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Construction and Selection of Six Sigma Quick Switching Sampling System: Sample Size Tightening

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ABSTRACT: Six Sigma at many organizations simply means a measure of quality that strives for near perfection. Six Sigma is a disciplined, data-driven approach and methodology for eliminating defects in any process, from manufacturing to transactional and from product to service. The statistical representation of Six Sigma describes quantitatively how a process is performing. To achieve Six Sigma, a process must not produce more than 3.4 defects per million opportunities. A Six Sigma defect is defined as anything outside of customer specifications. A Six Sigma opportunity is then the total quantity of chances for a defect. In this article, desining of Six Sigma Quick Switching Variables Sampling System [SSQSVSS(n_N,n_T;k)] indexed by Six Sigma Quality Level's is presented. Procedures are indicated and tables are constructed for designing the system indexed by six sigma quality levels, viz., six sigma acceptable quality level (SSAQL) and six sigma limiting quality level (SSLQL).

KEY WORDS: Quick Switching Sampling System, Variables Sampling Plan, OC Function, SSAQL and SSLQL.

I. INTRODUCTION

In quality control, the statistical procedure employed in determining whether to accept or reject a production batch. If the proportion of the units having a certain negative characteristic exceeds the acceptable limit for a given batch, it is rejected. Two types of acceptance sampling are (1) attributes sampling, in which the presence or absence of a characteristic in the inspected item is only taken note of, and (2) variable sampling, in which the presence or absence of a characteristic in the inspected item is measured on a predetermined scale.

Dodge (1967) proposed a sampling system called a 'quick switching system' (QSS), consisting of pairs of normal and tightened plans. The implication of the system is as follows:
(1) Adopt a pair of sampling plans--a normal plan (N) and a tightened plan (T). (2) Use plan N for the first lot (optional, but can start with plan T). (3) For each lot inspected, if the lot is accepted, then use plan N for the next lot; if the lot is rejected, then use plan T for the next lot.

Romboski (1969) studied the QSS with the single-sampling plan as a reference plan and introduced a system designated as QSS(n, kn; c_0), where (n, c_0) and (kn, c_0), k > 1 are respectively the normal and the tightened single-sampling plans. It is found that this system requires a lower average sample number (ASN) than that of its equivalent single-sampling plan. Also, the system offers an operating characteristic (OC) curve, referred to as a 'composite OC curve', which is more discriminating than the OC curves of corresponding normal and tightened single-sampling plans. Govindaraju (1991), Deveraj Arumainayagam (1991) and Taylor (1996) investigated how to evaluate and select quick switching systems. Soundarajan and Palanivel (1997 & 2000) have investigated on a quick switching variables sampling (QSVS) systems. Radhakrishnan and Sivakumaran (2008) have developed the procedure for the construction of six sigma repetitive group sampling plans of type (n_1, n_2; c)indexed by six sigma quality levels with attributes sampling plan as a reference plan. Senthilkumar and Esha Raffie (2012) have designed the procedure for six sigma quick switching variables sampling system indexed by six sigma quality levels.

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In this article, designing of six sigma quick switching variables sampling system [SSQSVSS(n_T, n_N; k)] indexed by six sigma quality level's is presented. The SSQSVSS (n_T, n_N; k), where (n_N, k) and (n_T, k), $n_T > n_N$ are respectively the normal and tightened single sampling plans. Procedures are indicated and tables are constructed for designing the system indexed by six sigma acceptable quality level (SSAQL) with the producer's risk $\alpha^*=3.4\text{x}10^{-6}$ and six sigma limiting quality level (SSLQL) with the consumer's risk $\beta^* \geq m\alpha^*$, where m=2.

II. SIX SIGMA QUICK SWITCHING VARIABLES SAMPLING SYSTEM OF TYPE SSQSVSS (n_T, n_N; k)

The conditions and the assumptions under which the SSQSVSS scheme can be applied are as follows:

Conditions for applications

- The production is steady, so that results on current and preceding lots are broadly indicative of a continuous process.
- Lots are submitted substantially in the order of production.
- Inspection is by variables, with the quality being defined as the fraction of non- conforming.
- The sample units are selected from a large lot and production is continuous.
- The production process should be depends on automation and man handling the process is very limited.

Basic Assumptions

- The quality characteristic is represented by a random variable X measurable on a continuous scale.
- Distribution of X is normal with mean and standard deviation.
- An upper limit U, has been specified and a product is qualified as defective when X>U. [when the lower limit L is Specified, the product is a defective one if X<L].
- The Purpose of inspection is to control the fraction defective, p in the lot inspected.

The fraction defective in a lot will be $p= 1-F(v)=F(-v)$ with $v=(U-\mu)/\sigma$ and

$$F(y) = \int_{-\infty}^{y} \frac{1}{\sqrt{2\pi}} e^{-z^2/2}\, dz \qquad (1)$$

Where z ~ N (0,1). Under the σ- method plan, the lot would be accepted if $\overline{X} + k\,\sigma \leq U,$ where U is the upper specification limit or $\overline{X} + k\,\sigma \geq L,$ where L is the lower specification limit.

III. SSQSVSS($n_{T\sigma}$, $n_{N\sigma}$; k_σ) WITH KNOWN σ VARIABLES PLAN AS THE REFERENCE PLAN

The operating procedure of the six sigma quick switching variables sampling system with known σ variables plan is as follows:

Operating Procedure

Step 1: Under normal inspection, draw a sample of size $n_{N\sigma}$ from the lot, inspect and record the measurement of the quality characteristic for each unit of the sample. Compute the sample mean $\overline{X}$. Where $\overline{X}_N = \sum X_i / n_N$

Step2: i) If $\overline{X}_N + k\,\sigma \leq U$ or $\overline{X}_N + k\,\sigma \geq L$ accept the lot and repeat Step 1 for the next lot.

ii) If $\overline{X}_N + k\,\sigma > U$ or $\overline{X}_N + k\,\sigma < L,$ reject the lot go to step 3.

Step 3: Under tightened inspection, draw a sample of size $n_{T\sigma}$ from the next lot inspect and record the measurement of the quality characteristic for each unit of the sample. Compute the sample mean $\overline{X}$. Where $\overline{X}_T = \sum X_i / n_T$

Step 4: i) If $\overline{X}_T + k\,\sigma \leq U$ or $\overline{X}_T + k\,\sigma \geq L$ accept the lot and repeat step 1, for the next lot.

ii) If $\overline{X}_T + k\,\sigma > U$ or $\overline{X}_T + k\,\sigma < L,$ reject the lot and repeat step 3.

Where $n_{N\sigma}$ and $n_{T\sigma}$ are the sample sizes of normal and tightened single sampling variable plans respectively and k is the acceptance constant under σ-method. Where $\overline{X}$ and σ are the average quality characteristic and standard deviation respectively. The six sigma quick switching variables sampling system as defind SSQSVSS(n_T, n_N; k). As the

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tightened plan sample size n_T is greater than the normal plan sample size n_N, for designing the SSQSVS system n_T is fixed as a multiple of n_N i.e. $n_T = m\, n_N$, where m >1.

Operating Characteristic Function

Based on Romboski (1969), the OC function of QSVSS (n_T, n_N; k_σ) can be written as

$$P_a(p)=\frac{P_T}{1-P_T+P_N} \qquad (2)$$

where P_T and P_N are the proportion of lots expected to be accepted using tightened (n_T, k) and normal (n_N, k) variable single sampling plans respectively.

Under the assumption of normal approximation to the non-central t distribution (Abramowitz and Stegun, 1964), the values of P_N and P_T are given by

$$P_N=\phi(w_N)=P[(U-\overline{X})/\sigma \geq k] \qquad (3)$$

$$P_T=\phi(w_T)=P[(U-\overline{X})/\sigma \geq k] \qquad (4)$$

respectively. Equation (3) and (4) are substituted in (2) to find $P_a(p)$ values for given p, n_N, n_T and k.

As the individual values of X follows normal distribution with mean μ and variance σ^2, the expressions given in (3) and (4) can be restated as

$$P_T = \int_{-\infty}^{w_T} \frac{1}{\sqrt{2\pi}} e^{(-z^2/2)}\, dz$$

and

$$P_N = \int_{-\infty}^{w_N} \frac{1}{\sqrt{2\pi}} e^{(-z^2/2)}\, dz$$

respectively, with

$$w_T=\sqrt{n_{T\sigma}}\,(U-k\,\sigma-\mu)/\sigma=(v-k)\sqrt{n_{T\sigma}}$$

$$w_N=\sqrt{n_{N\sigma}}\,(U-k\,\sigma-\mu)/\sigma=(v-k)\sqrt{n_{N\sigma}}$$

and $\quad v=(U-\mu)/\sigma$

For given p_1, p_2, α and β the values of $n_{T\sigma}$ and $n_{N\sigma}$ and k can be determined and should satisfy the following the equations.

$$P_a(p_1)=\frac{P_{T_1}}{1-P_{T_1}+P_{N_1}}=1-\alpha \qquad (5)$$

$$P_a(p_2)=\frac{P_{T_2}}{1-P_{T_2}+P_{N_2}}=\beta \qquad (6)$$

where $P_{T_1}=\Pr\left[\frac{\overline{X}_T-\overline{X}_{p_1}}{\sigma/\sqrt{n_{T_\sigma}}} \geq (z_{p_1}-k)\sqrt{n_{T_\sigma}}\right]$, $\quad P_{N_1}=\Pr\left[\frac{\overline{X}-\overline{X}_{p_1}}{\sigma/\sqrt{n_{N_\sigma}}} \geq (z_{p_1}-k)\sqrt{n_{N_\sigma}}\right]$,

$P_{T_2}=\Pr\left[\frac{\overline{X}-\overline{X}_{p_2}}{\sigma/\sqrt{n_{T_\sigma}}} \geq (z_{p_2}-k)\sqrt{n_{T_\sigma}}\right]$, and $\quad P_{N_2}=\Pr\left[\frac{\overline{X}-\overline{X}_{p_2}}{\sigma/\sqrt{n_{N_\sigma}}} \geq (z_{p_2}-k)\sqrt{n_{N_\sigma}}\right]$

Designing SSQSVSS($n_{N\sigma}$, $n_{T\sigma}$; k_σ) with known σ for given SSAQL and SSLQL

Example

Table 1 can be used to determine SSQSVSS($n_{T\sigma}$, $n_{N\sigma}$; k_σ) for specified values of SSAQL and SSLQL. For example, if it is desired to have a SSQSVSS($n_{T\sigma}$, $n_{N\sigma}$; k_σ) for given SSAQL = 0.000002 and SSLQL = 0.000007, and m=2, $\alpha^*= 3.4\times10^{-6}$, $\beta^* \geq 2\alpha^*$. Table 1 gives n_N = 6019, and k = 4.428. The sample size $n_{T\sigma} = m\, n_{N\sigma}$ = (2) (6019) = 12038. Thus, for given requirement, the SSQSVSS ($n_{T\sigma}$, $n_{N\sigma}$; k_σ) is specified by the parameters $n_{T\sigma}$ =12038, $n_{N\sigma}$ = 6019, and k = 4.428 as desired system parameters, which is associated with 4.7 sigma level.

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Practical Explanation

For the test, lot-by-lot acceptance inspection of Cylindrical Cell it is proposed to apply the system with n_T=12038, n_N=6019, and k=4.428. The characteristic to be inspected is the Cylindrical Cell with the upper limit (U) diameter of 14.5 mm with a known standard deviation (σ) of 0.006 mm.

Now, take a random sample of size n=6019 and record the diameter of each Cylindrical Cell. Compute the sample mean ($\overline{X}$). If $\overline{X}$ +k σ ≤ U ⇒ $\overline{X}$ +(4.428) (0.006) ≤ 14.5, accept the lot. Otherwise, switch to tightened inspection.

Draw a sample of 12038 from the next lot and record the results. Compute the sample mean ($\overline{X}$) and a known standard deviation (σ) of 0.006. If $\overline{X}$ +k σ ≤ U ⇒ $\overline{X}$ +(4.428) (0.006) ≤ 14.5, accept the lot. Then, switch to normal inspection. Otherwise, continue with tightened inspection process.

IV. SELECTION OF SSQSVSS (n_{TS}, n_{NS}; k_S) UNKNOWN σ FOR GIVEN SSAQL AND SSLQL

If the population standard deviation σ is unknown, then it is estimated from the sample standard deviation S (n-1 as the divisor). If the sample size of the unknown sigma variables system (s method) is n_{Ts}, n_{Ns} and the acceptance constant is k, then the operating procedure is as follows

Step 1: Draw a sample of size n_{Ns} from the lot, inspect and record the measurement of the quality characteristic for each unit of the sample. Compute the sample mean $\overline{X}$ and standard deviation S.

Where $\overline{X}_N=\sum X_i / n_N$, $S=\sqrt{\sum (x_i-\bar{x})^2 / n_N-1}$

Step2: i) If $\overline{X}_N + k\,S \le U$ or $\overline{X}_N + k\,S \ge L$ accept the lot and repeat step 1 for the next lot.

ii) If $\overline{X}_N + k\,S > U$ or $\overline{X}_N + k\,S < L$ reject the lot go to step 3.

Step 3: Draw a sample of size n_s from the next lot inspect and record the measurement of the quality characteristic for each unit of the sample. Compute the sample mean $\overline{X}$.

Where $\overline{X}_T=\sum X_i / n_T$,, $S=\sqrt{\sum (x_i-\bar{x})^2 / n_T-1}$

Step 4: i) If $\overline{X}_T + k\,S \le U$ or $\overline{X}_T + k\,S \ge L$ accept the lot and repeat step 1 for the next lot.

ii) If $\overline{X}_T + k\,S > U$ or $\overline{X}_T + k\,S < L$ reject the lot and repeat step 3.

where $\overline{X}$ and S are the average and the standard deviation of quality characteristic respectively from the sample. Under the assumptions for a six sigma quick switching system stated, the probability of acceptance $P_a(p)$ of a lot is given in the equations (3) and (4) and P_T and P_N respectively are

$$P_T = \int_{-\infty}^{w_T} \frac{1}{\sqrt{2\pi}} e^{-z^2/2}\, dz \quad \text{and} \quad P_N = \int_{-\infty}^{w_N} \frac{1}{\sqrt{2\pi}} e^{-z^2/2}\, dz$$

with
$$w_T = \frac{U-k\,S_T-\mu}{S_T} \frac{1}{\sqrt{\left(\frac{1}{n_{Ts}}+\frac{k^2}{2n_{Ts}}\right)}} \quad \text{and} \quad w_N = \frac{U-k\,S_N-\mu}{S_N} \frac{1}{\sqrt{\left(\frac{1}{n_{Ns}}+\frac{k^2}{2n_{Ns}}\right)}}$$

The values of n_{TS}, n_{NS}, and k_s for given p_1, p_2, α and β can be determined and should satisfy the following equations

$$P_a(p_1)=\frac{P_{T_1}}{1-P_{T_1}+P_{N_1}}=1-\alpha \qquad (7)$$

$$P_a(p_2)=\frac{P_{T_2}}{1-P_{T_2}+P_{N_2}}=\beta \qquad (8)$$

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where $P_{T_1} = \Pr\left[\frac{\overline{X}-\overline{X}_{p_1}}{S\sqrt{\frac{1}{n_{T_S}}+\frac{k^2}{2n_{T_S}}}} \geq \frac{(k-z_{p_1})}{\sqrt{\frac{1}{n_{T_S}}+\frac{k^2}{2n_{T_S}}}}\right]$, $P_{N_1} = \Pr\left[\frac{\overline{X}-\overline{X}_{p_1}}{S\sqrt{\frac{1}{n_{N_S}}+\frac{k^2}{2n_{N_S}}}} \geq \frac{(k-z_{p_1})}{\sqrt{\frac{1}{n_{N_S}}+\frac{k^2}{2n_{N_S}}}}\right]$

$P_{T_2} = \Pr\left[\frac{\overline{X}-\overline{X}_{p_2}}{S\sqrt{\frac{1}{n_{T_S}}+\frac{k^2}{2n_{T_S}}}} \geq \frac{(k-z_{p_2})}{\sqrt{\frac{1}{n_{T_S}}+\frac{k^2}{2n_{T_S}}}}\right]$, and $P_{N_2} = \Pr\left[\frac{\overline{X}-\overline{X}_{p_2}}{S\sqrt{\frac{1}{n_{N_S}}+\frac{k^2}{2n_{N_S}}}} \geq \frac{(k-z_{p_2})}{\sqrt{\frac{1}{n_{N_S}}+\frac{k^2}{2n_{N_S}}}}\right]$

Designing SSQSVSS (n_{Ts}, n_{Ns}; k_s) with unknown σ for given SSAQL and SSLQL

Example 2

Table 1 can be used to determine SSQSVSS ($n_{Ts,}$ n_{Ns}; k_s) for specified values of SSAQL and SSLQL. For example, if it is desired to have a SSQSVSS ($n_{Ts,}$ n_{Ns}; k_s) for given SSAQL = 0.000003 and SSLQL = 0.00008, and m=2, $\alpha^* = 3.4\text{x}10^{-6}$, $\beta^* \geq 2\alpha^*$. Table 1 gives n_{NS} = 6260, and k = 4.047. The sample size n_{Ts} = m n_{Ns} = (2) (6260) = 12520. Thus, for given requirement, the SSQSVSS ($n_{Ts,}$ n_{Ns}; k_s) is specified by the parameters n_{Ts} =12520, n_{NS} = 6260, and k = 4.047 as desired system parameters, which is associated with 4.7 sigma level.

Practical Explanation

For the test, lot-by-lot acceptance inspection of one liter water bottle it is proposed to apply the system with n_T= 12520, n_N=6260, and k=4.047. The characteristic to be inspected is the water bottle with the upper limit (U) diameter of 7.6 cm.

Now, take a random sample of size n_N=6260, record the diameter of each water bottle. Compute the sample mean ($\overline{X}$) and unknown standard deviation (S). If $\overline{X}$ +k S ≤ U ⇒ $\overline{X}$ +(4.047) S ≤ 7.6 cm, accept the lot. Otherwise, switch to tightened inspection.

Draw a sample of 12520 from the next lot and record the results. Compute the sample mean ($\overline{X}$) and unknown standard deviation (S). If $\overline{X}$ +k S ≤ U ⇒ $\overline{X}$ +(4.047) S ≤ 7.6 cm, accept the lot. Then, switch to normal inspection. Otherwise, continue with tightened inspection process.

Table 1: SSQSVSS(n_T, n_N; k) with known and unknown σ indexed by SSAQL and SSLQL (α=3.4 x 10^{-6} and β≥2α). ($n_{T\sigma}$=m$n_{N\sigma}$, where m = 2)

SSAQL	SSLQL	$n_{T\sigma}$	$n_{N\sigma}$	k_σ	σ - Level	n_{Ts}	n_{Ns}	k_s	σ - Level
0.000001	0.000002	29494	14747	4.679	4.9	352351	176175	4.679	5.5
	0.000003	20232	10116	4.636	4.8	237650	118825	4.636	5.5
	0.000004	17704	8852	4.606	4.8	205501	102751	4.606	5.4
	0.000005	15380	7690	4.577	4.7	176477	88239	4.577	5.4
	0.000006	13108	6554	4.556	4.7	149150	74575	4.556	5.3
	0.000007	10944	5472	4.540	4.6	123731	61865	4.540	5.3

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	0.000008	8810	4405	4.525	4.6	99005	49503	4.525	5.2
	0.000009	6724	3362	4.511	4.5	75138	37569	4.511	5.2
	0.00001	4662	2331	4.499	4.4	51844	25922	4.499	5.1
	0.00002	2380	1190	4.417	4.2	25597	12798	4.417	4.9
	0.00003	2092	1046	4.368	4.1	22049	11025	4.368	4.9
	0.00004	1846	923	4.331	4.1	19159	9580	4.331	4.8
	0.00005	1788	894	4.313	4.1	18418	9209	4.313	4.8
	0.00006	1560	780	4.291	4.0	15922	7961	4.291	4.8
	0.00007	1350	675	4.271	4.0	13663	6831	4.271	4.7
0.000002	0.000003	22255	11128	4.524	4.8	249999	125000	4.524	5.5
	0.000004	19474	9737	4.494	4.8	216127	108064	4.494	5.4
	0.000005	16918	8459	4.465	4.8	185559	92779	4.465	5.4
	0.000006	14419	7209	4.444	4.7	156798	78399	4.444	5.4
	0.000007	12038	6019	4.428	4.7	130058	65029	4.428	5.3
	0.000008	9691	4846	4.413	4.6	104055	52028	4.413	5.3
	0.000009	7396	3698	4.399	4.5	78961	39481	4.399	5.2
	0.00001	5128	2564	4.387	4.4	54476	27238	4.387	5.1
	0.00002	2618	1309	4.305	4.2	26878	13439	4.305	4.9
	0.00003	2301	1151	4.256	4.2	23143	11571	4.256	4.9
	0.00004	2031	1015	4.219	4.1	20103	10051	4.219	4.8
	0.00005	1967	983	4.201	4.1	19322	9661	4.201	4.8
	0.00006	1716	858	4.179	4.1	16700	8350	4.179	4.8
	0.00007	1485	743	4.159	4.0	14328	7164	4.159	4.7

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Table 1: (Continued…)

SSAQL	SSLQL	$n_{T\sigma}$	$n_{N\sigma}$	k_σ	σ - Level	n_{Ts}	n_{Ns}	k_s	σ - Level
0.000003	0.000004	21422	10711	4.412	4.8	229918	114959	4.412	5.5
	0.000005	18610	9305	4.382	4.8	197282	98641	4.382	5.4
	0.000006	15861	7930	4.353	4.8	166130	83065	4.353	5.4
	0.000007	13242	6621	4.332	4.7	137496	68748	4.332	5.3
	0.000008	10660	5330	4.316	4.7	109948	54974	4.316	5.3
	0.000009	8136	4068	4.301	4.6	83389	41694	4.301	5.2
	0.00001	5641	2821	4.287	4.5	57477	28739	4.287	5.1
	0.00002	2880	1440	4.275	4.3	29195	14597	4.275	4.9
	0.00003	2531	1266	4.193	4.2	24783	12392	4.193	4.9
	0.00004	2234	1117	4.144	4.2	21413	10706	4.144	4.9
	0.00005	2163	1082	4.107	4.2	20410	10205	4.107	4.9
	0.00006	1888	944	4.089	4.1	17668	8834	4.089	4.8
	0.00007	1634	817	4.067	4.1	15143	7571	4.067	4.8
	0.00008	1362	681	4.047	4.0	12520	6260	4.047	4.7
0.000004	0.000005	20471	10235	3.655	4.9	157206	78603	3.655	5.4
	0.000006	17447	8723	4.300	4.8	178742	89371	4.300	5.4
	0.000007	14566	7283	4.270	4.7	147361	73680	4.270	5.4
	0.000008	11726	5863	4.241	4.7	117179	58590	4.241	5.3
	0.000009	8950	4475	4.220	4.6	88639	44320	4.220	5.2
	0.00001	6205	3103	4.204	4.5	61039	30519	4.204	5.1
	0.00002	3168	1584	4.189	4.3	30961	15481	4.189	5.0
	0.00003	2784	1392	4.175	4.2	27052	13526	4.175	4.9
	0.00004	2457	1229	4.163	4.2	23748	11874	4.163	4.9
	0.00005	2380	1190	4.081	4.2	22197	11099	4.081	4.9
	0.00006	2076	1038	4.032	4.2	18954	9477	4.032	4.8
	0.00007	1797	898	3.995	4.1	16136	8068	3.995	4.8
	0.00008	1499	749	3.977	4.1	13351	6675	3.977	4.7
	0.00009	1198	599	3.955	4.0	10567	5283	3.955	4.7

Table 1: (continued…)

SSAQL	SSLQL	$n_{T\sigma}$	$n_{N\sigma}$	k_σ	σ - Level	n_{Ts}	n_{Ns}	k_s	σ - Level
0.000005	0.000006	19191	9596	3.583	4.9	142380	71190	3.583	5.4
	0.000007	16023	8012	3.560	4.8	117558	58779	3.560	5.3
	0.000008	12899	6449	3.543	4.8	93857	46928	3.543	5.3
	0.000009	9845	4922	4.188	4.6	96179	48089	4.188	5.3
	0.00001	6826	3413	4.158	4.5	65830	32915	4.158	5.2
	0.00002	3485	1742	4.129	4.3	33188	16594	4.129	5.0
	0.00003	3063	1531	4.108	4.3	28907	14454	4.108	4.9
	0.00004	2703	1351	4.092	4.2	25331	12665	4.092	4.9
	0.00005	2618	1309	4.077	4.2	24374	12187	4.077	4.9
	0.00006	2284	1142	4.063	4.2	21136	10568	4.063	4.9
	0.00007	1977	988	4.051	4.1	18195	9097	4.051	4.8
	0.00008	1649	824	3.969	4.1	14634	7317	3.969	4.8
	0.00009	1318	659	3.920	4.0	11442	5721	3.920	4.7
	0.0001	1007	504	3.883	3.9	8601	4301	3.883	4.6

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0.00001	0.00002	3833	1917	4.046	4.4	35206	17603	4.046	5.0
	0.00003	3369	1685	4.017	4.3	30552	15276	4.017	5.0
	0.00004	2973	1487	3.996	4.3	26709	13355	3.996	4.9
	0.00005	2880	1440	3.980	4.3	25687	12843	3.980	4.9
	0.00006	2512	1256	3.965	4.2	22261	11131	3.965	4.9
	0.00007	2174	1087	3.951	4.2	19144	9572	3.951	4.8
	0.00008	1813	907	3.939	4.1	15882	7941	3.939	4.8
	0.00009	1449	725	3.857	4.1	12231	6115	3.857	4.7
0.00005	0.00006	2764	1382	3.853	4.3	23278	11639	3.853	4.9
	0.00007	2392	1196	3.839	4.2	20015	10008	3.839	4.9
	0.00008	1995	997	3.827	4.2	16602	8301	3.827	4.8
	0.00009	1594	797	3.745	4.1	12775	6388	3.745	4.7
0.0001	0.0002	1341	670	3.584	4.1	9952	4976	3.584	4.7
	0.0007	261	131	3.470	3.4	1833	917	3.471	4.2
	0.0008	226	113	3.453	3.4	1574	787	3.454	4.1

V. CONSTRUCTION OF TABLE 1

The OC function of SSQSVSS (n_T, n_N; k) is given by the equation (2) for as a specified (p_1, α) and (p_2, β).

$$P_a(p) = \frac{P_T}{1 - P_T + P_N}$$

where $$P_N = \phi(w_N) = P[(U - \overline{X})/\sigma \geq k]$$

and $$P_T = \phi(w_T) = P[(U - \overline{X})/\sigma \geq k]$$

Using iterative procedure equations, (3) and (4) are solved for given values of p_1, p_2, m, α and β to get the values of $n_{N\sigma}$ and k_σ for the specified pair of points, say (p_1, α) and (p_2, β) on the OC curve. Here, the values of m can be taken m >1and find the desired parameters. In Table 1, provided, if m=2, the values of $n_{T\sigma}$, $n_{N\sigma}$ and k_σ are constructed. A procedure for finding the parameters of unknown σ - method plan from known σ-method plan with parameters (n_S, k_{TS}, k_{Ns}), are obtained by using computer search routine through C++ programme.The sample size $n_{T\sigma}$ equals $mn_{N\sigma}$ and n_{Ts} equals mn_{Ns}, and hence only $n_{N\sigma}$ n_{Ns} and k are tabulated.

Table 1 provided the values of $n_{T\sigma}$, $n_{N\sigma}$, k_σ, n_{Ts}, n_{Ns} and k_s which satisfying the equations (3) and (4). The sigma (σ) value is calculated using the process sigma calculator for given n and k for known σ and unknown σ methods.

VI. CONCLUSION

Six Sigma Quick Switching Variable Sampling System has wide potential applications in industries to ensure a higher standard of quality attainment and increased customer satisfaction. Here, an attempt made to apply the concept of Quick Switching Variable Sampling System to propose a plan designated as Six Sigma Quick Switching Variable Sampling System of type SSQSVSS in which disposal of a lot on the basis of normal and tightened plan. The concept of this article may used for assistance to quality control engineers and plan designers in the further plan development, which were useful and tailor made for industrial shop-floor situations.

REFERENCES

[1]. Abramowitz and Stegun," Handbook of mathematical functions with Formulas, Graphs, and Mathematical Tables". 1964
[2]. Devaraj Arumainayagam, S., "Contributions to the study of Quick Switching System(QSS) and its Applications". Doctoral Dissertation, Bharathiar University, Coimbatore, Tamil Nadu, India,1991.
[3]. Dodge,H.F., "A New Dual System of Acceptance Sampling Technical Report No.16", The Statistics Center, Rutgers – The State University, New Brunswick, NJ, 1967.
[4]. Govindaraju, K., "Procedures and tables for the selection of Zero Acceptance Number Quick Switching System for Compliance testing". Communications in Statistics – Simulation and Computation, vol.20, No.1, pp. 157-172, 1991.
[5]. Hamaker, H,C., " Acceptance Sampling for Percent Defective and by Attributes", Journal of Quality Technology, 11, pp.138-148,1979.
[6]. Radhakrishnan, R, and Sivakumaran, P.K., "Construction of Six Sigma Repetitive Group Sampling Plans", International Journal of Mathematics and Computation, vol.1, 2008.

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(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 3, March 2015

[7]. Senthilkumar, D., and Esha Raffie, B., "Six Sigma Quick Switching Variables Sampling System Indexed by Six Sigma Quality Levels", International Journal of Computer Science & Engineering Technology (IJCSET), ISSN: 2229-3345 Vol. 3 No.12, pp. 565 – 576, Dec 2012.

[8]. Soundarajan, V., and Palanivel, M., "Quick Switching Variables Single Sampling (QSVSS) System indexed by AQL and LQL Acceptance Criterion Tightening". Journal of Applied Statistics Science, Vol.6 (1): 45-57, 1997.

[9]. Soundarajan, V., and Palanivel, M., "Quick Switching Variables Single Sampling (QSVSS) System indexed by AQL and AOQL".Journal of Applied Statistics. Vol.27 (7): 771-778, 2000.

[10]. Taylor, W. A., "Quick Switching Systems. Journal of Quality Technology, Vol.28, No.4, pp. 460-472, 1996.