

A Comparative Study On Double Inspection Single Sampling Plan With Double Inspection Quick Switching System And Double Inspection Resampling Scheme Through Operating Characteristics Curves

¹Dr.P.Sabarish* and ²Dr.D.Senthilkumar

¹*Assistant Professor, Department of Statistics, PSG College of Arts & Science, Coimbatore- 641014, Tamilnadu, India.*

²*Associate Professor, Department of Statistics, PSG College of Arts & Science, Coimbatore- 641014, Tamilnadu, India.*

Abstract

Several acceptance sampling plans are currently applied in field of statistical quality control, although in recent year's process control techniques and offline quality control methods have taken important roles, acceptance sampling procedures remain as a major tool for many practical quality control systems. This article describes the comparative study of Double Inspection sampling plan with Double Inspection Quick Switching System and Double Inspection Resampling Scheme. The comparison made through Operating Characteristics curves.

Keywords: Statistical Quality Control, Acceptance sampling, DISSP, DIQSS, DIRS and OC curve

Introduction

Acceptance sampling is the foremost concept in statistical quality control, several plans, schemes and systems are federalism in many industries. Cost playing vital role in production, producer chooses some sampling inspection to check the quality of the product. Several sampling plans are active in production Industries, for inspect the samples and analyzing performance of the population. Each plan has some unique structure and methodology, some plans reduce the producer risk, some plans reduce the consumer risk some time favour for both. This study mainly focus Double

Inspection single sampling plan with Double Inspection Quick Switching System and Double Inspection Resampling Scheme. The Operating Characteristic Curves for Acceptance Sampling for Attributes procedure is a companion procedure to the procedure Acceptance Sampling for Attributes. This procedure is used view graphically the probability of lot acceptance versus the lot proportion defective for a given sample size and acceptance number. Plots with multiple curves for multiple sample sizes or multiple acceptance numbers may be generated using this procedure Double Inspection sampling plans are established only when needed. Focus on the bivariate situation where exactly two tests are performed on each unit. The two quality criteria are called X (number of errors in the first test) and Y (number of errors in the second test). Kawamura (1973) developed the structure of the bivariate Poisson distribution. X and Y are acquired for each unit, so the data for one observation is a pair (X, Y) and is independent. The two joint random variables X and Y are probabilistically independent only if their joint function is the product of the marginal distribution functions.

$$F(X, Y)_{xy} = F(X)_x \cdot F(Y)_y$$

Senthilkumar and Sabarish (2020) have developed the Construction and Selection of Double Inspection Single Sampling Plan [DISSP (0,1)]. Senthilkumar and Sabarish (2021) have developed Selection and Development of Double Inspection Single Sampling Plan. Senthilkumar and Sabarish (2021) have developed Economic Design of Double Inspection Single Sampling Plan. Senthilkumar and Sabarish (2022) have developed Design of Double Inspection Quick Switching System [DIQSS (0,1)] Senthilkumar and Sabarish, (2022) have developed “Construction and Selection of Double Inspection Single Sampling Plan for an Independent Process using Bivariate Poisson Distribution.

OC Function of Double Inspection Sampling Plan

$$Pa(p) = Pa1(p) \cdot Pa2(p)$$

PROBLEM PROCEDURAL STATEMENT

- During the production process, due to various reasons defectives may occur.
- Both Inspections are independent
- Passing rule is not allowed during the inspection
- Go on with the inspection process till it rejects the lot (or) accept the lot

Double Inspection Sampling Plan

First Inspection

Step 1: Draw a random sample of size ‘n’ units from the lot and test each unit for conformance to the specified attribute requirements.

Step 2: Count the number of defectives in the first inspection 'd₁' then go to next step.

Step 3: If $d_1 \leq c_1$ go to second inspection for the same sample of size 'n' otherwise ($d_1 > c_1$) reject the lot.

Second Inspection

Step 4: Count the number of defectives in second inspection for the same sample, d₂ then go to next step.

Step 5: If $d_1 \leq c_1$ and $d_2 \leq c_2$ accept the lot otherwise ($d_1 > c_1$ and (or) $d_2 > c_2$) reject the lot.

Double Inspection Quick Switching System

First Inspection

Step 1: In first inspection, find the number of defectives d₁₁ at the normal level, if $d_{11} \leq c_N$ move to second inspection otherwise shift to tightened level.

Step 2: Count the number of defectives 'd₁₂' at the tightened level, if $d_{12} \leq c_T$ move to second inspection, otherwise reject the lot.

After the conditions in first inspection is satisfied, move to second inspection for the same sample, to test the second quality characteristic of the same product using quick switching methodology.

Second Inspection

Step 3: In Second inspection find the number of defectives d₂₁ at the normal level, if $d_{21} \leq c_N$ accept the lot otherwise shift to tightened level.

Step 4: Count the number of defectives 'd₂₂' at the tightened level, if $d_{22} \leq c_T$ accept the lot otherwise reject the lot.

OC Function of Double Inspection Quick Switching System

$$Pa(p) = \left[Pa1(p) = \frac{P_T}{P_T + (1 - P_N)} \right] \left[Pa2(p) = \frac{P_T}{P_T + (1 - P_N)} \right]$$

Double Inspection Resampling Scheme

First Inspection

Step 1: Select a random sample of size 'n' units from the lot and test each unit for conformance to the specified attribute requirements.

Step 2: Count the Number of defectives in the first inspection ' d_1 ' then move to next step.

Step 3: If $d_1 \leq c_1$ Pass the same sample for the second inspection for the same sample of size ' n ' otherwise ($d_1 > c_1$) reject the lot in the original inspection, apply the reference plan ' m ' times and reject the lot if it is not accepted on $(m-1)^{st}$ resubmission.

Second Inspection

Step 4: Count the number of defectives in second inspection for the same sample, d_2 then move to next step.

Step 5: If $d_2 \leq c_2$ accept the lot otherwise ($d_2 > c_2$) reject the lot in the original inspection, apply the reference plan ' m ' times and reject the lot if it is not accepted on $(m-1)^{st}$ resubmission.

Operating Characteristic Function

$$P_a(p) = P_a(2 - P_a)$$

$$P_a(p) = P_{a1}(p) * P_{a2}(p)$$

Table 1

p	DISSP	DIQSS	DIRS
0.01	0.9962488	0.9992088	0.999988568
0.02	0.9587468	0.9671745	0.998799728
0.03	0.8588427	0.7873452	0.986872703
0.04	0.7040678	0.4329030	0.942295677
0.05	0.5276644	0.1651515	0.84567402
0.06	0.3639685	0.0542438	0.699059446
0.07	0.2332196	0.0173115	0.527719686
0.08	0.1401296	0.0055648	0.364218093
0.09	0.0796238	0.0018169	0.231420326
0.1	0.0431016	0.0006032	0.136657266

Illustration and Description of Tables

In the digital world usage of the wireless devices increases day by day. In this study two inspectors checking two different quality characteristics of smart glass with normal and tightened level, c_1 = checking the quality of the display and c_2 = checking the performance of the Bluetooth connector, both the quality characteristics are independent in their performance. Table 1 provides the values probability of acceptance for Double Inspection Single Sampling Plan $n=60$, $c_1= 3$ & $c_2= 4$, Double Inspection Quick Switching System $n=60$, $c_T= 3$ & $c_N= 4$ and Double Inspection Resampling Scheme $n=60$, $c_1= 3$, $c_2= 4$ and $m=2$

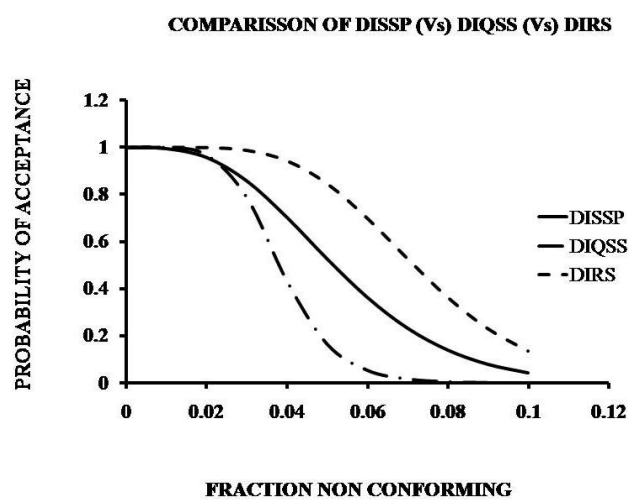


Figure 1

Description of Curves

Figure 1 Shows the Operating Characteristics Curve of Double Inspection Single Sampling Plan, Double Inspection Quick Switching System and Double Inspection Resampling Scheme.

Conclusion

In double inspection we inspect two different and important quality characteristics of the same product, so that the product gets more quality. This finest plan was applicable for Mass and costliest product production industries like foods, smart phones and gold ornament so on where the human intervention is much involved and also it decreases the consumer risk. The study mainly focus comparison of Double Inspection sampling plan with Double Inspection Quick Switching System and Double Inspection Resampling Scheme to find the best combined plan, system and scheme to provide protection to both producer and consumer risks. Form the figure 1 we concluded, compare to these three Operating Characteristics curves clearly explain

Operating Characteristics Curve of Double Inspection Quick Switching System more superior than other two.

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