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Establishing the AQL

The Acceptable Quality Level (AQL) is a common index to attribute sampling plans. Selecting an AQL is an application of risk management, so understanding its role and how it quantifies risk is important for the Quality Engineer (QE).

There are two aspects of the AQL that help guide the QE's decision. We start with definitions from Z1.4[1].

- The *AQL* is the maximum percentage nonconforming … that, for purposes of sampling inspection, can be considered satisfactory as a process average.
- The *process average* is the average percent nonconforming … of product submitted by the supplier for original inspection.

In the paradigm case, we sample at incoming inspection from an external supplier. This is not the only case, but illustrates the concepts.

Risk Determines the AQL

Sampling, by its very nature, implies risk. A sampling plan makes an accept/reject decision on a lot, after looking at only some of its items. We accept the risk of nonconforming items in the portion of the lot we didn't inspect. Going back to the definitions, unless the process average is zero, the process will produce some nonconforming material. Sampling accepts the risk that some of this nonconforming material will go to inventory.

The conceptual meaning of AQL, our first aspect, is that it is the maximum acceptable process average. Your Purchase Order might say, "The customer will accept product when the process average is 1.0% or better." In this case, the AQL is 1.0%. If the process average gets worse, say 1.5%, you will stop accepting product. With a sampling plan, you will accept the great majority of submitted lots, as long as the process average is 1.0% or less. The sampling plan cannot discriminate between process average values that are close together.

AQL is Also a Statistical Term

This is a segue to the second aspect of AQL, the technical meaning. Through the operating characteristic curve (OC curve), you can predict, in the long run, the percentage of lots a particular sampling plan will accept. The OC curve plots the process average on the x-axis and the probability of lot acceptance on the y-axis. By convention, the AQL is the point on the OC curve with a probability of acceptance of 95%. In our conceptual meaning the point (1.0%, 95.0%) is on the curve. This means if the supplier process operates at 1.0%, you will accept 95% of the lots submitted (in the long run).

[1] ANSI/ASQ Z1.4-2008: Sampling Procedures and Tables for Inspection by Attributes

Of course, you expect the supplier to have a process average that runs better than 1.0%. The sampling plan will accept a higher percentage of lots from this better process.

Illustrating the OC Curve

The OC curve in Figure 1 plots the probability of acceptance as a function of the process average. Figure 1 shows the AQL, the process average with a 95% probability of acceptance. Figure 1 also has another important point, the Rejectable Quality Level (RQL). By convention, this is the process average with 10% probability of acceptance. The RQL is also called the Lot Tolerance Percent Defective (LTPD).

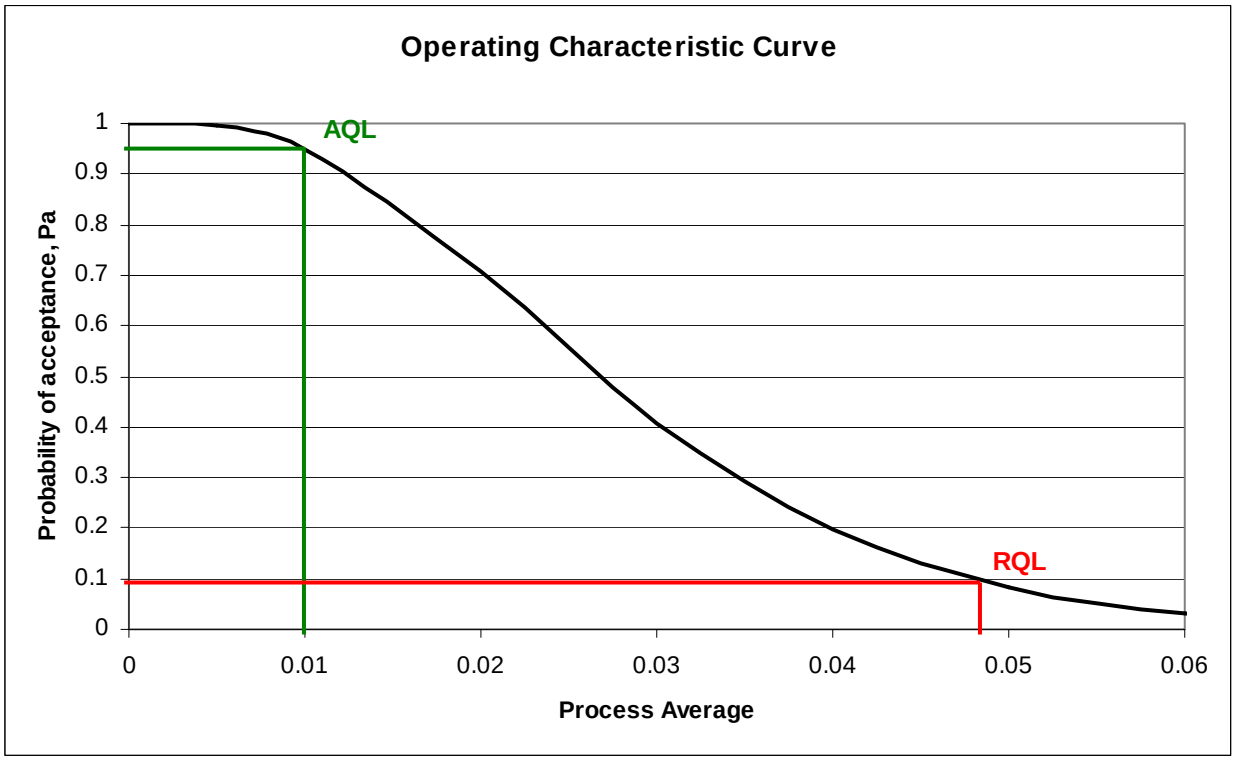

Figure 1 An OC Curve Showing the AQL and RQL Points

Understanding the OC curve is critical for the Quality Engineer. It describes the action of the sampling plan. In particular, it defines the risk associated with sampling.