Light fastness of offset inks

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 12 040 (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 standarised 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, woodfree and brightener-free art paper (APCO II/II, Papierfabrik Scheufelen) in accordance with DIN 2834. Ink coverage is 1,5 g/m^2.

How is the degree of light fastness established?

The light fastness is established only on the printed solid. To measure it the testprint and a light fastness standard are jointly exposed to daylight. Light fastness testing devices equipped with Xenon high pressure lamps permit quicker tests and provide results similar to the exposure with daylight. The degree of light fastness is determined by establishing which step of the light fastness standard has noticeably changed at the same time as the sample.

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
2 = poor
3 = moderate
4 = fairly good
5 = good
6 = very good
7 = excellent
8 = maximum light fastness

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 roll. The following table gives approximate indications:

The pigments determine the light fastness

Only few anorganic pigments have a practically unlimited light fastness. All organic and numerous anorganic 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, a change to a darker shade or a darkening with subsequent fading. Consequently, it would be best to describe the light fastness by means of a curve showing the alteration of the colormetric data of the print in relation to the radiant energy. Unfortunately, the determination of such curves is still very complicated and difficult which is why it is still necessary to refer to the comparison with the wool scale. However, one should realize that in this way one tries to characterize a curve by a single measuring point.

Pigments with high fastness properties are generally 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 of 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 the light fastness test require longer periods precise indications to this effect on the labels are possible only for standard inks. For newly developed inks and special matches only approximate light fastness properties can be indicated on the basis of the results of light fastness tests with the pigments contained in such inks. If necessary, precise indications can be submitted later after completion of the light fastness test of the respective ink.

Hints to be observed by the printer:

- When translating the degrees of light fastness into the requirements of practice it must also be taken into consideration that a number of deviations from the standard conditions influence the fastness of a print: e.g. a highly wood-containing substrate of low light fastness will soon yellow and it would be of little benefit to print on it with a blue ink of maximum light fastness. Although its pigments will not be affected but the colour of the print will change, nevertheless, to a more greenish shade through the influence of the yellowing of the paper. This underlines the importance of the selection of suitable substrates.
- The filmweight thickness of the standard specifications will also not always be maintained. It will very substantially depending on the substrate to be printed and the printing forme. A higher filmweight thickness than indicated in the standard specifications will result in an increase of the light fastness of the print because there will be more pigment particles in a given area to withstand longer the destructive influence of the light. The same applies to a more concentrated printing ink. On the other hand will a lesser film thickness and the lightening of an ink with cover or transparent white in most cases reduce the light fastness. Moreover, the light fastness in the halftone areas is generally lower than in the solids, which is particularly true for very light halftones.

- 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 the jobs he has to do and give him an idea of their approximate light fastness. He should moreover be aware of the fact that the demand for high light fastness often requires the use of very expensive pigments resulting in a high price of the ink. Moreover, slight colour deviations from the approved shade are sometimes unavoidable if maximum light fastness and other fastness properties are demanded.