APPENDIX – III

EXPERIMENTAL DATA OF CFT WITH SINGLE NOZZLE

Head = 3m, $\delta = 60°$ in the following cases. Other details of the runner and nozzle are listed in Table 6.1

(A) Front wall – Spiral vortex shape, Rear wall - Spiral vortex shape

1) $\alpha = 16°$, $N_b = 20$, $Q' = 0.041$, $P_{in} = 588.60$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	229.5	0	0	0	0.47
2	195.9	5.16	105.36	17.9	0.401
3	175.0	7.21	131.85	22.4	0.358
4	121.1	13.14	167.16	28.4	0.248
5	108.9	13.80	155.98	26.5	0.223

2) $\alpha = 16°$, $N_b = 20$, $Q' = 0.0614$, $P_{in} = 882.9$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	319.8	0	0	0	0.656
2	292.1	3.61	110.36	12.5	0.599
3	258.9	6.54	176.58	20.1	0.530
4	226.2	11.04	261.34	29.6	0.463
5	207.0	13.74	297.54	33.7	0.424
6	182.2	17.52	333.74	37.8	0.373
7	158.8	19.08	315.19	35.7	0.323
8	144.1	19.56	292.89	33.4	0.295

3) $\alpha = 16°$, $N_b = 20$, $Q' = 0.0718$, $P_{in} = 1030.0$ W

Sl.No.	Speed N, rpm	Torque T, Nm	Output Power P_o, W	Efficiency ,%	Speed Ratio Nr
1	382.88	0	0	0	0.784
2	332.62	4.26	148.32	14.40	0.681
3	311.08	7.97	259.56	25.19	0.637
4	270.68	11.59	328.57	31.91	0.554
5	250.02	14.44	378.01	36.72	0.512
6	210.02	22.95	504.70	39.99	0.430
7	179.15	27.67	519.22	50.43	0.367
8	165.09	32.17	556.20	54.19	0.338
9	260.20	33.31	558.78	54.25	0.328
10	151.41	35.14	557.23	54.10	0.311
11	134.81	38.54	544.15	52.83	0.276
12	107.94	41.83	572.72	45.92	0.221

4) $\alpha = 16°$, $N_b = 24$, $Q' = 0.041$, $P_{in} = 588.60$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	232.1	0	0	0	0.475
2	213.2	4.02	90.25	15.28	0.436
3	187.3	7.56	147.74	25.1	0.383
4	144.9	11.76	179.52	30.5	0.297
5	125.2	14.34	188.35	32.1	0.256
6	96.2	16.42	125.37	21.3	0.197
7	80.1	17.58	94.76	16.1	0.164

5) $\alpha = 16°$, $N_b = 24$, $Q' = 0.0614$, $P_{in} = 882.9$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	324.80	0	0	0	0.665
2	308.19	3.24	104.18	11.8	0.631
3	295.99	4.80	150.00	17.1	0.606
4	278.89	6.48	188.66	21.4	0.571
5	265.21	9.66	268.75	30.4	0.543
6	249.09	11.28	294.60	33.4	0.510
7	230.00	13.98	337.27	38.2	0.471
8	225.16	14.70	346.98	39.3	0.461
9	214.94	15.54	350.51	39.7	0.440
10	197.81	18.96	392.89	44.5	0.405

11	181.21	21.91	415.85	47.1	0.371
12	175.83	22.68	417.61	47.3	0.360
13	161.18	24.30	409.67	46.4	0.330
14	146.53	25.79	397.31	45.1	0.301
15	131.88	26.71	369.05	41.8	0.270
16	88.99	34.24	316.96	35.9	0.182

6) $\alpha = 16°$, $N_b = 24$, $Q' = 0.0718$, $P_{in} = 1030.0$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	422.50	0	0	0	0.865
2	381.46	4.92	195.70	19.1	0.781
3	337.15	10.98	387.49	37.6	0.690
4	313.10	14.04	459.38	44.6	0.641
5	288.17	17.46	526.12	51.1	0.591
6	265.70	22.38	623.15	60.5	0.544
7	230.05	28.98	698.34	67.8	0.471
8	206.60	35.34	764.26	74.2	0.423
9	188.04	39.06	769.41	74.7	0.385
10	169.28	45.06	799.28	77.6	0.347
11	161.18	47.52	802.37	77.9	0.330
12	148.53	51.60	793.10	77.1	0.300
13	144.62	52.40	762.20	74.2	0.296
14	126.65	55.80	740.57	71.9	0.259
15	103.79	59.40	645.81	62.7	0.213

7) $\alpha = 16°$, $N_b = 30$, $Q' = 0.041$, $P_{in} = 588.60$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	265.21	0	0	0	0.543
2	224.14	4.74	112.42	19.1	0.459
3	184.14	7.86	151.27	25.7	0.377
4	151.89	12.42	197.18	33.5	0.311
5	114.78	13.21	158.92	27.0	0.235

8) $\alpha = 16°$, $N_b = 30$, $Q' = 0.0614$, $P_{in} = 882.9$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	348.29	0	0	0	0.713
2	323.19	3.33	112.13	12.7	0.662
3	279.23	8.34	245.18	27.77	0.572
4	227.61	13.86	329.94	37.37	0.466
5	205.14	18.24	392.36	44.44	0.420
6	193.91	20.04	407.37	46.14	0.397
7	177.79	23.28	433.50	49.14	0.364
8	167.04	25.26	441.45	50.05	0.342
9	156.25	26.82	439.24	49.75	0.320
10	146.10	28.14	429.97	48.70	0.299
11	136.95	29.82	427.85	48.46	0.280
12	110.04	34.02	392.36	44.44	0.225

9) $\alpha = 16°$, $N_b = 30$, $Q' = 0.0718$, $P_{in} = 1030.0$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	382.88	0	0	0	0.784
2	332.62	4.74	164.82	16.0	0.681
3	311.08	7.21	234.74	22.8	0.637
4	270.68	13.14	371.83	36.1	0.554
5	250.08	16.26	425.39	41.3	0.512
6	210.06	25.50	560.32	54.4	0.430
7	179.15	30.72	576.81	56.1	0.367
8	165.09	35.46	612.85	59.5	0.338
9	160.20	36.84	617.95	60.0	0.328
10	151.41	38.71	613.88	59.6	0.310
11	134.81	42.90	605.64	58.8	0.276
12	107.94	46.74	528.39	51.3	0.221

10) $\alpha = 24°$, $N_b = 20$, $Q' = 0.041$, $P_{in} = 588.60$ W

Sl.No.	Speed N, rpm	Torque T, Nm	Output Power P_o, W	Efficiency ,%	Speed Ratio Nr
1	223.21	0	0	0	0.457
2	180.22	5.64	106.59	18.1	0.369
3	160.20	7.50	126.32	21.45	0.328
4	129.92	11.34	153.94	26.14	0.266
5	100.13	13.14	138.16	23.46	0.205

11) $\alpha = 24°$, $N_b = 20$, $Q' = 0.0614$, $P_{in} = 882.9$ W

Sl.No.	Speed N, rpm	Torque T, Nm	Output Power P_o, W	Efficiency ,%	Speed Ratio Nr
1	301.85	0	0	0	0.618
2	259.84	5.40	153.80	17.42	0.532
3	236.89	7.56	186.99	21.18	0.485
4	215.54	9.42	212.78	24.10	0.441
5	193.90	13.44	272.78	30.90	0.397
6	173.88	16.08	292.24	33.15	0.356
7	149.95	18.72	294.10	33.35	0.307
8	131.87	19.14	264.87	30.11	0.271

12) $\alpha = 24°$, $N_b = 20$, $Q' = 0.0718$, $P_{in} = 1030.0$ W

Sl.No.	Speed N, rpm	Torque T, Nm	Output Power P_o, W	Efficiency ,%	Speed Ratio Nr
1	322.36	0	0	0	0.660
2	297.94	5.64	176.34	17.12	0.611
3	266.19	9.42	262.34	25.47	0.545
4	234.93	13.14	324.45	31.50	0.481
5	210.99	16.98	374.61	36.37	0.432
6	176.81	22.08	408.91	39.71	0.362
7	147.31	26.34	406.85	39.54	0.302
8	131.88	28.21	390.58	37.92	0.271
9.	115.46	29.28	354.32	34.39	0.236

13) $\alpha = 24°$, $N_b = 24$, $Q' = 0.041$, $P_{in} = 588.60$ W

Sl.No.	Speed N, rpm	Torque T, Nm	Output Power P_o, W	Efficiency ,%	Speed Ratio Nr
1	230.11	0	0	0	0.471
2	199.77	5.64	118.37	20.1	0.409
3	165.09	8.11	140.16	23.8	0.338
4	145.06	10.80	164.31	27.9	0.297
5	119.19	11.88	137.74	23.4	0.244
6	87.92	12.13	98.94	16.8	0.181

14) $\alpha = 24°$, $N_b = 24$, $Q' = 0.0614$, $P_{in} = 882.9$ W

Sl.No.	Speed N, rpm	Torque T, Nm	Output Power P_o, W	Efficiency ,%	Speed Ratio Nr
1	322.84	0	0	0	0.661
2	274.05	5.71	163.87	18.56	0.561
3	270.09	7.53	212.96	24.12	0.553
4	254.95	9.42	251.45	28.48	0.522
5	247.14	11.29	292.24	33.10	0.506
6	226.15	13.18	312.37	35.38	0.463
7	209.04	14.71	321.91	36.46	0.428
8	197.81	18.46	382.29	43.30	0.405
9	187.07	18.93	370.82	42.11	0.383
10	177.83	22.06	406.13	46.05	0.361
11	166.03	23.28	404.37	45.80	0.344
12	156.29	23.64	386.71	43.81	0.320
13	144.10	23.88	360.22	40.79	0.295
14	135.29	24.20	314.75	35.65	0.277

15) $\alpha = 24°$, $N_b = 24$, $Q' = 0.0718$, $P_{in} = 1030.0$ W

Sl.No.	Speed N, rpm	Torque T, Nm	Output Power P_o, W	Efficiency ,%	Speed Ratio Nr
1	356.55	0	0	0	0.730
2	302.82	7.56	238.96	23.20	0.623
3	288.17	9.36	282.01	27.38	0.591
4	253.98	13.08	347.93	33.78	0.519
5	239.33	17.28	433.63	42.11	0.491
6	234.44	19.32	473.80	46.06	0.485
7	210.09	24.24	533.33	51.79	0.425
8	195.37	26.76	547.96	53.21	0.411
9	185.61	28.86	561.35	54.56	0.380
10	163.43	31.56	539.72	52.42	0.334
11	146.53	33.60	516.03	50.11	0.300
12	122.11	38.41	491.31	47.43	0.252

16) $\alpha = 24°$, $N_b = 30$, $Q' = 0.041$, $P_{in} = 588.60$ W

Sl.No.	Speed N, rpm	Torque T, Nm	Output Power P_o, W	Efficiency ,%	Speed Ratio Nr
1	239.33	0	0	0	0.490
2	185.16	5.25	101.82	17.29	0.379
3	136.79	9.37	134.15	22.78	0.281
4	117.22	11.19	137.33	23.32	0.244
5	106.13	11.81	131.32	22.30	0.217
6	97.68	12.87	111.30	18.91	0.205

17) $\alpha = 24°$, $N_b = 30$, $Q' = 0.0614$, $P_{in} = 882.9$ W

Sl.No.	Speed N, rpm	Torque T, Nm	Output Power P_o, W	Efficiency ,%	Speed Ratio Nr
1	312.59	0	0	0	0.640
2	293.05	3.78	115.92	13.13	0.611
3	263.75	6.40	176.58	20.11	0.539
4	222.67	12.98	302.83	34.29	0.456
5	190.41	18.81	375.23	42.51	0.391
6	156.30	23.52	384.94	43.59	0.312
7	136.76	25.58	366.40	41.51	0.281

18) $\alpha = 24°$, $N_b = 30$, $Q' = 0.0718$, $P_{in} = 1030.0$ W

Sl.No.	Speed N, rpm	Torque T, Nm	Output Power P_o, W	Efficiency ,%	Speed Ratio Nr
1	322.36	0	0	0	0.662
2	278.41	7.28	212.18	20.61	0.571
3	263.75	9.43	260.59	25.39	0.539
4	249.09	11.81	307.97	29.89	0.514
5	234.44	14.51	356.38	34.57	0.481
6	219.79	18.35	422.30	41.10	0.455
7	210.02	20.87	459.38	46.62	0.430
8	195.32	24.68	504.72	49.10	0.399
9	185.60	26.81	521.18	50.59	0.381
10	175.83	27.02	497.49	48.28	0.359
11	161.19	29.96	505.73	49.14	0.228
12	146.53	31.08	476.89	46.32	0.300
13	136.79	32.92	471.74	45.88	0.282

(B) Front wall – Circular arc, Rear wall - Spiral vortex shape

19) $\alpha = 16°$, $N_b = 24$, $Q' = 0.041$, $P_{in} = 588.60$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	231.08	0	0	0	0.502
2	203.46	4.44	94.47	16.05	0.442
3	185.04	8.07	155.15	26.26	0.402
4	156.94	11.47	188.52	32.03	0.341
5	117.84	12.03	148.45	25.22	0.256
6	90.68	13.86	131.67	22.37	0.197
7	75.49	15.18	120.05	20.40	0.164

20) $\alpha = 16°$, $N_b = 24$, $Q' = 0.0614$, $P_{in} = 882.9$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	319.00	0	0	0	0.693
2	290.46	3.66	111.33	12.61	0.631
3	278.95	5.66	165.37	18.73	0.606
4	262.84	7.55	207.83	23.54	0.571
5	249.95	11.30	295.78	33.55	0.543
6	234.76	13.18	324.29	36.73	0.510
7	216.81	16.34	371.08	42.03	0.471
8	212.20	17.14	380.97	43.15	0.461
9	202.54	20.37	432.09	48.94	0.440
10	186.43	23.44	457.69	51.81	0.405
11	165.72	25.92	449.83	50.95	0.360
12	151.90	27.47	436.94	49.49	0.330
13	138.10	28.17	407.46	46.15	0.300
14	124.29	31.19	405.95	45.98	0.270
15	83.78	39.75	348.75	39.50	0.182
16					

21) $\alpha = 16°$, $N_b = 24$, $Q' = 0.0718$, $P_{in} = 1030.0$ W

Sl.No.	Speed, N, rpm	Torque T, Nm	Output power, P_o, W	Efficiency, η, %	Speed Ratio Nr
1	407.84	0	0	0	0.886
2	359.51	5.58	210.94	20.48	0.781
3	318.54	12.52	417.78	40.56	0.692
4	295.07	16.03	495.33	48.09	0.641
5	272.05	19.55	567.32	55.08	0.591
6	255.02	25.16	671.97	65.24	0.554
7	216.81	33.16	752.93	73.10	0.471
8	194.72	40.41	824.05	80.00	0.423
9	177.22	44.68	829.25	80.51	0.385
10	159.73	51.49	861.18	83.61	0.347
11	152.37	54.24	865.51	84.03	0.331
12	139.48	54.33	793.62	77.05	0.303
13	136.25	57.62	822.15	79.82	0.296
14	119.22	63.96	798.56	77.53	0.259
15	98.05	67.81	696.28	67.60	0.213