

# Technical Information

## DF06

# Xpression

## Organic Colours for Low Temperature Decals

In this technical information leaflet Ferro presents Xpression, a series of organic colours for the screen printing of 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, skateboards, ski, bicycles, surfboards and other sports equipment, furniture, bottles, vases, lampshades and small household appliances, displays and industrial labels could be named. There is no limit to the imagination.

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.

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Fig. 1: Application example: Decorated motorcycle helmet

## 1. Processing Instructions for the Xpression Colours

### 1.1. 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 a water-soluble mixture. In practice, we recommend only the standard dextrin paper Trucal Plus by Tullis Russell.

### 1.2. Printing Pastes

The range of printing pastes comprises 12 basic colour pastes incl. white, additionally we offer the four process colours, see table 2 and fig. 4. The suitable auxiliaries and media are listed in table 1. Other effect colours like metallic or pearlescent colours can be found in our information leaflet DF66, "Xpression Effect Colours".

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.

When the thixotropic agent 80 4518 is added to the liquid basic colours, even fine lines and grid patterns can be printed. Please refer to the technical data sheet for this product prior to use.

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 adding the thinner 80 890. Therefore we recommend for first time usage of the pastes 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.

### 1.3. Protective Coatings

After the colour decals have been produced and thoroughly dried, they are overprinted with protective coating 80 4540 or 80 4542. 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 4540 for thermal curing, 80 4542 needs the addition of the hardener 80 4543, which provides the necessary chemical and mechanical surface resistance even at room temperature. When using the two-component system 80 4542 and 80 4543, thermal curing is obsolete, which is particularly interesting for the decoration of thermally sensitive objects. For detailed information, please refer to the technical data sheets.

The range of protective coatings is completed by 80 4541, 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 4540. To print the protective coatings we recommend polyester screens PET 120-31.

Fig. 2 clarifies the layer composition of a complete Xpression decal.

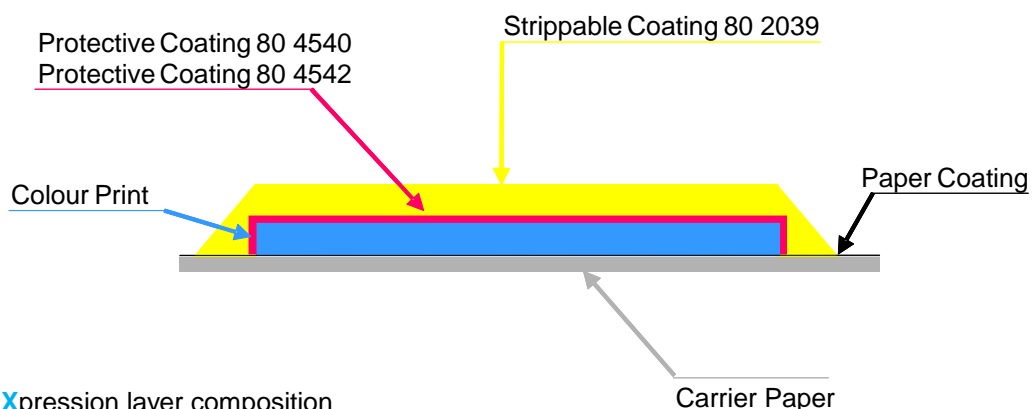


Fig. 2: Xpression layer composition

## 1.4. 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 4540	1C Protective coating for thermal curing
80 4541	1C Protective coating for thermal curing - satined
80 4542	2C Protective coating for curing at room temperature, to be used with curing agent 80 4543 only
80 4543	Curing agent for protective coating 80 4542
80 2039	Strippable coating
80 4515	Primer for dishwasher resistance
80 4516	Primer for dishwasher resistance
80 4520	Basecoat for plastics
80 4521	Primer especially for PP
80 4518	Thixotropic agent

## 2. Processing Instructions for the Xpression Decals

### 2.1. 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. 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 process step.

## 2.2. Adhesion Promoter

If desired, the dishwasher resistance of decals on glasslike surfaces (glass, ceramics, enamel) can be increased by using a primer. Before the decal is applied, the primer 80 4515 or 80 4516, prepared according to the instructions, is brushed on the area to be decorated. The decal is then being pressed on this prepared area with the squeegee. When using these primers, 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.

80 4520 was developed especially for the adhesion on certain plastics. It improves the adhesion on plastics like ABS, PC, PET, PMMA and PVC. The basecoat 80 4520 is printed underneath the Xpression colour. The complete decal is transferred to the object and dried, as described in 2.1. After removal of the strippable coating, a thermal curing at 80 °C for one hour follows.

For plastics mad of polypropylene (PP), the primer 80 4521 in combination with the 2C protective coating is used. This primer is brushed onto the object to be decorated. The primer needs to dry for 10 seconds. The decal is applied on the pre-treated area as usual. After the drying process of the decal, as described in 2.1., the strippable coating is removed and the object is thermally cured at 60 °C for 40 minutes.

### 2.3. After-Treatment

When applying the decal, remains of the water-soluble paper coating and, if used, primer 80 4515 or 80 4516 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 primer.



Fig. 3: Removal of the strippable coating 80 2039

**Table 2: The available Xpression printing pastes**

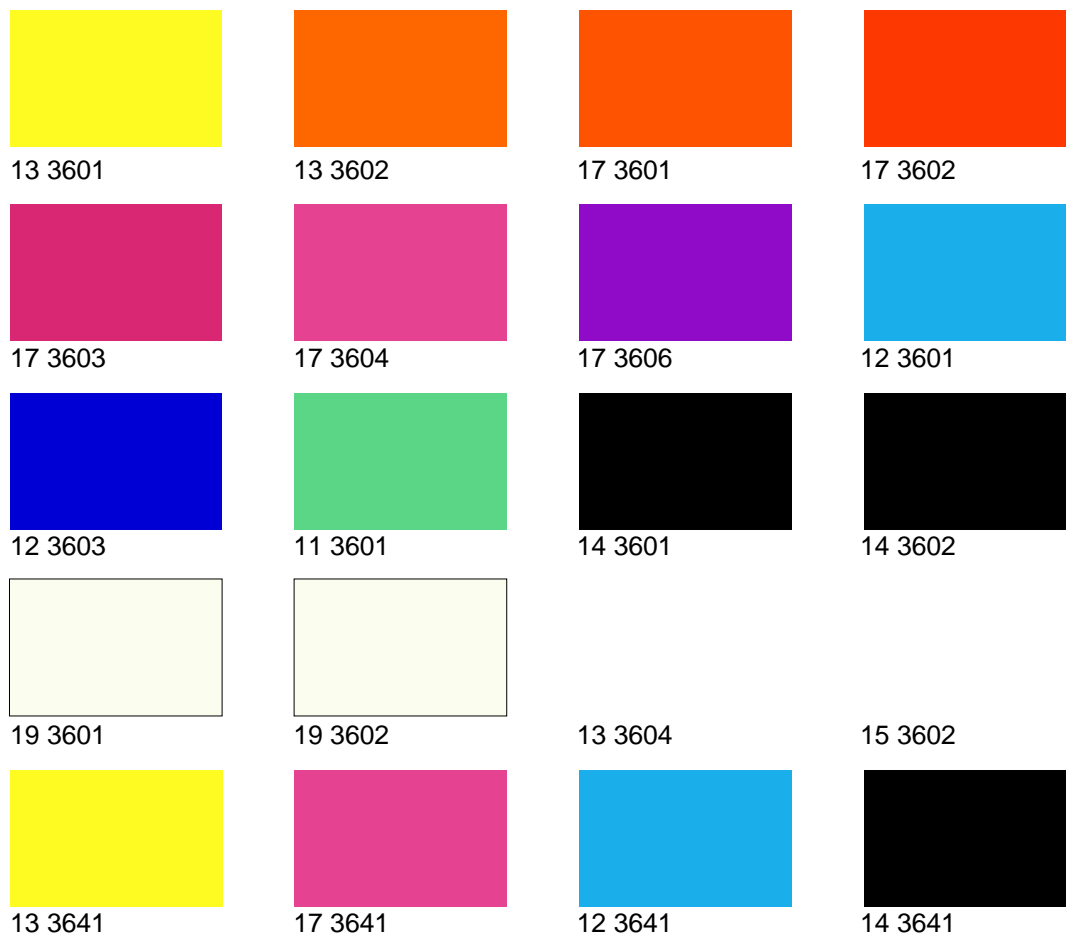
Product No.	Product Description	Pantone® Code*
11 3601	Printing Paste Green	Green C
12 3601	Printing Paste Blue 1	Process Blue C
12 3603	Printing Paste Blue 3	Reflex Blue C
13 3601	Printing Paste Yellow	Yellow C
13 3602	Printing Paste Orange	Orange 021 C
14 3601	Printing Paste Black	Black C
14 3602	Printing Paste Intensive 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
19 3602	Printing Paste Intensive White	White
12 3641	Printing Paste 4 Colour Cyan**	Process Cyan C
13 3641	Printing Paste 4 Colour Yellow**	Process Yellow C
14 3641	Printing Paste 4 Colour Black**	Process Black C
17 3641	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.

\*\* On the basis of the offset norm.

**Fig. 4: Colour samples of the Xpression range**



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

## 2.4. Thermal Curing

After the process described above, the decorated articles are thermally cured in a hot-air or other ventilated oven. Table 3 shows the recommended curing conditions.

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

**Table 3: Thermal curing conditions**

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

## 2.5. Storage of the Decals

The flexibility of the decals decreases while stored. By pre-heating the objects to be decorated, the flexibility of Xpression decals is enhanced. We generally recommend to decorate pre-heated objects.

## 3. Colour Management System

To match colours fast and easily, the easyMEMO software is available.

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, almost all desired 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.

## 4. Overview on the Properties

- suitable for interior and exterior application (with the exception of the fluorescent colours)
- for nearly all substrates, even for temperature sensitive ones
- large variety of colours
- excellent miscibility within the series
- easy colour matching with the colour management system easyMEMO
- hard surface
- very good lightfastness
- alkali and acid resistance
- dishwasher resistance
- solvent resistance
- very low yellowing
- longterm temperature stability up to 110 °C



Fig. 5: Xpression on wood

- flexible decals perfectly adapt to the objects
- fine prints possible, complete covering of background not necessary
- lead and cadmium free, no formaldehyde and phthalates (exception: fluorescent colours contain formaldehyde)
- 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.

Our Xpression colours are lead and cadmium free and do not contain formaldehyde or phthalates (exception: fluorescent colours are not free of formaldehyde).

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.

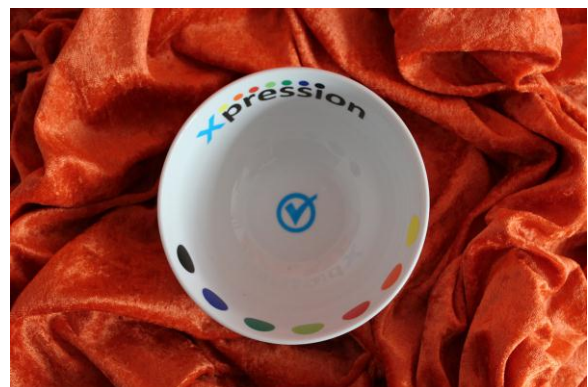


Fig. 6: Xpression on porcelain

## 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 500 cycles without visible deterioration when using the additives 80 4515 or 80 4516.

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.

## 5. Application Examples

### 5.1. 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.



Fig. 8: Application example porcelain



Fig. 7: Application examples on different materials

### 5.2. 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.

### 5.3. Process-Colour Printing

When using the process colours 12 3641 (cyan), 13 3641 (yellow), 17 3641 (magenta) and 14 3641 (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.

### 6.4. 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.

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