

## LAMPIRAN

### DATA RUNNING MESIN

TOTAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
POMPA UTAMA	15	17	16	15	16	17	18	18	19	18	15	17	18	15	13	18	17	18	19	17	16	20	19	15	17	17	18	18	15	16
POMPA UTAMA	15	17	16	15	16	17	18	18	19	18	16	17	18	14	14	17	17	19	18	18	16	20	19	14	18	17	17	19	15	15
POMPA INJEKTOR	15	16	15	16	15	17	17	18	19	18	15	16	18	14	13	17	16	19	18	17	16	20	19	14	18	16	17	19	15	15
POMPA INJEKTOR	14	16	14	15	14	17	17	17	17	17	15	16	16	13	13	17	17	18	17	17	15	18	18	13	17	16	17	17	15	15



	ge			2	2	5	1	9	4	3	4	3	5	2	6	1	9	2	1	1	9	3	6	3	1	7	6	6	7	4	1	4	3	1	
3	Desalinated Water stage	Flow rate	13.5 m <sup>3</sup> /h	14.5	12.5	11.2	11.1	11.2	11.2	11.2	11.2	11.3	11.2	11.2	11.2	11.2	11.1	11.2	11.2	11.2	11.1	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	
		Conductivity	<100 μs/cm	52	46.9	38.2	37.4	41.1	38.7	38.5	39.9	39.1	47.6	33.3	43.4	37.7	44	36.7	33.8	33.8	40.1	33.7	33.6	33.6	33.6	33.8	33.5	40.6	33.5	33.6	33.3	43.8	33.6	33.7	33.8
4	Feedwater E DI	Flow rate	13.5 m <sup>3</sup> /h	14.5	12.5	11.5	11.1	11.2	11.2	11.2	11.2	11.3	11.2	11.2	11.2	11.2	11.1	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	
		Pressure	3 bar	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
5	Concentrate E DI	Flow rate	1.5 m <sup>3</sup> /h	2	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.4	1.5	1.4	1.2	1.5	1.5	1.5	1.5	1.2	1.3	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
		Pressure	0.5 bar	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
6	PWE DI	Flow rate	12.5 m <sup>3</sup> /h	11.5	10.5	10.5	9.5	10.7	10.5	10.5	10.5	10.5	10.6	10.5	10.6	9.8	10.5	10.5	10.5	10.5	9.8	10.7	10.7	10.7	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
		Temperature	19.5 °C	24.5	24.7	24.8	25.6	25.5	25.5	24.9	24.7	26.1	25.5	25.1	25.1	25.8	24.4	24.4	24.1	24.2	24.5	24.6	24.5	24.5	24.5	24.4	23.4	23.9	24.2	24.4	24.5	24.7	24.8	24.6	24.3

		e																																				
		Co nd uct ivi ty																																				
		μ s / c m	0 · 0 5	0 · 5 8	0 · 6 1	0 · 6 5	0 · 6 2	0 · 6 9	0 · 5 1	0 · 4 1	0 · 4 1	0 · 6 7	0 · 6 8	0 · 7 1	0 · 6 3	0 · 6 4	0 · 7 8	0 · 7 8	0 · 6 2	0 · 6 9	0 · 6 4	0 · 6 8	0 · 6 7	0 · 6 7	0 · 6 3	0 · 6 6	0 · 6 7	0 · 6 1	0 · 6 5	0 · 7 9	0 · 6 7	0 · 6 5	0 · 6 1	0 · 6 4				
			1	2	3	4	5	6	7	8	9	0	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3		
7	El ect ric Su pl y to E DI	Voltage	A	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 5	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 5	4 3 5	4 3 5	4 3 5	4 3 5	4 3 5	4 3 0	4 3 0	4 3 0	4 3 0	4 3 5	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0		
			B	3 4 5	3 5 5	3 5 5	3 4 5	3 5 0	3 4 5	3 4 5	3 4 5	3 4 5	3 4 5	3 5 5	3 5 5	3 5 0	3 5 0	3 5 0	3 5 0	3 5 0	3 5 0	3 5 0	3 5 0	3 5 0	3 5 0	3 4 0	3 4 0	3 3 0	3 3 0	3 3 0	3 3 0	3 3 0	3 3 0	3 3 0	3 3 0	3 3 0	3 3 0	
			C	3 6 0	4 0 5	4 2 5	4 4 0	4 2 5	4 2 0	4 1 5	4 2 0	4 2 0	4 2 0	4 3 5	4 3 5	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0
			D	4 3 0	4 3 5	4 3 5	4 3 5	4 3 5	4 3 5	4 3 5	4 3 5	4 3 5	4 3 5	4 3 0	4 3 5	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0
		Current	A	4 · 6	4 · 1	3 · 9	4 · 1	4 · 4	4 · 4	3 · 9	3 · 9	3 · 9	3 · 6	3 · 5	3 · 4	3 · 5	3 · 2	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	3 · 3	
			B	2 · 7	· 7	· 7	· 8	· 7	· 8	· 9	· 8	· 8	· 7	· 7	· 9	· 7	· 6	· 8	· 7	· 7	· 7	· 8	· 7	· 7	· 7	· 7	· 7	· 7	· 7	· 7	· 7	· 7	· 7	· 7	· 7	· 7	· 7	· 7
			C	4 · 8	4 · 8	4 · 8	4 · 8	4 · 8	4 · 8	4 · 8	4 · 8	4 · 8	4 · 8	4 · 5	4 · 5	4 · 4	4 · 6	4 · 2	4 · 2	4 · 2	4 · 2	4 · 2	4 · 2	4 · 2	4 · 2	4 · 3	4 · 9	4 · 4	4 · 4	3 · 9	3 · 7	3 · 6	3 · 4	3 · 4	3 · 3	3 · 4	3 · 3	
			D	2 · 7	2 · 6	2 · 6	2 · 9	2 · 7	2 · 7	2 · 7	2 · 7	2 · 7	2 · 7	2 · 7	2 · 6	2 · 7	2 · 3	2 · 7	2 · 8	2 · 8	2 · 8	2 · 8	2 · 6	2 · 7	2 · 6	2 · 6	2 · 5	2 · 4	2 · 4	2 · 4	2 · 6	2 · 6	2 · 7	2 · 5	2 · 4	2 · 4	2 · 4	

TOTA L	1	2	3	4	5	6	7	8	9	10	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	
P 50	1 5	1 7	1 6	1 5	1 6	1 7	1 8	1 8	1 9	18	1 5	1 7	1 8	1 5	1 3	1 8	1 7	1 8	1 9	1 7	1 6	2 0	1 9	1 5	1 7	1 7	1 8	1 8	1 5	1 6
P. 50- 2	1 5	1 7	1 6	1 5	1 6	1 7	1 8	1 8	1 9	18	1 6	1 7	1 8	1 4	1 4	1 7	1 7	1 9	1 8	1 8	1 6	2 0	1 9	1 4	1 8	1 7	1 7	1 9	1 5	1 5
P.67- 10	1 5	1 6	1 5	1 6	1 5	1 7	1 7	1 8	1 9	18	1 5	1 6	1 8	1 4	1 3	1 7	1 6	1 9	1 8	1 7	1 6	2 0	1 9	1 4	1 8	1 6	1 7	1 9	1 5	1 5
PD. 67-50	1 4	1 6	1 4	1 5	1 4	1 7	1 7	1 7	1 7	17	1 5	1 6	1 6	1 3	1 3	1 7	1 7	1 8	1 7	1 7	1 5	1 8	1 8	1 3	1 7	1 6	1 7	1 7	1 5	1 5

**Tabel 4.1 Hasil Perhitungan Availability Pada Mesin RO mulai tanggal 1 sampai 30 november 2017**

Tgl	Jam kerja(jam)	Planned Downtime(jam)	Breakdown Time(jam)	Set up	Total Planned Downtime	Loading Time	Operating Time(jam)	Availability %
1	24	0	9	0	9	24	15	62.5
2	24	0	7	0	7	24	17	70.8
3	24	0	8	0	8	24	16	66.7
4	24	0	9	0	9	24	15	62.5
5	24	0	8	0	8	24	16	66.7
6	24	0	7	0	7	24	17	70.8
7	24	0	6	0	6	24	18	75
8	24	0	6	0	6	24	18	75
9	24	0	5	0	5	24	19	79.2
10	24	0	6	0	6	24	18	75
11	24	0	9	0	9	24	15	62.5
12	24	0	7	0	7	24	17	70.8
13	24	0	6	0	6	24	18	75
14	24	0	9	0	9	24	15	62.5
15	24	0	11	0	11	24	13	54.2
16	24	0	6	0	6	24	18	75
17	24	0	7	0	7	24	17	70.8
18	24	0	6	0	6	24	18	75
19	24	0	5	0	5	24	19	79.2
20	24	0	7	0	7	24	17	70.8
21	24	0	8	0	8	24	16	66.7
22	24	0	4	0	4	24	20	83.3
23	24	0	5	0	5	24	19	79.2

24	24	0	9	0	9	24	15	62.5
25	24	0	7	0	7	24	17	70.8
26	24	0	7	0	7	24	17	70.8
27	24	0	6	0	6	24	18	75
28	24	0	6	0	6	24	18	75
29	24	0	9	0	9	24	15	62.5
30	24	0	8	0	8	24	16	66.7

**Tabel 4.2 Hasil Perhitungan Performance Efficiency Pada Mesin RO mulai tanggal 1 sampai 30 november 2017**

Tanggal	Jumlah produksi (liter)	Ideal cycle time (jam)	operation time (jam)	Performance Efficiency%
1	132000	0.000083	15	73.0
2	126000	0.000083	17	61.5
3	126000	0.000083	16	65.4
4	114000	0.000083	15	63.1
5	128400	0.000083	16	66.6
6	126000	0.000083	17	61.5
7	126000	0.000083	18	58.1
8	126000	0.000083	18	58.1
9	138000	0.000083	19	60.3
10	127200	0.000083	18	58.7
11	126000	0.000083	15	69.7
12	127200	0.000083	17	62.1
13	117600	0.000083	18	54.2
14	126000	0.000083	15	69.7
15	126000	0.000083	13	80.4
16	126000	0.000083	18	58.1
17	126000	0.000083	17	61.5
18	117600	0.000083	18	54.2
19	128400	0.000083	19	56.1
20	128400	0.000083	17	62.7
21	128400	0.000083	16	66.6
22	126000	0.000083	20	52.3
23	126000	0.000083	19	55.0
24	126000	0.000083	15	69.7
25	126000	0.000083	17	61.5
26	128400	0.000083	17	62.7
27	117600	0.000083	18	54.2
28	129600	0.000083	18	59.8
29	129600	0.000083	15	71.7
30	126000	0.000083	16	65.4



**Tabel 4.3 Hasil Perhitungan Rate of Quality Product Pada Mesin RO mulai tanggal 1 sampai 30 november 2017**

Tanggal	Jumlah produksi (liter)	Jumlah produk rusak	Rate of quality product %
1	132000	7000	94.7
2	126000	7000	94.4
3	126000	7000	94.4
4	114000	7000	93.9
5	128400	7000	94.5
6	126000	7000	94.4
7	126000	7000	94.4
8	126000	7000	94.4
9	138000	7000	94.9
10	127200	7000	94.5
11	126000	7000	94.4
12	127200	7000	94.5
13	117600	7000	94.0
14	126000	7000	94.4
15	126000	7000	94.4
16	126000	7000	94.4
17	126000	7000	94.4
18	117600	7000	94.0
19	128400	7000	94.5
20	128400	7000	94.5
21	128400	7000	94.5
22	126000	7000	94.4
23	126000	7000	94.4
24	126000	7000	94.4
25	126000	7000	94.4
26	128400	7000	94.5
27	117600	7000	94.0
28	129600	7000	94.6
29	129600	7000	94.6
30	126000	7000	94.4

**Tabel 4.4. Pengukuran Overall Equipment Effectiveness Mesin RO mulai tanggal 1 sampai 30 november 2017**

Tanggal	Availability %	Performance Efficiency%	Rate of quality product %	OEE%
1	62.5	73.0	94.7	43.2
2	70.8	61.5	94.4	41.2
3	66.7	65.4	94.4	41.2
4	62.5	63.1	93.9	37.0
5	66.7	66.6	94.5	42.0
6	70.8	61.5	94.4	41.2
7	75	58.1	94.4	41.2
8	75	58.1	94.4	41.2
9	79.2	60.3	94.9	45.3
10	75	58.7	94.5	41.6
11	62.5	69.7	94.4	41.2
12	70.8	62.1	94.5	41.6
13	75	54.2	94.0	38.2
14	62.5	69.7	94.4	41.2
15	54.2	80.4	94.4	41.2
16	75	58.1	94.4	41.2
17	70.8	61.5	94.4	41.2
18	75	54.2	94.0	38.2
19	79.2	56.1	94.5	42.0
20	70.8	62.7	94.5	42.0
21	66.7	66.6	94.5	42.0
22	83.3	52.3	94.4	41.2
23	79.2	55.0	94.4	41.2
24	62.5	69.7	94.4	41.2
25	70.8	61.5	94.4	41.2
26	70.8	62.7	94.5	42.0
27	75	54.2	94.0	38.2
28	75	59.8	94.6	42.4
29	62.5	71.7	94.6	42.4
30	66.7	65.4	94.4	41.2

**Tabel 4.5 Breakdown Loss Mesin RO mulai tanggal 1 sampai 30 november 2017**

Tanggal	Breakdown Time(jam)	Loading Time (jam)	Breakdown %
1	9	24	37.5
2	7	24	29.2
3	8	24	33.3
4	9	24	37.5
5	8	24	33.3
6	7	24	29.2
7	6	24	25
8	6	24	25
9	5	24	20.8
10	6	24	25
11	9	24	37.5
12	7	24	29.2
13	6	24	25
14	9	24	37.5
15	11	24	45.8
16	6	24	25
17	7	24	29.2
18	6	24	25
19	5	24	20.8
20	7	24	29.2
21	8	24	33.3
22	4	24	16.7
23	5	24	20.8
24	9	24	37.5
25	7	24	29.2
26	7	24	29.2
27	6	24	25
28	6	24	25
29	9	24	37.5
30	8	24	33.3

**Tabel 4.6 Idling and Minor Stoppage Loss Mesin RO mulai tanggal 1 sampai 30 november 2017**

Tanggal	Non productive time/delay (jam)	Loading Time (jam)	Idling and Minor stoppage loss %	ideal production
1	0	24	0	11.0
2	0	24	0	10.5
3	0	24	0	10.5
4	0	24	0	9.5
5	0	24	0	10.7
6	0	24	0	10.5
7	0	24	0	10.5
8	0	24	0	10.5
9	0	24	0	11.5
10	0	24	0	10.6
11	1	24	4.2	10.5
12	0	24	0	10.6
13	0	24	0	9.8
14	0	24	0	10.5
15	0	24	0	10.5
16	0	24	0	10.5
17	0	24	0	10.5
18	1	24	4.2	9.8
19	0	24	0	10.7
20	1	24	4.2	10.7
21	0	24	0	10.7
22	0	24	0	10.5

23	0	24	0	10.5
24	0	24	0	10.5
25	1	24	4.2	10.5
26	0	24	0	10.7
27	0	24	0	9.8
28	1	24	4.2	10.8
29	0	24	0	10.8
30	0	24	0	10.5

**Tabel 4.7. Reduced Speed Loss untuk mesin RO mulai tanggal 1 sampai 30 november 2017**

Tanggal	Non productive time/delay (jam)	operation Time (jam)	Ideal Production Time (jam)	Loading Time (jam)	Reduced Speed loss%
1	0	15	11.0	24	16.9
2	0	17	10.5	24	27.3
3	0	16	10.5	24	23.1
4	0	15	9.5	24	23.1
5	0	16	10.7	24	22.3
6	0	17	10.5	24	27.3
7	0	18	10.5	24	31.4
8	0	18	10.5	24	31.4
9	0	19	11.5	24	31.4
10	0	18	10.6	24	31.0
11	1	15	10.5	24	14.8
12	0	17	10.6	24	26.8
13	0	18	9.8	24	34.3
14	0	15	10.5	24	18.9
15	0	13	10.5	24	10.6
16	0	18	10.5	24	31.4
17	0	17	10.5	24	27.3
18	1	18	9.8	24	30.2
19	0	19	10.7	24	34.8
20	1	17	10.7	24	22.3
21	0	16	10.7	24	22.3
22	0	20	10.5	24	39.8
23	0	19	10.5	24	35.6

24	0	15	10.5	24	18.9
25	1	17	10.5	24	23.1
26	0	17	10.7	24	26.4
27	0	18	9.8	24	34.3
28	1	18	10.8	24	26.0
29	0	15	10.8	24	17.7
30	0	16	10.5	24	23.1

**Tabel 4.8 Yield/Scrap Loss untuk mesin RO**

Tanggal	Idle cycle Time (jam)	Jumlah produk rusak (lt)	Loading Time (jam)	Yield/Scrap loss %
1	0.000083	7000	24	2.4
2	0.000083	7000	24	2.4
3	0.000083	7000	24	2.4
4	0.000083	7000	24	2.4
5	0.000083	7000	24	2.4
6	0.000083	7000	24	2.4
7	0.000083	7000	24	2.4
8	0.000083	7000	24	2.4
9	0.000083	7000	24	2.4
10	0.000083	7000	24	2.4
11	0.000083	7000	24	2.4
12	0.000083	7000	24	2.4
13	0.000083	7000	24	2.4
14	0.000083	7000	24	2.4
15	0.000083	7000	24	2.4
16	0.000083	7000	24	2.4
17	0.000083	7000	24	2.4
18	0.000083	7000	24	2.4
19	0.000083	7000	24	2.4
20	0.000083	7000	24	2.4
21	0.000083	7000	24	2.4
22	0.000083	7000	24	2.4
23	0.000083	7000	24	2.4
24	0.000083	7000	24	2.4
25	0.000083	7000	24	2.4
26	0.000083	7000	24	2.4
27	0.000083	7000	24	2.4
28	0.000083	7000	24	2.4
29	0.000083	7000	24	2.4
30	0.000083	7000	24	2.4



Tabel 4.9 Rekapitulasi

Tanggal	%	Breakdown losses Jam	%	Setup losses Jam	%	Idling/minor loss Jam	%	Reduce Speed Jam	%	Yield/Scrap loss Jam	%	Rework loss Jam
1	37.5	9	0	0	0	0	16.9	13.0	2.4	24	0	0
2	29.2	7	0	0	0	0	27.3	13.5	2.4	24	0	0
3	33.3	8	0	0	0	0	23.1	13.5	2.4	24	0	0
4	37.5	9	0	0	0	0	23.1	14.5	2.4	24	0	0
5	33.3	8	0	0	0	0	22.3	13.3	2.4	24	0	0
6	29.2	7	0	0	0	0	27.3	13.5	2.4	24	0	0
7	25	6	0	0	0	0	31.4	13.5	2.4	24	0	0
8	25	6	0	0	0	0	31.4	13.5	2.4	24	0	0
9	20.8	5	0	0	0	0	31.4	12.5	2.4	24	0	0
10	25	6	0	0	0	0	31.0	13.4	2.4	24	0	0
11	37.5	9	0	0	4.2	1	14.8	13.5	2.4	24	0	0
12	29.2	7	0	0	0	0	26.8	13.4	2.4	24	0	0
13	25	6	0	0	0	0	34.3	14.2	2.4	24	0	0
14	37.5	9	0	0	0	0	18.9	13.5	2.4	24	0	0
15	45.8	11	0	0	0	0	10.6	13.5	2.4	24	0	0
16	25	6	0	0	0	0	31.4	13.5	2.4	24	0	0
17	29.2	7	0	0	0	0	27.3	13.5	2.4	24	0	0
18	25	6	0	0	4.2	1	30.2	14.2	2.4	24	0	0
19	20.8	5	0	0	0	0	34.8	13.3	2.4	24	0	0
20	29.2	7	0	0	4.2	1	22.3	13.3	2.4	24	0	0
21	33.3	8	0	0	0	0	22.3	13.3	2.4	24	0	0
22	16.7	4	0	0	0	0	39.8	13.5	2.4	24	0	0
23	20.8	5	0	0	0	0	35.6	13.5	2.4	24	0	0
24	37.5	9	0	0	0	0	18.9	13.5	2.4	24	0	0
25	29.2	7	0	0	4.2	1	23.1	13.5	2.4	24	0	0
26	29.2	7	0	0	0	0	26.4	13.3	2.4	24	0	0
27	25	6	0	0	0	0	34.3	14.2	2.4	24	0	0

28	25	6	0	0	4.2	1	26.0	13.2	2.4	24	0	0
29	37.5	9	0	0	0	0	17.7	13.2	2.4	24	0	0
30	33.3	8	0	0	0	0	23.1	13.5	2.4	24	0	0