Gage R&R Study - ANOVA Method

**\* NOTE \* There are no operator values, or they are all the same. The operator factor will be  
omitted from the analysis.**

Gage R&R for Pat Score

|  |  |
| --- | --- |
| Gage name: | Snap Ring Verify |
| Date of study: | 06/24/2022 |
| Reported by: | AIS Technologies Group |
| Tolerance: |  |
| Misc: |  |

One-Way ANOVA Table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | DF | SS | MS | F | P |
| Part No | 9 | 0.0005774 | 0.0000642 | 24.3360 | 0.000 |
| Repeatability | 20 | 0.0000527 | 0.0000026 |  |  |
| Total | 29 | 0.0006301 |  |  |  |

*α to remove interaction term = 0.05*

Gage R&R

Variance Components

|  |  |  |
| --- | --- | --- |
| Source | VarComp | %Contribution (of VarComp) |
| Total Gage R&R | 0.0000026 | 11.39 |
| Repeatability | 0.0000026 | 11.39 |
| Part-To-Part | 0.0000205 | 88.61 |
| Total Variation | 0.0000231 | 100.00 |

Process tolerance = 0.5

Gage Evaluation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source | StdDev (SD) | Study Var (6 × SD) | %Study Var (%SV) | %Tolerance (SV/Toler) |
| Total Gage R&R | 0.0016236 | 0.0097418 | 33.75 | 1.95 |
| Repeatability | 0.0016236 | 0.0097418 | 33.75 | 1.95 |
| Part-To-Part | 0.0045284 | 0.0271702 | 94.13 | 5.43 |
| Total Variation | 0.0048106 | 0.0288639 | 100.00 | 5.77 |

Number of Distinct Categories = 3

Probabilities of Misclassification

Joint Probability

|  |  |
| --- | --- |
| Description | Probability |
| A randomly selected part is bad but accepted | 0.000 |
| A randomly selected part is good but rejected | 0.000 |

Conditional Probability

|  |  |
| --- | --- |
| Description | Probability |
| A part from a group of bad products is accepted | 0.292 |
| A part from a group of good products is rejected | 0.000 |

Gage R&R for Pat Score

Gage R&R Study - ANOVA Method

**\* NOTE \* There are no operator values, or they are all the same. The operator factor will be  
omitted from the analysis.**

Gage R&R for Pat Scale

|  |  |
| --- | --- |
| Gage name: | Snap Ring Verify |
| Date of study: | 06/24/2022 |
| Reported by: | AIS Technologies Group |
| Tolerance: |  |
| Misc: |  |

One-Way ANOVA Table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | DF | SS | MS | F | P |
| Part No | 9 | 0.0000276 | 0.0000031 | 98.4325 | 0.000 |
| Repeatability | 20 | 0.0000006 | 0.0000000 |  |  |
| Total | 29 | 0.0000282 |  |  |  |

*α to remove interaction term = 0.05*

Gage R&R

Variance Components

|  |  |  |
| --- | --- | --- |
| Source | VarComp | %Contribution (of VarComp) |
| Total Gage R&R | 0.0000000 | 2.99 |
| Repeatability | 0.0000000 | 2.99 |
| Part-To-Part | 0.0000010 | 97.01 |
| Total Variation | 0.0000010 | 100.00 |

Process tolerance = 2

Gage Evaluation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source | StdDev (SD) | Study Var (6 × SD) | %Study Var (%SV) | %Tolerance (SV/Toler) |
| Total Gage R&R | 0.0001765 | 0.0010593 | 17.28 | 0.05 |
| Repeatability | 0.0001765 | 0.0010593 | 17.28 | 0.05 |
| Part-To-Part | 0.0010061 | 0.0060367 | 98.50 | 0.30 |
| Total Variation | 0.0010215 | 0.0061289 | 100.00 | 0.31 |

Number of Distinct Categories = 8

Probabilities of Misclassification

Joint Probability

|  |  |
| --- | --- |
| Description | Probability |
| A randomly selected part is bad but accepted | 0.000 |
| A randomly selected part is good but rejected | 0.000 |

Conditional Probability

|  |  |
| --- | --- |
| Description | Probability |
| A part from a group of bad products is accepted | \* |
| A part from a group of good products is rejected | 0.000 |

*Probability of part within spec limits = 1.*

Gage R&R for Pat Scale

Gage R&R Study - ANOVA Method

**\* NOTE \* There are no operator values, or they are all the same. The operator factor will be  
omitted from the analysis.**

Gage R&R for Blob Area

|  |  |
| --- | --- |
| Gage name: | Snap Ring Verify |
| Date of study: | 06/24/2022 |
| Reported by: | AIS Technologies Group |
| Tolerance: |  |
| Misc: |  |

One-Way ANOVA Table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | DF | SS | MS | F | P |
| Part No | 9 | 25415.2 | 2823.91 | 636.972 | 0.000 |
| Repeatability | 20 | 88.7 | 4.43 |  |  |
| Total | 29 | 25503.9 |  |  |  |

*α to remove interaction term = 0.05*

Gage R&R

Variance Components

|  |  |  |
| --- | --- | --- |
| Source | VarComp | %Contribution (of VarComp) |
| Total Gage R&R | 4.433 | 0.47 |
| Repeatability | 4.433 | 0.47 |
| Part-To-Part | 939.826 | 99.53 |
| Total Variation | 944.259 | 100.00 |

Process tolerance = 200

Gage Evaluation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source | StdDev (SD) | Study Var (6 × SD) | %Study Var (%SV) | %Tolerance (SV/Toler) |
| Total Gage R&R | 2.1055 | 12.633 | 6.85 | 6.32 |
| Repeatability | 2.1055 | 12.633 | 6.85 | 6.32 |
| Part-To-Part | 30.6566 | 183.939 | 99.76 | 91.97 |
| Total Variation | 30.7288 | 184.373 | 100.00 | 92.19 |

Number of Distinct Categories = 20

Probabilities of Misclassification

Joint Probability

|  |  |
| --- | --- |
| Description | Probability |
| A randomly selected part is bad but accepted | 0.001 |
| A randomly selected part is good but rejected | 0.001 |

Conditional Probability

|  |  |
| --- | --- |
| Description | Probability |
| A part from a group of bad products is accepted | 0.065 |
| A part from a group of good products is rejected | 0.001 |

Gage R&R for Blob Area

Gage R&R Study - ANOVA Method

**\* NOTE \* There are no operator values, or they are all the same. The operator factor will be  
omitted from the analysis.**

Gage R&R for Circle Radius

|  |  |
| --- | --- |
| Gage name: | Snap Ring Verify |
| Date of study: | 06/24/2022 |
| Reported by: | AIS Technologies Group |
| Tolerance: |  |
| Misc: |  |

One-Way ANOVA Table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | DF | SS | MS | F | P |
| Part No | 9 | 2.02068 | 0.224520 | 0.718183 | 0.687 |
| Repeatability | 20 | 6.25245 | 0.312622 |  |  |
| Total | 29 | 8.27313 |  |  |  |

*α to remove interaction term = 0.05*

Gage R&R

Variance Components

|  |  |  |
| --- | --- | --- |
| Source | VarComp | %Contribution (of VarComp) |
| Total Gage R&R | 0.312622 | 100.00 |
| Repeatability | 0.312622 | 100.00 |
| Part-To-Part | 0.000000 | 0.00 |
| Total Variation | 0.312622 | 100.00 |

Process tolerance = 10

Gage Evaluation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source | StdDev (SD) | Study Var (6 × SD) | %Study Var (%SV) | %Tolerance (SV/Toler) |
| Total Gage R&R | 0.559126 | 3.35476 | 100.00 | 33.55 |
| Repeatability | 0.559126 | 3.35476 | 100.00 | 33.55 |
| Part-To-Part | 0.000000 | 0.00000 | 0.00 | 0.00 |
| Total Variation | 0.559126 | 3.35476 | 100.00 | 33.55 |

Number of Distinct Categories = 1

Probabilities of Misclassification

**\* WARNING \* Degenerate bivariate detected:  The variance-covariance matrix has determinant =  
0. Unable to proceed.**

Gage R&R for Circle Radius