• AQL DECEPTION AND ALTERNATIVE

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An E-mail Inquiry

I have the following question on AQL (Acceptable Quality Level). Hope you can help.

For AQL: 0.65
Lot size: 15000
Sampling: Single
Inspection level II

The sample size code I got is M and the MIL-STD-105D indicated that the sample size should be 315 with 5
accept and 6 reject.

Question: What is the probability that a bad lot is accepted with this sampling plan? If one changes to a sampling plan of 20 with 0 accept and 1 reject, what is the probability that a bad lot is accepted?

Thanks in advance for your help.

Response

I think that AQL sampling can be *very* deceiving. For example, I am confused by what is considered to be a "bad" lot?

A reduced sample size test procedure along with its implications is shown in Section 18.6 (1); however, I believe one can gain an appreciation of the dilemma confronted when trying to make lot pass/fail decisions by looking at confidence intervals.

When we assume the sample size is small relative to the population size, the 95% confidence intervals for the population failure rate ρ are:

5 failures from a sample of 315: $0.005173 \leq \rho \leq 0.036652$
6 failures from a sample of 315: $0.007021 \leq \rho \leq 0.040996$
0 failures from a sample of 20: $0.000000 \leq \rho \leq 0.139108$
1 failure from a sample of 20: $0.001265 \leq \rho \leq 0.248733$

As you can see even with a relatively large sample size the confidence interval is larger that you might expect. With this confidence interval you are probably not getting the acceptance risk level for the test that you really want.

For the low failure rates of today we can get much more information with less work when we measure the process that produces the product on a continuing basis, not as to whether an individual batch meets an AQL criterion or not. Section 10.1 (1) elaborates more on this.

It is more beneficial when customers ask their supplier questions that lead to the right activity. AQL testing has a "testing quality into the product" connotation. Instead of AQL testing the Smarter Six Sigma Solutions (S^4) approach would be for the supplier to measure a Key Process Output Variable (KPOV) of

the process that produces the product on an ongoing basis. This measure would assess the product as all customers receive it and then is track using a 30,000 Foot-Level control chart (3, 4). If the response could not be changed to a continuous response, the centerline of attribute control chart could be viewed as the best estimate for the "capability" of the product.

It would be much better if the 30,000 Foot-Level response could be quantified as a continuous variable. For this case all common cause data could be examined collectively to estimate the percentage expected beyond specification limits. A probability plot could be used to make such assessment.

Within companies there is a cultural difference between accepting the AQL procedure approach and the S^4 alternative. The AQL procedure has a fire fighting mentality. That is, everything is okay until a lot is rejected. When this occurs someone is then assigned the task of *fixing the problem of today*. With the S^4 approach we would view the overall output of the process. If the process has an unacceptable level of common cause non-conformance, we would establish a Six Sigma team to look at all data collectively when making improvements and establishing control measures for KPIV's to the process.(2)

References

1. Breyfogle, F. W. (1999), *Implementing Six Sigma: Smarter Solutions using Statistical Methods*, Wiley, New York.
2. Breyfogle, F. W. (2001), James M. Cupello, Becki Meadows, *Managing Six Sigma: A Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success*, Wiey, New York 2001.
3. Breyfogle III, F. W. David Enck, Phil Flories, Tom Pearson (2002), *Wisdom on the Green: Smarter Six Sigma Business Solutions*, Smarter Solutions, Austin.
4. Breyfogle III, F. W. and Becki Meadows (2001), "Bottom-line Success with Six Sigma," *Quality Progress*, May 2001.