UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2008/2009

April/May 2009

MSG 262 – Quality Control
[Kawalan Kualiti]

Duration : 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of FOURTEEN pages of printed materials before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi EMPAT BELAS muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer **all four** [4] questions.

*[**Arahan:** Jawab **semua empat** [4] soalan.]*

1. (a) The causes of variation in a process can be classified into two categories, namely chance causes and assignable causes. Explain each of these causes of variation.

[20 marks]

(b) State three of the seven quality control tools and explain the uses of each of these tools.

[30 marks]

(c) Samples of size $n = 5$ are collected from a process every half hour. After 50 samples have been collected, we calculate $\bar{\bar{X}} = 20$ and $\bar{S} = 1.5$. Assume that both the $\bar{X}$ and S charts exhibit control and that the quality characteristic is normally distributed.

(i) Estimate the process standard deviation.

(ii) Find the control limits on the $\bar{X}$ and S charts.

(iii) If the process mean shifts to 22, what is the probability of concluding that the process is still in-control?

[30 marks]

(d) An exponentially weighted moving average (EWMA) control chart uses $\lambda = 0.4$. How wide will the limits be on the Shewhart control chart, expressed as a multiple of the width of the steady-state EWMA control limits?

[20 marks]

1. (a) *Punca-punca variasi dalam proses boleh diklasifikasikan dalam dua kategori, iaitu sebab peluang dan sebab terumpukkan. Jelaskan setiap daripada punca-punca variasi ini.*

[20 markah]

(b) *Nyatakan tiga daripada tujuh alat kawalan kualiti dan jelaskan kegunaan setiap daripada alat ini.*

[30 markah]

(c) *Sampel bersaiz n = 5 diambil daripada suatu proses setiap setengah jam. Selepas 50 sampel diambil, kita mengira* $\bar{\bar{X}} = 20$ *dan* $\bar{S} = 1.5$. *Andaikan bahawa kedua-dua carta* $\bar{X}$ *dan S menunjukkan keadaan terkawal dan bahawa cirian kualiti bertaburan normal.*

(i) *Anggarkan sisihan piawai proses.*

(ii) *Cari had-had kawalan carta-carta* $\bar{X}$ *dan S.*

(iii) *Jika min proses beranjak kepada 22, apakah kebarangkalian untuk menyimpulkan bahawa proses masih berada dalam keadaan terkawal?*

[30 markah]

(d) *Suatu carta kawalan purata bergerak berpemberat eksponen (EWMA) menggunakan* $\lambda = 0.4$. *Apakah kelebaran had-had kawalan untuk carta Shewhart, diungkapkan sebagai bilangan kali kelebaran had-had kawalan carta EWMA keadaan stabil?*

[20 markah]

2. (a) The following data are collected from a process manufacturing power supplies. The variable of interest is output voltage, where the sample size is $n = 5$.

Sample number	$\bar{X}$	R	Sample number	$\bar{X}$	R
1	103	4	11	105	4
2	102	5	12	103	2
3	104	2	13	102	3
4	105	11	14	105	4
5	104	4	15	104	5
6	106	3	16	105	3
7	102	7	17	106	5
8	105	2	18	102	2
9	106	4	19	105	4
10	104	3	20	103	2

(i) Compute center lines and control limits for $\bar{X} - R$ charts suitable for monitoring future production. Assume that assignable causes can be found for all out-of-control points.

(ii) Assume that the quality characteristic is normally distributed. Estimate the process standard deviation.

(iii) Compute the three-sigma natural tolerance limits of the process.

(iv) Estimate the process fraction nonconforming if the specifications on the characteristic are 103 ± 4.

[50 marks]

(b) A process is being controlled with a fraction nonconforming control chart. The process average is 0.07. Three-sigma control limits are used and the procedure calls for taking daily samples of 400 items.

(i) Calculate the upper and lower control limits.

(ii) If the process average shifts to 0.10, what is the probability that the shift would be detected on the first subsequent sample?
(Hint : Use the normal approximation to the binomial)

(iii) What is the probability that the shift in part (ii) would be detected on the first or second sample taken after the shift?

[50 marks]

2. (a) *Data berikut dikutip daripada suatu proses yang mengeluarkan bekalan kuasa. Pembolehubah yang diminati ialah voltan'output, yang mana saiz sampel ialah n = 5.*

Nombor Sampel	$\bar{X}$	*R*	*Nombor Sampel*	$\bar{X}$	*R*
1	*103*	*4*	*11*	*105*	*4*
2	*102*	*5*	*12*	*103*	*2*
3	*104*	*2*	*13*	*102*	*3*
4	*105*	*11*	*14*	*105*	*4*
5	*104*	*4*	*15*	*104*	*5*
6	*106*	*3*	*16*	*105*	*3*
7	*102*	*7*	*17*	*106*	*5*
8	*105*	*2*	*18*	*102*	*2*
9	*106*	*4*	*19*	*105*	*4*
10	*104*	*3*	*20*	*103*	*2*

(i) *Kira garis-garis tengah dan had-had kawalan yang sesuai bagi carta-carta $\bar{X} - R$ untuk memantau pengeluaran masa depan. Andaikan bahawa sebab-sebab terumpukkan boleh dicari untuk semua titik di luar kawalan.*

(ii) *Andaikan bahawa cirian kualiti bertaburan normal. Anggarkan sisihan piawai proses.*

(iii) *Kira had-had toleransi semulajadi tiga-sigma untuk proses.*

(iv) *Anggarkan pecahan ketidakpatuhan proses jika spesifikasi cirian ialah 103 ± 4.*

[50 markah]

(b) *Suatu proses dikawal dengan carta kawalan untuk pecahan ketidakpatuhan. Purata proses ialah 0.07. Had-had kawalan tiga-sigma digunakan dan prosedur memerlukan pengambilan sampel harian sebanyak 400 benda.*

(i) *Kira had-had kawalan atas dan bawah.*

(ii) *Jika purata proses beranjak kepada 0.10, apakah kebarangkalian bahawa anjakan ini akan dikesan pada sampel pertama yang berikutnya? (Petua : Gunakan penghampiran normal kepada binomial)*

(iii) *Apakah kebarangkalian bahawa anjakan dalam bahagian (ii) akan dikesan pada sampel pertama atau kedua yang diambil selepas anjakan?*

[50 markah]

3. (a) Consider the following two processes, where the sample size is $n = 5$.

Process A	Process B
$\overline{\overline{X}}_A = 100$	$\overline{\overline{X}}_B = 105$
$\overline{S}_A = 3$	$\overline{S}_B = 1$

Specifications are set at 100 ± 10.

(i) Calculate C_p and C_{pk} for process A and process B.

(ii) Based on the C_p values of process A and process B, which process is more capable? Explain.

(iii) Are process A and process B off-center? Explain.

[50 marks]

(b) Explain the following sampling plans:

(i) Single sampling plan.

(ii) Double sampling plan.

[30 marks]

(c) A vendor ships a component in lots of size $N = 3000$ each. The average quality level (AQL) has been established for this product at 1%. Find the normal, tightened and reduced single sampling plans for this situation from MIL–STD 105E, assuming that the general inspection level II is appropriate.

[20 marks]

3. (a) *Pertimbangkan dua proses berikut, yang mana saiz sampel ialah n = 5.*

Proses A	*Proses B*
$\overline{\overline{X}}_A = 100$	$\overline{\overline{X}}_B = 105$
$\overline{S}_A = 3$	$\overline{S}_B = 1$

Spesifikasi ditetapkan pada 100 ± 10.

(i) *Kira C_p dan C_{pk} untuk proses A dan proses B.*

(ii) *Berdasarkan nilai-nilai C_p proses A dan proses B, proses manakah yang lebih berupaya? Jelaskan.*

(iii) *Adakah proses A dan proses B luar-pusat? Jelaskan.*

[50 markah]

(b) *Jelaskan pelan-pelan pensampelan berikut:*

(i) *Pelan pensampelan tunggal.*

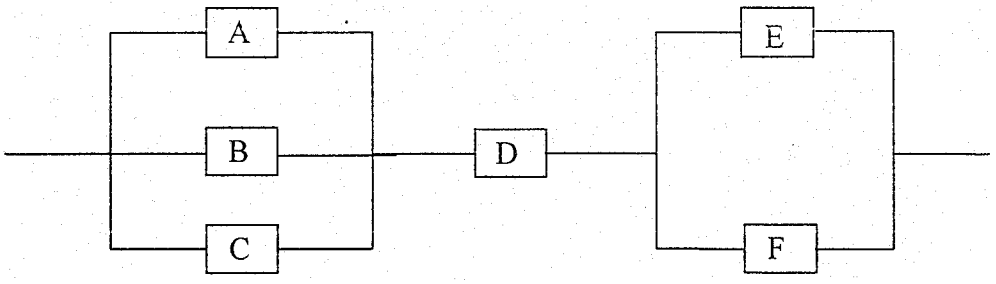
(ii) *Pelan pensampelan berganda dua.*

[30 markah]

(c) *Seorang penjual menghantar suatu komponen dalam lot-lot bersaiz N = 3000 setiap satu. Aras kualiti purata (AQL) sudah ditetapkan bagi produk ini pada 1%. Cari pelan-pelan pensampelan tunggal normal, ketat dan longgar untuk situasi ini daripada MIL–STD 105E dengan andaian bahawa tahap II inspeksi am adalah sesuai.*

[20 markah]

4. (a) Find the reliability of the below system, where components A, B, C, D, E and F have reliabilities 0.900, 0.956, 0.982, 0.995, 0.980 and 0.950, respectively.



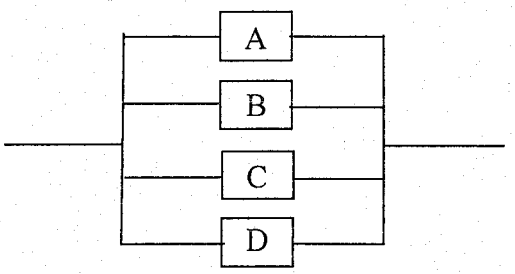
[20 marks]

(b) For the system in the below diagram, assume that all the components have an identical exponential time to fail distribution. Suppose that the time to fail for each of the components is independent of one another. The failure rate for each component is 0.0002/hour which is a constant. Find the

(i) system reliability for 1500 hours.

(ii) mean time to fail (MTTF) of the system.

(iii) mean time to fail (MTTF) of each component.

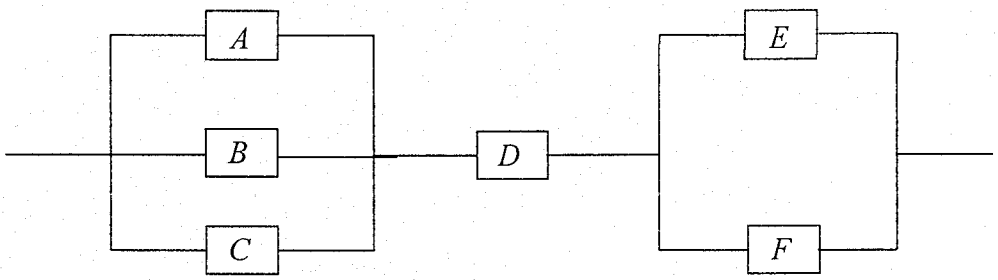


[30 marks]

(c) Explain the quality function deployment (QFD) matrix by drawing a QFD matrix diagram.

[50 marks]

4. *(a) Cari reliabiliti sistem di bawah, yang mana komponen-komponen A, B, C, D, E dan F, masing-masing mempunyai reliabiliti 0.900, 0.956, 0.982, 0.995, 0.980 dan 0.950.*



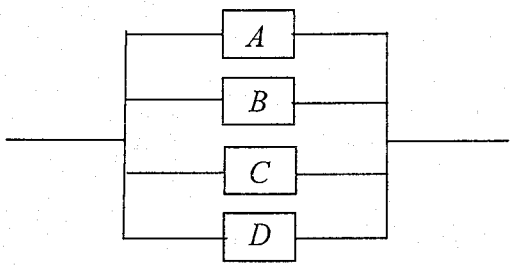
[20 markah]

(b) Untuk sistem dalam gambarajah di bawah, andaikan bahawa semua komponen mempunyai masa untuk gagal yang bertaburan eksponen secara secaman. Anggap bahawa masa untuk gagal bagi setiap komponen adalah tak bersandar antara satu sama lain. Kadar kegagalan bagi setiap komponen ialah 0.0002/jam dan adalah malar. Cari

(i) reliabiliti sistem bagi 1500 jam.

(ii) min masa untuk gagal (MTTF) bagi sistem.

(iii) min masa untuk gagal (MTTF) bagi setiap komponen.



[30 markah]

(c) Jelaskan matriks penempatan fungsi kualiti (QFD) dengan melukis gambarajah matriks QFD.

[50 markah]

Factors for Constructing Variables Control Charts

Observations in Sample, n	Chart for Averages: Factors for Control Limits A	A_2	A_3	Chart for Standard Deviations: Factors for Center Line c_4	$1/c_4$	Factors for Control Limits B_3	B_4	B_5	B_6	Chart for Ranges: Factors for Center Line d_2	$1/d_2$	d_3	Factors for Control Limits D_1	D_2	D_3	D_4
2	2.121	1.880	2.659	0.7979	1.2533	0	3.267	0	2.606	1.128	0.8865	0.853	0	3.686	0	3.267
3	1.732	1.023	1.954	0.8862	1.1284	0	2.568	0	2.276	1.693	0.5907	0.888	0	4.358	0	2.574
4	1.500	0.729	1.628	0.9213	1.0854	0	2.266	0	2.088	2.059	0.4857	0.880	0	4.698	0	2.282
5	1.342	0.577	1.427	0.9400	1.0638	0	2.089	0	1.964	2.326	0.4299	0.864	0	4.918	0	2.114
6	1.225	0.483	1.287	0.9515	1.0510	0.030	1.970	0.029	1.874	2.534	0.3946	0.848	0	5.078	0	2.004
7	1.134	0.419	1.182	0.9594	1.0423	0.118	1.882	0.113	1.806	2.704	0.3698	0.833	0.204	5.204	0.076	1.924
8	1.061	0.373	1.099	0.9650	1.0363	0.185	1.815	0.179	1.751	2.847	0.3512	0.820	0.388	5.306	0.136	1.864
9	1.000	0.337	1.032	0.9693	1.0317	0.239	1.761	0.232	1.707	2.970	0.3367	0.808	0.547	5.393	0.184	1.816
10	0.949	0.308	0.975	0.9727	1.0281	0.284	1.716	0.276	1.669	3.078	0.3249	0.797	0.687	5.469	0.223	1.777
11	0.905	0.285	0.927	0.9754	1.0252	0.321	1.679	0.313	1.637	3.173	0.3152	0.787	0.811	5.535	0.256	1.744
12	0.866	0.266	0.886	0.9776	1.0229	0.354	1.646	0.346	1.610	3.258	0.3069	0.778	0.922	5.594	0.283	1.717
13	0.832	0.249	0.850	0.9794	1.0210	0.382	1.618	0.374	1.585	3.336	0.2998	0.770	1.025	5.647	0.307	1.693
14	0.802	0.235	0.817	0.9810	1.0194	0.406	1.594	0.399	1.563	3.407	0.2935	0.763	1.118	5.696	0.328	1.672
15	0.775	0.223	0.789	0.9823	1.0180	0.428	1.572	0.421	1.544	3.472	0.2880	0.756	1.203	5.741	0.347	1.653
16	0.750	0.212	0.763	0.9835	1.0168	0.448	1.552	0.440	1.526	3.532	0.2831	0.750	1.282	5.782	0.363	1.637
17	0.728	0.203	0.739	0.9845	1.0157	0.466	1.534	0.458	1.511	3.588	0.2787	0.744	1.356	5.820	0.378	1.622
18	0.707	0.194	0.718	0.9854	1.0148	0.482	1.518	0.475	1.496	3.640	0.2747	0.739	1.424	5.856	0.391	1.608
19	0.688	0.187	0.698	0.9862	1.0140	0.497	1.503	0.490	1.483	3.689	0.2711	0.734	1.487	5.891	0.403	1.597
20	0.671	0.180	0.680	0.9869	1.0133	0.510	1.490	0.504	1.470	3.735	0.2677	0.729	1.549	5.921	0.415	1.585
21	0.655	0.173	0.663	0.9876	1.0126	0.523	1.477	0.516	1.459	3.778	0.2647	0.724	1.605	5.951	0.425	1.575
22	0.640	0.167	0.647	0.9882	1.0119	0.534	1.466	0.528	1.448	3.819	0.2618	0.720	1.659	5.979	0.434	1.566
23	0.626	0.162	0.633	0.9887	1.0114	0.545	1.455	0.539	1.438	3.858	0.2592	0.716	1.710	6.006	0.443	1.557
24	0.612	0.157	0.619	0.9892	1.0109	0.555	1.445	0.549	1.429	3.895	0.2567	0.712	1.759	6.031	0.451	1.548
25	0.600	0.153	0.606	0.9896	1.0105	0.565	1.435	0.559	1.420	3.931	0.2544	0.708	1.806	6.056	0.459	1.541

For $n > 25$.

$$A = \frac{3}{\sqrt{n}} \qquad A_3 = \frac{3}{c_4\sqrt{n}} \qquad c_4 \cong \frac{4(n-1)}{4n-3}$$

$$B_3 = 1 - \frac{3}{c_4\sqrt{2(n-1)}} \qquad B_4 = 1 + \frac{3}{c_4\sqrt{2(n-1)}}$$

$$B_5 = c_4 - \frac{3}{\sqrt{2(n-1)}} \qquad B_6 = c_4 + \frac{3}{\sqrt{2(n-1)}}$$

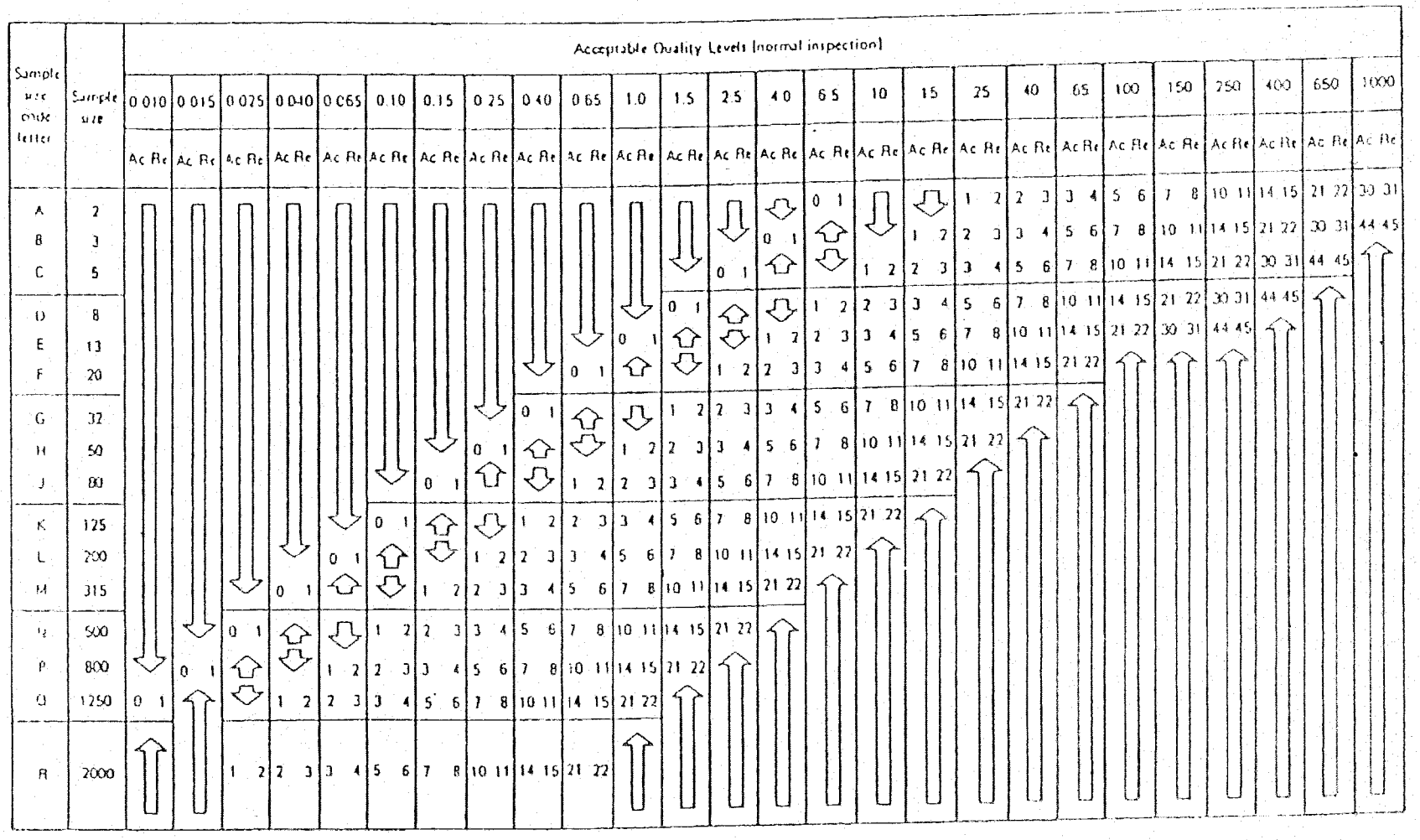
Table 6-5 Sample Size Code Letters (Table I of MIL-STD 105E)

Lot or batch size			Special inspection levels				General inspection levels		
			S-1	S-2	S-3	S-4	I	II	III
2	to	8	A	A	A	A	A	A	B
9	to	15	A	A	A	A	A	B	C
16	to	25	A	A	B	B	B	C	D
26	to	50	A	B	B	C	C	D	E
51	to	90	B	B	C	C	C	E	F
91	to	150	B	B	C	D	D	F	G
151	to	280	B	C	D	E	E	G	H
281	to	500	B	C	D	E	F	H	J
501	to	1200	C	C	E	F	G	J	K
1201	to	3200	C	D	E	G	H	K	L
3201	to	10000	C	D	F	G	J	L	M
10001	to	35000	C	D	F	H	K	M	N
35001	to	150000	D	E	G	J	L	N	P
150001	to	500000	D	E	G	J	M	P	Q
500001	and	over	D	E	H	K	N	Q	R

Note.

Small sample inspection levels of MIL-STD-105C	Convert to these sparse inspection levels
L-1 and L-2	S-1
L-3 and L-4	S-2
L-5 and L-6	S-3
L-7 and L-8	S-4

Table 6-6 Single Sampling Plans for Normal Inspection (Table II-A of MIL-STD 105D)*



Sample size code letter	Sample size	Acceptable Quality Levels (normal inspection)																								
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	3	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45
C	5	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	⇩
D	8	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	⇩	⇩
E	13	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	⇩	⇩	⇩
F	20	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇩	⇩	⇩	⇩	⇩
G	32	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇩	⇩	⇩	⇩	⇩	⇩	⇩
H	50	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
J	80	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
K	125	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
L	200	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
M	315	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
N	500	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
P	800	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
Q	1250	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
R	2000	⇧	⇧	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧

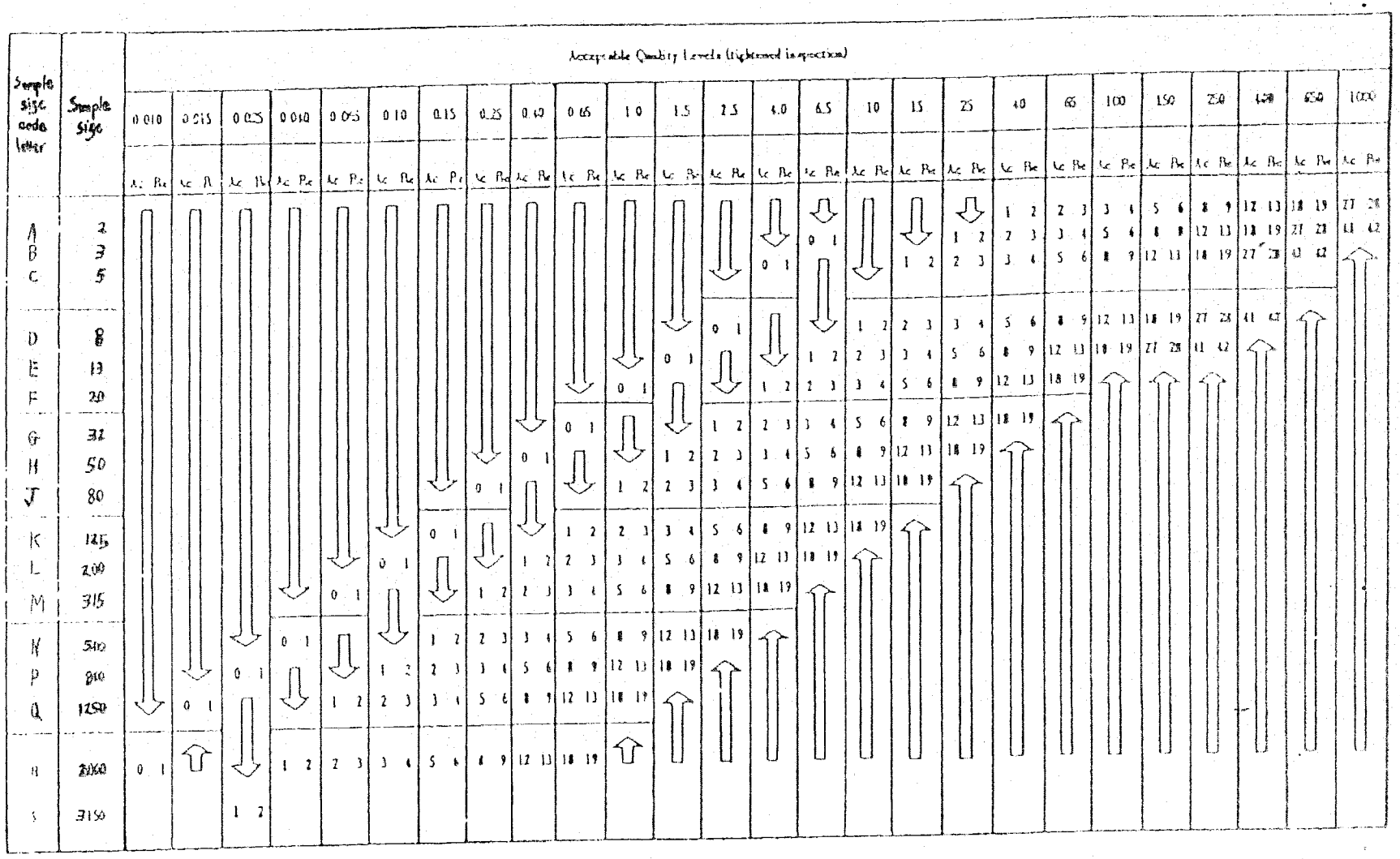
⇩ = Use first sampling plan below arrow. If sample size equals, or exceeds, lot or batch size, do 100 percent inspection.

⇧ = Use first sampling plan above arrow.

Ac = Acceptance number.

Re = Rejection number.

Table 6-7 Single Sampling Plans for Tightened Inspection (Table II-B of MIL-STD 105E)[a]



⇩ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.

⇧ = Use first sampling plan above arrow.

Ac = Acceptance number.

Re = Rejection number.

Table 6-8 Single Sampling Plans for Reduced Inspection (Table II-C of MIL-STD 105E)*

Sample size code letter	Sample size	Acceptable Quality Levels (reduced inspection)† 0.010 Ac Re	0.015 Ac Re	0.025 Ac Re	0.040 Ac Re	0.065 Ac Re	0.10 Ac Re	0.15 Ac Re	0.25 Ac Re	0.40 Ac Re	0.65 Ac Re	1.0 Ac Re	1.5 Ac Re	2.5 Ac Re	4.0 Ac Re	6.5 Ac Re	10 Ac Re	15 Ac Re	25 Ac Re	40 Ac Re	65 Ac Re	100 Ac Re	150 Ac Re	250 Ac Re	400 Ac Re	650 Ac Re	1000 Ac Re
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	2 4	3 5	5 6	7 8	10 11	14 15	21 22	30 31
C	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	21 24	↑
D	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	21 24	↑	↑
E	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	21 24	↑	↑	↑
F	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑
G	13	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑
H	20	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑
J	32	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑
K	50	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	80	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	125	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	200	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	315	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	500	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	800	↑	↑	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

↓ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.
↑ = Use first sampling plan above arrow.
Ac = Acceptance number.
Re = Rejection number.
† = If the acceptance number has been exceeded, but the rejection number has not been reached, accept the lot, but reinstate normal inspection (see 10.1.0).