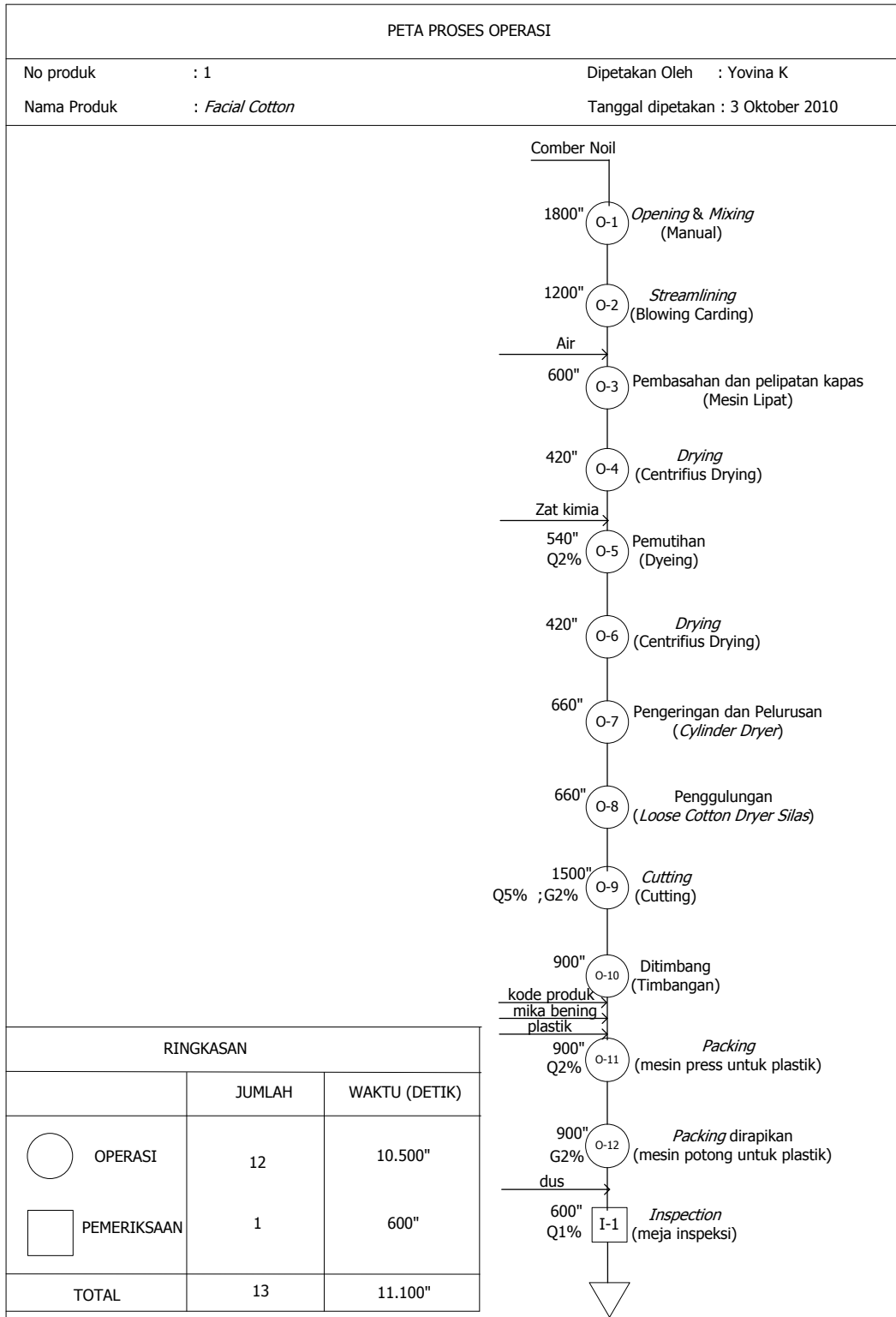
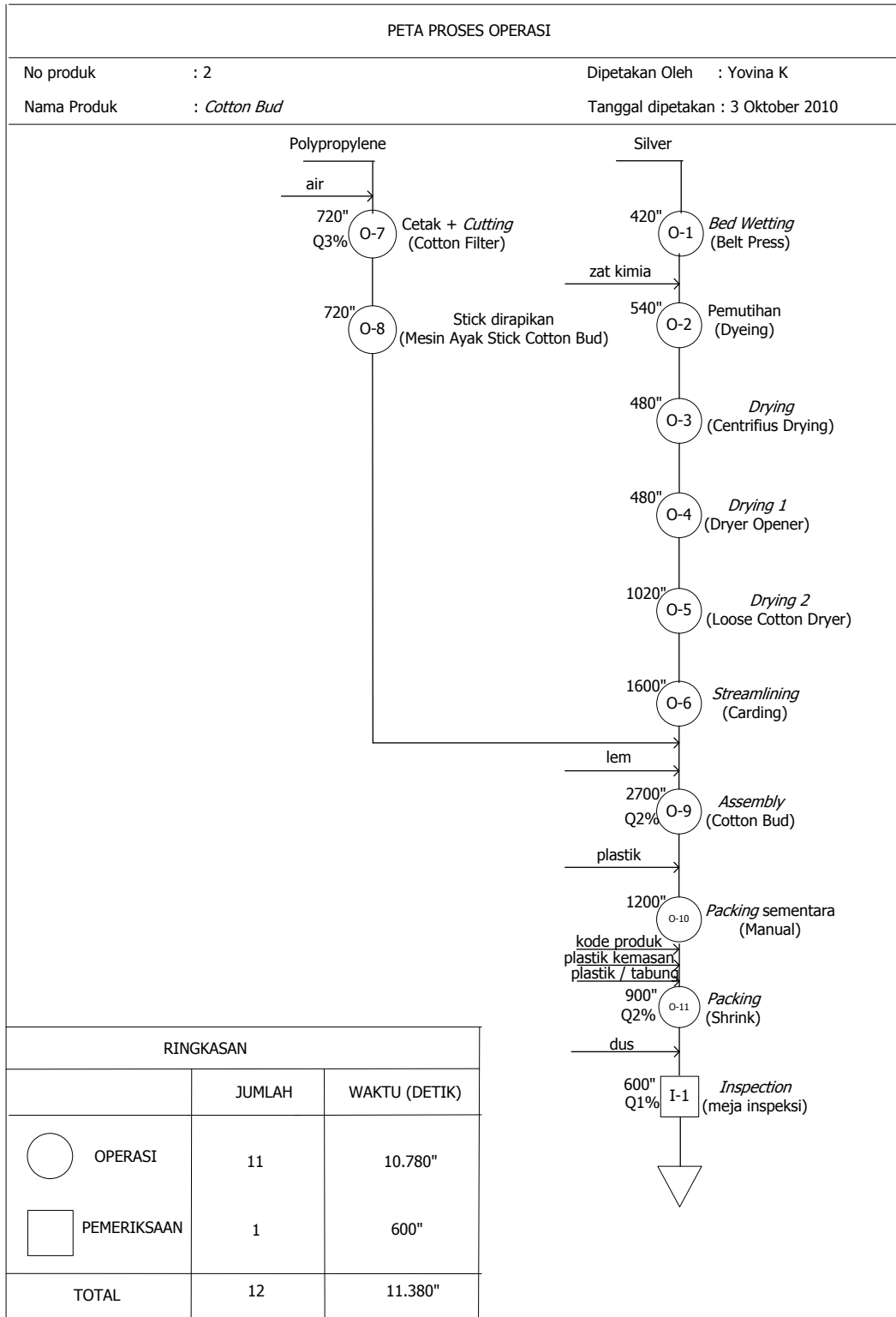


**LAMPIRAN A**  
**PETA PROSES OPERASI**

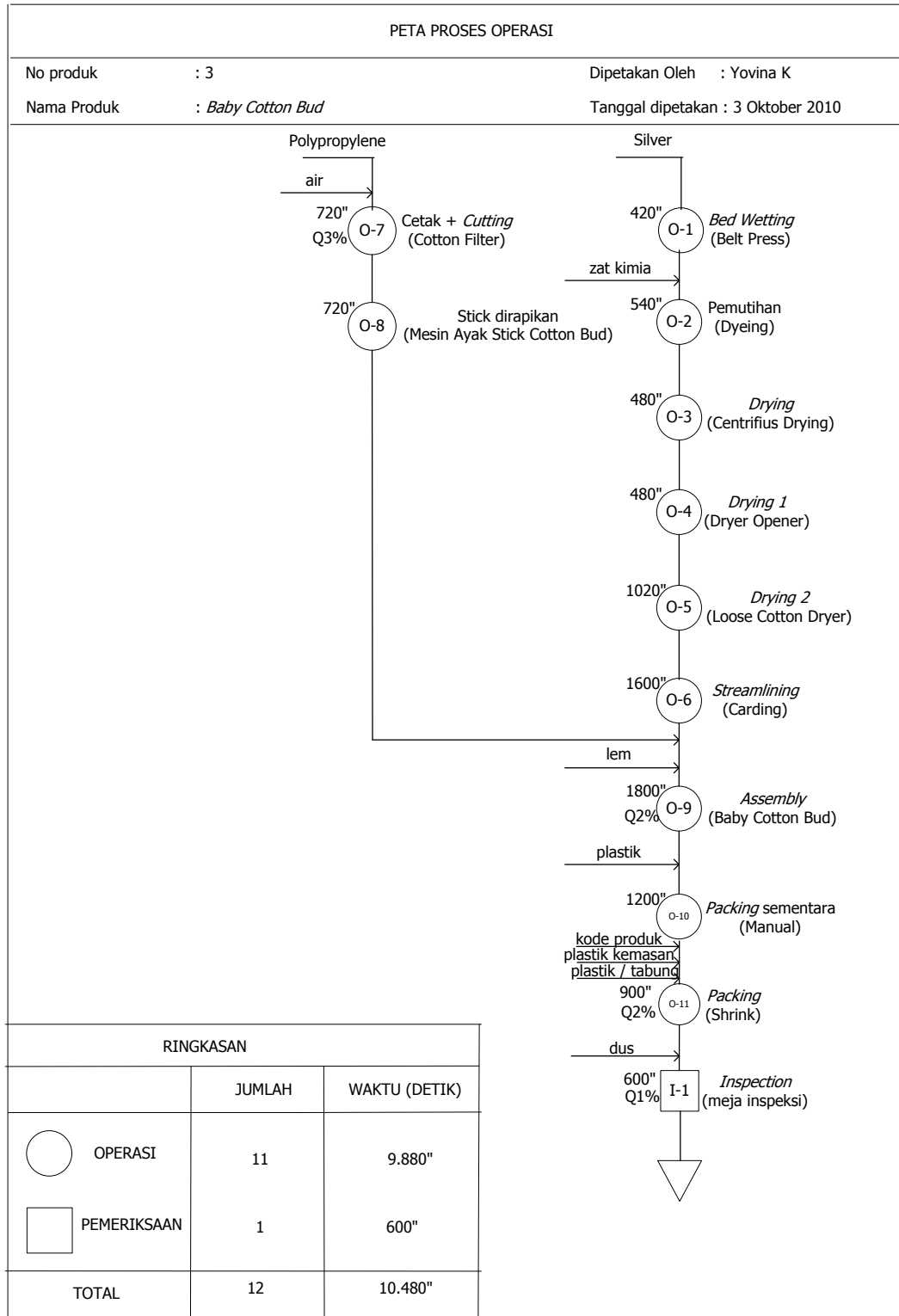
Lampiran A



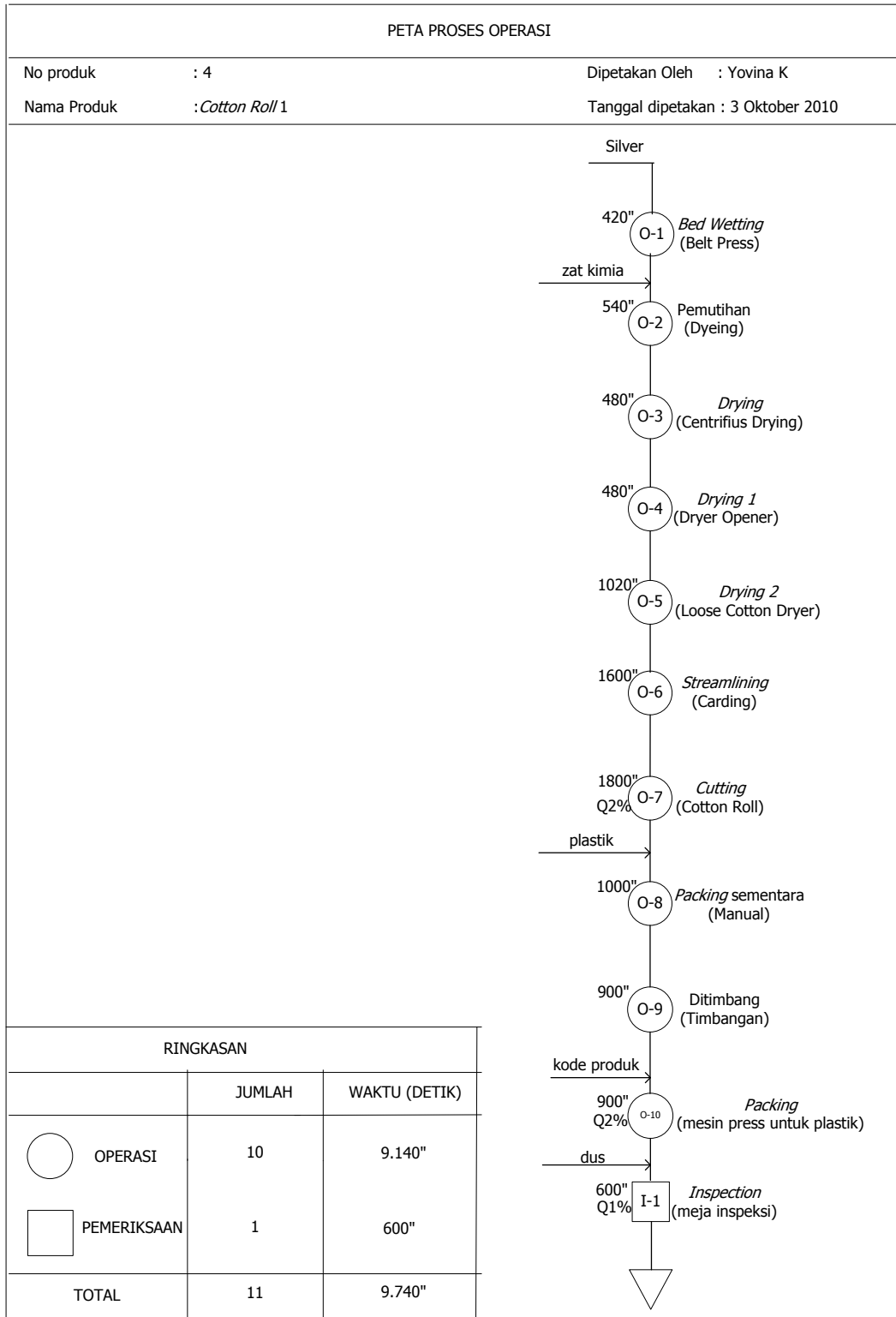
Lampiran A



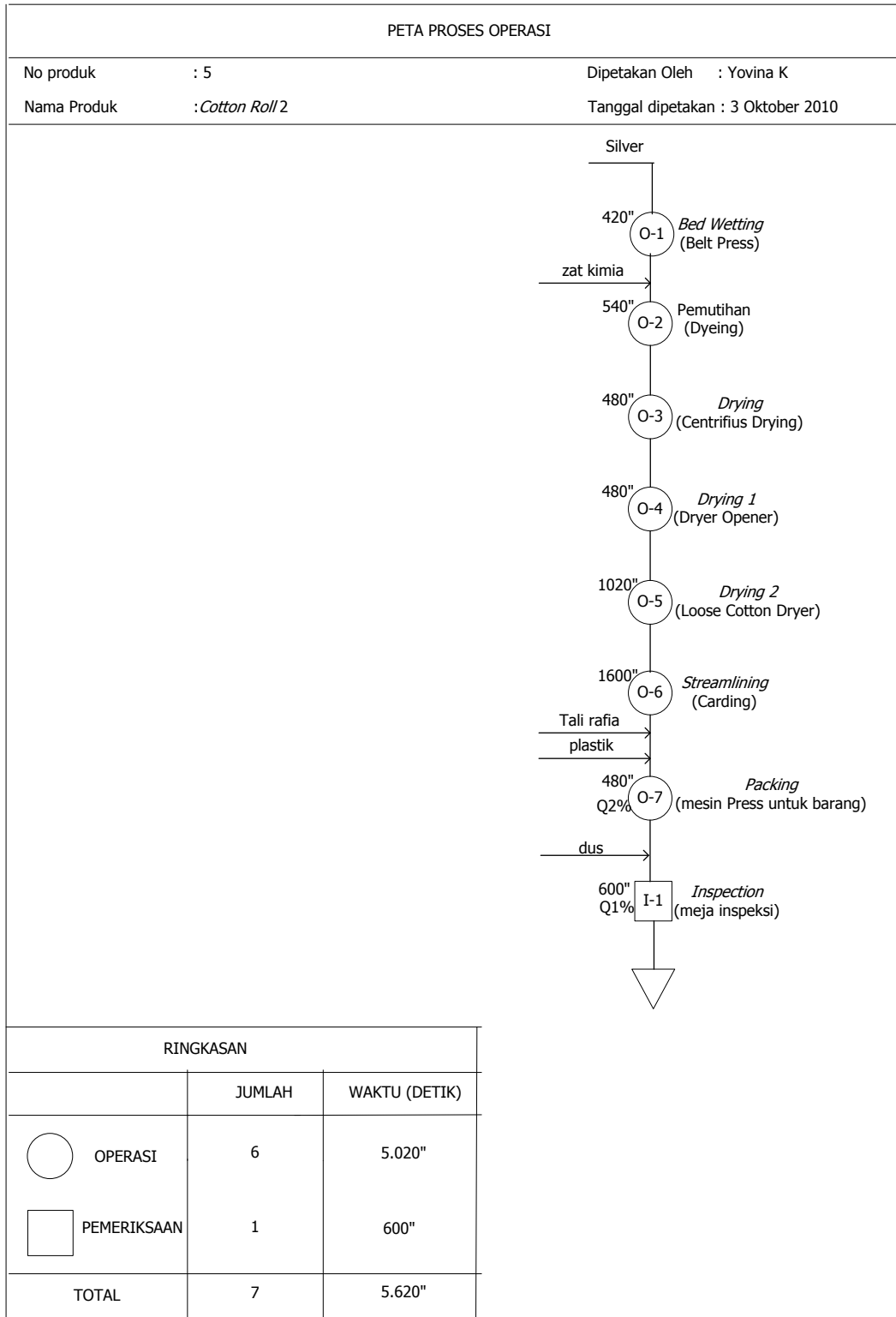
Lampiran A

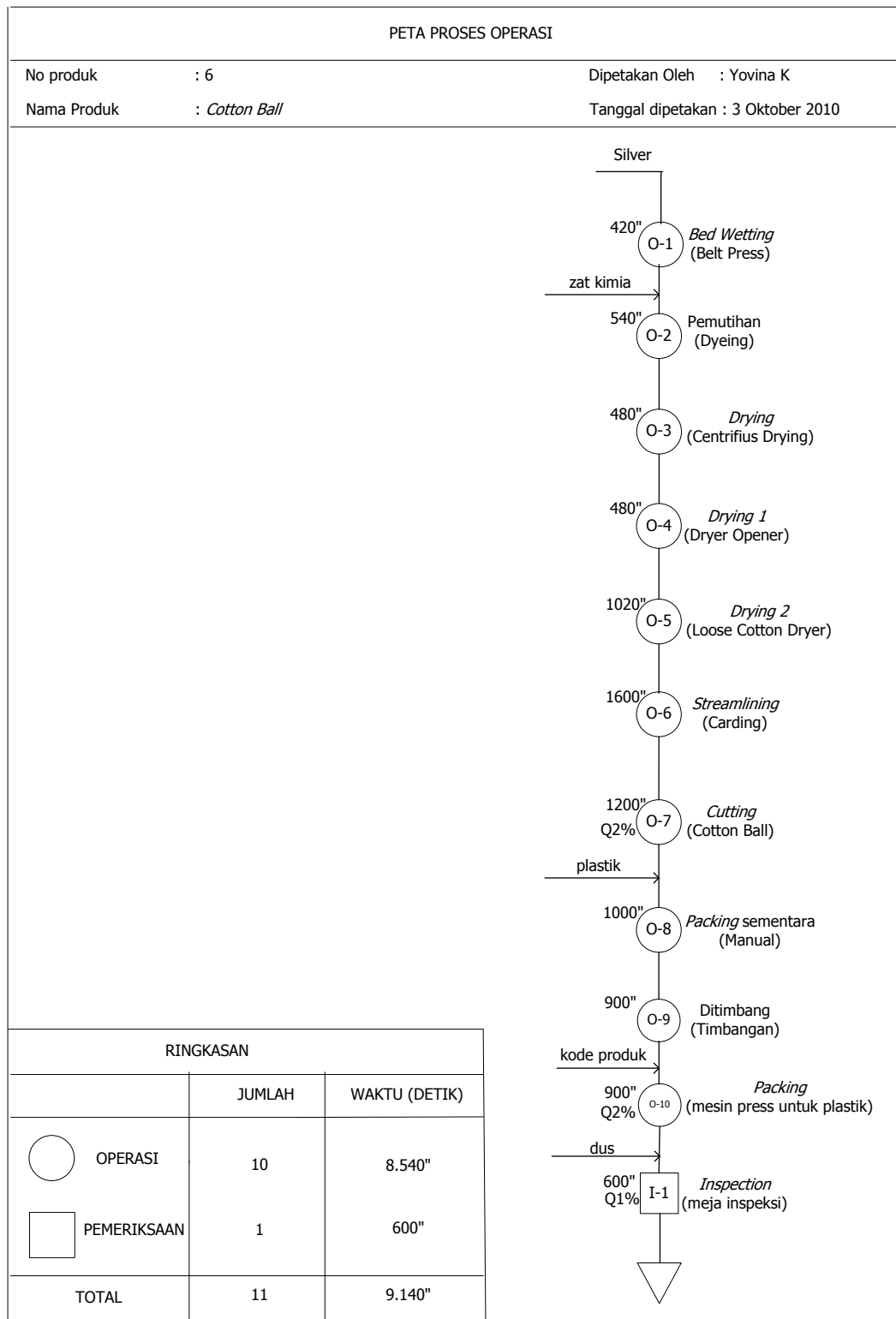


Lampiran A

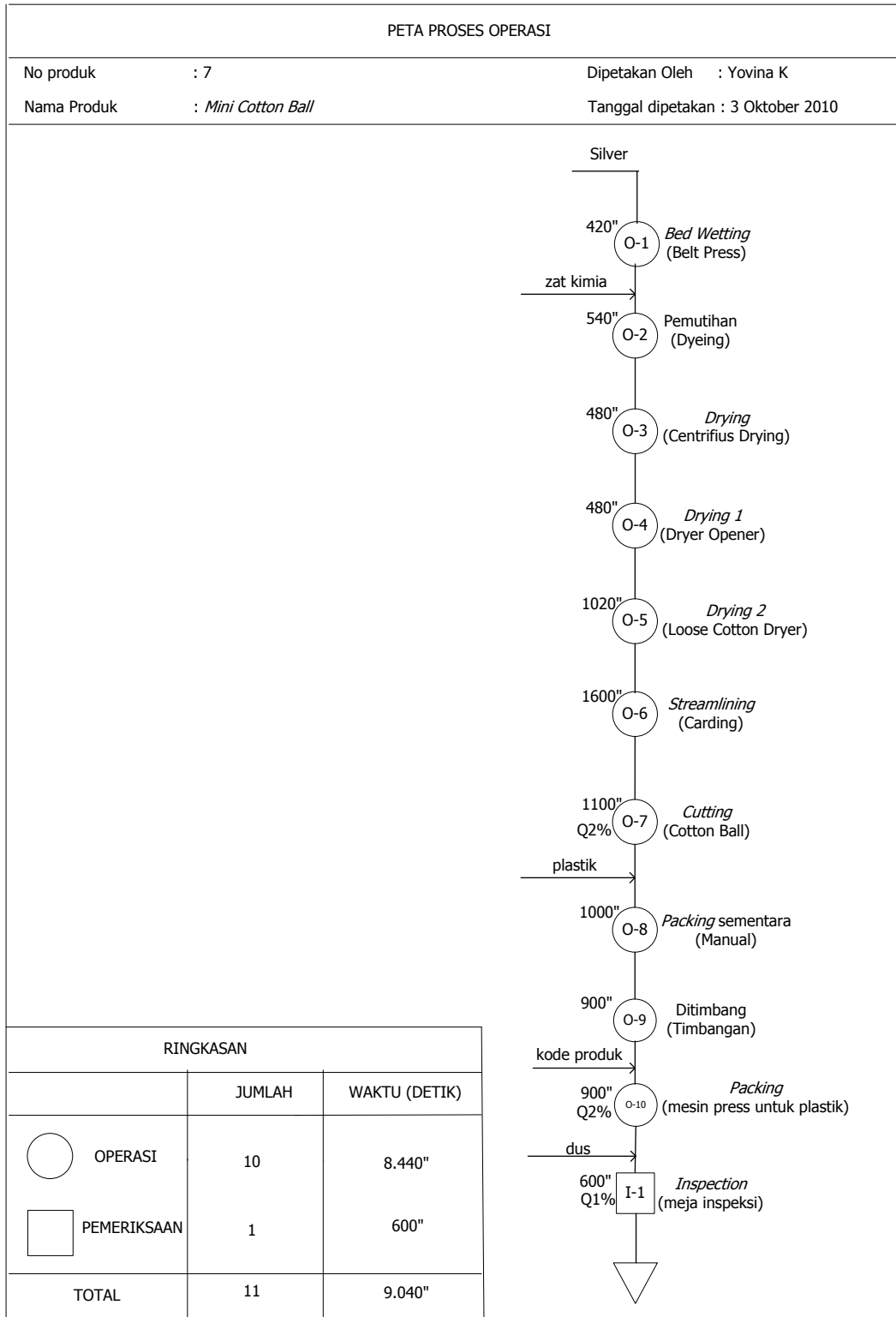


Lampiran A





Lampiran A





**LAMPIRAN B**  
**PETA PROSES PRODUK DARAB**  
**(MPPC)**



**LAMPIRAN C**  
***MATRIX CLUSTERING***

- Metode Rank Order Clustering (ROC)

- Matriks awal

		part (p)							
		1	2	3	4	5	6	7	8
machine (m)	1			1					
	2		1	1	1	1	1	1	
	3	1							
	4		1	1	1	1	1	1	
	5	1	1	1	1	1	1	1	
	6						1	1	
	7		1						
	8								1
	9				1				
	10	1							
	11	1							
	12		1	1	1	1	1	1	
	13	1	1	1	1	1	1	1	
	14		1	1	1	1	1	1	
	15	1							
	16	1	1	1	1	1	1	1	
	17								1
	18	1							
	19	1							
	20					1			
	21	1			1		1	1	
	22		1	1					
	23	1			1		1	1	

- Langkah-langkah ROC

- Langkah Pertama

		part (p)									
		1	2	3	4	5	6	7	8		
langkah 1	machine (m)	5	128	64	32	16	8	4	2	1	254
		13	1	1	1	1	1	1	1		254
		16	1	1	1	1	1	1	1		254
		21	1			1		1	1		150
		23	1			1		1	1		150
		3	1								128
		10	1								128
		11	1								128
		15	1								128
		18	1								128
		19	1								128
		2		1	1	1	1	1	1		126
		4		1	1	1	1	1	1		126
		12		1	1	1	1	1	1		126
		14		1	1	1	1	1	1		126
		22		1	1						96
		7		1							64
		1			1						32
		9				1					16
		20					1				8
6						1	1		6		
8								1	1		
17								1	1		

○ Langkah Kedua

		part (p)								
		8	6	7	5	4	3	2	1	
		1	4	2	8	16	32	64	128	
langkah 2	5	1								
	13	2								
	16	4								
	21	8								
	23	16								
	3	32								
	10	64								
	11	128								
	15	256								
	18	512								
	19	1024								
	machine (m)	2	2048							
		4	4096							
		12	8192							
		14	16384							
		22	32768							
		7	65536							
	1	131072								
	9	262144								
	20	524288								
	6	1048576								
	8	2097152								
	17	4194304								
		6291456	1079327	1079327	555015	292895	194567	129031	2047	

○ Langkah Ketiga

		part (p)									
		8	6	7	5	4	3	2	1		
		1	4	2	8	16	32	64	128		
langkah 3	5	1								254	
	13	2								254	
	16	4								254	
	21	8								150	
	23	16								150	
	3	32								128	
	10	64								128	
	11	128								128	
	15	256								128	
	18	512								128	
	19	1024								128	
	machine (m)	2	2048								126
		4	4096								126
		12	8192								126
		14	16384								126
		22	32768								96
		7	65536								64
	1	131072								32	
	9	262144								16	
	20	524288								8	
	6	1048576								6	
	8	2097152								1	
	17	4194304								1	

o Matriks akhir

		part (p)								
		6	7	5	4	3	2	1	8	
		4	2	8	16	32	64	128	1	
machine (m)	5	1	1	1	1	1	1	1	1	
	13	2	1	1	1	1	1	1	1	
	16	4	1	1	1	1	1	1	1	
	21	8	1	1		1			1	
	23	16	1	1		1			1	
	2	32	1	1	1	1	1	1		
	4	64	1	1	1	1	1	1		
	12	128	1	1	1	1	1	1		
	14	256	1	1	1	1	1	1		
	22	512					1	1		
	7	1024						1		
	1	2048					1			
	9	4096				1				
	20	8192			1					
	6	16384	1	1						
	3	32768							1	
	10	65536							1	
	11	131072							1	
	15	262144							1	
	18	524288							1	
	19	1048576							1	
	8	2097152								1
	17	4194304								1

• *Grouping Efficiency*

$$o = 64$$

$$e = 5$$

$$v = 34$$

$$M = 23$$

$$P = 8$$

$$\eta_1 = \frac{o - e}{o - e + v}$$

$$= \frac{64 - 5}{64 - 5 + 34} = 52,688\%$$

$$\eta_2 = \frac{MP - o - v}{MP - o - v + e} = \frac{(23 * 8) - 64 - 34}{(23 * 8) - 64 - 34 + 5} = 94,505\%$$

$$\eta = w\eta_1 + (1 - w)\eta_2 = 0.5 * 52,688\% + 0.5 * 94,505\% = 73,597\%$$

- **Grouping Efficacy**

$$o = 64$$

$$e = 5$$

$$v = 34$$

$$\tau = \frac{1 - \Psi}{1 + \phi} = \frac{o - e}{o + v} = \frac{64 - 5}{64 + 34} = 60,204\%$$

Dimana :

o = jumlah angka 1 dalam matriks

e = jumlah *exceptional elements* dalam solusi

v = jumlah *voids* dalam solusi

M = jumlah mesin

P = jumlah *part*

$\eta$  = *grouping efficiency*

- Metode *Cluster Identification Algorithm* (CIA)

- Matriks awal

		part (p)							
		1	2	3	4	5	6	7	8
machine (m)	1			1					
	2		1	1	1	1	1	1	
	3	1							
	4		1	1	1	1	1	1	
	5	1	1	1	1	1	1	1	
	6						1	1	
	7		1						
	8								1
	9				1				
	10	1							
	11	1							
	12		1	1	1	1	1	1	
	13	1	1	1	1	1	1	1	
	14		1	1	1	1	1	1	
	15	1							
	16	1	1	1	1	1	1	1	
	17								1
	18	1							
	19	1							
	20					1			
	21	1			1		1	1	
	22		1	1					
	23	1			1		1	1	

Lampiran C

- Langkah-langkah CIA
- Langkah Pertama

		part									
		1	2	3	4	5	6	7	8		
langkah 1	machine	1			1						
		2		1	1	1	1	1	1		
		3	1								
		4		1	1	1	1	1	1		
		5	1	1	1	1	1	1	1		h5
		6						1	1		
		7		1							
		8								1	
		9				1					
		10	1								
		11	1								
		12		1	1	1	1	1	1		
		13	1	1	1	1	1	1	1		
		14		1	1	1	1	1	1		
		15	1								
		16	1	1	1	1	1	1	1		
		17								1	
		18	1								
		19	1								
		20					1				
		21	1			1		1	1		
		22		1	1						
		23	1			1		1	1		

- Langkah Kedua

		part								
		1	2	3	4	5	6	7	8	
langkah 2	machine	1	1							
		2	1	1	1	1	1	1		
		3	1							
		4	1	1	1	1	1	1	1	
		5	1	1	1	1	1	1	1	h5
		6	1					1	1	
		7	1	1						
		8								1
		9				1				
		10	1							
		11	1							
		12		1	1	1	1	1	1	
		13	1	1	1	1	1	1	1	
		14		1	1	1	1	1	1	
		15	1							
		16	1	1	1	1	1	1	1	
		17								1
		18	1							
		19	1							
		20					1			
		21	1			1		1	1	
		22		1	1					
		23	1			1		1	1	
		v1	v2	v3	v4	v5	v6	v7		



○ Langkah Ketiga

		part									
		1	2	3	4	5	6	7	8		
langkah 3	machine	-1	+	+	+	+	+	+	+	h1	
		-2	+	+	+	+	+	+	+	h2	
		-3	+	+	+	+	+	+	+	h3	
		-4	+	+	+	+	+	+	+	h4	
		-5	+	+	+	+	+	+	+	h5	
		-6	+	+	+	+	+	+	+	h6	
		-7	+	+	+	+	+	+	+	h7	
		-8								1	
		-9				+					h9
		-10				+					h10
		-11				+					h11
		-12				+					h12
		-13				+					h13
		-14				+					h14
		-15				+					h15
		-16				+					h16
		-17								1	
		-18									h18
		-19									h19
		-20									h20
		-21									h21
		-22									h22
		-23									h23
		v1	v2	v3	v4	v5	v6	v7			

○ Langkah Keempat

		part	
		8	
langkah 4	machine	-8	h8
		-17	h17
		v8	

○ Matriks Akhir

		PF - 1							PF - 2
		1	2	3	4	5	6	7	8
MC - 1	5	1	1	1	1	1	1	1	
	13	1	1	1	1	1	1	1	
	16	1	1	1	1	1	1	1	
	2		1	1	1	1	1	1	
	4			1	1	1	1	1	
	12			1	1	1	1	1	
	14			1	1	1	1	1	
	3	1							
	10	1							
	11	1							
	15	1							
	18	1							
	19	1							
	21	1				1		1	1
	23	1				1		1	1
	21							1	1
	7			1					
1				1					
22			1	1					
9					1				
20						1			
MC - 2	8							1	
	17							1	

- **Grouping Efficiency**

$$o = 69$$

$$e = 0$$

$$v = 80$$

$$M = 23$$

$$P = 8$$

$$\begin{aligned}\eta_1 &= \frac{o - e}{o - e + v} \\ &= \frac{69 - 0}{69 - 0 + 80} = 46,309\%\end{aligned}$$

$$\eta_2 = \frac{MP - o - v}{MP - o - v + e} = \frac{(23 * 8) - 69 - 80}{(23 * 8) - 69 - 80 + 0} = 100\%$$

$$\eta = w\eta_1 + (1 - w)\eta_2 = 0.5 * 46,309\% + 0.5 * 100\% = 73,155\%$$

- **Grouping Efficacy**

$$o = 69$$

$$e = 0$$

$$v = 80$$

$$\tau = \frac{1 - \Psi}{1 + \phi} = \frac{o - e}{o + v} = \frac{69 - 0}{69 + 80} = 46,309\%$$

Dimana :

$o$  = jumlah angka 1 dalam matriks

$e$  = jumlah *exceptional elements* dalam solusi

$v$  = jumlah *voids* dalam solusi

$M$  = jumlah mesin

$P$  = jumlah *part*

$\eta$  = *grouping efficiency*

Lampiran C

- Metode *Direct Clustering Algorithm* (DCA)

- Matriks awal

		part (p)							
		1	2	3	4	5	6	7	8
machine (m)	1			1					
	2		1	1	1	1	1	1	
	3	1							
	4		1	1	1	1	1	1	
	5	1	1	1	1	1	1	1	
	6						1	1	
	7		1						
	8								1
	9				1				
	10	1							
	11	1							
	12		1	1	1	1	1	1	
	13	1	1	1	1	1	1	1	
	14		1	1	1	1	1	1	
	15	1							
	16	1	1	1	1	1	1	1	
	17								1
	18	1							
	19	1							
	20					1			
	21	1			1		1	1	
	22		1	1					
	23	1			1		1	1	

- Langkah-langkah DCA

- Langkah Pertama

Columns	Rows																						
8	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
7	8	17	1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	18	19	20	21	22	23
6	2	4	5	6	12	13	14	16	21	23	8	17	1	3	7	9	10	11	15	18	19	20	22
5	2	4	5	6	12	13	14	16	21	23	8	17	1	3	7	9	10	11	15	18	19	20	22
4	2	4	5	12	13	14	16	20	6	21	23	8	17	1	3	7	9	10	11	15	18	19	22
3	2	4	5	12	13	14	16	21	23	9	20	6	8	17	1	3	7	10	11	15	18	19	22
2	2	4	5	12	13	14	16	1	22	21	23	9	20	6	8	17	3	7	10	11	15	18	19
1	2	4	5	12	13	14	16	22	7	1	21	23	9	20	6	8	17	3	10	11	15	18	19
p	5	13	16	21	23	3	10	11	15	18	19	2	4	12	14	22	7	1	9	20	6	8	17

		part							
		1	2	3	4	5	6	7	8
langkah 1 machine	5	1	1	1	1	1	1	1	
	13	1	1	1	1	1	1	1	
	16	1	1	1	1	1	1	1	
	21	1			1		1	1	
	23	1			1		1	1	
	3	1							
	10	1							
	11	1							
	15	1							
	18	1							
	19	1							
	2		1	1	1	1	1	1	
	4		1	1	1	1	1	1	
	12		1	1	1	1	1	1	
	14		1	1	1	1	1	1	
	22		1	1					
	7		1						
	1			1					
	9				1				
	20					1			
	6						1	1	
	8								1
	17								1

○ Langkah Kedua

Rows	Coloumns							
5 (1)	1	2	3	4	5	6	7	8
13 (2)	1	2	3	4	5	6	7	8
16 (3)	1	2	3	4	5	6	7	8
21 (4)	1	2	3	4	5	6	7	8
23 (5)	1	4	6	7	2	3	5	8
3 (6)	1	4	6	7	2	3	5	8
10 (7)	1	4	6	7	2	3	5	8
11 (8)	1	4	6	7	2	3	5	8
15 (9)	1	4	6	7	2	3	5	8
18 (10)	1	4	6	7	2	3	5	8
19 (11)	1	4	6	7	2	3	5	8
2 (12)	1	4	6	7	2	3	5	8
4 (13)	4	6	7	2	3	5	1	8
12 (14)	4	6	7	2	3	5	1	8
14 (15)	4	6	7	2	3	5	1	8
22 (16)	4	6	7	2	3	5	1	8
7 (17)	2	3	4	6	7	5	1	8
1 (18)	2	3	4	6	7	5	1	8
9 (19)	3	2	4	6	7	5	1	8
20 (20)	4	3	2	6	7	5	1	8
6 (21)	5	4	3	2	6	7	1	8
8 (22)	6	7	5	4	3	2	1	8
17 (23)	8	6	7	5	4	3	2	1
c.a	8	6	7	5	4	3	2	1

		part								
		8	6	7	5	4	3	2	1	
5			1	1	1	1	1	1	1	1
13			1	1	1	1	1	1	1	1
16			1	1	1	1	1	1	1	1
21			1	1		1				1
23			1	1		1				1
3										1
10										1
11										1
15										1
18										1
19										1
2	machine		1	1	1	1	1	1		1
4			1	1	1	1	1	1		1
12			1	1	1	1	1	1		1
14			1	1	1	1	1	1		1
22							1	1		1
7								1		1
1							1			1
9						1				1
20					1					1
6			1	1						1
8		1								1
17		1								1
		1	2	3	4	5	6	7	8	

## Lampiran C

### ○ Langkah Ketiga

Columns	Rows																						
8(1)	1(5)	2(13)	3(16)	4(21)	5(23)	6(3)	7(10)	8(11)	9(15)	10(18)	11(19)	12(2)	13(4)	14(12)	15(14)	16(22)	17(7)	18(1)	19(9)	20(20)	21(6)	22(8)	23(17)
7(2)	5	13	16	21	23	3	10	11	15	18	19	2	4	12	14	22	7	1	9	20	6	8	17
6(3)	5	13	16	2	4	12	14	22	7	21	23	3	10	11	15	18	19	1	9	20	6	8	17
5(4)	5	13	16	2	4	12	14	22	1	7	21	23	3	10	11	15	18	19	9	20	6	8	17
4(5)	5	13	16	2	4	12	14	21	23	9	22	1	7	3	10	11	15	18	19	20	6	8	17
3(7)	5	13	16	2	4	12	14	20	21	23	9	22	1	7	3	10	11	15	18	19	6	8	17
2(6)	5	13	16	2	4	12	14	21	23	6	20	9	22	1	7	3	10	11	15	18	19	8	17
1(8)	5	13	16	2	4	12	14	21	23	6	20	9	22	1	7	3	10	11	15	18	19	8	17
p	8(22)	17(23)	5(1)	13(2)	16(3)	2(12)	4(13)	12(14)	14(15)	21(4)	23(5)	6(21)	20(20)	9(19)	22(16)	1(18)	7(17)	3(6)	10(7)	11(8)	15(9)	18(10)	19(11)

		part									
		8	6	7	5	4	3	2	1		
22		1								1	
23		1								2	
1			1	1	1	1	1	1	1	3	
2			1	1	1	1	1	1	1	4	
3			1	1	1	1	1	1	1	5	
12			1	1	1	1	1	1		6	
13			1	1	1	1	1	1		7	
14			1	1	1	1	1	1		8	
15			1	1	1	1	1	1		9	
4			1	1		1			1	10	
5	revise 1		1	1		1				11	
21	machine		1	1						12	
20					1					13	
19						1				14	
16							1	1		15	
18							1			16	
17								1		17	
6									1	18	
7									1	19	
8									1	20	
9									1	21	
10									1	22	
11									1	23	
		1	2	3	4	5	6	7	8		

### ○ Matriks Akhir

		part									
		8	6	7	5	4	3	2	1		
22		1								1	
23		1								2	
1			1	1	1	1	1	1	1	3	
2			1	1	1	1	1	1	1	4	
3			1	1	1	1	1	1	1	5	
12			1	1	1	1	1	1		6	
13			1	1	1	1	1	1		7	
14			1	1	1	1	1	1		8	
15			1	1	1	1	1	1		9	
4			1	1		1			1	10	
5			1	1		1				11	
21	machine		1	1						12	
20					1					13	
19						1				14	
16							1	1		15	
18							1			16	
17								1		17	
6									1	18	
7									1	19	
8									1	20	
9									1	21	
10									1	22	
11									1	23	
		1	2	3	4	5	6	7	8		

- **Grouping Efficiency**

$$o = 64$$

$$e = 5$$

$$v = 34$$

$$M = 23$$

$$P = 8$$

$$\begin{aligned}\eta_1 &= \frac{o - e}{o - e + v} \\ &= \frac{64 - 5}{64 - 5 + 34} = 52,688\%\end{aligned}$$

$$\eta_2 = \frac{MP - o - v}{MP - o - v + e} = \frac{(23 * 8) - 64 - 34}{(23 * 8) - 64 - 34 + 5} = 94,505\%$$

$$\eta = w\eta_1 + (1 - w)\eta_2 = 0.5 * 52,688\% + 0.5 * 94,505\% = 73,597\%$$

- **Grouping Efficacy**

$$o = 64$$

$$e = 5$$

$$v = 34$$

$$\tau = \frac{1 - \Psi}{1 + \phi} = \frac{o - e}{o + v} = \frac{64 - 5}{64 + 34} = 60,204\%$$

Dimana :

o = jumlah angka 1 dalam matriks

e = jumlah *exceptional elements* dalam solusi

v = jumlah *voids* dalam solusi

M = jumlah mesin

P = jumlah *part*

$\eta$  = *grouping efficiency*