ANSI/ASQ Z1.4 - 2003 계수형 샘플링 검사
(Sampling Procedures for Inspection By Attributes : ANSI/ASQ Z1.4 - 2003)

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Abstract

ANSI/ASQ Z1.4, Sampling Procedures and Tables for Inspection By Attributes, has recently been published by American Society for Quality is based upon the MIL-STD-105E. This paper discusses the features of the ANSI/ASQ Z1.4 - 2003 and Dodge - Romig Sampling.

Keywords : By Attributes, Z1.4 - 2003, Dodge - Romig

1. Introduction

1.1 Inspection by Attributes [4]

Plan	Type of Sampling	Type of Application	Key Features
MIL-STD-105E ANSI/ASQ Z1.4	Single, double and multiple	Bad lots are generally rejected but may be 100% inspected.	Based on an acceptable level. Minimizes the rejection of good lots. Easy to explain and administer.
Dodge-Romig	Single and double	Rejected lots are 100% inspected and bad product is replaced.	Plans for a LTPD risk or an AOQL. Minimum inspection is required.
Chain sampling	Single and two stage	Useful when inspection involves destructive or costly	Minimizes sample sizes without a large risk of good lot

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		tests.	rejection.
Bayesian plans (discovery sampling)	Generally single	Used when the probability of defective lots can be estimated in advance.	Relatively small sample sizes are required.
Sequential sampling	Unit sampling, binomial	Used to screen lots; rejected lots are 100% inspected	Examines one item at a time, with no lot organization. A minimum ATI
Skip-lot sampling plans	Single	Useful for high quality levels and when inspection is costly	Minimizes inspection with protection against quality deterioration.
H107	Continuous single level	Applicable when production is continuous and inspection is nondestructive.	Plans limit the average quality in the long run.
H106	Continuous multilevel	Same as above.	Plans limit the average quality in the long run.

2. Z1.4 - 2003 [1]

2.1 Application

End Items, Components and Materials, Operations, Material in Process, Supplies in Storage, Data or Records, Administrative Procedures.

2.2 Definition

2.2.1 Nonconformity

A departure of quality characteristic from intend level or state that occurs with severity sufficient to cause an associated product or service not to meet a specification requirement.

2.2.2 Percent Nonconforming(PN)

$$PN = \frac{Number\ of\ nonconforming}{Nmber\ of\ units\ inspected} \times 100$$

2.2.3 Nonconformities Per Hundred Units(NPHU)

$$NPHU = \frac{Nmber\ of\ nonconformities}{Nmber\ of\ units\ inspected} \times 100$$

2.3 Acceptance Quality Limit(AQL)

2.3.1 Definition
The AQL is the quality level that is the worst tolerable process average when a continuing series of lots is submitted for acceptance sampling. The use of the abbreviation AQL to mean Acceptable Quality Level is no longer recommended.

2.3.2 Specifying AQL vs Importance of Characteristics
0.010 ~ 10.0 : PN or NPHU
10.0 ~ 1000 : NPHU

2.4 Sampling Plan vs ASS(Average Sample Size)
Single(First), Double(Second), Multiple(Seventh)

2.5 Inspection Level vs Sample Size(Code Letter)
Special(S-1, S-2, S-3, S-4), General(I , II , III)

2.6 Switching Procedures

2.6.1 Normal to Tightened
When normal inspection is in effect, tightened inspection shall be instituted when 2 out of 5 or fewer consecutive lots or batches have been non-acceptable on orignal inspection(i.e., ignoring resubmitted lots or batches for this procedure).

2.6.2 Tightened to Normal
When tightened inspection is in effect, reduced inspection shall be instituted

providing that all of the following conditions are satisfied.

a. The preceding 10 lots or batches(or more, as indicated by the note to Table VIII) have been accepted on orginal inspection; and

b. The total number of nonconforming units(or nonconformities) in the samples from the preceding 10 lots or batches (or such other number as was used for condition "a" above) is equal to or less than the applicable limit number given in Table VIII(see 2.6.6). If double or multiple sampling is in use, all samples inspected should be included, non "first" samples only; and

c. Production is at a steady rate; and

d. Reduced inspection is considered desirable by the responsible authority.

2.6.4 Reduced to Normal
When reduced inspection is in effect, normal inspection shall be instituted if any of the following occur on original inspection:
a. A lot or batch is rejected; or

b. A lot or batch is considered acceptable under the procedures for reduced inspection; or

c. Production becomes irregular or delayed; or

d. Other conditions warrant that normal inspection shall be instituted.

2.6.5 Discontinuation of Inspection
If the cumulative number of lots not accepted in a sequence of consecutive lots on tightened inspection reaches 5, the acceptance procedures of this standard shall be discontinued. Inspection under the provisions of this standard shall not be resumed until corrective action has been taken. tightened inspection shall then be used as if 2.6.1 had been invoked.

2.6.6 Limit Numbers for Reduced Inspection
When agreed upon by responsible authority for both parties to the inspection, that is, the supplier and the end item customer, the requirements of 2.6.3b may be dropped. This action will have little effect on the operating properties of the

scheme.

2.7 AOQL

$$Factors \times (1 - \frac{Sample\ Size}{Lot\ or\ Batch\ Size}): Table\ V - A$$

2.8 Limiting Quality(LQ)

Isolated Lot

2.9 Matching ANSI/ASQ Z19 – 2003 [2]

ANSI/ASQ Z1.9 – 2003 Sample Size, Normal Inspection, Level II	ANSI/ASQ Z1.9 – 2003 New Code Letter	ANSI/ASQC Z1.9 – 1972 (414) Old Code Letter	ANSI/ASQ Z1.4 – 2003 (105) Matched Code Letter
3	B	B	B
4	C	C	C
5	D	D	D
7	E	E	E
10	F	F	F
15	G	G	G
20	H	H	H
25	I	I	H
35	J	K	J
50	K	M	K
75	L	N	L
100	M	O	M
150	N	P	N
200	P	Q	P

3. Dodge-Romig Sampling Inspection [3]

3.1 Sequence of Steps

Step 1. Decide what characteristics to include.

Step 2. Decide what is to constitute a lot.

Step 3. Choose the type of protection LTPD or AOQL.

Step 4. Choose a suitable value of LTPD or AOQL.

Step 5. Choose between single sampling and double sampling.

Step 6. Select the appropriate sampling table in Appendix 4,5,6, or 7.

Step 7. Obtain an estimate of the PA(process average per cent defective).

Step 8. Choose a sampling plan for the given lot size and estimated PA.

Step 9. Find the OC curve of the sampling plan. If it is satisfactory, adopt the play.

Step 10. Select sample units from the lot by a random procedure.

Step 11. Follow the prescribed procedure - single sampling or double sampling.

Step 12. Keep a running check of the PA. Charge the sampling plan as necessary to match shifts in the PA.

5. Summary

- Acceptance Quality Limit : Percent Nonforming, Nonconformities Per Hundred Units
- AQL vs Importance of Characteristic
- Sampling Plan : vs ASS
- Inspection Level : vs Sample Size
- Switch Procedures : Normal, Tightened, and Reduced Inspection
- AOQL, LQ

References

1. ANSI/ASQ Z1.4-2003, American National Standard, ASQ, Milwaukee,WI,2003.

2. ANSI/ASQ Z1.9-2003, American National Standard, ASQ, Milwaukee,WI,2003.

3. H.F. Dodge, H.G. Romig, Sampling Inspection Tables, 2nd ed., John Wiley & Sons, New York, 1959.

4. B.Wortman, CQE Primer, 7th ed., Quality Council of Indiana, 2005.