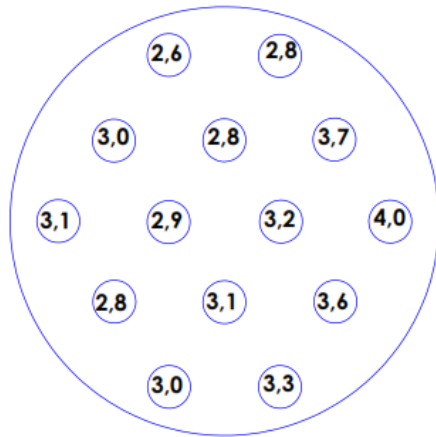


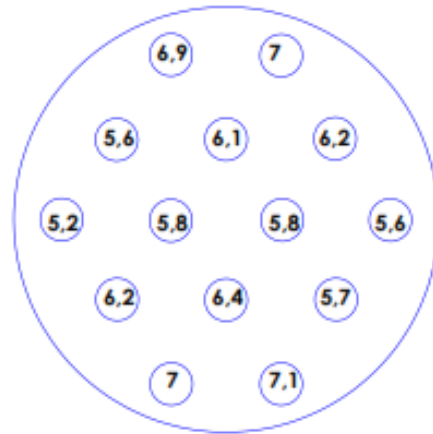
LAMPIRAN – LAMPIRAN

Lampiran 1. Penyebaran Angin

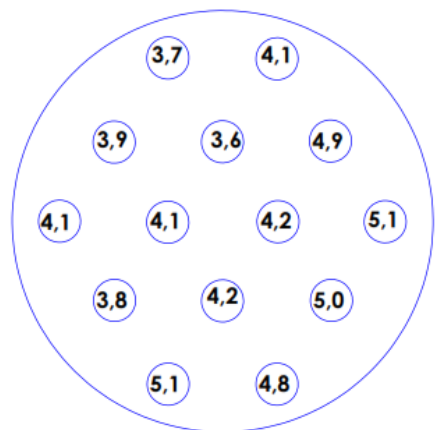
Kecepatan Angin 3,2 m/s



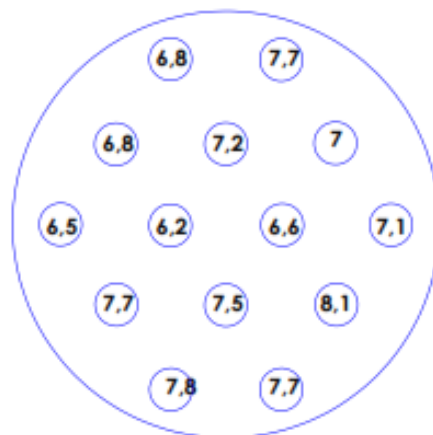
Kecepatan Angin 6,2 m/s



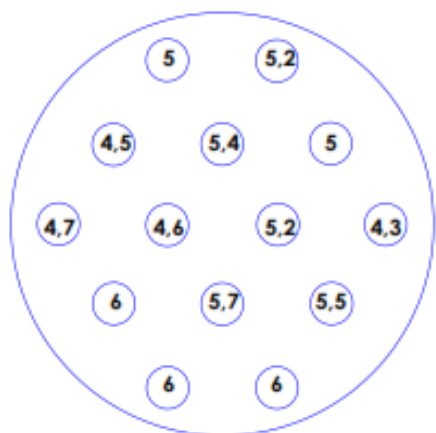
Kecepatan Angin 4,2 m/s



Kecepatan Angin 7,2 m/s



Kecepatan Angin 5,2 m/s



Lampiran 2. Data Hasil Penelitian

Data Pengukuran Tegangan (V)

0° tanpa <i>curveplate</i>				0° dengan <i>curveplate</i>					90° dengan <i>curveplate</i>				
v1	v2	v3	v4	v1	v2	v3	v4	v5	v1	v2	v3	v4	v5
0,28	1,1	1,39	1,79	0,28	1,12	2,08	2,75	3,18	1,08	1,77	2,51	2,92	3,43
0,35	1,14	1,41	1,8	0,39	1,08	2,13	2,72	3,16	1,02	1,73	2,48	2,87	3,38
0,32	1,15	1,42	1,78	0,43	1,1	2,06	2,76	3,12	1,07	1,79	2,46	2,86	3,39
0,32	1,13	1,41	1,79	0,37	1,10	2,09	2,74	3,15	1,06	1,76	2,48	2,88	3,40

Data Pengukuran Arus (mA)

0° tanpa <i>curveplate</i>				0° dengan <i>curveplate</i>					90° dengan <i>curveplate</i>				
v1	v2	v3	v4	v1	v2	v3	v4	v5	v1	v2	v3	v4	v5
21	77	124	142	22	85	132	166	198	107	152	198	239	291
23	80	127	141	23	83	137	172	191	95	147	192	242	285
22	84	126	134	24	82	138	168	187	98	154	187	237	286
22,00	80,33	125,67	139,00	23,00	83,33	135,67	168,67	192,00	100,00	151,00	192,33	239,33	287,33

Data Pengukuran Putaran (rpm)

0° tanpa <i>curveplate</i>				0° dengan <i>curveplate</i>					90° dengan <i>curveplate</i>				
v1	v2	v3	v4	v1	v2	v3	v4	v5	v1	v2	v3	v4	v5
41	153	207	256	38	158	257	344	428	150	236	298	386	467
43	161	203	259	53	147	262	342	426	148	225	307	385	462
43	162	207	248	55	146	261	347	422	154	219	302	382	465
42,33	158,67	205,67	254,33	48,67	150,33	260,00	344,33	425,33	150,67	226,67	302,33	384,33	464,67

Lampiran 3. Contoh Perhitungan Gaya Tangensial

Diketahui:

$$\theta = 0^\circ$$

$$\alpha = -90^\circ$$

$$\beta = 178^\circ$$

$$C_L = -0,043$$

$$C_D = 1,638$$

$$v = 5,2 \text{ m/s}$$

$$F_L = \frac{1}{2} \rho A v^2 C_L$$

$$F_L = 0,5 \times 1,22 \times (0,24 \times 0,3) \times 5,2^2 \times (-0,043)$$

$$F_L = -0,70926$$

$$F_D = \frac{1}{2} \rho A v^2 C_D$$

$$F_D = 0,5 \times 1,22 \times (0,24 \times 0,3) \times 5,2^2 \times (1,638)$$

$$F_D = 27,01$$

$$R = \sqrt{F_L^2 + F_D^2}$$

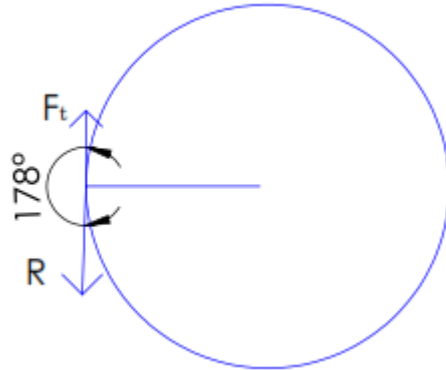
$$R = \sqrt{0,70926^2 + 27,01^2}$$

$$R = 27,02$$

$$F_t = R \cos \beta$$

$$F_t = 27,02 \cos 178$$

$$F_t = -27,01$$



Lampiran 4. Data Perhitungan Gaya Tangensial

Variasi Sudut Serang 0° Dengan *Curveplate*

Azimuth	Sudut Serang	C _L	C _D	Lift	Drag	Resultan	β	Gaya Tangensial
90	-90	0,00	1,63	-0,07	26,89	26,89	-90	0,07
100	-100	0,06	1,58	0,99	26,06	26,08	-78	5,50
110	-110	0,17	1,45	2,82	23,92	24,08	-63	10,83
120	-120	0,29	1,23	4,75	20,29	20,84	-47	14,26
130	-130	0,40	0,97	6,52	16,02	17,29	-28	15,29
140	-140	0,47	0,69	7,69	11,35	13,71	-6	13,63
150	-150	0,47	0,42	7,75	6,94	10,41	18	9,89
160	-160	0,39	0,20	6,37	3,30	7,17	43	5,28
170	-170	0,26	0,06	4,31	0,92	4,40	68	1,66
180	180	-0,13	0,01	-2,06	0,10	2,06	-87	0,10
190	170	-0,49	0,06	-8,08	0,94	8,14	-73	2,33
200	160	-0,83	0,20	-13,69	3,30	14,08	-56	7,78
210	150	-0,11	0,44	-1,80	7,18	7,40	16	7,11
220	140	-1,23	0,72	-20,29	11,86	23,50	-20	22,13
230	130	-1,20	1,02	-19,84	16,82	26,02	0	26,01
240	120	-1,01	1,31	-16,61	21,61	27,25	22	25,19
250	110	-0,66	1,55	-10,95	25,48	27,74	47	19,01
260	100	-0,22	1,69	-3,66	27,88	28,12	73	8,45
270	90	0,25	1,75	4,16	28,87	29,16	82	4,16
							Jumlah	198,67

Variasi Sudut Serang 0° Tanpa Curveplate

Azimuth	Sudut Serang	C _L	C _D	Lift	Drag	Resultan	β	Gaya Tangensial
0	0	0,47	0,01	7,77	0,12	7,77	91	-0,12
10	-10	-0,62	0,01	-10,23	0,21	10,23	81	1,56
20	-20	-0,42	0,19	-6,89	3,08	7,55	94	-0,54
30	-30	-0,42	0,42	-6,98	6,91	9,82	105	-2,50
40	-40	-0,44	0,69	-7,24	11,35	13,46	107	-4,04
50	-50	-0,40	0,97	-6,65	16,02	17,34	107	-5,20
60	-60	-0,33	1,23	-5,44	20,29	21,01	105	-5,43
70	-70	-0,24	1,45	-3,94	23,92	24,24	101	-4,48
80	-80	-0,14	1,59	-2,34	26,21	26,31	95	-2,24
90	-90	0,00	1,63	-0,07	26,89	26,89	-90	0,07
100	-100	0,06	1,58	0,99	26,06	26,08	-78	5,50
110	-110	0,17	1,45	2,82	23,92	24,08	-63	10,83
120	-120	0,29	1,23	4,75	20,29	20,84	-47	14,26
130	-130	0,40	0,97	6,52	16,02	17,29	-28	15,29
140	-140	0,47	0,69	7,69	11,35	13,71	-6	13,63
150	-150	0,47	0,42	7,75	6,94	10,41	18	9,89
160	-160	0,39	0,20	6,37	3,30	7,17	43	5,28
170	-170	0,26	0,06	4,31	0,92	4,40	68	1,66
180	180	-0,13	0,01	-2,06	0,10	2,06	-87	0,10
190	170	-0,49	0,06	-8,08	0,94	8,14	-73	2,33
200	160	-0,83	0,20	-13,69	3,30	14,08	-56	7,78
210	150	-0,11	0,44	-1,80	7,18	7,40	16	7,11
220	140	-1,23	0,72	-20,29	11,86	23,50	-20	22,13
230	130	-1,20	1,02	-19,84	16,82	26,02	0	26,01
240	120	-1,01	1,31	-16,61	21,61	27,25	22	25,19
250	110	-0,66	1,55	-10,95	25,48	27,74	47	19,01
260	100	-0,22	1,69	-3,66	27,88	28,12	73	8,45
270	90	0,25	1,75	4,16	28,87	29,16	82	4,16
280	80	0,69	1,69	11,38	27,88	30,11	78	6,37
290	70	1,05	1,53	17,32	25,24	30,61	76	7,64
300	60	1,28	1,29	21,11	21,28	29,97	75	7,65
310	50	1,38	1,00	22,76	16,49	28,11	76	6,83
320	40	1,38	0,68	22,76	11,22	25,38	76	6,04
330	30	1,30	0,33	21,44	5,44	22,12	74	6,01
340	20	1,57	0,11	25,90	1,73	25,95	74	7,23
350	10	1,45	0,01	23,97	0,23	23,97	81	3,93
360	0	0,47	0,01	7,77	0,12	7,77	91	-0,12
							Jumlah	227,27

Variasi Sudut Serang 90° Dengan Curveplate

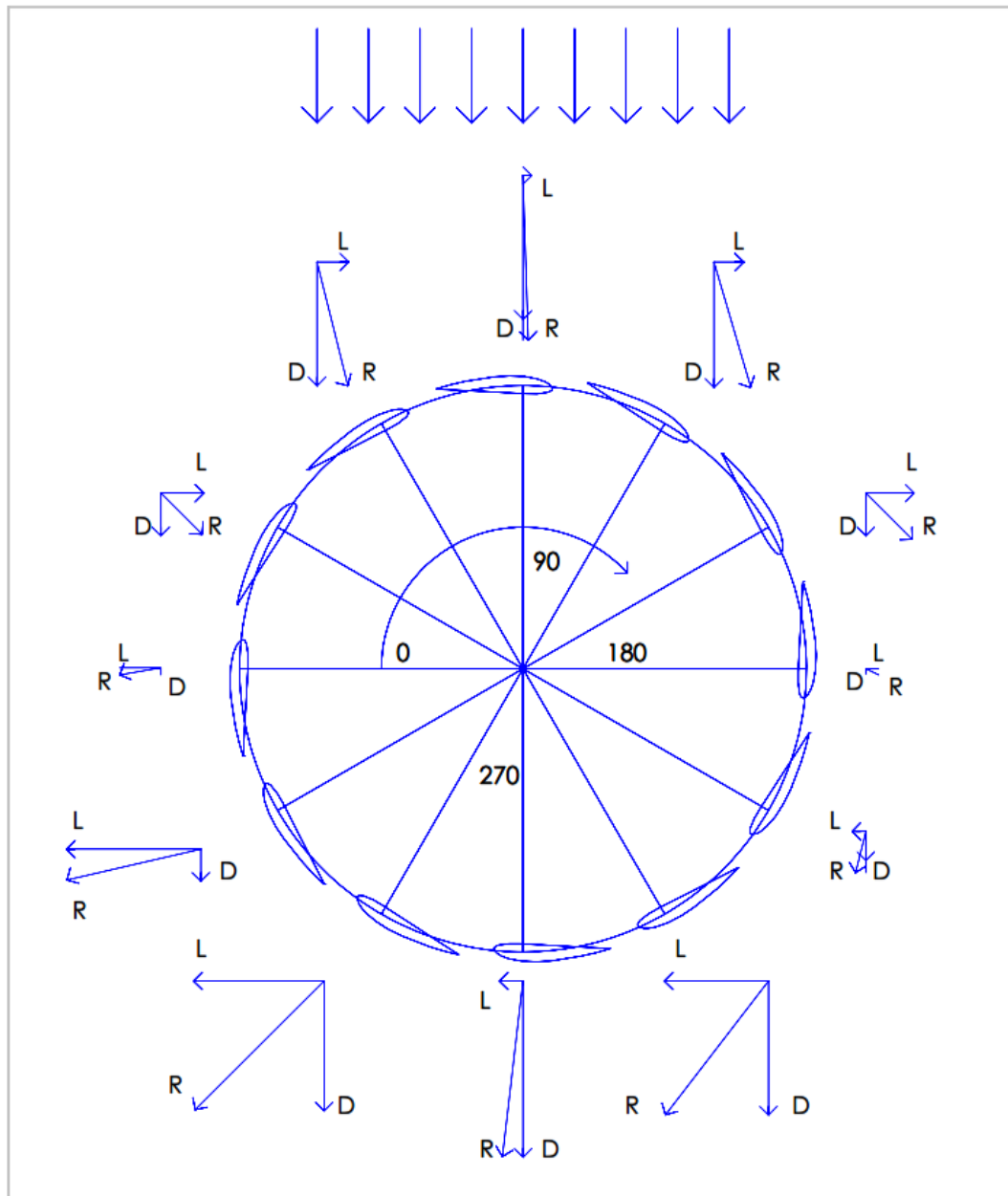
Azimuth	Sudut Serang	C _L	C _D	Lift	Drag	Resultan	β	Gaya Tangensial
90	0	0,47	0,01	7,77	0,12	7,77	-1	7,77
100	10	1,45	0,01	23,97	0,23	23,97	9	23,64
110	20	1,57	0,11	25,90	1,73	25,95	16	24,93
120	30	1,30	0,33	21,44	5,44	22,12	16	21,29
130	40	1,38	0,68	22,76	11,22	25,38	14	24,65
140	50	1,38	1,00	22,76	16,49	28,11	14	27,27
150	60	1,28	1,29	21,11	21,28	29,97	15	28,98
160	70	1,05	1,53	17,32	25,24	30,61	14	29,64
170	80	0,69	1,69	11,38	27,88	30,11	12	29,43
180	90	0,25	1,75	4,16	28,87	29,16	8	28,87
190	100	-0,22	1,69	-3,66	27,88	28,12	17	26,82
200	110	-0,66	1,55	-10,95	25,48	27,74	43	20,20
210	120	-1,01	1,31	-16,61	21,61	27,25	68	10,41
220	130	-1,20	1,02	-19,84	16,82	26,02	90	0,13
230	140	-1,23	0,72	-20,29	11,86	23,50	110	-7,92
240	150	-1,10	0,44	-18,13	7,18	19,50	128	-12,11
250	160	-0,83	0,20	-13,69	3,30	14,08	146	-11,74
260	170	-0,49	0,06	-8,08	0,94	8,14	163	-7,80
270	180	-0,13	0,01	-2,06	0,10	2,06	3	2,06
							Jumlah	266,52

Variasi Sudut Serang 90° Tanpa Curveplate

Azimuth	Sudut Serang	C _L	C _D	Lift	Drag	Resultan	β	Gaya Tangensial
0	-90	-0,04	1,64	-0,71	27,02	27,03	178	-27,02
10	-80	-0,14	1,59	-2,34	26,21	26,31	185	-26,22
20	-70	-0,24	1,45	-3,94	23,92	24,24	191	-23,82
30	-60	-0,33	1,23	-5,44	20,29	21,01	195	-20,29
40	-50	-0,40	0,97	-6,65	16,02	17,34	197	-16,54
50	-40	-0,44	0,69	-7,24	11,35	13,46	197	-12,84
60	-30	-0,42	0,42	-6,98	6,91	9,82	195	-9,50
70	-20	-0,42	0,19	-6,89	3,08	7,55	184	-7,53
80	-10	-0,62	0,01	-10,23	0,21	10,23	171	-10,11
90	0	0,47	0,01	7,77	0,12	7,77	-1	7,77
100	10	1,45	0,01	23,97	0,23	23,97	9	23,64
110	20	1,57	0,11	25,90	1,73	25,95	16	24,93
120	30	1,30	0,33	21,44	5,44	22,12	16	21,29
130	40	1,38	0,68	22,76	11,22	25,38	14	24,65
140	50	1,38	1,00	22,76	16,49	28,11	14	27,27
150	60	1,28	1,29	21,11	21,28	29,97	15	28,98
160	70	1,05	1,53	17,32	25,24	30,61	14	29,64
170	80	0,69	1,69	11,38	27,88	30,11	12	29,43
180	90	0,25	1,75	4,16	28,87	29,16	8	28,87
190	100	-0,22	1,69	-3,66	27,88	28,12	17	26,82
200	110	-0,66	1,55	-10,95	25,48	27,74	43	20,20
210	120	-1,01	1,31	-16,61	21,61	27,25	68	10,41
220	130	-1,20	1,02	-19,84	16,82	26,02	90	0,13
230	140	-1,23	0,72	-20,29	11,86	23,50	110	-7,92
240	150	-1,10	0,44	-18,13	7,18	19,50	128	-12,11
250	160	-0,83	0,20	-13,69	3,30	14,08	146	-11,74
260	170	-0,49	0,06	-8,08	0,94	8,14	163	-7,80
270	180	-0,13	0,01	-2,06	0,10	2,06	3	2,06
280	-170	0,26	0,06	4,31	0,92	4,40	22	4,08
290	-160	0,39	0,20	6,37	3,30	7,17	47	4,85
300	-150	0,47	0,42	7,75	6,94	10,41	72	3,24
310	-140	0,47	0,69	7,69	11,35	13,71	96	-1,41
320	-130	0,40	0,97	6,52	16,02	17,29	118	-8,08
330	-120	0,29	1,23	4,75	20,29	20,84	137	-15,19
340	-110	0,17	1,45	2,82	23,92	24,08	153	-21,51
350	-100	0,06	1,58	0,99	26,06	26,08	168	-25,49
360	-90	-0,04	1,64	-0,71	27,02	27,03	178	-27,02
							Jumlah	26,11

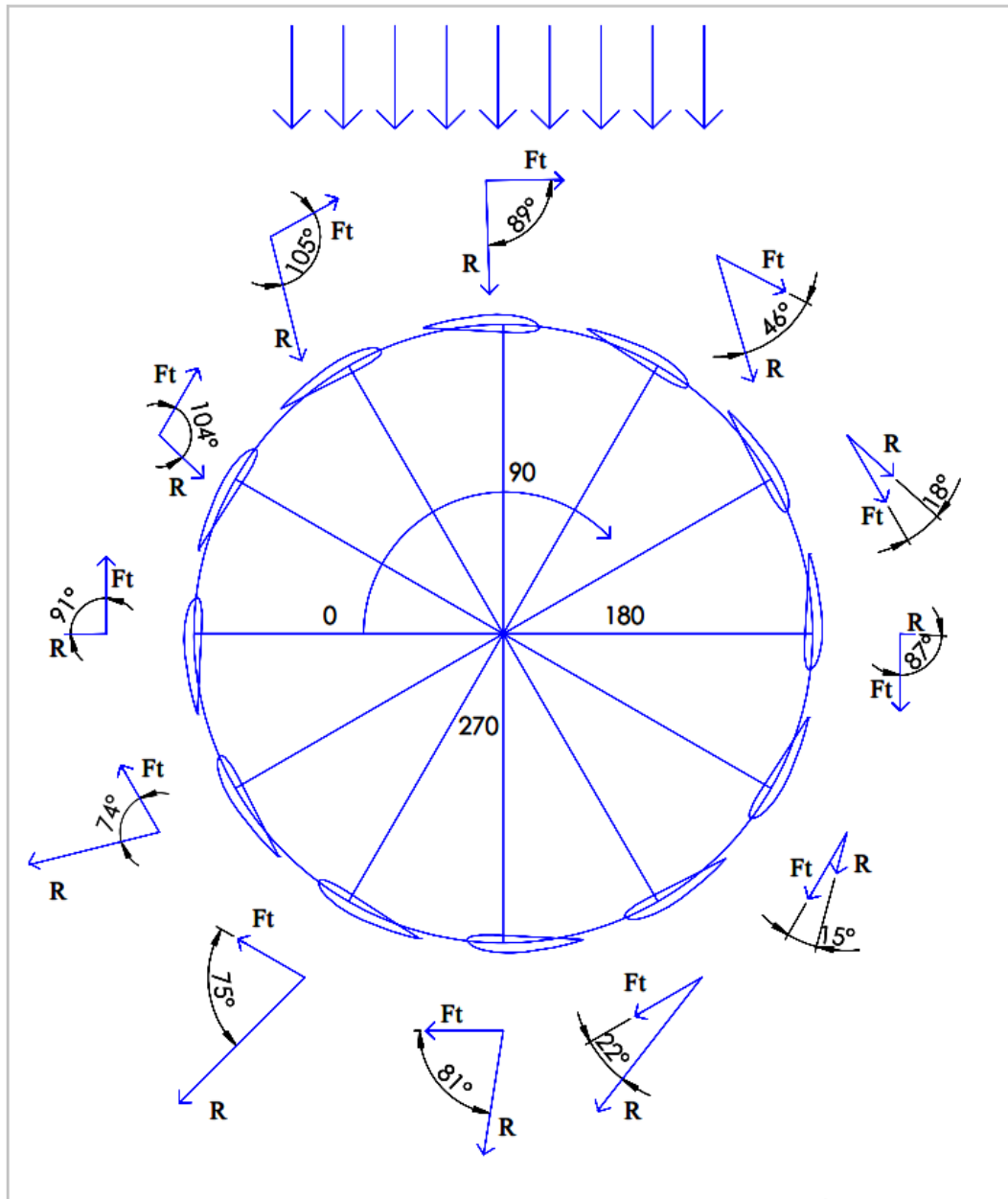
Lampiran 5. Gambar gaya yang bekerja pada sudu

Gaya turbin variasi sudut serang 0° tanpa *curveplate*



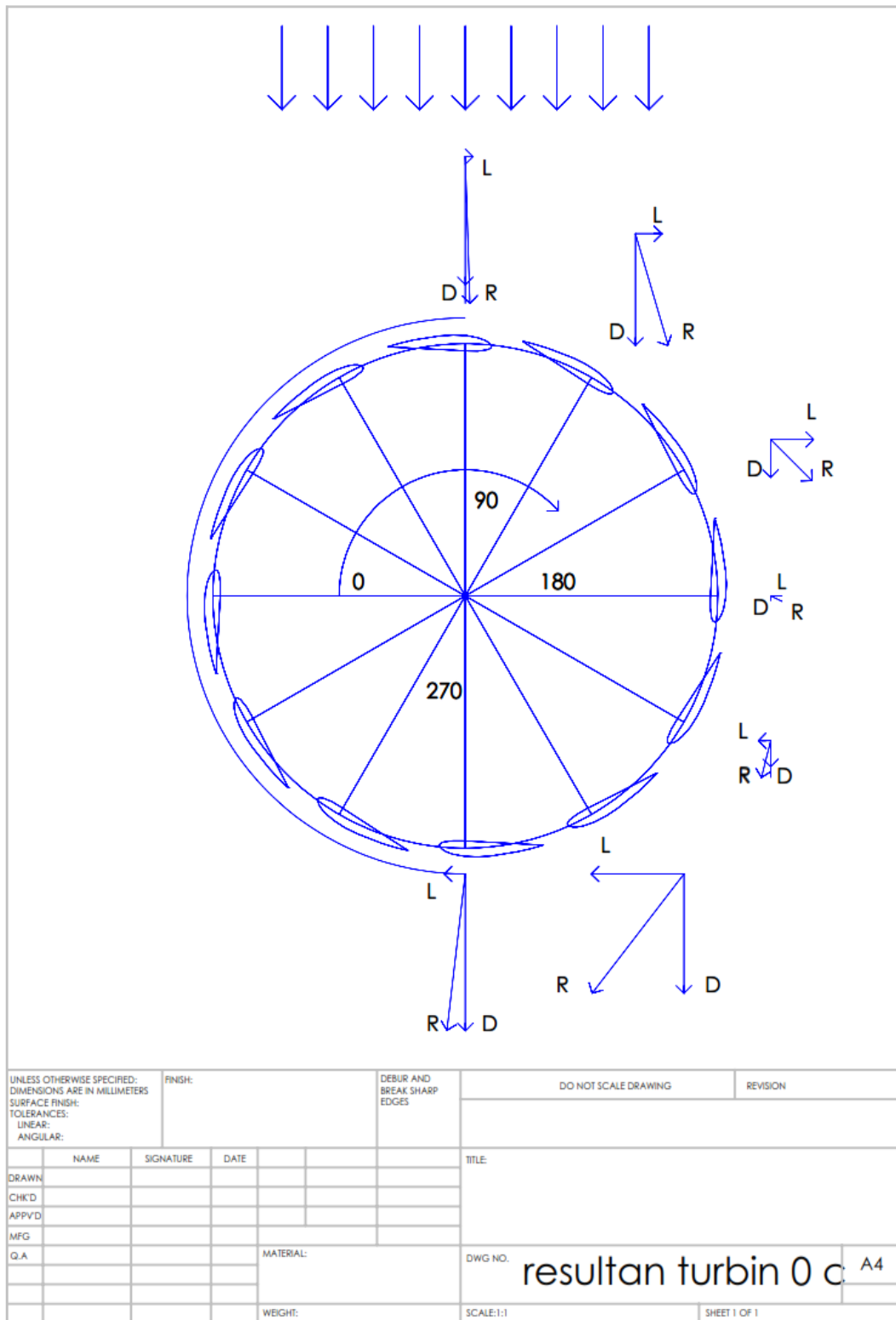
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:	DEBUR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING	REVISION
DRAWN:		NAME	SIGNATURE	DATE	TITLE:	
CHK'D:						
APP'VD:						
MFG:						
Q.A:				MATERIAL:	DWG. NO.	resultan turbin 0 r A4
				WEIGHT:	SCALE:1:1	SHEET 1 OF 1

Gaya Tangensial Turbin Variasi Sudut Serang 0° tanpa *curveplate*

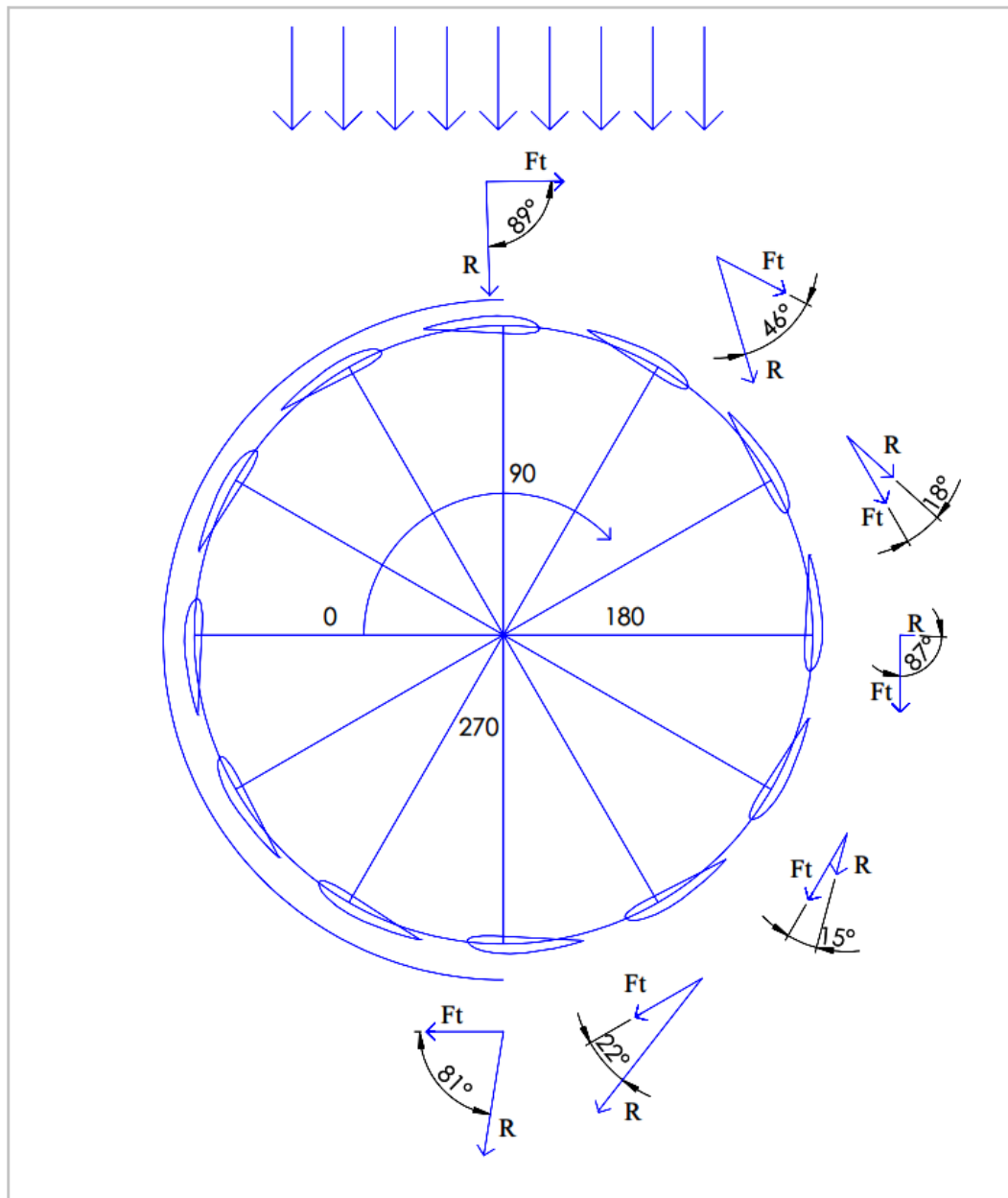


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:	DEBUR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING	REVISION
DRAWN		NAME	SIGNATURE	DATE	TITLE:	
CHK'D						
APP'VD						
MFG						
Q.A				MATERIAL:	DWG NO.	gaya tangensial 0 A4
				WEIGHT:	SCALE:1:1	SHEET 1 OF 1

Gaya turbin variasi sudut serang 0° dengan *curveplate*

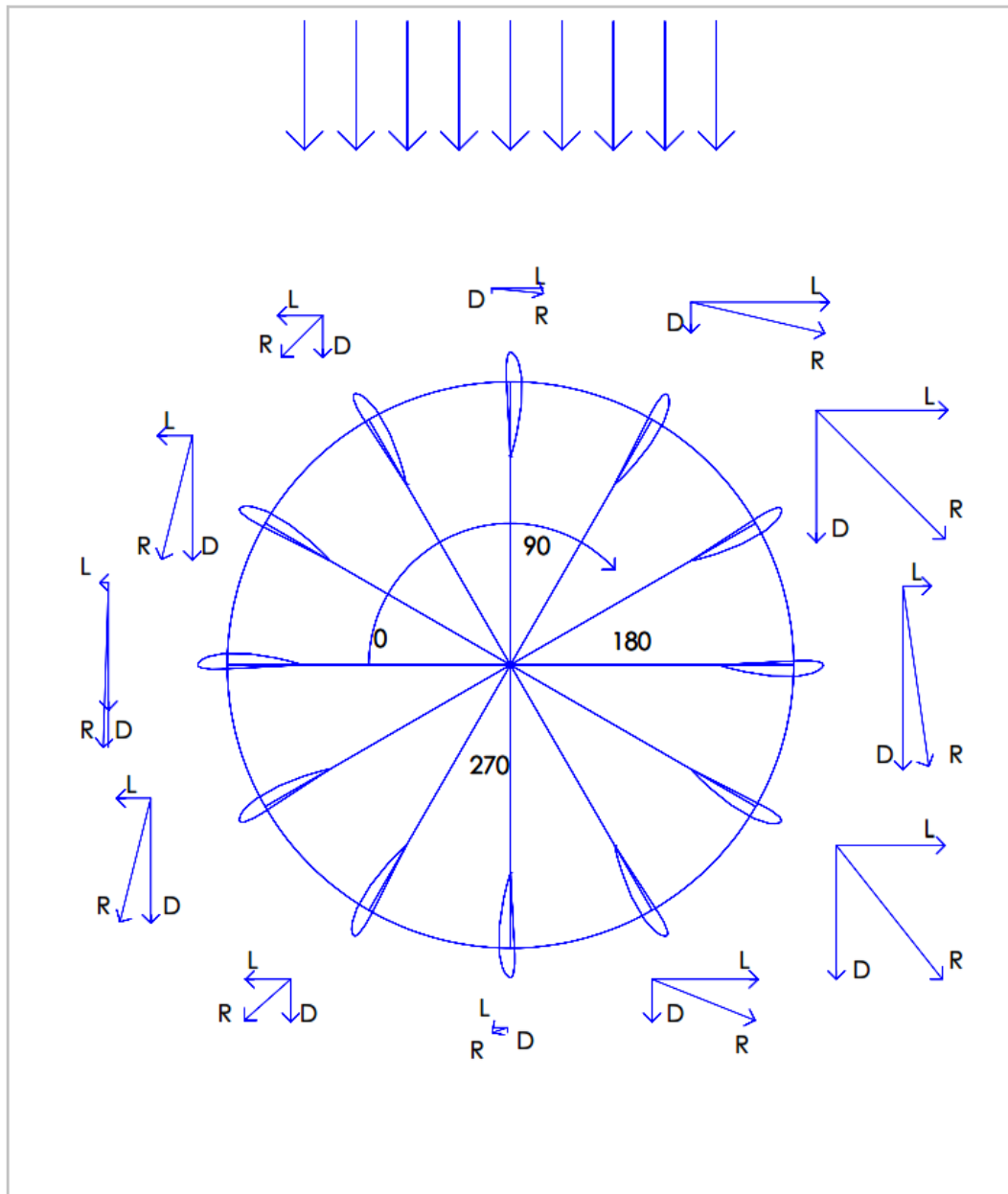


Gaya Tangensial Turbin Variasi Sudut Serang 0° tanpa *curveplate*



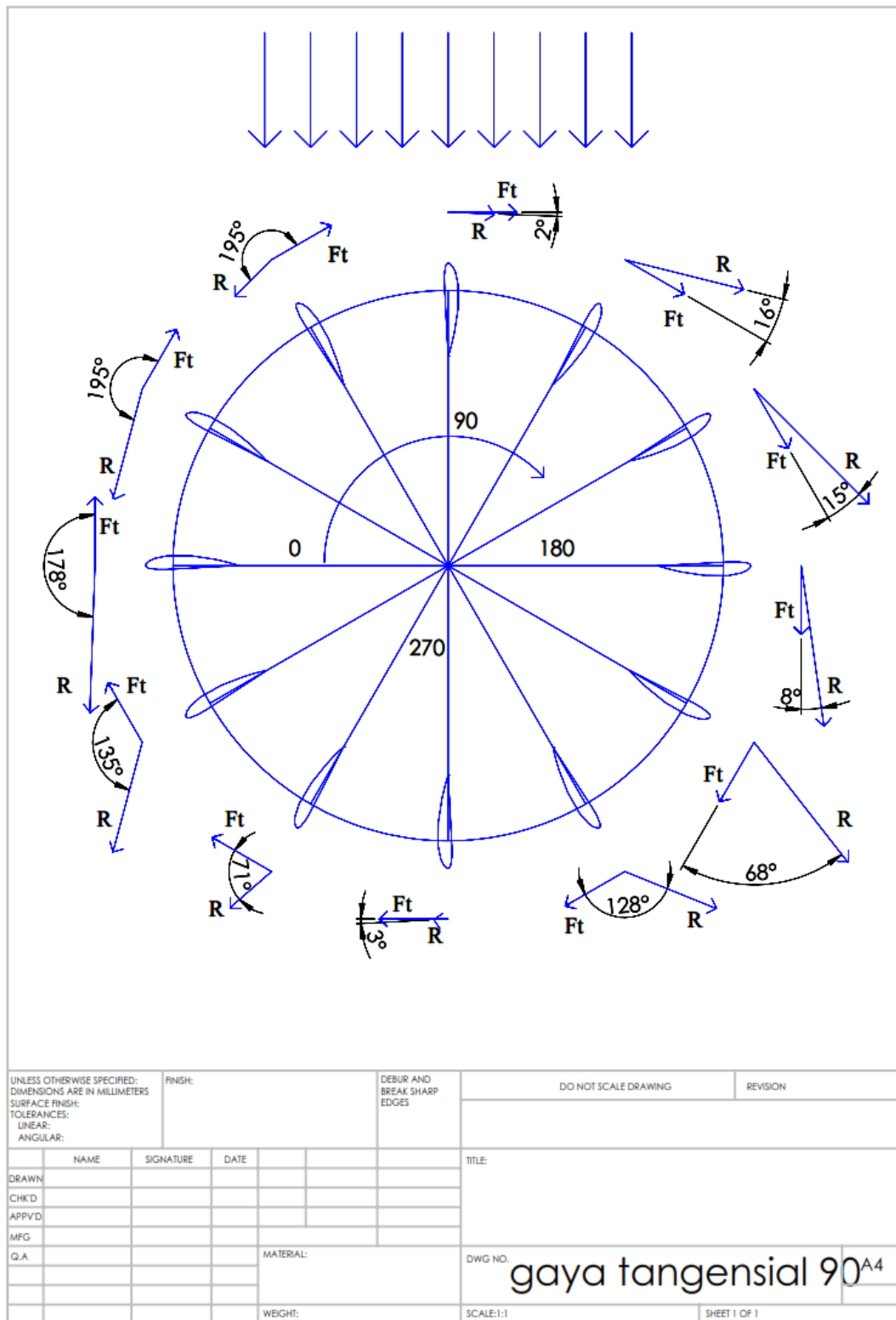
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:	DEBUR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING	REVISION
DRAWN		NAME	SIGNATURE	DATE	TITLE:	
CHKD						
APPVD						
MFG						
Q.A				MATERIAL:	DWG NO.	gaya tangensial 0 c ^{A4}
				WEIGHT:	SCALE:1:1	SHEET 1 OF 1

Gaya turbin variasi sudut serang 90° tanpa *curveplate*

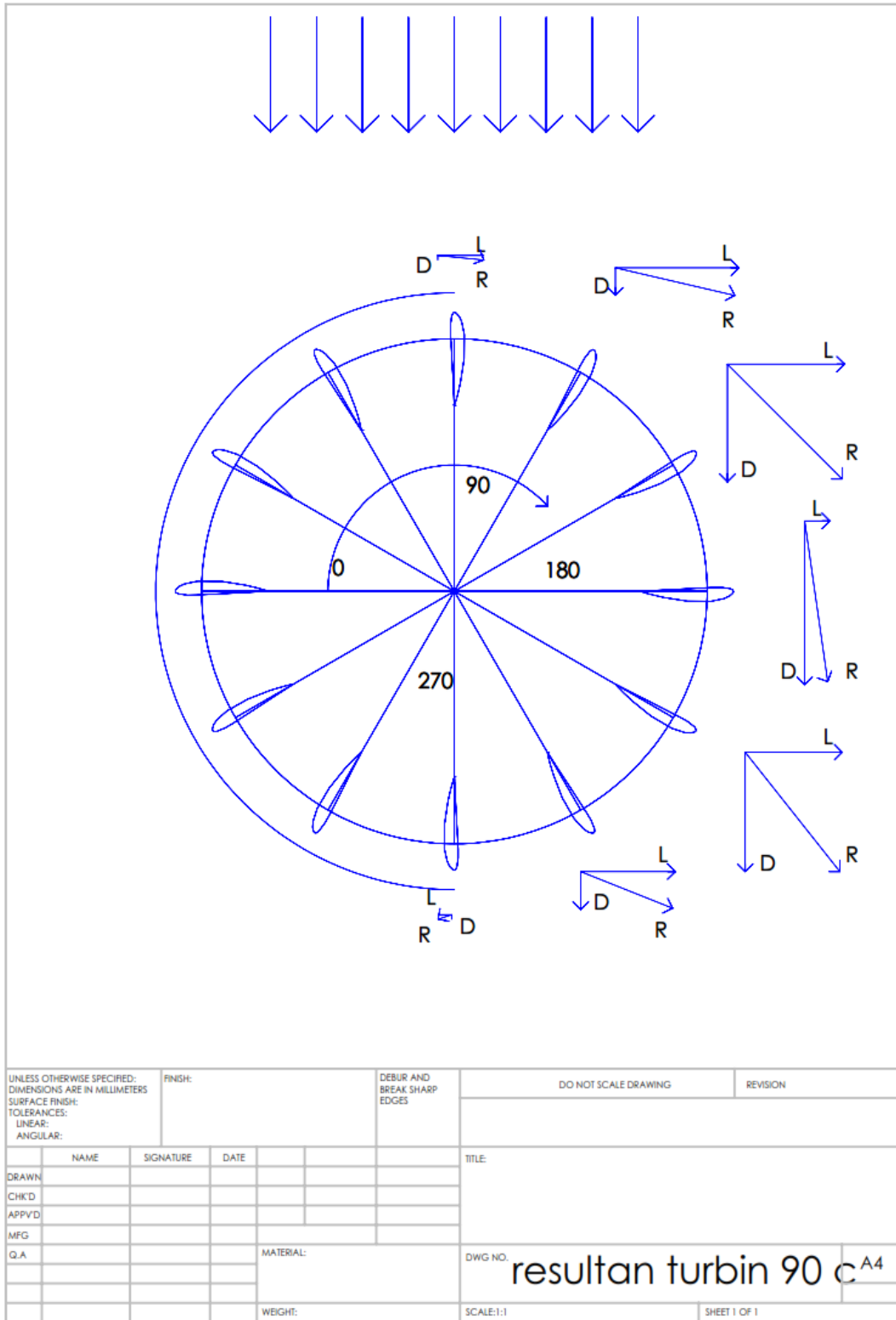


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:	DEBUR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING	REVISION
DRAWN	NAME	SIGNATURE	DATE		TITLE:	
CHKD						
APPVD						
MFG						
Q.A				MATERIAL:	DWG NO.	resultan turbin 90 r A4
				WEIGHT:	SCALE:1:1	SHEET 1 OF 1

Gaya Tangensial Turbin Variasi Sudut Serang 90° tanpa *curveplate*

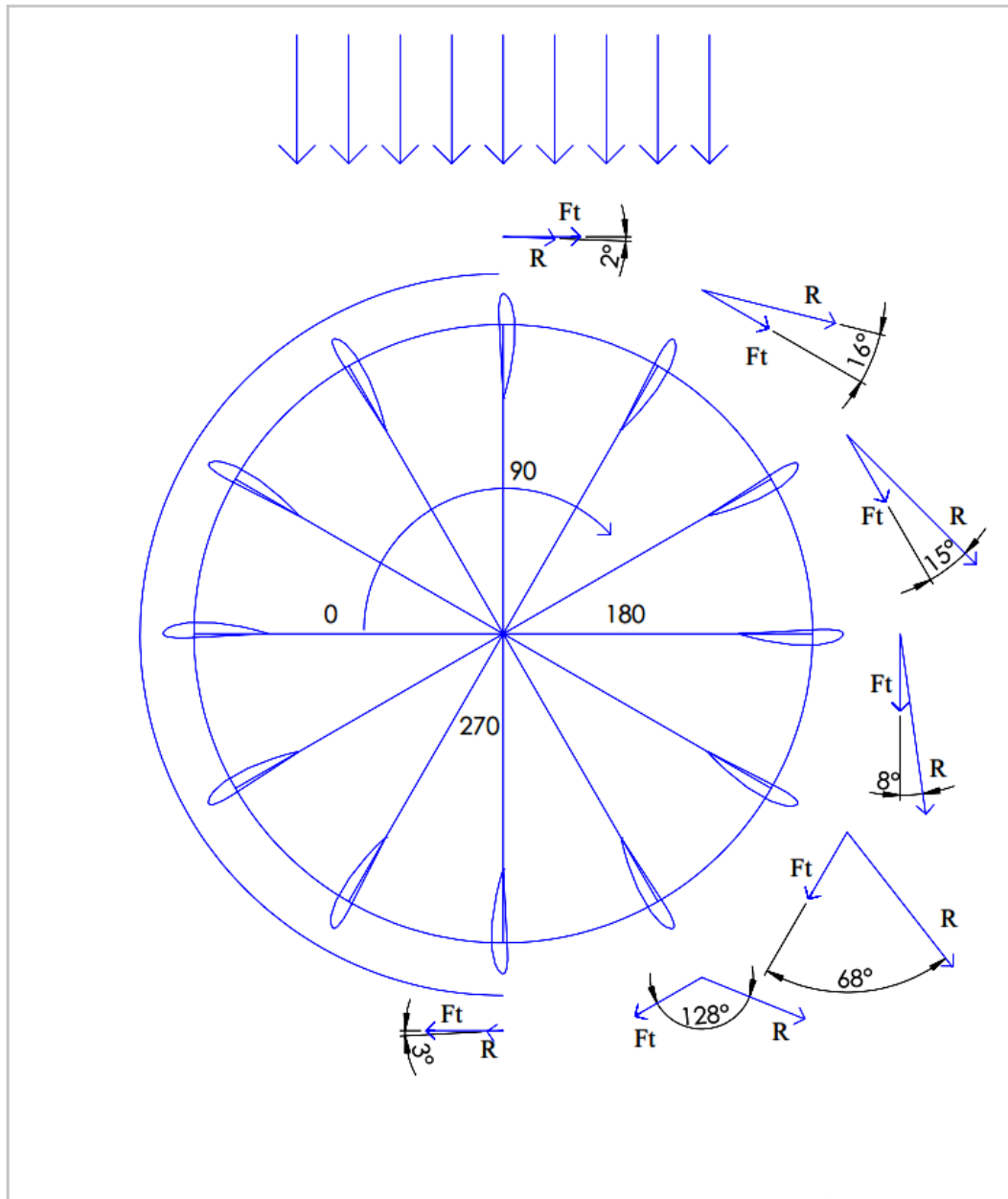


Gaya turbin variasi sudut serang 90° dengan *curveplate*



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS		FINISH:		DEBUR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:									
TOLERANCES:									
LINEAR:									
ANGULAR:									
DRAWN		SIGNATURE		DATE		TITLE:			
CHK'D						resultan turbin 90 c ^{A4}			
APP'VD									
MFG									
Q.A									
				MATERIAL:		DWG NO.			
						SCALE:1:1		SHEET 1 OF 1	
				WEIGHT:					

Gaya Tangensial Turbin Variasi Sudut Serang 90° tanpa curveplate



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS		FINISH:		DEBUR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:									
TOLERANCES:									
LINEAR:									
ANGULAR:									
DRAWN		NAME	SIGNATURE	DATE	TITLE:				
CHKD									
APPVD									
MFG									
Q.A					MATERIAL:	DWG NO.		gaya tangensial 90 °	
					WEIGHT:	SCALE:1:1		SHEET 1 OF 1	