THERMAL EXPANSION ERROR

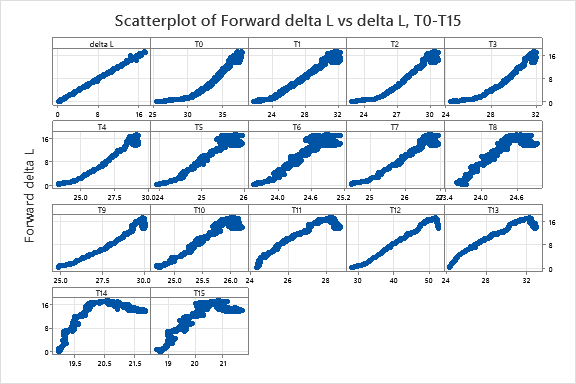
**Descriptive Statistics: delta L, T0, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15**

**Statistics**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Total Count** | **Mean** | **SE Mean** | **StDev** | **Minimum** | **Q1** | **Median** | **Q3** | **Maximum** |
| delta L | 4682 | 14.050 | 0.0510 | 3.490 | -0.0088 | 13.845 | 15.331 | 16.105 | 17.372 |
| T0 | 4682 | 36.623 | 0.0259 | 1.773 | 25.361 | 36.952 | 37.238 | 37.432 | 37.958 |
| T1 | 4682 | 30.784 | 0.0265 | 1.815 | 21.765 | 30.985 | 31.417 | 31.704 | 32.325 |
| T2 | 4682 | 29.723 | 0.0177 | 1.214 | 22.864 | 29.808 | 30.129 | 30.358 | 30.801 |
| T3 | 4682 | 31.222 | 0.0170 | 1.161 | 24.433 | 31.470 | 31.630 | 31.754 | 32.063 |
| T4 | 4682 | 28.479 | 0.0149 | 1.020 | 23.326 | 28.591 | 28.814 | 29.006 | 29.251 |
| T5 | 4682 | 25.556 | 0.00519 | 0.355 | 23.916 | 25.512 | 25.662 | 25.769 | 25.977 |
| T6 | 4682 | 24.720 | 0.00398 | 0.272 | 23.552 | 24.643 | 24.792 | 24.901 | 25.124 |
| T7 | 4682 | 26.536 | 0.00651 | 0.445 | 24.452 | 26.549 | 26.672 | 26.779 | 26.958 |
| T8 | 4682 | 24.536 | 0.00403 | 0.276 | 23.585 | 24.477 | 24.587 | 24.737 | 24.932 |
| T9 | 4682 | 29.490 | 0.0145 | 0.992 | 24.823 | 29.688 | 29.868 | 29.951 | 30.075 |
| T10 | 4682 | 25.899 | 0.00439 | 0.301 | 24.662 | 25.886 | 25.985 | 26.084 | 26.228 |
| T11 | 4682 | 27.835 | 0.0161 | 1.099 | 24.366 | 27.785 | 28.299 | 28.497 | 28.773 |
| T12 | 4682 | 49.659 | 0.0758 | 5.186 | 28.130 | 49.758 | 52.195 | 52.436 | 52.648 |
| T13 | 4682 | 31.419 | 0.0321 | 2.196 | 24.286 | 31.394 | 32.389 | 32.728 | 32.984 |
| T14 | 4682 | 20.688 | 0.0115 | 0.788 | 18.951 | 20.087 | 20.819 | 21.336 | 21.848 |
| T15 | 4682 | 20.619 | 0.0102 | 0.697 | 18.550 | 20.312 | 20.691 | 21.170 | 21.763 |

THERMAL EXPANSION ERROR

**Scatterplot of Forward delta L vs delta L, T0, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15**



THERMAL EXPANSION ERROR

**Regression Analysis: Forward delta L versus T0, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, delta L**

**Regression Equation**

|  |  |  |
| --- | --- | --- |
| Forward delta L | = | 3.79 + 0.0171 T0 - 0.0009 T1 + 0.0128 T2 + 0.0258 T3 - 0.0146 T4 - 0.1414 T5 + 0.139 T6 - 0.0003 T7 - 0.0726 T8 - 0.0013 T9 - 0.0674 T10 - 0.0622 T11 + 0.0144 T12 + 0.1554 T13 - 0.2457 T14 + 0.0374 T15 + 0.93215 delta L |

**Coefficients**

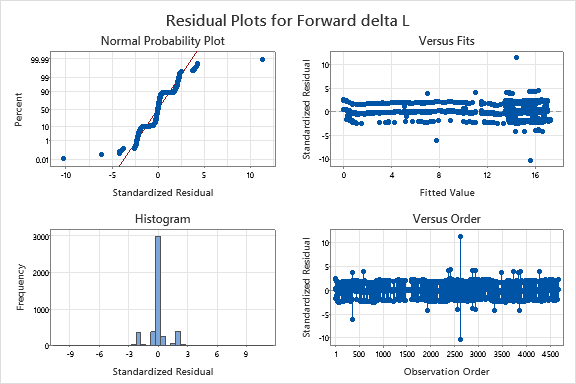
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Term** | **Coef** | **SE Coef** | **95% CI** | **T-Value** | **P-Value** | **VIF** |
| Constant | 3.79 | 1.22 | (1.41, 6.17) | 3.12 | 0.002 |  |
| T0 | 0.0171 | 0.0136 | (-0.0096, 0.0438) | 1.25 | 0.210 | 175.21 |
| T1 | -0.0009 | 0.0131 | (-0.0267, 0.0248) | -0.07 | 0.944 | 170.51 |
| T2 | 0.0128 | 0.0309 | (-0.0478, 0.0734) | 0.41 | 0.679 | 422.46 |
| T3 | 0.0258 | 0.0450 | (-0.0624, 0.1140) | 0.57 | 0.567 | 817.70 |
| T4 | -0.0146 | 0.0709 | (-0.1536, 0.1244) | -0.21 | 0.837 | 1567.10 |
| T5 | -0.1414 | 0.0939 | (-0.3255, 0.0427) | -1.51 | 0.132 | 333.55 |
| T6 | 0.139 | 0.104 | (-0.064, 0.342) | 1.34 | 0.180 | 238.53 |
| T7 | -0.0003 | 0.0836 | (-0.1642, 0.1635) | -0.00 | 0.997 | 415.27 |
| T8 | -0.0726 | 0.0531 | (-0.1767, 0.0316) | -1.37 | 0.172 | 64.26 |
| T9 | -0.0013 | 0.0457 | (-0.0910, 0.0884) | -0.03 | 0.977 | 616.91 |
| T10 | -0.0674 | 0.0741 | (-0.2127, 0.0780) | -0.91 | 0.363 | 148.86 |
| T11 | -0.0622 | 0.0570 | (-0.1739, 0.0496) | -1.09 | 0.275 | 1175.96 |
| T12 | 0.0144 | 0.0156 | (-0.0161, 0.0449) | 0.92 | 0.356 | 1951.98 |
| T13 | 0.1554 | 0.0435 | (0.0702, 0.2407) | 3.57 | 0.000 | 2734.12 |
| T14 | -0.2457 | 0.0232 | (-0.2912, -0.2002) | -10.58 | 0.000 | 100.25 |
| T15 | 0.0374 | 0.0144 | (0.0092, 0.0656) | 2.60 | 0.009 | 30.09 |
| delta L | 0.93215 | 0.00532 | (0.92172, 0.94258) | 175.19 | 0.000 | 103.38 |

**Model Summary**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S** | **R-sq** | **R-sq(adj)** | **PRESS** | **R-sq(pred)** | **AICc** | **BIC** |
| 0.124949 | 99.87% | 99.87% | 73.4149 | 99.87% | -6168.62 | -6046.20 |

**Analysis of Variance**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **Seq SS** | **Contribution** | **Adj SS** | **Adj MS** | **F-Value** | **P-Value** |
| Regression | 17 | 56734.8 | 99.87% | 56734.8 | 3337.34 | 213763.04 | 0.000 |
| T0 | 1 | 50711.4 | 89.27% | 0.0 | 0.02 | 1.57 | 0.210 |
| T1 | 1 | 75.4 | 0.13% | 0.0 | 0.00 | 0.00 | 0.944 |
| T2 | 1 | 303.5 | 0.53% | 0.0 | 0.00 | 0.17 | 0.679 |
| T3 | 1 | 18.9 | 0.03% | 0.0 | 0.01 | 0.33 | 0.567 |
| T4 | 1 | 47.4 | 0.08% | 0.0 | 0.00 | 0.04 | 0.837 |
| T5 | 1 | 9.6 | 0.02% | 0.0 | 0.04 | 2.27 | 0.132 |
| T6 | 1 | 406.7 | 0.72% | 0.0 | 0.03 | 1.80 | 0.180 |
| T7 | 1 | 25.1 | 0.04% | 0.0 | 0.00 | 0.00 | 0.997 |
| T8 | 1 | 434.9 | 0.77% | 0.0 | 0.03 | 1.86 | 0.172 |
| T9 | 1 | 560.7 | 0.99% | 0.0 | 0.00 | 0.00 | 0.977 |
| T10 | 1 | 797.6 | 1.40% | 0.0 | 0.01 | 0.83 | 0.363 |
| T11 | 1 | 384.3 | 0.68% | 0.0 | 0.02 | 1.19 | 0.275 |
| T12 | 1 | 68.6 | 0.12% | 0.0 | 0.01 | 0.85 | 0.356 |
| T13 | 1 | 659.7 | 1.16% | 0.2 | 0.20 | 12.78 | 0.000 |
| T14 | 1 | 1724.7 | 3.04% | 1.7 | 1.75 | 111.98 | 0.000 |
| T15 | 1 | 27.3 | 0.05% | 0.1 | 0.11 | 6.76 | 0.009 |
| delta L | 1 | 479.1 | 0.84% | 479.1 | 479.15 | 30690.24 | 0.000 |
| Error | 4664 | 72.8 | 0.13% | 72.8 | 0.02 |  |  |
| Total | 4681 | 56807.6 | 100.00% |  |  |  |  |



THERMAL EXPANSION ERROR

**Best Subsets Regression: Forward delta L versus delta L, T0, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15**

**Response is Forward delta L**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Vars** | **R-Sq** | **R-Sq (adj)** | **PRESS** | **R-Sq (pred)** | **Mallows Cp** | **S** | **AICc** | **BIC** | **Cond No** | **L** | **T 0** | **T 1** | **T 2** | **T 3** | **T 4** | **T 5** | **T 6** | **T 7** | **T 8** | **T 9** | **T 10** | **T 11** | **T 12** | **T 13** | **T 14** | **T 15** |
| 1 | 99.9 | 99.9 | 75.4 | 99.9 | 144.5 | 0.12684 | -6044.309 | -6024.960 | 1.000 | X |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 89.3 | 89.3 | 6115.6 | 89.2 | 385795.7 | 1.1413 | 14528.717 | 14548.066 | 1.000 |  | X |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 99.9 | 99.9 | 75.3 | 99.9 | 138.3 | 0.12674 | -6050.231 | -6024.433 | 35.336 | X | X |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 99.9 | 99.9 | 75.3 | 99.9 | 140.3 | 0.12677 | -6048.320 | -6022.522 | 30.085 | X |  |  |  | X |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | 99.9 | 99.9 | 74.1 | 99.9 | 61.8 | 0.12572 | -6125.217 | -6092.973 | 515.294 | X |  |  |  |  |  |  |  |  |  |  |  |  | X |  | X |  |
| 3 | 99.9 | 99.9 | 74.2 | 99.9 | 67.0 | 0.12579 | -6120.093 | -6087.849 | 683.517 | X |  |  |  |  |  |  |  |  |  |  |  |  |  | X | X |  |
| 4 | 99.9 | 99.9 | 73.5 | 99.9 | 22.5 | 0.12518 | -6164.225 | -6125.534 | 1073.988 | X | X |  |  |  |  |  |  |  |  |  |  |  |  | X | X |  |
| 4 | 99.9 | 99.9 | 73.7 | 99.9 | 34.4 | 0.12534 | -6152.435 | -6113.744 | 1004.151 | X |  |  |  |  |  |  |  |  |  |  |  |  | X | X | X |  |
| 5 | 99.9 | 99.9 | 73.2 | 99.9 | 7.6 | 0.12497 | -6179.170 | -6134.033 | 3937.104 | X | X |  |  |  |  |  |  |  |  |  |  | X |  | X | X |  |
| 5 | 99.9 | 99.9 | 73.4 | 99.9 | 16.2 | 0.12509 | -6170.514 | -6125.378 | 1544.570 | X | X |  |  |  |  |  |  |  |  |  | X |  |  | X | X |  |
| 6 | 99.9 | 99.9 | 73.3 | 99.9 | 7.7 | 0.12496 | -6179.067 | -6127.486 | 4876.495 | X | X |  |  |  |  |  |  |  | X |  |  | X |  | X | X |  |
| 6 | 99.9 | 99.9 | 73.3 | 99.9 | 8.2 | 0.12497 | -6178.537 | -6126.956 | 5098.943 | X | X |  |  |  |  |  |  |  |  |  | X | X |  | X | X |  |
| 7 | 99.9 | 99.9 | 73.2 | 99.9 | 4.3 | 0.12490 | -6182.444 | -6124.419 | 6346.394 | X | X |  |  |  |  |  |  |  |  |  | X |  | X | X | X | X |
| 7 | 99.9 | 99.9 | 73.2 | 99.9 | 5.6 | 0.12492 | -6181.123 | -6123.098 | 5648.477 | X | X |  |  |  |  |  |  |  | X |  |  | X |  | X | X | X |
| 8 | 99.9 | 99.9 | 73.2 | 99.9 | 4.2 | 0.12489 | -6182.493 | -6118.025 | 12381.989 | X | X |  |  |  |  |  |  |  |  |  | X | X | X | X | X | X |
| 8 | 99.9 | 99.9 | 73.2 | 99.9 | 5.3 | 0.12490 | -6181.463 | -6116.995 | 7337.202 | X | X |  |  |  |  |  |  | X |  |  | X |  | X | X | X | X |
| 9 | 99.9 | 99.9 | 73.2 | 99.9 | 5.9 | 0.12489 | -6180.835 | -6109.925 | 20012.436 | X | X |  |  |  |  |  |  |  | X |  | X | X | X | X | X | X |
| 9 | 99.9 | 99.9 | 73.2 | 99.9 | 5.9 | 0.12489 | -6180.776 | -6109.866 | 14971.732 | X | X |  | X |  |  |  |  |  |  |  | X | X | X | X | X | X |
| 10 | 99.9 | 99.9 | 73.2 | 99.9 | 5.7 | 0.12488 | -6181.016 | -6103.665 | 16708.786 | X | X |  |  |  |  | X | X |  | X |  |  | X | X | X | X | X |
| 10 | 99.9 | 99.9 | 73.2 | 99.9 | 6.2 | 0.12488 | -6180.539 | -6103.188 | 8960.366 | X | X |  |  | X |  | X | X |  | X |  |  | X |  | X | X | X |
| 11 | 99.9 | 99.9 | 73.2 | 99.9 | 7.1 | 0.12488 | -6179.635 | -6095.843 | 28722.916 | X | X |  |  |  |  | X | X |  | X |  | X | X | X | X | X | X |
| 11 | 99.9 | 99.9 | 73.2 | 99.9 | 7.3 | 0.12489 | -6179.388 | -6095.597 | 20950.492 | X | X |  | X |  |  | X | X |  | X |  |  | X | X | X | X | X |
| 12 | 99.9 | 99.9 | 73.3 | 99.9 | 8.3 | 0.12489 | -6178.365 | -6088.134 | 35438.532 | X | X |  |  | X |  | X | X |  | X |  | X | X | X | X | X | X |
| 12 | 99.9 | 99.9 | 73.3 | 99.9 | 8.4 | 0.12489 | -6178.306 | -6088.075 | 32286.603 | X | X |  | X |  |  | X | X |  | X |  | X | X | X | X | X | X |
| 13 | 99.9 | 99.9 | 73.3 | 99.9 | 10.2 | 0.12490 | -6176.525 | -6079.856 | 38736.495 | X | X |  | X | X |  | X | X |  | X |  | X | X | X | X | X | X |
| 13 | 99.9 | 99.9 | 73.3 | 99.9 | 10.2 | 0.12490 | -6176.499 | -6079.830 | 39429.197 | X | X |  |  | X |  | X | X |  | X | X | X | X | X | X | X | X |
| 14 | 99.9 | 99.9 | 73.3 | 99.9 | 12.0 | 0.12491 | -6174.659 | -6071.552 | 42884.164 | X | X |  | X | X | X | X | X |  | X |  | X | X | X | X | X | X |
| 14 | 99.9 | 99.9 | 73.3 | 99.9 | 12.1 | 0.12491 | -6174.606 | -6071.499 | 42676.476 | X | X |  | X | X |  | X | X |  | X | X | X | X | X | X | X | X |
| 15 | 99.9 | 99.9 | 73.4 | 99.9 | 14.0 | 0.12492 | -6172.650 | -6063.106 | 54540.621 | X | X | X | X | X | X | X | X |  | X |  | X | X | X | X | X | X |
| 15 | 99.9 | 99.9 | 73.4 | 99.9 | 14.0 | 0.12492 | -6172.646 | -6063.102 | 47855.798 | X | X |  | X | X | X | X | X | X | X |  | X | X | X | X | X | X |
| 16 | 99.9 | 99.9 | 73.4 | 99.9 | 16.0 | 0.12494 | -6170.636 | -6054.656 | 68348.547 | X | X | X | X | X | X | X | X |  | X | X | X | X | X | X | X | X |
| 16 | 99.9 | 99.9 | 73.4 | 99.9 | 16.0 | 0.12494 | -6170.635 | -6054.655 | 58552.343 | X | X | X | X | X | X | X | X | X | X |  | X | X | X | X | X | X |
| 17 | 99.9 | 99.9 | 73.4 | 99.9 | 18.0 | 0.12495 | -6168.620 | -6046.205 | 78415.830 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

THERMAL EXPANSION ERROR

**Regression Analysis: Forward delta L versus delta L, T0, T10, T12, T13, T14, T15**

**Regression Equation**

|  |  |  |
| --- | --- | --- |
| Forward delta L | = | 3.694 + 0.02321 T0 - 0.1495 T10 + 0.02211 T12 + 0.1035 T13 - 0.2436 T14 + 0.0456 T15 + 0.93447 delta L |

**Coefficients**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Term** | **Coef** | **SE Coef** | **95% CI** | **T-Value** | **P-Value** | **VIF** |
| Constant | 3.694 | 0.774 | (2.176, 5.212) | 4.77 | 0.000 |  |
| T0 | 0.02321 | 0.00798 | (0.00756, 0.03885) | 2.91 | 0.004 | 60.10 |
| T10 | -0.1495 | 0.0342 | (-0.2165, -0.0825) | -4.38 | 0.000 | 31.64 |
| T12 | 0.02211 | 0.00875 | (0.00496, 0.03927) | 2.53 | 0.012 | 617.90 |
| T13 | 0.1035 | 0.0185 | (0.0673, 0.1397) | 5.60 | 0.000 | 493.70 |
| T14 | -0.2436 | 0.0210 | (-0.2848, -0.2023) | -11.58 | 0.000 | 82.36 |
| T15 | 0.0456 | 0.0115 | (0.0231, 0.0681) | 3.97 | 0.000 | 19.19 |
| delta L | 0.93447 | 0.00520 | (0.92427, 0.94466) | 179.65 | 0.000 | 98.87 |

**Model Summary**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S** | **R-sq** | **R-sq(adj)** | **PRESS** | **R-sq(pred)** | **AICc** | **BIC** |
| 0.124900 | 99.87% | 99.87% | 73.1975 | 99.87% | -6182.44 | -6124.42 |

**Analysis of Variance**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **Seq SS** | **Contribution** | **Adj SS** | **Adj MS** | **F-Value** | **P-Value** |
| Regression | 7 | 56734.7 | 99.87% | 56734.7 | 8104.95 | 519551.41 | 0.000 |
| T0 | 1 | 50711.4 | 89.27% | 0.1 | 0.13 | 8.46 | 0.004 |
| T10 | 1 | 128.1 | 0.23% | 0.3 | 0.30 | 19.14 | 0.000 |
| T12 | 1 | 933.6 | 1.64% | 0.1 | 0.10 | 6.39 | 0.012 |
| T13 | 1 | 56.2 | 0.10% | 0.5 | 0.49 | 31.42 | 0.000 |
| T14 | 1 | 4348.9 | 7.66% | 2.1 | 2.09 | 134.10 | 0.000 |
| T15 | 1 | 53.0 | 0.09% | 0.2 | 0.25 | 15.77 | 0.000 |
| delta L | 1 | 503.5 | 0.89% | 503.5 | 503.46 | 32273.58 | 0.000 |
| Error | 4674 | 72.9 | 0.13% | 72.9 | 0.02 |  |  |
| Total | 4681 | 56807.6 | 100.00% |  |  |  |  |

