

DAFTAR PUSTAKA

- Agresti, A., & Franklin, C. A. (2007). *Statistics The Art and Science of Learning from Data*. New Jersey: Pearson Prentice Hall.
- Anderson, T.W. (2003). *An Introduction to Multivariate Statistical Analysis*. John Wiley & Sons Inc. New York.
- Chen, G., Cheng, S. W., & Xie, H. (2001). Monitoring Process Mean and Variability With One EWMA Chart. *Journal of Quality Technology*. 33(2), 12-21.
- Gunaratne, N., Abdollahian, M., Huda, S., & Yearwood, J. (2017). Exponentially weighted control charts to monitor multivariate process variability for high dimensions. *Internasional Journal of Production Research*, 55(17),4948-4962.
- Hamed, M. (2014). Generalized Variance Chart for Multivariate Quality Control Process Procedure with Application. *Applied Mathematical Sciences*, 8(163),8137-8151.
- Huwang, L., Yeh, A., & Wu, Chen. (2007). Monitoring Multivariate Process Variability for Individual Observation. *Journal of Quality technology*, 39(3),258-278.
- Johnson, Richard. Dean Wichern. (2007). *Applied Multivariate Statistical Analysis*, 5th ed. New Jersey: Prentice.
- Lowry, C. A., Woodall, W. H., Champ, C. W., & Rigdon, S. E. (1992). A Multivariate Exponentially Weighted Moving Average Control Chart. *Technometrics*, 34(1),46-53.
- Maharani, A. A., Mustafid, & Sudarno. (2018). Penerapan Diagram Kontrol MEWMA dan MEWMV pada Pengendalian Karakteristik Kualitas Air. *Jurnal Gaussian*, 7(1), 23-32.
- Montgomery, D. C. (2009). *Introduction to Statistical Quality Control, sixth Edition*. Amerika: John Wiley & Sons, Inc.
- Montgomery, D. C., Jennings, C. L., Kulahci, M. 2008. *Introduction to Time Series Analysis and Forecasting*. Amerika: John Wiley & Sons, Inc.
- Morrison, D. (1990). *Multivariate Statistical Methods (Third Edition)*. New York: Mc Graw Hill Publishing Comfiney.

Susanto, A.M. (2017). *Statistical Quality Control on Process Electric Resistance Welded (ERW) Pipe in PT X*. Skripsi. Program Studi Matematika Fakultas Matematika dan Ilmu pengetahuan Alam. Surabaya: Institute Teknologi Sepuluh November.

# LAMPIRAN

Lampiran 1. Data Pipa ERW Fase I (periode Januari-Juni)

No	Diameter	Panjang	Berat	Tanggal	Bulan
1	88.0667	6.0300	45.6750	3	Januari
2	88.0625	6.0308	45.6785	4	Januari
3	88.3773	6.0300	45.8430	4	Januari
4	88.2500	6.0308	45.7805	5	Januari
5	88.3700	6.0300	45.8391	7	Januari
6	88.3544	6.0309	45.8373	7	Januari
7	88.4368	6.0300	45.8752	8	Januari
8	88.2516	6.0267	45.7501	8	Januari
9	88.3929	6.0300	45.8514	9	Januari
10	88.3250	6.0300	45.8147	15	Januari
11	88.1500	6.0306	45.7243	6	Februari
12	88.1523	6.0303	45.7239	7	Februari
13	88.1885	6.0300	45.7409	8	Februari
14	88.1500	6.0300	45.7201	8	Februari
15	88.2150	6.0301	45.7557	9	Februari
16	88.4063	6.0300	45.8587	12	Februari
17	88.2500	6.0311	45.7826	13	Februari
18	88.3933	6.0300	45.8517	13	Februari
19	88.4000	6.0314	45.8661	28	Februari
20	88.4500	6.0300	45.8823	28	Februari
21	88.3500	6.0307	45.8008	1	Maret
22	88.4308	6.0300	45.8719	1	Maret
23	88.4250	6.0313	45.8783	2	Maret
24	88.4500	6.0300	45.8823	4	Maret
25	88.0500	6.0307	45.6714	29	Mei
26	88.1632	6.0359	45.7719	30	Mei
27	88.1464	6.0393	45.7886	30	Mei
28	88.1662	6.0329	45.7511	30	Mei
29	88.1750	6.0325	45.7526	31	Mei
30	88.2846	6.0327	45.3535	1	Juni
31	88.1750	6.0310	45.2821	1	Juni
32	88.1500	6.0300	45.2612	2	Juni
33	88.1563	6.0300	45.2646	2	Juni
34	88.0656	6.0325	45.2348	2	Juni
35	88.2917	6.0283	45.3246	21	Juni
36	88.2903	6.0362	45.3826	21	Juni
37	88.1250	6.0322	45.2643	21	Juni

38	88.1355	6.0329	45.2752	22	Juni
39	88.3115	6.0373	45.4027	22	Juni
40	88.2750	6.0368	45.3790	24	Juni
41	88.2500	6.0340	45.3448	24	Juni
42	88.3694	6.0417	45.4665	24	Juni
43	88.2063	6.0358	45.3352	25	Juni
44	88.2926	6.0350	45.3752	25	Juni
45	88.3250	6.0400	45.4301	26	Juni

**Lampiran 2.** Perbandingan jarak mahalanobis dengan nilai chisquare fase I

No	dj2 urut	chisquare	No	dj2 urut	chisquare
1	0.598041	0.123397	24	2.482048	2.486269
2	0.604225	0.26391	25	2.544703	2.61105
3	0.829438	0.379498	26	2.624604	2.740829
4	0.844266	0.48478	27	2.624959	2.876188
5	0.885446	0.584374	28	2.798479	3.0178
6	1.006518	0.680512	29	2.858519	3.166452
7	1.191556	0.774502	30	2.957837	3.323071
8	1.337583	0.867207	31	2.957837	3.488765
9	1.445807	0.959249	32	3.048758	3.664871
10	1.69289	1.051104	33	3.252327	3.85303
11	1.703895	1.14316	34	3.467847	4.055288
12	1.704392	1.235745	35	3.841367	4.27424
13	1.711248	1.329153	36	3.919596	4.513254
14	1.712193	1.423652	37	4.090684	4.776811
15	1.718866	1.519497	38	4.328138	5.071066
16	1.790808	1.616937	39	4.349081	5.404806
17	1.800772	1.716222	40	4.414792	5.791209
18	1.954748	1.817606	41	4.957958	6.251389
19	2.041474	1.921356	42	6.629685	6.82244
20	2.126994	2.027752	43	6.734961	7.579299
21	2.186957	2.137096	44	10.32898	8.714793
22	2.206604	2.249717	45	11.41011	11.11673
23	2.282016	2.365974			

**Lampiran 3. Uji *Bartlett* Fase I****KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.464
Bartlett's Test of Sphericity	Approx. Chi-Square	16.852
	df	3
	Sig.	.001

Lampiran 4. Tabel Nilai L untuk p=3

$\omega$	$\lambda$	$L$	$\omega$	$\lambda$	$L$	$\omega$	$\lambda$	$L$
0.1	0.1	2.7900	0.4	0.1	3.8984	0.7	0.1	4.3777
	0.2	2.7939		0.2	3.9063		0.2	4.3797
	0.3	2.7949		0.3	3.9121		0.3	4.3816
	0.4	2.7988		0.4	3.9219		0.4	4.3836
	0.5	2.7979		0.5	3.9277		0.5	4.3855
	0.6	2.8027		0.6	3.9395		0.6	4.3875
	0.7	2.8066		0.7	3.9492		0.7	4.3836
	0.8	2.8105		0.8	3.9511		0.8	4.3836
	0.9	2.8164		0.9	3.9492		0.9	4.3758
0.2	0.1	3.3105	0.5	0.1	4.1016	0.8	0.1	4.4707
	0.2	3.3086		0.2	4.1016		0.2	4.4668
	0.3	3.3164		0.3	4.1094		0.3	4.4629
	0.4	3.3213		0.4	4.1152		0.4	4.4688
	0.5	3.3340		0.5	4.1191		0.5	4.4688
	0.6	3.3438		0.6	4.1270		0.6	4.4688
	0.7	3.3535		0.7	4.1367		0.7	4.4629
	0.8	3.3594		0.8	4.1387		0.8	4.4590
	0.9	3.3691		0.9	4.1328		0.9	4.4551
0.3	0.1	3.6484	0.6	0.1	4.2578	0.9	0.1	4.5234
	0.2	3.6523		0.2	4.2578		0.2	4.5195
	0.3	3.6602		0.3	4.2617		0.3	4.5117
	0.4	3.6699		0.4	4.2695		0.4	4.5195
	0.5	3.6797		0.5	4.2715		0.5	4.5176
	0.6	3.6895		0.6	4.2715		0.6	4.5137
	0.7	3.6943		0.7	4.2734		0.7	4.5098
	0.8	3.7011		0.8	4.2813		0.8	4.5078
	0.9	3.7070		0.9	4.2715		0.9	4.4984



## Lampiran 5. Syntatx MATLAB Bagan Kendali MEWMV

```

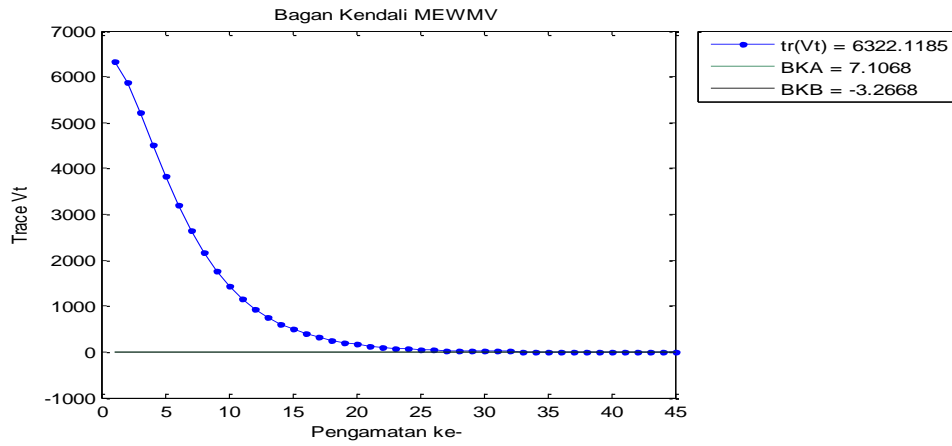
clear;
clc;
X=xlsread('C:\Users\acer\Documents\MATLAB\Data1.xlsx');
omega=0.9;
lamda=0.9;
p=3;
L=4.4984;
A=X*X';
[brsA,klmA]=size(A);
t=brsA;
I=eye(t);
for i=1:t
    elemen(i)=lamda*(1-lamda)^(i-1)
end
for i=1:t;
    for j=1:t;
        if i<j;
            M(i,j)=0;
        else
            for l=i:t;
                M(l,j)=elemen(l-j+1);
            end
        end
    end
end
for u=1:brsA
    Apartu=A(1:u,1:u);
    Ipartu=I(1:u,1:u);
    Mpartu=M(1:u,1:u);
    elemenC=[];
    for i=1:u
        if i>1
            elemenC(i)=omega*(1-omega)^(u-i);
        else
            elemenC(i)=(1-omega)^(u-i);
        end
    end
    C=diag(elemenC);
    Q=(Ipartu-Mpartu)'*C*(Ipartu-Mpartu);
    trv(u)=trace(Q*Apartu);
    ekspektasi(u)=p*trace(Q);
    Q2=Q.^2;
    sumQ2=sum(sum(Q2));
    var(u)=2*p*sumQ2;
    ba=ekspektasi+(L*sqrt(var));
    bb=ekspektasi-(L*sqrt(var));
end
trvpartial=trv(:,1:t);
ekspekpartial=ekspektasi(:,1:t);
varpartial=var(:,1:t);
bapartial=ba(:,1:t);

```

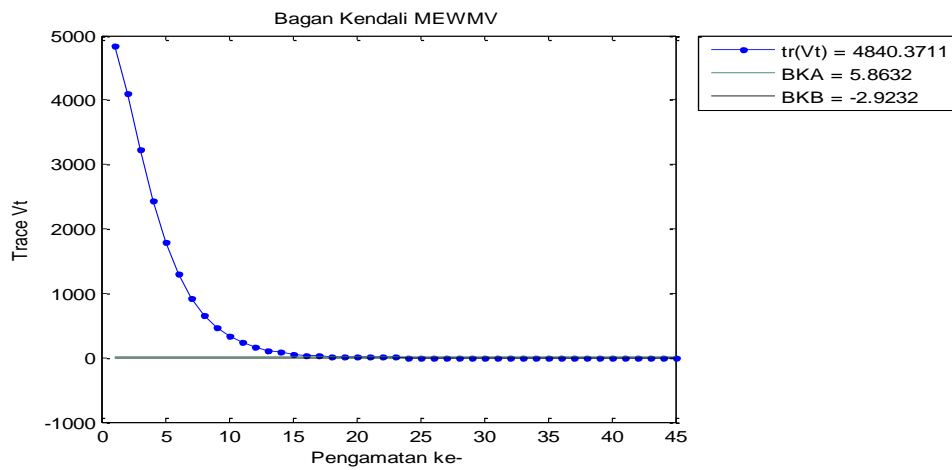
```
bbpartial=bb(:,1:t);
keluar=0;
d=0;
for i=1:t-1;
    if trvpartial(i)<bbpartial(i)
        keluar=keluar+1;
        d=d+1;
        yangkeluar(d)=i;
    end
    if trvpartial(i)>bapartial(i)
        keluar=keluar+1;
        d=d+1;
        yangkeluar(d)=i;
    end
end
x=1:t;
plot(x,trvpartial,'b.-',x,bapartial,'k-',x,bbpartial,'k-');
title('Bagan Kendali MEWMV');
xlabel('Pengamatan ke-');
ylabel('Trace Vt');
```

Lampiran 6. Output Bagan Kendali MEWMV Fese I

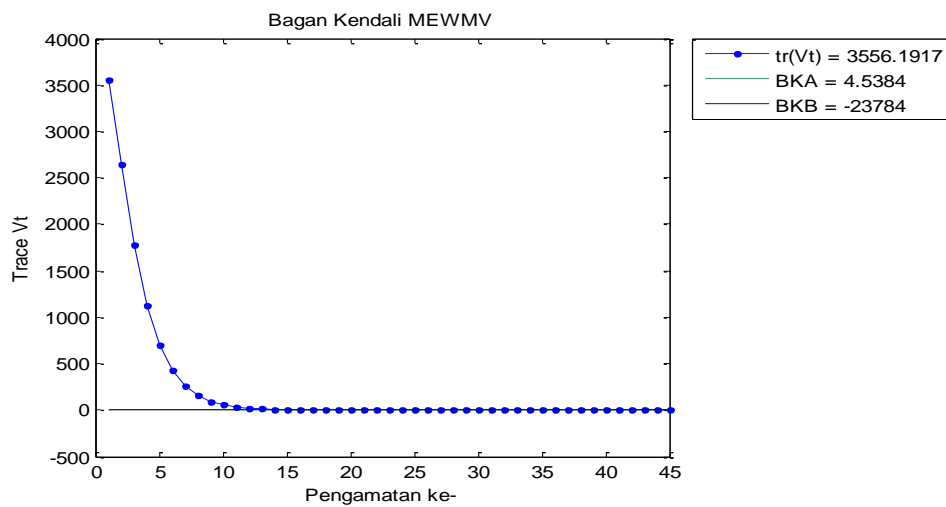
$\omega = 0.2$  dan  $\lambda = 0.2$   $L = 3.3086$



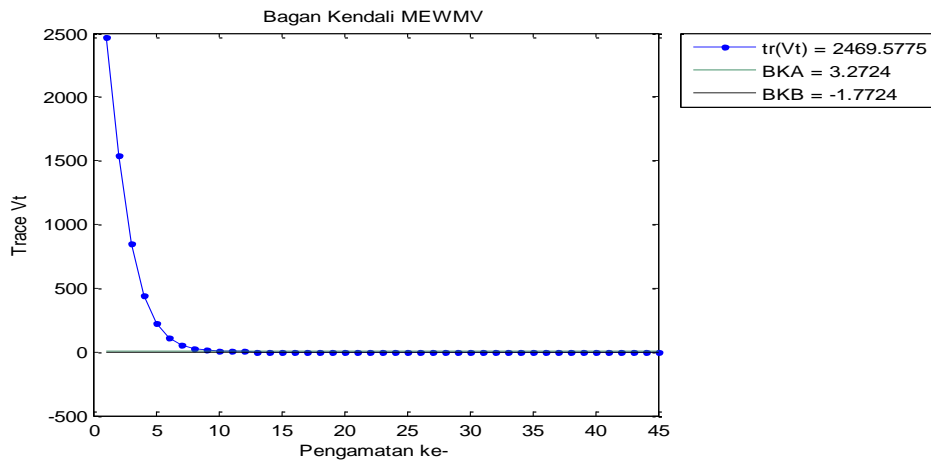
$\omega = 0.3$  dan  $\lambda = 0.3$   $L = 3.6602$



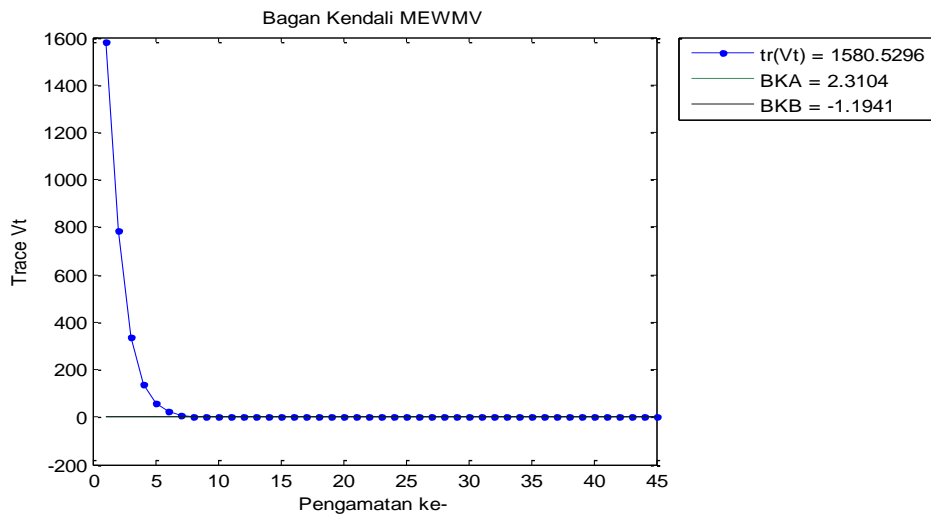
$\omega = 0.4$  dan  $\lambda = 0.4$   $L = 3.9291$



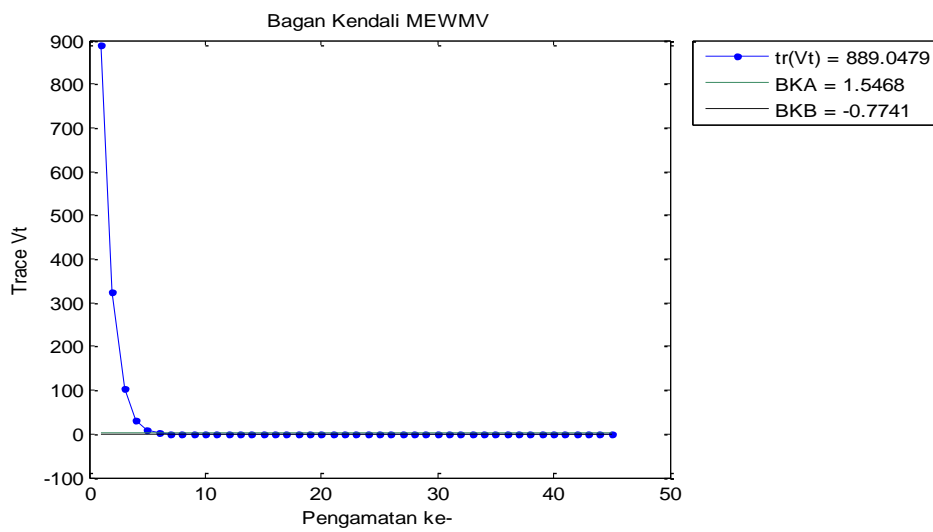
$\omega = 0.5$  dan  $\lambda = 0.5$   $L = 4.1191$



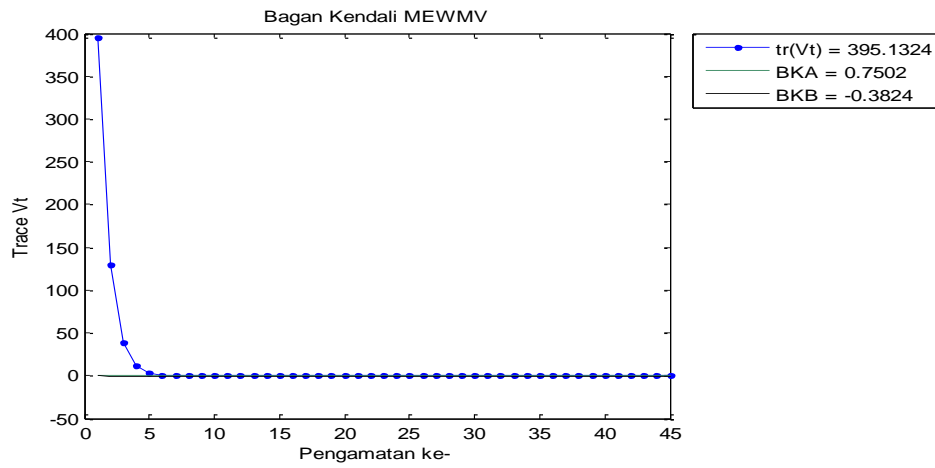
$\omega = 0.6$  dan  $\lambda = 0.6$   $L = 4.2715$



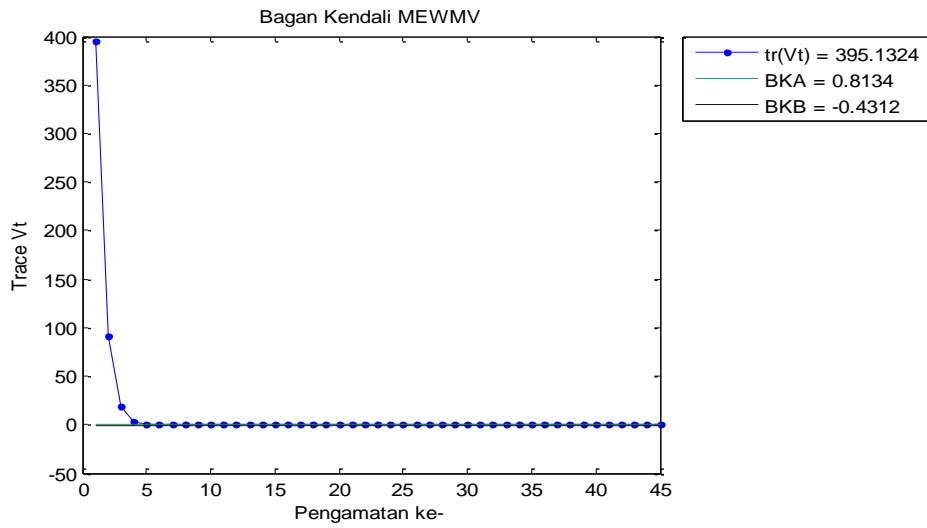
$\omega = 0.7$  dan  $\lambda = 0.7$   $L = 4.3836$



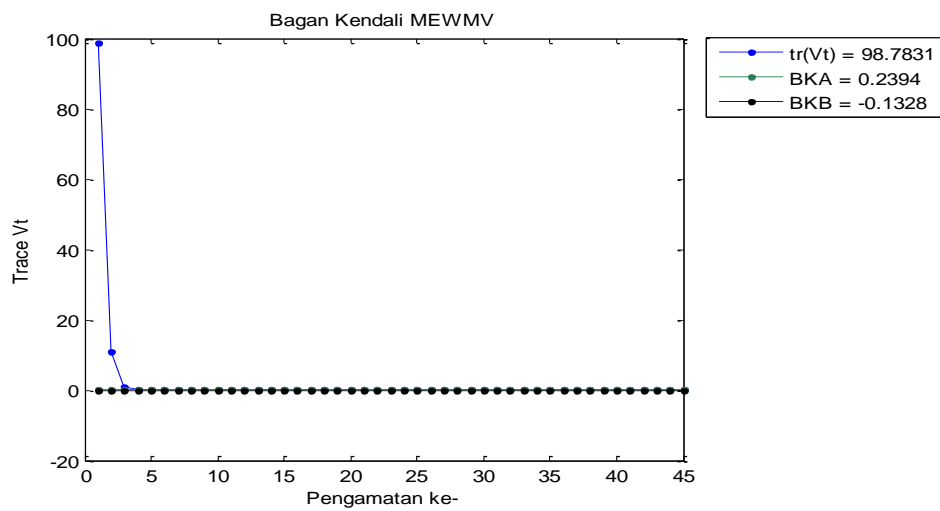
$\omega = 0.7$  dan  $\lambda = 0.8$   $L = 4.3836$



$\omega = 0.8$  dan  $\lambda = 0.8$   $L = 4.4590$



$\omega = 0.9$  dan  $\lambda = 0.9$   $L = 4.4984$



**Lampiran 7.** Data Pipa ERW Fase II (periode Juli-Desember)

No.	Diameter	Panjang	Berat	Tanggal	Bulan
1	88.2167	6.0317	45.7688	24	Juli
2	88.1969	6.0356	45.7881	24	Juli
3	88.1750	6.0300	45.7336	24	Juli
4	88.3250	6.0386	45.8799	25	Juli
5	88.2050	6.0320	45.7650	25	Juli
6	88.1292	6.0325	45.7278	25	Juli
7	88.3333	6.0383	45.8826	26	Juli
8	88.1900	6.0332	45.7657	26	Juli
9	88.1500	6.0329	45.7422	26	Juli
10	88.0696	6.0339	45.7064	27	Juli
11	88.0708	6.0367	45.7278	28	Juli
12	88.0625	6.0367	45.7233	28	Juli
13	88.1250	6.0331	45.7303	29	Juli
14	88.0750	6.0314	45.6904	29	Juli
15	87.9750	6.0325	45.6444	29	Juli
16	88.0250	6.0300	45.6525	30	Juli
17	88.2458	6.0358	45.8162	30	Juli
18	88.2786	6.0321	45.8059	31	Juli
19	88.1250	6.0325	45.7255	31	Juli
20	88.1531	6.0356	45.7645	6	Oktober
21	88.1886	6.0309	45.7479	7	Oktober
22	88.2235	6.0353	45.7998	7	Oktober
23	88.1750	6.0342	45.7657	7	Oktober
24	88.1000	6.0314	45.7034	8	Oktober
25	88.1281	6.0325	45.7272	8	Oktober
26	88.1021	6.0371	45.7479	8	Oktober
27	88.0341	6.0318	45.6712	13	Oktober
28	88.4600	6.0340	45.9182	14	Oktober
29	88.4273	6.0345	45.9046	14	Oktober
30	88.2250	6.0400	45.8365	14	Desember
31	88.2438	6.0363	45.8182	15	Desember
32	88.1167	6.0450	45.8157	15	Desember
33	88.0500	6.0308	45.6723	16	Desember
34	88.2596	6.0381	45.8407	16	Desember
35	88.3333	6.0400	45.8952	16	Desember
36	88.0458	6.0367	45.7143	17	Desember
37	88.3107	6.0386	45.8721	17	Desember
38	88.3500	6.0400	45.9042	17	Desember
39	88.2000	6.0314	45.7575	18	Desember
40	88.3050	6.0385	45.8685	18	Desember

**Lampiran 8.** Perbandingan jarak mahalanobis dengan nilai chisquare fase II

No	dj2 urut	chisquare	No	dj2 urut	chisquare
1	0.2322	0.133752	21	1.96096	2.433115
2	0.24505	0.286755	22	2.0359	2.571545
3	0.33422	0.413211	23	2.04422	2.716089
4	0.43785	0.52889	24	2.05491	2.867552
5	0.50825	0.63878	25	2.08647	3.026876
6	0.57964	0.745303	26	2.09342	3.195181
7	0.59066	0.849892	27	2.2912	3.373818
8	0.60817	0.953506	28	2.34561	3.564441
9	0.63632	1.056848	29	2.40432	3.769107
10	0.86656	1.16047	30	2.51986	3.990424
11	1.01015	1.264834	31	2.53026	4.231773
12	1.01814	1.370347	32	2.91347	4.49765
13	1.04794	1.477383	33	3.06595	4.794227
14	1.10804	1.586301	34	3.41599	5.130312
15	1.20533	1.697454	35	3.48446	5.519111
16	1.51602	1.811203	36	3.53527	5.981781
17	1.56529	1.927925	37	3.60182	6.55548
18	1.59538	2.04802	38	6.2091	7.315265
19	1.81668	2.171922	39	7.35387	8.454241
20	1.93646	2.300109	40	12.508	10.8613

Lampiran 9. Uji *Bartlett* Fase II

**KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.325
Bartlett's Test of Sphericity Approx. Chi-Square	444.339
df	3
Sig.	.000



**Lampiran 10.** Output Bagan Kendali MEWMV Fese II

$\omega = 0.9$  dan  $\lambda = 0.9$   $L = 4.4984$

