



UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF CHEMICAL & BIOENGINEERING
TECHNOLOGY

FINAL EXAMINATION
OCTOBER 2025 SEMESTER

COURSE CODE	: CPB 30603
COURSE NAME	: QA & QC IN CHEMICAL ENGINEERING
PROGRAMME NAME	: TECHNICAL FOUNDATION - BACHELOR
DATE	: 3 FEBRUARY 2026
TIME	: 02.00 PM – 05.00 PM
DURATION	: 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
 2. This question paper is printed on both sides of the paper.
 3. This question paper consist of TWO sections.
 4. Answer ALL questions for Section A.
 5. Section B consist of four questions. Answer THREE (3) questions only.
 6. Please write your answer on the answer booklet provided.
 7. Please answer all questions in English only.
 8. Refer to the attached Formula/ Appendies.
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THERE ARE 18 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.**Please use the answer booklet provided.****Question 1**

Process capability ratios (PCRs) are used to evaluate how well a process can produce output within specification limits. The two most common ratios are C_p and C_{pk} , which can be applied to both two-sided and one-sided specifications. C_p measures a process's potential (spread vs. specs) assuming it's centred, while C_{pk} measures actual capability by considering both spread and the process's central location (mean).

- (a) A process is in statistical control with $\bar{\bar{x}} = 802$ and $\bar{R} = 4.0$. The control chart uses a sample size of $n = 5$. Specifications are at 800 ± 10 . The quality characteristic is normally distributed.
- Estimate the potential capability of the process, C_p . (CLO3, C2)
(4 marks)
 - Estimate the actual process capability, C_{pk} . (CLO3, C2)
(4 marks)
 - Based on your answer in a(i) and a(ii), conclude the process capability. (CLO3, C2)
(4 marks)
- (b) The glass containers manufacturing evaluating the bursting strength of the containers. The lower specification limit on bursting strength is 200 psi. The $\bar{x} = 264$ psi and $s = 32$ psi.
- Construct a one-sided process-capability ratio, C_{pl} . (CLO3, C2)
(4 marks)
 - Based on your answer in b(i), conclude the process capability. (CLO3, C2)
(4 marks)

Question 2

In acceptance sampling, the Operating Characteristic (OC) curve describes the probability of accepting a lot as a function of the lot's fraction defective. On the other hand, Military Standard 105E (MIL STD 105E) provides standardised tables to select appropriate values of sample size and acceptance number based on lot size, inspection level, and the Acceptable Quality Level (AQL).

- (a) Suppose that a product is shipped in lots of size $N = 5,000$. The receiving inspection procedure used is single sampling with $n = 50$ and $c = 1$. Table 1 shows a partial of the probability of acceptance with its respective lot fraction defective. (CLO3, C4)

Table 1: Probability of acceptance with its respective lot fraction defective

Fraction defective	Probability of acceptance
0.002	0.995
0.004	0.983
0.006	y_1
0.008	0.939
0.010	0.911
0.020	0.736
0.030	0.555
0.040	y_2
0.050	0.279
0.060	0.190
0.070	0.126
0.080	0.083
0.090	0.053
0.100	0.034
0.120	0.013
0.140	0.005
0.160	0.002
0.180	0.001
0.200	0.000

- i. Determine y_1 and y_2 . (CLO3, C4)
(12 marks)
 - ii. Construct the OC curve. (CLO3, C4)
(4 marks)
- (b) A supplier ships a component in lots of size $N = 3,000$. The AQL has been established for this product at 1%. Determine the normal and tightened single-sampling plans for this situation from MIL STD 105E, assuming that general inspection level II is appropriate. (CLO3, C4)
(4 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE questions ONLY.

Please use the answer booklet provided.

Question 3

A hospital emergency department is monitoring the time required to admit a patient using $\bar{x}$ and R charts. Table 2 presents summary data for 20 subgroups of two patients each (time is in minutes).

Table 2: Hospital Admission Time Data

Subgroup	$\bar{x}_i$	R_i	Subgroup	$\bar{x}_i$	R_i
1	8.3	2	11	8.8	3
2	8.1	3	12	9.1	5
3	7.9	1	13	5.9	3
4	6.3	5	14	9.0	6
5	8.5	3	15	6.4	3
6	7.5	4	16	7.3	3
7	8.0	3	17	5.3	2
8	7.4	2	18	7.6	4
9	6.4	2	19	8.1	3
10	7.5	4	20	8.0	2

- (a) Given $\bar{\bar{x}} = 7.57$ and $\bar{R} = 3.15$, determine the control limits for the $\bar{x}$ and R control charts for this patient admitting process. (CLO1, C3)

(9 marks)

- (b) Based on the answer in (a), construct the $\bar{x}$ and R control charts. (CLO1, C3)

(11 marks)

Question 4

The data in Table 3 represent the number of nonconformities per 1,000 meters in telephone cable.

Table 3: Nonconformities per 1,000 meters in telephone cable

Sample Number	Number of Nonconformities	Sample Number	Number of Nonconformities
1	1.0	12	6.0
2	1.0	13	9.0
3	3.0	14	11.0
4	7.0	15	15.0
5	8.0	16	8.0
6	10.0	17	3.0
7	5.0	18	6.0
8	13.0	19	7.0
9	0.0	20	4.0
10	19.0	21	9.0
11	24.0	22	20.0

- (a) Construct a c-chart to conclude whether the process is in statistical control. (CLO1, C3)
(14 marks)

- (b) Recommend the control procedure for future production. (CLO1, C3)
(6 marks)

Question 5

Bath concentrations are measured hourly in a chemical process. Data (in ppm) for the last 24 hours are shown in Table 4. The process target is $\mu_0 = 175$ ppm and the standard deviation, $\sigma = 25.44$. (CLO2, C3) (Chapter 5)

Table 4: Bath concentrations of a chemical process and some information for tabular CUSUM

Sample	Temperature, x_i	$x_i - (\mu_o + K) + C_{(i-1)}^+$	$(\mu_o - K) - x_i + C_{(i-1)}^-$
1	160.0	-19.2	10.8
2	158.0	-21.2	23.6
3	150.0	-29.2	44.3
4	151.0	-28.2	C_4^-
5	153.0	-26.2	81.9
6	154.0	-25.2	98.7
7	158.0	-21.2	111.4
8	162.0	C_8^+	120.2
9	186.0	6.8	105.0
10	195.0	22.6	80.8
11	179.0	22.3	72.6
12	184.0	27.1	59.3
13	175.0	22.9	C_{13}^-
14	192.0	C_{14}^+	33.9
15	186.0	42.4	18.7
16	197.0	60.2	-7.5
17	190.0	71.0	-19.2
18	189.0	80.8	-18.2
19	185.0	86.6	-14.2
20	182.0	89.3	-11.2
21	181.0	91.1	-10.2
22	180.0	91.9	-9.2
23	183.0	95.7	-12.2
24	186.0	102.5	-15.2

- (a) Calculate C_8^+ , C_{14}^+ , C_4^- and C_{13}^- using standardised values $h = 3.34$ and $k = 0.75$.
(10 marks)
- (b) Set up a tabular CUSUM for this process.
(8 marks)
- (c) Interpret the tabular CUSUM chart in (b).
(2 marks)

Question 6

Table 5 presents data on the cycle time (in hours) to process small loan applications. Some of the EWMA values, including the upper control limit (UCL) and lower control limit (LCL), were presented in the table. (CLO2, C3)

Table 5: Cycle time (in hours) to process small loan applications and some EWMA data

Sample	Cycle Time (hr)	EWMA , z_i	UCL	LCL
1	16.3	17.7	UCL_1	16.318
2	19.1	17.9	20.154	LCL_1
3	22.0	18.8	20.408	15.592
4	10.6	17.1	20.557	15.443
5	19.3	17.6	20.649	15.351
6	17.6	17.6	20.705	15.295
7	16.4	17.3	20.741	15.259
8	19.6	17.8	20.764	15.236
9	16.3	17.5	20.778	15.222
10	18.5	17.7	20.787	15.213
11	14.7	17.1	20.793	15.207
12	18.1	$EWMA_1$	20.797	15.203
13	14.6	16.8	20.799	15.201
14	17.2	16.8	20.801	15.199
15	18.2	17.1	20.802	15.198
16	17.5	17.2	20.802	15.198
17	19.3	17.6	20.803	15.197
18	18.3	17.8	UCL_2	15.197
19	18.0	$EWMA_2$	20.803	15.197
20	19.6	18.2	20.803	LCL_2

- (a) Calculate $EWMA_1$, $EWMA_2$, UCL_1 , UCL_2 , LCL_1 and LCL_2 with $\lambda = 0.2$, $\mu_0 = 18$ hours, $L = 2.9$ and $\sigma = 2.9$.

(12 marks)

- (b) Set up an EWMA control chart.

(6 marks)

(c) Interpret the EWMA chart in (b).

(2 marks)

END OF EXAMINATION PAPER

LIST OF FORMULAE & TABLES

	Centreline	UCL	LCL
$\bar{x}$ and R Charts	$\bar{\bar{x}}$	$\bar{\bar{x}} + (A_2 * \bar{R})$	$\bar{\bar{x}} - (A_2 * \bar{R})$
	$\bar{R}$	$\bar{R} \times D_4$	$\bar{R} \times D_3$
	$\bar{\bar{x}}$	$\bar{\bar{x}} + (A_3 * \bar{S})$	$\bar{\bar{x}} - (A_3 * \bar{S})$
$\bar{x}$ and s Charts	$\bar{S}$	$B_4 \bar{S}$	$B_3 \bar{S}$
	$\bar{x}$	$\bar{\bar{x}} + 3 \frac{\overline{MR}}{d_2}$	$\bar{\bar{x}} - 3 \frac{\overline{MR}}{d_2}$
	$\overline{MR}$	$D_4 \overline{MR}$	$D_3 \overline{MR}$
p chart Note: subgroup's nonconformities rate $= \frac{D_i}{n_i}$	$\bar{p}$	$\bar{p} + 3 \sqrt{\frac{\bar{p}(1-\bar{p})}{n_i}}$ or $\bar{p} + 3 \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$	$\bar{p} - 3 \sqrt{\frac{\bar{p}(1-\bar{p})}{n_i}}$ or $\bar{p} - 3 \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$
np chart	$n\bar{p} = \sum np/k$ $\bar{p}$ = total number of nonconformities/total number of samples = $\frac{\sum np}{\sum n}$	$n\bar{p} + 3\sqrt{n\bar{p}(1-\bar{p})}$	$n\bar{p} - 3\sqrt{n\bar{p}(1-\bar{p})}$
c chart	$\bar{c}$ = total number of defects/number of lots $= \frac{\sum c}{k}$	$\bar{c} + 3\sqrt{\bar{c}}$	$\bar{c} - 3\sqrt{\bar{c}}$
u chart	$\bar{u}$ = total number of defects/number of samples = $\frac{\sum c}{\sum n}$	$\bar{u} + 3 \sqrt{\frac{\bar{u}}{\bar{n}_i}}$	$\bar{u} - 3 \sqrt{\frac{\bar{u}}{\bar{n}_i}}$

	One-sided	Two-sided
C_p or C_{pu} or C_{pl}	$C_{pu} = \frac{USL - \mu}{3\sigma}$ $C_{pl} = \frac{\mu - LSL}{3\sigma}$	$C_p = \frac{USL - LSL}{6\sigma}$
C_{pk}	$C_{pk} = \frac{USL - \mu}{3\sigma}$ $C_{pk} = \frac{\mu - LSL}{3\sigma}$	$C_{pk} = \min \left(\frac{USL - \mu}{3\sigma}, \frac{\mu - LSL}{3\sigma} \right)$

Gauge R&R

$s^2 = \sigma_{Total}^2 = \sigma_P^2 + \sigma_{Gauge}^2$

$\hat{\sigma}_{Gauge} = \frac{\bar{R}}{d_2}$

$\sigma_{Total}^2 = \sigma_P^2 + \sigma_{Gauge}^2$

$\rho_M = \frac{\hat{\sigma}_{Gauge}^2}{\sigma_{Total}^2}$

$\frac{P}{T} = \frac{k\hat{\sigma}_{Gauge}}{USL - LSL}$

Note: k = 5.15 (95% tolerance interval); k = 6 (99% tolerance interval)

Tabular CUSUM

$$C_i^+ = \max [0, x_i - (\mu_0 + K) + C_{i-1}^+]$$

$$C_i^- = \max [0, (\mu_0 - K) - x_i + C_{i-1}^-]$$

$$C_0^+ = C_0^- = 0$$

$$\mu_1 = \mu_0 + \delta\sigma$$

$$K = \frac{\delta}{2}\sigma = \left\lfloor \frac{\mu_1 - \mu_0}{2} \right\rfloor; \delta = 1\sigma; K = k\sigma$$

$$H = 5\sigma; H = h\sigma$$

$$\hat{\mu} = \begin{cases} \mu_0 + K + \frac{C_i^+}{N^+}, & \text{if } C_i^+ > H \\ \mu_0 - K - \frac{C_i^-}{N^-}, & \text{if } C_i^- > -H \end{cases}$$

EWMA

$$z_i = \lambda x_i + (1 - \lambda)z_{i-1}$$

$$z_0 = \mu_0$$

$$UCL: \mu_0 + L\sigma \sqrt{\left(\frac{\lambda}{2 - \lambda}\right) [1 - (1 - \lambda)^{2i}]}$$

$$LCL: \mu_0 - L\sigma \sqrt{\left(\frac{\lambda}{2 - \lambda}\right) [1 - (1 - \lambda)^{2i}]}$$

Standardised CUSUM

$$C_i^+ = \max [0, y_i - k + C_{i-1}^+]$$

$$C_i^- = \max [0, -k - y_i + C_{i-1}^-]$$

$$y_i = \frac{x_i - \mu_0}{\sigma}$$

$$C_0^+ = C_0^- = 0$$

$$K = k\sigma$$

$$H = h\sigma$$

$$\hat{\mu} = \begin{cases} \hat{\mu}_c = \mu + \sigma k + \frac{\sigma C_i^+}{N^+} > h \\ \hat{\mu}_c = \mu - \sigma k - \frac{\sigma C_i^-}{N^-} > -h \end{cases}$$

Single Sampling for Attributes (OC Curve)

$$P_a = P\{d \leq c\} = \sum_{d=0}^c \frac{n!}{d!(n-d)!} p^d (1-p)^{n-d}$$

Factors for Constructing Variables Control Charts

Observations in Sample, n	Chart for Averages					Chart for Standard Deviations						Chart for Ranges				
	Factors for Control Limits			Factors for Center Line		Factors for Control Limits			Factors for Center Line			Factors for Control Limits				
	A	A_2	A_3	c_4	$1/c_4$	B_3	B_4	B_5	B_6	d_2	$1/d_2$	d_3	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

Sample Size Code Letters (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 1,200	C	C	E	F	G	J	K
1,201 to 3,200	C	D	E	G	H	K	L
3,201 to 10,000	C	D	F	G	J	L	M
10,001 to 35,000	C	D	F	H	K	M	N
35,001 to 150,000	D	E	G	J	L	N	P
150,001 to 500,000	D	E	G	J	M	P	Q
500,001 and over	D	E	H	K	N	Q	R

Master Table for Normal Inspection for Single Sampling (U.S. Dept. of Defense MIL STD 105E, Table II-A)

Sample Size Code Letter		Acceptable Quality Levels (normal inspection)																								
		0.010	0.015	0.025	0.040	0.065	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000				
A	2	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			
B	3	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			
C	5	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			
D	8	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			
E	13	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			
F	20	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			
G	32	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			
H	50	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			
J	80	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			
K	125	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			
L	200	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			
M	315	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			
N	500	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			
P	800	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			
Q	1250	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			
R	2000	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			

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

Use first sampling plan above arrow.

Ac = Acceptance number.

Re = Rejection number.

Master Table for Tightened Inspection for Single Sampling (U.S. Dept. of Defense MIL STD 105E, Table II-B)

Sample Code Letter	Sample Size	Acceptable Quality Levels (tightened 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
A	2																												
B	3																												
C	5																												
D	8																												
E	13																												
F	20																												
G	32																												
H	50																												
J	80																												
K	125																												
L	200																												
M	315																												
N	500																												
P	800																												
Q	1250																												
R	2000																												
S	3150																												

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

↘ = Use first sampling plan above arrow.

Ac = Acceptance number.

Re = Rejection number.

Master Table for Reduced Inspection for Single Sampling (U.S. Dept. of Defense MIL STD 105E, Table II-C)

Sample Size Code Letter	Sample Size	Acceptable Quality Levels (reduced inspection)*																				
		0.010	0.015	0.025	0.040	0.065	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A	2	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
B	2	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
C	2	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
D	3	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
E	5	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
F	8	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
G	13	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
H	20	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
J	32	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
K	50	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
L	80	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
M	125	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
N	200	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
P	315	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
Q	500	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
R	800	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

→ = Use first sampling plan below arrow. If sample size equals, or exceeds, lot or batch size, do 100% 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.

