ANOVA Test Type

The Analysis of Variance (ANOVA) test type for the GR&R Report produces an Analysis of Variation Table that breaks down variation into four categories: parts, operators, interaction between parts and operators, and errors caused by the gage.

This test type produces a report with the following content:

Analysis of Variation Table

The Analysis of Variation Table for this test type lists each of the following values for the Operator, Parts, Opr X Parts (interaction of operators and parts), and Gage (Error):

SOURCE: This column lists the causes of the variations. Variance estimates for each cause are calculated as follows:

Gage: Mse

Interaction (Oper x Parts):

$$\frac{MS_{po} - MS_e}{r}$$

Operator:

$$C_g = \frac{0.15 \times \sigma_{process}}{S_{gage}}$$

Part:

> **DF:** This column lists the degrees of freedom associated with the source.

> **SS:** This is the sum of squares column, which lists the deviation around the mean of the source.

> **MS:** This is the mean square column, which lists the sum of squares divided by the degree of freedom.

> **F:** Values in this column are calculated only for the interaction. The F ratio is calculated as the mean square of interaction divided by the mean square gage (error).

> **Totals:** Totals for each of the values above are listed.

Judgment

> **Judgment:** This column displays below the Analysis of Variation Table only if you have set the report's configure options to **Show Judgment**. Values for **a** and **F** will display, along with a rating of the process's interaction variation: either **IS Significant** or **IS NOT Significant**. Significant interaction is determined by computing the F statistics for part and operator interaction and comparing the F statistic to an upper percentage point of an F distribution with numerator and denominator degrees of freedom taken from the

"Table of d*2 Values". If the interaction is significant, the non-additive model is used to calculate variance components and confidence limits. If the interaction is not significant, the additive model is used. Refer to Variance Component and Confidence Limit Calculations for the calculations used in the additive and nonadditive models.

Variation Table

All reports using the ANOVA test type also include a table listing the following values:

Variance: This column lists the variance in repeatability, operators, interaction between operators and parts, repeatability and reproducibility, and parts.

Std. Dev.: This column lists the standard deviation in repeatability, operators, interaction between operators and parts, repeatability and reproducibility, and parts.

.90 Lower: This column lists the lower confidence limits for repeatability, operators, interaction between operators and parts, repeatability and reproducibility, and parts.

.90 Upper: This column lists the upper confidence limits for repeatability, operators, interaction between operators and parts, repeatability and reproducibility, and parts.

Variation: This column lists the total variation for each variance component.

% of Total: This column lists the percent of total variation for each variation component, calculated by dividing the total process variation by the variation of each component and multiplying by 100.

% of Contrib: This column lists the percent of total variation assignable to each variation component, calculated by dividing the total process variation by the variation of each component, squaring the result and multiplying by 100.

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