-31 13:58:19.859	366,60	2025-07-31 14:01:02.474	347,00	2025-07-31 14:03:39.645	292,70	2025-07-31 14:06:10.309	277,60	2025-07-31 14:07:55.140	245,20	2025-07-31 14:12:10.595
2	454,80	2025-07-31 13:55:41.818	405,70	2025-07-31 13:58:20.376	366,60	2025-07-31 14:01:02.978	347,00	2025-07-31 14:03:40.146	294,40	2025-07-31 14:06:10.807	277,60	2025-07-31 14:07:55.645	248,70	2025-07-31 14:12:11.115
3	454,80	2025-07-31 13:55:42.322	405,70	2025-07-31 13:58:20.864	370,30	2025-07-31 14:01:03.463	342,80	2025-07-31 14:03:40.635	294,40	2025-07-31 14:06:11.328	276,10	2025-07-31 14:07:56.165	248,70	2025-07-31 14:12:11.601
4	459,10	2025-07-31 13:55:42.826	404,80	2025-07-31 13:58:21.366	370,30	2025-07-31 14:01:03.986	342,80	2025-07-31 14:03:41.134	293,90	2025-07-31 14:06:11.817	276,10	2025-07-31 14:07:56.651	251,90	2025-07-31 14:12:12.089
5	459,10	2025-07-31 13:55:43.330	404,80	2025-07-31 13:58:21.857	379,00	2025-07-31 14:01:04.471	338,90	2025-07-31 14:03:41.639	293,90	2025-07-31 14:06:12.305	270,20	2025-07-31 14:07:57.156	251,90	2025-07-31 14:12:12.590
6	460,50	2025-07-31 13:55:43.834	404,80	2025-07-31 13:58:22.359	379,00	2025-07-31 14:01:04.974	338,90	2025-07-31 14:03:42.142	293,70	2025-07-31 14:06:12.809	270,20	2025-07-31 14:07:57.643	251,90	2025-07-31 14:12:13.096
7	460,50	2025-07-31 13:55:44.318	403,10	2025-07-31 13:58:22.864	383,90	2025-07-31 14:01:05.464	336,60	2025-07-31 14:03:42.631	293,70	2025-07-31 14:06:13.329	272,10	2025-07-31 14:07:58.146	250,70	2025-07-31 14:12:13.596
8	457,80	2025-07-31 13:55:44.825	403,10	2025-07-31 13:58:23.350	383,90	2025-07-31 14:01:05.965	336,60	2025-07-31 14:03:43.139	295,40	2025-07-31 14:06:13.815	272,10	2025-07-31 14:07:58.648	250,70	2025-07-31 14:12:14.089
9	457,80	2025-07-31 13:55:45.327	403,40	2025-07-31 13:58:23.856	383,90	2025-07-31 14:01:06.470	339,40	2025-07-31 14:03:43.639	295,40	2025-07-31 14:06:14.334	275,00	2025-07-31 14:07:59.155	251,10	2025-07-31 14:12:14.589
10	457,80	2025-07-31 13:55:45.832	403,40	2025-07-31 13:58:24.375	384,40	2025-07-31 14:01:06.974	339,40	2025-07-31 14:03:44.145	291,70	2025-07-31 14:06:14.805	275,00	2025-07-31 14:07:59.641	251,10	2025-07-31 14:12:15.096
11	453,20	2025-07-31 13:55:46.316	406,20	2025-07-31 13:58:24.863	384,40	2025-07-31 14:01:07.463	343,60	2025-07-31 14:03:44.646	291,70	2025-07-31 14:06:15.311	275,00	2025-07-31 14:08:00.144	244,90	2025-07-31 14:12:15.598
12	453,20	2025-07-31 13:55:46.822	406,20	2025-07-31 13:58:25.351	386,00	2025-07-31 14:01:07.961	343,60	2025-07-31 14:03:45.138	285,30	2025-07-31 14:06:15.815	275,40	2025-07-31 14:08:00.647	244,90	2025-07-31 14:12:16.087
13	450,60	2025-07-31 13:55:47.325	406,80	2025-07-31 13:58:25.869	386,00	2025-07-31 14:01:08.470	343,60	2025-07-31 14:03:45.641	285,30	2025-07-31 14:06:16.320	275,40	2025-07-31 14:08:01.154	235,70	2025-07-31 14:12:16.640
14	450,60	2025-07-31 13:55:47.832	406,80	2025-07-31 13:58:26.356	385,70	2025-07-31 14:01:08.973	341,10	2025-07-31 14:03:46.145	288,50	2025-07-31 14:06:16.805	277,50	2025-07-31 14:08:01.640	235,70	2025-07-31 14:12:17.093
15	452,10	2025-07-31 13:55:48.314	403,60	2025-07-31 13:58:26.862	385,70	2025-07-31 14:01:09.460	341,10	2025-07-31 14:03:46.647	288,50	2025-07-31 14:06:17.327	277,50	2025-07-31 14:08:02.143	237,50	2025-07-31 14:12:17.596
16	452,10	2025-07-31 13:55:48.821	403,60	2025-07-31 13:58:27.350	380,80	2025-07-31 14:01:09.964	337,20	2025-07-31 14:03:47.136	295,60	2025-07-31 14:06:17.817	279,80	2025-07-31 14:08:02.647	237,50	2025-07-31 14:12:18.100
17	458,30	2025-07-31 13:55:49.326	401,30	2025-07-31 13:58:27.852	380,80	2025-07-31 14:01:10.469	337,20	2025-07-31 14:03:47.638	295,60	2025-07-31 14:06:18.318	279,80	2025-07-31 14:08:03.149	237,50	2025-07-31 14:12:18.587
18	458,30	2025-07-31 13:55:49.827	401,30	2025-07-31 13:58:28.387	375,40	2025-07-31 14:01:10.973	332,50	2025-07-31 14:03:48.142	297,60	2025-07-31 14:06:18.804	279,50	2025-07-31 14:08:03.652	241,90	2025-07-31 14:12:19.090
19	464,50	2025-07-31 13:55:50.314	401,40	2025-07-31 13:58:28.909	375,40	2025-07-31 14:01:11.493	332,50	2025-07-31 14:03:48.647	297,60	2025-07-31 14:06:19.308	279,50	2025-07-31 14:08:04.141	241,90	2025-07-31 14:12:19.594
20	464,50	2025-07-31 13:55:50.820	401,40	2025-07-31 13:58:29.413	375,40	2025-07-31 14:01:11.964	329,10	2025-07-31 14:03:49.134	295,00	2025-07-31 14:06:19.811	279,50	2025-07-31 14:08:04.644	244,10	2025-07-31 14:12:20.102
21	465,00	2025-07-31 13:55:51.323	401,00	2025-07-31 13:58:29.851	379,10	2025-07-31 14:01:12.531	329,10	2025-07-31 14:03:49.638	295,00	2025-07-31 14:06:20.314	279,50	2025-07-31 14:08:05.151	244,10	2025-07-31 14:12:20.605
22	465,00	2025-07-31 13:55:51.826	401,00	2025-07-31 13:58:30.356	379,10	2025-07-31 14:01:12.972	326,10	2025-07-31 14:03:50.142	289,90	2025-07-31 14:06:20.817	281,60	2025-07-31 14:08:05.671	244,10	2025-07-31 14:12:21.091
23	464,00	2025-07-31 13:55:52.333	401,10	2025-07-31 13:58:30.859	387,90	2025-07-31 14:01:13.488	326,10	2025-07-31 14:03:50.646	289,90	2025-07-31 14:06:21.309	281,60	2025-07-31 14:08:06.139	245,30	2025-07-31 14:12:21.594
24	464,00	2025-07-31 13:55:52.820	401,10	2025-07-31 13:58:31.378	387,90	2025-07-31 14:01:13.978	326,10	2025-07-31 14:03:51.133	288,40	2025-07-31 14:06:21.813	283,50	2025-07-31 14:08:06.643	245,30	2025-07-31 14:12:22.100
25	462,50	2025-07-31 13:55:53.324	402,40	2025-07-31 13:58:31.848	390,40	2025-07-31 14:01:14.465	323,10	2025-07-31 14:03:51.634	288,40	2025-07-31 14:06:22.315	283,50	2025-07-31 14:08:07.196	247,10	2025-07-31 14:12:22.585
26	462,50	2025-07-31 13:55:53.825	402,40	2025-07-31 13:58:32.352	390,40	2025-07-31 14:01:14.970	323,10	2025-07-31 14:03:52.141	293,20	2025-07-31 14:06:22.816	283,50	2025-07-31 14:08:07.654	247,10	2025-07-31 14:12:23.087
27	457,90	2025-07-31 13:55:54.332	404,90	2025-07-31 13:58:32.859	388,00	2025-07-31 14:01:15.473	327,30	2025-07-31 14:03:52.641	293,20	2025-07-31 14:06:23.304	280,40	2025-07-31 14:08:08.138	247,10	2025-07-31 14:12:23.592
28	457,90	2025-07-31 13:55:54.832	404,90	2025-07-31 13:58:33.376	388,00	2025-07-31 14:01:15.961	327,30	2025-07-31 14:03:53.149	297,60	2025-07-31 14:06:23.811	280,40	2025-07-31 14:08:08.641	252,30	2025-07-31 14:12:24.097
29	455,20	2025-07-31 13:55:55.321	404,90	2025-07-31 13:58:33.850	383,70	2025-07-31 14:01:16.463	331,40	2025-07-31 14:03:53.633	297,60	2025-07-31 14:06:24.314	275,60	2025-07-31 14:08:09.164	252,30	2025-07-31 14:12:24.615
30	455,20	2025-07-31 13:55:55.842	402,00	2025-07-31 13:58:34.371	383,70	2025-07-31 14:01:16.996	331,40	2025-07-31 14:03:54.140	297,60	2025-07-31 14:06:24.816	275,60	2025-07-31 14:08:09.664	257,00	2025-07-31 14:12:25.090
	457,74		403,65		381,39		335,40		293,02		277,54		246,17	

3,5 kg		4 kg		4,5 kg		5 kg		5,5 kg		6 kg		6,5 kg		0 kg	
Putaran	Tanggal/Waktu														
210,40	2025-07-31 14:15:30.354	207,20	2025-07-31 14:19:24.451	158,30	2025-07-31 14:21:30.528	152	2025-07-31 14:23:43.651	79,14	2025-07-31 14:25:51.956	100,80	2025-07-31 14:27:47.902	38,48	2025-07-31 14:32:13.425	0	2025-07-31 14:27:47.902
210,40	2025-07-31 14:15:30.858	207,20	2025-07-31 14:19:24.941	158,30	2025-07-31 14:21:31.033	152	2025-07-31 14:23:44.156	135,50	2025-07-31 14:25:52.489	104,60	2025-07-31 14:27:48.405	38,48	2025-07-31 14:32:13.932	0	2025-07-31 14:27:48.405
210,40	2025-07-31 14:15:31.362	208,80	2025-07-31 14:19:25.442	159,00	2025-07-31 14:21:31.519	148,8	2025-07-31 14:23:44.659	135,50	2025-07-31 14:25:52.946	104,60	2025-07-31 14:27:48.910	38,48	2025-07-31 14:32:14.433	0	2025-07-31 14:27:48.910
212,60	2025-07-31 14:15:31.865	208,80	2025-07-31 14:19:25.930	159,00	2025-07-31 14:21:32.025	148,8	2025-07-31 14:23:45.164	135,50	2025-07-31 14:25:53.450	104,60	2025-07-31 14:27:49.412	67,16	2025-07-31 14:32:14.939	0	2025-07-31 14:27:49.412
212,60	2025-07-31 14:15:32.353	208,80	2025-07-31 14:19:26.449	160,00	2025-07-31 14:21:32.526	143,1	2025-07-31 14:23:45.652	134,80	2025-07-31 14:25:53.954	101,20	2025-07-31 14:27:49.901	67,16	2025-07-31 14:32:15.427	0	2025-07-31 14:27:49.901
218,50	2025-07-31 14:15:32.856	205,80	2025-07-31 14:19:26.937	160,00	2025-07-31 14:21:33.032	143,1	2025-07-31 14:23:46.157	134,80	2025-07-31 14:25:54.458	101,20	2025-07-31 14:27:50.403	67,16	2025-07-31 14:32:15.929	0	2025-07-31 14:27:50.403
218,50	2025-07-31 14:15:33.364	205,80	2025-07-31 14:19:27.456	162,40	2025-07-31 14:21:33.516	143,1	2025-07-31 14:23:46.676	133,10	2025-07-31 14:25:54.944	97,70	2025-07-31 14:27:50.910	71,90	2025-07-31 14:32:16.434	0	2025-07-31 14:27:50.910
224,20	2025-07-31 14:15:33.884	200,70	2025-07-31 14:19:27.928	162,40	2025-07-31 14:21:34.021	142,4	2025-07-31 14:23:47.163	133,10	2025-07-31 14:25:55.451	97,70	2025-07-31 14:27:51.414	71,90	2025-07-31 14:32:16.937	0	2025-07-31 14:27:51.414
224,20	2025-07-31 14:15:34.368	200,70	2025-07-31 14:19:28.448	164,20	2025-07-31 14:21:34.526	142,4	2025-07-31 14:23:47.668	133,10	2025-07-31 14:25:55.953	102,30	2025-07-31 14:27:51.915	71,90	2025-07-31 14:32:17.441	0	2025-07-31 14:27:51.915
226,40	2025-07-31 14:15:34.859	200,70	2025-07-31 14:19:28.920	164,20	2025-07-31 14:21:35.030	143,2	2025-07-31 14:23:48.155	129,50	2025-07-31 14:25:56.458	102,30	2025-07-31 14:27:52.405	71,90	2025-07-31 14:32:17.958	0	2025-07-31 14:27:52.405
226,40	2025-07-31 14:15:35.362	201,10	2025-07-31 14:19:29.424	164,20	2025-07-31 14:21:35.532	143,2	2025-07-31 14:23:48.659	129,50	2025-07-31 14:25:56.945	102,30	2025-07-31 14:27:52.910	71,77	2025-07-31 14:32:18.434	0	2025-07-31 14:27:52.910
226,90	2025-07-31 14:15:35.911	201,10	2025-07-31 14:19:29.944	168,90	2025-07-31 14:21:36.020	143,2	2025-07-31 14:23:49.178	129,50	2025-07-31 14:25:57.446	103,40	2025-07-31 14:27:53.409	71,77	2025-07-31 14:32:18.953	0	2025-07-31 14:27:53.409
226,90	2025-07-31 14:15:36.370	198,10	2025-07-31 14:19:30.447	168,90	2025-07-31 14:21:36.526	144,5	2025-07-31 14:23:49.664	123,60	2025-07-31 14:25:57.953	103,40	2025-07-31 14:27:53.898	71,77	2025-07-31 14:32:19.439	0	2025-07-31 14:27:53.898
226,60	2025-07-31 14:15:36.857	198,10	2025-07-31 14:19:30.935	173,80	2025-07-31 14:21:37.027	144,5	2025-07-31 14:23:50.152	123,60	2025-07-31 14:25:58.453	103,20	2025-07-31 14:27:54.402	66,98	2025-07-31 14:32:19.928	0	2025-07-31 14:27:54.402
226,60	2025-07-31 14:15:37.361	198,10	2025-07-31 14:19:31.422	173,80	2025-07-31 14:21:37.532	141,2	2025-07-31 14:23:50.658	123,60	2025-07-31 14:25:58.973	103,20	2025-07-31 14:27:54.924	66,98	2025-07-31 14:32:20.433	0	2025-07-31 14:27:54.924
226,60	2025-07-31 14:15:37.866	193,30	2025-07-31 14:19:31.958	176,90	2025-07-31 14:21:38.020	141,2	2025-07-31 14:23:51.177	122,70	2025-07-31 14:25:59.447	103,20	2025-07-31 14:27:55.423	66,98	2025-07-31 14:32:20.953	0	2025-07-31 14:27:55.423
222,70	2025-07-31 14:15:38.369	193,30	2025-07-31 14:19:32.446	176,90	2025-07-31 14:21:38.522	141,2	2025-07-31 14:23:51.661	122,70	2025-07-31 14:25:59.952	100,70	2025-07-31 14:27:55.900	66,98	2025-07-31 14:32:21.439	0	2025-07-31 14:27:55.900
222,70	2025-07-31 14:15:38.855	194,90	2025-07-31 14:19:32.938	174,60	2025-07-31 14:21:39.028	139,9	2025-07-31 14:23:52.153	122,70	2025-07-31 14:26:00.453	100,70	2025-07-31 14:27:56.401	63,70	2025-07-31 14:32:21.941	0	2025-07-31 14:27:56.401
220,00	2025-07-31 14:15:39.360	194,90	2025-07-31 14:19:33.421	174,60	2025-07-31 14:21:39.548	139,9	2025-07-31 14:23:52.657	129,50	2025-07-31 14:26:00.960	93,73	2025-07-31 14:27:56.903	63,70	2025-07-31 14:32:22.431	0	2025-07-31 14:27:56.903
220,00	2025-07-31 14:15:39.865	195,70	2025-07-31 14:19:33.927	161,00	2025-07-31 14:21:40.017	145,4	2025-07-31 14:23:53.158	129,50	2025-07-31 14:26:01.446	93,73	2025-07-31 14:27:57.439	63,70	2025-07-31 14:32:22.932	0	2025-07-31 14:27:57.439
219,00	2025-07-31 14:15:40.366	195,70	2025-07-31 14:19:34.448	161,00	2025-07-31 14:21:40.523	145,4	2025-07-31 14:23:53.662	129,50	2025-07-31 14:26:01.951	93,73	2025-07-31 14:27:57.913	67,57	2025-07-31 14:32:23.437	0	2025-07-31 14:27:57.913
219,00	2025-07-31 14:15:40.872	195,70	2025-07-31 14:19:34.932	151,50	2025-07-31 14:21:41.027	145,4	2025-07-31 14:23:54.152	129,40	2025-07-31 14:26:02.451	91,64	2025-07-31 14:27:58.400	67,57	2025-07-31 14:32:23.925	0	2025-07-31 14:27:58.400
212,50	2025-07-31 14:15:41.359	191,90	2025-07-31 14:19:35.420	151,50	2025-07-31 14:21:41.531	153,4	2025-07-31 14:23:54.655	129,40	2025-07-31 14:26:02.956	91,64	2025-07-31 14:27:58.905	67,57	2025-07-31 14:32:24.430	0	2025-07-31 14:27:58.905
212,50	2025-07-31 14:15:41.864	191,90	2025-07-31 14:19:35.923	151,50	2025-07-31 14:21:42.019	153,4	2025-07-31 14:23:55.159	129,40	2025-07-31 14:26:03.445	91,42	2025-07-31 14:27:59.439	67,57	2025-07-31 14:32:24.965	0	2025-07-31 14:27:59.439
212,50	2025-07-31 14:15:42.368	190,30	2025-07-31 14:19:36.428	147,80	2025-07-31 14:21:42.519	156,2	2025-07-31 14:23:55.662	125,30	2025-07-31 14:26:03.966	91,42	2025-07-31 14:27:59.912	69,43	2025-07-31 14:32:25.433	0	2025-07-31 14:27:59.912
205,20	2025-07-31 14:15:42.871	190,30	2025-07-31 14:19:36.931	147,80	2025-07-31 14:21:43.025	156,2	2025-07-31 14:23:56.167	125,30	2025-07-31 14:26:04.450	91,42	2025-07-31 14:28:00.400	69,43	2025-07-31 14:32:25.940	0	2025-07-31 14:28:00.400
205,20	2025-07-31 14:15:43.392	190,30	2025-07-31 14:19:37.450	145,20	2025-07-31 14:21:43.531	152,6	2025-07-31 14:23:56.654	128,10	2025-07-31 14:26:04.957	88,47	2025-07-31 14:28:00.903	69,43	2025-07-31 14:32:26.428	0	2025-07-31 14:28:00.903
199,10	2025-07-31 14:15:43.863	190,70	2025-07-31 14:19:37.923	145,20	2025-07-31 14:21:44.046	152,6	2025-07-31 14:23:57.170	128,10	2025-07-31 14:26:05.444	88,47	2025-07-31 14:28:01.406	68,81	2025-07-31 14:32:26.931	0	2025-07-31 14:28:01.406
199,10	2025-07-31 14:15:44.366	190,70	2025-07-31 14:19:38.427	145,20	2025-07-31 14:21:44.585	152,6	2025-07-31 14:23:57.673	128,10	2025-07-31 14:26:05.949	88,47	2025-07-31 14:28:01.907	68,81	2025-07-31 14:32:27.435	0	2025-07-31 14:28:01.907
197,60	2025-07-31 14:15:44.898	190,70	2025-07-31 14:19:38.930	145,90	2025-07-31 14:21:45.025	151,9	2025-07-31 14:23:58.161	130,40	2025-07-31 14:26:06.466	89,51	2025-07-31 14:28:02.396	68,81	2025-07-31 14:32:27.955	0	2025-07-31 14:28:02.396
216,51		198,04		160,47		146,76		127,46		97,69		65,46		0	

Tabel L.4 Hasil pengujian sudut busur 150⁰

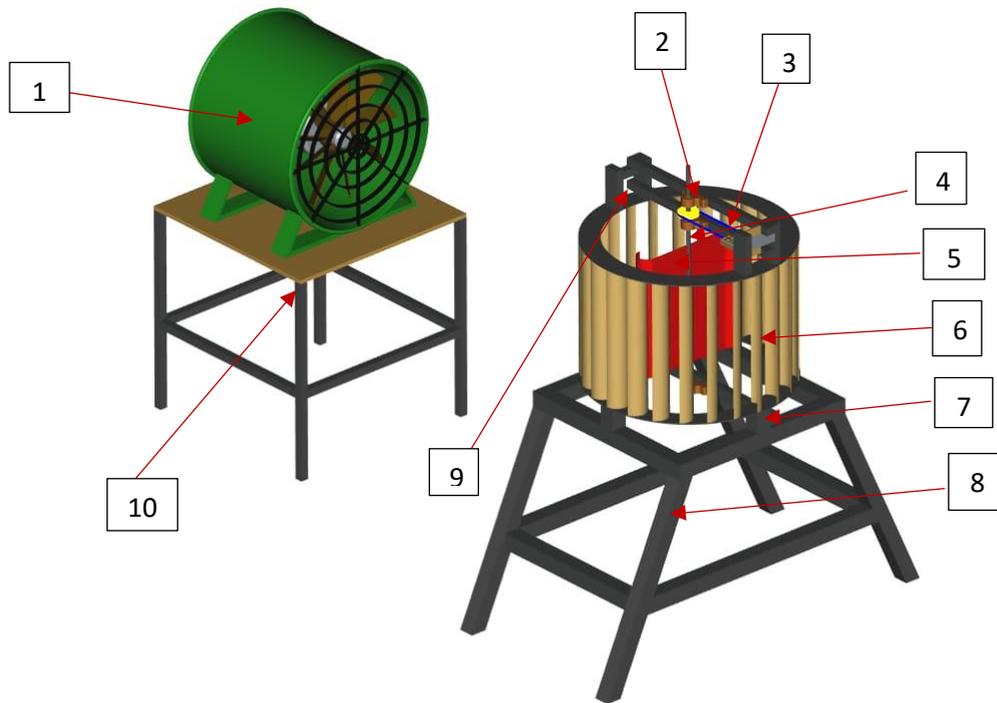
Tanpa beban			0.5 kg		1 kg		1.5 kg		2 kg		2.5 kg		3 kg	
No.	Putaran	Tanggal/Waktu												
1	443,90	2025-07-31 12:46:21.137	370,10	2025-07-31 12:54:52.267	323,50	2025-07-31 12:56:54.008	145,80	2025-07-31 13:01:11.043	279,30	2025-07-31 13:03:16.818	130,70	2025-07-31 13:06:03.530	208,00	2025-07-31 13:15:37.973
2	442,10	2025-07-31 12:46:21.628	376,30	2025-07-31 12:54:52.769	323,50	2025-07-31 12:56:54.511	145,80	2025-07-31 13:01:11.547	279,30	2025-07-31 13:03:17.321	130,70	2025-07-31 13:06:04.037	209,10	2025-07-31 13:15:38.479
3	442,10	2025-07-31 12:46:22.129	376,30	2025-07-31 12:54:53.275	323,50	2025-07-31 12:56:54.997	292,70	2025-07-31 13:01:12.063	283,10	2025-07-31 13:03:17.826	249,80	2025-07-31 13:06:04.542	209,10	2025-07-31 13:15:38.954
4	445,90	2025-07-31 12:46:22.665	381,10	2025-07-31 12:54:53.760	346,00	2025-07-31 12:56:55.500	292,70	2025-07-31 13:01:12.553	283,10	2025-07-31 13:03:18.328	249,80	2025-07-31 13:06:05.040	209,50	2025-07-31 13:15:39.440
5	445,90	2025-07-31 12:46:23.154	381,10	2025-07-31 12:54:54.265	346,00	2025-07-31 12:56:56.005	305,60	2025-07-31 13:01:13.043	281,50	2025-07-31 13:03:18.817	256,90	2025-07-31 13:06:05.549	209,50	2025-07-31 13:15:39.943
6	445,90	2025-07-31 12:46:23.674	381,10	2025-07-31 12:54:54.767	346,80	2025-07-31 12:56:56.504	305,60	2025-07-31 13:01:13.545	281,50	2025-07-31 13:03:19.320	256,90	2025-07-31 13:06:06.034	209,50	2025-07-31 13:15:40.448
7	450,30	2025-07-31 12:46:24.127	388,00	2025-07-31 12:54:55.274	346,80	2025-07-31 12:56:56.997	305,60	2025-07-31 13:01:14.050	278,50	2025-07-31 13:03:19.826	264,60	2025-07-31 13:06:06.551	211,10	2025-07-31 13:15:40.980
8	450,30	2025-07-31 12:46:24.632	388,00	2025-07-31 12:54:55.761	348,80	2025-07-31 12:56:57.502	317,00	2025-07-31 13:01:14.550	278,50	2025-07-31 13:03:20.329	264,60	2025-07-31 13:06:07.028	211,10	2025-07-31 13:15:41.438
9	449,70	2025-07-31 12:46:25.135	388,90	2025-07-31 12:54:56.265	348,80	2025-07-31 12:56:58.005	317,00	2025-07-31 13:01:15.041	282,70	2025-07-31 13:03:20.863	264,60	2025-07-31 13:06:07.544	211,00	2025-07-31 13:15:41.943
10	449,70	2025-07-31 12:46:25.642	388,90	2025-07-31 12:54:56.767	343,10	2025-07-31 12:56:58.506	315,40	2025-07-31 13:01:15.561	282,70	2025-07-31 13:03:21.318	266,80	2025-07-31 13:06:08.035	211,00	2025-07-31 13:15:42.443
11	452,20	2025-07-31 12:46:26.145	382,30	2025-07-31 12:54:57.271	343,10	2025-07-31 12:56:58.994	315,40	2025-07-31 13:01:16.048	282,70	2025-07-31 13:03:21.825	266,80	2025-07-31 13:06:08.537	210,00	2025-07-31 13:15:42.950
12	452,20	2025-07-31 12:46:26.650	382,30	2025-07-31 12:54:57.774	343,70	2025-07-31 12:56:59.500	310,90	2025-07-31 13:01:16.553	285,70	2025-07-31 13:03:22.326	265,30	2025-07-31 13:06:09.043	210,00	2025-07-31 13:15:43.439
13	456,80	2025-07-31 12:46:27.134	374,90	2025-07-31 12:54:58.263	343,70	2025-07-31 12:57:00.001	310,90	2025-07-31 13:01:17.057	285,70	2025-07-31 13:03:22.815	265,30	2025-07-31 13:06:09.530	210,00	2025-07-31 13:15:43.943
14	456,80	2025-07-31 12:46:27.641	374,90	2025-07-31 12:54:58.767	351,10	2025-07-31 12:57:00.507	310,90	2025-07-31 13:01:17.545	281,10	2025-07-31 13:03:23.319	265,90	2025-07-31 13:06:10.034	211,90	2025-07-31 13:15:44.461
15	459,80	2025-07-31 12:46:28.125	375,60	2025-07-31 12:54:59.271	351,10	2025-07-31 12:57:00.994	309,70	2025-07-31 13:01:18.065	281,10	2025-07-31 13:03:23.823	265,90	2025-07-31 13:06:10.538	211,90	2025-07-31 13:15:44.947
16	459,80	2025-07-31 12:46:28.628	375,60	2025-07-31 12:54:59.773	353,60	2025-07-31 12:57:01.497	309,70	2025-07-31 13:01:18.551	280,90	2025-07-31 13:03:24.326	268,80	2025-07-31 13:06:11.041	215,80	2025-07-31 13:15:45.437
17	460,10	2025-07-31 12:46:29.133	375,60	2025-07-31 12:55:00.260	353,60	2025-07-31 12:57:02.017	309,00	2025-07-31 13:01:19.053	280,90	2025-07-31 13:03:24.814	268,80	2025-07-31 13:06:11.527	215,80	2025-07-31 13:15:45.940
18	460,10	2025-07-31 12:46:29.640	377,60	2025-07-31 12:55:00.781	353,70	2025-07-31 12:57:02.502	309,00	2025-07-31 13:01:19.543	283,20	2025-07-31 13:03:25.316	268,80	2025-07-31 13:06:12.033	216,90	2025-07-31 13:15:46.443
19	456,20	2025-07-31 12:46:30.140	377,60	2025-07-31 12:55:01.266	353,70	2025-07-31 12:57:03.007	314,50	2025-07-31 13:01:20.045	283,20	2025-07-31 13:03:25.835	270,40	2025-07-31 13:06:12.535	216,90	2025-07-31 13:15:46.948
20	456,20	2025-07-31 12:46:30.630	375,90	2025-07-31 12:55:01.773	355,00	2025-07-31 12:57:03.496	314,50	2025-07-31 13:01:20.550	282,70	2025-07-31 13:03:26.327	270,40	2025-07-31 13:06:13.040	217,40	2025-07-31 13:15:47.452
21	454,80	2025-07-31 12:46:31.132	375,90	2025-07-31 12:55:02.260	355,00	2025-07-31 12:57:04.015	318,30	2025-07-31 13:01:21.052	282,70	2025-07-31 13:03:26.830	265,40	2025-07-31 13:06:13.528	217,40	2025-07-31 13:15:47.939
22	454,80	2025-07-31 12:46:31.634	379,60	2025-07-31 12:55:02.765	353,40	2025-07-31 12:57:04.504	318,30	2025-07-31 13:01:21.542	280,30	2025-07-31 13:03:27.316	265,40	2025-07-31 13:06:14.028	220,60	2025-07-31 13:15:48.443
23	455,00	2025-07-31 12:46:32.139	379,60	2025-07-31 12:55:03.270	353,40	2025-07-31 12:57:05.004	318,30	2025-07-31 13:01:22.045	280,30	2025-07-31 13:03:27.817	262,70	2025-07-31 13:06:14.535	220,60	2025-07-31 13:15:48.947
24	455,00	2025-07-31 12:46:32.627	383,50	2025-07-31 12:55:03.768	351,80	2025-07-31 12:57:05.496	314,40	2025-07-31 13:01:22.548	278,70	2025-07-31 13:03:28.337	262,70	2025-07-31 13:06:15.039	222,60	2025-07-31 13:15:49.448
25	456,70	2025-07-31 12:46:33.165	383,50	2025-07-31 12:55:04.271	351,80	2025-07-31 12:57:06.000	314,40	2025-07-31 13:01:23.051	278,70	2025-07-31 13:03:28.827	262,70	2025-07-31 13:06:15.524	222,60	2025-07-31 13:15:49.936
26	456,70	2025-07-31 12:46:33.635	382,20	2025-07-31 12:55:04.758	351,50	2025-07-31 12:57:06.503	309,80	2025-07-31 13:01:23.540	278,70	2025-07-31 13:03:29.316	262,60	2025-07-31 13:06:16.028	222,60	2025-07-31 13:15:50.441
27	456,70	2025-07-31 12:46:34.139	382,20	2025-07-31 12:55:05.266	351,50	2025-07-31 12:57:07.008	309,80	2025-07-31 13:01:24.044	278,90	2025-07-31 13:03:29.851	262,60	2025-07-31 13:06:16.534	222,00	2025-07-31 13:15:50.944
28	462,30	2025-07-31 12:46:34.627	382,20	2025-07-31 12:55:05.767	352,50	2025-07-31 12:57:07.493	309,80	2025-07-31 13:01:24.549	278,90	2025-07-31 13:03:30.323	260,60	2025-07-31 13:06:17.037	222,00	2025-07-31 13:15:51.450
29	462,30	2025-07-31 12:46:35.145	376,80	2025-07-31 12:55:06.269	352,50	2025-07-31 12:57:07.996	309,80	2025-07-31 13:01:25.052	285,50	2025-07-31 13:03:30.841	260,60	2025-07-31 13:06:17.539	220,20	2025-07-31 13:15:51.937
30	466,70	2025-07-31 12:46:35.635	376,80	2025-07-31 12:55:06.777	354,70	2025-07-31 12:57:08.502	309,80	2025-07-31 13:01:25.556	285,50	2025-07-31 13:03:31.315	261,00	2025-07-31 13:06:18.040	220,20	2025-07-31 13:15:52.439
	453,90		379,81		347,57		299,68		281,52		254,60		214,88	

3,5 kg		4 kg		4,5 kg		5 kg		5,5 kg		6 kg		6,5 kg	
Putaran	Tanggal/Waktu												
187,00	2025-07-31 13:13:12.585	157,50	2025-07-31 13:18:04.440	132,00	2025-07-31 13:19:56.390	101,00	2025-07-31 13:26:00.644	86,47	2025-07-31 13:29:24.760	49,36	2025-07-31 13:35:01.652	0	2025-07-31 13:29:24.760
187,00	2025-07-31 13:13:13.090	159,40	2025-07-31 13:18:04.928	132,00	2025-07-31 13:19:56.894	101,00	2025-07-31 13:26:01.163	86,47	2025-07-31 13:29:25.261	49,36	2025-07-31 13:35:02.158	0	2025-07-31 13:29:25.261
190,20	2025-07-31 13:13:13.596	159,40	2025-07-31 13:18:05.433	127,70	2025-07-31 13:19:57.399	101,00	2025-07-31 13:26:01.650	86,47	2025-07-31 13:29:25.764	55,03	2025-07-31 13:35:02.649	0	2025-07-31 13:29:25.764
190,20	2025-07-31 13:13:14.113	160,30	2025-07-31 13:18:05.937	127,70	2025-07-31 13:19:57.884	103,60	2025-07-31 13:26:02.157	85,24	2025-07-31 13:29:26.266	55,03	2025-07-31 13:35:03.150	0	2025-07-31 13:29:26.266
190,20	2025-07-31 13:13:14.618	160,30	2025-07-31 13:18:06.441	127,70	2025-07-31 13:19:58.391	103,60	2025-07-31 13:26:02.658	85,24	2025-07-31 13:29:26.753	53,85	2025-07-31 13:35:03.671	0	2025-07-31 13:29:26.753
188,80	2025-07-31 13:13:15.218	163,30	2025-07-31 13:18:06.926	125,80	2025-07-31 13:19:58.893	105,20	2025-07-31 13:26:03.143	85,24	2025-07-31 13:29:27.256	53,85	2025-07-31 13:35:04.157	0	2025-07-31 13:29:27.256
188,80	2025-07-31 13:13:16.097	163,30	2025-07-31 13:18:07.434	125,80	2025-07-31 13:19:59.398	105,20	2025-07-31 13:26:03.647	84,11	2025-07-31 13:29:27.760	50,83	2025-07-31 13:35:04.644	0	2025-07-31 13:29:27.760
186,30	2025-07-31 13:13:16.585	165,00	2025-07-31 13:18:07.933	127,30	2025-07-31 13:19:59.885	106,60	2025-07-31 13:26:04.150	84,11	2025-07-31 13:29:28.280	50,83	2025-07-31 13:35:05.149	0	2025-07-31 13:29:28.280
186,30	2025-07-31 13:13:17.089	165,00	2025-07-31 13:18:08.443	127,30	2025-07-31 13:20:00.405	106,60	2025-07-31 13:26:04.655	86,19	2025-07-31 13:29:28.751	50,83	2025-07-31 13:35:05.635	0	2025-07-31 13:29:28.751
187,60	2025-07-31 13:13:17.591	163,80	2025-07-31 13:18:08.943	127,30	2025-07-31 13:20:00.893	107,00	2025-07-31 13:26:05.158	86,19	2025-07-31 13:29:29.255	47,41	2025-07-31 13:35:06.187	0	2025-07-31 13:29:29.255
187,60	2025-07-31 13:13:18.097	163,80	2025-07-31 13:18:09.433	131,90	2025-07-31 13:20:01.409	107,00	2025-07-31 13:26:05.645	86,19	2025-07-31 13:29:29.759	47,41	2025-07-31 13:35:06.646	0	2025-07-31 13:29:29.759
187,60	2025-07-31 13:13:18.597	163,80	2025-07-31 13:18:09.933	131,90	2025-07-31 13:20:01.883	107,00	2025-07-31 13:26:06.149	87,39	2025-07-31 13:29:30.262	49,65	2025-07-31 13:35:07.147	0	2025-07-31 13:29:30.262
187,50	2025-07-31 13:13:19.087	161,10	2025-07-31 13:18:10.440	131,90	2025-07-31 13:20:02.388	108,20	2025-07-31 13:26:06.653	87,39	2025-07-31 13:29:30.751	49,65	2025-07-31 13:35:07.687	0	2025-07-31 13:29:30.751
187,50	2025-07-31 13:13:19.591	161,10	2025-07-31 13:18:10.960	133,10	2025-07-31 13:20:02.890	108,20	2025-07-31 13:26:07.140	87,39	2025-07-31 13:29:31.254	49,65	2025-07-31 13:35:08.154	0	2025-07-31 13:29:31.254
188,40	2025-07-31 13:13:20.162	160,80	2025-07-31 13:18:11.431	133,10	2025-07-31 13:20:03.410	109,60	2025-07-31 13:26:07.644	87,73	2025-07-31 13:29:31.773	49,66	2025-07-31 13:35:08.643	0	2025-07-31 13:29:31.773
188,40	2025-07-31 13:13:20.602	160,80	2025-07-31 13:18:11.932	133,10	2025-07-31 13:20:03.900	109,60	2025-07-31 13:26:08.148	87,73	2025-07-31 13:29:32.262	49,66	2025-07-31 13:35:09.163	0	2025-07-31 13:29:32.262
188,40	2025-07-31 13:13:21.086	162,80	2025-07-31 13:18:12.439	132,00	2025-07-31 13:20:04.399	108,30	2025-07-31 13:26:08.652	87,73	2025-07-31 13:29:32.765	47,28	2025-07-31 13:35:09.650	0	2025-07-31 13:29:32.765
188,50	2025-07-31 13:13:21.589	162,80	2025-07-31 13:18:12.941	132,00	2025-07-31 13:20:04.909	108,30	2025-07-31 13:26:09.155	87,62	2025-07-31 13:29:33.252	47,28	2025-07-31 13:35:10.170	0	2025-07-31 13:29:33.252
188,50	2025-07-31 13:13:22.096	164,00	2025-07-31 13:18:13.430	131,60	2025-07-31 13:20:05.394	104,90	2025-07-31 13:26:09.659	87,62	2025-07-31 13:29:33.757	51,11	2025-07-31 13:35:10.659	0	2025-07-31 13:29:33.757
186,70	2025-07-31 13:13:22.595	164,00	2025-07-31 13:18:13.932	131,60	2025-07-31 13:20:05.896	104,90	2025-07-31 13:26:10.163	88,35	2025-07-31 13:29:34.260	51,11	2025-07-31 13:35:11.146	0	2025-07-31 13:29:34.260
186,70	2025-07-31 13:13:23.085	166,30	2025-07-31 13:18:14.436	131,60	2025-07-31 13:20:06.398	104,90	2025-07-31 13:26:10.651	88,35	2025-07-31 13:29:34.781	51,11	2025-07-31 13:35:11.668	0	2025-07-31 13:29:34.781
186,70	2025-07-31 13:13:23.587	166,30	2025-07-31 13:18:14.941	131,40	2025-07-31 13:20:06.889	103,30	2025-07-31 13:26:11.171	88,35	2025-07-31 13:29:35.252	51,11	2025-07-31 13:35:12.138	0	2025-07-31 13:29:35.252
186,80	2025-07-31 13:13:24.095	166,30	2025-07-31 13:18:15.429	131,40	2025-07-31 13:20:07.407	103,30	2025-07-31 13:26:11.642	85,96	2025-07-31 13:29:35.755	51,11	2025-07-31 13:35:12.639	0	2025-07-31 13:29:35.755
186,80	2025-07-31 13:13:24.596	163,60	2025-07-31 13:18:15.933	131,40	2025-07-31 13:20:07.895	103,50	2025-07-31 13:26:12.146	85,96	2025-07-31 13:29:36.275	42,89	2025-07-31 13:35:13.177	0	2025-07-31 13:29:36.275
190,70	2025-07-31 13:13:25.102	163,60	2025-07-31 13:18:16.436	135,00	2025-07-31 13:20:08.385	103,50	2025-07-31 13:26:12.649	85,96	2025-07-31 13:29:36.779	42,89	2025-07-31 13:35:13.645	0	2025-07-31 13:29:36.779
190,70	2025-07-31 13:13:25.586	159,40	2025-07-31 13:18:16.941	135,00	2025-07-31 13:20:08.917	103,60	2025-07-31 13:26:13.153	85,05	2025-07-31 13:29:37.250	41,11	2025-07-31 13:35:14.137	0	2025-07-31 13:29:37.250
190,70	2025-07-31 13:13:26.108	159,40	2025-07-31 13:18:17.443	140,30	2025-07-31 13:20:09.390	103,60	2025-07-31 13:26:13.641	85,05	2025-07-31 13:29:37.754	41,11	2025-07-31 13:35:14.638	0	2025-07-31 13:29:37.754
198,20	2025-07-31 13:13:26.596	158,90	2025-07-31 13:18:17.947	140,30	2025-07-31 13:20:09.895	103,60	2025-07-31 13:26:14.144	85,05	2025-07-31 13:29:38.259	55,01	2025-07-31 13:35:15.144	0	2025-07-31 13:29:38.259
198,20	2025-07-31 13:13:27.084	158,90	2025-07-31 13:18:18.436	140,30	2025-07-31 13:20:10.380	104,10	2025-07-31 13:26:14.648	84,85	2025-07-31 13:29:38.762	55,01	2025-07-31 13:35:15.647	0	2025-07-31 13:29:38.762
199,50	2025-07-31 13:13:27.603	158,30	2025-07-31 13:18:18.937	140,60	2025-07-31 13:20:10.885	104,10	2025-07-31 13:26:15.151	84,85	2025-07-31 13:29:39.249	58,35	2025-07-31 13:35:16.152	0	2025-07-31 13:29:39.249
189,22		162,11		132,00		105,14		86,34		49,95		0	

Tabel L.4 Hasil pengujian sudut busur 180^o

No.	Tanpa beban		0.5 kg		1 kg		1.5 kg		2 kg		2.5 kg		3 kg		3.5 kg		4 kg		
	Putaran	Tanggal/Waktu	Putaran	Tanggal/Waktu	Putaran	Tanggal/Waktu	Putaran	Tanggal/Waktu	Putaran	Tanggal/Waktu	Putaran	Tanggal/Waktu	Putaran	Tanggal/Waktu	Putaran	Tanggal/Waktu	Putaran	Tanggal/Waktu	
1	438,90	2025-07-31 10:46:02.127	209,80	2025-07-31 11:03:52.526	279,50	2025-07-31 11:08:49.233	363,30	2025-07-31 11:13:43.595	340,4	2025-07-31 11:15:34.350	302,3	2025-07-31 11:17:57.572	278,40	2025-07-31 11:20:25.882	232,70	2025-07-31 11:22:20.202	112,30	2025-07-31 11:24:08.884	
2	435,50	2025-07-31 10:46:02.634	209,80	2025-07-31 11:03:53.044	336,80	2025-07-31 11:08:49.752	368,10	2025-07-31 11:13:44.098	340,4	2025-07-31 11:15:34.855	302,3	2025-07-31 11:17:58.077	280,00	2025-07-31 11:20:26.389	232,70	2025-07-31 11:22:20.719	224,60	2025-07-31 11:24:09.388	
3	435,50	2025-07-31 10:46:03.121	417,90	2025-07-31 11:03:53.536	336,80	2025-07-31 11:08:50.244	368,10	2025-07-31 11:13:44.602	338,2	2025-07-31 11:15:35.371	302,3	2025-07-31 11:17:58.564	280,00	2025-07-31 11:20:26.872	234,10	2025-07-31 11:22:21.194	224,60	2025-07-31 11:24:09.859	
4	435,50	2025-07-31 10:46:03.622	417,90	2025-07-31 11:03:54.040	398,80	2025-07-31 11:08:50.729	375,00	2025-07-31 11:13:45.106	338,2	2025-07-31 11:15:35.876	312,2	2025-07-31 11:17:59.066	280,10	2025-07-31 11:20:27.377	234,10	2025-07-31 11:22:21.698	227,00	2025-07-31 11:24:10.362	
5	431,70	2025-07-31 10:46:04.128	420,80	2025-07-31 11:03:54.528	398,80	2025-07-31 11:08:51.233	375,00	2025-07-31 11:13:45.593	339	2025-07-31 11:15:36.350	312,2	2025-07-31 11:17:59.605	280,10	2025-07-31 11:20:27.881	234,10	2025-07-31 11:22:22.201	227,00	2025-07-31 11:24:10.866	
6	431,70	2025-07-31 10:46:04.645	420,80	2025-07-31 11:03:55.031	399,60	2025-07-31 11:08:51.735	373,40	2025-07-31 11:13:46.097	339	2025-07-31 11:15:36.852	316	2025-07-31 11:18:00.073	277,10	2025-07-31 11:20:28.387	238,70	2025-07-31 11:22:22.689	226,20	2025-07-31 11:24:11.386	
7	435,30	2025-07-31 10:46:05.134	420,80	2025-07-31 11:03:55.532	399,60	2025-07-31 11:08:52.241	373,40	2025-07-31 11:13:46.601	342,4	2025-07-31 11:15:37.357	316	2025-07-31 11:18:00.562	277,10	2025-07-31 11:20:28.872	238,70	2025-07-31 11:22:23.192	226,20	2025-07-31 11:24:11.890	
8	435,30	2025-07-31 10:46:05.625	426,90	2025-07-31 11:03:56.040	397,60	2025-07-31 11:08:52.743	371,10	2025-07-31 11:13:47.104	342,4	2025-07-31 11:15:37.860	314	2025-07-31 11:18:01.082	276,00	2025-07-31 11:20:29.377	242,70	2025-07-31 11:22:23.695	223,30	2025-07-31 11:24:12.362	
9	443,70	2025-07-31 10:46:06.127	426,90	2025-07-31 11:03:56.525	397,60	2025-07-31 11:08:53.233	371,10	2025-07-31 11:13:47.592	346,4	2025-07-31 11:15:38.365	314	2025-07-31 11:18:01.569	276,00	2025-07-31 11:20:29.882	242,70	2025-07-31 11:22:24.200	223,30	2025-07-31 11:24:12.865	
10	443,70	2025-07-31 10:46:06.631	430,50	2025-07-31 11:03:57.028	401,10	2025-07-31 11:08:53.737	371,10	2025-07-31 11:13:48.095	346,4	2025-07-31 11:15:38.852	310	2025-07-31 11:18:02.074	277,00	2025-07-31 11:20:30.403	240,30	2025-07-31 11:22:24.733	223,80	2025-07-31 11:24:13.368	
11	450,60	2025-07-31 10:46:07.133	430,50	2025-07-31 11:03:57.532	401,10	2025-07-31 11:08:54.239	371,80	2025-07-31 11:13:48.615	347,7	2025-07-31 11:15:39.356	310	2025-07-31 11:18:02.561	277,00	2025-07-31 11:20:30.888	240,30	2025-07-31 11:22:25.190	223,80	2025-07-31 11:24:13.888	
12	450,60	2025-07-31 10:46:07.620	430,70	2025-07-31 11:03:58.037	402,10	2025-07-31 11:08:54.742	371,80	2025-07-31 11:13:49.103	347,7	2025-07-31 11:15:39.860	310	2025-07-31 11:18:03.064	279,10	2025-07-31 11:20:31.375	240,30	2025-07-31 11:22:25.696	225,60	2025-07-31 11:24:14.361	
13	455,90	2025-07-31 10:46:08.140	430,70	2025-07-31 11:03:58.537	402,10	2025-07-31 11:08:55.228	370,20	2025-07-31 11:13:49.606	349,4	2025-07-31 11:15:40.363	305,3	2025-07-31 11:18:03.569	279,10	2025-07-31 11:20:31.881	238,40	2025-07-31 11:22:26.198	225,60	2025-07-31 11:24:14.864	
14	455,90	2025-07-31 10:46:08.629	432,30	2025-07-31 11:03:59.046	399,00	2025-07-31 11:08:55.736	370,20	2025-07-31 11:13:50.094	349,4	2025-07-31 11:15:40.849	305,3	2025-07-31 11:18:04.090	282,10	2025-07-31 11:20:32.383	238,40	2025-07-31 11:22:26.703	224,80	2025-07-31 11:24:15.368	
15	458,30	2025-07-31 10:46:09.133	432,30	2025-07-31 11:03:59.534	399,00	2025-07-31 11:08:56.238	370,10	2025-07-31 11:13:50.598	349,3	2025-07-31 11:15:41.353	305	2025-07-31 11:18:04.577	282,10	2025-07-31 11:20:32.887	241,10	2025-07-31 11:22:27.190	224,80	2025-07-31 11:24:15.887	
16	458,30	2025-07-31 10:46:09.620	432,30	2025-07-31 11:04:00.032	397,00	2025-07-31 11:08:56.741	370,10	2025-07-31 11:13:51.133	349,3	2025-07-31 11:15:41.857	305	2025-07-31 11:18:05.064	282,10	2025-07-31 11:20:33.372	241,10	2025-07-31 11:22:27.710	223,80	2025-07-31 11:24:16.361	
17	461,70	2025-07-31 10:46:10.126	432,50	2025-07-31 11:04:00.538	397,00	2025-07-31 11:08:57.230	374,60	2025-07-31 11:13:51.605	349,3	2025-07-31 11:15:42.375	305	2025-07-31 11:18:05.582	284,40	2025-07-31 11:20:33.875	239,80	2025-07-31 11:22:28.211	223,80	2025-07-31 11:24:16.881	
18	461,70	2025-07-31 10:46:10.629	432,50	2025-07-31 11:04:01.025	398,40	2025-07-31 11:08:57.731	374,60	2025-07-31 11:13:52.094	341,3	2025-07-31 11:15:42.849	303,8	2025-07-31 11:18:06.070	284,40	2025-07-31 11:20:34.379	239,80	2025-07-31 11:22:28.698	223,80	2025-07-31 11:24:17.370	
19	461,70	2025-07-31 10:46:11.132	428,30	2025-07-31 11:04:01.530	398,40	2025-07-31 11:08:58.238	374,60	2025-07-31 11:13:52.597	341,3	2025-07-31 11:15:43.351	303,8	2025-07-31 11:18:06.593	282,80	2025-07-31 11:20:34.885	239,80	2025-07-31 11:22:29.184	225,10	2025-07-31 11:24:17.889	
20	461,20	2025-07-31 10:46:11.636	428,30	2025-07-31 11:04:02.033	401,10	2025-07-31 11:08:58.740	375,90	2025-07-31 11:13:53.100	332,8	2025-07-31 11:15:43.855	300,1	2025-07-31 11:18:07.061	282,80	2025-07-31 11:20:35.374	239,80	2025-07-31 11:22:29.687	225,10	2025-07-31 11:24:18.362	
21	461,20	2025-07-31 10:46:12.124	428,50	2025-07-31 11:04:02.539	401,10	2025-07-31 11:08:59.245	375,90	2025-07-31 11:13:53.605	332,8	2025-07-31 11:15:44.389	300,1	2025-07-31 11:18:07.566	279,40	2025-07-31 11:20:35.894	239,80	2025-07-31 11:22:30.191	223,50	2025-07-31 11:24:18.863	
22	457,10	2025-07-31 10:46:12.642	428,50	2025-07-31 11:04:03.023	401,10	2025-07-31 11:08:59.733	370,80	2025-07-31 11:13:54.092	334,8	2025-07-31 11:15:44.862	299,5	2025-07-31 11:18:08.068	279,40	2025-07-31 11:20:36.382	241,30	2025-07-31 11:22:30.694	223,50	2025-07-31 11:24:19.368	
23	457,10	2025-07-31 10:46:13.129	431,60	2025-07-31 11:04:03.530	403,80	2025-07-31 11:09:00.236	370,80	2025-07-31 11:13:54.596	334,8	2025-07-31 11:15:45.351	299,5	2025-07-31 11:18:08.571	275,30	2025-07-31 11:20:36.887	241,30	2025-07-31 11:22:31.231	218,10	2025-07-31 11:24:19.870	
24	455,70	2025-07-31 10:46:13.635	431,60	2025-07-31 11:04:04.034	403,80	2025-07-31 11:09:00.738	370,90	2025-07-31 11:13:55.099	337,1	2025-07-31 11:15:45.857	302,7	2025-07-31 11:18:09.062	275,30	2025-07-31 11:20:37.374	241,30	2025-07-31 11:22:31.691	218,10	2025-07-31 11:24:20.390	
25	455,70	2025-07-31 10:46:14.122	434,00	2025-07-31 11:04:04.534	410,60	2025-07-31 11:09:01.244	370,90	2025-07-31 11:13:55.603	337,1	2025-07-31 11:15:46.358	302,7	2025-07-31 11:18:09.579	277,10	2025-07-31 11:20:37.878	242,70	2025-07-31 11:22:32.193	211,70	2025-07-31 11:24:20.862	
26	454,70	2025-07-31 10:46:14.626	434,00	2025-07-31 11:04:05.020	410,60	2025-07-31 11:09:01.731	376,30	2025-07-31 11:13:56.092	334,2	2025-07-31 11:15:46.862	302,7	2025-07-31 11:18:10.067	277,10	2025-07-31 11:20:38.381	242,70	2025-07-31 11:22:32.700	211,70	2025-07-31 11:24:21.365	
27	454,70	2025-07-31 10:46:15.130	434,00	2025-07-31 11:04:05.543	417,40	2025-07-31 11:09:02.251	376,30	2025-07-31 11:13:56.594	334,2	2025-07-31 11:15:47.362	307,7	2025-07-31 11:18:10.572	280,60	2025-07-31 11:20:38.899	246,50	2025-07-31 11:22:33.202	211,70	2025-07-31 11:24:21.867	
28	455,50	2025-07-31 10:46:15.630	434,50	2025-07-31 11:04:06.027	417,40	2025-07-31 11:09:02.736	376,30	2025-07-31 11:13:57.099	336,4	2025-07-31 11:15:47.853	307,7	2025-07-31 11:18:11.075	280,60	2025-07-31 11:20:39.386	246,50	2025-07-31 11:22:33.688	208,80	2025-07-31 11:24:22.373	
29	455,50	2025-07-31 10:46:16.121	434,50	2025-07-31 11:04:06.551	418,00	2025-07-31 11:09:03.241	380,80	2025-07-31 11:13:57.603	336,4	2025-07-31 11:15:48.359	309,1	2025-07-31 11:18:11.564	279,20	2025-07-31 11:20:39.878	246,50	2025-07-31 11:22:34.191	208,80	2025-07-31 11:24:22.864	
30	455,10	2025-07-31 10:46:16.624	432,90	2025-07-31 11:04:07.038	418,00	2025-07-31 11:09:03.731	380,80	2025-07-31 11:13:58.091	336,9	2025-07-31 11:15:48.863	309,1	2025-07-31 11:18:12.069	279,20	2025-07-31 11:20:40.377	248,10	2025-07-31 11:22:34.697	209,80	2025-07-31 11:24:23.369	
	450,17		414,55		394,77		372,78		340,83		306,51		279,36		240,21		217,67		

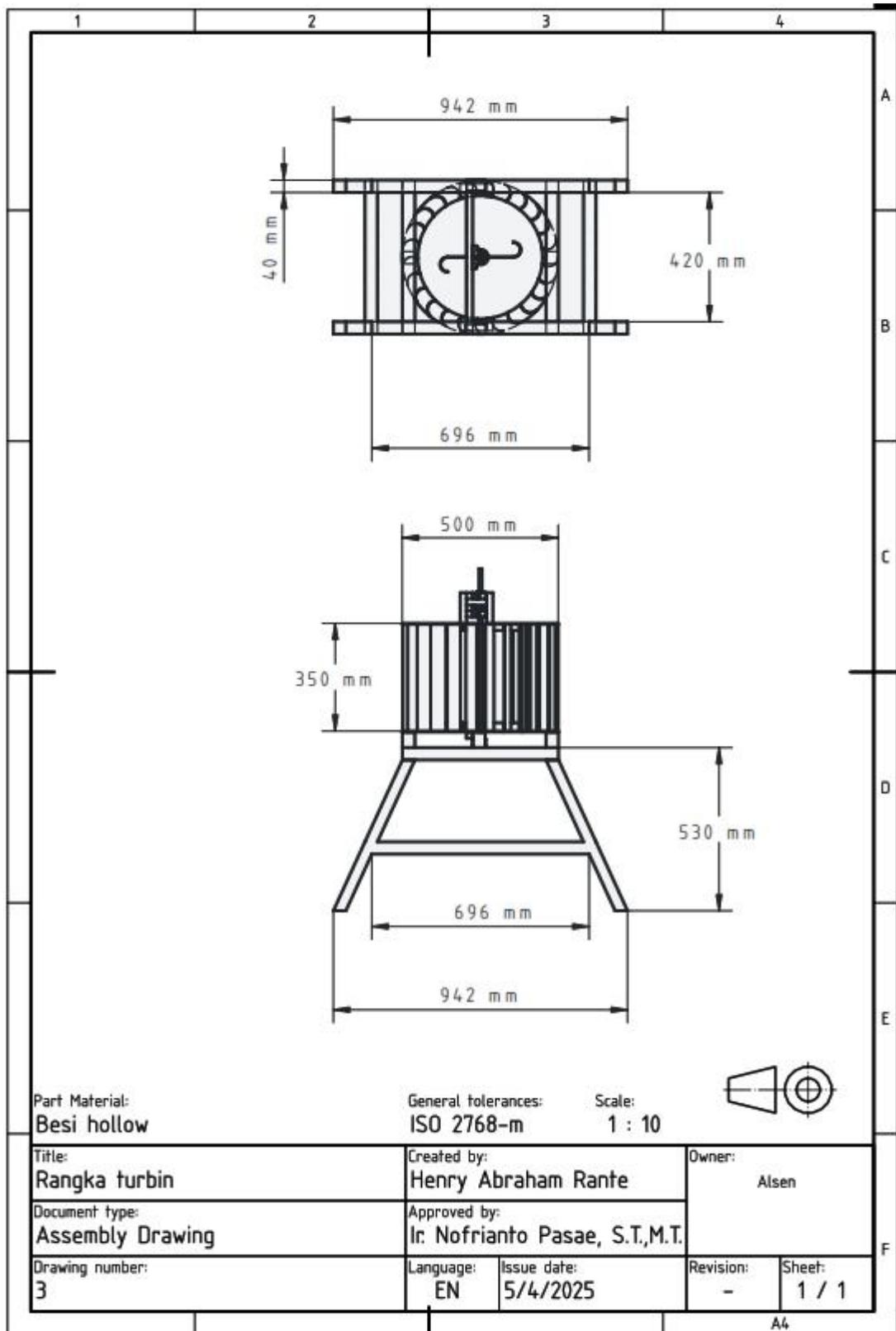
4,5 kg		5 kg		5,5 kg		6 kg		6,5 kg		7 kg		7,5 kg	
Putaran	Tanggal/Waktu												
212,20	2025-07-31 11:26:21.062	155,20	2025-07-31 11:27:53.493	142,30	2025-07-31 11:30:02.053	125,50	2025-07-31 11:31:52.323	81,75	2025-07-31 11:34:50.990	42,00	2025-07-31 11:39:42.603	0	2025-07-31 11:31:52.323
212,20	2025-07-31 11:26:21.568	155,20	2025-07-31 11:27:54.009	142,30	2025-07-31 11:30:02.570	125,50	2025-07-31 11:31:52.827	80,96	2025-07-31 11:34:51.494	42,00	2025-07-31 11:39:43.104	0	2025-07-31 11:31:52.827
212,20	2025-07-31 11:26:22.072	154,90	2025-07-31 11:27:54.502	142,30	2025-07-31 11:30:03.073	123,10	2025-07-31 11:31:53.333	80,96	2025-07-31 11:34:51.998	57,29	2025-07-31 11:39:43.627	0	2025-07-31 11:31:53.333
206,50	2025-07-31 11:26:22.557	154,90	2025-07-31 11:27:55.004	140,00	2025-07-31 11:30:03.546	123,10	2025-07-31 11:31:53.833	80,96	2025-07-31 11:34:52.501	57,29	2025-07-31 11:39:44.097	0	2025-07-31 11:31:53.833
206,50	2025-07-31 11:26:23.079	156,70	2025-07-31 11:27:55.493	140,00	2025-07-31 11:30:04.052	123,10	2025-07-31 11:31:54.324	81,30	2025-07-31 11:34:53.004	57,29	2025-07-31 11:39:44.599	0	2025-07-31 11:31:54.324
196,30	2025-07-31 11:26:23.581	156,70	2025-07-31 11:27:56.009	142,10	2025-07-31 11:30:04.572	117,90	2025-07-31 11:31:54.826	81,30	2025-07-31 11:34:53.490	55,79	2025-07-31 11:39:45.103	0	2025-07-31 11:31:54.826
196,30	2025-07-31 11:26:24.071	157,60	2025-07-31 11:27:56.518	142,10	2025-07-31 11:30:05.057	117,90	2025-07-31 11:31:55.333	84,87	2025-07-31 11:34:54.011	55,79	2025-07-31 11:39:45.607	0	2025-07-31 11:31:55.333
196,30	2025-07-31 11:26:24.558	157,60	2025-07-31 11:27:57.003	142,10	2025-07-31 11:30:05.644	113,20	2025-07-31 11:31:55.819	84,87	2025-07-31 11:34:54.514	53,59	2025-07-31 11:39:46.093	0	2025-07-31 11:31:55.819
187,40	2025-07-31 11:26:25.059	157,60	2025-07-31 11:27:57.506	141,80	2025-07-31 11:30:06.048	113,20	2025-07-31 11:31:56.322	84,87	2025-07-31 11:34:55.002	53,59	2025-07-31 11:39:46.617	0	2025-07-31 11:31:56.322
187,40	2025-07-31 11:26:25.562	158,10	2025-07-31 11:27:57.993	141,80	2025-07-31 11:30:06.600	115,30	2025-07-31 11:31:56.823	84,97	2025-07-31 11:34:55.491	52,22	2025-07-31 11:39:47.102	0	2025-07-31 11:31:56.823
184,60	2025-07-31 11:26:26.082	158,10	2025-07-31 11:27:58.529	140,40	2025-07-31 11:30:07.054	115,30	2025-07-31 11:31:57.332	84,97	2025-07-31 11:34:55.996	52,22	2025-07-31 11:39:47.639	0	2025-07-31 11:31:57.332
184,60	2025-07-31 11:26:26.557	158,40	2025-07-31 11:27:59.002	140,40	2025-07-31 11:30:07.608	117,10	2025-07-31 11:31:57.818	84,97	2025-07-31 11:34:56.499	53,23	2025-07-31 11:39:48.094	0	2025-07-31 11:31:57.818
184,60	2025-07-31 11:26:27.056	158,40	2025-07-31 11:27:59.492	140,40	2025-07-31 11:30:08.064	117,10	2025-07-31 11:31:58.323	82,79	2025-07-31 11:34:57.002	53,23	2025-07-31 11:39:48.600	0	2025-07-31 11:31:58.323
185,00	2025-07-31 11:26:27.565	157,60	2025-07-31 11:27:59.994	143,80	2025-07-31 11:30:08.598	115,10	2025-07-31 11:31:58.840	82,79	2025-07-31 11:34:57.492	53,23	2025-07-31 11:39:49.102	0	2025-07-31 11:31:58.840
185,00	2025-07-31 11:26:28.067	157,60	2025-07-31 11:28:00.498	143,80	2025-07-31 11:30:09.102	115,10	2025-07-31 11:31:59.332	82,79	2025-07-31 11:34:58.007	53,23	2025-07-31 11:39:49.606	0	2025-07-31 11:31:59.332
188,50	2025-07-31 11:26:28.556	157,60	2025-07-31 11:28:01.003	147,10	2025-07-31 11:30:09.544	113,70	2025-07-31 11:31:59.832	84,91	2025-07-31 11:34:58.495	53,23	2025-07-31 11:39:50.108	0	2025-07-31 11:31:59.832
188,50	2025-07-31 11:26:29.076	158,80	2025-07-31 11:28:01.520	147,10	2025-07-31 11:30:10.044	113,70	2025-07-31 11:32:00.322	84,91	2025-07-31 11:34:59.016	41,30	2025-07-31 11:39:50.597	0	2025-07-31 11:32:00.322
188,50	2025-07-31 11:26:29.561	158,80	2025-07-31 11:28:01.991	147,10	2025-07-31 11:30:10.552	114,40	2025-07-31 11:32:00.825	84,91	2025-07-31 11:34:59.489	41,30	2025-07-31 11:39:51.101	0	2025-07-31 11:32:00.825
194,10	2025-07-31 11:26:30.067	161,20	2025-07-31 11:28:02.498	142,80	2025-07-31 11:30:11.057	114,40	2025-07-31 11:32:01.343	85,81	2025-07-31 11:34:59.993	41,95	2025-07-31 11:39:51.619	0	2025-07-31 11:32:01.343
194,10	2025-07-31 11:26:30.571	161,20	2025-07-31 11:28:02.998	142,80	2025-07-31 11:30:11.559	112,80	2025-07-31 11:32:01.833	85,81	2025-07-31 11:35:00.498	41,95	2025-07-31 11:39:52.109	0	2025-07-31 11:32:01.833
196,80	2025-07-31 11:26:31.058	164,60	2025-07-31 11:28:03.505	142,80	2025-07-31 11:30:12.060	112,80	2025-07-31 11:32:02.317	85,81	2025-07-31 11:35:01.000	57,70	2025-07-31 11:39:52.597	0	2025-07-31 11:32:02.317
196,80	2025-07-31 11:26:31.562	164,60	2025-07-31 11:28:03.990	134,50	2025-07-31 11:30:12.596	112,80	2025-07-31 11:32:02.822	84,99	2025-07-31 11:35:01.505	57,70	2025-07-31 11:39:53.099	0	2025-07-31 11:32:02.822
196,80	2025-07-31 11:26:32.096	168,70	2025-07-31 11:28:04.496	134,50	2025-07-31 11:30:13.054	107,20	2025-07-31 11:32:03.328	84,99	2025-07-31 11:35:01.993	56,70	2025-07-31 11:39:53.602	0	2025-07-31 11:32:03.328
197,50	2025-07-31 11:26:32.570	168,70	2025-07-31 11:28:05.045	134,50	2025-07-31 11:30:13.558	107,20	2025-07-31 11:32:03.831	88,57	2025-07-31 11:35:02.514	56,70	2025-07-31 11:39:54.108	0	2025-07-31 11:32:03.831
197,50	2025-07-31 11:26:33.055	172,10	2025-07-31 11:28:05.503	130,10	2025-07-31 11:30:14.043	106,30	2025-07-31 11:32:04.318	88,57	2025-07-31 11:35:03.045	56,70	2025-07-31 11:39:54.595	0	2025-07-31 11:32:04.318
193,80	2025-07-31 11:26:33.573	172,10	2025-07-31 11:28:06.005	130,10	2025-07-31 11:30:14.548	106,30	2025-07-31 11:32:04.822	88,57	2025-07-31 11:35:03.501	56,70	2025-07-31 11:39:55.097	0	2025-07-31 11:32:04.822
193,80	2025-07-31 11:26:34.081	174,60	2025-07-31 11:28:06.495	130,70	2025-07-31 11:30:15.050	108,90	2025-07-31 11:32:05.325	94,21	2025-07-31 11:35:03.990	44,10	2025-07-31 11:39:55.616	0	2025-07-31 11:32:05.325
193,80	2025-07-31 11:26:34.567	174,60	2025-07-31 11:28:07.013	130,70	2025-07-31 11:30:15.571	108,90	2025-07-31 11:32:05.828	94,21	2025-07-31 11:35:04.491	44,10	2025-07-31 11:39:56.104	0	2025-07-31 11:32:05.828
186,60	2025-07-31 11:26:35.068	177,20	2025-07-31 11:28:07.502	130,70	2025-07-31 11:30:16.042	110,90	2025-07-31 11:32:06.334	94,31	2025-07-31 11:35:05.015	44,10	2025-07-31 11:39:56.642	0	2025-07-31 11:32:06.334
186,60	2025-07-31 11:26:35.559	177,20	2025-07-31 11:28:08.003	130,80	2025-07-31 11:30:16.578	110,90	2025-07-31 11:32:06.819	94,31	2025-07-31 11:35:05.505	44,10	2025-07-31 11:39:57.097	0	2025-07-31 11:32:06.819
194,36		162,22		139,40		114,62		85,67		51,01		0	



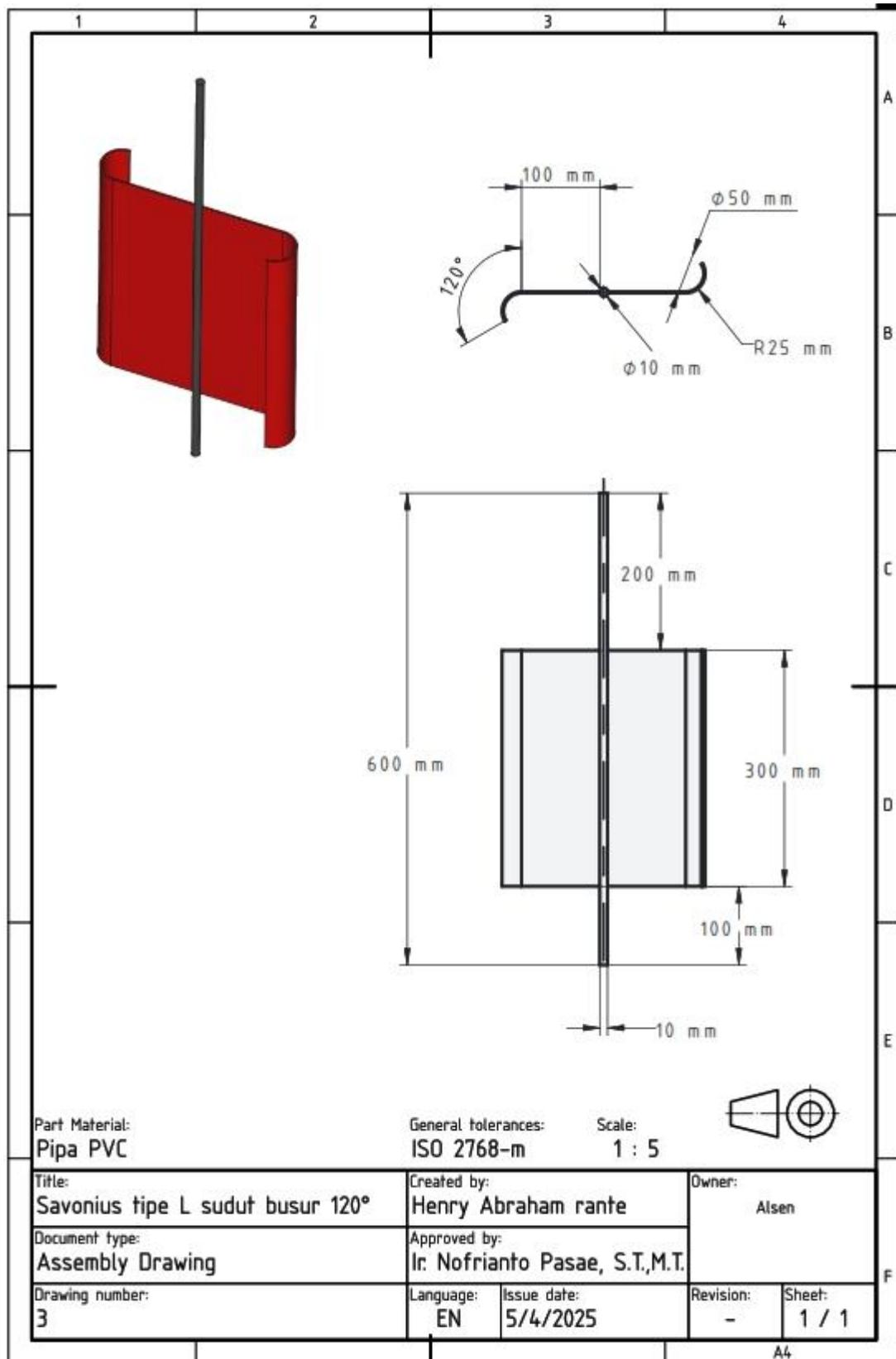
Gambar L.1 Layout Penelitian

Keterangan gambar:

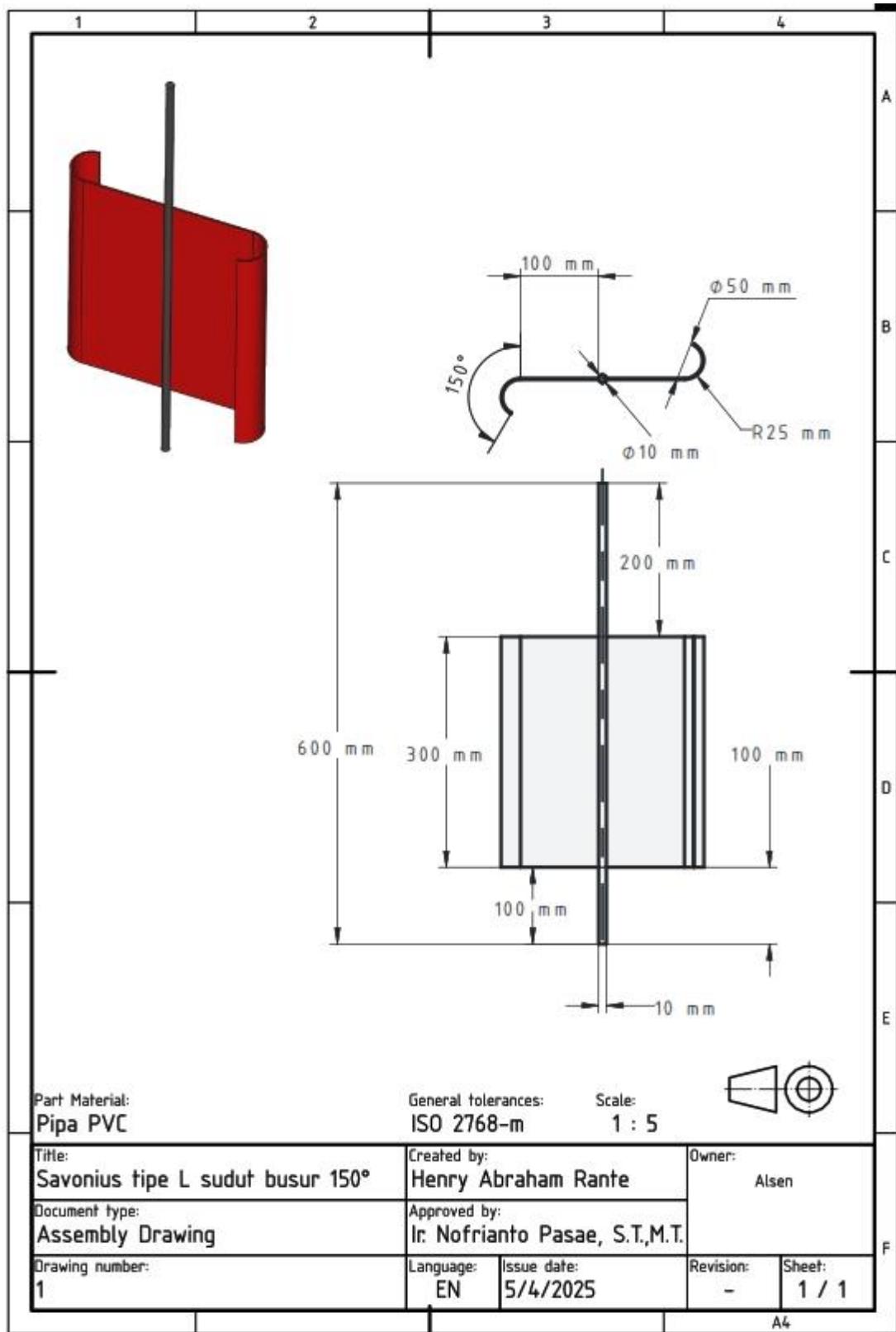
1. *Blower*
2. Neraca digital
3. Pulley
4. Poros
5. Sudu/ *blade*
6. *cylindrical guide vane*
7. Penyangga rotor
8. Rangka turbin
9. *Bearing*
10. Dudukan/ penyangga *blower*



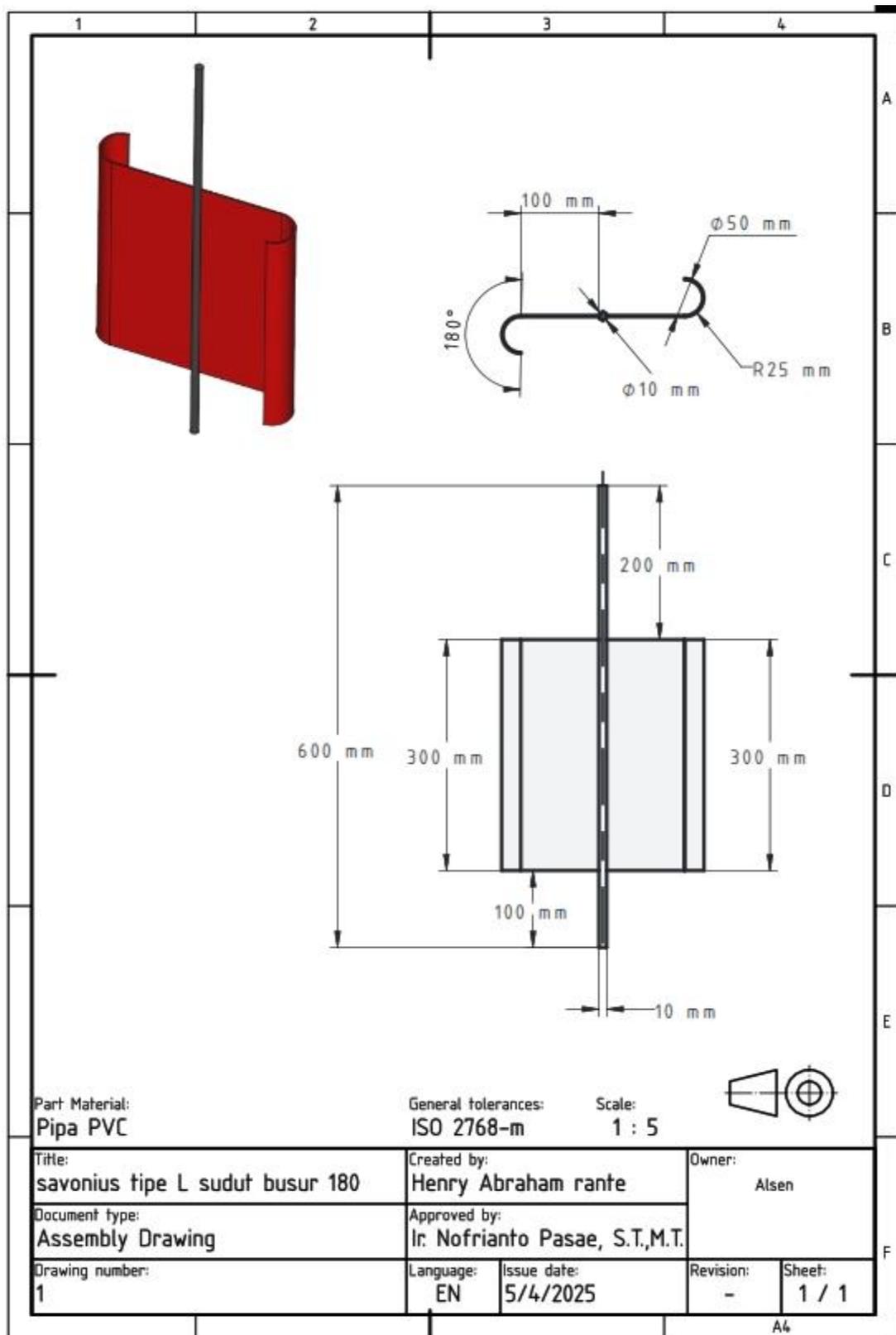
Gambar L.2 Rangka Turbin Savonius



Gambar L.3 Dua Sudu Sudut 120°



Gambar L.4 Dua Sudu Sudut Busur 150°



Gambar L.5 Dua Sudu Sudut busur 180°



Gambar L.6 Proses pemotongan pipa PVC



Gambar L.7 Proses pemotongan poros



Gambar L.8 Meja



Gambar L.9 Proses pemasangan sudu



Gambar L.10 Proses pemasangan rotor



Gambar L.11 Proses pengukuran kecepatan angin



Gambar L.12 Blower tampak depan



Gambar L.13 Blower tampak samping



Gambar L.14 turbin angin Savonius tipe L dua sudu tampak samping



Gambar L.14 Proses pengukuran kecepatan putaran menggunakan *tachometer*



Gambar L.15 Proses pengukuran pembebanan menggunakan torsi meter