

## 1 Introduction

Prim Jet Color prepared a number of over-print lacquer samples, incorporating various levels of NanoZ-40AQ UV absorber as outlined in Table 1. NanoZ-40AQ is a water based dispersion of zinc oxide particles manufactured by Antaria Limited with high transparency, having proven UV absorption characteristics. When used in clear coatings over a UV sensitive substrate, NanoZ-40AQ offers excellent protection against fading. Ink jet printouts prepared using both pigmented inks and dye inks were coated with Prim Jet Color's protective lacquers; these samples were sent to Antaria for QUV testing (accelerated weathering).

Prim Jet Color Lacquer	NanoZ-40AQ Concentration
Improved	2%
Extended	4%
Ultra Extended	6%

Table 1 Level of NanoZ-40AQ UV absorber in Prim Jet Color lacquers

## 2 Test Method

Test panels were prepared from samples supplied by Prim Jet Color. These featured pigmented ink and dye ink printouts respectively, coated with lacquers described in Table 1. Pigmented ink samples were exposed to UV radiation for 2000 hours. Dye inks were exposed for 200 hours.

Equipment:

Exposure device model: QUV  
Light source model: fluorescent UV lamps, UVA-340  
Manufacturer: Q-Panel Lab Products, 800 Canterbury Rd, Cleveland, USA

Colour-meter: Color-guide sphere d/8° spex (6835)  
Manufacturer: BYK-Gardner GmbH, Geretsried, Germany.

Camera: Kodak Easy Share C875

Weathering Condition: UV Cycle only, 60°C

## 3 Results

### 3.1 QUV Exposure – Prim Jet Color Pigmented Ink Samples

Fig 1 shows photographs of pigmented ink samples before and after UV exposure. Table 2 shows colour change ( $\Delta E$ ) for uncoated sample and samples coated with improved, extended and ultra-extended lacquers.

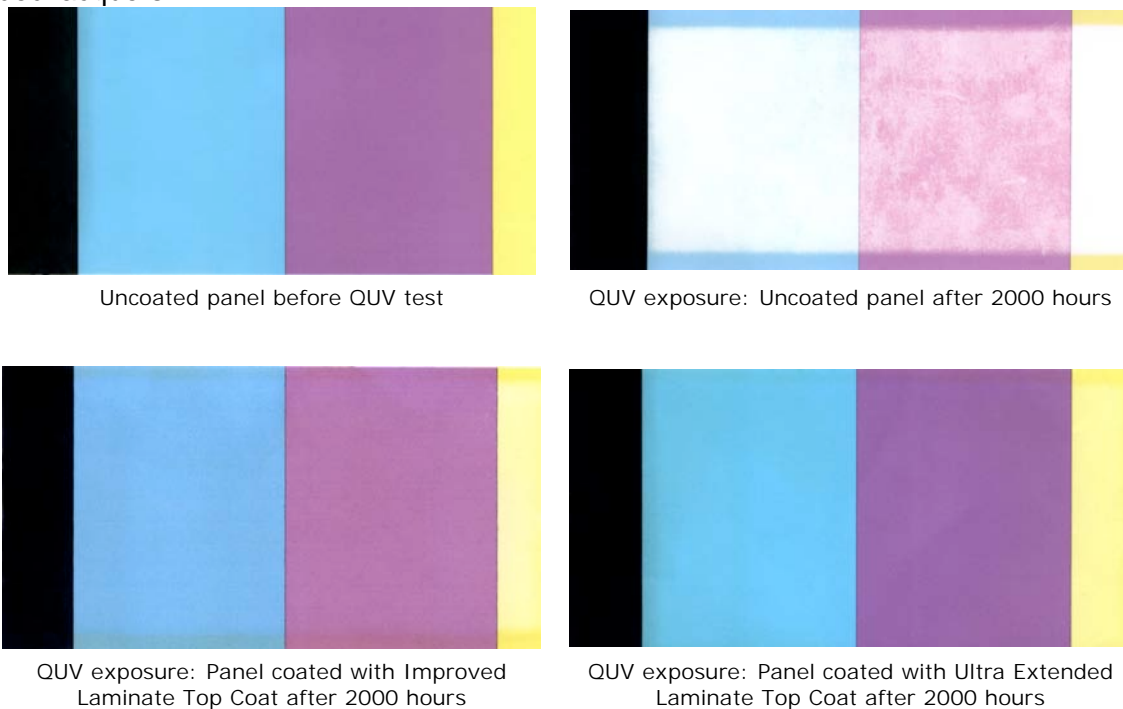


Fig 1 Photographs of pigmented ink test panels before and after 2000 hours UV exposure

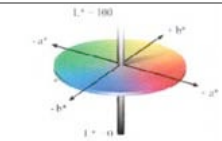
Pigmented ink light-fastness test summary						
Panel	Parameter	Colour				Result
		Blue	Red	Yellow	Black *	
Uncoated	$\Delta E_{0-2000h}$	25.1	18.8	51.7	4.3	Poor
Coated with liquid laminate:						
Improved	$\Delta E_{0-2000h}$	2.8	5.7	26.6	2.0	Very good
Extended	$\Delta E_{0-2000h}$	5.9	5.9	10.3	3.9	Excellent
Ultra Extended	$\Delta E_{0-2000h}$	5.6	3.2	10.7	3.1	Excellent

Table 2 Results summary – colour change of pigmented ink samples after 2000 hr UV exposure

\*Black panel exposed for 750 hrs

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Figures 2-5 show the changes in colour occurring over the duration of the test associated with blue, red, yellow and black pigments respectively for the unprotected test panel compared with panels treated with improved, extended and ultra-extended lacquers.

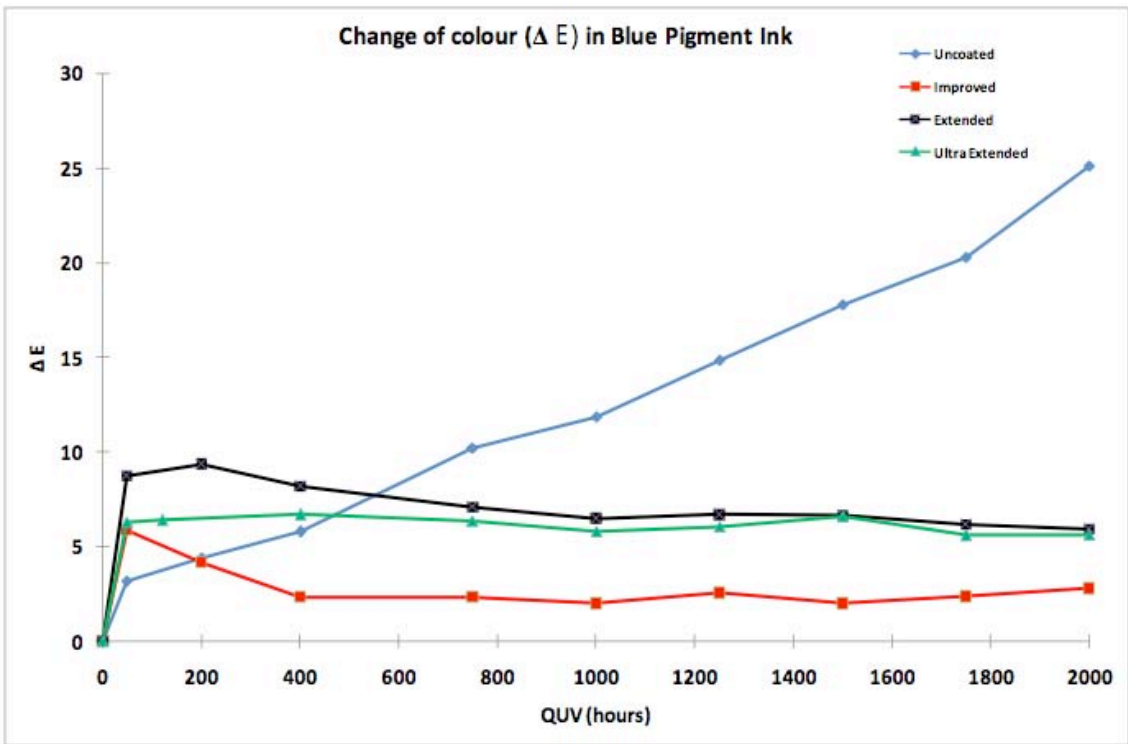


Fig 2 Colour change associated with blue pigment during 2000 hrs UV exposure

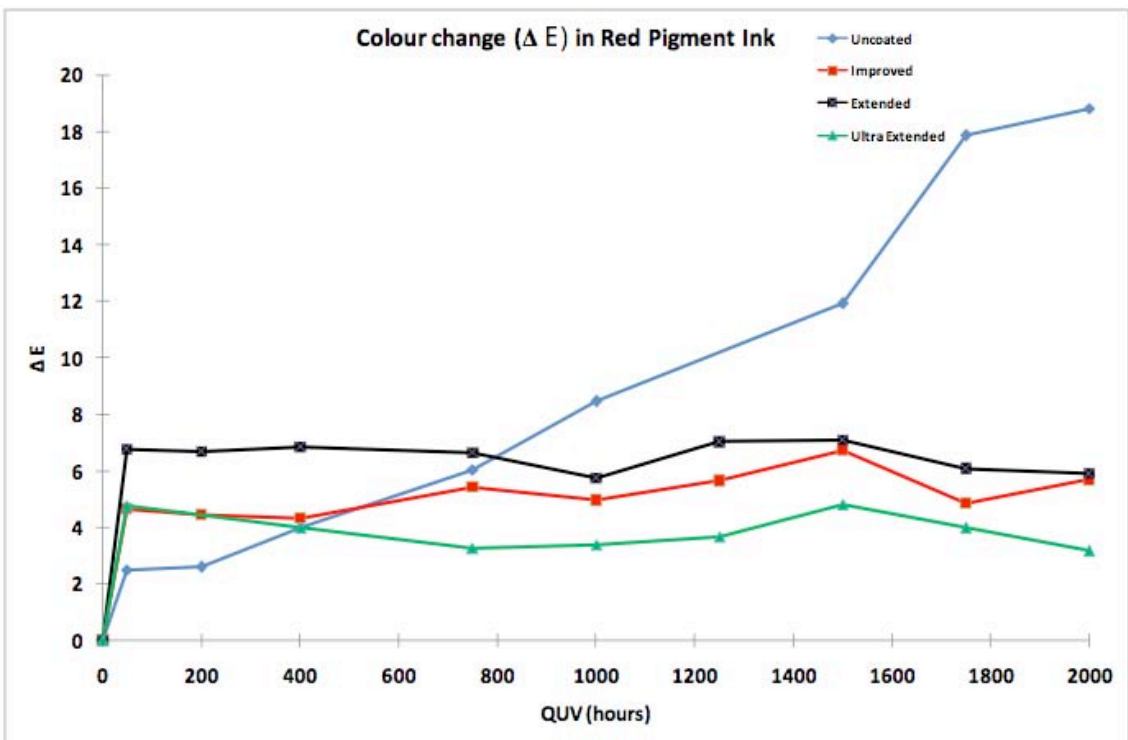


Fig 3 Colour change associated with red pigment during 2000 hrs UV exposure

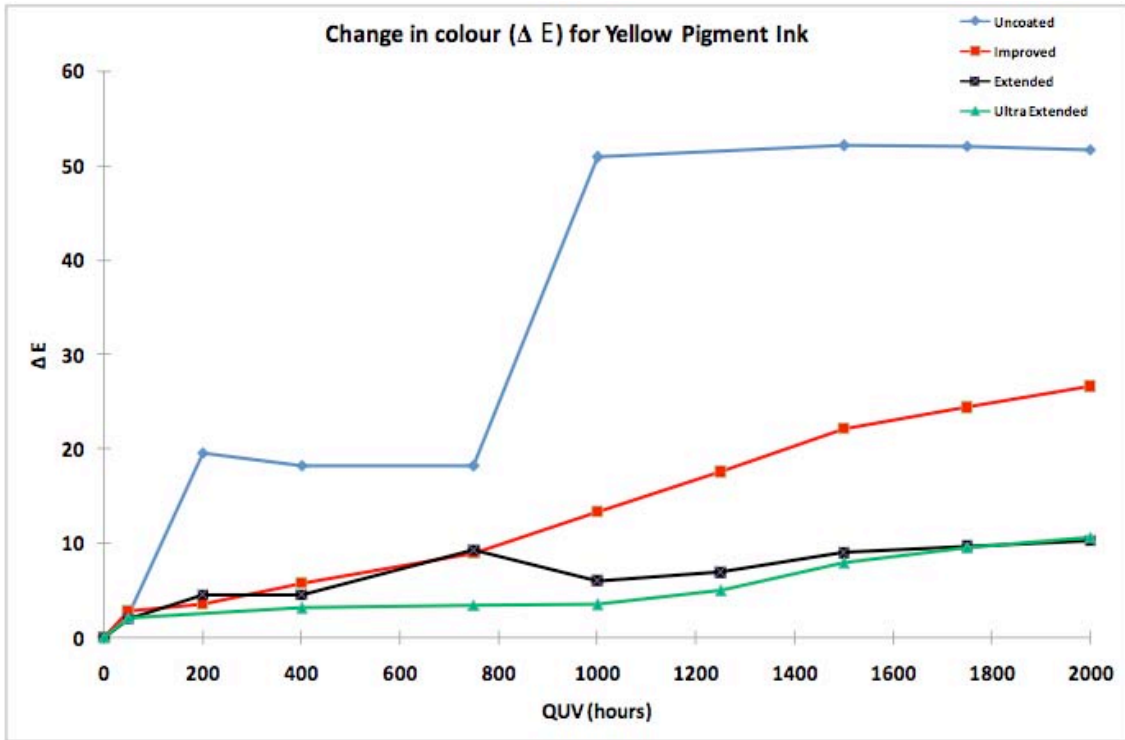


Fig 4 Colour change associated with yellow pigment during 2000 hrs UV exposure

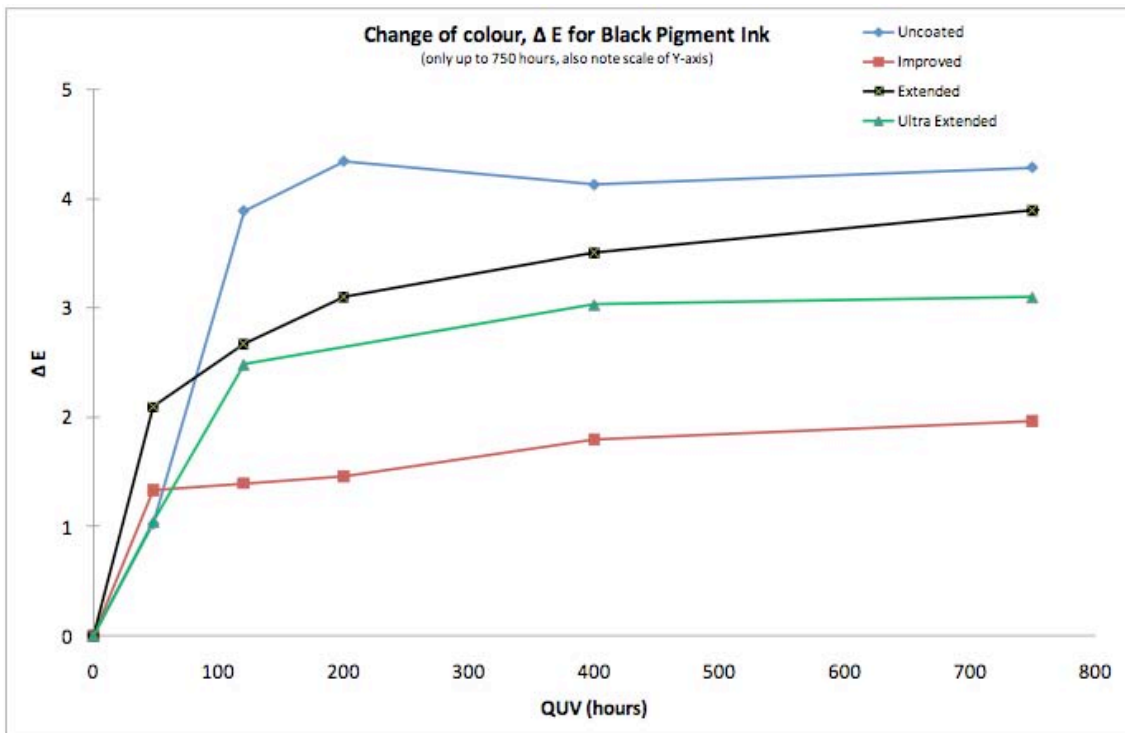


Fig 5 Colour change associated with black pigment during 750 hrs UV exposure

## 3.2 QUV Exposure – Prim Jet Color Dye Ink Samples

Fig 6 shows photographs of dye ink samples before and after UV exposure. Table 3 shows colour change ( $\Delta E$ ) for uncoated sample and samples coated with improved, extended and ultra-extended lacquers.

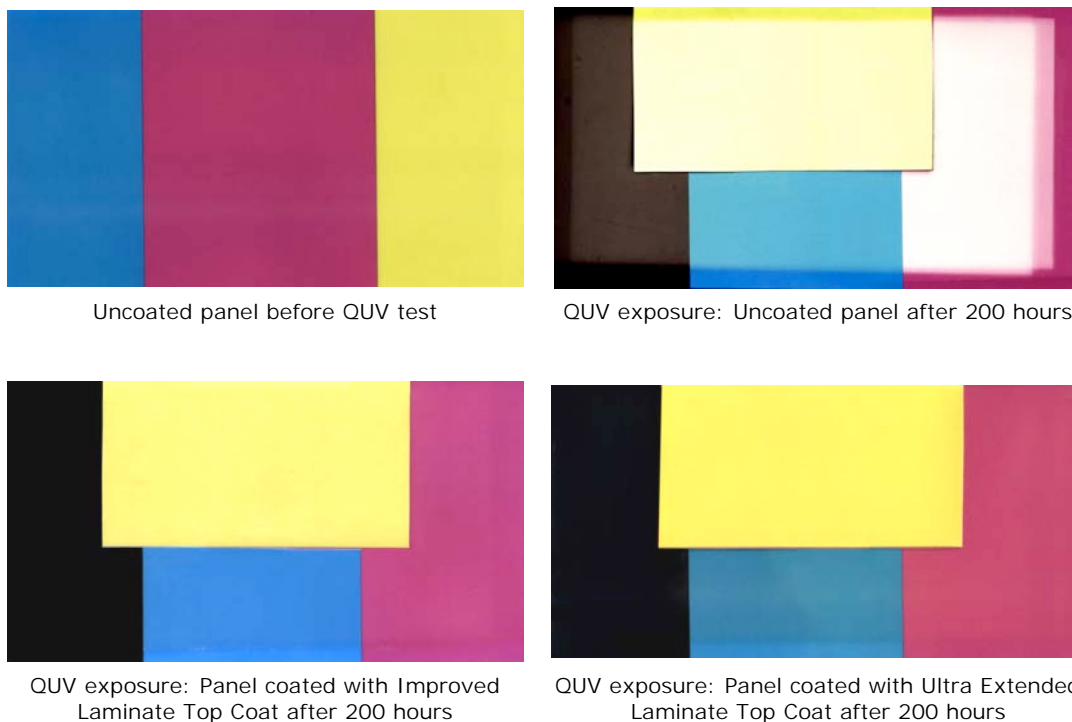


Fig 6 Photographs of dye ink test panels before and after 200 hours UV exposure

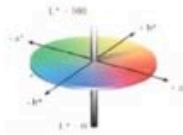
Dye ink light-fastness test summary						
Panel	Parameter	Colour				Result
		Blue	Red	Yellow	Black	
Uncoated	$\Delta E_{0-200h}$	23.8	62.0	47.6	25.5	Very poor
Coated with liquid laminate:						
Improved	$\Delta E_{0-200h}$	11.0	6.3	9.9	1.9	Very good
Extended	$\Delta E_{0-200h}$	11.6	5.7	7.6	0.9	Excellent
Ultra Extended	$\Delta E_{0-200h}$	10.4	5.9	7.3	6.9	Excellent

Table 3 Results summary – colour change of dye ink samples after 200 hr UV exposure

Figures 7-10 show the changes in colour occurring over the duration of the test associated with blue, red, yellow and black dye inks respectively for the unprotected test panel compared with panels treated with improved, extended and ultra-extended lacquers.

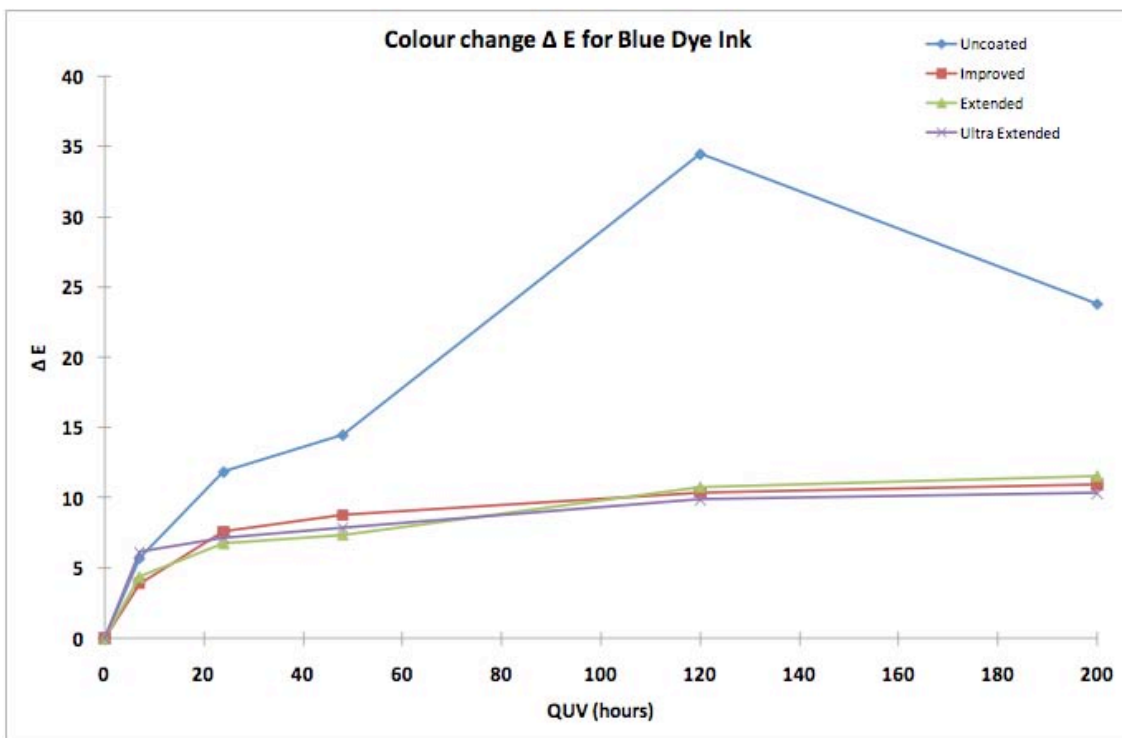


Fig 7 Colour change associated with blue dye during 200 hrs UV exposure

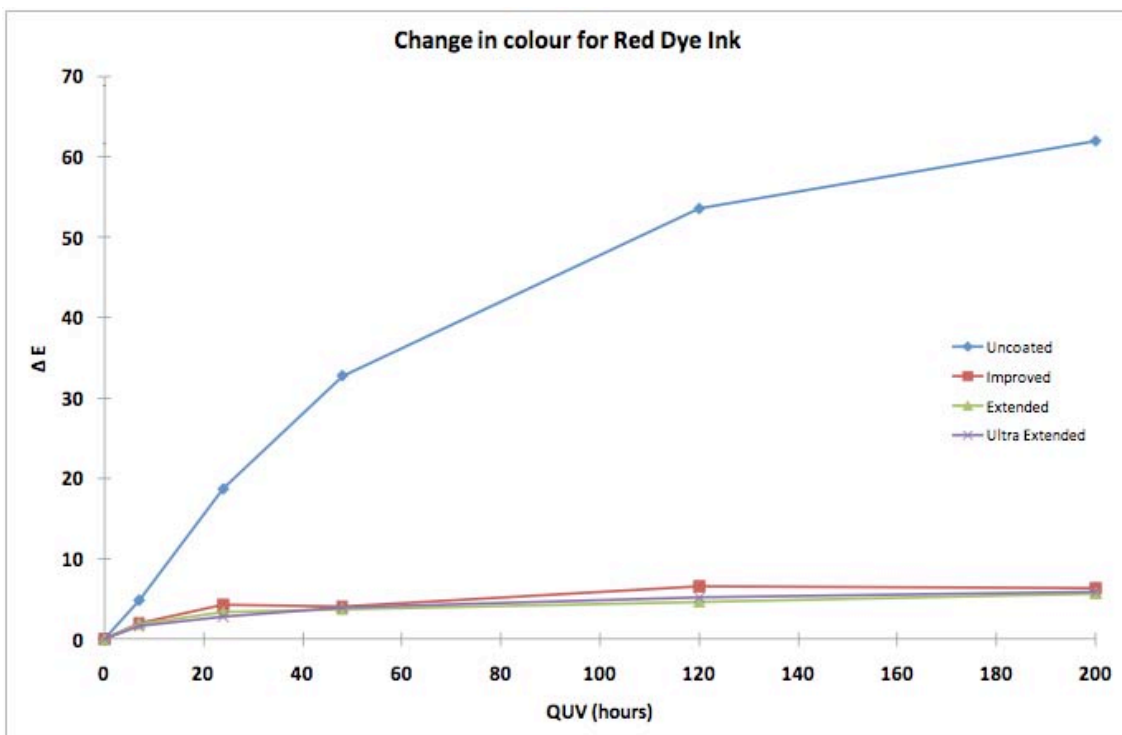


Fig 8 Colour change associated with red dye during 200 hrs UV exposure



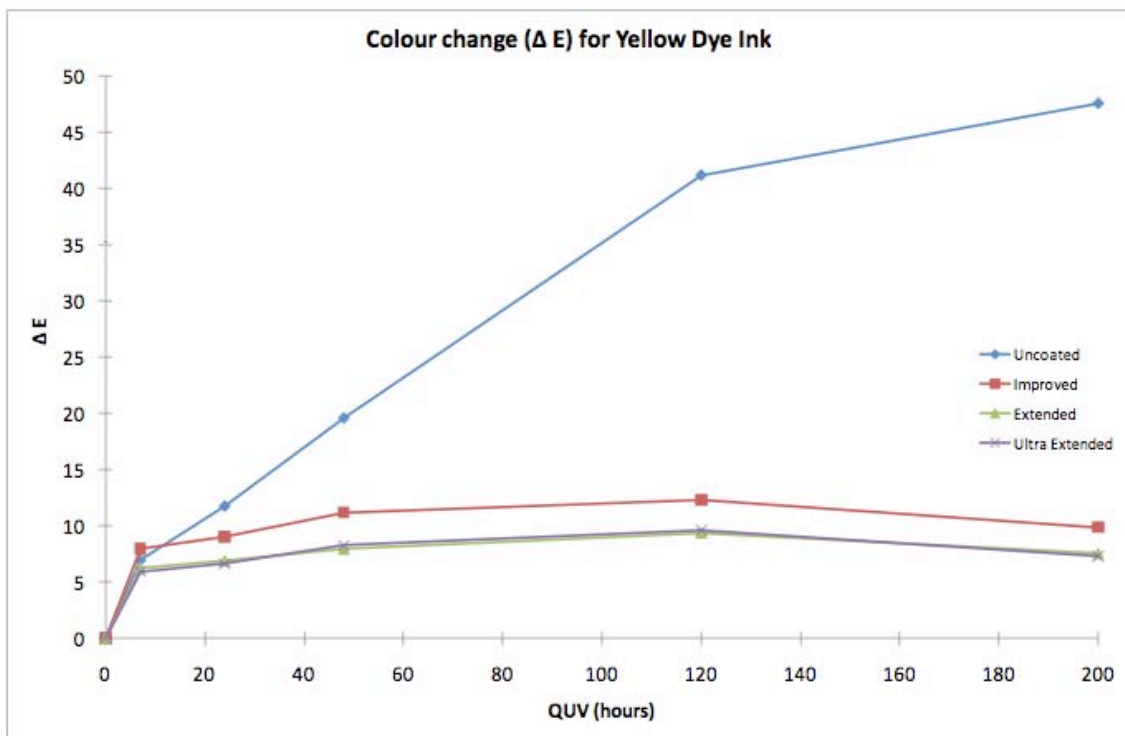


Fig 9 Colour change associated with yellow dye during 200 hrs UV exposure

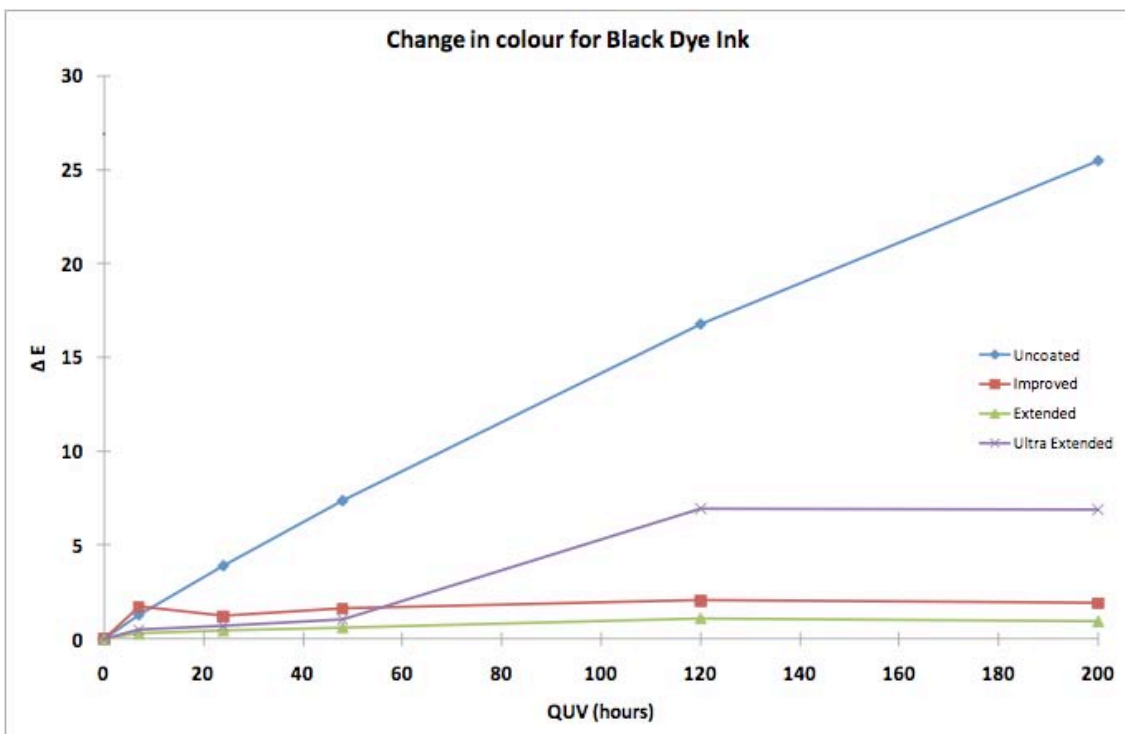


Fig 10 Colour change associated with black dye during 200 hrs UV exposure

## 4 Conclusions

The results of these tests show very clearly that upon subsequent exposure to UV radiation, the use of Prim Jet Color's special lacquers containing NanoZ-40AQ offers excellent resistance to fading when applied to ink jet print outs using either pigmented inks or dye inks.

## 5 Disclaimer

The measurements outlined in this report were made by Antaria limited on samples provided by Prim Jet Color. To the best of our knowledge, the results are a true reflection of the resistance to fading offered by the use of 2%, 4% and 6% NanoZ-40AQ in Prim Jet Color's special lacquers, when applied to ink jet print outs which are subsequently exposed to UV radiation. Antaria Limited does not guarantee in any way the performance of Prim Jet Color special lacquers in the field.



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