# COLOUR BLACK OE 430 W

## Easy-to-disperse specialty carbon black preparation for top quality high jet water-borne coating systems

Technical Information 1372

orion ENGINEERED CARBONS

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## Introduction

The performance requirements of specialty carbon black used for automotive basecoats are becoming increasingly stringent with regard to jetness and a bluish undertone. The pigments must be, first and foremost, stable in water-borne systems and feature very high resistance to weathering. An example of this is the two year Florida weathering.

For years now, Orion Engineered Carbons has been offering specialty carbon blacks that are manufactured by the Degussa gas black process and are suitable for high-jetness use. The furnace black process has also been used for decades in addition to the gas black process to produce high quality HCF (High color furnace) blacks for the coatings industry. Orion Engineered Carbons is the sole manufacturer of specialty carbon blacks, capable of offering both HCG (High color gas black) and HCF blacks.

It is a well-known fact that pigment powders often have to be dispersed extensively to achieve satisfactory development of colorimetric properties. Specialty carbon blacks have always been considered one of the most difficult pigments to disperse into coatings. Orion Engineered Carbons has always been keen to offer preparations that facilitate, if not altogether eliminate, the dispersion step.

## Advantages of COLOUR BLACK OE 430 W

Orion Engineered Carbons has developed COLOUR BLACK OE 430 W, which is the subject of this technical information and perfectly complements Orion Engineered Carbons pigment portfolio for high-end water-borne coatings. COLOUR BLACK OE 430 W has many crucial advantages over traditional specialty carbon blacks for water-borne coating systems:

- Extremely easy-to-disperse in water providing very stable pigment pastes within minutes
- No milling or further wetting additives needed
- Easy to handle free-flowing powder (Specialty carbon black conc. = 52.6 %)
- Excellent pigment stabilization providing highest jetness levels combined with a strong bluish undertone
- Broad compatibility with most commonly used water-borne binder systems

## Simple access to high jet water-borne coatings

COLOUR BLACK OE 430 W can be dispersed directly in water and develop the final colorimetric properties within 15 to 20 minutes. A typical water-borne binder free paste formulation for COLOUR BLACK OE 430 W is given in Table 1. A paste with 13 % of specialty carbon black is prepared by mixing water, defoamer and COLOUR BLACK OE 430 W using a dissolver for 20 minutes. There is no need for intensive milling or addition of further wetting additives. The viscosity of the obtained paste is low. Fineness of grind is below 5 µm as required for automotive, refinish and partly for industrial coatings applications.

**Table 1**

| | |
|---|---|
| Deion. water | 74.9 g |
| Surfynol® 104e | 0.4 g |
| COLOUR BLACK OE 430 W (52.6 % SCB) | 24.7 g |
| Total | 100 g |
| Specialty carbon black concentration | 13 % |
| pH-value | 6.5 – 8 |
| Viscosity @ 80 $s^{-1}$ 70 | 170 mPas |
| Viscosity @ 800 $s^{-1}$ 50 | 30 mPas |

Recommended paste formulation for COLOUR BLACK OE 430 W

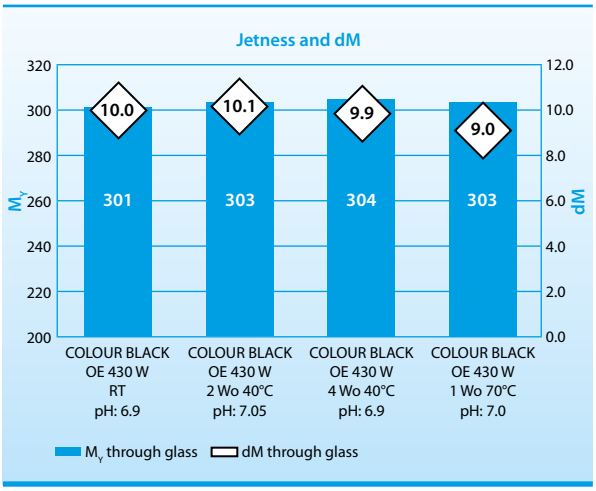
The concentrated paste is very stable upon storage and can be letdown using standard water-borne binder systems leading to high gloss, highest jetness coatings with a strong bluish undertone and low haze.

## Excellent storage stability

For storage stability tests a paste based on COLOUR BLACK OE 430 W was stored at 40°C for four weeks. No visual or measurable change in the quality could be detected for the paste. Final coatings with a carbon black concentration of 1.5 % (typical for automotive) were prepared using a coating system based on a commercially available 35 % PU dispersion (Alberdingk® U9800, Alberdingk & Boley GmbH).

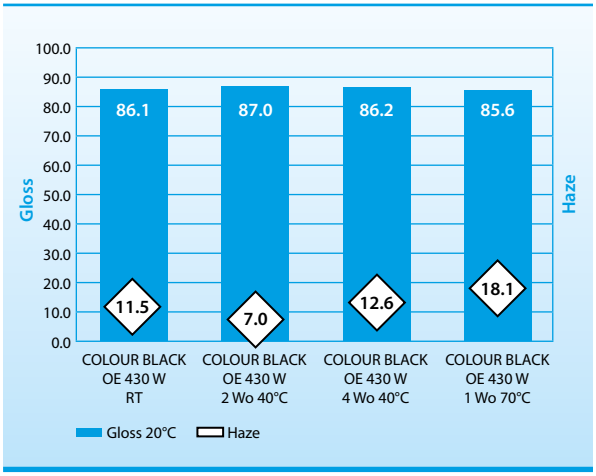
The coatings were applied on glass plates (200 µm wet film thickness), flash-off for 15 minutes and force dried at 60°C for 15 minutes. The colorimetric results are shown in figure 1 and 2. All coatings provided very high jetness levels ($M_Y$ of 300 to 310), a strong bluish undertone, high gloss and low haze. No change of the colorimetric properties was obtained after storage which is evidence for perfect stabilization of the specialty carbon black in the preparation and as well in the paste and the final coating.

**Figure 1**




Colorimetric results of water-borne coatings based on COLOUR BLACK OE 430 W (directly and after storage of the COLOUR BLACK OE 430 W paste for two and four weeks at 40°C and 1 week at 70°C). Letdowns were prepared using a 1C PU coating system (Alberdingk® U9800). The final specialty carbon black concentration is 1.5 %.

**Figure 2**




Results for gloss and haze of water-borne coatings based on COLOUR BLACK OE 430 W (directly and after storage of the COLOUR BLACK OE 430 W paste for two and four weeks at 40°C and 1 week at 70°C). Letdowns were prepared using a 1C PU coating system (Alberdingk® U9800). The final specialty carbon black concentration is 1.5 %.

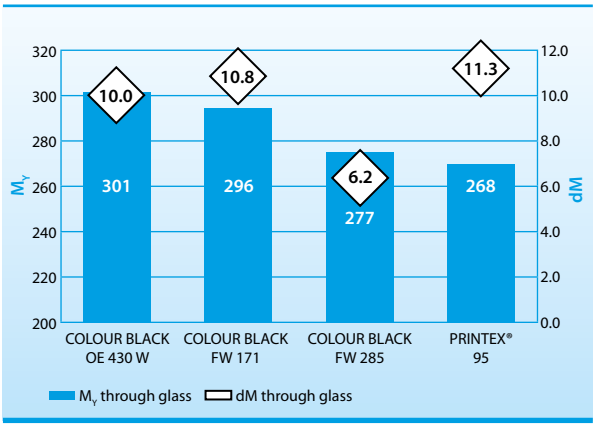
## Perfect colorimetric performance

Figure 3 and 4 show the colorimetric results of COLOUR BLACK OE 430 W in comparison to several Orion Engineered Carbons high jet specialty carbon black powders. For the preparation of the coatings COLOUR BLACK OE 430 W was dispersed within 20 minutes as described above to get a concentrated paste. The other specialty carbon blacks were dispersed as follows: In order to improve the dispersion of the specialty carbon black powders and stabilize the water-borne mill bases, 70 % of active wetting agent related to the specialty carbon black powders was used. A suitable additive for this purpose is TEGO® Dispers 760W (Evonik Resource Efficiency GmbH, 35 % active). After the initial wetting out of the pigment using a dissolver (5 minutes at a peripheral speed of 10 m/s) milling was done using standard laboratory shaker, steel beads (3 mm) and a dispersing time of one hour. The viscosities of the mill bases were water like. Fineness of grind was below 5 µm. The concentration of the specialty carbon blacks in binder-free millbases was 13 %.

Final coatings with a specialty carbon black concentration of 1.5 % (typical for automotive) were prepared using a coating system based on a commercially available 35 % PU dispersion (Alberdingk® U9800, Alberdingk & Boley GmbH). The coatings were applied on glass plates (200 µm wet film thickness), flash-off for 15 minutes and force dried at 60°C for 15 minutes.

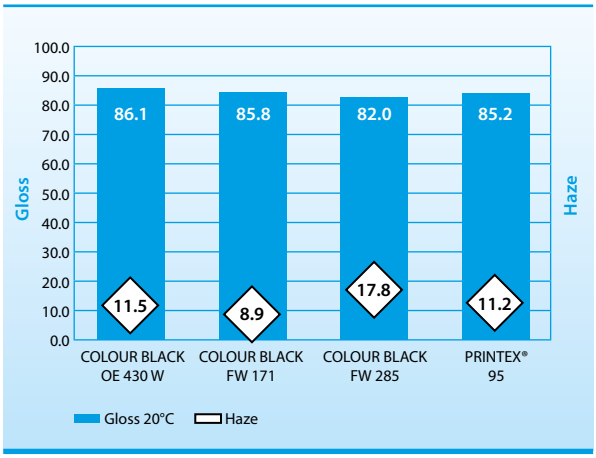
High gloss, very low haze coatings with highest jetness values combined with very strong bluish undertones were obtained for COLOUR BLACK OE 430 W. The colorimetric properties outperform even the best and extremely well stabilized OEC specialty carbon black powders.

**Figure 3**




Colorimetric results of water-borne coatings based on COLOUR BLACK OE 430 W and OEC high jetness specialty carbon blacks (stabilized with 70 % active to pigment). Letdowns were prepared using a coating system based on a commercially available 35 % PU dispersion (Alberdingk® U9800, Alberdingk & Boley GmbH). The final specialty carbon black concentration is 1.5 %.

**Figure 4**




Results for gloss and haze of water-borne coatings based on COLOUR BLACK OE 430 W and several OEC high jetness specialty carbon blacks (stabilized with 70 % active to pigment). Letdowns were prepared using a coating system based on a commercially available 35 % PU dispersion (Alberdingk® U9800, Alberdingk & Boley GmbH). The final specialty carbon black concentration is 1.5 %.

## Cost calculation

Looking at a solid pigment preparation from a cost/performance perspective might result in objections, but only at first glance. While doing sound cost calculations of the overall production process, we have seen many examples supporting the COLOUR BLACK OE 430 W approach. We have developed a cost calculation sheet to do a rough calculation. The higher price of our pigment preparation – compared to a pure carbon black – should take into account that there is no energy necessary for the main milling step. This energy input can be rather high, depending on the equipment and the desired results, with many hours or even days of necessary milling time.

Dispersion and wetting additives are also high cost factors. For high jetness carbon blacks, ratios of 70 % to 120 % solid on pigment are typical to achieve a good stabilization. These are no longer necessary. Cleaning times, using highspeed mixers only, can be reduced compared to bead mills. It is possible to increase flexibility in production due to shorter dispersion times. Even smaller batch sizes are easily processed instead of batch grinding once per month.

Coatings manufacturers should include all these factors, plus labor, in their calculations.

## Shelf life

Correctly stored COLOUR BLACK OE 430 W has an indefinite lifespan. However, we recommend verifying application-related properties before usage, after storage periods exceeding 36 months. COLOUR BLACK OE 430 W should be stored under cool and dry conditions. The storage temperatures should not exceed 50°C.

## Summary

Water-borne coatings will gain further importance in comparison to solvent-containing systems. The results shown above for the easy-to-disperse specialty carbon black preparation COLOUR BLACK OE 430 W clearly prove that COLOUR BLACK OE 430 W is an outstanding product for tinting high jetness black waterborne coatings. The extremely easy-to-disperse powder provides very fast and simple access to concentrated specialty carbon black pastes with broad compatibility. Highest jetness levels combined with very strong bluish undertones, high gloss and low haze can be obtained.

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