TECH NOTES – Average Scale Data

The PerfecTest system provides corrected scale factors in both X and Y axis, for ***each layer*** of a PCB panel, based on historical data from previous jobs with the same construction. To simplify the use of his scaling data, some PerfecTest users average the corrected scale factors for all of the layers of each axis. While this will usually result in some improvement, it does not take full advantage of the potential for reducing scaling error. The following example will help to illustrate the importance of using the corrected scale factors provided for ***each layer***.

Corrected scale factors for layers:

2x 1.00033 (indicates this layer was short in x)
3x 1.00033 (indicates this layer was short in x)
4x 0.99967 (indicates this layer was long in x)
5x 0.99967 (indicates this layer was long in x)

Averaged:
1.00033
1.00033
0.99967
0.99967
4.00000 divided by 4 = 1.0000

By averaging the scale factors for the above example, you may end up using the same scale factor that was used on the original job, with no change in the results, because the + scaling error and - scaling error averaged 0, canceling each other.

Corrected scale factors for layers:

2x 1.00001 (indicates this layer has very small error in +x)
3x 1.00001 (indicates this layer has very small error in +x)
4x 1.00555 (indicates this layer has very large error in +x)
5x 1.00555 (indicates this layer has very large error in +x)

If you average the corrected scale factors in this example, you will nearly double the actual error on layers 2 & 3, while reducing the actual error on layers 4 & 5 by only 50%. By using the corrected scale factor for each layer, the problem is solved.

When the corrected scale factor is used for each layer, the best result will be achieved.

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The formula used by PerfecTest to calculate ***scale factors*** is as follows:

$$\frac{\text{(X or Y) coupon distance, center-to-center}}{\text{X or Y coupon distance, center-to-center + X or Y expansion error}}$$

Example: $\frac{18”}{18.0186”} = .99896$ scale factor

The formula for calculating ***expansion error*** is:

X expansion = (site 2x + site 3x) minus (site 1x + site 4x) divided by 2
Y expansion = (site 3y + site 4y) minus (site 1y + site 2y) divided by 2

Processes and systems described here have become the primary tools for controlling material scaling and registration with fabricators worldwide, ranging from the very largest to some of the smallest. Patents worldwide protect these processes and systems.

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