

## Applications Note

$\Delta = 2t + \frac{\lambda}{2}$  (must equal a whole number of  $\lambda$  for a bright fringe or

$$n\lambda = 2t + \frac{\lambda}{2}$$

$$t = \frac{n\lambda - \frac{\lambda}{2}}{2} = \frac{\lambda}{2} \left( n - \frac{1}{2} \right)$$

substituting

$$D^2 = 2s \left[ \frac{\lambda}{2} \left( n - \frac{1}{2} \right) \right]$$

AN 1079



## Shade Numbering and Shade Sorting


**... calculates a shade number for each sample based on how close its color is to the standard. . .**

### Abstract

The shade sorting feature calculates a shade number for each sample based on how close its color is to the standard, but ALSO has the ability to sort all samples into shade groups and provide data on which samples belong to each shade number. All the samples in a particular group may be used together in producing an end product with certainty that the parts will match .

Shade numbering, sorting, and grouping are used in many industries, but particularly the textile industry. Sorting methods are appropriate for use when the normal color variation within a process is greater than a visible amount of difference and this difference is unacceptable to a customer. The dyeing of textiles is a good example. Variation in temperature, humidity, dye strength, and the dye uptake characteristics of cloth can result in color variation that is visible and unacceptable between cloth pieces used in a cut-and-sew shirt product. Yet the economics of the textile industry do not allow large amounts of re-work.

If the color of each bolt of cloth can be assessed and then the bolts ordered or grouped so that there is no visible difference from bolt to bolt, then a gradual color change can be accommodated between the first and last bolts in a single order. As long as the manufacturer of the shirts cuts and sews in the defined order or grouping, there will be no visible difference within a single shirt, though there might be a slight visible difference between the first shirt and the thirtieth.



Parameter	Value
ΔL*	.008
ΔC*	.07
ΔH*	.000
SS#	555

## Shade Numbering

The shade numbering feature, such as that present in EasyMatch QC software the ColorFlex EZ and MiniScan EZ, performs calculations on the sample data and assigns each sample a shade number based on how close its color is to the standard. This data is presented only as the shade number (i.e., 555, 455). It appears in a field similar to the one shown to the right, obtained using the MiniScan EZ.

This information is presented in the form of three numbers, one representing each component of the color scale. For instance, a sample assigned shade number 555 is very close in color to the standard, which is also 555. A sample with shade number 356 is two blocks from the standard for L\* (3 versus 5), in the same block as the standard for a\* (5 versus 5), and one block from the standard for b\* (6 versus 5). All samples with the same shade number are similar enough that they can be shipped or sewn together.

## Shade Sorting

The shade sorting feature calculates a shade number for each sample based on how close its color is to the standard, but ALSO has the ability to sort all samples into shade groups and provide data on which samples belong to each shade number. All the samples in a particular group may be used together in producing an end product with certainty that the parts will match. For example, shirt sleeves made from fabric placed in the "444" shade group may be slightly off-color in relation to the standard, but the sleeves can still be used in making a shirt provided the shirt body combined with it is also characterized as "444." Shade sorting performs one extra step and groups samples for you by shade numbers. Shade sorting is available in EasyMatch QC software by adding the 555 Shade field to your Color Data Table. Then, with all the samples you wish to sort displayed, click on the 555 Shade column (or row) header to sort the samples based on the shade numbers.

	555 Shade	L*	a*	b*	dE*
Sample89317971	555	25.81	-0.91	-9.46	0.20
Sample89317071	657	27.19	-1.05	-7.61	2.20
Sample893179101	655	26.80	-1.06	-9.70	0.83
Sample8931791012	555	25.65	-0.85	-9.56	0.38
sample893179112	555	26.05	-0.93	-9.65	0.19
Sample8931791122	555	25.55	-0.88	-9.24	0.52
Sample99317931	455	25.28	-0.89	-9.52	0.74
Sample993179312	95+	30.24	-1.32	-4.22	6.75
Sample893179111	555	25.95	-0.95	-9.22	0.26
Sample8931791112	555	26.00	-0.89	-9.37	0.11
Sample109317921	555	25.76	-0.89	-9.58	0.28
Sample1093179212	555	25.77	-0.88	-9.46	0.25
Sample99317941	555	25.72	-0.88	-9.47	0.29
Sample993179412	555	25.69	-1.00	-9.02	0.55
Sample118317991	655	26.69	-0.97	-9.71	0.72

Unsorted Samples

	555 Shade	L*	a*	b*	dE*
Sample8931791012	555	25.65	-0.85	-9.56	0.38
Sample993179412	555	25.69	-1.00	-9.02	0.55
Sample99317941	555	25.72	-0.88	-9.47	0.29
Sample1093179212	555	25.77	-0.88	-9.46	0.25
Sample109317921	555	25.76	-0.89	-9.58	0.28
Sample8931791112	555	26.00	-0.89	-9.37	0.11
Sample893179111	555	25.95	-0.95	-9.22	0.26
sample893179112	555	26.05	-0.93	-9.65	0.19
Sample9530931212	555	25.80	-0.84	-9.97	0.55
Sample8931791122	555	25.55	-0.88	-9.24	0.52
Sample89317971	555	25.81	-0.91	-9.46	0.20
Sample893179101	655	26.80	-1.06	-9.70	0.83
Sample118317991	655	26.69	-0.97	-9.71	0.72
Sample89317071	657	27.19	-1.05	-7.61	2.20
Sample993179312	95+	30.24	-1.32	-4.22	6.75

Samples Sorted by Shade Number

### Shade Grouping

An add-on package to EasyMatch QC, can **group** these samples into clusters of product that are close enough in shade to be shipped together, though the various clusters themselves may be too different from each other to be sold together. It can also taper, or **sequence**, the samples into the order in which you would lay them out on a cutting table, minimizing the color difference between samples placed next to each other. Both of these assessments can be performed much more quickly and repeatably within EasyGroup than they can visually.

**So, when should you use shade numbering/sorting and when should you use grouping or sequencing?**

Shade numbering/sorting is preferable when you wish to sort product based on all three components of the color scale (such as L, a, and b) and to easily understand which of those components differs from the product standard.

Grouping is preferable when you wish to create very few shade groups, as it will generally produce fewer groups than shade sorting. You will also want to use grouping if you wish to maintain group histories and fit new samples into the historical groups, so that customer A always receives similar samples and customer B always receives similar samples, though they may be different from customer A's.

Grouping will be more accurate than shade sorting in cases where samples are very close to the corners of their shade blocks, such as in the picture. (Only two dimensions are shown.) The four circled samples are placed in different shade blocks by shade numbering, though they are very close in shade. EasyGroup would place these samples in the same group and they would, rightly, be used together.

Though basic groupings are based on the CMC color difference equation, EasyGroup also allows you to select one parameter (such as  $L^*$ ,  $a^*$ , or  $b^*$ ) by which to group samples, so if one parameter is your main concern, you will want to use grouping.

If you plan to ship or sew all product, but need to lay them out in an order where the differences between adjoining samples are slight, tapering/sequencing will do what you need.

EasyGroup allows grouping and tapering to be used at the same time, creating groups and then tapering within them. This combination decreases the possibility of visually noticing shade differences more than any single one of these techniques.

537	547	557	567	577
536	546	556	566	576
535	545	555	565	575
534	544	554	564	574
533	543	553	563	573

## References

Harold, Richard W., "Textiles: Appearance Analysis and Shade Sorting," *Textile Chemist and Colorist*, Volume 19, No. 12, December 1987.

## About HunterLab

HunterLab is the technology leader in color measurement solutions, providing instruments, software, knowledge and service to a wide variety of industries.

With over 5 decades of experience in more than 65 countries, HunterLab applies our leading edge technology to your products helping you measure and communicate color simply and effectively.

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11/2023

