ANSI / ASQ Z1.4-2003 (R2018): Sampling Procedures and Tables for Inspection by Attributes

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What is the ANSI/ASQ Z1.4 Sampling Standard?

- It is an acceptance sampling system used to inspect incoming, in-process, and final products to determine compliance with established acceptance criteria through the selection of random samples of items.

- It is an acceptance sampling system used with switching rules on a continuing stream of lots (car sets or products) for a specific pre-determined Acceptable Quality Limit (AQL).

- It provides tightened, normal, and reduced plans to be applied depending upon actual product quality performance, more specifically percent nonconforming or nonconformities per 100 units.

It Allows an Organization to

- Determine the quality of parts and products by evaluating only a percentage of the overall quantity available.

- Use the results of the assessment to establish a transition to a reduced or tightened inspection based upon actual quality performance.

- Use the results of the assessment to reach conclusions regarding the quality of the overall batch predictive maintenance opportunities.

Origin

- MIL-STD-105E was a United States defense standard that provided procedures and tables for sampling by attributes (pass or fail characteristics) based on Walter A. Shewhart, Harry Romig, and Harold F. Dodge sampling inspection theories and mathematical formulas.

- Although widely adopted outside of military procurement applications, MIL-STD-105 was cancelled in 1995, ANSI/ASQ Z1.4 was recommended as its replacement and is nearly identical to the MIL-STD-105E Standard.

Application

- Used when inspection can be defined as an inspection where a "good or bad"; "accepted or rejected"; "conforming or nonconforming" outcome is determined, such as in the inspection of:
    - End items or completed rail cars, rail car components and raw materials.
    - Items In-process or in storage.
    - Operations, quality, or maintenance processes.
    - Data, records, or forms of objective evidence.

- Sampling plans can be used for the inspection of both a continuous and an isolated series or of lots or batches.

The Benefits of Using Statistical-Based Sampling

- Lower Sampling Cost

- Less Time Consuming

- Higher Accuracy of Data

- Higher Scope of Sampling

- Intensive and Exhaustive Data

- Suitable in Case of Limited Resources

Percent Nonconforming and Nonconformities per 100 Units

- The percent nonconforming of any given quantity of units of product is one hundred times the number of nonconforming units divided by the total number of items inspected, i.e.:

$$\text{Percent Nonconforming} = \frac{\text{Number of Nonconforming}}{\text{Number of Items Inspected}} \times 100$$

The Process

1. Prior to the Sampling Inspection Activity Determine:

    a) Inspection Level and Sample Size Code Letter.

    b) Acceptable Quality Level (AQL).

    c) Continuation of Inspection Stating Point (Switching Rules).

    d) Sample Size, and Accept and Reject Criteria.

2. Draw Samples and Initiate Inspection

    a) Samples are to be Drawn on a Random Basis.

    b) Conduct Inspections on Lots or Batches.

    c) Determine Acceptability of Lot(s).

    d) Conduct Inspections on successive lots in accordance to established switching rules.

Inspection Level and Code Determination Table

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

Sampling Table

Acceptance Quality Limits, AQLs, in Percent Nonconforming Items and Nonconformities per 100 Items (Normal Inspection)

Each AQL cell shows **Ac Re** (Ac = Acceptance number, Re = Rejection number). Arrows: ↓ = Use the first sampling plan below the arrow; ↑ = Use the first sampling plan above the arrow.

Sample size code letter	Sample size	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
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	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	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	0 1	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

↓ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 percent inspection.
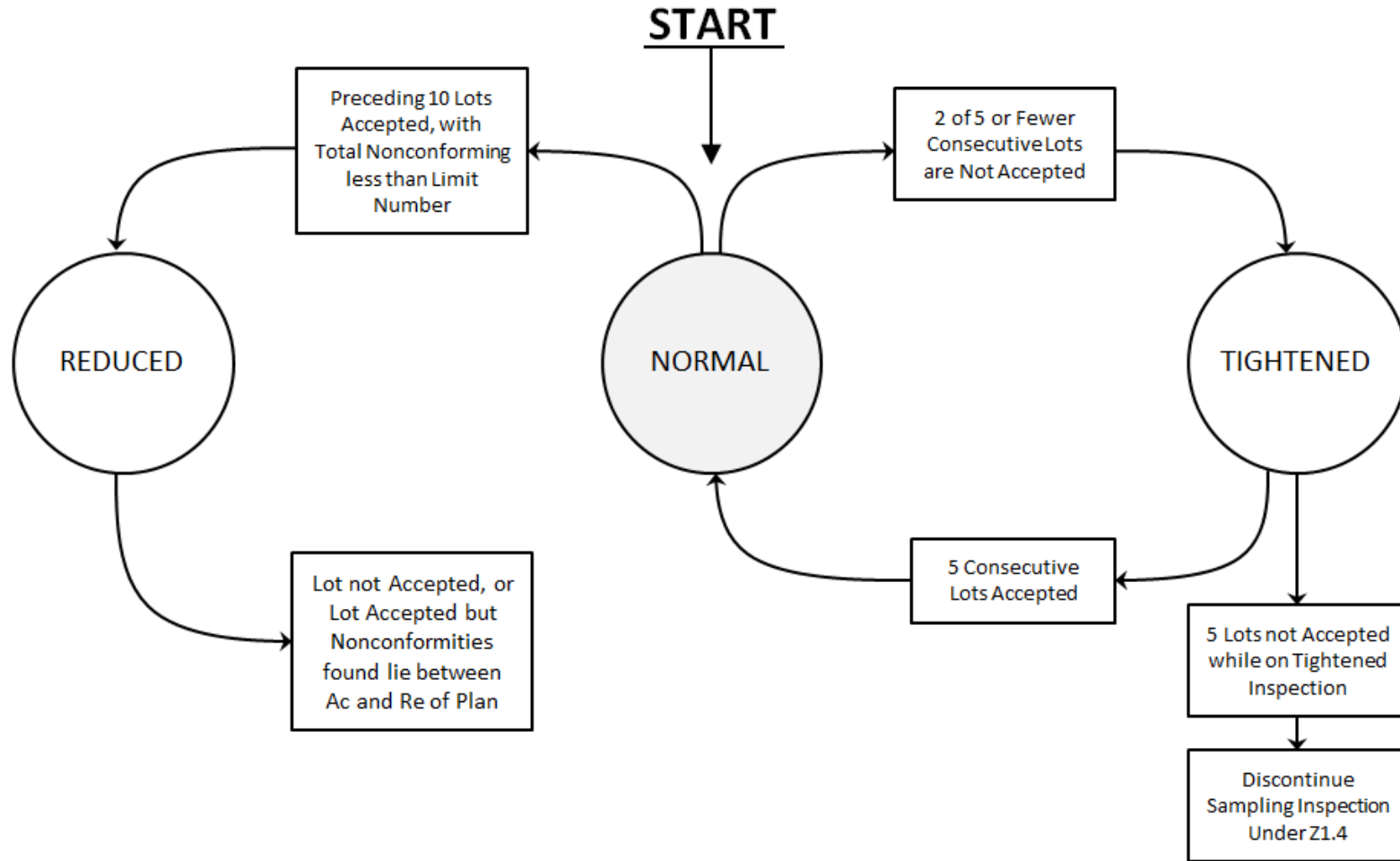
↑ = Use the first sampling plan above the arrow.

Ac = Acceptance number.

Re = Rejection number.

Continuation of Inspection Stating Point or Switching Rules

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Thank you