

<b>Outdoor durability</b> Agfa WF UV inks	Issue date	14-10-2019
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## Document scope

This document is made to share information with Agfa customers about the outdoor durability of Agfa Graphics Wide Format UV inks.

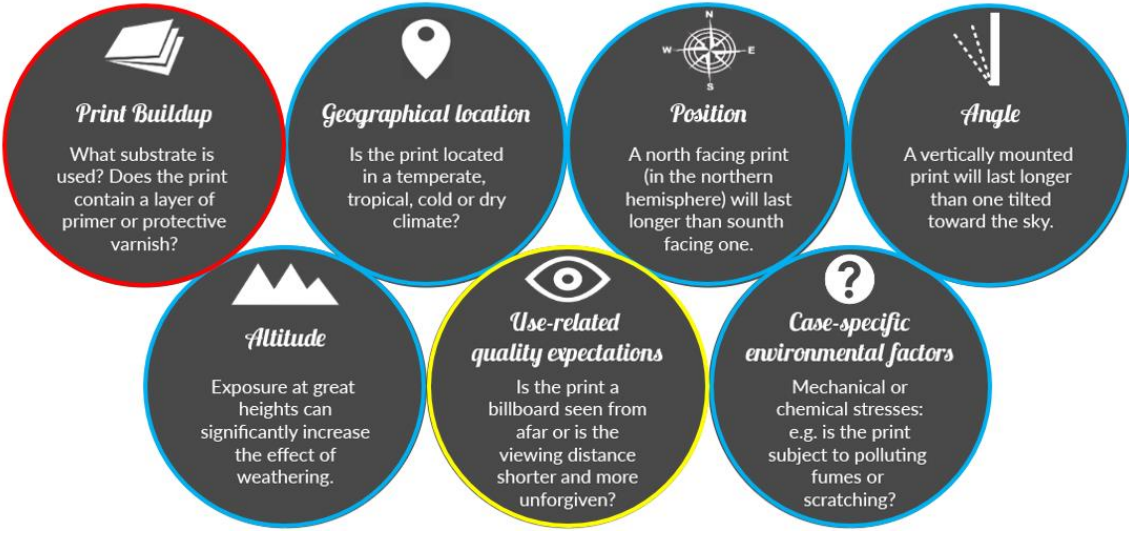
Agfa strongly believes it is crucial to communicate with enough background information on this topic in order to inform correctly. We do not believe in making simple statements on outdoor durability that do not help in getting control over this topic.

Respecting you as valued customers means that we will not send you away with over-simplified statements that lack the link with the reality.

This document shall help you to answer your questions on weathering, based on knowledge and data, rather than just on gut feeling. The numbers in this document are intended to guide you, so that you can link data in this document to the intended use profile based on technical judgement considering various factors influencing outdoor permanence of digital prints in the field. Such translation is needed and can only define a “performance range”, but not a one-number warranty.

## Introduction on Outdoor durability

How long will the printed image last outdoor?  
It depends on the choice of **print buildup** in view of **stress factors** and **performance expectations** in use profile ...



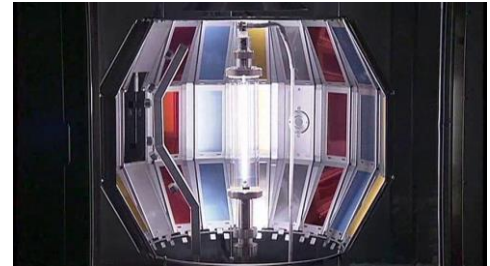
Outdoor durability of printed matter is defined by their resistance against different possible failure modes encountered in outdoor display. Typically, the following failure modes have been observed:

- Light fading
- Adhesion failure
- Cracking of ink layer
- Media deformation

- Media Yellowing
- Gloss changes
- Mould growth

Agfa only uses high quality color pigments that have proven to be very stable under natural daylight in outdoor conditions. **Accelerated light-fading test** indicates **light stability equivalent to 3 years outdoor UV dose (CEC)**. However, overall lifetime of display is more than light stability, as additional failure modes may be introduced by the interplay with other environmental factors, such as: temperature, rain, wind, sand abrasion, air pollutants, cyclic stress fatigue by day-night temperature changes and / or periodic wet- and dry phases, mould growth, ...

The **accelerated weathering test cycle in ISO18930** has proven best suited to simulate (and thus predict) the outdoor behaviour of printed matter. This test cycle contains simulated daylight, water spray cycles, day-night cycles, and does reproduce all failure modes as listed above in a consistent way.



In order to relate ISO18930 test to display life-time in outdoor conditions, Agfa performs **real time outdoor tests** on different geographical locations in so-called prototype climates, including Central European, Mediterranean, hot humid (tropical) and hot dry (desert) climate. Results of actual natural weathering exposure may vary up to 30% due to variability of aforementioned factors that impact outdoor performance over seasons and year-to-year.



### Outdoor durability statement on Agfa WF UV inks

Outdoor durability of **Agfa WF UV inks** has been tested by **real time exposure** of printed images to natural weathering, and indicates an **outdoor life time of typically 3 years** on standard media in Central European Climate (CEC). Some data used in tables below has been extrapolated from results of accelerated ISO18930 tests using consolidated correlation with Agfa ink performance in natural weathering.

<i>Expected Outdoor lifetime Standard media (time in years)</i>	<i>Central European (CEC) Mortsel, Belgium</i>
Anuvia 250	2.5 years
Anapura 500	3.5 years
Anuvia 550	2.5 – 3 years
Anapura 1500	3.5 years
Anuvia 1550	2.5 – 3 years

- Outdoor stability is tested under typical severe display conditions, i.e. direct vertical exposure (90°) facing the direction of sun at noon. Performance will be better for orientations other than facing towards the equator (South in northern hemisphere) or for indirect exposure such as zones with shading.

- The acceptance level for outdoor color fading is set to  $\Delta E_{00} = 7$  (45°/0° spectrophotometer, CIE 2°/D50). Color fading evaluated over a range of different ink coverages of primary, secondary and tertiary colors (C,M,Y,K,R,G,B,[C+M+Y]). For each color, the worst performing ink coverage is determined and then the average worst performance over all colors is calculated. The color fading at this level is visibly noticeable, still not yet an issue for most applications. This approach provides a critical, yet practical evaluation of the image permanence performance.
- Outdoor stability is tested with prints that were printed on a range of materials with Agfa systems at recommended printer settings.
- The general outdoor performance statement is related to standard media like digital grade self-adhesive vinyl (e.g. Metamark MD5) and digital grade coated metal composites (e.g. Alcan Dibond).
- Prints on media like polypropylene (sheet or corrugated) will perform typically at 50% of the aforementioned life time for prints on standard media.
- Many substrates do have limited outdoor performance due to media characteristics like physical disintegration of media, deformation of the media, cracking of the media surface layer, yellowing of media, mould growth etc. ... Agfa makes abstraction of such media related failure modes when communicating outdoor lifetime for their inks.

Agfa has tested the outdoor stability of printed images in several prototype climates. Aforementioned display lifetimes in temperate CEC are typically reduced by a factor 1.3 – 1.5 times in Mediterranean, humid continental and desert climate, and a factor 2 – 2.5 times in tropical climate. Performance is generally better in dry climates or in exposure situations without direct precipitation or for displays not directly (or only partially) facing the sun.

<b>Expected Outdoor lifetime Standard media (time in years)</b>	<i>Central European (CEC) Mortsel, Belgium</i>	<i>Mediterranean Sanary, France</i>	<i>Hot/humid (tropical) Miami, Florida</i>	<i>Arid (desert) Phoenix, Arizona</i>
Anuvia 250	2.5	1.5 – 2	1.5 – 2	1.5 – 2
Anapura 500	3.5	2.5	1.8	2.5
Anuvia 550	2.5 – 3	2	1.5	2
Anapura 1500	3.5	2.5	1.5 – 2	2.5
Anuvia 1550	2.5 – 3	2	1.5	2

<b>Expected Outdoor lifetime PP media (time in years)</b>	<i>Central European (CEC) Mortsel, Belgium</i>	<i>Mediterranean Sanary, France</i>	<i>Hot/humid (tropical) Miami, Florida</i>	<i>Arid (desert) Phoenix, Arizona</i>
Anapura 500	2	1.5	1	1.5
Anuvia 550	1.5	1	0.5 – 1	1
Anapura 1500	2	1.5	1	1.5
Anuvia 1550	1.5	1	0.5 – 1	1.1

Primers, pre-white and/or varnishes typically extend the outdoor performance to large extend (2 – 4 times).

In applications where extended outdoor display of 4 years or longer is required, backside printing on UV-stabilized transparent sheets (PC, PMMA, ...) with post-white printing is recommended.