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3-Way Control Charts

In this lesson, we've focused on using subgroups to provide an estimate of the standard deviation within the subgroups.

But what about the variation between the subgroups? If the variability within subgroups is very small compared to the subgroup-to-subgroup variability, the limits on the X-bar chart might not be appropriate.

You can use 3-way control charts to study both variation within subgroups and variation between subgroups.

Let's look at a new example. You are studying fill weights for vials of a chemical. After production, batches of the chemical are divided into vials. The target fill weight for the vials is 6.1 grams.

You weigh six vials per batch over the course of five days. Here, a subgroup is six vials drawn from the same batch.

You use a control chart to study both the average fill weight per subgroup and the within-subgroup variability over time.

You plot the data using an X-bar and R chart, and immediately see some problems. Many points in both the average and range chart are outside the control limits.

When we look closer at the data, we see why this is happening. There is variability within the subgroups. But there is also a lot of variability between the subgroups.

A 3-way control chart adds a third plot to capture this between-batch variability. This is a plot of the moving ranges between the batches.

The control limits for the X-bar chart are now based on the variability between subgroups rather than the variability within subgroups. Now the control limits for the X-bar chart are much more realistic.

We can use these limits to study the stability of vial fill weights and to make statements about the performance of the process.

For example, now we can see that there appears to be a repeating or systematic pattern in the measurements of the samples across the five days.

In this video, you learned how to study both within- and between-subgroup variation using 3-way control charts. In the next video, you see how to construct 3-way control charts in JMP.

For more information about 3-way control charts and for information about systematic variation, see the Read About It for this lesson.

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