International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 09 | Sep 2018 www.irjet.net p-ISSN: 2395-0072

Six Sigma Modified Quick Switching Variables Sampling System Indexed by Six Sigma AQL and Six Sigma AOQL: Sample Size Tightened

Dr. D. Senthilkumar[1], Dr. B. Esha Raffie[2]

[1]Head & Associate Professor, Department of Statistic, PSG College of Arts & Science, Coimbatore – 641014.
[2] Assistant Professor, Department of Statistic, PSG College of Arts & Science, Coimbatore – 641014.

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Abstract:- In this article gives sample size tightened in Modified Quick Switching Variables Sampling System indexed by Six Sigma AQL and Six Sigma AOQL. The resulting system is referred to as a "Six Sigma Modified Quick Switching Variables Sampling System" (SSQSVSS-r($n_{T\sigma}$, $n_{N\sigma}$; k_{σ}), r= 2 and 3). These procedures verified with practical applications and also constructed tables for easy selection of plans given indexed by six sigma quality levels.

Keywords: Modified Quick Switching Variables Sampling System, Operating Characteristic Curve, Six Sigma AQL and Six Sigma AOQL.

Introduction

The construction procedure for the SSQSVSS ($n_{T\sigma}$, $n_{N\sigma}$; k_{σ}), r=2 and 3, indexed by SSAQL and SSAOQL is based on Govindaraju (1990) procedures and tables, developing for the selection of single sampling plan for variables indexed by AQL and AOQL. Soundararajan (1981) has developed procedures and tables for the selection of single sampling plans for attributes for given AQL and AOQL. Govindaraju (1990) has developed procedures and tables for the selection of single sampling plans for variables indexed by AQL and AOQL. Later Soundarajan and Palanivel (2000) have developed procedures and tables for the selection of quick switching single sampling variables systems indexed by AQL and AOQL. Based on above article Senthilkumar and Esha Raffie (2017) have constructed SSQSVSS (n_{σ}; $k_{T\sigma}$, $k_{N\sigma}$) indexed by Six Sigma AQL and Six Sigma AOQL. Senthilkumar and Esha Raffie (2016) have constructed six sigma modified quick switching variables sampling system [SSMQSVSS-r (nTσ, nNσ; kσ), r=2 and 3] indexed by six sigma quality levels of SSAQL and SSLQL. This concept can be extended to variables quality characteristics of the study, the resulting plan would be designated as SSQSVSS-r and would be applied under the following conditions:

- 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 depends on automation and human involvement in the process is negligible.
- The industry may adopt system method with decision makers have an experience in adopting the six sigma quality initiatives.

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.

When the conditions listed above are satisfied the fraction defective in a lot will be defined by $p = 1 - F(v) = F(-v)$ 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). Here the decision criterion for the σ- method variables plan is to accept the lot if $\overline{X} + k\sigma \le U$, where U is the upper specification limit or if $\overline{X} + k\sigma \ge L$, where L is the lower specification limit.

SSQSVSS-r((n_{σ}; $k_{T\sigma}$, $k_{N\sigma}$), where r=2 and 3) with known σ for given SSAQL and SSLQL

The Six Sigma Modified Quick Switching Variables Sampling System with known σ variables plan as the reference plan has following Operating Procedure

Operating Procedure

Step 1: Draw a sample of size n_σ from the lot through normal inspection, inspect and record the measurement of the quality characteristic for each unit of the sample. Compute the sample mean $\overline{X}$.

Step 2: If $\overline{X}+k_{N\sigma}\sigma \le U$ or $\overline{X}+k_{N\sigma}\sigma \ge L$ accept the lot and repeat Step 1 otherwise, go to Step 3.

Step 3: Under tightened inspection, draw a sample of size n_σ from the next lot inspect and record the measurement of the quality characteristic for each unit of the sample. Compute the sample mean $\overline{X}$.

Step 4: If $\overline{X}+k_{T\sigma}\sigma \le U$ or $\overline{X}+k_{T\sigma}\sigma \ge L$ accept the lot. When r consecutive lots are accepted, switch to Step 1, otherwise repeat Step 3.

where $k_{N\sigma}$ and $k_{T\sigma}$ are the acceptance criterion of the variable sampling plan under normal and tightened inspection respectively. Tightened inspection may be achieved by reducing k_N but leaving n_σ fixed. This moves the OC curve to the left, thus reducing the consumer's risk but increasing the producer's risk. Under σ-method $\overline{X}$ and σ are the average quality characteristic and standard deviation respectively.

Variable Sampling Plan and SSAOQL procedures

The fraction defective of SSQSVSS-r($n_{T\sigma}$, $n_{N\sigma}$; k_σ), r= 2 and 3 in a given lot is $p = F(-v)$ with $v = (U-\mu)/\sigma$ and its probability of acceptance has been in (2) and (3)

with $w_N = (v - k_\sigma)\sqrt{n_{N\sigma}}$

and $w_T = (v - k_\sigma)\sqrt{n_{T\sigma}}$

If the quality of the accepted lot is p and all defective units found in the rejected lots are replaced by non-defective units in a rectifying inspection plan, the Six Sigma average outgoing quality (SSAOQ) can be approximated as

$$SSAOQ = pP_a(p) \quad (2)$$

If p_m is the proportion nonconforming items at which SSAOQ is maximum, one has

$$SSAOQL = p_m P_a(p_m) \quad (3)$$

If SSAQL (p_1) is prescribed, then the corresponding value of v_{SSAQL} or v_1 will be fixed and if $P_a(p)$ is fixed at 99.99966%, that is (1-α). Where, $\alpha = 0.0000034\text{x}10^{-6}$. Hence we have $P_a(p_1) = (1-\alpha)$
So that for given values of n_σ, w_N, w_T and SSAQL, $k_{N\sigma}$, $k_{T\sigma}$ are determined.

Selection of known σ SSQSVSS-r($n_{T\sigma}$, $n_{N\sigma}$; k_σ), r=2 and 3, for given SSAQL and SSAOQL

Table 1 is used for selection of σ- method SSQSVSS-2($n_{T\sigma}$, $n_{N\sigma}$; k_σ). For example, if the SSAQL is fixed at 0.00001 and the SSAOQL is fixed at 0.00003, m=2. Table 1 yields $n_{N\sigma}$ = 159 and k_σ =3.664, which is associated with 3.5 sigma level of SSQSVSS-2($n_{T\sigma}$, $n_{N\sigma}$; k_σ). The sample size n_{Ts} = m n_{Ns} = (2) (159) = 319. Thus, for the given requirement, the SSQSVSS-3 ($n_{T\sigma}$, $n_{N\sigma}$; k_σ) is specified by the parameters $n_{T\sigma}$ = 319, $n_{N\sigma}$ = 159, and k_σ = 3.664 which is associated with 4.5 sigma level.

Table 2 is used for the selection of σ- method SSQSVSS-3($n_{T\sigma}$, $n_{N\sigma}$; k_σ). For example, if the SSAQL is fixed at 0.000003 and the SSAOQL is fixed at 0.00001, m=2. Table 2 yields $n_{N\sigma}$ = 256 and k_σ =4.089. The sample size $n_{T\sigma}$ = m $n_{N\sigma}$ = (2) (256) = 513. Thus, for the given requirement, the SSQSVSS-3($n_{T\sigma}$, $n_{N\sigma}$; k_σ) is specified by the parameters $n_{T\sigma}$ = 513, $n_{N\sigma}$ = 256, and k_σ = 4.089which is associated with 3.6 sigma level.

The user of Table 1 and Table 10 should understand the limitations of plans indexed by SSAOQL. Sampling with rectifying of rejected lots on the one hand reduces the average percentage of nonconforming items in the lots, but on the other hand introduces non-homogeneity in the series of lots finally accepted. That is, any particular lot will have a quality of p% or 0% nonconforming depending on whether the lot is accepted or rectified. Thus the assumption underlying the SSAOQL principle is that the homogeneity in the qualities of individual lots is unimportant and only the average quality matters. For plans listed in Table 1 and Table 2, if the individual lot quality happens to be the product quality p_m at which SSAOQL occurs, then the associated probability of acceptance will be poor. Table 1 gives $P_a(p_m)$ values of plans given in Table 1. For example, for SSAQL is 0.00001 and SSAOQL is 0.00005, Table 1 gives $P_a(p_m)$ = 0.64. Then p_m = SSAOQL/ $P_a(p_m)$

= 0.00008 and Table 4 gives $P_a(p_m)$ values of plans given in Table 2. For example, for SSAQL of p_1=0.00001and SSAOQL = 0.00004, Table 4 gives $P_a(p_m)$ = 0.6 Then p_m = SSAOQL/ $P_a(p_m)$ = 0.00006.

In order to avoid such inconvenience, the producer should maintain the process quality more or less at the SSAQL. The high rate of rejection of lots at p = p_m will also indirectly put pressure on the producer to improve the submitted quality.

Selection of unknown σ SSQSVSS-r(n_{Ts}, n_{Ns}; k_s), r = 2 and 3, for given SSAQL and SSAOQL

Table 1 also gives such matched S-method plan. For example, for given SSAQL is 0.000005 and SSAOQL is 0.00001, m=2, one obtains the parameters of the S-method plan from Table 1 to be n_{Ns} = 2809 and k_s =3.870, which is associated with 4.5 sigma level of SSQSVSS-2 (n_{Ts}, n_{Ns}; k_s) .The sample size n_{Ts} = m n_{Ns} = (2) (2809) = 5618. Thus, for the given requirement, the SSQSVSS-2(n_{Ts}, n_{Ns}; k_s) is specified by the parameters n_{Ts} = 5618, n_{Ns} = 2809, and k_s = 3.870 which is associated with 4.5 sigma level.

Table 2 also gives such matched S-method plan. For example, for given SSAQL is 0.000004 and SSAOQL is 0.00001, m=2, one obtains the parameters of the S-method plan from Table 2 to be be n_{NS} = 2600 and k_s =3.977, which is associated with 4.5 sigma level of SSQSVSS-3(n_{Ts}, n_{Ns}; k_s) .The sample size n_{Ts} = m n_{Ns} = (2) (2600) = 5199. Thus, for the given requirement, the SSQSVSS-3(n_{Ts}, n_{Ns}; k_s) is specified by the parameters n_{Ts} = 5199, n_{Ns} = 2600, and k_s = 3.977which is associated with 4.5 sigma level.

Construction of Table 1 and Table 2

For constructing Table 1 and 2, a trial value of p_m is assumed and the probability of acceptance at p_m is found using (2) as

$$P_a(p_m) = SSAOQL / p_m$$

The auxiliary variables v_m, w_{Nm} and w_{Tm} corresponding to the values of p_m and $P_a(p_m)$ respectively, are found using (1), (2), and (3). For given values of p_1, determine the values of v_1, w_N and w_T using the approximation (Abramwitz and Stegun (1972)) for the ordinate of the cumulative normal distribution. With the values of v_m, w_{Nm} and w_{Tm}, the following equation is used for calculating n_σ.

SSQSVSS-2, formula of n_σ is

$$\sqrt{n_{N\sigma}} = (\text{-AOQL}) / (p_m^2((1-P_N)(1-P_N+2P_T)\sqrt{(\exp(v_m^2-w_T^2))}$$

$$+P_T^2\sqrt{(\exp(v_m^2-w_N^2))}) / (P_T^2+(1-P_N)(1+P_T))^2) \qquad (4)$$

and SSQSVSS-3, formula of n_σ is

$$\sqrt{n_{N\sigma}}=(\text{-AOQL})/(p_m^2((X\sqrt{(\exp(v_m^2\text{-}w_T^2}))+P_T^2\sqrt{(\exp(v_m^2\text{-}w_N^2))})/Y^2) \qquad (5)$$

where

$$X=(3P_T^2+2P_T-2P_N-3P_NP_T^2+2P_N^2P_T-4P_NP_T+1)$$

$$Y=P_T^3+(1\text{-}P_N)(P_T^2+P_T+1)$$

with $P_N=\phi(w_N)=pr[(U\text{-}\bar{x})/\sigma>k_{N\sigma}]$

and $P_T=\phi(w_T)=pr[(U\text{-}\bar{x})/\sigma>k_{T\sigma}]$

Equation (4) and (5) are the formulae for finding the sample size of a known σ SSQSVSS-r($n_{T\sigma}$, $n_{N\sigma}$; k_σ), r = 2 and 3 system. For two points given on the OC curve it is then checked to see whether the assumed value of p_m corresponds to the proportion non-conforming at which the SSAOQL occurs or not. That is, it is checked to see whether or not the trial value of p_m satisfies the following conditions.

For SSQSVSS-2 condition is

$$AOQL - p_m^2((1-P_N)(1-P_N+2P_T)\sqrt{(n_{T\sigma}\exp(v_m^2-w_T^2))}-$$

$$P_T^2(\sqrt{(n_{N\sigma}\exp(v_m^2-w_N^2)})/(P_T^2+(1-P_N)(1+P_T))^2)=0 \quad (6)$$

and for SSQSVSS-3 condition is

$$AOQL/[p_m^2(((X\sqrt{(n_{T\sigma}\exp(v_m^2-w_T^2)})+P_T^2\sqrt{n_{N\sigma}(\exp(v_m^2-w_N^2))})/Y^2)]=0 \quad (7)$$

where

$$X=(3P_T^2+2P_T-2P_N-3P_NP_T^2+2P_N^2P_T-4P_NP_T+1)$$

$$Y=P_T^3+(1-P_N)(P_T^2+P_T+1)$$

Equation (6) and (7) are obtained from the following relation

$$\frac{d(SSAOQ)}{dp}=P_a(p)+p\frac{dP_a(p)}{dp}=0 \quad (8)$$

in which, for SSQSVSS-2

$$\frac{dP_a(P)}{dp}=((1-P_N)(1-P_N+2P_T)\sqrt{(n_{T\sigma}\exp(v_m^2-w_T^2)})-P_T^2(\sqrt{(n_{N\sigma}\exp(v_m^2-w_N^2)})/(P_T^2+(1-P_N)(1+P_T))^2 \quad (9)$$

and for SSQSVSS-3

$$\frac{dP_a(P)}{dp}=[(X\sqrt{(n_{T\sigma}\exp(v_m^2-w_T^2)})+P_T^2\sqrt{n_{N\sigma}(\exp(v_m^2-w_N^2))})/Y^2] \quad (10)$$

If assumed value of p_m does not satisfy (6) and (7), then another trial value of p_m is obtained from (6) and (7) by numerical methods. The methods of successive substitution is often found to give good results in equation (6) and (7) is rewritten for this purpose as

for SSQSVSS-2

$$p_m=AOQL/(p_m((1-P_N)(1-P_N+2P_T)\sqrt{(n_{T\sigma}\exp(v_m^2-w_T^2)})+P_T^2(\sqrt{(n_{N\sigma}\exp(v_m^2-w_N^2)})/(P_T^2+(1-P_N)(1+P_T))^2) \quad (11)$$

and for SSQSVSS-3

$$p_m=AOQL/[p_m(X\sqrt{(n_{T\sigma}\exp(v_m^2-w_T^2)})+P_T^2\sqrt{n_{N\sigma}(\exp(v_m^2-w_N^2))})/Y^2)] \quad (12)$$

After determining the next trial value of p_m, again the values of v_m, w_{Nm}, w_{Tm} and n_σ are found and the conditions (6) and (7) are rechecked.

For obtaining the values of v_1, w_N and w_T, the approximation for the ordinate of the cumulative normal distribution available in Abramowitz and Stegun (1972) was used.

The S-method plans matching the σ-method plans were obtained using computer search routine through C++ programme. For selected combinations of SSAQL and SSAOQL, Table 1 and 2 was constructed following the above iterative procedure.

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Table 1: SSQSVSS-2 with known and unknown σ indexed by SSAQL and SSAOQL
($n_{T\sigma}$ = m $n_{N\sigma}$,when m=2)

SSAQL	SSAOQL	$n_{T\sigma}$	$n_{N\sigma}$	k_σ	σ - level	n_{TS}	n_{NS}	k_S	σ - level
0.000001	0.000002	2724	1362	4.486	4.2	30134	15067	4.486	4.9
	0.000003	1808	904	4.443	4.1	19654	9827	4.443	4.8
	0.000004	1544	772	4.413	4.0	16579	8290	4.413	4.8
	0.000005	1316	658	4.384	4.0	13963	6981	4.384	4.7
	0.000006	1102	551	4.363	3.9	11591	5796	4.363	4.7
	0.000007	890	445	4.347	3.8	9299	4650	4.347	4.6
	0.000008	662	331	4.332	3.7	6874	3437	4.332	4.5
	0.000009	454	227	4.318	3.6	4687	2343	4.319	4.4
	0.00001	308	154	4.306	3.4	3164	1582	4.307	4.3
	0.00002	220	110	4.224	3.3	2183	1091	4.225	4.2
	0.00003	174	87	4.175	3.2	1691	845	4.176	4.1
0.000002	0.000003	2000	1000	4.331	4.1	20756	10378	4.331	4.8
	0.000004	1709	855	4.301	4.1	17521	8760	4.301	4.8
	0.000005	1456	728	4.272	4.0	14747	7373	4.272	4.7
	0.000006	1212	606	4.251	4.0	12166	6083	4.251	4.7
	0.000007	979	490	4.235	3.9	9759	4879	4.235	4.6
	0.000008	950	475	4.220	3.9	9413	4707	4.220	4.6
	0.000009	728	364	4.206	3.8	7170	3585	4.206	4.5
	0.00004	203	102	3.951	3.3	1790	895	3.952	4.1
	0.00005	203	102	3.914	3.3	1760	880	3.915	4.1
0.000005	0.000006	1613	807	3.936	4.1	14112	7056	3.936	4.8
	0.000007	1303	652	3.915	4.0	11290	5645	3.915	4.7
	0.000008	1265	632	3.899	4.0	10881	5440	3.899	4.7

	0.000009	969	485	3.884	3.9	8280	4140	3.884	4.6
	0.00001	662	331	3.870	3.8	5618	2809	3.870	4.5
0.00001	0.00002	354	177	3.746	3.5	2840	1420	3.747	4.3
	0.00003	319	159	3.664	3.5	2459	1230	3.665	4.2
	0.00004	271	135	3.615	3.4	2039	1019	3.616	4.2
	0.00005	271	135	3.578	3.4	2003	1001	3.579	4.2
	0.00006	229	114	3.560	3.4	1678	839	3.561	4.1
	0.00007	187	93	3.538	3.3	1356	678	3.539	4.1
	0.00008	164	82	3.518	3.2	1181	590	3.520	4.0
	0.00009	119	60	3.484	3.1	843	421	3.486	3.9
0.00005	0.00006	252	126	3.372	3.4	1682	841	3.373	4.2
	0.00007	206	103	3.350	3.3	1359	679	3.351	4.1
	0.00008	181	90	3.330	3.3	1183	591	3.332	4.0
	0.00009	131	66	3.296	3.1	843	422	3.298	3.9
	0.0001	114	57	3.154	3.1	681	341	3.156	3.9
	0.0002	84	42	3.002	3.0	463	231	3.005	3.7
	0.0003	66	33	2.875	2.9	339	169	2.879	3.6

Table 2: SSQSVSS-3 with known and unknown σ indexed by SSAQL and SSAOQL ($n_{T\sigma}$ = m $n_{N\sigma}$, when m=2)

SSAQL	SSAOQL	$n_{T\sigma}$	$n_{N\sigma}$	k_σ	σ - level	n_{TS}	n_{NS}	k_S	σ - level
0.000001	0.000002	2694	1347	4.481	4.2	29742	14871	4.481	4.9
	0.000003	1784	892	4.438	4.1	19353	9677	4.438	4.8
	0.000004	1510	755	4.408	4.0	16181	8090	4.408	4.8
	0.000005	1282	641	4.379	4.0	13574	6787	4.379	4.7
	0.000006	876	438	4.358	3.8	9195	4597	4.358	4.6
	0.000007	872	436	4.342	3.8	9092	4546	4.342	4.6
	0.000008	652	326	4.327	3.7	6756	3378	4.327	4.5
	0.000009	424	212	4.313	3.5	4368	2184	4.314	4.4
	0.00001	284	142	4.301	3.4	2911	1455	4.302	4.3
	0.00002	186	93	4.219	3.2	1841	921	4.220	4.1
	0.00003	140	70	4.170	3.1	1357	679	4.172	4.0
0.000004	0.000005	1732	866	4.072	4.1	16094	8047	4.072	4.8
	0.000006	1443	721	4.043	4.0	13235	6617	4.043	4.7
	0.000007	1151	575	4.022	4.0	10457	5229	4.022	4.7
	0.000008	1116	558	4.006	3.9	10071	5036	4.006	4.7
	0.000009	588	294	3.991	3.7	5268	2634	3.991	4.5
	0.00001	584	292	3.977	3.7	5199	2600	3.977	4.5
	0.00002	283	141	3.965	3.4	2506	1253	3.966	4.2
	0.00003	234	117	3.883	3.3	1994	997	3.884	4.2

	0.00004	200	100	3.834	3.3	1667	833	3.835	4.1
	0.00005	190	95	3.797	3.3	1556	778	3.798	4.1
	0.00006	155	78	3.779	3.2	1262	631	3.781	4.0
	0.00007	122	61	3.757	3.0	981	491	3.759	3.9
	0.00008	118	59	3.737	3.0	940	470	3.739	3.9
0.000005	0.000006	1579	790	3.931	4.1	13783	6892	3.931	4.8
	0.000007	1251	625	3.910	4.0	10814	5407	3.910	4.7
	0.000008	1247	623	3.894	4.0	10702	5351	3.894	4.7
	0.000009	959	480	3.879	3.9	8176	4088	3.879	4.6
0.00001	0.00002	305	152	3.741	3.5	2438	1219	3.742	4.2
	0.00003	301	150	3.659	3.5	2315	1158	3.660	4.2
	0.00004	261	130	3.610	3.4	1959	979	3.611	4.2
	0.00005	241	120	3.573	3.4	1776	888	3.574	4.2
	0.00006	205	102	3.555	3.3	1498	749	3.556	4.1
	0.00007	153	76	3.533	3.2	1107	553	3.535	4.0
	0.00008	130	65	3.513	3.1	934	467	3.515	3.9
	0.00009	85	43	3.479	2.9	601	300	3.482	3.8
0.00005	0.00006	222	111	3.367	3.4	1478	739	3.368	4.1
	0.00007	182	91	3.345	3.3	1197	599	3.347	4.0
	0.00008	147	73	3.325	3.2	958	479	3.327	4.0
	0.00009	97	49	3.291	3.0	623	311	3.294	3.8

Table 3: SSQSVSS-2 known σ plans of $P_a(p_m)$ Values

SSAOQL	SSAQL						
	0.000001	0.000002	0.000003	0.000004	0.000005	0.00001	0.00005
0.000002	0.91						
0.000003	0.89	0.91					
0.000004	0.84	0.86	0.89				
0.000005	0.81	0.83	0.86	0.88			
0.000006	0.78	0.80	0.83	0.85	0.88		
0.000007	0.76	0.78	0.81	0.83	0.86		
0.000008	0.72	0.74	0.77	0.79	0.82		
0.000009	0.71	0.73	0.76	0.78	0.81		
0.00001	0.63	0.65	0.68	0.70	0.73		
0.00002	0.61	0.63	0.66	0.68	0.71	0.74	
0.00003	0.58	0.60	0.63	0.65	0.68	0.71	
0.00004	0.54	0.56	0.59	0.61	0.64	0.67	
0.00005	0.51	0.53	0.56	0.58	0.61	0.64	
0.00006		0.41	0.44	0.46	0.49	0.52	0.57

0.00007			0.38	0.40	0.43	0.46	0.51
0.00008				0.35	0.38	0.41	0.46
0.00009					0.32	0.35	0.40

Table 4: SSQSVSS-3 known σ plans of $P_a(p_m)$ Values

SSAOQL	SSAQL (p_1)						
	0.000001	0.000002	0.000003	0.000004	0.000005	0.00001	0.00005
0.000002	0.90						
0.000003	0.88	0.90					
0.000004	0.83	0.85	0.88				
0.000005	0.80	0.82	0.85	0.88			
0.000006	0.77	0.79	0.82	0.85	0.88		
0.000007	0.75	0.77	0.80	0.83	0.86		
0.000008	0.71	0.73	0.76	0.79	0.82		
0.000009	0.70	0.72	0.75	0.78	0.81		
0.00001	0.62	0.64	0.67	0.70	0.73		
0.00002	0.60	0.62	0.65	0.68	0.71	0.74	
0.00003	0.57	0.59	0.62	0.65	0.68	0.71	
0.00004	0.53	0.55	0.58	0.61	0.64	0.67	
0.00005	0.50	0.52	0.55	0.58	0.61	0.64	
0.00006		0.40	0.43	0.46	0.49	0.52	0.57
0.00007			0.37	0.40	0.43	0.46	0.51
0.00008				0.34	0.37	0.40	0.45
0.00009					0.31	0.34	0.39