

Light Fastness of Offset Inks

Resistance to light exposure without direct exposure to the weather

What do we mean by „light fastness“?

The method for assessing the light fastness of prints and printing inks in graphic technology is laid down in ISO 12040 (can be purchased from www.iso.org) and distinguishes between testing and assessment of the light fastness of

- a) Prints that are produced using any of the graphical printing processes, on any substrate, without any test conditions being set and
- b) Printing inks for which test prints are prepared in accordance with ISO 2834.

The light fastness of prints refers to a print's resistance to light exposure without direct exposure to the weather. The light fastness of printing inks refers to the resistance of a standardised test print (printed sample) in line with ISO 2834 to light exposure without direct exposure to the weather.

Making a standardised test print

The light fastness rating printed on the label of a can of offset ink refers to a standardised test print of the printing ink in question. A test print is prepared with the aid of a printability tester, on white, lightfast, wood-free and brightener-free art paper (IGT 2846). Ink coverage is 1,5 g/m².

How is the degree of light fastness determined?

The light fastness is determined exposing the printed solid on the test print and a light fastness standard jointly to daylight. Light fastness testing devices equipped with high-pressure Xenon lamps allow quicker testing and provide results similar to the exposure with daylight. The degree of light fastness is equal to the light fastness standard that has changed last, right before the sample has changed its colour.

The light fastness standard consists of a graded set of blue coloured wool in 8 light fastness steps, therefore referred to as the wool scale. The degrees of light fastness determined in this way are classified as follows:

- | | | | |
|---|-------------|---|-----------|
| 1 | very poor | 5 | good |
| 2 | poor | 6 | very good |
| 3 | moderate | 7 | excellent |
| 4 | fairly good | 8 | maximum |

What do the different degrees of light fastness mean?

What conclusions can be drawn in practice from the indication of the light fastness? How important is it for the work produced by the printer? All he wants to know is whether the prints he produces meet the requirements in practice. He must have an idea how many days or weeks a certain degree of light fastness stands up to the influence of daylight whereby the season and the geographical position etc. play a decisive role. The following table gives approximate indications:

The pigments determine the light fastness

Only few inorganic pigments have a practically unlimited light fastness. All organic and numerous inorganic pigments change under the influence of light sooner or later to a lesser or greater extent. The degree of alteration is influenced among other things by the chemical constitution, the concentration, the physical state of the pigment (grain size and distribution and crystal modification) and last not least by the vehicle enveloping it.

degree or light fastness	summer	winter
WS 3	4 – 8 days	2 – 4 weeks
WS 4	2 – 3 weeks	2 – 3 months
WS 5	3 – 5 weeks	4 – 5 months
WS 6	6 – 8 weeks	5 – 6 months
WS 7	3 – 4 months	7 – 9 months
WS 8	over 18 months	

The pigment crystalloids are not destroyed at once but slowly and the result is a slow or faster fading of the colour, or a change of tint with subsequent fading. Consequently, it would be best to describe the light fastness by means of a curve showing the alteration of the colorimetric data of the print in relation to the radiant energy. Unfortunately, the determination of such curves is still very complicated which is why it is still common to refer to the comparison with the wool scale.

Some Pigments with high light fastness properties are quite expensive. For this reason alone the decision maker should consider which light fastness is really required for a specific printing job. In some cases where the fastness properties are of no relevance, a cheaper printing ink with relatively low light fastness may be sufficient if it remains visible long enough and does not change too much.

Indications of light fastness of special inks

Since testing light fastness properties takes time, precise indications on the labels are possible only for standard inks. For new and special matches, the estimated light fastness properties are only an indication, based on a calculation with the values from the pigments contained in such inks. If required, precise values can only be attained by performing the time consuming light fastness assessment.

Helping hints for the pressman:

When applying the rules of light fastness to practice, a number of influences deviating from the standard conditions must be taken into consideration: e.g. a substrate with wood-fibre will show yellowing very fast. It would be of little benefit to print with a blue ink of maximum light fastness, since the print will change to a more greenish shade, due to the yellowing of the paper. This underlines the importance of the selection of suitable substrates.

The ink film weight will vary substantially depending on the substrate to be printed on. With a higher ink volume applied than specified in the standard ISO 12040 will result in an increase of the light fastness of the print. With more pigment particles in a given area an ink will longer withstand the destructive influence of the light. The same applies to a higher pigmented printing ink. For the opposite situation, with lower thickness or higher shares of transparent white, the light fastness will decrease. Moreover, the light fastness in the light halftones is generally lower than in the solids, which is particularly true for very light screen values.

If two or more printing inks of different light fastness properties are being mixed the weak one is not improved by the good one but the good one is always impaired in its light fastness which means that in a mixture the ink of the lowest light fastness determines the light fastness of the mixed ink.

Lightening of an ink diminishes its light fastness. As a rule of thumb the following correlation can be assumed:

Lightening with transparent white	Reduction of light fastness
1 : 1	1 grade
1 : 3	2 grades

The above information will be of assistance to the printer when selecting the inks for his jobs. It will also provide an idea of their approximate light fastness to expect from the ink. The demand for high light fastness may require the use of very expensive pigments, resulting in a high price for the ink. Slight colour deviations from the original are sometimes unavoidable if maximum light fastness or other fastness properties are demanded.