LAMPIRAN

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Lampiran 2. Diagram Blok Subsistem dan Komponen

Lampiran 3. Best Fit Distribution Subsistem

Lampiran 4. Reliability Plot Subsistem

Lampiran 5. Data Frekuensi Frekuensi kegagalan Subsistem

SUBSISTEM FREKUENSI KEGAGALAN FREKUENSI

SUBSISTEM	NO	COMPONENT	FREKUENSI
PRESS PART	1	Doctor Blade P1 & P2	79
	2	Mecanic	11
	3	Area (Contaminant)	66
	4	Clothing	5
	5	Electric	9
	6	Instrument	3
	7	Other	2
		Total Frek	175
DRYER PART	1	Carrier Rope	71
	2	Mecanic	11
	3	Area (Contaminant)	33
	4	Clothing	7
	5	Electric	11
	6	Other	11
	7	Doctor Blade	5
		Total Frek	149
WIRE PART	1	Area (Contaminant)	75
	2	Mecanic	10
	3	Clothing	3
	4	Other	14
	5	Electric	7

	6	Instrument	1
	Total Frek		110
TOTAL SUBSISTEM FREKUENSI KEGAGALAN FREKUENSI			434

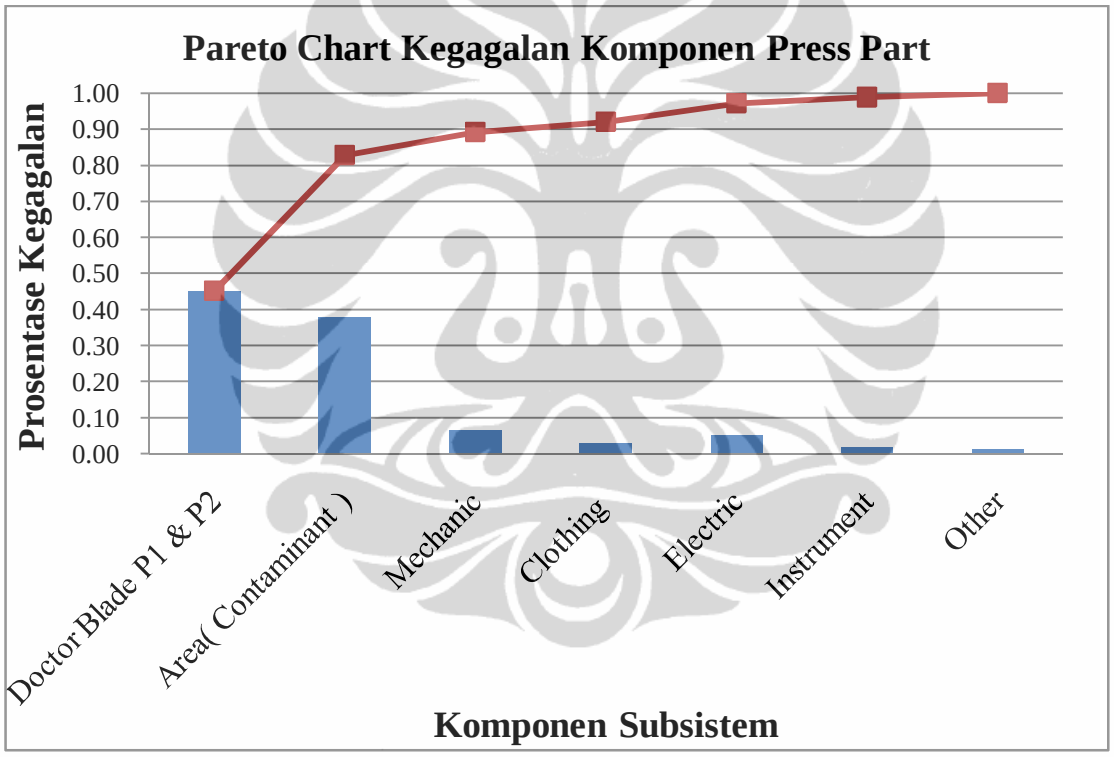
Lampiran 6. Data Durasi kegagalan Subsistem

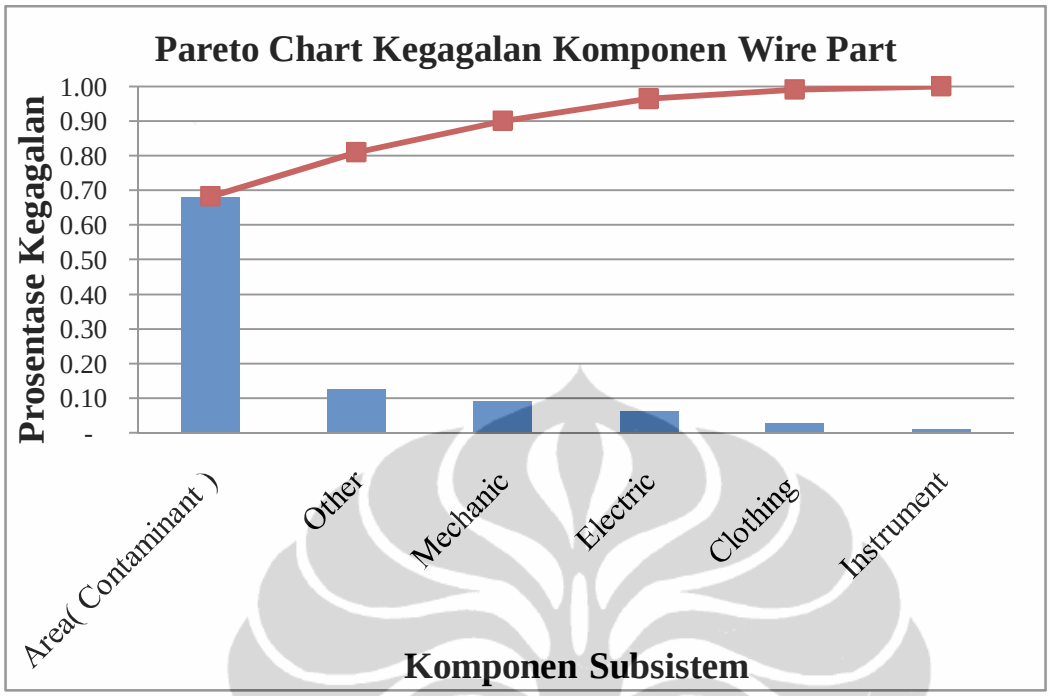
SUBSISTEM DURASI KEGAGALAN

SUBSISTEM	NO	COMPONENT	DURASI KEGAGALAN
PRESS PART	1	Doctor Blade P1 & P2	114:14
	2	Mechanic	58:07
	3	Area (Contaminant)	49:55
	4	Clothing	23:43
	5	Electric	4:16
	6	Instrument	4:12
	7	Other	0:58
	Total Durasi kegagalan		255:25
DRYER PART	1	Carrier Rope	43:36
	2	Mechanic	33:32
	3	Area (Contaminant)	31:26
	4	Clothing	25:15
	5	Electric	9:40
	6	Other	5:18
	7	Doctor Blade	3:25
	Total Durasi kegagalan		152:12
WIRE PART	1	Area (Contaminant)	83:47
	2	Mechanic	23:31
	3	Clothing	18:49

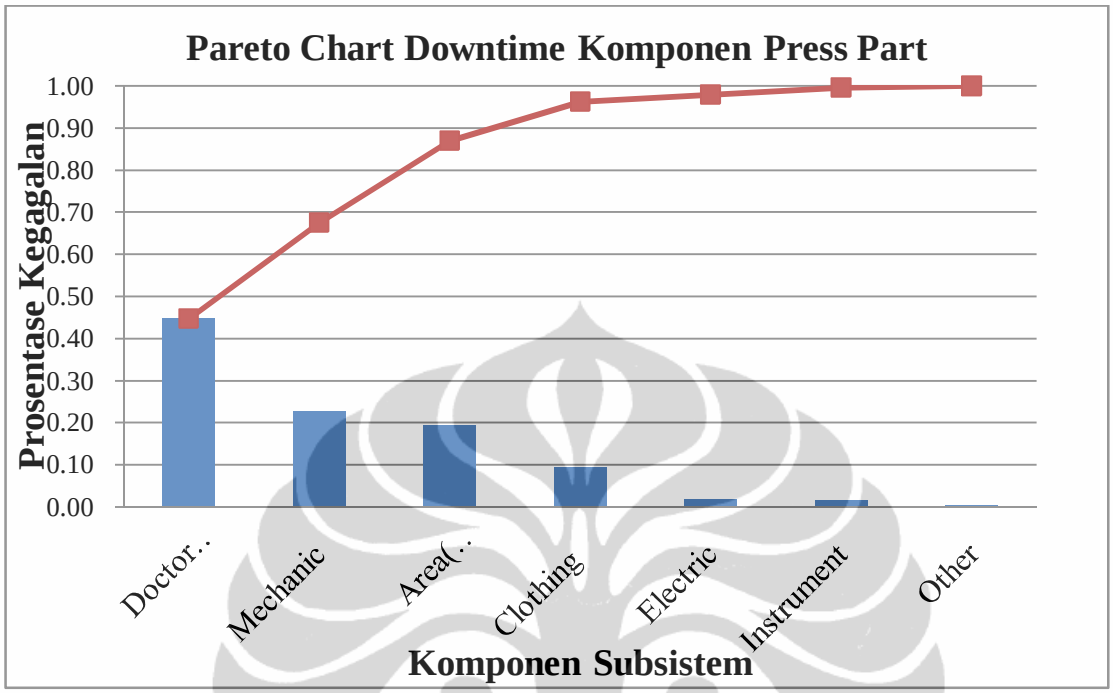
	4	Other	13:34
	5	Electric	5:00
	6	Instrument	1:37
	Total Durasi kegagalan		146:18
TOTAL SUBSISTEM DURASI KEGAGALAN			553:55

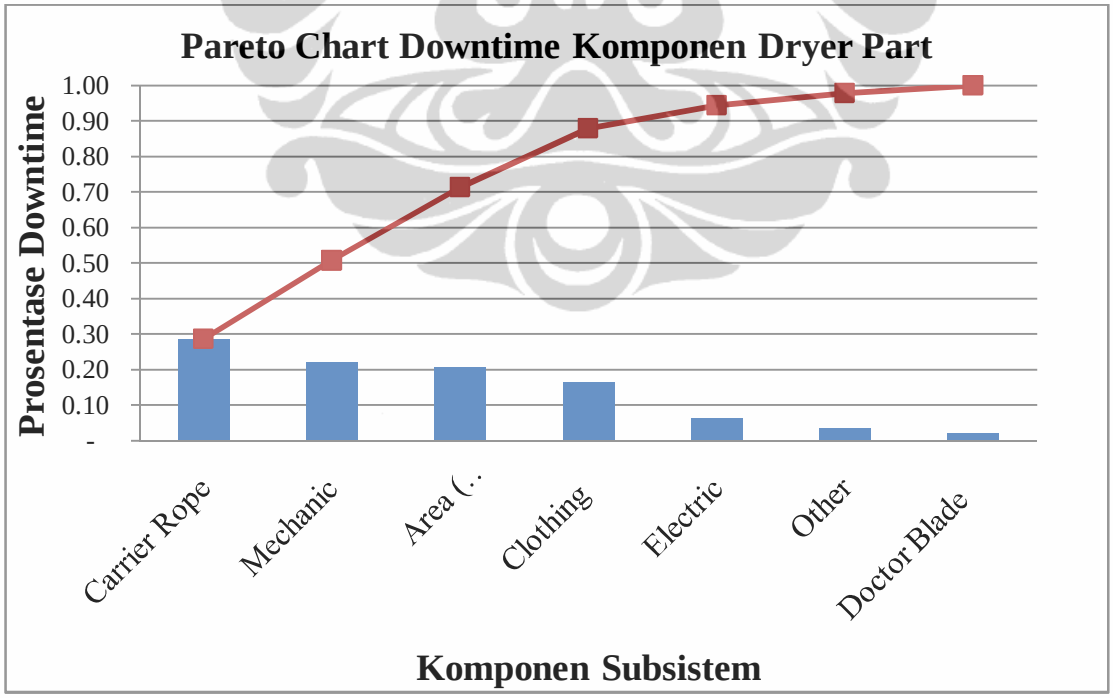
Lampiran 7. Pareto Frekuensi Frekuensi kegagalan Subsistem

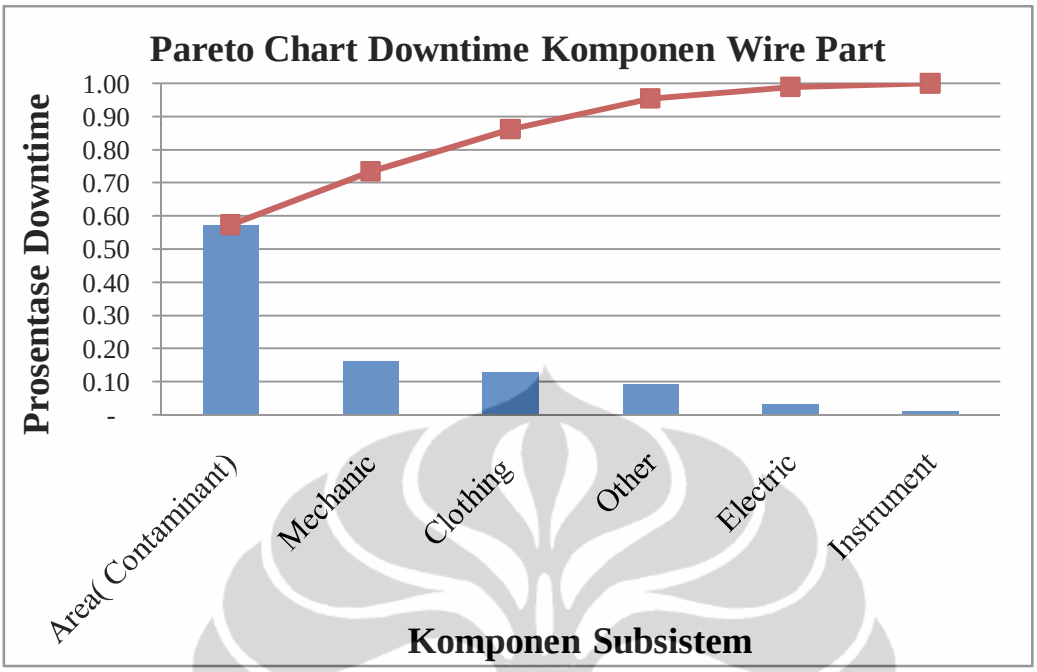




Lampiran 8. Pareto Durasi kegagalan Subsistem







Lampiran 9. Perhitungan Kehandalan Subsistem Saat Ini

Diketahui : MTBF Press Part = 100.05

MTBF Dryer Part = 122.31

MTBF Wire Part = 159.39

t (*mission time* ketiga subsistem) = 30 hari = 720 jam

Kehandalan Press Part :

$R = e^{(-t / MTBF)}$

$R = e^{(-720/100.05)}$

$R = e^{(-7.196)}$

R = 0.000749

Kehandalan Dryer Part:

$R = e^{(-t / MTBF)}$

$R = e^{(-720/122.31)}$

$R = e^{(-5.887)}$

R = 0.00279

Kehandalan Wire Part :

$R = e^{(-t / MTBF)}$

$R = e^{(-720/159.39)}$

$R = e^{(-4.517)}$

R = 0.011

Lampiran 10. Perhitungan Failure Rate Subsistem Saat Ini

Jika $R = e^{(-t / MTBF)}$ atau $R = e^{(-\lambda . t)}$

dimana λ = failure rate

t = mission time

Jika diketahui : Kehandalan Press Part = 0.44

Kehandalan Dryer Part = 0.56

Kehandalan Wire Part = 0.59

t = 720 jam (1 bulan)

Sehingga λ bisa dicari:

a. Failure Rate Press Part :

R = 0.44

$R(t) = e^{(-\lambda . t)}$

$0.44 = e^{(-\lambda . 720)}$

$\ln 0.44 = \ln e^{(-\lambda . 720)}$

$\ln 0.44 = -720 \lambda . \ln e$

$-0.820 = -720 \lambda . 1$

$\lambda = 0.00114$ kali/jam

b. Failure Rate Dryer Part :

R = 0.56

$R(t) = e^{(-\lambda . t)}$

$0.56 = e^{(-\lambda . 720)}$

$\ln 0.56 = \ln e^{(-\lambda . 720)}$

$\ln 0.56 = -720 \lambda . \ln e$

$-0.580 = -720 \lambda . 1$

$\lambda = 0.0008$ kali/jam

c. Failure Rate Dryer Part :

$R = 0.59$

$R(t) = e^{(-\lambda . t)}$

$0.59 = e^{(-\lambda . 720)}$

$\ln 0.59 = \ln e^{(-\lambda . 720)}$

$\ln 0.59 = -720 \lambda . \ln e$

$-0.528 = -720 \lambda . 1$

$\lambda = 0.00073$ kali/jam

Lampiran 11. Perhitungan Proyeksi Frekuensi Frekuensi kegagalan Subsistem

Lampiran 12. Perhitungan Proyeksi Failure Rate

Jika $R = e^{(-t / MTBF)}$ atau $R = e^{(-\lambda . t)}$

dimana λ = failure rate

t = mission time

Jika diketahui : Kehandalan Press Part = 0.100

Kehandalan Dryer Part = 0.135

Kehandalan Wire Part = 0.180

t = 720 jam (1 bulan)

Sehingga λ bisa dicari:

a. Failure Rate Press Part :

R = 0.100

$R(t) = e^{(-\lambda . t)}$

$0.100 = e^{(-\lambda . 720)}$

$\ln 0.100 = \ln e^{(-\lambda . 720)}$

$\ln 0.100 = -720 \lambda . \ln e$

$\lambda = 0.0032$ kali/jam

b. Failure Rate Dryer Part :

R = 0.135

$R(t) = e^{(-\lambda . t)}$

$0.135 = e^{(-\lambda . 720)}$

$\ln 0.135 = \ln e^{(-\lambda . 720)}$

$\ln 0.35 = -720 \lambda . \ln e$

$\lambda = 0.0028$ kali/jam

c. Failure Rate Dryer Part :

R = 0.180

$R(t) = e^{(-\lambda . t)}$

$0.180 = e^{(-\lambda . 720)}$

$\ln 0.180 = \ln e^{(-\lambda . 720)}$

$\ln 0.180 = -720 \lambda . \ln e$

$\lambda = 0.0024$ kali/jam

Lampiran 13. Perhitungan Proyeksi Frekuensi Frekuensi kegagalan Subsistem

a. Frekuensi Frekuensi kegagalan Press Part

Frek = λ^{*} t

Frek = 0.0032* 17520

Frek = 56.03 kali

b. Frekuensi Frekuensi kegagalan Dryer Part

Frek = λ^{*} t

Frek = 0.0028* 17520

Frek = 48.73 kali

c. Frekuensi Frekuensi kegagalan Wire Part

Frek = λ^{*} t

Frek = 0.0024* 17520

Frek = 41.73 kali

Lampiran 14. Perhitungan Peningkatan Ketersediaan dan Produksi

= Peningkatan *Ketersediaan * Available Time*

=97.3% - 95.5 % * 17520 jam (2 tahun)

=1.8 % * 17520 jam (2 tahun)

= 324.04jam

Peningkatan jumlah produksinya adalah :

= Peningkatan waktu produksi **Production Rate/Trhoughput (* ton/jam *)*

=324.04 * 4 ton /jam

= 1,296.16 ton (selama 2 tahun)

Jika dihitung benefitnya maka :

Benefit (USD)= Peningkatan Produksi (ton) * EBITDA (per ton kertas)

= 1,296.16 ton * USD 270 per ton kertas

= USD 349,963.45 selama 2 tahun

Lampiran 15. Perhitungan Penurunan Waktu Kerja Pemeliharaan

Total Penurunan Waktu= Penurunan / Penambahan durasi *Scheduled planned Shutdown* + Penurunan durasi *Unplanned Shutdown*

Penurunan Durasi Schedulled Planed Shutdown = 288 jam – 288 jam = 0 jam

Penurunan Durasi Unplanned Shutdown = Penurunan Waktu $^{\text{Press Part}}$ + Penurunan Waktu $^{\text{Dryer Part}}$ + Penurunan Waktu $^{\text{Wire Part}}$

Penurunan Waktu $^{\text{Press Part}}$ =(Frekuensi Frekuensi kegagalan $^{\text{sekarang}}$ – Frekuensi Frekuensi kegagalan $^{\text{proyeksi}}$) * MTTR

Penurunan Waktu $^{\text{Press Part}}$ = (173 – 56.03) * MTTR

= 116.97 * 1.22

= 142.7 jam/ 2 tahun

Penurunan Waktu $^{\text{Dryer Part}}$ =(Frekuensi Frekuensi kegagalan $^{\text{sekarang}}$ – Frekuensi Frekuensi kegagalan $^{\text{proyeksi}}$) * MTTR

Penurunan Waktu $^{\text{Dryer Part}}$ = (142 – 48.73) * MTTR

= 93.27 * 1.07

= 99.79 jam/ 2 tahun

Penurunan Waktu $^{\text{Wire Part}}$ =(Frekuensi Frekuensi kegagalan $^{\text{sekarang}}$ – Frekuensi Frekuensi kegagalan $^{\text{proyeksi}}$) * MTTR

Penurunan Waktu $^{\text{Wire Part}}$ = (108 – 41.73) * MTTR

= 66.27 * 1.34

= 88.8 jam/ 2 tahun

Total Penurunan Waktu = Penurunan Waktu $^{\text{Press Part}}$ + Penurunan Waktu $^{\text{Dryer Part}}$

+ Penurunan Waktu $^{\text{Wire Part}}$

= 142.7+ 99.79 +88.8

= 331.29 jam / 2 tahun

Total Penurunan Durasi Aktifitas Pemeliharaan = 0 + 331.29 jam

= 331.29 jam (selama 2 tahun)