

## Technical Information

DF06

Performance Pigments and Colors

# Xpression

### Organic Colours for Low Temperature Decals

In this technical information leaflet Ferro presents Xpression, a series of organic colours for low temperature decals.

Until now, the use of organic colours was limited to interior applications. Ferro has succeeded in developing a totally new colour series that is designed especially also for exterior use.

Low temperature decals can be applied on almost all substrates. The choice of the protective coating allows the curing on heat resistant substrates at 160 °C to 200 °C as well as curing on temperature sensitive substrates at room temperature.

Even objects that could not be thermally cured, like plastics can be decorated with Xpression decals without any problem.

Suitable substrates are wood, plastics, porcelain, glass, ceramics, stainless steel, coated aluminium and varnished surfaces. As application examples decorated helmets, motorcycles and other vehicles, skateboards, ski, bicycles, surfboards and other sports equipment, strollers, furniture, bottles, vases, lampshades and small household appliances, displays and industrial labels could be named. There is no limit to the imagination. A decoration with decals is suitable for almost all objects.

The advantage of decals is a decoration without problems even on objects with a complex design. Due to their high flexibility, the decals can be applied on non-flat articles. They adapt to the form of the object, whereas stickers get creased. Decals open up a way of decorating complex objects easily.

Moreover, decals printed with Xpression colours can be perfectly matched to the image: free areas within the illustration really stay free. Only the protective coating is printed 0.4 millimetre bigger than the image. This enables high-grade decoration. In contrast to this, labels or adhesives can only be printed completely, the background is then entirely covered.

Our Xpression colours are lead and cadmium free and do not contain formaldehyde or phthalates.

All colours may be mixed with each other and therefore enable the printer to achieve a huge colour space. For fast and efficient colour matching, a colour management system is available.

After being transferred, the colours show a hard surface. They are lightfast and do not become yellow. They are resistant to alkali and acids and have a high solvent resistance.



Fig. 1: Application example  
Decorated  
motorcycle helmet

## Advantages of the Xpression Series

- suitable for interior and exterior application
- for nearly all substrates, even for temperature sensitive ones
- large variety of colours
- excellent miscibility within the series
- easy colour matching with Ferro colour management system Xpression Matchbox
- hard surface
- very good lightfastness
- alkali and acid resistance
- dishwasher resistance
- solvent resistance
- very low yellowing
- longterm temperature stability up to 110 °C
- flexible decals perfectly adapt to the objects
- fine prints possible, complete covering of background not necessary
- lead and cadmium free, no formaldehyde and phthalates
- heavy metal free according to DIN EN 71-3 (safety of childrens' toys)

The series Xpression for decal printing covers a niche that had been open until now. Xpression therefore is a valuable addition to the world of decoration.

## Resistance

The scratch resistance of the decorated and thermally cured designs and patterns is comparable to that of varnished household objects. The mechanical resistance on a Erichsen cross-cut instrument according to EN ISO 2409/DIN 53151 is  $\leq 1$ . The scratch hardness test with a Erichsen test specimen results in a value of 5 N.

The surfaces comprise a good solvent resistance. The dishwasher resistance was tested in a Winterhalter industrial dishwasher. The decoration stands 3000 cycles without visible deterioration when using the additive 80 4515. The series also passes three cycles in the Calgonite test.

The Xpression series combines light-fast pigments and a weather and UV stable varnish system. The outdoor stability was confirmed with a QUVA and a Xenon test.

## Application Examples

### 1. Exterior Application

The weather stable and light-fast varnish system and the light-fast pigments are also stable in exterior applications. The decoration of sports equipment like bicycle frames or motorcycle helmets is possible without any problem.

### 2. Easier Decoration of Glass Lamp Shades

Firing temperatures of 550 °C to 620 °C are necessary when decorating glass lampshades and glass vases with ceramic glass decals. Depending on the shape of the object, long annealing times are necessary to prevent breakage. This problem is avoided by using Xpression decals. The decoration can be applied without a subsequent long tempering process.

### 3. Process-Colour Printing

When using the process colours 12 3640 (Cyan), 13 3640 (Yellow), 17 3640 (Magenta), and 14 3640 (Black), very beautiful decorations may be produced. Due to their thixotropic flow behaviour, the mentioned colour pastes allow exact halftone printing in the four-colour process.

### 4. Satined Bottles

The satin surface of bottles is today often obtained with organic, transparent coatings. If the bottles have been decorated with Xpression decals first, the bottles can be satin-glazed before the decals are thermally cured. One process step is saved and two effects, decoration and satin glaze, are achieved at the same time.



Fig. 2: Application examples from the glass and ceramics area

## Processing Instructions

### 1. Printing Paper

The well-known types of paper for producing ceramic decals are also used for producing Xpression decals. On top of a barrier layer, this kind of decal paper is coated with water-soluble mixtures consisting of dextrin, polyvinyl alcohol (PVA) and plasticizers, e.g. polyethylene glycol (PEG).

In practice, we recommend a standard dextrin paper, e.g. Trucal by Tullis Russell or Calcotrans by Ahlstrom.

### 2. Printing Pastes

The range of printing pastes comprises 12 basic colour pastes incl. white, additionally we offer the four process-colours and gold and silver bronze powder, see table 3 and fig. 5. The suitable auxiliaries and media are listed in table 1.

The printing medium 80 4500 is especially designed for the printing pastes and can be mixed with these in any ratio in order to obtain the desired transparency of the pastes. For more colour shades, the printing pastes may as well be mixed with each other. The gold and silver metallic pastes must be pasted and printed with the medium 80 4500 as well. They should not be mixed with the colour printing pastes.

All printing pastes are supplied with a higher viscosity than suitable for printing in order to fulfil the different printing requirements. The pastes are delivered with given tolerance in viscosity and opacity. This small variability can be adjusted by addition of the thinner 80 890.

Therefore we recommend in the first print a general addition of 1 % 80 890. If necessary, the viscosity can be lowered with up to 10 % 80 890. Printing is carried out with fine screens due to the high colour intensity of the pastes. We recommend polyester screens PET 120-34 to PET 165-31 or similar stainless steel screens.

### 3. Protective Coatings

After the colour decals have been produced and thoroughly dried, they are overprinted with protective coating 80 4510 or 80 4512. The protective coatings produce a uniform gloss on the decal surface, but also ensure that strippable coating 80 2039 can be removed.

In contrast to 80 4510 for thermal curing, 80 4512 needs the addition of 6,5% of the hardener 80 4513, which provides the necessary chemical and mechanical surface resistance even at room temperature. When using the two-component system 80 4512 and 80 4513, thermal curing is obsolete, which is particularly interesting for the decoration of thermally

sensitive objects.

The range of protective coatings is completed by 80 4511, a satination. The overprinting does not influence the strippability of the strippable or transfer coating 80 2039. The grade of satination can be adjusted by addition of the clear protective coating 80 4510. To print the protective coatings we recommend polyester screens PET 120-31.

### 4. Strippable Coating

After printing the pastes and overprinting with one of the protective coatings, the decals must be thoroughly dried. We recommend drying over night, before the overprinting with strippable coating 80 2039 is done. After transferring the decal to the object being decorated, the strippable coating is removed from the protective coating in a dry state. 80 2039 is thus only the transfer coating.

We recommend printing strippable coating 80 2039 with a polyester screen PET 21-140 or stainless steel 80-37. A minimum dry film thickness of 28-30 µm guarantees good processing of the decals during decoration and easy removal of the strippable coating afterwards.

**Table 1: Media and auxiliaries**

Product No.	Product Description
80 4500	Printing medium
80 890	Thinner and cleaner
80 4510	Protective coating for thermal curing
80 4511	Protective coating for thermal curing - satined
80 4512	Protective coating for curing at room temperature, to be used with curing agent 80 4513 only
80 4513	Curing agent for protective coating 80 4512
80 2039	Strippable coating
80 4515	Additive for dishwasher resistance

## 5. Decoration

The Xpression decals are soaked for a few minutes in water, just like normal ceramic decals, and then applied to the object. The decals have to be pressed firmly with a rubber squeegee.

If desired, the dishwasher resistance of decals on glass objects or glazed surfaces can be increased by using a special additive. Before the decal is applied, the area to be decorated is pre-treated with a 2 % hydrous solution of additive 80 4515. The decal is then being pressed on this prepared area with the squeegee. When using this additive, the surface of the pattern should be cleaned with a wet sponge or cloth before drying, otherwise a white film may be visible that is difficult to remove.

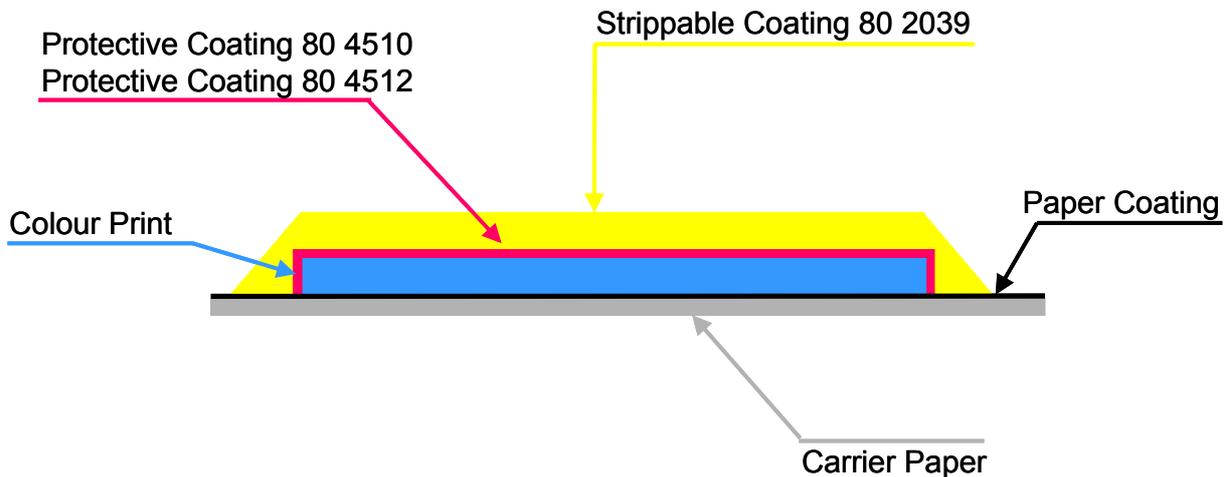
Afterwards, the decorated articles are dried for at least 60 minutes at 40 °C or for 24 hours at room temperature.

After the drying process the coating on top of the decal (strippable coating 80 2039) is removed completely. Only the high-grade decoration remains on the object.

Fig. 3 shows this procedure, fig. 4 clarifies the layer composition of a complete Xpression decal.



**Fig. 3: Removal of the strippable coating 80 2039**



**Fig. 4: Xpression layer composition**

## 6. After-Treatment

When applying the decal, remains of the water-soluble paper coating and, if used, additive 80 4515 are transferred to the object. These residues leave a visible beige film on the substrate after firing or thermal curing. To avoid this effect we recommend wiping the decal surface thoroughly with a wet sponge or cloth directly after decal application. After removal of the strippable coating, the cleaning step can be repeated before thermal curing, in order to remove all traces of the additive.

## 7. Thermal Curing

After the process described above, the decorated articles are thermally cured in a hot-air or other ventilated oven. Table 2 shows the recommended curing conditions.

**Table 2: Thermal curing conditions**

Curing Temperature	Curing Time
160 °C	30 min.
180 °C	20 min.
200 °C	15 min.

In case of higher temperatures or longer curing times, a yellowing of the decoration is possible.

## 8. Ferro Colour Management System

To match colours fast and easily, Ferro developed the Xpression Matchbox software.

Corresponding with several colour systems (Pantone®, HKS®, RAL®, NCS® etc.), suggested formulations for the desired colour are shown. Due to the excellent intermiscibility of the Xpression colours, up to 3000 colour shades can be achieved.

For this purpose, the colours are simply mixed with each other. They should not be dispersed e.g. on a triple roll mill.

**Table 3: The available Xpression printing pastes**

Product No.	Product Description	Pantone® Code*
11 3601	Printing Paste Green	Green C
12 3601	Printing Paste Blue 1	Process Blue C
12 3603	Printing Paste Blue 3	Reflex Blue C
13 3601	Printing Paste Yellow	Yellow C
13 3602	Printing Paste Orange	Orange 021 C
14 3601	Printing Paste Black	Black C
17 3601	Printing Paste Red 1	Warm Red C
17 3602	Printing Paste Red 2	Red 32 C
17 3603	Printing Paste Red 3	Rubine Red C
17 3604	Printing Paste Red 4	Rhodamine Red C
17 3606	Printing Paste Violet	Violet C
19 3601	Printing Paste White	White
13 3604	Printing Paste Gold Pigment	/
15 3601	Printing Paste Silver Pigment	/
12 3640	Printing Paste 4 Colour Cyan	Process Cyan C
13 3640	Printing Paste 4 Colour Yellow	Process Yellow C
14 3640	Printing Paste 4 Colour Black	Process Black C
17 3640	Printing Paste 4 Colour Magenta	Process Magenta C

\* The above mentioned Pantone® -code is only a guideline for the colour shade.

Pantone® is a registered trade mark of Pantone Inc.

**Fig. 5: Colour samples of the Xpression range**



13 3601



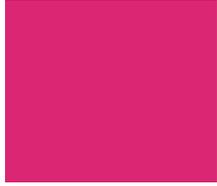
13 3602



17 3601



17 3602



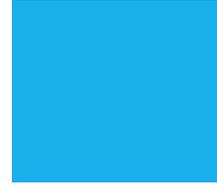
17 3603



17 3604



17 3606



12 3601



12 3603



11 3601



14 3601



19 3601



13 3604



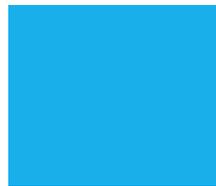
15 3601



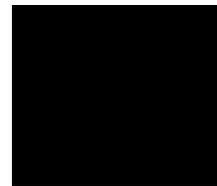
13 3640



17 3640



12 3640



14 3640

While every attempt has been made to reproduce colours exactly, the samples printed here may differ slightly from the original.

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