



Selecting Representative Samples for Color Measurement

The ideal sample for yielding repeatable color measurements is completely opaque or completely transparent, flat, smooth, homogenous, non-directional, non-photochromic (not affected by light), non-thermochromic (not affected by heat), and non-hygrochromic (not affected by moisture). If any of these qualities is not present, the sample must be made as ideal as possible when presenting it to the instrument for measurements, such as making a translucent sample as opaque as possible by increasing the thickness provided and/or backing it with something opaque. However, before presenting a sample to the instrument, you must first select it from a batch, a roll, or a collection of parts.

It is important to select samples appropriately. Choose samples that are representative of the material used. If samples are non-representative of the batch or are spoiled, damaged, or irregular, then the result may be biased. When choosing a sample, select randomly and examine the sample for the appropriate condition to avoid biased results. If your sampling procedure is adequate, a different sample selected from the same batch should result in comparable measurement values.

There are several published standards that address sample selection for various industries, as listed below. Specifics from each method are also summarized.

ASTM E1164, “Standard Practice for Obtaining Spectrometric Data for Object-Color Evaluation.” Section 9 explains that results will not be better than the samples read, and the samples should be:

- Uniform across the area being measured.
- Opaque with one plane surface or translucent/transparent with two surfaces that are plane and parallel. Translucent samples should be read with a specific backing and should be a specified thickness.
- Clean and in good condition.

ASTM D1441, “Standard Practice for Sampling Cotton Fibers for Testing.” This practice reduces a lot of fibers to a small sample for testing.

- Each single shipment or product from a single source is considered its own lot.
- Choose lots to measure at random.
- Select samples that are as uniform as possible.
- Take enough samples to represent the lot adequately.

- Indicate the sample selection and handling methods in your report.

ASTM D2258, “Standard Practice for Sampling Yarn for Testing.” Using this standard, shipments of single, plied, or cabled yarn and cords can be divided into test lots and sampled for testing. It also allows for sampling yarn removed from woven or knitted fabrics with the recognition that these yarns are not usually representative of an entire shipment and their assessment should only be used to characterize the yarns, not to accept or reject them.

- Select the sampling scheme that is most precise and most economical.
- Portions of a single order that are received as separate shipments should be treated as separate lots.
- Select the units for testing randomly based on their assigned numbers.
- Choose the number of units to be tested based on the number of units in the lot. (A table is given in the standard indicating the appropriate number.)

ASTM D3925, “Standard Practice for Sampling Liquid Paints and Related Pigmented Coatings.” This standard describes how to take representative samples of fluid paint or pigmented coatings from containers, but does not cover sampling of dry powder paints, clear coatings, or mixed solvents. Such samples are taken from batches, lots, and shipments and should be of convenient and economical size, representative of the batch when it was placed in the container. Using a representative sample reduces the amount of laboratory work required and reduces rejections of acceptable material.

- All containers, mixers, and sampling apparatus must be clean so they can’t contaminate the sample.
- The sample container should be dry and the same temperature as or warmer than the area where the sample is being taken.
- The paint must be mixed before sampling.
- Samples must be stored in clean, dry, air-tight containers. The containers cannot be plastic.
- After sampling and before measurement, the samples should be kept at a temperature between 40° and 100°F (5-40°C).

ASTM D3964, “Standard Practice for Selection of Coating Specimens for Appearance Measurements.” If procedures for selection and presentation of coatings samples are standardized, inter-laboratory measurements will agree more closely and better correlation between visual evaluations and instrumental measurements will be achieved.

- The specimen must be at least large enough to cover the instrument’s sample port, and you should use the largest port available, if possible. Average multiple readings.
- Select an opaque specimen when possible. For translucent and transparent specimens, use a stable, durable backing material during measurement, such as an identical specimen, black, or white.
- Choose a rigid specimen. If the specimen is of thin, flexible material, you will have to press it flat against the sample port using a reproducible technique.
- Specimens that exhibit directionality should be measured in both directions and the readings averaged.

- The specimen must be clean. If it needs cleaning, it should be done so using a standardized procedure that does not alter its surface texture.
- Any cleaning, backing, pressing, and/or averaging should be reported with the measurement.

Other Standards That May Be Helpful That Are Not Discussed Here:

ASTM C50, “Standard Practice for Sampling, Sample Preparation, Packaging, and Marking of Lime and Limestone Products.”

ASTM C172, “Standard Practice for Sampling Freshly Mixed Concrete.”

ASTM C224, “Standard Practice for Sampling Glass Containers.”

ASTM C1264, “Standard Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Board.”

ASTM D585, “Standard Practice for Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, and Related Product.”

ASTM D3665, “Standard Practice for Random Sampling of Construction Materials.”

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