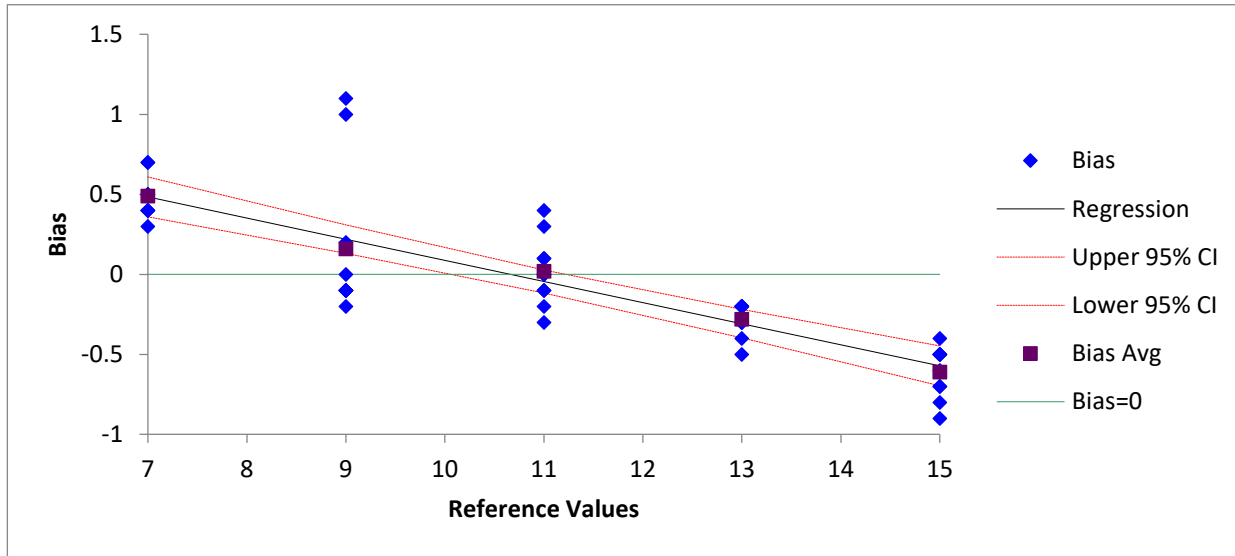


## Linearity and Bias Study

|                 |                              |
|-----------------|------------------------------|
| Date:           | Operator:                    |
| Gage Name:      | Process Sigma: 0.2           |
| Characteristic: | Number of Parts: 5           |
| Analysis by:    | Maximum Number of Trials: 10 |

### Linearity Chart



This is a plot of bias (operator result - reference value for the part) against the reference value. The best fit line is also shown. If this line is close to horizontal, then the bias does not change across the parts. If the horizontal line is close to 0, then there is no significant bias. If the line is not close to horizontal, the bias may change across the reference values. The regression results below determine this.

### Linearity Results

Best Fit Equation: Bias = 1.408 + -0.132(Reference Value)

R Squared = % of variation in bias explained by variation in reference values = 69.40%  
 s = estimate of standard deviation about the best fit line = 0.253

|           | Coef.  | SE     | 95% LCL | 95% UCL | t      | p     |
|-----------|--------|--------|---------|---------|--------|-------|
| Intercept | 1.408  | 0.144  | 1.119   | 1.697   | 9.798  | 0.000 |
| Slope     | -0.132 | 0.0127 | -0.157  | -0.107  | -10.43 | 0.000 |

Linearity = 6(process sigma)(|slope|) = 0.158  
 % Linearity = 100(Linearity)/(6\*process sigma) = 13.20%

**The p-value for the slope is less than 0.05. Linearity is present.**

Assess the bias at each reference value below.  
 Those with p-values < 0.05 have significant bias.

### Bias Results

| Reference Value | Bias    | %Bias  | StDev of Mean | t     | p     |
|-----------------|---------|--------|---------------|-------|-------|
| Average         | -0.0440 | 3.67%  | 0.0364        | 1.210 | 0.233 |
| 7               | 0.490   | 40.83% | 0.0407        | 12.04 | 0.000 |
| 9               | 0.160   | 13.33% | 0.152         | 1.051 | 0.320 |
| 11              | 0.0200  | 1.67%  | 0.0680        | 0.294 | 0.775 |
| 13              | -0.280  | 23.33% | 0.0327        | 8.573 | 0.000 |
| 15              | -0.610  | 50.83% | 0.0504        | 12.09 | 0.000 |

The following reference values have significant bias:  
7, 13, 15

### Data

| Run | Part | Reference | Result |
|-----|------|-----------|--------|
| 1   | 1    | 7         | 7.7    |
| 2   | 1    | 7         | 7.5    |
| 3   | 1    | 7         | 7.4    |
| 4   | 1    | 7         | 7.5    |
| 5   | 1    | 7         | 7.7    |
| 6   | 1    | 7         | 7.3    |
| 7   | 1    | 7         | 7.5    |
| 8   | 1    | 7         | 7.5    |
| 9   | 1    | 7         | 7.4    |
| 10  | 1    | 7         | 7.4    |
| 11  | 2    | 9         | 10.1   |
| 12  | 2    | 9         | 8.9    |
| 13  | 2    | 9         | 9.2    |
| 14  | 2    | 9         | 10     |
| 15  | 2    | 9         | 8.8    |
| 16  | 2    | 9         | 8.9    |
| 17  | 2    | 9         | 8.9    |
| 18  | 2    | 9         | 8.9    |
| 19  | 2    | 9         | 8.9    |
| 20  | 2    | 9         | 9      |
| 21  | 3    | 11        | 10.8   |
| 22  | 3    | 11        | 10.7   |
| 23  | 3    | 11        | 10.9   |
| 24  | 3    | 11        | 10.9   |
| 25  | 3    | 11        | 11     |
| 26  | 3    | 11        | 11.1   |
| 27  | 3    | 11        | 11     |
| 28  | 3    | 11        | 11.1   |
| 29  | 3    | 11        | 11.4   |
| 30  | 3    | 11        | 11.3   |
| 31  | 4    | 13        | 12.6   |

|    |   |    |      |
|----|---|----|------|
| 32 | 4 | 13 | 12.7 |
| 33 | 4 | 13 | 12.8 |
| 34 | 4 | 13 | 12.7 |
| 35 | 4 | 13 | 12.8 |
| 36 | 4 | 13 | 12.8 |
| 37 | 4 | 13 | 12.8 |
| 38 | 4 | 13 | 12.7 |
| 39 | 4 | 13 | 12.8 |
| 40 | 4 | 13 | 12.5 |
| 41 | 5 | 15 | 14.1 |
| 42 | 5 | 15 | 14.3 |
| 43 | 5 | 15 | 14.5 |
| 44 | 5 | 15 | 14.3 |
| 45 | 5 | 15 | 14.4 |
| 46 | 5 | 15 | 14.5 |
| 47 | 5 | 15 | 14.5 |
| 48 | 5 | 15 | 14.5 |
| 49 | 5 | 15 | 14.6 |
| 50 | 5 | 15 | 14.2 |